

Audi

Workshop Manual

Audi A2 2001 ➤

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**4-cylinder direct injection engine (1.6 ltr. 4-valve),
mechanics**

Engine ID	BAD								
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Edition 11.2015

List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, valve gear
- 17 - Lubrication
- 19 - Cooling
- 26 - Exhaust system



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

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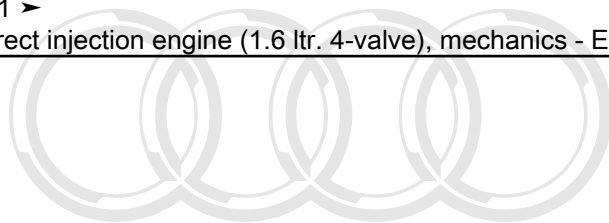


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Audi A2 2001 ►

4-cylinder direct injection engine (1.6 ltr. 4-valve), mechanics - Edition 11.2015



Audi

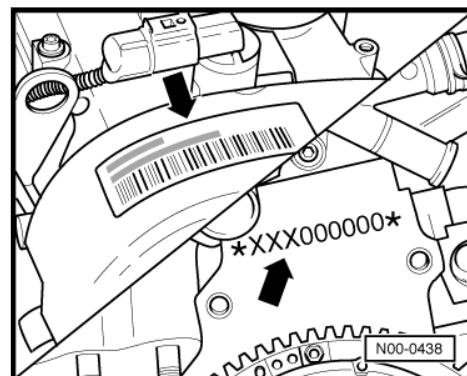
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00 – Technical data

1 Engine number

(ARL004449; Edition 11.2015)

- ◆ The engine number ("engine code" and "serial number") can be found on the cylinder block above the gearbox beneath the thermostat housing -bottom arrow-.
- ◆ Additionally there is a sticker on the toothed belt cover showing the "engine code" and "serial number" -top arrow-.
- ◆ The engine code is also to be found on the vehicle data sticker.



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2 Safety precautions

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

⇒ [“2.2 Safety precautions when using testers and measuring instruments during a road test”, page 2](#)

⇒ [“2.3 Safety precautions when working on the ignition system”, page 3](#)

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

2.1 Safety precautions when working on the fuel supply system

Risk of injury - fuel system operates under high pressure

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

Before opening the fuel system:

- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap 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.

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2.2 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.

2.3 Safety precautions when working on the ignition system

Risk of injury caused by 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.

2.4 Safety precautions when working on the cooling system

Risk of scalding as hot coolant can escape

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

- Wear protective gloves.
- Wear safety goggles.
- Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).

3 Repair instructions

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

⇒ [“3.2 Foreign particles in engine”, page 4](#)

⇒ [“3.3 Contact corrosion”, page 4](#)

⇒ [“3.4 Routing and attachment of pipes, hoses and wiring”, page 5](#)

⇒ [“3.5 Installing radiators and condensers”, page 5](#)

⇒ [“3.6 Checking vacuum system”, page 5](#)

⇒ [“3.7 General notes”, page 6](#)

3.1 Rules for cleanliness

Even small amounts of dirt can cause malfunctions. For this reason, please observe the following rules when working on the fuel supply system, injection system and turbocharger:

- ◆ Carefully clean connection points and the surrounding area with engine cleaner or brake cleaner and dry thoroughly before opening.
- ◆ Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- ◆ Place parts that have been removed on a clean surface and cover them over. 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.

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 used.

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 .

Note the following:

- ◆ We recommend using only genuine replacement parts; these have been tested and are compatible with aluminium.
- ◆ We recommend the use of Audi accessories.
- ◆ Damage caused by contact corrosion is not covered under 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.
- ◆ To prevent damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (little space in engine compartment).

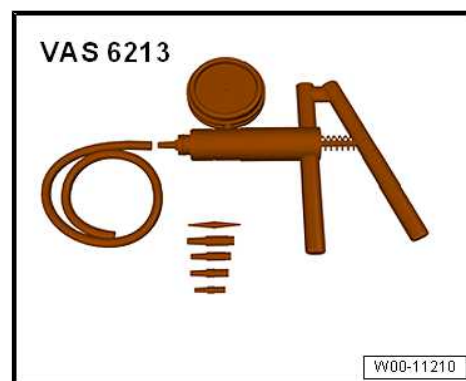
3.5 Installing radiators and condensers

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 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
 - ◆ Lines porous or leaking
- 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.



3.7 General notes

- ◆ For the applicable current flow diagrams, refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

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10 – Removing and installing engine

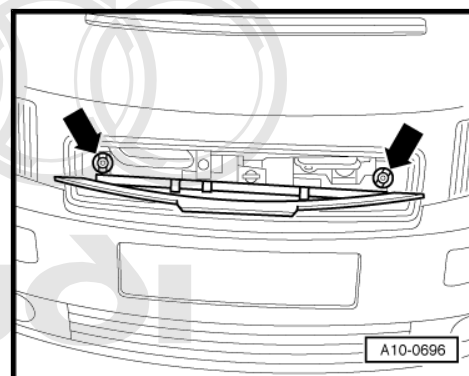
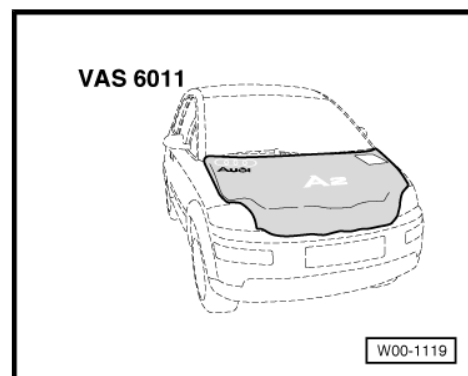
1 Detaching bonnet

Special tools and workshop equipment required

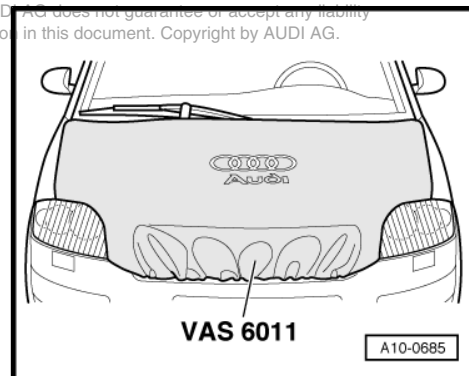
- ◆ Engine cover protector - VAS 6011-

Procedure

- Wash outer side of bonnet and dry with chamois leather.
- Release service flap from inside the vehicle.
- Release bonnet -arrows- and pull slightly to front.



- Attach engine cover protector - VAS 6011- to bonnet.



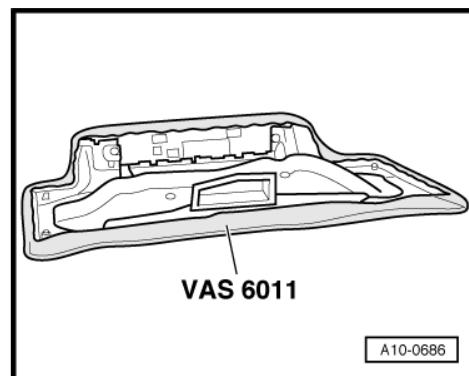
- Detach bonnet and put aside with the engine cover protector - VAS 6011- facing downwards.



Caution

Risk of damage.

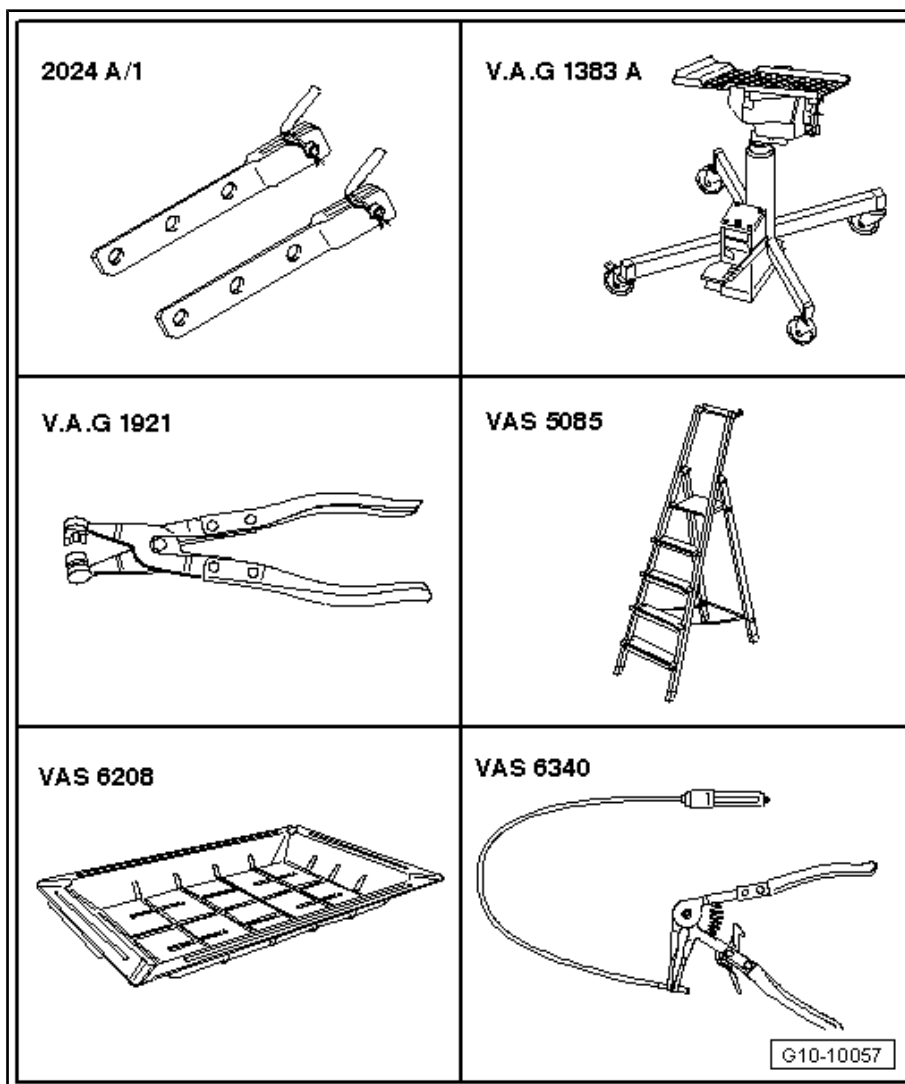
- ◆ *Do not store bonnet in upright position.*



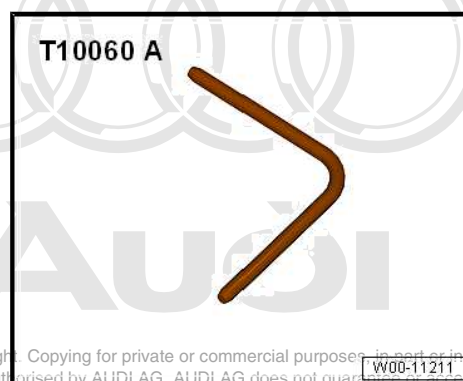
2 Removing engine

Special tools and workshop equipment required

- ◆ Extension -2024 A /1-
- ◆ Engine and gearbox jack - V.A.G 1383 A-
- ◆ Hose clip pliers - V.A.G 1921-
- ◆ Stepladder - VAS 5085-
- ◆ Drip tray for workshop hoist - VAS 6208-
- ◆ Hose clip pliers - VAS 6340-

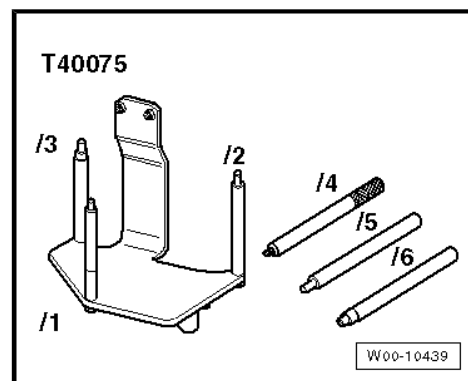


- ◆ Locking pin - T10060 A-



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◆ Engine support - T40075-



◆ Bolt M10x25 with washer

Preparations

Preparations for removal of the 1.6 ltr. FSI engine on the Audi A2:

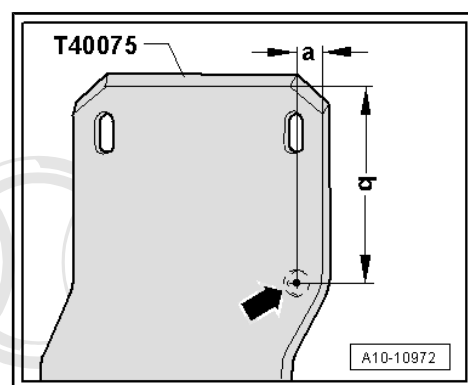
- Modify engine support - T40075- by drilling a hole $\varnothing$ 12 mm -arrow- as shown.
- Dimension -a- = 12 mm
- Dimension -b- = 73 mm

Procedure



Note

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



Caution

To prevent irreparable damage to the electronic components when disconnecting the battery:

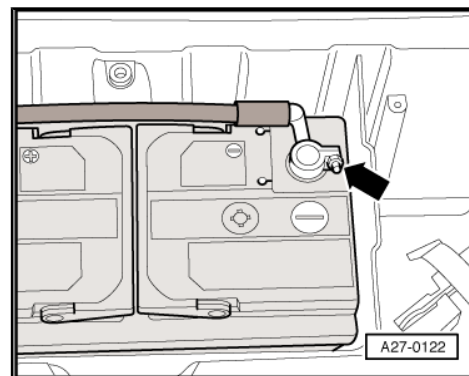
- ◆ **Observe notes on procedure for disconnecting the battery**
⇒ Rep. gr. 27.



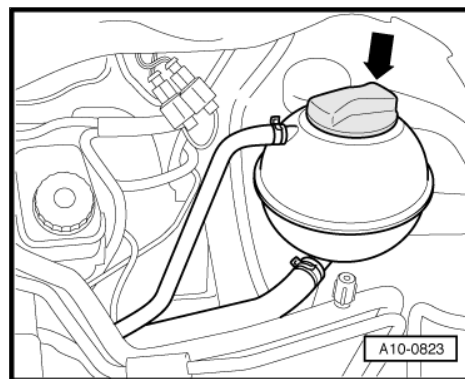
Note

The battery is located in the luggage compartment panel.

- Switch off ignition and take out ignition key.
- Loosen nut a few turns and disconnect battery clamp on earth wire -arrow- from battery terminal.



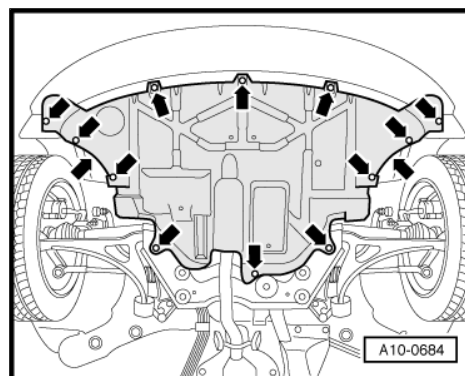
- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .



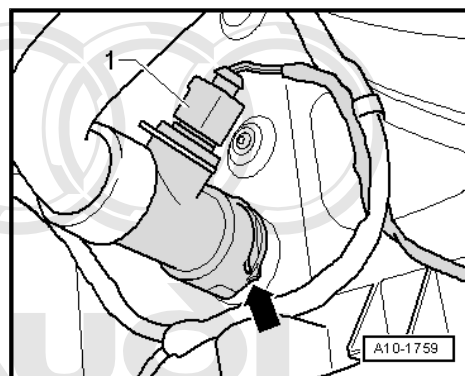
Risk of scalding as hot coolant can escape

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

- Wear protective gloves.
- Wear safety goggles.
- Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).
- Open filler cap -arrow- on coolant expansion tank.
- Remove both front wheels.
- Release fasteners -arrows- and remove noise insulation.

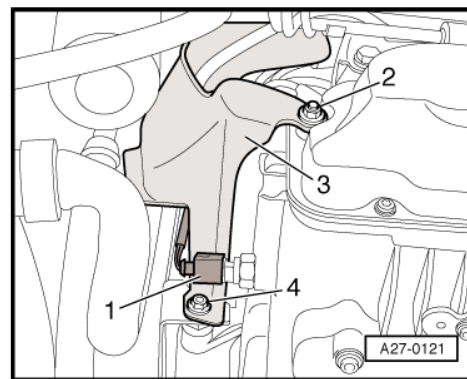


- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Unplug electrical connector -1- at radiator outlet coolant temperature sender - G83- .
- Lift retaining clip, disconnect coolant hose -arrow- from radiator (bottom) and drain off coolant.

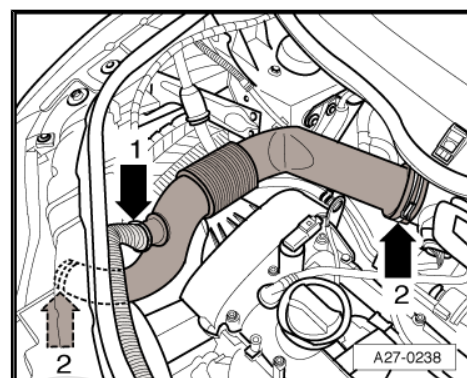


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- Remove nuts -2- and -4- for panel protecting starter -3-.
- Unplug electrical connector -1-.



- Press release tabs and detach resonator from air hose -arrow 1-.
- Use hose clip pliers - V.A.G 1921- to loosen spring-type hose clips -arrows 2- and detach air duct.



Risk of injury - fuel system operates under high pressure

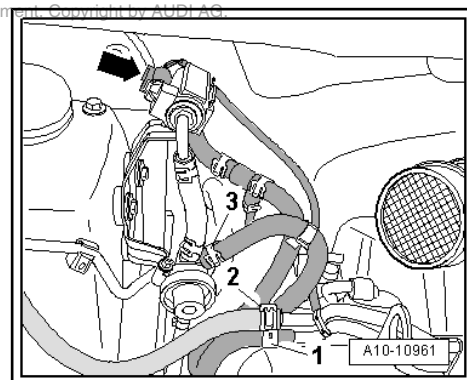
The fuel system is pressurised. There is a risk of injury as fuel may spray out.

Before opening the fuel system:

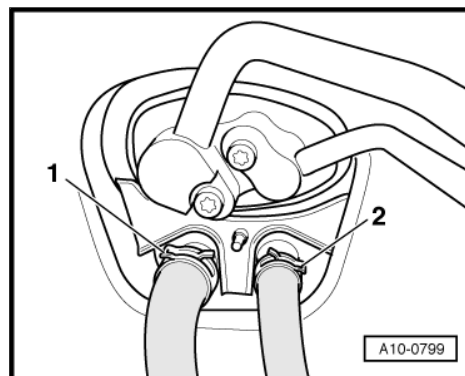
- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap clean cloth around connection and open connection carefully).

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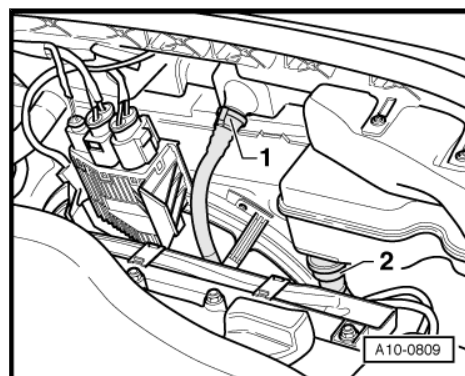
- Unplug electrical connector -arrow- at fuel metering valve - N290- .
- Detach fuel hoses -1- and -3-.
- Detach hose from activated charcoal filter -2-.



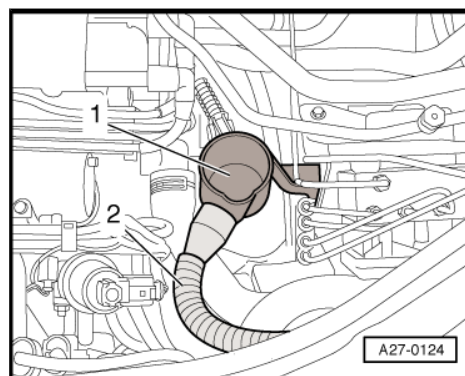
- Mark coolant supply hose -1- and return hose -2- going to and from heat exchanger and detach hoses at plenum chamber partition panel.



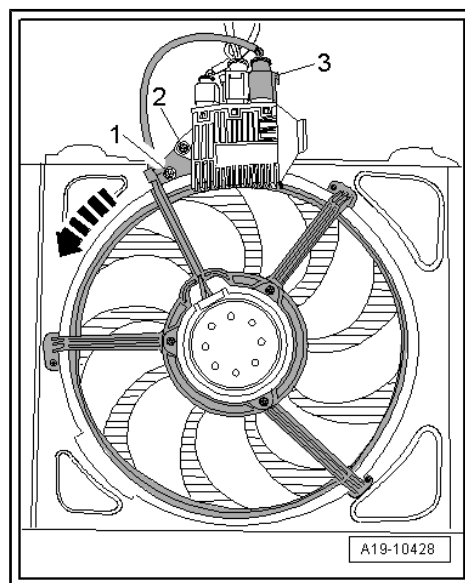
- Pull oil dipstick out of guide tube.
- Detach guide tube -1- for oil dipstick (press release tabs).
- Detach oil filler pipe -2- from oil filler reservoir.



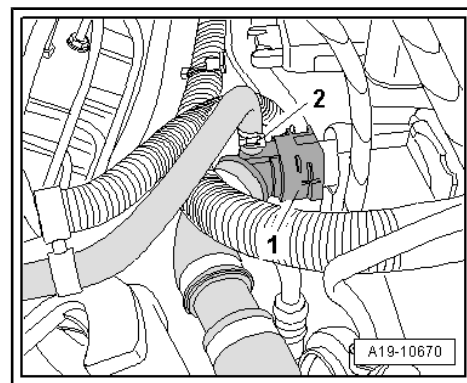
- Detach water collector -1- and move clear to one side (drain hose -2- remains connected).



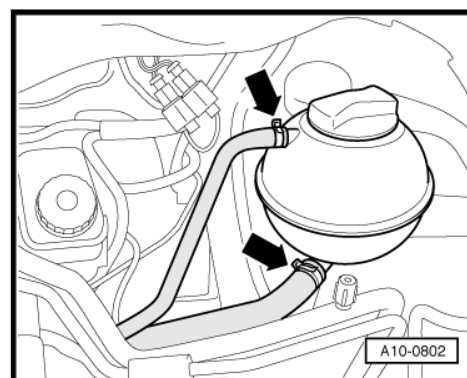
- Unplug electrical connector -3- at radiator fan control unit - J293- .
- Remove bolt -2- and detach radiator fan control unit - J293- .
- Remove securing bolt -1- .
- Turn retaining ring anti-clockwise arrow and detach radiator fan - V7- with retaining ring.



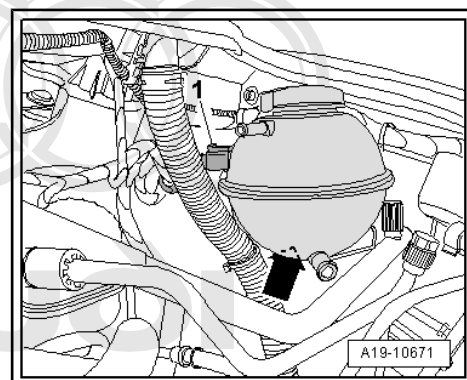
- Detach coolant hose -2-.
- Disconnect coolant hose -1- from radiator (pull out retaining clip).



- Disconnect coolant hoses -arrows- from coolant expansion tank and move coolant hose (top) clear.



- Unplug electrical connector -1- at coolant shortage indicator switch - F66- .
- Remove nut -arrow- and detach coolant expansion tank.



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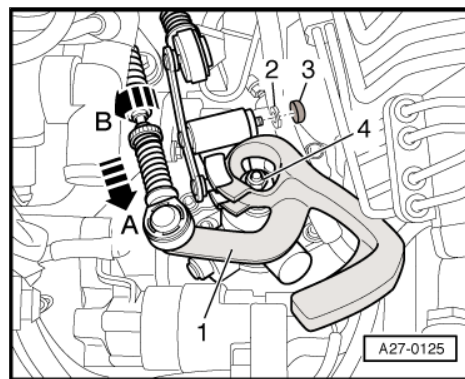
Caution

Risk of damage to cable end-pieces.

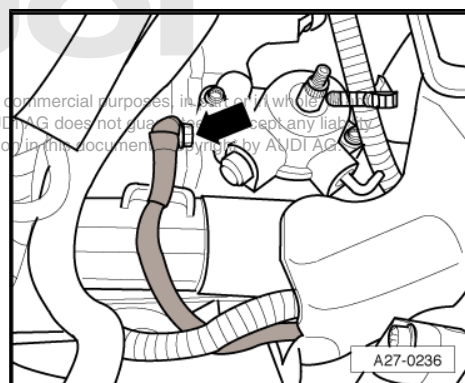
- ◆ **Do not detach cable end-pieces from selector shaft lever or gear selector relay lever. The cable end-pieces must always be renewed if they have been detached.**

Release cable end-pieces for gate selector cable and gear selector cable as follows:

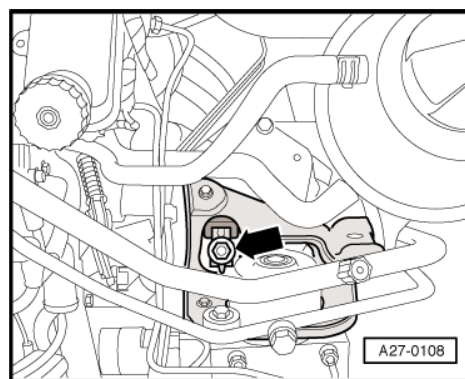
- Pull locking device on gear selector cable forwards onto stop -arrow A-.
- Turn locking sleeve as far as stop -arrow B- and lock in position.
- Disengage cables from cable end-pieces.
- Detach cover cap -3- from securing clip.
- Detach securing clip -2-.
- Pull relay lever to side.
- Unscrew nut -4- and remove selector shaft lever -1-.
- Remove nut -arrow- and move earth wire clear.



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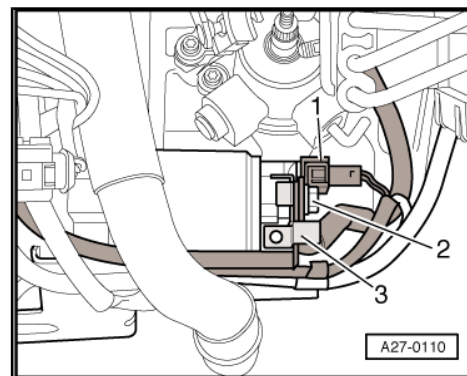
- Remove nut -arrow- and lift out panel protecting starter.



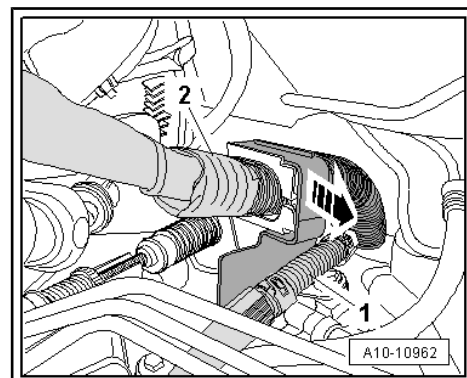
- Remove nut -2-. (To prevent damage to solenoid switch, make sure wiring is not twisted.)
- Detach B+ wiring.
- Detach locating element -3-.

**Note**

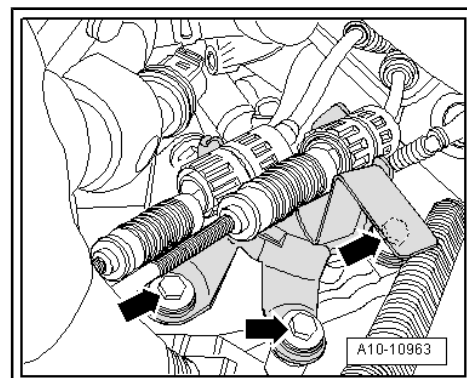
Disregard item -1-.



- Move B+ wire -1- clear at bracket.
- Move engine wiring harness -2- clear at cable support bracket -arrow-.



- Remove bolts -arrows- and remove cable support bracket from gearbox.

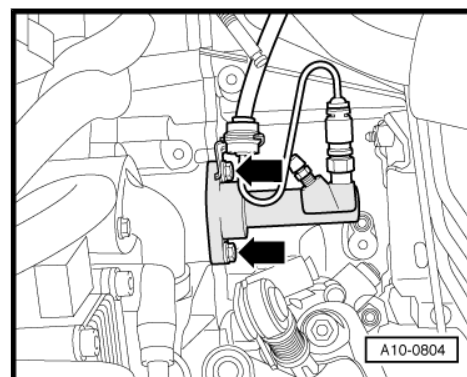


- Remove bolts -arrows-, detach clutch slave cylinder and place to one side. Do not open pipes.

**Caution**

Avoid damage to clutch slave cylinder.

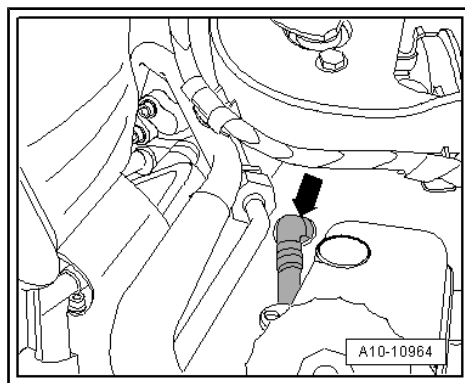
◆ **Do not operate clutch pedal with slave cylinder removed.**



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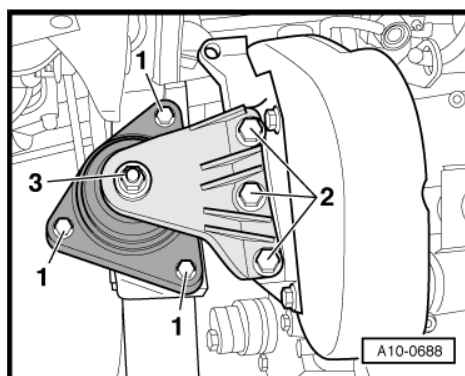
- Detach vacuum line -arrow- for brake servo.



Note

Do not loosen nut -3- unless renewing engine mounting.

- Loosen bolts -1- and -2- approx. 2 turns.

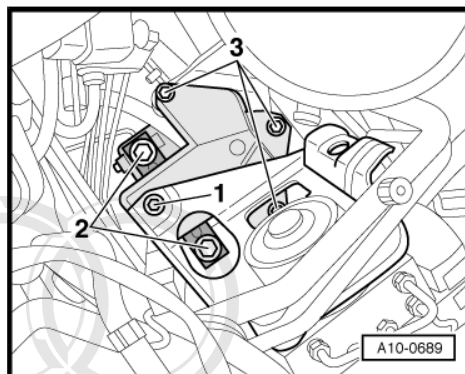


- Loosen bolts -2- at gearbox mounting approx. 2 turns.

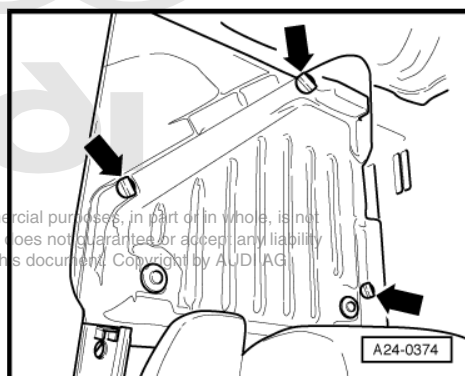


Note

Disregard -items 1 and 3-.

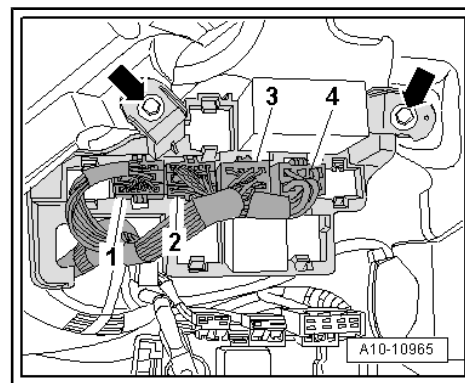


- Lift carpeting in driver's footwell and detach cover -arrows-.

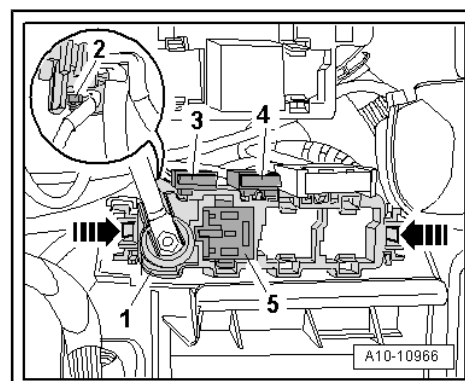


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- Unplug electrical connectors -1 ... 4- and move electrical wiring harness clear.
- Remove bolts -arrows- and place relay carrier to one side.



- Detach fuse holders -3- and -4- from relay carrier -1-.
- Detach relay socket -5- from relay carrier.
- Release fasteners -arrows- and unscrew wire on underside -2- to detach relay carrier.



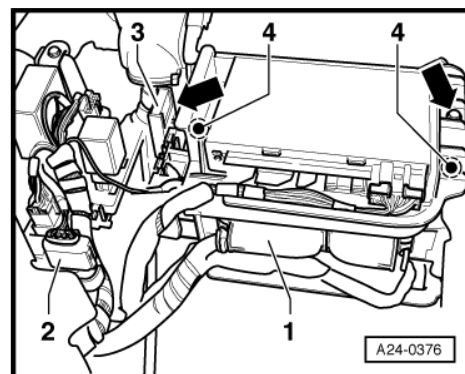
- Remove bolt and nut -arrows- and carefully pull out control unit support.



Note

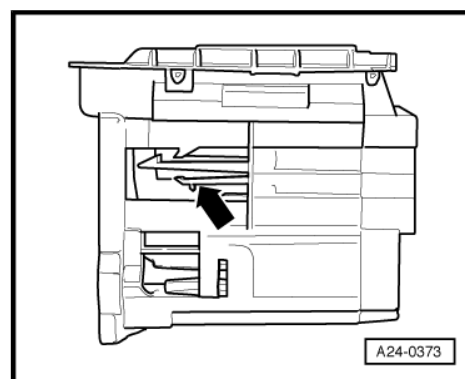
Disregard -items 2 and 3-.

- Release retaining clips -4- as shown in illustration below and carefully pull out engine control unit -1-.

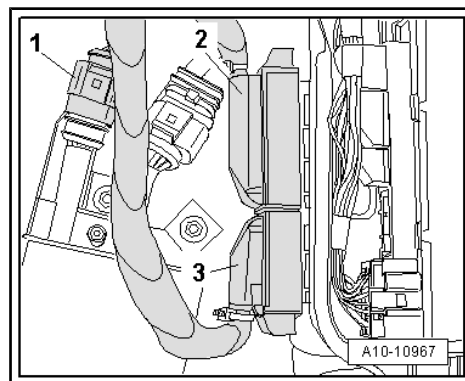


Note

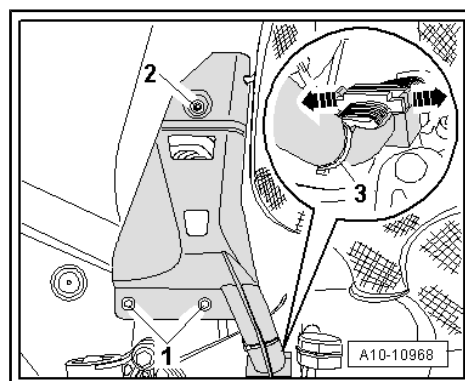
The illustration shows the control unit support as seen from the side. Press retaining clips in direction of -arrow- to release control unit.



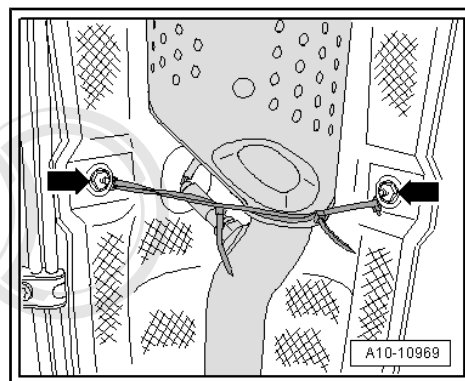
- Unplug electrical connectors -2- and -3- from engine control unit.
- Unplug electrical connector -1- for NOx sender - G295- .
- Move electrical wiring clear.



- Remove bolts -1- and -2-.
- Cut through cable tie -3-, release fasteners -arrows- and detach wiring guide.
- Guide out engine wiring harness through body.



- Loosen bolts -arrows- and secure main catalytic converter with cable ties.

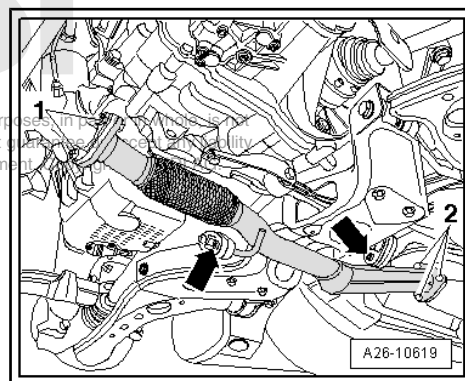


Caution

Risk of damage to flexible joint.

- ◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**

- Remove nuts -1- and bolts -2-.
- Disengage front exhaust pipe at rubber mountings -arrows- and detach.

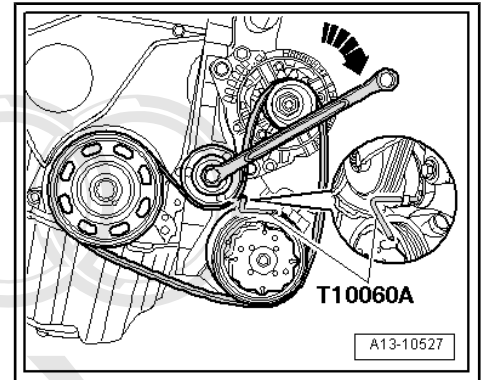


**Caution**

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

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

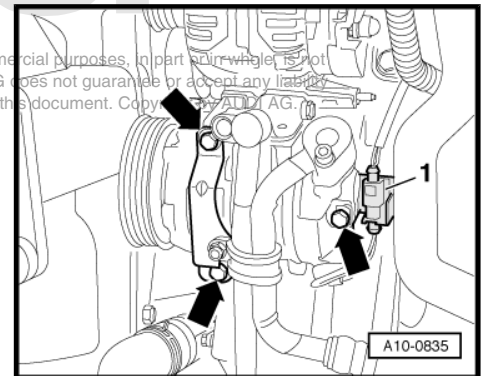
- To slacken poly V-belt use ring spanner to turn tensioner in clockwise direction -arrow-.
- Use locking pin - T10060 A- to lock poly V-belt tensioner and detach poly V-belt.
- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**WARNING**

Risk of injury caused by refrigerant.

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

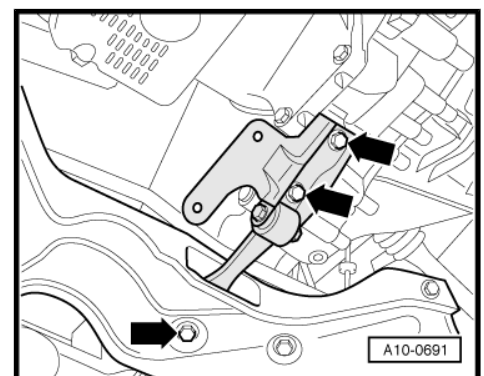
- Remove bolts -arrows- for air conditioner compressor.

**Caution**

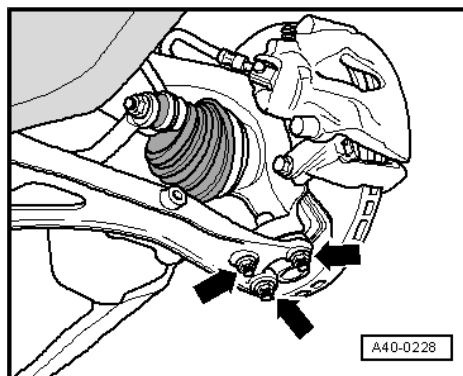
Danger of damage to refrigerant lines and hoses.

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

- Tie up air conditioner compressor together with refrigerant hoses to lock carrier (refrigerant hoses remain connected).
- Unbolt drive shafts (left and right) from gearbox flange shafts.
- Remove bolts -arrows- and detach pendulum support.



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

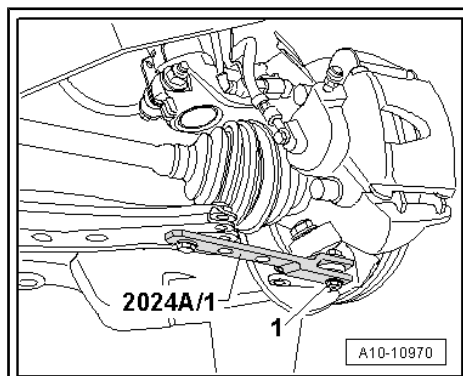


- Swing suspension strut (left-side) outwards and support with extension -2024 A /1- as shown in illustration.


WARNING

Accident risk from loose components of support bracket.

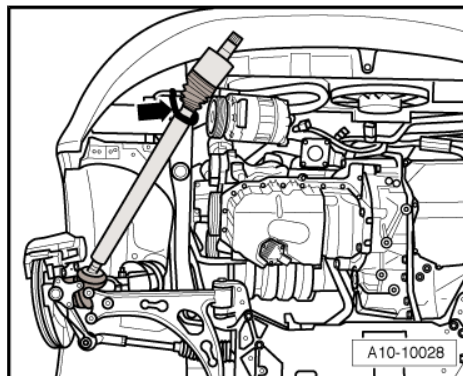
- ◆ *Secure swivel joint with nut -1-.*



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


Note

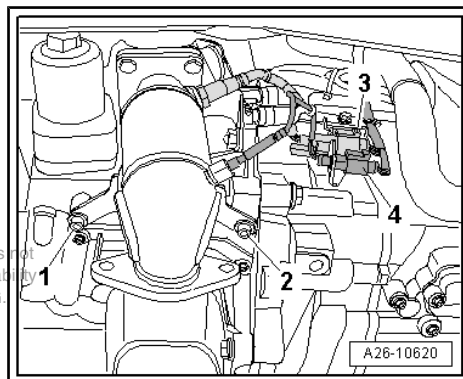
Take care not to damage the surface coating of the drive shaft.



- Remove bolt -1-.

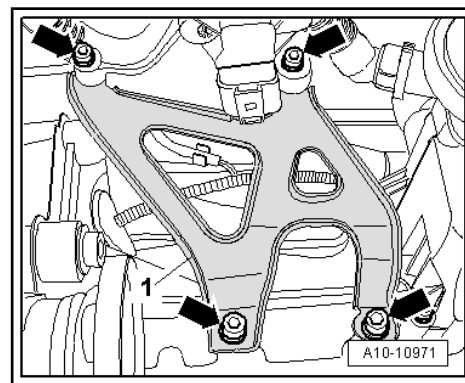

Note

Disregard items -2, 3 and 4-.

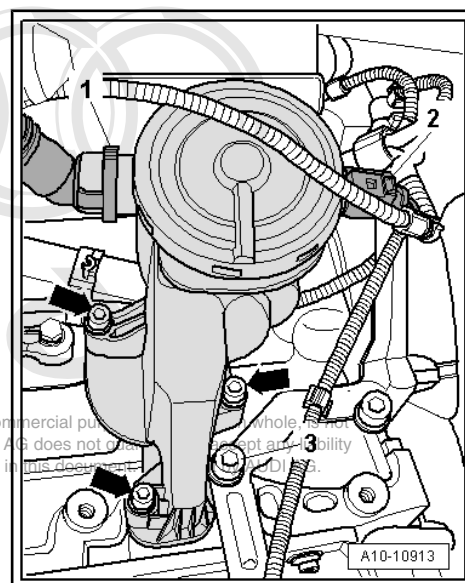


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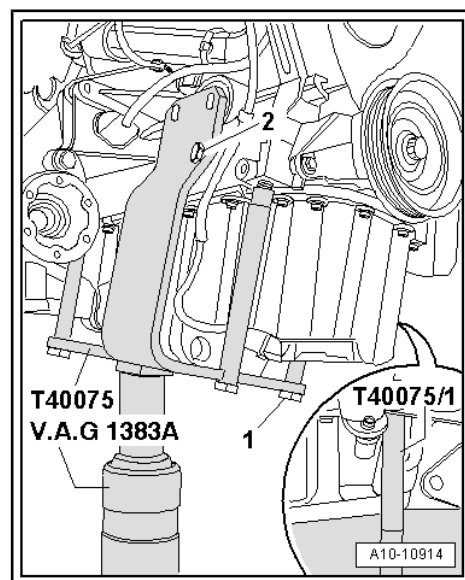
- Unscrew bolts -arrows- and remove support -1- for intake manifold.



- Unplug electrical connector -2-.
- Press release tabs and disconnect air hose -1-.
- Unscrew bolts -arrows- and remove pressure control valve for crankcase breather system from cylinder block.
- Remove bolt -3- securing bracket.



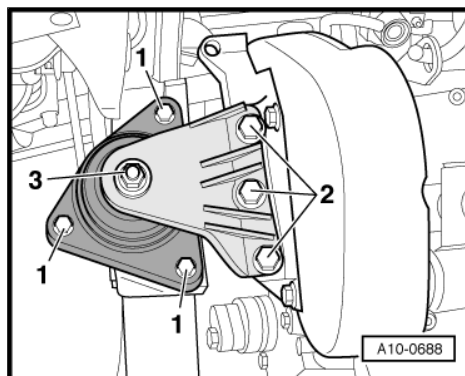
- Make sure that engine support - T40075- is prepared as required for removal of engine ⇒ [page 9](#) .
- Remove bolt -1- for support -T40075/1- on engine support - T40075-
- Fit support -T40075/1- into vacant threaded hole for catalytic converter.
- Attach engine support - T40075- to engine as shown in illustration and secure with bolt -1- to support -T40075/1- .
- Securely fix engine support - T40075- to cylinder block at rear of engine with bolt M10x25 -2- and washer (tightening torque 20 Nm).
- Fit engine support - T40075- onto engine and gearbox jack - V.A.G 1383 A- .
- Raise engine slightly using engine and gearbox jack - V.A.G 1383 A- .



**Note**

Do not loosen nut -3- unless renewing engine mounting.

- Remove bolts -1- and -2-.



- Remove bolts -2- at gearbox mounting.

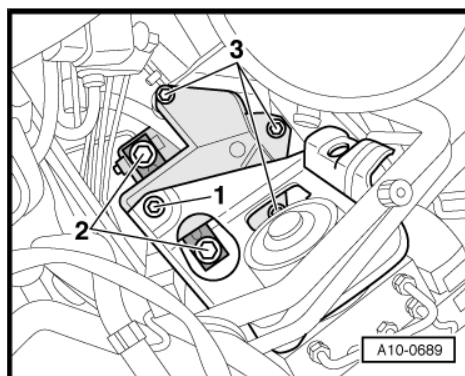
**Note**

Disregard -items 1 and 3-.

**Note**

- ◆ *Check that all hoses, pipes and wiring connections between engine, gearbox and body have been detached.*
- ◆ *Carefully guide engine/gearbox assembly when lowering to avoid damage.*
- ◆ *Make sure there is sufficient clearance for gear selector cables and engine wiring harness.*

- Lower engine and gearbox slowly using engine and gearbox jack - V.A.G 1383 A- .

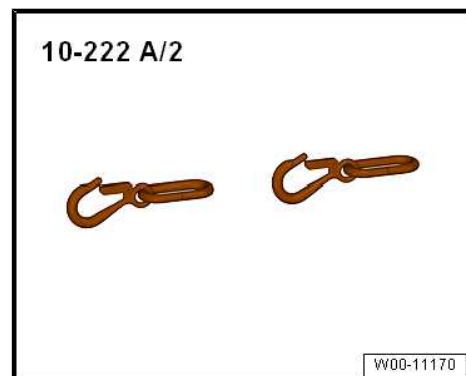


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3 Separating engine and gearbox

Special tools and workshop equipment required

- ◆ Hooks - 10 - 222 A /2-



- ◆ Shackle - 10 - 222 A /12-

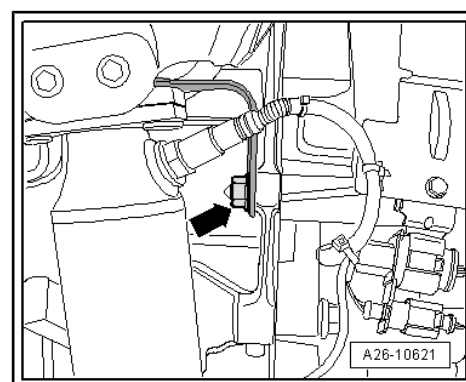


- ◆ Workshop hoist - VAS 6100-

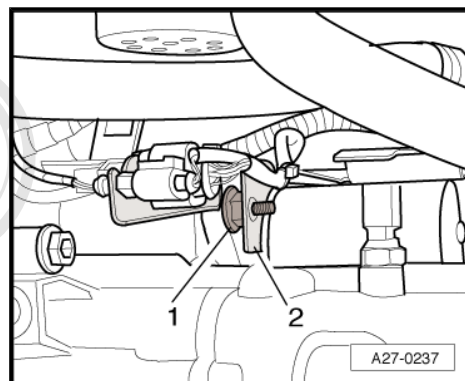


Procedure

- Engine/gearbox assembly removed and attached to engine support - T40075- .
- Unscrew nut -arrow- securing bracket for exhaust manifold.



- Detach bracket -2- for connector from centre hex stud -1- and remove centre hex stud.
- Remove top centre hex stud and detach starter.

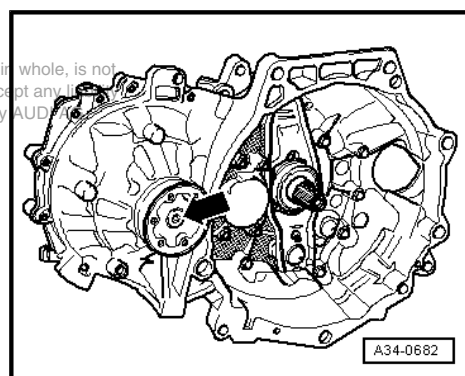


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Place a cloth below the flange shaft to catch escaping gear oil.

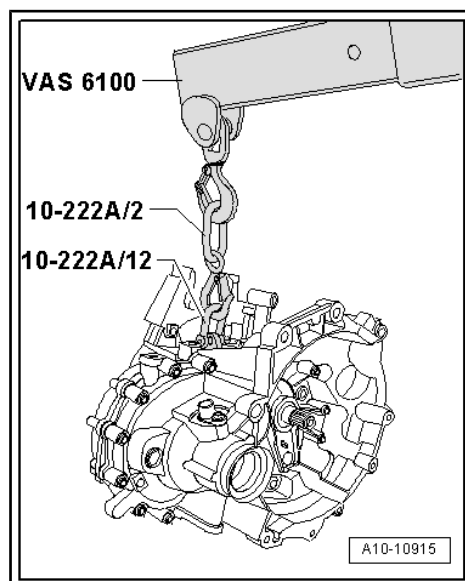
- Remove bolt -arrow- and detach flange shaft (right-side).



Note

Seal off opening in gearbox with a plug or clean cloth to prevent gear oil from escaping.

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



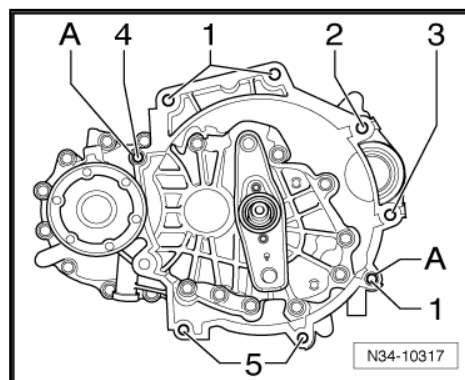
- Remove bolts -1 ... 5- securing gearbox to engine.



Note

Disregard -item A-.

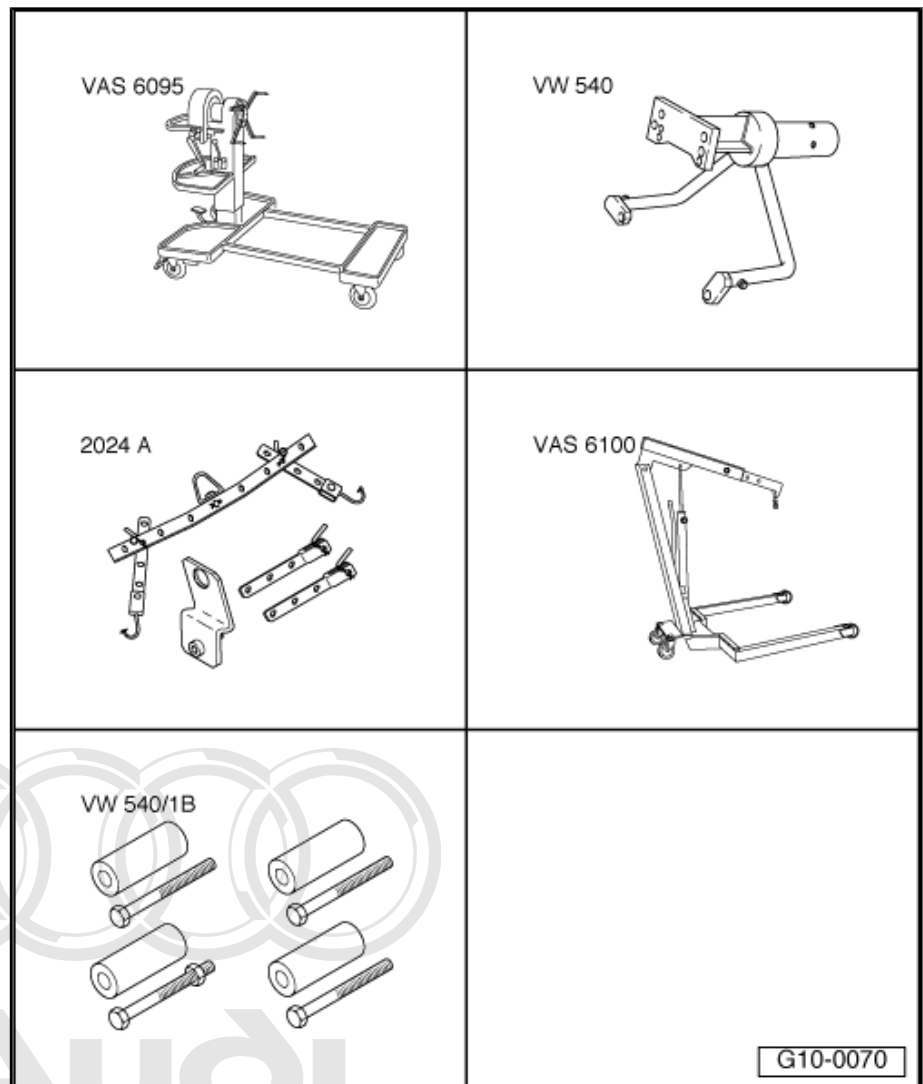
- Detach gearbox from engine.



