

Audi A8 1994 ➤

6-Cylinder engine, Mechanics

| | | | | | | | | | |
|-----------|-----|--|--|--|--|--|--|--|--|
| Engine ID | AAH | | | | | | | | |
|-----------|-----|--|--|--|--|--|--|--|--|

Edition 09.1998



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A8 1994 ➤

6-Cylinder engine, Mechanics

Repair Group

00 - Technical data

10 - Removing and installing engine

13 - Crankshaft group

15 - Cylinder head, Valve gear

17 - Lubrication

19 - Cooling system

26 - Exhaust system



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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.

All rights reserved.
No reproduction without prior agreement from publisher.

Contents

| | |
|--|-----------|
| 00 - Technical data | 1 |
| 1 Technical data | 1 |
| 1.1 Technical data | 1 |
| 1.2 Engine number | 1 |
| 1.3 Engine data | 1 |
| 10 - Removing and installing engine | 3 |
| 1 Removing and installing engine | 3 |
| 1.1 Removing and installing engine | 3 |
| 1.2 Removing | 4 |
| 1.3 Attaching engine to repair stand | 19 |
| 1.4 Installing | 19 |
| 1.5 Tightening torques | 22 |
| 13 - Crankshaft group | 24 |
| 1 Dismantling and assembling engine | 24 |
| 1.1 Dismantling and assembling engine | 24 |
| 1.2 Ribbed belt drive for vane pump, alternator and air conditioner | 24 |
| 1.3 Removing and installing viscous fan | 29 |
| 1.4 Removing and installing ribbed belt | 30 |
| 1.5 Removing and installing vibration damper | 33 |
| 1.6 Toothed belt drive | 34 |
| 1.7 Removing and installing toothed belt | 39 |
| 2 Removing and installing sealing flange and flywheel/drive plate | 44 |
| 2.1 Removing and installing sealing flange and flywheel/drive plate | 44 |
| 2.2 Renewing crankshaft oil seal - pulley end | 50 |
| 2.3 Removing and installing dual mass flywheel/ drive plate | 52 |
| 2.4 Removing and installing needle bearing in dual-mass flywheel | 55 |
| 2.5 Adjusting engine speed sender bracket | 56 |
| 3 Removing and installing crankshaft | 58 |
| 3.1 Removing and installing crankshaft | 58 |
| 3.2 Crankshaft dimensions | 62 |
| 3.3 Measuring axial and radial clearance | 62 |
| 4 Dismantling and assembling pistons and conrods | 64 |
| 4.1 Dismantling and assembling pistons and conrods | 64 |
| 4.2 Piston and cylinder dimensions | 69 |
| 4.3 Checking radial clearance of conrods | 69 |
| 15 - Cylinder head, Valve gear | 71 |
| 1 Removing and installing cylinder head | 71 |
| 1.1 Removing and installing cylinder head | 71 |
| 1.2 Removing and installing intake manifold (with change-over function) | 77 |
| 1.3 Removing and installing left cylinder head cover | 81 |
| 1.4 Removing and installing right cylinder head cover | 83 |
| 1.5 Removing left cylinder head | 84 |
| 1.6 Removing right cylinder head | 86 |
| 1.7 Installing cylinder head | 88 |
| 1.8 Checking compressions | 91 |
| 2 Servicing valve gear | 93 |
| 2.1 Servicing valve gear | 93 |
| 2.2 Checking camshaft axial clearance | 100 |
| 2.3 Renewing front camshaft oil seals | 101 |
| 2.4 Renewing rear oil seal for left camshaft | 103 |



