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Workshop Manual

Audi Q3 2012 ➤

4-cylinder TDI engine, 2.0 ltr. 4-valve common rail (EA 288 Gen. I)									
Engine ID	CUVC	CUWA	CUVB	CUVD	CYLA	DBBA	DFUA	DFTA	DFTB
	DFTC								

Edition 12.2016

List of Workshop Manual Repair Groups

Repair Group

00 - Technical data
10 - Removing and installing engine
13 - Crankshaft group
15 - Cylinder head, valve gear
17 - Lubrication
19 - Cooling
21 - Turbocharging/supercharging
23 - Mixture preparation - injection
26 - Exhaust system
28 - Glow plug system

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

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Contents

00 - Technical data 1
1 Identification 1
1.1 Engine identification number/engine data 1
2 Safety precautions 2
2.1 Safety precautions when working on the fuel supply system 2
2.2 Safety precautions when using testers and measuring instruments during a road test 3
2.3 Safety precautions when working on the cooling system 3
2.4 Safety precautions when working on vehicles with start/stop system 3
2.5 Safety precautions when working on the SCR system 4
2.6 Safety precautions when working on the exhaust system 4
3 Repair instructions 6
3.1 Rules for cleanliness 6
3.2 General notes 6
3.3 General repair instructions 7
3.4 Adapting learnt values for SCR system 7
3.5 Foreign particles in engine 8
3.6 Contact corrosion 8
3.7 Routing and attachment of pipes, hoses and wiring 8
3.8 Installing radiators and condensers 8
10 - Removing and installing engine 9
1 Removing and installing engine 9
1.1 Removing engine 9
1.2 Separating engine and gearbox 21
1.3 Securing engine to engine and gearbox support 26
1.4 Installing engine 27
2 Assembly mountings 32
2.1 Exploded view - assembly mountings 32
2.2 Supporting engine in installation position 33
2.3 Removing and installing engine mountings 36
2.4 Removing and installing gearbox mounting 36
2.5 Removing and installing pendulum support 37
2.6 Checking adjustment of assembly mountings (engine/gearbox mountings) 38
2.7 Adjusting assembly mountings 38
3 Engine cover panel 40
3.1 Removing and installing engine cover panel 40
13 - Crankshaft group 41
1 Cylinder block (pulley end) 41
1.1 Exploded view - cylinder block (pulley end) 41
1.2 Exploded view - sealing flange (pulley end) 43
1.3 Removing and installing poly V-belt 44
1.4 Removing and installing tensioner for poly V-belt 45
1.5 Removing and installing vibration damper 45
1.6 Removing and installing bracket for ancillaries 46
1.7 Removing and installing engine support 47
1.8 Removing and installing sealing flange (pulley end) 48
2 Cylinder block (gearbox end) 51
2.1 Exploded view - cylinder block (gearbox end) 51
2.2 Removing and installing flywheel 52
2.3 Removing and installing sealing flange (gearbox end) 53
3 Crankshaft 60

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3.1 Measuring axial clearance of crankshaft . . . 60
3.2 Renewing needle bearing in crankshaft . . . 60
4 Pistons and conrods . . . 63
4.1 Exploded view - pistons and conrods . . . 63
4.2 Removing and installing pistons . . . 65
4.3 Measuring piston projection at TDC . . . 66
4.4 Checking pistons and cylinder bores . . . 68
4.5 Separating parts of new conrod . . . 69
4.6 Checking radial clearance of conrod bearings . . . 69

15 - Cylinder head, valve gear . . . 71
1 Toothed belt drive . . . 71
1.1 Exploded view - toothed belt cover . . . 71
1.2 Exploded view - toothed belt . . . 72
1.3 Removing and installing toothed belt cover . . . 73
1.4 Detaching toothed belt from camshaft . . . 76
1.5 Removing and installing toothed belt . . . 86
2 Cylinder head . . . 96
2.1 Exploded view - cylinder head cover . . . 96
2.2 Exploded view - cylinder head . . . 98
2.3 Removing and installing cylinder head cover . . . 100
2.4 Removing and installing seals for injectors . . . 101
2.5 Removing and installing camshaft housing . . . 102
2.6 Removing and installing cylinder head . . . 106
2.7 Checking compression . . . 113
3 Valve gear . . . 115
3.1 Exploded view - valve gear . . . 115
3.2 Removing and installing camshaft oil seal . . . 118
3.3 Removing and installing camshaft control valve 1 N205 . . . 120
3.4 Removing and installing camshaft adjuster . . . 120
3.5 Removing and installing control valve for camshaft control valve 1 N205 . . . 123
3.6 Checking hydraulic compensation elements . . . 125
3.7 Removing and installing valve stem oil seals . . . 126
4 Inlet and exhaust valves . . . 134
4.1 Checking valve guides . . . 134
4.2 Checking valves . . . 135
4.3 Valve dimensions . . . 135

17 - Lubrication . . . 136
1 Sump/oil pump . . . 136
1.1 Exploded view - sump/oil pump . . . 136
1.2 Removing and installing oil pump . . . 149
1.3 Removing and installing oil level and oil temperature sender G266 . . . 150
1.4 Engine oil . . . 151
2 Engine oil cooler . . . 152
3 Oil filter/oil pressure switches . . . 153
3.1 Exploded view - oil filter housing/oil pressure switches . . . 153
3.2 Removing and installing oil filter housing . . . 154
3.3 Removing and installing oil pressure switch F22 . . . 156
3.4 Removing and installing oil pressure switch for reduced oil pressure F378 . . . 157
3.5 Removing and installing valve for oil pressure control N428 . . . 158
3.6 Checking oil pressure . . . 158

19 - Cooling . . . 160
1 Cooling system/coolant . . . 160

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1.1 Connection diagram - coolant hoses . . . 160
1.2 Checking cooling system for leaks . . . 161
1.3 Draining and filling cooling system . . . 163
2 Coolant pump/thermostat assembly . . . 171
2.1 Exploded view - coolant pump/thermostat . . . 171
2.2 Exploded view - electric coolant pump . . . 173
2.3 Exploded view - coolant temperature senders . . . 174
2.4 Removing and installing electric coolant pump . . . 174
2.5 Removing and installing coolant pump . . . 178
2.6 Removing and installing thermostat . . . 178
2.7 Removing and installing coolant valve for cylinder head N489 . . . 180
2.8 Checking thermostat . . . 180
2.9 Removing and installing coolant temperature sender G62 . . . 180
3 Coolant pipes . . . 183
3.1 Exploded view - coolant pipes . . . 183
3.2 Removing and installing coolant pipes . . . 184
4 Radiator/radiator fans . . . 195
4.1 Exploded view - radiator/radiator fans . . . 195
4.2 Removing and installing radiator . . . 197
4.3 Removing and installing water radiator for charge air cooling circuit . . . 200
4.4 Removing and installing radiator cowl . . . 202
4.5 Removing and installing radiator fan V7 . . . 204

21 - Turbocharging/supercharging . . . 206
1 Turbocharger . . . 206
1.1 Exploded view - turbocharger . . . 206
1.2 Removing and installing turbocharger . . . 208
1.3 Renewing vacuum unit for turbocharger . . . 213
2 Charge air system . . . 217
2.1 Exploded view - charge air system . . . 217
2.2 Exploded view - hose connections for charge air system . . . 218
2.3 Removing and installing charge pressure sender G31 . . . 219
2.4 Removing and installing charge air temperature sender . . . 219
2.5 Checking charge air system for leaks . . . 220

23 - Mixture preparation - injection . . . 225
1 Injection system . . . 225
1.1 Overview of fitting locations - injection system . . . 225
1.2 Overview - fuel system . . . 231
1.3 Filling and bleeding fuel system . . . 232
1.4 Checking fuel system for leaks . . . 233
2 Vacuum system . . . 234
2.1 Connection diagram - vacuum system . . . 234
2.2 Checking vacuum system . . . 234
3 Air cleaner . . . 236
3.1 Exploded view - air cleaner housing . . . 236
3.2 Removing and installing air cleaner housing . . . 237
4 Intake manifold . . . 238
4.1 Exploded view - intake manifold . . . 238
4.2 Removing and installing throttle valve module J338 . . . 240
4.3 Removing and installing intake manifold . . . 242
5 Injectors/high-pressure reservoir (rail) . . . 246
5.1 Exploded view - injectors . . . 246
5.2 Exploded view - high-pressure reservoir (rail) . . . 249

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5.3 Checking injectors . . . 249
5.4 Performing adaption of correction values for injectors . . . 250
5.5 Checking for injectors sticking open . . . 250
5.6 Checking return flow rate of injectors with engine running . . . 252
5.7 Checking return flow rate of injectors at starter cranking speed . . . 254
5.8 Removing and installing injectors . . . 256
5.9 Removing and installing high-pressure pipes . . . 259
5.10 Removing and installing high-pressure reservoir (rail) . . . 262

6 High-pressure pump . . . 264
6.1 Exploded view - high-pressure pump . . . 264
6.2 Removing and installing high-pressure pump . . . 265

7 Senders and sensors . . . 268
7.1 Removing and installing fuel temperature sender G81 . . . 268
7.2 Removing and installing air mass meter G70 . . . 268
7.3 Checking fuel pressure regulating valve N276 . . . 269
7.4 Removing and installing fuel pressure regulating valve N276 . . . 270
7.5 Removing and installing fuel pressure sender G247 . . . 271

8 Lambda probe . . . 273
8.1 Exploded view - Lambda probe . . . 273
8.2 Removing and installing Lambda probe . . . 274
8.3 Removing and installing NOx sender . . . 275

9 Engine control unit . . . 277
9.1 Removing and installing engine control unit J623 . . . 277

26 - Exhaust system . . . 280

1 Exhaust pipes/silencers . . . 280
1.1 Exploded view - silencers . . . 280
1.2 Removing and installing front exhaust pipe . . . 283
1.3 Removing and installing silencers . . . 283
1.4 Separating exhaust pipe from silencer . . . 284
1.5 Stress-free alignment of exhaust system . . . 285
1.6 Checking exhaust system for leaks . . . 287

2 Emission control system . . . 288
2.1 Exploded view - emission control system . . . 288
2.2 Removing and installing emission control module . . . 290
2.3 Removing and installing pressure differential sender G505 . . . 297
2.4 Removing and installing exhaust gas pressure sensor 1 G450 . . . 298
2.5 Removing and installing exhaust flap control unit J883 . . . 299

3 SCR (selective catalytic reduction) system . . . 301
3.1 Exploded view - reducing agent tank . . . 301
3.2 Exploded view - delivery unit for reducing agent . . . 303
3.3 Exploded view - reducing agent supply line . . . 304
3.4 Unplugging connector for reducing agent line . . . 305
3.5 Draining reducing agent tank . . . 305
3.6 Removing and installing delivery unit for reducing agent . . . 306
3.7 Removing and installing reducing agent tank . . . 307
3.8 Removing and installing injector for reducing agent N474 . . . 309
3.9 Removing and installing control unit for reducing-agent heater J891 . . . 311

4 Exhaust gas temperature control . . . 312
4.1 Exploded view - exhaust gas temperature control . . . 312
4.2 Removing and installing exhaust gas temperature sender . . . 313

5 Exhaust gas recirculation . . . 318
5.1 Exploded view - exhaust gas recirculation system . . . 318
5.2 Removing and installing exhaust gas recirculation control motor V338 . . . 321

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5.3 Removing and installing exhaust gas recirculation control motor 2 V339 321
5.4 Removing and installing exhaust gas recirculation cooler 322
5.5 Checking exhaust gas recirculation cooler for leaks 325

28 - Glow plug system 329

1 Glow plug system 329
1.1 Exploded view - glow plug system 329
1.2 Removing and installing glow plug 330
1.3 Removing and installing automatic glow period control unit J179 332
1.4 Removing and installing Hall sender G40 332
1.5 Removing and installing engine speed sender G28 333

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00 – Technical data

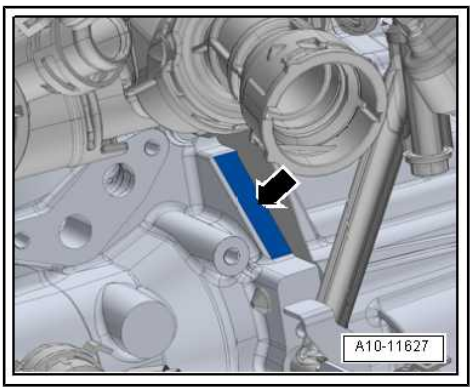
1 Identification

(ARL005071; Edition 12.2016)

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

1.1 Engine identification 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.

Note

- *The four-letter engine code is found on the type plate (country specific version), vehicle data sticker and engine control unit.*
- *Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 820 .*

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

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2 Safety precautions

⇒ “2.1 Safety precautions when working on the fuel supply system”, page 2

⇒ “2.2 Safety precautions when using testers and measuring instruments during a road test”, page 3

⇒ “2.3 Safety precautions when working on the cooling system”, page 3

⇒ “2.4 Safety precautions when working on vehicles with start/stop system”, page 3

⇒ “2.5 Safety precautions when working on the SCR system”, page 4

⇒ “2.6 Safety precautions when working on the exhaust system”, page 4

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2.1 Safety precautions when working on the fuel supply system

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.

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).

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 232 .

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.

Risk of irreparable damage to electronic components.

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

– Always switch off the ignition before disconnecting the battery.

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– Remove fuse for fuel pump control unit - J538- in fuse holder B - SB- in electronics box in engine compartment; for identification of fuses refer to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

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

Risk of injury if test equipment is not secured

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

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

Or:

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

2.3 Safety precautions when working on the cooling system

When working on the cooling system note the following warnings:

Risk of scalding as hot coolant can escape

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

– Put on protective gloves.

– Put on safety goggles.

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

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– **After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.**

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

Risk of injury - engine may start unexpectedly

On vehicles with the start/stop system activated, the engine may start unexpectedly. A message in the instrument cluster indicates whether the start/stop system is activated.

– Deactivate start/stop system by switching off ignition.

2.5 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.

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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 on the SCR system, please 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 tank must be drained.

Manual drawing back of reducing agent

• The reducing agent line can also be drained using a ⇒ Vehicle diagnostic tester in `Guided Functions` mode, `Drain metering line`.

2.6 Safety precautions when working on the exhaust system

Do not dismantle exhaust gas temperature sender - risk of injury.

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.

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.

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3 Repair instructions

⇒ “3.1 Rules for cleanliness”, page 6

⇒ “3.2 General notes”, page 6

⇒ “3.3 General repair instructions”, page 7

⇒ “3.4 Adapting learnt values for SCR system”, page 7

⇒ “3.5 Foreign particles in engine”, page 8

⇒ “3.6 Contact corrosion”, page 8

⇒ “3.7 Routing and attachment of pipes, hoses and wiring”, page 8

⇒ “3.8 Installing radiators and condensers”, page 8

3.1 Rules for cleanliness

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

- Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- Immediately seal open lines and connections with clean plugs, for example from engine bung set - VAS 6122- .
- 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.

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- 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

- 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 via the fuel pump relay.
- At the same time, this system also improves the engine's starting performance. When the driver's door is opened, the fuel pump is activated for 2 seconds in order to build up pressure in the fuel system ⇒ page 2 .

3.3 General repair instructions

- 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 re-installed 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.

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3.4 Adapting learnt values for SCR system

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
- Injector for reducing agent

- Reducing agent line
- Engine control unit

Reset learnt values. Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `Reset reduction agent system learned values`

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.

Note

If the turbocharger has suffered mechanical damage
⇒ page 208

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 (little 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.

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10 – Removing and installing engine

1 Removing and installing engine

⇒ “1.1 Removing engine”, page 9

⇒ “1.2 Separating engine and gearbox”, page 21

⇒ “1.3 Securing engine to engine and gearbox support”, page 26

⇒ “1.4 Installing engine”, page 27

1.1 Removing engine

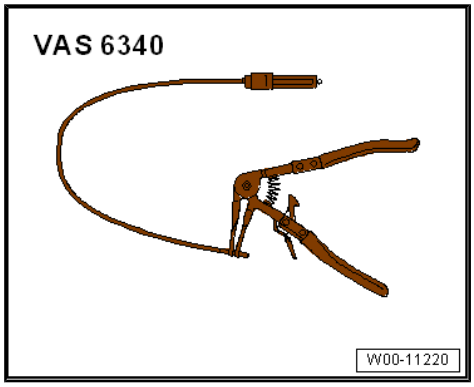
Special tools and workshop equipment required

- Removal lever - 80-200-
- Stepladder - VAS 5085-
- Engine bung set - VAS 6122-
- Drip tray for workshop hoist - VAS 6208-
- Hose clip pliers - VAS 6362-
- Engine and gearbox jack - VAS 6931-

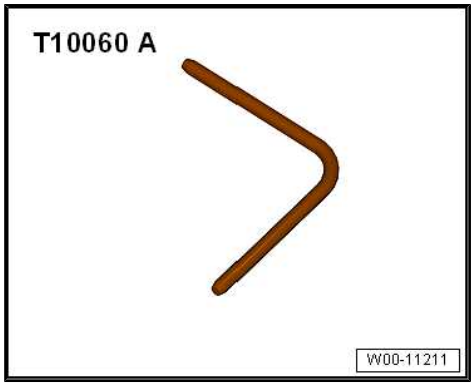


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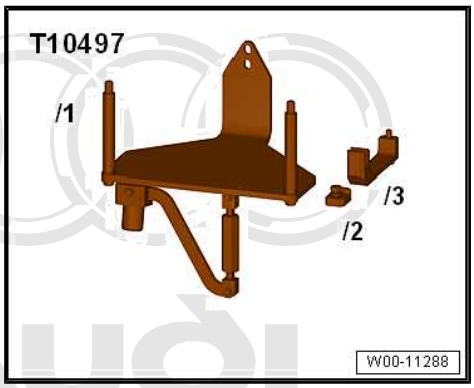
- Hose clip pliers - VAS 6340-



- Locking pin - T10060A-



- Engine bracket - T10497- with pin -T10497/1-



- Safety goggles
- Protective gloves

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Procedure

Note

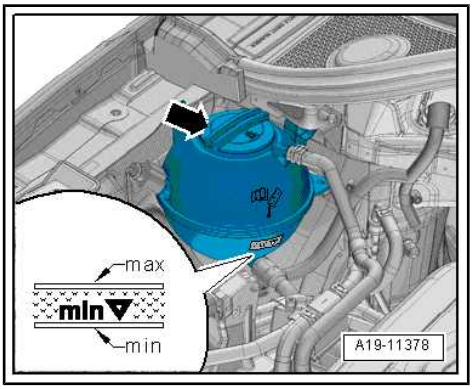
- *The engine is removed from underneath together with the gearbox.*
- *Re-fit all cable ties and heat insulation sleeves in the same locations when installing.*

CAUTION

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

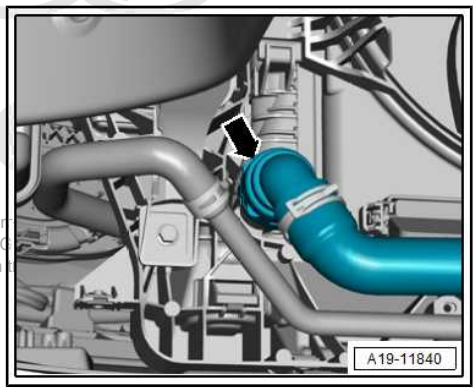
Danger of scalding skin and other parts of the body.

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

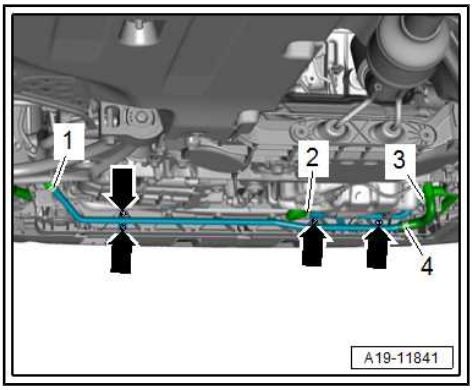


- Open filler cap -arrow- on coolant expansion tank.
- Remove subframe with steering rack ⇒ Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
- Remove wheel spoilers (front) on both sides ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
- Place drip tray for workshop hoist - VAS 6208- underneath.
- Lift retaining clip -arrow-, disconnect coolant hose from radiator (bottom left) and drain off coolant.

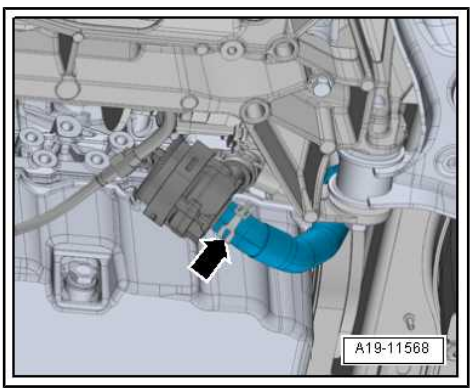
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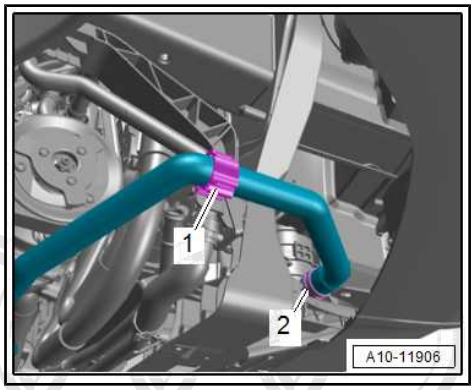
- Release hose clips -1, 4-, disconnect coolant hoses and drain off coolant.
- Unscrew bolts -arrows- and detach coolant pipes on lock carrier.



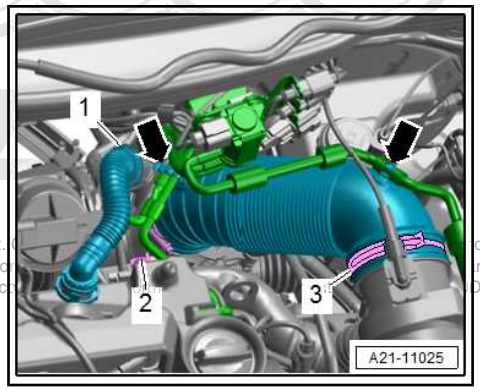
- Release hose clip -arrow-, disconnect coolant hose (bottom) from auxiliary pump for heating - V488- and drain off coolant.



– Release hose clip -2-, detach coolant hose and move clear at retaining clip -1-.
– Remove engine cover panel ⇒ page 40 .
– Remove air cleaner housing ⇒ page 237 .

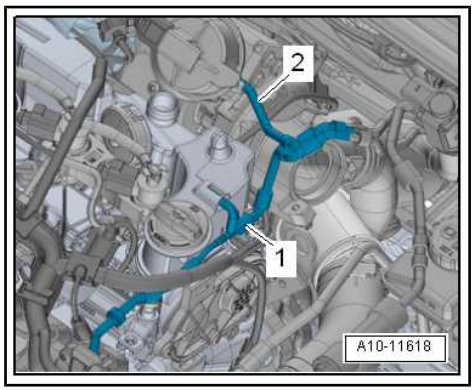


– Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from connection.
– Move clear vacuum hoses at air pipe -arrows-.
– Remove bolt -2-, swivel air pipe with connection to rear and detach from turbocharger.

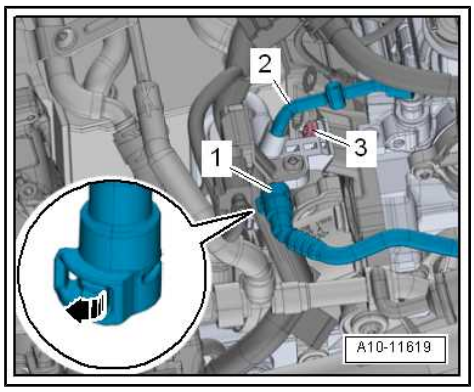


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– Detach vacuum hose -2- from vacuum unit of turbocharger.
– Disconnect vacuum hose -1- from T-piece.



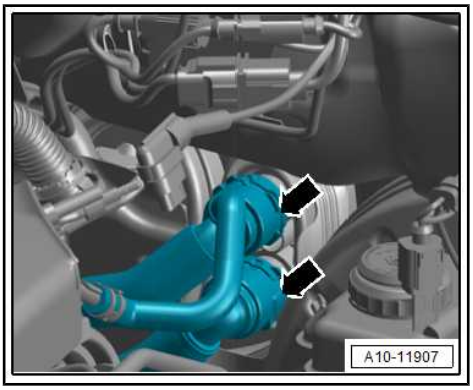
– Release catch -arrow- and disconnect vacuum hose -1-.



Note

Place a cloth underneath to catch escaping coolant.

– Lift retaining clips -arrows- and disconnect coolant hoses from heat exchanger for heater.



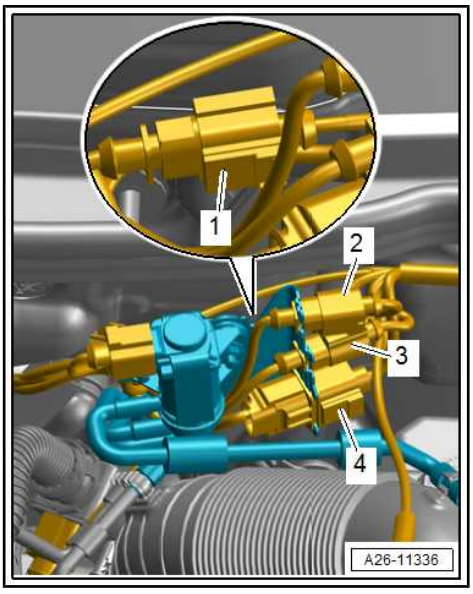
– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

1 - For exhaust gas temperature sender 4 - G648-

2 - For exhaust gas temperature sender 3 - G495-

3 - For exhaust gas temperature sender 2 - G448-

4 - For Lambda probe - G39-



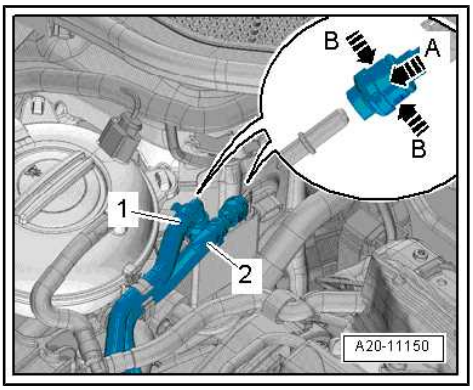
CAUTION

The fuel system is pressurised.

Risk of injury as fuel may spray out.

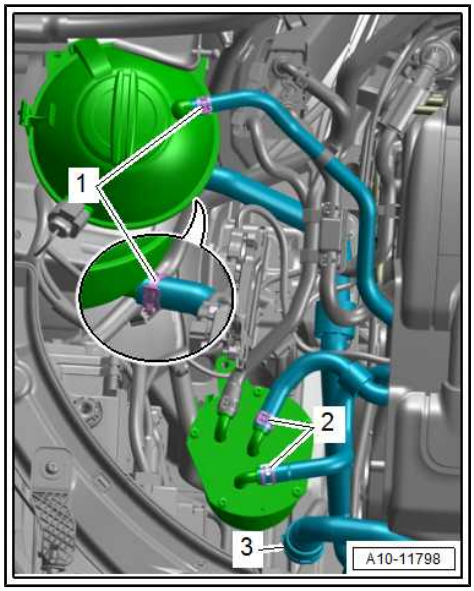
- **Put on safety goggles.**
- **Put on protective gloves.**
- **Release pressure (wrap a clean cloth around connection and open connection carefully).**

– Disconnect fuel line -1- ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .

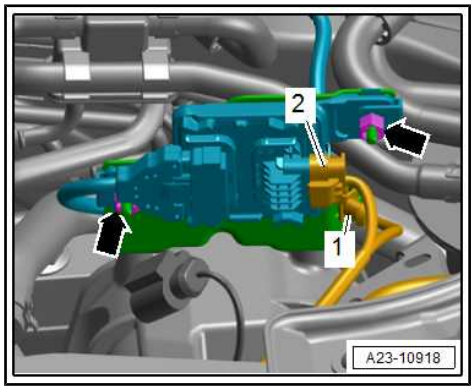


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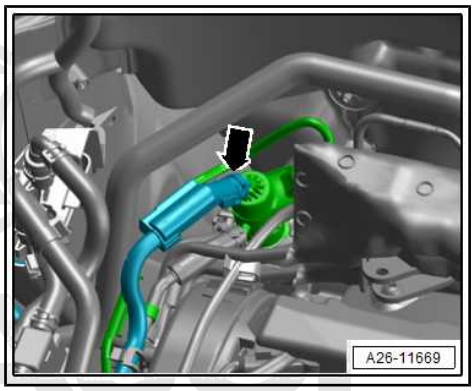
– Release hose clips -2- and disconnect fuel supply hose and fuel return hose.
– Release hose clips -1-, lift retaining clip -3- and detach coolant hoses.



– Remove electrical connector -1- for injector for reducing agent - N474- from bracket and unplug connector.
– Unplug electrical connector -2-.
– Remove nuts -arrows-, take control unit for NOx sender - J583- out of bracket and place it on engine.

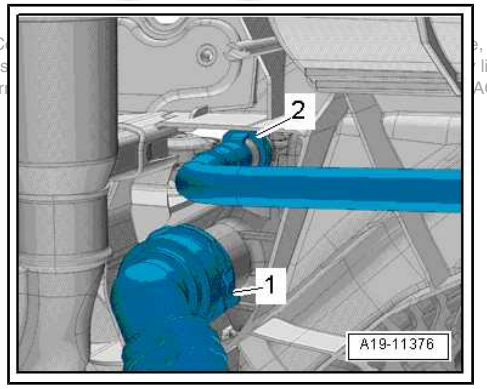


– Disconnect reducing agent line -arrow- from injector for reducing agent - N474- and move clear.



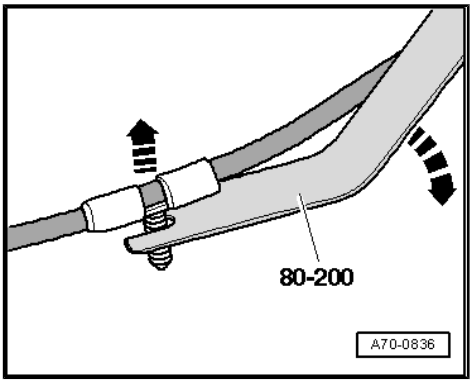
– Lift retaining clips -1 and 2- and disconnect coolant hoses (top left) from radiator.
– Remove engine control unit - J623- ⇒ page 277 .

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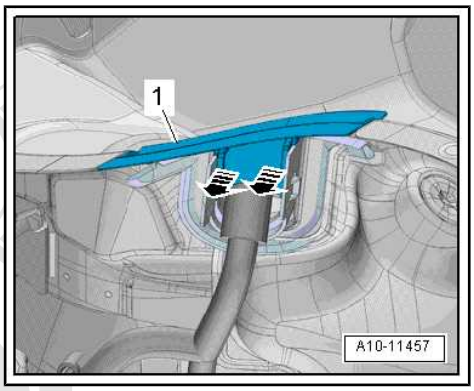


Note

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

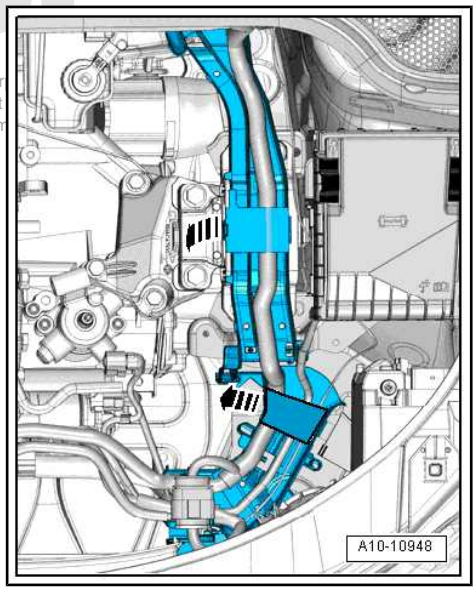


– Release wiring protector -1- for engine wiring harness -arrows- and lift off.

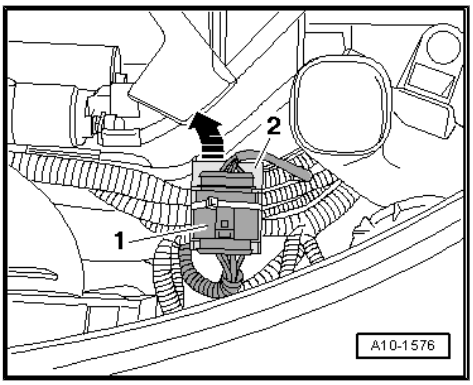


– Open retainers for wiring duct -arrows-.

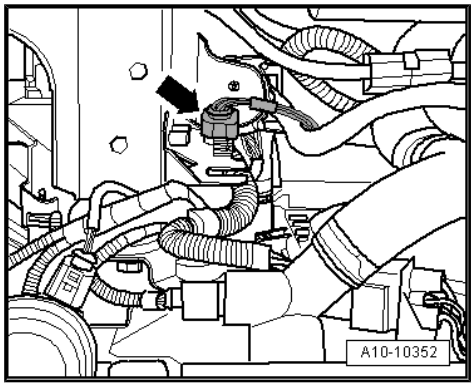
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– Move clear and unplug electrical connector -1-.
– Open retainer -2- for wiring duct -arrow- (located underneath connector).
– Remove wiring harness for engine control unit from wiring duct and place on engine.



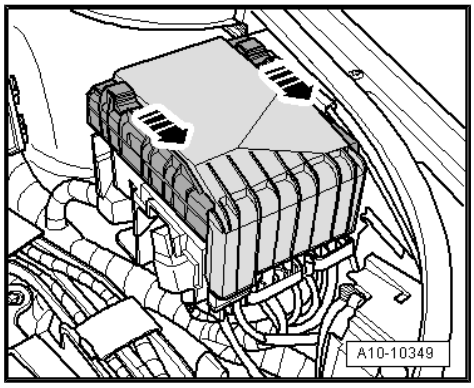
– Unplug electrical connector -arrow- at longitudinal member (bottom left).



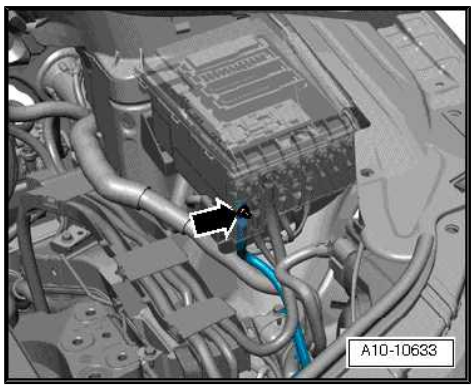
Note

For illustration purposes, the installation position is shown from below.

– Slide the two clips in the direction of the -arrows- and remove cover from electronics box in engine compartment.



– Remove nut -arrow-, detach terminal 30 wire from electronics box in engine compartment and move it clear.

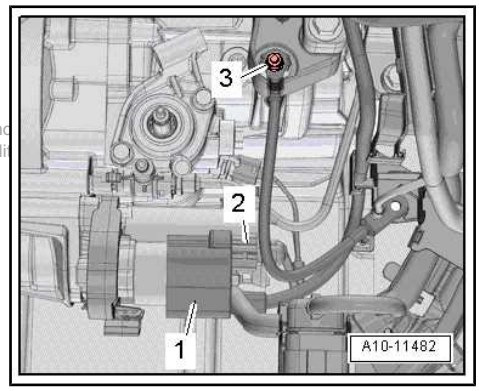


Vehicles with manual gearbox:

– Unplug electrical connector -2-.

– Push back cover -1- for positive battery terminal and unscrew positive wire from starter solenoid switch.

– Remove nut -3- and detach earth wire.



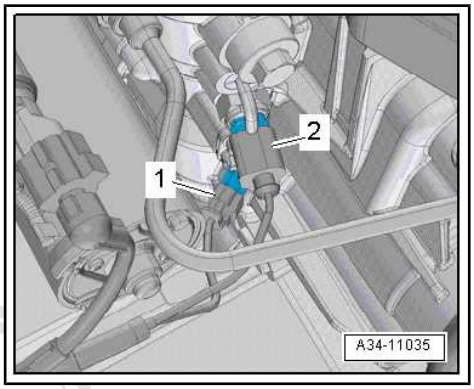
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– Unplug electrical connectors on gearbox (front left):

1 - For gearbox neutral position sender - G701-

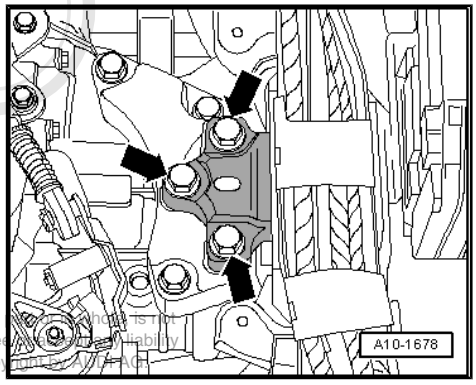
2 - For reversing light switch - F4-

– Detach gear selector cable and gate selector cable from gearbox, remove cable support bracket and place to one side with selector cables attached ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .



– Detach pipe/hose assembly from bleeder connection on clutch slave cylinder ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing lines for clutch hydraulics .

– Loosen bolts -arrows- for gearbox mounting approx. 2 turns.



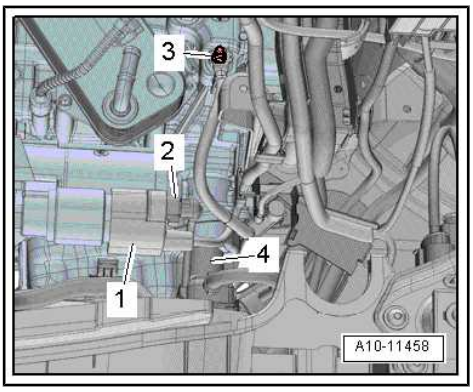
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Vehicles with dual clutch gearbox:

– Unplug electrical connector -2-.

– Push back cover -1- for positive battery terminal and unscrew positive wire from starter solenoid switch.

– Remove nut -3- and detach earth wire.



NOTICE

Risk of irreparable damage due to electrostatic discharge.

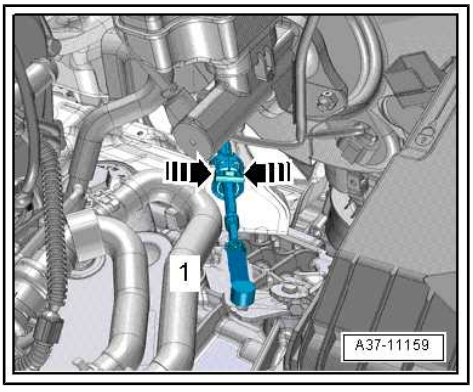
- **Do NOT touch connector contacts with your hands.**
- **Touch the lifting platform or other earthed object to discharge static electricity.**

– Touch vehicle earth with bare hands to eliminate any static charge.

– Turn retainer catch anti-clockwise and unplug electrical connector -4- at gearbox.

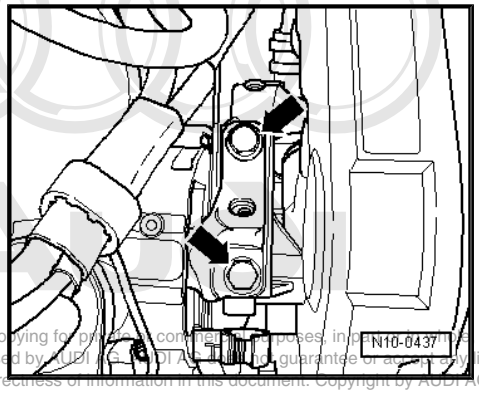
– Pry ball socket -1- of selector lever cable off gearbox selector lever using removal lever - 80-200- .

– Release fasteners -arrows- and move selector lever cable clear.



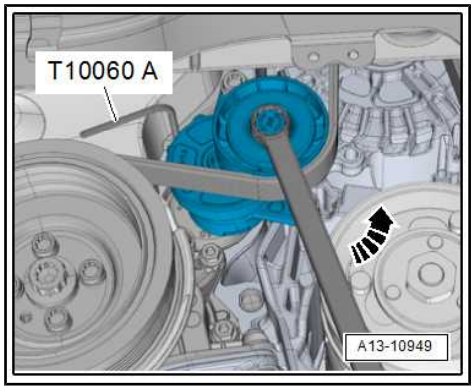
Continued for all vehicles:

– Unscrew bolts -arrows- for engine mounting approx. 2 turns.



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– Before removing the poly V-belt mark the direction of rotation with chalk or a felt-tip pen for re-installation.
– To slacken poly V-belt turn tensioner in anti-clockwise direction -arrow-.
– Lock tensioner with locking pin - T10060A- .
– Take off poly V-belt.



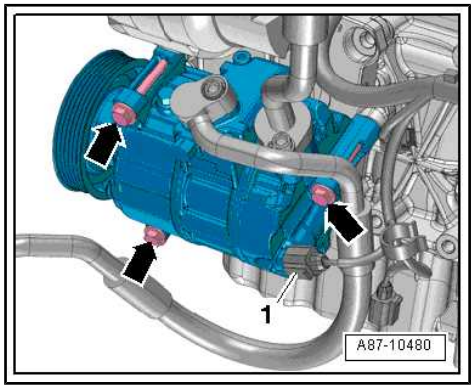
– Unplug electrical connector -1- on air conditioner compressor regulating valve - N280- .

NOTICE

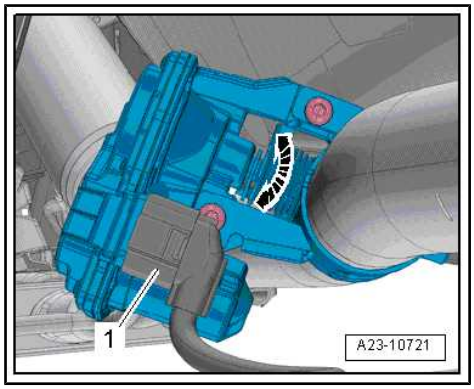
Danger of damage to refrigerant lines and hoses when detaching and pivoting air conditioner compressor.

– Do NOT stretch, kink or bend refrigerant lines and hoses.

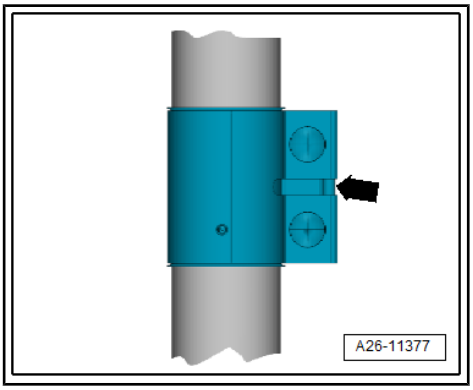
– Remove bolts -arrows-.
– Detach air conditioner compressor from bracket (refrigerant hoses remain connected) and tie up to right side.
– Unbolt drive shaft (left and right) from gearbox and tie up to rear ⇒ Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .



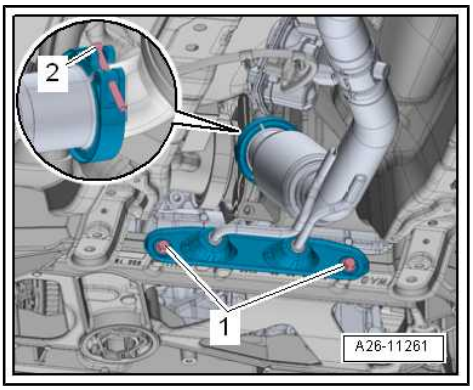
– Unplug electrical connector -1- for exhaust flap control unit - J883- .



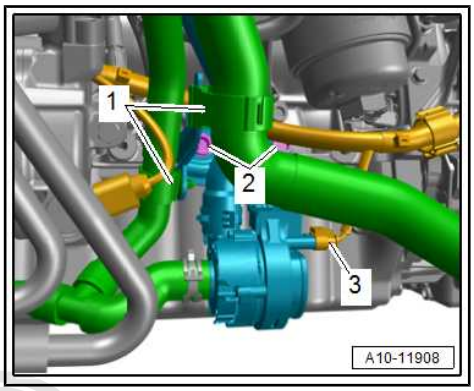
– Loosen clamp -arrow- and push towards rear.



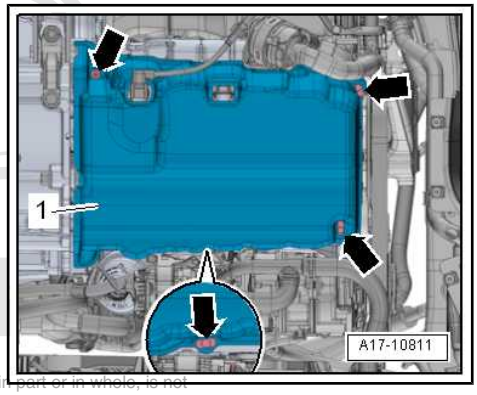
– Loosen bolt -2- and remove screw-type clip.
– Detach front exhaust pipe.



– Unplug electrical connector -3-.
– Move coolant hoses -1- clear.
– Remove bolts -2- and press charge air cooling pump - V188- to side.



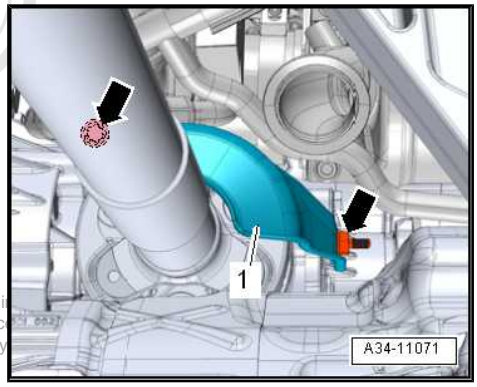
– Release fasteners -arrows- and detach noise insulation -1- for sump.



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Vehicles with four-wheel drive:

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



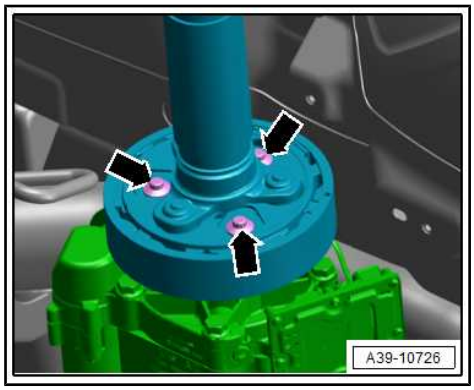
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– Mark position of flexible coupling and flange for bevel box in relation to each other for re-installation.

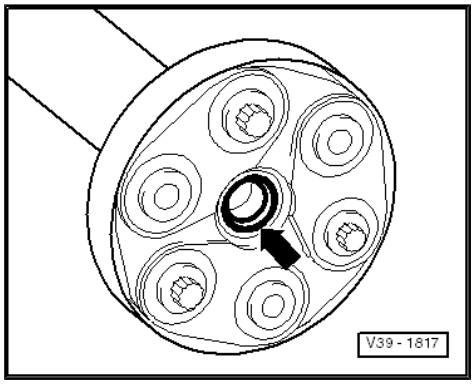
– Unbolt propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).

– Push engine/gearbox assembly forward slightly (towards front end) and pull propshaft off bevel box.

– Detach propshaft horizontally from bevel box and press towards right side of vehicle.



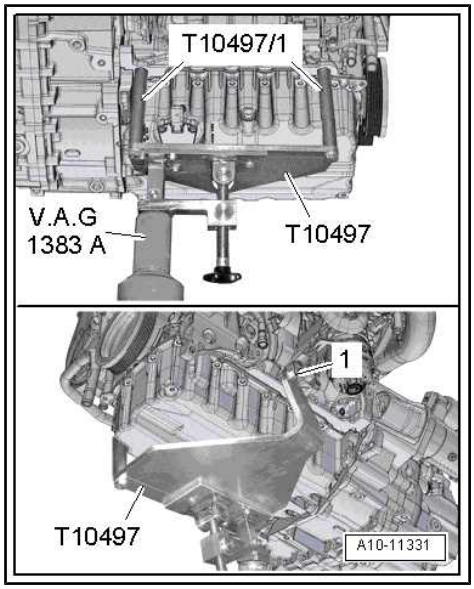
• Propshaft must be renewed if oil seal -arrow- is damaged.



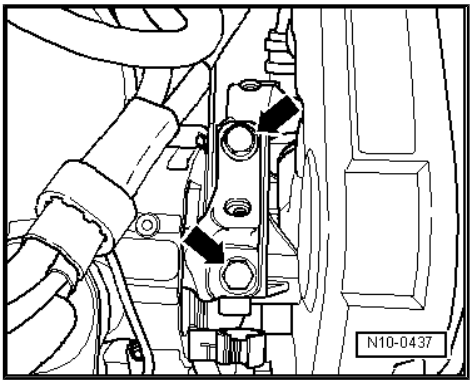
Continued for all vehicles:

– Attach engine bracket - T10497- with pin -T10497/1- to cylinder block with bolt -1-; tighten to approx. 20 Nm and use top elongated hole “A” -item 1-.

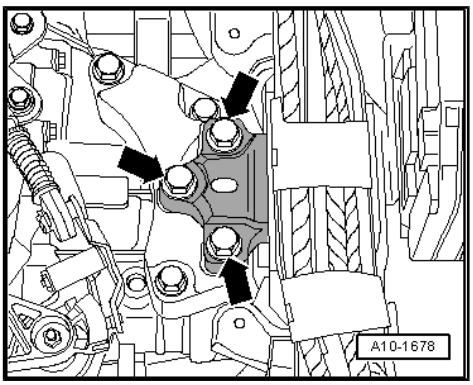
– Insert engine and gearbox jack - V.A.G 1383 A- in engine bracket - T10497- and raise engine/gearbox assembly slightly.



– Unscrew bolts -arrows- for assembly mounting fully (use step-ladder - VAS 5085- when doing so).



– Remove bolts -arrows- securing gearbox mounting.
– Lower engine/gearbox assembly.



1.2 Separating engine and gearbox

⇒ “1.2.1 Separating engine and gearbox - vehicles with manual gearbox”, page 21

⇒ “1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox”, page 23

1.2.1 Separating engine and gearbox - vehicles with manual gearbox

Special tools and workshop equipment required

♦ Hooks - 10-222A/2-

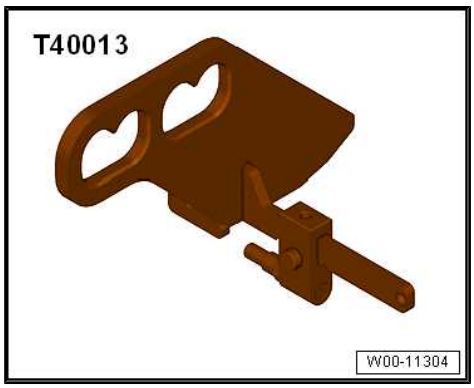


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♦ Workshop hoist - VAS 6100-



♦ Lifting tackle - T40013-

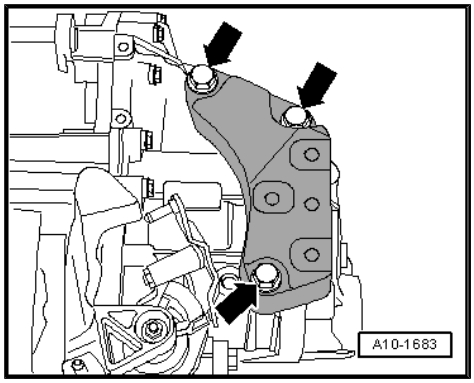


Procedure

- Engine/gearbox assembly removed and attached to engine bracket - T10497- .

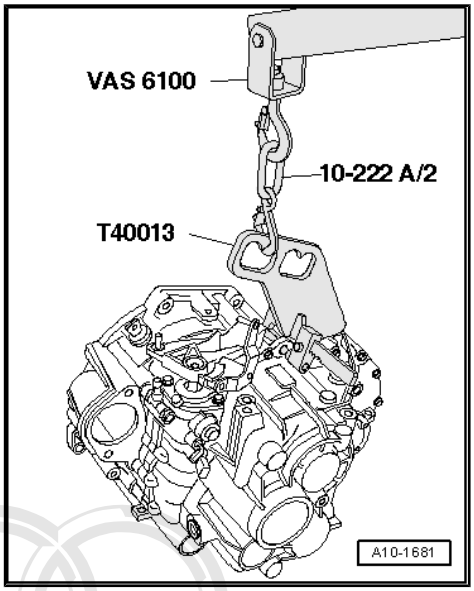
– Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .

– Unscrew bolts -arrows- and detach gearbox support.

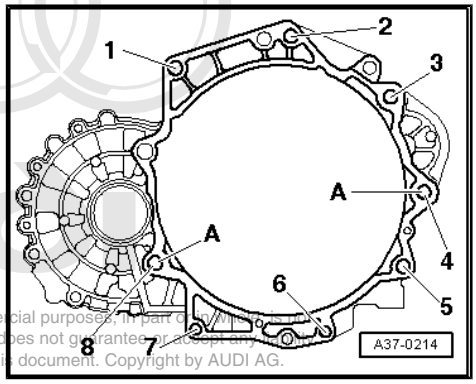


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– Attach lifting tackle - T40013- to gearbox and close lock.
– Attach workshop hoist - VAS 6100- with hooks - 10-222A/2- to the lifting tackle.



– Remove bolts -1, 2, 5, 6, 7, 8- securing gearbox to engine.
– Detach gearbox from engine (pay attention to intermediate plate).

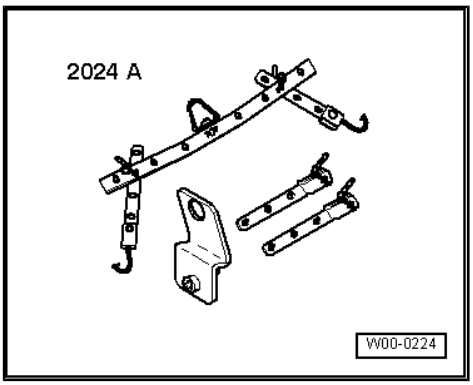


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1.2.2 Separating engine and gearbox - vehicles with dual clutch gearbox

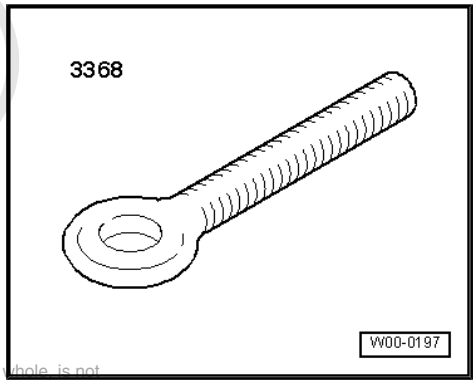
Special tools and workshop equipment required

♦ Lifting tackle - 2024A-



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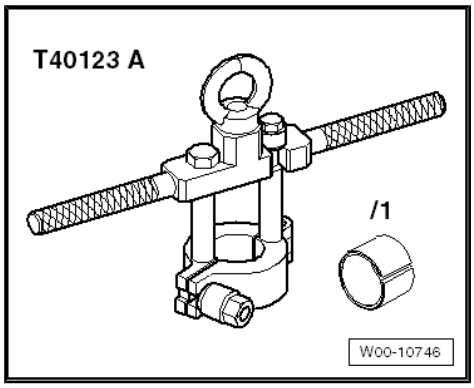
- Eye-head bolt - 3368-



- Workshop hoist - VAS 6100-



- Puller for ATF-supply - T40123 A-



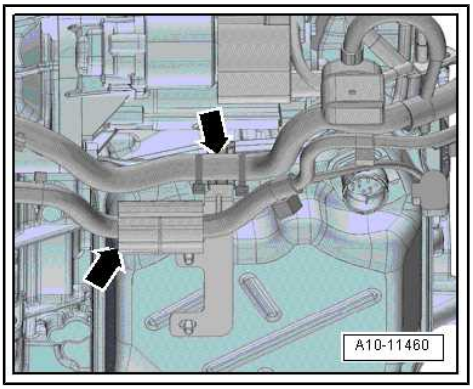
Procedure

- Engine/gearbox assembly removed and attached to engine bracket - T10497- .

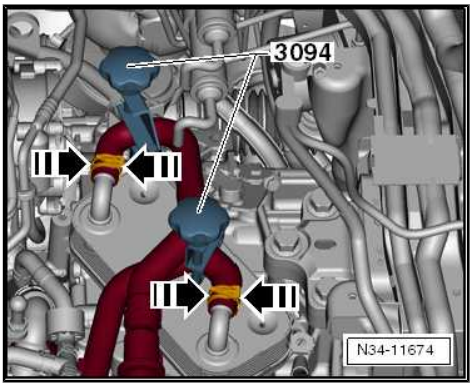
– Remove bevel box ⇒ Rep. gr. 34 ; Bevel box; Removing bevel box .

– Remove starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Removing and installing starter .

– Move electrical wiring harnesses clear -arrows-.

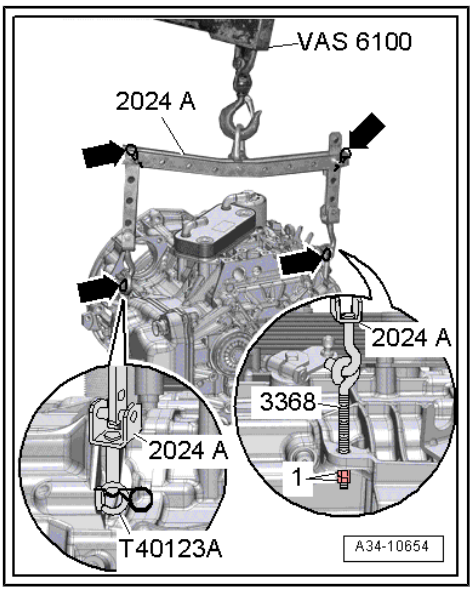


– Slacken hose clips -arrows- and detach coolant hoses from gear oil cooler.

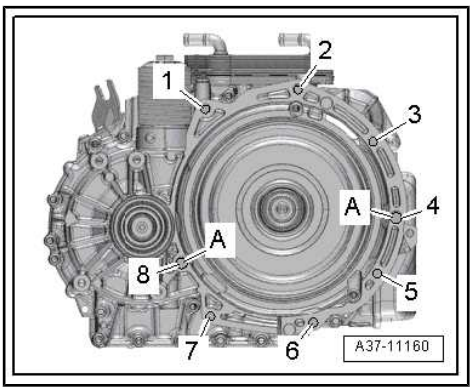


– Remove eye on puller for ATF-supply - T40123 A- and screw into lower threaded hole for starter bolt as far as stop.
– Secure eye-head bolt - 3368- to bore in gearbox housing with two lock nuts -1-.
– Attach lifting tackle - 2024 A- to both eyes and to workshop hoist - VAS 6100- as shown in illustration.
– To adjust to the centre of gravity of the gearbox, the perforated rails of the support hooks must be positioned as shown.
• The support hooks and retaining pins on the lifting tackle must be secured with locking pins -arrows-.

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– Remove bolts -1 … 8- securing gearbox to engine.
– Detach gearbox from engine.



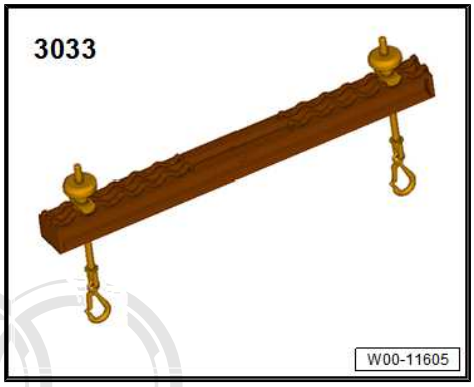
1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required

- Engine and gearbox support - VW 540-



- Lifting tackle - 3033-



- Engine and gearbox support - VAS 6095-



- Workshop hoist - VAS 6100-



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Procedure

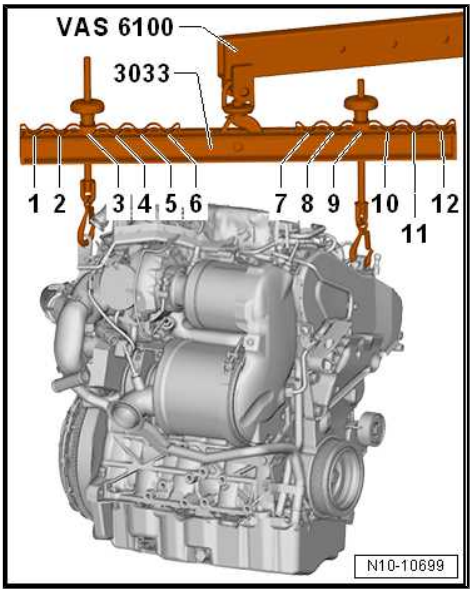
- Gearbox detached from engine ⇒ page 21 .

– Attach lifting tackle - 3033- to engine and workshop hoist - VAS 6100- as shown in illustration.

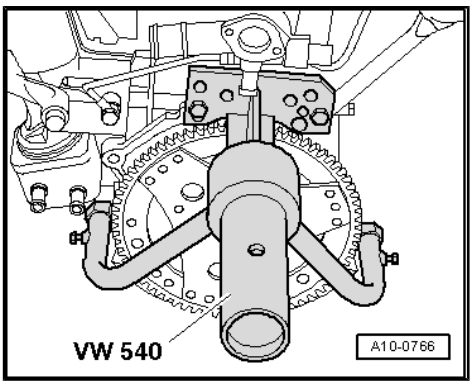
♦ Gearbox end: position 3.

♦ Pulley end: position 9.

– Lift engine off engine bracket -T10497- using workshop hoist - VAS 6100- .



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



1.4 Installing engine

Tightening torques

Note

♦ *Tightening torques apply only to lightly greased, oiled, phosphated or black-finished nuts and bolts.*

♦ *Additional lubricants such as engine or gear oil may be used, but do not use lubricants containing graphite.*

♦ *Do not use degreased parts.*

♦ *Tolerance for tightening torques: ± 15 %.*

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

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♦ ⇒ “2.1 Exploded view - assembly mountings”, page 32

♦ Securing engine to gearbox ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox

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 ⇒ page 246 after installing the high-pressure pipes. If these instructions are not observed, the engine could be damaged.

Procedure

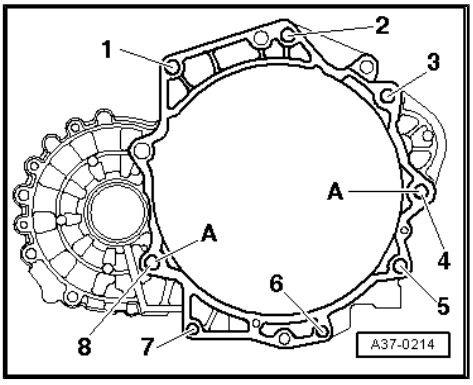
Note

- *After removing, renew bolts tightened with specified tightening angle.*
- *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings after removal.*
- *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 .*
- *Re-install all cable ties in the same locations when installing.*

– Install intermediate plate ⇒ page 52 .

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– If not already fitted, install dowel sleeves -A- for centring engine and gearbox in cylinder block.



Note

The illustration shows a vehicle with a manual gearbox.

Vehicles with manual gearbox:

– Remove needle bearing in crankshaft if fitted ⇒ page 60 .

– Renew clutch release bearing if worn ⇒ Gearbox; Rep. gr. 30 ; Clutch mechanism .

– Lubricate splines of gearbox input shaft lightly with grease for clutch plate splines ⇒ Electronic parts catalogue .

– Make sure that clutch plate is properly centred.

Vehicles with dual clutch gearbox:

– Install needle bearing if not fitted in crankshaft ⇒ page 60 .

Vehicles with four-wheel drive:

– Install bracket for bevel box ⇒ Rep. gr. 34 ; Bevel box .

– Install bevel box ⇒ Rep. gr. 34 ; Bevel box; Installing bevel box .

Continued for all vehicles:

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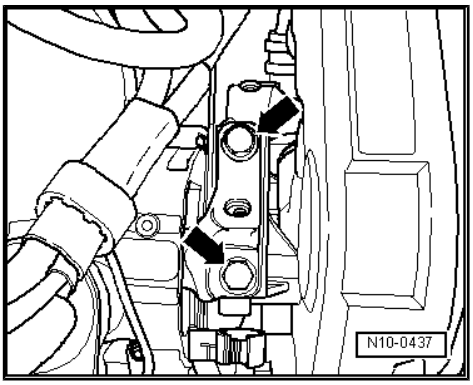
– Secure gearbox to engine.

– Install gearbox support.

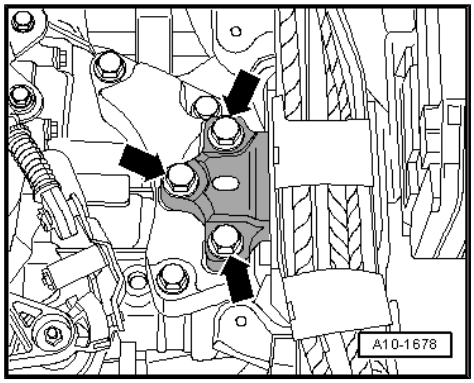
– Take up engine/gearbox assembly with engine bracket -T10497- .

– Guide engine/gearbox assembly into body.

– Initially screw in bolts -arrows- for engine mounting by hand until they make contact.



– Initially screw in bolts -arrows- for gearbox mounting by hand until they make contact.



Note

The bolts are tightened to final torque only after adjusting the assembly mountings ⇒ page 38 .

– Remove engine bracket - T10497- from engine.
– Install starter ⇒ Electrical system; Rep. gr. 27 ; Starter; Exploded view - starter .
– Install charge air cooling pump - V188- ⇒ page 174 .
– Install air pipe ⇒ page 217 .

Vehicles with dual clutch gearbox:

– Install and adjust selector lever cable ⇒ Rep. gr. 34 ; Selector mechanism .

Vehicles with four-wheel drive:

– Secure propshaft to bevel box ⇒ Rear final drive; Rep. gr. 39 ; Propshaft; Removing and installing propshaft .
– Install control unit for NOx sender - J583- ⇒ page 273 .
– Install connection ⇒ page 206 .
– Install front exhaust pipe ⇒ page 283 .
– Install drive shafts ⇒ Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .
– Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit .
– Install poly V-belt ⇒ page 44 .
– Install engine control unit ⇒ page 277 .
– Connect clutch slave cylinder ⇒ Gearbox; Rep. gr. 30 ; Clutch mechanism .
– Bleed clutch hydraulics ⇒ Gearbox; Rep. gr. 30 ; Clutch mechanism .
– Install cables with cable support bracket ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector cables .
– Adjust assembly mountings ⇒ page 38 .
– Install battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Exploded view - battery .
– Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Connect vacuum hoses ⇒ page 234 .
– Install air cleaner housing ⇒ page 236 .
– Connect fuel lines ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
– Check oil level ⇒ Maintenance ; Booklet 820 .

Propshaft; Removing and installing propshaft .
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NOTICE

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

– Do not use a battery charger to boost starting.

– Bleed fuel system ⇒ page 232 .

– Connect coolant hoses with plug-in connector ⇒ page 196 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/bled.

– After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.

Note

Do not reuse coolant.

– Fill up with coolant ⇒ page 165 .

– Install subframe with steering rack ⇒ Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .

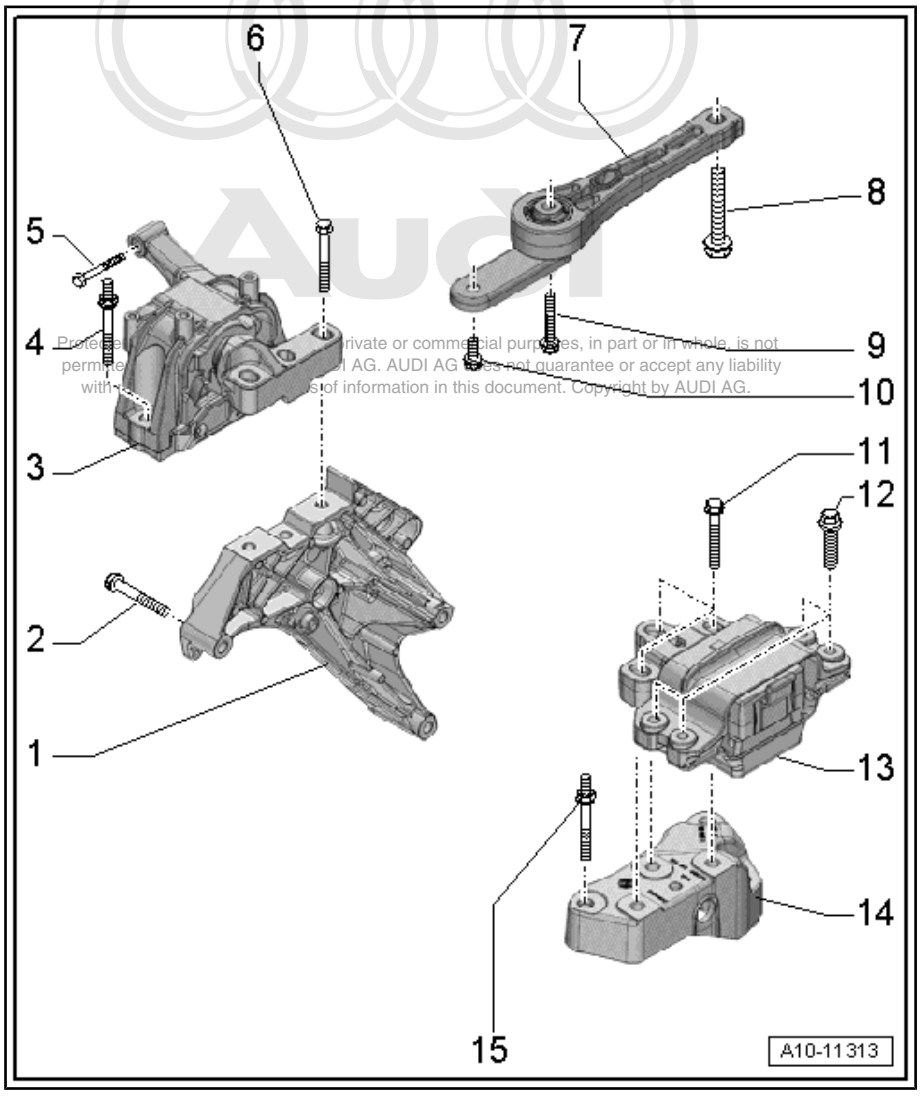
– Install wheel spoilers (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

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2 Assembly mountings

⇒ “2.1 Exploded view - assembly mountings”, page 32
⇒ “2.2 Supporting engine in installation position”, page 33
⇒ “2.3 Removing and installing engine mountings”, page 36
⇒ “1.7 Removing and installing engine support”, page 47
⇒ “2.4 Removing and installing gearbox mounting”, page 36
⇒ “2.5 Removing and installing pendulum support”, page 37
⇒ “2.6 Checking adjustment of assembly mountings (engine/ gearbox mountings)”, page 38
⇒ “2.7 Adjusting assembly mountings”, page 38

2.1 Exploded view - assembly mountings



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1 - Engine support

2 - Bolt
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 33

3 - Engine mounting
- ❑ With support arm
- ❑ Removing and installing ⇒ page 36

4 - Bolt
- ❑ Renew after removing
- ❑ 40 Nm +90°

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

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

7 - Pendulum support
- ❑ Removing and installing ⇒ page 37

8 - Bolt
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 33

9 - Bolt
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 33

10 - Bolt
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 33

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

12 - Bolt

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

13 - Gearbox mounting

- ❑ With support arm
- ❑ Removing and installing ⇒ page 36

14 - Gearbox support

- ❑ Different versions; for allocation refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ Rep. gr. 34 ; Removing and installing gearbox

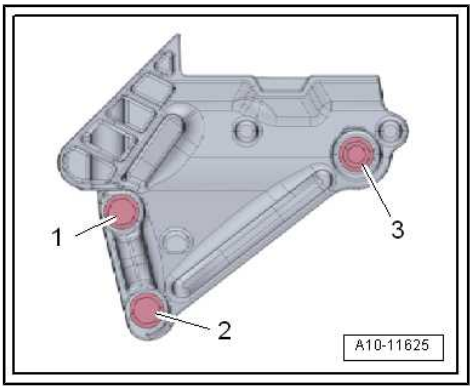
15 - Bolt

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

Engine support - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

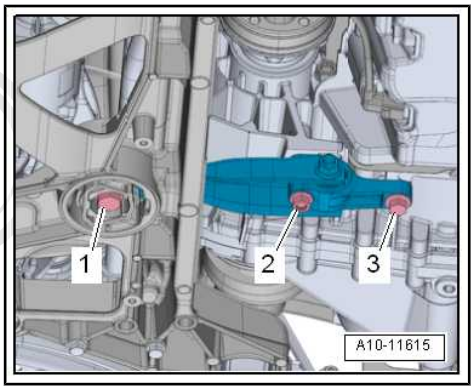
Stage	Bolts	Tightening torque/angle specification
1.	-1 … 3-	7 Nm
2.	-1 … 3-	40 Nm
3.	-1 … 3-	Turn 180° further



Installing pendulum support

– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-2, 3-	50 Nm with DQ 250 or DQ 350 gearbox 60 Nm with DQ 500 gearbox
2.	-1-	100 Nm
3.	-1 … 3-	Turn 90° further

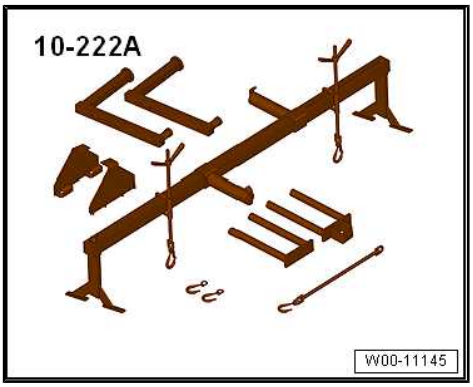


2.2 Supporting engine in installation position

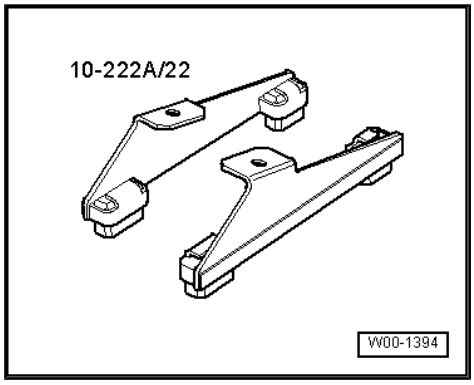
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Special tools and workshop equipment required

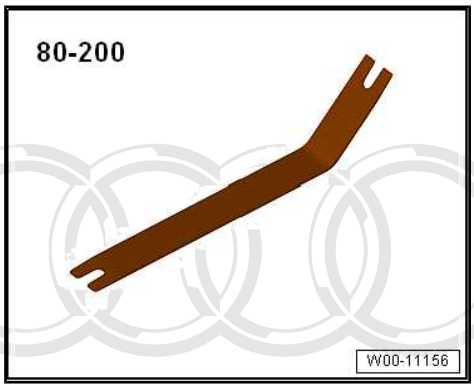
♦ Support bracket - 10-222A-



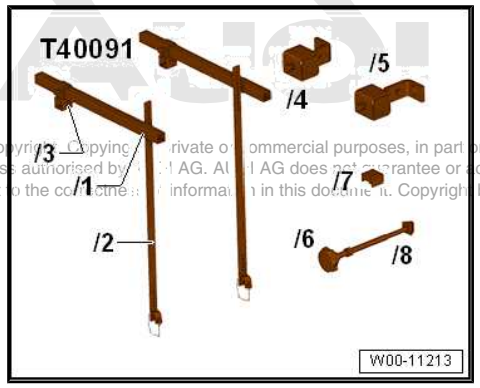
- Adapter - 10-222A/22-



- Removal lever - 80-200-

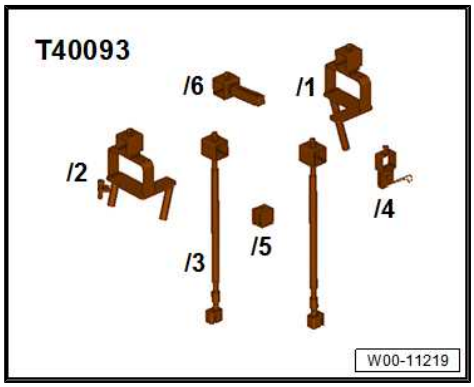


- Engine support bracket (basic set) - T40091-



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- -T40093/3- from engine support supplementary set - T40093-

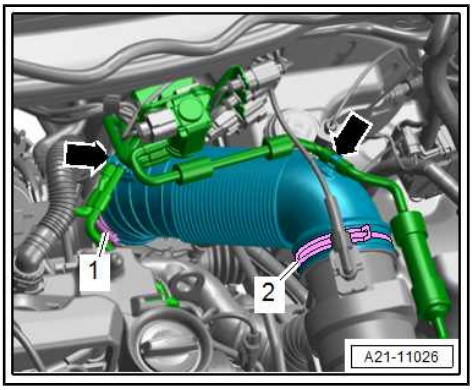


Procedure

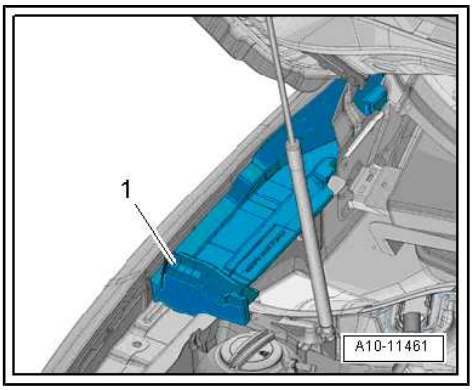
– Remove engine cover panel ⇒ page 40 .

– Move clear vacuum hoses -arrows-.

– Loosen hose clips -1, 2- and remove air pipe.



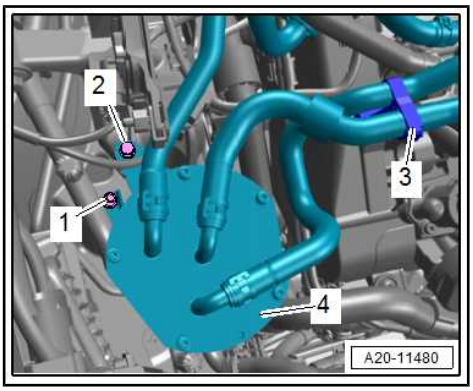
– Unclip sealing element -1- (left and right) using removal lever - 80-200- .



– Move clear bracket -3- with fuel hoses.

– Loosen bolt -1- and remove bolt -2-.

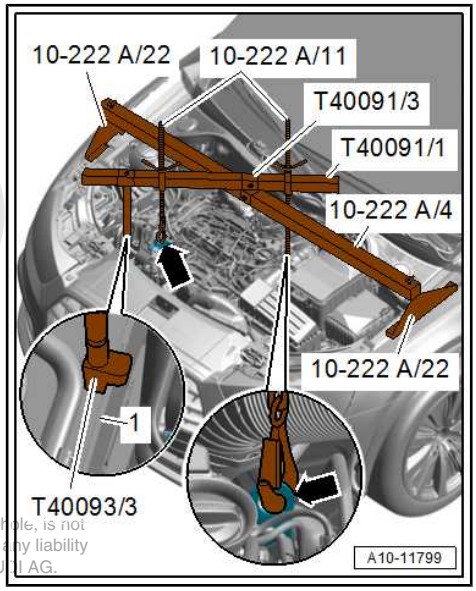
– Move fuel filter -4- clear to one side.



– Position support bracket - 10-222A- on bolted flanges of wing panels and place -T40093/3- on longitudinal member -1-, as shown in illustration.

– Attach hooks of spindles -10-222A/11- to engine lifting eyes -arrows-.

– Take up weight of engine/gearbox assembly evenly with both spindles (do not raise assembly).



Assembling

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

– Install engine cover panel ⇒ page 40 .

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2.3 Removing and installing engine mountings

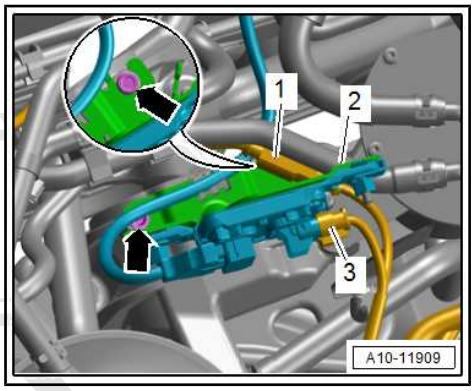
Removing

– Support engine in installation position ⇒ page 33 .

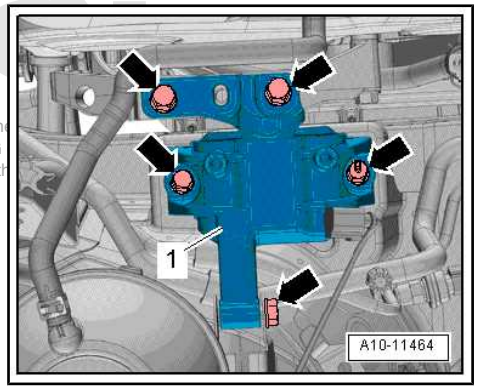
– Remove electrical connector -1- for injector for reducing agent - N474- from bracket and unplug connector.

– Unplug electrical connector -3-.

– Remove bolts -arrows- and move control unit for NOx sender - J583- clear to one side with bracket -2-.



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



Installing

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

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– Check adjustment of assembly mountings (engine/gearbox mountings) ⇒ page 38 .

Tightening torques

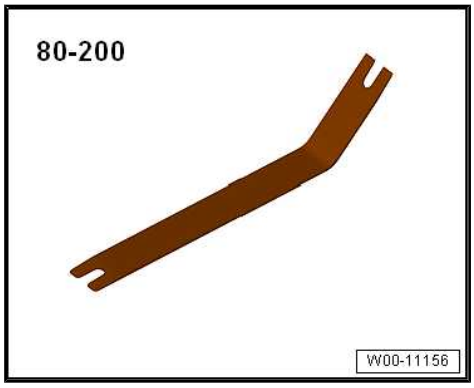
◆ ⇒ “2.1 Exploded view - assembly mountings”, page 32

◆ Control unit for NOx sender - J583- ⇒ “8.1 Exploded view - Lambda probe”, page 273

2.4 Removing and installing gearbox mounting

Special tools and workshop equipment required

◆ Removal lever - 80-200-



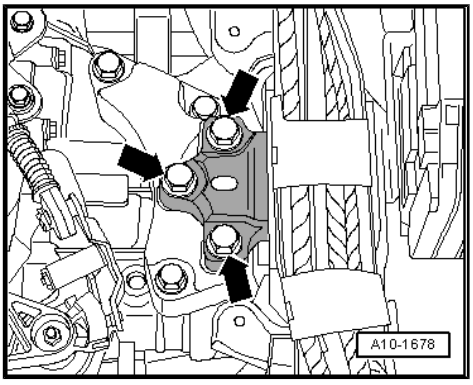
Removing

– Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .

– Support engine in installation position ⇒ page 33 .

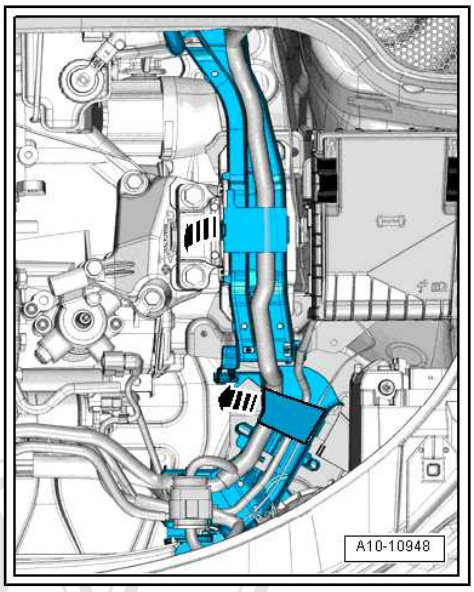
– Remove bolts -arrows- securing gearbox mounting.

• The illustration shows the gearbox mounting for a manual gearbox.



– Open retainers for wiring duct -arrows- and press electrical wiring to one side.

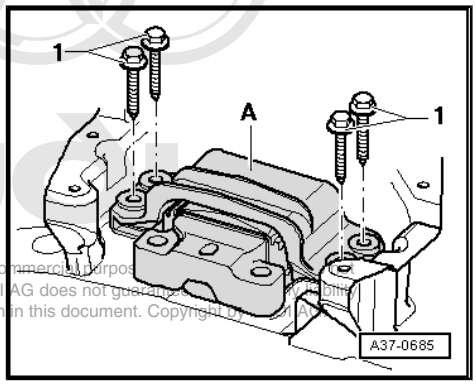
– Use removal lever - 80-200- to unclip wiring duct.



– Unscrew bolts -1- and remove gearbox mounting -A-.

Installing

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



• Renew bolts tightened with specified tightening angle.

– Tighten gearbox mounting on longitudinal member.

– Lift gearbox with spindle of support bracket until gearbox support makes contact with support arm of gearbox mounting.

– Check adjustment of assembly mountings (engine/gearbox mountings) ⇒ page 38 .

– Detach support bracket - 10-222A- from engine ⇒ page 33 .

Tightening torques

♦ ⇒ Electrical system; Rep. gr. 27 ; Battery; Exploded view - battery

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

2.5 Removing and installing pendulum support

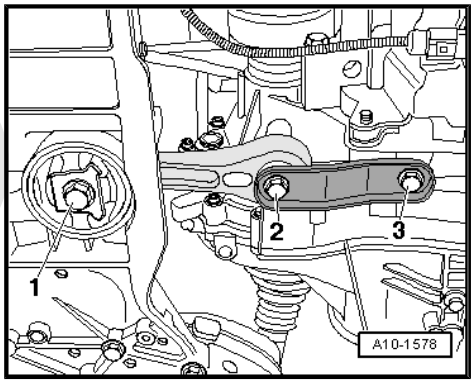
Removing

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

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– Remove bolts -1, 2, 3- and remove pendulum support.

• The illustration shows the pendulum support for a manual gearbox.



Installing

Install in reverse sequence.

• While the bolt -1- is being tightened, the support must either be secured to prevent it from turning or bolted to the gearbox.

Tightening torques

♦ ⇒ Fig. ""Installing pendulum support"" , page 33

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

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2.6 Checking adjustment of assembly mountings (engine/gearbox mountings)

Procedure

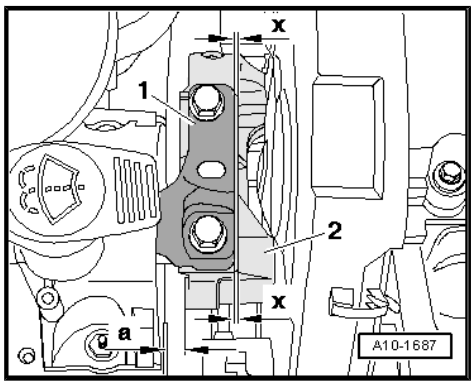
The following specifications must be obtained:

• There must be a distance of at least -a- = 13.5 mm between engine support -2- and longitudinal member (right-side).

• The side of the engine support casting -2- must be aligned parallel to the support arm -1- (distance -x- = distance -x-).

• Distance -a- (at least 13.5 mm) can also be checked with a metal rod of suitable size, or similar.

– If the distance measured is too large or small, the assembly mountings must be adjusted ⇒ page 38 .



2.7 Adjusting assembly mountings

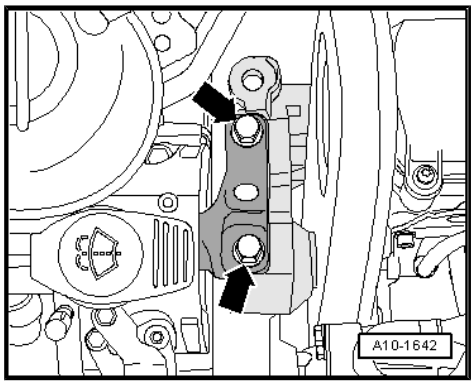
Procedure

– Support engine in installation position ⇒ page 33 .

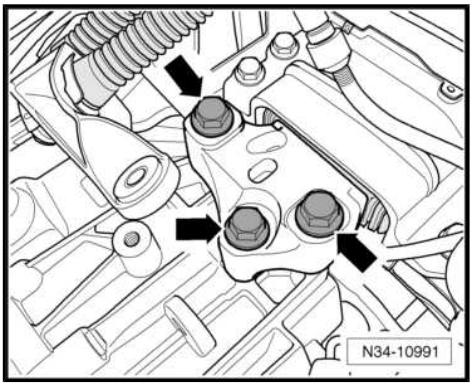
– Remove battery tray ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery tray .

– Remove bolts -arrows- for engine mounting one by one and renew (if they were not renewed when installing engine).

– Initially fit bolts hand-tight.



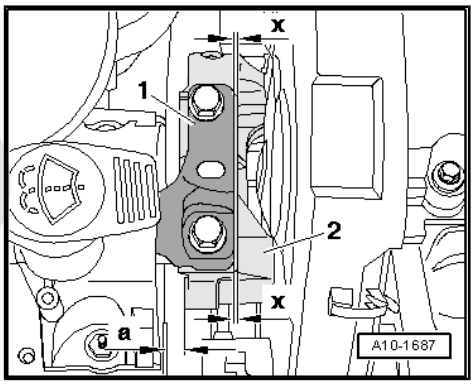
– Remove bolts -arrows- for gearbox mounting one by one and renew (if they were not renewed when installing engine).
– Initially fit bolts hand-tight.



– Using assembly lever, adjust engine/gearbox assembly between engine mounting and support arm -1- until specifications listed below are attained:

• There must be a distance of at least -a- = 13.5 mm between engine support -2- and longitudinal member (right-side).
• The side of the engine support casting -2- must be aligned parallel to the support arm -1- (distance -x- = distance -x-).
• Distance -a- (at least 13.5 mm) can also be checked with a metal rod of suitable size, or similar.

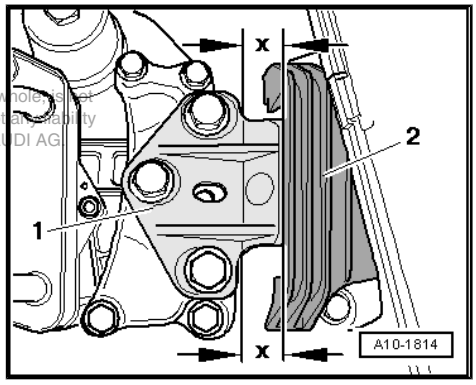
– Tighten bolts for engine mounting.



– Ensure that edges of support arm (on gearbox side) -1- and gearbox mounting -2- are parallel.

• Dimension -x- = dimension -x-.

– Tighten bolts for gearbox mounting.



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Install in reverse sequence.

Tightening torques

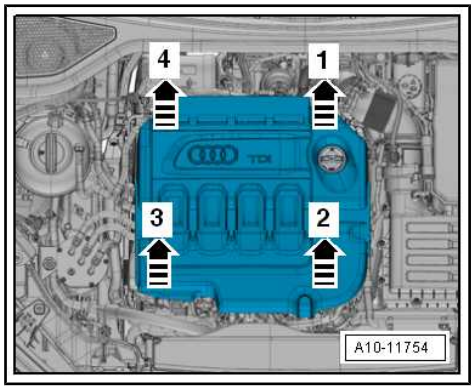
♦ ⇒ “2.1 Exploded view - assembly mountings”, page 32
♦ ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings
♦ ⇒ Electrical system; Rep. gr. 27 ; Battery; Exploded view - battery

3 Engine cover panel

⇒ “3.1 Removing and installing engine cover panel”, page 40

3.1 Removing and installing engine cover panel

Removing



NOTICE

Risk of damage to fuel return line if engine cover panel is handled incorrectly.

Risk of leaks in fuel system.

- **Pay attention to surrounding components when removing and installing engine cover panel.**

– Carefully detach engine cover panel from retaining pins one after the other in the sequence -1-2-3-4- and lift engine cover panel off, keeping it straight.

Installing

NOTICE

Risk of damage to engine cover panel if force is applied.

- **Never strike the engine cover panel with your fist or with any kind of tool.**

– Position engine cover panel on all retaining pins, paying attention to oil filler neck and dipstick.

– Press engine cover panel onto retaining pins, starting at oil filler neck -item 1- and working clockwise.

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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ “1.1 Exploded view - cylinder block (pulley end)”, page 41

⇒ “1.2 Exploded view - sealing flange (pulley end)”, page 43

⇒ “1.3 Removing and installing poly V-belt”, page 44

⇒ “1.4 Removing and installing tensioner for poly V-belt”, page 45

⇒ “1.5 Removing and installing vibration damper”, page 45

⇒ “1.6 Removing and installing bracket for ancillaries”, page 46

⇒ “1.8 Removing and installing sealing flange (pulley end)”, page 48

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 45
- ❑ Removing and installing ⇒ page 44
- ❑ When installing, make sure it is properly seated on pulleys.

2 - Bolt

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

3 - Vibration damper

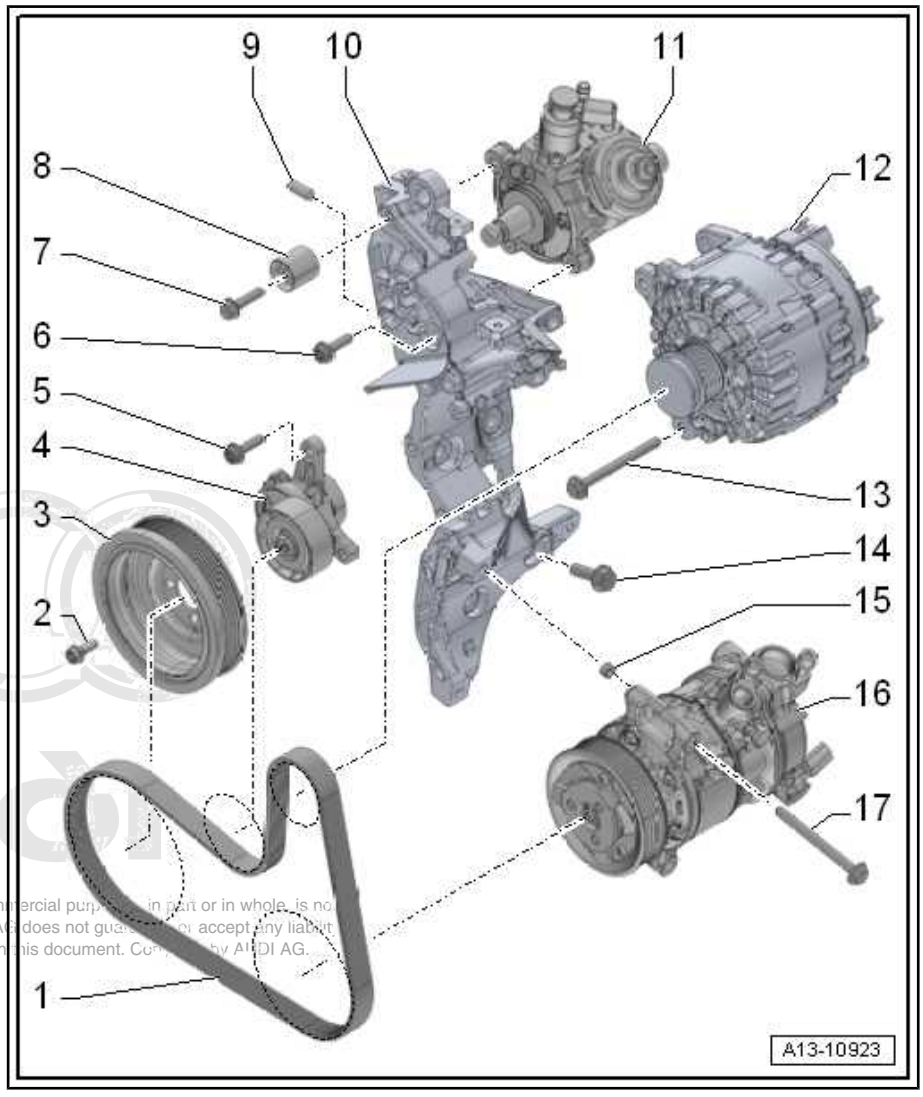
- ❑ With poly V-belt pulley
- ❑ Installation position: hole in vibration damper must be positioned over raised section of crankshaft sprocket
- ❑ Removing and installing ⇒ page 45

4 - Tensioner for poly V-belt

- ❑ Removing and installing ⇒ page 45

5 - Bolt

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



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6 - Bolt

- ❑ Tightening torque ⇒ Item 2 (page 264)

7 - Bolt

- ❑ Tightening torque ⇒ Item 14 (page 73)

8 - Damper wheel

9 - Dowel sleeve

- ❑ Ensure correct seating in bracket for ancillaries

10 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 46

11 - High-pressure pump

- ❑ Exploded view ⇒ page 264

12 - Alternator

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

13 - Bolt

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

14 - Bolt

- ❑ Renew after removing
- ❑ Different lengths ⇒ page 42
- ❑ Tightening torque and sequence ⇒ page 42

15 - Dowel sleeve

- ❑ Ensure correct seating in air conditioner compressor

16 - Air conditioner compressor

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

17 - Bolt

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

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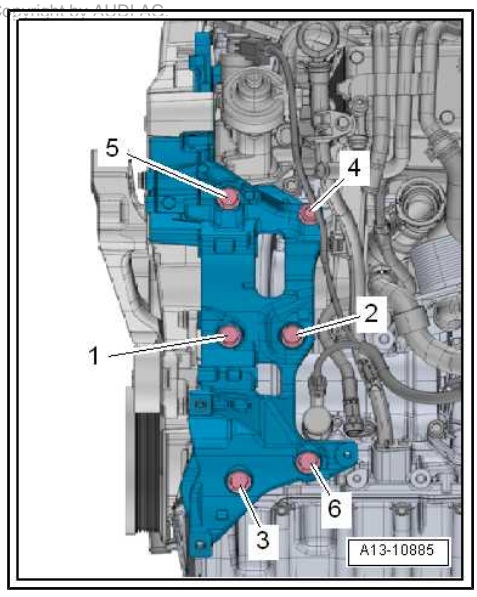
Bracket for ancillaries - tightening torque and tightening sequence

– Fit new bolts in the following sequence:

- ♦ Bolts -1, 2, 3, 6- M10x35
- ♦ Bolt -4- M10x115
- ♦ Bolt -5- M10x175

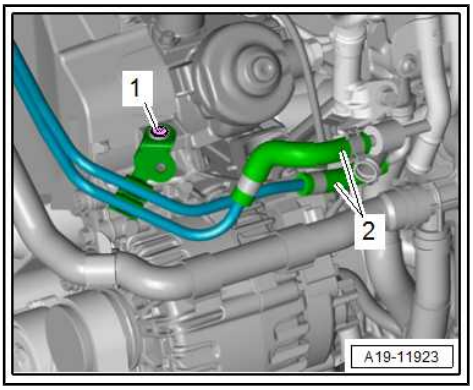
– Tighten bolts in stages in the sequence shown:

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



Bracket for coolant pipes on vehicles with SCR system - tightening torque

– Tighten bolt -1- to 9 Nm.



1.2 Exploded view - sealing flange (pulley end)

1 - Sealing flange (pulley end)

- ❑ With crankshaft oil seal
- ❑ Renew after removing
- ❑ Removing and installing ⇒ page 48

2 - Bolt

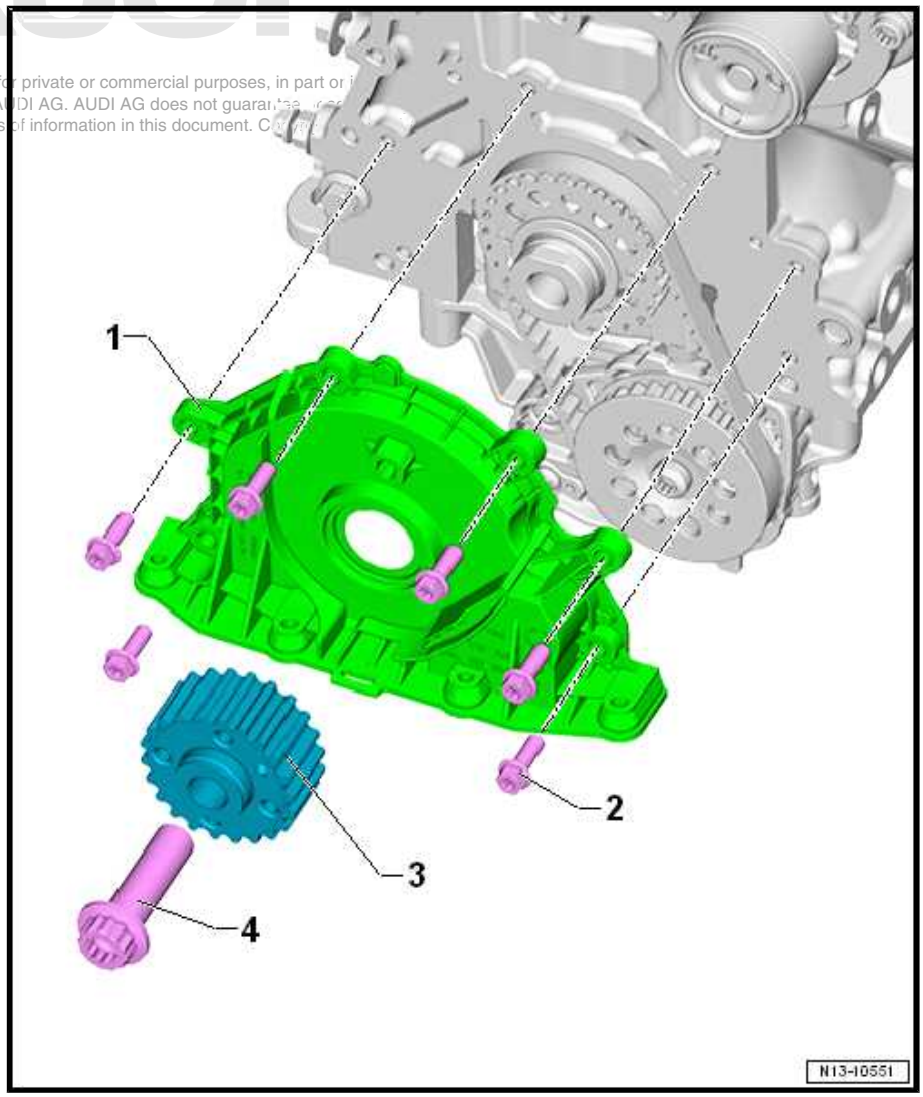
- ❑ Tightening torque and sequence ⇒ page 44

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 72)

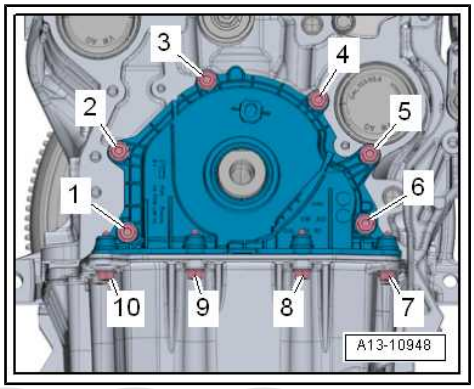


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Sealing flange (pulley end) - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

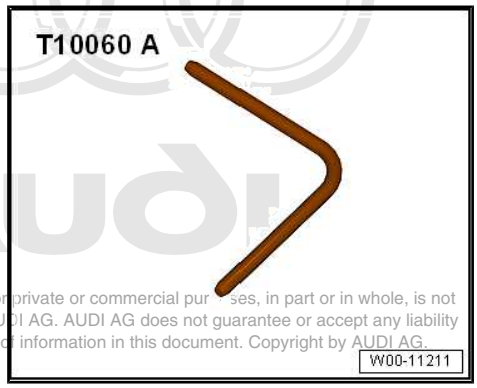
Stage	Bolts	Tightening torque
1.	-1 … 10-	Screw in by hand until contact is made
2.	-1 … 6-	Tighten in stages and in diagonal sequence; final torque 13 Nm
3.	-7 … 10-	13 Nm



1.3 Removing and installing poly V-belt

Special tools and workshop equipment required

♦ Locking pin - T10060A-



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Removing

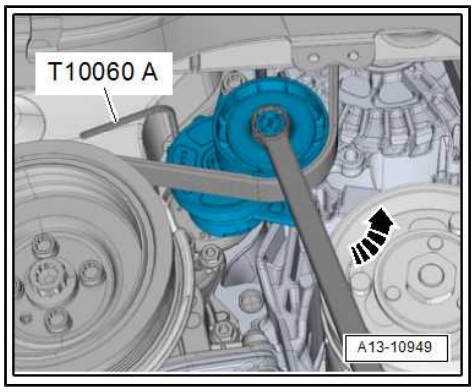
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

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 pin - T10060A- .

