Workshop Manual

Audi A4 2015 ➤ , Audi A4 Avant 2015 ➤ , Audi A5 2016 ➤ , Audi A6 2019 ➤ , Audi Q5 2017 ➤

Servicing 4-cylinder TDI engine, common rail (EA 288 Gen. I)									
Engine ID	DET A	DEU A	DEU B	DES A	CZH A	DEU C	DET B		

Edition 02.2019

List of Workshop Manual Repair Groups

Repair Group

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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.

Contents

00 – Technical data

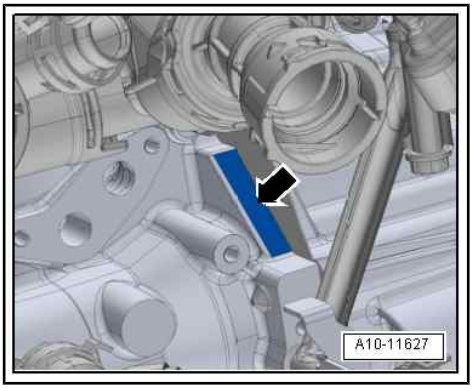
1 Identification

(ARL006264; Edition 02.2019)

⇒ “1.1 Engine number/engine data”, page 1

1.1 Engine number/engine data

Engine number



- The engine number (“engine code” and “serial number”) is located on the front of the joint between the engine and the gearbox -arrow-.
- Additionally there is a sticker on the toothed belt cover (top) with engine code and serial number.
- Engine codes starting with the letter “C” have four letters (previously three letters).
- The first 3 characters of the engine code stand for the engine capacity and the mechanical construction and design. They are stamped onto the cylinder block together with the serial number.
- The 4th character indicates the power output and torque of the engine and is determined by the engine control unit.

Engine data

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

2 Safety precautions

2.1 Safety precautions when working on the fuel supply system

Risk of injury - fuel system operates under high pressure

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

Before opening the fuel system:

– Put on safety goggles.

– Put on protective gloves.

– Release pressure (wrap a clean cloth around connection and open connection carefully).

Risk of fire due to escaping fuel

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

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

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

Risk of injury - engine may start unexpectedly

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

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

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

Risk of injury if test equipment is not secured

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

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

Or:

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

2.4 Safety precautions when working on the cooling system

Risk of scalding as hot coolant can escape

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

– Put on protective gloves.

– Put on safety goggles.

– Cover filler cap on expansion tank with a cloth and open carefully to release pressure.

2.5 Safety precautions when working on the exhaust system

Risk of injury caused by components of the exhaust system

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

– Allow exhaust system to cool down.

– Put on protective gloves.

Risk of injury when disconnecting the exhaust system

There is a risk of eye irritation caused by soot particles in the air.

– Put on safety goggles.

Components of the exhaust system can pose health risk

Risk to health if exhaust gas temperature sender is dismantled.

– Do not dismantle exhaust gas temperature sender.

Danger from toxic exhaust gases

Auxiliary/supplementary heater produces toxic exhaust gases. There is a risk of poisoning and of damage to the respiratory tract.

– In enclosed spaces, only switch on the auxiliary/supplementary heater if there is an exhaust extraction system.

– In enclosed spaces without an exhaust extraction system, switch off the auxiliary/supplementary heater.

Risk of damage to flexible joint

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

– Do not bend flexible joint more than 10°.

– Install flexible joint so that it is not under tension.

2.6 Safety precautions when working on the SCR system

When working on the SCR system, note the following warnings:

Risk of injury caused by reducing agent

Reducing agent can cause eye and skin irritation, damage to the respiratory tract and poisoning.

– Put on safety goggles.

– Put on protective gloves.

– Wear protective clothing.

– Ensure that there is sufficient fresh air. In enclosed spaces, switch on the exhaust extraction system.

Risk of damage caused by reducing agent

Reducing agent which has come into contact with trim or body components can crystallise after some time and damage the affected surfaces.

– Ensure that no reducing agent makes contact with parts of trim or body.

– Clean any surfaces which have come into contact with reducing agent immediately with water and a cloth.

When removing and installing components at the SCR system, note the following:

♦ The reducing agent tank must be empty when you are working on the SCR system. Refer to the corresponding work description to find out when the reducing agent must be drained from

the tank. Drain the reducing agent tank if necessary; procedure ⇒ page 217 .

When removing and installing the reducing agent tank, note the following:

- The reducing agent tank must be empty. Drain the reducing agent tank if necessary; procedure ⇒ page 217 .

Automatic drawing back of reducing agent

- After the ignition is switched off, the reducing agent is automatically drawn back into the reducing agent tank from the metering line going to the injector for reducing agent - N474- .
- Before performing work in this area, you must therefore wait until the reducing agent has been drawn back; this can take up to 10 minutes after the ignition has been switched off.
- It is also important to wait until the reducing agent has been drawn back (i.e. 10 minutes after the ignition is switched off) before disconnecting the battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

2.7 Safety precautions when working on the subframe

Risk of damage to components

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

– Never lower vehicle onto its wheels with suspension components unfastened or detached.

– Never support weight of vehicle on subframe or subframe cross brace with suspension components unfastened or detached.

3 Repair instructions

3.1 Rules for cleanliness

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

- Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- Seal off open pipes and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- Do not remove sealing caps from components until immediately prior to installation. Keep components that are to be reused in new, sealable plastic bags.
- After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have not been stored in the proper packaging (e.g. in tool boxes etc.).
- Do not work with compressed air when the system is open. If possible, do not move vehicle.
- Make sure that no fuel runs onto the fuel hoses. Should this occur, the fuel hoses must be cleaned again immediately.
- Also ensure that no diesel fuel comes into contact with the coolant hoses. Should this occur, the hoses must be cleaned immediately. Damaged hoses must be renewed.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

3.2 General notes

Fuel supply/injection

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

- The vehicles are fitted with a crash fuel shut-off system. This system is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump.
- At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system ⇒ page 2 .

Glow plug system

- The glow plug system is activated via the automatic glow period control unit - J179- . The control unit is self-diagnosis compatible.
- Fitting location of automatic glow period control unit - J179- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
- A fault is stored in the engine control unit - J623- if a fault occurs in the glow plug system.
- Checking glow plug system ⇒ Vehicle diagnostic tester
- For faster starting, the vehicle is equipped with electronically controlled glow plugs and a separate glow period control unit.
- Each glow plug is activated and diagnosed separately.
- Wait for 60 seconds each time after performing final control diagnosis of the glow period control unit. The ignition must remain switched on.
- If you do not wait for 60 seconds (if ignition is switched off and immediately switched on again), the glow plugs can be damaged (due to repeated pre-heating).
- The activation of the glow plugs is controlled according to coolant temperature.

3.3 General repair instructions

If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled
⇒ “1.3 Filling and bleeding fuel system”, page 147 .

Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

– Never allow fuel pump to run while it is empty.

– Fill/bleed fuel pump.

- Clean tools and workbench etc. before working on the injection system.
- Before installing, check the injectors and their surroundings visually; they must be undamaged and clean. Make sure the injector bores in the cylinder head are clean. Wipe out if necessary using a clean cloth, taking care not to cause damage. Do not use sharp objects of any kind.
- If the high-pressure fuel lines are to be re-used, you must mark them before removal. High-pressure pipes must always be reinstalled on the same cylinder.

- Take care not to damage the injectors when removing the old copper seals.
- Check all new O-rings for damage before installing. Lubricate O-rings with engine oil or assembly oil before installing.
- Position high-pressure pipes so they are free of stress. Tighten all unions lightly to start with before tightening to final torque.
- Never attempt to bend high-pressure fuel lines to shape.
- When working on any parts of the high-pressure fuel system, tools may only be used for loosening and tightening pipe unions. All other components must always be removed and installed by hand without using tools or other equipment.
- Press the fuel return hoses onto the injectors by hand from above so that they engage audibly on each injector (do not press in the release pins when doing this). Then press down the release pin after connecting the return line. Check that the fuel return hoses are seated securely and sealed properly by pulling them by hand from above.
- Do not dismantle individual common rail components. If there is a fault, the complete components must be renewed.
- When the engine is running, do not perform any repairs to the common rail system.
- Do not bleed the common rail system by unfastening high-pressure components after the engine has been started.
- All cable ties which are released or cut open when removing must be refitted in the same position when installing.
- Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.

3.4 Bolts and nuts

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

3.5 Foreign particles in engine

- When performing assembly work on the engine, all open passages in the intake and exhaust systems must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.

- If the turbocharger has suffered mechanical damage ⇒ page 128

3.6 Contact corrosion

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

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

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

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

Please note:

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

3.7 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 avoid damaging pipes, hoses and wiring, ensure sufficient clearance from all moving or hot components in engine compartment (limited space in engine compartment).

3.8 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, charge air cooler or condenser.

10 – Removing and installing engine

1 Removing and installing engine

⇒ “1.1 Removing engine”, page 10

⇒ “1.2 Securing engine to engine and gearbox support”, page 10

⇒ “1.3 Installing engine”, page 11

1.1 Removing engine

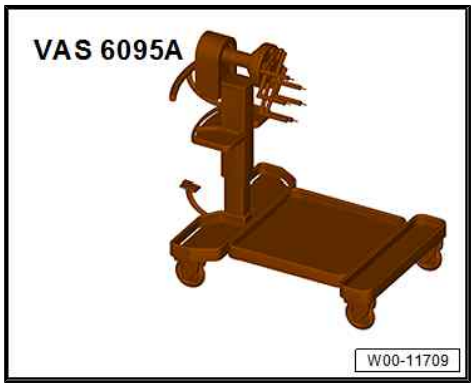
All procedures are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 10 ; Removing and installing engine; Removing engine .

1.2 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- Engine and gearbox support - VW 540-

- Engine and gearbox support - VAS 6095A-



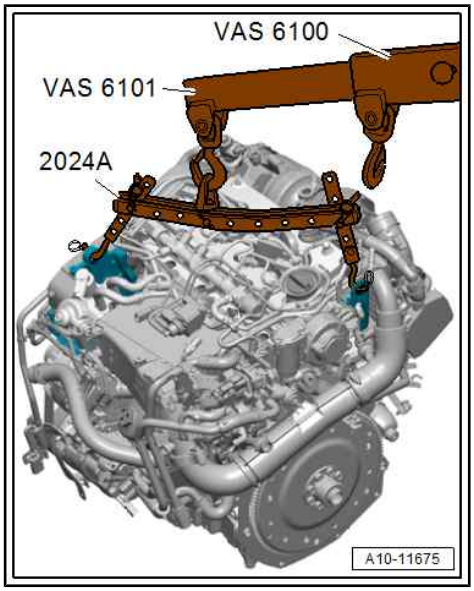
Procedure

– Remove lifting eye of lifting tackle - 2024A- (pull out split pin and press out pin).

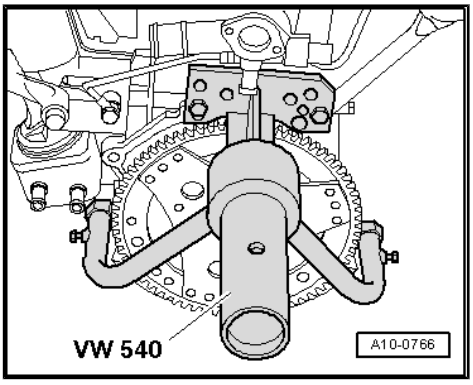
– Reinsert lifting eye in 4th hole from front on lifting tackle.

– Secure pin with split pin again.

– Attach lifting tackle - 2024A- to engine and workshop hoist - VAS 6100- with lift arm extension/workshop hoist - VAS 6101- as shown in illustration.



– Secure engine to engine and gearbox support - VW 540- using engine and gearbox support - VAS 6095A- .



1.3 Installing engine

All procedures are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 10 ; Removing and installing engine; Installing engine .

2 Assembly mountings

All procedures and components are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 10 ; Assembly mountings .

3 Engine cover panel

⇒ “3.1 Removing and installing engine cover panel”, page 13

3.1 Removing and installing engine cover panel

Removing

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

Installing

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

– Position engine cover panel, paying attention to oil filler neck and dipstick.

– Press engine cover panel into rubber grommets first on left side, then on right side.

13 – Crankshaft group

1 Cylinder block (pulley end)

1.1 Exploded view - cylinder block (pulley end)

1 - Poly V-belt

- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen
- ❑ Do not kink
- ❑ Routing of poly V-belt ⇒ page 16
- ❑ Removing and installing ⇒ page 17
- ❑ When installing, make sure it is properly seated on pulleys.

2 - Tensioner for poly V-belt

- ❑ Removing and installing ⇒ “1.4 Removing and installing tensioner for poly V-belt”, page 18

3 - Bolt

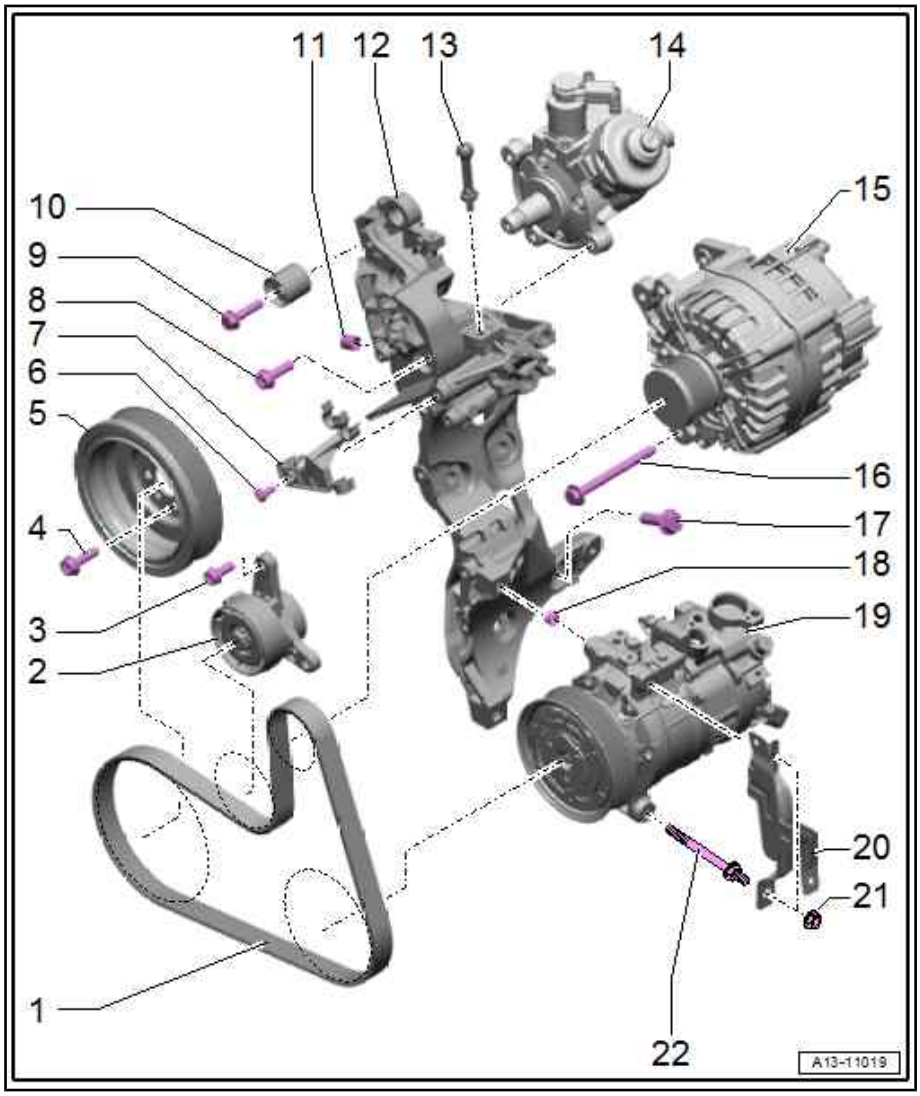
- ❑ Renew after removing
- ❑ 20 Nm +90°

4 - Bolt

- ❑ Renew after removing
- ❑ Use only genuine bolts ⇒ Electronic parts catalogue
- ❑ 10 Nm +90°

5 - Vibration damper

- ❑ With poly V-belt pulley
- ❑ Installation position: hole in vibration damper must be positioned over raised section of crankshaft sprocket



- ❑ Removing and installing ⇒ “1.5 Removing and installing vibration damper”, page 19

6 - Bolt

- ❑ 8 Nm

7 - Bracket

- ❑ For coolant hose

8 - Bolt

- ❑ Tightening torque ⇒ Item 2 (page 180)

9 - Bolt

- ❑ Tightening torque ⇒ Item 14 (page 46)

10 - Damper wheel

11 - Dowel sleeve

- ❑ Ensure correct seating in bracket for ancillaries

12 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 21

13 - Ball stud

- ❑ For engine cover panel

14 - High-pressure pump

- ❑ Exploded view ⇒ page 180

15 - Alternator

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

16 - Bolt

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

17 - Bolt

- ❑ Renew after removing
- ❑ Different lengths ⇒ page 16
- ❑ Tightening torque and sequence ⇒ page 16

18 - Dowel sleeve

- ❑ Bolt, 2x
- ❑ Ensure correct seating in air conditioner compressor

19 - Air conditioner compressor

- ❑ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket

20 - Bracket

- ❑ For SCR line

21 - Nut

- ❑ 20 Nm

22 - Centre hex stud

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

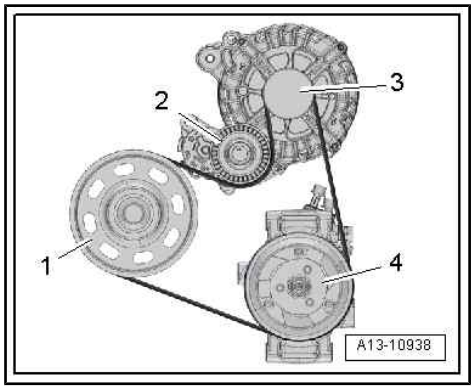
Routing of poly V-belt

1 - Vibration damper

2 - Tensioning roller

3 - Alternator

4 - Air conditioner compressor



Bracket for ancillaries - tightening torque and tightening sequence

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

– Fit bolts in the following sequence:

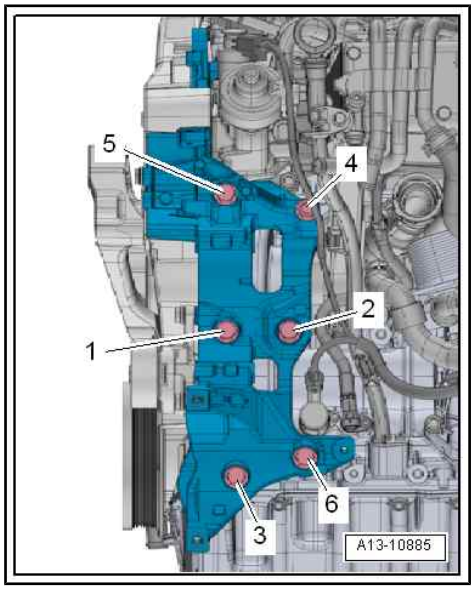
♦ Bolts -1, 2, 3, 6- M10x35

♦ Bolt -4- M10x115

♦ Bolt -5- M10x175

– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 6-	Screw in by hand until contact is made
2.	-1 … 6-	40 Nm
3.	-4- and -5-	Turn 180° further
4.	-1, 2, 3, 6-	Turn 45° further



1.2 Exploded view - sealing flange (pulley end)

1 - Sealing flange (pulley end)

- ❑ With crankshaft oil seal
- ❑ Renew after removing
- ❑ Removing and installing ⇒ page 22

2 - Bolt

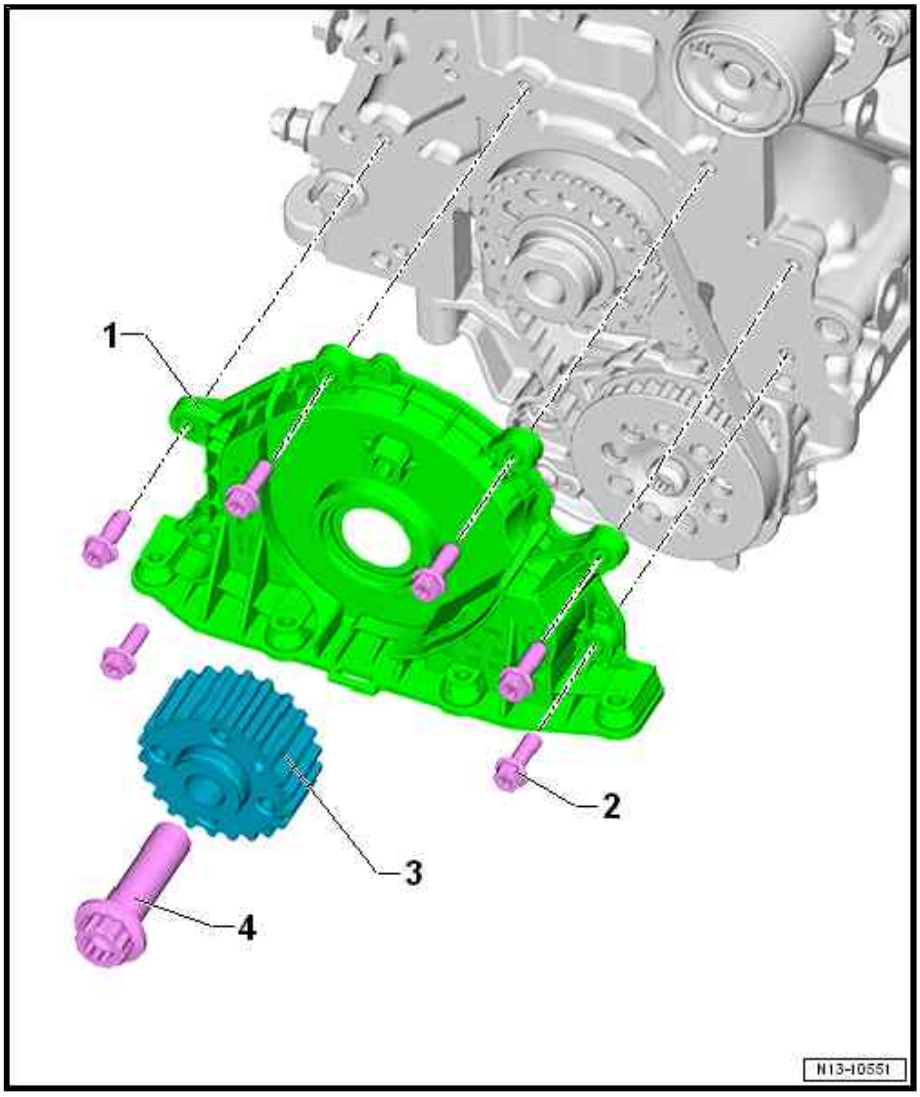
- ❑ Tightening torque and sequence ⇒ page 17

3 - Crankshaft sprocket

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

4 - Bolt

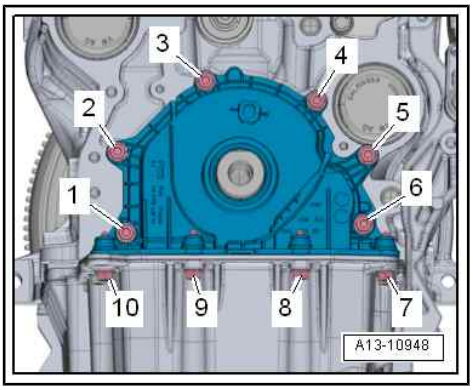
- ❑ Tightening torque ⇒ Item 1 (page 45)



Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

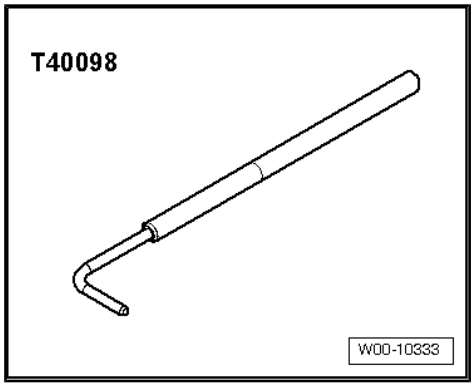
Stage	Bolts	Tightening torque
1.	-1 … 10-	Screw in by hand until contact is made
2.	-1 … 6-	Tighten in stages and in diagonal sequence; final torque 13 Nm
3.	-7 … 10-	13 Nm



1.3 Removing and installing poly V-belt

Special tools and workshop equipment required

◆ Locking tool - T40098-



Removing

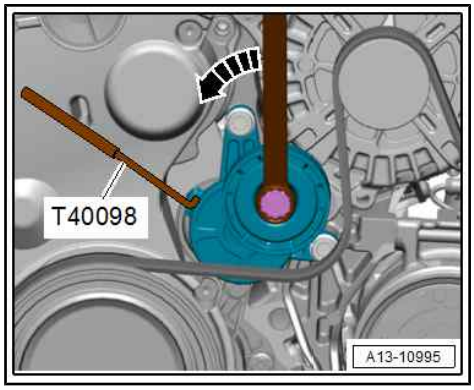
– Remove engine cover panel ⇒ page 13 .

NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

– Mark running direction before removing.

– Pay attention to running direction when reinstalling.



– To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow- using ring spanner.

– Lock tensioner with locking tool - T40098- .

– Take off poly V-belt.

Installing

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

– Fit poly V-belt ⇒ page 16 .

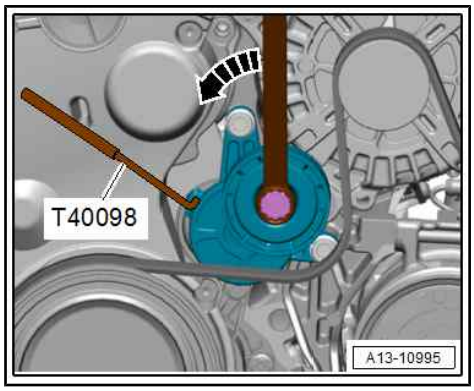
– Hold tensioner with ring spanner and remove locking tool - T40098- .

– Release tensioner.

– Check that poly V-belt is properly seated.

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

– Install engine cover panel ⇒ page 13 .



1.4 Removing and installing tensioner for poly V-belt

Removing

– Remove poly V-belt ⇒ page 17 .

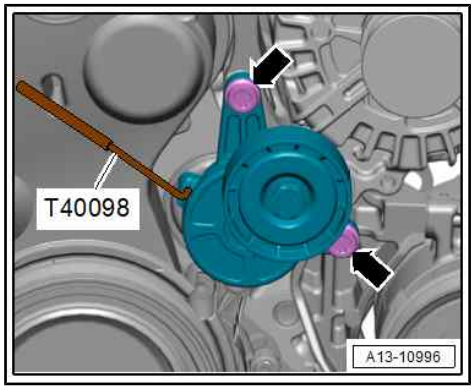
– Remove bolts -arrows- and take off poly V-belt tensioner.

Installing

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

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

– Install poly V-belt ⇒ page 17 .



Tightening torques

◆ ⇒ “1.1 Exploded view - cylinder block (pulley end)”, page 14

1.5 Removing and installing vibration damper

Special tools and workshop equipment required

- Torque wrench - VAS 6583A-

- Tool insert - T10572-

- Multi-point bit (10 mm), e.g. from plug socket set - VAS 6928-
- Offset ring spanner (19 mm)

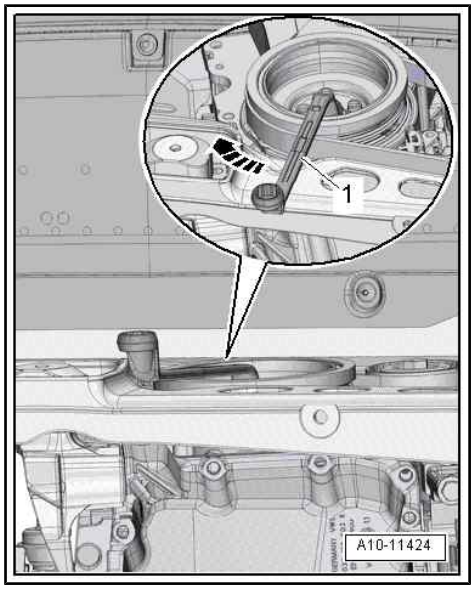
Removing

– Remove noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

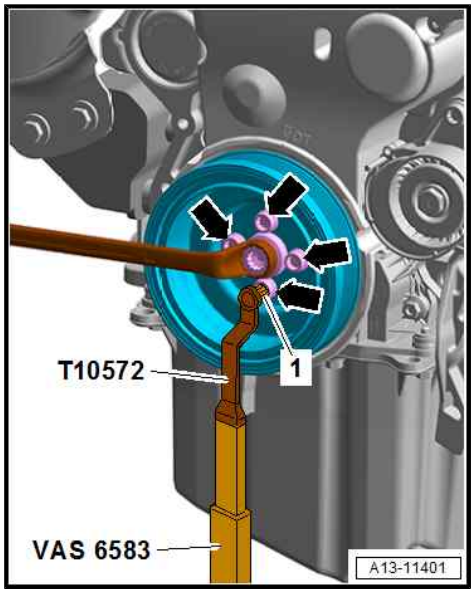
– Remove poly V-belt
⇒ “1.3 Removing and installing poly V-belt”, page 17 .

– Detach cap from vibration damper.

– Counterhold crankshaft on central bolt using angled ring spanner -1- when loosening bolts for vibration damper.



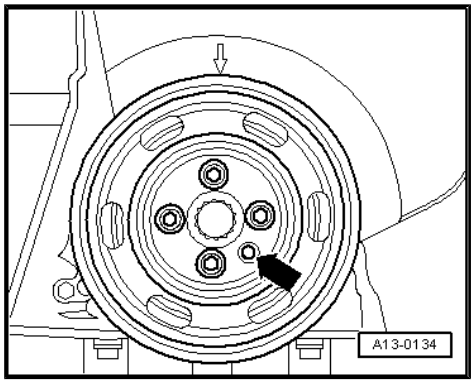
– Loosen bolts -arrows- on vibration damper using insert tool -T10572- and multi-point bit (10 mm) -1-.
– Remove bolts and take off vibration damper.



Installing

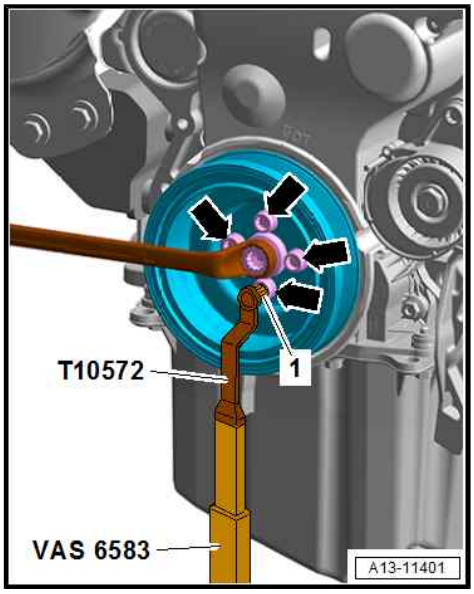
Installation is carried out in reverse order; note the following:

- After removing, renew bolts tightened with specified tightening angle.
- Installation position: hole -arrow- in vibration damper must be positioned over raised section of crankshaft sprocket.



– Tighten bolts -arrows- using torque wrench - VAS 6583A- and insert tool - T10572- and using multi-point bit (10 mm) -1-.
– Install poly V-belt ⇒ page 17 .
– Fit cap on vibration damper.
– Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

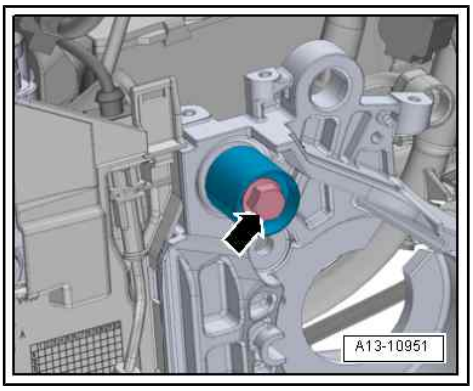
◆ ⇒ “1.1 Exploded view - cylinder block (pulley end)”, page 14



1.6 Removing and installing bracket for ancillaries

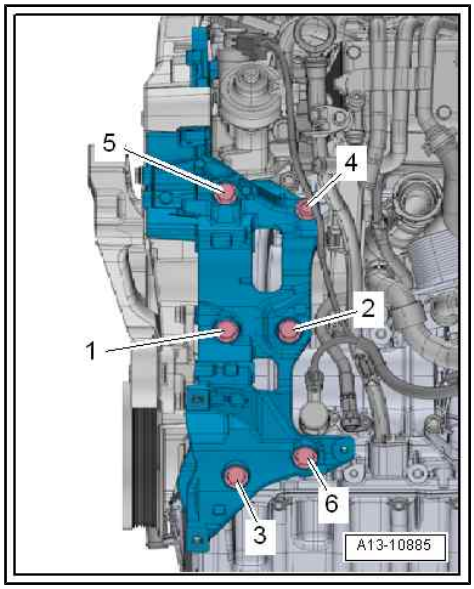
Removing

– Remove poly V-belt ⇒ page 17 .
– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Remove high-pressure pump ⇒ page 181 .
– Remove bolt -arrow- and detach damper wheel.



– Loosen bolts in the sequence -6 ... 1-.

– Remove bolts and detach bracket for ancillaries.



Installing

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

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

– Check that a dowel sleeve is fitted between bracket for ancillaries and cylinder block.

– Install high-pressure pump ⇒ page 181 .

– Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .

– Install poly V-belt ⇒ page 17 .

Tightening torques

♦ ⇒ Fig. ""Bracket for ancillaries - tightening torque and tightening sequence"" , page 16

♦ ⇒ "1.2 Exploded view - toothed belt", page 45

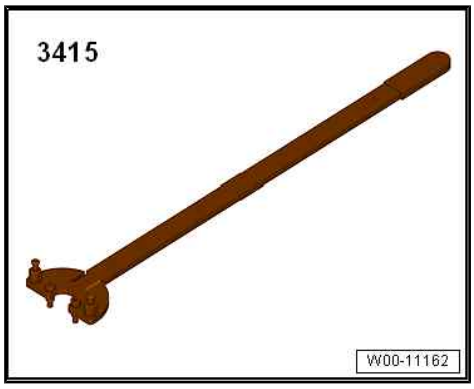
1.7 Removing and installing engine support

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 13 ; Cylinder block (pulley end); Removing and installing engine support .

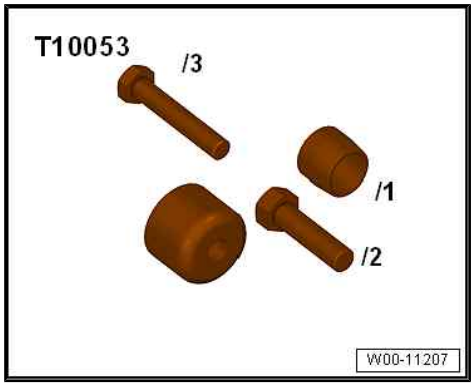
1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

♦ Counterhold tool - 3415-



♦ Assembly tool - T10053-



♦ Electric drill with plastic brush attachment

- Safety goggles
- Sealant ⇒ Electronic parts catalogue

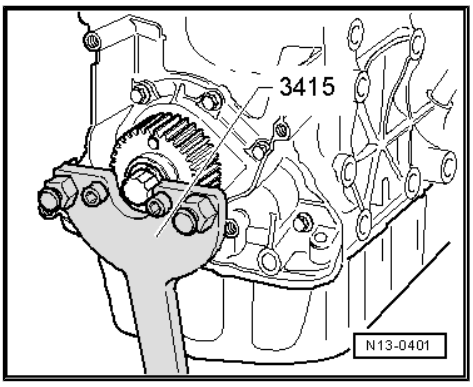
Removing

– Remove toothed belt ⇒ page 54 .

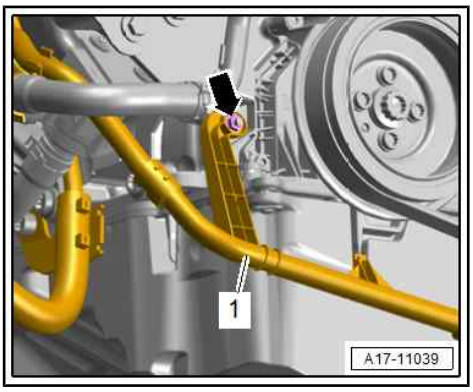
– Loosen bolt for crankshaft sprocket using counterhold tool -3415- .

– Remove bolt and detach crankshaft sprocket.

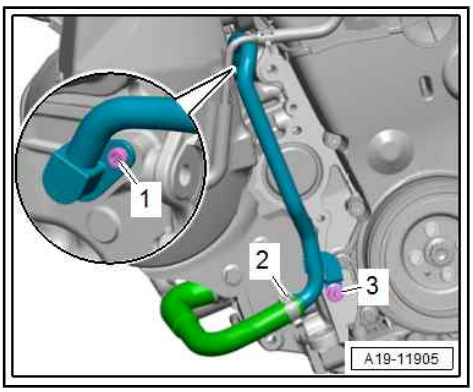
– Remove sump
⇒ “1.3 Removing and installing sump”, page 98 .



– Remove nut -arrow-, move cable duct -1- with B+ wire clear and push it to one side.



– Remove bolt -3- and push coolant pipe -2- slightly to side.



NOTICE

Risk of irreparable damage to coolant pipes if they are bent

– Never bend the coolant pipes out of their original shape.

– Remove remaining bolts and carefully release sealing flange from bonded joint.

Installing

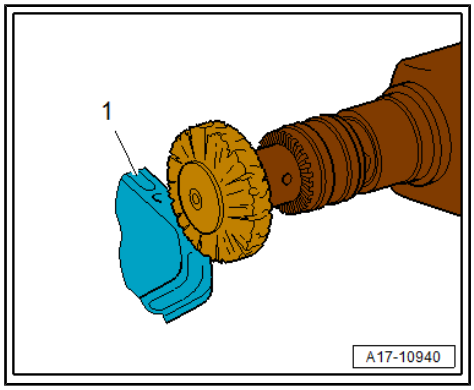
Installation is carried out in reverse order; note the following:

CAUTION

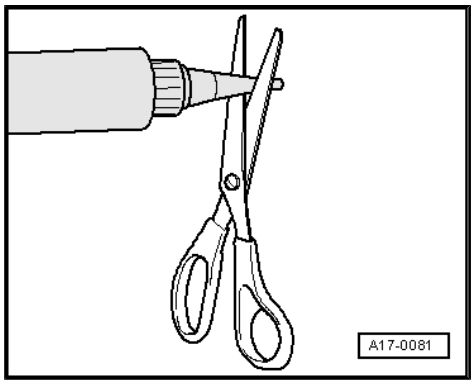
Risk of eye injury due to sealant residue.

– Put on safety goggles.

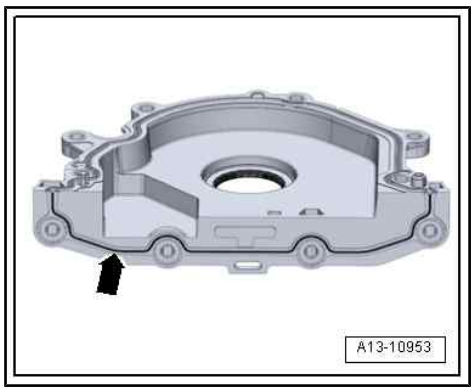
– Remove sealant residue from sump -1- using rotating plastic brush or similar.
– Clean sealing surfaces using commercially available chemical sealant remover; they must be free of oil and grease.
• Note the use-by date of the sealant.



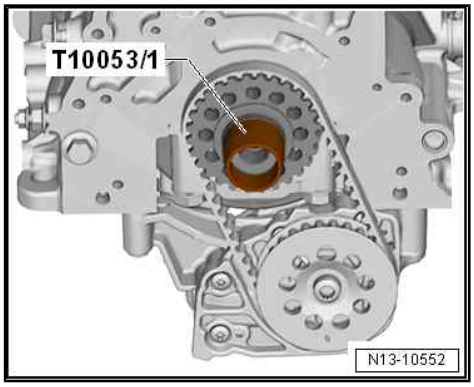
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2 mm).



– Apply sealant bead -arrow- onto clean sealing surface of sealing flange as shown in illustration.
• Thickness of sealant bead: 2 ... 3 mm
• The sealant bead must not be thicker than specified.
– The sealing flange must be installed within 5 minutes after applying sealant.



– Position assembly sleeve - T10053/1- on crankshaft journal.
– Slide sealing flange over assembly sleeve - T10053/1- .
• Dowel pins should then engage in bores on cylinder block.
– Detach assembly tool - T10053/1- .
– Tighten sealing flange bolts ⇒ page 17 .



Note

It is important to tighten the bolts in the correct sequence.

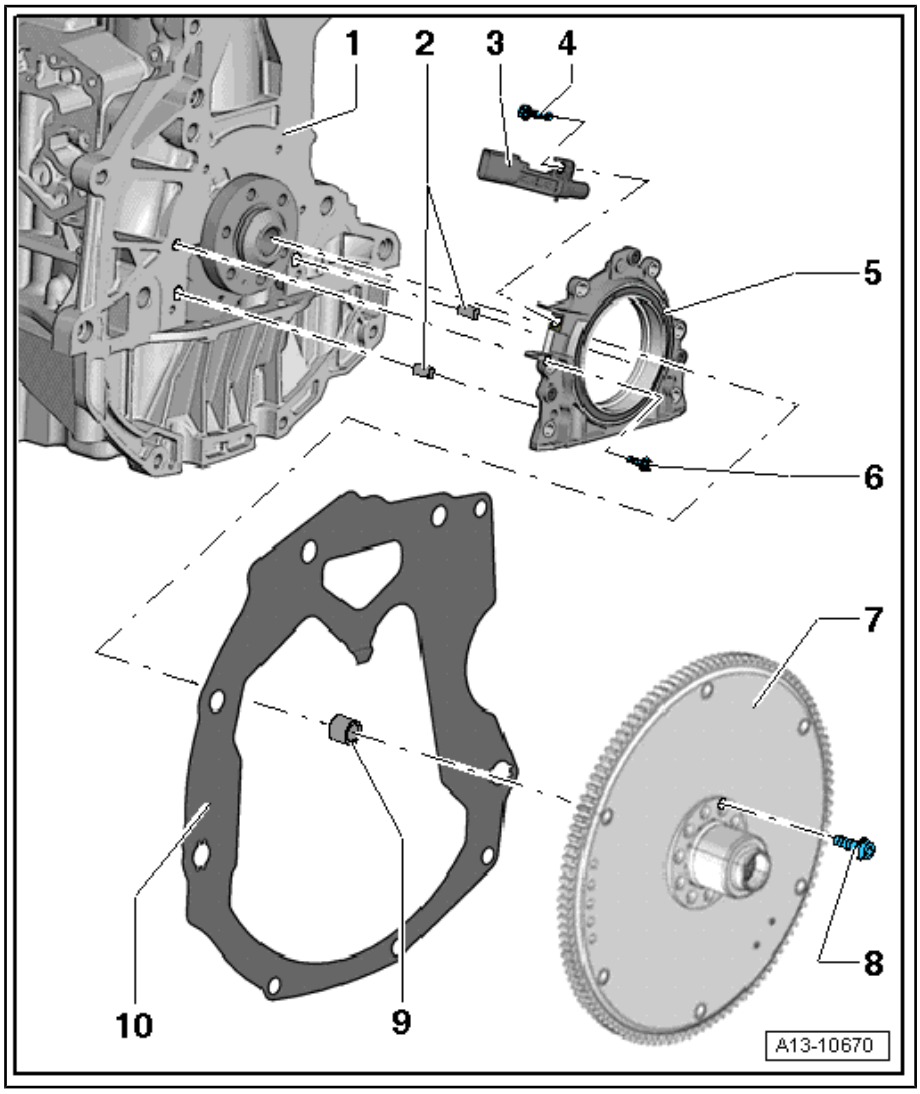
– Install sump
⇒ “1.3 Removing and installing sump”, page 98 .
– Install toothed belt (adjust valve timing) ⇒ page 57 .

Tightening torques

♦ ⇒ Fig. ““Sealing flange (pulley end) - tightening torque and sequence”“ , page 17
♦ Crankshaft sprocket ⇒ Item 1 (page 45)
♦ ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Exploded view - coolant pipes

2 Cylinder block (gearbox end)

2.1 Exploded view - cylinder block (gearbox end)



1 - Cylinder block

2 - Dowel pins

3 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 243

4 - Bolt

- ❑ Tightening torque ⇒ Item 7 (page 240)

5 - Sealing flange (gearbox end)

- ❑ With oil seal
- ❑ Renewing ⇒ page 28

6 - Bolt

- ❑ Tightening torque and sequence ⇒ page 27

7 - Drive plate

- ❑ Lock with counterhold tool - 3067- to slacken off bolts
- ❑ Removing and installing ⇒ page 27

8 - Bolt

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

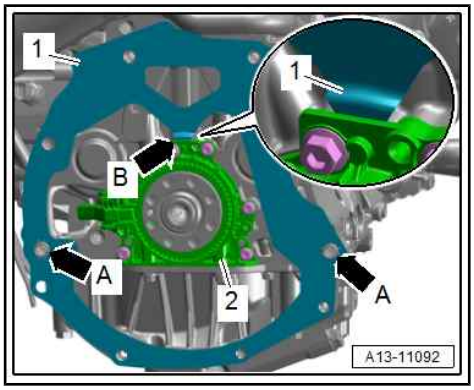
9 - Not fitted

10 - Intermediate plate

- ❑ Do not damage or bend when assembling
- ❑ Installing ⇒ page 27

Installing intermediate plate

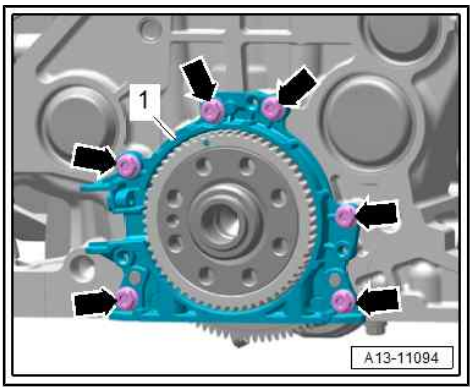
– Engage intermediate plate on sealing flange -arrow B- and push onto dowel sleeves -arrows A-.



Sealing flange (gearbox end) - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

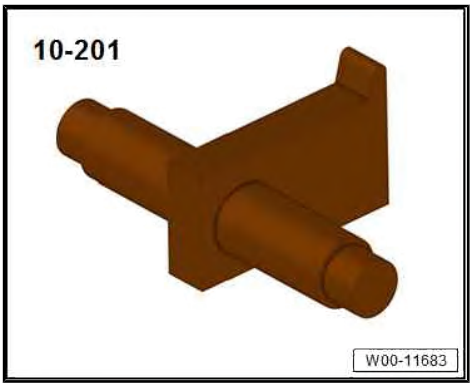
Stage	Bolts	Tightening torque
1.	-arrows-	Screw in by hand until contact is made
2.	-arrows-	Tighten in stages and in diagonal sequence; final torque 15 Nm



2.2 Removing and installing drive plate

Special tools and workshop equipment required

♦ Counterhold tool - 10-201-



Removing

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

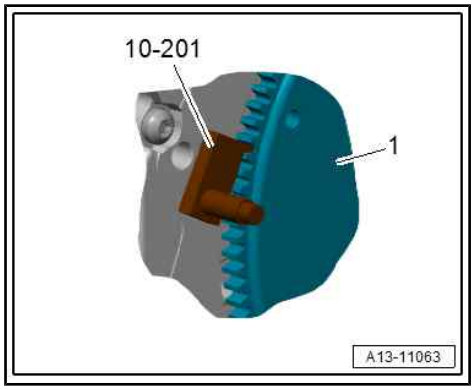
NOTICE

Risk of damage to thread if an impact driver (or similar) is used.

– When screwing in bolts, fit them manually and perform the first few turns by hand.

– Do not use an impact driver to loosen or tighten bolts.

– Insert counterhold tool - 10-201- in hole on cylinder block, slacken bolts for drive plate -1-.
– Remove bolts and take off drive plate.



Installing

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

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

– Pay attention to dowel pin when installing drive plate.
– Fit counterhold tool - 10-201- the other way round to tighten bolts.

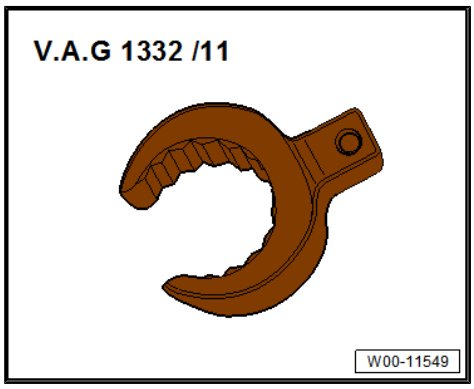
Tightening torques

♦ ⇒ “2.1 Exploded view - cylinder block (gearbox end)”, page 26

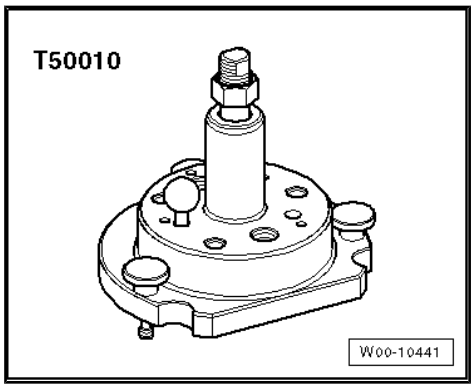
2.3 Removing and installing sealing flange (gearbox end)

Special tools and workshop equipment required

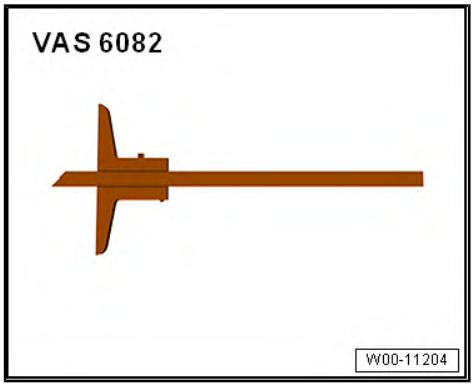
♦ Open end spanner insert, AF 24 - V.A.G 1332/11-



♦ Assembly tool - T50010-



♦ Depth gauge - VAS 6082-



♦ Bolt, M6x35 (3x)

♦ Bolt, M7x35 (2x)

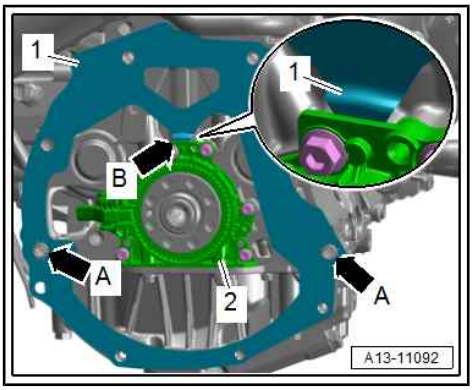
Pressing out sealing flange with sender wheel

• Gearbox removed

– Remove drive plate ⇒ page 27 .

– Detach intermediate plate -1- from dowel sleeves -arrows A-.

– Guide intermediate plate upwards; at the same time, pull retaining tab -arrow B- out of opening behind sealing flange -2-.

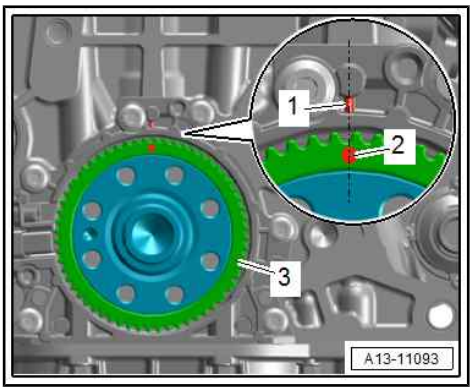


– Rotate crankshaft by turning bolt for toothed belt sprocket until crankshaft is positioned at “TDC”, as shown in illustration.

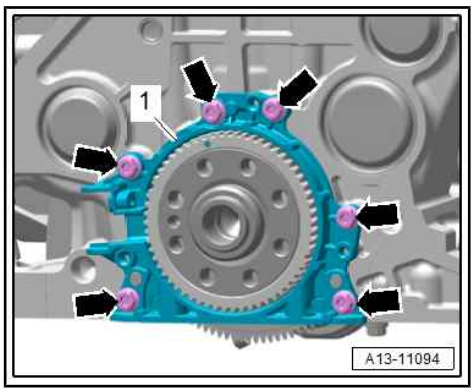
• The hole -2- in the sender wheel -3- must be aligned with the vertical rib -1- on the sealing flange.

– Remove sump ⇒ page 98 .

– Remove engine speed sender - G28- ⇒ page 243 .



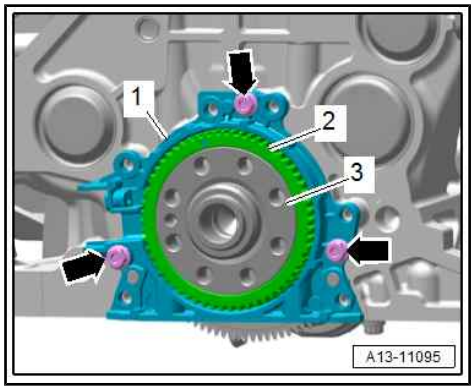
– Remove bolts -arrows- for sealing flange -1-.



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

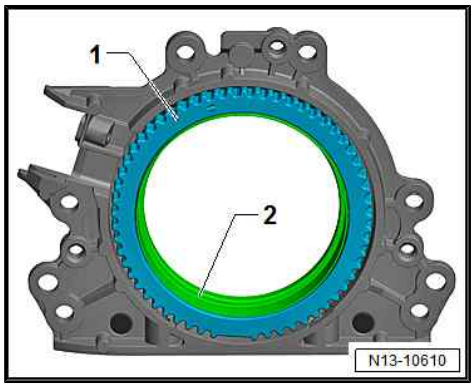
– To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than $^{1}/_{2}$ turn at a time.

– Detach sealing flange together with sender wheel.



Pressing in sealing flange with sender wheel

- The sealing flange with PTFE oil seal is fitted with a sealing lip support ring -2-. This support ring acts as an assembly sleeve and must not be removed before installation.
- Sealing flange and sender wheel -1- must not be separated or rotated out of position after removal from packaging.
- The sender wheel is held in its installation position by a locating pin on the assembly tool - T50010- .
- The sealing flange and oil seal are one unit and can only be replaced together with the sender wheel.
- The assembly tool - T50010- 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 - T50010- :

A - Tensioning flats

B - Nut

C - Guide pin

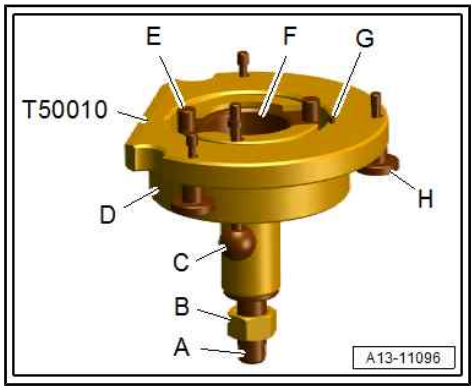
D - Assembly housing

E - Hexagon socket head bolts (2x)

F - Inner section

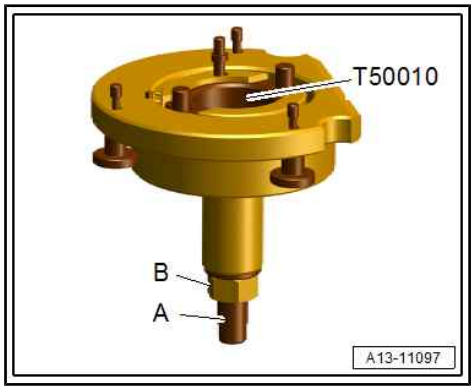
G - Locating pin

H - Knurled screw (3x)

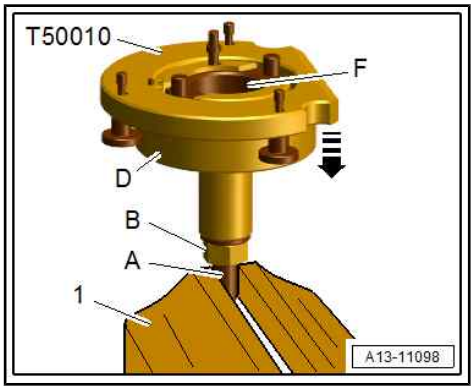


Fitting sealing flange with sender wheel onto assembly tool - T50010- :

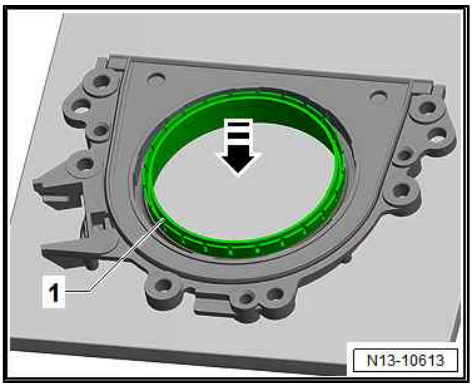
– Unscrew nut -B- until it is just in front of tightening flats -A- on threaded spindle.



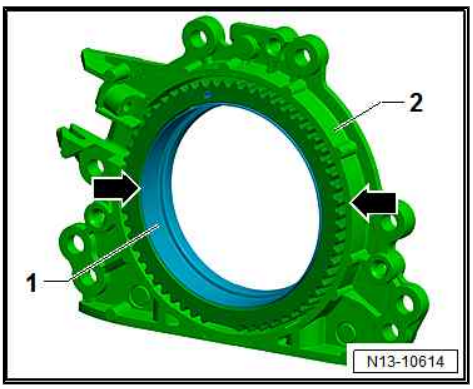
– Clamp assembly tool - T50010- in a vice -1- on tightening flats -A- of threaded spindle.
– Press assembly housing -D- downwards -arrow- so that it rests on nut -B-.
• Inner part -F- of assembly device and assembly housing -D- must be level with each other.



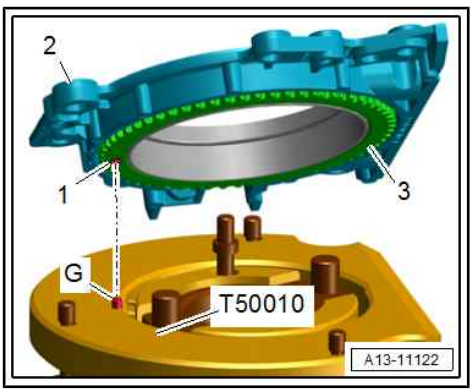
– Place sealing flange (with front side downwards) on a clean flat surface.
• Do not take the sender wheel out of the sealing flange or rotate it out of position.
– Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.



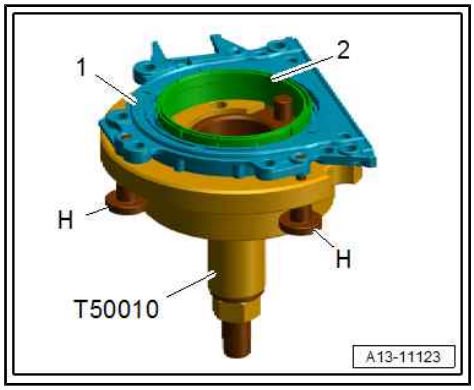
• Upper edge of sealing lip support ring -1- must be flush -arrows- with front edge of sealing flange -2-.



– Place front side of sealing flange -2- on assembly tool - T50010- so that locating pin -G- is seated in hole -1- in sender wheel -3-.
• Ensure that sealing flange lies flat on assembly tool.



– Screw knurled screws -H- onto sealing flange -1-.



Note:

Only the two knurled screws shown in the illustration can be screwed on.

– When tightening, press sealing flange and sealing lip support ring -2- against surface of assembly tool - T50010- .

– This prevents locating pin from sliding out of hole in sender wheel.

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

Securing assembly tool - T50010- with sealing flange -1- on crankshaft flange:

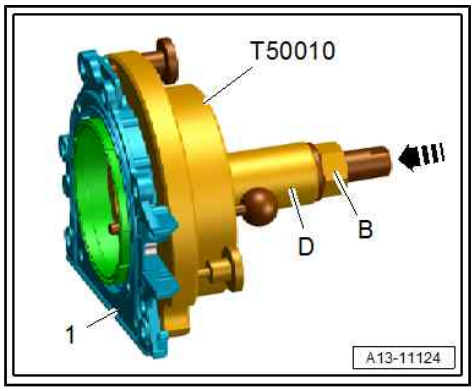
• Crankshaft flange must be free of oil and grease.

• Engine is at “TDC” position.

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

– Press threaded spindle of assembly tool - T50010- in direction of -arrow- until nut -B- makes contact with assembly housing -D-.

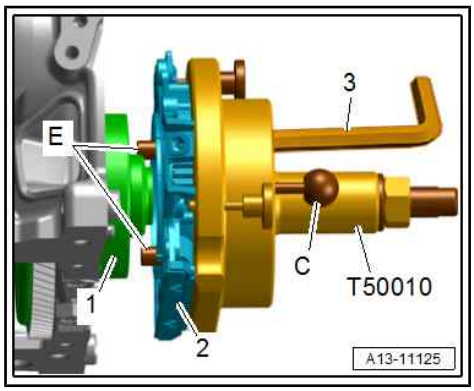
– Position flat edge of assembly housing towards sealing surface for sump on cylinder block.



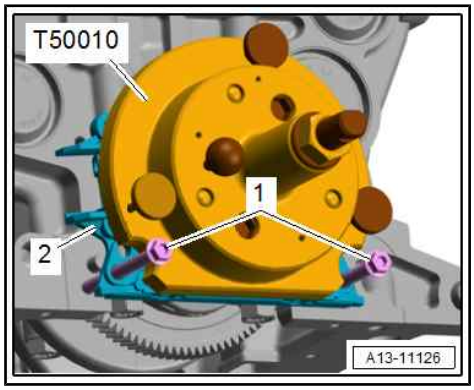
– Secure assembly tool - T50010- with sealing flange -2- to crankshaft flange -1-.

– To do so, screw hexagon socket head bolts -E- approx. 5 turns into crankshaft flange with hexagon key -3-.

– Insert guide pin -C- into crankshaft flange.



– Screw 2 bolts M6x35 -item 1- into cylinder block to guide sealing flange -2-.



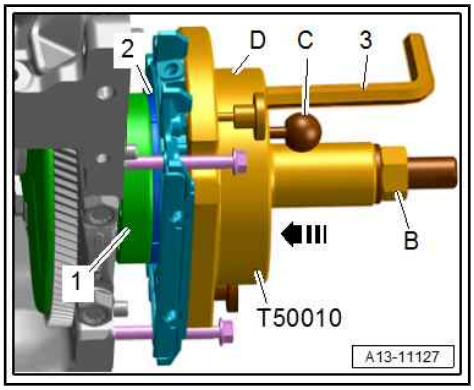
Securing assembly tool - T50010- on crankshaft flange:

– Press assembly housing -D- by hand in direction of -arrow- until sealing lip support ring -2- makes contact with crankshaft flange -1-.

– Check that guide pin -C- is fitted correctly in hole in crankshaft. This ensures that sender wheel reaches its final installation position.

– Use hexagon key -3- to tighten the two hexagon socket head bolts on assembly tool - T50010- hand-tight.

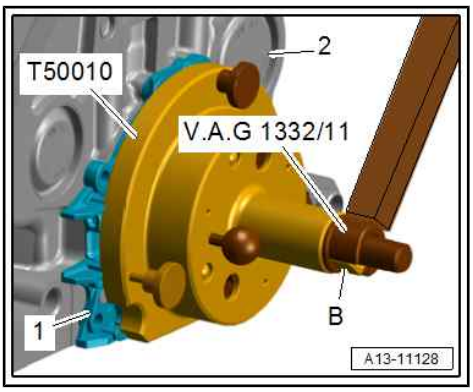
– Screw nut -B- onto threaded spindle by hand until it touches assembly housing -D-.



Pressing sender wheel onto crankshaft flange with assembly tool - T50010- :

– Tighten nut -B- on assembly tool - T50010- to 35 Nm.

• There must be a small gap between cylinder block -2- and sealing flange -1- after nut has been tightened to 35 Nm.



Checking installation position of sender wheel on crankshaft:

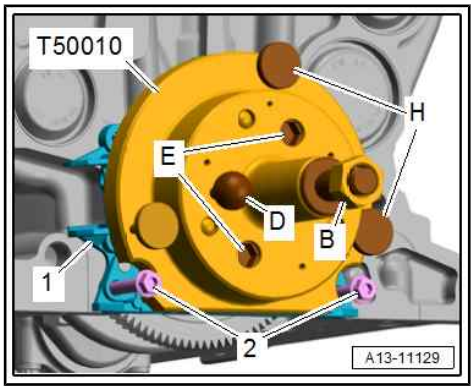
– Screw nut -B- to end of threaded spindle.

– Remove both bolts -2- from cylinder block.

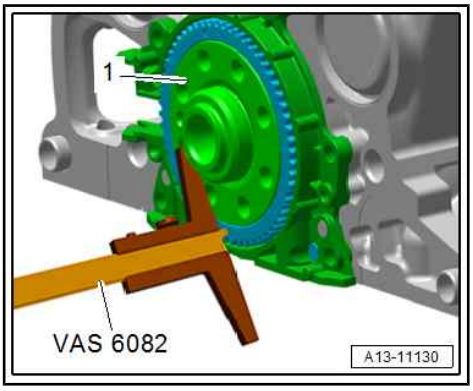
– Unscrew knurled screws -H- from sealing flange -1-.

– Unbolt assembly tool - T50010- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).

– Detach sealing lip support ring.



– Apply depth gauge - VAS 6082- to crankshaft flange -1-.

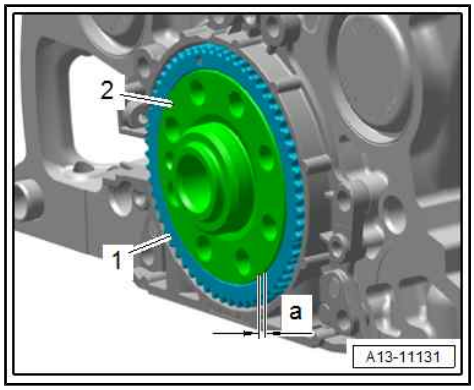


– Measure distance -a- between crankshaft flange -2- and sender wheel -1-.

• Specification: Distance -a- = 0.5 mm.

– Press sender wheel in further if measurement is too small ⇒ page 34 .

– If reading matches specification, continue with assembly ⇒ page 34 .

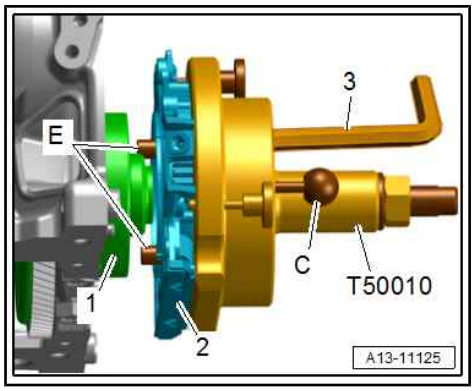


Pressing sender wheel in further:

– Secure assembly tool - T50010- to crankshaft flange.

– Ensure that locating pin of assembly tool - T50010- is fitted in hole in sender wheel.

– Use hexagon key -3- to tighten the two hexagon socket head bolts -E- hand-tight.

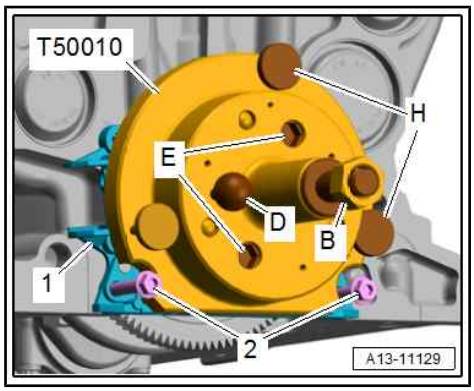


– Slide assembly tool - T50010- onto sealing flange -1- by hand.

– Screw nut -B- onto threaded spindle by hand until it touches assembly tool - T50010- .

– Insert guide pin -C- into crankshaft flange.

– Screw 2 bolts M6x35 -item 2- into cylinder block to guide sealing flange -1-.

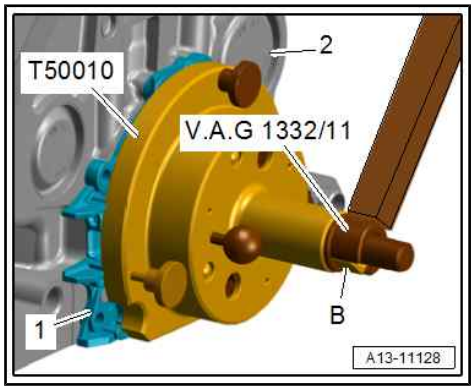


– Tighten nut -B- on assembly tool - T50010- to 40 Nm.

– Check installation position of sender wheel on crankshaft again ⇒ page 33 .

– Tighten nut on assembly tool - T50010- to 45 Nm if measurement is too small.

– Check installation position of sender wheel on crankshaft again ⇒ page 33 .



Assembling:

Assembly is performed in reverse sequence; note the following:

– Install sump ⇒ page 98 .

– Install intermediate plate ⇒ page 27 .

– Install drive plate ⇒ page 27 .

Tightening torques

◆ ⇒ Fig. ""Sealing flange (gearbox end) - tightening torque and sequence"" , page 27

◆ ⇒ "1.1 Exploded view - glow plug system", page 239

3 Crankshaft

There is currently no provision for removing and installing the crankshaft.

⇒ “3.1 Crankshaft dimensions”, page 35

⇒ “3.2 Measuring axial clearance of crankshaft”, page 35

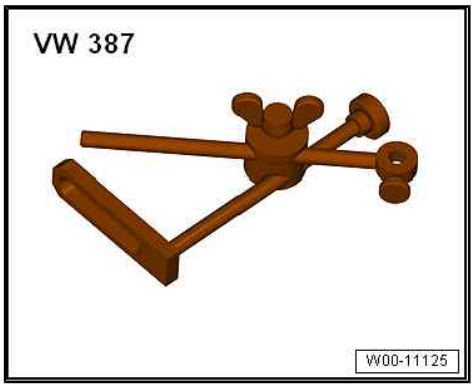
3.1 Crankshaft dimensions

	Main bearing journal Ø mm	Conrod journal Ø mm
Basic dimension	54.00 -0.022 -0.042	50.90 -0.022 -0.042

3.2 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-

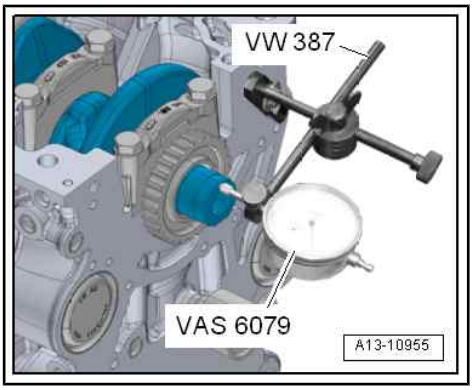
Procedure

– Bolt dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- onto cylinder block (as shown in illustration) and set it against crankshaft.

– Press crankshaft against dial gauge by hand.

– Set dial gauge to “0”.

– Push crankshaft away from dial gauge and read off value.