4 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- ◆ Engine and gearbox support - VAS 6095-
- ◆ Engine and gearbox support - VW 540-
- ◆ Lifting tackle - 2024 A-
- ◆ Workshop hoist - VAS 6100-
- ◆ Engine and gearbox support supplement - VW 540/1 B-



Procedure

- Engine separated from gearbox
- To transport engine, engage lifting tackle - 2024 A- on engine and workshop hoist - VAS 6100- .



Note

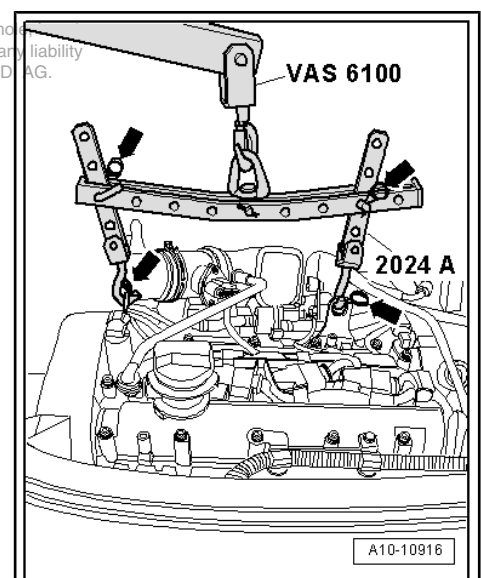
To adjust to the centre of gravity of the assembly, the perforated rails of the support hooks must be positioned as shown.



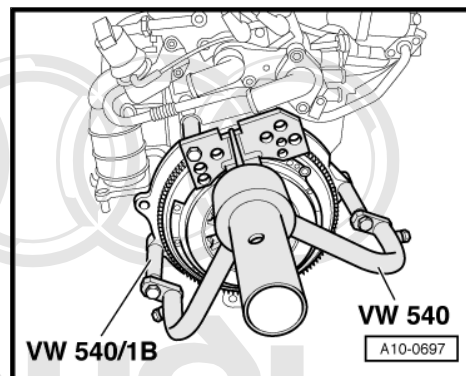
WARNING

Accident risk from loose components of lifting tackle.

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



- Attach engine to engine and gearbox support - VAS 6095- with engine and gearbox support - VW 540- and engine and gearbox support supplement - VW 540/1 B- .



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5 Installing engine

Tightening torques



Note

- ◆ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*
- ◆ *Additional lubricants such as engine or gearbox oil may be used, but do not use lubricants containing graphite.*
- ◆ *Do not use degreased parts.*
- ◆ **Tolerance for tightening torques: $\pm 15\%$** poses, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Tightening torques

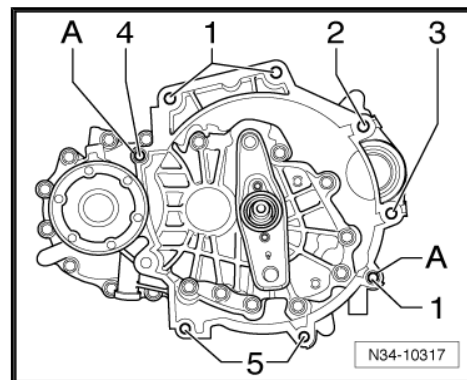
⇒ ["6.1 Assembly mountings - exploded view", page 30](#)

Further tightening torques

Component		Nm
Bolts/nuts	M6	10
	M7	15
	M8	22
	M10	40
	M12	65

Securing gearbox to engine

Item	Bolt	Nm
1	M12x65	80
2 ¹⁾	M12x135	80
3 ¹⁾	M12x150	80
4	M12x80	80
5	M10x50	40
A	Dowel sleeves for centralising	
• ¹⁾ Also for starter to gearbox		



Procedure

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

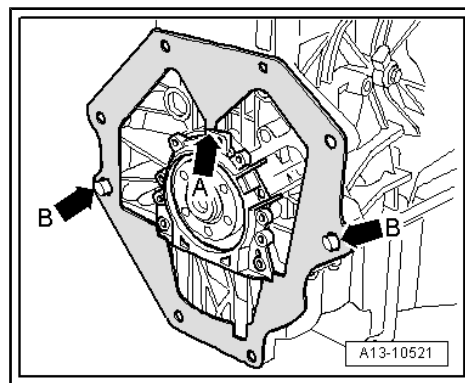
- Engine attached to engine support - T40075-



Note

- ◆ *Renew self-locking nuts and bolts.*
- ◆ *Renew bolts which are tightened to a specified angle as well as seals and gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *Fit cable ties in the original positions when installing.*
- If not already fitted, install dowel sleeves for centring engine and gearbox in cylinder block.

- Ensure that intermediate plate is engaged on sealing flange -arrow A- and pushed onto dowel sleeves -arrows B-.
- Clean the input shaft splines and the hub splines. Remove corrosion and apply only a very thin coating of grease to the splines. Remove excess grease ⇒ Electronic parts catalogue (ETKA) .
- Check clutch release bearing for wear; renew if necessary ⇒ Rep. gr. 30 .
- Check oil seal for flange shaft (right-side) for leaks; renew if necessary ⇒ Rep. gr. 39 .
- Secure gearbox to engine.
- Install flange shaft (right-side) ⇒ Rep. gr. 39 .
- Install starter ⇒ Rep. gr. 27
- Install bracket for exhaust manifold
⇒ ["2.1 Exhaust manifold - exploded view", page 164](#) .
- Make sure there is sufficient clearance for gear selector cables and engine wiring harness when lifting engine/gearbox assembly.
- Guide engine/gearbox assembly into body.
- Install gearbox mounting ⇒ Rep. gr. 34 .
- Install engine mountings
⇒ ["6.2 Removing and installing engine mountings", page 31](#) .
- Remove engine support - T40075- from engine.
- Install pressure control valve for crankcase breather system
⇒ [Fig. "Pressure control valve for crankcase breather system - tightening torques", page 119](#) .
- Install support for intake manifold ⇒ Rep. gr. 24 .
- Install pendulum support
⇒ ["6.3 Removing and installing pendulum support", page 32](#) .
- Install drive shafts and swivel joints ⇒ Rep. gr. 40 .
- Install air conditioner compressor ⇒ Rep. gr. 87 .
- Install poly V-belt
⇒ ["1.2 Removing and installing poly V-belt", page 35](#) .
- Install front exhaust pipe
⇒ ["1.3 Removing and installing front exhaust pipe", page 159](#) .
- Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.



Caution

Avoid damage to clutch slave cylinder.

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

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- Install clutch slave cylinder ⇒ Rep. gr. 30 .
- Install and adjust gear selector cable and gate selector cable
⇒ Rep. gr. 34 .
- Install radiator fan
⇒ ["1.12 Removing and installing radiator fan V7 ", page 155](#) .

- Install connection with guide tube for oil dipstick and oil filler pipe
⇒ Fig. [““Connection with guide tube for oil dipstick and oil filler pipe - tightening torque””](#), page 120 .
- Observe notes on procedure for connecting the battery ⇒ Rep. gr. 27 .
- Check engine oil level ⇒ Maintenance ; Booklet 809 .



Caution

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

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

- Fill up with coolant ⇒ [page 134](#) .

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6 Assembly mountings

⇒ "6.1 Assembly mountings - exploded view", page 30

⇒ "6.2 Removing and installing engine mountings", page 31

⇒ "6.3 Removing and installing pendulum support", page 32

6.1 Assembly mountings - exploded view

1 - Bolt

- ☐ 50 Nm

2 - Bolts

- ☐ Renew
- ☐ 60 Nm + turn 90° further

3 - Pendulum support

- ☐ Removing and installing ⇒ "6.3 Removing and installing pendulum support", page 32

4 - Engine mounting

- ☐ Removing and installing ⇒ "6.2 Removing and installing engine mountings", page 31

5 - Bolt

- ☐ Renew
- ☐ 23 Nm + turn 90° further

6 - Support arm

7 - Nut

- ☐ Do not loosen unless renewing engine mounting-item 4-
- ☐ Renew
- ☐ 40 Nm + turn 90° further

8 - Bolt

- ☐ Renew
- ☐ 60 Nm + turn 90° further

9 - Engine support

10 - Bolt

- ☐ 50 Nm

11 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34

12 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34

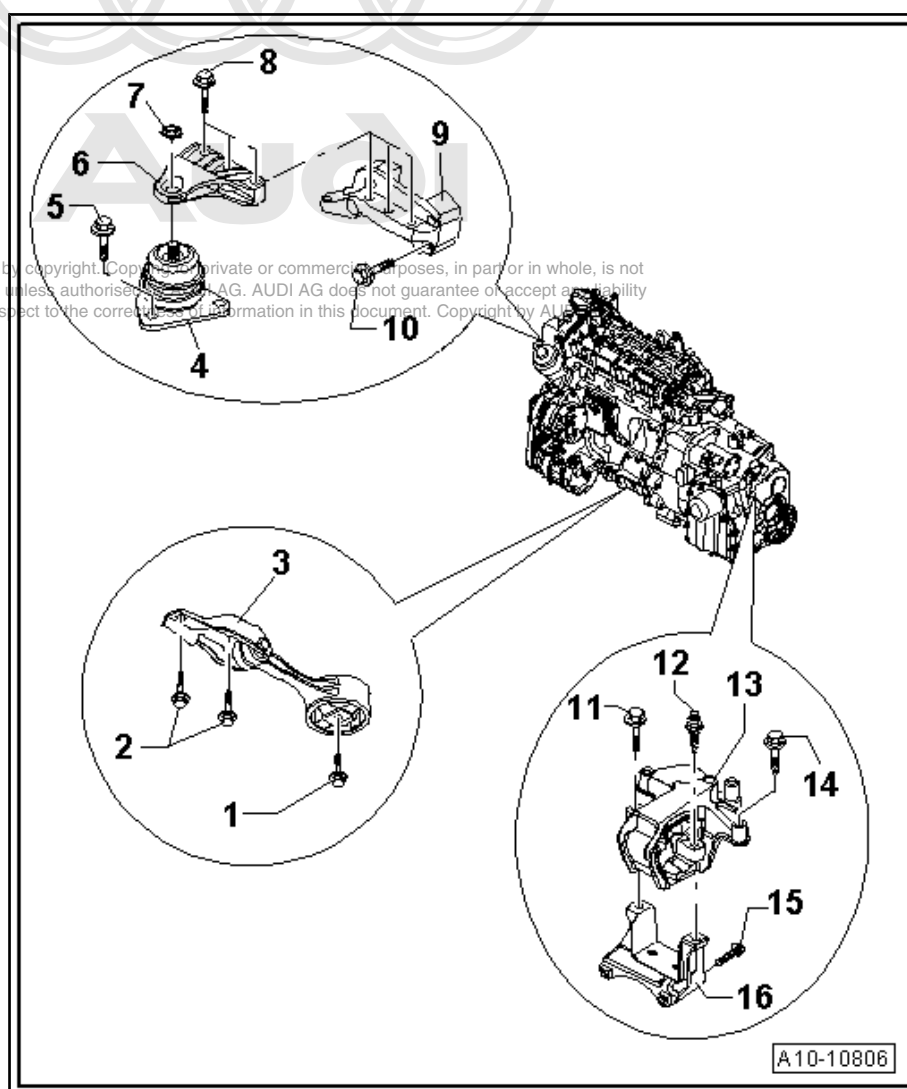
13 - Gearbox mounting

14 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34

15 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 34

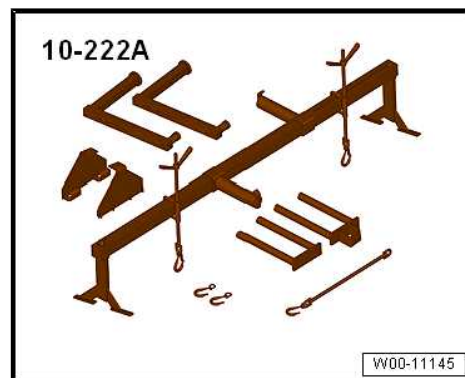


16 - Gearbox support

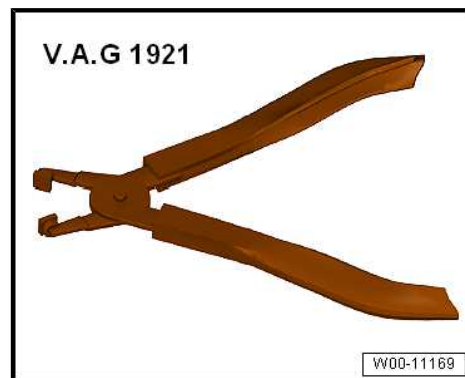
6.2 Removing and installing engine mountings

Special tools and workshop equipment required

- ◆ Support bracket - 10 - 222 A-

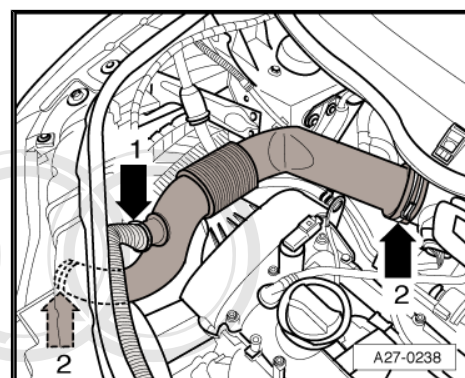


- ◆ Hose clip pliers - V.A.G 1921-

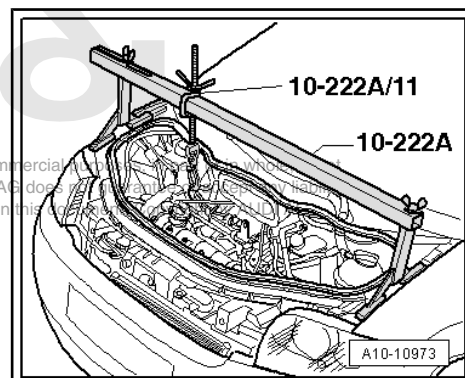


Removing

- Detach bonnet ⇒ ["1 Detaching bonnet", page 7](#).
- Press release tabs and detach resonator from air hose -arrow 1-.
- Use hose clip pliers - V.A.G 1921- to loosen spring-type hose clips -arrows 2- and detach air duct.



- Set up support bracket - 10 - 222 A- on bolted flanges of wing panels.
- The spindle is located at rear.
- Attach hook of spindle - 10 - 222 A /11- to engine lifting eye (right-side).
- Take up weight of engine with the spindle, but do not lift.





Note

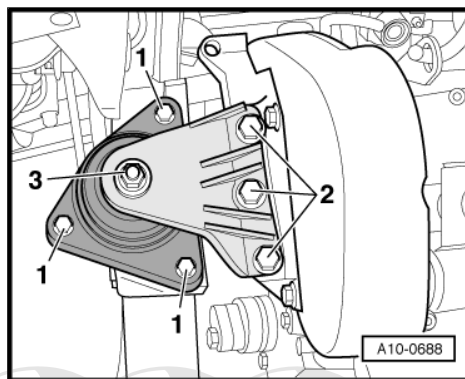
Do not loosen nut -3- unless renewing engine mounting.

- Remove bolts -1- and -2- and detach engine mounting with support arm.

Installing

- Tightening torque
⇒ ["6.1 Assembly mountings - exploded view", page 30](#)

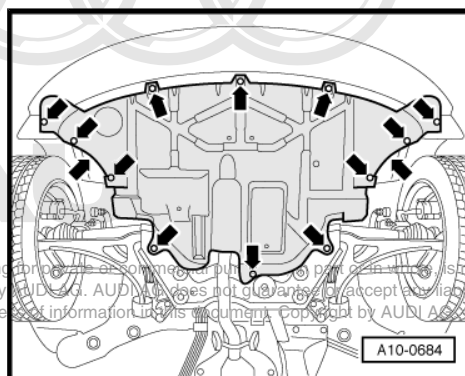
Install in reverse order.



6.3 Removing and installing pendulum support

Removing

- Release fasteners -arrows- and remove noise insulation.



- Remove bolts -arrows- and detach pendulum support.

Installing

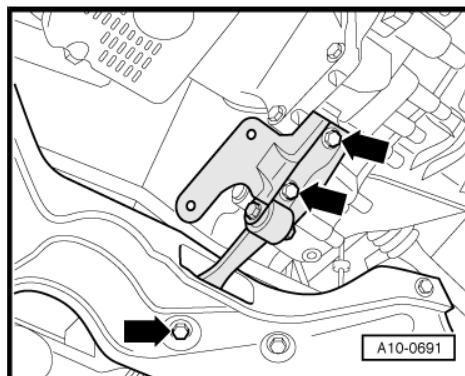
Installation is carried out in the reverse order; note the following:



Note

Renew the bolts tightened with specified tightening angle.

- Install noise insulation ⇒ Rep. gr. 50 .



13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ [“1.1 Poly V-belt drive - exploded view”, page 33](#)

⇒ [“1.2 Removing and installing poly V-belt”, page 35](#)

⇒ [“1.3 Removing and installing tensioner for poly V-belt”, page 36](#)

⇒ [“1.4 Removing and installing poly V-belt pulley for crankshaft”, page 37](#)

⇒ [“1.5 Removing and installing bracket for ancillaries”, page 38](#)

1.1 Poly V-belt drive - exploded view

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1 - Poly V-belt pulley for crankshaft

- ☐ Removing and installing
⇒ [“1.4 Removing and installing poly V-belt pulley for crankshaft”, page 37](#)

- ☐ Note location

2 - Bolt

- ☐ With washer
- ☐ For poly V-belt pulley and crankshaft sprocket
- ☐ Renew
- ☐ Lubricate thread with oil before fitting
- ☐ Tightening torque
⇒ [page 34](#)

3 - Poly V-belt

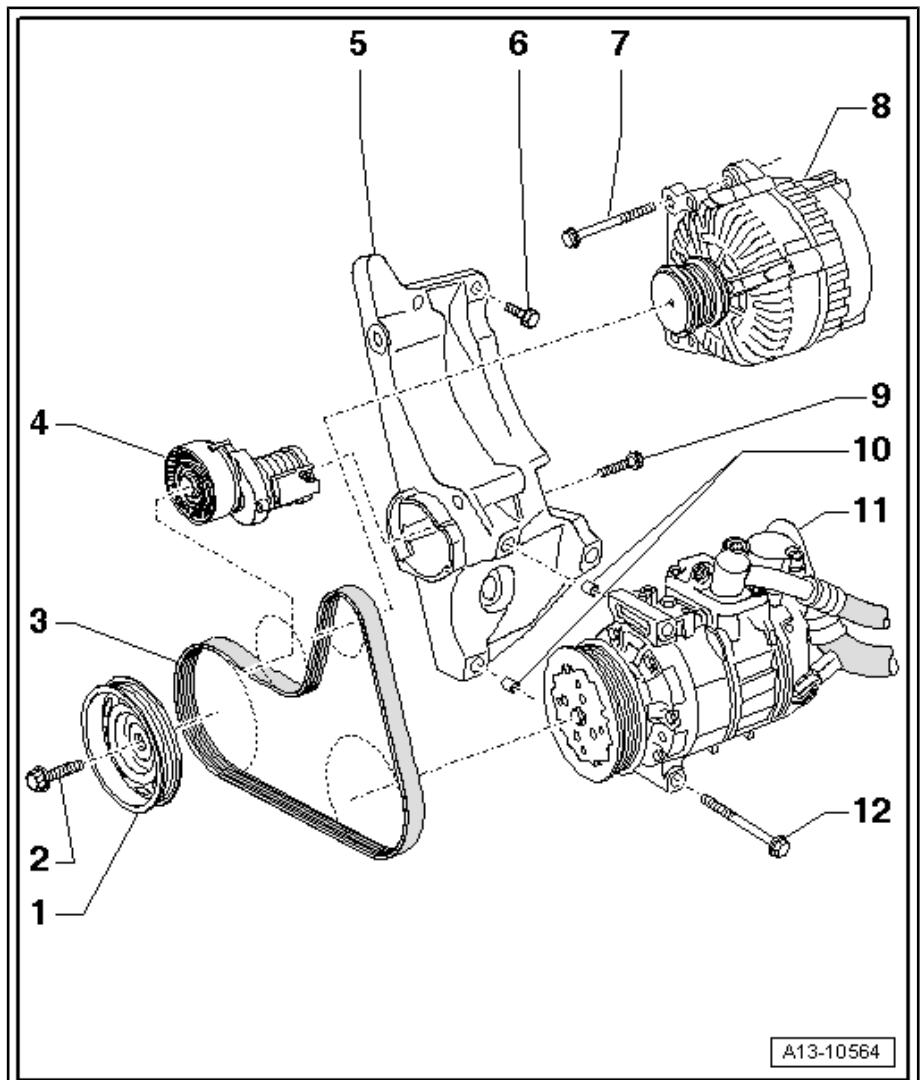
- ☐ Check for wear
- ☐ Do not kink
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing
⇒ [“1.2 Removing and installing poly V-belt”, page 35](#)
- ☐ When installing, make sure it is properly seated on pulleys.

4 - Poly V-belt tensioner

- ☐ Pivot with ring spanner to slacken poly V-belt
- ☐ Lock with locking pin - T10060 A-
- ☐ Removing and installing ⇒ [“1.3 Removing and installing tensioner for poly V-belt”, page 36](#)

5 - Bracket for ancillaries

- ☐ Removing and installing ⇒ [“1.5 Removing and installing bracket for ancillaries”, page 38](#)



6 - Bolt

- ☐ Tightening torque and sequence

⇒ Fig. ["Bracket for ancillaries - tightening torque and tightening sequence"](#), page 35

7 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 27

8 - Alternator

- ☐ Removing and installing ⇒ Rep. gr. 27

9 - Bolt

- ☐ Renew
- ☐ 20 Nm + turn 90° further

10 - Bushes

11 - Air conditioner compressor

- ☐ Removing and installing ⇒ Rep. gr. 87

12 - Bolt

- ☐ Tightening torque ⇒ Rep. gr. 87



Bolt for pulley - tightening torque



Note

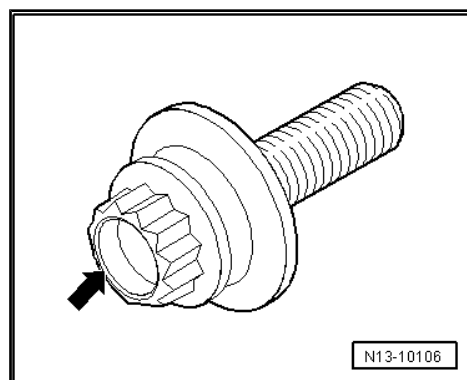
- ◆ *A new securing bolt is being introduced gradually.*
- ◆ *Until new bolt type is introduced, please use old type.*
- ◆ *Introduction of the new securing bolt ⇒ Electronic parts catalogue*
- ◆ *Please note that the contact surfaces of the pulley and the securing bolt must be free of oil and grease.*

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Version 1: Bolt with bored head -arrow-

- Renew bolt.

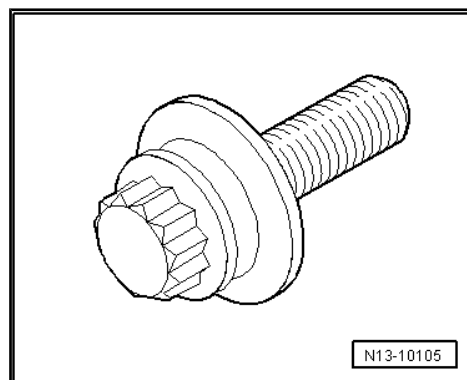
Tightening torque: 150 Nm + turn 180° further.



Version 2: Bolt without bored head

- Renew bolt.

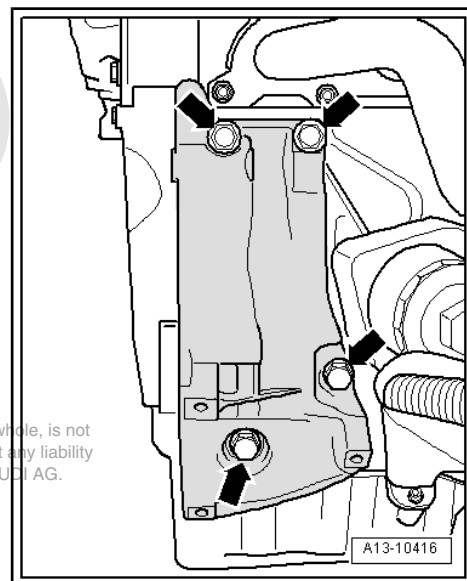
Tightening torque: 90 Nm + turn 90° further.



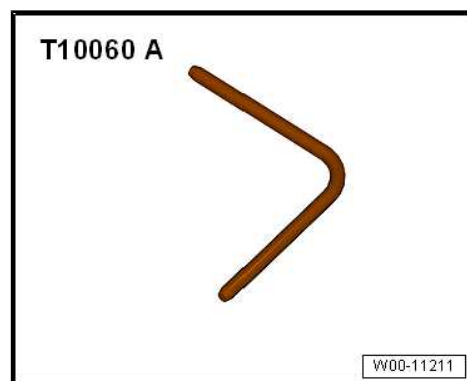
Bracket for ancillaries - tightening torque and tightening sequence

- Tighten bolts -arrows- for bracket for ancillaries in two stages as follows:
 1. Screw in by hand until contact is made.
 2. Tighten in diagonal sequence to 23 Nm.

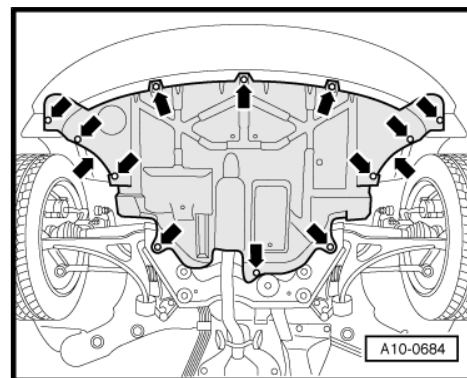
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**1.2 Removing and installing poly V-belt****Special tools and workshop equipment required**

- ◆ Locking pin - T10060 A-

**Removing**

- Release fasteners -arrows- and remove noise insulation.





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 poly V-belt with chalk or felt-tip pen for re-installation.*

- To slacken poly V-belt use ring spanner to turn tensioner in clockwise direction -arrow-.
- Use locking pin - T10060 A- to lock poly V-belt tensioner and detach poly V-belt.

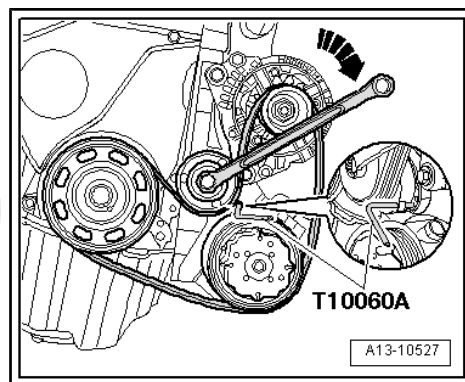
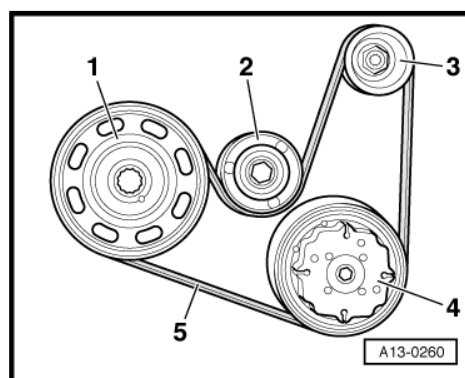
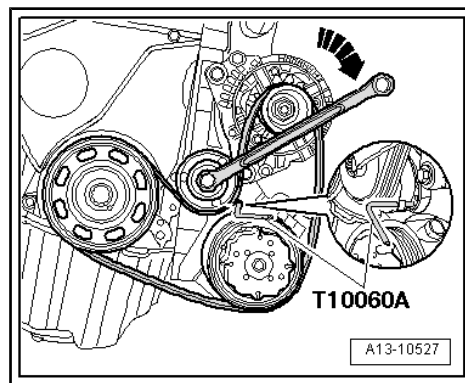
Installing

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

Routing of poly V-belt on vehicles with air conditioner:

- 1 - Poly V-belt pulley for crankshaft
- 2 - Tensioner
- 3 - Alternator
- 4 - Air conditioner compressor
- 5 - Poly V-belt

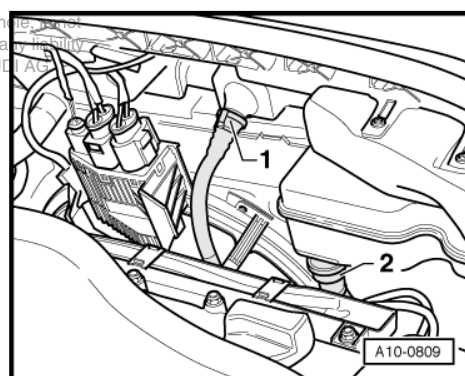
- Use ring spanner to turn tensioner slightly in clockwise direction -arrow- and pull out locking pin - T10060 A- .
- Check that poly V-belt is properly seated.
- Start engine and check that poly V-belt runs properly.
- Install noise insulation ⇒ Rep. gr. 50 .



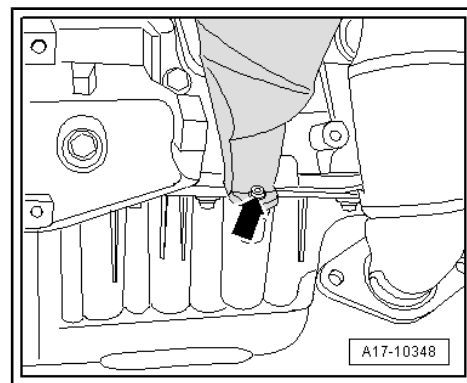
1.3 Removing and installing tensioner for poly V-belt

Removing

- Detach bonnet ⇒ ["1 Detaching bonnet", page 7](#) .
- Pull oil dipstick out of guide tube.
- Detach guide tube -1- for oil dipstick (press release tabs).
- Detach oil filler pipe -2- from oil filler reservoir.
- Remove poly V-belt ⇒ ["1.2 Removing and installing poly V-belt", page 35](#) .



- Remove bolt -arrow-, detach connection with guide tube for oil dipstick and oil filler pipe from sump.



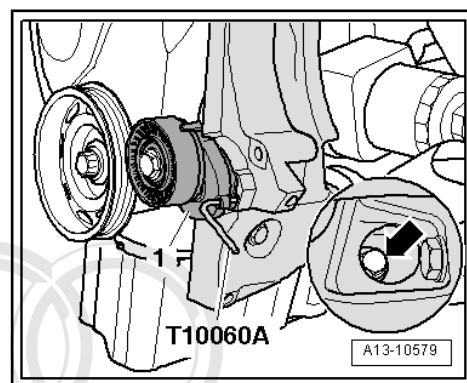
- Remove bolt -arrow- and take off tensioner -1- for poly V-belt.

Installing

- Tightening torque
⇒ [“1.1 Poly V-belt drive - exploded view”, page 33](#)

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

- Install connection with guide tube for oil dipstick and oil filler pipe
⇒ [Fig. “Connection with guide tube for oil dipstick and oil filler pipe - tightening torque”, page 120](#).
- Install poly V-belt
⇒ [“1.2 Removing and installing poly V-belt”, page 35](#).



1.4 Removing and installing poly V-belt pulley for crankshaft

Special tools and workshop equipment required

- ◆ Counterhold tool - 3415- with pins -3415/1-

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Removing

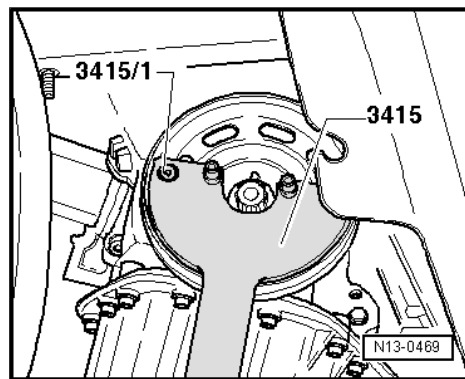
- Remove poly V-belt
⇒ [“1.2 Removing and installing poly V-belt”, page 35](#).
- Loosen bolt for poly V-belt pulley and toothed belt sprocket using counterhold tool - 3415- with pin -3415/1- to lock poly V-belt pulley.
- Remove bolt and take off poly V-belt pulley.



Caution

Risk of damage to engine.

- ◆ **To prevent the crankshaft sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.**
- ◆ **Fit bolt with 2 washers again to secure crankshaft sprocket.**



Installing

- Tightening torque
⇒ [“1.1 Poly V-belt drive - exploded view”, page 33](#)

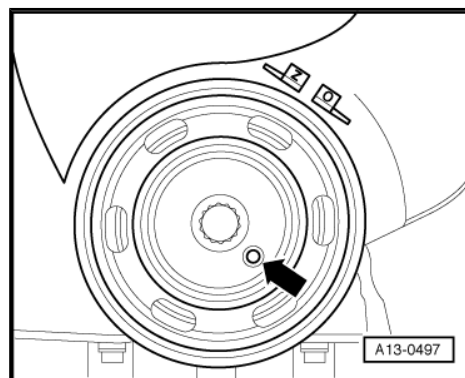
Installation is carried out in the reverse order; note the following:



Note

Renew bolt for poly V-belt pulley.

- Fit poly V-belt pulley so that recess on poly V-belt pulley engages in lug on toothed belt sprocket -arrow-.
- Install poly V-belt
⇒ [“1.2 Removing and installing poly V-belt”, page 35](#).



1.5 Removing and installing bracket for ancillaries

Removing

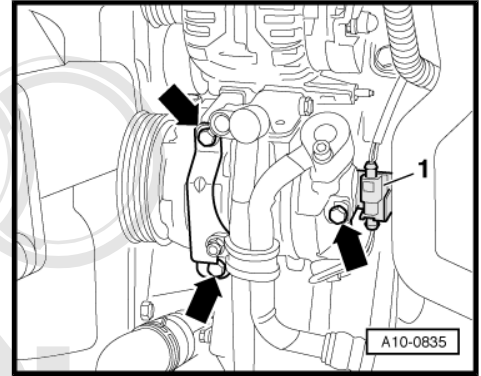
- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#).
- Remove poly V-belt
⇒ [“1.2 Removing and installing poly V-belt”, page 35](#).

- Unplug electrical connector -1- for magnetic clutch on air conditioner compressor.

**WARNING**

Risk of injury caused by refrigerant.

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



- Remove bolts -arrows- for air conditioner compressor.

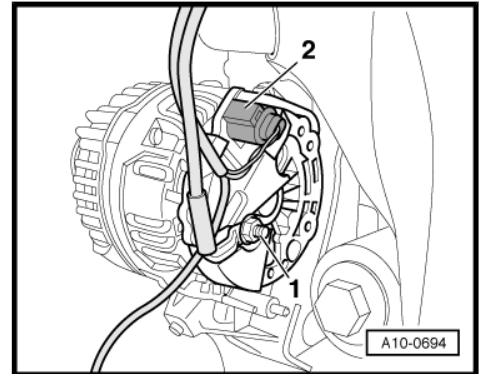
**Caution**

Danger of damage to refrigerant lines and hoses.

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

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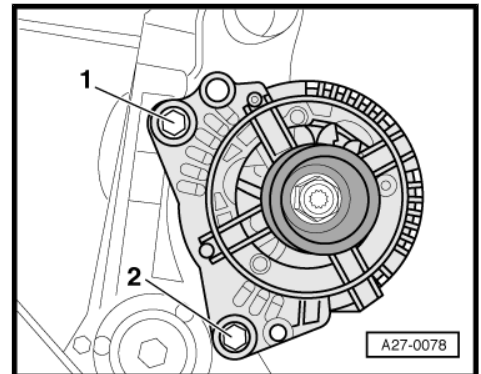
- Tie up air conditioner compressor together with refrigerant hoses to lock carrier (refrigerant hoses remain connected).
- Unscrew wiring for terminal 30/B+ -item 1- from alternator.
- Unplug electrical connector -2-.



- Remove bolts -1- and -2- for alternator.

**Note**

- ◆ *If alternator sticks in its bracket, screw securing bolt back in again down to the last 2 turns.*
- ◆ *Tap carefully on bolt heads with flat side of hammer to release bushes of alternator mountings.*
- Remove alternator.

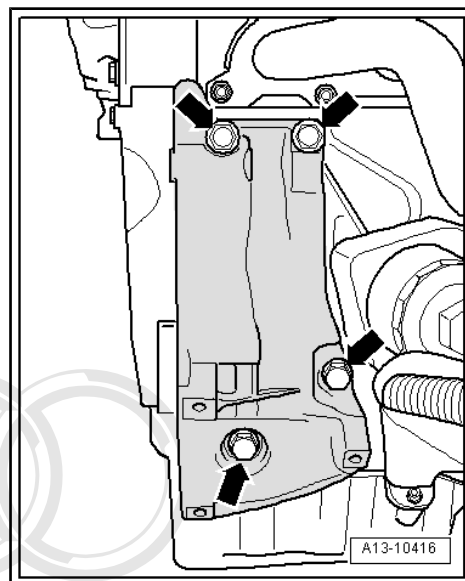


- Remove bolts -arrows- and detach bracket for ancillaries.

Installing

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

- Tighten bolts for bracket for ancillaries
⇒ Fig. “Bracket for ancillaries - tightening torque and tightening sequence”, page 35 .
- Install alternator ⇒ Rep. gr. 27 .
- Install air conditioner compressor ⇒ Rep. gr. 87 .



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2 Toothed belt drive

⇒ [“2.1 Toothed belt drive - exploded view”, page 41](#)

⇒ [“2.2 Checking valve timing”, page 42](#)

⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#)

⇒ [“2.4 Removing and installing coupling drive toothed belt”, page 50](#)

⇒ [“2.5 Checking tensioning roller for main drive toothed belt”, page 51](#)

⇒ [“2.6 Checking tensioning roller for coupling drive toothed belt”, page 52](#)

2.1 Toothed belt drive - exploded view

1 - Bolt

- ☐ Renew
- ☐ 12 Nm

2 - Cover (bottom) for toothed belt

3 - Bolt

- ☐ Tightening torque
⇒ [Item 6 \(page 139\)](#)

4 - Cover (rear) for toothed belt

5 - Bolt

- ☐ 10 Nm

6 - Bolt

- ☐ 50 Nm

7 - Idler roller

- ☐ For main drive toothed belt

8 - Screw plug

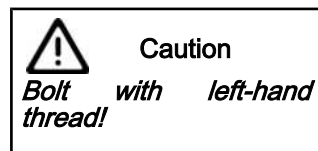
- ☐ 25 Nm

9 - O-ring

- ☐ Renew if damaged

10 - Cover (top) for toothed belt

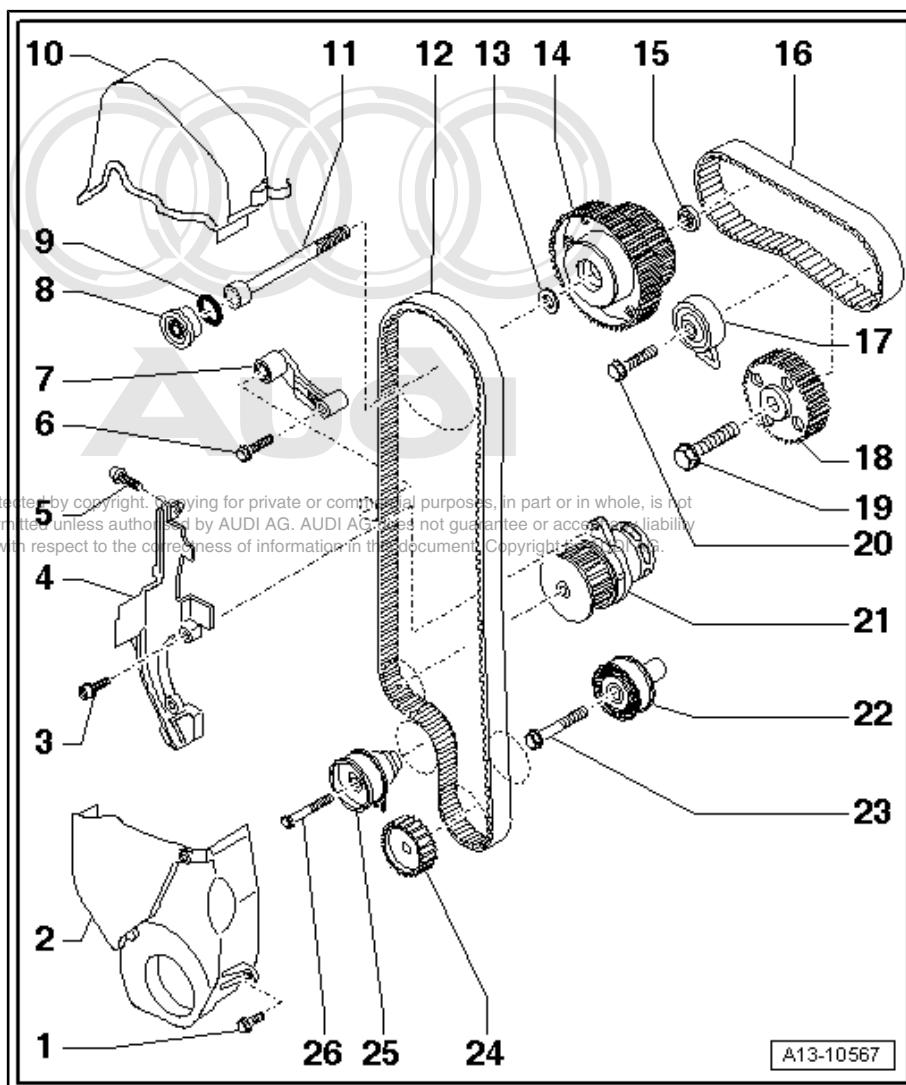
11 - Bolt



- ☐ Tightening torque
⇒ [Item 5 \(page 87\)](#)

12 - Main drive toothed belt

- ☐ Check for wear
- ☐ Do not kink
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing ⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#)



13 - Washer**14 - Inlet camshaft sprocket with camshaft adjuster**

- ☐ Do not dismantle
- ☐ Removing and installing
⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#)

15 - Washer

- ☐ Not fitted on later versions ⇒ Electronic parts catalogue
- ☐ If a washer was originally fitted, renew washer and install again

16 - Coupling drive toothed belt

- ☐ Check for wear
- ☐ Do not kink
- ☐ Before removing, mark direction of rotation with chalk or felt-tip pen
- ☐ Removing and installing ⇒ [“2.4 Removing and installing coupling drive toothed belt”, page 50](#)

17 - Tensioning roller

- ☐ For coupling drive toothed belt
- ☐ Checking ⇒ [“2.6 Checking tensioning roller for coupling drive toothed belt”, page 52](#)

18 - Exhaust camshaft sprocket

- ☐ Removing and installing
⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#)

19 - Bolt

- ☐ Tightening torque ⇒ [Item 32 \(page 88\)](#)

20 - Bolt

- ☐ 20 Nm

21 - Coolant pump

- ☐ Removing and installing ⇒ [“1.4 Removing and installing coolant pump”, page 139](#)

22 - Idler roller

- ☐ For main drive toothed belt

23 - Bolt

- ☐ 50 Nm

24 - Crankshaft sprocket

- ☐ Contact surface between sprocket and crankshaft must be free of oil
- ☐ Can only be installed in one position
- ☐ Detach after removing main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#)

25 - Tensioning roller

- ☐ For main drive toothed belt
- ☐ Checking ⇒ [“2.5 Checking tensioning roller for main drive toothed belt”, page 51](#)

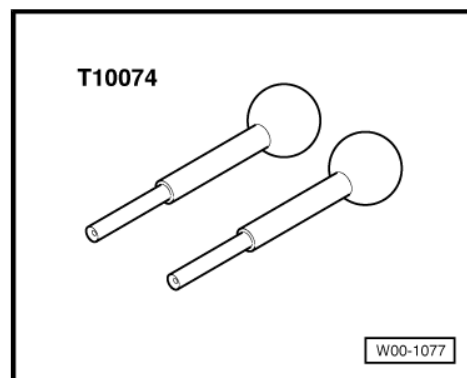
26 - Bolt

- ☐ 20 Nm

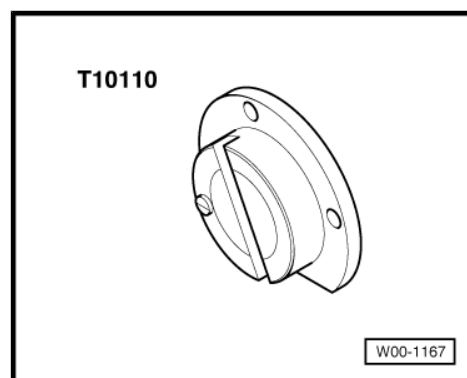
2.2 Checking valve timing

Special tools and workshop equipment required

◆ Locking pin - T10074-

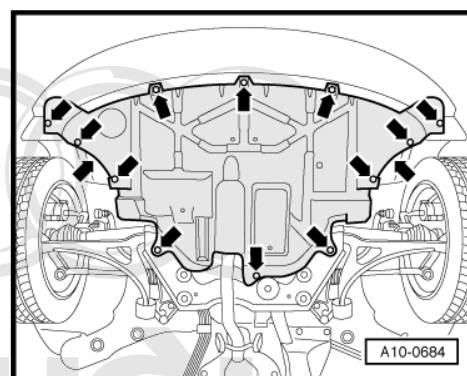


◆ Locating flange - T10110-

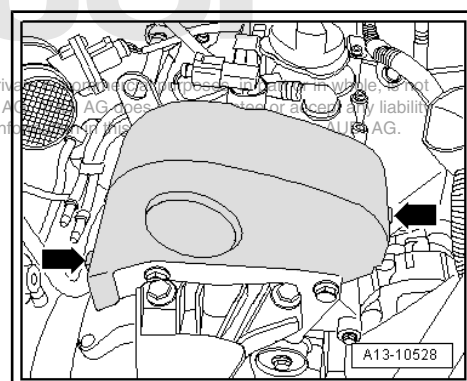


Procedure

- Remove high-pressure pump ⇒ Rep. gr. 24 .
- Release fasteners -arrows- and remove noise insulation.

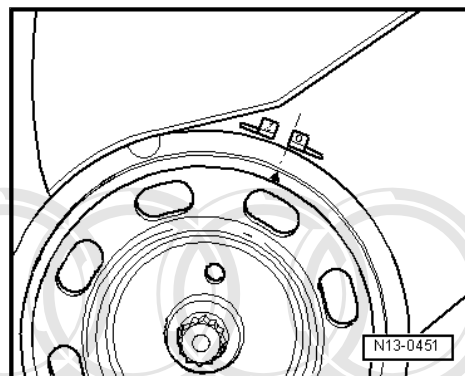


- Release retaining clips -arrows- and detach cover (top) for toothed belt.



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- Rotate crankshaft in normal direction of rotation to “TDC”.
- Notch on crankshaft pulley must align with edge of marking -O-.



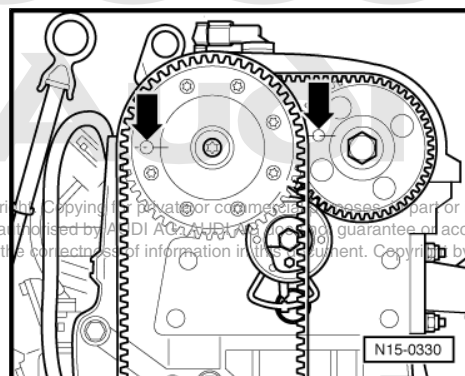
- The locking pin holes in the inlet camshaft sprocket with camshaft adjuster and in the exhaust camshaft sprocket must align with the corresponding holes in the camshaft housing -arrows-.



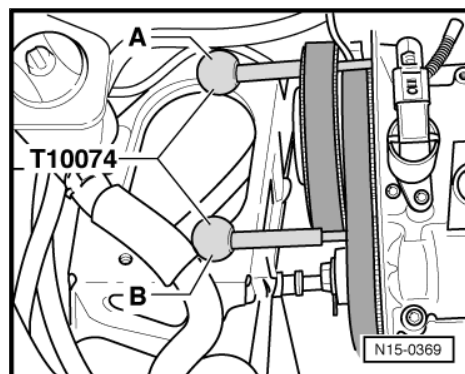
Note

If the locating holes are positioned on the opposite side, the crankshaft must be turned one revolution further.

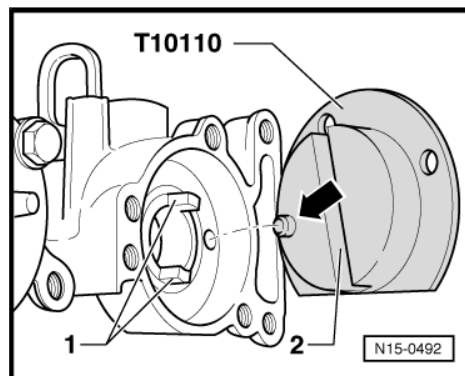
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- Lock camshafts using locking pins - T10074- :
- It should be possible to insert locking pin -A- through locking pin hole in inlet camshaft sprocket into corresponding hole in camshaft housing.
- It should be possible to insert locking pin -B- through locking pin hole in exhaust camshaft sprocket into corresponding hole in camshaft housing.



- Attach locating flange - T10110- to camshaft housing of inlet camshaft working from side facing gearbox as follows:
- The pin -arrow- on the locating flange -T10110- must engage in the small hole on the axial bearing of the inlet camshaft.
- The lugs -1- on the inlet camshaft must engage in the slot -2- in the locating flange -T10110- .

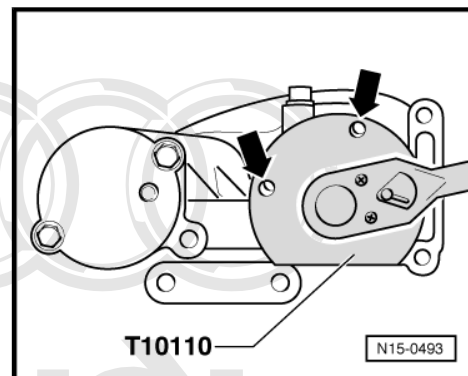


- Turn inlet camshaft at hexagon of locating flange -T10110- in opposite direction of engine rotation as far as stop and hold in position.
- If the valve timing is correct, the holes -arrows- in the locating flange - T10110- must align with the tapped holes in the camshaft housing.

Assembling

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

- Install noise insulation ⇒ Rep. gr. 50 .
- Install high-pressure pump ⇒ Rep. gr. 24 .

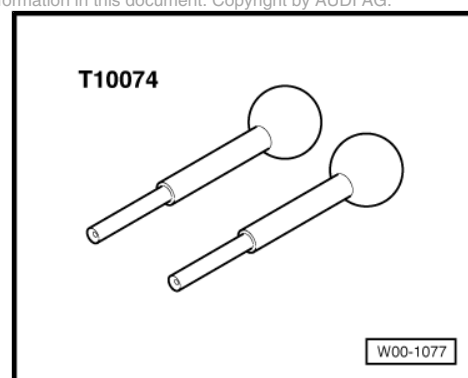


2.3 Removing and installing main drive toothed belt

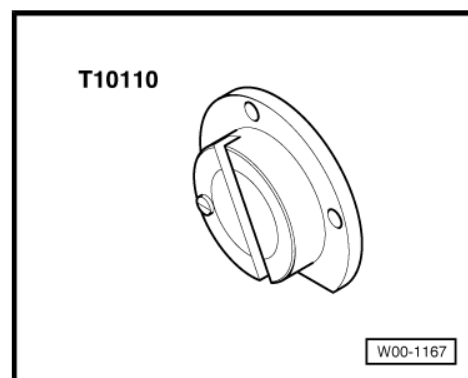
Special tools and workshop equipment required

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- ◆ Locking pin - T10074-

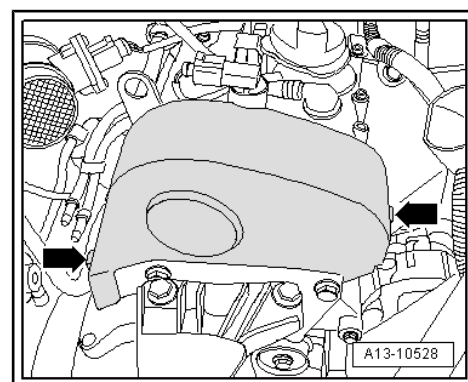


- ◆ Locating flange - T10110-

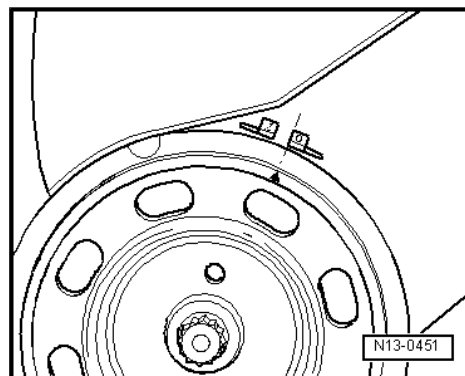


Removing

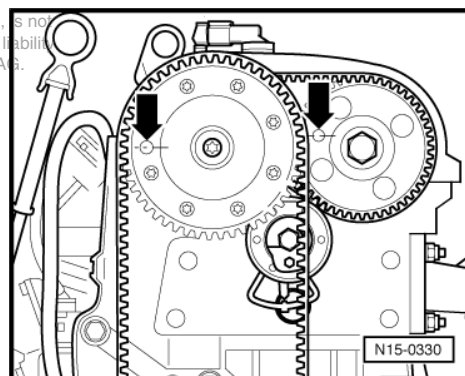
- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .
- Remove poly V-belt
⇒ [“1.2 Removing and installing poly V-belt”, page 35](#) .
- Release retaining clips -arrows- and detach cover (top) for toothed belt.