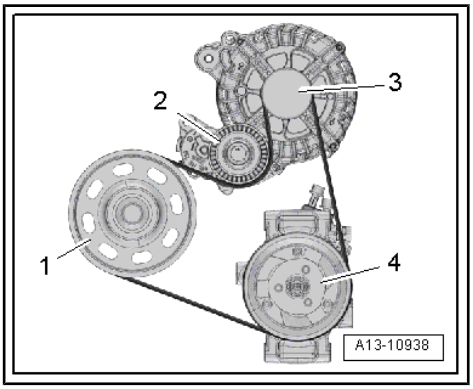
– Take off poly V-belt.

Installing

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

– Fit poly V-belt on poly V-belt pulleys:

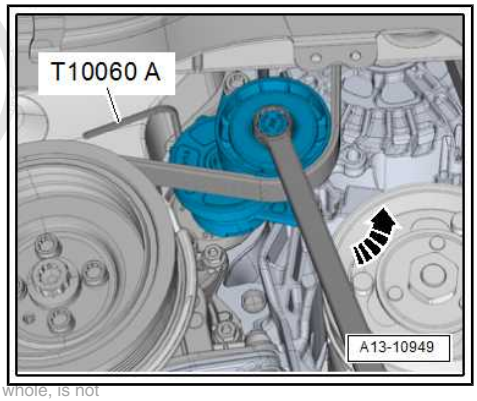
1 - Vibration damper
2 - Tensioning roller
3 - Alternator
4 - Air conditioner compressor



– Counterhold tensioner with ring spanner -arrow- and pull out locking pin - T10060A- .
– Release tensioner.
– Check that poly V-belt is in correct position.
– Start engine and check that poly V-belt(s) run properly.

Tightening torques

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



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1.4 Removing and installing tensioner for poly V-belt

Removing

– Remove poly V-belt ⇒ page 44 .
– Remove bolts -arrows- and take off poly V-belt tensioner.

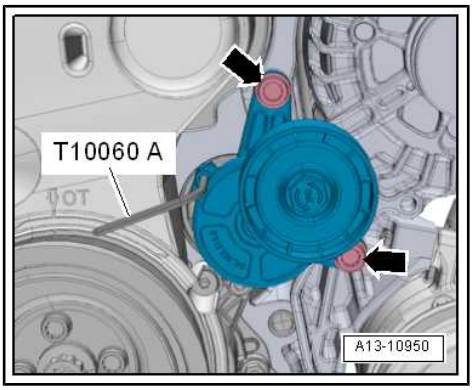
Installing

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

– Install poly V-belt ⇒ page 44 .

Tightening torques

♦ ⇒ “1.1 Exploded view - cylinder block (pulley end)”, page 41

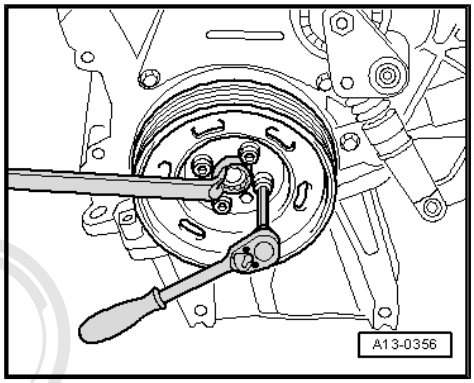


1.5 Removing and installing vibration damper

Removing

– Remove poly V-belt ⇒ page 44 .
– Remove wheel spoiler (front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

– Counterhold by applying ring spanner to bolt for crankshaft sprocket and slacken bolts for vibration damper.
– Remove bolts and take off vibration damper.



Installing

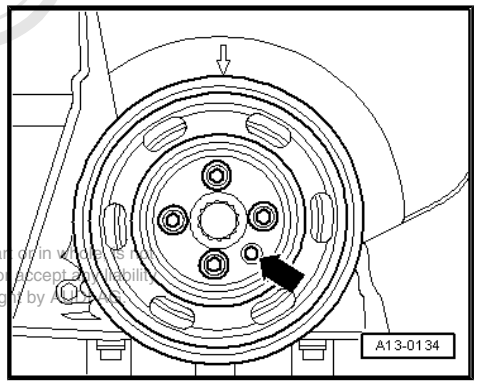
Installation is carried out in the reverse order; note the following:

- Installation position: hole -arrow- in vibration damper must be positioned over raised section of crankshaft sprocket.

– Install poly V-belt ⇒ page 44 .

Tightening torques

◆ ⇒ “1.1 Exploded view - cylinder block (pulley end)” page 41
◆ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)

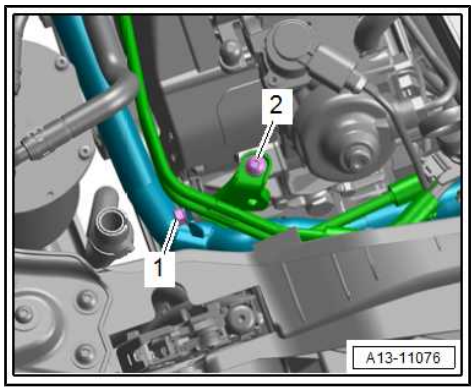


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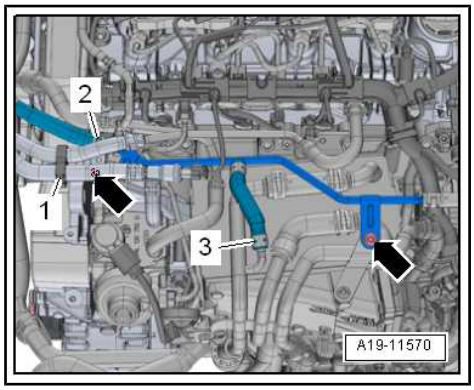
1.6 Removing and installing bracket for ancillaries

Removing

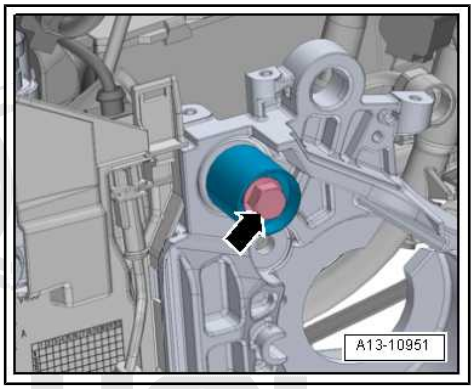
– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .
– Remove high-pressure pump ⇒ page 265 .
– Remove bolts -1, 2-.
– Press coolant lines and coolant hose to side.



– Unclip bracket -1- with fuel hoses.
– Remove bolts -arrows-.

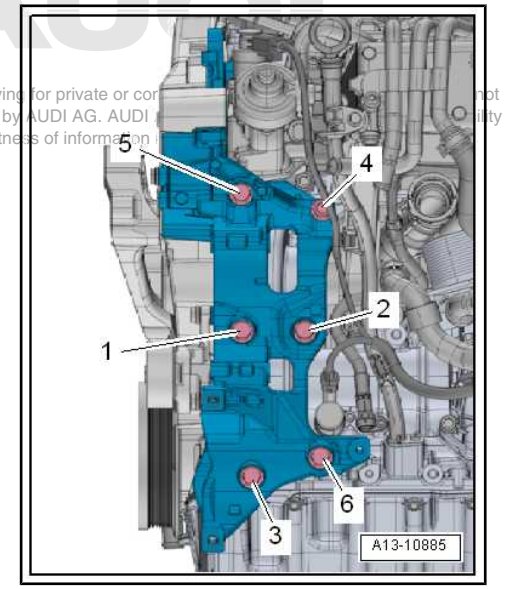


– Remove bolt -arrow- and detach damper wheel.



– Loosen bolts in the sequence -6 ... 1-.
– Remove bolts and detach bracket for ancillaries.

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Installing

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

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

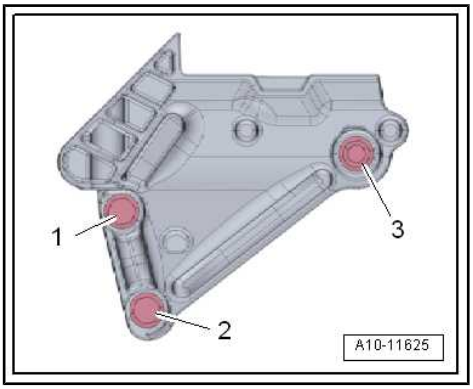
Tightening torques

- ⇒ Fig. ""Bracket for ancillaries - tightening torque and tightening sequence"" , page 42
- ⇒ "1.2 Exploded view - toothed belt", page 72
- ⇒ "6.1 Exploded view - high-pressure pump", page 264
- ⇒ Electrical system; Rep. gr. 27 ; Alternator; Exploded view - alternator

1.7 Removing and installing engine support

Removing

– Remove engine mounting ⇒ page 36 .
– Remove toothed belt cover (top) ⇒ page 73 .
– Use spindle - 10-222A/11- to raise/lower engine until appropriate bolt of engine bracket is accessible.
• Bolt -2- can only be removed after engine bracket has been detached.
– Unscrew bolts -1, 2 and 3- and detach engine support.



Installing

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

– Insert bolt -2- in hole in engine support before fitting engine support.
– Fit engine support and initially hand-tighten bolts -1, 2, 3-, then tighten to specified torque in specified sequence.
– Install toothed belt cover (top) ⇒ page 73 .
– Install engine mountings ⇒ page 36 .

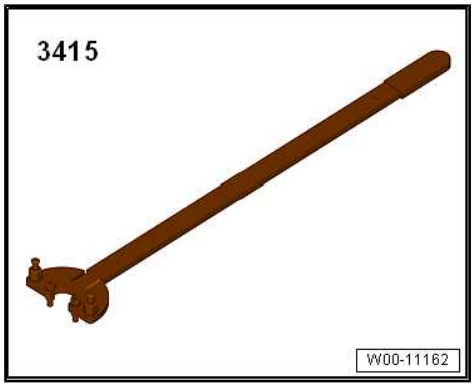
Tightening torques

- ⇒ Fig. ""Engine support - tightening torque and sequence"" , page 33

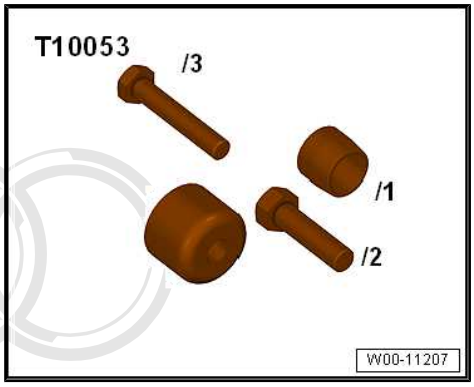
1.8 Removing and installing sealing flange (pulley end)

Special tools and workshop equipment required

- Counterhold tool - 3415-



- Assembly tool - T10053-



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

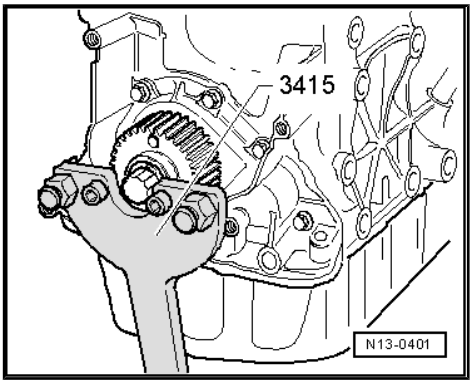
Removing

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– Detach toothed belt from camshaft ⇒ page 76 .
– Remove toothed belt cover (bottom) ⇒ page 75 .

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

– Remove bolt and detach crankshaft sprocket.



Vehicles with one-piece sump:

– Remove sump
⇒ “1.1.3 Removing and installing sump”, page 140 .

Vehicles with two-piece sump:

– Remove sump (bottom section)
⇒ “1.1.4 Removing and installing sump (bottom section)”, page 143 .

– Remove sump (top section)
⇒ “1.1.5 Removing and installing sump (top section)”, page 146 .

Continued for all vehicles:

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

Installing

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

CAUTION

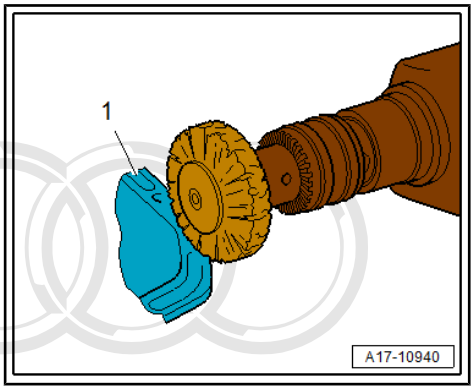
Risk of eye injury due to sealant residue.

– Put on safety goggles.

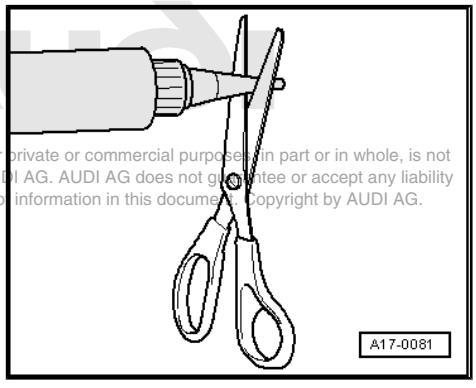
– Remove sealant residue from sump -1- using rotating plastic brush or similar.

– 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).



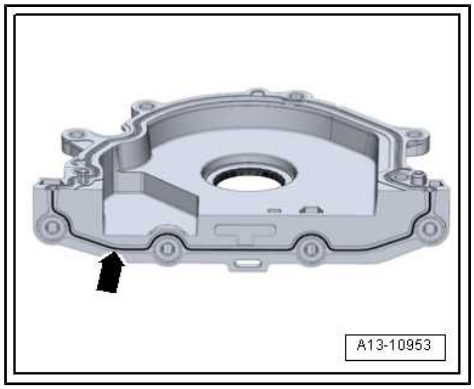
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– Apply bead of sealant -arrow- onto clean sealing surface of sealing flange as shown in illustration.

• 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.



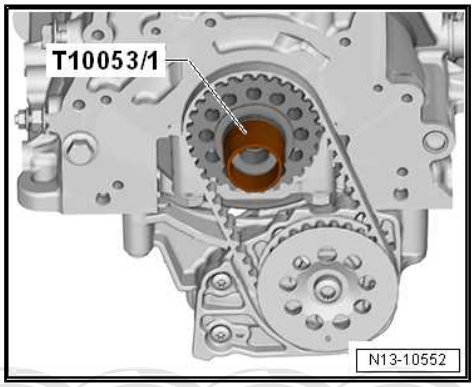
– Position assembly sleeve - T10053/1- on crankshaft journal.

– 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 44 .



Note

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

Vehicles with one-piece sump:

– Install sump
⇒ “1.1.3 Removing and installing sump”, page 140 .

Vehicles with two-piece sump:

– Install sump (bottom section)
⇒ “1.1.4 Removing and installing sump (bottom section)”, page 143 .

– Install sump (upper section)
⇒ “1.1.5 Removing and installing sump (top section)”, page 146 .

Continued for all vehicles:

– Install toothed belt (adjust valve timing) ⇒ page 79 .

Tightening torques

♦ ⇒ Fig. ““Sealing flange (pulley end) - tightening torque and sequence”“ , page 44

♦ Crankshaft sprocket ⇒ Item 1 (page 72)

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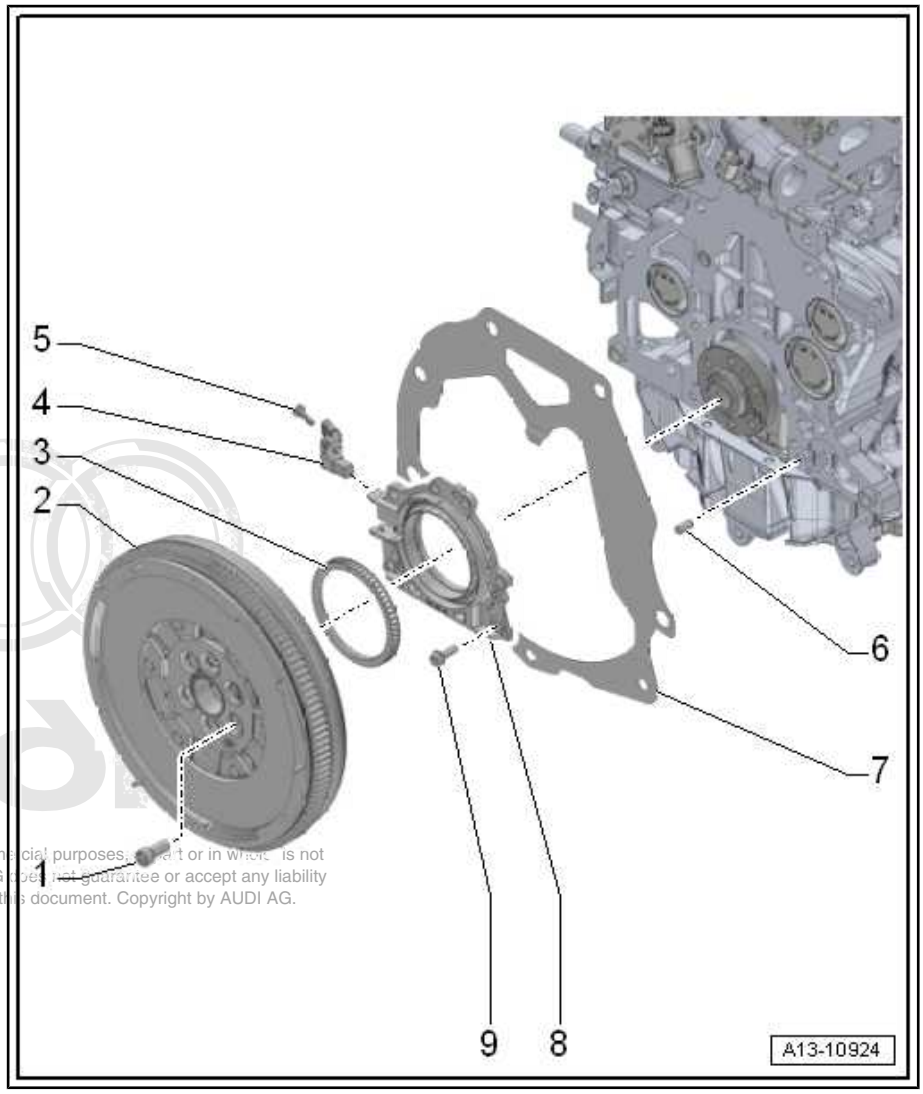
2 Cylinder block (gearbox end)

⇒ “2.1 Exploded view - cylinder block (gearbox end)”, page 51

⇒ “2.2 Removing and installing flywheel”, page 52

⇒ “2.3 Removing and installing sealing flange (gearbox end)”, page 53

2.1 Exploded view - cylinder block (gearbox end)



1 - Bolt

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

2 - Flywheel

- ❑ Removing and installing ⇒ page 52
- ❑ Can only be installed in one position

3 - Sender wheel

- ❑ For engine speed sender - G28-
- ❑ Removing and installing ⇒ “2.3 Removing and installing sealing flange (gearbox end)”, page 53

4 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 333

5 - Bolt

- ❑ Tightening torque ⇒ Item 9 (page 330)

6 - Dowel pin

- ❑ 2x

7 - Intermediate plate

- ❑ Do not damage or bend when assembling
- ❑ Installing ⇒ page 52

8 - Sealing flange (gearbox end)

- ❑ With oil seal
- ❑ Renewing ⇒ page 53

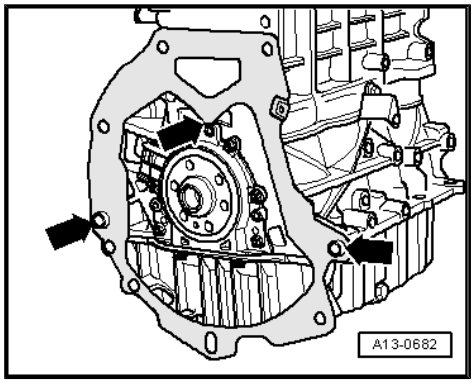
9 - Bolt

- ❑ Tightening torque and sequence ⇒ page 52

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Installing intermediate plate

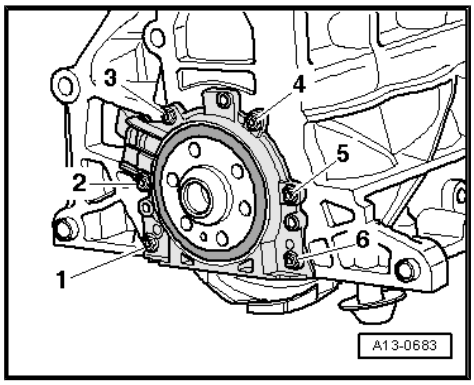
– Engage intermediate plate on sealing flange -top arrow- and push onto dowel sleeves -bottom arrows-.



Sealing flange (gearbox end) - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

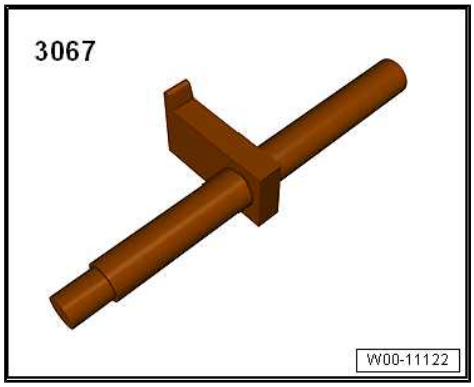
Stage	Bolts	Tightening torque
1.	-1 … 6-	Screw in by hand until contact is made
2.	-1 … 6-	Tighten in stages and in diagonal sequence; final torque 13 Nm



2.2 Removing and installing flywheel

Special tools and workshop equipment required

♦ Counterhold tool - 3067-



Removing

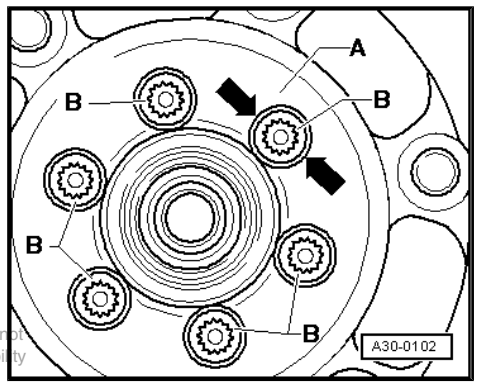
• Gearbox removed

NOTICE

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

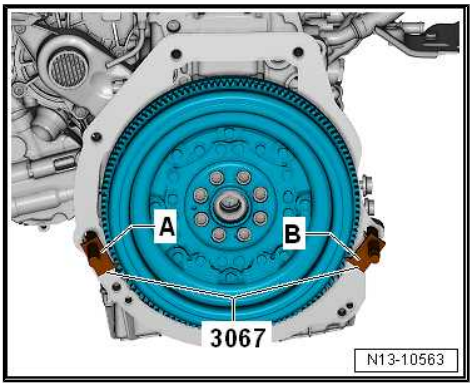
– **When screwing in bolts, fit them manually and perform the first few turns by hand.**

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



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– Insert counterhold tool - 3067- in hole on cylinder block -item B-, slacken bolts for flywheel.
– Remove bolts and take off flywheel.



Installing

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

– Insert counterhold - 3067- in hole on cylinder block -item A-.

Tightening torques

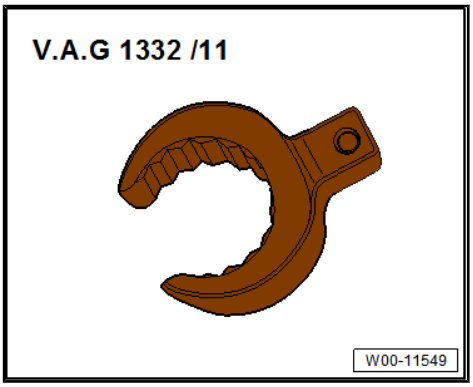
♦ ⇒ “2.1 Exploded view - cylinder block (gearbox end)”, page 51

2.3 Removing and installing sealing flange (gearbox end)

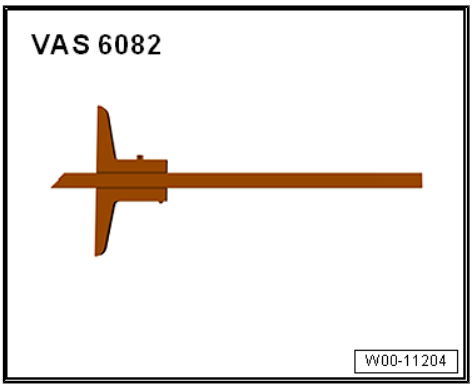
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Special tools and workshop equipment required

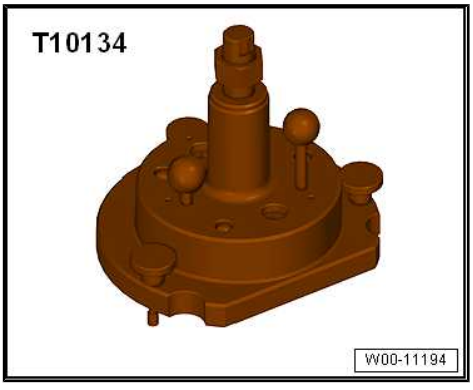
♦ Open end spanner insert, AF 24 - V.A.G 1332/11-



♦ Depth gauge - VAS 6082-



♦ Assembly tool - T10134-



♦ Bolt M6x35 (3x)
♦ Bolt M7x35 (2x)

Pressing out sealing flange with sender wheel

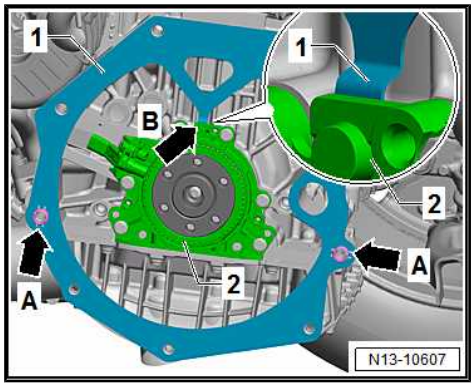
- Gearbox removed

– Remove flywheel ⇒ page 52 .

- For clarity, the engine is removed in the following illustrations.

– 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-.



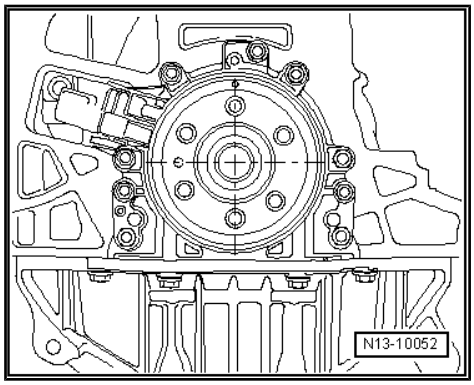
– Rotate crankshaft by turning bolt for toothed belt sprocket until crankshaft is positioned at “TDC”, as shown in illustration.

– Remove sump (refer to appropriate chapter).

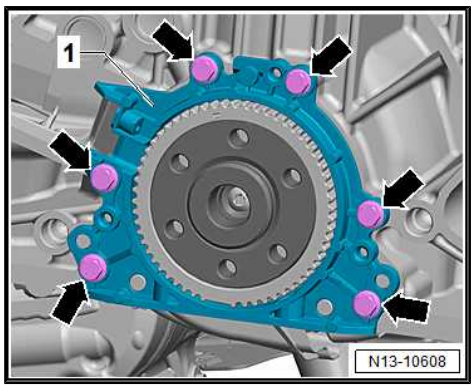
♦ ⇒ “1.1.1 Exploded view - sump (1-part)”, page 136

♦ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

– Remove engine speed sender - G28- ⇒ page 333 .

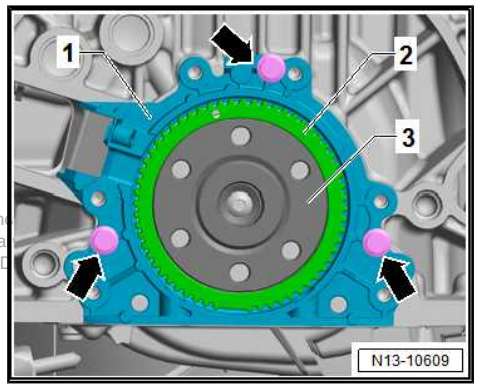


– Remove bolts -arrows- for sealing flange -1-.



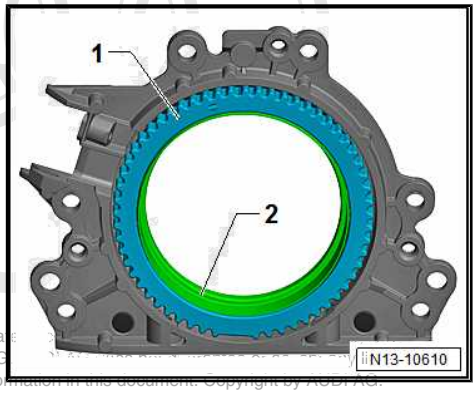
– To press off, screw 3 bolts M6x35 -arrows- alternately into sealing flange not more than $^{1}/_{2}$ turn at a time.

– Detach sealing flange together with sender wheel.



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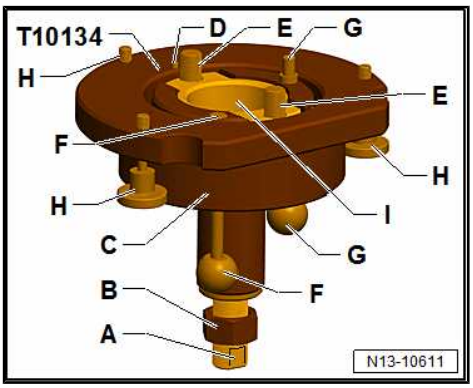
Pressing in sealing flange with sender wheel



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

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Construction of assembly tool - T10134- :



A - Tensioning flats

B - Nut

C - Assembly housing

D - Locating pin

E - Hexagon socket head bolts (2x)

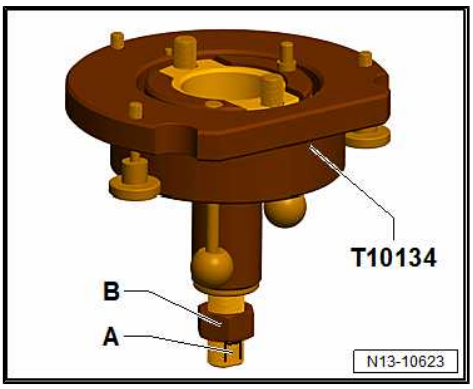
F - Guide pin for diesel engines (black handle)

G - Guide pin for petrol engines (red handle)

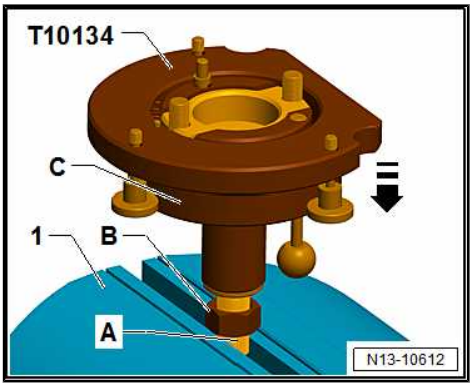
H - Knurled screws (3x)

I - Inner section

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



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

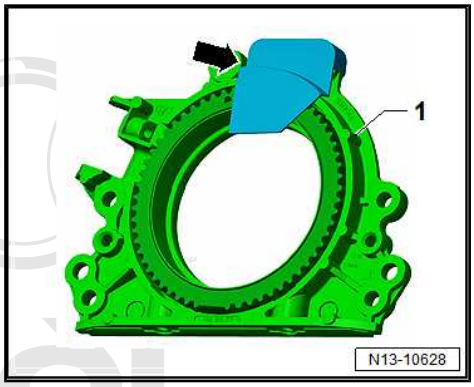


– Clamp assembly tool - T10134- in a vice -1- on tightening flats -A- of threaded spindle.

– Press assembly housing -C- downwards -arrow- so that it rests on nut -B-.

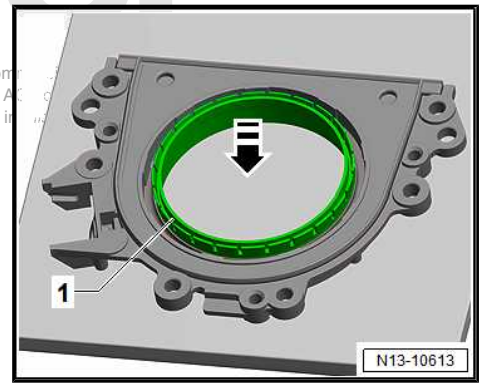
- Inner part of assembly device and assembly housing must align (be level) with each other.

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

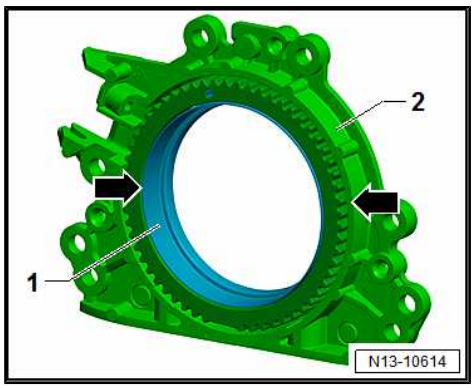


– Place sealing flange (with front side downwards) on a clean flat surface.
– Press sealing lip support ring -1- downwards in direction of -arrow- until it touches flat surface.

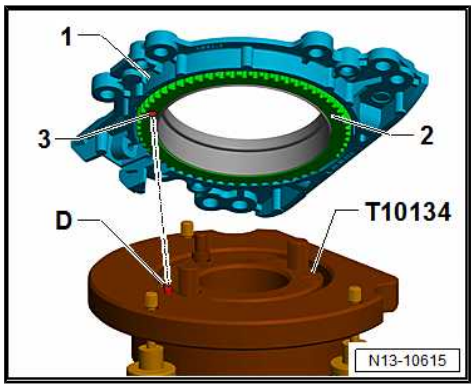
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• Upper edge of sealing lip support ring -1- must be flush -arrows- with front edge of sealing flange -2-.



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



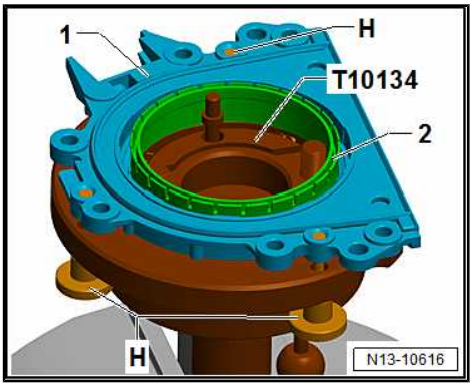
– Screw knurled screws -H- onto sealing flange -1-.

• Only the two knurled screws at top and right can be fitted; knurled screw on left does not fit thread on sealing flange.

– When tightening, press sealing flange and sealing lip support ring -2- against surface of assembly tool - T10134- .

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

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



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

• Crankshaft flange must be free of oil and grease.

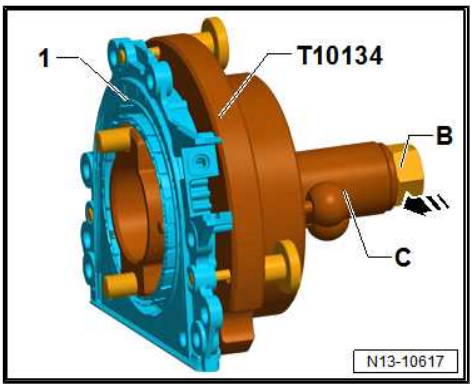
• Engine is at “TDC” position.

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

– Press threaded spindle of assembly tool - T10134- in direction of -arrow- until nut -B- makes contact with assembly housing -C-.

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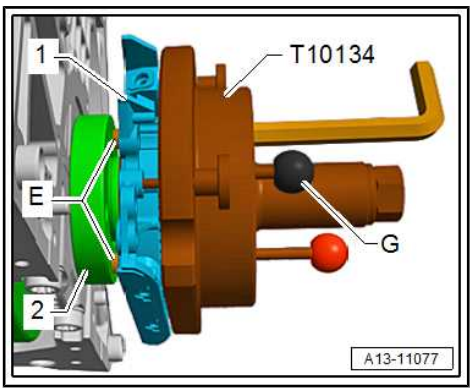
– Position flat edge of assembly housing towards sealing surface for sump on cylinder block.



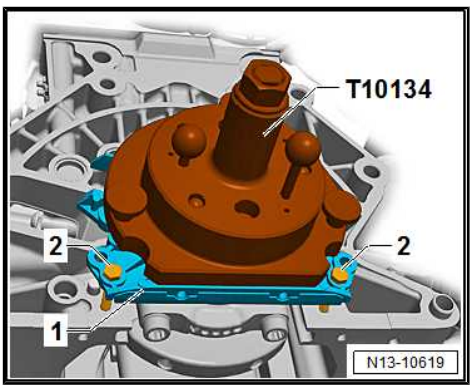
– Secure assembly tool - T10134- with sealing flange -1- to crankshaft flange -2-.

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

– Insert guide pin for diesel engines (black handle) -G- into crankshaft flange.



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



Securing assembly tool - T10134- on crankshaft flange:

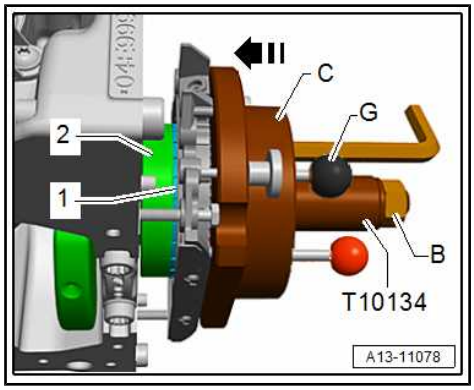
– Press assembly housing -C- by hand in direction of -arrow- until sealing lip support ring -1- touches surface of crankshaft flange -2-.

– Check that guide pin for diesel engines (black handle) -G- is fitted correctly in hole in crankshaft. This ensures that sender wheel reaches its final installation position.

• The guide pin for PETROL engines (red handle) MUST NOT be inserted into the threaded hole in the crankshaft.

– Tighten the two hexagon socket head bolts on assembly tool hand-tight.

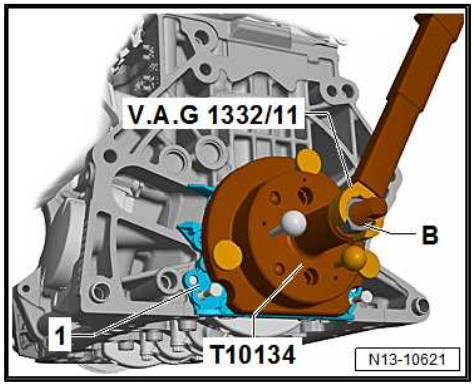
– Screw nut -B- onto threaded spindle by hand until it touches assembly housing -C-.



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

– Tighten nut -B- on assembly tool - T10134- to 35 Nm.

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



Checking installation position of sender wheel on crankshaft:

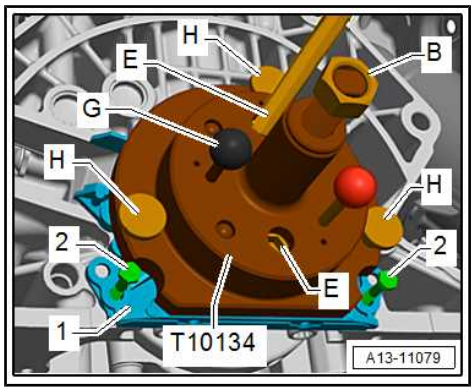
– Screw nut -B- to end of threaded spindle.

– Remove both bolts -2- from cylinder block.

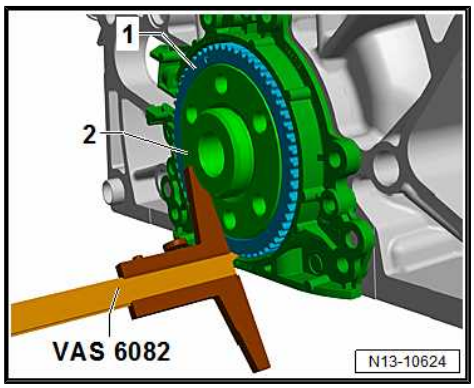
– Unscrew knurled screws -H- from sealing flange -1-.

– Unbolt assembly tool - T10134- from crankshaft flange (remove hexagon socket head bolts -E- from crankshaft flange).

– Detach sealing lip support ring.



– Apply depth gauge - VAS 6082- to crankshaft flange -2-.



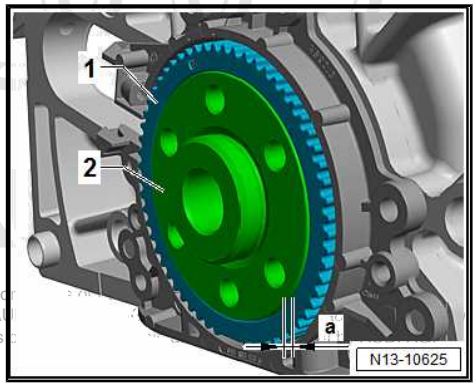
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– Measure distance -a- between crankshaft flange -2- and sender wheel -1-.

• Specification: Distance -a- = 0.5 mm.

– Press sender wheel in further if measurement is too small ⇒ page 59 .

– If reading matches specification, continue with assembly ⇒ page 59 .



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Pressing sender wheel in further:

– Secure assembly tool - T10134- to crankshaft flange.

– Ensure that locating pin of assembly tool - T10134- is fitted in hole in sender wheel.

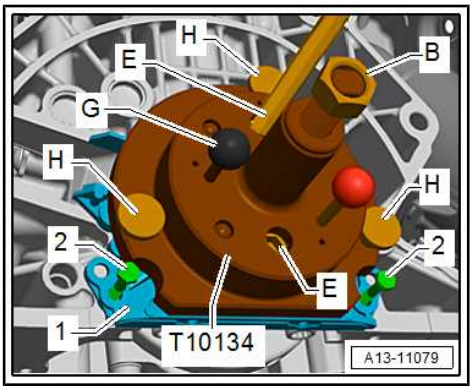
– Hand-tighten hexagon socket head bolts -E-.

– Slide assembly tool - T10134- onto sealing flange -1- by hand.

– Screw nut -B- onto threaded spindle by hand until it touches assembly tool - T10134- .

– Insert guide pin for diesel engines (black handle) -G- into crankshaft flange.

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

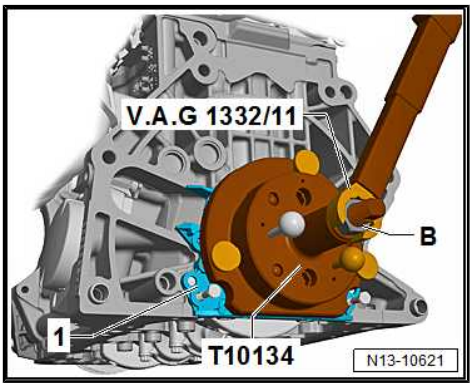


– Tighten nut -B- on assembly tool - T10134- to 40 Nm.

– Check installation position of sender wheel on crankshaft again ⇒ page 58 .

– Tighten nut on assembly tool - T10134- to 45 Nm if measurement is too small.

– Check installation position of sender wheel on crankshaft again ⇒ page 58 .



Assembling:

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

– Install sump (refer to appropriate chapter).

◆ ⇒ “1.1.1 Exploded view - sump (1-part)”, page 136

◆ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

– Install intermediate plate ⇒ page 52 .

– Install flywheel ⇒ page 52 .

Tightening torques

◆ ⇒ Fig. ““Sealing flange (gearbox end) - tightening torque and sequence”“ , page 52

◆ ⇒ “1.1 Exploded view - glow plug system”, page 329

3 Crankshaft

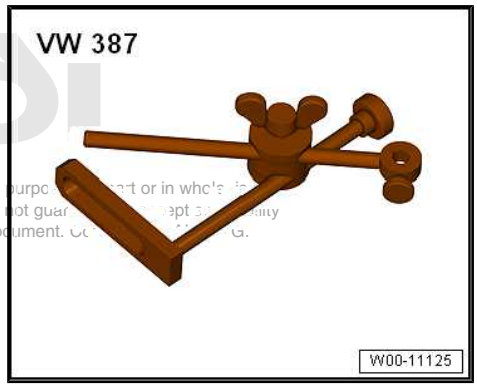
⇒ “3.2 Renewing needle bearing in crankshaft”, page 60

⇒ “3.1 Measuring axial clearance of crankshaft”, page 60

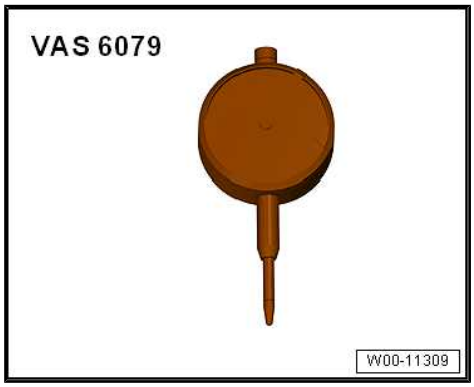
3.1 Measuring axial clearance of crankshaft

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-



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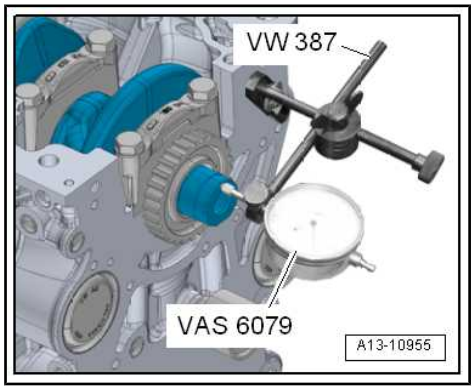
Procedure

– 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

3.2 Renewing needle bearing in crankshaft

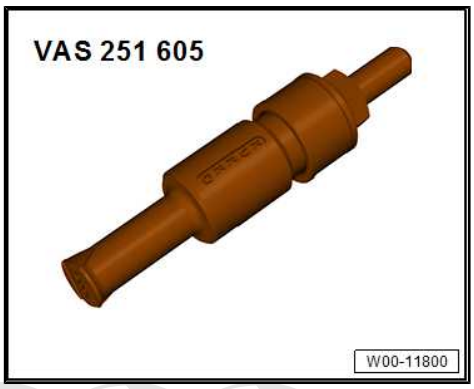
Only fitted on vehicles with dual clutch gearbox

Special tools and workshop equipment required

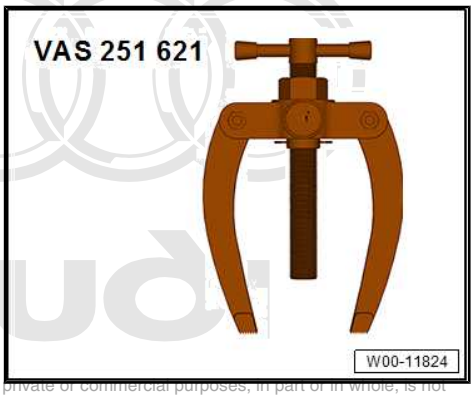
- Drift - VW 207 C-



- Internal puller - VAS 251 605- (previously Kukko 21/2)



- Counter-support - VAS 251 621- (previously Kukko 22/1)

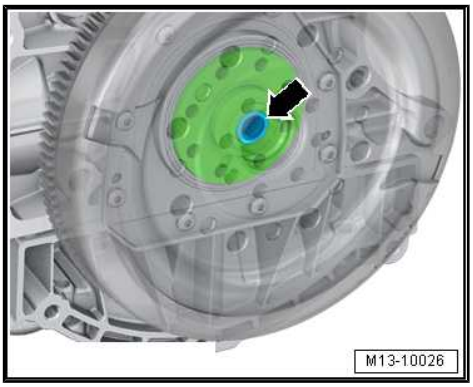


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Procedure

Conditions

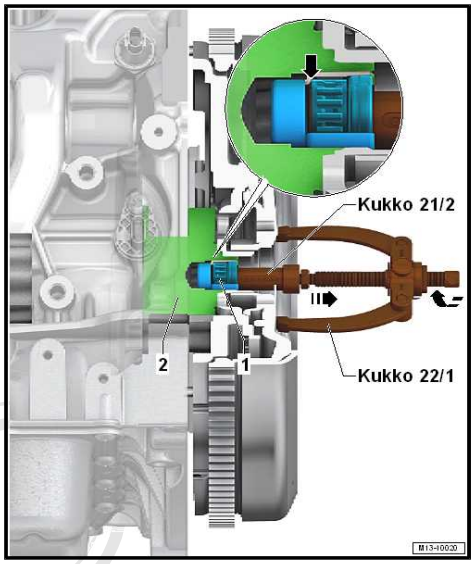
- Gearbox removed ⇒ Rep. gr. 34 ; Removing and installing gearbox; Removing gearbox
- The front edges of the internal puller must not be chipped.



Removing

– Remove needle bearing -1- from crankshaft -2- using internal puller and counter-support.

– Internal puller must be positioned behind needle roller -top arrow-.

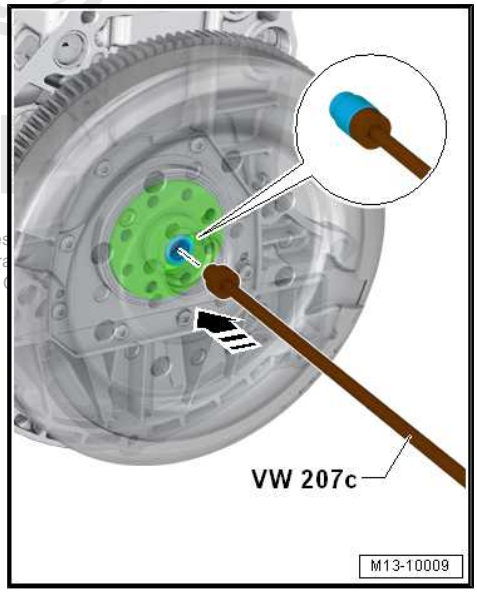


Installing

– Clean bearing seat in crankshaft and grease lightly.

– Drive in with drift - VW 207 C- or centring mandrel - 3176- .

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• Installation depth: dimension -a- = 2.0 mm

Note

Renew needle bearing if you drive it in too far (needle bearing is damaged when it is pulled out again).



4 Pistons and conrods

⇒ “4.1 Exploded view - pistons and conrods”, page 63

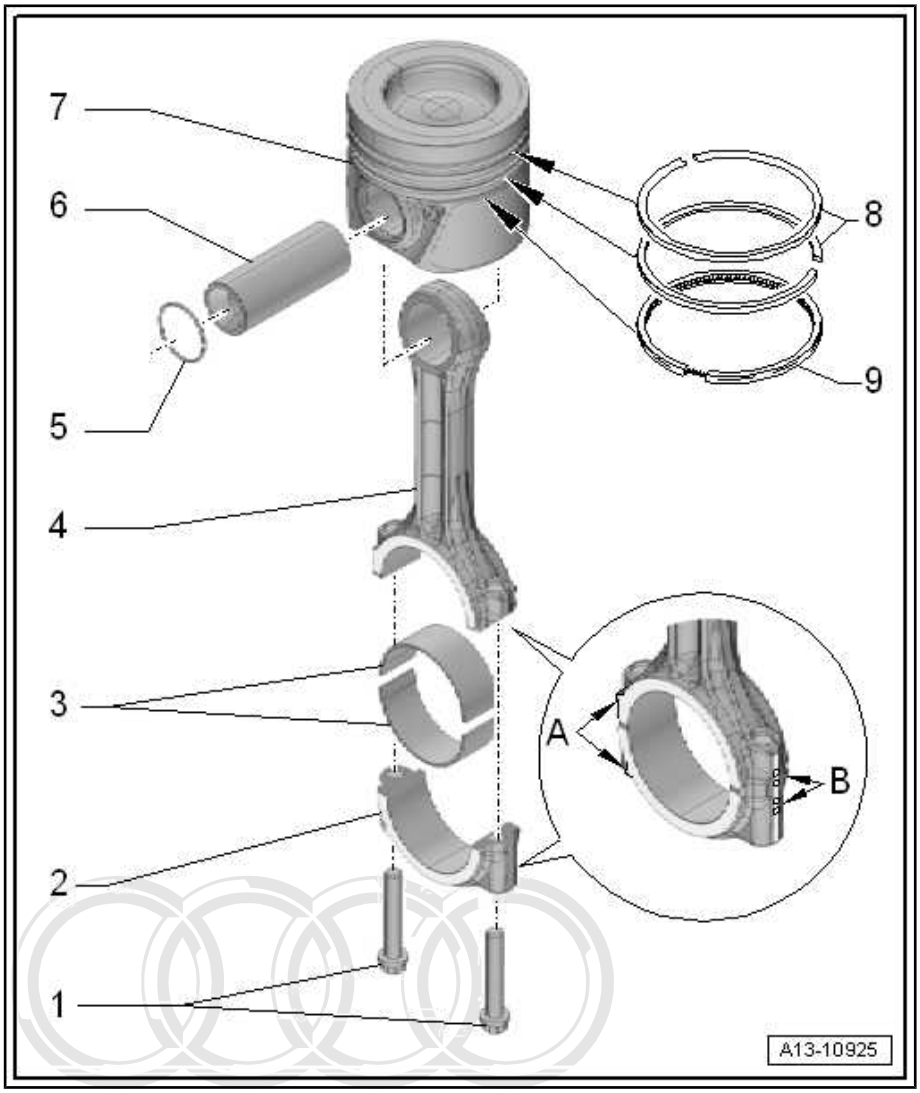
⇒ “4.2 Removing and installing pistons”, page 65

⇒ “4.3 Measuring piston projection at TDC”, page 66

⇒ “4.4 Checking pistons and cylinder bores”, page 68

⇒ “4.6 Checking radial clearance of conrod bearings”, page 69

4.1 Exploded view - pistons and conrods



1 - Bolts

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

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 65
- ❑ 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 69
- ❑ Separating parts of new conrod ⇒ page 69

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- ❑ Installation position: Markings -A- face towards pulley end

5 - Circlip

- ❑ 2x
- ❑ Renew after removing

6 - Piston pin

- ❑ Removing and installing ⇒ “4.2 Removing and installing pistons”, page 65

7 - Piston

- ❑ With combustion chamber
- ❑ Renew piston if cracking is visible on piston crown or piston skirt
- ❑ Mark installation position and cylinder number ⇒ page 64
- ❑ Removing and installing ⇒ page 65
- ❑ Checking pistons and cylinder bores ⇒ page 68
- ❑ Measuring piston projection at “TDC” ⇒ page 66

8 - Compression rings

- ❑ Measuring ring gap ⇒ page 68
- ❑ Measuring ring-to-groove clearance ⇒ page 69
- ❑ Use piston ring pliers (commercially available) to remove and install
- ❑ Installation position: marking “TOP” or side with lettering faces towards piston crown
- ❑ Offset gaps by 120°

9 - Oil scraper ring

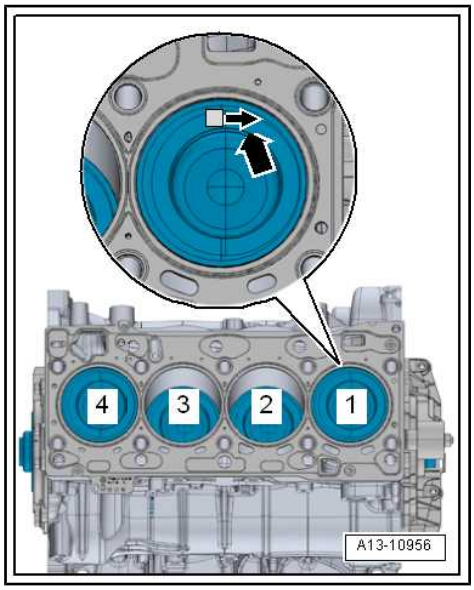
- ❑ Measuring ring gap ⇒ page 68
- ❑ Measuring ring-to-groove clearance ⇒ page 69
- ❑ Use piston ring pliers to remove and install
- ❑ Installation position: marking “TOP” or side with lettering faces towards piston crown
- ❑ Offset gap 120° from bottom compression ring

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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.

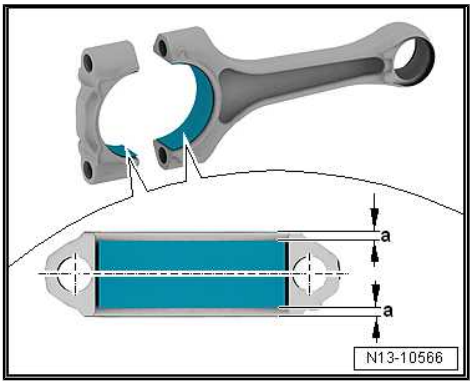
• Arrow on piston crown points to pulley end -arrow-.



Installation position of bearing shells in conrods

– Insert bearing shells centrally in conrod and conrod bearing cap.

• Dimension -a- = 2.5 mm

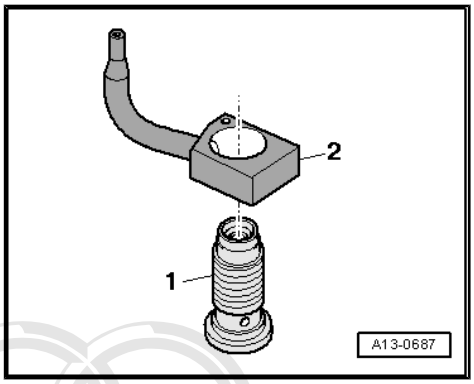


Oil spray jet and pressure relief valve

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

♦ Drift - VW 222A-



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♦ Piston ring clamp, commercially available

Removing

• Engine secured to engine and gearbox support ⇒ page 26 .

– Remove cylinder head ⇒ page 106 .

– Remove oil pump ⇒ page 149 .

– Mark installation position and matching of conrod bearing caps to cylinder and to conrods for re-installation ⇒ Item 2 (page 63) .

– Unbolt conrod bearing caps.

– Pull out pistons upwards with conrods.

Note

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

– Take circlip out of piston pin boss.

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

Installing

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

Note

After removing, renew bolts tightened with specified tightening angle.

– Oil running surfaces of bearing shells.
– Install pistons using piston ring clamp.

Installation position:

- Pistons ⇒ page 64
- Bearing shells in conrods ⇒ page 65

– Install conrod bearing caps according to markings.
– Install oil pump ⇒ page 149 .
– Install cylinder head ⇒ page 106 .

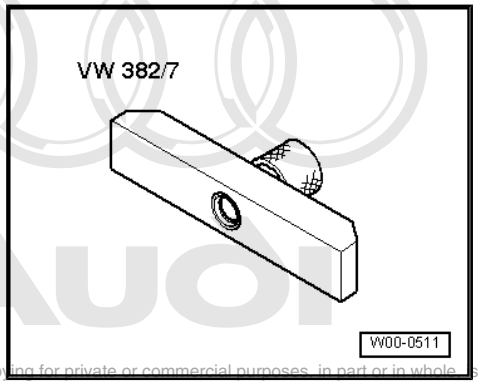
Tightening torques

◆ ⇒ “4.1 Exploded view - pistons and conrods”, page 63

4.3 Measuring piston projection at TDC

Special tools and workshop equipment required

◆ Measuring bridge - VW 382/7-

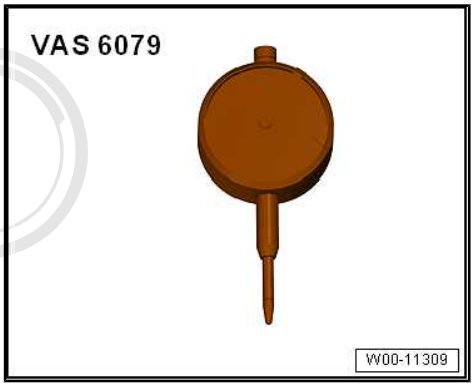


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◆ Measuring plate -VW 385/17- from universal measuring tool - VW 385-



♦ Dial gauge - VAS 6079-



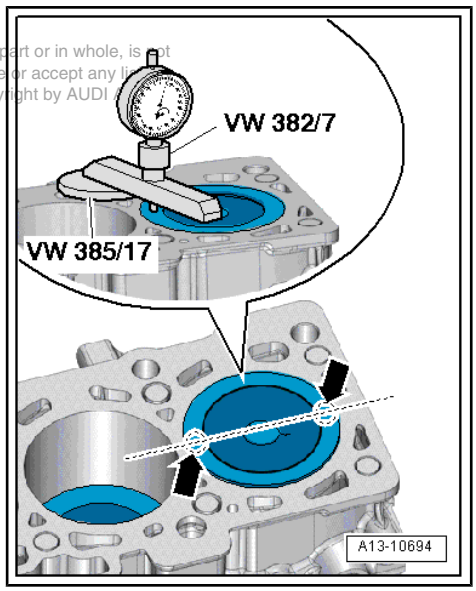
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Procedure

– 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

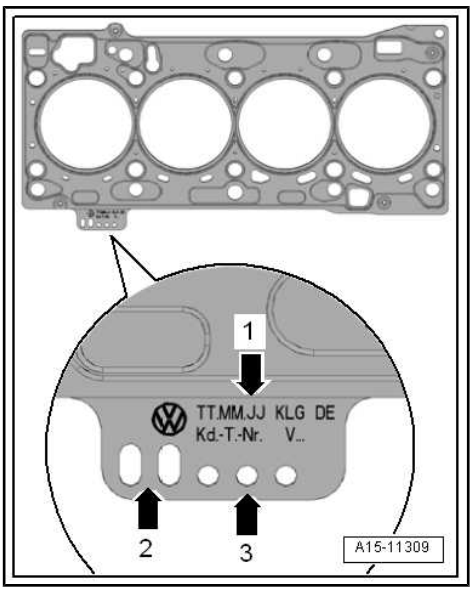
1 - Part number

2 - Ignore

3 - Holes

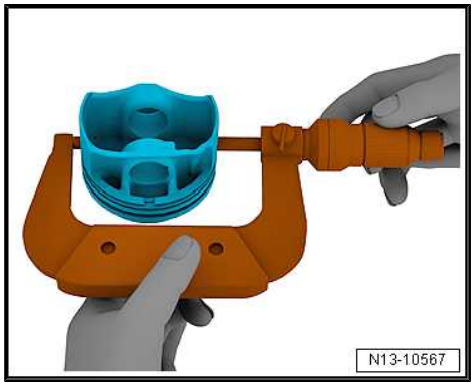
Note

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



4.4 Checking pistons and cylinder bores

Checking piston

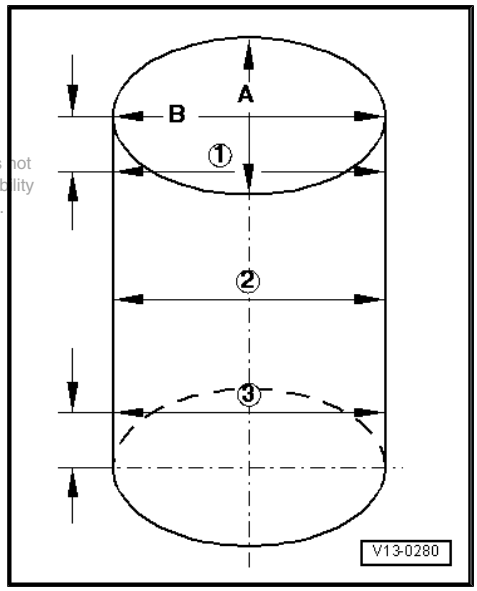


– Using a micrometer (75 ... 100 mm), measure approx. 15 mm from the lower edge, perpendicular to the piston pin axis.

- Maximum deviation from nominal dimension: 0.04 mm.
- Renew piston if cracking is visible on piston skirt.

Piston ∅ mm		
Nominal dimension	1.6 ltr.	79.455 1)
	2.0 ltr.	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.

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Checking cylinder bore

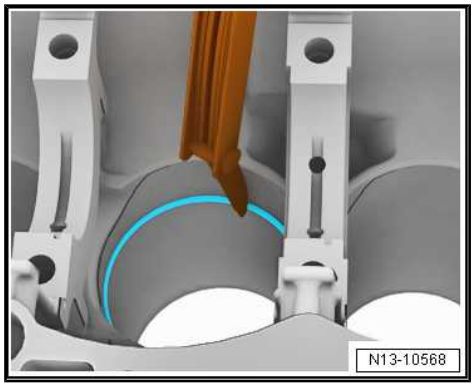
– Check cylinder bore for wear, scoring and other abnormalities.

Cylinder bore ∅ mm		
Nominal dimension	1.6 ltr.	79.5
	2.0 ltr.	81.0

Note

Measuring the cylinder bores must not be done when the cylinder block is mounted to the engine and gearbox support - VAS 6095- , 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.

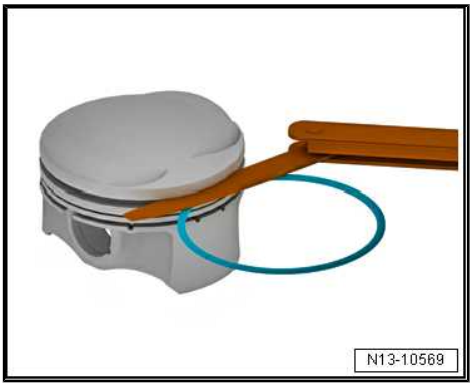
– To do so, use a piston without rings.

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

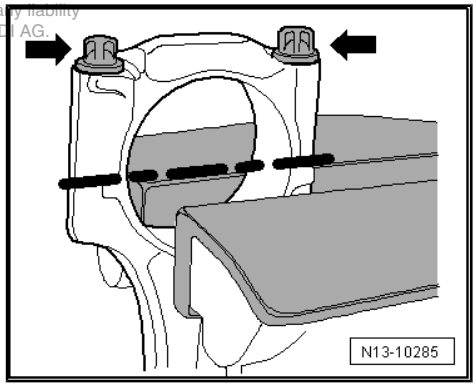
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It is possible that the two parts of a new conrod are not completely separated as intended. If it is not possible to take off the conrod bearing cap by hand, proceed as follows:

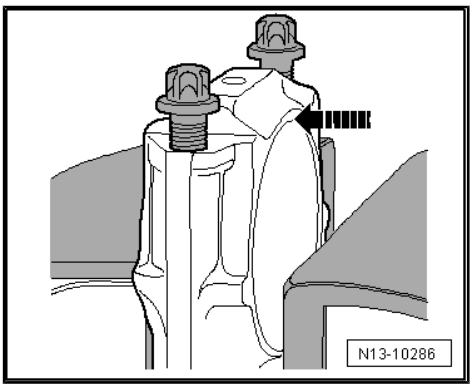
– To avoid any risk of damage, the conrod should only be clamped lightly in a vice using jaw covers as shown in illustration.

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

– Unscrew bolts -arrows- approx. 5 turns.



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



4.6 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 63) 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.

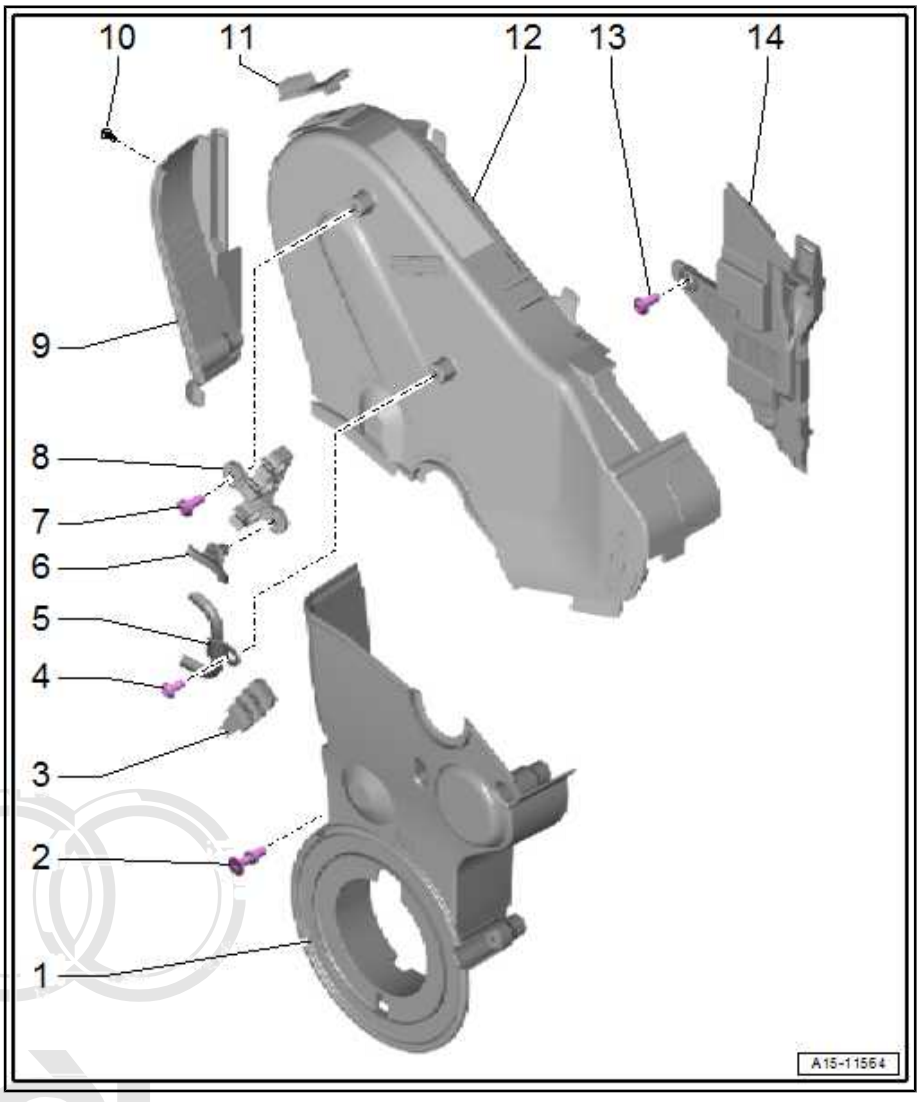
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15 – Cylinder head, valve gear

1 Toothed belt drive

⇒ "1.1 Exploded view - toothed belt cover", page 71
⇒ "1.2 Exploded view - toothed belt", page 72
⇒ "1.3 Removing and installing toothed belt cover", page 73
⇒ "1.4 Detaching toothed belt from camshaft", page 76
⇒ "1.5 Removing and installing toothed belt", page 86

1.1 Exploded view - toothed belt cover



1 - Toothed belt cover (bottom)
- ❑ Removing and installing ⇒ page 75

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

3 - Bracket
- ❑ For coolant pipes

4 - Bolt
- ❑ 5 Nm

5 - Pipe
- ❑ To pressure differential sender - G505-

6 - Clip

7 - Bolt
- ❑ 5 Nm

8 - Bracket
- ❑ For coolant pipes and SCR line

9 - Heat shield

10 - Bolt
- ❑ 5 Nm

11 - Bracket
- ❑ For measuring tube

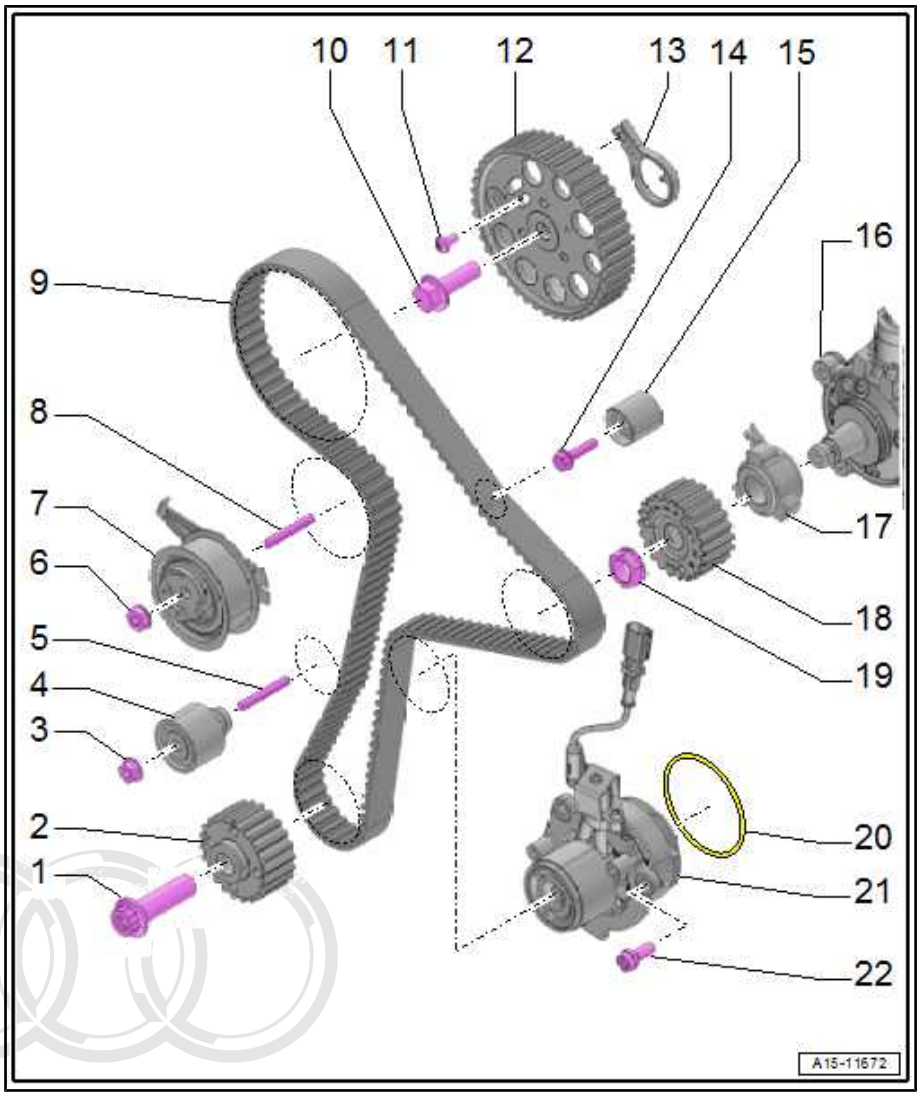
12 - Toothed belt cover (top)
- ❑ Removing and installing ⇒ page 73

13 - Bolt
- ❑ Apply locking fluid when installing; refer to ⇒ Electronic parts catalogue
- ❑ 12 Nm

14 - Toothed belt cover (rear)
- ❑ To remove, take out coolant pump ⇒ page 178

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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: Use rigid wrench to turn 90° further
- ♦ 3rd stage: Use rigid wrench to 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 after removing
- ❑ Make sure that stud is fitted securely
- ❑ 20 Nm +45°

7 - Tensioning roller

8 - Stud

- ❑ 15 Nm

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9 - Toothed belt

- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen
- ❑ Check for wear
- ❑ Removing ⇒ page 86
- ❑ Installing (adjusting valve timing) ⇒ page 89

10 - Bolt

- ❑ Use counterhold tool - T10172A- 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 and camshaft must be free of oil

13 - Locating arm for camshaft

- ❑ Removing and installing ⇒ “2.5 Removing and installing camshaft housing”, page 102

14 - Bolt

- ❑ 20 Nm

15 - Damper wheel

16 - High-pressure pump

- ❑ Exploded view ⇒ page 264

17 - High-pressure pump hub

- ❑ Exploded view ⇒ page 264
- ❑ Contact surface between hub and toothed belt sprocket must be free of oil

18 - High-pressure pump sprocket

- ❑ Exploded view ⇒ page 264
- ❑ Contact surface between hub and toothed belt 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 178

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22 - Bolt

- ❑ Tightening torque ⇒ Item 11 (page 171)

1.3 Removing and installing toothed belt cover

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

⇒ “1.3.2 Removing and installing toothed belt cover (bottom)”, page 75

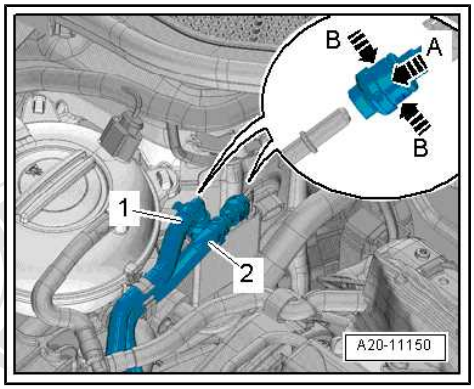
1.3.1 Removing and installing toothed belt cover (top)

Removing

– Remove engine cover panel ⇒ page 40 .

- Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

– Disconnect fuel lines -1, 2- ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .

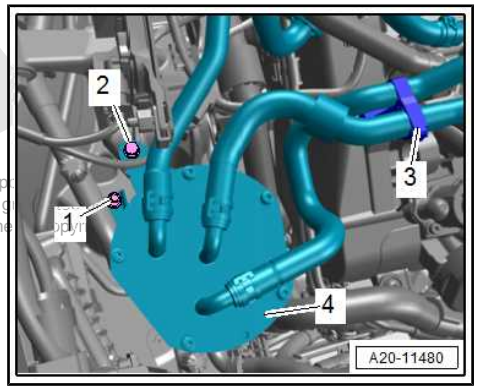


– Move clear bracket -3- with fuel hoses.

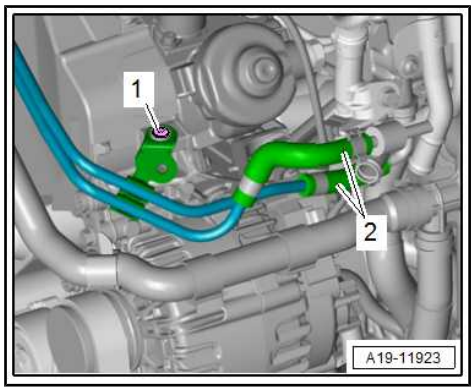
– Loosen bolt -1- and remove bolt -2-.

– Move fuel filter -4- clear to one side.

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– Remove bolt -1- on bracket for coolant pipes.

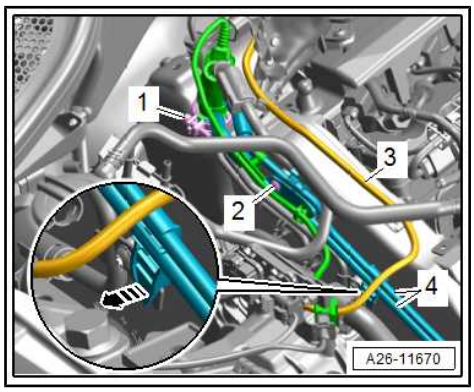


– Remove bolt -2-.

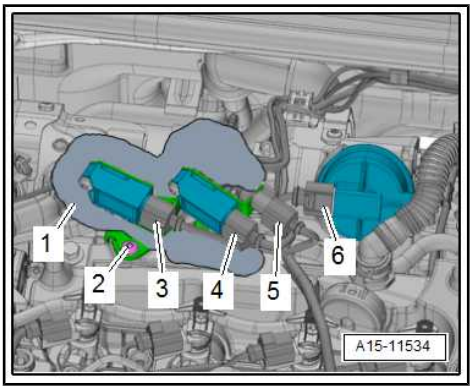
– Release fastener -arrow- and move coolant lines -4- clear.

– Move electrical wire -3- for control unit for NOx sender - J583- clear and press to side.

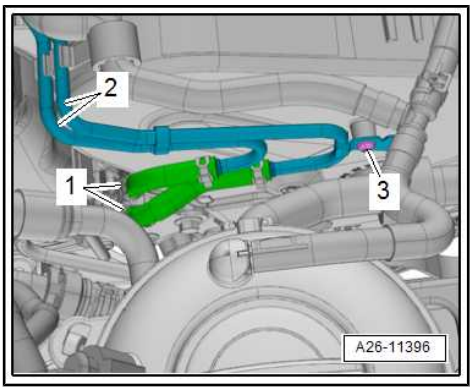
– Release retaining clip -1-, detach injector for reducing agent - N474- and place to right side.



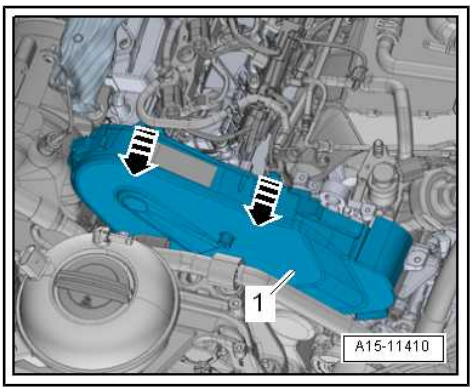
– Open heat insulation sleeve -1-.
– Unplug electrical connectors -3, 4- and move electrical wiring clear.
– Remove electrical connector -5- for exhaust gas temperature sender 1 - G235- from bracket and move electrical wiring clear.
– Remove bolt -2-.



– Remove bolt -3-.
– Move pipes -2- clear and press towards right side together with bracket and pressure differential senders.



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



Installing

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

– Install engine cover panel ⇒ page 40 .
– Connect fuel lines ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Plug-in connectors; Disconnecting plug-in connectors .
– Install injector for reducing agent - N474- ⇒ page 309 .
– Bleed fuel system ⇒ page 232 .

Tightening torques

♦ Bracket for pressure differential sender - G505- ⇒ Item 6 (page 96)
♦ Control pipe for pressure differential sender ⇒ “1.1 Exploded view - toothed belt cover”, page 71
♦ ⇒ Rep. gr. 20 ; Fuel filter; Exploded view - fuel filter
♦ ⇒ Fig. ““Bracket for coolant pipes on vehicles with SCR system - tightening torque”“ , page 43

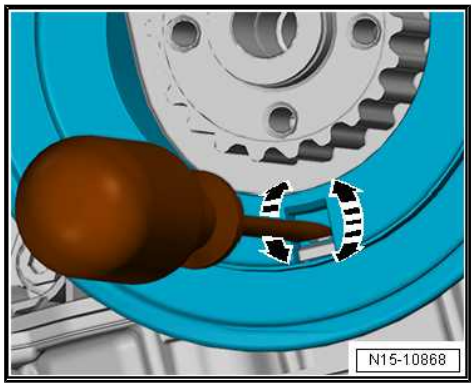
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1.3.2 Removing and installing toothed belt cover (bottom)

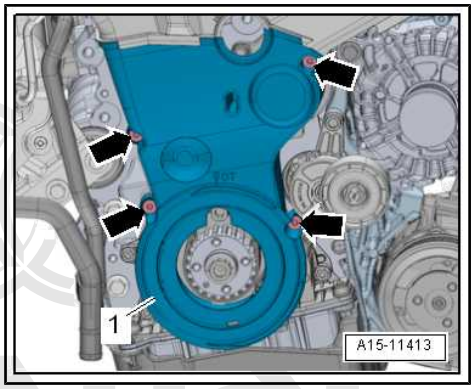
Removing

• To simplify the production process during manufacturing, the toothed belt cover (bottom) has a guide lug which engages in the sealing flange. This guide lug must be irreparably damaged in order to remove the toothed belt cover (bottom), even with the engine support installed.
• Note different versions.

– Remove vibration damper ⇒ page 45 .
– Insert screwdriver into slot in guide lug on toothed belt cover.
– Break off guide lug by turning screwdriver in direction of -arrow-.



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

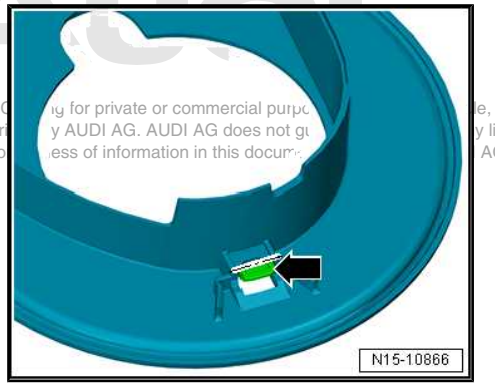


Installing

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

- If installing a new toothed belt cover, guide lug -arrow- must be removed before installation.

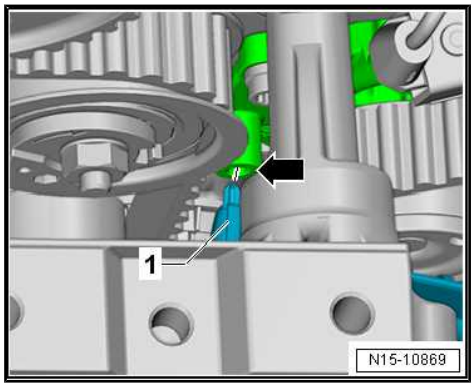
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– Fit toothed belt cover -1- (note position of dowel pin -arrow-).
– Install vibration damper ⇒ page 45 .

Tightening torques

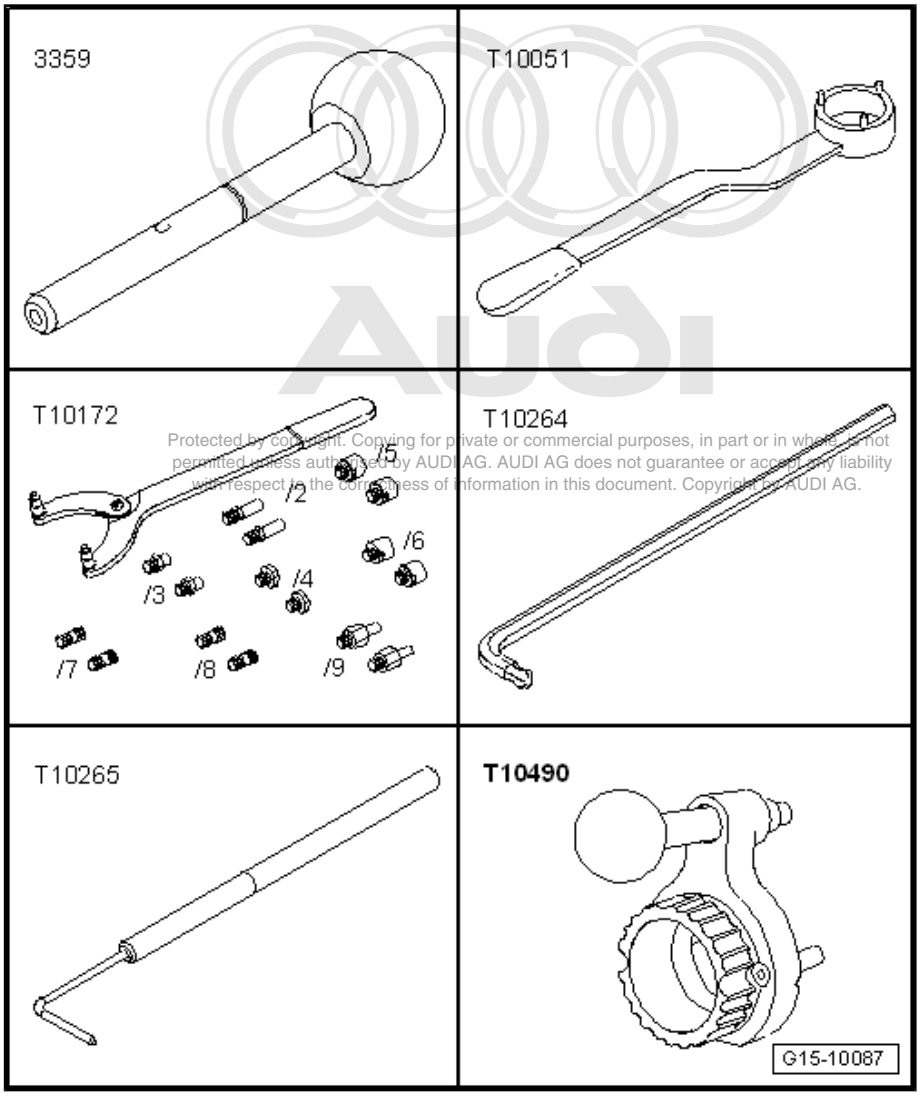
◆ ⇒ “1.1 Exploded view - toothed belt cover”, page 71



1.4 Detaching toothed belt from camshaft

Special tools and workshop equipment required

- Diesel injection pump locking pin - 3359-
- Counterhold tool - T10051-
- Counterhold tool - T10172A- with adapters - T10172/11-
- Offset screwdriver - T10264-
- Locking tool - T10265-
- Crankshaft stop - T10490-



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- Locking pin - T10492-



Note

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

Removing

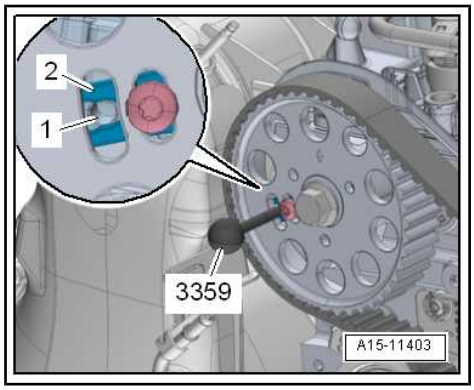
– Remove toothed belt cover (top) ⇒ page 73 .

– Remove vibration damper ⇒ page 45 .

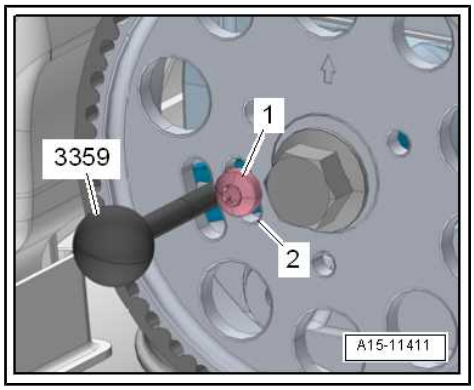
- Only turn crankshaft in direction of engine rotation.

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

– Lock camshaft hub with diesel injection pump locking pin - 3359- ; to do so, insert locking pin into fork on locating arm -2- and into hole -1- behind it in cylinder head.

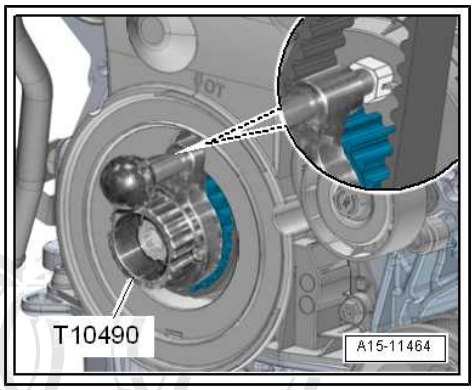


– Loosen locking bolt -1- in camshaft sprocket one half turn, but do not remove.



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

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



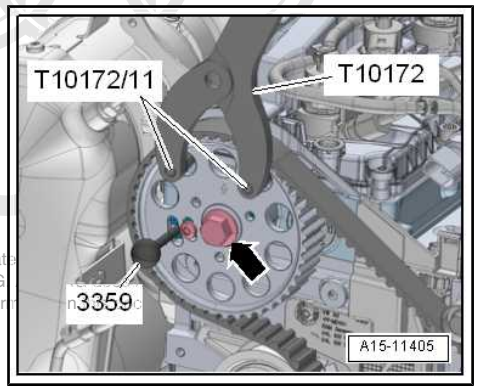
NOTICE

Risk of damage to camshaft if handled incorrectly.

– Never use camshaft clamp as a counterhold tool.

– Pull out locking pin and slacken bolt for camshaft slightly, but insert pin again before fully slackening bolt.

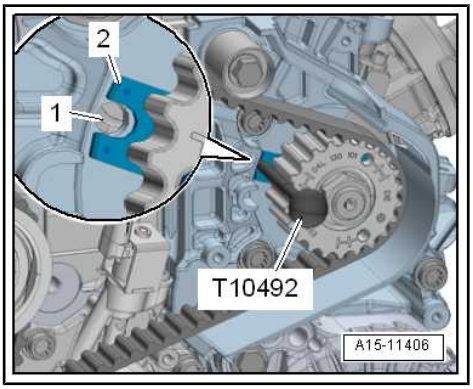
– Slacken bolt -arrow- for camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .



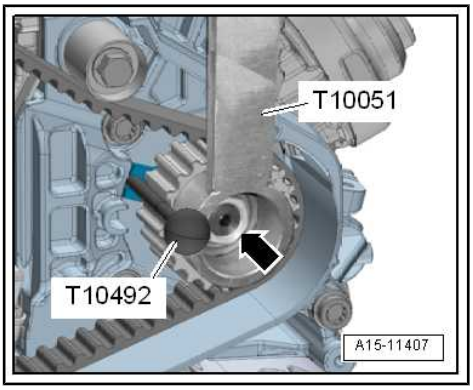
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– Lock hub of high-pressure pump in position with locking pin - T10492- ; to do so, insert locking pin into fork -2- on hub and into hole -1- behind it in bracket for ancillaries.

– Pull out locking pin and slacken nut for high-pressure pump sprocket slightly, but insert pin again before fully slackening nut.



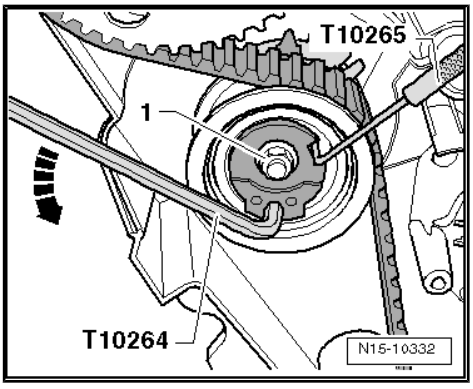
– Slacken nut -arrow- for toothed belt sprocket of high-pressure pump approx. 90° using counterhold tool - T10051- .



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– Slacken nut -1- for tensioning roller.

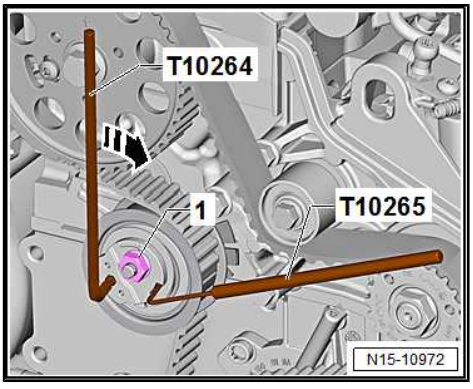
– Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until tensioning roller can be secured with locking tool - T10265- .



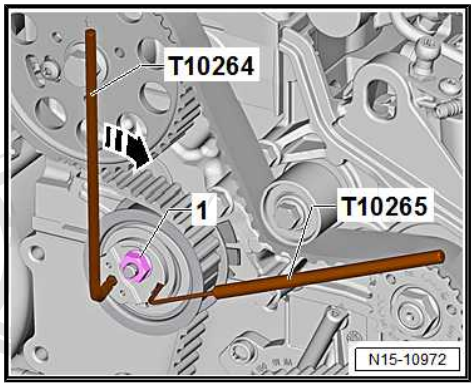
– Then use offset screwdriver - T10264- to turn eccentric adjuster of tensioning roller clockwise -arrow- as far as stop and tighten nut -1- by hand.

– Take toothed belt off camshaft sprocket.

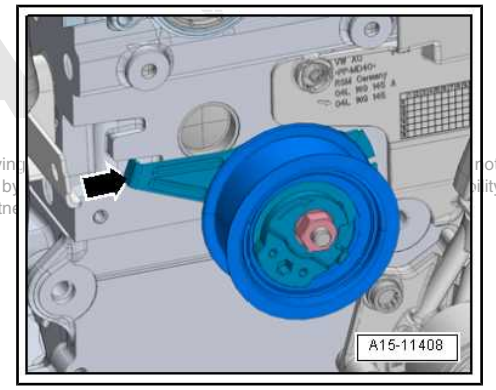
Installing (adjusting valve timing)



- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.

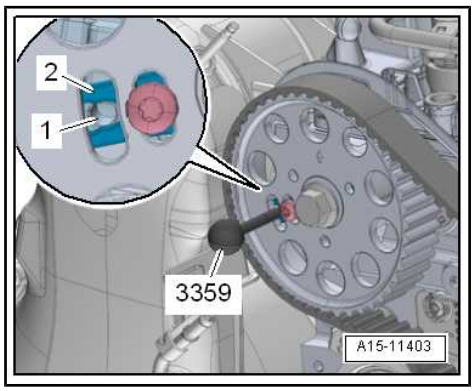


- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.

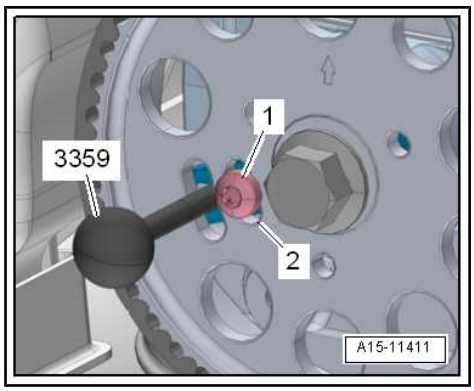


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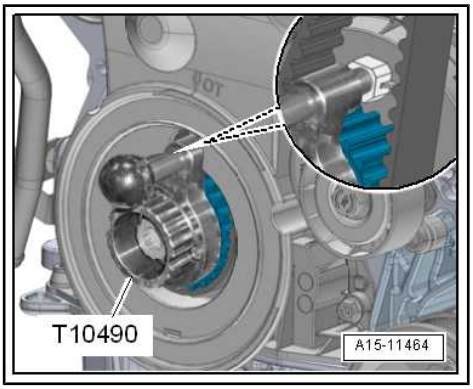
- Camshaft hub locked with diesel injection pump locking pin -3359- .
- Bolt fitted but not tightened.
- It should just be possible to turn the sprocket on the camshaft without axial movement.



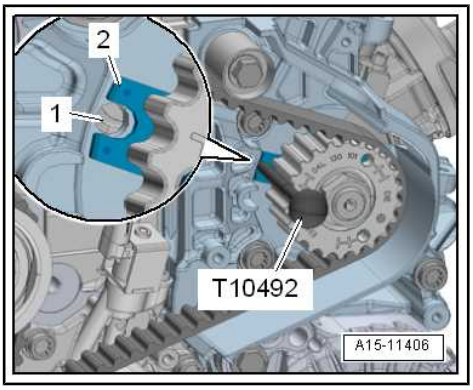
- Locking bolt -1- in locating arm loosened one half turn, positioned in centre of elongated hole -2-.



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



- High-pressure pump hub is locked with locking pin - T10492- .
- Nut fitted but not tightened.
- The high-pressure pump sprocket should still just turn, but there must be no 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:

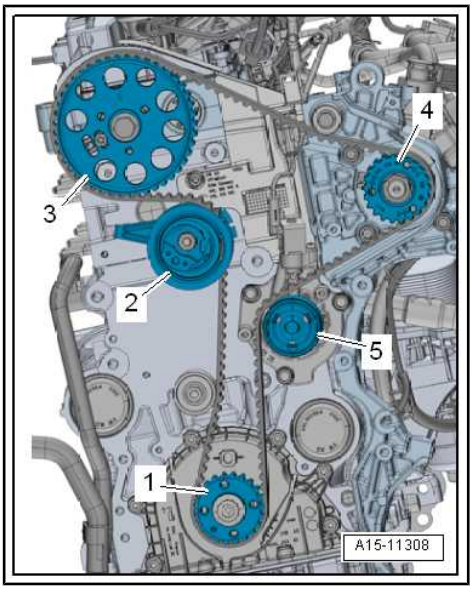
1 - Crankshaft sprocket

2 - Tensioning roller

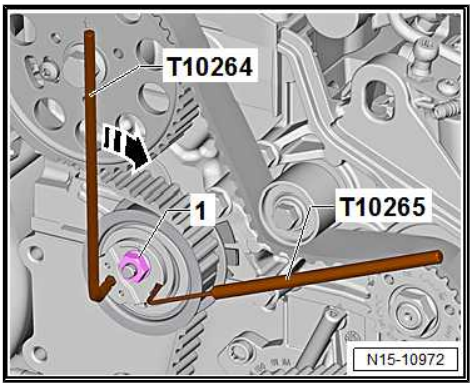
3 - Camshaft sprocket

4 - High-pressure pump sprocket

5 - Coolant pump sprocket

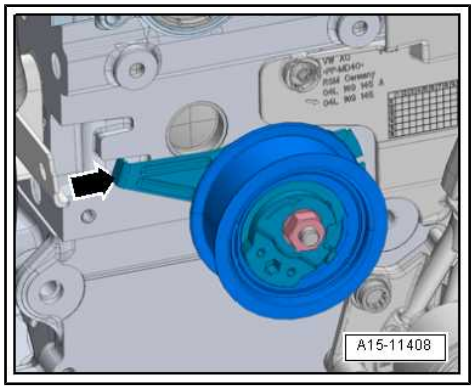


– Loosen nut -1- for tensioning roller and detach locking tool - T10265- .



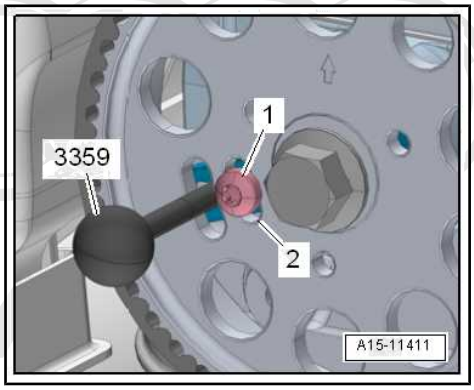
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- Metal lug of tensioning roller must remain engaged in cast recess on cylinder head.



- Locking bolt -1- must not come into contact with upper end of elongated hole after toothed belt has been tensioned.

– 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.

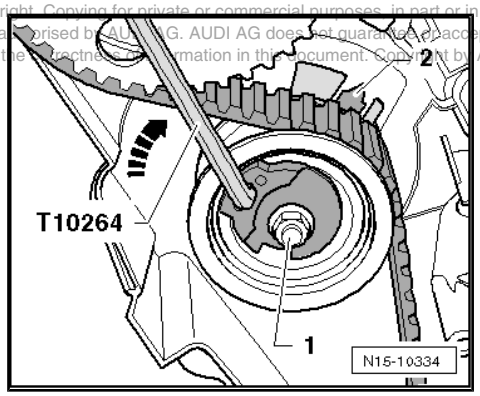


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– Carefully turn eccentric adjuster of tensioning roller clockwise -arrow- using offset screwdriver - T10264- until pointer -2- aligns with centre of slot on base plate.

- Nut -1- must not turn.

– Hold tensioning roller in this position and tighten nut.

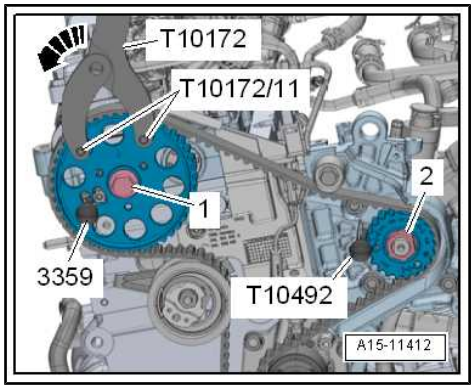


– Position counterhold tool - T10172A- with adapters - T10172/11- on camshaft sprocket as shown in illustration.

– Apply force to counterhold tool in anti-clockwise direction -arrow- and maintain tension.