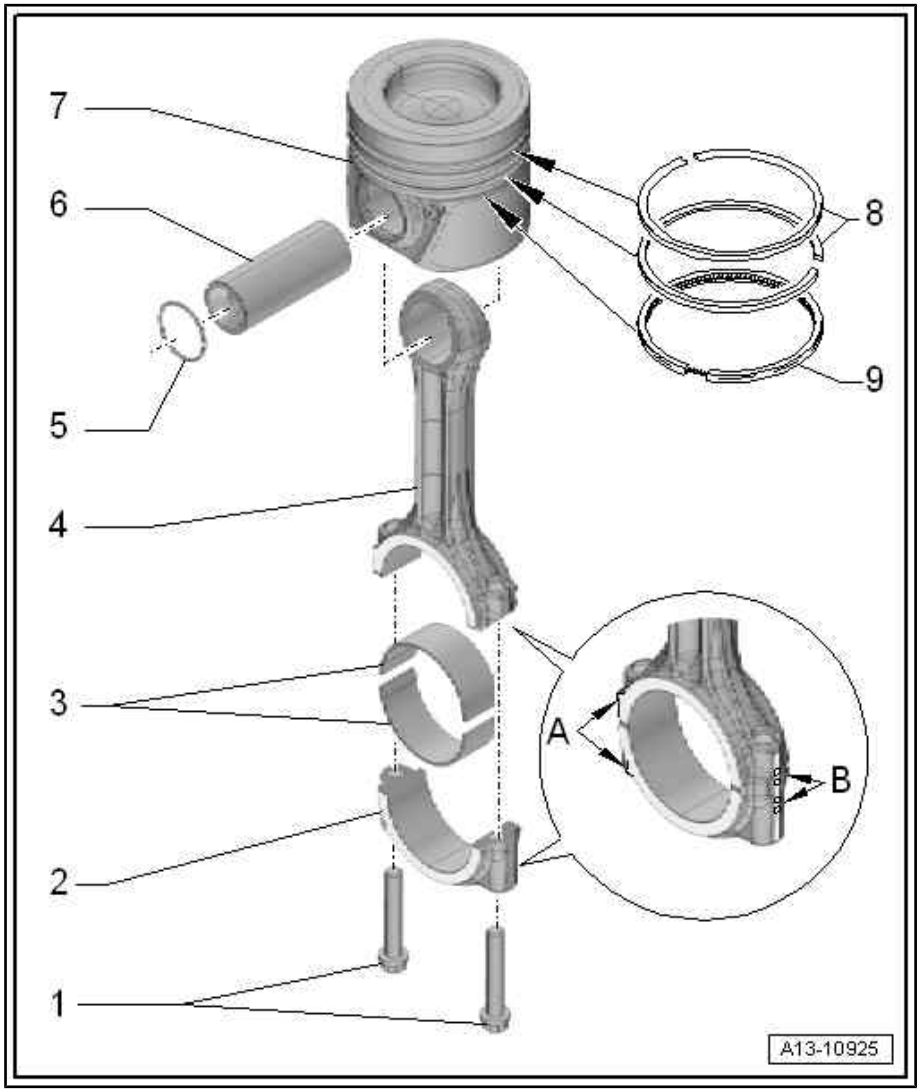


Axial clearance:

- New: 0.07 ... 0.17 mm
- Wear limit: 0.37 mm

4 Pistons and conrods

4.1 Exploded view - pistons and conrods



1 - Bolts

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

2 - Conrod bearing cap

- ❑ Note installation position
- ❑ Due to the cracking method used to separate the bearing cap from the conrod in manufacture, the caps only fit in one position and only on the appropriate conrod
- ❑ Mark conrod and cylinder allocation with paint -B-
- ❑ Installation position: Markings -A- face towards pulley end

3 - Bearing shells

- ❑ Installation position ⇒ page 38
- ❑ Renew used bearing shells
- ❑ Note version: Upper bearing shell (closest to piston) is constructed from a more wear-resistant material; refer to ⇒ Electronic parts catalogue
- ❑ Check that it is securely seated

4 - Conrod

- ❑ With industrially cracked conrod bearing cap
- ❑ Only renew as a complete set
- ❑ Mark conrod bearing cap and cylinder allocation with paint -B-
- ❑ Axial clearance: wear limit: 0.37 mm
- ❑ Measuring radial clearance ⇒ page 43

- ❑ Separating parts of new conrod ⇒ page 42
- ❑ Installation position: Markings -A- face towards pulley end

5 - Circlip

- ❑ 2x
- ❑ Renew after removing

6 - Piston pin

- ❑ Removing and installing ⇒ page 38

7 - Piston

- ❑ With combustion chamber
- ❑ Renew piston if cracking is visible on piston crown or piston skirt
- ❑ Mark installation position and cylinder number ⇒ page 37
- ❑ Removing and installing ⇒ page 38
- ❑ Checking pistons and cylinder bores ⇒ page 41
- ❑ Measuring piston projection at “TDC” ⇒ page 40

8 - Compression rings

- ❑ Measuring ring gap ⇒ page 42
- ❑ Measuring ring-to-groove clearance ⇒ page 42
- ❑ Install using piston ring pliers -VAS 211 003- ⇒ page 38
- ❑ Installation position: marking “TOP” or side with lettering faces towards piston crown.
- ❑ Offset gaps by 120°

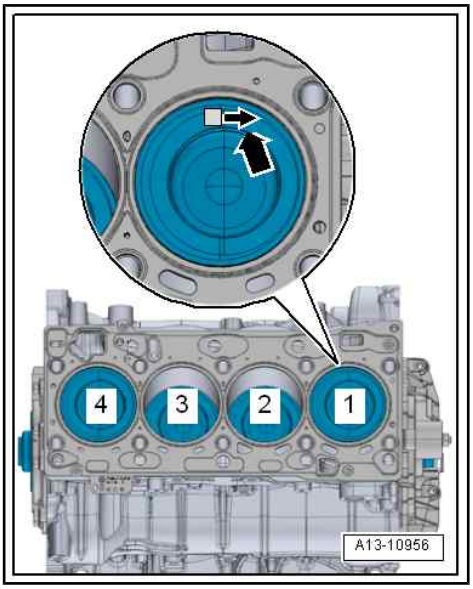
9 - Oil scraper ring

- ❑ Measuring ring gap ⇒ page 42
- ❑ Measuring ring-to-groove clearance ⇒ page 42
- ❑ Install using piston ring pliers -VAS 211 003- ⇒ page 38
- ❑ Installation position: marking “TOP” or side with lettering faces towards piston crown
- ❑ Offset gap by 120° to bottom compression ring

Installation position of pistons and allocation of piston/cylinder

– If you intend to re-install used pistons, mark the cylinder number on the piston crown using paint.

• Arrow on piston crown points to pulley end -arrow-.

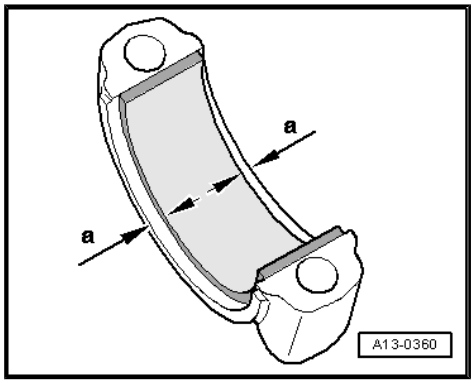


Installing piston rings

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

Installation position of bearing shells in conrods

– Insert bearing shells centrally in conrod and conrod bearing cap.
- Distance -a- = 2.5 mm



Oil spray jet and pressure relief valve

1 - Bolt with pressure relief valve, 24 Nm

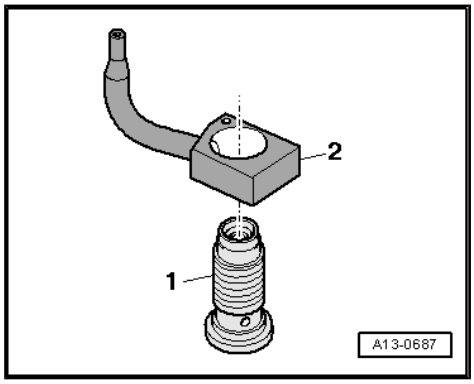
2 - Oil spray jet (for cooling of pistons)

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

NOTICE

Risk of damage to oil spray jets due to deformation.

– Never bend oil spray jets.



4.2 Removing and installing pistons

Special tools and workshop equipment required

♦ Pin - VW 222A-

♦ Piston ring pliers -VAS 211 003-

Removing

• Engine secured to engine and gearbox support ⇒ page 10 .

– Remove cylinder head ⇒ page 66 .

– Remove oil pump ⇒ page 101 .

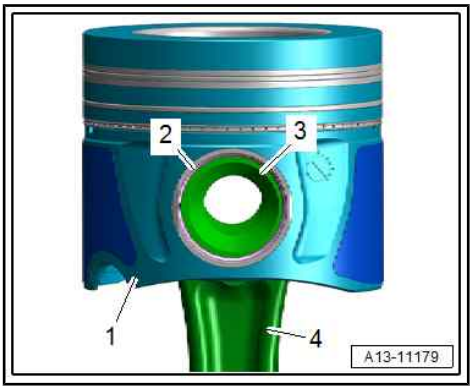
– Mark installation position and matching of conrod bearing caps to cylinder and to conrods for re-installation ⇒ Item 2 (page 36) .

– Unbolt conrod bearing caps.

– Pull out pistons upwards with conrods.

– Take circlip -2- out of piston pin boss.

– Use drift - VW 222A- to drive out piston pin -3-.



Note:

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

– Detach piston -1- from conrod -4-.

Installing

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

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

– Oil running surfaces of bearing shells.

– Install piston rings ⇒ page 38 .

– Install pistons using piston ring clamp.

Installation position:

• Pistons ⇒ page 37

• Bearing shells in conrods ⇒ page 38

– Install conrod bearing caps according to markings.

– Install oil pump ⇒ page 101 .

– Install cylinder head ⇒ page 66 .

– If pistons have been renewed, perform adaptions listed in `Guided Function` `01 - Functions component replacement` ⇒ Vehicle diagnostic tester.

Tightening torques

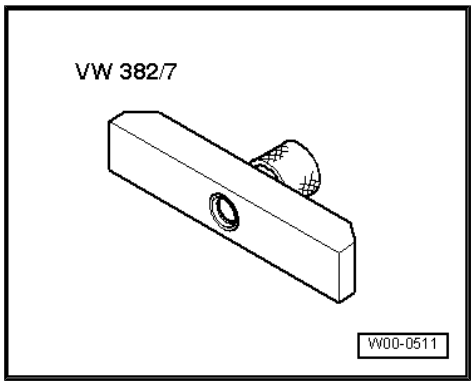
♦ ⇒ “4.1 Exploded view - pistons and conrods”, page 36

4.3 Measuring piston projection at TDC

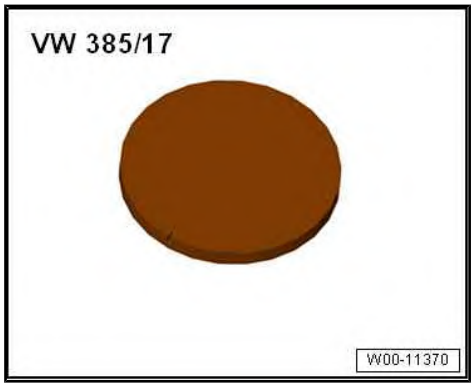
Measure piston projection at “TDC” when installing new pistons or a short engine.

Special tools and workshop equipment required

- Measuring bridge -VW 382/7- from measuring tool - VW 382-



- Measuring plate -VW 385/17- from universal measuring tool - VW 385-



- Dial gauge - VAS 6079-

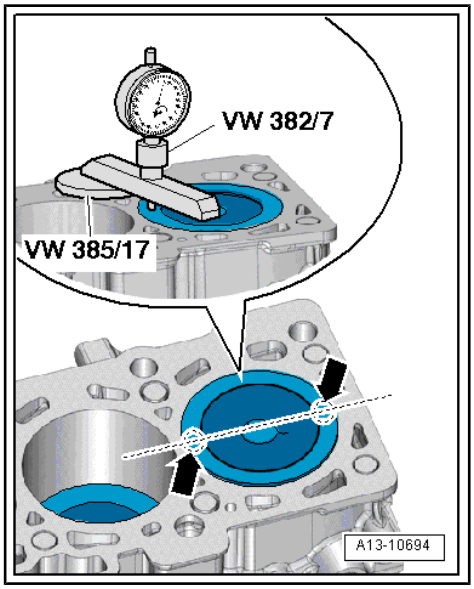
Procedure

– Secure dial gauge - VAS 6079- with measuring bridge - VW 382/7- and measuring plate -VW 385/17- to cylinder block as shown in illustration.

– Measure projection at each piston at both locations marked with -arrows- (seen in longitudinal direction of engine: at front and rear of piston).

– Depending on piston projection, install corresponding cylinder head gasket according to following table:

Piston projection above top surface of cylinder block mm	Identification (no. of holes)
0.91 … 1.00	1
1.01 … 1.10	2
1.11 … 1.20	3



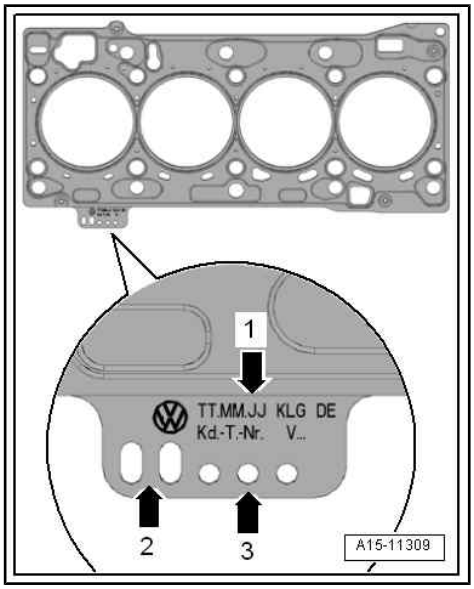
Identification of cylinder head gasket

1 - Part number

2 - Ignore

3 - Holes

• If the values measured for piston projection are not the same for all pistons, use the highest value to determine the correct gasket size.



4.4 Checking pistons and cylinder bores

Checking piston

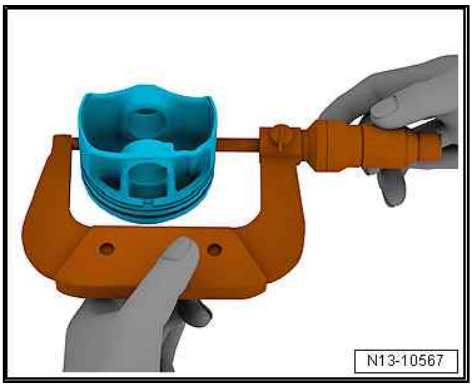
– Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.

• Maximum deviation from nominal dimension: 0.04 mm.

• Check for wear on piston skirt coating and for any carbon deposits.

• Renew piston if cracking is visible on piston skirt.

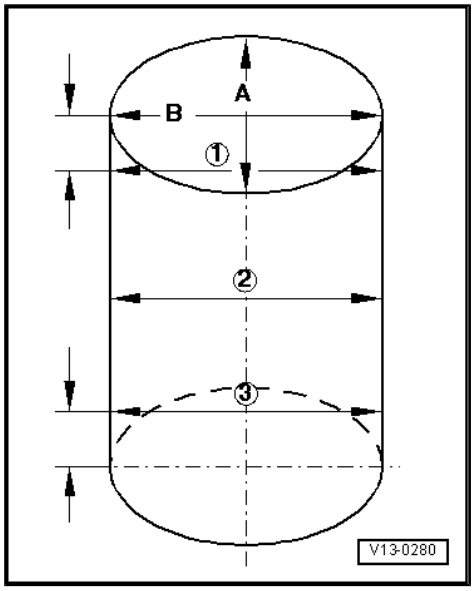
Piston ∅ mm	
Nominal dimension	80.92 [1)]
• [1)] Dimensions including coating (thickness 0.02 mm). The coating will wear down in service.	



Measuring cylinder bore

– Use a cylinder gauge - VAS 6078- to take measurements at 3 points in transverse direction -A- and in longitudinal direction -B-.

• Maximum deviation from nominal dimension: 0.10 mm.



Checking cylinder bore

– Check cylinder bore for wear, scoring and other abnormalities.

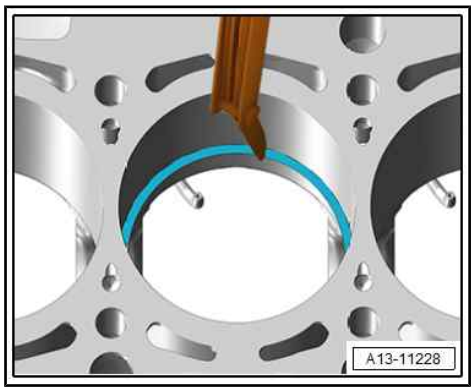
Cylinder bore ∅ mm	
Nominal dimension	81.0

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

Measuring piston ring gap

– Insert ring at right angle to cylinder wall from above and push down into lower cylinder opening approx. 15 mm from bottom of cylinder.

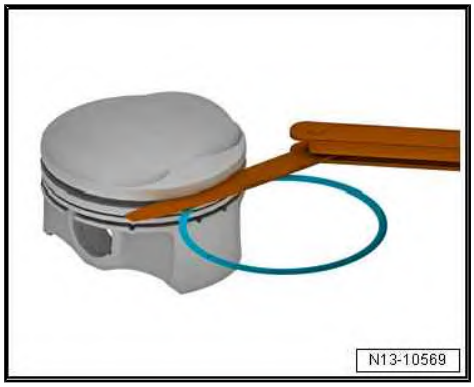
– To do so, use a piston without rings.



Piston ring	new mm	Wear limit mm
1st compression ring	0.3 … 0.40	0.55
2nd compression ring	0.20 … 0.45	0.95
Oil scraper ring	0.25 … 0.50	0.75

Measuring ring-to-groove clearance

– Clean groove in piston before checking clearance.



Piston ring	Wear limit mm
1st compression ring	0.08
2nd compression ring	0.08
Oil scraper ring	0.08

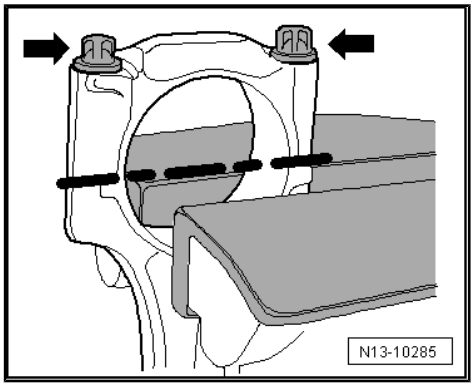
4.5 Separating parts of new conrod

On new conrods, the rod and the bearing cap may be very firmly attached to one another. If it is not possible to take off the conrod bearing cap by hand, proceed as follows:

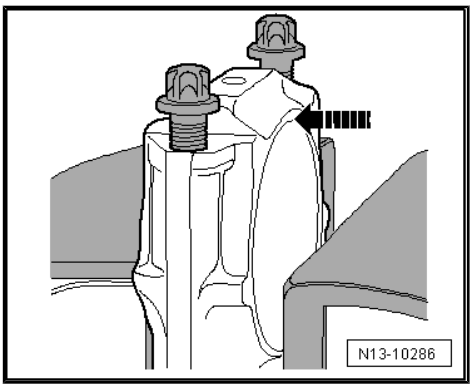
– To avoid any risk of damage, the conrod should only be clamped lightly in a vice using jaw covers as shown in illustration.

• The conrod is clamped in position below the dotted line.

– Unscrew bolts -arrows- approx. 5 turns.



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



4.6 Checking radial clearance of conrod bearings

Special tools and workshop equipment required

♦ Plastigauge

Procedure

– Remove conrod bearing cap. Clean bearing cap and bearing journal.

– Place a length of Plastigauge corresponding to the width of the bearing on the bearing journal or in the bearing shell.

– Fit conrod bearing cap and secure with old bolts ⇒ Item 1 (page 36) without rotating crankshaft.

– Remove conrod bearing cap again.

– Compare width of Plastigauge with measurement scale.

Radial clearance:

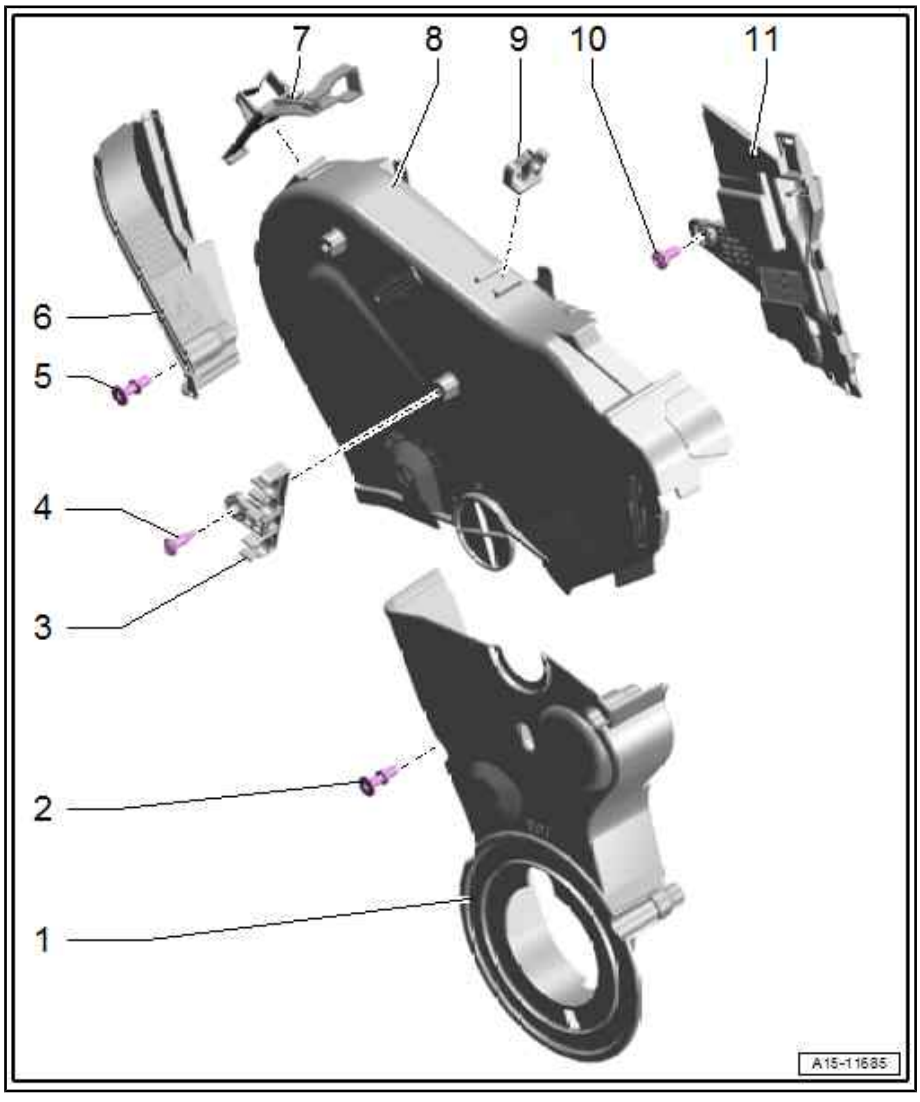
• Wear limit: 0.08 mm.

– Renew conrod bolts.

15 – Cylinder head, valve gear

1 Toothed belt drive

1.1 Exploded view - toothed belt cover



1 - Toothed belt cover (bottom)
- ❑ Removing and installing ⇒ page 47

2 - Bolt
- ❑ With collar
- ❑ Captive in toothed belt cover (bottom)
- ❑ 12 Nm

3 - Bracket

4 - Bolt
- ❑ 5 Nm

5 - Bolt
- ❑ With collar
- ❑ Captive in toothed belt cover (bottom)
- ❑ 12 Nm

6 - Toothed belt cover (side)

7 - Bracket

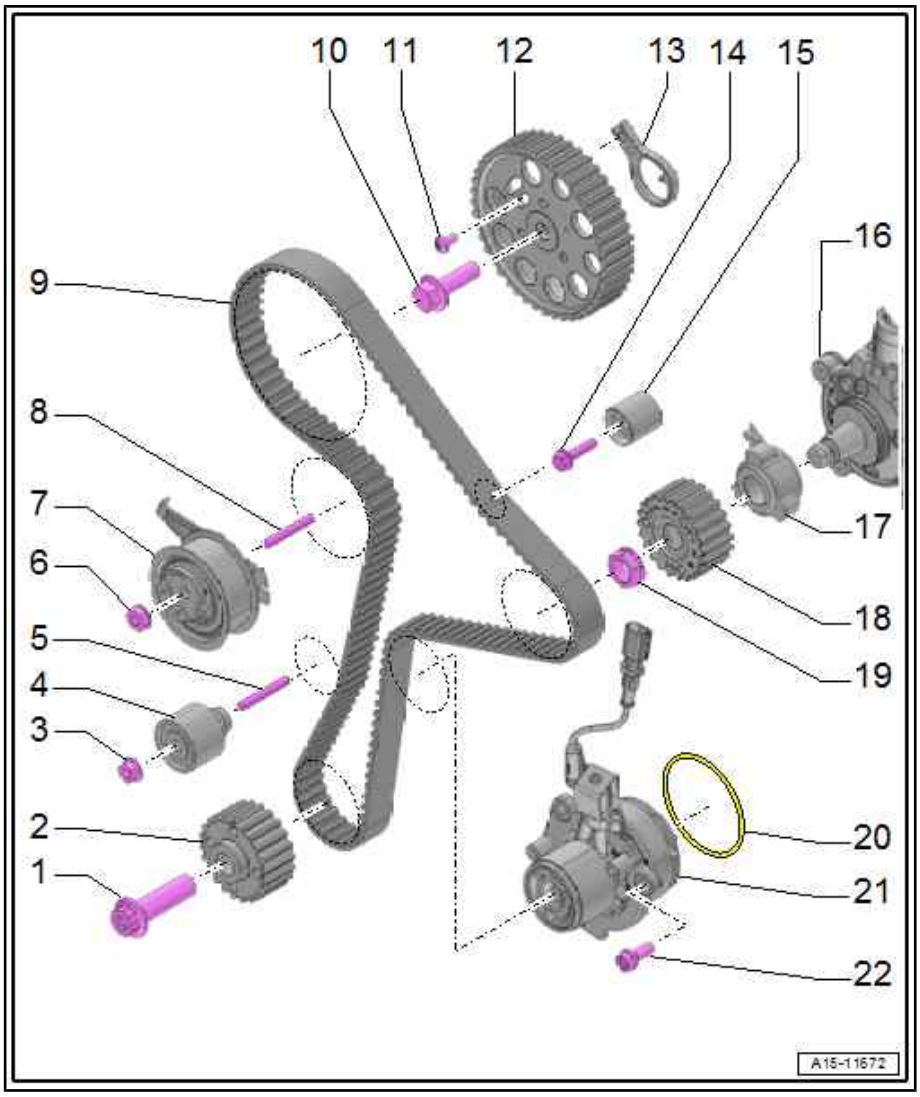
8 - Toothed belt cover (top)
- ❑ Removing and installing ⇒ page 46

9 - Bracket

10 - Bolt
- ❑ Clean threaded hole for bolt using a thread tap or similar
- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ❑ 12 Nm

11 - Toothed belt cover (rear)
- ❑ To remove, take out coolant pump ⇒ page 119

1.2 Exploded view - toothed belt



1 - Bolt

- ❑ Renew after removing
- ❑ Slacken and tighten with counterhold tool - 3415-
- ❑ Do not additionally oil threads and shoulder
- ❑ Tighten in three stages as follows:

- ♦ 1st stage: 180 Nm
- ♦ 2nd stage: turn 90° further
- ♦ 3rd stage: turn 45° further

2 - Crankshaft sprocket

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

3 - Nut

- ❑ Make sure that stud is fitted securely
- ❑ 20 Nm

4 - Damper wheel

5 - Stud

- ❑ 15 Nm

6 - Nut

- ❑ Renew
- ❑ Make sure that stud is fitted securely
- ❑ 20 Nm +45°

7 - Tensioning roller

8 - Stud

- ❑ 15 Nm

9 - Toothed belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen
- ❑ Check for wear
- ❑ Removing ⇒ page 54
- ❑ Installing (adjusting valve timing) ⇒ page 57

10 - Bolt

- ❑ Use counterhold tool - T10172- with adapters -T10172/11- to loosen and tighten
- ❑ Do not additionally oil threads and shoulder
- ❑ 100 Nm

11 - Locking bolt

- ❑ 9 Nm

12 - Camshaft sprocket

- ❑ Contact surface between sprocket, camshaft and locating arm for camshaft must be free of oil

13 - Locating arm for camshaft

14 - Bolt

- ❑ 20 Nm

15 - Damper wheel

16 - High-pressure pump

- ❑ Exploded view ⇒ page 180

17 - High-pressure pump hub

- ❑ Exploded view ⇒ page 180
- ❑ Contact surface between high-pressure pump, high-pressure pump hub and high-pressure pump sprocket must be free of oil

18 - High-pressure pump sprocket

- ❑ Exploded view ⇒ page 180
- ❑ Contact surface between high-pressure pump, high-pressure pump hub and high-pressure pump sprocket must be free of oil

19 - Nut

- ❑ Do not additionally oil threads and shoulder
- ❑ Use counterhold tool - T10051- when loosening and tightening
- ❑ 95 Nm

20 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

21 - Coolant pump

- ❑ Removing and installing ⇒ page 119

22 - Bolt

- ❑ Tightening torque ⇒ Item 1 (page 116)

1.3 Removing and installing toothed belt cover

⇒ “1.3.1 Removing and installing toothed belt cover (top)”, page 46

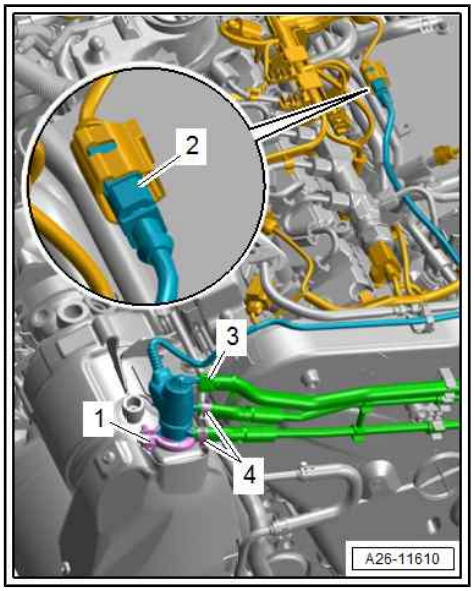
⇒ “1.3.2 Removing and installing toothed belt cover (bottom)”, page 47

1.3.1 Removing and installing toothed belt cover (top)

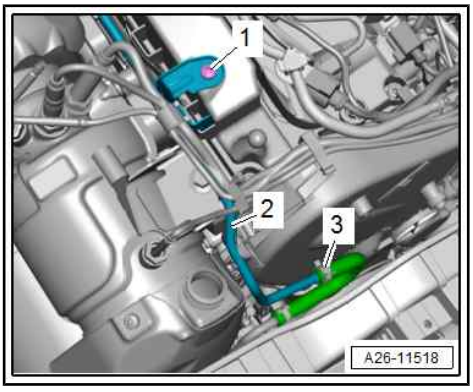
Removing

– Remove engine cover panel ⇒ page 13 .

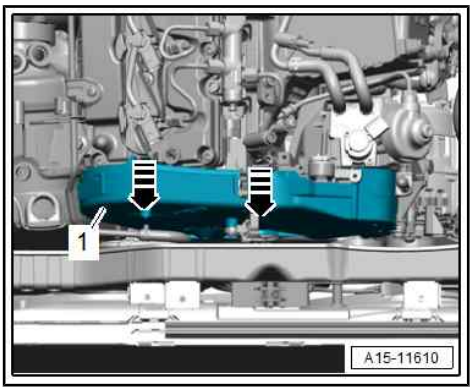
– Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.
– Loosen screw-type clip -1-.
– Move coolant hoses -4- and SCR supply line -3- clear.
– Detach injector for reducing agent - N474- and place to left side.



– Remove bolt -1- and push measuring tube -2- to right side.



– Move electrical wiring clear.
– Release catches -arrows-, disengage toothed belt cover (top) -1- and detach.



Installing

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

– Install injector for reducing agent - N474- ⇒ page 217 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Install engine cover panel ⇒ page 13 .

Tightening torques

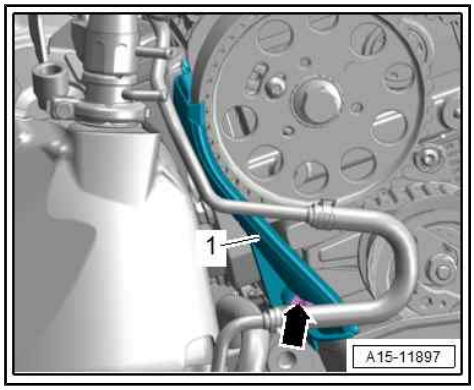
♦ Measuring tube ⇒ Item 7 (page 65)

1.3.2 Removing and installing toothed belt cover (bottom)

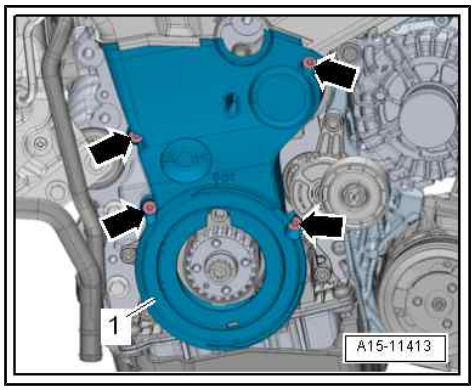
Removing

– Remove toothed belt cover (top) ⇒ page 46 .
– Remove vibration damper ⇒ page 19 .

– Remove bolt -arrow- and detach toothed belt cover (side) -1-.



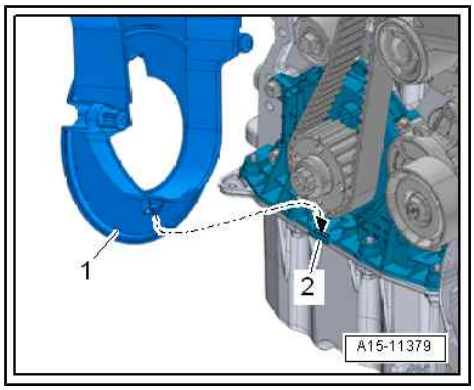
– Remove bolts -arrows-.
– Disengage toothed belt cover (bottom) -1- and detach.



Installing

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

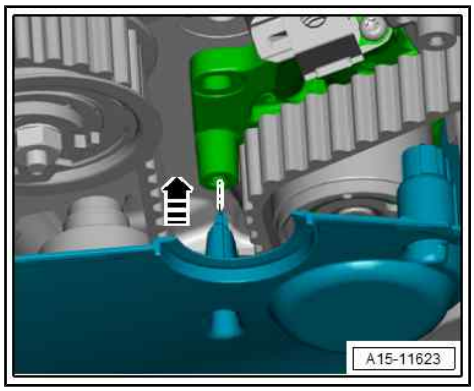
– Insert toothed belt cover (bottom) -1- into sealing flange (front) -2- -arrow-.



– Fit toothed belt cover (note position of dowel pin -arrow-).
– Install vibration damper ⇒ page 19 .
– Install toothed belt cover (top) ⇒ page 46 .

Tightening torques

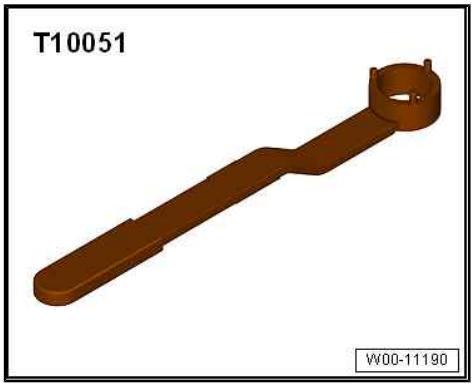
♦ ⇒ “1.1 Exploded view - toothed belt cover”, page 44



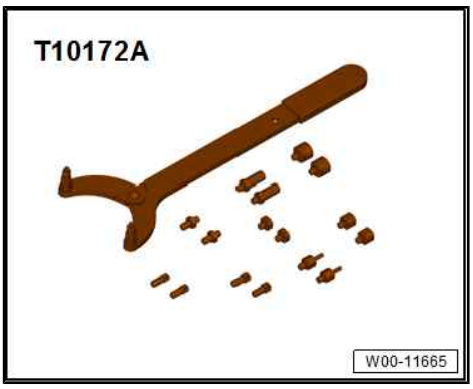
1.4 Detaching toothed belt from camshaft

Special tools and workshop equipment required

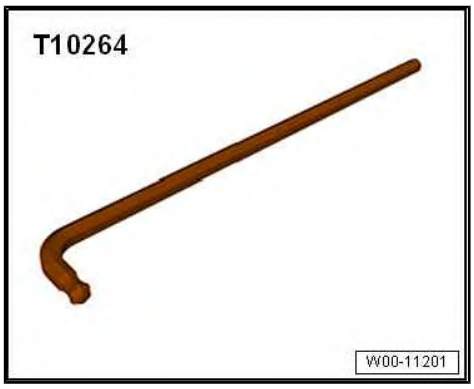
- Counterhold tool - T10051-



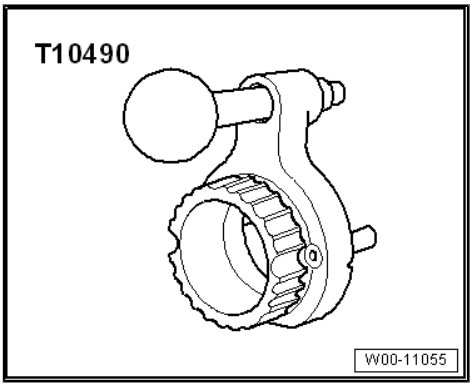
- Counterhold tool - T10172A- with adapters -T10172/11-



- Offset screwdriver - T10264-



- Crankshaft stop - T10490-



♦ Locking pin - T10492-

♦ Diesel injection pump locking pin - 3359-

Note:

Diesel injection pump locking pin - 3359- or locking pin - T10492- can be used to lock camshaft sprocket and high-pressure pump sprocket.

Removing

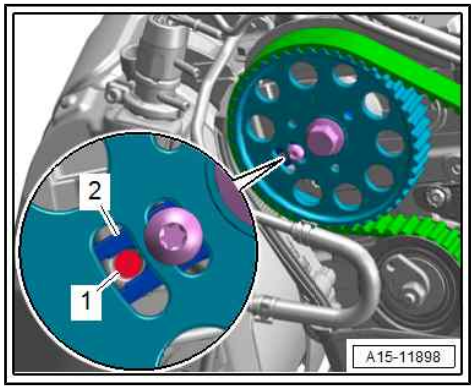
– Remove toothed belt cover (top) ⇒ page 46 .

– Remove vibration damper ⇒ page 19 .

• Only turn crankshaft in direction of engine rotation.

– Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at “TDC”.

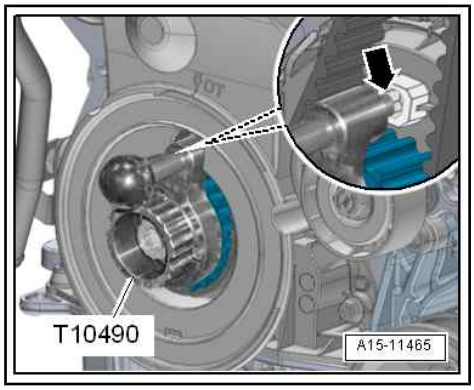
• Locating arm -2- on camshaft must align with hole -1- behind it in cylinder head.



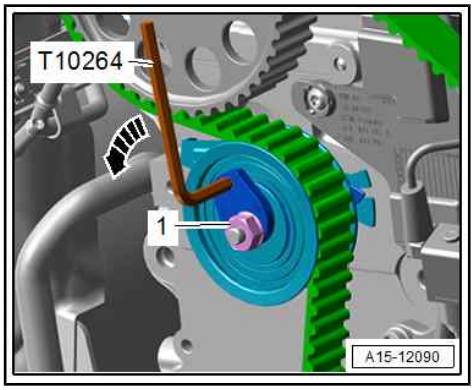
– Lock crankshaft sprocket in position with crankshaft stop - T10490- .

• Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.

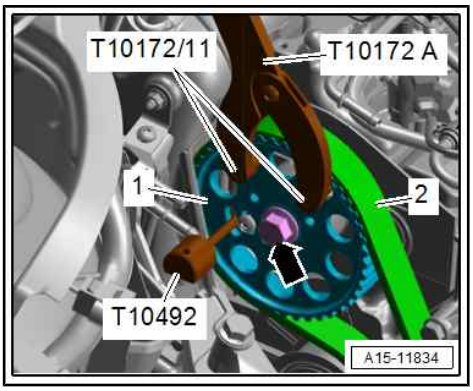
• Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.



– Slacken nut -1- for tensioning roller.
– Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until toothed belt is slackened.



– Slacken bolt -arrow- by 90°; counterhold camshaft sprocket -1- with counterhold tool - T10172A- and adapters - T10172/11- when doing so.
– Take toothed belt -2- off camshaft sprocket. If necessary, push toothed belt cover (right-side) slightly to right side.
– Lock locating arm for camshaft in place using locking pin - T10492- , as outlined in description of continued steps.

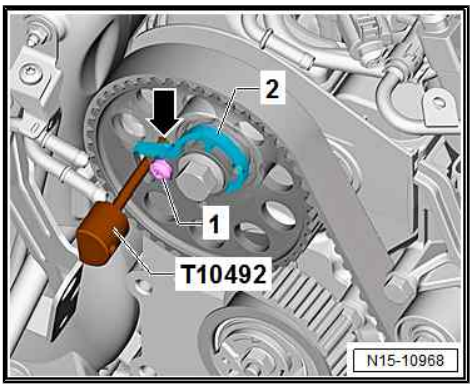


NOTICE

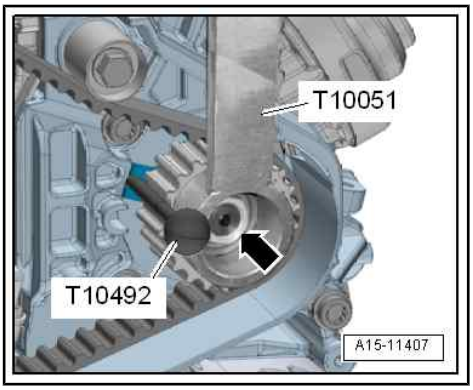
Risk of damage to camshaft if handled incorrectly

– Never use camshaft clamp as a counterhold tool.

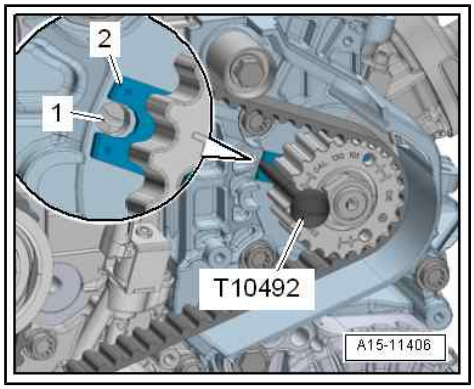
– Insert locking pin - T10492- through locating arm -2- for camshaft and into hole -arrow- behind it in cylinder head.
– If necessary, align camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .
– Loosen locking bolt -1- one half turn, but do not remove it.



– Slacken nut -arrow- for toothed belt sprocket of high-pressure pump approx. 90° using counterhold tool - T10051- .
– Lock hub of high-pressure pump in place using locking pin - T10492- , as outlined in description of continued steps.



– Insert locking pin - T10492- into hub -2- and into hole -1- behind it in bracket for ancillaries.
– To do so, adjust toothed belt sprocket for high-pressure pump using counterhold tool - T10051- .

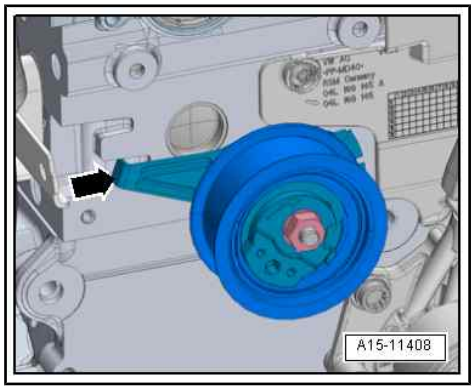


Installing (adjusting valve timing)

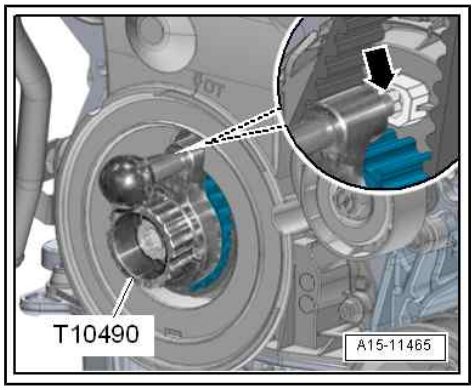
- Perform adjustments on toothed belt only when engine is cold.
- Renew nut and stud for tensioning roller.

Requirements:

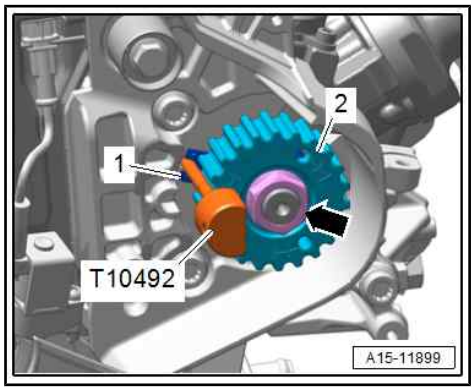
- Base plate -arrow- for tensioning roller must be engaged in cast recess on cylinder head, as shown.



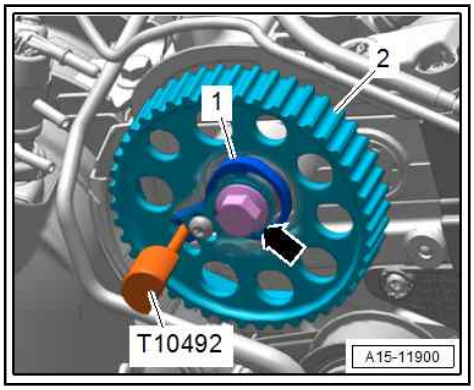
- Crankshaft is locked in position with crankshaft stop - T10490- -arrow-.



- Contact surface between high-pressure pump, high-pressure pump hub and high-pressure pump sprocket must be free of oil.
- Hub -1- of high-pressure pump locked in place with locking pin - T10492- .
- Nut -arrow- for toothed belt sprocket for high-pressure pump -2- screwed on loosely. It should just be possible to easily turn the high-pressure pump sprocket, but there must be no axial movement.



- Contact surface between camshaft, camshaft sprocket and locating arm for camshaft must be free of oil.
- Locating arm for camshaft -1- is locked with locking pin - T10492- .
- Bolt -arrow- for camshaft sprocket -2- screwed on loosely. It should just be possible to turn the sprocket on the camshaft easily without axial movement.



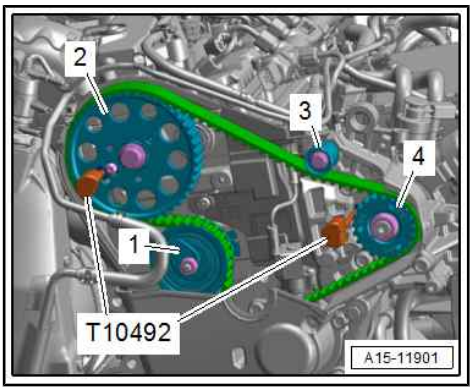
– Turn the camshaft sprocket and high-pressure pump sprocket in their elongated holes clockwise as far as the stop.
– Install toothed belt in the specified sequence:

4 - High-pressure pump sprocket

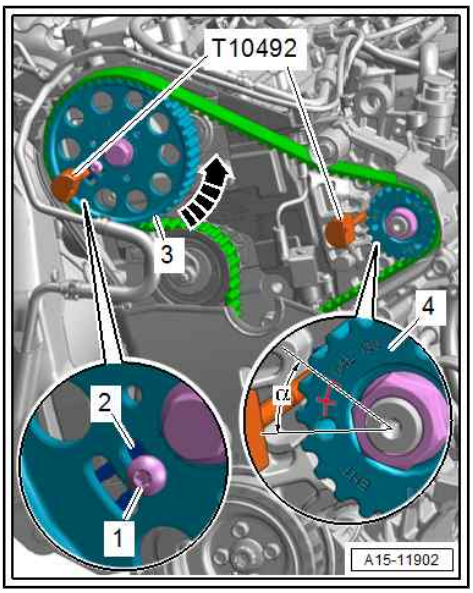
3 - Idler roller

1 - Tensioning roller

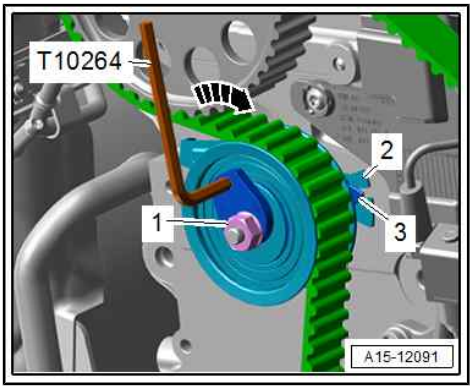
2 - Camshaft sprocket



– Check positions of camshaft sprockets. To do so, turn camshaft sprocket -3- by hand as far as stop in direction of -arrow- and hold it in place.
- Locking bolt -1- should now be positioned in approx. the bottom half of elongated hole -2-, as shown in illustration.
- At approx. centre of area of rotation -α-, toothed belt sprocket for high-pressure pump -4- should now be aligned with locking pin - T10492- , as shown in illustration.

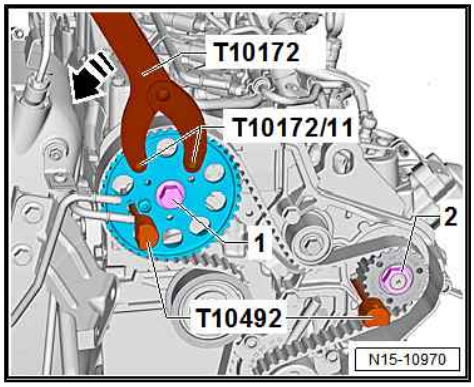


- If the installation position of the toothed belt sprockets is not correct, adjust position of toothed belt on sprocket in question.
- Base plate for tensioning roller must remain engaged in cast recess on cylinder head.
– Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -3- aligns with centre of slot on base plate.
- Nut -1- must not turn.
– Hold tensioning roller in this position and tighten nut.



– Using counterhold tool - T10172A- and adapters -T10172/11- , apply tension to camshaft sprocket in anti-clockwise direction -arrow-.
– Tighten bolt -1- for camshaft sprocket and nut -2- for high-pressure pump sprocket to 20 Nm.
– Remove locking pins -T10492- and crankshaft stop - T10490- and check valve timing ⇒ page 59 .

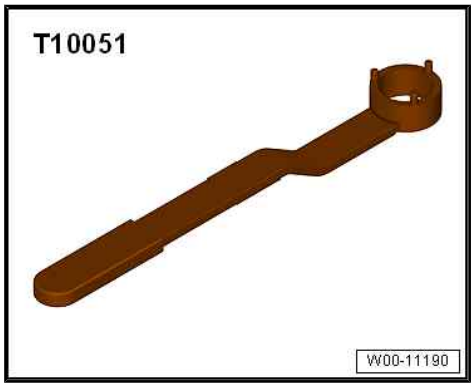
Checking valve timing ⇒ page 59



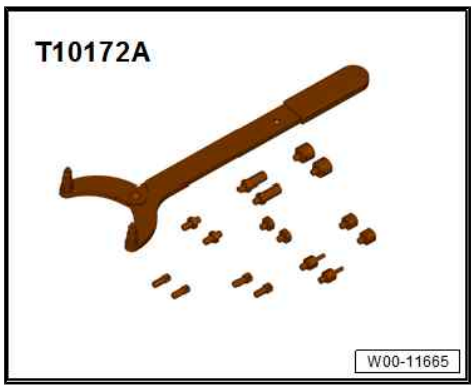
1.5 Removing and installing toothed belt

Special tools and workshop equipment required

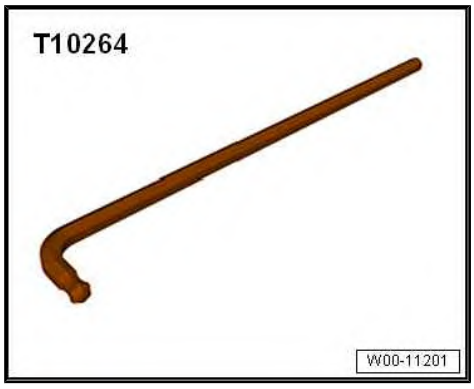
♦ Counterhold tool - T10051-



♦ Counterhold tool - T10172A- with adapters -T10172/11-

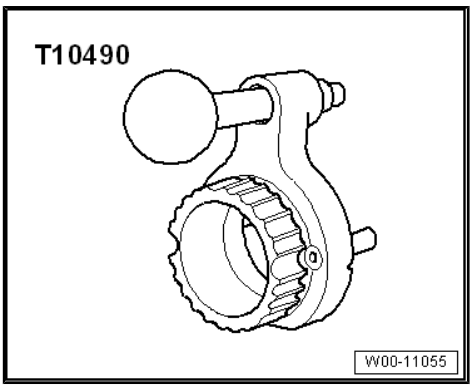


♦ Offset screwdriver - T10264-



♦ Locking pin - T10492-

♦ Crankshaft stop - T10490-



♦ Diesel injection pump locking pin - 3359-

Note:

Diesel injection pump locking pin - 3359- or locking pin - T10492- can be used to lock camshaft sprocket and high-pressure pump sprocket.

Removing

– Remove toothed belt cover (bottom) ⇒ page 47 .

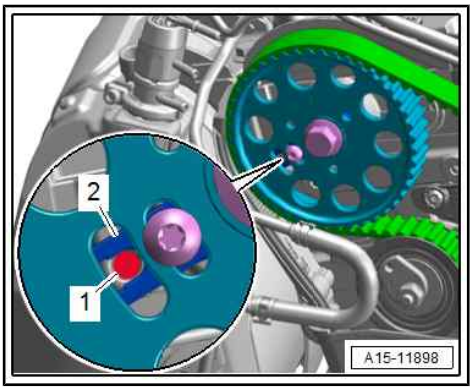
NOTICE

Risk of damage to camshaft if handled incorrectly

– Never use camshaft clamp as a counterhold tool.

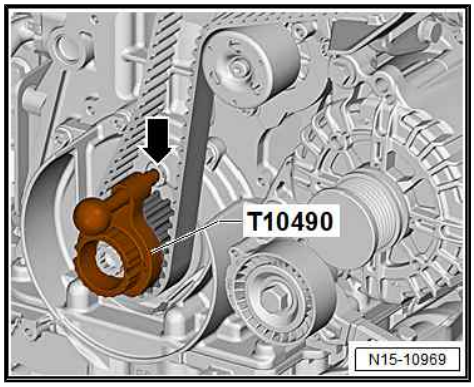
– Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at “TDC”.

• Locating arm -2- on camshaft must align with hole -1- behind it in cylinder head.



– Lock crankshaft sprocket in position with crankshaft stop - T10490- .

- Pins of crankshaft stop - T10490- must engage in threaded holes of crankshaft sprocket.
- Locking pin of crankshaft stop - T10490- must engage in hole -arrow- on sealing flange.



– Slacken nut -1- for tensioning roller.

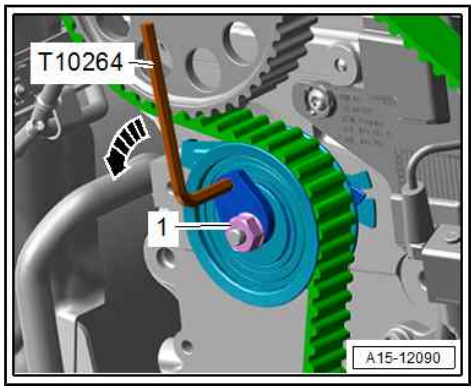
– Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until toothed belt is slackened.

NOTICE

Risk of irreparable damage due to running a used belt in the opposite direction when it is refitted.

– Mark running direction before removing.

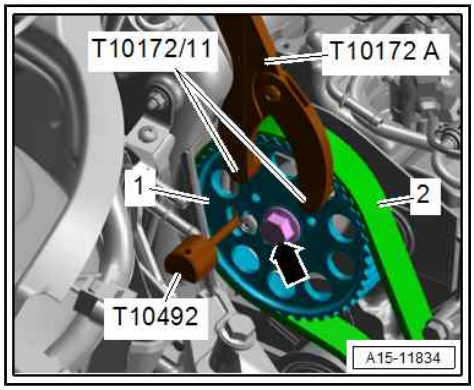
– Pay attention to running direction when reinstalling.



– Slacken bolt -arrow- by 90°; counterhold camshaft sprocket -1- with counterhold tool - T10172A- and adapters - T10172/11- when doing so.

– Remove toothed belt -2-.

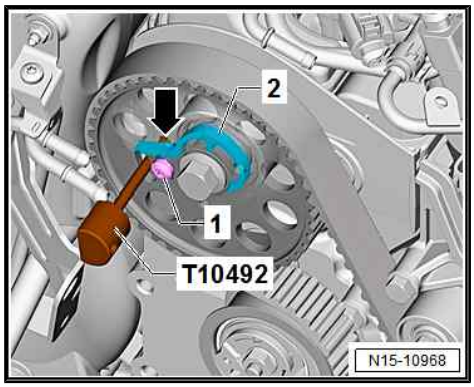
– Lock locating arm for camshaft in place using locking pin - T10492- , as outlined in description of continued steps.



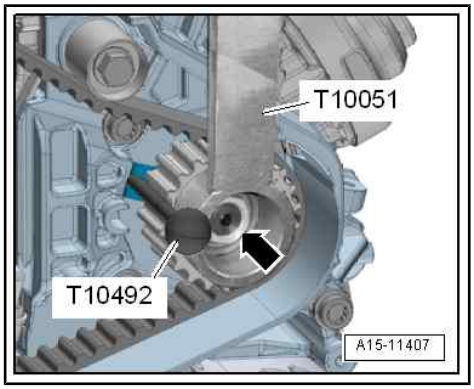
– Insert locking pin - T10492- through locating arm -2- for camshaft and into hole -arrow- behind it in cylinder head.

– If necessary, align camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .

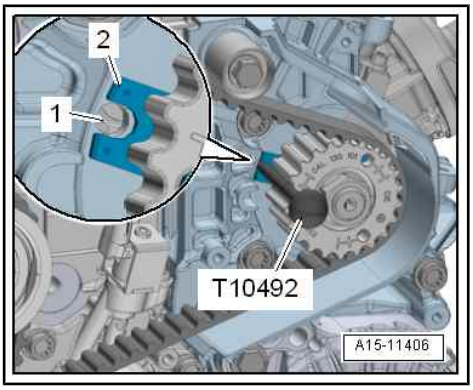
– Loosen locking bolt -1- one half turn, but do not remove it.



– Slacken nut -arrow- for toothed belt sprocket of high-pressure pump approx. 90° using counterhold tool - T10051- .
– Lock hub of high-pressure pump in place using locking pin - T10492- , as outlined in description of continued steps.



– Insert locking pin - T10492- into hub -2- and into hole -1- behind it in bracket for ancillaries.
– To do so, adjust toothed belt sprocket for high-pressure pump using counterhold tool - T10051- .

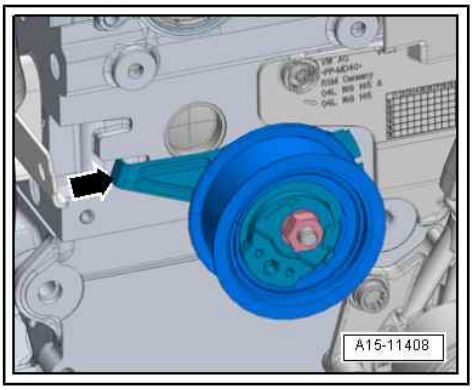


Installing (adjusting valve timing)

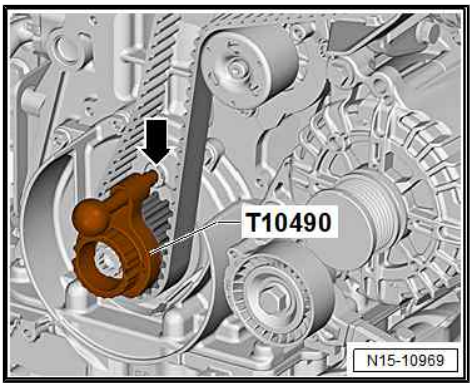
- Perform adjustments on toothed belt only when engine is cold.
- Renew nut and stud for tensioning roller.

Requirements:

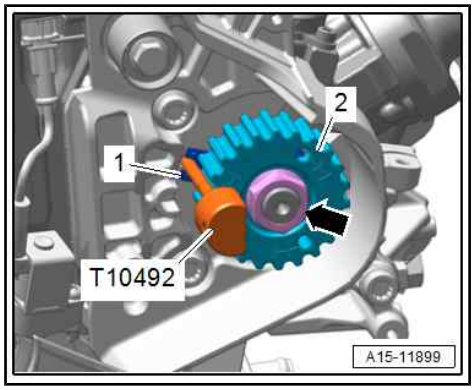
- Base plate -arrow- for tensioning roller must be engaged in cast recess on cylinder head, as shown.



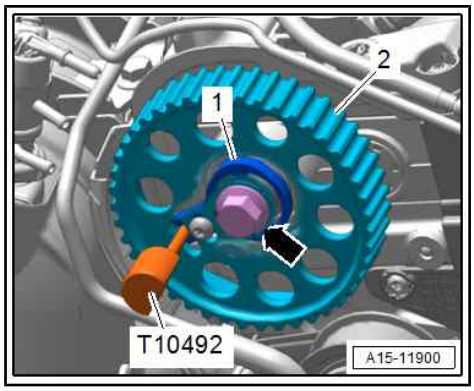
- Crankshaft is locked in position with crankshaft stop - T10490- -arrow-.



- Contact surface between high-pressure pump, high-pressure pump hub and high-pressure pump sprocket must be free of oil.
- Hub -1- of high-pressure pump locked in place with locking pin - T10492- .
- Nut -arrow- for toothed belt sprocket for high-pressure pump -2- screwed on loosely. It should just be possible to easily turn the high-pressure pump sprocket, but there must be no axial movement.



- Contact surface between camshaft, camshaft sprocket and locating arm for camshaft must be free of oil.
- Locating arm for camshaft -1- is locked with locking pin - T10492- .
- Bolt -arrow- for camshaft sprocket -2- screwed on loosely. It should just be possible to turn the sprocket on the camshaft easily without axial movement.



– Turn the camshaft sprocket and high-pressure pump sprocket in their elongated holes clockwise as far as the stop.

– Install toothed belt in the specified sequence:

1 - Crankshaft sprocket

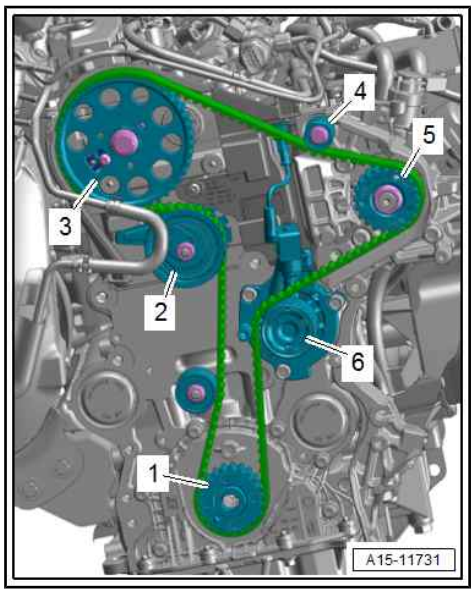
2 - Tensioning roller

3 - Camshaft sprocket

4 - Damper wheel

5 - High-pressure pump sprocket

6 - Coolant pump sprocket



– Check positions of camshaft sprockets. To do so, turn camshaft sprocket -3- by hand as far as stop in direction of -arrow- and hold it in place.

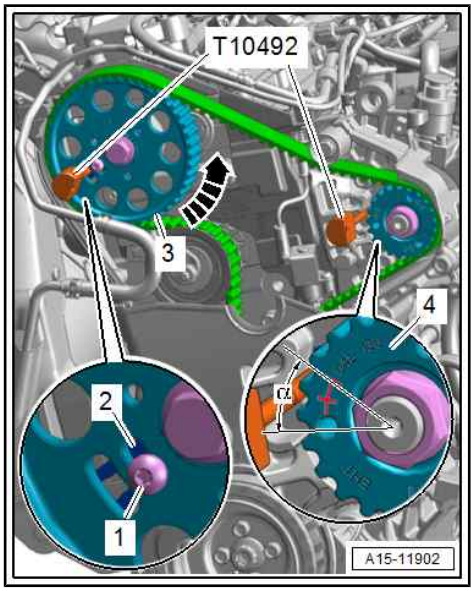
• Locking bolt -1- should now be positioned in approx. the bottom half of elongated hole -2-, as shown in illustration.

– Check that locking bolt -1- is located between centre and lower end -2- of elongated hole. If necessary, adjust position of camshaft sprocket by moving it one tooth clockwise then fit toothed belt again.

• At approx. centre of area of rotation -α-, toothed belt sprocket for high-pressure pump -4- should now be aligned with locking pin - T10492- , as shown in illustration.

• If the installation position of the toothed belt sprockets is not correct, adjust position of toothed belt on sprocket in question.

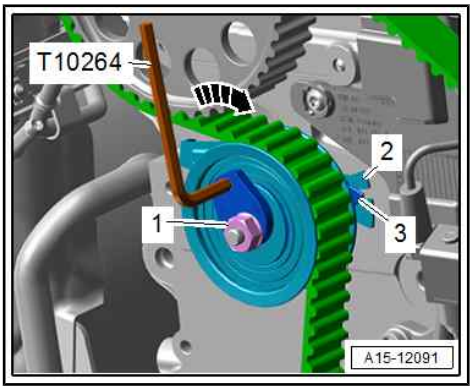
• Base plate for tensioning roller must remain engaged in cast recess on cylinder head.



– Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -3- aligns with centre of slot on base plate -2-.

• Nut -1- must not turn.

– Hold tensioning roller in this position and tighten nut.



– Using counterhold tool - T10172A- and adapters -T10172/11- , apply tension to camshaft sprocket in anti-clockwise direction -arrow-.

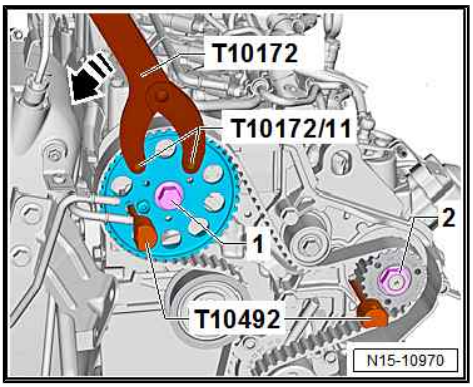
– Tighten bolt -1- for camshaft sprocket and nut -2- for high-pressure pump sprocket to 20 Nm.

– Remove locking pins -T10492- and crankshaft stop - T10490- and check valve timing ⇒ page 59 .

Checking valve timing:

• Only turn crankshaft in direction of engine rotation.

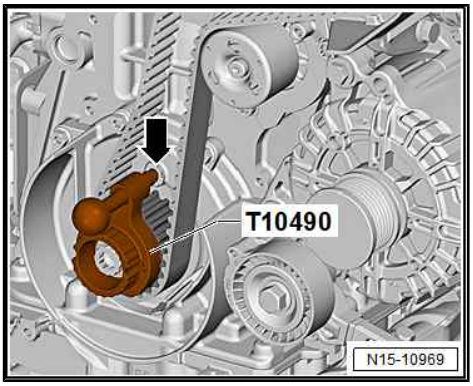
– Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before “TDC”.



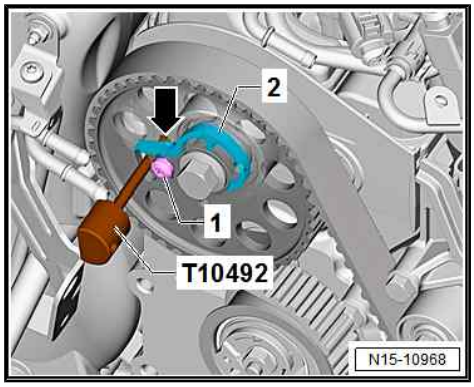
– Fit crankshaft stop - T10490- to crankshaft sprocket again.

– Then turn crankshaft in direction of engine rotation until pin on crankshaft stop - T10490- engages in hole -arrow- in sealing flange as crankshaft rotates.

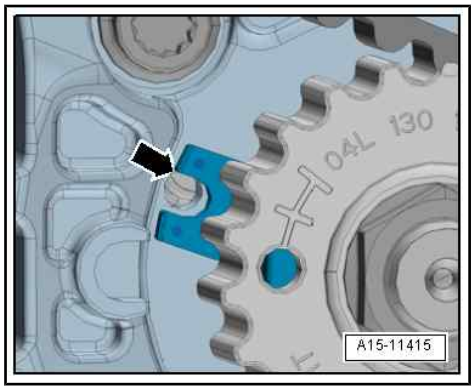
• If crankshaft has been turned past “TDC” position, turn crankshaft two further rotations until it is again positioned just before “TDC”. Then turn further in the same direction and lock crankshaft with crankshaft stop - T10490- .



- It must be possible to lock locating arm -2- for camshaft using locking pin - T10492- .



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



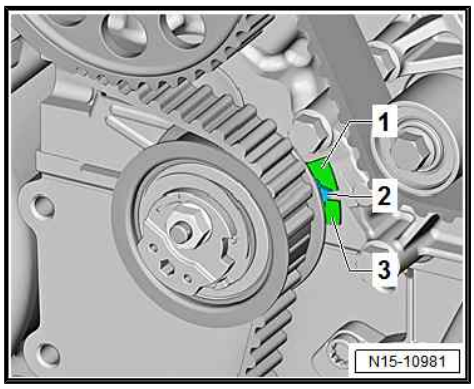
- Pointer -2- on tensioner roller must be centred between tabs -1- and -3- on base plate.

Note:

The maximum permissible sideways deviation from the specified position is 5 mm.

If requirements are met, continue with procedure after adjusting valve timing correctly as described below ⇒ page 61 .

Re-adjust valve timing if requirements are not met ⇒ page 60 .



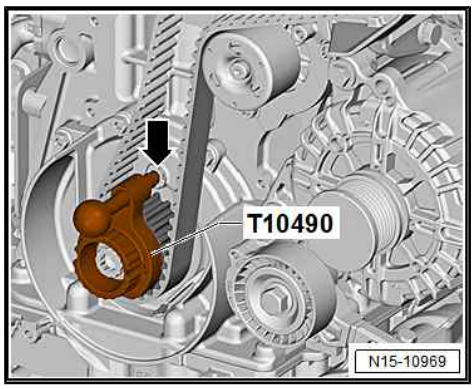
Re-adjusting valve timing:

– If camshaft hub cannot be locked, withdraw crankshaft stop - T10490- until pin is clear of bore -arrow-.

– Turn crankshaft in opposite direction of engine rotation slightly past “TDC”.

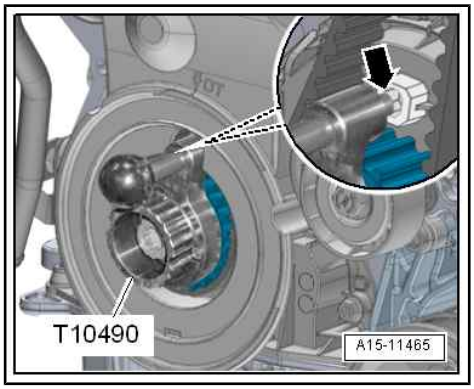
– Now turn crankshaft slowly in direction of engine rotation until it is possible to lock camshaft hub with locking pin - T10492- .