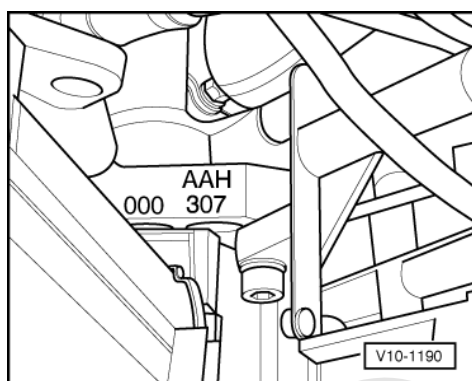
| | | |
|-----------|--|------------|
| 2.5 | Removing and installing camshafts | 105 |
| 2.6 | Checking hydraulic bucket tappets | 106 |
| 2.7 | Renewing valve stem seals | 108 |
| 2.8 | Checking valve guides | 111 |
| 2.9 | Checking valves | 111 |
| 2.10 | Replacing valve guides | 112 |
| 2.11 | Reworking valve seats | 113 |
| 17 | - Lubrication | 116 |
| 1 | Removing and installing parts of lubrication system | 116 |
| 1.1 | Removing and installing parts of lubrication system | 116 |
| 1.2 | Different oil circuits | 116 |
| 1.3 | Vehicles up to VIN 4D S_ 000 496 | 117 |
| 1.4 | Vehicles from VIN 4D S_ 000 497 onwards | 123 |
| 1.5 | Removing and installing lower section of sump | 128 |
| 1.6 | Removing and installing upper section of sump | 129 |
| 1.7 | Removing and installing oil pump | 136 |
| 1.8 | Renewing oil retention valves | 139 |
| 1.9 | Testing oil pressure and oil pressure switch | 141 |
| 1.10 | Engine oil | 143 |
| 1.11 | Checking oil level | 144 |
| 19 | - Cooling system | 145 |
| 1 | Removing and installing parts of cooling system | 145 |
| 1.1 | Removing and installing parts of cooling system | 145 |
| 1.2 | Coolant pump and coolant thermostat | 146 |
| 1.3 | Draining and filling cooling system | 147 |
| 1.4 | Removing and installing coolant pump | 152 |
| 1.5 | Removing and installing, checking coolant thermostat | 153 |
| 1.6 | Coolant pipes - overview | 155 |
| 1.7 | Removing and installing small coolant pipe | 157 |
| 1.8 | Removing and installing large coolant pipe | 157 |
| 1.9 | Removing and installing radiator | 159 |
| 1.10 | Checking cooling system for leaks | 163 |
| 26 | - Exhaust system | 165 |
| 1 | Removing and installing parts of exhaust system | 165 |
| 1.1 | Removing and installing parts of exhaust system | 165 |
| 1.2 | Separating centre and rear silencers | 175 |
| 1.3 | Removing and installing front exhaust pipe with catalytic converter (left side) | 176 |
| 1.4 | Removing and installing front exhaust pipe with catalytic converter (right side) | 178 |
| 1.5 | Removing and installing exhaust manifold (left side) | 180 |
| 1.6 | Removing and installing exhaust manifold (right side) | 181 |
| 1.7 | Stress-free alignment of exhaust system | 182 |
| 1.8 | Checking exhaust system for leaks | 184 |

00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



-> The engine number ("Engine code" and "Serial number") is stamped on the inner right-hand side of the cylinder block between the cylinder head and the hydraulic pump.

Additionally there is a sticker on the toothed belt guard with "Engine code" and "Serial number".

The engine code is also included on the vehicle data sticker.

1.3 - Engine data

| Engine code | | AAH |
|--------------------------------------|---|----------|
| Manufactured | Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG. | 03.94 ä |
| Displacement | litre | 2.771 |
| Power | kW at rpm | 128/5500 |
| Torque | Nm at rpm | 250/3000 |
| Bore | mm | 82.5 |
| Stroke | mm | 86.4 |
| Compression ratio | | 10.3 |
| RON (recommended) | | 98 |
| RON (minimum) | | 95 |
| Injection/ignition system | | MPI |
| Knock control | | yes |
| Self-diagnosis | | yes |
| Lambda control | | yes |
| Catalytic converter | | yes |
| Charging | | no |
| Intake manifold change-over function | | yes |



| | |
|-------------------------|------------|
| Engine code | AAH |
| Camshaft timing control | no |