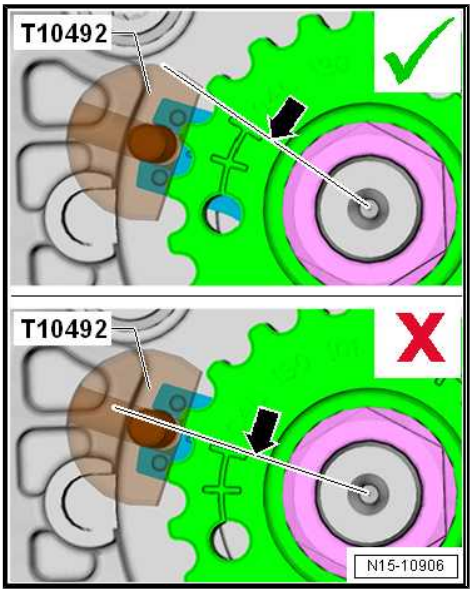
– Tighten bolt -1- for camshaft sprocket and nut -2- for high-pressure pump sprocket to 20 Nm.

– Check that sprocket is not at end of area within which it can turn.



– Check that marking on high-pressure pump sprocket is not aligned with locking pin. If necessary, adjust position of high-pressure pump sprocket by one tooth in clockwise direction and fit toothed belt again.

– Remove locking pins -3359- , -T10492- and crankshaft stop -T10490- ⇒ page 83 .



Checking valve timing:

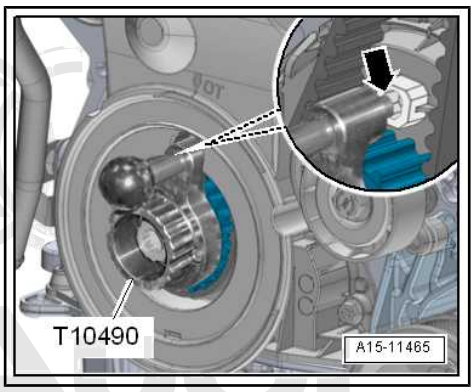
- Only turn crankshaft in direction of engine rotation.

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

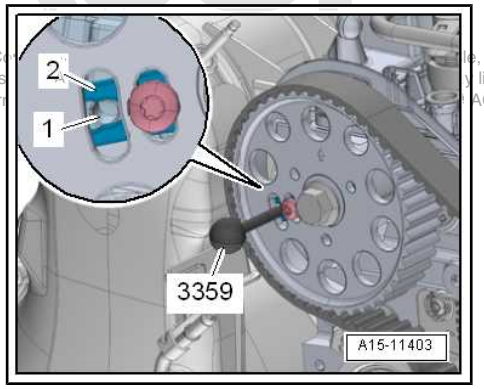
– Fit crankshaft stop - T10490- to crankshaft sprocket again.

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

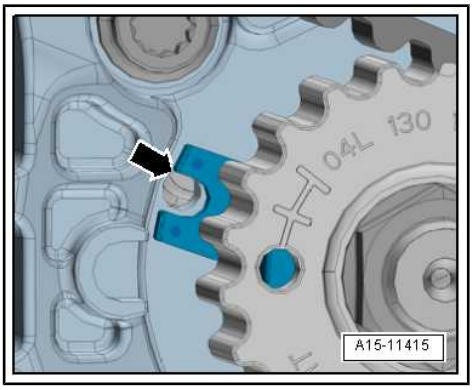
- If crankshaft has been turned past “TDC” position, turn crankshaft two further rotations until it is again positioned just before “TDC”. Then turn further in the same direction and lock crankshaft with crankshaft stop - T10490- .



- It should now be possible to lock camshaft hub with diesel injection pump locking pin - 3359- .



- 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.

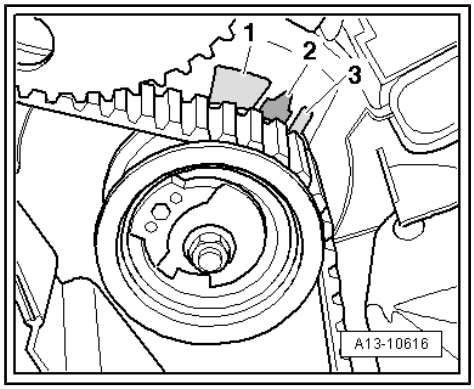


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- Pointer -2- on tensioner roller must be centred between tabs -1- and -3- on base plate.
- The maximum permissible sideways deviation from the specified position is 5 mm.

If requirements are met, continue with procedure after adjusting valve timing correctly as described below ⇒ page 85 .

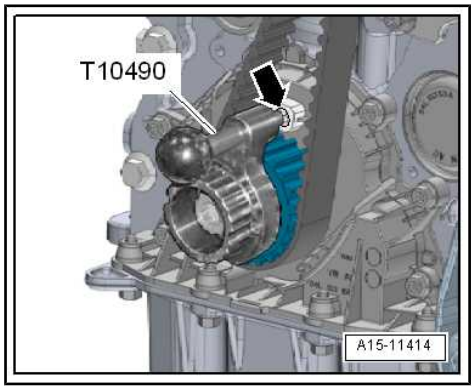
Re-adjust valve timing if requirements are not met ⇒ page 84 .



Re-adjusting valve timing:

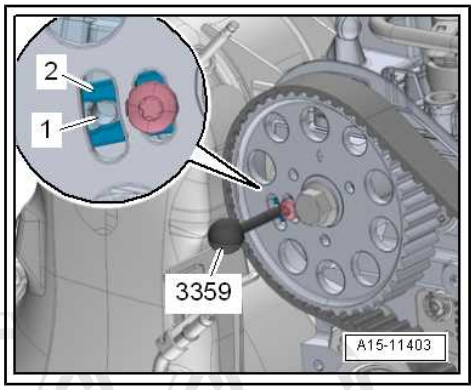
– If camshaft hub cannot be locked, withdraw crankshaft stop -T10490- until pin is clear of bore.

– 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 -3359- .

– After camshaft hub has been locked, slacken bolt for camshaft sprocket using counterhold tool - T10172A- with adapters - T10172/11- .



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Procedure if crankshaft stop - T10490- is now on left side of bore:

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

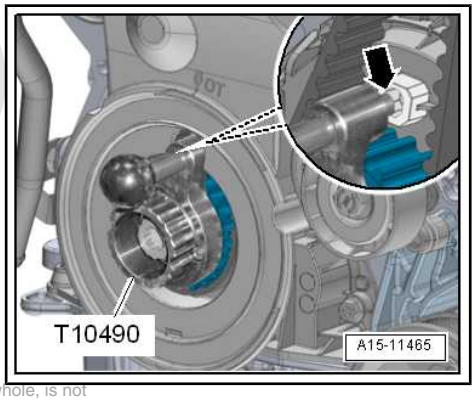
– Tighten camshaft sprocket bolt to 20 Nm.

Procedure if crankshaft stop - T10490- is now on right side of bore:

– 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 camshaft sprocket bolt to 20 Nm.



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Procedure after adjusting valve timing correctly:

– Remove diesel injection pump locking pin - 3359- 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 83 .

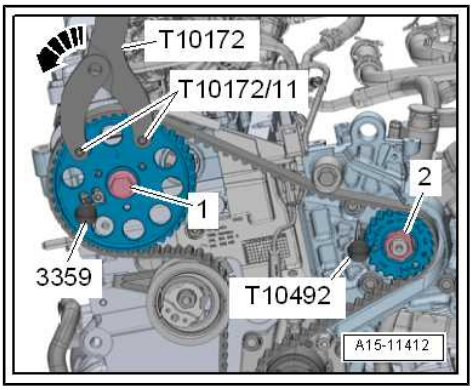
NOTICE

Risk of damage to camshaft if handled incorrectly.

– Never use camshaft clamp as a counterhold tool.

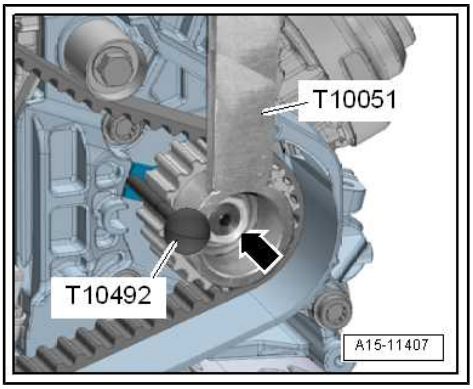
– If camshaft hub can now be locked, tighten camshaft sprocket bolt -1- to final torque using counterhold tool - T10172A- with adapters -T10172/11- .

– Tighten nut -2- for high-pressure pump sprocket to final torque ⇒ page 264 .



– Use counterhold tool - T10051- to do so.

– Check valve timing once again ⇒ page 83 .



Assembling

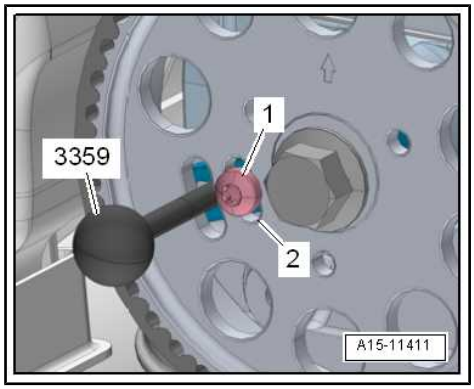
Further installation is carried out in the reverse order; note the following:

- Renew seals and gaskets.

– Tighten locking bolt -1-.
– Install vibration damper ⇒ page 45 .
– Install toothed belt cover (top) ⇒ page 73 .

Tightening torques

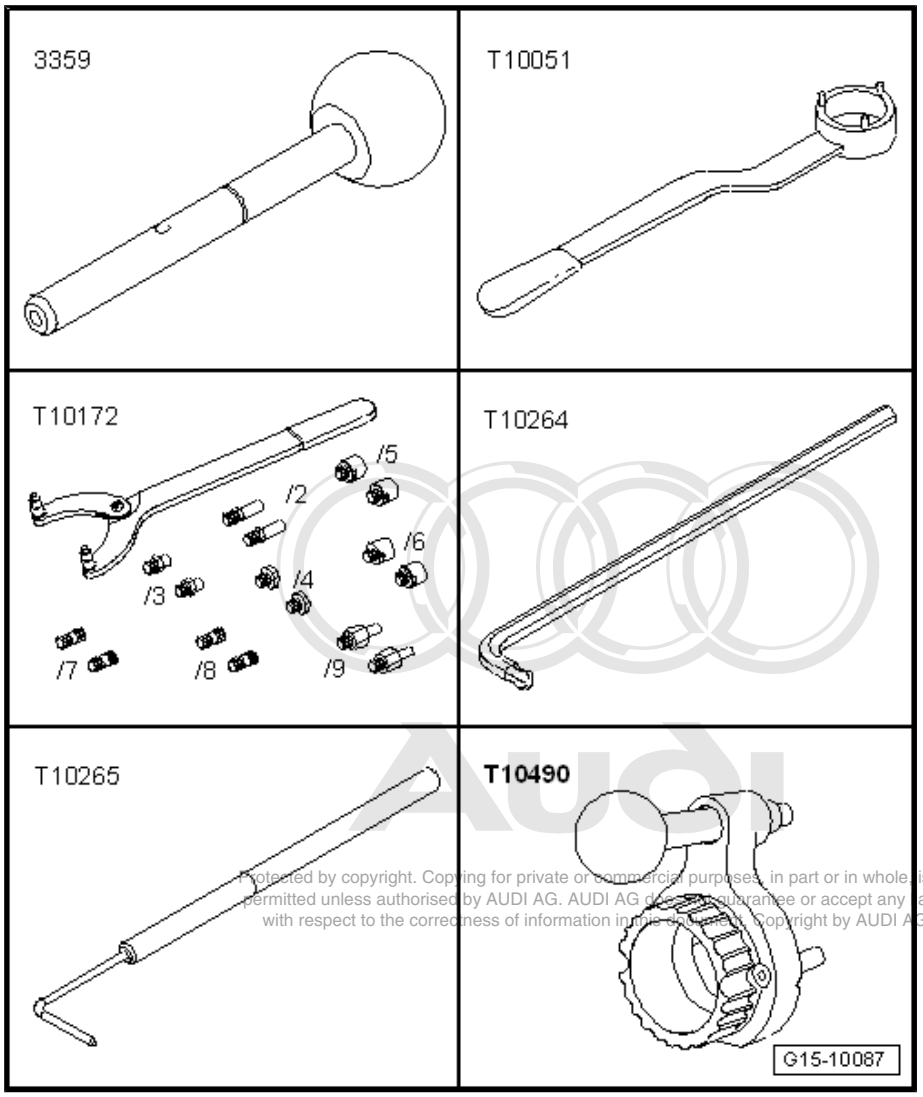
♦ ⇒ “1.2 Exploded view - toothed belt”, page 72



1.5 Removing and installing toothed belt

Special tools and workshop equipment required

♦ Diesel injection pump locking pin - 3359-
♦ Counterhold tool - T10051-
♦ Counterhold tool - T10172A- with adapters - T10172/11-
♦ Offset screwdriver - T10264-
♦ Locking tool - T10265-
♦ Crankshaft stop - T10490-



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♦ Locking pin - T10492-



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 engine support ⇒ page 47 .

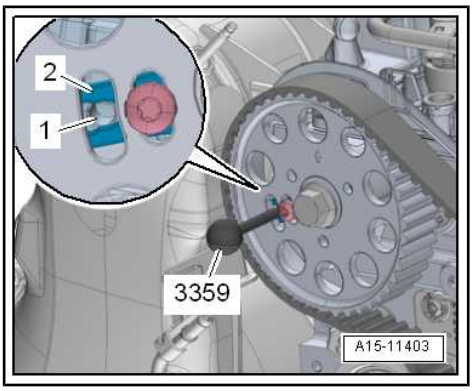
– Remove toothed belt cover (bottom) ⇒ page 75 .

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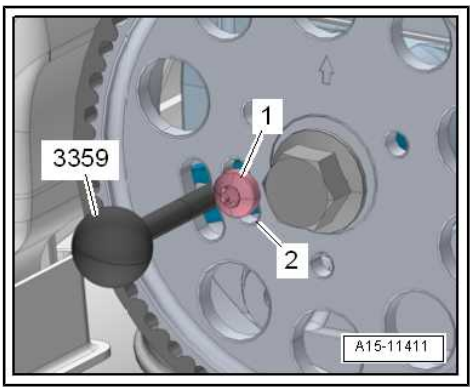
• Only turn crankshaft in direction of engine rotation.

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

– Lock camshaft hub with diesel injection pump locking pin - 3359- ; to do so, insert locking pin into fork on locating arm -2- and into hole -1- behind it in cylinder head.



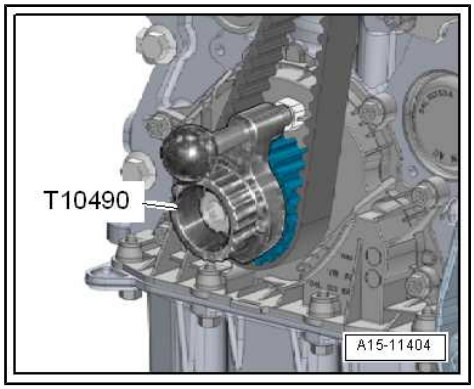
– Loosen locking bolt -1- in camshaft sprocket one half turn, but do not remove.



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

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

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



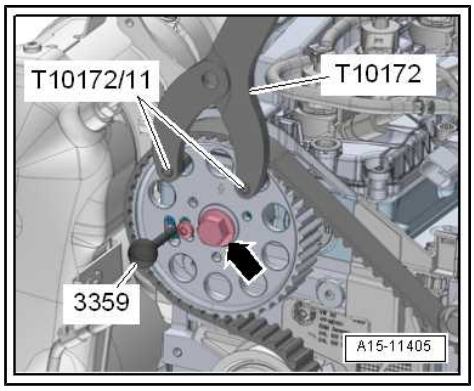
NOTICE

Risk of damage to camshaft if handled incorrectly.

– Never use camshaft clamp as a counterhold tool.

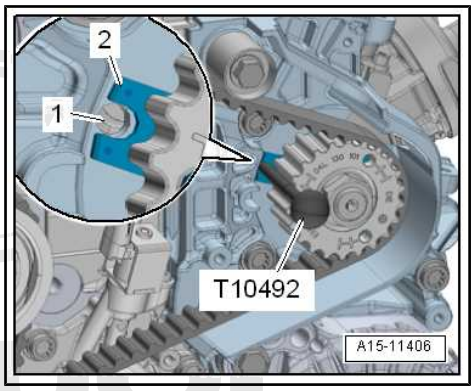
– Pull out locking pin and slacken bolt for camshaft slightly, but insert pin again before fully slackening bolt.

– Slacken bolt -arrow- for camshaft sprocket using counterhold tool - T10172A- with adapters -T10172/11- .

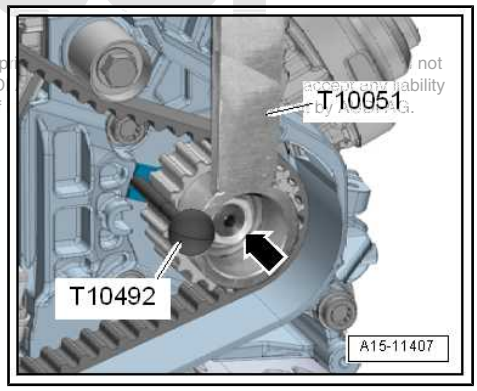


– Lock hub of high-pressure pump in position with locking pin - T10492- ; to do so, insert locking pin into fork -2- on hub and into hole -1- behind it in bracket for ancillaries.

– Pull out locking pin and slacken nut for high-pressure pump sprocket slightly, but insert pin again before fully slackening nut.



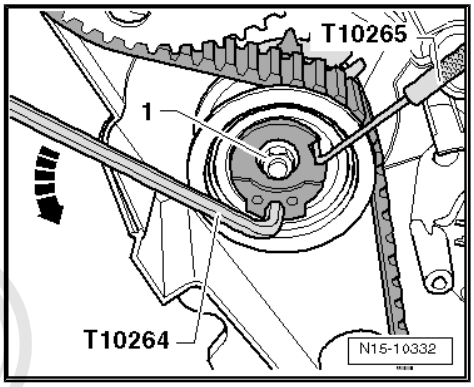
– Slacken nut -arrow- for toothed belt sprocket of high-pressure pump approx. 90° using counterhold tool - T10051- .



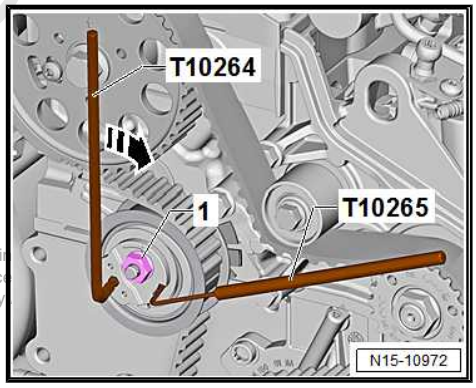
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– Slacken nut -1- for tensioning roller.

– Turn eccentric adjuster of tensioning roller with offset screwdriver - T10264- anti-clockwise -arrow- until tensioning roller can be secured with locking tool - T10265- .



– Then use offset screwdriver - T10264- to turn eccentric adjuster of tensioning roller clockwise -arrow- as far as stop and tighten nut -1- by hand.



NOTICE

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

– **Mark running direction before removing.**

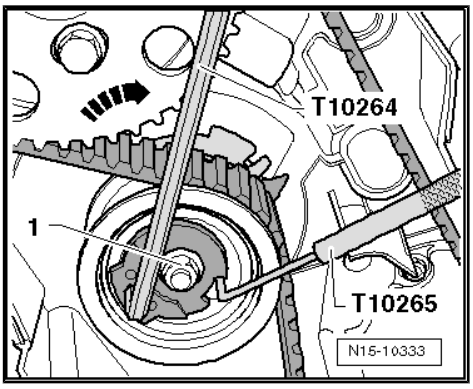
– **Pay attention to running direction when reinstalling.**

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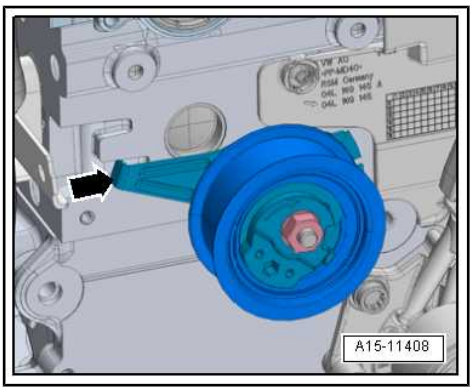
– Take off toothed belt first from coolant pump and then from remaining sprockets.

Installing (adjusting valve timing)

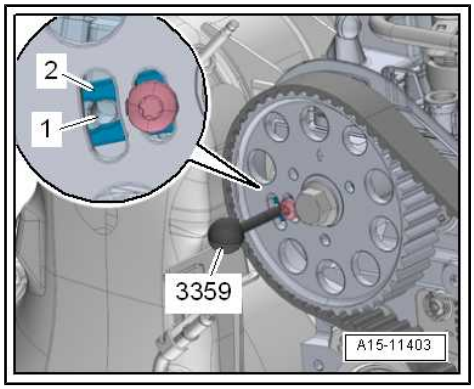
- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.
- Tensioning roller is locked with locking tool - T10265- and secured at right stop with nut -1-.



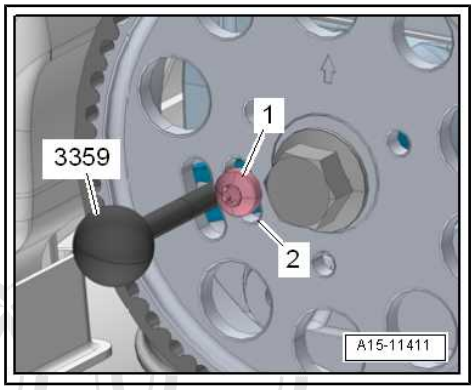
- Metal lug -arrow- of tensioning roller must engage in cast recess on cylinder head.



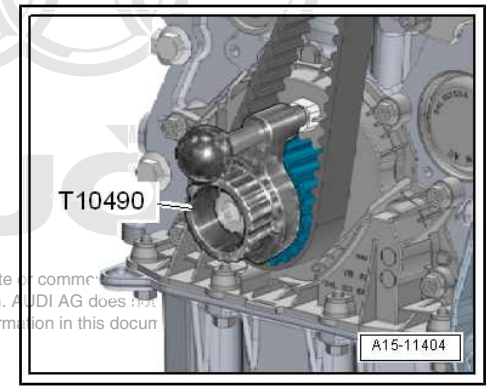
- Camshaft hub locked with diesel injection pump locking pin - 3359- .
- Bolt fitted but not tightened.
- It should just be possible to turn the sprocket on the camshaft easily without axial movement.



- Locking bolt -1- in locating arm loosened one half turn, positioned in centre of elongated hole -2-.

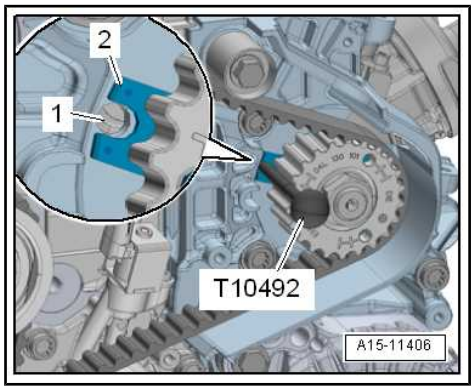


- Crankshaft is locked in position with crankshaft stop - T10490- .



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- High-pressure pump hub is locked with locking pin - T10492- .
- Nut fitted but not tightened.
- It should just be possible to easily turn the high-pressure pump sprocket, but there must be no 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:

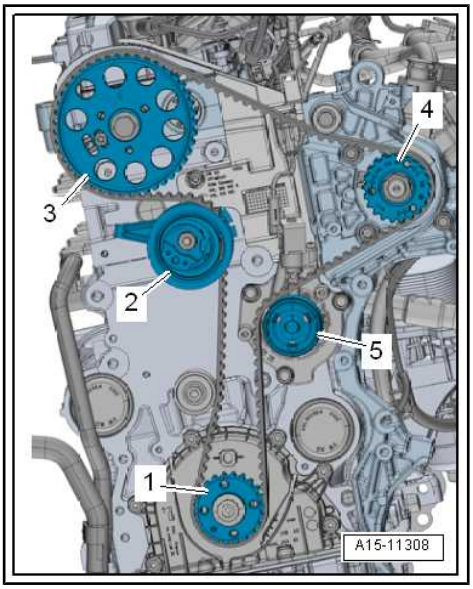
1 - Crankshaft sprocket

2 - Tensioning roller

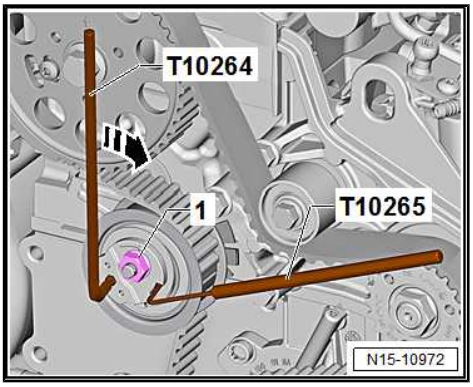
3 - Camshaft sprocket

4 - High-pressure pump sprocket

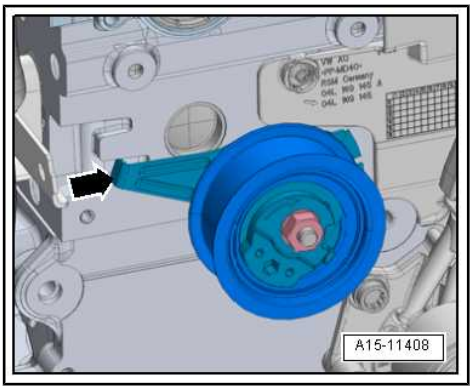
5 - Coolant pump sprocket



– Loosen nut -1- for tensioning roller and detach locking tool -T10265- .



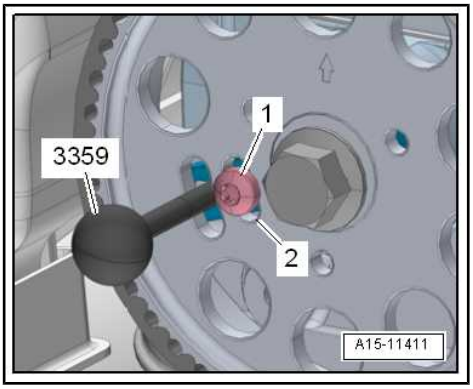
• Metal lug of tensioning roller must remain engaged in cast recess on cylinder head.



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• Locking bolt -1- must not come into contact with upper end of elongated hole after toothed belt has been tensioned.

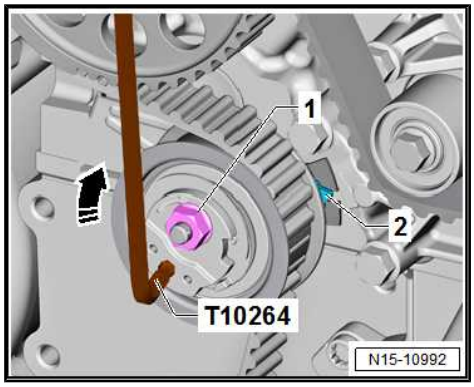
– Check that locking bolt -1- is located between centre and lower end -2- of elongated hole. If necessary, adjust position of camshaft sprocket by moving it one tooth clockwise then fit toothed belt again.



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

• Nut -1- must not turn.

– Hold tensioning roller in this position and tighten nut.

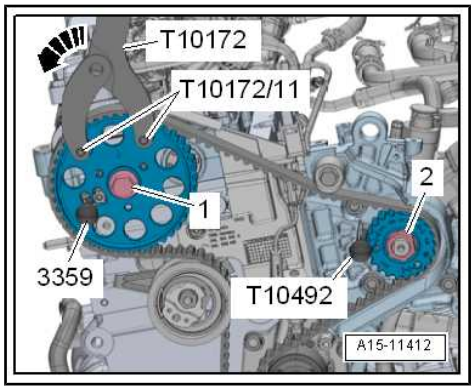


– Position counterhold tool - T10172A- with adapters - T10172/11- on camshaft sprocket as shown in illustration.

– Apply force to counterhold tool in anti-clockwise direction -arrow- and maintain tension.

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

– Check that sprocket is not at end of area within which it can turn.



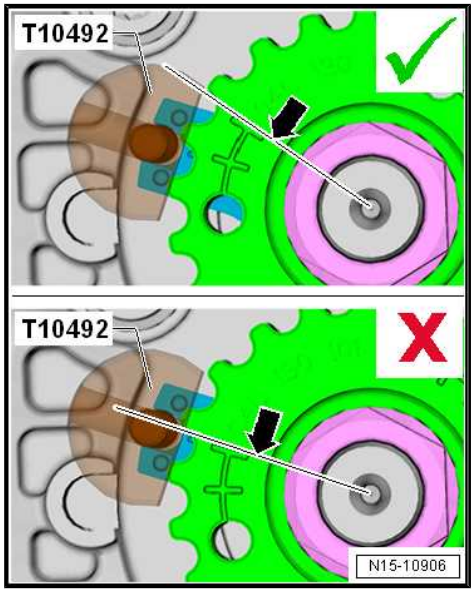
– Check that marking on high-pressure pump sprocket is not aligned with locking pin. If necessary, adjust position of high-pressure pump sprocket by one tooth in clockwise direction and fit toothed belt again.

– Remove locking pins -3359- , -T10492- and crankshaft stop - T10490- and check valve timing ⇒ page 92 .

Checking valve timing:

• Only turn crankshaft in direction of engine rotation.

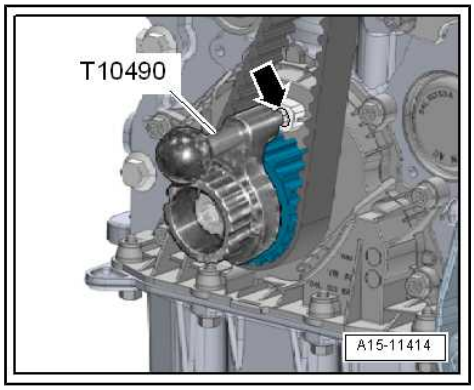
– Turn crankshaft two rotations in direction of engine rotation by turning bolt for crankshaft sprocket until crankshaft is just before “TDC”.



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

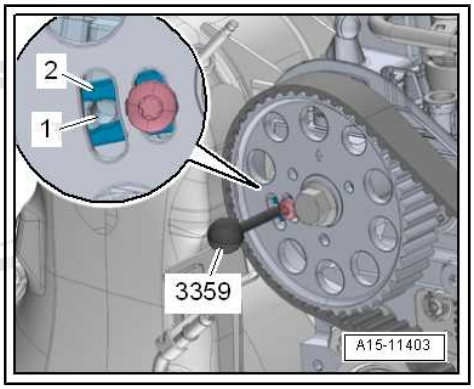
– Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.

• 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-.



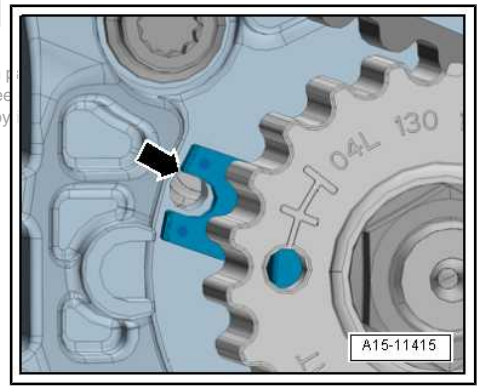
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- It should now be possible to lock camshaft hub with diesel injection pump locking pin - 3359- .

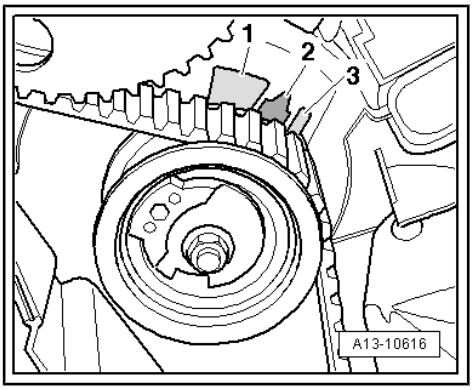


- It is very difficult to reproduce the locking position of the high-pressure pump hub. However, a slight deviation -arrow- does not influence engine operation.

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- Pointer -2- on tensioner roller must be centred between tabs -1- and -3- on base plate.
- The maximum permissible sideways deviation from the specified position is 5 mm.



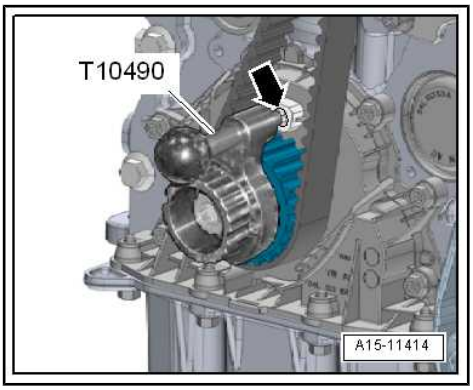
If requirements are met, continue with procedure after adjusting valve timing correctly as described below ⇒ page 94 .

Re-adjust valve timing if requirements are not met ⇒ page 93 .

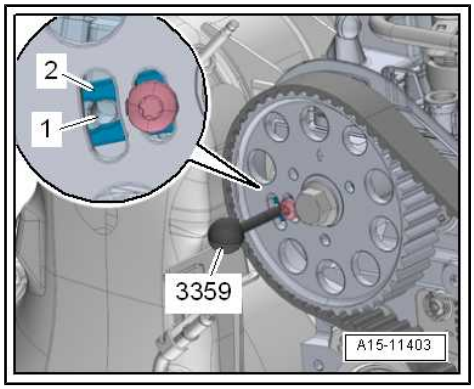
Re-adjusting valve timing:

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

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

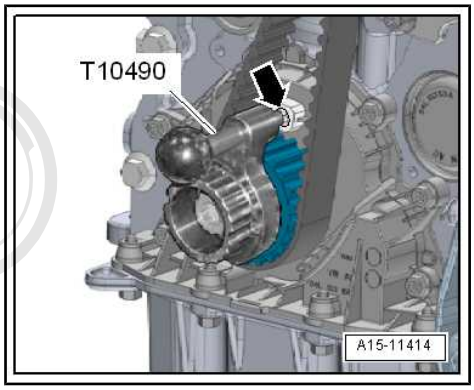


– Now turn crankshaft slowly in direction of engine rotation until it is possible to lock camshaft hub with locking pin -3359- .
– After camshaft hub has been locked, slacken bolt for camshaft sprocket using counterhold tool - T10172A- with adapters - T10172/11- .



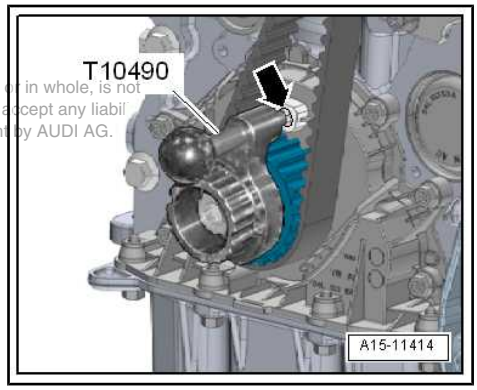
Procedure if crankshaft stop - T10490- is now on left side of bore:

– Turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop engages in sealing flange as crankshaft rotates.
– Tighten camshaft sprocket bolts to 20 Nm.



Procedure if crankshaft stop - T10490- is now on right side of bore:

– 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 camshaft sprocket bolt to 20 Nm.



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Procedure after adjusting valve timing correctly:

– Remove diesel injection pump locking pin - 3359- 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 92 .

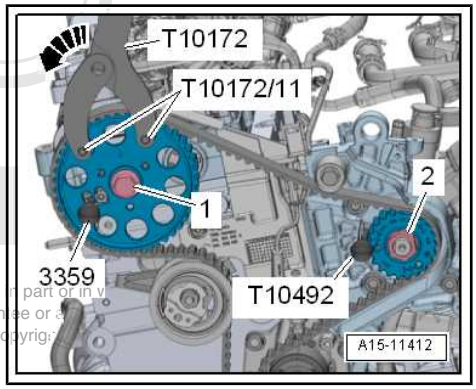
NOTICE

Risk of damage to camshaft if handled incorrectly.

– **Never use camshaft clamp as a counterhold tool.**

– If locating arm for camshaft can now be locked, tighten bolt -1- for camshaft sprocket to final torque; to do so, remove diesel injection pump locking pin - 3359- and counterhold camshaft sprocket using counterhold tool - T10172A- and adapters -T10172/11- .

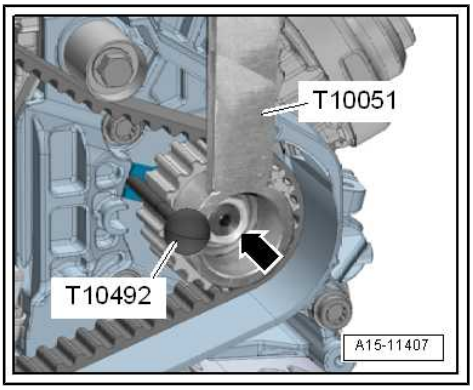
– Tighten nut -2- for high-pressure pump sprocket to final torque.



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– Use counterhold tool - T10051- to do so.

– Check valve timing again ⇒ page 92 .



Assembling

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

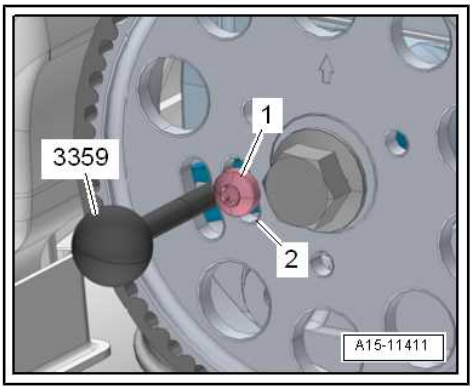
• Renew seals and gaskets.

– Tighten locking bolt -1-.

– Install toothed belt cover (bottom) ⇒ page 75 .

– Install engine support ⇒ page 47 .

– Install toothed belt cover (top) ⇒ page 73 .



Tightening torques

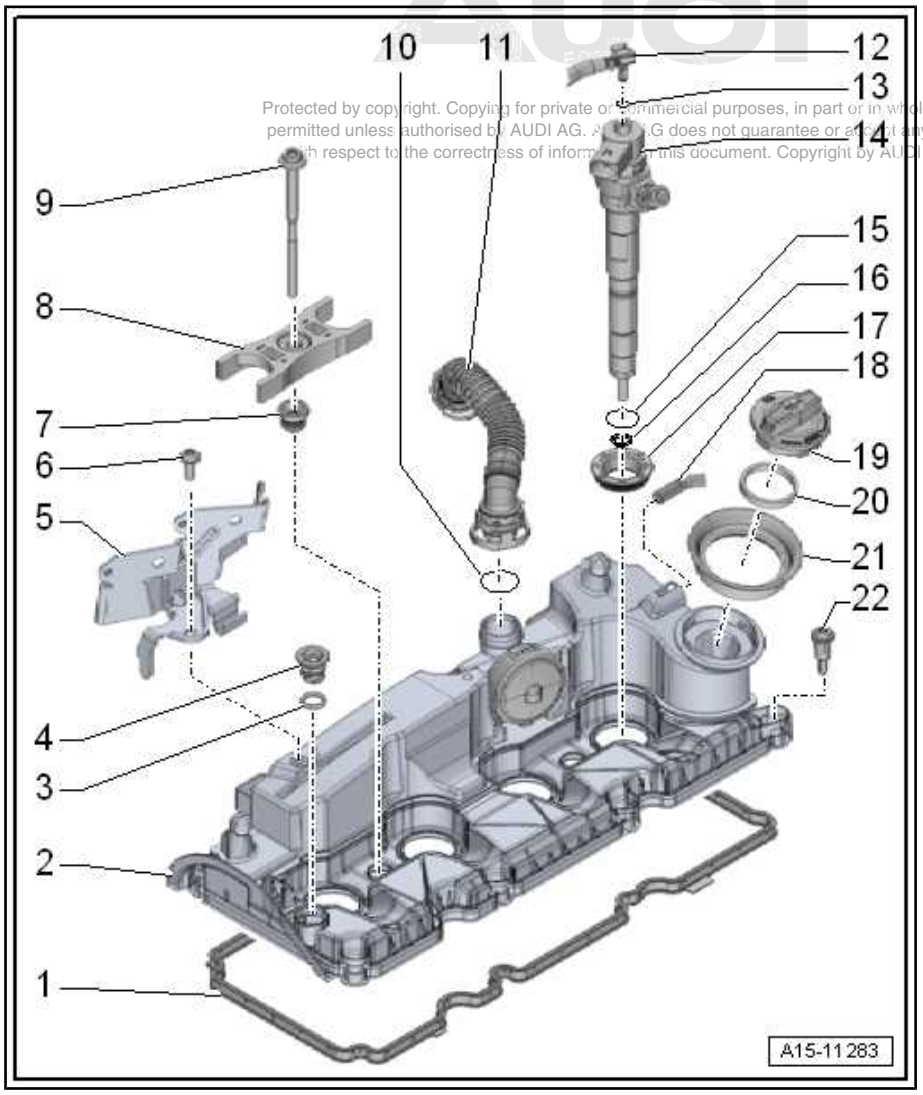
♦ ⇒ “1.2 Exploded view - toothed belt”, page 72

♦ ⇒ “1.1 Exploded view - toothed belt cover”, page 71

2 Cylinder head

⇒ “2.1 Exploded view - cylinder head cover”, page 96
⇒ “2.2 Exploded view - cylinder head”, page 98
⇒ “2.3 Removing and installing cylinder head cover”, page 100
⇒ “2.4 Removing and installing seals for injectors”, page 101
⇒ “2.5 Removing and installing camshaft housing”, page 102
⇒ “2.6 Removing and installing cylinder head”, page 106
⇒ “2.7 Checking compression”, page 113

2.1 Exploded view - cylinder head cover



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1 - Gasket
- ❑ Renew if damaged or leaking

2 - Cylinder head cover
- ❑ Removing and installing ⇒ page 100

3 - O-ring
- ❑ Renew after removing

4 - Sealing plug

5 - Bracket
- ❑ For electrical wiring

6 - Bolt
- ❑ 8 Nm

7 - Grommet
- ❑ In cylinder head cover
- ❑ Renew if damaged or leaking

8 - Clamping piece

9 - Bolt
- ❑ Tightening torque ⇒ Item 8 (page 247)

10 - O-ring
- ❑ Renew after removing

11 - Hose
- ❑ For crankcase breather
- ❑ Press release tabs to detach

12 - Fuel return line

13 - O-ring
- ❑ Renew after removing

14 - Injector
- ❑ Observe rules for cleanliness ⇒ page 6
- ❑ Exploded view ⇒ page 246

15 - O-ring
- ❑ Renew after removing

16 - Insulating seal

- ❑ Renew after removing

17 - Seal

- ❑ For injector
- ❑ Renewing ⇒ page 101

18 - Vacuum hose

19 - Filler cap

20 - Seal

- ❑ For filler cap

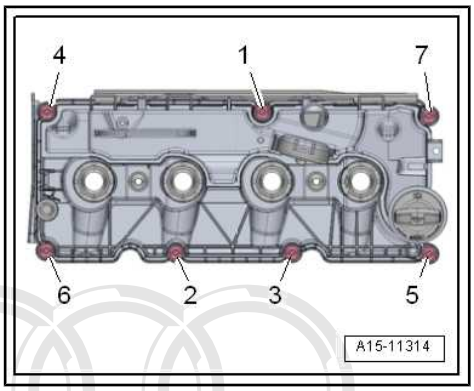
21 - Grommet

22 - Bolt

- ❑ Renew if seal is damaged
- ❑ Tightening torque and sequence ⇒ page 97

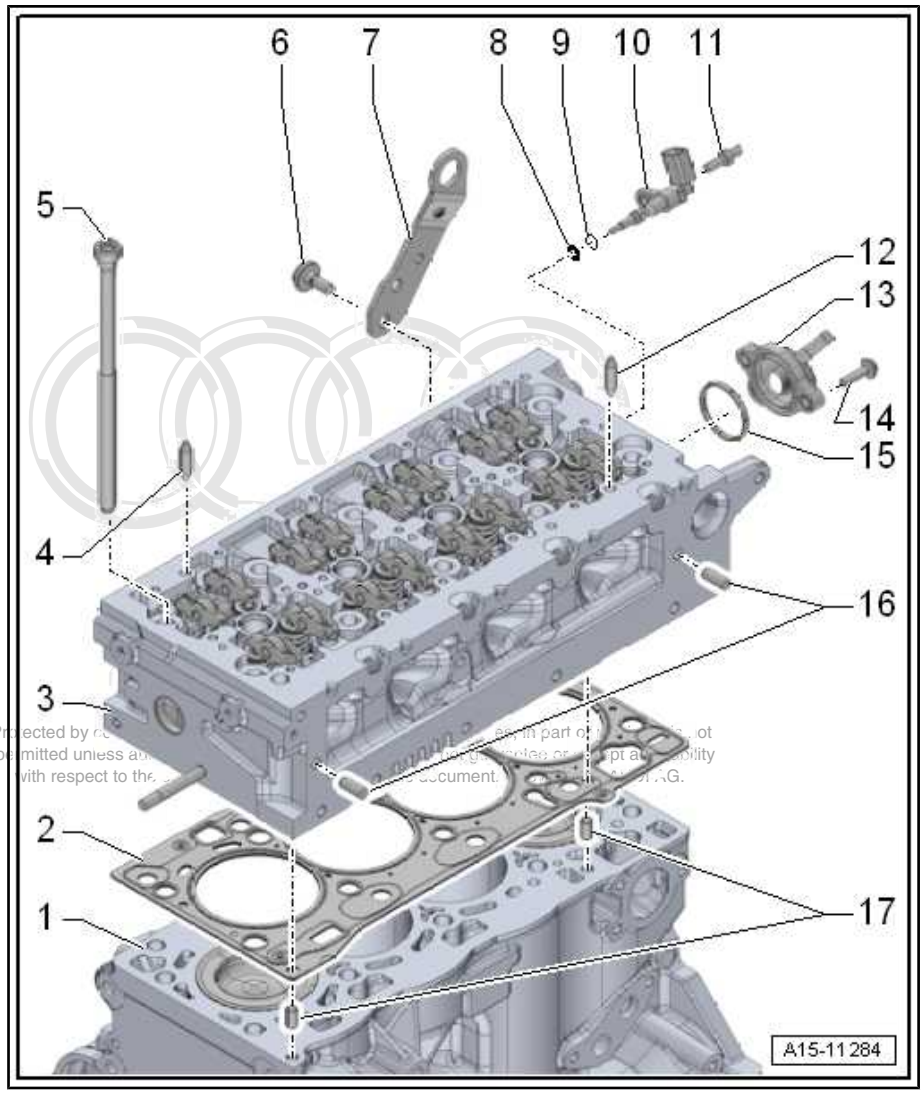
Cylinder head cover - tightening torque and sequence

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



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2.2 Exploded view - cylinder head



1 - Cylinder block

2 - Cylinder head gasket

- ❑ Renewing ⇒ “2.6 Removing and installing cylinder head”, page 106
- ❑ Identification of cylinder head gasket ⇒ page 99
- ❑ If renewed, change coolant and engine oil

3 - Cylinder head

- ❑ Removing and installing ⇒ page 106
- ❑ To prevent damage to glow plugs, always place cylinder head on a soft foam surface after removal.
- ❑ Checking for distortion ⇒ page 99
- ❑ 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 - Bolt

- ❑ Renew after removing
- ❑ Correct sequence when slackening ⇒ page 111
- ❑ Tightening torque and sequence ⇒ page 100

6 - Bolt

- ❑ 20 Nm

7 - Engine lifting eye

8 - Spacer ring

- ❑ Renew if damaged

9 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

10 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 180

11 - Centre hex stud

- ❑ Tightening torque ⇒ Item 4 (page 174)

12 - Dowel pin

- ❑ For camshaft housing

13 - Connection

❑ For coolant hoses

14 - Bolt

❑ 10 Nm

15 - Seal

❑ Renew after removing

16 - Dowel pins

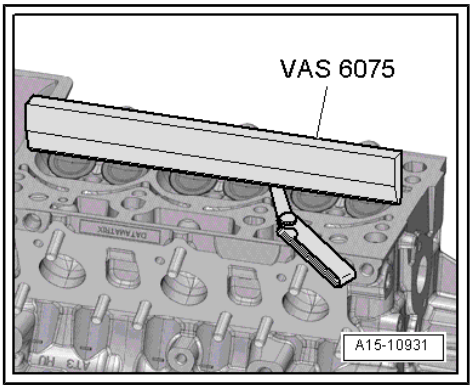
❑ For intake manifold with charge air cooler

17 - 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.



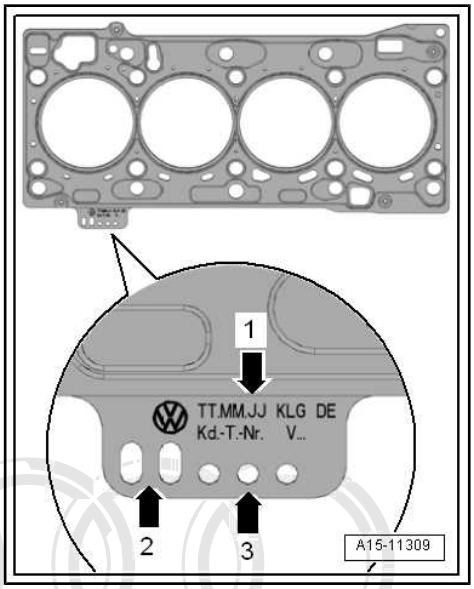
Identification of cylinder head gasket

1 - Part number

2 - Ignore

3 - Holes

- Cylinder head gaskets of different thicknesses are fitted depending on the amount of piston projection ⇒ page 66 . When renewing only the cylinder head gasket, the new gasket should have the same identification as the old one.



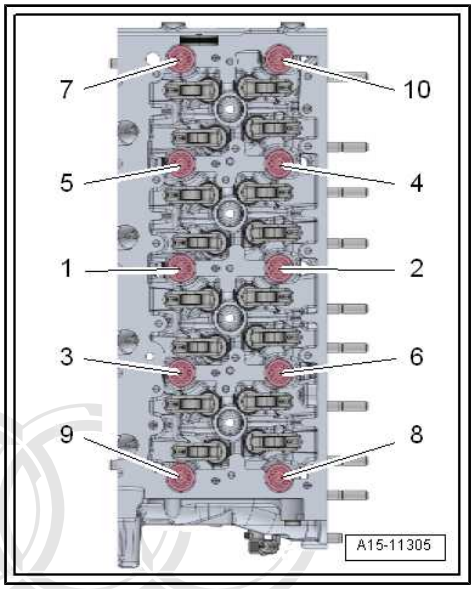
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Cylinder head - tightening torque and sequence

– Renew bolts.

– 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



2.3 Removing and installing cylinder head cover

Removing

- Secure the heat insulation sleeve in the original position when installing.

– Remove toothed belt cover (top) ⇒ page 73 .

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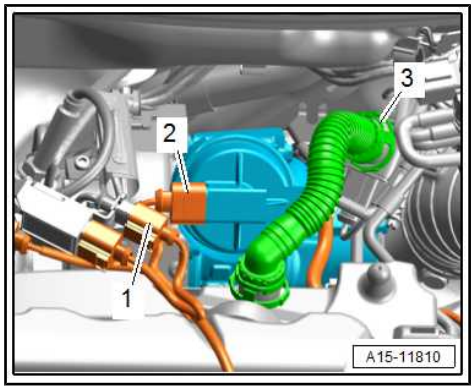
– Remove injectors ⇒ page 256 .

– Unplug electrical connectors and move electrical wiring harness clear:

1 - For exhaust gas temperature sender 1 - G235-

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

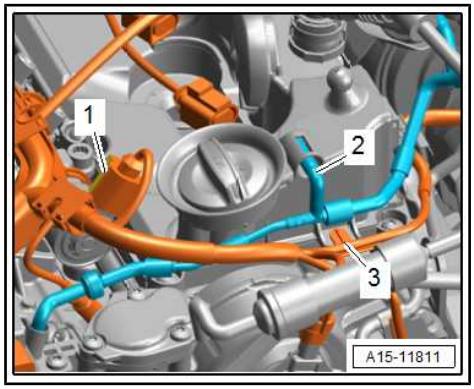
– Press release tabs on both sides of crankcase breather hose -3- and disconnect hose from connection.



– Unplug electrical connector -1- for fuel pressure sender - G247- .

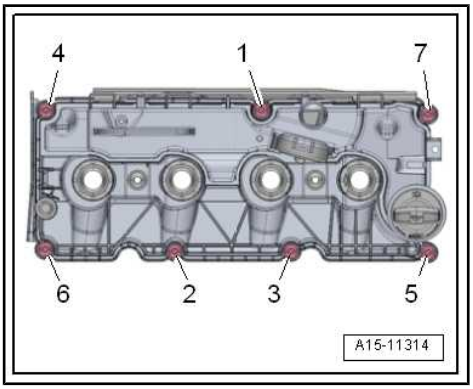
– Disconnect vacuum hose -2-.

– Move electrical wiring harness -3- clear.



– Slacken cylinder head cover bolts in the sequence -7 ... 1- and remove.

– Detach cylinder head cover.



Installing

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

- Renew O-ring.
- Renew gasket and bolts for cylinder head cover if damaged or leaking.

– Install injectors ⇒ page 256 .

– Install toothed belt cover (top) ⇒ page 73 .

– Connect vacuum hose ⇒ page 234 .

Tightening torques

- ⇒ Fig. ""Cylinder head cover - tightening torque and sequence"" , page 97
- ⇒ "1.1 Exploded view - turbocharger", page 206
- ⇒ "5.1 Exploded view - injectors", page 246

2.4 Removing and installing seals for injectors

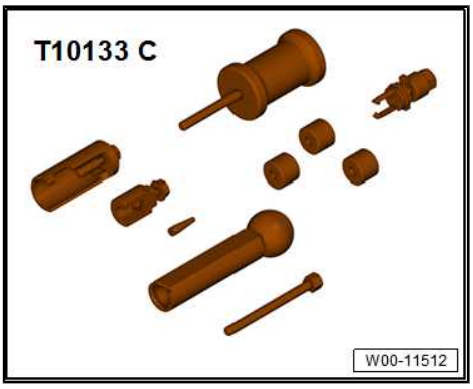
Special tools and workshop equipment required

- Carrier - 3390-

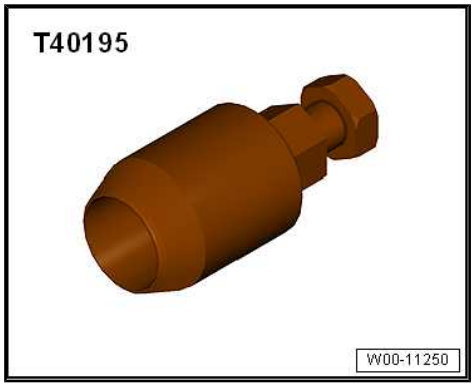


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- Tool set for FSI engines - T10133C-



♦ Oil seal extractor - T40195-

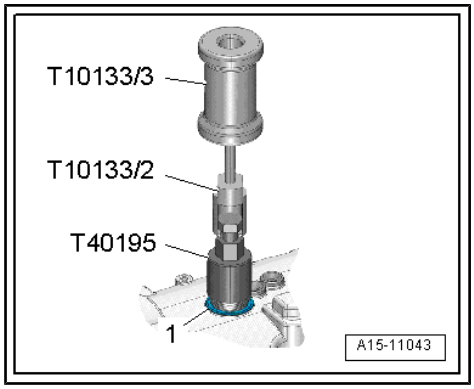


Procedure

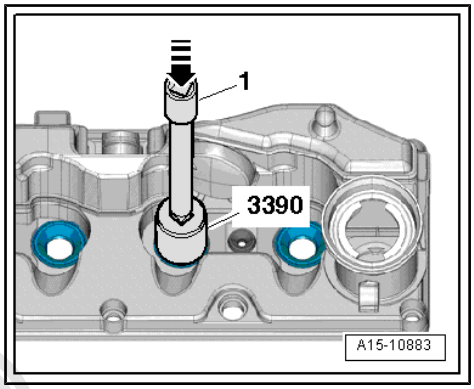
– Remove corresponding injector ⇒ page 256 .

– 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.



2.5 Removing and installing camshaft housing

Special tools and workshop equipment required

♦ Electric drill with plastic brush attachment

♦ Safety goggles

♦ Sealant ⇒ Electronic parts catalogue

Removing

• Cylinder head installed.

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– Detach toothed belt from camshaft ⇒ page 76 .

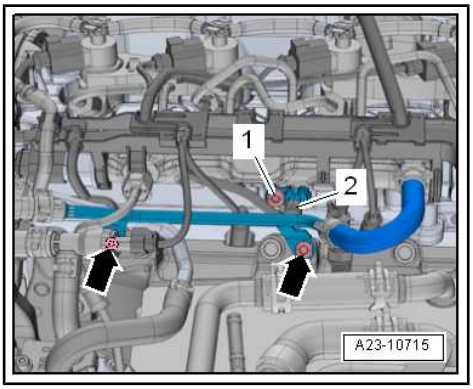
– Remove cylinder head cover ⇒ page 100 .

– Remove high-pressure reservoir (rail) ⇒ page 262 .

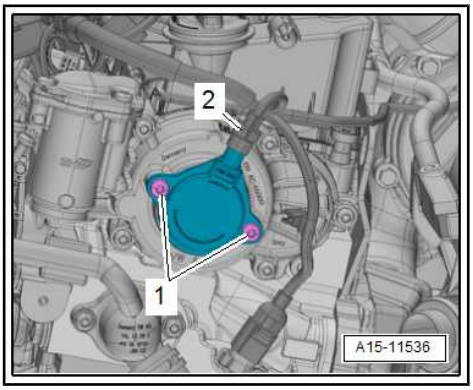
– Remove coolant pipe (rear) ⇒ page 189 .

– Remove coolant pipes (left-side) ⇒ page 187 .

– Remove bolts -arrows- and push fuel lines slightly towards front.
– Unplug electrical connector -2- for Hall sender - G40- .

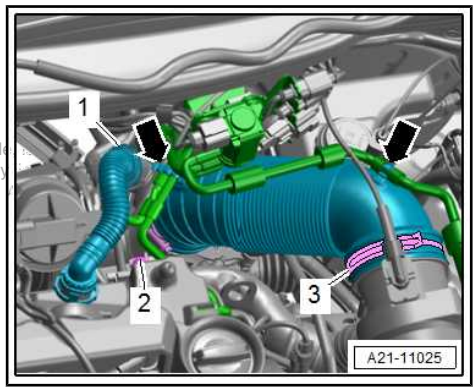


– Unplug electrical connector -2-.

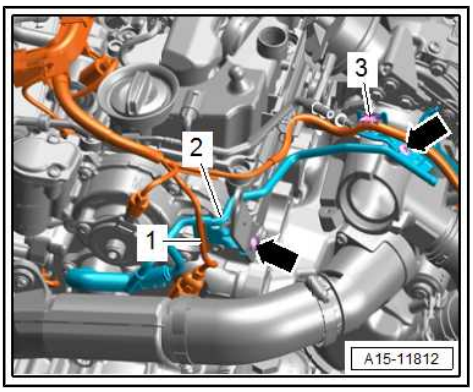


– Move clear vacuum hoses at air pipe -arrows-.
– Remove bolt -2-, swivel air pipe with connection to rear and detach from turbocharger.

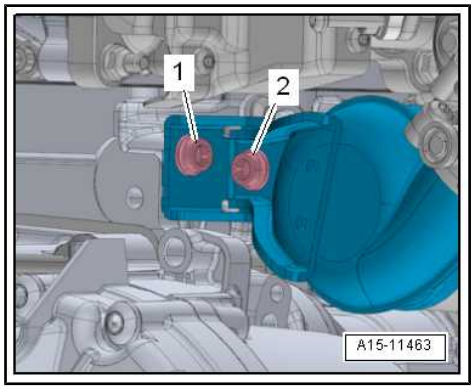
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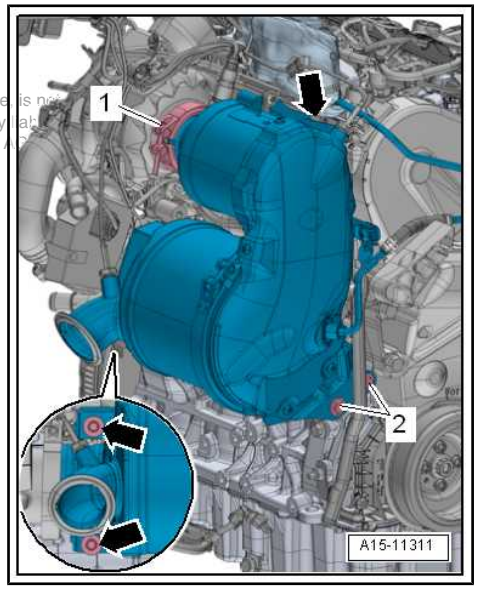
– Move electrical wiring -1, 3- clear.
– Remove bolts -arrows- and press coolant line -2- to left side.



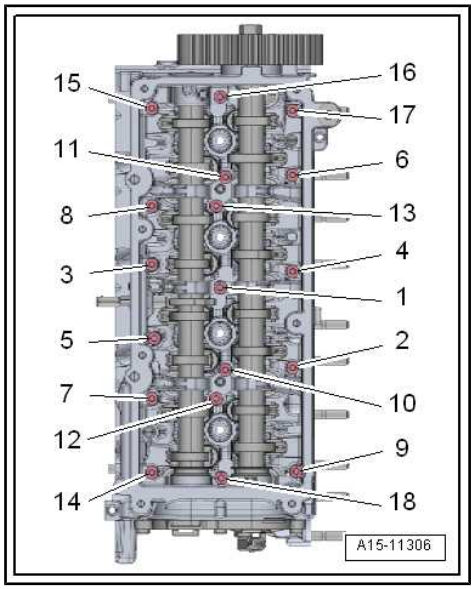
– Remove bolt -1- and loosen bolt -2-.



– Open clip -1- and place it on intake funnel of emission control module.
– Loosen bolts -2- and remove bolts -arrows-.
– Press emission control module slightly towards rear.



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



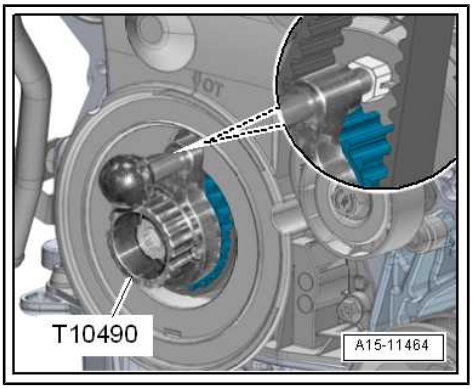
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Installing

Requirements:

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

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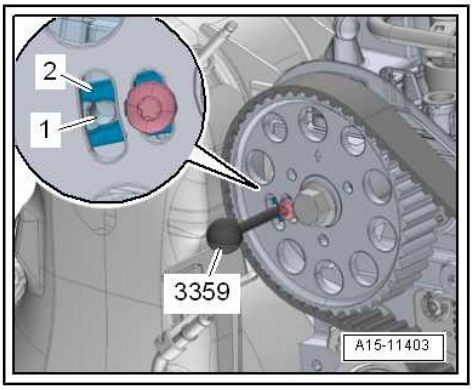
- Camshaft hub locked with diesel injection pump locking pin - 3359- .
- Bolt fitted but not tightened.

– Cover exposed parts of the engine with clean cloths.

CAUTION

Risk of eye injury due to sealant residue.

– Put on safety goggles.

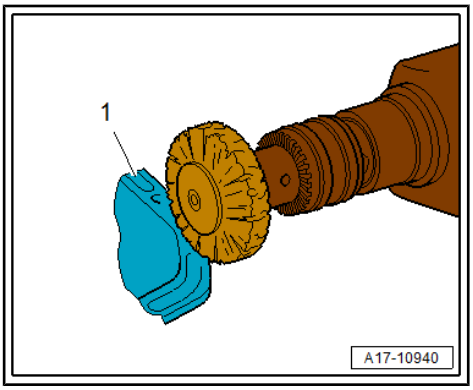


– Remove remaining sealant from cylinder head and camshaft housing -1- using rotating plastic brush or similar.

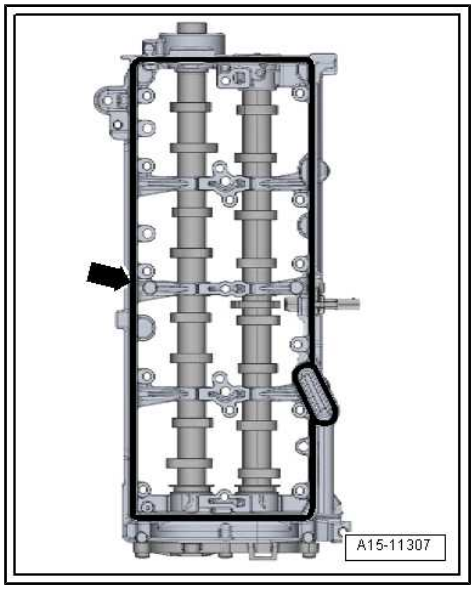
– Remove remaining sealant from cylinder head and camshaft housing -1- using rotating plastic brush or similar.

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

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



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



• Width of sealant beads: 2 mm.

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

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

– Tighten camshaft housing bolts ⇒ page 118 .

• After installing the camshaft housing, wait about 30 minutes for the sealant to dry.

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

– Install emission control module ⇒ page 290 .

– Install camshaft oil seal ⇒ page 118 .

– Install coolant pipes (left-side) ⇒ page 187 .

– Install coolant pipe (rear) ⇒ page 189 .

– Install cylinder head cover ⇒ page 100 .

– Install toothed belt (adjust valve timing) ⇒ page 79 .

NOTICE

Risk of damage to valves and piston crowns if work has been performed on valve gear.

- **After installing the camshaft, wait at least 30 minutes before starting the engine as the hydraulic compensation elements need time to settle.**
- **Turn the crankshaft carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.**

Tightening torques

♦ ⇒ Fig. ""Camshaft housing - tightening torque and sequence"", page 118

♦ ⇒ "5.2 Exploded view - high-pressure reservoir (rail)", page 249

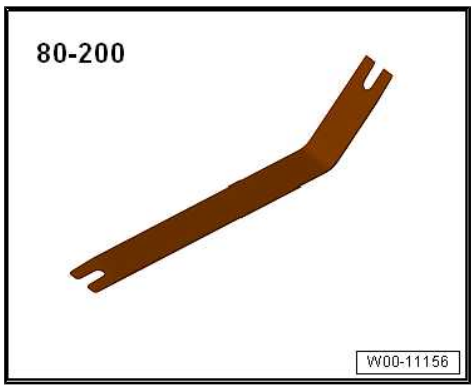
♦ ⇒ "1.1 Exploded view - turbocharger", page 206

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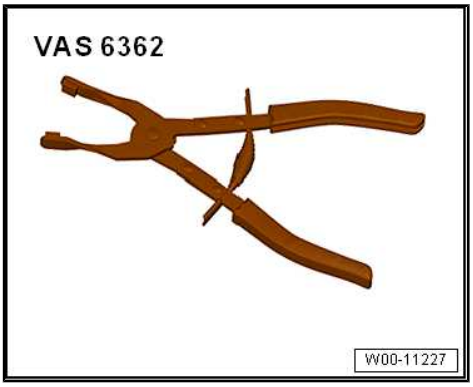
2.6 Removing and installing cylinder head

Special tools and workshop equipment required

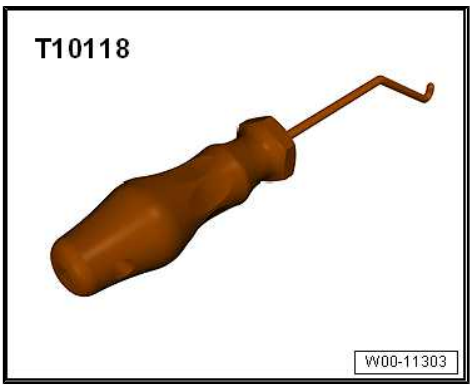
♦ Removal lever - 80 - 200-



♦ Hose clip pliers - VAS 6362-



♦ Assembly tool - T10118-



♦ Bit XZN 10 - T10501-



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Removing

- Fit all heat insulation sleeves in the original position when installing.

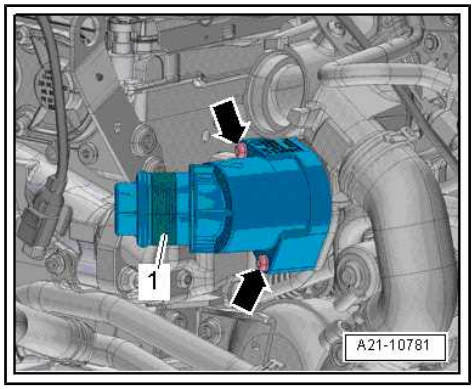
– Remove engine cover panel ⇒ page 40 .

– Remove coolant pipes (top) ⇒ page 184 .

– Remove front exhaust pipe ⇒ page 283 .

– Remove camshaft housing ⇒ page 102 .

– Unscrew bolts -arrows- and remove resonator -1-.



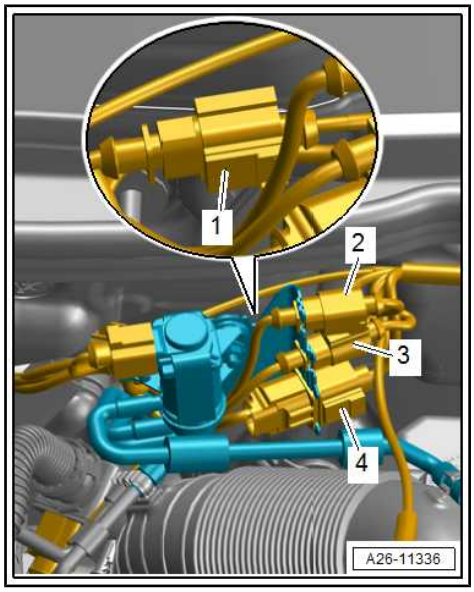
– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

1 - For exhaust gas temperature sender 4 - G648-

2 - For exhaust gas temperature sender 3 - G495-

3 - For exhaust gas temperature sender 2 - G448-

4 - For Lambda probe - G39-



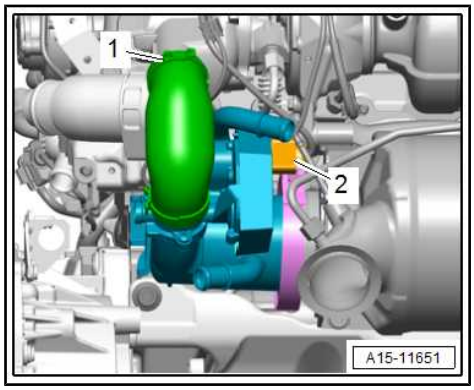
Vehicles with four-wheel drive:

– Remove exhaust gas recirculation cooler ⇒ page 322 .

Vehicles with front-wheel drive:

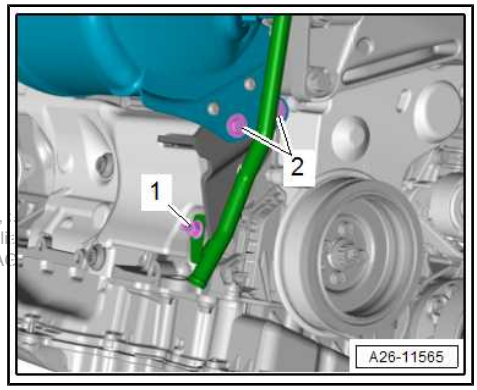
– Release hose clip -1- and detach air hose.

– Push heat insulation sleeve to one side, unplug electrical connector -2- using assembly tool - T10118- and move electrical wire clear.



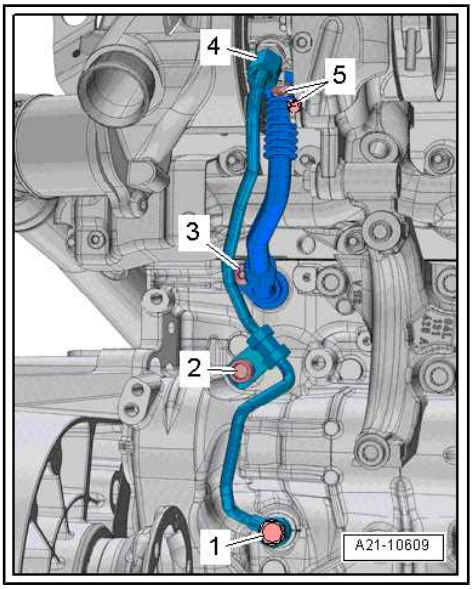
Continued for all vehicles:

– Remove bolts -2- and press emission control module and (on front-wheel drive vehicles) exhaust gas recirculation cooler towards rear.

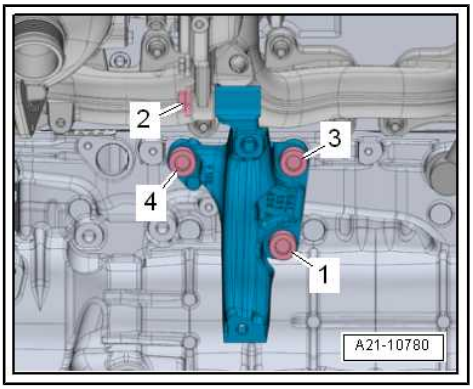


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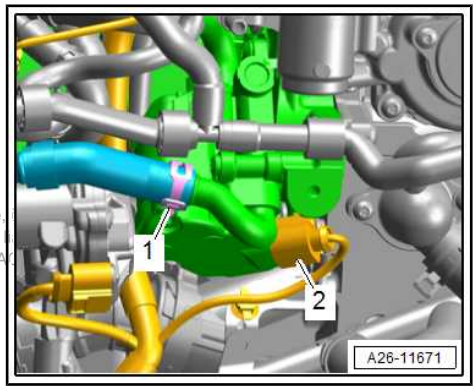
– Unscrew bolt -2- and union nut -4-.
– Remove bolts -3, 5- and detach oil return pipe.



– Remove bolt -2- and loosen bolts -1, 3, 4-.



– Unplug electrical connector -2-.
– Release hose clip -1- and disconnect coolant hose.



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– Unplug electrical connectors and move clear:

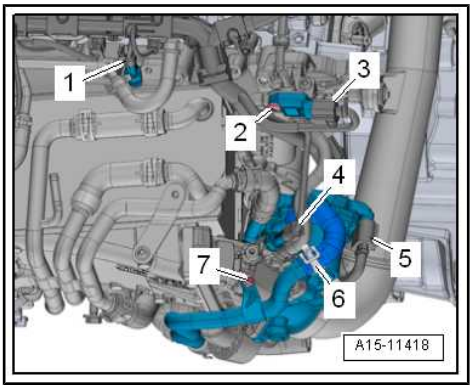
1 - For charge air temperature sender after charge air cooler - G811-

3 - For charge pressure sender - G31-

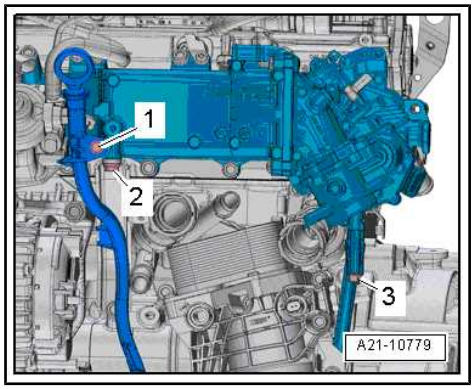
4 - For charge air temperature sender before charge air cooler - G810-

5 - For throttle valve module - J338-

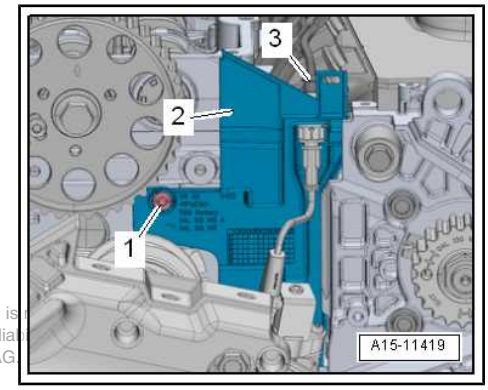
– Remove bolts -2, 7- and detach coolant hose -6-.
– Place coolant pipe (front left) to side.



– Remove bolt -1- for dipstick guide tube.
– Remove bolts -2, 3- for bracket for intake manifold.
– Remove throttle valve module - J338- ⇒ page 240 .

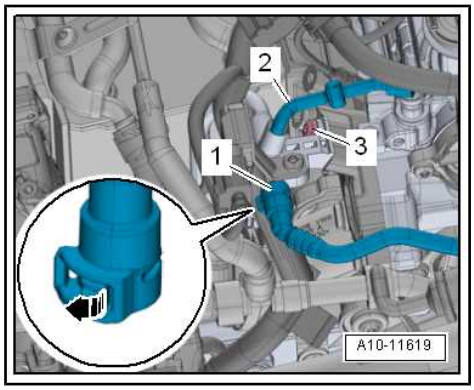


– Unplug electrical connector -3-.
– Remove bolt -1- but leave cover -2- in installation position.

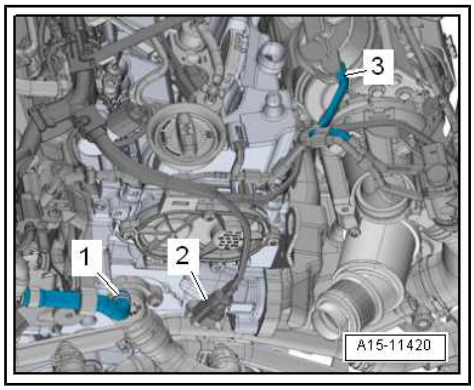


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– Release catch -arrow- and disconnect vacuum hose -1-.
– Disconnect vacuum hose -2-.
– Remove bolt -3-.



– Unplug electrical connector -2- for coolant temperature sender - G62- .
– Release hose clip -1- and disconnect coolant hose.
– Disconnect vacuum hose -3-.
– Detach electrical connectors at glow plugs ⇒ page 330 .
– Move electrical wiring harness to one side.



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

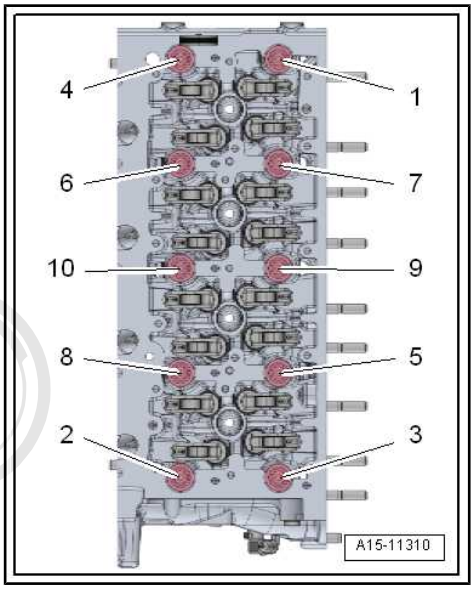
• A second mechanic is required for removal of the cylinder head.

– 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

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

• Renew bolts tightened with specified tightening angle.

• Renew self-locking nuts, seals, gaskets and O-rings.

• Oil contact surfaces between roller rocker fingers and cams.

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

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

• Handle the cylinder head gasket very carefully to ensure it is not damaged.

– Carefully remove sealant residue from cylinder head and cylinder block.

– Carefully remove any remaining emery and abrasive material.

– Clean blind holes for cylinder head bolts in cylinder block so that they are free of oil and coolant residue.

– 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.

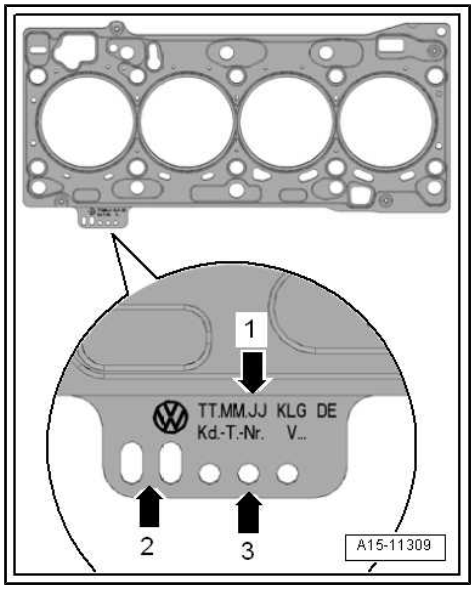
– Note cylinder head gasket identification:

1 - Part number

2 - Ignore

3 - Holes

- If the cylinder head gasket or cylinder head have been replaced, 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, the new cylinder head gasket must be selected by measuring the piston projection at “TDC” ⇒ page 66 .



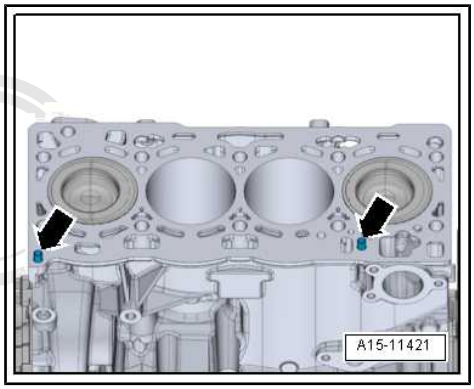
– Fit cylinder head gasket onto dowel sleeves -arrows- in cylinder block.

- Installation position of cylinder head gasket: the word “oben” (top) or the part number should face towards the cylinder head.

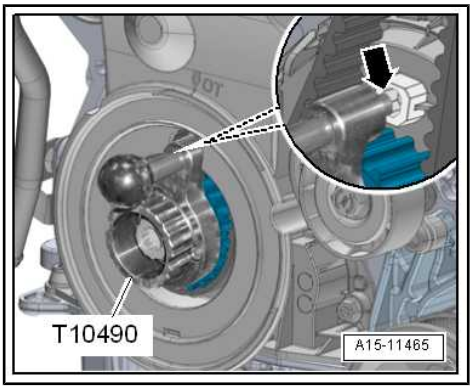
– Fit cylinder head.

– Fit and tighten cylinder head bolts ⇒ page 100 .

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



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– Then turn crankshaft in direction of engine rotation until pin -arrow- on crankshaft stop - T10490- engages in sealing flange as crankshaft rotates.
– Install toothed belt (adjust valve timing) ⇒ page 79 .

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

– Install emission control module ⇒ page 290 .
– Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
– Install camshaft housing ⇒ page 102 .
– Install front exhaust pipe ⇒ page 283 .
– Install engine cover panel ⇒ page 40 .
– Change engine oil ⇒ Maintenance ; Booklet 820 .
– Fill cooling system with fresh coolant ⇒ page 165 .

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Tightening torques

- ⇒ “2.2 Exploded view - cylinder head”, page 98
- ⇒ “1.1 Exploded view - sump/oil pump”, page 136
- ⇒ “3.1 Exploded view - coolant pipes”, page 183
- ⇒ “1.1 Exploded view - turbocharger”, page 206
- ⇒ “4.1 Exploded view - intake manifold”, page 238
- ⇒ “2.1 Exploded view - emission control system”, page 288
- ⇒ “5.1 Exploded view - exhaust gas recirculation system”, page 318

2.7 Checking compression

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

Procedure using ⇒ Vehicle diagnostic tester

– Connect a ⇒ Vehicle diagnostic tester.
– Switch on ignition.
– Select `Engine electronics` in vehicle self-diagnosis.
– Then select `Subsystems, conditions`.
– Select `Compression test` from the list.

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

Special tools and workshop equipment required

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



Procedure

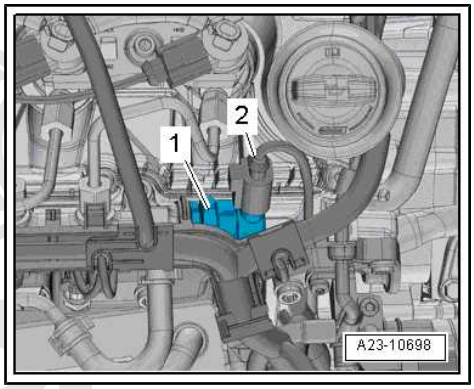
- Operating temperature
- Battery voltage at least 12.5 V

– Remove engine cover panel ⇒ page 40 .

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

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

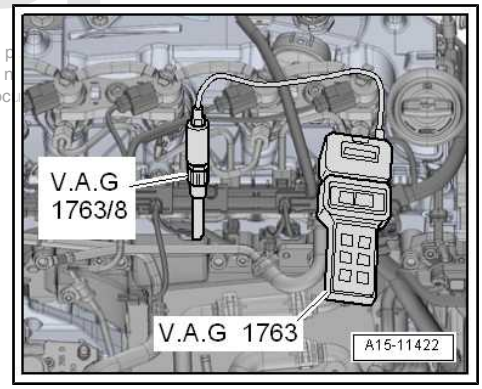
– Remove all glow plugs ⇒ page 330 .



– Screw in adapter - V.A.G 1763/8- in place of corresponding glow plug and connect compression tester - V.A.G 1763- .

– 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

Assembling

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

– Install glow plugs ⇒ page 330 .

– Install engine cover panel ⇒ page 40 .

– Erase any entries in event memory resulting from testing ⇒ Vehicle diagnostic tester, `Guided Functions`, then `Interrogate event memory`.

Tightening torques

♦ ⇒ “1.1 Exploded view - glow plug system”, page 329

3 Valve gear

⇒ “3.1 Exploded view - valve gear”, page 115

⇒ “3.2 Removing and installing camshaft oil seal”, page 118

⇒ “3.3 Removing and installing camshaft control valve 1 N205 ”, page 120

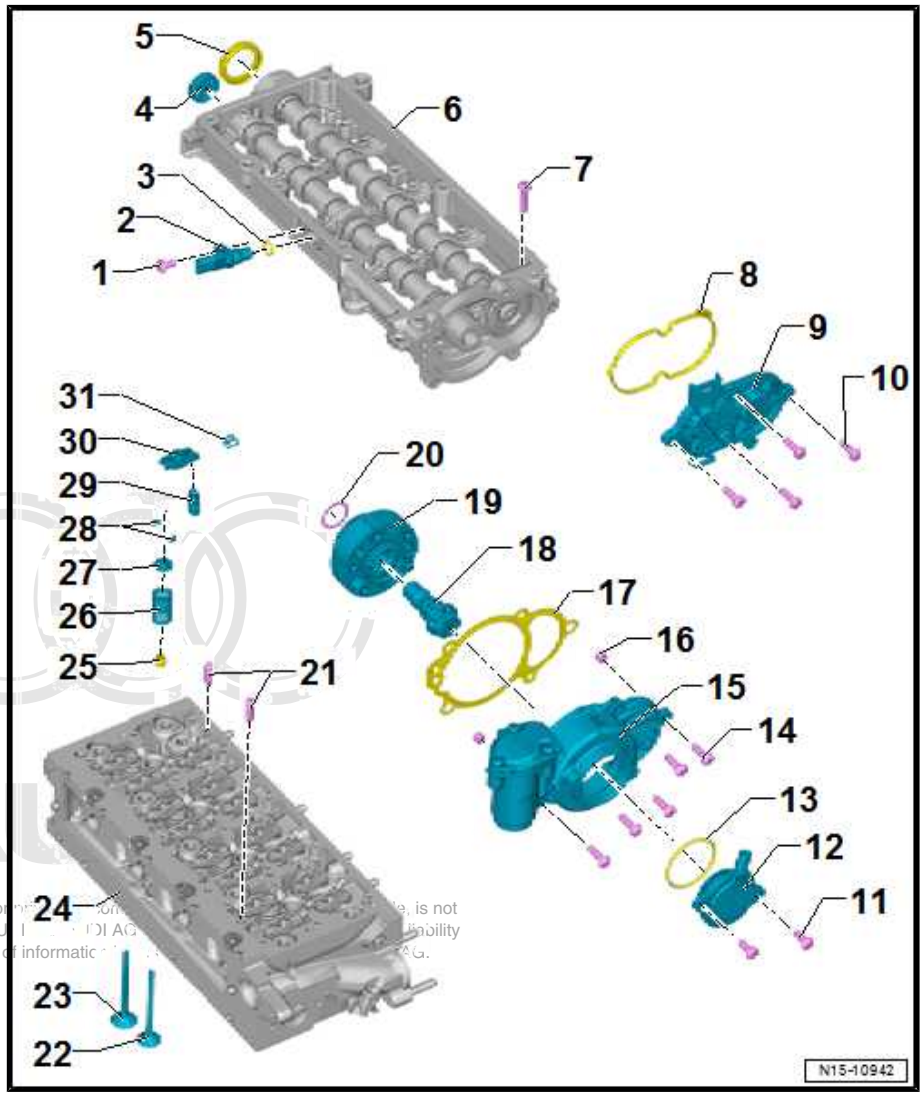
⇒ “3.4 Removing and installing camshaft adjuster”, page 120

⇒ “3.5 Removing and installing control valve for camshaft control valve 1 N205 ”, page 123

⇒ “3.6 Checking hydraulic compensation elements”, page 125

⇒ “3.7 Removing and installing valve stem oil seals”, page 126

3.1 Exploded view - valve gear



1 - Bolt

- ❑ Tightening torque ⇒ Item 2 (page 329)

2 - Hall sender - G40-

- ❑ Exploded view ⇒ page 329

3 - O-ring

- ❑ Renew after removing

4 - Sealing cap

- ❑ Renew after removing
- ❑ Removing: With camshaft housing installed, pierce 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-

5 - Camshaft oil seal

- ❑ Renewing ⇒ page 118

6 - Camshaft housing

- ❑ With integrated camshafts
- ❑ Removing and installing ⇒ page 102

7 - Bolt

- ❑ Renew after removing
- ❑ Correct sequence when slackening ⇒ page 117
- ❑ Tightening torque and sequence ⇒ page 118

8 - Gasket

- ❑ Renew after removing

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9 - Cover

10 - Bolt

- ❑ 8 Nm

11 - Bolt

- ❑ 8 Nm

12 - Camshaft control valve 1 - N205-

- ❑ Adaption must be performed after renewal or removal and installation of camshaft control valve 1 - N205- ; to do so, use ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Adaption elec. adjuster with checkback`.
- ❑ Removing and installing ⇒ page 120

13 - Seal

- ❑ Renew after removing

14 - Bolt

- ❑ Tightening torque and sequence ⇒ page 118

15 - Housing

- ❑ For camshaft adjuster

16 - Dowel sleeve

17 - Gasket

- ❑ Renew after removing

18 - Control valve

- ❑ Adaption must be performed after renewal or removal and installation; to do so, use ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Adaption elec. adjuster with checkback`
- ❑ Removing and installing ⇒ page 123
- ❑ 50 Nm

19 - Camshaft adjuster

- ❑ Make sure that friction washer is fitted (risk of damage to engine)
- ❑ Adaption must be performed after renewal or removal and installation; to do so, use ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Adaption elec. adjuster with checkback`
- ❑ Removing and installing ⇒ page 120

20 - Friction washer

- ❑ Check whether this component is fitted before installing camshaft adjuster

21 - Dowel pins

- ❑ For camshaft housing

22 - Exhaust valve

- ❑ Must not be machined; only grinding-in is permissible
- ❑ Mark installation position for re-installation
- ❑ Checking ⇒ page 135
- ❑ Valve dimensions ⇒ page 135
- ❑ Checking valve guides ⇒ page 134

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23 - Inlet valve

- ❑ Must not be machined; only grinding-in is permissible
- ❑ Mark installation position for re-installation
- ❑ Checking ⇒ page 135
- ❑ Valve dimensions ⇒ page 135
- ❑ Checking valve guides ⇒ page 134

24 - Cylinder head

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

25 - Valve stem oil seal

- ❑ Renewing ⇒ page 126

26 - Valve spring

27 - Valve spring plate

28 - Valve cotters

29 - Hydraulic compensation element

- ❑ Checking ⇒ page 125
- ❑ Mark installation position for re-installation
- ❑ Lubricate contact surfaces before installing

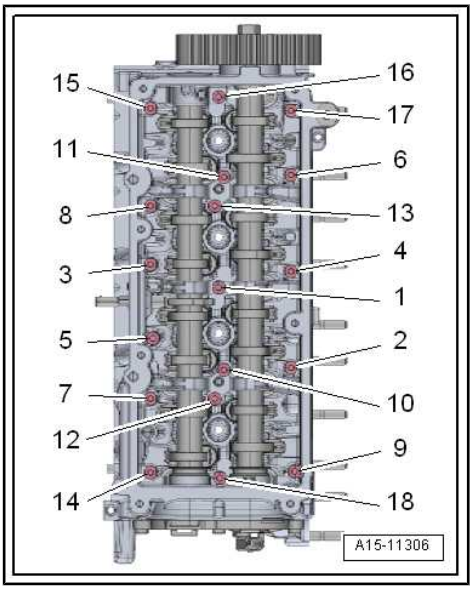
30 - Roller rocker finger

- ❑ Removing and installing ⇒ “2.5 Removing and installing camshaft housing”, page 102
- ❑ Mark installation position for re-installation
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surfaces before installing

31 - Securing clip

- ❑ For hydraulic compensation element

Slacken camshaft housing bolts in the sequence -18 ... 1-.

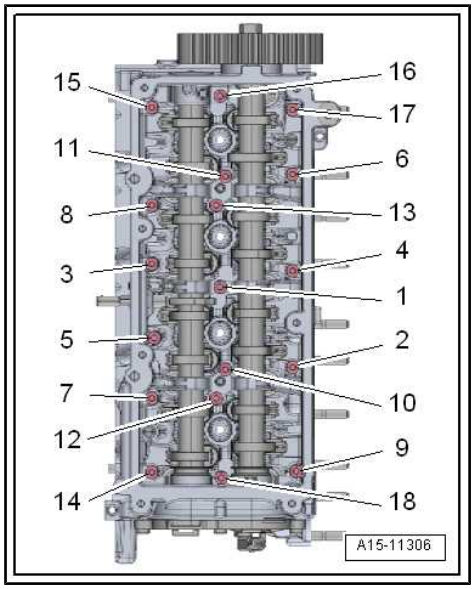


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Camshaft housing - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

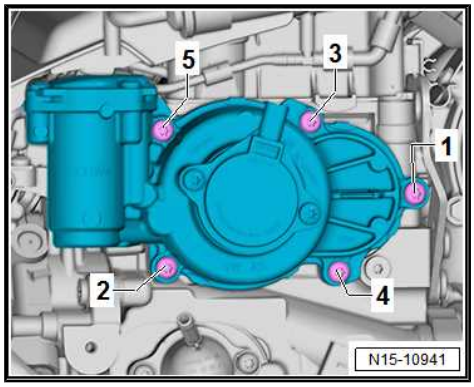
Stage	Bolts	Tightening torque
1.	-1 … 18-	Screw in by hand until contact is made • The camshaft housing should make contact with the cylinder head over the full surface.
2.	-1 … 18-	8 Nm
3.	-1 ... 18-	Turn 90° further



Camshaft adjuster housing - tightening torque and sequence

– Tighten bolts in stages in the sequence shown:

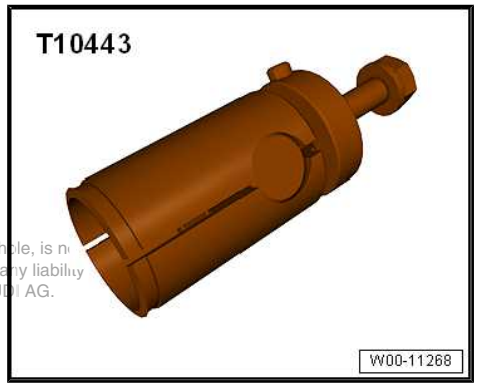
Stage	Bolts	Tightening torque
1.	-1 … 5-	Screw in by hand until contact is made
2.	-1 … 5-	8 Nm



3.2 Removing and installing camshaft oil seal

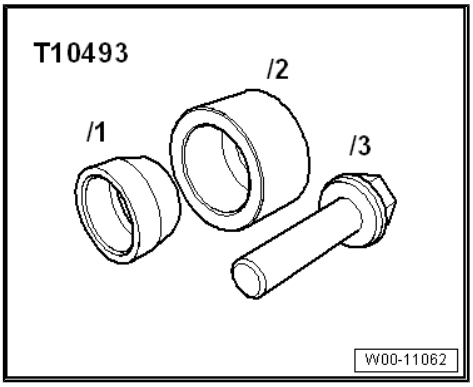
Special tools and workshop equipment required

♦ Puller - T10443-



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♦ Assembly tool - T10493-



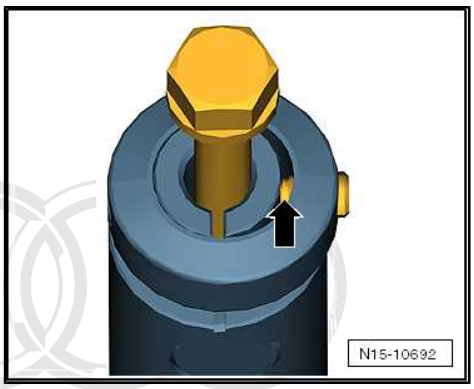
Procedure

– Detach toothed belt from camshaft ⇒ page 76 .

Note

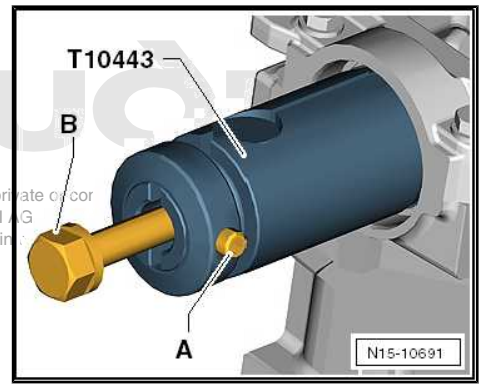
If the grub screw is unscrewed too far the thrust plate inside the puller -T10443- will come loose from the thrust bolt. If this happens, the thrust plate must be pushed back onto the thrust bolt.

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



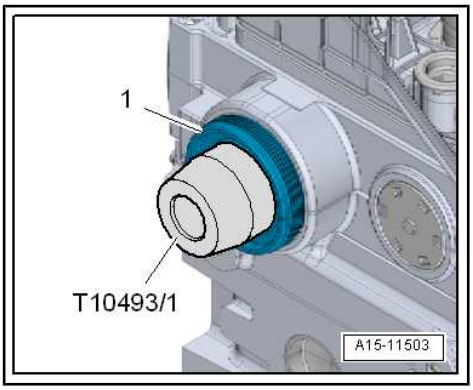
– Apply puller - T10443- in a straight line, as shown in illustration, and lock by screwing in grub screw.-A-.
– Screw in thrust bolt -B- until oil seal is pulled out.
– Clean contact surface and sealing surface.
– The sealing lip of the oil seal must not be additionally oiled or greased.

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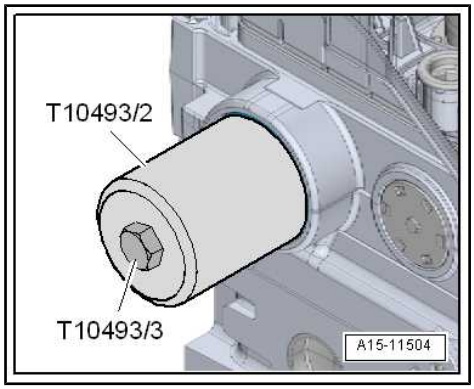


– Apply guide sleeve -T10493/1- to camshaft as shown in illustration.
– Carefully push oil seal -1- over guide sleeve and onto camshaft.

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



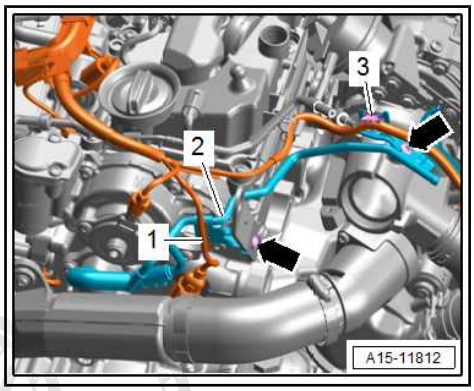
– Press oil seal in onto stop using press tool -T10493/2- and bolt -T10493/3- .
– Install toothed belt (adjust valve timing) ⇒ page 79 .



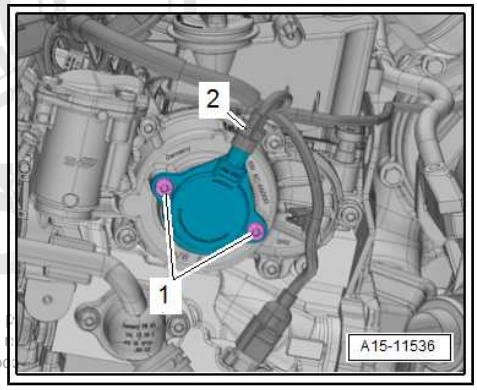
3.3 Removing and installing camshaft control valve 1 - N205-

Removing

– Remove engine cover panel ⇒ page 40 .
– Remove air cleaner housing ⇒ page 237 .
– Move electrical wiring -1, 3- clear.
– Remove bolts -arrows- and press coolant line -2- to left side.



– Unplug electrical connector -2-.
– Unscrew bolts -1- and remove camshaft control valve 1 - N205- .



Installing

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

• Renew O-ring.
– Install engine cover panel ⇒ page 40 .
– Adaption must be performed after renewal or removal and installation of camshaft control valve 1 - N205- , to do so, use ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Adaption elec. adjuster with checkback`.

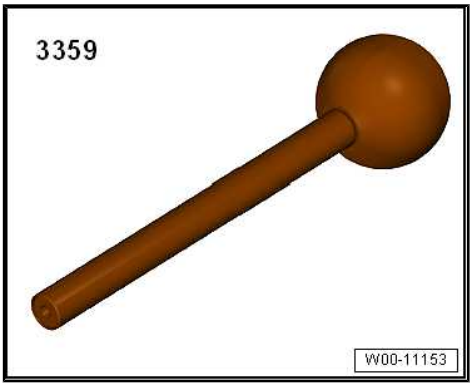
Tightening torques

♦ ⇒ “3.1 Exploded view - valve gear”, page 115
♦ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

3.4 Removing and installing camshaft adjuster

Special tools and workshop equipment required

♦ Diesel injection pump locking pin - 3359-



Removing

– Remove toothed belt cover (top) ⇒ page 73 .

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

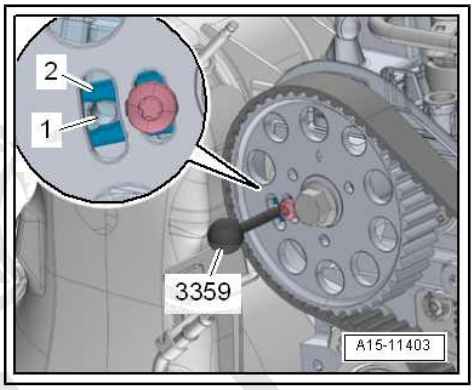
NOTICE

Irreparable engine damage can be caused if the toothed belt slips.

– Only turn crankshaft in direction of engine rotation.

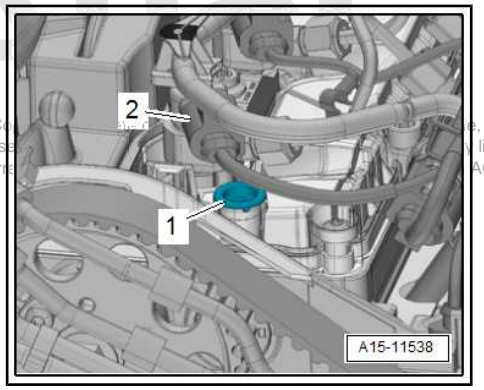
– Rotate crankshaft by turning bolt on crankshaft sprocket until camshaft sprocket is positioned at “TDC”.

– Lock camshaft hub with diesel injection pump locking pin - 3359- ; to do so, insert locking pin into fork on locating arm -2- and into hole -1- behind it in cylinder head.



– Unplug electrical connector -2- at injector for cylinder 1.

– Release plugs -1- on cylinder head cover by turning anti-clockwise and detach plugs.