- Rotate crankshaft in normal direction of rotation to “TDC”.
- Notch on crankshaft pulley must align with edge of marking -O-.



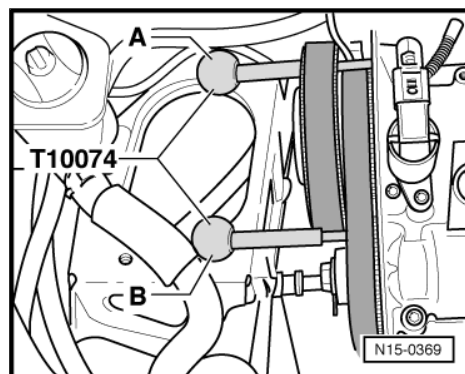
- The locking pin holes in the inlet camshaft sprocket with camshaft adjuster and in the exhaust camshaft sprocket must align with the corresponding holes in the camshaft housing -arrows-.



Note

If the locating holes are positioned on the opposite side, the crankshaft must be turned one revolution further.

- Lock camshafts using locking pins - T10074- :
- It should be possible to insert locking pin -A- through locking pin hole in inlet camshaft sprocket into corresponding hole in camshaft housing.
- It should be possible to insert locking pin -B- through locking pin hole in exhaust camshaft sprocket into corresponding hole in camshaft housing.
- Remove engine mounting
⇒ [“6.2 Removing and installing engine mountings”, page 31](#) .



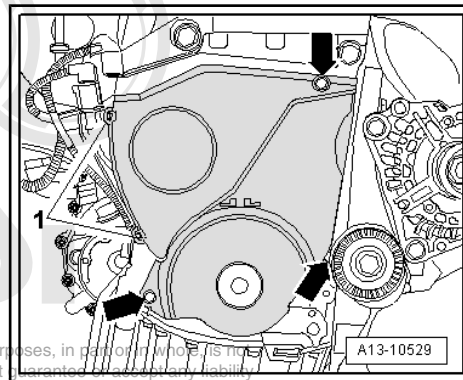
Caution

Risk of damage to engine.

- ◆ To prevent the crankshaft sprocket from slipping off the drive lug, do not rotate the crankshaft after the poly V-belt pulley has been detached.
- ◆ Secure crankshaft sprocket with bolt and 2 washers before turning crankshaft.

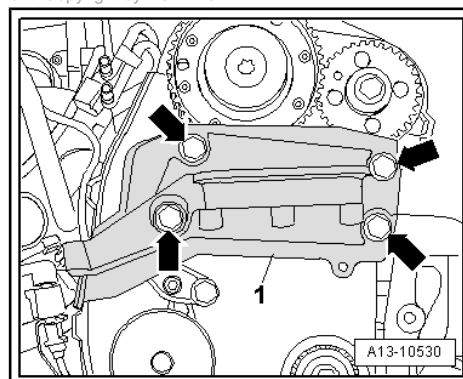
- Remove poly V-belt pulley for crankshaft
⇒ [“1.4 Removing and installing poly V-belt pulley for crankshaft”, page 37](#) .

- Remove bolts -arrows- and loosen retaining clips -1- to detach toothed belt cover (bottom).



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

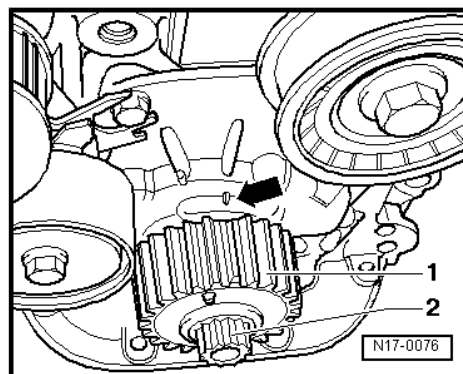


- Check “TDC” position of crankshaft:
 - The flat tooth on crankshaft sprocket -1- must align with marking -arrow- on oil pump housing.



Note

Disregard item -2-.

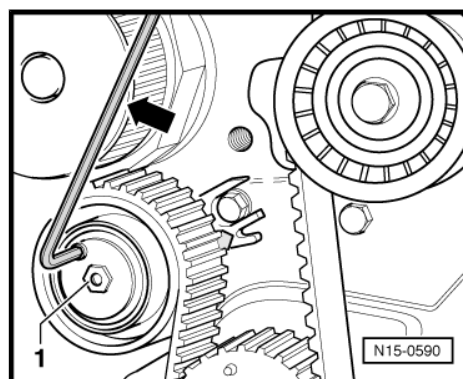


Caution

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- for main drive tensioning roller.
- Use an Allen key to turn tensioning roller in anti-clockwise direction -arrow- and detach toothed belt.

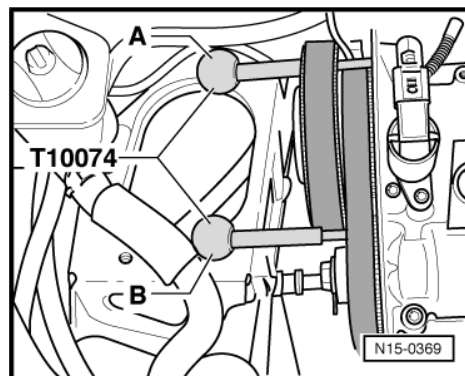


Installing

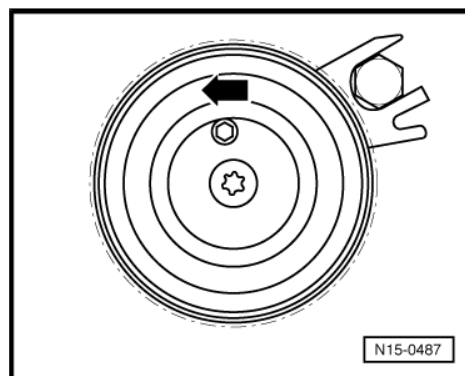
- Tightening torques
⇒ ["2.1 Toothed belt drive - exploded view", page 41](#)

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

- Inlet camshaft sprocket with camshaft adjuster and exhaust camshaft are locked with locking pins - T10074- .



- Install tensioning roller for main drive (if removed) and turn anti-clockwise to position shown -arrow- using Allen key.

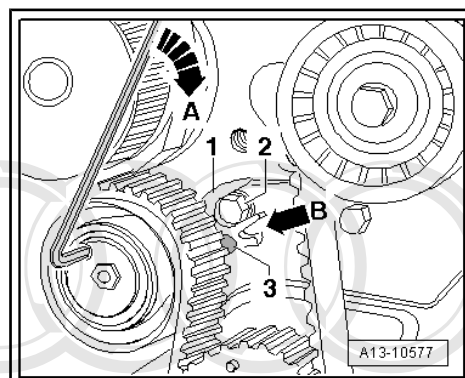


- Tighten bolt for main drive tensioning roller hand-tight.
- Bolt -2- for oil pump housing must engage in the recess in base plate -1-.



Note

Disregard items marked -3- and -arrows-.

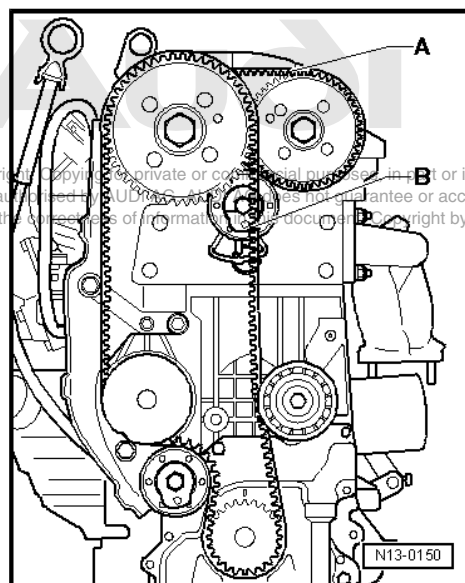


Note

Note the marking for direction of rotation when reinstalling a used toothed belt.

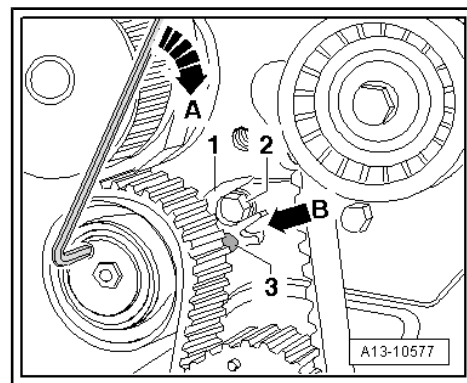
- Fit main drive toothed belt -B- in the sequence coolant pump, tensioning roller, crankshaft and inlet camshaft.

A - Coupling drive toothed belt



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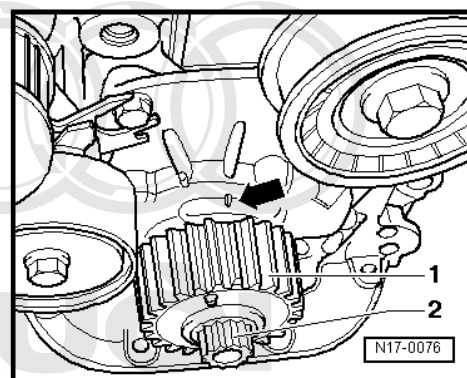
- To tension toothed belt, turn tensioning roller in clockwise direction -arrow A- until indicator -3- aligns with notch -arrow B- in base plate -1-.
- Tighten bolt for main drive tensioning roller.
- Remove locking pins - T10074- .
- Turn crankshaft 2 revolutions in direction of engine rotation and set to “TDC” once again.



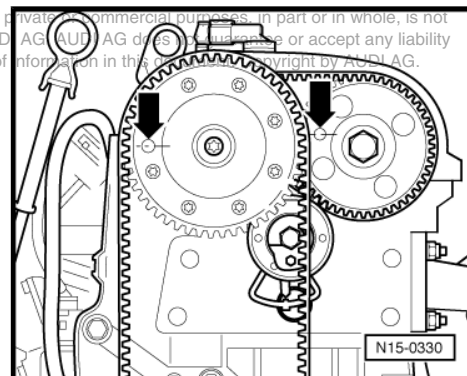
- Check “TDC” position of crankshaft:
 - The flat tooth on crankshaft sprocket -1- must align with marking -arrow- on oil pump housing.

**Note**

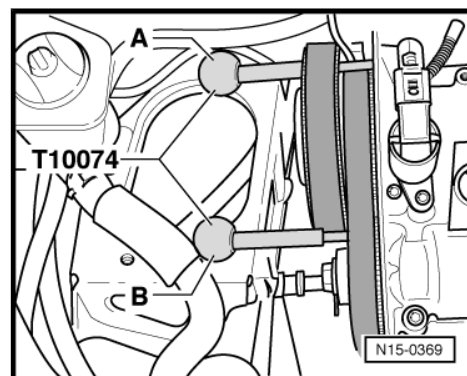
Disregard item -2-.



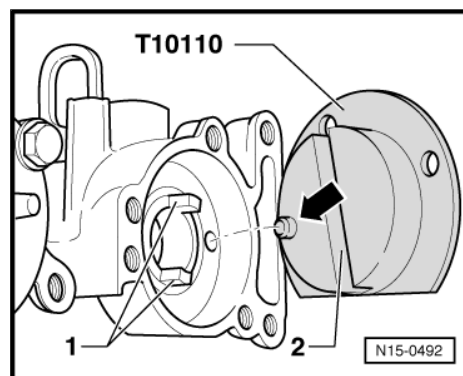
- The locking pin holes in the inlet camshaft sprocket with camshaft adjuster and in the exhaust camshaft sprocket must align with the corresponding holes in the camshaft housing -arrows-.



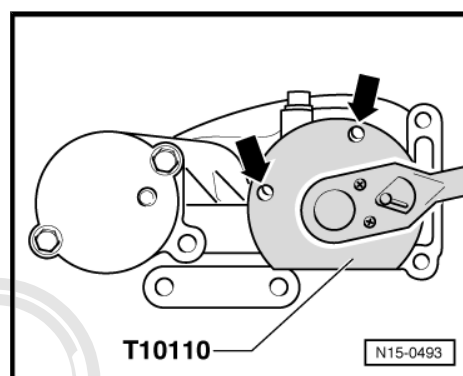
- Lock camshafts using locking pins - T10074- :
 - It should be possible to insert locking pin -A- through locking pin hole in inlet camshaft sprocket into corresponding hole in camshaft housing.
 - It should be possible to insert locking pin -B- through locking pin hole in exhaust camshaft sprocket into corresponding hole in camshaft housing.



- Attach locating flange - T10110- to camshaft housing of inlet camshaft working from side facing gearbox as follows:
- The pin -arrow- on the locating flange -T10110- must engage in the small hole on the axial bearing of the inlet camshaft.
- The lugs -1- on the inlet camshaft must engage in the slot -2- in the locating flange -T10110- .



- Turn inlet camshaft at hexagon of locating flange -T10110- in opposite direction of engine rotation as far as stop and hold in position.
- If the valve timing is correct, the holes -arrows- in the locating flange - T10110- must align with the tapped holes in the camshaft housing.
- Repeat adjustment procedure if holes do not align
⇒ [page 49](#) .



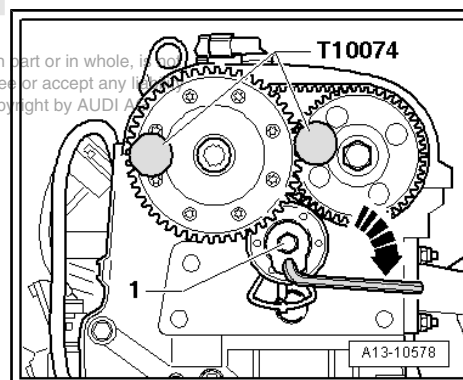
Remaining installation steps are carried out in reverse sequence; note the following:

- Install engine support and engine mounting
⇒ [“6.2 Removing and installing engine mountings”, page 31](#) .
- Install poly V-belt pulley for crankshaft
⇒ [“1.4 Removing and installing poly V-belt pulley for crankshaft”, page 37](#) .

2.4 Removing and installing coupling drive toothed belt

Removing

- Remove main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#) .
- Loosen bolt -1- on tensioning roller.
- Use Allen key to turn tensioning roller in clockwise direction -arrow- and slacken toothed belt.
- Remove bolt, detach tensioning roller and toothed belt.



Installing

- Tightening torque
⇒ ["2.1 Toothed belt drive - exploded view", page 41](#)

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

- Inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket are locked with locking pins - T10074- .
- Fit coupling drive toothed belt first onto inlet camshaft sprocket and then onto exhaust camshaft sprocket from above.
- The slack section of the toothed belt must be at the bottom.



Note

Note the marking for direction of rotation when reinstalling a used toothed belt.

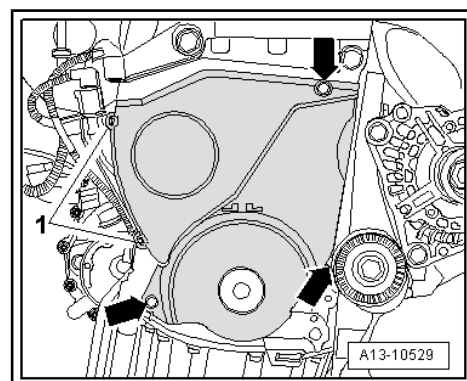
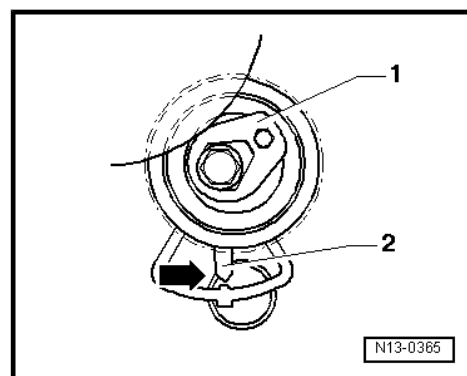
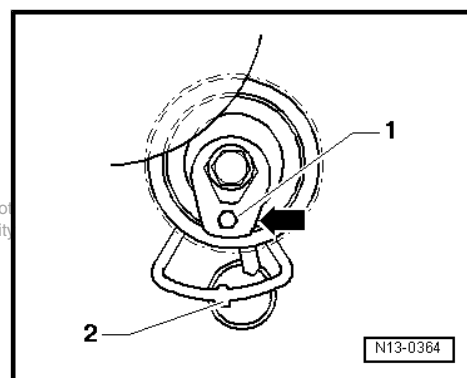
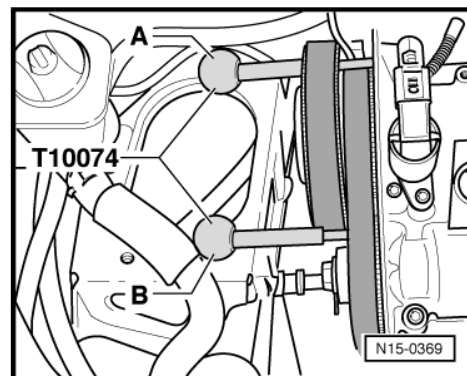
- Apply Allen key to hexagon socket -1- and turn tensioning roller in clockwise direction towards marking window -arrow-.
- Tensioning roller is in untensioned position.
- Press lower section of coupling drive toothed belt upwards with tensioning roller and fit bolt securing tensioning roller hand-tight.
- The lug -2- on the base plate must engage in the hole in the cylinder head.

- Tension toothed belt by turning tensioning roller -1- anti-clockwise until the indicator -2- aligns with the lug on the base plate in the marking window -arrow-.
- Tighten bolt for tensioning roller in this position.
- Install main drive toothed belt
⇒ ["2.3 Removing and installing main drive toothed belt", page 45](#) .

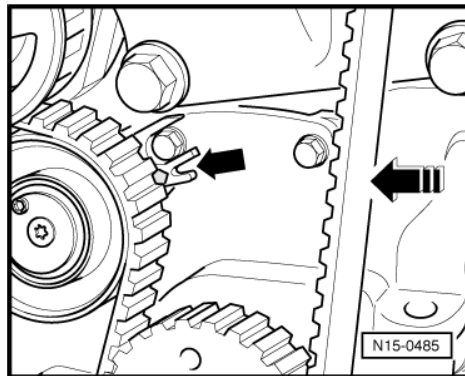
2.5 Checking tensioning roller for main drive toothed belt

Procedure

- Detach bonnet ⇒ [page 7](#) .
- Remove poly V-belt pulley for crankshaft
⇒ ["1.4 Removing and installing poly V-belt pulley for crankshaft", page 37](#) .
- Remove bolts -arrows- and loosen retaining clips -1- to detach toothed belt cover (bottom).



- Note position of indicator -left arrow- on tensioning roller and push in toothed belt with firm thumb pressure -right arrow-.
- The indicator must move to the side.
- Release tension on toothed belt.
- Turn crankshaft 2 rotations in direction of engine rotation.
- Check position of indicator on tensioning roller.
- The indicator must move back to its normal position.
- **Renew the tensioning roller if the indicator does not return to its previous position.**



Assembling

- Tightening torque
⇒ ["2.1 Toothed belt drive - exploded view", page 41](#)

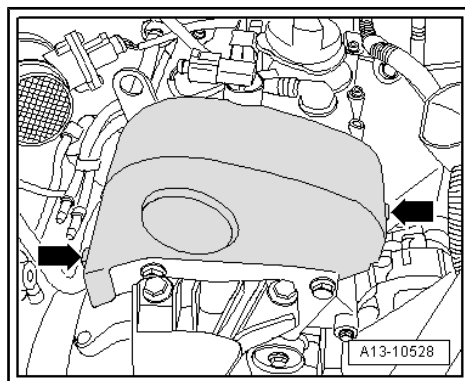
Installation is carried out in the reverse order; note the following:

- Install poly V-belt pulley for crankshaft
⇒ ["1.4 Removing and installing poly V-belt pulley for crankshaft", page 37](#).

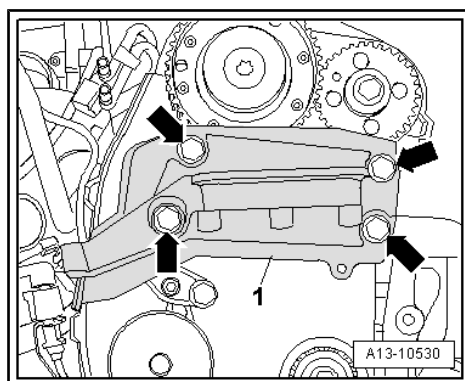
2.6 Checking tensioning roller for coupling drive toothed belt

Removing

- Remove engine mounting
⇒ ["6.2 Removing and installing engine mountings", page 31](#).
- Release retaining clips -arrows- and detach cover (top) for toothed belt.



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



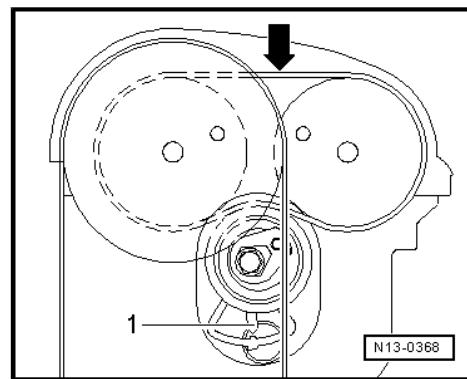
- Note position of indicator -1- on tensioning roller and push in toothed belt with firm thumb pressure -arrow-.
- The indicator must move to the side.
- Release tension on toothed belt.
- Turn crankshaft 2 rotations in direction of engine rotation.
- Check position of indicator on tensioning roller.
- The indicator must move back to its normal position.
- Renew the tensioning roller if the indicator does not return to its previous position.

Assembling

- Tightening torque
⇒ ["2.1 Toothed belt drive - exploded view", page 41](#)

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

- Install engine support and engine mounting
⇒ ["6.2 Removing and installing engine mountings", page 31](#) .



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3 Sealing flanges and flywheel



Note

Servicing clutch ⇒ Rep. gr. 30

⇒ ["3.1 Sealing flanges and flywheel - exploded view", page 54](#)

⇒ ["3.2 Renewing crankshaft oil seal", page 55](#)

⇒ ["3.3 Removing and installing flywheel", page 57](#)

⇒ ["3.4 Removing and installing sealing flange \(gearbox end\)", page 57](#)

3.1 Sealing flanges and flywheel - exploded view

1 - Bolt

- ☐ Renew
- ☐ Tightening torque
⇒ [Item 10 \(page 118\)](#)

2 - Crankshaft sprocket

- ☐ Contact surface between sprocket and crankshaft must be free of oil
- ☐ Can only be installed in one position
- ☐ Detach after removing main drive toothed belt
⇒ ["2.3 Removing and installing main drive toothed belt", page 45](#)

3 - Poly V-belt pulley for crankshaft

- ☐ Removing and installing
⇒ ["1.4 Removing and installing poly V-belt pulley for crankshaft", page 37](#)

4 - Bolt

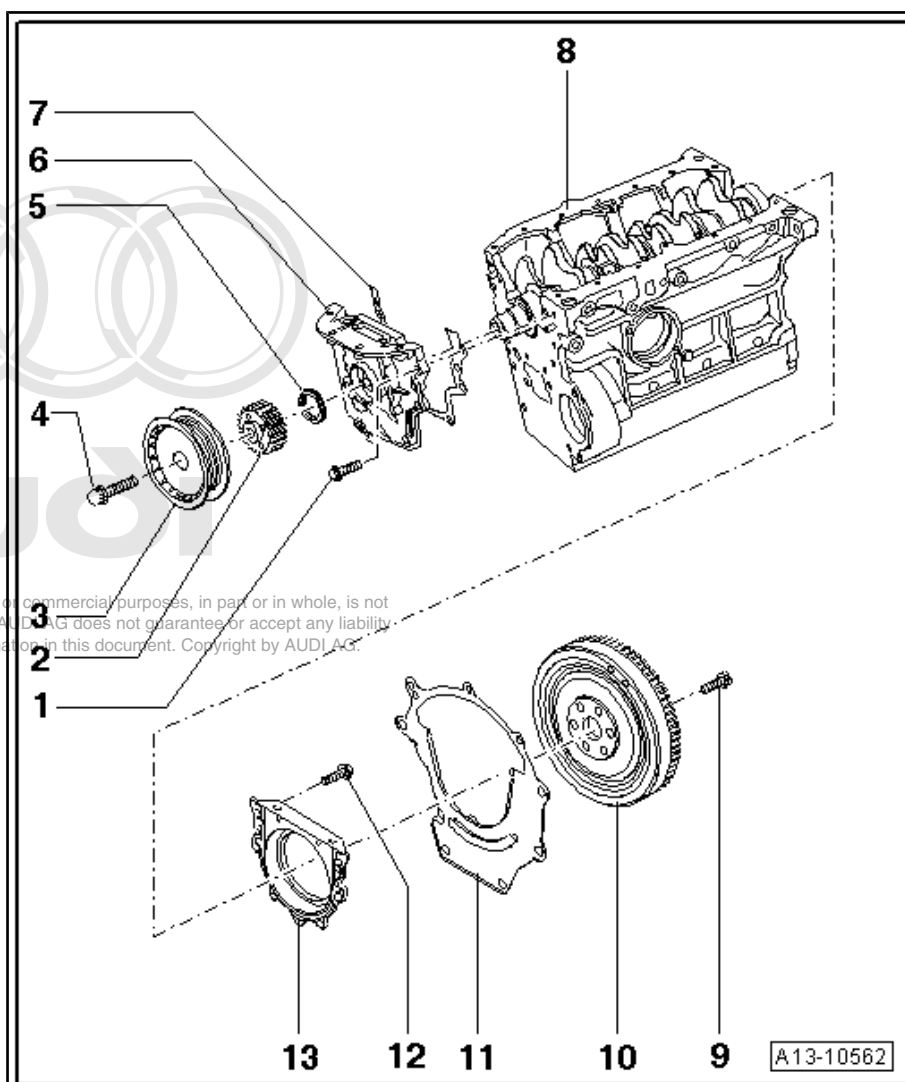
- ☐ With washer
- ☐ For poly V-belt pulley and crankshaft sprocket
- ☐ Renew
- ☐ Tightening torque
⇒ [Item 2 \(page 33\)](#)

5 - Crankshaft oil seal

- ☐ Renewing
⇒ ["3.2 Renewing crankshaft oil seal", page 55](#)

6 - Oil pump

- ☐ Oil pump housing is combined as one unit with sealing flange (pulley end)
- ☐ Removing and installing ⇒ ["1.4 Removing and installing oil pump", page 124](#)
- ☐ When installing note drive cams on crankshaft
- ☐ Must be positioned on dowel sleeves



7 - Gasket

- ☐ Renew
- ☐ Must be positioned on dowel sleeves

8 - Cylinder block**9 - Bolt**

- ☐ Renew
- ☐ 60 Nm + turn 90° further

10 - Flywheel

- ☐ Removing and installing ⇒ [“3.3 Removing and installing flywheel”, page 57](#)

11 - Intermediate plate

- ☐ Do not damage or bend when assembling
- ☐ Installing ⇒ [Fig. “Installing intermediate plate””, page 55](#)

12 - Bolt

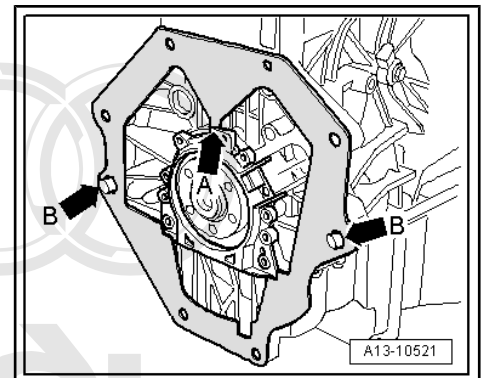
- ☐ Renew
- ☐ Tighten in diagonal sequence
- ☐ 12 Nm

13 - Sealing flange (gearbox end)

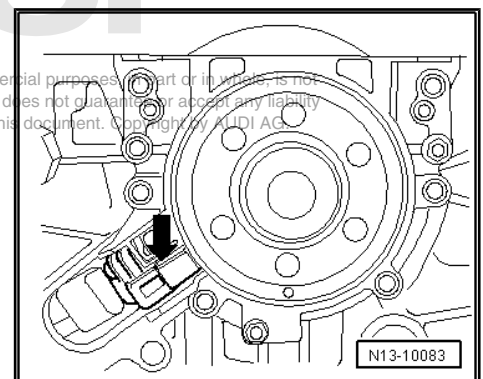
- ☐ With oil seal
- ☐ Removing and installing ⇒ [“3.4 Removing and installing sealing flange \(gearbox end\)”, page 57](#)
- ☐ Install using sealant; sealant ⇒ Parts catalogue

Installing intermediate plate

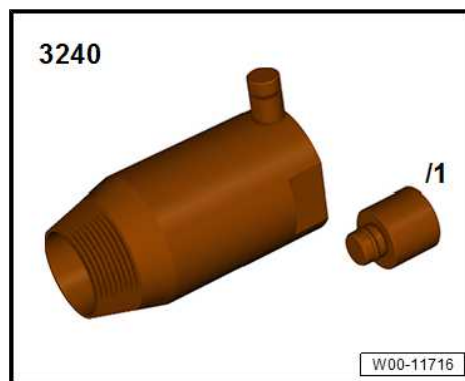
- Engage intermediate plate on sealing flange -arrow A- and push onto dowel sleeves -arrows B-.

**Engine speed sender - G28- - tightening torque**

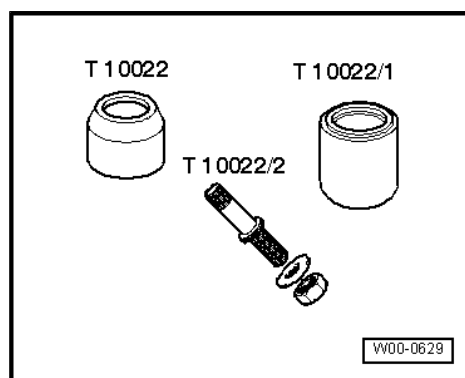
- Tighten bolt for engine speed sender - G28- to 4.5 Nm.

**3.2 Renewing crankshaft oil seal****Special tools and workshop equipment required**

◆ Oil seal extractor - 3240-

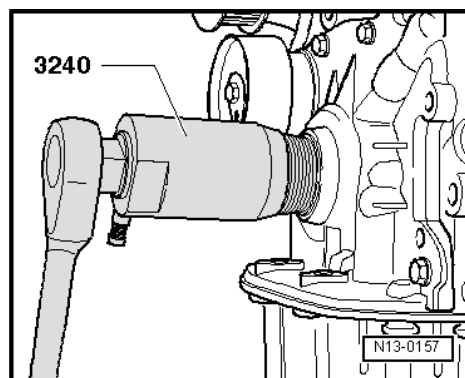


◆ Assembly tool - T10022-



Procedure

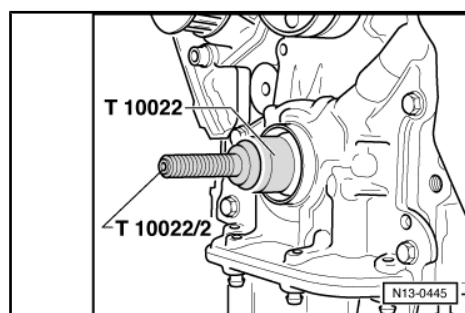
- Engine in vehicle.
- Remove main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#).
- Detach crankshaft sprocket.
- To guide oil seal extractor, screw bolt for poly V-belt pulley and toothed belt sprocket into crankshaft onto stop.
- Screw inner section of oil seal extractor - 3240- two turns (approx. 3 mm) out of outer section and lock with knurled screw.
- Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface for oil seal.



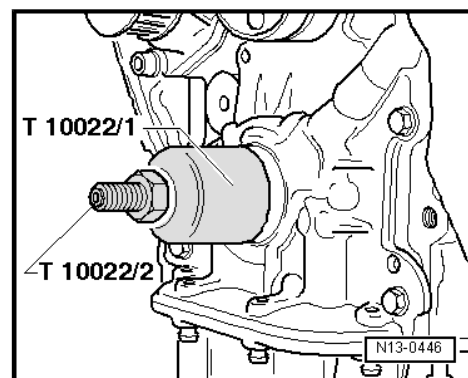
i Note

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

- Fit guide sleeve -T10022- onto crankshaft journal and turn spindle -T10022/2- in onto stop.
- Slide oil seal over guide sleeve.



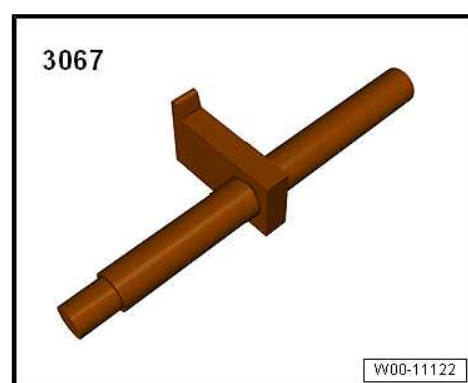
- Press oil seal in onto stop with thrust piece -T10022/1- .
- Fit crankshaft sprocket onto crankshaft and secure with bolt.
- Install main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#) .



3.3 Removing and installing flywheel

Special tools and workshop equipment required

- ◆ Counterhold tool - 3067-



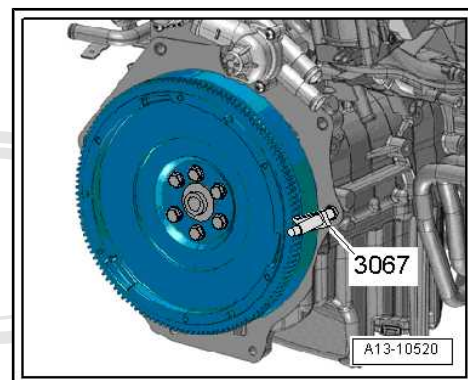
Removing

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

Installing

- Tightening torque
⇒ [“3.1 Sealing flanges and flywheel - exploded view”, page 54](#)

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



Note

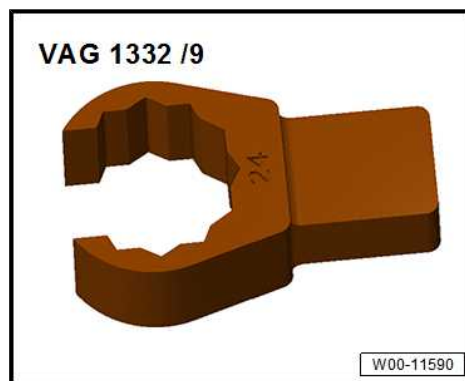
- ◆ *Renew bolts for flywheel.*
- ◆ *Can only be installed in one position (holes are off-set)*

- Fit counterhold tool - 3067- the other way round to tighten bolts.
- Install clutch pressure plate ⇒ Rep. gr. 30 .

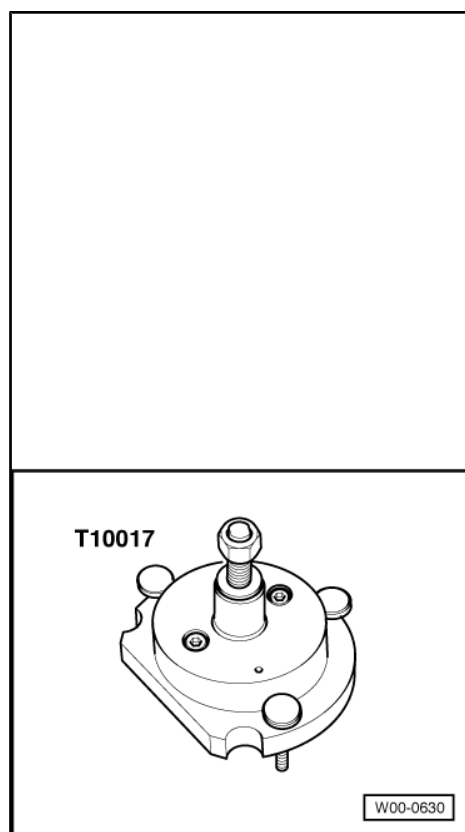
3.4 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

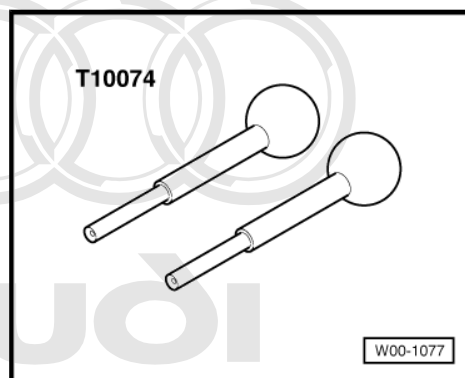
- ◆ Open ring spanner insert - V.A.G 1332/9-



- ◆ Assembly tool - T10017-



- ◆ Locking pin - T10074-



- ◆ Electric drill with plastic brush attachment

- ◆ Safety goggles

- ◆ Sealant ⇒ Parts catalogue

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Procedure

- Gearbox removed

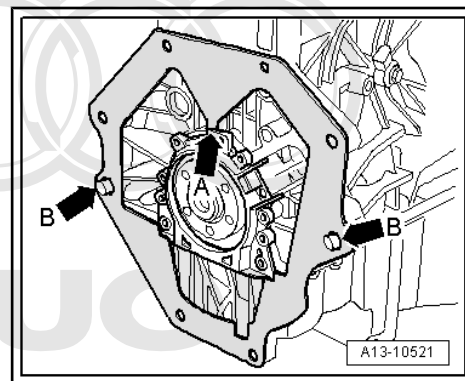


Note

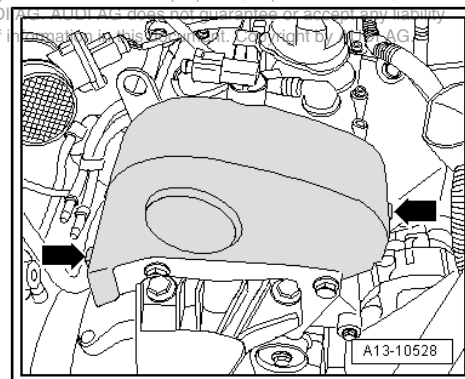
For illustration purposes, the procedure is shown with the engine removed.

Pressing sealing flange with sender wheel off crankshaft

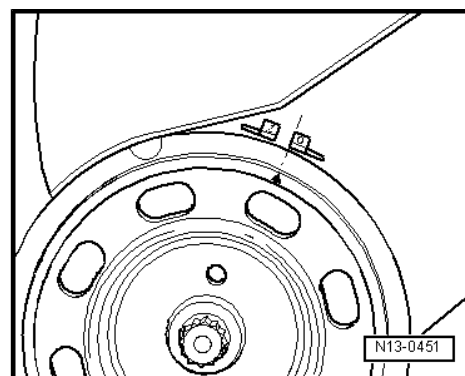
- Remove flywheel
⇒ ["3.3 Removing and installing flywheel", page 57](#).
- Press intermediate plate off dowel sleeves -arrows B- and detach from top of sealing flange -arrow A-



- Release retaining clips -arrows- and detach cover (top) for toothed belt.



- Rotate crankshaft in normal direction of rotation to "TDC".
- Notch on crankshaft pulley must align with edge of marking -O-.

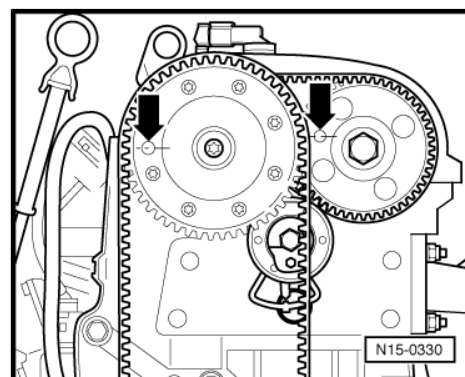


- The locking pin holes in the inlet camshaft sprocket with camshaft adjuster and in the exhaust camshaft sprocket must align with the corresponding holes in the camshaft housing -arrows-.

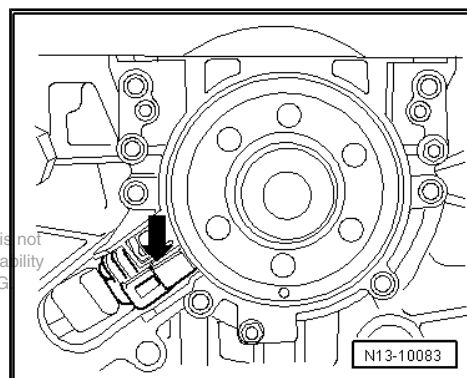
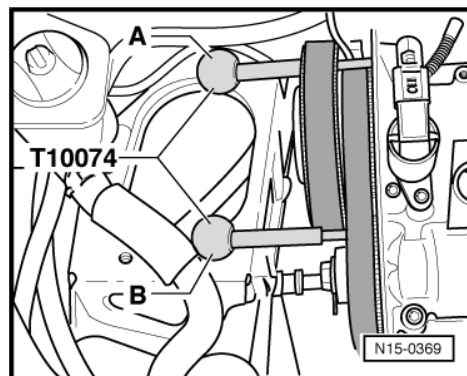


Note

If the locating holes are positioned on the opposite side, the crankshaft must be turned one revolution further.



- Lock camshafts using locking pins - T10074- :
- It should be possible to insert locking pin -A- through locking pin hole in inlet camshaft sprocket into corresponding hole in camshaft housing.
- It should be possible to insert locking pin -B- through locking pin hole in exhaust camshaft sprocket into corresponding hole in camshaft housing.
- Remove sump
⇒ ["1.3 Removing and installing sump", page 121](#) .
- Remove bolt -arrow- and detach engine speed sender - G28- .



- Remove bolts for sealing flange.



Note

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

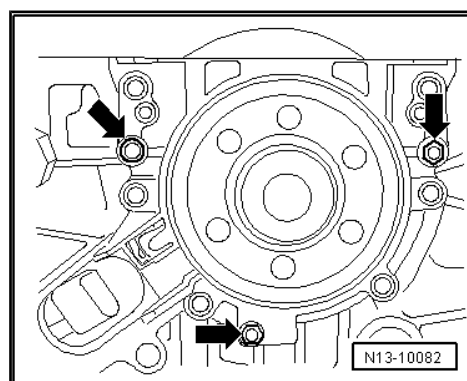
- To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than $\frac{1}{2}$ turn at a time.
- Take off sealing flange with sender wheel.

Pressing in sealing flange with sender wheel



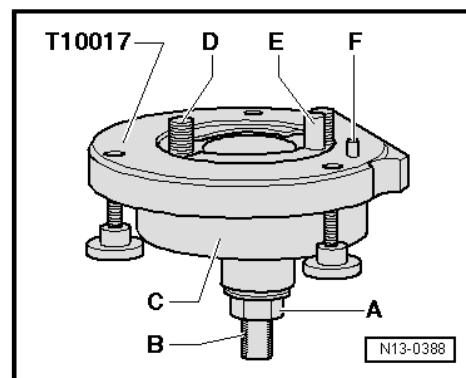
Note

- ◆ *The sealing flange with PTFE oil seal is fitted with a sealing lip support ring. This support ring acts as an assembly sleeve and must not be removed before installation.*
- ◆ *Sealing flange and sender wheel must not be separated or rotated out of position after removal from packaging.*
- ◆ *The sender wheel is held in its installation position by a locating pin on the assembly tool - T10017- .*
- ◆ *The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.*
- ◆ *The assembly tool - T10017- is held in the correct position relative to the crankshaft by a guide pin which is inserted into a hole in the crankshaft.*



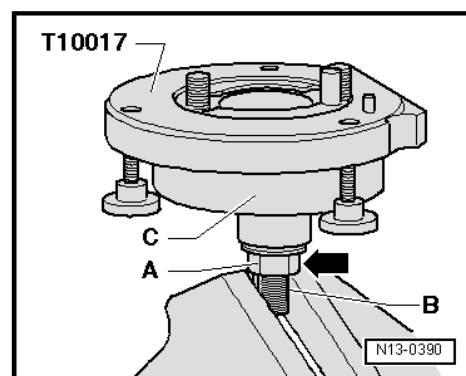
Construction of assembly tool - T10017- :

- A - Nut
- B - Tightening flats
- C - Assembly housing
- D - Hexagon socket-head bolt
- E - Guide pin
- F - Locating pin



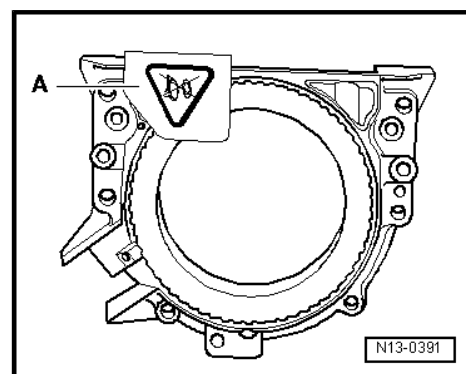
A - Fitting sealing flange with sender wheel onto assembly tool - T10017- :

- Unscrew nut -A- until it is just in front of flats -B- on threaded spindle.
- Clamp assembly tool - T10017- in a vice on flats of threaded spindle.
- Press the assembly housing -C- downwards so that it lies on the nut -arrow-.
- Inner part of assembly device and assembly housing must align (be level) with each other.
- Remove the securing clip -A- from new sealing flange.

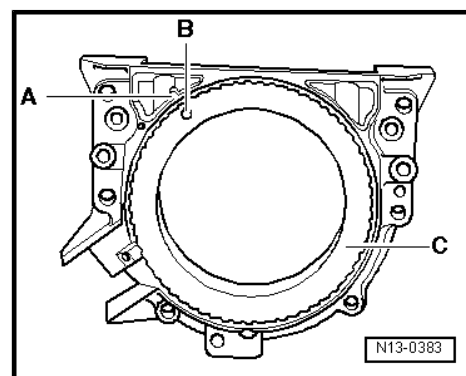


Note

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

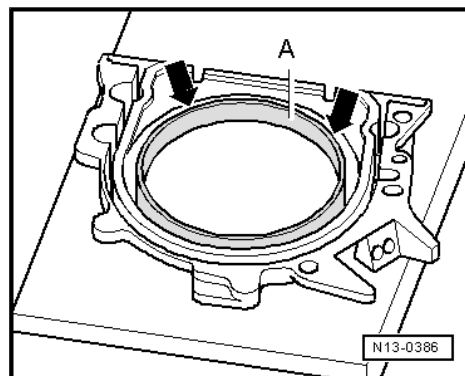


- The locating hole -B- on the sender wheel -C- must align with the marking -A- on the sealing flange.

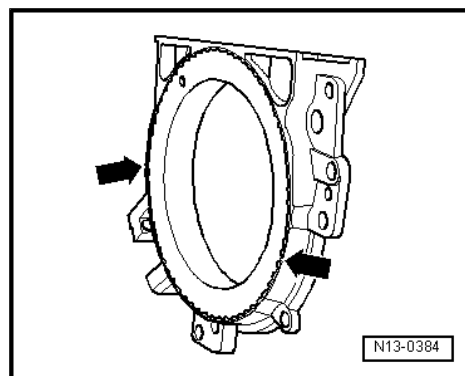


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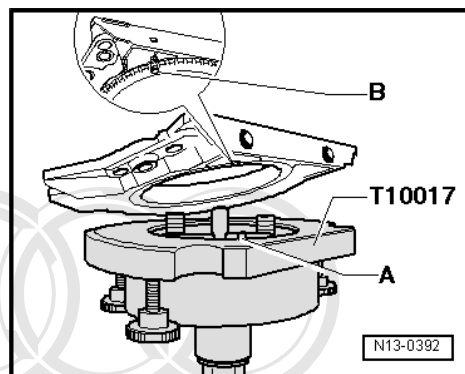
- Place sealing flange (with front side downwards) on a clean flat surface.
- Press the sealing lip support ring -A- downwards in direction of -arrows- until it lies against the flat surface.



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



- Place front side of sealing flange on assembly tool - T10017- , so that locating pin -A- can be inserted in hole -B- in sender wheel.
- Ensure that sealing flange lies flat on assembly tool.

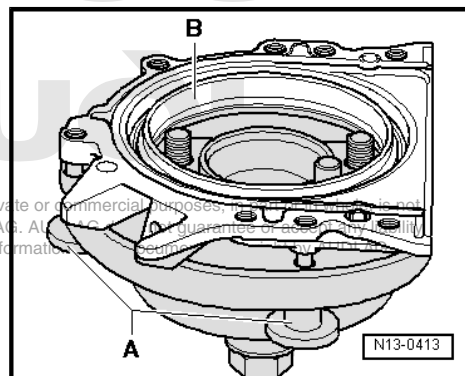


- Press the sealing flange and sealing lip support ring -B- onto the surface of the assembly tool - T10017- while tightening the 3 knurled screws -A- so that the locating pin will not slip out of the hole in the sender wheel.



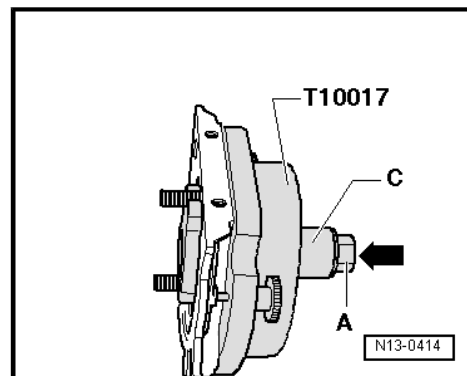
Note

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

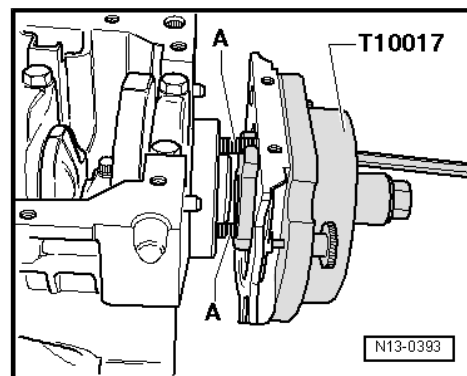


B - Installing assembly tool - T10017- with sealing flange on crankshaft flange:

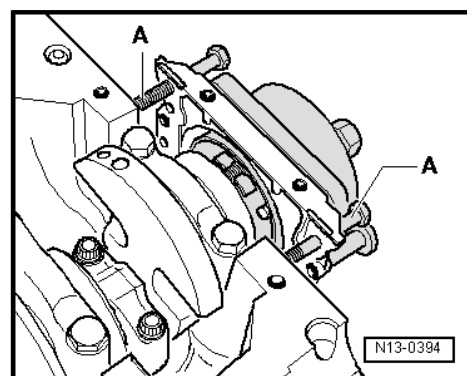
- Crankshaft flange must be free of oil and grease.
- Engine is at "TDC" position.
- Screw nut -A- to end of threaded spindle.
- Press the threaded spindle of assembly tool - T10017- in direction of -arrow- until the nut -A- lies on the assembly housing -C-.



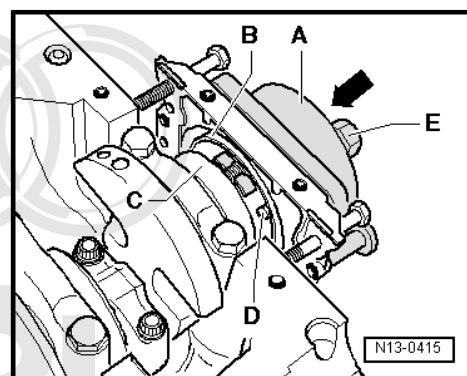
- Position flat edge of assembly housing towards sealing surface for sump on cylinder block.
- Secure assembly tool - T10017- to crankshaft flange by screwing hexagon socket head bolts -A- approx. 5 threads into crankshaft flange.



- Screw two bolts M6×35 mm -item A- into cylinder block to guide sealing flange.

**C - Securing assembly tool - T10017- onto crankshaft flange:**

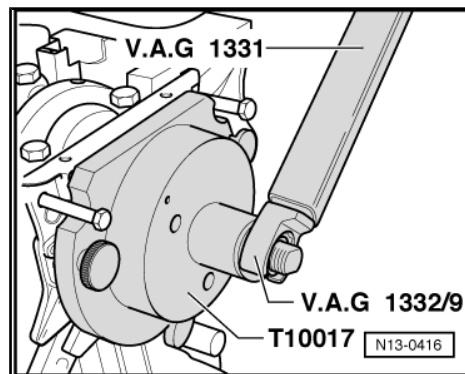
- Press the assembly housing -A- by hand in the direction of the crankshaft flange -C- -arrow- until the sealing lip support ring -B- lies on the surface of the crankshaft flange.
- Push guide pin -D- into hole in crankshaft. This brings the sender wheel into its final installation position.
- Tighten the two hexagon socket head bolts on assembly tool hand-tight.
- Screw nut -E- onto threaded spindle by hand until it lies against the assembly housing -A-.