– After locking camshaft in place, loosen bolt for camshaft sprocket; counterhold with counterhold tool - T10172/11- and adapters -T10172A- to do so.



If pin of crankshaft stop - T10490- is on left side of hole:

– Then turn crankshaft in direction of engine rotation until pin on crankshaft stop - T10490- engages in hole -arrow- in sealing flange as crankshaft rotates.

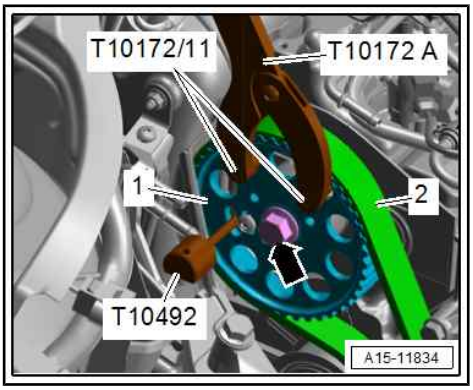


– Tighten bolt -arrow- for camshaft sprocket -1- to 20 Nm; to do so, remove locking pin - T10492- and counterhold camshaft sprocket using counterhold tool - T10172A- and adapters - T10172/11- .

If pin of crankshaft stop - T10490- is on right side of hole:

– Turn crankshaft slightly in opposite direction to engine rotation.

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



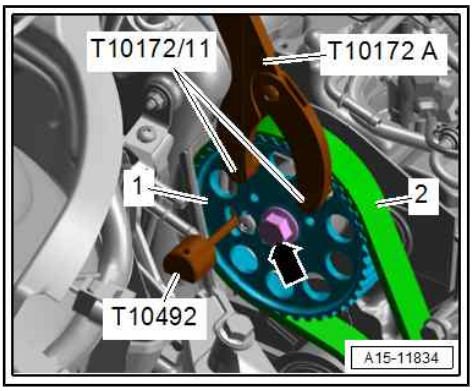
– Tighten bolt -arrow- for camshaft sprocket -1- to 20 Nm; to do so, remove locking pin - T10492- and counterhold camshaft sprocket using counterhold tool - T10172A- and adapters - T10172/11- .

Procedure after adjusting valve timing correctly:

– Remove locking pin - T10492- and crankshaft stop - T10490- .

– Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before “TDC”.

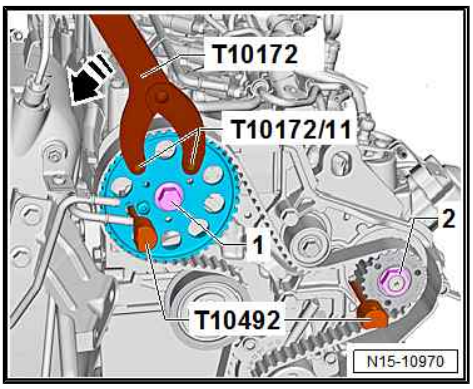
– Check valve timing once again ⇒ page 59 .



– If locating arm for camshaft can now be locked, tighten bolt -1- for camshaft sprocket to final torque ⇒ Item 10 (page 45) ; to do so, remove locking pin - T10492- and counterhold camshaft sprocket using counterhold tool - T10172A- and adapters -T10172/11- .

– Tighten nut -2- for high-pressure pump sprocket to final torque ⇒ Item 19 (page 46) ; to do so, use counterhold tool - T10051- .

– Check valve timing once again ⇒ page 59 .



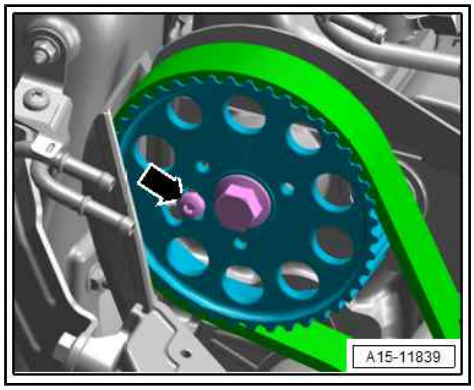
Attaching

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

- Renew seals after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .

– Tighten locking bolt -arrow-.

– Install toothed belt cover ⇒ page 47 .

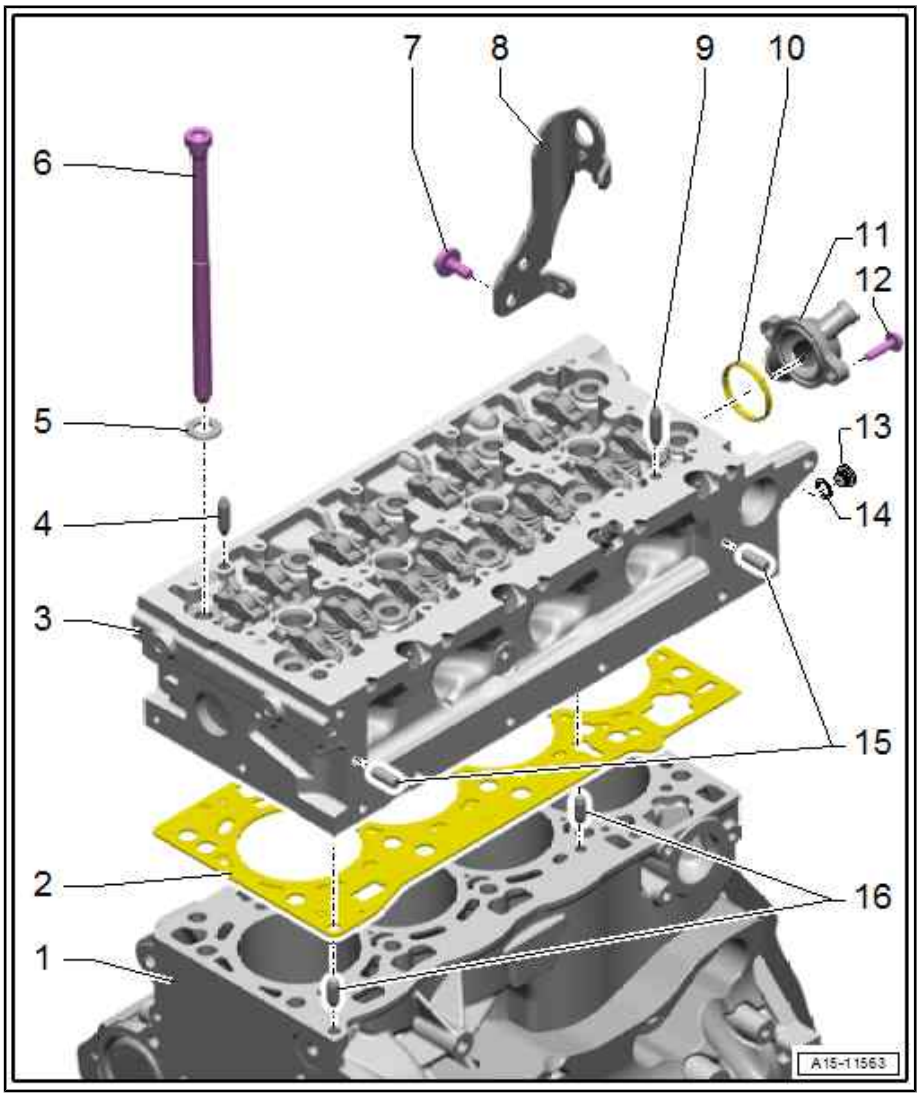


Tightening torques

- ⇒ “1.2 Exploded view - toothed belt”, page 45
- ⇒ “1.1 Exploded view - toothed belt cover”, page 44

2 Cylinder head

2.1 Exploded view - cylinder head



1 - Cylinder block

2 - Cylinder head gasket

- ❑ Renewing ⇒ page 66
- ❑ Identification of cylinder head gasket ⇒ page 64
- ❑ If renewed, change coolant and engine oil

3 - Cylinder head

- ❑ Removing and installing ⇒ page 66
- ❑ To prevent damage to glow plugs, always place cylinder head on a soft foam surface after removal.
- ❑ Checking for distortion ⇒ page 64
- ❑ Must not be machined
- ❑ Before installing, check that the two dowel sleeves for centring cylinder head are fitted on cylinder block
- ❑ If renewed, change coolant and engine oil

4 - Dowel pin

- ❑ For camshaft housing

5 - Washer

6 - Bolt

- ❑ Renew after removing
- ❑ Correct sequence when slackening ⇒ page 69
- ❑ Tightening torque and sequence ⇒ page 65

7 - Bolt

- ❑ 20 Nm

8 - Engine lifting eye

9 - Dowel pin

- ❑ For camshaft housing

10 - Seal

- ❑ Renew after removing
- ❑ Lubricate with coolant

11 - Connection

- ❑ For coolant hoses

12 - Bolt

- ❑ 10 Nm

13 - Plug

- ❑ 9 Nm

14 - Seal

- ❑ Renew after removing
- ❑ Lubricate with coolant

15 - Dowel pins

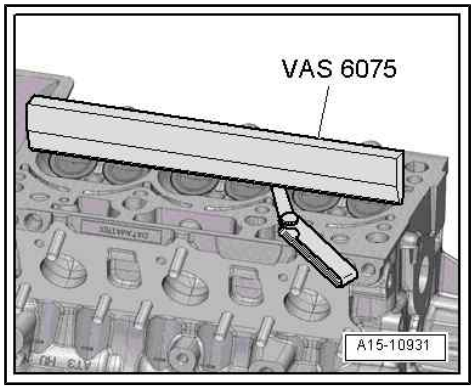
- ❑ For intake manifold with charge air cooler

16 - Dowel sleeves

Checking cylinder head for distortion

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

- Max. permissible distortion: 0.1 mm.
- Cylinder heads must not be reworked on TDI engines.



Identification of cylinder head gasket

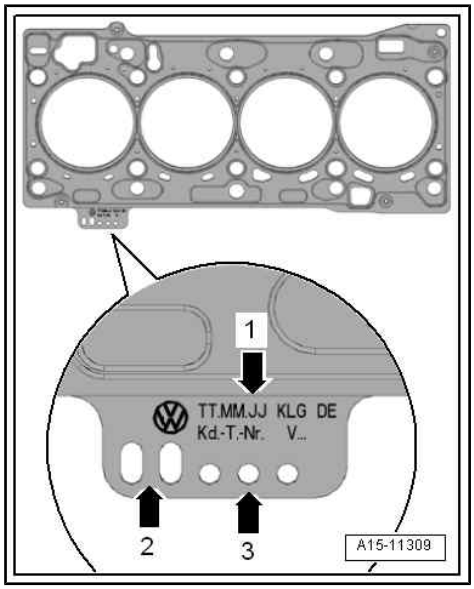
1 - Part number

2 - Ignore

3 - Holes

Note:

Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection ⇒ page 40 . If renewing the cylinder head gasket only, the new gasket should have the same identification as the old one.

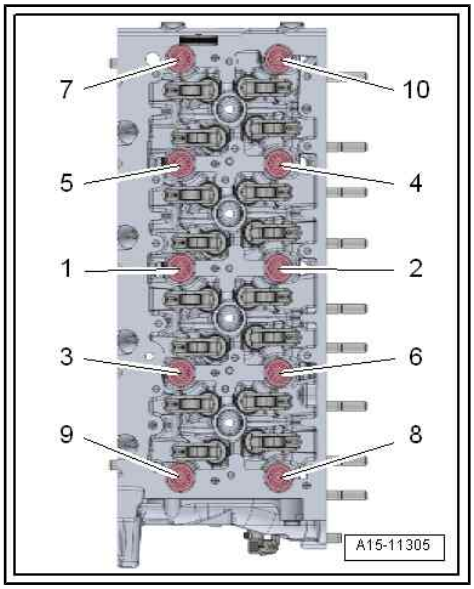


Cylinder head - tightening torque and sequence

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

– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 10-	30 Nm
2.	-1 … 10-	70 Nm
3.	-1 … 10-	Turn 90° further
4.	-1 … 10-	Turn 90° further
5.	-1 … 10-	Turn 90° further



2.2 Exploded view - cylinder head cover

1 - Gasket
- ❑ Renew if damaged or leaking

2 - Cylinder head cover
- ❑ Removing and installing ⇒ page 72

3 - Bolt
- ❑ Renew if gasket is damaged
- ❑ Tightening torque and sequence ⇒ page 66

4 - O-ring
- ❑ Renew after removing

5 - Sealing plug

6 - Measuring tube
- ❑ To pressure differential sender - G505-

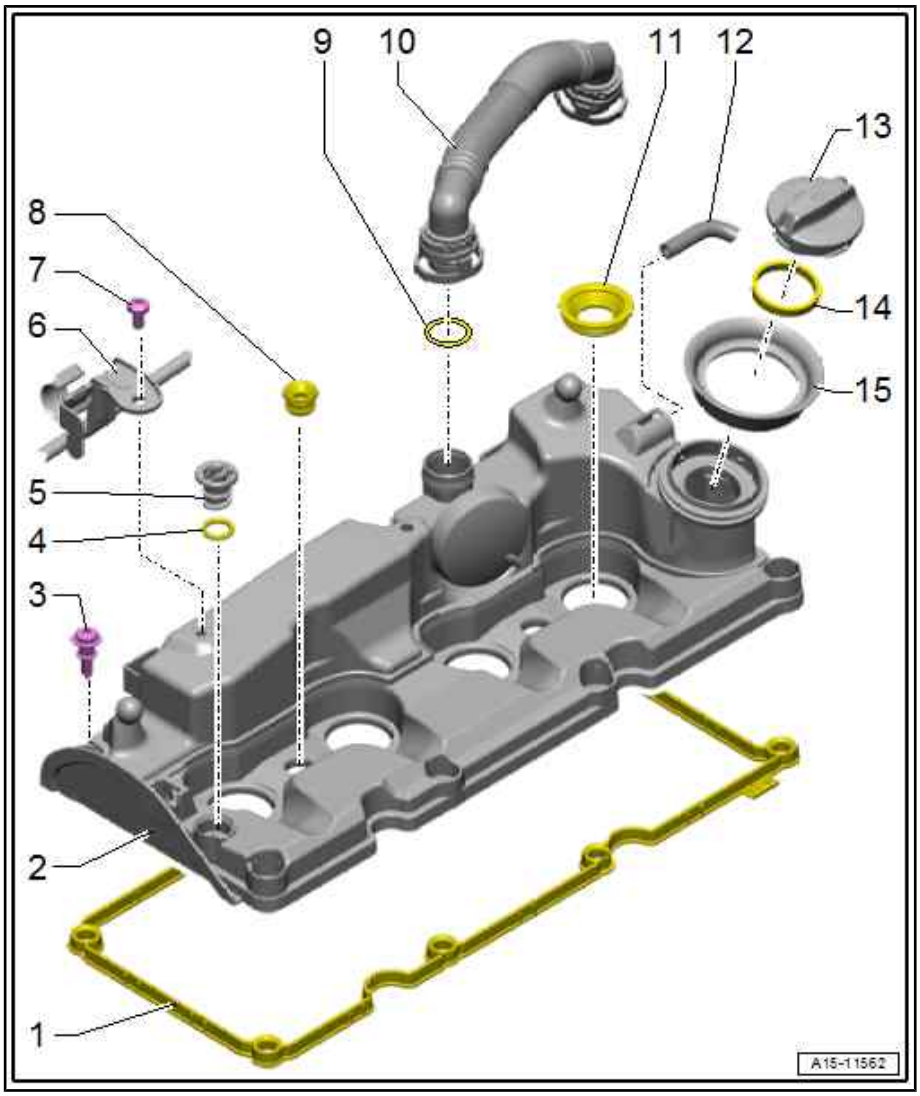
7 - Bolt
- ❑ 8 Nm

8 - Grommet
- ❑ In cylinder head cover

9 - O-ring
- ❑ Renew after removing

10 - Hose
- ❑ For crankcase breather
- ❑ Press release tabs on both sides to detach

11 - Seal
- ❑ For injector
- ❑ Renewing ⇒ page 74



12 - Vacuum hose

- ❑ Connection can break off if vacuum hose is pulled off
- ❑ To detach vacuum hose, insert screwdriver between hose and cover and tilt it; this will release hose from connection

13 - Filler cap

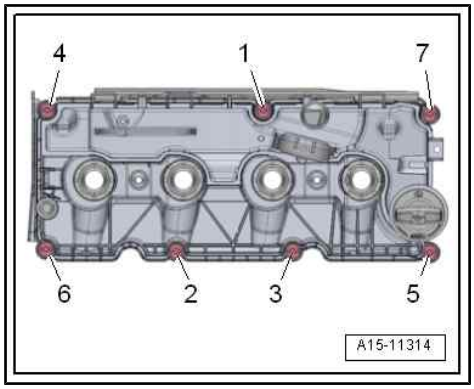
14 - Seal

- ❑ For filler cap

15 - Grommet

Cylinder head cover - tightening torque and sequence

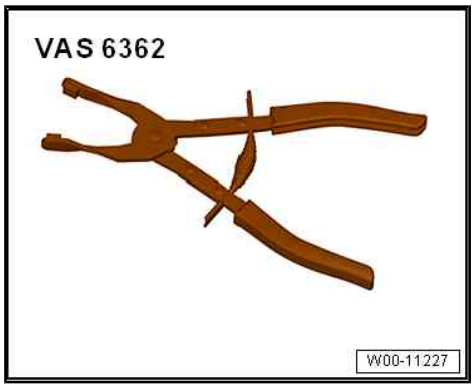
– Tighten bolts for cylinder head cover in the sequence -1 ... 7- to 9 Nm.



2.3 Removing and installing cylinder head

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-

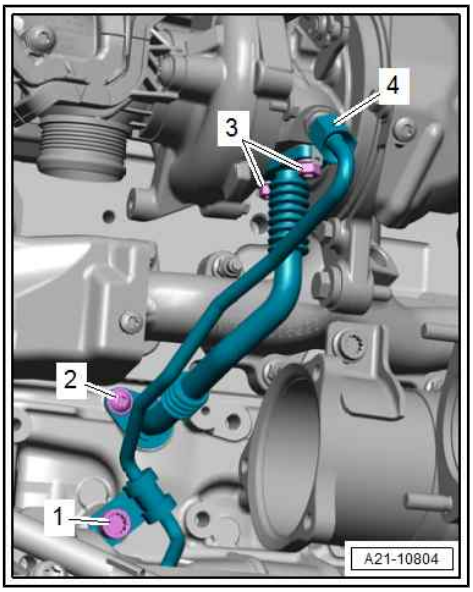


♦ Bit XZN 10 - T10501-

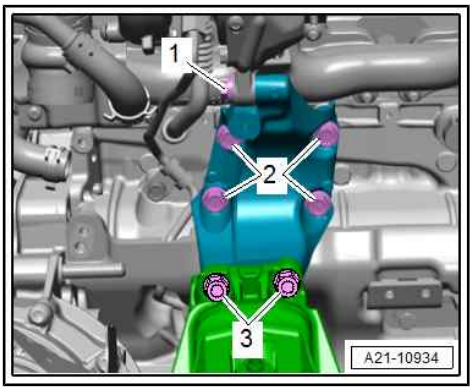
Removing

– Remove coolant pipes (rear left and top left) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

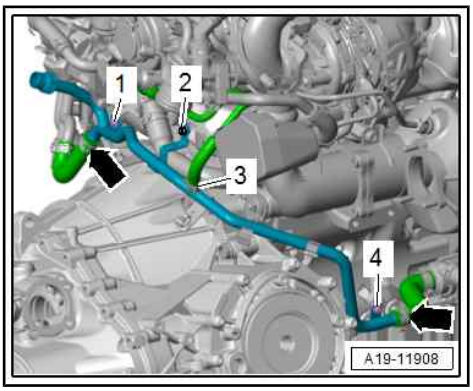
– Remove throttle valve module - J338- with connection ⇒ page 153 .
– Remove emission control module ⇒ page 205 .
– Unscrew bolt -1- and union nut -4-.
– Unscrew bolts -2 and 3- and detach oil return line.



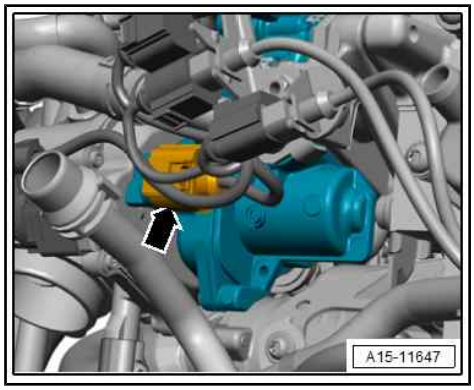
– Remove bolt -1-; slacken bolts -2 and 3- by one turn, but do not remove them.
– Lower engine onto engine mounting on right side and detach support bracket - 10-222A- .



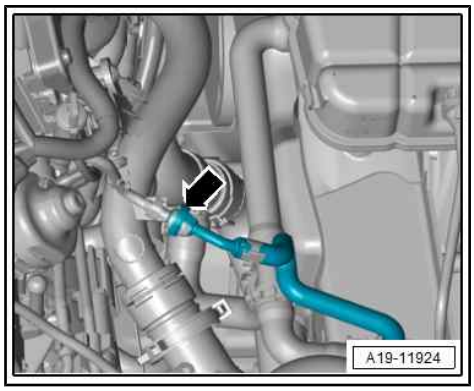
– Release hose clip -3- and disconnect coolant hose.
– Loosen bolt -4-.
– Unscrew bolt -1- and nut -2- and push coolant pipe (rear) slightly towards rear.
– Remove camshaft housing ⇒ page 75 .



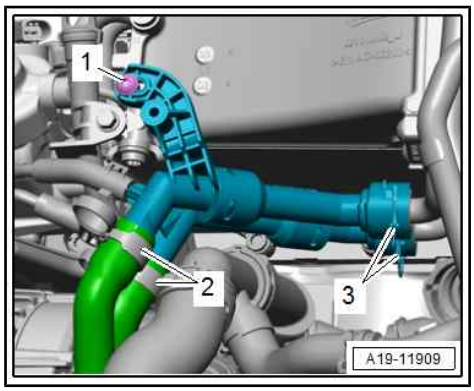
– Unplug electrical connector -arrow- from exhaust gas recirculation control motor - V338- and move electrical wiring clear.



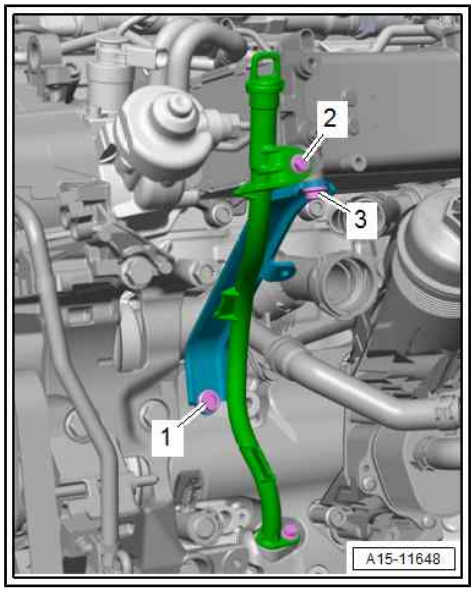
– Lift retaining clip -1- and disconnect coolant hose.



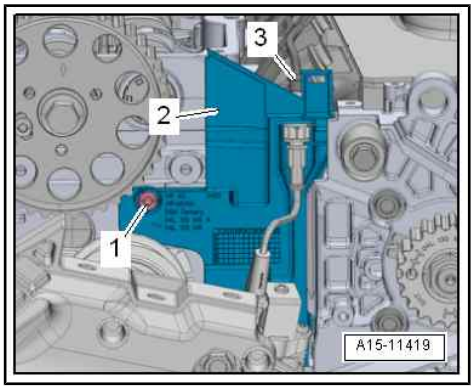
– Release hose clips -2- and disconnect coolant hoses.
– Remove bolt -1-.
– Lift retaining clips -3- and detach coolant connection.



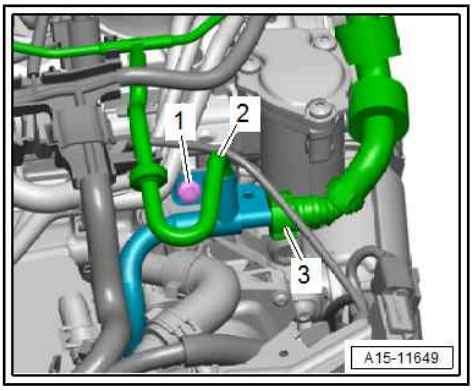
– Loosen bolt -1-.
– Remove bolt -2- for dipstick guide tube.
– Remove bolt -3- for bracket for intake manifold.



– Unplug electrical connector -3-.
– Remove bolt -1- but leave cover -2- in installation position.



– Remove bolt -1-.
– Unplug electrical connector at glow plug for cylinder 1 ⇒ page 240 .
– Move electrical wiring harness clear and place to one side.

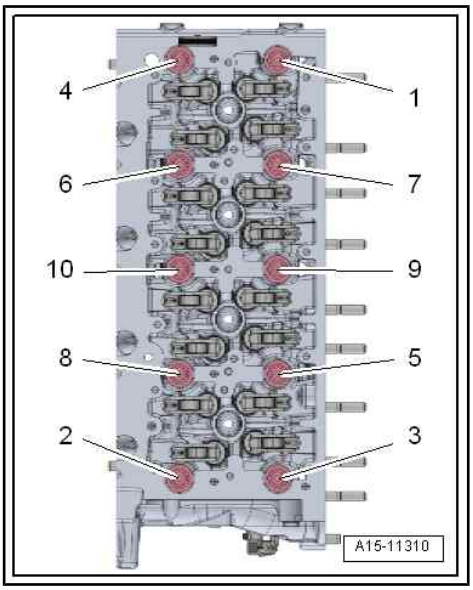


– Slacken cylinder head bolts in the sequence -1 ... 10-.

• A second mechanic is required for the following step.

– Swivel cylinder head to left and out of rear toothed belt cover and detach tensioning roller at the same time.
– Take care not to damage oil return line for turbocharger.
– Take care to place cylinder head down without bending oil return line. If necessary, place a block of wood below exhaust manifold.

• After removal, the cylinder head must not be put down on the sealing surface with the glow plugs still installed because the glow plugs project slightly beyond the sealing surface.



Installing

Note

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

– Sealant residue may only be removed from the cylinder head and cylinder block using a commercially available ceramic hob scraper.

• Sealing surfaces must NOT be damaged.

• No oil or coolant must be allowed to remain in the blind holes for the bolts.

• Do not remove new cylinder head gasket from packaging until it is ready to be fitted.

• If a new cylinder head is installed, the contact surfaces between the roller rocker fingers and the running surface of the cam must be lubricated.

• Handle the cylinder head gasket very carefully to prevent damage to the silicone coating or the indented area of the gasket.

• Turn the crankshaft carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

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

– Remove loose residue with a lint-free cloth.

– Before fitting cylinder head, remove crankshaft stop - T10490- and turn crankshaft against normal direction of rotation until all pistons are positioned approximately equally below “TDC”.

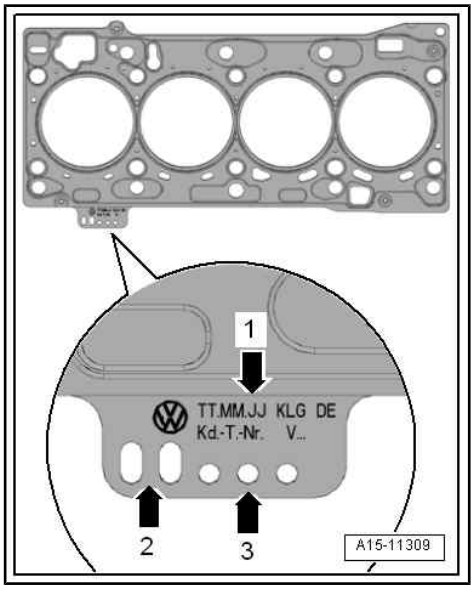
– If not already fitted, install dowel sleeves for centring cylinder block and cylinder head in cylinder block.

– Note cylinder head gasket identification:

1 - Part number

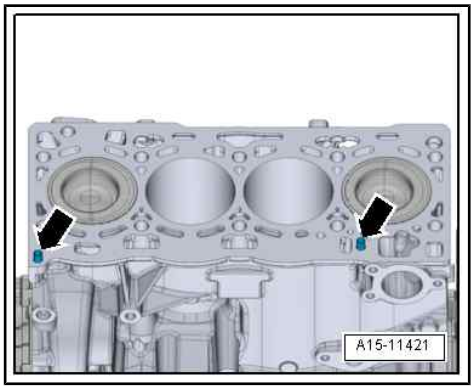
2 - Ignore

3 - Holes



- If the cylinder head gasket or cylinder head have been renewed, select the new cylinder head gasket according to the number of holes on the old gasket.
- If parts of the crankshaft drive have been renewed, select the new cylinder head gasket by measuring the piston projection at “TDC” ⇒ page 40 .

– Fit cylinder head gasket onto dowel sleeves -arrows- in cylinder block.



- Installation position of cylinder head gasket: the word “oben” (top) or the part number should face towards the cylinder head.
- A second mechanic is required for the following step.

– Fit cylinder head.

– Renew and tighten cylinder head bolts ⇒ page 65 .

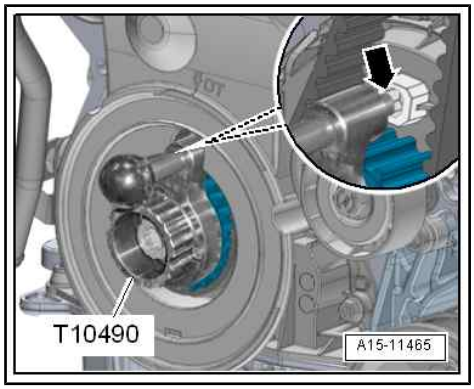
Note:

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

– Install camshaft housing ⇒ page 75 .

– Then turn crankshaft in direction of engine rotation until pin on crankshaft stop - T10490- engages in hole -arrow- in sealing flange as crankshaft rotates.

– Install toothed belt (adjust valve timing) ⇒ page 57 .



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

– Set up support bracket - 10-222A- again on wing mounting flanges (left and right) ⇒ 4-cyl. TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Emission control system; Removing and installing emission control module .

– Attach hook - 10-222A/10- to engine lifting eye (rear right).

– Raise engine with spindle of hook until load on engine mounting (right-side) is relieved.

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install emission control module ⇒ page 205 .

– Install throttle valve module - J338- ⇒ page 153 .

– Install coolant pipes ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

– Change engine oil ⇒ page 98 .

– Change coolant ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Cooling system/coolant; Draining and filling cooling system .

– If cylinder head has been renewed, perform adaptions listed in `Guided Function` `01 - Functions component replacement` ⇒ Vehicle diagnostic tester.

Tightening torques

- ⇒ “2.1 Exploded view - cylinder head”, page 63
- ⇒ “1.1 Exploded view - toothed belt cover”, page 44
- ⇒ “1.1 Exploded view - turbocharger”, page 125
- ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Exploded view - assembly mountings
- ⇒ “4.1 Exploded view - intake manifold”, page 151

2.4 Removing and installing cylinder head cover

Removing

– Remove engine cover panel ⇒ page 13 .

– Remove toothed belt cover (top) ⇒ page 46 .

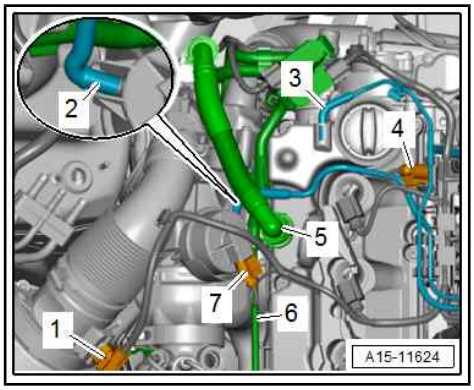
– Remove injectors ⇒ page 172 .

– Unplug electrical connectors and move wiring clear:

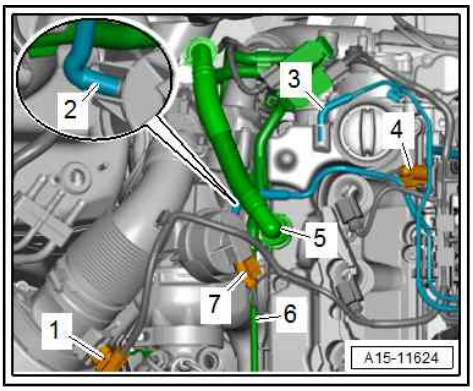
1 - For air mass meter - G70-

4 - For fuel pressure regulating valve - N276-

7 - For position sender for charge pressure positioner - G581-



– Detach vacuum hose -2- from vacuum unit and move clear.



Note

- *The connection for the vacuum hose -3- can break off if the hose is pulled off.*
- *To detach the vacuum hose, insert a screwdriver between the hose and the cover and tilt it; this will release the hose from the connection.*

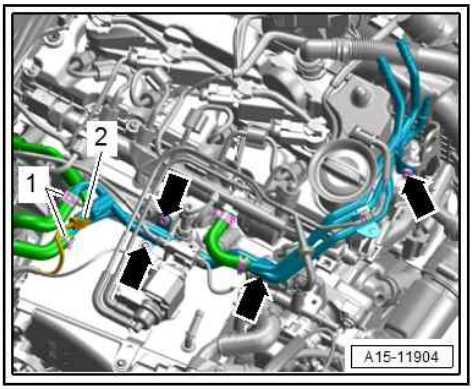
– Detach vacuum hose -3- and move clear.

– Press release tabs on both sides of crankcase breather hose -5- and disconnect hose from cylinder head cover.

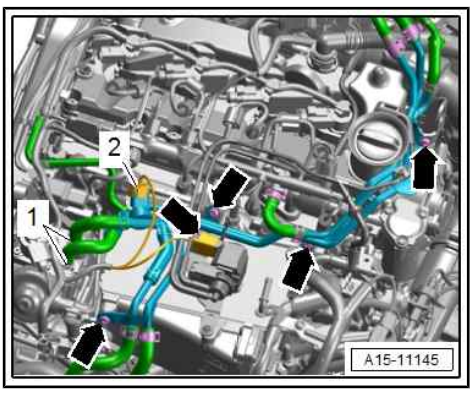
– Move line -6- clear and place to one side.

– Remove exhaust gas pressure sensor 1 - G450- ⇒ page 193 .

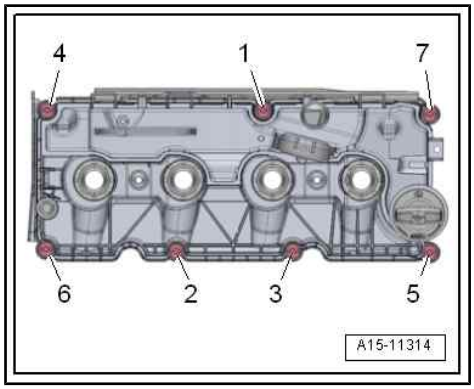
– Version 1: Remove bolts -arrows- and push fuel lines slightly to rear.



– Version 2: Remove bolts -arrows- and push fuel lines slightly to rear.



– Move electrical wiring harness clear.
– Slacken cylinder head cover bolts in the sequence -7 ... 1- and remove.
– Detach cylinder head cover.



Installing

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

- Renew O-ring after removal.
- Renew gasket and bolts for cylinder head cover if damaged or leaking.
- Before fitting, check vacuum hoses for damage and renew if necessary.

– Install toothed belt cover (top) ⇒ page 46 .
– Install injectors ⇒ page 172 .
– Install exhaust gas pressure sensor 1 - G450- ⇒ page 191 .
– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Install engine cover panel ⇒ page 13 .

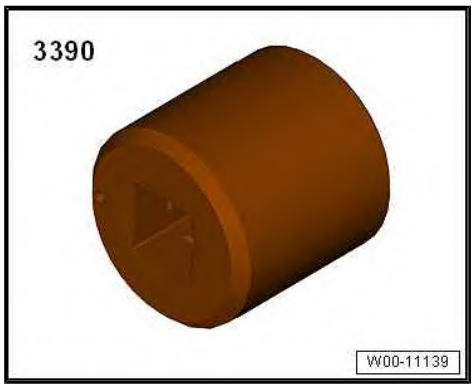
Tightening torques

♦ ⇒ Fig. ""Cylinder head cover - tightening torque and sequence"" , page 66

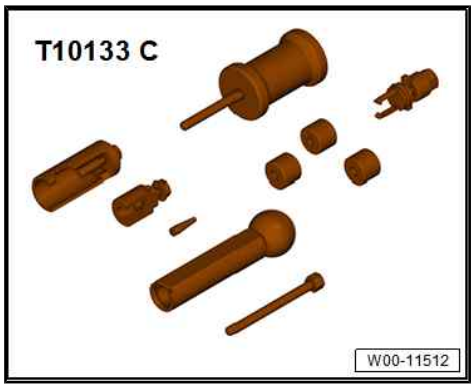
2.5 Removing and installing seals for injectors

Special tools and workshop equipment required

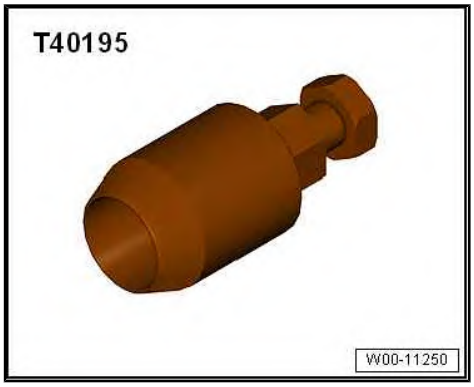
♦ Carrier - 3390-



♦ Tool set for FSI engines - T10133-



♦ Oil seal extractor - T40195-

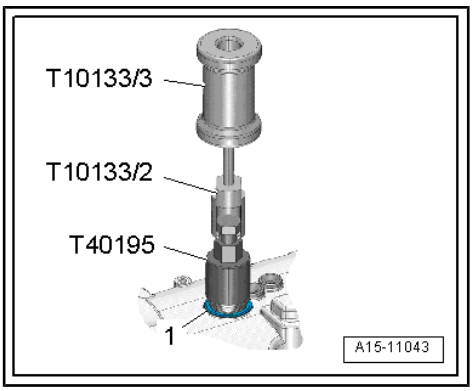


Procedure

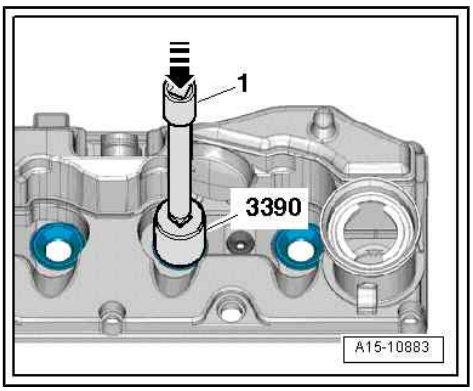
- Injector removed ⇒ page 172 .

– Screw oil seal extractor - T40195- into seal -1-.

– Fit striker -T10133/3- with adapter -T10133/2- on oil seal extractor, as shown in illustration, and pull out seal upwards by tapping gently.



– Apply carrier - 3390- and short extension -1- at top and press new injector seal in as far as stop.



2.6 Removing and installing camshaft housing

Special tools and workshop equipment required

♦ Bit XZN 10 - T10501- or ball head Torx T30 (commercially available)

♦ Electric drill with plastic brush attachment

♦ Safety goggles

♦ Sealant ⇒ Electronic parts catalogue

Removing

- Cylinder head installed.

– Detach toothed belt from camshaft ⇒ page 48 .

– Remove cylinder head cover ⇒ page 72 .

– Remove high-pressure reservoir (rail) ⇒ page 178 .

– Remove front exhaust pipe ⇒ 4-cyl. TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Removing and installing front exhaust pipe .

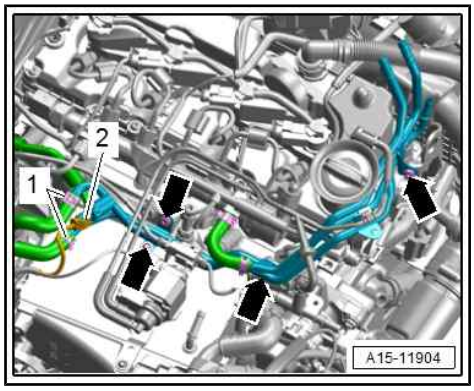
– Move electrical wiring and vacuum hoses clear.

Version 1:

– Unplug electrical connector -2- for fuel temperature sender - G81- .

– Release hose clips -1- and detach fuel hoses from fuel lines.

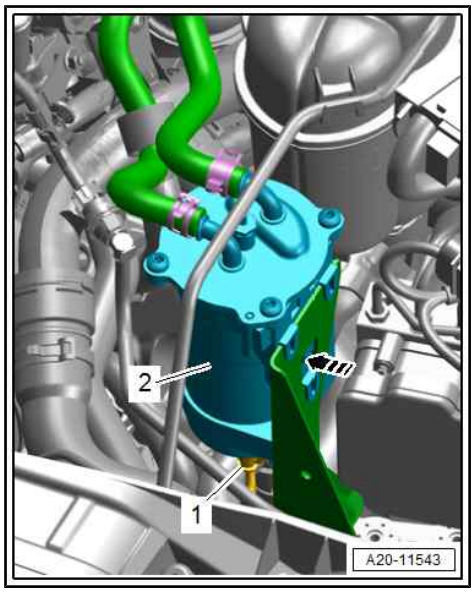
– Place fuel lines to right side.



Version 2:

– Unplug electrical connector -1- for water level sender - G120- .

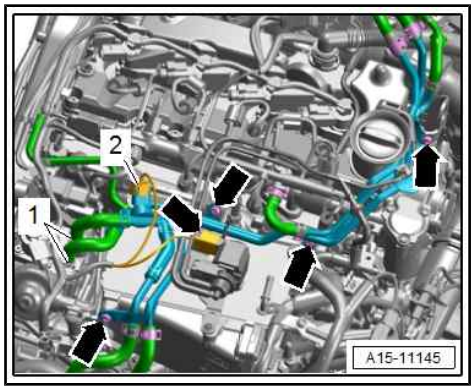
– Release fastener -arrow-, lift water separator -2- off bracket and place it on engine.



– Unplug electrical connector -2- for fuel temperature sender - G81- .

– Release hose clips -1- and detach fuel hoses from fuel lines.

– Place fuel lines to right side.

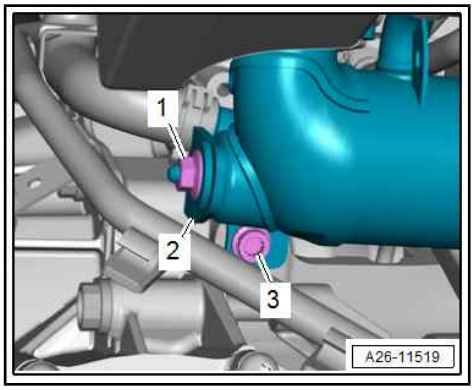


All vehicles (continued):

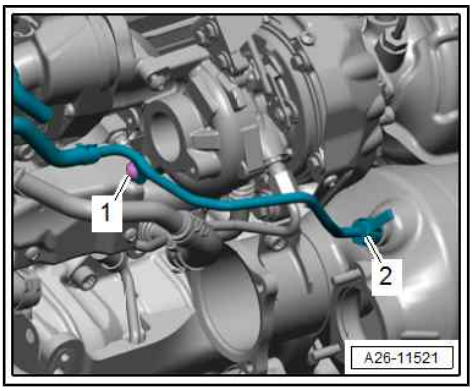
– Loosen nut -1- and bolt -3-.

Note:

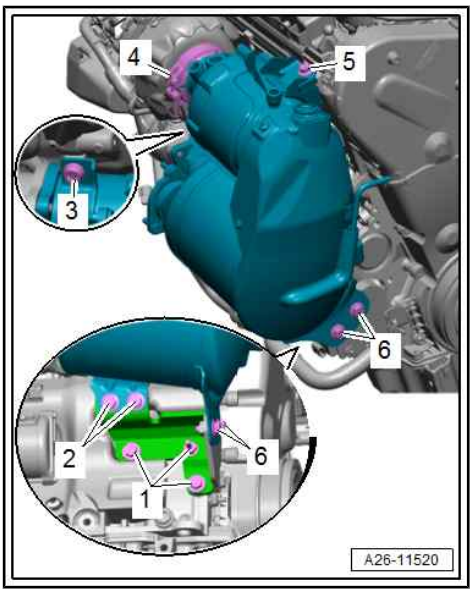
To loosen bolt -3-, use bit XZN 10 - T10501- or ball head Torx T30 (commercially available).



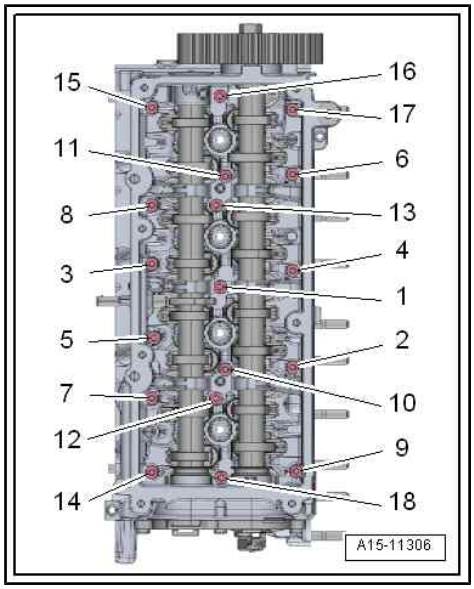
– Remove union nut -2-.



– Loosen bolt -4- and remove screw-type clip.
– Slacken bolts -2- and remove bolts -3, 5, 6-.
– Press emission control module slightly to right side.



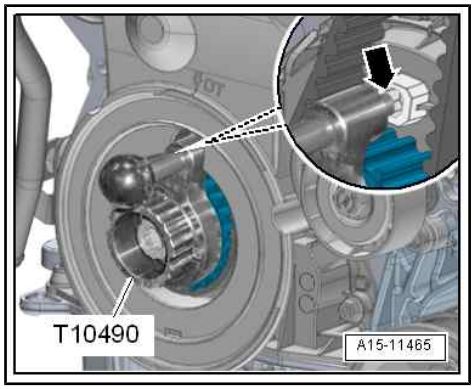
– Slacken camshaft housing bolts in the sequence -18 ... 1-.
– Remove bolts and carefully release and detach camshaft housing from bonded joint.



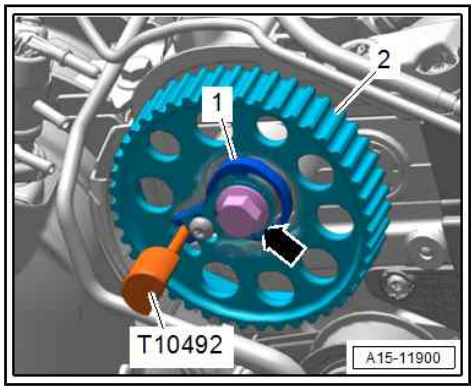
Installing

Requirements:

- Crankshaft locked in position with crankshaft stop - T10490- .



- Locating arm for camshaft -1- is locked with locking pin - T10492- .
- Bolt -arrow- for camshaft sprocket -2- screwed on loosely.

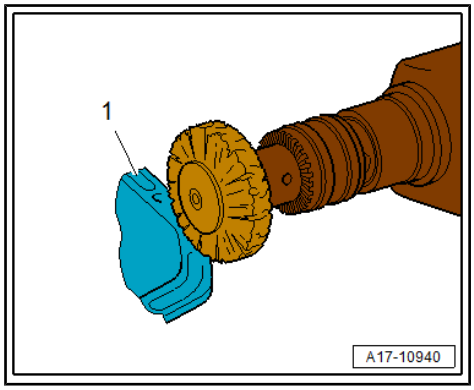


– Remove remaining sealant from cylinder head and camshaft housing -1- using rotating plastic brush or similar.
– Cover exposed parts of the engine with clean cloths.

CAUTION

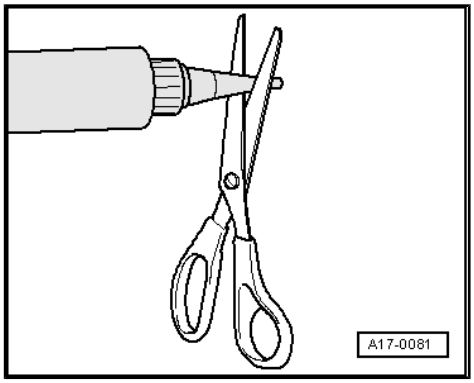
Risk of eye injury due to sealant residue.
– Put on safety goggles.

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

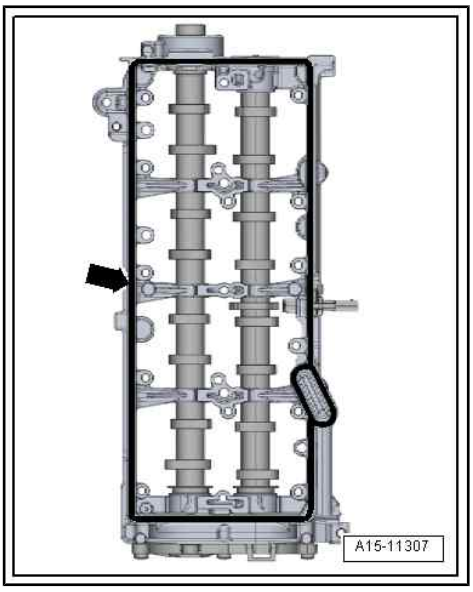


- Note expiry date of sealant.

– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



– Apply sealant bead -arrow- onto clean sealing surfaces of camshaft housing as shown in illustration.



- Width of sealant beads: 2 mm.
- Install the camshaft housing within 5 minutes after applying the sealant.
- After installing the camshaft housing, wait about 30 minutes for the sealant to dry.

– Carefully fit camshaft housing on cylinder head, paying attention to dowel pins.

– Tighten camshaft housing bolts ⇒ page 83 .

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

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install emission control module ⇒ page 205 .

– Install high-pressure reservoir (rail) ⇒ page 178 .

– Install cylinder head cover ⇒ page 72 .

– Install toothed belt (adjust valve timing) ⇒ page 57 .

Tightening torques

◆ ⇒ Fig. ""Camshaft housing - tightening torque and sequence"" , page 83

◆ ⇒ Fig. ""Exhaust gas recirculation cooler - tightening torque and sequence"" , page 230

2.7 Checking compression

⇒ "2.7.1 Checking using diagnostic tester", page 79

⇒ "2.7.2 Checking using compression tester", page 80

2.7.1 Checking using diagnostic tester

Compression pressure can be checked with a vehicle diagnostic tester or with compression tester - V.A.G 1763- .

Special tools and workshop equipment required

◆ Vehicle diagnostic tester

Procedure

– Connect ⇒ Vehicle diagnostic tester.

– Switch on ignition.

– Select `Engine electronics` in vehicle self-diagnosis.

– Select `Subsystems, conditions`.

– Select `Compression check` from list.

• If the result for one of the cylinders is unusual, check the compression using the compression tester - V.A.G 1763- .

2.7.2 Checking using compression tester

Special tools and workshop equipment required

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

Procedure

• Engine oil temperature at least 30 °C

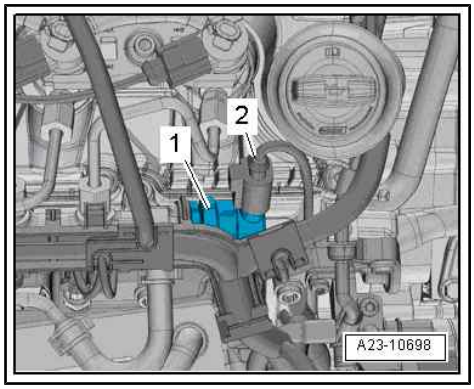
• Battery voltage at least 12.5 V

– Remove engine cover panel ⇒ page 13 .

– Unplug electrical connector on fuel pressure regulating valve - N276- -item 2-.

– Briefly start engine to relieve fuel pressure in high-pressure reservoir.

– Remove all glow plugs ⇒ page 240 .

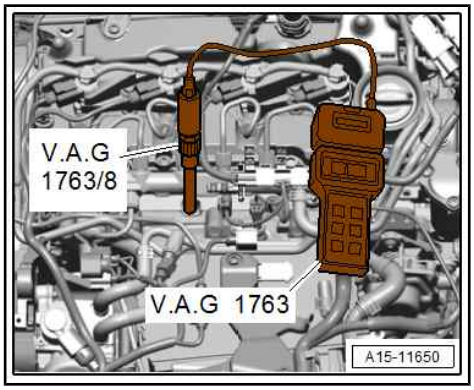


– Screw in adapter - V.A.G 1763/8- in place of corresponding glow plug and connect compression tester - V.A.G 1763- . (Using the compression tester ⇒ Operating instructions .)

• A second mechanic is required for the following step.

– Have a second mechanic operate starter until tester shows no further pressure increase.

– Repeat procedure on each cylinder.



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

Attaching

Assembly is performed in reverse sequence; note the following:

– Install glow plugs ⇒ page 240 .

– Install engine cover panel ⇒ page 13 .

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

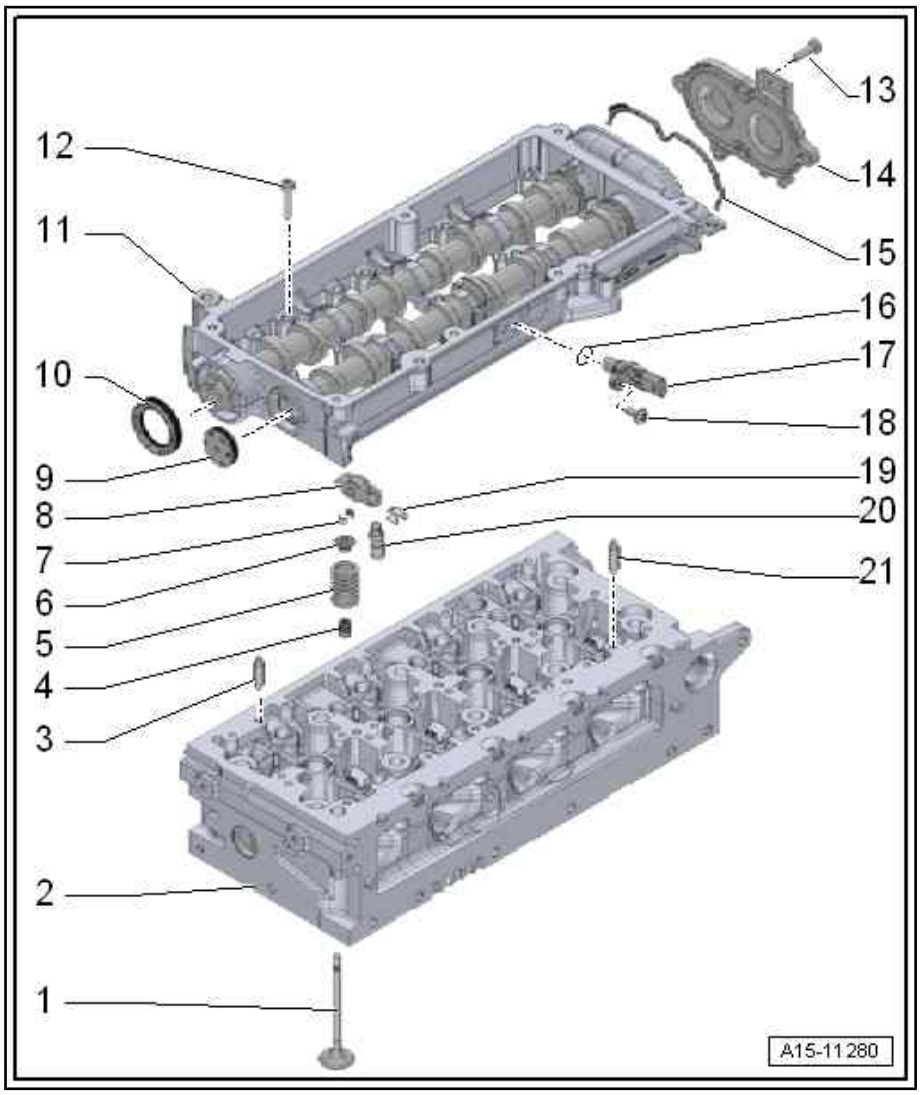
Tightening torques

◆ ⇒ “1.1 Exploded view - glow plug system”, page 239

3 Valve gear

3.1 Exploded view - valve gear

Cylinder heads with cracks between the valve seats may be used without reducing engine life, provided the cracks are small and not more than 0.5 mm wide.



1 - Valve

- ❑ Must not be machined; only grinding-in is permissible
- ❑ Mark installation position for re-installation
- ❑ Checking ⇒ page 94
- ❑ Valve dimensions ⇒ page 95
- ❑ Checking valve guides ⇒ page 94

2 - Cylinder head

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

3 - Dowel pin

- ❑ For camshaft housing

4 - Valve stem oil seal

- ❑ Renewing ⇒ page 86

5 - Valve spring

6 - Valve spring plate

7 - Valve cotters

8 - Roller rocker finger

- ❑ Removing and installing ⇒ “2.6 Removing and installing camshaft housing”, page 75
- ❑ Mark installation position for re-installation
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surfaces before installing

9 - Sealing cap

- ❑ Renew
- ❑ Removing: With camshaft housing installed, pierce on one side of sealing cap with an awl and pry out
- ❑ Installing: Drive in without sealant until flush using suitable thrust piece, e.g. carrier - 3390-

10 - Oil seal

- ❑ Renewing ⇒ page 83

11 - Camshaft housing

- ❑ With integrated camshafts
- ❑ Removing and installing ⇒ "2.6 Removing and installing camshaft housing", page 75

12 - Bolt

- ❑ Correct sequence when slackening ⇒ page 78
- ❑ Tightening torque and sequence ⇒ page 83

13 - Bolt

- ❑ 8 Nm

14 - Cover

15 - Seal

- ❑ Renew

16 - O-ring

- ❑ Renew

17 - Hall sender - G40-

- ❑ Exploded view ⇒ page 239

18 - Bolt

- ❑ Tightening torque ⇒ Item 5 (page 239)

19 - Securing clip

- ❑ For hydraulic compensation element

20 - Hydraulic compensation element

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

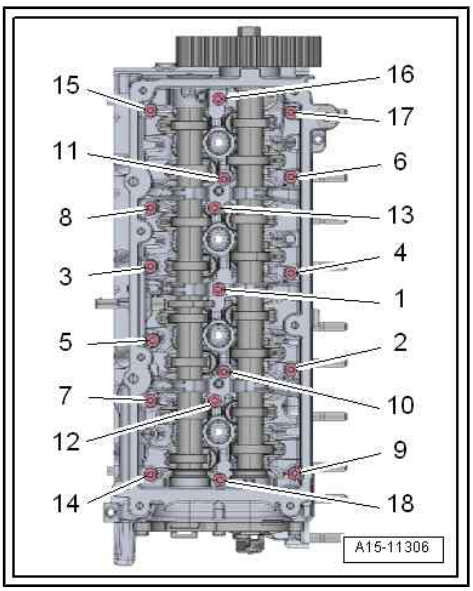
21 - Dowel pin

- ❑ For camshaft housing

Camshaft housing - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

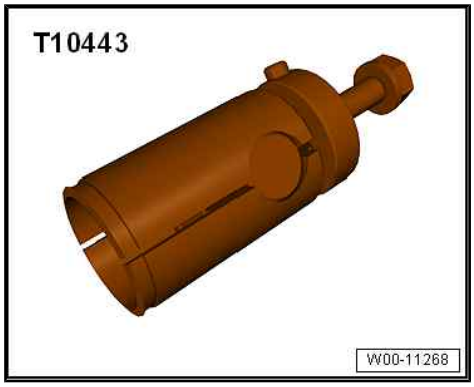
Stage	Bolts	Tightening torque
1.	-1 … 18-	Screw in by hand until contact is made • The camshaft housing should make contact with the cylinder head over the full surface.
2.	-1 … 18-	10 Nm



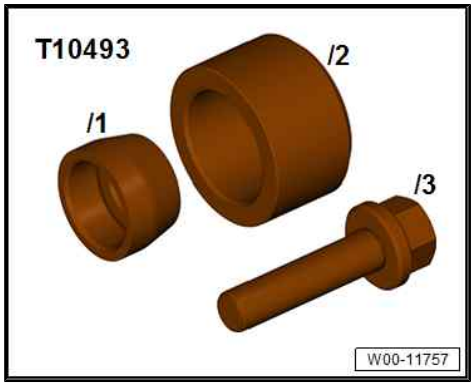
3.2 Removing and installing camshaft oil seal

Special tools and workshop equipment required

- Puller - T10443-



- Assembly tool - T10493-



Procedure

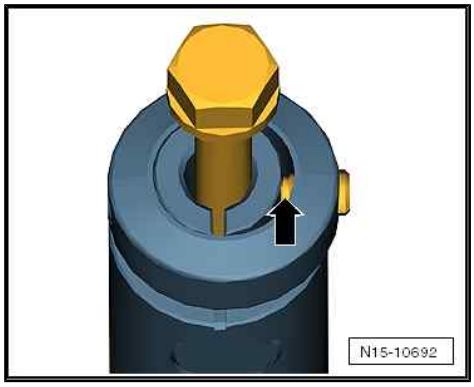
All necessary preparatory work is described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 15 ; Valve gear; Removing and installing camshaft oil seal .

– Detach toothed belt from camshaft ⇒ page 48 .

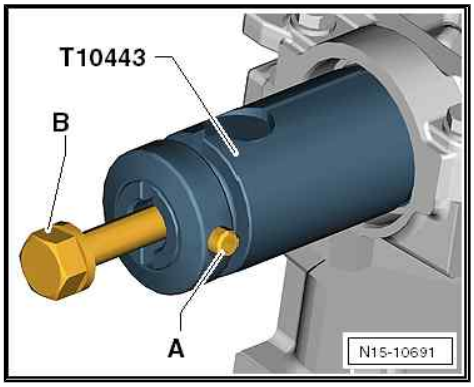
Note:

If the grub screw is unscrewed too far the thrust plate inside the puller -T10443- will come loose from the thrust bolt. If this happens, the thrust plate must be pushed back onto the thrust bolt.

– Carefully unscrew grub screw -arrow- of puller -T10443- until slight resistance is felt.



– Apply puller - T10443- to oil seal so that it is straight.



Note:

If the engine was supported in its installation position, you will need to raise the engine slightly with the spindles -10-222/11- before performing this step. Take care not to damage the drive shafts when doing so.

– Screw in a grub screw -A- to lock puller in place.

– Screw in thrust bolt -B- until oil seal is pulled out.

– Completely remove any oil residue on running and sealing surfaces using degreasing agent.

– Clean entire outer circumference of sealing lip of new oil seal using degreasing agent (remove wax layer).

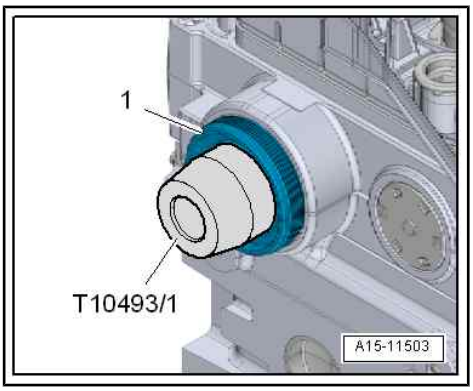
Note:

Use silicone adhesive sealant D 176 501 A1 to seal off oil seal.

– Apply silicone adhesive sealant evenly onto sealing lip of oil seal.

• Sealant bead must be applied evenly over entire circumference.

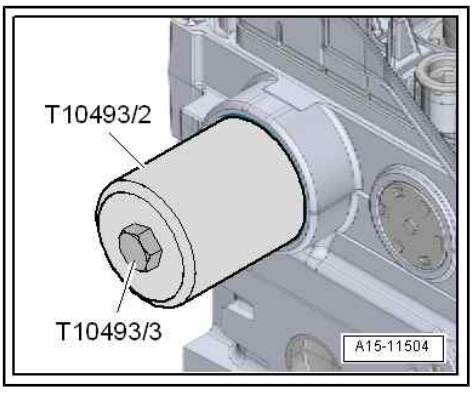
– Apply guide sleeve -T10493/1- to camshaft as shown in illustration.



– Carefully push oil seal -1- over guide sleeve and onto camshaft.

• When pressing in oil seal, guide sleeve remains on camshaft as a stop.

– Press oil seal in onto stop using press tool -T10493/2- and bolt -T10493/3- .



– Install toothed belt (adjust valve timing) ⇒ page 57 .

Additional work ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 15 ; Valve gear; Removing and installing camshaft oil seal .

3.3 Removing and installing valve stem oil seals

⇒ “3.3.1 Removing and installing valve stem oil seals (cylinder head installed)”, page 86

⇒ “3.3.2 Removing and installing valve stem oil seals (cylinder head removed)”, page 89

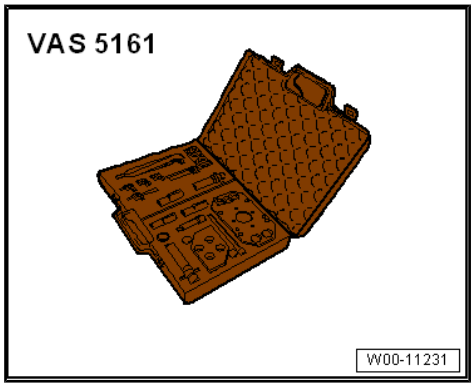
3.3.1 Removing and installing valve stem oil seals (cylinder head installed)

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 A-



- Sealing pin -VAS 5161/29-1-
- Guide plate -VAS 5161 A/31-
- Sleeve -VAS 5161 A/31-1-

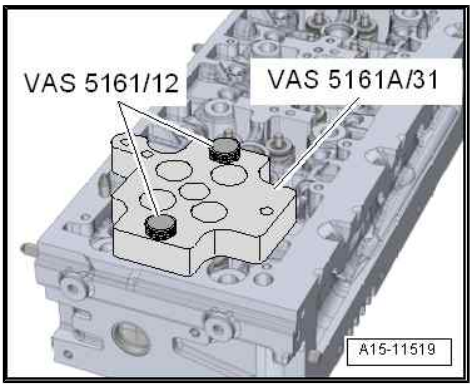
Procedure

– Remove all glow plugs ⇒ page 240 .

– Remove camshaft housing ⇒ page 75 .
– Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.
– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.
– Set piston of appropriate cylinder to “bottom dead centre”.

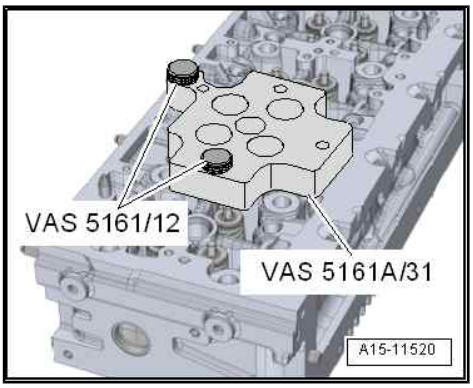
Cylinders 1, 3, 4:

– Fit guide plate -VAS 5161 A/31- onto cylinder head.
• The lettering -A- faces towards turbocharger side
• The lettering -E- faces towards intake manifold side
– Secure guide plate with knurled screws -VAS 5161/12- by hand.
• Position of knurled screws, as shown in illustration



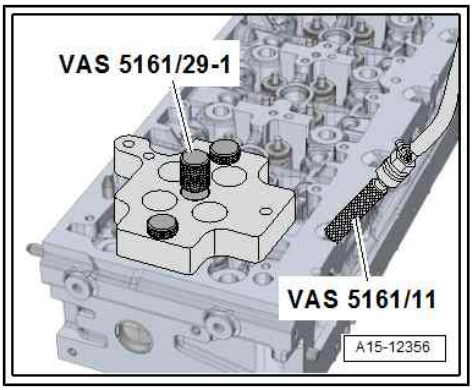
Cylinder 2:

– Fit guide plate -VAS 5161 A/31- onto cylinder head.
• The lettering -A- faces towards turbocharger side
• The lettering -E- faces towards intake manifold side
– Secure guide plate with knurled screws -VAS 5161/12- by hand.
• Position of knurled screws, as shown in illustration

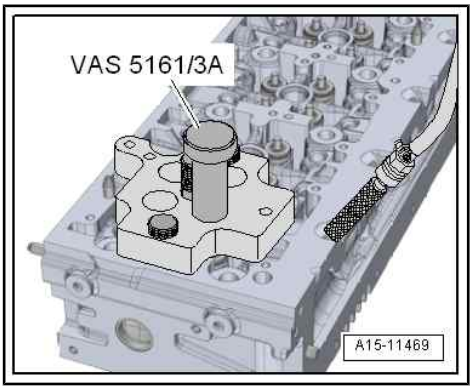


Continued for all cylinders:

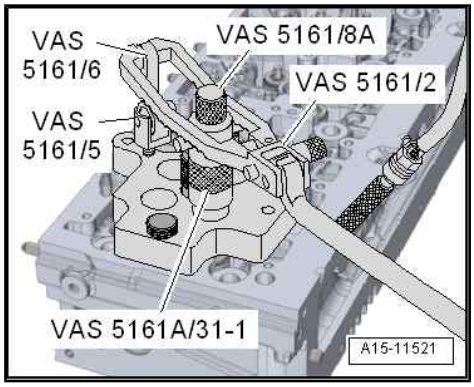
– Screw sealing pin -VAS 5161/29-1- into guide plate.
– Screw adapter -VAS 5161/11- hand-tight into corresponding glow plug thread.



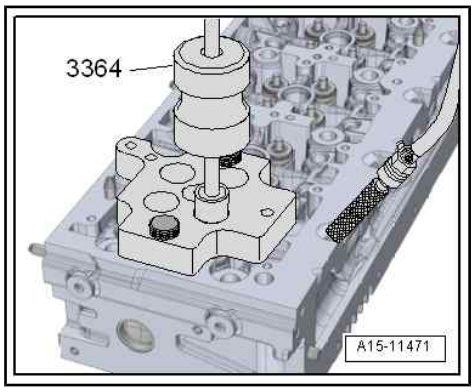
– Insert drift -VAS 5161/3A- into guide plate and use plastic-headed hammer to release sticking valve cotters.



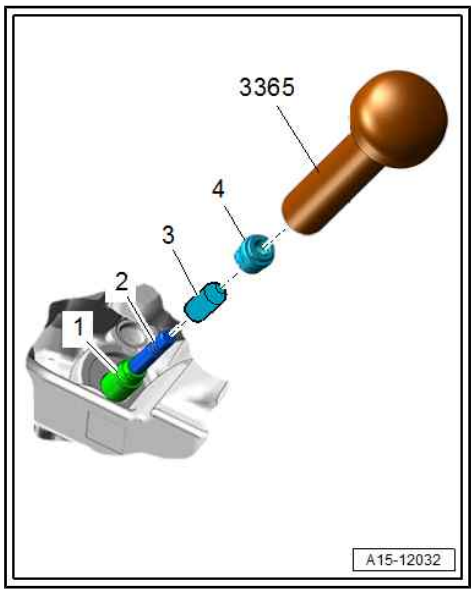
– Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8A- (slide on sleeve - VAS 5161 A/31-1-) in guide plate.
– Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.
• Minimum pressure: 6 bar
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge 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 off assembly cartridge with sleeve.
– Detach valve spring with valve spring plate.



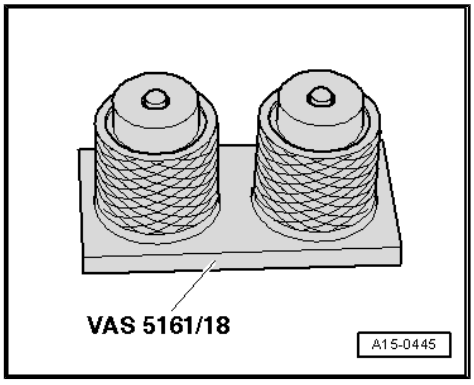
– Pull off valve stem oil seal with valve stem seal puller - 3364- .