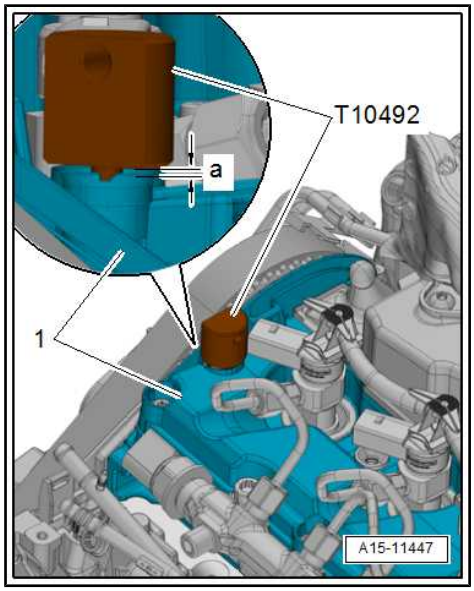


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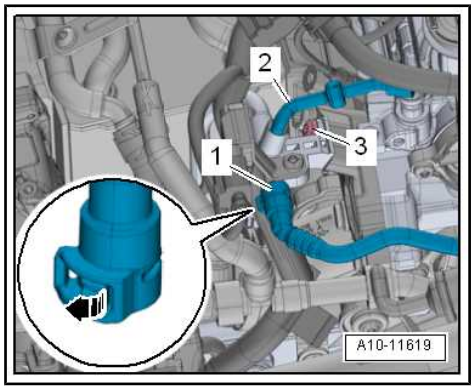
– Lock inlet camshaft with locking pin - T10492- ; note the following:

• Distance -a- must be about 1 mm.

– Remove air cleaner housing ⇒ page 237 .



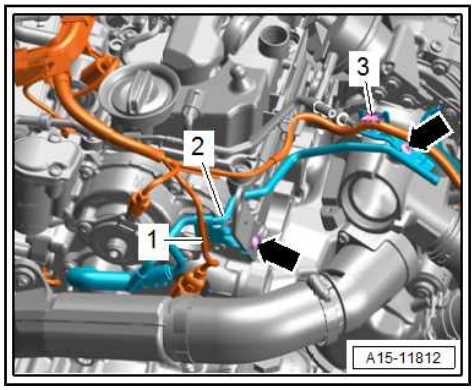
– Release catch -arrow- and disconnect vacuum hose -1-.



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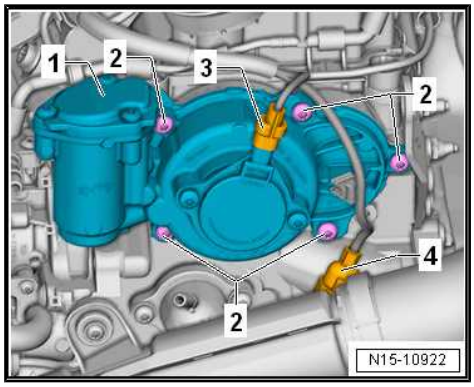
– Move electrical wiring -1, 3- clear.

– Remove bolts -arrows- and press coolant line -2- to left side.



– Unplug electrical connectors -3- and -4-. Pull retaining clip off housing.

– Remove bolts -2- and detach housing -1-.

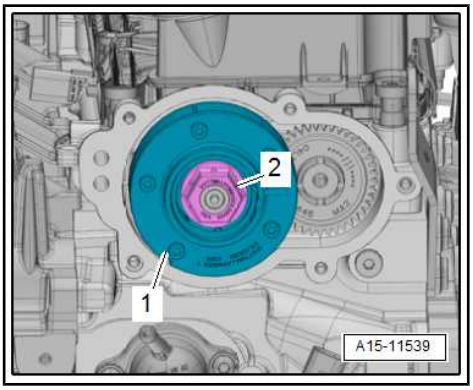


NOTICE

Irreparable engine damage can be caused if the piston sticks.

– If the piston sticks, the control valve must be renewed.

– Unscrew control valve -2- and detach camshaft adjuster -1-.



Installing

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

NOTICE

Irreparable engine damage can be caused if the friction washer is not fitted.

– Check that the friction washer (diamond-coated washer) is fitted between the camshaft adjuster and the stub on the camshaft.

– Make sure that friction washer is fitted.

– Install toothed belt cover (top) ⇒ page 73 .

– Adaption must be performed after renewal or removal and installation; to do so, use ⇒ Vehicle diagnostic tester, Guided Functions, 01 - Adaption elec. adjuster with check-back.

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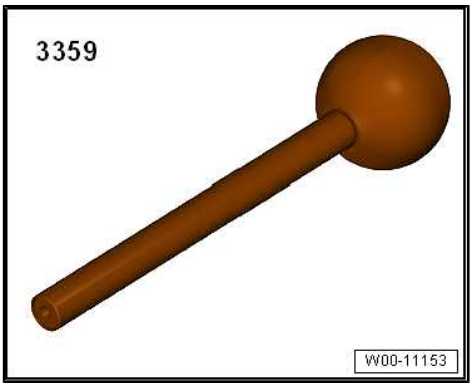
Tightening torques

- ⇒ “3.1 Exploded view - valve gear”, page 115
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

3.5 Removing and installing control valve for camshaft control valve 1 - N205-

Special tools and workshop equipment required

- Diesel injection pump locking pin - 3359-



- Locking pin - T10492-



Removing

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

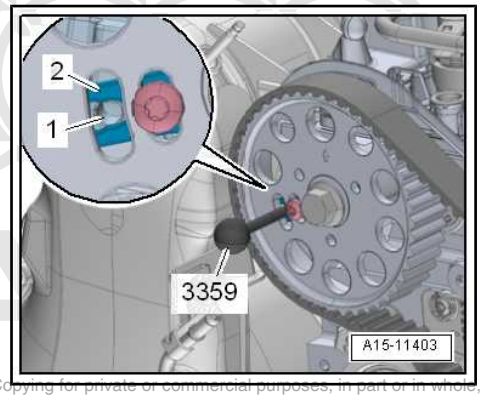
– Remove toothed belt cover (top) ⇒ page 73 .

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

NOTICE

Irreparable engine damage can be caused if the toothed belt slips.

– Only turn crankshaft in direction of engine rotation.

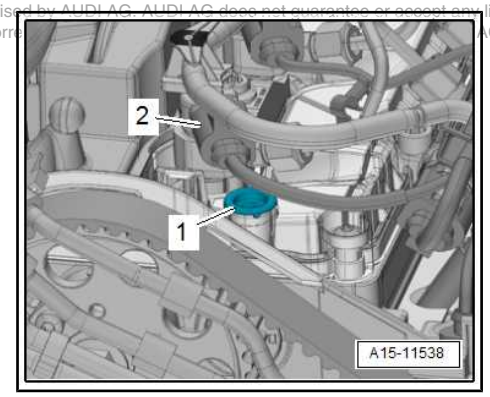


– Lock camshaft hub with diesel injection pump locking pin - 3359- ; to do so, insert locking pin into fork on locating arm -2- and into hole -1- behind it in cylinder head.

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– Unplug electrical connector -2- at injector for cylinder 1.

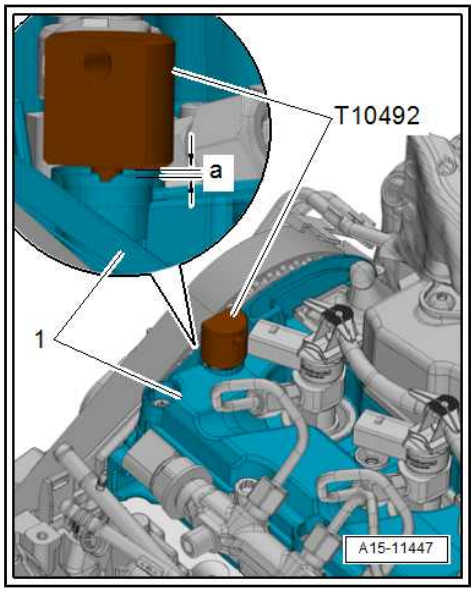
– Release plugs -1- on cylinder head cover by turning anti-clockwise and detach plugs.



– Lock inlet camshaft with locking pin - T10492- ; note the following:

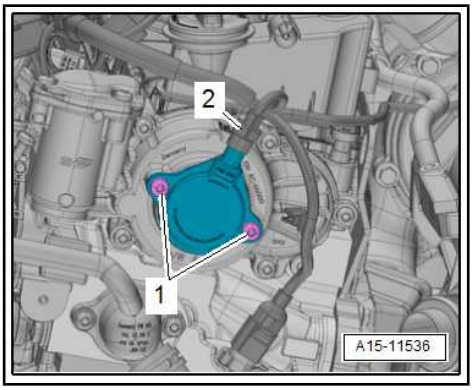
• Distance -a- must be about 1 mm.

– Remove air cleaner housing ⇒ page 237 .



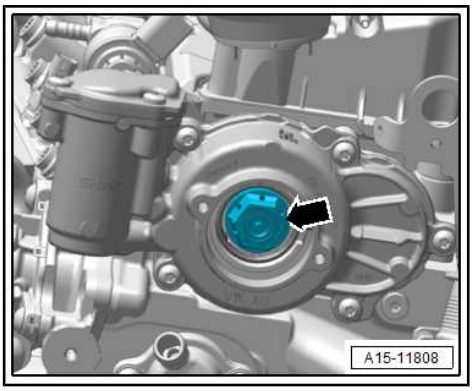
– Unplug electrical connector -2-.

– Unscrew bolts -1- and remove camshaft control valve 1 - N205- .



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– Unscrew and pull out control valve -arrow-.



Installing

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

- Renew O-ring after removal.

– Adaption must be performed after renewal or removal and installation; to do so, use ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Adaption elec. adjuster with check-back`.

Tightening torques

- ⇒ “3.1 Exploded view - valve gear”, page 115
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

3.6 Checking hydraulic compensation elements

The hydraulic compensation elements cannot be serviced.

Irregular valve noises when starting engine are normal.

Special tools and workshop equipment required

- Feeler gauge

Procedure

– Start engine and run until radiator fan has started up once.

– Increase engine speed to approx. 2500 rpm for 2 minutes (perform road test if necessary).

Note

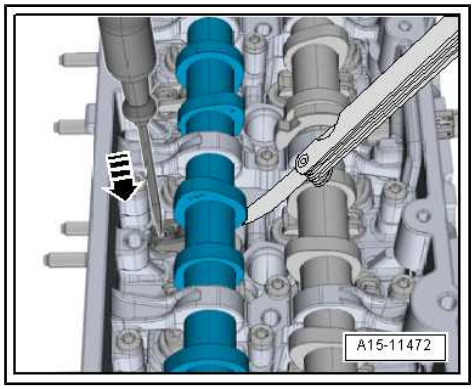
If irregular valve noise disappears but repeatedly re-occurs when travelling short distances, renew oil retention valve. The oil retention valve is located in the oil filter housing ⇒ Item 9 (page 153) .

– If the compensation elements are still noisy, locate the defective compensation element as follows:

– Remove cylinder head cover ⇒ page 100 .

– Rotate crankshaft by turning bolt for toothed belt sprocket until cam of supporting element to be tested is facing upwards.

– Press roller rocker finger down -arrow- to determine clearance between cam and roller rocker finger.
– If it is possible to insert a feeler gauge of 0.20 mm between cam and roller rocker finger, renew hydraulic compensation element
⇒ “2.5 Removing and installing camshaft housing”, page 102 .



Additional steps required

– Install cylinder head cover ⇒ page 100 .

3.7 Removing and installing valve stem oil seals

⇒ “3.7.1 Removing and installing valve stem oil seals (cylinder head installed)”, page 126

⇒ “3.7.2 Removing and installing valve stem oil seals (cylinder head removed)”, page 129

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

Special tools and workshop equipment required

♦ Valve stem seal puller - 3364-

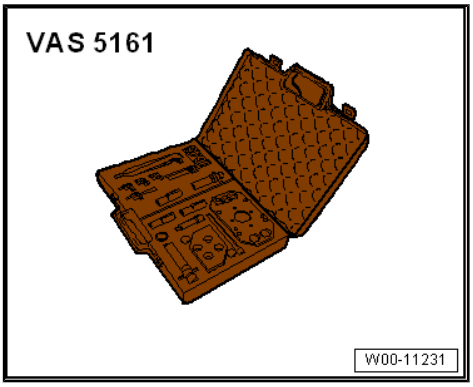


♦ Valve stem seal fitting tool - 3365-



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♦ Removal and installation device for valve cotters - VAS 5161 A- with sealing pin -VAS 5161/29-2- , guide plate -VAS 5161 A/31- and sleeve -VAS 5161 A/31-1- .



Procedure

– Remove all glow plugs ⇒ page 330 .

– Remove camshaft housing ⇒ page 102 .

– 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:

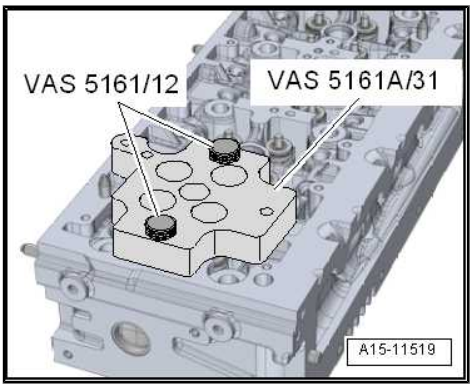
– Fit guide plate -VAS 5161 A/31- onto cylinder head.

• 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:

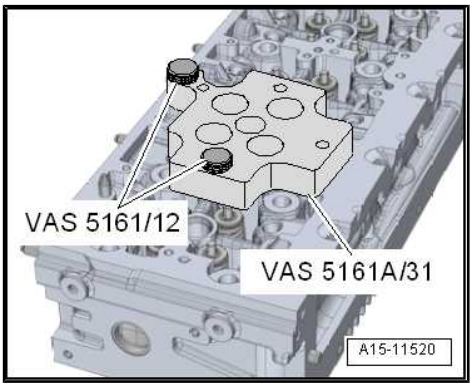
– Fit guide plate -VAS 5161 A/31- onto cylinder head.

• 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

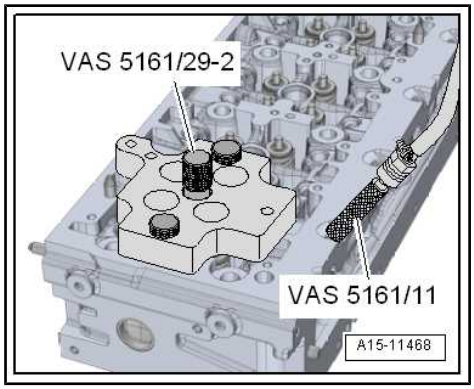


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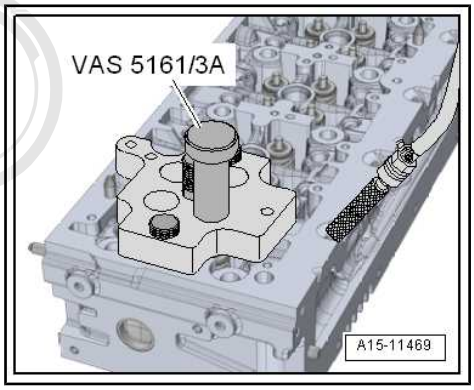
Continued for all cylinders:

– Screw sealing pin -VAS 5161/29-2- 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.



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– 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.

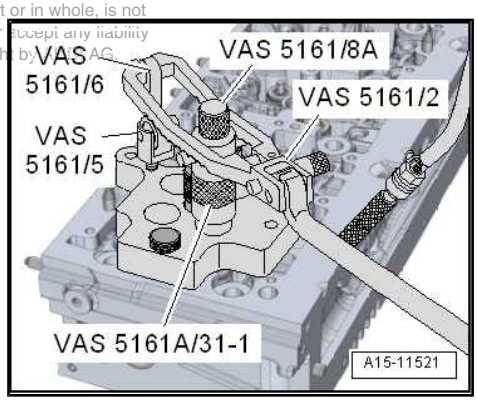
– At the same time, turn knurled screw of assembly cartridge clockwise until tips engage in valve cotters.

– Move knurled screw back and forth slightly; the valve cotters are thus forced apart and taken up by the assembly cartridge.

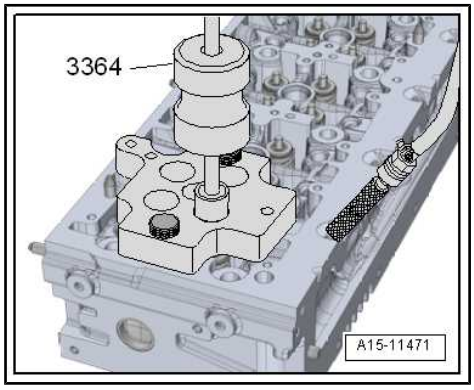
– Release pressure fork.

– Take off assembly cartridge with sleeve.

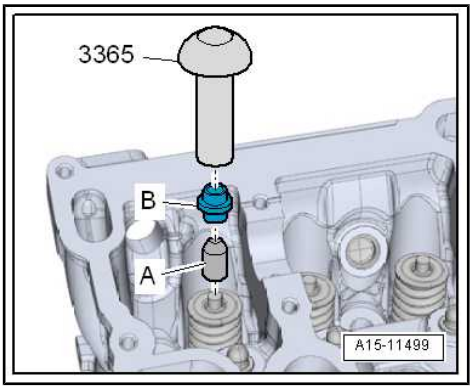
– Detach valve spring with valve spring plate.



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

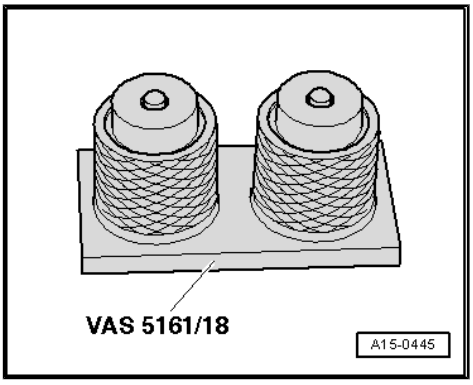


– New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
– Take off plastic sleeve.

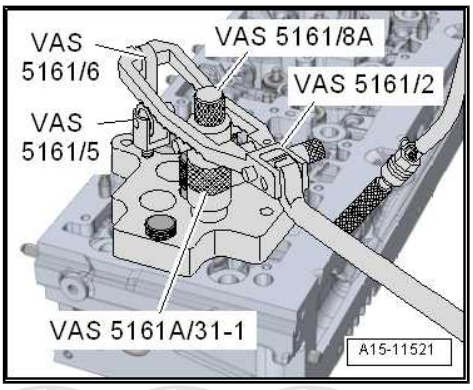


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

• Larger diameter of valve cotters faces upwards.
– 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.



Assembling

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

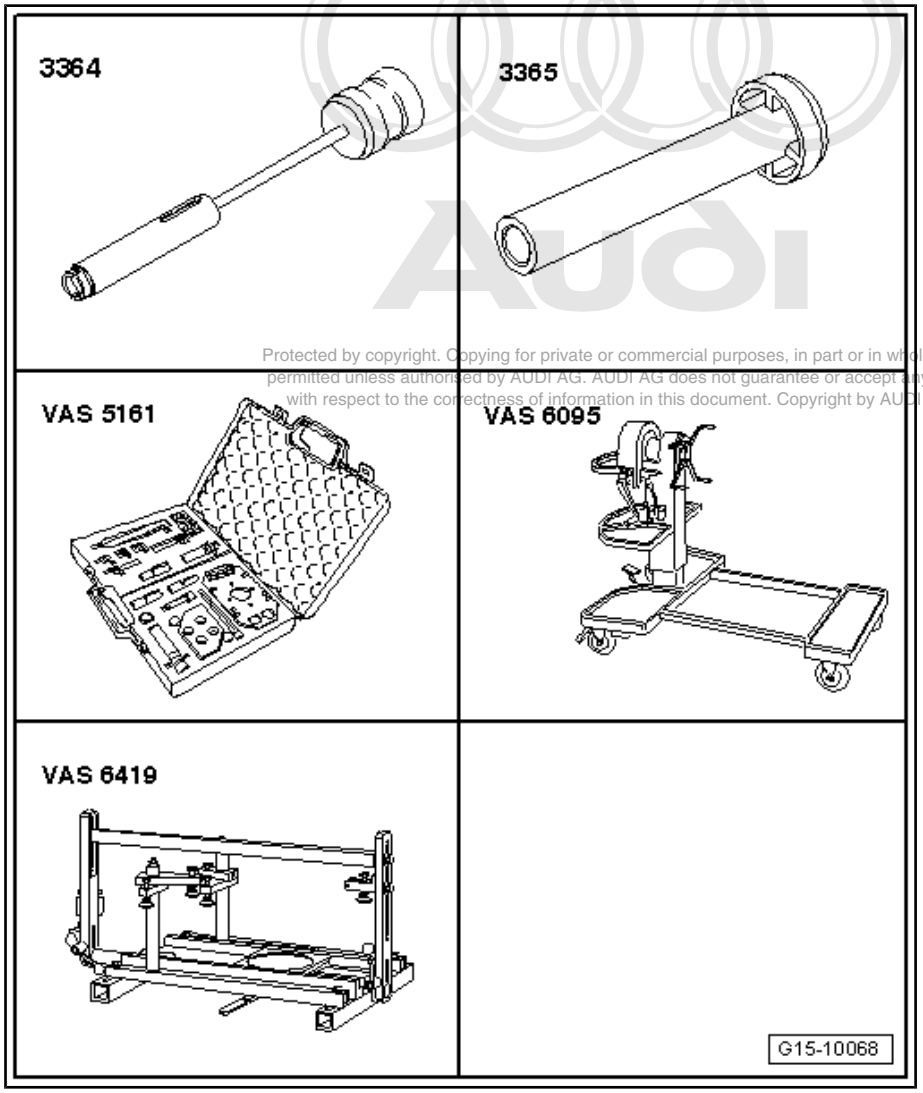
– Ensure that all roller rocker fingers make contact with the ends of the valve stems correctly and are clipped onto their respective hydraulic compensation elements.
– Install camshaft housing ⇒ page 102 .
– Install glow plugs ⇒ page 329 .

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

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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 6095-
- Cylinder head tensioning device - VAS 6419-



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Procedure

– Remove camshaft housing ⇒ page 102 .

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

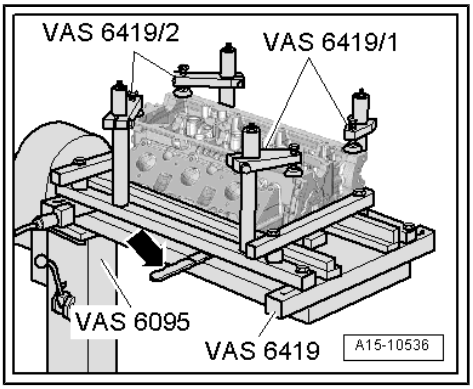
– Remove roller rocker fingers together with hydraulic compensation elements and put down on a clean surface.

– Remove cylinder head ⇒ page 106 .

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

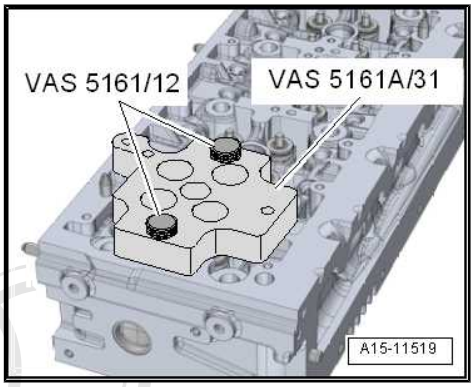
– Insert cylinder head tensioning device - VAS 6419- into engine and gearbox support - VAS 6095- .

– 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.



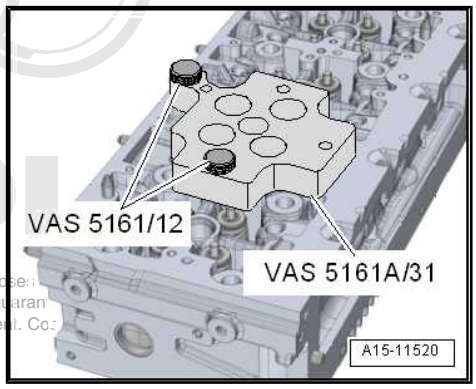
Cylinders 1, 3, 4:

– 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:

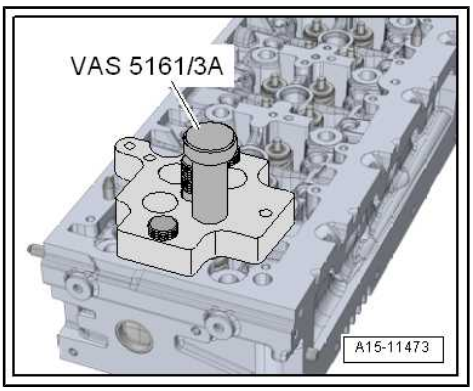
– Fit guide plate -VAS 5161 A/31- onto cylinder head.
• The lettering -A- faces towards turbocharger side
• The lettering -E- faces towards intake manifold side
– Secure guide plate with knurled screws -VAS 5161/12- by hand.
• Position of knurled screws, as shown in illustration



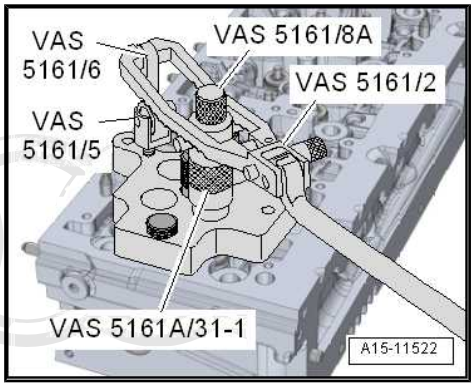
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Continued for all cylinders:

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

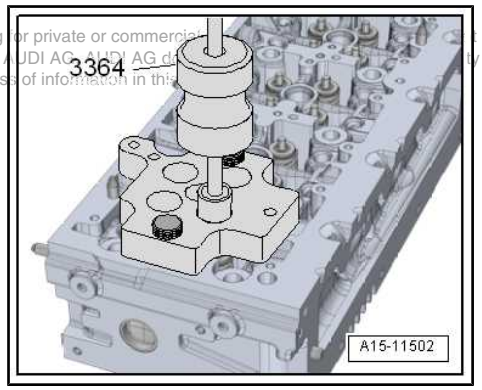


– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8A- (slide on sleeve -VAS 5161 A/31-1-) in guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time, turn knurled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

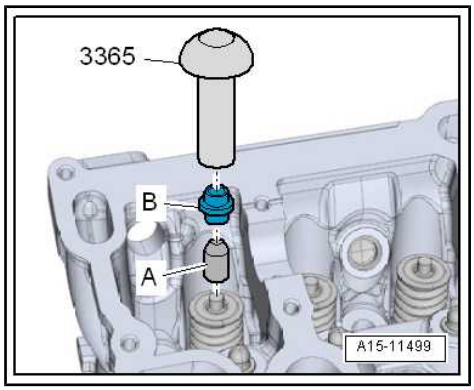


– Pull off valve stem oil seal with valve stem seal puller - 3364- .

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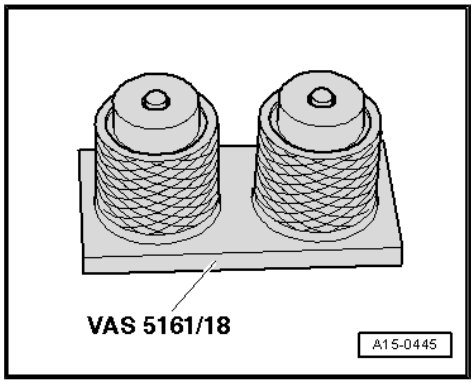


– New valve stem oil seals -B- are supplied with plastic sleeve; fit plastic sleeve -A- onto valve stem.
– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
– Take off plastic sleeve.

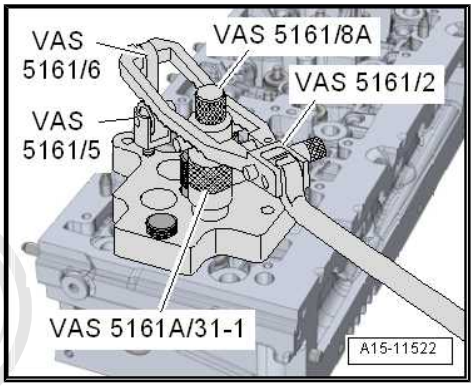


If valve cotters have been removed from assembly cartridge, they must first be inserted in insertion device -VAS 5161/18- .

• Larger diameter of valve cotters faces upwards.
– Press assembly cartridge onto insertion device from above and take up valve cotters.
– Insert valve spring and valve spring plate.



– 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.



Assembling

Installation is carried out in the reverse order; 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 102 .

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4 Inlet and exhaust valves

⇒ “4.1 Checking valve guides”, page 134

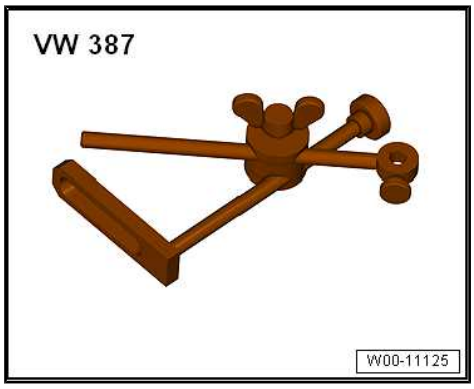
⇒ “4.2 Checking valves”, page 135

⇒ “4.3 Valve dimensions”, page 135

4.1 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-

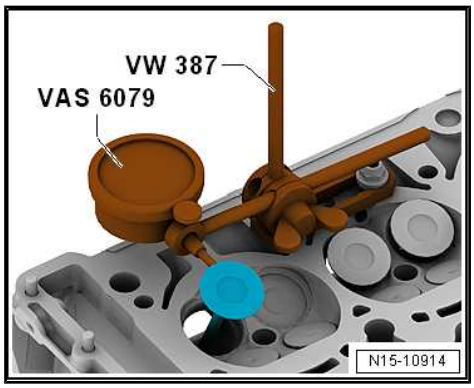


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Procedure

- 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.
- Valve guides cannot be renewed.

– 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.

4.2 Checking valves

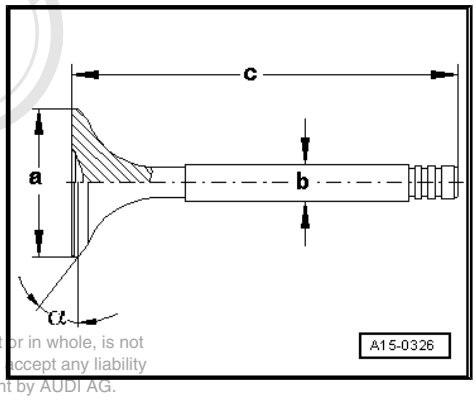
– Visually inspect for scoring on valve stems and valve seat surfaces.

– Renew valve if scoring is clearly visible.

4.3 Valve dimensions

Note

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

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17 – Lubrication

1 Sump/oil pump

⇒ “1.1 Exploded view - sump/oil pump”, page 136

⇒ “1.2 Removing and installing oil pump”, page 149

⇒ “1.3 Removing and installing oil level and oil temperature sender G266 ”, page 150

⇒ “1.4 Engine oil”, page 151

1.1 Exploded view - sump/oil pump

⇒ “1.1.1 Exploded view - sump (1-part)”, page 136

⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

⇒ “1.1.3 Removing and installing sump”, page 140

⇒ “1.1.4 Removing and installing sump (bottom section)”, page 143

⇒ “1.1.5 Removing and installing sump (top section)”, page 146

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1.1.1 Exploded view - sump (1-part)

1 - Bolt
- ❑ Self-locking
- ❑ Renew after removing
- ❑ 8 Nm

2 - Oil level and oil temperature sender - G266-
- ❑ ⇒ “1.3 Removing and installing oil level and oil temperature sender G266 ”, page 150

3 - Seal
- ❑ Renew after removing

4 - Oil drain plug
- ❑ 30 Nm

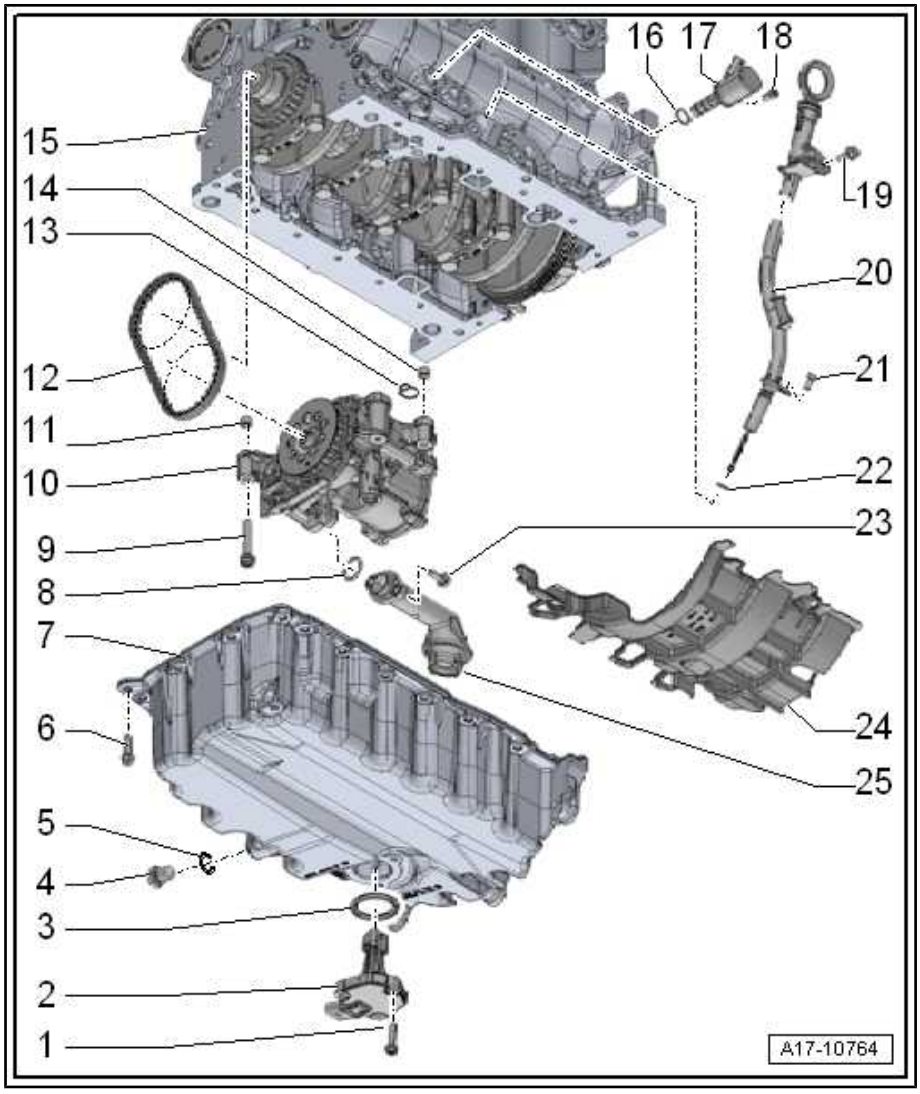
5 - Seal
- ❑ Renew after removing

6 - Bolt
- ❑ Tightening torque and sequence ⇒ page 138

7 - Sump
- ❑ ⇒ “1.1.3 Removing and installing sump”, page 140

8 - O-ring
- ❑ Renew after removing

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



10 - Oil pump

- ❑ With vacuum pump
- ❑ ⇒ “1.2 Removing and installing oil pump”, page 149

11 - Dowel sleeve

12 - Toothed belt

- ❑ Do not kink or twist toothed belt, or allow it to be damaged on sharp edges
- ❑ Removing:

– ⇒ “1.2 Removing and installing oil pump”, page 149

– Remove sealing flange (pulley end) ⇒ page 48 .

13 - Seal

- ❑ Renew after removing

14 - Dowel sleeve

15 - Cylinder block

16 - O-ring

- ❑ Renew after removing

17 - Valve for oil pressure control - N428-

- ❑ ⇒ “3.5 Removing and installing valve for oil pressure control N428 ”, page 158

18 - Bolt

- ❑ 8 Nm

19 - Bolt

- ❑ 8 Nm

20 - Guide tube for oil dipstick

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21 - Bolt

- ❑ 8 Nm

22 - O-ring

- ❑ Renew after removing

23 - Bolt

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

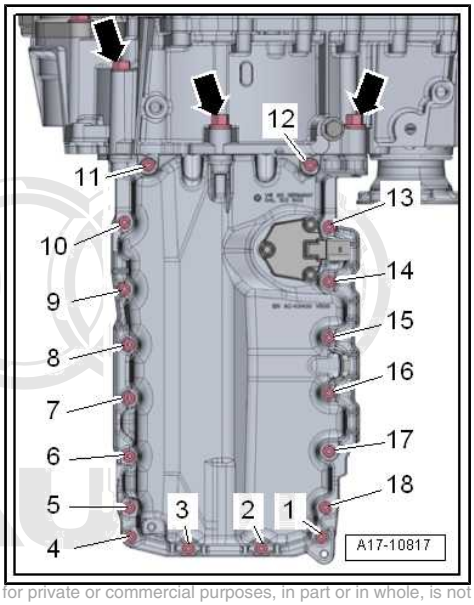
24 - Baffle plate

25 - Oil intake pipe

Sump - tightening torque and sequence

– Tighten bolts in stages as follows:

Stage	Bolts	Tightening torque
1.	-1 … 18-	5 Nm in diagonal sequence
2.	-arrows-	40 Nm
3.	-1 … 18-	Tighten in stages and in diagonal sequence; final torque 13 Nm



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1.1.2 Exploded view - sump (2-part)

1 - Valve for oil pressure control - N428-

- ❑ ⇒ “3.5 Removing and installing valve for oil pressure control N428 ”, page 158

2 - Bolt

- ❑ 8 Nm

3 - Guide tube for oil dipstick

4 - Bolt

- ❑ 8 Nm

5 - Bolt

- ❑ 8 Nm

6 - O-ring

- ❑ Renew after removing

7 - Baffle plate

8 - Sump (top section)

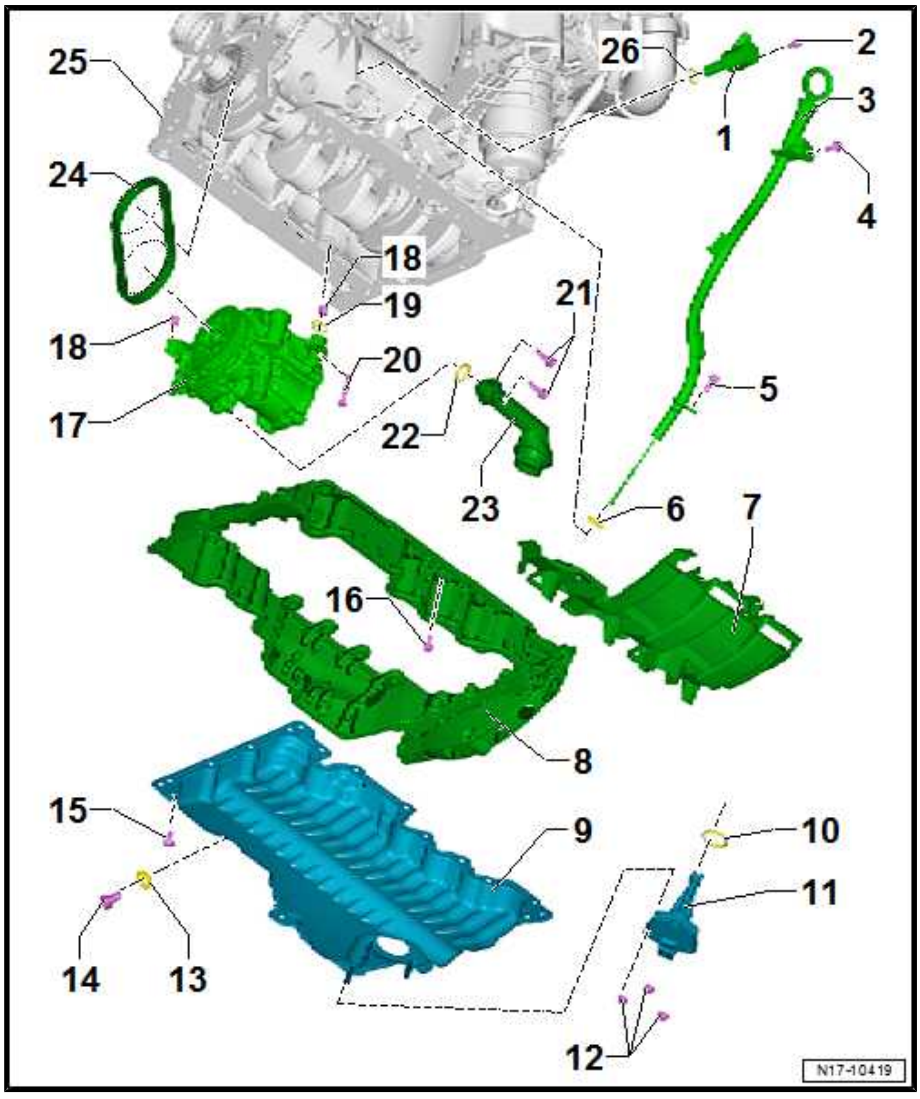
- ❑ ⇒ “1.1.5 Removing and installing sump (top section)”, page 146
- ❑ Tightening sequence and tightening torque ⇒ page 140

9 - Sump (bottom section)

- ❑ ⇒ “1.1.4 Removing and installing sump (bottom section)”, page 143
- ❑ Tightening sequence and tightening torque ⇒ page 140

10 - Seal

- ❑ Renew after removing



11 - Oil level and oil temperature sender - G266-

- ❑ Removing and installing ⇒ page 150

12 - Nut

- ❑ 9 Nm

13 - Seal

- ❑ Renew after removing

14 - Oil drain plug

- ❑ 30 Nm

15 - Bolt

- ❑ For sump (bottom section)
- ❑ Tightening sequence and tightening torque ⇒ page 140

16 - Bolt

- ❑ For sump (top section)
- ❑ Tightening sequence and tightening torque ⇒ page 140

17 - Oil pump

- ❑ With vacuum pump
- ❑ Removing and installing ⇒ page 149

18 - Dowel sleeve

19 - Seal

- ❑ Renew after removing

20 - Bolt

- ❑ Renew after removing

Note different bolts:

- ♦ Torx socket head bolt (12 Nm + 180°)
- ♦ External hexagon head bolt (10 Nm + 180°)

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21 - Bolt

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

22 - O-ring

- ❑ Renew after removing

23 - Oil intake pipe

24 - Toothed belt

- ❑ Do not kink or twist toothed belt, or allow it to be damaged on sharp edges
- ❑ Removing:

- ♦ ⇒ “1.2 Removing and installing oil pump”, page 149
- ♦ ⇒ “1.8 Removing and installing sealing flange (pulley end)”, page 48

25 - Cylinder block

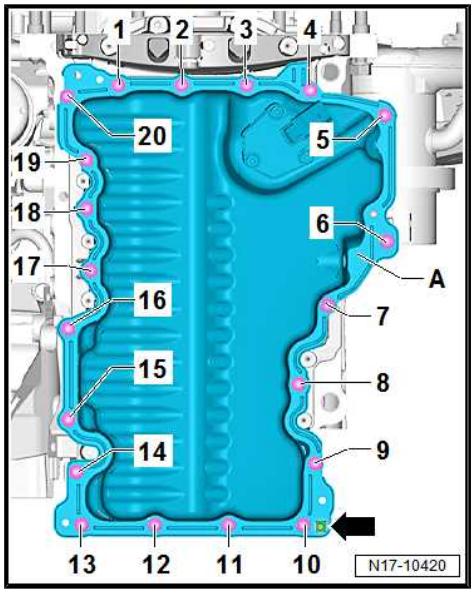
26 - O-ring

- ❑ Renew after removing

Sump (bottom section) - tightening torque and sequence

– Tighten bolts in stages as follows:

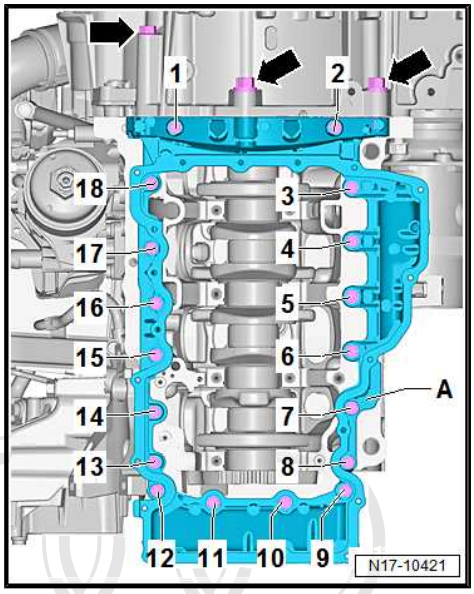
Stage	Bolts	Tightening torque
1.	-1 … 20-	Screw in by hand until contact is made
2.	-1 … 20-	12 Nm



Sump (top section) - tightening torque and sequence

– Tighten new bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 18-	Screw in by hand until contact is made
1.	-1 … 18-	8 Nm
2.	-1 … 18-	Turn 90° further



1.1.3 Removing and installing sump

Special tools and workshop equipment required

♦ Articulated wrench, 10 mm - 3185-



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♦ Socket - T10058-



♦ Electric drill with plastic brush

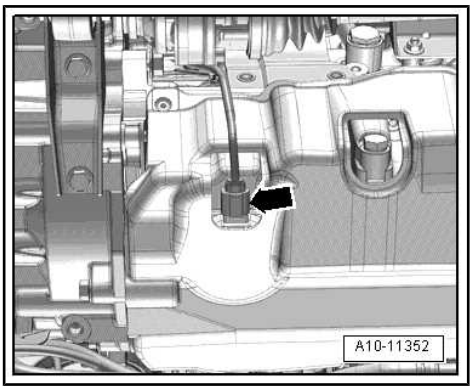
♦ Sealant ⇒ Electronic parts catalogue

♦ Safety goggles

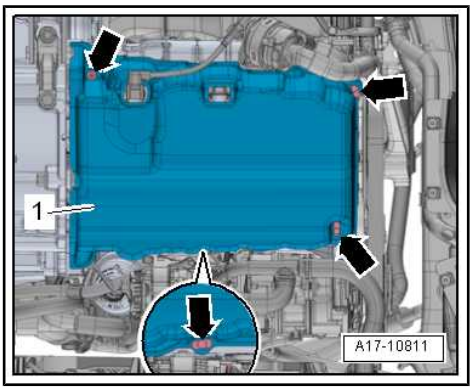
Removing

• Engine oil drained ⇒ Maintenance ; Booklet 820

– Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .

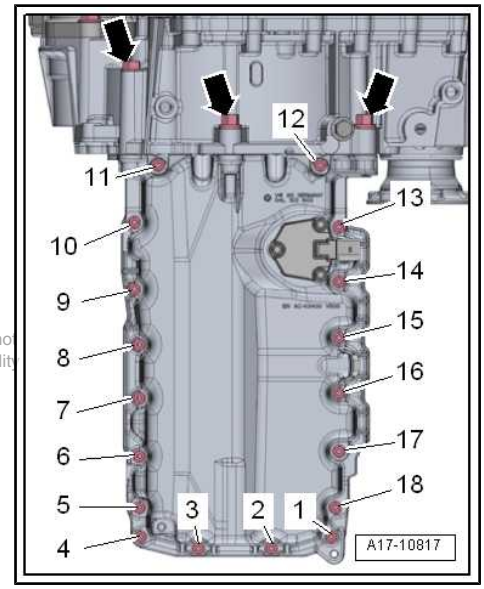


– Release clips -arrows- and detach noise insulation -1- for sump.



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– Remove bolts securing sump to gearbox -arrows-.
– Slacken bolts -1 ... 18- in diagonal sequence and remove.
– Carefully release sump from bonded joint.
• The illustration shows a vehicle with manual gearbox 02Q.



Installing

– Cover exposed parts of the engine with clean cloths.

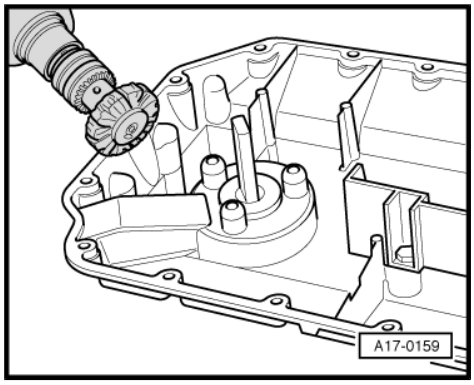
CAUTION

Risk of eye injury due to sealant residue.

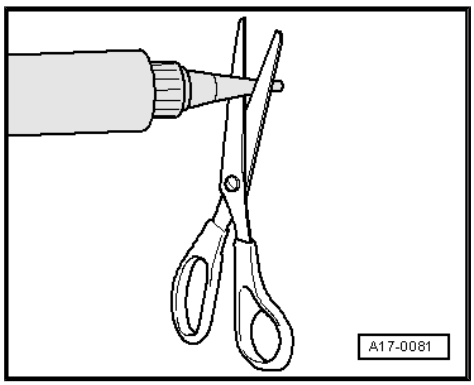
– Put on safety goggles.

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

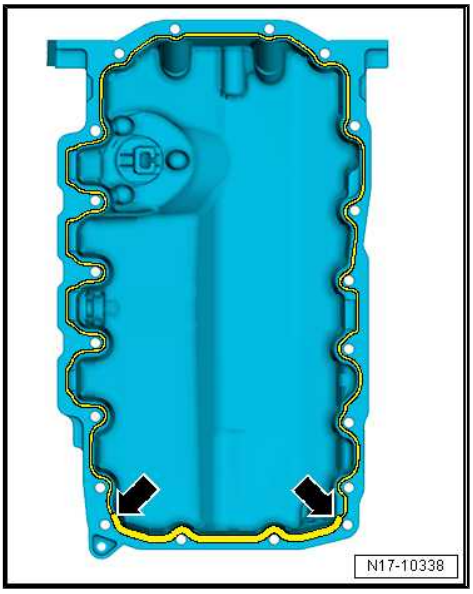


– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



If the sealing flange (pulley end) was NOT renewed:

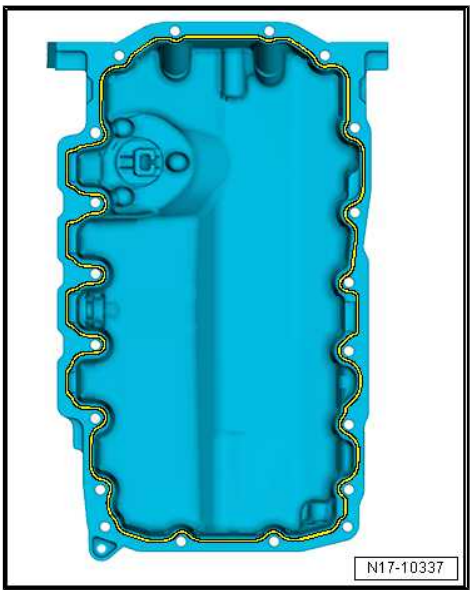
– Apply bead of sealant onto clean sealing surface of sump as illustrated.



- The lower surface of the sealing flange (pulley end) deviates from the lower surface of the cylinder block by approx. 1 mm after removal of the old silicone seal.
- This must be compensated for by applying an appropriate amount of sealant to the corresponding section of the sealing surface of the sump (top section).
- In area of sealing surface for sealing flange (pulley end) -arrows-: 3 ... 4 mm.
- In area of sealing surfaces for cylinder block and sealing flange (gearbox end): 2 ... 3 mm.
- The bead of sealant must be able to replace the silicone seal (no longer present) in the area of the sealing flange (pulley end) in both height and width.
- The sump (top section) must be installed within 5 minutes after applying sealant.

If the sealing flange (pulley end) was renewed:

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



- Thickness of sealant bead: 2 ... 3 mm

Continued for both procedures:

– Insert baffle plate.

– Fit sump and tighten bolts ⇒ page 138 .

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

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- 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.

– Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 820 .

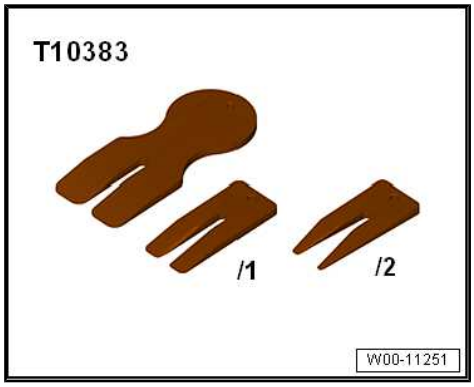
Tightening torques

◆ ⇒ Fig. ""Sump - tightening torque and sequence"" , page 138

1.1.4 Removing and installing sump (bottom section)

Special tools and workshop equipment required

- Wedge - T10383/2-



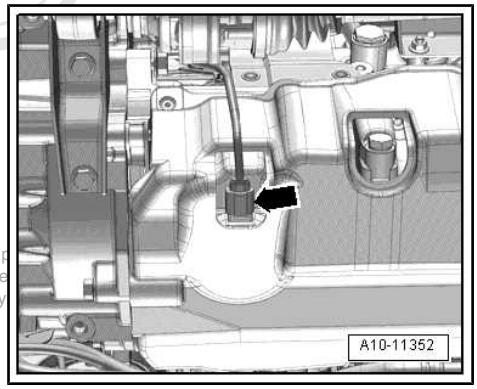
- Flat scraper
- Spatula (commercially available)
- Sealant remover
- Electric drill with plastic brush attachment
- Safety goggles
- Sealant ⇒ Electronic parts catalogue

Removing

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

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

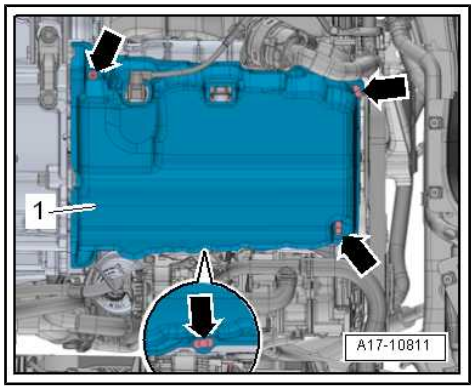
– Release and unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .



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– Release fasteners -arrows- and detach noise insulation -1- for sump.

– Drain off engine oil ⇒ Maintenance ; Booklet .



– Unscrew bolts -1- to -20- in diagonal sequence and remove.

– Screw one of the bolts for sump (bottom section) eight turns into threaded hole -arrow-.

Note

Joint bonding will separate audibly at approx. eight turns. If bolt is screwed in too far, this may cause distortion of the sump.

- Do not use excessive force when screwing in bolt.
- Do not bend sump (bottom section) when releasing from bonded joint.

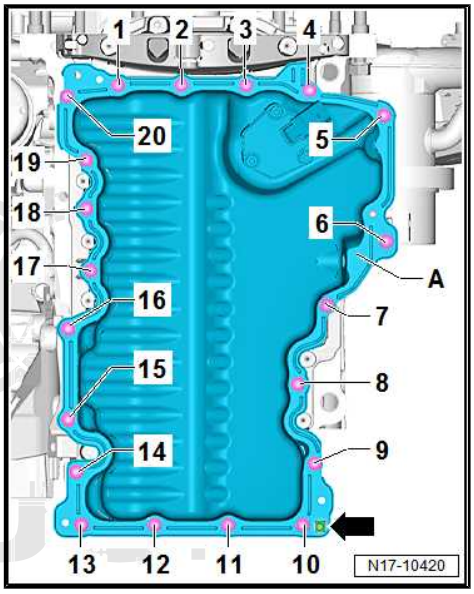
– Apply wedge - T10383/2- at point of release -arrow-.

– Apply wedge - T10383/2- so that inner V fits onto bolt.

– Carefully knock on wedge with a plastic hammer.

– Carefully release sump (bottom section) from bonded joint.

– Apply wedge - T10383/2- at different positions to further release bonded joint.



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Installing

– Check sump (bottom section) for distortion and re-align if necessary.

– Cover exposed parts of the engine with clean cloths.

– Spray sealing surface with sealant remover and wait for it to take effect.

– Remove sealant remaining on sump (top section) with flat scraper.

– Take care not to damage surface coating of sump (bottom section).

⚠ CAUTION

Risk of eye injury due to sealant residue.

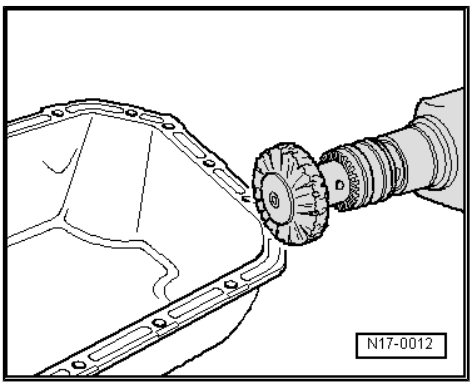
– Put on safety goggles.

– Remove sealant residue on sump (bottom section) using rotating plastic brush or similar.

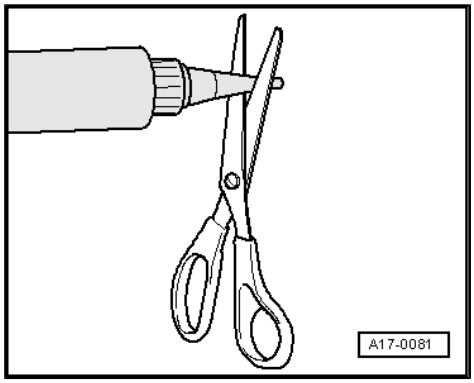
– Clean surfaces; they must be free of oil and grease.

– Take care not to damage coating of sump (bottom section).

- Note expiry date of sealant.



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

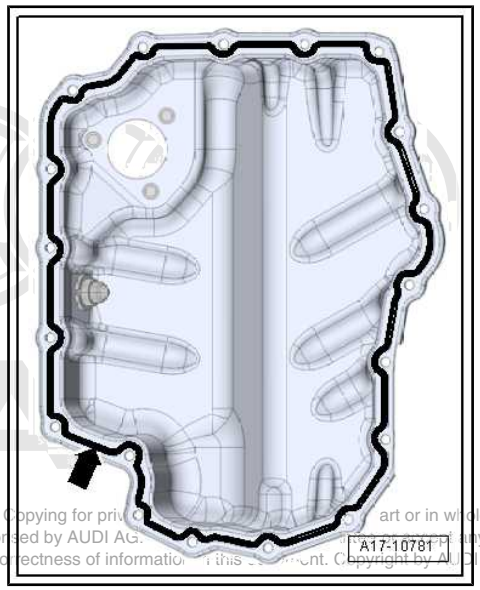


– Apply bead of sealant -arrow- onto clean sealing surface of sump (bottom section) as shown in illustration.

– Take particular care when applying sealant bead in area of sealing flange.

• Thickness of sealant bead: 2 ... 3 mm

– Install sump (bottom section) within 5 minutes of applying sealant and tighten bolts ⇒ page 140 .



After installing the sump (top section), wait about 30 minutes for the sealant to dry. Then (and only then) fill the engine with engine oil.

– Then fill with engine oil and check oil level ⇒ Maintenance ; Booklet 820 .

Tightening torques

♦ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

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

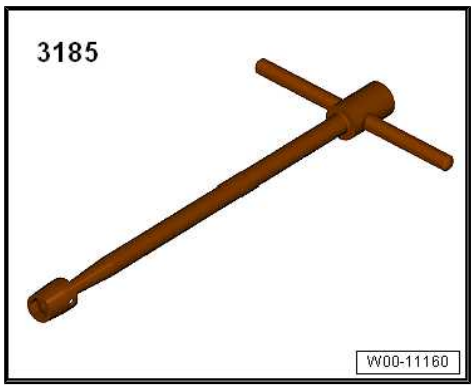
♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front)

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1.1.5 Removing and installing sump (top section)

Special tools and workshop equipment required

♦ Articulated wrench, 10 mm - 3185-



♦ Socket - T10058-



♦ Electric drill with plastic brush

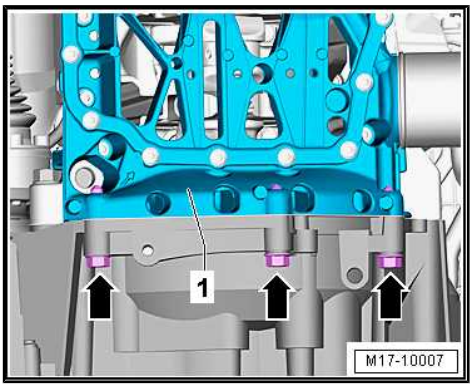
♦ Sealant ⇒ Electronic parts catalogue

♦ Safety goggles

Removing

– Remove sump (bottom section)
⇒ “1.1.4 Removing and installing sump (bottom section)”, page 143 .

– Remove bolts -arrows- securing gearbox to sump (top section) -1-.



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– Unscrew bolts -1- to -18- in diagonal sequence and remove.

– Carefully release sump (top section) from bonded joint.

– Detach baffle plate.

Installing

⚠ CAUTION

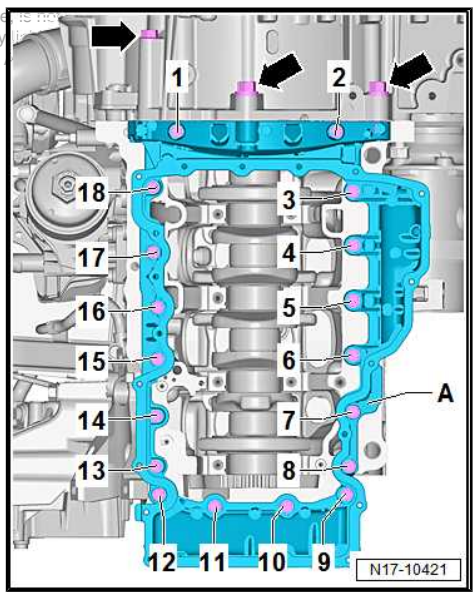
Risk of eye injury due to sealant residue.
– Put on safety goggles.

– Cover exposed parts of the engine to protect against dirt.

– Remove remaining sealant from cylinder block and sump (top section) using chemical sealant remover (commercially available).

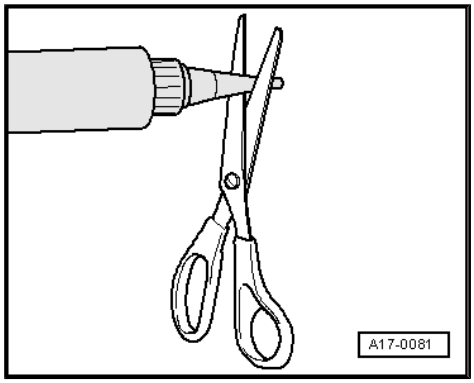
– Clean sealing surfaces; they must be free of oil and grease.

• Note expiry date of sealant.



– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2 ... 3 mm).

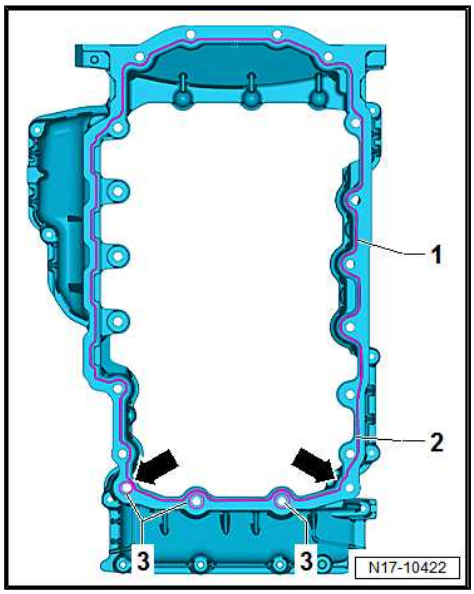
- Make sure lubrication system is not clogged by excess sealant.
- The sealant bead must not be thicker than specified.



If sealing flange (pulley end) was not renewed:

– Apply bead of sealant -2- onto clean sealing surface of sump (top section) -1-, as shown in illustration.

- The lower surface of the sealing flange (pulley end) deviates from the lower surface of the cylinder block by approx. 1 mm after removal of the old silicone seal.
- This must be compensated for by applying an appropriate amount of sealant to the corresponding section of the sealing surface of the sump (top section).
- Circle 3 … 4 mm around holes when applying sealant in area of the 4 holes between the -arrows-.
- In area of sealing surface for sealing flange (pulley end) -between the arrows-: 3 ... 4 mm.
- In area of sealing surfaces for cylinder block and sealing flange (gearbox end): 2 ... 3 mm.
- The bead of sealant must be able to replace the silicone seal (no longer present) in the area of the sealing flange (pulley end) in both height and width.
- The sump (top section) must be installed within 5 minutes after applying sealant.

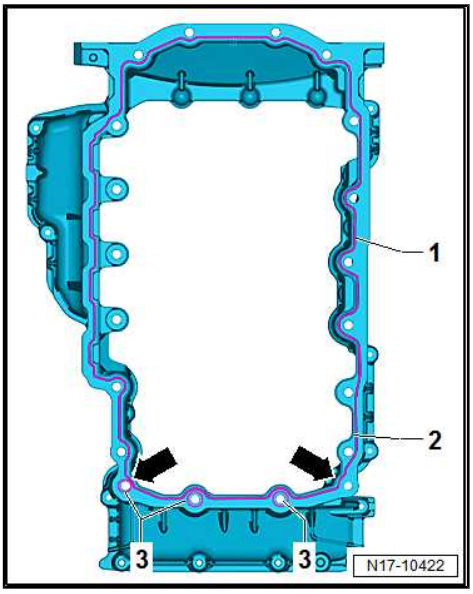


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If sealing flange (pulley end) was renewed:

– Apply bead of sealant -2- evenly onto clean sealing surface of sump (top section) -1-, as shown in illustration.

- Circle 2 … 3 mm around holes when applying sealant in area of the 4 holes between the -arrows-.
- Thickness of sealant bead: 2 ... 3 mm.
- The sump (top section) must be installed within 5 minutes after applying sealant.



Continued for both procedures:

– Install baffle plate.

– Fit sump (top section) and tighten bolts ⇒ page 140 .

- The sump (top section) must make flush contact with intermediate plate/gearbox flange.
- The sump (top section) must make flush contact with intermediate plate/gearbox flange.
- The three bolts -10- to -12- have a special protective paint coating and must be installed in the correct position.
- When installing the sump (top section) with the engine out of the vehicle, ensure that the sump (top section) is flush with the cylinder block at the flywheel end.
- After installing the sump (top section), wait about 30 minutes for the sealant to dry. Then (and only then) fill the engine with engine oil.

– Then fill with engine oil and check oil level ⇒ Maintenance ; Booklet 820 .

Tightening torques

◆ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

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

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

1.2 Removing and installing oil pump

Removing

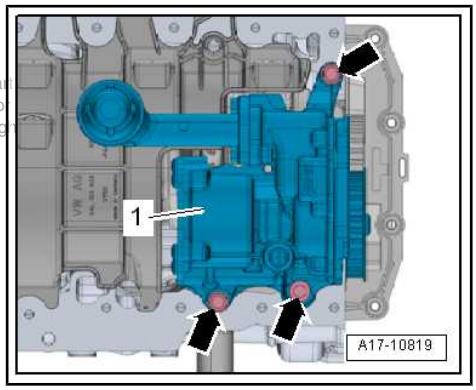
– Remove sump (refer to appropriate chapter).

◆ ⇒ “1.1.1 Exploded view - sump (1-part)”, page 136

◆ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

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

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



Installing

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

- Renew seal.
- Renew bolts tightened with specified tightening angle.

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

– Install sump (refer to appropriate chapter).

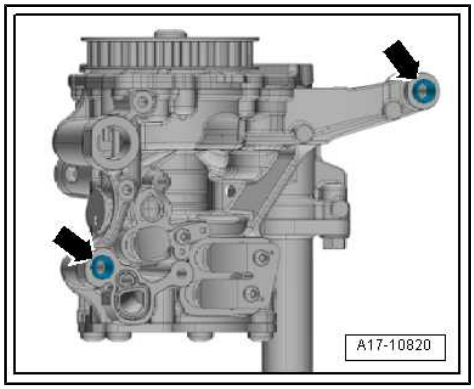
◆ ⇒ “1.1.1 Exploded view - sump (1-part)”, page 136

◆ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

Tightening torques

◆ ⇒ “1.1.1 Exploded view - sump (1-part)”, page 136

◆ ⇒ “1.1.2 Exploded view - sump (2-part)”, page 138

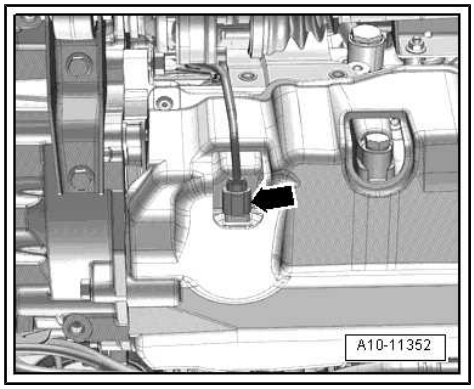


1.3 Removing and installing oil level and oil temperature sender - G266-

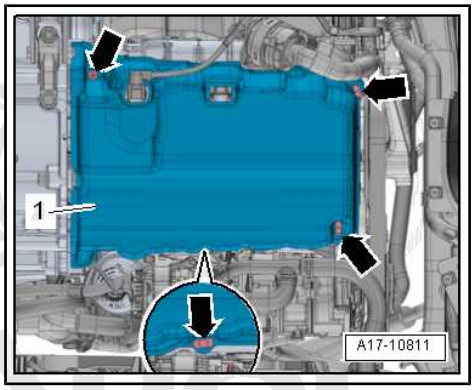
Removing

• Engine oil drained ⇒ Maintenance ; Booklet 820

– Unplug electrical connector -arrow- at oil level and oil temperature sender - G266- .



– Release fasteners -arrows- and detach noise insulation -1- for sump.



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– Remove bolts -1- and detach oil level and oil temperature sender - G266- -item 3- with seal -4-.

Installing

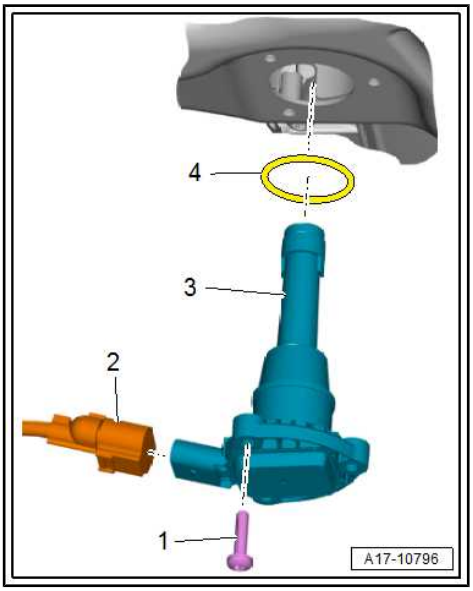
Installation is carried out in the reverse order; note the following:

– Renew seal -4- and self-locking bolts -1-.

– Fill with engine oil and check oil level ⇒ Maintenance ; Booklet 820 .

Tightening torques

◆ ⇒ “1.1 Exploded view - sump/oil pump”, page 136



1.4 Engine oil

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

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2 Engine oil cooler

Note

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 154* *.*

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3 Oil filter/oil pressure switches

⇒ “3.1 Exploded view - oil filter housing/oil pressure switches”, page 153

⇒ “3.2 Removing and installing oil filter housing”, page 154

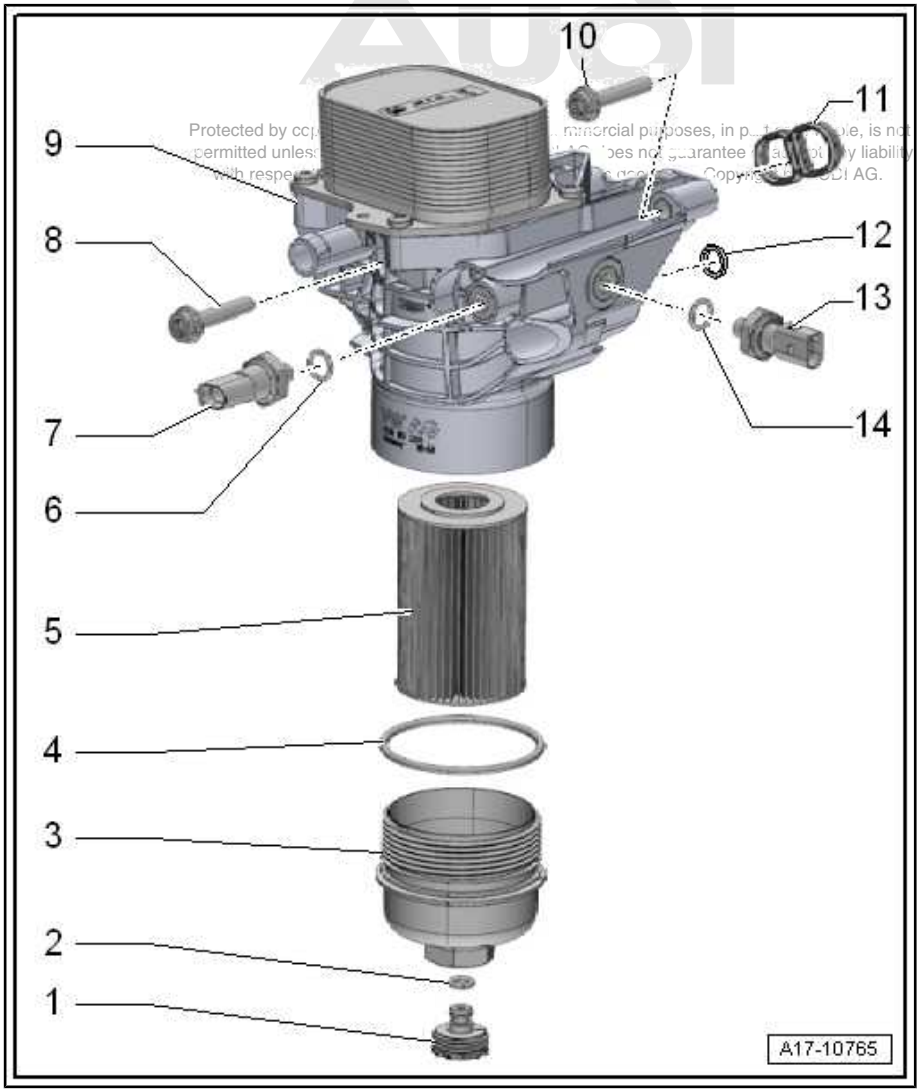
⇒ “3.3 Removing and installing oil pressure switch F22 ”, page 156

⇒ “3.4 Removing and installing oil pressure switch for reduced oil pressure F378 ”, page 157

⇒ “3.5 Removing and installing valve for oil pressure control N428 ”, page 158

⇒ “3.6 Checking oil pressure”, page 158

3.1 Exploded view - oil filter housing/oil pressure switches



1 - Oil drain plug
- ❑ 5 Nm

2 - O-ring
- ❑ Renew after removing

3 - Sealing cap
- ❑ 25 Nm

4 - O-ring
- ❑ Renew after removing
- ❑ Lubricate lightly with engine oil

5 - Oil filter element
- ❑ Removing and installing ⇒ Maintenance ; Booklet 820

6 - Seal
- ❑ Captive, in event of leak renew oil pressure switch

7 - Oil pressure switch - F22-
- ❑ Opening/closing pressure 2.5 ... 3.2 bar
- ❑ Brown insulation
- ❑ Removing and installing ⇒ page 156
- ❑ 20 Nm

8 - Bolt
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 154

9 - Oil filter housing with engine oil cooler
- ❑ Do not separate oil filter housing and engine oil cooler
- ❑ Removing and installing ⇒ page 154

10 - Bolt
- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 154

11 - Gasket

- ❑ Renew after removing

12 - O-ring

- ❑ Renew after removing

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

- ❑ Opening/closing pressure 0.3 ... 0.6 bar
- ❑ Green insulation
- ❑ Check in `Guided Fault Finding` ⇒ Vehicle diagnostic tester
- ❑ Removing and installing ⇒ page 157
- ❑ 20 Nm

14 - Seal

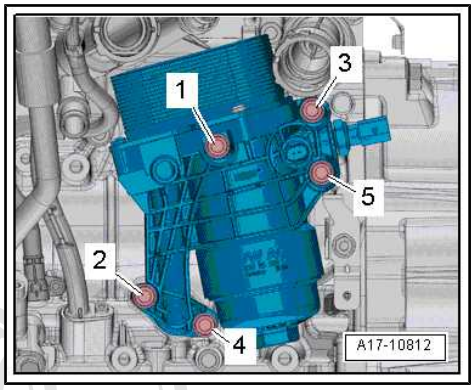
- ❑ Captive, in event of leak renew oil pressure switch

Oil filter housing - tightening torque and sequence

– Fit new bolts at top left and bottom right first.

– Tighten bolts in stages in the sequence shown:

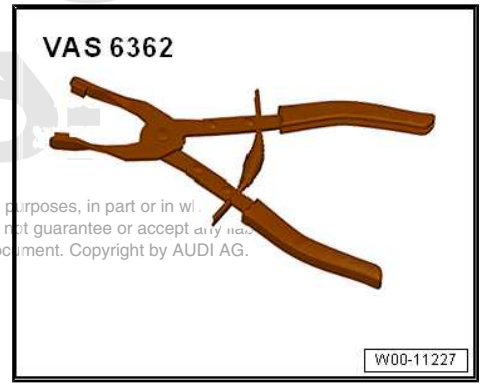
Stage	Bolts	Tightening torque/angle specification
1.	-1 … 5-	20 Nm
2.	-1 … 5-	Turn 90° further



3.2 Removing and installing oil filter housing

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



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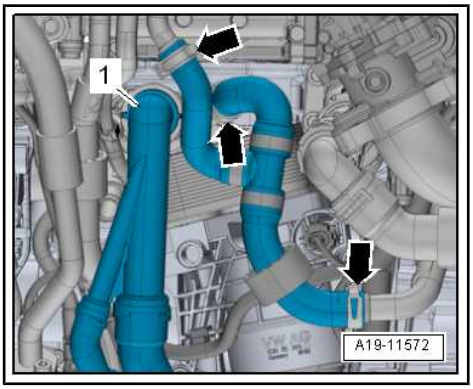
Removing

– Remove air cleaner housing ⇒ page 237 .

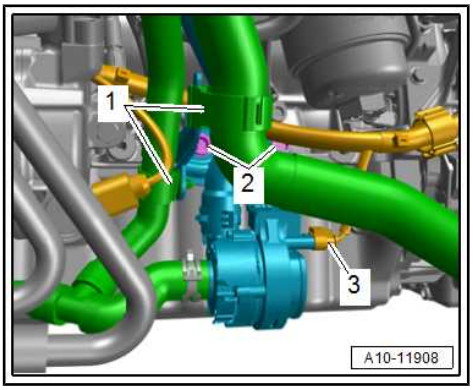
– Remove radiator cowl ⇒ page 202 .

– Remove coolant pipe (front left) ⇒ page 187 .

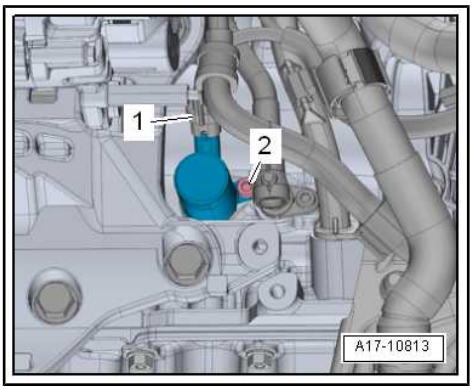
– Loosen hose clips -arrows- and remove air hoses.



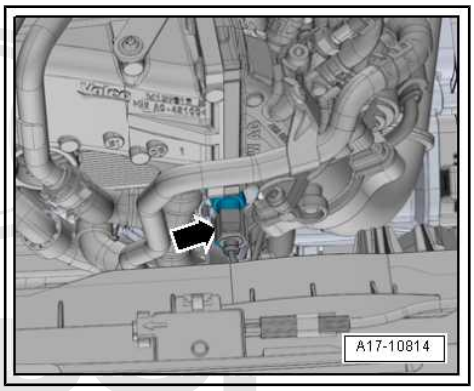
– Unplug electrical connector -3-.
– Move coolant hoses -1- clear.
– Remove bolts -2- and press charge air cooling pump - V188- to side.



– Unplug electrical connector -1- at valve for oil pressure control - N428- .

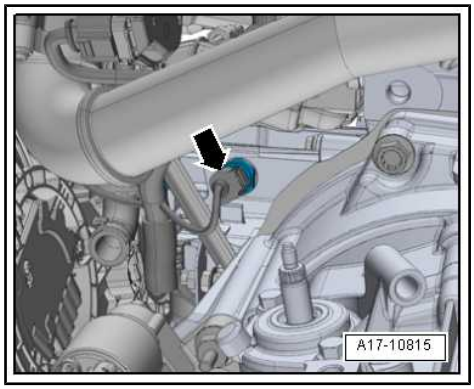


– Unplug electrical connector -arrow- on oil pressure switch - F22- .



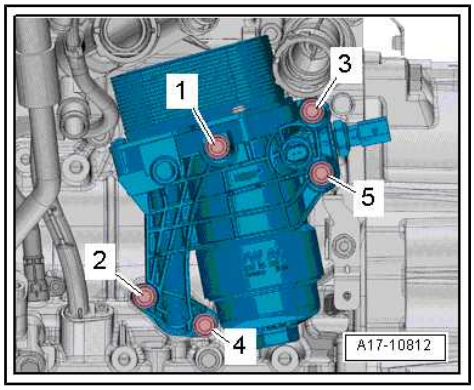
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– Unplug electrical connector -arrow- at oil pressure switch for reduced oil pressure - F378- .



– 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 the reverse order; note the following:

- Renew seal and O-ring.
- Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

– Install radiator cowl ⇒ page 202 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

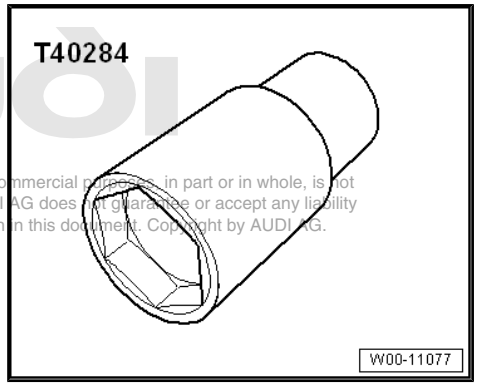
Tightening torques

- ⇒ “3.1 Exploded view - oil filter housing/oil pressure switches”, page 153
- ⇒ “2.2 Exploded view - electric coolant pump”, page 173
- ⇒ “3.1 Exploded view - coolant pipes”, page 183
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236

3.3 Removing and installing oil pressure switch - F22-

Special tools and workshop equipment required

- Socket, AF 24 mm - T40284-

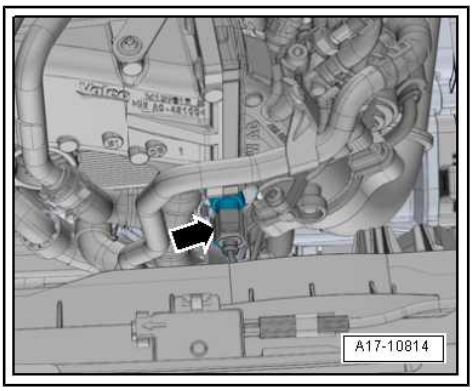


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♦ Torque wrench with ratchet - V.A.G 1331/1-

Removing

– Remove engine cover panel ⇒ page 40 .
– Remove air cleaner housing ⇒ page 237 .
– Unplug electrical connector -arrow-.
– Place a cloth underneath to catch escaping engine oil.
– Unscrew oil pressure switch - F22- .



Installing

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

• Renew seal.
– Install engine cover panel ⇒ page 40 .
– Check oil level ⇒ Maintenance ; Booklet 820 .

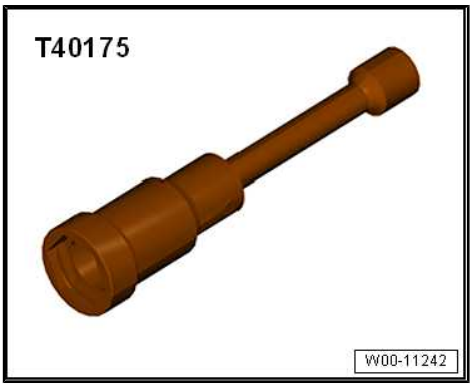
Tightening torques

♦ ⇒ “3.1 Exploded view - oil filter housing/oil pressure switches”, page 153
♦ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

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

Special tools and workshop equipment required

♦ Articulated wrench, 24 mm - T40175-

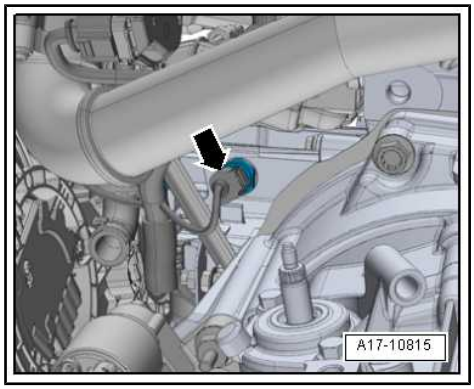


Removing

– Remove air cleaner housing ⇒ page 237 .
– Remove charge air pipe.

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– Unplug electrical connector -arrow-.
– Place a cloth underneath to catch escaping engine oil.
– Unscrew oil pressure switch for reduced oil pressure - F378- .



Installing

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

• Renew seal.
– Check oil level ⇒ Maintenance ; Booklet 820 .

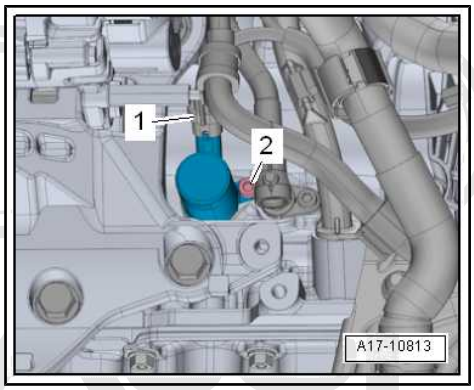
Tightening torques

♦ ⇒ “3.1 Exploded view - oil filter housing/oil pressure switches”, page 153
♦ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

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

Removing

– Remove poly V-belt ⇒ page 44 .
– Remove air conditioner compressor from bracket with refrigerant lines still attached and tie up to right side ⇒ 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 the reverse order; note the following:

• Renew O-ring.
– Install poly V-belt ⇒ page 44 .
– Check oil level ⇒ Maintenance ; Booklet 820 .

Tightening torques

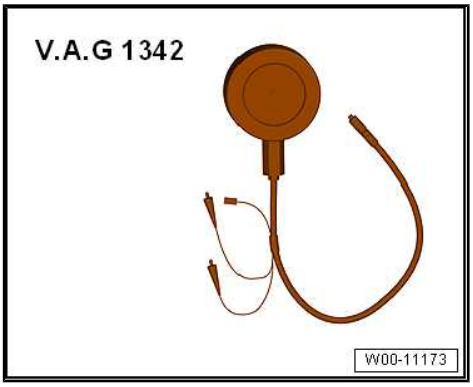
♦ ⇒ “1.1 Exploded view - sump/oil pump”, page 136
♦ ⇒ Rep. gr. 87 ; Air conditioner compressor; Exploded view - air conditioner compressor drive unit

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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 - F22- ⇒ page 156 .

– Connect oil pressure tester - V.A.G 1342- to threaded hole for oil pressure switch - F22- .

– 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 ⇒ “1.2 Removing and installing oil pump”, page 149 .

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

– Let engine warm up.

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`.

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– 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` on the Select 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 (checking the oil pressure valve changeover) 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”, page 160

⇒ “1.3 Draining and filling cooling system”, page 163

⇒ “1.2 Checking cooling system for leaks”, page 161

1.1 Connection diagram - coolant hoses

Note

- *Blue = Large coolant circuit.*
- *Red = Small coolant circuit.*
- *Violet = Coolant circuit for charge air cooler.*
- *Brown = Heating circuit.*
- *Arrows show direction of coolant flow.*

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1 - Water radiator for charge air cooling circuit

2 - Charge air cooler

3 - Restrictor

4 - Non-return valve

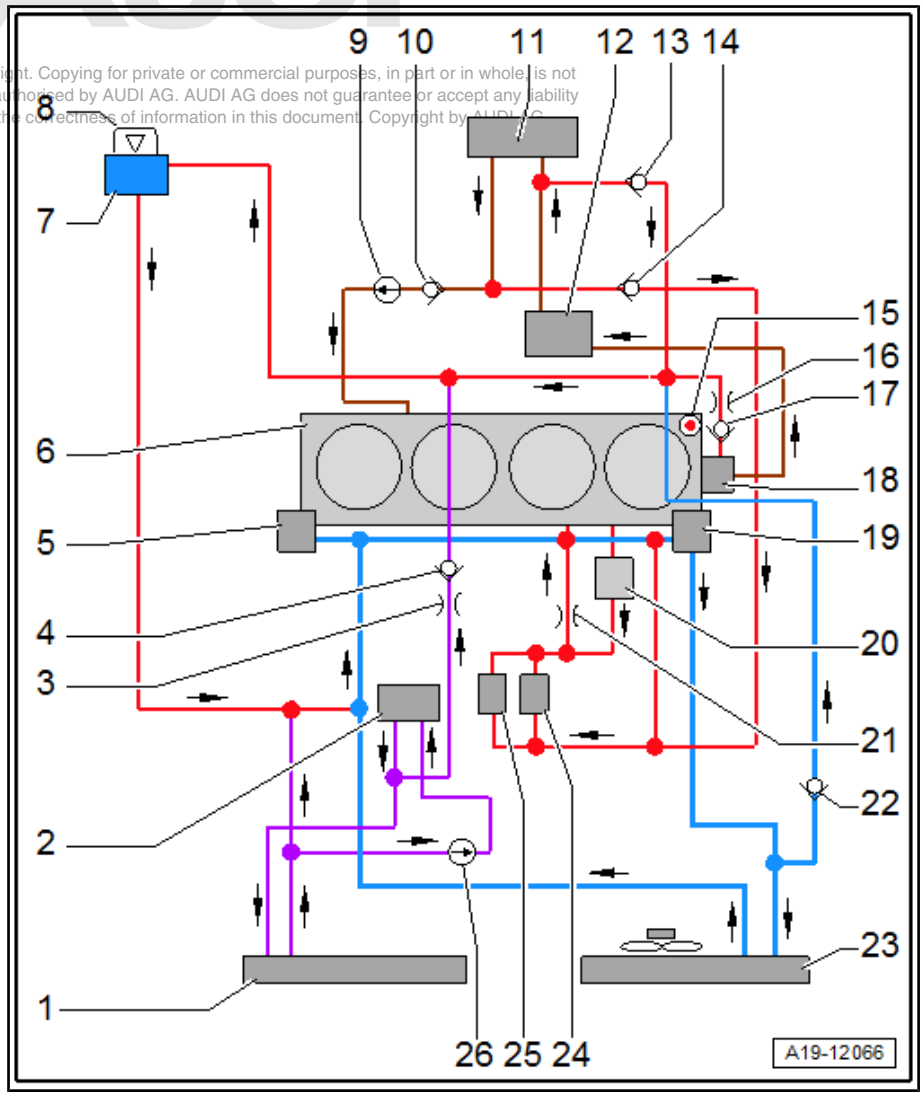
5 - Coolant pump

6 - Cylinder head/cylinder block

7 - Coolant expansion tank

8 - Filler cap

- ❑ For coolant expansion tank
- ❑ Checking pressure relief valve ⇒ page 163

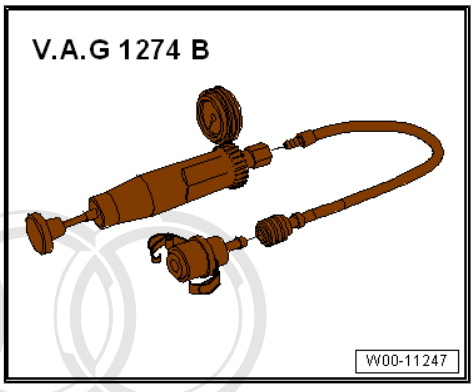


9 - Auxiliary pump for heating - V488-
10 - Non-return valve
11 - Heat exchanger for heater
12 - Exhaust gas recirculation cooler
13 - Non-return valve
14 - Non-return valve
15 - Coolant temperature sender - G62-
16 - Restrictor
17 - Non-return valve
18 - Coolant connection
19 - Thermostat
20 - Engine oil cooler
21 - Restrictor
22 - Non-return valve
23 - Radiator
24 - Throttle valve module - J338-
25 - Exhaust gas recirculation control motor - V338-
26 - Charge air cooling pump - -

1.2 Checking cooling system for leaks

Special tools and workshop equipment required

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

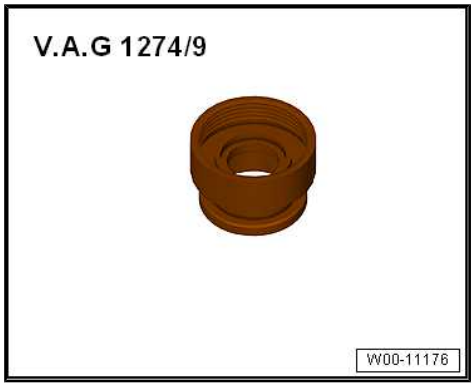


- Adapter for cooling system tester - V.A.G 1274/8-



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♦ Adapter for cooling system tester - V.A.G 1274/9-



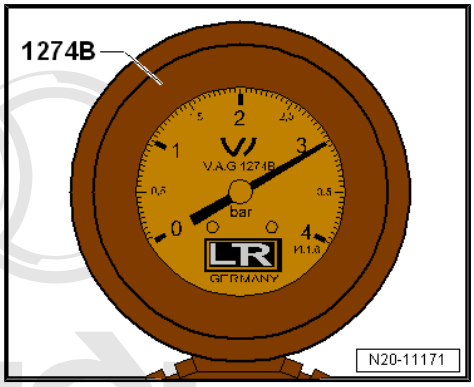
- To ensure that the leak test is carried out correctly, a self-test must first be performed on the cooling system tester - V.A.G 1274 B- .

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.

CAUTION

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

Danger of scalding skin and other parts of the body.

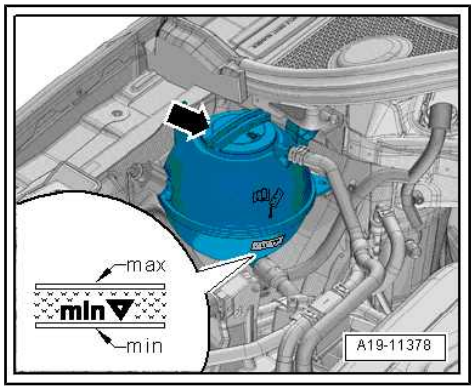
– Put on protective gloves.

– Put on safety goggles.

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

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

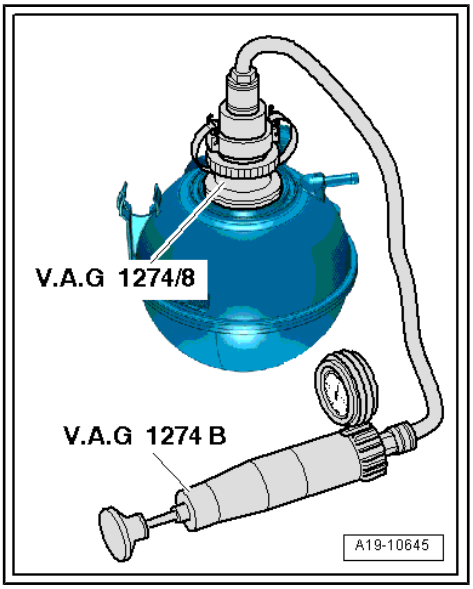


– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
– Using hand pump on cooling system tester, build up a pressure of approx. 1.5 bar.

• The pressure should not drop more than 0.2 bar within 10 minutes.
• 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.
– If no leaks can be found, check for leaks in water-cooled charge air cooler and exhaust gas recirculation cooler.



Checking pressure relief valve in filler cap

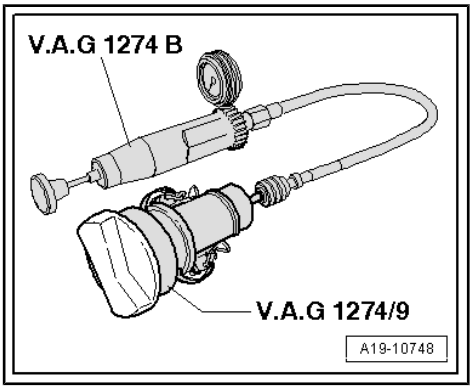
– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
– Build up pressure with hand pump on cooling system tester.

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.



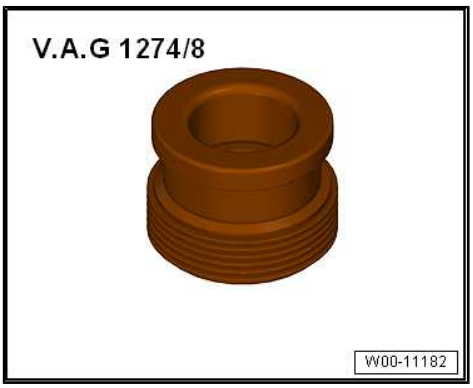
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– Renew filler cap if pressure relief valve does not open as described.

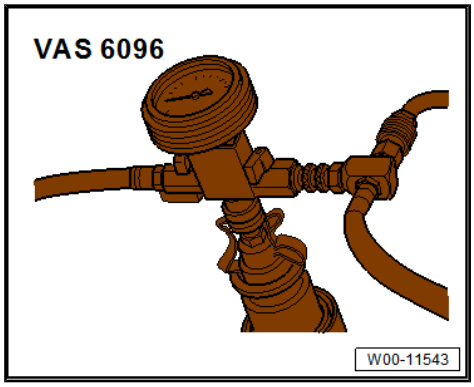
1.3 Draining and filling cooling system

Special tools and workshop equipment required

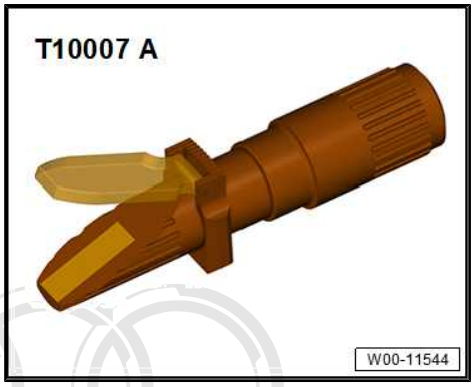
♦ Vehicle diagnostic tester
♦ Adapter for cooling system tester - V.A.G 1274/8-



- Cooling system charge unit - VAS 6096-



- Refractometer - T10007A-

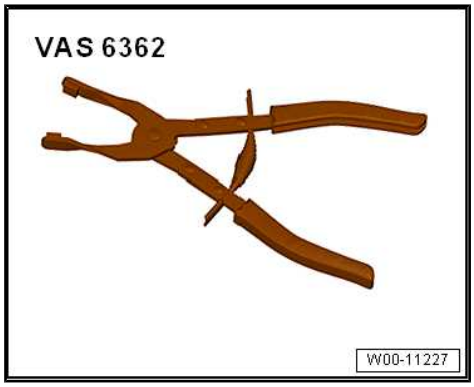


- Coolant collecting system - VAS 5014- or drip tray for workshop hoist - VAS 6208-



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- Hose clip pliers - VAS 6362-



- Safety goggles
- Protective gloves

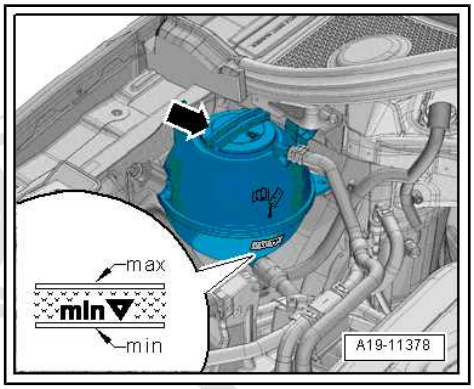
Draining

CAUTION

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

Danger of scalding skin and other parts of the body.

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



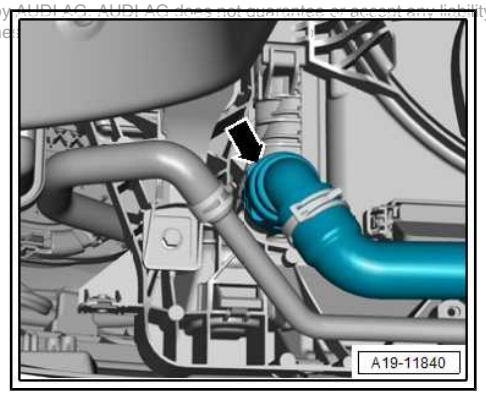
– Open filler cap -arrow- on coolant expansion tank.

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

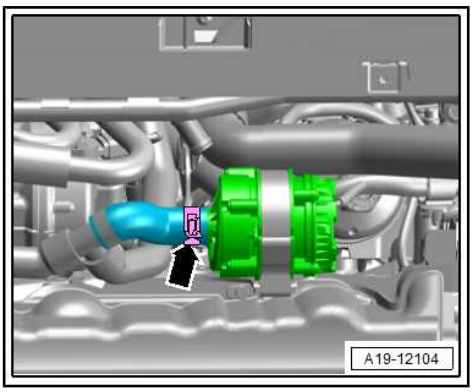
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– Place drip tray for workshop hoist - VAS 6208- underneath.

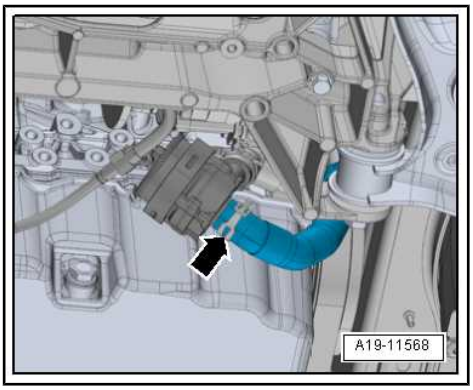
– Lift retaining clip -arrow-, disconnect coolant hose from radiator (bottom left) and drain off coolant.



– Release hose clip -arrow-, disconnect coolant hose (bottom) from charge air cooling pump - V188- and drain off coolant.



– Release hose clip -arrow-, disconnect coolant hose (bottom) from auxiliary pump for heating - V488- and drain off coolant.

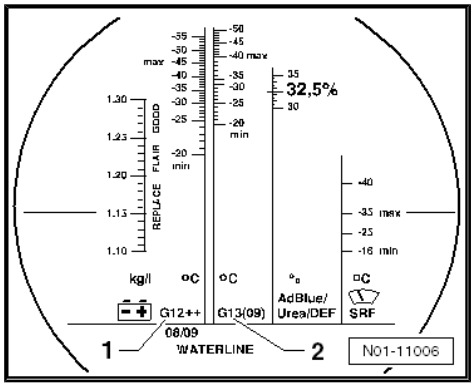


Filling and bleeding coolant circuit:

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

- **After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.**



Note

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

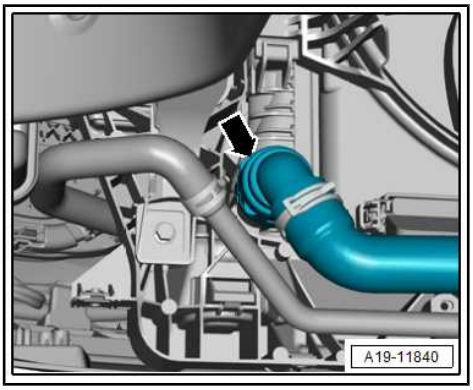
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Recommended mixture ratio for coolant

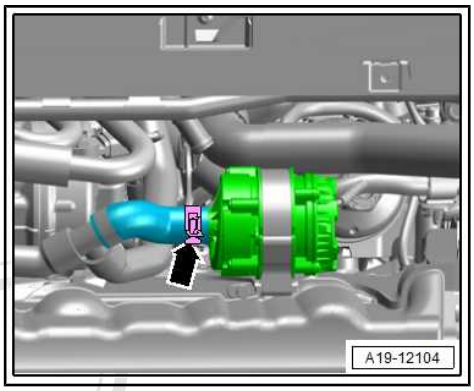
- Coolant (40 %) and distilled water (60 %) for frost protection to -25 °C
- Coolant (50 %) and distilled water (50 %) for frost protection to -36 °C
- Coolant ⇒ Electronic parts catalogue (ETKA)

Only if coolant has been drained off:

– Connect coolant hose with plug-in connector -arrow- to radiator (bottom left) ⇒ page 196 .