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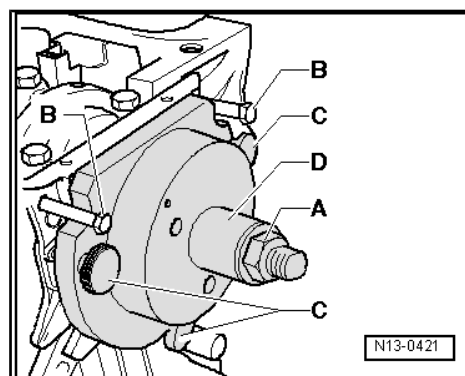
D - Pressing sender wheel onto crankshaft flange with assembly tool - T10017- :

- Tighten nut on assembly tool - T10017- to 35 Nm.
- A small air gap must be present between cylinder block and sealing flange after tightening nut to 35 Nm.

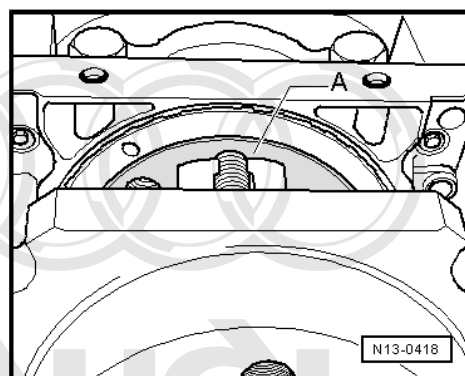


E - Checking installation position of sender wheel on crankshaft:

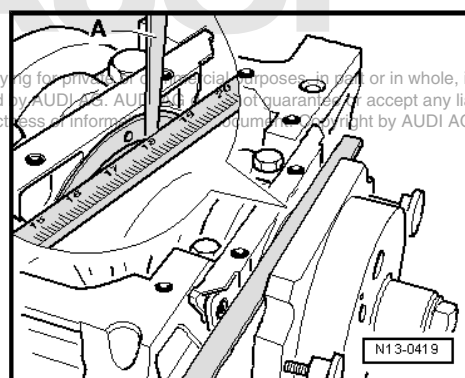
- Screw nut -A- to end of threaded spindle.
- Remove both bolts M6x35 -item B- from cylinder block.
- Unscrew the three knurled screws -C- from sealing flange.
- Detach assembly tool - T10017- and sealing lip support ring.



- Apply depth gauge to crankshaft flange -A-.

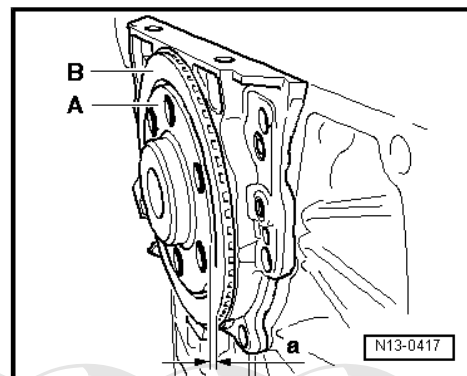


- Use feeler gauge -A- to measure between depth gauge and sender wheel.



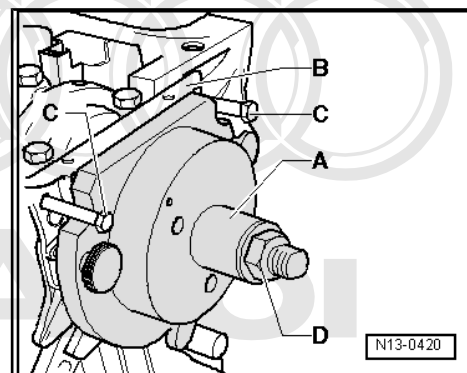
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- Measure distance -a- between crankshaft flange -A- and sender wheel -B-.
- Specification: Distance -a- = 0.5 mm.
- Press sender wheel in further if distance is too small
⇒ [page 65](#) .
- If reading matches specification, continue with assembly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



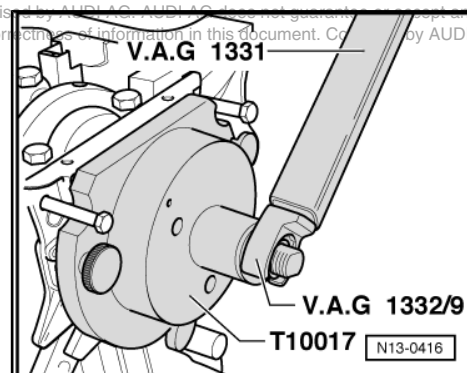
F - Pressing sender wheel in further:

- Slide assembly housing -A- onto sealing flange -B- by hand.
- Screw two bolts M6×36 mm -item C- into cylinder block to guide sealing flange -B-.
- Screw nut -D- onto threaded spindle by hand until it lies against the assembly housing.



- Tighten nut on assembly tool - T10017- to 40 Nm.
- Check installation position of sender wheel on crankshaft again ⇒ [page 64](#) .
- Tighten nut on assembly tool - T10017- to 45 Nm if distance is too small.
- Check installation position of sender wheel on crankshaft again ⇒ [page 64](#) .

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Assembling

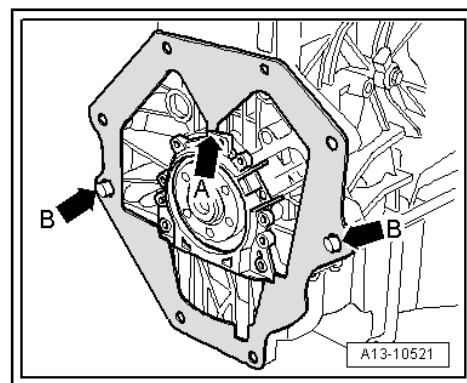
- Tightening torque ⇒ [page 54](#)



Note

Renew sealing flange bolts.

- Install engine speed sender - G28-
⇒ Fig. ““ Engine speed sender -G28- - tightening torque””,
[page 55](#) .
- Install sump ⇒ [page 122](#) .
- Engage intermediate plate at top of sealing flange -arrow A- and push onto dowel sleeves -arrows B-.
- Install flywheel
⇒ “3.3 Removing and installing flywheel”, [page 57](#) .



4 Crankshaft



Note

- ◆ *All bearing and running surfaces must be oiled before assembling.*
- ◆ *When carrying out repairs, secure engine with engine and gearbox support - VW 540- to engine and gearbox support
⇒ "4 Securing engine to engine and gearbox support", page 25.*

⇒ "4.1 Crankshaft - exploded view", page 66

⇒ "4.2 Crankshaft dimensions", page 67

⇒ "4.3 Measuring axial clearance", page 68

⇒ "4.4 Measuring radial clearance", page 68

4.1 Crankshaft - exploded view



Note

- ◆ *Mark used bearing shells for re-installation (but do not mark bearing surface).*
- ◆ *If bearing shells are worn down to nickel layer they must be renewed.*
- ◆ *Bearing shells are only supplied as a replacement part with "yellow" marking*



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1 - Bearing shell

- ☐ For bearings 1, 2, 4, 5
- ☐ For cylinder block (with oil groove)
- ☐ Note location

2 - Bearing shell

- ☐ For bearings 1, 2, 4, 5
- ☐ For bearing cap (without oil groove)
- ☐ Note location

3 - Bolts

- ☐ Renew
- ☐ 65 Nm

4 - Bearing cap

- ☐ Bearing 1: pulley end
- ☐ Retaining lugs on bearing shells in cylinder block and bearing cap must be on the same side

5 - Bearing shell

- ☐ For bearing No. 3
- ☐ For bearing cap (without oil groove)
- ☐ Note location

6 - Thrust washers

- ☐ For bearing No. 3
- ☐ Note location

7 - Crankshaft

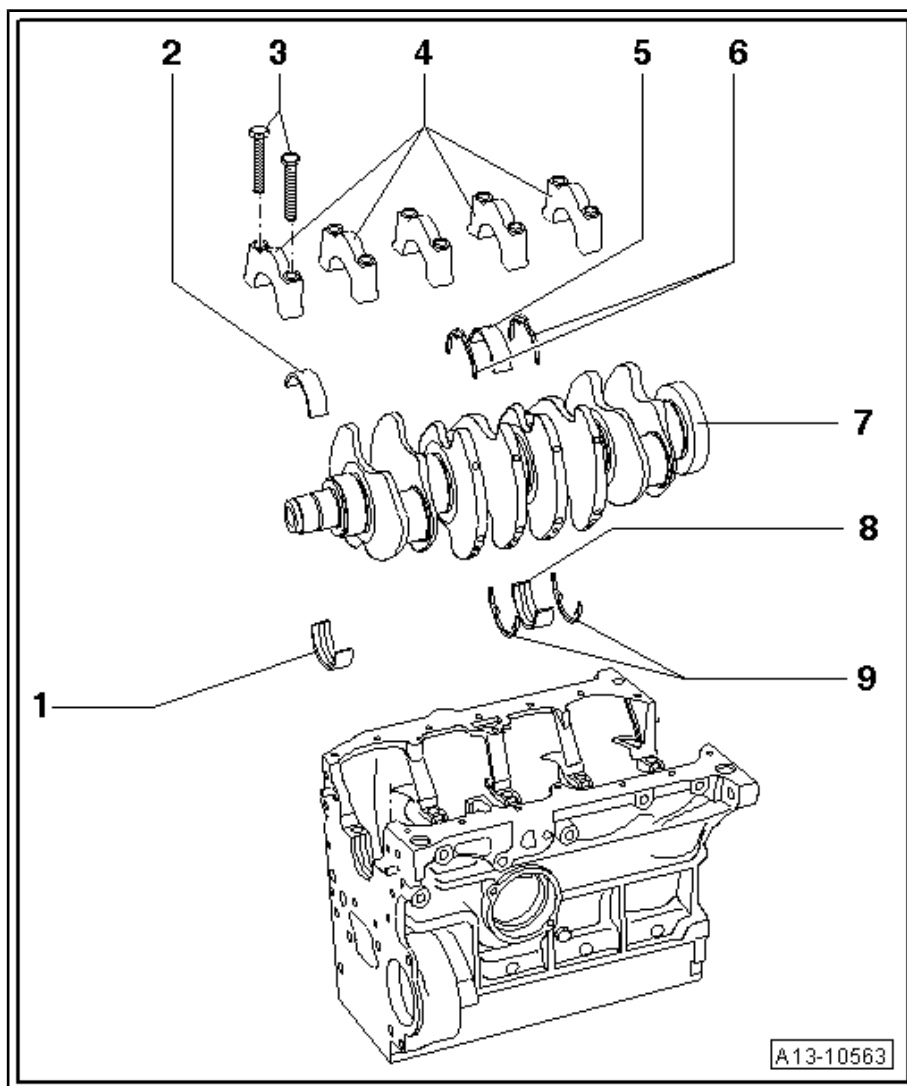
- ☐ Measuring axial clearance
⇒ [“4.3 Measuring axial clearance”, page 68](#)
- ☐ Measuring radial clearance ⇒ [“4.4 Measuring radial clearance”, page 68](#)
- ☐ Crankshaft dimensions ⇒ [“4.2 Crankshaft dimensions”, page 67](#)

8 - Bearing shell

- ☐ For bearing No. 3
- ☐ For cylinder block (with oil groove)
- ☐ Note location

9 - Thrust washers

- ☐ For bearing No. 3
- ☐ Note location

**4.2 Crankshaft dimensions**

Honing dimension (in mm)	Main bearing journal $\varnothing$	Conrod journal $\varnothing$
Basic dimension	54.000 – 0.022 – 0.037	47.800 – 0.022 – 0.037
Repair under-size I	53.750 – 0.022 – 0.037	47.550 – 0.022 – 0.037

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Honing dimension (in mm)	Main bearing journal Ø	Conrod journal Ø
Repair under-size II	–	47.300 – 0.022 – 0.037
Repair under-size III	–	47.050 – 0.022 – 0.037

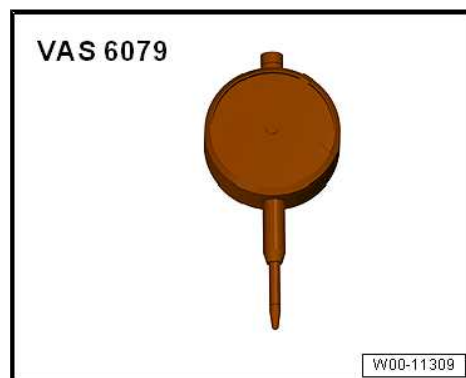
4.3 Measuring axial clearance

Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-



- ◆ Dial gauge - VAS 6079-

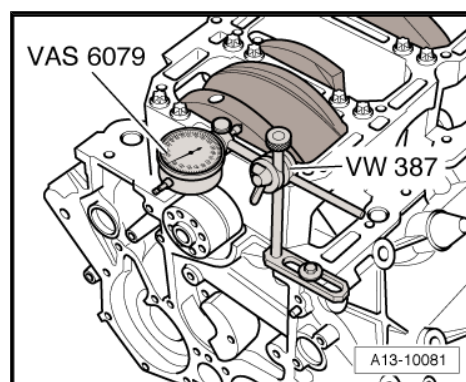


Procedure

- Secure dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder block as shown in illustration.
- Apply dial gauge to crank web.
- Press crankshaft against dial gauge by hand and set gauge to "0".
- Push crankshaft away from dial gauge and read off value.

Axial clearance

- New: 0.07 ... 0.18 mm.
- Wear limit: 0.20 mm.



4.4 Measuring radial clearance

Special tools and workshop equipment required

- ◆ Plastigage

Procedure



Note

- ◆ *Mark used bearing shells for re-installation (but do not mark bearing surface).*
- ◆ *If bearing shells are worn down to nickel layer they must be renewed.*
- Remove bearing cap and clean bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shell.
- The Plastigage must be positioned in the centre of the bearing shell.
- Fit bearing cap and tighten ⇒ [Item 3 \(page 67\)](#) . Kurbelwelle nicht verdrehen.
- Remove bearing cap again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

- New: 0.03 ... 0.08 mm.
- Wear limit: 0.17 mm.

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5 Pistons and conrods



Note

All bearing and running surfaces must be oiled before assembling.

⇒ **“5.1 Pistons and conrods - exploded view”, page 70**

⇒ **“5.2 Piston and cylinder dimensions”, page 73**

⇒ “5.3 Measuring radial clearance of conrods”, page 73

5.1 Pistons and conrods - exploded view

1 - Bolt

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

2 - Conrod bearing cap

- ❑ Mark cylinder allocation before removing -A-
- ❑ Installation position: marking -B- faces towards pulley end (apply marking before removal if no marking is visible)

3 - Bearing shells

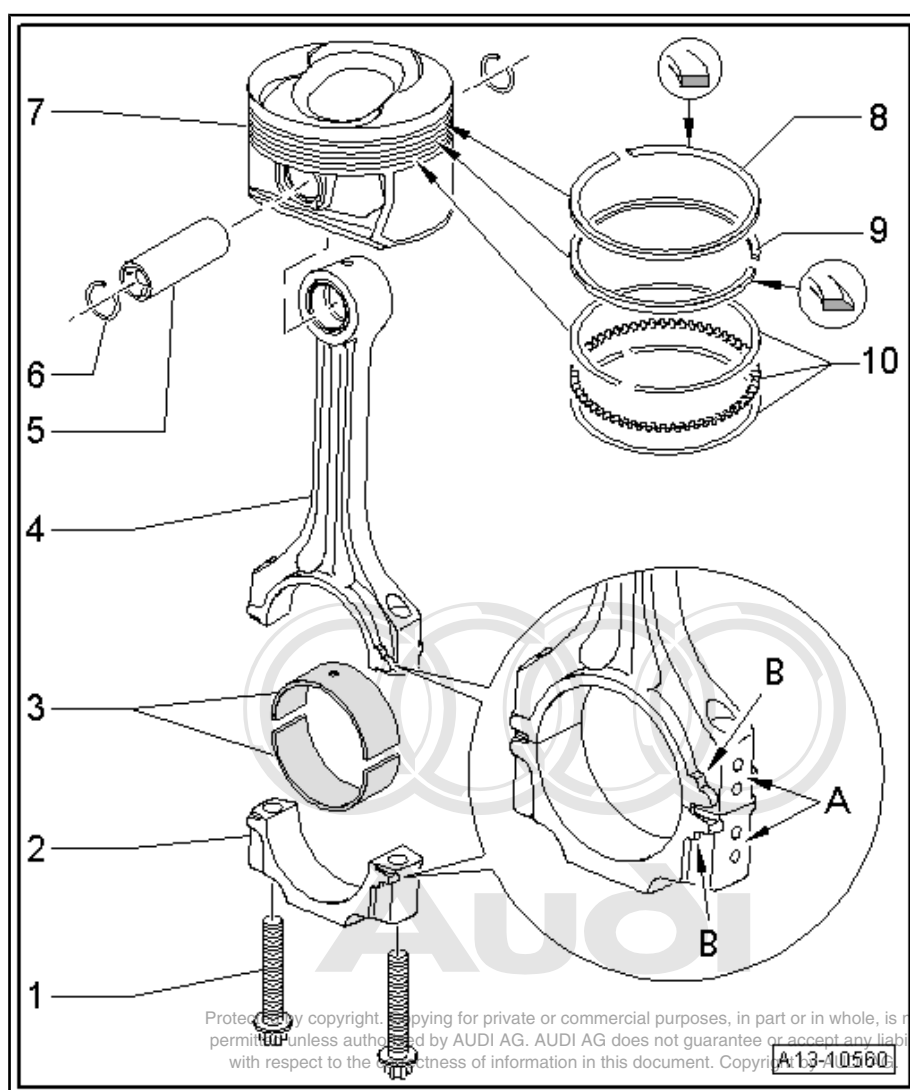
- ❑ Upper bearing shell with oil hole for piston pin lubrication
- ❑ Mark used bearing shells for re-installation but not on bearing surface
- ❑ Measuring preload
 ⇒ Fig. “Measuring bearing shell preload”, page 72

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark cylinder allocation before removing -A-
- ❑ Installation position: marking -B- faces towards pulley end (apply marking before removal if no marking is visible)
- ❑ Guided axially via piston
- ❑ Measuring radial clearance ⇒ **“5.3 Measuring radial clearance of conrods”, page 73**

5 - Piston pin

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



6 - Circlip

- ☐ Renew

7 - Piston

- ☐ Checking ⇒ [Fig. "Checking piston", page 72](#)
- ☐ Mark installation position and cylinder number
- ☐ Installation position: arrow on piston crown points to pulley end
- ☐ Install using piston ring clamp
- ☐ Checking cylinder bore ⇒ [Fig. "Checking cylinder bore", page 72](#)
- ☐ Piston and cylinder dimensions ⇒ ["5.2 Piston and cylinder dimensions", page 73](#)

8 - Compression ring

- ☐ Use piston ring pliers to remove and install
- ☐ Pay attention to cross section
- ☐ Offset gap by 120° to next compression ring
- ☐ Inscription "TOP" faces towards piston crown
- ☐ Checking ring gap ⇒ [Fig. "Checking piston ring gap", page 71](#)
- ☐ Checking ring-to-groove clearance ⇒ [Fig. "Checking ring-to-groove clearance", page 72](#)

9 - Compression ring

- ☐ Use piston ring pliers to remove and install
- ☐ Pay attention to cross section
- ☐ Offset gap 120° relative to adjacent oil scraper ring
- ☐ Inscription "TOP" faces towards piston crown
- ☐ Checking ring gap ⇒ [Fig. "Checking piston ring gap", page 71](#)
- ☐ Checking ring-to-groove clearance ⇒ [Fig. "Checking ring-to-groove clearance", page 72](#)

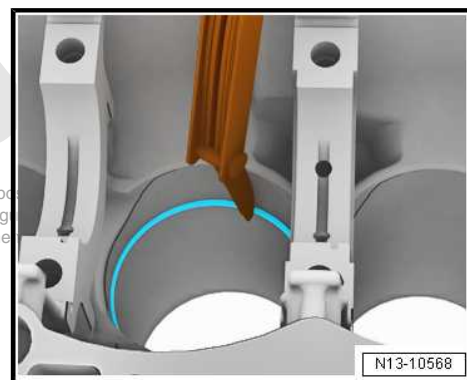
10 - Oil scraper ring

- ☐ 3 parts
- ☐ Offset gap of top steel element of piston ring by 120° to next compression ring
- ☐ Offset gaps of individual parts of oil scraper ring
- ☐ Checking ring gap ⇒ [Fig. "Checking piston ring gap", page 71](#)
- ☐ Ring-to-groove clearance cannot be checked

Checking piston ring gap

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

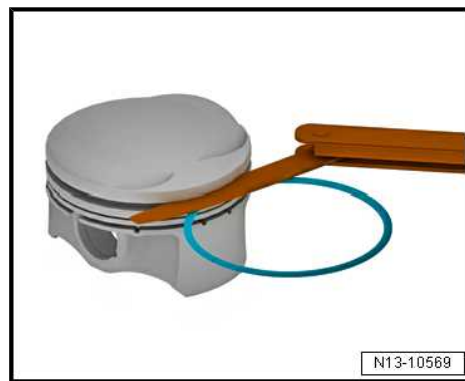
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.20 ... 0.50	1.00
2nd compression ring	0.40 ... 0.70	1.00
Oil scraper ring	0.40 ... 1.40	No wear limit data available



Checking ring-to-groove clearance

- Clean groove in piston before checking clearance.

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.04 ... 0.08	0.15
2nd compression ring	0.04 ... 0.08	0.15
Oil scraper ring	Cannot be measured	

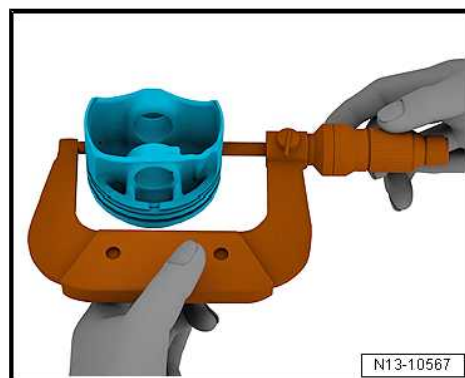


Checking piston

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

Nominal dimension

⇒ ["5.2 Piston and cylinder dimensions", page 73](#).



Checking cylinder bore

- Use an internal dial 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.

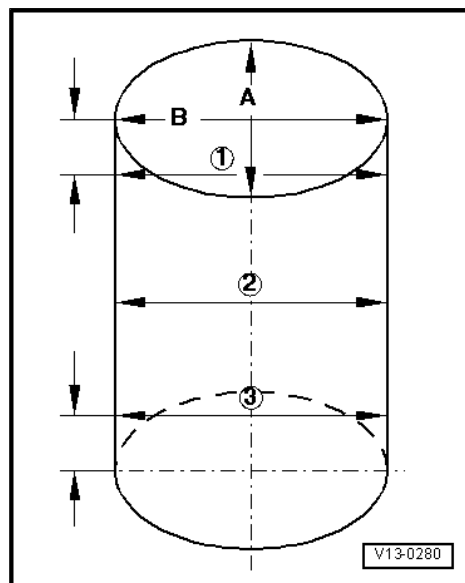
Nominal dimension

⇒ ["5.2 Piston and cylinder dimensions", page 73](#).



Note

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



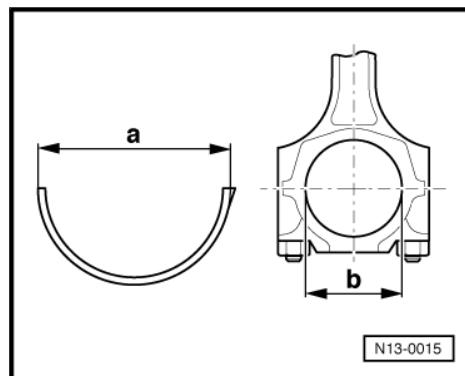
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Measuring bearing shell preload

- Use caliper gauge to determine dimension -a- for bearing shell and dimension -b- for conrod diameter.

Preload = Distance -a- – distance -b-

- Specification: at least 1.5 mm.
- If the specification is not attained, renew bearing shell.



5.2 Piston and cylinder dimensions

Honing dimension (in mm)	Piston $\varnothing$ ¹⁾	Cylinder bore $\varnothing$
Basic dimension	76.475	76.510
Repair oversize I	76.725	76.760
Repair oversize II	76.975	77.010
Repair oversize III	77.225	77.260
¹⁾ Dimensions including coating (thickness 0.01 mm). The coating will wear down in service.		

5.3 Measuring radial clearance of conrods

Special tools and workshop equipment required

- ◆ Plastigage

Procedure

- Remove conrod bearing cap.
- Clean bearing cap and bearing journal.
- Place a length of Plastigage 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 \(page 70\)](#) without rotating crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with measurement scale.

Radial clearance:

- New: 0.022 ... 0.063 mm.
- Wear limit: 0.091 mm.
- Renew conrod bolts.

15 – Cylinder head, valve gear

1 Cylinder head



Note

All bearing and running surfaces must be oiled before assembling.

⇒ "1.1 Cylinder head - exploded view", page 74

⇒ "1.2 Removing and installing cylinder head", page 76

⇒ "1.3 Checking compression", page 83

1.1 Cylinder head - exploded view

1 - Cylinder head

- ☐ Removing and installing
⇒ "1.2 Removing and installing cylinder head", page 76

- ☐ Checking for distortion
⇒ Fig. "Checking cylinder head for distortion", page 75

- ☐ Sealing surface for camshaft housing must be free of oil and grease

- ☐ If renewed, change coolant and engine oil

2 - Bolt

- ☐ 20 Nm

3 - Engine lifting eye

4 - Hydraulic compensation element

- ☐ Mark installation position for re-installation
- ☐ Lubricate contact surface

5 - Securing clip

- ☐ Check for firm attachment
- ☐ Not supplied separately

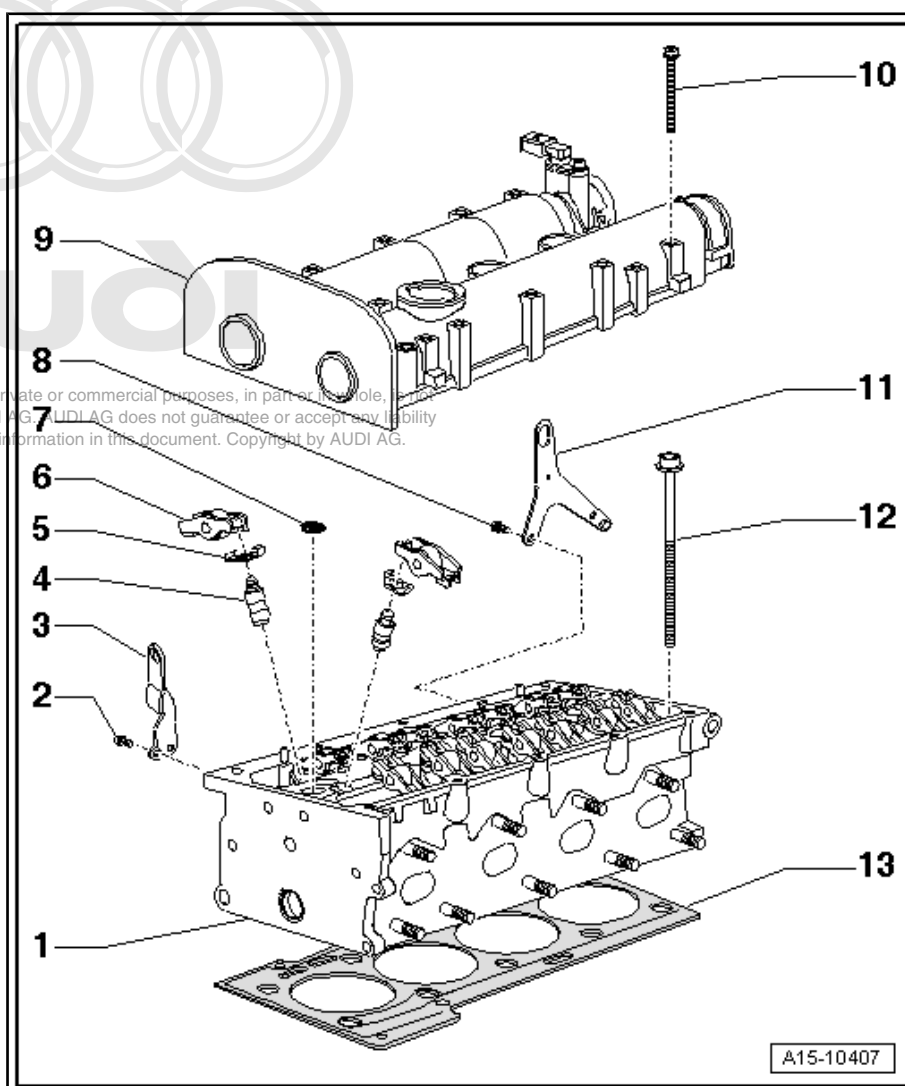
6 - Roller rocker finger

- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate contact surface

- ☐ Attach to hydraulic compensation element -item 4- using securing clip -item 5-

7 - Oil strainer

- ☐ Inserted into cylinder head



- ☐ Renew

8 - Bolt

- ☐ 20 Nm

9 - Camshaft housing

- ☐ Removing and installing ⇒ [“2.6 Removing and installing camshaft housing”, page 98](#)

10 - Bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 102](#)
- ☐ Tightening torque and sequence ⇒ [page 89](#)

11 - Engine lifting eye

12 - Bolt

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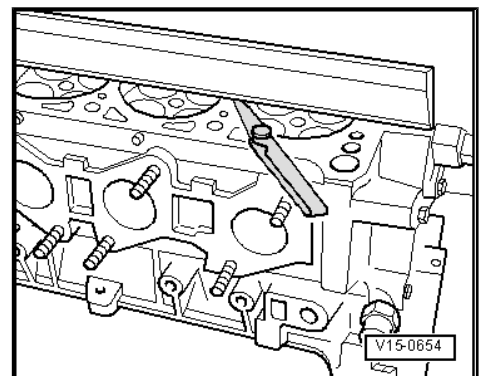
- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 81](#)
- ☐ Tightening torque and sequence ⇒ [Fig. ““Cylinder head - tightening torque and sequence””, page 76](#)

13 - Cylinder head gasket

- ☐ Renewing ⇒ [“1.2 Removing and installing cylinder head”, page 76](#)
- ☐ Installation position: Part number points towards cylinder head, and must be legible from the inlet side
- ☐ If renewed, change coolant and engine oil

Checking cylinder head for distortion

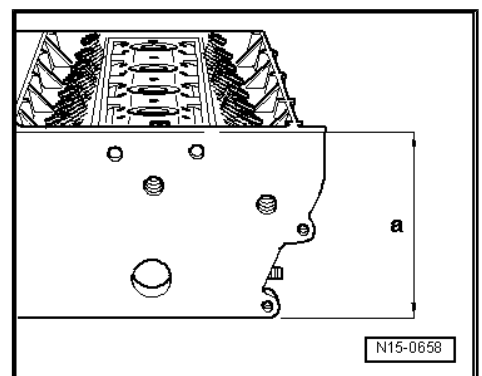
- Use straight edge and feeler gauge to measure cylinder head for distortion at several points.
- Max. permissible distortion: 0.05 mm.



Reworking cylinder head sealing surface

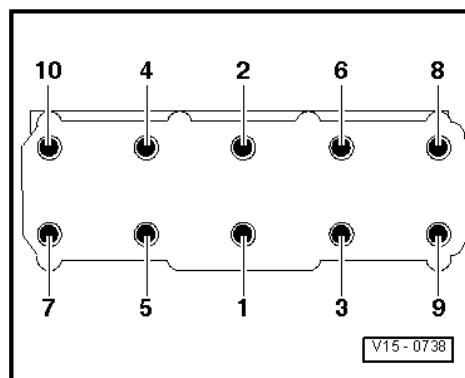
Machining of the cylinder head (surface grinding) is only permissible down to the minimum dimension -a-.

- Minimum dimension: -a- = 108.25 mm



Cylinder head - tightening torque and sequence

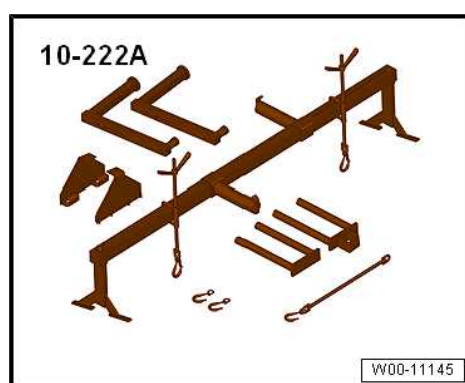
- Renew cylinder head bolts.
- Tighten bolts in the sequence -1 ... 10- in 4 stages as follows:
 1. Screw in by hand until contact is made.
 2. Tighten to 30 Nm.
 3. Turn 90° further.
 4. Turn 90° further.



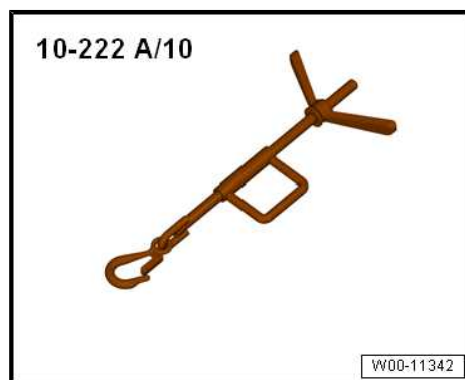
1.2 Removing and installing cylinder head

Special tools and workshop equipment required

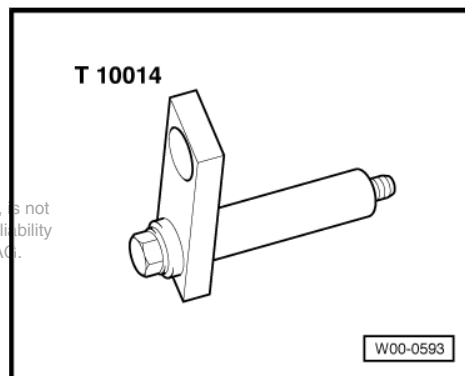
- ◆ Support bracket - 10 - 222 A-



- ◆ Hook - 10 - 222 A /10-



- ◆ Retainer - T10014-



- ◆ Sealant remover, commercially available
- ◆ Sealant ⇒ Electronic parts catalogue

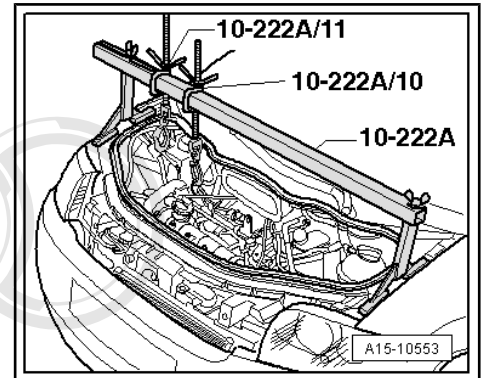
Removing

- Drain coolant
⇒ [“1.2 Draining and filling cooling system”, page 133](#) .
- Remove intake manifold ⇒ Rep. gr. 24 .
- Set crankshaft to “TDC” and lock camshafts with locking pins - T10074- ⇒ [“2.2 Checking valve timing”, page 42](#) .
- Position support bracket - 10 - 222 A- with hook - 10 - 222 A / 10- and spindle - 10 - 222 A / 11- on bolted flanges of wing panels as shown in illustration.
- Spindles are located at the rear.
- Attach snap element of hook - 10-222A/10- to engine lifting eye (right-side).



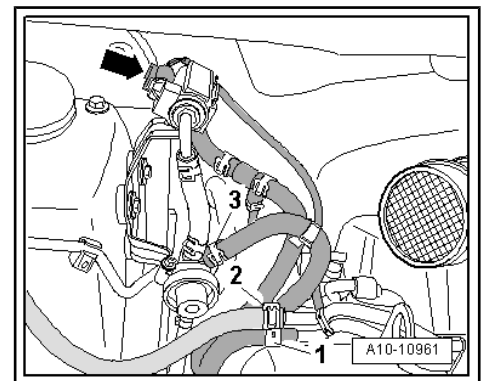
Note

The spindle - 10 - 222 A / 11- is used at a later stage.



- Remove main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#) .
- Remove camshaft housing
⇒ [“2.6 Removing and installing camshaft housing”, page 98](#) .

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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:

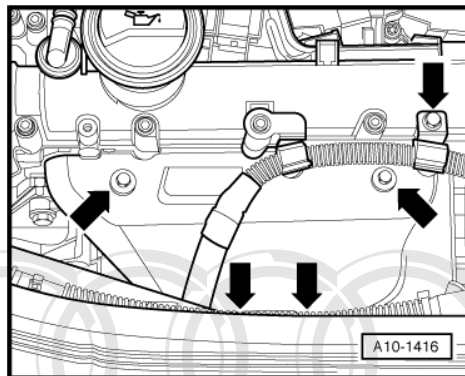
- Put on safety goggles.
- Put on protective gloves.
- Release pressure (wrap clean cloth around connection and open connection carefully).
- Detach fuel hoses -1- and -3-.
- Disconnect hose -2- from activated charcoal filter.



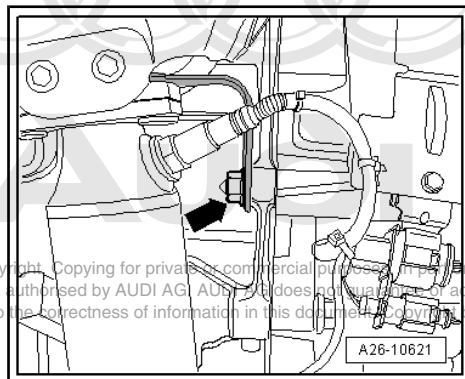
Note

Disregard -arrow-.

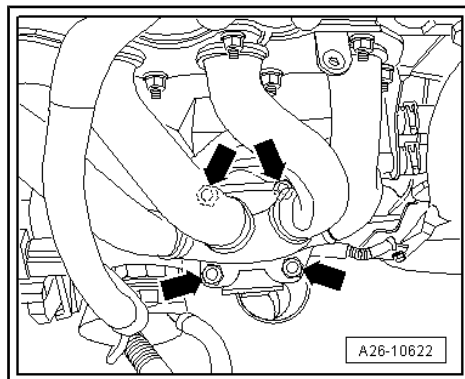
- Remove bolts -arrows- and detach heat shield.



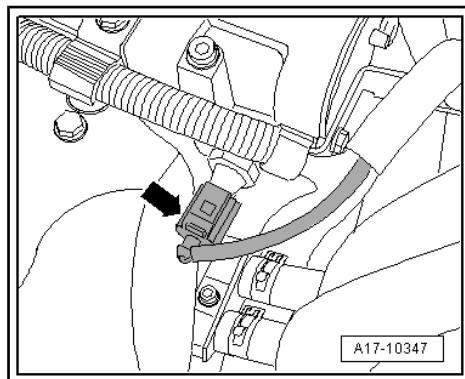
- Unscrew nut -arrow- securing bracket for exhaust manifold.



- Remove nuts -arrows- securing starter catalytic converter to exhaust manifold.
- Detach bracket for exhaust manifold.



- Unplug electrical connector -arrow- on oil pressure switch - F1- .

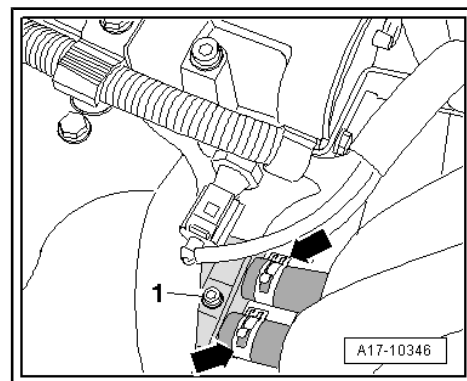


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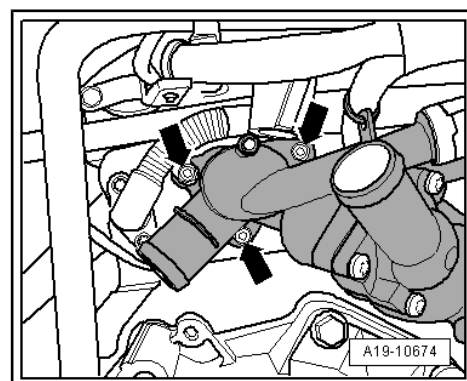
- Remove bolt -1- securing bracket for coolant supply and return lines at oil cooler and detach together with retainer.

**Note**

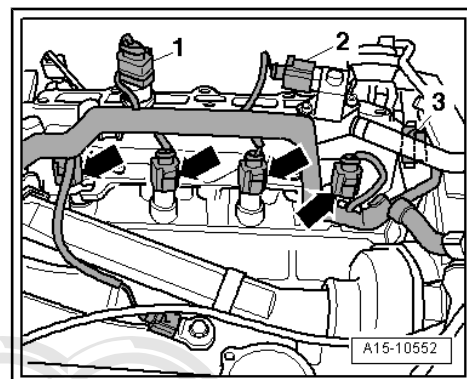
Disregard -arrows-.



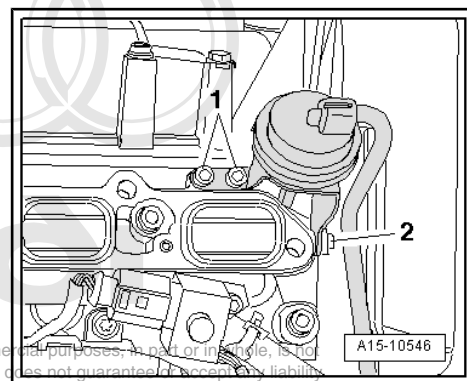
- Remove bolts -arrows- for thermostat housing.



- Unplug electrical connectors -1, 2, 3- and -arrows- and move electrical wiring harness at cylinder head clear.

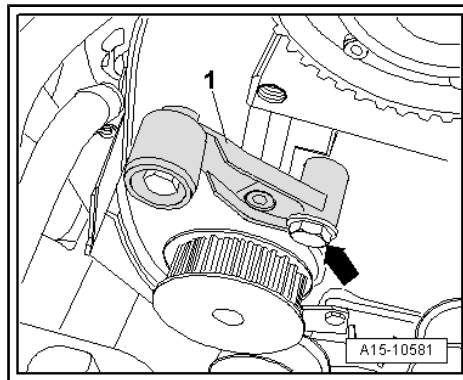


- Remove bolts -1- and loosen bolt -2-.
- Push vacuum unit for intake manifold flap slightly towards the rear.

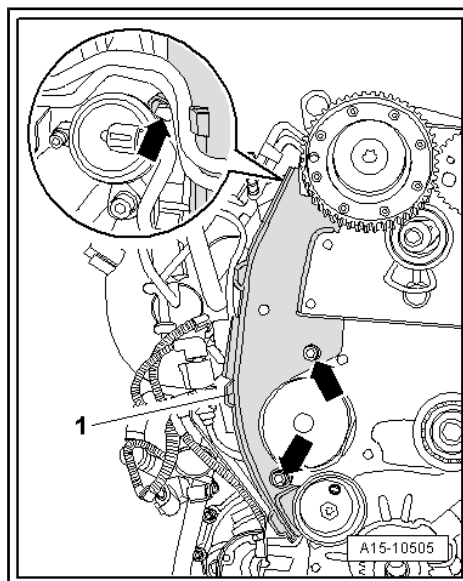


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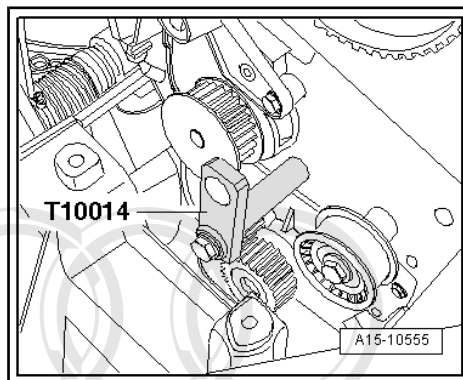
- Remove bolt -arrow- and take off idler roller -1- for main drive toothed belt.



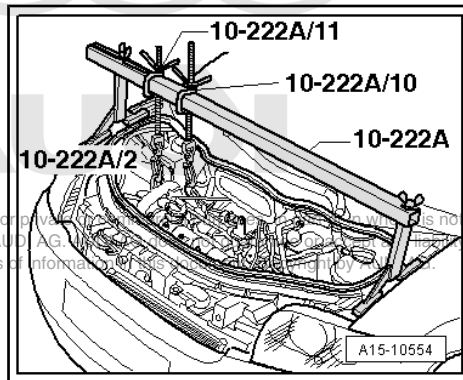
- Remove bolts -arrows- and remove rear cover -1- for toothed belt.



- Secure retainer - T10014- in threaded hole in cylinder block as shown in illustration and tighten to 40 Nm.



- Attach spindle - 10 - 222 A /11- with hook - 10 - 222 A /2- onto retainer - T10014- at right.
- Take up weight at spindle, detach hook - 10 - 222 A /10- and move to side.



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- Slacken cylinder head bolts in the sequence -1 ... 10-.
- Remove bolts and carefully take off cylinder head.
- Place cylinder head onto soft surface (foam plastic).

Installing

- Tightening torques
⇒ "1.1 Cylinder head - exploded view", page 74

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Risk of damage to sealing surfaces.

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

Risk of damage to cylinder block.

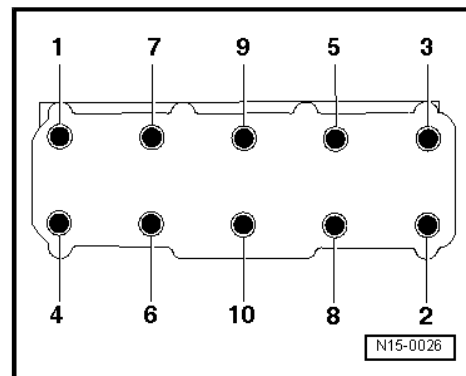
- ◆ *No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.*

Risk of leaks at cylinder head gasket.

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

Risk of damage to open valves.

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



Note

- ◆ *Renew the bolts tightened with specified tightening angle.*
- ◆ *Renew self-locking nuts as well as seals, gaskets and O-rings.*
- ◆ *Renew oil strainer in cylinder head.*
- ◆ *When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the camshaft housing.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *After fitting a new cylinder head or cylinder head gasket, change the engine oil and the coolant in the entire cooling system.*

**Caution**

Protect lubrication system and bearings against contamination.

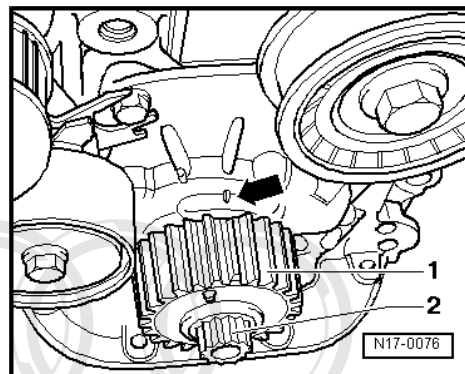
- ◆ ***Cover exposed parts of the engine.***

- Remove sealant residue on cylinder head and camshaft housing using commercially available sealant remover.
- Clean sealing surfaces; they must be free of oil and grease.
- Check "TDC" position of crankshaft:
 - The flat tooth on crankshaft sprocket -1- must align with marking -arrow- on oil pump housing.

**Note**

Disregard item -2-.

- Turn back crankshaft in opposite direction of engine rotation by approx. 45° from this position.
- Fit seal for thermostat housing.
- Place cylinder head gasket in position.
- Note position of dowel sleeves in cylinder block.
- Check installation position of cylinder head gasket: the word "oben" (top) or the Part No. should be visible.
- Fit cylinder head.



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- Tighten cylinder head bolts
⇒ Fig. [“Cylinder head - tightening torque and sequence”](#),
[page 76](#).

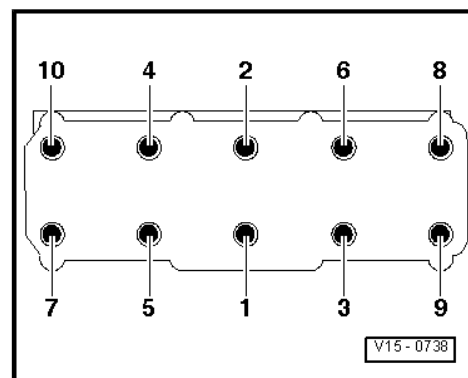


Note

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:

- Install cover (rear) for toothed belt
⇒ [“2.1 Toothed belt drive - exploded view”](#), [page 41](#).
- Install idler roller for main drive toothed belt
⇒ [“1.1 Poly V-belt drive - exploded view”](#), [page 33](#).
- Install vacuum unit for intake manifold flap ⇒ Rep. gr. 24.
- Install thermostat housing
⇒ [“1.7 Removing and installing thermostat housing and coolant pipe \(rear\)”](#), [page 144](#).
- Install bracket for exhaust manifold and heat shield
⇒ [“2.2 Removing and installing exhaust manifold”](#),
[page 165](#).
- Install camshaft housing
⇒ [“2.6 Removing and installing camshaft housing”](#),
[page 98](#).
- Install main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”](#), [page 45](#).
- Install intake manifold ⇒ Rep. gr. 24.
- Change engine oil ⇒ Maintenance ; Booklet 809.
- Fill cooling system with fresh coolant
⇒ [“1.2 Draining and filling cooling system”](#), [page 133](#).



1.3 Checking compression

Special tools and workshop equipment required

- ◆ Spark plug socket and extension - 3122B-

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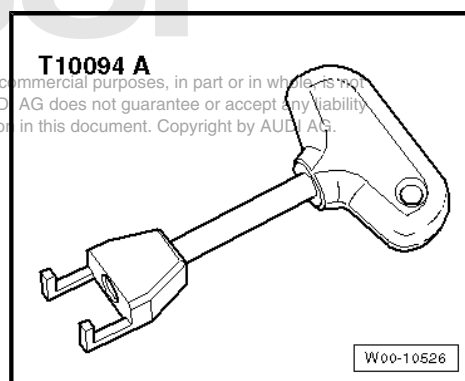


◆ Compression tester - V.A.G 1763-



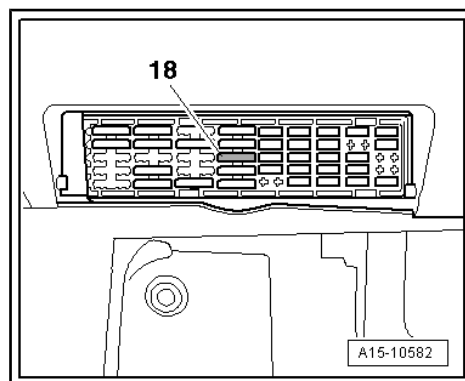
◆ Puller - T10094 A-

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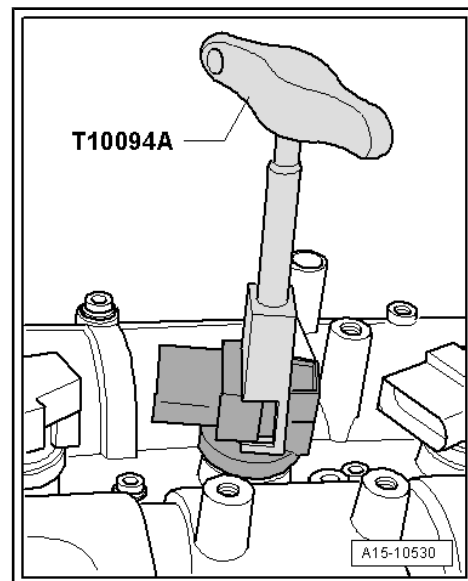
Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V
- Switch off ignition.
- Detach cover from 9-position relay carrier / fuse holder on left side of dash panel.
- Remove fuse 18 in fuse holder B - SB18- for fuel system pressurisation pump - G6- on left side of dash panel.
- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .



- Apply puller - T10094 A- to all ignition coils -arrow-, pull out ignition coils and at the same time unplug electrical connectors at ignition coils for cylinders 1 ... 4.
- Remove spark plugs with spark plug socket and extension - 3122 B- .
- Check compression pressure with compression tester - V.A.G 1763- (see ⇒ operating instructions for details of how to use tester).
- Have a 2nd mechanic press down the accelerator pedal completely and at the same time operate the starter until the pressure on the tester display no longer increases.
- Repeat procedure on each cylinder.

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



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

- Install spark plugs ⇒ Maintenance ; Booklet 809 .



Note

Faults will have been stored in the memory because connectors have been unplugged. Interrogate and, if necessary, erase event memory after completing the check.

- Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester.



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2 Valve gear



Note

All bearing and running surfaces must be oiled before assembling.