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



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

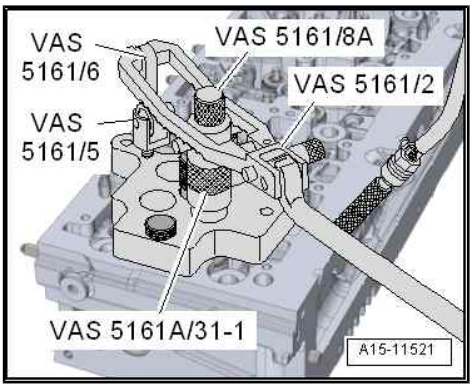


- Larger diameter of valve cotters faces upwards.

– Insert valve spring and valve spring plate.

– Press assembly cartridge onto insertion device from above and take up valve cotters.

– Insert assembly cartridge in guide plate -VAS 5161 A/31- again.



– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.

– Release pressure fork with knurled screw still in pulled position.

– Repeat procedure for each valve.

Attaching

Assembly is performed in reverse sequence; note the following:

– Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.

– Install camshaft housing ⇒ page 75 .

– Install glow plugs ⇒ page 239 .

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

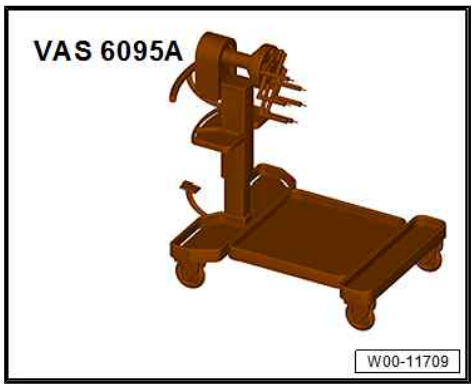
Special tools and workshop equipment required

♦ Valve stem seal puller - 3364-

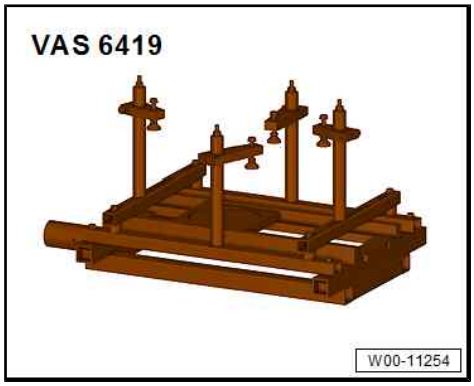
- Valve stem seal fitting tool - 3365-

- Removal and installation device for valve cotters - VAS 5161 A- with guide plate -VAS 5161 A/31- and sleeve -VAS 5161 A/31-1- .

- Engine and gearbox support - VAS 6095A-



- Cylinder head tensioning device - VAS 6419-



- Assembly sleeve ⇒ Electronic parts catalogue

Procedure

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

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

– Remove cylinder head ⇒ page 66 .

• Intake manifold and exhaust manifold must be detached from cylinder head after it has been removed.

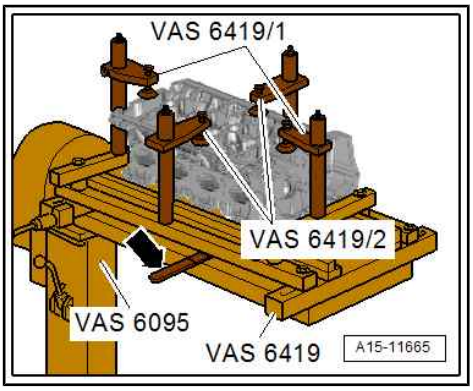
– Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .

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

– Connect cylinder head tensioning device to compressed air supply.

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

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



Cylinders 1, 3, 4:

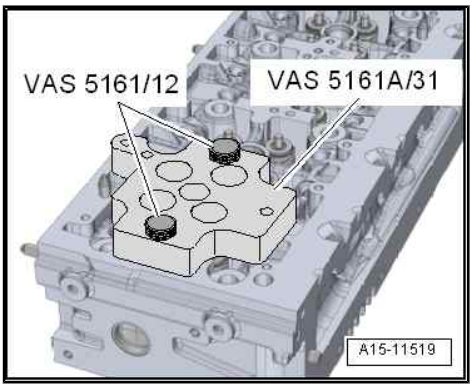
– Fit guide plate -VAS 5161 A/31- onto cylinder head.

• The lettering -A- faces towards turbocharger side

• The lettering -E- faces towards intake manifold side

– Secure guide plate with knurled screws -VAS 5161/12- by hand.

• Position of knurled screws, as shown in illustration



Cylinder 2:

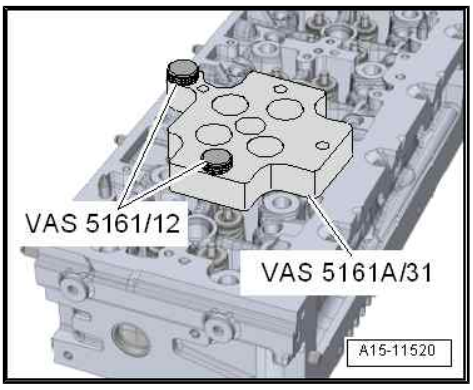
– Fit guide plate -VAS 5161 A/31- onto cylinder head.

• The lettering -A- faces towards turbocharger side

• The lettering -E- faces towards intake manifold side

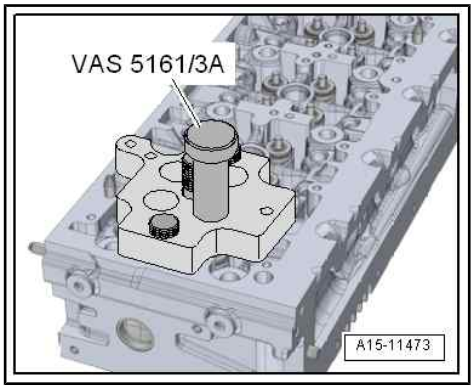
– Secure guide plate with knurled screws -VAS 5161/12- by hand.

• Position of knurled screws, as shown in illustration

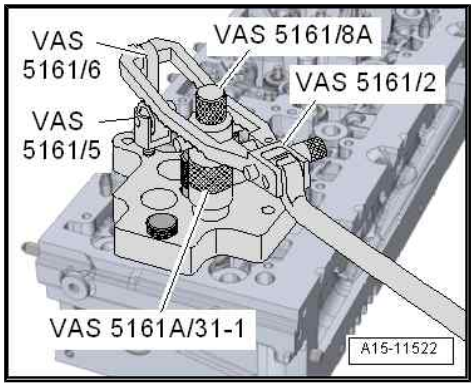


Continued for all cylinders:

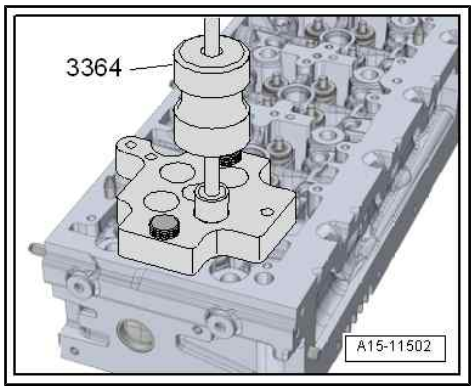
– Insert drift -VAS 5161/3A- into guide plate and use plastic-headed hammer to release sticking valve cotters.



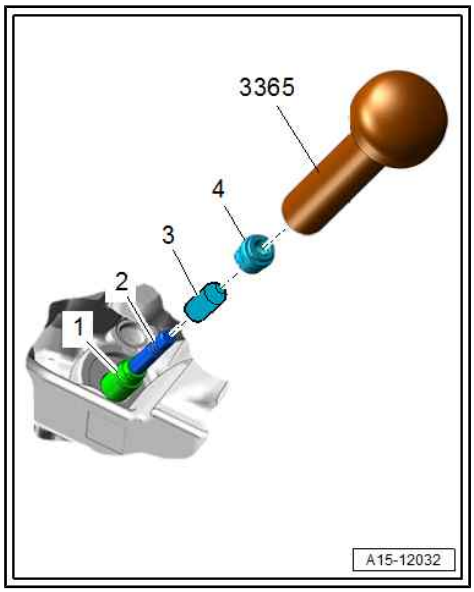
– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8A- (slide on sleeve -VAS 5161 A/31-1-) in guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled 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 off assembly cartridge with sleeve.
– Detach valve spring with valve spring plate.



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



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

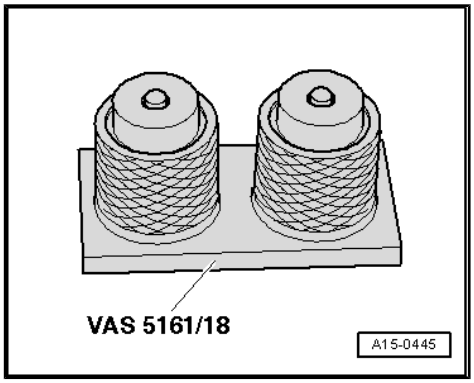


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

- 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.

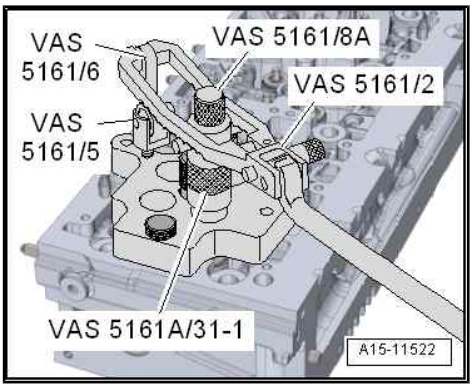


– Insert assembly cartridge in guide plate -VAS 5161 A/31- again.

– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.

– Release pressure fork with knurled screw still in pulled position.

– Repeat procedure for each valve.



Attaching

Assembly is performed in reverse sequence; note the following:

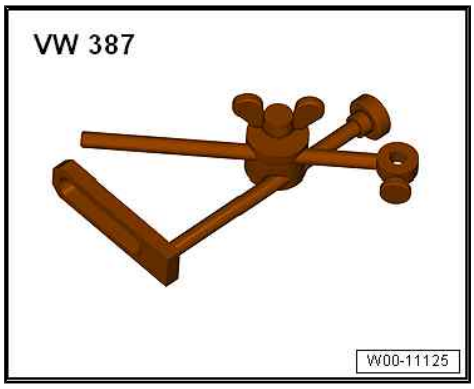
– Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.

4 Inlet and exhaust valves

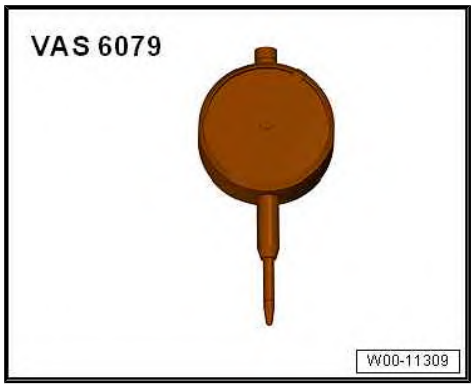
4.1 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-



Procedure

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

– Attach dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder head.

– Insert valve into guide.

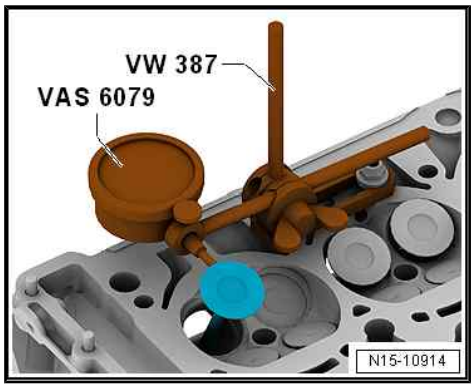
- End of valve stem must be flush with guide.

– Measure the amount of sideways play.

- Wear limit: 1.0 mm.

– If the wear limit is exceeded, repeat the measurement with new valves.

– Renew cylinder head if wear limit is still exceeded. Valve guides cannot be renewed.



4.2 Checking valves

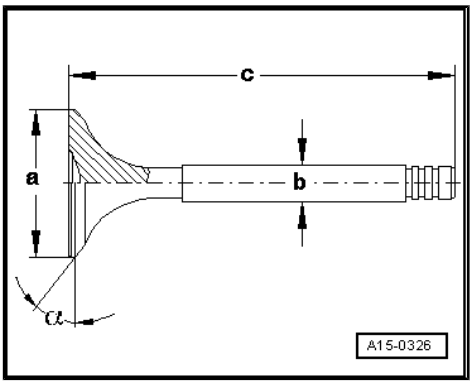
– Visually inspect for scoring on valve stems and valve seat surfaces.

– Renew valve if scoring is clearly visible.

4.3 Valve dimensions

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

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

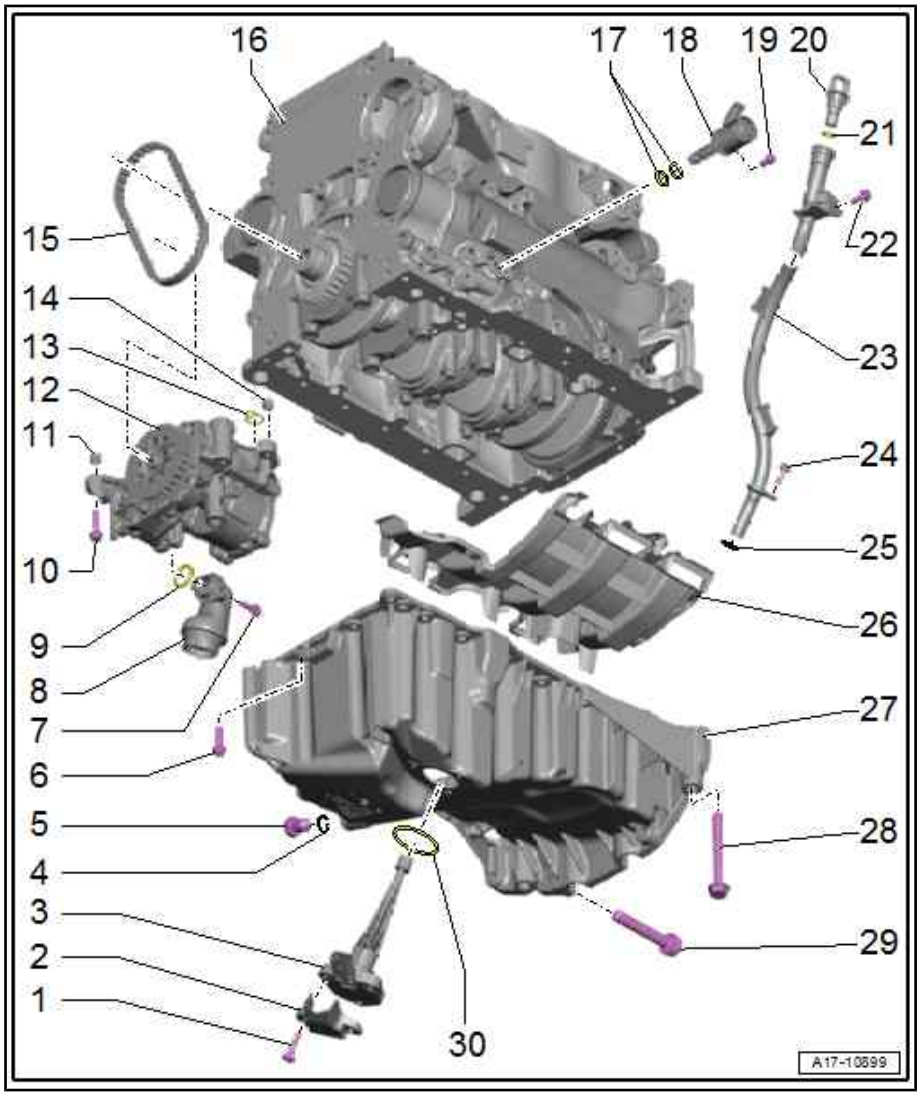


17 – Lubrication

1 Sump/oil pump

1.1 Exploded view - sump/oil pump

- If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully in order to prevent further damage occurring later. In addition, renew oil spray jets, engine oil cooler and oil filter.
- Oil spray jet and pressure relief valve ⇒ page 38



1 - Bolt
- ❑ Self-locking
- ❑ Renew after removing
- ❑ Clean threaded holes for bolts using a thread tap or similar
- ❑ 8 Nm

2 - Cover

3 - Oil level and oil temperature sender - G266-
- ❑ Removing and installing ⇒ page 101

4 - Seal
- ❑ Renew after removing

5 - Oil drain plug
- ❑ 30 Nm

6 - Bolt
- ❑ Tightening torque and sequence ⇒ page 98

7 - Bolt
- ❑ 8 Nm +90°

8 - Oil intake pipe

9 - O-ring
- ❑ Renew after removing

10 - Bolt
- ❑ Renew after removing
- ❑ 12 Nm +180°

11 - Dowel sleeve

12 - Oil pump
- ❑ With vacuum pump

❑ Removing and installing ⇒ page 101

13 - Gasket

❑ Renew after removing

14 - Dowel sleeve

15 - Toothed belt

❑ Removing:

– Remove oil pump ⇒ page 101 .

– Remove sealing flange (pulley end) ⇒ page 22 .

16 - Cylinder block

17 - O-rings

❑ Renew after removing

18 - Valve for oil pressure control - N428-

❑ Removing and installing ⇒ page 109

19 - Bolt

❑ 8 Nm

20 - Oil dipstick

21 - O-ring

❑ Renew after removing

22 - Bolt

❑ 8 Nm

23 - Dipstick guide tube

24 - Bolt

❑ 8 Nm

25 - O-ring

❑ Renew after removing

26 - Baffle plate

27 - Sump

❑ Removing and installing ⇒ page 98

28 - Bolt

❑ Tightening torque and sequence ⇒ page 98

29 - Bolt

❑ Tightening torque ⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox

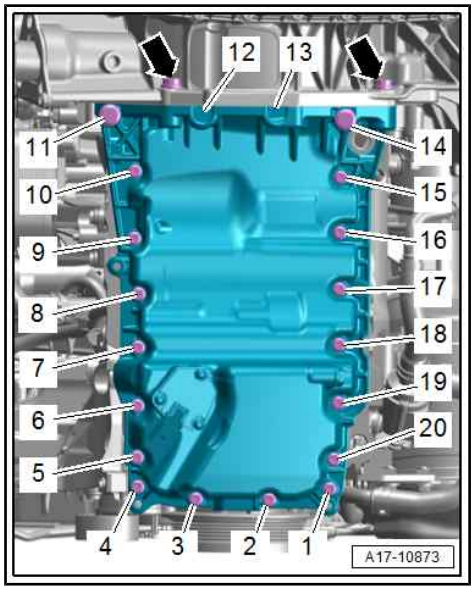
30 - Seal

❑ Renew after removing

Sump - tightening torques and sequence

– Tighten bolts in stages as follows:

Stage	Bolts	Tightening torque
1.	-1 … 10-, -12 and 13-, -15 … 20-	5 Nm in diagonal sequence
2.	-arrows-	⇒ Gearbox; Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox
3.	-1 … 10-, -12 and 13-, -15 … 20-	Tighten in stages and in diagonal sequence; final torque 13 Nm
4.	-11 and 14-	40 Nm



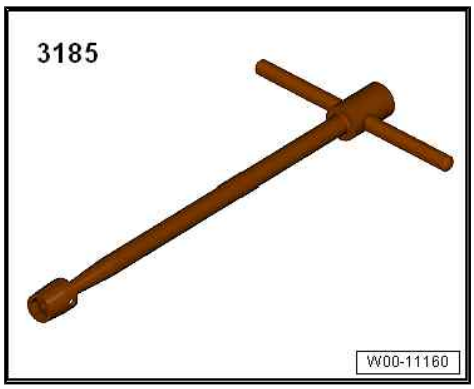
1.2 Engine oil

- Draining and filling up engine oil, checking oil level, removing and installing oil filter element ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 17 ; Sump/oil pump; Engine oil
- Oil capacities, oil specifications and viscosity grades ⇒ Maintenance tables .

1.3 Removing and installing sump

Special tools and workshop equipment required

- Articulated wrench, 10 mm - 3185-



- Socket - T10058-

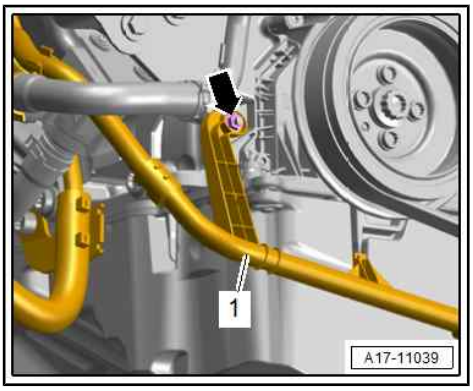
- Electric drill with plastic brush
- Safety goggles

♦ Sealant ⇒ Electronic parts catalogue

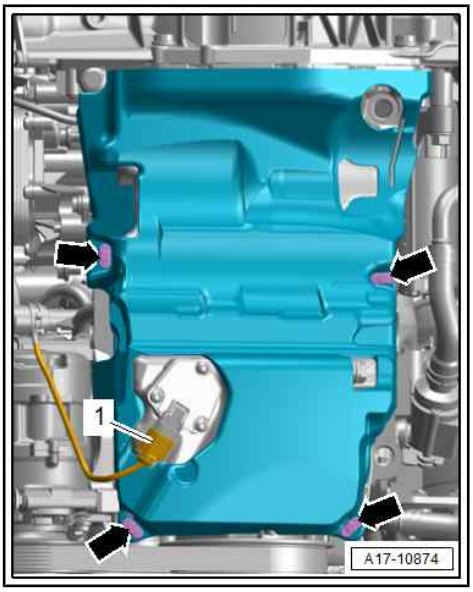
Removing

All necessary preparatory work is described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 17 ; Sump/oil pump; Removing and installing sump .

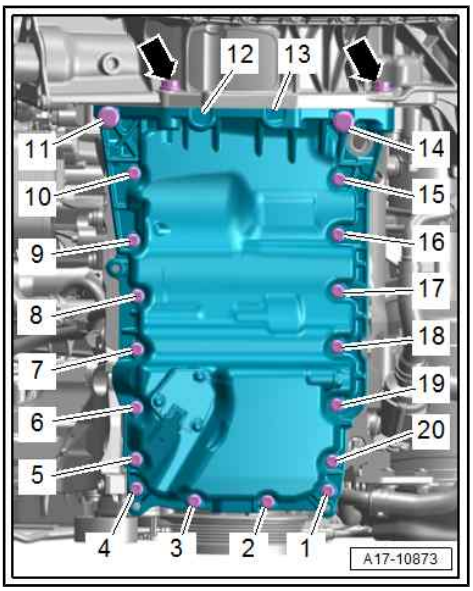
– Remove nut -arrow-, move cable duct -1- with B+ wire clear and push it to one side.



– Unplug electrical connector -1- for oil level and oil temperature sender - G266- .
– Release fasteners -arrows- and detach noise insulation for sump.



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



Installing

– Remove sealant residue from sump -1- and cylinder block using rotating plastic brush or similar.

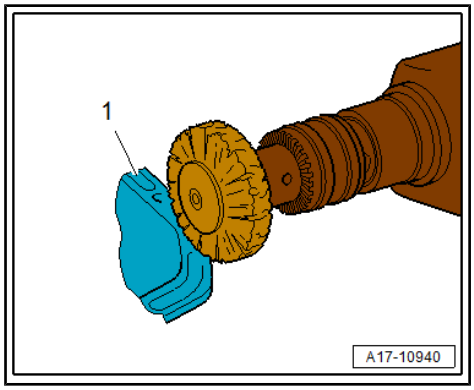
– Cover exposed parts of the engine with clean cloths.

CAUTION

Risk of eye injury due to sealant residue.

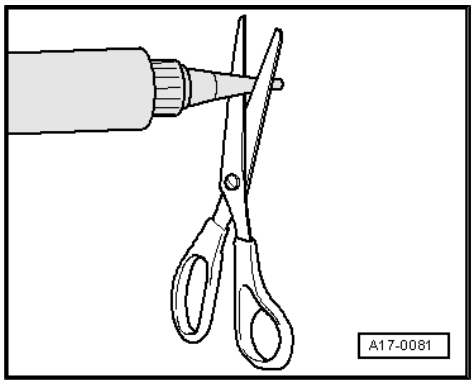
– Put on safety goggles.

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



• Note expiry date of sealant.

– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



– Apply sealant bead onto clean sealing surface of sump as illustrated.

• Thickness of sealant bead: 1.6 ... 1.9 mm

• Take particular care when applying sealant bead in area of rear sealing flange -arrows-.

• Install sump within 5 minutes after applying the sealant.

– Insert baffle plate.

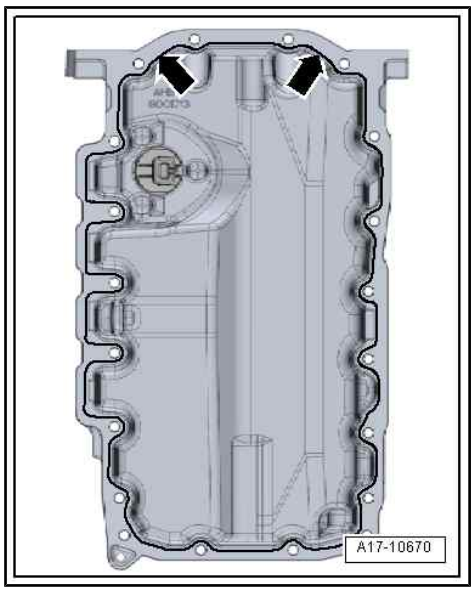
– Fit sump and tighten bolts.

• The sump must make flush contact with intermediate plate/ gearbox flange.

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

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

– Top up engine oil and check oil level ⇒ page 98 .



Additional work ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 17 ; Sump/oil pump; Removing and installing sump

Tightening torques

◆ ⇒ Fig. ““Sump - tightening torques and sequence”“ , page 98

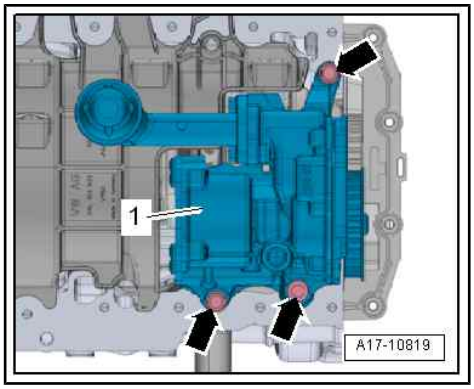
1.4 Removing and installing oil pump

Removing

– Remove sump ⇒ page 98 .

– Remove bolts -arrows- and detach oil pump -1-.

• The bolt on the pump impeller must NOT be loosened.



Installing

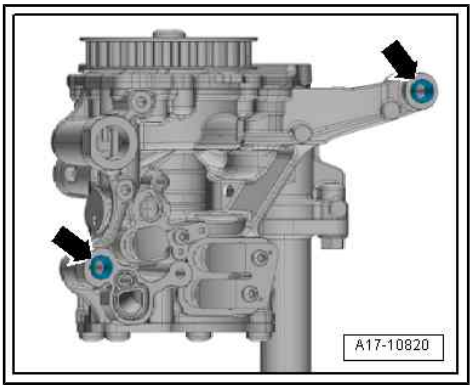
Installation is carried out in reverse order; note the following:

• Renew gasket after removing.

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

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

– Install sump ⇒ page 98 .



Tightening torques

◆ ⇒ “1.1 Exploded view - sump/oil pump”, page 96

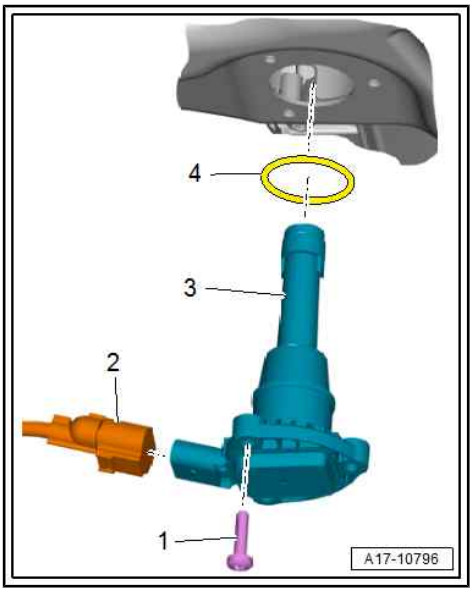
1.5 Removing and installing oil level and oil temperature sender - G266-

Removing

• Engine oil drained ⇒ page 98 .

– Unplug electrical connector -2-.

– Remove bolts -1- and detach oil level and oil temperature sender - G266- -item 3-.



Installing

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

• Renew seal -4- and self-locking bolts -1- after removal.

– Fill with engine oil and check oil level ⇒ page 98 .

Tightening torques

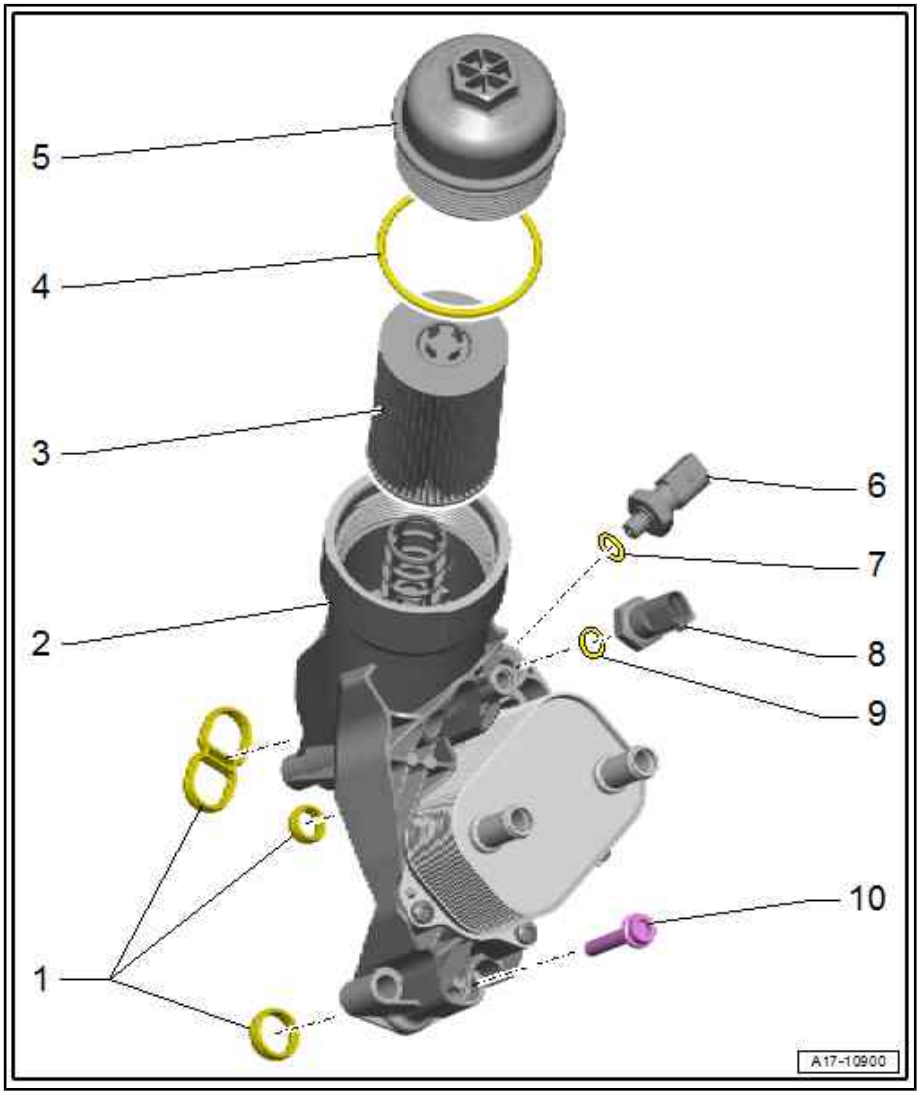
◆ ⇒ “1.1 Exploded view - sump/oil pump”, page 96

2 Engine oil cooler

Engine oil cooler must not be separated from oil filter housing. If defective, engine oil cooler must be renewed together with oil filter housing ⇒ page 107 .

3 Oil filter/oil pressure switches

3.1 Exploded view - oil filter housing/oil pressure switch



1 - Gaskets

- ❑ Renew

2 - Oil filter housing with engine oil cooler

- ❑ Do not separate oil filter housing and engine oil cooler
- ❑ Removing and installing ⇒ page 107

3 - Oil filter element

- ❑ See note ⇒ page 96
- ❑ Removing and installing ⇒ page 98

4 - Seal

- ❑ Renew (cut seal open to do so)

5 - Sealing cap

- ❑ 25 Nm

6 - Oil pressure switch for reduced oil pressure - F378-

- ❑ Opening/closing pressure 0.3 ... 0.6 bar
- ❑ Green insulation
- ❑ Checking ⇒ Vehicle diagnostic tester
- ❑ Removing and installing ⇒ page 106
- ❑ 20 Nm

7 - Seal

- ❑ Renew (cut seal open to do so)
- ❑ If seal is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal

8 - Oil pressure switch - F22-

- ❑ Opening/closing pressure 2.5 ... 3.2 bar
- ❑ Brown insulation
- ❑ Checking ⇒ Vehicle diagnostic tester

- ❑ Removing and installing ⇒ page 104
- ❑ 20 Nm

9 - Seal

- ❑ Renew (cut seal open to do so)
- ❑ If seal is not available separately, refer to ⇒ Electronic parts catalogue ; renew oil pressure switch after removal

10 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 104

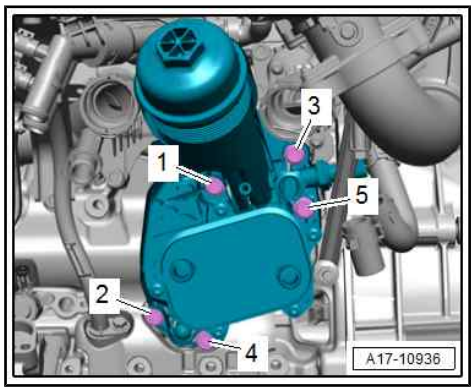
Oil filter housing - tightening torque and sequence

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

– Fit bolts at top left and bottom right first.

– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 5-	20 Nm
2.	-1 … 5-	Turn 90° further



3.2 Removing and installing oil pressure switch - F22-

Special tools and workshop equipment required

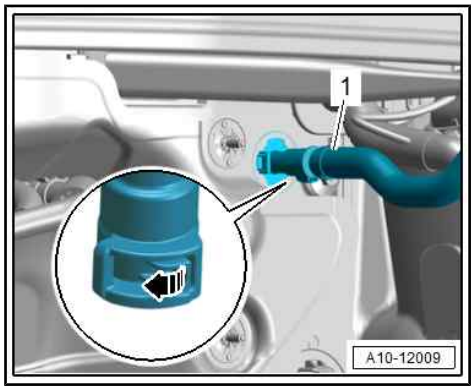
♦ Crow-foot ring spanner, 24 mm (commercially available)

Removing

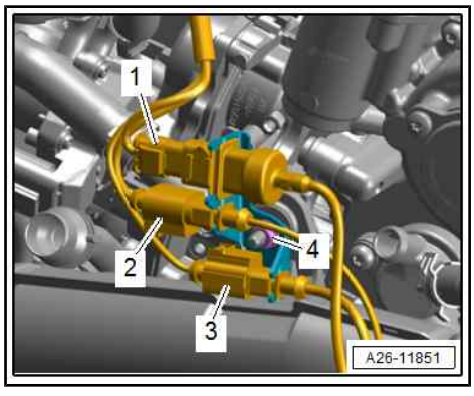
– Remove engine cover panel ⇒ page 13 .

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

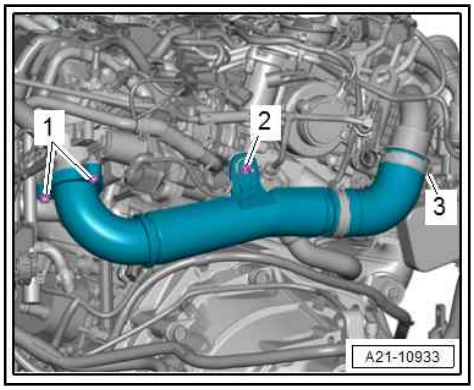
– Unscrew bolt from coolant expansion tank, detach coolant expansion tank towards front and place to one side.



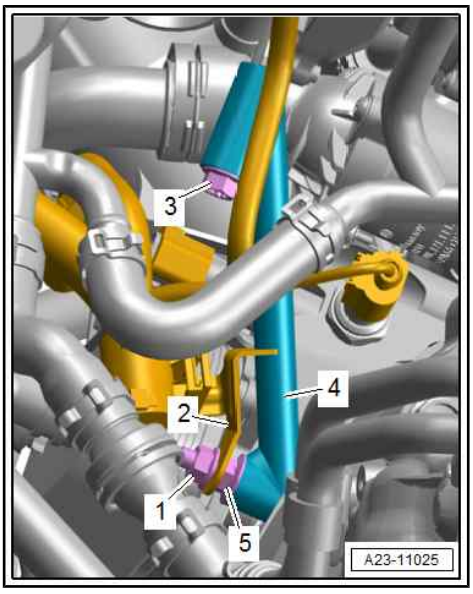
– Remove nut -4- and move bracket with electrical connectors -1, 2, 3- to one side.



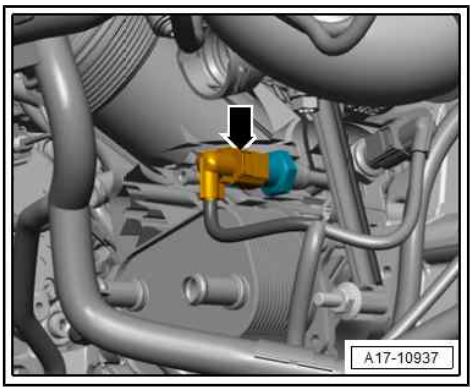
– Remove bolts -1- and centre hex stud -2-.
– Detach air pipe towards rear and place to one side.



– Remove nut -1- and press bracket -2- with electrical wiring harness to one side.
– Remove bolt -3- and centre hex stud -5-, and detach support -4- for throttle valve module - J338- .



– Unplug electrical connector -arrow-.
– Place a cloth underneath to catch escaping engine oil.
– Use crow-foot ring spanner, 24 mm to unscrew oil pressure switch - F22- .



Installing

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

- Before fitting, check vacuum hoses for damage and renew if necessary.

– If old oil pressure switch - F22- is to be reinstalled, renew seal for oil pressure switch - F22- after removal.
– Cut seal open to renew.
– Install engine cover panel ⇒ page 13 .
– Check oil level ⇒ page 98 .

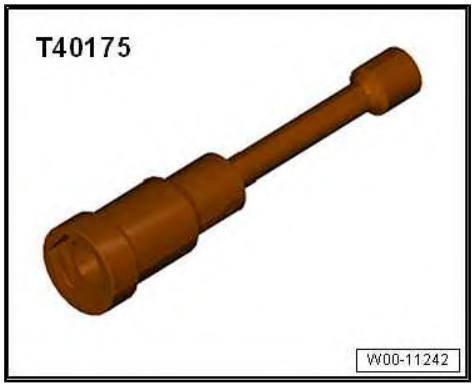
Tightening torques

◆ ⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 103
◆ ⇒ “2.2 Exploded view - hose connections for charge air system”, page 140
◆ ⇒ “4.1 Exploded view - intake manifold”, page 151

3.3 Removing and installing oil pressure switch for reduced oil pressure - F378-

Special tools and workshop equipment required

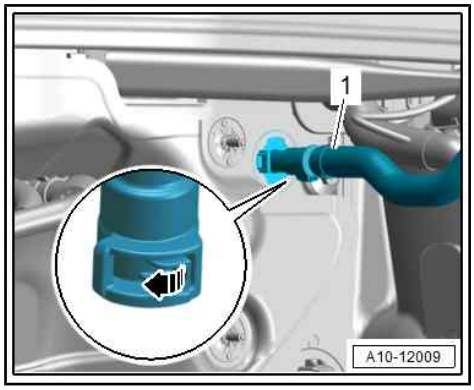
- Articulated wrench, 24 mm - T40175-



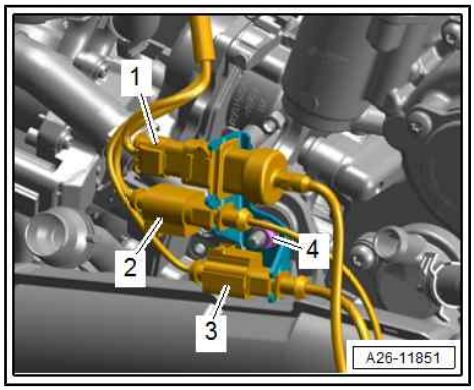
Removing

– Remove engine cover panel ⇒ page 13 .

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

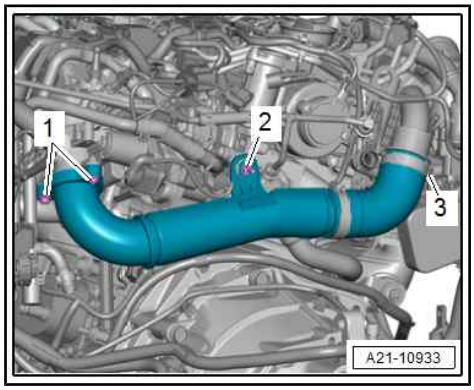


– Remove nut -4- and move bracket with electrical connectors -1, 2, 3- to one side.

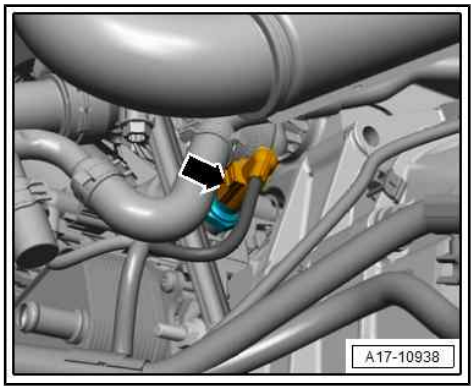


– Remove bolts -1- and centre hex stud -2-.

– Release hose clip -3- and detach air pipe.



– Unplug electrical connector -arrow-.



– Place a cloth underneath to catch escaping engine oil.

– Use articulated wrench, 24 mm - T40175- to remove oil pressure switch for reduced oil pressure - F378- .

Installing

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

• Before fitting, check vacuum hoses for damage and renew if necessary.

– Renew seal for oil pressure switch for reduced oil pressure - F378- after removal.

– Cut seal open to renew.

– Check oil level ⇒ page 98 .

– Install engine cover panel ⇒ page 13 .

Tightening torques

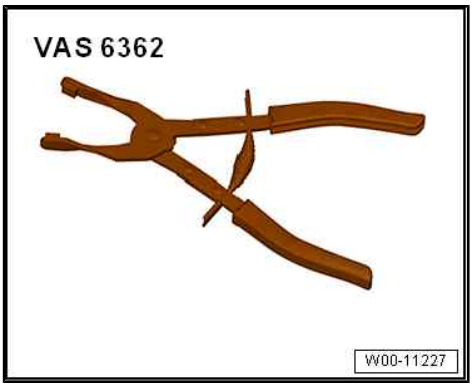
♦ ⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 103

♦ ⇒ “2.2 Exploded view - hose connections for charge air system”, page 140

3.4 Removing and installing oil filter housing

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-

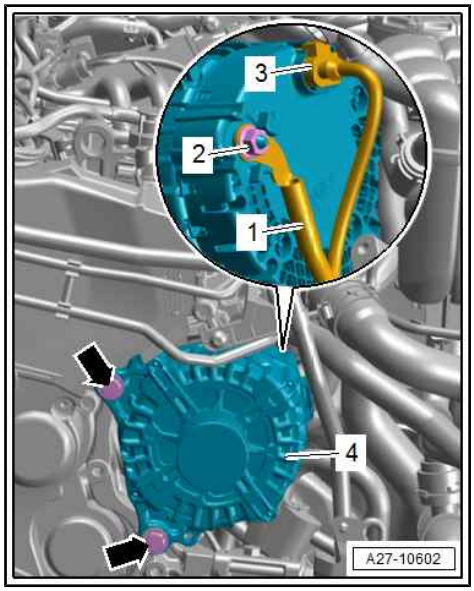


Removing

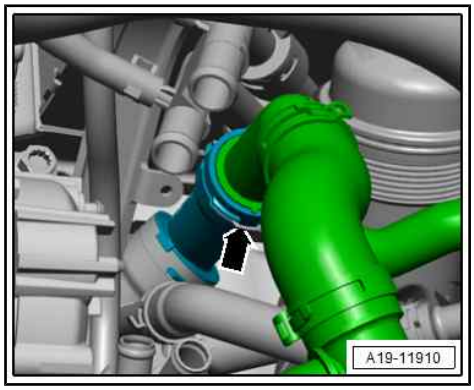
– Remove engine support (left-side) ⇒ 4-cyl. TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 13 ; Cylinder block (pulley end); Removing and installing engine support .

– Remove coolant pipes (rear left and top left) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

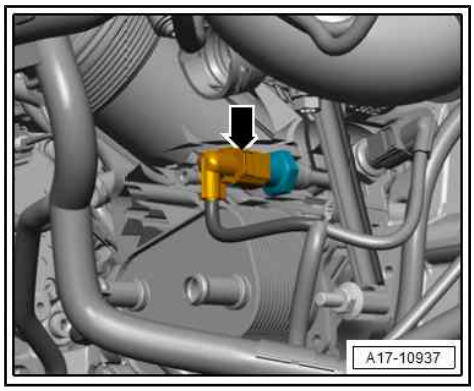
– Unplug electrical connector -3- at alternator -4-.



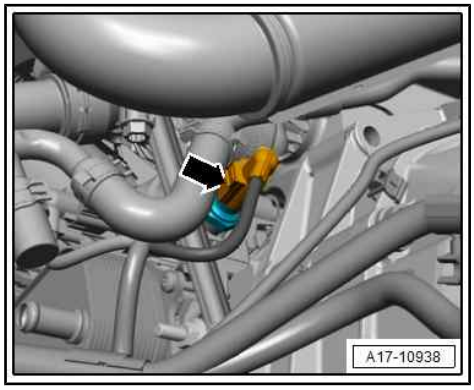
– Lift retaining clip -arrow- and detach coolant connection.



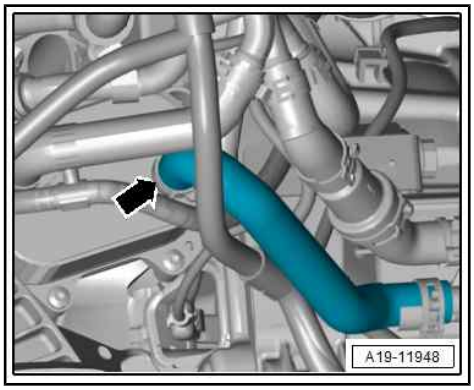
– Unplug electrical connector -arrow- on oil pressure switch - F22- .



– Unplug electrical connector -arrow- at oil pressure switch for reduced oil pressure - F378- .

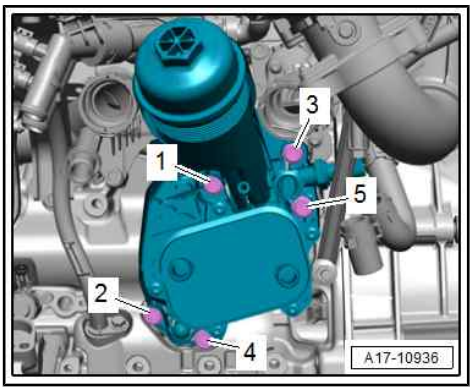


– Release hose clip -arrow- and detach coolant hose.



– Place a cloth underneath to catch escaping engine oil.

– Unscrew bolts in the sequence -5 ... 1- and detach oil filter housing together with engine oil cooler.



Installing

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

- Renew seals and O-ring after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Do not reuse coolant.

– Install coolant pipes ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

– Install engine support (left-side) ⇒ 4-cyl. TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 13 ; Cylinder block (pulley end); Removing and installing engine support .

– Connect coolant hose with plug-in connector ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Radiator/radiator fans; Exploded view - radiator/radiator fans .

– Fill up with coolant ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Cooling system/coolant; Draining and filling cooling system .

Tightening torques

♦ ⇒ “3.1 Exploded view - oil filter housing/oil pressure switch”, page 103

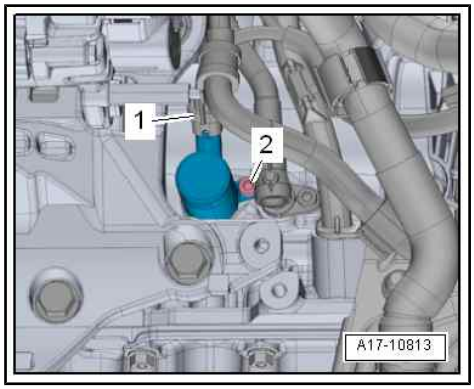
3.5 Removing and installing valve for oil pressure control - N428-

Removing

– Remove poly V-belt ⇒ page 17 .

– Remove air conditioner compressor from bracket with refrigerant lines still attached and tie up to left side ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Detaching and attaching air conditioner compressor at bracket .

– Unplug electrical connector -1-.
– Place a cloth underneath to catch escaping engine oil.
– Unscrew bolt -2- and remove valve for oil pressure control - N428- .



Installing

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

• Renew O-ring after removal.
– Install poly V-belt ⇒ page 17 .
– Check oil level ⇒ page 98 .

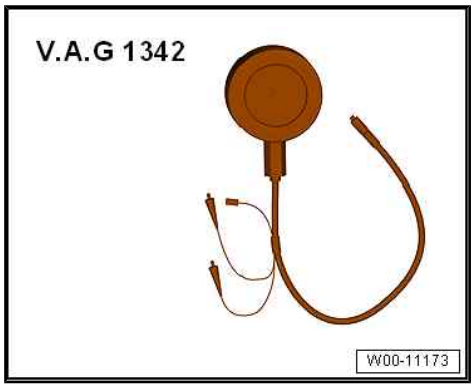
Tightening torques

♦ ⇒ “1.1 Exploded view - sump/oil pump”, page 96
♦ ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

3.6 Checking oil pressure

Special tools and workshop equipment required

♦ Oil pressure tester - V.A.G 1342-



Procedure

• Oil level OK
– Remove oil pressure switch for reduced oil pressure - F378- ⇒ page 106 .
– Connect oil pressure tester - V.A.G 1342- to threaded hole for oil pressure switch for reduced oil pressure - F378- .
– Screw a used oil pressure switch into threaded hole on oil pressure tester - V.A.G 1342- to seal hole.
– Start engine.
• Oil pressure when starting and then at idling speed: at least 1.4 bar.

If specification is not obtained, switch off engine immediately and check oil pump drive; renew oil pump if necessary ⇒ page 101 .

If specification is obtained, higher oil pressure must be checked using ⇒ Vehicle diagnostic tester.

– Allow engine to warm up.

Note:

It is not possible to test all levels of the oil pressure control system while the vehicle is stationary. The higher oil pressure must therefore be checked using the ⇒ Vehicle diagnostic tester:

– Connect ⇒ Vehicle diagnostic tester.
– Switch on ignition.
– Select `Engine electronics` in vehicle self-diagnosis.
– Then select `Basic setting`.
– Select `Checking oil pressure valve change-over` on the Basic setting page and then click on `>` (not >I).
– No settings are required on the parameter settings page. Now click on `>` (not >I).
– Select `Operating instructions` and `Oil pressure actual value` on the measured values page and then click on `>` (not >I).
– Start the basic setting routine and follow the operating instructions.
– Do not press the pedals until requested; otherwise the routine will be cancelled for safety reasons.

• Oil pressure must rise to at least 3.5 bar.

19 – Cooling

1 Cooling system/coolant

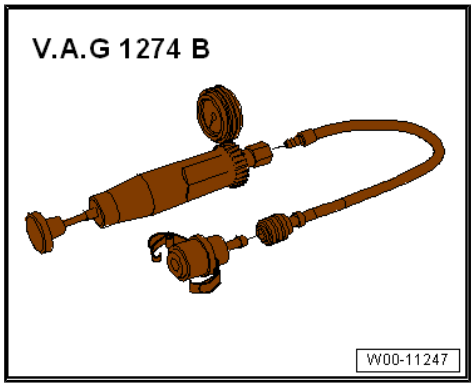
1.1 Connection diagram - coolant hoses

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Cooling system/coolant; Connection diagram - coolant hoses .

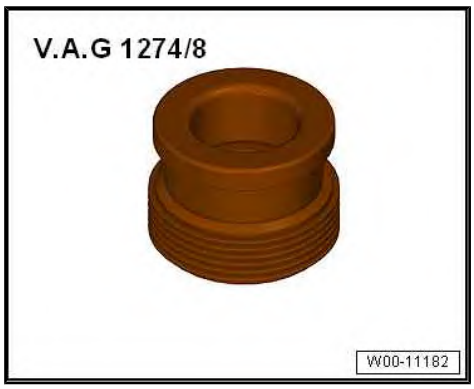
1.2 Checking cooling system for leaks

Special tools and workshop equipment required

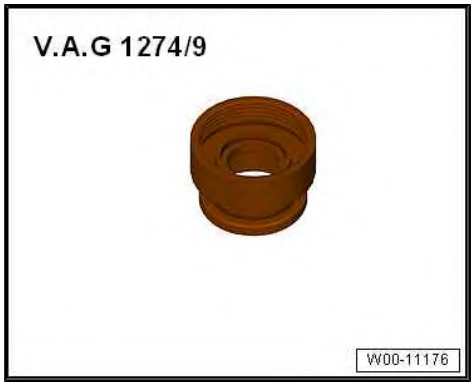
- Cooling system tester - V.A.G 1274 B-



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



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

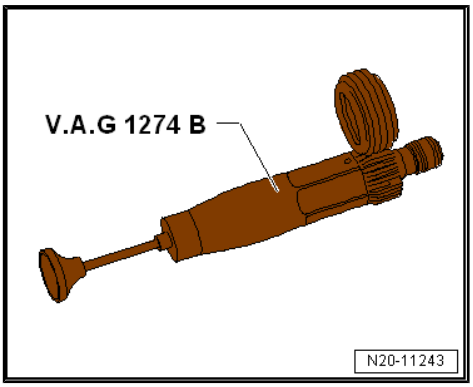


- ♦ Safety goggles
- ♦ Protective gloves
- • To ensure that the leak test is carried out correctly, a self-test must first be performed on the cooling system tester - V.A.G 1274 B- .

Checking cooling system tester - V.A.G 1274 B- (self-test)

– Operate cooling system tester - V.A.G 1274 B- several times.

– Build up a pressure of 3.0 bar on cooling system tester.



– Monitor pressure on pressure gauge of cooling system tester - V.A.G 1274 B- for 30 seconds.

If pressure does not build up, or if pressure dissipates again:

- • Cooling system tester - V.A.G 1274 B- is leaking and must not be used.

Checking cooling system for leaks

- • Engine must be warm.
- • Ignition switched off.

CAUTION

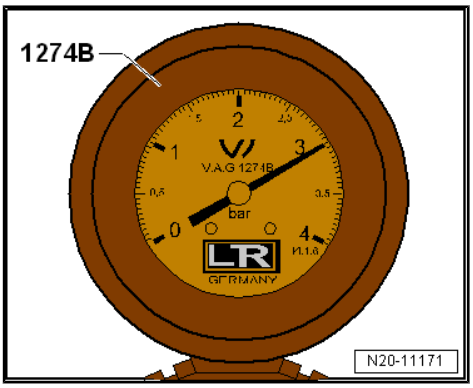
The cooling system is under pressure when the power unit is hot. Risk of scalding due to hot steam and hot coolant.

Danger of scalding skin and other parts of the body.

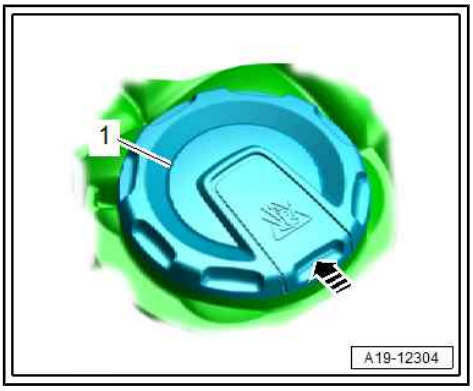
– Put on protective gloves.

– Put on safety goggles.

– Cover filler cap on expansion tank with a cloth and open carefully to release pressure.



– Release fastener -arrow- and open filler cap -1- on coolant expansion tank.



– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
– Using hand pump on cooling system tester, build up a pressure of approx. 1.5 bar.

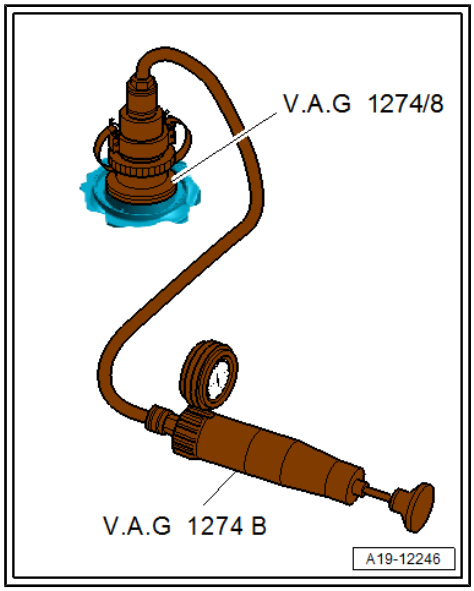
• The pressure should not drop more than 0.2 bar within 10 minutes.

Note:

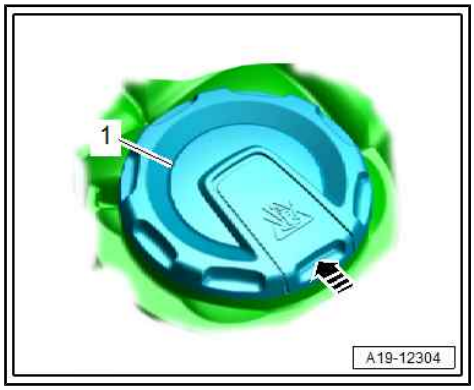
The drop in pressure of 0.2 bar within 10 minutes is caused by the decrease in coolant temperature. The colder the engine is, the less the pressure will fall. If necessary, check again when the engine is cold.

If the pressure drops by more than 0.2 bar:

– Examine engine and radiator to find and eliminate the leak.



Checking pressure relief valve in filler cap, version 1



– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274 B/15- onto filler cap.
– Using hand pump on cooling system tester, build up a pressure of approx. 2 bar.

Blue filler cap

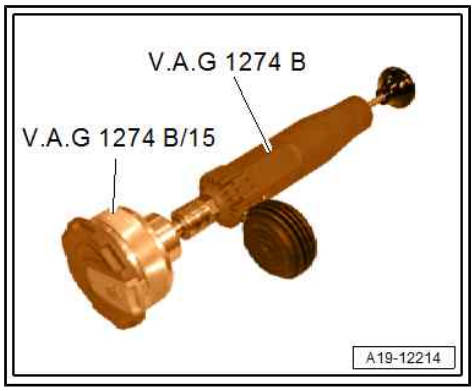
• The pressure must be reduced to 1.6 ... 1.4 bar and kept at this level.

Black filler cap

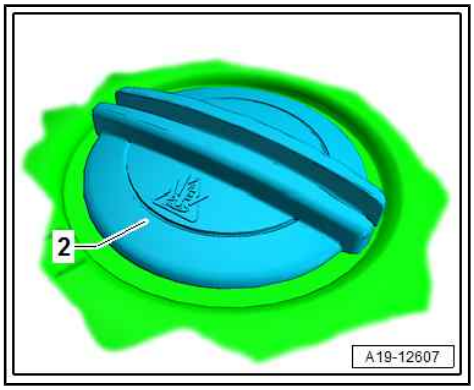
• The pressure must be reduced to 1.8 ... 1.6 bar and kept at this level.

All filler caps

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

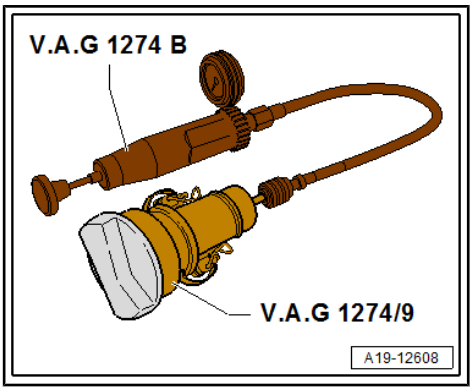


Checking pressure relief valve in filler cap, version 2



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

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



Blue filler cap

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

Black filler cap

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

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

1.3 Draining and filling cooling system

– Drain and fill cooling system ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Cooling system/coolant; Draining and filling cooling system .

2 Coolant pump/thermostat assembly

2.1 Exploded view - coolant pump/thermostat

1 - Bolt
- ❑ Renew after removing
- ❑ 20 Nm +45°

2 - Coolant pump
- ❑ Removing and installing ⇒ page 119

3 - O-rings
- ❑ Renew after removing
- ❑ Lubricate with coolant

4 - Coolant valve for cylinder head - N489-
- ❑ Removing and installing ⇒ page 119

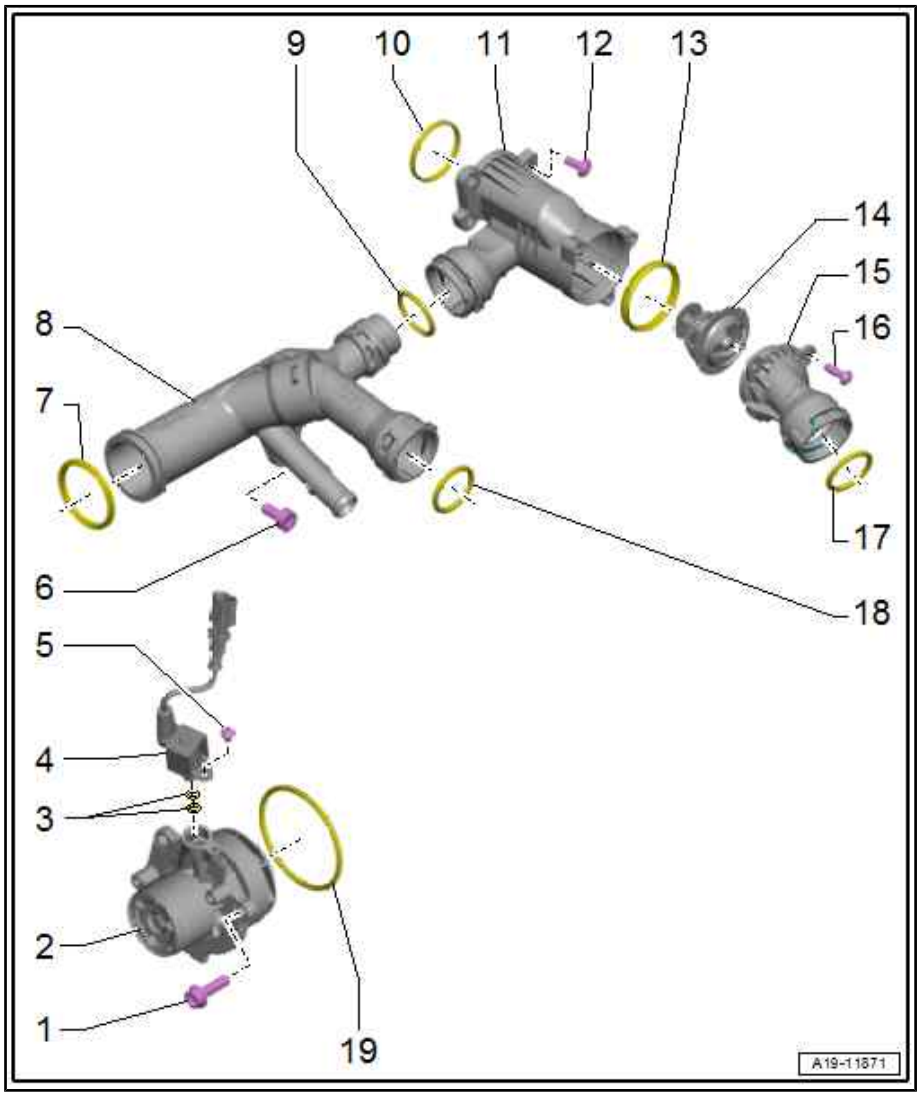
5 - Bolt
- ❑ 8 Nm

6 - Bolt
- ❑ 20 Nm

7 - O-ring
- ❑ Renew after removing
- ❑ Lubricate with coolant

8 - Coolant pipe (left-side)
- ❑ Removing and installing ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes

9 - O-ring
- ❑ Renew after removing
- ❑ Lubricate with coolant



10 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

11 - Thermostat housing

12 - Bolt

- ❑ 20 Nm

13 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

14 - Thermostat

- ❑ Can only be renewed together with coolant pipe (left-side) ⇒ Item 8 (page 116)

15 - Connection

16 - Bolt

- ❑ 8 Nm

17 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

18 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

19 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

2.2 Exploded view - electric coolant pump

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Coolant pump/thermostat assembly; Exploded view - electric coolant pump .

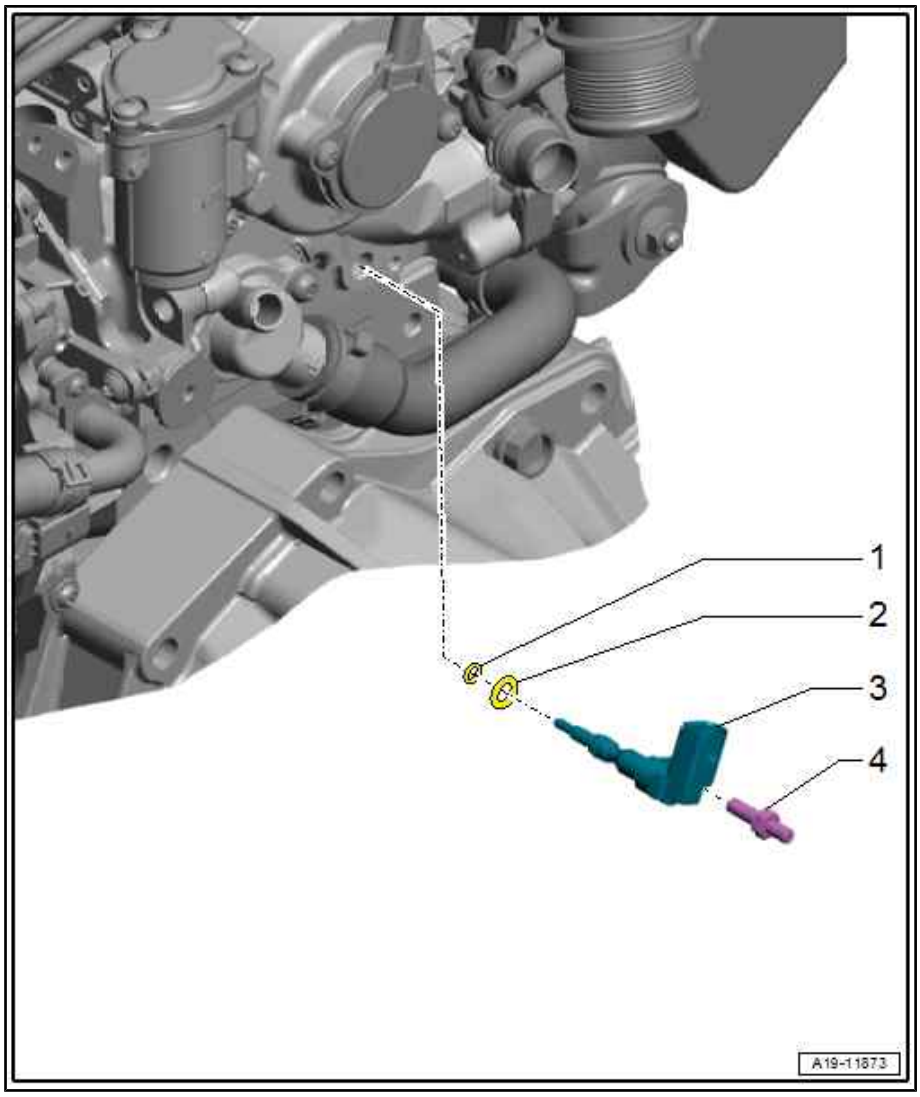
2.3 Exploded view - coolant temperature senders

1 - Spacer ring
- ❑ Renew if damaged

2 - O-ring
- ❑ Renew after removing
- ❑ Lubricate with coolant

3 - Coolant temperature sender - G62-
- ❑ Removing and installing ⇒ page 120

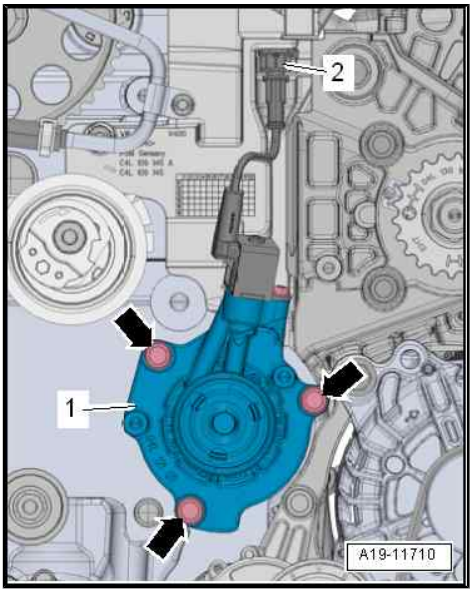
4 - Centre hex stud
- ❑ 8 Nm



2.4 Removing and installing electric coolant pump

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Coolant pump/thermostat assembly; Removing and installing electric coolant pump .

2.5 Removing and installing coolant pump



Removing

– Drain coolant ⇒ page 115 .

– Remove toothed belt ⇒ page 54 .

– Unplug electrical connector -2- and move wiring clear.

– Remove bolts -arrows- and detach coolant pump -1-.

Installing

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

NOTICE

Risk of damage to coolant pump if functional check is performed manually.

– Never pull the modulating mechanism of the coolant pump with your hand to check its function.

- Do not hold or carry the coolant pump by the connector or modulating mechanism.
- Do not operate the modulating mechanism.
- Renew O-rings after removing.
- Do not reuse coolant.

– Clean and smoothen sealing surface for O-ring.

– Lubricate O-ring with coolant.

– Install toothed belt (adjust valve timing) ⇒ page 57 .

– Fill up with coolant ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Cooling system/coolant; Draining and filling cooling system .

Tightening torques

◆ ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 116

2.6 Removing and installing thermostat

Thermostat can only be renewed together with coolant pipe (left-side) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

2.7 Checking thermostat

– Remove thermostat and heat it in a water bath.

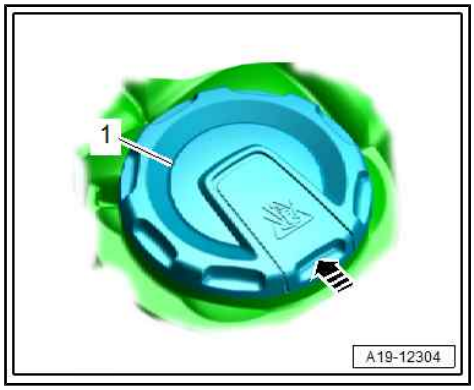
Starts to open	Fully open	Opening travel
87 ± 2 °C	approx. 102 °C[1)]	at least 9 mm
• [1)] Cannot be tested.		