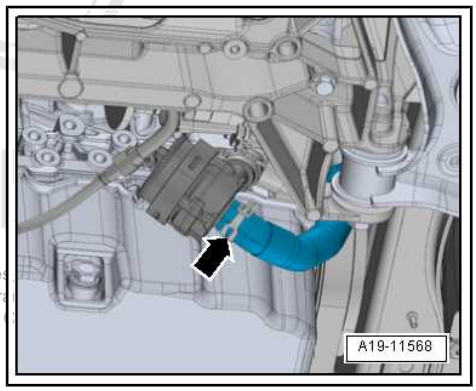


– Connect coolant hose to charge air cooling pump - V188- (bottom) with hose clip -arrow-.



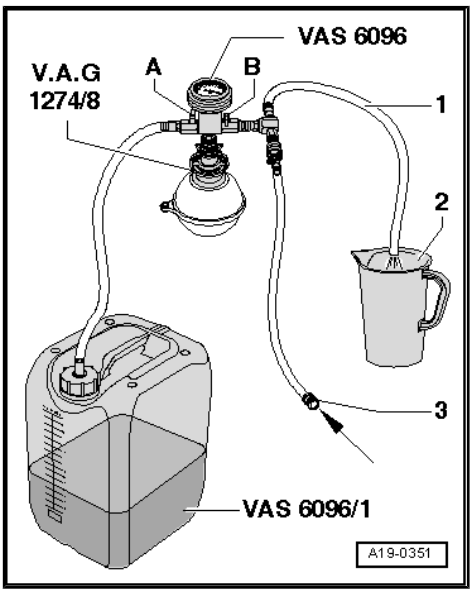
– Connect coolant hose to auxiliary pump for heating - V488- (bottom) with hose clip -arrow-.

To fill up with coolant:



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– Fill reservoir of -VAS 6096- with at least 8 litres of premixed coolant (according to recommended ratio):
– Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
– Attach cooling system charge unit - VAS 6096- to adapter - V.A.G 1274/8- .
– Run vent hose -1- into a small container -2-.
– Close both valves -A- and -B- (turn lever at right angles to direction of flow).
– Connect hose -3- to compressed air supply.
• Pressure: 7 ... 10 bar.



– Open valve -B- by setting lever in direction of flow.

• The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.

– Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.

– Close valve -A- again.

– Leave valve -B- open for another 2 minutes.

• The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.

– Close valve -B-.

• The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

• If the needle does not reach the green zone, repeat the process.

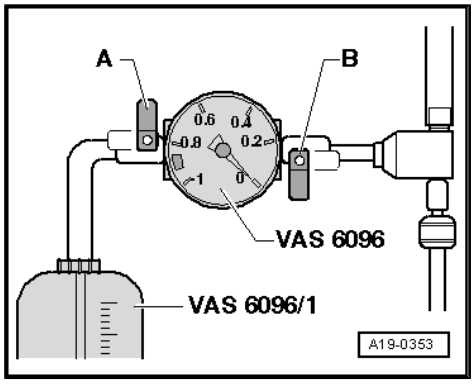
• Check cooling system for leaks if the vacuum is not maintained.

– Detach compressed air hose.

– Open valve -A-.

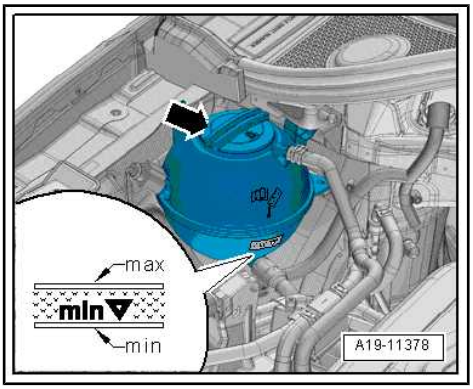
• The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.

– Detach cooling system charge unit - VAS 6096- from coolant expansion tank.



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– Top up coolant to “max” mark.



– All hose connections and air pipes and hoses must be free of oil and grease before assembly.
– Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Set temperature to “HI”.
– Switch off air conditioner compressor (press AC button).
• LED in button should not light up.
– Set fresh air blower to lowest setting.

Filling and bleeding coolant circuit:

– Switch on ignition and 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 - Coolant circuit charge`

– Follow instructions shown on ⇒ Vehicle diagnostic tester.

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Check coolant level.

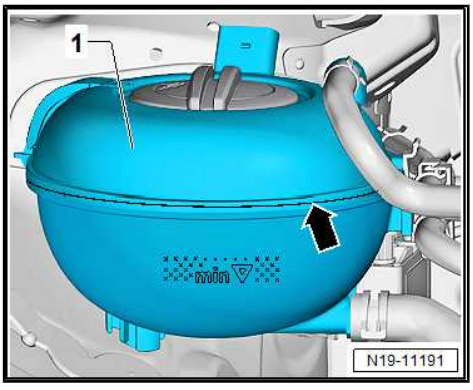
⚠ CAUTION

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

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.

– The coolant level must not be above the -seam- -arrow- when the engine is warm.



– The coolant level should be about 5 mm above the MAX mark -arrow- when the engine is cold.



Note

The increased coolant level is necessary as the coolant level can drop during the bleeding process.

– Top up with coolant again if necessary.

– Erase event memory ⇒ Vehicle diagnostic tester.

– Install engine cover panel ⇒ page 40 .

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2 Coolant pump/thermostat assembly

⇒ “2.1 Exploded view - coolant pump/thermostat”, page 171

⇒ “2.2 Exploded view - electric coolant pump”, page 173

⇒ “2.3 Exploded view - coolant temperature senders”, page 174

⇒ “2.4 Removing and installing electric coolant pump”, page 174

⇒ “2.5 Removing and installing coolant pump”, page 178

⇒ “2.6 Removing and installing thermostat”, page 178

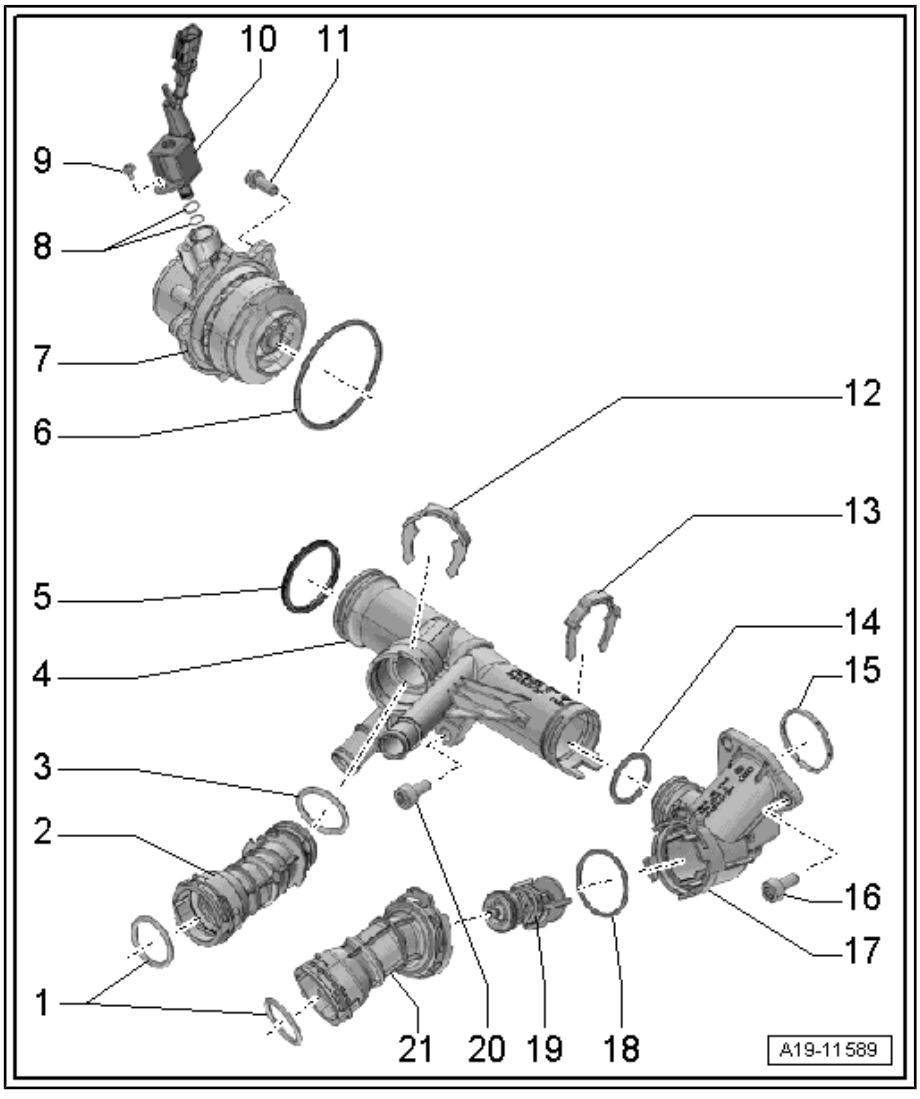
⇒ “2.7 Removing and installing coolant valve for cylinder head N489”, page 180

⇒ “2.8 Checking thermostat”, page 180

⇒ “2.9 Removing and installing coolant temperature sender G62”, page 180

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2.1 Exploded view - coolant pump/thermostat



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

2 - Connection

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

4 - Coolant pipe (bottom front)
- ❑ Removing and installing ⇒ page 185

5 - Seal
- ❑ Renew after removing

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

7 - Coolant pump
- ❑ Removing and installing ⇒ page 178

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

9 - Bolt
- ❑ 8 Nm

10 - Coolant valve for cylinder head - N489-
- ❑ Removing and installing ⇒ page 180

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

12 - Retaining clip

- ❑ Check that it is securely seated

13 - Retaining clip

- ❑ Check that it is securely seated

14 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

15 - Seal

- ❑ Renew after removing

16 - Bolt

- ❑ 20 Nm

17 - Thermostat housing

18 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

19 - Thermostat

- ❑ Removing and installing ⇒ page 178

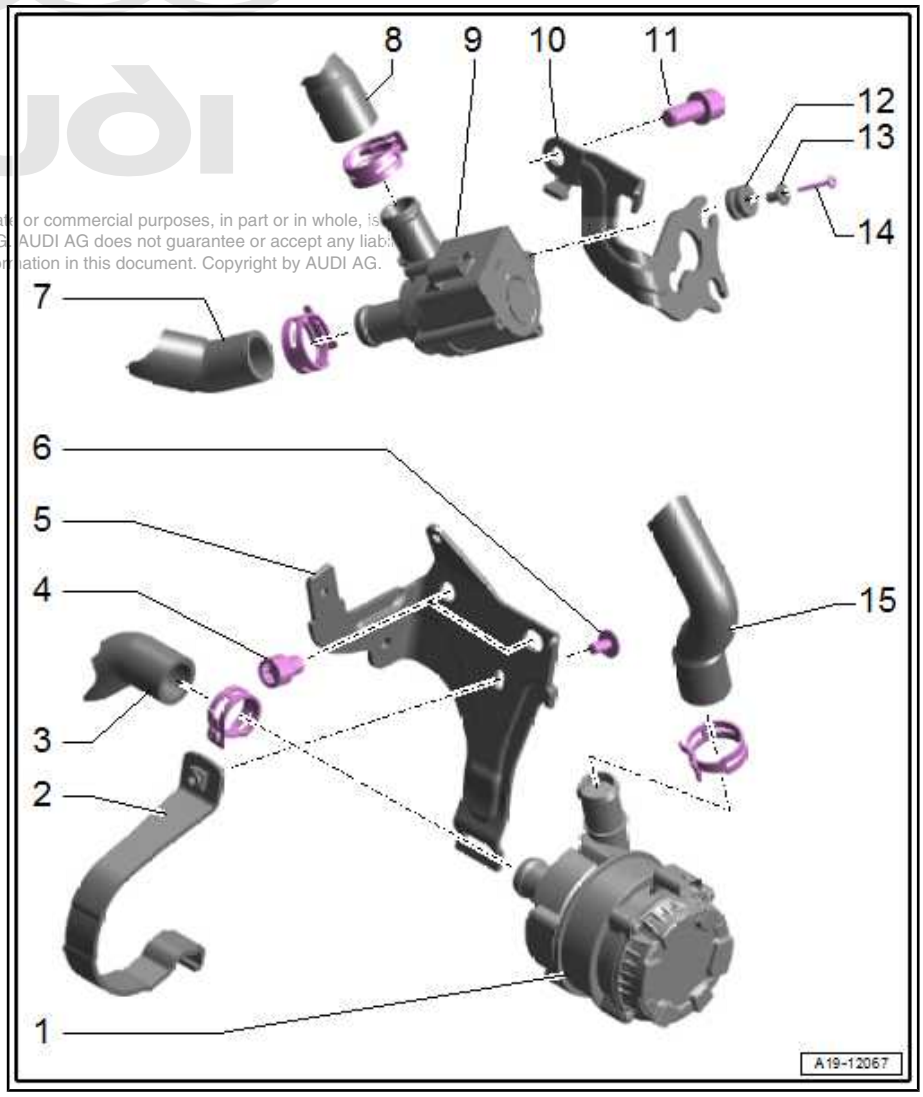
20 - Bolt

- ❑ 20 Nm

21 - Connection

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2.2 Exploded view - electric coolant pump



1 - Charge air cooling pump - V188-

- ❑ Removing and installing ⇒ page 174

2 - Retaining bracket

3 - Coolant hose

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4 - Bolt

- ❑ 40 Nm

5 - Bracket

- ❑ For charge air cooling pump - V188-

6 - Bolt

- ❑ 9 Nm

7 - Coolant hose

8 - Coolant hose

9 - Auxiliary pump for heating - V488-

- ❑ Removing and installing ⇒ page 176

10 - Bracket

- ❑ For auxiliary pump for heating - V488-

11 - Bolt

- ❑ 40 Nm

12 - Grommet

13 - Spacer bush

14 - Bolt

- ❑ 2.7 Nm

15 - Coolant hose

2.3 Exploded view - coolant temperature senders

1 - Coolant temperature sender - G62-

- ❑ Removing and installing ⇒ page 180

2 - Spacer ring

- ❑ Renew if damaged

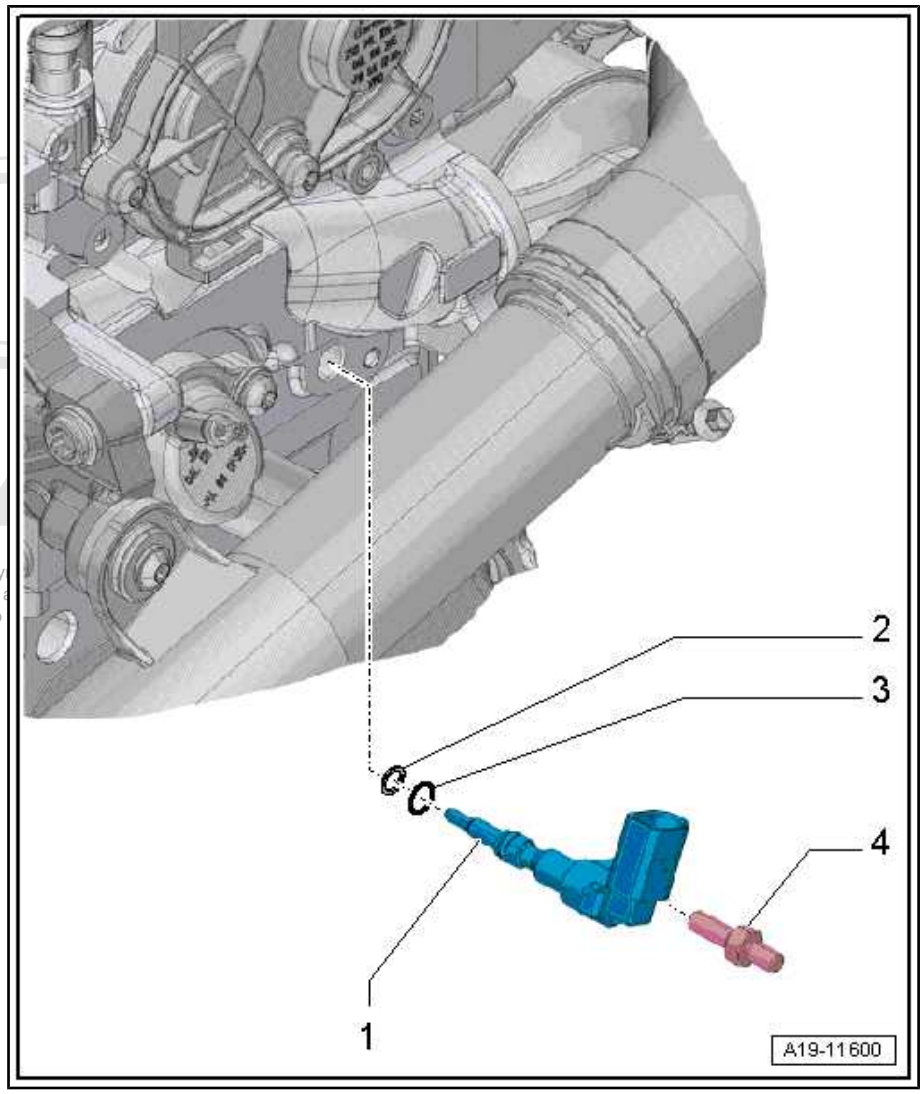
3 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

4 - Centre hex stud

- ❑ 8 Nm

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with respect to



2.4 Removing and installing electric coolant pump

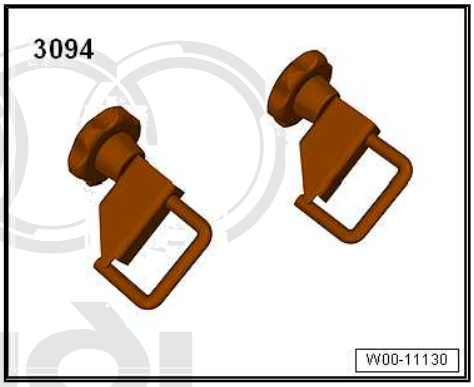
⇒ "2.4.1 Removing and installing charge air cooling pump V188 ", page 174

⇒ "2.4.2 Removing and installing auxiliary pump for heating V488 ", page 176

2.4.1 Removing and installing charge air cooling pump - V188-

Special tools and workshop equipment required

♦ Hose clamps, up to 25 mm - 3094-



♦ Hose clip pliers - VAS 6362-



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Removing

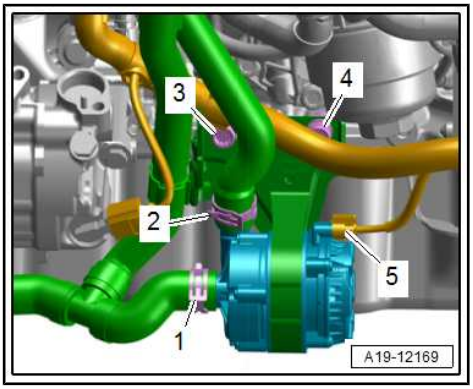
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Unplug electrical connector -5-.

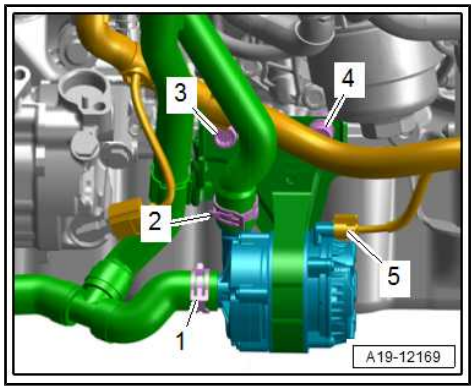
– Use hose clamps up to 25 mm - 3094- to clamp off the two coolant hoses connected to charge air cooling pump - V188- .

– Hold a clean cloth under separating point to catch escaping coolant.

– Release hose clips -1 and 2- and disconnect coolant hoses.



– Remove bolts -3 and 4- and detach charge air cooling pump - V188- .
– Unbolt retaining clip for charge air cooling pump - V188- from bracket.



Installing

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

Note

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

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– **After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.**

– Check coolant ⇒ page 165 .

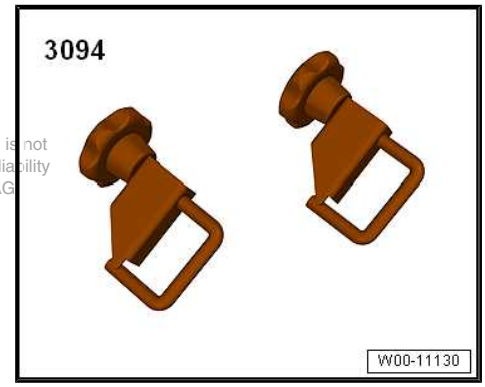
Tightening torques

- ⇒ “2.2 Exploded view - electric coolant pump”, page 173
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

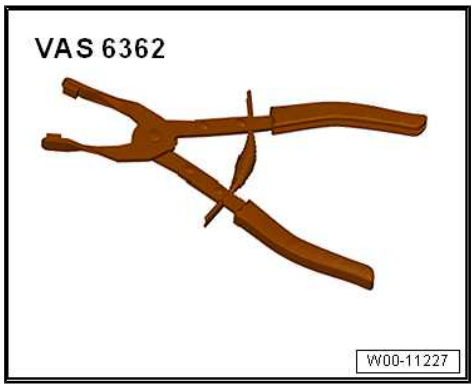
2.4.2 Removing and installing auxiliary pump for heating - V488-

Special tools and workshop equipment required

- Hose clamps, up to 25 mm - 3094-



- Hose clip pliers - VAS 6362-



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Removing

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

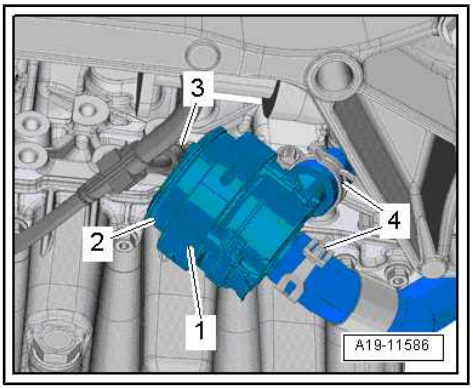
– Unplug electrical connector -3-.

– Hold a clean cloth under separating point to catch escaping coolant.

– Clamp off coolant hoses with hose clamps up to 25 mm - 3094- .

– Release hose clips -4- and disconnect coolant hoses.

– Detach auxiliary pump for heating - V488- -item 2- from mounting -1-.



Installing

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

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Note

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

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

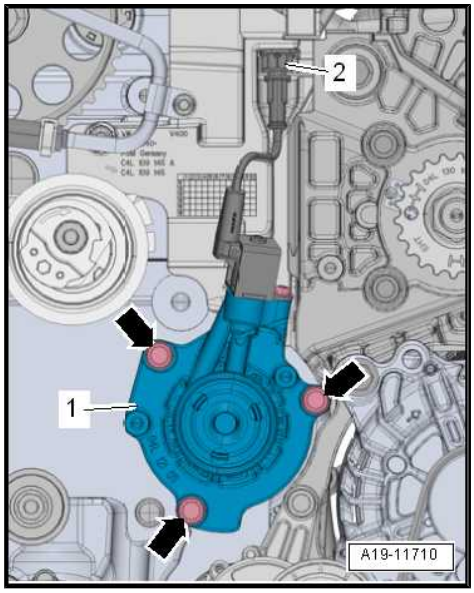
– After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.

– Check coolant ⇒ page 165 .

Tightening torques

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

2.5 Removing and installing coolant pump



Removing

– Drain coolant ⇒ page 163 .
– Remove toothed belt cover (bottom) ⇒ page 75 .
– Detach toothed belt from camshaft ⇒ page 76 .
– Unplug electrical connector -2- and move wiring clear.
– Remove bolts -arrows- and detach coolant pump -1-.

Installing

Installation is carried out in the 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.

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– Clean and smoothen sealing surfaces for O-rings.
– Lubricate O-rings with coolant.
– Install toothed belt cover (bottom) ⇒ page 75 .
– Install toothed belt (adjust valve timing) ⇒ page 89 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.

Note

Do not reuse coolant.

– Fill up with coolant ⇒ page 165 .

Tightening torques

◆ ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 171

2.6 Removing and installing thermostat

Special tools and workshop equipment required

♦ Hook - 3438-



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Removing

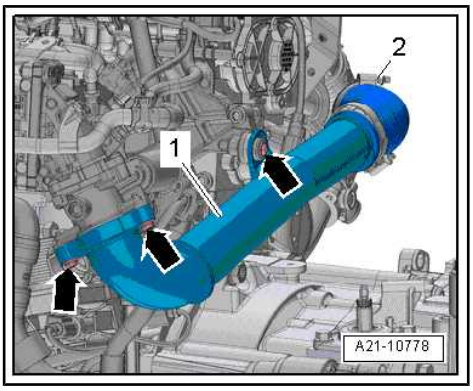
– Drain coolant ⇒ page 163 .

– Remove air cleaner housing ⇒ page 237 .

– Remove bolts -arrows-.

– Release screw-type clip -2- and detach air pipe -1-.

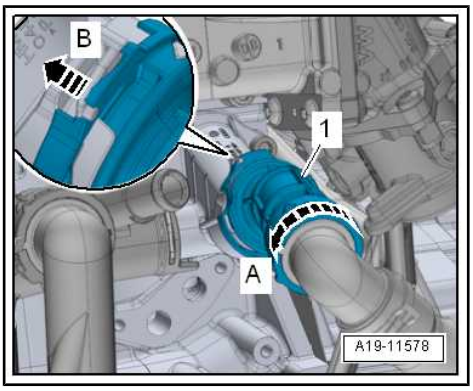
– Remove throttle valve module - J338-
⇒ “4.2 Removing and installing throttle valve module J338 ”, page 240 .



– Release catch from left side using hook - 3438- -arrow B-.

– Turn connection -1- in direction of -arrow A- and disconnect.

– Detach thermostat.



Installing

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

• Renew O-rings.

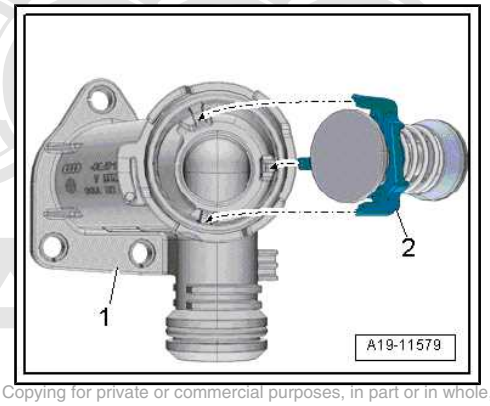
– Clean and smoothen sealing surface for O-ring.

– Lubricate O-ring with coolant.

– Fit thermostat -2- in thermostat housing -1-.

• Retaining lugs must engage in guides -arrows-.

– Install throttle valve module - J338- ⇒ “4.2 Removing and installing throttle valve module J338 ”, page 240 .



NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.

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– Fill up with coolant ⇒ page 165 .

Tightening torques

◆ ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 171

◆ ⇒ “2.1 Exploded view - charge air system”, page 217

◆ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

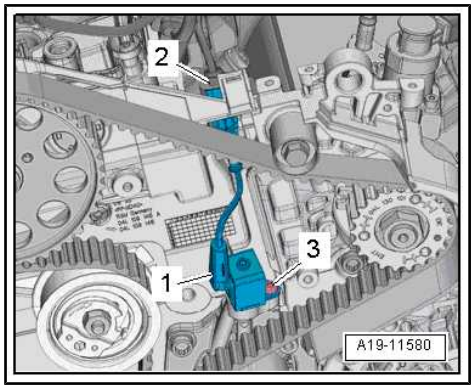
2.7 Removing and installing coolant valve for cylinder head - N489-

Removing

– Remove toothed belt cover (top) ⇒ page 73 .

– 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 the reverse order; note the following:

• Renew O-rings.

– Install toothed belt cover (top) ⇒ page 73 .

Tightening torques

◆ ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 171

2.8 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.		

2.9 Removing and installing coolant temperature sender - G62-

Special tools and workshop equipment required

♦ Bit XZN 10 - T10501-

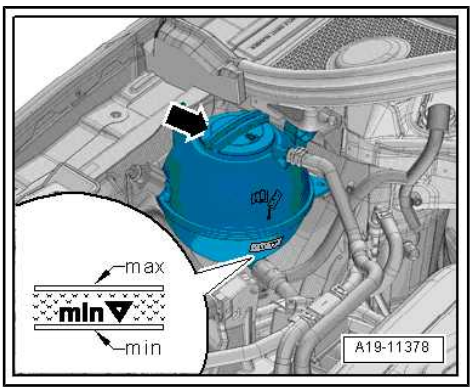


Removing

- Engine cold.

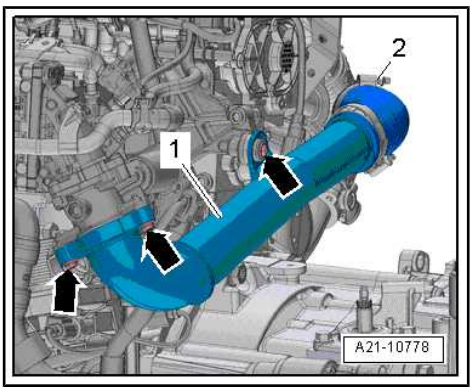
– Open filler cap -arrow- on coolant expansion tank briefly to relieve residual pressure in cooling system.

– Remove air cleaner housing ⇒ page 237 .



– Unscrew bolts -arrows- using bit XZN 10 - T10501- .

– Release screw-type clip -2- and detach air pipe -1-.

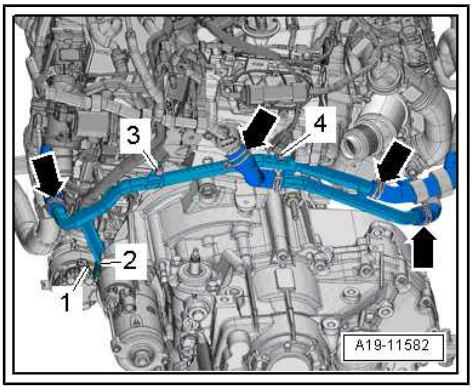


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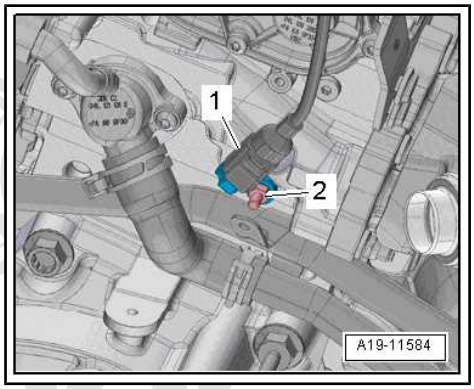
– Move electrical wiring harness -1- clear.

– Remove nut -4- and bolts -2 and 3-.

– Push coolant pipes slightly to the left.



– Unplug electrical connector -1-.
– Unscrew centre hex stud -2- and pull off coolant temperature sender - G62- .



Installing

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

- Renew O-rings.
- Renew spacer ring if damaged.

– Install coolant pipes (left-side) ⇒ page 187 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.

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– Check coolant ⇒ page 165 .

Tightening torques

- ⇒ “2.2 Exploded view - cylinder head”, page 98
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236
- ⇒ “4.1 Exploded view - intake manifold”, page 238
- ⇒ “2.1 Exploded view - charge air system”, page 217
- ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector mechanism

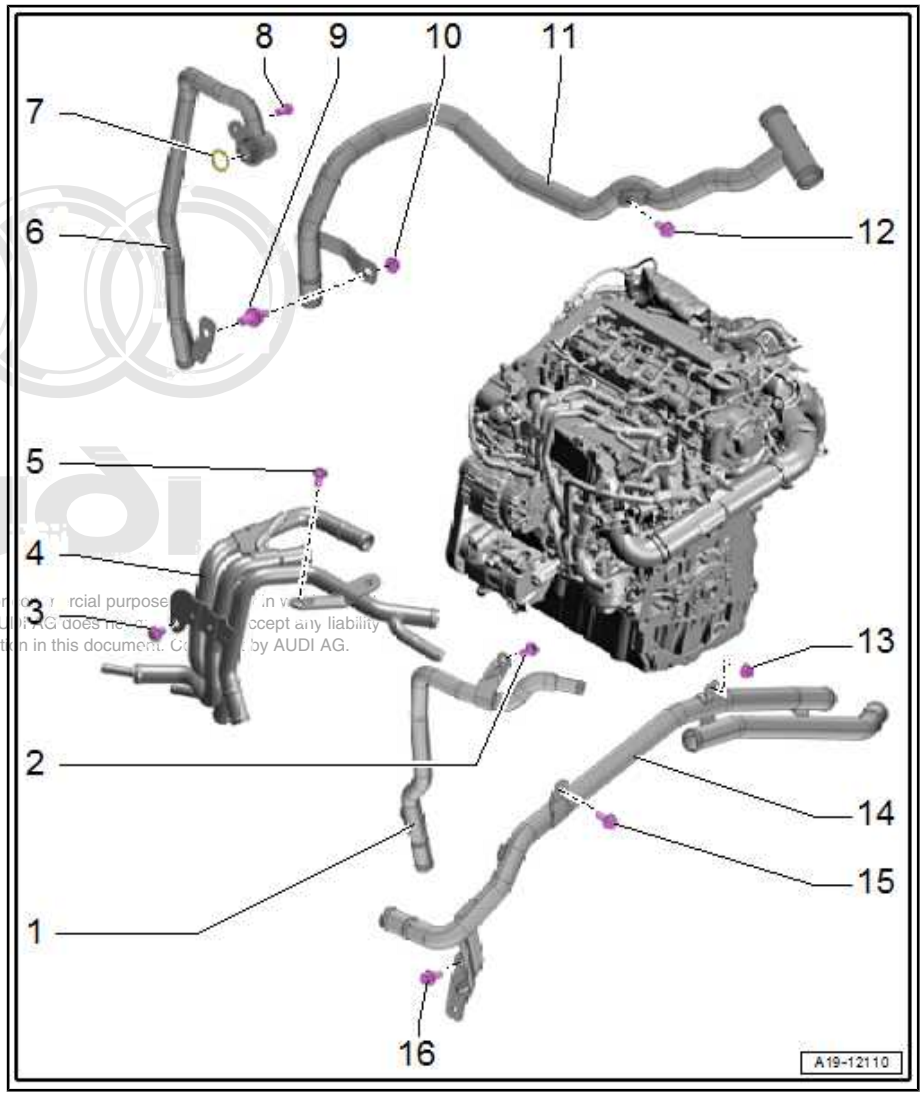
3 Coolant pipes

⇒ “3.1 Exploded view - coolant pipes”, page 183

⇒ “3.2 Removing and installing coolant pipes”, page 184

3.1 Exploded view - coolant pipes

The arrow markings on coolant pipes and on ends of hoses must align.



1 - Coolant pipe (front left)

- ❑ Removing and installing ⇒ page 187

2 - Bolt

- ❑ 10 Nm

3 - Bolt

- ❑ 10 Nm

4 - Coolant pipes (top)

- ❑ Different versions; for allocation refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ page 184

5 - Bolt

- ❑ 10 Nm

6 - Coolant pipe (rear right)

- ❑ Removing and installing ⇒ page 191

7 - O-ring

- ❑ Renew after removing
- ❑ Lubricate with coolant

8 - Bolt

- ❑ 10 Nm

9 - Centre hex stud

- ❑ 23 Nm

10 - Nut

- ❑ 10 Nm

11 - Coolant pipe (rear)

- ❑ Removing and installing ⇒ page 189

12 - Bolt

- ❑ 10 Nm

13 - Bolt

- ❑ 10 Nm

14 - Coolant pipes (left-side)

- ❑ Different versions; for allocation refer to ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ page 187

15 - Bolt

- ❑ 8 Nm

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16 - Bolt

- ❑ 8 Nm

3.2 Removing and installing coolant pipes

⇒ “3.2.1 Removing and installing coolant pipes (top)”, page 184

⇒ “3.2.2 Removing and installing coolant pipe (bottom front)”, page 185

⇒ “3.2.3 Removing and installing coolant pipe (front left)”, page 187

⇒ “3.2.4 Removing and installing coolant pipes (left-side)”, page 187

⇒ “3.2.5 Removing and installing coolant pipe (rear)”, page 189

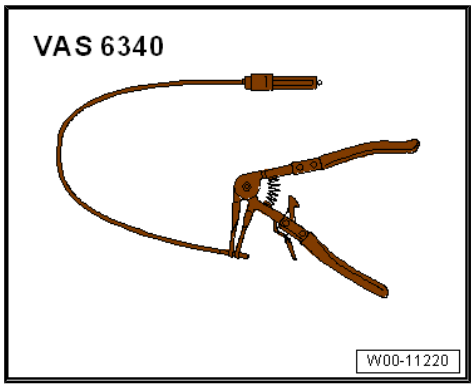
⇒ “3.2.6 Removing and installing coolant pipe (rear right)”, page 191

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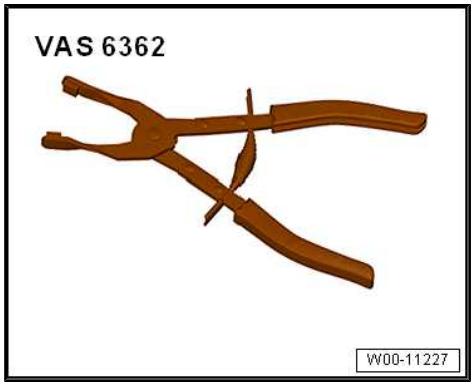
3.2.1 Removing and installing coolant pipes (top)

Special tools and workshop equipment required

- ♦ Hose clip pliers - VAS 6340-

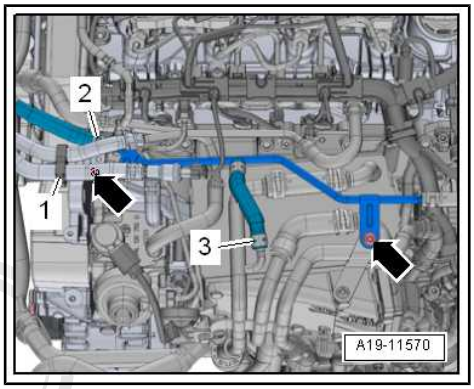


- ♦ Hose clip pliers - VAS 6362-

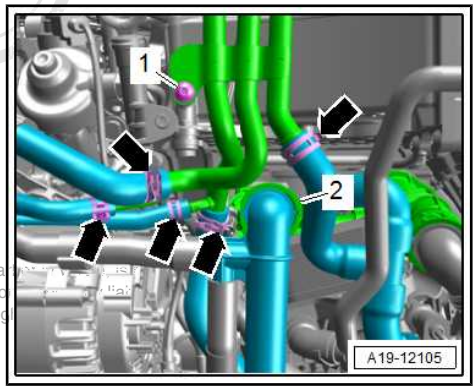


Removing

– Remove engine cover panel ⇒ page 40 .
– Drain coolant ⇒ page 163 .
– Release hose clips -2, 3- and disconnect coolant hoses.
– Unclip bracket -1- with fuel hoses.
– Remove bolts -arrows-.

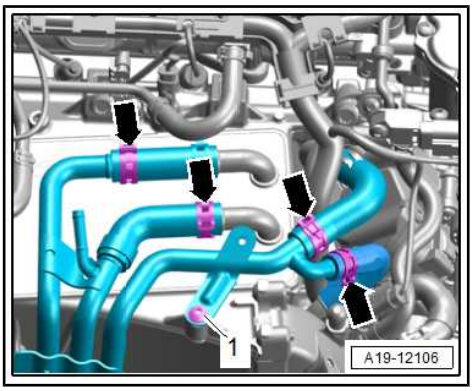


– Lift retaining clip -2- and press coolant connection to side.
– Release hose clips -arrows- and disconnect coolant hoses.
– Remove bolt -1-.



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– Remove bolt -1-.
– Release hose clips -arrows- and disconnect coolant hoses.
– Detach coolant pipes (top).



Installing

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

– Connect coolant connection with plug-in connector ⇒ page 196 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled/ bled.

– **After it is filled, the cooling system must be bled using the ⇒ Vehicle diagnostic tester.**

– Fill up with coolant ⇒ page 165 .
– Install engine cover panel ⇒ page 40 .

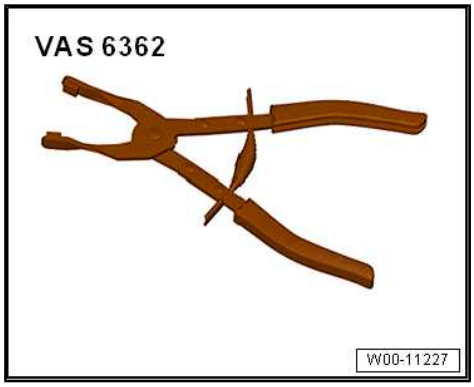
Tightening torques

◆ ⇒ “3.1 Exploded view - coolant pipes”, page 183

3.2.2 Removing and installing coolant pipe (bottom front)

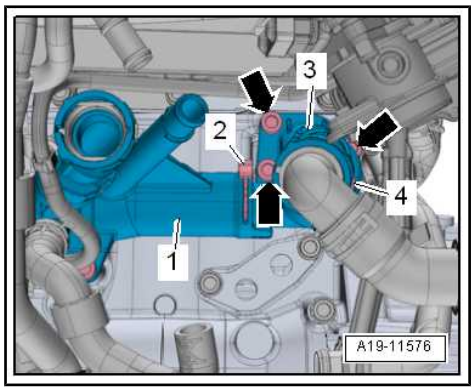
Special tools and workshop equipment required

◆ Hose clip pliers - VAS 6362-

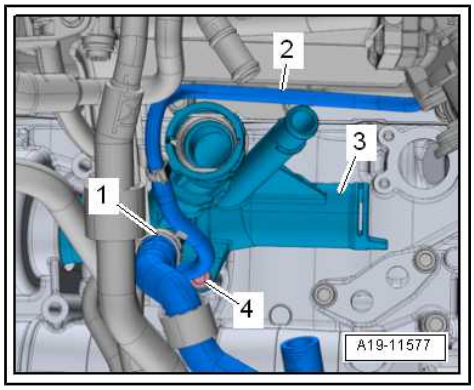


Removing

– Drain coolant ⇒ page 163 .
– Remove oil filter housing ⇒ page 154 .
– Remove throttle valve module - J338- ⇒ page 240 .
– Lift retaining clip -4- and disconnect coolant hose.
– Remove bolts -arrows-.
– Pull off securing clip -2-, disconnect thermostat housing -3- from coolant pipe (bottom front) -1- and detach.



– Release hose clip -1- and disconnect coolant hose.
– Remove bolt -4-.
– Detach and remove coolant pipe (bottom front) -3-, taking care not to damage vacuum line -2-.



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Installing

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

• Renew seals and O-rings.
– Clean and smoothen sealing surfaces for seals and O-rings.
– Lubricate seals and O-rings with coolant.
– Install oil filter housing ⇒ page 154 .
– Connect coolant hose with plug-in connector ⇒ page 196 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

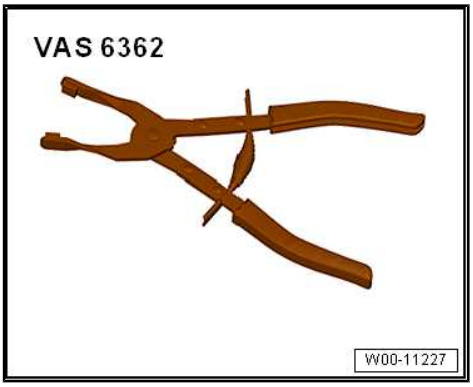
Tightening torques

◆ ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 171
◆ ⇒ “4.1 Exploded view - intake manifold”, page 238

3.2.3 Removing and installing coolant pipe (front left)

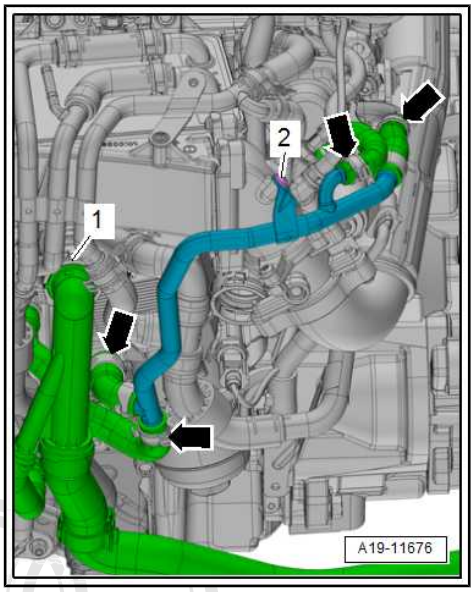
Special tools and workshop equipment required

- Hose clip pliers - VAS 6362-



Removing

– Remove engine cover panel ⇒ page 40 .
– Remove air cleaner housing ⇒ page 237 .
– Drain coolant ⇒ page 163 .
– Lift retaining clip -1- and detach connection for coolant.
– Remove bolt -2-.
– Release hose clips -arrows- and disconnect coolant hoses.
– Detach coolant pipe (front left).



Installing

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

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .
– Install engine cover panel ⇒ page 40 .

Tightening torques

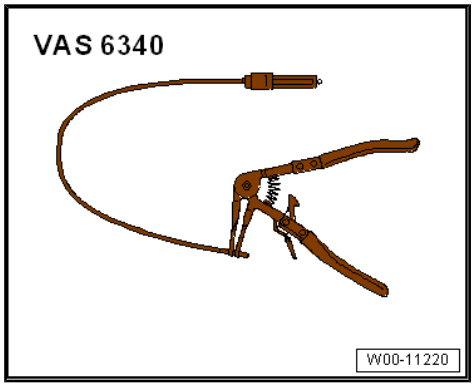
- ⇒ “3.1 Exploded view - coolant pipes”, page 183
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236

3.2.4 Removing and installing coolant pipes (left-side)

Special tools and workshop equipment required

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♦ Hose clip pliers - VAS 6340-



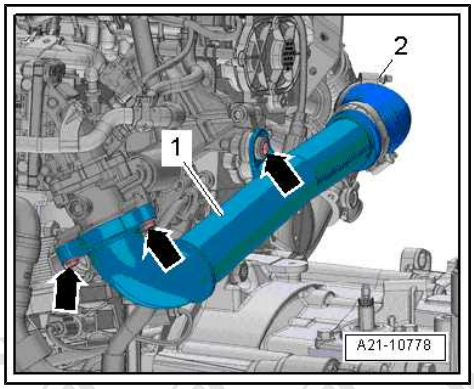
Removing

– Drain coolant ⇒ page 163 .

– Remove air cleaner housing ⇒ page 237 .

– Remove bolts -arrows-.

– Release screw-type clip -2- and detach air pipe -1-.



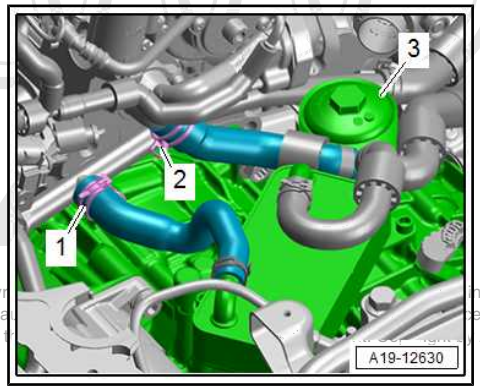
Vehicles with manual gearbox:

– Detach gear selector cable and gate selector cable from gearbox, remove cable support bracket and place to one side with selector cables attached ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector mechanism .

Vehicles with automatic gearbox:

– Release screw-type clips -1 and 2- and disconnect both coolant hoses.

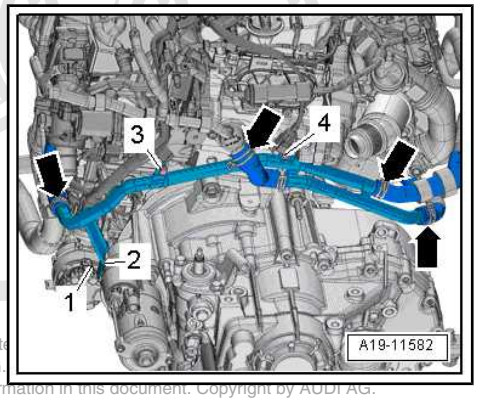
– Remove gear oil filter -3- ⇒ 7-speed dual clutch gearbox 0BH (S tronic); Rep. gr. 34 ; Gear oil circuit; Removing and installing gear oil filter .



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Continued for all vehicles:

– Move electrical wiring harness -1- clear.
– Remove nut -4- and bolts -2 and 3-.
– Release hose clips -arrows- and disconnect coolant hoses.
– Detach coolant pipes (left-side).



Installing

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

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

Tightening torques

- ⇒ “3.1 Exploded view - coolant pipes”, page 183
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236
- ⇒ “4.1 Exploded view - intake manifold”, page 238
- ⇒ “2.1 Exploded view - charge air system”, page 217
- ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector cables
- ⇒ 7-speed dual clutch gearbox 0BH (S tronic); Rep. gr. 34 ; Gear oil circuit; Removing and installing gear oil filter

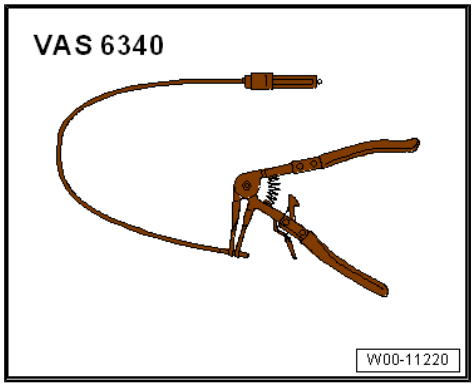
3.2.5 Removing and installing coolant pipe (rear)

Special tools and workshop equipment required

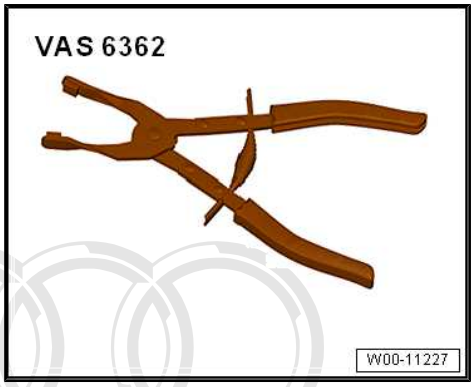
- Drip tray for workshop hoist - VAS 6208-



- Hose clip pliers - VAS 6340-



- Hose clip pliers - VAS 6362-



- Hose clamps up to 25 mm - 3094- (3x)



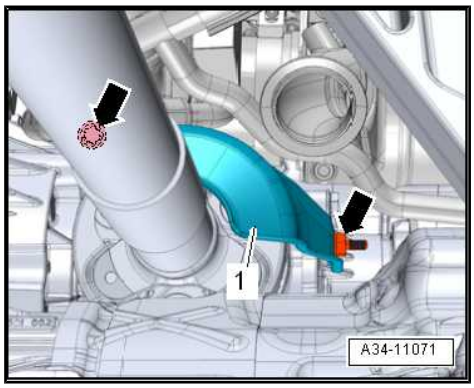
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Removing

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

Vehicles with four-wheel drive:

– Remove front exhaust pipe ⇒ page 283 .
– Remove bolts -arrows- and detach heat shield -1-.



Continued for all vehicles:

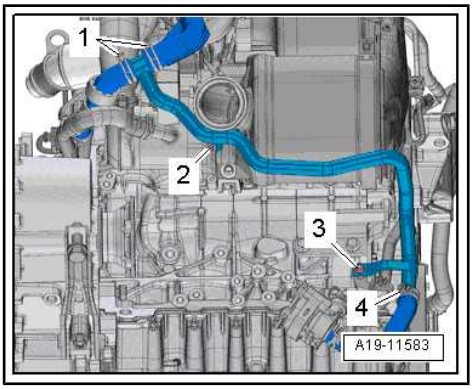
– Place drip tray for workshop hoist - VAS 6208- underneath.

– Clamp off all coolant hoses connected to coolant pipe (as far as necessary) with hose clamps up to 25 mm - 3094- .

– Release hose clip -4- and disconnect coolant hose.

– Release hose clips -1- and disconnect coolant hoses.

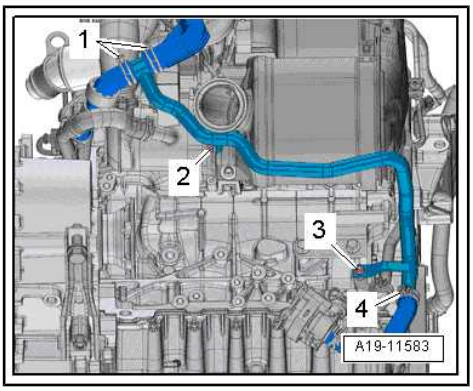
– Remove nut -3- and bolt -2- and detach coolant pipe (rear).



Installing

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

Observe correct tightening sequence (coolant pipe must be free of tension when installed, otherwise there is a risk of leaks):



♦ Initially tighten bolt -2- to 10 Nm.

♦ Then tighten nut -3- to 10 Nm.

– Install front exhaust pipe ⇒ page 283 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

Tightening torques

♦ ⇒ “3.1 Exploded view - coolant pipes”, page 183

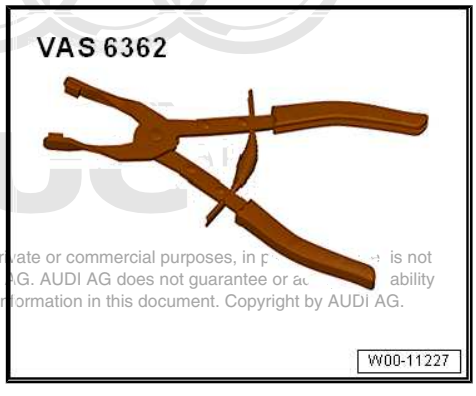
♦ ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

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

3.2.6 Removing and installing coolant pipe (rear right)

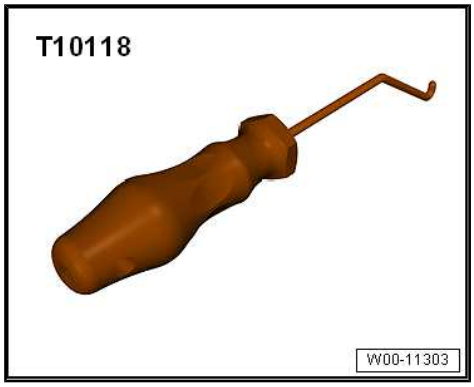
Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



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- Assembly tool - T10118-



- Bit XZN 10 - T10501-



Removing

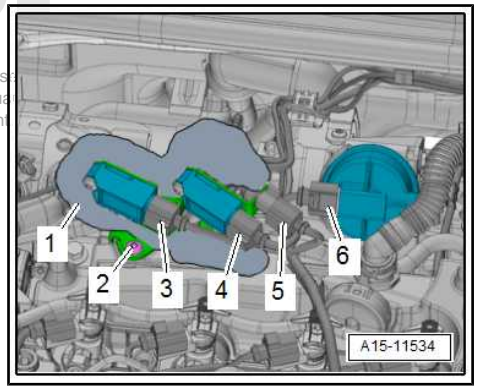
– Remove engine cover panel ⇒ page 40 .
– Drain coolant ⇒ page 163 .
– Remove coolant pipe (rear) ⇒ page 189 .
– Remove coolant pipes (left-side) ⇒ page 187 .

Vehicles with front-wheel drive:

– Remove front exhaust pipe ⇒ page 283 .

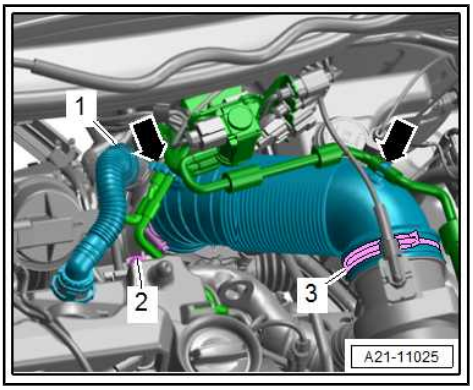
Continued for all vehicles:

– Open heat insulation sleeve -1-.
– Unplug electrical connectors -3, 4, 6- and move wiring harness clear.
– Remove bolt -2-.
– Unplug electrical connector -5- for exhaust gas temperature sender 1 - G235- .
– Move bracket to rear with pressure differential senders.



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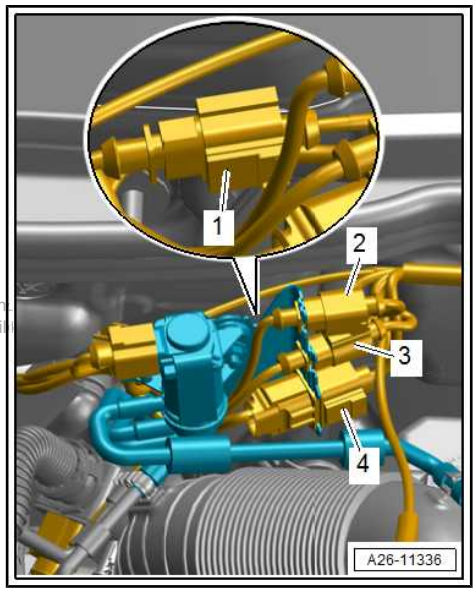
– Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from connection.
– Move clear vacuum hoses at air pipe -arrows-.
– Remove bolt -2-, swivel air pipe with connection to rear and detach from turbocharger.



– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

1 - For exhaust gas temperature sender 4 - G648-
2 - For exhaust gas temperature sender 3 - G495-
3 - For exhaust gas temperature sender 2 - G448-
4 - For Lambda probe - G39-

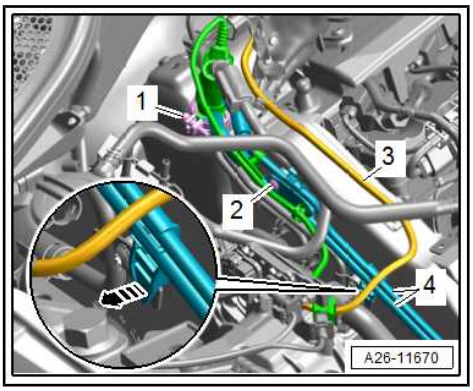
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– Remove bolt -2-.
– Release fastener -arrow- and move coolant lines -4- clear.
– Move electrical wire -3- for control unit for NOx sender - J583- clear and press to side.
– Release retaining clip -1-, detach injector for reducing agent - N474- and place to right side.

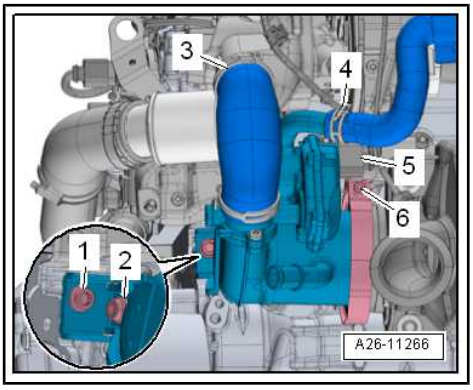
Vehicles with four-wheel drive:

– Detach drive shaft (right-side) from bevel box ⇒ Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .

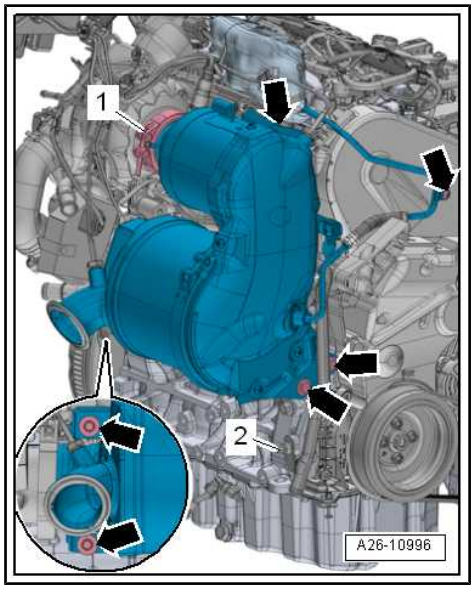


Continued for all vehicles:

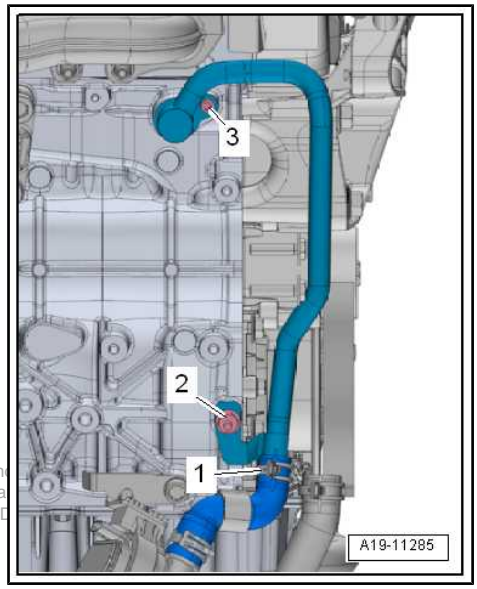
– Push heat insulation sleeve to one side and unplug electrical connector -5- using assembly tool - T10118- .
– Release hose clip -3- and detach air hose.
– Release hose clip -4- and disconnect coolant hose.
– Remove bolt -1- with bit XZN 10 - T10501- and loosen bolt -2-.



– Open clip -1- and place it on intake funnel of emission control module.
– Remove bolts -arrows- and push emission control module and exhaust gas recirculation cooler towards rear.



– Release hose clip -1- and disconnect coolant hose.
– Remove centre hex stud -2- and bolt -3- and take off coolant pipe (rear right).



Installing

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

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

– Install emission control module ⇒ page 290 .
– Install front exhaust pipe ⇒ page 283 .
– Install injector for reducing agent - N474- ⇒ page 309 .
– Install coolant pipe (rear) ⇒ page 189 .
– Install coolant pipes (left-side) ⇒ page 187 .
– Install engine cover panel ⇒ page 40 .

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NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

Tightening torques

- ⇒ “3.1 Exploded view - coolant pipes”, page 183
- ⇒ “1.1 Exploded view - silencers”, page 280
- Bracket for pressure differential sender - G505- ⇒ Item 6 (page 96)
- ⇒ “1.1 Exploded view - turbocharger”, page 206
- ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft

4 Radiator/radiator fans

⇒ “4.1 Exploded view - radiator/radiator fans”, page 195

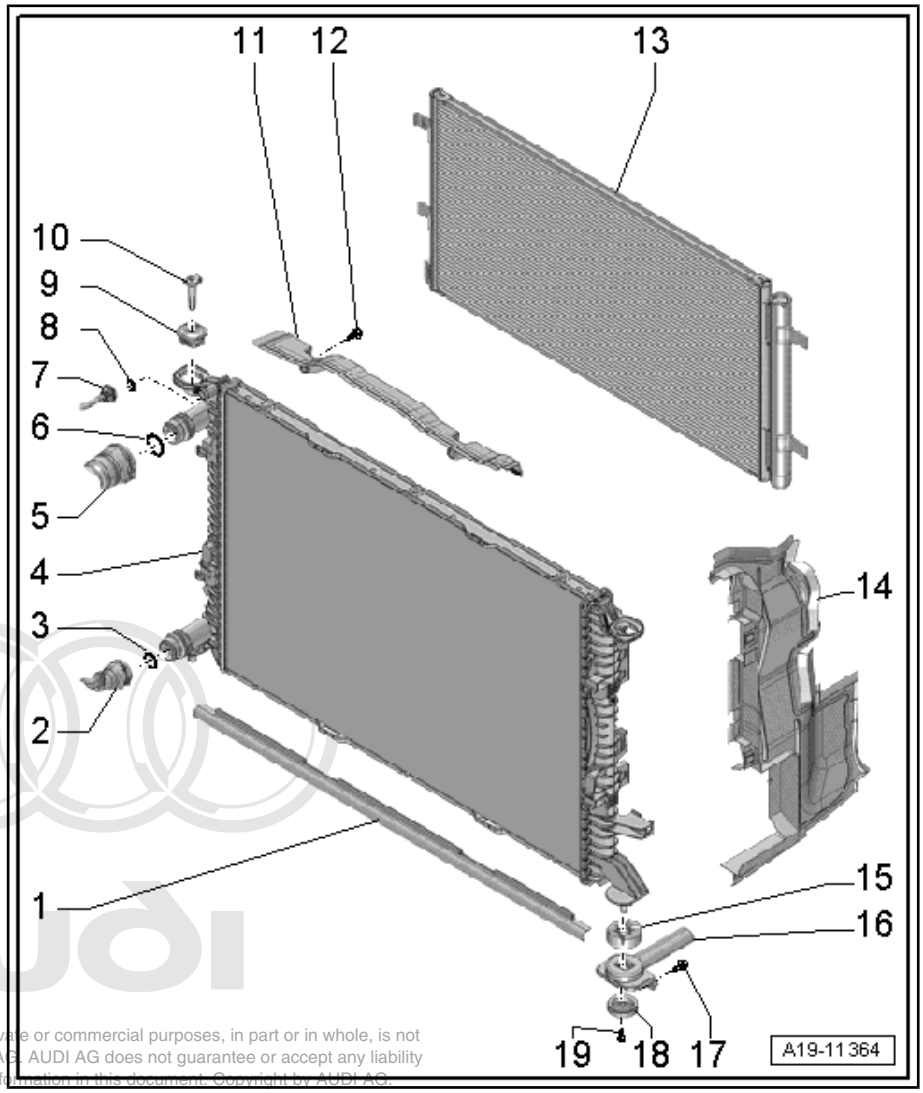
⇒ “4.2 Removing and installing radiator”, page 197

⇒ “4.3 Removing and installing water radiator for charge air cooling circuit”, page 200

⇒ “4.4 Removing and installing radiator cowl”, page 202

⇒ “4.5 Removing and installing radiator fan V7 ”, page 204

4.1 Exploded view - radiator/radiator fans



1 - Air duct

2 - Coolant hose

- ❑ Lift retaining clip to detach
- ❑ Connecting ⇒ page 196

3 - O-ring

- ❑ Renew after removing

4 - Radiator

- ❑ Removing and installing ⇒ page 197
- ❑ If renewed, change coolant in entire system

5 - Coolant hose

- ❑ Lift retaining clip to detach
- ❑ Connecting ⇒ page 196

6 - O-ring

- ❑ Renew after removing

7 - Coolant pipe

- ❑ To coolant expansion tank
- ❑ Press release ring to detach
- ❑ Connecting ⇒ page 196

8 - O-ring

- ❑ Renew after removing

9 - Rubber bush

- ❑ For radiator

10 - Retaining pin

- ❑ Use screwdriver to release and pull off

11 - Air duct

12 - Bolt

- ❑ 2.5 Nm

13 - Condenser

- ❑ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser

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14 - Air duct

15 - Rubber mounting

- ❑ For radiator

16 - Radiator bracket

17 - Bolt

- ❑ 5 Nm

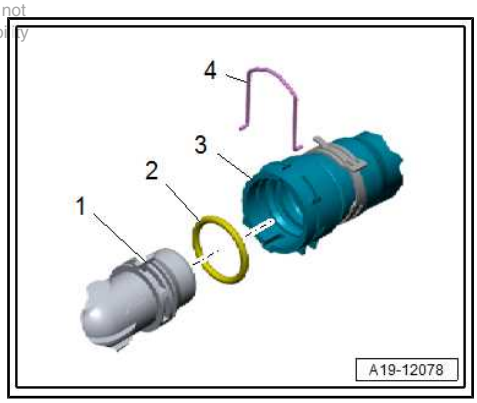
18 - Washer

19 - Bolt

- ❑ 4.5 Nm

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Connecting coolant hose with plug-in connector



– If damaged, renew retaining clip -4-.
– Remove old O-ring -2- from coolant hose -3-.
– Lightly lubricate new O-ring with coolant and fit O-ring in coolant hose.
– Press coolant hose onto connection -1- until it engages audibly.
– Press coolant hose in again and then pull to check that plug-in connector is correctly engaged.

Radiator cowl and radiator fans

1 - Radiator fan control unit

- ❑ Radiator fan control unit - J293- with radiator fan control unit 2 - J671-
- ❑ Removing and installing ⇒ page 205

2 - Bolt

- ❑ 3.5 Nm

3 - Bolt

- ❑ 5 Nm

4 - Radiator cowl

- ❑ Removing and installing ⇒ page 202

5 - Radiator fan - V7-

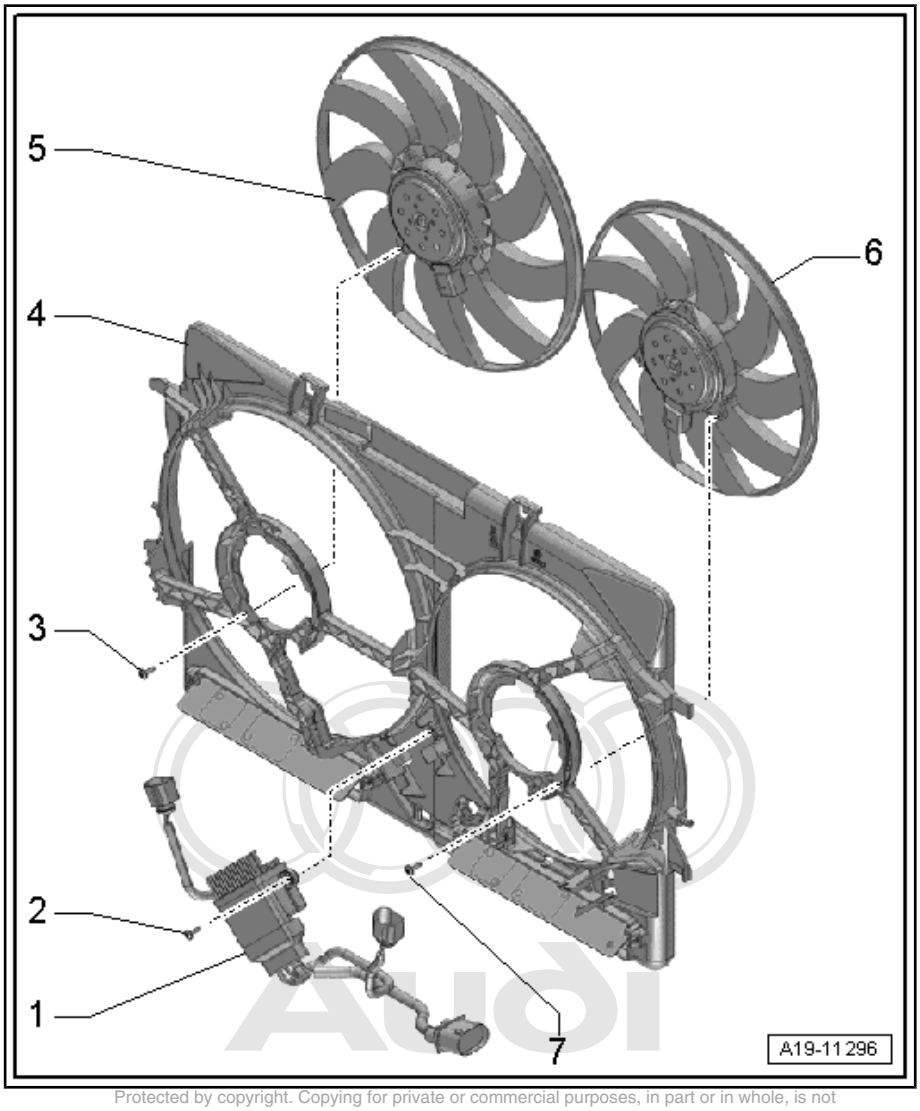
- ❑ Removing and installing ⇒ page 204

6 - Radiator fan 2 - V177-

- ❑ Removing and installing ⇒ page 204

7 - Bolt

- ❑ 5 Nm



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4.2 Removing and installing radiator

Radiator and radiator cowl are removed together.

Special tools and workshop equipment required

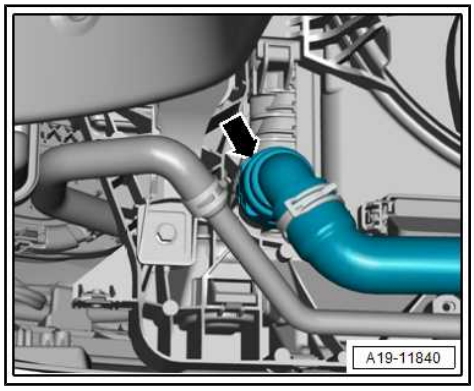
♦ Drip tray for workshop hoist - VAS 6208-



Removing

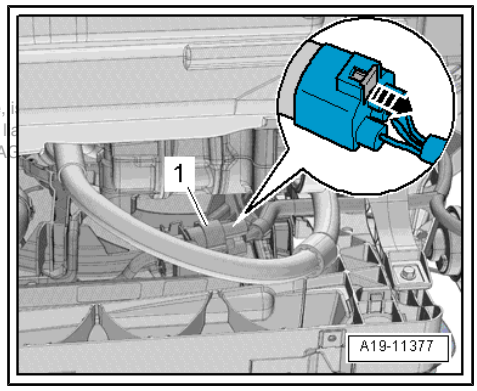
– Remove noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Removing and installing noise insulation .

– Remove bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
– Remove water radiator for charge air cooling circuit ⇒ page 200 .
– Remove condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .
– Remove air cleaner housing ⇒ page 237 .
– Place drip tray for workshop hoist - VAS 6208- underneath.
– Lift retaining clip -arrow-, disconnect coolant hose from radiator (bottom left) and drain off coolant.

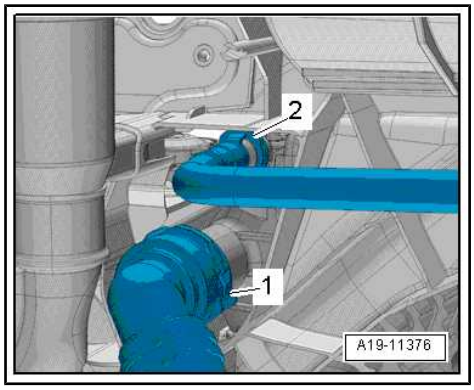


– Unplug electrical connector -1- for radiator fan (push retainer to the rear -arrow- and press down release catch).

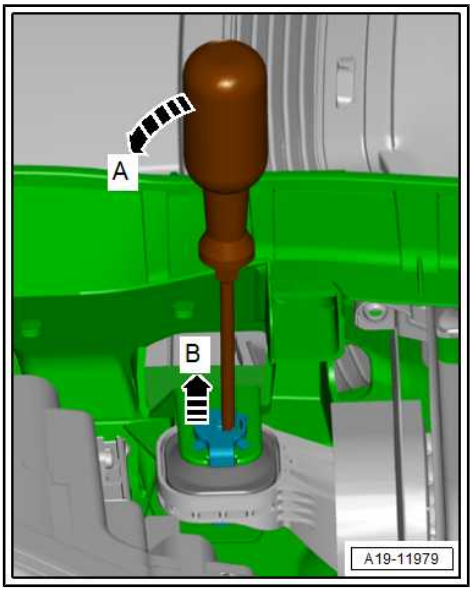
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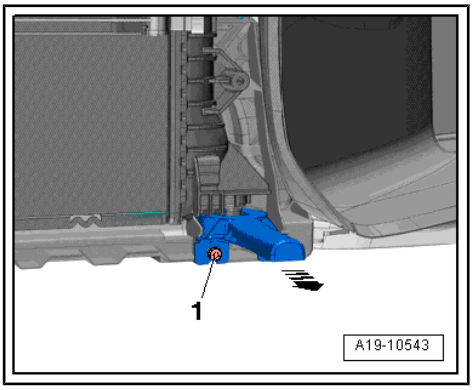
– Lift retaining clips -1- and -2- and detach connection from radiator.



– Release retaining pins for radiator on both sides -arrow A- and pull out upwards -arrow B-.

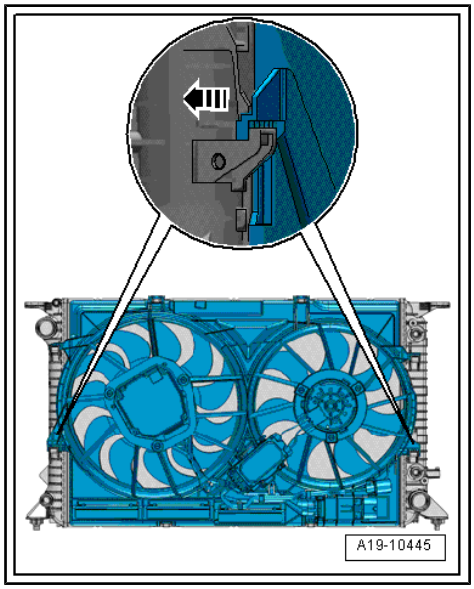


– Remove bolts -1- on both sides and detach radiator bracket with radiator from lock carrier -arrow-.
– Detach radiator downwards.



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– Press locking tabs on left and right sides of radiator cowl -arrow- and at the same time lift radiator cowl off radiator.



Installing

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

- Renew O-rings.

– Install condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .

– Install water radiator for charge air cooling circuit ⇒ page 200 .

– Connect coolant hose with plug-in connector ⇒ page 196 .

– Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

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

– Fill up with coolant ⇒ page 165 .

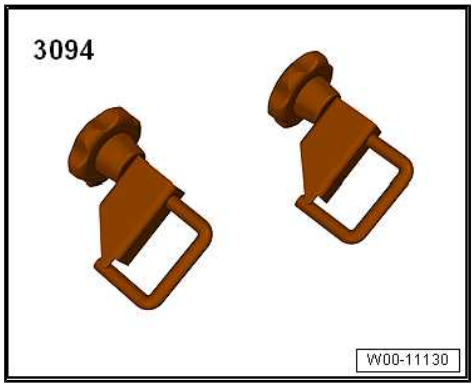
Tightening torques

- ⇒ “4.1 Exploded view - radiator/radiator fans”, page 195
- ⇒ “3.1 Exploded view - air cleaner housing”, page 236
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

4.3 Removing and installing water radiator for charge air cooling circuit

Special tools and workshop equipment required

- Hose clamps, up to 25 mm - 3094-

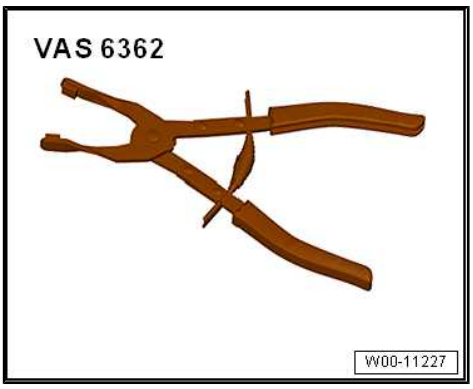


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♦ Drip tray for workshop hoist - VAS 6208-



♦ Hose clip pliers - VAS 6362-

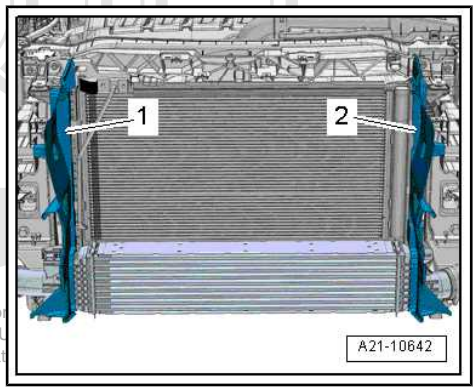


Removing

– Remove lock carrier cover (vehicles from model year 2015 onwards ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments).

– Remove closure plate for bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .

– Unclip air ducts -1 and 2-.



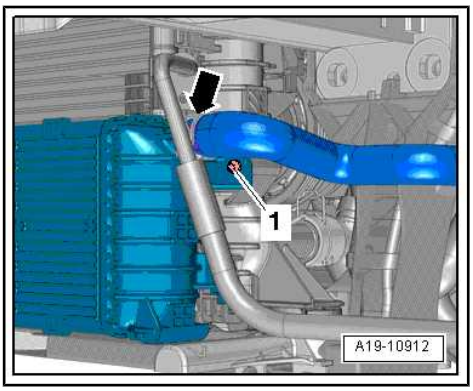
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– Place drip tray for workshop hoist - VAS 6208- underneath.

– Clamp off coolant hoses (left and right) on water radiator for charge air cooling circuit using hose clamps up to 25 mm - 3094- .

– Release hose clip (left-side) -arrow- and detach coolant hose.

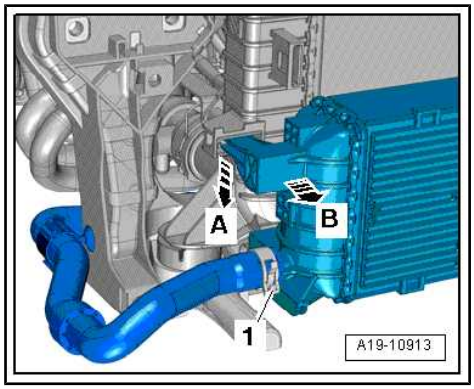
– Remove bolt -1-.



– Release hose clip -1- and disconnect coolant hose.

– Push catch down -arrow A- and move water radiator for charge air cooling circuit slightly in direction of -arrow B-.

– Detach water radiator for charge air cooling circuit.



Installing

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

– Install lock carrier cover (vehicles from model year 2015 onwards ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments).

– Install closure plate for bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing attachments .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

Tightening torques

◆ ⇒ “4.1 Exploded view - radiator/radiator fans”, page 195

4.4 Removing and installing radiator cowl

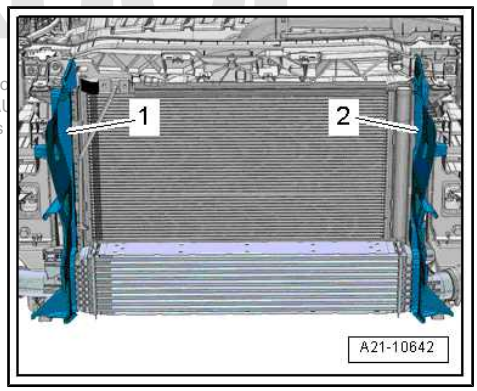
Removing

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

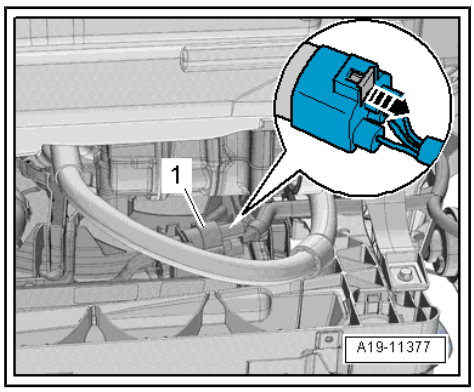
– Remove lock carrier cover and closure plate at bumper cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .

– Unclip air ducts -1 and 2-.

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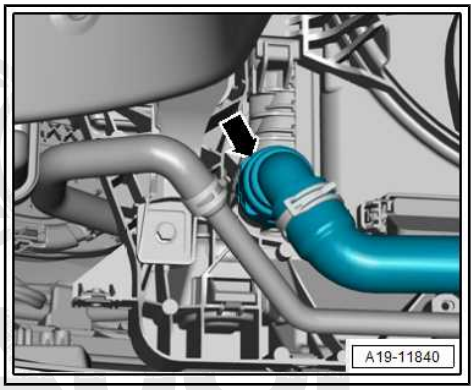


– Unplug electrical connector -1- for radiator fan (push retainer to the rear -arrow- and press down release catch).

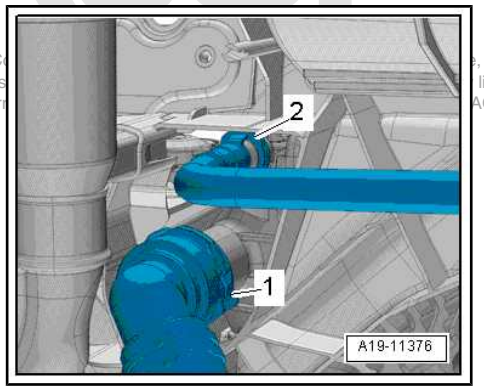


– Place drip tray for workshop hoist - VAS 6208- underneath.

– Lift retaining clip -arrow-, disconnect coolant hose (bottom) from radiator and drain off coolant.

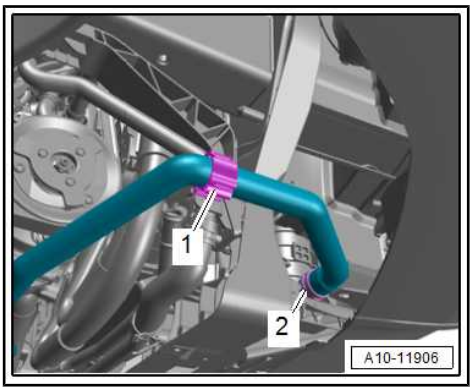


– Lift retaining clips -1 and 2- and disconnect coolant hoses (top left) from radiator.

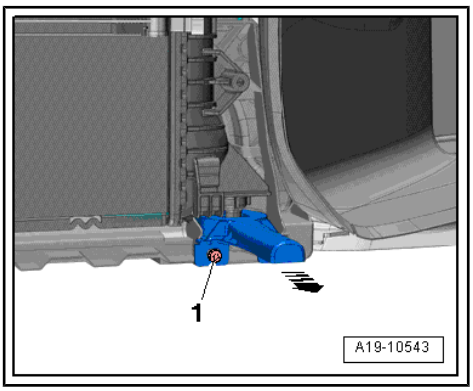


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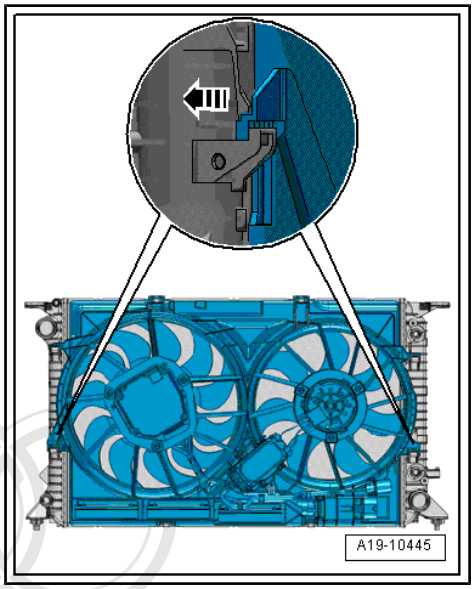
– Move coolant hose (right-side) to water radiator for charge air cooling circuit clear at retaining clip -1-.



– Remove bolts -1- on both sides and detach radiator bracket with radiator from lock carrier -arrow-.



– Press locking tabs on left and right sides of radiator cowl simultaneously -arrow- and detach radiator cowl downwards from radiator.



Installing

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

– Connect coolant hose with plug-in connector ⇒ page 196 .

NOTICE

Risk of damage to engine if cooling system is insufficiently filled.

– Only fill up cooling system using ⇒ Vehicle diagnostic tester.

– Fill up with coolant ⇒ page 165 .

Tightening torques

- ⇒ “4.1 Exploded view - radiator/radiator fans”, page 195
-
- ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

4.5 Removing and installing radiator fan - V7-

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⇒ “4.5.1 Removing and installing radiator fan”, page 204

⇒ “4.5.2 Removing and installing radiator fan control unit J293 ”, page 205

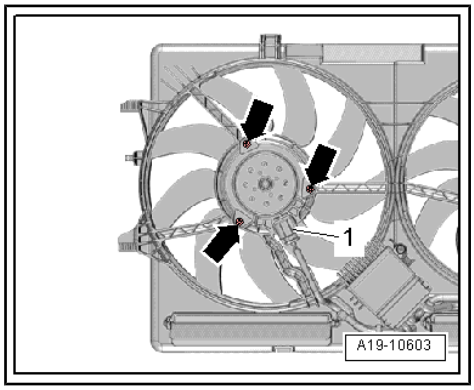
4.5.1 Removing and installing radiator fan

Removing

– Remove radiator cowl ⇒ page 202 .

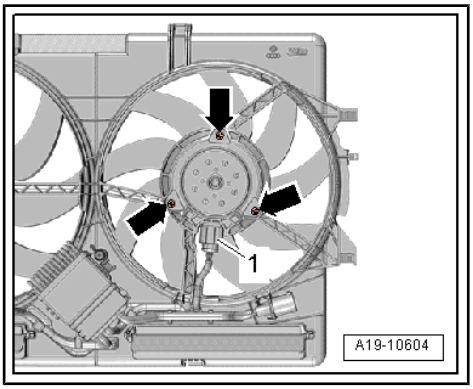
– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and remove radiator fan - V7- .



– Unplug electrical connector -1-.

– Unscrew bolts -arrows- and remove radiator fan 2 - V177- .



Installing

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

– Install radiator cowl ⇒ page 202 .

Tightening torques

♦ ⇒ “4.1 Exploded view - radiator/radiator fans”, page 195

4.5.2 Removing and installing radiator fan control unit - J293-

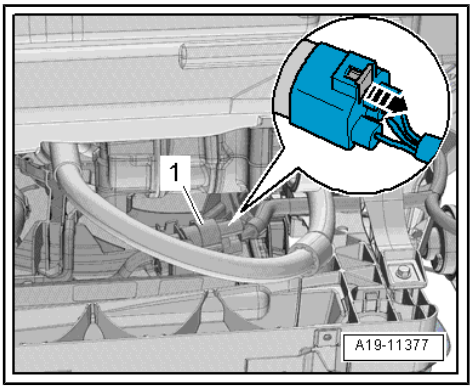
Removing

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

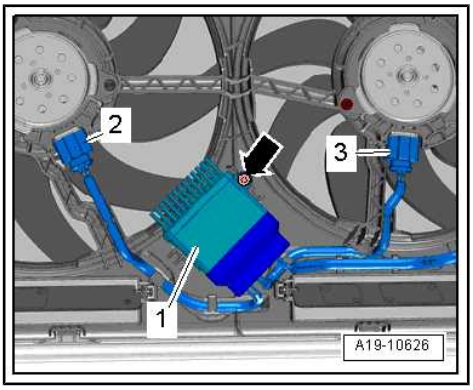
– Take electrical connector -1- for radiator fan out of bracket and unplug connector (push retainer to the rear -arrow- and press down release catch).

– Move electrical wiring harness going to radiator fan control unit clear.



– Unplug electrical connector -2-.

– Unscrew bolt -arrow- and remove radiator fan control unit -1-.



Installing

Install in reverse sequence.

Tightening torques

♦ ⇒ “4.1 Exploded view - radiator/radiator fans”, page 195

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

21 – Turbocharging/supercharging

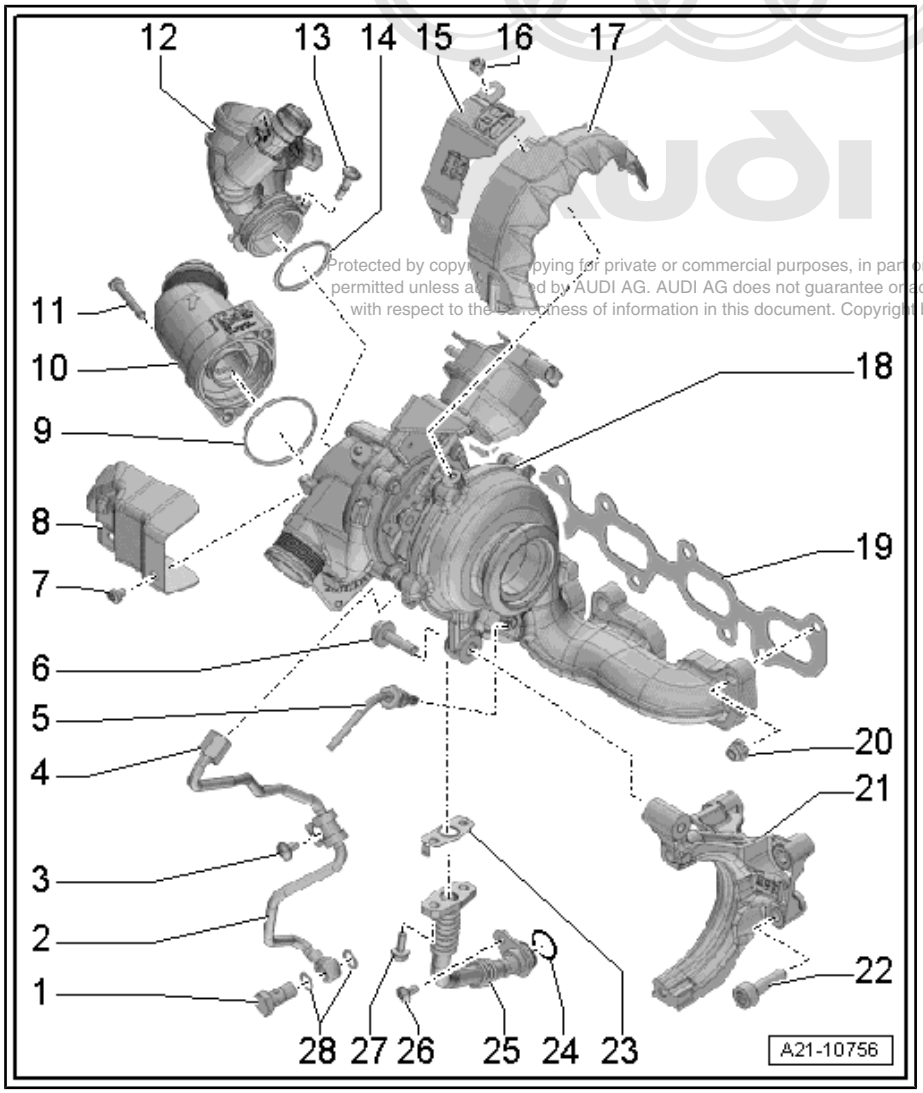
1 Turbocharger

⇒ “1.1 Exploded view - turbocharger”, page 206

⇒ “1.2 Removing and installing turbocharger”, page 208

⇒ “1.3 Renewing vacuum unit for turbocharger”, page 213

1.1 Exploded view - turbocharger



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1 - Banjo bolt

- ❑ 30 Nm
- ❑ Tighten banjo bolt using a commercially available open-end spanner insert, 27 mm and a suitable torque wrench

2 - Oil supply line

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

3 - Bolt

- ❑ 12 Nm

4 - Union nut

- ❑ 22 Nm

5 - Exhaust gas temperature sender 1 - G235-

- ❑ Exploded view ⇒ page 312

6 - Bolt

- ❑ Tightening torque and sequence ⇒ page 207

7 - Bolt

- ❑ 15 Nm

8 - Heat shield

9 - O-ring

- ❑ Renew after removing

10 - Pulsation damper

11 - Bolt

- ❑ 8 Nm

12 - Connection

13 - Bolt

- ❑ 8 Nm

14 - O-ring

- ❑ Renew after removing

15 - Bracket

- ❑ For electrical wiring

16 - Bolt

- ❑ 15 Nm

17 - Heat shield

18 - Turbocharger

- ❑ Removing and installing ⇒ page 208

19 - Gasket

- ❑ Renew after removing

20 - Nut

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 208

21 - Bracket

- ❑ For emission control module

22 - Bolt

- ❑ Tightening torque and sequence ⇒ page 207

23 - Gasket

- ❑ Renew after removing

24 - O-ring

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

25 - Oil return line

26 - Bolt

- ❑ 10 Nm

27 - Ribbed bolt

- ❑ 14 Nm

28 - Seals

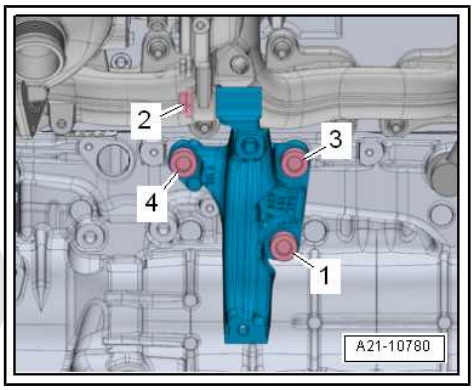
- ❑ Renew after removing

Bracket for emission control module - tightening torque and tightening sequence

– Fit bracket in correct installation position.

– Tighten bolts in stages in the sequence given:

Stage	Bolts	Tightening torque
1.	-1, 2, 3, 4-	Screw in by hand until contact is made
2.	-2-	20 Nm
3.	-1-	40 Nm
4.	-3, 4-	40 Nm

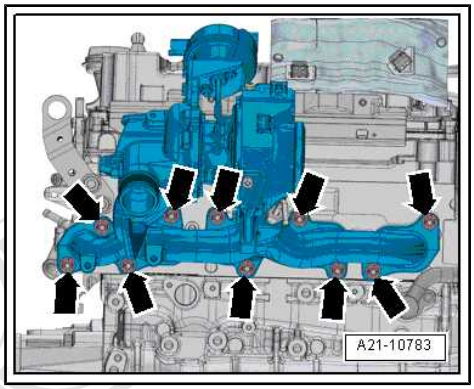


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Turbocharger - tightening torque and sequence

– Tighten bolts in stages in the sequence given:

Stage	Bolts	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

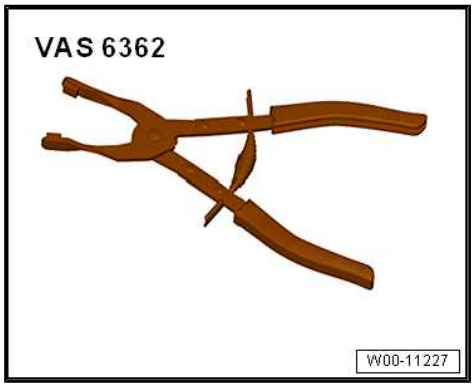
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If the turbocharger has suffered mechanical damage (e.g. damaged compressor wheel), it is not sufficient merely to fit a new turbocharger. The following work must be performed in order to avoid further damage:

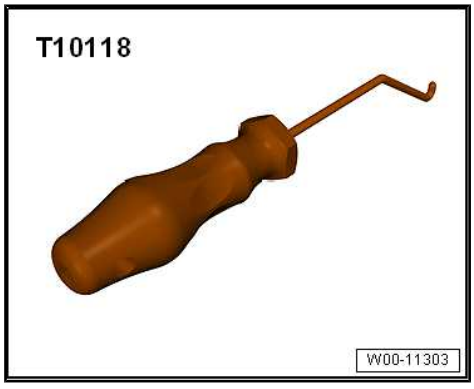
- Check air cleaner housing, air filter element and air hoses for dirt and foreign particles.
- Check the entire charge air system (including the charge air cooler) for foreign matter.
- If foreign matter is found in the charge air system, clean all relevant ducts and hoses and renew charge air cooler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

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



♦ Assembly tool - T10118-



♦ Bit XZN 10 - T10501-



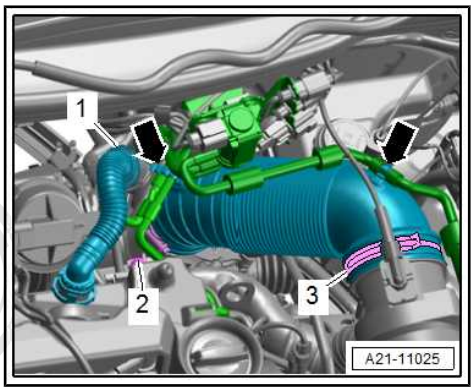
Removing

Note

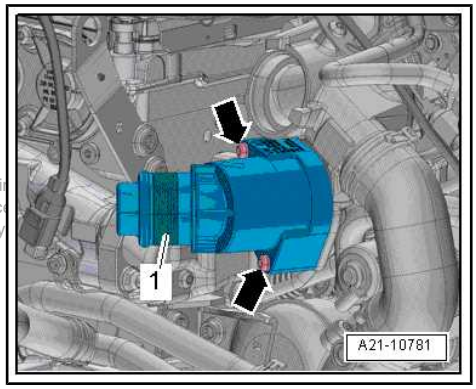
Re-install all heat insulation sleeves in the same locations when installing.

– Remove engine cover panel ⇒ page 40 .
– Remove front exhaust pipe ⇒ page 283 .
– Drain coolant ⇒ page 163 .
– Remove coolant pipe (rear) ⇒ page 189 .

– Remove coolant pipes (left-side) ⇒ page 187 .
– Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from connection.
– Move clear vacuum hoses at air pipe -arrows-.
– Remove bolt -2-, swivel air pipe with connection to rear and detach from turbocharger.

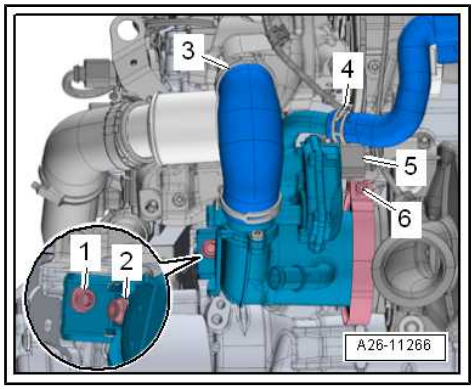


– Unscrew bolts -arrows- and remove resonator -1-.



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– Push heat insulation sleeve to one side and unplug electrical connector -5- using assembly tool - T10118- .
– Release hose clip -3- and detach air hose.
– Release hose clip -4- and disconnect coolant hose.
– Remove bolt -1- with bit XZN 10 - T10501- and loosen bolt -2-.

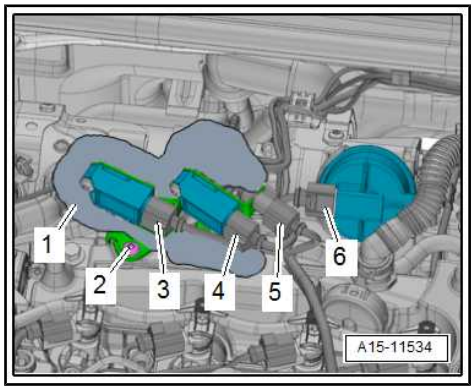


Vehicles with four-wheel drive:

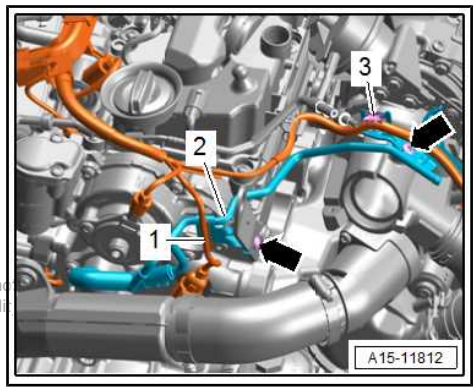
– Remove exhaust gas recirculation cooler ⇒ page 322 .

Continued for all vehicles:

– Open heat insulation sleeve -1-.
– Take electrical connector -5- out of bracket, unplug it and move electrical wiring clear.
– Unplug electrical connectors -3, 4, 6- and move wiring harness clear.
– Remove bolt -2-.
– Move bracket to rear with pressure differential senders.