⇒ [“2.1 Camshaft housing - exploded view”, page 86](#)

⇒ [“2.2 Checking axial clearance of camshafts”, page 89](#)

⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#)

⇒ [“2.4 Renewing oil seal for inlet camshaft sprocket with camshaft adjuster”, page 94](#)

⇒ [“2.5 Renewing exhaust camshaft oil seal”, page 96](#)

⇒ [“2.6 Removing and installing camshaft housing”, page 98](#)

⇒ [“2.7 Removing and installing camshafts”, page 104](#)

⇒ [“2.8 Valves - exploded view”, page 104](#)

⇒ [“2.9 Renewing valve stem oil seals with cylinder head installed”, page 106](#)

⇒ [“2.10 Renewing valve stem oil seals with cylinder head removed”, page 109](#)

⇒ [“2.11 Valve dimensions”, page 112](#)

⇒ [“2.12 Checking valve guides”, page 112](#)

⇒ [“2.13 Checking valves”, page 113](#)

⇒ [“2.14 Machining valve seats”, page 114](#)

2.1 Camshaft housing - exploded view

1 - Inlet camshaft sprocket with camshaft adjuster

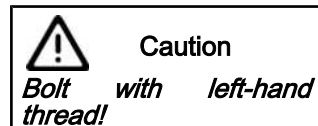
- ☐ Do not dismantle
- ☐ Removing and installing
⇒ ["2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket"](#), page 90

2 - Washer**3 - Screw plug**

- ☐ 25 Nm

4 - O-ring

- ☐ Renew if damaged

5 - Bolt

- ☐ Renew
- ☐ Lubricate threads and contact surface of bolt head with oil
- ☐ 40 Nm + turn 90° further

6 - Oil strainer

- ☐ Inserted in cylinder head
- ☐ Renew

7 - Camshaft housing

- ☐ With integrated camshaft bearings
- ☐ Removing and installing ⇒ ["2.6 Removing and installing camshaft housing"](#), page 98
- ☐ Remove old sealant residues
- ☐ Carefully clean sealing surfaces; they must be free of oil and grease
- ☐ Coat with sealant before installing; for sealant refer to ⇒ Electronic parts catalogue
- ☐ Installing: fit vertically from above onto studs and dowel pins

8 - O-ring

- ☐ Renew

9 - Camshaft control valve 1 - N205-**10 - Bolt**

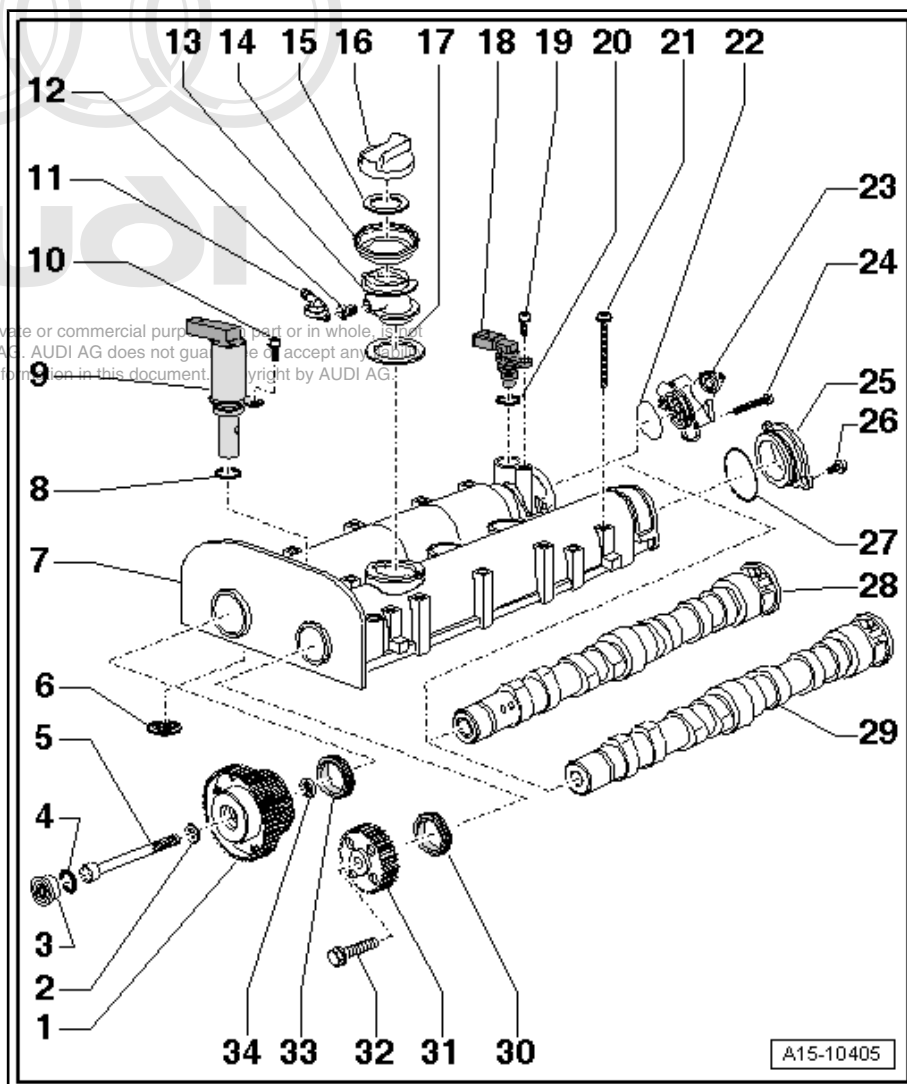
- ☐ 10 Nm

11 - Non-return valve**12 - Rubber grommet****13 - Oil filler neck****14 - Sealing collar**

- ☐ Renew if damaged

15 - Seal

- ☐ Renew if damaged



16 - Filler cap**17 - Seal**

- ☐ Renew

18 - Hall sender - G40-**19 - Bolt**

- ☐ 10 Nm

20 - O-ring

- ☐ Renew

21 - Bolt

- ☐ Renew
- ☐ Note correct sequence when loosening ⇒ [page 102](#)
- ☐ Tightening torque and sequence
⇒ [Fig. "Camshaft housing - tightening torque and sequence", page 89](#)

22 - O-ring

- ☐ Renew

23 - High-pressure pump with fuel pressure regulating valve - N276-

- ☐ Removing and installing ⇒ [Rep. gr. 24](#)

24 - Bolt

- ☐ Tightening torque ⇒ [Rep. gr. 24](#)

25 - Sealing cap**26 - Bolt**

- ☐ 10 Nm

27 - O-ring

- ☐ Renew

28 - Inlet camshaft

- ☐ With cam for high-pressure pump
- ☐ Before removing, detach roller tappet for high-pressure pump
- ☐ Checking axial clearance ⇒ ["2.2 Checking axial clearance of camshafts", page 89](#)
- ☐ Removing and installing ⇒ ["2.7 Removing and installing camshafts", page 104](#)
- ☐ Lubricate with oil before installing (also lubricate collar of axial bearing)

29 - Exhaust camshaft

- ☐ Checking axial clearance ⇒ ["2.2 Checking axial clearance of camshafts", page 89](#)
- ☐ Removing and installing ⇒ ["2.7 Removing and installing camshafts", page 104](#)
- ☐ Lubricate with oil before installing (also lubricate collar of axial bearing)

30 - Oil seal

- ☐ For exhaust camshaft
- ☐ Renewing ⇒ ["2.5 Renewing exhaust camshaft oil seal", page 96](#)

31 - Exhaust camshaft sprocket

- ☐ Removing and installing
⇒ ["2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket", page 90](#)

32 - Bolt

- ☐ Renew
- ☐ 20 Nm + turn 90° further

33 - Oil seal

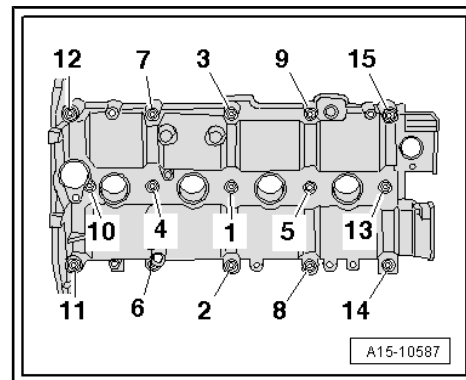
- ☐ For inlet camshaft sprocket with camshaft adjuster
- ☐ Renewing ⇒ ["2.4 Renewing oil seal for inlet camshaft sprocket with camshaft adjuster", page 94](#)

34 - Washer

- ☐ Not fitted on later versions ⇒ Electronic parts catalogue
- ☐ If a washer was originally fitted, renew washer and install again

Camshaft housing - tightening torque and sequence

- Renew camshaft housing bolts.
- Tighten bolts in the sequence -1 ... 15- in 2 stages as follows:
 1. Tighten to 10 Nm.
 2. Turn 90° further.

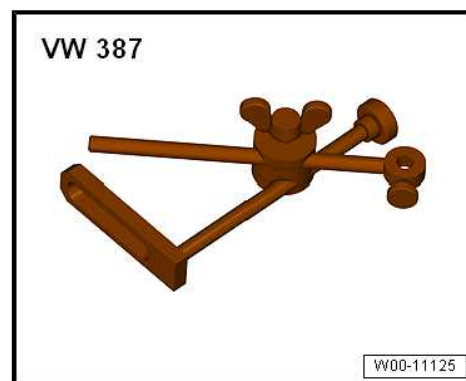


2.2 Checking axial clearance of camshafts

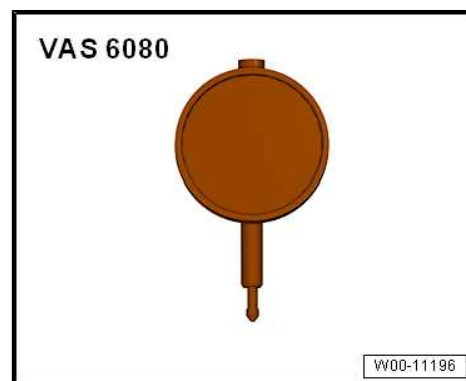
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Special tools and workshop equipment required

- ◆ Universal dial gauge bracket - VW 387-

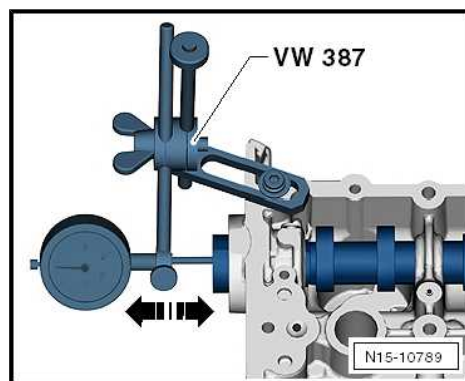


- ◆ Dial gauge - VAS 6080-



Procedure

- Perform measurement with camshaft housing removed.
- Sealing cap or high-pressure pump is fitted.
- Attach dial gauge bracket - VW 387- with dial gauge - VAS 6080- to cylinder head.
- Measure axial clearance -arrows-.
- Wear limit: 0.40 mm.



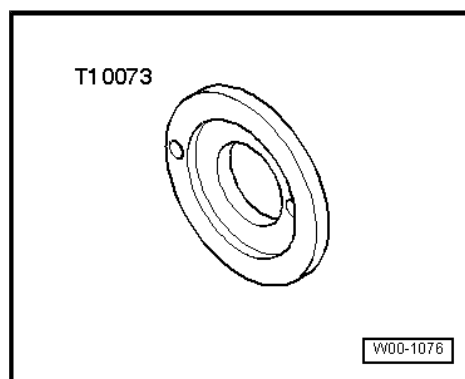
2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket

Special tools and workshop equipment required

- ◆ Socket - T10061-

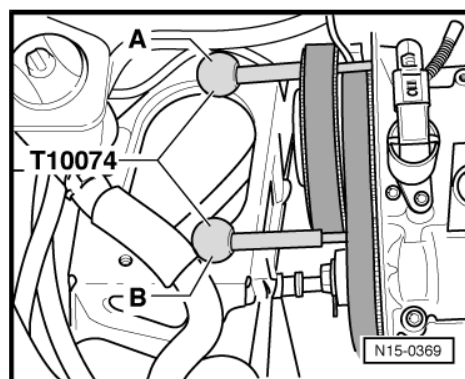


- ◆ Retaining plate - T10073-

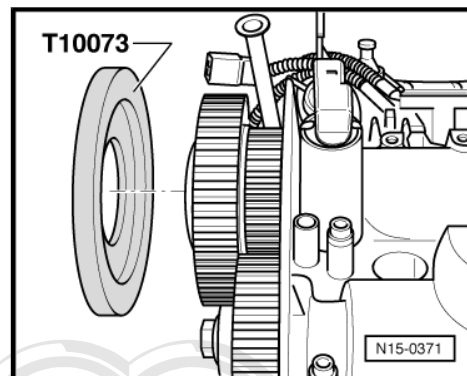


Removing

- Remove coupling drive toothed belt
⇒ [“2.4 Removing and installing coupling drive toothed belt”, page 50](#).
- Turn crankshaft 45° in opposite direction of engine rotation to make sure no piston is at “TDC”.
- Remove locking pins - T10074- from inlet camshaft sprocket with camshaft adjuster and from exhaust camshaft sprocket.



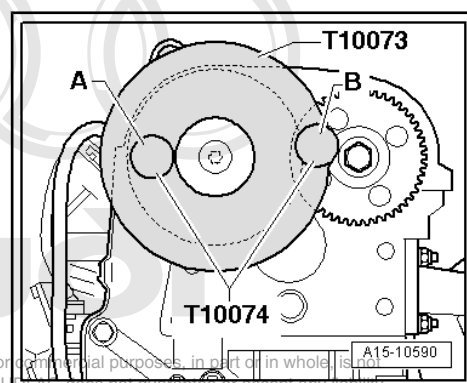
- Fit retaining plate - T10073- onto inlet camshaft sprocket with camshaft adjuster.



- Insert locking pins - T10074- again as far as stop into locating holes in camshaft housing as follows:
 - Insert locking pin -A- through locating hole in inlet camshaft sprocket with camshaft adjuster.
 - Insert locking pin -B- through locating hole in exhaust camshaft sprocket.

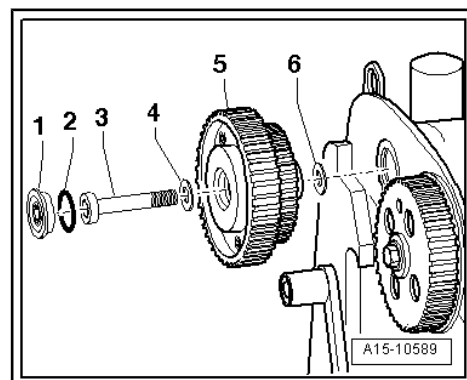
**Note**

To make it easier to insert locking pin -B-, turn exhaust camshaft sprocket at bolt slightly backwards and forwards until locating holes align.

**Note**

Place a cloth underneath to catch escaping engine oil.

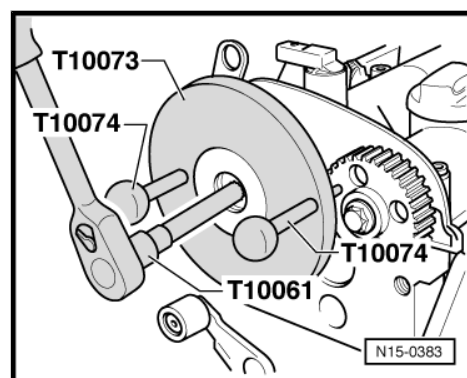
- Remove screw plug -1- with O-ring -2-.

**Caution**

Risk of damage to thread.

- ◆ **The bolt securing the inlet camshaft sprocket with camshaft adjuster has a left-hand thread.**

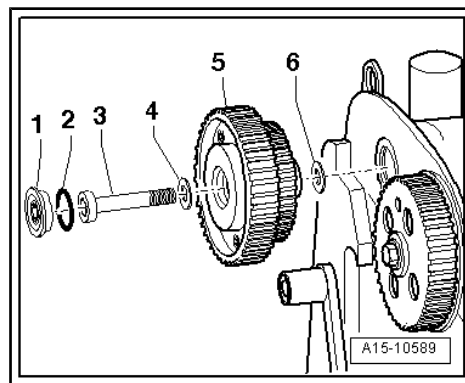
- Use socket, multi-point bit - T10061- to loosen bolt for inlet camshaft sprocket with camshaft adjuster.
- Remove bolt for exhaust camshaft sprocket.
- Pull out locking pins - T10074- and detach retaining plate - T10073- .



- Remove bolt -3-, detach washer -4-, inlet camshaft sprocket -5- with camshaft adjuster and washer -6- (if fitted).
- Place inlet camshaft sprocket with camshaft adjuster on a clean surface (camshaft contact surface downwards).
- Detach exhaust camshaft sprocket.

Installing

- Tightening torques
⇒ ["2.1 Camshaft housing - exploded view", page 86](#)
- No piston at "TDC".



Note

- ◆ *Renew bolts for inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket.*
- ◆ *Also renew washer, if previously fitted between inlet camshaft sprocket with camshaft adjuster and camshaft (only on early versions).*
- ◆ *Also renew oil seal if you are renewing inlet camshaft sprocket with camshaft adjuster*
⇒ ["2.4 Renewing oil seal for inlet camshaft sprocket with camshaft adjuster", page 94](#).

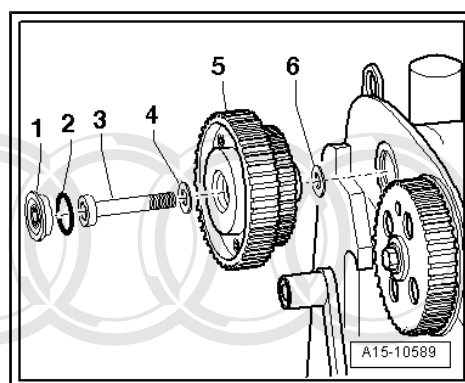
- Fit exhaust camshaft sprocket and tighten bolt hand-tight.
- Note position of exhaust camshaft sprocket relative to keyway in exhaust camshaft.
- Oil threads and contact surface of bolt -3- for inlet camshaft sprocket with camshaft adjuster.
- Insert bolt with washer -4- through inlet camshaft sprocket -5- with camshaft adjuster as far as stop.
- Also renew washer -6-, if previously fitted between inlet camshaft sprocket with camshaft adjuster and camshaft (only on early versions).



Caution

Risk of damage to thread.

- ◆ *The bolt securing the inlet camshaft sprocket with camshaft adjuster has a left-hand thread.*

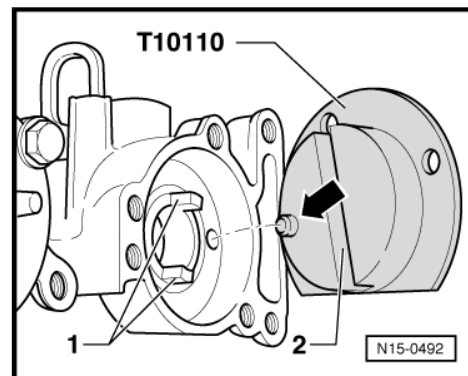


- Screw bolt for inlet camshaft sprocket with camshaft adjuster several turns into inlet camshaft.
- Carefully slide inlet camshaft sprocket with camshaft adjuster into oil seal.
- Take care not to damage the oil seal.
- Tighten bolt for inlet camshaft sprocket with camshaft adjuster just far enough so that inlet camshaft sprocket with camshaft adjuster still turns easily on camshaft.
- Remove high-pressure pump ⇒ Rep. gr. 24.

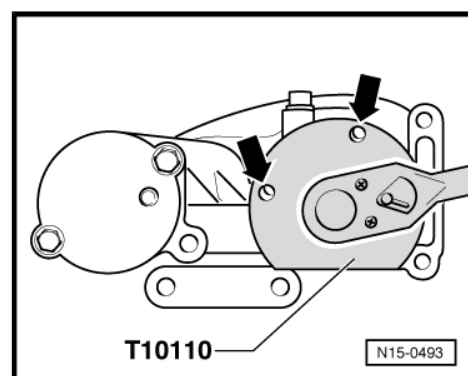
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- Attach locating flange - T10110- to camshaft housing of inlet camshaft working from side facing gearbox as follows:
- The pin -arrow- on the locating flange -T10110- must engage in the small hole on the axial bearing of the camshaft.
- The lugs -1- on the camshaft must engage in the slot -2- in the locating flange -T10110-.

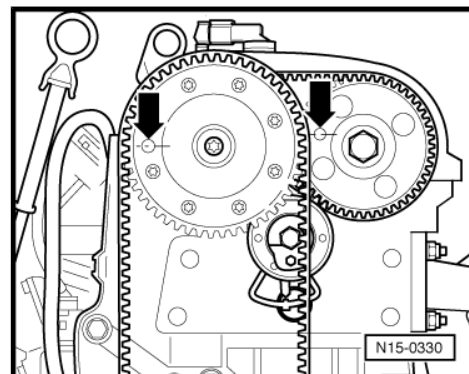
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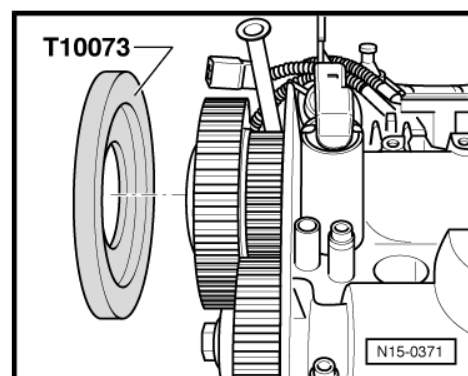
- Turn inlet camshaft at hexagon flats of locating flange - T10110- in opposite direction to normal engine rotation until holes -arrows- in locating flange - T10110- align with threaded holes in camshaft housing.
- Secure locating flange - T10110- with 2 bolts M6x15 and tighten to 10 Nm.



- Turn inlet camshaft sprocket with camshaft adjuster until locating hole in inlet camshaft sprocket with camshaft adjuster aligns with hole in camshaft housing -left arrow-.



- Fit retaining plate - T10073- onto inlet camshaft sprocket with camshaft adjuster.

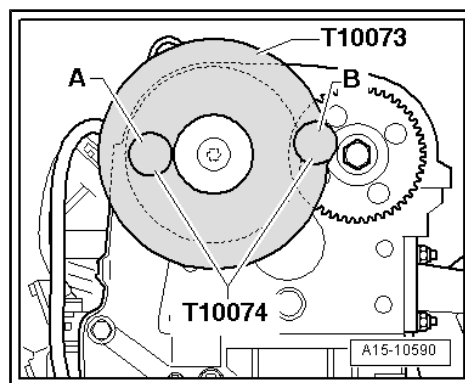


- Insert locking pins - T10074- all the way into locating holes in camshaft housing as follows:
- Insert locking pin -A- through locating hole in inlet camshaft sprocket with camshaft adjuster.
- Insert locking pin -B- through locating hole in exhaust camshaft sprocket.



Note

To make it easier to insert locking pin -B-, turn exhaust camshaft sprocket at bolt slightly backwards and forwards until locating holes align.



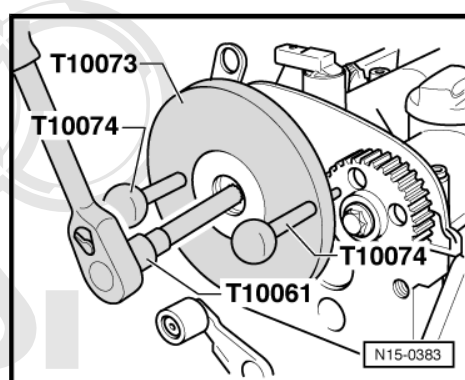
- Tighten bolt for exhaust camshaft sprocket to final torque.



Caution

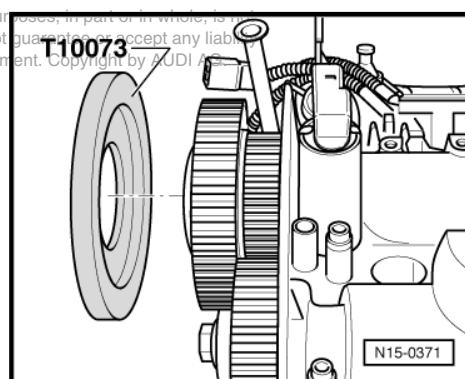
Risk of damage to thread.

- ◆ The bolt securing the inlet camshaft sprocket with camshaft adjuster has a left-hand thread.



- Tighten bolt for inlet camshaft sprocket with camshaft adjuster to final torque.

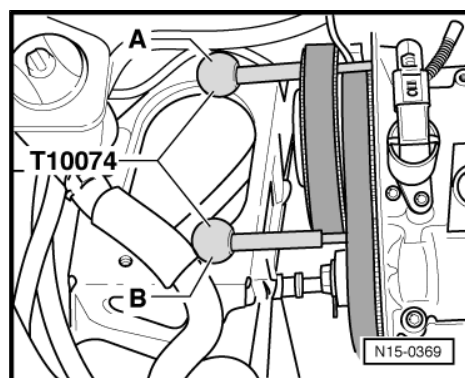
- Pull out locking pins - T10074- and detach retaining plate - T10073- .



- Lock inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket once again with locking pins - T10074- .

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

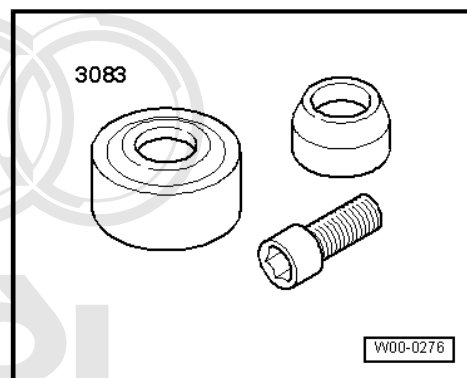
- Install coupling drive toothed belt
⇒ "2.4 Removing and installing coupling drive toothed belt", page 50 .



2.4 Renewing oil seal for inlet camshaft sprocket with camshaft adjuster

Special tools and workshop equipment required

◆ Oil seal fitting tool - 3083-

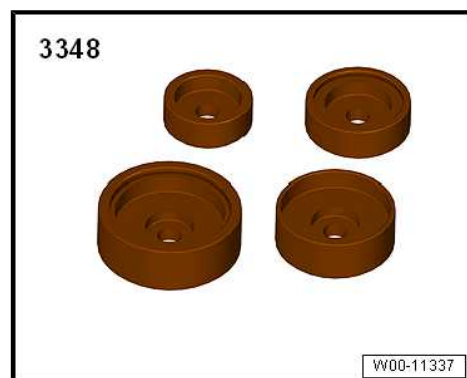


◆ Oil seal extractor - 3203-

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◆ Assembly tool - 3348-

**Procedure**

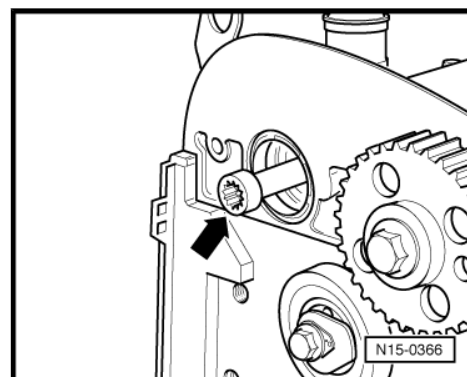
- Cylinder head installed.
- Remove inlet camshaft sprocket with camshaft adjuster
 ⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#) .

**Caution**

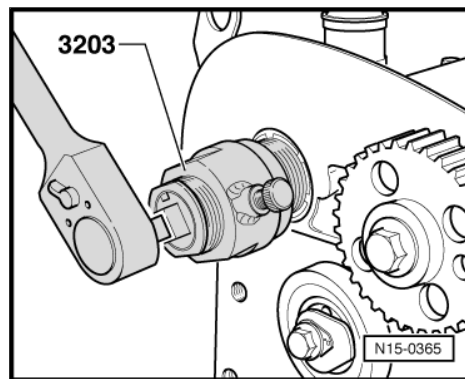
Risk of damage to thread.

- ◆ *The bolt securing the inlet camshaft sprocket with camshaft adjuster has a left-hand thread.*

- Screw bolt -arrow- for inlet camshaft sprocket with camshaft adjuster into camshaft as far as stop.



- Screw inner section of oil seal extractor -3203- out of outer section until only 3 threads of inner section remain in outer section, then lock with knurled screw.
- Oil threaded head of oil seal extractor.
- Screw oil seal extractor - 3203- into oil seal as far as possible, applying firm pressure.
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface for oil seal.



Note

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

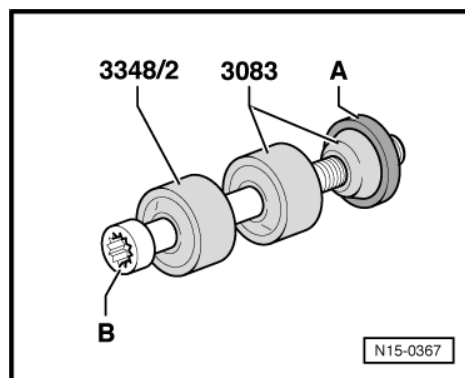
- Slide conical side of oil seal -A- over guide sleeve of oil seal fitting tool - 3083- .
- Slide press sleeve -3348/2- and oil seal fitting tool - 3083- with oil seal onto bolt -B- for inlet camshaft sprocket with camshaft adjuster.



Caution

Risk of damage to thread.

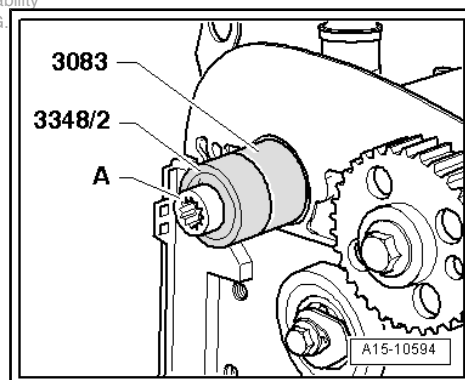
- ♦ **The bolt securing the inlet camshaft sprocket with camshaft adjuster has a left-hand thread.**



- Carefully screw bolt for inlet camshaft sprocket with camshaft adjuster several turns into inlet camshaft.

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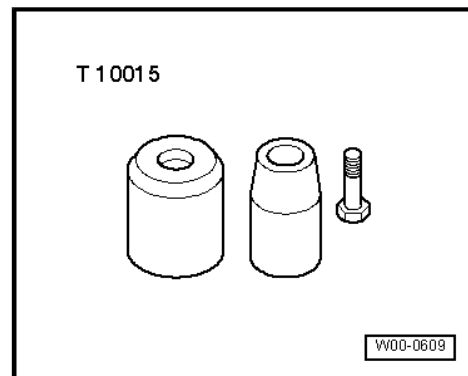
- Slide press sleeve -3348/2- and oil seal fitting tool - 3083- with oil seal onto camshaft housing until oil seal makes contact all round.
- Press oil seal with press sleeve -3348/2- and oil seal fitting tool - 3083- into camshaft housing as far as stop.
- Install inlet camshaft sprocket with camshaft adjuster
⇒ “2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90 .



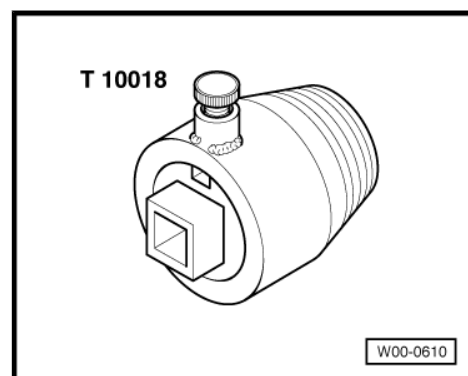
2.5 Renewing exhaust camshaft oil seal

Special tools and workshop equipment required

◆ Fitting tool - T10015-

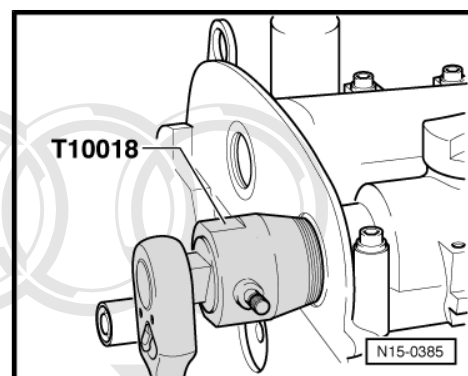


◆ Oil seal extractor - T10018-



Procedure

- Cylinder head installed.
- Remove inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket
⇒ ["2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket", page 90](#).
- Screw inner section of oil seal extractor -T10018- two turns out of outer section (approx. 3 mm) and lock with knurled screw.
- Oil threaded head of oil seal extractor.
- Screw oil seal extractor - T10018- into oil seal as far as possible, applying firm pressure.
- Loosen knurled screw and turn inner section against camshaft until oil seal is pulled out.
- Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.
- Clean contact surface and sealing surface for oil seal.



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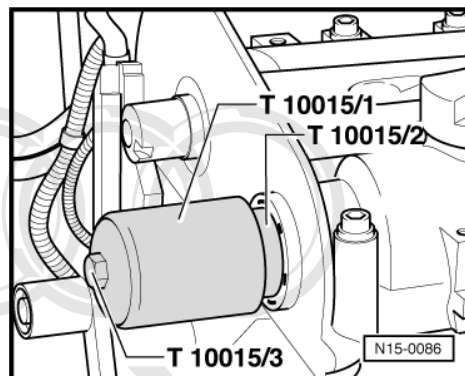
- Fit guide sleeve -T10015/2- onto camshaft journal.



Note

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

- Slide oil seal over guide sleeve.
- Press oil seal in onto stop using press sleeve -T10015/1- and bolt -T10015/3- .
- Install inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket
⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#) .

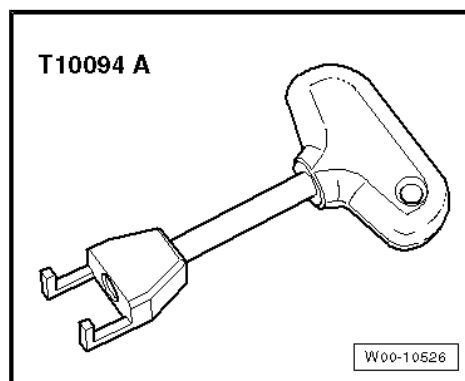


2.6 Removing and installing camshaft housing

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Special tools and workshop equipment required

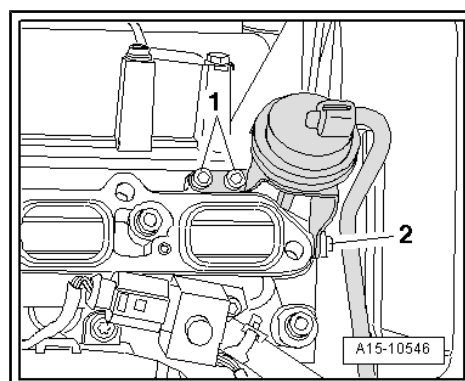
- ◆ Puller - T10094 A-



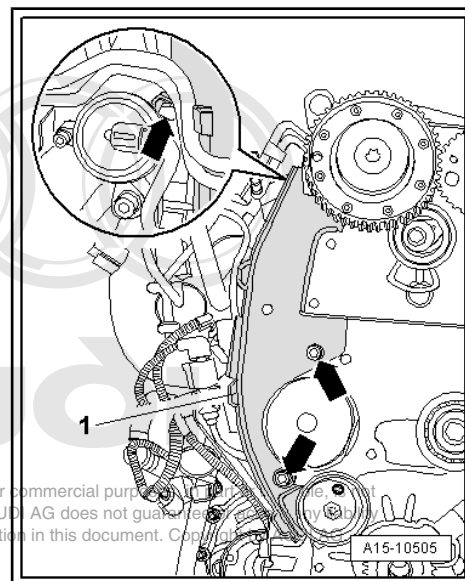
- ◆ Sealant remover, commercially available
- ◆ Sealant ⇒ Electronic parts catalogue

Removing

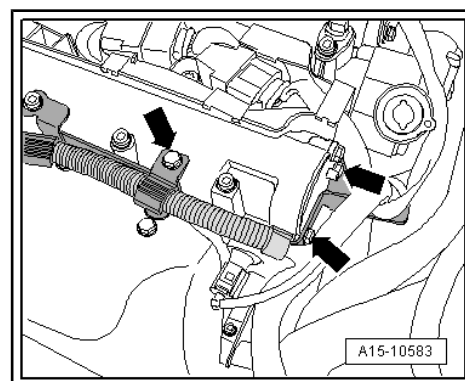
- Remove coupling drive toothed belt
⇒ [“2.4 Removing and installing coupling drive toothed belt”, page 50](#) .
- Remove bolts -1- and loosen bolt -2-.
- Push vacuum unit for intake manifold flap slightly towards the rear.



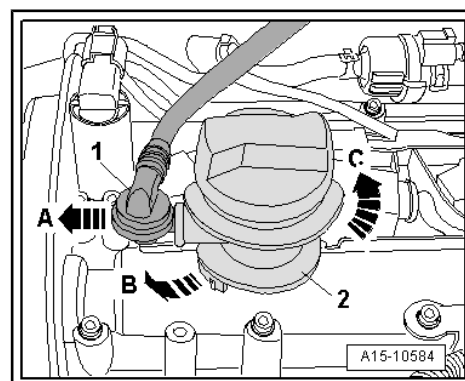
- Remove bolt -top arrow- securing rear cover -1- for toothed belt.



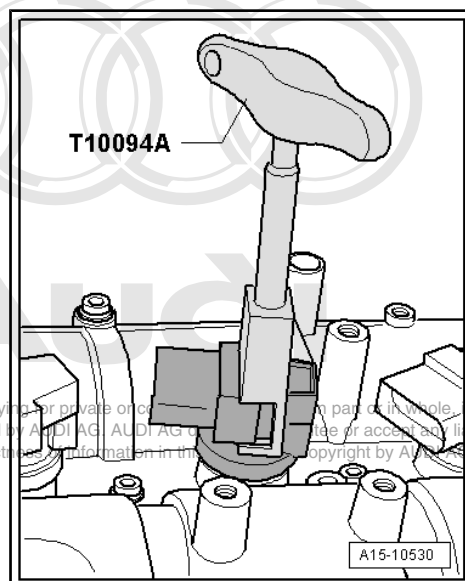
- Remove bolts -arrows- and move bracket with wiring to one side.



- Detach non-return valve -1- from oil filler neck -2- -arrow A- and move to one side.
- Release catch -arrow B-, turn oil filler neck in anti-clockwise direction -arrow C- and detach.

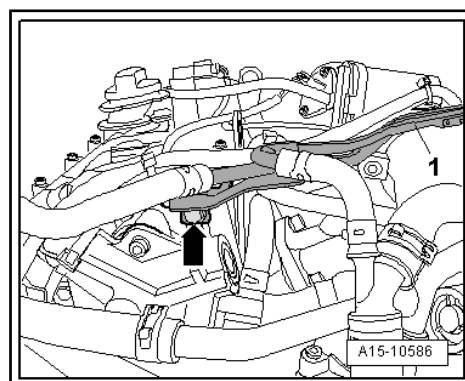
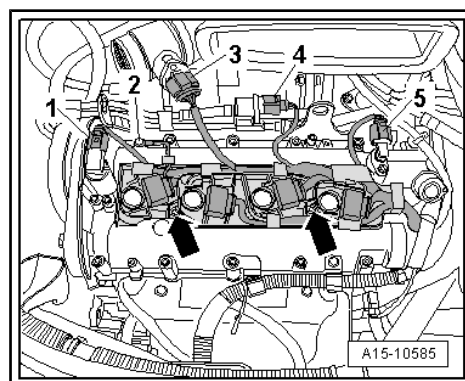


- Apply puller - T10094 A- to all ignition coils -arrow-, pull out ignition coils and at the same time unplug electrical connectors at ignition coils for cylinders 1 ... 4.

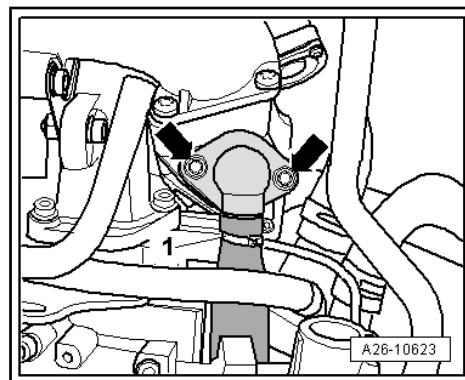


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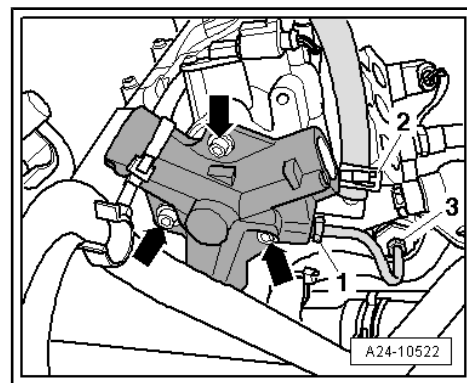
- Unplug electrical connectors:
 - 1 - Camshaft control valve 1 - N205-
 - 3 - Air mass meter - G70-
 - 4 - Activated charcoal filter solenoid valve 1 - N80-
 - 5 - Hall sender - G40-
- Remove bolt -2- for earth wire and bolts -arrows- for wiring guide, move wiring guide with wiring harness to the left.
- Remove bolt -arrow- and push coolant pipes -1- to the side.



- Remove bolts -arrows- and push exhaust gas recirculation pipe -1- to the side.



- Detach fuel supply hose -2-.



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 clean cloth around connection and open connection carefully).

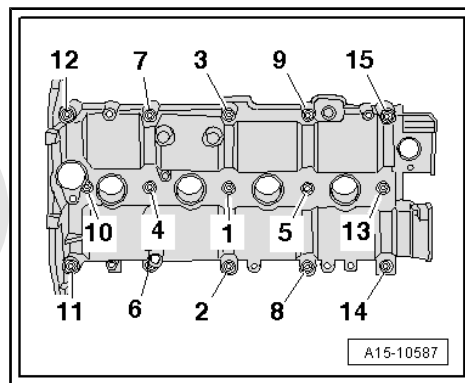
- Unscrew connections -1- and -3- and detach high-pressure pipe.

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- Slacken camshaft housing bolts in the sequence -15 ... 1-.
- Carefully lift off camshaft housing.
- 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

- Tightening torques
⇒ Fig. [“Camshaft housing - tightening torque and sequence”](#),
[page 89](#)
- No piston at “TDC”.



Note

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- ◆ **Renew oil strainer in cylinder head.**
- ◆ **Renew bolts for camshaft housing.**

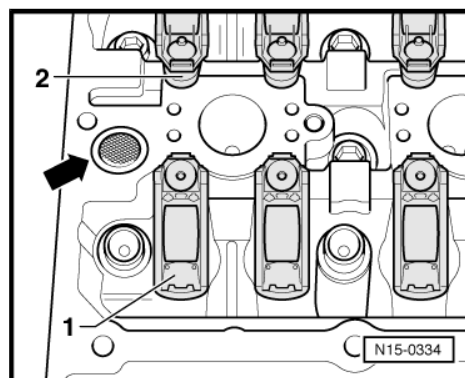
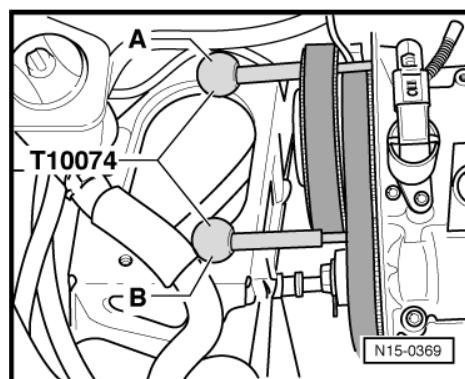


Caution

Protect lubrication system and bearings against contamination.

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

- Remove sealant residue on cylinder head and camshaft housing using commercially available sealant remover.
- Clean sealing surfaces; they must be free of oil and grease.
- Make sure that camshafts are locked as follows:
 - It should be possible to insert locking pin -A- through locking pin hole in inlet camshaft sprocket into corresponding hole in camshaft housing.
 - It should be possible to insert locking pin -B- through locking pin hole in exhaust camshaft sprocket into corresponding hole in camshaft housing.
- Ensure all roller rocker fingers contact the valve ends -1- correctly and are clipped into their respective support elements -2-.
- Fit new oil strainer -arrow- into cylinder head.



**Caution**

Make sure lubrication system is not clogged by excess sealant.

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

- Apply a thin and even layer of sealant to the clean sealing surface of the camshaft housing at grey-shaded area shown in illustration.

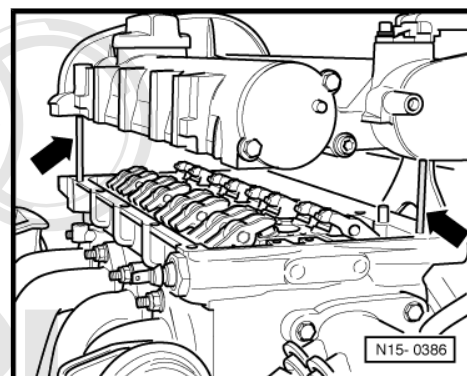
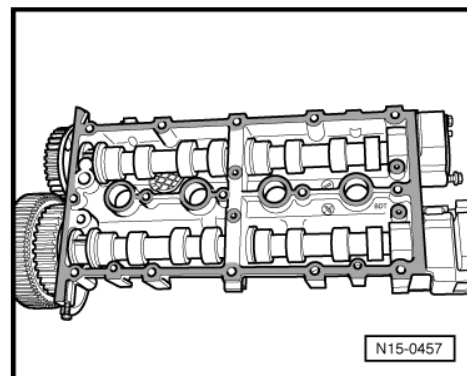
- Screw in 2 threaded pins M6x70 -arrows- into cylinder head to guide camshaft housing.

**Caution**

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

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

- Carefully fit the camshaft housing vertically onto the threaded pins and dowel pins on cylinder head from above.

**Note**

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Make sure that camshaft housing is kept straight.

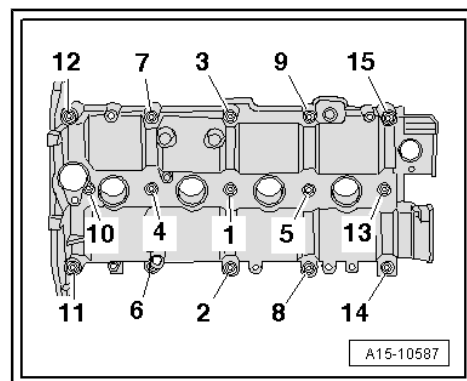
- Tighten camshaft housing bolts
⇒ [Fig. "Camshaft housing - tightening torque and sequence"](#), [page 89](#).

**Note**

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

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

- Install high-pressure pipe ⇒ Rep. gr. 24.
- Install exhaust gas recirculation pipe
⇒ ["3.1 Exhaust gas recirculation system - exploded view"](#), [page 167](#).
- Install cover (rear) for toothed belt
⇒ ["2.1 Toothed belt drive - exploded view"](#), [page 41](#).
- Install vacuum unit for intake manifold flap ⇒ Rep. gr. 24.
- Install coupling drive toothed belt
⇒ ["2.4 Removing and installing coupling drive toothed belt"](#), [page 50](#).



2.7 Removing and installing camshafts

Removing

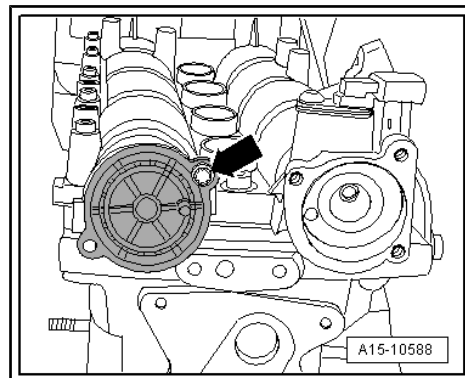
- Remove inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket
⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#) .
- Remove camshaft housing
⇒ [“2.6 Removing and installing camshaft housing”, page 98](#) .
- Remove high-pressure pump ⇒ Rep. gr. 24 .
- Remove bolt -arrow- and detach sealing cap.
- Pull camshafts out of camshaft housing.

Installing

- Tightening torque
⇒ [“2.1 Camshaft housing - exploded view”, page 86](#)

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

- Insert camshafts into camshaft housing (lubricate running surfaces with oil before inserting).
- Install high-pressure pump ⇒ Rep. gr. 24 .
- Install camshaft housing
⇒ [“2.6 Removing and installing camshaft housing”, page 98](#) .
- Install inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket
⇒ [“2.3 Removing and installing inlet camshaft sprocket with camshaft adjuster and exhaust camshaft sprocket”, page 90](#) .



2.8 Valves - exploded view



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1 - Inlet valve

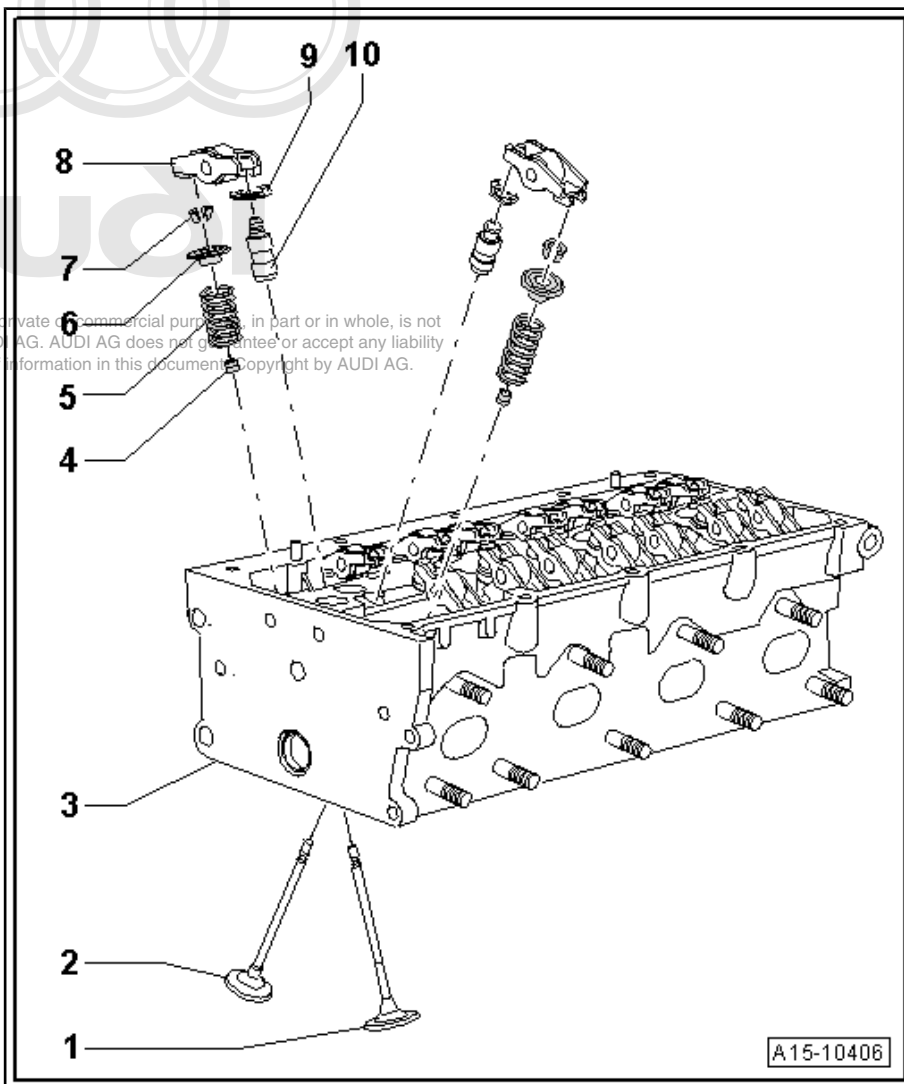
- ☐ Must not be machined; only grinding-in is permissible
- ☐ Valve dimensions
⇒ [“2.11 Valve dimensions”, page 112](#)
- ☐ Checking valve guides
⇒ [“2.12 Checking valve guides”, page 112](#)
- ☐ Machining valve seats
⇒ [“2.14 Machining valve seats”, page 114](#)

2 - Exhaust valve

- ☐ Must not be machined; only grinding-in is permissible
- ☐ Valve dimensions
⇒ [“2.11 Valve dimensions”, page 112](#)
- ☐ Checking valve guides
⇒ [“2.12 Checking valve guides”, page 112](#)
- ☐ Machining valve seats
⇒ [“2.14 Machining valve seats”, page 114](#)

3 - Cylinder head**4 - Valve stem oil seal**

- ☐ Renewing: with cylinder head installed
⇒ [“2.9 Renewing valve stem oil seals with cylinder head installed”, page 106](#), with cylinder head removed
⇒ [“2.10 Renewing valve stem oil seals with cylinder head removed”, page 109](#)

**5 - Valve spring****6 - Valve spring plate****7 - Valve cotters****8 - Roller rocker finger**

- ☐ Mark installation position for re-installation
- ☐ Check roller bearings for ease of movement
- ☐ Lubricate running surfaces with oil
- ☐ Attach to hydraulic compensation element -item 10- using securing clip -item 9-

9 - Securing clip

- ☐ Check for firm attachment
- ☐ Not supplied separately

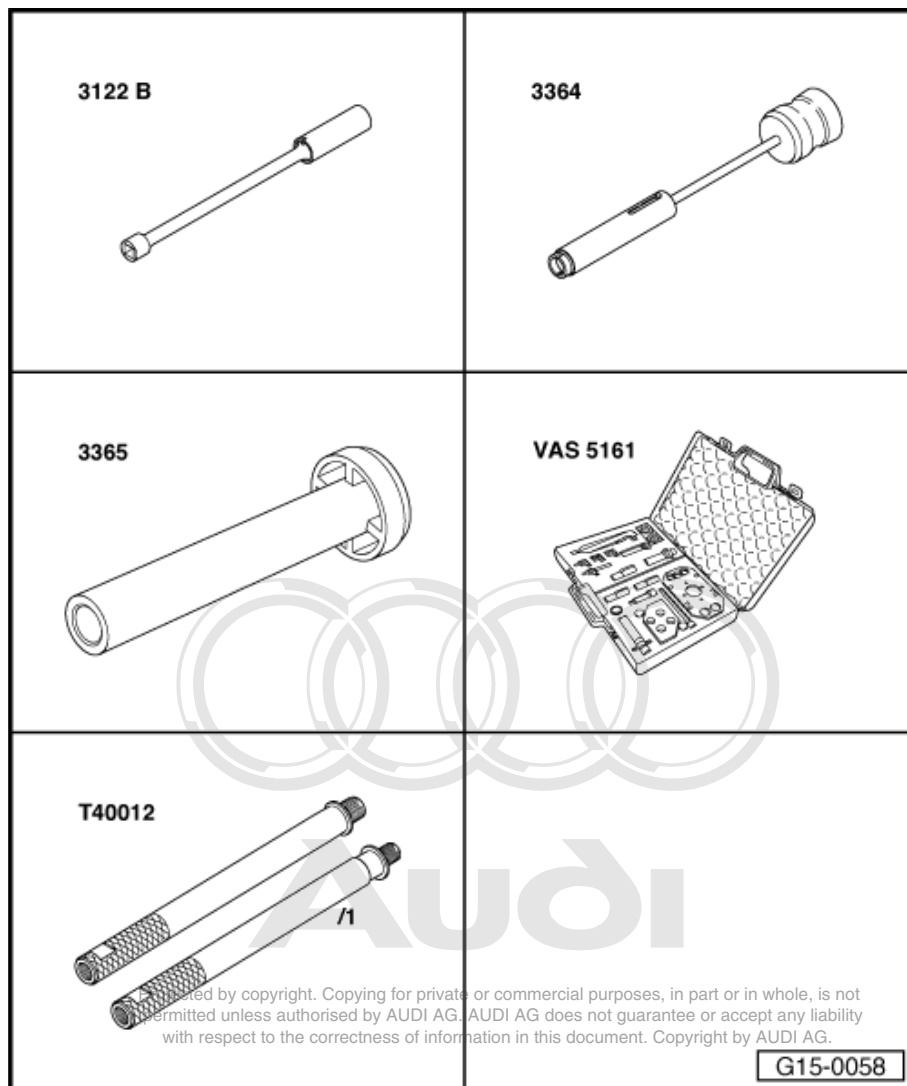
10 - Hydraulic compensation element

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

2.9 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required

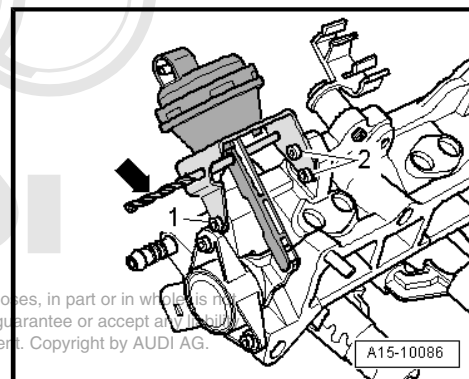
- ◆ Spark plug socket and extension - 3122 B-
- ◆ Valve stem seal puller - 3364-
- ◆ Valve stem seal fitting tool - 3365-
- ◆ Removal and installation device - VAS 5161-
- ◆ Adapter - T40012-



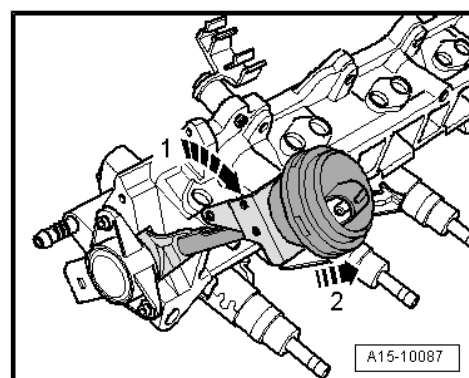
Procedure

- Remove intake manifold ⇒ Rep. gr. 24 .
- Remove camshaft housing
⇒ [“2.6 Removing and installing camshaft housing”, page 98](#) .
- Detach intake manifold (bottom section) with fuel rail from cylinder head ⇒ Rep. gr. 24 .
- Detach engine lifting eyes from cylinder head.

