Workshop Manual

Audi A4 2008 ➤
Audi A5 Cabriolet 2009 ➤
Audi A5 Coupé 2008 ➤

8-cylinder direct injection engine (4.2 ltr. 4-valve, RS 4, RS 5)									
Engine ID	CFS A								

Edition 07.2019

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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
24 - Mixture preparation - injection
26 - Exhaust system
28 - Ignition system

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 number/engine data 2
2 General notes 3
2.1 Rules for cleanliness when working on the auxiliary/supplementary heater and the fuel system 3
2.2 General notes on self-diagnosis 3
2.3 General notes on ignition system 3
3 Safety precautions 5
3.1 Safety precautions when working on the fuel supply system 5
3.2 Safety precautions when working on the cooling system 6
3.3 Safety precautions when using testers and measuring instruments during a road test 6
3.4 Safety precautions when working on the exhaust system 6
3.5 Safety precautions when working on the subframe 7
3.6 Safety precautions when working on the ignition system 7
4 Repair instructions 9
4.1 General notes 9
4.2 Bolts/nuts 9
4.3 Identification plates 10
4.4 Use of impact wrenches 10
4.5 Foreign particles in engine 10
4.6 Contact corrosion 10
4.7 Routing and attachment of pipes, hoses and wiring 11
4.8 Installing radiators and condensers 11
4.9 Checking vacuum system 11
5 Technical data 13
5.1 Technical data of injection system 13

10 - Removing and installing engine 14
1 Removing and installing engine 14
1.1 Removing engine 14
1.2 Separating engine and gearbox 34
1.3 Securing engine to engine and gearbox support 41
1.4 Installing engine 45
2 Assembly mountings 53
2.1 Exploded view - assembly mountings 53
2.2 Removing and installing engine mountings 54
3 Engine cover panel 64
3.1 Removing and installing engine cover panel 64

13 - Crankshaft group 65
1 Cylinder block (pulley end) 65
1.1 Exploded view - poly V-belt drive 65
1.2 Removing and installing poly V-belt 67
1.3 Removing and installing tensioner for poly V-belt 68
1.4 Removing and installing vibration damper 68
1.5 Removing and installing bracket for ancillaries 69
1.6 Renewing crankshaft oil seal (pulley end) 69
2 Cylinder block (gearbox end) 72
2.1 Exploded view - drive plate 72
2.2 Removing and installing drive plate 72
2.3 Renewing crankshaft oil seal (gearbox end) 73

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3 Crankshaft ... 76
3.1 Exploded view - crankshaft ... 76
3.2 Allocation of main bearing shells ... 79
3.3 Crankshaft dimensions ... 81
3.4 Measuring axial clearance of crankshaft ... 81
3.5 Measuring radial clearance of crankshaft ... 82
4 Auxiliary drive ... 83
4.1 Exploded view - auxiliary drive ... 83
4.2 Removing and installing spur gear drive ... 84
4.3 Renewing oil seal for power steering pump drive ... 87
4.4 Renewing oil seal for AC compressor drive ... 88
5 Pistons and conrods ... 91
5.1 Exploded view - pistons and conrods ... 91
5.2 Removing and installing pistons ... 93
5.3 Checking pistons and cylinder bores ... 94
5.4 Checking radial clearance of conrod bearings ... 95

15 - Cylinder head, valve gear ... 97
1 Cylinder head ... 97
1.1 Exploded view - cylinder head ... 97
1.2 Removing and installing cylinder head ... 99
1.3 Removing and installing cylinder head cover ... 105
1.4 Checking compression ... 107
2 Timing chain cover ... 110
2.1 Exploded view - timing chain cover ... 110
2.2 Removing and installing timing chain cover (left-side) ... 112
2.3 Removing and installing timing chain cover (right-side) ... 115
2.4 Removing and installing timing chain cover (bottom) ... 117
3 Chain drive ... 122
3.1 Exploded view - camshaft timing chains ... 122
3.2 Exploded view - drive chain for valve gear ... 125
3.3 Exploded view - drive chain for auxiliary drives ... 127
3.4 Removing and installing camshaft timing chain ... 127
3.5 Removing camshaft timing chain from camshafts ... 129
3.6 Removing and installing drive chain for valve gear ... 137
3.7 Removing and installing drive chain for auxiliary drive ... 138
4 Valve gear ... 140
4.1 Exploded view - valve gear ... 140
4.2 Measuring axial clearance of camshaft ... 143
4.3 Measuring radial clearance of camshaft ... 143
4.4 Removing and installing camshaft ... 144
4.5 Checking hydraulic compensation elements ... 153
4.6 Removing and installing valve stem oil seals ... 155
5 Inlet and exhaust valves ... 163
5.1 Valve dimensions ... 163
5.2 Checking valve guides ... 163
5.3 Checking valves ... 164

17 - Lubrication ... 165
1 Sump/oil pump ... 165
1.1 Exploded view - sump/oil pump ... 165
1.2 Exploded view - sump (top section) ... 168
1.3 Engine oil ... 169
1.4 Removing and installing sump (bottom section) ... 169
1.5 Removing and installing sump (top section) ... 171

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1.6 Removing and installing oil pump . . . 175
1.7 Removing and installing oil level and oil temperature sender G266 . . . 176
1.8 Checking oil level . . . 177
2 Engine oil cooler . . . 178
2.1 Exploded view - engine oil cooler . . . 178
2.2 Removing and installing engine oil cooler . . . 179
2.3 Removing and installing engine oil cooler (front) . . . 181
3 Crankcase breather . . . 183
3.1 Removing and installing hose for crankcase breather system . . . 183
4 Oil filter/oil pressure switches . . . 184
4.1 Exploded view - oil filter housing/oil pressure switches . . . 184
4.2 Removing and installing oil temperature sender G8 . . . 185
4.3 Checking oil pressure switch F22 / oil pressure switch for reduced oil pressure F378 . . . 186
4.4 Removing and installing oil pressure switch F22 . . . 186
4.5 Removing and installing oil pressure switch for reduced oil pressure F378 . . . 187
4.6 Removing and installing valve for oil pressure control N428 . . . 188
4.7 Checking oil pressure . . . 188
4.8 Removing and installing oil filter housing . . . 189
5 Oil circuit . . . 191
5.1 Exploded view - oil spray jets/valves . . . 191
5.2 Removing and installing oil spray jets/valves . . . 192

19 - Cooling . . . 194
1 Cooling system/coolant . . . 194
1.1 Connection diagram - coolant hoses . . . 194
1.2 Draining and filling cooling system . . . 196
1.3 Checking cooling system for leaks . . . 202
2 Coolant pump/thermostat assembly . . . 205
2.1 Exploded view - coolant pump/thermostat . . . 205
2.2 Removing and installing electric coolant pump . . . 206
2.3 Thermostat opening values . . . 208
2.4 Removing and installing coolant pump . . . 208
2.5 Removing and installing coolant temperature sender G62 . . . 210
2.6 Removing and installing map-controlled engine cooling system thermostat F265 . . . 211
3 Coolant pipes . . . 213
3.1 Exploded view - coolant pipes . . . 213
3.2 Removing and installing coolant pipes (front) . . . 214
3.3 Removing and installing coolant pipes (top front) . . . 214
3.4 Removing and installing coolant pipes (front centre) . . . 216
4 Radiator/radiator fans . . . 218
4.1 Exploded view - radiator/radiator fans . . . 218
4.2 Exploded view - radiator cowl and radiator fan . . . 220
4.3 Removing and installing radiator . . . 220
4.4 Removing and installing radiator fans . . . 226
4.5 Removing and installing auxiliary radiator . . . 227

24 - Mixture preparation - injection . . . 229
1 Injection system . . . 229
1.1 Overview of fitting locations - injection system . . . 229
1.2 Checking fuel system for leaks . . . 235
1.3 Reducing pressure in high-pressure section of injection system . . . 235
2 Vacuum system . . . 237
2.1 Exploded view - vacuum system . . . 237
2.2 Checking vacuum system . . . 237

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3 Injectors ... 239
3.1 Removing and installing injectors ... 239
3.2 Cleaning injectors ... 243
4 Air cleaner ... 245
4.1 Exploded view - air cleaner housing ... 245
4.2 Removing and installing air cleaner housing ... 246
4.3 Removing and installing air filter element ... 248
5 Intake manifold ... 249
5.1 Exploded view - intake manifold (top section) ... 249
5.2 Exploded view - intake manifold (bottom section) with fuel rail ... 251
5.3 Removing and installing intake manifold (top section) ... 253
5.4 Removing and installing intake manifold (bottom section) with fuel rail ... 255
5.5 Removing and installing throttle valve module J338 / J544 ... 259
6 Senders and sensors ... 260
6.1 Removing and installing fuel pressure sender G247 / G624 ... 260
6.2 Checking fuel pressure and residual pressure (up to high-pressure pump) ... 260
7 Engine control unit ... 266
7.1 Removing and installing engine control unit J623 ... 266
7.2 Wiring and component check with isolator boxes VAS 6606 ... 269
8 High-pressure pump ... 271
8.1 Exploded view - high-pressure pump ... 271
8.2 Removing and installing high-pressure pump ... 272
8.3 Removing and installing high-pressure pipe ... 275
9 Lambda probe ... 278
9.1 Exploded view - Lambda probe ... 278
9.2 Removing and installing Lambda probe ... 278

26 - Exhaust system ... 281
1 Exhaust pipes/silencers ... 281
1.1 Exploded view - silencers ... 281
1.2 Separating exhaust pipes/silencers ... 283
1.3 Removing and installing front silencers ... 284
1.4 Stress-free alignment of exhaust system ... 286
1.5 Aligning tailpipes ... 287
1.6 Checking exhaust system for leaks ... 287
1.7 Checking function of exhaust flap ... 288
2 Exhaust manifold ... 289
2.1 Exploded view - exhaust manifold ... 289
2.2 Removing and installing exhaust manifold ... 290
3 Secondary air system ... 294
3.1 Exploded view - secondary air system ... 294
3.2 Removing and installing secondary air pump V101 / V189 ... 296
3.3 Removing and installing combination valve ... 297
3.4 Checking combination valve for correct operation and leaks ... 298
3.5 Removing and installing senders for secondary air pressure G609 / G610 ... 300

28 - Ignition system ... 301
1 Ignition system ... 301
1.1 Exploded view - ignition system ... 301
1.2 Test data - spark plugs ... 302
1.3 Removing and installing ignition coils ... 302
1.4 Removing and installing knock sensor ... 304
1.5 Removing and installing Hall senders ... 305
1.6 Removing and installing engine speed sender G28 ... 306

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00 – Technical data

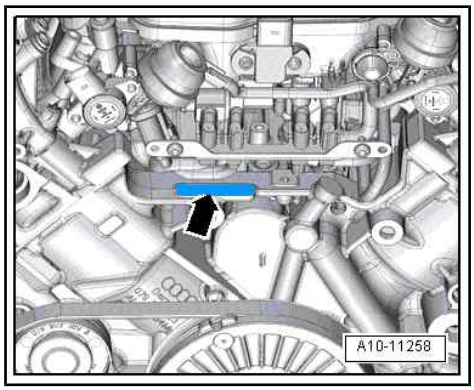
1 Identification

(ARL006507; Edition 07.2019)

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⇒ “1.1 Engine number/engine data”, page 2

1.1 Engine number/engine data



- The engine number (engine code and serial number) is located on the top of the cylinder block at the front -arrow-.
- There is also a sticker on the intake manifold showing the 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 (certain countries only), vehicle data sticker and engine control unit.*
- *Fitting locations of the type plate (certain countries only) and the vehicle data sticker ⇒ Maintenance ; Booklet 811 ; ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .*

Code letters		CFSA
Capacity	ltr.	4.163
Power output	kW at rpm	331/7000
Torque	Nm at rpm	440/3500
Bore	∅ mm	84.5
Stroke	mm	92.8
Compression ratio		12.5
RON	at least	98[1)]
Injection/ignition system		Bosch Motronic
Firing order		1-5-4-8-6-3-7-2
Turbocharging/supercharging		no
Lambda control		2 probes before catalytic converter 2 probes after catalytic converter
Variable valve timing		Inlet Exhaust
Intake manifold changeover		Yes
Secondary air system		Yes
Valves per cylinder		4

- [1)] Unleaded premium RON 95 can also be used, but results in reduced power

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2 General notes

⇒ “2.1 Rules for cleanliness when working on the auxiliary/supplementary heater and the fuel system”, page 3

⇒ “2.2 General notes on self-diagnosis”, page 3

⇒ “2.3 General notes on ignition system”, page 3

2.1 Rules for cleanliness when working on the auxiliary/supplementary heater and the fuel system

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

- Clean connections and surrounding area thoroughly with engine cleaner or brake cleaner and dry cleaned area before loosening.
- Seal off open pipes/lines and connections immediately with clean plugs, e.g. from engine bung set - VAS 6122- .
- After removal, place parts on a clean surface and cover them. Only use lint-free cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components; replacement parts should only be unpacked immediately prior to installation. Do not use parts that have been previously unpacked and stored away loose (e.g. in toolboxes, etc.).
- Do not work with compressed air when the system is open. If possible, do not move vehicle.
- Protect unplugged electrical connectors against dirt and moisture and make sure connections are dry when attaching.

2.2 General notes on self-diagnosis

- The engine control unit has a self-diagnosis capability.
- Interrogate the event memory before carrying out any repairs or Fault Finding.
- The vacuum hoses and connections must be checked (to prevent unmetered air).
- Fuel hoses in engine compartment must only be secured with spring-type clips. O-type clips or screw-type clips must not be used.
- 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 function is designed to reduce the risk of a vehicle fire after a crash by deactivating the fuel pump via the engine control unit.

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2.3 General notes on ignition system

- The engine control unit has a self-diagnosis capability. Before carrying out repairs and fault finding, the event memory must be interrogated.

- A voltage of at least 11.5 V is required for proper operation of the electrical components.
- During some of the tests the control unit may detect a fault and store it in the memory. The event memory should therefore be interrogated and, if necessary, erased after completing all tests and repair work.
- If the engine starts, runs for a short period and then cuts out after completing fault finding, repairs or component tests, this may be due to the immobiliser disabling the engine control unit. The event memory must then be interrogated and, if necessary, the control unit must be adapted.

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3 Safety precautions

⇒ “3.1 Safety precautions when working on the fuel supply system”, page 5

⇒ “3.2 Safety precautions when working on the cooling system”, page 6

⇒ “3.3 Safety precautions when using testers and measuring instruments during a road test”, page 6

⇒ “3.4 Safety precautions when working on the exhaust system”, page 6

⇒ “3.5 Safety precautions when working on the subframe”, page 7

⇒ “3.6 Safety precautions when working on the ignition system”, page 7

3.1 Safety precautions when working on the fuel supply system

When working on the fuel system note the following warnings:

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).

– Procedure before opening high-pressure section of injection system ⇒ page 235 .

Observe the following to prevent injuries to persons and damage to the injection and ignition system:

♦ Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.

♦ Always switch off ignition before washing engine.

♦ Entries are stored in event memory of engine control unit if electrical connectors were unplugged and engine was started: `Generate readiness code` in `Guided Functions` ⇒ Vehicle diagnostic tester.

Risk of fire due to escaping fuel

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

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

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

WARNING

- *The injection system consists of a high-pressure section (maximum approx. 120 bar) and a low-pressure section (approx. 6 bar).*
- *The fuel pressure in the high-pressure section must be reduced to a residual pressure of approx. 6 bar prior to opening the system. Procedure* *⇒ page 235*

3.2 Safety precautions when working on the cooling system

Risk of scalding as hot coolant can escape

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

– Put on protective gloves.

– Put on safety goggles.

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

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

Risk of injury if test equipment is not secured

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

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

Or:

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

3.4 Safety precautions when working on the exhaust system

When working on the exhaust system please note the following:

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.

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Danger from toxic exhaust gases

The auxiliary/supplementary heater produces toxic exhaust gases during operation. 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.

Risk of injury caused by components of the exhaust system

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

– Allow exhaust system to cool down.

– Put on protective gloves.

3.5 Safety precautions when working on the subframe

When working on the subframe note the following warnings:

Caution

Risk of damage to running gear components.

- ***The vehicle must NOT be lowered onto its wheels if the engine/gearbox mountings, steering rack or subframe cross brace are not properly installed.***
- ***The vehicle must NOT be supported by applying a trolley jack or similar to the subframe or subframe cross brace.***

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3.6 Safety precautions when working on the ignition system

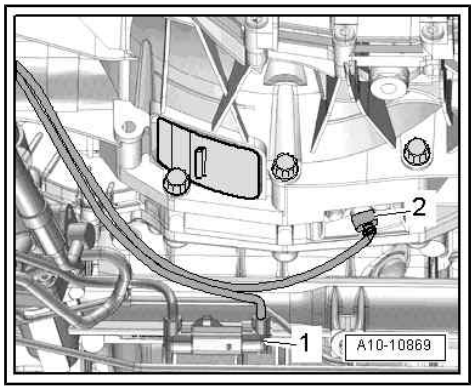
To prevent injuries to persons and/or damage to the fuel injection and ignition system, note the following:

- Persons wearing a cardiac pacemaker must at all times maintain a safe distance from high-voltage components such as the ignition system and xenon headlights.

- Always switch off the ignition before connecting or disconnecting electrical wiring for the injection or ignition system or tester cables.
- For safety reasons, the battery must be disconnected before opening the fuel system to prevent the fuel pump from being activated by the contact switch on the driver's door.
- Do not open any fuel line connections while the engine is running.
- Always switch off ignition before washing engine.
- If you want to turn the engine at cranking speed without actually starting the engine (e.g. compression test), first unplug the electrical connectors from the injectors and the ignition coils ⇒ page 302 .

To prevent injuries to persons and/or irreparable damage to the fuel injection and ignition system, the following must be noted:

- Do not touch or disconnect ignition coils when the engine is running or being turned at cranking speed.
- The ignition must be switched off before disconnecting or connecting ignition system wiring, high-voltage wires and test leads.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- If you want to turn the engine at cranking speed without actually starting it (e.g. compression test), first unplug connector -2- at engine speed sender - G28- .



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4 Repair instructions

⇒ “4.1 General notes”, page 9

⇒ “4.2 Bolts/nuts”, page 9

⇒ “4.3 Identification plates”, page 10

⇒ “4.4 Use of impact wrenches”, page 10

⇒ “4.5 Foreign particles in engine”, page 10

⇒ “4.6 Contact corrosion”, page 10

⇒ “4.7 Routing and attachment of pipes, hoses and wiring”, page 11

⇒ “4.8 Installing radiators and condensers”, page 11

⇒ “4.9 Checking vacuum system”, page 11

4.1 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 (to prevent unmetered air)
  ⇒ “4.9 Checking vacuum system”, page 11 .
- 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 two seconds in order to build up pressure in the fuel system.

4.2 Bolts/nuts

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

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4.3 Identification plates

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

4.4 Use of impact wrenches

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

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

Requirements:

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

Use:

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

4.5 Foreign particles in engine

- When working on the engine, all open inlet and exhaust ports must be sealed with suitable plugs (e.g. from engine bung set - VAS 6122-) to prevent foreign particles from entering the engine.
- In the event of mechanical damage to one of the cylinder banks, the intake and exhaust systems and combustion chambers of the opposite cylinder bank must always be examined for foreign particles to prevent further damage occurring later.

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4.6 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 using Audi Genuine Accessories.
- Damage caused by contact corrosion is not covered by warranty.

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4.7 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.
- Because of the limited space in the engine compartment, it is important to ensure that there is adequate clearance to any moving or hot components to avoid damage to lines and wiring.

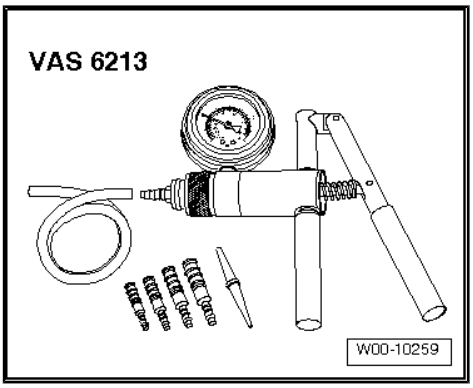
4.8 Installing radiators and condensers

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

4.9 Checking vacuum system

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



Procedure

– Check all vacuum lines in the complete vacuum system for:

- Cracks
- Traces of animal bites
- Kinked or crushed lines
- Porous or leaking lines

– Check vacuum line to solenoid valve and from solenoid valve to corresponding component.

– If a fault is stored in the event memory, check the vacuum lines leading to the relevant component and also check the remaining vacuum lines in the system.
– 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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5 Technical data

⇒ “5.1 Technical data of injection system”, page 13

5.1 Technical data of injection system

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Engine data		4.2 ltr. FSI engine
Idling speed is not adjustable (controlled by idling speed stabilisation).		620 ... 720 rpm
Maximum rpm governed by deactivation of fuel injectors		8500 rpm
Fuel pressure	Initial fuel pressure up to high-pressure pump (generated by electric fuel pump in fuel tank)	5.0 ... 6.5 bar
	Pressure in high-pressure fuel circuit (generated by mechanical single-plunger pump) at a coolant temperature of approx. 85°C.	25 ... 135 bar (depending on operating conditions)

10 – Removing and installing engine

1 Removing and installing engine

⇒ “1.1 Removing engine”, page 14

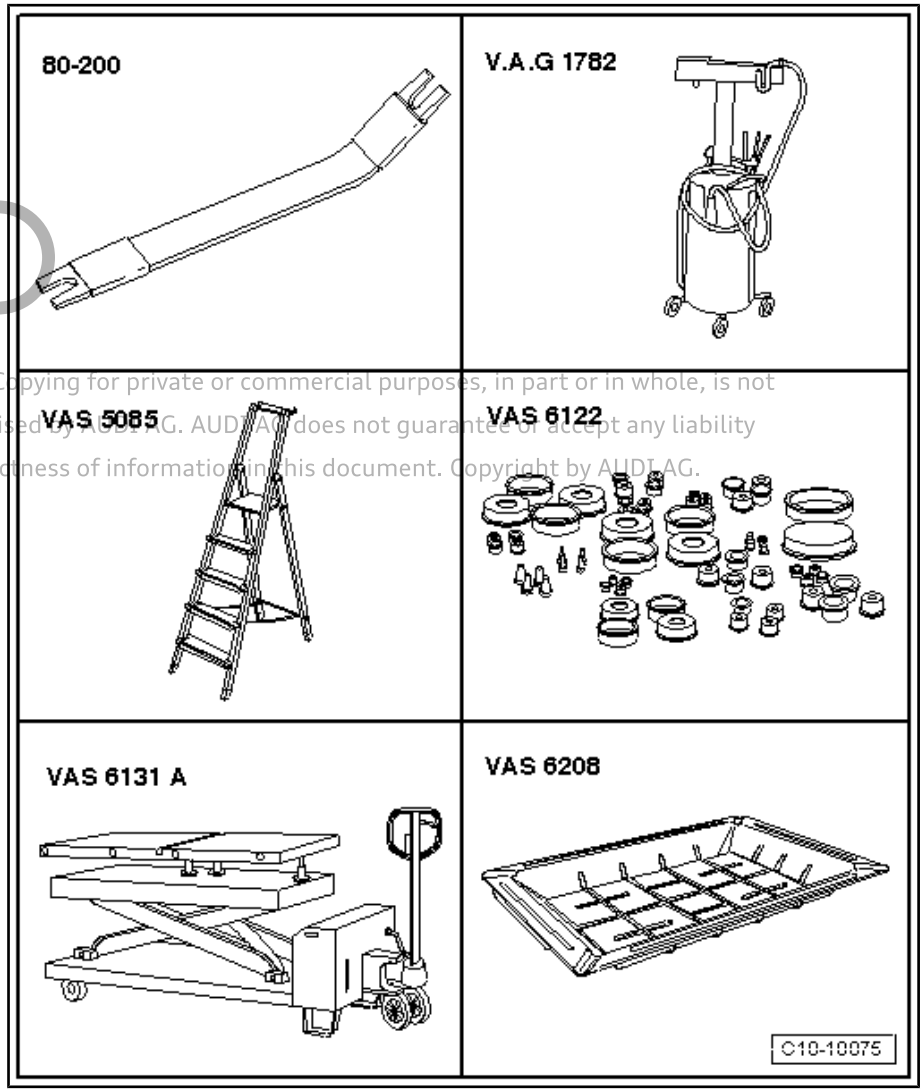
⇒ “1.2 Separating engine and gearbox”, page 34

⇒ “1.3 Securing engine to engine and gearbox support”, page 41

⇒ “1.4 Installing engine”, page 45

1.1 Removing engine

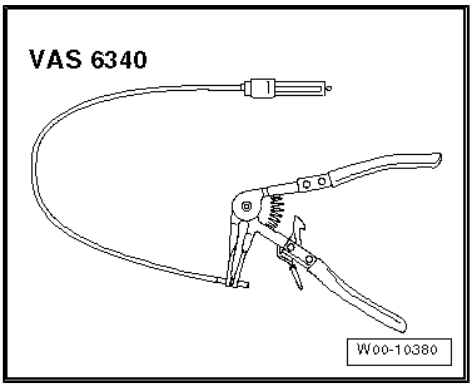
Special tools and workshop equipment required



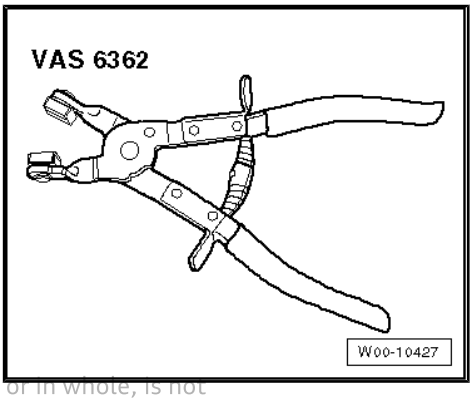
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- Removal lever - 80 - 200-
- Used oil collection and extraction unit - V.A.G 1782-
- Stepladder - VAS 5085-
- Engine bung set - VAS 6122-

- Scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/13-
- Drip tray for workshop hoist - VAS 6208-
- Hose clip pliers - VAS 6340-



- Hose clip pliers - VAS 6362-



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Procedure

Note

- *The engine is removed from underneath together with the gearbox and subframe (with lock carrier installed).*
- *Fit cable ties in the original positions when installing.*

WARNING

Make sure the vehicle cannot tip over when the engine is removed.

- ***Secure the vehicle, to do so, the luggage compartment must be empty.***

The fuel system operates at extremely high pressure. This can cause injury.

- ***The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.***

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 235 .

Note

- *To make sure you can still move the front wheels when the battery has been disconnected, only disconnect the battery with the ignition key inserted.*
- *Move the selector lever to position "N" and release the electromechanical parking brake before disconnecting the battery, so that the propshaft can be turned during removal.*

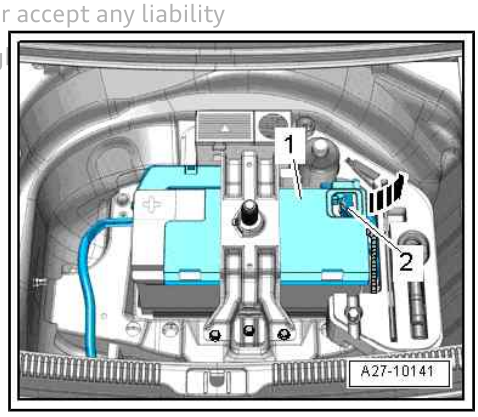
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– Bring front wheels into straight-ahead position.
– Switch off ignition and remove ignition key.

Caution

Risk of irreparable damage to electronic components.

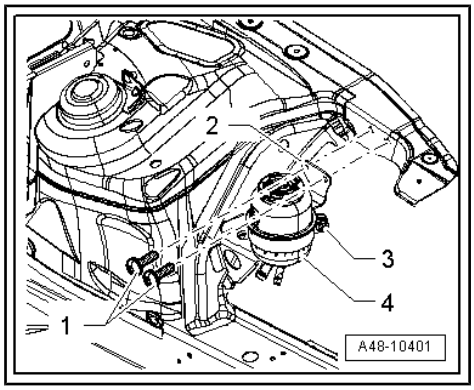
- *Observe notes on procedure for disconnecting the battery.*



– Disconnect earth wire -2- from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery, Disconnecting and connecting battery .
– Discharge refrigerant system ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; Refrigerant circuit .

Vehicles with hydraulic power steering:

– Extract hydraulic fluid for power steering from reservoir using used oil collection and extraction unit - V.A.G 1782- .



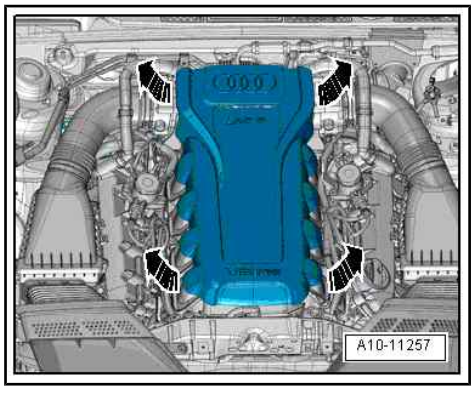
All vehicles (continued):

– Remove engine cover panel -arrows-.

WARNING

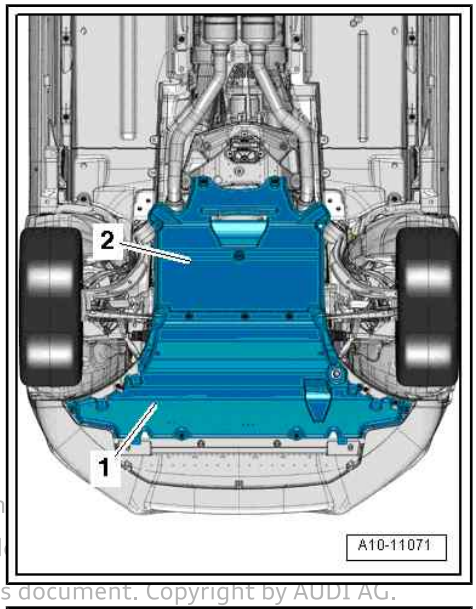
Risk of scalding due to hot steam and hot coolant.

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



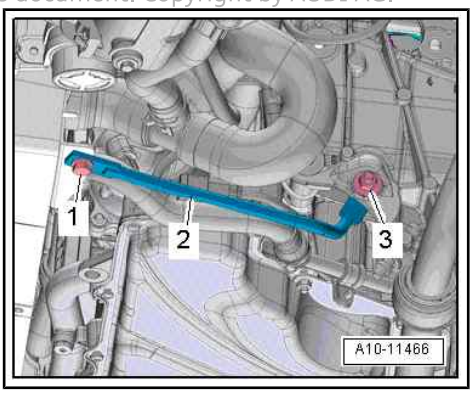
– Open filler cap on coolant expansion tank.
– Remove both front wheels.
– Remove wheel housing liners (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

– Remove noise insulation -1- and -2- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Remove bracket for headlight housing (right-side) ⇒ Electrical system; Rep. gr. 94 ; Headlights; Exploded view - headlights .



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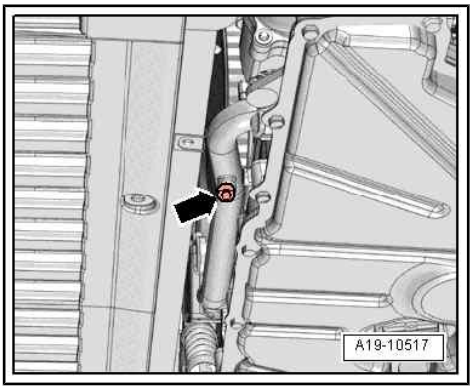
– Unscrew bolt -1-, unscrew nut -3- and detach strut -2- (both sides).



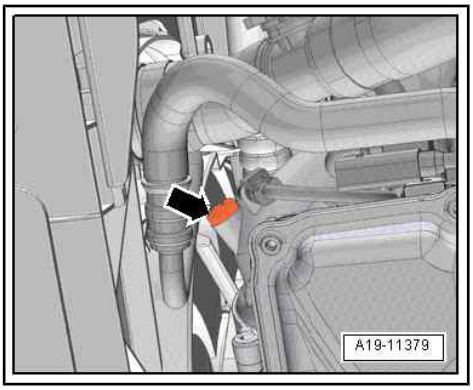
Note

Collect drained coolant in a clean container for re-use or disposal.

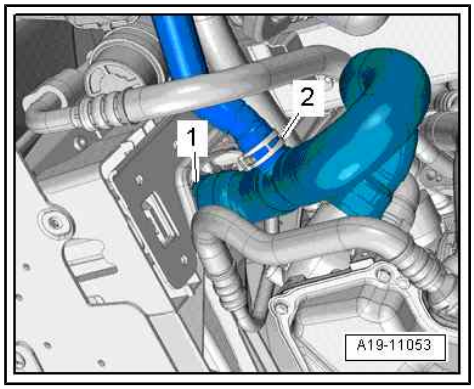
– Place drip tray for workshop hoist - VAS 6208- beneath engine.
– Unscrew drain plug -arrow- on coolant pipe (front) and drain off coolant.



– Unscrew drain plug -arrow- on map-controlled engine cooling system thermostat - F265- and drain off coolant.

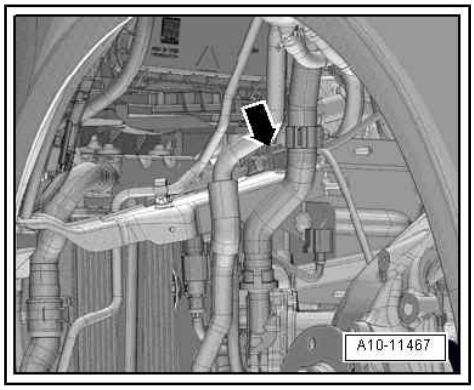


– Detach coolant hoses from radiator (lift retaining clip -1- and open hose clip -2-).



Vehicles with hydraulic power steering:

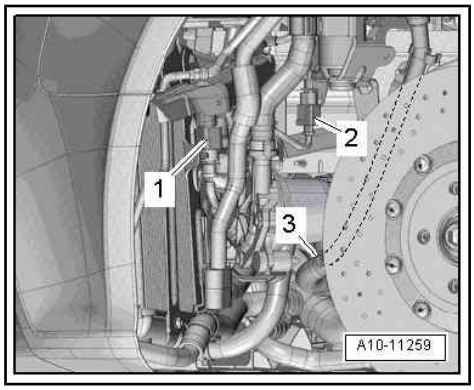
– Unplug electrical connector -arrow- for power steering.



– Position used oil collection and extraction unit - V.A.G 1782- below connection point.
– Disconnect hydraulic hose -3- for power steering.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

All vehicles (continued):

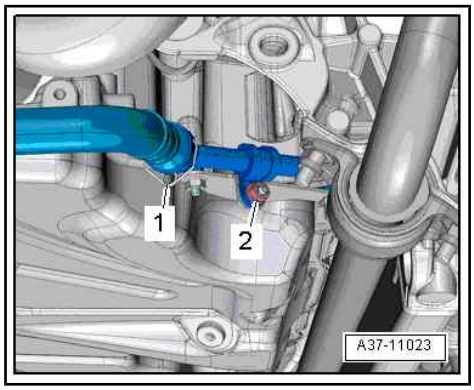
– Unplug electrical connector -1- for secondary air pump motor 2 - V189- and move electrical wiring clear.
– Unplug electrical connector -2- for vacuum pump for brakes - V192- .



Note

Observe rules for cleanliness when working on dual clutch gearbox ⇒ Rep. gr. 00 ; Repair instructions; Rules for cleanliness .

– Position used oil collection and extraction unit - V.A.G 1782- below connection point.
– Detach clip -1- and disconnect ATF line.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



Note

Disregard -item 2-.

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WARNING

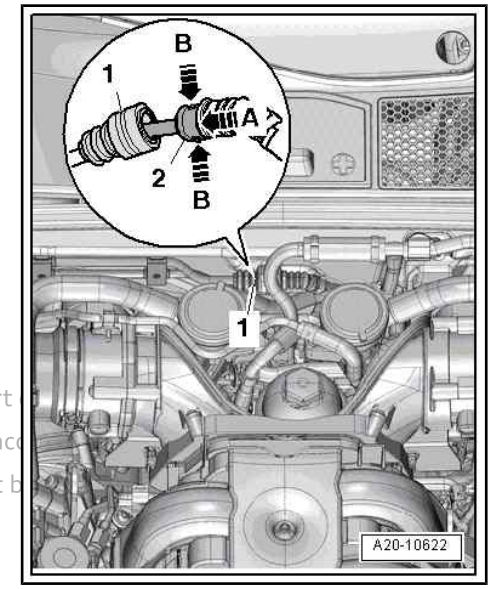
Risk of injury caused by fuel.

- *To allow the fuel pressure to dissipate, wrap a clean cloth around the connection and carefully loosen the connection before opening the fuel system.*

Caution

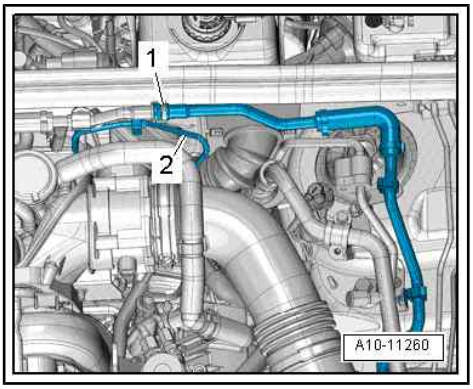
Risk of damage caused by particles of dirt.

- *Observe rules for cleanliness when working on the fuel supply system ⇒ page 3 .*

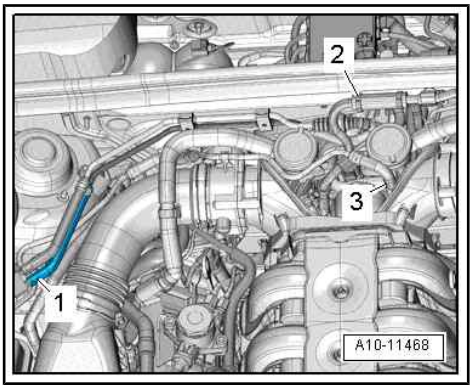


– Move clear fuel line at plenum chamber partition panel.
– Push down protective sleeve -1- and disconnect fuel line.
– First press hose connector -2- downwards -arrow A-, then press release tabs -arrows B-.
– Pull off hose connector, keeping release tabs depressed.

– Disconnect vacuum hoses -1 and 2-.

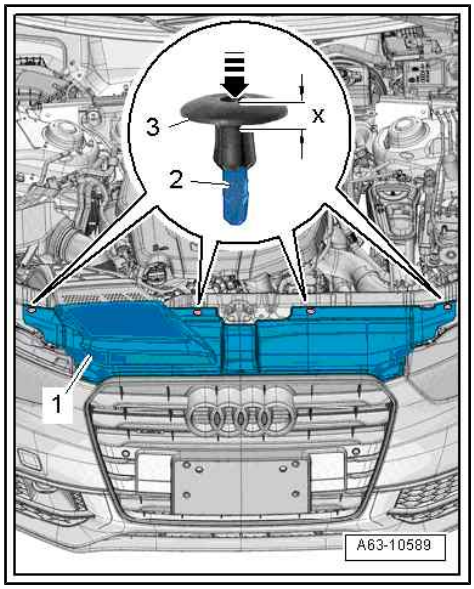


– Disconnect vacuum hose -2- for brake servo.
– Detach coolant line -3-, move clear and push to side.
– Disconnect line -1- from activated charcoal filter and move clear at plenum chamber partition panel.

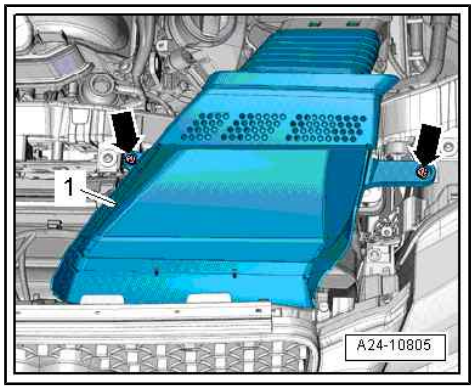


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– Remove lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .



– Remove bolts -arrows- and detach air duct -1- from air cleaner housing (left and right).



– Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

– Press release tabs and detach crankcase breather hose -1- from air pipe.

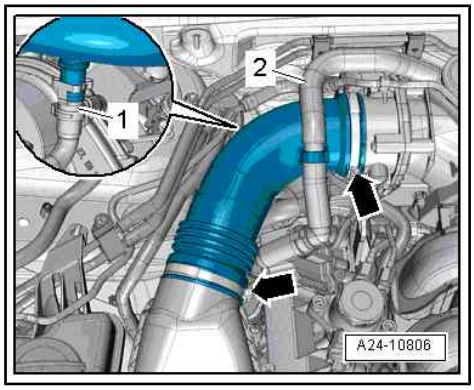
– Loosen hose clips -arrows- and detach air pipe.

– Repeat procedure on opposite side.

Crankcase breather with permanently connected hose:

– Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).

– Repeat procedure on opposite side.



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All vehicles (continued):

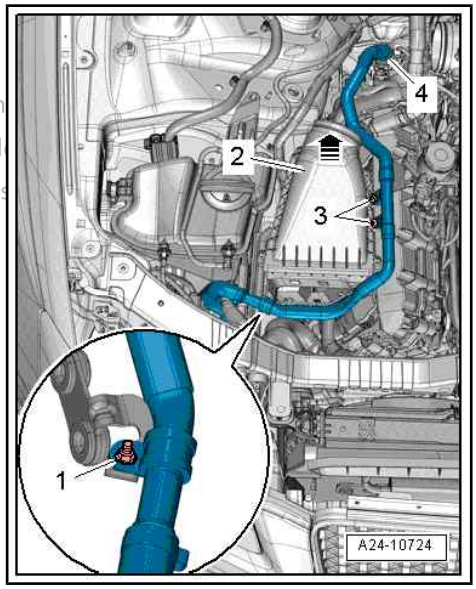
– Remove bolts -3-.

– Press release tabs and disconnect hose -4- from combination valve for secondary air system.

– Pull air cleaner housing -2- at rear off bracket -arrow- and detach.

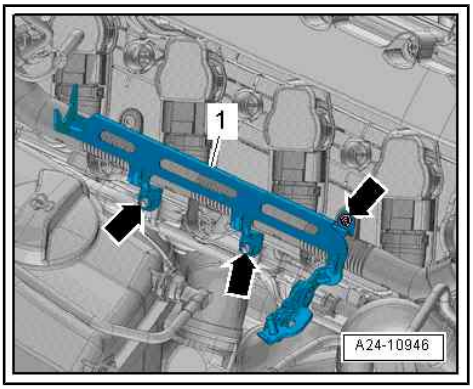
– Remove nut -1- and move hose clear to one side.

– Repeat procedure on opposite side.



– Remove nuts and bolt -arrows- and detach bracket -1- for air cleaner housing.

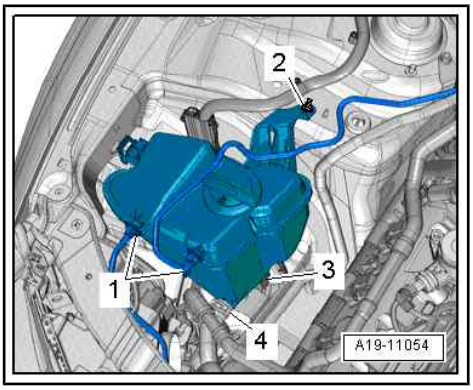
– Repeat procedure on opposite side.



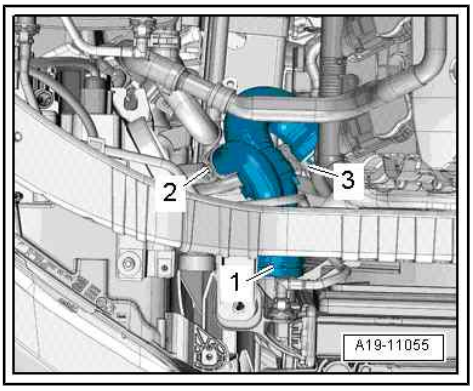
– Unplug electrical connector -3- at coolant shortage indicator switch - F66- .

– Lift retaining clips -1-, release hose clip -4- and detach coolant hoses.

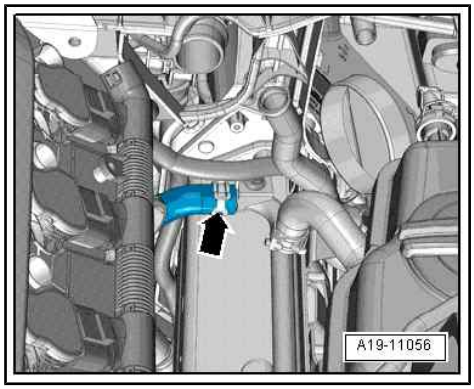
– Remove nut -2- and detach coolant expansion tank.



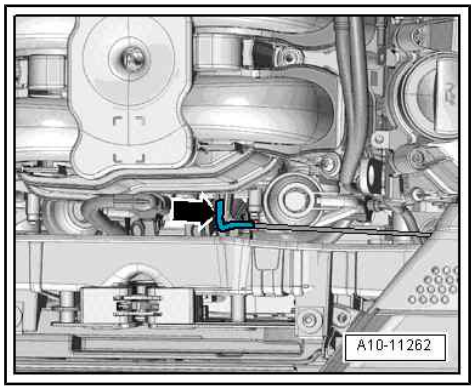
– Lift retaining clip -1-, release hose clips -2- and -3- and remove coolant hose.



– Release hose clip -arrow- and detach coolant hose at longitudinal member (right-side).



– Disconnect vacuum hose -arrow- at front of intake manifold.

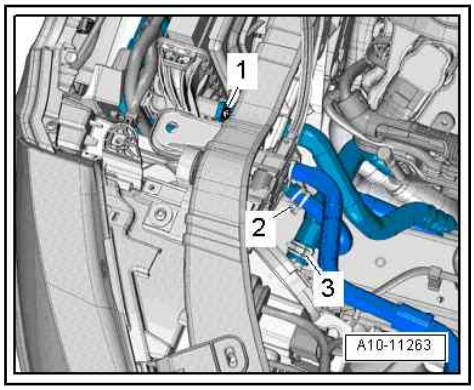


Vehicles with hydraulic power steering:

Note

Lay a cloth underneath vehicle to catch escaping hydraulic fluid.

– Disconnect hydraulic hose -2- for power steering.



All vehicles (continued):

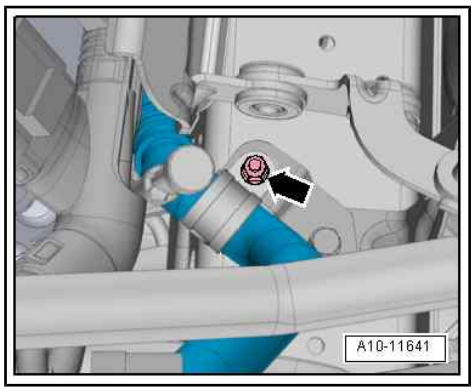
Note

Place a cloth underneath to catch escaping ATF.

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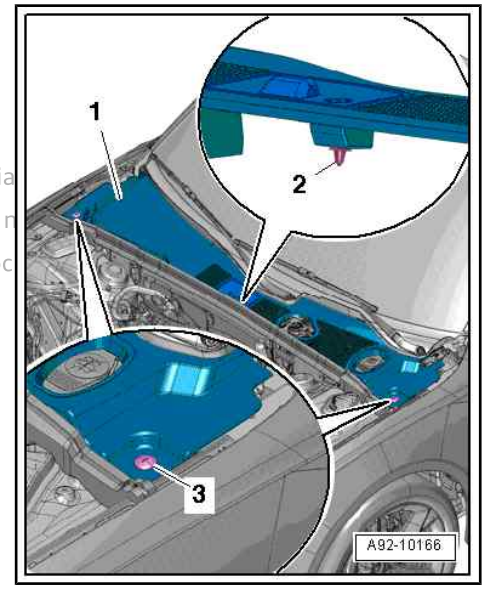
– Remove bolt -1- and detach ATF line from radiator.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .
– Release hose clip -3- and detach coolant hose at longitudinal member (left-side).

– If installed, remove nut -arrow- and move ATF hose clear.

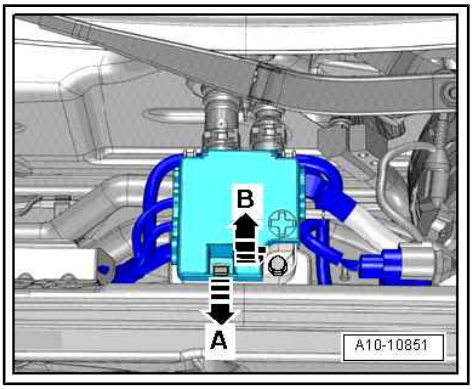


– Remove bolts -3-.
– Unclip retaining clips -2- from mounting and detach plenum chamber cover -1-.

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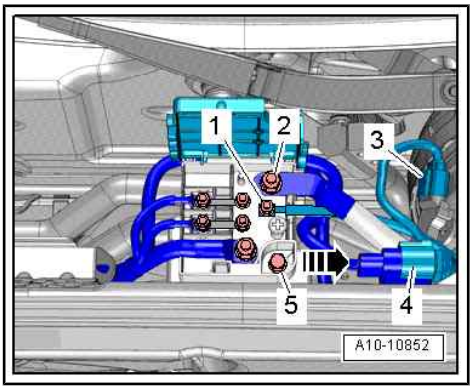


– Release catch -arrow A- and open cover -arrow B-.



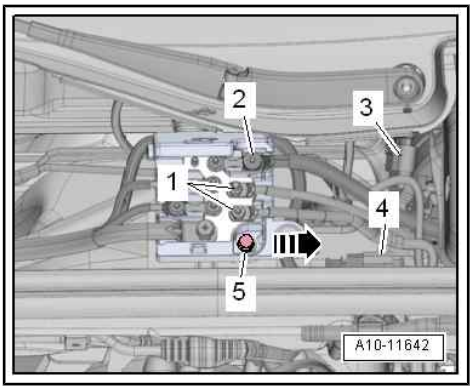
Wiring junction - version 1:

– Remove nuts -1- and -2- for electrical wiring.
– Unplug electrical connectors -3- and -4- and move clear.
– Remove bolt -5- and detach terminal 30 wiring junction 2 - TV22- from body brace -arrow-.



Wiring junction - version 2:

– Unplug electrical connectors -3- and -4- and move clear.
– Remove bolt -5- and detach terminal 30 wiring junction 2 - TV22- from body brace -arrow-.

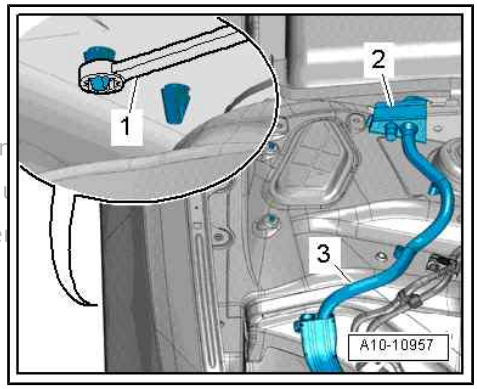


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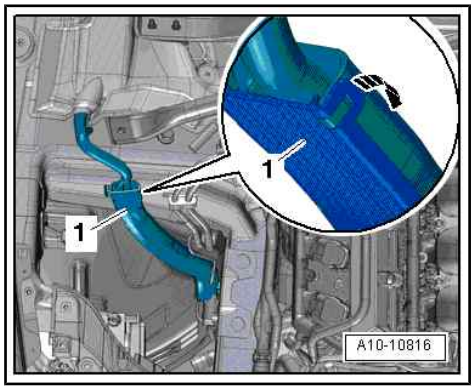
All vehicles (continued):

– Working from wheel housing, release catches using a 5.5 mm ring spanner -item 1- and remove wiring protector -2- from above.

– Release wiring harness -3- leading to alternator and starter using removal lever 80 - 200- and move clear.

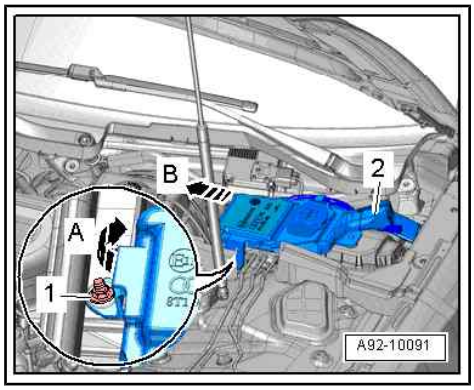


– Release catch -arrow- to open wiring duct -1- and move wiring harness clear.

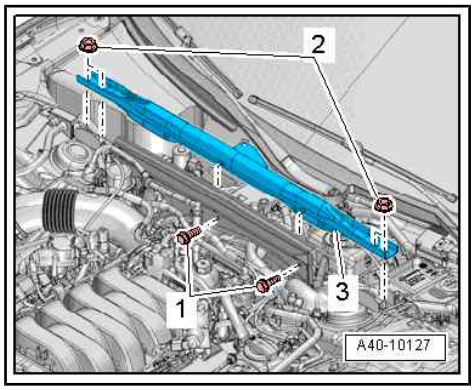


– Remove nut -1- and swivel filler neck -2- for washer fluid reservoir slightly upwards -arrow A-.

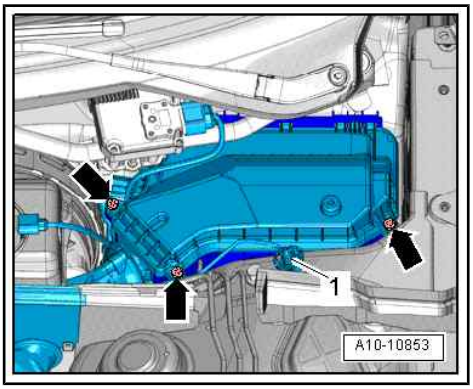
– Pull filler neck with filler pipe out of washer fluid reservoir and through opening in body -arrow B-.



– Remove bolts -1- and nuts -2- and detach body brace -3- (different types may be fitted depending on version).

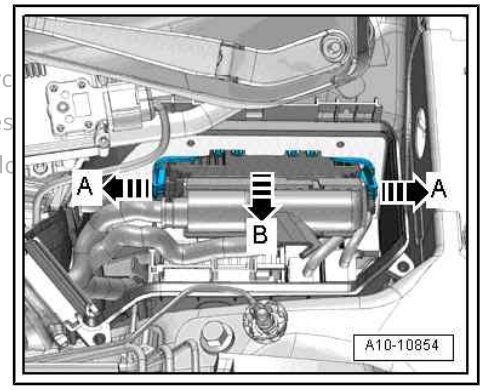


– Remove bolts -arrows- and detach cover for electronics box in engine compartment.
– Remove nut -1- and move electrical wiring clear.

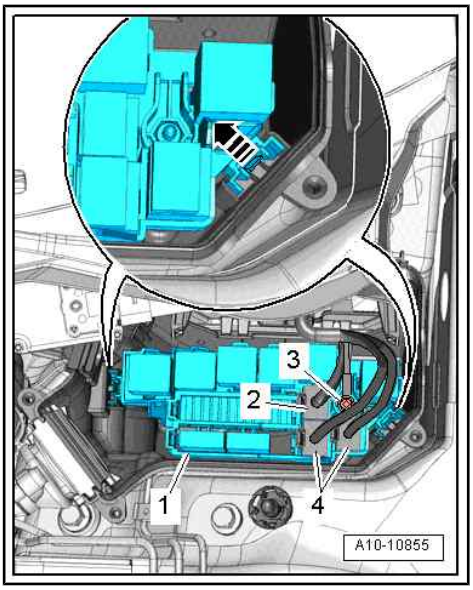


– Release catches -arrows A- and take out engine control unit -arrow B-.

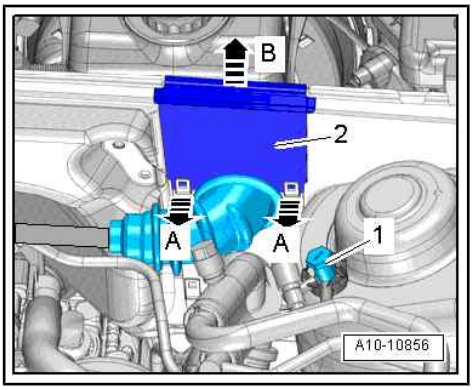
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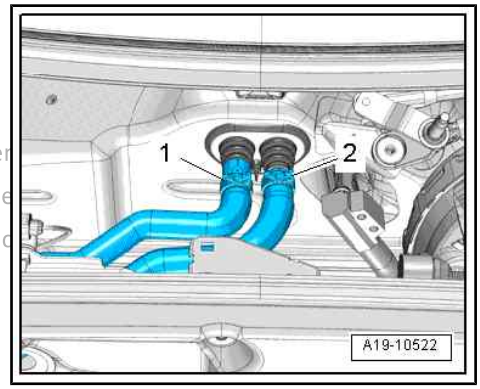
– If fitted, unplug electrical connector -2-.
– Unplug electrical connectors -4-.
– Remove nut -3- for electrical wiring.
– Release catches -arrow- and detach relay carrier with fuse holder -1-.
– Disengage engine wiring harness at electronics box in engine compartment and move clear.



– Release catches -arrows A- and detach wiring protector -2- -arrow B-.
– Unscrew earth stud -1- and move earth wiring clear.
– Place wiring harness on engine and secure engine control unit to prevent it from dropping.



– Release hose clip -2- and detach coolant hose.
– Push coolant hose with hose protector through into engine compartment.



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Note

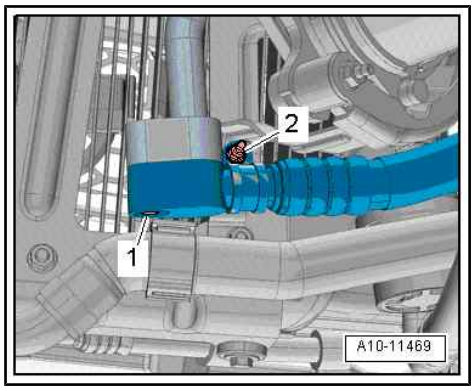
Disregard -item 1-.

Caution

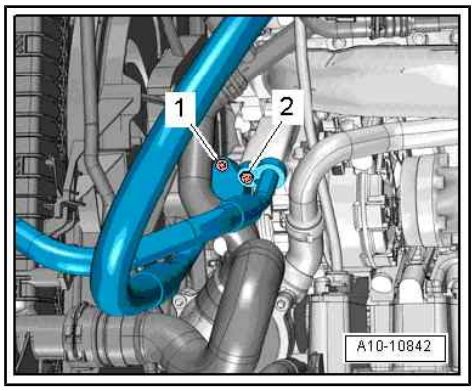
Risk of damage to refrigerant lines and hoses

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

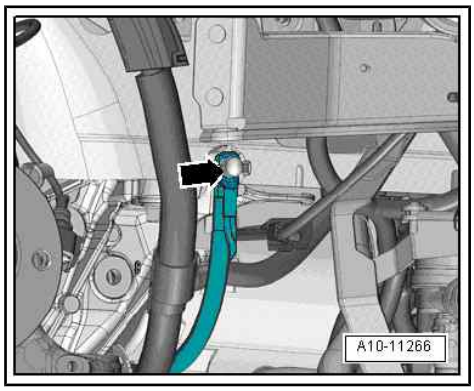
– Remove bolt -1- and nut -2- and disconnect refrigerant line.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



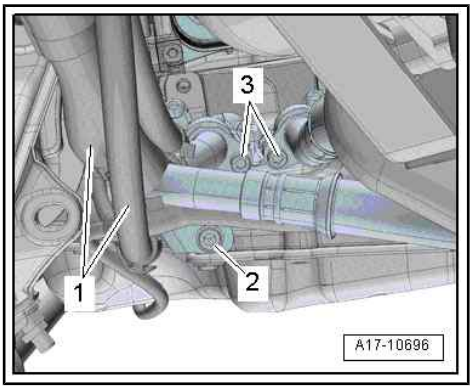
– Remove bolt -2-.
– Disconnect refrigerant line from A/C compressor.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



– Unscrew nut -arrow- on longitudinal member (right-side) and move earth cables clear.



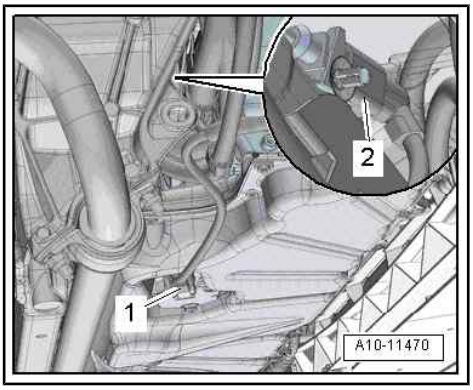
– Position used oil collection and extraction unit - V.A.G 1782- below engine.
– Move clear electrical wiring -1-.
– Remove bolts -2 and 3- and disconnect oil lines.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



– Unplug electrical connectors and move wiring clear:

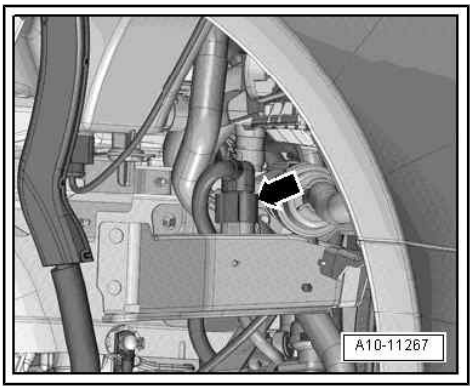
1 - Oil level and oil temperature sender - G266-

2 - Right electrohydraulic engine mounting solenoid valve - N145-



Audi RS 4/RS 5 Coupé:

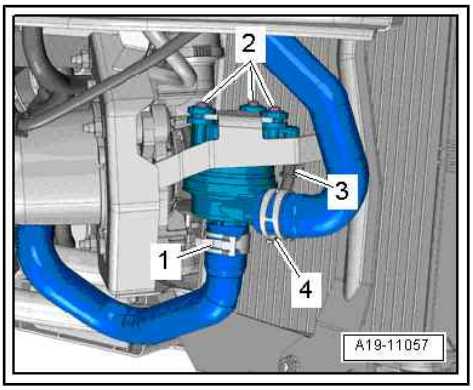
– Unplug electrical connector -arrow- at secondary air pump motor - V101- and move electrical wiring clear.



– Unplug electrical connector -3- and move wiring clear.
– Place drip tray for workshop hoist - VAS 6208- beneath engine.
– Release hose clip -1- and disconnect coolant hose from continued coolant circulation pump - V51- .

Note

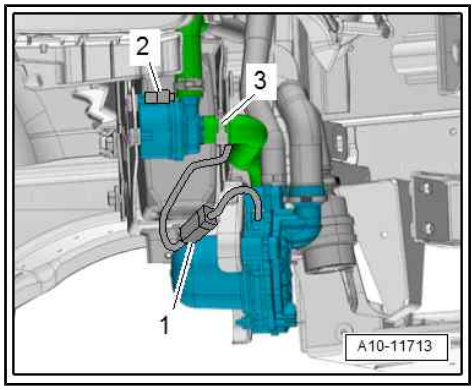
Disregard items -2 and 4-.



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Audi RS 5 Cabriolet:

– Unplug electrical connectors -1 and 2- and move electrical wiring clear.



Note

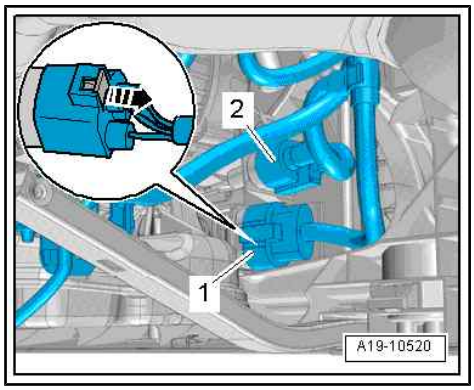
Place a cloth underneath to catch escaping coolant.

– Release hose clip -3- and detach coolant hose.

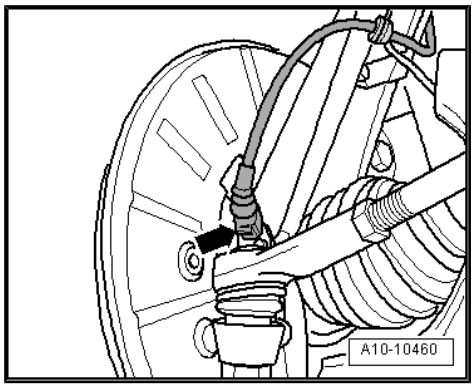
All vehicles (continued):

– Unplug electrical connectors -1- and -2- for radiator fan (push retainer to the rear -arrow- and press down release catch).

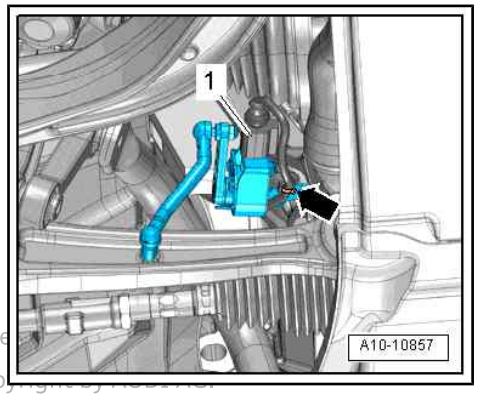
– Move electrical wiring harness clear.



– Unplug electrical connectors -arrow- at front wheel speed sensors on both sides.

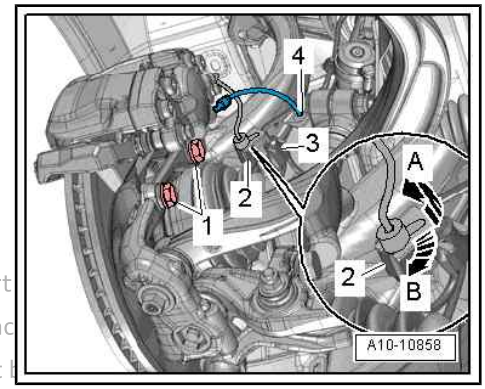


– If installed, unplug electrical connector -1- on headlight range control sender 1 - G233- and move wiring clear -arrow-.



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– Release electrical connector -2- at bracket by pulling retainer catch to the rear -arrow A- and turning connector approx. 90° in direction of -arrow B-.
– Move clear electrical wire -3- and brake hose -4- at bracket.
– Remove bolts -1- and tie up brake caliper in wheel housing with wire (brake line remains attached).



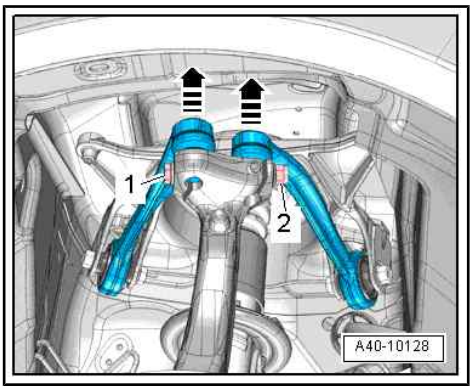
Caution

Risk of damage to brake pistons.

- ***Do not operate brake pedal with brake caliper removed.***

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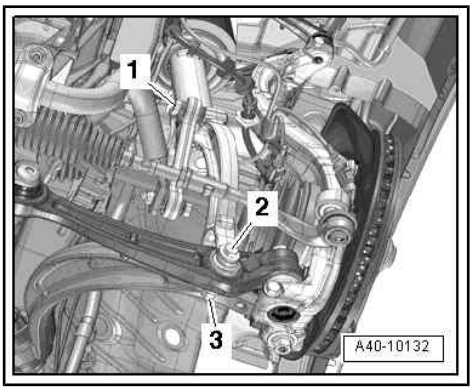
– Remove nut -2- and pull out bolt -1-.
– Pull upper suspension links upwards out of wheel bearing housing -arrows-.
– Repeat procedure on opposite side of vehicle.



– Remove bolt -1- for anti-roll bar on both sides.
– Remove nut -3- on both sides.

Note

The bolt -2- is removed at a later stage.

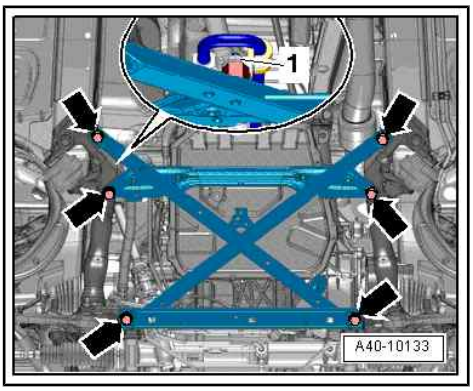


– Remove subframe cross brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing subframe cross brace .

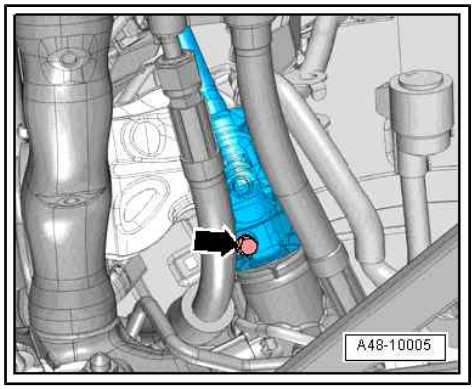
Caution

Risk of damage to running gear components.

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



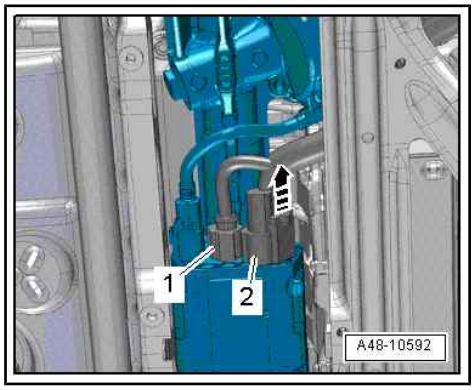
– Detach intermediate steering shaft from steering rack and move clear by telescoping upwards ⇒ Running gear, axles, steering; Rep. gr. 48 ; Steering column; Removing and installing intermediate steering shaft .



Vehicles with electromechanical power steering:

– Unplug electrical connector -2- at power steering control unit - J500- (release retainer -arrow- and press down release catch).

– Move electrical wiring harness clear.

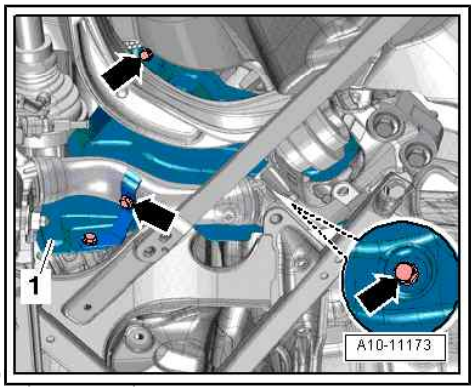


Note

Disregard -item 1-.

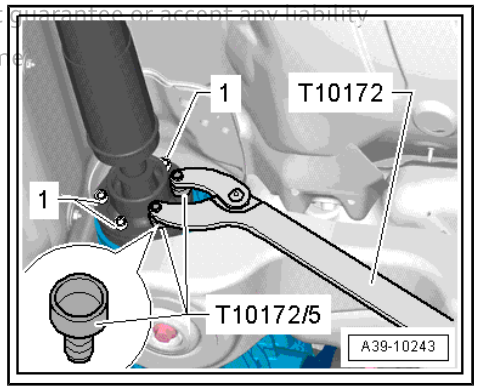
All vehicles (continued):

– Remove bolts -arrows- on both sides and detach heat shield -1-.

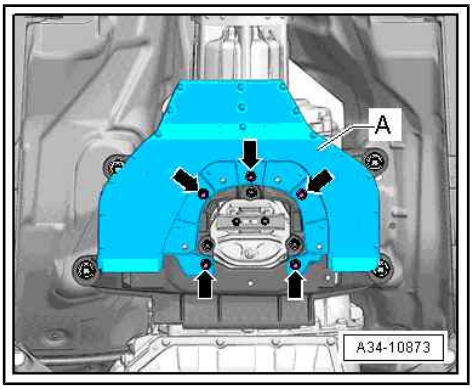


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– Remove propshaft ⇒ Rear final drive; Rep. gr. 39 ; Propshaft; Removing and installing propshaft .



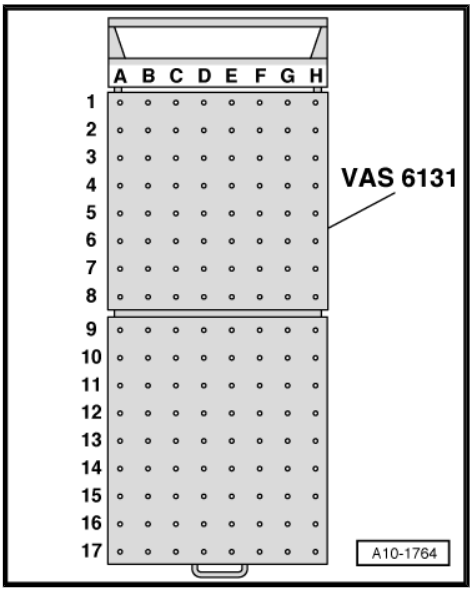
– Remove bolts -arrows- and detach air duct -A-.



Setting up scissor-type assembly platform:

– Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , support set -VAS 6131/11- and supplementary set -VAS 6131/13- as follows:

Platform coordinates	Parts of support set for Audi - VAS 6131/10- , support set -VAS 6131/11- and supplementary set - VAS 6131/13-			
B4	/13-4	/10-4	/10-5	/13-1
G4	/13-4	/10-4	/10-5	/13-1
B6	/10-1	/10-2	/10-5	/10-11
G6	/10-1	/10-2	/10-5	/10-11
A8+C8	/13-6			/13-2
F8+H8	/13-5			/13-2
B14	/10-1	/10-4	/10-5	/10-7
G14	/10-1	/10-4	/10-5	/11-1
B17	/10-1	/10-3	/10-5	/13-2
G17	/10-1	/10-3	/10-5	/13-2



– Initially hand-tighten the support elements on the scissor-type assembly platform.

– Position scissor-type assembly platform - VAS 6131 A- horizontally.

• Take note of spirit level (bubble gauge).

– Position scissor-type assembly platform - VAS 6131 A- below engine/gearbox assembly.

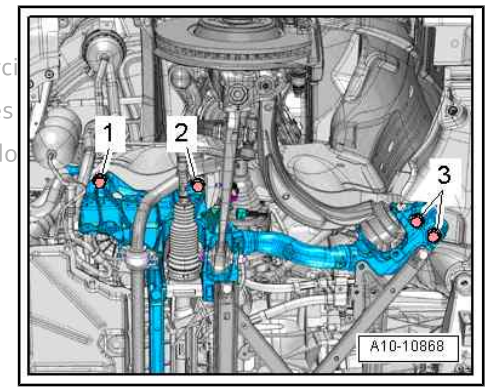
WARNING

Accident risk if subframe mountings are detached.

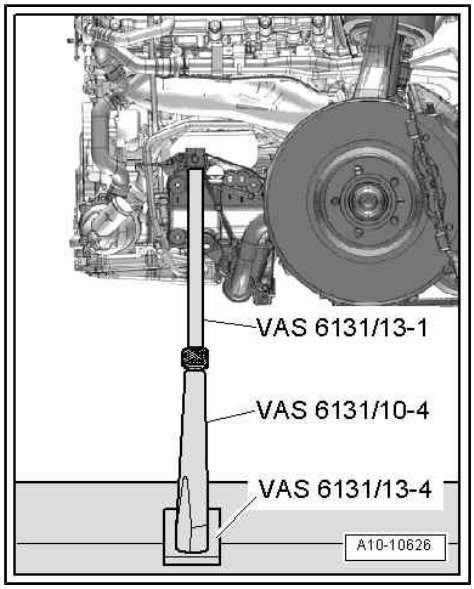
- ***Subframe bolts -2- and -3- must not be loosened.***

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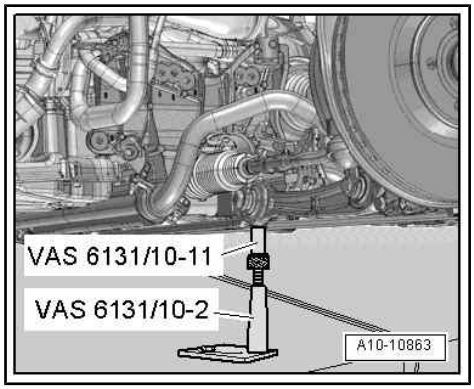
– Remove subframe bolts -1- on both sides.



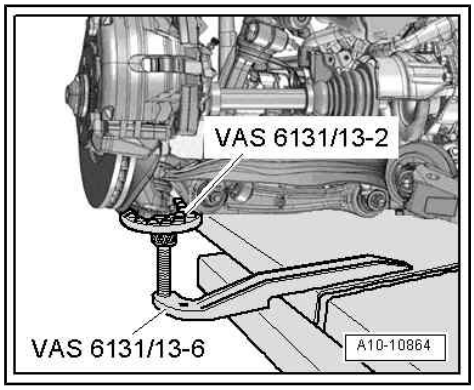
– Position support elements from -VAS 6131/10- and -VAS 6131/13- at front left and right of subframe as shown.
– Make sure that threaded spindles are screwed in completely.



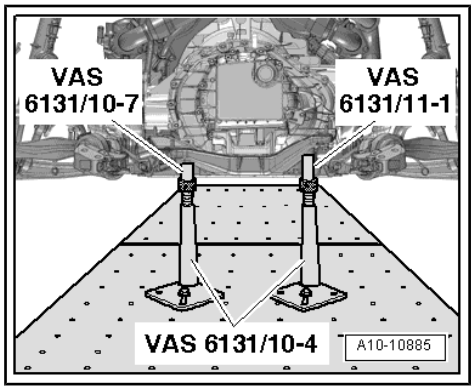
– Position support elements from -VAS 6131/10- (rear left and right) at front attachment points of subframe cross brace as shown.



– Position support elements from -VAS 6131/13- under left and right wheel bearing housings as shown.

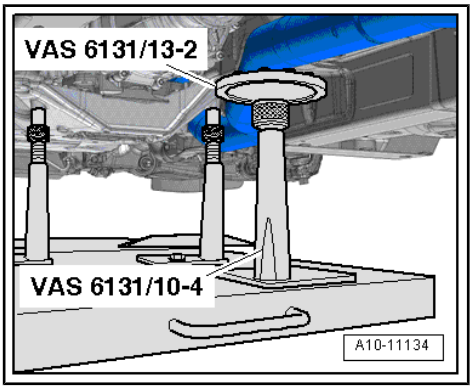


– Position support elements from -VAS 6131/10- and -VAS 6131/11- (rear left and right) at tunnel cross member as shown.

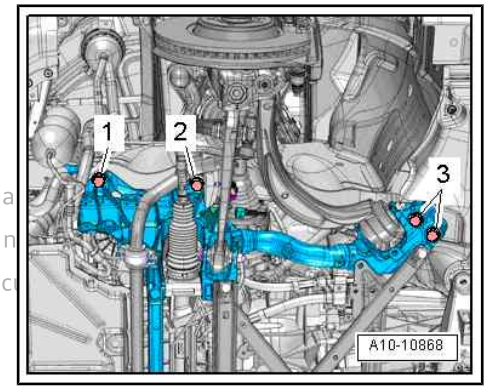


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– Position the support elements from -VAS 6131/10- and -VAS 6131/13- at left and right below front exhaust pipe, as shown in the illustration.
– Turn all spindles for support elements upwards until all locating lugs make contact with mounting points.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .



– Mark installation position of subframe and tunnel cross member on longitudinal members with felt-tip pen.
– Unscrew subframe bolts -2- and -3- on both sides in several stages and in diagonal sequence.

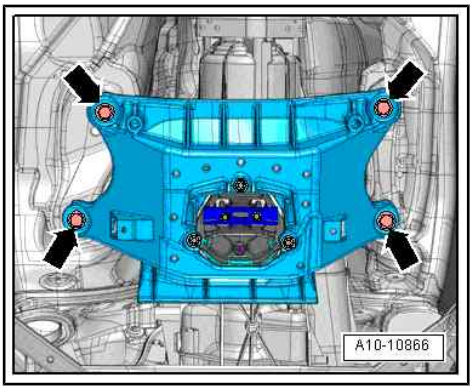


Note

Disregard -item 1-.

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– Remove bolts -arrows- on tunnel cross member.

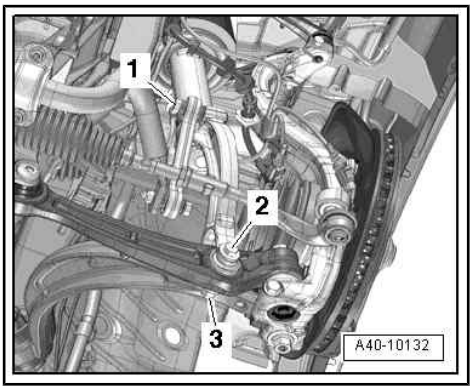


– Remove bolt -2- on both sides.

Caution

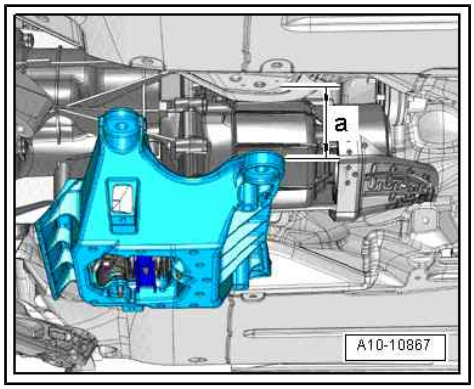
Danger of damage to hydraulic lines, vacuum lines or electrical wiring and to engine compartment.

- ***Check that all hydraulic lines, vacuum lines and electrical wiring between engine, gearbox, subframe and body have been detached.***
- ***Carefully guide out engine/gearbox assembly with subframe from engine compartment when lowering.***



– Lower engine/gearbox assembly using scissor-type assembly platform - VAS 6131 A- initially only as far as distance -a-.

• Dimension -a- = 80 mm (maximum).

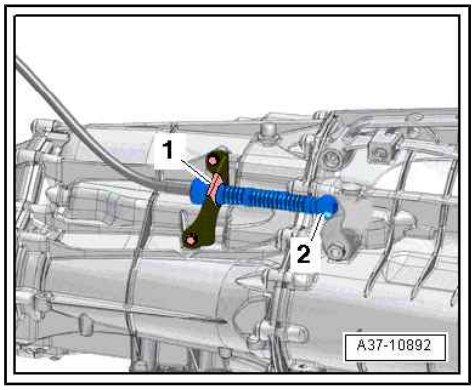


– Pry ball socket -2- of selector lever cable off gearbox selector lever using removal lever - 80 - 200- .

– Pull off securing clip -1- and move clear selector lever cable.

Note

Take care not to bend or kink selector lever cable.



– Lower engine/gearbox assembly further.

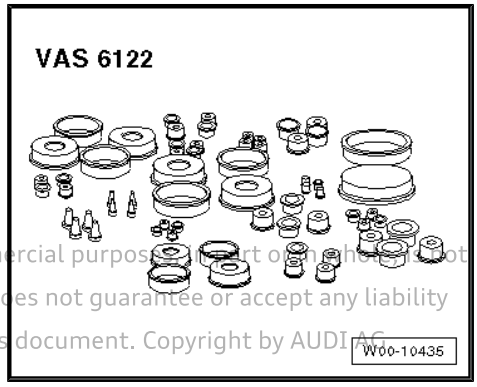
– Pull out scissor-type assembly platform - VAS 6131 A- with engine/gearbox assembly from underneath vehicle.

1.2 Separating engine and gearbox

Special tools and workshop equipment required

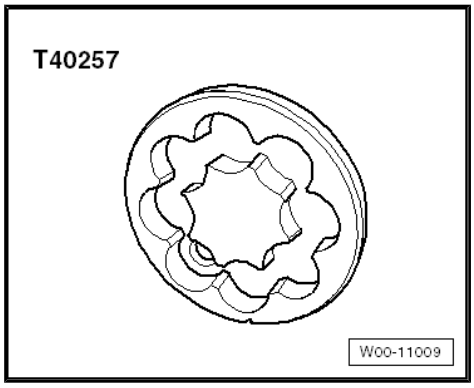
♦ Support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/11- and support -VAS 6131/13-7-

♦ Engine bung set - VAS 6122-

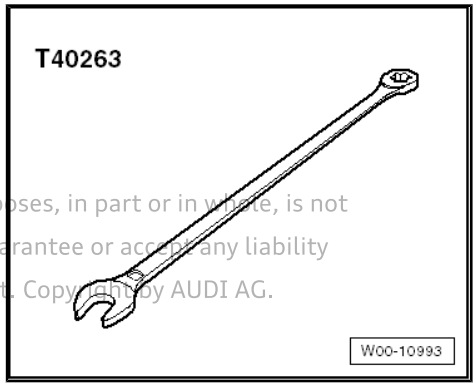


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♦ Turning-over tool - T40257-



♦ Wrench, 21 mm - T40263-



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♦ M10x65 bolt

Procedure

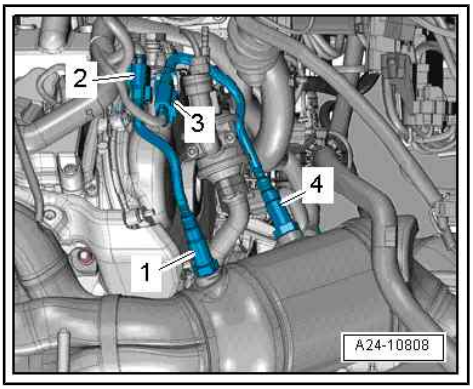
- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

– Unbolt drive shaft (left and right) from gearbox flange shaft.

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

2 - For Lambda probe 2 - G108-

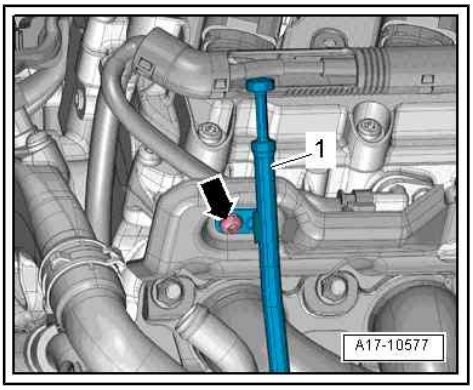
3 - For Lambda probe 2 after catalytic converter - G131-



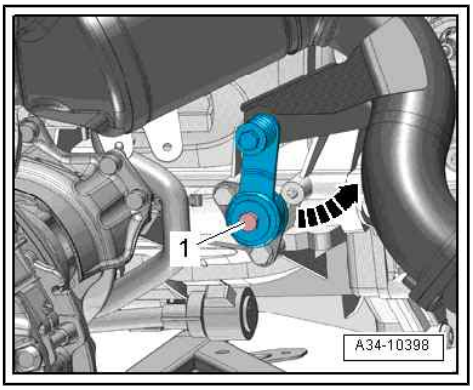
Note

Disregard items -1 and 4-.

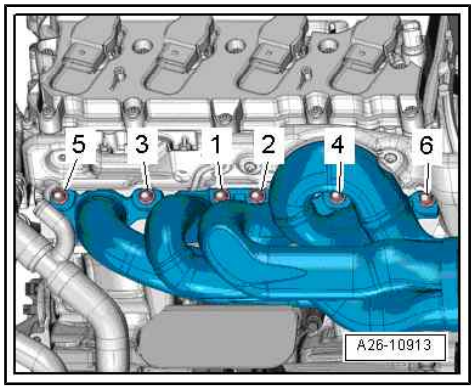
– Remove bolt -arrow- and pull out guide tube -1- for oil dipstick.



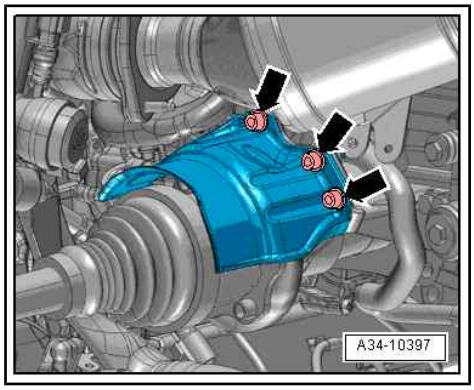
– Remove bolt -1-, press bracket off gearbox and swivel to rear -arrow-.



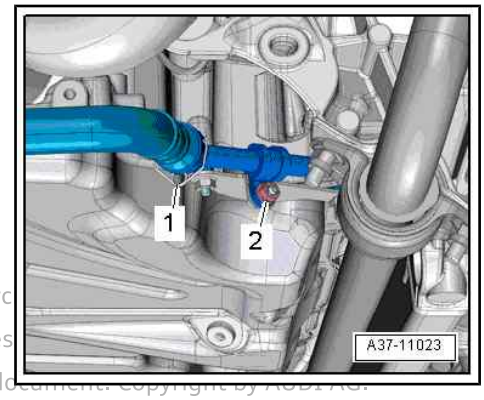
– Remove nuts in the sequence -6 ... 1- and detach exhaust manifold with catalytic converter and front silencer (right-side).



– Remove bolts -arrows- and detach heat shield for drive shaft.



– Unscrew nut -2-.



Note

Disregard -item 1-.

Note

Place a cloth underneath to catch escaping ATF.

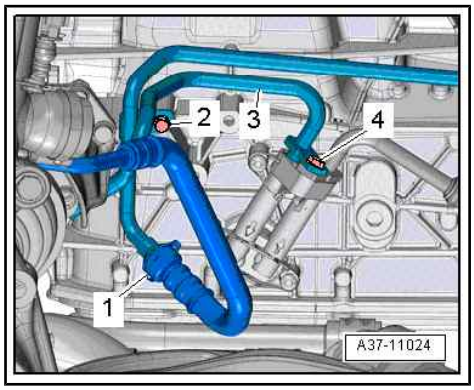
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Vehicles up to 05.2010:

– Detach clip -1- and disconnect ATF line.

– Remove bolt -4-, detach ATF line -3- from gearbox and move to one side.

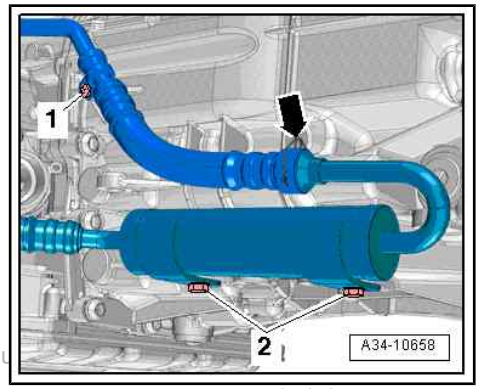
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



Note

Disregard -item 2-.

– Remove bolt -1-.



Note

Disregard -item 2- and -arrow-.

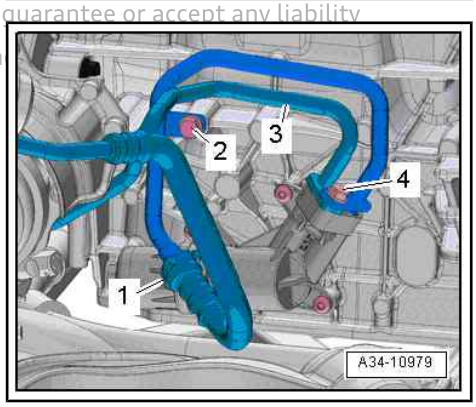
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Vehicles from 06.2010 onwards:

– Detach clip -1- and disconnect ATF line.

– Remove bolt -4-, detach ATF line -3- from gearbox and move to one side.

– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



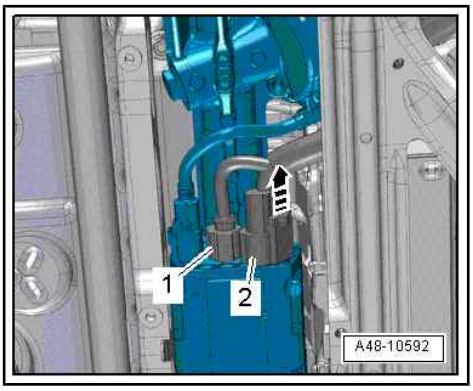
Note

Disregard -item 2-.

Vehicles with electromechanical power steering:

– Unplug electrical connector -1- at power steering control unit - J500- .

– Move electrical wiring harness clear.



Note

Disregard -item 2- and -arrow-.

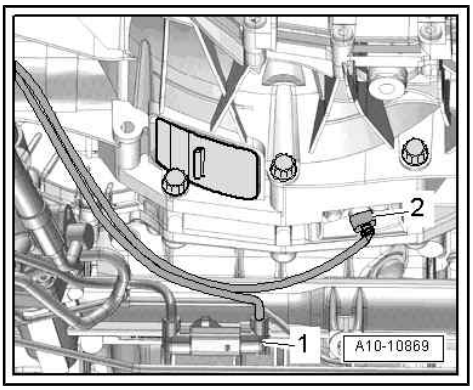
Vehicles with hydraulic power steering:

– If fitted, unplug electrical connector -1- for Servotronic solenoid valve - N119- .

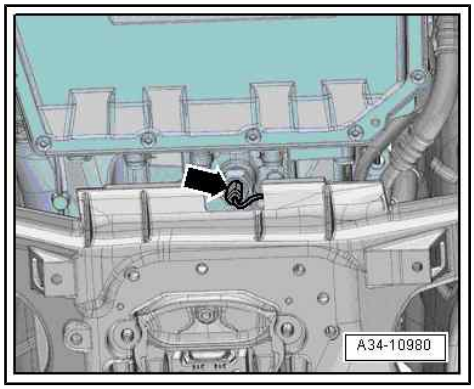
All vehicles (continued):

– Unplug electrical connector -2- for engine speed sender - G28- .

– Move electrical wiring clear.



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



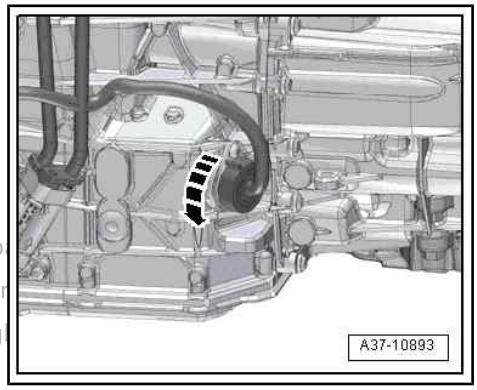
Caution

Risk of irreparable damage to gearbox control unit (mechatronic unit) because of static discharge.

- ***Do NOT touch connector contacts in gearbox connector with your hands.***

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– Touch gearbox housing with your hand (without wearing gloves) to eliminate static charge.



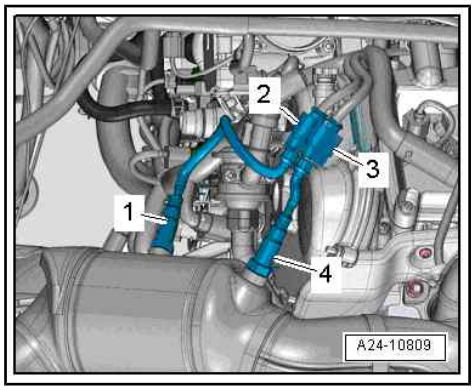
– Turn fastener anti-clockwise -arrow- and unplug electrical connector at gearbox.

– Move electrical wiring harness clear at gearbox.

– Detach electrical connectors from bracket and unplug.

2 - For Lambda probe after catalytic converter - G130-

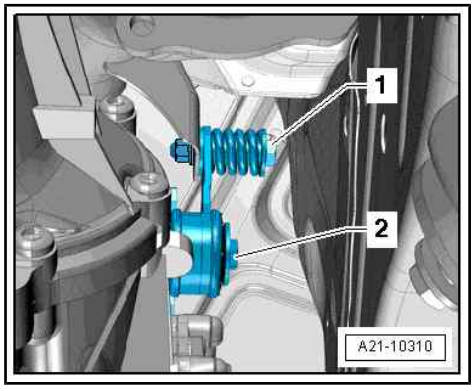
3 - For Lambda probe - G39-



Note

Disregard items -1 and 4-.

– Remove bolt -2-.

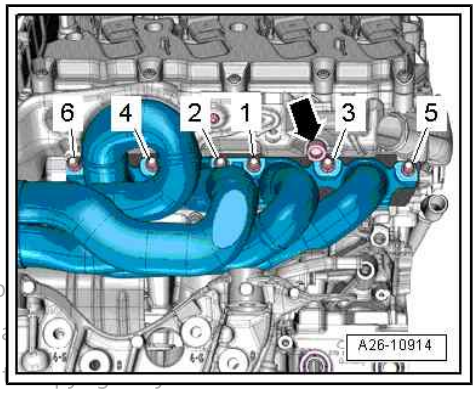


Note

Disregard -item 1-.

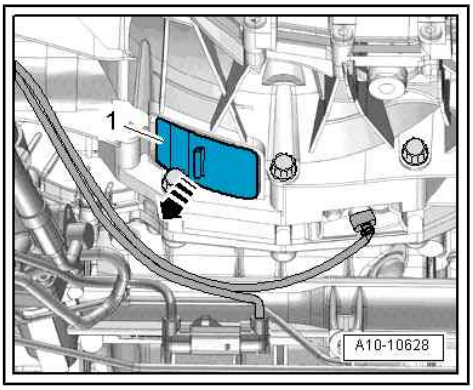
– Remove bolt -arrow-.

– Remove nuts in the sequence -6 ... 1- and detach exhaust manifold with catalytic converter and front silencer (left-side).



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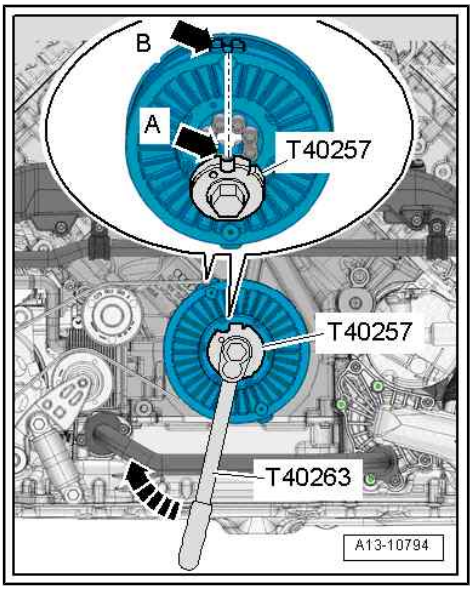
– Detach bottom cover -1- from gearbox -arrow-.



– Fit turning-over tool - T40257- onto wrench (21 mm) - T40263- .

– Position turning-over tool - T40257- on bolts of vibration damper.

• Semi-circular recess -arrow A- on turning-over tool - T40257- must point to semi-circular recess -arrow B- on vibration damper.



Note

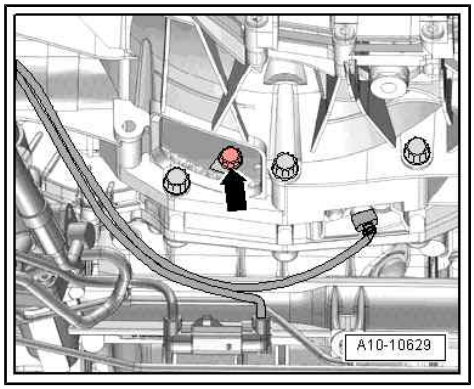
Disregard notch on turning-over tool - T40257- .

– Counterhold crankshaft using turning-over tool - T40257- and wrench (21 mm) - T40263- when loosening bolts for clutch module.

Note

When performing the next step, turn the crankshaft only in the normal direction of rotation -arrow-.

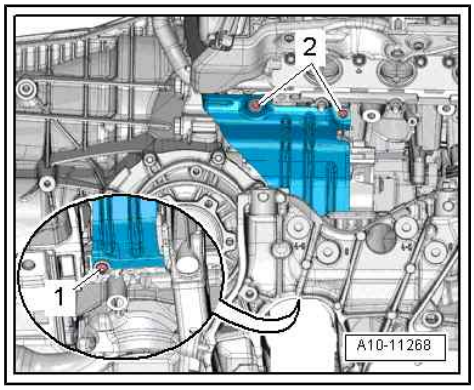
– Remove 6 bolts -arrow- for clutch module, turning crankshaft 60° in normal direction of rotation each time.



– Remove bolt -1- and press heat shield for starter slightly to the side.

Note

Disregard -item 2-.

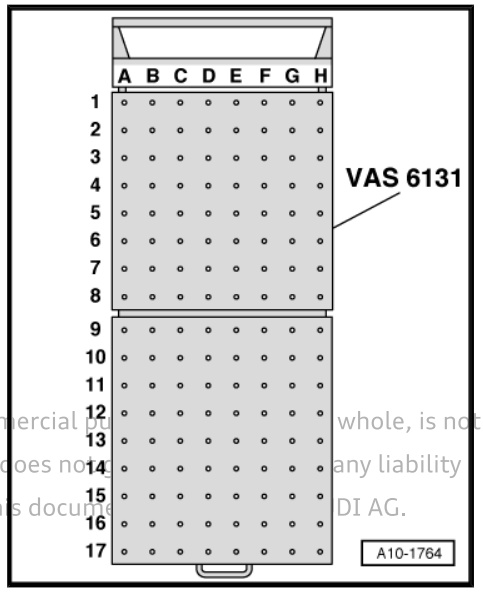


– Set up scissor-type assembly platform - VAS 6131 A- with support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/11- and support -VAS 6131/13-7- as follows:

Note

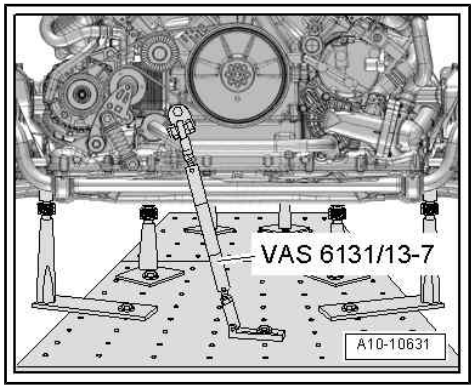
The other support elements remain unchanged.