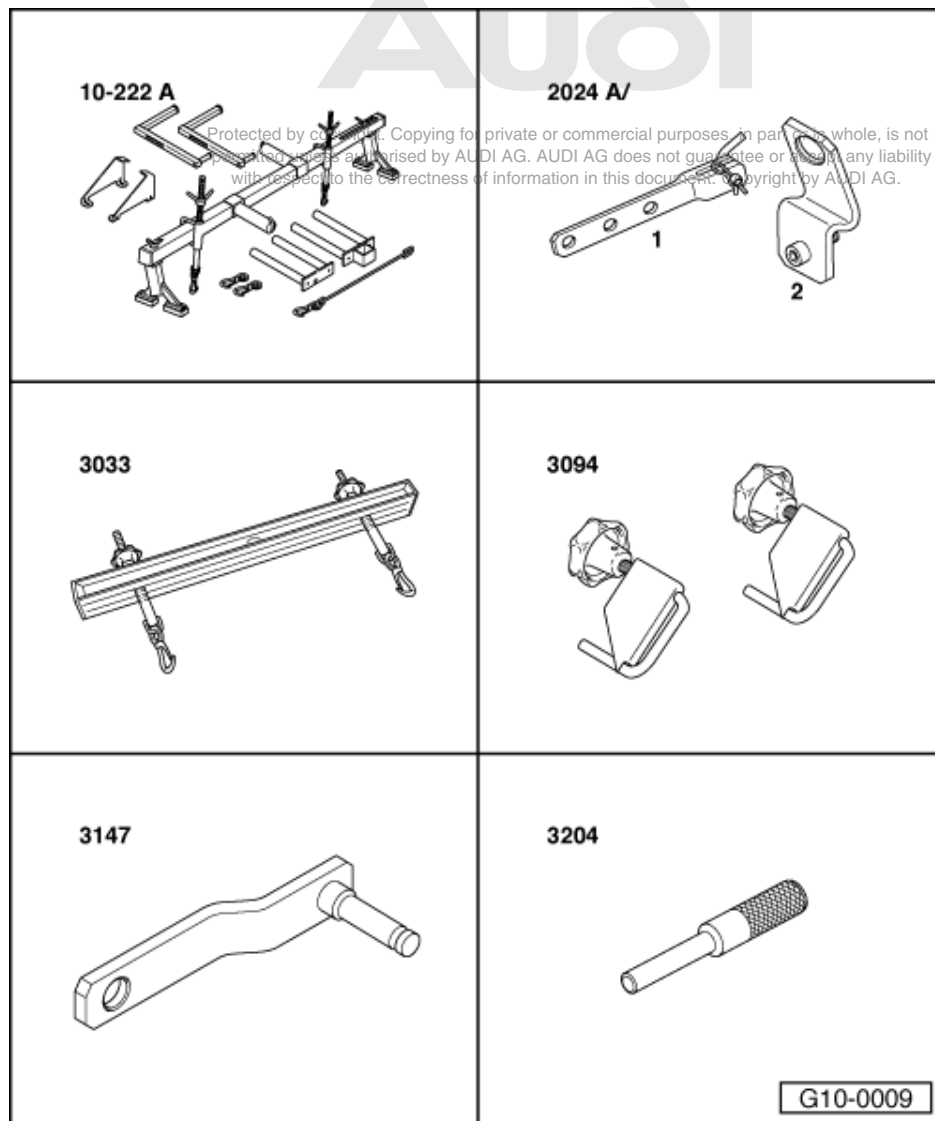
| | |
|---|------------|
| Engine code | AAH |
| Valve timing at 1 mm valve lift and 0 mm valve clearance | |
| Intake opens after TDC | 10.5° |
| Intake closes after BDC | 45.45° |
| Exhaust opens before BDC | 37.5° |
| Exhaust closes after TDC | 2.55° |

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

10 - Removing and installing engine

1 - Removing and installing engine


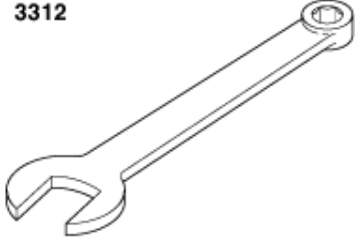


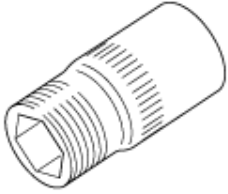
1.1 - Removing and installing engine



Special tools and workshop equipment required

- ◆ Special tool 10-222A
with 10-222A/1, 10 222A/2 and 10 222A/4
- ◆ Special tool 2024 A/1 and 2024 A/2
- ◆ Special tool 3033
- ◆ Special tool 3094
- ◆ Special tool 3147
- ◆ Special tool 3204 (on vehicles with air conditioner and/or automatic gearbox)