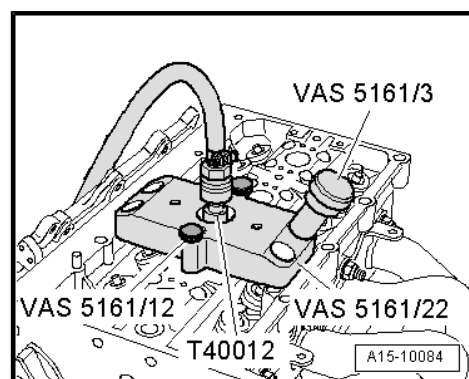
- Wrap insulating tape around tip and shaft of 2.5 mm Ø drill bit to avoid cuts.
- Press operating rod of vacuum unit towards vacuum unit and lock with 2.5 mm drill -arrow-.
- Remove bolts -1- and -2-.



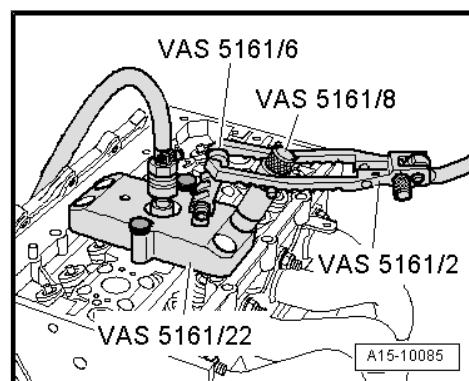
- Swivel vacuum unit to side -arrow 1- and detach from operating rod for intake manifold flap -arrow 2-.
- Unscrew bracket for high-pressure pipes from intake manifold (bottom section) with fuel rail.
- Secure intake manifold (bottom section) with fuel rail back onto cylinder head.
- Remove spark plugs with spark plug socket and extension - 3122 B-.
- Set piston of appropriate cylinder to "bottom dead centre".



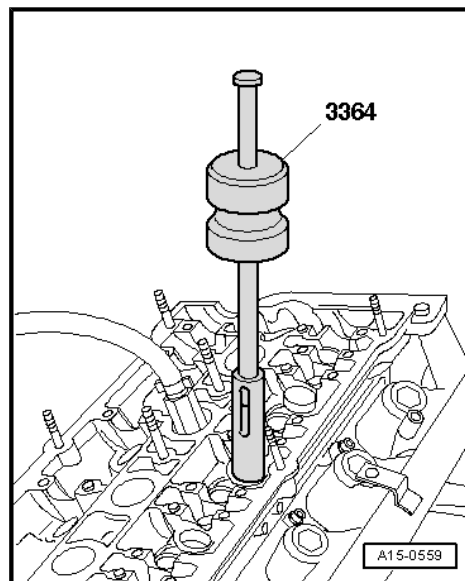
- Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.
- Connect adapter to compressed air line using a commercially available connection piece, and apply constant air pressure.
- Minimum pressure: 6 bar
- Fit guide plate -VAS 5161/22- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- onto cylinder head.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.



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



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

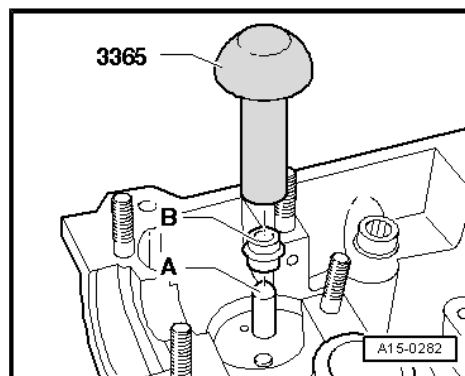


Caution

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

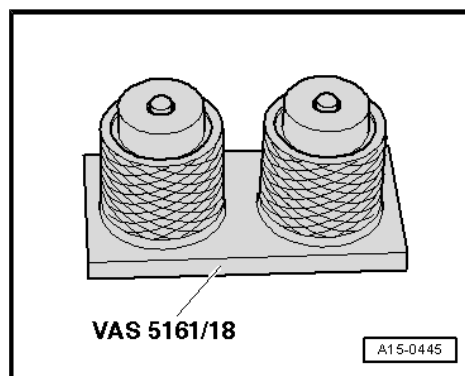
- ◆ **New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.**

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



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

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



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- Insert valve spring and valve spring plate.
- Secure guide plate -VAS 5161/22- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotteners.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.

Assembling

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

- Install spark plugs ⇒ Maintenance ; Booklet 809 .
- Install engine lifting eyes
⇒ ["1.1 Cylinder head - exploded view", page 74](#) .
- Install intake manifold (bottom section) with fuel rail ⇒ Rep. gr. 24 .
- Install camshaft housing
⇒ ["2.6 Removing and installing camshaft housing", page 98](#) .
- Install intake manifold ⇒ Rep. gr. 24 .

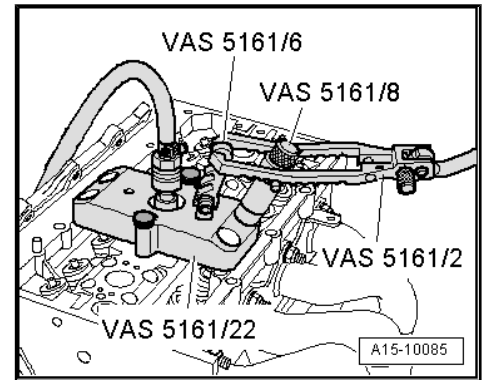
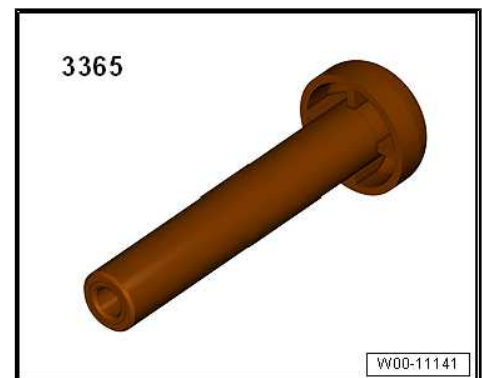
2.10 Renewing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required

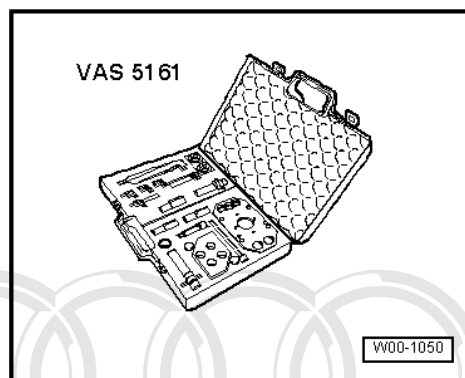
- ◆ Valve stem seal puller - 3364-



- ◆ Valve stem seal fitting tool - 3365-



◆ Removal and installation device for valve cotters - VAS 5161-



◆ Engine and gearbox support - VAS 6095-

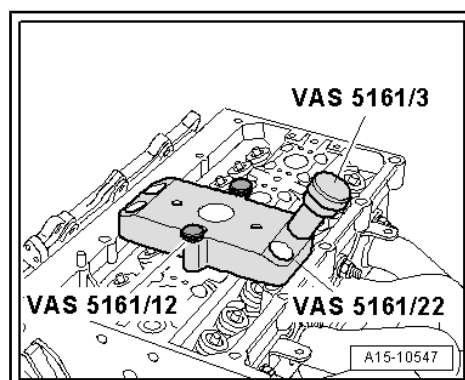
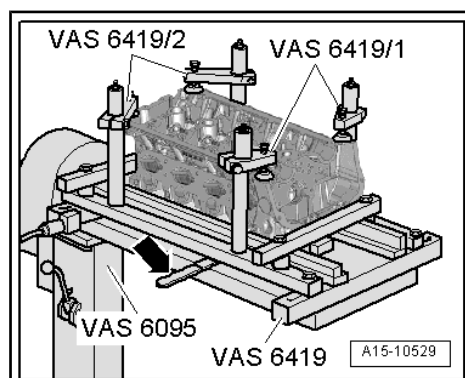


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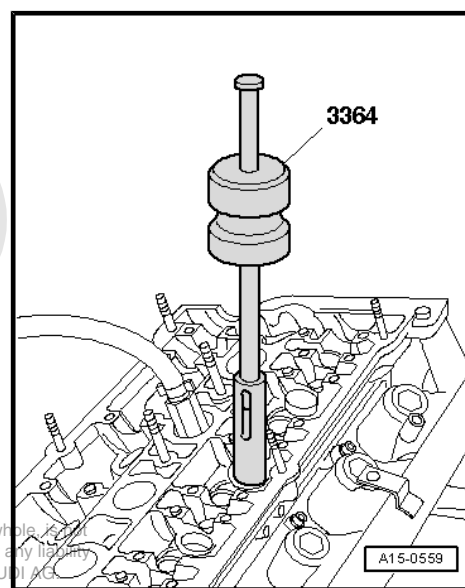
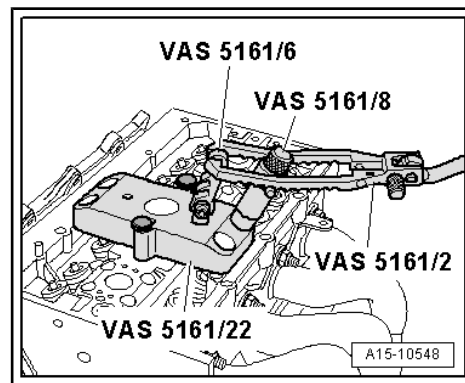
◆ Tensioning device -VAS 6419-

Procedure

- Attach tensioning device -VAS 6419- to engine and gearbox support - VAS 6095- .
- Secure cylinder head in tensioning device -VAS 6419- as illustrated.
- Connect compressed air line to tensioning device -VAS 6419- .
- 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 5161/22- onto cylinder head.
- Secure guide plate with knurled screws -VAS 5161/12- onto cylinder head.
- Apply drift -VAS 5161/3- to guide plate and use plastic-headed hammer to release sticking valve cotters.



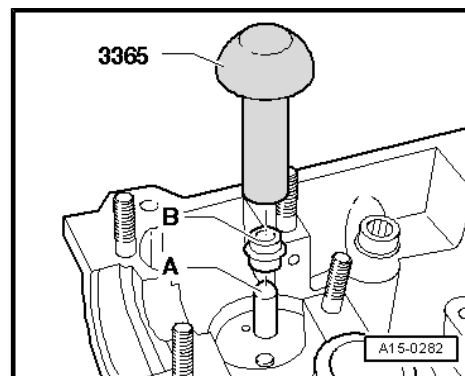
- Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
- At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.
- Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.
- Release pressure fork.
- Take out assembly cartridge.
- Detach guide plate and turn to one side.
- Detach valve spring with valve spring plate.
- Pull off valve stem oil seal with valve stem seal puller - 3364- .

**Caution**

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

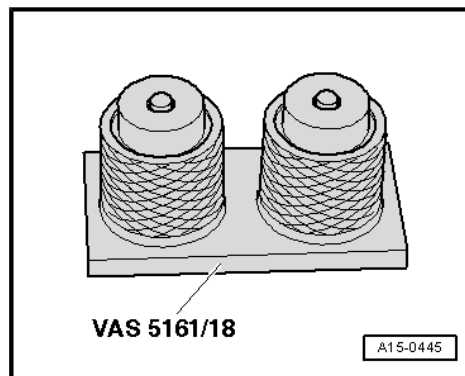
- ◆ ***New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.***

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

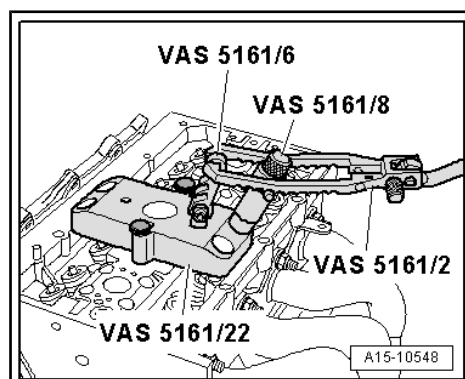


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

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



- Insert valve spring and valve spring plate.
- Secure guide plate -VAS 5161/22- back onto cylinder head.
- Insert assembly cartridge -VAS 5161/8- in guide plate.
- Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
- Release pressure fork with knurled screw still in pulled position.
- Repeat procedure for each valve.



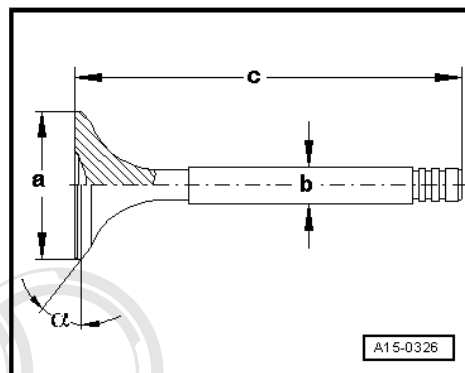
2.11 Valve dimensions

Dimension		Inlet valve	Exhaust valve
$\varnothing a$	mm	29.5	26.0
$\varnothing b$	mm	5.973	5.953
c	mm	100.9	100.5
α	$^{\circ}$	45	45



Note

Valves must not be machined. Only grinding is permitted.



2.12 Checking valve guides

Special tools and workshop equipment required

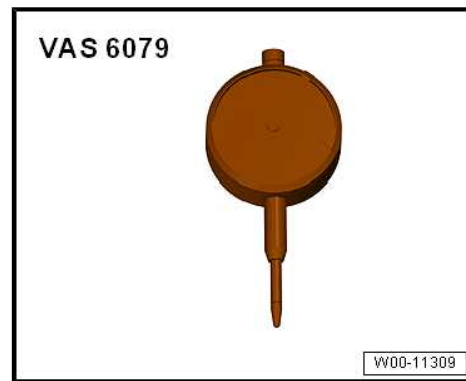
- ♦ Universal dial gauge bracket - VW 387-

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◆ Dial gauge - VAS 6079-

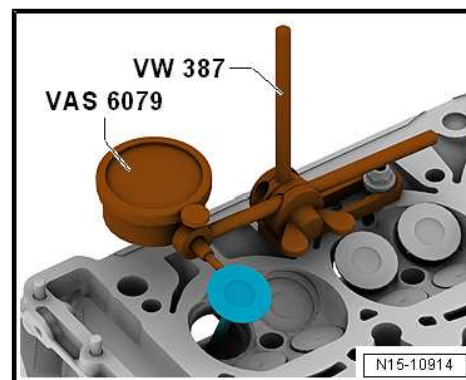
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**Procedure****Note**

- ◆ *If the valve has to be renewed as part of a repair, use a new valve for the measurement.*
- ◆ *Only insert inlet valve into inlet valve guide and exhaust valve into exhaust valve guide, as the stem diameters are different.*
- Insert valve into guide.
- End of valve stem must be flush with valve guide.
- Measure sideways play -arrows-.
- Wear limit: 0.8 mm.
- If the wear limit is exceeded, repeat the measurement with new valves.
- Renew cylinder head if wear limit is still exceeded.

**Note**

Valve guides cannot be renewed.

**2.13 Checking valves**

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

2.14 Machining valve seats

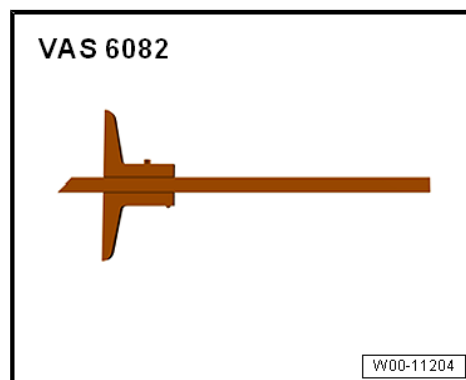


Note

- ◆ *If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (machined).*
- ◆ *When servicing engines with leaking valves, it is not sufficient to machine (reface) the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high-mileage engines
⇒ ["2.12 Checking valve guides", page 112](#) .*
- ◆ *Valve seats should only be machined to the extent required to give a proper seating pattern.*
- ◆ *The maximum permissible machining dimension must be calculated before starting work.*
- ◆ *If the machining dimension is exceeded, the function of the hydraulic valve play compensation can no longer be guaranteed and the cylinder head must be renewed.*

Special tools and workshop equipment required

- ◆ Depth gauge - VAS 6082-



- ◆ Valve seat machining tool



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A - Calculating maximum permissible machining dimension

- Insert valve and press firmly against valve seat.

Note

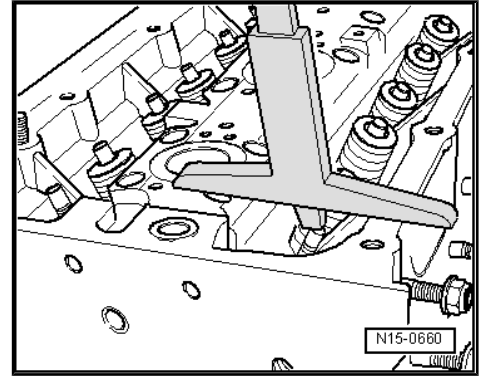
If the valve has to be renewed as part of a repair, use a new valve for the measurement.

- Use depth gauge - VAS 6082- to measure distance between end of valve stem (upper edge) and top surface of cylinder head.
- Calculate maximum permissible machining dimension from measured distance and minimum dimension.
- Minimum dimension for inlet valve and exhaust valve: 7.6 mm.

Measured distance minus minimum dimension = max. permissible machining dimension.

Example:

Measured distance	8.0 mm
Minimum dimension	– 7.6 mm
Maximum permissible machining dimension	= 0.4 mm



Note

- ◆ *If the calculated maximum permissible machining dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve.*
- ◆ *If the result is again 0 mm or less than 0 mm, renew the cylinder head.*

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B - Machining valve seats

Inlet valve seat

a - $\varnothing$ 28.7 mm

b - Maximum permissible machining dimension

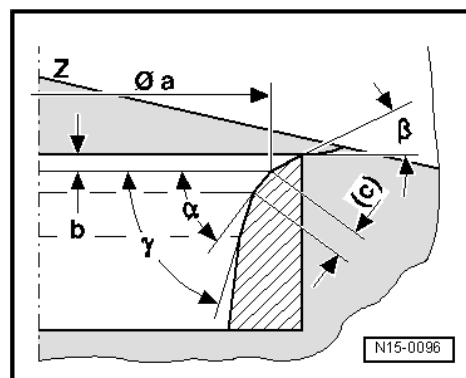
c - 1.5 ... 1.8 mm

Z - Bottom surface of cylinder head

α - 45° valve seat angle

β - 30° upper correction angle

γ - 60° lower correction angle



Exhaust valve seat

a - $\varnothing$ 25.0 mm

b - Maximum permissible machining dimension

c - approx. 1.8 mm

Z - Lower edge of cylinder head

α - 45° valve seat angle

β - 30° upper correction angle

γ - 60° lower correction angle



Note

Calculating maximum permissible machining dimension
⇒ [page 115](#).



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17 – Lubrication

1 Lubrication system



Caution

Risk of damage to catalytic converter.

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



Note

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- ◆ *If large quantities of metal shavings or abrasion are found when performing engine repairs, this may be an indication of damage to the crankshaft or conrod bearings. To prevent further damage, the following steps are required after completion of repair work: clean the oil galleries carefully and renew the oil cooler and oil filter.*
- ◆ *Refer to ⇒ Maintenance tables for engine oil capacity, oil specifications and viscosity grades.*

⇒ ["1.1 Lubrication system - exploded view", page 117](#)

⇒ ["1.2 Removing and installing oil level and oil temperature sender G266", page 120](#)

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

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

⇒ ["1.5 Removing and installing oil cooler", page 127](#)

⇒ ["1.6 Removing and installing oil pressure switch F1", page 128](#)

⇒ ["1.7 Checking oil pressure switch F1 and oil pressure", page 128](#)

⇒ ["1.8 Engine oil", page 130](#)

⇒ ["1.9 Checking oil level", page 130](#)

1.1 Lubrication system - exploded view

1 - Bolt

- ☐ 10 Nm

2 - Oil level and oil temperature sender - G266-

- ☐ Removing and installing
⇒ ["1.2 Removing and installing oil level and oil temperature sender G266", page 120](#)

3 - Seal

- ☐ Renew

4 - Sump

- ☐ Removing and installing
⇒ ["1.3 Removing and installing sump", page 121](#)

5 - Oil drain plug

- ☐ 30 Nm

6 - Bolt

- ☐ 10 Nm

7 - Suction pipe

- ☐ Clean strainer if dirty

8 - Bolt

- ☐ 10 Nm

9 - Gasket

- ☐ Renew

10 - Bolt

- ☐ Renew
- ☐ 12 Nm

11 - Crankshaft oil seal

- ☐ Renewing ⇒ ["3.2 Renewing crankshaft oil seal", page 55](#)

12 - Oil pump

- ☐ Oil pump housing is combined as one unit with sealing flange (pulley end)
- ☐ Removing and installing ⇒ ["1.4 Removing and installing oil pump", page 124](#)
- ☐ Before installing, check that the two dowel sleeves for centring oil pump/cylinder block are fitted
- ☐ When installing note drive cams on crankshaft

13 - Gasket

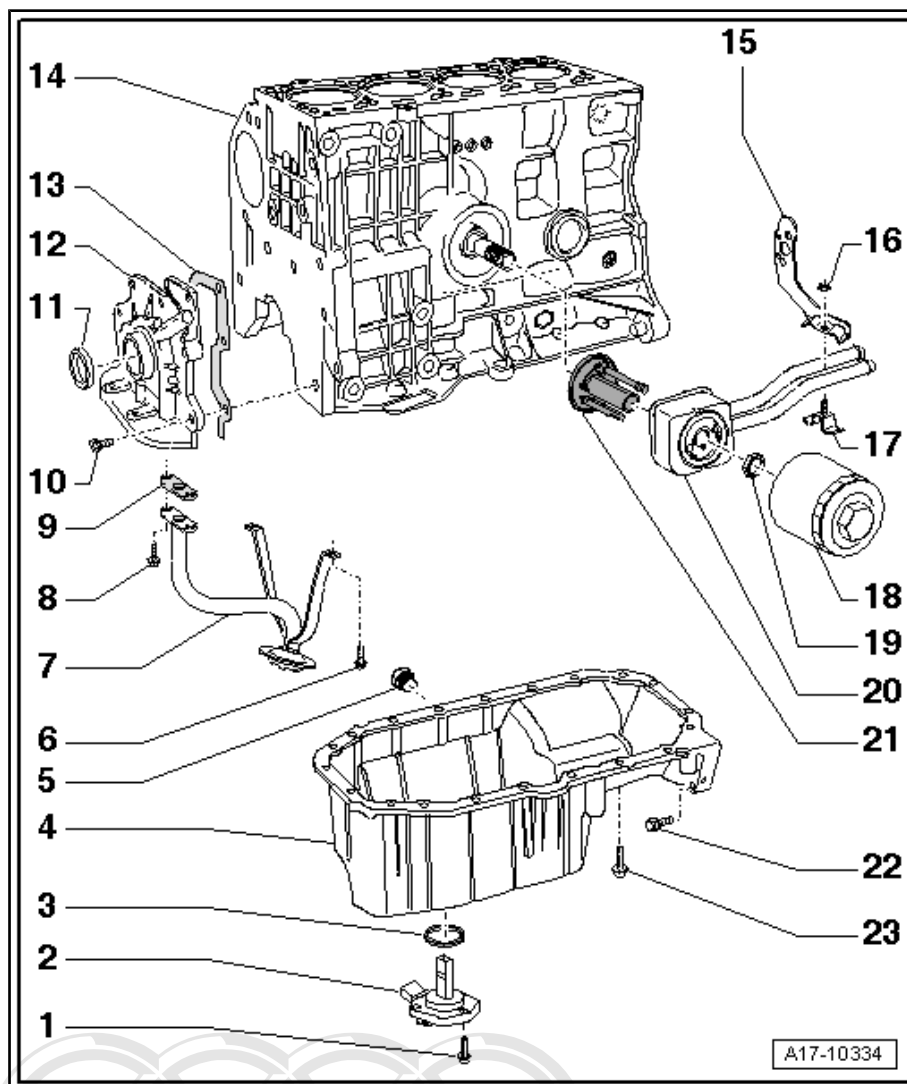
- ☐ Renew
- ☐ Must be positioned on dowel sleeves

14 - Cylinder block
15 - Bracket
16 - Nut

- ☐ 10 Nm

17 - Retaining clamp
18 - Oil filter

- ☐ Removing and installing ⇒ Maintenance ; Booklet 809
- ☐ See note ⇒ [page 117](#)



19 - Nut

- ☐ 25 Nm

20 - Oil cooler

- ☐ Removing and installing ⇒ [“1.5 Removing and installing oil cooler”, page 127](#)
- ☐ Ensure clearance from surrounding components
- ☐ See note ⇒ [page 117](#)
- ☐ If renewed, refill system with fresh coolant

21 - Seal

- ☐ Renew
- ☐ Lubricate before fitting
- ☐ Insert into oil cooler
- ☐ Note installation position

22 - Bolt

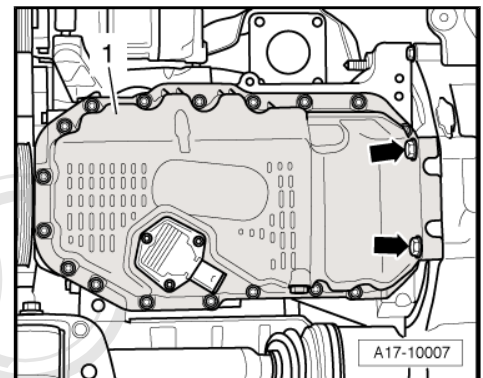
- ☐ Tightening torque and sequence ⇒ [Fig. “Sump - tightening torque and sequence””, page 119](#)

23 - Bolt

- ☐ Renew
- ☐ Tightening torque and sequence ⇒ [Fig. “Sump - tightening torque and sequence””, page 119](#)
- ☐ Use Allen key (long reach) - T10058- to loosen and tighten at flywheel end

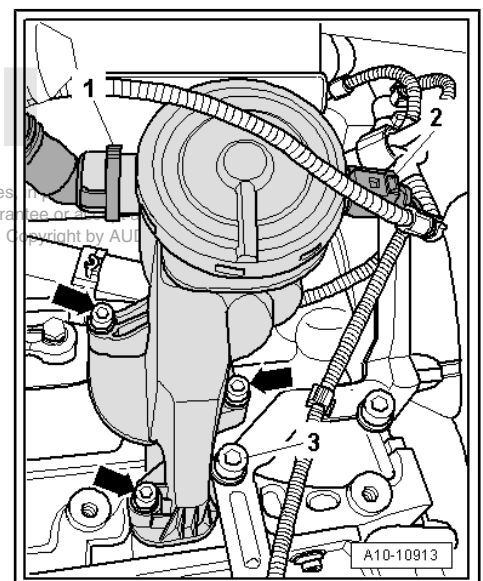
Sump - tightening torque and sequence

- Tighten bolts securing sump in three stages as follows:
 1. Tighten bolts securing sump to cylinder block initially to 5 Nm.
 2. Tighten bolts -arrows- securing sump to gearbox to 45 Nm.
 3. Tighten bolts securing sump to cylinder block to 13 Nm.



Pressure control valve for crankcase breather system - tightening torques

- Tighten bolts -arrows- to 10 Nm.
- Tighten bolt -3- securing bracket to 20 Nm.



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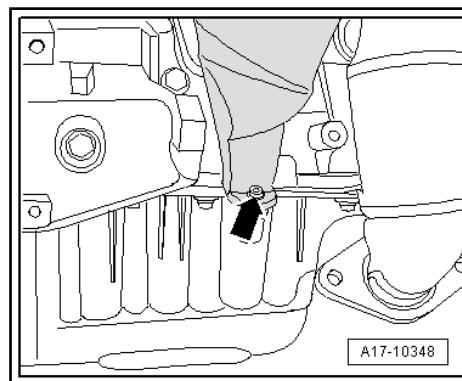
Connection with guide tube for oil dipstick and oil filler pipe - tightening torque



Note

Fit new O-rings.

- Tighten bolt securing connection with guide tube for oil dipstick and oil filler pipe to 9 Nm.

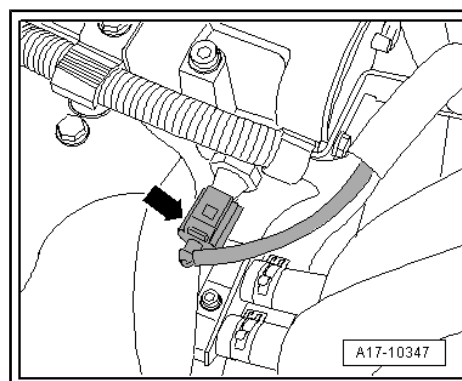


Oil pressure switch - F1-



Note

- ◆ Opening/closing pressure 0.3 bar.
- ◆ Checking oil pressure switch - F1-
⇒ ["1.7 Checking oil pressure switch F1 and oil pressure", page 128](#).
- ◆ Renew seal.
- Tighten oil pressure switch - F1- to 25 Nm.



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

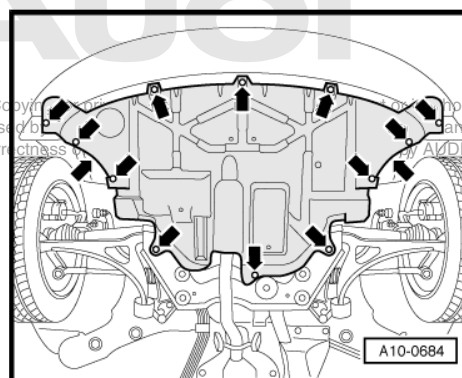
Special tools and workshop equipment required

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



Removing

- Release fasteners -arrows- and remove noise insulation.
- Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.



- Unplug electrical connector -3-.
- Remove bolt -1- and detach oil level and oil temperature sender - G266- -item 4-.

Installing

- Tightening torque
⇒ ["1.1 Lubrication system - exploded view", page 117](#)

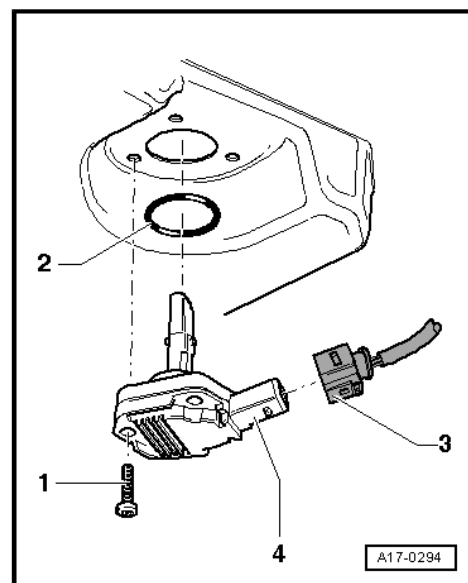
Installation is carried out in the reverse order; note the following:



Note

Renew seal -2-.

- Fill up with engine oil and check engine oil level ⇒ Maintenance ; Booklet 809 .
- Install noise insulation ⇒ Rep. gr. 50 .



1.3 Removing and installing sump

Special tools and workshop equipment required

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



- ◆ Allen key, long reach - T10058-

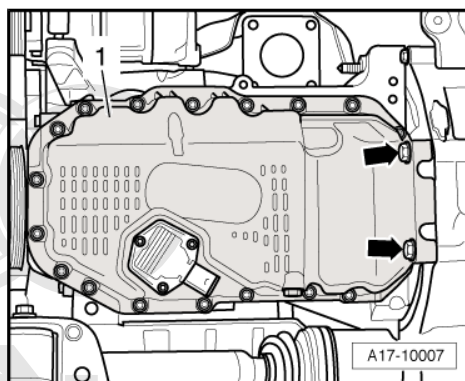
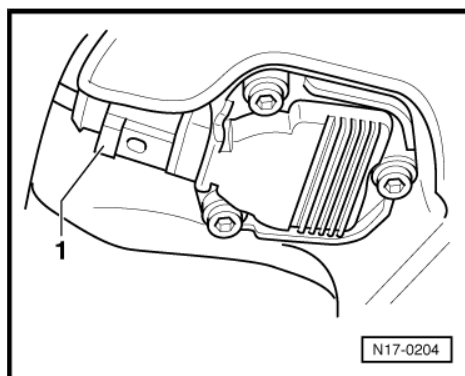
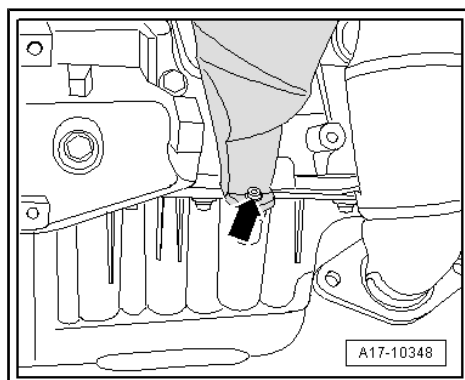
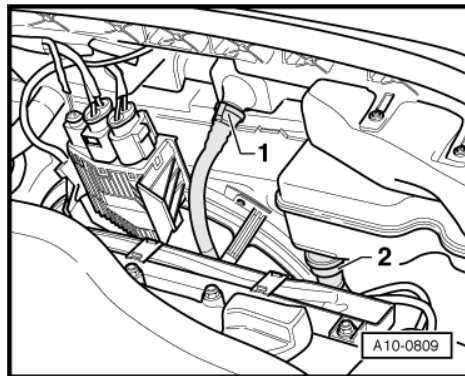


- ◆ Electric drill with plastic brush attachment
- ◆ Sealant ⇒ Parts catalogue
- ◆ Safety goggles

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Removing

- Detach bonnet ⇒ ["1 Detaching bonnet", page 7](#) .
- Pull oil dipstick out of guide tube.
- Detach guide tube -1- for oil dipstick (press release tabs).
- Detach oil filler pipe -2- from oil filler reservoir.
- Remove front exhaust pipe
⇒ ["1.3 Removing and installing front exhaust pipe", page 159](#) .
- Remove bolt -arrow-, detach connection with guide tube for oil dipstick and oil filler pipe from sump.
- Unplug electrical connector -1- at oil level and oil temperature sender - G266- .
- Place used oil collection and extraction unit - V.A.G 1782- under engine and drain engine oil.
- Remove bolts securing sump to gearbox -arrows-.
- Unscrew bolts for sump -1- in diagonal sequence and remove.
- Carefully release sump from bonded joint.



Installing

- Tightening torque
⇒ ["1.1 Lubrication system - exploded view", page 117](#)

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



Note

Fit new O-ring to dipstick guide tube.

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**Caution**

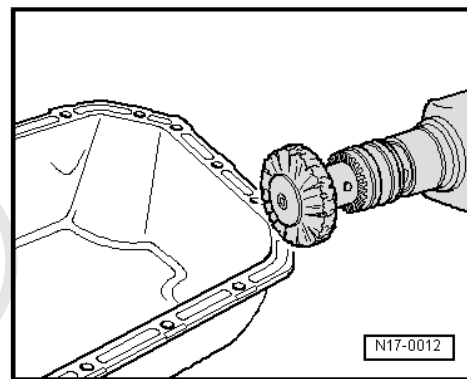
Protect lubrication system against contamination.

- ◆ *Cover exposed parts of the engine.*

**WARNING**

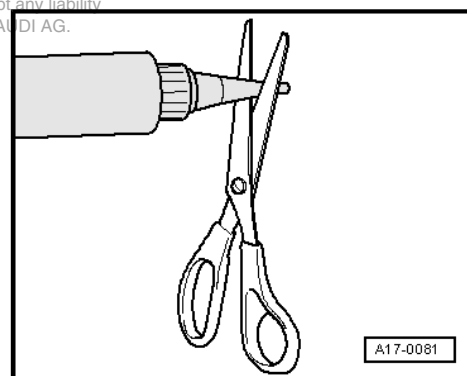
Risk of eye injury.

- ◆ *Wear safety goggles.*



- Remove sealant residue from sump and cylinder block using rotating plastic brush or similar.
- Clean sealing surfaces; they must be free of oil and grease.
- Cut off nozzle of tube at front marking (nozzle $\varnothing$ approx. 2 mm).

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**Caution**

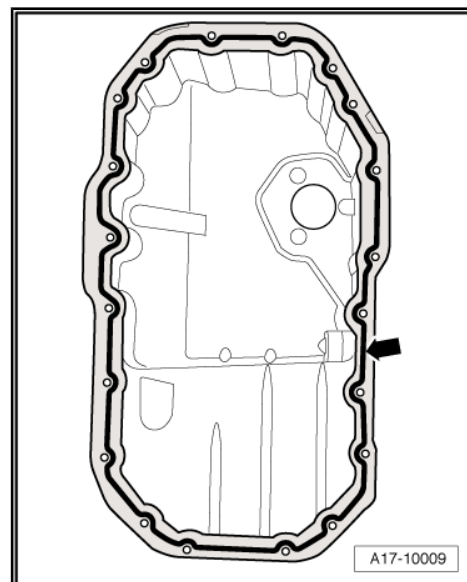
Make sure lubrication system is not clogged by excess sealant.

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

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

**Note**

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



- Fit sump and tighten bolts
⇒ [Fig. “Sump - tightening torque and sequence”](#),
[page 119](#) .

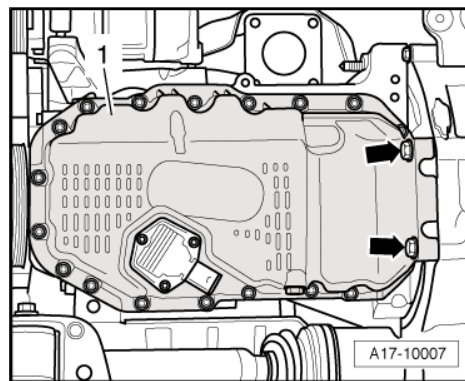


Note

- ◆ If sump is fitted with engine removed, make sure sump is flush with cylinder block at gearbox end.
- ◆ After fitting sump assembly, the sealant must dry for approx. 30 minutes. Then (and only then) fill the engine with engine oil.

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

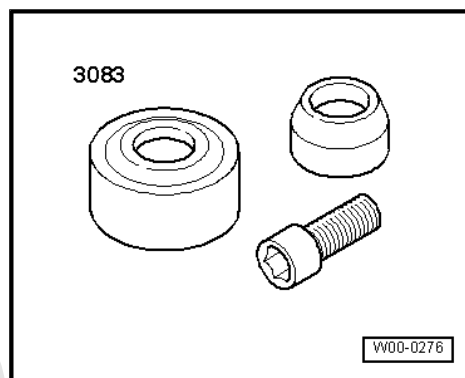
- Install connection with guide tube for oil dipstick and oil filler pipe
⇒ [Fig. “Connection with guide tube for oil dipstick and oil filler pipe - tightening torque”](#), [page 120](#) .
- Install front exhaust pipe
⇒ [“1.3 Removing and installing front exhaust pipe”](#),
[page 159](#) .
- Fill up with engine oil and check engine oil level ⇒ Maintenance ; Booklet 809 .



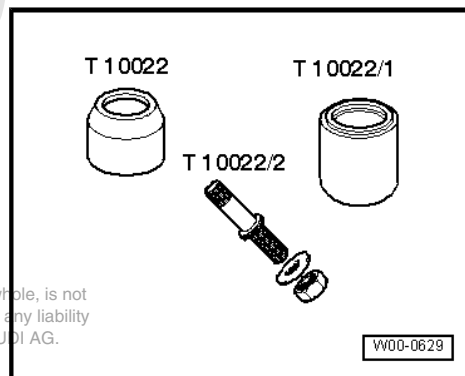
1.4 Removing and installing oil pump

Special tools and workshop equipment required

- ◆ Oil seal fitting tool - 3083-



- ◆ Assembly tool - T10022-



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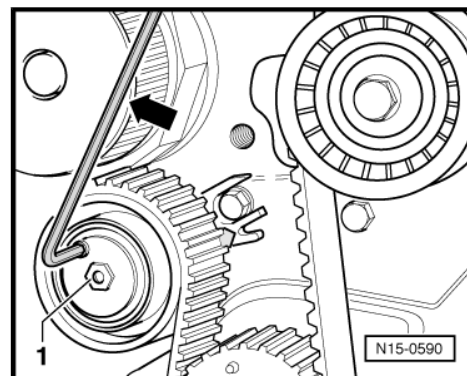
Removing

- Remove main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#).
- Remove bolt -1- and detach tensioning roller for main drive.



Note

Disregard -arrow-.



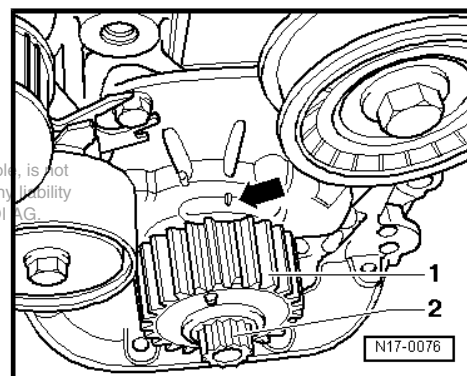
- Check “TDC” position of crankshaft:
 - The flat tooth on crankshaft sprocket -1- must align with marking -arrow- on oil pump housing.



Note

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Disregard item -2-.

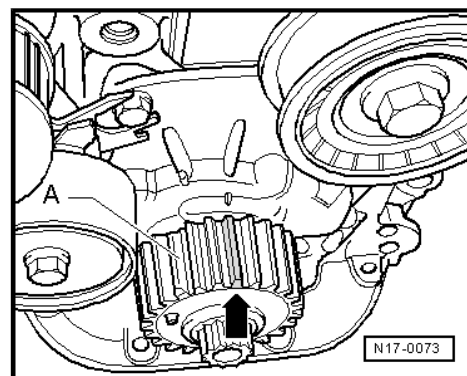


- Turn crankshaft slightly in opposite direction to engine rotation.
- The third tooth -arrow- to the right of flat tooth -A- on crankshaft sprocket must align with marking on oil pump housing.

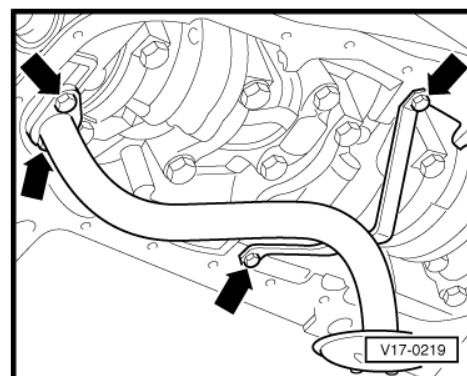


Note

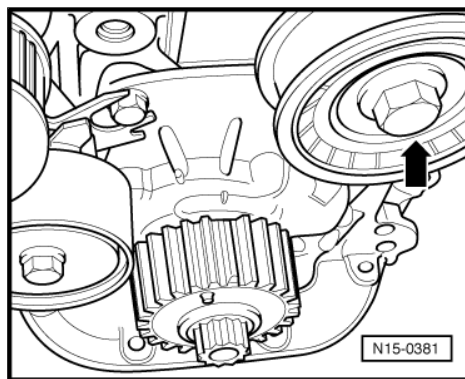
With the crankshaft in this position, one of the drive cams is positioned at the top, which makes it easier to install the oil pump.



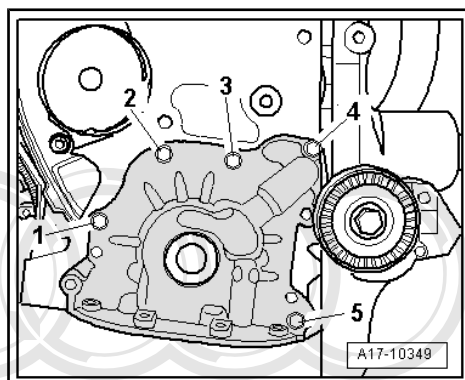
- Remove sump
⇒ [“1.3 Removing and installing sump”, page 121](#).
- Remove bolts -arrows- and detach suction pipe.



- Remove bolt -arrow- and take off idler roller for main drive toothed belt.
- Remove bolt and detach crankshaft sprocket.



- Remove bolts -1 ... 5- and detach oil pump housing.



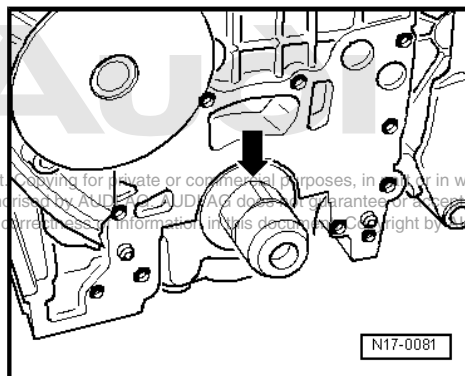
Installing

- Tightening torques
⇒ ["1.1 Lubrication system - exploded view", page 117](#)
- One of the 4 drive cams -arrow- on the crankshaft is positioned at the top.



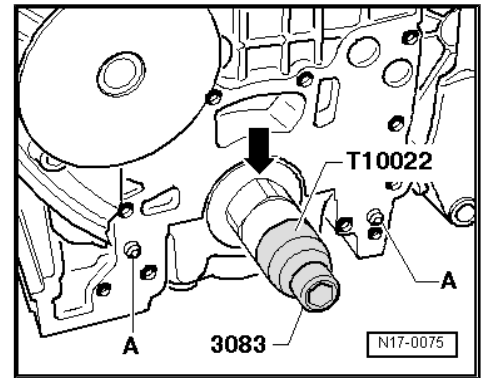
Note

Renew gasket and bolts securing oil pump housing.



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- Apply hexagon socket head bolt from oil seal fitting tool - 3083- with assembly tool - T10022- to crankshaft and tighten hand-tight.
- Fit gasket for oil pump housing onto dowel sleeves -A-.
- Lubricate drive cams on crankshaft with oil.
- Lightly oil sealing lip of oil pump oil seal.
- Carefully fit oil pump onto drive cam on crankshaft.
- Align inner rotor with drive cams by turning oil pump slightly if necessary.
- Carefully press oil pump housing onto dowel sleeves.



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

- Install sump
⇒ [“1.3 Removing and installing sump”, page 121](#) .
- Install tensioning roller and idler roller for main drive toothed belt ⇒ [“2.1 Toothed belt drive - exploded view”, page 41](#) .
- Install main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#) .

1.5 Removing and installing oil cooler

Special tools and workshop equipment required

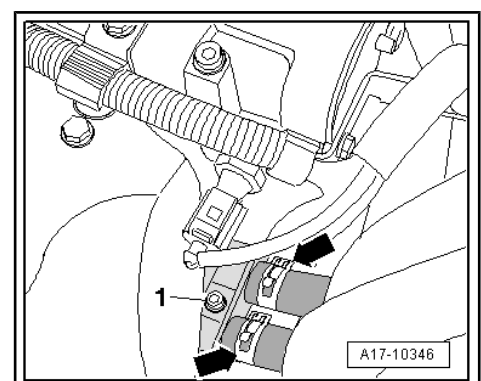
- ◆ Hose clamps, up to 25 mm - 3094-

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Removing

- Remove starter catalytic converter
⇒ [“1.2 Removing and installing starter catalytic converter”, page 158](#) .
- Remove exhaust manifold
⇒ [“2.2 Removing and installing exhaust manifold”, page 165](#) .
- Remove oil filter ⇒ Maintenance ; Booklet 809 .
- Remove bolt -1-.
- Clamp off coolant hoses -arrows- with hose clamps up to 25 mm - 3094- and detach.



- Unscrew nut -arrow- and remove oil cooler -1-.

Installing

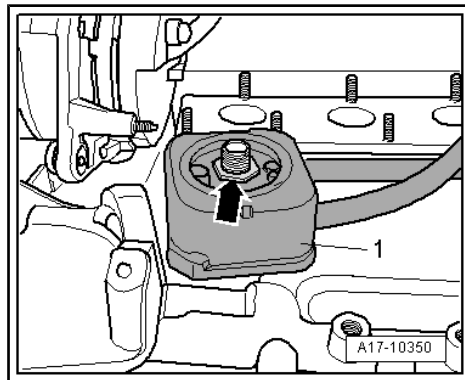
- Tightening torque
⇒ [“1.1 Lubrication system - exploded view”, page 117](#)

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



Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ [Parts catalogue](#) .*
- ◆ *Make sure there is sufficient clearance from surrounding components.*
- Install oil filter and check engine oil level ⇒ Maintenance ; Booklet 809 .
- Install exhaust manifold
⇒ [“2.2 Removing and installing exhaust manifold”, page 165](#) .
- Install starter catalytic converter
⇒ [“1.2 Removing and installing starter catalytic converter”, page 158](#) .



1.6 Removing and installing oil pressure switch - F1-

Removing

- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .
- Unplug electrical connector -arrow- on oil pressure switch - F1- .



Note

Place a cloth underneath to catch any escaping oil.

- Unscrew oil pressure switch.

Installing

- Tightening torque
⇒ [“1.1 Lubrication system - exploded view”, page 117](#)

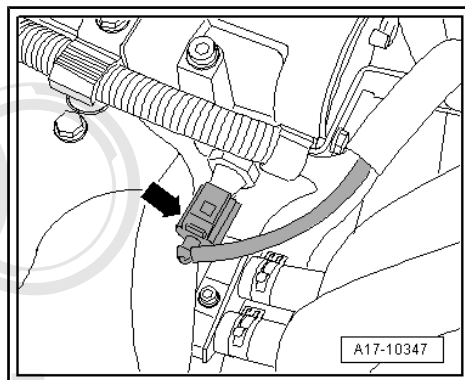
Installation is carried out in the reverse order; note the following:



Note

Renew seal.

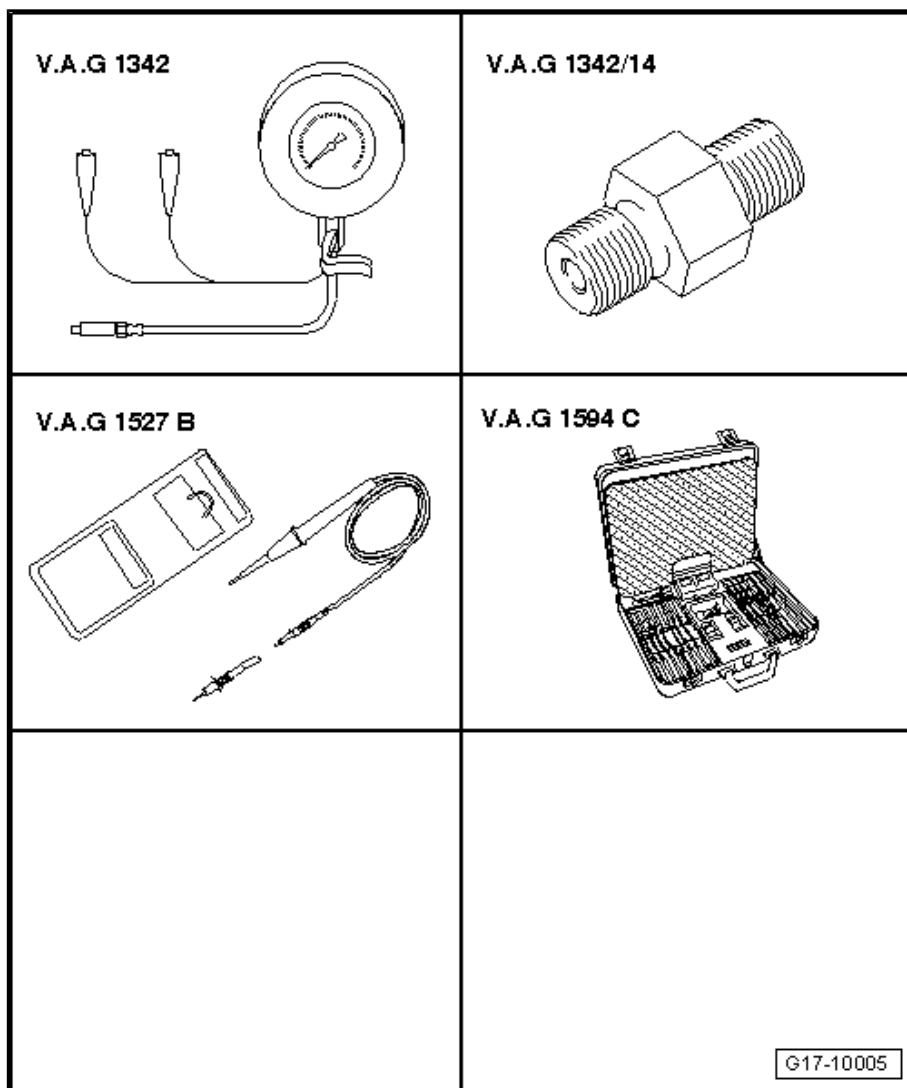
- Check engine oil level ⇒ Maintenance ; Booklet 809 .