2.8 Removing and installing coolant valve for cylinder head - N489-

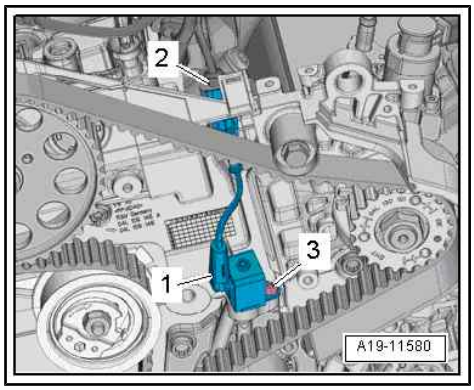
Removing

- Engine cold.

– Relieve residual pressure in cooling system by releasing fastener -arrow- and opening filler cap -1- on coolant expansion tank.



– Close filler cap -arrow- again.
– Remove toothed belt cover (top) ⇒ page 46 .
– Unplug electrical connector -2- and move wiring clear.
– Remove bolt -3- and detach coolant valve for cylinder head - N489- -item 1-.



Installing

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

- Renew O-rings after removing.

– Install toothed belt cover (top) ⇒ page 46 .
– Fill coolant expansion tank and carry out bleeding routine using ⇒ Vehicle diagnostic tester ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Cooling system/coolant; Draining and filling cooling system .

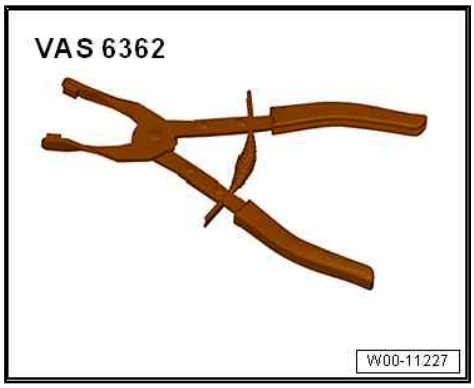
Tightening torques

◆ ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 116

2.9 Removing and installing coolant temperature sender - G62-

Special tools and workshop equipment required

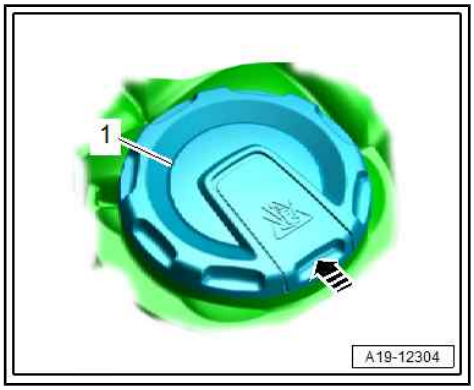
◆ Hose clip pliers - VAS 6362-



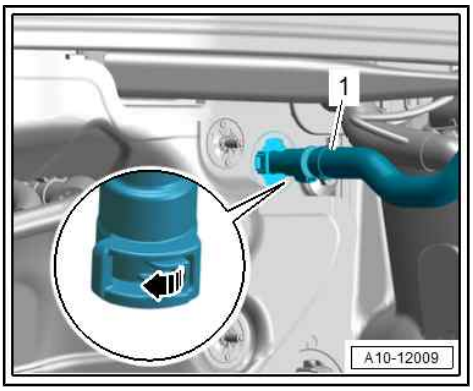
Removing

- Engine cold.

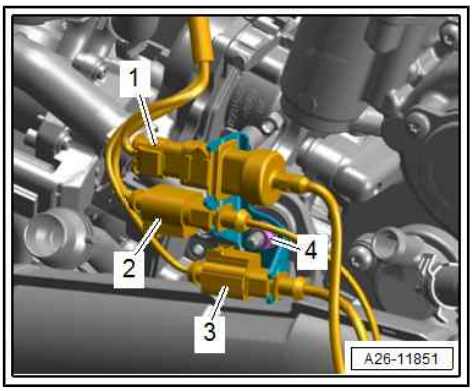
– Relieve residual pressure in cooling system by releasing fastener -arrow- and opening filler cap -1- on coolant expansion tank.
– Close filler cap -arrow- again.
– Remove engine cover panel ⇒ page 13 .



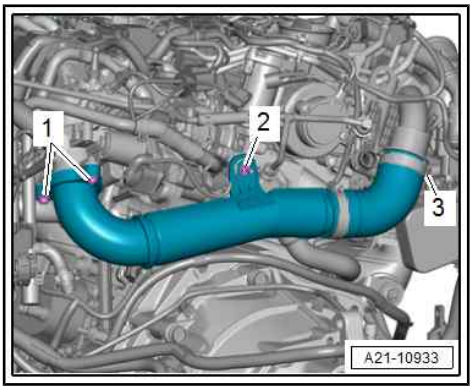
– Release fastener -arrow- and disconnect vacuum hose -1-, taking care not to damage it.



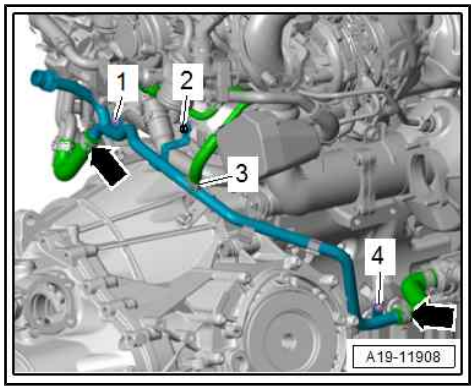
– Remove nut -4- and move bracket with electrical connectors -1, 2, 3- to one side.



– Remove bolts -1- and centre hex stud -2-.
– Release hose clip -3- and detach air pipe.
– Remove support mounting (right-side) ⇒ 4-cyl. TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Removing and installing engine mountings .

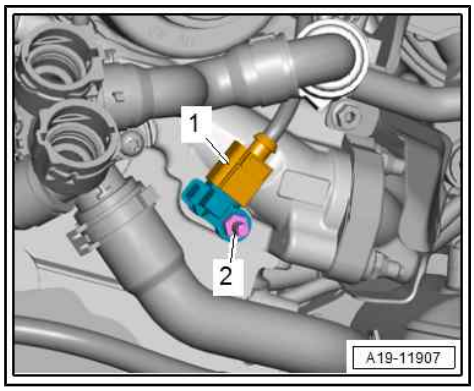


– Unscrew bolts -1, 4- and nut -2- and push coolant pipe (rear) slightly to right side.



– Unplug electrical connector -1-.

– Unscrew centre hex stud -2- and pull off coolant temperature sender - G62- .



Note:

If an O-ring or spacer ring remains lodged in cylinder head, lift it out with a piece of wire, taking care not to damage sealing surface.

Installing

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

- Renew O-rings after removing.
- Renew spacer ring if damaged.
- Before fitting, check vacuum hoses for damage and renew if necessary.
- Do not reuse coolant.

– Install support mounting ⇒ 4-cyl. TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Removing and installing engine mountings .

– Fill coolant expansion tank and carry out bleeding routine using ⇒ Vehicle diagnostic tester ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Cooling system/coolant; Draining and filling cooling system .

Tightening torques

- ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Exploded view - coolant pipes
- ⇒ “2.1 Exploded view - charge air system”, page 138
- ⇒ “2.2 Exploded view - hose connections for charge air system”, page 140

3 Coolant pipes

All procedures and components are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes .

4 Radiator/radiator fans

All procedures and components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Radiator/radiator fans .

21 – Turbocharging/supercharging

1 Turbocharger

⇒ “1.1 Exploded view - turbocharger”, page 125

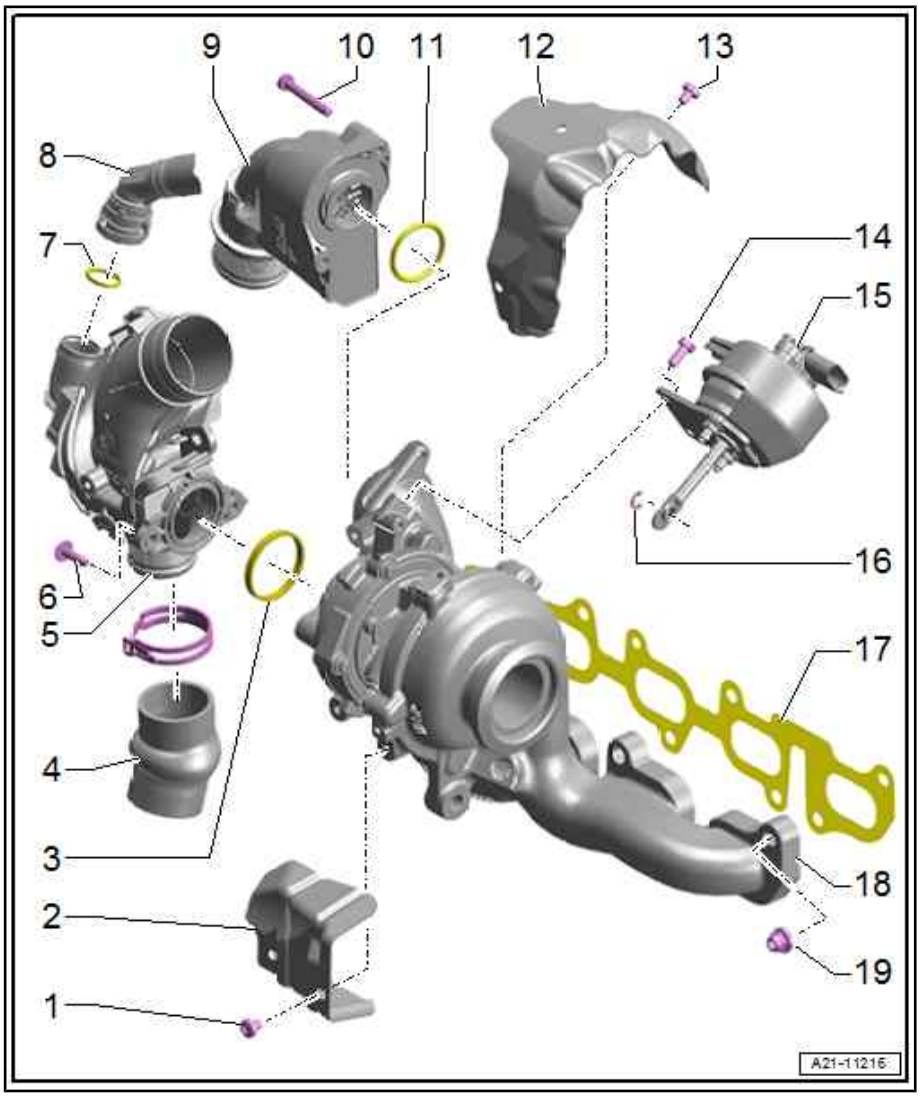
⇒ “1.2 Removing and installing turbocharger”, page 128

⇒ “1.3 Renewing vacuum unit for turbocharger”, page 132

1.1 Exploded view - turbocharger

Part I

Part II ⇒ page 126



1 - Bolt
- ❑ 15 Nm

2 - Heat shield

3 - Seal
- ❑ Renew after removing

4 - Air hose

5 - Intake connecting pipe

6 - Bolt
- ❑ 8 Nm

7 - O-ring
- ❑ Renew after removing

8 - Hose
- ❑ For crankcase breather
- ❑ Press release tabs on both sides to detach

9 - Pulsation damper

10 - Bolt
- ❑ 8 Nm

11 - O-ring
- ❑ Renew after removing

12 - Heat shield

13 - Bolt
- ❑ Renew
- ❑ 15 Nm

14 - Bolt
- ❑ Tightening torque ⇒ “1.3 Renewing vacuum unit for turbocharger”, page 132

15 - Vacuum unit for turbocharger
- ❑ Renewing ⇒ “1.3 Renewing vacuum unit for turbocharger”, page 132

16 - Securing clip
- ❑ Renew after removing

17 - Gasket

- ❑ Renew after removing

18 - Turbocharger

- ❑ Adaption must be performed after renewing this component
- ❑ Select `01 - Engine electronics, functions` and perform Guided Function `01 - Functions, engine mechanics`
- ❑ Removing and installing ⇒ page 128

19 - Nut

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 128
- ❑ Lubricate exhaust manifold studs with high-temperature paste
- ❑ If studs are renewed, too, tighten them to 15 Nm

Part II

Part I ⇒ page 125

1 - Gasket

- ❑ Renew after removing

2 - Seals

- ❑ Renew after removing

3 - Banjo bolt

- ❑ 30 Nm

4 - Oil supply line

- ❑ Check for obstructions
- ❑ Before installing turbocharger, fill connection for oil supply line with engine oil

5 - Bolt

- ❑ 20 Nm

6 - Union nut

- ❑ 16 Nm

7 - Exhaust gas temperature sender 1 - G235-

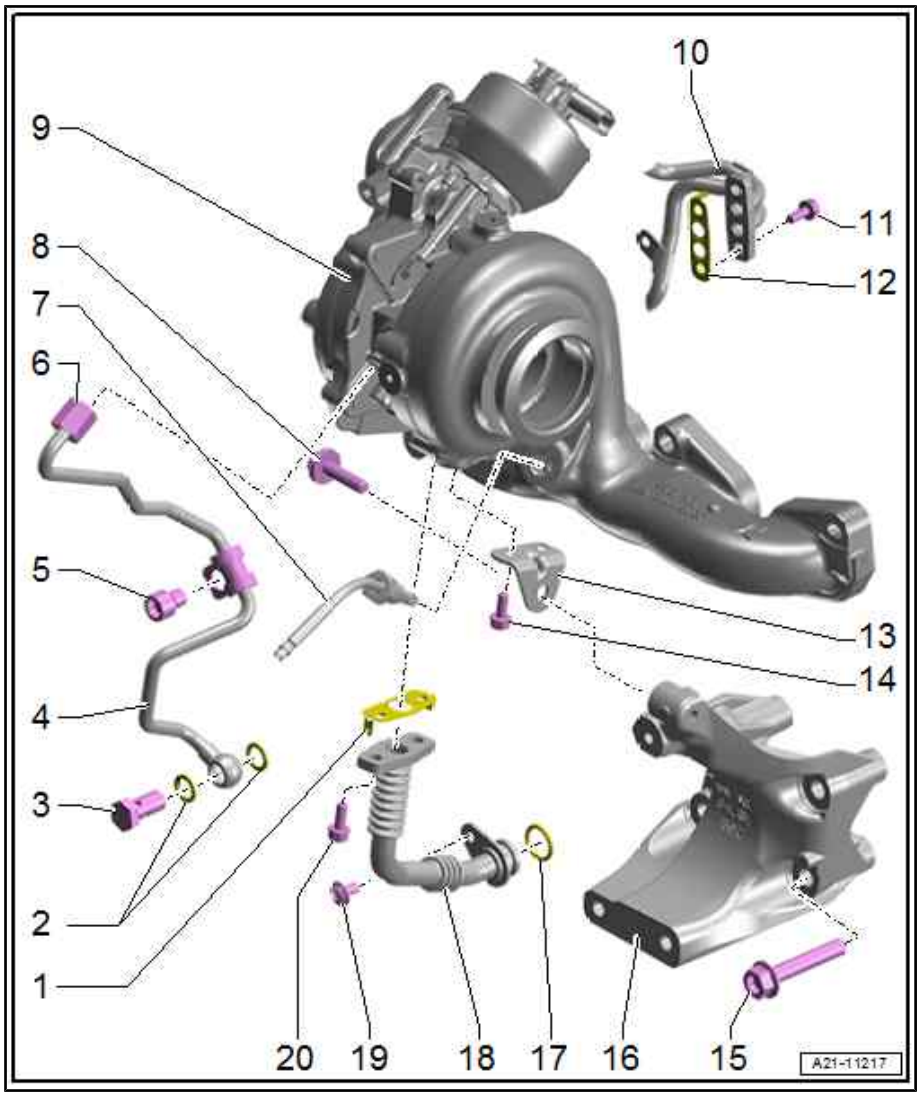
- ❑ Exploded view ⇒ page 221

8 - Bolt

- ❑ Tightening torque and sequence ⇒ page 127

9 - Turbocharger

- ❑ Adaption must be performed after renewing this component
- ❑ Select `01 - Engine electronics, functions` and perform Guided Function `01 - Functions, engine mechanics`
- ❑ Removing and installing ⇒ page 128



10 - Coolant lines

11 - Bolt

- ❑ 8 Nm

12 - Gasket

- ❑ Renew after removing

13 - Bracket

- ❑ For turbocharger

14 - Bolt

- ❑ 8 Nm

15 - Bolt

- ❑ Tightening torque and sequence ⇒ page 127

16 - Bracket

- ❑ For emission control module

17 - O-ring

- ❑ Renew after removing

18 - Oil return line

19 - Bolt

- ❑ 10 Nm

20 - Ribbed bolt

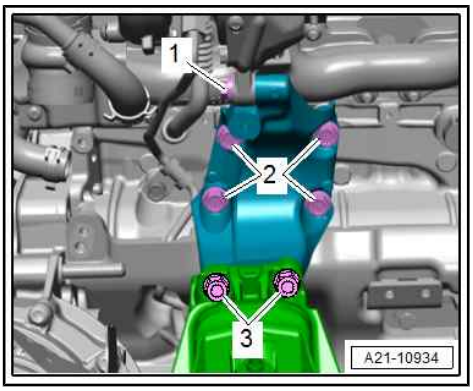
- ❑ 14 Nm

Bracket for emission control module - tightening torque and tightening sequence

– Fit bracket in correct installation position.

– Tighten bolts in stages in the sequence described:

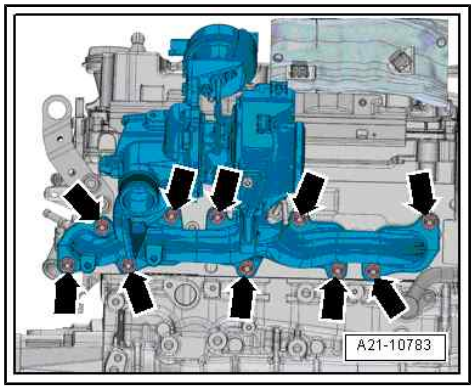
Stage	Bolts	Tightening torque
1.	-1, 2, 3-	Screw in by hand until contact is made
2.	-1-	20 Nm
3.	-2-	40 Nm
4.	-3-	⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Exploded view - assembly mountings



Turbocharger - tightening torque and sequence

– Tighten nuts in stages in the sequence given:

Stage	Nuts	Tightening torque
1.	-arrows-	Tighten to 11 Nm in diagonal sequence, working from centre outwards
2.	-arrows-	Tighten to 22 Nm in diagonal sequence, working from centre outwards
3.	-arrows-	Tighten to 22 Nm in diagonal sequence, working from centre outwards • This procedure has been specified in order to compensate for the settling of the components.



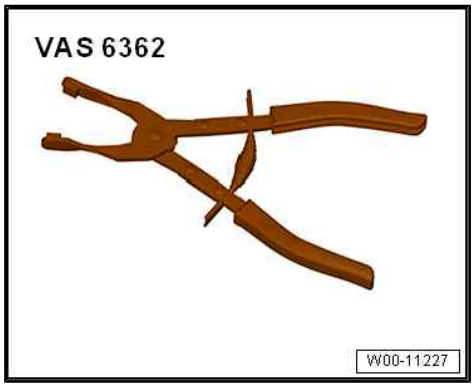
1.2 Removing and installing turbocharger

If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

- Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.
- Check the entire charge air system (including the charge air cooler) for foreign matter.
- If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler if necessary.

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



♦ Bit XZN 10 - T10501-

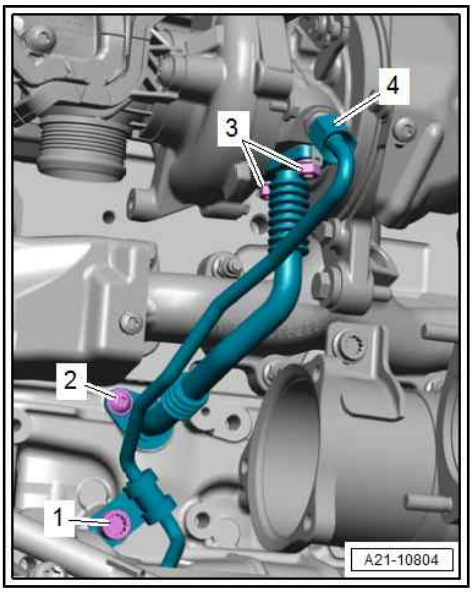
Removing

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

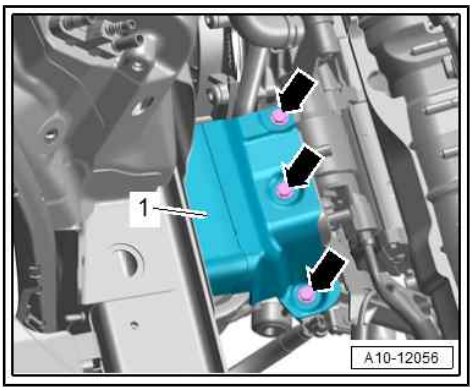
– Remove emission control module ⇒ page 205 .

– Unscrew bolt -1- and union nut -4-.

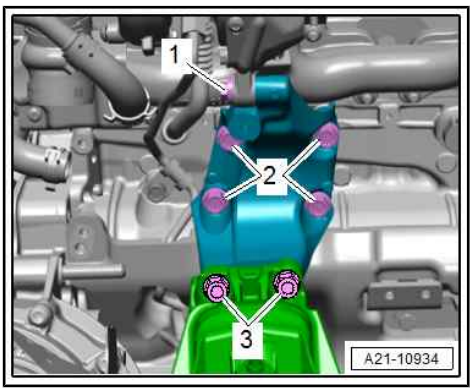
– Unscrew bolts -2 and 3- and detach oil return line.



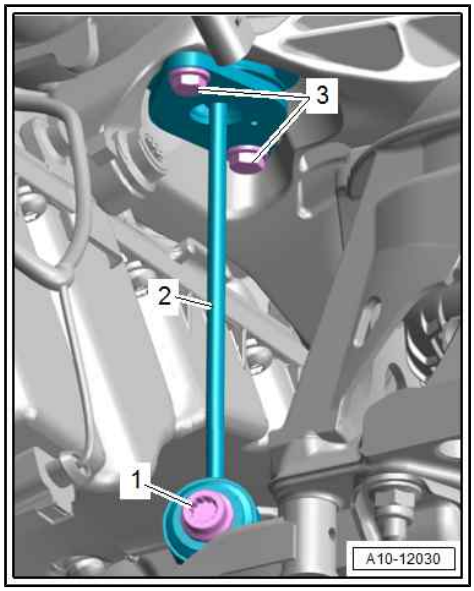
– Remove bolts -arrows- and detach heat shield -1-.



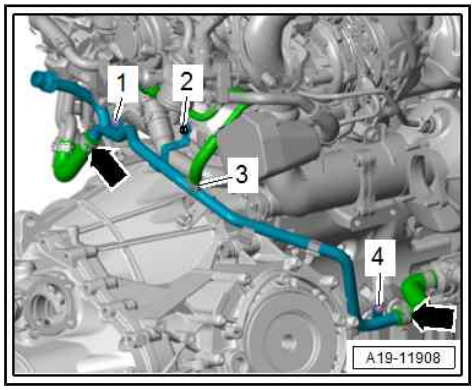
– Unbolt bracket for emission control module. To do so, remove bolts -1, 2, 3- (bracket is detached later).



– Unscrew bolts -1, 3- and detach support mounting -2-.



– Unscrew bolt -4- from coolant pipe.

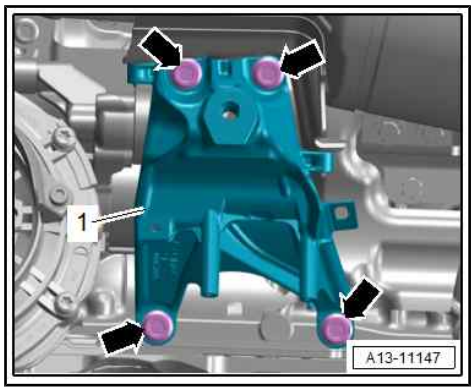


– Unscrew the two bolts -bottom arrows- for the engine support -1- by a few turns only; do not remove them.

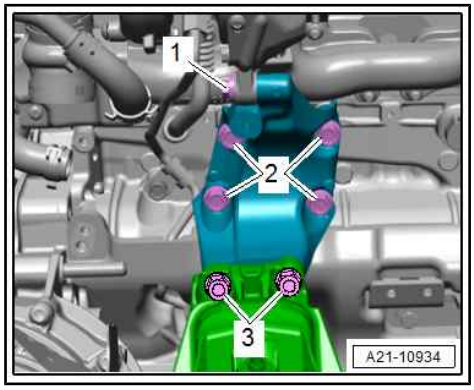
Note:

Press coolant pipe to side to loosen bolts.

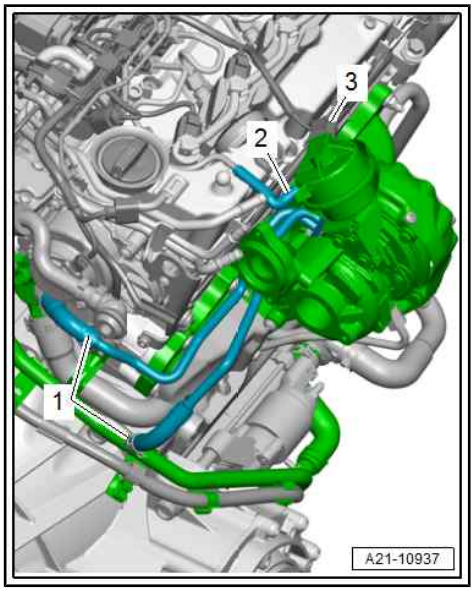
The two bolts -top arrows- have already been removed.



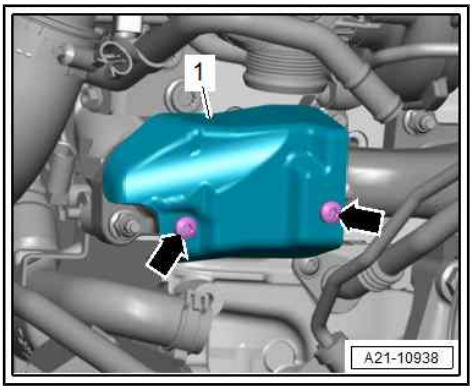
– Detach bracket for emission control module towards front.



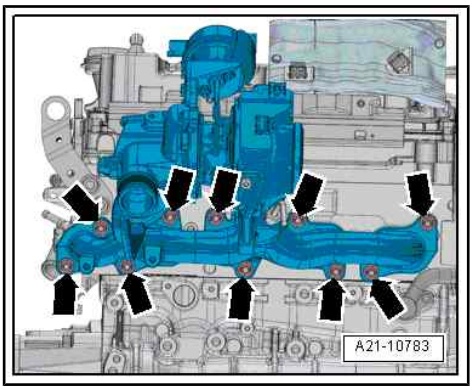
– Unplug electrical connector -3-.
– Being careful not to damage it, detach vacuum hose -2-.
– Release hose clips -1- and disconnect coolant hoses.



– Remove bolts -arrows- and detach heat shield -1-.
– Mask suspension turret (right-side) with adhesive tape to avoid damaging suspension turret when lifting out turbocharger.



– Remove nuts -arrows-.
– Detach turbocharger with exhaust manifold from cylinder head (pay attention to oil supply line).



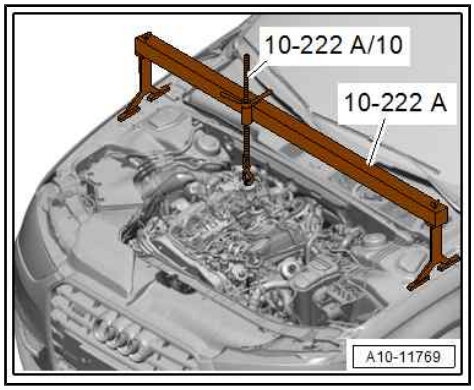
NOTICE

Risk of damage to oil supply line.

– Do not bend oil supply line.

Note

If necessary, use hook - 10 - 222 A /10- to lift engine by approx. 25 mm.



Installing

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

- Renew gaskets, seals, O-rings and self-locking nuts after removal.
- Fill turbocharger with engine oil at connection for oil supply line.
- Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Before fitting, check vacuum hoses for damage and renew if necessary.
- After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install emission control module ⇒ page 205 .

– Connect vacuum hose ⇒ page 149 .

– If turbocharger has been renewed, perform adaptions listed in `Guided Function` `01 - Functions component replacement` ⇒ Vehicle diagnostic tester.

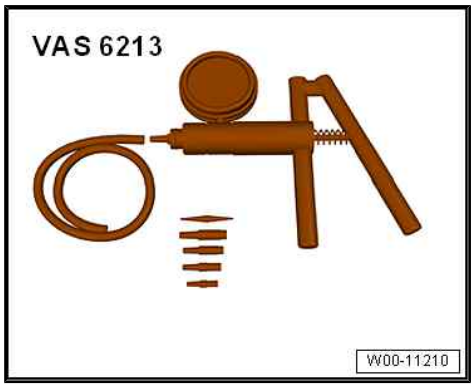
Tightening torques

- ⇒ Fig. ""Turbocharger - tightening torque and sequence"" , page 128
- ⇒ "1.1 Exploded view - turbocharger", page 125
- ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Exploded view - assembly mountings

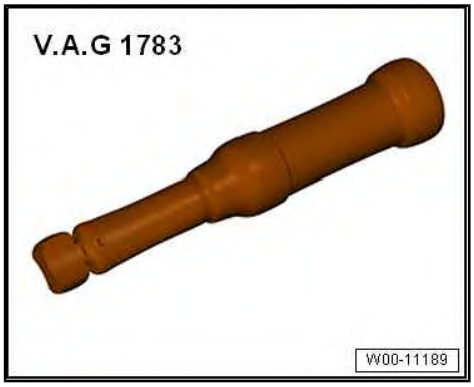
1.3 Renewing vacuum unit for turbocharger

Special tools and workshop equipment required

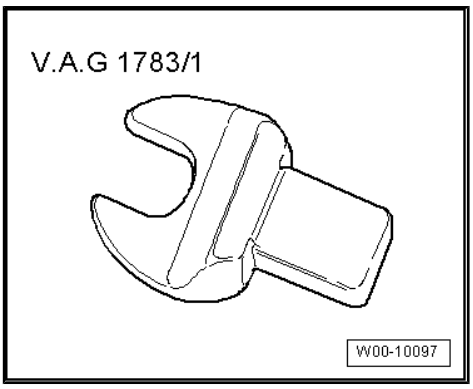
- Vehicle diagnostic tester
- Hand vacuum pump - VAS 6213-



♦ Torque wrench - V.A.G 1783-

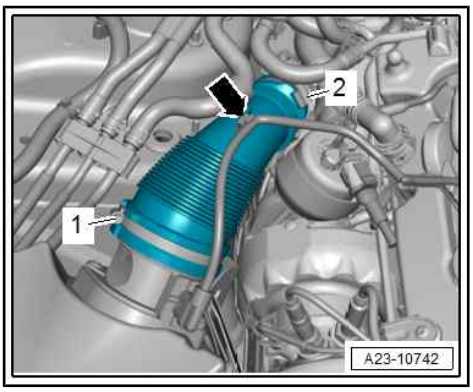


♦ Open-end spanner insert AF 10 - V.A.G 1783/1-

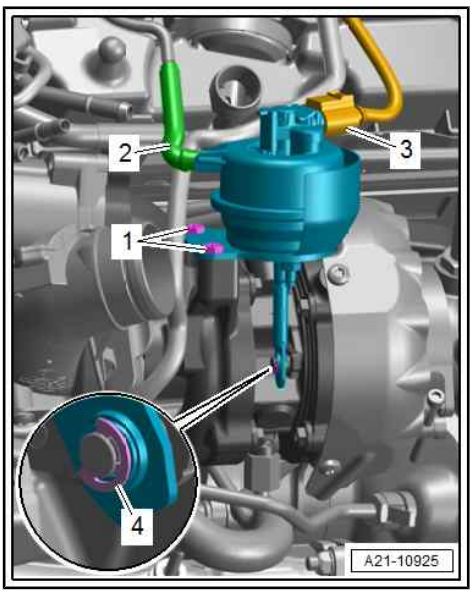


Removing

– Remove engine cover panel ⇒ page 13 .
– Unclip fuel lines from air hose.
– Release hose clips -1, 2- and detach air hose.



– Unplug electrical connector -3- at position sender for charge pressure positioner - G581- .
– Detach vacuum hose -2- from vacuum unit of turbocharger, making sure not to damage it.
– Remove circlip -4-.
– Remove bolts -1- for vacuum unit.
– Disengage control rod at adjusting lever and detach vacuum unit.



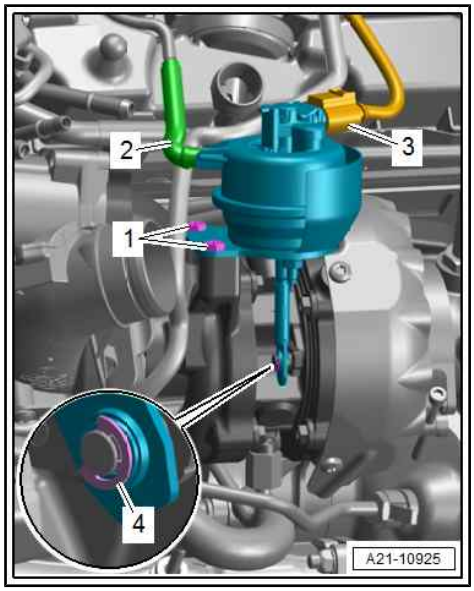
Installing

- Use new bolts and a new circlip from the repair kit.

– Attach control rod at adjusting lever, position vacuum unit and tighten bolts -1- to 10 Nm.

- Do not insert circlip -4- at adjusting lever yet.

– Plug in electrical connector -3- at position sender for charge pressure positioner - G581- .

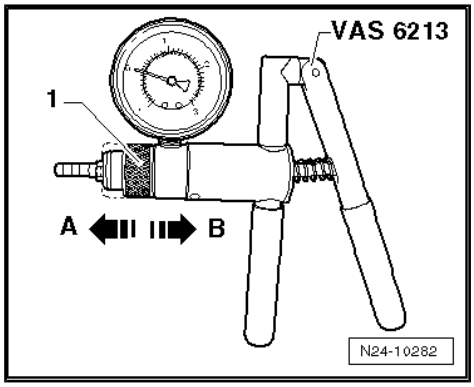


Checking adjustment of vacuum unit

– Use ⇒ Vehicle diagnostic tester.

– From the list in `Self-diagnosis` under `Measured values`, select `Turbine actuator 1 bank 1, position feedback, raw voltage`.

– Move adjuster ring -1- on hand vacuum pump - VAS 6213- to position -A- to select “vacuum”.

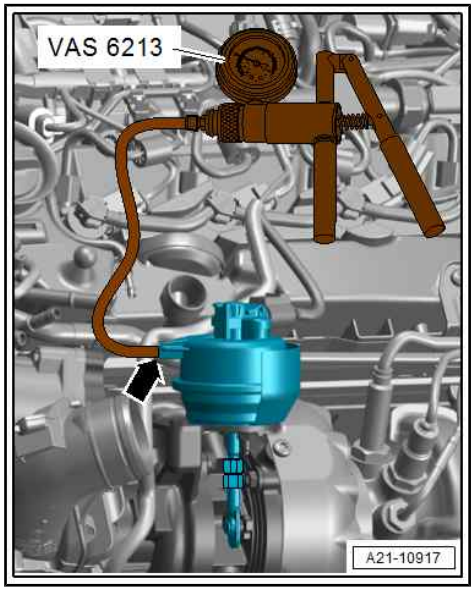


– Connect hand vacuum pump - VAS 6213- to vacuum unit -arrow-.

NOTICE

Risk of damage to vacuum unit on account of excessive vacuum.

– Vacuum must NOT exceed -800 mbar.

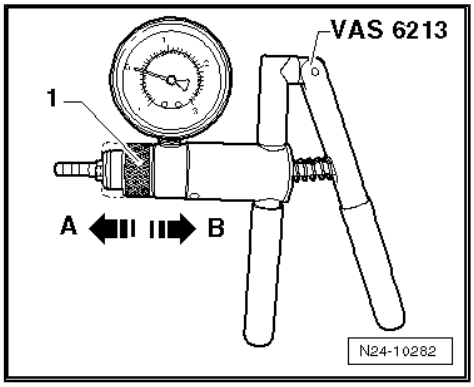


– Operate hand vacuum pump - VAS 6213- until a vacuum between -650 ... -700 mbar is displayed on pressure gauge.

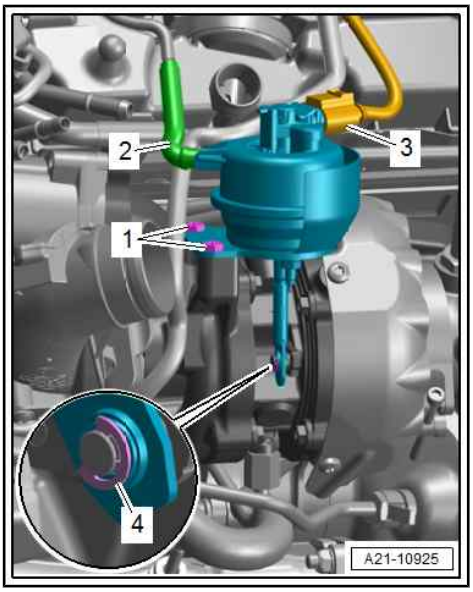
◆ Specification: 0.75 ± 0.05 V

If specification is obtained:

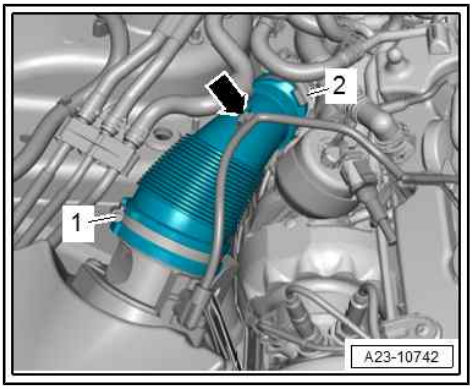
– Move adjuster ring -1- on hand vacuum pump - VAS 6213- to position -B- to vent vacuum in vacuum unit to ambient pressure.



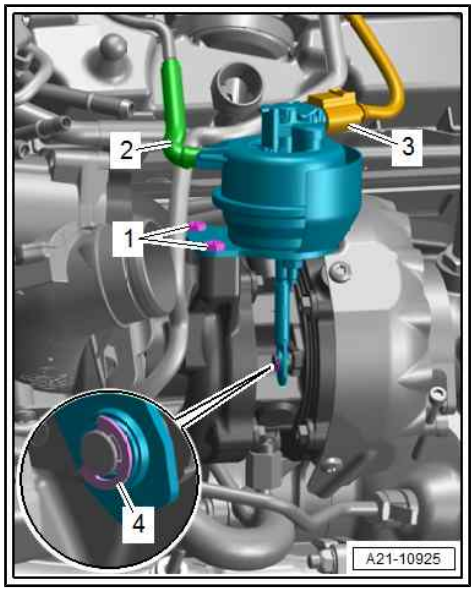
– Fit circlip -4-.



– Install air hose; to do so, tighten hose clips -1, 2- and clip fuel lines into place.

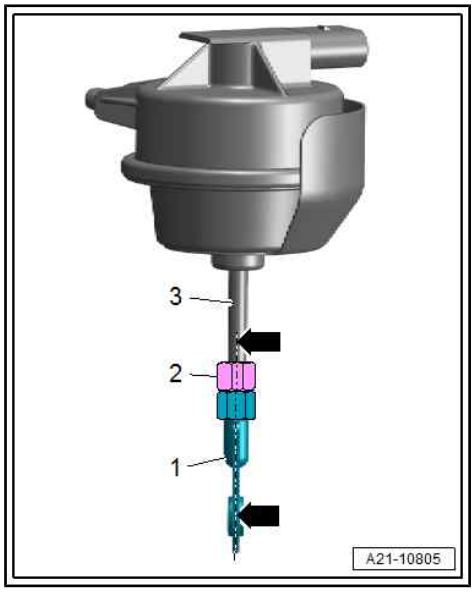


– Plug in electrical connector -3- at position sender for charge pressure positioner - G581- .
– Attach vacuum hose -2- to vacuum unit of turbocharger.
– Perform adaption ⇒ page 136 .



If specification is not obtained:

– Mark position of grommet -1- in relation to control rod -3- for re-installation -arrows-.
– Remove vacuum unit again.
– Loosen union nut -2- on control rod and extend or retract rod as appropriate.
• 180 degrees (half a turn) corresponds to 0.05 volts.
• If specification is too high, extend rod.
– Tighten lock nut to 7.5 Nm, noting position of grommet -1- according to the marking made previously.
– Install vacuum unit; engage control rod on adjusting lever to do so.



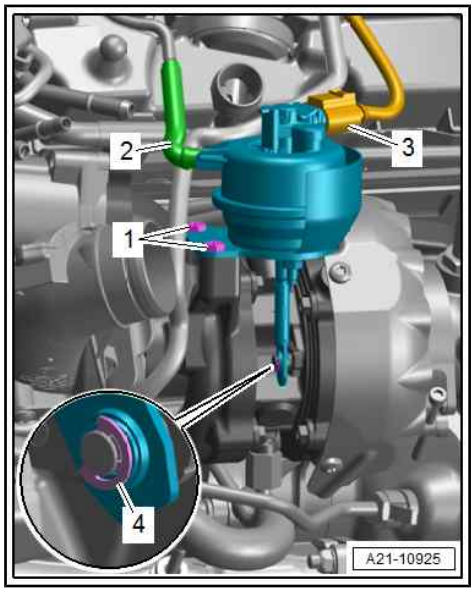
– Tighten bolts -1- for vacuum unit to 10 Nm.
– Then check adjustment of vacuum unit again ⇒ page 134 .

Performing adaption

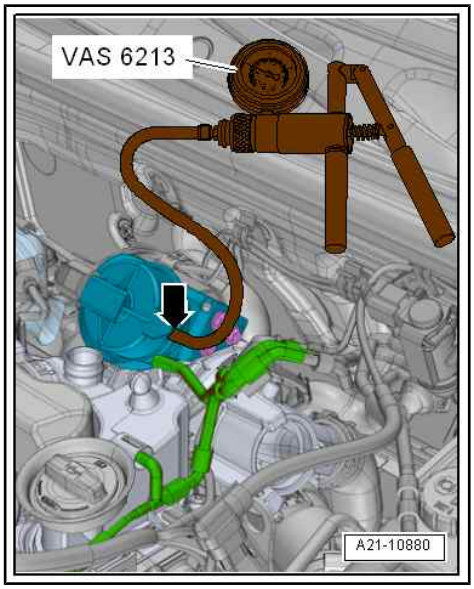
– Switch to `Guided Functions` and select `01 - Adaption after replacing positioner`.
– Perform adaption.

Check voltage value again after adaption.

– Switch to `Self-diagnosis` and in the list under `Measured values`, select `Turbine actuator 1 bank 1, position feedback, raw voltage`.



– Connect hand vacuum pump - VAS 6213- to vacuum unit -arrow-.



NOTICE

Risk of damage to vacuum unit on account of excessive vacuum.

– Vacuum must NOT exceed -800 mbar.

– Operate hand vacuum pump - VAS 6213- until a vacuum between -650 ... -700 mbar is displayed on pressure gauge.

– A voltage of 0.75 ± 0.05 V should now be shown in the `Measured values` display zone.

Voltage value not OK

– Adjust voltage value again ⇒ page 136 .

Voltage value OK

• Before fitting, check vacuum hoses for damage and renew if necessary.

– Attach vacuum hose to vacuum unit of turbocharger.

– Fit circlip.

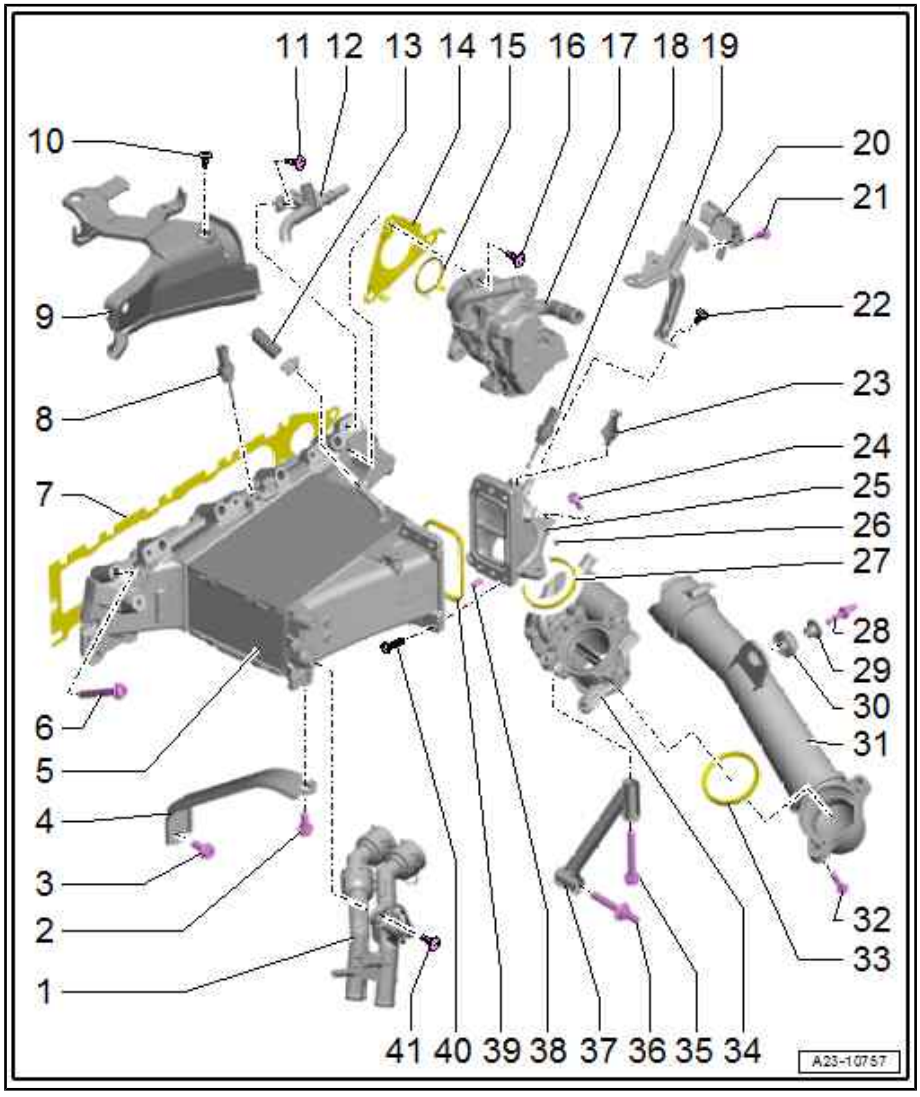
– Secure bolts and union nut on control rod with sealing paint.

– Install engine cover panel ⇒ page 13 .

– Erase all event memories ⇒ Vehicle diagnostic tester.

2 Charge air system

2.1 Exploded view - charge air system



1 - Coolant connection

2 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

3 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

4 - Bracket

- ❑ For intake manifold

5 - Intake manifold with charge air cooler

- ❑ Intake manifold and charge air cooler are combined as one unit
- ❑ Removing and installing ⇒ page 155

6 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

7 - Gasket

- ❑ Renew after removing

8 - Charge air temperature sender after charge air cooler - G811-

- ❑ Removing and installing ⇒ page 141
- ❑ 22 Nm

9 - Bracket

- ❑ For electrical wiring harness
- ❑ Different versions depending on model

10 - Bolt

- ❑ Tightening torque ⇒ Item 10 (page 151)

11 - Bolt

- ❑ Tightening torque ⇒ Item 11 (page 151)

12 - Vacuum line

- ❑ Leading from vacuum pump

13 - Coolant hose

- ❑ A plug may be fitted depending on version

14 - Gasket

- ❑ Renew after removing

15 - Gasket

- ❑ Renew after removing

16 - Bolt

- ❑ Tightening torque ⇒ Item 1 (page 228)

17 - Exhaust gas recirculation control motor - V338-

- ❑ Removing and installing ⇒ page 230

18 - Charge air temperature sender before charge air cooler - G810-

- ❑ 22 Nm
- ❑ Removing and installing ⇒ page 141

19 - Bracket

- ❑ For charge pressure sender - G31-

20 - Charge pressure sender - G31-

- ❑ Removing and installing ⇒ page 141

21 - Bolt

- ❑ 8 Nm

22 - Bolt

- ❑ 8 Nm

23 - Ball stud

- ❑ For engine cover panel

24 - Bolt

- ❑ Tightening torque ⇒ Item 24 (page 152)

25 - Connection

- ❑ For throttle valve module - J338-

26 - Dowel pin

27 - Seal

- ❑ Check for damage and renew if necessary

28 - Centre hex stud

- ❑ 8 Nm

29 - Spacer sleeve

30 - Rubber buffer

31 - Air pipe

32 - Bolt

- ❑ 8 Nm

33 - Seal

- ❑ Check for damage and renew if necessary

34 - Throttle valve module - J338-

- ❑ Removing and installing ⇒ page 153

35 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

36 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

37 - Bracket

- ❑ For throttle valve module - J338-

38 - Dowel pin

39 - Gasket

- ❑ Renew after removing

40 - Bolt

- ❑ Tightening torque ⇒ Item 40 (page 153)

41 - Bolt

- ❑ Tightening torque ⇒ Item 41 (page 153)

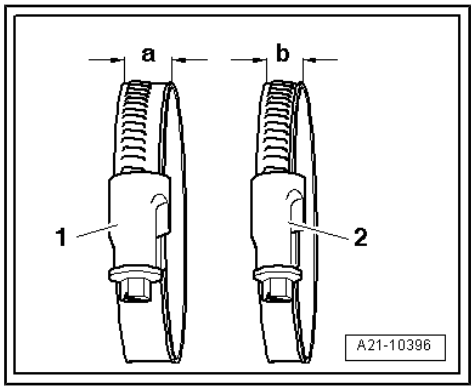
2.2 Exploded view - hose connections for charge air system

- Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- If using used hose clips to secure the air hoses at their connections, spray rust remover onto the worm threads before installing.

Tightening torque for

1 - Hose clip with width -a- = 13 mm: 5.5 Nm

2 - Hose clip with width -b- = 9 mm: 3.4 Nm

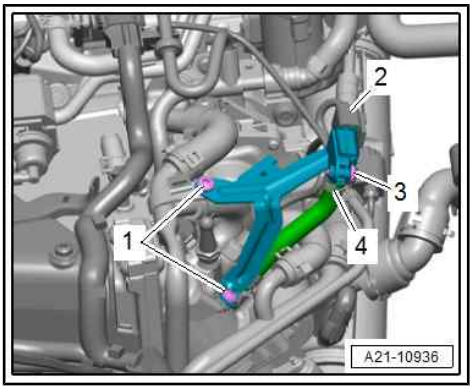


2.3 Removing and installing charge pressure sender - G31-

Removing

– Remove engine cover panel ⇒ page 13 .

– Unplug electrical connector -2-.



NOTICE

Irreparable damage to charge pressure sender can be caused if the connection breaks off.

– Carefully disconnect hose from connection, taking care to keep hose straight.

– Remove bolt -1-.

– Detach bracket together with charge pressure sender - G31- , release hose clip at connection and disconnect hose.

Installing

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

– Install engine cover panel ⇒ page 13 .

Tightening torques

◆ ⇒ “2.1 Exploded view - charge air system”, page 138

2.4 Removing and installing charge air temperature sender

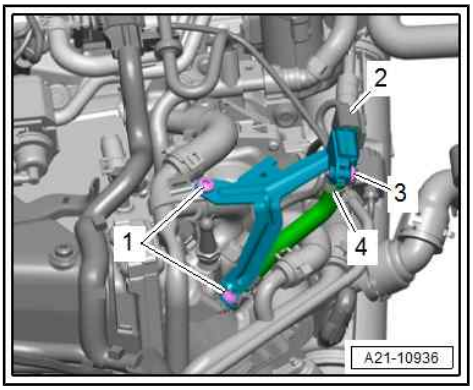
Removing

– Remove engine cover panel ⇒ page 13 .

Charge air temperature sender before charge air cooler - G810-

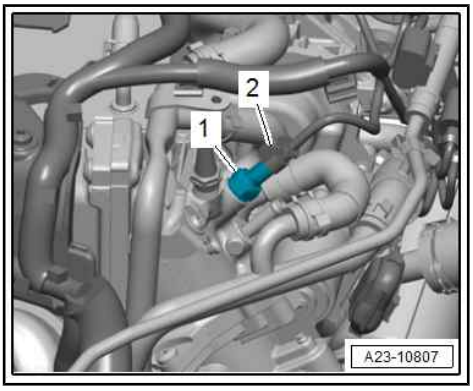
– Unplug electrical connector -2-.

– Remove bolts -1- and press charge pressure sender - G31- with bracket to side.

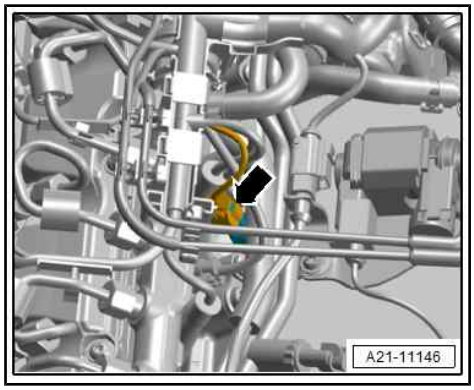


– Unplug electrical connector -2-.

– Unscrew charge air temperature sender before charge air cooler - G810- -item 1-.



Charge air temperature sender after charge air cooler - G811-



– Press coolant hose slightly to one side.
– Unplug electrical connector -arrow-.
– Unscrew charge air temperature sender after charge air cooler - G811- .

Installing

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

– Install engine cover panel ⇒ page 13 .

Tightening torques

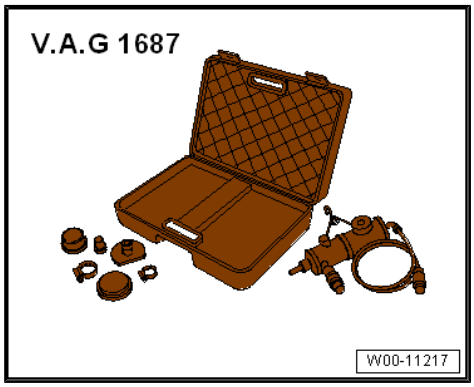
♦ ⇒ “2.1 Exploded view - charge air system”, page 138

2.5 Checking charge air system for leaks

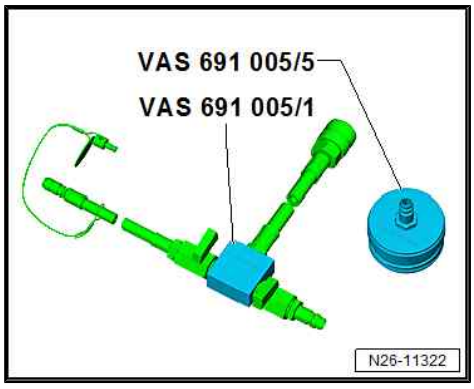
Water-cooled charge air cooler is integrated in intake manifold (combined as one part).

Special tools and workshop equipment required

♦ Charge air system tester - V.A.G 1687-

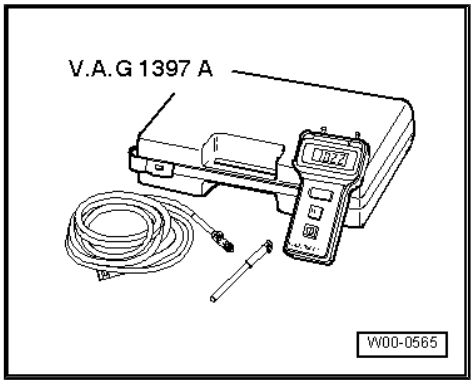


♦ Adapter - V.A.G 1687/11-
♦ Adapter - V.A.G 1687/15- for exhaust pipes with 60 mm and 65 mm diameter
♦ Adapter - V.A.G 1687/16- for exhaust pipe with 55 mm diameter
♦ Y-connector - VAS 691 005/1-



♦ Test instrument adapter - VAS 691 005/5-

♦ Turbocharger tester - V.A.G 1397A-



Procedure

– Remove engine cover panel ⇒ page 13 .

Connecting turbocharger tester - V.A.G 1397A- :

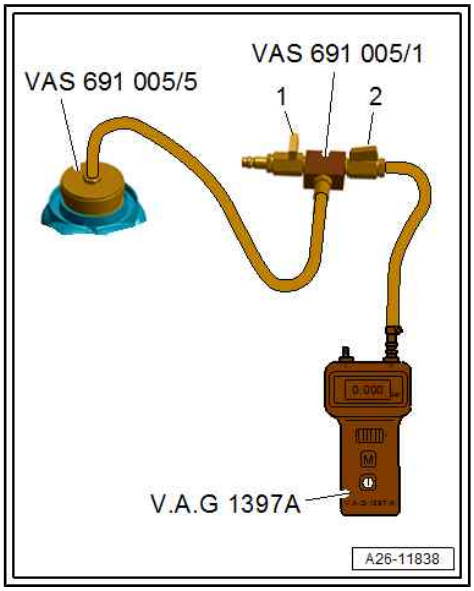
– Fit test adapter - VAS 691 005/5- onto coolant expansion tank.

– Fit Y-connector - VAS 691 005/1- onto test adapter - VAS 691 005/5- .

– Close valve -1- for connection »C« and open valve -2- for connection »A«.

– Attach hose from connection »A« on Y-connector to connection »II« on turbocharger tester - V.A.G 1397A- .

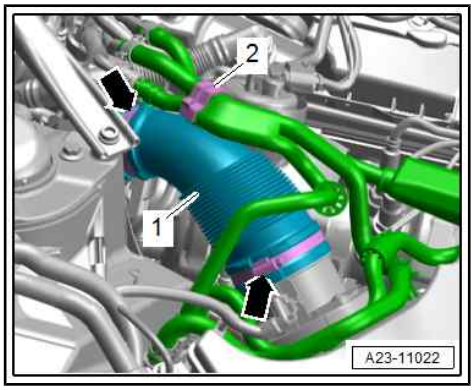
– Set turbocharger tester - V.A.G 1397A- to switch position »II« (relative pressure measurement) and switch it on. The »II« must be visible.



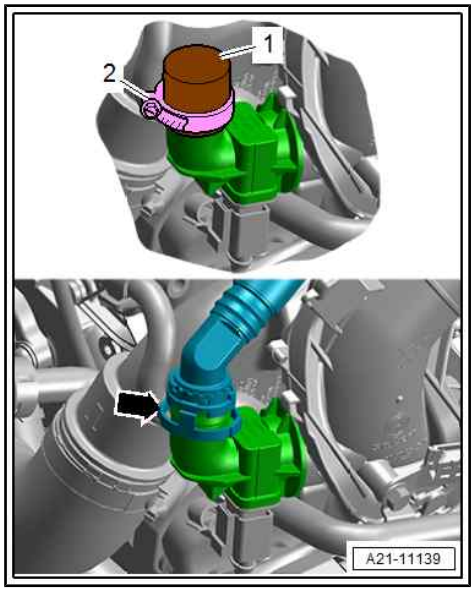
Connecting tester - V.A.G 1687- :

– Move coolant hose clear at retaining clip -2-.

– Release hose clips -arrows- and detach air pipe -1-.

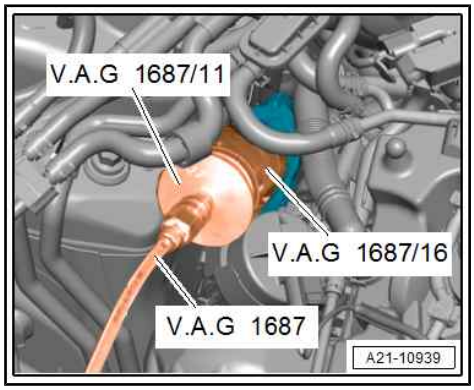


– Disconnect crankcase breather pipe -arrow-.
– Seal off connecting piece with a plug -1- from engine bung set - VAS 6122- .
– Secure plug with a hose clip -2-.

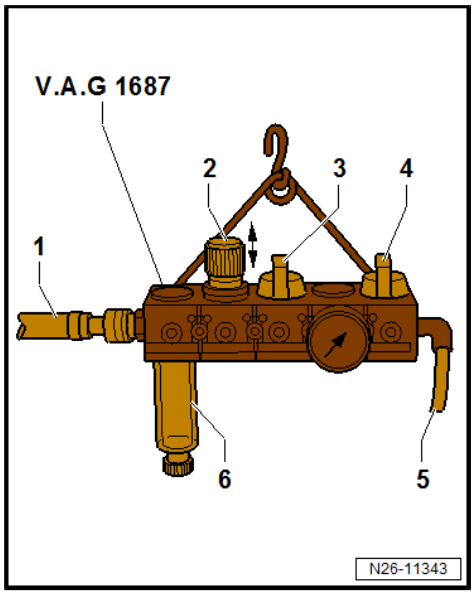


– Connect adapter - V.A.G 1687/11- with adapter - V.A.G 1687/16- to turbocharger.

Prepare charge air system tester - V.A.G 1687- as follows:



– Connect charge air system tester - V.A.G 1687- to adapter.
– Pull pressure control valve -2- upwards, then unscrew completely and close valves -3- and -4-.
– Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.
– If there is water in sight glass, remove drain plug -6- and drain water.
– Open valve -3-.



NOTICE

Risk of damage if pressure is set too high.

– The pressure must not exceed 0.5 bar.

– Adjust pressure to 0.5 bar via pressure control valve -2-.

– Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.

• A small amount of air escapes through the valves and enters the engine and the exhaust gas recirculation cooler. Therefore it is not possible to perform a pressure retention test.

• For operation of ultrasonic tester -V.A.G 1842- , refer to ⇒ Operating instructions .

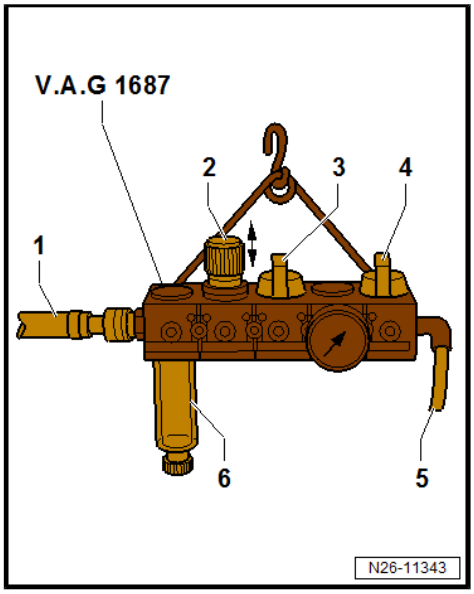
– Check entire charge air system for leaks:

♦ By listening

♦ By feeling

♦ Using a commercially available leak detection spray

If no leak is found in the charge air system, check water-cooled charge air cooler for leaks.



Reading off values from turbocharger tester - V.A.G 1397A- :

– Pressure must remain set to 0.5 bar.

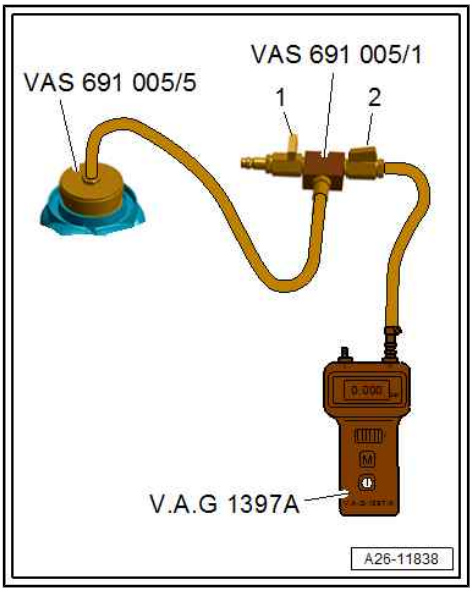
• Observe turbocharger tester for approx. 5 minutes.

• The pressure displayed on the turbocharger tester must not rise.

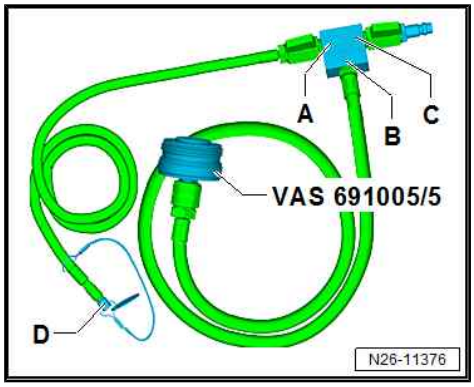
– If pressure displayed on turbocharger tester rises, this means that compressed air is escaping into the cooling system.

– Charge air cooler has a leak, renew intake manifold with charge air cooler.

• If there are no leaks in the charge air cooler, a vacuum may form when the coolant cools down. A minus sign on the turbocharger tester indicates that a vacuum has formed.



Cleaning Y-connector - VAS 691 005/1- :



- After the leak test has been completed, the Y-connector - VAS 691 005/1- must be cleaned to remove any water which may have entered.

– Insert cleaning nozzle -D- in hose from connection -A- on Y connector .

– Fit test adapter - VAS 691 005/5- onto hose from connection -B-.

– Fit compressed air hose on connection -C-.

– Open cut-off valves and blow through hose for approx. 15 seconds.

– Release pressure in test circuit by detaching hose coupling from adapter before removing adapter.

Attaching

Assembly is performed in reverse sequence; note the following:

– Install engine cover panel ⇒ page 13 .

Tightening torques

◆ ⇒ “2.2 Exploded view - hose connections for charge air system”, page 140

23 – Mixture preparation - injection

1 Injection system

1.1 Overview - fuel system

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Injection system; Overview - fuel system .

1.2 Overview of fitting locations - injection system

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Injection system; Overview of fitting locations - injection system .

1.3 Filling and bleeding fuel system

Special tools and workshop equipment required

- Vehicle diagnostic tester

If components of the fuel system between the fuel tank and the high-pressure pump are removed or renewed, the fuel system must be bled.

Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

– Never allow fuel pump to run while it is empty.

– Fill/bleed fuel pump.

Proceed as follows to fill high-pressure pump with fuel.

• Check fuel gauge in instrument cluster; fuel gauge needle must indicate that fuel is above reserve level.

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`

- ♦ `Activate fuel pump`
- ♦ Press `Carry out check`
- ♦ Select 120 seconds.

– The fuel pump must run for 120 seconds to ensure that the fuel system is filled sufficiently with fuel.

– Start engine after filling fuel system.

– Run engine at moderate speed for several minutes and then switch off.

– Check fuel system for leaks.

– Erase entry in event memory.

– Road-test vehicle and accelerate with full throttle at least once.

– Then check high-pressure system again for leaks.

1.4 Checking fuel system for leaks

Procedure

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

– Check complete fuel system for leaks.

– If leaks are found although the connections have been tightened to the correct torque, the relevant component must be renewed.

– Road-test vehicle and accelerate with full throttle at least once.

– Then check high-pressure system again for leaks.

2 Vacuum system

⇒ "2.1 Connection diagram - vacuum system", page 149

⇒ "2.2 Checking vacuum system", page 149

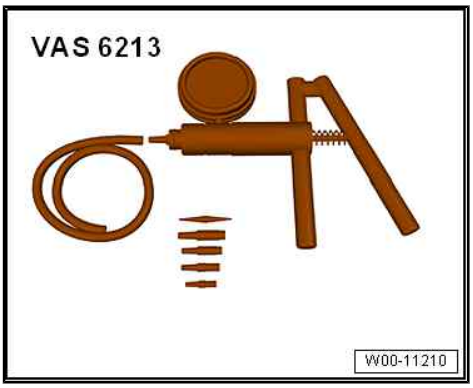
2.1 Connection diagram - vacuum system

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Vacuum system; Connection diagram - vacuum system .

2.2 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Porous or leaking lines

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If an entry is stored in the event memory, check all vacuum lines leading to the corresponding component and also check the remaining vacuum lines leading to other components.

– If it is not possible to build up a vacuum with the hand vacuum pump - VAS 6213- or if the vacuum pressure drops again immediately, check the hand vacuum pump and connecting hoses for leaks.

3 Air cleaner

All procedures and components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Air cleaner .