Platform coordinates	Parts from support set for Audi - VAS 6131/10- , supplementary set -VAS 6131/11- and support - VAS 6131/13-7-			
D2	/13-7			
C10	/10-1	/10-3	/10-5	/11-4
F10	/10-1	/10-3	/10-5	



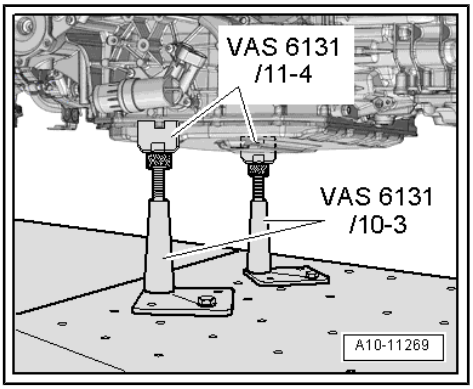
– Secure support -VAS 6131/13-7- at tapped hole at front of engine (right-side) with bolt M10x65, as illustrated.

– Secure support -VAS 6131/13-7- to scissor-type assembly platform and tighten to 20 Nm.

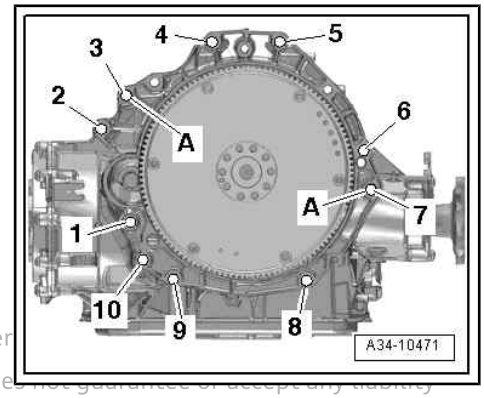


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– Position support elements from -VAS 6131/10- and -VAS 6131/11- at front of gearbox, as shown in illustration.
– Screw spindles on both sides upwards until support elements -VAS 6131/11-4- make full contact with gearbox.
– Tighten base plates for support elements to 20 Nm on scissor-type assembly platform - VAS 6131 A- .



– Remove bolts -1- and -2- for starter.
– Separate starter from gearbox and leave in position.
– Unscrew remaining bolts -3 ... 10- securing engine to gearbox.

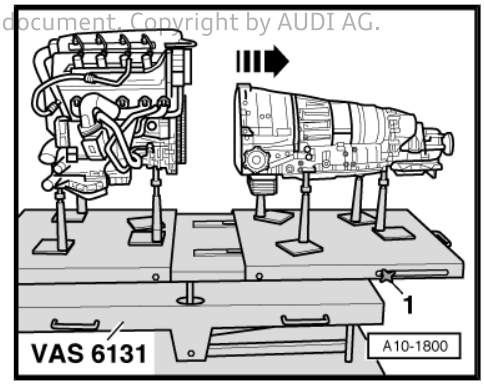


Note

- *Vehicles with electromechanical power steering: Counterhold nut at bolt -7-.*
- *Disregard -item A-.*

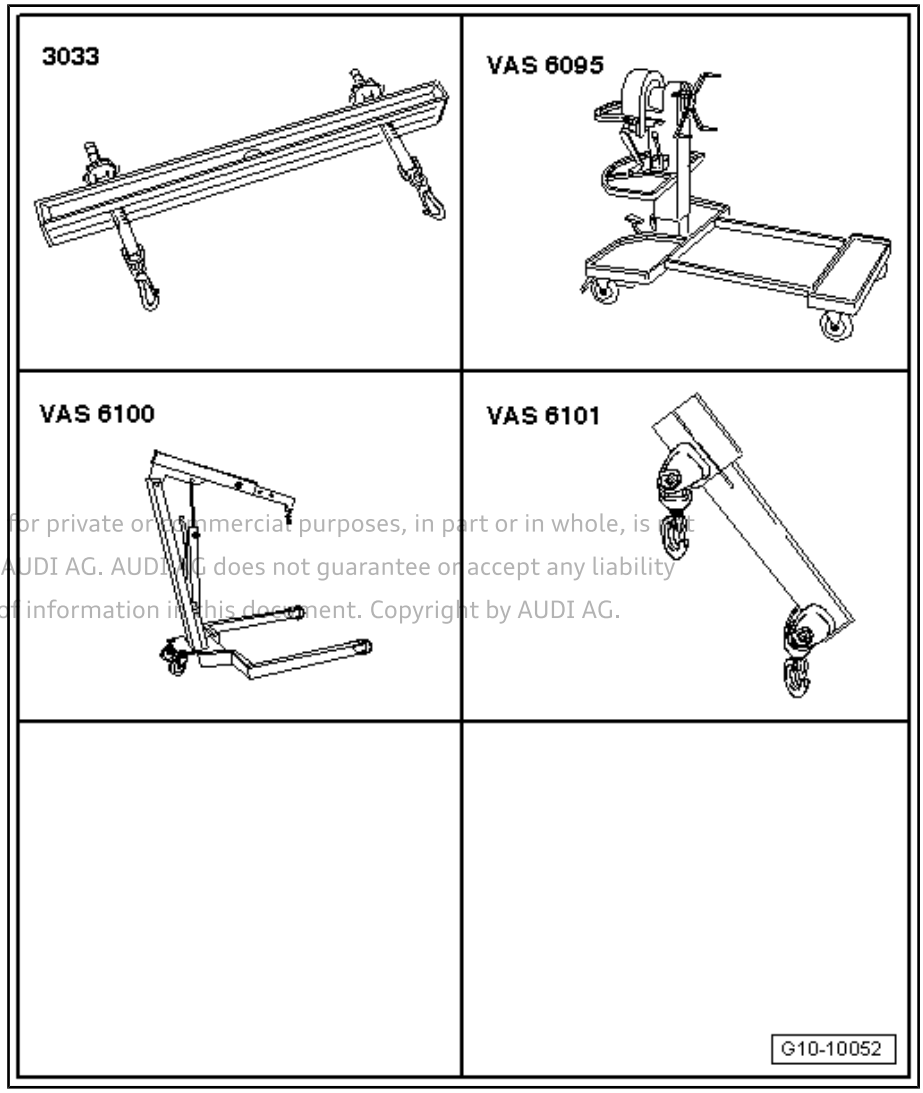
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– Loosen clamping bolts -1- on sides of scissor-type assembly platform - VAS 6131 A- and pull rear section of platform together with gearbox towards rear -arrow-.



1.3 Securing engine to engine and gearbox support

Special tools and workshop equipment required



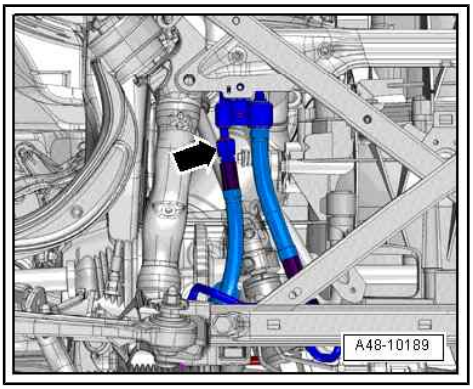
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- Lifting tackle - 3033-
- Engine and gearbox support - VAS 6095- with universal mounting - VAS 6095/1- and support bracket for V8 FSI engine -VAS 6095/1-6A-
- Workshop hoist - VAS 6100-
- Lift arm extension/workshop hoist - VAS 6101-

Procedure

- Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .
- Engine secured with support -VAS 6131/13-7- .

Vehicles with hydraulic power steering:



Note

Lay a cloth under the separating point to catch escaping hydraulic fluid.

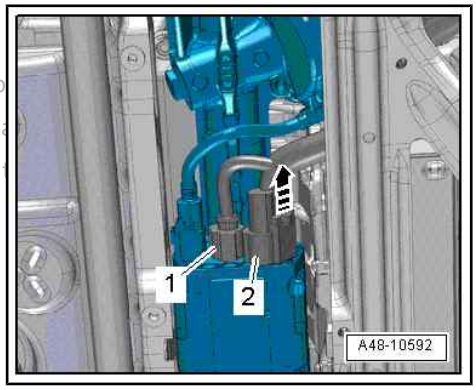
– Disconnect hydraulic line -arrow- for power steering.

Vehicles with electromechanical power steering:

– Unplug electrical connector -1- at power steering control unit - J500- .

– Move electrical wiring harness clear.

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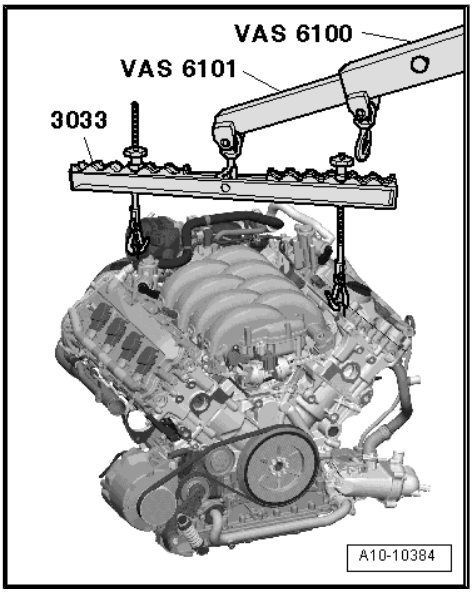
Note

Disregard -item 2- and -arrow-.

All vehicles (continued):

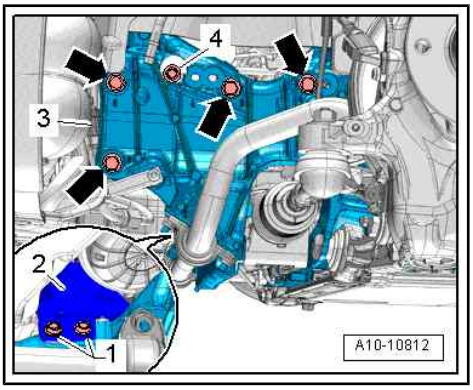
– Attach lifting tackle - 3033- to engine lifting eyes and workshop hoist as shown in illustration.

– Take up weight of engine with workshop hoist, but do not lift.



– Unplug electrical connector -3- on left electrohydraulic engine mounting solenoid valve - N144- .

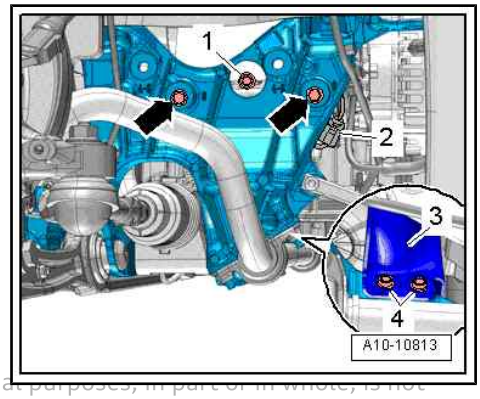
– Remove bolt -4- for engine mounting (left-side).



Note

Disregard items marked -1, 2- and -arrows-.

– Unplug electrical connector -2- on right electrohydraulic engine mounting solenoid valve - N145- .
– Remove bolt -1- for engine mounting (right-side).

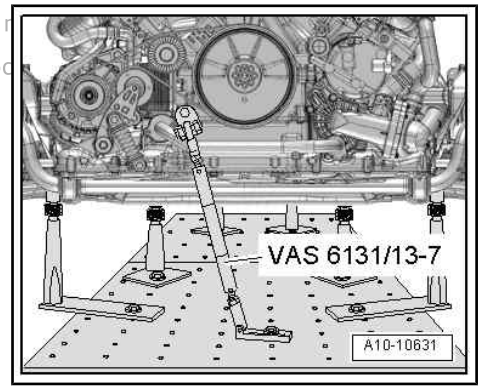


Note

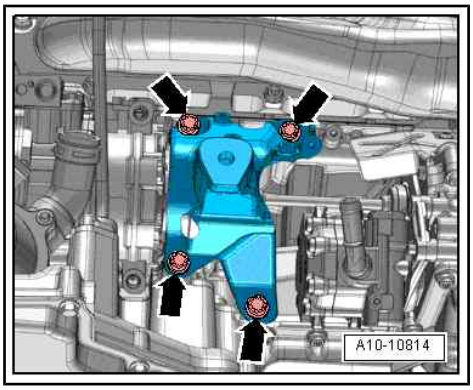
Disregard items marked -3, 4- and -arrows-.

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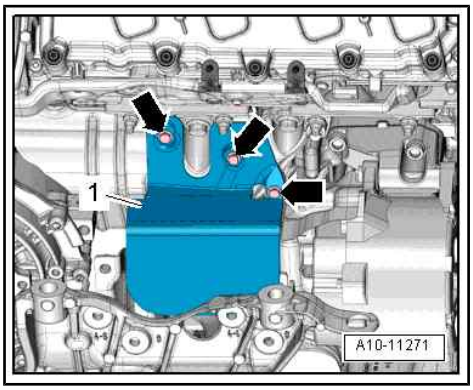
– Remove support -VAS 6131/13-7- from engine.
– Lift engine off engine cross member.



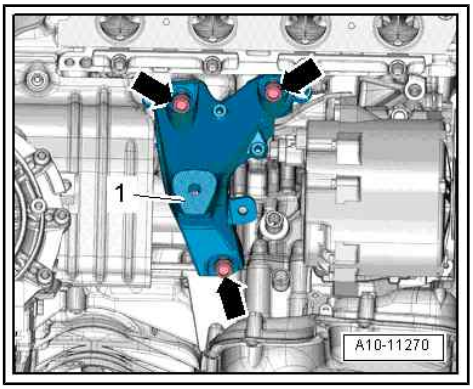
– Unscrew bolts -arrows- and remove engine support (left-side).



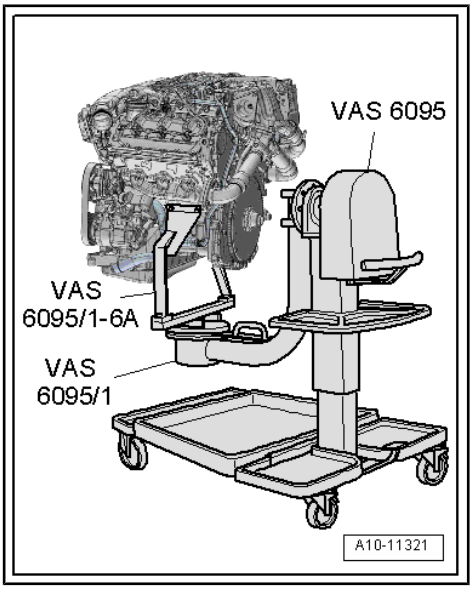
– Remove bolts -arrows- and detach heat shield -1-.



– Remove bolts -arrows- and detach engine support -1-.
– Tie up starter on engine.



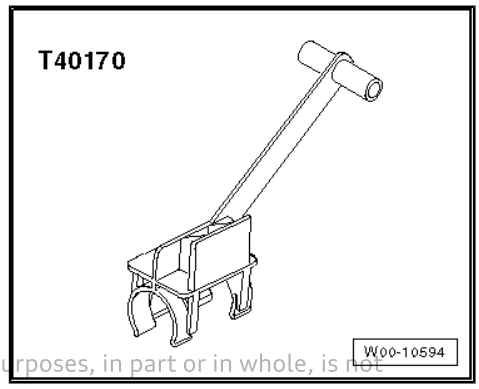
– Secure engine to engine and gearbox support - VAS 6095- (40 Nm) using universal mounting - VAS 6095/1- and support bracket for V8 FSI engine -VAS 6095/1-6A- , as shown in illustration.



1.4 Installing engine

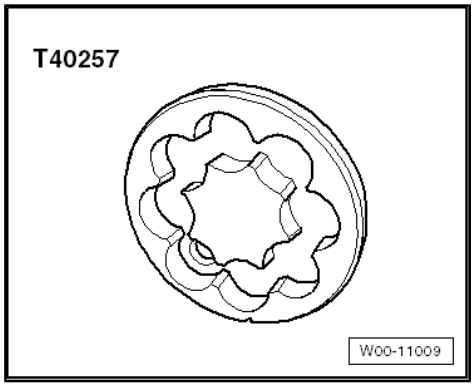
Special tools and workshop equipment required

♦ Transportation lock - T40170-

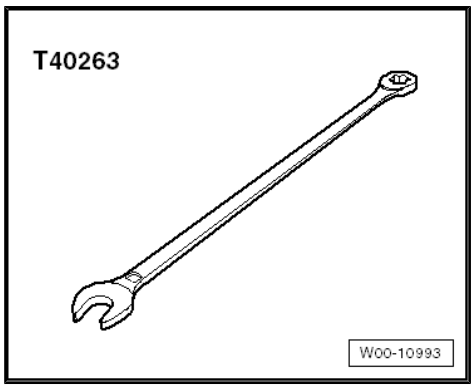


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- Turning-over tool - T40257-



- Wrench, 21 mm - T40263-



Tightening torques

Note

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

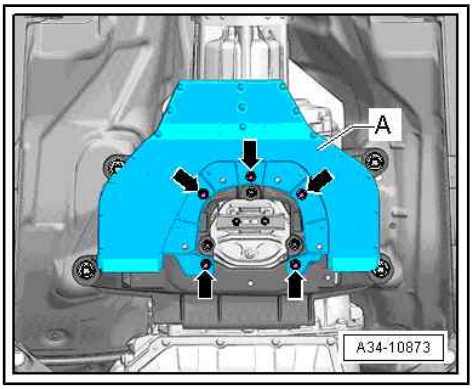
Component		Nm
Bolts/nuts	M6	9
	M7	15
	M8	20
	M10	40
	M12	65

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Assembly mountings
⇒ "2.1 Exploded view - assembly mountings", page 53

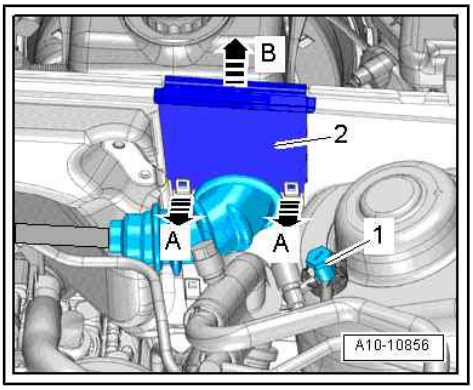
Air duct on tunnel cross member - tightening torques

– Tighten bolts -arrows- to 3 Nm.



Earth stud at suspension turret - tightening torque

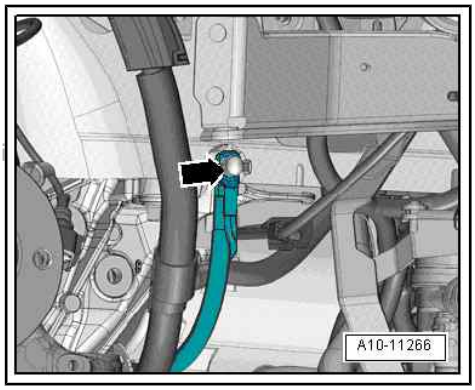
– Tighten earth stud -1- to 9 Nm.



Earth wiring at longitudinal member - tightening torque

– Tighten nut -arrow- to 9 Nm.

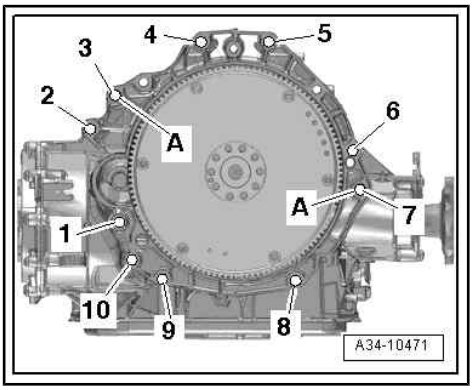
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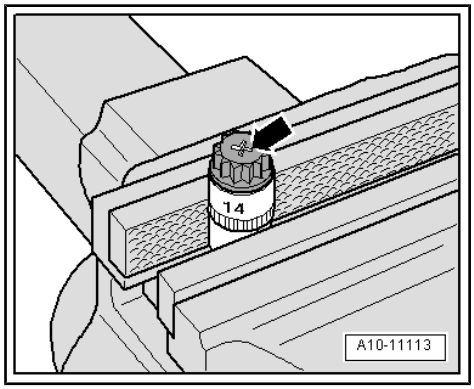
Engine to dual clutch gearbox 0B5

Item	Bolt	Nm
1[1)]	M10x50 [2)]	65
2[1)], 3, 4, 5, 6	M12x100 [3)]	30 +90°
7[4)]	M12x175 [3)]	30 +90°
8, 9, 10	M10x60 [3)]	15 +90°
A	Dowel sleeves for centralising	

- [1)] Also secures starter.
- [2)] Property class 10.9. The steel bolt may be re-used as often as necessary.
- [3)] Aluminium bolts must not be used more often than twice ⇒ page 48 .
- [4)] Vehicles with electromechanical power steering: with nut and washer. Counterhold nut when loosening and tightening.



- The aluminium bolts -2 … 10- may only be used twice. After first use, bolts must therefore be identified with an “X” made by two chisel marks -arrow-.
- To avoid damaging the bolts when making this mark, do not clamp them directly in a vice. Clamp a 14 mm socket with 1/2" drive in a vice and insert the bolt as shown.
- Bolts already marked with an “X” must not be used again.



Procedure

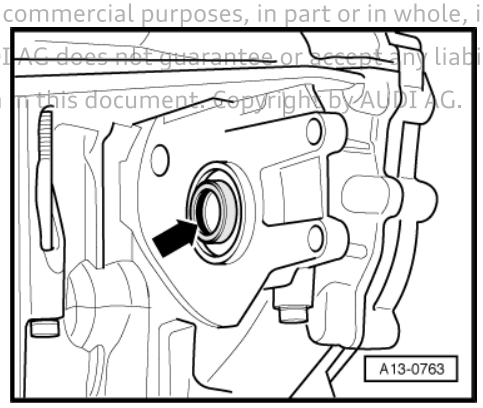
Note

- *Renew bolts tightened with specified tightening angle.*
- *Renew self-locking nuts and bolts as well as seals, gaskets and O-rings.*
- *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 .*
- *Fit all cable ties in the original positions when installing.*

– Before installing gearbox, remove residue from threaded holes for engine/gearbox bolts in cylinder block using a thread tap.

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– Before installing an exchange engine, check whether flat-section O-ring -arrow- is fitted in drive shaft of power steering pump.

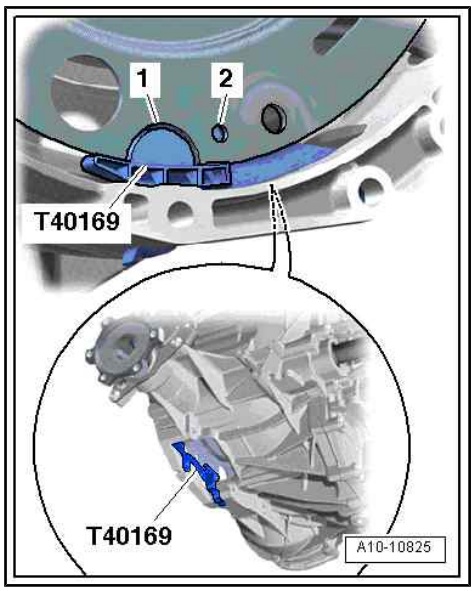


– Install engine supports and engine mountings ⇒ page 53 .

– The following preparations are required before joining engine and gearbox:

– Insert assembly aid - T40169- into gearbox housing and clutch module from below, as illustrated.

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

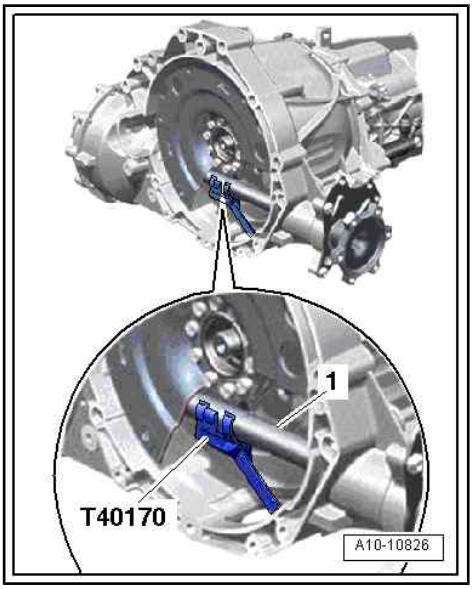


Note

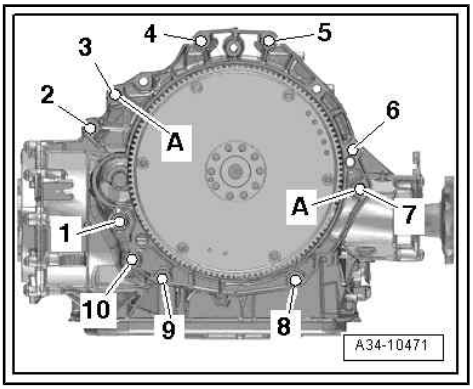
There is only one inspection hole on the circumference; turn the clutch module accordingly.

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

– Insert transportation lock - T40170- into gearbox housing from below and clamp onto flange shaft -1-.
– Hold ATF lines in installation position when joining engine and subframe.



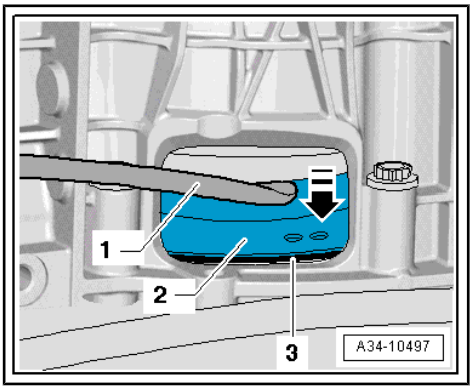
– Check whether dowel sleeves -A- for centring engine and gearbox are fitted in cylinder block; install missing dowel sleeves.
– Check whether aluminium bolts securing engine to gearbox can be reused; if so, apply marking ⇒ page 48 .
– Bring gearbox into position on engine and tighten bolts -1 … 10-.
– Remove transport lock - T40170- and assembly aid - T40169- .
– Install engine supports and engine mountings ⇒ page 53 .



Note

The following step is necessary to ensure that the clutch module is straight and that it makes even contact with the drive plate.

– Use assembly lever -1- to press clutch module -2- slightly against drive plate -3- in direction of -arrow-.

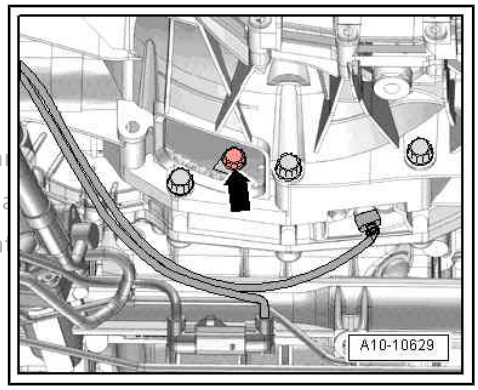


– Bolt clutch module onto drive plate as follows:

Note

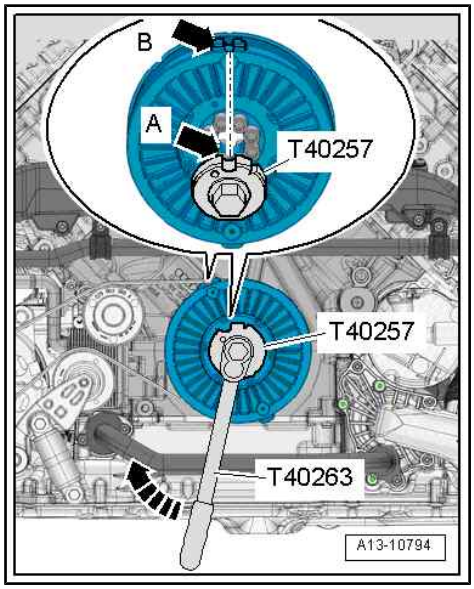
Use ring spanner insert AF 16 - V.A.G 1332/14- to tighten bolts.

– Screw in first bolt -arrow- hand-tight (2 Nm).



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– Fit turning-over tool - T40257- onto wrench (21 mm) - T40263- .
– Position turning-over tool - T40257- on bolts of vibration damper.
• Semi-circular recess -arrow A- on turning-over tool - T40257- must point to semi-circular recess -arrow B- on vibration damper.

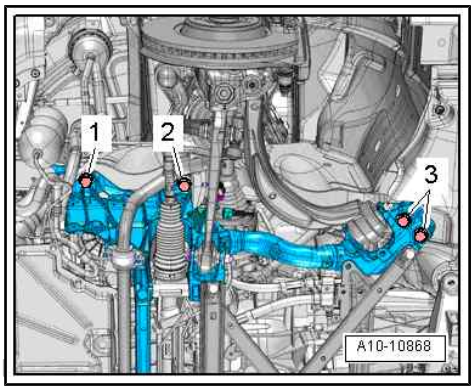


Note

Disregard notch on turning-over tool - T40257- .

– Turn crankshaft 180° in direction of engine rotation -arrow-.
– Tighten bolt accessible in this crankshaft position to specified torque ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox .
– Turn crankshaft by 60° each time and tighten remaining 5 bolts to specified torque ⇒ Rep. gr. 34 ; Removing and installing gearbox; Tightening torques for gearbox .
– Install power steering hydraulic lines ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Exploded view - hydraulic lines, reservoir .
– Secure drive shafts (left and right) to gearbox flange shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .
– Install selector lever cable ⇒ Rep. gr. 34 ; Selector mechanism; Removing and installing selector lever cable .
– Install ATF lines ⇒ Rep. gr. 34 ; ATF circuit; Removing and installing ATF lines .
– Install exhaust manifolds with catalytic converters ⇒ page 281 .
– Raise engine/gearbox assembly using scissor-type assembly platform - VAS 6131 A- .
– Align subframe and tunnel cross member on longitudinal members according to markings made before removal.

– Tighten subframe bolts only to specified torque (do not turn further); the bolts should only be fully tightened after performing the wheel alignment check ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Exploded view - subframe .

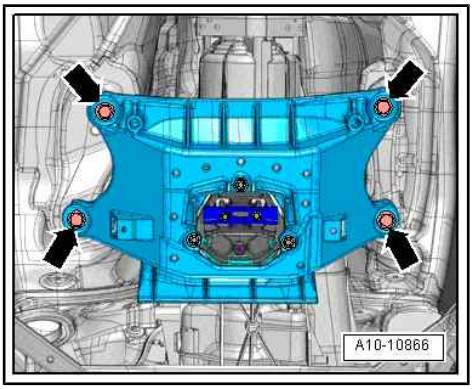


WARNING

Risk of accident if bolted connections are loose.

- ***Do NOT drive the vehicle unless the subframe bolts have been tightened to their final torque.***

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– Tighten bolts -arrows- for tunnel cross-piece ⇒ Rep. gr. 34 ; Assembly mountings; Exploded view - assembly mountings .

– Secure air duct on tunnel cross member ⇒ page 47 .

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

– Secure intermediate steering shaft to steering rack ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Exploded view - hydraulic lines, reservoir .

– Install propshaft ⇒ Rear final drive; Rep. gr. 39 ; Propshaft; Exploded view - propshaft .

– Align the exhaust system so it is free of stress ⇒ page 286 .

– Install subframe cross brace and anti-roll bar ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Exploded view - subframe .

– Install upper suspension links and secure suspension strut to track control link ⇒ Running gear, axles, steering; Rep. gr. 40 ; Suspension strut, upper links; Exploded view - suspension strut, upper links .

– Install brake calipers ⇒ Brake system; Rep. gr. 46 ; Front brakes; Exploded view - front brakes .

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

– Install electrical wiring, terminal 30 wiring junction 2 - TV22- and cover for electronics box in engine compartment ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes .

– Install earth stud ⇒ page 47 .

– Install electrical wiring ⇒ page 47 .

– Install oil lines ⇒ page 178 .

– Install body brace ⇒ Running gear, axles, steering; Rep. gr. 40 ; Suspension strut, upper links; Removing and installing body brace .

– Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 ; Windscreen washer system; Exploded view - windscreen washer system .

– Install refrigerant lines ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .

– Install secondary air pipes ⇒ page 294 .

– Install lock carrier cover ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .

– Install air pipes and air cleaner housing ⇒ page 245 .

– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

– Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .

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Caution

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

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

– Before starting engine, top up hydraulic fluid in power steering reservoir ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Checking power steering fluid level .

Note

The power steering pump must not be run when dry.

– Connect coolant hoses with plug-in connector ⇒ page 220 .

– Fill up with coolant ⇒ page 198 .

Note

Do not reuse coolant.

– Charge refrigerant system ⇒ Air conditioner with refrigerant R134a; Rep. gr. 87 ; Refrigerant circuit .

– Align subframe ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Exploded view - subframe .

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

– Fit front wheels ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres; Tightening torque for wheel bolts .

– Perform wheel alignment ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheel alignment .

WARNING

Risk of accident if bolted connections are loose.

- ***Tighten subframe bolts to final setting after performing wheel alignment check.***

– Fill up ATF ⇒ Rep. gr. 34 ; ATF; Draining and filling ATF .

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

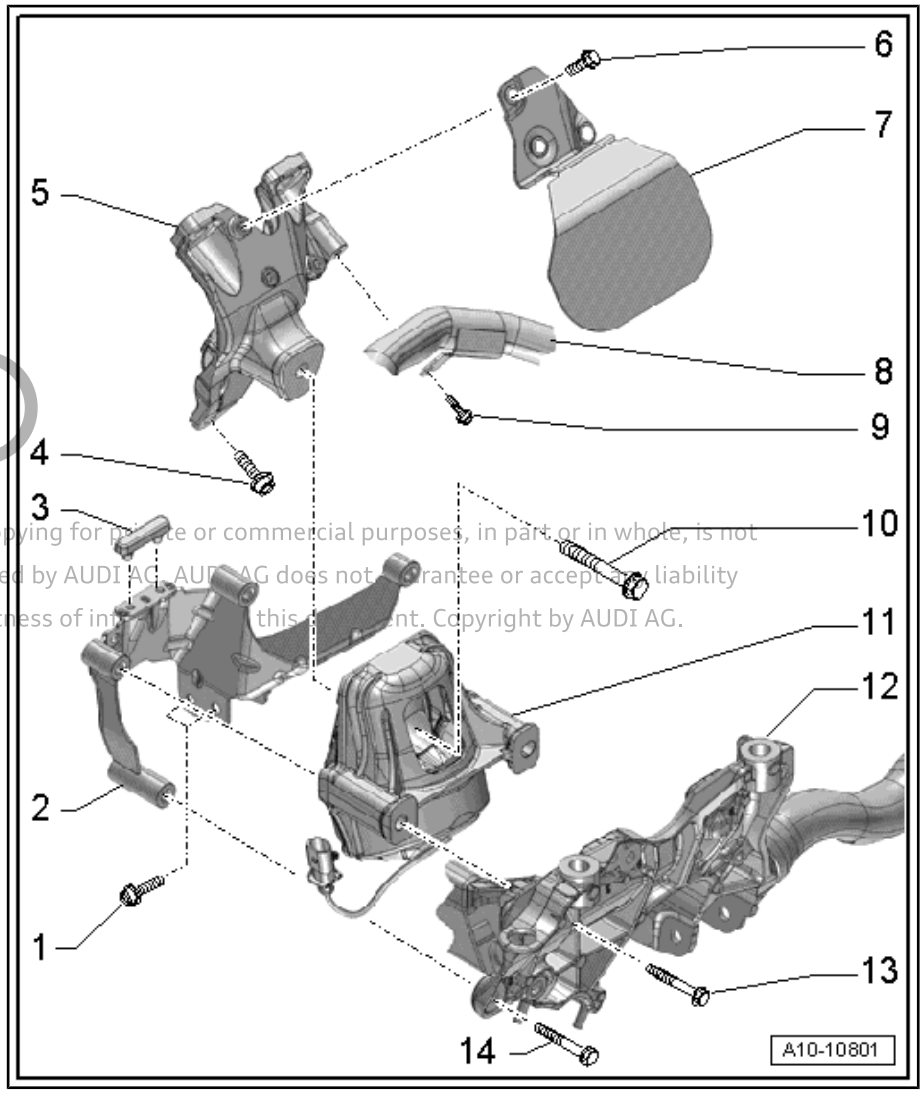
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2 Assembly mountings

⇒ "2.1 Exploded view - assembly mountings", page 53

⇒ "2.2 Removing and installing engine mountings", page 54

2.1 Exploded view - assembly mountings



1 - Bolt
- ❑ 20 Nm

2 - Bracket
- ❑ For engine mounting
- ❑ Renew retaining plate if engine mounting is defective
- ❑ Check retaining plate on opposite side; renew if necessary

3 - Stop buffer
- ❑ Not available as separate part

4 - Bolt
- ❑ 40 Nm

5 - Engine support

6 - Bolt
- ❑ 10 Nm

7 - Heat shield

8 - Not fitted

9 - Not fitted

10 - Bolt
- ❑ Renew
- ❑ 90 Nm +90°

11 - Engine mounting
- ❑ Left side with left electrohydraulic engine mounting solenoid valve - N144-
- ❑ Right side with right electrohydraulic engine mounting solenoid valve - N145-
- ❑ Removing and installing: engine mounting (left-side) ⇒ page 54 , engine mounting (right-side) ⇒ page 61
- ❑ Renew in pairs

12 - Subframe

13 - Bolt
- ❑ 55 Nm

14 - Bolt
- ❑ 55 Nm

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2.2 Removing and installing engine mountings

⇒ “2.2.1 Removing and installing engine mounting (left-side)”, page 54

⇒ “2.2.2 Removing and installing engine mounting (right-side)”, page 61

2.2.1 Removing and installing engine mounting (left-side)

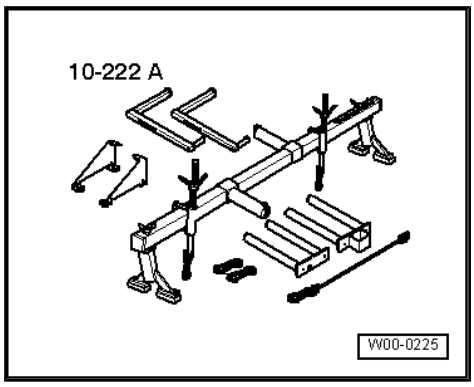
Note

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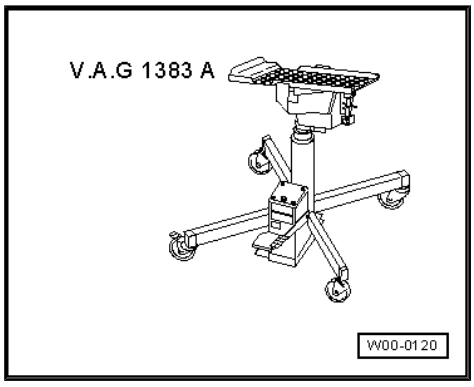
- *To avoid repeat repairs, proceed as follows if an engine mounting is defective:*
- *Renew engine mounting and corresponding retaining plate.*
- *Also renew engine mounting on opposite side; check corresponding bracket and renew if necessary.*

Special tools and workshop equipment required

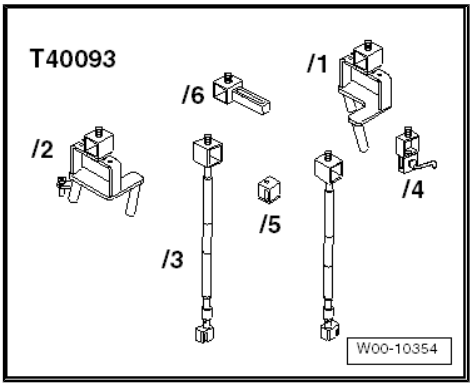
- Support bracket - 10 - 222 A-



- Engine and gearbox jack - V.A.G 1383 A-



♦ Engine support supplement set - T40093-



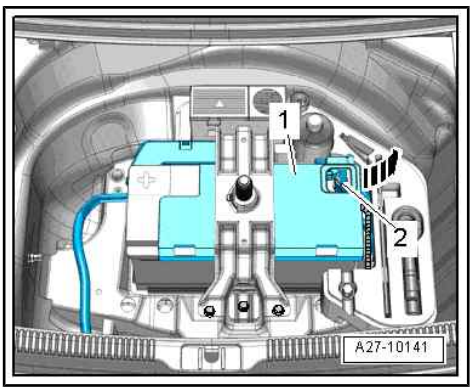
Removing

– Bring front wheels into straight-ahead position.

Caution

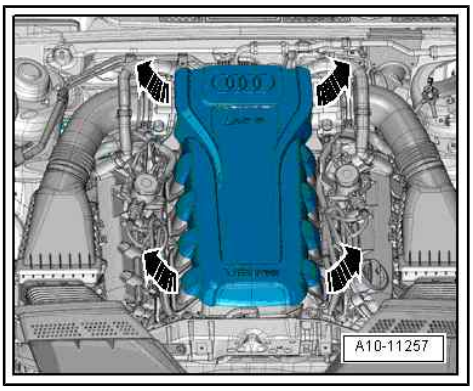
Risk of irreparable damage to electronic components.

♦ ***Observe notes on procedure for disconnecting the battery.***



– Disconnect earth wire -2- from battery terminal ⇒ Electrical system; Rep. gr. 27 ; Battery, Disconnecting and connecting battery .

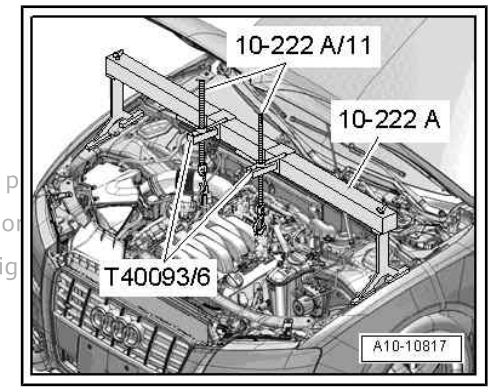
– Remove engine cover panel -arrows-.



– Set up support bracket - 10 - 222 A- with adapters -T40093/6- on suspension turrets (left and right) as illustrated.

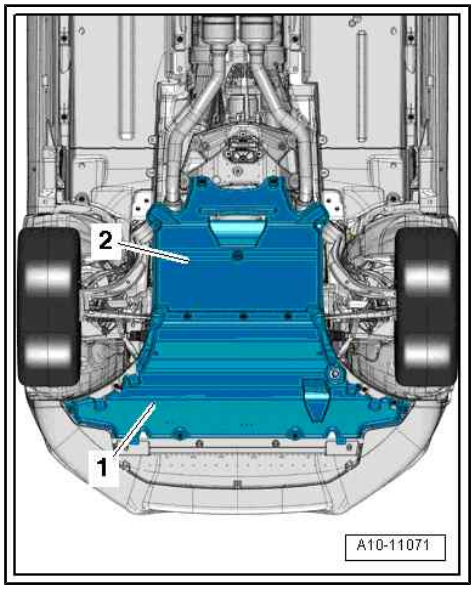
– Attach spindles -10 - 222 A /11- to engine lifting eyes.

– Partly take up weight of engine with spindles.



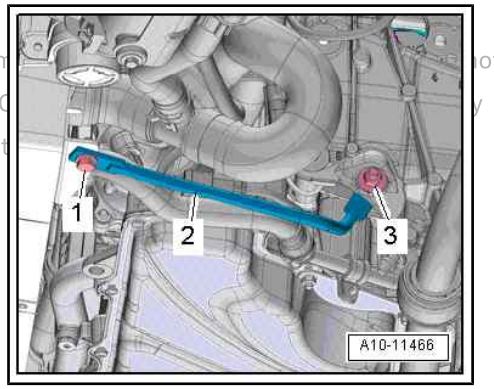
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– Remove noise insulation -1- and -2- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Remove both front wheels.
– Remove wheel housing liners (front left and front right) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
– Unbolt drive shaft (left and right) from gearbox flange shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Removing and installing drive shaft .

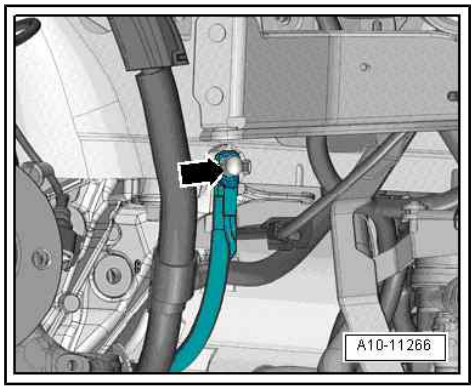


– Unscrew bolt -1-, unscrew nut -3- and detach strut -2- (both sides).

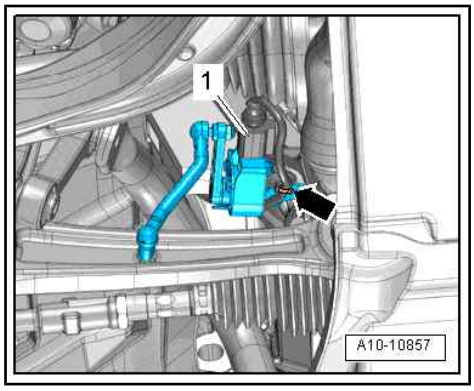
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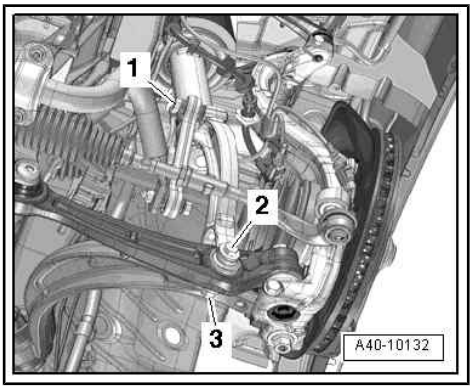
– Unscrew nut -arrow- on longitudinal member (right-side) and move earth cables clear.



– If installed, unplug electrical connector -1- on headlight range control sender 1 - G233- and move wiring clear -arrow-.



– Remove bolt -1- for anti-roll bar on both sides.

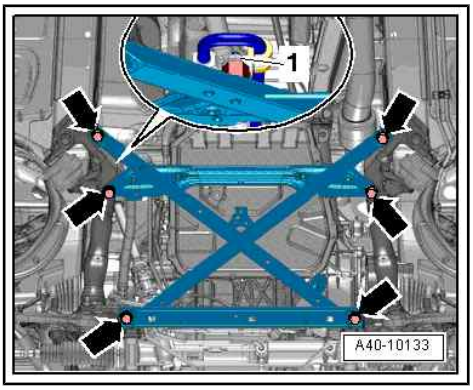


Note

Disregard -items 2 and 3-.

Vehicles with hydraulic power steering:

– Remove nut -1- for power steering hydraulic line.

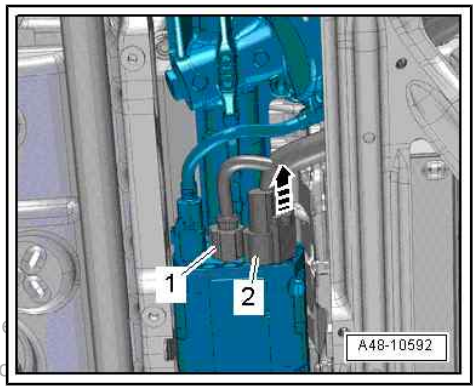


Note

Disregard -arrows-.

Vehicles with electromechanical power steering:

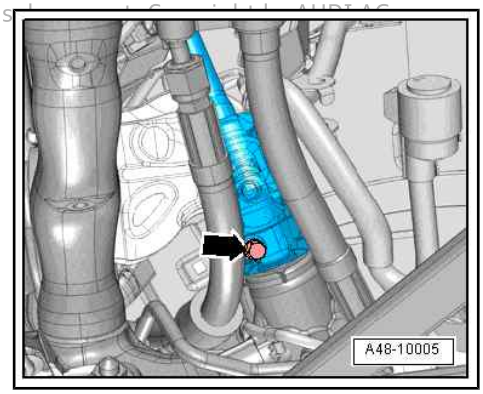
– Unplug electrical connector -2- at power steering control unit - J500- (release retainer -arrow- and press down release catch).
– Unplug electrical connector -1-.
– Move electrical wiring harness clear.



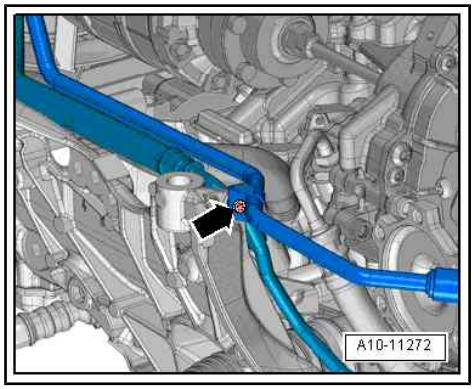
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All vehicles (continued):

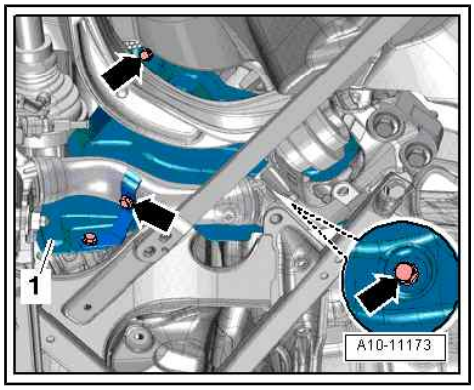
– Detach intermediate steering shaft from steering rack and move clear by telescoping upwards ⇒ Running gear, axles, steering; Rep. gr. 48 ; Steering column; Removing and installing intermediate steering shaft .



– Remove bolt -arrow- for ATF lines.

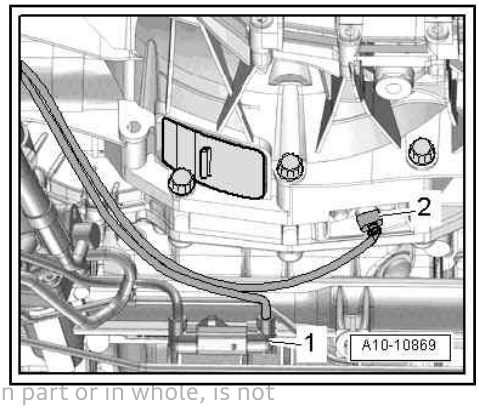


– Remove bolts -arrows- on both sides but leave heat shield -1- in position.



Vehicles with hydraulic power steering:

– Unplug electrical connector -1- at Servotronic solenoid valve - N119- and move electrical wiring clear.



Note

Disregard -item 2-.

– Move clear hydraulic hose for power steering on subframe (left-side).

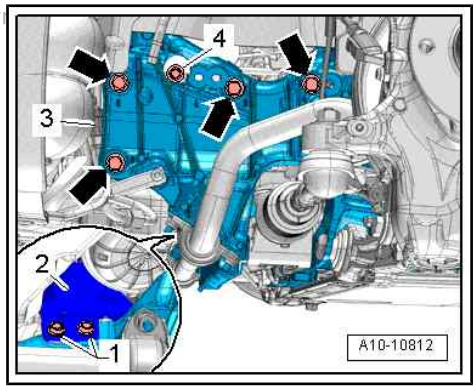
All vehicles (continued):

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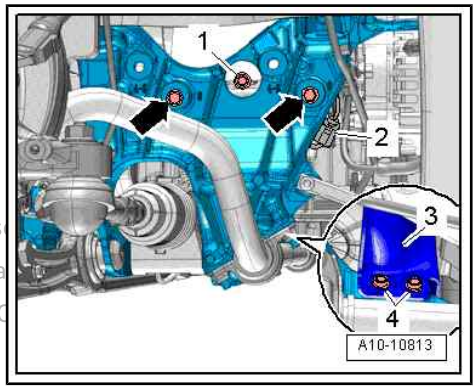
– Move clear electrical wiring on subframe (right-side).

– Unplug electrical connector -3- on left electrohydraulic engine mounting solenoid valve - N144- .

– Remove bolts -1, 4- and -arrows-; retaining plate -2- for engine mounting (left-side) does not have to be removed.



– Unplug electrical connector -2- on right electrohydraulic engine mounting solenoid valve - N145- .
– Remove bolt -1- for engine mounting (right-side).

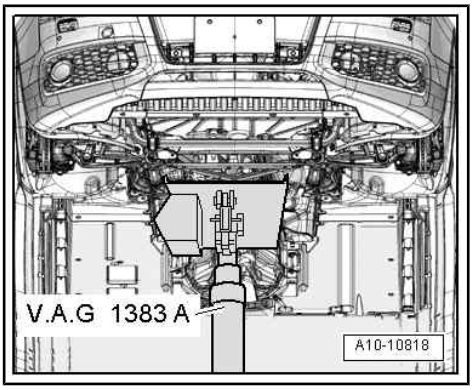


Note

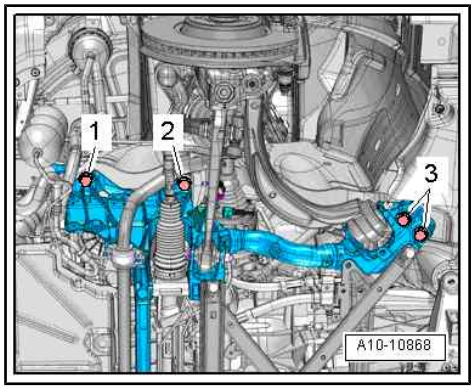
Disregard items marked -3, 4- and -arrows-.

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– Support subframe with engine and gearbox jack - V.A.G 1383 A- as shown in illustration.



– Mark installation position of subframe on longitudinal members with felt-tip pen.
– Unscrew subframe bolts -1, 2, 3- on both sides in several stages and in diagonal sequence.



Caution

Risk of damage to running gear components.

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

– Lower subframe using engine and gearbox jack - V.A.G 1383 A- only far enough to detach engine mounting (left-side). At the same time check clearance of hydraulic fluid hoses (left-side) and electrical wiring (right-side).
– Detach engine mounting (left-side).

Installing

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

- Tightening torques ⇒ “2.1 Exploded view - assembly mountings”, page 53

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Note

- *Renew bolts tightened with specified tightening angle.*
- *Fit all cable ties in the original positions when installing.*

– Align subframe on longitudinal members according to markings made before removal.
– Tighten subframe bolts only to specified torque (do not turn further); the bolts should only be fully tightened after performing the wheel alignment check ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Exploded view - subframe .

WARNING

Risk of accident if bolted connections are loose.

- ***Do NOT drive the vehicle unless the subframe bolts have been tightened to their final torque.***

– Install anti-roll bar ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing anti-roll bar .
– Secure suspension strut to track control link ⇒ Running gear, axles, steering; Rep. gr. 40 ; Suspension strut, upper links; Exploded view - suspension strut, upper links .
– Install electrical wiring ⇒ page 47 .
– Observe steps required after re-connecting battery ⇒ Electrical system; Rep. gr. 27 ; Battery; Disconnecting and connecting battery .
– Install ATF lines ⇒ Rep. gr. 34 ; ATF circuit; Removing and installing ATF lines .

– Secure intermediate steering shaft to steering rack ⇒ Running gear, axles, steering; Rep. gr. 48 ; Steering column; Removing and installing intermediate steering shaft .
– Install power steering hydraulic line ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Exploded view - hydraulic lines, reservoir .
– Secure drive shafts (left and right) to gearbox flange shafts ⇒ Running gear, axles, steering; Rep. gr. 40 ; Drive shaft; Exploded view - drive shaft .
– Install wheel housing liners ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .
– Fit front wheels ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres; Tightening torque for wheel bolts .
– Perform wheel alignment ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheel alignment .

WARNING

Risk of accident if bolted connections are loose.

- ***Tighten subframe bolts to final setting after performing wheel alignment check.***

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

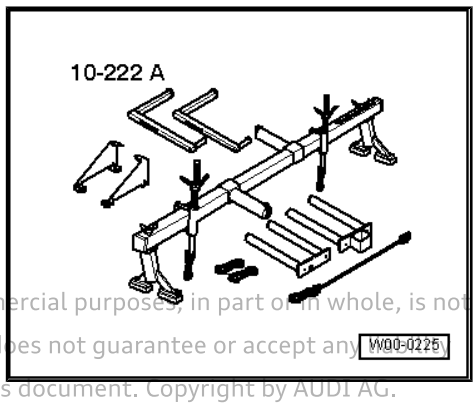
2.2.2 Removing and installing engine mounting (right-side)

Note

- *To avoid repeat repairs, proceed as follows if an engine mounting is defective:*
- *Renew engine mounting and corresponding retaining plate.*
- *Also renew engine mounting on opposite side; check corresponding bracket and renew if necessary.*

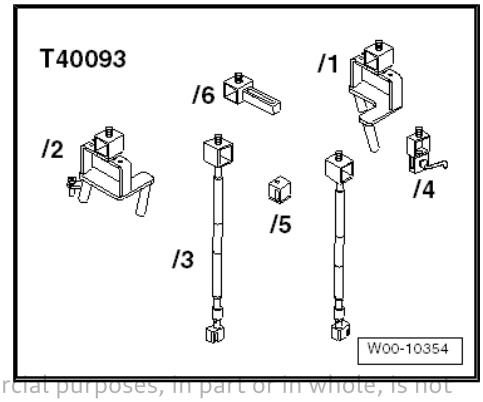
Special tools and workshop equipment required

- Support bracket - 10 - 222 A-



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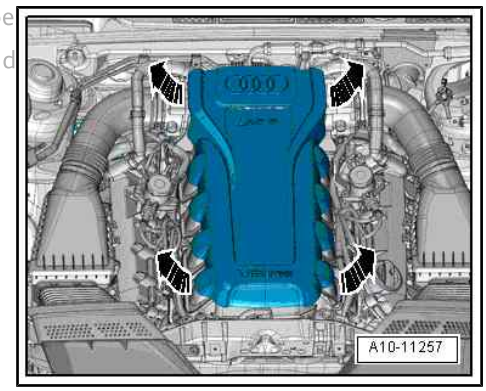
♦ Engine support supplement set - T40093-



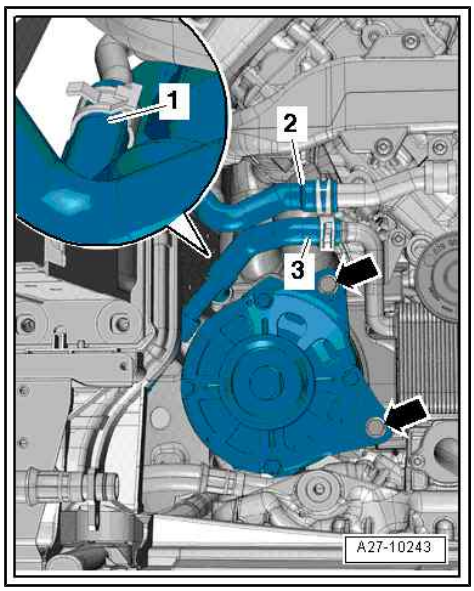
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Removing

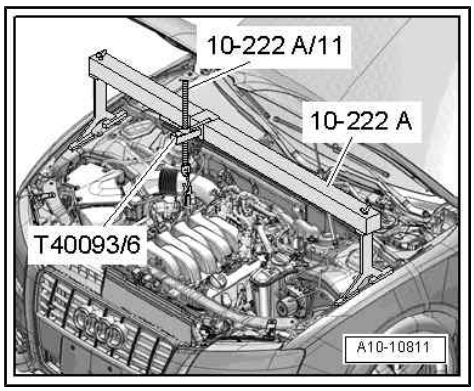
– Remove engine cover panel -arrows-.



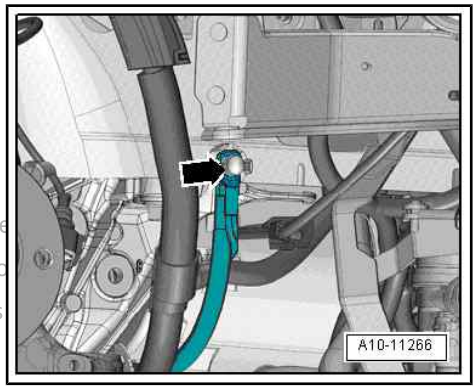
– Remove alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .



– Set up support bracket - 10 - 222 A- with adapter -T40093/6- on suspension turrets (left and right) as illustrated.
– Attach spindle -10 - 222 A /11- to engine lifting eye (right-side).
– Partly take up weight of engine with spindle.

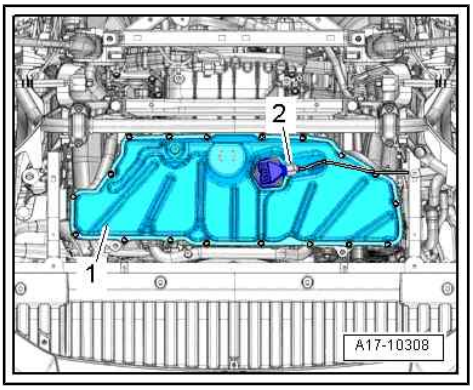


– Unscrew nut -arrow- on longitudinal member (right-side) and move earth cables clear.



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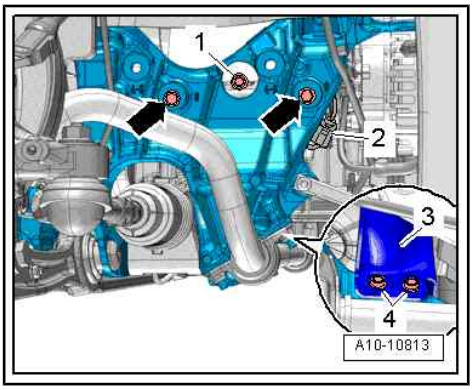
– Unplug electrical connector -2- at oil level and oil temperature sender - G266- and move clear.



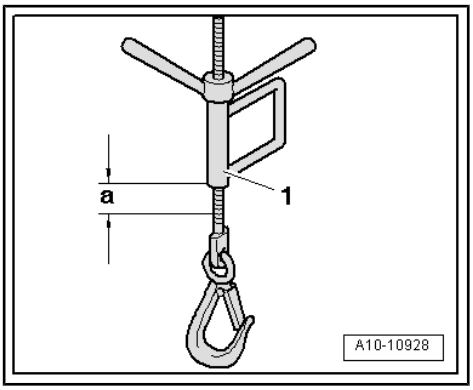
Note

Disregard -item 1-.

– Unplug electrical connector -2- on solenoid valve (right-side) for electro-hydraulic engine mounting - N145- and move clear.
– Remove bolts -1, 4- and -arrows- for retaining plate for engine mounting (right-side).
– Move wiring harness clear at retaining plate -3- for engine mounting (right-side).
– Move retaining plate for engine mounting clear to one side.



– Using spindle - 10 - 222 A /11- -item 1-, raise engine through distance -a-.
• Distance -a- = approx. 20 mm.
– Detach engine mounting (right-side).



Installing

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

• Tightening torques
⇒ “2.1 Exploded view - assembly mountings”, page 53

Note

Fit all cable ties in the original positions when installing.

– Install electrical wiring ⇒ page 47 .
– Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .

3 Engine cover panel

⇒ “3.1 Removing and installing engine cover panel”, page 64

3.1 Removing and installing engine cover panel

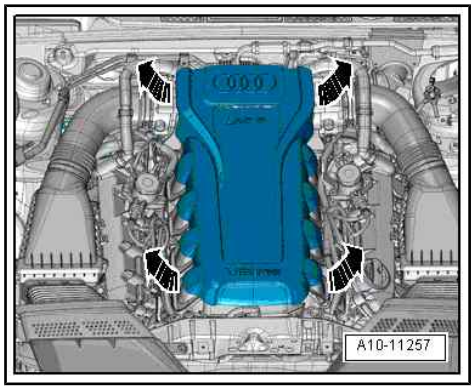
Removing

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

Installing

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

– Press engine cover panel with both hands first into retaining clips at rear and then into retaining clips at front.



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13 – Crankshaft group

1 Cylinder block (pulley end)

⇒ "1.1 Exploded view - poly V-belt drive", page 65

⇒ "1.2 Removing and installing poly V-belt", page 67

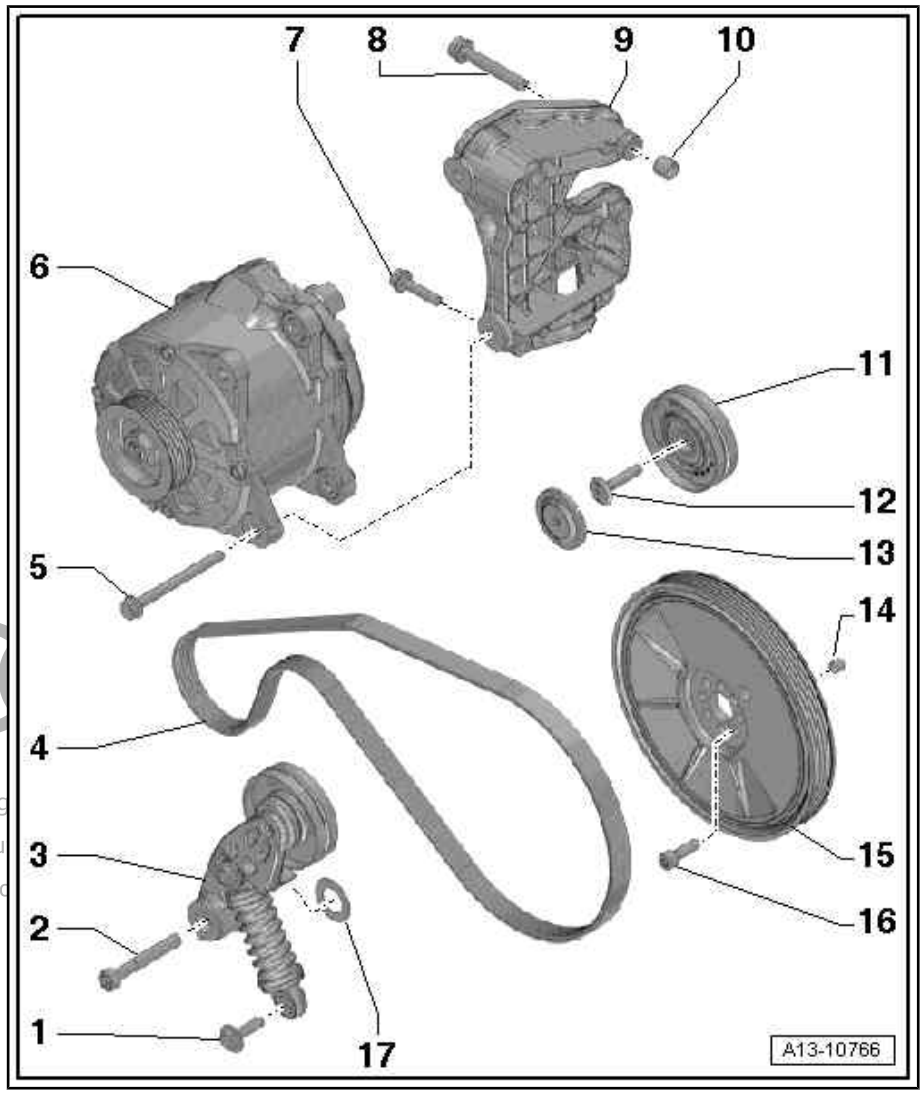
⇒ "1.3 Removing and installing tensioner for poly V-belt", page 68

⇒ "1.4 Removing and installing vibration damper", page 68

⇒ "1.5 Removing and installing bracket for ancillaries", page 69

⇒ "1.6 Renewing crankshaft oil seal (pulley end)", page 69

1.1 Exploded view - poly V-belt drive



1 - Bolt
- ❑ 22 Nm

2 - Bolt
- ❑ 55 Nm

3 - Tensioner
- ❑ For poly V-belt
- ❑ Removing and installing ⇒ page 68

4 - Poly V-belt
- ❑ Check for wear
- ❑ Before removing, mark direction of rotation with chalk or felt-tip pen
- ❑ Removing and installing ⇒ page 67
- ❑ Do not kink
- ❑ When installing, make sure it is properly seated on pulleys

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

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

7 - Bolt
- ❑ 22 Nm

8 - Bolt
- ❑ 46 Nm

9 - Bracket
- ❑ For alternator

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- ❑ Removing and installing ⇒ page 69

10 - Dowel sleeve

- ❑ For bracket for alternator
- ❑ 2x

11 - Idler roller

- ❑ For poly V-belt
- ❑ With bolt -item 12-

12 - Bolt

- ❑ 22 Nm

13 - Cap

- ❑ For idler roller

14 - Dowel sleeve

- ❑ For vibration damper

15 - Vibration damper

- ❑ With poly V-belt pulley
- ❑ Removing and installing ⇒ page 68

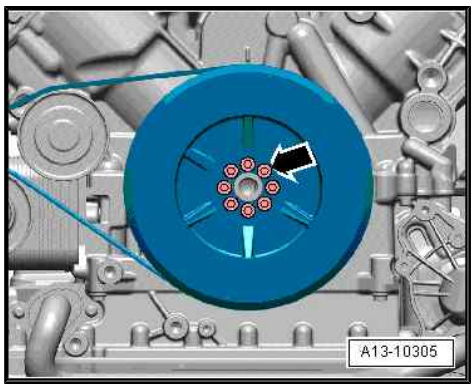
16 - Bolt

- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 66

17 - Thrust washer

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Vibration damper - tightening torque and sequence



Note

- ♦ *Check that dowel sleeve is fitted in vibration damper. Install dowel sleeve if necessary.*
- ♦ *Renew bolts tightened with specified tightening angle.*

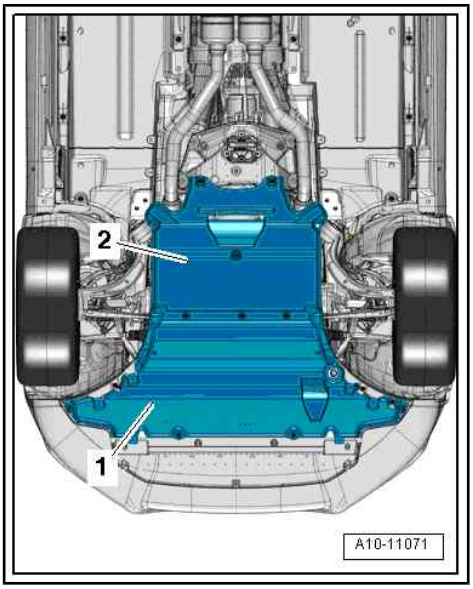
– Tighten bolts in 3 stages as follows:

Stage	Bolts	Tightening torque/angle specification
1.	-arrow-	15 Nm in diagonal sequence
2.	-arrow-	22 Nm in diagonal sequence
3.	-arrow-	Turn 90° further in diagonal sequence

1.2 Removing and installing poly V-belt

Removing

– Remove front noise insulation -1- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

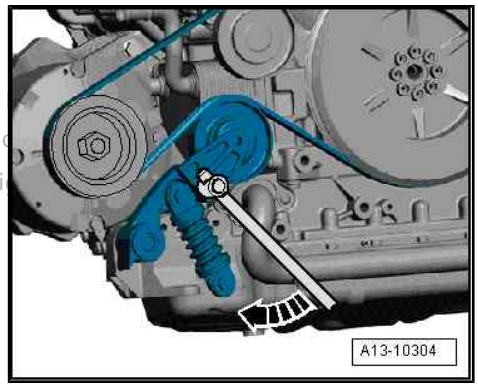


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Caution

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

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



– To slacken poly V-belt turn tensioner in direction of -arrow-.

– Remove poly V-belt and release tensioner.

Installing

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

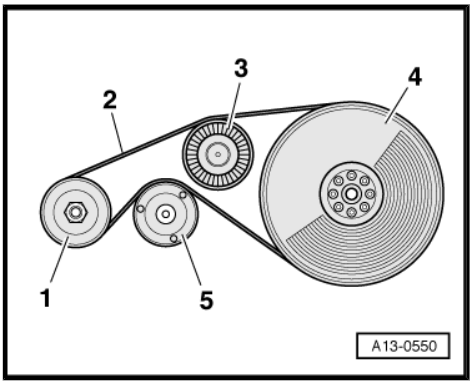
– Fit poly V-belt -2- onto pulleys in the following sequence:

1 - Alternator

3 - Idler roller

4 - Vibration damper

5 - Tensioner



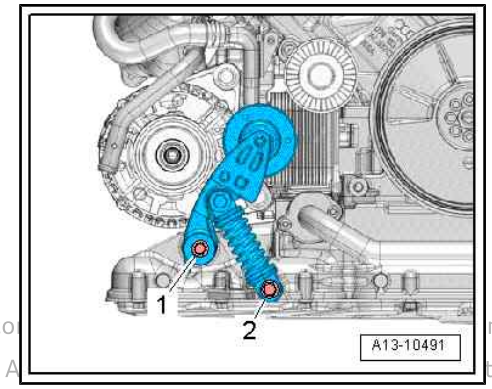
Note

When installing poly V-belt, make sure it is properly seated on pulleys.

– Start engine and check that poly V-belts run properly.

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

1.3 Removing and installing tensioner for poly V-belt



Removing

– Remove radiator with radiator cowl ⇒ page 220 .

– Remove poly V-belt ⇒ page 67 .

– Remove bolts -1- and -2-.

– Detach poly V-belt tensioner from sump (top section)

Installing

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

• Tightening torque ⇒ “1.1 Exploded view - poly V-belt drive”, page 65

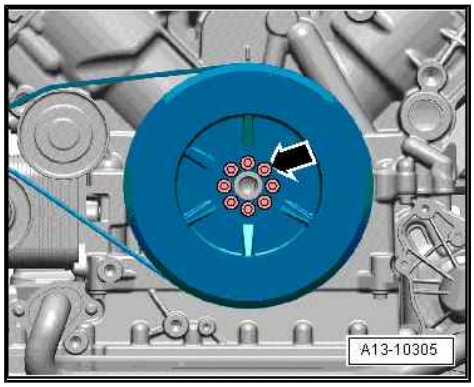
– Attach poly V-belt tensioner with thrust washer at sump (top section) and secure.

– Install poly V-belt ⇒ page 67 .

– Install radiator with radiator cowl ⇒ page 220 .

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1.4 Removing and installing vibration damper



Removing

– Remove radiator with radiator cowl ⇒ page 220 .

– Slacken off bolts -arrow- on vibration damper several turns (counterhold with ring spanner on nut for poly V-belt pulley for alternator).

– Remove poly V-belt ⇒ page 67 .

– Unscrew bolts -arrow- and remove vibration damper.

Installing

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

• Tightening torque ⇒ Fig. ““Vibration damper - tightening torque and sequence”“ , page 66

Note

- *Check that dowel sleeve is fitted in vibration damper. Install dowel sleeve if necessary.*
- *Renew bolts tightened with specified tightening angle.*
- *The threaded holes for the bolts must be cleaned using a thread tap or similar.*
- *Apply locking fluid to bolts when installing; for locking fluid refer to ⇒ Electronic parts catalogue .*

• The vibration damper can only be fitted in one position.

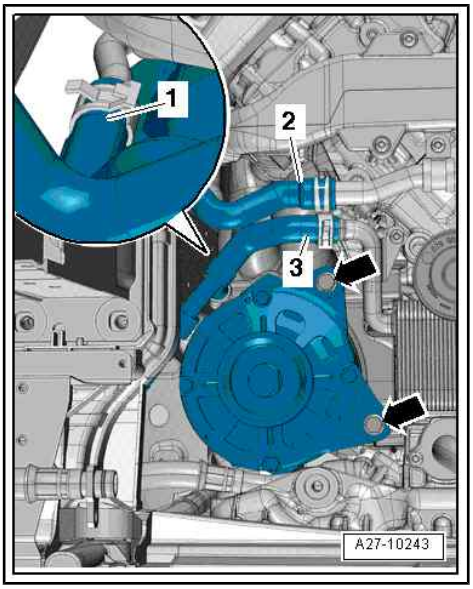
– Install radiator with radiator cowl ⇒ page 220 .

– Install poly V-belt ⇒ page 67 .

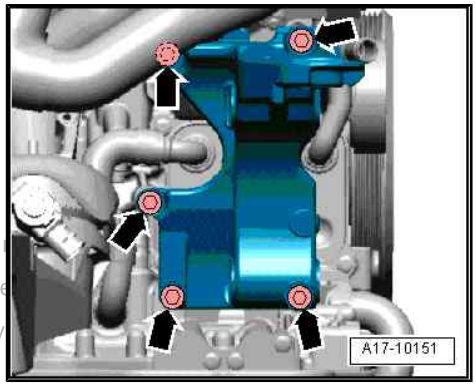
1.5 Removing and installing bracket for ancillaries

Removing

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



– Remove bolts -arrows- and detach bracket for alternator.



Installing

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

- Tightening torques
  ⇒ “1.1 Exploded view - poly V-belt drive”, page 65

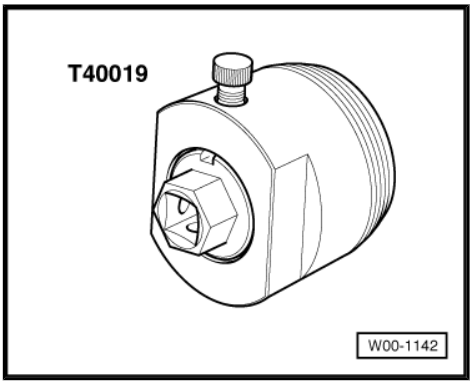
– Install alternator ⇒ Electrical system; Rep. gr. 27 ; Alternator; Removing and installing alternator .

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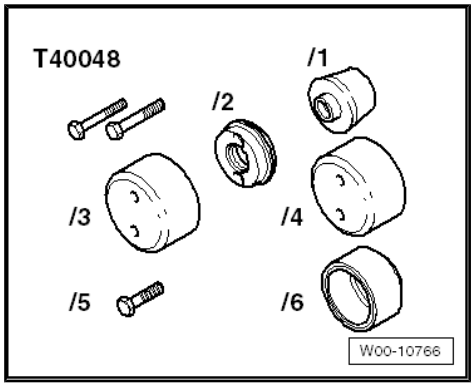
1.6 Renewing crankshaft oil seal (pulley end)

Special tools and workshop equipment required

♦ Oil seal extractor - T40019-



♦ Assembly tool - T40048-



♦ Bolts M8x55 mm (2x)

Procedure

– Remove vibration damper ⇒ page 68 .

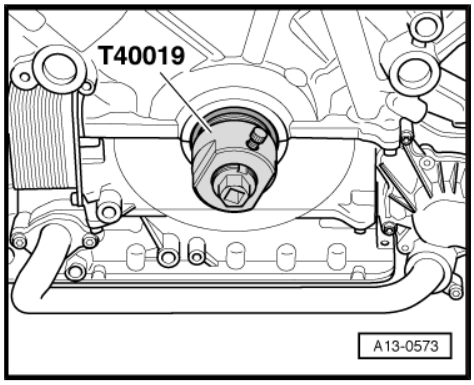
– Adjust inner part of oil seal extractor -T40019- so that it is level with the outer part and lock in position with knurled screw.

– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).

– Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.

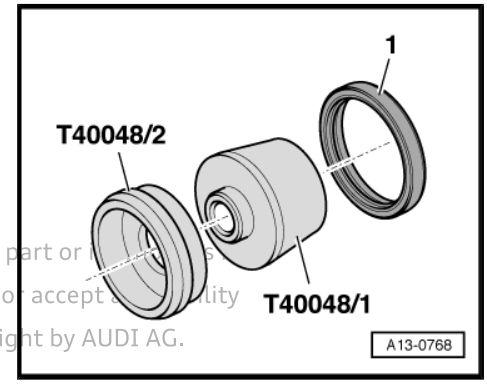
– Clamp flats of oil seal extractor in vice and use pliers to remove oil seal.

– Clean contact surface and sealing surface.



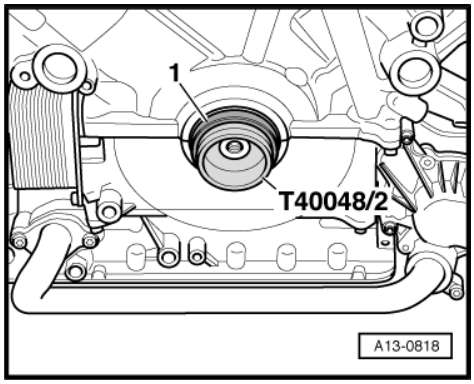
– Fit assembly aid -T40048/1- onto assembly sleeve -T40048/2- and slide oil seal -1- onto assembly sleeve.

– Detach assembly aid.



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– Fit assembly sleeve -T40048/2- on crankshaft and slide oil seal -1- into sealing surface in cylinder block.



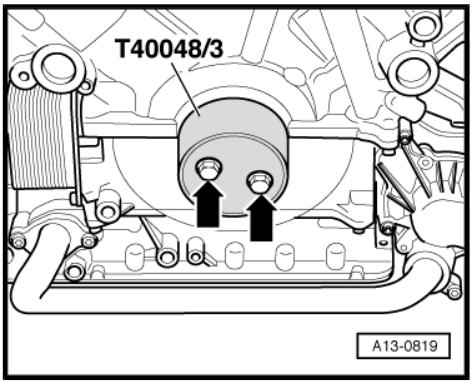
Note

Leave assembly sleeve in position on crankshaft when pressing in seal.

– Apply press sleeve -T40048/3- to crankshaft using two M8×55 mm bolts -arrows-.
– Screw in bolts hand-tight at first.
– Tighten bolts alternately, $^{1}/_{2}$ turn at a time, to press in oil seal onto stop.

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

– Install vibration damper ⇒ page 68 .



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2 Cylinder block (gearbox end)

⇒ “2.1 Exploded view - drive plate”, page 72

⇒ “2.2 Removing and installing drive plate”, page 72

⇒ “2.3 Renewing crankshaft oil seal (gearbox end)”, page 73

2.1 Exploded view - drive plate

Note

When performing assembly work, secure engine to engine and gearbox support - VAS 6095- ⇒ page 41 .

1 - Bolt
- ❑ Renew
- ❑ 60 Nm +90°

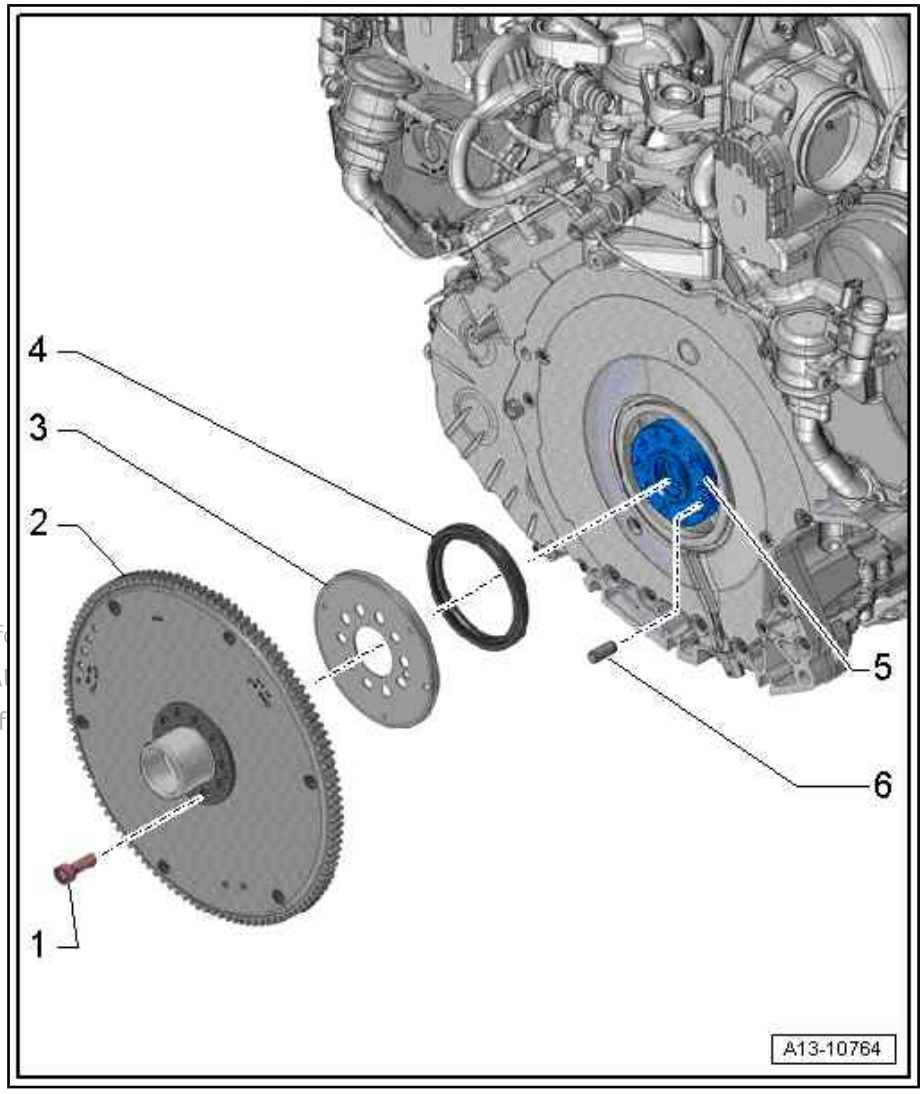
2 - Drive plate
- ❑ With bearing flange
- ❑ Check running surface on bearing flange and holes for clutch module for cracks and scoring.
- ❑ Removing and installing ⇒ page 72

3 - Sender wheel
- ❑ For engine speed sender - G28-

4 - Oil seal
- ❑ For crankshaft (gearbox end)
- ❑ Renewing ⇒ page 73

5 - Crankshaft

6 - Dowel pin

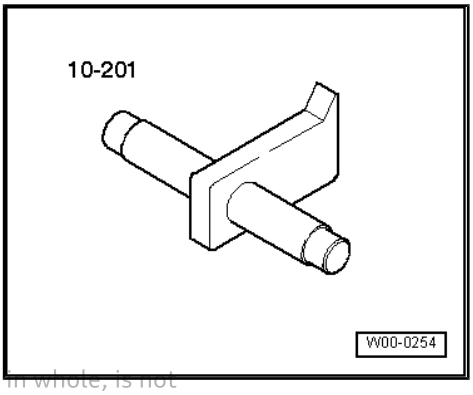


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2.2 Removing and installing drive plate

Special tools and workshop equipment required

♦ Counterhold tool - 10 - 201-

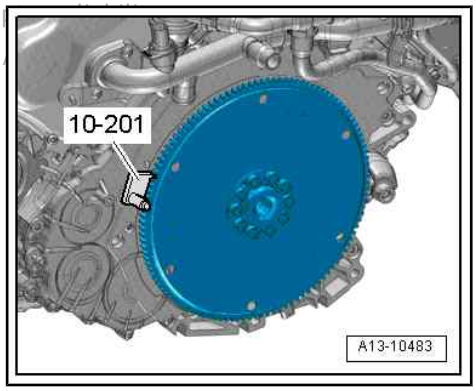


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Removing

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

– Insert counterhold tool - 10 - 201- to slacken bolts.



Caution

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

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

– Remove bolts and take off drive plate and sender wheel.

Installing

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

- Tightening torque
⇒ “2.1 Exploded view - drive plate”, page 72

Note

Renew bolts tightened with specified tightening angle.

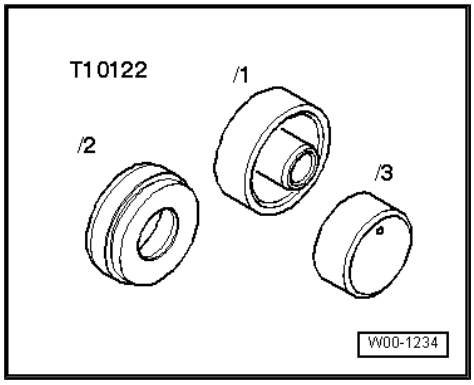
– Pay attention to dowel pin when installing sender wheel and drive plate.

– Fit counterhold tool - 10 - 201- the other way round to tighten bolts.

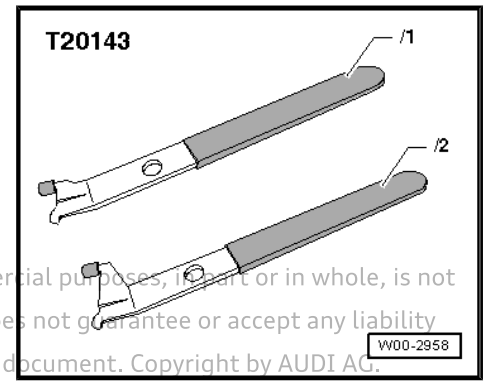
2.3 Renewing crankshaft oil seal (gearbox end)

Special tools and workshop equipment required

♦ Fitting tool - T10122-



♦ Extractor hook - T20143/2-



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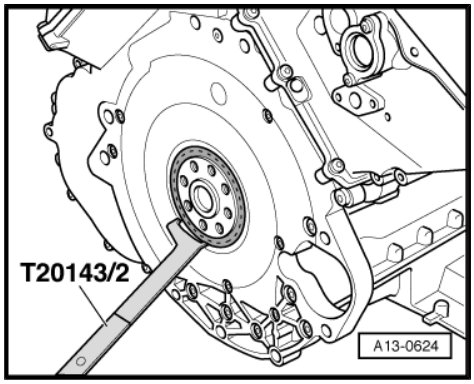
Procedure

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

– Remove drive plate ⇒ page 72 .

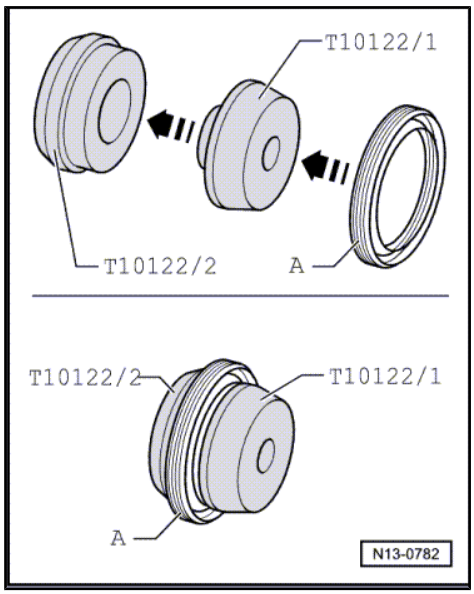
– Pry out oil seal using extractor hook -T20143/2- .

– Clean contact surface and sealing surface.

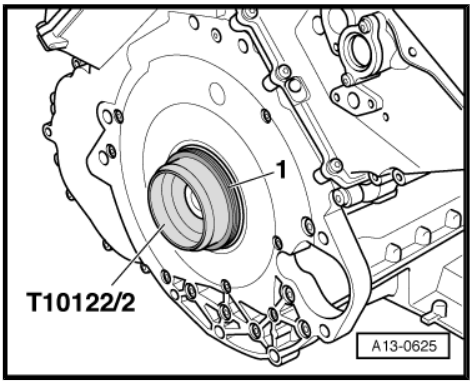


– Fit assembly aid -T10122/1- onto assembly sleeve -T10122/2- and slide oil seal -A- onto assembly sleeve.

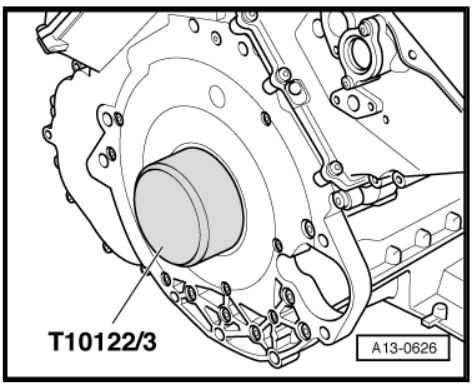
– Detach assembly aid.



– Fit assembly sleeve -T10122/2- with oil seal -1- onto crankshaft.



– Drive in oil seal uniformly until flush all round using thrust piece -T10122/3- .
– Install drive plate ⇒ page 72 .



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3 Crankshaft

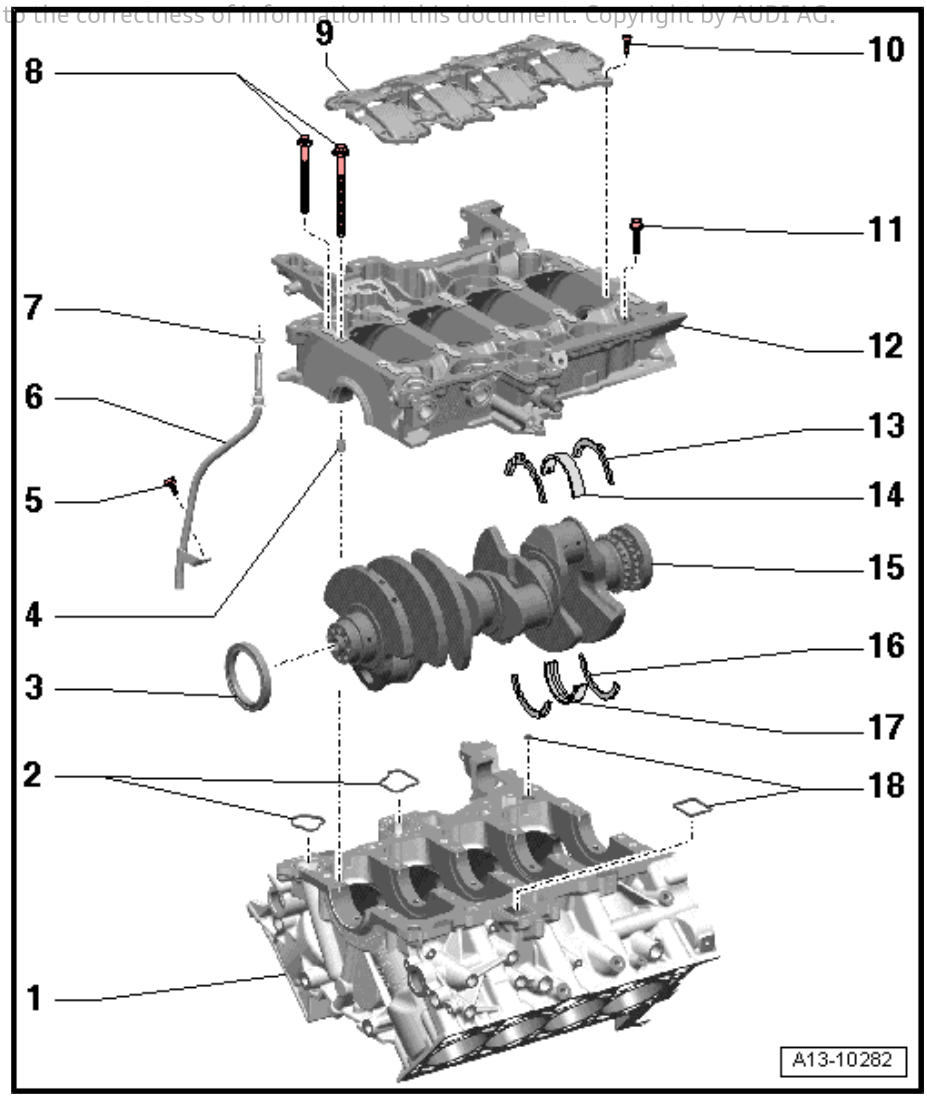
⇒ “3.1 Exploded view - crankshaft”, page 76
⇒ “3.2 Allocation of main bearing shells”, page 79
⇒ “3.3 Crankshaft dimensions”, page 81
⇒ “3.4 Measuring axial clearance of crankshaft”, page 81
⇒ “3.5 Measuring radial clearance of crankshaft”, page 82

3.1 Exploded view - crankshaft

Note

When performing assembly work, secure engine to engine and gearbox support - VAS 6095- ⇒ page 41 .

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1 - Cylinder block
- ❑ Matched to -item 12-
- ❑ Applying sealant onto cylinder block (for retaining frame) ⇒ page 78

2 - Seals
- ❑ Renew

3 - Oil seal
- ❑ For crankshaft (pulley end)
- ❑ Renewing ⇒ page 69

4 - Dowel sleeve
- ❑ 2x
- ❑ Insert in retaining frame
- ❑ Installation position ⇒ page 78

5 - Bolt
- ❑ 9 Nm

6 - Guide tube
- ❑ For oil dipstick

7 - O-ring
- ❑ Renew

8 - Bolts
- ❑ For retaining frame
- ❑ Renew
- ❑ Different bolt lengths
- ❑ Tightening torque and sequence ⇒ page 79

9 - Baffle plate

10 - Bolt
- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 77

11 - Bolt

- ❑ For sealing surfaces: retaining frame to cylinder block
- ❑ Different bolt lengths
- ❑ Tightening sequence ⇒ page 79

12 - Retaining frame

- ❑ Matched to -item 1-
- ❑ Applying sealant onto cylinder block (for retaining frame) ⇒ page 78

13 - Thrust washer

- ❑ Only fitted on 4th crankshaft bearing
- ❑ Installation position: oil grooves face outwards
- ❑ Make sure it engages in retaining frame

14 - Bearing shell

- ❑ For retaining frame (without oil groove)
- ❑ Always renew after removing
- ❑ Fit new bearing shells for retaining frame with the correct colour coding: new crankshaft ⇒ page 79 , used and machined crankshaft ⇒ page 80

15 - Crankshaft

- ❑ Measuring axial clearance ⇒ page 81
- ❑ Measuring radial clearance ⇒ page 82
- ❑ Crankshaft dimensions ⇒ page 81

16 - Thrust washer

- ❑ Only fitted on 4th crankshaft bearing
- ❑ Installation position: oil grooves face outwards

17 - Bearing shell

- ❑ For cylinder block (with oil groove)
- ❑ Always renew after removing
- ❑ Fit new bearing shells for cylinder block with the correct colour coding: new crankshaft ⇒ page 79 , used and machined crankshaft ⇒ page 80

18 - Seals

- ❑ Renew

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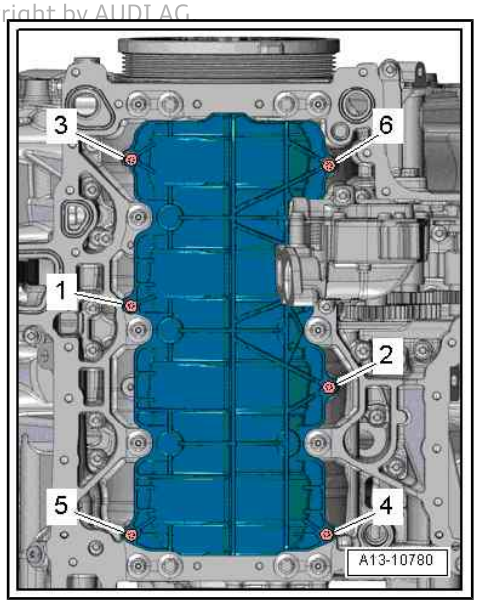
Baffle plate - tightening torque and tightening sequence

Note

Renew bolts tightened with specified tightening angle.

– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 6-	5 Nm
2.	-1 … 6-	Turn 90° further



Applying sealant onto cylinder block (for retaining frame)

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

Caution

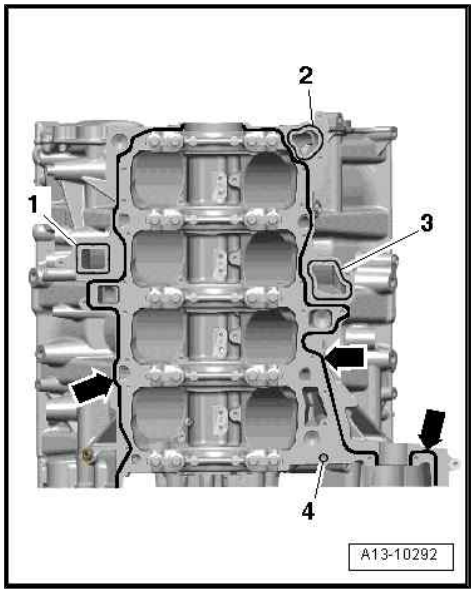
Make sure lubrication system is not clogged by excess sealant.

- ***The sealant beads must not be thicker than specified.***

– Apply beads of sealant -arrows- onto clean sealing surfaces as shown in illustration.

- Width of sealant beads: 2.0 mm.

– Fit seals -1 ... 4-.

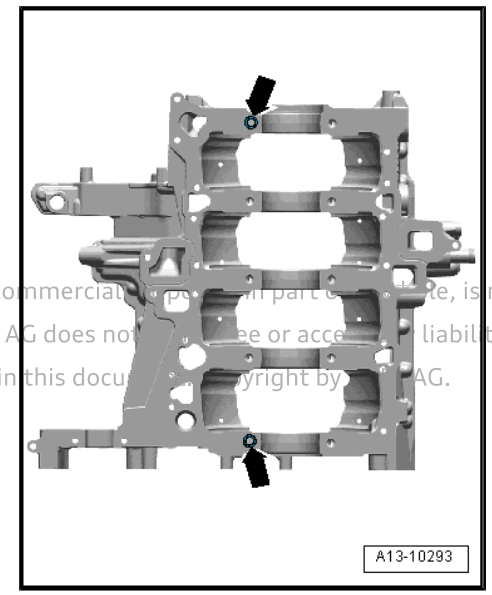


Note

The retaining frame must be installed within 5 minutes after applying the sealant.