1.7 Checking oil pressure switch - F1- and oil pressure

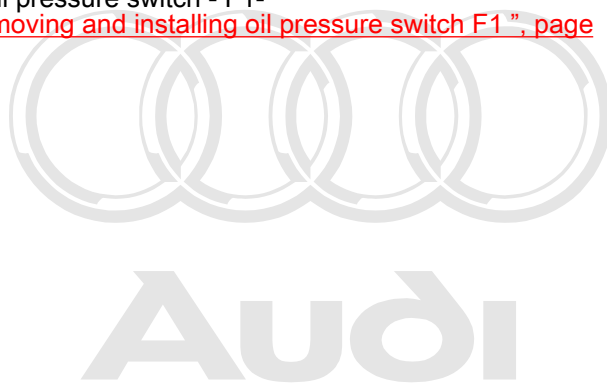
Special tools and workshop equipment required

- ◆ Oil pressure tester - V.A.G 1342-
- ◆ Adapter - V.A.G 1342/14-
- ◆ Voltage tester - V.A.G 1527B-
- ◆ Auxiliary measuring set - V.A.G 1594C-



Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C
- Remove oil pressure switch - F1-
⇒ ["1.6 Removing and installing oil pressure switch F1", page 128](#).

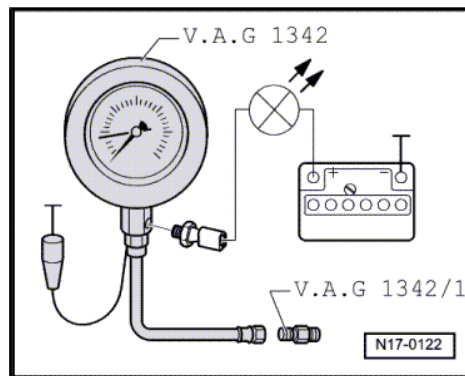


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- Connect oil pressure tester - V.A.G 1342- with adapter - V.A.G 1342/14- to bore for oil pressure switch.
- Screw oil pressure switch - F1- into oil pressure tester - V.A.G 1342- .
- Connect brown wire of oil pressure tester to earth “-”.

Checking oil pressure switch

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



Note

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

- Start engine.



Note

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

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

Checking oil pressure

- Start engine.
- Oil pressure at 2000 rpm: at least 2.0 bar.

Assembling

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

- Install oil pressure switch - F1-
⇒ [“1.6 Removing and installing oil pressure switch F1”, page 128](#) .

1.8 Engine oil

Refer to ⇒ Maintenance tables for engine oil capacity, viscosity grades and oil specifications.

1.9 Checking oil level

⇒ Maintenance ; Booklet 809

19 – Cooling

1 Cooling system

Risk of scalding as hot coolant can escape

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

- Wear protective gloves.
- Wear safety goggles.
- Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).



Note

- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- ◆ *The arrow markings on coolant pipes and on ends of hoses must align.*

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⇒ [“1.1 Connection diagram - coolant hoses”, page 131](#)

⇒ [“1.2 Draining and filling cooling system”, page 133](#)

⇒ [“1.3 Coolant pump - exploded view”, page 138](#)

⇒ [“1.4 Removing and installing coolant pump”, page 139](#)

⇒ [“1.5 Thermostat and rear coolant pipe - exploded view”, page 140](#)

⇒ [“1.6 Removing and installing map-controlled engine cooling system thermostat F265”, page 141](#)

⇒ [“1.7 Removing and installing thermostat housing and coolant pipe \(rear\)”, page 144](#)

⇒ [“1.8 Removing and installing coolant temperature sender G62”, page 147](#)

⇒ [“1.9 Removing and installing radiator outlet coolant temperature sender G83”, page 148](#)

⇒ [“1.10 Removing and installing radiator”, page 149](#)

⇒ [“1.11 Checking cooling system for leaks”, page 153](#)

⇒ [“1.12 Removing and installing radiator fan V7”, page 155](#)

1.1 Connection diagram - coolant hoses

1 - Coolant pump

- ❑ Removing and installing
⇒ ["1.4 Removing and installing coolant pump", page 139](#)

2 - Throttle valve module - J338-

3 - Heat exchanger for heater

- ❑ Removing and installing
⇒ Rep. gr. 80
- ❑ If renewed, refill system with fresh coolant

4 - Coolant expansion tank

- ❑ With filler cap
- ❑ Checking pressure relief valve in filler cap
⇒ [page 155](#)

5 - Thermostat housing

- ❑ Removing and installing
⇒ ["1.7 Removing and installing thermostat housing and coolant pipe \(rear\)", page 144](#)

6 - Map-controlled engine cooling system thermostat - F265-

- ❑ Removing and installing
⇒ ["1.6 Removing and installing map-controlled engine cooling system thermostat F265", page 141](#)

7 - Coolant temperature sender - G62-

- ❑ Removing and installing
⇒ ["1.8 Removing and installing coolant temperature sender G62", page 147](#)

8 - Radiator

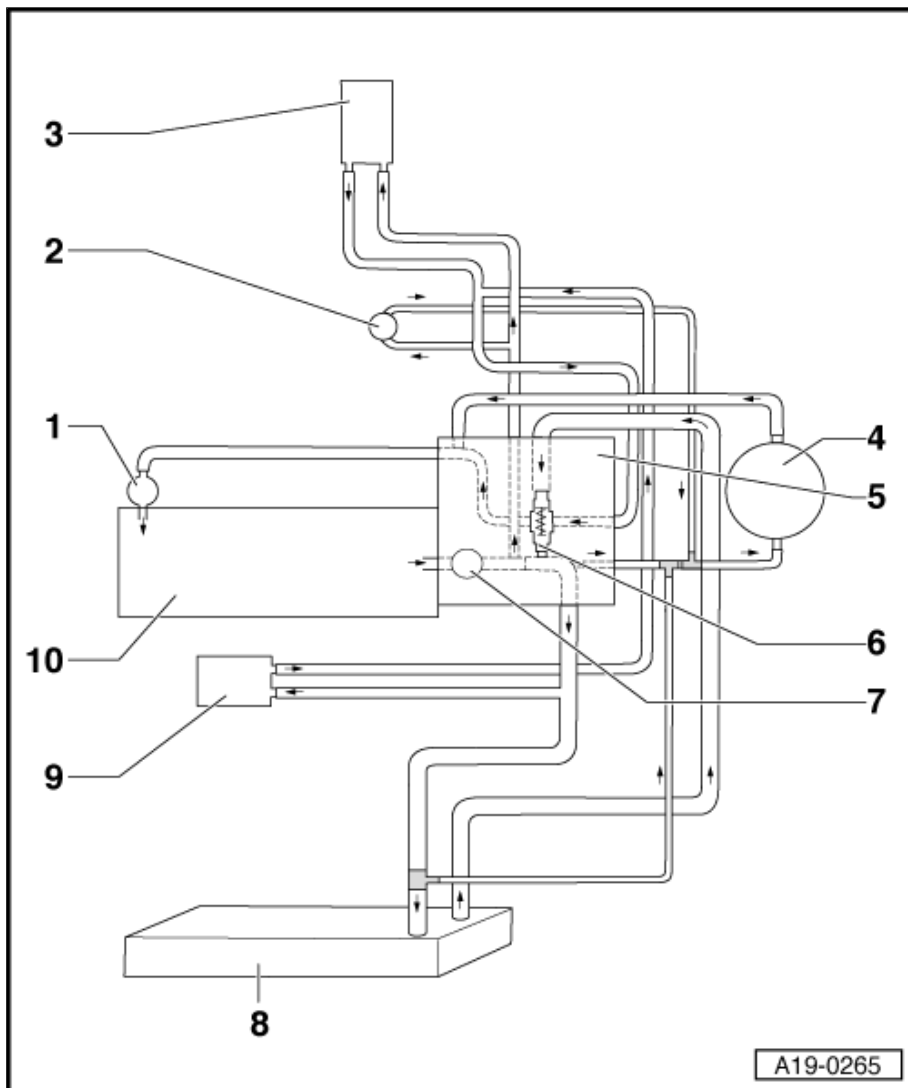
- ❑ Removing and installing ⇒ ["1.10 Removing and installing radiator", page 149](#)
- ❑ If renewed, refill system with fresh coolant
- ❑ With radiator outlet coolant temperature sender - G83- in coolant hose going to coolant distributor housing
- ❑ Removing and installing radiator outlet coolant temperature sender - G83-
⇒ ["1.9 Removing and installing radiator outlet coolant temperature sender G83", page 148](#)

9 - Oil cooler

- ❑ Removing and installing ⇒ ["1.5 Removing and installing oil cooler", page 127](#)
- ❑ If renewed, refill system with fresh coolant

10 - Cylinder head and cylinder block

- ❑ If renewed, refill system with fresh coolant

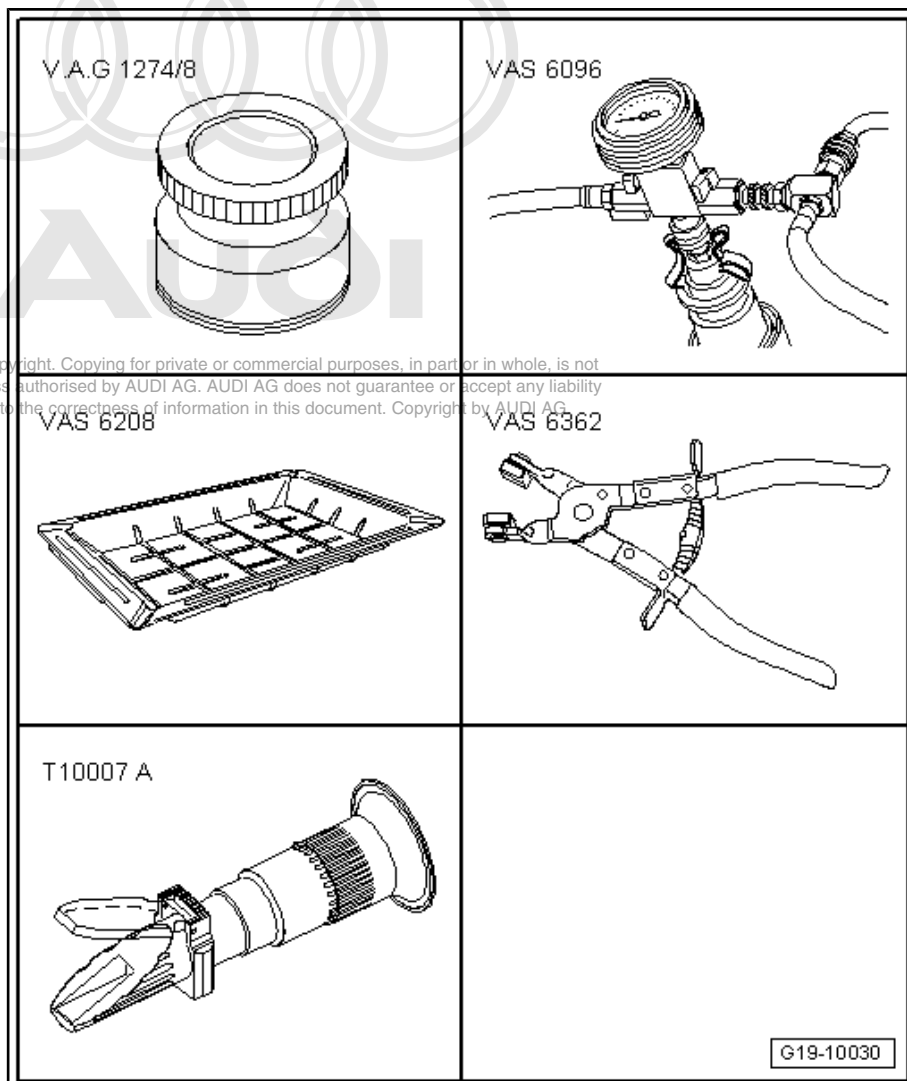


1.2 Draining and filling cooling system

Special tools and workshop equipment required

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

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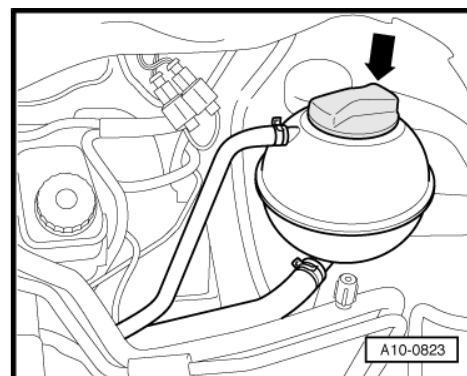
Draining



Note

Collect drained coolant in a container for disposal.

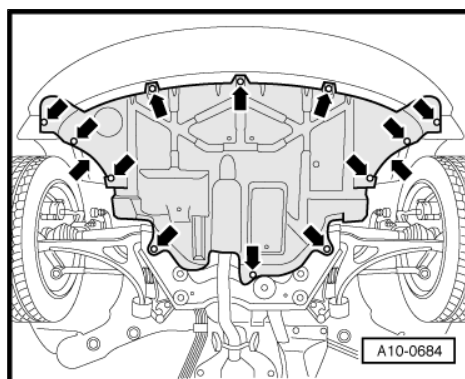
- Detach bonnet ⇒ ["1 Detaching bonnet", page 7](#).



Risk of scalding as hot coolant can escape

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

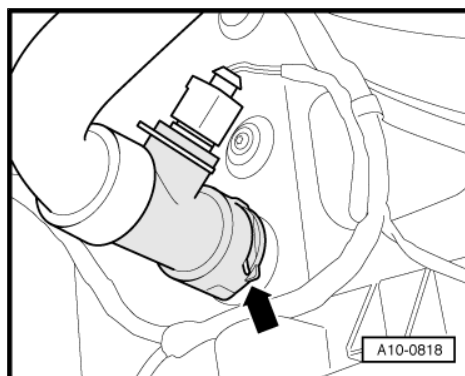
- Wear protective gloves.
- Wear safety goggles.
- Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).
- Open filler cap -arrow- on coolant expansion tank.
- Release fasteners -arrows- and remove noise insulation.



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

Filling**Caution**

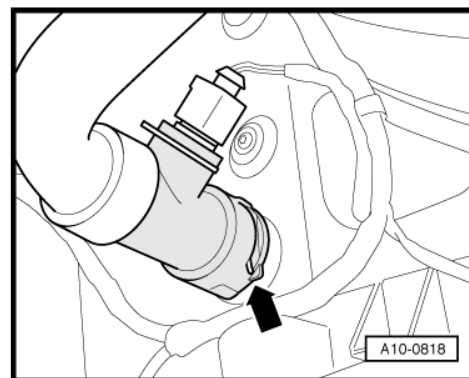
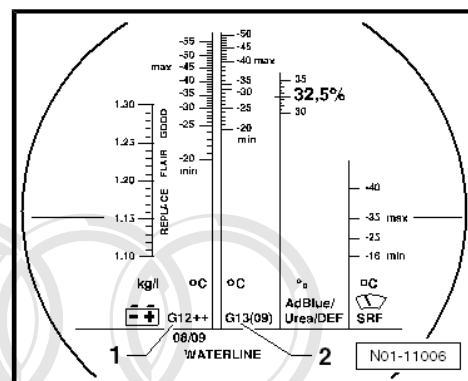
Always use distilled water for mixing coolant additives as this ensures optimum corrosion protection.



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**Note**

- ◆ *The effectiveness of the coolant is greatly influenced by the quality of the water with which it is mixed. Because water may contain different substances depending on the country or even the region, the water quality to be used for cooling systems has been specified. Distilled water meets all the requirements and is therefore recommended for use when topping up or filling up with coolant.*
 - ◆ *Use only coolant additives listed in the ⇒ Electronic parts catalogue (ETKA) . Other coolant additives could seriously impair in particular the anti-corrosion properties. The resulting damage could lead to loss of coolant and consequently to serious engine damage.*
 - ◆ *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.*
 - ◆ *The refractometer - T10007A- MUST be used to determine the current level of frost 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.*
 - ◆ *Read off the level of frost protection on the scale for the relevant coolant additive.*
 - ◆ *The temperature indicated on the refractometer - T10007A- 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.*
- Connect coolant hose -arrow- with plug-in connector to radiator ⇒ [page 153](#) .



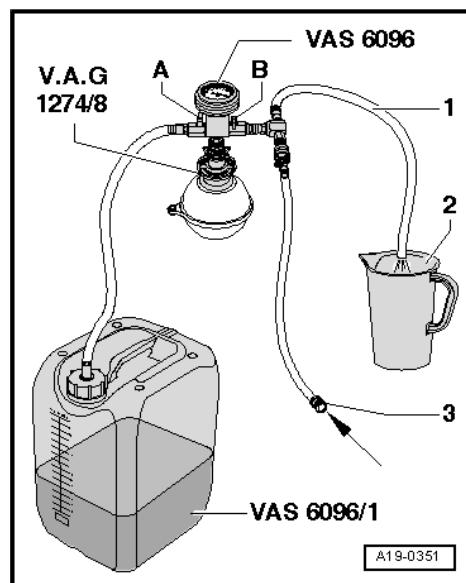
- Fill reservoir of cooling system charge unit - VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio):
 - Coolant (40 %) and water (60 %) for frost protection to -25 °C
 - Coolant (50 %) and water (50 %) for frost protection to -36 °C
 - Coolant: ⇒ Electronic parts catalogue (ETKA)
- 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

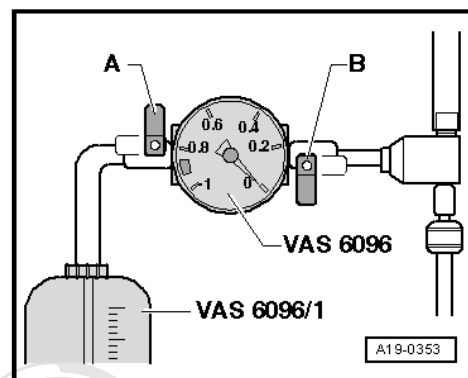
The vented air draws along a small amount of coolant, which should be collected.

- Close both valves -A- and -B- (turn lever at right angles to direction of flow).
- Connect hose -3- to compressed air.
- Pressure: 6 ... 10 bar.



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- 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 cooling system charge unit - VAS 6096- can fill with coolant.
- Close valve -A- again.
- Leave valve -B- open for another 2 minutes.
- The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.
- Close valve -B-.
- The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

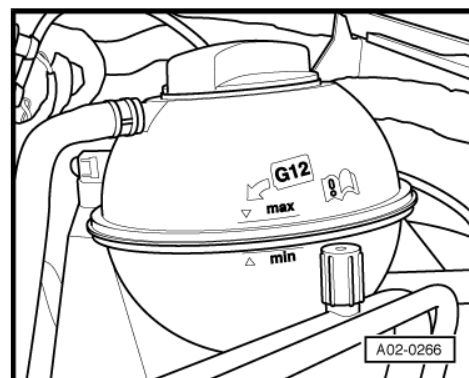


Note

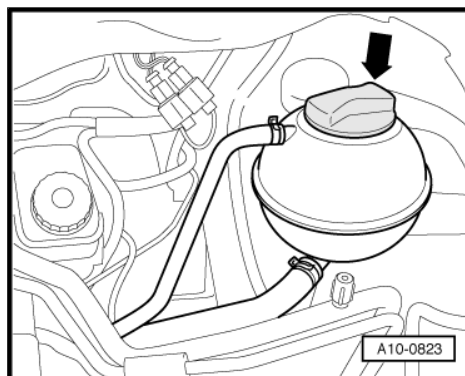
- ◆ *If the needle does not reach the green zone, repeat the process.*
- ◆ *Check cooling system for leaks if the vacuum is not maintained.*

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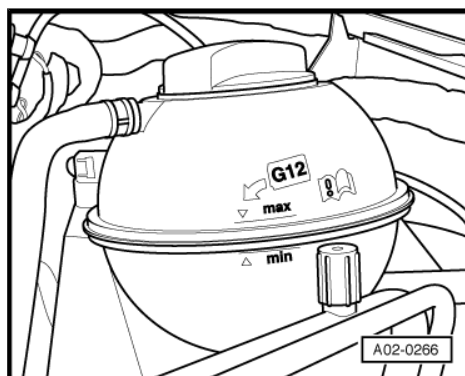
- Detach compressed air hose.
- Open valve -A-.
- The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of the cooling system charge unit - VAS 6096- ; the cooling system is then filled.
- Detach cooling system charge unit - VAS 6096- from coolant expansion tank.
- Top up coolant to “max” mark.
- Start engine and run for 2 minutes (maximum) at approx. 1500 rpm.
- Top up coolant to overflow hole on expansion tank with engine running.
- On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
- Start engine and run for 2 minutes (maximum) at approx. 1500 rpm.
- Top up coolant to overflow hole on expansion tank with engine running.



- Close filler cap -arrow- on expansion tank.
- Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
- Switch off ignition and allow engine to cool down.
- Install noise insulation ⇒ Rep. gr. 50 .



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



1.3 Coolant pump - exploded view



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1 - Coolant pump

- ☐ With integral seal
- ☐ Removing and installing
⇒ ["1.4 Removing and installing coolant pump", page 139](#)

2 - Bolt

- ☐ Tightening torque
⇒ [Item 5 \(page 41\)](#)

3 - Cover (rear) for toothed belt**4 - Idler roller**

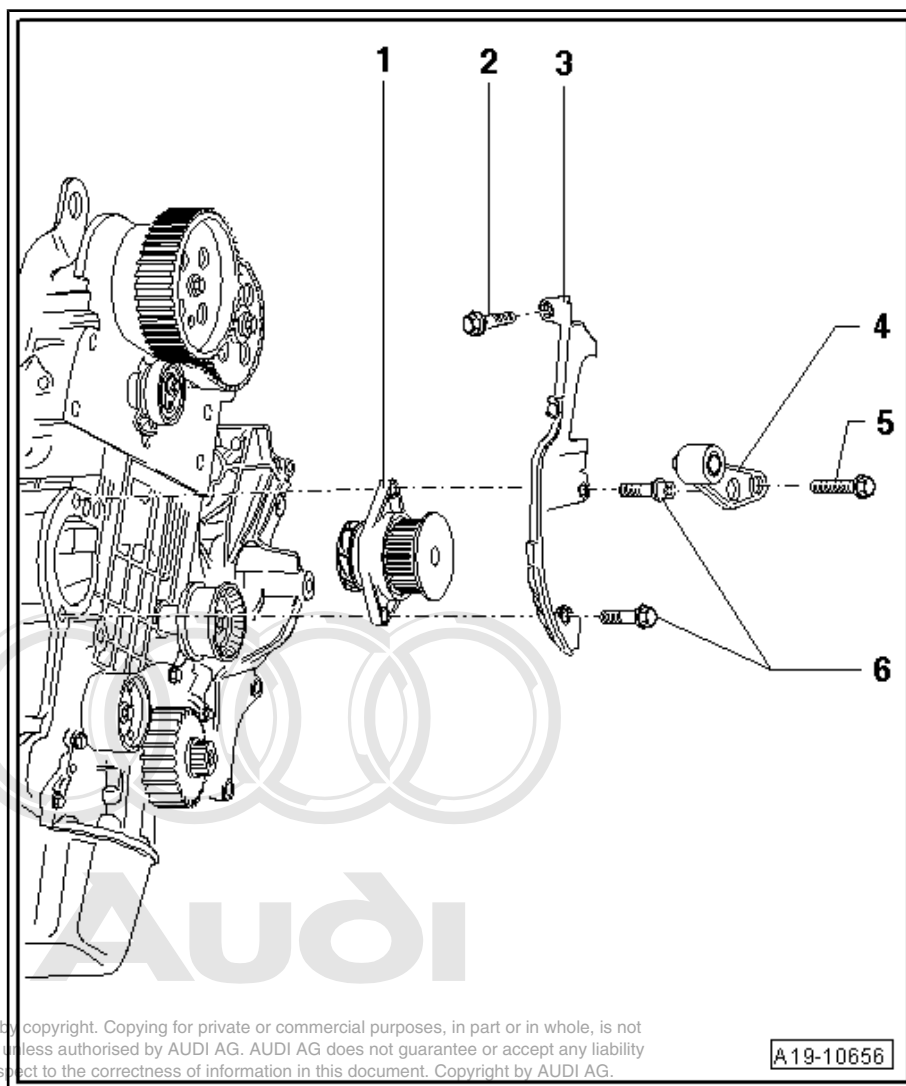
- ☐ For main drive toothed belt

5 - Bolt

- ☐ Tightening torque
⇒ [Item 6 \(page 41\)](#)

6 - Bolts

- ☐ 20 Nm

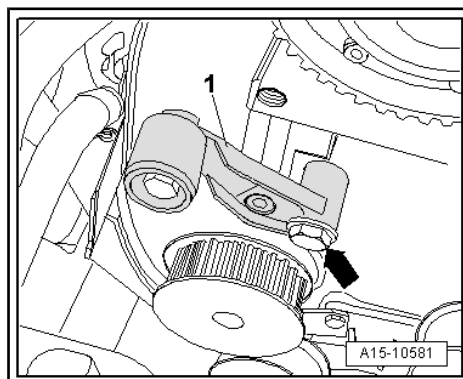
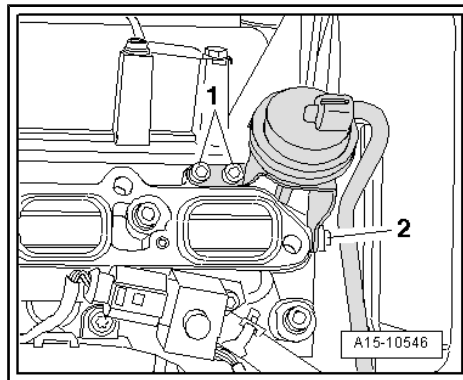
**1.4 Removing and installing coolant pump****Special tools and workshop equipment required**

- ◆ Drip tray for workshop hoist - VAS 6208-



Removing

- Drain coolant
⇒ [“1.2 Draining and filling cooling system”, page 133](#) .
- Remove main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#) .
- Remove bolts -1- and loosen bolt -2-.
- Push vacuum unit for intake manifold flap slightly towards the rear.
- Remove bolt -arrow- and detach idler roller -1-.



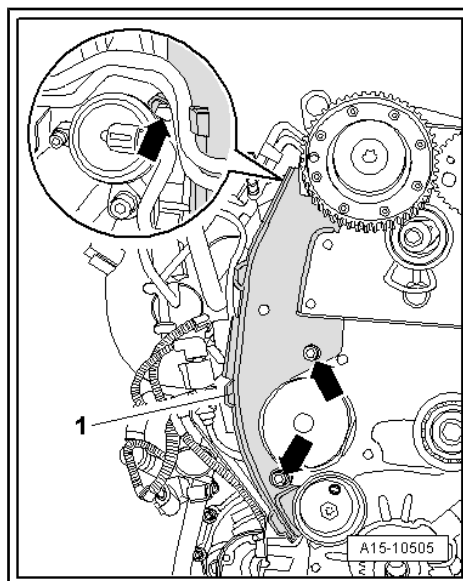
- Remove bolts -arrows- and remove rear cover -1- for toothed belt.
- Place drip tray for workshop hoist - VAS 6208- beneath engine.

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Installing

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

- Install idler roller for main drive toothed belt
⇒ [“2.1 Toothed belt drive - exploded view”, page 41](#) .
- Install vacuum unit for intake manifold flap ⇒ Rep. gr. 24 .
- Install main drive toothed belt
⇒ [“2.3 Removing and installing main drive toothed belt”, page 45](#) .
- Fill up with coolant ⇒ [page 134](#) .



1.5 Thermostat and rear coolant pipe - exploded view

1 - Coolant temperature sender - G62-

- ☐ Removing and installing
⇒ ["1.8 Removing and installing coolant temperature sender G62", page 147](#)

2 - O-ring

- ☐ Renew

3 - Retaining clip

- ☐ Check for firm attachment

4 - O-ring

- ☐ Renew

5 - Bolt

- ☐ 10 Nm

6 - O-ring

- ☐ Renew

7 - Coolant pipe (rear)

- ☐ Removing and installing
⇒ ["1.7 Removing and installing thermostat housing and coolant pipe \(rear\)", page 144](#)

8 - Retaining clip

- ☐ Check for firm attachment

9 - O-ring

- ☐ Renew

10 - Map-controlled engine cooling system thermostat - F265-

- ☐ Removing and installing
⇒ ["1.6 Removing and installing map-controlled engine cooling system thermostat F265", page 141](#)

11 - Bolt

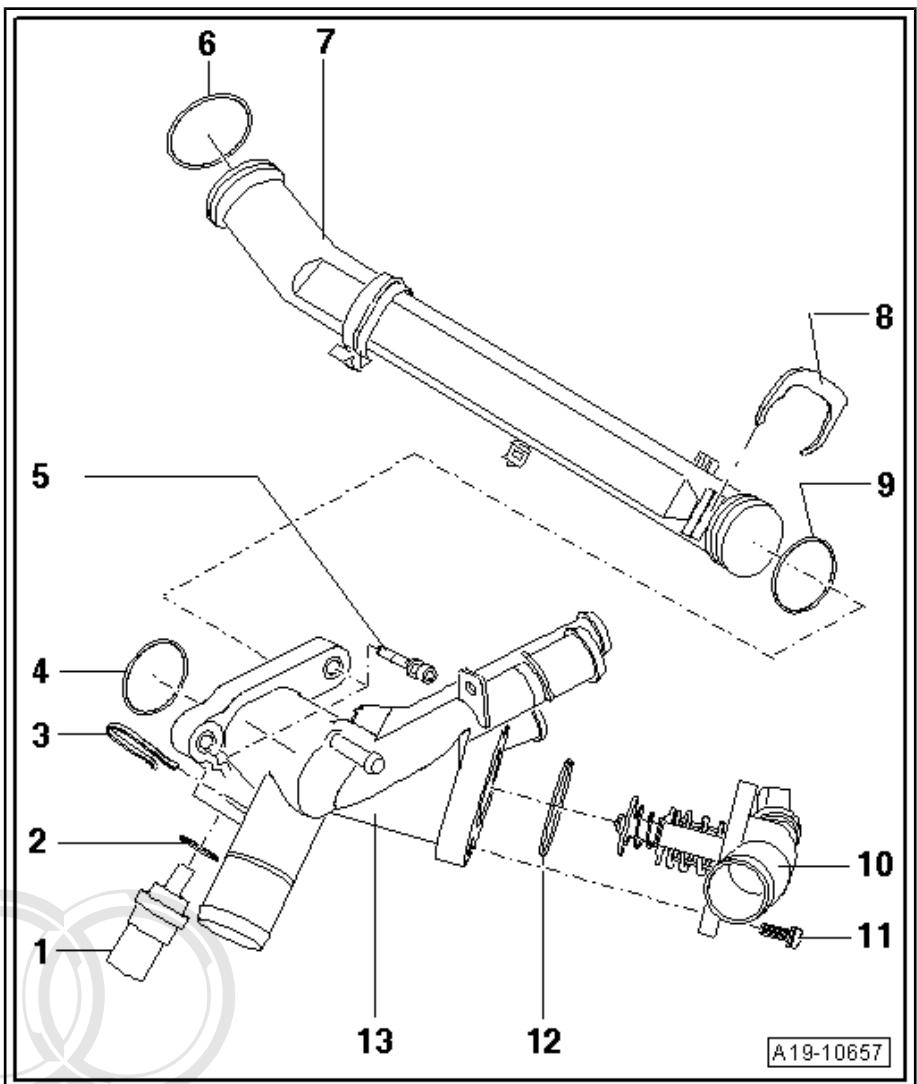
- ☐ 10 Nm

12 - O-ring

- ☐ Renew

13 - Thermostat housing

- ☐ Removing and installing
⇒ ["1.7 Removing and installing thermostat housing and coolant pipe \(rear\)", page 144](#)

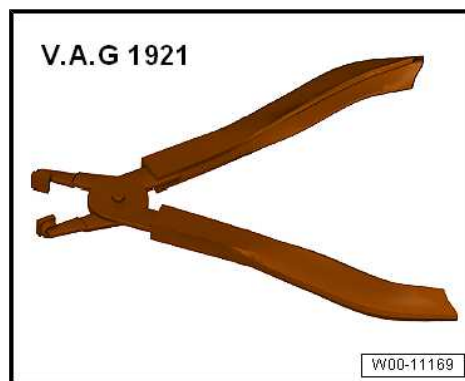


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1.6 Removing and installing map-controlled engine cooling system thermostat - F265-

Special tools and workshop equipment required

◆ Hose clip pliers - V.A.G 1921-

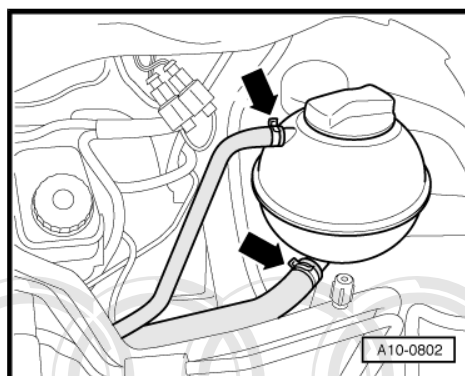


◆ Drip tray for workshop hoist - VAS 6208-

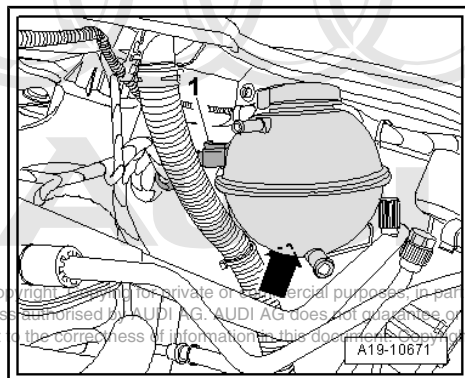


Removing

- Drain coolant
⇒ ["1.2 Draining and filling cooling system", page 133](#) .
- Disconnect coolant hoses -arrows- from coolant expansion tank and move coolant hose (top) clear.

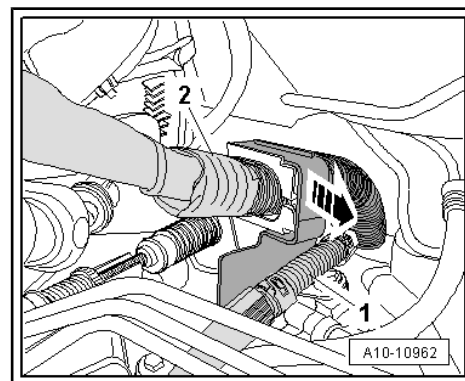


- Unplug electrical connector -1- at coolant shortage indicator switch - F66- .
- Remove nut -arrow- and detach coolant expansion tank.



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- Move B+ wire -1- clear at bracket.
- Move engine wiring harness -2- clear at cable support bracket -arrow-.

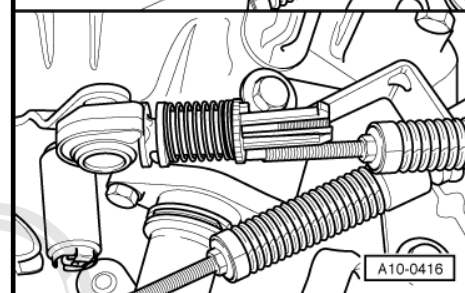
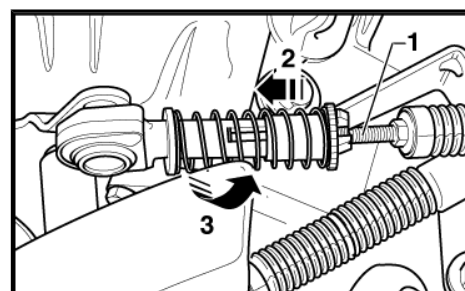
**Caution**

Risk of damage to cable end-pieces.

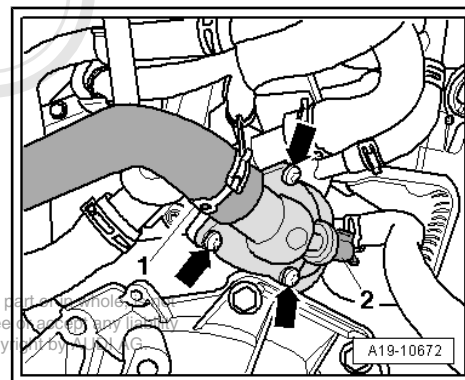
- ◆ *Do not detach cable end-pieces from selector shaft lever or gear selector relay lever. The cable end-pieces must always be renewed if they have been detached.*

Release cable end-piece for gate selector cable as follows:

- Press locking mechanism on gate selector cable to front as far as stop -arrow 2-.
- Turn locking sleeve as far as stop -arrow 3- and lock.
- Pull gate selector cable -1- out of cable end-piece.



- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Unplug electrical connector -2-.
- Detach coolant hose -1- from map-controlled engine cooling system thermostat - F265- .
- Remove bolts -arrows- and detach map-controlled engine cooling system thermostat - F265- .

**Installing**

- Tightening torque ⇒ "1.5 Thermostat and rear coolant pipe - exploded view", page 140

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

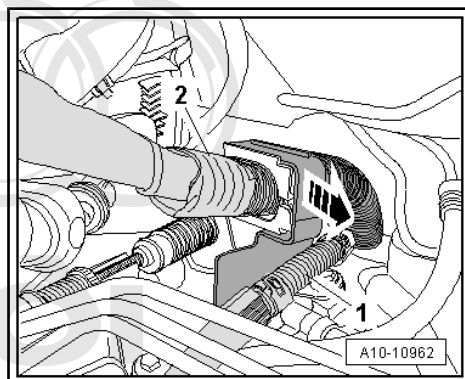
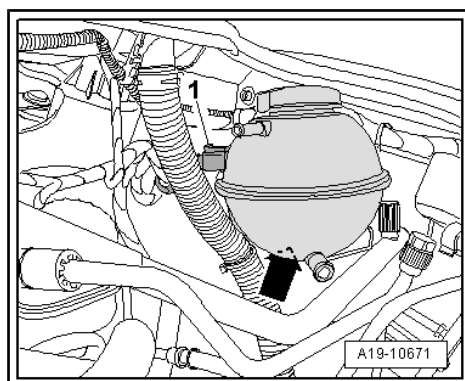
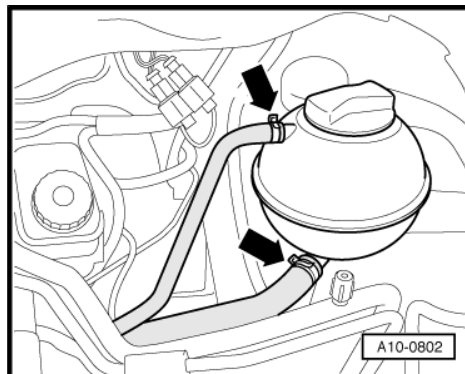
**Note**

- ◆ *Fit new O-ring.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Install gate selector cable and adjust ⇒ Rep. gr. 34 .
- Fill up with coolant ⇒ page 134 .

1.7 Removing and installing thermostat housing and coolant pipe (rear)

Removing

- Drain coolant
⇒ ["1.2 Draining and filling cooling system", page 133](#) .
- Disconnect coolant hoses -arrows- from coolant expansion tank and move coolant hose (top) clear.
- Unplug electrical connector -1- at coolant shortage indicator switch - F66- .
- Remove nut -arrow- and detach coolant expansion tank.
- Move B+ wire -1- clear at bracket.
- Move engine wiring harness -2- clear at cable support bracket -arrow- and move to side.



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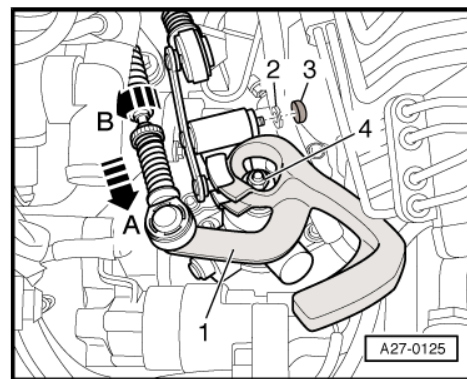
**Caution**

Risk of damage to cable end-pieces.

- ◆ *Do not detach cable end-pieces from selector shaft lever or gear selector relay lever. The cable end-pieces must always be renewed if they have been detached.*

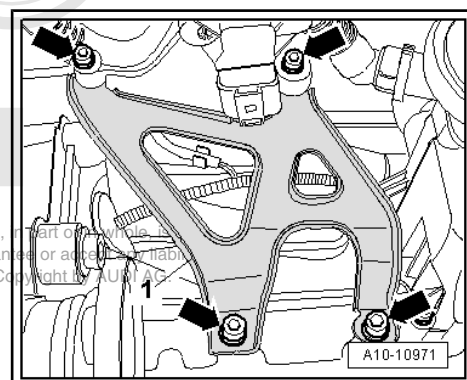
Release cable end-pieces for gear selector cable and gate selector cable as follows:

- Press locking mechanism on selector cable to front as far as stop -arrow A-.
- Turn locking sleeve as far as stop -arrow B- and lock in position.
- Pull gear selector cable and gate selector cable out of cable end-pieces.
- Detach cover cap -3- from securing clip.
- Pull out securing clip -2- and detach relay lever.

**Note**

Disregard -items 1 and 4-.

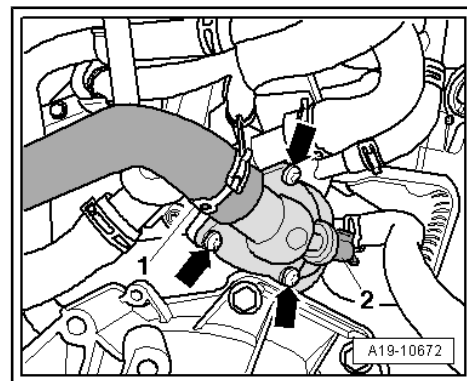
- Detach drive shaft (right-side) from flange shaft of gearbox.
- Remove bolts -arrows- and detach intake manifold support.



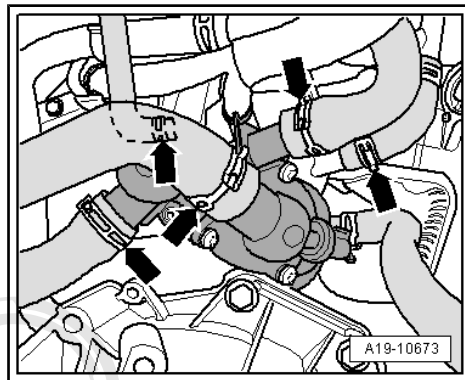
- Unplug electrical connector -2-.

**Note**

Disregard items marked -1- and -arrows-.



- Detach coolant hoses -arrows-.



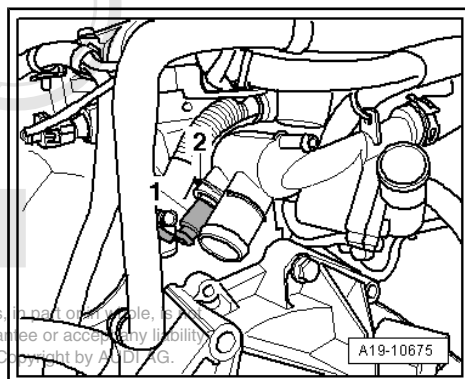
- Unplug electrical connector -1- at coolant temperature sender - G62- .



Note

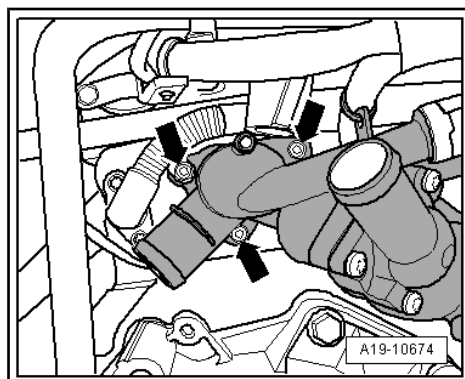
Disregard item -2-.

- Move electrical wiring on coolant pipe (rear) clear.



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- Place drip tray for workshop hoist - VAS 6208- beneath engine.
- Remove bolts -arrows- and carefully detach thermostat housing with coolant pipe (rear) from cylinder block and remove.



- Detach retaining clip -2- and detach coolant pipe (rear) -3- from housing -1- for thermostat -arrow-.

Installing

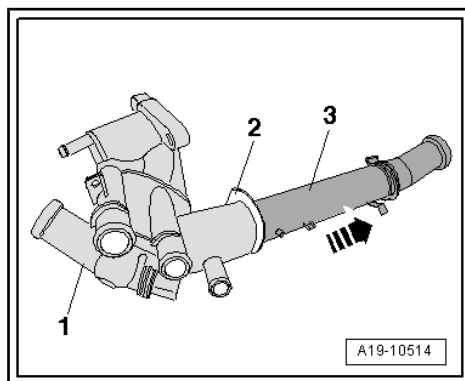
- Tightening torque
⇒ ["1.5 Thermostat and rear coolant pipe - exploded view", page 140](#)

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

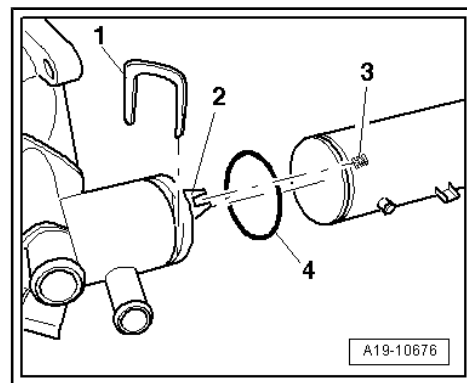


Note

- ◆ Renew gaskets and O-rings.
- ◆ Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ *Parts catalogue* .



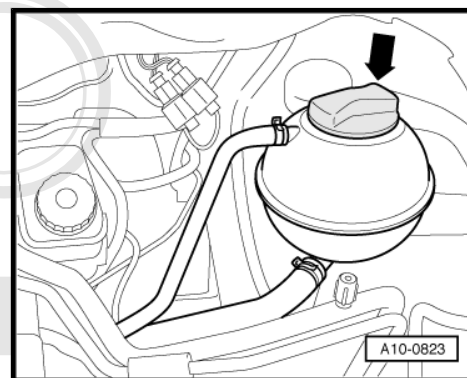
- Fit new O-ring -4- and insert coolant pipe in thermostat housing.
- Lug -3- must engage in U-shaped recess -2-.
- Secure coolant pipe with retaining clip -1-.
- Clean and smoothen sealing surface for O-ring in cylinder head.
- Lubricate O ring with coolant additive.
- Install intake manifold support ⇒ Rep. gr. 24 .
- Install drive shaft (right-side) ⇒ Rep. gr. 40 .
- Install and adjust gear selector cable and gate selector cable ⇒ Rep. gr. 34 .
- Fill up with coolant ⇒ [page 134](#) .



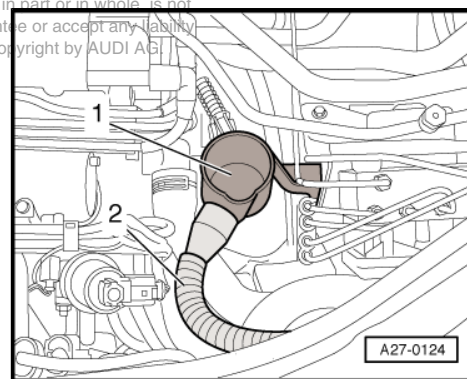
1.8 Removing and installing coolant temperature sender - G62-

Removing

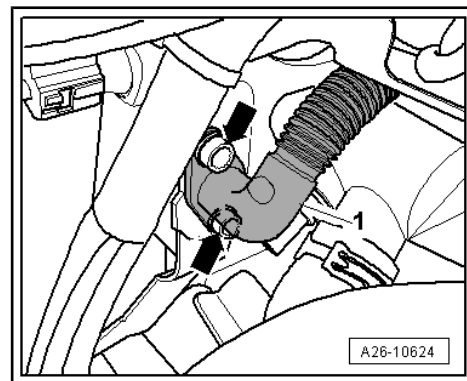
- Engine cold.
- Detach bonnet ⇒ ["1 Detaching bonnet", page 7](#) .
- Open filler cap -arrow- on coolant expansion tank briefly to relieve residual pressure in cooling system.



- Detach water collector -1- and move clear to one side (drain hose -2- remains connected).



- Remove bolts -arrows- and push exhaust gas recirculation pipe -1- slightly upwards.



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



Note

Place a cloth underneath to catch escaping coolant.

- Pull off retaining clip -2- and detach coolant temperature sender - G62- .

Installing

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



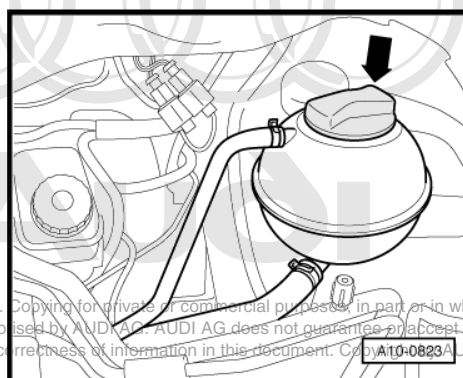
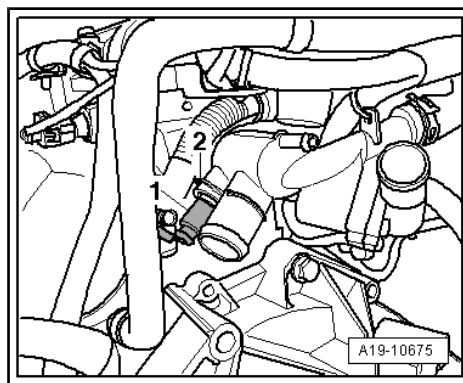
Note

- ◆ Renew gasket and O-ring.
- ◆ Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.
- Install exhaust gas recirculation pipe
⇒ [“3.1 Exhaust gas recirculation system - exploded view”, page 167](#) .
- Check coolant level ⇒ [page 138](#) .

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

Removing

- Engine cold.
- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .
- Open filler cap -arrow- on coolant expansion tank briefly to relieve residual pressure in cooling system.



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- Unplug electrical connector -1- at radiator outlet coolant temperature sender - G83- .

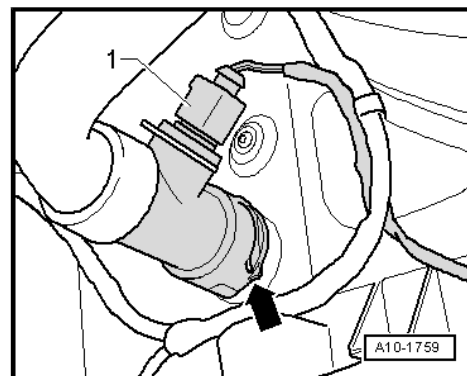
**Note**

Place a cloth underneath to catch escaping coolant.

- Pull out retaining clip and detach radiator outlet coolant temperature sender - G83- .

**Note**

Disregard -arrow-.

**Installing**

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

**Note**

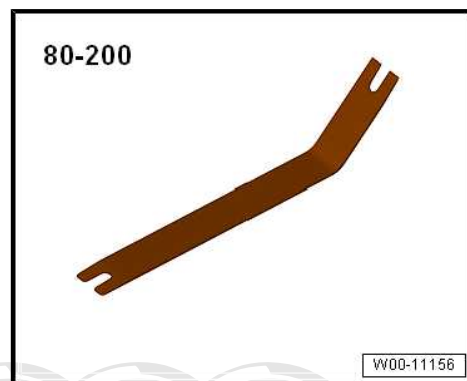
Insert new radiator outlet coolant temperature sender - G83- immediately into connection to avoid loss of coolant.

- Check coolant level ⇒ [page 138](#) .
- Install noise insulation ⇒ Rep. gr. 50 .

1.10 Removing and installing radiator

Special tools and workshop equipment required

- ◆ Removal lever - 80 - 200-



- ◆ Hose clip pliers - V.A.G 1921-



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◆ Drip tray for workshop hoist - VAS 6208-



Removing



Note

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

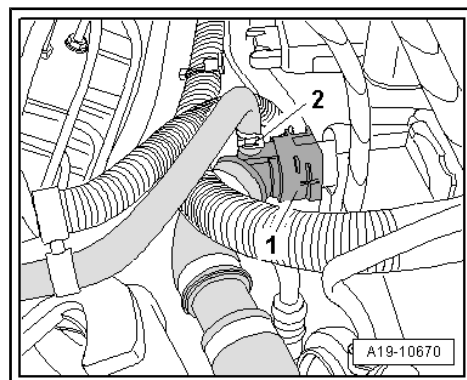
- Drain coolant
⇒ ["1.2 Draining and filling cooling system", page 133](#) .
- Remove bumper cover (front) ⇒ Rep. gr. 63 .
- Disconnect coolant hose -1- from radiator (pull out retaining clip).