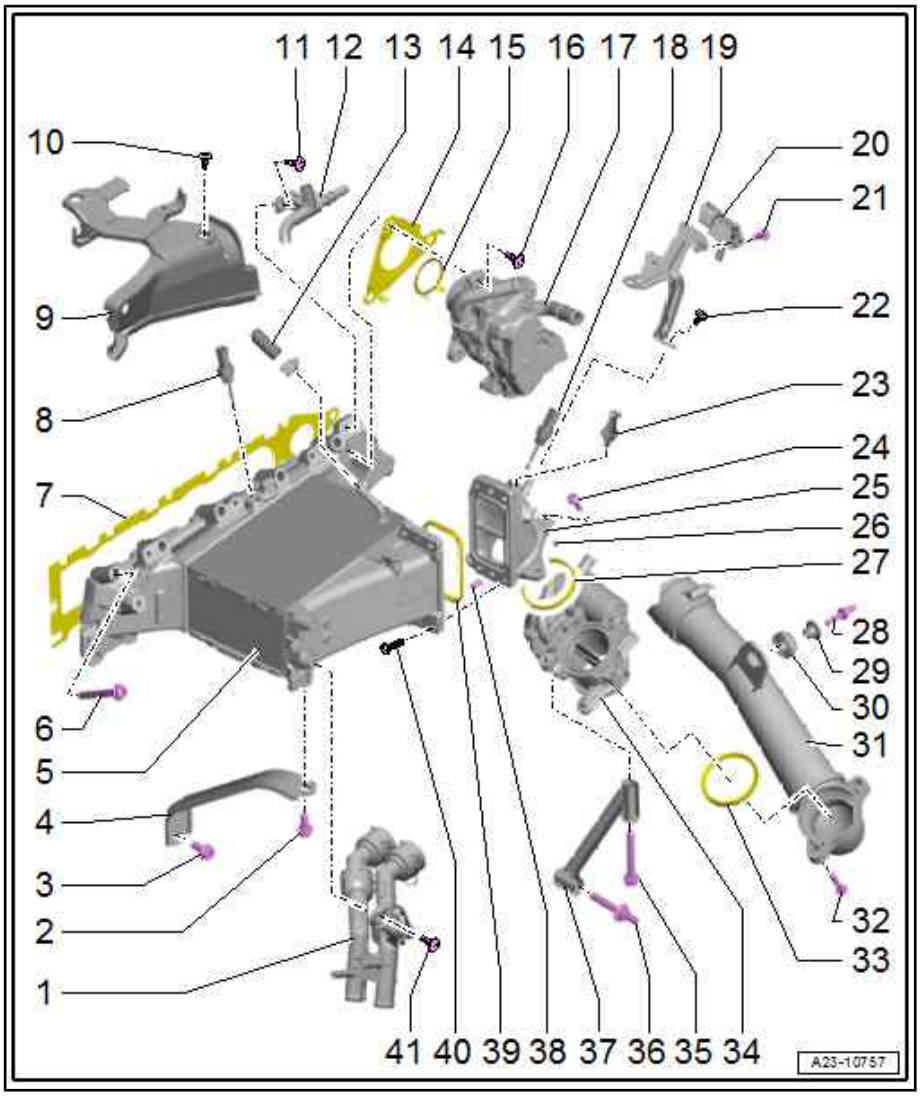
4 Intake manifold

⇒ "4.1 Exploded view - intake manifold", page 151

⇒ "4.2 Removing and installing throttle valve module J338 ", page 153

⇒ "4.3 Removing and installing intake manifold", page 155

4.1 Exploded view - intake manifold



1 - Coolant connection

2 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

3 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

4 - Bracket

- ❑ For intake manifold

5 - Intake manifold with charge air cooler

- ❑ Intake manifold and charge air cooler are combined as one unit
- ❑ Removing and installing ⇒ page 155

6 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 153

7 - Gasket

- ❑ Renew after removing

8 - Charge air temperature sender after charge air cooler - G811-

- ❑ Removing and installing ⇒ page 141

9 - Bracket

- ❑ For electrical wiring harness
- ❑ Different versions depending on model

10 - Bolt

- ❑ 8 Nm

11 - Bolt

- ❑ 8 Nm

12 - Vacuum line

- ❑ Leading from vacuum pump

13 - Sealing plug

14 - Gasket

- ❑ Renew after removing

15 - Gasket

- ❑ Renew after removing

16 - Bolt

- ❑ Tightening torque ⇒ Item 1 (page 228)

17 - Exhaust gas recirculation control motor - V338-

- ❑ Removing and installing ⇒ page 230

18 - Charge air temperature sender before charge air cooler - G810-

- ❑ Removing and installing ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 21 ; Charge air system; Removing and installing charge air temperature sender
- ❑ 22 Nm

19 - Bracket

- ❑ For charge pressure sender - G31-

20 - Charge pressure sender - G31-

- ❑ Removing and installing ⇒ page 141

21 - Bolt

- ❑ Tightening torque ⇒ Item 21 (page 139)

22 - Bolt

- ❑ Tightening torque ⇒ Item 22 (page 139)

23 - Ball stud

- ❑ For engine cover panel

24 - Bolt

- ❑ 8 Nm

25 - Connection

- ❑ For throttle valve module - J338-

26 - Dowel pin

27 - Seal

- ❑ Renew after removing

28 - Centre hex stud

- ❑ Tightening torque ⇒ Item 28 (page 139)

29 - Spacer sleeve

30 - Rubber buffer

31 - Air pipe

32 - Bolt

- ❑ Tightening torque ⇒ Item 32 (page 139)

33 - Seal

- ❑ Renew after removing

34 - Throttle valve module - J338-

- ❑ Removing and installing ⇒ page 153

35 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

36 - Bolt

- ❑ Tightening torque and sequence ⇒ page 153

37 - Bracket

- ❑ For throttle valve module - J338-

38 - Dowel pin

39 - Gasket

- ❑ Renew after removing

40 - Bolt

- ❑ 8 Nm

41 - Bolt

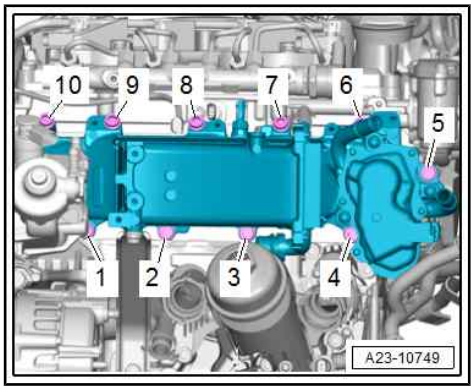
- ❑ 8 Nm

Intake manifold with charge air cooler - tightening torque and sequence

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

– Tighten bolts in stages:

Stage	Bolts	Tightening torque
1.	-1 … 10-	Screw in by hand until contact is made
2.	-1 … 10-	Tighten to 20 Nm
3.	-1 … 10-	Turn 90° further



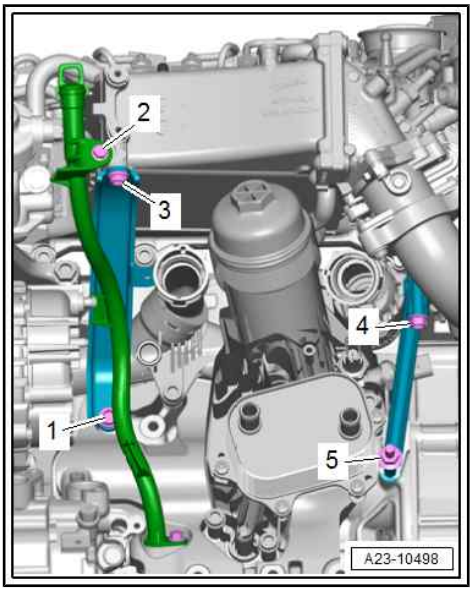
Bracket for intake manifold and bracket for throttle valve module - tightening torques and sequence

– Tighten bolts in stages:

Note

When installing bracket for intake manifold/bracket for throttle valve module, it is very important to ensure that the bracket is not bolted on while under tension.

Stage	Bolts	Tightening torque
1.	-1, 3, 4, 5-	Screw in hand-tight as far as stop
2.	-1, 3, 4, 5-	Tighten to 20 Nm
3.	-2-	Tighten to 10 Nm

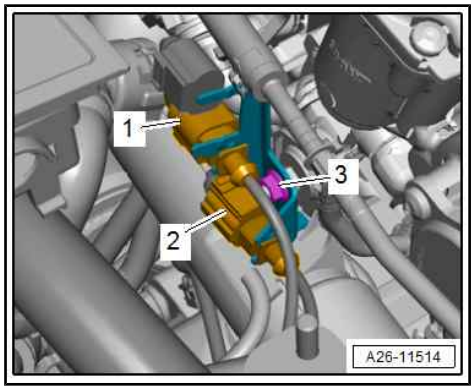


4.2 Removing and installing throttle valve module - J338-

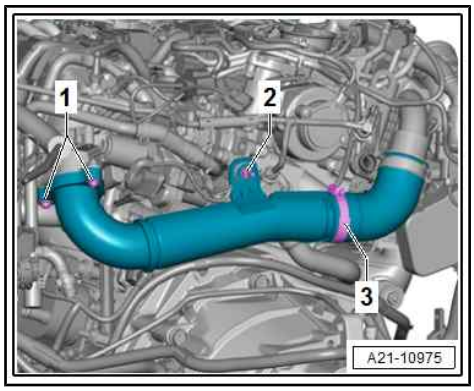
Removing

– Remove coolant pipes (rear left) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

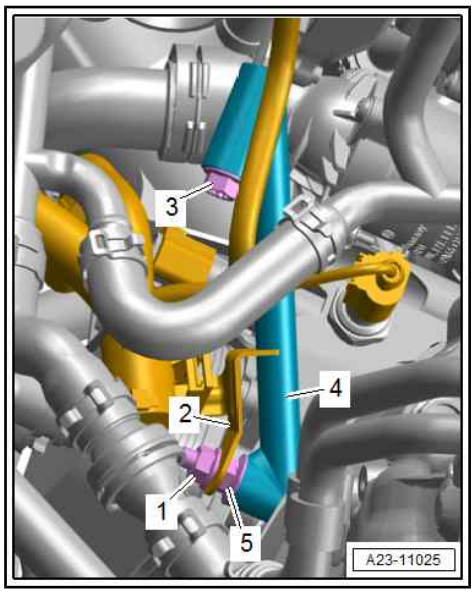
– Remove nut -3- and move bracket with electrical connectors -1, 2- to one side.



– Remove bolts -1- and centre hex stud -2-.
– Loosen hose clip -3- and move air pipe clear towards rear.



– Remove nut -1- and press bracket -2- with electrical wiring harness to one side.
– Remove bolt -3- and centre hex stud -5-, and detach support -4- for throttle valve module - J338- .

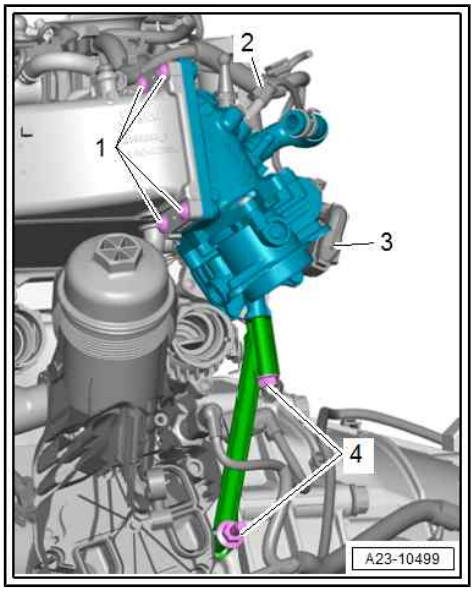


– Unplug electrical connectors:

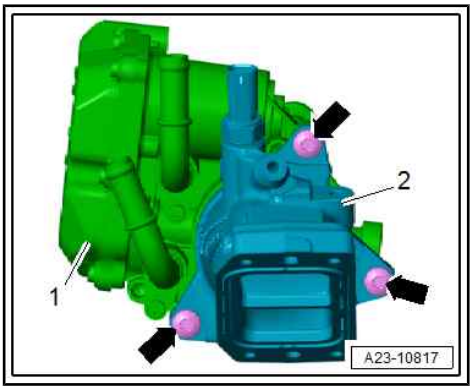
2 - For charge air temperature sender before charge air cooler - G810-

3 - For throttle valve module - J338-

– Remove bolts -1- and detach connection with throttle valve module - J338- .



– Remove bolts -arrows- and disconnect throttle valve module - J338- -item 2- from connection -1-.



Installing

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

- Renew seals and O-ring after removal.

– When fitting connection with throttle valve module - J338- , pay attention to dowel pins.

– Install coolant pipes (rear left) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

Tightening torques

♦ ⇒ “2.2 Exploded view - hose connections for charge air system”, page 140

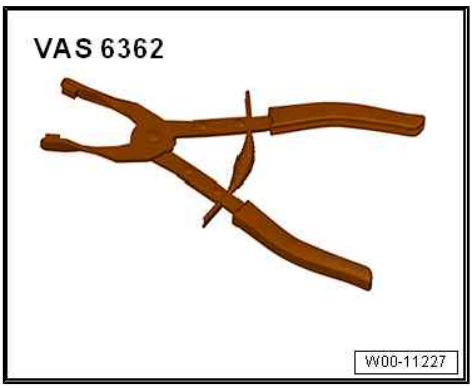
♦ ⇒ “4.1 Exploded view - intake manifold”, page 151

4.3 Removing and installing intake manifold

Intake manifold and charge air cooler are combined as one unit.

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



♦ Bit XZN 10 - T10501-

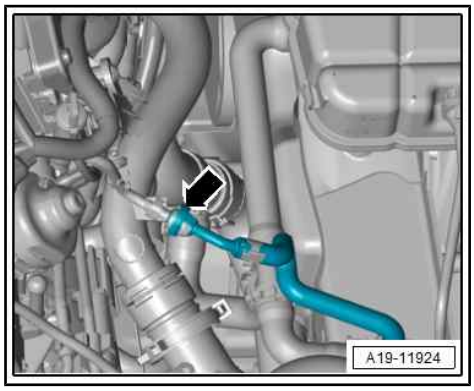
Removing

– Remove high-pressure pipe ⇒ page 175 .

– Remove throttle valve module - J338- ⇒ page 153 .

– Remove coolant pipe (top left) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

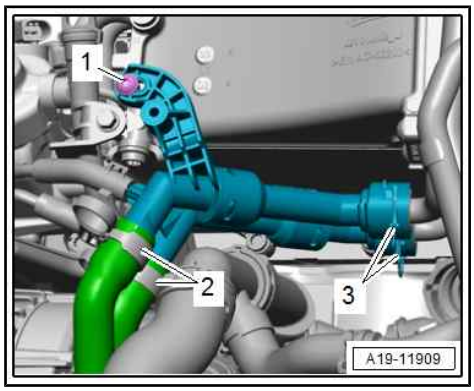
– Lift retaining clip -1- and disconnect coolant hose.



– Release hose clips -2- and disconnect coolant hoses.

– Remove bolt -1-.

– Lift retaining clips -3-, detach coolant connection and place to side.



– Unplug electrical connectors and move clear:

1 - For injectors

2 - For glow plugs ⇒ page 240

3 - For fuel pressure regulating valve - N276-

4 - For injector for reducing agent - N474-

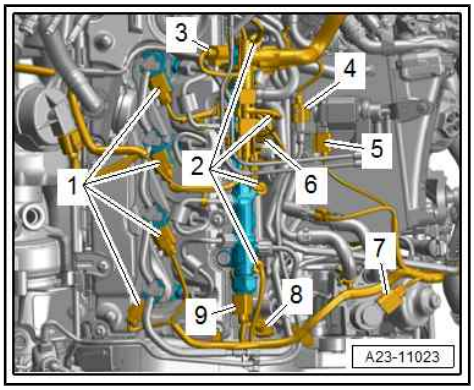
5 - Remove electrical connector for charge pressure control solenoid valve - N75- from bracket and place to one side.

6 - For charge air temperature sender after charge air cooler - G811-

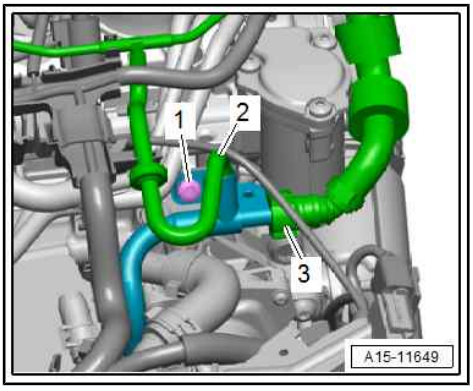
7 - For high-pressure pump

8 - For coolant valve for cylinder head - N489-

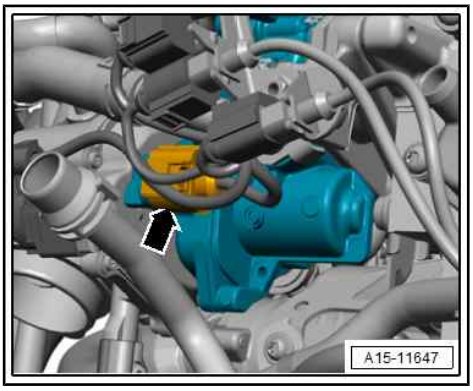
9 - For fuel pressure sender - G247-



– Press release tabs on both sides and detach vacuum hose -3-, taking care not to damage it.
– Being careful not to damage it, detach vacuum hose -2-.
– Remove bolt -1- at vacuum line.

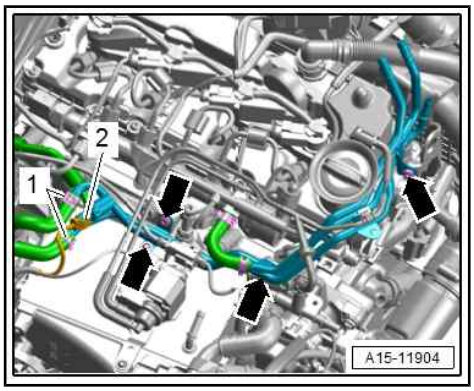


– Unplug electrical connector -arrow- from exhaust gas recirculation control motor - V338- and move electrical wiring clear.



Version without water level sender:

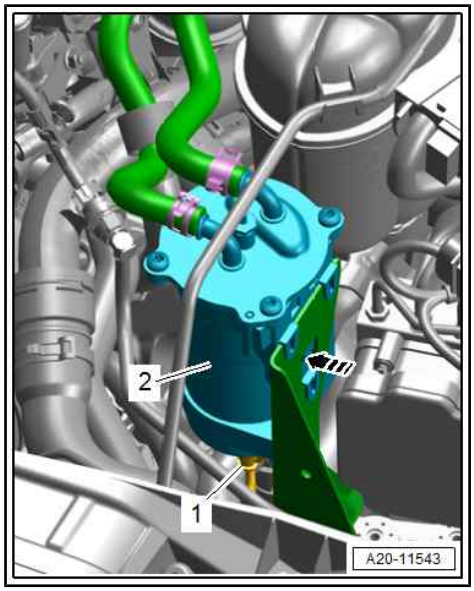
– Release hose clips -1- and detach fuel hoses.
– Unplug electrical connector -2- on fuel temperature sender - G81- .
– Remove bolts -arrows- and place fuel lines to one side.



Version with water level sender - G120- :

– Unplug electrical connector -1-.

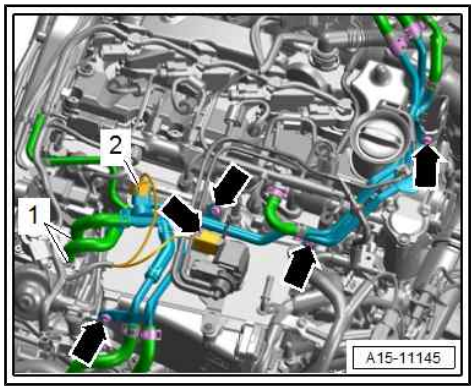
– Release fastener -arrow-, lift water separator -2- off bracket and place it on engine.



– Release hose clips -1- and detach fuel hoses from fuel lines.

– Unplug electrical connector -2- for fuel temperature sender - G81- .

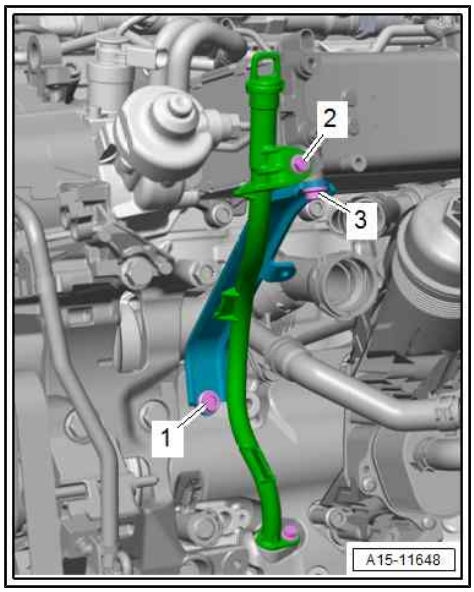
– Remove bolts -arrows- and place fuel lines to right side.



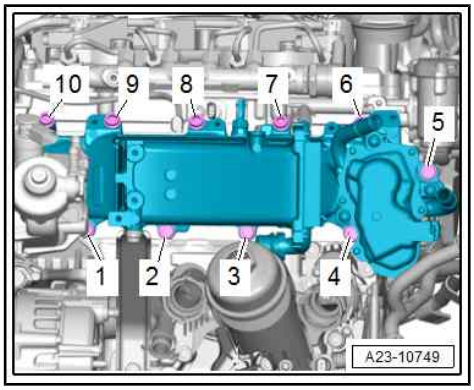
All vehicles (continued):

– Loosen bolt -1-.

– Remove bolts -2, 3-.



– Using bit XZN 10 - T10501- , slacken and remove bolts in the sequence: -10 ... 1-.



Installing

- Renew gasket after removing.
- Before fitting, check vacuum hoses for damage and renew if necessary.

– Fit new gasket onto dowel pins in cylinder block.

– Fit intake manifold onto dowel pins in cylinder block and tighten bolts.

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

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install coolant pipe (top left) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

– Install throttle valve module - J338- ⇒ page 153 .

– Install high-pressure pipe ⇒ page 175 .

Tightening torques

- ⇒ Fig. ""Intake manifold with charge air cooler - tightening torque and sequence"" , page 153
- ⇒ "4.1 Exploded view - intake manifold", page 151
- ⇒ "1.1 Exploded view - sump/oil pump", page 96

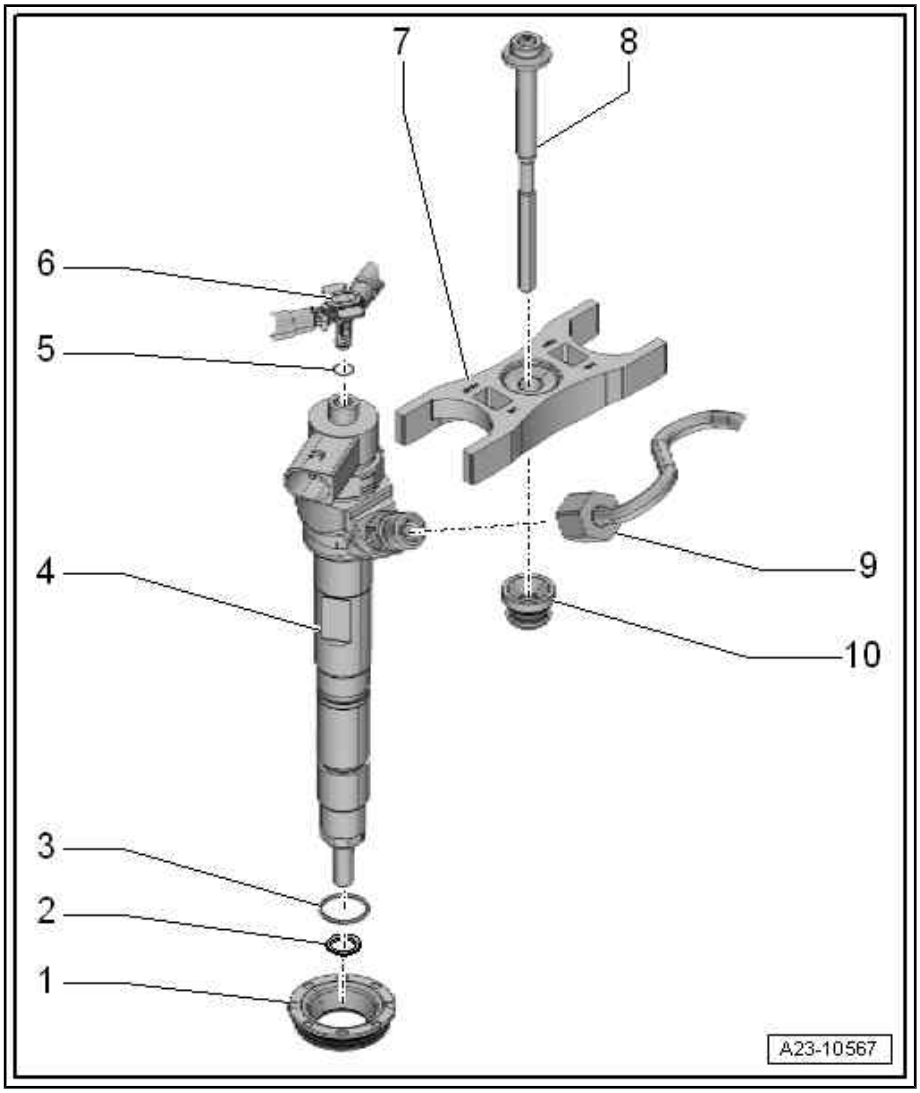
5 Injectors/high-pressure reservoir (rail)

5.1 Exploded view - injectors

When installing a new base engine, you must check whether there is a sticker on the cylinder head cover.

If a sticker is attached which states `Spannpratzen auf vorgeschriebenes Drehmoment angezogen` (clamping pieces tightened to specified torque), the clamping pieces have already been tightened to the specified final torque at the factory.

If no sticker is attached, it is essential that the clamping pieces for the injectors are tightened to the specified torque ⇒ Item 8 (page 161) after installing the high-pressure pipes. If these instructions are not observed, the engine could be damaged.



1 - Seal

- ❑ In cylinder head cover
- ❑ Renew if leaking ⇒ page 74

2 - Copper seal

- ❑ Always renew copper seal when removing and installing
- ❑ Copper seal without chamfer: has no specified installation position
- ❑ Copper seal with chamfer: note installation position ⇒ page 162

3 - O-ring

- ❑ Renew after removing

4 - Injector

- ❑ Use a coloured pen to mark allocation of injectors to corresponding clamping piece and high-pressure pipe, and to corresponding cylinder for re-installation; pay attention to markings when installing
- ❑ Renew copper seal after removing
- ❑ To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- (it is important to do this to avoid leaks)
- ❑ Removing and installing ⇒ page 172

5 - O-ring

- ❑ Renew after removing

6 - Fuel return line

- ❑ To fuel tank
- ❑ Must not be kinked, damaged or clogged
- ❑ Do not dismantle
- ❑ Fill and bleed fuel system after renewing ⇒ page 147

7 - Clamping piece

- ❑ Use a coloured pen to mark injectors and corresponding clamping piece and cylinder for re-installation; pay attention to markings when installing
- ❑ The clamping pieces can be re-used when installing new injectors
- ❑ Each clamping piece secures two injectors
- ❑ Installation position ⇒ page 162

8 - Bolt

- ❑ Renew after removing
- ❑ Tighten initially to 2 Nm, then screw on union nuts for high-pressure pipes hand-tight and align injectors
- ❑ 8 Nm + 270° (3x 90° further)

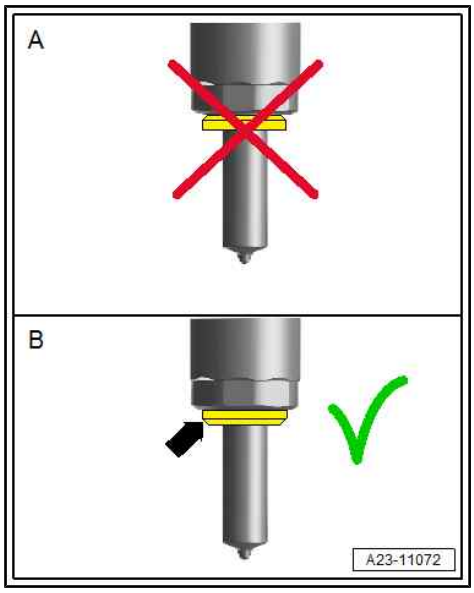
9 - High-pressure pipe

- ❑ Removing and installing ⇒ page 175
- ❑ 28 Nm

10 - Grommet

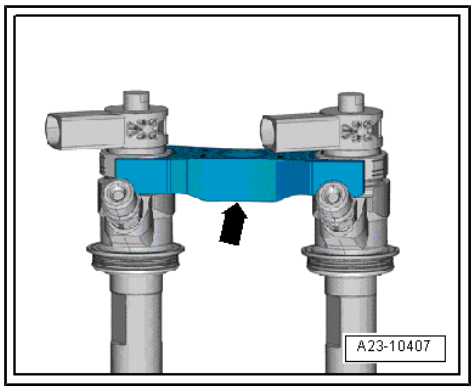
- ❑ In cylinder head cover
- ❑ Renew if damaged

Note installation position for copper seal with chamfer:

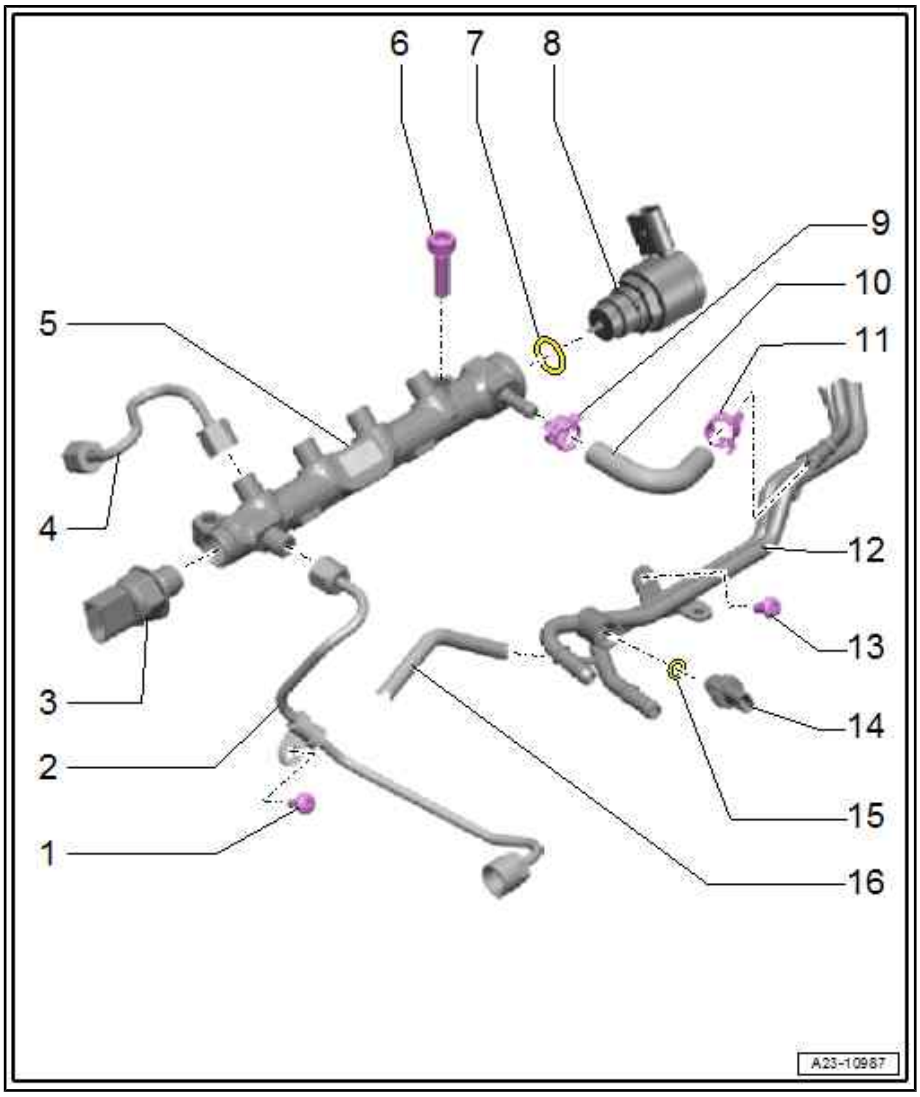


Installation position of clamping piece

- Each clamping piece secures two injectors.
- The bulge -arrow- of the clamping piece should point downwards.



5.2 Exploded view - high-pressure reservoir (rail)



1 - Bolt
- ❑ 8 Nm

2 - High-pressure pipe
- ❑ Between high-pressure pump and high-pressure reservoir (rail)
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 175
- ❑ 28 Nm

3 - Fuel pressure sender - G247-
- ❑ Renew after removing
- ❑ Removing and installing ⇒ page 186
- ❑ 100 Nm

4 - High-pressure pipe
- ❑ Between high-pressure reservoir and injectors
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 175
- ❑ 28 Nm

5 - High-pressure reservoir (rail)
- ❑ Removing and installing ⇒ page 178

6 - Bolt
- ❑ 20 Nm

7 - O-ring
- ❑ Renew after removing

8 - Fuel pressure regulating valve - N276-
- ❑ Renew after removing
- ❑ Checking ⇒ page 188
- ❑ Removing and installing ⇒ page 189
- ❑ Reset learnt values after renewing ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Reset learnt values`
- ❑ 80 Nm

9 - Spring-type clip
- ❑ Renew after removing

10 - Fuel return hose

11 - Spring-type clip
- ❑ Renew after removing

12 - Fuel lines

13 - Bolt
- ❑ 8 Nm

14 - Fuel temperature sender - G81-
- ❑ Removing and installing ⇒ page 185

❑ 2 Nm

15 - O-ring

❑ Renew after removing

16 - Fuel return hose

5.3 Checking injectors

There are four different tests for checking the operation of the injectors.

- ⇒ “5.4 Performing adaption of correction values for injectors”, page 164
- ⇒ “5.5 Checking for injectors sticking open”, page 165
- ⇒ “5.6 Checking return flow rate of injectors with engine running”, page 167
- ⇒ “5.7 Checking return flow rate of injectors at starter cranking speed”, page 170

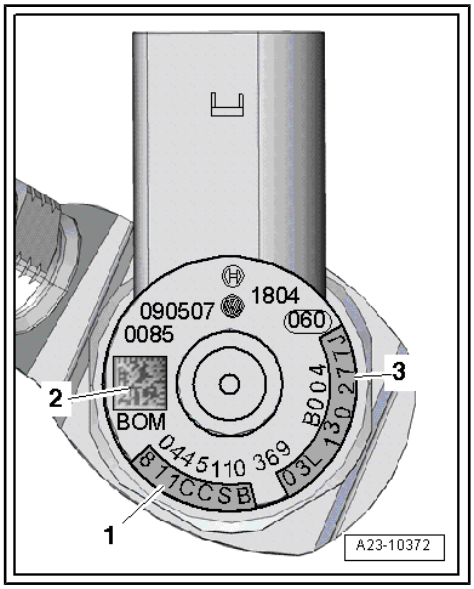
Perform the following tests first if the engine does not start at all:

- ⇒ “5.5 Checking for injectors sticking open”, page 165
- ⇒ “5.7 Checking return flow rate of injectors at starter cranking speed”, page 170
- ⇒ “7.4 Checking fuel pressure regulating valve N276 ”, page 188 .

5.4 Performing adaption of correction values for injectors

- The “Injector delivery calibration” and “Injector voltage calibration” serve to correct the injection rates for each cylinder of a common rail system individually across the entire operating range.
- The 7-digit adaption values are marked on each injector. The values may consist of letters and/or numbers.

Injector (view from above)



1 - Adaption value (checksum; details in illustration are only an example)

2 - Data matrix code

3 - Part number

Special tools and workshop equipment required

♦ Vehicle diagnostic tester

– Perform adaption ⇒ Vehicle diagnostic tester.

– When a new injector is installed, the adaption value for the new injector must be stored in the engine control unit.

– Additionally, check that the “Injector delivery calibration values” with “Injector voltage calibration values” are correctly entered for all the other injectors. Do NOT attempt to re-enter these values if the correct values are already stored in the engine control unit.

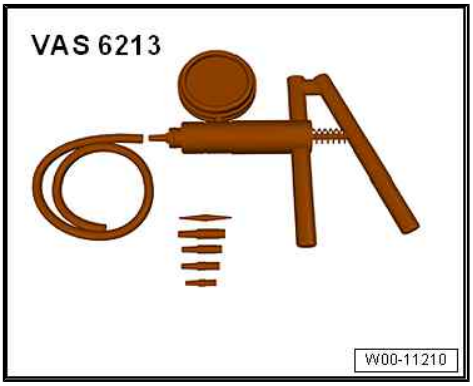
– When the engine control unit is renewed, the appropriate “Injector delivery calibration values” with “Injector voltage calibration” values must be written into the new engine control unit.

5.5 Checking for injectors sticking open

If one of the injectors is sticking open, this means that the injector needle is not closing fully and fuel escapes into the cylinder.

Special tools and workshop equipment required

♦ Hand vacuum pump - VAS 6213-



♦ Adapter of return flow meter - VAS 6684-

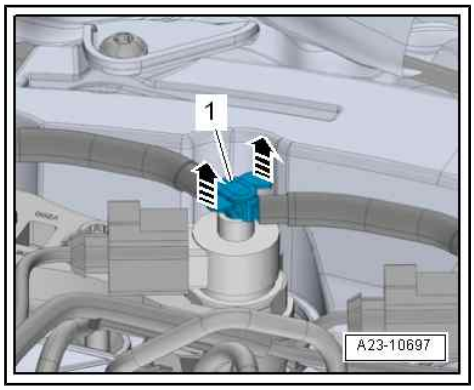
Procedure

• Observe rules for cleanliness when working on the fuel supply system ⇒ “3.1 Rules for cleanliness”, page 6 .

– Remove engine cover panel ⇒ page 13 .
– Detach noise insulation.
– Clean all connections (with commercial cleaning solution or similar) before removing.
– Dry all components after cleaning.

Start with cylinder No. 1.

– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.



– Connect adapter -arrow- of return flow meter - VAS 6684- to return line connection of injector to be tested after adapter has been cleaned and blown out.

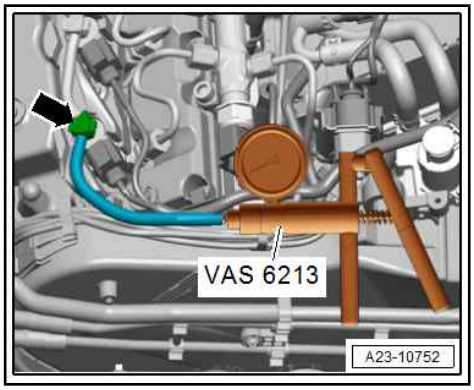
– Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

• If the vacuum reading remains the same for 30 seconds, the injector is OK.

• If the injector is faulty, the vacuum reading will fall back to 0 bar within 2 to 3 seconds.

– Repeat test if necessary; note drop in vacuum reading on hand vacuum pump - VAS 6213- .

– Renew faulty injectors ⇒ page 172 .



Installing fuel return lines

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

• Lubricate all seals with engine oil or assembly oil before installing.

– Push return line connections carefully over seals and onto injectors. The catch should engage audibly. Then press release pin down carefully.

– Erase entry in event memory using ⇒ Vehicle diagnostic tester.

Checking fuel system for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

– Install engine cover panel ⇒ page 13 .

5.6 Checking return flow rate of injectors with engine running

Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

Checking return flow rate of all injectors

Special tools and workshop equipment required

♦ Fuel-resistant measuring container

Procedure

– Remove engine cover panel ⇒ page 13 .

– Disconnect hose at non-return valve -1-.

• Observe rules for cleanliness when working on the fuel supply system ⇒ “3.1 Rules for cleanliness”, page 6 .

– Seal off open return hose with clean plug -2- from engine bung set - VAS 6122- .

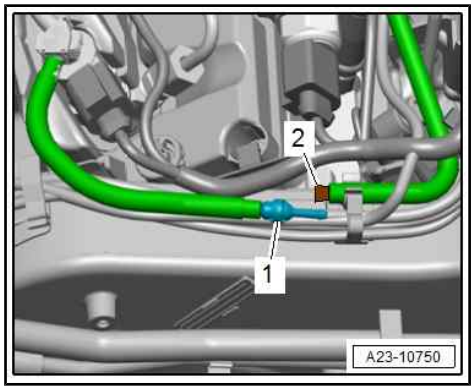
– Hold end of fuel return hose (lengthen if necessary) in a measuring container to measure the total return flow rate.

– Start engine and run at idling speed for two minutes.

• Specification for 2 minutes: 0 ml to 50 ml

– If specification is attained, increase engine speed to 2000 ... 2500 rpm for approx. 2 minutes and then check return flow rate again.

• Specification for 2 minutes: less than 250 ml



Note:

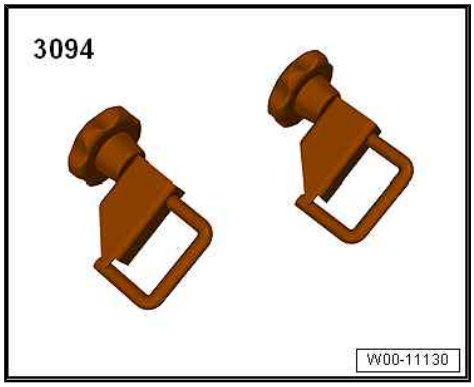
1000 ml = 1 litre

If specification is exceeded, this indicates that one or more injectors are defective. Check return flow rate of each individual injector.

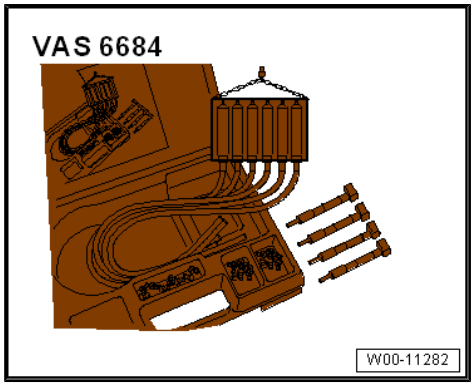
Checking return flow rate of individual injectors

Special tools and workshop equipment required

♦ Hose clamps, up to 25 mm - 3094-



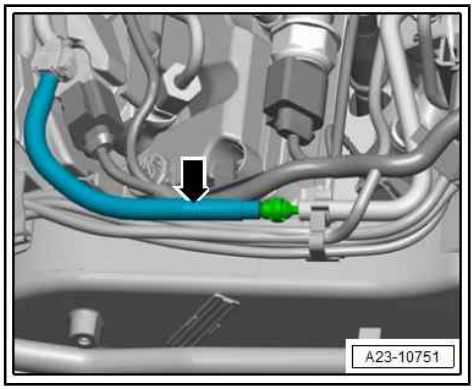
♦ Return flow meter - VAS 6684-



• Observe rules for cleanliness when working on the fuel supply system ⇒ “3.1 Rules for cleanliness”, page 6 .

– Clean all return line connections with engine cleaner or brake cleaner and dry.

– Clamp off fuel return hose -arrow- with a hose clamp -3094- .
– Detach noise insulation.

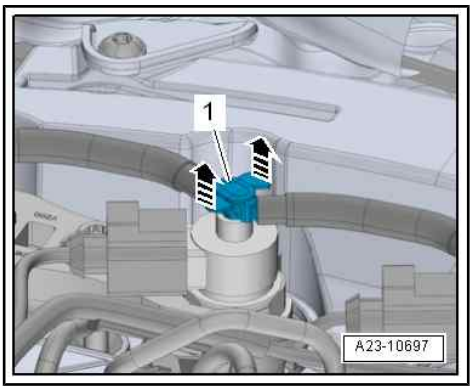


– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.
– Connect adapters of return flow meter - VAS 6684- to return line connections of all 4 injectors.

NOTICE

Risk of damage to injectors when return lines are disconnected.

– **Do NOT press the accelerator during this test; the engine must only run at idling speed.**

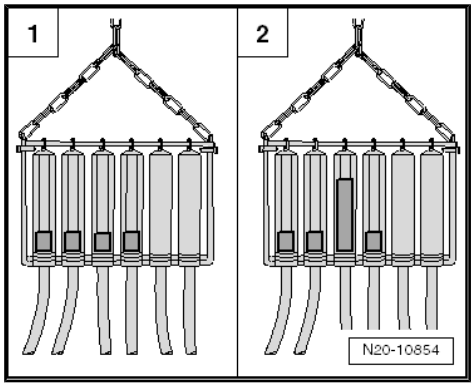


– Start engine and run at idling speed for several minutes:

– When the engine is warm and running at idling speed, the return flow rates at each of the 4 return lines must not differ by more than a small amount (example -1-).

1 - Injectors OK. Return flow rate approx. identical on all injectors.

2 - Injector for cylinder 3 not OK. Return flow rate greater than three times the volume of smallest measured return flow rate.



Note

There is a mechanical fault at the injector if the return flow rate is greater than three times the volume of the smallest measured return flow rate.

– If one injector has a significantly higher return flow rate than the others (example -2-), it must be renewed ⇒ page 172 .

Installing fuel return lines

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

• Lubricate all seals with engine oil or assembly oil before installing.

– Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.

– Erase entry in event memory using ⇒ Vehicle diagnostic tester.

Checking fuel system for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

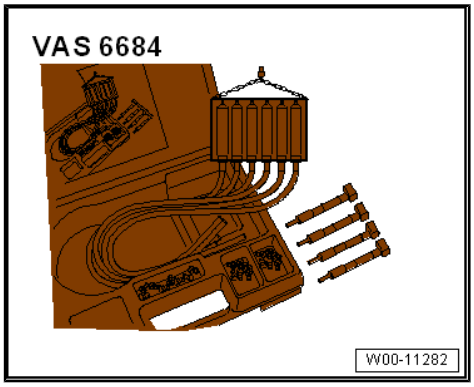
– Install engine cover panel ⇒ page 13 .

5.7 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

Special tools and workshop equipment required

♦ Return flow meter - VAS 6684-



Procedure

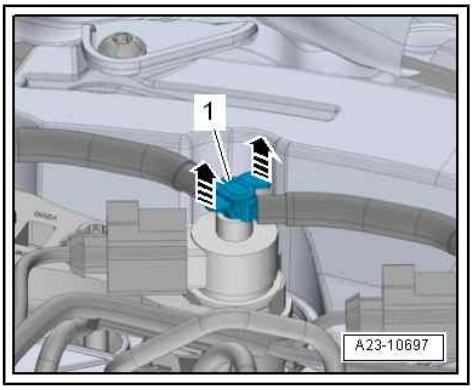
Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

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

– Remove engine cover panel ⇒ page 13 .

– Clean all return line connections with engine cleaner or brake cleaner and dry.

– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.



– Connect hoses of return flow meter - VAS 6684- to return line connections of all four injectors.

– Operate starter three times (wait approx. 20 seconds each time after operating starter to prevent it from overheating).

- Specification of return flow rate: 0 ml

– If fuel comes out of an injector, that injector must be renewed.

Installing fuel return lines

– Check O-ring for fuel return line connection for damage and deformation.

If O-ring is damaged or deformed, renew O-ring.

- Lubricate all seals with engine oil or assembly oil before installing.

– Push return line connections carefully onto injectors. The catch should engage audibly. Then press release pin down carefully.

– Erase entry in event memory using ⇒ Vehicle diagnostic tester.

Checking fuel system for leaks

– Run engine at idling speed for several minutes (do not press accelerator) and then switch off. Fuel system will bleed itself automatically.

– Check the entire fuel system for leaks.

Renew the affected component if leakage occurs.

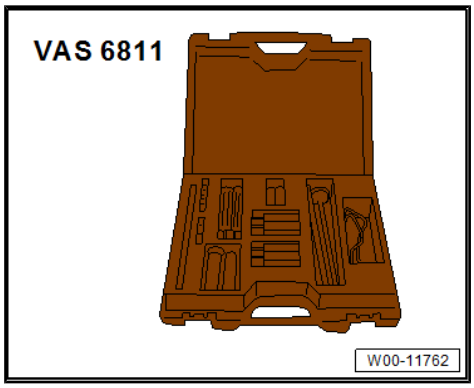
– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

– Install engine cover panel ⇒ page 13 .

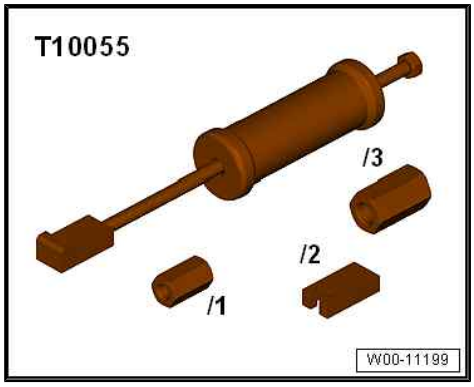
5.8 Removing and installing injectors

Special tools and workshop equipment required

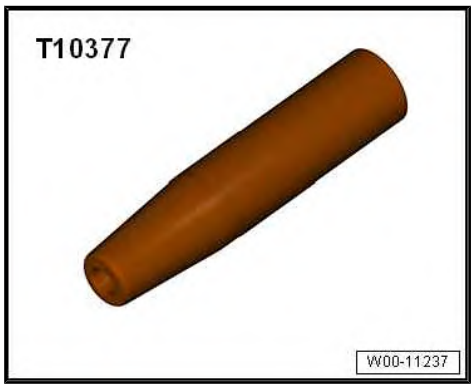
- Cleaning kit - VAS 6811-



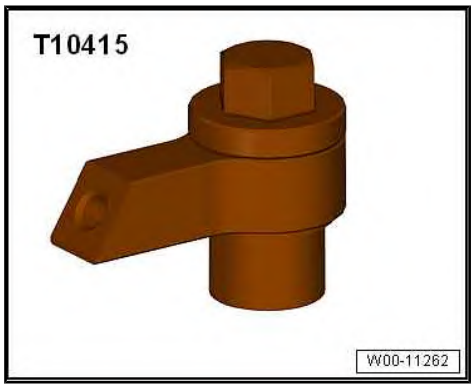
- Puller - T10055-



- Assembly sleeve - T10377-



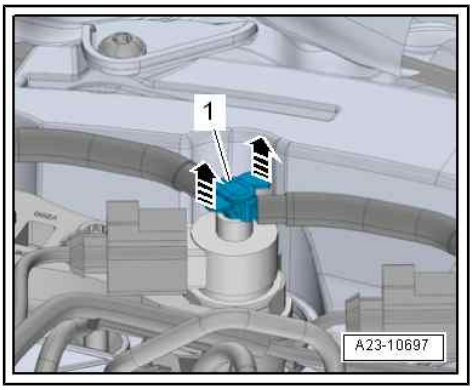
- Puller - T10415-



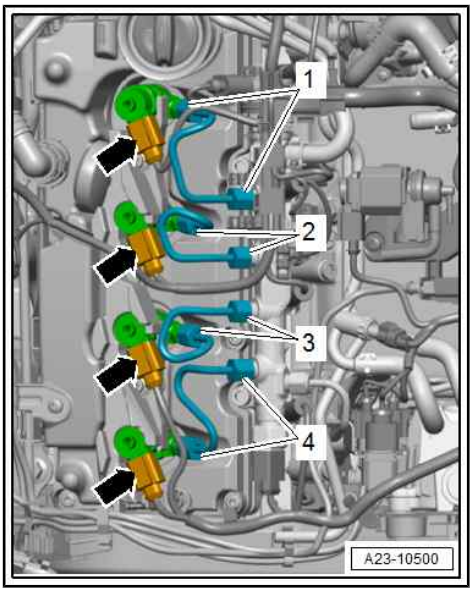
Removing

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

– Remove engine cover panel ⇒ page 13 .
– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.



– Unplug electrical connectors -arrows- at injectors.
– Unscrew union nut on corresponding high-pressure pipe (-1 to 4-) and detach corresponding high-pressure pipe.
– Seal off open lines and connections with clean plugs.



– Move electrical wiring harness clear and detach noise insulation.

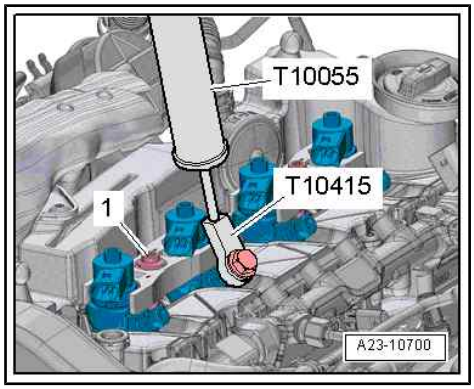
Note:

Each clamping piece always secures two injectors and can only be taken out if both injectors are removed.

– Unscrew bolt -1- and detach clamping piece.

• Sequence for removing injectors: First remove injector for cylinder 2, then for cylinder 1/cylinder 4, and then for cylinder 3.

– Apply puller - T10055- with puller - T10415- as shown in illustration, and pull out injectors upwards.



– Detach clamping piece before taking injector out.

Note:

To avoid damaging the sealing lip, rotate the injector while pulling it out.

– Place removed injectors on a clean cloth.

Installing

NOTICE

Risk of damage to injector sealing surface if it is not cleaned properly.

– To remove carbon deposits from the injector sealing surface, clean the injector bore in the cylinder head with cleaning kit - VAS 6811- .

Installing new injectors

When installing new injectors, the following components must be renewed:

♦ Bolt for clamping piece

♦ O-ring for injector bore

♦ O-ring for fuel return line connection

– Observe all instructions for installing high-pressure pipes ⇒ page 175 .

Installing used injectors

When re-installing used injectors, the following components must be renewed:

♦ Bolt for clamping piece

♦ Copper seal

♦ O-ring for injector bore

♦ O-ring for fuel return line connection

– Spray tip of injector nozzle with rust-solvent spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.

– To remove the old copper seal from the injector, clamp the seal carefully in a vice so that it is just held between the jaws without turning. Then carefully pull and twist the injector out of the copper seal by hand.

– Clean off deposits under the copper seal using a suitable scraper.

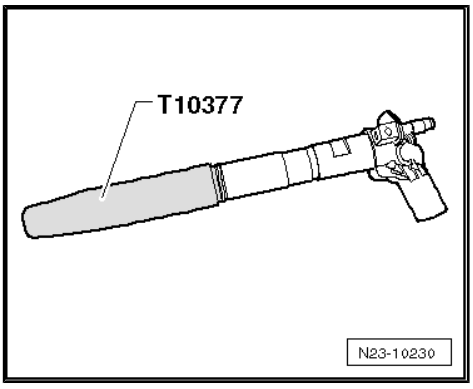
Continued (same procedure for used and new injectors):

– Fit new copper seal.

– Lubricate all O-rings with engine oil or assembly oil before installing.

– Renew O-ring for injector bore using assembly sleeve - T10377- .

– Install injectors.



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

– Install high-pressure pipes ⇒ page 175 .

• Lubricate all O-rings with engine oil or assembly oil before installing.

– Push the return line connections carefully over the new seals and onto the injectors.

• The connection must engage audibly.

– Carefully press down release pin.

• After renewing one or more injectors, the “injector delivery calibration values” and “injector voltage calibration values” for the new injectors must be written into the engine control unit ⇒ page 164 .

– Install engine cover panel ⇒ page 13 .

Tightening torques

♦ ⇒ “5.1 Exploded view - injectors”, page 160

5.9 Removing and installing high-pressure pipes

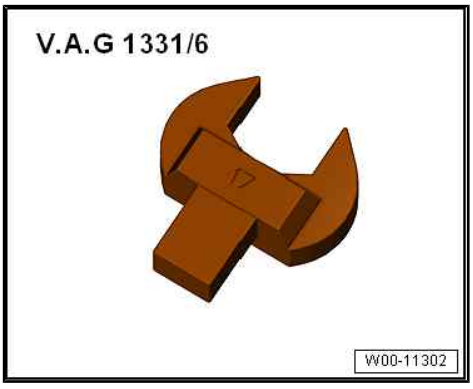
⇒ “5.9.1 Removing high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump”, page 175

⇒ “5.9.2 Installing high-pressure pipe”, page 176

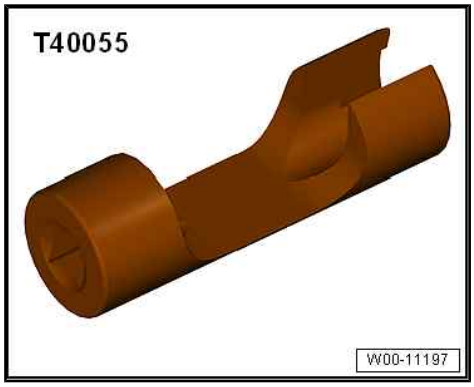
5.9.1 Removing high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump

Special tools and workshop equipment required

♦ Open end spanner insert, AF 17 - V.A.G 1331/6-



♦ Socket - T40055-



Removing

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

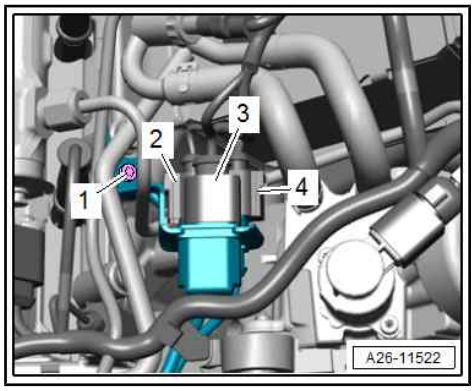
– Remove engine cover panel ⇒ page 13 .

– Detach electrical connectors -2, 3, 4- from bracket and unplug connectors.

– Remove bolt -1- and detach bracket.

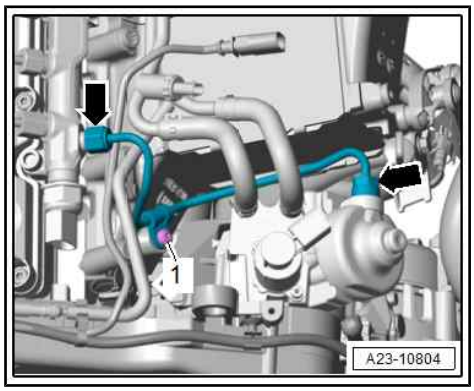
– Use vacuum cleaner to remove dirt from taper seat at high-pressure reservoir.

– Clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.



– Remove bolt -1-.

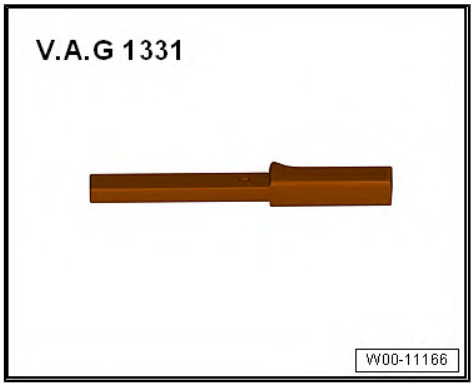
– Unscrew union nuts -arrows- and detach high-pressure pipe.



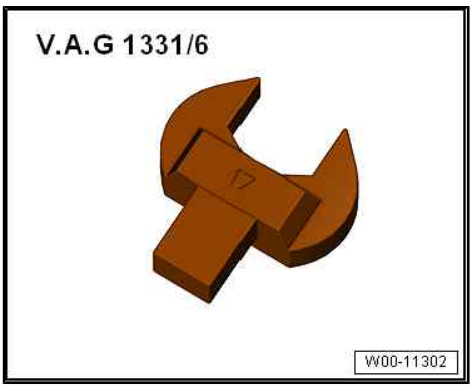
5.9.2 Installing high-pressure pipe

Special tools and workshop equipment required

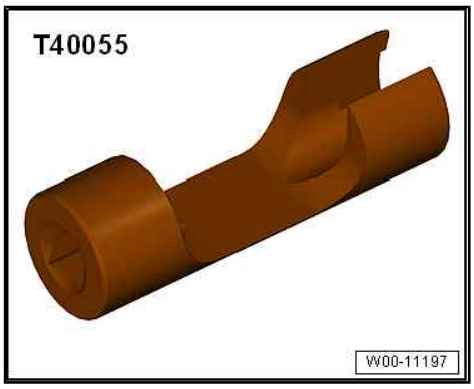
♦ Torque wrench - V.A.G 1331-



♦ Open end spanner insert, AF 17 - V.A.G 1331/6-



♦ Socket - T40055-



Installing

- Note identification marks for cylinder allocation when re-installing high-pressure pipes.
- The high-pressure pipes can be re-used after performing the following checks:
- Check taper seats of high-pressure pipes for deformation and cracks.
- The bore of the pipe must not be distorted, restricted or otherwise damaged.
- Corroded pipes must not be used again.

NOTICE

High-pressure pipes must be free of tension when installed.

Risk of damage to high-pressure pipes.

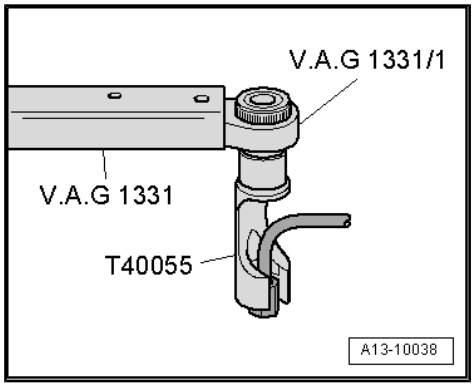
- **If necessary, the high-pressure reservoir can be slackened and moved slightly so that the injector pipes are not installed under tension.**
- **Never bend the high-pressure pipes or subject them to tension.**

– Use vacuum cleaner to remove dirt from taper seat at high-pressure reservoir.

– Lubricate threads of union nuts with clean engine oil.

– Hand-tighten union nuts on high-pressure pipes (ensure that pipes are not under tension).

– To tighten unions of high-pressure pipes at high-pressure reservoir and injectors, use torque wrench - V.A.G 1331- with open end spanner insert, AF 17 - V.A.G 1331/6- or socket - T40055- .



– Check fuel system for leaks ⇒ page 148 .

– Install engine cover panel ⇒ page 13 .

Tightening torques

- ⇒ “5.1 Exploded view - injectors”, page 160
- ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 163

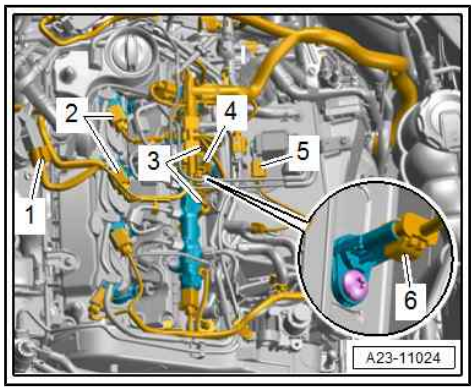
5.10 Removing and installing high-pressure reservoir (rail)

Removing

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

– Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ⇒ page 175 .

– Unplug electrical connectors and move clear:



1 - For turbocharger

2 - For injectors for cylinders 3, 4

3 - For glow plugs for cylinders 2, 3

4 - For charge air temperature sender after charge air cooler - G811-

6 - For Hall sender - G40-

– Unplug electrical connector -5-, take charge pressure control solenoid valve - N75- out of bracket and place to one side.

– Detach bracket for electrical wiring harness from high-pressure reservoir (rail) and place to one side.

– Unplug electrical connectors:

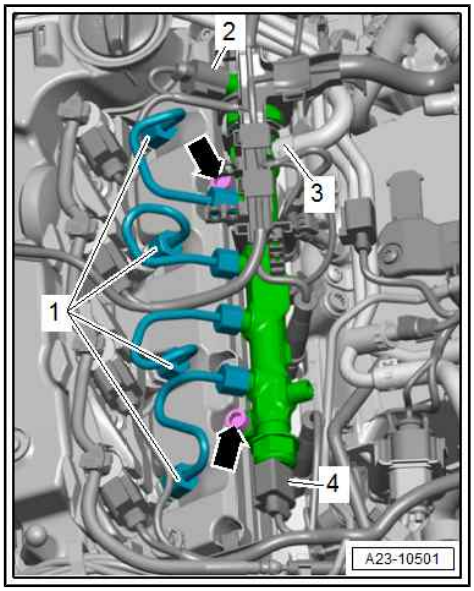
2 - For fuel pressure regulating valve - N276-

4 - For fuel pressure sender - G247-

– Release hose clip -3- and detach fuel return hose.

– Remove union nuts -1- for high-pressure pipes.

– Remove bolts -arrows- and detach high-pressure reservoir.



Installing

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

– Observe all instructions for installing high-pressure pipes ⇒ page 175 .

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

Tightening torques

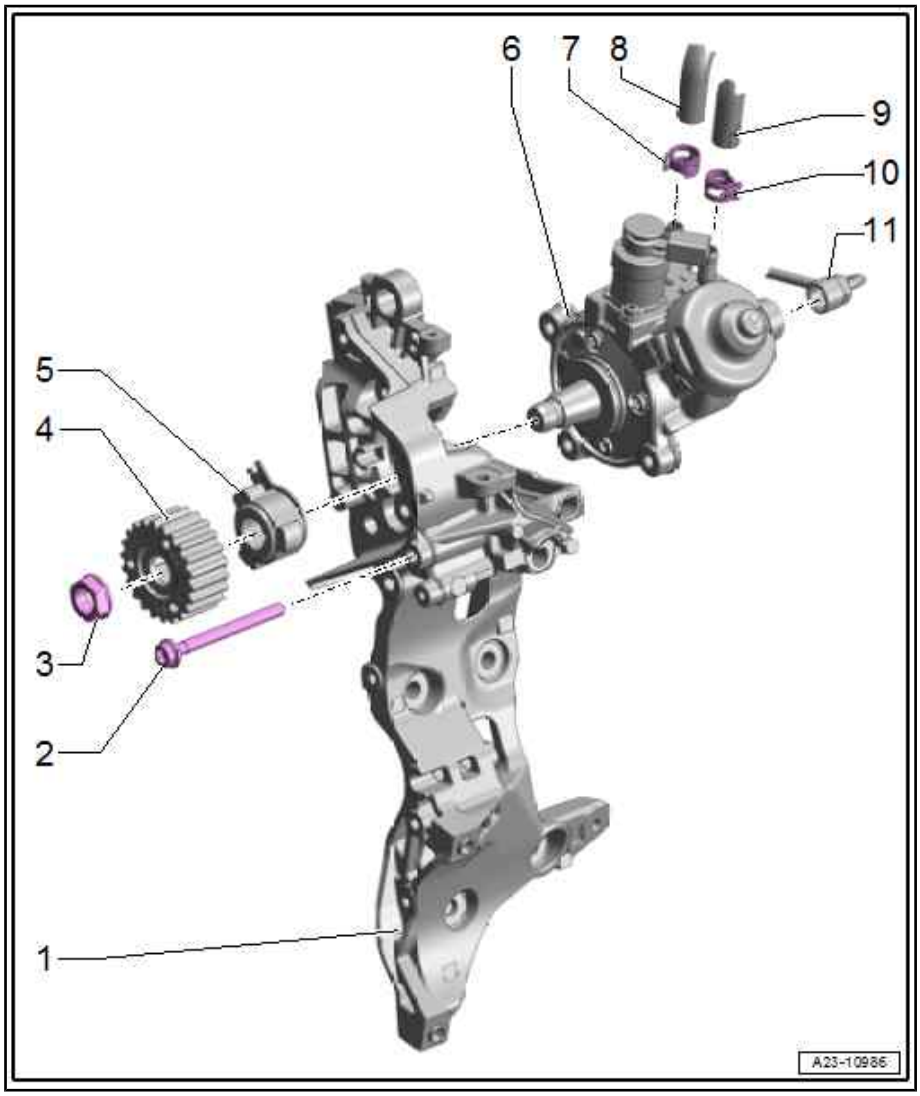
- ⇒ “5.1 Exploded view - injectors”, page 160
- ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 163

6 High-pressure pump

⇒ “6.1 Exploded view - high-pressure pump”, page 180

⇒ “6.2 Removing and installing high-pressure pump”, page 181

6.1 Exploded view - high-pressure pump



1 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 21

2 - Bolt

- ❑ 3x
- ❑ Renew after removing
- ❑ Different lengths
- ❑ Different tightening torques:

- ◆ Short bolt, 20 Nm + 45°
- ◆ Long bolt, 20 Nm + 180°

3 - Nut

- ❑ Use counterhold tool - T10051- when loosening and tightening
- ❑ 95 Nm

4 - High-pressure pump sprocket

5 - Hub

- ❑ To remove, use puller - T10489-

6 - High-pressure pump

- ❑ With fuel metering valve - N290- (do not open)
- ❑ Removing and installing ⇒ page 181
- ❑ Reset learnt values after renewing ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Reset learnt values`

7 - Spring-type clip

- ❑ Renew after removing

8 - Fuel supply hose

9 - Fuel return hose

10 - Spring-type clip

- ❑ Renew after removing

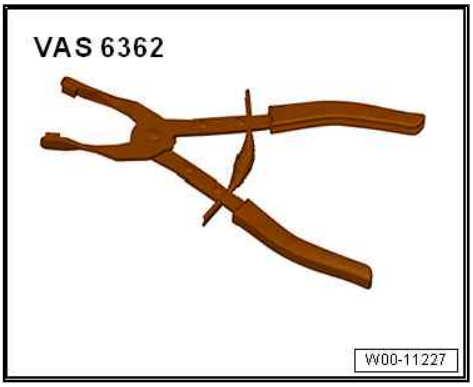
11 - High-pressure pipe

- ❑ Between high-pressure reservoir (rail) and high-pressure pump
- ❑ Removing ⇒ page 175
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 175
- ❑ 28 Nm

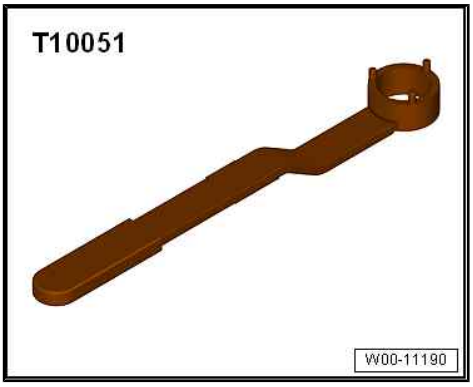
6.2 Removing and installing high-pressure pump

Special tools and workshop equipment required

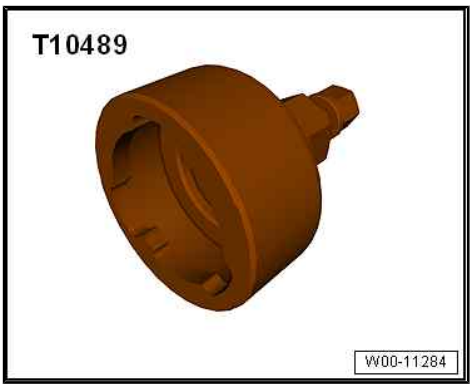
- Hose clip pliers - VAS 6362-



- Counterhold tool - T10051-



- Puller - T10489-



- Locking pin - T10492-

Removing

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

– Detach toothed belt from camshaft ⇒ page 48 .

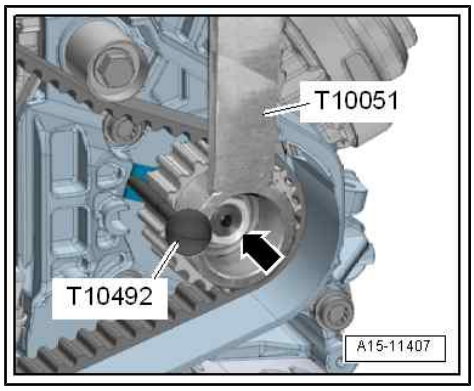
– Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ⇒ page 175 .

– Apply counterhold tool - T10051- to high-pressure pump sprocket.

– Detach locking pin - T10492- and slowly turn high-pressure pump shaft to a position in which it is not under tension.

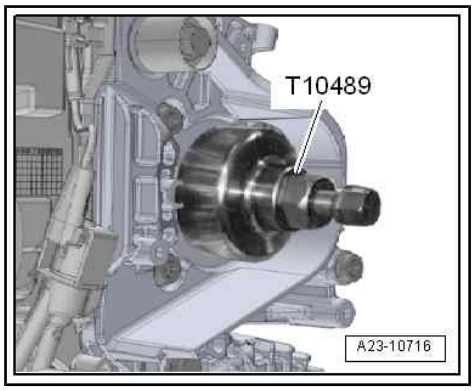
– Remove nut -arrow- and detach counterhold tool - T10051- .

– Detach high-pressure pump sprocket.



– Engage puller - T10489- at hub of high-pressure pump by turning it clockwise.

– Detach hub of high-pressure pump.

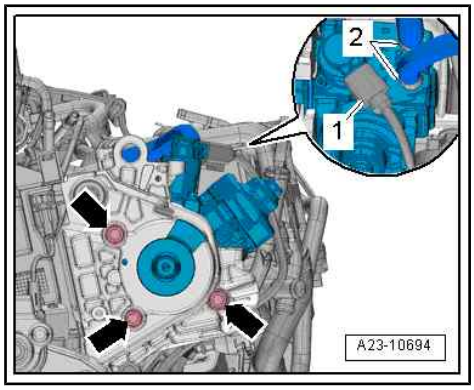


– Disconnect fuel hoses -2-.

– Unplug electrical connector -1-.

– Remove bolts -arrows-.

– Carefully take out high-pressure pump.



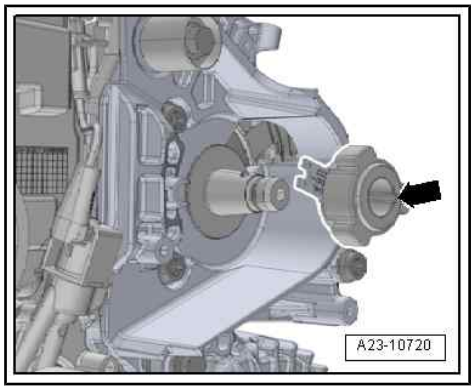
Installing

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

- After removing, renew bolts tightened with specified tightening angle.
- Renew spring-type clips after removing.

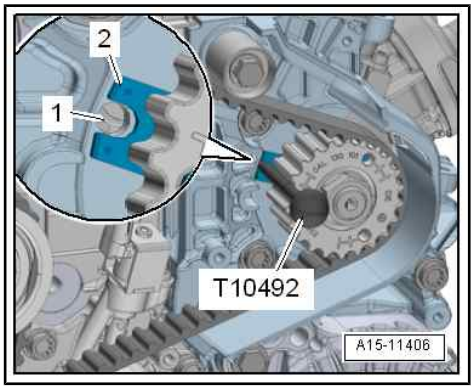
– Apply hub -arrow- to high-pressure pump shaft.

- The parallel key on the high-pressure pump shaft must engage in the groove in the hub.



– Place high-pressure pump sprocket on hub.