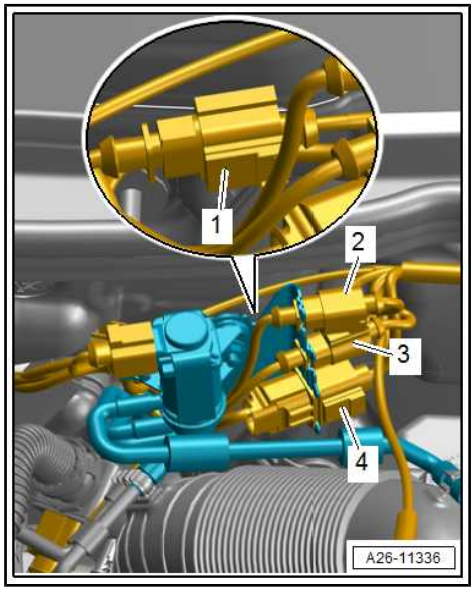
– Move electrical wiring -1, 3- clear.
– Remove bolts -arrows- and press coolant line -2- to left side.



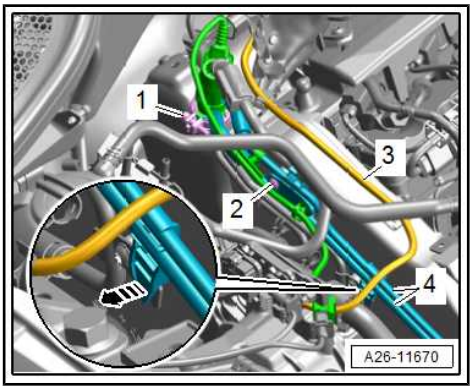
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– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

1 - For exhaust gas temperature sender 4 - G648-
2 - For exhaust gas temperature sender 3 - G495-
3 - For exhaust gas temperature sender 2 - G448-
4 - For Lambda probe - G39-

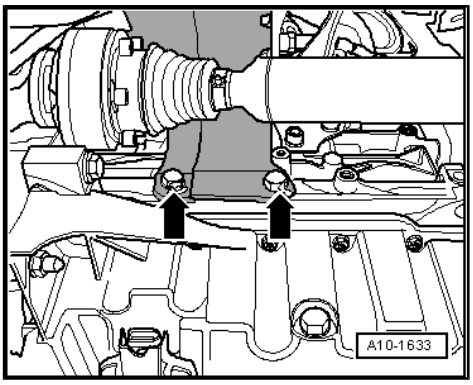


– Remove bolt -2-.
– Release fastener -arrow- and move coolant lines -4- clear.
– Move electrical wire -3- for control unit for NOx sender - J583- clear and press to side.
– Release retaining clip -1-, detach injector for reducing agent - N474- and place to right side.

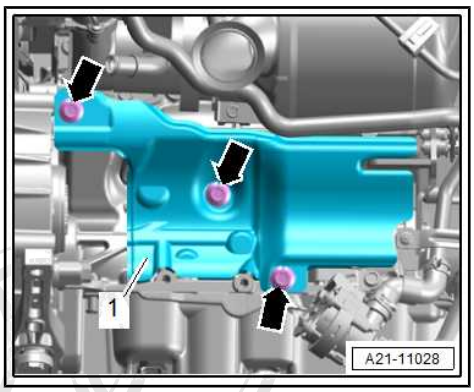


Vehicles with front-wheel drive:

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



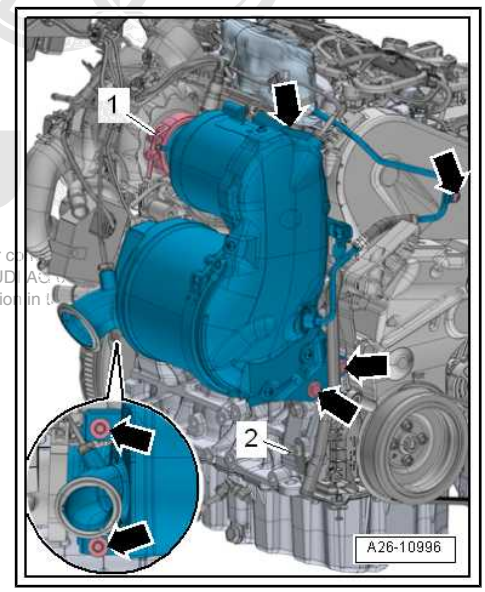
– Remove bolts -arrows- and detach heat shield -1-.



Continued for all vehicles:

– Open clip -1- and place it on intake funnel of emission control module.
– Loosen centre hex stud -2- and push coolant pipe slightly towards rear.
– Remove bolts -arrows- and push emission control module and exhaust gas recirculation cooler towards rear.

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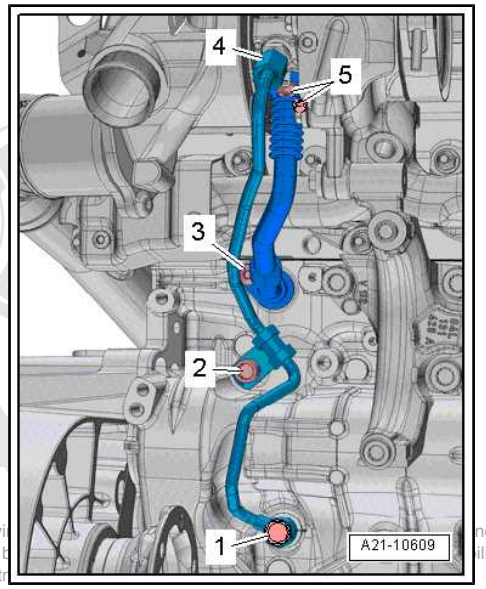
– Unscrew bolt -2- and union nut -4-.

NOTICE

Risk of damage to oil supply line.

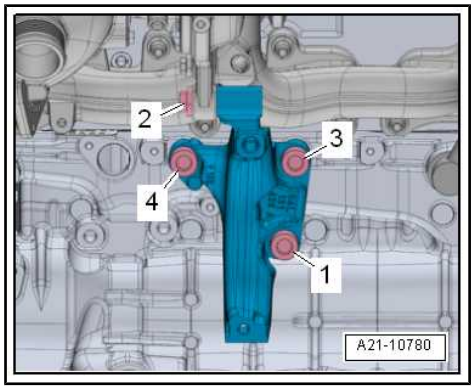
– Do not bend oil supply line.

– Remove bolts -3, 5- and detach oil return pipe.

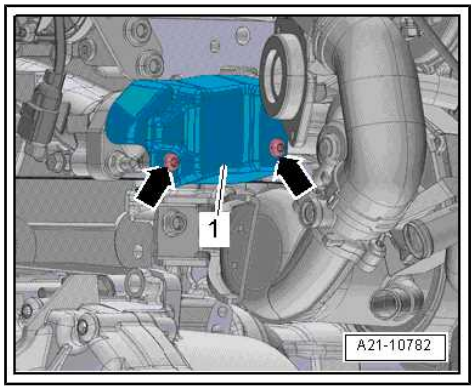


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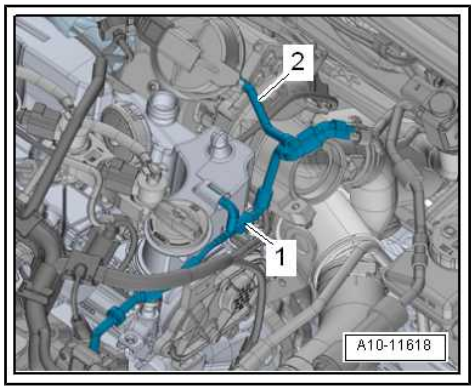
– Remove bolts -1 … 4- and detach bracket for particulate filter.



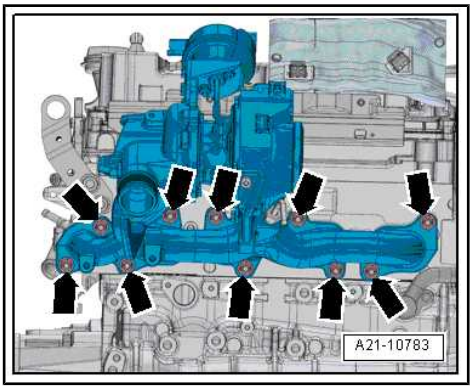
– Remove bolts -arrows- and detach heat shield -1-.



– Detach vacuum hose -2- from vacuum unit of turbocharger.



– Remove nuts -arrows-, detach turbocharger with exhaust manifold from cylinder head and remove upwards.



Installing

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

- Renew gaskets, seals, O-rings and self-locking nuts.
- 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 the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .
- After installing the turbocharger, allow the engine to idle for approx. 1 minute without pressing the accelerator to ensure that the turbocharger is supplied with oil.

– Install emission control module ⇒ page 290 .

– Install injector for reducing agent - N474- ⇒ page 309 .

– Install coolant pipes (left-side) ⇒ page 187 .

– Install coolant pipe (rear) ⇒ page 189 .

– Install front exhaust pipe ⇒ page 283 .

– Connect vacuum hose ⇒ page 234 .

– Install engine cover panel ⇒ page 40 .

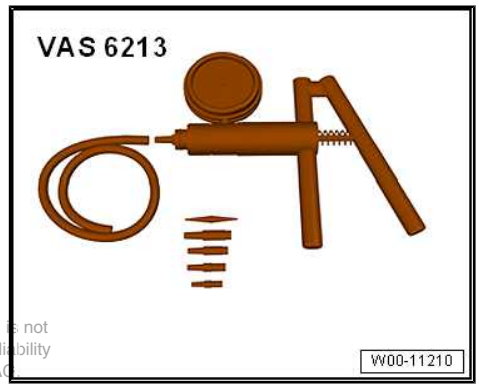
Tightening torques

- ⇒ “1.1 Exploded view - turbocharger”, page 206
- ⇒ Fig. ““Bracket for emission control module - tightening torque and tightening sequence”“ , page 207
- ⇒ “2.1 Exploded view - emission control system”, page 288
- Bracket for pressure differential sender - G505- ⇒ Item 6 (page 96)

1.3 Renewing vacuum unit for turbocharger

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



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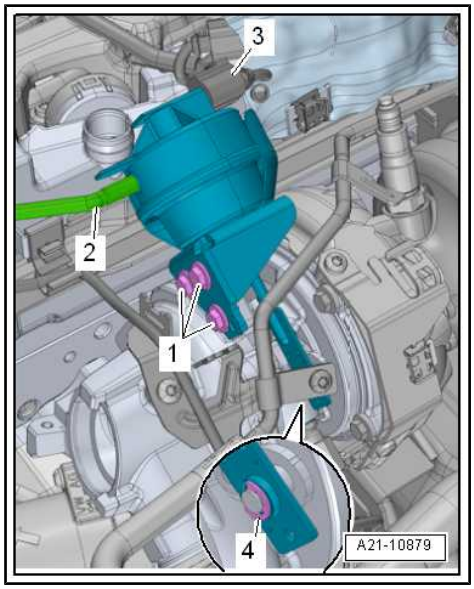
- Vehicle diagnostic tester

Removing

– Remove engine cover panel ⇒ page 40 .

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

– Detach vacuum hose -2- from vacuum unit of turbocharger.



Note

When removing and installing the circlip, apply as little force as possible on the lever linkage.

Pressing the circlip down with a large screwdriver or similar tool may damage the turbocharger.

– Remove circlip -4-.

– Remove bolts -1- for vacuum unit.

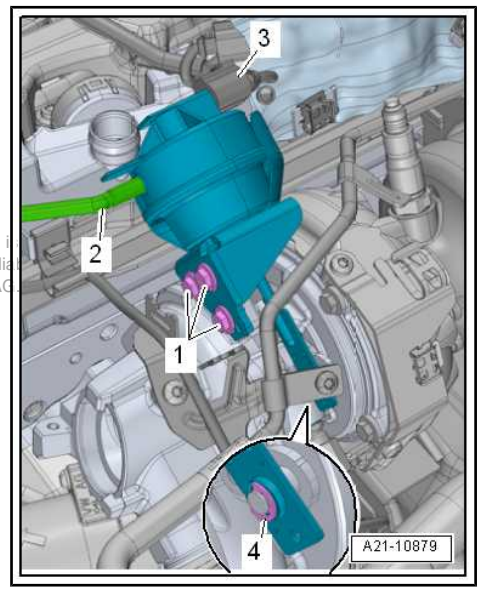
– Disengage control rod at adjusting lever and detach vacuum unit with position sender for charge pressure positioner - G581- .

Installing

– Attach control rod at adjusting lever, position vacuum unit and screw in bolts -1- by hand until they make contact.

– Install circlip -4-.

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



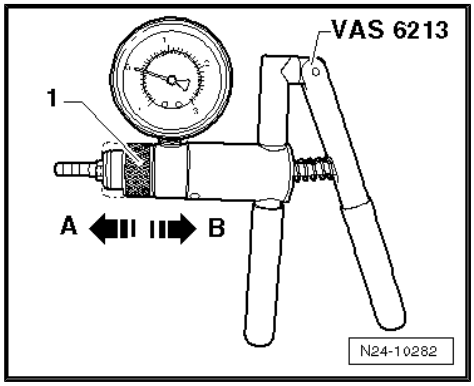
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Checking adjustment of vacuum unit

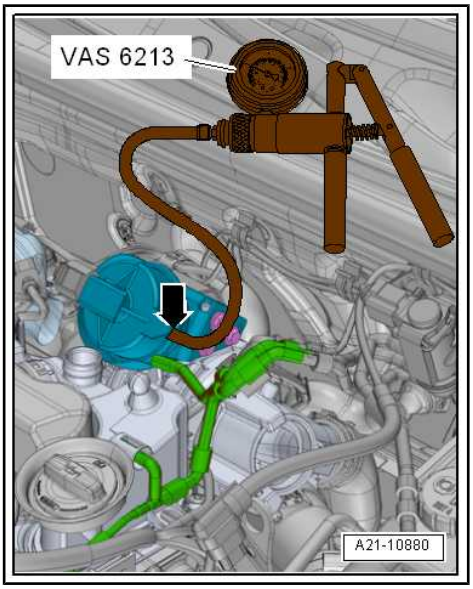
– Use ⇒ Vehicle diagnostic tester.

– 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.

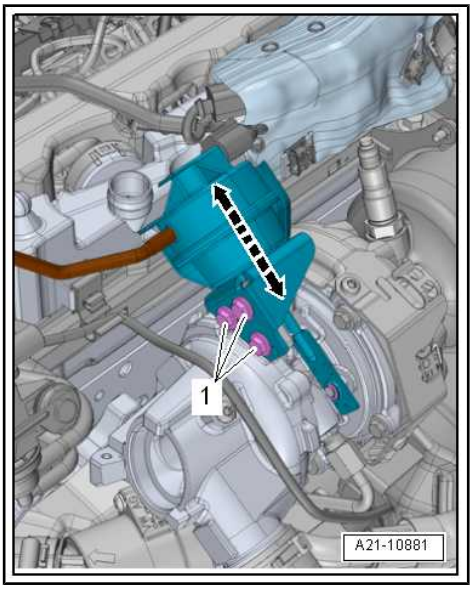
– **Vacuum must NOT exceed -800 mbar.**

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

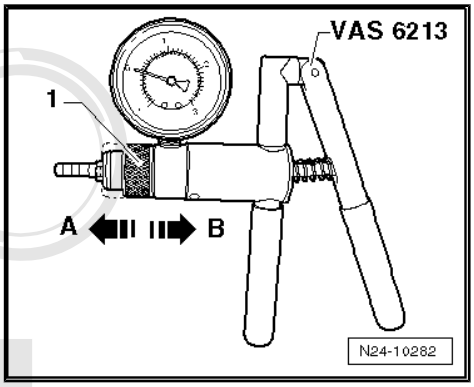
– Slide vacuum unit -arrow- until specification in `Measured values` display zone is attained.

♦ Specification: 0.75 ± 0.05 V

– Then tighten bolts -1- to 10 Nm.



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



Performing adaption

– Switch to `Guided Functions` and select `01 - Adaption elec. adjuster with checkback`.

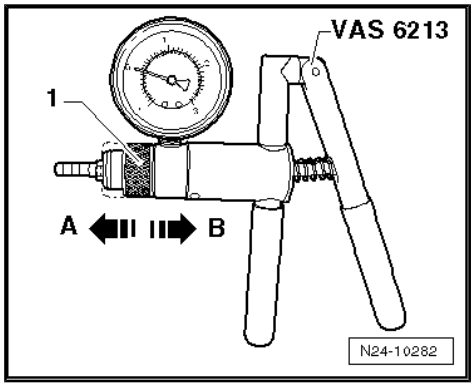
– Perform adaption.

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`.

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

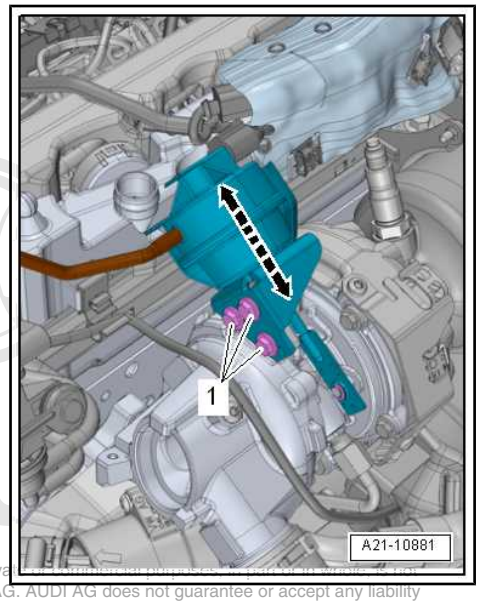


Voltage value not OK

– Loosen bolts -1-.
– Adjust voltage value again ⇒ page 214 .

Voltage value OK

– Secure bolts with sealing paint.
– Install engine cover panel ⇒ page 40 .
– Erase all event memories ⇒ Vehicle diagnostic tester.



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2 Charge air system

⇒ "2.1 Exploded view - charge air system", page 217

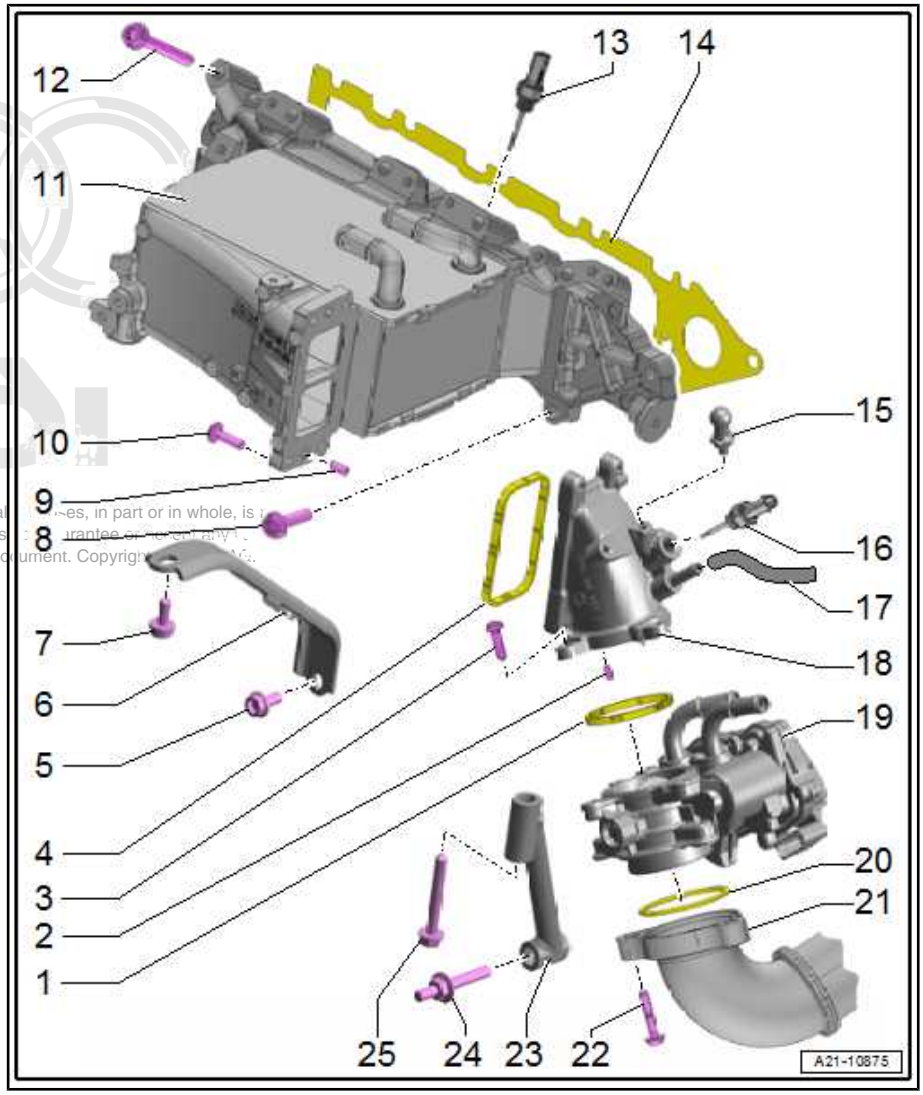
⇒ "2.2 Exploded view - hose connections for charge air system", page 218

⇒ "2.3 Removing and installing charge pressure sender G31 ", page 219

⇒ "2.4 Removing and installing charge air temperature sender", page 219

⇒ "2.5 Checking charge air system for leaks", page 220

2.1 Exploded view - charge air system



1 - Seal
- ❑ Renew after removing

2 - Dowel pin

3 - Bolt
- ❑ Tightening torque ⇒ Item 3 (page 238)

4 - Gasket
- ❑ Renew after removing

5 - Bolt
- ❑ Tightening torque ⇒ Item 5 (page 238)

6 - Bracket
- ❑ For intake manifold

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7 - Bolt
- ❑ Tightening torque ⇒ Item 7 (page 238)

8 - Bolt
- ❑ Tightening torque and sequence ⇒ page 239

9 - Dowel pin

10 - Bolt
- ❑ Tightening torque ⇒ Item 10 (page 238)

11 - Intake manifold with charge air cooler
- ❑ Intake manifold and charge air cooler are combined as one unit
- ❑ Removing and installing ⇒ page 242

12 - Bolt
- ❑ Tightening torque and sequence ⇒ page 239

13 - Charge air temperature sender after charge air cooler - G811-
- ❑ Removing and installing ⇒ page 219

14 - Gasket
- ❑ Renew after removing

15 - Ball stud

- ❑ For engine cover panel
- ❑ Tightening torque ⇒ Item 15 (page 238)

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

- ❑ Removing and installing ⇒ page 219
- ❑ 22 Nm

17 - Hose

- ❑ To charge pressure sender - G31-

18 - Connection

- ❑ For throttle valve module - J338-

19 - Throttle valve module - J338-

- ❑ With throttle valve potentiometer - G69-
- ❑ Removing and installing ⇒ page 240

20 - O-ring

- ❑ Renew after removing

21 - Air pipe

22 - Bolt

- ❑ 8 Nm

23 - Bracket

- ❑ For throttle valve module - J338-

24 - Centre hex stud

- ❑ Tightening torque and sequence ⇒ page 240

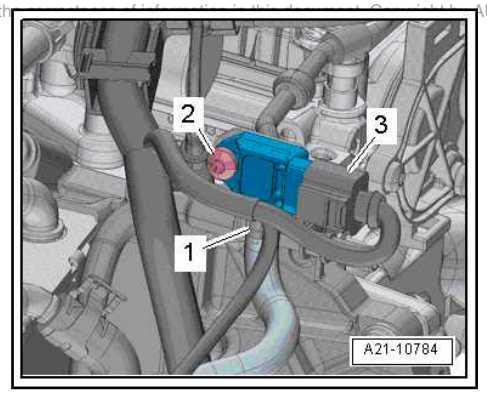
25 - Bolt

- ❑ Tightening torque and sequence ⇒ page 240

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Charge pressure sender - G31- - tightening torque

– Tighten bolt -2- to 9 Nm.



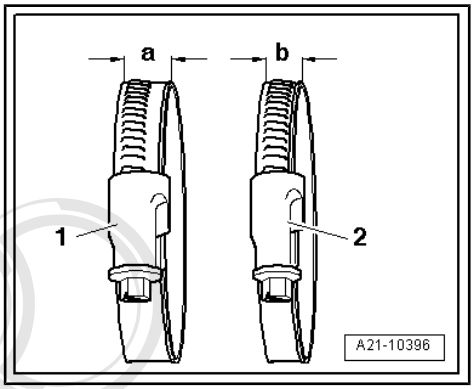
2.2 Exploded view - hose connections for charge air system

- 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 .
- The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.

Tightening torques

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

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



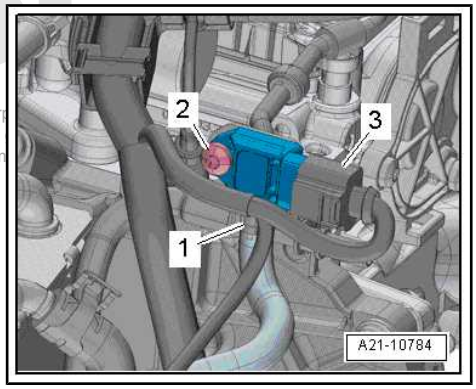
2.3 Removing and installing charge pressure sender - G31-

Removing

– Remove engine cover panel ⇒ page 40 .

– Unplug electrical connector -3-.

– Spray hose -1- on charge pressure sender - G31- with suitable release agent before disconnecting.



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.

– Unscrew bolts -2- and remove charge pressure sender - G31- .

Installing

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

– Install engine cover panel ⇒ page 40 .

Tightening torques

♦ ⇒ Fig. "" Charge pressure sender -G31- - tightening torque"" , page 218

2.4 Removing and installing charge air temperature sender

Removing

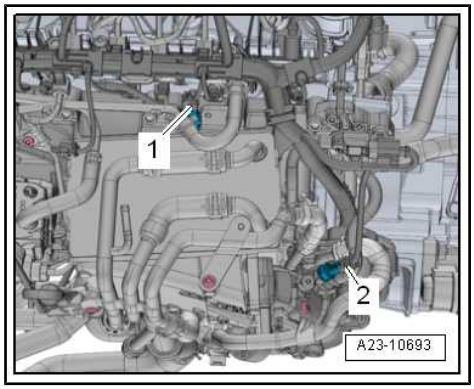
– Remove engine cover panel ⇒ page 40 .

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– Unplug corresponding electrical connector:

1 - For charge air temperature sender after charge air cooler - G811-

2 - For charge air temperature sender before charge air cooler - G810-



– Unscrew relevant charge air temperature sender.

Installing

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

– Install engine cover panel ⇒ page 40 .

Tightening torques

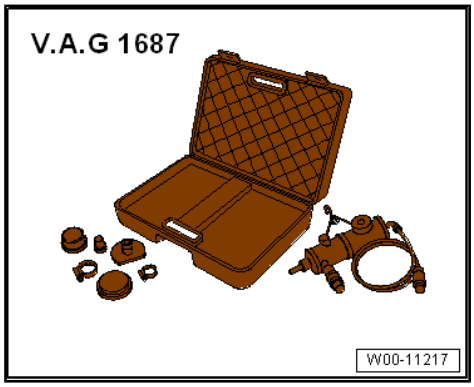
♦ ⇒ “4.1 Exploded view - intake manifold”, page 238

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

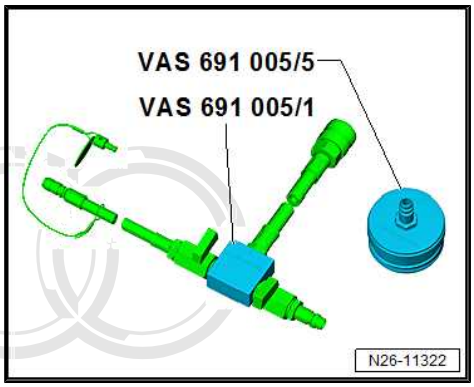
♦ Charge air system tester - V.A.G 1687-



♦ Adapter - V.A.G 1687/11-

♦ Adapter - V.A.G 1687/15-

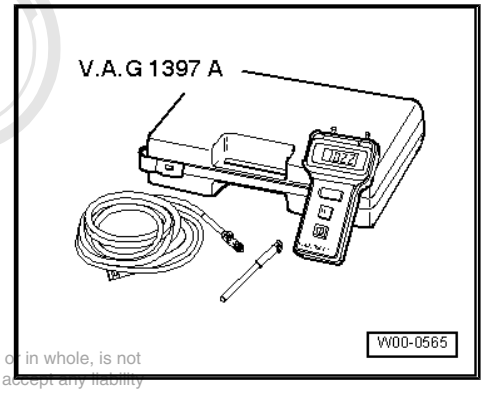
♦ Y-connector - VAS 691 005/1-



♦ Test adapter - VAS 691 005/5-

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- Turbocharger tester - V.A.G 1397A-

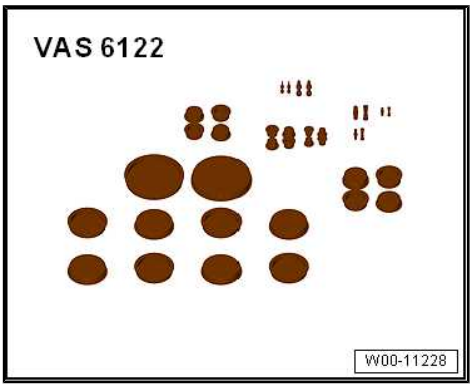


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- Hose clip pliers - VAS 6362-



- Engine bung set - VAS 6122-



Procedure

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

– Remove engine cover panel ⇒ page 40 .

– 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«.

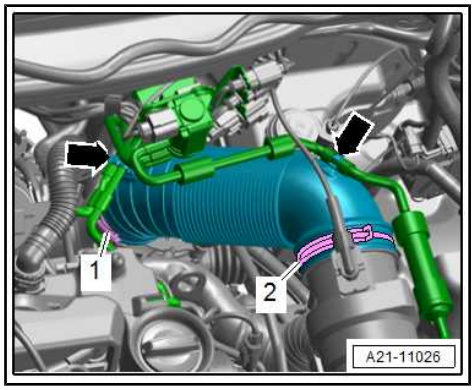
– Attach hose from connection »A« on Y-connector to connection »II« on turbocharger tester - V.A.G 1397A- .

– 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- :

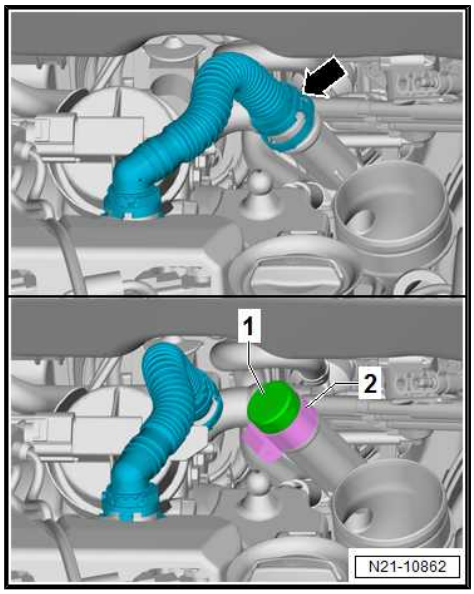
– Move clear vacuum hoses -arrows-.

– Loosen hose clips -1, 2- and remove air pipe.



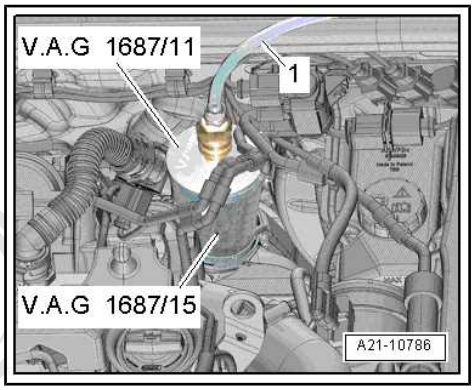
– Detach breather pipe for crankcase breather system -arrow-.

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



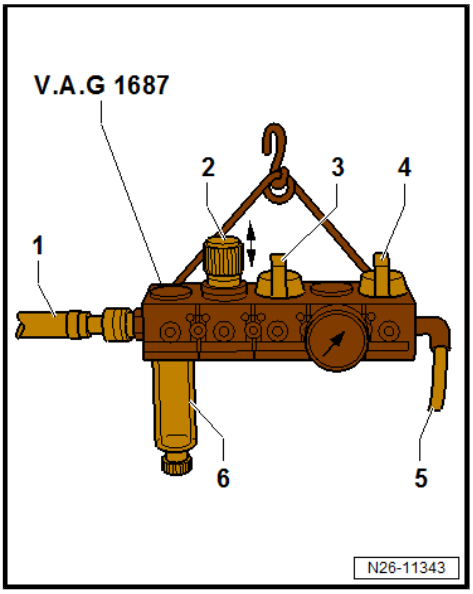
– Connect adapter - V.A.G 1687/11- with -V.A.G 1687/15- to turbocharger.

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



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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-.

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

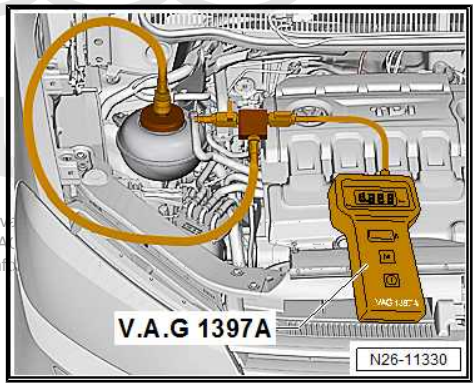
♦ By feeling

♦ Using a commercially available leak detection spray

♦ Using ultrasonic tester - V.A.G 1842-

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.

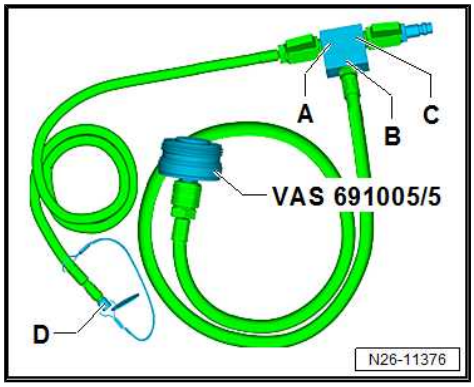
– If pressure displayed on turbocharger tester rises, this means that compressed air is escaping into the cooling system.

– 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.

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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.

Assembling

Assemble in reverse order.

– Install engine cover panel ⇒ page 40 .

Tightening torques

♦ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

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23 – Mixture preparation - injection

1 Injection system

⇒ “1.1 Overview of fitting locations - injection system”, page 225

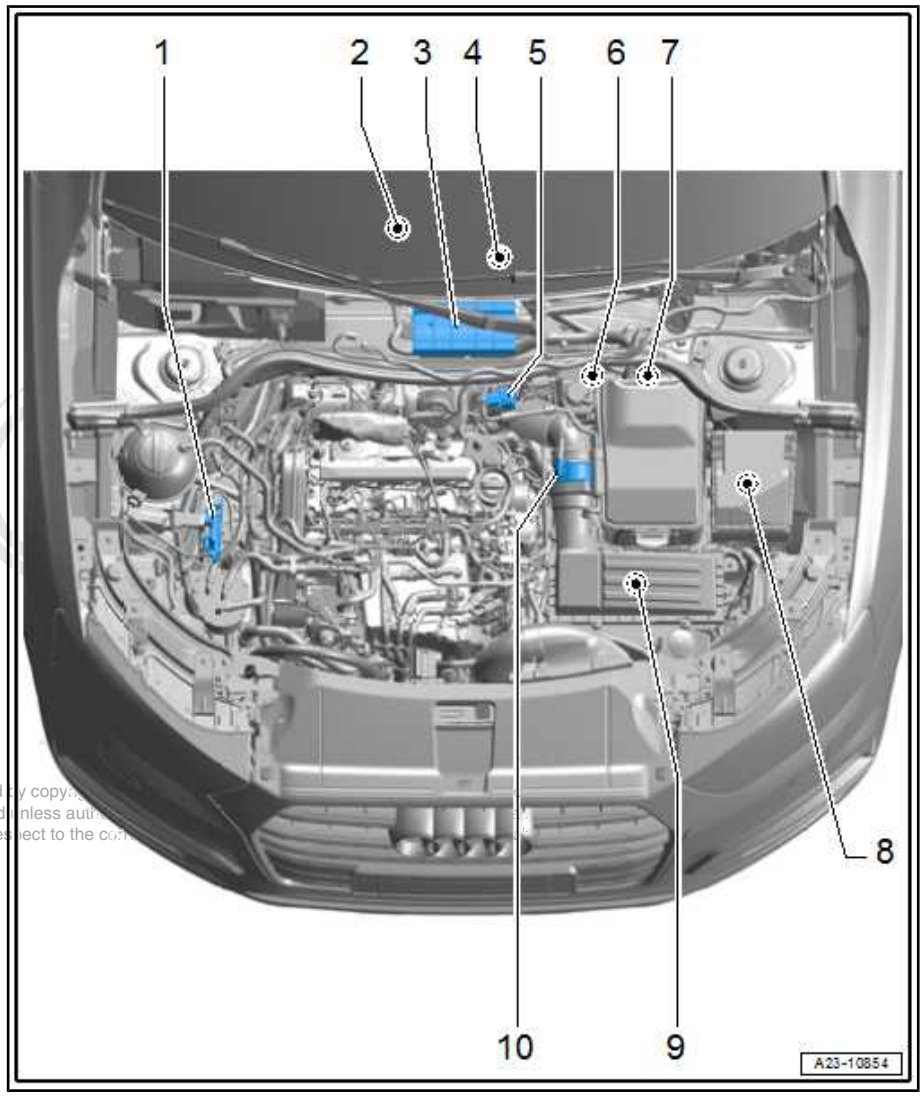
⇒ “1.2 Overview - fuel system”, page 231

⇒ “1.3 Filling and bleeding fuel system”, page 232

⇒ “1.4 Checking fuel system for leaks”, page 233

1.1 Overview of fitting locations - injection system

Overview of fitting locations - engine compartment



1 - Control unit for NOx sender - J583-

- ❑ Exploded view ⇒ page 273

2 - Exhaust flap control unit - J883-

- ❑ Fitting location ⇒ page 227

3 - Engine control unit - J623-

- ❑ Removing and installing ⇒ page 277

4 - Accelerator position sender - G79- and accelerator position sender 2 - G185-

- ❑ Fitting location ⇒ page 226

5 - Charge pressure control solenoid valve - N75-

6 - Brake light switch - F- / brake pedal switch - F63-

- ❑ Fitting location ⇒ page 226

7 - Clutch position sender - G476-

- ❑ Only fitted on vehicles with manual gearbox
- ❑ Fitting location ⇒ page 226

8 - Automatic glow period control unit - J179-

- ❑ Fitting location ⇒ page 227

9 - Gearbox neutral position sender - G701- / reversing light switch - F4-

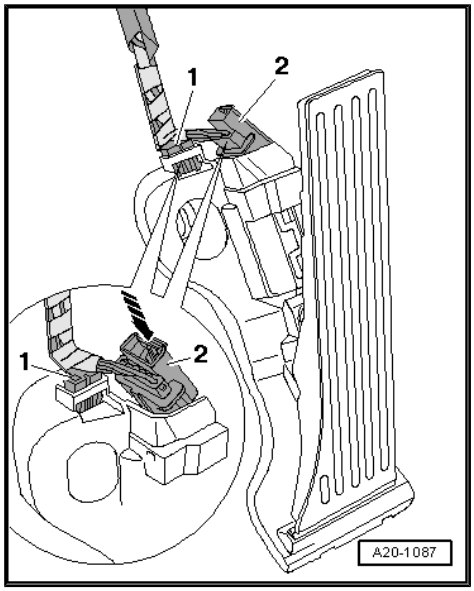
- ❑ Only fitted on vehicles with manual gearbox
- ❑ Fitting location ⇒ page 227

10 - Air mass meter - G70-

- ❑ Exploded view ⇒ page 236

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Fitting location of accelerator position sender - G79- / accelerator position sender 2 - G185-



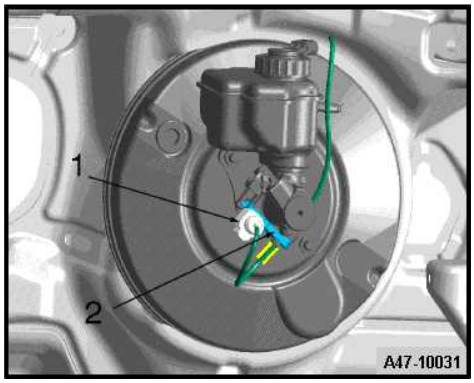
♦ In accelerator pedal module

2 - Electrical connector for accelerator pedal module

- The accelerator position sender - G79- and accelerator position sender 2 - G185- are integrated in the accelerator pedal module and cannot be renewed individually.

Removing and installing ⇒ Fuel supply system, diesel engines; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79-/-G185- .

Fitting location of brake light switch - F- / brake pedal switch - F63-



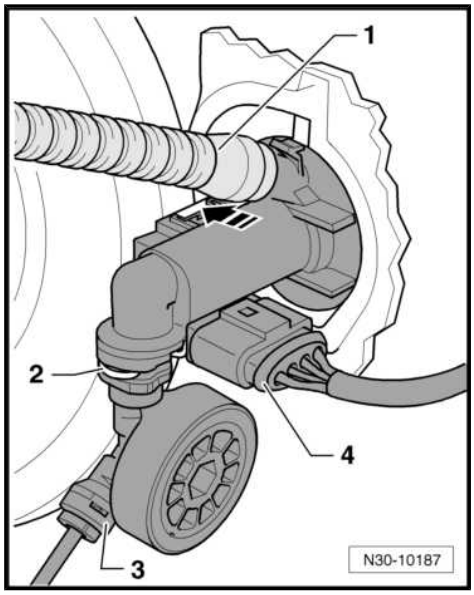
♦ On brake master cylinder in engine compartment

1 - Brake light switch - F- and brake pedal switch - F63-

Removing and installing ⇒ Brake system; Rep. gr. 47 ; Brake servo/brake master cylinder; Removing and installing brake light switch

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Fitting location of clutch position sender - G476-



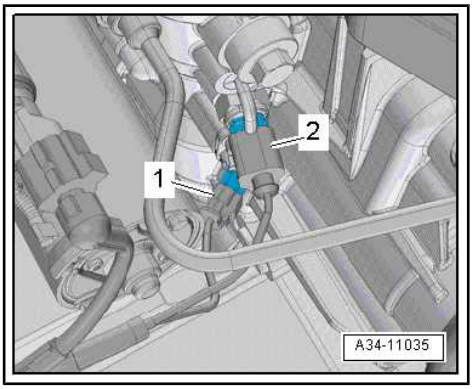
♦ On clutch master cylinder (bottom)

Integrated functions: clutch pedal switch for engine start - F194- and clutch pedal switch - F36-

4 - Electrical connector for clutch position sender - G476-

Removing and installing ⇒ Rep. gr. 30 ; Clutch mechanism; Removing and installing clutch position sender - G476-

Fitting location of gearbox neutral position sender - G701- / reversing light switch - F4-

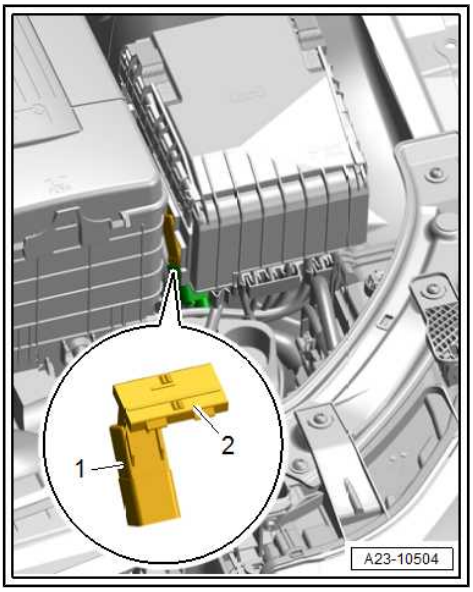


♦ On manual gearbox (front left)

1 - Electrical connector for gearbox neutral position sender - G701-

2 - Electrical connector for reversing light switch - F4-

Fitting location of automatic glow period control unit - J179-

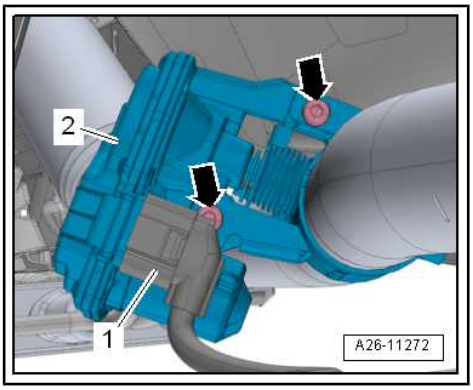


♦ Under electronics box in engine compartment (left-side)

1 - Automatic glow period control unit - J179-

2 - Relay carrier

Fitting location of exhaust flap control unit - J883-



• In front exhaust pipe

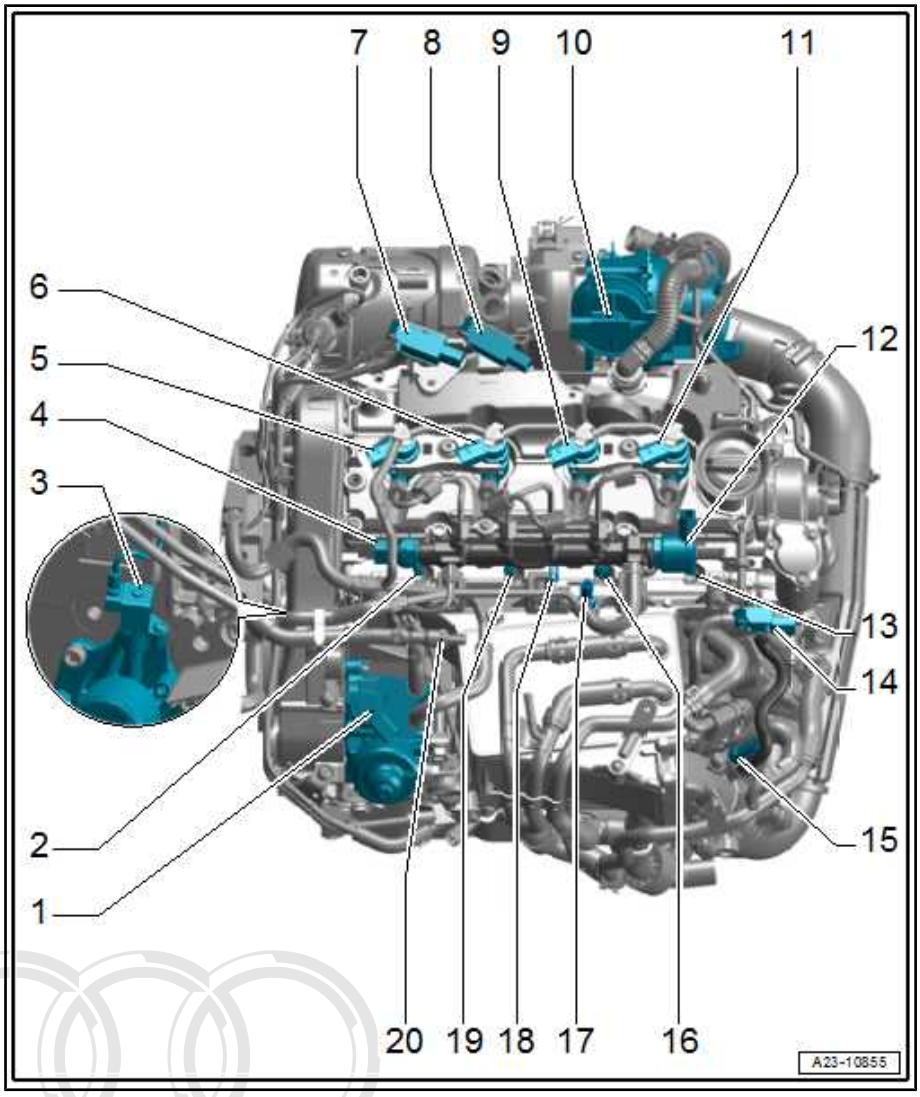
1 - Electrical connector

2 - Exhaust flap control unit - J883-

Removing and installing ⇒ page 299

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Overview of fitting locations - engine (view from above)



1 - Fuel metering valve - N290-

- ❑ Integrated in high-pressure pump
- ❑ Exploded view ⇒ page 264

2 - Glow plug 1 - Q10-

- ❑ Exploded view ⇒ page 329

3 - Coolant valve for cylinder head - N489-

- ❑ Exploded view ⇒ page 171

4 - Fuel pressure sender - G247-

- ❑ Exploded view ⇒ page 249

5 - Injector, cylinder 1 - N30-

- ❑ Exploded view ⇒ page 246

6 - Injector, cylinder 2 - N31-

- ❑ Exploded view ⇒ page 246

7 - Pressure differential sender - G505-

- ❑ Exploded view ⇒ page 273

8 - Exhaust gas pressure sensor 1 - G450-

- ❑ Exploded view ⇒ page 273

9 - Injector, cylinder 3 - N32-

- ❑ Exploded view ⇒ page 246

10 - Position sender for charge pressure positioner - G581-

11 - Injector, cylinder 4 - N33-

- ❑ Exploded view ⇒ page 246

12 - Fuel pressure regulating valve - N276-

- ❑ Exploded view ⇒ page 249

13 - Glow plug 4 - Q13-

- ❑ Exploded view ⇒ page 329

14 - Charge pressure sender - G31-

- ❑ Exploded view ⇒ page 217

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

- ❑ Exploded view ⇒ page 238

16 - Glow plug 3 - Q12- with cylinder 3 combustion chamber pressure sender - G679-

- ❑ Exploded view ⇒ page 329

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

- ❑ Exploded view ⇒ page 238

18 - Hall sender - G40- (camshaft position sensor)

- ❑ Exploded view ⇒ page 329

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19 - Glow plug 2 - Q11-

- ❑ Exploded view ⇒ page 329

20 - Fuel temperature sender - G81-

- ❑ In fuel supply line
- ❑ Removing and installing ⇒ page 268

Overview of fitting locations - engine (view from left side)

1 - Charge air cooling pump - V188-

- ❑ Exploded view ⇒ page 173

2 - Valve for oil pressure control - N428-

- ❑ Exploded view ⇒ Item 18 (page 137)

3 - Throttle valve module - J338-

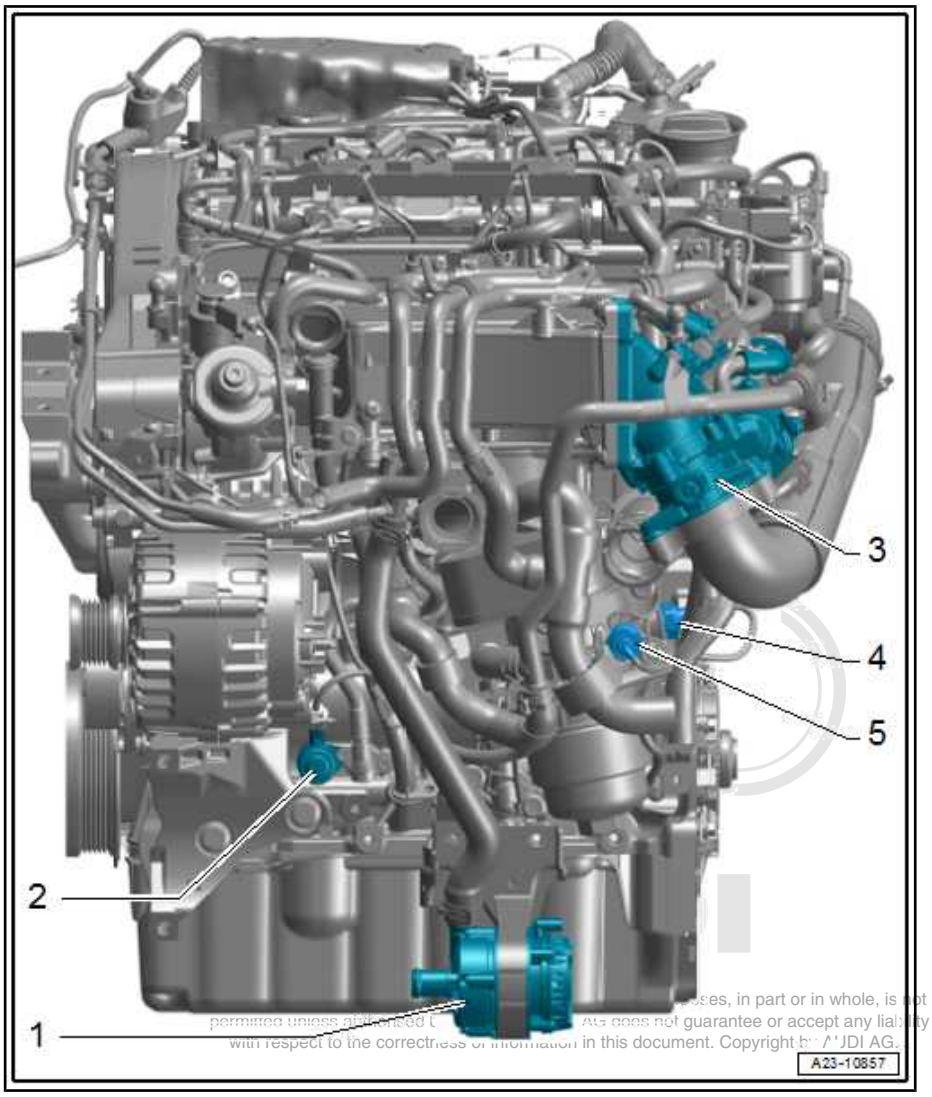
- ❑ With throttle valve potentiometer - G69-
- ❑ Exploded view ⇒ page 238

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

- ❑ Exploded view ⇒ page 153

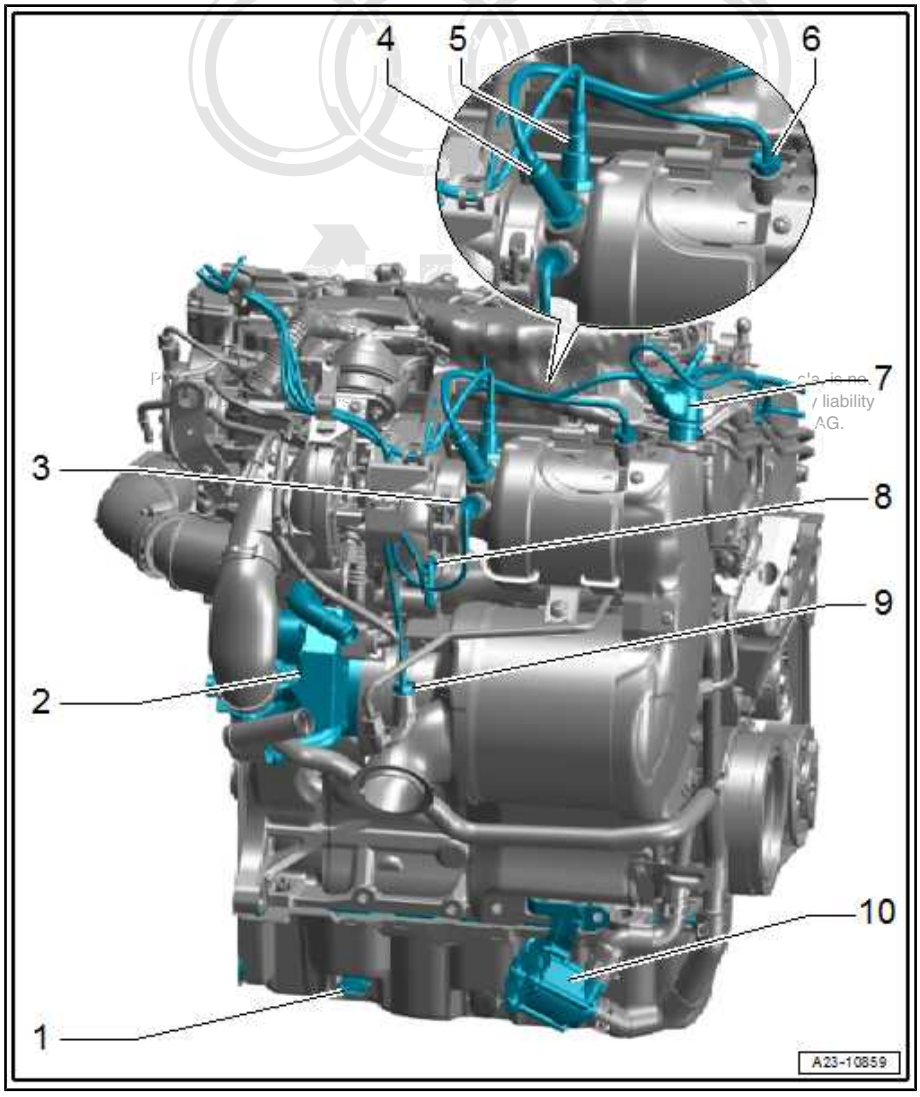
5 - Oil pressure switch - F22-

- ❑ Exploded view ⇒ page 153



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Overview of fitting locations - engine (view from right side)



1 - Oil level and oil temperature sender - G266-

- ❑ Removing and installing ⇒ “1.3 Removing and installing oil level and oil temperature sender G266 ”, page 150

2 - Exhaust gas recirculation control motor 2 - V339- with exhaust gas recirculation potentiometer 2 - G466-

- ❑ Exploded view ⇒ page 318

3 - Exhaust gas temperature sender 2 - G448-

- ❑ Exploded view ⇒ page 273

4 - NOx sender - G295-

- ❑ Exploded view ⇒ page 273

5 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Exploded view ⇒ page 273

6 - Exhaust gas temperature sender 3 - G495-

- ❑ Exploded view ⇒ page 273

7 - Injector for reducing agent - N474-

- ❑ Removing and installing ⇒ page 309

8 - Exhaust gas temperature sender 1 - G235-

- ❑ Exploded view ⇒ page 273

9 - Exhaust gas temperature sender 4 - G648-

- ❑ Exploded view ⇒ page 273

10 - Auxiliary pump for heating - V488-

- ❑ Exploded view ⇒ page 173

1 - Engine speed sender - G28-

- ❑ Exploded view
  ⇒ page 329

2 - Exhaust gas recirculation control motor - V338- with exhaust gas recirculation potentiometer - G212-

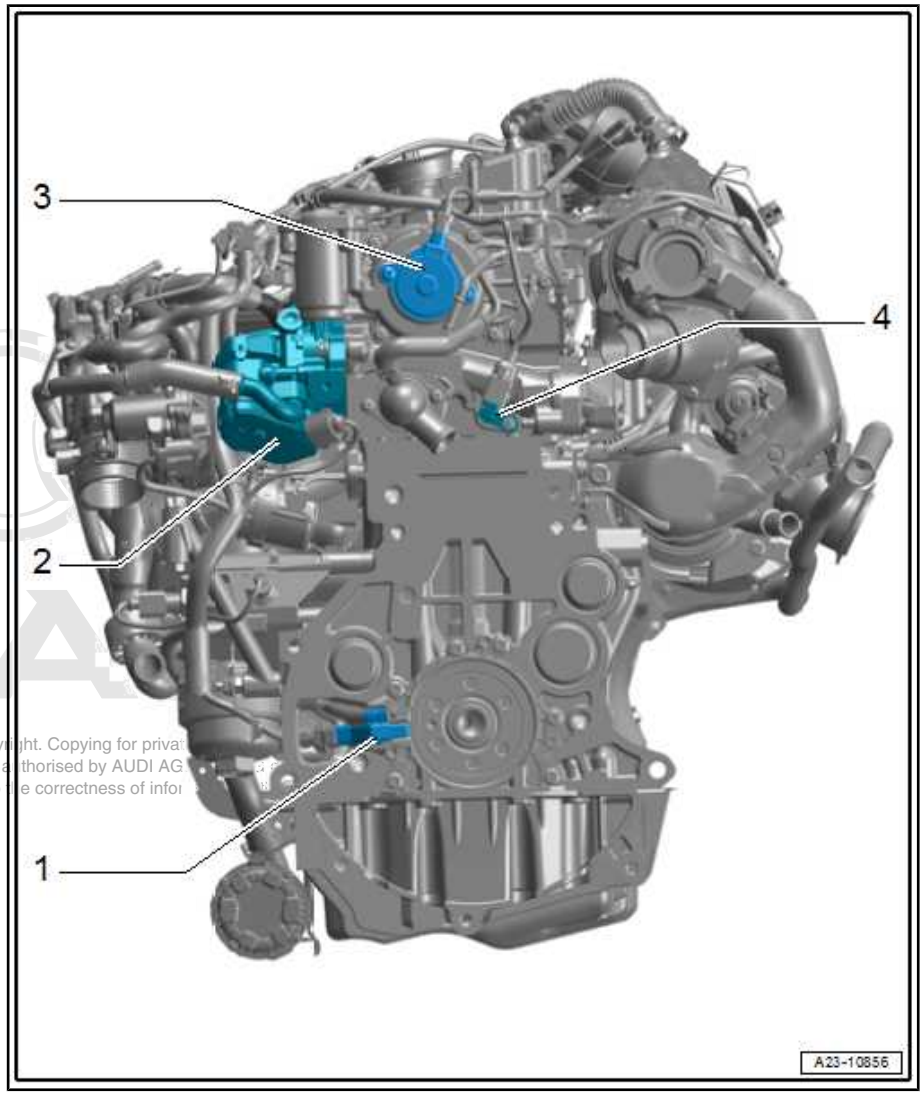
- ❑ Exploded view
  ⇒ page 318

3 - Camshaft control valve 1 - N205-

- ❑ Exploded view
  ⇒ page 115

4 - Coolant temperature sender - G62-

- ❑ Exploded view
  ⇒ page 174



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1.2 Overview - fuel system

Note

- *Red = Fuel supply lines*
- *Blue = Fuel return lines*
- *Arrows show direction of fuel flow.*

1 - Fuel filter

- ❑ Exploded view ⇒ Fuel supply system; Rep. gr. 20 ; Fuel filter; Exploded view - fuel filter

2 - High-pressure pump

- ❑ Exploded view ⇒ page 264

3 - Fuel metering valve - N290-

4 - Fuel temperature sender - G81-

5 - Fuel pressure sender - G247-

- ❑ Exploded view ⇒ page 249

6 - Fuel rail

- ❑ Exploded view ⇒ page 249

7 - Fuel pressure regulating valve - N276-

- ❑ Exploded view ⇒ page 249

8 - Injectors

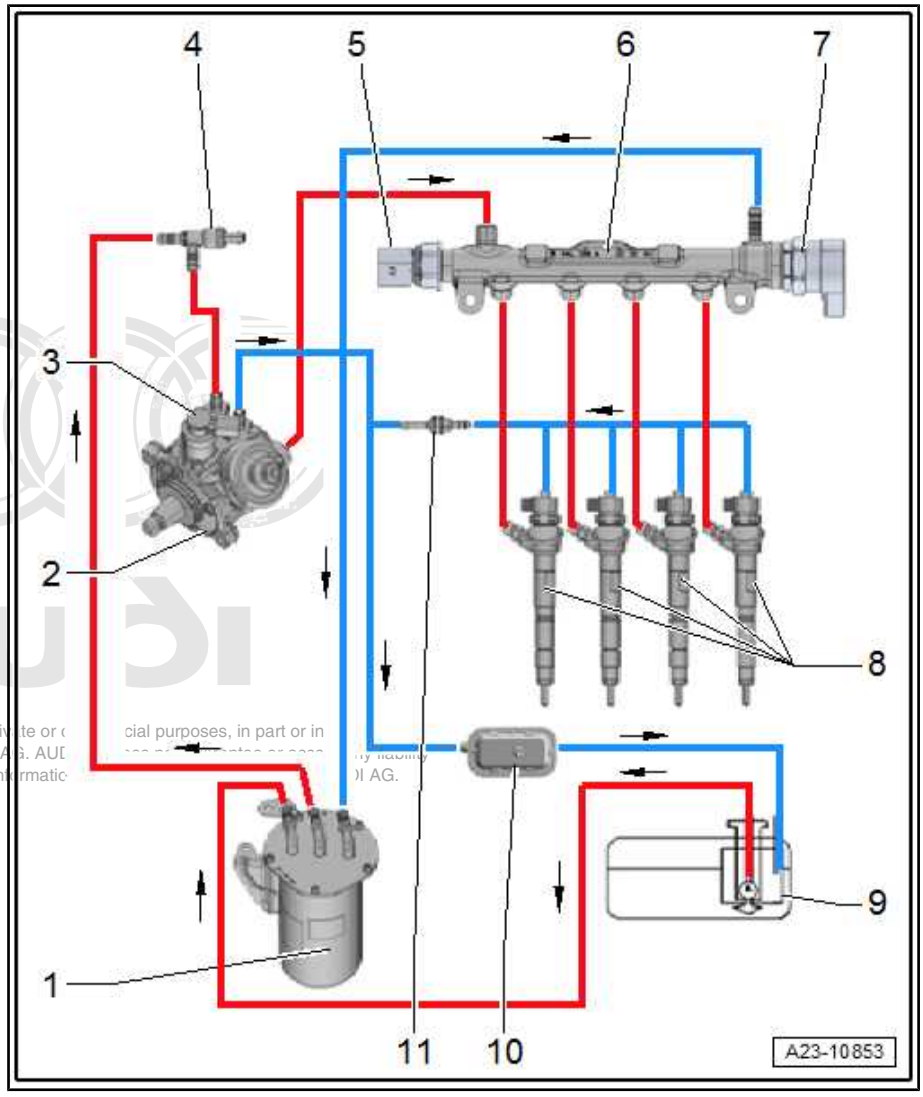
- ❑ Exploded view ⇒ page 246

9 - Fuel tank

- ❑ With fuel system pressurisation pump - G6-
- ❑ Exploded view ⇒ Fuel supply system - diesel engines; Rep. gr. 20 ; Fuel tank; Exploded view - fuel tank

10 - Damper

11 - Restrictor



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1.3 Filling and bleeding fuel system

Special tools and workshop equipment required

- ♦ Vehicle diagnostic tester

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`

– The fuel pump starts running.
– The fuel pump must run for approx. 3 minutes 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.
– 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

– 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 fuel system again for leaks.

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2 Vacuum system

⇒ “2.1 Connection diagram - vacuum system”, page 234

⇒ “2.2 Checking vacuum system”, page 234

2.1 Connection diagram - vacuum system

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1 - Vacuum line

2 - Non-return valve

- ❑ Note installation position

3 - Cylinder head cover

- ❑ With vacuum reservoir

4 - Vacuum unit for charge pressure control

- ❑ With position sender for charge pressure positioner - G581-
- ❑ On turbocharger

5 - Control pipe for vacuum

- ❑ From charge pressure control solenoid valve - N75- to vacuum unit on turbocharger

6 - Charge pressure control solenoid valve - N75-

7 - To brake servo

8 - Non-return valve

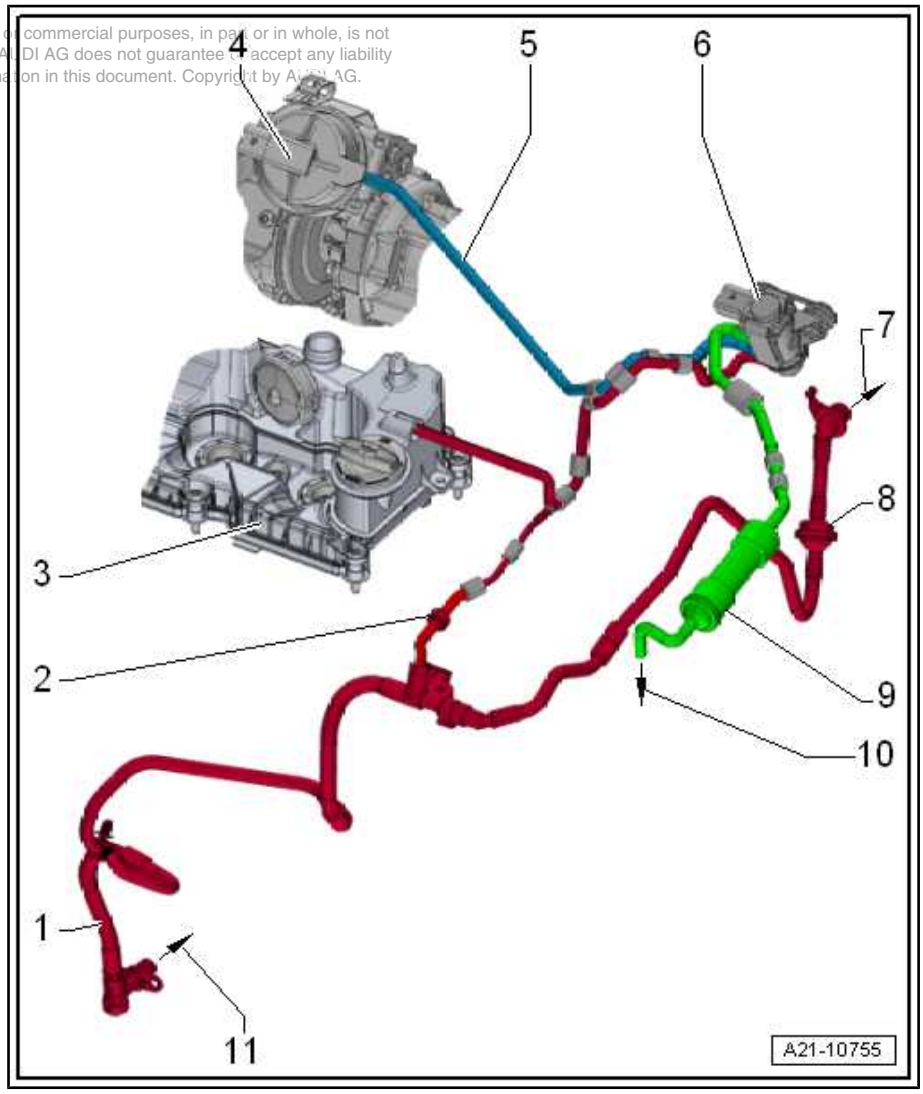
- ❑ Note installation position

9 - Vent line

10 - To air cleaner housing

11 - To vacuum pump

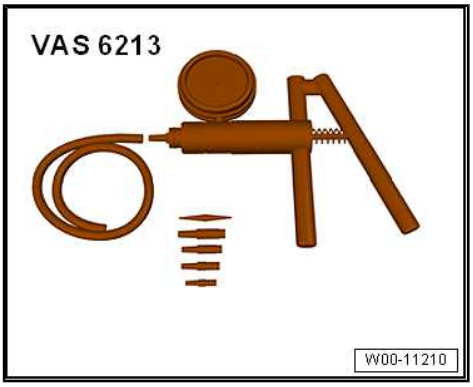
- ❑ In oil pump



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.

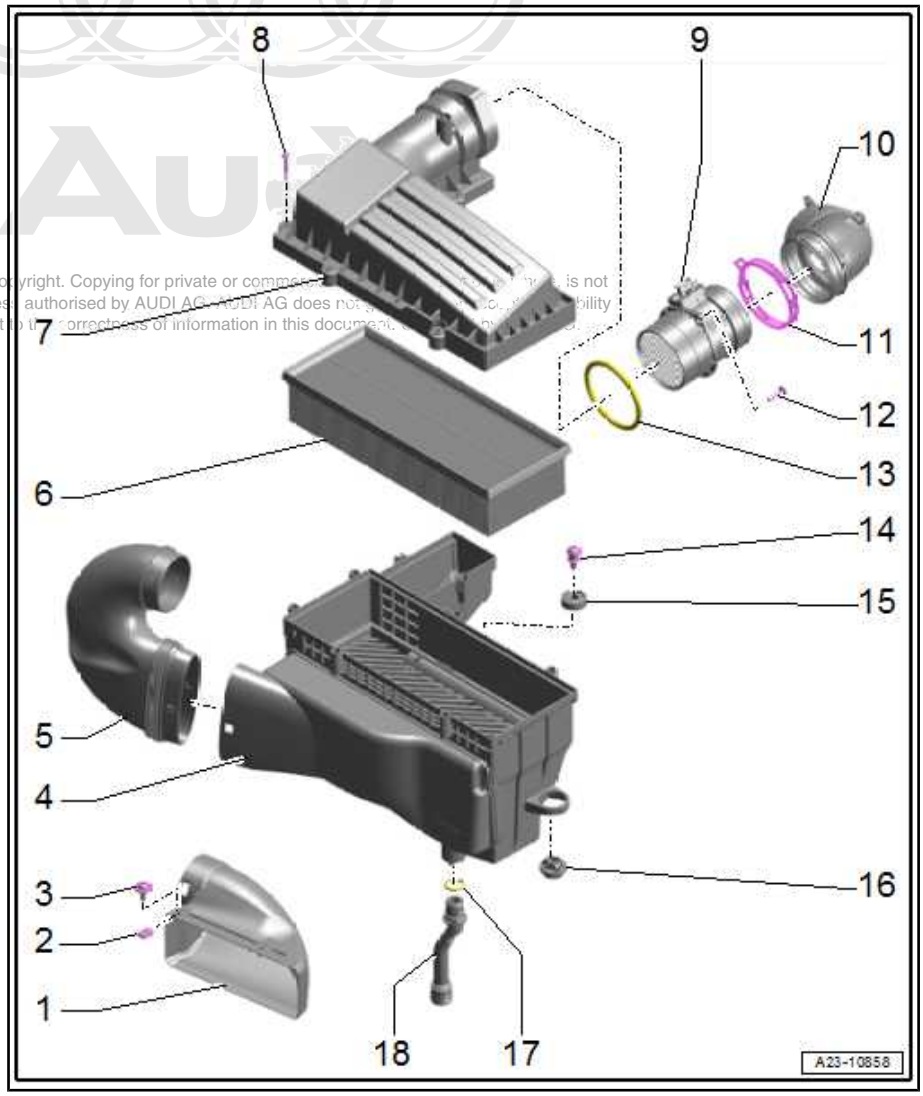
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3 Air cleaner

⇒ “3.1 Exploded view - air cleaner housing”, page 236

⇒ “3.2 Removing and installing air cleaner housing”, page 237

3.1 Exploded view - air cleaner housing



1 - Air duct

- ❑ On lock carrier
- ❑ Remove any salt residue, dirt and leaves

2 - Speed nut

3 - Bolt

- ❑ 1.5 Nm

4 - Air cleaner (bottom section)

- ❑ Remove any salt residue, dirt and leaves
- ❑ On vehicles for cold climates, air cleaner (bottom section) with hot air intake is installed
- ❑ Country-specific version with snow screen
- ❑ Removing and installing air cleaner housing ⇒ page 237

5 - Air duct

- ❑ On air cleaner (bottom section)
- ❑ Remove any salt residue, dirt and leaves

6 - Air filter element

- ❑ Always use genuine part for air filter element
- ❑ Removing and installing ⇒ Maintenance ; Booklet 820
- ❑ Change intervals ⇒ Maintenance tables

7 - Air cleaner (top section)

- ❑ Check for dirt

8 - Bolts

- ❑ For air cleaner (top section)
- ❑ 1.5 Nm

9 - Air mass meter - G70-

- ❑ Removing and installing ⇒ page 268

10 - Air hose

- ❑ To turbocharger
- ❑ Check for dirt

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11 - Spring-type clip

12 - Bolt

- ❑ 1.5 Nm

13 - O-ring

- ❑ Renew after removing
- ❑ Use silicone-free lubricant when installing

14 - Bolt

- ❑ With captive washer and spacer sleeve
- ❑ 8 Nm

15 - Grommet

16 - Grommet

17 - O-ring

- ❑ Renew after removing

18 - Water drain hose

- ❑ Clean

3.2 Removing and installing air cleaner housing

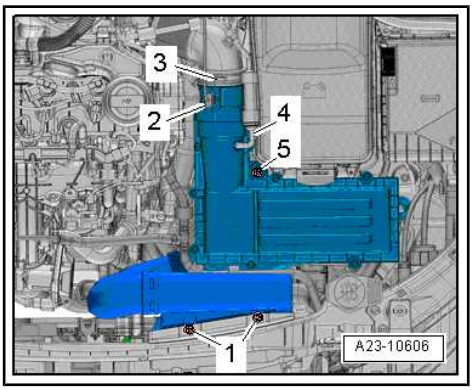
Removing

– Unplug electrical connector -2- at air mass meter - G70- .

– Detach hose -4-.

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

– Unscrew bolts -1 and 5- and detach air cleaner housing.



Installing

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

Note

Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.

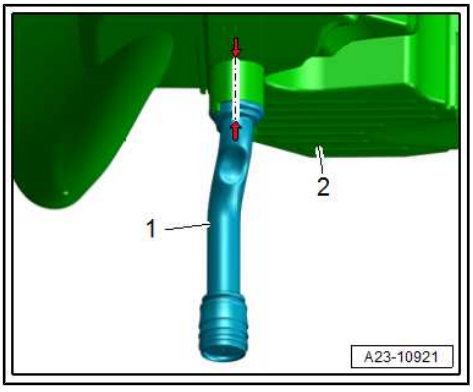
Use silicone-free lubricant when installing air hose.

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

– Turn water drain hose -1- anti-clockwise and detach from air cleaner (bottom section) -2-.

– Clean dirt and leaves out of connection and hose.

– Bring water drain hose into installation position and turn clockwise until both arrow marks are opposite each other, as shown in illustration.



Tightening torques

◆ ⇒ "3.1 Exploded view - air cleaner housing", page 236

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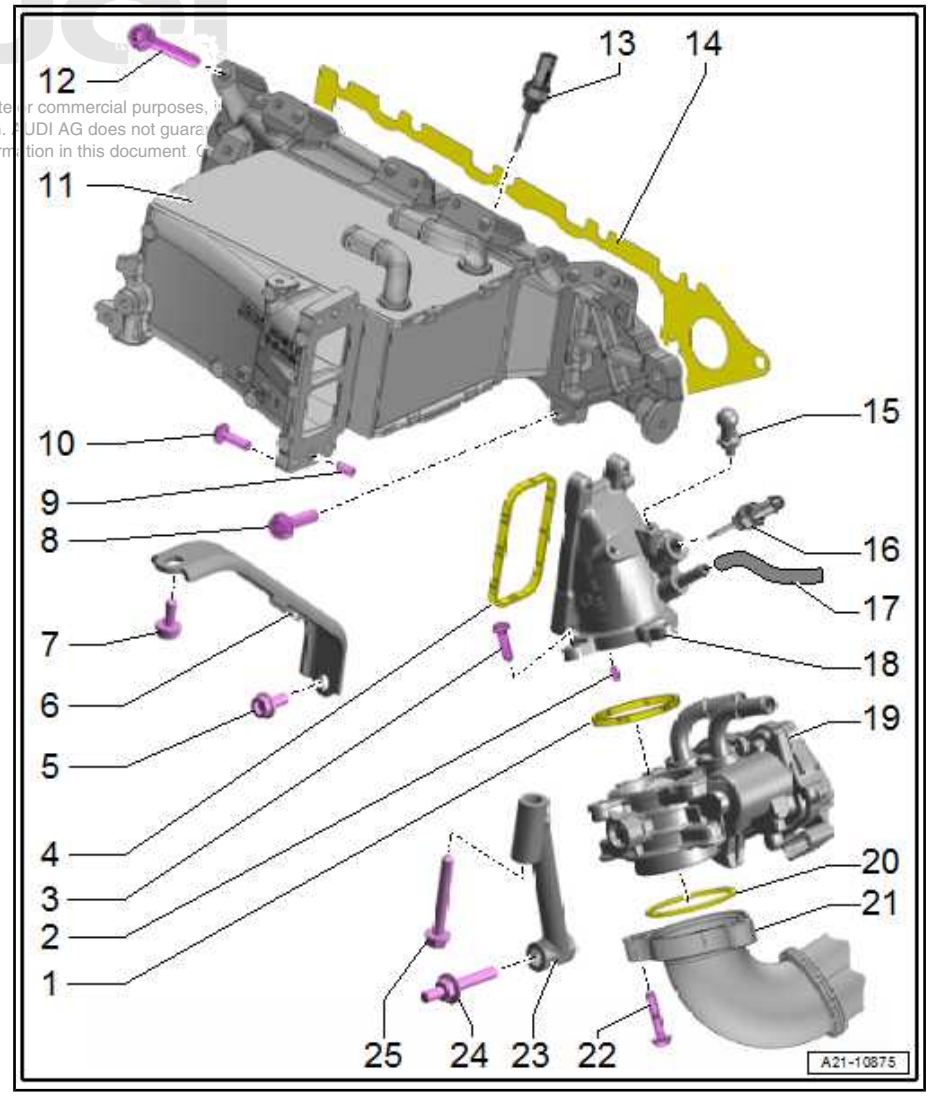
4 Intake manifold

⇒ “4.1 Exploded view - intake manifold”, page 238

⇒ “4.2 Removing and installing throttle valve module J338 ”, page 240

⇒ “4.3 Removing and installing intake manifold”, page 242

4.1 Exploded view - intake manifold



1 - Seal

- ❑ Renew after removing

2 - Dowel pin

3 - Bolt

- ❑ 8 Nm

4 - Gasket

- ❑ Renew after removing

5 - Bolt

- ❑ Tightening torque and sequence ⇒ page 240

6 - Bracket

- ❑ For intake manifold

7 - Bolt

- ❑ Tightening torque and sequence ⇒ page 240

8 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 239

9 - Dowel pin

10 - Bolt

- ❑ 8 Nm

11 - Intake manifold with charge air cooler

- ❑ Intake manifold and charge air cooler are combined as one unit
- ❑ Removing and installing ⇒ page 242

12 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 239

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

- ❑ Removing and installing ⇒ page 219
- ❑ 22 Nm

14 - Gasket

- ❑ Renew after removing

15 - Ball stud

- ❑ For engine cover panel
- ❑ 9 Nm

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

- ❑ Removing and installing ⇒ page 219
- ❑ Tightening torque ⇒ Item 16 (page 218)

17 - Hose

- ❑ To charge pressure sender - G31-

18 - Connection

- ❑ For throttle valve module - J338-

19 - Throttle valve module - J338-

- ❑ With throttle valve potentiometer - G69-
- ❑ Removing and installing ⇒ page 240

20 - O-ring

- ❑ Renew after removing

21 - Air pipe

22 - Bolt

- ❑ Tightening torque ⇒ Item 22 (page 218)

23 - Bracket

- ❑ For throttle valve module - J338-

24 - Centre hex stud

- ❑ 8 Nm

25 - Bolt

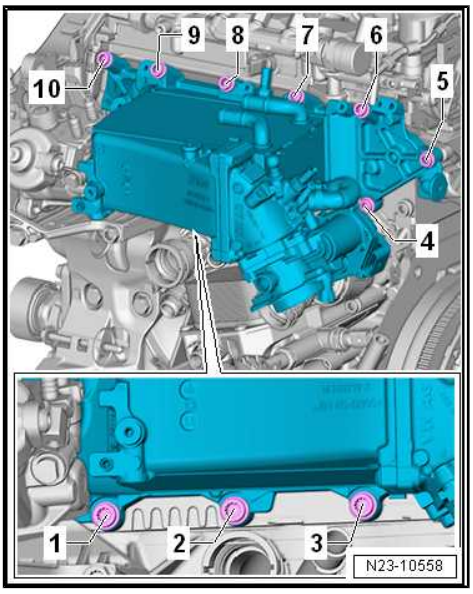
- ❑ Tightening torque and sequence ⇒ page 240

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Intake manifold with charge air cooler - tightening torque and sequence

– Tighten new 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

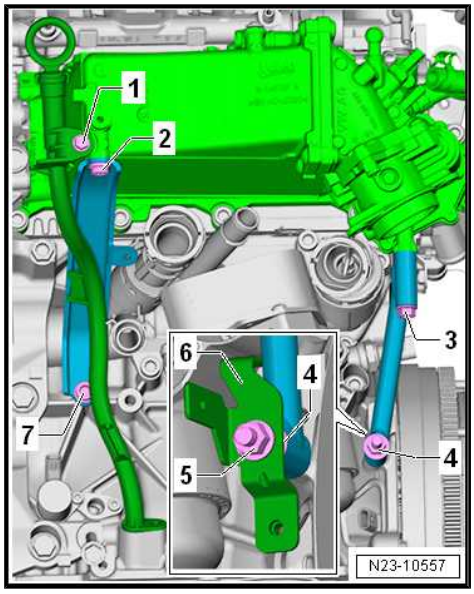


Bracket for intake manifold and bracket for throttle valve module - tightening torque and sequence

– Tighten bolts in stages:

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.

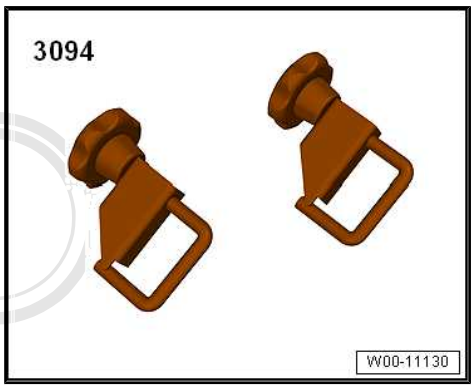
Stage	Bolts/nuts	Tightening torque
1.	-2, 3, 4, 7-	Screw in hand-tight as far as stop
2.	-2, 3, 4, 7-	Tighten to 20 Nm
3.	-5-	Tighten to 10 Nm
4.	-1-	Tighten to 10 Nm



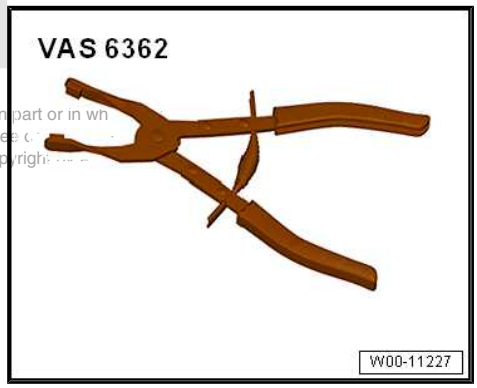
4.2 Removing and installing throttle valve module - J338-

Special tools and workshop equipment required

♦ Hose clamps, up to 25 mm - 3094-



♦ Hose clip pliers - VAS 6362-



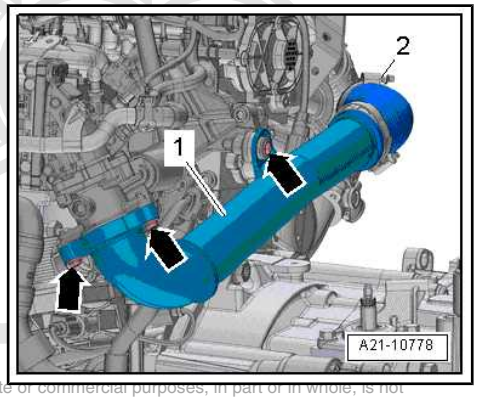
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Removing

– Remove engine cover panel ⇒ page 40 .

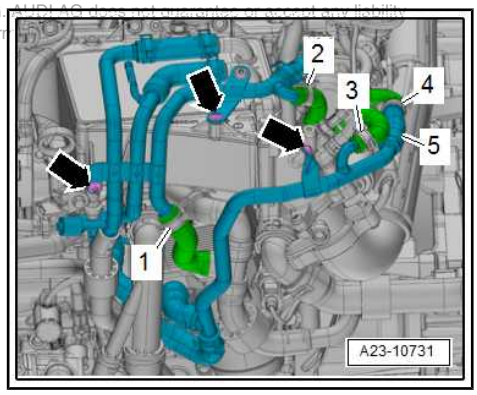
– Remove air cleaner housing ⇒ page 237 .

– Remove bolts -arrows-.
– Release screw-type clip -2- and detach air pipe -1-.

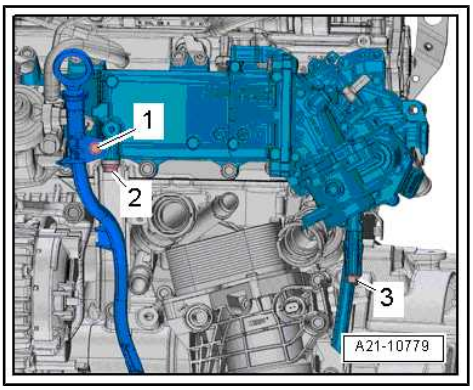


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– Remove bolts -arrows-.
– Clamp off coolant hoses -1, 5- with hose clamps up to 25 mm - 3094- .
– Hold a clean cloth under separating point to catch escaping coolant.
– Release hose clips -2, 3, 4- and disconnect coolant hoses.



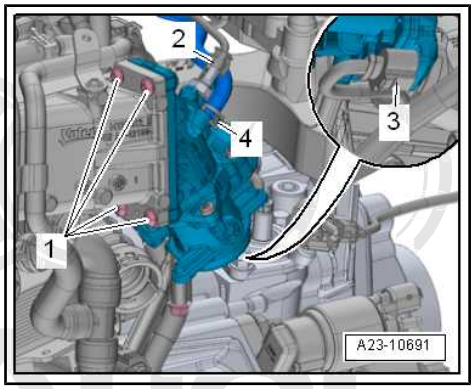
– Remove bolt -3-.



– Unplug electrical connectors:

2 - For charge air temperature sender before charge air cooler - G810-

3 - For throttle valve module - J338-



– Release hose clip -4- and detach air hose.

– Remove bolts -1- and detach connection with throttle valve module - J338- .

Installing

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

• Renew seals and O-ring.

– When fitting connection with throttle valve module - J338- , pay attention to dowel pins.

– Install coolant pipe (front left) ⇒ page 187 .

– Install coolant pipes (top) ⇒ page 184 .

– Install engine cover panel ⇒ page 40 .

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Tightening torques

♦ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

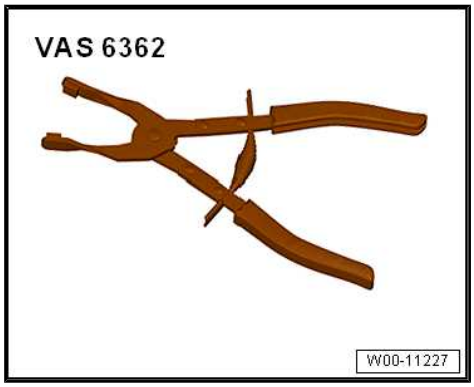
♦ ⇒ “4.1 Exploded view - intake manifold”, page 238

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-



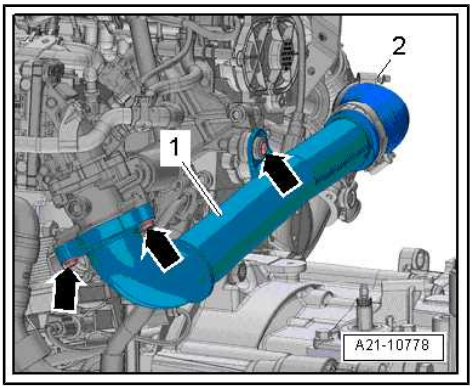
Removing

– Remove coolant pipes (top) ⇒ page 184 .

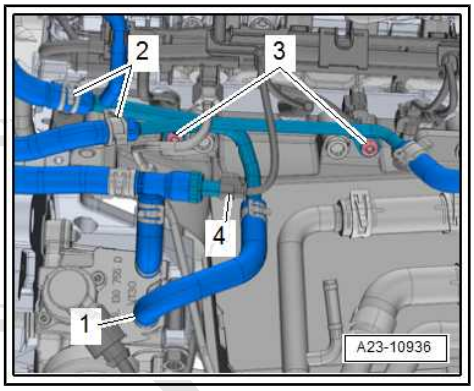
– Remove high-pressure pipe ⇒ page 259 .

– Remove air cleaner housing ⇒ page 237 .

– Unscrew bolts -arrows- using bit XZN 10 - T10501- .
– Release screw-type clip -2- and detach air pipe -1-.
• Observe rules for cleanliness ⇒ page 6 .

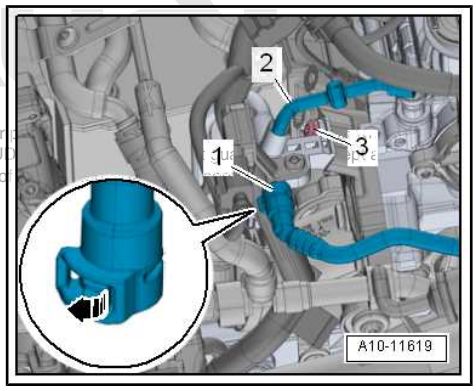


– Unplug electrical connector -4-.
– Release hose clip -1- and detach fuel hoses from high-pressure pump.
– Release hose clips -2- and detach fuel hoses.
– Remove bolts -3- and move fuel lines to rear.

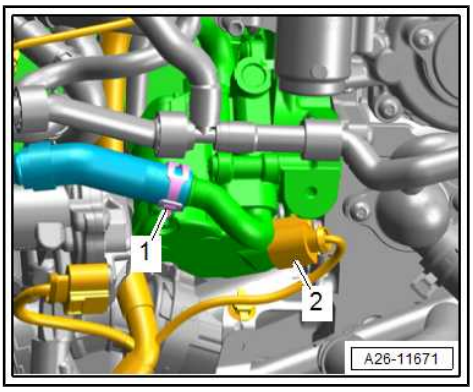


– Release catch -arrow- and disconnect vacuum hose -1-.
– Remove bolt -3- and disconnect vacuum hose -2-.

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– Unplug electrical connector -2-.
– Release hose clip -1- and disconnect coolant hose.



– Unplug electrical connectors and move clear:

1 - For charge air temperature sender after charge air cooler - G811-

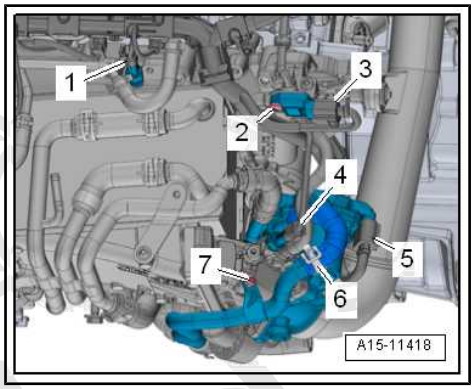
3 - For charge pressure sender - G31-

4 - For charge air temperature sender before charge air cooler - G810-

5 - For throttle valve module - J338-

– Remove bolts -2, 7- and detach coolant hose -6-.

– Remove connection together with throttle valve module - J338- ⇒ page 240 .

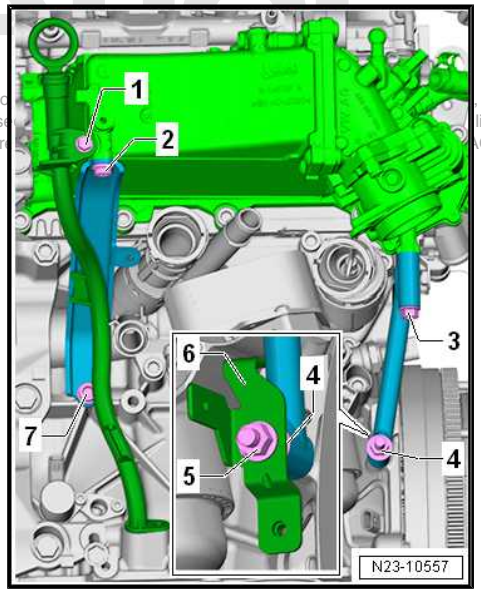


– Remove bolt -1- for dipstick guide tube.

– Remove nut -5- and detach bracket -6- from centre hex stud -4-.

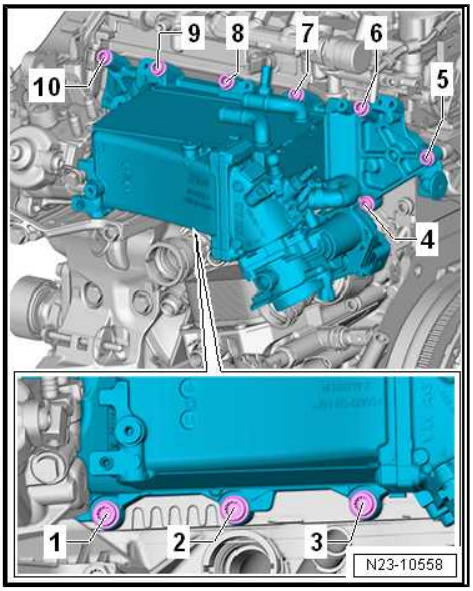
– Loosen bolts -4 and 7- several turns.

– Remove bolts -2, 3- for intake manifold support.



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– Remove bolts -10 … 1- with bit XZN 10 - T10501- and detach intake manifold with charge air cooler.



Installing

– Fit new gasket onto dowel pins in cylinder block.

– Fit intake manifold onto dowel pins in cylinder block.

– Tighten bolts for intake manifold ⇒ page 239 .

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

– Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install high-pressure pipe ⇒ page 259 .

– Install coolant pipe (front left) ⇒ page 187 .

– Install coolant pipes (top) ⇒ page 184 .

Tightening torques

- ⇒ “3.1 Exploded view - air cleaner housing”, page 236
- ⇒ “2.2 Exploded view - hose connections for charge air system”, page 218
- ⇒ Fig. ““Intake manifold with charge air cooler - tightening torque and sequence”“ , page 239
- ⇒ “4.1 Exploded view - intake manifold”, page 238
- ⇒ “1.1 Exploded view - sump/oil pump”, page 136

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5 Injectors/high-pressure reservoir (rail)

⇒ “5.1 Exploded view - injectors”, page 246

⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 249

⇒ “5.3 Checking injectors”, page 249

⇒ “5.4 Performing adaption of correction values for injectors”, page 250

⇒ “5.5 Checking for injectors sticking open”, page 250

⇒ “5.6 Checking return flow rate of injectors with engine running”, page 252

⇒ “5.7 Checking return flow rate of injectors at starter cranking speed”, page 254

⇒ “5.8 Removing and installing injectors”, page 256

⇒ “5.9 Removing and installing high-pressure pipes”, page 259

⇒ “5.10 Removing and installing high-pressure reservoir (rail)”, page 262

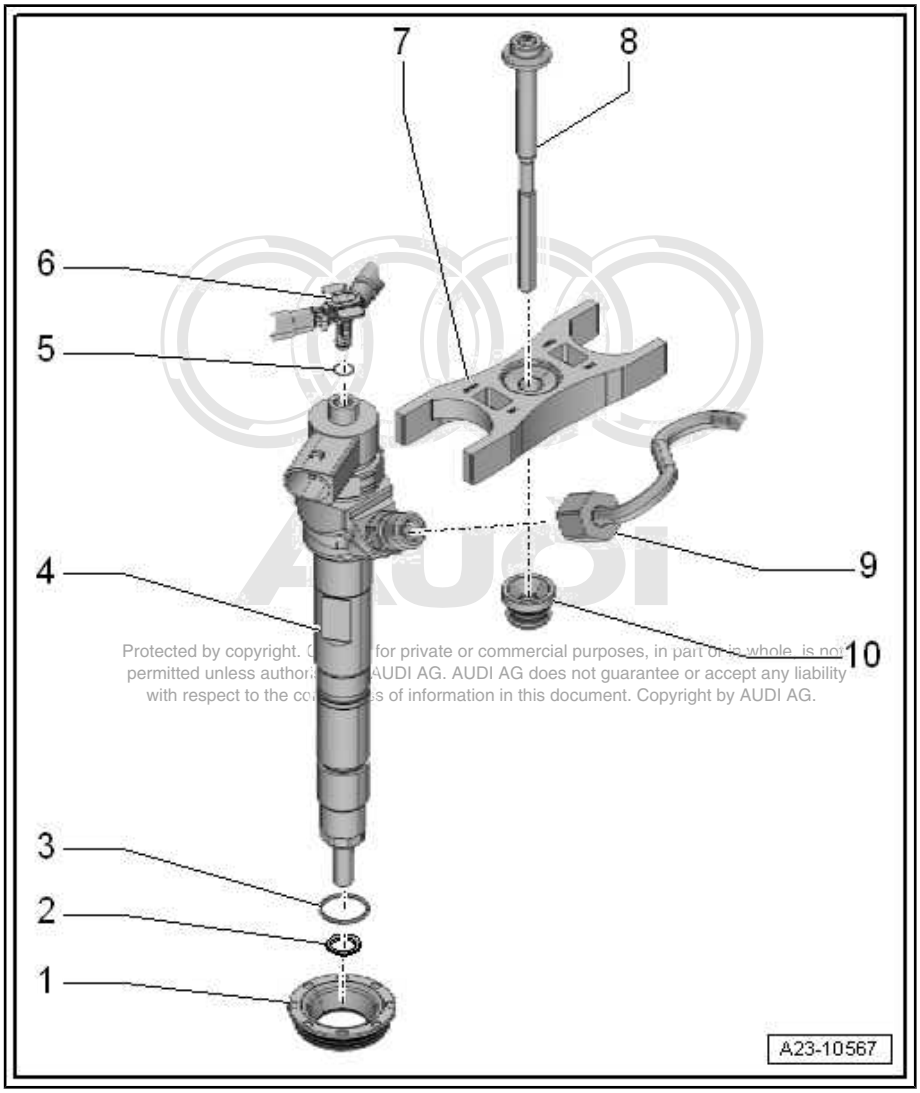
5.1 Exploded view - injectors

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 7 (page 247) after installing the high-pressure pipes. If these instructions are not observed, the engine could be damaged.

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1 - Seal

- ❑ In cylinder head cover
- ❑ Renew if leaking ⇒ page 101

2 - Copper seal

- ❑ Always renew copper seal when removing and installing

3 - O-ring

- ❑ Renew after removing

4 - Injector

- ❑ If they are to be re-installed, the injectors and high-pressure pipes must always be re-fitted on the same cylinder
- ❑ Always renew copper seal when removing and installing
- ❑ 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 256

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 232

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
- ❑ Installation position ⇒ page 248

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)
- ❑ Note warning instructions for clamping piece ⇒ Item 7 (page 247)

9 - High-pressure pipe

- ❑ Between high-pressure reservoir and injectors
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 259
- ❑ Install free of stress
- ❑ Fit damper weights ⇒ page 248
- ❑ 28 Nm

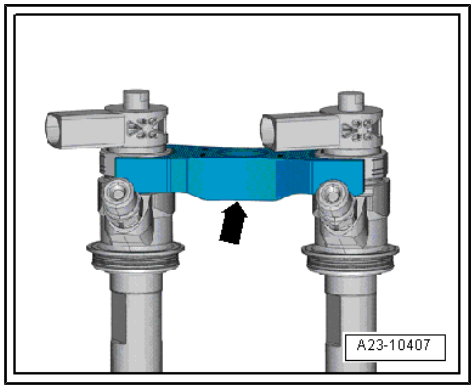
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10 - Grommet

- ❑ In cylinder head cover
- ❑ Renew if damaged or leaking

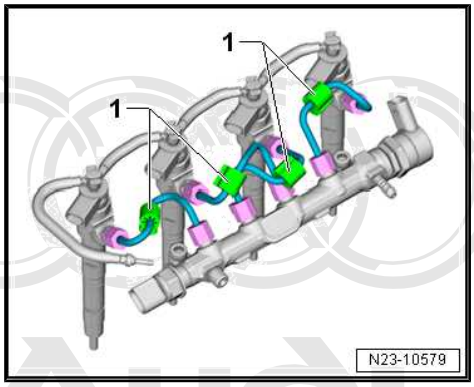
Installation position of clamping piece

- Each clamping piece secures two injectors.
- The bulge -arrow- of the clamping piece should point downwards.