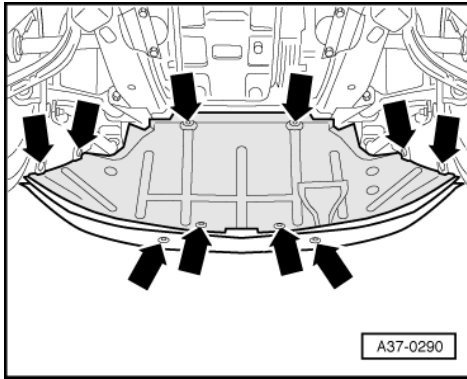
| | |
|--|---|
| 3212  | 3312  |
| V.A.G 1202 A  | V.A.G 1306  |
| V/175  | <p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.</p> <p>G10-0010</p> |

- ♦ Special tool 3212
- ♦ Special tool 3312
- ♦ V.A.G 1202 A
- ♦ V.A.G 1306
- ♦ Special tool Matra V/175
(on vehicles with automatic gearbox)

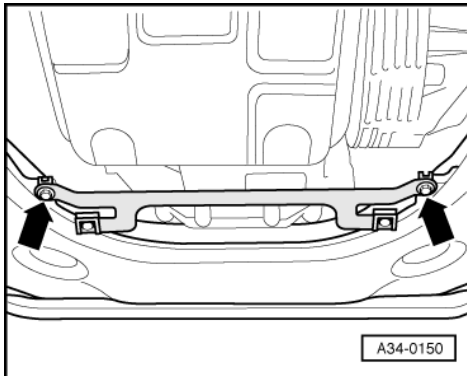
1.2 - Removing

Notes:

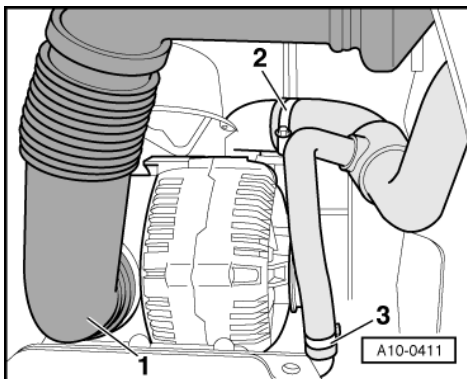
- ♦ All cable ties which are opened or cut open when removing the engine must be replaced in the same position when installing the engine.
- ♦ The engine is removed from the front without the gearbox.
- ♦ Catch drained-off coolant in a clean container for re-use or disposal.
- Obtain radio code on vehicles with coded radio.
- Disconnect earth strap on battery (on right of luggage compartment) with ignition switched off.



- Open cap on coolant expansion tank.
- -> Remove noise insulation -arrows-.



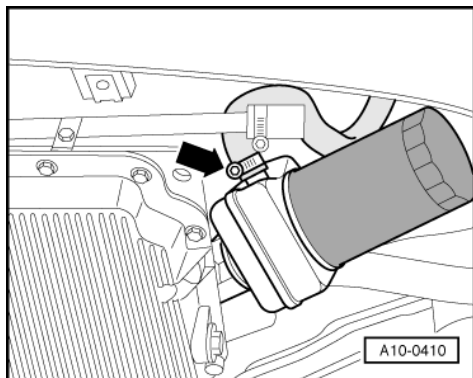
- -> Unbolt brackets for noise insulation -arrows-.



- Place drip tray V.A.G 1306 below engine.
- -> Detach hose -3- and drain coolant.
- Then detach hose -2- and hold hose end down to drain coolant from radiator.
- Unclip alternator air duct -1-.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

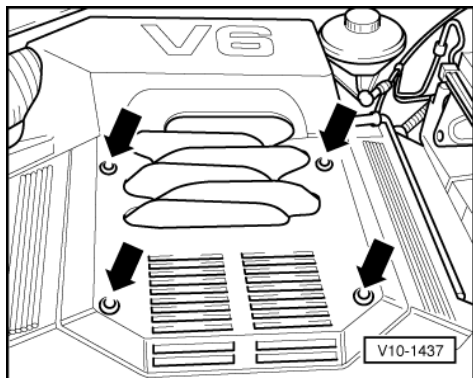


- -> In addition, detach coolant hose from bottom of oil cooler -arrow- and drain off remaining coolant.