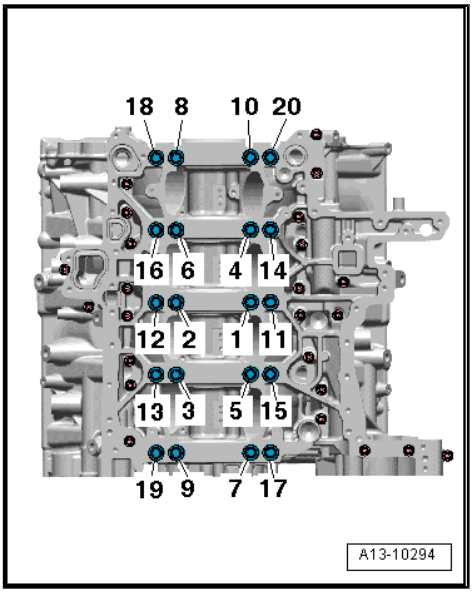
Fitting location of dowel sleeves

– Fit dowel sleeves -arrows-, if not fitted on the retaining frame at the points marked.



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Retaining frame - tightening torque and sequence



Note

Renew bolts tightened with specified tightening angle.

– Tighten bolts in 6 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 10-	30 Nm
2.	-11 … 20-	30 Nm
3.	-1 … 10-	50 Nm
4.	-1 … 10-	Turn 90° further
5.	-11 … 20-	50 Nm
6.	-11 … 20-	Turn 90° further

– Tighten bolts for sealing surfaces between retaining frame and cylinder block -shaded dark- to 9 Nm in diagonal sequence.

3.2 Allocation of main bearing shells

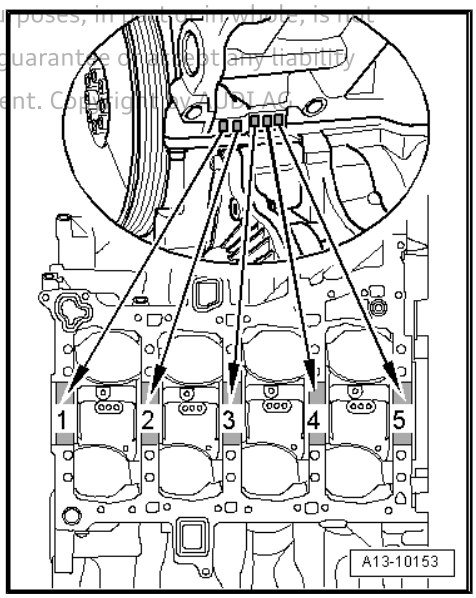
⇒ “3.2.1 Allocation of main bearing shells for new crankshaft”, page 79

⇒ “3.2.2 Allocation of main bearing shells on used and machined crankshafts”, page 80

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3.2.1 Allocation of main bearing shells for new crankshaft

Allocation of crankshaft bearing shells for cylinder block



- Bearing shells of the correct thickness are matched to the bearings in the cylinder block at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- The allocation of the bearing shells to the cylinder block is indicated by letters on the front left of the cylinder block (legible from outside), as shown in illustration.

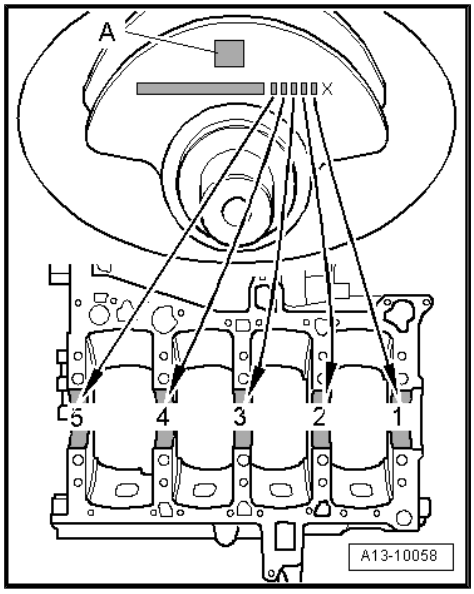
Letter on cylinder block	Colour coding of bearing
R =	Red
S =	Black
G =	Yellow
Ü =	Green
B =	Blue

Note

The code letters are also stamped on the retaining frame.

Allocation of crankshaft bearing shells for retaining frame

- Bearing shells of the correct thickness are matched to the bearings in the retaining frame at the factory. Coloured dots on the side of the bearing shells are used to identify the bearing shell thickness.
- The allocation of the bearing shells to the retaining frame is indicated by letters on the front crankshaft web, as shown in illustration. The “X” indicates the end of the row of letters and is next to the colour coding for bearing 1 (pulley end).



Note

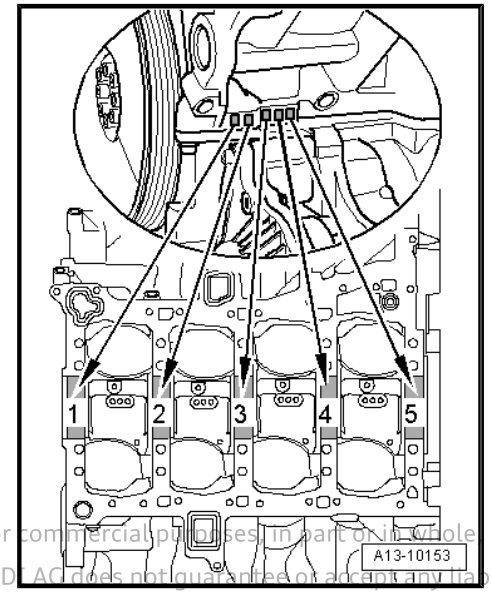
Disregard -item A-.

Letter on crankshaft	Colour coding of bearing
R =	Red
S =	Black
G =	Yellow
Ü =	Green
B =	Blue

3.2.2 Allocation of main bearing shells on used and machined crankshafts

Allocation of crankshaft bearing shells for cylinder block

- Bearing shells are allocated to the cylinder block according to the colour codes stamped on the cylinder block.
- On a used and machined crankshaft, the crankshaft bearing journals must be measured in order to allocate the correct bearing shells.
- Crankshaft dimensions ⇒ page 81 .
- Oversized (thicker) bearing shells are available for a machined crankshaft. However, these bearing shells have the same colour coding as the original-size bearing shells.



Letter on cylinder block	Colour coding of bearing
R =	Red
S =	Black
G =	Yellow
Ü =	Green
B =	Blue

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Allocation of crankshaft bearing shells for retaining frame

- On a used and machined crankshaft, the crankshaft bearing journals must be measured in order to allocate the correct bearing shells.
- Any markings still visible on a machined crankshaft are invalid.
- Allocate the bearing shells according to the measured diameter of the crankshaft bearing journals as follows:

Crankshaft main bearing journal ∅	Colour code of bearing shells for bearing 1, 3, 5 for retaining frame		
Dimensions in mm	**Yellow**	**Green**	**Blue**
Basic dimension 67.000	66.974 … 66.970	66.969 … 66.964	66.963 … 66.958
Repair undersize 66.750 [1)]	66.724 … 66.720	66.719 … 66.714	66.713 … 66.708

- [1)] The colour codes for oversized (thicker) bearing shells for machined crankshafts are the same as those on bearing shells for new crankshafts.

Crankshaft main bearing journal ∅	Colour code of bearing shells for bearing 2 and 4 for retaining frame				
Dimensions in mm	**Red**	**Black**	**Yellow**	**Green**	**Blue**
Basic dimension 67.000	66.974 … 66.973	66.973 … 66.970	66.969 … 66.964	66.965 … 66.960	66.961 … 66.958
Repair undersize 66.750 [1)]	66.724 … 66.723	66.723 … 66.720	66.719 … 66.714	66.715 … 66.710	66.711 … 66.708

- [1)] The colour codes for the oversized (thicker) bearing shells required for a machined crankshaft are the same as those on bearing shells for a new crankshaft, in spite of the greater bearing thickness.

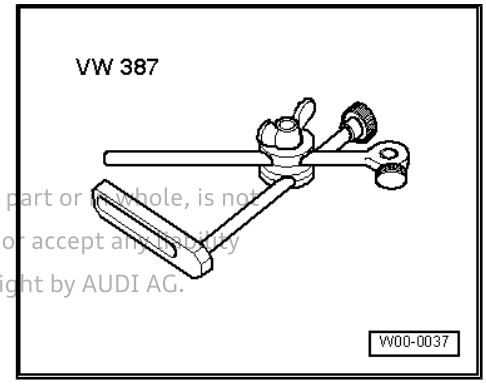
3.3 Crankshaft dimensions

Honing dimension	Crankshaft bearing journal ∅ mm	Crankshaft conrod journal ∅ mm
Basic dimension	67.000 - 0.026 - 0.042	54.000 - 0.024 - 0.040
Repair oversize	66.750 - 0.026 - 0.042	53.750 - 0.024 - 0.040

3.4 Measuring axial clearance of crankshaft

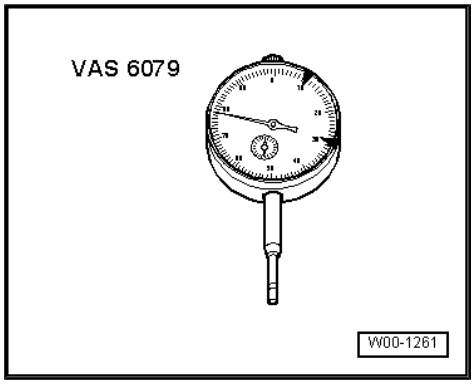
Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



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♦ Dial gauge - VAS 6079-



Procedure

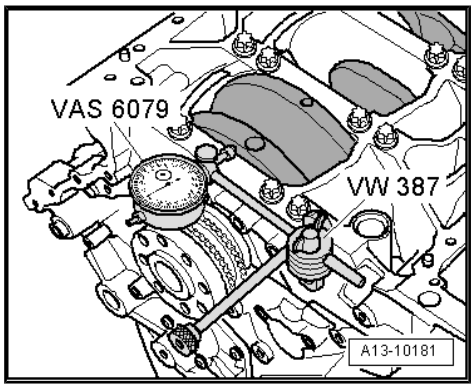
– Secure dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to cylinder block as shown in illustration.

– Apply dial gauge to crank web.

– Press crankshaft against dial gauge by hand and set gauge to “0”.

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

• Axial clearance: 0.090 ... 0.231 mm



3.5 Measuring radial clearance of crankshaft

Special tools and workshop equipment required

♦ Plastigauge

Procedure

– Remove retaining frame and clean bearing journals.

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

• The Plastigauge must be positioned in the centre of the bearing shell.

– Fit retaining frame and tighten to 30 Nm without turning bolts further; do not rotate crankshaft.

– Remove retaining frame again.

– Compare width of Plastigauge with measurement scale.

Radial clearance:

• New: 0.017 ... 0.044 mm.

• Wear limit: 0.08 mm.

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4 Auxiliary drive

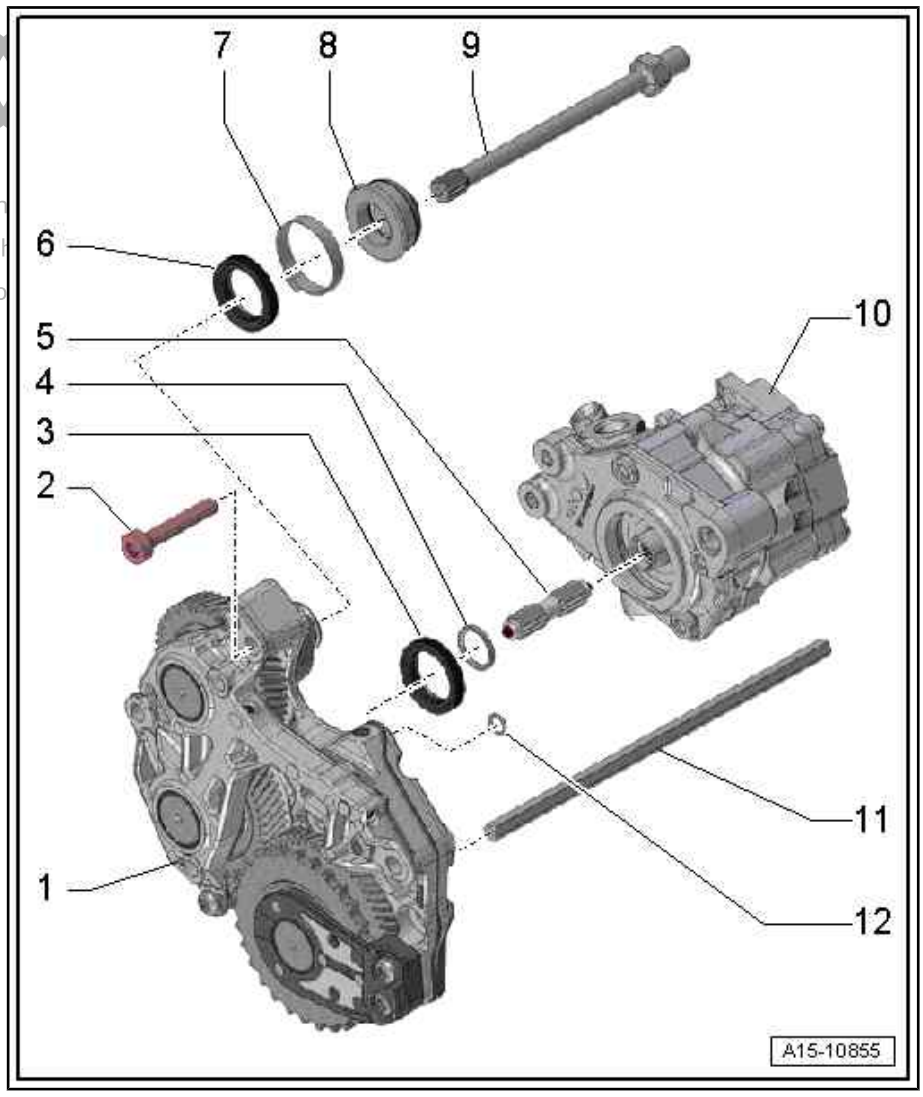
⇒ “4.1 Exploded view - auxiliary drive”, page 83

⇒ “4.2 Removing and installing spur gear drive”, page 84

⇒ “4.3 Renewing oil seal for power steering pump drive”, page 87

⇒ “4.4 Renewing oil seal for AC compressor drive”, page 88

4.1 Exploded view - auxiliary drive



1 - Spur gear drive
- ❑ Do not dismantle
- ❑ Removing and installing ⇒ page 84

2 - Bolt
- ❑ Tightening torque and sequence ⇒ page 84

3 - Oil seal
- ❑ For power steering pump drive
- ❑ For vehicles with hydraulic power steering
- ❑ Renewing ⇒ page 87

4 - Flat-section O-ring
- ❑ For vehicles with hydraulic power steering
- ❑ Installation position ⇒ page 84

5 - Drive shaft
- ❑ For power steering pump
- ❑ For vehicles with hydraulic power steering
- ❑ With bonded rubber buffers

6 - Oil seal
- ❑ For AC compressor drive
- ❑ Renewing ⇒ page 88

7 - Clamp

8 - Dust cap
- ❑ For AC compressor drive

9 - Drive shaft
- ❑ For air conditioner compressor
- ❑ Tightening torque ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor

10 - Power steering pump
- ❑ For vehicles with hydraulic power steering

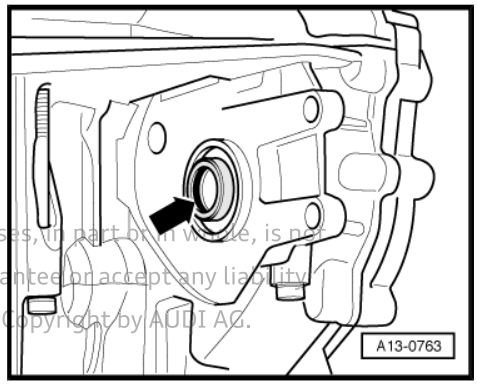
11 - Drive shaft
- ❑ For oil pump

12 - O-ring

❑ Renew

Installation position of flat-section O-ring

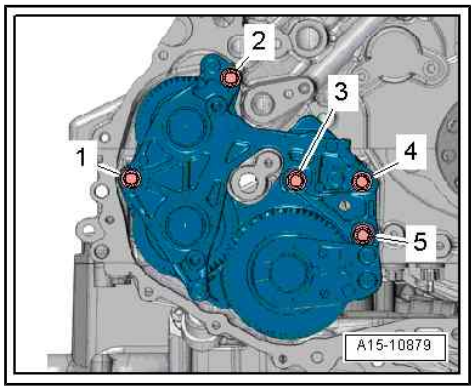
♦ In power steering pump drive -arrow-.



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Spur gear drive - tightening torque and sequence

– Tighten bolts -1 ... 5- to 22 Nm in diagonal sequence.



4.2 Removing and installing spur gear drive

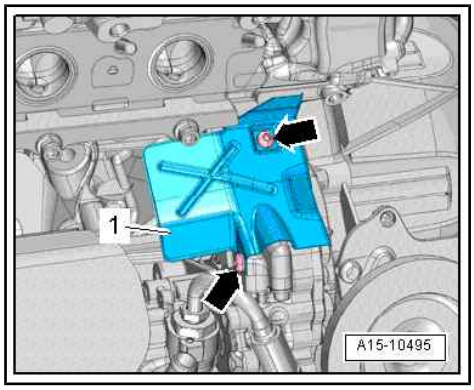
Special tools and workshop equipment required

♦ Sealant ⇒ Electronic parts catalogue

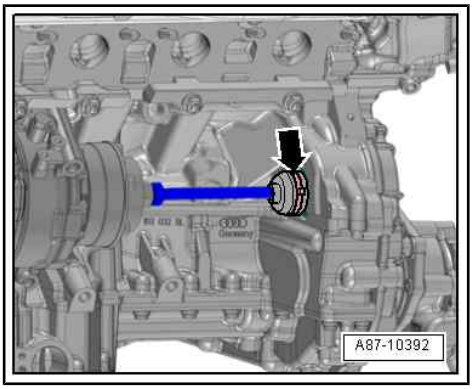
Removing

- Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .
- Engine secured with support -VAS 6131/13-7- .

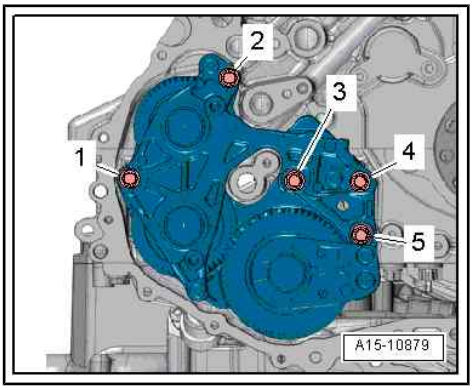
– Remove bolts -arrows- and detach heat shield -1-.



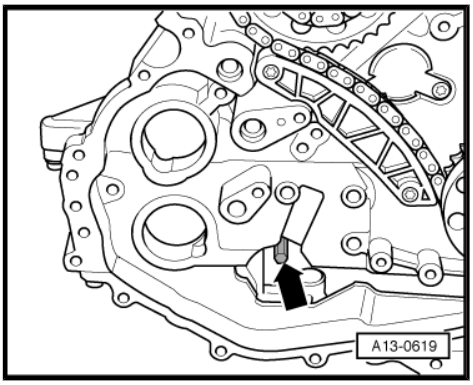
– Detach hose clip on dust cap -arrow- for air conditioner compressor drive.
– Remove timing chain cover (bottom) ⇒ page 117 .
– Vehicles with hydraulic power steering: Detach power steering pump from retaining frame.
– Remove drive chain for auxiliary drives ⇒ page 138 .



– Slacken bolts -1 ... 5- in diagonal sequence and remove.
– Carefully release spur gear drive from bonded joint and detach.



– Pull out oil pump drive shaft -arrow-.



Installing

• Tightening torque
⇒ Fig. ""Spur gear drive - tightening torque and sequence"" , page 84

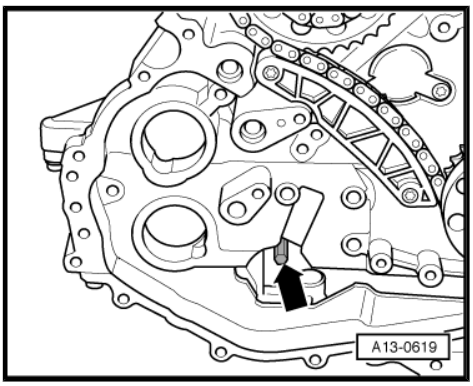
Note

Fit new O-ring.

– Renew oil seals ⇒ Item 3 (page 83) ⇒ Item 6 (page 83) and flat-section O-ring ⇒ page 84 in power steering pump drive if damaged.
– Remove sealant residues from spur gear drive and cylinder block.
– Clean sealing surfaces; they must be free of oil and grease.

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– Insert drive shaft -arrow- for oil pump into guide sleeve at oil pump.



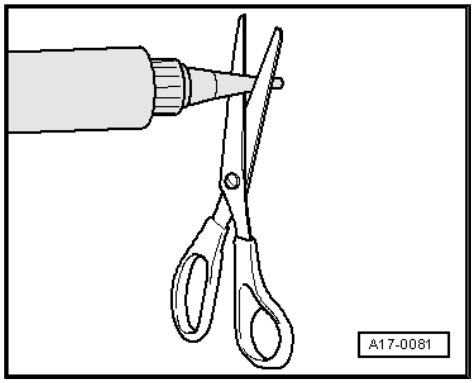
Note

To ensure that drive shaft engages correctly in oil pump, insert drive shaft separately into oil pump (NOT together with spur gear drive).

Note

Note the use-by date of the sealant.

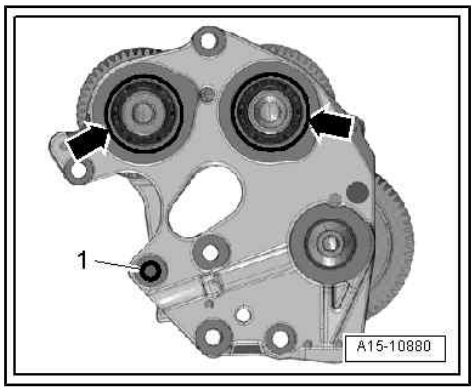
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 1.5 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

- ***The sealant beads must not be thicker than specified.***



– Apply beads of sealant -arrows- onto clean sealing surfaces of spur gear drive as shown in illustration.

• Width of sealant beads: 2.0 mm.

– Fit new O-ring -1- and secure in position with a small amount of grease.

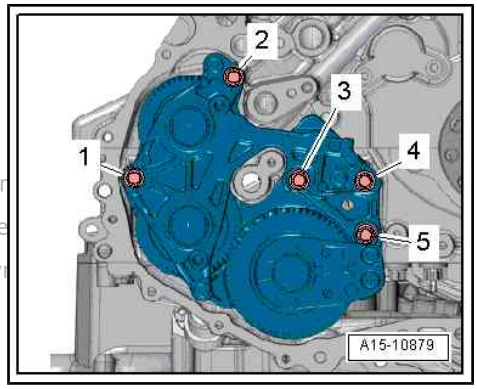
Note

The spur gear drive must be installed within 5 minutes after applying the sealant.

– Fit spur gear drive and tighten bolts ⇒ page 84 .

– Install drive chain for auxiliary drives ⇒ page 138 .

– Slide power steering pump with new O-ring onto spur gear for power steering pump drive.



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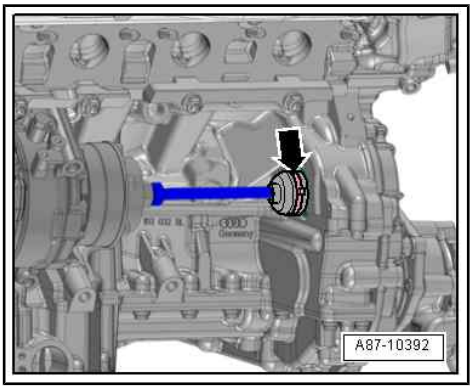
Note

Secure with correct type of hose clip (same as original equipment) ⇒ Electronic parts catalogue .

– Press dust cap -arrow- with hose clip fitted onto stub shaft of spur gear for AC compressor drive.

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

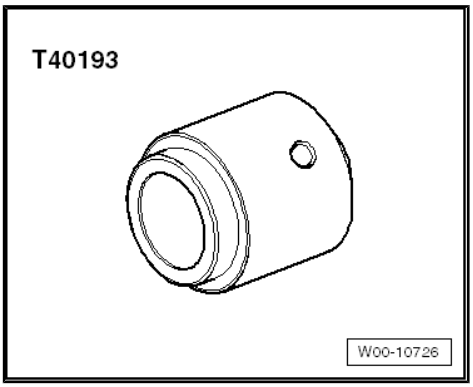
– Install drive chain for auxiliary drives ⇒ page 138 .
– Install power steering pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing power steering pump .
– Install timing chain cover (bottom) ⇒ page 117 .



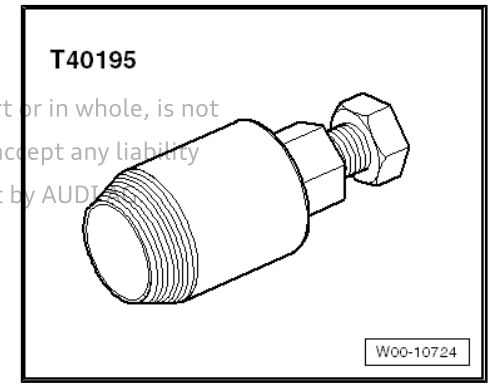
4.3 Renewing oil seal for power steering pump drive

Special tools and workshop equipment required

♦ Thrust piece - T40193-



♦ Oil seal extractor - T40195-



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Procedure

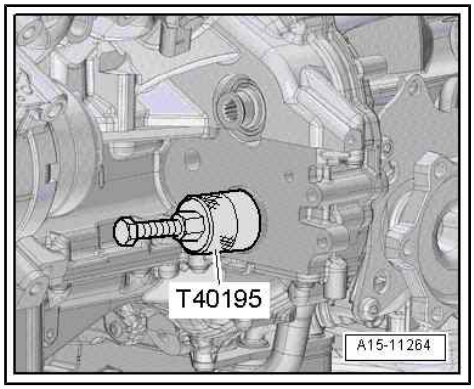
- Subframe lowered.

– Remove power steering pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing power steering pump

– Screw spindle of oil seal extractor -T40195- all the way out.

– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).

– Turn inner part of oil seal extractor against spur gear drive until the oil seal is pulled out.



Note

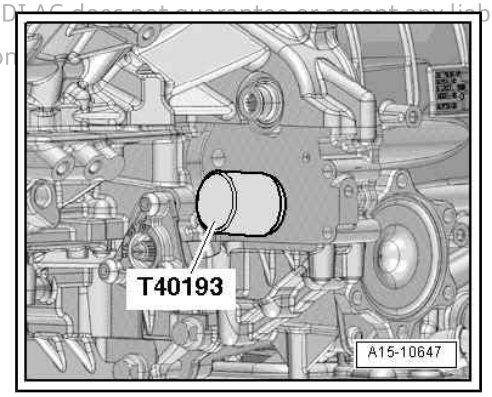
If the sections of the oil seal come apart, apply oil seal extractor again and pull out remaining part of oil seal.

– Clamp hexagon flats of oil seal extractor in vice and use pliers to remove oil seal.

– Clean contact surface and sealing surface.

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– Drive in oil seal for power steering pump drive as far as stop using thrust piece - T40193-.



Note

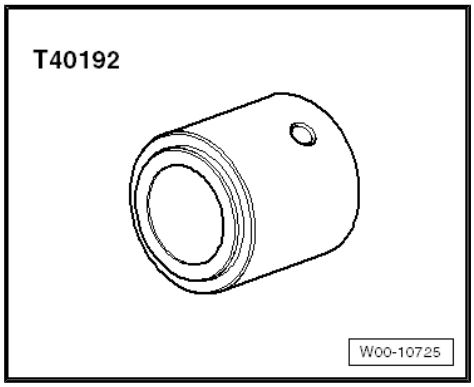
For illustration purposes, the installation position is shown with the engine removed.

– Install power steering pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing power steering pump .

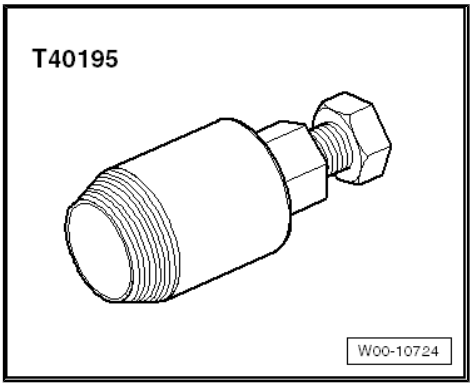
4.4 Renewing oil seal for AC compressor drive

Special tools and workshop equipment required

♦ Thrust piece - T40192-



♦ Oil seal extractor - T40195-

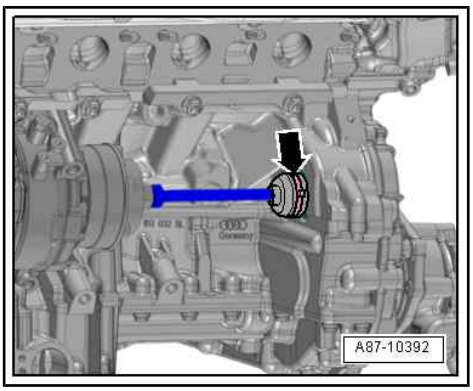


Procedure

– Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .

– Detach hose clip on dust cap -arrow-.

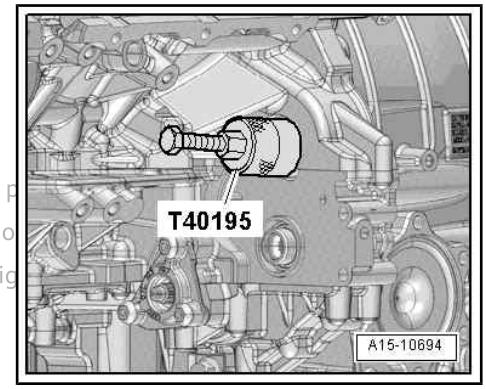
– Pull off dust cap together with drive shaft for air conditioner compressor from stub shaft of spur gear for air conditioner compressor drive.



– Screw spindle of oil seal extractor -T40195- all the way out.

– Lubricate threaded head of oil seal extractor, place it in position and screw it into oil seal as far as possible (applying firm pressure).

– Turn inner part of oil seal extractor against spur gear drive until the oil seal is pulled out.



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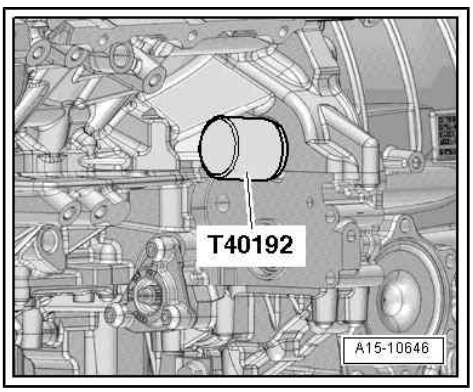
Note

If the sections of the oil seal come apart, apply oil seal extractor again and pull out remaining part of oil seal.

– Clamp hexagon flats of oil seal extractor in vice and use pliers to remove oil seal.

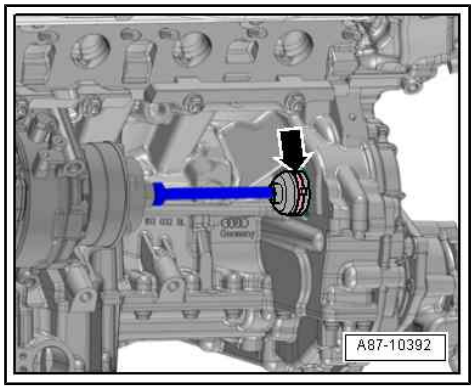
– Clean contact surface and sealing surface.

– Drive in oil seal for AC compressor drive using thrust piece - T40192- .



Note

Secure with correct type of hose clip (same as original equipment) ⇒ Electronic parts catalogue .



- Press dust cap -arrow- with hose clip fitted onto stub shaft of spur gear for AC compressor drive.
- Install air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .

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5 Pistons and conrods

⇒ “5.1 Exploded view - pistons and conrods”, page 91

⇒ “5.2 Removing and installing pistons”, page 93

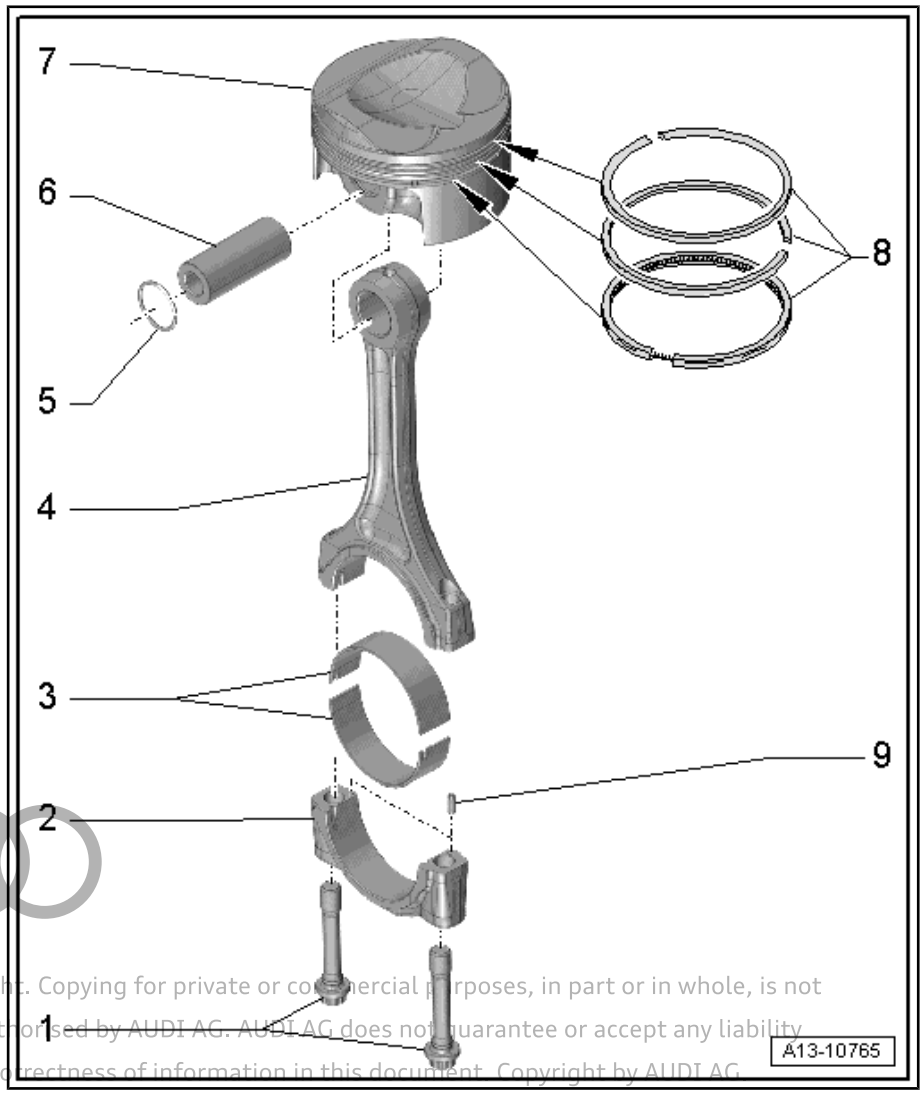
⇒ “5.3 Checking pistons and cylinder bores”, page 94

⇒ “5.4 Checking radial clearance of conrod bearings”, page 95

5.1 Exploded view - pistons and conrods

Note

- *All bearing and running surfaces must be oiled before assembling.*
- *Oil spray jet for piston cooling ⇒ page 93 .*



1 - Bolts

- ❑ Renew
- ❑ Lubricate threads and contact surface
- ❑ 40 Nm +120°

2 - Conrod bearing cap

- ❑ Mark installation position for re-installation
- ❑ Mark cylinder allocation in colour ⇒ page 92
- ❑ Installation position of conrod pairs ⇒ page 93

3 - Bearing shells

- ❑ Ensure that retaining lugs are securely seated.
- ❑ Always renew after removing
- ❑ There are oversized bearings available for machined crankshaft conrod journals ⇒ Electronic parts catalogue

4 - Conrod

- ❑ Only renew as a complete set
- ❑ Mark cylinder allocation in colour ⇒ page 92
- ❑ Installation position of conrod pairs ⇒ page 93
- ❑ Axial clearance for each conrod pair (when new): 0.16 … 0.29 mm
- ❑ Measuring radial clearance ⇒ page 95

5 - Circlip

- ❑ 2x

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- ❑ Renew

6 - Piston pin

- ❑ Removing and installing ⇒ “5.2 Removing and installing pistons”, page 93

7 - Piston

- ❑ Removing and installing ⇒ page 93
- ❑ Checking pistons and cylinder bores ⇒ page 94
- ❑ Installation position ⇒ page 92

8 - Piston rings

- ❑ Measuring ring gap ⇒ page 95
- ❑ Measuring ring-to-groove clearance ⇒ page 95
- ❑ 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 - Dowel pin

- ❑ 2x
- ❑ Ensure secure fit in conrod bearing cap

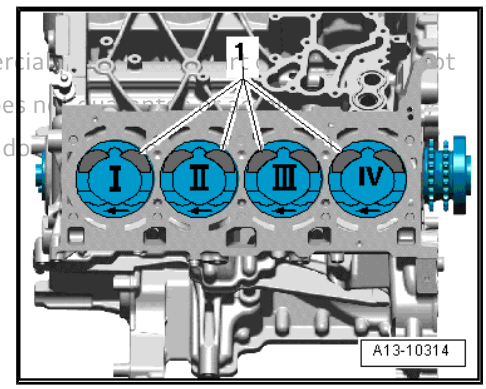
Installation position of pistons

Caution

Do not damage the coating of the piston crown.

- ***If you intend to re-install used pistons, mark the cylinder number on the piston crown using paint. Do not mark piston crown by means of centre punch, notch or the like.***

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Installation position:

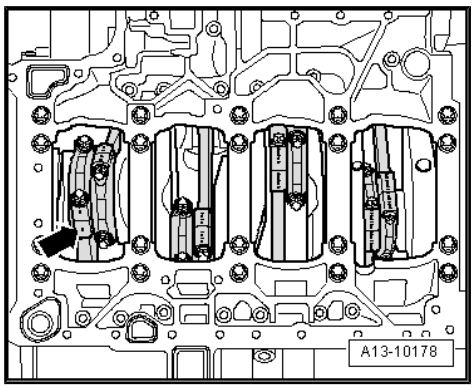
- Arrows on piston crowns point to pulley end.
- Large valve recesses -1- face centre of engine.

Marking conrods

Note

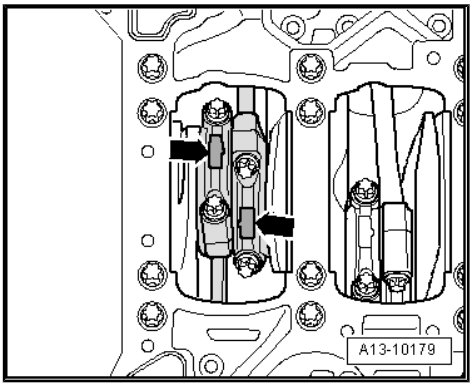
Only renew conrods as a complete set.

– Use a coloured pen to mark matching conrods and conrod bearing caps with cylinder numbers -arrow- for re-installation.



Installation position of conrods

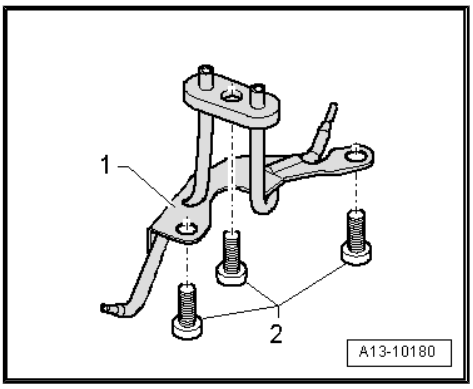
- The cast lugs -arrows- on the ground surfaces of the conrod pairs “1 and 2”, “3 and 4”, “5 and 6” and “7 and 8” must face each other.



Oil spray jet for piston cooling

1 - Oil spray jet

2 - Apply locking fluid to bolts and tighten to 9 Nm; for locking fluid refer to ⇒ Electronic parts catalogue .



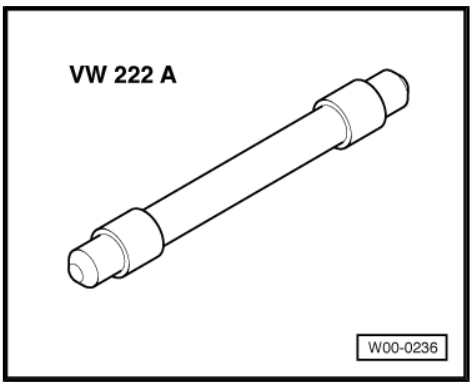
Note

- *Do not bend piston cavity oil jets.*
- *Always renew bent spray jets for pistons.*

5.2 Removing and installing pistons

Special tools and workshop equipment required

- Pin - VW 222 A-



- Piston ring clamp, commercially available

Removing

- Engine secured to engine and gearbox support - VAS 6095- ⇒ page 41

– Remove cylinder head ⇒ page 99 .

– Remove sump (top section) ⇒ page 171 .

– Mark installation position and matching of conrod bearing caps to cylinders for re-installation ⇒ page 92 .

– Unbolt conrod bearing caps.

– Pull out pistons upwards with conrods.

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Note

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

– Take circlip out of piston pin boss.

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

Installing

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

- Tightening torques
  ⇒ “5.1 Exploded view - pistons and conrods”, page 91

Note

Renew bolts tightened with specified tightening angle.

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– Oil running surfaces of bearing shells.

– Install pistons using piston ring clamp.

Installation position:

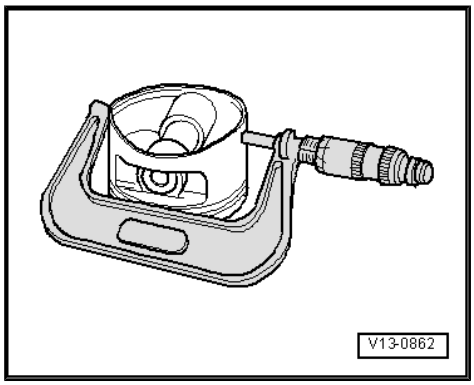
- Pistons ⇒ page 92
- Conrods ⇒ page 93

– Install conrod bearing caps according to markings.

– Install sump (upper section) ⇒ page 171 .

– Install cylinder head ⇒ page 99 .

5.3 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: 0.03 mm.

There are different piston sizes specifically matched to the varying bore dimensions for the cylinder block.

Piston ∅ mm	
Nominal piston dimension I	84.490[1)]
Nominal piston dimension II	84.590[1)]

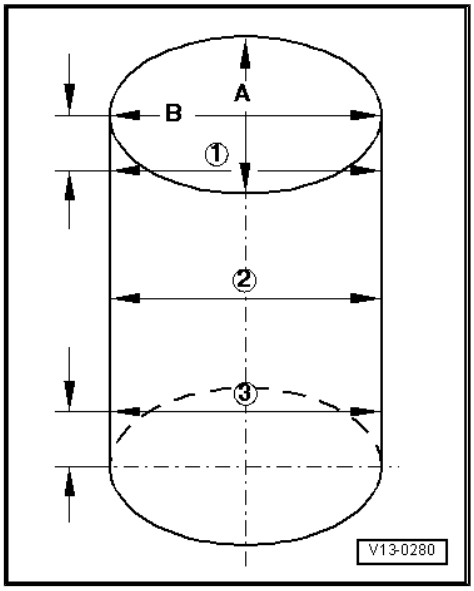
- [1)] Dimensions including coating (thickness 0.01 mm). The coating will wear down in service.

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: 0.08 mm.

Cylinder bore ∅ mm	
Nominal bore dimension I	84.510 ± 0.005
Nominal bore dimension II	84.610 ± 0.005

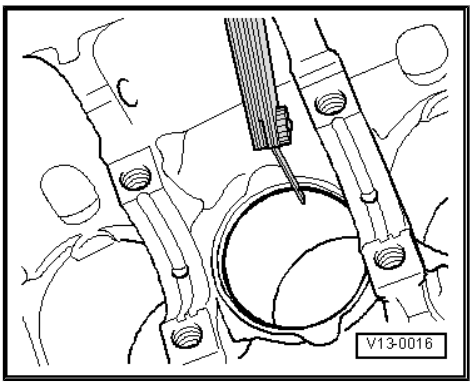


Measuring piston ring gap

– 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.

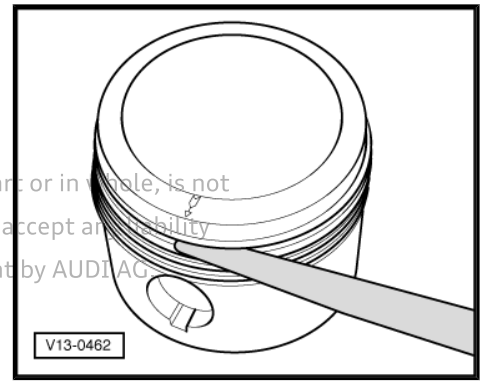
Piston ring	new mm	Wear limit mm
1st compression ring	0.20 … 0.35	0.80
2nd compression ring	0.20 … 0.40	0.80
Oil scraper ring	0.20 … 0.40	0.80



Measuring ring-to-groove clearance

– Clean groove in piston before checking clearance.

Piston ring	new mm	Wear limit mm
1st compression ring	0.020 … 0.070	0.200
2nd compression ring	0.005 … 0.045	0.150
Oil scraper ring	0.020 … 0.060	0.200



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5.4 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 caps and tighten to 40 Nm without turning bolts further; do not rotate crankshaft.
– Remove conrod bearing cap again.
– Compare width of Plastigauge with measurement scale.

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Radial clearance:

- New: 0.020 ... 0.069 mm.
- Wear limit: 0.120 mm.

– Renew conrod bolts.

15 – Cylinder head, valve gear

1 Cylinder head

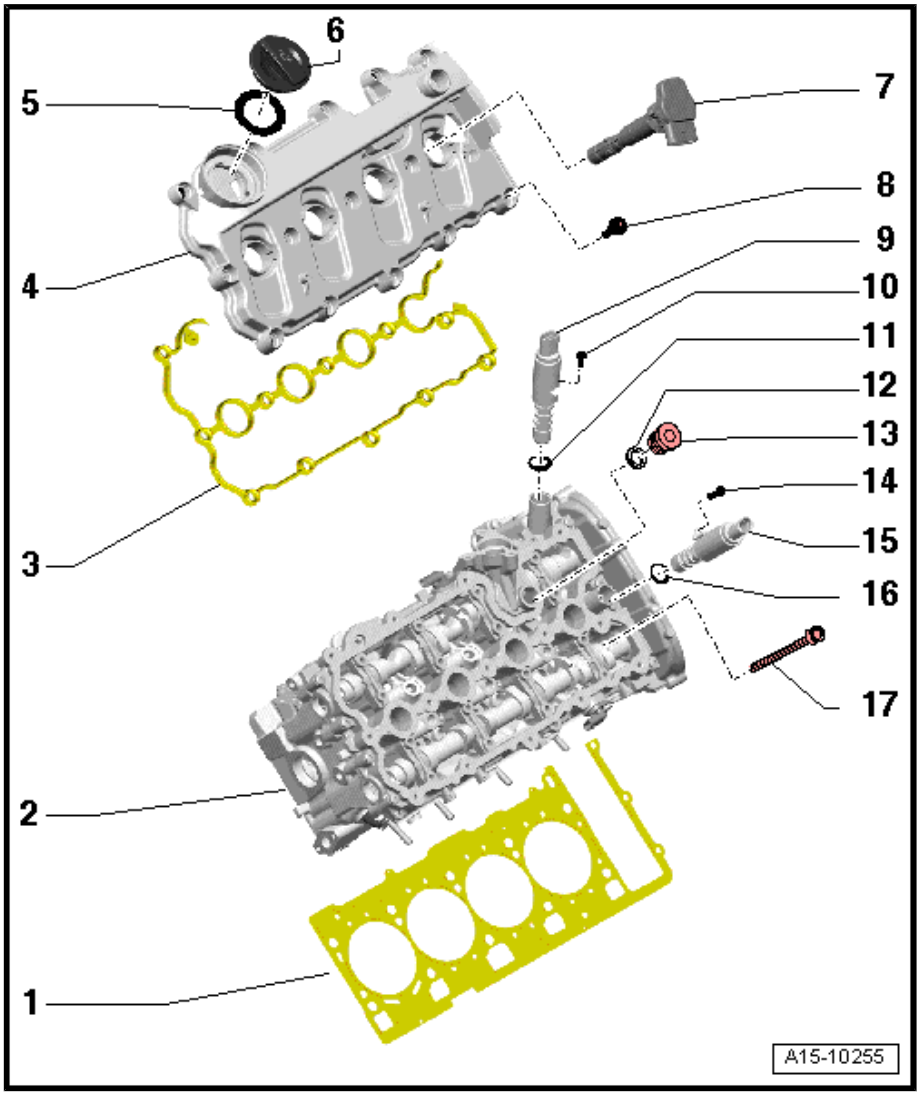
⇒ “1.1 Exploded view - cylinder head”, page 97
⇒ “1.2 Removing and installing cylinder head”, page 99
⇒ “1.3 Removing and installing cylinder head cover”, page 105
⇒ “1.4 Checking compression”, page 107

1.1 Exploded view - cylinder head

Note

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The diagram shows the cylinder head on cylinder bank 2 (left-side).



1 - Cylinder head gasket

- ❑ Renewing ⇒ “1.2 Removing and installing cylinder head”, page 99
- ❑ Installation position: part number must face cylinder head
- ❑ If renewed, change coolant and engine oil

2 - Cylinder head

- ❑ Removing and installing ⇒ page 99
- ❑ Checking for distortion ⇒ page 99
- ❑ Machining limit ⇒ page 99
- ❑ If renewed, change coolant and engine oil

3 - Gasket

- ❑ For cylinder head cover
- ❑ Renew if damaged or leaking

4 - Cylinder head cover

- ❑ Removing and installing ⇒ page 105

5 - Seal

- ❑ For filler cap
- ❑ Renew if damaged or leaking

6 - Filler cap

7 - Ignition coil

- ❑ Removing ⇒ page 302

8 - Bolt

- ❑ Renew if seal is damaged

- ❑ Tightening torque and tightening sequence: cylinder head cover (left-side) ⇒ page 98 , cylinder head cover (right-side) ⇒ page 98

9 - Camshaft control valve 2 - N208-

10 - Bolt

- ❑ 2.4 Nm

11 - O-ring

- ❑ Renew

12 - Seal

- ❑ Renew

13 - Plug

- ❑ 45 Nm

14 - Bolt

- ❑ 2.4 Nm

15 - Exhaust camshaft control valve 2 - N319-

16 - O-ring

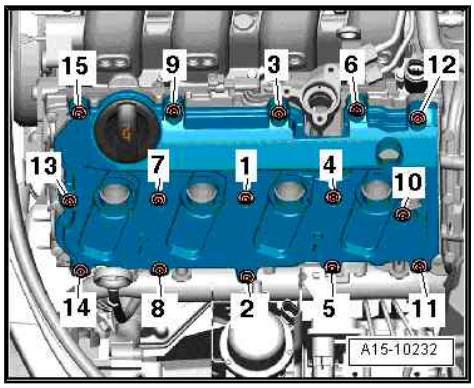
- ❑ Renew

17 - Bolt

- ❑ Renew
- ❑ Correct sequence when slackening ⇒ page 102
- ❑ Tightening torque and sequence ⇒ page 99

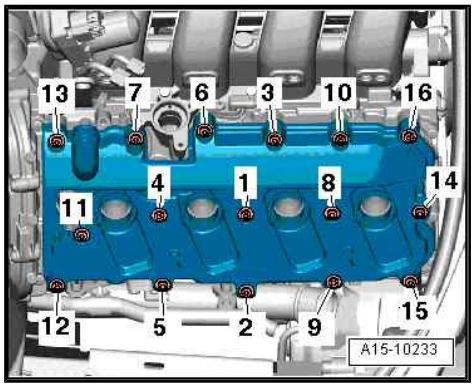
Cylinder head cover (left-side) - tightening torque and sequence

– Tighten bolts in the sequence -1 ... 15- to 9 Nm.



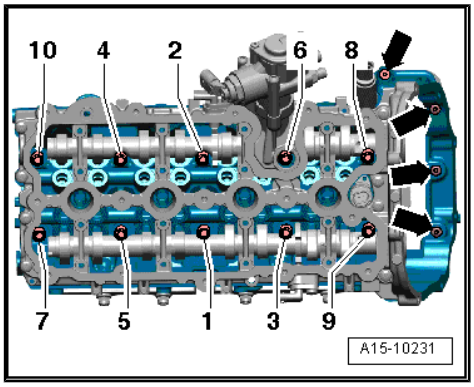
Cylinder head cover (right-side) - tightening torque and sequence

– Tighten bolts in the sequence -1 ... 16- to 9 Nm.



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Cylinder head - tightening torque and sequence



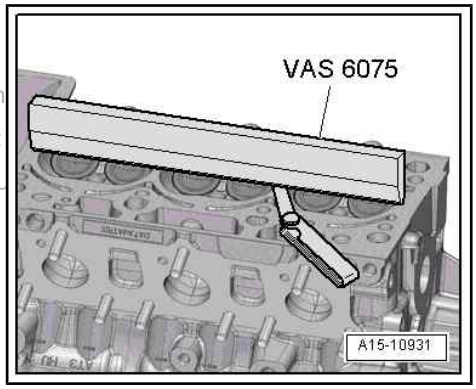
Note

Renew bolts tightened with specified tightening angle.

– Tighten bolts in 7 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 10-	Screw in by hand until contact is made
2.	-1 … 10-	30 Nm
3.	-1 … 10-	60 Nm
4.	-1 … 10-	Turn 90° further
5.	-1 … 10-	Turn 90° further
6.	-Arrows-	Apply locking fluid when installing; 11 Nm Locking fluid ⇒ Electronic parts catalogue
7.	-Arrows-	Turn 90° further

Checking cylinder head for distortion

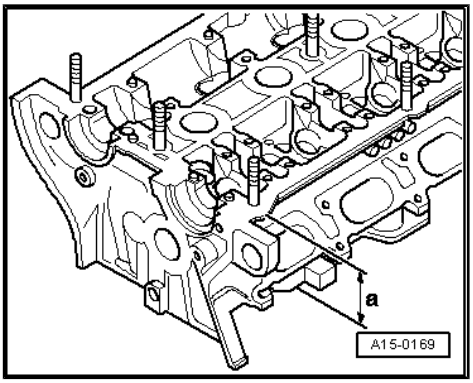


– Use straight edge 500 mm - VAS 6075- and feeler gauge to measure cylinder head for distortion at several points.

- Max. permissible distortion: 0.1 mm.

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Cylinder head machining limit



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

- Minimum dimension: -a- = 139.5 mm

1.2 Removing and installing cylinder head

Special tools and workshop equipment required

♦ Socket XZN M12 (at least 75 mm), commercially available

Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

– Remove timing chain from camshafts on relevant side ⇒ page 129 .

– Remove coolant pipe (top front) ⇒ page 214 .

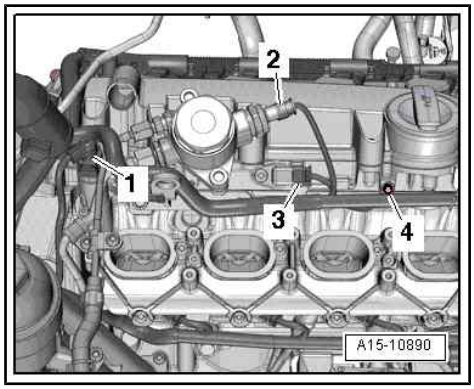
– Unplug electrical connectors:

1 - At camshaft control valve

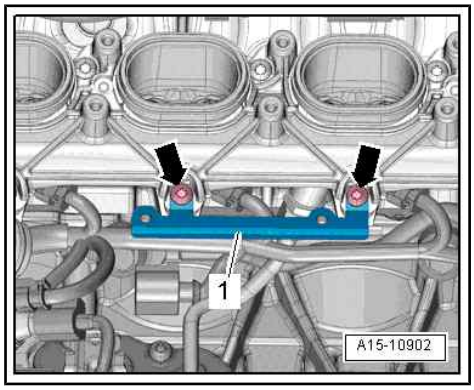
2 - At high-pressure pump

3 - At Hall sender

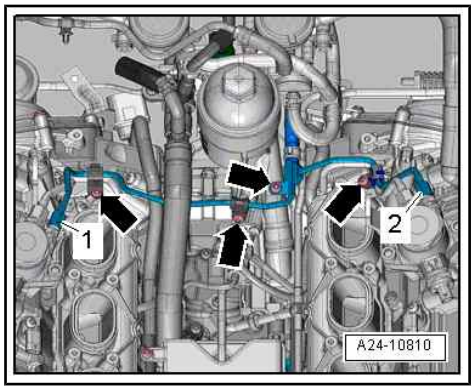
– Remove bolt -4- and move wiring harness to one side.



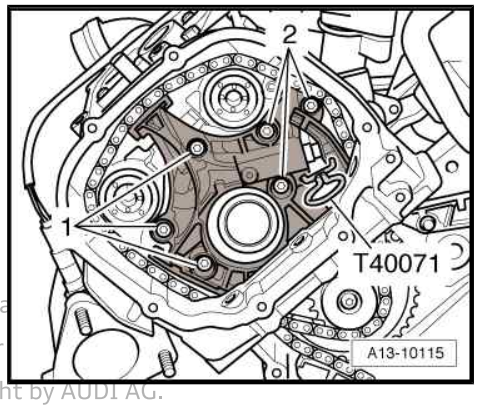
– Unscrew bolts -arrows- and detach bracket -1-.



– Remove bolts -arrows- and union nuts -1, 2- and move fuel supply line to one side.

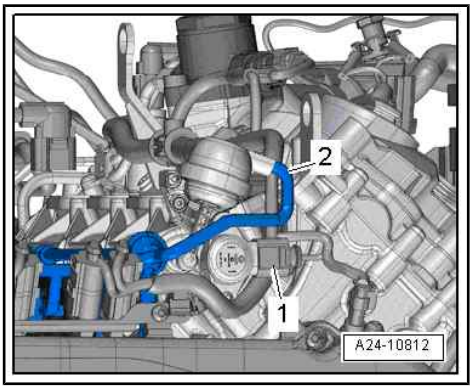


– Remove bolts -1- and -2- and take off chain tensioner.

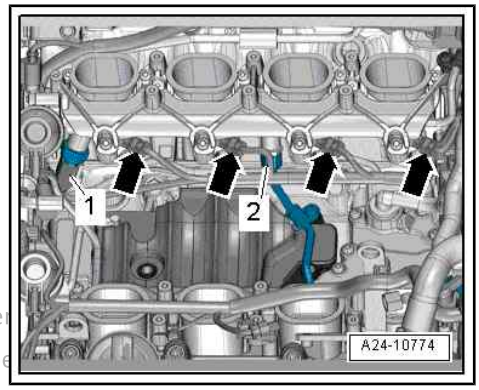


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– Unplug electrical connector -1- and disconnect vacuum hose -2-.



– Unplug electrical connectors -arrows- at injectors.
– Cylinder head (right-side): Unplug electrical connector -1- at fuel rail.
– Unscrew high-pressure pipe -2- from connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nut.

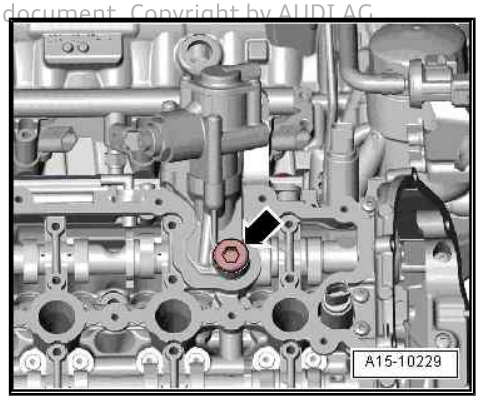


Note

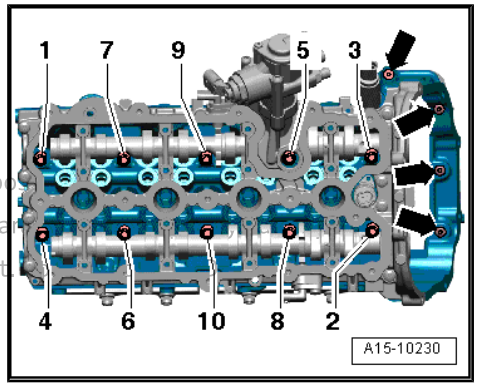
Do not attempt to bend high-pressure pipe to a different shape.

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– Remove screw plug -arrow-.



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



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Installing

- Tightening torques
⇒ "1.1 Exploded view - cylinder head", page 97 ,
⇒ Fig. ""Cylinder head - tightening torque and sequence"" , page 99

Caution

Risk of damage to sealing surfaces.

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

Risk of damage to cylinder block.

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

Risk of leaks at cylinder head gasket.

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

Risk of damage to open valves.

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

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

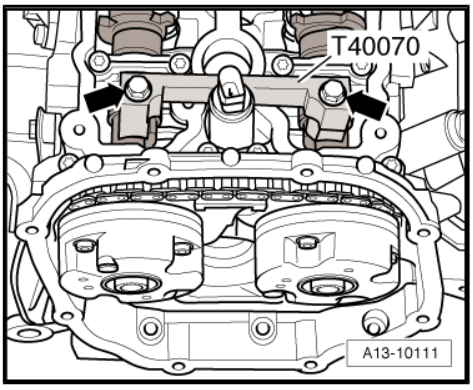
- *Turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.*

Note

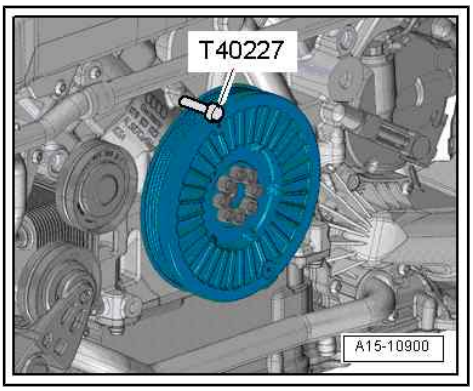
- *Renew bolts tightened with specified tightening angle.*
- *Renew gaskets, seals and O-rings.*
- *When installing an exchange cylinder head, the contact surfaces between the hydraulic compensation elements, roller rocker fingers and cams must be oiled before installing the cylinder head cover.*
- *Secure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

– Check that camshafts on both cylinder heads are positioned at “TDC”.

• Camshaft clamps - T40070- secured on both cylinder heads and tightened to 25 Nm -arrows-.



• Crankshaft locked in “TDC” position with locking pin - T40227- .

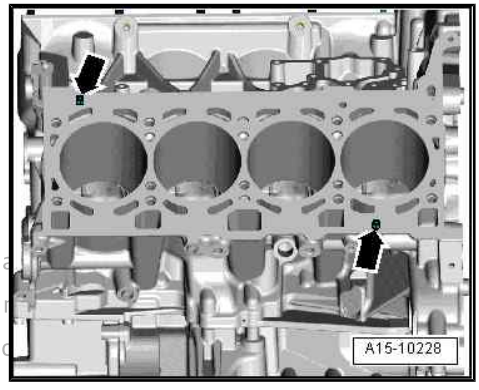


– Fit dowel sleeves -arrows-, if not fitted on the cylinder block at the points marked.

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

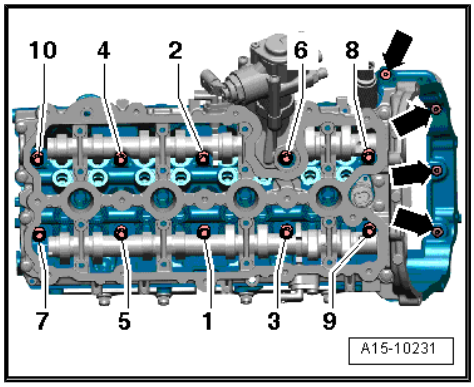
• Installation position of cylinder head gasket: the word “oben” (top) or the part number should face towards the cylinder head.

– Fit cylinder head.



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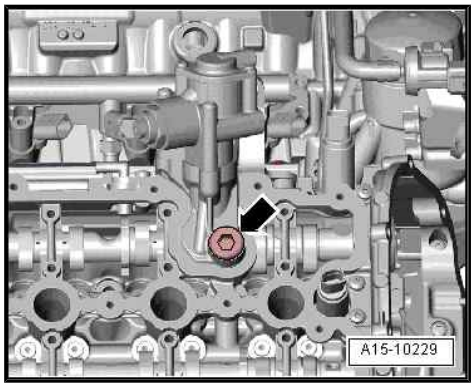
– Tighten cylinder head bolts ⇒ page 99 .



Note

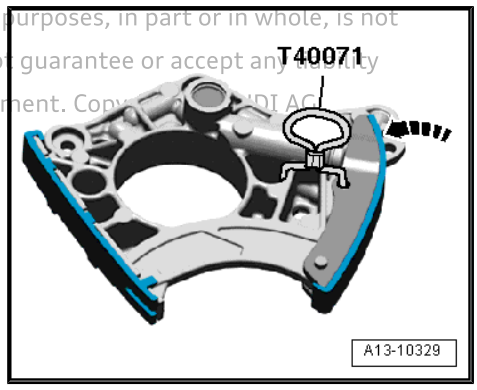
Cylinder head bolts do not have to be torqued down again later after repair work.

– Tighten screw plug -arrow-.



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– Make sure that guide rail of chain tensioner for camshaft timing chain is locked with locking pin - T40071- .

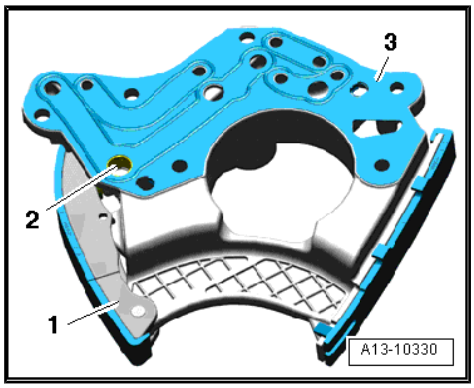


Note

- *Note the correct installation position if the tensioning element has been removed from the chain tensioner: drilling in base of housing faces chain tensioner and piston faces tensioner rail.*
- *Disregard -arrow-.*

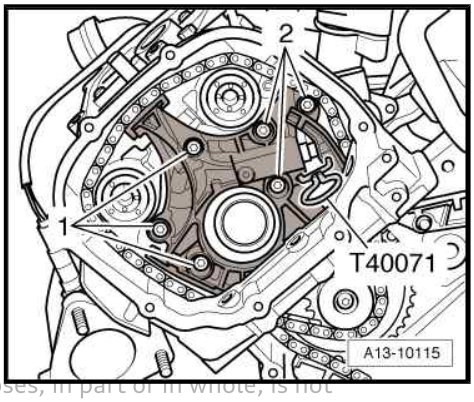
– Clean oil strainer -2- of chain tensioner.

– Fit new gasket -3- on rear of chain tensioner -1-.



– Install chain tensioner and fit timing chain as shown in illustration.

– Tighten bolts -1- and -2-.



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

– Install cylinder head cover ⇒ page 105 .

– Install fuel supply line, high-pressure pipe and intake manifold (bottom section) ⇒ page 255 .

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

– Install coolant pipe (top front) ⇒ page 214 .

– Fit timing chains on camshafts ⇒ page 133 .

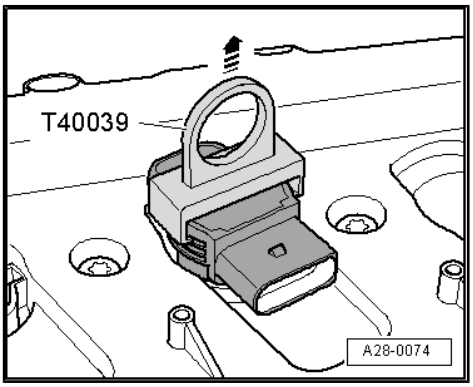
– After installing engine, change engine oil ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 and coolant ⇒ page 198 .

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1.3 Removing and installing cylinder head cover

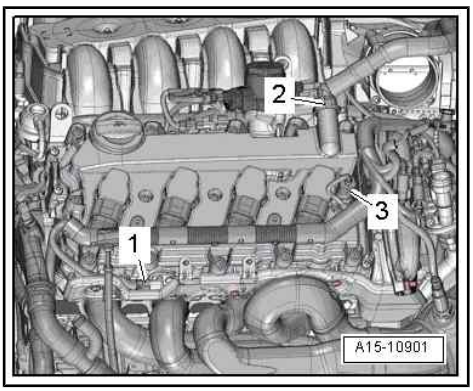
Removing

– Remove ignition coils ⇒ page 302 .

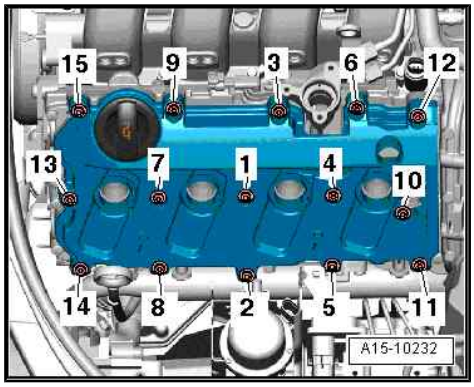


– Press release tabs and detach crankcase breather hose -2-.

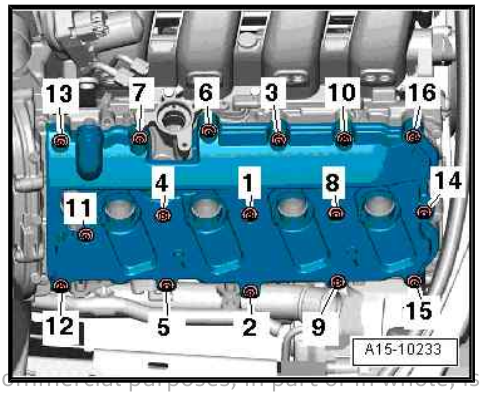
– Unplug electrical connectors -1, 3- and move electrical wiring harness clear.



– Slacken bolts for cylinder head cover (left-side) in the sequence -15 ... 1-.



– Slacken bolts for cylinder head cover (right-side) in the sequence -16 ... 1-.



– Remove bolts and take off cylinder head cover.

Installing

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

Tightening torques

- ⇒ Fig. ""Cylinder head cover (left-side) - tightening torque and sequence"" , page 98
- ⇒ Fig. ""Cylinder head cover (right-side) - tightening torque and sequence"" , page 98

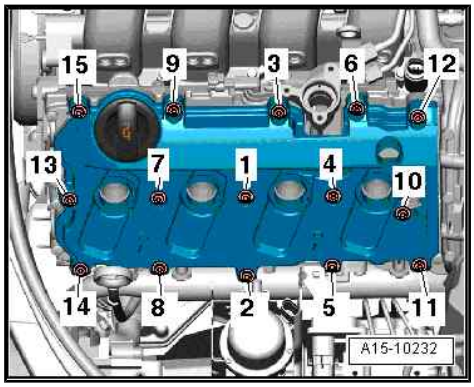
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Note

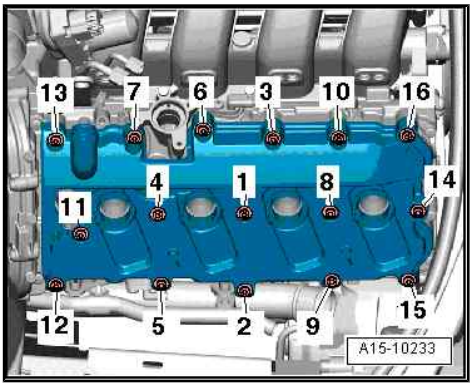
- *Fit new O-ring.*
- *Renew gasket for cylinder head cover if damaged.*
- *Renew bolts for cylinder head cover if seals on bolts are damaged.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

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

– Tighten bolts for cylinder head cover (left-side) ⇒ page 98 .



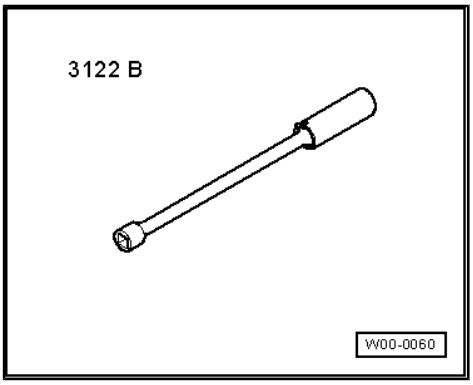
– Tighten bolts for cylinder head cover (right-side) ⇒ page 98 .
– Install ignition coils ⇒ page 302 .



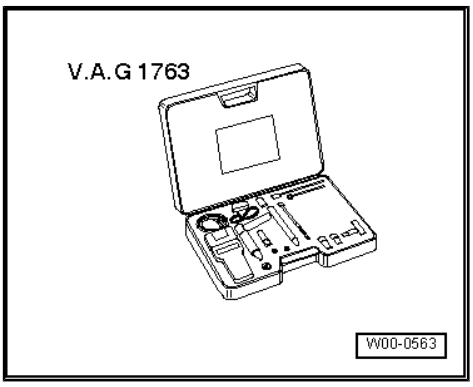
1.4 Checking compression

Special tools and workshop equipment required

♦ Spark plug spanner - 3122 B-



♦ Compression tester - V.A.G 1763-

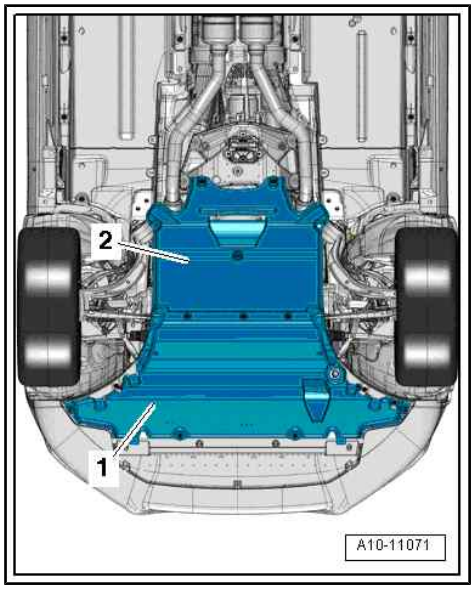


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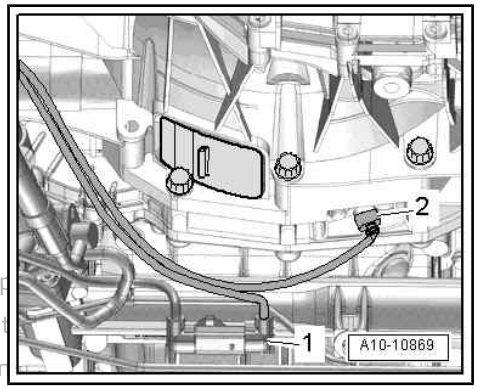
Procedure

- Engine oil temperature at least 30 °C
- Battery voltage at least 12.5 V

– Remove rear noise insulation -2- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



– Unplug electrical connector -2- for engine speed sender - G28- .

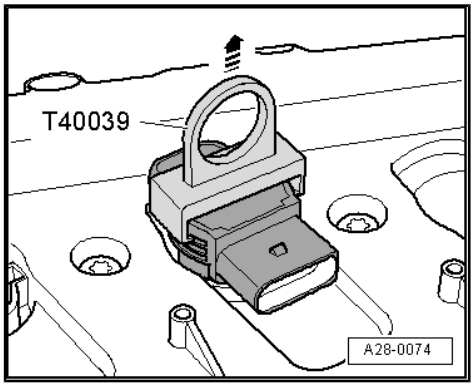


Note

Disregard -item 1-.

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– Remove ignition coils ⇒ page 302 .
– Unscrew spark plugs using spark plug socket - 3122 B- .
– Check compression pressure with compression tester - V.A.G 1763- .



Note

Using the compression tester ⇒ Operating instructions .

– Have a 2nd mechanic press down the accelerator pedal completely and at the same time operate the starter until the pressure on the tester display no longer increases.
– Repeat procedure on each cylinder.

Compression pressure	bar
When new	10.0 … 14.0
Wear limit	9.0
Maximum difference between cylinders	3.0

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

– Install noise insulation ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .
– Install spark plugs ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .
– Install ignition coils ⇒ page 302 .
– Entries are stored in the event memory of the engine control unit because electrical connectors have been unplugged and the engine started: `Generate readiness code` in `Guided Functions` ⇒ Vehicle diagnostic tester.

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2 Timing chain cover

⇒ “2.1 Exploded view - timing chain cover”, page 110

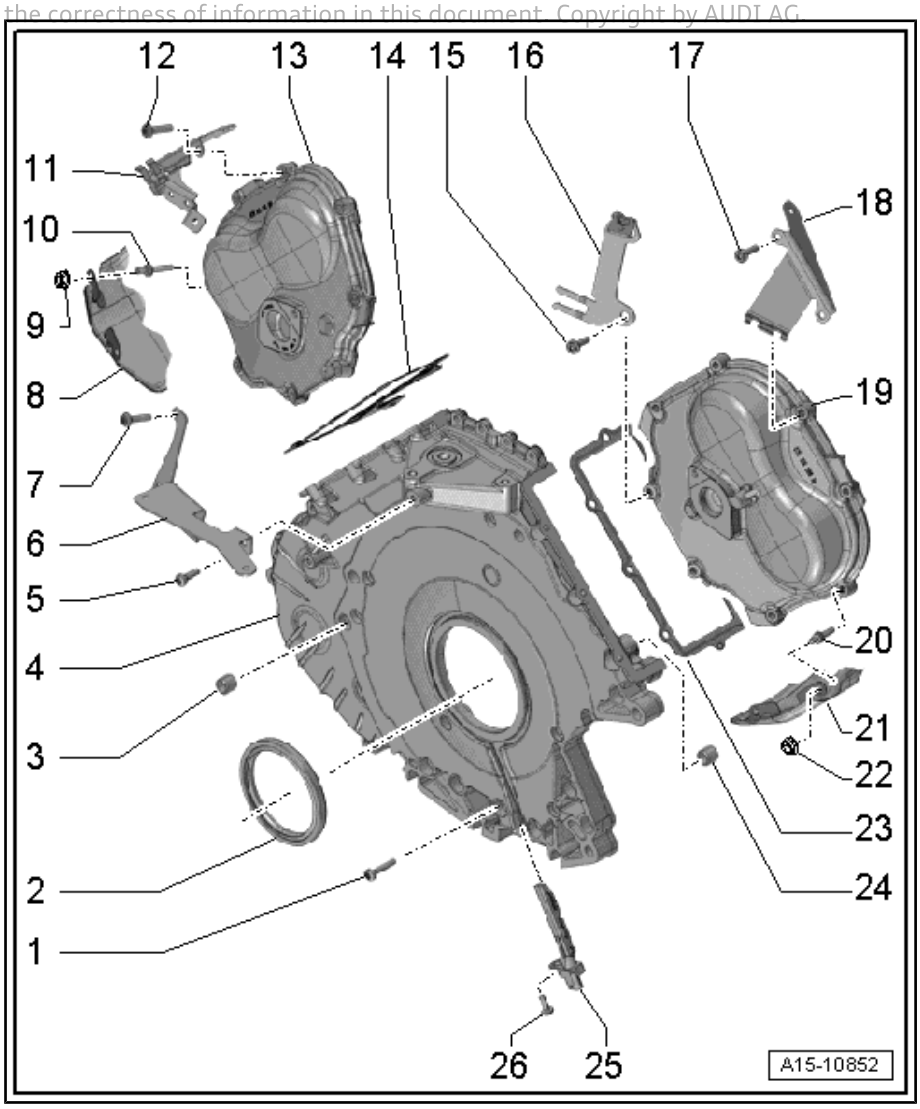
⇒ “2.2 Removing and installing timing chain cover (left-side)”, page 112

⇒ “2.3 Removing and installing timing chain cover (right-side)”, page 115

⇒ “2.4 Removing and installing timing chain cover (bottom)”, page 117

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2.1 Exploded view - timing chain cover



1 - Bolt
- ❑ Tightening torque and sequence ⇒ page 112

2 - Oil seal
- ❑ For crankshaft (gearbox end)
- ❑ Renewing ⇒ page 73

3 - Dowel sleeve
- ❑ For centring engine/ gearbox assembly
- ❑ 2x

4 - Cover (bottom)
- ❑ For timing chains
- ❑ Removing and installing ⇒ page 117

5 - Bolt
- ❑ 9 Nm

6 - Bracket
- ❑ For electrical wiring harness

7 - Bolt
- ❑ Tightening torque and sequence ⇒ page 111

8 - Heat shield

9 - Nut
- ❑ 9 Nm

10 - Threaded pin
- ❑ Tightening torque and sequence ⇒ page 111

11 - Bracket
- ❑ For electrical connectors

12 - Bolt
- ❑ Tightening torque and sequence ⇒ page 111

13 - Cover (left-side)
- ❑ For timing chain
- ❑ Removing and installing ⇒ page 112

14 - Cylinder head gasket (left-side)

15 - Bolt

- ❑ Tightening torque and sequence ⇒ page 111

16 - Bracket

- ❑ For electrical connectors

17 - Bolt

- ❑ Tightening torque and sequence ⇒ page 111

18 - Bracket

- ❑ For electrical wiring

19 - Cover (right-side)

- ❑ For timing chain
- ❑ Removing and installing ⇒ page 115

20 - Threaded pin

- ❑ Tightening torque and sequence ⇒ page 111

21 - Heat shield

22 - Nut

- ❑ 9 Nm

23 - Cylinder head gasket (right-side)

24 - Dowel sleeve

- ❑ 2x

25 - Engine speed sender - G28-

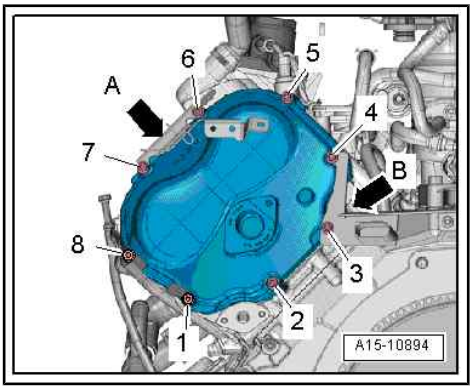
- ❑ Removing and installing ⇒ page 306

26 - Bolt

- ❑ Tightening torque ⇒ page 301

Timing chain cover (left-side) - tightening torque and sequence

– Tighten bolts and threaded pin in the sequence -1 ... 8- to 9 Nm.

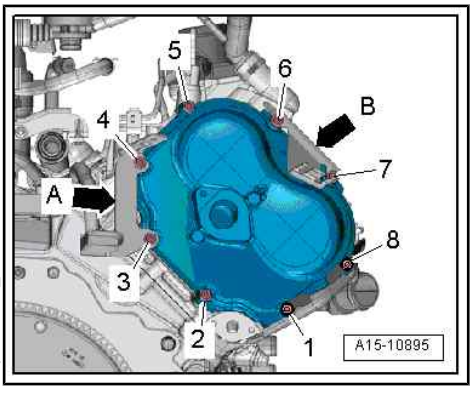


Note

The brackets -arrows A and B- are secured together with the timing chain cover (left-side).

Timing chain cover (right-side) - tightening torque and sequence

– Tighten bolts and threaded pin in the sequence -1 ... 8- to 9 Nm.

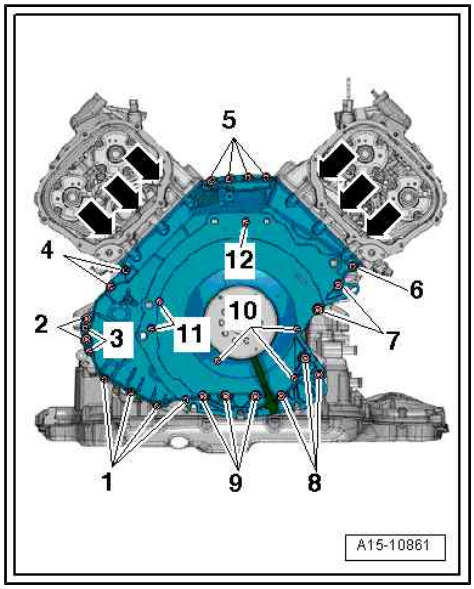


Note

The brackets -arrows A and B- are secured together with the timing chain cover (right-side).

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Timing chain cover (bottom) - tightening torque and sequence



Note

Renew bolts tightened with specified tightening angle.

– Tighten bolts in 6 stages as follows:

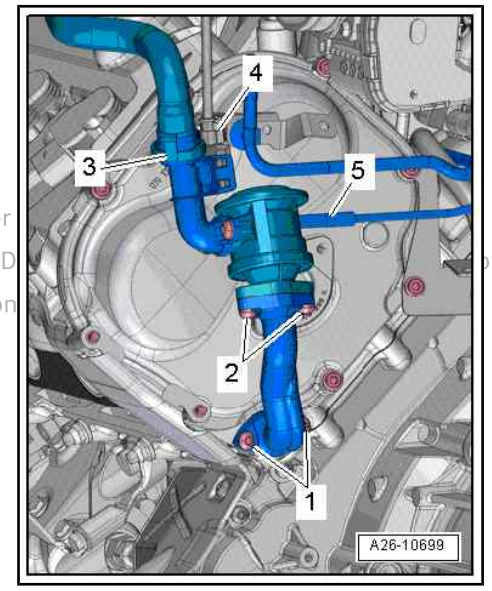
Stage	Bolts	Tightening torque/angle specification
1.	-Arrows-	Apply locking fluid when installing; 5 Nm Locking fluid ⇒ Electronic parts catalogue
2.	-1 … 12-	8 Nm in diagonal sequence
3.	-Arrows-	11 Nm
4.	-2, 7, 8, 9-	22 Nm in diagonal sequence
5.	-1, 3, 4, 5, 6, 10, 11, 12-	Turn 90° further in diagonal sequence
6.	-Arrows-	Turn 90° further

2.2 Removing and installing timing chain cover (left-side)

Special tools and workshop equipment required

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

Removing



- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

– Remove exhaust manifold with catalytic converter (left-side) ⇒ page 290 .

– Remove throttle valve module 2 - J544- ⇒ page 259 .

– Disconnect vacuum hose -5-.

– Unplug electrical connector -4-.

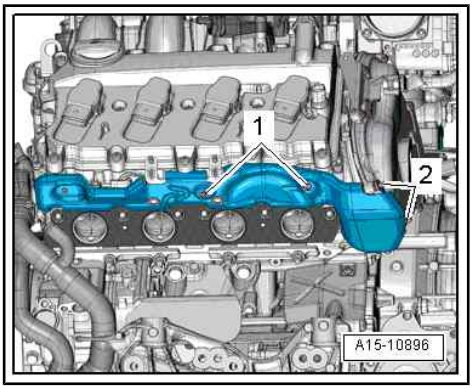
– Unscrew bolts -1- and detach combination valve for secondary air system.

Note

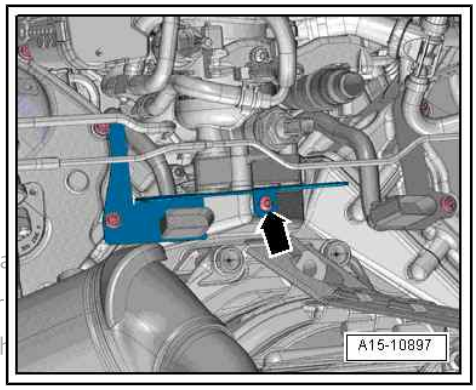
Disregard items -2 and 3-.

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– Remove bolts -1- and nuts -2- for heat shield.

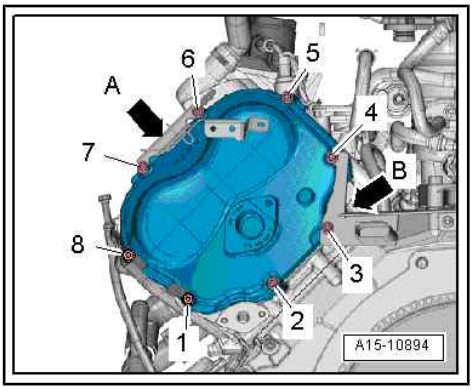


– Remove bolt -arrow- on bracket for electrical connectors.



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– Slacken and remove bolts and threaded pin in the sequence: -8 ... 1-.
– Detach bracket -arrow A- for electrical connectors.
– Push bracket -arrow B- for electrical wiring harness to one side.
– Carefully release timing chain cover (left-side) from bonded joint and detach.



Installing

- Tightening torque
⇒ Fig. ““Timing chain cover (left-side) - tightening torque and sequence”“ , page 111

Note

Fit new O-rings.

– Remove old sealant from grooves on timing chain cover and from sealing surfaces.

Caution

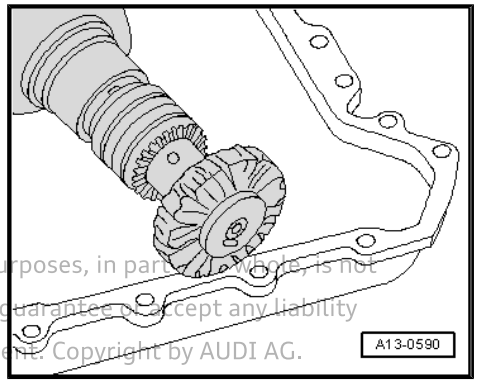
Protect lubrication system against contamination.

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

WARNING

Risk of eye injury.

- *Put on safety goggles.*



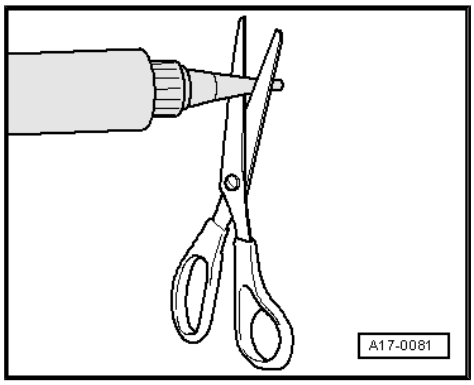
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– Remove remaining sealant on timing chain cover and cylinder head using rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

Note

Note the use-by date of the sealant.

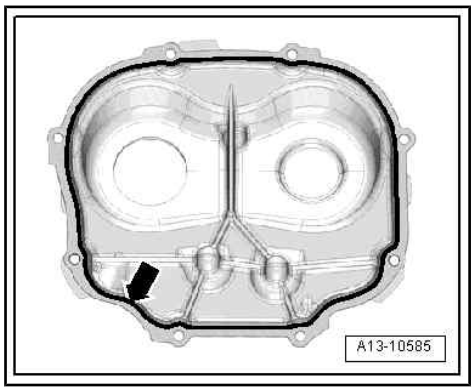
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2 mm).



Caution

Make sure lubrication system is not clogged by excess sealant.

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



– Apply sealant bead -arrow- onto clean sealing surfaces of timing chain cover (left-side) as illustrated.

• Width of sealant bead: 2.5 mm.

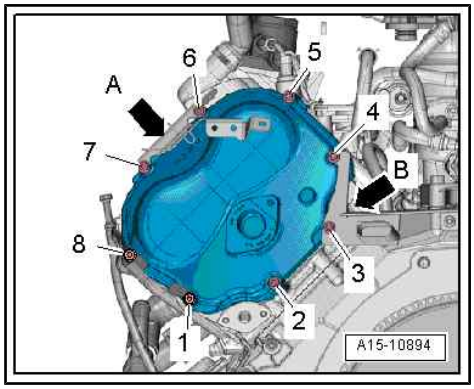
Note

The timing chain cover must be installed within 5 minutes after applying the sealant.

– Fit timing chain cover (left-side) together with both brackets -arrows A and B-.
– Secure bolts and threaded pin ⇒ page 111 .

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

– Install combination valve for secondary air ⇒ page 297 .
– Install throttle valve module 2 - J544- ⇒ page 259 .
– Install exhaust manifold with catalytic converter ⇒ page 290 .



2.3 Removing and installing timing chain cover (right-side)

Special tools and workshop equipment required

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

Removing

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- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

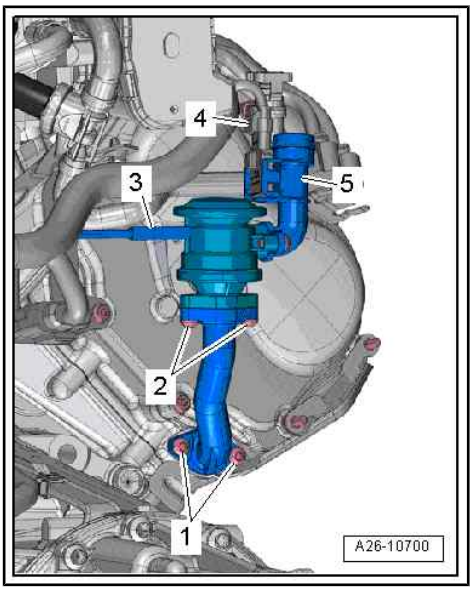
– Remove exhaust manifold (right-side) ⇒ page 290 .

– Remove throttle valve module - J338- ⇒ page 259 .

– Unplug electrical connector -4-.

– Disconnect vacuum hose -3-.

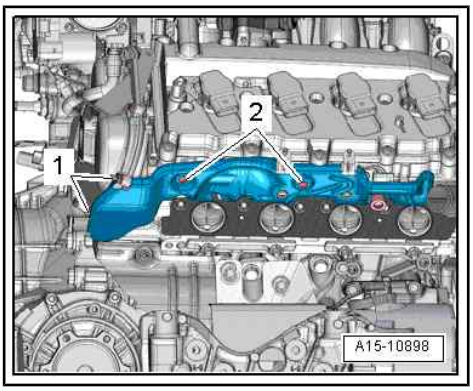
– Unscrew bolts -1- and detach combination valve (right-side) for secondary air system.



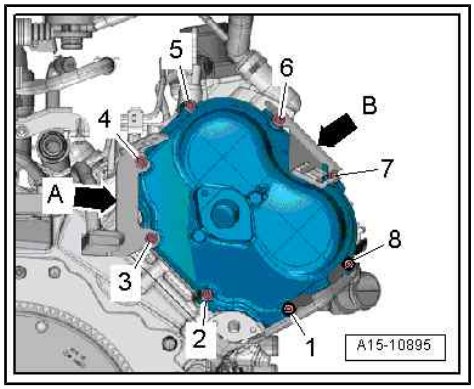
Note

Disregard items -2 and 5-.

– Remove nuts -1- and bolts -2- and detach heat shield.



– Slacken and remove bolts and threaded pin in the sequence: -8 ... 1-.
– Push brackets -arrows A and B- for electrical connectors to one side.
– Carefully release timing chain cover (right-side) from bonded joint and detach.



Installing

- Tightening torques
⇒ Fig. ““Timing chain cover (right-side) - tightening torque and sequence”“ , page 111

Note

Fit new O-rings.

– Remove old sealant from grooves on timing chain cover and from sealing surfaces.

Caution

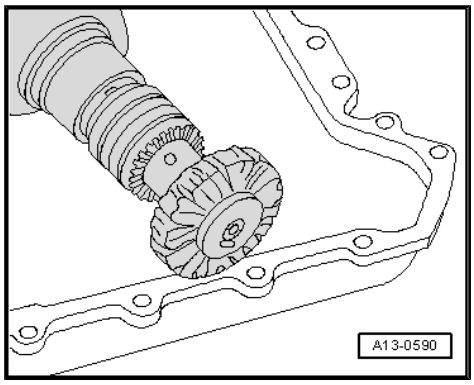
Protect lubrication system against contamination.

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

WARNING

Risk of eye injury.

- ***Put on safety goggles.***

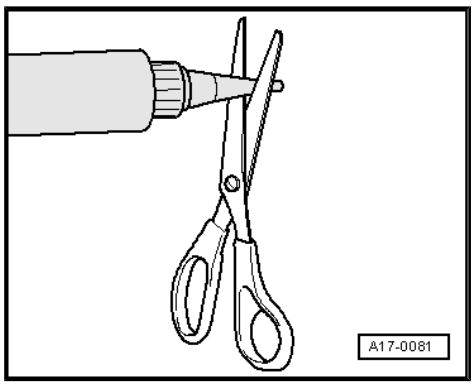


– Remove remaining sealant on timing chain cover and cylinder head using rotating plastic brush or similar.
– Clean sealing surfaces; they must be free of oil and grease.

Note

Note the use-by date of the sealant.

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



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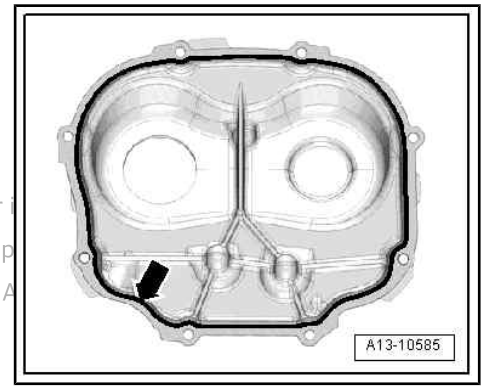
Caution

Make sure lubrication system is not clogged by excess sealant.

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

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– Apply sealant bead -arrow- onto clean sealing surfaces of timing chain cover (right-side) as illustrated.



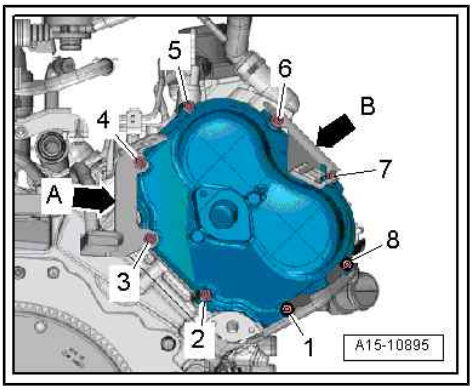
- Width of sealant bead: 2.5 mm.

Note

The timing chain cover must be installed within 5 minutes after applying the sealant.

– Fit timing chain cover (right-side) together with brackets -arrows A and B-.

– Secure bolts and threaded pin ⇒ page 111 .



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

– Install combination valve for secondary air ⇒ page 297 .

– Install throttle valve module - J338- ⇒ page 259 .

– Install exhaust manifold with catalytic converter ⇒ page 290 .

2.4 Removing and installing timing chain cover (bottom)

Special tools and workshop equipment required

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

Removing

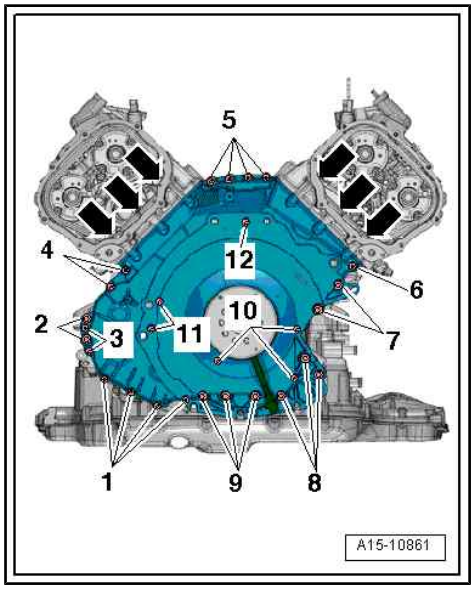
- Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .
- Engine secured with support -VAS 6131/13-7- .

– Remove drive plate ⇒ page 72 .

– Remove timing chain cover: left-side ⇒ page 112 , right-side ⇒ page 115 .

– Remove oil filter housing ⇒ page 189 .

– Remove bolts -arrows-.
– Slacken bolts -1 ... 12- in diagonal sequence and remove.
– Carefully release timing chain cover (bottom) from bonded joint and remove cover.
– Press crankshaft oil seal (gearbox end) out of timing chain cover (bottom).



Installing

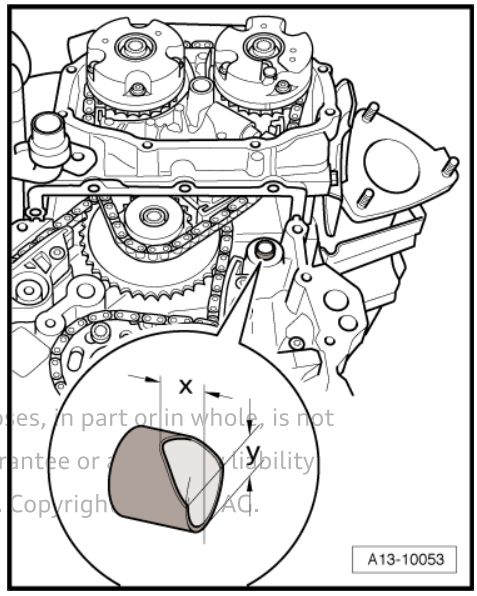
Installation is carried out in reverse order; note the following:

- Tightening torques
⇒ Fig. ““Timing chain cover (bottom) - tightening torque and sequence”“ , page 112

Note

Renew M6 bolts.