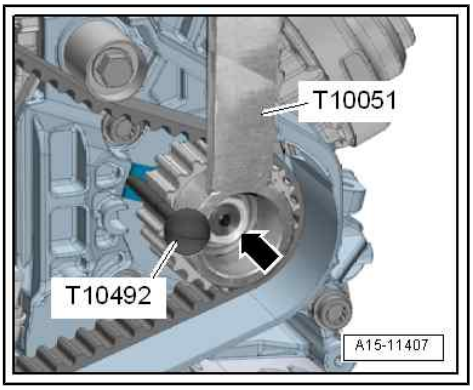
• Contact surface between counterhold tool and toothed belt sprocket must be free of oil.



– Screw nut -arrow- onto thread of high-pressure pump shaft.

– Apply counterhold tool - T10051- to high-pressure pump sprocket and hand-tighten nut -arrow-.

– Turn high-pressure pump sprocket with counterhold tool - T10051- until it can be locked in position with locking pin - T10492- .



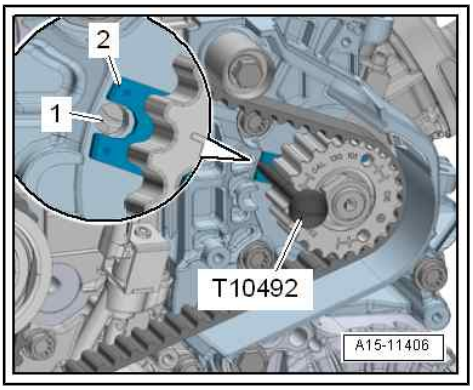
– To do so, insert locking pin - T10492- into fork -2- on hub and into hole -1- behind it in bracket for ancillaries.

– Loosen nut -arrow- again.

• The high-pressure pump sprocket should still just turn, but there must be no axial movement.

– Install high-pressure pipe ⇒ page 175 .

– Install toothed belt (adjust valve timing) ⇒ page 57 .



Risk of irreparable damage to fuel pump

After working on the fuel system, the fuel pump may be irreparably damaged if it is allowed to run while empty.

– Never allow fuel pump to run while it is empty.

– Fill/bleed fuel pump.

– Bleed fuel system
⇒ “1.3 Filling and bleeding fuel system”, page 147 .

– Learnt values must be reset on engine control unit after renewing high-pressure pump.

– Connect ⇒ Vehicle diagnostic tester.

Select following menu options on ⇒ Vehicle diagnostic tester:

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Reset learnt values`

Tightening torques

- ⇒ “6.1 Exploded view - high-pressure pump”, page 180

7 Senders and sensors

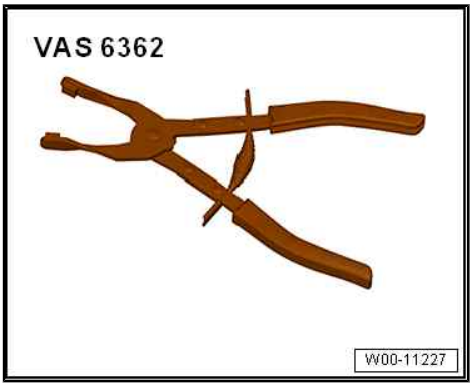
7.1 Removing and installing air mass meter - G70-

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Senders and sensors; Removing and installing air mass meter - G70- .

7.2 Removing and installing fuel temperature sender - G81-

Special tools and workshop equipment required

- Hose clip pliers - VAS 6362-



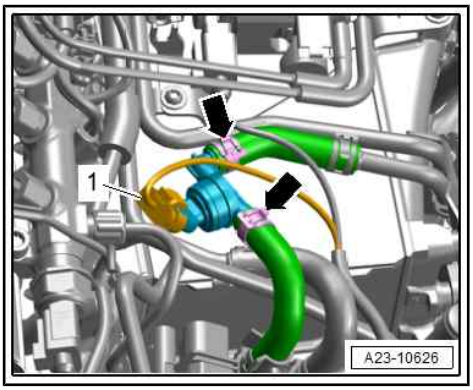
Removing

– Remove engine cover panel ⇒ page 13 .

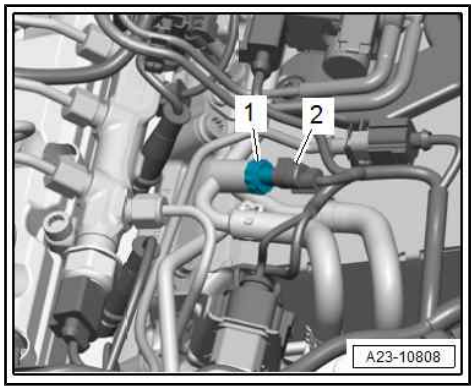
Version 1:

– Unplug electrical connector -1-.

– Release hose clips -arrows- and disconnect fuel return hoses.



Version 2:



– Unplug electrical connector -2-.
– Unscrew fuel temperature sender - G81- -item 1-.

Installing

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

- Renew O-ring after removal.

– Check fuel system for leaks ⇒ page 148 .
– Install engine cover panel ⇒ page 13 .

Tightening torques

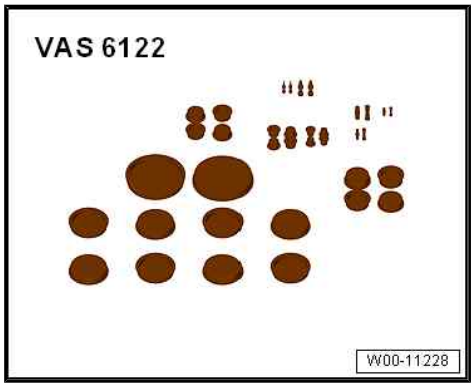
♦ ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 163

7.3 Removing and installing fuel pressure sender - G247-

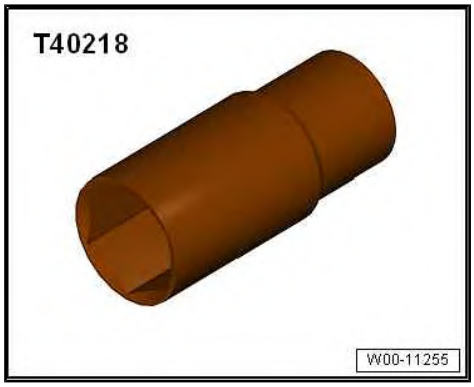
- The fuel pressure sender - G247- continuously measures the fuel pressure in the high-pressure system. It transmits a corresponding voltage signal to the engine control unit - J623- .
- Should the fuel pressure sender fail, the engine control unit will control the fuel pressure via a mapped open-loop backup function. Maximum engine speed in this mode is restricted.
- The fuel pressure sender - G247- does not have a seal; instead, it has a deformable sealing lip.

Special tools and workshop equipment required

♦ Engine bung set - VAS 6122-



♦ Socket, 27 mm - T40218-



Removing

– Remove engine cover panel ⇒ page 13 .

– Clean area all around fuel pressure sender - G247- with engine cleaner or brake cleaner and dry.

• Clean carefully; cleaning solution must not enter the electrical connector.

• Make sure no dirt gets into opening in high-pressure reservoir (rail).

– Move electrical wiring and fuel hoses clear, and press them to one side.

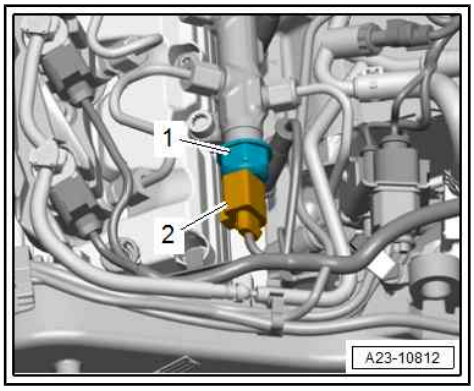
– Unplug electrical connector -2-.

• Do not use an open-end spanner for loosening or tightening.

– Unscrew fuel pressure sender - G247- -item 1- using socket, 27 mm - T40218- .

– Remove dirt from opening in high-pressure reservoir (rail) using a vacuum cleaner. Do not use metal tools, etc.

– Seal off hole in high-pressure reservoir (rail) with a plug (thoroughly cleaned) from engine bung set - VAS 6122- .



Installing

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

• If the deformable sealing lip and the thread of the fuel pressure sender - G247- are not damaged, the sender can be re-used once.

• Check sealing surface at opening in high-pressure reservoir.

• The beginning of the thread and the deformable sealing lip of the fuel pressure sender must be coated with diesel fuel.

– Screw in fuel pressure sender - G247- by hand until it makes contact and then tighten.

Tightening torques

◆ ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 163

After installing fuel pressure sender - G247- , leave engine running at moderate speed for a few minutes when bleeding fuel system and then switch off again.

• The fuel system is “self-bleeding”; do NOT open the high-pressure connections.

– Switch off ignition.

– Carefully check the entire fuel system for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.

Note:

If there is any air left in the fuel system, the engine may switch to the backup mode ('emergency running' mode) during the road test. Switch off the engine and erase the event memory. Then continue the road test.

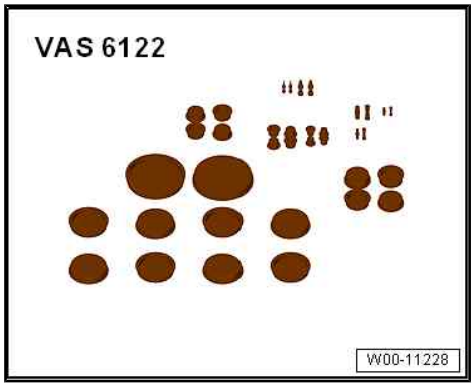
– After road test, interrogate event memory again.

– Install engine cover panel ⇒ page 13 .

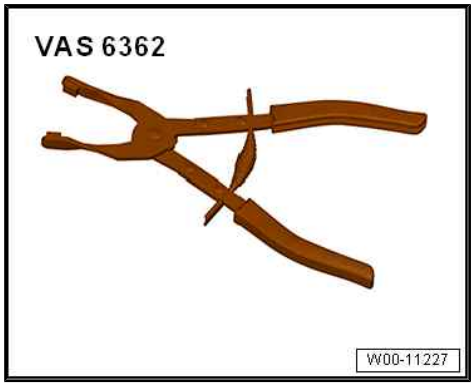
7.4 Checking fuel pressure regulating valve - N276-

Special tools and workshop equipment required

- Engine bung set - VAS 6122-



- Hose clip pliers - VAS 6362-



- Fuel-resistant measuring container

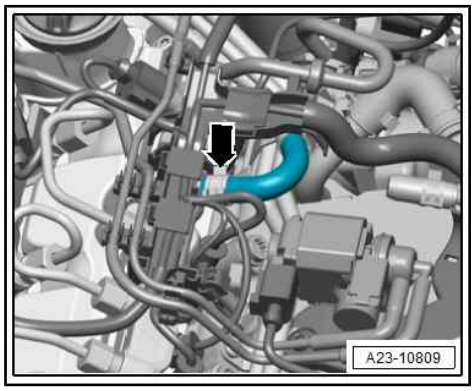
Procedure

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

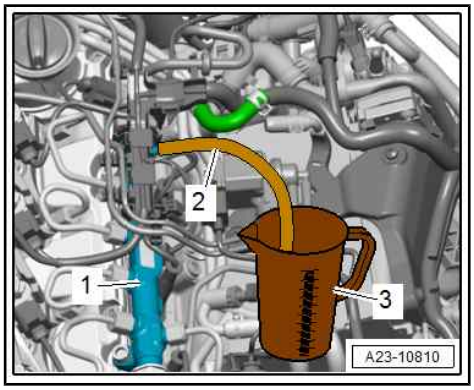
– Remove engine cover panel ⇒ page 13 .

– Release hose clip -arrow-.

– Disconnect fuel return line from high-pressure reservoir and seal off immediately with a plug (thoroughly cleaned) from engine bung set - VAS 6122- .



– Connect test hose -2- to return line connection of high-pressure reservoir -1- and place end of hose in a measuring container -3-.



1) Checking while engine is running

– Start the engine and run at idling speed.

- Specification: more than 75 ml in 30 seconds

If specification is not obtained, fuel pressure regulating valve - N276- is defective.

2) Checking while engine is running

If condition for 1) is met, start engine and increase engine speed to ≥ 2000 rpm.

- Fuel is still discharged in the first few seconds after the engine is started
- Specification after a few seconds: return flow rate = 0 ml
- Drip leaks are permissible

If specification is not obtained, fuel pressure regulating valve - N 276- is defective.

3) If engine can no longer be started

Perform test with engine at cranking speed.

- Specification of return flow rate: 0 ml
- Drip leaks are permissible

If specification is not obtained, fuel pressure regulating valve - N 276- is defective.

Attaching

Assembly is performed in reverse sequence; note the following:

- Renew spring-type clips after removing.

– Install engine cover panel ⇒ page 13 .

7.5 Removing and installing fuel pressure regulating valve - N276-

Special tools and workshop equipment required

♦ Vehicle diagnostic tester

♦ Open-end spanner insert, 30 mm - T10553-

♦ Torque wrench - V.A.G 1332-

Removing

– Remove engine cover panel ⇒ page 13 .

– Remove high-pressure reservoir (rail) ⇒ “5.10 Removing and installing high-pressure reservoir (rail)”, page 178 .

– Before removal, clean area around thread for fuel pressure regulating valve - N276- using e.g. commercial cleaning solution.

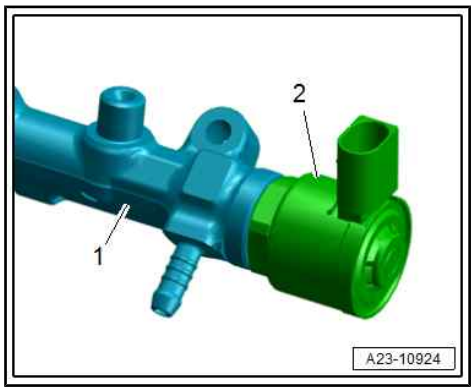
• Make sure no dirt gets into opening in high-pressure reservoir.

• Clean carefully; cleaning solution must not enter the electrical connector.

– Dry off fuel pressure regulating valve - N276- .

Note

The high-pressure reservoir can be clamped in a vice in order to remove the pressure regulating valve; however, it is essential that protective jaw covers are used. Do NOT take up the weight of the high-pressure reservoir by the threaded connections for the high-pressure pipes or the retaining tabs for the cylinder head.



– Mark installation position of connector of fuel pressure regulating valve - N276- relative to high-pressure reservoir.

– Unscrew fuel pressure regulating valve - N276- -item 2- from high-pressure reservoir -1- using insert tool (30 mm) - T10553- .

– Extract dirt from opening in high-pressure reservoir (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.

– Seal off open connection in high-pressure reservoir with clean plug.

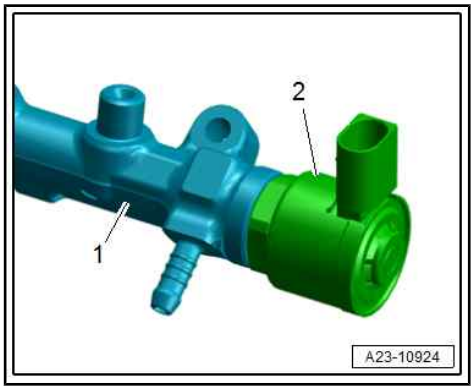
Installing

• Renew fuel pressure regulating valve - N276- after removing.

• Check sealing surface at opening in high-pressure reservoir.

• Check that the deformable sealing lip and the thread on the new regulating valve are not damaged.

• Coat beginning of thread, deformable sealing lip and O-ring of regulating valve lightly with diesel fuel.



– Tighten fuel pressure regulating valve - N276- -item 2- using insert tool (30 mm) - T10553- .
– Turn valve body to align connector of fuel pressure regulating valve - N276- with high-pressure reservoir according to mark made previously.
– Install high-pressure reservoir (rail) ⇒ page 178 .
– If necessary, turn valve body to align regulating valve so that connecting wire is free of tension after connector is attached.
– Learnt values must be reset in engine control unit after renewing high-pressure pump or fuel pressure regulating valve - N276- .
– Connect ⇒ Vehicle diagnostic tester.

Select following menu options on ⇒ Vehicle diagnostic tester:

– Select `Diagnosis` mode and then `Start diagnosis`.
– Choose `Select own test` tab and select following options one after the other:

♦ `Drive train`
♦ `Select engine code and engine`
♦ `01 - Self-diagnosis compatible systems`
♦ `01 - Engine electronics`
♦ `01 - Engine electronics, functions`
♦ `01 - Reset learnt values`

After installing fuel pressure regulating valve - N276- , leave engine running at moderate speed for a few minutes to bleed fuel system and then switch off again.

Note

♦ The fuel system is “self-bleeding”; do NOT open the high-pressure connections.
– Interrogate event memory.
– Switch off ignition.
– Carefully check the entire fuel system for leaks.

Renew affected component if leakage still occurs after tightening to correct torque.

– After completing the repair, road-test the vehicle. Accelerate with full throttle at least once. Then check the high-pressure section of the fuel system again for leaks.
– After road test, interrogate event memory again.
– Install engine cover panel ⇒ page 13 .

Tightening torques

♦ ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 163

7.6 Removing and installing pressure differential sender - G505-

Special tools and workshop equipment required

♦ Vehicle diagnostic tester

The pressure differential sender - G505- detects the amount of deposits in the particulate filter.

Special tools and workshop equipment required

- Vehicle diagnostic tester

Removing

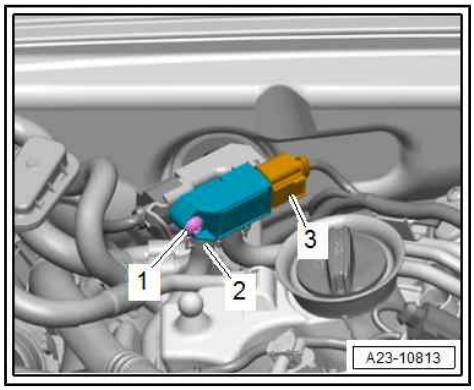
– Remove engine cover panel ⇒ page 13 .

– Unplug electrical connector -3-.

– Detach retaining clip -2-.

– Remove bolt -1-.

– Spray hose -2- with suitable release agent before disconnecting it from pressure differential sender - G505- .



NOTICE

Risk of damage to pressure differential sender if connection breaks off.

– Carefully disconnect hose from connection, taking care to keep hose straight.

– Disconnect hoses -2-.

Installing

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

- Before installing, blow out control pipes from pressure differential sender - G505- to particulate filter towards particulate filter with compressed air (pipes can become obstructed or may ice up due to condensation).
- Make sure that hose is securely fitted and that there are no leaks.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .

– Install engine cover panel ⇒ page 13 .

– Learnt values must be reset on engine control unit after renewing pressure differential sender - G505- .

– Connect ⇒ Vehicle diagnostic tester.

Select following menu options on ⇒ Vehicle diagnostic tester:

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Reset learnt values`

Tightening torques

- ⇒ “8.1 Exploded view - Lambda probe”, page 194

7.7 Removing and installing exhaust gas pressure sensor 1 - G450-

Special tools and workshop equipment required

- Vehicle diagnostic tester

Removing

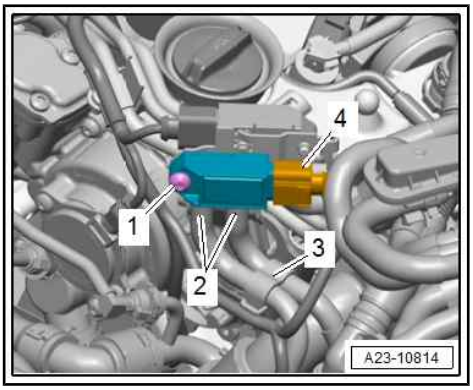
– Remove engine cover panel ⇒ page 13 .

– Unplug electrical connector -4-.

– Remove bolt -1- and detach exhaust gas pressure sensor 1 - G450- from bracket.

– Before disconnecting hoses from exhaust gas pressure sender 1 - G450- , spray hoses with suitable release agent.

– Release hose clips -2-.



NOTICE

Risk of damage to pressure differential sender if connection breaks off.

– Carefully disconnect hose from connection, taking care to keep hose straight.

Installing

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

- Before installing, blow out control pipes from exhaust gas pressure sensor 1 - G450- to particulate filter towards particulate filter with compressed air (pipes can become obstructed or may ice up due to condensation).
- Make sure that hose is securely fitted and that there are no leaks.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .

– Install engine cover panel ⇒ page 13 .

– Learnt values must be adapted on engine control unit after renewing exhaust gas pressure sensor 1 - G450- .

Select following menu options on ⇒ Vehicle diagnostic tester:

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Reset learnt values`

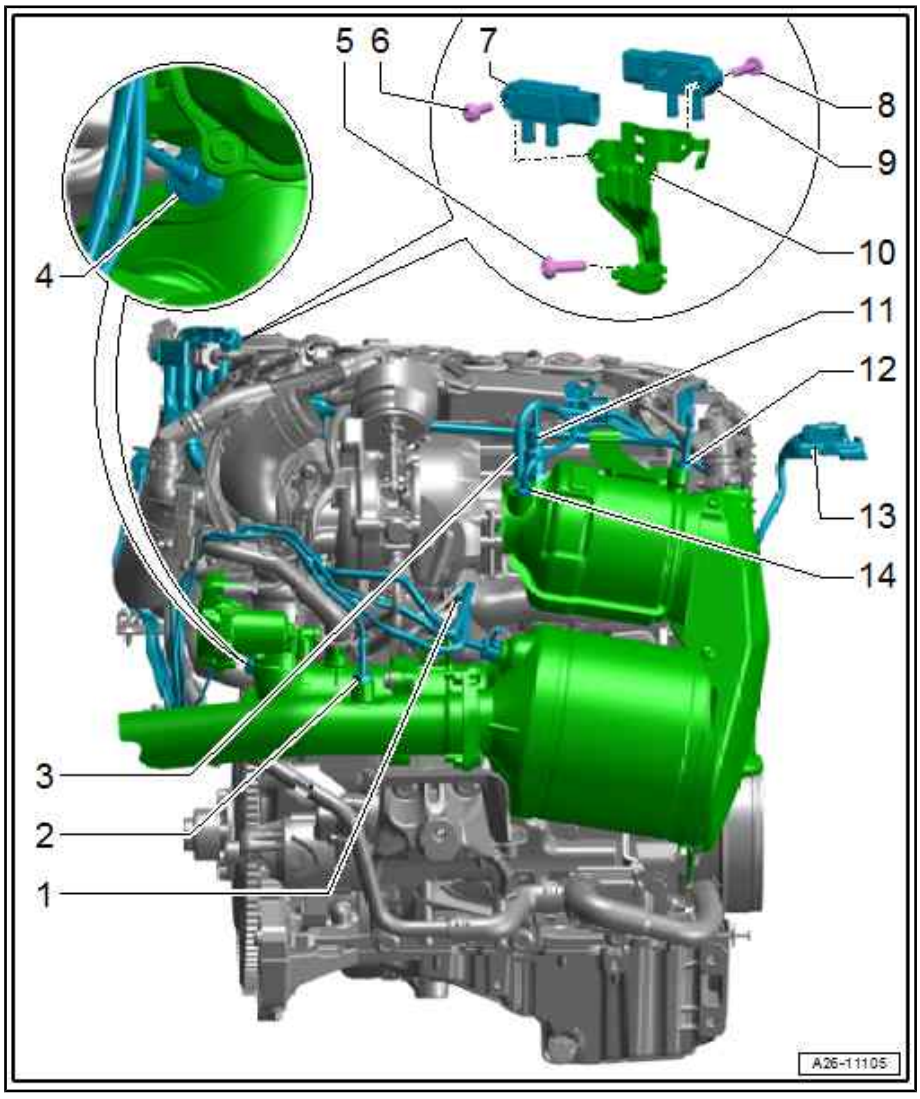
Tightening torques

- ⇒ “8.1 Exploded view - Lambda probe”, page 194
- ⇒ “2.1 Exploded view - emission control system”, page 202

8 Lambda probe

8.1 Exploded view - Lambda probe

- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .



1 - Exhaust gas temperature sender 1 - G235-

- ❑ Removing and installing ⇒ page 222
- ❑ Coat with high-temperature paste ⇒ Electronic parts catalogue
- ❑ 45 Nm

2 - Exhaust gas temperature sender 4 - G648-

- ❑ Removing and installing ⇒ page 226
- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ 60 Nm

3 - NOx sender - G295-

- ❑ Removing and installing ⇒ “8.3.1 Removing and installing NOx sender G295 with control unit for NOx sender J583 ”, page 197
- ❑ 55 Nm

4 - Exhaust gas recirculation temperature sensor - G98-

- ❑ Not fitted on all country-specific versions
- ❑ Removing and installing ⇒ “5.6 Removing and installing exhaust gas recirculation temperature sensor G98 ”, page 237
- ❑ 20 Nm

5 - Bolt

- ❑ 8 Nm

6 - Bolt

- ❑ 8 Nm

7 - Exhaust gas pressure sensor 1 - G450-

- ❑ Removing and installing ⇒ page 193

8 - Bolt

- ❑ 8 Nm

9 - Pressure differential sender - G505-

- ❑ Removing and installing ⇒ page 191
- ❑ After renewal, perform adaptions listed in Guided Function `01 - Functions component replacement` ⇒ Vehicle diagnostic tester

10 - Bracket

- ❑ For pressure differential sender

11 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 195
- ❑ New Lambda probes are coated with an assembly paste
- ❑ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- ❑ The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- ❑ After renewal, perform adaptions listed in Guided Function `01 - Functions component replacement` ⇒ Vehicle diagnostic tester
- ❑ 55 Nm

12 - Exhaust gas temperature sender 3 - G495-

- ❑ Removing and installing ⇒ page 225
- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ 60 Nm

13 - Control unit for NOx sender - J583-

- ❑ Removing and installing
  ⇒ “8.3.1 Removing and installing NOx sender G295 with control unit for NOx sender J583 ”, page 197

14 - Exhaust gas temperature sender 2 - G448-

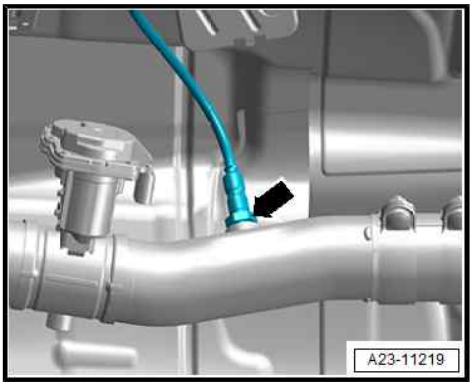
- ❑ Removing and installing ⇒ page 223
- ❑ 60 Nm

NOx sender 2 - G687- with control unit for NOx sender 2 - J881-

May be fitted depending on emission standard.

Tightening torque: 55 Nm

Removing and installing
⇒ “8.3.2 Removing and installing NOx sender 2 G687 with control unit for NOx sender 2 J881 ”, page 199



8.2 Removing and installing Lambda probe

Special tools and workshop equipment required

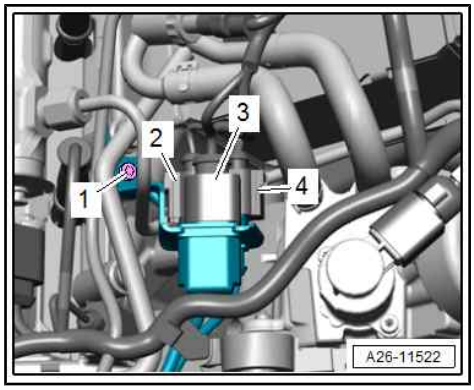
♦ Socket AF 22 mm - T10491-

Removing

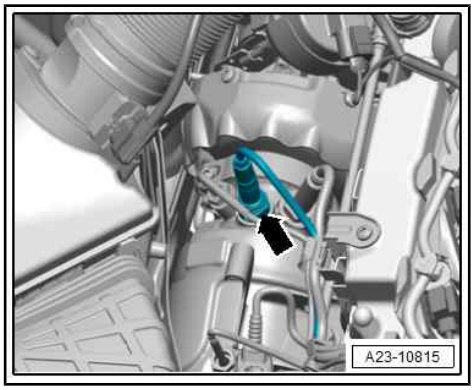
– Remove engine cover panel ⇒ page 13 .

• Observe safety precautions when working on the exhaust system
⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

– Take electrical connector -3- for Lambda probe - G39- out of bracket, unplug and move wiring clear.



– Unscrew Lambda probe - G39- -arrow- using socket AF 22 mm - T10491- .



Installing

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

- Threads of new Lambda probes are already coated with assembly paste; the paste must not get into the slots on the probe body.
- In the case of a used Lambda probe grease only the thread with high-temperature paste. The paste must not get into the slots on the Lambda probe body. For high-temperature paste refer to ⇒ Electronic parts catalogue
- When installing, the Lambda probe wiring must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.

– Install engine cover panel ⇒ page 13 .

– Adaptions must be reset in engine control unit after renewing Lambda probe - G39- .

Select following menu options on ⇒ Vehicle diagnostic tester:

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Functions component replacement`

Tightening torques

- ⇒ “8.1 Exploded view - Lambda probe”, page 194

8.3 Removing and installing NOx sender

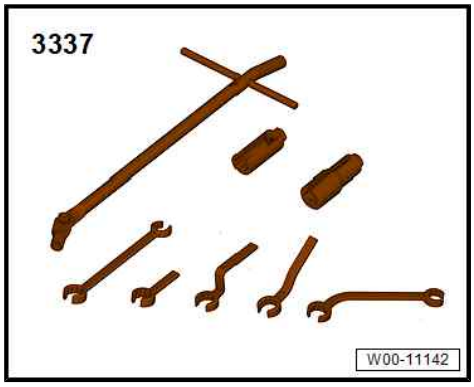
⇒ “8.3.1 Removing and installing NOx sender G295 with control unit for NOx sender J583 ”, page 197

⇒ “8.3.2 Removing and installing NOx sender 2 G687 with control unit for NOx sender 2 J881 ”, page 199

8.3.1 Removing and installing NOx sender - G295- with control unit for NOx sender - J583-

Special tools and workshop equipment required

♦ Lambda probe open ring spanner set - 3337-



♦ High-temperature paste ⇒ Electronic parts catalogue

Removing

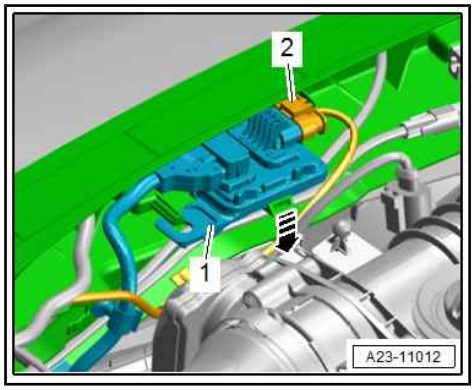
- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

– Remove engine cover panel ⇒ page 13 .

Version 1:

– Unplug electrical connector -2-.

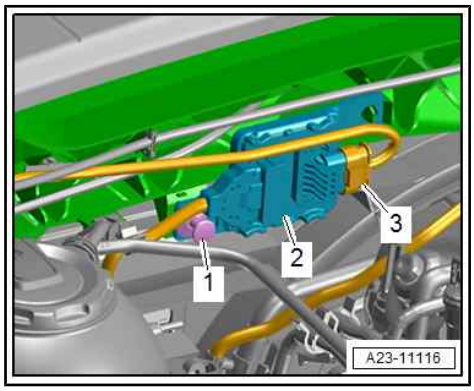
– Release fastener -arrow-, detach control unit for NOx sender - J583- -item 1- and move it clear.



Version 2:

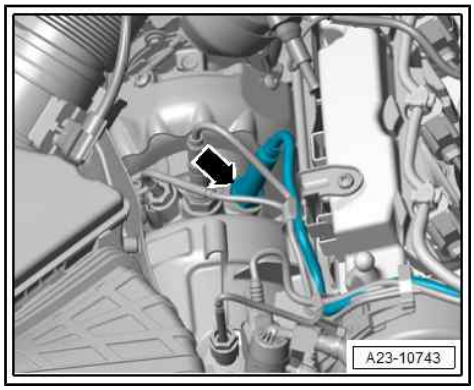
– Unplug electrical connector -3-.

– Remove spreader rivet -1-, detach control unit for NOx sender - J583- -item 2- and move it clear.



All vehicles (continued):

– Unscrew NOx sender - G295- -arrow- using a tool from Lambda probe open ring spanner set - 3337- and move electrical wiring clear.



Installing

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

– Install engine cover panel ⇒ page 13 .

Tightening torques

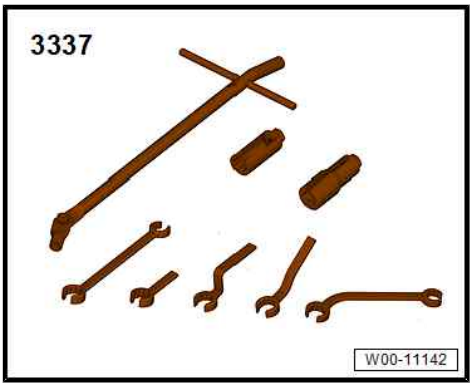
♦ ⇒ “8.1 Exploded view - Lambda probe”, page 194

8.3.2 Removing and installing NOx sender 2 - G687- with control unit for NOx sender 2 - J881-

May be fitted depending on emission standard.

Special tools and workshop equipment required

- Lambda probe open ring spanner set - 3337-



Removing

- Re-install all cable ties in original positions.

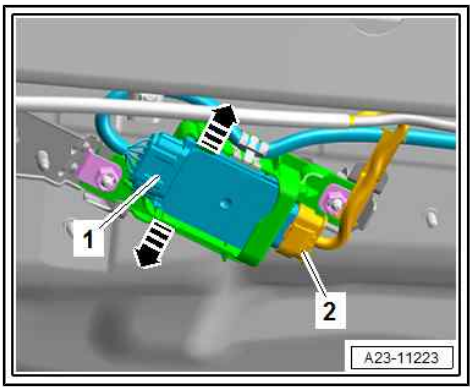
CAUTION

Risk of injury caused by soot particles in the air.
Eyes and skin can suffer irritation or injuries.
– Put on safety goggles.
– Put on protective gloves.

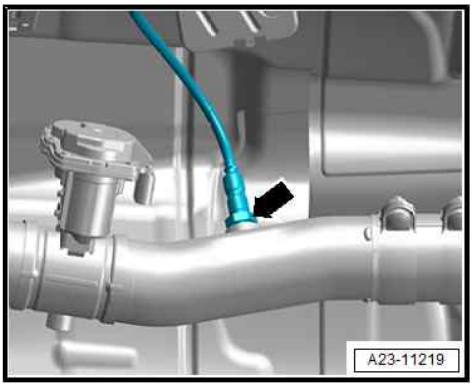
– Unfasten underbody trim (left-side) and lower it slightly ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .

– Unplug electrical connector -2-.

– Release fasteners -arrows- and move control unit for NOx sender 2 - J881- clear.



– Unscrew NOx sender 2 - G687- -arrow- using a tool from Lambda probe open ring spanner set - 3337- .



Installing

Installation is carried out in reverse sequence.

Tightening torques

- ⇒ page 195
- ⇒ “8.1 Exploded view - Lambda probe”, page 194
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim

9 Engine control unit

All procedures and components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Engine control unit .

26 – Exhaust system

1 Exhaust pipes/silencers

1.1 Exploded view - silencers

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Exploded view - silencers .

1.2 Removing and installing front exhaust pipe

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Removing and installing front exhaust pipe .

1.3 Separating exhaust pipes/silencers

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Separating exhaust pipes/silencers .

1.4 Removing and installing silencers

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Removing and installing silencers .

1.5 Stress-free alignment of exhaust system

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Stress-free alignment of exhaust system .

1.6 Checking exhaust system for leaks

Procedure

- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

– Start the engine and run at idling speed.

– Plug tailpipes during leak test (e.g. with cloth or plug).

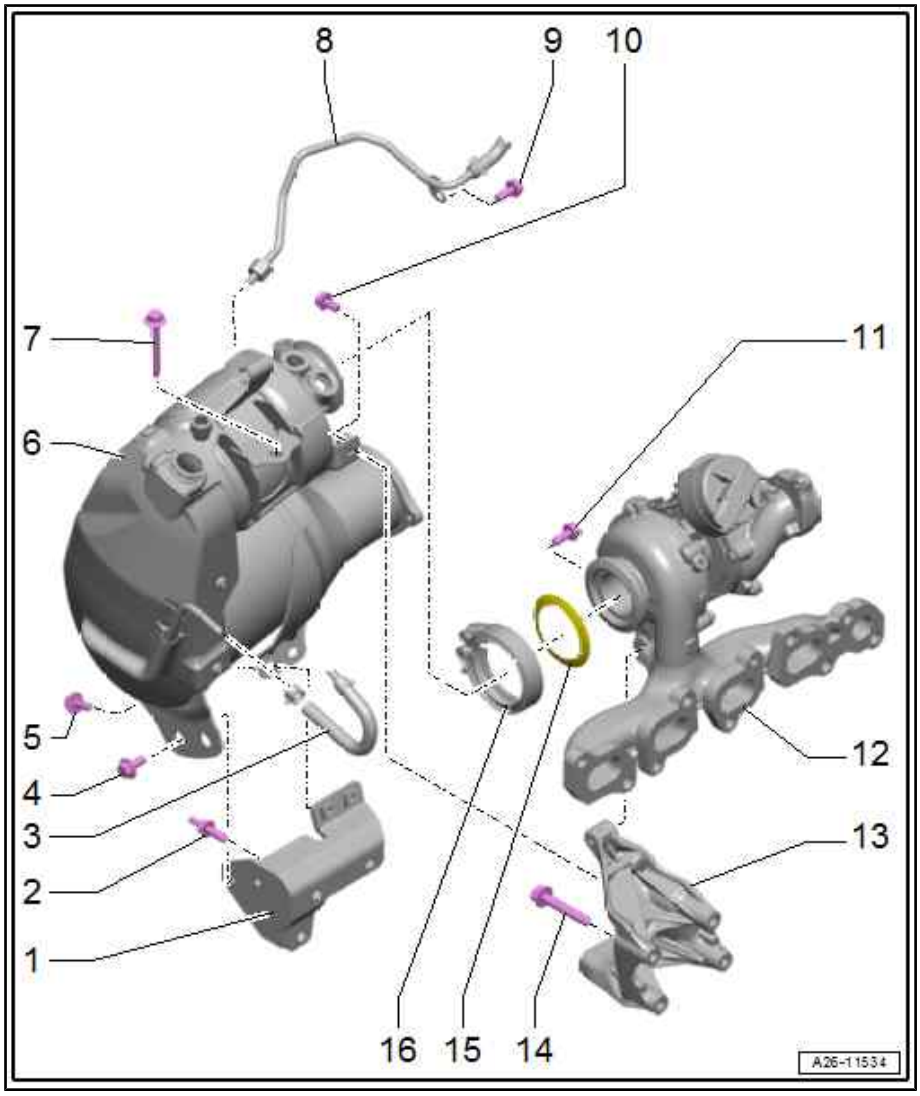
– Listen for noise at the connection points of cylinder head/exhaust manifold, turbocharger/front exhaust pipe etc. to locate any leaks.

– Rectify any leaks that are found.

2 Emission control system

2.1 Exploded view - emission control system

- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .



1 - Bracket

- ❑ For emission control module

2 - Bolt

- ❑ Tightening torque and sequence ⇒ page 211

3 - Hose

- ❑ To exhaust gas pressure sensor 1 - G450-
- ❑ Tightening torque for union nut: 45 Nm

4 - Bolt

- ❑ Tightening torque and sequence ⇒ page 211

5 - Bolt

- ❑ Tightening torque and sequence ⇒ page 211

6 - Emission control module

- ❑ Diesel particulate filter with oxidation catalytic converter
- ❑ Removing and installing ⇒ page 205
- ❑ After renewal, perform adaptions listed in Guided Function `01 - Functions component replacement` ⇒ Vehicle diagnostic tester

7 - Bolt

- ❑ Tightening torque and sequence ⇒ page 127

8 - Measuring tube

- ❑ To pressure differential sender - G505-
- ❑ Additional measuring tube to exhaust gas pressure sensor 1 - G450-
- ❑ Tightening torque for union nut: 45 Nm

9 - Bolt

- ❑ 9 Nm

10 - Bolt

- ❑ Tightening torque and sequence ⇒ page 211

11 - Bolt

Tightening torque and sequence ⇒ page 127

12 - Turbocharger

- ❑ Removing and installing ⇒ page 128

13 - Bracket

- ❑ For emission control module

14 - Bolt

- ❑ Tightening torque and sequence ⇒ page 127

15 - Seal

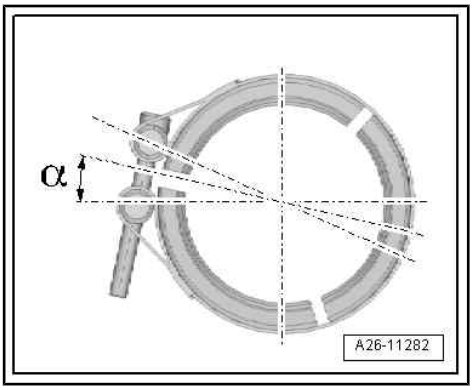
- ❑ Renew after removing
- ❑ Fit on emission control module

16 - Screw-type clip

- ❑ Renew after removing
- ❑ Installation position ⇒ page 203
- ❑ Tightening torque and sequence ⇒ page 211

Installation position of screw-type clip for emission control module

- Angle -α- = 20° ± 10°.



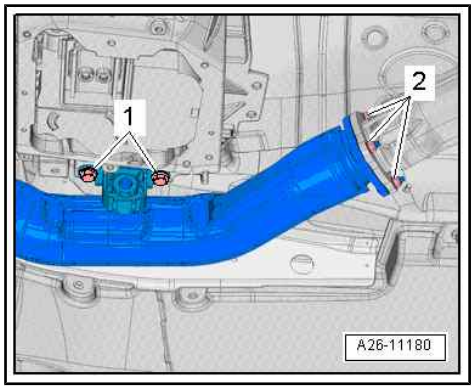
2.2 Removing and installing catalytic converter

Removing

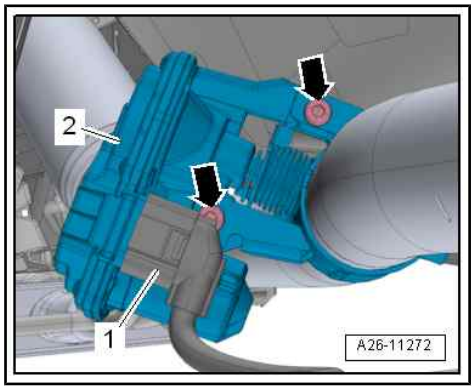
- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

– Remove underbody trim ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .

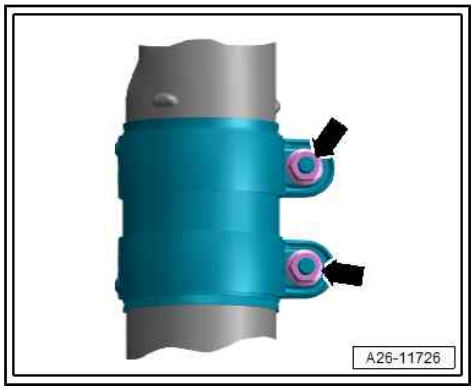
– Remove nuts -2-.



– Unplug electrical connector -1- for exhaust flap control unit - J883- -item 2-.



– Loosen bolts -arrows-, push back clamp and detach catalytic converter.



Installing

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

- Renew seals and nuts after removing.

– Align the exhaust system so it is free of stress ⇒ page 201 .

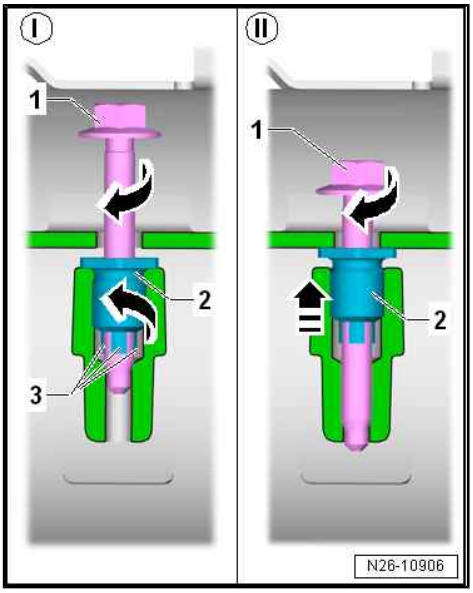
– Install underbody trim ⇒ General body repairs, exterior; Rep. gr. 66 ; Underbody trim; Exploded view - underbody trim .

Tightening torques

♦ ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Exploded view - silencers

2.3 Removing and installing emission control module

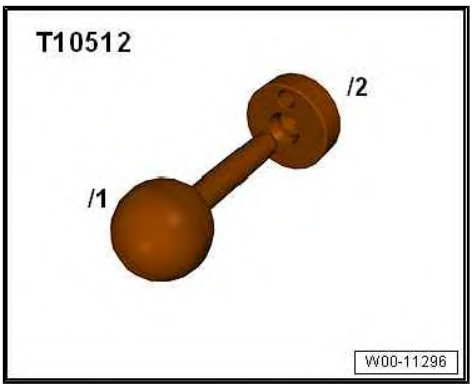
- The emission control module is secured to the engine in part by a compensation element. This compensation element has a left-hand thread on the outside. When the bolt -1- is screwed in, the friction against the retaining tabs -3- initially causes the compensation element -2- to turn as well. Even though the bolt is turned clockwise, the left-hand thread causes the compensation element to move towards the bolt head, which compensates for the play between the components. The compensation element must rotate freely on the left-hand thread, otherwise the retaining tabs will not produce enough friction on the bolt to turn the compensation element. To avoid impairing the required friction, ensure that the retaining tabs do not come in contact with any lubricant.



Special tools and workshop equipment required

- Socket (8 mm) - 3247-

- Calibration tool - T10512-

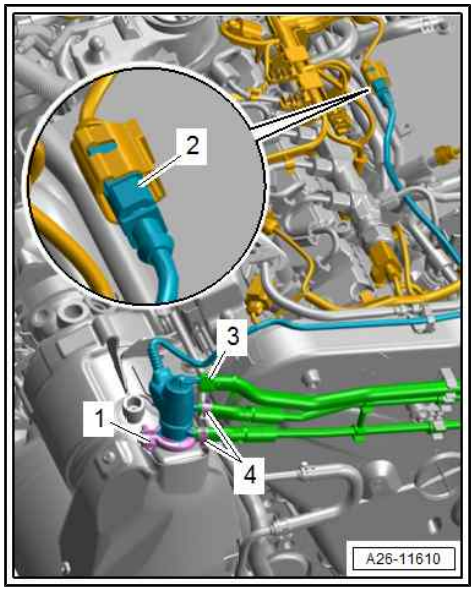


Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

– Remove exhaust gas recirculation cooler ⇒ page 232 .

– Remove wheel spoiler (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Removing and installing wheel housing liner (front) .
– Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.
– Loosen screw-type clip -1-.
– Move coolant hoses -4- and SCR supply line -3- clear.
– Detach injector for reducing agent - N474- and place to left side.

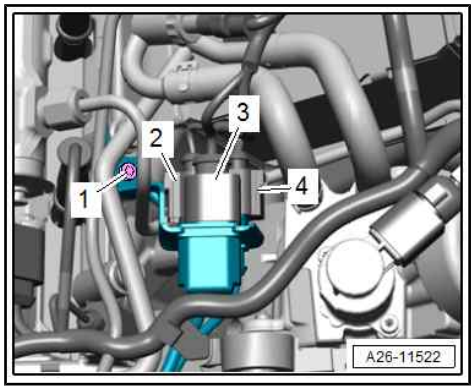


– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

2 - For exhaust gas temperature sender 3 - G495-

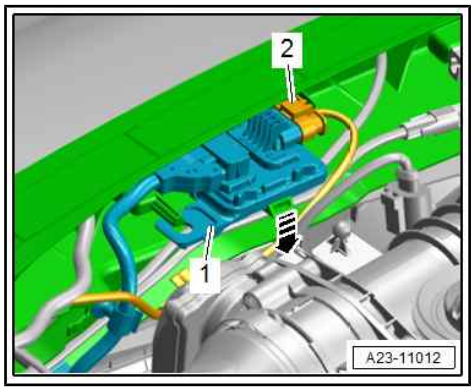
3 - For Lambda probe - G39-

4 - For exhaust gas temperature sender 2 - G448-



Version 1:

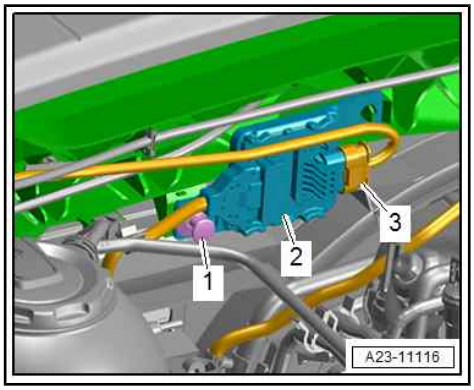
– Unplug electrical connector -2-.
– Release fastener -arrow-, detach control unit for NOx sender - J583- -item 1- and move it clear.



Version 2:

– Unplug electrical connector -3-.

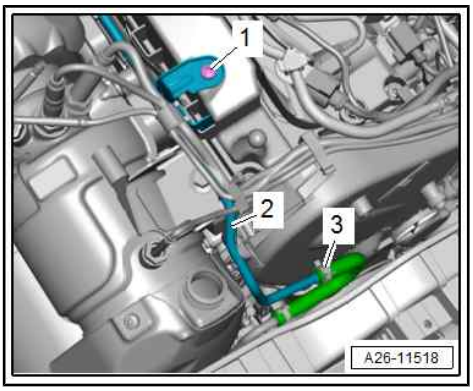
– Remove spreader rivet -1-, detach control unit for NOx sender - J583- -item 2- and move it clear.



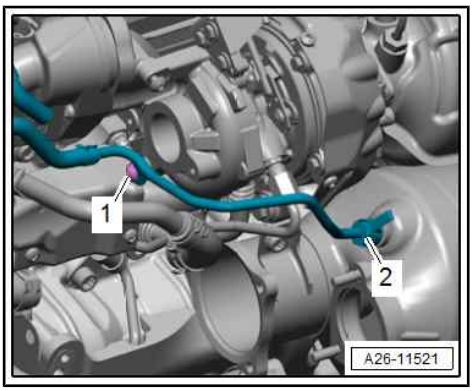
All vehicles (continued):

– Release hose clip -3- and detach hose.

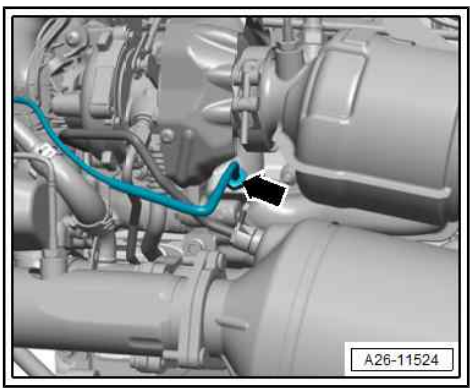
– Remove bolt -1- and push measuring tube -2- to side.



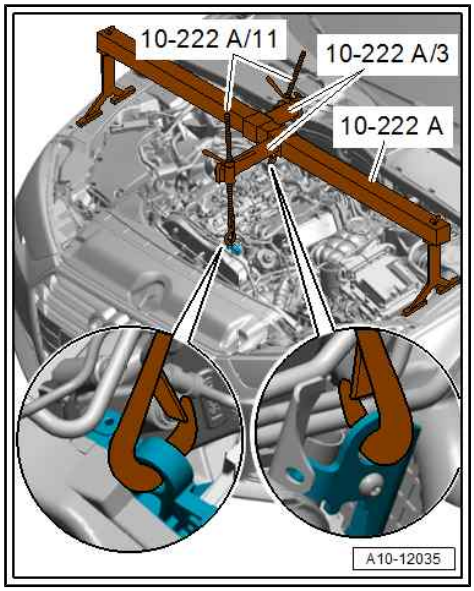
– Remove union nut -2- and bolt -1- and move measuring tube to one side.



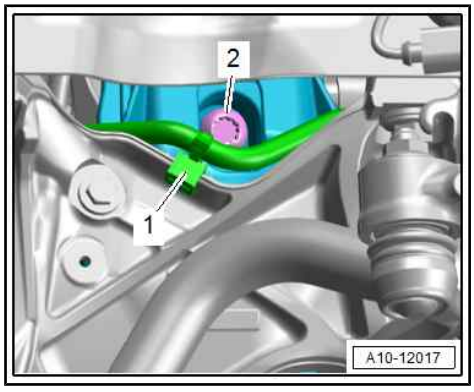
– Unscrew exhaust gas temperature sender 1 - G235- -arrow- using flared ring spanner tool insert (17 mm) - V.A.G 1331/10- .



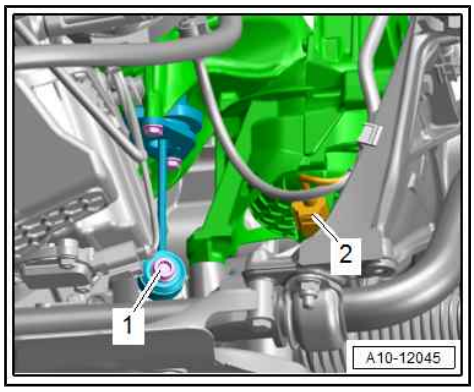
– Support engine in installation position ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Supporting engine in installation position .



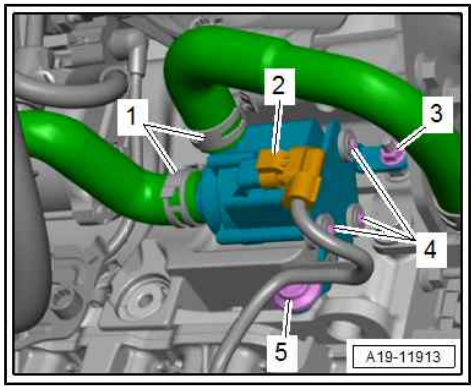
– Remove bolt -2- for engine mounting (right-side).



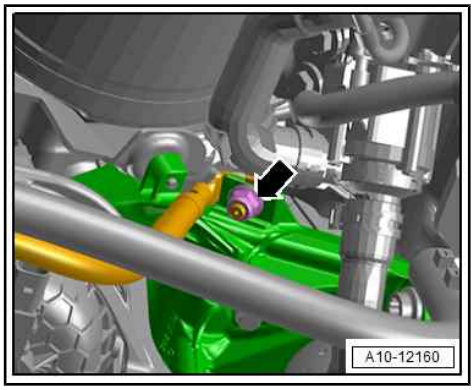
– Remove bolt -1- for support mounting (right-side).
– Unbolt drive shaft (right-side) from gearbox ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .



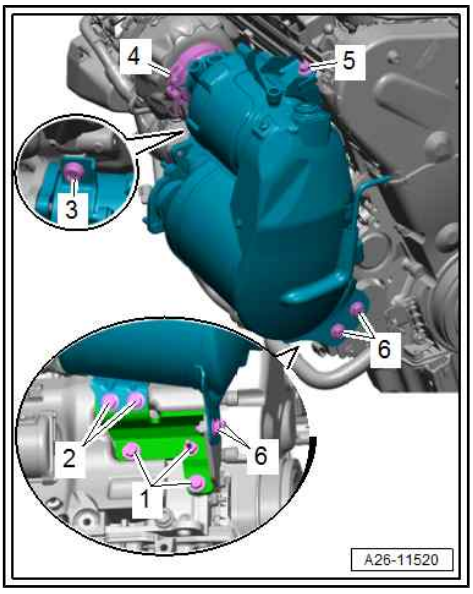
– Remove nut -3- and bolt -5- and push auxiliary pump for heating - V488- clear to one side.



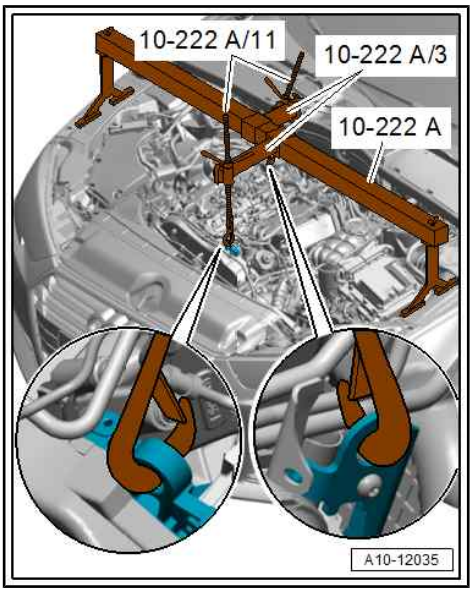
– Remove nut -arrow- and move earth wire clear.



– Open clip -4- and place it on intake funnel of emission control module.
– Remove bolts in the sequence: -5, 6, 2, 3- and slacken bolts -1-.



– Use spindles -10-222A/11- to raise engine slightly (just far enough so that emission control module can be removed).
– Lift out emission control module.



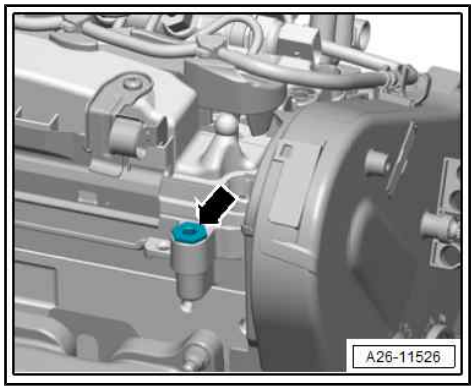
Installing

- After removing, renew bolts tightened with specified tightening angle.
- Renew seals, self-locking nuts and screw-type clips for emission control module after removal.
- Re-fit all cable ties and heat insulation sleeves in the same locations when installing.

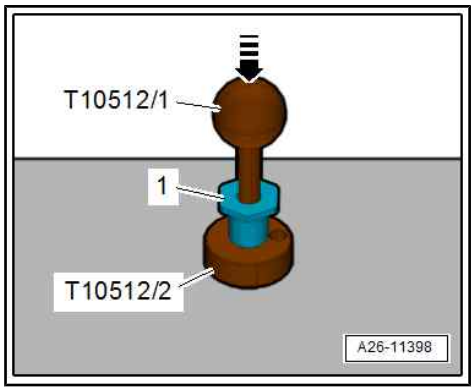
Installation requirements:

- ♦ Emission control module must be installed free of tension to avoid risk of stress fractures and engine damage.
- ♦ Prior to installation, ensure that the compensation elements move easily and do not stick.
- ♦ Compensation element must turn easily on its threads.
- ♦ Lubricant must only be applied to thread; retainer tabs must remain free of lubricant.
- ♦ The retainer tabs for the bolt must be bent together so that when the bolt is screwed in, the compensation element turns as well.

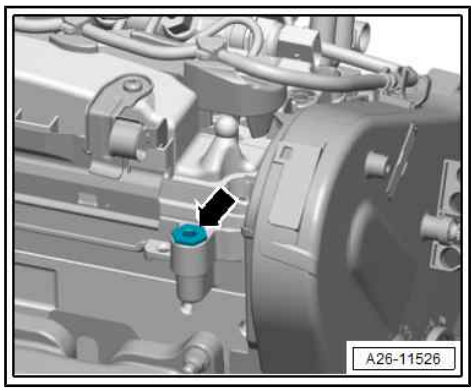
– Check to ensure freedom of movement of compensation element -arrow-.
– Unscrew compensation element completely in clockwise direction (left-hand thread).
– Clean thread if it does not turn easily and lubricate lightly with rust remover if necessary.
• Do not use any kind of lubricant on the retaining tabs of the compensation element, as this will reduce the build-up of friction and compromise the function of the compensation element.



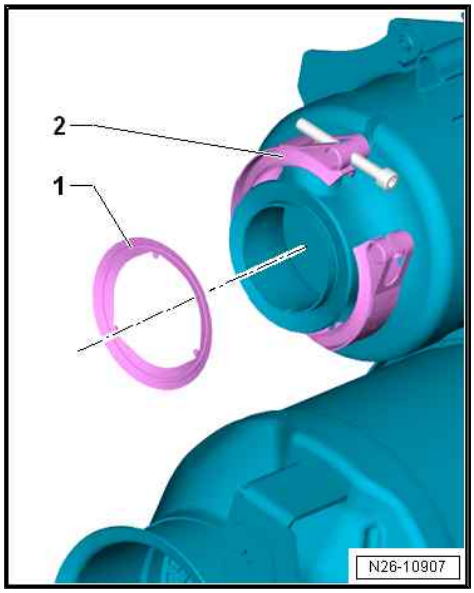
– Adjust retainer tabs to functional dimension using calibration tool -T10512/1-2- as follows:
– Slide compensation element -1- onto pin -T10512/1- , insert into centring sleeve -T10512/2- and bend back retainer tabs by gently striking -arrow- ball head with heel of your hand.



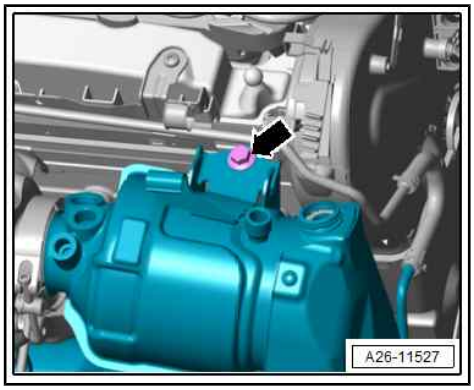
– Tighten compensation element -arrow- to 3 Nm and slacken again by 90°.



• Renew seal -1- and screw-type clip -2- after removal.
– Fit seal -1- onto emission control module.
– Disengage screw on clip -2- and move clip all the way onto intake funnel of emission control module. Do not bend clip open.



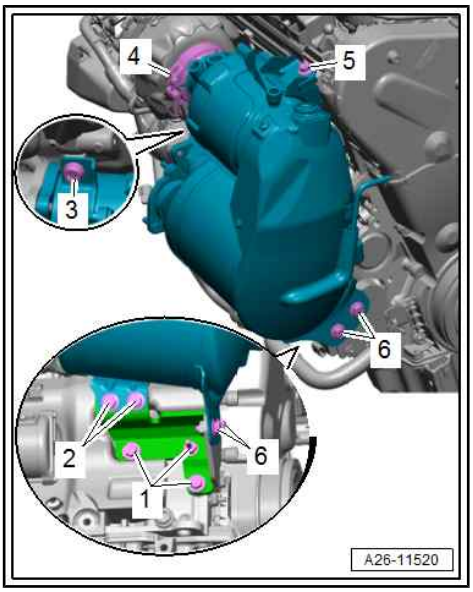
– Guide emission control module into installation position.
– Insert bolt -arrow- to secure in place.
• Emission control module is now suspended approximately in installation position with its weight supported.



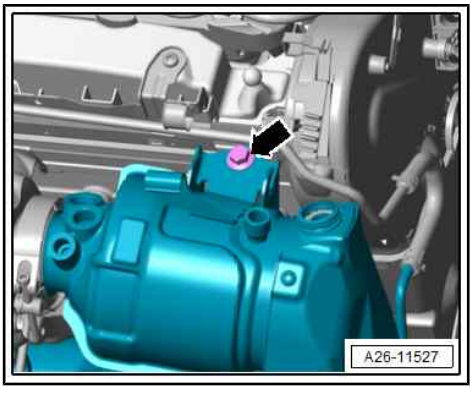
Tightening sequence for emission control module

• Renew all securing bolts for emission control module after removal.

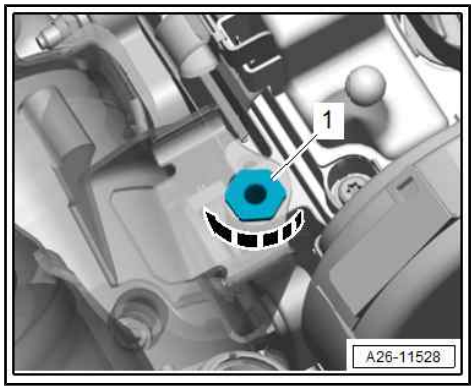
Stage	Bolt	Step
1.	Screw-type clip -4-	Fit over sealing flange, engage screw and tighten to 1 Nm
2.	Bolt -3-	Tighten to 2 Nm and loosen immediately by 90°
3.	Screw-type clip -4-	Tighten to 7 Nm
4.	Bolt -3-	Tighten to 20 Nm
5.	Bolts -1-	Tighten to 2 Nm and loosen immediately by 90°
6.	Bolts -2-	Tighten to 2 Nm and loosen immediately by 90°
7.	Bolts -6-	Tighten to 2 Nm
8.	Bolts -1-	Tighten to 20 Nm
9.	Bolt -6-	Tighten to 20 Nm
10.	Bolt -2-	Tighten to 20 Nm



– Remove bolt -arrow- previously inserted to secure in place.

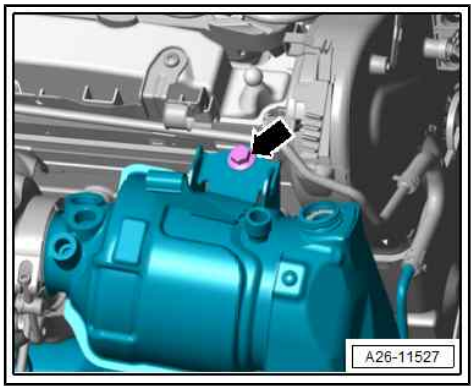


– Using socket, 8 mm - 3247- , unscrew compensation element (left-hand thread) -1- on cylinder head in direction of -arrow- to 2 Nm until it makes contact, then turn 90° further.



Tightening sequence continued

Stage	Bolt	Step
11.	Bolt -arrow-	Insert and press until it engages
12.	Bolt -arrow-	Tighten to 20 Nm
13.	Bolt -arrow-	Turn 90° further
14.	Bolt -arrow-	Turn another 45° further



– Remove support mounting ⇒ 4-cyl. TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Supporting engine in installation position .

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

– Install exhaust gas temperature sender 1 - G235- ⇒ page 222 .

– Install injector for reducing agent - N474- ⇒ page 217 .

– Install exhaust gas recirculation cooler ⇒ page 232 .

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Adaptions must be reset in engine control unit after renewing emission control module.

Select following menu options on ⇒ Vehicle diagnostic tester:

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Functions, component replacement`

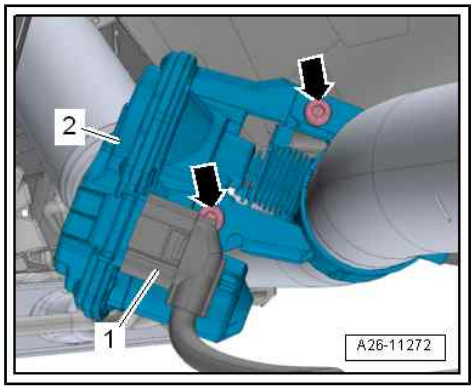
Tightening torques

- ⇒ “8.1 Exploded view - Lambda probe”, page 194
- Measuring tube ⇒ “2.2 Exploded view - cylinder head cover”, page 65
- ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 19 ; Coolant pump/thermostat assembly; Exploded view - electric coolant pump
- ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 10 ; Assembly mountings; Exploded view - assembly mountings
- ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft
- ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing heat shield for drive shaft
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)

2.4 Removing and installing exhaust flap control unit - J883-

- Observe safety precautions when working on the exhaust system
⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

Removing

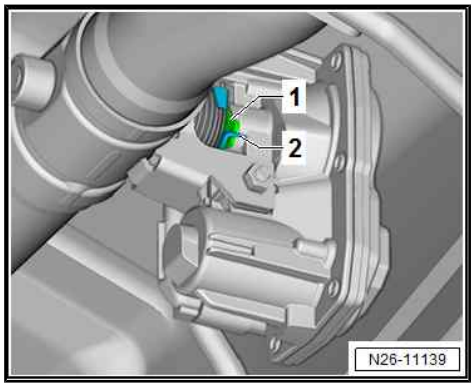


– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and remove exhaust flap control unit - J883- .

Installing

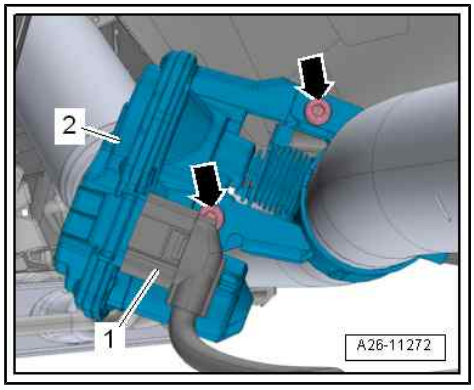
Installation is carried out in reverse order; note the following:



- Renew bolts and nuts after removing.

– Fit exhaust flap control unit.

- Coupling -1- must engage in retainer of exhaust flap -2-.



– Tighten upper bolt first, then tighten lower bolt.

– Remove protective cap for electrical connector and plug connector -1- in. Secure heat insulation sleeve if necessary.

Tightening torques

♦ ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; Exhaust pipes/silencers; Exploded view - silencers

– Learnt values must be adapted in engine control unit after renewing exhaust flap control unit - J883- .

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

♦ `Drive train`

♦ `Select engine code and engine`

♦ `01 - Self-diagnosis compatible systems`

♦ `01 - Engine electronics`

♦ `01 - Engine electronics, functions`

♦ `01 - Functions, component replacement`

3 SCR (selective catalytic reduction) system

3.1 Exploded view - reducing agent tank

All components are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; SCR (selective catalytic reduction) system; Exploded view - reducing agent tank .

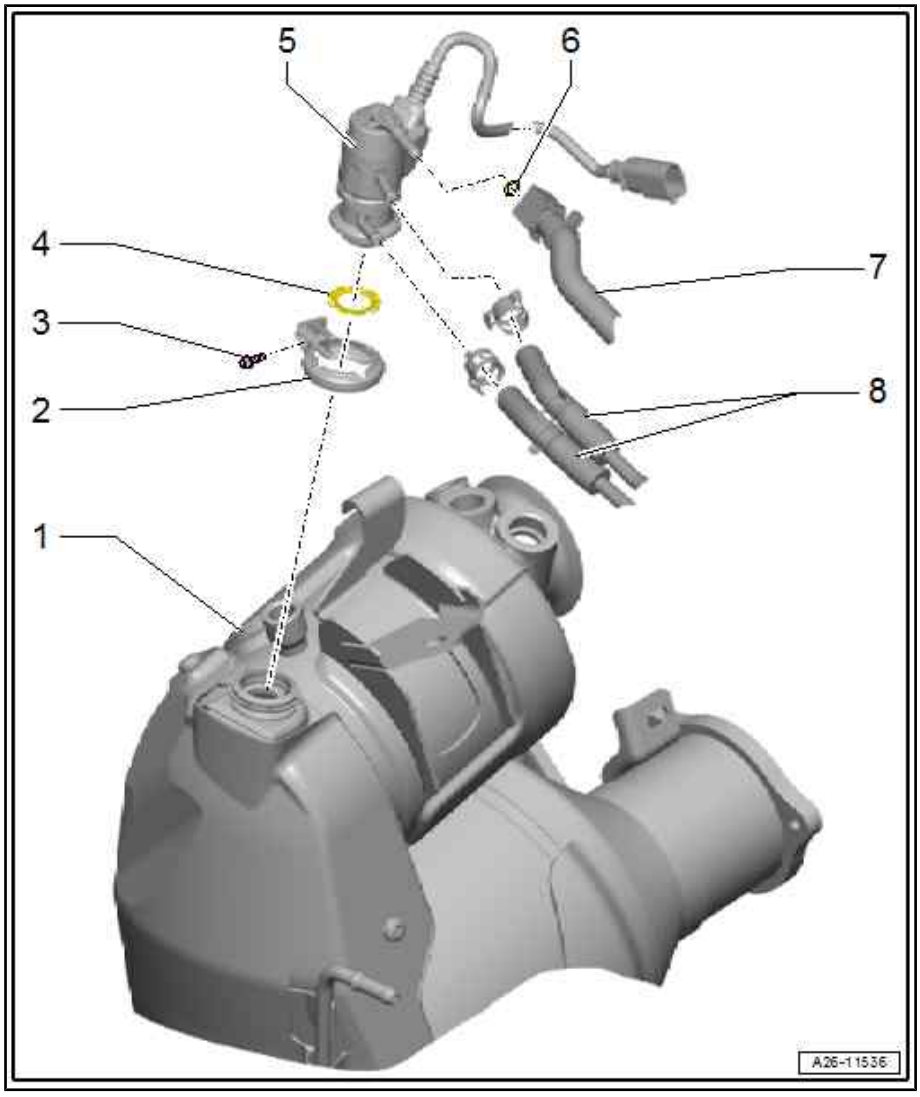
3.2 Exploded view - control unit for SCR system

All components are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 26 ; SCR (selective catalytic reduction) system; Exploded view - control unit for SCR system .