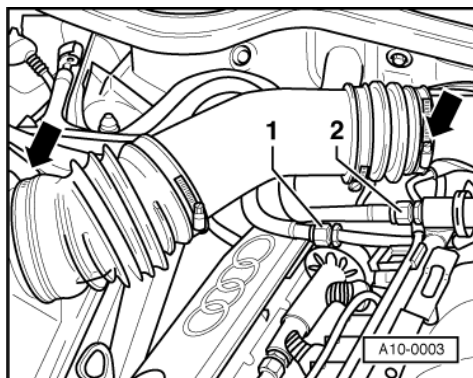


- -> Also unscrew coolant drain plug on engine -arrow-.

Note:
 Replace O-ring.



- -> Remove engine cover panel -arrows-.



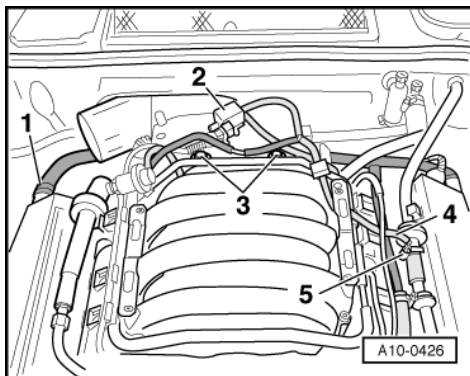
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Remove air hose between air mass meter and intake manifold -arrows-.

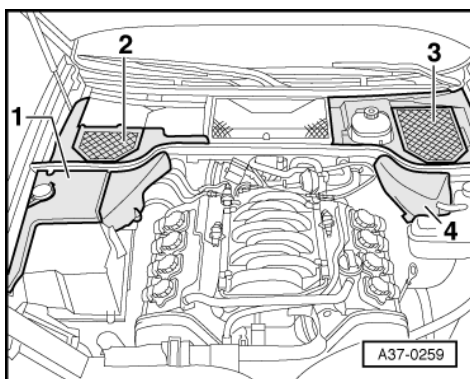
Warning

Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

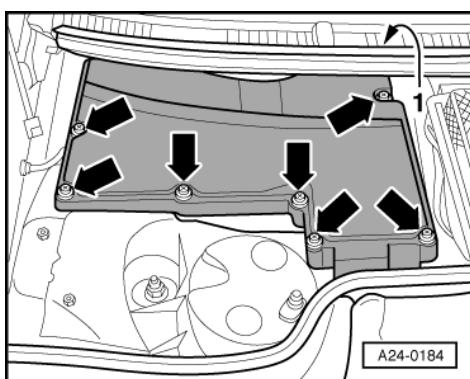
- Disconnect fuel supply line -1- and fuel return line -2-.



- -> Detach crankcase breather hose -1- at right-hand cylinder head cover.
- Unbolt intake manifold change-over valve -N156 -2- and place it on intake manifold with hoses connected.
- Ease vacuum hose -4- off.
- Unscrew bolts -3- and detach air duct from throttle valve housing.
- Detach left crankcase breather hose from air duct.
- Disconnect hose connection -5- going to brake servo and take non-return valve out of bracket.

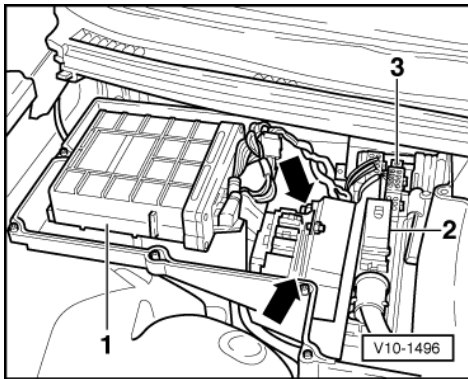


- -> Remove covers 1 - 4.

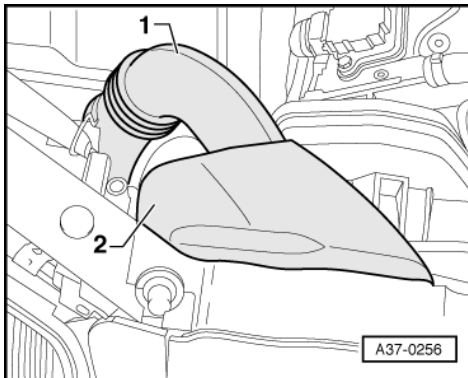


- -> Pry out cover -1- in scuttle panel trim and loosen rear cross-head screw -arrow in top-right corner-.
- Loosen the remaining cross-head screws -arrows-.
- Remove cover on electronics box in plenum chamber.