– Pull dowel sleeve at top right out of cylinder block.
– Bevel the dowel sleeve with a file, as illustrated.
- Dimension -x- = 6.5 mm
- Dimension -y- = 8 mm
– Fit dowel sleeve on cylinder block in such a way that the bevelled side points upwards.



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Note

Bevelling the dowel sleeve makes it easier to fit the timing chain cover (bottom) with the cylinder head installed.

Caution

Protect lubrication system against contamination.

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

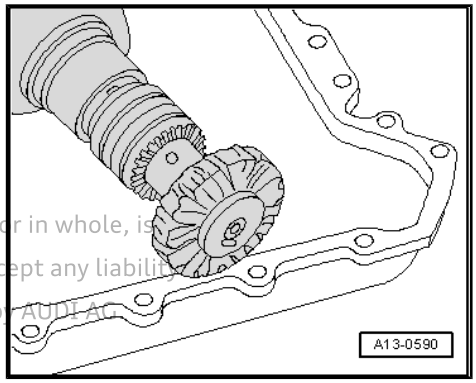
WARNING

Risk of eye injury.

- *Put on safety goggles.*

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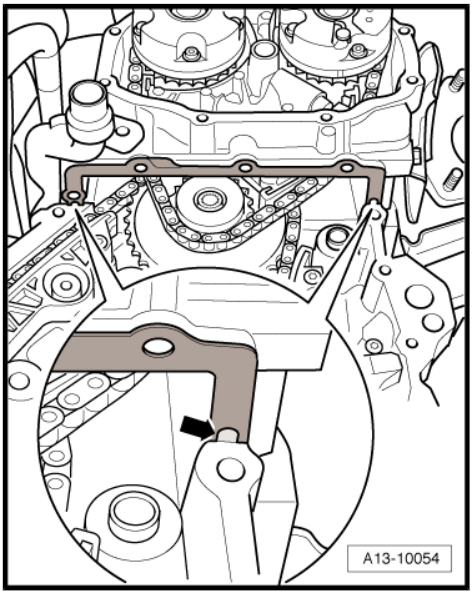
– Remove remaining sealant on timing chain cover (bottom), cylinder block and cylinder head using rotating plastic brush or similar.



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

– Before installing gearbox, remove residue from threaded holes for engine/gearbox bolts in cylinder block using a thread tap.

– Clean old sealant from holes -arrow- in cylinder head gaskets.



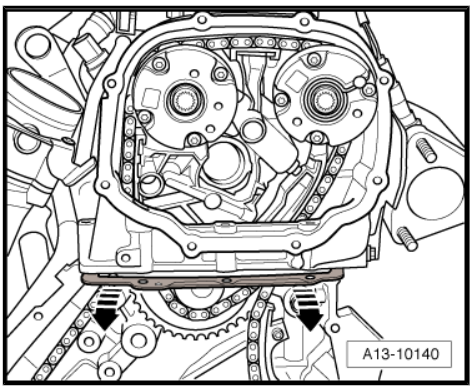
Note

With the cylinder head installed the holes in the cylinder head gasket are only half visible.

Caution

Avoid damage to cylinder head gasket.

- *Only bend the ends of the cylinder head gaskets slightly and do not kink.*



Note

If the cylinder head gasket has been bent and kinked it must be renewed.

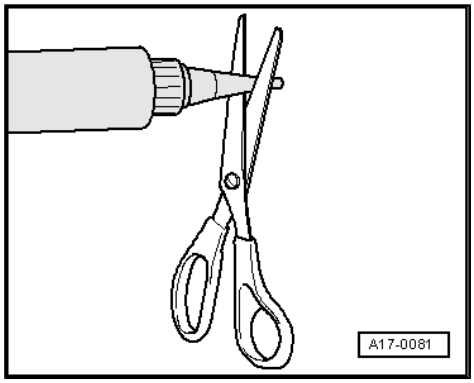
– Carefully bend the ends of the cylinder head gaskets down very slightly -arrows-, just far enough to be able to clean the upper sealing surface on the cylinder head gasket and cylinder head.

– Clean cylinder head gaskets (top and bottom); they must be free of oil and grease.

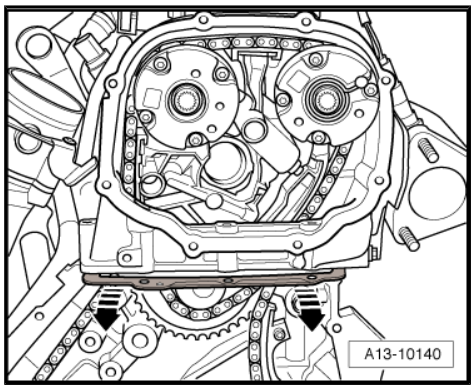
Note

Note the use-by date of the sealant.

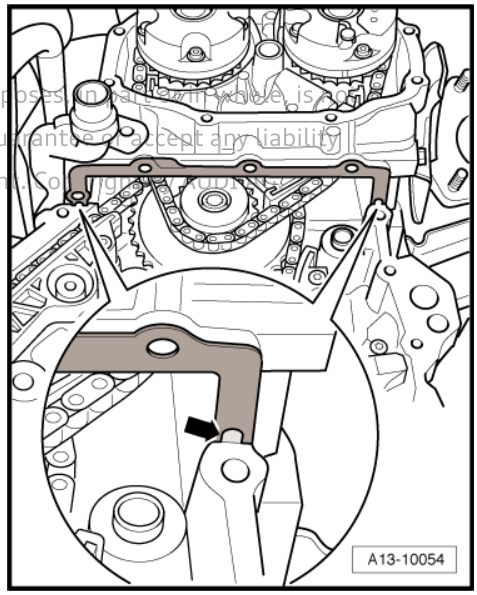
– Cut off nozzle of tube at front marking (nozzle ∅ approx. 2 mm).



– Apply a small amount of sealant to sealing surfaces of cylinder head gaskets (top and bottom). To do so, you again have to bend cylinder head gaskets down very slightly -arrows-.
– Use a flat object (e.g. a feeler gauge) to apply sealant to the area between cylinder head and gasket.



– Clean holes -arrow- in cylinder head gaskets and fill them with sealant.

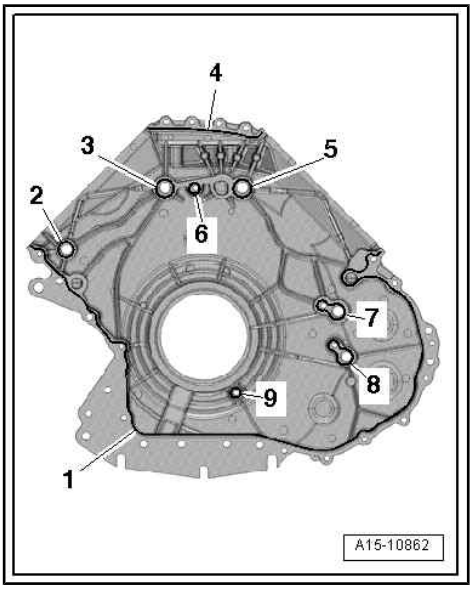


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Caution

Make sure lubrication system is not clogged by excess sealant.

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

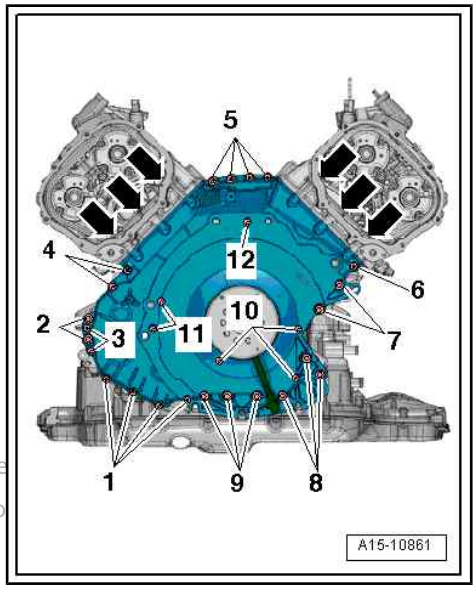


– Apply sealant beads -1 ... 9- onto the clean sealing surfaces of the timing chain cover (bottom) as illustrated.

• Width of sealant beads: 2.5 mm.

Note

The timing chain cover must be installed within 5 minutes after applying the sealant.



– Fit timing chain cover (bottom), guiding it towards the sealing surface on cylinder block and cylinder head at an angle and from below.

– Take care not to damage the cylinder head gaskets when fitting the cover.

– Tighten bolts ⇒ page 112 .

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

– Install crankshaft oil seal (gearbox end) ⇒ page 73 .

– Install oil filter housing ⇒ page 189 .

– Install timing chain covers: left-side ⇒ page 112 , right-side ⇒ page 115 .

– Install drive plate ⇒ page 72 .

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3 Chain drive

⇒ “3.1 Exploded view - camshaft timing chains”, page 122

⇒ “3.2 Exploded view - drive chain for valve gear”, page 125

⇒ “3.3 Exploded view - drive chain for auxiliary drives”, page 127

⇒ “3.4 Removing and installing camshaft timing chain”, page 127

⇒ “3.5 Removing camshaft timing chain from camshafts”, page 129

⇒ “3.6 Removing and installing drive chain for valve gear”, page 137

⇒ “3.7 Removing and installing drive chain for auxiliary drive”, page 138

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3.1 Exploded view - camshaft timing chains

Camshaft timing chain (left-side)

1 - Camshaft adjuster
- ❑ For exhaust camshaft
- ❑ Identification: “EX”
- ❑ Removing and installing ⇒ “3.4 Removing and installing camshaft timing chain”, page 127

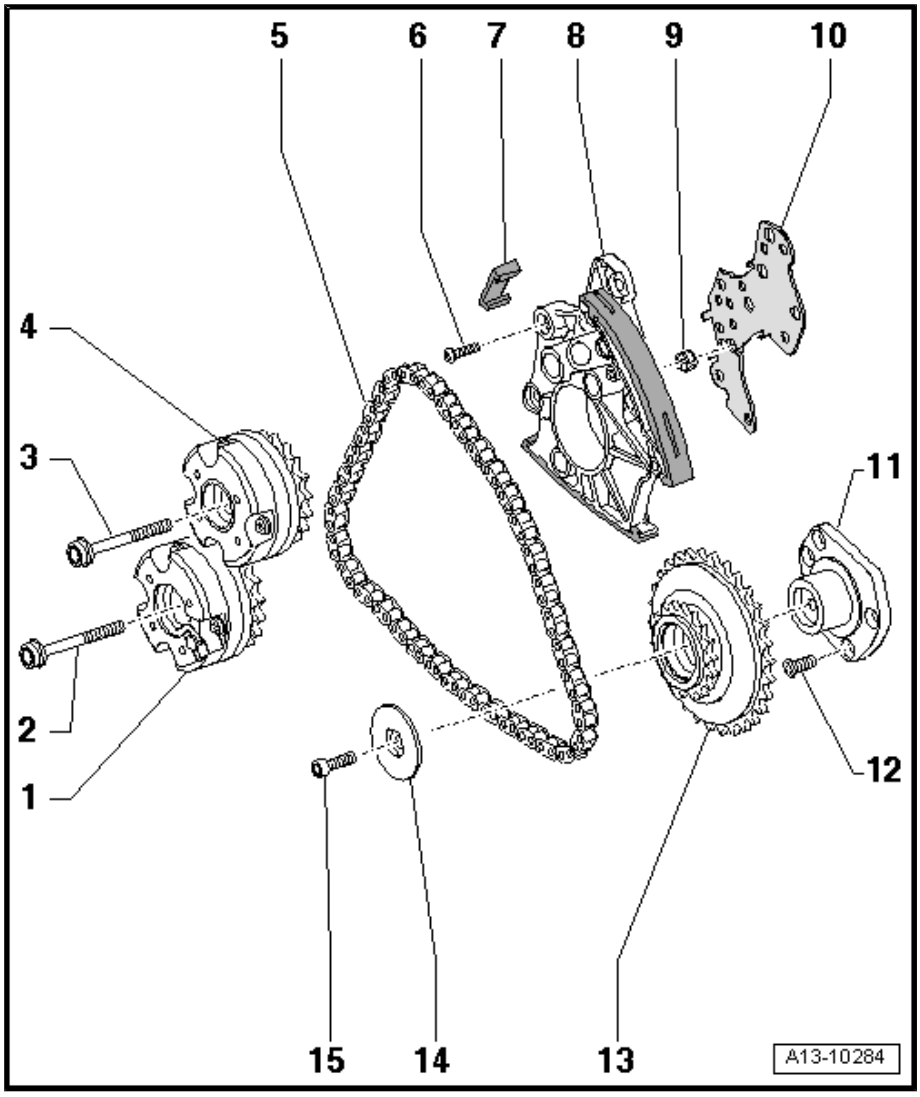
2 - Bolt
- ❑ Renew
- ❑ 80 Nm +90°

3 - Bolt
- ❑ Renew
- ❑ 80 Nm +90°

4 - Camshaft adjuster
- ❑ For inlet camshaft
- ❑ Identification: “IN”
- ❑ Removing and installing ⇒ “3.4 Removing and installing camshaft timing chain”, page 127

5 - Camshaft timing chain (left-side)
- ❑ Removing from camshafts ⇒ page 129
- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 127

6 - Bolt
- ❑ Renew
- ❑ 5 Nm +90°



7 - Slide

8 - Chain tensioner

- ❑ For camshaft timing chain (left-side)
- ❑ Removing and installing ⇒ “3.4 Removing and installing camshaft timing chain”, page 127

9 - Oil strainer

- ❑ Inserted in chain tensioner
- ❑ Watch position of locking lug on outer circumference

10 - Gasket

- ❑ Renew
- ❑ Clipped onto chain tensioner

11 - Bearing bracket

- ❑ For drive chain sprocket
- ❑ Version fitted in vehicle may differ from illustration

12 - Bolt

- ❑ 9 Nm

13 - Drive chain sprocket

- ❑ For camshaft timing chain (left-side)

14 - Thrust washer

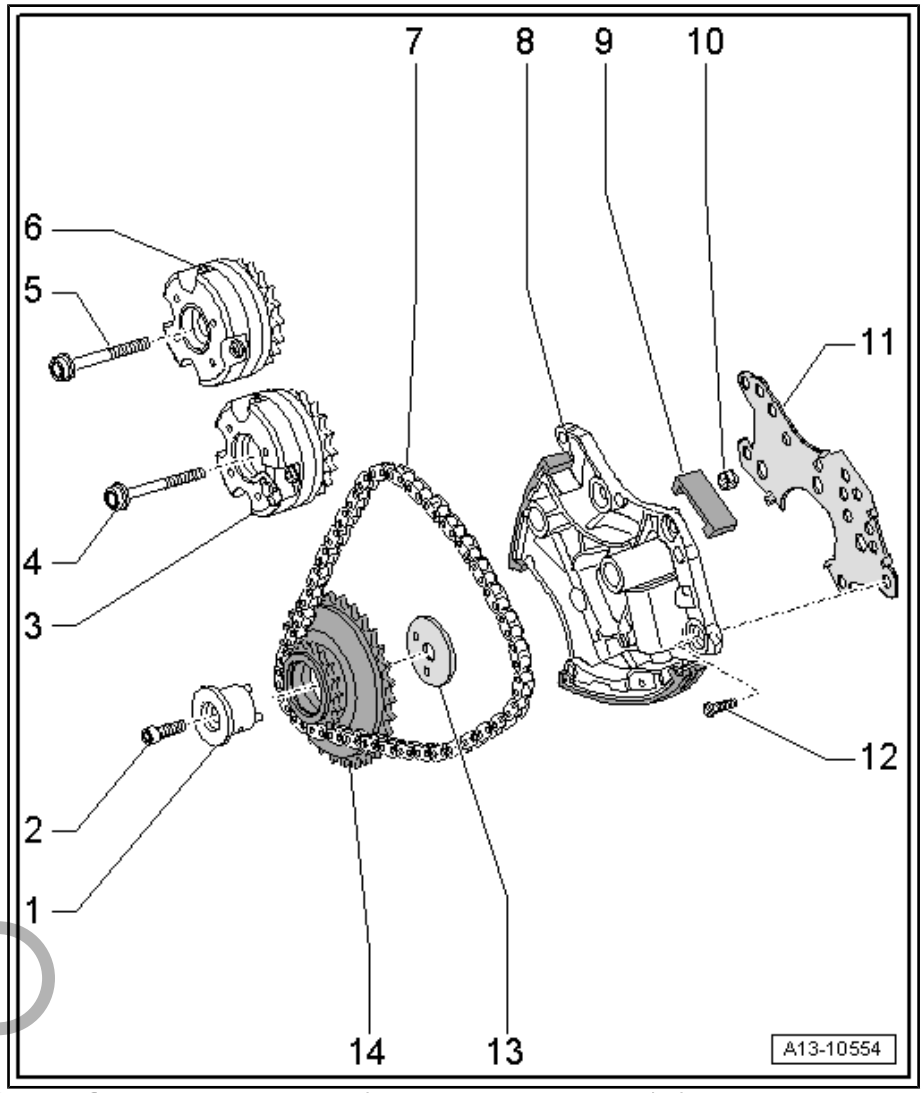
- ❑ For drive chain sprocket

15 - Bolt

- ❑ 22 Nm

Camshaft timing chain (right-side)

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1 - Bearing mounting

- ❑ For drive chain sprocket for camshaft timing chain (right-side)
- ❑ Asymmetric version
- ❑ Installation position ⇒ page 125

2 - Bolt

- ❑ 42 Nm

3 - Camshaft adjuster

- ❑ For exhaust camshaft
- ❑ Identification: “EX”
- ❑ Removing and installing ⇒ “3.4 Removing and installing camshaft timing chain”, page 127

4 - Bolt

- ❑ Renew
- ❑ 80 Nm +90°

5 - Bolt

- ❑ Renew
- ❑ 80 Nm +90°

6 - Camshaft adjuster

- ❑ For inlet camshaft
- ❑ Identification: “IN”
- ❑ Removing and installing ⇒ “3.4 Removing and installing camshaft timing chain”, page 127

7 - Camshaft timing chain (right-side)

- ❑ Removing from camshafts ⇒ page 129
- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 127

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8 - Chain tensioner

- ❑ For camshaft timing chain (right-side)
- ❑ Version fitted in vehicle may differ from illustration
- ❑ Removing and installing ⇒ “3.4 Removing and installing camshaft timing chain”, page 127

9 - Slide

10 - Oil strainer

- ❑ Inserted in chain tensioner
- ❑ Installation position: note locating lug on outer circumference

11 - Gasket

- ❑ Renew
- ❑ Clipped onto chain tensioner

12 - Bolt

- ❑ Renew
- ❑ 5 Nm +90°

13 - Thrust washer

- ❑ For drive chain sprocket

14 - Drive chain sprocket

- ❑ For camshaft timing chain (right-side)

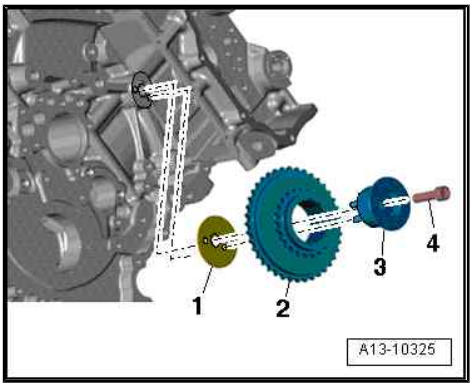
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Installation position: bearing mounting for drive sprocket for camshaft timing chain (right-side)

- Dowel pins in bearing mounting -3- for drive sprocket for camshaft timing chain (right-side) must engage in drillings in thrust washer -1- and in cylinder block drillings.

2 - Drive sprocket for camshaft timing chain (right-side)

4 - Bolt



3.2 Exploded view - drive chain for valve gear

1 - Guide rail

2 - Bolt

- ❑ Renew
- ❑ 17 Nm +90°

3 - Bolt

- ❑ Tightening torque ⇒ Item 2 (page 124)

4 - Bolt

- ❑ Tightening torque ⇒ Item 15 (page 123)

5 - Thrust washer

- ❑ For drive chain sprocket

6 - Drive chain sprocket

- ❑ For timing chain (left-side)

7 - Bolt

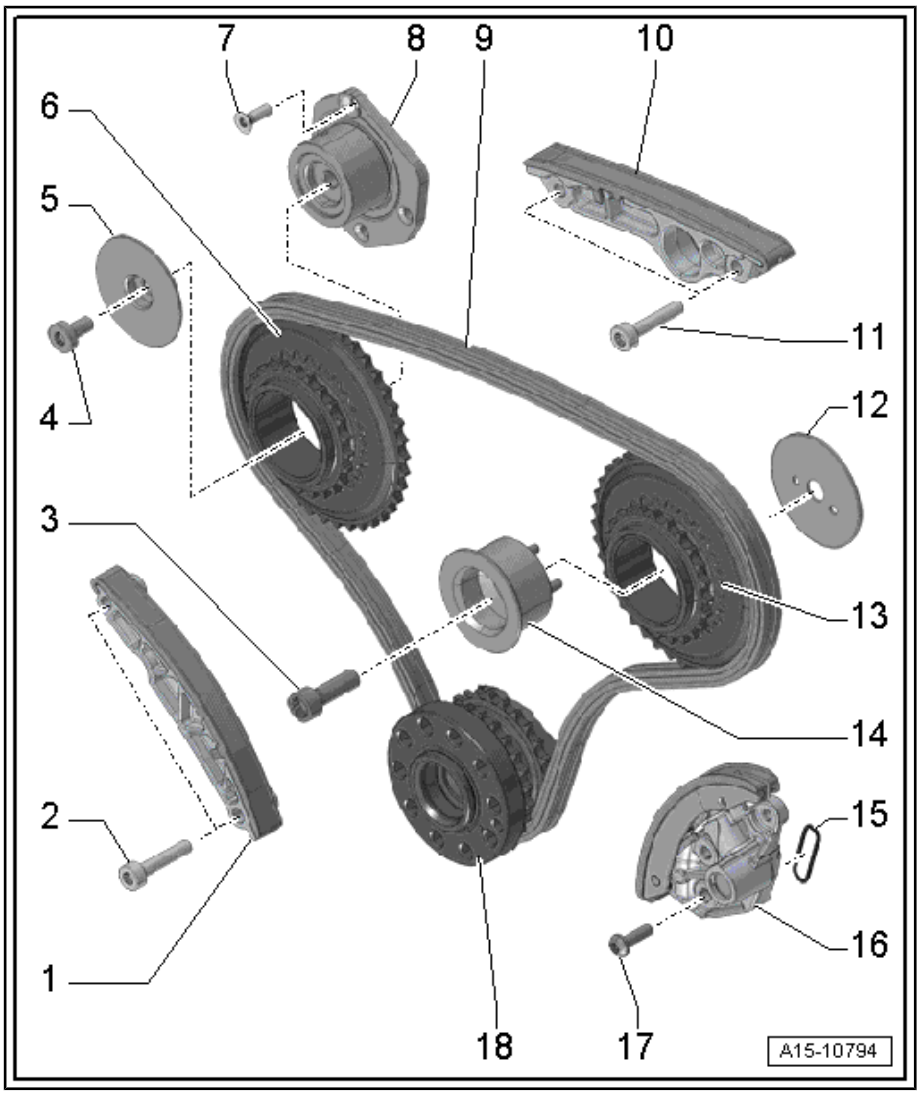
- ❑ Tightening torque ⇒ Item 12 (page 123)

8 - Bearing mounting

- ❑ For drive chain sprocket for camshaft timing chain (right-side)
- ❑ Asymmetric version
- ❑ Installation position ⇒ page 125

9 - Drive chain

- ❑ For timing drive
- ❑ Before removing, mark running direction with paint
- ❑ Removing and installing ⇒ page 137



10 - Guide rail

11 - Bolt

- ❑ Renew
- ❑ 17 Nm +90°

12 - Thrust washer

13 - Drive chain sprocket

- ❑ For timing chain (right-side)

14 - Bearing mounting

- ❑ For drive chain sprocket

15 - Seal

- ❑ Renew

16 - Chain tensioner

17 - Bolt

- ❑ Renew
- ❑ 5 Nm +90°

18 - Crankshaft

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3.3 Exploded view - drive chain for auxiliary drives

1 - Bolt
- ❑ Renew
- ❑ 5 Nm +90°

2 - Chain tensioner
- ❑ With guide rail

3 - Gasket
- ❑ Renew

4 - Drive chain sprocket
- ❑ For auxiliary drives
- ❑ Part of spur gear drive

5 - Bolt
- ❑ 42 Nm

6 - Bearing mounting
- ❑ For idler sprocket

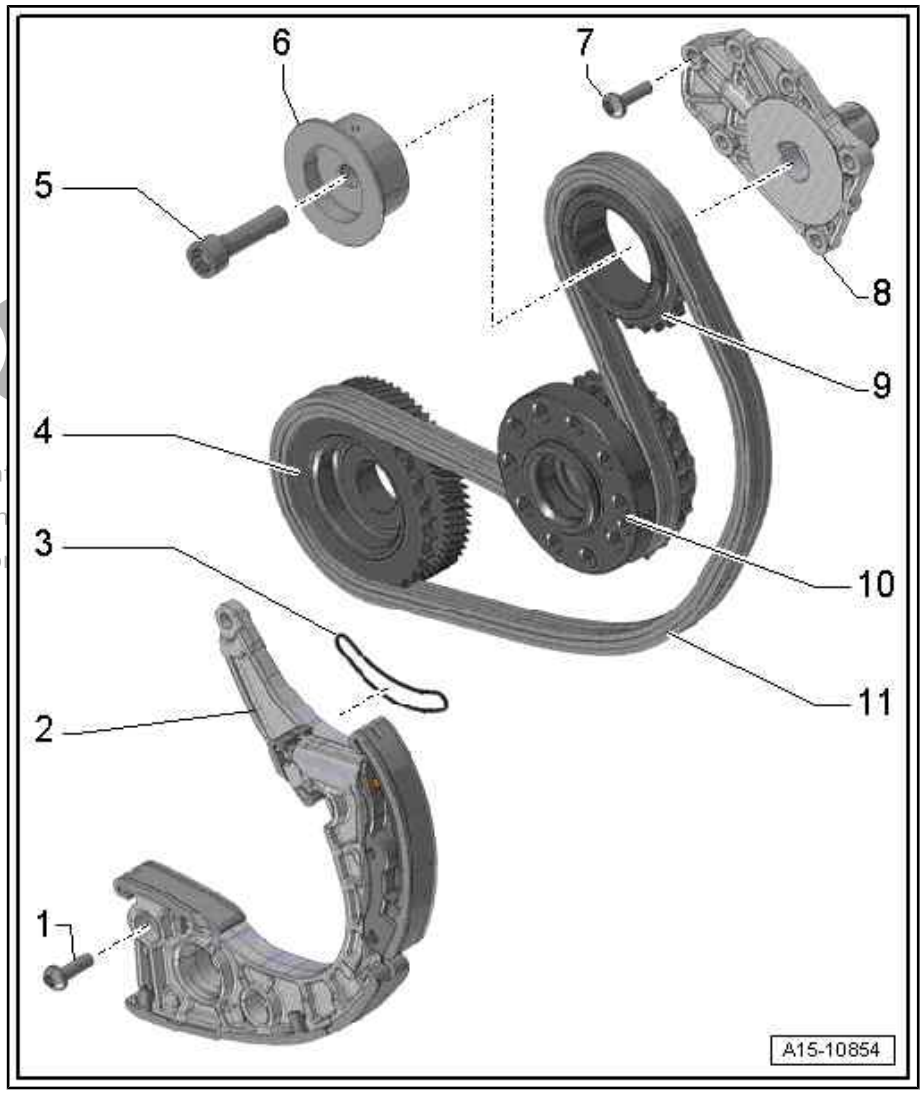
7 - Bolt
- ❑ Renew
- ❑ 5 Nm +90°

8 - Bearing bracket
- ❑ For idler sprocket

9 - Idler sprocket
- ❑ For drive chain for auxiliary drives

10 - Crankshaft

11 - Drive chain
- ❑ For auxiliary drives
- ❑ Removing and installing ⇒ page 138



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3.4 Removing and installing camshaft timing chain

Removing

- Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .
- Engine secured with support -VAS 6131/13-7- .

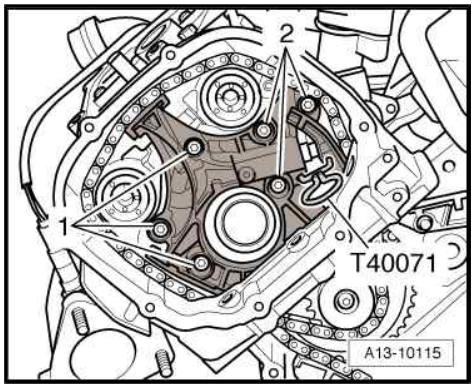
– Remove timing chain cover (bottom) ⇒ page 117 .

– Remove timing chains from camshafts ⇒ page 129 .

Caution

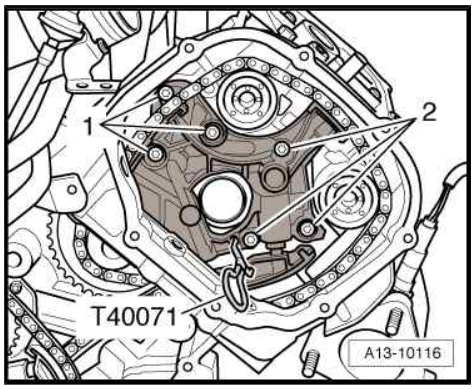
If a used timing chain rotates in the opposite direction when it is refitted, this can cause breakage.

- ***Mark running direction of timing chain with coloured arrows for re-installation.***



– Remove bolts -1- and -2- and take off chain tensioner (left-side) and camshaft timing chain (left-side).

– Remove bolts -1- and -2- and take off chain tensioner (right-side) and timing chain (right-side).



Installing

- Tightening torque
⇒ “3.1 Exploded view - camshaft timing chains”, page 122

Note

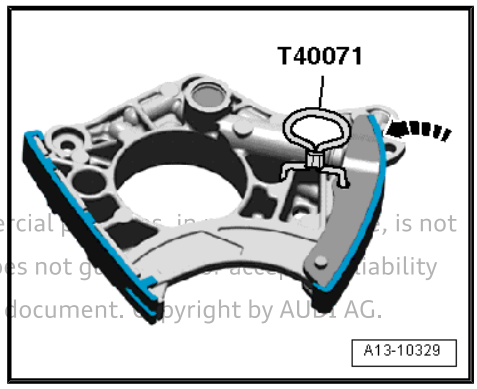
- *Note the correct installation position if the tensioning element has been removed from the chain tensioner: open side in base of housing faces chain tensioner and piston faces tensioner rail.*
- *Renew bolts tightened with specified tightening angle.*
- *Renew seals and/or gaskets.*

Caution

Risk of damage to valves and piston crowns.

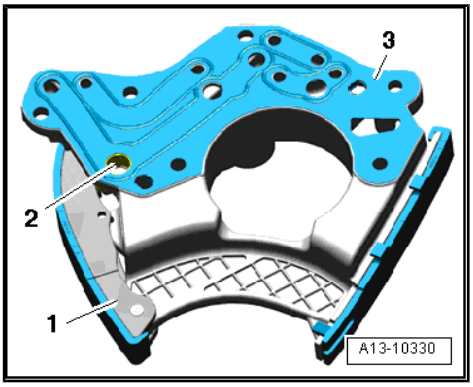
- ***The crankshaft must not be at “TDC” at any cylinder when the camshafts are turned.***

– Press guide rail of chain tensioner for camshaft timing chain (left or right) inwards -arrow- as far as the stop. Then lock chain tensioner by inserting locking pin - T40071- .

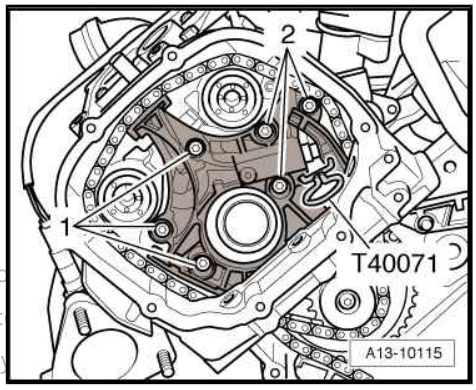


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– If necessary, clean oil strainer -2- in both chain tensioners.
– Fit new gasket -3- on rear of chain tensioner -1-.

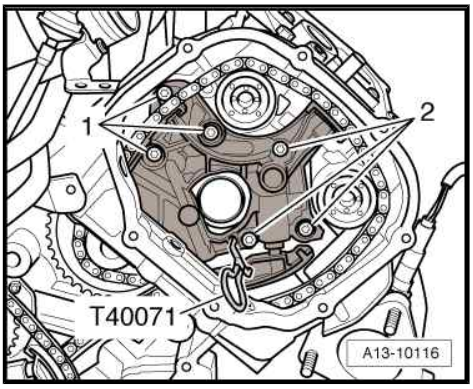


– Fit chain tensioner on cylinder head (left-side) and position timing chain as shown in the illustration (according to marks applied when removing).
– Tighten bolts -1- and -2-.



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– Fit chain tensioner on cylinder head (right-side) and position timing chain as shown in the illustration (according to marks applied when removing).
– Tighten bolts -1- and -2-.

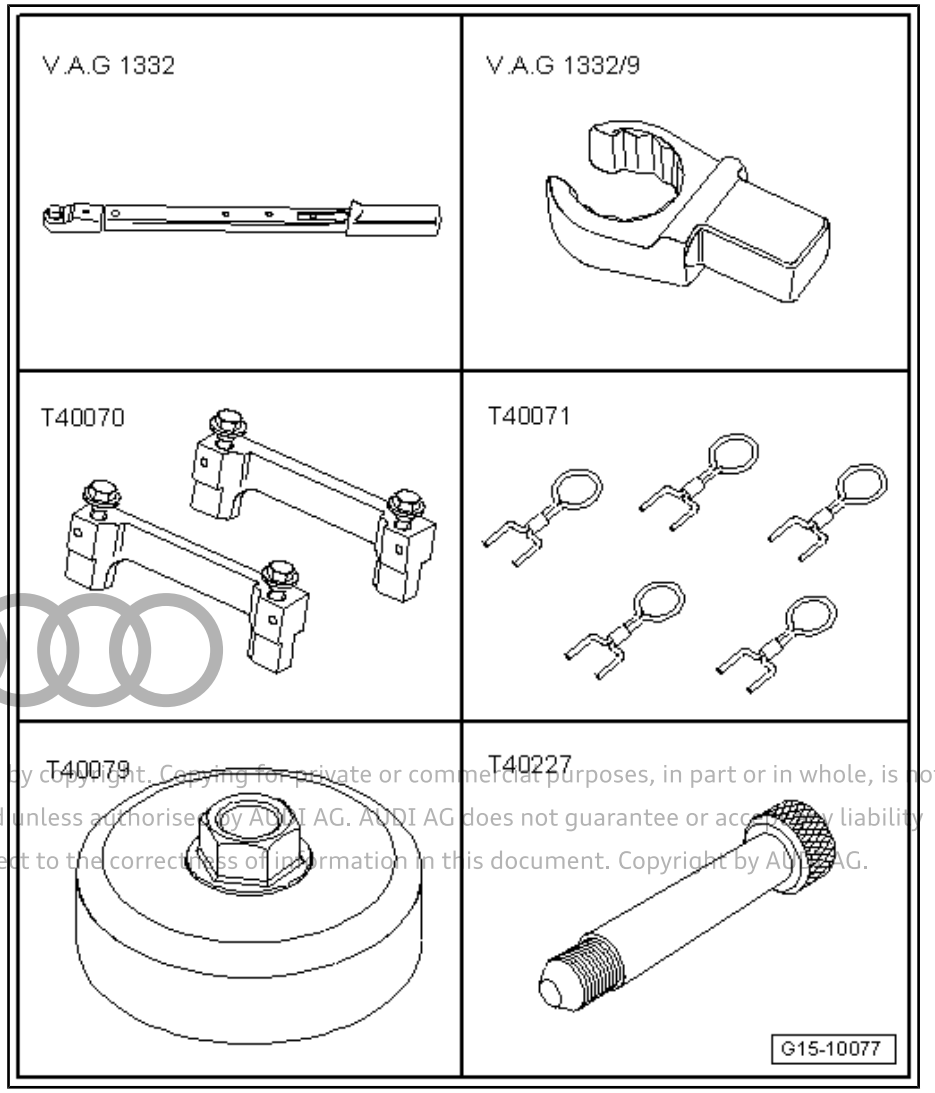


Remaining installation steps are carried out in reverse sequence; note the following:

– Fit timing chains on camshafts ⇒ page 133 .
– Install timing chain cover (bottom) ⇒ page 117 .

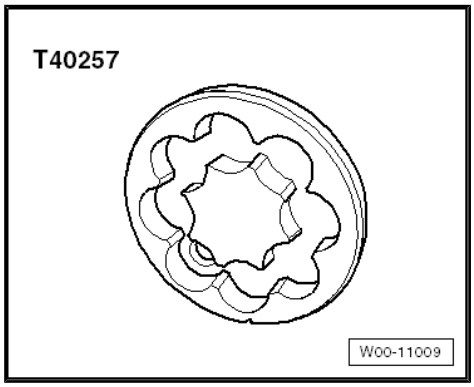
3.5 Removing camshaft timing chain from camshafts

Special tools and workshop equipment required

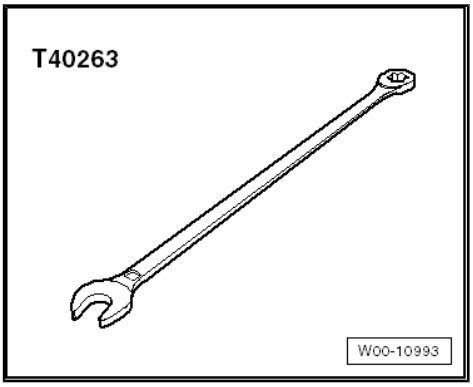


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- Torque wrench - V.A.G 1332-
- Tool insert - V.A.G 1332/9-
- 2x Camshaft clamp - T40070-
- 2x Locking pin - T40071-
- Key - T40079-
- Locking pin - T40227-
- Turning-over tool - T40257-



♦ Wrench, 21 mm - T40263-



Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

Note

In the following procedure the camshaft timing chains remain on the engine.

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– Remove corresponding cylinder head cover ⇒ page 105 .

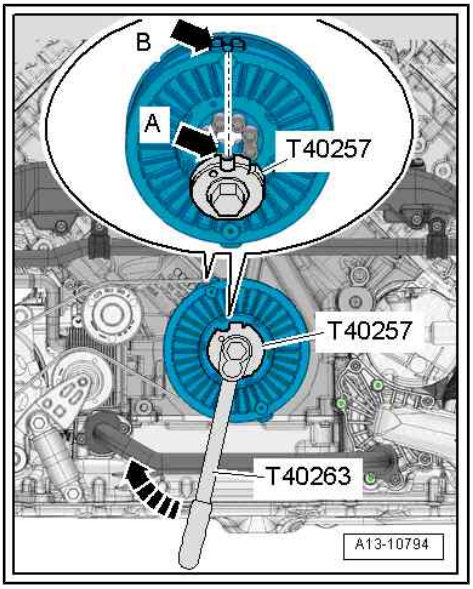
– Remove relevant timing chain cover: left-side ⇒ page 112 ; right-side ⇒ page 115 .

– Remove poly V-belt ⇒ page 67 .

– Fit turning-over tool - T40257- onto wrench (21 mm) - T40263- .

– Position turning-over tool - T40257- on bolts of vibration damper.

- Semi-circular recess -arrow A- on turning-over tool - T40257- must point to semi-circular recess -arrow B- on vibration damper.

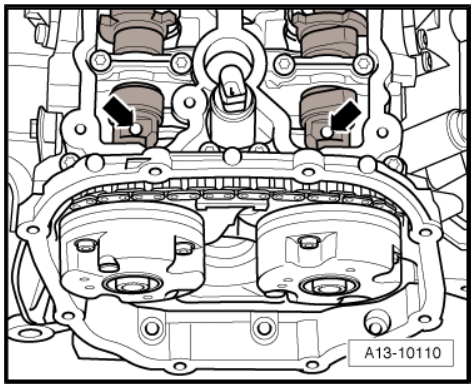


Note

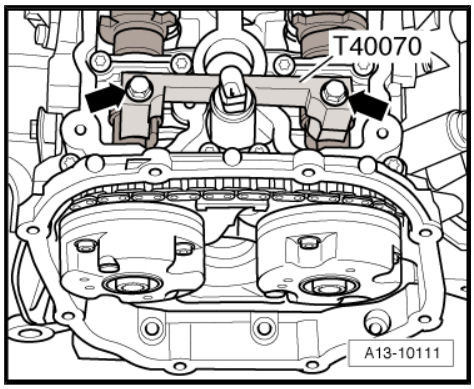
Disregard notch on turning-over tool - T40257- .

– Rotate crankshaft in normal direction of rotation -arrow- to “TDC”.

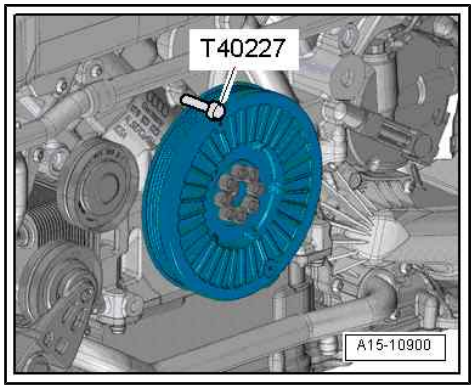
- The threaded holes -arrows- in the camshafts must face upwards.



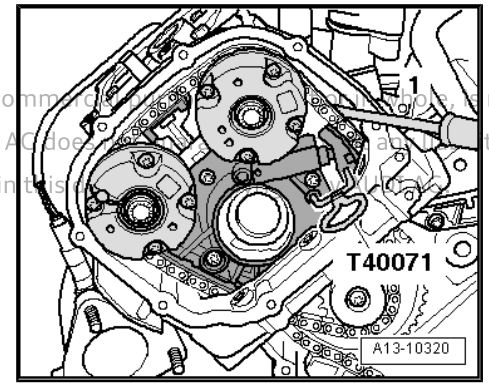
– Secure camshaft clamps - T40070- on both cylinder heads and tighten to 25 Nm -arrows-.
- The camshaft clamp - T40070- is positioned correctly if the holes for the cylinder head bolts remain free.



– Screw locking pin - T40227- into cylinder block by hand as far as stop; if necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



– Press guide rail of chain tensioner for camshaft timing chain (left-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .

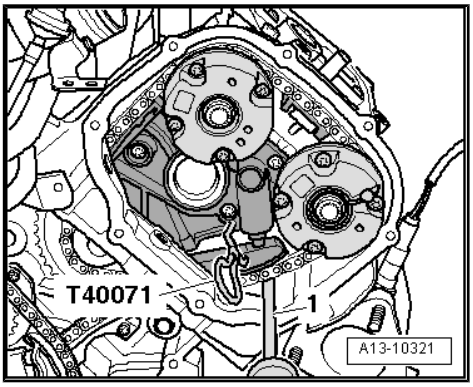


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Note

The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.

– Press guide rail of chain tensioner for camshaft timing chain (right-side) inwards as far as the stop using a screwdriver -1-. Then lock chain tensioner by inserting locking pin - T40071- .



Note

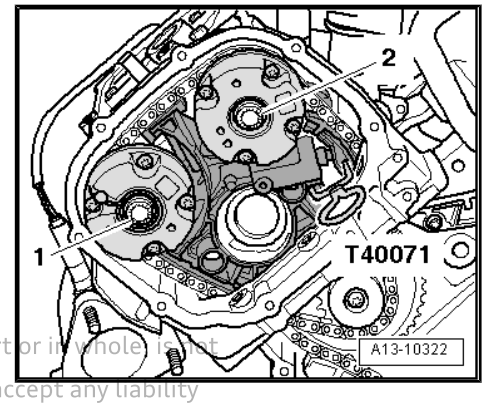
The chain tensioner is oil-damped and can therefore only be compressed slowly by applying constant pressure.

– Mark position of camshaft adjusters in relation to camshafts with paint for re-installation.

Caution

Risk of irreparable damage to engine.

- *Block off the opening in the valve timing housing with a clean cloth to prevent small items from dropping into the engine.*

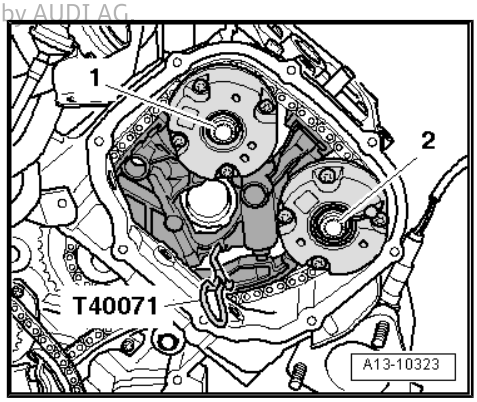


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– Unscrew bolts -1- and -2- on cylinder head (left-side) and remove both camshaft adjusters.

– Mark position of camshaft adjusters in relation to camshafts with paint for re-installation.

– Unscrew bolts -1- and -2- on cylinder head (right-side) and remove both camshaft adjusters.



Installing

- Tightening torques
⇒ “3.1 Exploded view - camshaft timing chains”, page 122

Note

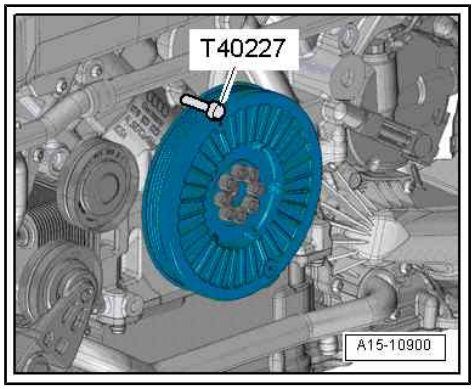
Renew bolts tightened with specified tightening angle.

Caution

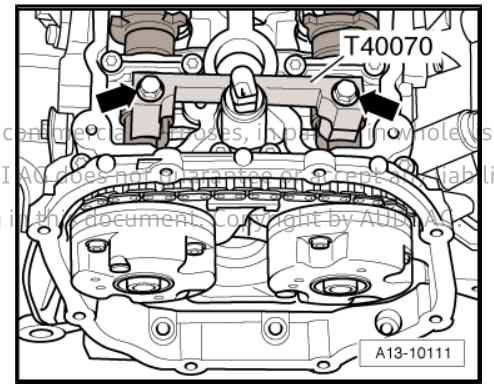
Risk of damage to valves and piston crowns.

- *The crankshaft must not be at “TDC” at any cylinder when the camshafts are turned.*

- Drive chain for valve gear installed ⇒ page 137
- Crankshaft locked in “TDC” position with locking pin - T40227- .

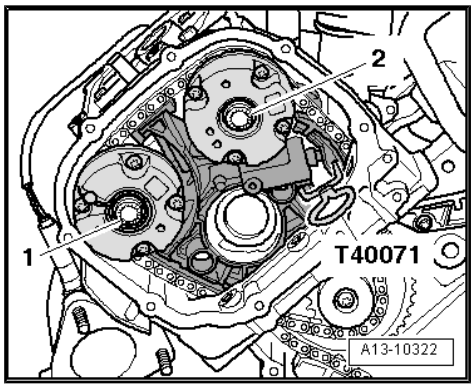


- Camshaft clamps - T40070- secured on both cylinder heads and tightened to 25 Nm -arrows-.



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– Install camshaft adjuster on cylinder head (left-side).

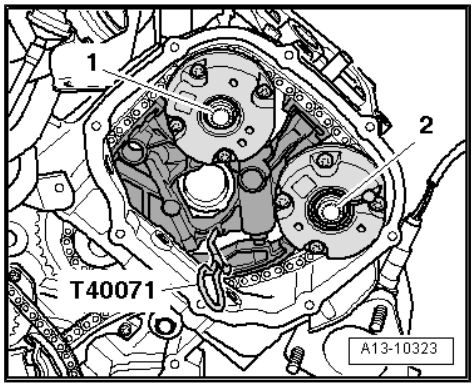


Note

Ensure correct allocation of camshaft adjusters to camshafts based on marks made during removal.

– Fit timing chain onto drive chain sprocket and camshaft adjusters and fit bolts -1- and -2- without tightening.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
– Remove locking pin - T40071- .

– Install camshaft adjuster on cylinder head (right-side).



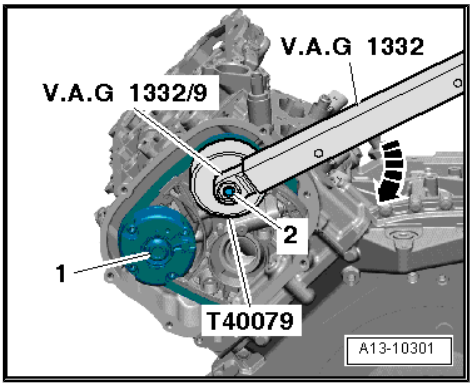
Note

Ensure correct allocation of camshaft adjusters to camshafts based on marks made during removal.

– Fit timing chain onto drive chain sprocket and camshaft adjusters and fit bolts -1- and -2- without tightening.
- It should just be possible to turn both camshaft adjusters on the camshaft without axial movement.
– Remove locking pin - T40071- .

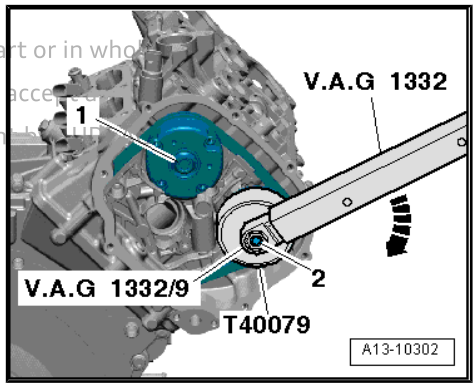
– Fit key - T40079- onto camshaft adjuster of inlet camshaft on cylinder head (left-side).
– Apply torque wrench - V.A.G 1332- with open ring spanner insert - V.A.G 1332/9- to key - T40079- .
– Have a second mechanic apply a torque of 40 Nm to camshaft adjuster in direction of -arrow-.
– Tighten bolts as follows while keeping camshaft adjuster under tension:

Stage	Bolt	Tightening torque
1.	-1-	On exhaust camshaft: 60 Nm
1.	-2-	On inlet camshaft: 60 Nm



– Fit key - T40079- onto camshaft adjuster of exhaust camshaft on cylinder head (right-side).
– Apply torque wrench - V.A.G 1332- with open ring spanner insert - V.A.G 1332/9- to key - T40079- .
– Have a second mechanic apply a torque of 40 Nm to camshaft adjuster in direction of -arrow-.
– Tighten bolts as follows while keeping camshaft adjuster under tension:

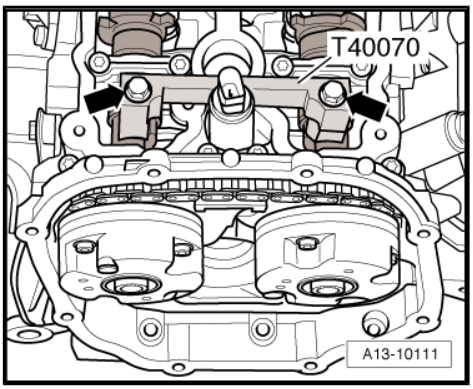
Stage	Bolt	Tightening torque
1.	-1-	On inlet camshaft: 60 Nm
1.	-2-	On exhaust camshaft: 60 Nm



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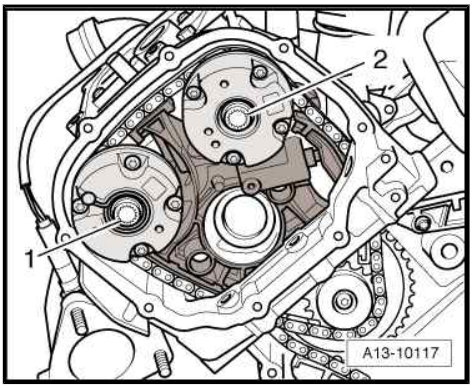
– Remove key - T40079- .

– Remove camshaft clamps - T40070- from both cylinder heads -arrows-.



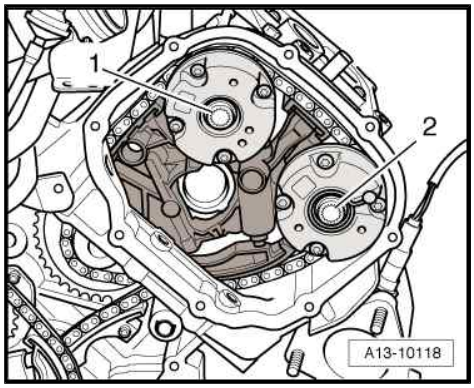
– Tighten camshaft adjuster bolts on cylinder head (left-side) as follows:

Stage	Bolt	Tightening torque
2.	-1-	Tighten on exhaust camshaft to final tightening torque
2.	-2-	Tighten on inlet camshaft to final tightening torque

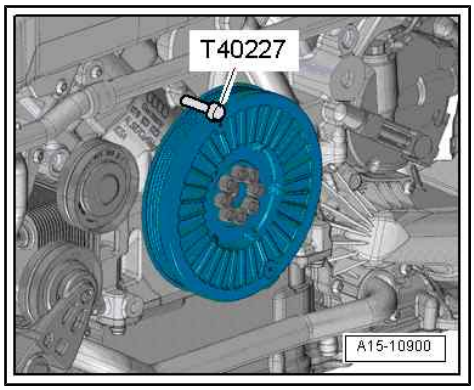


– Tighten camshaft adjuster bolts on cylinder head (right-side) as follows:

Stage	Bolt	Tightening torque
2.	-1-	Tighten on inlet camshaft to final tightening torque
2.	-2-	Tighten on exhaust camshaft to final tightening torque



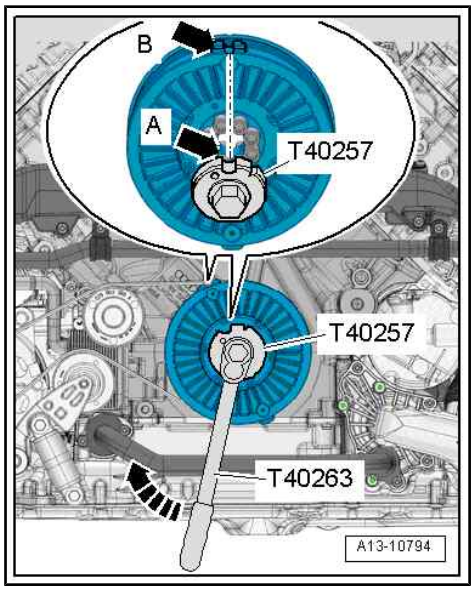
– Remove locking pin - T40227- .



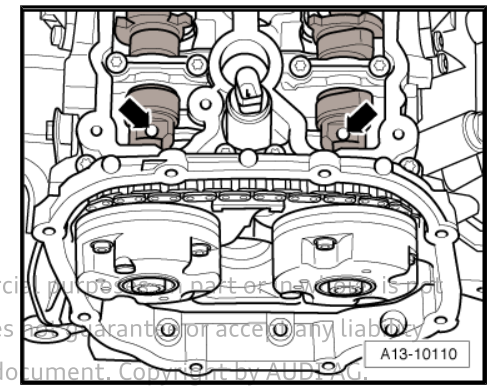
– Turn crankshaft two revolutions in normal direction of rotation -arrow- until crankshaft is once again at “TDC”.

Note

If you turn the crankshaft beyond “TDC” by mistake, turn it back approx. 30° and set to “TDC” again.



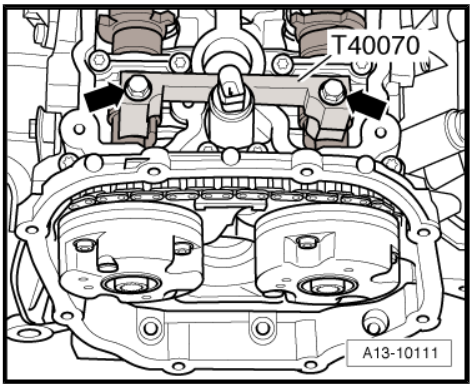
• The threaded holes -arrows- in the camshafts must face upwards.



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– Secure camshaft clamps - T40070- on both cylinder heads and tighten to 25 Nm -arrows-.

• The camshaft clamp - T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

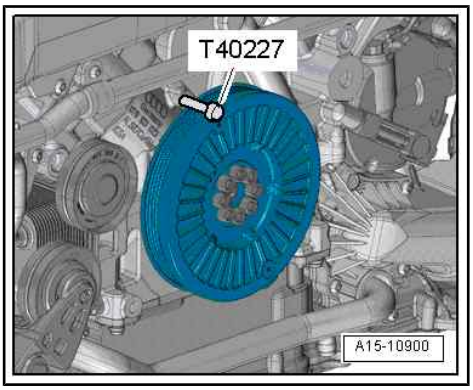


– Screw in locking pin - T40227- into cylinder block by hand until it makes contact.

• The locking pin - T40227- must engage in the locating hole in cylinder block. If it does not, reset valve timing.

– Remove camshaft clamps from both cylinder heads.

– Remove locking pin - T40227- .



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

– Install timing chain cover: left-side ⇒ page 112 , right-side ⇒ page 115 .

– Install cylinder head cover ⇒ page 105 .

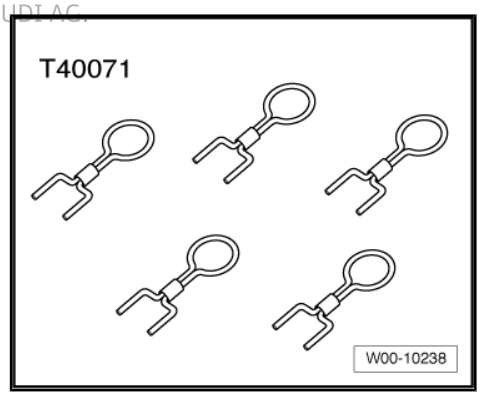
– Install poly V-belt ⇒ page 67 .

3.6 Removing and installing drive chain for valve gear

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Special tools and workshop equipment required

◆ Locking pin - T40071-



Removing

• Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .

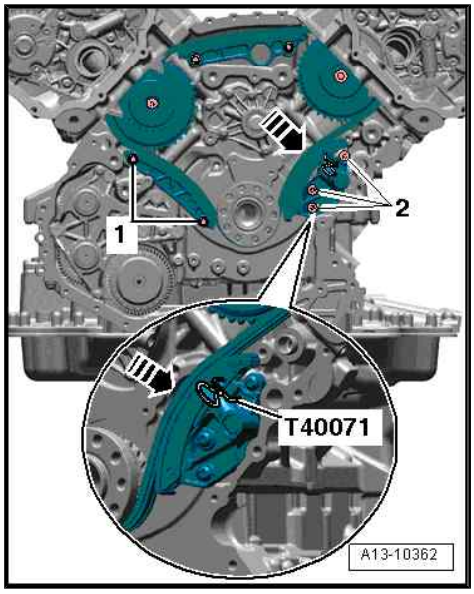
• Engine secured with support -VAS 6131/13-7- .

– Remove timing chain cover (bottom) ⇒ page 117 .

– Remove timing chains ⇒ page 127 .

– Remove drive chain for auxiliary drives ⇒ page 138 .

– Press guide rail of chain tensioner for drive chain in direction of -arrow- and lock chain tensioner by inserting locking pin - T40071- .



Caution

If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

- *Mark running direction of drive chain with coloured arrows for re-installation.*

– Unscrew bolts -1- and remove guide rail.

– Remove bolts -2- and take off chain tensioner.

– Detach drive chain for valve gear.

Installing

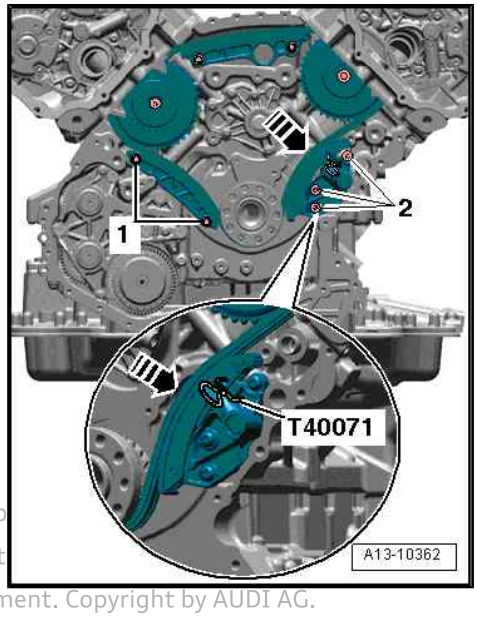
Installation is carried out in reverse order; note the following:

- Tightening torques
⇒ “3.2 Exploded view - drive chain for valve gear”, page 125

Note

Renew bolts tightened with specified tightening angle.

– Position drive chain for valve gear onto drive chain sprockets (according to marks applied during removal).



– Install guide rail and tighten bolts -1-.

– Install chain tensioner and tighten bolts -2-.

– Press guide rail of chain tensioner for drive chain in direction of -arrow- and pull locking pin - T40071- out of chain tensioner.

– Install drive chain for auxiliary drives ⇒ page 138 .

– Install camshaft timing chains ⇒ page 127 .

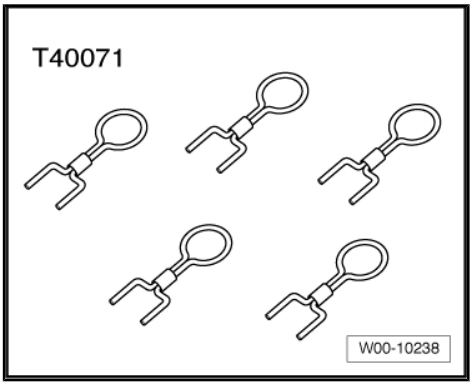
– Install timing chain cover (bottom) ⇒ page 117 .

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3.7 Removing and installing drive chain for auxiliary drive

Special tools and workshop equipment required

♦ Locking pin - T40071-



Removing

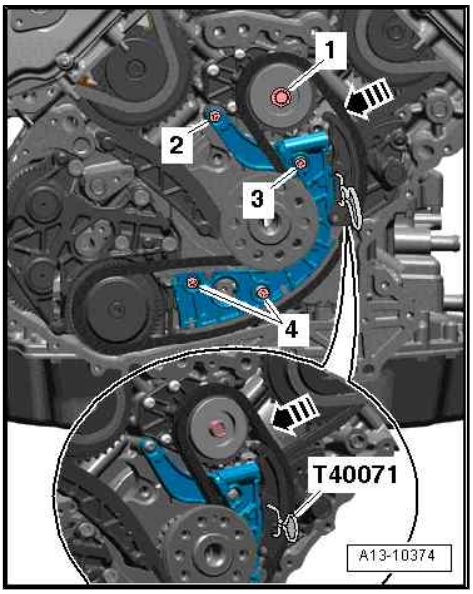
- Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .
- Engine secured with support -VAS 6131/13-7- .

– Remove timing chain cover (bottom) ⇒ page 117 .

Caution

If a used drive chain rotates in the opposite direction when it is refitted, this can cause breakage.

♦ *Mark running direction of drive chain for auxiliary drives with coloured arrows for re-installation.*



– Press tensioning rail in direction of -arrow- and lock chain tensioner in place using locking pin - T40071- .
– Unscrew bolt -1- and remove idler sprocket.
– Remove bolts -2, 3, 4- and take off chain tensioner.
– Detach drive chain for auxiliary drives.

Installing

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

- Tightening torques ⇒ "3.3 Exploded view - drive chain for auxiliary drives", page 127

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Note

♦ *Renew seal.*
♦ *Renew bolts tightened with specified tightening angle.*

– Install timing chain cover (bottom) ⇒ page 117 .

4 Valve gear

⇒ “4.1 Exploded view - valve gear”, page 140
⇒ “4.2 Measuring axial clearance of camshaft”, page 143
⇒ “4.3 Measuring radial clearance of camshaft”, page 143
⇒ “4.4 Removing and installing camshaft”, page 144
⇒ “4.5 Checking hydraulic compensation elements”, page 153
⇒ “4.6 Removing and installing valve stem oil seals”, page 155

4.1 Exploded view - valve gear

Caution

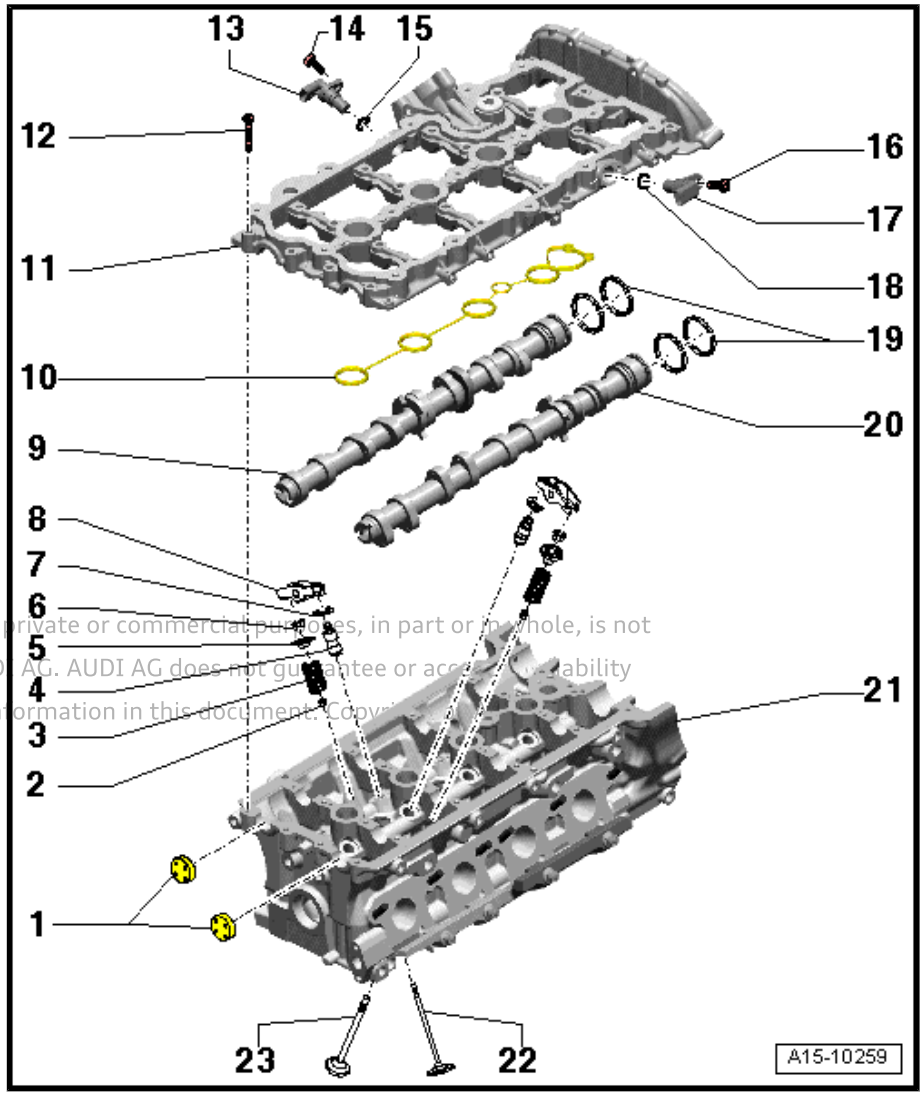
Risk of damage to valves and piston crowns after working on valve gear.

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

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Note

- *Cylinder heads which have cracks between the valve seats or between a valve seat insert and the spark plug thread can be re-installed without reducing service life, provided the cracks are only slight and do not exceed a maximum of 0.3 mm in width, and no more than the first 4 turns of the spark plug threads are cracked.*
- *The diagram shows the cylinder head on cylinder bank 2 (left-side).*



1 - Sealing plug

2 - Valve stem oil seal

- ❑ Renewing with cylinder head installed ⇒ page 155
- ❑ Renewing with cylinder head removed ⇒ page 159

3 - Valve spring

- ❑ Installation position ⇒ page 143

4 - Hydraulic compensation element

- ❑ Clipped into roller rocker finger -item 8-
- ❑ Checking ⇒ page 153
- ❑ Mark installation position for re-installation with a coloured pen
- ❑ Lubricate contact surfaces before installing

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5 - Valve spring plate

6 - Valve cotters

7 - Securing clip

- ❑ Not available as separate part
- ❑ Check for firm attachment

8 - Roller rocker finger

- ❑ Mark installation position for re-installation with a coloured pen
- ❑ Check roller bearings for ease of movement
- ❑ Lubricate contact surfaces before installing
- ❑ Attach to hydraulic compensation element -item 4- using securing clip -item 7-

9 - Inlet camshaft

- ❑ Removing and installing ⇒ page 144
- ❑ Measuring axial clearance ⇒ page 143
- ❑ Measuring radial clearance ⇒ page 143
- ❑ Runout: max. 0.04 mm

10 - Gasket

- ❑ Renew

11 - Retaining frame

- ❑ With integrated camshaft bearings
- ❑ Removing and installing ⇒ “4.4 Removing and installing camshaft”, page 144

12 - Bolt

- ❑ Renew
- ❑ Tightening sequence ⇒ page 142

13 - Hall sender 2 - G163-

14 - Bolt

- ❑ Tightening torque ⇒ page 301

15 - O-ring

- ❑ Renew

16 - Bolt

- ❑ Tightening torque ⇒ page 301

17 - Hall sender 4 - G301-

18 - O-ring

- ❑ Renew

19 - Rectangular section seals

- ❑ For camshaft adjuster

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20 - Exhaust camshaft

- ❑ Removing and installing ⇒ page 144
- ❑ Measuring axial clearance ⇒ page 143
- ❑ Measuring radial clearance ⇒ page 143
- ❑ Runout: max. 0.04 mm

21 - Cylinder head

- ❑ Checking valve guides ⇒ page 163

22 - Inlet valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ page 163
- ❑ Checking valve guides ⇒ page 163

23 - Exhaust valve

- ❑ Do not machine, only grinding-in is permitted
- ❑ Mark installation position for re-installation
- ❑ Valve dimensions ⇒ page 163
- ❑ Checking valve guides ⇒ page 163

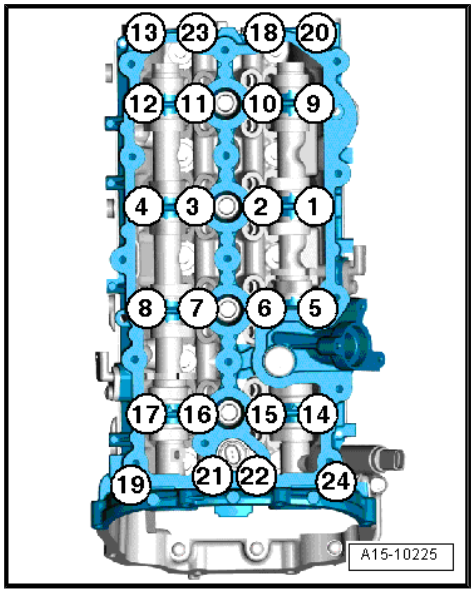
Retaining frame for camshafts - tightening torque and sequence

Note

Renew bolts tightened with specified tightening angle.

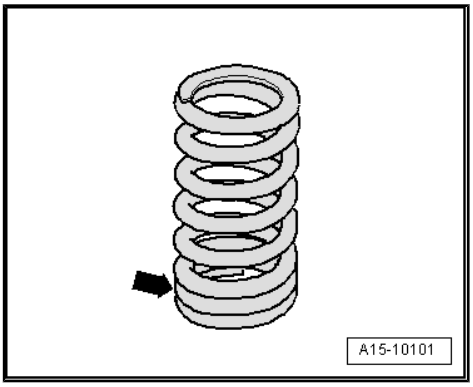
– Tighten bolts in 3 stages in the sequence shown:

Stage	Bolts	Tightening torque/angle specification
1.	-1 … 24-	Screw in by hand until contact is made • The retaining frame should make contact with the cylinder head over the full surface
2.	-1 … 24-	8 Nm
3.	-1 … 24-	Turn 90° further



Position of valve spring

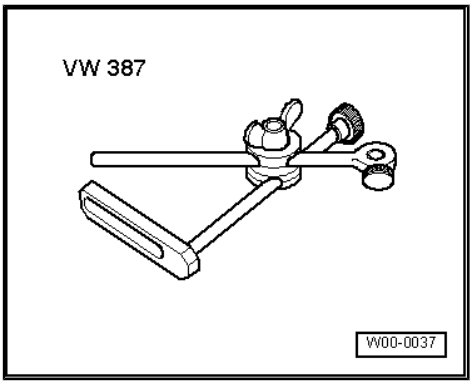
- Closely spaced spring coils -arrow- face towards cylinder head.



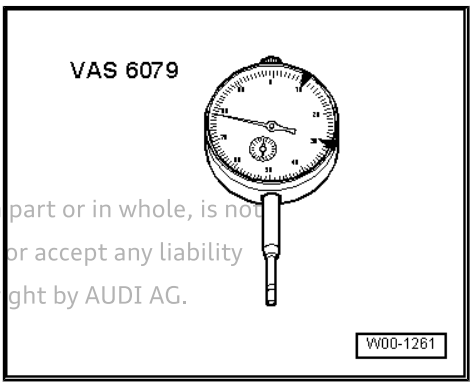
4.2 Measuring axial clearance of camshaft

Special tools and workshop equipment required

♦ Universal dial gauge bracket - VW 387-



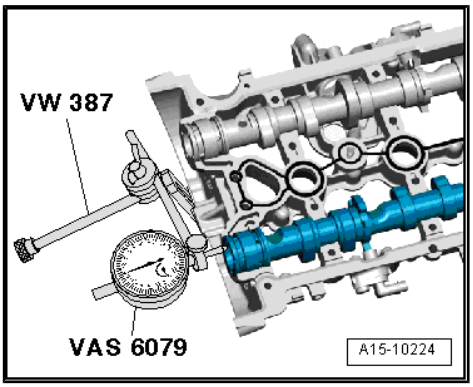
♦ Dial gauge - VAS 6079-



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Procedure

– Remove retaining frame
⇒ “4.4 Removing and installing camshaft”, page 144 .
– Fit camshaft to be tested in retaining frame.
– Attach dial gauge - VAS 6079- with universal dial gauge bracket - VW 387- to retaining frame.
– Press camshaft against dial gauge by hand.
– Set dial gauge to “0”.
– Press camshaft away from dial gauge and read off value:
• Axial clearance: 0.100 ... 0.191 mm



4.3 Measuring radial clearance of camshaft

Special tools and workshop equipment required

♦ Plastigauge

Procedure

– Remove camshafts ⇒ page 144 .

– Mark allocation of roller rocker fingers for re-installation.

– Carefully remove roller rocker fingers and place them on a clean surface.

– Clean bearings and bearing journals.

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

• The Plastigauge must be positioned in the centre of the bearing.

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– Re-insert camshafts, fit retaining frame and tighten to 8 Nm, but do not turn bolts further: Do not rotate camshafts ⇒ page 142 .

– Remove retaining frame and camshafts again.

– Compare width of Plastigauge with measurement scale.

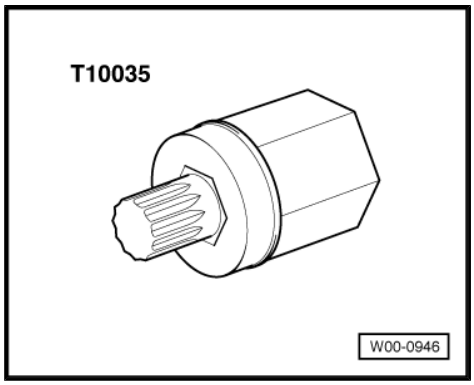
Radial clearance:

• 24 mm bearing ∅: 0.024 ... 0.066 mm

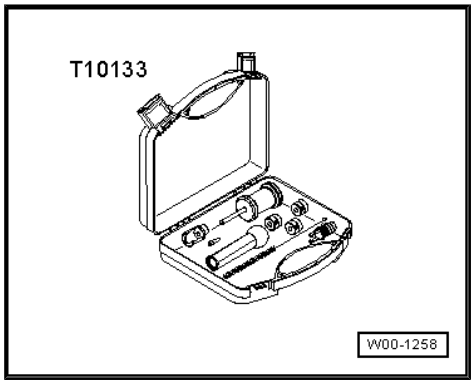
• 36 mm bearing ∅: 0.032 ... 0.078 mm

4.4 Removing and installing camshaft

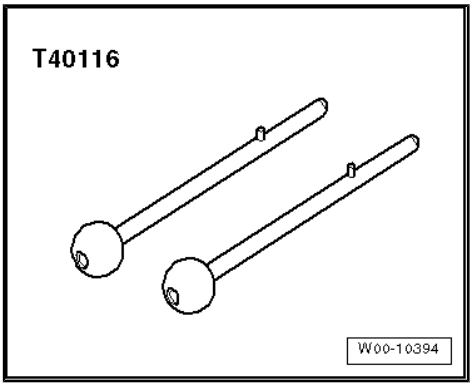
♦ Socket - T10035-



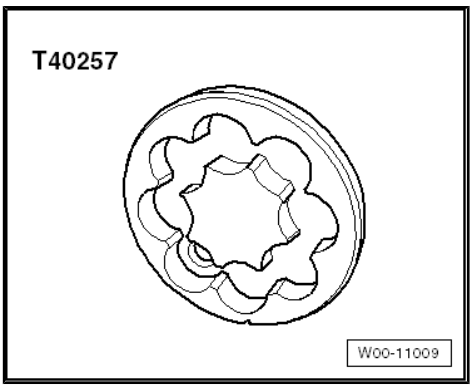
♦ Impact extractor attachment -T10133/3- from tool set for FSI engines - T10133-



- Locating pins - T40116-

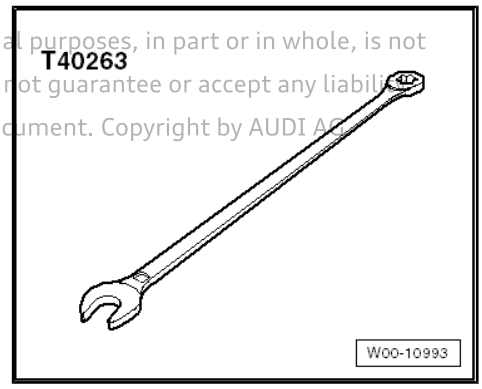


- Turning-over tool - T40257-



- Wrench, 21 mm - T40263-

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

Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

Note

The following description is for removing and installing on the cylinder bank 2 (left-side).

– Remove timing chain from camshafts on relevant side ⇒ page 129 .

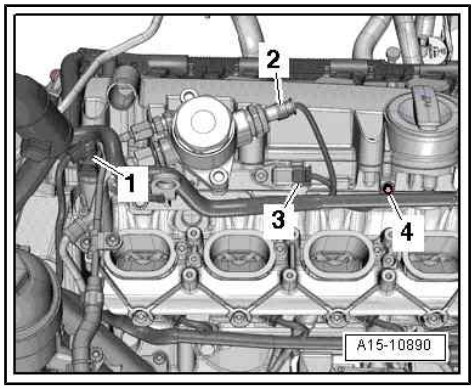
– Unplug electrical connectors:

1 - at camshaft control valve 2 - N208-

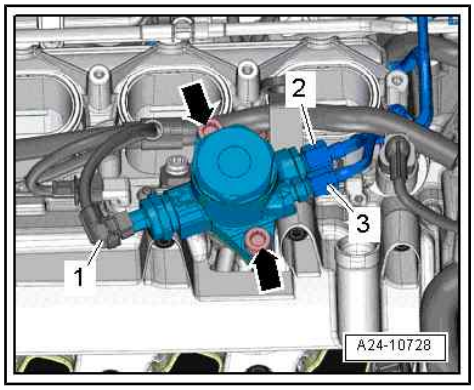
2 - At high-pressure pump (left-side)

3 - at Hall sender 2 - G163-

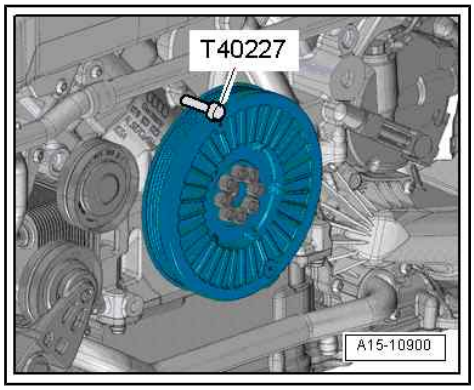
– Remove bolt -4- and move wiring harness clear.



– Remove high-pressure pump ⇒ page 272 .

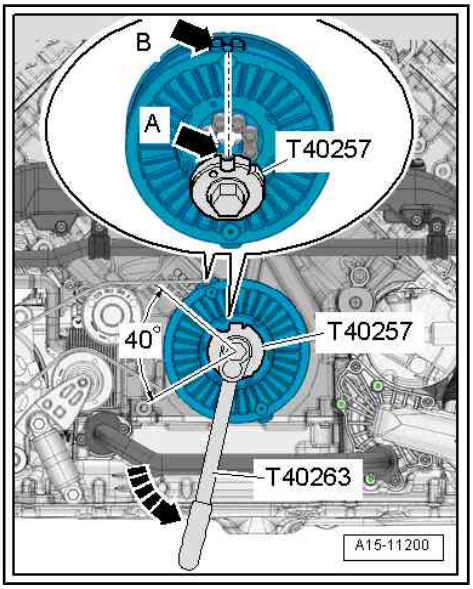


– Remove locking pin - T40227- .



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– Fit turning-over tool - T40257- onto wrench (21 mm) - T40263- .
– Position turning-over tool - T40257- on bolts of vibration damper.
• Semi-circular recess -arrow A- on turning-over tool - T40257- must point to semi-circular recess -arrow B- on vibration damper.



Note

Disregard notch on turning-over tool - T40257- .

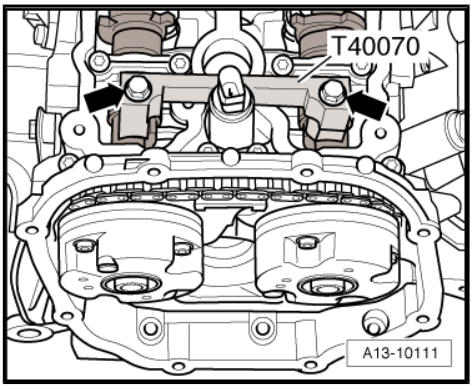
Caution

Risk of damage to valves and piston crowns.

- ***When performing the following steps, the crankshaft must not be at "TDC" position at any cylinder.***

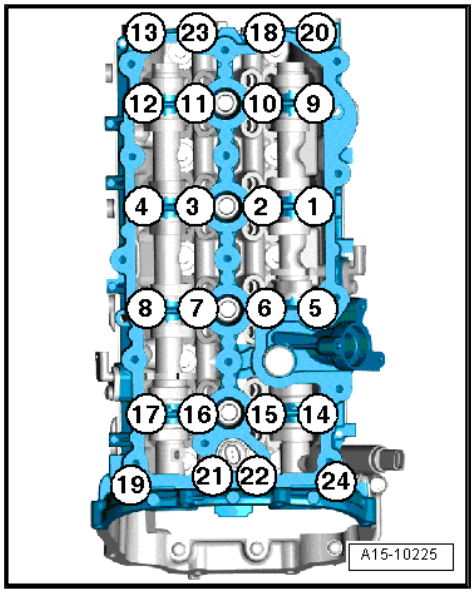
– Turn crankshaft through 40° out of "TDC" position in opposite direction of normal rotation -arrow-.

– Remove camshaft clamp - T40070- -arrows-.



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– Slacken and remove bolts in the sequence: -24 ... 1-.



Note

Perform the same procedure (laterally reversed) on retaining frame (right-side).

– Carefully release retaining frame from bonded joint and detach.

– Mark fitting location of camshafts for re-installation and remove.

Installing

- Tightening torques
⇒ Fig. ""Retaining frame for camshafts - tightening torque and sequence"" , page 142

Note

- *Renew all seals and gaskets.*
- *Renew bolts tightened with specified tightening angle.*

Caution

Protect lubrication system and bearings against contamination.

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

WARNING

Risk of eye injury.

- ***Put on safety goggles.***

– Remove remaining sealant from cylinder head and retaining frame using rotating plastic brush or similar.

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

– Oil running surfaces of both camshafts.

– Insert camshafts in cylinder head; note position of camshafts to make sure retaining frame is fitted free of stress.

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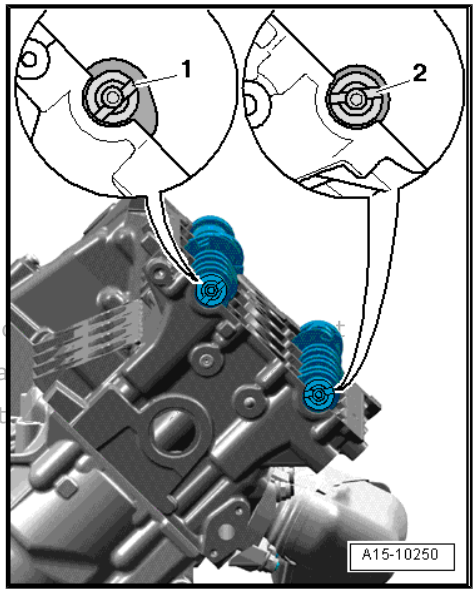
Cylinder head (left-side):

1 - Inlet camshaft

2 - Exhaust camshaft

- The groove on the end of the shaft must be positioned as shown in the illustration.

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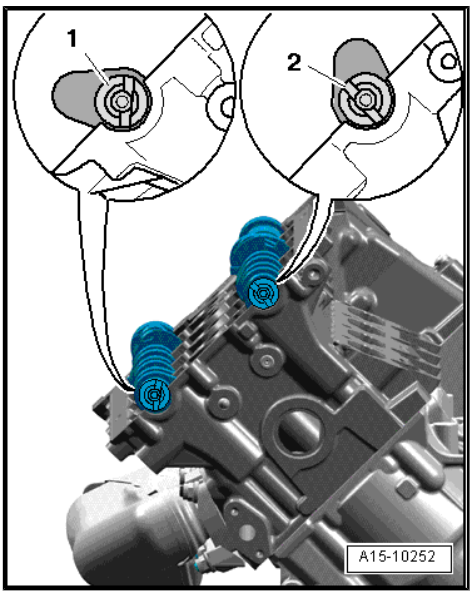


Cylinder head (right-side):

1 - Exhaust camshaft

2 - Inlet camshaft

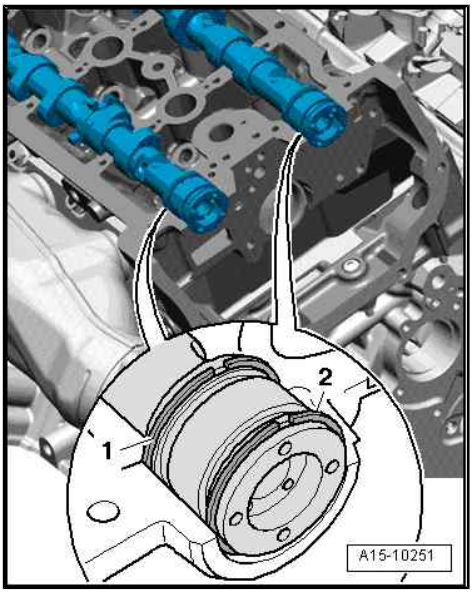
- The groove on the end of the shaft must be positioned as shown in the illustration.



Both sides (continued):

– Check position of ends of rectangular section seals.

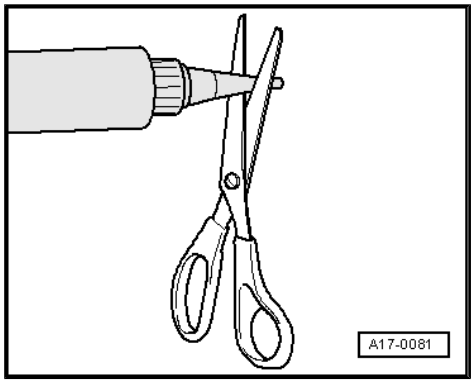
- The ends of the rectangular section seals -1 and 2- must point up or down, never to the side.



Note

Note the use-by date of the sealant.

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

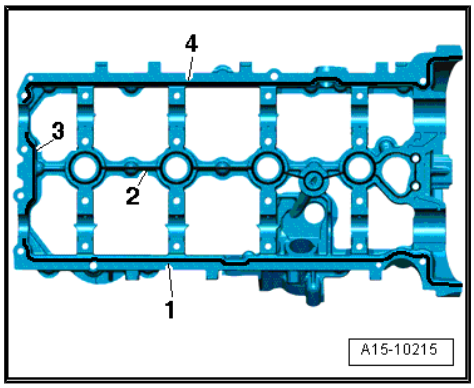


– Fit gasket -2- in grooves on retaining frame.

Caution

Make sure excess sealant does not contaminate camshaft bearings.

- ***The sealant beads must not be thicker than specified.***



– Apply sealant beads -1, 3, 4- onto clean sealing surfaces of retaining frame as shown in illustration.

- Width of sealant beads: 2.5 mm.

Note

The retaining frame must be installed within 5 minutes after applying the sealant.

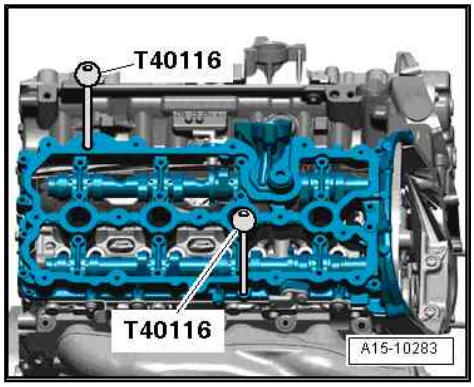
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– Fit retaining frame onto cylinder head.

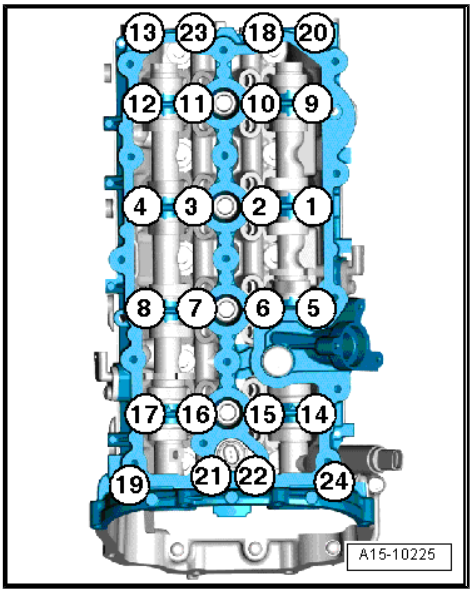
Note

Make sure that camshafts can be inserted into axial bearing of retaining frame without applying force.

– Insert locating pins -T40116- in retaining frame and cylinder head.



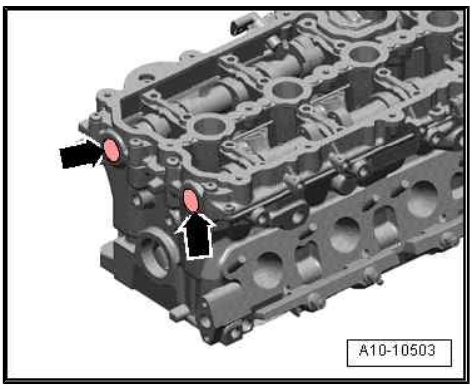
– Tighten bolts for retaining frame ⇒ page 142 .



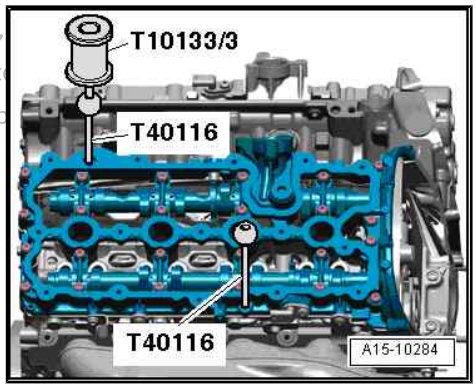
Note

After installing the retaining frame, the sealant must dry for approx. 30 minutes.

– Drive in sealing plugs -arrows- until flush.

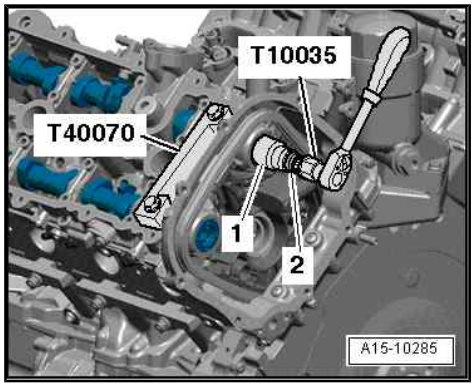


– Use impact extractor attachment -T40116- to pull out locating pins -T10133/3- .



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– Turn inlet camshaft to “TDC” position; to do so, fit a socket (24 mm) -item 1- between inlet camshaft and camshaft adjuster bolt -2- and secure camshaft adjuster bolt to camshaft as shown in illustration.



Note

Use pliers to counterhold socket when tightening bolt.

– Apply lever or ratchet with special wrench - T10035- and turn camshaft until threaded hole for camshaft clamp - T40070- points upwards.

– Initially screw bolt for camshaft clamp - T40070- only a few turns into inlet camshaft.

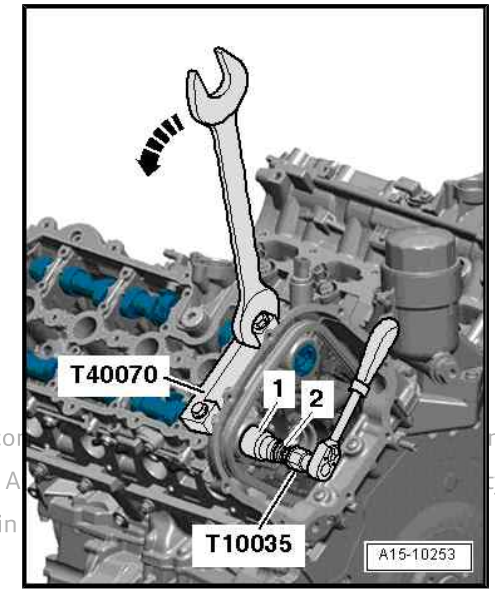
• The camshaft clamp - T40070- is positioned correctly if the holes for the cylinder head bolts remain free.

– Fit camshaft adjuster bolt -2- and socket (24 mm) -item 1- onto exhaust camshaft.

– Turn exhaust camshaft until threaded hole for camshaft clamp - T40070- points upwards.

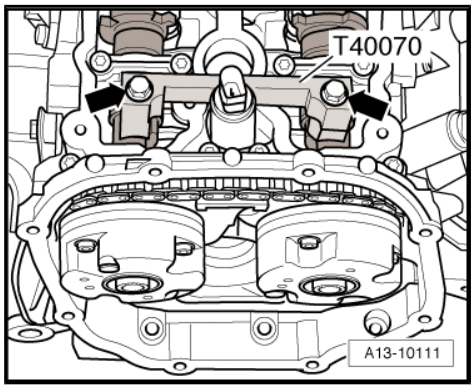
– At the same time apply open-end spanner (24 mm) to camshaft clamp - T40070- and pivot camshaft clamp - T40070- towards exhaust camshaft -arrow- until camshaft clamp can be fastened.

– Secure camshaft clamp - T40070- to exhaust camshaft only hand-tight, to avoid damaging the thread (assistance of second mechanic required).

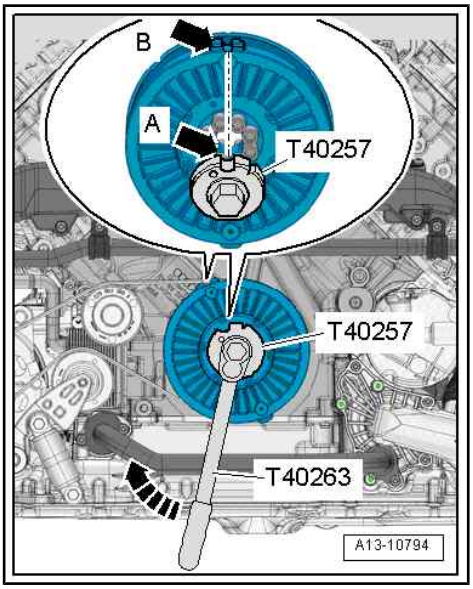


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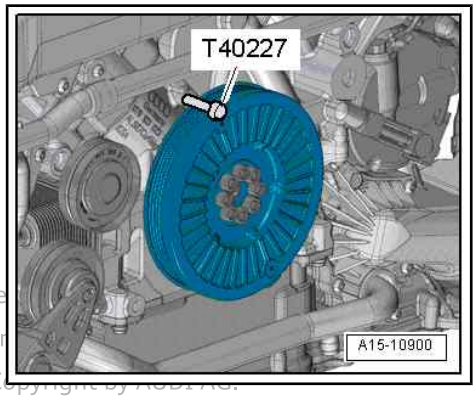
– Tighten bolts on camshaft clamp - T40070- to 25 Nm -arrows-.



– Fit turning-over tool - T40257- onto wrench (21 mm) - T40263- .
– Rotate crankshaft in normal direction of rotation -arrow- to “TDC”.



– Screw in locking pin - T40227- into cylinder block by hand until it makes contact. If necessary, turn crankshaft backwards and forwards slightly to fully centralise locking pin.



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

– Install high-pressure pump ⇒ page 272 .
– Fit timing chains on camshafts ⇒ page 133 .

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Caution

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

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

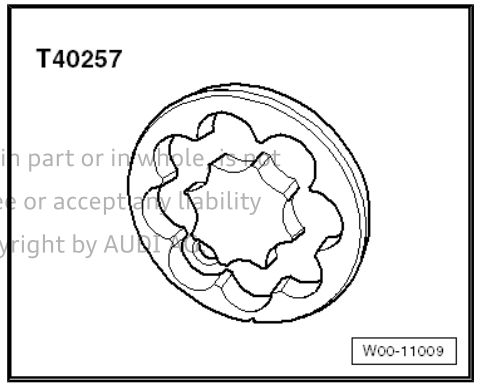
4.5 Checking hydraulic compensation elements

Note

- *The hydraulic compensation elements cannot be serviced.*
- *Irregular valve noises when starting engine are normal.*

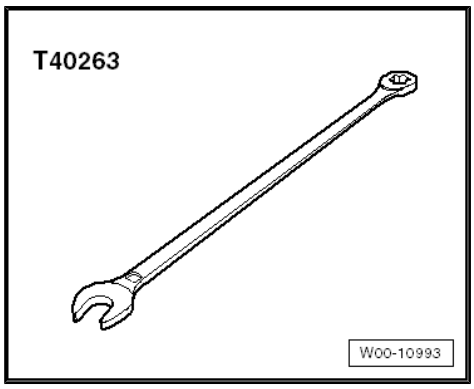
Special tools and workshop equipment required

- Turning-over tool - T40257-



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- Wrench, 21 mm - T40263-



- 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

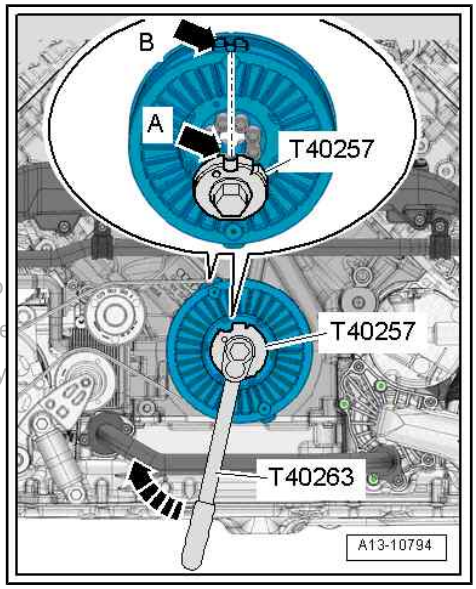
If irregular valve noise disappears but repeatedly re-occurs when travelling short distances, renew oil retention valve. Fitting location of oil retention valve ⇒ *page 191* .

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

– Remove cylinder head cover ⇒ page 105 .

– Fit turning-over tool - T40257- onto wrench (21 mm) - T40263- .
– Position turning-over tool - T40257- on bolts of vibration damper.

• Semi-circular recess -arrow A- on turning-over tool - T40257- must point to semi-circular recess -arrow B- on vibration damper.



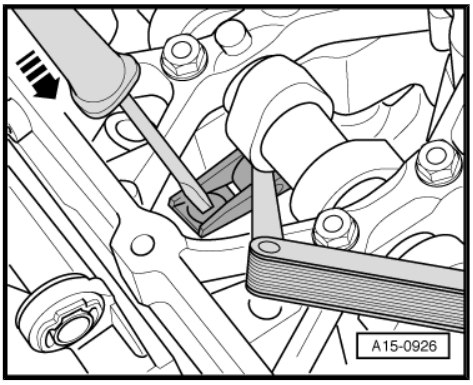
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Note

Disregard notch on turning-over tool - T40257- .