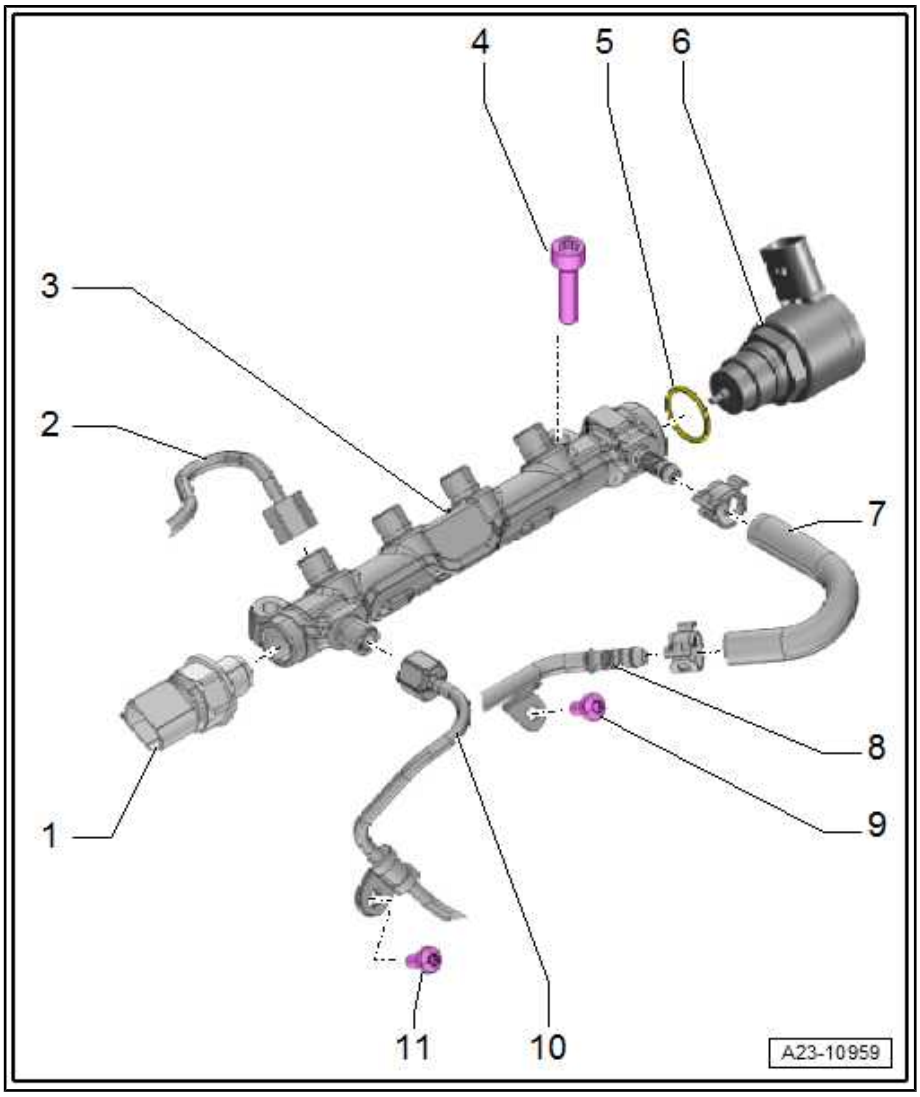
Fitting damper weights to high-pressure pipes

– Fit damper weights -1- to high-pressure pipes.



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5.2 Exploded view - high-pressure reservoir (rail)



1 - Fuel pressure sender - G247-

- ❑ Renew after removing
- ❑ Removing and installing ⇒ page 271
- ❑ 100 Nm

2 - High-pressure pipe

- ❑ Between high-pressure reservoir and injectors
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 259
- ❑ Fit damper weights ⇒ page 248
- ❑ 28 Nm

3 - High-pressure reservoir (rail)

- ❑ Removing and installing ⇒ page 262

4 - Bolt

- ❑ 20 Nm

5 - O-ring

- ❑ Renew after removing

6 - Fuel pressure regulating valve - N276-

- ❑ Renew after removing
- ❑ Removing and installing ⇒ page 270
- ❑ Reset learnt values after renewing ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Reset learnt values`
- ❑ 80 Nm

7 - Fuel return hose

8 - Fuel return line

9 - Bolt

- ❑ 8 Nm

10 - High-pressure pipe

- ❑ Between high-pressure pump and high-pressure reservoir (rail)
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 259
- ❑ 28 Nm

11 - Bolt

- ❑ 8 Nm

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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 250
- ⇒ “5.5 Checking for injectors sticking open”, page 250
- ⇒ “5.6 Checking return flow rate of injectors with engine running”, page 252
- ⇒ “5.7 Checking return flow rate of injectors at starter cranking speed”, page 254

Perform the following tests first if the engine does not start at all:

- ⇒ “5.5 Checking for injectors sticking open”, page 250
- ⇒ “5.7 Checking return flow rate of injectors at starter cranking speed”, page 254
- ⇒ “7.3 Checking fuel pressure regulating valve N276 ”, page 269

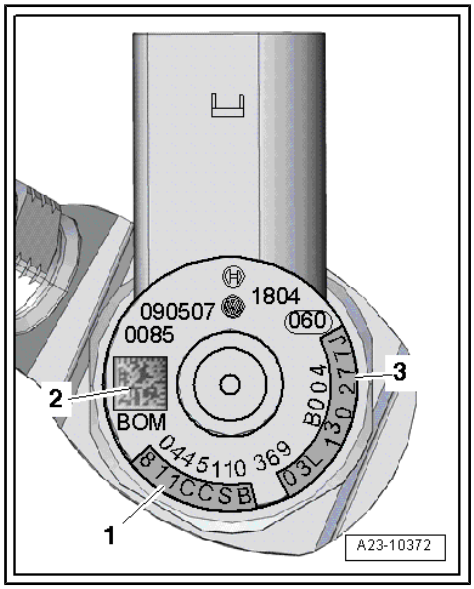
5.4 Performing adaption of correction values for injectors

- The “Injector delivery calibration values” function serves 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.



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Injector (view from above)



1 - Adaption value (checksum; details in illustration are only an example)

2 - Data matrix code

3 - Part number

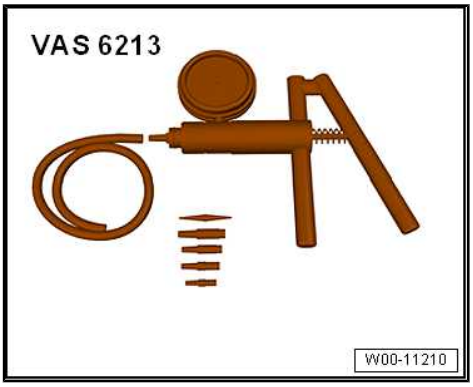
- When a new injector is installed, the adaption value must be written into the engine control unit.
- When a new engine control unit is installed, the “Adaption values for injectors” must be written into the new control unit.
- Additionally, check that the “injector delivery calibration values” are 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.
- The adaption procedure is described in `Guided Functions` mode of ⇒ Vehicle diagnostic tester.

5.5 Checking for injectors sticking open

Special tools and workshop equipment required

- Vehicle diagnostic tester

♦ Hand vacuum pump - VAS 6213-



♦ Adapter of return flow meter - VAS 6684-

Procedure

– Remove engine cover panel ⇒ page 40 .

• Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

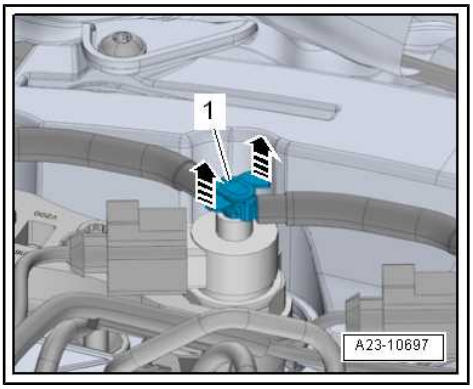
– Clean all connections (with commercial cleaning solution or similar) before removing.

– Dry all components after cleaning.

Start with cylinder No. 1.

– Detach noise insulation.

– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.



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– Connect adapter of return flow meter - VAS 6684- to return line connection of injector to be tested -arrow- after adapter has been cleaned and blown out.

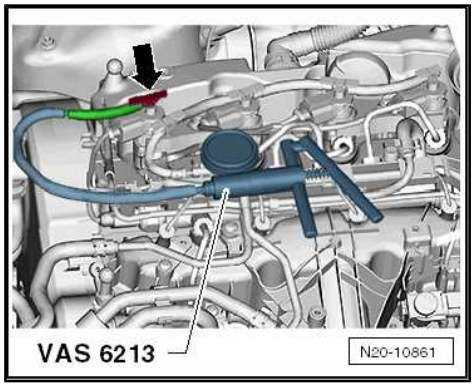
– Generate a vacuum of -500 mbar using the hand vacuum pump - VAS 6213- .

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 256 .



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.

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 40 .

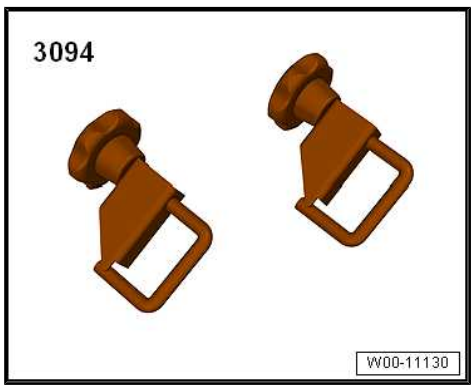
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5.6 Checking return flow rate of injectors with engine running

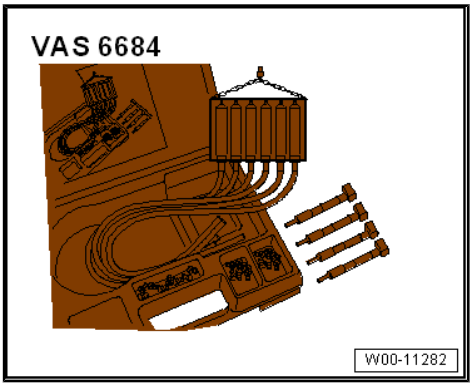
Checking return flow rate of all injectors

Special tools and workshop equipment required

♦ Hose clamps, up to 25 mm - 3094-



♦ Return flow meter - VAS 6684-



♦ Fuel-resistant measuring container

Procedure

– Remove engine cover panel ⇒ page 40 .

– Disconnect hose connection -2- at fuel return line.

• Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

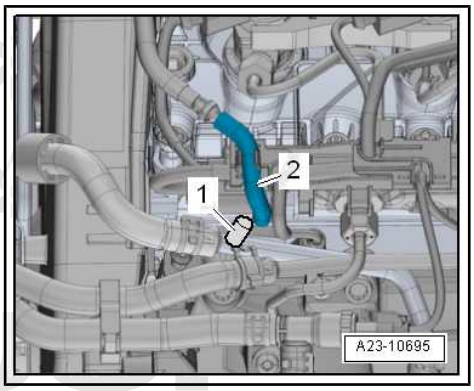
– Seal off open return line connection with plug -1-.

– Hold end of fuel return hose -2- (lengthen if necessary) in a measuring container to measure the total return flow rate.

– Start engine and let it idle for 2 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

If specification is exceeded, this indicates that one or more injectors are defective. Check return flow rate from each injector individually.

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Checking return flow rate of individual injectors

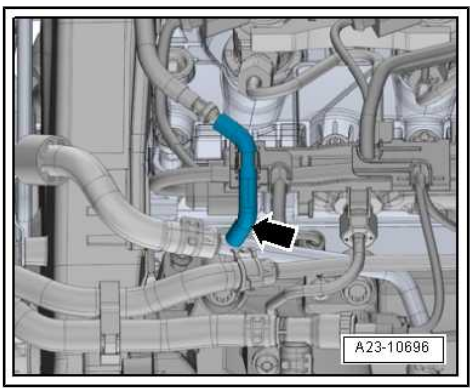
Each injector normally has a relatively low fuel return flow rate. If the return flow rate at one injector is relatively high compared to the other injectors, that injector is probably defective.

– Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.

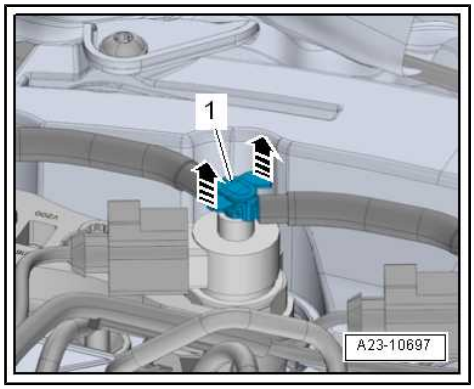
– Dry all components after cleaning.

– Clamp off fuel return hose -arrow- using hose clamp up to 25 mm -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.

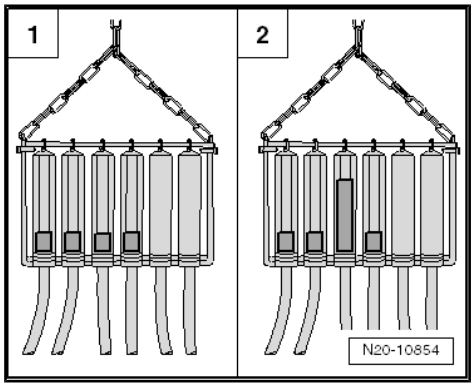


NOTICE

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 let it idle 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-).
– If one injector has a significantly higher return flow rate than the others (example -2-), it must be renewed ⇒ page 256 .
– 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.



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.

Bleeding fuel system and checking 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 40 .

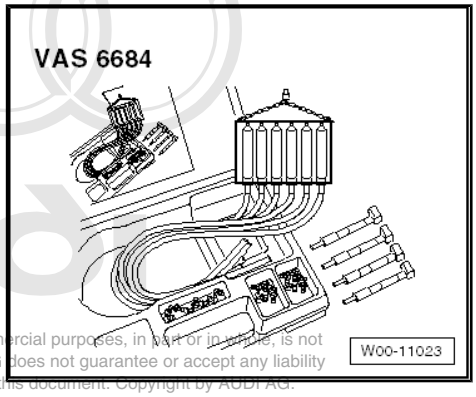
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5.7 Checking return flow rate of injectors at starter cranking speed

Only perform this test if the engine does not start at all.

Special tools and workshop equipment required

♦ Return flow meter - VAS 6684-



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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.

– Remove engine cover panel ⇒ page 40 .

• Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

– Clean all return line connections (e.g. with commercial cleaning solution etc.) before removing.

– Dry all components after cleaning.

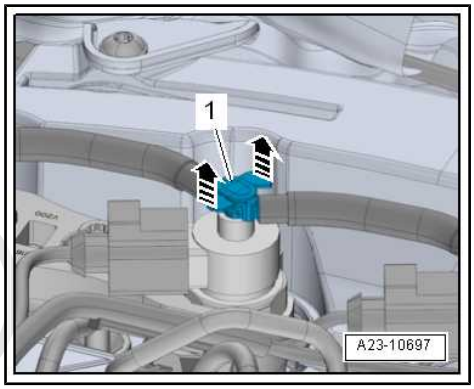
– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.

– 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.

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– Erase entry in event memory using ⇒ Vehicle diagnostic tester.

Bleeding fuel system and checking 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.

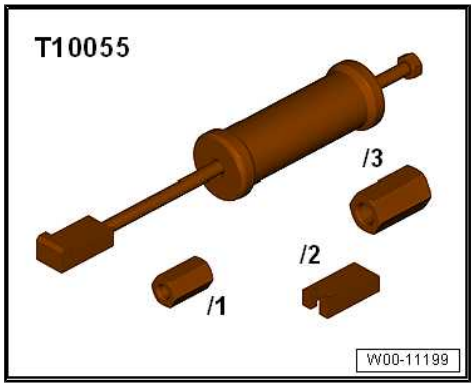
– Install engine cover panel ⇒ page 40 .

5.8 Removing and installing injectors

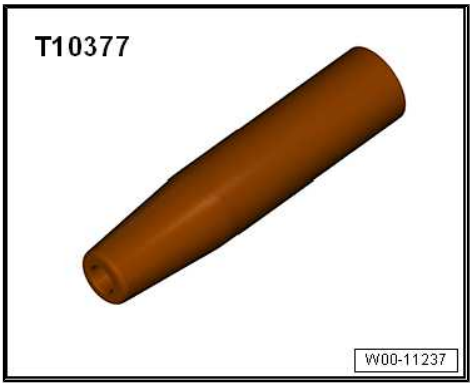
Special tools and workshop equipment required

♦ Cleaning kit - VAS 6811-

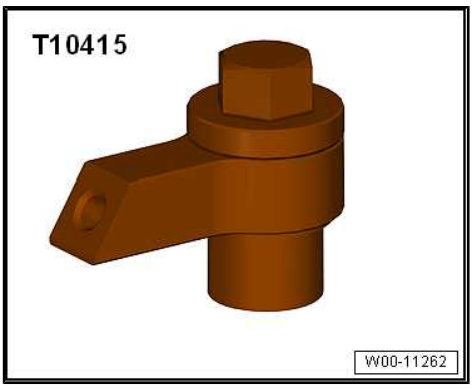
♦ Puller - T10055-



♦ Assembly sleeve - T10377-



♦ Puller - T10415-



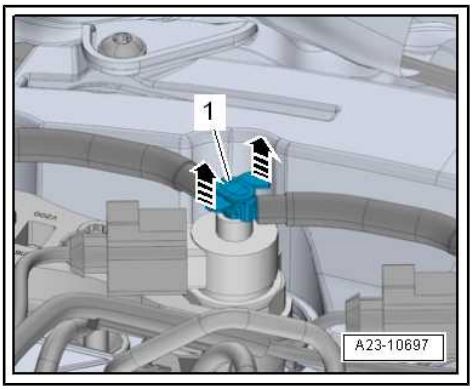
Removing

– Remove engine cover panel ⇒ page 40 .

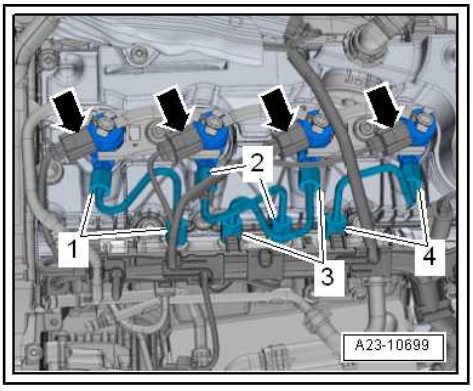
– Detach noise insulation.

• Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

– Pull release tabs upwards -arrows- and pull return line connections -1- off injectors.



– Unplug electrical connectors -arrows- at injectors.



Note

Each clamping piece always secures two injectors and can only be taken out if both injectors are removed.

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– 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.

– Remove bolt -1-.

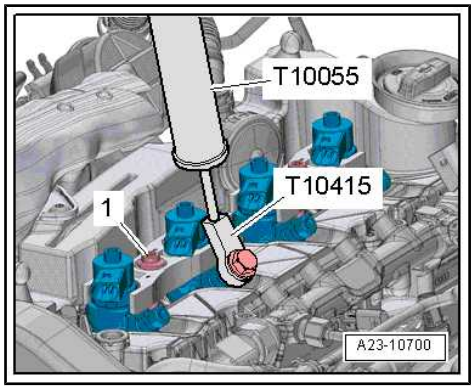
• Sequence for removing injectors: First remove injector for cylinder 2, then for cylinder 1/cylinder 4, and then for cylinder 3.

– Apply puller - T10055- with puller - T10415- as shown in illustration, and pull out injectors upwards.

– Detach clamping piece before taking injector out.

– Remove injectors (rotate them while pulling them 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 also be renewed:

♦ Bolt for clamping piece

♦ O-ring for fuel return line connection

– Observe all instructions for installing high-pressure pipes ⇒ page 259 .

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

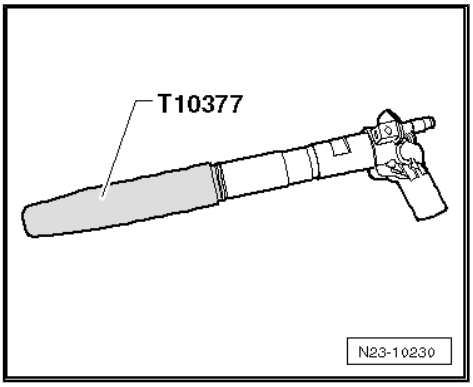
– Spray tip of injector nozzle with rust-releasing spray. Wait approx. 5 minutes and wipe off soot particles and oil with a cloth.

– 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.

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– Renew seal for injector using assembly sleeve - T10377- .



Continued (same procedure for used and new injectors):

– Lubricate all O-rings with assembly oil, engine oil or diesel fuel before installing.

– Install injectors.

– Push the return line connections carefully over the new seals and onto the injectors. The catch should engage audibly. Then press release pin down carefully.

– Tighten union nuts on high-pressure pipes hand-tight initially. Make sure that connections are not under tension.

– When one or more injectors have been renewed, the adaption of the correction values for the new injectors must be written into the engine control unit ⇒ page 250 .

– Install engine cover panel ⇒ page 40 .

Tightening torques

◆ ⇒ “5.1 Exploded view - injectors”, page 246

5.9 Removing and installing high-pressure pipes

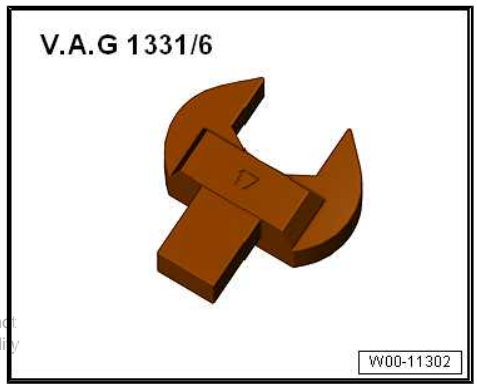
⇒ “5.9.1 Removing high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump”, page 259

⇒ “5.9.2 Installing high-pressure pipe”, page 260

5.9.1 Removing high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump

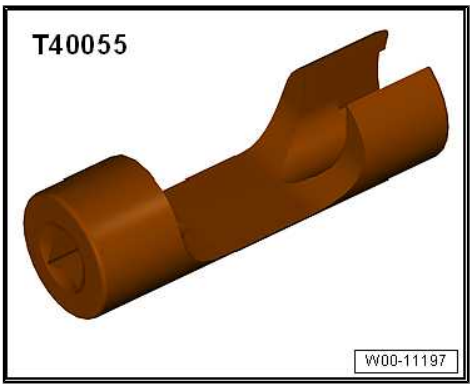
Special tools and workshop equipment required

◆ Open end spanner insert, AF 17 - V.A.G 1331/6-



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◆ Socket - T40055-



Removing

– Remove engine cover panel ⇒ page 40 .

• Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

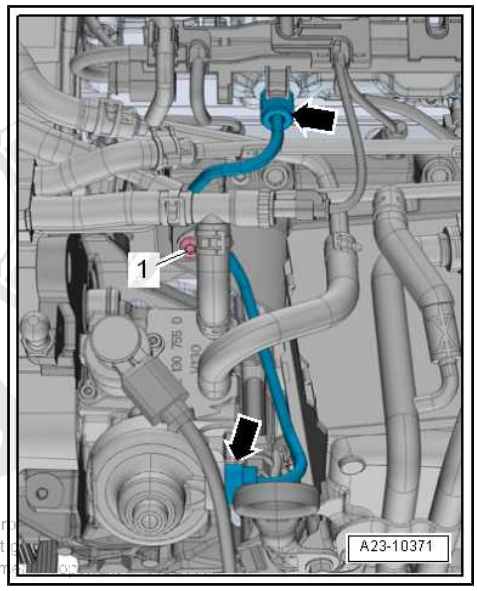
– Use vacuum cleaner to remove dirt from taper seat at high-pressure reservoir.

– 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.

Installing high-pressure pipe ⇒ page 260

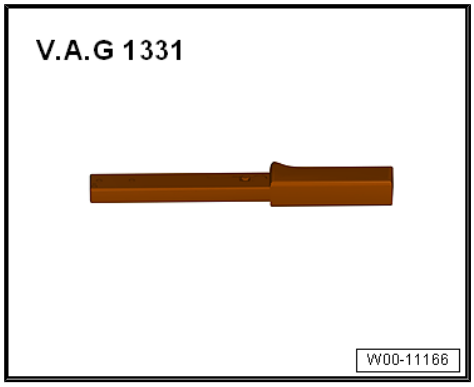


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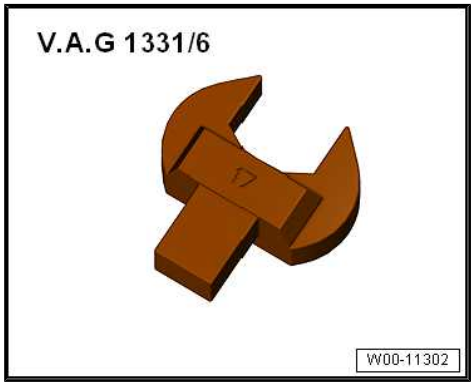
5.9.2 Installing high-pressure pipe

Special tools and workshop equipment required

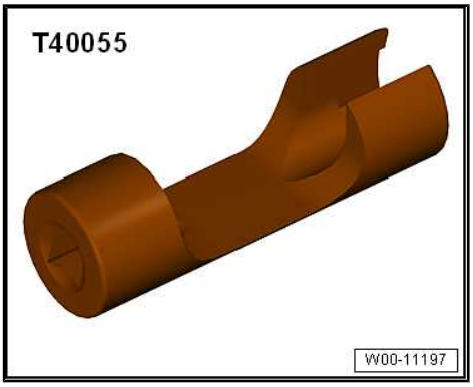
♦ Torque wrench - V.A.G 1331-



♦ Open end spanner insert, AF 17 - V.A.G 1331/6-



♦ Socket - T40055-



Installing

- Before removing, clean fuel pipe and end of pipe using cleaning solution and dry with compressed air.
- 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.

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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.**

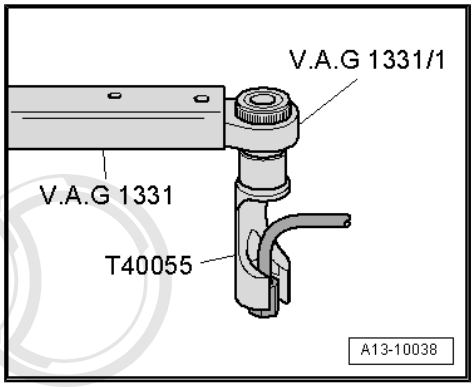
- Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

– 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 SW 17 - V.A.G 1331/6- or socket - T40055- .



– Fit damper weights to high-pressure pipes ⇒ page 248 .

– Check fuel system for leaks ⇒ page 233 .

– Install engine cover panel ⇒ page 40 .

Tightening torques

- ⇒ “5.1 Exploded view - injectors”, page 246
- ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 249

5.10 Removing and installing high-pressure reservoir (rail)

Removing

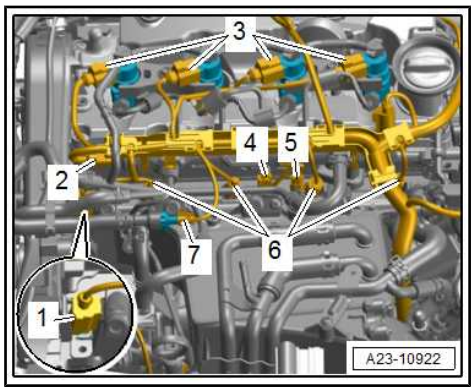
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- Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

– Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ⇒ page 259 .

– Detach noise insulation.

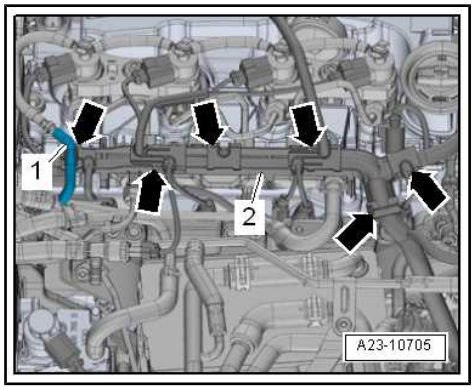
– Unplug electrical connectors:



1 - For coolant valve for cylinder head - N489-
2 - For fuel pressure sender - G247-
3 - For injectors
4 - For Hall sender - G40-
5 - For intake air temperature sender - G42-
6 - For glow plugs
7 - For fuel temperature sender - G81-

– Move clear fuel return hose -1-.

– Open retaining clips -arrows-, and unclip and detach wiring duct -2-.



– Unplug electrical connectors:

1 - For fuel pressure sender - G247-

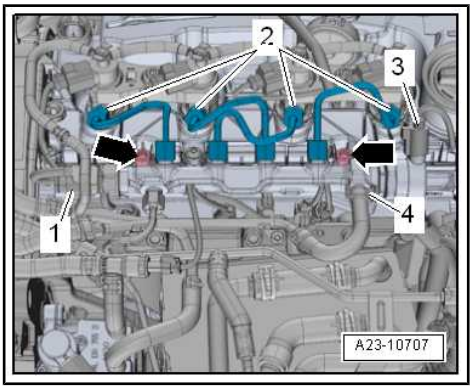
3 - For fuel pressure regulating valve - N276-

– Release hose clip -4- and detach fuel return hose.

– Remove union nuts -2- for high-pressure pipes.

– Detach high-pressure pipe and set it down on a clean cloth.

– Remove bolts -arrows- and detach high-pressure reservoir.



Installing

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

– Electrical connections and routing ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes; Overview of fitting locations - relay carriers, fuse carriers, electronics boxes and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Observe all instructions for installing high-pressure pipes ⇒ page 259 .

Tightening torques

- ⇒ “5.1 Exploded view - injectors”, page 246
- ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 249

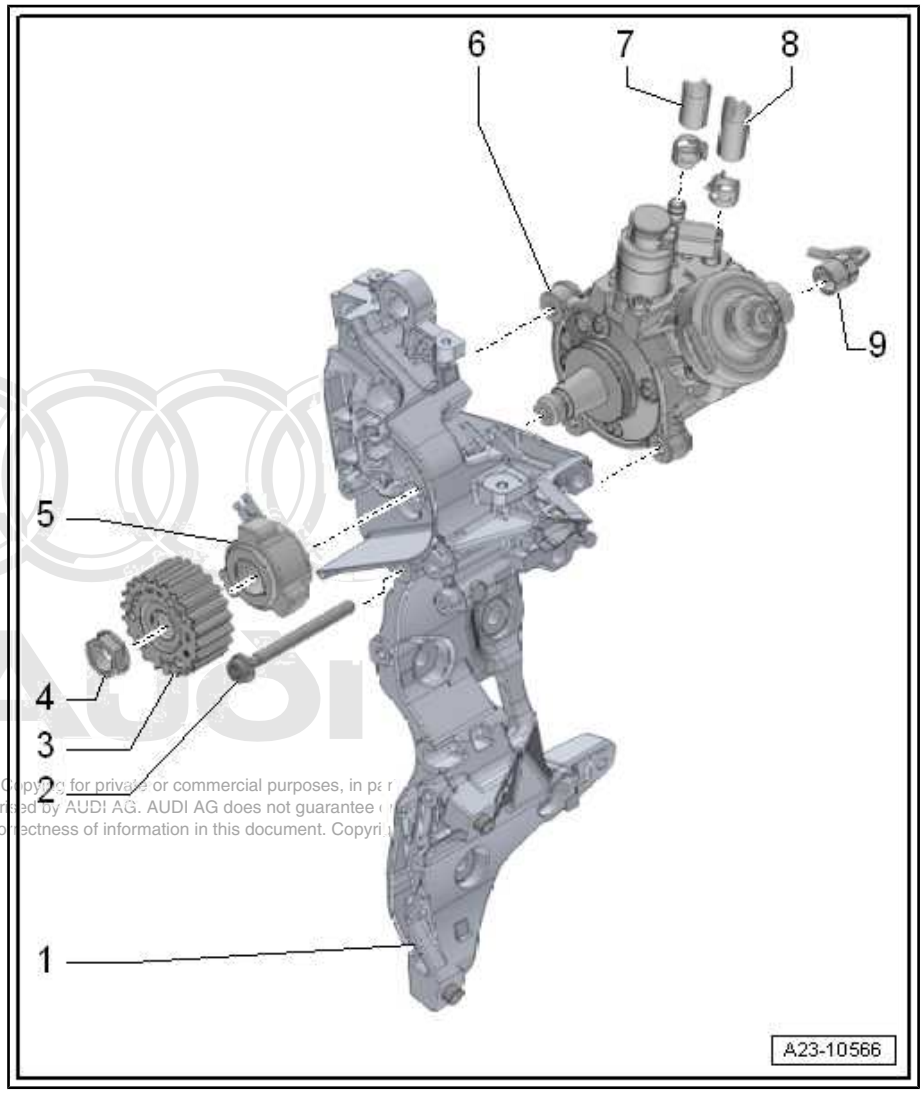
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6 High-pressure pump

⇒ “6.1 Exploded view - high-pressure pump”, page 264

⇒ “6.2 Removing and installing high-pressure pump”, page 265

6.1 Exploded view - high-pressure pump



1 - Bracket for ancillaries

- ❑ Removing and installing ⇒ page 46

2 - Bolt

- ❑ 3x
- ❑ Renew after removing
- ❑ Different lengths
- ❑ Different tightening torques:

- ◆ Short bolt, 20 Nm + 45°
- ◆ Long bolt, 20 Nm + 180°

3 - High-pressure pump sprocket

4 - Nut

- ❑ Use counterhold tool - T10051- when loosening and tightening
- ❑ 95 Nm

5 - Hub

- ❑ To remove, use puller - T10489-

6 - High-pressure pump

- ❑ With fuel metering valve - N290- (do not open)
- ❑ Removing and installing ⇒ page 265
- ❑ If the high-pressure pump is removed or renewed, it is important to fill and bleed the fuel system before the engine is started for the first time ⇒ page 232 .
- ❑ Reset learnt values after renewing ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Reset learnt values`

7 - Fuel supply hose

8 - Fuel return hose

9 - High-pressure pipe

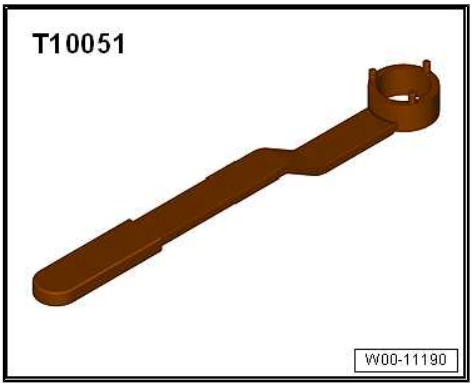
- ❑ Between high-pressure reservoir (rail) and high-pressure pump
- ❑ Removing ⇒ page 259
- ❑ Observe all instructions for installing high-pressure pipes ⇒ page 259
- ❑ 28 Nm

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6.2 Removing and installing high-pressure pump

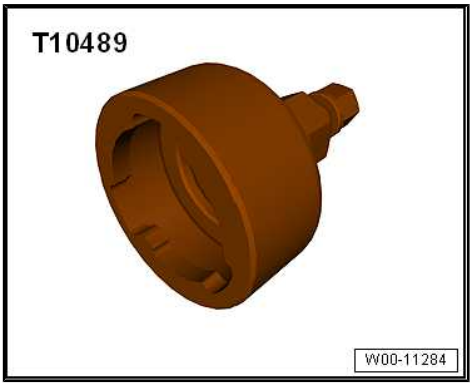
Special tools and workshop equipment required

- Counterhold tool - T10051-



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- Puller - T10489-



- Locking pin - T10492-



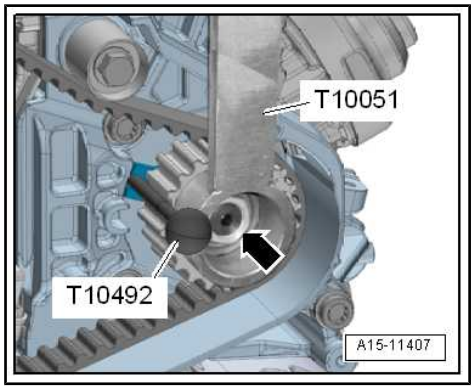
Removing

- Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

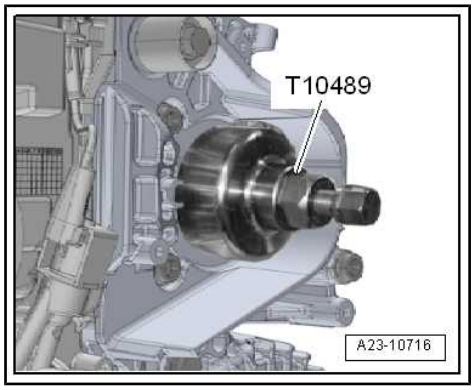
– Detach toothed belt from camshaft ⇒ page 76 .

– Remove high-pressure pipe between high-pressure reservoir (rail) and high-pressure pump ⇒ page 259 .

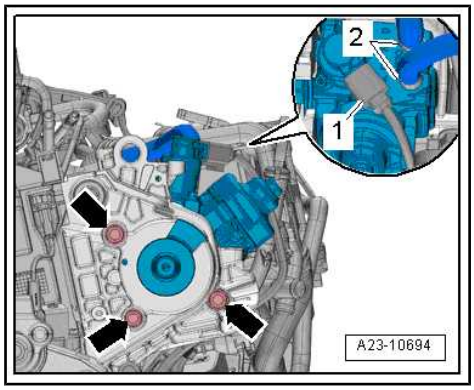
– Apply counterhold tool - T10051- to high-pressure pump sprocket.
– Hand-tighten nut -arrow-.
– Detach locking pin - T10492- and slowly turn high-pressure pump shaft to a position in which it is not under tension.
– Remove nut -arrow- and detach counterhold tool - T10051- .
– Detach high-pressure pump sprocket.



– Engage puller - T10489- at hub of high-pressure pump by turning it clockwise.
– Detach hub of high-pressure pump.



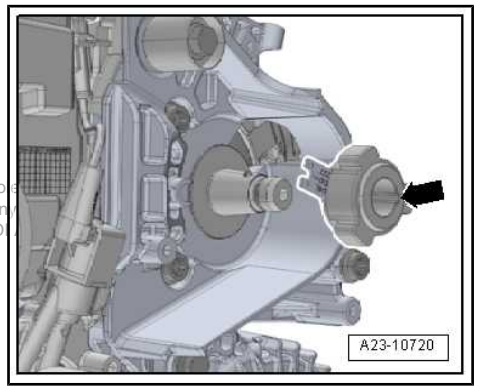
– Detach fuel return hoses -2-.
– Unplug electrical connector -1-.
– Remove bolts -arrows-.
– Carefully take out high-pressure pump.



Installing

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

– 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.



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– Screw nut -arrow- onto thread of high-pressure pump shaft.

– Apply counterhold tool to toothed belt 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- .

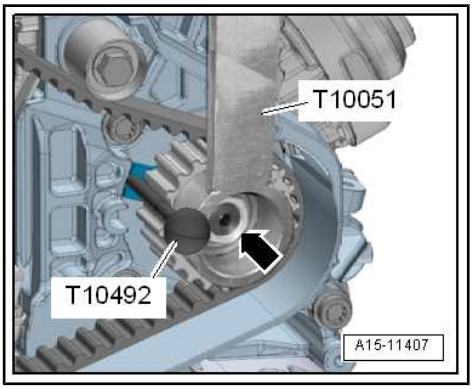
– To do so, insert locking pin - T10492- into fork -2- on hub and into hole -1- behind it in bracket for ancillaries.

– Loosen nut -arrow- again.

• The high-pressure pump sprocket should still just turn, but there must be no axial movement.

– Install toothed belt (adjust valve timing) ⇒ page 89 .

– Install high-pressure pipe ⇒ page 259 .



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 ⇒ page 232 .

– Reset learnt values after renewing high pressure pump ⇒ Vehicle diagnostic tester, `Guided Functions`, `01 - Reset learnt values`.

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Tightening torques

♦ ⇒ “6.1 Exploded view - high-pressure pump”, page 264

7 Senders and sensors

⇒ “7.1 Removing and installing fuel temperature sender G81 ”, page 268

⇒ “7.2 Removing and installing air mass meter G70 ”, page 268

⇒ “7.3 Checking fuel pressure regulating valve N276 ”, page 269

⇒ “7.4 Removing and installing fuel pressure regulating valve N276 ”, page 270

⇒ “7.5 Removing and installing fuel pressure sender G247 ”, page 271

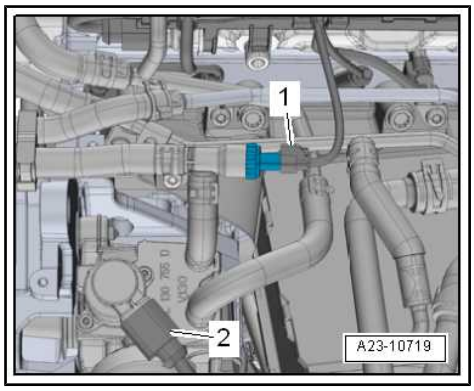
7.1 Removing and installing fuel temperature sender - G81-

Removing

– Remove engine cover panel ⇒ page 40 .

– Unplug electrical connector -1-.

– Remove fuel temperature sender - G81- .



Installing

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

– Check fuel system for leaks ⇒ page 233 .

– Install engine cover panel ⇒ page 40 .

7.2 Removing and installing air mass meter - G70-

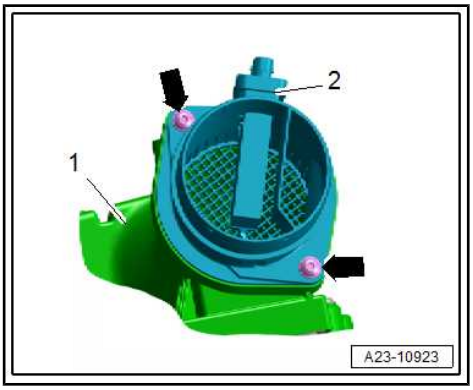
Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-



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Removing



– Remove air cleaner housing ⇒ page 237 .

– Remove bolts -arrows-.

– Detach air mass meter - G70- -item 2- from air cleaner housing -1-.

Installing

To ensure the proper function of the air mass meter - G70- it is important to observe the following instructions.

- If the air filter element is very dirty or wet, dirt particles or water can reach the air mass meter and falsify the detected air mass values. This will cause a loss of power, as the calculated injection quantities will be too low.
- Always use genuine air filter elements (same as original equipment).
- Always renew seal if damaged (air leaks in intake system).
- Use a silicone-free lubricant when installing the air hose and seal.
- Hose connections and air pipes/hoses must be free of oil and grease prior to fitting.
- Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .

– Check air mass meter and air hose (engine intake side) for salt residue, dirt and leaves.

– Check intake duct as far as air filter element for dirt. If necessary, clean salt residue, dirt and leaves out of air cleaner housing (top and bottom sections); wash out or use a vacuum cleaner as required.

Tightening torques

◆ ⇒ “3.1 Exploded view - air cleaner housing”, page 236

◆ ⇒ “2.1 Exploded view - charge air system”, page 217

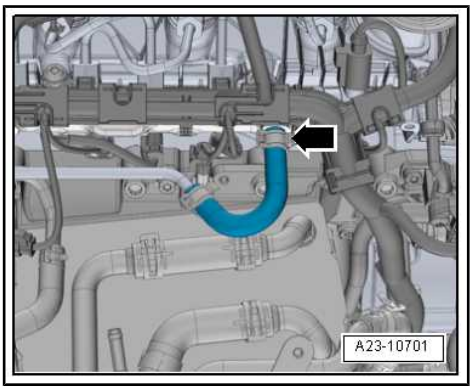
7.3 Checking fuel pressure regulating valve - N276-

Audi
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Special tools and workshop equipment required

◆ Fuel-resistant measuring container

Procedure



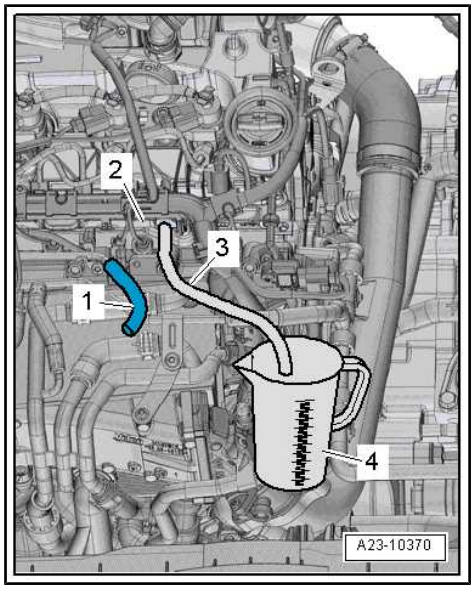
– Remove engine cover panel ⇒ page 40 .

– Release hose clip -arrow- and detach fuel return hose from high-pressure reservoir.

– Seal off open return line connection with a plug.

- Observe rules for cleanliness when working on the fuel supply system ⇒ page 6 .

– Connect test hose -3- to return line connection of high-pressure reservoir -2-.



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 - N276- is defective.

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3) If engine can no longer be started

Perform check 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.

– Install engine cover panel ⇒ page 40 .

7.4 Removing and installing fuel pressure regulating valve - N276-

Removing

– Remove engine cover panel ⇒ page 40 .

– Remove high-pressure reservoir (rail) ⇒ page 262 .

– Before removal, clean area around thread for fuel pressure regulating valve - N276- using e.g. commercial cleaning solution.

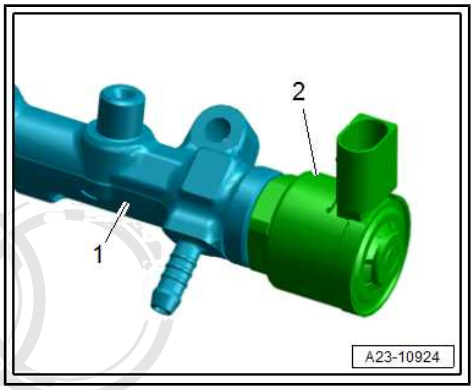
- Make sure no dirt gets into opening in high-pressure reservoir.
- Clean carefully; cleaning solution must not enter the electrical connector.

– Dry off fuel pressure regulating valve - N276- .

– Unscrew fuel pressure regulating valve - N276- -item 2- from high-pressure reservoir -1-.

– 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

- Fuel pressure regulating valve - N276- must always be renewed after it has been removed.

– The beginning of the thread and the deformable sealing lip of the fuel pressure regulating valve - N276- must be coated with diesel fuel.

– Use suitable torque wrench with suitable open-end spanner insert to tighten fuel pressure regulating valve - N276- .

– Install high-pressure reservoir (rail) ⇒ page 262 .

After renewing high-pressure pump or fuel pressure regulating valve - N276- , learnt values must be re-adapted; see "Guided Functions" in ⇒ Vehicle diagnostic tester

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– Check fuel system for leaks ⇒ page 233 .

– Install engine cover panel ⇒ page 40 .

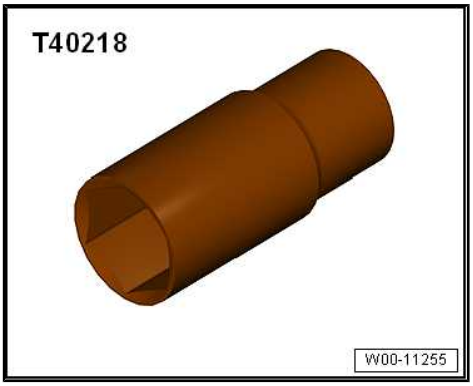
Tightening torques

♦ ⇒ "5.2 Exploded view - high-pressure reservoir (rail)", page 249

7.5 Removing and installing fuel pressure sender - G247-

Special tools and workshop equipment required

♦ Socket - T40218-



Removing

– Remove engine cover panel ⇒ page 40 .

– Before removal, clean area around thread for fuel pressure sender - G247- 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 sender - G247- .

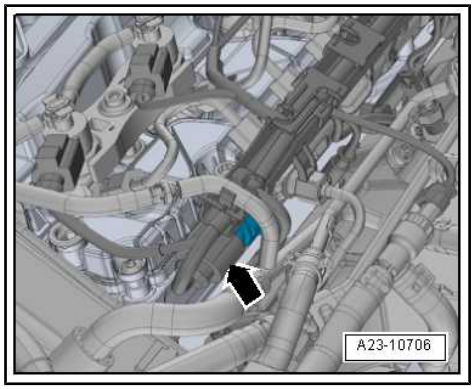
– Unplug electrical connector -arrow-.

– Unscrew fuel pressure sender - G247- using socket, 27 mm - T40218- .

• An open-end spanner must not be used for loosening or tightening.

– Extract dirt from opening in high-pressure reservoir (thread and sealing surface) using a vacuum cleaner. Do not use metal tools, etc.

– Seal off opening in high-pressure reservoir with a plug.



Installing

• Fuel pressure regulating valve - N276- must always be renewed after it has been removed.

– Also check sealing surface at opening in high-pressure reservoir for damage.

– The beginning of the thread and the deformable sealing lip of the fuel pressure sender - G247- must be coated with diesel fuel.

– Screw in fuel pressure sender - G247- by hand.

– Then tighten fuel pressure sender - G247- to specified torque.

– Check fuel system for leaks ⇒ page 233 .

– Install engine cover panel ⇒ page 40 .

Tightening torques

◆ ⇒ “5.2 Exploded view - high-pressure reservoir (rail)”, page 249

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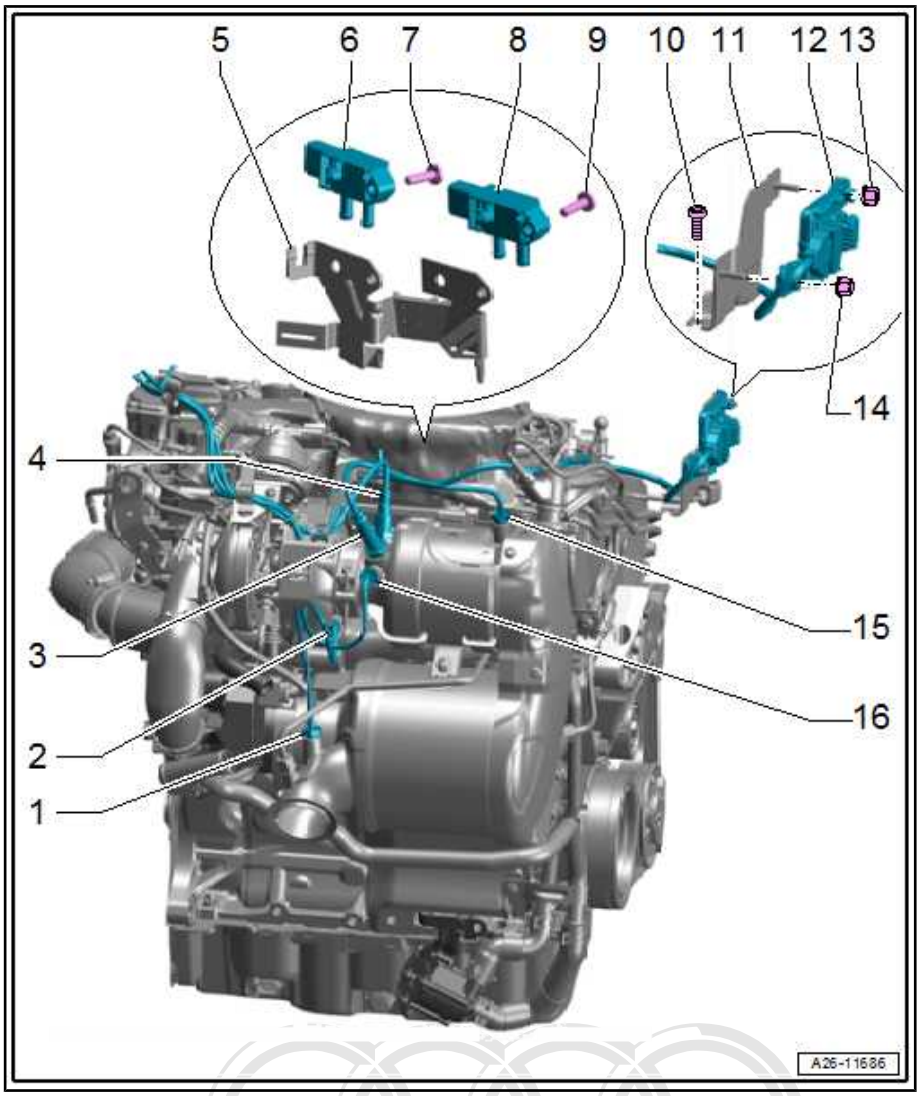
8 Lambda probe

⇒ "8.1 Exploded view - Lambda probe", page 273

⇒ "8.2 Removing and installing Lambda probe", page 274

⇒ "8.3 Removing and installing NOx sender", page 275

8.1 Exploded view - Lambda probe



1 - Exhaust gas temperature sender 4 - G648-

- ❑ Removing and installing ⇒ page 316

2 - Exhaust gas temperature sender 1 - G235-

- ❑ Removing and installing ⇒ page 313

3 - NOx sender - G295-

- ❑ Removing and installing ⇒ page 275
- ❑ 52 Nm

4 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 274
- ❑ Observe fitting instructions ⇒ page 275
- ❑ 52 Nm

5 - Bracket

- ❑ For pressure differential senders

6 - Exhaust gas pressure sensor 1 - G450-

- ❑ Removing and installing ⇒ page 298

7 - Bolt

- ❑ 8 Nm

8 - Pressure differential sender - G505-

- ❑ Removing and installing ⇒ page 297

9 - Bolt

- ❑ 8 Nm

10 - Bolt

- ❑ 20 Nm

11 - Bracket

- ❑ For control unit for NOx sender - J583-

12 - Control unit for NOx sender - J583-

- ❑ Removing and installing ⇒ page 275

13 - Nut

- ❑ Push on as far as stop

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14 - Nut

- ❑ Push on as far as stop

15 - Exhaust gas temperature sender 3 - G495-

- ❑ Removing and installing ⇒ page 316

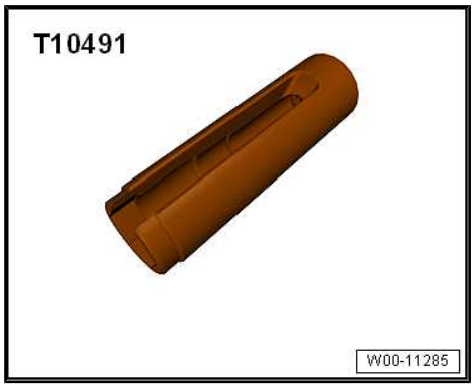
16 - Exhaust gas temperature sender 2 - G448-

- ❑ Removing and installing ⇒ page 315

8.2 Removing and installing Lambda probe

Special tools and workshop equipment required

- ♦ Socket, 22 mm - T10491-

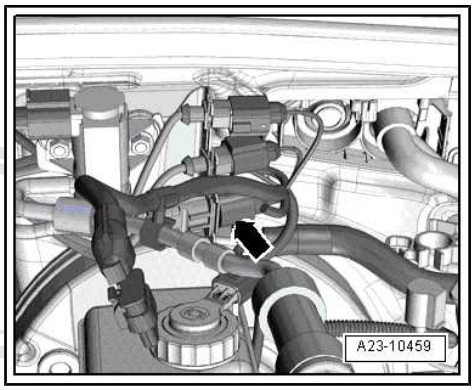


Removing

- Observe safety precautions when working on the exhaust system ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

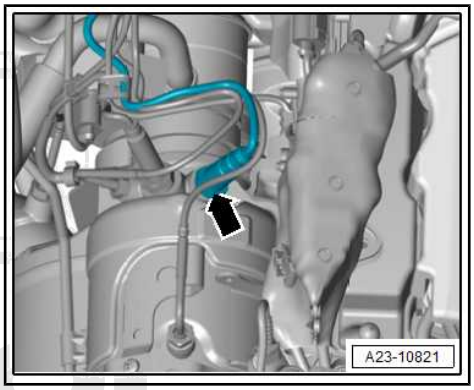
– Remove engine cover panel ⇒ page 40 .

– Remove electrical connector -arrow- for Lambda probe - G39- from bracket and unplug connector.



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– Unscrew Lambda probe - G39- -arrow- using socket, AF 22 mm - T10491- .



Installing

Installation is carried out in the 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 40 .

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Tightening torques

- ⇒ “8.1 Exploded view - Lambda probe”, page 273

8.3 Removing and installing NOx sender

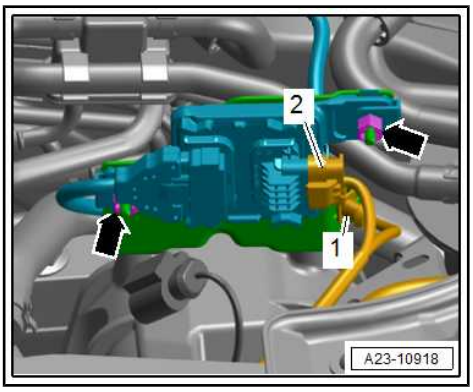
Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

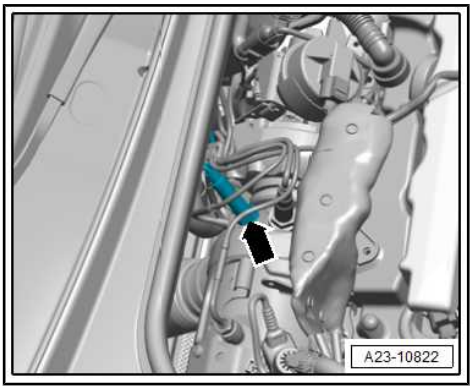
– Remove engine cover panel ⇒ page 40 .

– Unplug electrical connector -2-.

– Unscrew nuts -arrows-, take control unit for NOx sender - J583- out of bracket and move electrical wire clear.



– Unscrew NOx sender - G295- -arrow-.



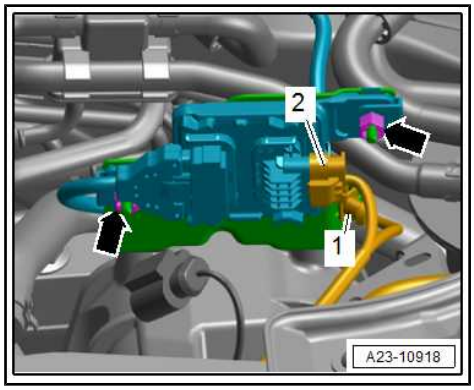
Installing

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

– Coat thread with high-temperature paste ⇒ Electronic parts catalogue .

– Bring control unit for NOx sender - J583- into installation position and press nuts -arrows- in as far as stop.

– Install engine cover panel ⇒ page 40 .



Tightening torques

◆ ⇒ “8.1 Exploded view - Lambda probe”, page 273

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9 Engine control unit

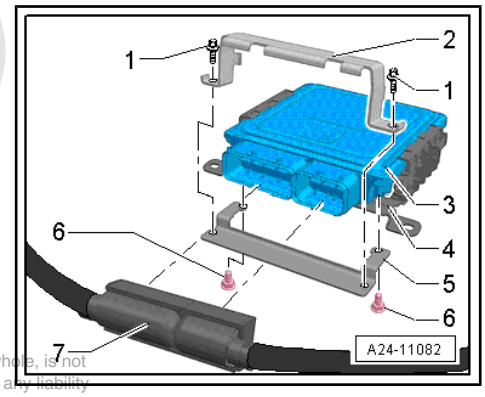
⇒ "9.1 Removing and installing engine control unit J623 ", page 277

9.1 Removing and installing engine control unit - J623-

Not every engine control unit is bolted to a protective housing. Whether a protective housing is fitted depends on the engine/ gearbox combination.

The engine control unit -3- is bolted to the retaining bracket -2 and 5-. To make it more difficult to unscrew the shear bolts -1- for locking plate -2-, their threads have been coated with locking fluid.

The protective housing has to be removed before the connectors can be unplugged from the engine control unit (e.g. to connect the test box or renew the engine control unit).



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Special tools and workshop equipment required

- Mole grips (commercially available type)

Removing

– If the engine control unit - J623- is renewed, the adaption values must be read out and stored before the engine control unit - J623- is removed.

– Connect ⇒ Vehicle diagnostic tester.

– Select `Diagnosis` mode and then `Start diagnosis`.

– Choose `Select own test` tab and select following options one after the other:

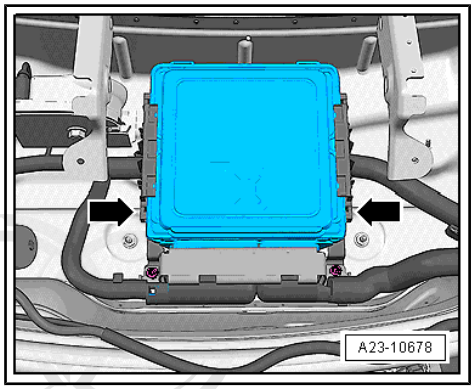
- `Drive train`
- `Select engine code and engine`
- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Replace control unit`

– Switch off ignition and remove ignition key after storing electronic file containing adaption values.

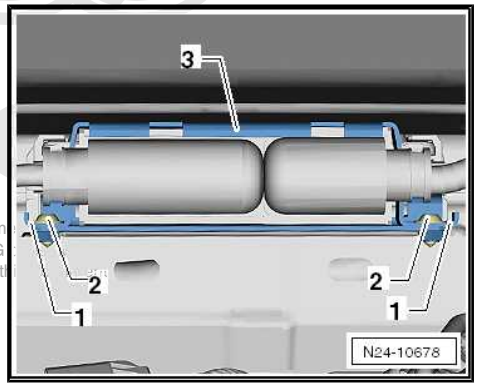
- If the adaption values of the injectors cannot be read out of the old (defective) engine control unit, the adaption values must be entered into the new engine control unit manually and the adaption procedure must be performed accordingly.

– Remove plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber cover .

– Release clips -arrows- and pull out engine control unit - J623- towards front.

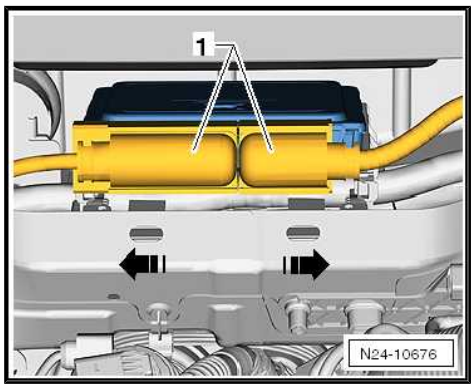


– Bend vertical edges -1- of retaining bracket outwards.
– Remove shear bolts -2- using mole grips and detach retaining bracket -3-.



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– Slide catches -1- on engine control unit in direction of -arrow- and unplug both connectors.

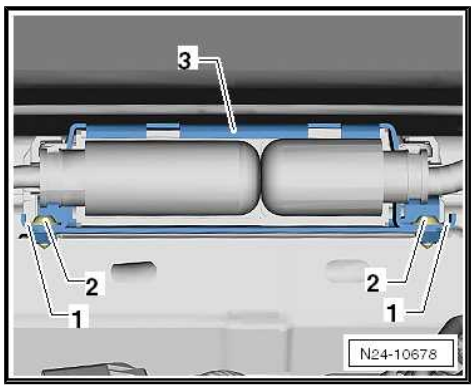


Installing

Installation is performed in the reverse sequence.

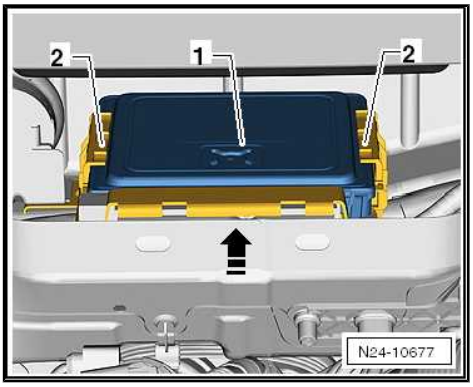
– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.
– Always use new shear bolts and a new retaining bracket.

– Tighten new holding bracket -3- with new shear bolts -2- evenly until heads of bolts shear off.



– Slide engine control unit -1- in direction of -arrow- into side guides -2-.

– Install plenum chamber cover ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Removing and installing plenum chamber cover .



After installing a new engine control unit, the following operation must be performed:

– If the engine control unit - J623- has been renewed, the adaption values must be written into the new engine control unit - J623- .

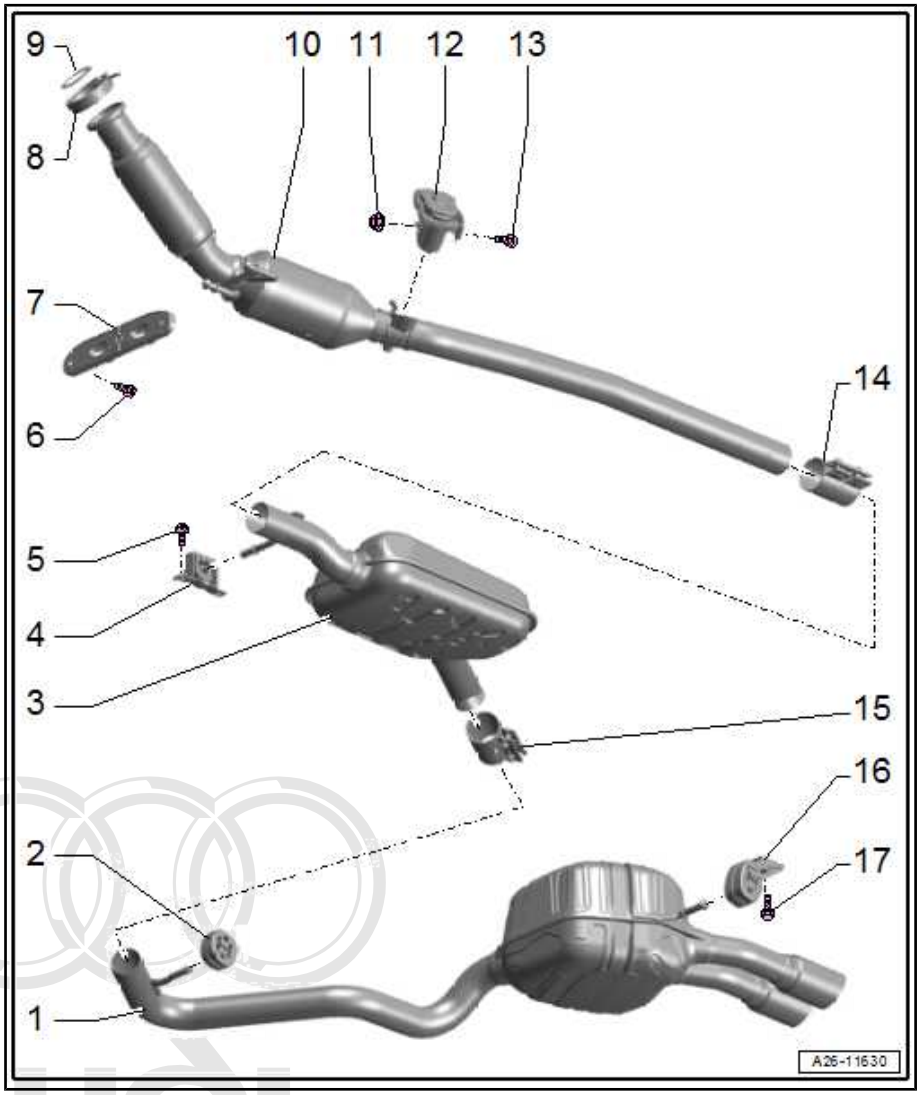
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26 – Exhaust system

1 Exhaust pipes/silencers

⇒ “1.1 Exploded view - silencers”, page 280
⇒ “1.2 Removing and installing front exhaust pipe”, page 283
⇒ “1.3 Removing and installing silencers”, page 283
⇒ “1.4 Separating exhaust pipe from silencer”, page 284
⇒ “1.5 Stress-free alignment of exhaust system”, page 285
⇒ “1.6 Checking exhaust system for leaks”, page 287

1.1 Exploded view - silencers



1 - Rear silencer

- ❑ Combined in one unit with centre silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 284
- ❑ Align exhaust system so it is free of stress ⇒ page 285
- ❑ Removing and installing ⇒ page 283

2 - Rubber mounting

- ❑ Renew if damaged

3 - Centre silencer

- ❑ Combined in one unit with rear silencer as original equipment. Can be renewed individually for repair purposes
- ❑ Cutting point: centre silencer / rear silencer ⇒ page 284
- ❑ Align exhaust system so it is free of stress ⇒ page 285
- ❑ Removing and installing ⇒ page 283

4 - Mounting

- ❑ Renew if damaged

5 - Bolt

- ❑ 23 Nm

6 - Bolt

- ❑ 23 Nm

7 - Mounting

- ❑ Renew if damaged

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8 - Screw-type clip

- ❑ Renew after removing
- ❑ Installation position ⇒ page 282
- ❑ 7 Nm

9 - Seal

- ❑ Renew after removing
- ❑ Note installation position ⇒ page 281

10 - Front exhaust pipe

- ❑ Removing and installing ⇒ page 283
- ❑ Align exhaust system so it is free of stress ⇒ page 285

11 - Nut

- ❑ 10 Nm

12 - Exhaust flap control unit - J883-

- ❑ Removing and installing ⇒ page 299

13 - Bolt

14 - Clamp (front)

- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 285
- ❑ Installation position ⇒ page 282
- ❑ Tighten bolted connections evenly
- ❑ Tightening torque and installation position ⇒ page 282

15 - Clamp (rear)

- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 285
- ❑ Installation position ⇒ page 282
- ❑ Tighten bolted connections evenly
- ❑ Tightening torque ⇒ page 282

16 - Mounting

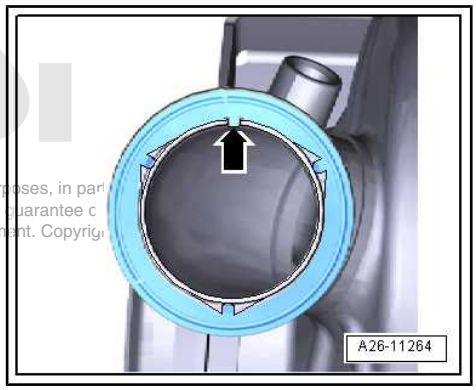
- ❑ Renew if damaged

17 - Bolt

- ❑ 23 Nm

Installation position of seal between emission control module and front exhaust pipe

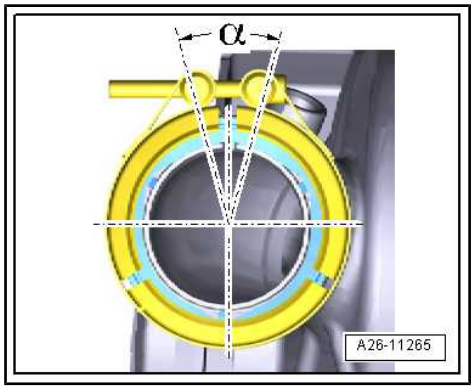
- Square tab on seal -arrow- must fit into groove on emission control module.



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Installation position of screw-type clip for front exhaust pipe

- Angle -α- = 0 ± 30°



Clamp - versions and tightening torques

Clamp -A- (comprising two separate clamps):

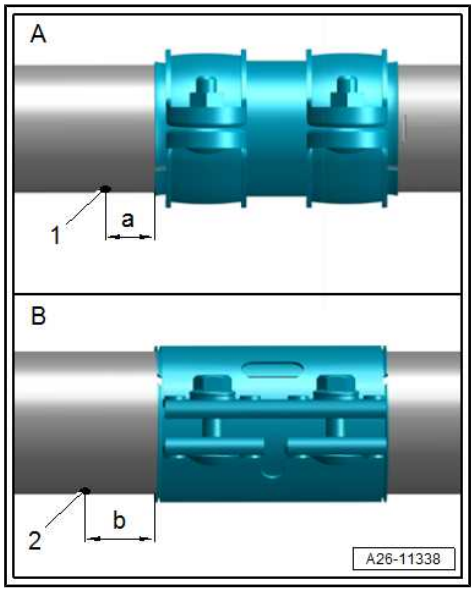
a - Installation position for front clamp = 5 mm from marking -1-

– Tighten bolted connections to 25 Nm.

Clamp -B- (comprising one continuous clamp):

b - Installation position for front clamp = 8.5 mm from marking -2-

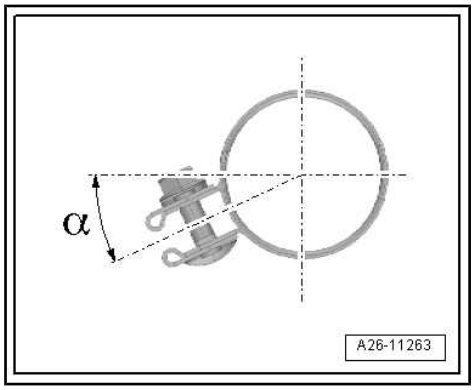
– Tighten bolted connections to 35 Nm.



Installation position of front clamp

– Fit clamp in position shown:

- Angle -α- = 0 ... 5°
- Bolted connections face towards left.
- Nuts face upwards.

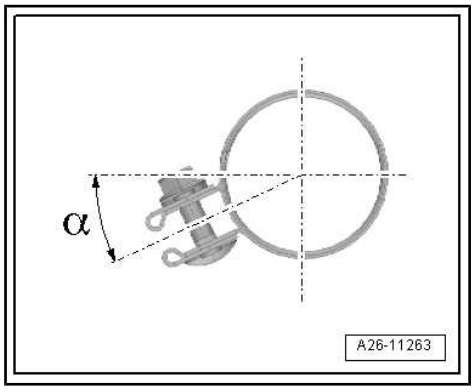


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Installation position of rear clamp

– Fit clamp in position shown:

- Angle -α- = 0 ... 5°
- Bolted connections face towards rear/towards centre of vehicle.
- Nuts face upwards.



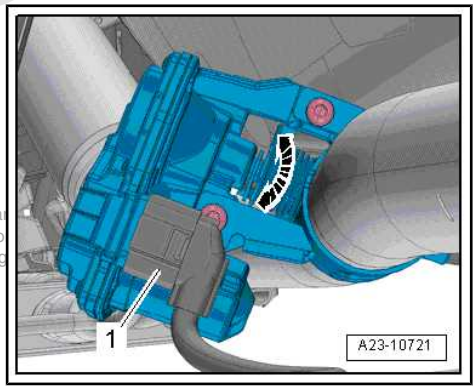
1.2 Removing and installing front exhaust pipe

Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

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

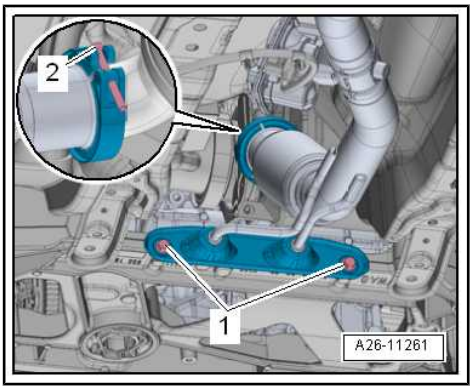
– Unplug electrical connector -1- from exhaust flap control unit - J883- .



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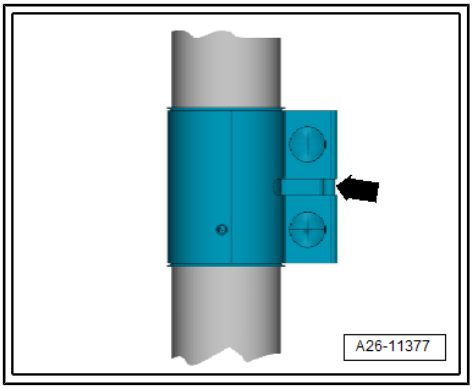
– Remove bolts -1-.

– Slacken bolt -2- and remove clip.



– Loosen clamp -arrow- and push towards rear.

– Detach front exhaust pipe.



Installing

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

- Renew seal.

– Align the exhaust system so it is free of stress ⇒ page 285 .

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

Tightening torques

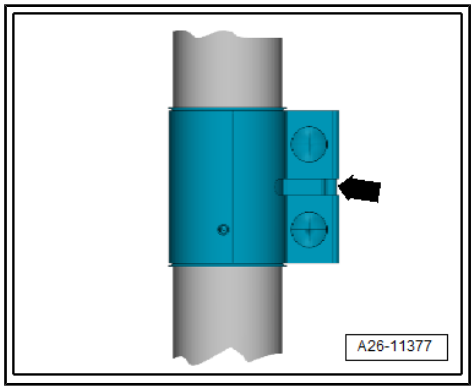
◆ ⇒ “1.1 Exploded view - silencers”, page 280

1.3 Removing and installing silencers

Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

– Loosen clamp -arrow- and push towards rear.



– Disengage mounting -2- at exhaust system (rear).
– A second mechanic is required for removal of the rear silencer.
– Unscrew bolts -1, 3- and remove silencers.

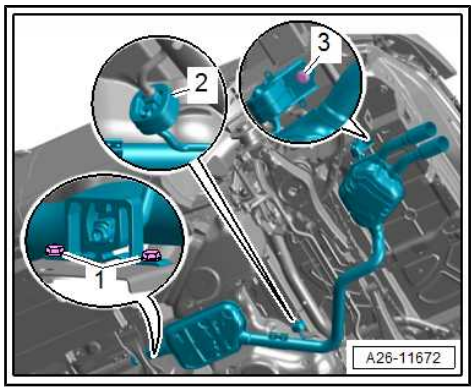
Installing

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

– Align the exhaust system so it is free of stress ⇒ page 285 .

Tightening torques

♦ ⇒ “1.1 Exploded view - silencers”, page 280

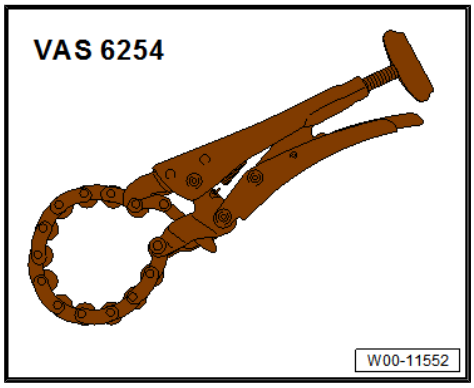


1.4 Separating exhaust pipe from silencer

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Special tools and workshop equipment required

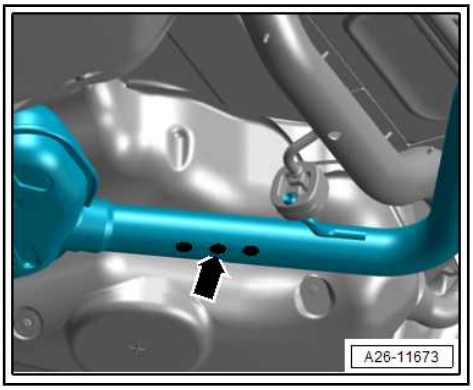
♦ Chain pipe cutter - VAS 6254-



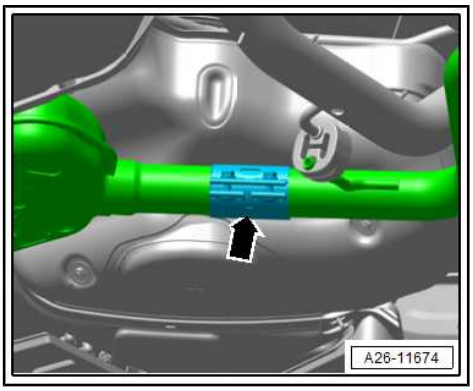
Procedure

• Observe safety precautions when working on the exhaust system
⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

– Cut through exhaust pipe at right angles at the position marked -arrow- using chain pipe cutter - VAS 6254-



– Align the exhaust system so it is free of stress ⇒ page 285 .
– Align clamp (rear) -arrow- ⇒ page 282 and tighten ⇒ page 282 .



1.5 Stress-free alignment of exhaust system

⇒ “1.5.1 Stress-free alignment of exhaust system - vehicles without clamp between centre and rear silencer”, page 285

⇒ “1.5.2 Stress-free alignment of exhaust system - vehicles with clamp between centre and rear silencer”, page 286

⇒ “1.5.3 Aligning tailpipes”, page 287

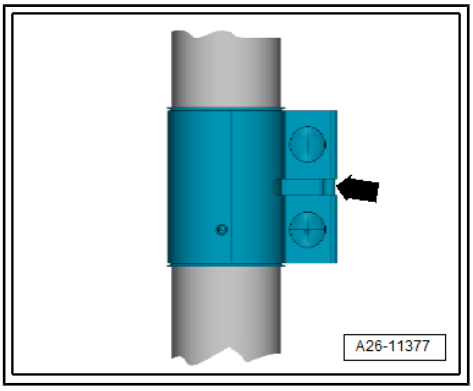
1.5.1 Stress-free alignment of exhaust system - vehicles without clamp between centre and rear silencer

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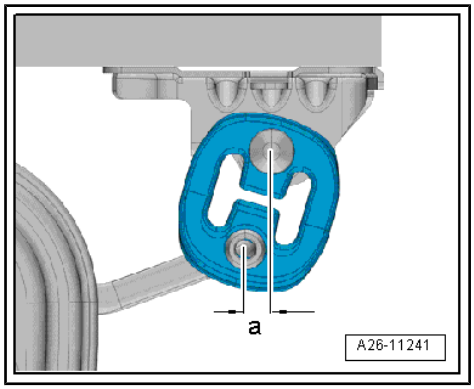
Procedure

• The exhaust system must be aligned when it is cool.

– Loosen bolt connections for clamp -arrow-.



– Push exhaust system towards front of vehicle until preloading at mounting (rear) for rear silencer -a- = 10.3 mm.
– Align clamp (front) ⇒ page 282 and tighten ⇒ page 282 .
– Tighten bolt connections on clamp evenly.

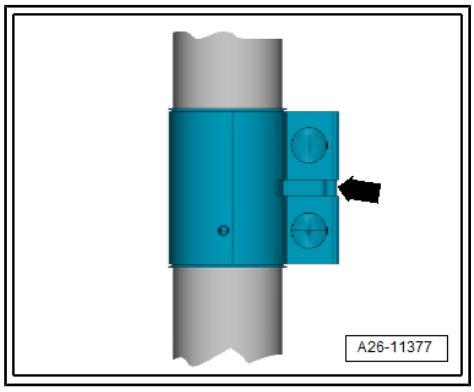


1.5.2 Stress-free alignment of exhaust system - vehicles with clamp between centre and rear silencer

Procedure

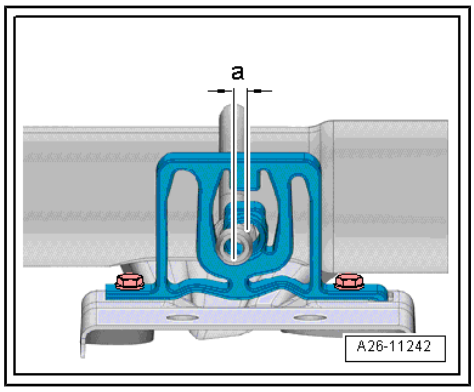
- The exhaust system must be aligned when it is cool.

– Loosen bolt connections on front and rear clamps -arrow-.

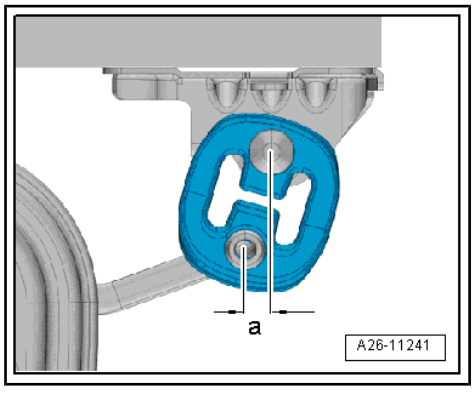


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– Push centre silencer towards front of vehicle until preloading at front mounting for centre silencer -a- = 4.7 mm.
– Align clamp (front) ⇒ page 282 and tighten ⇒ page 282 .
– Tighten bolt connections on clamp evenly.



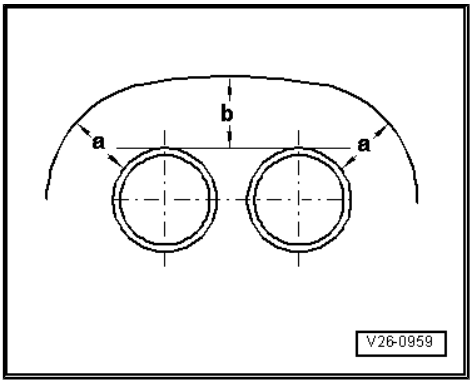
– Push rear silencer towards front of vehicle until preloading at mounting (rear) for rear silencer -a- = 10.3 mm.
– Align clamp (rear) ⇒ page 282 and tighten ⇒ page 282 .
– Tighten bolt connections on clamp evenly.



1.5.3 Aligning tailpipes

– Align rear silencer so that there is an equal distance -a- and -b- between bumper cut-out and tailpipes.

– Unfasten rear silencer mounting to align tailpipes.



1.6 Checking exhaust system for leaks

– 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.

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2 Emission control system

⇒ “2.1 Exploded view - emission control system”, page 288

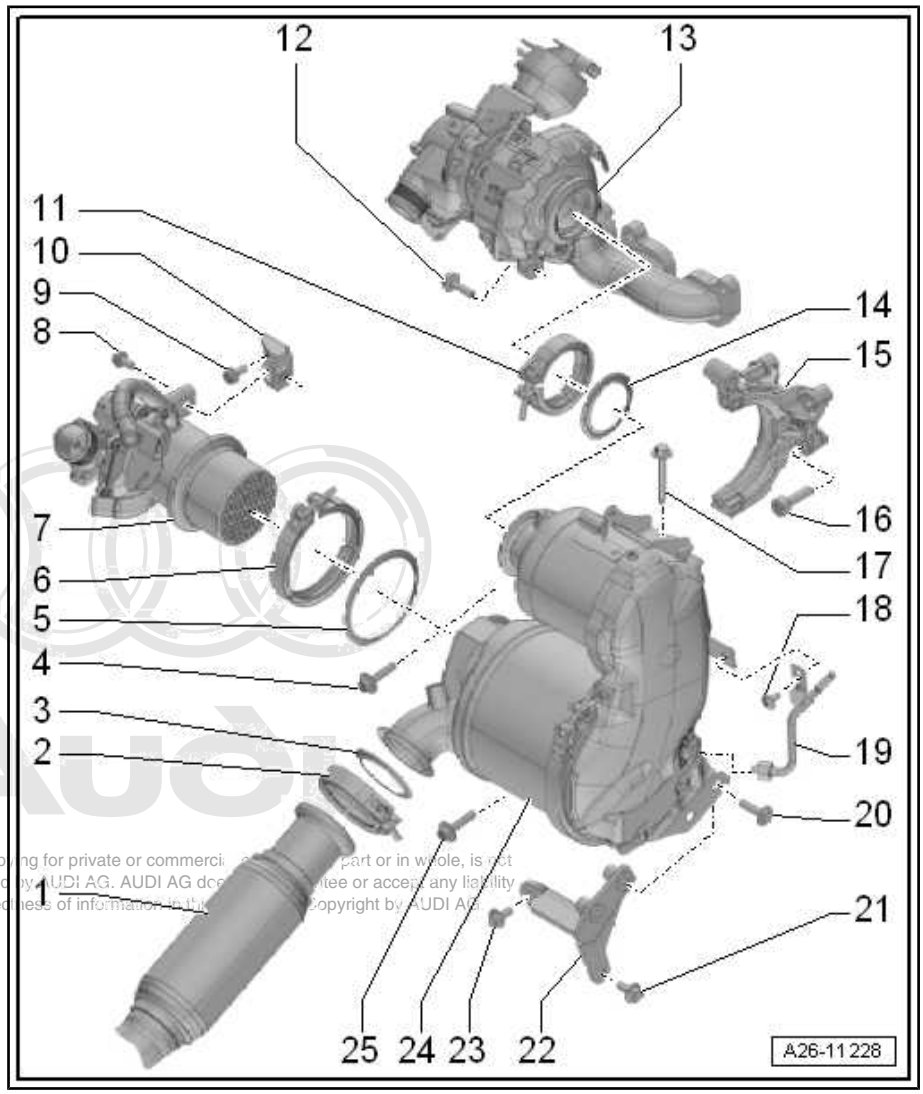
⇒ “2.2 Removing and installing emission control module”, page 290

⇒ “2.3 Removing and installing pressure differential sender G505 ”, page 297

⇒ “2.4 Removing and installing exhaust gas pressure sensor 1 G450 ”, page 298

⇒ “2.5 Removing and installing exhaust flap control unit J883 ”, page 299

2.1 Exploded view - emission control system



1 - Front exhaust pipe

- ❑ Removing and installing ⇒ page 283
- ❑ Align exhaust system so it is free of stress ⇒ page 285

2 - Screw-type clip

- ❑ Renew after removing
- ❑ Installation position ⇒ page 282
- ❑ Tightening torque ⇒ Item 8 (page 281)

3 - Seal

- ❑ Renew after removing
- ❑ Note installation position ⇒ page 281

4 - Bolt

- ❑ Tightening torque and sequence ⇒ page 296

5 - Seal

- ❑ Renew after removing

6 - Screw-type clip

- ❑ Renew after removing
- ❑ Installation position ⇒ page 319
- ❑ Tightening torque and sequence ⇒ page 319

7 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 322

8 - Bolt

- ❑ Tightening torque and sequence ⇒ page 296

9 - Bolt

- ❑ Tightening torque and sequence ⇒ page 296

10 - Bracket

- ❑ For exhaust gas recirculation cooler

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11 - Screw-type clip

- ❑ Renew after removing
- ❑ Installation position ⇒ page 290

12 - Bolt

- ❑ Tightening torque and sequence ⇒ page 207

13 - Turbocharger

- ❑ Removing and installing ⇒ page 208

14 - Seal

- ❑ Renew after removing
- ❑ Fit on catalytic converter

15 - Bracket

- ❑ For emission control module
- ❑ With compensation element
- ❑ Preparing compensation element for fitting ⇒ page 295

16 - Bolt

Tightening torque and sequence ⇒ page 207

17 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 296

18 - Bolt

- ❑ 9 Nm

19 - Measuring tube

- ❑ To pressure differential sender - G505-
- ❑ Additional measuring tube to exhaust gas pressure sensor 1 - G450-
- ❑ Tightening torque for union nut: 45 Nm

20 - Bolt

- ❑ Tightening torque and sequence ⇒ page 296

21 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 296

22 - Bracket

- ❑ For emission control module
- ❑ With compensation elements
- ❑ Preparing compensation elements for fitting ⇒ page 295

23 - Bolt

- ❑ Tightening torque and sequence ⇒ page 296

24 - Emission control module

- ❑ Diesel particulate filter with catalytic converter
- ❑ Removing and installing ⇒ page 290

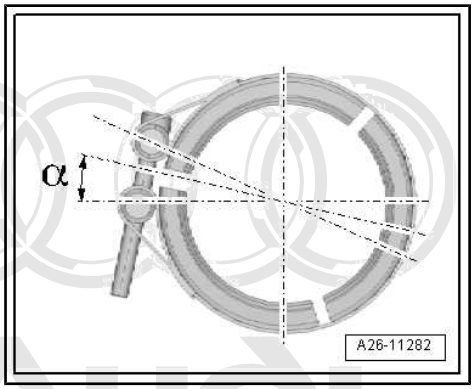
25 - Bolt

- ❑ Renew after removing
- ❑ Tightening torque and sequence ⇒ page 296

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Installation position of screw-type clip for emission control module

- Angle -α- = 30°

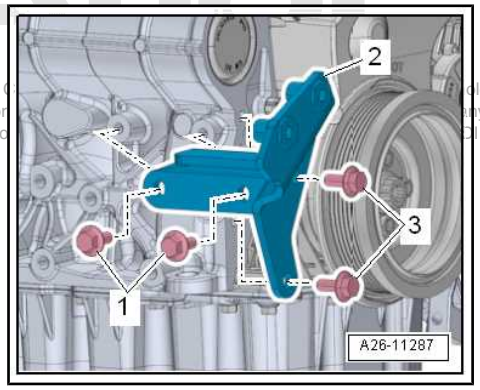


Bracket -2- for emission control module - tightening torque and tightening sequence

– Tighten bolts in stages in the sequence given:

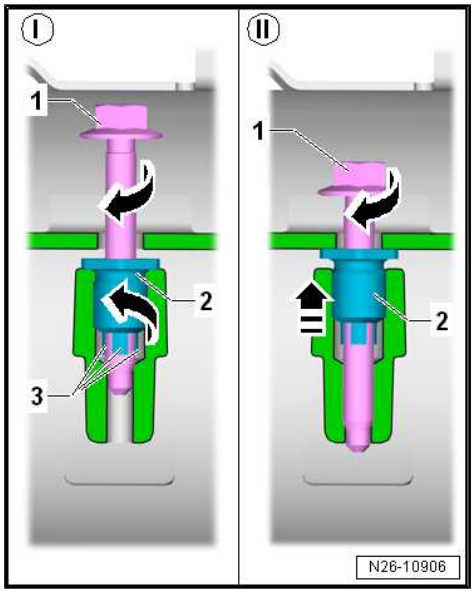
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Stage	Bolts	Tightening torque
1.	-3-	Screw in by hand until contact is made
2.	-1-	20 Nm
3.	-3-	20 Nm



2.2 Removing and installing emission control module

The emission control module is secured to the engine in part by four compensation elements. These compensation elements have a left-hand thread on the outside. When the bolt -1- is screwed in, the friction against the retainer 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 retainer tabs will not produce enough friction on the bolt to turn the compensation element. To avoid impairing the required friction, ensure that the retainer tabs do not come in contact with any lubricant.

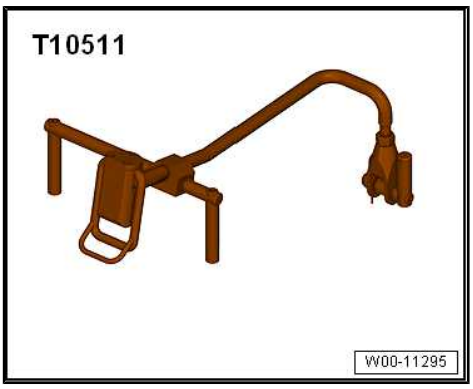


Special tools and workshop equipment required

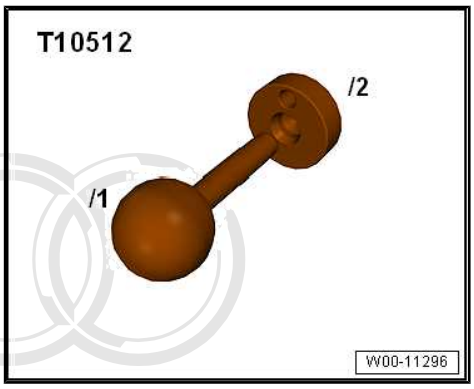
♦ Socket (8 mm) - 3247-



♦ Assembly aid - T10511-



♦ Calibration tool - T10512-



Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

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– Remove subframe with steering rack ⇒ Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .
– Remove front exhaust pipe ⇒ page 283 .
– Drain coolant ⇒ page 163 .
– Remove coolant pipe (rear) ⇒ page 189 .
– Remove coolant pipes (left-side) ⇒ page 187 .
– Remove exhaust gas recirculation cooler ⇒ page 322 .

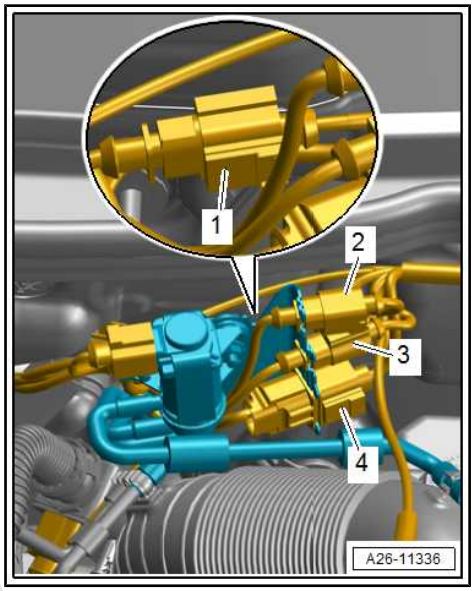
– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

1 - For exhaust gas temperature sender 4 - G648-

2 - For exhaust gas temperature sender 3 - G495-

3 - For exhaust gas temperature sender 2 - G448-

4 - For Lambda probe - G39-

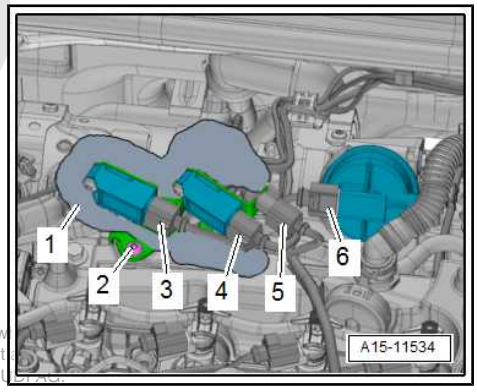


– Open heat insulation sleeve -1-.

– Take electrical connector -5- out of bracket, unplug it and move electrical wiring clear.

– Unplug electrical connectors -3, 4- and move electrical wiring harness clear.

– Remove bolt -2-.



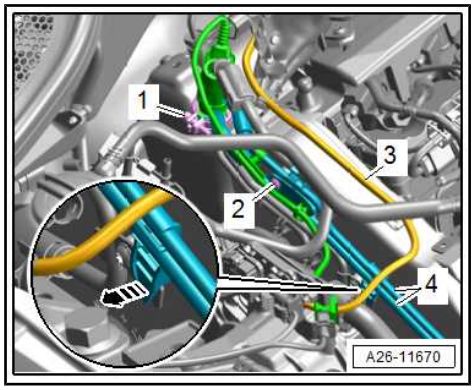
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– Remove bolt -2-.

– Release fastener -arrow- and move coolant lines -4- clear.

– Move electrical wire -3- for control unit for NOx sender - J583- clear and press to side.

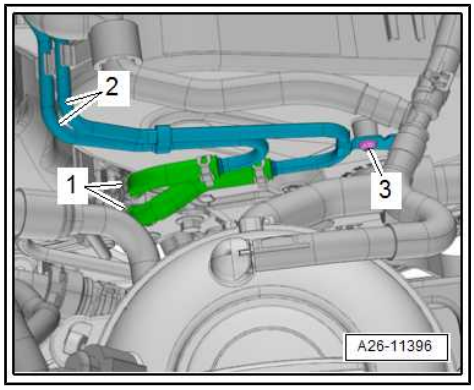
– Release retaining clip -1-, detach injector for reducing agent - N474- and place to right side.



– Remove bolt -3-.

– Release hose clips -1- and detach hoses.

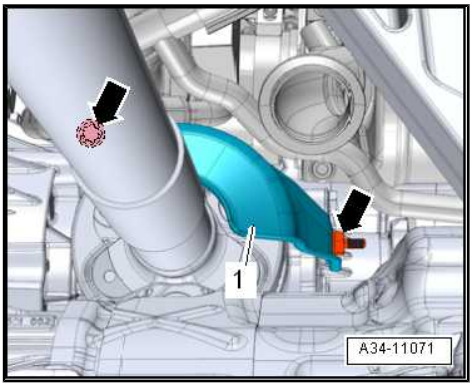
– Unclip measuring tube -2- and detach pressure differential senders together with bracket.



Vehicles with four-wheel drive:

– Unbolt drive shaft (right-side) from bevel box and tie up to rear ⇒ Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .

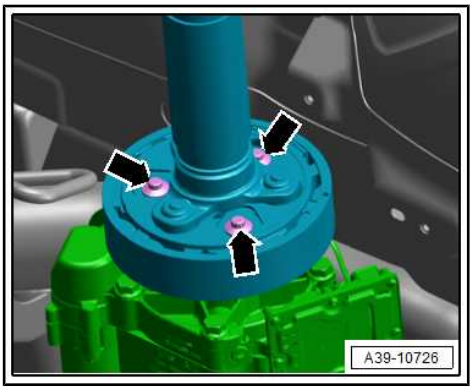
– Remove bolts -arrows- and detach heat shield -1-.



– Mark position of flexible coupling and flange for bevel box in relation to each other for re-installation.

– Unbolt propshaft at bevel box -arrows- (counterhold using a suitable lever at the triangular flange).

– Push engine/gearbox assembly forward slightly (towards front end) and pull propshaft off bevel box.

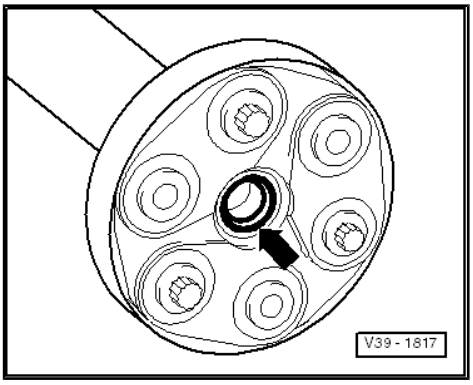


• Make sure not to damage the oil seal -arrow- in the propshaft flange.

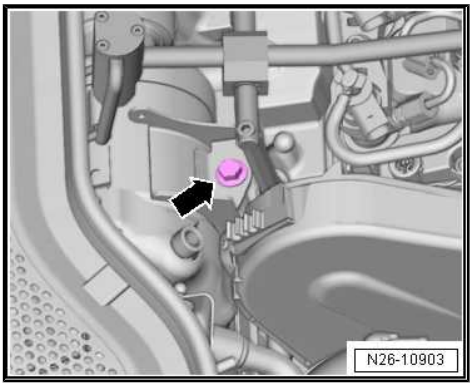
• Push the propshaft horizontally to the rear and towards the left side of vehicle as far as possible.

• Propshaft must be renewed if seal in propshaft flange is damaged.

– Tie up propshaft to left side of vehicle.

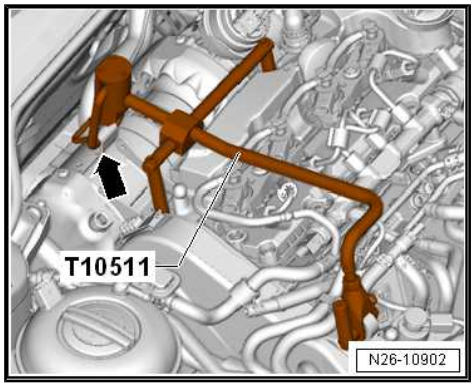


– Remove bolt -arrow-.

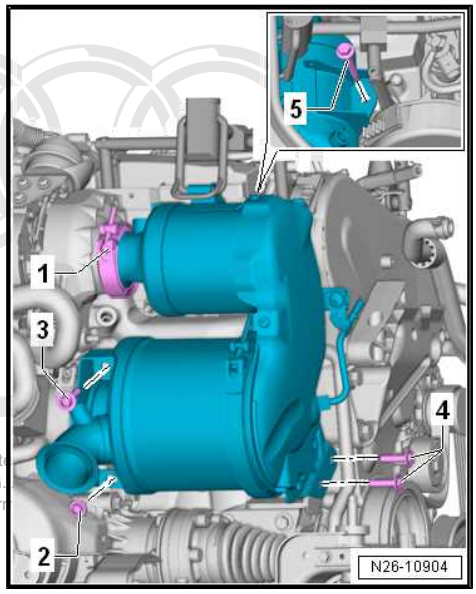


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– Set up assembly aid - T10511- as shown and engage retainer -arrow- in bracket of emission control module.
– The legs of the assembly aid - T10511- are positioned on the heads of the bolts for the cylinder head cover.



– Open screw-type clip -1- and place it on intake funnel of emission control module.
– Remove remaining bolts in the sequence -4, 3, 2-.
– With the help of a second mechanic supporting the engine from below, push engine towards front.
– Pivot lower part of emission control module away from engine and push upwards.
– Pull retainer out of bracket of emission control module and remove emission control module downwards.



Installing

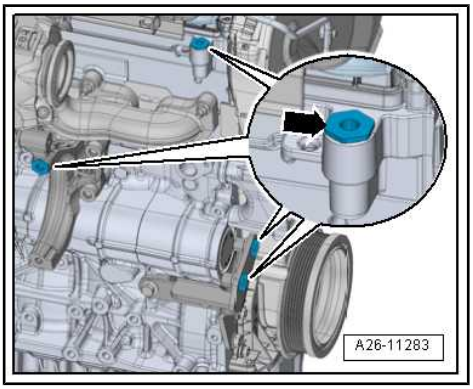
- Assembly aid - T10511- set up on engine
- ♦ Ensure that the retainer of the assembly tool - T10511- is pivoted in the direction of the plenum chamber partition panel.
- ♦ Renew bolts tightened with specified tightening angle.
- ♦ Renew seals, self-locking nuts and screw-type clips for emission control module.
- ♦ Fit all cable ties and heat insulation sleeves in the original positions when installing.