3.3 Exploded view - delivery unit

All components are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 26 ; SCR (selective catalytic reduction) system; Exploded view - delivery unit .

3.4 Exploded view - reducing agent supply line



1 - Emission control module

- ❑ Removing and installing ⇒ page 205

2 - Screw-type clip

- ❑ Renew after removing

3 - Bolt

- ❑ 5 Nm

4 - Seal

- ❑ Renew after removing

5 - Injector for reducing agent - N474-

- ❑ Removing and installing ⇒ page 217
- ❑ Lugs in injector for reducing agent - N474- must be inserted in corresponding mountings
- ❑ Adapt SCR learnt values after filling up reducing agent or renewing components ⇒ “3.13 Adapting SCR learnt values”, page 219 .

6 - O-ring

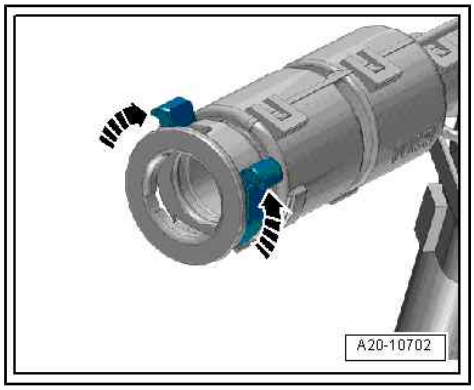
- ❑ Renew after removing

7 - Supply line

- ❑ From reducing agent pump - V437-
- ❑ With heater
- ❑ Clip onto fuel tank
- ❑ Disconnecting and connecting plug-in connector ⇒ page 216
- ❑ Adapt SCR learnt values after filling up reducing agent or renewing components ⇒ “3.13 Adapting SCR learnt values”, page 219 .

8 - Coolant hoses

Disconnecting and connecting supply line - version with release catch



Separating

- To prevent large amounts of reducing agent from escaping when the supply line is opened, wait until the reducing agent has been drawn back automatically ⇒ page 5 .

– To disconnect supply line, press release catches in direction of -arrows-.

Connecting

- Plug-in connector must engage audibly when connecting.

– Pull to check that plug-in connectors are correctly engaged.

3.5 Releasing pressure in SCR system

Special tools and workshop equipment required

- Safety goggles
- Protective gloves

Procedure

CAUTION

The SCR system is pressurised.

Risk of injury as fuel may spray out.

– Put on safety goggles.

– Put on protective gloves.

– Release pressure (wrap a clean cloth around connection and open connection carefully).

– Disconnect quick connector at reducing agent tank or supply line - version with release catch ⇒ page 216 .

3.6 Draining reducing agent tank

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; SCR (selective catalytic reduction) system; Draining reducing agent tank .

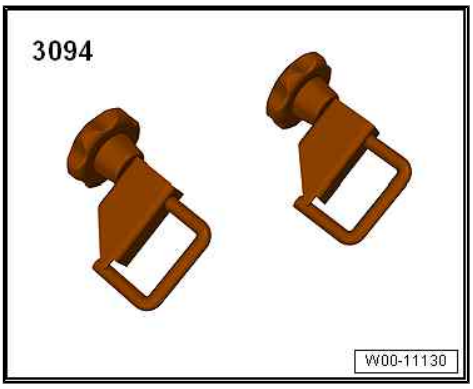
3.7 Removing and installing reducing agent tank

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; SCR (selective catalytic reduction) system; Removing and installing reducing agent tank .

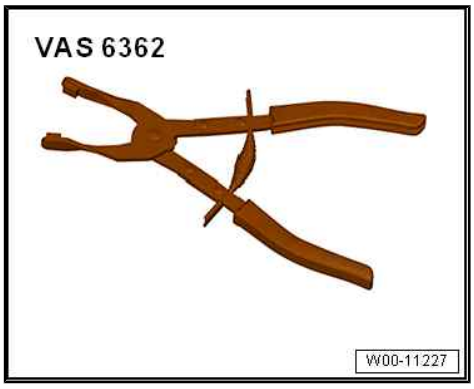
3.8 Removing and installing injector for reducing agent - N474-

Special tools and workshop equipment required

- Hose clamps, up to 25 mm - 3094-



- Hose clip pliers - VAS 6362-



Removing

CAUTION

Risk of injury caused by escaping reducing agent

Reducing agent can cause eye and skin irritation, damage to the respiratory tract and poisoning.

- **Put on safety goggles.**
- **Put on protective gloves.**
- **Wear protective clothing.**
- **Ensure that there is sufficient fresh air. In enclosed spaces, switch on the exhaust extraction system.**

– Remove engine cover panel ⇒ page 13 .

– Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.

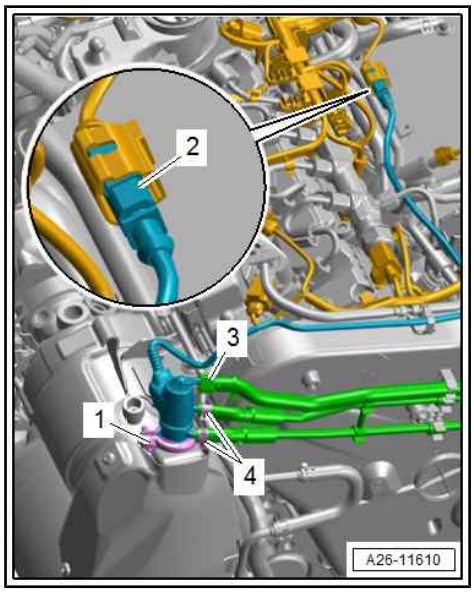
– Hold a clean cloth under separating point to catch escaping reducing agent.

– Release pressure in SCR system ⇒ page 216 .

– Disconnect supply line -3- from injector for reducing agent - N474- ⇒ page 216 .

– Clamp off coolant hoses using hose clamps -3094- , release hose clips -4- and disconnect coolant hoses.

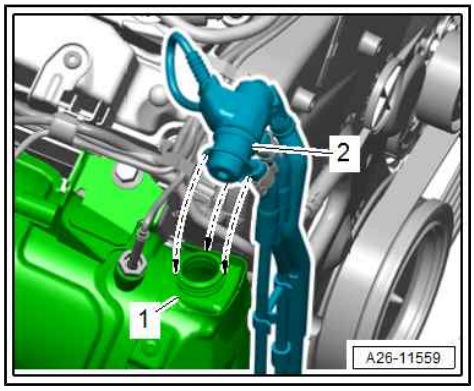
– Release retaining clip -1- and detach injector for reducing agent - N474- .



Installing

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

- Renew gasket and retaining clip after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .
- Installation position: lugs in injector for reducing agent - N474- -item 2- must be inserted -arrows- in corresponding mountings in front exhaust pipe -1-.



– Connect supply line ⇒ page 216 .

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install engine cover panel ⇒ page 13 .

– Adapt SCR learnt values after filling up reducing agent or renewing components ⇒ “3.13 Adapting SCR learnt values”, page 219 .

Tightening torques

◆ ⇒ “3.4 Exploded view - reducing agent supply line”, page 215

3.9 Removing and installing control unit for reducing agent metering system - J880-

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 26 ; SCR (selective catalytic reduction) system ; Removing and installing control unit for reducing agent metering system - J880- .

3.10 Removing and installing pump for reducing agent - V437-

All procedures are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 26 ; SCR (selective catalytic reduction) system; Removing and installing pump for reducing agent - V437- .

3.11 Removing and installing pressure sender for reducing agent metering system - G686-

All procedures are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 26 ; SCR (selective catalytic reduction) system; Removing and installing pressure sender for reducing agent metering system - G686- .

3.12 Removing and installing connection for SCR supply line

All procedures are described in ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 26 ; SCR (selective catalytic reduction) system ; Removing and installing connection for SCR supply line.

3.13 Adapting SCR learnt values

Special tools and workshop equipment required

- Vehicle diagnostic tester

The learnt value in the engine control unit must be re-adapted using the ⇒ Vehicle diagnostic tester if reducing agent has been drained or any of the following components have been renewed:

- Reducing agent tank
- Pump for reducing agent - V437-
- Injector for reducing agent
- Reducing agent line
- Engine control unit
- Control unit for reducing agent metering system - J880-

Adapting learnt values

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

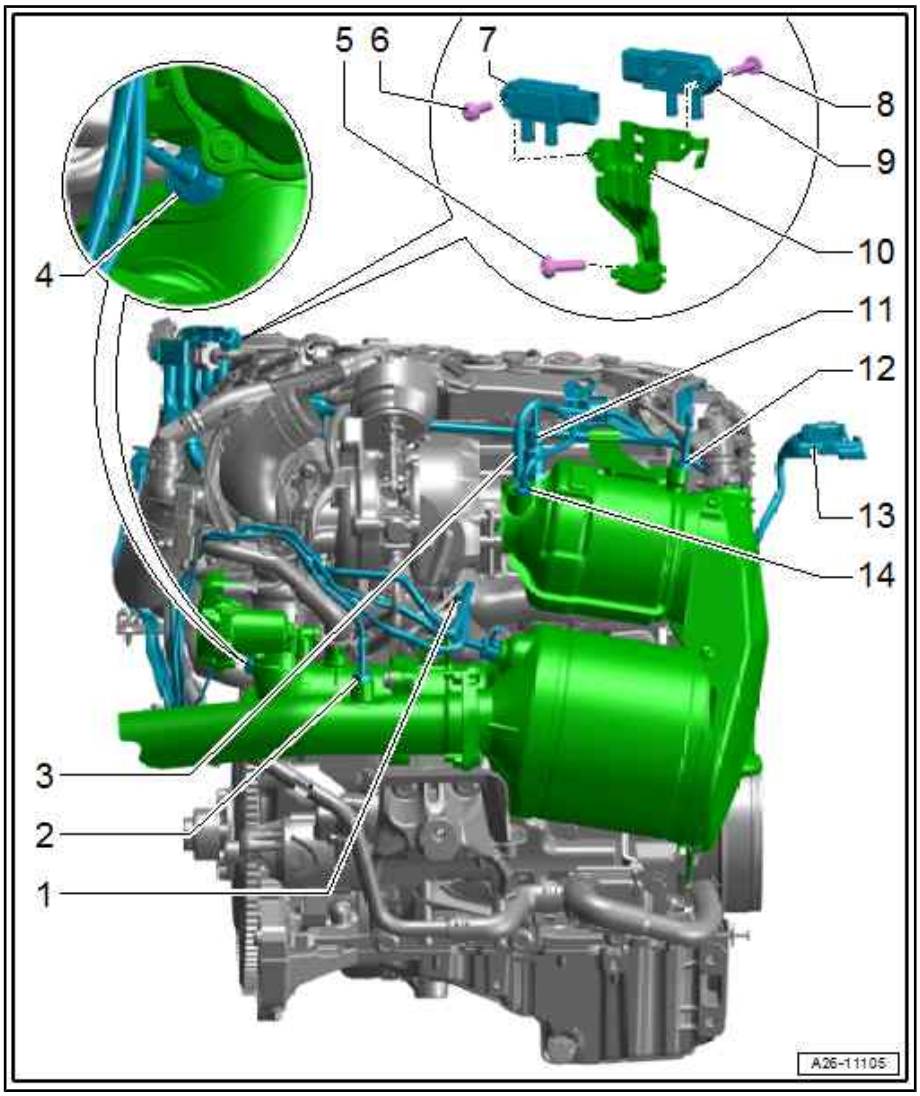
- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Adapt reduction agent system learned values`

If control unit for reducing agent metering system - J880- was renewed, use following function:

- 0001 - Reductant metering control unit, replace/ parameterise

4 Exhaust gas temperature control

4.1 Exploded view - exhaust gas temperature control



1 - Exhaust gas temperature sender 1 - G235-

- ❑ Removing and installing ⇒ page 222
- ❑ Coat with high-temperature paste ⇒ Electronic parts catalogue
- ❑ 45 Nm

2 - Exhaust gas temperature sender 4 - G648-

- ❑ Removing and installing ⇒ page 226
- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ 60 Nm

3 - NOx sender - G295-

- ❑ Removing and installing ⇒ page 197
- ❑ 55 Nm

4 - Exhaust gas recirculation temperature sensor - G98-

- ❑ Not fitted on all country-specific versions
- ❑ Removing and installing ⇒ page 237
- ❑ 20 Nm

5 - Bolt

- ❑ 8 Nm

6 - Bolt

- ❑ 8 Nm

7 - Exhaust gas pressure sensor 1 - G450-

- ❑ Removing and installing ⇒ page 193

8 - Bolt

- ❑ 8 Nm

9 - Pressure differential sender - G505-

- ❑ Removing and installing ⇒ page 191

10 - Bracket

- ❑ For pressure differential sender

11 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 195
- ❑ New Lambda probes are coated with an assembly paste
- ❑ If you are re-using Lambda probe, coat only thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste
- ❑ The assembly paste/high-temperature paste must not get into the slots on the Lambda probe body
- ❑ After renewal, perform adaptions listed in Guided Function `01 - Functions component replacement` ⇒ Vehicle diagnostic tester
- ❑ 55 Nm

12 - Exhaust gas temperature sender 3 - G495-

- ❑ Removing and installing ⇒ page 225
- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ 60 Nm

13 - Control unit for NOx sender - J583-

- ❑ Removing and installing ⇒ page 197

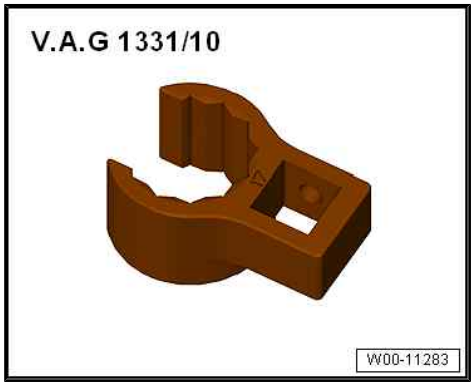
14 - Exhaust gas temperature sender 2 - G448-

- ❑ Removing and installing ⇒ page 223
- ❑ 60 Nm

4.2 Removing and installing exhaust gas temperature sender 1 - G235-

Special tools and workshop equipment required

- ♦ Flared ring spanner tool insert (17 mm) - V.A.G 1331/10-



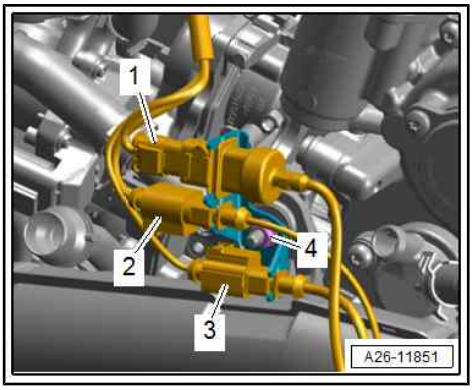
Removing

- Observe safety precautions when working on the exhaust system ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .
- Re-install all cable ties in original positions.
- When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.

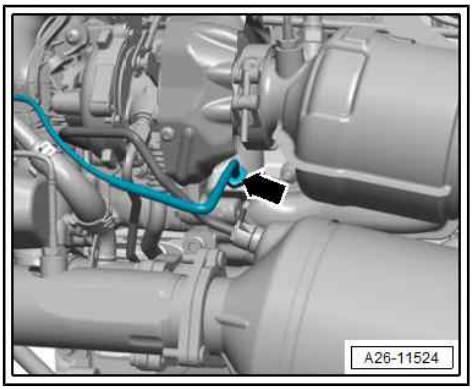
– Remove engine cover panel ⇒ page 13 .

– Remove air cleaner housing ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Air cleaner; Removing and installing air cleaner housing .

– Detach electrical connector -1- for exhaust gas temperature sender 1 - G235- from bracket, unplug connector and move electrical wiring clear.



– Unscrew exhaust gas temperature sender 1 - G235- -arrow- using flared ring spanner tool insert (17 mm) - V.A.G 1331/10- .

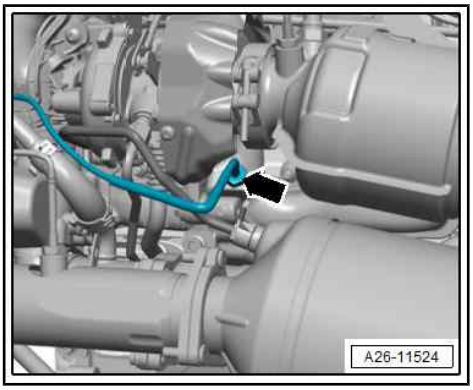


Installing

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

- Observe safety precautions when working on the exhaust system
⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .
- Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.
- Coat thread with high-temperature paste ⇒ Electronic parts catalogue .

Installation position of exhaust gas temperature sender 1 - G235- :



- Angled part of line -arrow- must point vertically downwards.

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install air cleaner housing ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Air cleaner; Removing and installing air cleaner housing .

– Install engine cover panel ⇒ page 13 .

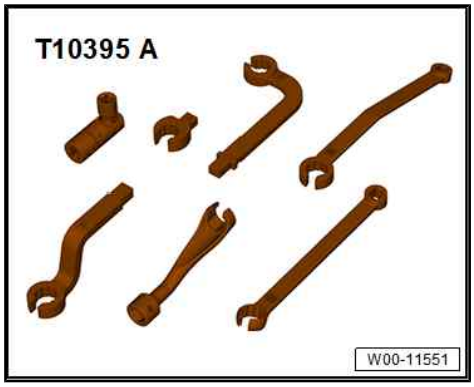
Tightening torques

♦ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 221

4.3 Removing and installing exhaust gas temperature sender 2 - G448-

Special tools and workshop equipment required

♦ Tool set - T10395 A- with suitable tool insert



♦ Supplement tool set - T10395/8-/10-

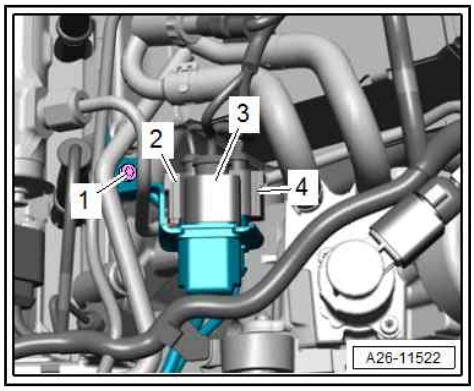
Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .
- Re-install all cable ties in original positions.
- When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.

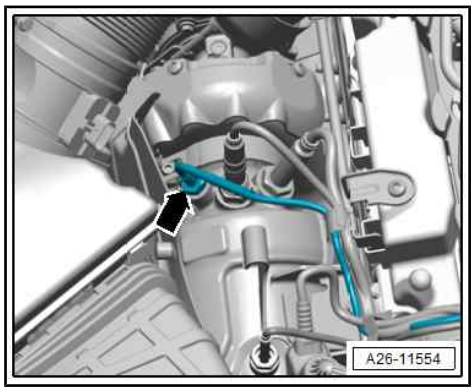
– Remove engine cover panel ⇒ page 13 .

– Detach electrical connector -3- from bracket.

– Take electrical connector -4- out of bracket, unplug it and move electrical wiring clear.



– Unscrew exhaust gas temperature sender 2 - G448- -arrow-.

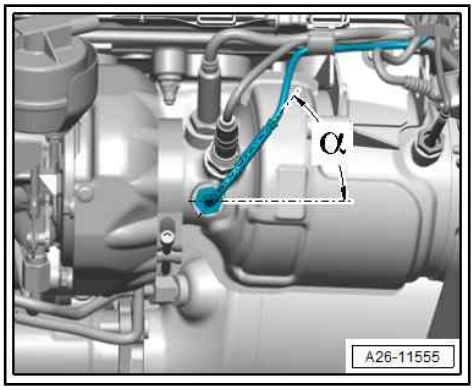


Installing

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

- Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.

Installation position of exhaust gas temperature sender 2 - G448- :



- Angle -α- = 80°

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install engine cover panel ⇒ page 13 .

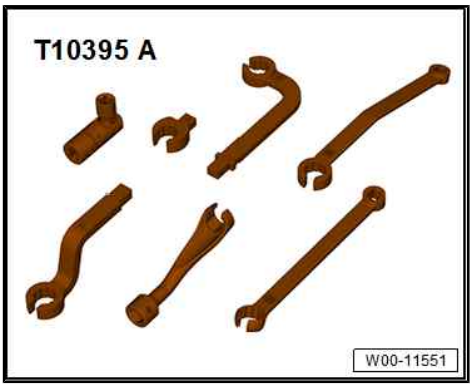
Tightening torques

♦ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 221

4.4 Removing and installing exhaust gas temperature sender 3 - G495-

Special tools and workshop equipment required

♦ Tool set - T10395 A-



♦ Supplement tool set - T10395/8-/10- with suitable tool insert

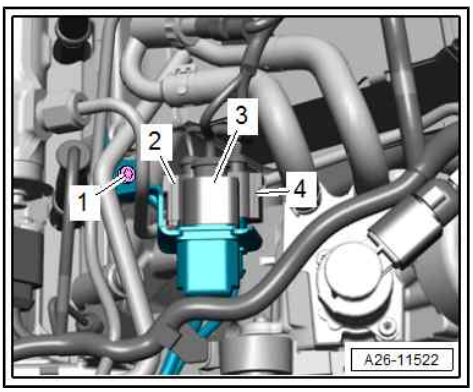
Removing

- Observe safety precautions when working on the exhaust system
⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .
- Re-install all cable ties in original positions.
- When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.

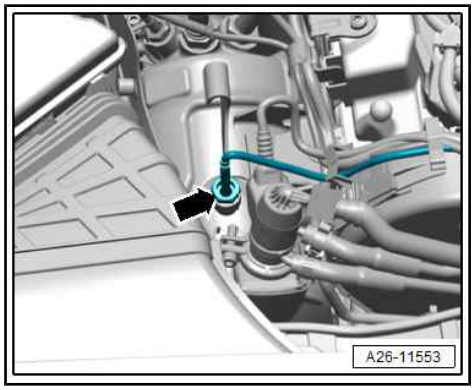
– Remove engine cover panel ⇒ page 13 .

– Detach electrical connector -3- from bracket.

– Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.



– Unscrew exhaust gas temperature sender 3 - G495- -arrow-.



Installing

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

– The threads of the exhaust gas temperature senders -G495- and -G648- are coated. Do NOT lubricate additionally with high-temperature paste.

- Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install engine cover panel ⇒ page 13 .

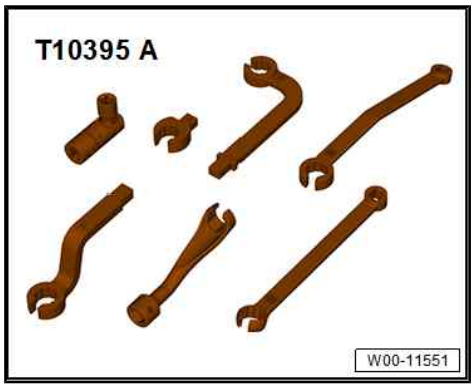
Tightening torques

♦ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 221

4.5 Removing and installing exhaust gas temperature sender 4 - G648-

Special tools and workshop equipment required

♦ Tool set - T10395 A- with suitable tool insert



♦ Supplement tool set - T10395/8-/10-

Removing

- Observe safety precautions when working on the exhaust system
⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .

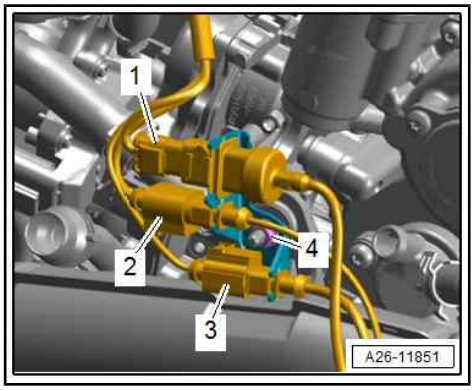
- Re-install all cable ties in original positions.

- When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.

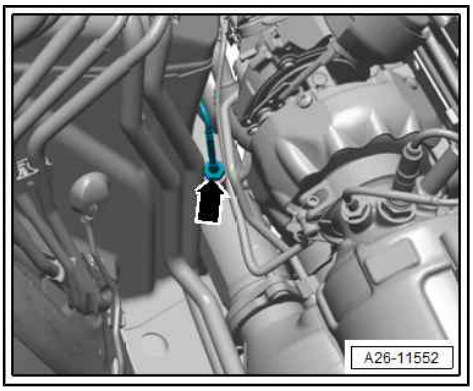
– Remove engine cover panel ⇒ page 13 .

– Remove air cleaner housing ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Air cleaner; Removing and installing air cleaner housing .

– Detach electrical connector -3- for exhaust gas temperature sender 4 - G648- from bracket, unplug connector and move electrical wiring clear.



– Unscrew exhaust gas temperature sender 4 - G648- -arrow-.



Installing

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

– The threads of the exhaust gas temperature senders -G495- and -G648- are coated. Do NOT lubricate additionally with high-temperature paste.

• Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.

– Electrical connections and routing ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install air cleaner housing ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 23 ; Air cleaner; Removing and installing air cleaner housing .

– Install engine cover panel ⇒ page 13 .

Tightening torques

◆ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 221

5 Exhaust gas recirculation

5.1 Exploded view - exhaust gas recirculation system

Exhaust gas recirculation control motor - V338-

1 - Bolt

- ❑ 9 Nm

2 - Exhaust gas recirculation control motor - V338-

- ❑ With exhaust gas recirculation potentiometer - G212-
- ❑ Removing and installing ⇒ page 230
- ❑ After renewing exhaust gas recirculation control motor - V338- , learnt values must be re-adapted; see `Guided Functions` of ⇒ Vehicle diagnostic tester, `01 - Functions component replacement`

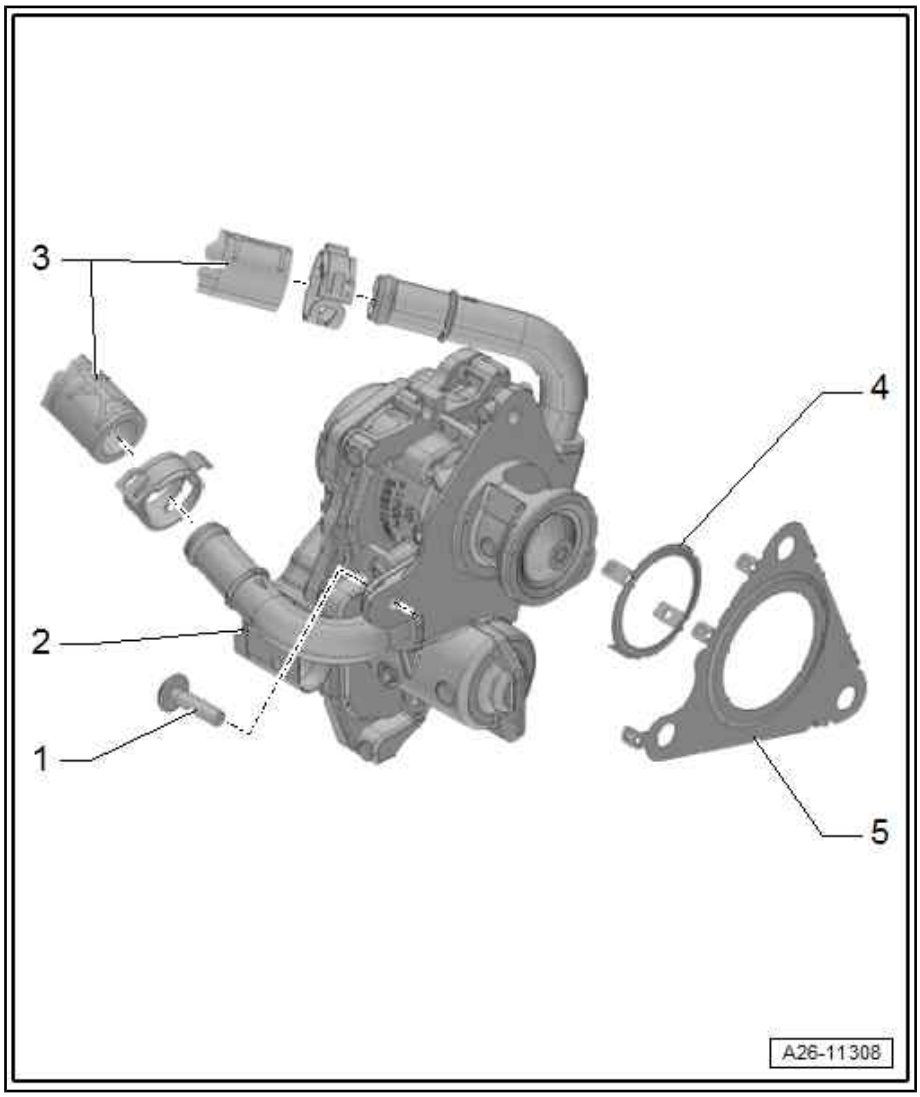
3 - Coolant hoses

4 - Gasket

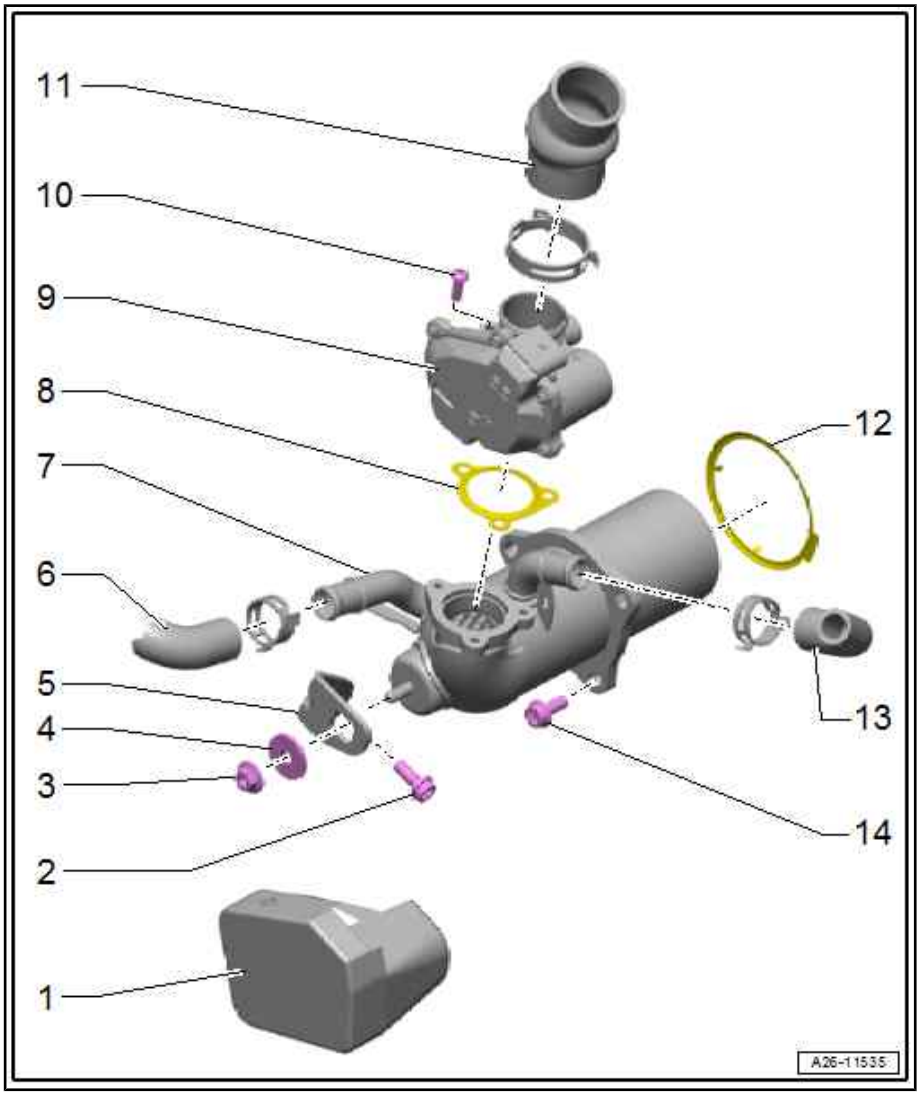
- ❑ Renew after removing

5 - Gasket

- ❑ Renew after removing



Exhaust gas recirculation control motor 2 - V339-



1 - Insulation mat

2 - Bolt

- ❑ Tightening torque and sequence ⇒ page 230 if only exhaust gas recirculation cooler was removed

3 - Nut

- ❑ Tightening torque and sequence ⇒ page 230 if only exhaust gas recirculation cooler was removed

4 - Washer

5 - Bracket

- ❑ For exhaust gas recirculation cooler

6 - Coolant hose

7 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 232

8 - Gasket

- ❑ Renew after removing

9 - Exhaust gas recirculation control motor 2 - V339-

- ❑ With exhaust gas recirculation potentiometer 2 - G466-
- ❑ Removing and installing ⇒ page 231
- ❑ After renewing exhaust gas recirculation control motor 2 - V339- , learnt values must be re-adapted; see ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Functions component replacement`

10 - Bolt

- ❑ 9 Nm

11 - Air hose

12 - Seal

- ❑ Renew after removing

13 - Coolant hose

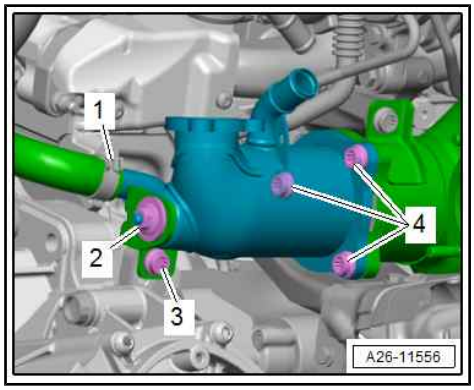
14 - Bolt

- ❑ Tightening torque and sequence ⇒ page 230 if only exhaust gas recirculation cooler was removed

Exhaust gas recirculation cooler - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

Stage	Bolts/nuts	Tightening torque
1.	-4-	20 Nm
2.	-1, 2, 3-	Screw in by hand until contact is made
3.	-1, 2, 3-	20 Nm



5.2 Removing and installing exhaust gas recirculation control motor - V338-

Special tools and workshop equipment required

♦ Vehicle diagnostic tester

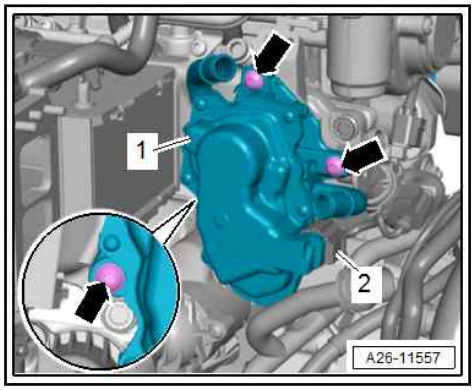
Removing

– Observe rules for cleanliness.

– Remove throttle valve module - J338- ⇒ page 153 .

– Unplug electrical connector -2-.

– Unscrew bolts -arrows- and detach exhaust gas recirculation control motor - V338- -1-.



Installing

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

• Renew gaskets/seals after removing.

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

– Install throttle valve module - J338- ⇒ page 153 .

– Learnt values must be reset in engine control unit after renewing exhaust gas recirculation control motor - V338- .

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

♦ `Drive train`

♦ `Select engine code and engine`

♦ `01 - Self-diagnosis compatible systems`

♦ `01 - Engine electronics`

♦ `01 - Engine electronics, functions`

♦ `01 - Functions component replacement`

Tightening torques

♦ ⇒ “5.1 Exploded view - exhaust gas recirculation system”, page 228

5.3 Removing and installing exhaust gas recirculation control motor 2 - V339-

Special tools and workshop equipment required

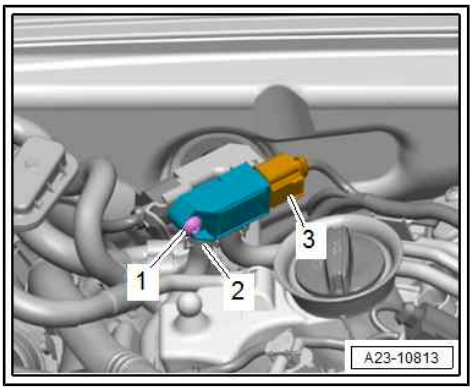
- Vehicle diagnostic tester

Removing

– Remove coolant pipe (rear right) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .

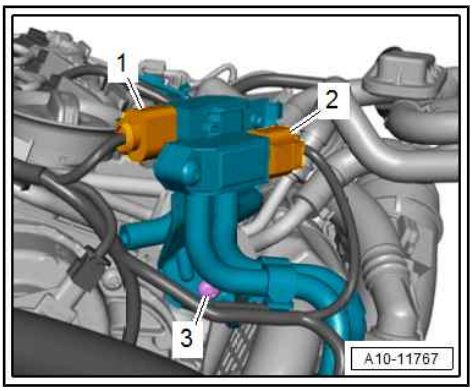
– Unplug electrical connector -3-.

– Remove bolt -1- and move exhaust gas pressure sensor 1 - G450- to side with hose -2- attached.



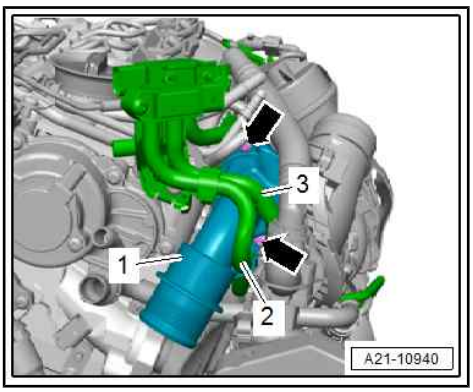
– Unplug electrical connector -2-.

– Remove bolt -3- and move pressure differential sender - G505- with bracket clear to one side.

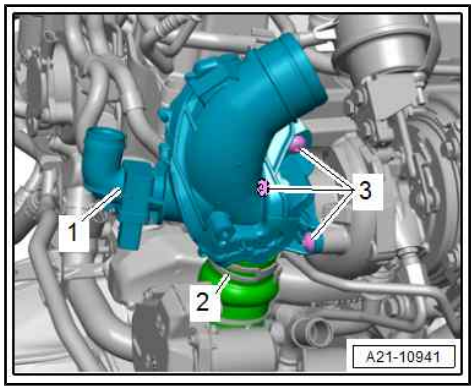


– Unscrew bolts -arrows- using socket Torx T30 - T10405- and move hose -2- clear.

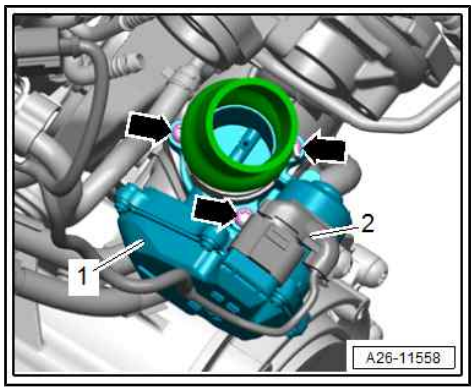
– Detach pulsation damper -1-.



– Remove bolts -3-.
– Open hose clip -2- and detach intake connecting pipe -1-.



– Unplug electrical connector -2-.
– Unscrew bolts -arrows- using socket Torx T30 - T10405- and detach control motor 2 for exhaust gas recircuation - V339- -item 1-.



Installing

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

- Renew insulation mat for control motor if damaged. Additionally check control motor for thermal damage and renew if necessary.
- Renew seal and O-ring after removal.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .

– Install coolant pipe (rear right) ⇒ 4-cylinder TDI engine, 2.0 ltr. 4-valve common rail; Rep. gr. 19 ; Coolant pipes; Removing and installing coolant pipes .
– Learnt values must be reset in engine control unit after renewing exhaust gas recirculation control motor 2 - V339- .
– Connect ⇒ Vehicle diagnostic tester.
– Select `Diagnosis` mode and then `Start diagnosis`.
– Choose `Select own test` tab and select following options one after the other:

◆ `Drive train`
◆ `Select engine code and engine`
◆ `01 - Self-diagnosis compatible systems`
◆ `01 - Engine electronics`
◆ `01 - Engine electronics, functions`
◆ `01 - Functions component replacement`

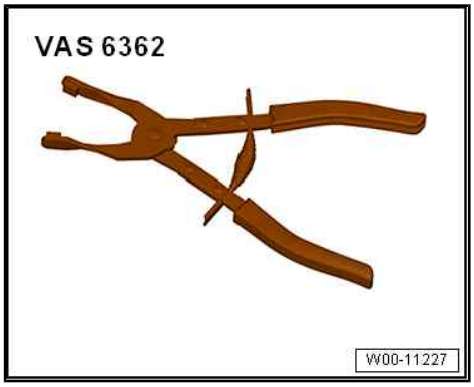
Tightening torques

◆ ⇒ “5.1 Exploded view - exhaust gas recirculation system”, page 228
◆ ⇒ “1.1 Exploded view - turbocharger”, page 125
◆ ⇒ “8.1 Exploded view - Lambda probe”, page 194

5.4 Removing and installing exhaust gas recirculation cooler

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



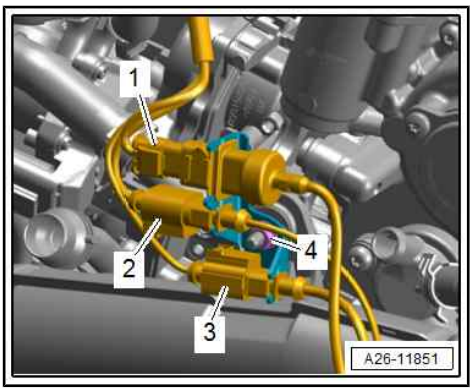
♦ Bit XZN 10 - T10501-

Removing

– Remove exhaust gas recirculation control motor 2 - V339- ⇒ page 231 .

– Remove front exhaust pipe ⇒ page 201 .

– Country-specific version: Take electrical connector -2- out of bracket, unplug it and move it clear.

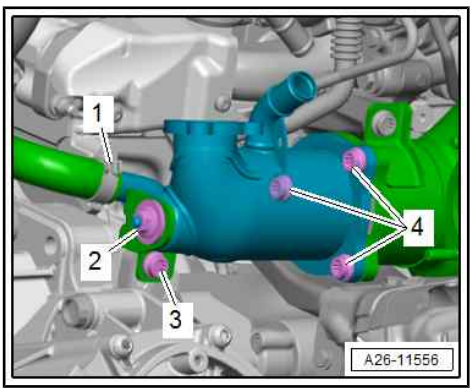


– Release hose clip -1- and disconnect coolant hose.

– Remove bolt -3- and nut -2- and detach bracket.

– Unscrew bolts -4- using bit XZN 10 - T10501- .

– Detach exhaust gas recirculation cooler.



Installing

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

- Renew gasket after removing.
- Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .

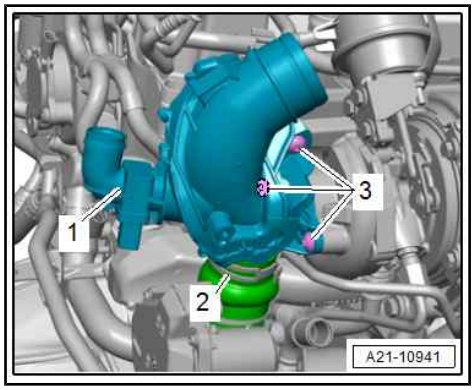
– Install exhaust gas recirculation control motor 2 - V339- ⇒ page 231 .

– Install intake connecting pipe -1- ⇒ page 125 .

– Tighten bolts securing exhaust gas recirculation cooler ⇒ page 230 .

Tightening torques

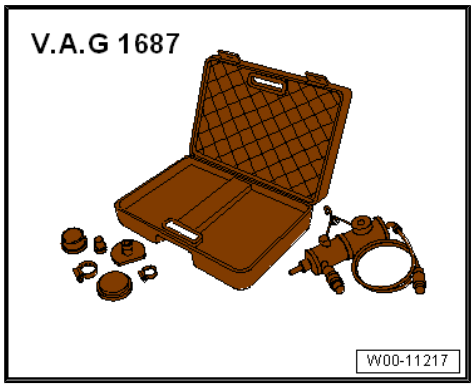
- ⇒ Fig. ""Exhaust gas recirculation cooler - tightening torque and sequence"" , page 230
- ⇒ "5.1 Exploded view - exhaust gas recirculation system", page 228
- ⇒ "1.1 Exploded view - silencers", page 201



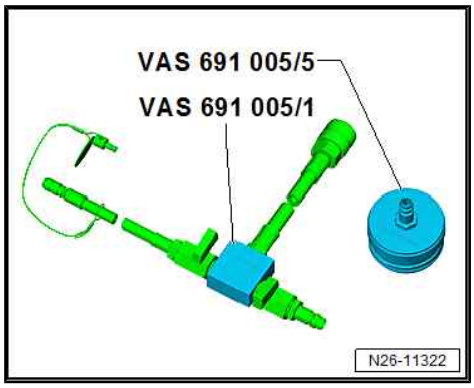
5.5 Checking exhaust gas recirculation cooler for leaks

Special tools and workshop equipment required

- Charge air system tester - V.A.G 1687-

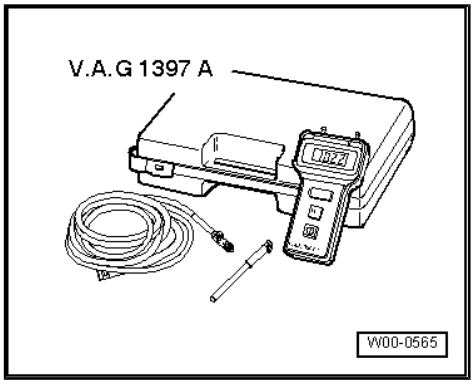


- Adapter - V.A.G 1687/11-
- Adapter - V.A.G 1687/15- for exhaust pipes with 60 mm and 65 mm diameter
- Adapter - V.A.G 1687/16- for exhaust pipe with 55 mm diameter
- Y-connector - VAS 691 005/1-



- Test instrument adapter - VAS 691 005/5-

♦ Turbocharger tester - V.A.G 1397A-



Test condition:

- Coolant temperature must be at least 40°C.

Connecting turbocharger tester - V.A.G 1397A- :

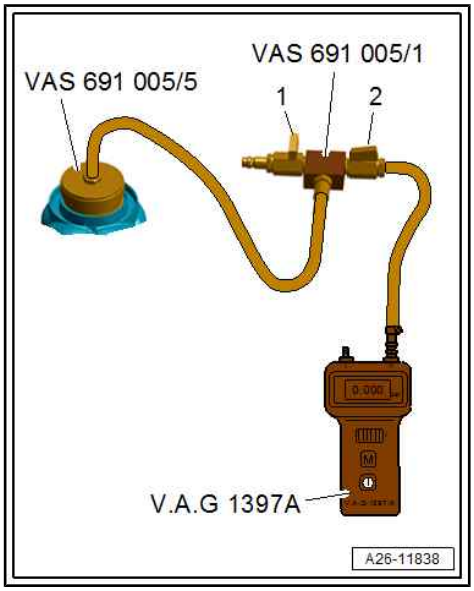
– Fit test adapter - VAS 691 005/5- onto coolant expansion tank.

– Fit Y-connector - VAS 691 005/1- onto test adapter - VAS 691 005/5- .

– Close valve -1- for connection »C« and open valve -2- for connection »A«.

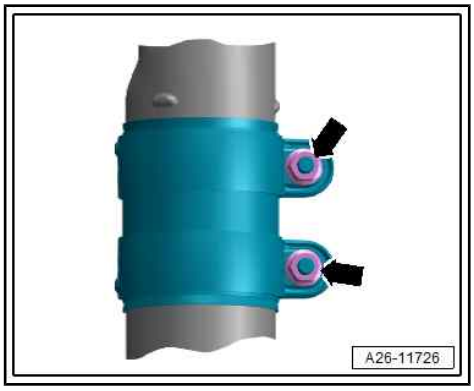
– Attach hose from connection »A« on Y-connector to connection »II« on turbocharger tester - V.A.G 1397A- .

– Set turbocharger tester - V.A.G 1397A- to switch position »II« (relative pressure measurement) and switch it on. The »II« must be visible.

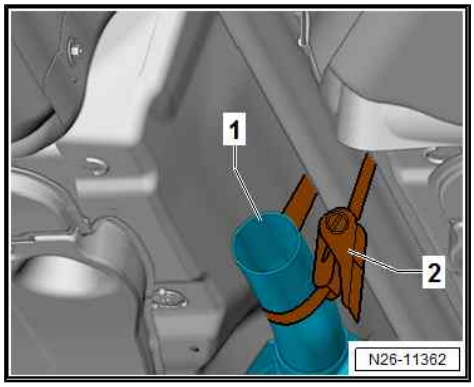


Connecting tester - V.A.G 1687- :

– Loosen clamp on exhaust pipe -arrows- and push towards rear.



– On vehicles without tunnel cross-piece, exhaust pipe -1- must be tied up with a tensioning strap -2-.

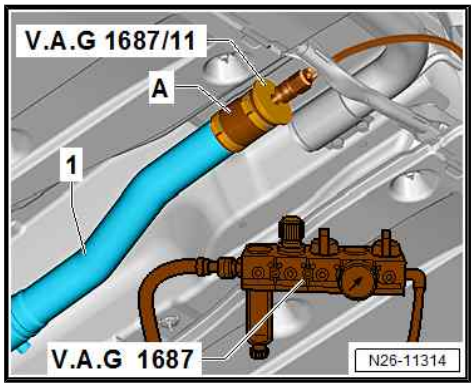


– Connect adapter - V.A.G 1687/11- with hose -A- to exhaust pipe (engine end). Secure hose with hose clips.

  Hose -A- for exhaust pipes with 55 mm diameter: Use hose - V.A.G 1687/16- .

  Hose -A- for exhaust pipes with 60 mm or 65 mm diameter: Use hose - V.A.G 1687/15- .

– Connect charge air system tester - V.A.G 1687- to adapter - V.A.G 1687/11- .



Prepare charge air system tester - V.A.G 1687- as follows:

– Pull pressure control valve -2- upwards, then unscrew completely and close valves -3- and -4-.

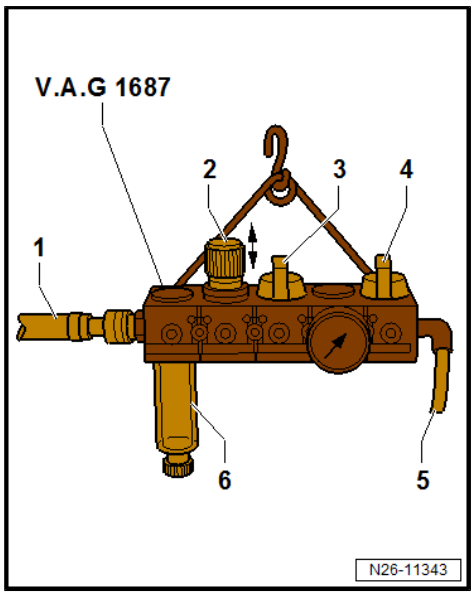
– Using a commercially available connection piece, connect charge air system tester - V.A.G 1687- to compressed air -1-.

– If there is water in sight glass, remove drain plug -6- and drain water.

– Open valve -3-.

– Adjust pressure to 0.5 bar via pressure control valve -2-.

– Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.

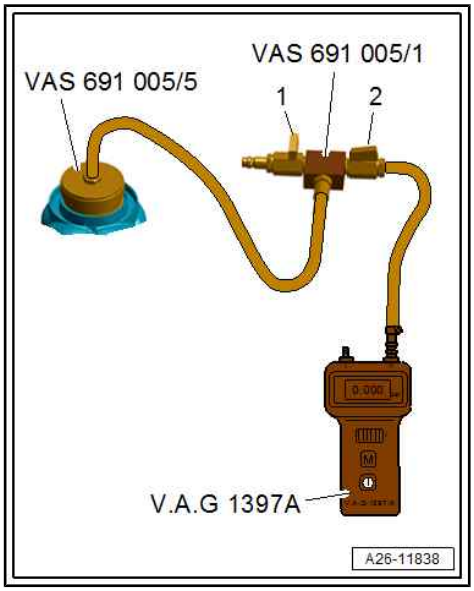


Reading off values from turbocharger tester - V.A.G 1397A- :

- Observe turbocharger tester for approx. 5 minutes.
- The pressure displayed on the turbocharger tester must not rise.

– If pressure displayed on turbocharger tester rises, this means that compressed air is escaping from the exhaust end into the cooling system. There is a leak in exhaust gas recirculation cooler; renew exhaust gas recirculation cooler.

- If there are no leaks in the exhaust gas recirculation cooler, a vacuum may form when the coolant cools down. A minus sign on the turbocharger tester indicates that a vacuum has formed.



Cleaning Y-connector - VAS 691 005/1- :

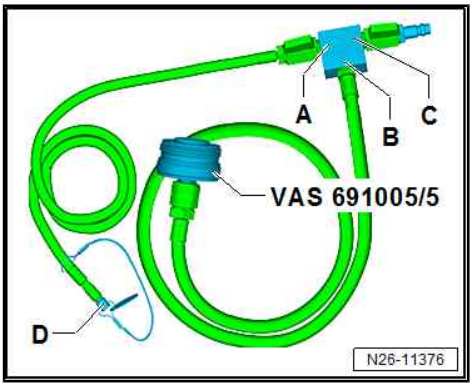
- After the leak test has been completed, the Y-connector - VAS 691 005/1- must be cleaned to remove any water which may have entered.

– Insert cleaning nozzle -D- in hose from connection -A- on Y connector .

– Fit test adapter - VAS 691 005/5- onto hose from connection -B-.

– Fit compressed air hose on connection -C-.

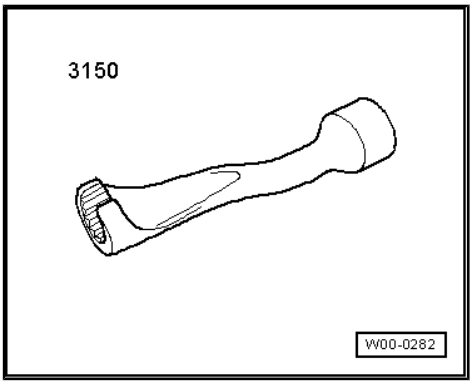
– Open cut-off valves and blow through hose for approx. 15 seconds.



5.6 Removing and installing exhaust gas recirculation temperature sensor - G98-

Special tools and workshop equipment required

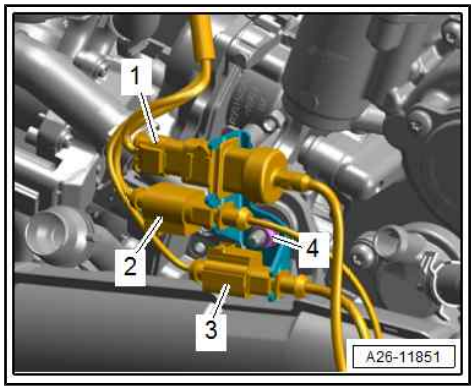
♦ 14 mm socket wrench - 3150-



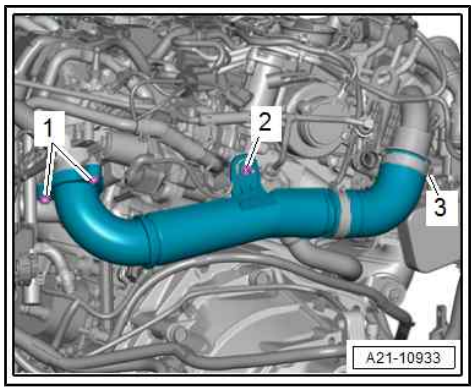
Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.5 Safety precautions when working on the exhaust system”, page 3 .
- Re-install all cable ties in original positions.
- When removing, the electrical wiring must not be cut, otherwise a fault diagnosis would no longer be possible.

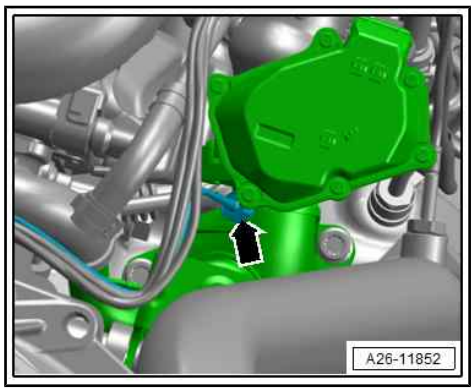
– Take electrical connector -2- out of bracket, unplug it and move electrical wiring clear.
– Remove nut -4- and move bracket with electrical connectors to one side.



– Remove bolts -1- and centre hex stud -2-.
– Release hose clip -3- and detach air pipe.



– Use socket, 14 mm - 3150- to unscrew exhaust gas recirculation temperature sensor - G98- -arrow-.



Installing

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

- Take care to protect exhaust gas temperature sender from knocks and impact; if dropped, the exhaust gas temperature sender can no longer be used.
- Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

– Align exhaust gas recirculation temperature sensor - G98- with as much clearance from surrounding components as possible.

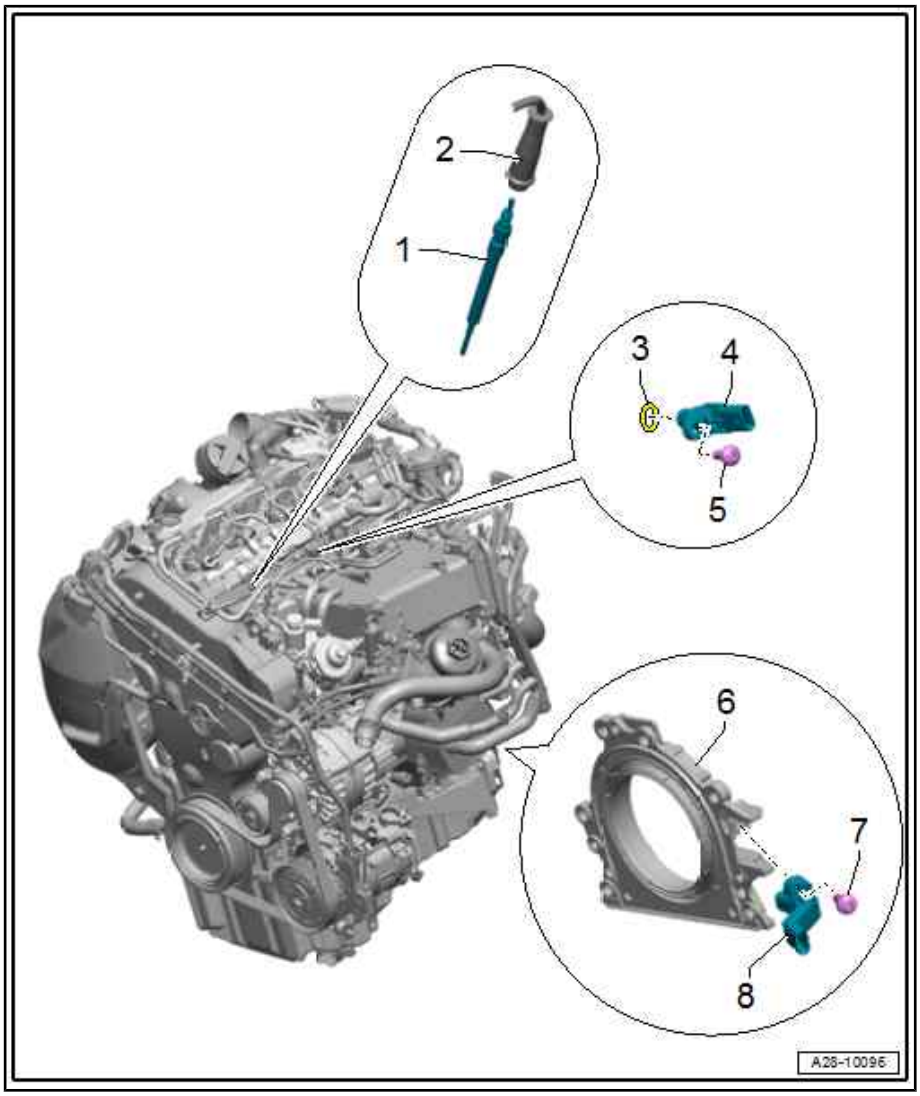
Tightening torques

◆ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 221

28 – Glow plug system

1 Glow plug system

1.1 Exploded view - glow plug system



1 - Glow plug

- Glow plug 1 - Q10- ; country-specific version with cylinder 1 combustion chamber pressure sender - G677-
- Glow plug 2 - Q11- ; country-specific version with cylinder 2 combustion chamber pressure sender - G678-
- Glow plug 3 - Q12- with cylinder 3 combustion chamber pressure sender - G679-
- Glow plug 4 - Q13- ; country-specific version with cylinder 4 combustion chamber pressure sender - G680-
  - ❑ Learnt values must be reset in engine control unit after renewing a glow plug
  - ❑ Glow plug versions and tightening torques ⇒ page 240
  - ❑ Removing and installing ⇒ page 240

2 - Electrical connector

3 - O-ring

- ❑ Renew Hall sender - G40- if damaged

4 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 243

5 - Bolt

- ❑ 9 Nm

6 - Sealing flange (gearbox end)

- ❑ With sender wheel for engine speed sender - G28-
- ❑ Cannot be dismantled

❑ Removing and installing ⇒ page 28

7 - Bolt

❑ 4.5 Nm

8 - Engine speed sender - G28-

❑ Removing and installing ⇒ page 243

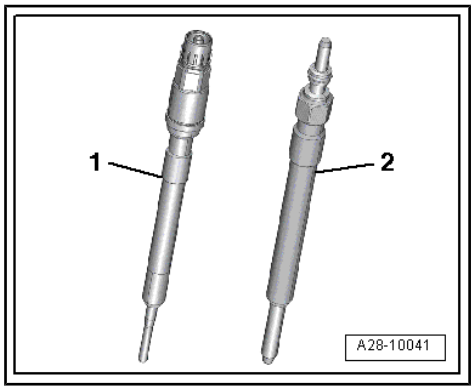
Glow plug versions and tightening torques

1 - Glow plug with combustion chamber pressure sender

♦ 12 Nm

2 - Glow plug without combustion chamber pressure sender

♦ 17 Nm

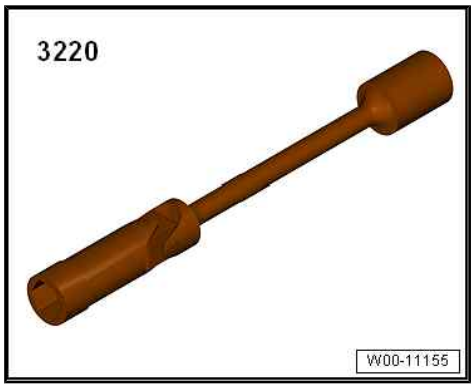


1.2 Removing and installing glow plug

Special tools and workshop equipment required

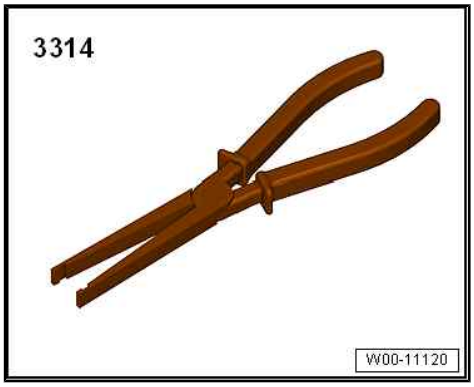
♦ Vehicle diagnostic tester

♦ Articulated wrench, 10 mm - 3220-



♦ Socket insert AF 12 for glow plugs 4-cyl.TDI CR diesel - VAS 6454- for glow plug with combustion chamber pressure sender

♦ Pliers - 3314-



Removing

– Switch off ignition.

– Remove engine cover panel ⇒ page 13 .

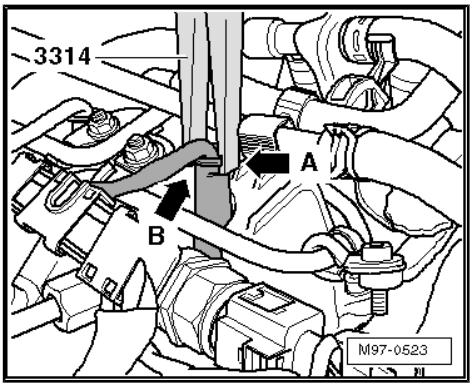
NOTICE

Risk of damage to support sleeves when removing.

– Do not squeeze pliers - 3314- too firmly when removing glow plug connectors.

– Release retaining clips at wiring harness and detach electrical connectors from glow plugs as follows.

– Apply groove -arrow A- of pliers - 3314- to collar of support sleeve -arrow B- as shown in illustration.



– Carefully detach glow plug connectors from glow plugs.

– Clean glow plug opening to make sure no dirt gets into cylinders; note the following:

CAUTION

Risk of injury caused by soot particles in the air.

Eyes and skin can suffer irritation or injuries.

– Put on safety goggles.

– Put on protective gloves.

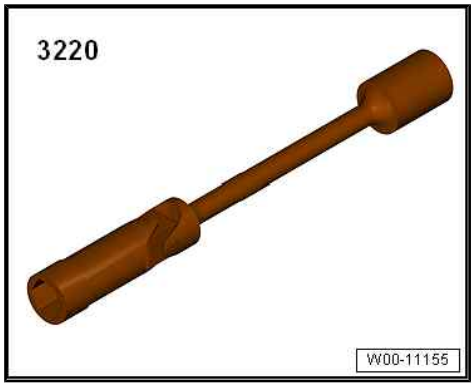
♦ Use a vacuum cleaner to remove coarse dirt.

♦ Spray brake cleaner or suitable cleaning agent into glow plug apertures, let it work in briefly, and blow out with compressed air.

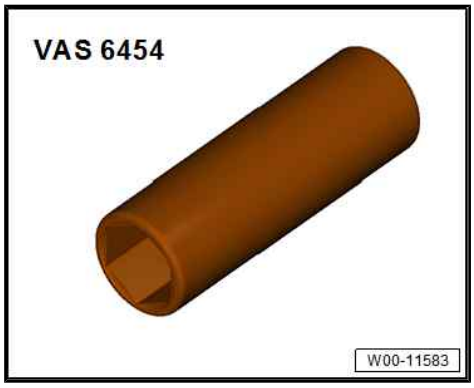
♦ Clean glow plug opening with an oily cloth.

– Loosen glow plugs using tool and unscrew by hand:

- Use U/J extension and socket, 10 mm - 3220- for glow plugs without combustion chamber pressure sender.



- Use socket insert AF 12 for glow plugs 4-cyl.TDI CR diesel - VAS 6454- for glow plugs with combustion chamber pressure sender.



Installing

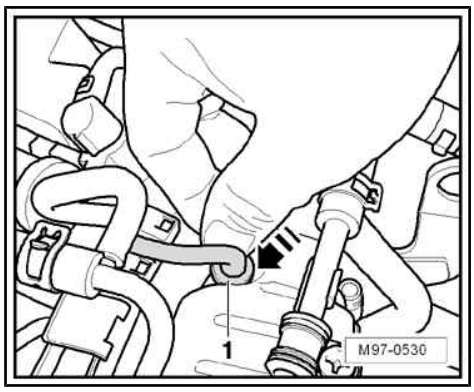
Installation is carried out in reverse order; note the following:

– Fit glow plug connectors -1- back onto glow plugs -arrow-.

• Check that glow plug connectors are securely seated.

– Learnt values must be reset in engine control unit after renewing a glow plug.

– Connect ⇒ Vehicle diagnostic tester.



Select following menu options on ⇒ Vehicle diagnostic tester:

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Functions component replacement`

– Install engine cover panel ⇒ page 13 .

Tightening torques

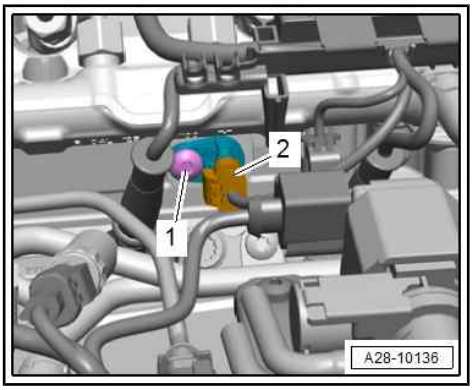
- ⇒ Fig. ““Glow plug versions and tightening torques”“ , page 240

1.3 Removing and installing automatic glow period control unit - J179-

All procedures are described in ⇒ 4-cylinder TDI engine (2.0 ltr. 4-valve common rail); Rep. gr. 28 ; Glow plug system; Removing and installing automatic glow period control unit - J179- .

1.4 Removing and installing Hall sender - G40-

Removing



– Remove engine cover panel ⇒ page 13 .
– Unplug electrical connector -2-.
– Unscrew bolt -1- and detach Hall sender - G40- .

Installing

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

– Install engine cover panel ⇒ page 13 .

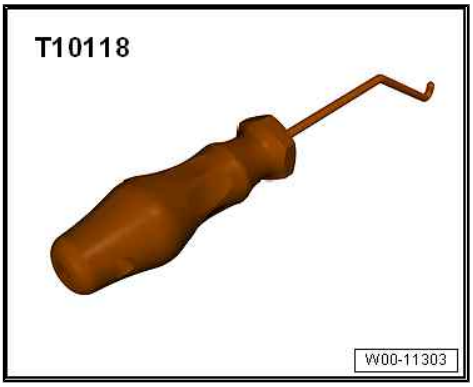
Tightening torques

♦ ⇒ “1.1 Exploded view - glow plug system”, page 239

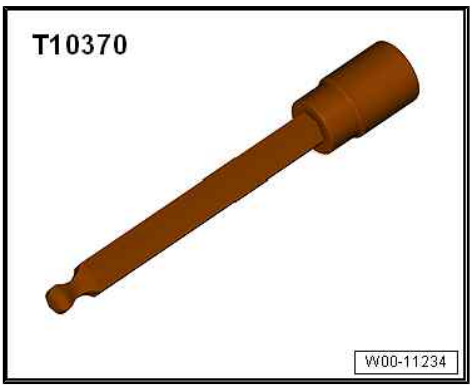
1.5 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

♦ Assembly tool - T10118-



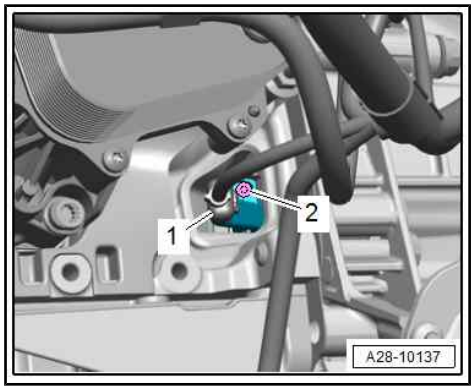
♦ Socket (4 mm) - T10370-



Removing

– Remove oil filter housing ⇒ page 107 .

– Use assembly tool - T10118- to unplug electrical connector -1-.
– Unscrew bolt -2- and detach engine speed sender - G28- .



Installing

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

– Install oil filter housing ⇒ page 107 .

Tightening torques

◆ ⇒ “1.1 Exploded view - glow plug system”, page 239