– Turn crankshaft in direction of engine rotation -arrow- until cam of compensation 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
⇒ “4.4 Removing and installing camshaft”, page 144 .



Additional steps required

– Install cylinder head cover ⇒ page 105 .

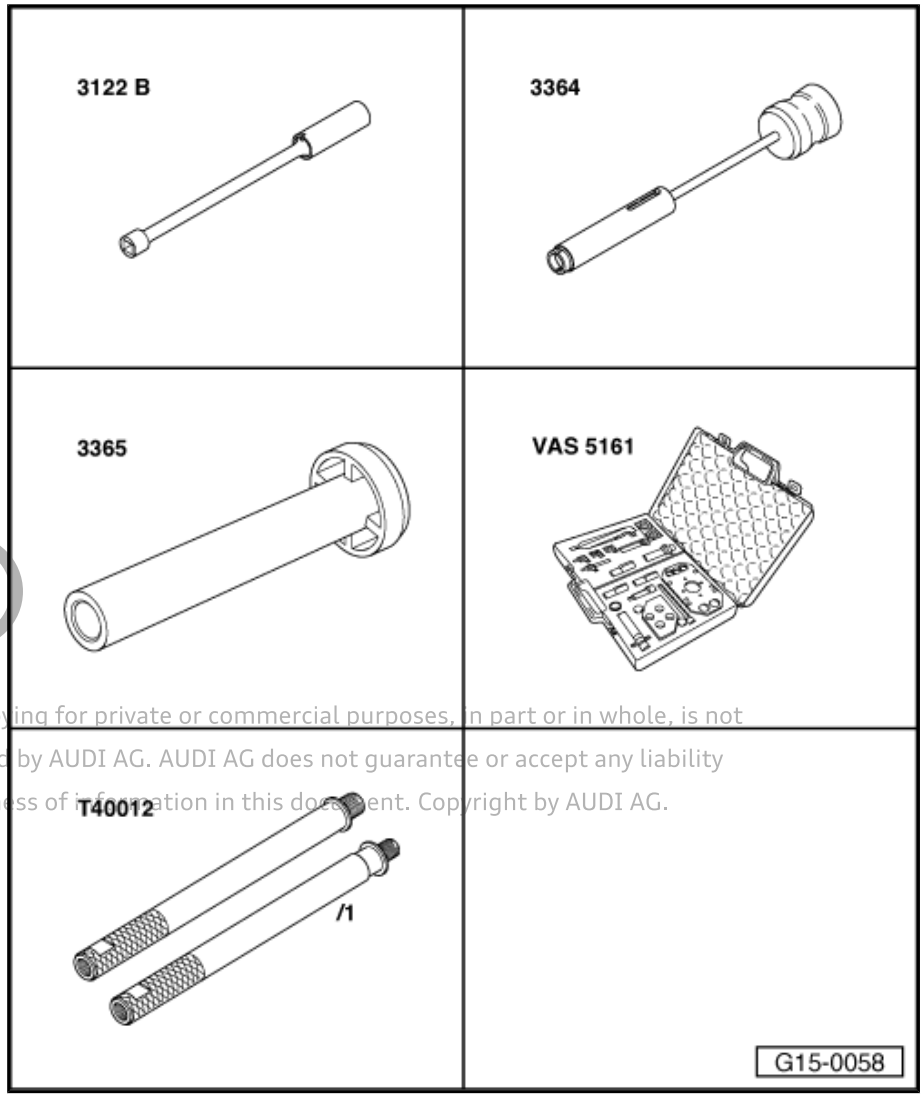
4.6 Removing and installing valve stem oil seals

⇒ “4.6.1 Renewing valve stem oil seals with cylinder head installed”, page 155

⇒ “4.6.2 Renewing valve stem oil seals with cylinder head removed”, page 159

4.6.1 Renewing valve stem oil seals with cylinder head installed

Special tools and workshop equipment required



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- Spark plug spanner - 3122 B-
- Valve stem seal puller - 3364-
- Valve stem oil seal fitting tool - 3365-
- Removal and installation device for valve cotters - VAS 5161- with guide plate for 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B-
- Adapters - T40012-

Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

– Remove camshafts ⇒ page 144 .

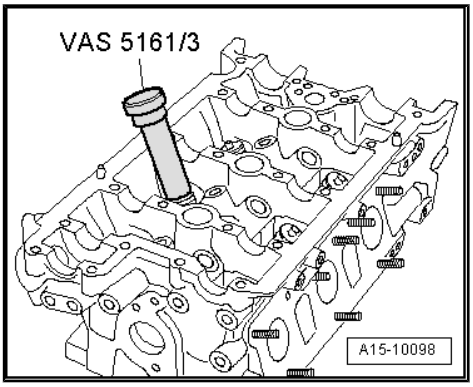
– Mark original positions of roller rocker fingers and hydraulic compensation elements for re-installation.

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

– Unscrew spark plugs using spark plug socket - 3122 B- .

– Set piston of appropriate cylinder to “bottom dead centre”.

– Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



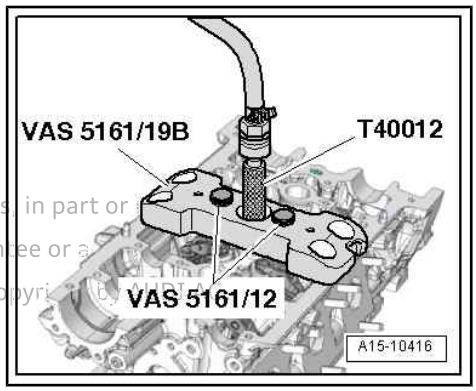
– Fit guide plate for 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B- from removal and installation device for valve cotters - VAS 5161- on cylinder head.

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

– Screw adapter - T40012- with seal hand-tight into the corresponding spark plug thread.

– Connect adapter to compressed air line using a commercially available connection piece and apply constant air pressure.

• Minimum pressure: 6 bar



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– Screw snap-in device -VAS 5161/6- with engaging fork - VAS 5161/5- into guide plate.

– Insert assembly cartridge -VAS 5161/8- in guide plate.

– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.

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

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

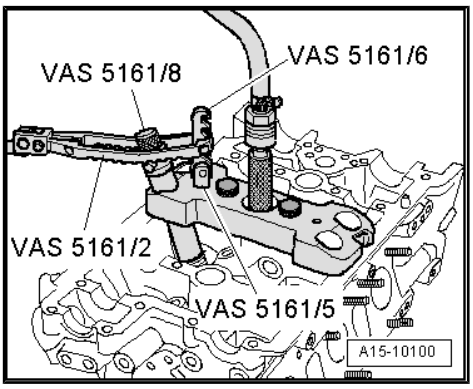
– Release pressure fork.

– Take out assembly cartridge.

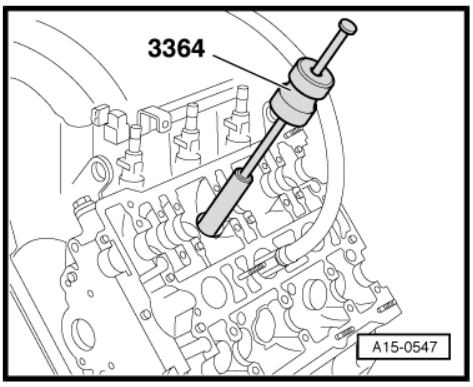
– Detach guide plate and turn to one side.

• The compressed air hose remains connected.

– Detach valve spring with valve spring plate.



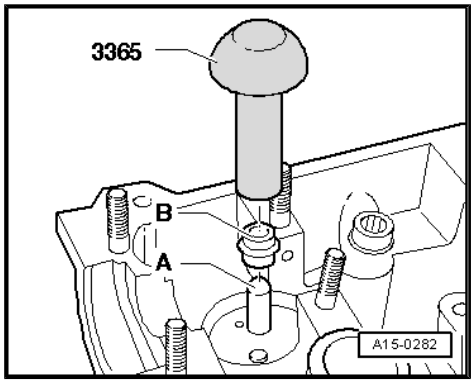
– Pull off valve stem oil seal with valve stem seal puller - 3364- .



Caution

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

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



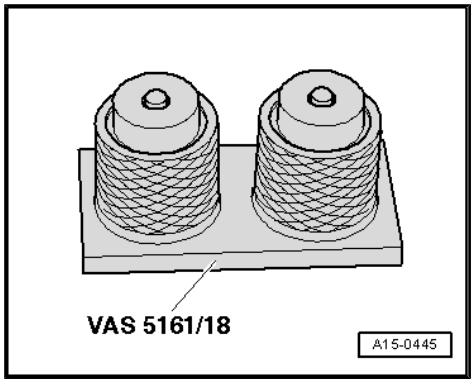
– Lightly oil sealing lip of valve stem oil seal.

– Slide valve stem oil seal onto plastic sleeve.

– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .

– Remove plastic sleeve.

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

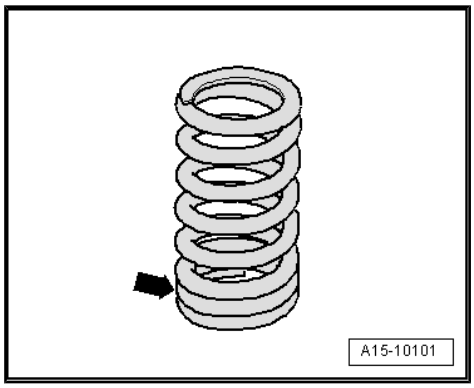


• Larger diameter of valve cotters faces upwards.

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

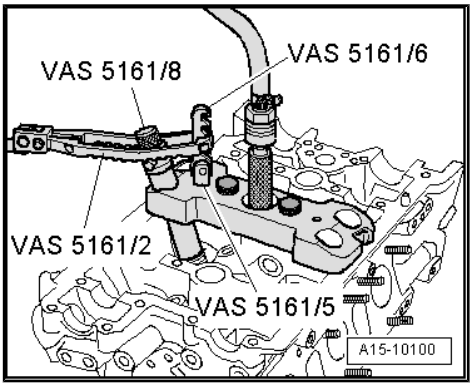
– Insert valve spring and valve spring plate.

• The closely spaced spring coils -arrow- face the cylinder head.



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– Bolt guide plate for 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B- onto cylinder head once again.
– Insert assembly cartridge in guide plate.
– Press down pressure fork and pull knurled screw upwards while turning screw in both directions - this will insert the valve cotters.
– Release pressure fork with knurled screw still in pulled position.
– Repeat procedure for each valve.

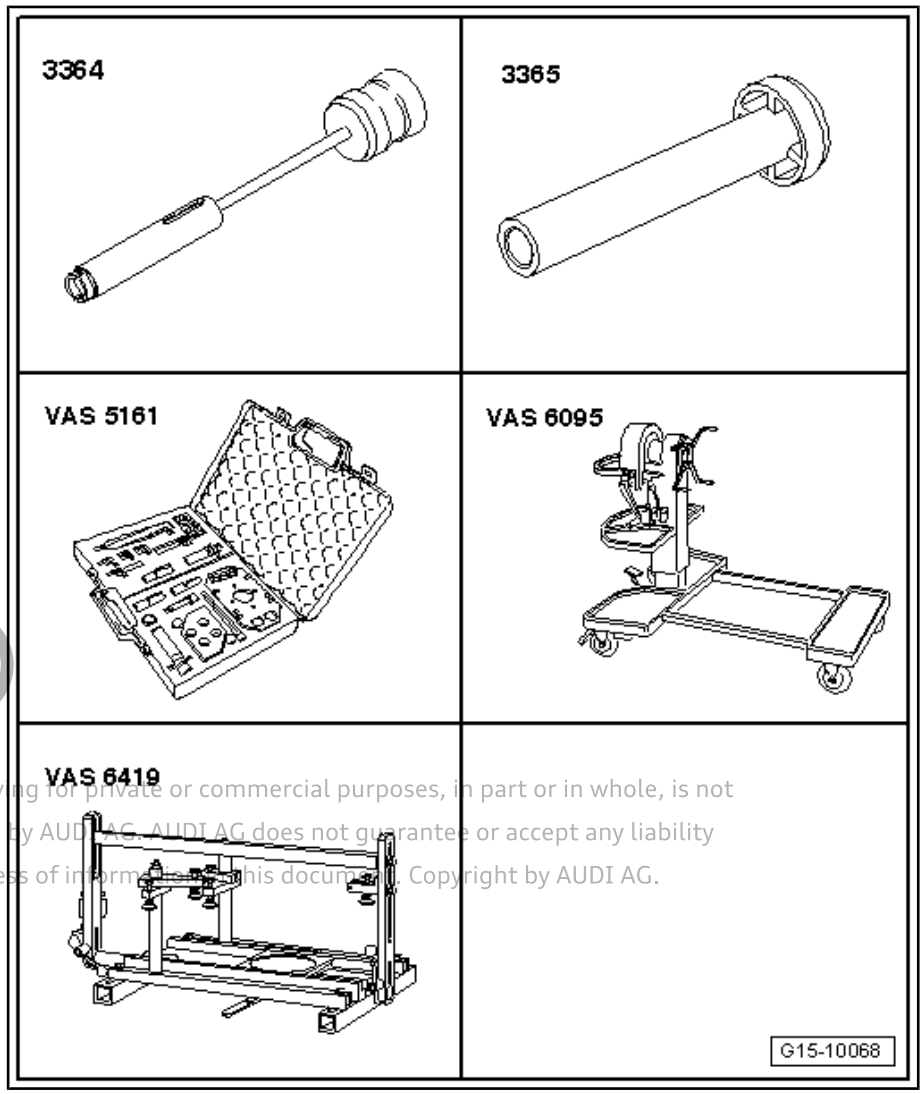


Assembling

– 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 spark plugs ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .
– Install camshafts ⇒ page 144 .

4.6.2 Renewing valve stem oil seals with cylinder head removed

Special tools and workshop equipment required



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- Valve stem seal puller - 3364-
- Valve stem oil seal fitting tool - 3365-
- Removal and installation device for valve cotters - VAS 5161- with guide plate for 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B-
- Engine and gearbox support - VAS 6095-
- Cylinder head tensioning device - VAS 6419-

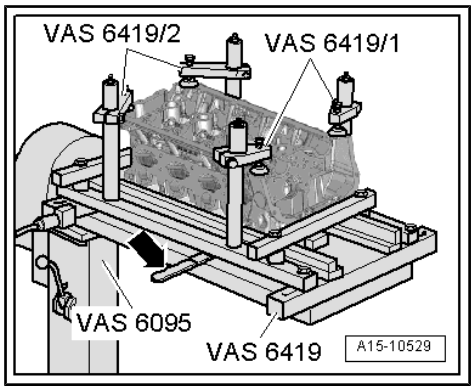
Procedure

– Remove camshafts ⇒ page 144 .

– 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.

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



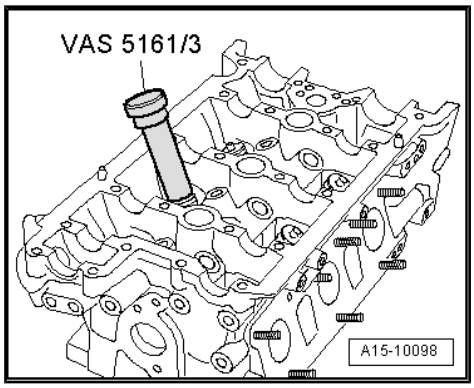
– Secure cylinder head in cylinder head tensioning device, as shown in illustration.

– 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.

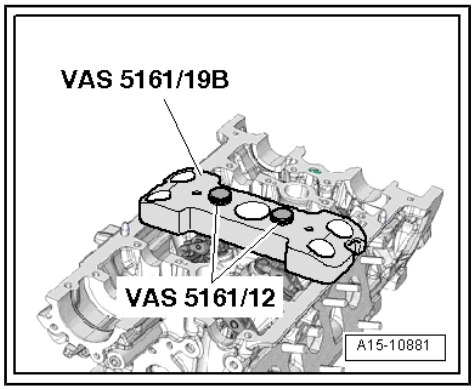
– Apply just enough compressed air to bring air pad into contact with valve heads.

– Apply drift -VAS 5161/3- to valve spring plate and use plastic-headed hammer to release sticking valve cotters.



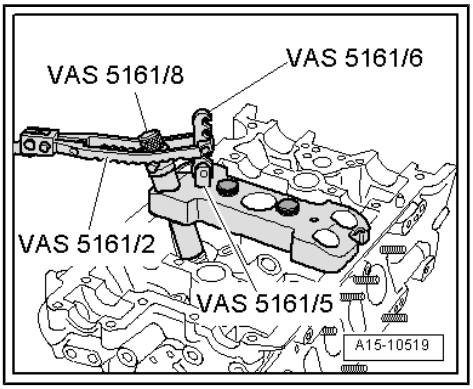
– Fit guide plate for 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B- from removal and installation device for valve cotters - VAS 5161- on cylinder head.

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

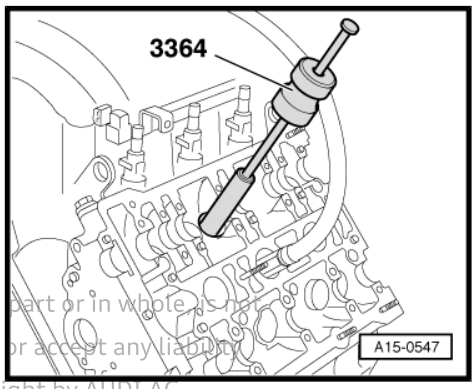


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– Screw snap-in device -VAS 5161/6- with engaging fork -VAS 5161/5- into guide plate.
– Insert assembly cartridge -VAS 5161/8- in guide plate.
– Attach pressure fork -VAS 5161/2- to snap-in device and push assembly cartridge down.
– At the same time,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



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

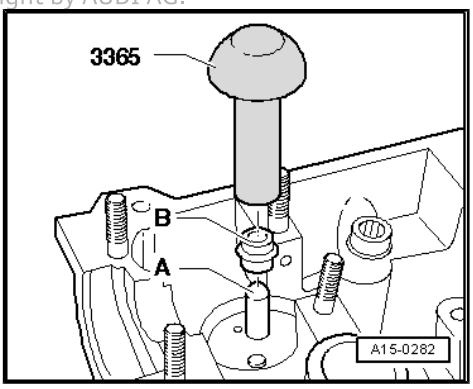


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Caution

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

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

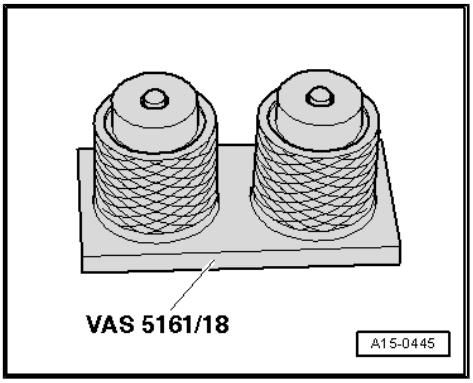


– Lightly oil sealing lip of valve stem oil seal.
– Slide valve stem oil seal onto plastic sleeve.
– Carefully press valve stem oil seal onto valve guide using valve stem seal fitting tool - 3365- .
– Remove plastic sleeve.

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

- Larger diameter of valve cotters faces upwards.

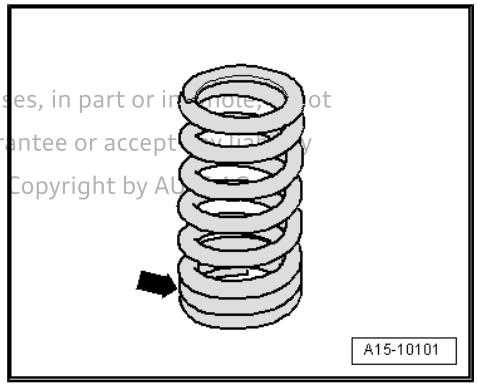
– Press assembly cartridge onto insertion device from above and pick up valve cotters.



– Insert valve spring and valve spring plate.

• The closely spaced spring coils -arrow- face the cylinder head.

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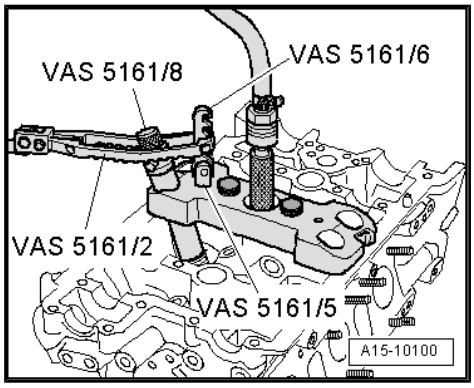
– Bolt guide plate for 2.0 ltr. and 3.0 ltr. FSI engine - VAS 5161/19B- onto cylinder head once again.

– Insert assembly cartridge in guide plate.

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

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

– Repeat procedure for each valve.



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 camshafts ⇒ page 144 .

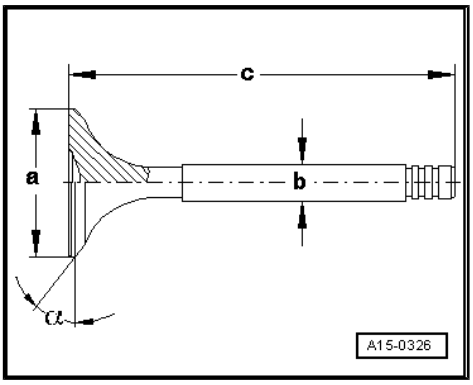
5 Inlet and exhaust valves

⇒ “5.1 Valve dimensions”, page 163

⇒ “5.2 Checking valve guides”, page 163

⇒ “5.3 Checking valves”, page 164

5.1 Valve dimensions



Note

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

Dimension		Inlet valve	Exhaust valve
∅ a	mm	33.85 ± 0.10	28.0 ± 0.1
∅ b	mm	5.98 ± 0.01	5.96 ± 0.01
c	mm	103.97 ± 0.20	101.9 ± 0.2
α	∠°	45	45

WARNING

Care must be taken when disposing of old sodium-cooled exhaust valves - risk of injury.

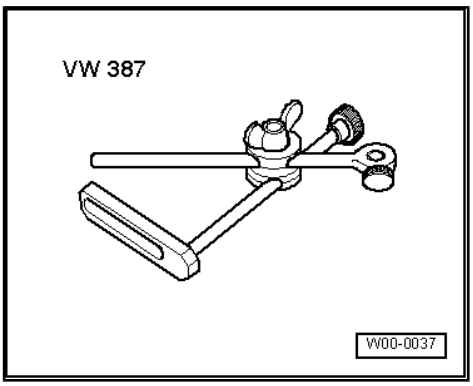
- *The valves must be sawn in two with a metal saw between the centre of the stem and valve head. When doing so, the valves must not come into contact with water.*
- *Then throw a maximum of ten valves into a bucket of water and step away immediately.*
- *A sudden chemical reaction will occur upon contact with water in which the sodium filling burns.*
- *After performing these steps the valves can be disposed of in the normal way.*

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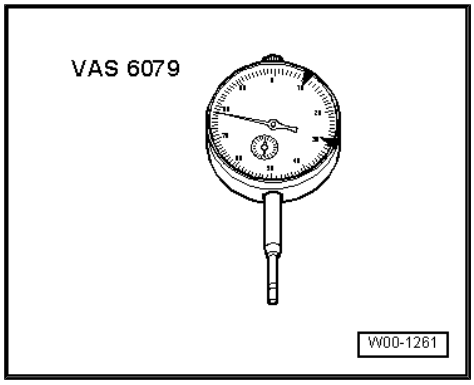
5.2 Checking valve guides

Special tools and workshop equipment required

- Universal dial gauge bracket - VW 387-



- Dial gauge - VAS 6079-



Procedure

Note

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

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

– Insert valve into guide.

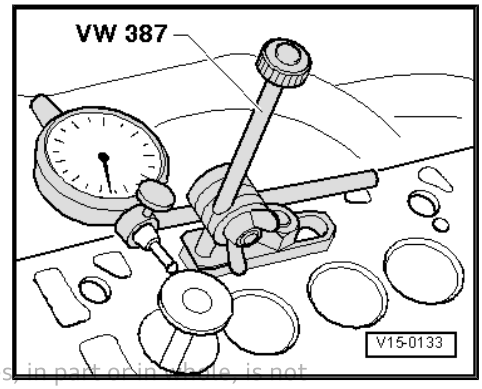
• End of valve stem must be flush with valve guide.

– Measure the amount of sideways play.

• Wear limit: 0.8 mm.

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

– Renew cylinder head if wear limit is still exceeded.



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Note

Valve guides cannot be renewed.

5.3 Checking valves

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

– Renew valve if scoring is clearly visible.

17 – Lubrication

1 Sump/oil pump

⇒ “1.1 Exploded view - sump/oil pump”, page 165

⇒ “1.2 Exploded view - sump (top section)”, page 168

⇒ “1.3 Engine oil”, page 169

⇒ “1.4 Removing and installing sump (bottom section)”, page 169

⇒ “1.5 Removing and installing sump (top section)”, page 171

⇒ “1.6 Removing and installing oil pump”, page 175

⇒ “1.7 Removing and installing oil level and oil temperature sender G266 ”, page 176

⇒ “1.8 Checking oil level”, page 177

1.1 Exploded view - sump/oil pump

Caution

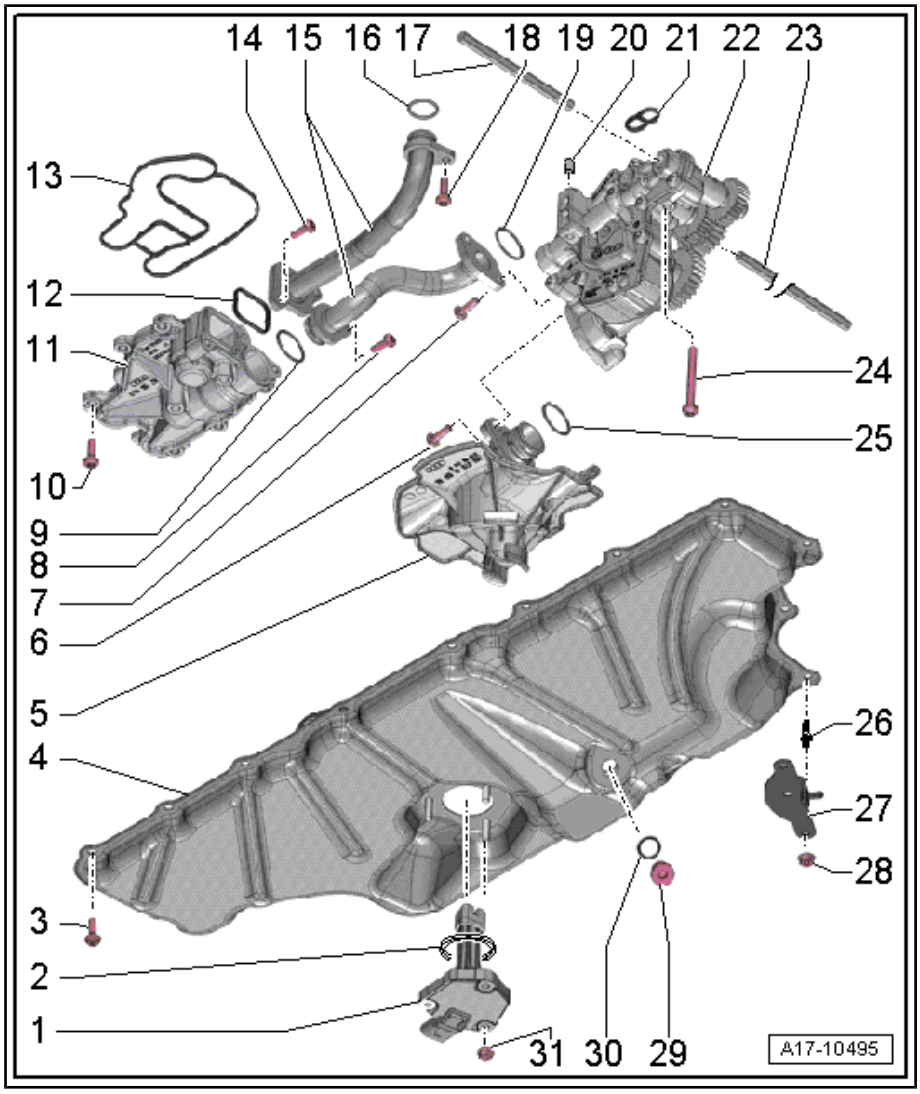
Risk of damage to catalytic converter.

- ***The oil level must not be above the “MAX” mark on the dipstick.***

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Note

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



1 - Oil level and oil temperature sender - G266-
- ❑ Removing and installing ⇒ page 176

2 - Seal
- ❑ Renew

3 - Bolt
- ❑ Tightening torque and sequence ⇒ page 167

4 - Sump (bottom section)
- ❑ Removing and installing ⇒ page 169

5 - Intake connecting pipe
- ❑ For oil pump

6 - Bolt
- ❑ Renew
- ❑ 5 Nm +45°

7 - Bolt
- ❑ 9 Nm

8 - Bolt
- ❑ 9 Nm

9 - O-ring
- ❑ Renew

10 - Bolt
- ❑ Renew
- ❑ 5 Nm +90°

11 - Housing
- ❑ For oil retention valve
- ❑ Removing and installing ⇒ “1.6 Removing and installing oil pump”, page 175

12 - Seal
- ❑ Renew

13 - Gasket
- ❑ Renew

14 - Bolt
- ❑ 9 Nm

15 - Oil pipes
- ❑ Removing and installing ⇒ “1.6 Removing and installing oil pump”, page 175

16 - O-ring
- ❑ Renew

17 - Drive shaft
- ❑ For coolant pump

18 - Bolt
- ❑ 9 Nm

19 - O-ring
- ❑ Renew

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20 - Dowel sleeve
- ❑ 2x

21 - Gasket
- ❑ Renew

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22 - Oil pump
- ❑ Do not dismantle
- ❑ With pressure control valve
- ❑ Removing and installing ⇒ page 175

23 - Drive shaft
- ❑ For oil pump

24 - Bolt
- ❑ Renew
- ❑ 8 Nm +90°

25 - O-ring
- ❑ Renew

26 - Threaded pin
- ❑ Tightening torque and sequence ⇒ page 167

27 - Bracket
- ❑ For ATF lines

28 - Nut
- ❑ 9 Nm

29 - Oil drain plug
- ❑ 25 Nm

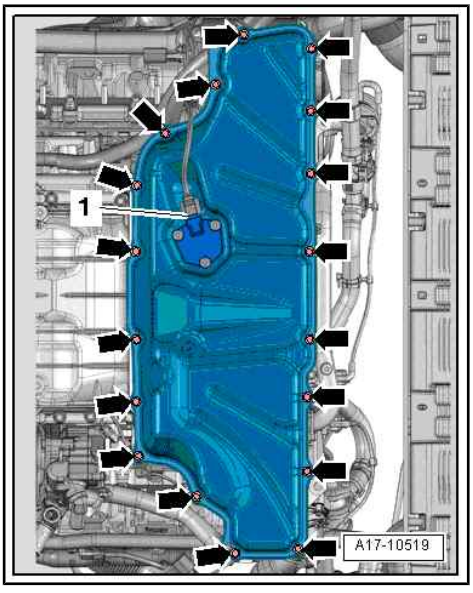
30 - Seal
- ❑ Renew

31 - Nut
- ❑ 9 Nm

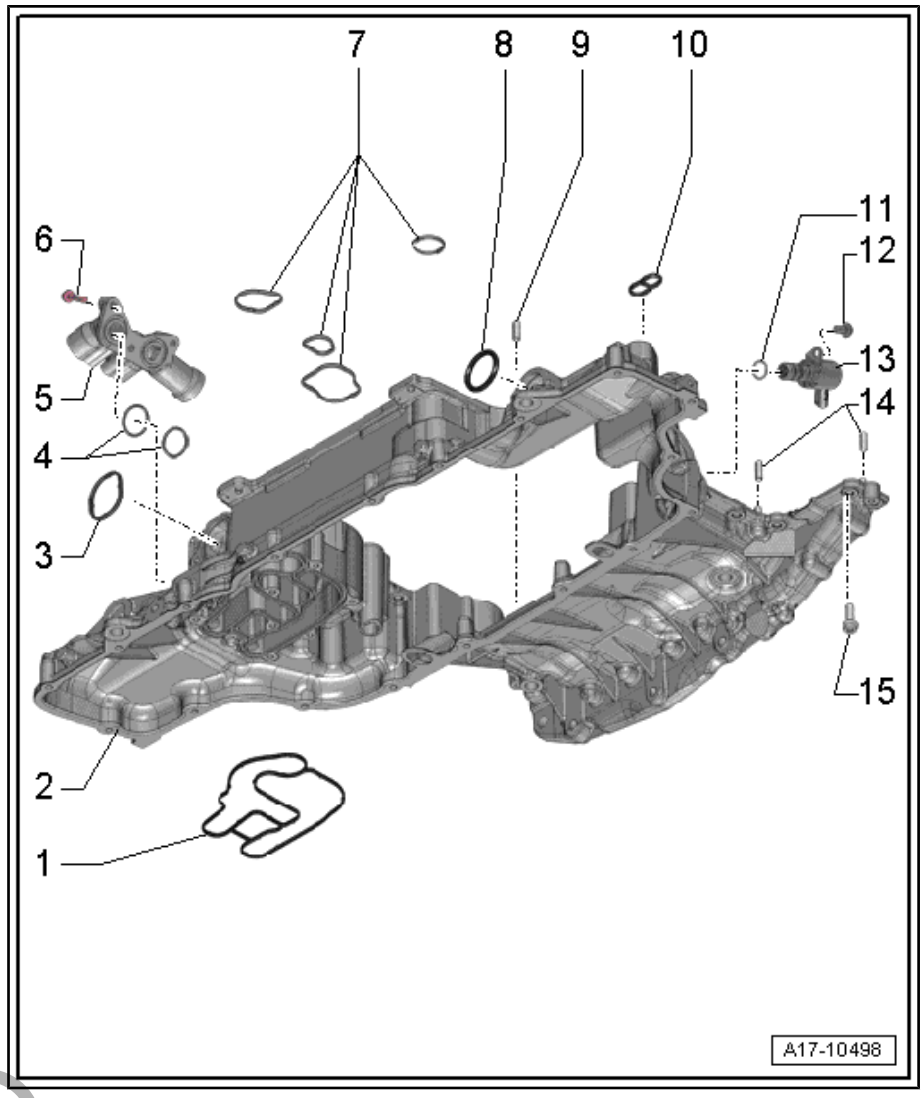
Sump (bottom section) - tightening torque and sequence

– Tighten bolts and threaded pins in 3 stages as follows:

Stage	Bolts/threaded pins	Tightening torque
1.	-Arrows-	Screw in by hand until contact is made
2.	-Arrows-	5 Nm in diagonal sequence
3.	-Arrows-	9 Nm in diagonal sequence



1.2 Exploded view - sump (top section)



1 - Gasket
- ❑ Renew

2 - Sump (top section)
- ❑ Removing and installing ⇒ page 171

3 - Seal
- ❑ Renew

4 - Seals
- ❑ Renew

5 - Temperature regulator for engine oil

6 - Bolt
- ❑ 9 Nm

7 - O-rings
- ❑ Renew

8 - O-ring
- ❑ Renew

9 - Dowel sleeve

10 - Gasket
- ❑ Renew

11 - O-ring
- ❑ Renew

12 - Bolt
- ❑ 9 Nm

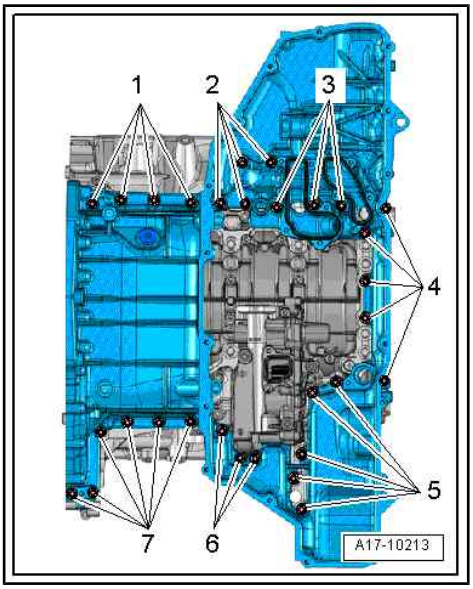
13 - Valve for oil pressure control - N428-
- ❑ Removing and installing ⇒ page 188

14 - Dowel sleeves

15 - Bolt
- ❑ Renew
- ❑ Tightening torque and sequence ⇒ page 169

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Sump (top section) - tightening torque and sequence



Note

Renew bolts tightened with specified tightening angle.

– Tighten bolts in 3 stages as follows:

Stage	Bolts	Tightening torque
1.	-1 … 7-	Screw in by hand until contact is made
2.	-1 … 7-	5 Nm in diagonal sequence
3.	-1 … 7-	Turn 90° further in diagonal sequence

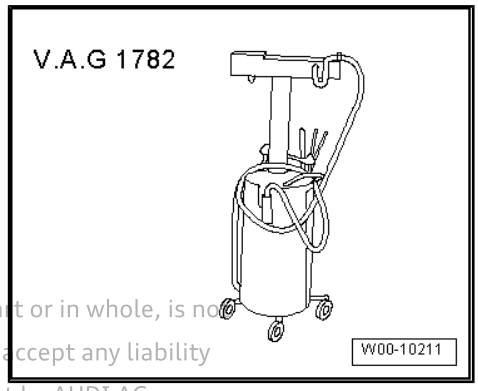
1.3 Engine oil

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

1.4 Removing and installing sump (bottom section)

Special tools and workshop equipment required

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



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♦ Electric drill with plastic brush attachment

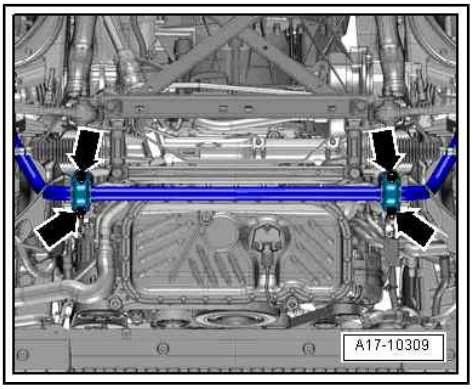
♦ Safety goggles

♦ Sealant ⇒ Electronic parts catalogue

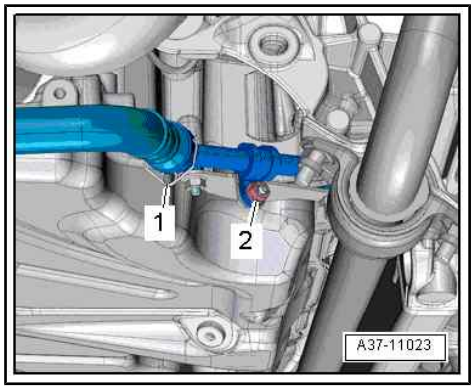
Removing

• Engine oil drained ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

– Remove nuts -arrows- and lower anti-roll bar.



– Remove nut -2- and move ATF line-1- clear.

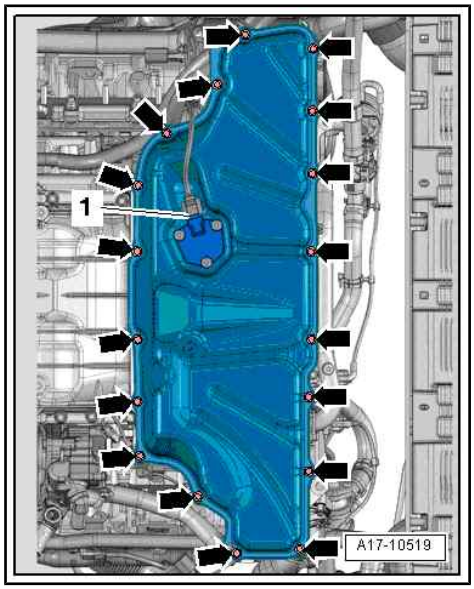


– Unplug electrical connector -1- at oil level and oil temperature sender - G266- .

Caution

Take care to keep components clean.

- *There will still be some oil in the sump (bottom section).*



– Loosen bolts and threaded pins -arrows- in diagonal sequence and remove.

Installing

- Tightening torque
⇒ Fig. ""Sump (bottom section) - tightening torque and sequence"" , page 167

Caution

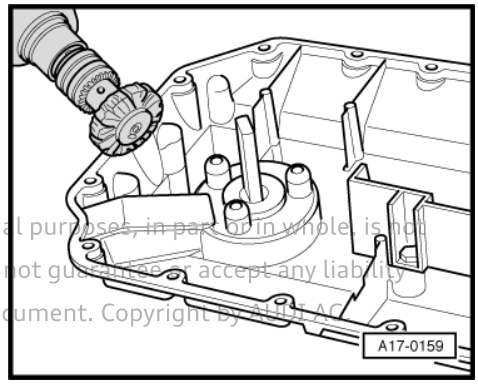
Protect lubrication system and bearings against contamination.

- *Cover exposed parts of the engine.*

WARNING

Risk of eye injury.

- *Put on safety goggles.*



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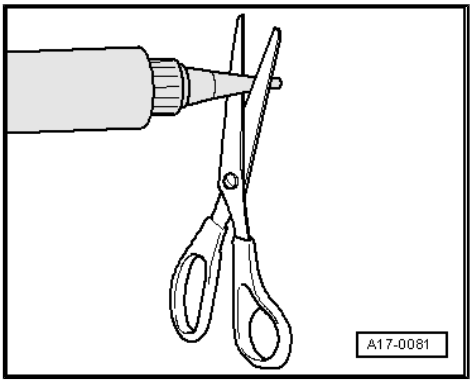
– Remove sealant residue from sump (bottom section) and sump (top section) using rotating plastic brush or similar.

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

Note

Note the use-by date of the sealant.

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



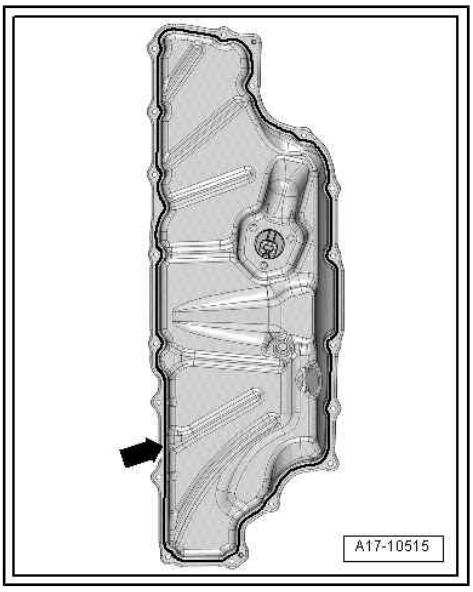
Caution

Make sure lubrication system is not clogged by excess sealant.

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

– Apply sealant bead -arrow- onto clean sealing surface of sump (bottom section) as shown in illustration.

• Width of sealant bead: 2.5 mm.



Note

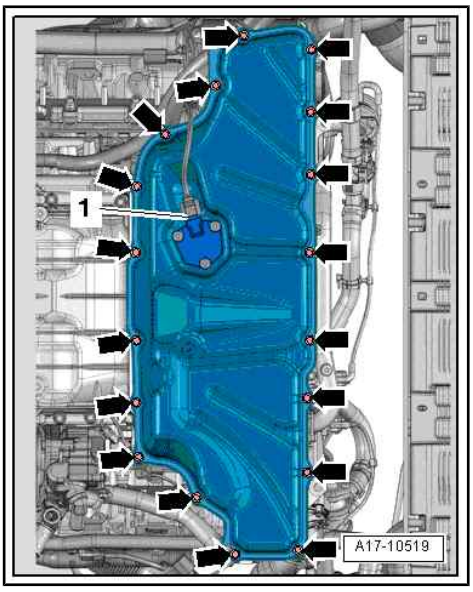
The sump (bottom section) must be installed within 5 minutes after applying the sealant.

– Fit bottom section of sump, tighten bolts and threaded pins ⇒ page 167 and attach electrical connector -1-.

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

– Install anti-roll bar ⇒ Running gear, axles, steering; Rep. gr. 40 ; Subframe; Removing and installing anti-roll bar .

– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .



1.5 Removing and installing sump (top section)

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Special tools and workshop equipment required

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

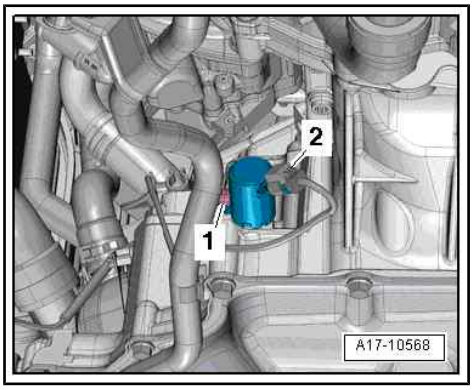
Removing

- Engine removed and secured to engine and gearbox support ⇒ page 41

– Remove bracket for alternator ⇒ page 69 .

– Remove oil pump ⇒ page 175 .

– Unplug electrical connector -2- at valve for oil pressure control - N428- .

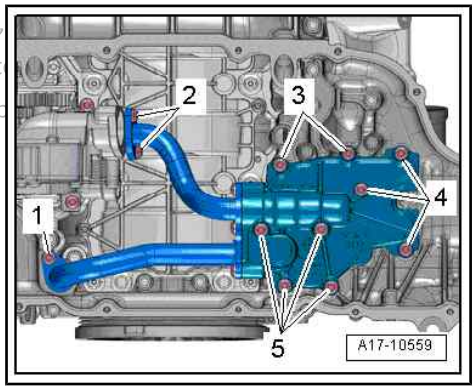


Note

Disregard -item 1-.

– Unscrew bolts -1, 3, 4, 5- and remove cover plate.

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Note

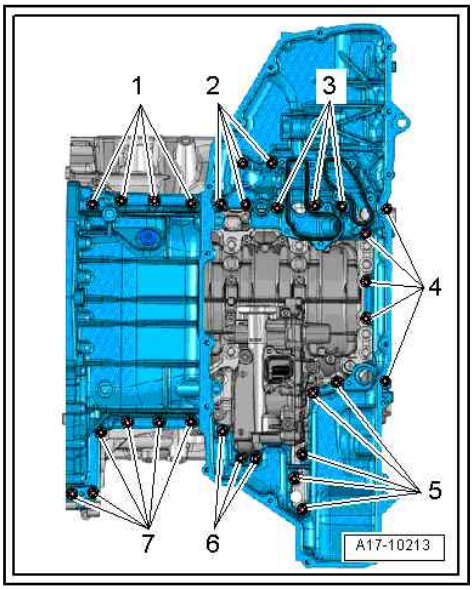
Disregard -item 2-.

– Slacken bolts -1 ... 7- in diagonal sequence and remove.

– Carefully release sump (top section) from bonded joint, pry sump off dowel sleeves and detach.

Installing

- Tightening torque ⇒ Fig. ""Sump (top section) - tightening torque and sequence"" , page 169



Note

- *Renew seals and O-rings.*
- *Renew bolts tightened with specified tightening angle.*

Caution

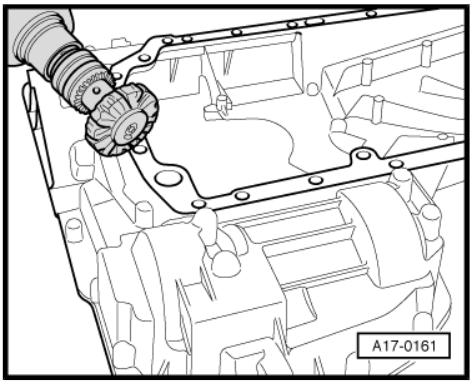
Protect lubrication system and bearings against contamination.

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

WARNING

Risk of eye injury.

- *Put on safety goggles.*



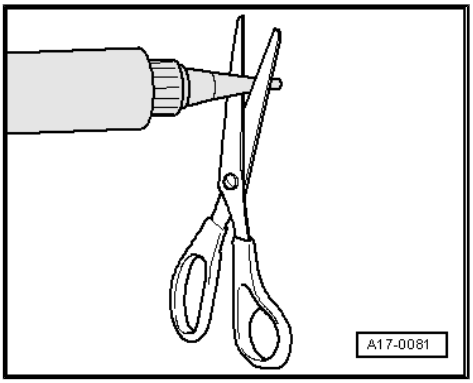
– Remove sealant residue from sump (top section) and cylinder block using rotating plastic brush or similar.

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

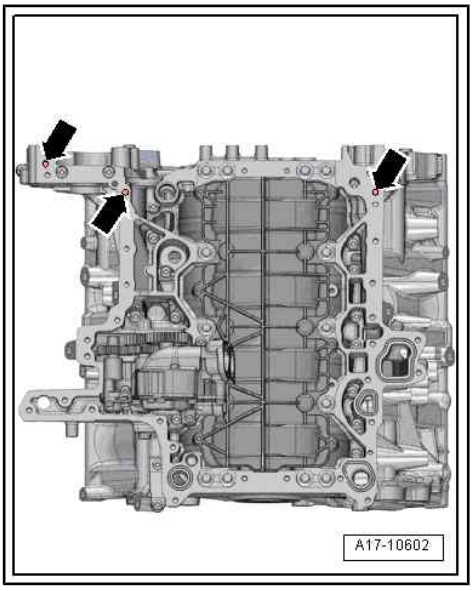
Note

Note the use-by date of the sealant.

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

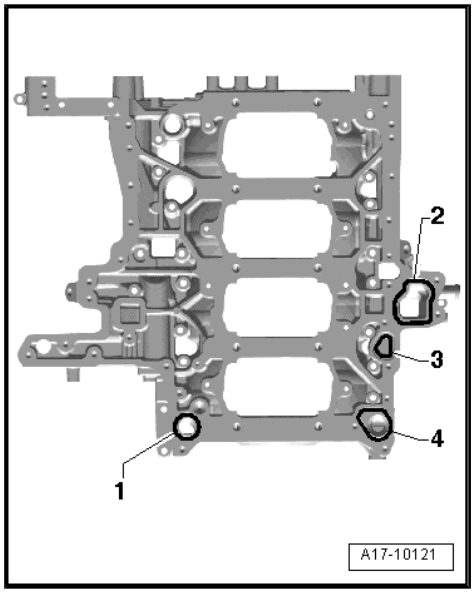


– Fit dowel sleeves -arrows-, if not fitted on the cylinder block at the points marked.



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– Fit new gaskets -1 … 4- in grooves on retaining frame.



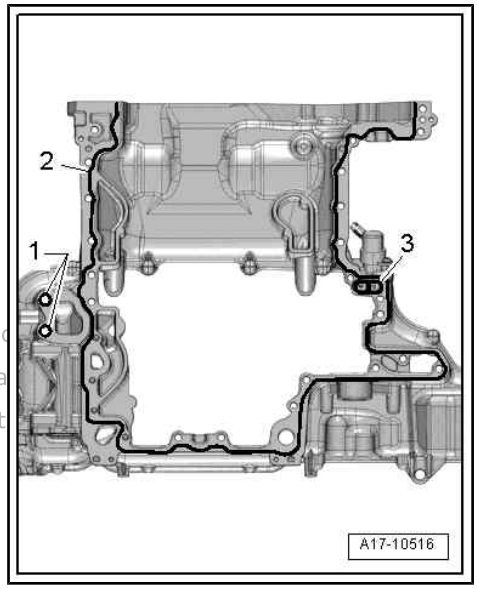
– Insert gasket -3- in sump (top section).

Caution

Make sure lubrication system is not clogged by excess sealant.

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

– Apply beads of sealant -1- and -2- onto clean sealing surface of sump (top section) as shown in illustration.



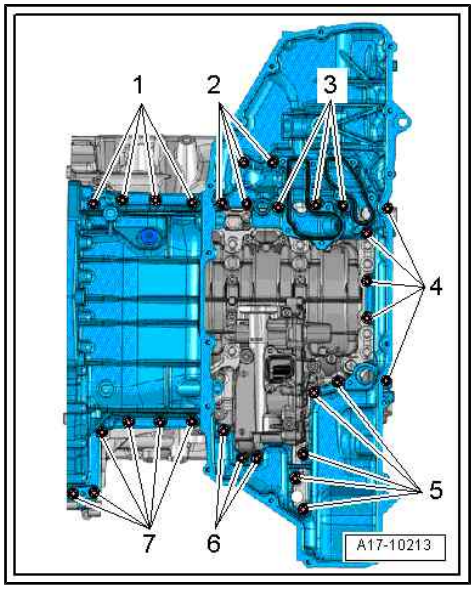
- Width of sealant beads: 2.5 mm.

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Note

The sump (top section) must be installed within 5 minutes after applying the sealant.

– Fit sump (bottom section) and tighten bolts ⇒ page 169 .



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

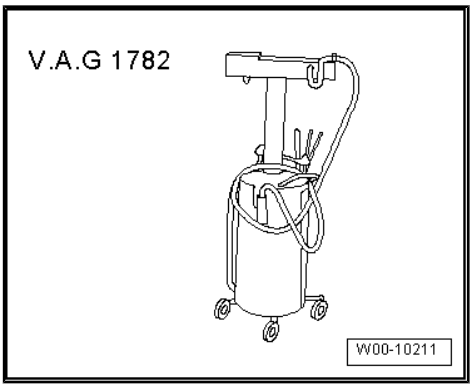
– Install oil pump ⇒ page 175 .

– Install bracket for alternator ⇒ page 65 .

1.6 Removing and installing oil pump

Special tools and workshop equipment required

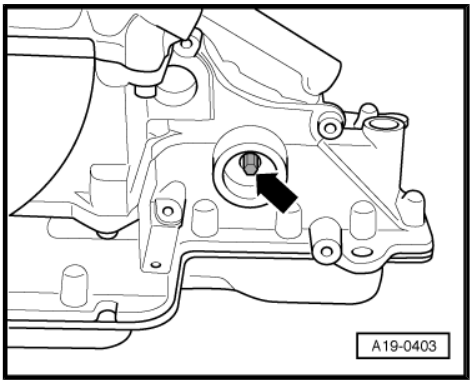
- Used oil collection and extraction unit - V.A.G 1782-



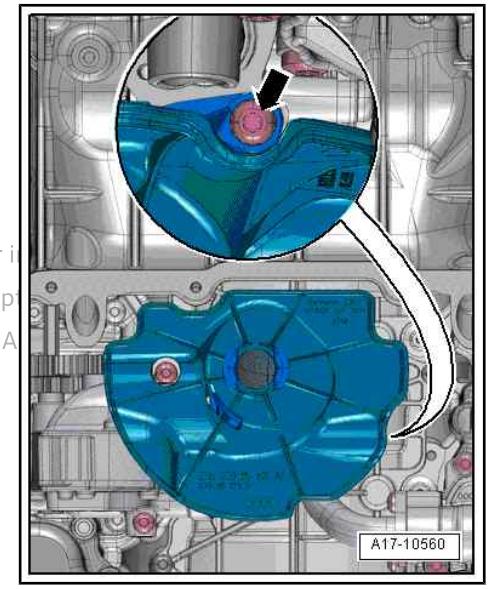
Removing

- Engine/gearbox assembly removed; engine separated from gearbox ⇒ page 34 .
- Engine secured with support -VAS 6131/13-7- .

– Remove spur gear drive ⇒ page 84 .
– Remove coolant pump ⇒ page 208 .
– Remove sump (bottom section) ⇒ page 169 .
– Detach coolant pump drive shaft -arrow- from oil pump.
– Place used oil collection and extraction unit - V.A.G 1782- under engine and leave in position for the following procedure.



– Remove bolt -arrow- and take out intake connection.

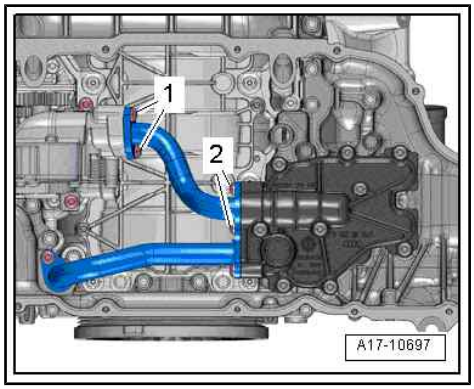


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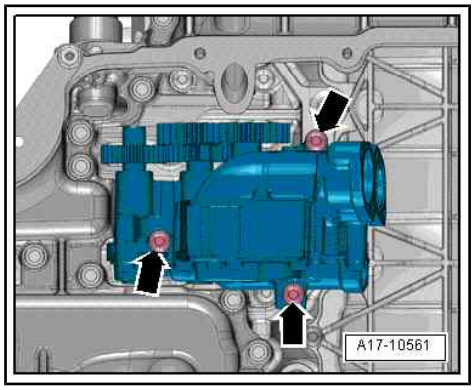
Note

Some oil will come out when oil pipes are removed.

– Remove bolts -1 and 2-, turn oil pipe downwards and detach oil pipe.



– Remove bolts -arrows- and remove oil pump.



Installing

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

- Tightening torques
  ⇒ “1.1 Exploded view - sump/oil pump”, page 165

Note

- *Renew seals and O-rings.*
- *Renew bolts tightened with specified tightening angle.*

– Check whether both dowel sleeves for centring in cylinder block or sump (top section) are fitted; insert missing dowel sleeves.

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– Install coolant pump ⇒ page 208 .

– Install sump (bottom section) ⇒ page 170 .

– Install spur gear drive ⇒ page 84 .

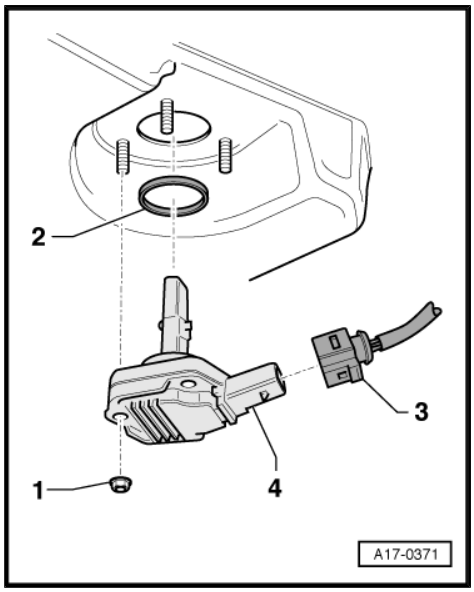
1.7 Removing and installing oil level and oil temperature sender - G266-

Removing

- Engine oil drained ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

– Unplug electrical connector -3-.

– Remove nuts -1- and detach oil level and oil temperature sender - G266- -item 4-.



Installing

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

- Tightening torque
  ⇒ “1.1 Exploded view - sump/oil pump”, page 165

Note

Renew seal -2-.

– Fill up with engine oil and check oil level ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

1.8 Checking oil level

Check oil level ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

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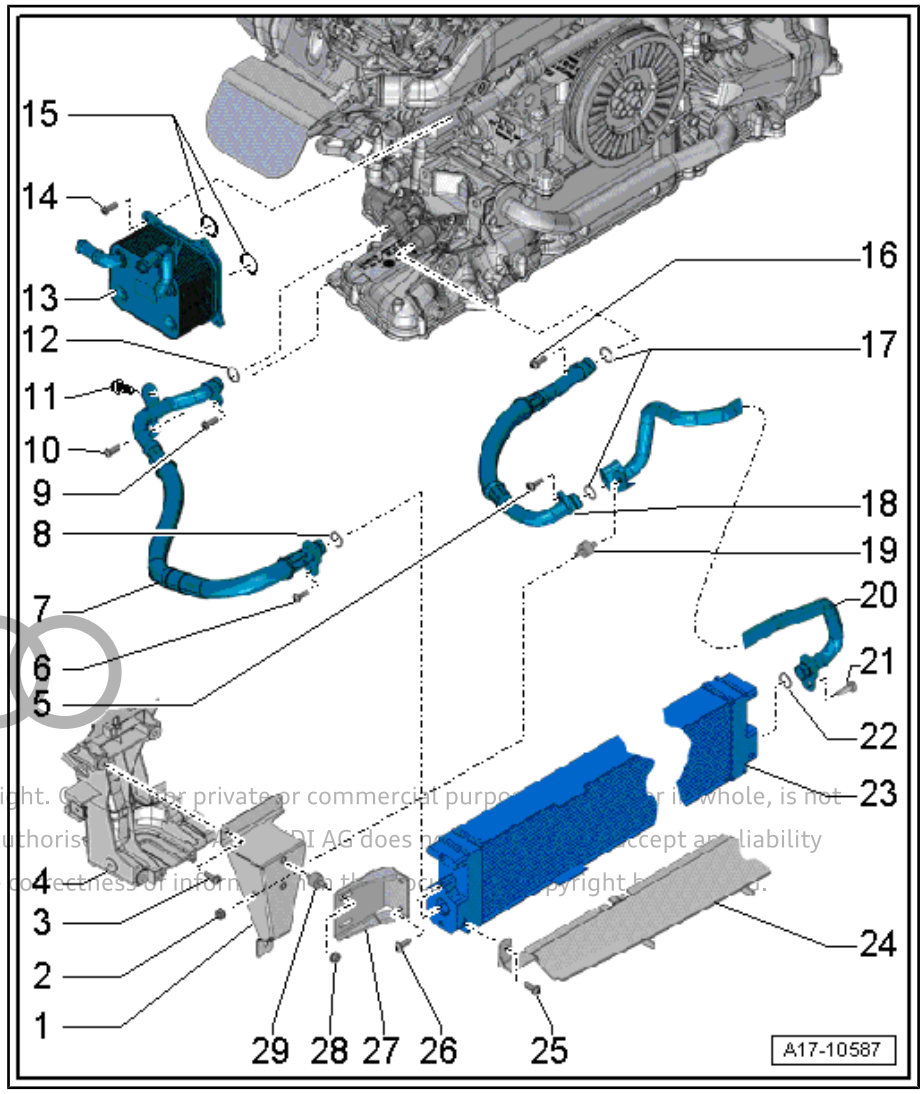
2 Engine oil cooler

⇒ “2.1 Exploded view - engine oil cooler”, page 178

⇒ “2.2 Removing and installing engine oil cooler”, page 179

⇒ “2.3 Removing and installing engine oil cooler (front)”, page 181

2.1 Exploded view - engine oil cooler



1 - Bracket
- ❑ For engine oil cooler (front)

2 - Nut
- ❑ 6 Nm

3 - Bolt
- ❑ 9 Nm

4 - Lock carrier

5 - Bolt
- ❑ 9 Nm

6 - Bolt
- ❑ Depending on version, stud with nut
- ❑ 9 Nm

7 - Pipe/hose assembly
- ❑ For engine oil

8 - O-ring
- ❑ Renew

9 - Bolt
- ❑ 9 Nm

10 - Bolt
- ❑ 9 Nm

11 - Bolt
- ❑ 9 Nm

12 - O-ring
- ❑ Renew

13 - Engine oil cooler
- ❑ Removing and installing ⇒ page 179

14 - Bolt
- ❑ Tightening torque and sequence ⇒ page 179

15 - Seals
- ❑ Renew

16 - Bolt
- ❑ 9 Nm

17 - O-rings
- ❑ Renew

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18 - Pipe/hose assembly

- ❑ For engine oil

19 - Bonded rubber bush

- ❑ Screw in by hand until contact is made

20 - Oil pipe

21 - Bolt

- ❑ 9 Nm

22 - O-ring

- ❑ Renew

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23 - Engine oil cooler (front)

- ❑ Removing and installing ⇒ page 181

24 - Air duct

25 - Bolt

- ❑ 7 Nm

26 - Bolt

- ❑ 9 Nm

27 - Bracket

- ❑ For engine oil cooler (front)

28 - Nut

- ❑ 6 Nm

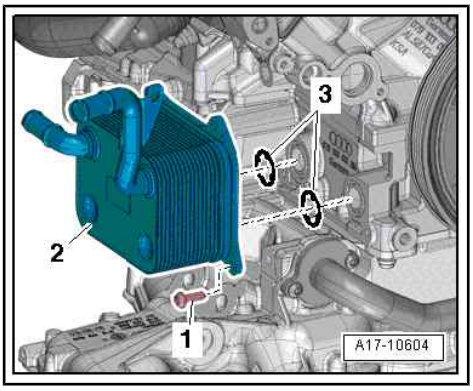
29 - Bonded rubber bush

- ❑ Screw in by hand until contact is made

Engine oil cooler - tightening torque and sequence

– Tighten bolts in 2 stages as follows:

Stage	Bolts	Tightening torque
1.	-Arrows-	3 Nm
2.	-Arrows-	9 Nm

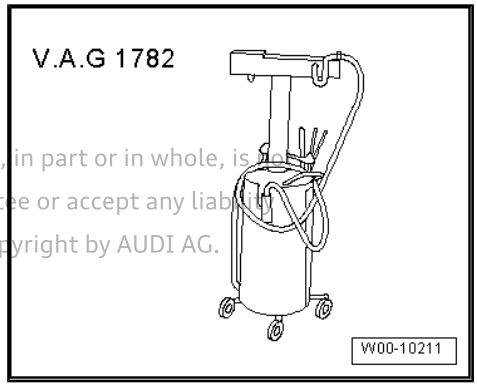


2.2 Removing and installing engine oil cooler

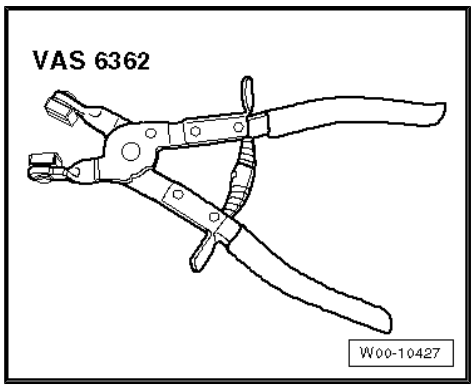
Special tools and workshop equipment required

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

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- Hose clip pliers - VAS 6362-



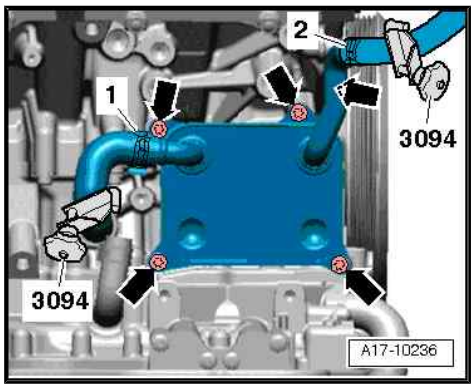
Removing

– Remove bracket for alternator ⇒ page 69 .

– Position used oil collection and extraction unit - V.A.G 1782- below engine.

– Release hose clips -1, 2- and disconnect coolant hoses from engine oil cooler.

– Unscrew bolts -arrows- and detach engine oil cooler.



Note

Ignore -3094- .

Installing

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

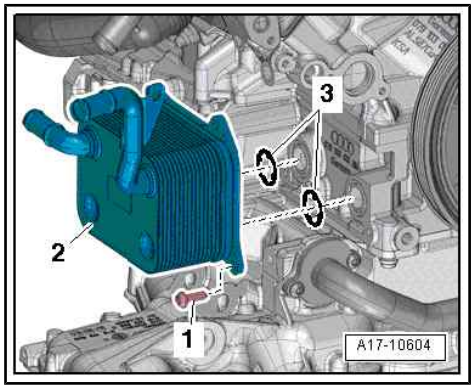
- Tightening torques
  ⇒ Fig. ""Engine oil cooler - tightening torque and sequence"" , page 179

Note

- *Renew gaskets -3-.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Tighten bolts for engine oil cooler ⇒ page 179 .

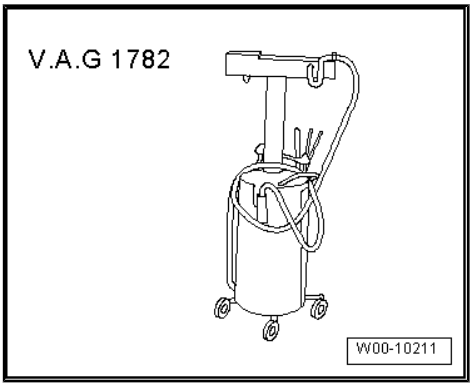
– Install bracket for alternator ⇒ page 65 .



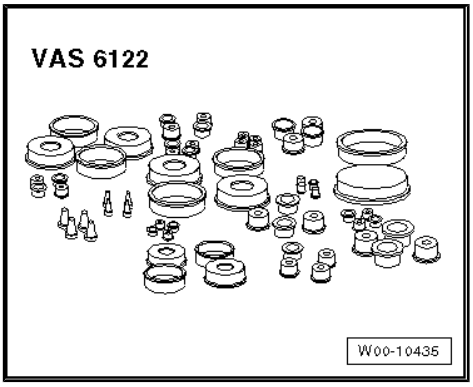
2.3 Removing and installing engine oil cooler (front)

Special tools and workshop equipment required

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



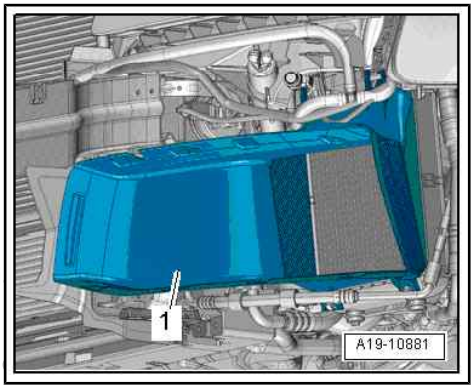
- Engine bung set - VAS 6122-



Removing

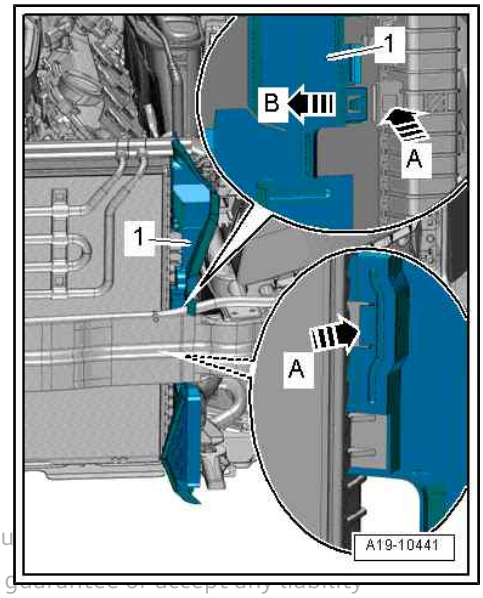
– Remove bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

– Unclip air duct -1- on both sides.



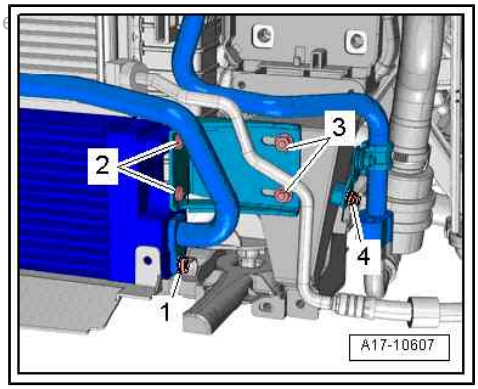
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– Release catches -arrows A- and detach air duct -1- on left and right -arrow B-.



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the reliability, completeness and accuracy of this docume

– Position used oil collection and extraction unit - V.A.G 1782- below engine.
– Unscrew bolted connection -1- on both sides and detach oil line.
– Unscrew bolts -2- on both sides and remove engine oil cooler (front).
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .



Note

Disregard items -3 and 4-.

Installing

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

- Tightening torques
⇒ “2.1 Exploded view - engine oil cooler”, page 178

Note

Fit new O-rings.

– Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

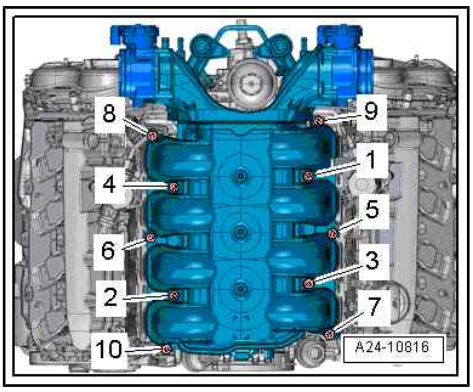
3 Crankcase breather

⇒ “3.1 Removing and installing hose for crankcase breather system”, page 183

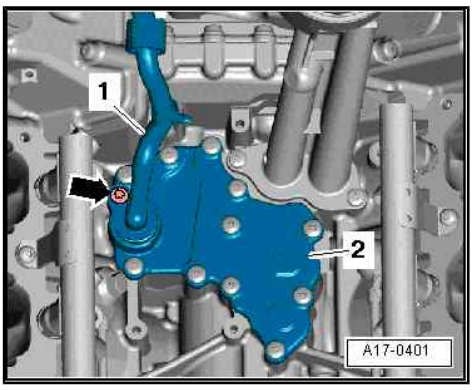
3.1 Removing and installing hose for crankcase breather system

Removing

– Remove intake manifold (top section) ⇒ page 253 .



– Remove bolt -arrow- and pull crankcase breather hose -1- out of cover -2-.



Installing

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

- Tightening torque
  ⇒ “5.1 Exploded view - oil spray jets/valves”, page 191

Note

Fit new O-ring.

– Install intake manifold (top section) ⇒ page 253 .

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4 Oil filter/oil pressure switches

⇒ “4.1 Exploded view - oil filter housing/oil pressure switches”, page 184

⇒ “4.2 Removing and installing oil temperature sender G8 ”, page 185

⇒ “4.3 Checking oil pressure switch F22 / oil pressure switch for reduced oil pressure F378 ”, page 186

⇒ “4.4 Removing and installing oil pressure switch F22 ”, page 186

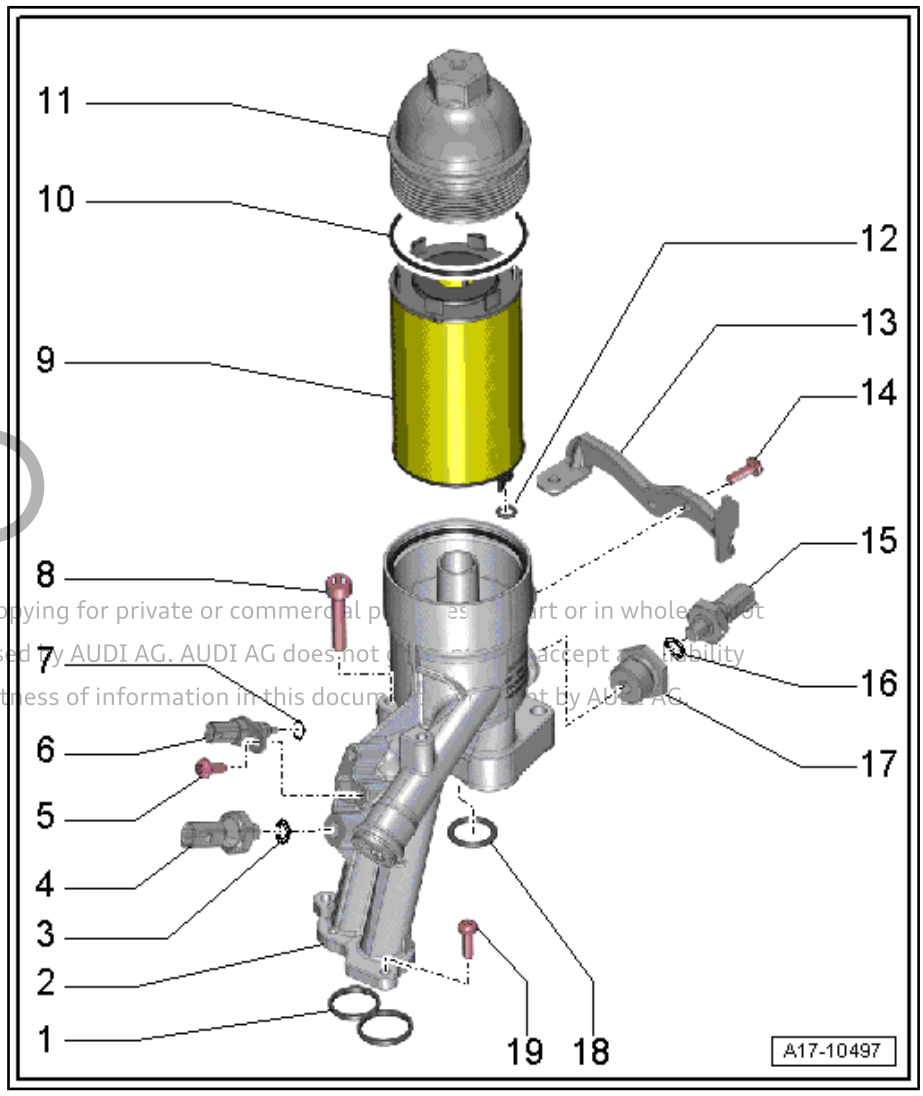
⇒ “4.5 Removing and installing oil pressure switch for reduced oil pressure F378 ”, page 187

⇒ “4.6 Removing and installing valve for oil pressure control N428 ”, page 188

⇒ “4.7 Checking oil pressure”, page 188

⇒ “4.8 Removing and installing oil filter housing”, page 189

4.1 Exploded view - oil filter housing/oil pressure switches



1 - Seal
- ❑ Renew

2 - Oil filter housing
- ❑ Removing and installing ⇒ page 189

3 - Seal
- ❑ Renew

4 - Oil pressure switch - F22-
- ❑ Opening/closing pressure 3.8 ... 4.6 bar
- ❑ Grey insulation
- ❑ Removing and installing ⇒ page 186
- ❑ Check in Guided Fault Finding ⇒ Vehicle diagnostic tester
- ❑ 20 Nm

5 - Bolt
- ❑ 9 Nm

6 - Oil temperature sender - G8-
- ❑ Removing and installing ⇒ page 185

7 - O-ring
- ❑ Renew

8 - Bolt
- ❑ 22 Nm

9 - Oil filter element
- ❑ Removing and installing ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818

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10 - O-ring
- ❑ Renew

11 - Sealing cap
- ❑ 25 Nm

12 - O-ring
- ❑ Part of oil filter element

13 - Bracket

14 - Bolt
- ❑ 9 Nm

15 - 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 187
- ❑ 20 Nm

16 - Seal
- ❑ Renew

17 - Plug
- ❑ 50 Nm

18 - O-ring
- ❑ Renew

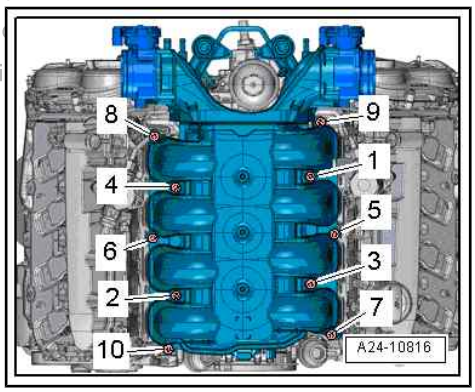
19 - Bolt
- ❑ 9 Nm

4.2 Removing and installing oil temperature sender - G8-

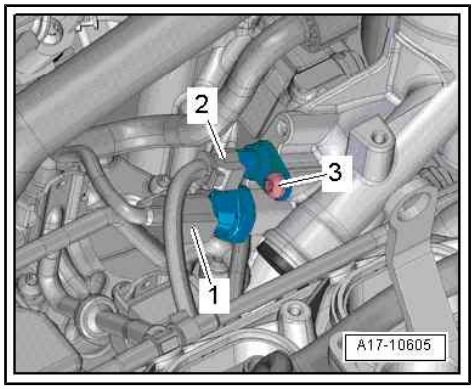
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Removing

– Remove intake manifold (top section) ⇒ page 253



– Unplug electrical connector -2-.
– Remove bolt -3-.
– Detach oil temperature sender - G8- .



Note

Disregard -item 1-.

Installing

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

- Tightening torque
  ⇒ "4.1 Exploded view - oil filter housing/oil pressure switches", page 184

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Note

Fit new O-ring.

– Install intake manifold (top section) ⇒ page 253 .

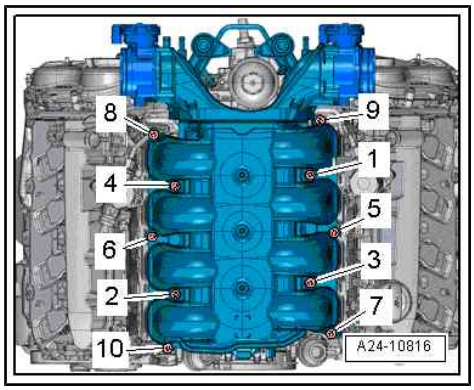
4.3 Checking oil pressure switch - F22- / oil pressure switch for reduced oil pressure - F378-

Checking oil pressure switch in `Guided Fault Finding` ⇒ Vehicle diagnostic tester

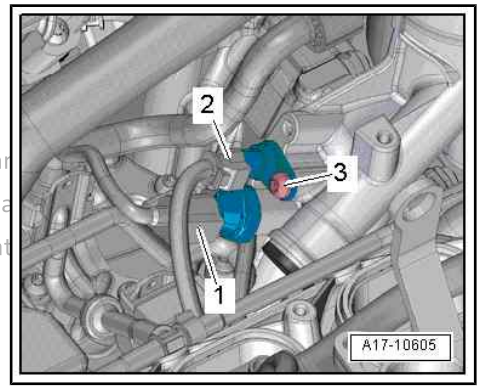
4.4 Removing and installing oil pressure switch - F22-

Removing

– Remove intake manifold (top section) ⇒ page 253 .



– Unplug electrical connectors -1-.
– Unscrew oil pressure switch - F22- .



Note

Disregard items -2 and 3-.

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Installing

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

- Tightening torque
  ⇒ "4.1 Exploded view - oil filter housing/oil pressure switches", page 184

Note

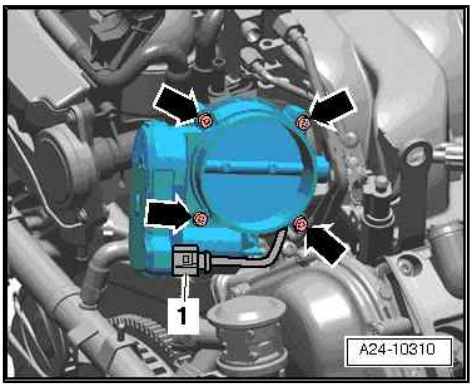
Renew seal.

– Install intake manifold (top section) ⇒ page 253 .

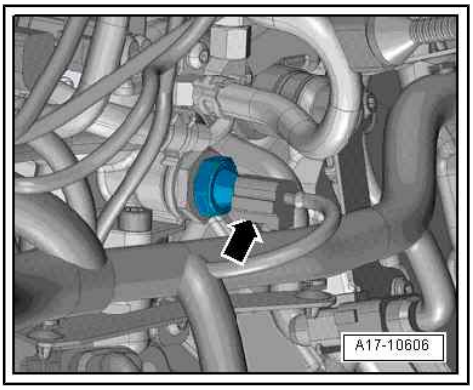
4.5 Removing and installing oil pressure switch for reduced oil pressure - F378-

Removing

– Remove throttle valve module 2 - J544- ⇒ page 259 .



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



Installing

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

- Tightening torque
  ⇒ "4.1 Exploded view - oil filter housing/oil pressure switches", page 184

Note

Renew seal.

– Install throttle valve module 2 - J544- ⇒ page 259 .

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

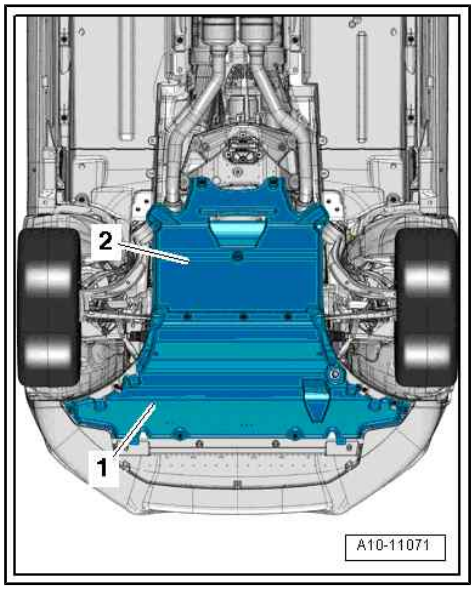
Removing

Vehicles with hydraulic power steering:

– Remove power steering pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing power steering pump

Vehicles with electromechanical power steering:

– Remove noise insulation -1, 2- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

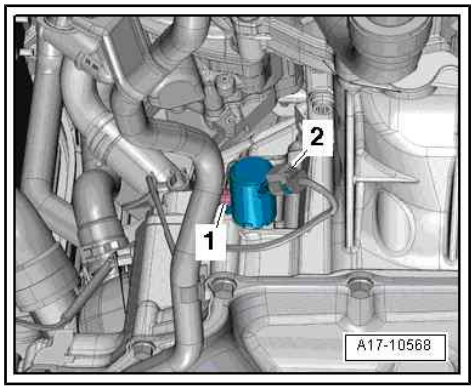


All vehicles (continued):

– Remove bolt -1-.

– Unplug electrical connector -2-.

– Detach valve for oil pressure control - N428- from sump (top section).



Installing

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

- Tightening torque
⇒ “1.2 Exploded view - sump (top section)”, page 168

Note

Fit new O-ring.

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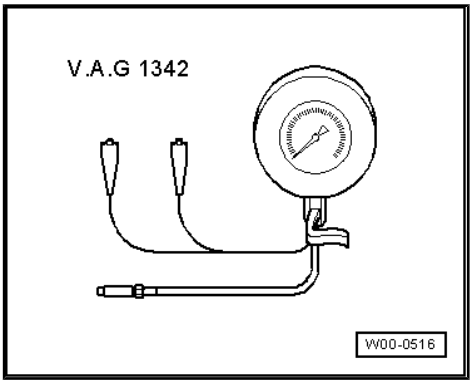
– Install power steering pump ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing power steering pump .

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

4.7 Checking oil pressure

Special tools and workshop equipment required

♦ Oil pressure tester - V.A.G 1342-



Procedure

- Oil level OK
- Engine oil temperature approx. 80 °C

– Remove oil pressure switch - F22- ⇒ page 186 .

– Connect oil pressure tester - V.A.G 1342- to bore for oil pressure switch.

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– Screw oil pressure switch - F22- into oil pressure tester.

– Start engine.

- Minimum oil pressure at idling speed: 1.4 bar.
- Minimum oil pressure at 2000 rpm: 2.1 bar.

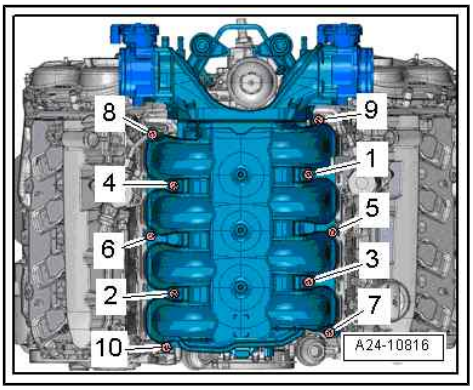
Assembling

– Install oil pressure switch - F22- ⇒ page 186 .

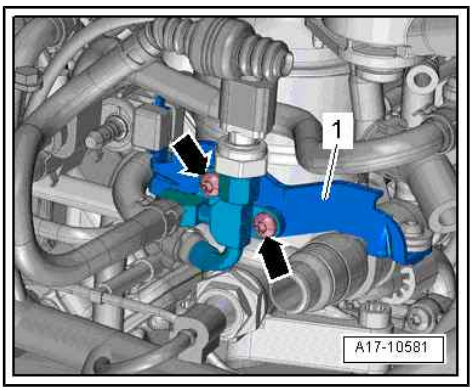
4.8 Removing and installing oil filter housing

Removing

– Remove intake manifold (top section) ⇒ page 253 .



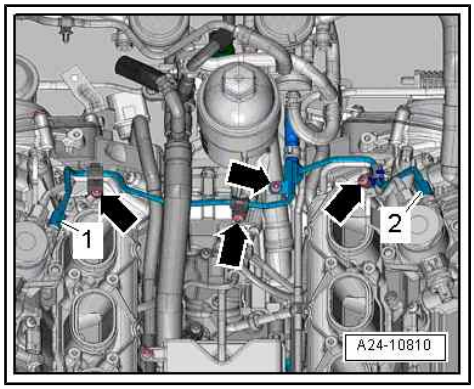
– Remove bolts -arrows- and push bracket to one side.



Caution

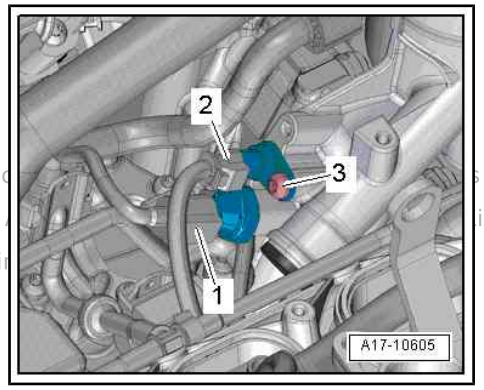
Risk of damage caused by particles of dirt.

- *Observe rules for cleanliness when working on the fuel supply system ⇒ page 3 .*



– Remove bolts -arrows- and union nuts -1, 2- and move fuel supply line to one side.

– Unplug electrical connectors -1- and -2-.

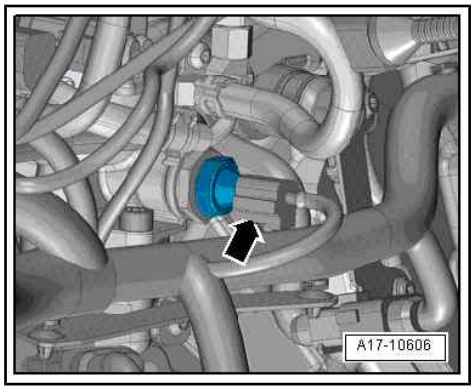


Note

Disregard -item 3-.

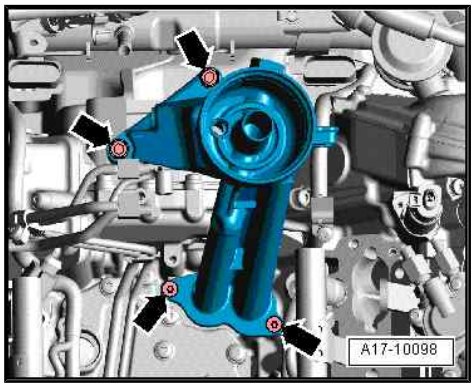
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– Unplug electrical connector -arrow-.



– Remove oil filter element ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

– Unscrew bolts -arrows- and remove oil filter housing.



Installing

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

- Tightening torques
  ⇒ "4.1 Exploded view - oil filter housing/oil pressure switches", page 184

Note

Renew seals and O-rings.

– Install fuel supply line and intake manifold (top section) ⇒ page 253 .

– Check oil level ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818 .

5 Oil circuit

⇒ “5.1 Exploded view - oil spray jets/valves”, page 191

⇒ “5.2 Removing and installing oil spray jets/valves”, page 192

5.1 Exploded view - oil spray jets/valves

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1 - O-ring
- ❑ Renew

2 - Spray nozzle valve
- ❑ Removing and installing ⇒ page 192

3 - Gasket
- ❑ Renew

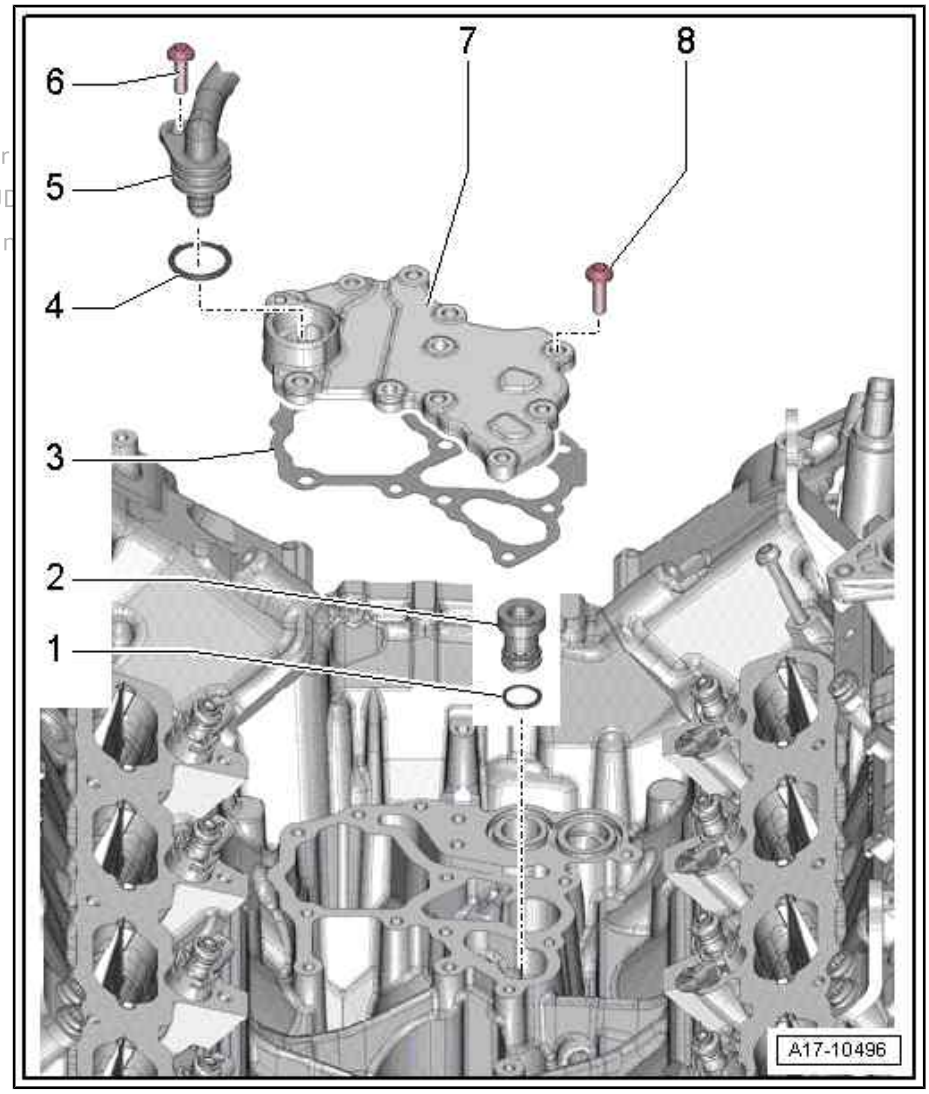
4 - O-ring
- ❑ Renew

5 - Oil return hose

6 - Bolt
- ❑ 9 Nm

7 - Cover

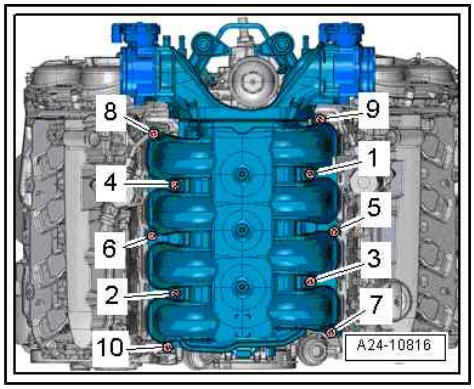
8 - Bolt
- ❑ Renew
- ❑ 5 Nm +90°



5.2 Removing and installing oil spray jets/ valves

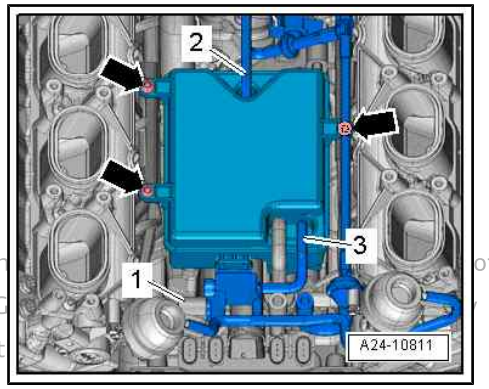
Removing

– Remove intake manifold (top section) ⇒ page 253 .



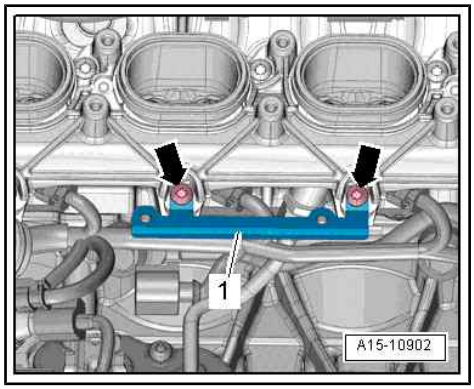
– Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.

– Remove bolts -arrows- and detach vacuum reservoir.



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– Unscrew bolts (left and right) -arrows- and detach bracket -1- for vacuum reservoir.

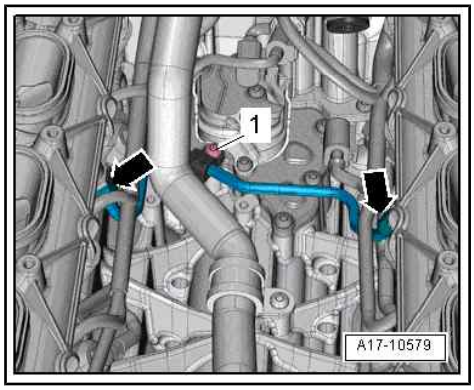


– Remove bolt -1-.

Caution

Risk of damage caused by particles of dirt.

- ***Observe rules for cleanliness when working on the fuel supply system ⇒ page 3 .***

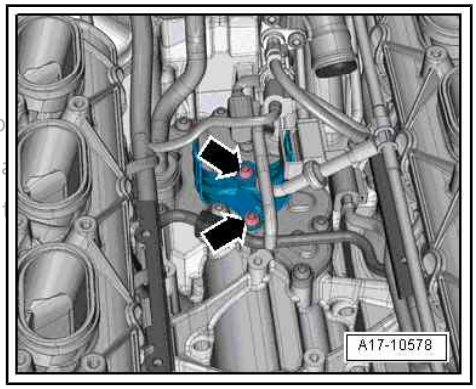


– Detach high-pressure pipes (left and right) from connections -arrows- on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nut.

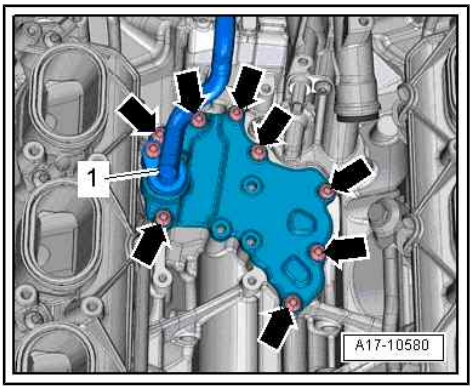
– Detach high-pressure pipe.

– Unscrew bolts -arrows- and move bracket with change-over valve to one side.

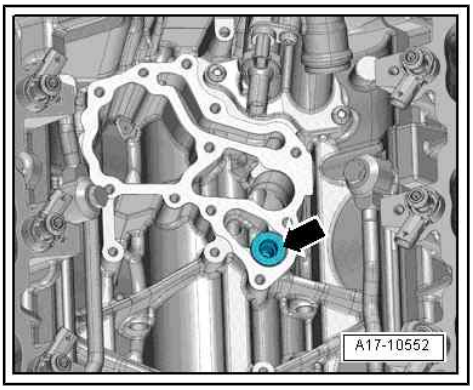
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– Remove bolts -arrows-.
– Detach cover with crankcase breather hose -1-.
– Detach gasket.



– Pull out spray nozzle valve -arrow-.



Installing

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

- Tightening torques
  ⇒ “5.1 Exploded view - oil spray jets/valves”, page 191

Note

♦ *Renew gaskets and O-rings.*

♦ *Renew bolts tightened with specified tightening angle.*

– Install high-pressure pipe and intake manifold (top section)
  ⇒ page 275 , ⇒ page 253 .