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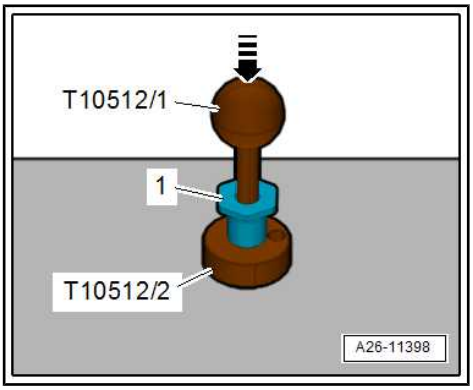
Installation requirements:

- ♦ 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 elements -arrow-.
– Unscrew compensation elements completely in clockwise direction (left-hand thread).
– Clean any threads that do not turn easily and lubricate lightly with rust remover if necessary.
– Adjust retainer tabs to functional dimension using calibration tool - T10512- as follows:

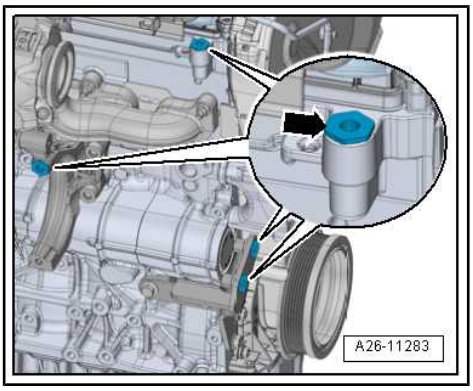


– Slide compensation element -1- onto pin -T10512/1- , insert into centring sleeve -T10512/2- and bend back retainer tabs by gently striking -arrow- ball head with heel of your hand.

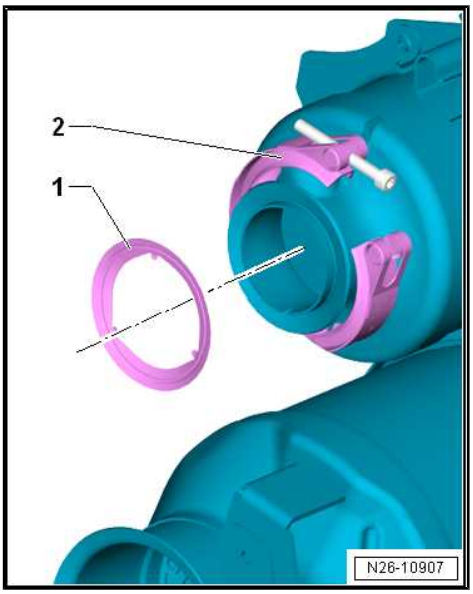


– Screw in compensation elements -arrow- by hand as far as they will go, then loosen again by 45°.

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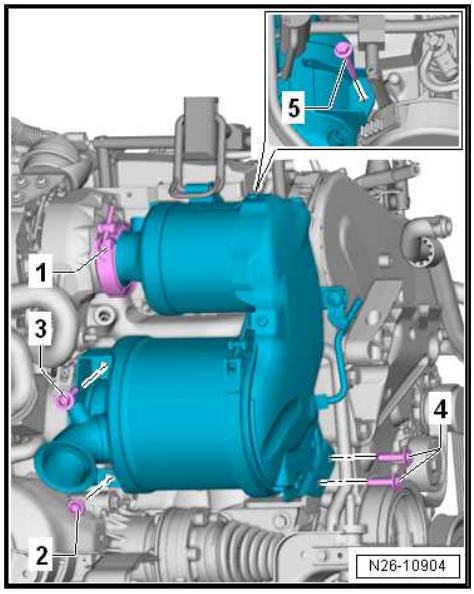
– Renew seal -1- and screw-type clip -2- after removal.
– Fit seal -1- onto emission control module.
– Disengage screw on clip -2- and move clip all the way onto intake funnel of emission control module. Do not bend clip open.
– Guide emission control module into installation position from below, push upwards and hook retainer into bracket of emission control module.
• Emission control module is now suspended approximately in installation position with its weight supported.



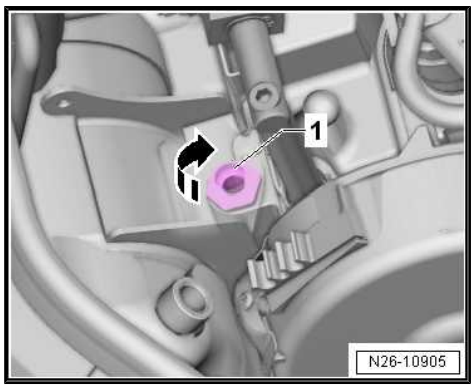
Tightening sequence for emission control module

- Renew all securing bolts for emission control module.

Stage	Bolt	Step
1.	Screw-type clip -1-	Fit over sealing flange and engage screw
2.	Bolt -2-	Tighten by hand and loosen immediately by 90°
3.	Screw-type clip -1-	Tighten to 8 Nm
4.	Bolt -2-	Tighten to 20 Nm
5.	Bolt -3-	Insert and press until it engages. Do not tighten or turn bolt
6.	Bolts -4-	Insert and press until it engages. Tighten bolts to 20 Nm.
7.	Bolt -3-	Tighten to 20 Nm



– Using socket, 8 mm - 3247- , unscrew compensation element (left-hand thread) -1- on cylinder head in direction of -arrow- until it makes contact, then turn 90° further.



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Tightening sequence continued

Stage	Bolt	Step
8.	Bolt -5-	Insert and press until it engages
9.	Bolt -5-	Tighten to 20 Nm
10.	Bolt -5-	Turn 90° further
11.	Bolt -5-	Turn another 45° further.

– Detach assembly aid - T10511- .

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

Vehicles with four-wheel drive:

– Secure propshaft to bevel box ⇒ Rear final drive; Rep. gr. 39 ; Propshaft; Removing and installing propshaft .

– Secure drive shaft (right-side) to bevel box ⇒ Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .

Continued for all vehicles:

– Install exhaust gas recirculation cooler ⇒ page 322 .

– Install coolant pipes (left-side) ⇒ page 187 .

– Install coolant pipe (rear) ⇒ page 189 .

– Install injector for reducing agent - N474- ⇒ page 309 .

– Install front exhaust pipe ⇒ page 283 .

– Install subframe ⇒ Rep. gr. 40 ; Subframe; Removing and installing subframe with steering rack .

– Fill up with coolant ⇒ page 165 .

– Install engine cover panel ⇒ page 40 .

– Adaption must be performed on engine control unit after renewing emission control module. To do so, switch on ignition and select following menu options on ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `Guided Functions`
- `01 - Replacing engine CU / particulate filter`

Tightening torques

- Bracket for pressure differential sender - G505- ⇒ Item 6 (page 96)
- ⇒ “1.1 Exploded view - toothed belt cover”, page 71

2.3 Removing and installing pressure differential sender - G505-

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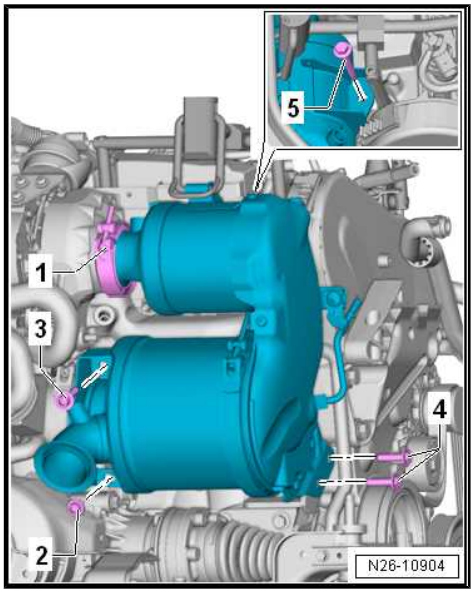
The pressure differential sender - G505- detects the amount of deposits in the particulate filter.

Special tools and workshop equipment required

- Vehicle diagnostic tester

Removing

– Remove engine cover panel ⇒ page 40 .

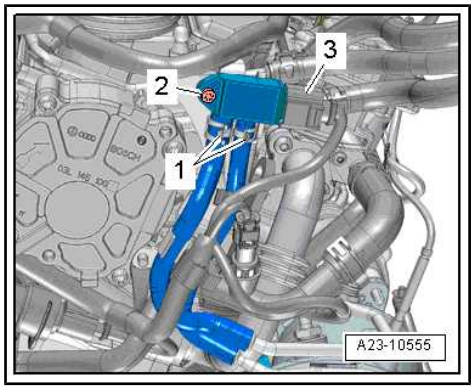


– Unplug electrical connector -3-.

– Unscrew bolt -2- and detach pressure differential sender - G505- .

– Before disconnecting, spray the hoses for the pressure differential sender - G505- with suitable release agent.

– Release hose clips -1-.



NOTICE

Risk of damage to pressure differential sender if connection breaks off.

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

– Carefully disconnect the hoses from their connections (take care to keep the hoses straight).

Installing

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

– Before installing, blow out control pipe from pressure differential sender - G505- to particulate filter towards particulate filter with compressed air (pipe can become obstructed or may ice up due to condensation).

– When connecting hose, make sure that it is securely fitted and that there are no leaks.

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

– Install engine cover panel ⇒ page 40 .

– Learnt values must be reset on engine control unit after renewing pressure differential sender - G505- . To do so, switch on ignition and select following menu options on ⇒ Vehicle diagnostic tester.

♦ `01 - Self-diagnosis compatible systems`

♦ `01 - Engine electronics`

♦ `Guided Functions`

♦ `01 - Reset learnt values`

Tightening torques

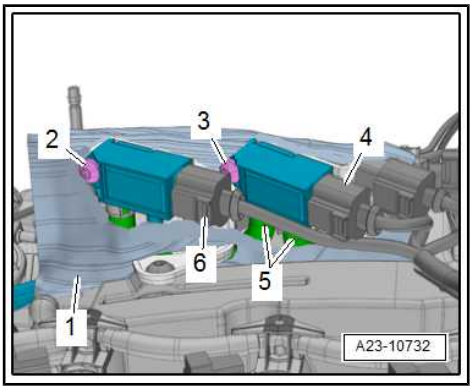
♦ ⇒ “8.1 Exploded view - Lambda probe”, page 273

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2.4 Removing and installing exhaust gas pressure sensor 1 - G450-

Removing

– Remove engine cover panel ⇒ page 40 .



– Open heat insulation sleeve -1-.
– Unplug electrical connector -6-.
– Remove bolt -2- and press pressure differential sender - G505- slightly to side.
– Unplug electrical connector -4-.
– Remove bolt -3- from exhaust gas pressure sensor 1 - G450- .
– Before disconnecting hoses from exhaust gas pressure sender 1 - G450- , spray hoses with suitable release agent.
– Release hose clips -5- and detach hoses.

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 the 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).
– When connecting hose, make sure that it is securely fitted and that there are no leaks.
• Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .
– Install engine cover panel ⇒ page 40 .
– Learnt values must be adapted on engine control unit after renewing exhaust gas pressure sensor 1 - G450- . To do so, switch on ignition and select following menu options on ⇒ Vehicle diagnostic tester.

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♦ `01 - Self-diagnosis compatible systems`
♦ `01 - Engine electronics`
♦ `Guided Functions`
♦ `01 - Reset learnt values`

Tightening torques

♦ ⇒ “8.1 Exploded view - Lambda probe”, page 273

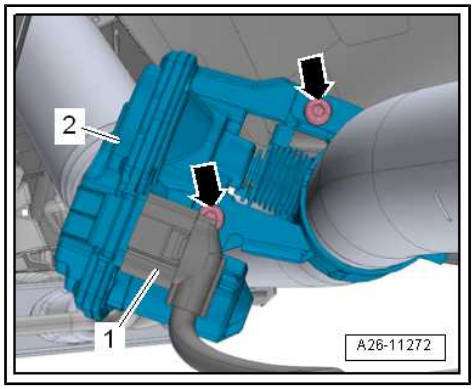
2.5 Removing and installing exhaust flap control unit - J883-

• Observe safety precautions when working on the exhaust system
⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

Removing

– Unplug electrical connector -1-.

– Remove bolts -arrows- and detach exhaust flap control unit - J883- -item 2-.

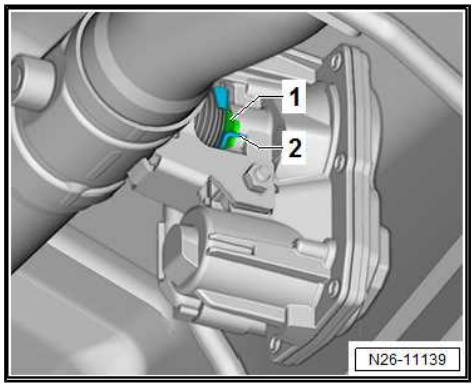


Installing

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– Fit new exhaust flap control unit. When doing so, ensure that coupling of control unit -1- engages in tab on exhaust flap -2-.

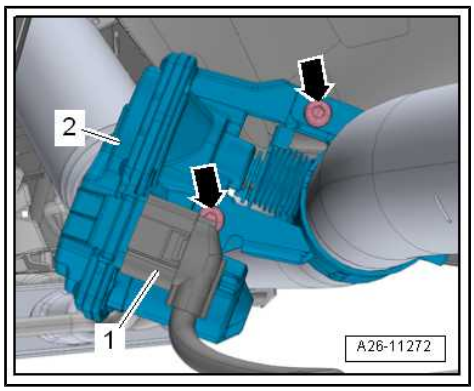
– Fit new securing bolts and nuts.



– 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.

– Learnt values must be adapted in engine control unit after renewing exhaust flap control unit - J883- . To do so, switch on ignition and select following menu options on ⇒ Vehicle diagnostic tester.



- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `Guided Functions`
- `01 - Adaption elec. adjuster with checkback`

Tightening torques

- ⇒ Item 11 (page 281)

3 SCR (selective catalytic reduction) system

⇒ “3.1 Exploded view - reducing agent tank”, page 301

⇒ “3.3 Exploded view - reducing agent supply line”, page 304

⇒ “3.5 Draining reducing agent tank”, page 305

⇒ “3.6 Removing and installing delivery unit for reducing agent”, page 306

⇒ “3.7 Removing and installing reducing agent tank”, page 307

⇒ “3.8 Removing and installing injector for reducing agent N474 ”, page 309

⇒ “3.9 Removing and installing control unit for reducing-agent heater J891 ”, page 311

3.1 Exploded view - reducing agent tank

1 - Cover

- ❑ For reducing agent tank

2 - Delivery unit

- ❑ with:
- ♦ Pump for reducing agent - V437-
- ♦ Reducing agent return flow pump - V561-
  - ❑ Removing and installing delivery unit ⇒ page 306

3 - Seals

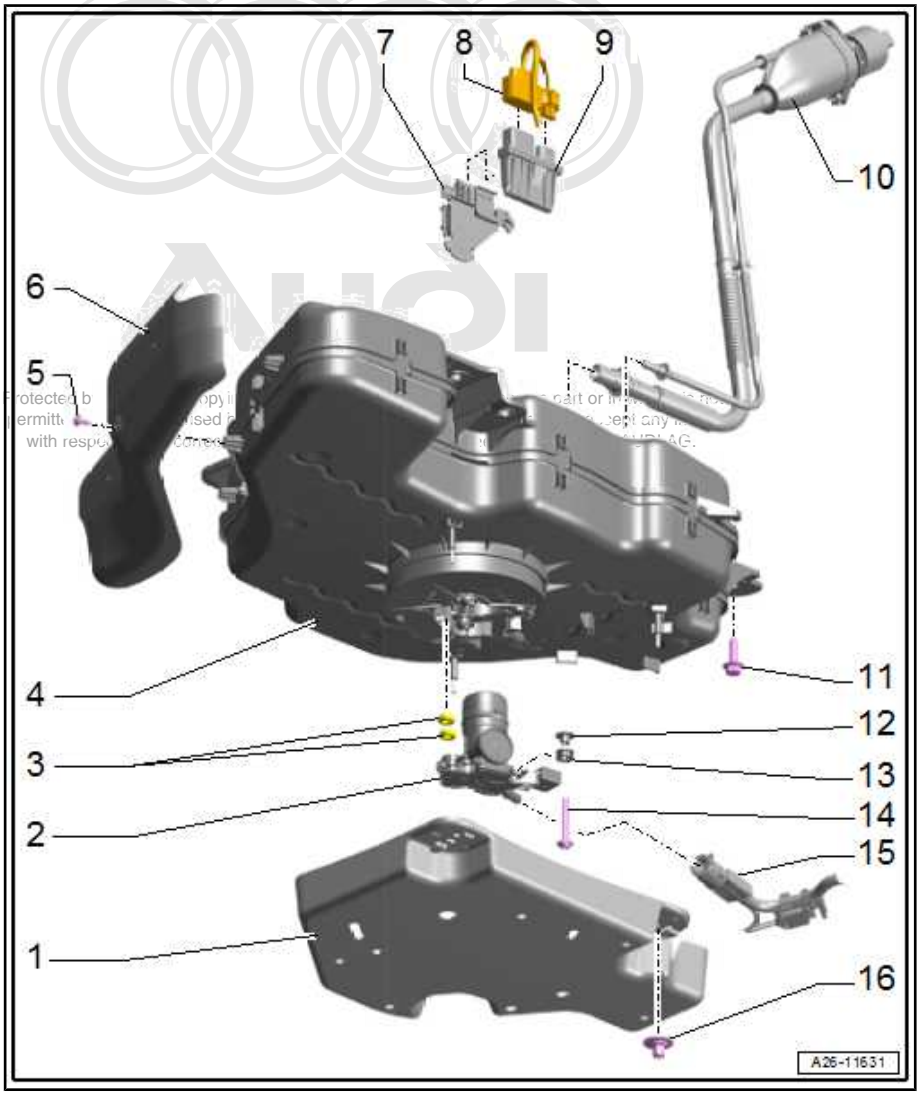
- ❑ Renew after removing

4 - Reducing agent tank

- ❑ with:
- ♦ Temperature sender for reducing agent - G685-
- ♦ Reducing agent level sender - G697-
- ♦ Reducing agent quality sensor - G849-
- ♦ Heater for reducing agent tank (heater circuit 1) - Z102-
  - ❑ Fitting location: Beneath luggage compartment (right-side) on underside of vehicle
  - ❑ Removing and installing ⇒ page 307

5 - Bolt

- ❑ 2 Nm



6 - Heat shield

7 - Bracket

- ❑ For control unit for reducing-agent heater - J891-

8 - Electrical wiring harness

9 - Control unit for reducing-agent heater - J891-

- ❑ Removing and installing ⇒ page 311

10 - Filler neck

- ❑ For filling up SCR

11 - Bolt

- ❑ Renew
- ❑ 25 Nm

12 - Spacer sleeve

13 - Grommet

14 - Bolt

- ❑ 5.75 Nm

15 - Reducing agent line

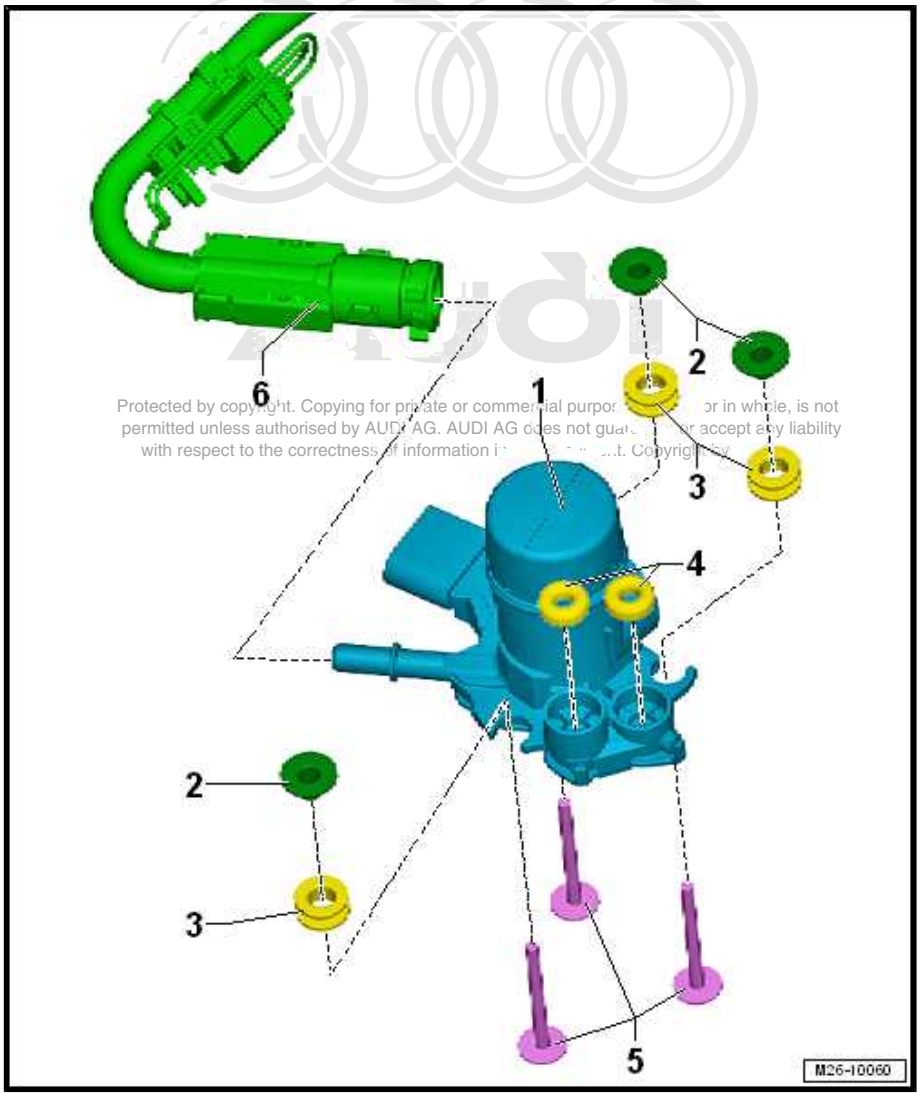
- ❑ From delivery unit to injector for reducing agent - N474- (from production date 06.2015 onwards, reducing agent line has two parts)
- ❑ With heater for reducing-agent line (heater circuit 2) - Z104-
- ❑ Press release tabs to disconnect ⇒ page 305
- ❑ Clip can be renewed separately
- ❑ Clip onto fuel tank

16 - Nut

- ❑ 2 Nm

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3.2 Exploded view - delivery unit for reducing agent



1 - Delivery unit for reducing agent

- ❑ with:
- ♦ Pump for reducing agent - V437-
- ♦ Reducing agent return flow pump - V561-
  - ❑ Removing and installing ⇒ page 306

2 - Spacer sleeve

- ❑ 3x
- ❑ Renew after removing
- ❑ Supplied with repair kit

3 - Damper

- ❑ 3x
- ❑ Renew after removing
- ❑ Supplied with repair kit

4 - Seal

- ❑ 2x
- ❑ Renew after removing

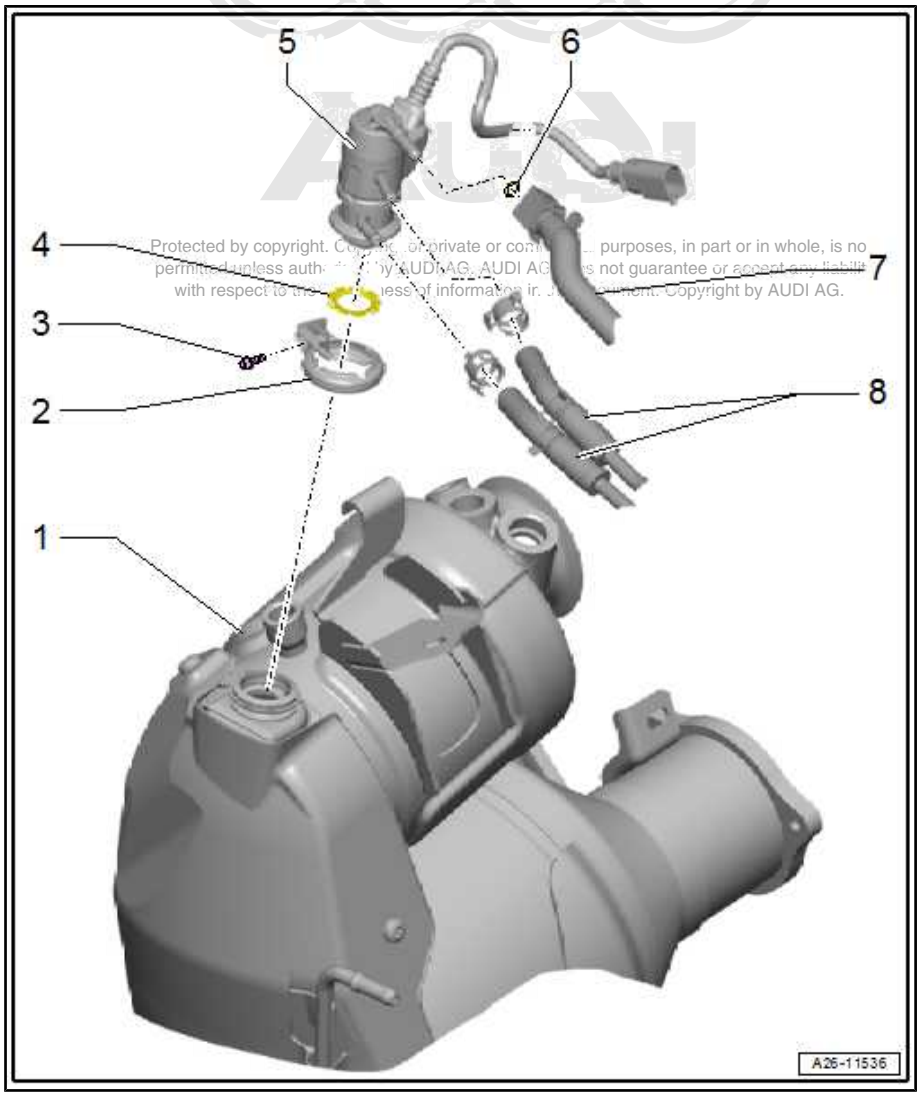
5 - Bolt

- ❑ 3x
- ❑ Renew after removing
- ❑ 6 Nm

6 - Reducing agent line

- ❑ From delivery unit to injector for reducing agent - N474-
- ❑ With heater for reducing-agent line (heater circuit 2) - Z104-
- ❑ Press release tabs to disconnect ⇒ page 305

3.3 Exploded view - reducing agent supply line



1 - Emission control module

- ❑ Diesel particulate filter with catalytic converter
- ❑ Removing and installing ⇒ page 290

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 309
- ❑ Lugs in injector for reducing agent - N474- must be inserted in corresponding mountings

6 - O-ring

- ❑ Check for damage; reducing agent line must be renewed if O-ring is damaged

7 - Reducing agent line

- ❑ From delivery unit to injector for reducing agent - N474- (from production date 06.2015 onwards, reducing agent line has two parts)
- ❑ With heater for reducing-agent line (heater circuit 2) - Z104-
- ❑ Press release tabs to disconnect ⇒ page 305
- ❑ Clip can be renewed separately
- ❑ Clip onto fuel tank

8 - Coolant hoses

3.4 Unplugging connector for reducing agent line

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.**

– Drain reducing agent line.

Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Drain metering line`

– Clean area around securing clip with water.

– Place a clean cloth under coupling point to catch escaping reducing agent.

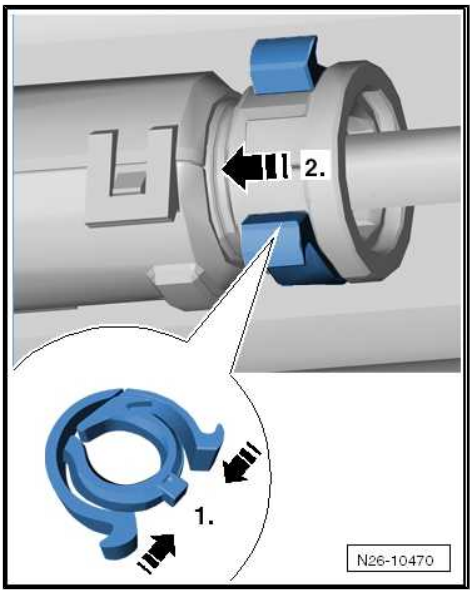
– Push connector in opposite direction of -arrow 2-.

– Compress securing clip for reducing agent line -1- in direction of -arrow 1- as shown.

– Pull reducing agent line off smoothly in direction of -arrow 2- without using any tools.

– Hold a clean cloth under separating point to catch escaping reducing agent.

– Seal off all open lines and connections with clean plugs from engine bung set - VAS 6122- .



3.5 Draining reducing agent tank

Procedure

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The reducing agent tank does not have an outlet for draining off the reducing agent.

Procedure

– Remove reducing agent tank ⇒ page 307 .

– Drain reducing agent tank via filler neck into a suitable container.

After re-filling, the following step must be carried out:

– Adapt learnt value for SCR system after draining reducing agent or renewing components ⇒ page 7 .

Tightening torques

◆ ⇒ “3.1 Exploded view - reducing agent tank”, page 301

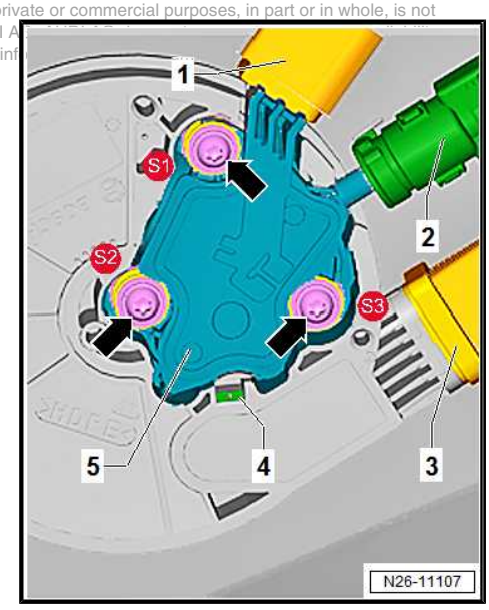
3.6 Removing and installing delivery unit for reducing agent

Removing

The reducing agent tank must be removed before the reducing agent is drained off.

– Remove reducing agent tank ⇒ page 307 .
– Place reducing agent tank on a clean surface.
– The delivery unit must face upwards.
– Clean area around delivery unit -5-,
– Remove bolts -arrows-.
– Apply a flat-bladed screwdriver at recess -4- and carefully lever out delivery unit -5-.
– Pull delivery unit out of reducing agent tank.

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Installing

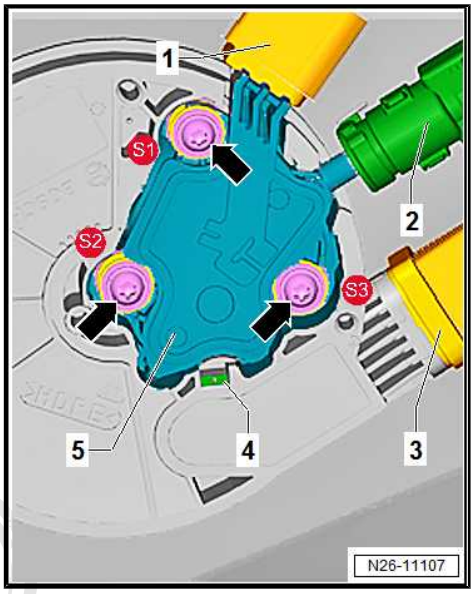
Installation is carried out in the reverse order; note the following:

- Do not use compressed air to clean delivery unit for reducing agent.
- Clean all components and connections with water and a lint-free cloth.
- All components must be dry before they are installed.
- Lightly coat seals with lubricant before installing ⇒ Electronic parts catalogue (ETKA) .
- Check seals for damage.

– Clean all components and connections with water and a lint-free cloth.
– Renew dampers ⇒ Item 3 (page 303) .
– Renew spacer sleeves ⇒ Item 2 (page 303) .
– Renew seals ⇒ Item 4 (page 303) .
– Fit delivery unit for reducing agent and press it into mounting (take care to keep it straight).
– Apply appropriate force across entire surface.

- There are labels marked on the delivery unit on the reducing agent tank.
- These labels (-S1- to -S3-) indicate the tightening sequence.
- Renew bolts.

Tighten bolts for delivery unit in the following sequence:



Tightening sequence	Label for bolt on delivery unit	Position of bolt	Tightening torque
1	S1	Bolt furthest from seal	6 Nm
2	S2	Bolt second-closest to seal	
3	S3	Bolt closest to seal	

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Adapt learnt value for SCR system after draining reducing agent or renewing components. Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Reset learnt values - reduction agent system`

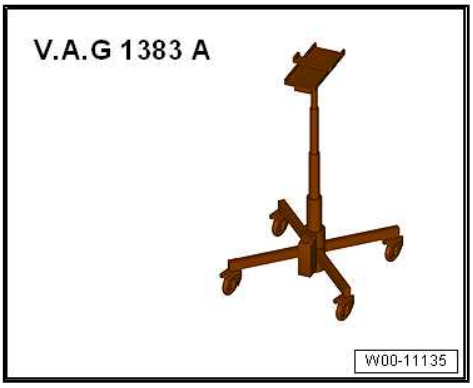
Tightening torques

- ⇒ “3.1 Exploded view - reducing agent tank”, page 301

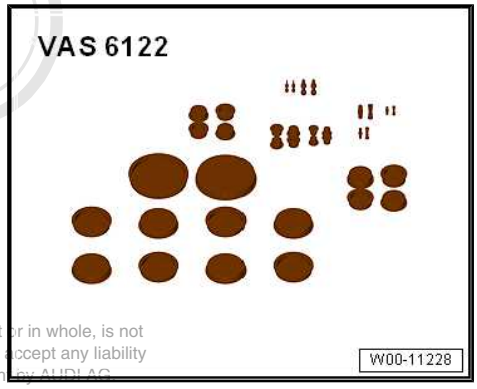
3.7 Removing and installing reducing agent tank

Special tools and workshop equipment required

- Engine and gearbox jack - V.A.G 1383 A-



♦ Engine bung set - VAS 6122-



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Removing

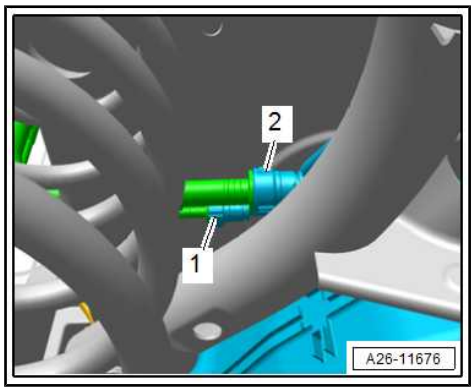
- Observe safety measures for handling reducing agent ⇒ page 4 .

The reducing agent tank must be removed before the reducing agent is drained off.

– Drain reducing agent line using a ⇒ Vehicle diagnostic tester in `Guided Functions` mode, `01 - Drain metering line`.

– Press release tabs on both sides and detach hose connections -1, 2-.

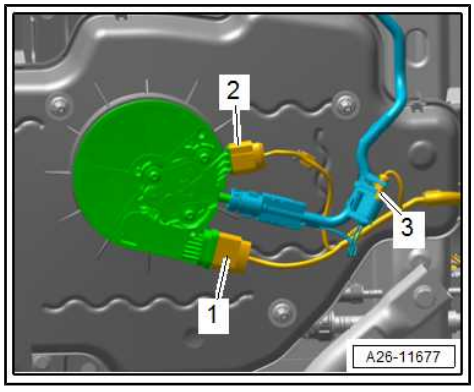
– Seal hoses with clean plugs from engine bung set - VAS 6122- .



– Unplug electrical connectors -1, 2-.

– Unclip and unplug electrical connector -3- for heater for reducing-agent line.

– Move electrical wiring harness clear at reducing agent tank.

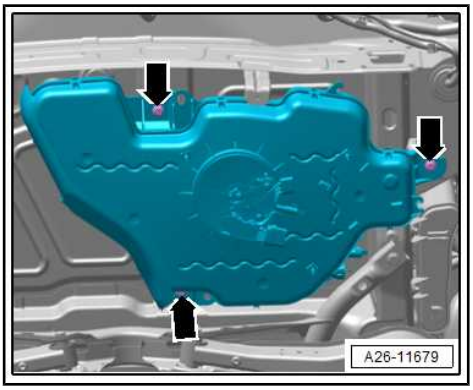


CAUTION

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 bolts -arrows- and lower reducing agent tank using engine and gearbox jack - V.A.G 1383 A- (have a second mechanic support reducing agent tank by hand).

– Detach reducing agent tank.

– Drain reducing agent tank carefully via filler neck.

– Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .

Installing

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

– Check that lines are clipped onto reducing agent tank.

Adapt learnt value for SCR system after draining reducing agent or renewing components. Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Reset learnt values - reduction agent system`

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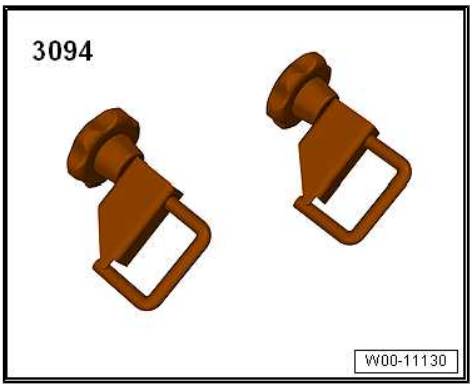
Tightening torques

- ⇒ “3.1 Exploded view - reducing agent tank”, page 301

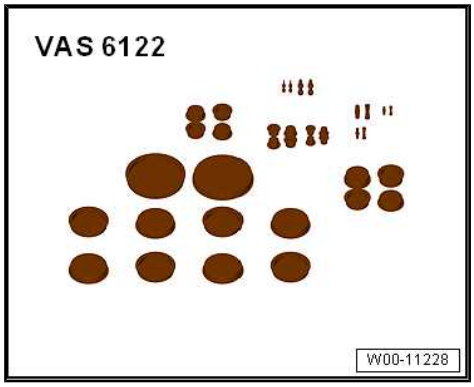
3.8 Removing and installing injector for reducing agent - N474-

Special tools and workshop equipment required

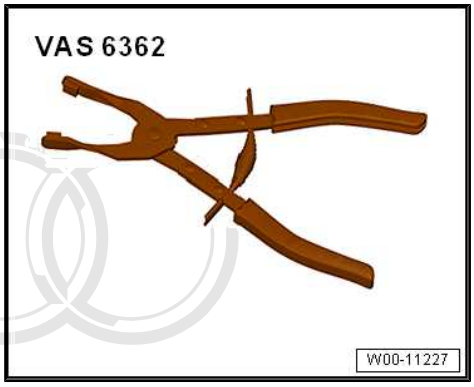
- Hose clamps, up to 25 mm - 3094-



♦ Engine bung set - VAS 6122-



♦ Hose clip pliers - VAS 6362-



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Removing

- Observe safety measures for handling reducing agent ⇒ page 4 .

– Remove engine cover panel ⇒ page 40.

⚠ 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.**

– Unplug electrical connector -4- and move clear.

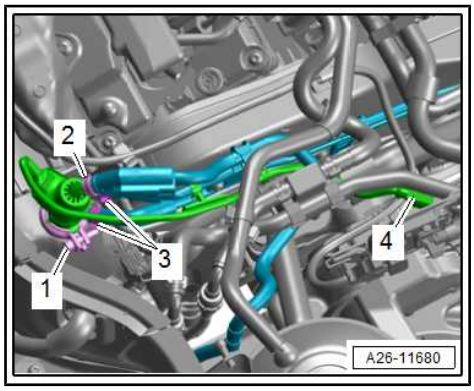
– Lay a clean cloth under the separating point to catch escaping reducing agent.

– Disconnect reducing agent line -2- from injector for reducing agent - N474- ⇒ page 305 .

– Clamp off coolant hoses using hose clamps up to 25 mm - 3094- , release hose clips -3- and disconnect hoses.

– Seal off open lines and connections with clean plugs from engine bung set - VAS 6122- .

– Release screw-type clip -1- and detach injector for reducing agent - N474- .

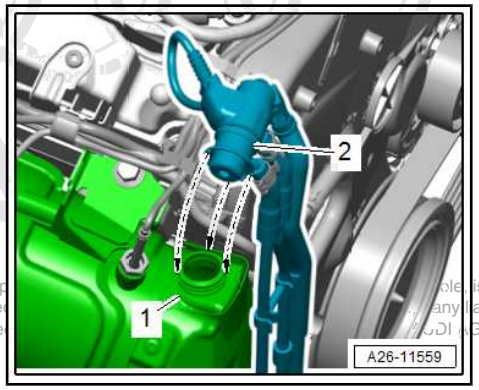


Installing

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

- Renew seal.
- Installation position: lugs in injector for reducing agent - N474- -item 2- must be inserted -arrows- in corresponding mountings in front exhaust pipe -1-.
- Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue.

– Install engine cover panel ⇒ page 40 .



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Adapt learnt value for SCR system after draining reducing agent or renewing components. Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Reset learnt values - reduction agent system`

Tightening torques

- ⇒ “3.1 Exploded view - reducing agent tank”, page 301

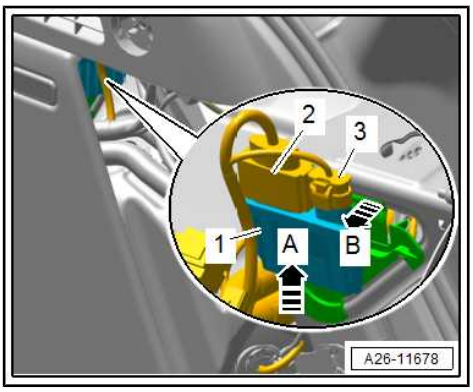
3.9 Removing and installing control unit for reducing-agent heater - J891-

Removing

– Take trailer detector control unit - J345- out of bracket and place to one side ⇒ Electrical system; Rep. gr. 96 ; Towing bracket; Removing and installing trailer detector control unit - J345- .

– Release fastener -arrow B- and take off control unit for reducing-agent heater - J891- -item 1- upwards -arrow A-.

– Unplug electrical connectors -2, 3-.



Installing

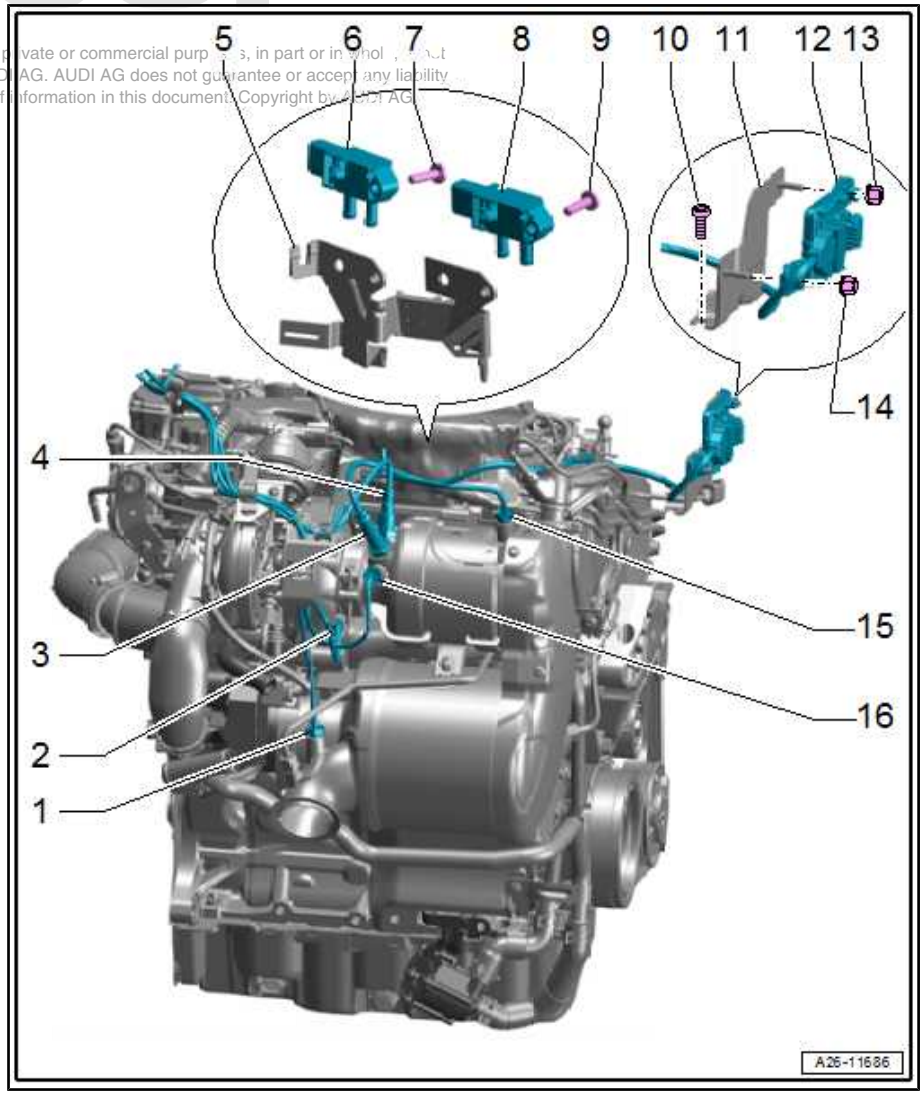
Install in reverse sequence.

4 Exhaust gas temperature control

⇒ "4.1 Exploded view - exhaust gas temperature control", page 312

⇒ "4.2 Removing and installing exhaust gas temperature sender", page 313

4.1 Exploded view - exhaust gas temperature control



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1 - Exhaust gas temperature sender 4 - G648-

- ❑ Removing and installing ⇒ page 316
- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ 60 Nm

2 - Exhaust gas temperature sender 1 - G235-

- ❑ Removing and installing ⇒ page 313
- ❑ Coat with high-temperature paste when installing; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 45 Nm

3 - NOx sender - G295-

- ❑ Removing and installing ⇒ page 275

4 - Lambda probe - G39- with Lambda probe heater - Z19-

- ❑ Removing and installing ⇒ page 274

5 - Bracket

- ❑ For pressure differential senders

6 - Pressure differential sender - G505-

- ❑ Removing and installing ⇒ page 297

7 - Bolt

- ❑ Tightening torque ⇒ Item 7 (page 273)

8 - Exhaust gas pressure sensor 1 - G450-

- ❑ Removing and installing ⇒ page 298

9 - Bolt

- ❑ Tightening torque ⇒ Item 9 (page 273)

10 - Bolt

- ❑ Tightening torque ⇒ Item 10 (page 273)

11 - Bracket

- ❑ For control unit for NOx sender - J583-

12 - Control unit for NOx sender - J583-

- ❑ Removing and installing ⇒ page 275

13 - Nut

14 - Nut

15 - Exhaust gas temperature sender 3 - G495-

- ❑ Removing and installing ⇒ page 316
- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ 45 Nm

16 - Exhaust gas temperature sender 2 - G448-

- ❑ The thread of the exhaust gas temperature sender is coated; it must not additionally be greased with high-temperature paste
- ❑ Removing and installing ⇒ page 315
- ❑ 60 Nm

4.2 Removing and installing exhaust gas temperature sender

⇒ "4.2.1 Removing and installing exhaust gas temperature sender 1 G235 ", page 313

⇒ "4.2.2 Removing and installing exhaust gas temperature sender 2 G448 ", page 315

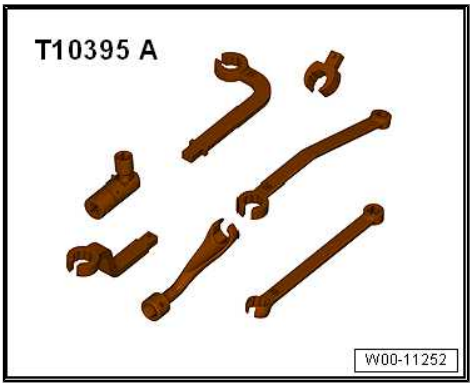
⇒ "4.2.3 Removing and installing exhaust gas temperature sender 3 G495 / exhaust gas temperature sender 4 G648 ", page 316

4.2.1 Removing and installing exhaust gas temperature sender 1 - G235-

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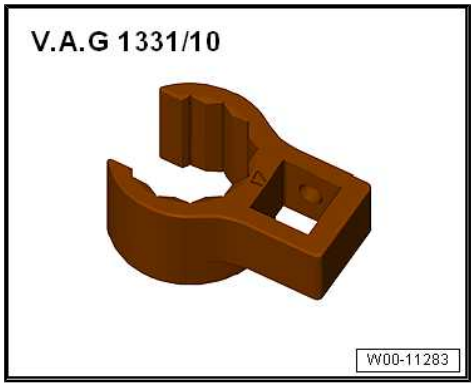
Special tools and workshop equipment required

- ♦ Tool set - T10395 A/B-



- ♦ Supplement tool set - T10395/8-/10-

♦ Flared ring spanner tool insert (17 mm) - V.A.G 1331/10-



Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

– Remove engine cover panel ⇒ page 40 .

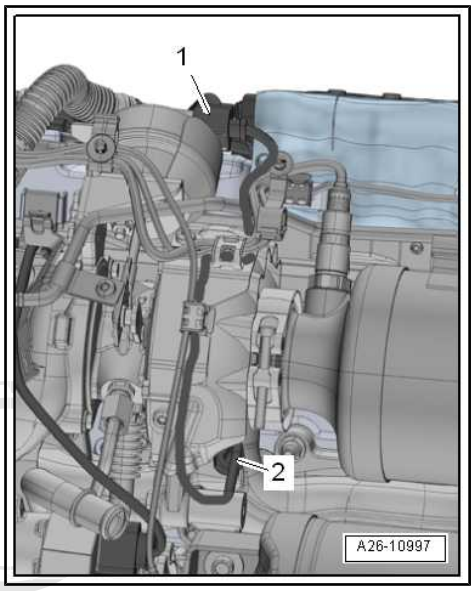
– Remove front exhaust pipe ⇒ page 283 .

– Open heat insulation sleeve.

- Do not cut off electrical wiring.

– Take electrical connector -1- out of bracket, unplug connector and move wiring harness clear.

– Unscrew exhaust gas temperature sender 1 - G235- -2-.



Installing

Installation is carried out in the 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.

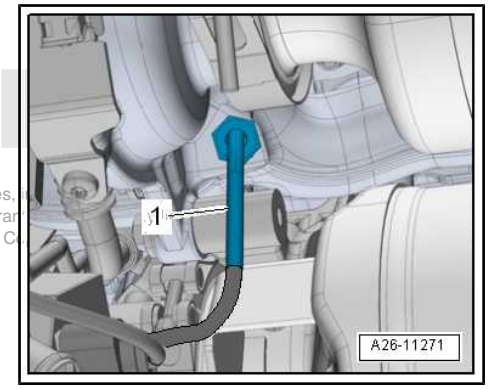
– Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue .

Installation position of exhaust gas temperature sender 1 - G235- :

- Angled part of line -1- must point vertically downwards.

– Install front exhaust pipe ⇒ page 283 .

– Install engine cover panel ⇒ page 40 .



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Tightening torques

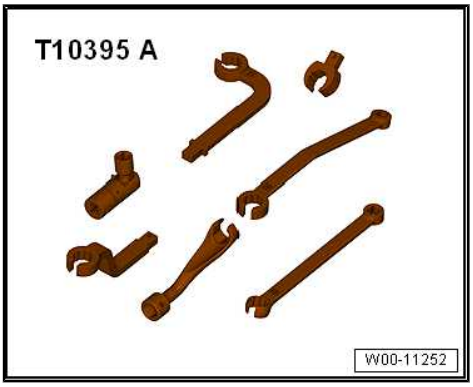
♦ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 312

♦ ⇒ “1.1 Exploded view - silencers”, page 280

4.2.2 Removing and installing exhaust gas temperature sender 2 - G448-

Special tools and workshop equipment required

- Tool set - T10395 A/B-



- Supplement tool set - T10395/8-/10-

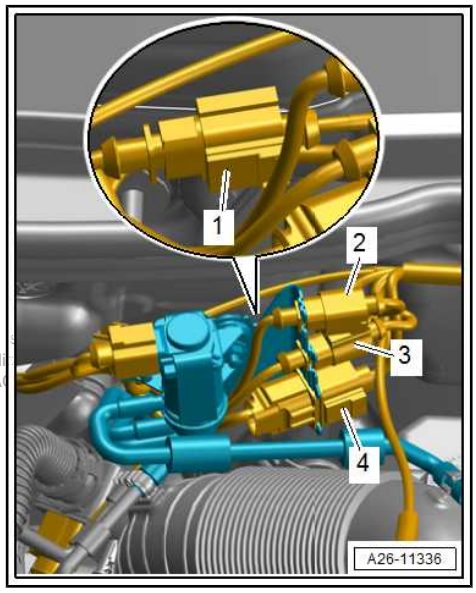
Removing

- Observe safety precautions when working on the exhaust system
  ⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

– Remove engine cover panel ⇒ page 40 .

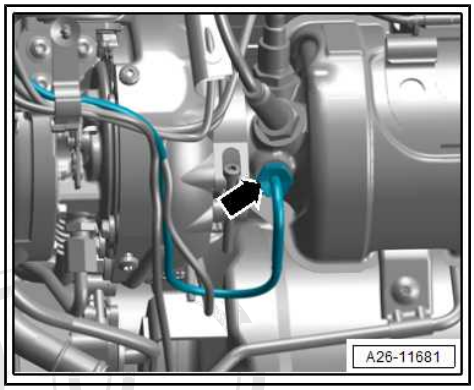
- Do not cut off electrical wiring.

– Detach electrical connector -3- for exhaust gas temperature sender 2 - G448- from bracket, unplug connector and move electrical wiring clear.



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– Unscrew exhaust gas temperature sender 2 - G448- -arrow-.



Installing

Installation is carried out in the 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.

Installation position of exhaust gas temperature sender 2 - G448- :

• Angled part of line must point vertically downwards.

– Install engine cover panel ⇒ page 40 .

Tightening torques

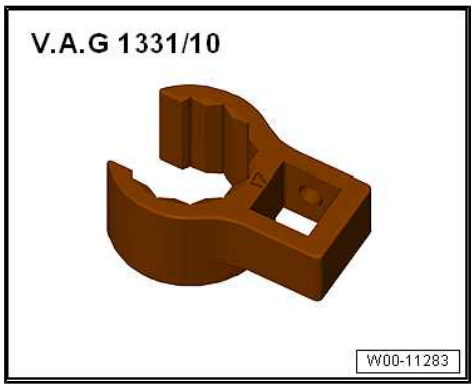
♦ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 312

4.2.3 Removing and installing exhaust gas temperature sender 3 - G495- / exhaust gas temperature sender 4 - G648-

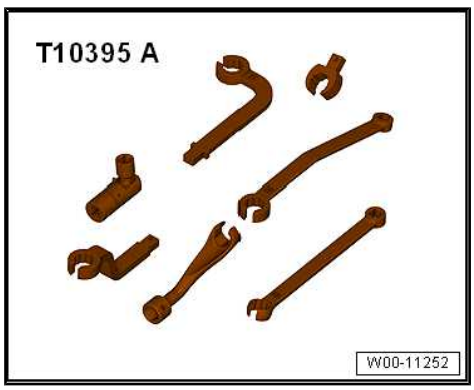
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Special tools and workshop equipment required

♦ Flared ring spanner tool insert (17 mm) - V.A.G 1331/10-



♦ Tool set - T10395 A/B-



♦ Supplement tool set - T10395/8-/10-

Removing

• Observe safety precautions when working on the exhaust system
⇒ “2.6 Safety precautions when working on the exhaust system”, page 4 .

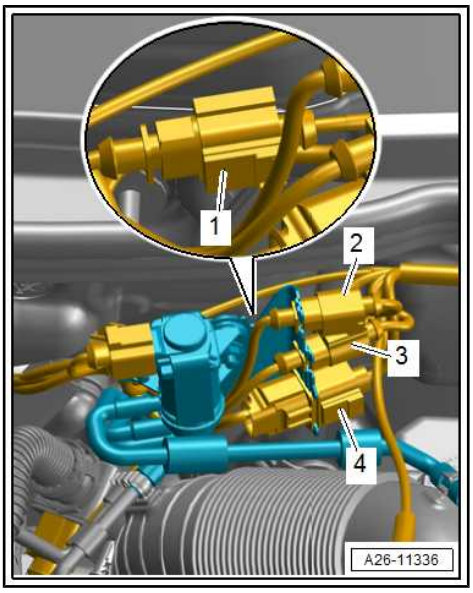
– Remove engine cover panel ⇒ page 40 .

• Do not cut off electrical wiring.

– Detach electrical connectors from bracket, unplug connectors and move electrical wiring clear:

1 - For exhaust gas temperature sender 3 - G495-

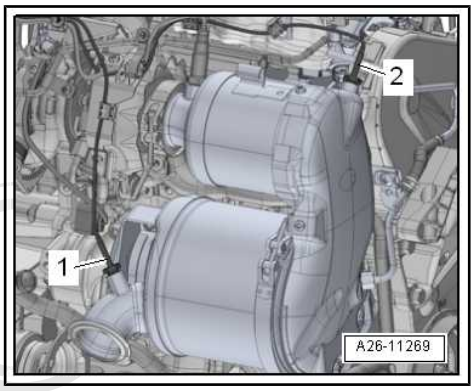
2 - For exhaust gas temperature sender 4 - G648-



– Unscrew relevant exhaust gas temperature sender.

1 - Exhaust gas temperature sender 4 - G648-

2 - Exhaust gas temperature sender 3 - G495-



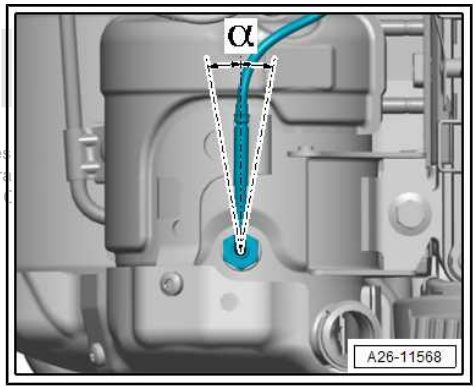
Installing

Installation is carried out in the 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.

Installation position of exhaust gas temperature sender 3 - G495- :



• Angle α = 5°

– Install engine cover panel ⇒ page 40 .

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Tightening torques

◆ ⇒ “4.1 Exploded view - exhaust gas temperature control”, page 312

5 Exhaust gas recirculation

⇒ “5.1 Exploded view - exhaust gas recirculation system”, page 318

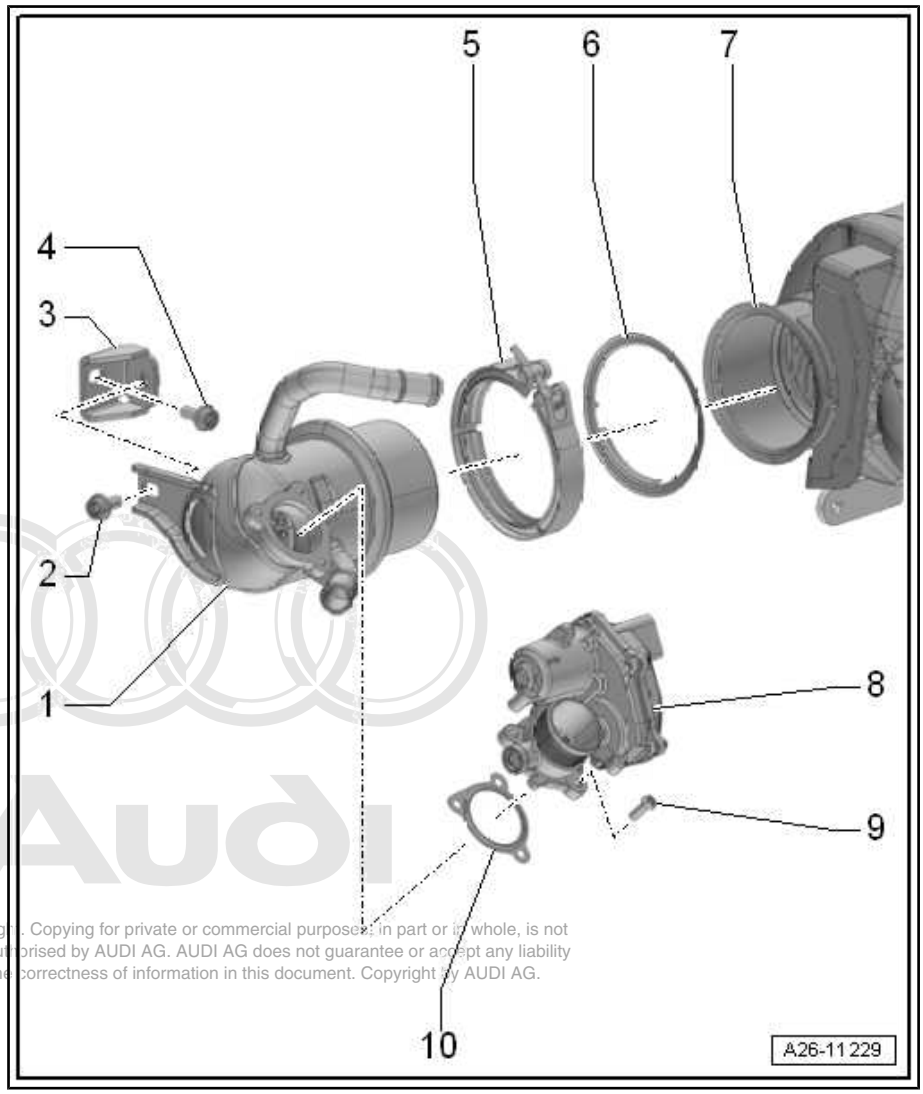
⇒ “5.2 Removing and installing exhaust gas recirculation control motor V338 ”, page 321

⇒ “5.3 Removing and installing exhaust gas recirculation control motor 2 V339 ”, page 321

⇒ “5.4 Removing and installing exhaust gas recirculation cooler”, page 322

⇒ “5.5 Checking exhaust gas recirculation cooler for leaks”, page 325

5.1 Exploded view - exhaust gas recirculation system



1 - Exhaust gas recirculation cooler

- ❑ Removing and installing ⇒ page 322

2 - Bolt

- ❑ Tightening torque and sequence ⇒ page 319 if only exhaust gas recirculation cooler was removed

3 - Bracket

- ❑ For exhaust gas recirculation cooler

4 - Bolt

- ❑ Tightening torque and sequence ⇒ page 319 if only exhaust gas recirculation cooler was removed

5 - Screw-type clip

- ❑ Renew after removing
- ❑ Installation position ⇒ page 319
- ❑ Tightening torque and sequence ⇒ page 319

6 - Seal

- ❑ Renew after removing

7 - Emission control module

- ❑ Removing and installing ⇒ page 290

8 - Exhaust gas recirculation control motor 2 - V339-

- ❑ With exhaust gas recirculation potentiometer 2 - G466-
- ❑ Removing and installing ⇒ page 321
- ❑ The control motor for exhaust gas recirculation is protected from heat damage by an insulation mat.
- ❑ If the insulation mat is damaged, it must be renewed. The control motor must then be checked for heat damage and renewed if necessary.
- ❑ Learnt values must be re-adapted after renewing exhaust gas recirculation control motor 2 - V339- .

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- 01 - Self-diagnosis compatible systems
- 01 - Engine electronics
- 01 - Engine electronics, functions
- 01 - Adaption elec. adjuster with checkback

9 - Bolt

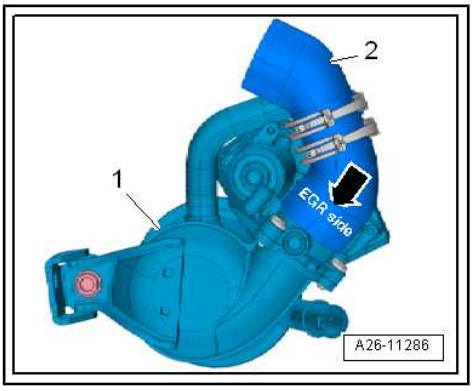
❑ 9 Nm

10 - Gasket

❑ Renew after removing

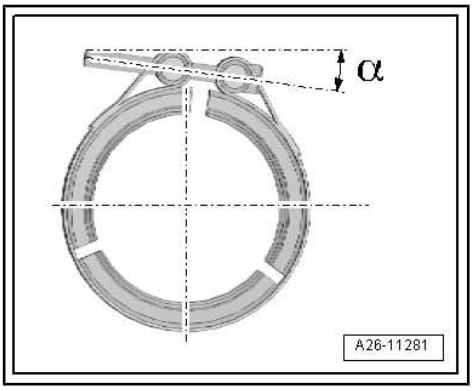
Installation position of air hose on exhaust gas recirculation cooler

- Installation position: “EGR side” marking -arrow- faces exhaust gas recirculation cooler.



Installation position of screw-type clip for exhaust gas recirculation cooler

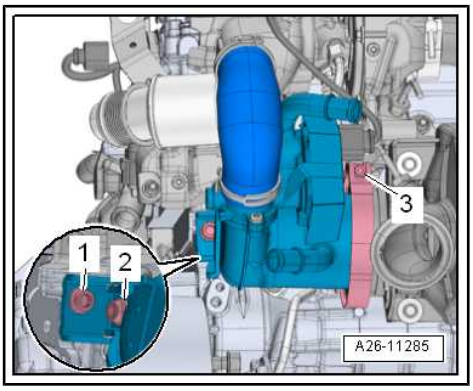
- Angle -α- = 10 ... 15°



Exhaust gas recirculation cooler - tightening torque and sequence

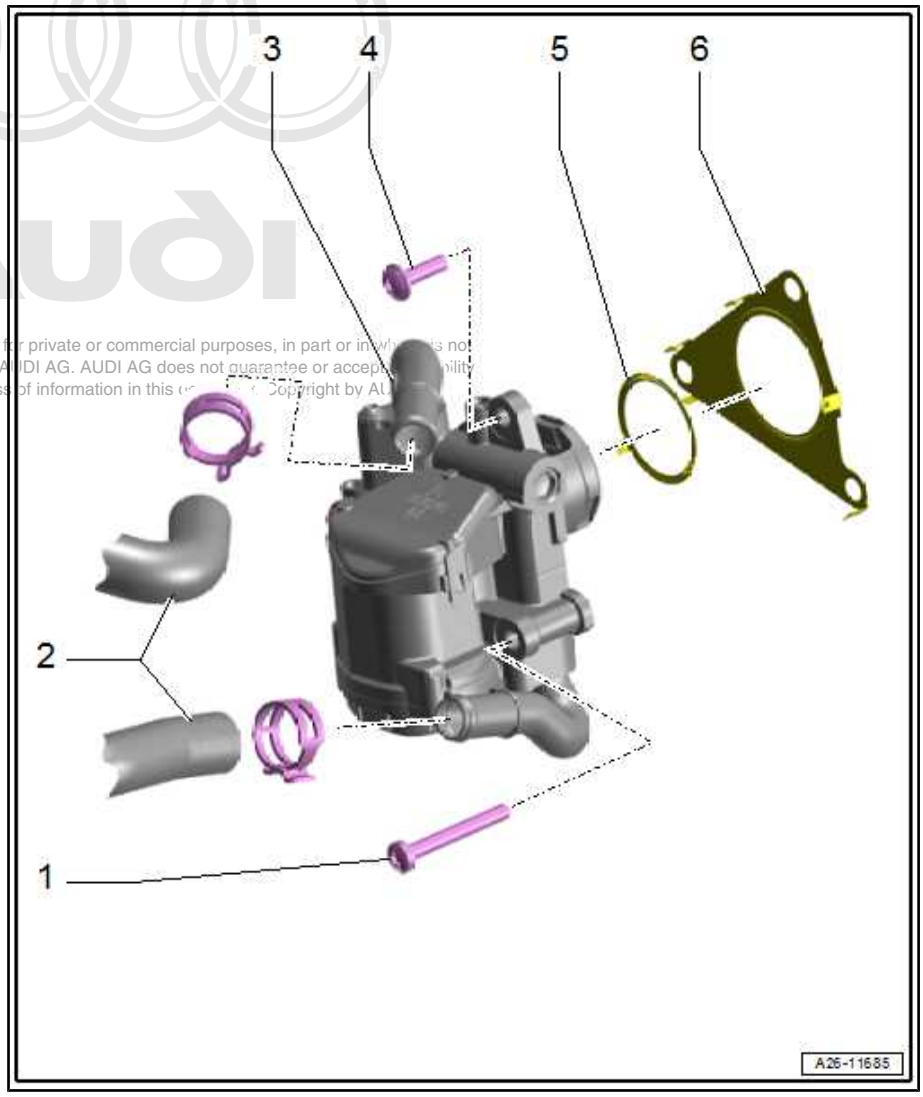
– Tighten bolts in stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	Screw-type clip -3-	7 Nm
2.	-1, 2-	Screw in by hand until contact is made
3.	-1, 2-	20 Nm



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5.1.1 Exploded view - exhaust gas recirculation system, exhaust gas recirculation control motor - V338-



1 - Bolt

- ❑ 9 Nm

2 - Coolant hoses

3 - Exhaust gas recirculation control motor - V338-

- ❑ With exhaust gas recirculation potentiometer - G212-
- ❑ Removing and installing ⇒ page 321
- ❑ Learnt values must be re-adapted after renewing exhaust gas recirculation control motor 2 - V339- .

- ◆ 01 - Self-diagnosis compatible systems
- ◆ 01 - Engine electronics
- ◆ 01 - Engine electronics, functions
- ◆ 01 - Adaption elec. adjuster with check-back

4 - Bolt

- ❑ 9 Nm

5 - Seal

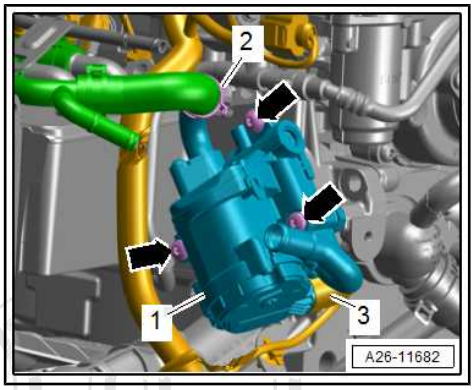
- ❑ Renew after removing

6 - Gasket

- ❑ Renew after removing

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5.2 Removing and installing exhaust gas recirculation control motor - V338-



Removing

– Remove throttle valve module - J338- ⇒ page 240 .

– Unplug electrical connector -3-.

– Release hose clip -2- and disconnect coolant hose.

– Unscrew bolts -arrows- and detach exhaust gas recirculation control motor - V338- -1-.

Installing

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

– Renew all gaskets.

– Bleed cooling system ⇒ page 165 .

– Learnt values must be re-adapted after renewing exhaust gas recirculation control motor 2 - V339- .

Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Adaption elec. adjuster with checkback`

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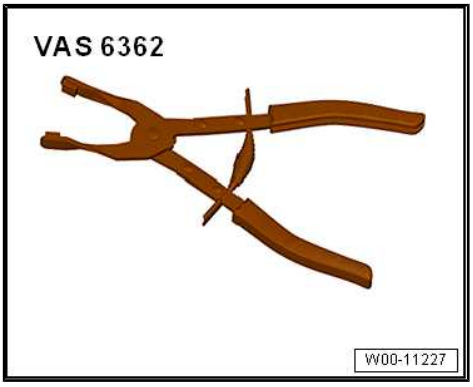
Tightening torques

- ⇒ “5.1 Exploded view - exhaust gas recirculation system”, page 318
- ⇒ “4.1 Exploded view - intake manifold”, page 238

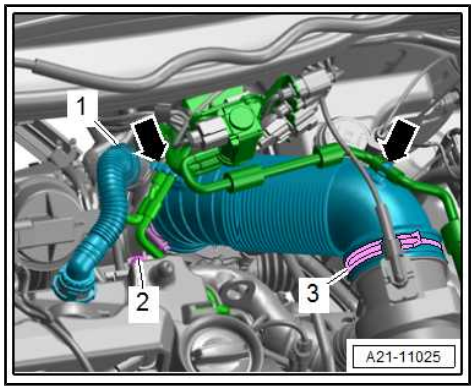
5.3 Removing and installing exhaust gas recirculation control motor 2 - V339-

Special tools and workshop equipment required

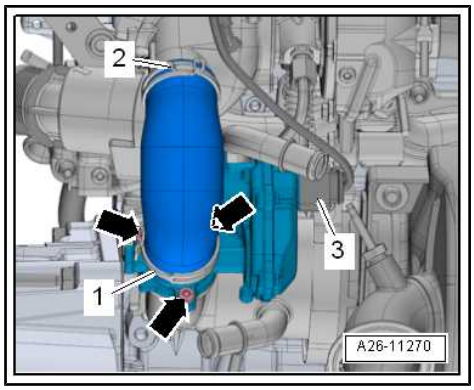
- Hose clip pliers - VAS 6362-



Removing



- Remove engine cover panel ⇒ page 40 .
- Press release tabs on both sides of crankcase breather hose -1- and disconnect hose from connection.
- Move clear vacuum hoses at air pipe -arrows-.
- Release hose clip -3- and detach air pipe from air mass meter - G70- .
- Remove bolt -2-, swivel air pipe with connection to rear and detach from turbocharger.



- Release hose clips -1, 2- and detach hose for exhaust gas recirculation.
- Unscrew bolts -arrows- and detach exhaust gas recirculation control motor 2 - V339- .
- Push heat insulation sleeve to one side and unplug electrical connector -3-.

Installing

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

- Renew seal and O-ring.
- Install engine cover panel ⇒ page 40 .
- Learnt values must be reset after renewing exhaust gas recirculation control motor 2 - V339- .

Use ⇒ Vehicle diagnostic tester.

- `01 - Self-diagnosis compatible systems`
- `01 - Engine electronics`
- `01 - Engine electronics, functions`
- `01 - Adaption elec. adjuster with checkback`

Tightening torques

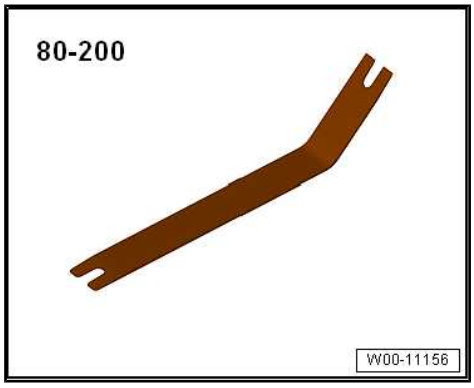
- ⇒ “5.1 Exploded view - exhaust gas recirculation system”, page 318
- ⇒ “1.1 Exploded view - turbocharger”, page 206

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5.4 Removing and installing exhaust gas recirculation cooler

Special tools and workshop equipment required

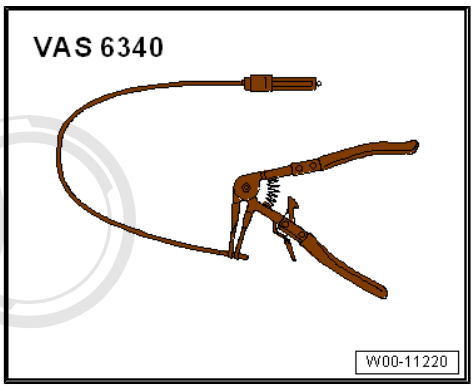
- Removal lever - 80-200-



♦ Bit XZN 10 - T10501-



♦ Hose clip pliers - VAS 6340-

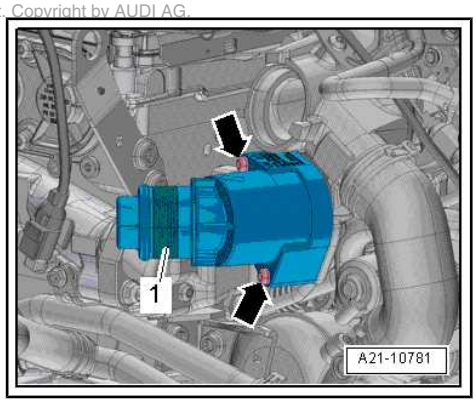


Removing

– Remove coolant pipes (left-side) ⇒ page 187 .

– Remove exhaust gas recirculation control motor 2 - V339- ⇒ page 321 .

– Unscrew bolts -arrows- and remove resonator -1-.



Vehicles with four-wheel drive:

– Remove front exhaust pipe ⇒ page 283 .

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Vehicles with dual clutch gearbox:

– Release hose clip -5- and disconnect coolant hose.

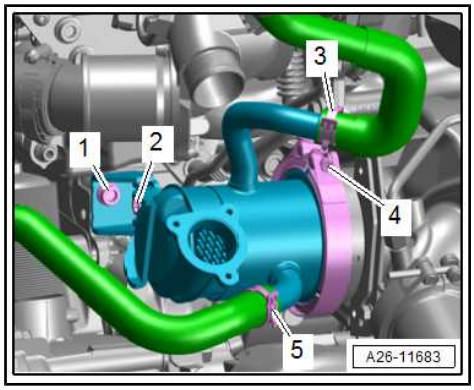
Continued for all vehicles:

– Release hose clip -3- and disconnect coolant hose.

– Loosen screw-type clip -4- and push towards particulate filter.

– Remove bolt -1- with bit XZN 10 - T10501- and loosen bolt -2-.

– Detach exhaust gas recirculation cooler.



Installing

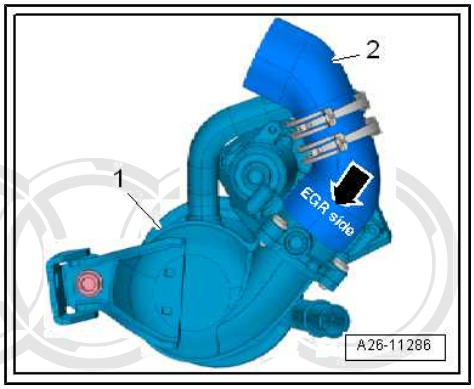
Installation is carried out in the reverse order; note the following:

– Renew seal and screw-type clips.

– Fit hose -2- on exhaust gas recirculation cooler -1-.

• Installation position: “EGR side” marking -arrow- faces exhaust gas recirculation cooler.

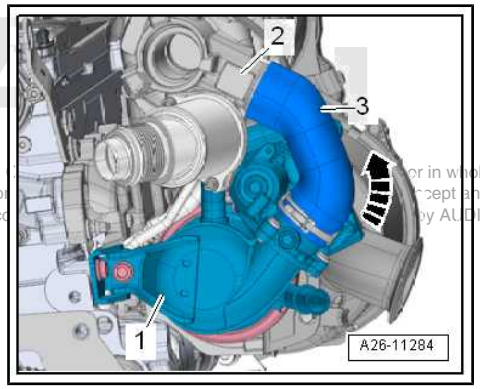
– Ensure that air hose is not under tension.



– Fit exhaust gas recirculation cooler -1- with seal and screw-type clip on emission control module.

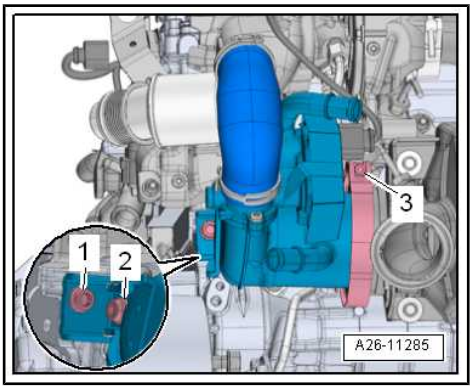
– Install exhaust gas recirculation control motor 2 - V339- ⇒ page 321 .

– Turn exhaust gas recirculation cooler anti-clockwise -arrow- and at the same time attach hose -3- to turbocharger -2-.



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– Fit screw-type clip -3- in correct installation position ⇒ page 319 .
– Tighten connections ⇒ page 319 .
– Install coolant pipes (left-side) ⇒ page 187 .
– Install and adjust selector lever cable ⇒ Rep. gr. 34 ; Selector mechanism .



Tightening torques

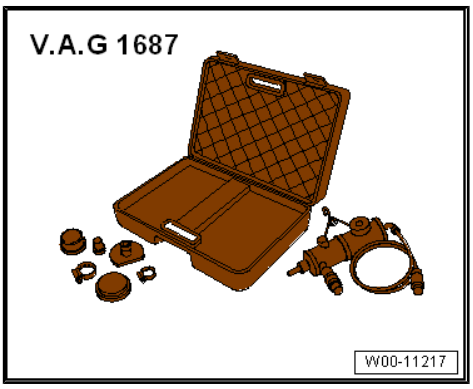
- ⇒ "1.1 Exploded view - turbocharger", page 206
- ⇒ "5.1 Exploded view - exhaust gas recirculation system", page 318
- ⇒ Fig. ""Exhaust gas recirculation cooler - tightening torque and sequence"" , page 319
- ⇒ "1.1 Exploded view - silencers", page 280
- ⇒ Rep. gr. 34 ; Selector mechanism; Exploded view - selector cables

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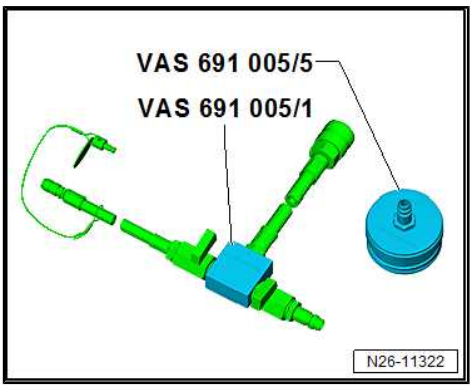
5.5 Checking exhaust gas recirculation cooler for leaks

Special tools and workshop equipment required

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

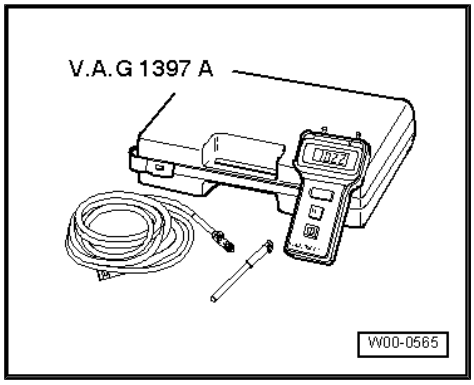


- Adapter - V.A.G 1687/11-
- Adapter - V.A.G 1687/15- for exhaust pipes with 60 mm and 65 mm diameter
- Adapter - V.A.G 1687/16- for exhaust pipe with 55 mm diameter
- Y-connector - VAS 691 005/1-



- Test 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- :

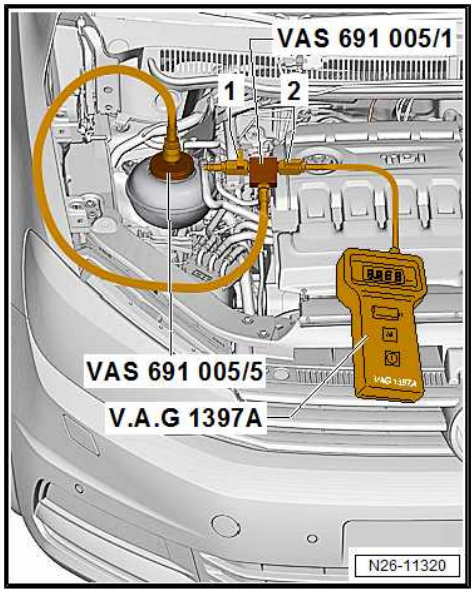
– Fit test adapter - VAS 691 005/5- onto coolant expansion tank.

– 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«.

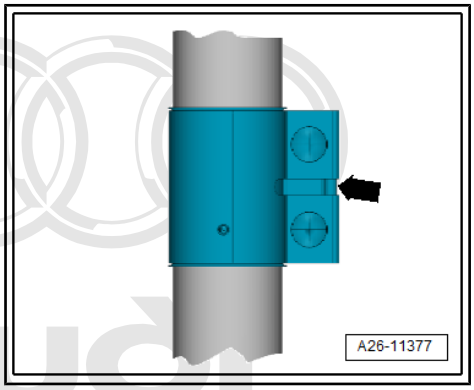
– Attach hose from connection »A« on Y-connector to connection »II« on turbocharger tester - V.A.G 1397A- .

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



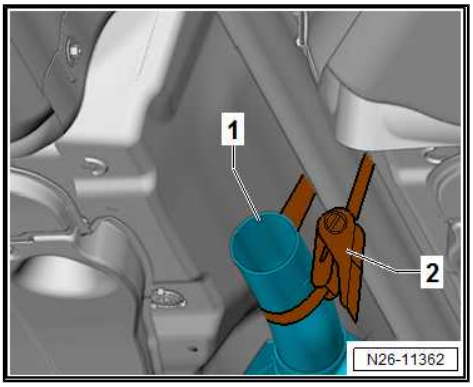
Connecting tester - V.A.G 1687- :

– Loosen clamp -2- on exhaust pipe and push to rear.



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– On vehicles without tunnel cross-piece, exhaust pipe -1- must be tied up with a tensioning strap -2-.

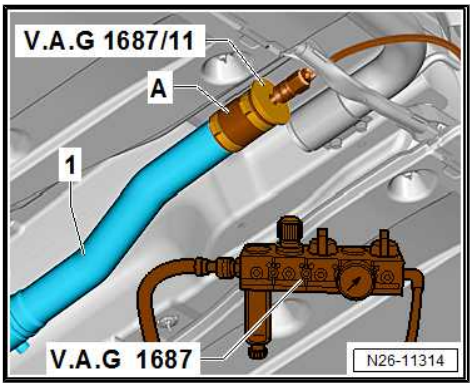


– Connect adapter - V.A.G 1687/11- with hose -A- to exhaust pipe (engine end). Secure hose with hose clips.

  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- .

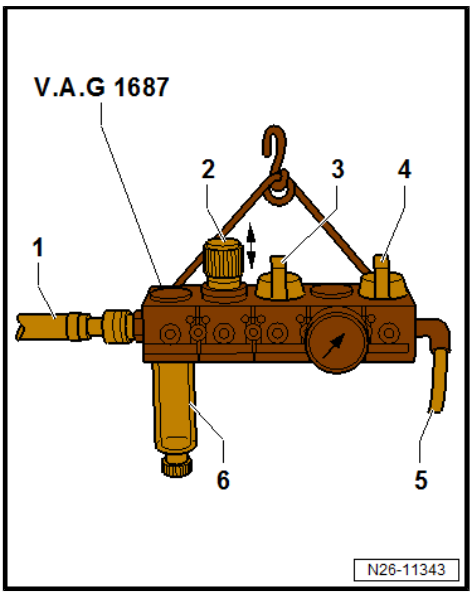


Prepare charge air system tester - V.A.G 1687- as follows:

– Unscrew pressure control valve -2- completely and close valves -3- and -4-.

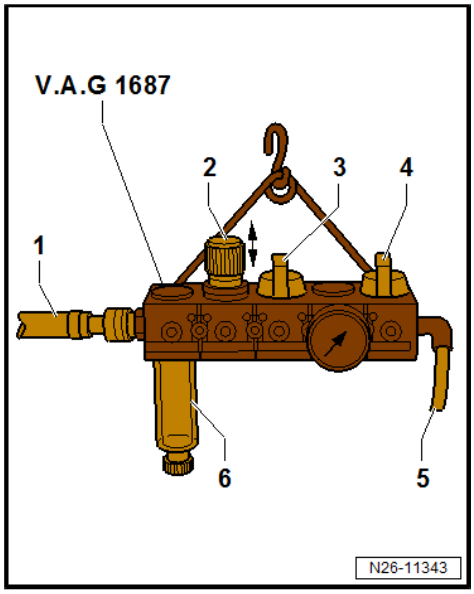
• Make sure knob is pulled out before turning pressure control valve -2-.

– Connect charge air system tester - V.A.G 1687- to compressed air hose -1-.



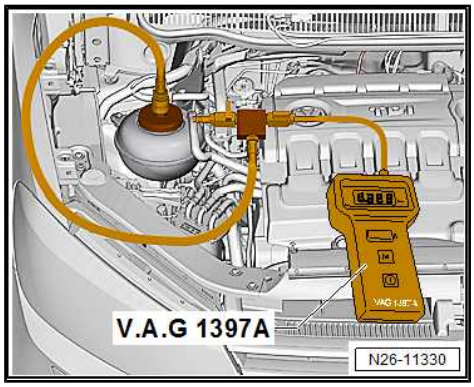
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– Open valve -3-.
– Adjust pressure to 0.5 bar via pressure control valve -2-.
– Open valve -4- and wait until test system is pressurised. If necessary, adjust pressure to 0.5 bar again.
• A small amount of air escapes through the valves and enters the engine. Therefore it is not possible to perform a pressure retention test.



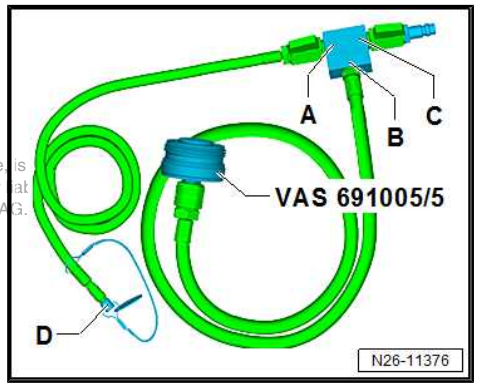
Reading off values from turbocharger tester - V.A.G 1397A- :

• 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.



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28 – Glow plug system

1 Glow plug system

⇒ “1.1 Exploded view - glow plug system”, page 329

⇒ “1.2 Removing and installing glow plug”, page 330

⇒ “1.3 Removing and installing automatic glow period control unit J179 ”, page 332

⇒ “1.4 Removing and installing Hall sender G40 ”, page 332

⇒ “1.5 Removing and installing engine speed sender G28 ”, page 333

1.1 Exploded view - glow plug system

1 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 332

2 - Bolt

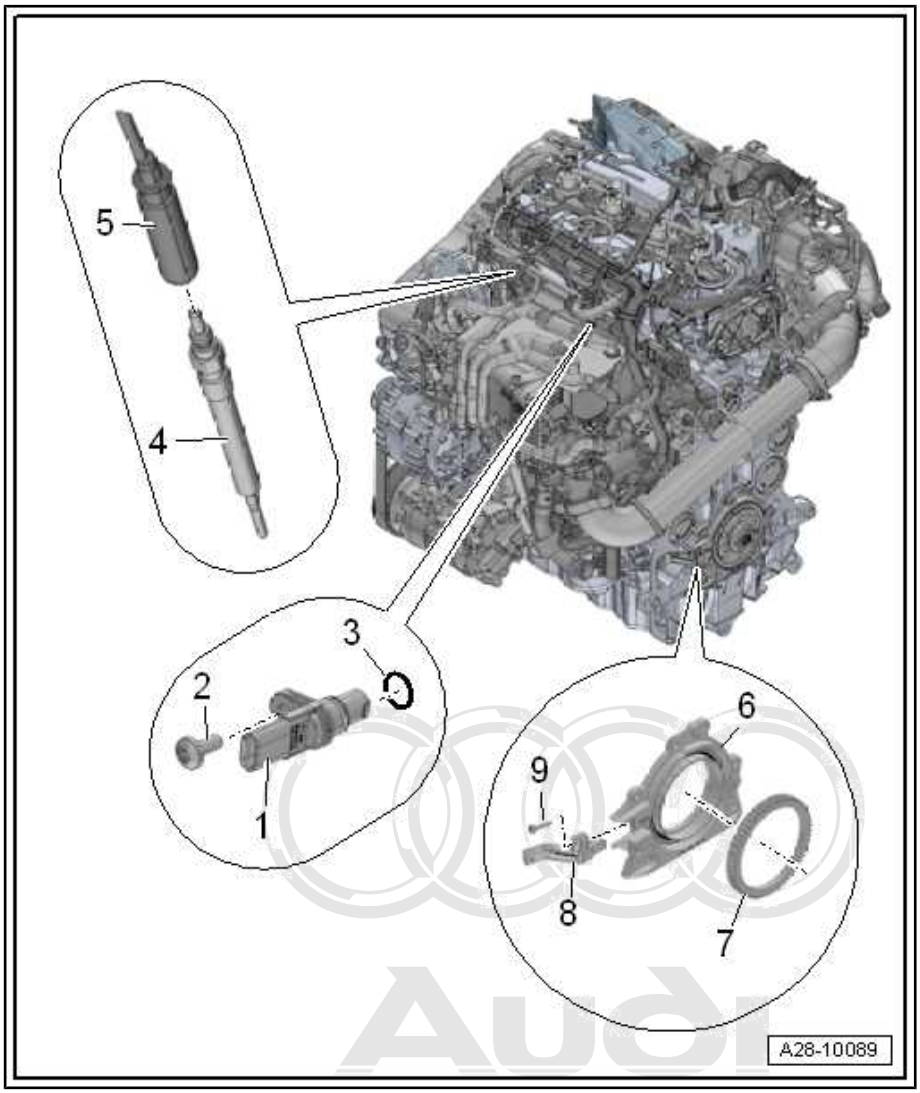
- ❑ 9 Nm

3 - O-ring

- ❑ If damaged, renew Hall sender - G40-

4 - Glow plug

- ♦ Glow plug 1 - Q10-
- ♦ Glow plug 2 - Q11-
- ♦ Glow plug 3 - Q12-
- ♦ Glow plug 4 - Q13-
  - ❑ Depending on the emission standard, an internal cylinder pressure sender may additionally be integrated in the glow plug:
- ♦ Cylinder 1 combustion chamber pressure sender - G677- (engine code DFUA only)
- ♦ Cylinder 2 combustion chamber pressure sender - G678- (engine code DFUA only)
- ♦ Cylinder 3 combustion chamber pressure sender - G679- (engine codes DFUA, CUVB, CUVC, CUVD, CUWA, DFTA, DFTB, DFTC only)



- ♦ Cylinder 4 combustion chamber pressure sender - G680- (engine code DFUA only)
  - ❑ Glow plug versions and tightening torques ⇒ page 330
  - ❑ Removing and installing ⇒ page 330

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5 - Electrical connector

6 - Sealing flange (gearbox end)

- ❑ Removing and installing ⇒ page 53

7 - Sender wheel

- ❑ For engine speed sender - G28-
- ❑ Removing and installing ⇒ “2.3 Removing and installing sealing flange (gearbox end)”, page 53

8 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 333
- ❑ Note installation position ⇒ page 334

9 - Bolt

- ❑ 4.5 Nm

Glow plug versions and tightening torques

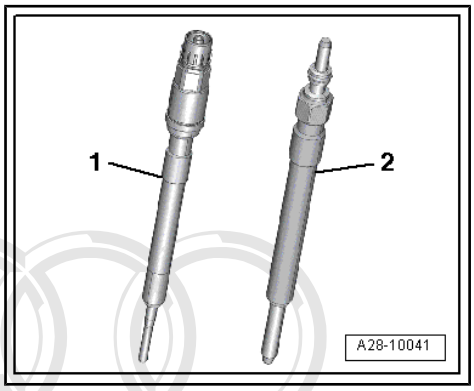
Note different tightening torques:

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

- ♦ Articulated wrench, 10 mm - 3220-

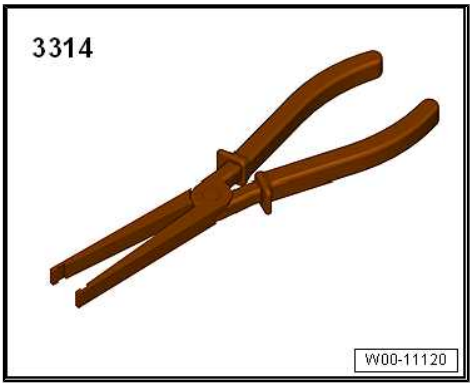


- ♦ Socket insert AF 12 for glow plugs 4-cyl. TDI CR diesel - VAS 6454-



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♦ Pliers - 3314-



Removing

– Switch off ignition.

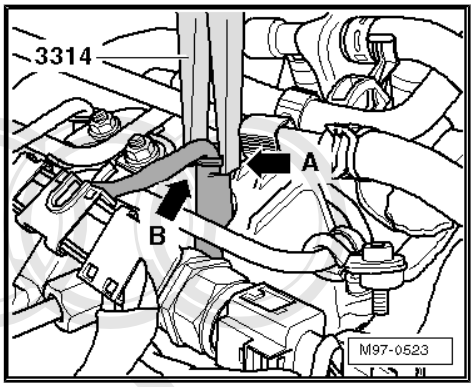
– Remove engine cover panel ⇒ page 40 .

NOTICE

Risk of damage to support sleeves when removing.

– Do not squeeze pliers - 3314- too firmly when removing glow plug connectors.

– 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 openings in cylinder head; make sure no dirt gets into cylinder.

♦ Use a vacuum cleaner to remove coarse dirt.

♦ Spray brake cleaner or suitable cleaning agent into glow plug openings, let it work in briefly, and blow out with compressed air.

♦ Then clean the glow plug openings using a cloth moistened with oil.

CAUTION

Risk of injury caused by soot particles in the air.

Eyes and skin can suffer irritation or injuries.

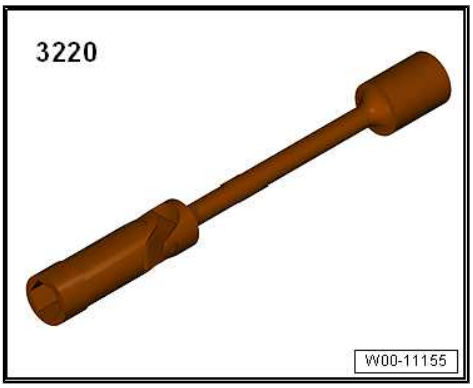
– Put on safety goggles.

– Put on protective gloves.

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– Loosen glow plugs using tool and unscrew by hand:

Use U/J extension and socket, 10 mm - 3220- for all glow plugs without combustion chamber pressure sender.



Use socket insert AF 12 for glow plugs 4-cyl. TDI CR diesel - VAS 6454- for all glow plugs with combustion chamber pressure senders.



Installing

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

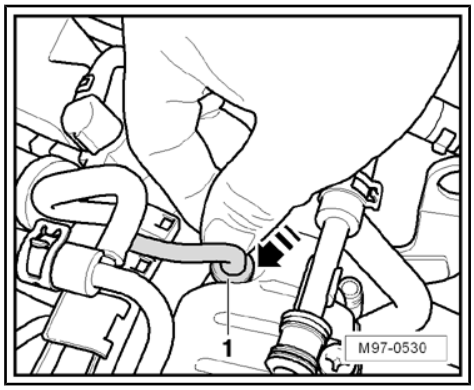
– Fit glow plug connectors -1- back onto glow plugs -arrow-.

– Check that glow plug connectors are fitted securely.

– Install engine cover panel ⇒ page 40 .

Tightening torques

♦ ⇒ Fig. ""Glow plug versions and tightening torques"" , page 330



1.3 Removing and installing automatic glow period control unit - J179-

Removing

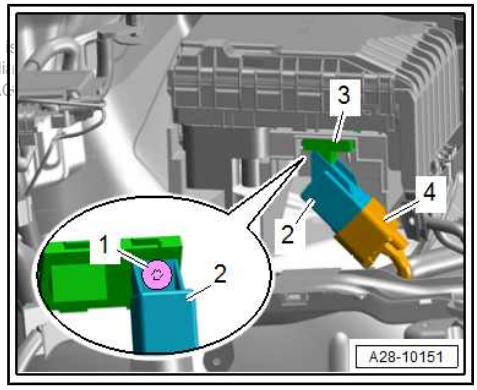
– Remove battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Removing and installing battery .

– Detach relay carrier -3- from electronics box towards right.

– Unplug electrical connector -4-.

– Remove bolt -1-, and detach automatic glow period control unit - J179- -item 2-.

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Installing

Install in reverse sequence.

Tightening torques

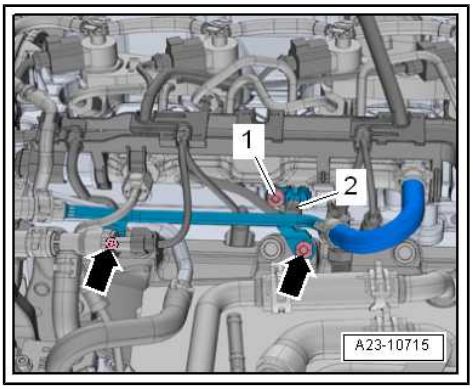
♦ ⇒ Electrical system; Rep. gr. 27 ; Battery; Exploded view - battery

1.4 Removing and installing Hall sender - G40-

Removing

– Remove engine cover panel ⇒ page 40 .

– Remove bolts -arrows- and push fuel lines slightly towards front.
– Unplug electrical connector -2-.
– Unscrew bolt -1- and detach Hall sender - G40- .



Installing

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

– Install engine cover panel ⇒ page 40 .

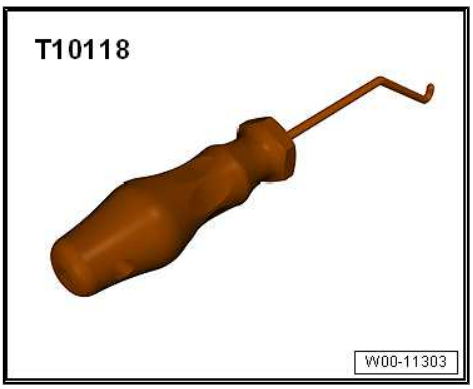
Tightening torques

♦ ⇒ “1.1 Exploded view - glow plug system”, page 329

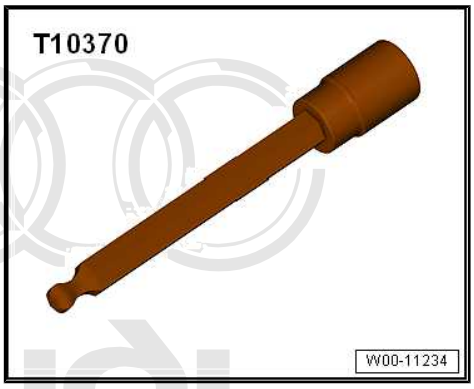
1.5 Removing and installing engine speed sender - G28-

Special tools and workshop equipment required

♦ Assembly tool - T10118-



♦ Socket, AF 4 mm - T10370-

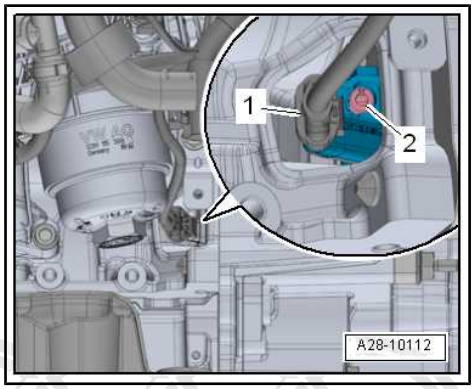


Removing

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

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– Use assembly tool - T10118- to unplug electrical connector -1-.



Note

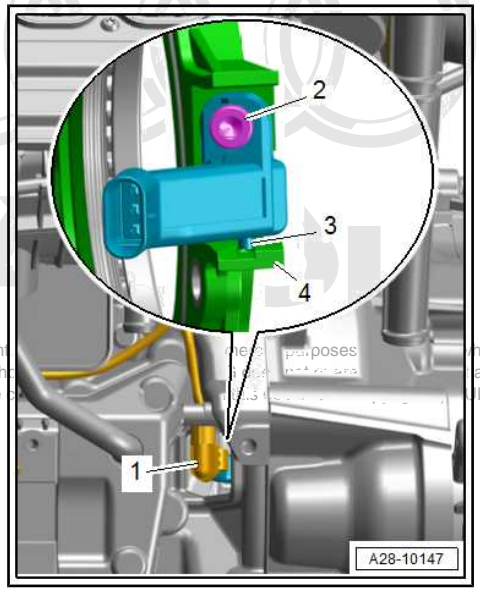
To release electrical connector without assembly tool - T10118- , press connector on engine speed sender in with a screwdriver and at the same time lift release tab with a thin wire hook.

– Unscrew bolt -2- and detach engine speed sender - G28- .

Installing

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

– Move engine speed sender - G28- into installation position, ensuring that tab -3- slides into guide slot on sealing flange -4-, as shown in illustration.



– Tighten bolt -2- and plug in electrical connector -1-.

Tightening torques

- ⇒ “1.1 Exploded view - glow plug system”, page 329
- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation

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