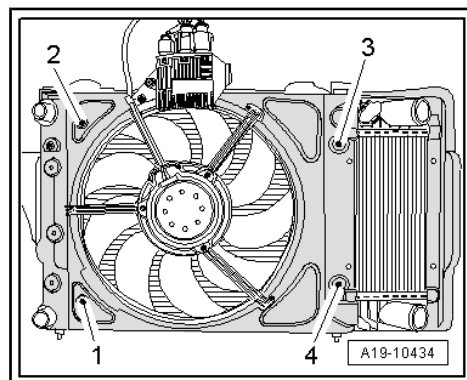
Note

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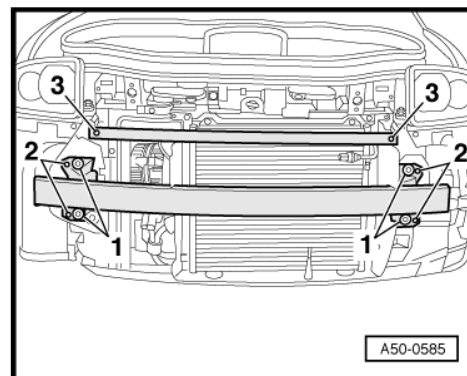
Disregard item -2-.



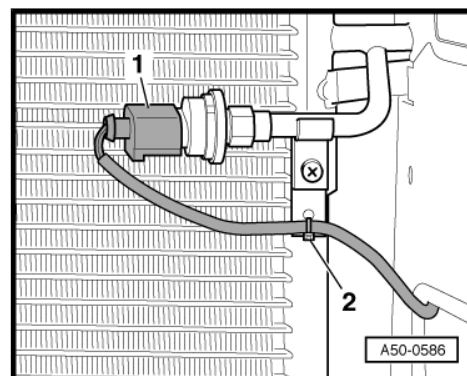
- Remove bolts -1- and -4- securing radiator at bottom of radiator cowl.



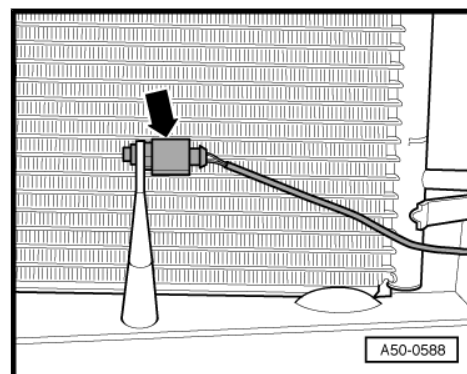
- Unplug electrical connector at horn.
- Remove bolts -3- (2x) on both sides and detach reinforcement rail.
- Prise off securing clips -2-.
- Remove bolts -1- on both sides and detach impact bar for bumper.



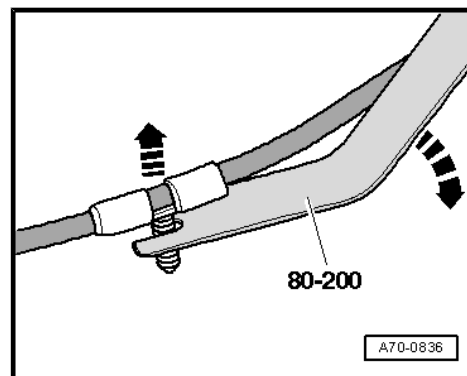
- Unplug electrical connector -1- at high-pressure sender - G65- .
- Cut open cable tie -2-.



- Detach ambient temperature sensor - G17- -arrow- from bracket.

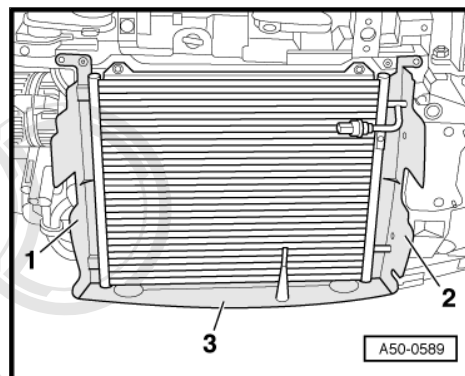


- Use removal lever - 80 - 200- to press off electrical wiring harness leading to high-pressure sender - G65- and ambient temperature sensor - G17- from air duct (left-side).



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- Remove air ducts -1, 2, 3- from lock carrier.



WARNING

Risk of injury caused by refrigerant.

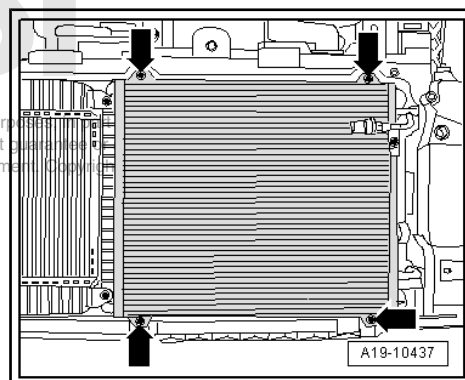
- ◆ **The air conditioner refrigerant circuit must not be opened.**



Caution

Risk of damage to condenser and refrigerant pipes/hoses.

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



- Remove bolts -arrows-.
- Pivot condenser slightly forward on right side of vehicle -arrow-.
- Carefully pull condenser forward as far as possible on left side (connection side).
- Place drip tray for workshop hoist - VAS 6208- beneath radiator.
- Guide radiator connections out of radiator cowl one by one, moving radiator up or down as required.
- Detach radiator.

Installing

- Tightening torques:

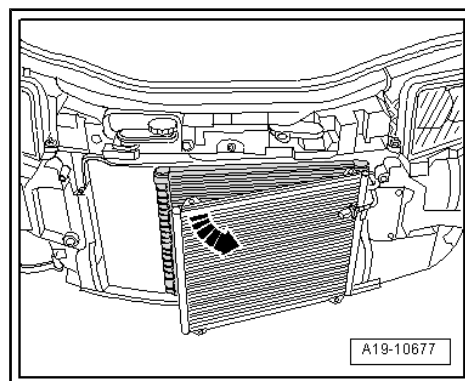
Component	Nm
Radiator to radiator cowl	6
Condenser to radiator cowl	6
Air ducts to radiator cowl	1.5

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

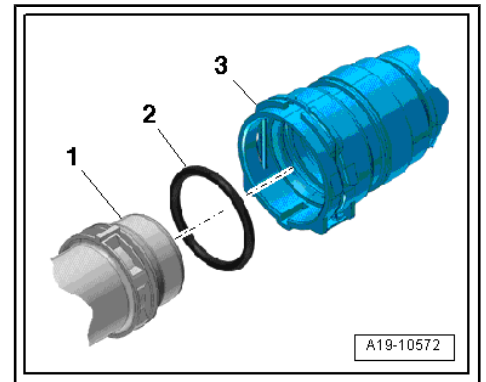


Note

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



- Connect coolant hose with plug-in connector to radiator as follows:
 1. Remove old O-ring -2- from coolant hose -3-.
 2. Lubricate new O-ring with coolant additive and fit O-ring in coolant hose.
 3. Press coolant hose onto radiator -1- until it engages with a click.
 4. Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.
- Install impact absorber and reinforcement rail ⇒ Rep. gr. 63 .
- Install bumper cover (front) ⇒ Rep. gr. 63 .



Note

The coolant in the entire system must be changed if the radiator is renewed.

- Fill up with coolant ⇒ [page 134](#) .

1.11 Checking cooling system for leaks

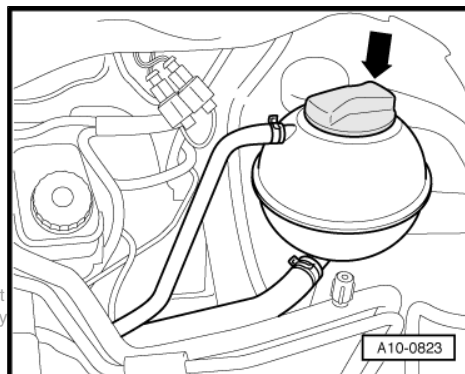
Special tools and workshop equipment required

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



Procedure

- Engine must be warm.
- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .



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Risk of scalding as hot coolant can escape

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

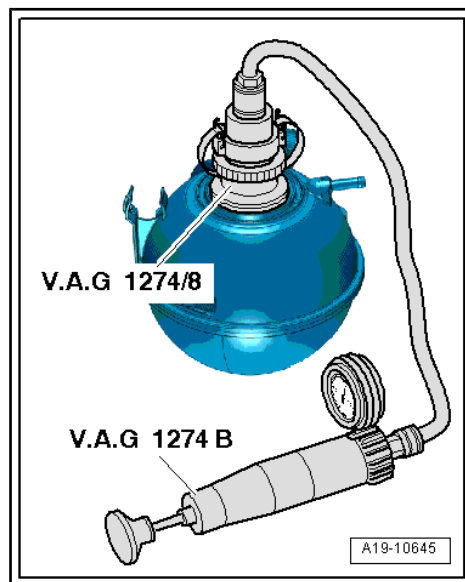
- Wear protective gloves.
- Wear safety goggles.
- Release pressure (cover filler cap on coolant expansion tank with a cloth and open carefully).

- Open filler cap -arrow- on coolant expansion tank.
- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
- Using hand pump on cooling system tester, build up a pressure of approx. 1.5 bar.
- The pressure should not drop more than 0.2 bar within 10 minutes.
- If the pressure drops more than 0.2 bar, locate leak and eliminate fault.



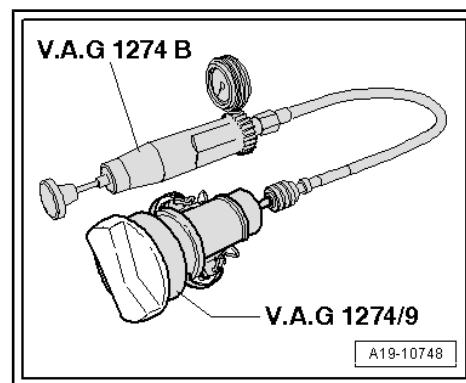
Note

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



Checking pressure relief valve in filler cap

- Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
- Build up pressure with hand pump on cooling system tester.
- ◆ The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.



1.12 Removing and installing radiator fan - V7-

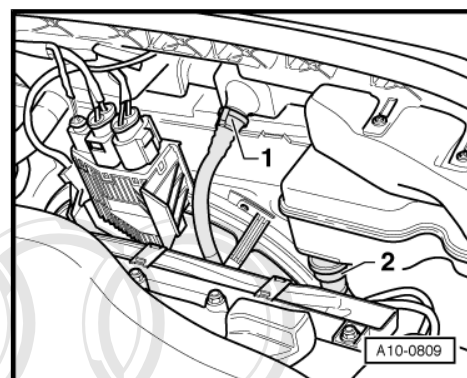
Removing

- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .
- Pull oil dipstick out of guide tube.
- Detach guide tube -1- for oil dipstick (press release tabs).



Note

Disregard item -2-.



- Unplug electrical connector -3- at radiator fan control unit - J293- .
- Remove bolt -2- and detach radiator fan control unit - J293- .
- Remove securing bolt -1-.
- Turn retaining ring anti-clockwise -arrow- and detach radiator fan - V7- with retaining ring.

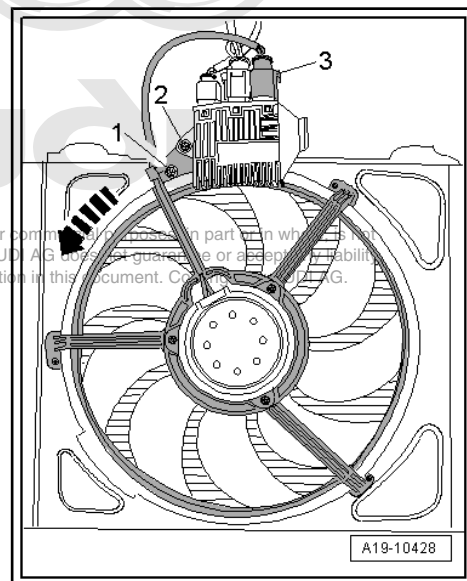
Installing

- Tightening torques:

Component	Nm
Retaining bolt for radiator fan - V7- to radiator cowl	5
Radiator fan control unit - J293- to radiator cowl	5

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

- Install connection with guide tube for oil dipstick and oil filler pipe
⇒ Fig. [““Connection with guide tube for oil dipstick and oil filler pipe - tightening torque””, page 120](#) .



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26 – Exhaust system

1 Silencers

⇒ [“1.1 Silencers - exploded view”, page 156](#)

⇒ [“1.2 Removing and installing starter catalytic converter”, page 158](#)

⇒ [“1.3 Removing and installing front exhaust pipe”, page 159](#)

⇒ [“1.4 Removing and installing main catalytic converter and centre silencer”, page 160](#)

⇒ [“1.5 Separating main catalytic converter and centre silencer”, page 161](#)

⇒ [“1.6 Checking exhaust system for leaks”, page 163](#)

1.1 Silencers - exploded view

1 - Nut

- ☐ Renew
- ☐ 25 Nm

2 - Starter catalytic converter

- ☐ Protect against knocks and impact
- ☐ Removing and installing
⇒ [“1.2 Removing and installing starter catalytic converter”, page 158](#)

3 - Gasket

- ☐ Renew

4 - Rubber mounting

- ☐ Renew if damaged

5 - Centre silencer

- ☐ Combined in one unit with main catalytic converter as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point
⇒ [“1.5 Separating main catalytic converter and centre silencer”, page 161](#)

6 - Clamp (rear)

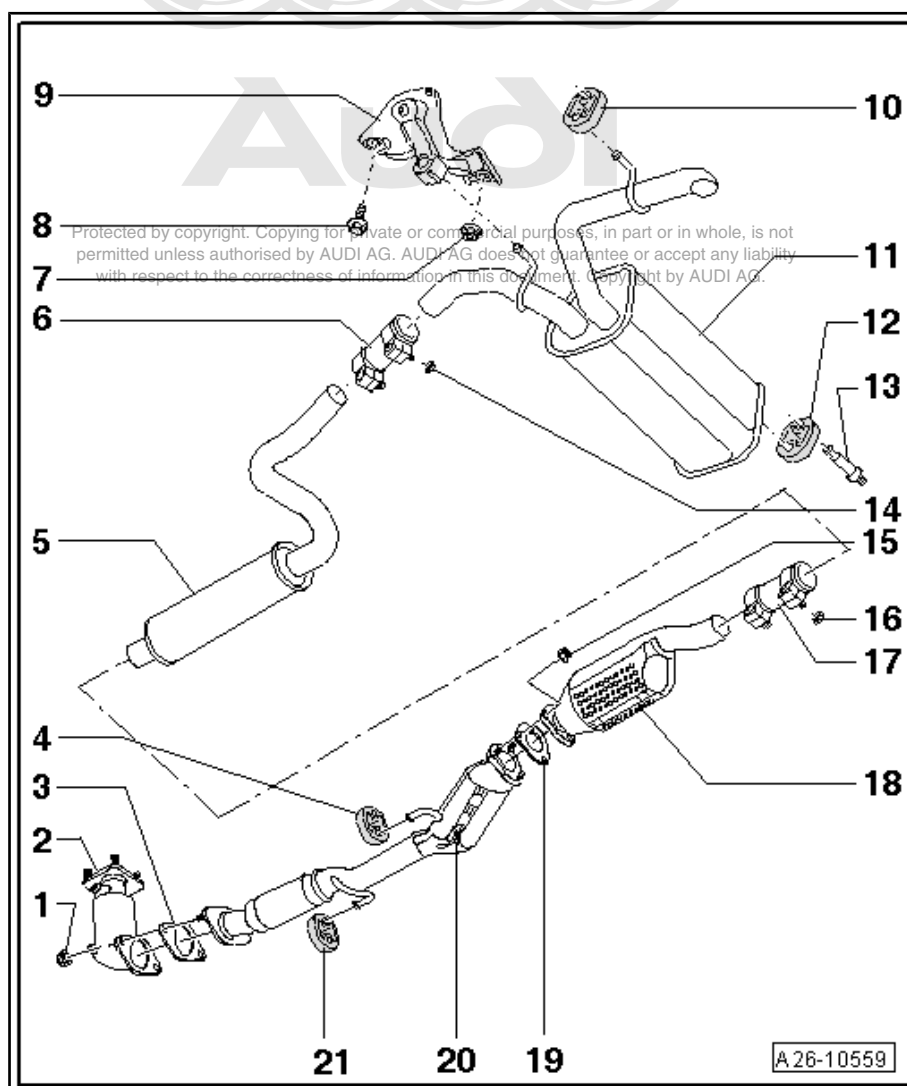
- ☐ Installation position
⇒ [Fig. “Installation position of rear clamp”, page 158](#)
- ☐ Tighten bolted connections evenly

7 - Nut

- ☐ 23 Nm

8 - Bolt

- ☐ 23 Nm



9 - Mounting

- ☐ Renew if damaged

10 - Rubber mounting

- ☐ Renew if damaged

11 - Rear silencer

12 - Rubber mounting

- ☐ Renew if damaged

13 - Bracket

- ☐ 23 Nm

14 - Nut

- ☐ M8: 23 Nm
- ☐ M10: 40 Nm

15 - Nut

- ☐ With bolt
- ☐ 23 Nm

16 - Nut

- ☐ M8: 23 Nm
- ☐ M10: 40 Nm

17 - Clamp (front)

- ☐ For separate replacement of main catalytic converter and centre silencer
- ☐ Installation position ⇒ [Fig. "Installation position of front clamp", page 157](#)
- ☐ Tighten bolted connections evenly

18 - Main catalytic converter

- ☐ Protect against knocks and impact
- ☐ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ☐ Cutting point ⇒ ["1.5 Separating main catalytic converter and centre silencer", page 161](#)

19 - Gasket

- ☐ Renew

20 - Front exhaust pipe

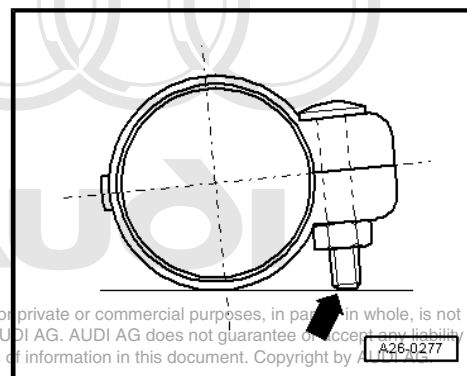
- ☐ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ☐ Removing and installing ⇒ ["1.3 Removing and installing front exhaust pipe", page 159](#)

21 - Rubber mounting

- ☐ Renew if damaged

Installation position of front clamp

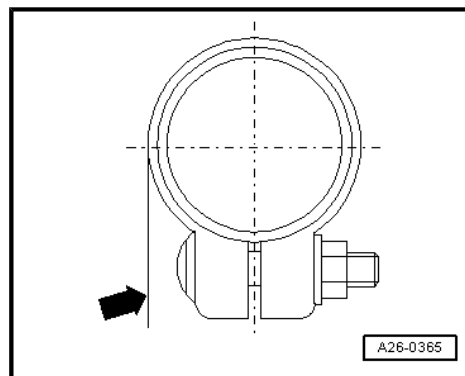
- Install clamp so that ends of bolts do not protrude beyond bottom of clamp -arrow-.
- Installation position: bolt connection on right



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Installation position of rear clamp

- Install clamp so that bolts are positioned horizontally -arrow-.
- Installation position: bolt connection faces downwards

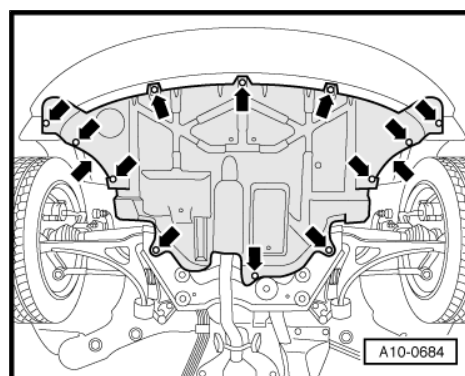


1.2 Removing and installing starter catalytic converter

Removing

- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#) .
- Release fasteners -arrows- and remove noise insulation.

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Caution

Risk of damage to flexible joint.

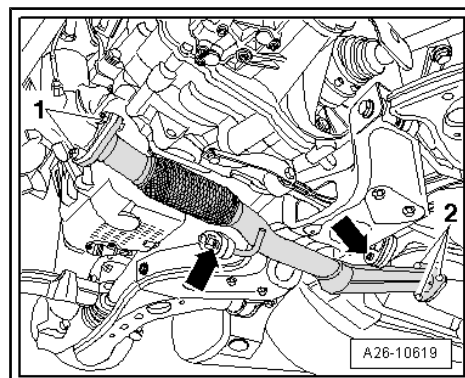
- ◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**

- Remove nuts -1-.

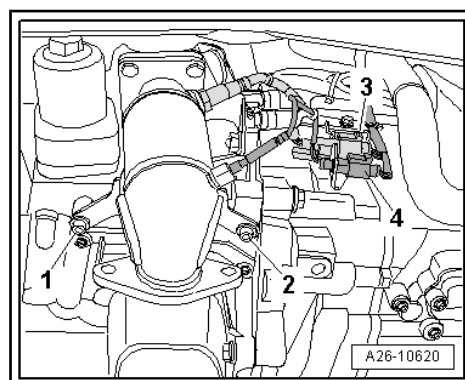


Note

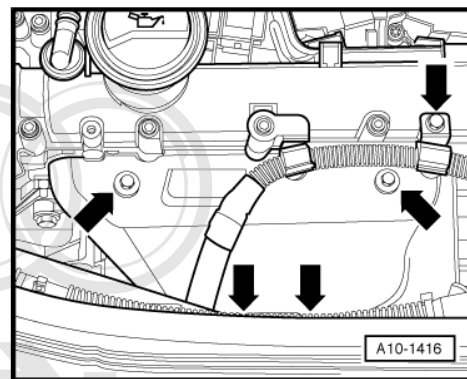
Disregard items marked -2- and -arrows-.



- Remove electrical connectors -3- for Lambda probe - G39- and -4- for exhaust gas temperature sender 1 - G235- from bracket and unplug.
- Remove bolts -1- and -2-.



- Remove bolts -arrows-, move wiring harness clear to one side and detach heat shield.



- Unscrew nuts -arrows- and remove starter catalytic converter.

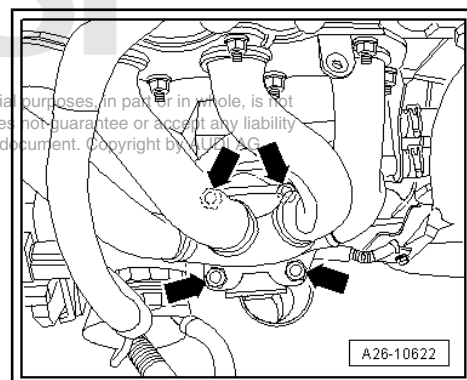
Installing

- Tightening torques

⇒ ["1.1 Silencers - exploded view", page 156](#)

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

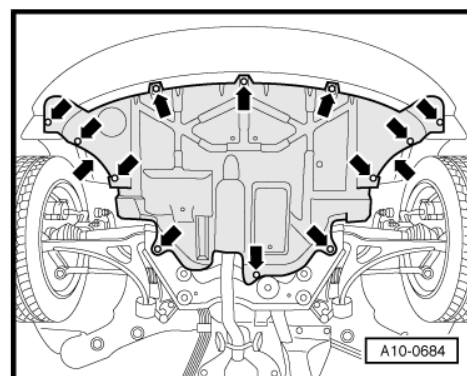
- Install heat shield
⇒ ["2.2 Removing and installing exhaust manifold", page 165](#).
- Install noise insulation ⇒ Rep. gr. 50.



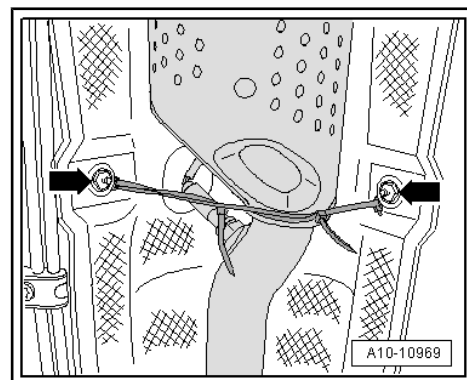
1.3 Removing and installing front exhaust pipe

Removing

- Release fasteners -arrows- and remove noise insulation.



- Loosen bolts -arrows- and secure main catalytic converter with cable ties.





Caution

Risk of damage to flexible joint.

- ◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**

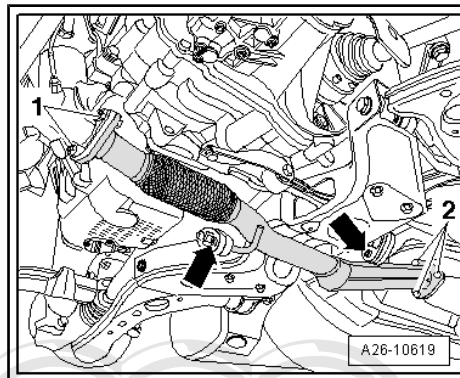
- Remove nuts -1- and bolts -2-.
- Disengage front exhaust pipe at rubber mountings -arrows- and detach.

Installing

- Tightening torques
⇒ ["1.1 Silencers - exploded view", page 156](#)

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

- Install noise insulation ⇒ Rep. gr. 50 .



1.4 Removing and installing main catalytic converter and centre silencer

Removing

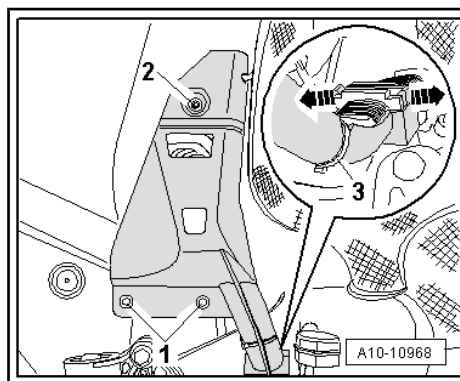
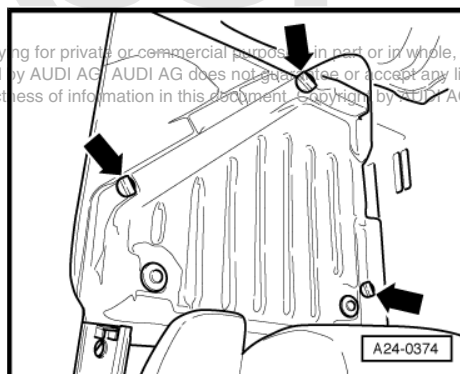
- Lift carpeting in driver's footwell and detach cover -arrows-.
- Unplug electrical connector -2- for NOx sender - G295- and move clear.



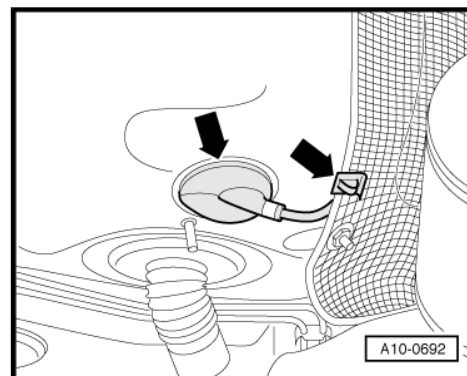
Note

Disregard -items 1, 3 and 4-.

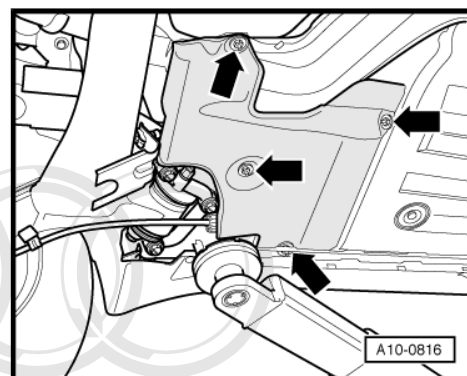
- Remove bolts -1- and -2-.
- Cut through cable tie -3-, release fasteners -arrows- and detach wiring guide.



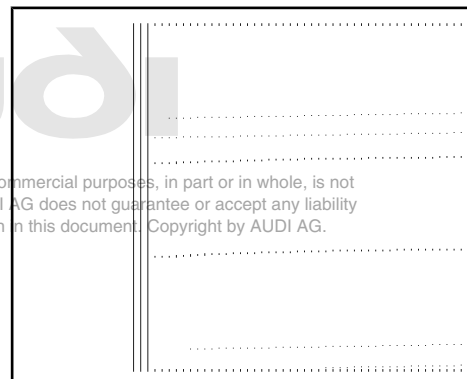
- Pull electrical wiring for NOx sender - G295- out of rubber grommet -left arrow- and unclip from heat shield -right arrow-.
- Remove 2 bolts for heat shield and move electrical wiring for NOx sender - G295- clear.



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



- Loosen bolt connections -arrows- on clamp.

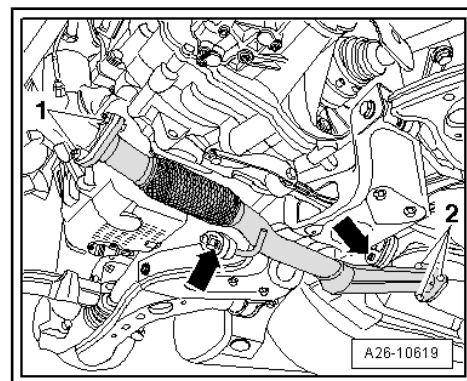


- Unscrew connections -2- and detach main catalytic converter and centre silencer.

Installing

- Tightening torques
⇒ ["1.1 Silencers - exploded view", page 156](#)

Install in reverse order.

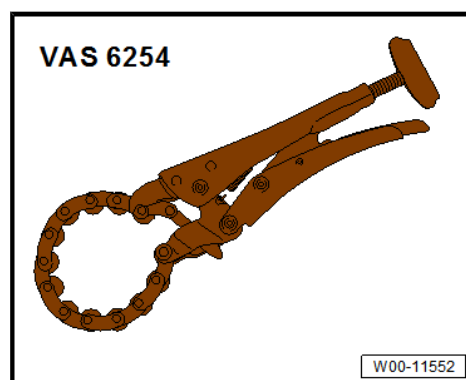


1.5 Separating main catalytic converter and centre silencer

- ◆ The connecting pipe can be cut through at the cutting point provided in order to renew the main catalytic converter or centre silencer separately.
- ◆ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

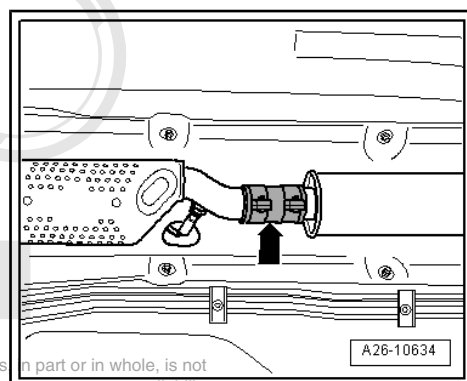
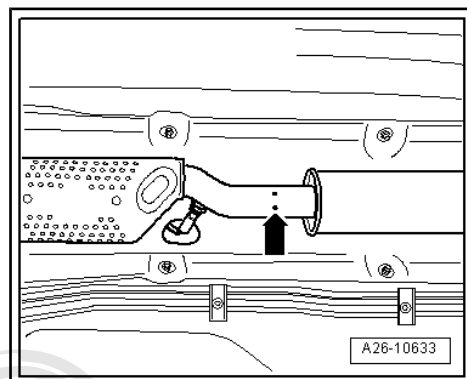
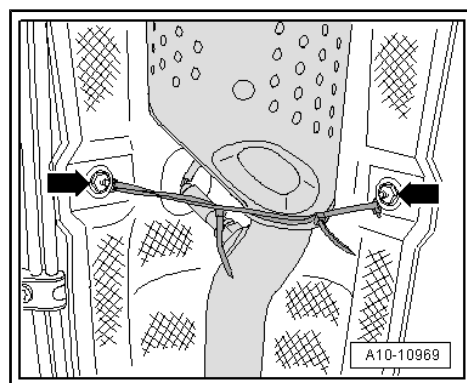
Special tools and workshop equipment required

- ◆ Chain pipe cutter - VAS 6254-



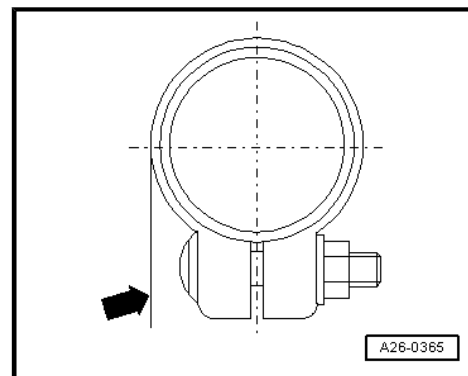
Procedure

- Tightening torques
⇒ ["1.1 Silencers - exploded view", page 156](#)
- Loosen bolts -arrows- and secure main catalytic converter with cable ties.
- Cut through the exhaust pipe at a right angle at the position marked -arrow- using chain pipe cutter - VAS 6254- .
- Push clamp towards centre silencer when installing.
- Permissible gap in pipe: 0 mm.



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- Install clamp so that bolts are positioned horizontally -arrow-.
- Installation position: bolt connection faces downwards



1.6 Checking exhaust system for leaks

- Start the engine and run at idling speed.
- Plug tailpipe during leak test (e.g. with cloth or plug).
- Listen for noise at connections between cylinder head/exhaust manifold, exhaust manifold with turbocharger/front exhaust pipe, etc. to locate any leaks.
- Rectify any leaks that are found.



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2 Exhaust manifold

⇒ ["2.1 Exhaust manifold - exploded view", page 164](#)

⇒ ["2.2 Removing and installing exhaust manifold", page 165](#)

2.1 Exhaust manifold - exploded view

1 - Bolts

□ 10 Nm

2 - Heat shield

3 - Bolts

□ 10 Nm

4 - Exhaust manifold

□ Removing and installing
⇒ ["2.2 Removing and installing exhaust manifold", page 165](#)

5 - Gasket

□ Renew

6 - Nut

□ Renew

□ 25 Nm

7 - Nut

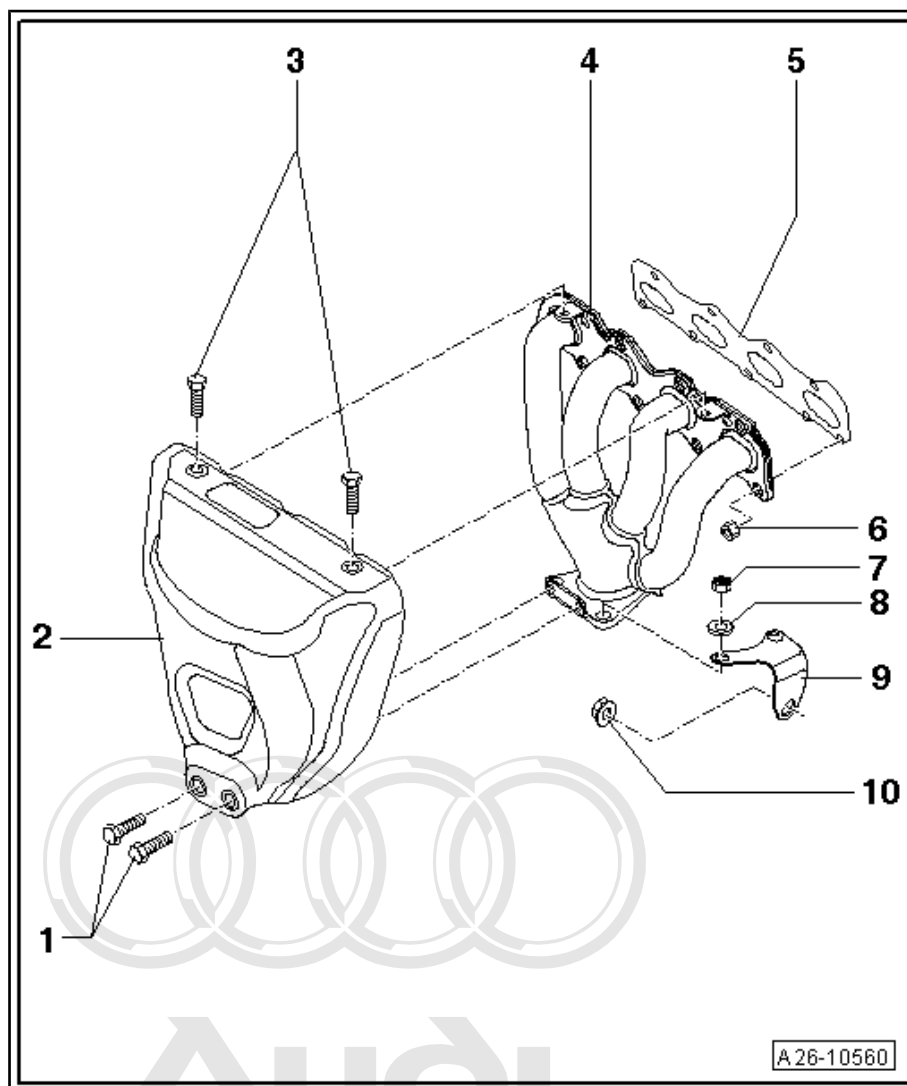
□ 40 Nm

8 - Washer

9 - Bracket for exhaust manifold

10 - Nut

□ 60 Nm



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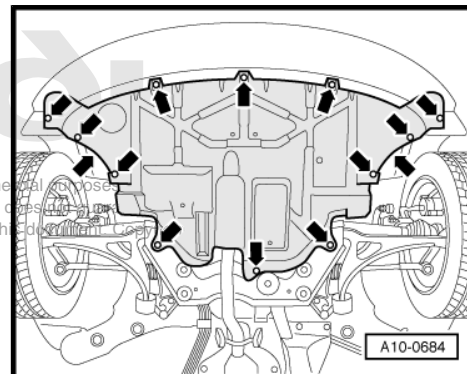
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2.2 Removing and installing exhaust manifold

Removing

- Detach bonnet ⇒ [“1 Detaching bonnet”, page 7](#).
- Release fasteners -arrows- and remove noise insulation.

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Caution

Risk of damage to flexible joint.

- ◆ **Do NOT bend flexible joint in front exhaust pipe more than 10°.**

- Remove nuts -1-.



Note

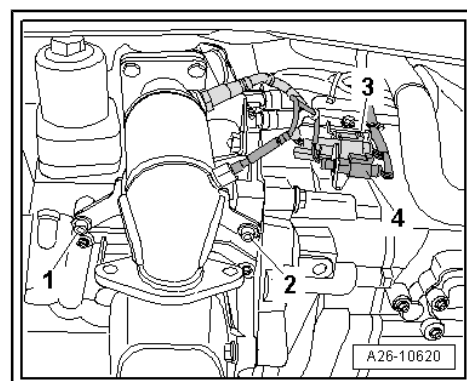
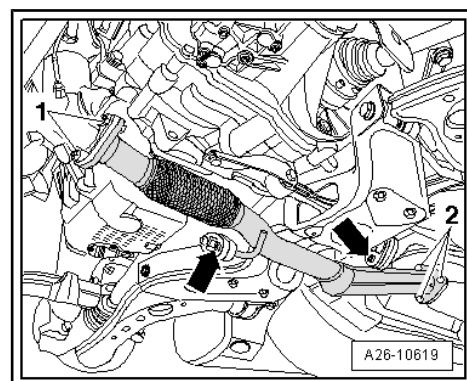
Disregard items marked -2- and -arrows-.

- Loosen bolts -1- and -2- several turns.

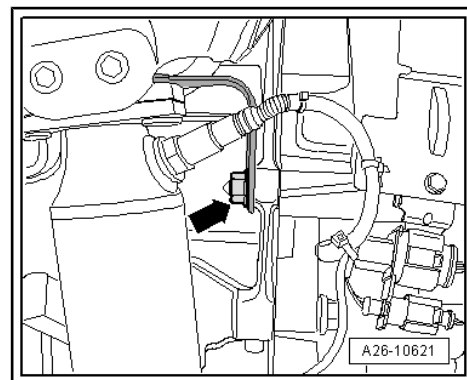


Note

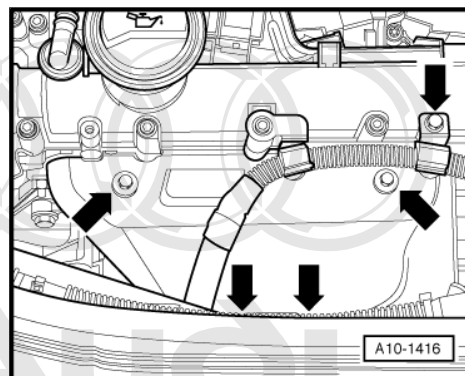
Disregard -items 3 and 4-.



- Unscrew nut -arrow- securing bracket for exhaust manifold.

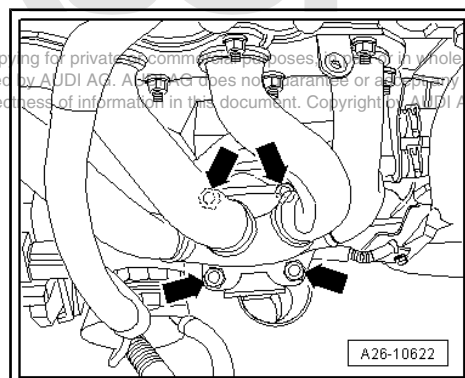


- Remove bolts -arrows-, move wiring harness clear to one side and detach heat shield.



- Remove nuts -arrows-.

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- Remove nuts -arrows- and detach exhaust manifold.

Installing

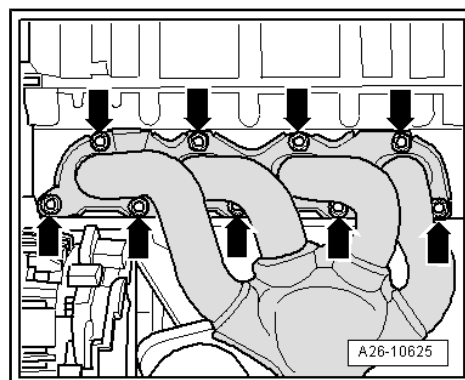
Installation is carried out in the reverse order; note the following:



Note

Renew gasket and self-locking nuts.

- Install front exhaust pipe
⇒ [“1.3 Removing and installing front exhaust pipe”, page 159](#).



3 Exhaust gas recirculation system

⇒ [“3.1 Exhaust gas recirculation system - exploded view”, page 167](#)

⇒ [“3.2 Removing and installing exhaust gas recirculation valve N18 with exhaust gas recirculation potentiometer G212”, page 168](#)

3.1 Exhaust gas recirculation system - exploded view

1 - Intake manifold

- ☐ Removing and installing
⇒ Rep. gr. 24

2 - Gasket

- ☐ Renew
- ☐ Note installation position

3 - Exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer G212-

- ☐ Removing and installing
⇒ [“3.2 Removing and installing exhaust gas recirculation valve N18 with exhaust gas recirculation potentiometer G212”, page 168](#)
- ☐ Adapt to engine control unit after renewing
⇒ Vehicle diagnostic tester

4 - Gasket

- ☐ Renew
- ☐ Note installation position

5 - Throttle valve module - J338-

- ☐ Removing and installing
⇒ Rep. gr. 24

6 - Bolt

- ☐ Tightening torque ⇒
Rep. gr. 24

7 - Gasket

- ☐ Renew

8 - Bolt

- ☐ 5 Nm

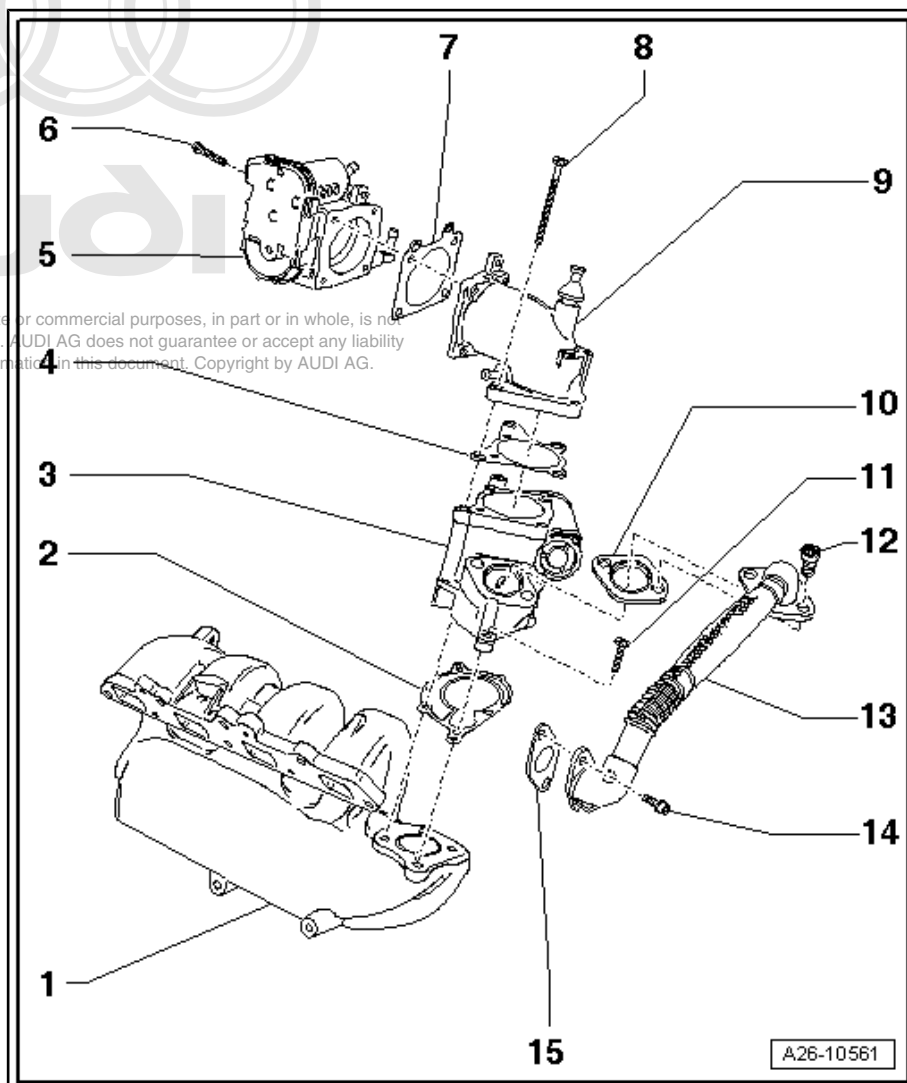
9 - Intake manifold connection

10 - Gasket

- ☐ Renew

11 - Bolt

- ☐ 9 Nm



12 - Bolt

- ☐ 16 Nm

13 - Pipe for exhaust gas recirculation

14 - Bolt

- ☐ 20 Nm

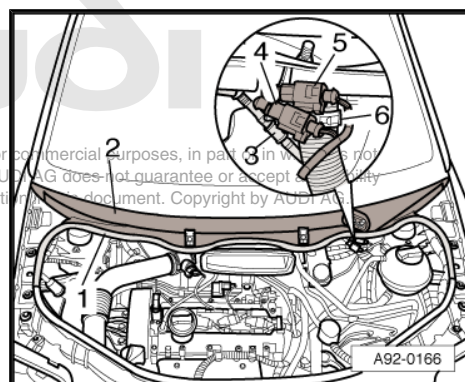
15 - Gasket

- ☐ Renew

3.2 Removing and installing exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212-

Removing

- Remove wiper arm ⇒ Rep. gr. 92 .
- Detach bonnet ⇒ ["1 Detaching bonnet", page 7](#) .
- Disconnect washer fluid hose -3-.
- If fitted, unplug electrical connectors -4- and -5- for heated washer jets.
- Use hose clip pliers - V.A.G 1921- to loosen hose clip -6- and detach water drain hose from cowl panel grille.
- Detach seal -1- for cowl panel grille.

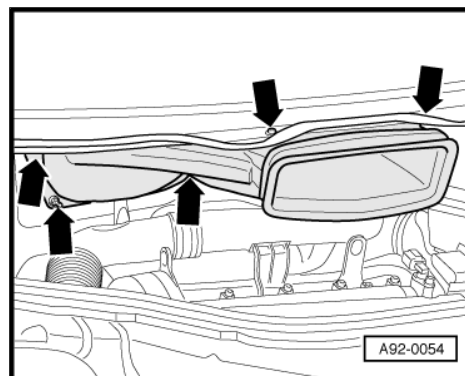


Caution

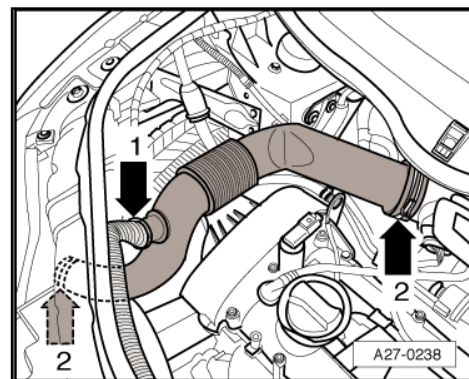
Risk of damage to cowl panel grille.

- ◆ *To avoid cracking the cowl panel grille -2- during removal, apply a small amount of soap solution to the joint between the windscreen and the cowl panel grille and pull the grille vertically up out of the fastening strip, starting from the edge of the windscreen.*

- Detach cowl panel grille -2-.
- Move washer fluid hose clear.
- Remove nuts and bolts -arrows-.
- Pull fresh air duct forwards and remove by turning it to right side of vehicle.



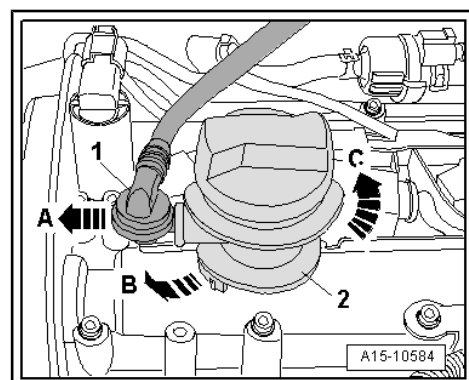
- Press release tabs and detach resonator from air hose -arrow 1-.
- Use hose clip pliers - V.A.G 1921- to loosen spring-type hose clips -arrows 2- and detach air duct.



- Detach non-return valve -1- from oil filler neck -2- -arrow A- and move to one side.

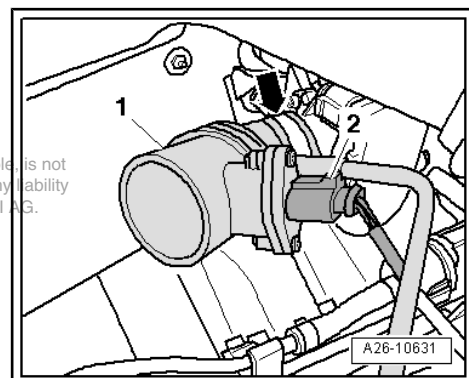
**Note**

Disregard -arrows B, C-.

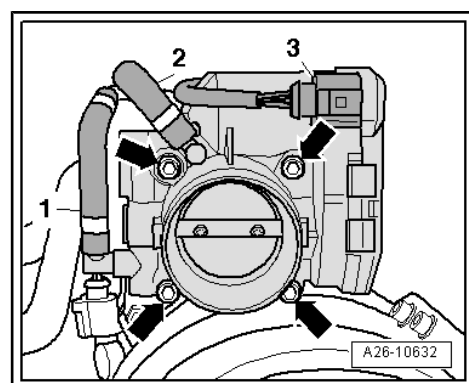


- Unplug electrical connector -2- from air mass meter - G70- .
- Release clamp -arrow- and detach connection -1- with air mass meter - G70- .

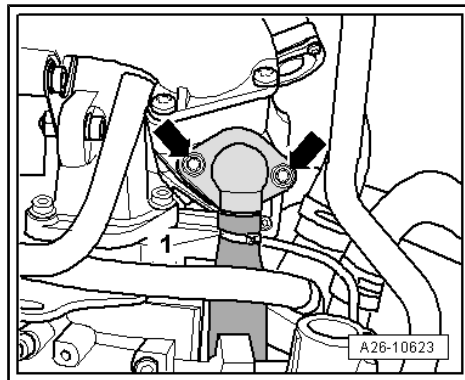
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- Unplug electrical connector -3-.
- Remove bolts -arrows- and move throttle valve module - J338- clear to one side (coolant hoses -1- and -2- remain connected)



- Remove bolts -arrows- for exhaust gas recirculation pipe.



- Disconnect hose -2- from activated charcoal filter.
- Remove bolts -arrows- and detach intake manifold support -3-.
- Unplug connector -4- and detach exhaust gas recirculation valve - N18- with exhaust gas recirculation potentiometer - G212- .

Installing

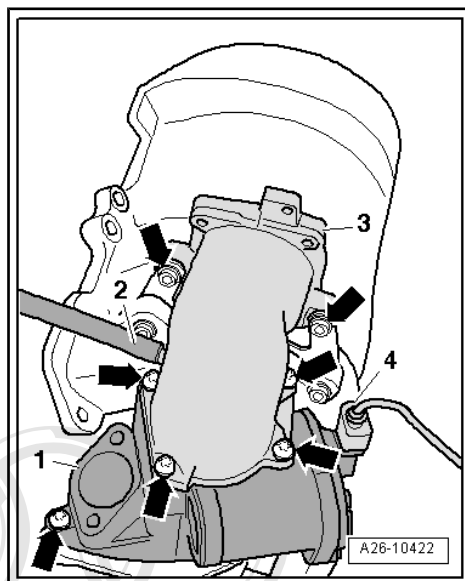
- Tightening torque
⇒ ["3.1 Exhaust gas recirculation system - exploded view", page 167](#)

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



Note

- ◆ *Renew seals and/or gaskets.*
- ◆ *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Parts catalogue .*
- Install throttle valve module - J338- ⇒ Rep. gr. 24 .
- Install fresh air duct ⇒ Rep. gr. 80 .



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