19 – Cooling

1 Cooling system/coolant

⇒ “1.1 Connection diagram - coolant hoses”, page 194
⇒ “1.2 Draining and filling cooling system”, page 196
⇒ “1.3 Checking cooling system for leaks”, page 202

1.1 Connection diagram - coolant hoses

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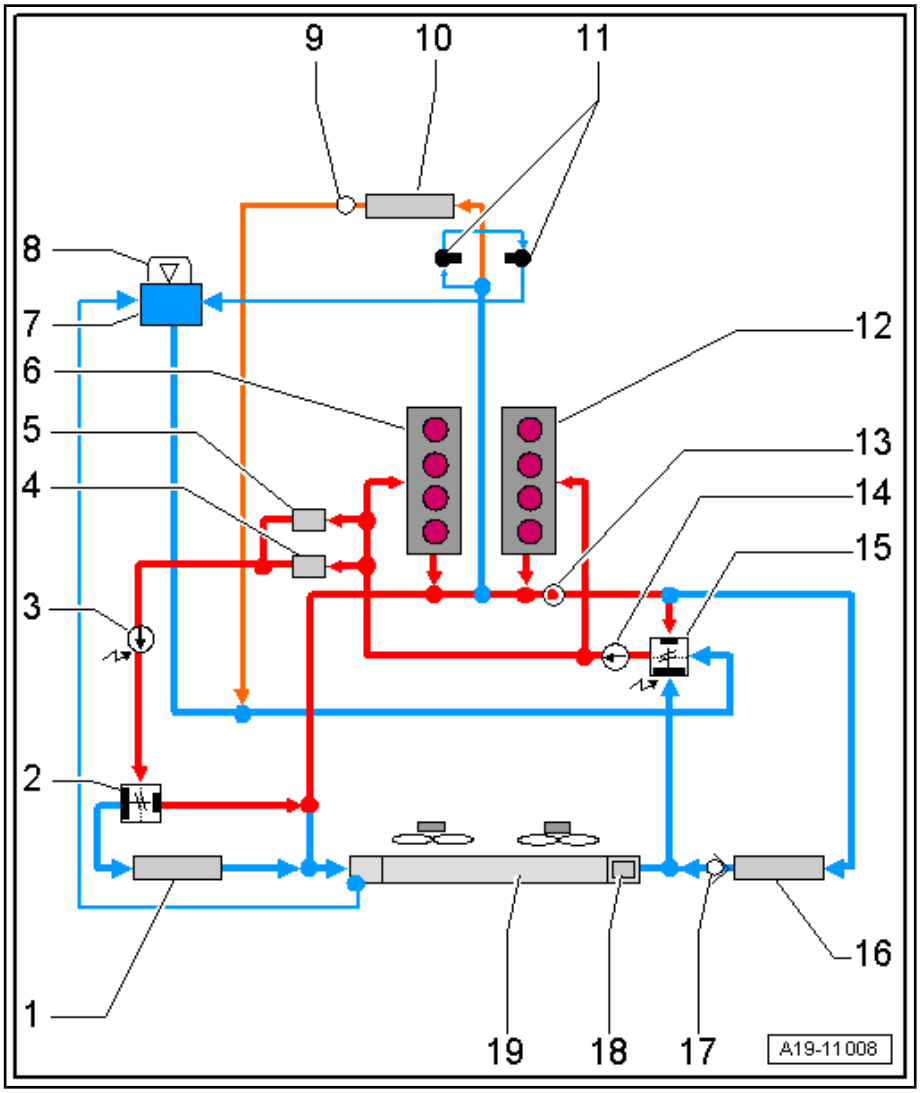
WARNING

Risk of scalding due to hot steam and hot coolant.

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

Note

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



1 - Auxiliary radiator

- ❑ Right-side
- ❑ If renewed, refill system with fresh coolant

2 - Thermostat

- ❑ For auxiliary radiator (right-side)

3 - Continued coolant circulation pump - V51-

4 - Alternator

5 - Engine oil cooler

- ❑ If renewed, refill system with fresh coolant

6 - Cylinder head

- ❑ Cylinder bank 1 (right-side)
- ❑ If renewed, refill system with fresh coolant

7 - Coolant expansion tank

8 - Filler cap

- ❑ Checking pressure relief valve ⇒ page 204

9 - Bleeder hole

- ❑ In coolant hose for heat exchanger

10 - Heat exchanger for heater

- ❑ If renewed, refill system with fresh coolant

11 - Crankcase breather

12 - Cylinder head

- ❑ Cylinder bank 2 (left-side)
- ❑ If renewed, refill system with fresh coolant

13 - Coolant temperature sender - G62-

14 - Coolant pump

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

16 - Auxiliary radiator

- ❑ Left-side
- ❑ If renewed, refill system with fresh coolant

17 - Non-return valve

18 - ATF cooler

- ❑ Integrated into radiator

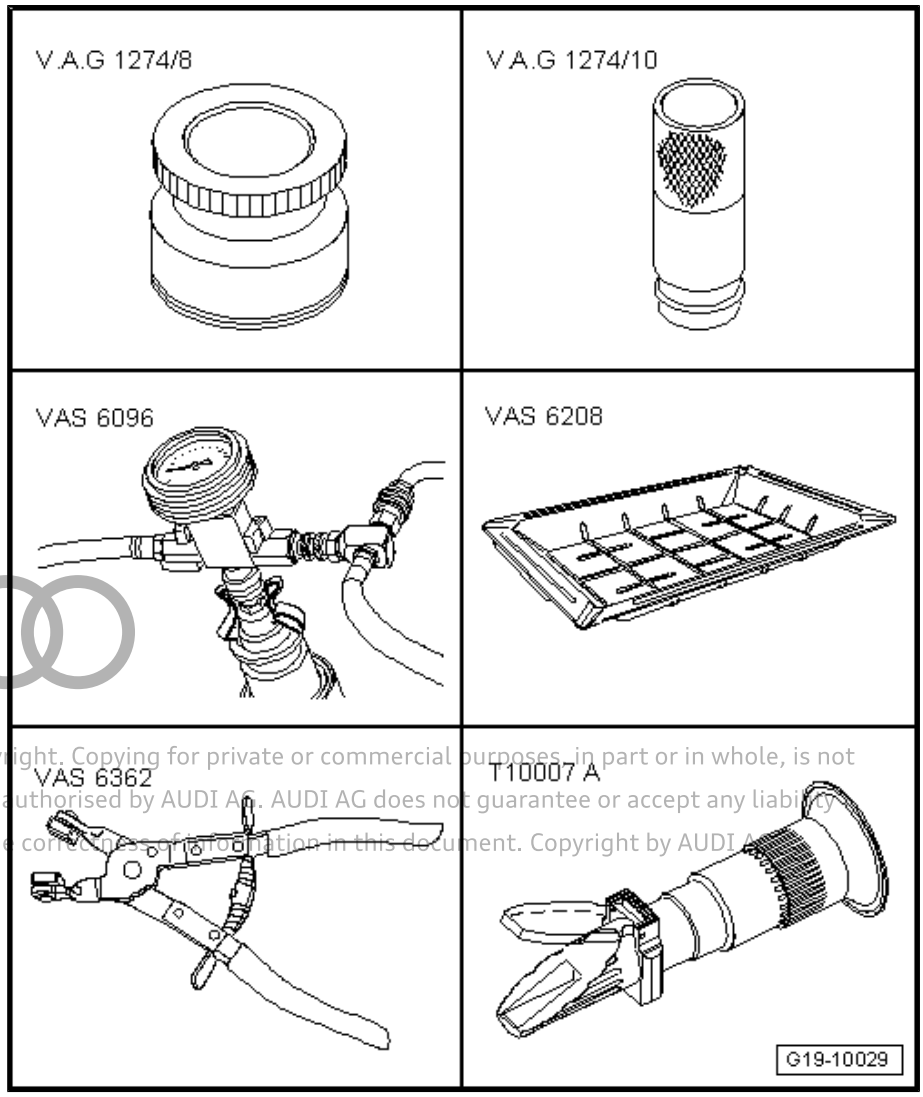
19 - Radiator

- ❑ If renewed, refill system with fresh coolant

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1.2 Draining and filling cooling system

Special tools and workshop equipment required



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- Adapter for cooling system tester - V.A.G 1274/8-
- Pipe for cooling system tester - V.A.G 1274/10-
- Cooling system charge unit - VAS 6096-
- Drip tray for workshop hoist - VAS 6208-
- Hose clip pliers - VAS 6362-
- Refractometer - T10007 A-

Draining

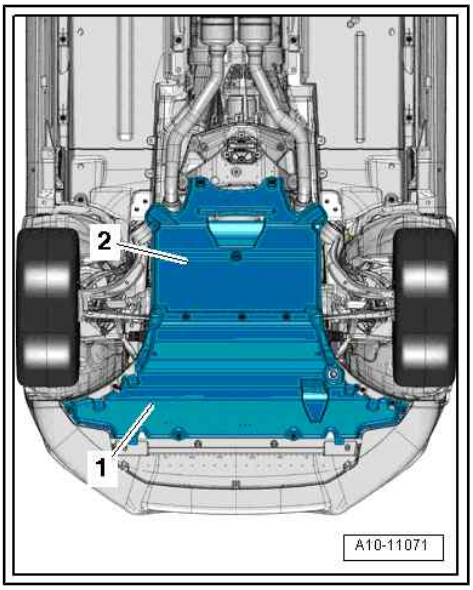
WARNING

Risk of scalding due to hot steam and hot coolant.

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

– Open filler cap on coolant expansion tank.

– Remove front noise insulation -1- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

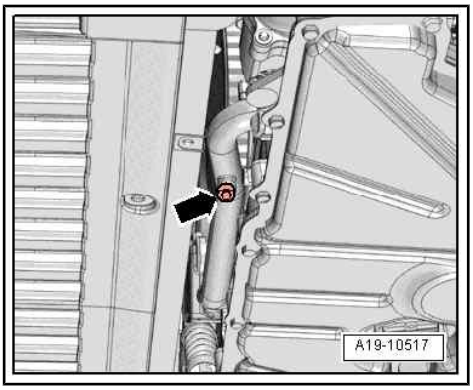


Note

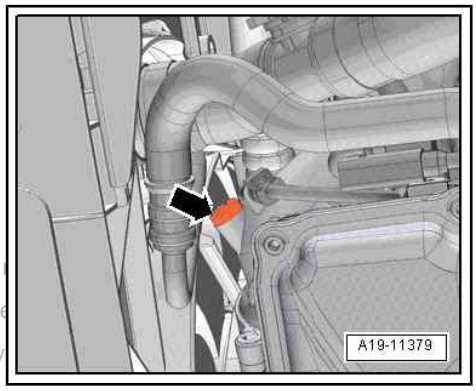
Collect drained coolant in a clean container for re-use or disposal.

– Place drip tray for workshop hoist - VAS 6208- beneath engine.

– Unscrew drain plug -arrow- on coolant pipe (front) and drain off coolant.

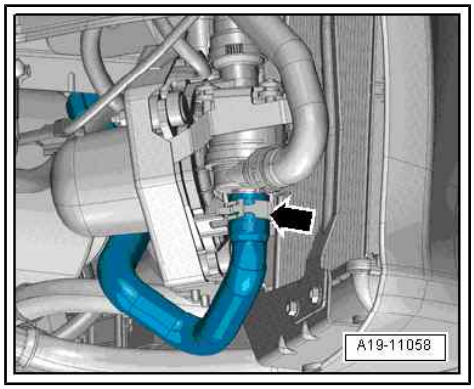


– Unscrew drain plug -arrow- on map-controlled engine cooling system thermostat - F265- and drain off coolant.



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– Audi RS 4/RS 5 Coupé: Open hose clip -arrow-, disconnect coolant hose at continued coolant circulation pump - V51- and drain off remaining coolant.



Filling

- Tightening torques
  ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 205 ,
  ⇒ “3.1 Exploded view - coolant pipes”, page 213
- Ignition switched off.

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 (also applies to all older models).*
- *Use only coolant additives listed in the ⇒ Electronic parts catalogue . 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 ⇒ page 198 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.*
- *Anti-freeze protection must be guaranteed to about -25 °C (in countries with an arctic climate to approx. -36 °C).*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The coolant additive concentration must be at least 40 %.*
- *If greater frost protection is required in very cold climates, the amount of antifreeze can be increased, but only up to 55 %, as otherwise the cooling efficiency is impaired and frost protection decreases again.*
- *The refractometer - T10007 A- must be used to determine the current anti-freeze density.*
- *Read off the level of frost protection on the scale for the relevant coolant additive.*
- *The temperature indicated on the refractometer - T10007 A- 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.*
- *Secure all hose connections with correct type of hose clips (as original equipment) ⇒ Electronic parts catalogue .*

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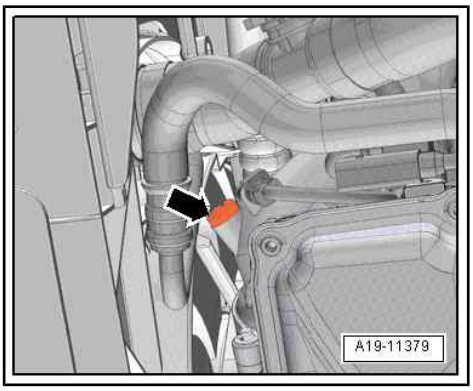
Recommended mixture ratio for coolant

- Coolant (40 %) and water (60 %) for frost protection to -25 °C

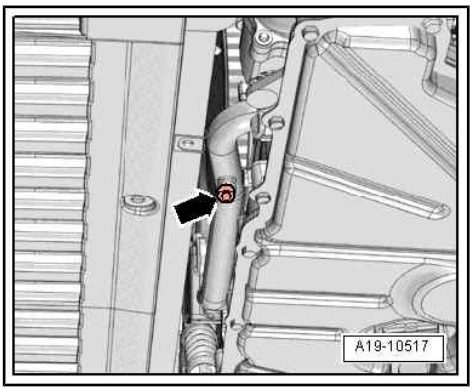
- Coolant (50 %) and water (50 %) for frost protection to –35 °C
- Coolant ⇒ Electronic parts catalogue

Procedure

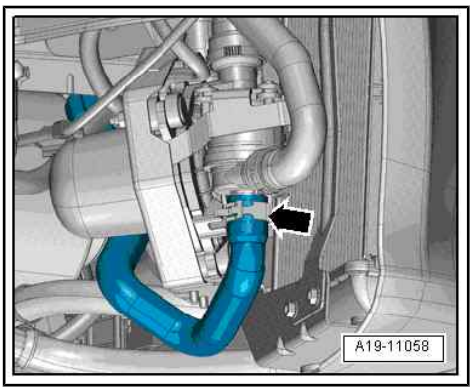
– Install drain plug -arrow- with new O-ring on map-controlled engine cooling system thermostat - F265- .



– Install drain plug -arrow- with new seal on coolant pipe (front).

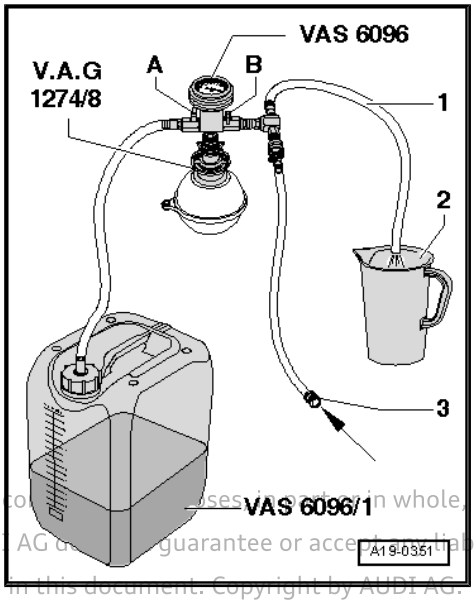


– Audi RS 4/RS 5 Coupé: Connect coolant hose at continued coolant circulation pump - V51- -arrow-.



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– Fill reservoir of -VAS 6096- with at least 15 litres of premixed coolant (according to recommended ratio):
– Fit adapter for cooling system tester - V.A.G 1274/8- onto coolant expansion tank.
– Attach cooling system charge unit - VAS 6096- to adapter -V.A.G 1274/8- .
– Run vent hose -1- into a small container -2-.



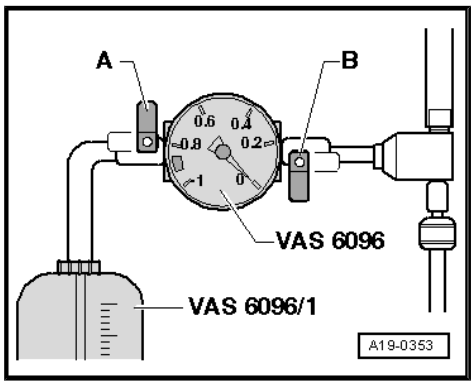
Note

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

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

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– Open valve -B- by setting lever in direction of flow.
• The suction jet pump generates a partial vacuum in the cooling system; the needle on the gauge should move into the green zone.
– Also briefly open valve -A- (turn lever in direction of flow) so that hose on reservoir of -VAS 6096- can fill with coolant.
– Close valve -A- again.
– Leave valve -B- open for another 2 minutes.
• The suction jet pump continues to generate a partial vacuum in the cooling system; the needle on the gauge should remain in the green zone.
– Close valve -B-.
• The needle on the gauge should stop in the green zone. The vacuum level in the cooling system is then sufficient for subsequent filling.

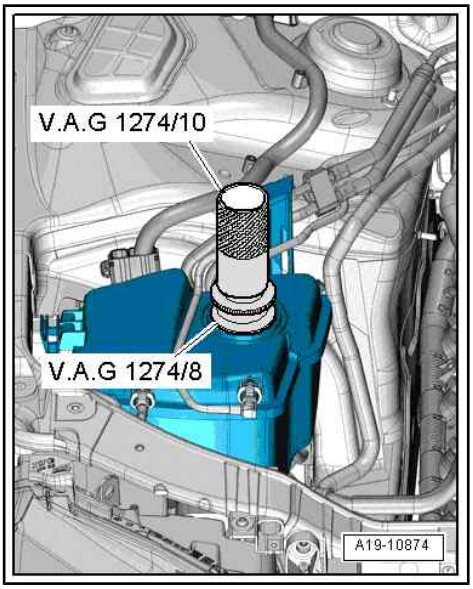


Note

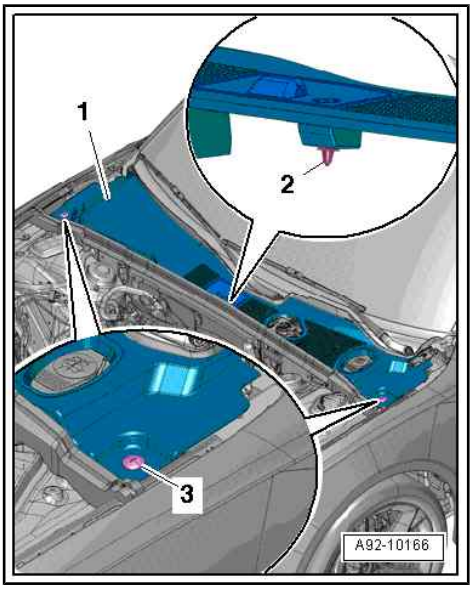
♦ *If the needle does not reach the green zone, repeat the process.*
♦ *Check cooling system for leaks if the vacuum is not maintained.*

– Detach compressed air hose.
– Open valve -A-.
• The vacuum in the cooling system causes the coolant to be drawn out of the reservoir of -VAS 6096- ; the cooling system is then filled.
– Detach cooling system charge unit - VAS 6096- from adapter -V.A.G 1274/8- on coolant expansion tank.

– Attach pipe -V.A.G 1274/10- onto adapter -V.A.G 1274/8- .

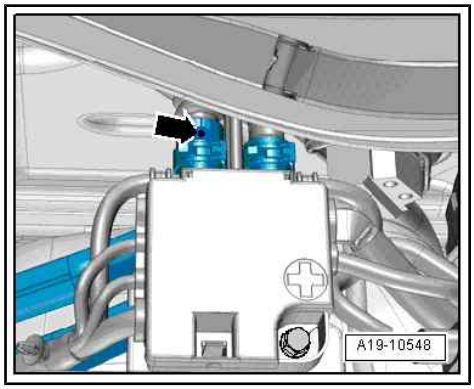


– Remove bolts -3-.
– Unclip retaining clips -2- from mounting and detach plenum chamber cover -1-.



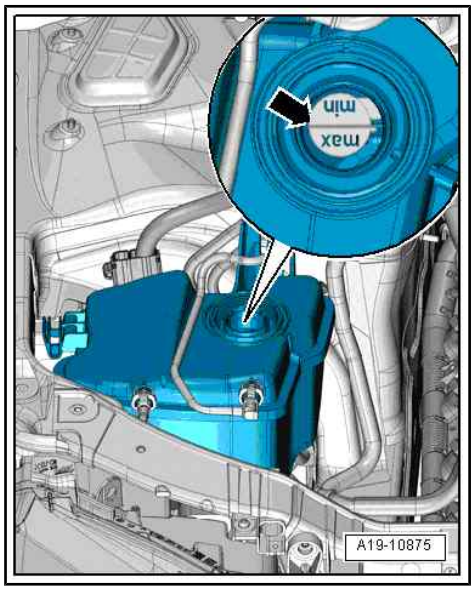
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– Release coolant hose going to heat exchanger for heater and pull back hose until bleeder hole -arrow- in hose is no longer blocked by connection.
– Fill up with coolant until it flows out at bleeder hole in coolant hose.
– Push coolant hose back onto connection and secure with spring-type hose clip.
– On vehicles with auxiliary heater, switch heater on (for about 30 seconds) and then off again.
– Close filler cap on coolant expansion tank (make sure it engages).
– Start engine.
– Set temperature to “HI” in all zones.
– Switch off air conditioner compressor (press AC button).
• LED in button should not light up.
– Run engine for 3 minutes at 2000 rpm.
– Allow engine to run at idling speed until both large coolant hoses at radiator become warm.
– Run engine for 1 minute at 2000 rpm.
– Switch off ignition and allow engine to cool down.
– Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



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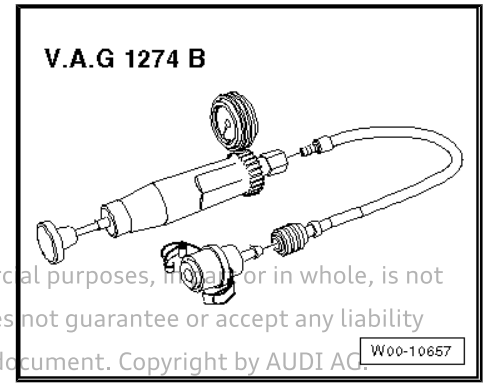
– Check coolant level.
• The coolant level must be at the MAX marking when the engine is cold.
• The coolant level can be above the MAX marking when the engine is warm.



1.3 Checking cooling system for leaks

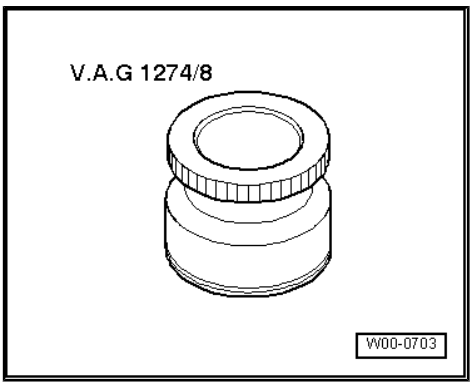
Special tools and workshop equipment required

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

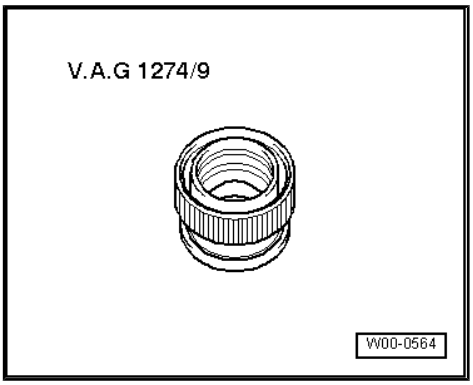


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- Adapter for cooling system tester - V.A.G 1274/8-



- Adapter for cooling system tester - V.A.G 1274/9-



Procedure

- Engine must be warm.

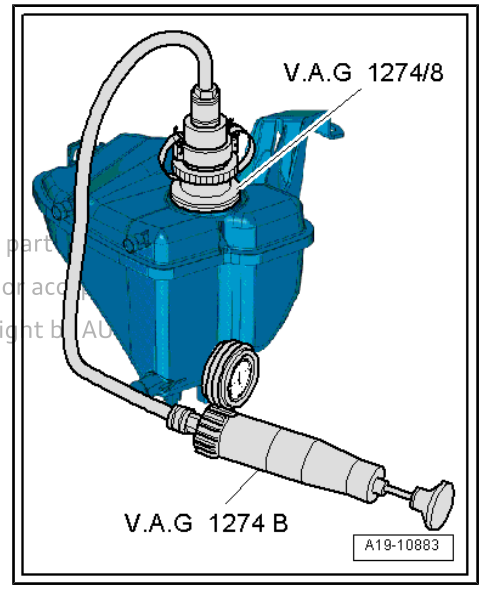
WARNING

Risk of scalding due to hot steam and hot coolant.

- ***The cooling system is under pressure when the power unit is hot.***
- ***Cover filler cap on coolant expansion tank with a cloth and open carefully to dissipate pressure.***

– Open filler cap on coolant expansion tank.

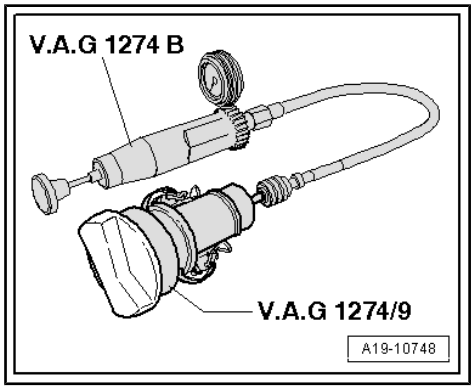
– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/8- onto coolant expansion tank.
– Using hand pump on cooling system tester, build up a pressure of approx. 1.0 bar.
– If this pressure is not maintained, locate and rectify leaks.



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Checking pressure relief valve in filler cap

– Fit cooling system tester - V.A.G 1274 B- with adapter - V.A.G 1274/9- onto filler cap.
– Build up pressure with hand pump on cooling system tester.
• The pressure relief valve should open at a pressure of 1.4 ... 1.6 bar.
– Renew filler cap if pressure relief valve does not open as described.



2 Coolant pump/thermostat assembly

⇒ “2.1 Exploded view - coolant pump/thermostat”, page 205

⇒ “2.2 Removing and installing electric coolant pump”, page 206

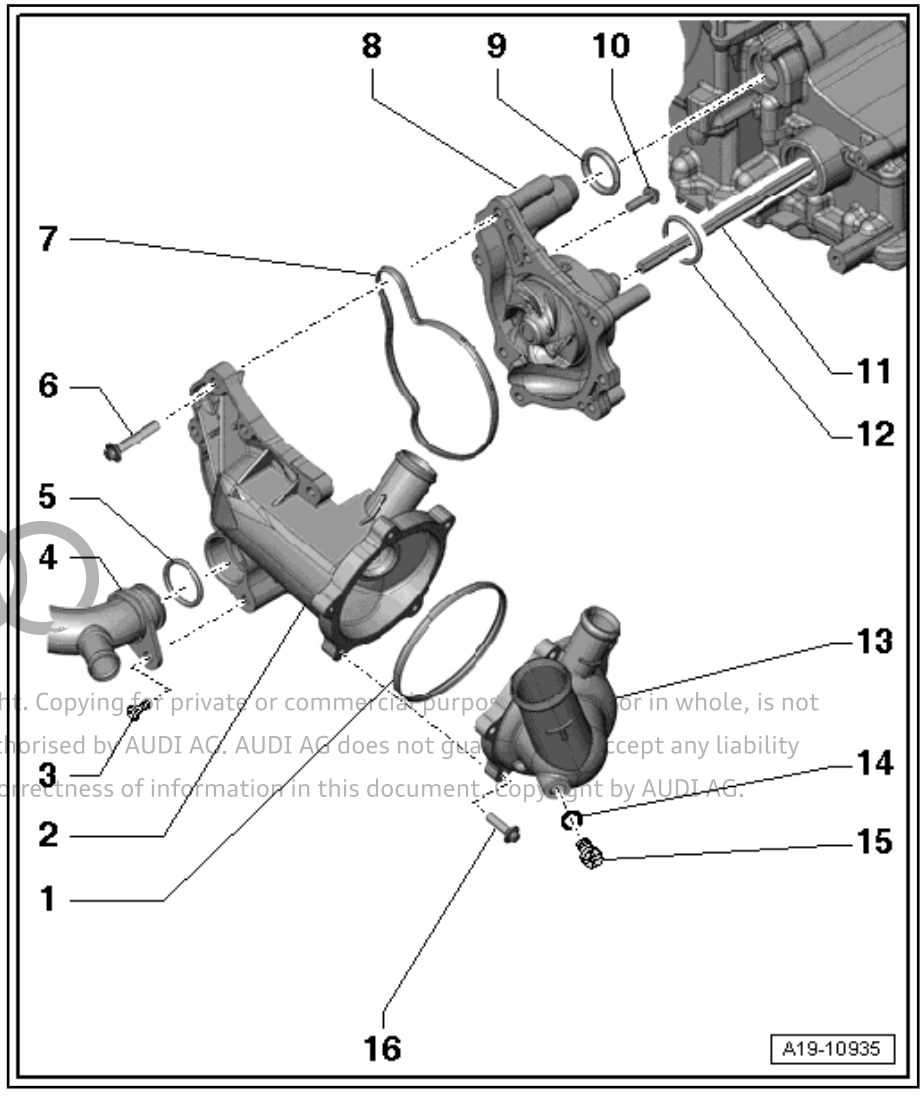
⇒ “2.3 Thermostat opening values”, page 208

⇒ “2.4 Removing and installing coolant pump”, page 208

⇒ “2.5 Removing and installing coolant temperature sender G62 ”, page 210

⇒ “2.6 Removing and installing map-controlled engine cooling system thermostat F265 ”, page 211

2.1 Exploded view - coolant pump/thermostat



1 - Seal
- ❑ Renew

2 - Housing
- ❑ For coolant pump
- ❑ Removing and installing ⇒ “2.4 Removing and installing coolant pump”, page 208

3 - Bolt
- ❑ 9 Nm

4 - Coolant pipe (front)
- ❑ Version fitted in vehicle may differ from illustration
- ❑ Removing and installing ⇒ page 214

5 - O-ring
- ❑ Renew

6 - Bolt
- ❑ 9 Nm

7 - Seal
- ❑ Renew

8 - Coolant pump
- ❑ Removing and installing ⇒ page 208

9 - O-ring
- ❑ Renew

10 - Bolt
- ❑ 9 Nm

11 - Drive shaft
- ❑ For coolant pump

12 - O-ring
- ❑ Renew

13 - Map-controlled engine cooling system thermostat - F265-
- ❑ Removing and installing ⇒ page 211

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- ❑ Thermostat opening data ⇒ page 208

14 - O-ring

- ❑ Renew

15 - Drain plug

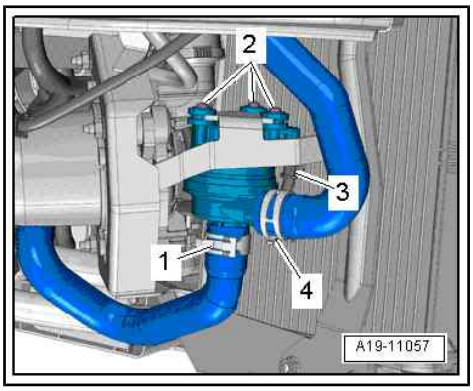
- ❑ 4 Nm

16 - Bolt

- ❑ 9 Nm

Continued coolant circulation pump - V51- - tightening torque

– Tighten bolts -2- for continued coolant circulation pump - V51- to 5 Nm.



Note

Illustration shows fitting location on an Audi RS 4/RS 5 Coupé.

2.2 Removing and installing electric coolant pump

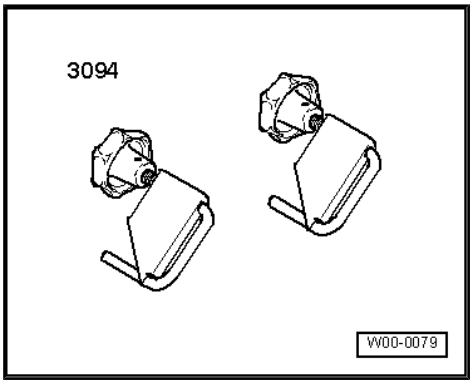
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⇒ “2.2.1 Removing and installing continued coolant circulation pump V51 ”, page 206

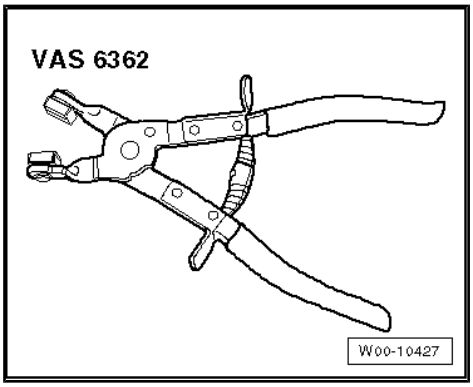
2.2.1 Removing and installing continued coolant circulation pump - V51-

Special tools and workshop equipment required

♦ Hose clamps up to 25 mm - 3094-



♦ Hose clip pliers - VAS 6362-



Removing

WARNING

Risk of scalding due to hot steam and hot coolant.

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

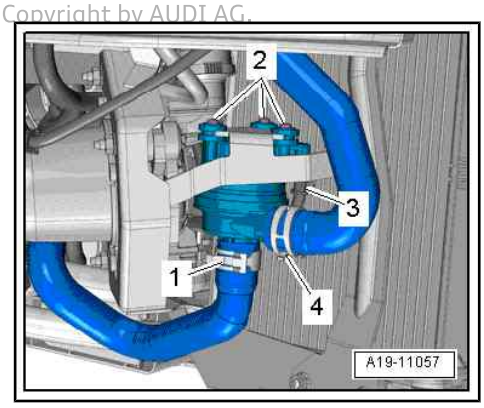
– Open filler cap on coolant expansion tank.

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

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Audi RS 4/RS 5 Coupé:

– Unplug electrical connector -3-.



Note

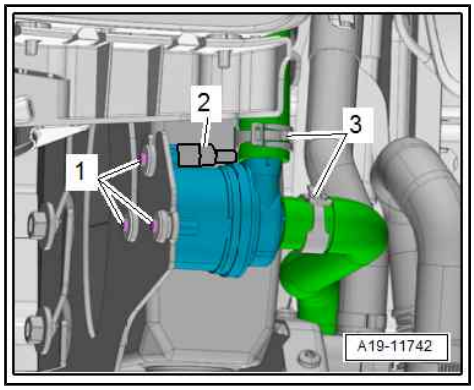
Place a cloth underneath to catch escaping coolant.

– Clamp off coolant hoses using hose clamps -3094- , release hose clips -1- and -4- and disconnect coolant hoses.

– Remove bolts -2- and detach continued coolant circulation pump - V51- .

Audi RS 5 Cabriolet:

– Unplug electrical connector -2-.



Note

Place a cloth underneath to catch escaping coolant.

– Remove bolts -1-.

– Clamp off coolant hoses using hose clamps -3094- , release hose clips -3- and disconnect coolant hoses.

– Detach continued coolant circulation pump - V51- .

Installing

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

- Tightening torque
  ⇒ Fig. "" Continued coolant circulation pump -V51- - tightening torque"" , page 206

Note

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

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

– Fit front wheel (right-side) ⇒ Running gear, axles, steering; Rep. gr. 44 ; Wheels, tyres; Tightening torque for wheel bolts .

– Check coolant level ⇒ page 202 .

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2.3 Thermostat opening values

Starts to open	Fully open	Opening travel	Voltage measured at thermostat
approx. 105 °C	approx. 117 °C	at least 8 mm	0 V
–	approx. 105 °C	at least 8 mm	14 V

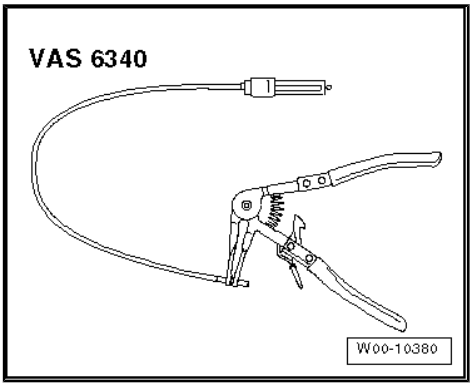
Note

The thermostat cannot be tested with workshop equipment.

2.4 Removing and installing coolant pump

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6340-



Removing

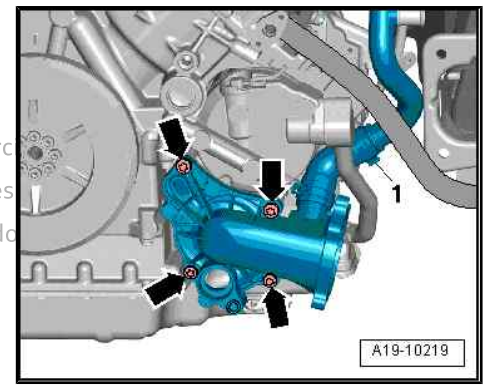
– Remove coolant pipe (front) ⇒ page 214 .

– Remove map-controlled engine cooling system thermostat - F265- ⇒ page 211 .

– Release hose clip -1- on coolant hose.

– Remove bolts -arrows-.

– Pull off coolant pump housing forwards (note the drive shaft for coolant pump).

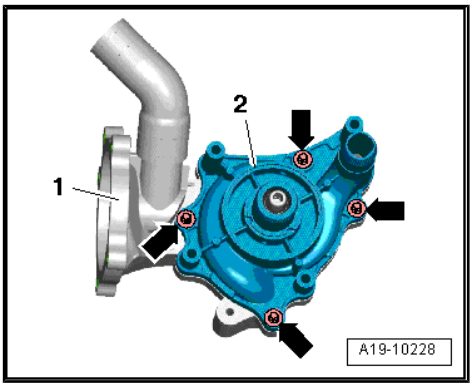


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Note

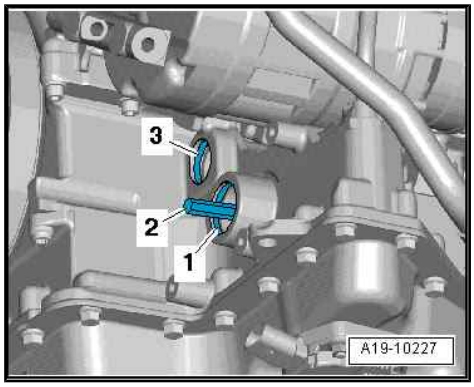
The coolant hose can only be disconnected when the coolant pump is removed.

– Remove bolts -arrows- and remove coolant pump -2- from housing -1-.



Installing

- Tightening torques
  ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 205



Note

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

– Fit new O-rings -1- and -3-.

– Insert drive shaft -2- for coolant pump in mounting for oil pump as far as stop.

– Slide coolant pipe into mountings on sump (top section).

Note

To fit the drive flange onto the hexagon flats of the drive shaft, use your finger to turn the impeller (access through the bottom pipe connection of coolant pump) until the coolant pump can be pressed on all the way.

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

– Install map-controlled engine cooling system thermostat - F265- ⇒ page 211 .

– Install coolant pipe (front) ⇒ page 214 .

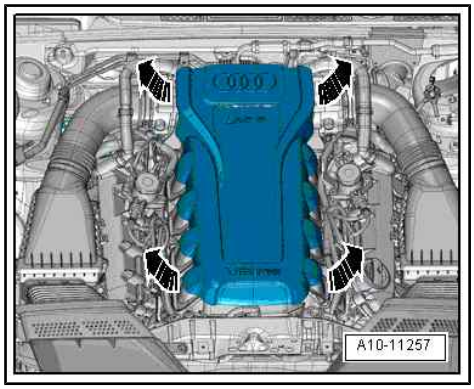
2.5 Removing and installing coolant temperature sender - G62-

Removing

- Engine cold.

– Remove engine cover panel -arrows-.

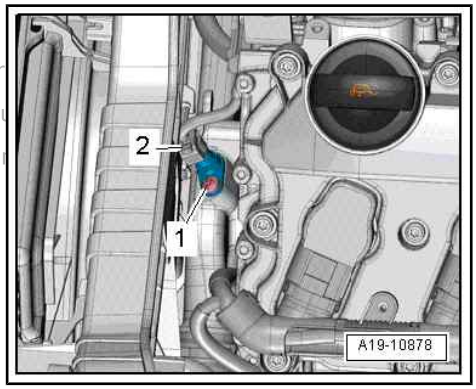
– Open filler cap on coolant expansion tank briefly to dissipate residual pressure in cooling system.



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– Unplug electrical connector -2- at coolant temperature sender - G62- .



Note

Place a cloth underneath to catch escaping coolant.

– Unscrew bolt -1- and detach coolant temperature sender - G62- .

Installing

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

- Tightening torque
⇒ “3.1 Exploded view - coolant pipes”, page 213

Note

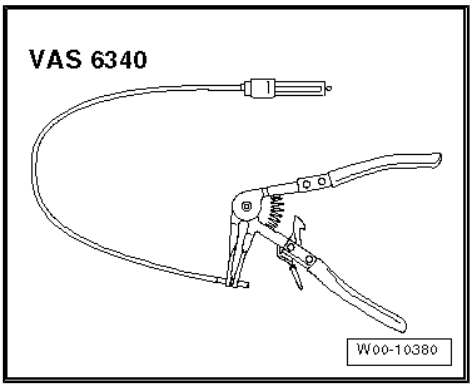
- *Fit new O-ring.*
- *Insert new coolant temperature sender - G62- immediately into connection to avoid loss of coolant.*

– Check coolant level ⇒ page 202 .

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

Special tools and workshop equipment required

- Hose clip pliers - VAS 6340-



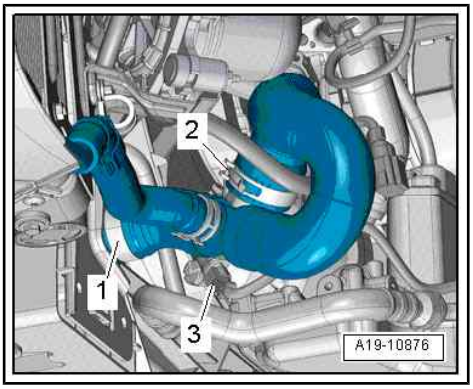
Removing

– Drain coolant ⇒ page 196 .

– Unplug electrical connector -3- at map-controlled engine cooling system thermostat - F265- .

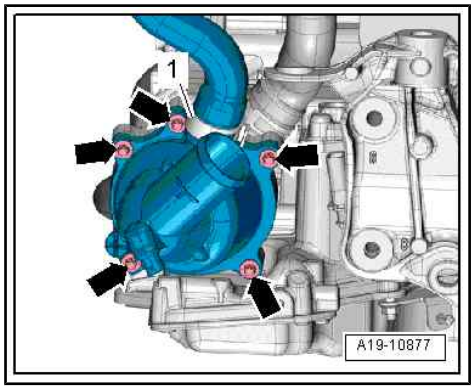
– Lift retaining clip -1- on coolant hose, release hose clip -2- and remove coolant hose.

– Place coolant hoses to the side.



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

– Remove bolts -arrows- and detach map-controlled engine cooling system thermostat - F265- .



Installing

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

- Tightening torque
  ⇒ “2.1 Exploded view - coolant pump/thermostat”, page 205

Note

♦ *Renew seals and O-rings.*

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

– Connect coolant hose with plug-in connector ⇒ page 220 .

– Fill up with coolant ⇒ page 198 .

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3 Coolant pipes

⇒ “3.1 Exploded view - coolant pipes”, page 213

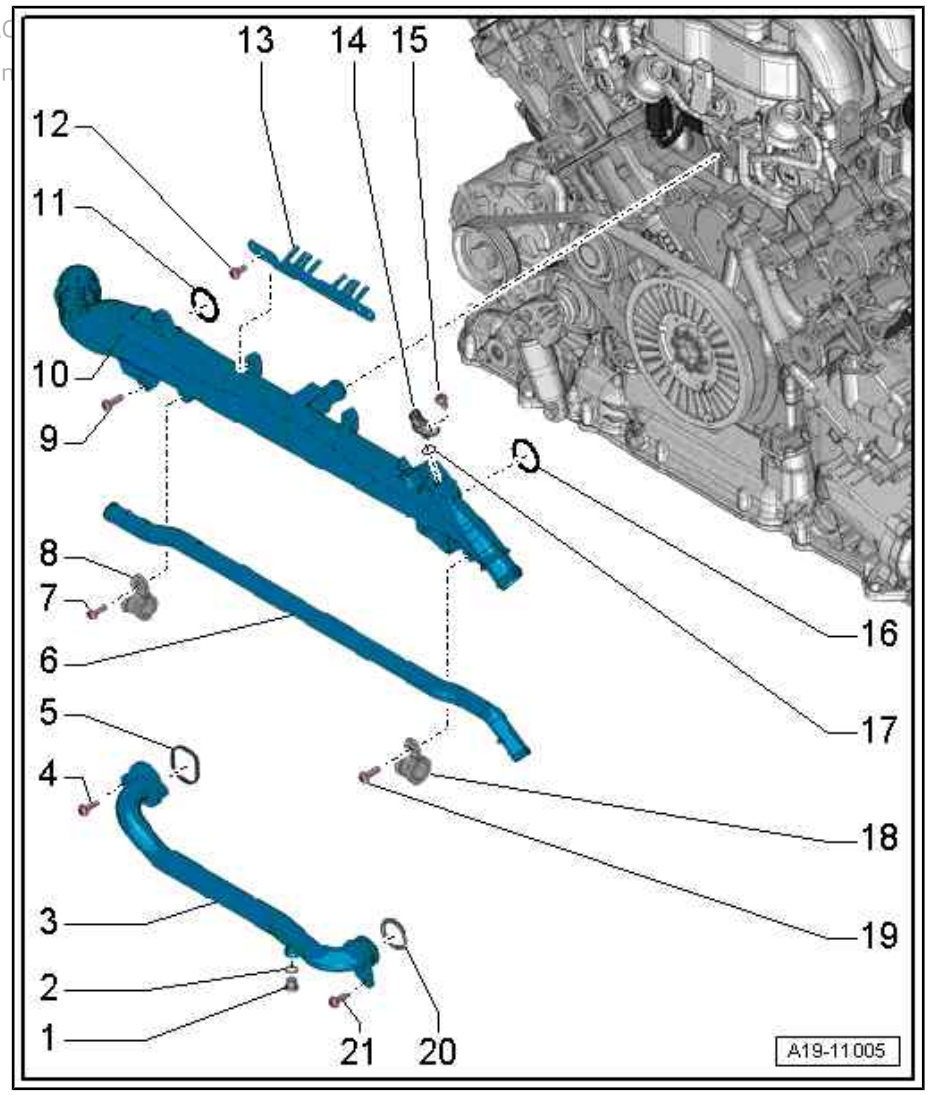
⇒ “3.2 Removing and installing coolant pipes (front)”, page 214

⇒ “3.3 Removing and installing coolant pipes (top front)”, page 214

⇒ “3.4 Removing and installing coolant pipes (front centre)”, page 216

3.1 Exploded view - coolant pipes

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1 - Drain plug
- ❑ 15 Nm

2 - Seal
- ❑ Renew

3 - Coolant pipe (front)
- ❑ Removing and installing ⇒ page 214

4 - Bolt
- ❑ Renew
- ❑ 8 Nm +90°

5 - Seal
- ❑ Renew

6 - Coolant pipe (front centre)
- ❑ Removing and installing ⇒ page 216

7 - Bolt
- ❑ 9 Nm

8 - Retaining clamp

9 - Bolt
- ❑ 9 Nm

10 - Coolant pipe (top front)
- ❑ Removing and installing ⇒ page 214

11 - O-ring
- ❑ Renew

12 - Bolt
- ❑ 9 Nm

13 - Bracket
- ❑ For electrical connectors

14 - Coolant temperature sender - G62-
- ❑ Removing and installing ⇒ page 210

15 - Bolt
- ❑ 9 Nm

16 - O-ring
- ❑ Renew

17 - O-ring

- ❑ Renew

18 - Retaining clamp

19 - Bolt

- ❑ 9 Nm

20 - O-ring

- ❑ Renew

21 - Bolt

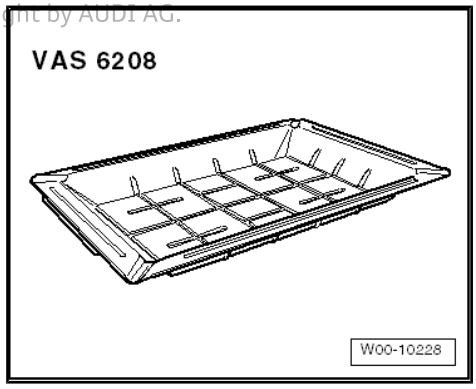
- ❑ Renew
- ❑ 8 Nm +90°

3.2 Removing and installing coolant pipes (front)

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Special tools and workshop equipment required

♦ Drip tray for workshop hoist - VAS 6208-

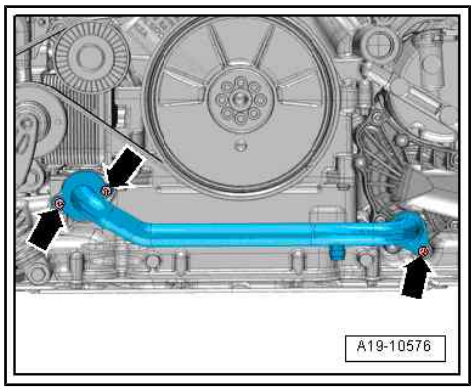


Removing

– Remove radiator with radiator cowl ⇒ page 220 .

– Remove bolts -arrows-.

– Detach front coolant pipe from engine and coolant pump.



Installing

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

- Tightening torque
  ⇒ “3.1 Exploded view - coolant pipes”, page 213

Note

♦ *Renew seal and O-ring.*

♦ *Renew bolts tightened with specified tightening angle.*

– Clean or smoothen sealing surfaces for seal and O-ring.

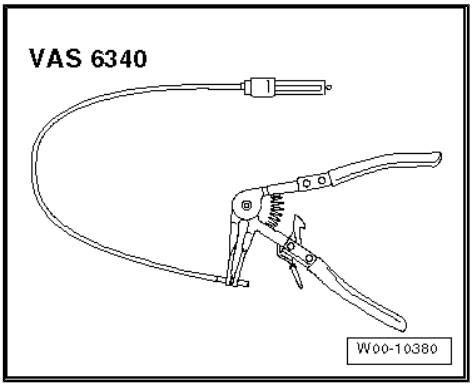
– Lubricate seal and O-ring with coolant and fit.

– Install radiator with radiator cowl ⇒ page 220 .

3.3 Removing and installing coolant pipes (top front)

Special tools and workshop equipment required

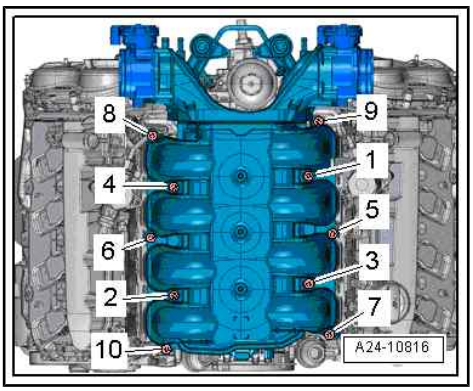
♦ Hose clip pliers - VAS 6340-



Removing

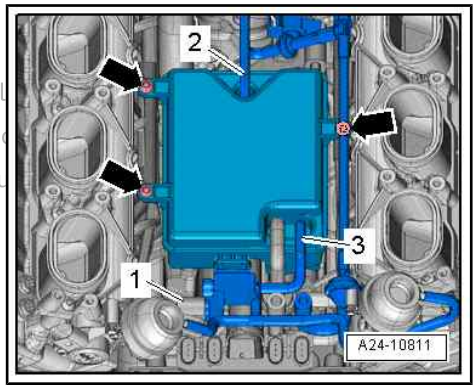
– Remove intake manifold (top section) ⇒ page 253 .

– Remove radiator with radiator cowl ⇒ page 220 .

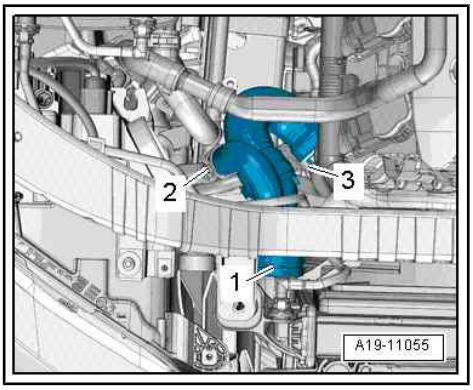


– Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.

– Remove bolts -arrows- and detach vacuum reservoir.

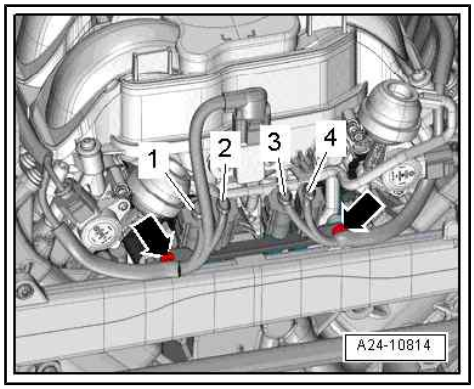


– Lift retaining clip -1-, release hose clips -2, 3- and remove coolant hose.

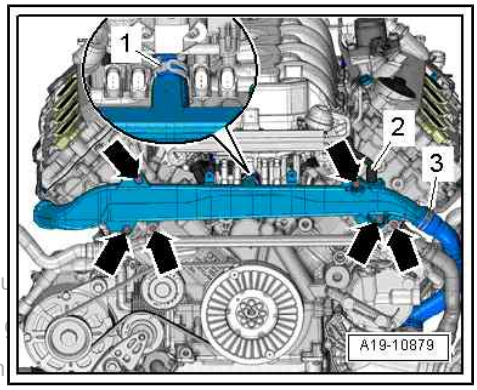


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– Remove bolts -arrows- and move bracket with electrical connectors -1 ... 4- to one side.



– Unplug electrical connector -2-.
– Remove bolts -arrows-.
– Release hose clips -1- and -3- and disconnect coolant pipe (top front) from coolant hoses.



Installing

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

- Tightening torque
  ⇒ "3.1 Exploded view - coolant pipes", page 213

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Note

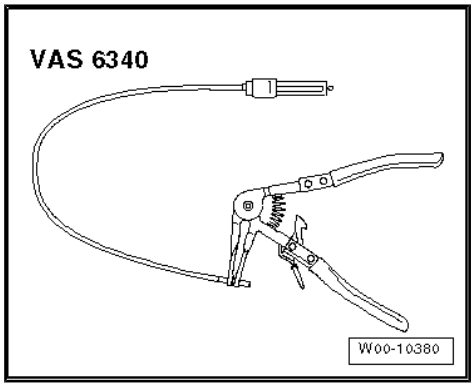
- *Fit new O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Clean or smoothen sealing surfaces for O-rings.
– Lubricate O-rings with coolant and fit O-rings.
– Connect coolant hose with plug-in connector ⇒ page 220 .
– Install radiator with radiator cowl ⇒ page 220 .
– Install intake manifold (top section) ⇒ page 253 .

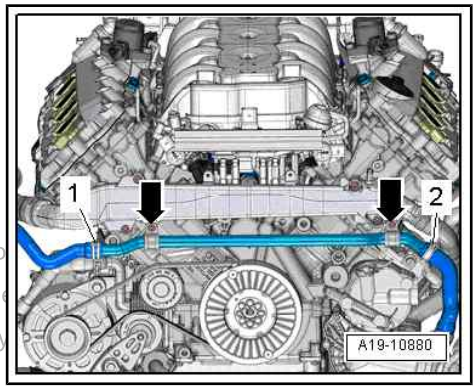
3.4 Removing and installing coolant pipes (front centre)

Special tools and workshop equipment required

- Hose clip pliers - VAS 6340-



Removing



– Remove radiator with radiator cowl ⇒ page 220 .
– Remove bolts -arrows-.
– Release hose clips -1- and -2- and disconnect coolant pipe (centre front) from coolant hoses.

Installing

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

- Tightening torque ⇒ "3.1 Exploded view - coolant pipes", page 213

– Install radiator with radiator cowl ⇒ page 220 .

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4 Radiator/radiator fans

⇒ “4.1 Exploded view - radiator/radiator fans”, page 218

⇒ “4.3 Removing and installing radiator”, page 220

⇒ “4.2 Exploded view - radiator cowl and radiator fan”, page 220

⇒ “4.4 Removing and installing radiator fans”, page 226

⇒ “4.5 Removing and installing auxiliary radiator”, page 227

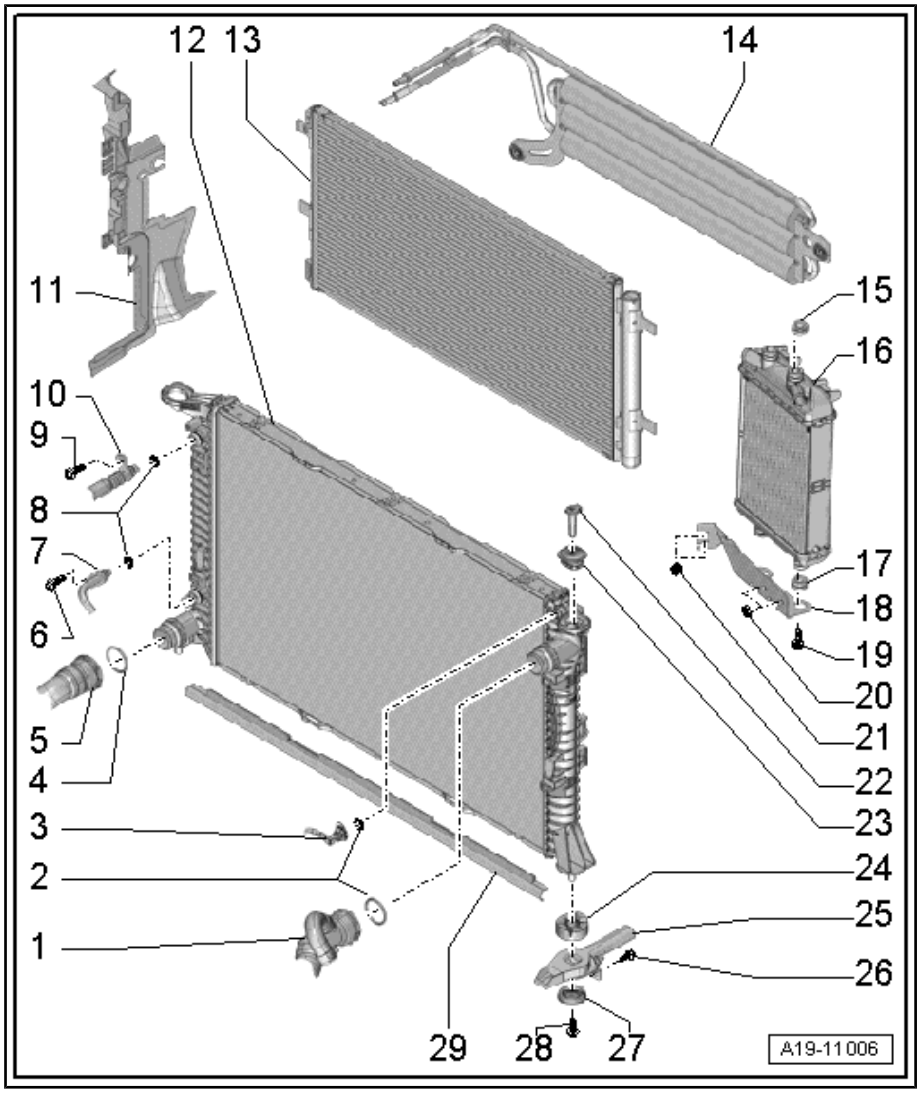
4.1 Exploded view - radiator/radiator fans

WARNING

Risk of injury as the radiator fans may start up automatically.

- ***Unplug electrical connectors before working in vicinity of radiator cowl.***

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1 - Coolant hose

- ❑ Lift retaining clip to detach
- ❑ Connecting ⇒ page 220

2 - O-rings

- ❑ Renew

3 - Coolant hose

- ❑ Lift retaining clip to detach
- ❑ Connecting ⇒ page 220

4 - O-ring

- ❑ Renew

5 - Coolant hose

- ❑ Lift retaining clip to detach
- ❑ Connecting ⇒ page 220

6 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34 ; ATF circuit

7 - ATF line

- ❑ Removing and installing ⇒ Rep. gr. 34 ; ATF circuit; Removing and installing ATF lines

8 - O-rings

- ❑ Renew

9 - Bolt

- ❑ Tightening torque ⇒ Rep. gr. 34 ; ATF circuit

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10 - ATF line

- ❑ Removing and installing ⇒ Rep. gr. 34 ; ATF circuit; Removing and installing ATF lines

11 - Air duct

12 - Radiator

- ❑ With integrated ATF cooler
- ❑ Removing and installing ⇒ page 220
- ❑ If renewed, change coolant in entire system

13 - Condenser

- ❑ Removing and installing ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser

14 - Hydraulic fluid cooler

- ❑ For vehicles with hydraulic power steering
- ❑ Removing and installing ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing hydraulic fluid cooler

15 - Rubber bush

- ❑ For auxiliary radiator

16 - Auxiliary radiator

- ❑ Right-side
- ❑ Removing and installing ⇒ page 227
- ❑ If renewed, change coolant in entire system

17 - Rubber bush

- ❑ For auxiliary radiator

18 - Bracket

- ❑ For auxiliary radiator

19 - Bolt

- ❑ 3.5 Nm

20 - Nut

- ❑ 8 Nm

21 - Nut

- ❑ 8 Nm

22 - Retaining pin

- ❑ Use screwdriver to release and pull off

23 - Rubber bush

- ❑ For radiator

24 - Rubber bush

- ❑ For radiator

25 - Bracket

- ❑ For radiator

26 - Bolt

27 - Support

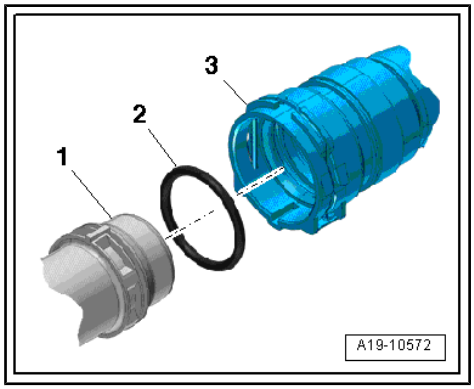
28 - Bolt

- ❑ 4.5 Nm

29 - Sealing strip

Connecting coolant hose with plug-in connector

- 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.



4.2 Exploded view - radiator cowl and radiator fan

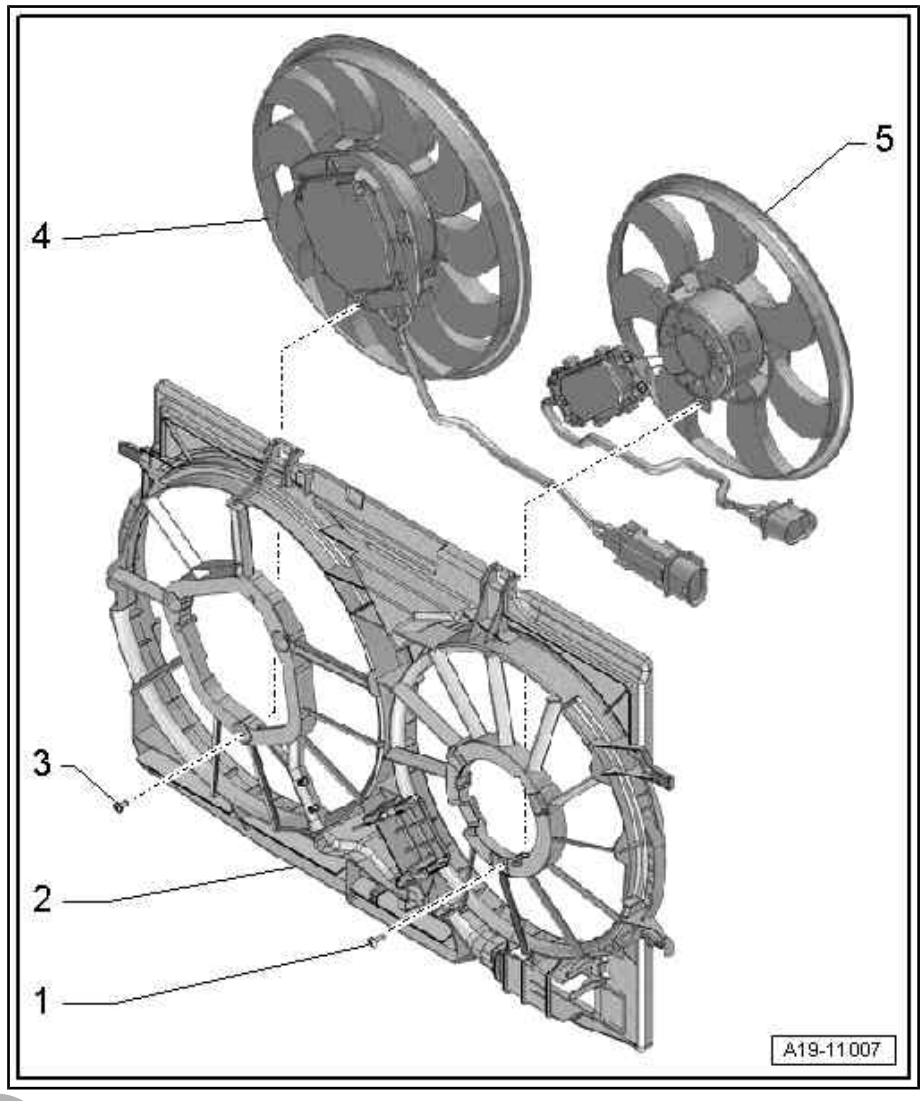
1 - Bolt
- ❑ 5 Nm

2 - Radiator cowl
- ❑ Removing and installing ⇒ “4.3 Removing and installing radiator”, page 220

3 - Bolt
- ❑ 5 Nm

4 - Radiator fan - V7-
- ❑ With radiator fan control unit - J293-
- ❑ Removing and installing ⇒ page 226

5 - Radiator fan 2 - V177-
- ❑ With radiator fan control unit 2 - J671-
- ❑ Removing and installing ⇒ page 226

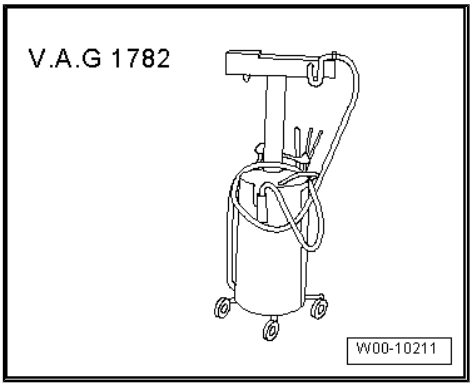


4.3 Removing and installing radiator

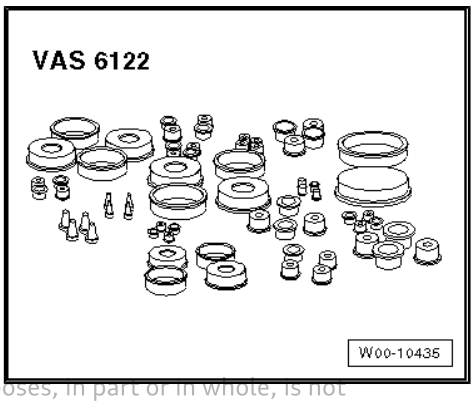
Special tools and workshop equipment required

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

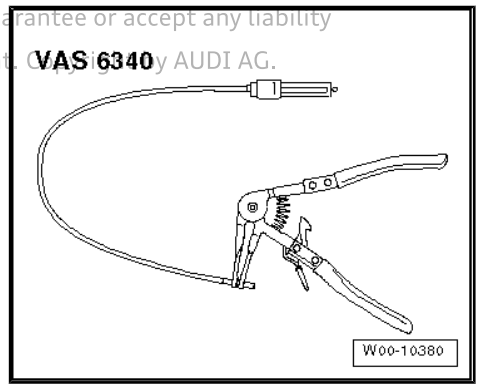


- Engine bung set - VAS 6122-



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- Hose clip pliers - VAS 6340-



Removing

Note

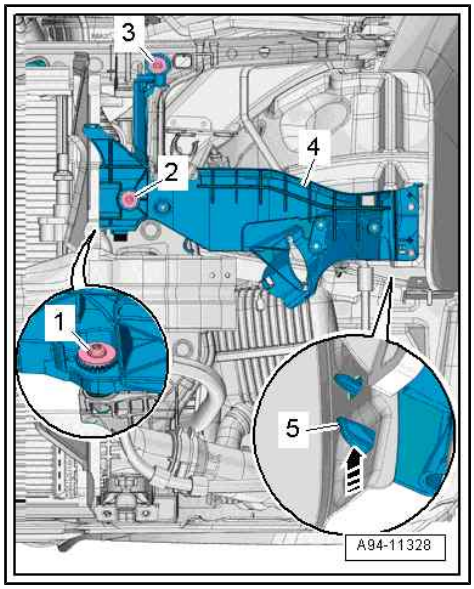
If there are slight impressions on the fins, refer to ⇒ page 11 .

– Drain coolant ⇒ page 196 .

– Remove impact absorber (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing impact absorber .

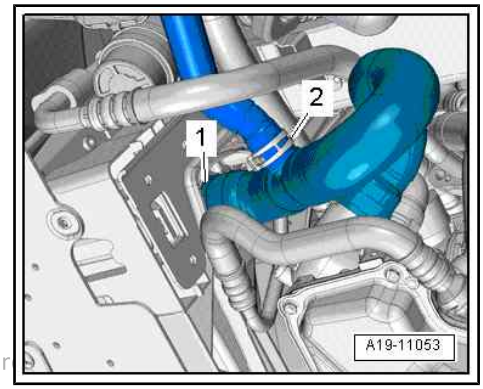
Vehicles from model year 2012 onwards:

– Remove bracket for mounting for headlight housing (right-side) ⇒ Electrical system; Rep. gr. 94 ; Headlights; Exploded view - headlights .



All vehicles (continued):

– Pull out retaining clip -1- and disconnect coolant hose from radiator.



Note

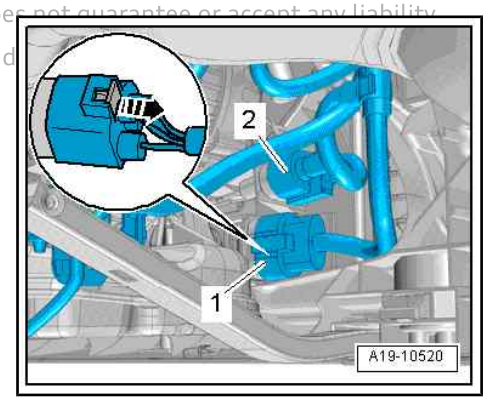
Disregard -item 2-.

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WARNING

Risk of injury as the radiator fans may start up automatically.

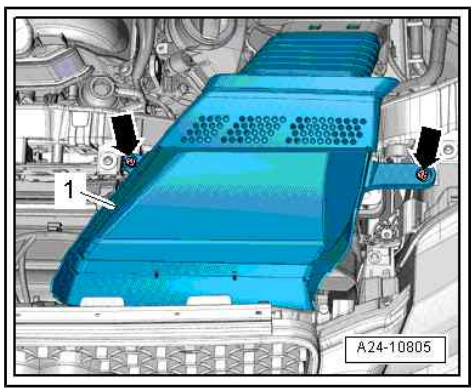
- ***Unplug electrical connectors before working in vicinity of radiator cowl.***



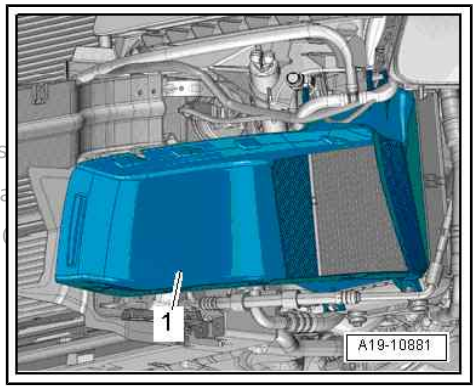
– Unplug electrical connectors -1- and -2- for radiator fan (push retainer to the rear -arrow- and press down release catch).

– Move electrical wiring harness clear.

– Remove bolts -arrows- and detach air duct -1- from air cleaner housing (left and right).

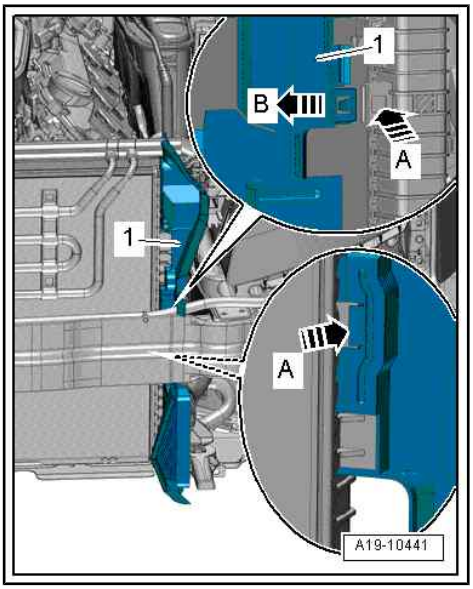


– Unclip air duct -1- on both sides.

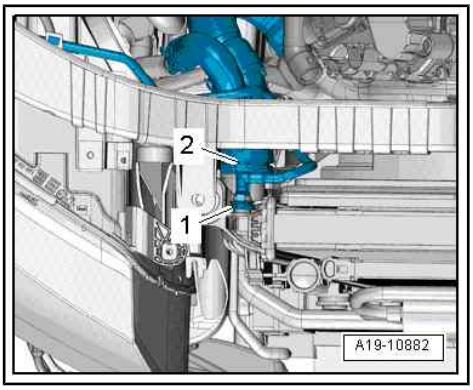


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– Release catches -arrows A- and detach air duct -1- on left and right -arrow B-.



– Lift retaining clips -1- and -2- and disconnect coolant hoses (top right) from radiator.



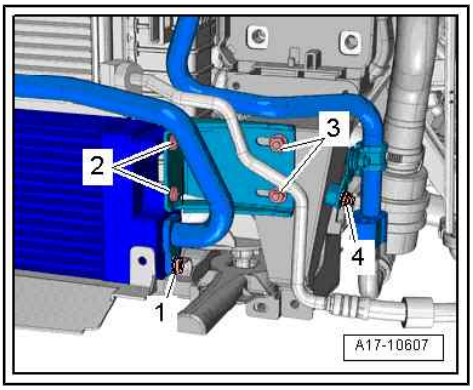
Vehicles without adaptive cruise control (ACC):

– Remove nuts -3- for bracket for engine oil cooler (front).

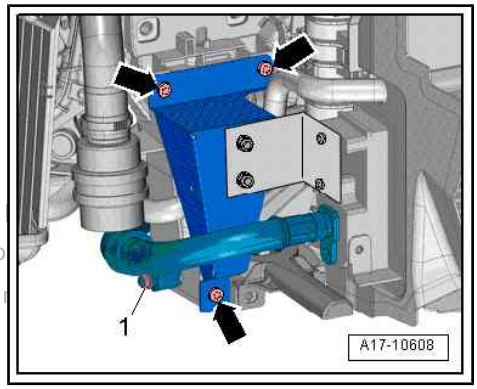
– Remove nut -4- at retaining clip for refrigerant line.

Note

Disregard items -1 and 2-.



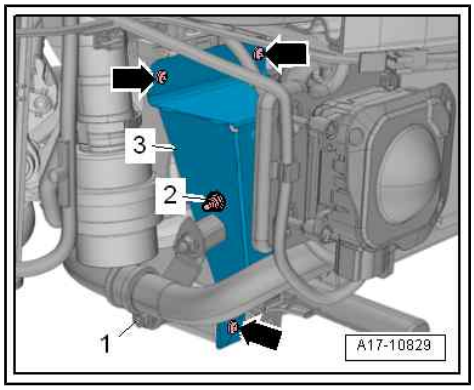
– Remove nut -1- at retaining clip for pipe/hose assembly.
– Remove bolts -arrows- and tie engine oil cooler (front) to the right.



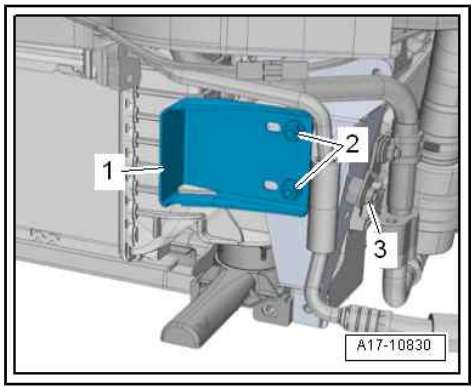
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Vehicles with adaptive cruise control (ACC):

– Remove engine oil cooler (front) ⇒ page 181 .
– Remove nuts -1, 2-.
– Unscrew bolts -arrows- and detach bracket -3- for engine oil cooler (front).



– Unscrew nuts -2- and detach bracket -1- for engine oil cooler (front).
– Remove nut -3- at retaining clip for refrigerant line.

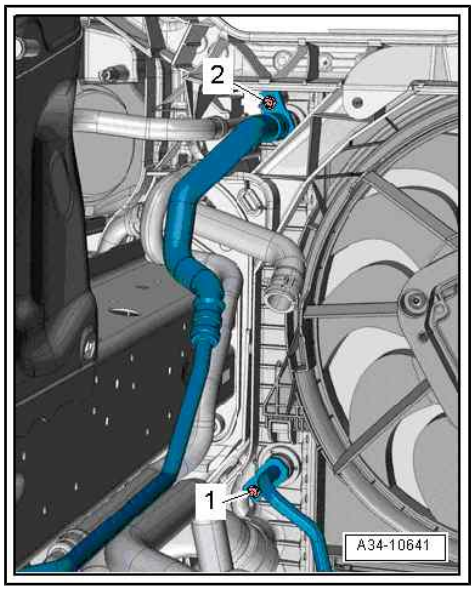


All vehicles (continued):

– Position used oil collection and extraction unit - V.A.G 1782- below connection point.
– Remove bolts -1, 2-, and detach ATF lines.
– Seal off open pipes/lines and connections with clean plugs from engine bung set - VAS 6122- .

Note

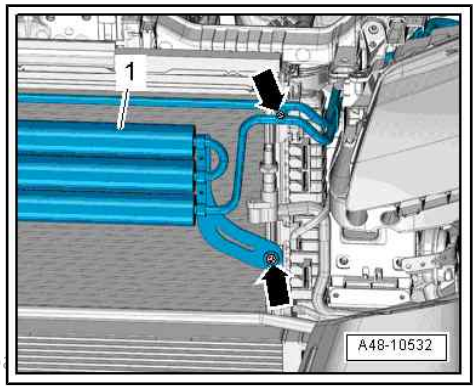
For illustration purposes, the installation position is shown with the engine removed.



Vehicles with hydraulic power steering:

– Remove bolts -arrows-.

– Detach hydraulic fluid cooler -1- to the left and swivel upwards.

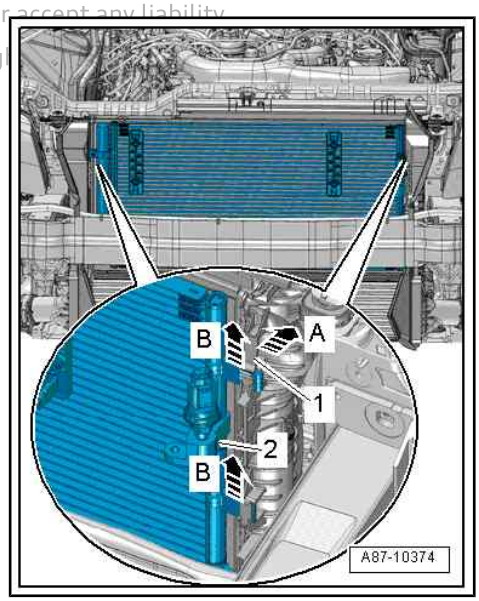


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Condenser with angled connection for refrigerant line:

– Have a 2nd mechanic release retaining clips -1- in direction of -arrow A- and lift condenser -2- out of mounts on radiator -arrows B-.

> **Caution**
>
> ***Risk of damage to condenser, refrigerant lines and refrigerant hoses.***
>
> ♦ ***Do NOT stretch, kink or bend refrigerant lines and hoses.***



– Pivot condenser forwards with pipes/hoses attached.

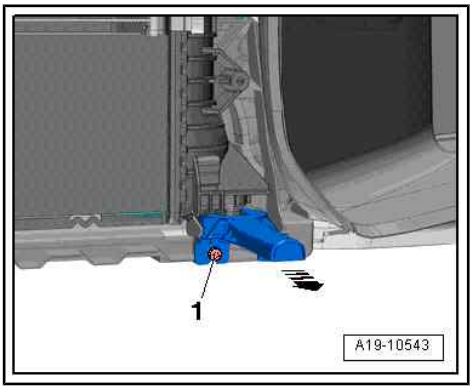
Condenser with straight connection for refrigerant line:

– Remove condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .

All vehicles (continued):

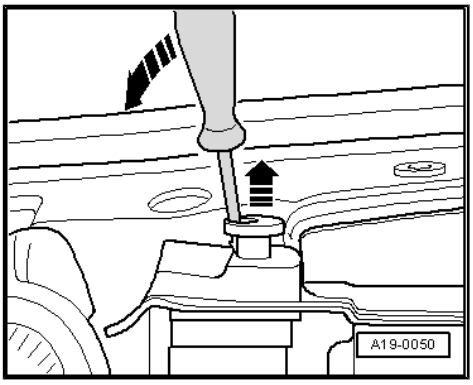
– Remove bolts -1- on both sides and detach radiator bracket with radiator from lock carrier -arrow-.

– Slightly lower radiator.

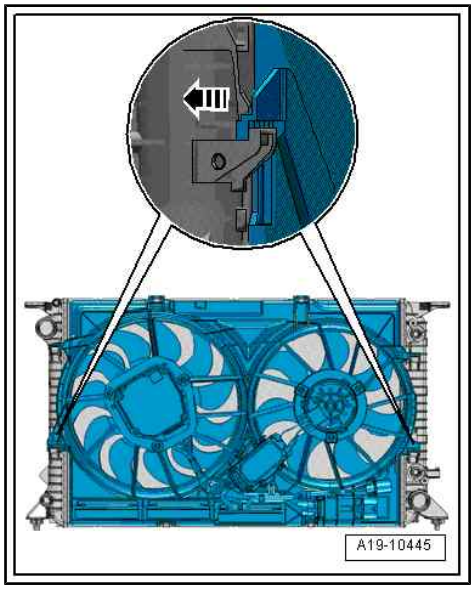


– Release retaining pins for radiator on both sides and pull out upwards -arrows-.

– Detach radiator.



– Press locking tabs on left and right sides of radiator cowl together -arrow- and lift radiator cowl off radiator.



Installing

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

- Tightening torques
  ⇒ “4.1 Exploded view - radiator/radiator fans”, page 218

Note

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

– Install condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Removing and installing condenser .
– Install bracket for mounting for headlight housing ⇒ Electrical system; Rep. gr. 94 ; Headlights; Exploded view - headlights .
– Install hydraulic fluid cooler ⇒ Running gear, axles, steering; Rep. gr. 48 ; Hydraulic power steering; Removing and installing hydraulic fluid cooler .
– Install ATF lines ⇒ Rep. gr. 34 ; ATF circuit; Removing and installing ATF lines .
– Install engine oil cooler (front) ⇒ page 178 .
– Install impact bar (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing impact bar .
– Attach air duct to intermediate flange for air cleaner housing ⇒ page 245 .

Note

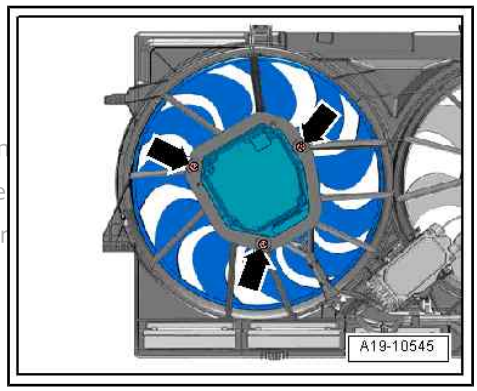
The coolant in the entire system must be changed if the radiator is renewed.

– Connect coolant hoses with plug-in connector ⇒ page 220 .
– Fill up with coolant ⇒ page 198 .
– Check ATF level ⇒ Rep. gr. 34 ; ATF; Checking ATF level .

4.4 Removing and installing radiator fans

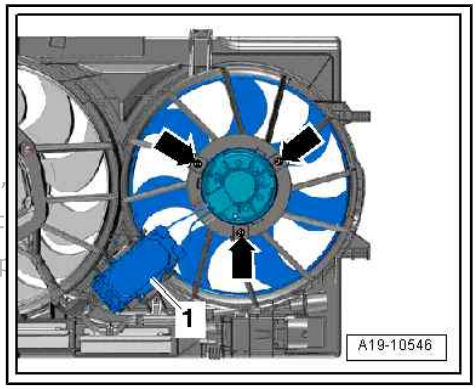
Removing

– Remove radiator cowl
  ⇒ “4.3 Removing and installing radiator”, page 220 .
– Remove bolts -arrows- on radiator fan - V7- (left-side).
– Move electrical wiring harness clear and detach radiator fan (left-side).



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– Remove bolts -arrows- on radiator fan 2 - V177- (right-side).
– Move electrical wiring harness clear.
– Unclip radiator fan control unit -1- from radiator cowl and detach radiator fan with control unit.



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Installing

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

- Tightening torques
  ⇒ “4.2 Exploded view - radiator cowl and radiator fan”, page 220

Note

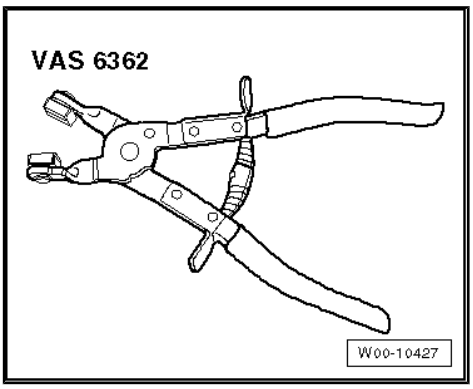
Fit all cable ties in the original positions when installing.

– Install radiator cowl
  ⇒ “4.3 Removing and installing radiator”, page 220 .

4.5 Removing and installing auxiliary radiator

Special tools and workshop equipment required

♦ Hose clip pliers - VAS 6362-

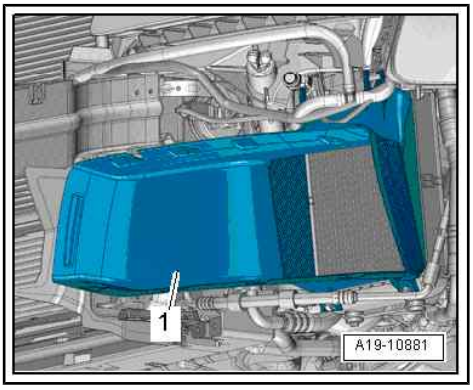


Removing

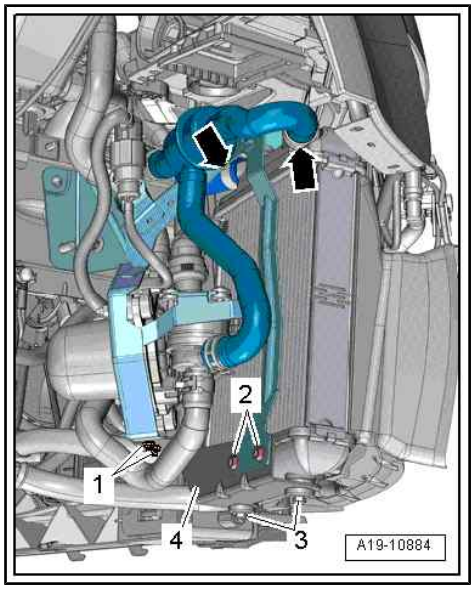
Note

The following instructions describe the removal and installation of the auxiliary radiator (right-side) on the Audi RS 5 Coupé as an example.

– Drain coolant ⇒ page 196 .
– Remove bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .
– Unclip corresponding air duct -1-.



– Loosen nuts -1-.
– Remove nuts -2-.
– Unscrew bolts -3- and remove bracket -4-.
– Lower auxiliary radiator slightly, release hose clips -arrows- and detach coolant hoses.



Installing

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

- Tightening torques
  ⇒ “4.1 Exploded view - radiator/radiator fans”, page 218

– Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .

Note

- *The coolant in the entire system must be changed if the radiator is renewed.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*

– Fill up with coolant ⇒ page 198 .

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24 – Mixture preparation - injection

1 Injection system

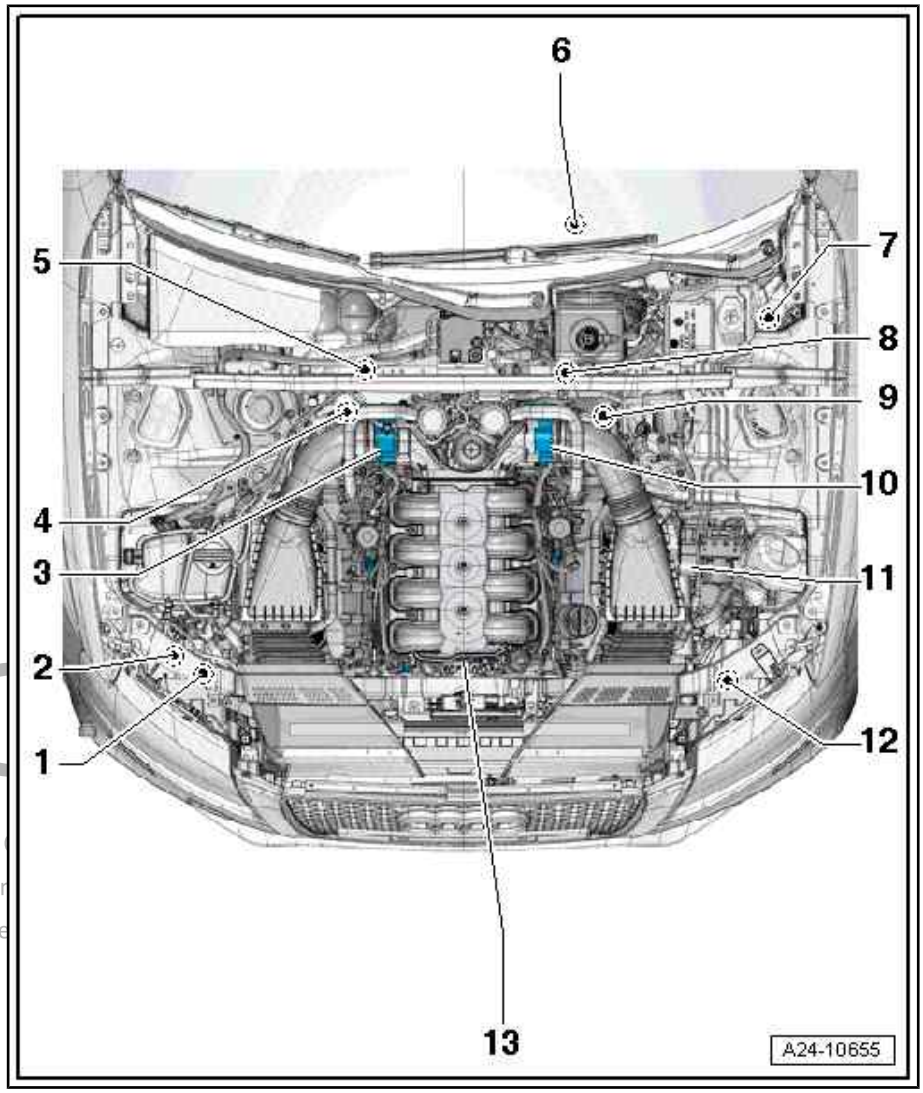
⇒ "1.1 Overview of fitting locations - injection system", page 229

⇒ "1.2 Checking fuel system for leaks", page 235

⇒ "1.3 Reducing pressure in high-pressure section of injection system", page 235

1.1 Overview of fitting locations - injection system

Part 1



1 - Secondary air pump motor - V101-

- ❑ Fitting location ⇒ page 234
- ❑ Removing and installing ⇒ page 294

2 - Continued coolant circulation pump - V51-

- ❑ Fitting location ⇒ page 234
- ❑ Removing and installing ⇒ page 206

3 - Throttle valve module - J338-

- ❑ Including throttle valve drive for electric throttle - G186- , throttle valve drive angle sender 1 for electric throttle - G187- and throttle valve drive angle sender 2 for electric throttle - G188-
- ❑ Removing and installing ⇒ page 259
- ❑ After renewing, perform `Adaption` in `Guided Functions` ⇒ Vehicle diagnostic tester

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4 - Lambda probe - G39-

- ❑ (Before catalytic converter) with Lambda probe heater - Z19-
- ❑ Exploded view ⇒ page 278

5 - Lambda probe after catalytic converter - G130-

- ❑ With Lambda probe 1 heater after catalytic converter - Z29-
- ❑ Exploded view ⇒ page 278

6 - Accelerator pedal module

- ❑ With accelerator position sender - G79- / accelerator position sender 2 - G185-
- ❑ Fitting location ⇒ page 234

- ❑ Removing and installing ⇒ Fuel supply system; Rep. gr. 20 ; Accelerator mechanism

7 - Engine control unit - J623-

- ❑ Fitting location ⇒ page 233
- ❑ Removing and installing ⇒ page 266

8 - Lambda probe 2 after catalytic converter - G131-

- ❑ With Lambda probe 2 heater after catalytic converter - Z30-
- ❑ Exploded view ⇒ page 278

9 - Lambda probe 2 - G108-

- ❑ (Before catalytic converter) with Lambda probe heater 2 - Z28-
- ❑ Exploded view ⇒ page 278

10 - Throttle valve module 2 - J544-

- ❑ With throttle valve drive 2 - G296- , angle sender 1 for throttle valve drive 2 - G297- and angle sender 2 for throttle valve drive 2 - G298-
- ❑ Removing and installing ⇒ page 259
- ❑ After renewing, perform `Adaption` in `Guided Functions` ⇒ Vehicle diagnostic tester

11 - Vacuum pump for brakes - V192-

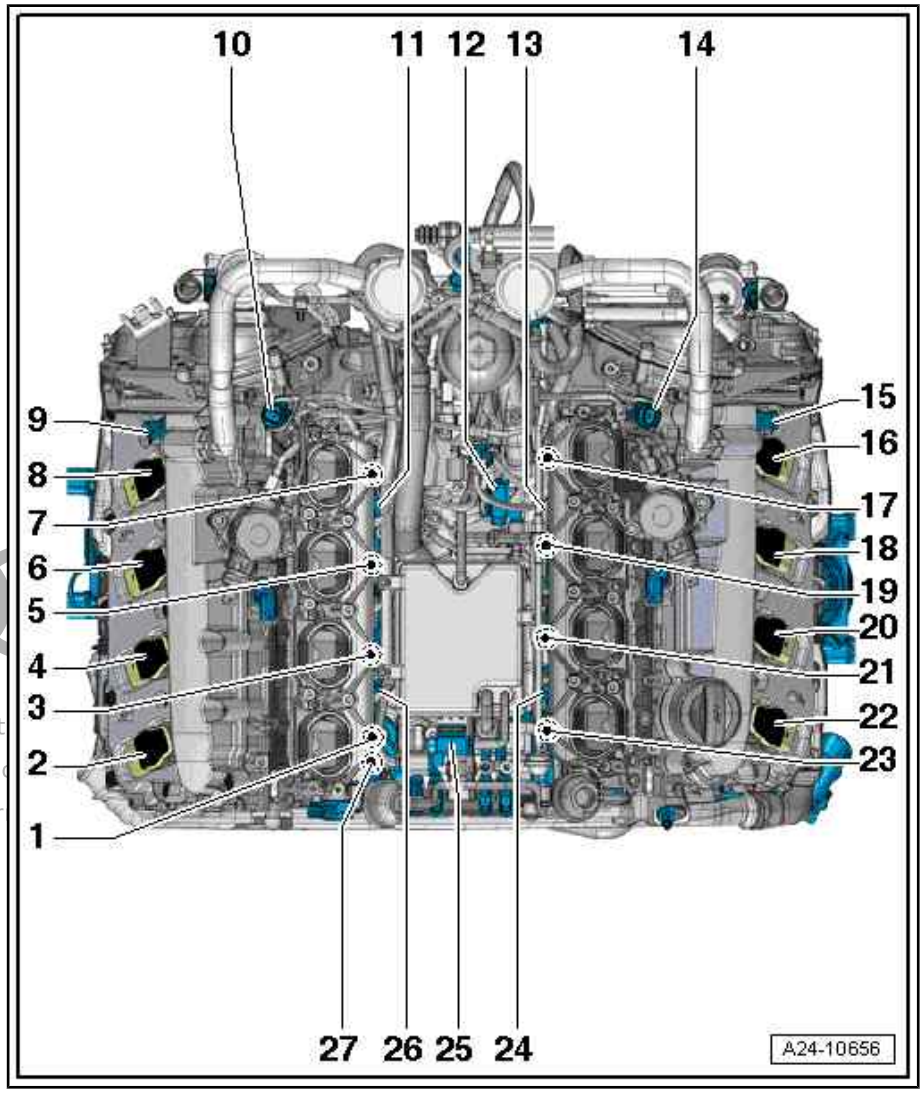
12 - Secondary air pump motor 2 - V189-

- ❑ Fitting location ⇒ page 234
- ❑ Removing and installing ⇒ page 296

13 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

- ❑ Fitting location ⇒ page 235

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1 - Injector, cylinder 1 - N30-
- ❑ Exploded view ⇒ page 251

2 - Ignition coil 1 with output stage - N70-
- ❑ Removing and installing ⇒ page 302

3 - Injector, cylinder 2 - N31-

4 - Ignition coil 2 with output stage - N127-

5 - Injector, cylinder 3 - N32-

6 - Ignition coil 3 with output stage - N291-

7 - Injector, cylinder 4 - N33-

8 - Ignition coil 4 with output stage - N292-

9 - Exhaust camshaft control valve 1 - N318-

10 - Camshaft control valve 1 - N205-

11 - Knock sensor 2 - G66-
- ❑ Removing and installing ⇒ page 304

12 - Secondary air inlet valve - N112-

13 - Knock sensor 4 - G199-
- ❑ Removing and installing ⇒ page 304

14 - Camshaft control valve 2 - N208-

15 - Exhaust camshaft control valve 2 - N319-

16 - Ignition coil 8 with output stage - N326-

17 - Injector, cylinder 8 - N86-

18 - Ignition coil 7 with output stage - N325-

19 - Injector, cylinder 7 - N85-

20 - Ignition coil 6 with output stage - N324-

21 - Injector, cylinder 6 - N84-

22 - Ignition coil 5 with output stage - N323-

23 - Injector, cylinder 5 - N83-

24 - Knock sensor 3 - G198-
- ❑ Removing and installing ⇒ page 304

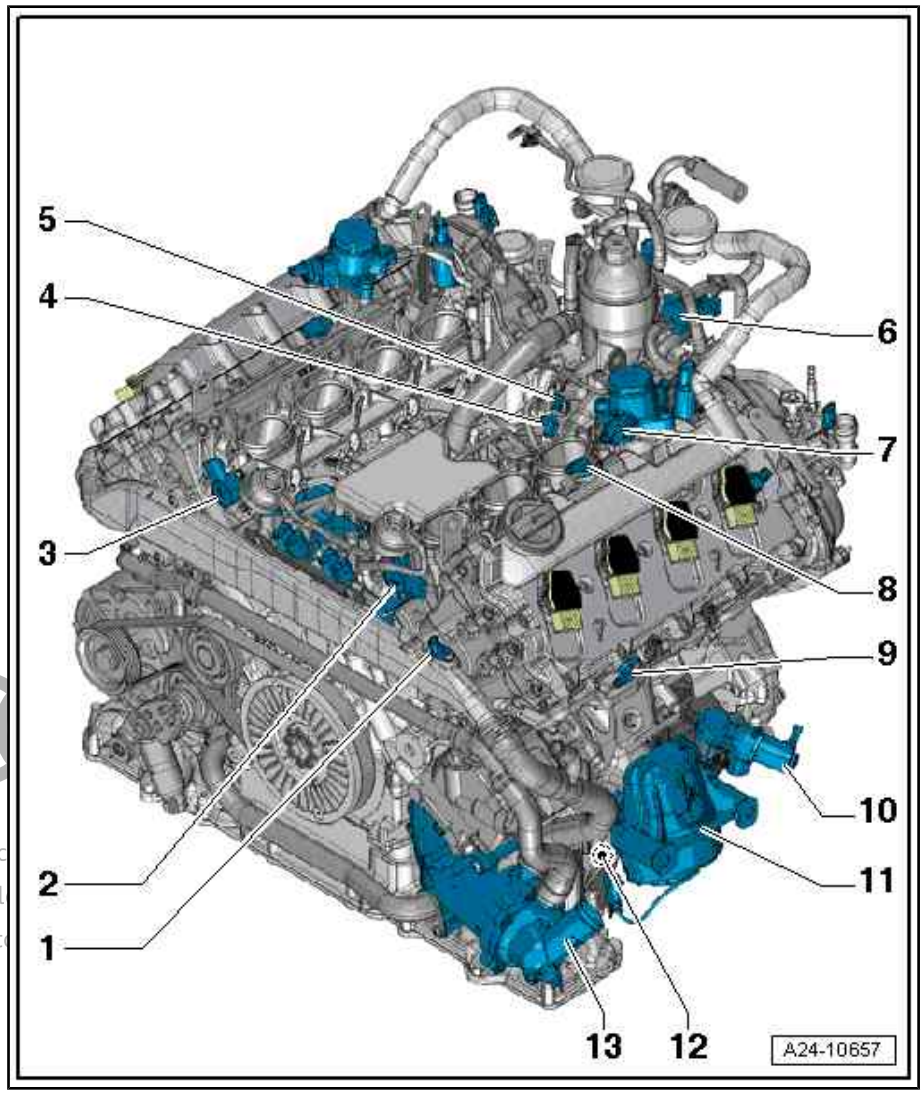
25 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-
- ❑ Fitting location ⇒ page 235

26 - Knock sensor 1 - G61-
- ❑ Removing and installing ⇒ page 7 , ⇒ page 304

27 - Fuel pressure sender - G247-
- ❑ Fitting location ⇒ page 253

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❑ Removing and installing ⇒ page 260



1 - Coolant temperature sender - G62-

❑ Removing and installing ⇒ page 210

2 - Intake manifold flap potentiometer 2 - G512-

3 - Intake manifold flap potentiometer - G336-

4 - Oil pressure switch - F22-

❑ Removing and installing ⇒ page 186

5 - Oil temperature sender - G8-

❑ Removing and installing ⇒ page 185

6 - Activated charcoal filter solenoid valve 1 - N80-

7 - Fuel metering valve 2 - N402-

8 - Hall sender 2 - G163-

❑ Removing and installing ⇒ page 305

9 - Hall sender 4 - G301-

❑ Removing and installing ⇒ page 305

10 - Servotronic solenoid valve - N119-

❑ Only on vehicles with hydraulic power steering

11 - Left electrohydraulic engine mounting solenoid valve - N144-

❑ On engine mounting (left-side)

12 - Valve for oil pressure control - N428-

❑ Fitting location ⇒ page 235

❑ Removing and installing ⇒ page 188

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

❑ Removing and installing ⇒ page 211

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

- ❑ Removing and installing

2 - Fuel pressure sender for low pressure - G410-

3 - Sender 2 for secondary air pressure - G610-

- ❑ Removing and installing ⇒ page 300

4 - Fuel metering valve - N290-

- ❑ At high-pressure pump (right-side)

5 - Hall sender - G40-

- ❑ Removing and installing ⇒ page 305

6 - Hall sender 3 - G300-

- ❑ Removing and installing ⇒ page 305

7 - Right electrohydraulic engine mounting solenoid valve - N145-

- ❑ On engine mounting (right-side)

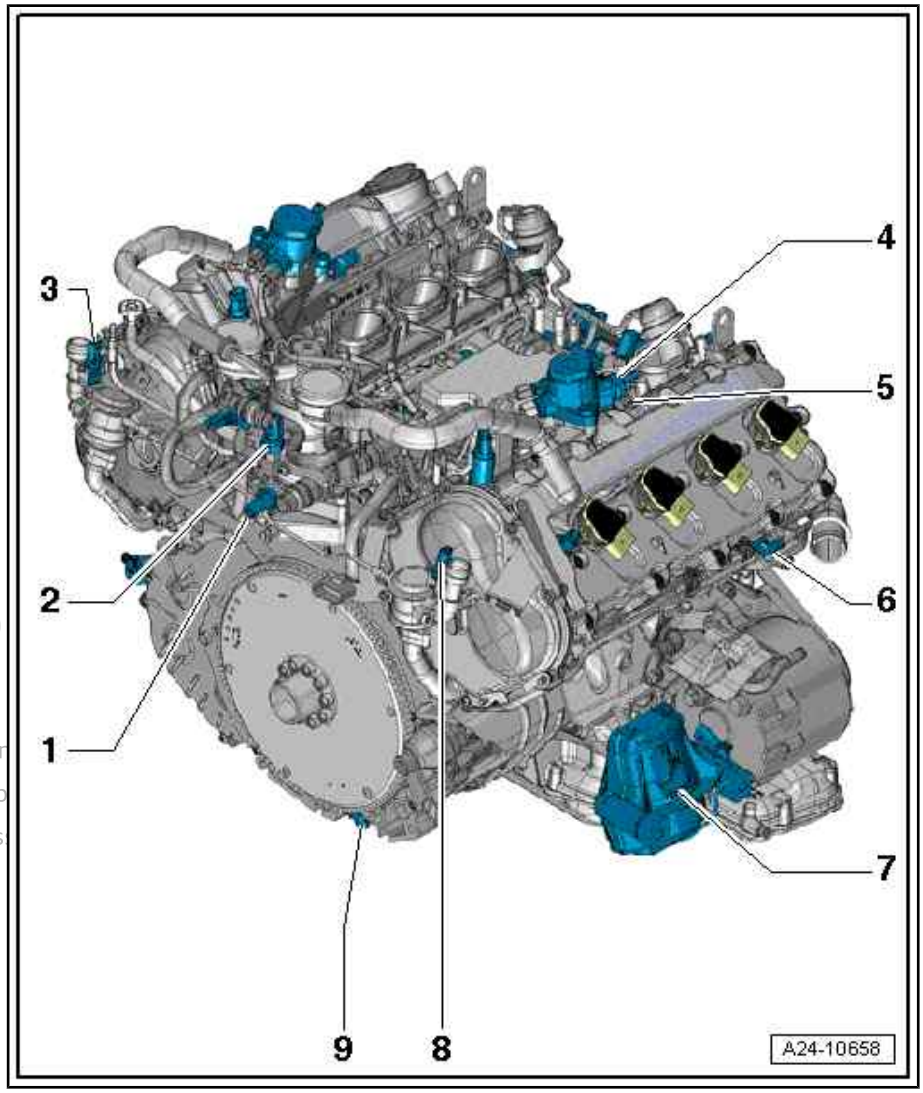
8 - Sender 1 for secondary air pressure - G609-

- ❑ Removing and installing ⇒ page 300

9 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 306

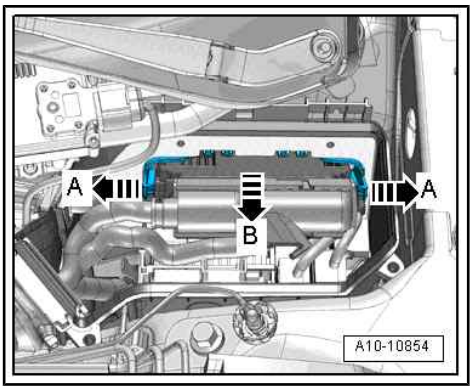
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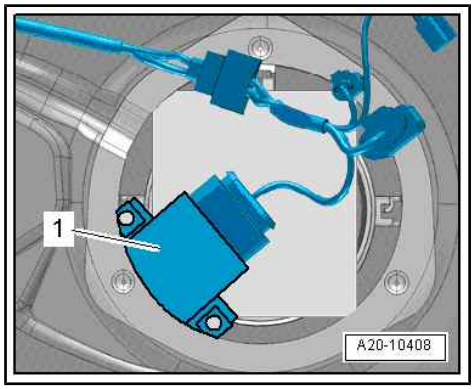
Fitting location of engine control unit - J623-

♦ In electronics box in engine compartment (left-side)

Removing and installing ⇒ page 266



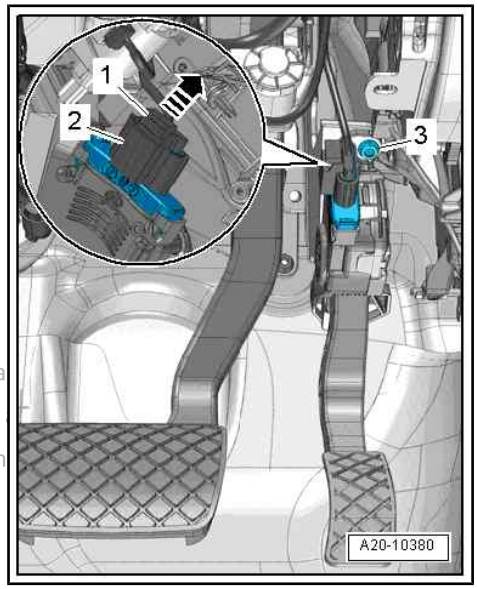
Fitting location of fuel pump control unit - J538-



- Beneath rear seat bench

Removing and installing ⇒ Fuel supply system; Rep. gr. 20 ; Fuel pump; Removing and installing fuel pump control unit - J538-

Fitting location of accelerator pedal module with accelerator position sender - G79- / accelerator position sender 2 - G185-

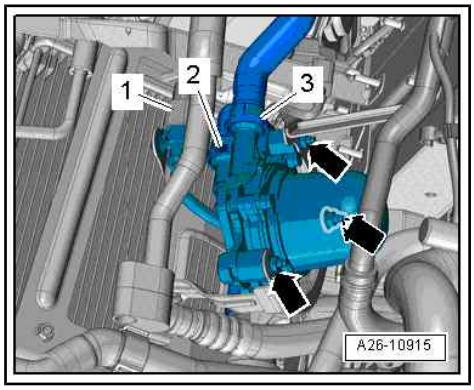


- On pedal bracket

Removing and installing ⇒ Fuel supply system; Rep. gr. 20 ; Accelerator mechanism; Removing and installing accelerator pedal module with accelerator position sender -G79- / -G185-

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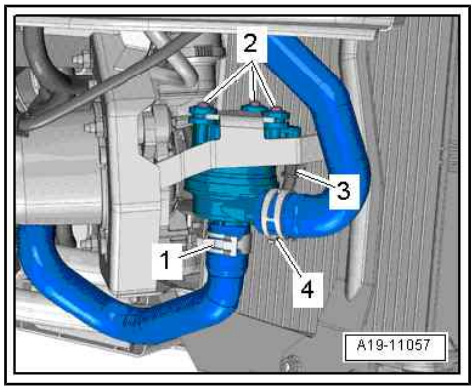
Fitting location of secondary air pump motor -V101- / -V189-



- Behind wheel housing liner (front)
- Illustration shows secondary air pump motor 2 - V189- (left-side).
- Fitting location on right side: symmetrically reversed

Removing and installing ⇒ page 296

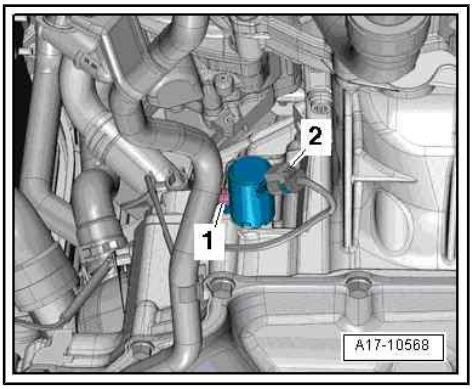
Fitting location of continued coolant circulation pump - V51-



- Behind wheel housing liner (front right)

Removing and installing ⇒ page 206

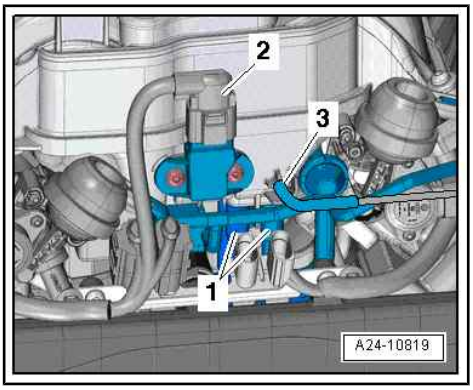
Fitting location of valve for oil pressure control - N428-



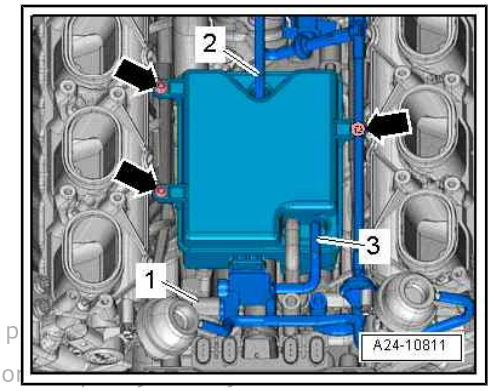
- On left of sump (top section)

Removing and installing ⇒ page 188

Intake air temperature sender - G42- / intake manifold pressure sender - G71- -2-



Intake manifold flap valve - N316- -1-



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1.2 Checking fuel system for leaks

– Allow engine to run for several minutes at moderate rpm.
– Switch off ignition.
– 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 inspect high-pressure section of fuel system again for leaks.

1.3 Reducing pressure in high-pressure section of injection system

Special tools and workshop equipment required

- Vehicle diagnostic tester

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WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ***The injection system consists of a high-pressure section (maximum approx. 140 bar) and a low-pressure section (4 ... 7 bar).***
- ***Prior to opening the high-pressure section (e.g. when removing the high-pressure pump, fuel rail, injectors, fuel pipes or fuel pressure sender - G247-), the pressure in the high-pressure section must be reduced to a specified level. The procedure is described below.***

Procedure

– Connect ⇒ Vehicle diagnostic tester, select function “Reducing fuel pressure in fuel rail” in “Guided Functions” and follow on-screen instructions.

• Fuel pressure will drop to a specified value.

– Switch off ignition.

The fuel rail is still filled with fuel, however it is no longer under high pressure.

WARNING

There is a risk of injury: avoid skin contact with fuel.

- ***Wear safety goggles and protective clothing when opening the fuel system.***
- ***Before opening the high-pressure section of the fuel system, place a clean cloth around the connection to catch escaping fuel.***

– The high-pressure system must be opened »immediately« after reducing the fuel pressure; wrap a clean cloth around the connection. Catch the escaping fuel.

Note

- *The pressure will increase again due to the effect of residual heat if the high-pressure system is not opened immediately.*
- *The ignition must not be switched on again from this point on as this would increase the pressure again.*

Additional steps required

– Erase event memory and generate readiness code in engine control unit in “Guided Functions” mode.

2 Vacuum system

⇒ "2.1 Exploded view - vacuum system", page 237

⇒ "2.2 Checking vacuum system", page 237

2.1 Exploded view - vacuum system

Note

Checking vacuum system ⇒ page 237

1 - Vacuum reservoir
- ❑ Beneath intake manifold

2 - Secondary air inlet valve - N112-

3 - Combination valve for secondary air system (right-side)

4 - Vacuum reservoir
- ❑ In plenum chamber

5 - Grommet
- ❑ As leadthrough for vacuum line

6 - Combination valve for secondary air system (left-side)

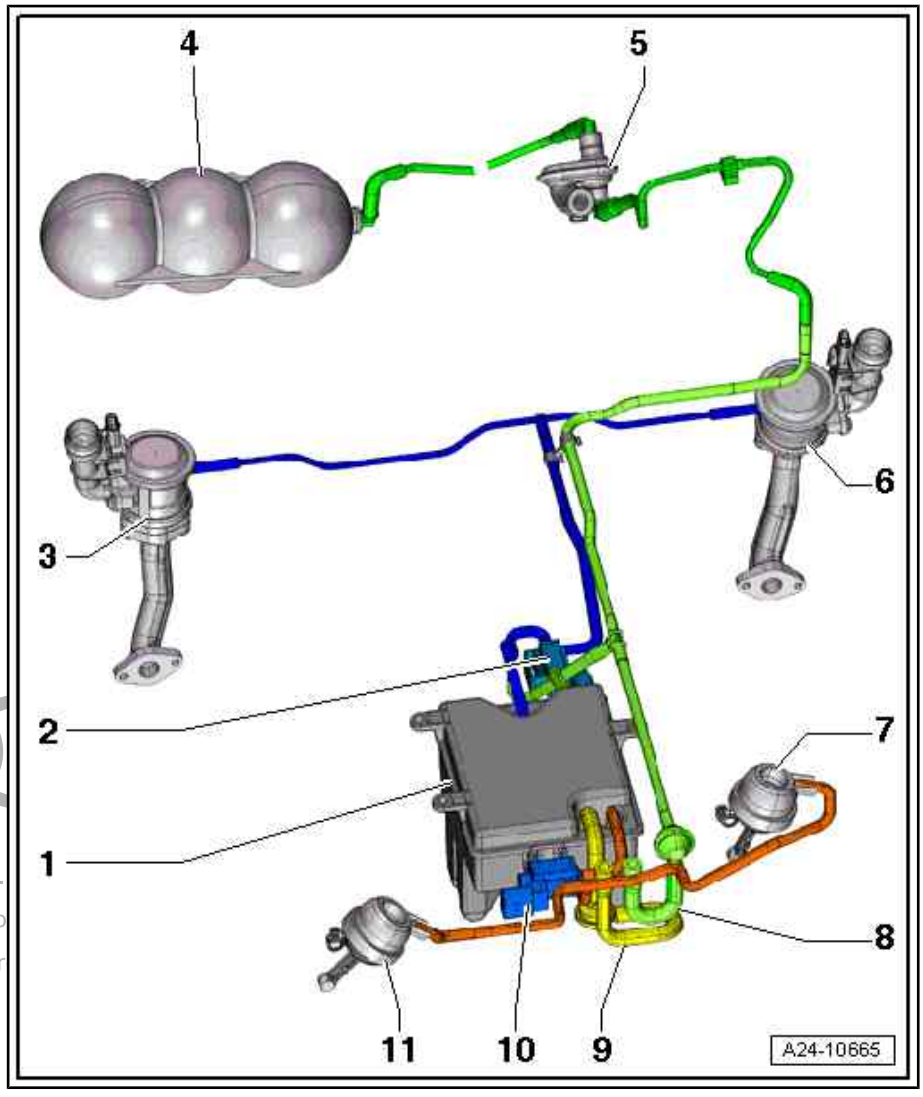
7 - Vacuum unit
- ❑ For intake manifold flaps (left-side)

8 - Vacuum line
- ❑ With non-return valves
- ❑ To vacuum reservoir in plenum chamber

9 - Vacuum line
- ❑ With non-return valves
- ❑ To vacuum reservoir

10 - Intake manifold flap valve - N316-
- ❑ Fitting location ⇒ page 235

11 - Vacuum unit
- ❑ For intake manifold flaps (right-side)

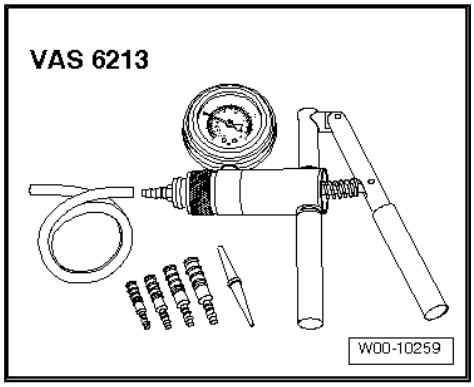


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2.2 Checking vacuum system

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 a fault 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.

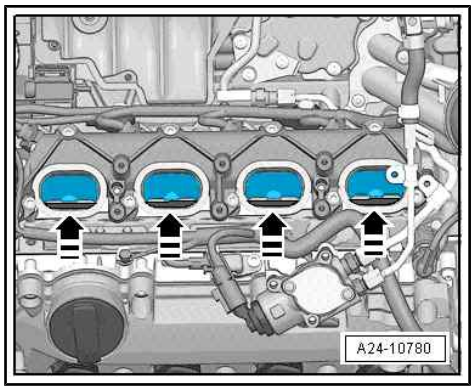
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Vacuum units

– After renewing vacuum units, check vacuum system for leaks.

– If there are still leaks, remove intake manifold (bottom section) and trace leaks.

– Also check that intake manifold flaps -arrows- function correctly and are not obstructed by guide plates in cylinder head.



3 Injectors

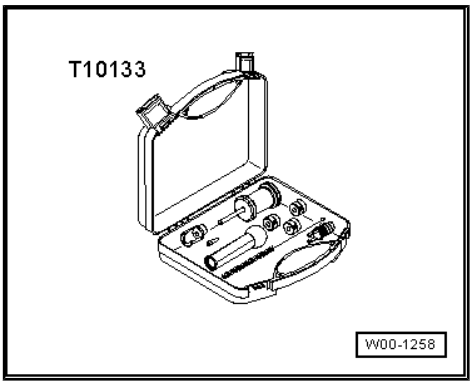
⇒ “3.1 Removing and installing injectors”, page 239

⇒ “3.2 Cleaning injectors”, page 243

3.1 Removing and installing injectors

Special tools and workshop equipment required

- Tool set for FSI engines - T10133-

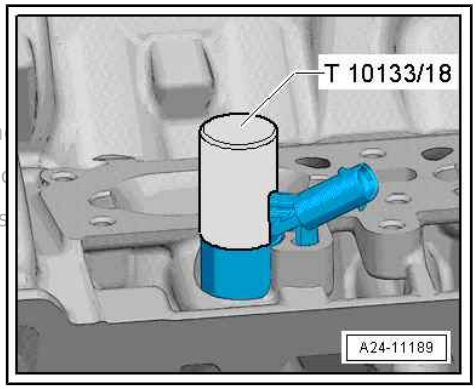


Removing

Note

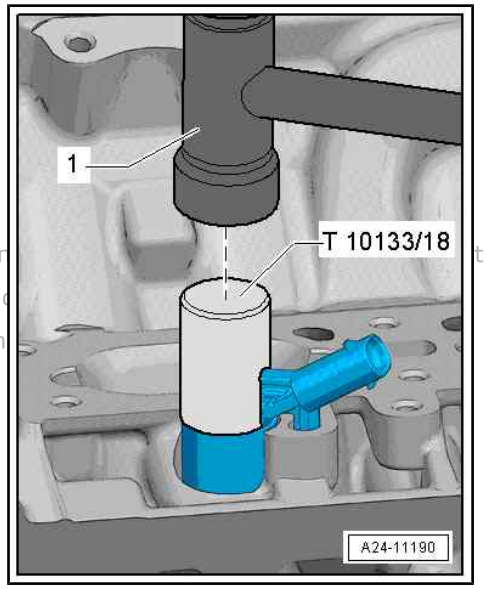
Injectors must only be installed when engine is cold.

– Remove corresponding intake manifold (bottom section) ⇒ page 255 .
– Cover open inlet ports with a clean cloth.
– Unplug electrical connector at injector that is to be removed.
– Slide stop sleeve -T10133/18- over injector.



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– Carefully knock against stop sleeve several times to loosen injector.

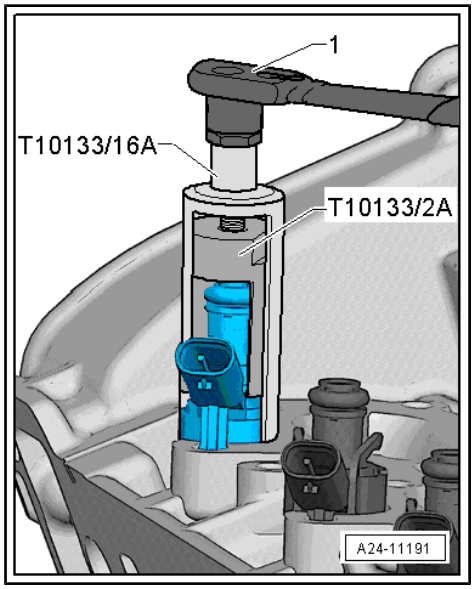


Note

- *Use a torque wrench to pull out injector.*
- *Adjust torque wrench to 5 Nm.*

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– Guide puller -T10133/2A- into groove on injector.
– Then apply puller T10133/16A .
– Pull out injector by turning bolt with torque wrench -1-.
– If injector does not come loose after limit torque of 5 Nm is reached, remove puller and repeat procedure using stop sleeve to loosen injector.



Note

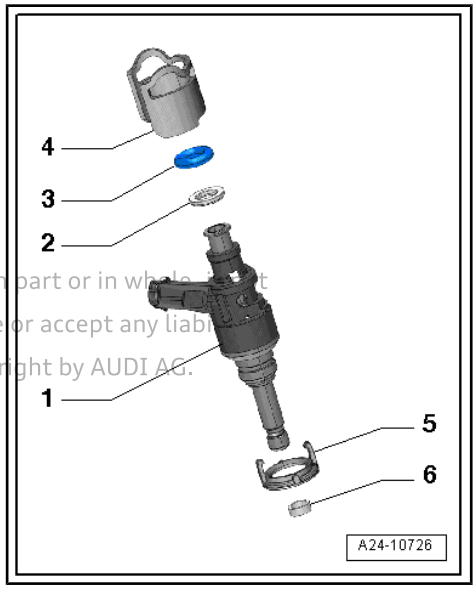
- *Observe correct torque to avoid irreparable damage to injector.*
- *The combustion chamber ring seal must always be renewed prior to reinstalling the injector* ⇒ , page 241 .

Dismantling injector

– Pull support ring -4-, O-ring -3- and spacer ring -2- off injector -1-.

– Unclip sealing element -5-.

– Carefully remove old combustion chamber ring seal -6-. To do so, cut open combustion chamber ring seal using knife or prise open with small screwdriver and then pull off.



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Note

The injector must be renewed if the groove is damaged.

Installing

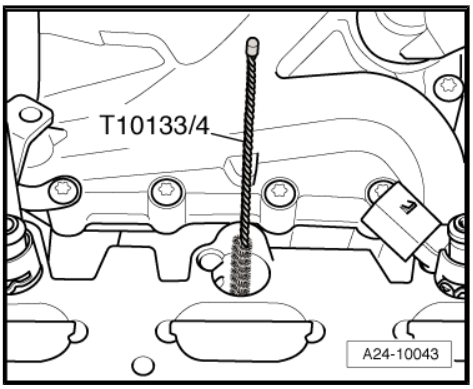
Renewing combustion chamber ring seal (teflon ring seal)

Note

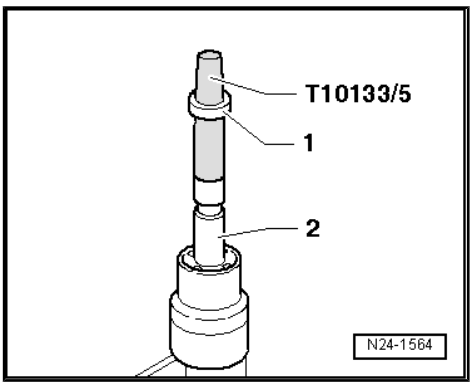
- *Renew combustion chamber ring seal and O-ring.*
- *Renew spacer ring if damaged.*

– Before installing injectors, thoroughly clean apertures for injectors in cylinder head using supplied nylon brush - T10133/4- .

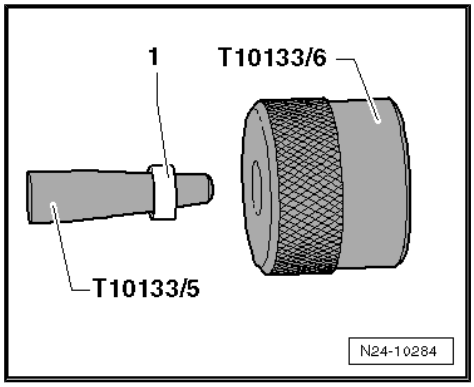
– Before new combustion chamber ring seal is fitted, any combustion residue must be removed from ring groove and injector stem using a clean cloth.



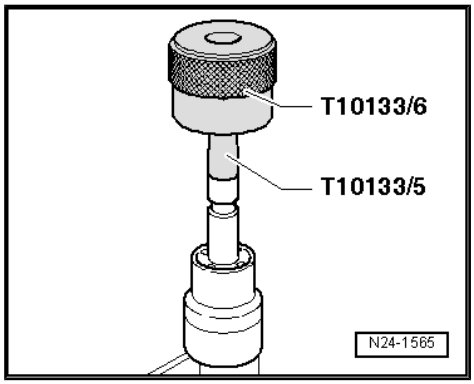
– Fit assembly cone -T10133/5- with new combustion chamber ring seal -1- onto injector -2-.



– Using assembly sleeve -T10133/6- , push combustion chamber ring seal onto assembly cone -T10133/5- as far as it will go.



– Turn round assembly sleeve -T10133/6- and slide combustion chamber ring seal into groove.

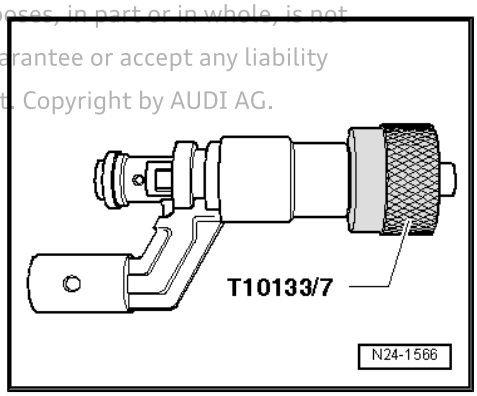


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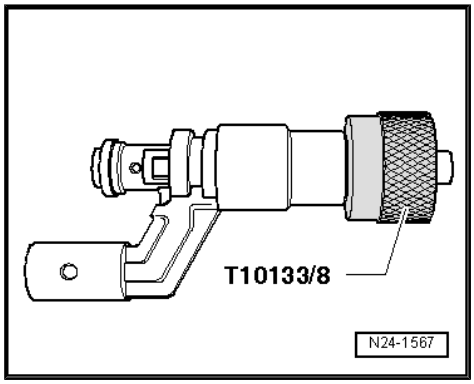
Note

The combustion chamber ring seal is widened when it is pushed onto the injector. After pushing it on, it therefore has to be compressed again. This is done in two stages, as described below.

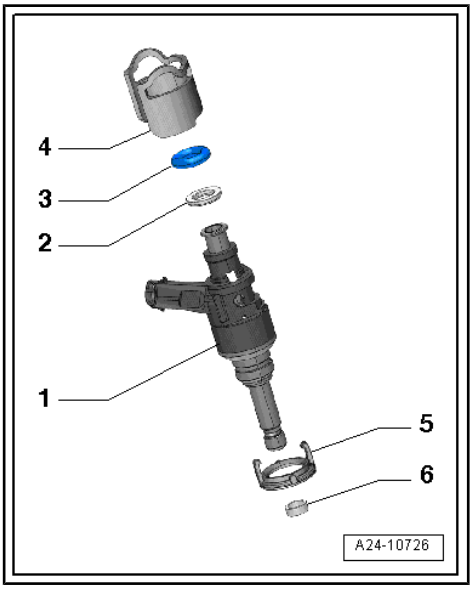
– Push calibration sleeve -T10133/7- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/7- off again by turning it in the opposite direction.



– Push calibration sleeve -T10133/8- onto injector as far as it will go and simultaneously turn it slightly (approx. 180°).
– Pull calibration sleeve -T10133/8- off again by turning it in the opposite direction.



– Before installing new injector -1-, lubricate new O-ring -3- lightly with clean engine oil.



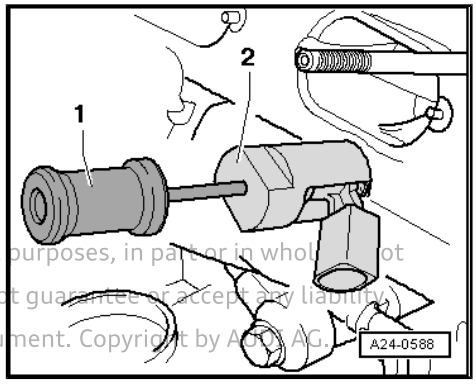
Note

- *The combustion chamber ring seal -6- must not be lubricated.*
- *Make sure that there is no cleaning fluid or oil in the holes in the cylinder head when installing the injectors.*

– Push injector by hand as far as it will go into aperture in cylinder head (do not use oil or grease). Ensure that the injector is properly seated in the cylinder head.

Note

- *It should be possible to insert injector easily. If necessary wait until the combustion chamber ring seal has contracted sufficiently.*
- *Note correct installation position and ensure that injectors are properly seated in cylinder head.*
- *If the injector cannot be pushed in by hand, use puller - T10133/2A- -2- with striker - T10133/3- to insert the injector.*



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- Electrical connector of injector must engage in recess in cylinder head.

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

– Install intake manifold (bottom section) ⇒ page 255 .

3.2 Cleaning injectors

Special tools and workshop equipment required

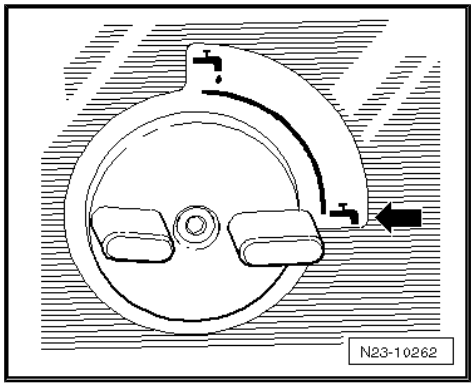
- Ultrasonic cleaning unit - VAS 6418-
- Mounting plate for injection modules - VAS 6418/1-
- Cleaning fluid - VAS 6418/2-

Cleaning

– Remove injectors
⇒ “3.1 Removing and installing injectors”, page 239 .

– Close drain tap -arrow- on ultrasonic cleaning unit - VAS 6418- (located on right side of housing).

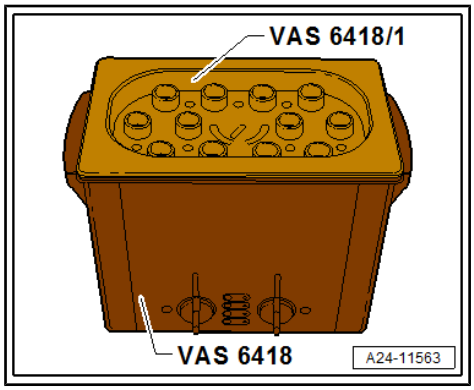
– Fill ultrasonic unit with 2,120 ml of water which has been allowed to settle for a few minutes and cleaning fluid - VAS 6418/2- .



Mixture ratio for cleaning fluid

- 2,100 ml of tap water which has been allowed to settle for a few minutes and 20 ml of cleaning fluid - VAS 6418/2-

– Place mounting plate for injection modules - VAS 6418/1- on top of cleaning unit.



WARNING

It is important to read the safety notes in the operating instructions before switching on the ultrasonic cleaning unit - VAS 6418- .

The ideal fluid level is approx. 1-4 mm above the base of the mounting plate. The ultrasonic cleaning unit - VAS 6418- can be damaged if the fluid level is too low.

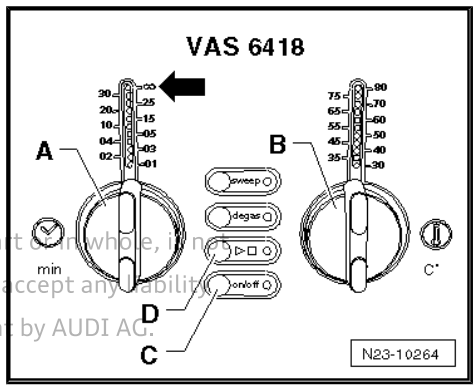
– Insert FSI injectors all the way into guides of mounting plate for injection modules - VAS 6418/1- .

– Switch on cleaning unit by pressing on/off button -C-.

– Select a cleaning time of 30 minutes with rotary control -A-.

– Set rotary control -B- to a temperature of 50°C.

– Press ▶ button -D- to start cleaning procedure.



Note

- *The temperature-controlled cleaning process is now started. While the fluid is being heated, the ultrasound is activated at intervals in order to circulate the cleaning solution. The ultrasound is activated continuously when the preselected temperature is reached.*
- *The actual cleaning process commences when the temperature reaches at least 50 °C and must last for at least 30 minutes.*

– After cleaning, renew combustion chamber ring seal (teflon ring seal) for each injector ⇒ , page 241 .

– Then re-installed injectors ⇒ “3.1 Removing and installing injectors”, page 239 .

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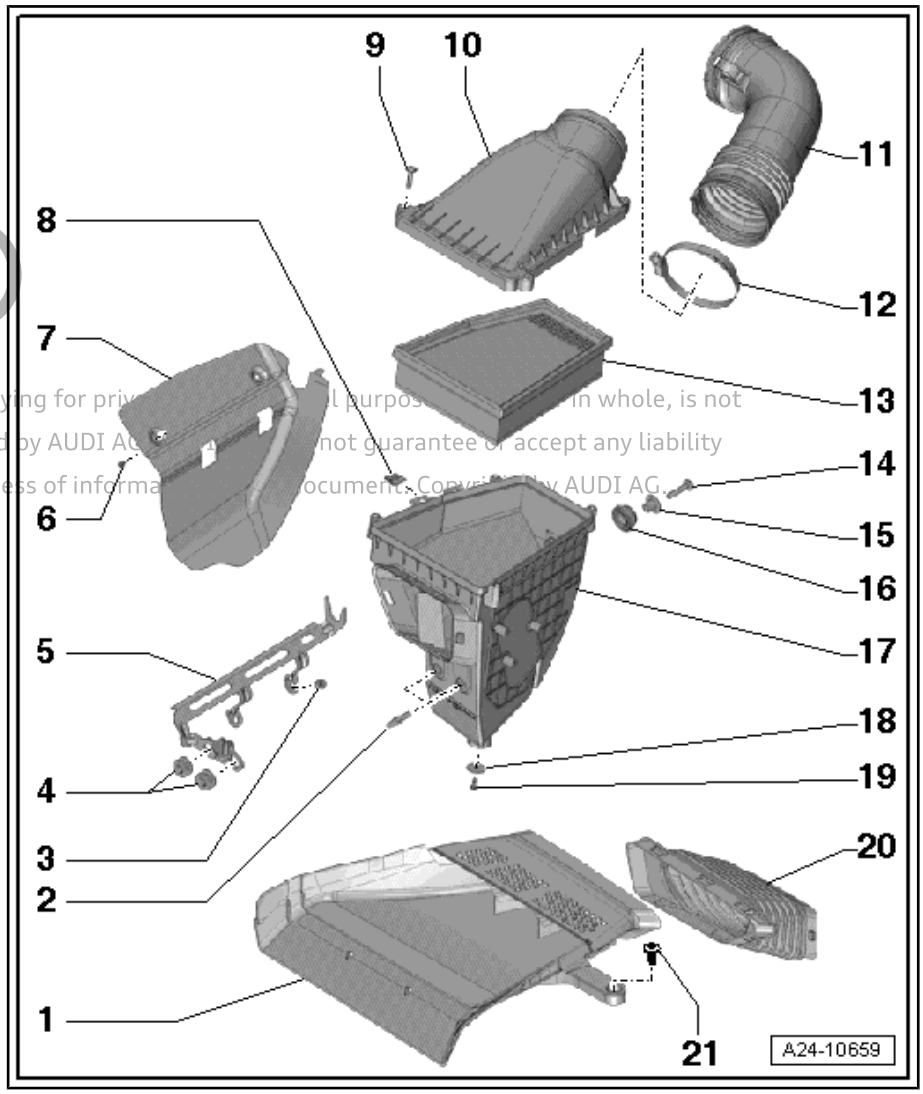
4 Air cleaner

⇒ “4.1 Exploded view - air cleaner housing”, page 245

⇒ “4.2 Removing and installing air cleaner housing”, page 246

⇒ “4.3 Removing and installing air filter element”, page 248

4.1 Exploded view - air cleaner housing



1 - Air duct

2 - Threaded pin

- ❑ 9 Nm

3 - Nut

- ❑ 9 Nm

4 - Rubber grommets

- ❑ Inserted in bracket for air cleaner

5 - Bracket

- ❑ For air cleaner

6 - Bolt

- ❑ 2.5 Nm

7 - Heat shield

8 - Speed nut

9 - Bolt

- ❑ 3.5 Nm

10 - Air cleaner (top section)

- ❑ Clean out salt deposits, dirt and leaves, etc.

11 - Air hose

- ❑ Clean out salt deposits, dirt and leaves, etc.

12 - Hose clip

- ❑ Spray rust remover onto worm thread before installing
- ❑ 3.5 Nm

13 - Air filter element

- ❑ Use genuine air filter element ⇒ Electronic parts catalogue
- ❑ Removing and installing ⇒ page 248
- ❑ Maintenance intervals ⇒ Maintenance tables

14 - Bolt

- ❑ 9 Nm

15 - Spacer sleeve

16 - Rubber grommet

17 - Air cleaner (bottom section)

- ❑ Clean out salt deposits, dirt and leaves, etc.
- ❑ Removing and installing ⇒ “4.2 Removing and installing air cleaner housing”, page 246

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18 - Grommet

- ❑ For water drain

19 - Water drain

- ❑ Clean

20 - Air duct

21 - Bolt

- ❑ 2 Nm

4.2 Removing and installing air cleaner housing

Removing

– Move crankcase breather hose -2- clear at air pipe.

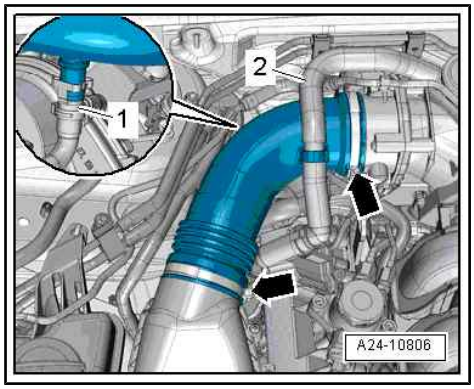
Crankcase breather with separate hose:

– Press release tabs and detach crankcase breather hose -1- from air pipe.

– Loosen hose clips -arrows- and detach air pipe.

Crankcase breather with permanently connected hose:

– Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).

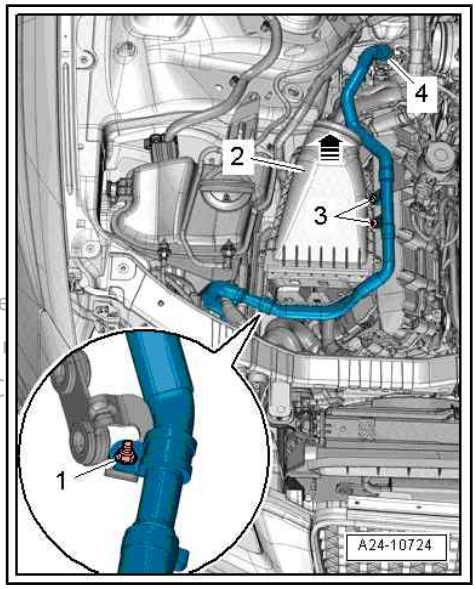


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All vehicles (continued):

– Remove bolts -3-.

– Lift air cleaner housing -2- off bracket at rear -arrow- and detach it towards rear.



Note

Disregard items -1 and 4-.

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he correctness of information in this document. C

Installing

- Tightening torques
  ⇒ “4.1 Exploded view - air cleaner housing”, page 245

Note

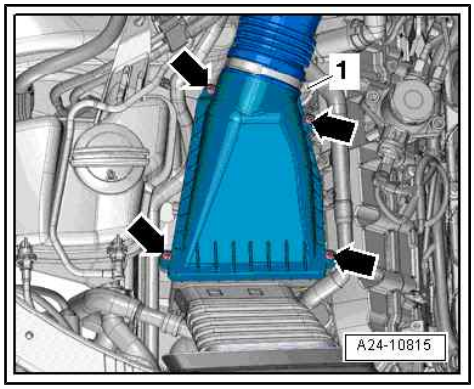
- *Hose connections and hoses must be free of oil and grease at intake section prior to fitting. Do not use any lubricants containing silicone when assembling.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*

– Check for salt residue, dirt and leaves in air hose (engine intake side).

– Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.

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

4.3 Removing and installing air filter element



Removing

– Release hose clip -1-.

– Remove bolts -arrows- and detach air cleaner (top section).

– Take out air filter element.

Installing

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

- Tightening torques
  ⇒ “4.1 Exploded view - air cleaner housing”, page 245

Note

- *Always use genuine air filter elements (same as original equipment).*
- *Hose connections and hoses must be free of oil and grease at intake section prior to fitting. Do not use any lubricants containing silicone when assembling.*
- *The air cleaner housing must always be clean.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *The screw sections of used screw-type clips must be sprayed with rust remover prior to fitting so that the air hoses can be attached securely to the hose connections.*
- *When cleaning the air cleaner housing with compressed air, cover the critical components of the engine intake system such as intake pipes etc. with a clean cloth to avoid malfunctioning.*
- *Observe environmental requirements for disposal.*

– Blow out water drain ⇒ Item 19 (page 246) with compressed air.

– Clean air cleaner housing (top and bottom sections) to remove any salt residue, dirt and leaves (vacuum-clean).

– Check for salt residue, dirt and leaves in air hose (engine intake side).

– Check air duct leading from lock carrier to air cleaner housing for dirt and leaves.

– When installing air filter element, make sure it is positioned centrally on mounting in air cleaner (bottom section).

– Carefully fit top section of air cleaner onto bottom section, without applying any force. Make sure top section of air cleaner housing is fitted straight on air filter element (note sealing lip on air filter element).

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

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5 Intake manifold

⇒ “5.1 Exploded view - intake manifold (top section)”, page 249

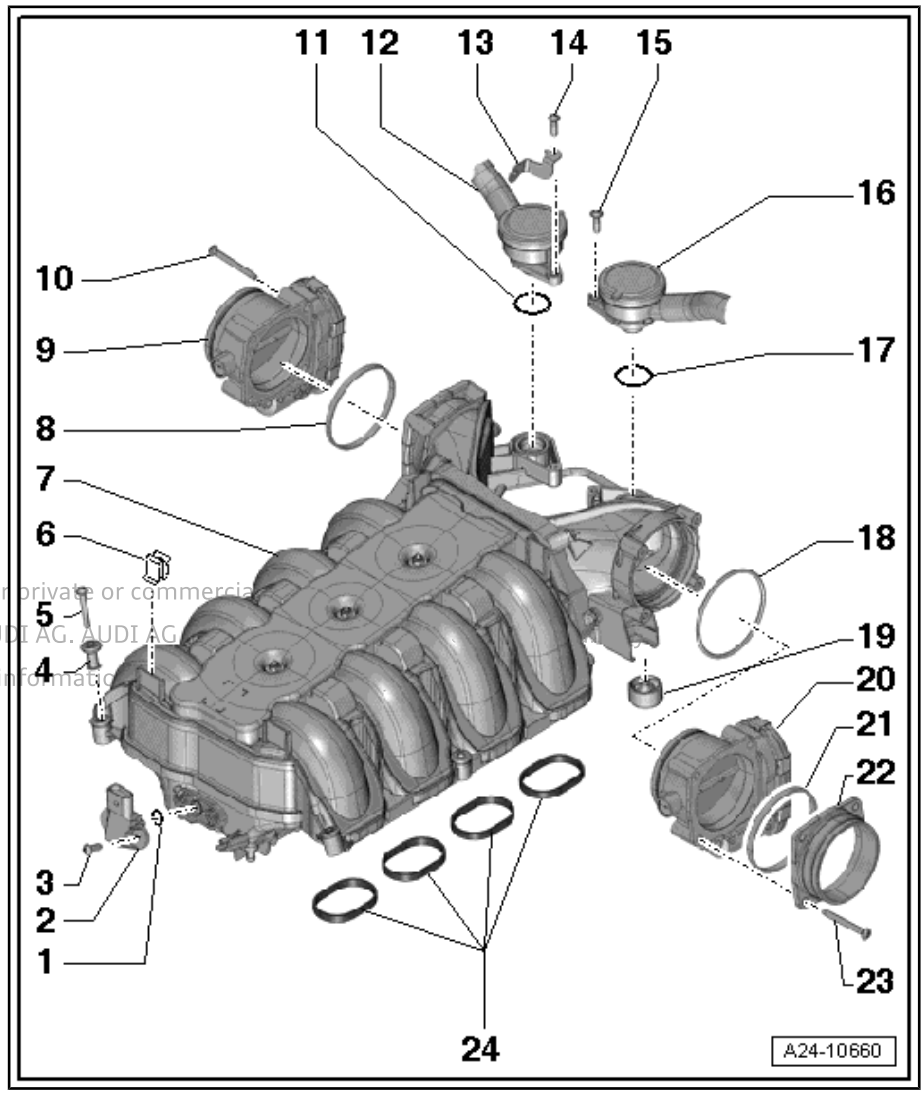
⇒ “5.2 Exploded view - intake manifold (bottom section) with fuel rail”, page 251

⇒ “5.3 Removing and installing intake manifold (top section)”, page 253

⇒ “5.4 Removing and installing intake manifold (bottom section) with fuel rail”, page 255

⇒ “5.5 Removing and installing throttle valve module J338 / J544 ”, page 259

5.1 Exploded view - intake manifold (top section)



1 - O-ring

- ❑ Renew

2 - Intake air temperature sender - G42- / intake manifold pressure sender - G71-

3 - Bolt

- ❑ 5 Nm

4 - Damper element

5 - Bolt

- ❑ Tightening torque and sequence ⇒ page 250

6 - Retaining clip

- ❑ For engine cover panel
- ❑ 4x
- ❑ Clips should make contact at front at inner stop on intake manifold

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7 - Intake manifold (top section)

- ❑ Removing and installing ⇒ page 253

8 - Seal

- ❑ Renew

9 - Throttle valve module - J338-

- ❑ Cylinder bank 1 (right-side)
- ❑ Removing and installing ⇒ page 259
- ❑ After renewing, perform `Adaption` in `Guided Functions` ⇒ Vehicle diagnostic tester

10 - Bolt

- ❑ Thread-forming
- ❑ Allow bolt to engage in existing thread on intake manifold
- ❑ 9 Nm

11 - O-ring
- ❑ Renew

12 - Pressure control valve
- ❑ For crankcase breather

13 - Bracket

14 - Bolt
- ❑ 4.5 Nm

15 - Bolt
- ❑ 4.5 Nm

16 - Pressure control valve
- ❑ For crankcase breather

17 - O-ring
- ❑ Renew

18 - O-ring
- ❑ Renew

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19 - Buffer
- ❑ For intake manifold (top section)

20 - Throttle valve module 2 - J544-
- ❑ Cylinder bank 2 (right-side)
- ❑ Removing and installing ⇒ page 259
- ❑ After renewing, perform `Adaption` in `Guided Functions` ⇒ Vehicle diagnostic tester

21 - Seal
- ❑ Renew

22 - Connection

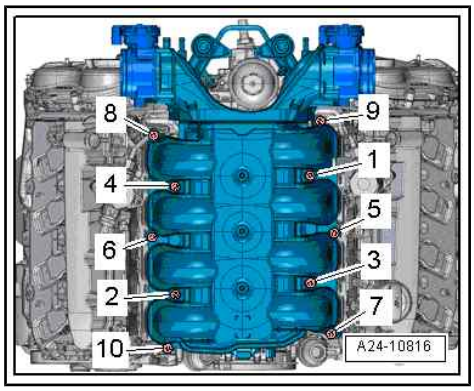
23 - Bolt
- ❑ Thread-forming
- ❑ Allow bolt to engage in existing thread on intake manifold
- ❑ 9 Nm

24 - Gaskets
- ❑ Renew

Intake manifold (top section) - tightening torque and sequence

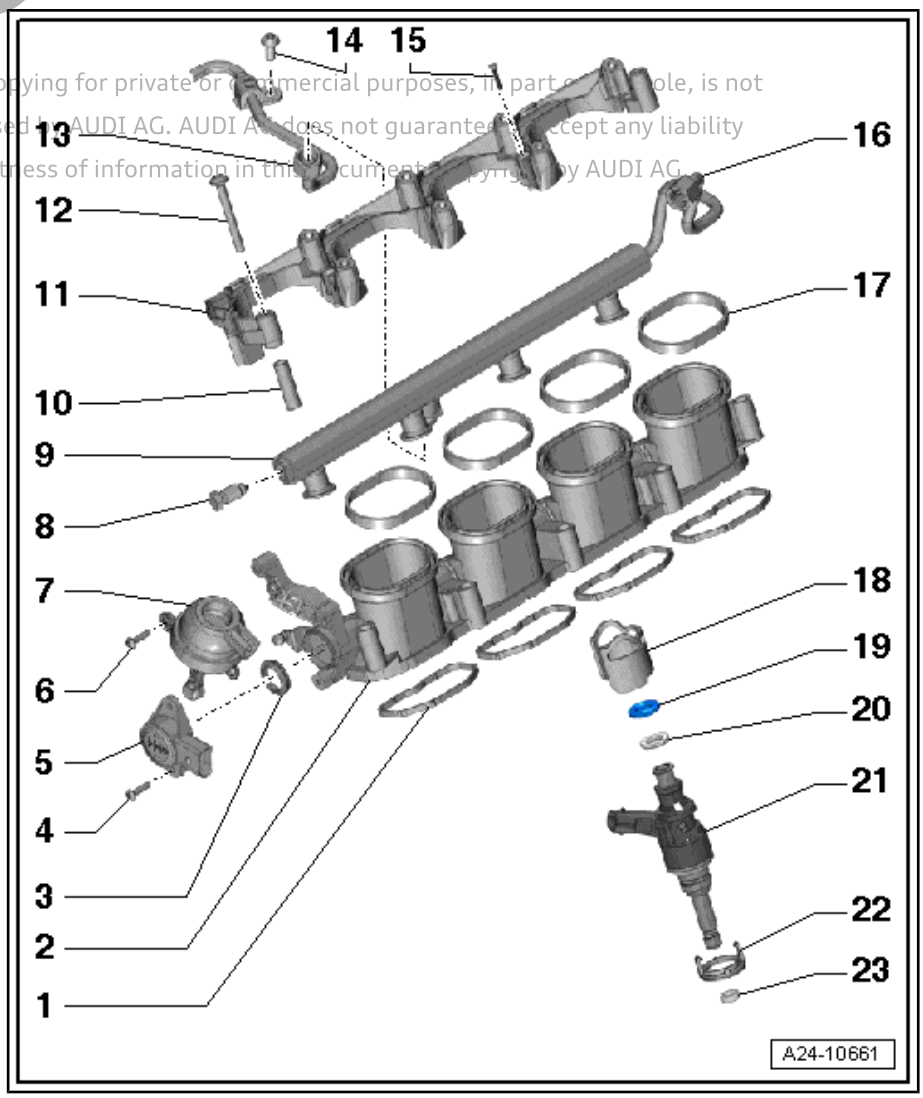
– Tighten bolts in 2 stages in the sequence shown:

Stage	Bolts	Tightening torque
1.	-1 … 10-	8 Nm
2.	-1 … 10-	11 Nm



5.2 Exploded view - intake manifold (bottom section) with fuel rail

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1 - Gaskets

- ❑ Renew

2 - Intake manifold (bottom section)

- ❑ Removing and installing ⇒ page 255

3 - Seal

- ❑ Renew if damaged
- ❑ When renewing lever out with screwdriver
- ❑ Press in by hand

4 - Bolt

- ❑ 2.5 Nm

5 - Intake manifold flap potentiometer

- ❑ Cylinder bank 1 (right-side): intake manifold flap potentiometer - G336-
- ❑ Cylinder bank 2 (left-side): intake manifold flap potentiometer 2 - G512-
- ❑ Before removing, remove intake manifold (top section)
- ❑ Adaption must be performed after this component has been renewed; use a ⇒ Vehicle diagnostic tester

6 - Bolt

- ❑ 2.5 Nm

7 - Vacuum unit

- ❑ For intake manifold flaps
- ❑ After renewing, check vacuum system for leaks ⇒ page 237

8 - Plug

- ❑ 25 Nm

9 - Fuel rail

- ❑ Removing and installing ⇒ “3.1 Removing and installing injectors”, page 239 , ⇒ page 255

10 - Sleeve

11 - Retaining bracket

- ❑ For fuel rail

12 - Bolt

- ❑ Tightening torque and sequence ⇒ page 253

13 - High-pressure pipe

> **WARNING**
> *The fuel system operates at extremely high pressure. This can cause injury.*
> *The pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- ❑ Reducing fuel pressure in high-pressure section of injection system ⇒ page 235
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ Removing and installing ⇒ “8.3 Removing and installing high-pressure pipe”, page 275
- ❑ Lubricate thread lightly with engine oil
- ❑ 25 Nm

14 - Bolt

- ❑ 9 Nm

15 - Bolt

- ❑ 2.5 Nm

16 - Union nut

- ❑ Lubricate thread lightly with engine oil
- ❑ 25 Nm

17 - Gaskets

- ❑ Renew

18 - Support ring

- ❑ Renew
- ❑ Via this support ring, the fuel rail exerts the clamping force that holds the injector in the cylinder head

19 - O-ring

- ❑ Renew
- ❑ Lubricate lightly with clean engine oil

20 - Spacer ring

- ❑ Renew if damaged

21 - Injector

- ❑ Removing and installing ⇒ page 239

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22 - Sealing washer

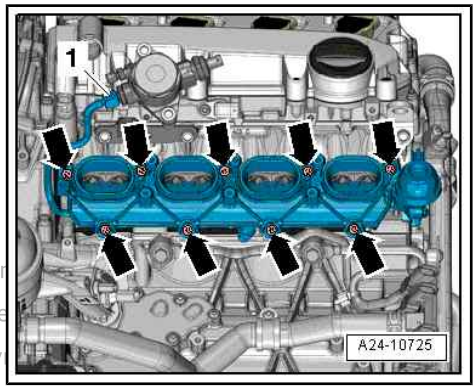
- ❑ Renew

23 - Combustion chamber ring seal

- ❑ Renew
- ❑ Do not apply grease or use any other lubricants

Intake manifold (bottom section) - tightening torque and sequence

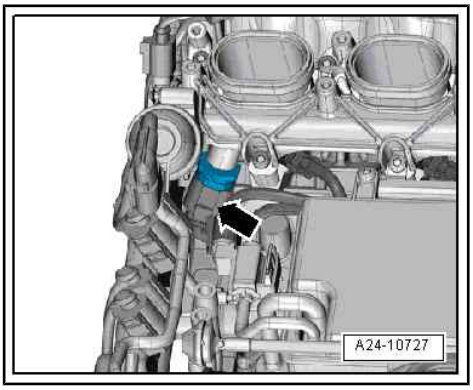
– Tighten bolts -arrows- in stages and in diagonal sequence; final torque 9 Nm.



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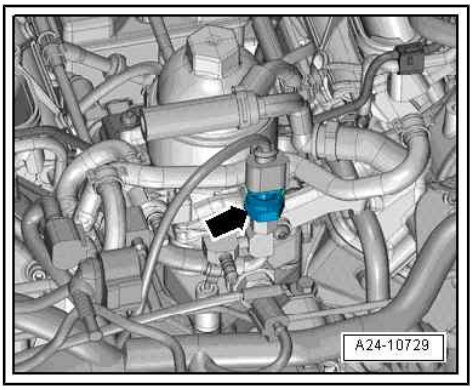
Fuel pressure sender -G247- / -G624-

- At front of fuel rail
- Cylinder bank 1 (right-side): fuel pressure sender - G247- -arrow-
- Cylinder bank 2 (left-side): fuel pressure sender 2 - G624-
- Removing and installing ⇒ page 260
- 25 Nm



Fuel pressure sender for low pressure - G410-

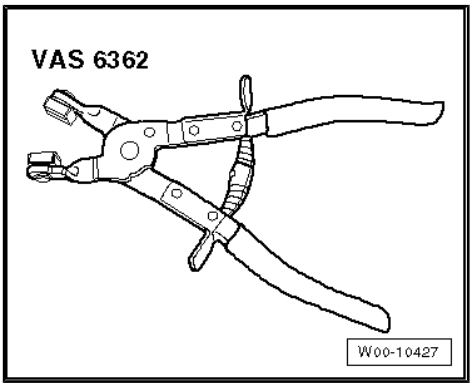
- Behind oil filter housing -arrow-
- 15 Nm



5.3 Removing and installing intake manifold (top section)

Special tools and workshop equipment required

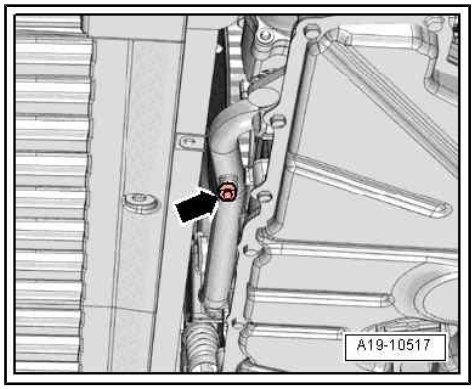
- Hose clip pliers - VAS 6362-



Removing

– Drain coolant from coolant pipe (front) -arrow- ⇒ page 214 .

– Remove engine cover panel ⇒ page 64 .



Removing

– Move crankcase breather hose -2- clear at air pipe.

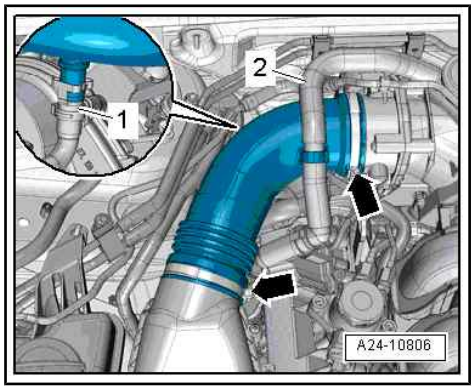
Crankcase breather with separate hose:

– Press release tabs and detach crankcase breather hose -1- from air pipe.

– Loosen hose clips -arrows- and detach air pipe.

Crankcase breather with permanently connected hose:

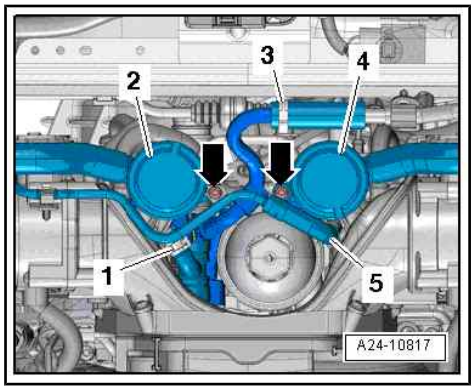
– Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).



All vehicles (continued):

– Unscrew bolts -arrows- and move pressure control valves -2- and -4- for crankcase breather system clear to one side.

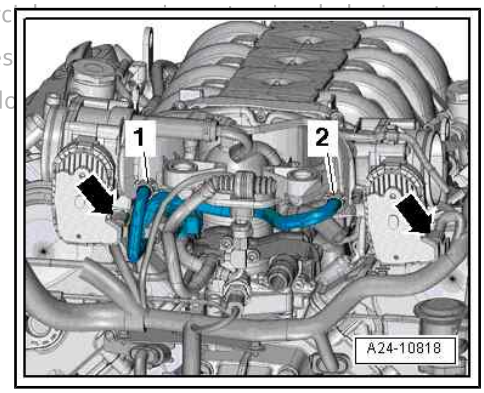
– Release hose clips -1, 3 and 5- and disconnect coolant hoses and vacuum hose.



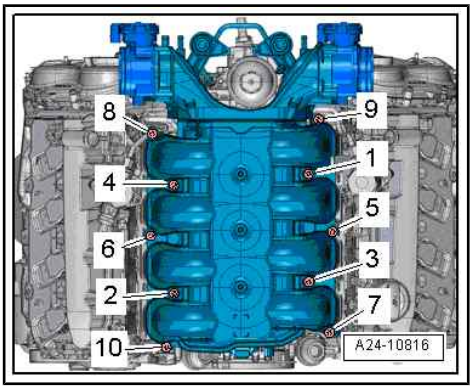
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– Unplug electrical connectors -arrows- at throttle valve modules.

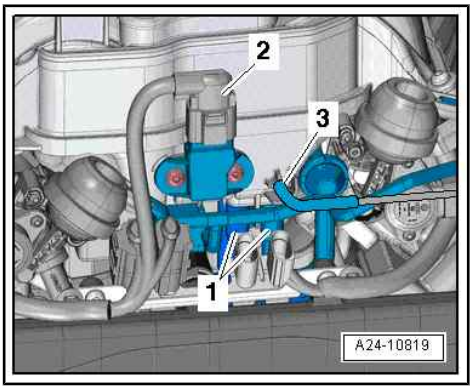
– Release hose clips -1- and -2- and detach hoses coming from activated charcoal filter.



– Slacken and remove bolts in the sequence: -10 ... 1-.



– Unplug electrical connector -2-.
– Disconnect vacuum hose -3-.
– Detach intake manifold (top section) and disconnect vacuum hoses -1-.



Caution

Risk of irreparable damage to engine.

- ***Block off the intake ports in the cylinder heads with clean cloths to prevent small items from dropping into the ports.***

Installing

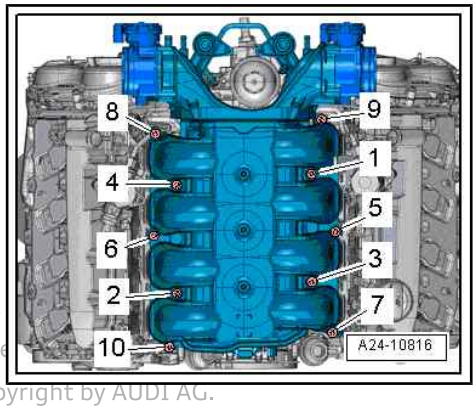
Installation is carried out in reverse order; note the following:

- Tightening torques
  ⇒ Fig. ""Intake manifold (top section) - tightening torque and sequence"" , page 250

Note

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

– Tighten bolts for intake manifold (top section) ⇒ page 250 .
– Fill up with coolant ⇒ page 196 .

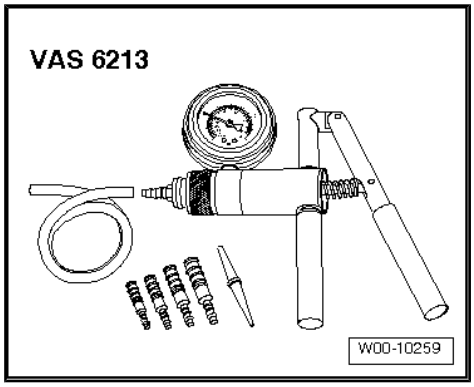


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5.4 Removing and installing intake manifold (bottom section) with fuel rail

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



Removing

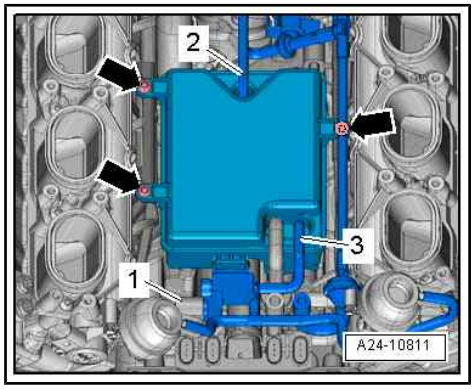
WARNING

The fuel system operates at extremely high pressure. This can cause injury.

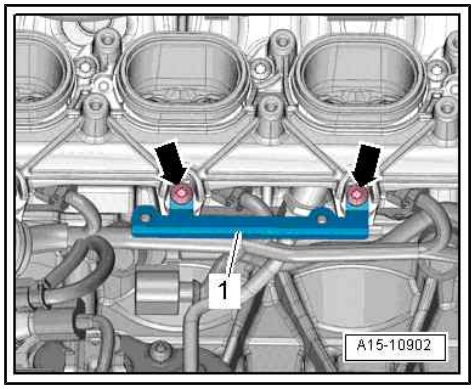
- ***The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.***

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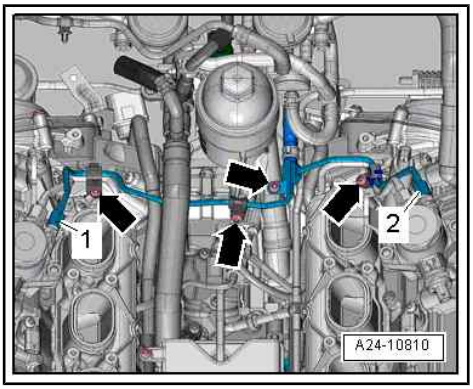
– Reduce fuel pressure in high-pressure section of injection system ⇒ page 235 .
– Remove intake manifold (top section) ⇒ page 253 .
– Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.
– Remove bolts -arrows- and detach vacuum reservoir.



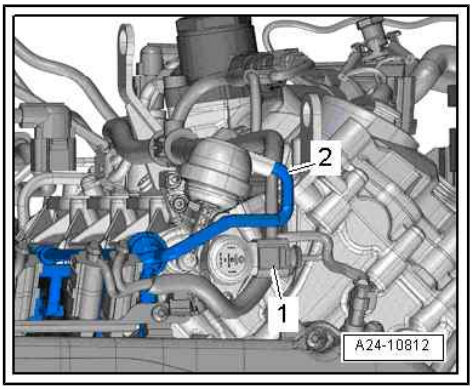
– Unscrew bolts -arrows- and detach bracket -1- for vacuum reservoir.



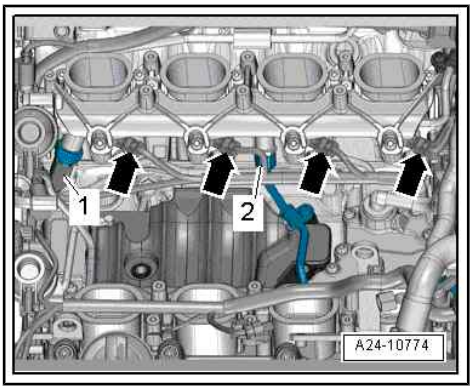
– Remove bolts -arrows- and union nuts -1, 2- and move fuel supply line to one side.



– Unplug electrical connector -1- and disconnect vacuum hose -2-.



– Unplug electrical connectors -arrows- at injectors.
– Cylinder head (right-side): Unplug electrical connector -1- at fuel rail.
– Unscrew high-pressure pipe -2- from connection on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nut.

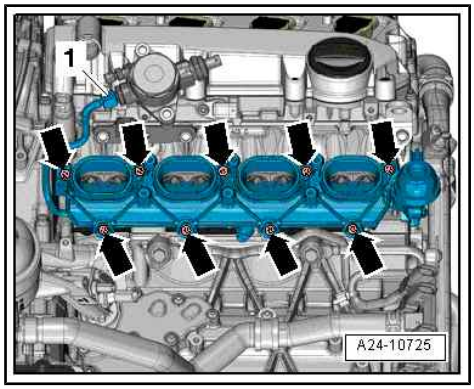


Note

Do not attempt to bend high-pressure pipe to a different shape.

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– Remove union nut -1-.
– Loosen bolts -arrows- in diagonal sequence and remove.
– Pull off intake manifold (bottom section) with fuel rail.



Caution

Risk of irreparable damage to engine.

- *Block off the intake manifolds (bottom section) with clean cloths to prevent small objects from dropping into the engine through the intake ports in the cylinder heads.*

Installing

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

- Tightening torque
⇒ Fig. ""Intake manifold (bottom section) - tightening torque and sequence"" , page 253

Note

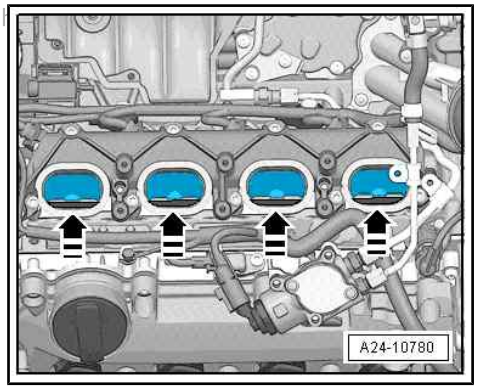
- *If an injector has been pulled out of the cylinder head, the teflon ring seal must be renewed.*
- *Renew gaskets and O-rings.*
- *Lubricate O-rings of injectors lightly with clean engine oil.*

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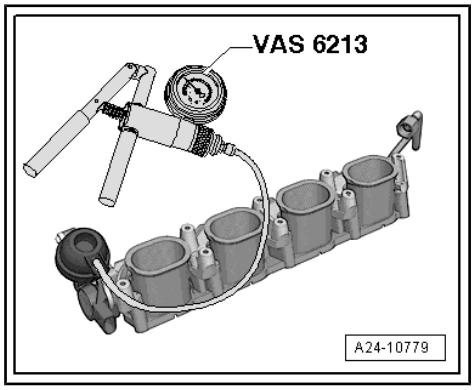
Caution

Risk of damage to intake manifold flaps.

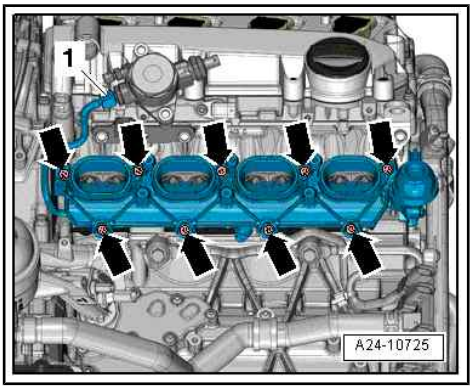
- *If the intake manifold flaps are closed, they can catch on the guide plates in the cylinder head -arrows- when the intake manifold (bottom section) is installed.*



– Connect hand vacuum pump - VAS 6213- to vacuum unit for actuating intake manifold flaps, as shown in illustration.
– Operate hand vacuum pump to produce a vacuum.
• This will cause the intake manifold flaps to open.
– Install intake manifold (bottom section) and press fuel rail evenly onto injectors.



– Tighten bolts for intake manifold (bottom section) ⇒ page 253 .
– Disconnect vacuum hose of hand vacuum pump - VAS 6213- from vacuum unit for actuating intake manifold flaps.
– Install high-pressure pipe ⇒ “8.3 Removing and installing high-pressure pipe”, page 275 .
– Install intake manifold (top section) ⇒ “5.3 Removing and installing intake manifold (top section)”, page 253 .



Note

After installation, check vacuum system for leaks ⇒ page 237 .

5.5 Removing and installing throttle valve module -J338- / -J544-

Removing

– Remove engine cover panel ⇒ page 64 .

Removing

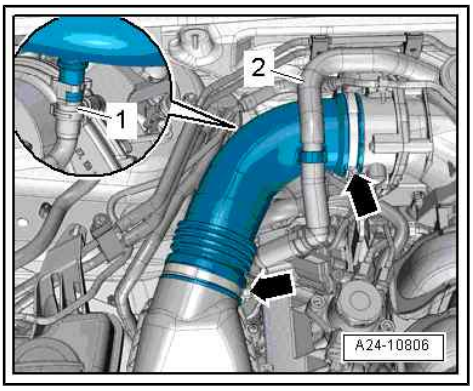
– Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

– Press release tabs and detach crankcase breather hose -1- from air pipe.
– Loosen hose clips -arrows- and detach air pipe.

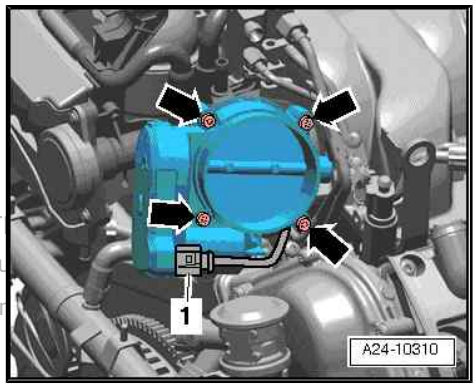
Crankcase breather with permanently connected hose:

– Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).



All vehicles (continued):

– Unplug electrical connector -1-.
– Remove bolts -arrows- and detach throttle valve module.



Installing

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

- Tightening torques ⇒ “5.1 Exploded view - intake manifold (top section)”, page 249

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Note

Renew seal.

– Install engine cover panel ⇒ page 64 .

6 Senders and sensors

⇒ “6.1 Removing and installing fuel pressure sender G247 / G624 ”, page 260

⇒ “6.2 Checking fuel pressure and residual pressure (up to high-pressure pump)”, page 260

6.1 Removing and installing fuel pressure sender -G247- / -G624-

Removing

– Remove intake manifold (top section) ⇒ page 253 .

If removing fuel pressure sender - G247- :

– Cylinder bank 1 (right-side): Remove intake manifold flap potentiometer - G336- -item 5- ⇒ Item 5 (page 251) .

– Cylinder bank 1 (right-side): Remove vacuum unit for intake manifold flaps -item 7- ⇒ Item 7 (page 251) .

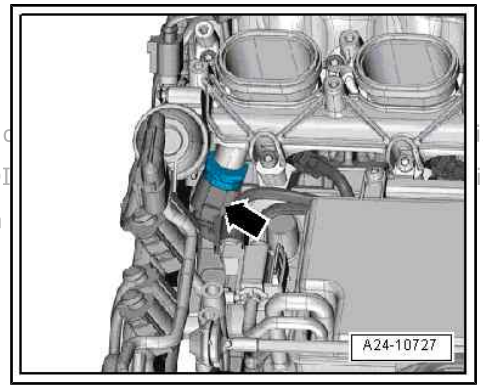
If removing fuel pressure sender 2 - G624- :

– Cylinder bank 2 (left-side): Remove intake manifold flap potentiometer 2 - G512- -item 5- ⇒ Item 5 (page 251) .

– Cylinder bank 1 (right-side): Remove vacuum unit for intake manifold flaps -item 7- ⇒ Item 7 (page 251) .

Both senders:

– Unplug electrical connector -arrow-.



Note

Illustration shows fuel pressure sender - G247- .

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– Unscrew fuel pressure sender.

Installing

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

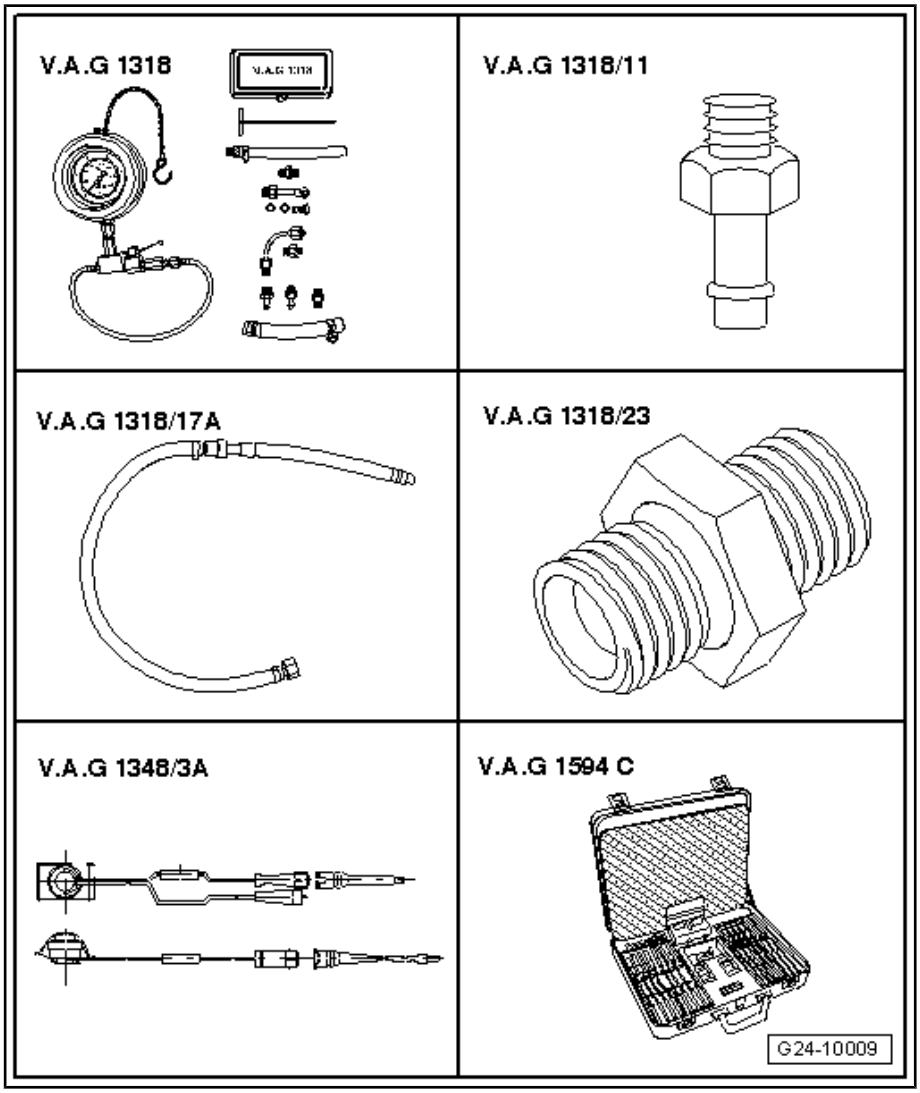
Tightening torque

- ⇒ Fig. ““Fuel pressure sender -G247- / -G624- ”“ , page 253
- ⇒ “5.2 Exploded view - intake manifold (bottom section) with fuel rail”, page 251

– Install intake manifold (top section) ⇒ “5.3 Removing and installing intake manifold (top section)”, page 253 .

6.2 Checking fuel pressure and residual pressure (up to high-pressure pump)

Special tools and workshop equipment required



- K-Jetronic pressure tester - V.A.G 1318-
- Adapter - V.A.G 1318/11-
- Adapter set - V.A.G 1318/17A-
- Connector - V.A.G 1318/23-
- Remote control - V.A.G 1348/3A- for V.A.G 1348 with adapter cable -V.A.G 1348/3-3-
- Auxiliary measuring set - V.A.G 1594C-
- Fuel-resistant measuring container

Test conditions

- Battery voltage at least 12.5 V
- Fuel filter OK.
- Fuel tank at least $^1/_4$ full.
- Fuel pump control unit - J538- OK; checking in `Guided Fault Finding` ⇒ Vehicle diagnostic tester.

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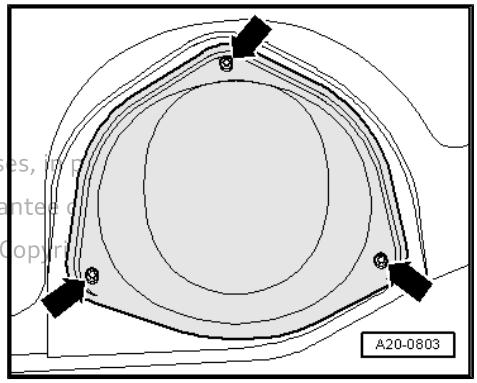
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Preparations

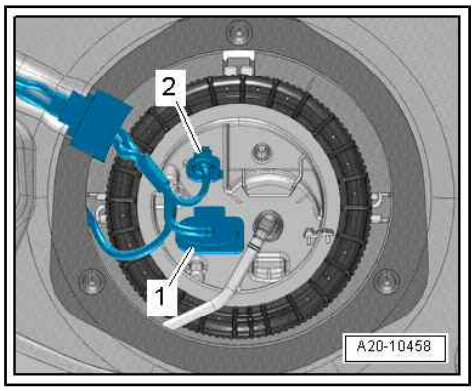
- Ignition switched off.

– Remove rear seat bench ⇒ General body repairs, interior; Rep. gr. 72 ; Rear seats; Exploded view - seat bench/individual seats.

– Unscrew cover for flange -arrows-.



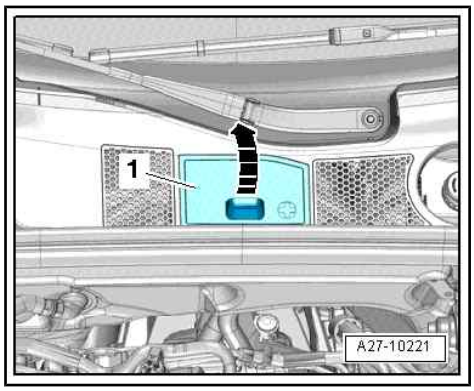
– Unplug electrical connector -1- on flange.



Note

Disregard -item 2-.

– Lift cover -1- by its handle -arrow-.

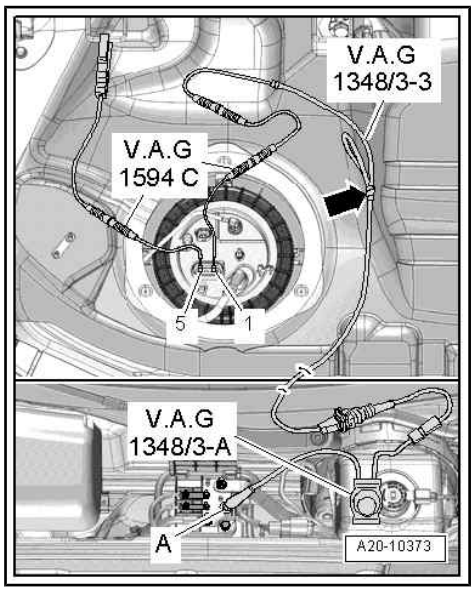


– Connect remote control - V.A.G 1348/3A- for V.A.G 1348 to contact -1- using adapter cable -V.A.G 1348/3-3- and test lead from auxiliary measuring set - V.A.G 1594C- .

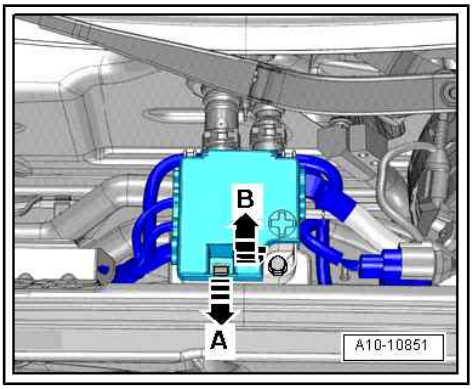
– Tape off 2nd connector contact of adapter cable -V.A.G 1348/3-3- with insulating tape -arrow- to prevent short circuits.

– Connect contact -5- to vehicle body (earth) using a test lead from auxiliary measuring set - V.A.G 1594C- .

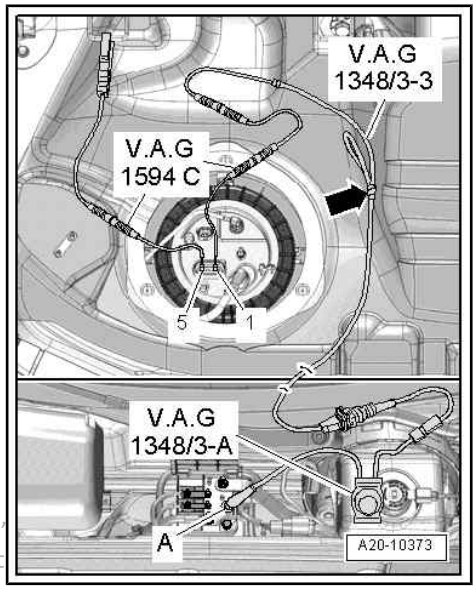
– Move switch of remote control - V.A.G 1348/3A- for V.A.G 1348 to front of engine compartment.



– Release catch -arrow A- and open cover -arrow B-.



– Connect crocodile clip to jump start socket - U6- -item A- in terminal 30 wiring junction 2 - TV22- located in plenum chamber.
– Remove filler cap from fuel filler neck.



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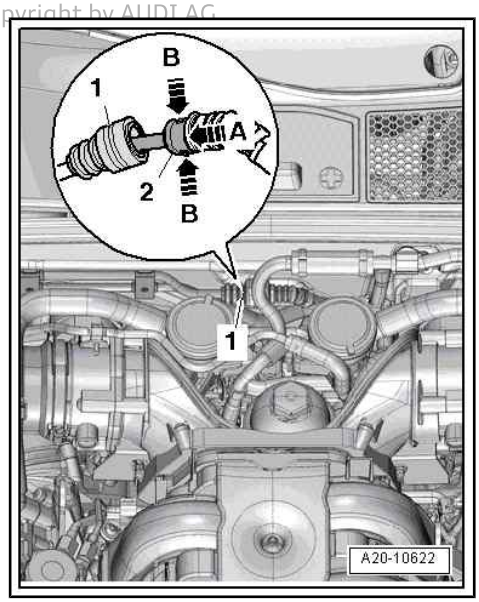
– Remove engine cover panel ⇒ page 64 .

WARNING

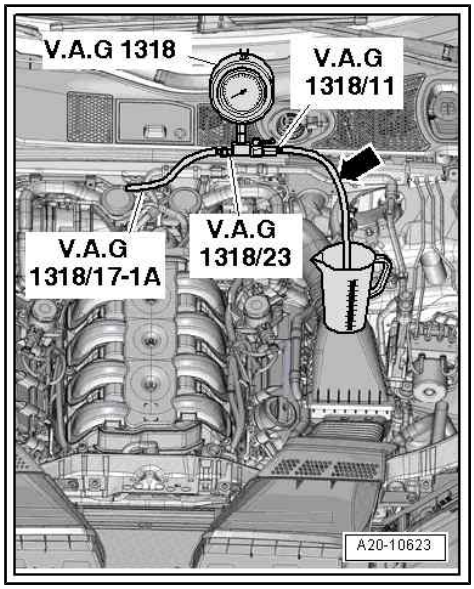
The fuel system operates at high pressure - risk of injuries!

- ***To reduce the pressure in the fuel system, wrap a clean cloth around the connection and loosen the connection carefully.***

– Push down protective sleeve -1- and disconnect fuel supply line.
– First press hose connector -2- downwards -arrow A-, then press release tabs -arrow B-.
– Pull off hose connector, keeping release tabs depressed.

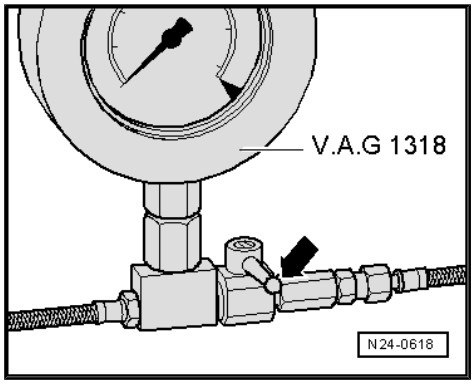


– Screw connector - V.A.G 1318/23- and adapter -V.A.G 1318/17-1A- onto K-Jetronic pressure tester - V.A.G 1318- .
– Fit -V.A.G 1318/17-1A- onto disconnected fuel line.
– Connect adapter -V.A.G 1318/11- to -V.A.G 1318- .
– Attach test hose -arrow- and hold end of hose in measuring container.
– Open cut-off valve on pressure tester.
• Lever points in direction of flow.
– Bleed fuel system by pressing remote control briefly.



Checking fuel pressure

– Close cut-off valve on pressure tester.
• Lever is at right angle to direction of flow -arrow-.
– Press and hold remote control switch until K-Jetronic pressure tester - V.A.G 1318- shows no further increase in pressure.
• Specification: approx. 5.5 bar (4.5 ... 8.0 bar)
– If specification is not attained, check delivery rate of fuel pump ⇒ Fuel supply system; Rep. gr. 20 ; Accelerator mechanism .



Checking residual pressure

– Check system for leaks and check residual pressure by watching the drop in pressure on the K-Jetronic pressure tester - V.A.G 1318- .
• After 10 minutes pressure should still be at least 3.0 bar.

If the residual pressure drops below 3 bar:

♦ Check union between K-Jetronic pressure tester - V.A.G 1318- and fuel supply line for leaks.
♦ Check K-Jetronic pressure tester - V.A.G 1318- for leaks.
♦ Check fuel lines and their connections for leaks.
♦ Check fuel filter with integrated fuel pressure regulator ⇒ Fuel supply system; Rep. gr. 20 ; Fuel filter .
♦ If fuel filter is OK, renew fuel pump ⇒ Fuel supply system; Rep. gr. 20 ; Fuel delivery unit/fuel gauge sender .

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

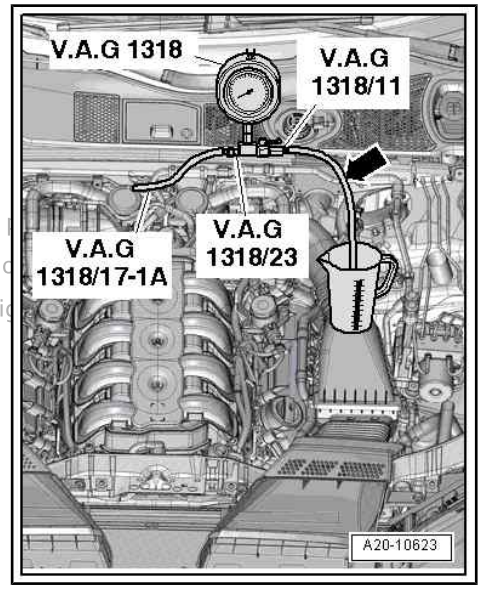
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Note

Before removing the pressure tester, release the fuel pressure by opening the cut-off valve. Hold end of test hose into measuring container -arrow-.

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– Re-attach fuel supply line (make sure that all parts are clean and that there are no leaks).



7 Engine control unit

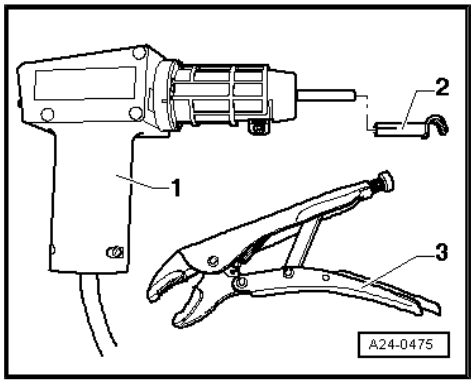
⇒ “7.1 Removing and installing engine control unit J623 ”, page 266

⇒ “7.2 Wiring and component check with isolator boxes VAS 6606 ”, page 269

7.1 Removing and installing engine control unit - J623-

Special tools and workshop equipment required

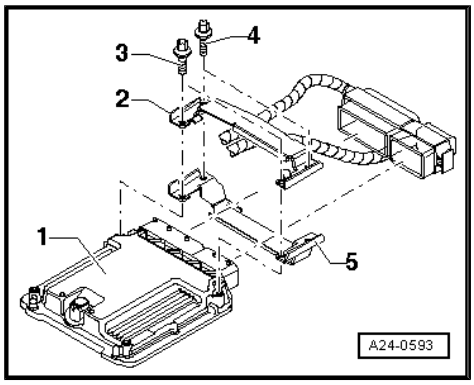
- Hot air blower - VAS 1978/14A- -item 1- with nozzle attachment -2- from wiring harness repair set - VAS 1978 B-



- Small, commercially available mole grips -3-

Note

- *The engine control unit -1- is bolted to the protective housing -5-. To make it more difficult to unscrew the shear bolts -4- 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).*



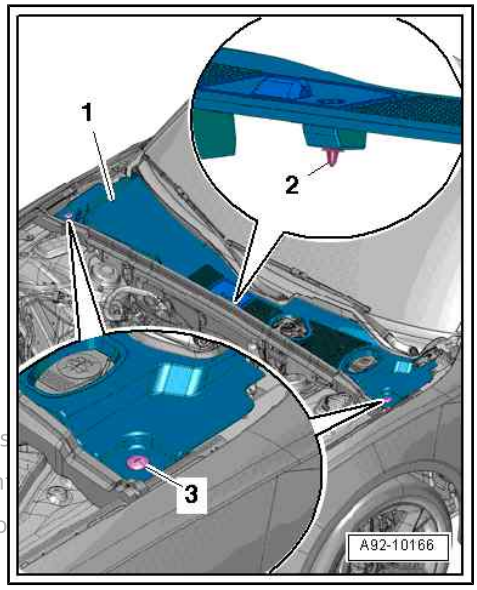
Removing

– When renewing engine control unit, select diagnosis object “Replace engine control unit” in “Guided Functions” mode of ⇒ Vehicle diagnostic tester.

– Switch off ignition and remove ignition key.

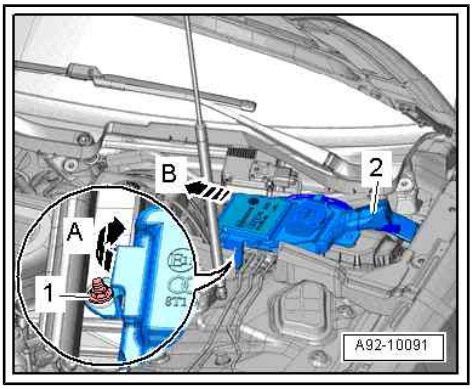
– Remove bolts -3-.

– Unclip retaining clips -2- from mounting and detach plenum chamber cover -1-.



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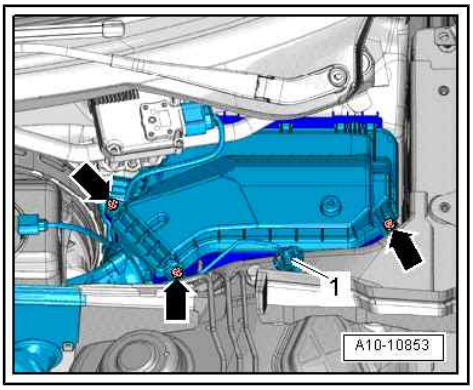
– Remove nut -1- and swivel filler neck for washer fluid reservoir slightly upwards -arrow A-.
– Pull filler neck -2- with filler pipe out of washer fluid reservoir and through opening in body -arrow B-.



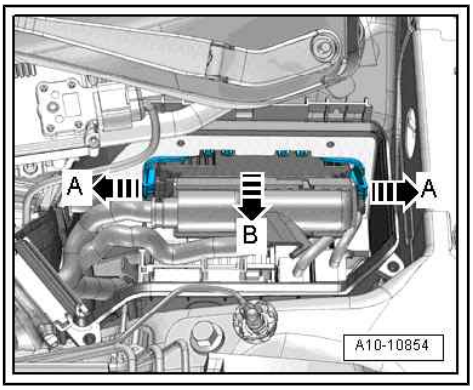
– Remove bolts -arrows- and detach cover for electronics box in engine compartment.

Note

Disregard -item 1-.



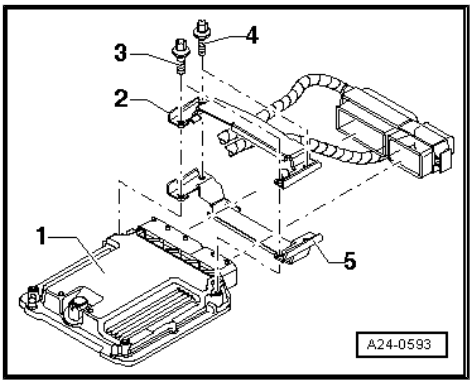
– Release catches -arrows A- and take out engine control unit -arrow B-.



To help prevent unauthorised access to the connectors on the engine control unit, the engine control unit -1- is bolted to a protective housing -5- by means of shear bolts -3 and 4- and a locking plate -2-.

The threads of the two shear bolts -4- which are not screwed into the engine control unit are secured with locking fluid. To unscrew these two bolts, the threads must therefore be heated with the hot air blower.

The threads of the two shear bolts -3- which are screwed into the engine control unit are not secured with locking fluid. Do not apply heat to the threads in the control unit housing; this is not necessary and would cause overheating of the control unit.



Caution

Wiring, connectors, insulation and control units can be burnt and damaged.

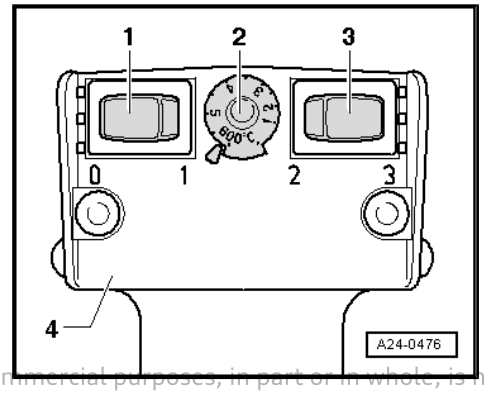
- ***Keep exactly to the following procedure. Observe operating instructions for hot air blower.***

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– Select settings on hot air blower -4- as shown in illustration:

2 - Temperature potentiometer to maximum heat output

3 - Two-stage air flow switch to position “3”



WARNING

Risk of burns.

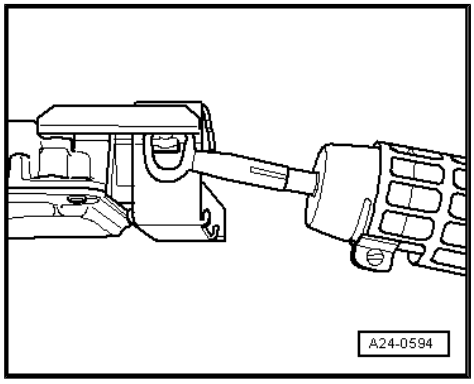
- *Parts of the metal locking plate will become very hot as a result of heating the shear bolts. Try to ensure that only the thread is heated and none of the nearby components. These should be covered if necessary.*

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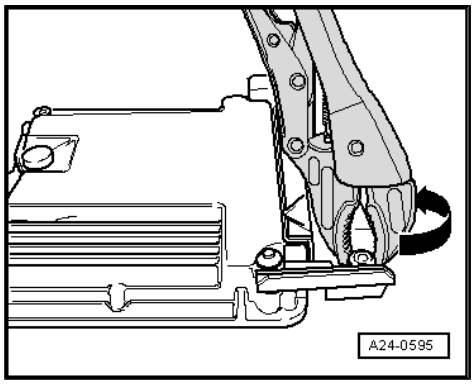
Apply heat to the threads of the shear bolts on the connector side as shown in the illustration.

Switch on the hot air blower and heat the bolt for approximately 20 ... 30 seconds.

– Unscrew shear bolts using mole grips (see arrow in illustration).



– The two shear bolts screwed into the engine control unit do not need to be heated. They should be removed without being heated.



– Detach protective housing from control unit connectors.

– Release connectors on engine control unit and unplug connectors.

– Take out old engine control unit - J623- and install new engine control unit - J623- .

Installing

Installation is performed in the reverse sequence.

– After installation, the protective housing must be re-fitted on the engine control unit - J623- .

– Clean threaded holes for shear bolts to remove any residue from locking fluid. This can be done using a thread tap.

– Use new shear bolts.

– Install cover for electronics box in engine compartment ⇒ Electrical system; Rep. gr. 97 ; Relay carriers, fuse carriers, electronics boxes .

– Install filler neck for washer fluid reservoir ⇒ Electrical system; Rep. gr. 92 ; Windscreen washer system; Removing and installing washer fluid reservoir .

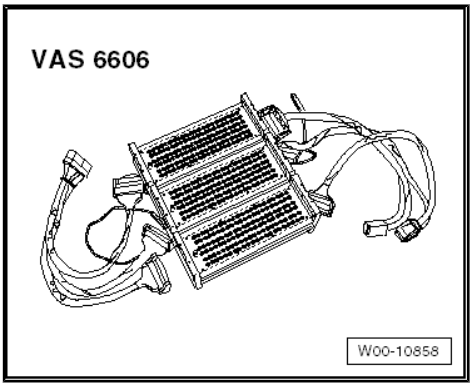
After installing a new engine control unit, the following operation must be performed:

– Activate engine control unit using ⇒ Vehicle diagnostic tester in “Guided Functions” mode, “Replace engine control unit”.

7.2 Wiring and component check with isolator boxes -VAS 6606-

Special tools and workshop equipment required

- Isolator box, 198-pin - VAS 6606/1-1-
- Isolator box, 198-pin - VAS 6606/1-2-
- Isolator box, 198-pin - VAS 6606/1-3-
- Sheets -VAS 6606/1-1-
- Sheets -VAS 6606/2-1-
- Sheets -VAS 6606/3-1-
- Set of cables -VAS 6606/7-1- and -VAS 6606/7-2-



Note

- *Always make sure that the cables are properly connected.*
- *Do not use damaged or worn tools and accessories.*
- *Observe operating instructions.*

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– Connect both cable sets -VAS 6606/7-1- and -VAS 6606/7-2- to the three isolator boxes -VAS 6606- .

– Use the following sheets:

- -VAS 6606/1-1- for isolator box, 198-pin - VAS 6606/1-1-
- -VAS 6606/2-1- for isolator box, 198-pin - VAS 6606/1-2-
- -VAS 6606/3-1- for isolator box, 198-pin - VAS 6606/1-3-

Note

Make sure that all plug-in bridges are inserted completely in all isolator boxes.

– Connect earth strap to an isolator box and to an earth point on the vehicle.

– Remove engine control unit ⇒ page 266 .

– Connect engine control unit to cable set -VAS 6606/7-1- .

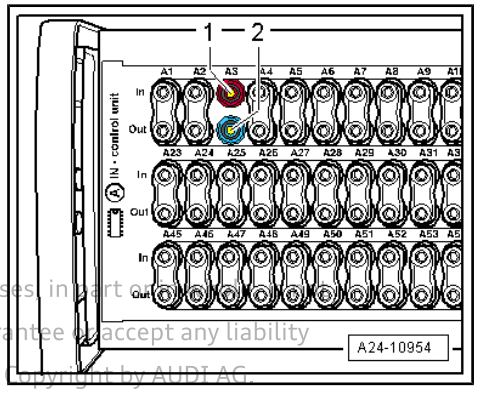
– Connect vehicle wiring harness to cable set -VAS 6606/7-2- .

The connection on the engine control unit consists of a large and a small connector.

The large connector has 105 pins and is assigned to the sheets for the isolator box marked “A 1 to A 105”.

The small connector has 91 pins and is assigned to the sheets for the isolator box marked “B 1 to B 91”.

When a push-in bridge is pulled out, the corresponding wiring connection is disconnected.



Note

- *The “In” contact -1- (red socket) leads to the engine control unit.*
- *The “Out” contact -2- (blue socket) leads to the wiring harness.*

– Carry out test as described in appropriate repair procedures.

Installing engine control unit

Installation is performed in the reverse sequence.

The procedure required after connecting the engine control unit is described in the Guided Fault Finding or Guided Functions. Use ⇒ Vehicle diagnostic tester.

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Note

After completion of the Guided Fault Finding routine, the tester will attempt to erase the event memories of all control units. If this is not successful, the remaining events saved in the memories must be dealt with so that all event memory entries can be erased.

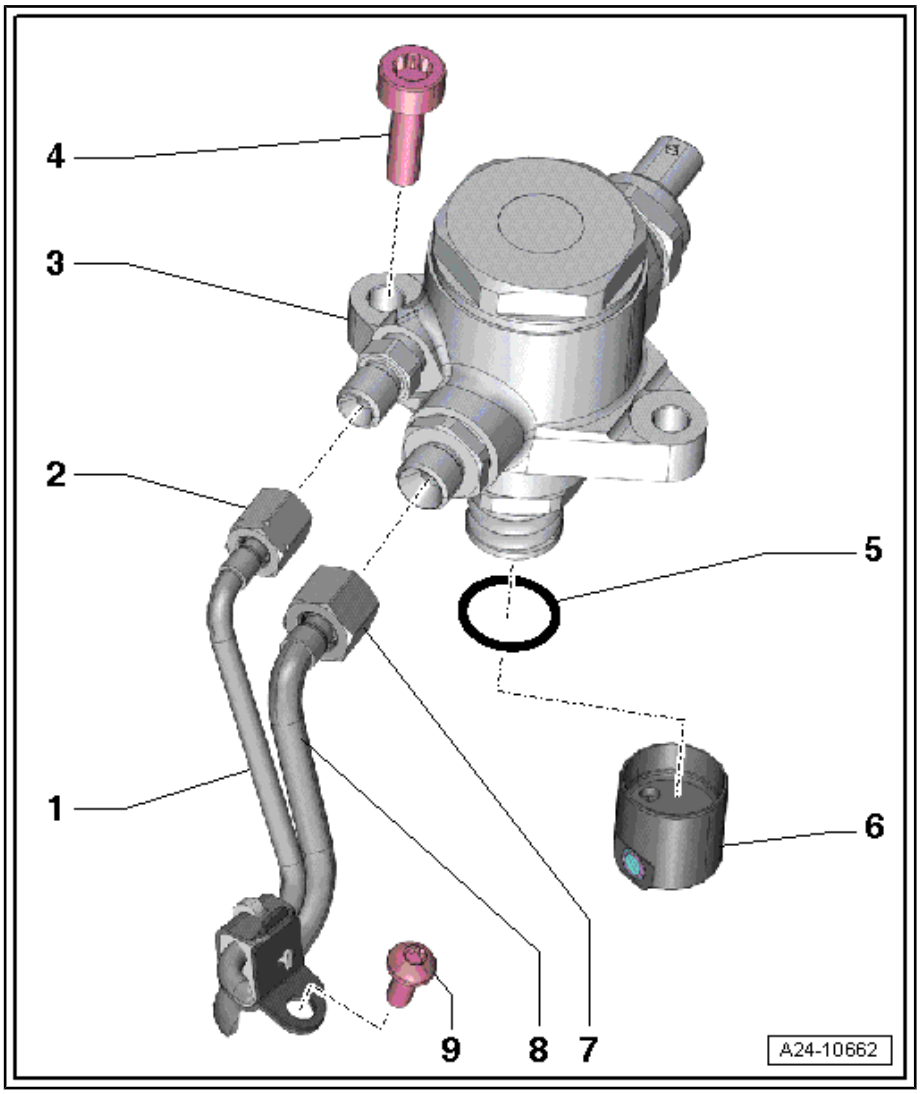
8 High-pressure pump

⇒ “8.1 Exploded view - high-pressure pump”, page 271

⇒ “8.2 Removing and installing high-pressure pump”, page 272

⇒ “8.3 Removing and installing high-pressure pipe”, page 275

8.1 Exploded view - high-pressure pump



1 - High-pressure pipe

> **WARNING**
> *The fuel system operates at high pressure - risk of injuries!*
> *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- ❑ Reducing fuel pressure in high-pressure section of injection system ⇒ page 235
- ❑ Tighten connecting piece to 40 Nm (always make sure that connecting piece is tightened to specified torque before installing fuel line)
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ Lubricate thread lightly with engine oil
- ❑ Removing and installing ⇒ “8.3 Removing and installing high-pressure pipe”, page 275

2 - Union nut

- ❑ Connections must not be damaged
- ❑ Lubricate thread lightly with engine oil
- ❑ 25 Nm

3 - High-pressure pump

- ❑ Cylinder bank 1 (right-side): with fuel metering valve - N290-
- ❑ Cylinder bank 2 (left-side): with fuel metering valve 2 - N402-
- ❑ Removing and installing ⇒ page 272

4 - Bolt

- ❑ 22 Nm

5 - O-ring

- ❑ Renew

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6 - Roller tappet

7 - Union nut

- ❑ Connections must not be damaged
- ❑ Lubricate thread lightly with engine oil
- ❑ 25 Nm

8 - High-pressure pipe

> **WARNING**
> *The fuel system operates at high pressure - risk of injuries!*
> *The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.*

- ❑ Reducing fuel pressure in high-pressure section of injection system ⇒ page 235
- ❑ Tighten connecting piece to 40 Nm (always make sure that connecting piece is tightened to specified torque before installing fuel line)
- ❑ Connections must not be damaged
- ❑ Do not alter shape
- ❑ Lubricate thread lightly with engine oil
- ❑ Removing and installing ⇒ “8.3 Removing and installing high-pressure pipe”, page 275

9 - Bolt

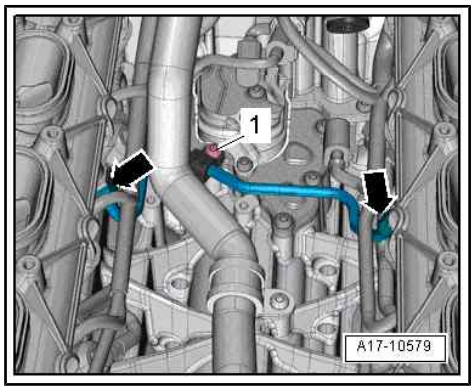
- ❑ 9 Nm

High-pressure pipe - tightening torques

– Tighten each union nut by hand until it makes contact, making sure that high-pressure pipe is not under tension.

– Tighten union nuts -arrows- to 25 Nm; to do so, counterhold at hexagon flats of threaded connection on fuel rail with an open-end spanner.

– Do not tighten bolt -1- for retainer until high-pressure pipe has been tightened; tightening torque ⇒ Item 9 (page 272) .

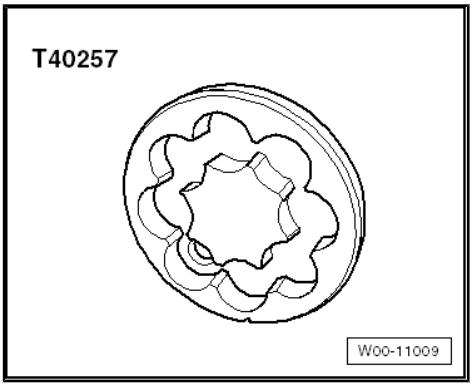


8.2 Removing and installing high-pressure pump

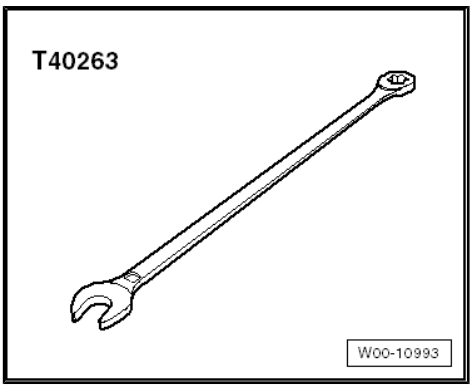
Special tools and workshop equipment required

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- Turning-over tool - T40257-



- Wrench, 21 mm - T40263-



Removing

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WARNING

The fuel system operates at extremely high pressure. This can cause injury.

- ***The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.***

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 235 .

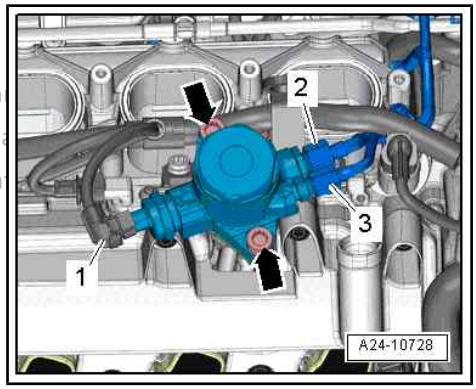
– Remove engine cover panel ⇒ page 64 .

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– Unplug electrical connector -1- for fuel metering valve.

– Detach high-pressure pipes at connections on high-pressure pump. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nuts -2- and -3-.

– Unscrew bolts -arrows- and detach high-pressure pump.



Note

Do not attempt to bend high-pressure pipe to a different shape.

– Pull roller tappet out of cylinder head.

Installing

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

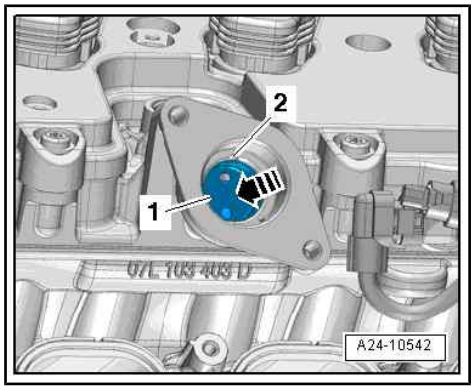
- Tightening torques
⇒ “8.1 Exploded view - high-pressure pump”, page 271

Note

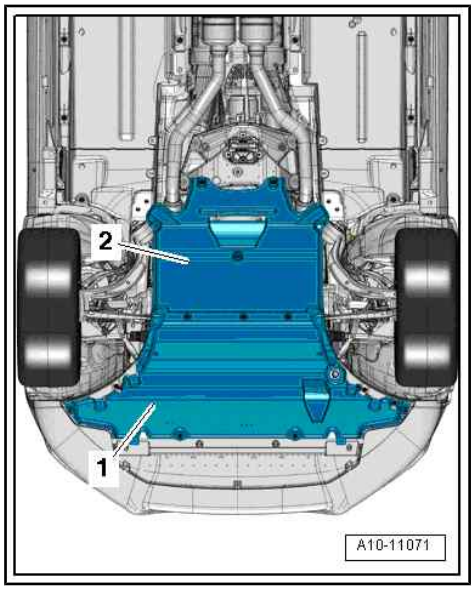
- *Renew O-ring for high-pressure pump.*
- *The connections of the high-pressure pipes must not be damaged.*

– Check roller tappet -1- for damage and renew if necessary.

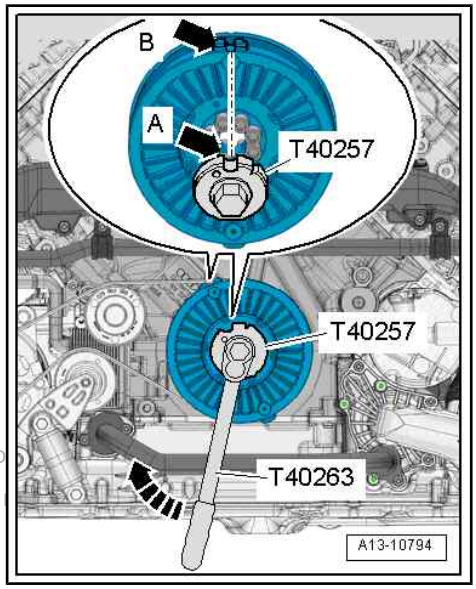
– Lightly lubricate roller tappet with oil and fit in cylinder head so that guide -2- is in correct position -arrow-.



– Remove front noise insulation -1- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



– Fit adapter -T40257- onto wrench -T40263- .
– Position turning-over tool - T40257- on bolts of vibration damper.
• Semi-circular recess -arrow A- on turning-over tool - T40257- must point to semi-circular recess -arrow B- on vibration damper.



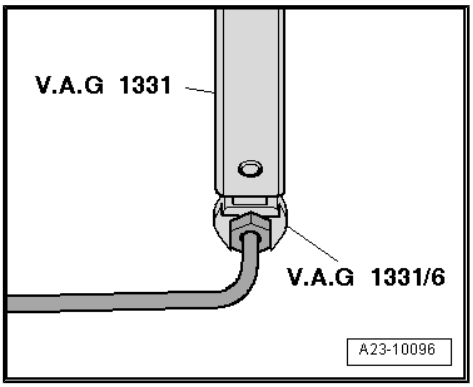
Note

Disregard notch on turning-over tool - T40257- .

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– Rotate crankshaft in direction of engine rotation -arrow- and at the same time press roller tappet into cylinder head until it reaches its lowest point.
– Fit high-pressure pump and press downwards in guide as far as stop.
– Tighten bolts by hand in several stages until they make contact.
– Tighten bolts alternately to specified torque.

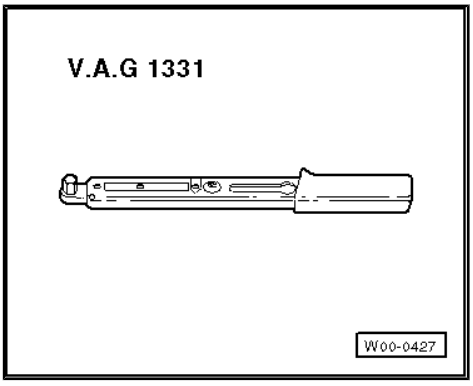
– Lubricate threads of both union nuts lightly with engine oil.
– First tighten union nut by hand until it makes contact, making sure that high-pressure pipe is not under tension.
– Tighten union nut with torque wrench - V.A.G 1331- and open end spanner insert, AF 17 - V.A.G 1331/6- ; to do so, counterhold at hexagon flats of threaded connection on high-pressure pump with an open-end spanner.
– Install engine cover panel ⇒ page 64 .



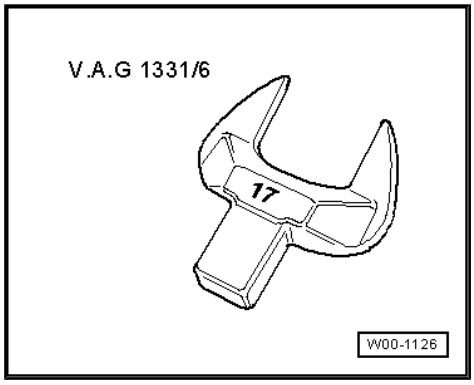
8.3 Removing and installing high-pressure pipe

Special tools and workshop equipment required

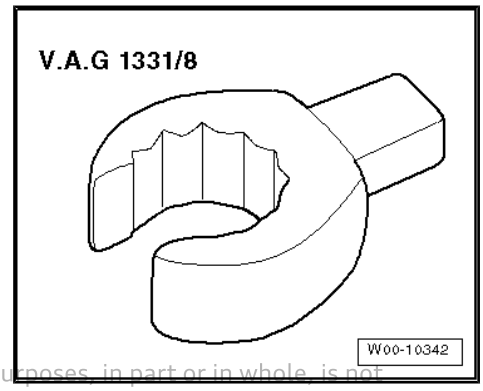
♦ Torque wrench - V.A.G 1331-



- Open end spanner insert, AF 17 - V.A.G 1331/6-



- Socket insert AF 14, flared ring spanner - V.A.G 1331/8-



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Removing

WARNING

The fuel system operates at extremely high pressure. This can cause injury.

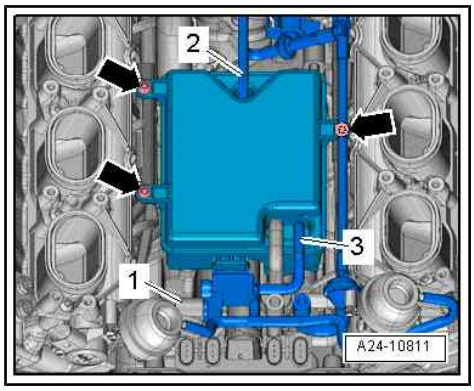
- ***The fuel pressure in the high-pressure section of the injection system must be reduced to a residual pressure prior to opening the system.***

– Reduce fuel pressure in high-pressure section of injection system ⇒ page 235 .

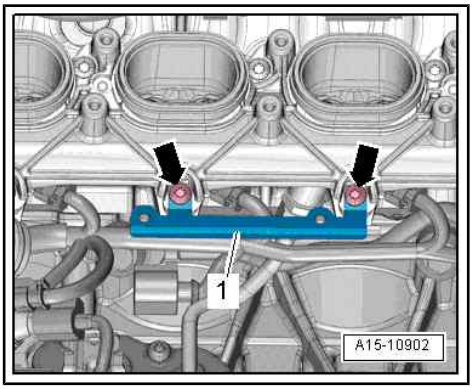
– Remove intake manifold (top section) ⇒ page 253 .

– Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.

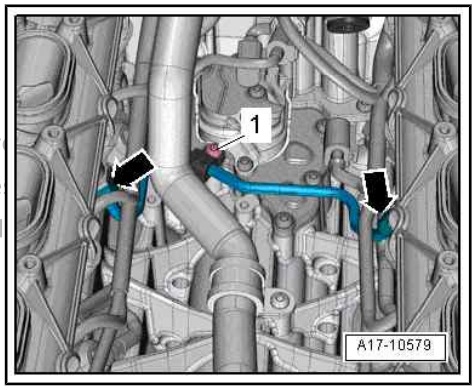
– Remove bolts -arrows- and detach vacuum reservoir.



– Unscrew bolts (left and right) -arrows- and detach bracket -1- for vacuum reservoir.



– Remove bolt -1-.



– Detach high-pressure pipes (left and right) from connections -arrows- on fuel rail. To do so, counterhold at hexagon flats with an open-end spanner and loosen union nut.

– Detach high-pressure pipe.

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Note

Do not attempt to bend high-pressure pipe to a different shape.

Installing

- Tightening torque
⇒ Fig. ““High-pressure pipe - tightening torques”“ , page 272

Note

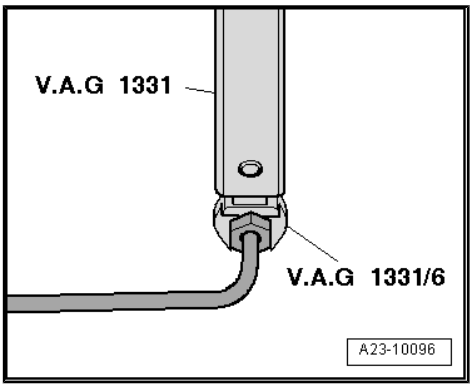
♦ *The connections of the high-pressure pipe must not be damaged.*

♦ *Do not attempt to bend high-pressure pipe to a different shape.*

– Lubricate threads of both union nuts lightly with engine oil.

– Tighten union nuts using torque wrench - V.A.G 1331- and open end spanner insert, AF 17 - V.A.G 1331/6-
⇒ page 272 .

– Install intake manifold (top section) ⇒ page 253 .



9 Lambda probe

⇒ “9.1 Exploded view - Lambda probe”, page 278

⇒ “9.2 Removing and installing Lambda probe”, page 278

9.1 Exploded view - Lambda probe

Note

- *New Lambda probes are coated with an assembly paste.*
- *In the case of a used Lambda probe, coat only the thread with high-temperature paste; refer to ⇒ Electronic parts catalogue for high-temperature paste.*
- *The assembly paste/high-temperature paste must not make contact with the slots on the Lambda probe body.*

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1 - Lambda probe 2 after catalytic converter - G131-

- ❑ With Lambda probe 2 heater after catalytic converter - Z30-
- ❑ Removing and installing ⇒ page 278
- ❑ 55 Nm

2 - Lambda probe 2 - G108-

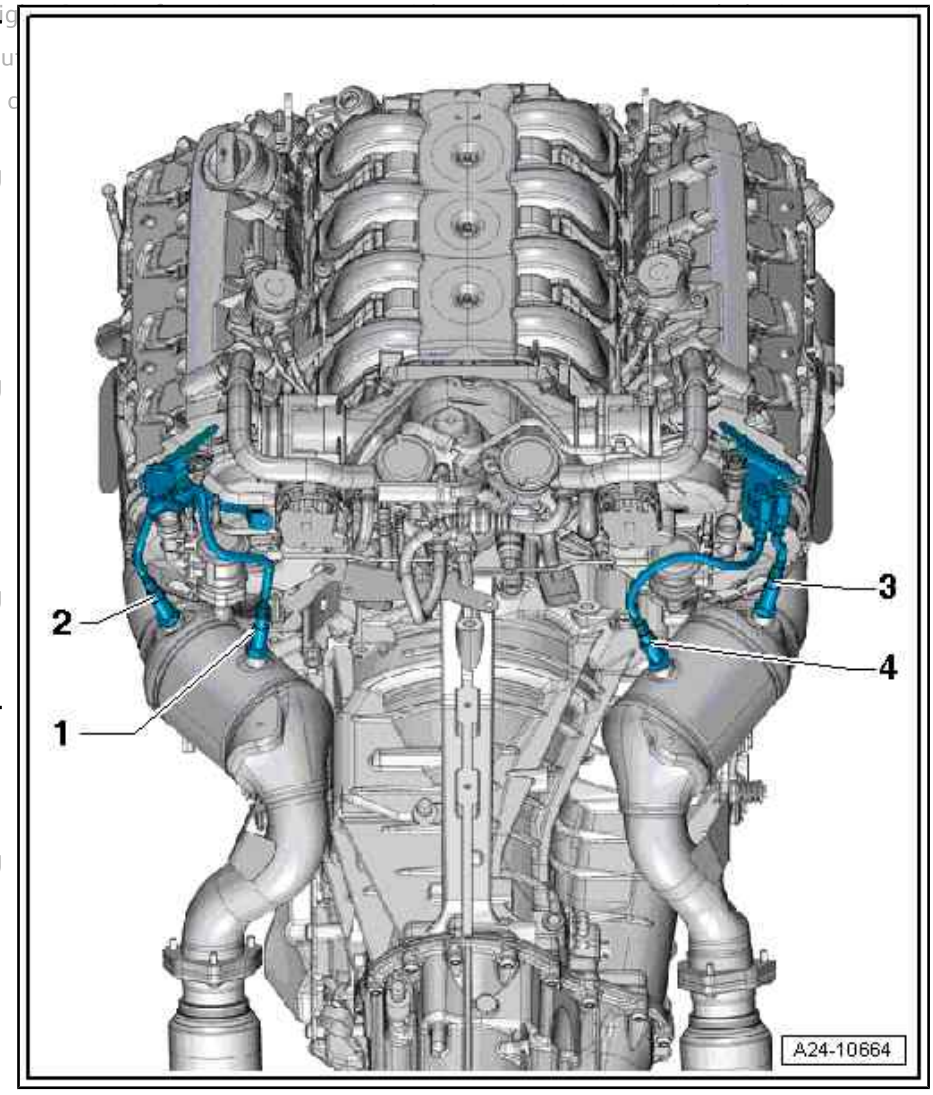
- ❑ With Lambda probe heater 2 - Z28-
- ❑ Removing and installing ⇒ page 278
- ❑ 55 Nm

3 - Lambda probe - G39-

- ❑ With Lambda probe heater - Z19-
- ❑ Removing and installing ⇒ page 278
- ❑ 55 Nm

4 - Lambda probe after catalytic converter - G130-

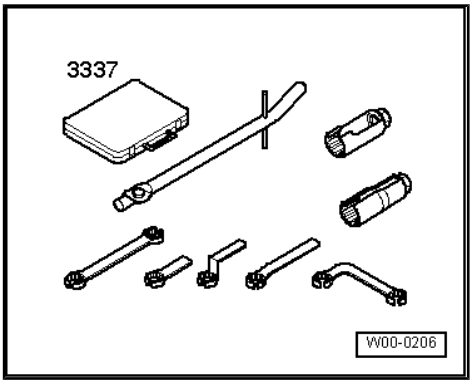
- ❑ With Lambda probe 1 heater after catalytic converter - Z29-
- ❑ Removing and installing ⇒ page 278
- ❑ 55 Nm



9.2 Removing and installing Lambda probe

Special tools and workshop equipment required

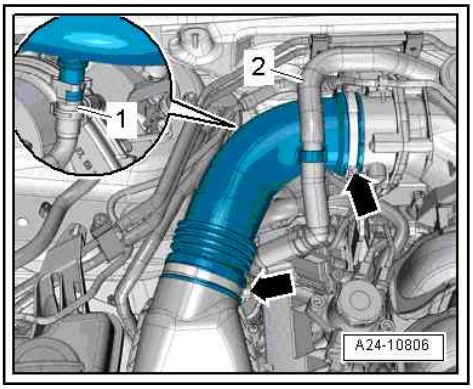
♦ Lambda probe open ring spanner set - 3337-



Removing

– Remove engine cover panel ⇒ page 64 .

Lambda probe - G39- / Lambda probe 2 - G108- before catalytic converter:



Note

The preparations are described for cylinder bank 1 (left-side).

– Move crankcase breather hose -2- clear at air pipe.

Crankcase breather with separate hose:

– Press release tabs and detach crankcase breather hose -1- from air pipe.

– Loosen hose clips -arrows- and detach air pipe.

Crankcase breather with permanently connected hose:

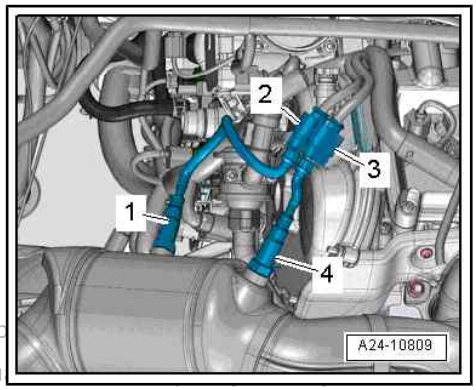
– Remove air pipe; to do so, loosen hose clips -arrows- and move air pipe clear to one side (hose -1- remains connected).

– To remove Lambda probe 2 - G108- , remove throttle valve module 2 - J544- as well ⇒ page 259 .

Lambda probe after catalytic converter - G130- / Lambda probe 2 after catalytic converter - G131- :

– Remove corresponding throttle valve module ⇒ page 259 .

Continued for cylinder bank 1 (right-side):



– Detach electrical connectors from bracket and unplug.

2 - For Lambda probe after catalytic converter - G130-

3 - For Lambda probe - G39-

– Unscrew Lambda probe using a tool from Lambda probe open ring spanner set - 3337- :

1 - Lambda probe after catalytic converter - G130-

4 - Lambda probe - G39-

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Note

For illustration purposes, the installation position is shown with the engine removed.

Continued for cylinder bank 2 (left-side):

– Detach electrical connectors from bracket and unplug.

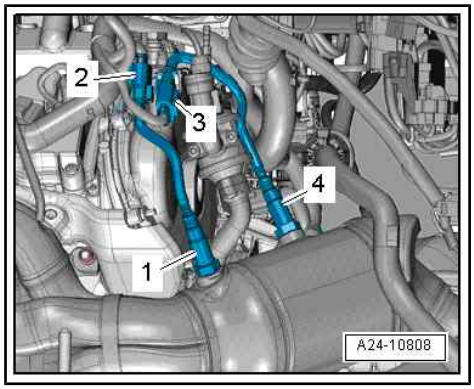
2 - For Lambda probe 2 - G108-

3 - For Lambda probe 2 after catalytic converter - G131-

– Unscrew Lambda probe using ring spanner -3337/7- :

1 - Lambda probe 2 - G108-

4 - Lambda probe 2 after catalytic converter - G131-



Note

For illustration purposes, the installation position is shown with the engine removed.

Installing

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

- Tightening torques
  ⇒ “9.1 Exploded view - Lambda probe”, page 278

Note

- *New Lambda probes are coated with an assembly paste.*
- *In the case of a used Lambda probe, coat only the thread with high-temperature paste; refer to ⇒ Parts catalogue for high-temperature paste.*
- *The assembly paste/high-temperature paste must not make contact with the slots on the Lambda probe body.*
- *When installing, the Lambda probe wire must always be reattached at the same locations to prevent it from coming into contact with the exhaust pipe.*

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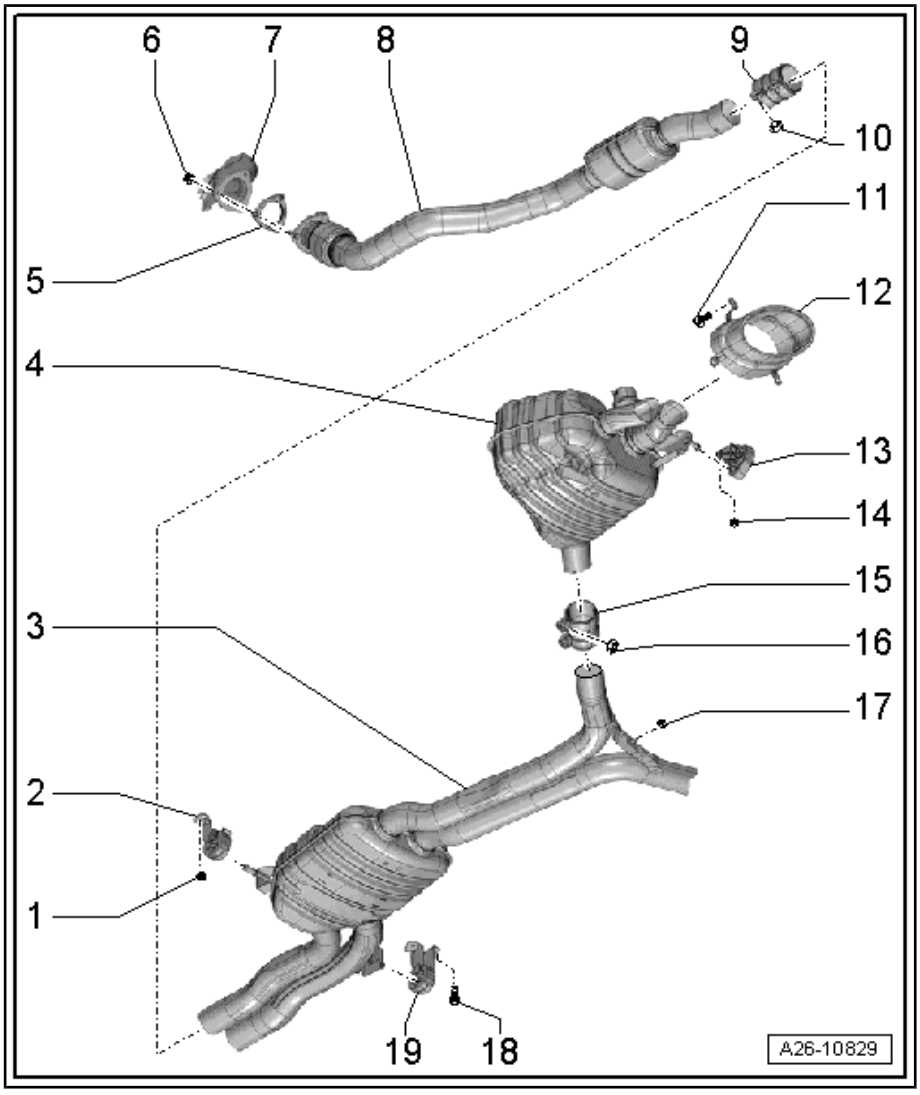
26 – Exhaust system

1 Exhaust pipes/silencers

⇒ “1.1 Exploded view - silencers”, page 281
⇒ “1.2 Separating exhaust pipes/silencers”, page 283
⇒ “1.3 Removing and installing front silencers”, page 284
⇒ “1.4 Stress-free alignment of exhaust system”, page 286
⇒ “1.5 Aligning tailpipes”, page 287
⇒ “1.6 Checking exhaust system for leaks”, page 287
⇒ “1.7 Checking function of exhaust flap”, page 288

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1.1 Exploded view - silencers



1 - Nut

- ❑ 20 Nm

2 - Mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ “1.4 Stress-free alignment of exhaust system”, page 286

3 - Centre silencer

- ❑ Combined in one unit with rear silencers as original equipment. Can be renewed separately for repair purposes
- ❑ Cutting point ⇒ page 283
- ❑ Align exhaust system so it is free of stress ⇒ page 286

4 - Rear silencer

- ❑ With exhaust flap
- ❑ Checking vacuum unit for exhaust flap ⇒ page 288
- ❑ Combined as one unit with centre silencer as original equipment
- ❑ Centre silencer and rear silencer can be renewed separately
- ❑ Cutting point between centre silencer and rear silencer ⇒ page 283
- ❑ Align exhaust system so it is free of stress ⇒ page 286

5 - Gasket

- ❑ Renew

6 - Nut

- ❑ Renew

- ❑ Coat threads with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 23 Nm

7 - Exhaust manifold

- ❑ With catalytic converter

8 - Front silencer

- ❑ With flexible joint; do not bend flexible joint more than 10° – otherwise it can be damaged
- ❑ Removing and installing ⇒ page 284
- ❑ Align exhaust system so it is free of stress ⇒ page 286

9 - Clamp (front)

- ❑ Installation position ⇒ page 283
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 286
- ❑ Tighten bolted connections evenly

10 - Nut

- ❑ 23 Nm

11 - Bolt

- ❑ Tightening torque ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (rear); Exploded view - bumper cover

12 - Trim

- ❑ For tailpipe

13 - Mounting

- ❑ Renew if damaged
- ❑ Check preload ⇒ “1.4 Stress-free alignment of exhaust system”, page 286

14 - Nut

- ❑ 20 Nm

15 - Clamp (rear)

- ❑ For separate replacement of centre and rear silencers
- ❑ Installation position ⇒ page 283
- ❑ Before tightening, align exhaust system so it is free of stress ⇒ page 286
- ❑ Tighten bolted connections evenly

16 - Nut

- ❑ 23 Nm

17 - Nut

- ❑ 23 Nm

18 - Bolt

- ❑ 20 Nm

19 - Mounting

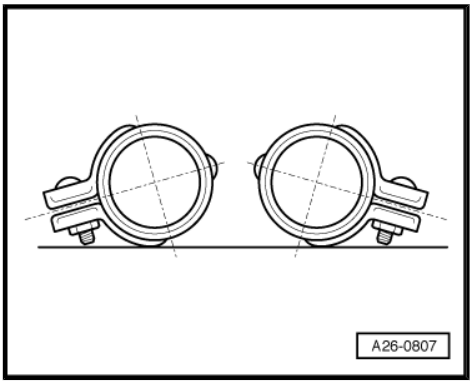
- ❑ Renew if damaged
- ❑ Check preload ⇒ “1.4 Stress-free alignment of exhaust system”, page 286

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Installation position of front clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

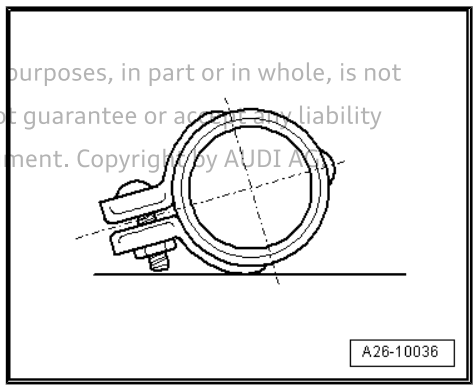
• Installation position: bolted connections face outwards.



Installation position of rear clamps

– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Installation position: bolted connections face forwards.



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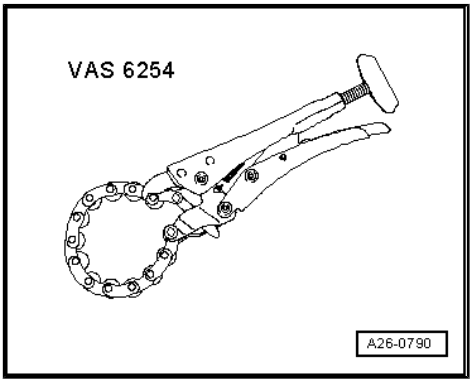
1.2 Separating exhaust pipes/silencers

♦ The connecting pipe can be cut through at the cutting point in order to renew the centre or rear silencer separately.

♦ The cutting point is marked by an indentation on the circumference of the exhaust pipe.

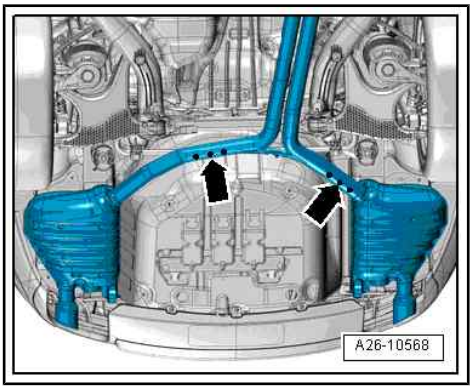
Special tools and workshop equipment required

♦ Chain pipe cutter - VAS 6254-

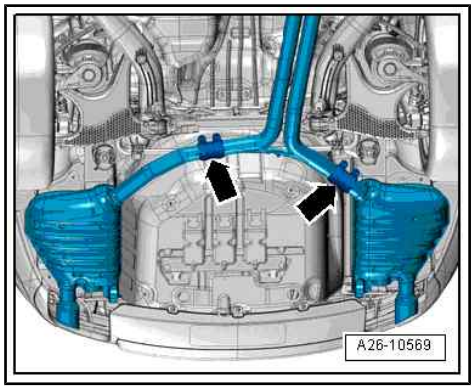


Procedure

– Cut through exhaust pipes at right angles at the positions marked -arrows- using chain pipe cutter - VAS 6254- .



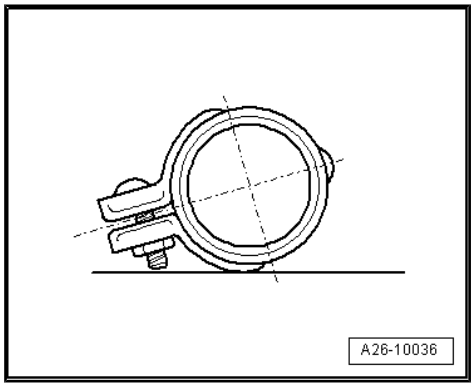
– Position centre of clamps -arrows- over cutting location.



– Install clamps so that the bolt ends do not protrude beyond bottom of clamp.

• Installation position: bolted connections face forwards.

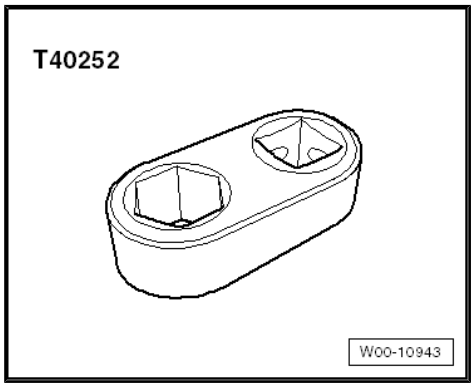
– Align the exhaust system so it is free of stress ⇒ page 286 .



1.3 Removing and installing front silencers

Special tools and workshop equipment required

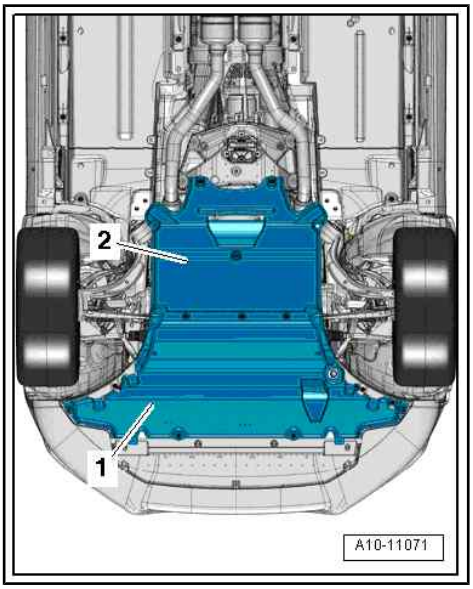
◆ Special tool -T40252-



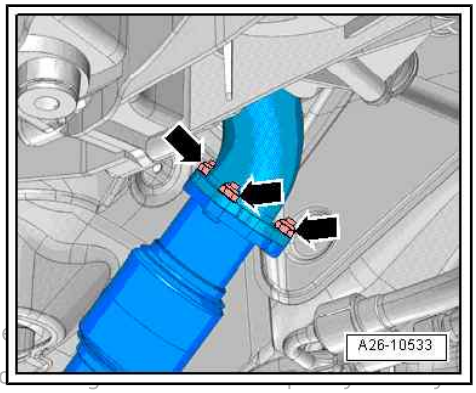
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Removing

– Remove rear noise insulation -2- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

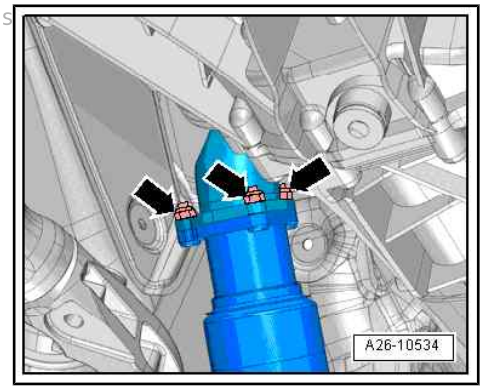


– Unscrew nuts -arrows- for front silencer (left-side) using -T40252- .



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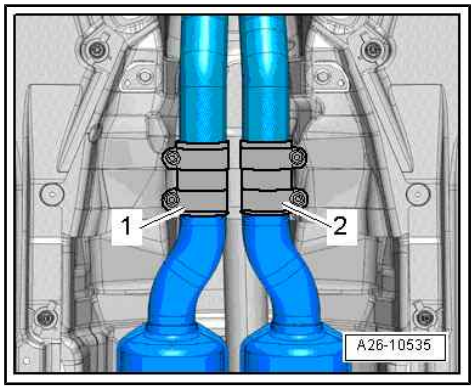
– Unscrew nuts -arrows- for front silencer (right-side) using -T40252- .



Caution

Risk of damage to flexible joints in front silencer.

- *Do NOT bend the flexible joints in the front silencer more than 10°.*



– Release and push back clamp -1- or -2- and detach relevant front silencer.

Installing

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

- Tightening torques
⇒ “1.1 Exploded view - silencers”, page 281

Note

Renew seals, gaskets and self-locking nuts.

– Align the exhaust system so it is free of stress ⇒ page 286 .

– Install noise insulation (rear) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

1.4 Stress-free alignment of exhaust system

Procedure

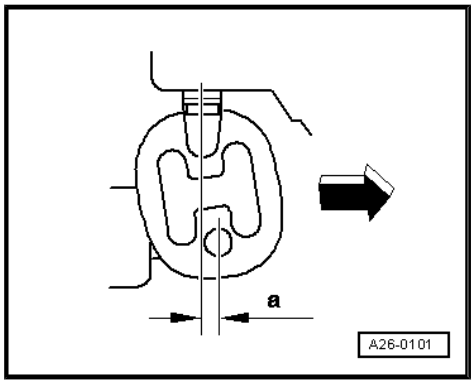
- The exhaust system must be aligned when it is cool.
- Tightening torques
⇒ “1.1 Exploded view - silencers”, page 281

Vehicles without clamps between centre silencer and rear silencers

– Loosen bolted connections on front clamps.

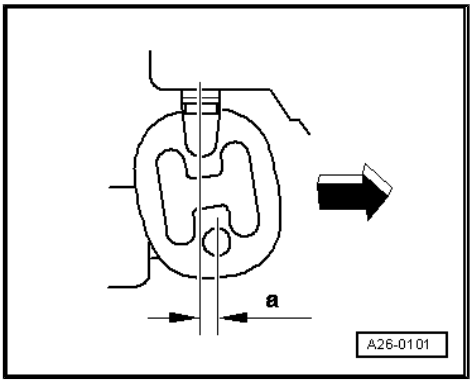
– Push exhaust system towards front of vehicle -arrow- until mountings in front of centre silencer are preloaded by -a- = 6 ... 10 mm.

– Tighten bolted connections on clamps evenly.



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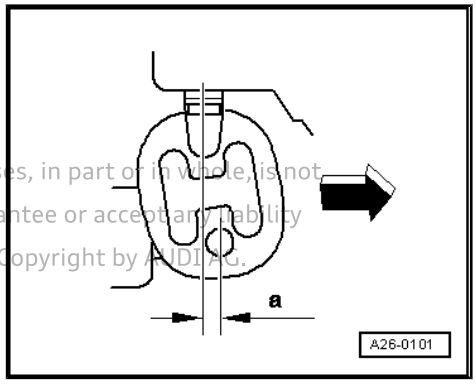
Vehicles with clamps between centre silencer and rear silencers



Note

On a vehicle with clamps fitted between the centre silencer and rear silencers, it is also necessary to align the centre silencer.

– Loosen bolted connections on front and rear clamps.
– Push exhaust system towards front of vehicle -arrow- until mountings in front of centre silencer are preloaded by -a- = 6 ... 10 mm.
– Tighten bolted connections on front clamps evenly.



– Push rear section of exhaust system towards front of vehicle -arrow-, so that mountings (rear) for rear silencers are preloaded by -a- = 11 ... 15 mm.
– Align rear silencer so it is horizontal.
– Tighten bolted connections on rear clamps evenly.

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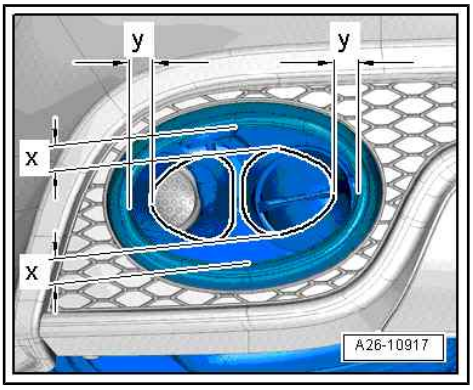
1.5 Aligning tailpipes

Procedure

- Tightening torque
⇒ “1.1 Exploded view - silencers”, page 281

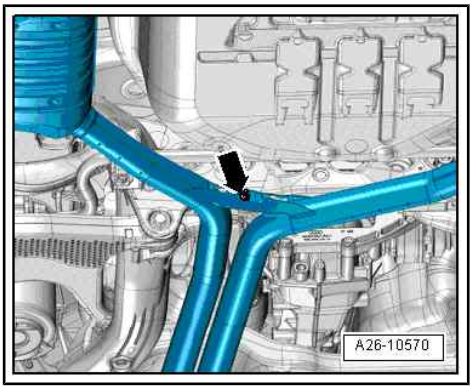
– Check clearance between tailpipes and bumper on both sides:

- Dimension -x- is the same at top and bottom.
- Distance -y- is the same on both sides.



If necessary, correct dimension -y- as follows:

– Loosen connection -arrow- on strut between exhaust pipes.
– Adjust the distance between the rear silencers.
– If necessary, check whether the exhaust system is aligned free of stress ⇒ page 286 .



1.6 Checking exhaust system for leaks

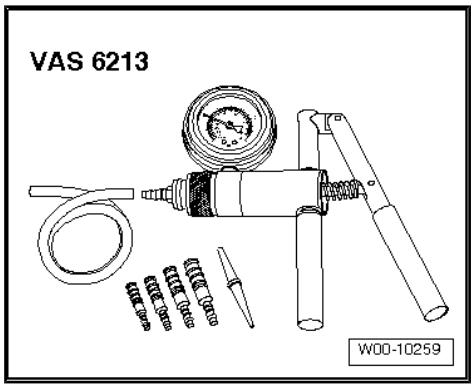
– Start the engine and run at idling speed.
– Plug tailpipes during leak test (e.g. with cloth or plugs).

– Listen for noise at connections between cylinder head/exhaust manifold, catalytic converter/front silencer, etc. to locate any leaks.
– Rectify any leaks that are found.

1.7 Checking function of exhaust flap

Special tools and workshop equipment required

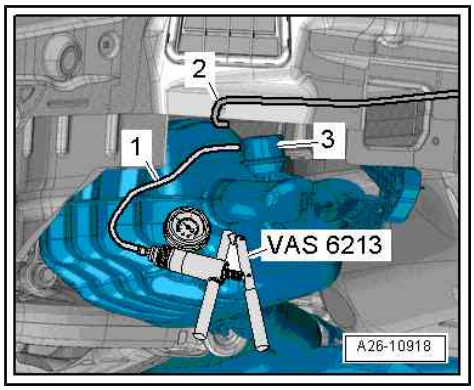
♦ Hand vacuum pump - VAS 6213-



Procedure

- Vacuum hoses and hose connections do not leak.
- Vacuum hoses are not clogged.

– Detach vacuum hose -2- from vacuum unit for exhaust flap at rear silencer.
– Connect hand vacuum pump - VAS 6213- to vacuum unit using auxiliary hose, as shown in illustration.



Note

The illustration shows the exhaust flap on the left side.

– Operate hand vacuum pump to produce a vacuum.
- The exhaust flap should close.
– Vent vacuum pump.
- The exhaust flap should open.
– If exhaust flap does not move, check linkage for ease of movement and check vacuum unit for leaks.

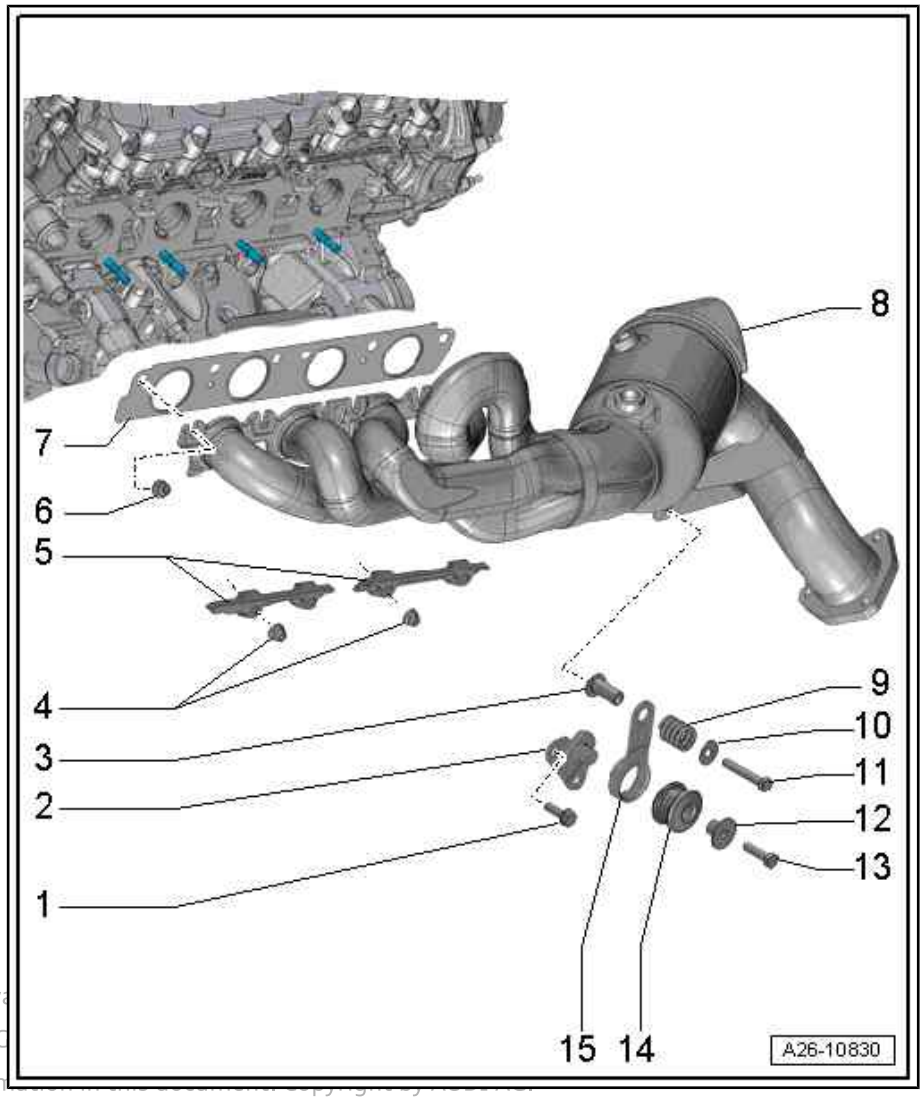
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2 Exhaust manifold

⇒ "2.1 Exploded view - exhaust manifold", page 289

⇒ "2.2 Removing and installing exhaust manifold", page 290

2.1 Exploded view - exhaust manifold



1 - Bolt
- ❑ 23 Nm

2 - Bracket

3 - Spacer sleeve

4 - Nuts
- ❑ Renew
- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ 25 Nm

5 - Mounting strips
- ❑ Remain installed when exhaust manifold is removed

6 - Nut
- ❑ Renew
- ❑ Coat thread with high-temperature paste; for high-temperature paste refer to ⇒ Electronic parts catalogue
- ❑ Tightening torque and tightening sequence: exhaust manifold (left-side) ⇒ page 290 ; exhaust manifold (right-side) ⇒ page 290

7 - Gasket
- ❑ Renew

8 - Exhaust manifold
- ❑ With catalytic converter
- ❑ Removing and installing ⇒ page 290

9 - Compression spring

10 - Washer

11 - Bolt
- ❑ 23 Nm

12 - Spacer sleeve

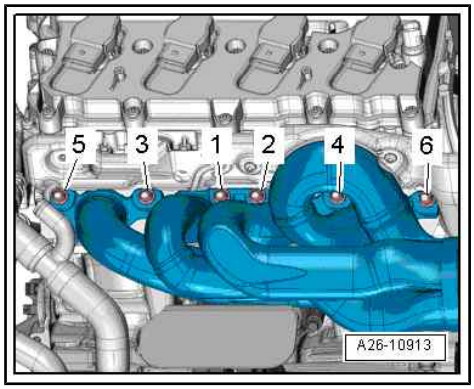
13 - Bolt
- ❑ 23 Nm

14 - Buffer

15 - Bracket

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Exhaust manifold (left-side) - tightening torque and sequence



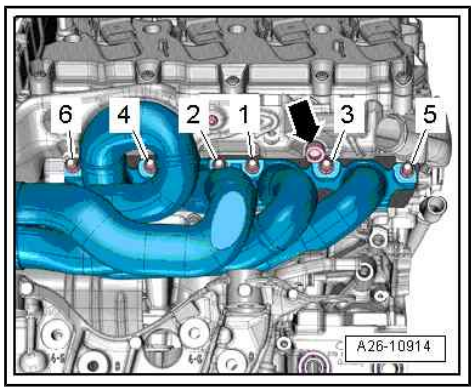
Note

- *Renew nuts for exhaust manifold.*
- *Coat threads of nuts with high-temperature paste; for high temperature paste refer to ⇒ Electronic parts catalogue .*

– Tighten nuts in 3 stages in the sequence shown:

Stage	Nuts	Tightening torque
1.	-1 … 6-	Screw in by hand until contact is made
2.	-1 … 6-	20 Nm
3.	-1 … 6-	30 Nm

Exhaust manifold (right-side) - tightening torque and sequence



Note

- *Renew nuts for exhaust manifold.*
- *Coat threads of nuts with high-temperature paste; for high temperature paste refer to ⇒ Electronic parts catalogue .*

– Tighten nuts in 3 stages in the sequence shown:

Stage	Nuts	Tightening torque
1.	-1 … 6-	Screw in by hand until contact is made
2.	-1 … 6-	20 Nm
3.	-1 … 6-	30 Nm

2.2 Removing and installing exhaust manifold

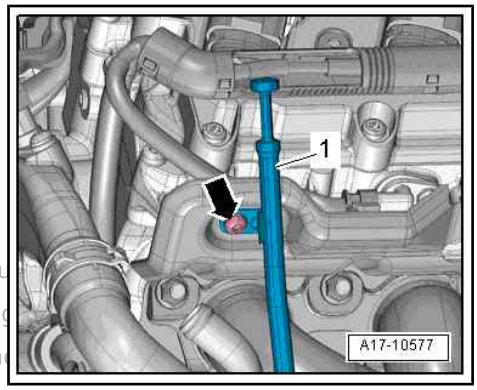
Removing

- Engine/gearbox assembly removed and secured to scissor-type assembly platform - VAS 6131 A-

– Remove front silencer ⇒ page 284 .

Exhaust manifold (left-side):

– Remove bolt -1- and pull out guide tube for oil dipstick.



Note

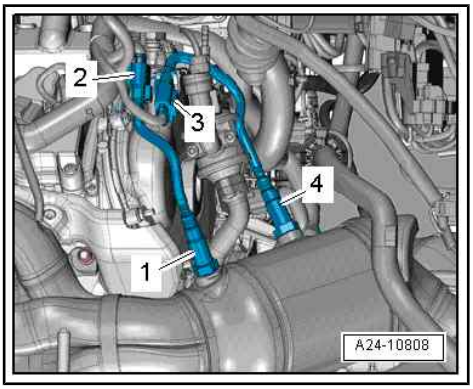
Disregard -arrow-.

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

2 - For Lambda probe 2 - G108-

3 - For Lambda probe 2 after catalytic converter - G131-



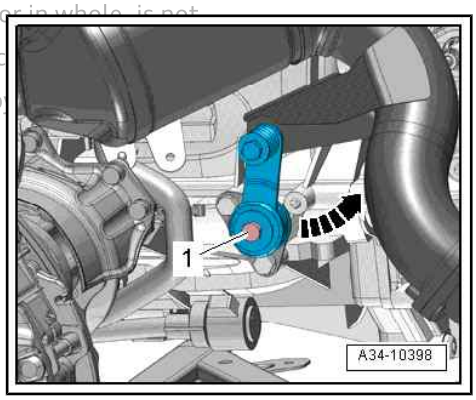
Note

Disregard items -1 and 4-.

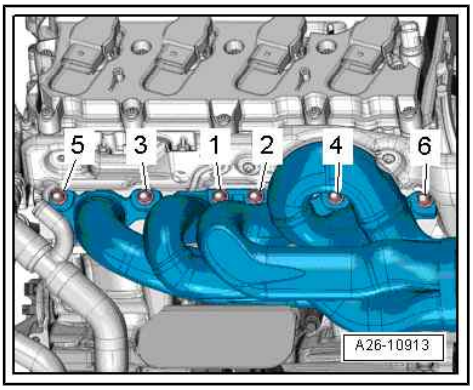
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– Remove bolt -1-.

– Press bracket off gearbox and swivel to rear -arrow-.



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

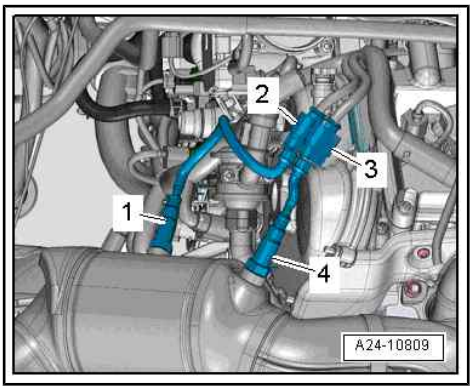


Exhaust manifold (right-side):

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

2 - For Lambda probe after catalytic converter - G130-

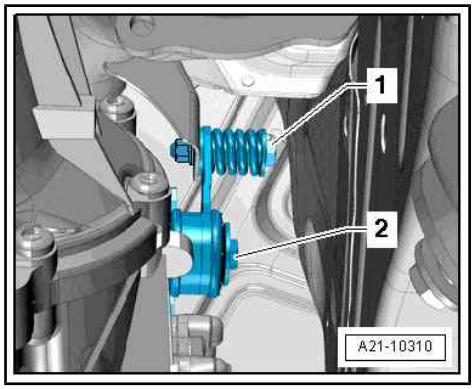
3 - For Lambda probe - G39-



Note

Disregard items -1 and 4-.

– Remove bolt -1-.

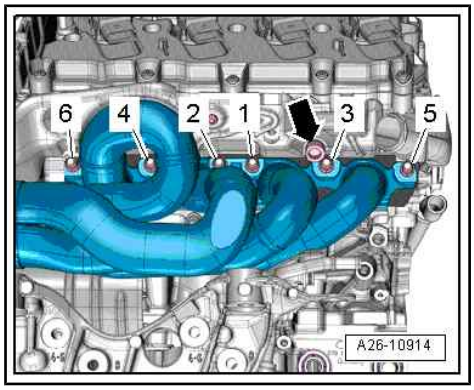


– Remove bolt -arrow-.

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

Both sides (continued):

– Unscrew nuts, detach exhaust manifold with catalytic converter from mounting strips and remove.



Note

Mounting strips remain installed.

Installing

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

Tightening torques

- ⇒ Fig. ""Exhaust manifold (left-side) - tightening torque and sequence"" , page 290
- ⇒ Fig. ""Exhaust manifold (left-side) - tightening torque and sequence"" , page 290

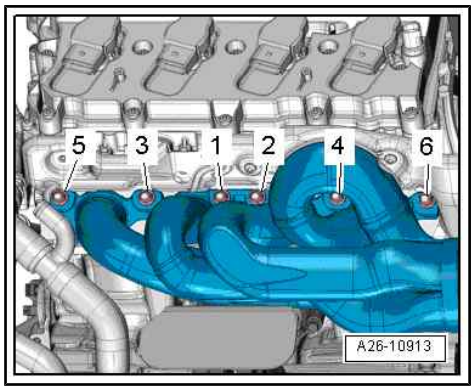
Note

- *Renew gasket and nuts.*
- *Coat threads of nuts with high-temperature paste; for high temperature paste refer to ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

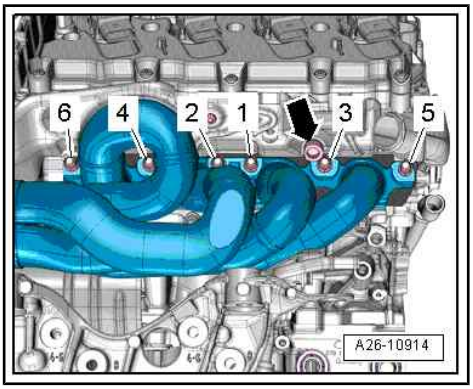
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– Fit gasket onto studs.

– Fit exhaust manifold (left-side) with catalytic converter in mounting strips and tighten nuts ⇒ page 290 .



– Fit exhaust manifold (right-side) with catalytic converter in mounting strips and tighten nuts ⇒ page 290 .
– Install dipstick guide tube ⇒ page 76 .
– Install front silencers ⇒ page 284 .



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3 Secondary air system

⇒ “3.1 Exploded view - secondary air system”, page 294

⇒ “3.2 Removing and installing secondary air pump V101 / V189 ”, page 296

⇒ “3.3 Removing and installing combination valve”, page 297

⇒ “3.4 Checking combination valve for correct operation and leaks”, page 298

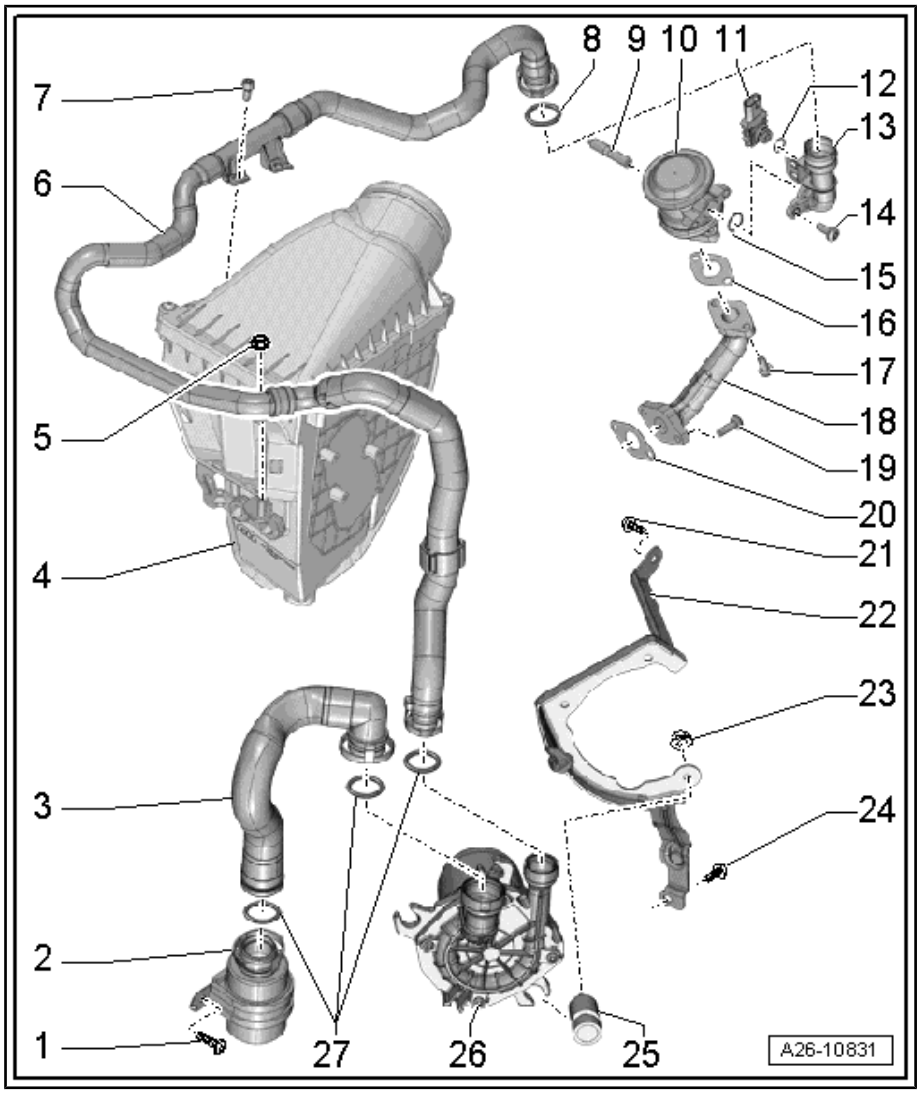
⇒ “3.5 Removing and installing senders for secondary air pressure G609 / G610 ”, page 300

3.1 Exploded view - secondary air system

Note

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Illustration shows fitting location of secondary air system (left-side) on an Audi RS 4/RS 5 Coupé.



1 - Bolt
- ❑ 9 Nm

2 - Air cleaner
- ❑ For secondary air pump

3 - Hose
- ❑ For secondary air

4 - Air cleaner housing

5 - Nut
- ❑ 9 Nm

6 - Hose
- ❑ For secondary air

7 - Bolt
- ❑ 5 Nm

8 - O-ring
- ❑ Renew

9 - Vacuum hose

10 - Combination valve for secondary air system (left-side)
- ❑ Symmetrically reversed on right side
- ❑ Fitting location: at rear of cylinder head
- ❑ Checking ⇒ page 298
- ❑ Removing and installing ⇒ page 297

11 - Sender for secondary air pressure
- ❑ Cylinder bank 1 (right-side) sender 1 for secondary air pressure - G609-
- ❑ Cylinder bank 2 (left-side) sender 2 for secondary air pressure - G610-
- ❑ Removing and installing ⇒ page 300

12 - O-ring
- ❑ Renew

13 - Connection

14 - Bolt
- ❑ 5 Nm

15 - O-ring
- ❑ Renew

16 - Gasket
- ❑ Renew

17 - Bolt
- ❑ 9 Nm

18 - Connecting pipe
- ❑ To cylinder head (left-side)

19 - Bolt
- ❑ 9 Nm

20 - Gasket
- ❑ Renew

21 - Bolt
- ❑ 9 Nm

22 - Bracket
- ❑ For secondary air pump

23 - Nut
- ❑ 9 Nm

24 - Bolt
- ❑ 9 Nm

25 - Bonded rubber bush

26 - Secondary air pump
- ❑ Cylinder bank 1 (right-side): secondary air pump motor - V101-
- ❑ Cylinder bank 2 (left-side): secondary air pump motor 2 - V189-
- ❑ Fitting location: behind auxiliary radiator
- ❑ Removing and installing ⇒ page 296
- ❑ Check in `Guided Fault Finding` ⇒ Vehicle diagnostic tester

27 - O-rings
- ❑ Renew

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3.2 Removing and installing secondary air pump -V101- / -V189-

⇒ “3.2.1 Removing and installing secondary air pump V101 / V189 - Audi RS 4/RS 5”, page 296

⇒ “3.2.2 Removing and installing secondary air pump V101 - Audi RS 5 Cabriolet”, page 297

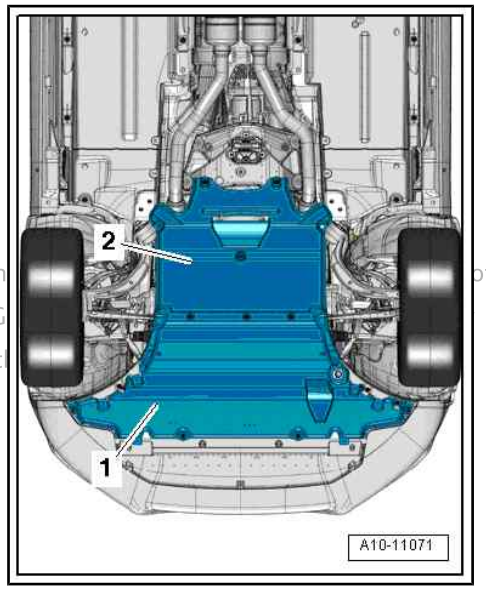
3.2.1 Removing and installing secondary air pump -V101- / -V189- - Audi RS 4/RS 5

Removing

– Remove front noise insulation -1- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

– To remove secondary air pump, remove wheel housing liner (front left) ⇒ General body repairs, exterior; Rep. gr. 66 ; Wheel housing liners; Exploded view - wheel housing liner (front) .

– Remove auxiliary radiator (right-side) prior to removing secondary air pump (right-side) ⇒ page 227 .

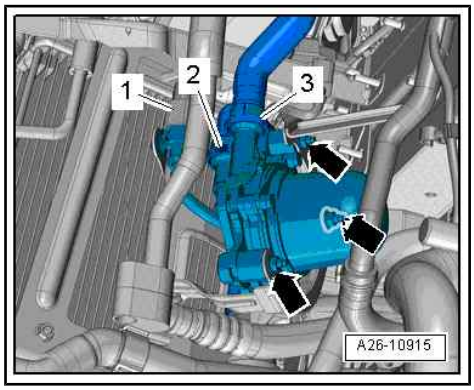


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– Unplug electrical connector -1- at secondary air pump motor.

– Press release tabs and detach secondary air hoses -2- and -3-.

– Remove nuts -arrows- and detach secondary air pump.



Installing

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

- Tightening torques
  ⇒ “3.1 Exploded view - secondary air system”, page 294

Note

- *Renew gasket and O-ring.*
- *Fit all cable ties in the original positions when installing.*

– Install auxiliary radiator ⇒ page 227 .

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

– Install noise insulation (front) ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .

3.2.2 Removing and installing secondary air pump -V101- - Audi RS 5 Cabriolet

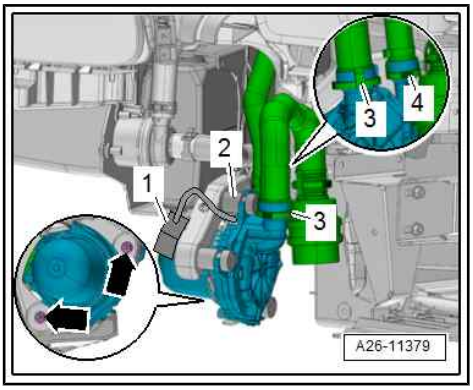
Removing

– Remove bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Removing and installing bumper cover .

– Move clear and unplug electrical connector -1-.

– Press release tabs and disconnect secondary air hoses -3, 4-.

– Remove nuts -arrows- and detach secondary air pump motor - V101- from bonded rubber bush -2-.



Installing

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

- Tightening torques
⇒ “3.1 Exploded view - secondary air system”, page 294

Note

Renew gasket and O-rings.

– Install bumper cover (front) ⇒ General body repairs, exterior; Rep. gr. 63 ; Bumper (front); Exploded view - bumper cover .

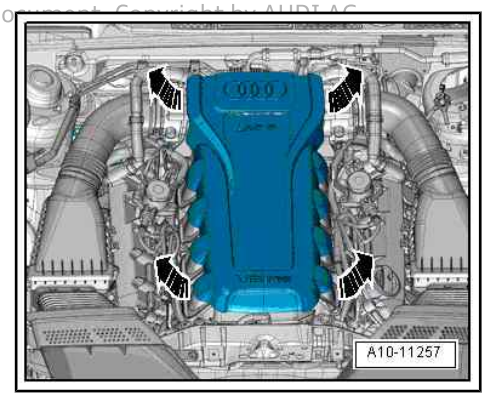
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3.3 Removing and installing combination valve

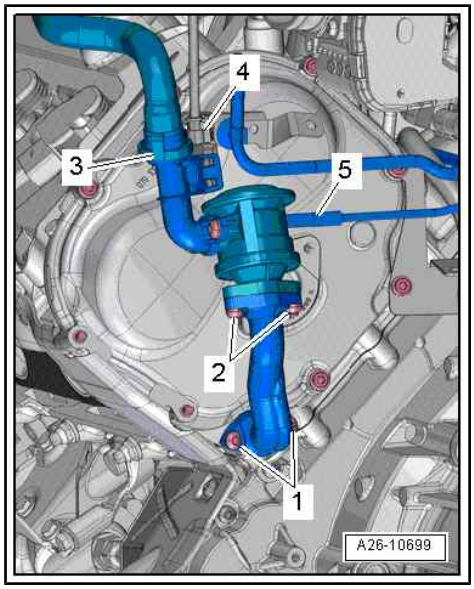
Removing

– Remove engine cover panel -arrows-.

– Remove plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .



– Unplug electrical connector -4-.
– Disconnect vacuum hose -5-.
– Press release tabs and disconnect secondary air hose -3-.
– Unscrew bolts -2- and detach combination valve for secondary air system.



Note

- *Disregard -item 1-.*
- *For illustration purposes, the installation position is shown from the rear and with the engine removed.*

Installing

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

- Tightening torques
  ⇒ "3.1 Exploded view - secondary air system", page 294

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Note

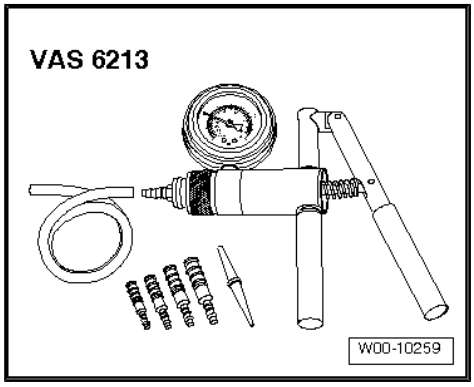
- *Renew gaskets and O-rings.*
- *Secure all hose connections with the correct type of hose clips (same as original equipment) ⇒ Electronic parts catalogue .*
- *Fit all cable ties in the original positions when installing.*

– Install plenum chamber partition panel ⇒ General body repairs, exterior; Rep. gr. 50 ; Bulkhead; Exploded view - plenum chamber partition panel .

3.4 Checking combination valve for correct operation and leaks

Special tools and workshop equipment required

- Hand vacuum pump - VAS 6213-



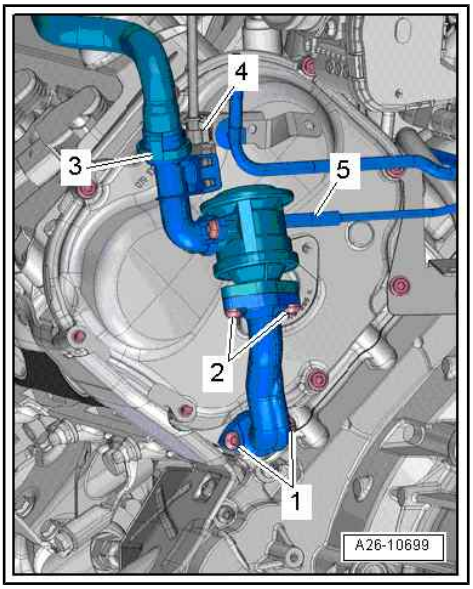
Procedure

- Vacuum hoses and hose connections do not leak.
- Vacuum hoses are not clogged.

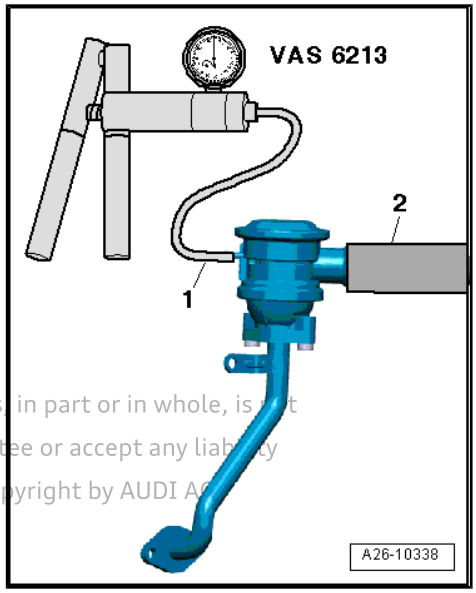
– Remove corresponding throttle valve module ⇒ page 259 .

Note

The illustration shows the combination valve (left side).



– Detach vacuum hose -5- from combination valve to be checked.
– Press release tabs and disconnect secondary air hose -3-.



– Connect hand vacuum pump - VAS 6213- to vacuum connection -1- of combination valve to be checked.
– Connect test hose -2- to combination valve for secondary air system.
– Blow lightly into test hose with your mouth (do not use compressed air).

• The combination valve for secondary air system should be closed; it should not be possible to blow through the hose.

– Operate hand vacuum pump.

• The combination valve for secondary air system should open; it should now be possible to blow through the hose.

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Note

Disregard -items 1, 2, 4-.

– Renew combination valve for secondary air system if it does not open ⇒ page 297 .

Assembling

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

Note

Fit new O-ring.

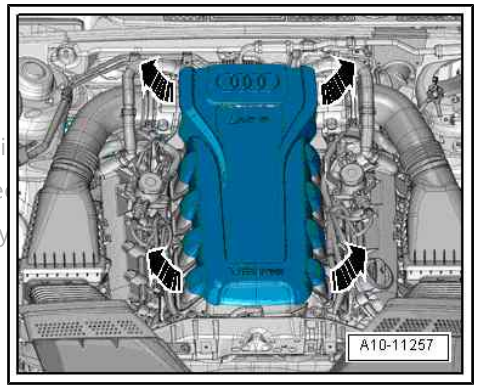
– Install throttle valve module ⇒ page 259 .

3.5 Removing and installing senders for secondary air pressure -G609- / -G610-

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Removing

– Remove engine cover panel -arrows-.

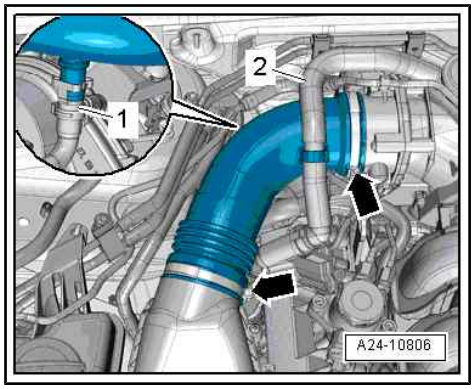


Crankcase breather with separate hose:

– Press release tabs and detach crankcase breather hose -1- from air pipe.

– Move crankcase breather hose -2- clear at air pipe.

– Loosen hose clips -arrows- and detach air pipe.



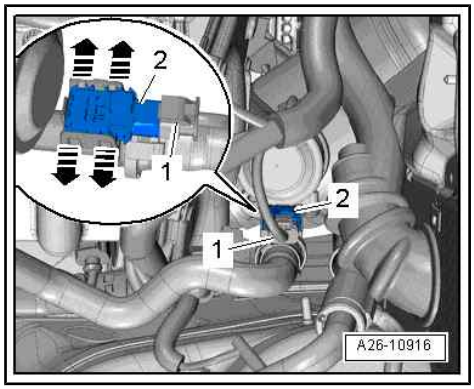
Cylinder bank 2 (left-side), crankcase breather with permanently connected hose:

– Remove throttle valve module 2 - J544- ⇒ page 259 .

All vehicles (continued):

– Unplug electrical connector -1-.

– Release catches -arrows- and detach sender for secondary air pressure -2-.



Installing

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

Note

Fit new O-ring.

– Install throttle valve module 2 - J544- ⇒ page 259 .

28 – Ignition system

1 Ignition system

⇒ “1.1 Exploded view - ignition system”, page 301

⇒ “1.2 Test data - spark plugs”, page 302

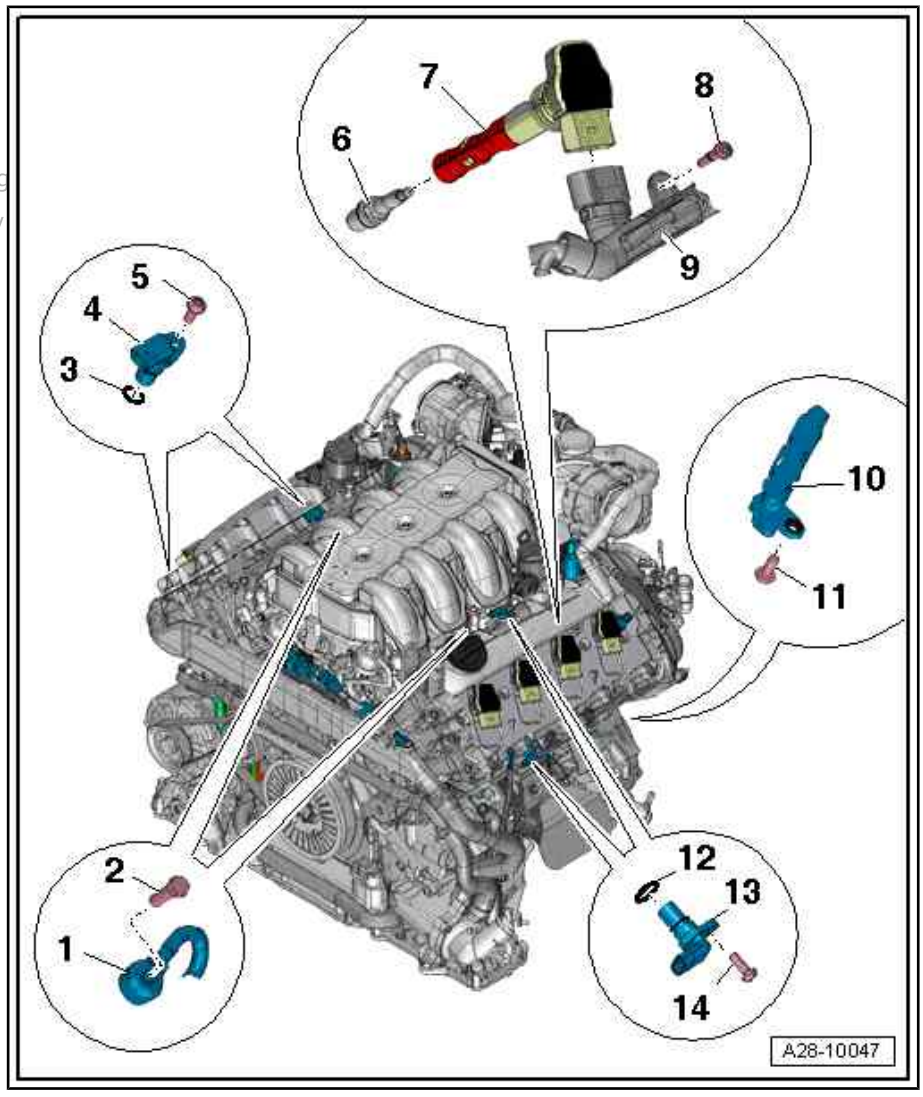
⇒ “1.3 Removing and installing ignition coils”, page 302

⇒ “1.4 Removing and installing knock sensor”, page 304

⇒ “1.5 Removing and installing Hall senders”, page 305

⇒ “1.6 Removing and installing engine speed sender G28 ”, page 306

1.1 Exploded view - ignition system



1 - Knock sensor

- ❑ Cylinder bank 1 (right-side): knock sensor 1 - G61- , knock sensor 3 - G198-
- ❑ Cylinder bank 2 (left-side): knock sensor 2 - G66- , knock sensor 4 - G199-
- ❑ Removing and installing ⇒ page 304

2 - Bolt

- ❑ 20 Nm

3 - O-ring

- ❑ Renew

4 - Hall sender

- ❑ Cylinder bank 1 (right-side)
- ❑ Inlet side: Hall sender - G40-
- ❑ Removing and installing Hall sender (inlet side) ⇒ page 305
- ❑ Exhaust side: Hall sender 3 - G300-
- ❑ Removing and installing Hall sender (exhaust side) ⇒ page 305

5 - Bolt

- ❑ 9 Nm

6 - Spark plug

- ❑ Change interval ⇒ Maintenance tables
- ❑ Tightening torque ⇒ Maintenance ; Booklet 811 , ⇒ Maintenance ; Booklet 812 or ⇒ Maintenance ; Booklet 818

7 - Ignition coil

- ❑ Removing and installing ⇒ page 302

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8 - Bolt

- ❑ 5 Nm

9 - Electrical wiring harness

10 - Engine speed sender - G28-

- ❑ Removing and installing ⇒ page 306

11 - Bolt

- ❑ 9 Nm

12 - O-ring

- ❑ Renew

13 - Hall sender

- ❑ Cylinder bank 2 (left-side)
- ❑ Inlet side: Hall sender 2 - G163-
- ❑ Removing and installing Hall sender (inlet side) ⇒ page 305
- ❑ Exhaust side: Hall sender 4 - G301-
- ❑ Removing and installing Hall sender (exhaust side) ⇒ page 305

14 - Bolt

- ❑ 9 Nm

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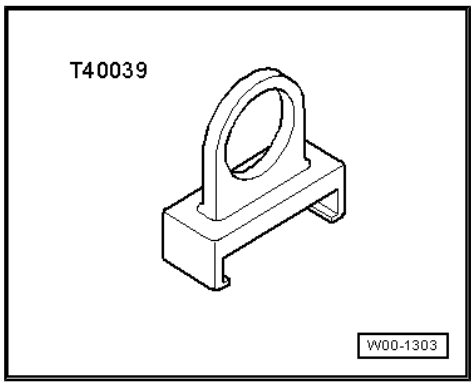
1.2 Test data - spark plugs

Engine data		4.2 ltr. FSI engine
Idling speed		Cannot be adjusted; regulated by idling speed stabilisation
Ignition timing		Not adjustable (determined by control unit)
Ignition system		Multi-coil system with 8 ignition coils (output stages integrated) connected directly to spark plugs via spark plug connectors
Spark plugs	Designations	⇒ Electronic parts catalogue
	Tightening torque	⇒ Maintenance ; Booklet 811
Firing order		1-5-4-8-6-3-7-2

1.3 Removing and installing ignition coils

Special tools and workshop equipment required

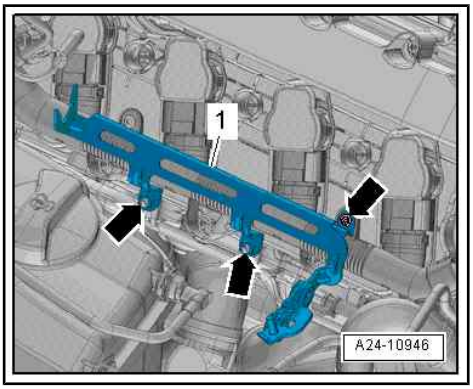
- ♦ Puller - T40039-



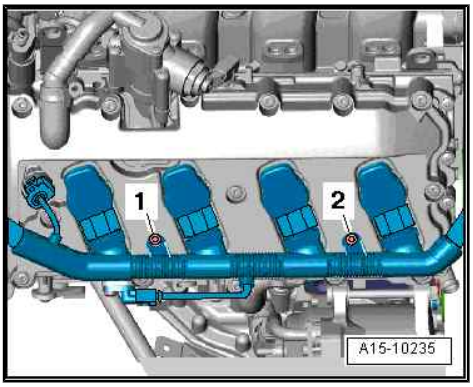
Removing

– Remove engine cover panel ⇒ page 64 .

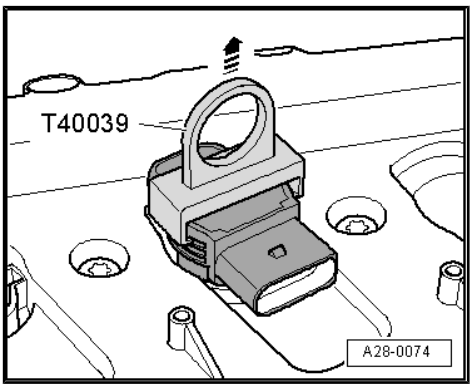
– Remove corresponding air cleaner housing ⇒ page 246 .
– Unscrew nuts and bolts -arrows- and remove corresponding bracket -1- for air cleaner housing.



– Remove bolts -1- and -2-.



– Pull ignition coils approx. 30 mm out of spark plug apertures using puller - T40039- .
– Release electrical connectors and detach from ignition coils simultaneously.
– Pull out ignition coils.



Installing

• Tightening torques
⇒ “1.1 Exploded view - ignition system”, page 301

– Fit all ignition coils loosely into spark plug holes.
– Align ignition coils with connectors and attach all connectors onto ignition coils simultaneously.
– Press ignition coils onto spark plugs by hand evenly (do not knock in with tools).

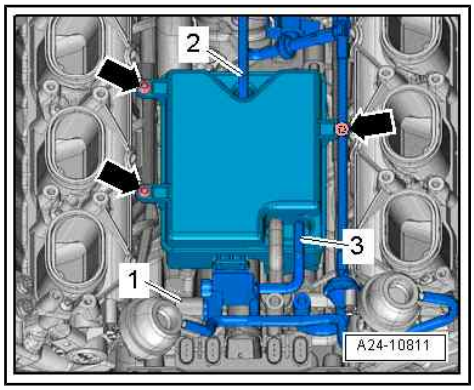
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1.4 Removing and installing knock sensor

⇒ “1.4.1 Removing and installing knock sensors G61 / G66 / G198 / G199 ”, page 304

1.4.1 Removing and installing knock sensors -G61- / -G66- / -G198- / -G199-

Removing knock sensors -G61- / -G198- (front):



– Remove intake manifold (top section) ⇒ page 253 .

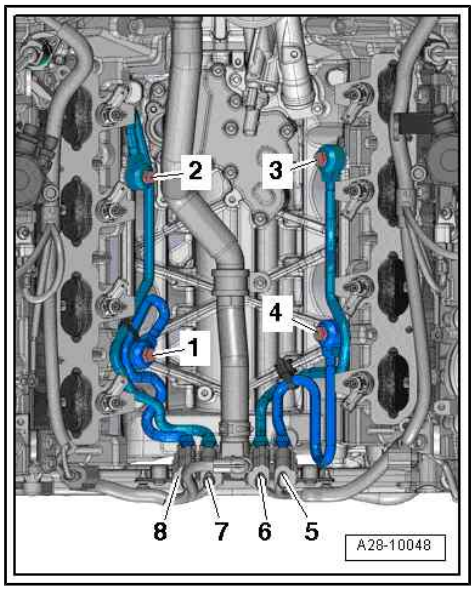
– Disconnect vacuum hose -2- and -3- and take change-over valve -1- out of bracket.

– Remove bolts -arrows- and detach vacuum reservoir.

Removing knock sensors -G66- / -G199- (centre of engine):

– Remove high-pressure pipe ⇒ “8.3 Removing and installing high-pressure pipe”, page 275 .

All knock sensors (continued):



– Take corresponding electrical connector out of bracket (right-side) and unplug:

5 - Blue connector for knock sensor 3 - G198-

6 - Orange connector for knock sensor 4 - G199-

7 - Grey connector for knock sensor 2 - G66-

8 - Black connector for knock sensor 1 - G61-

– Remove corresponding bolt and detach knock sensor:

1 - Knock sensor 1 - G61-

2 - Knock sensor 2 - G66-

3 - Knock sensor 4 - G199-

4 - Knock sensor 3 - G198-

Installing

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

- Tightening torques ⇒ “1.1 Exploded view - ignition system”, page 301

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Note

Fit all cable ties in the original positions when installing.

– Install high-pressure pipe ⇒ “8.3 Removing and installing high-pressure pipe”, page 275 .

– Install intake manifold (top section) ⇒ page 253 .

1.5 Removing and installing Hall senders

⇒ “1.5.1 Removing and installing Hall senders G40 / G163 ”, page 305

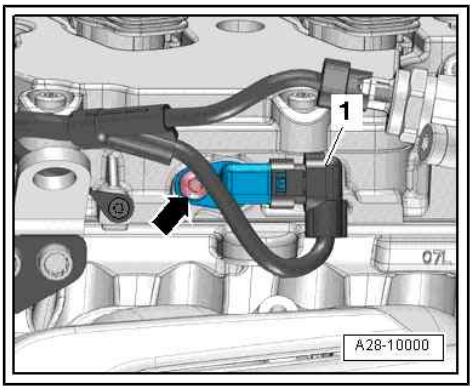
⇒ “1.5.2 Removing and installing Hall senders G300 / G301 ”, page 305

1.5.1 Removing and installing Hall senders - G40- / -G163-

Removing

– Unplug electrical connector -1-.

– Unscrew bolt -arrow- and remove Hall sender.



Installing

- Tightening torques
  ⇒ “1.1 Exploded view - ignition system”, page 301

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

Note

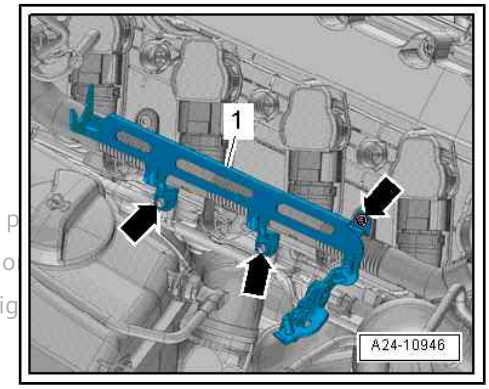
Fit new O-rings.

1.5.2 Removing and installing Hall senders - G300- / -G301-

Removing

– Remove corresponding air cleaner housing ⇒ page 246 .

– Unscrew nuts and bolts -arrows- and remove corresponding bracket -1- for air cleaner housing.

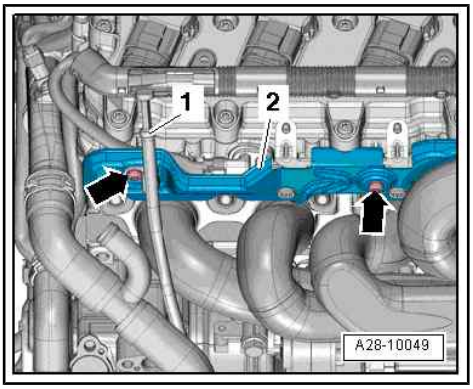


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Hall sender 4 - G301-

– Remove bolts -arrows- and pull out guide tube for oil dipstick.

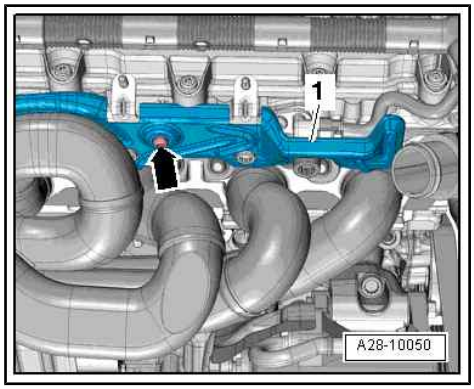
– Carefully bend heat shield -2- slightly to the side.



Hall sender 3 - G300-

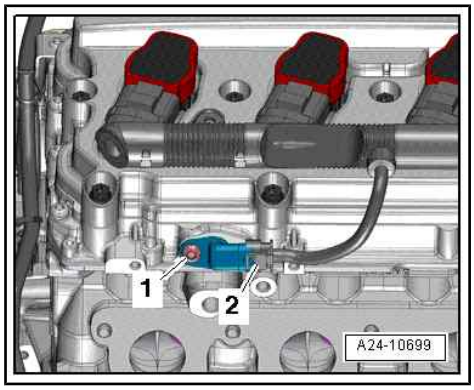
– Remove bolts -arrows-.

– Carefully bend heat shield -1- slightly to the side.



– Unplug electrical connector -2-.

– Unscrew bolt -1- and detach Hall sender.



Installing

- Tightening torques
  ⇒ “1.1 Exploded view - ignition system”, page 301

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

– Install dipstick guide tube ⇒ Item 6 (page 76) .

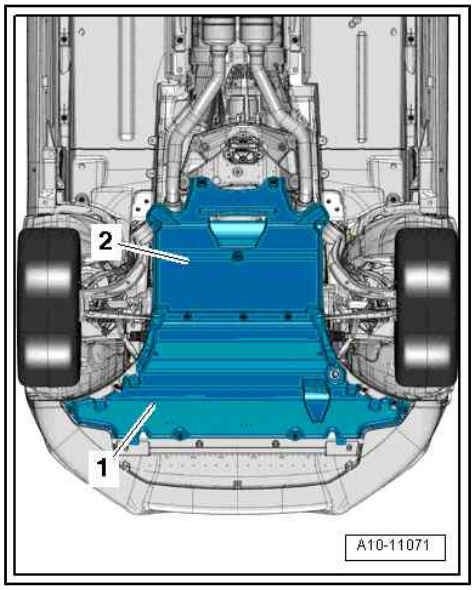
Note

Fit new O-rings.

1.6 Removing and installing engine speed sender - G28-

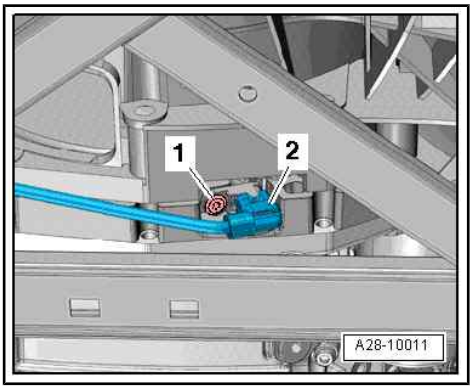
Removing

– Remove rear noise insulation -2- ⇒ General body repairs, exterior; Rep. gr. 66 ; Noise insulation; Exploded view - noise insulation .



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– Unplug electrical connector -2-.
– Unscrew bolt -1- and detach engine speed sender - G28- downwards.



Installing

- Tightening torque
  ⇒ “1.1 Exploded view - ignition system”, page 301

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

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

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