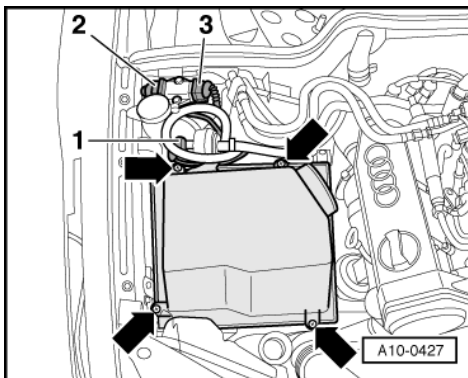
Any reproduction, copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



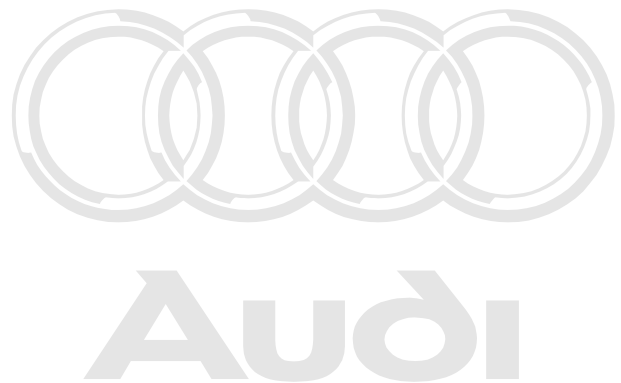
- -> Unplug all connectors from engine control unit -1-, gearbox control unit -2- and all connectors located at bulkhead.
- Unplug connector at CCS-control unit.
- Unscrew CCS-control unit together with relays and fuse holder -arrows-.
- Pull out sealing strip between engine compartment and plenum chamber.
- Cut open cable tie on engine wiring harness.
- Unscrew wiring harness from bulkhead, take out spacer sleeves and move harness clear.



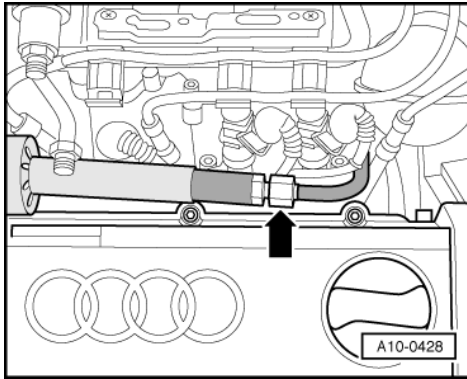
- -> Unclip cover -2- for air duct at lock carrier.
- Remove air duct -1-.



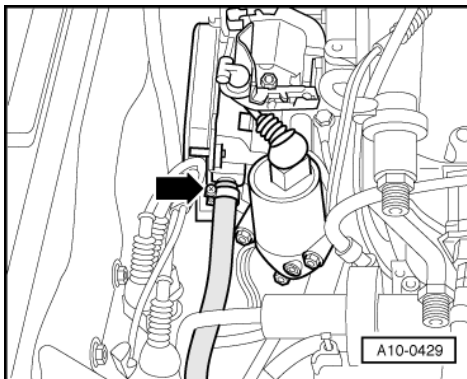
- -> Unscrew bolts -arrows- and take out top section of air cleaner. When doing this, unplug connector on air mass meter and move wiring clear.
- Unplug connectors -1 ... 3- and move wiring clear.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

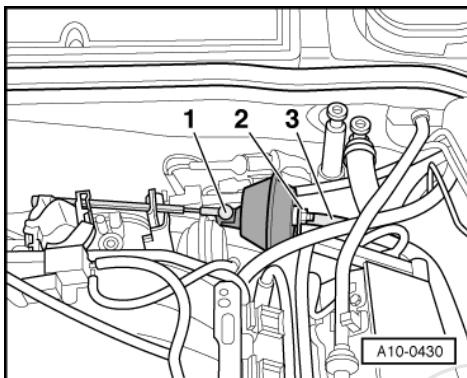


- -> Disconnect hydraulic pump supply pipe -arrow-.



- -> Detach vacuum hose -arrow- going to ACF valve

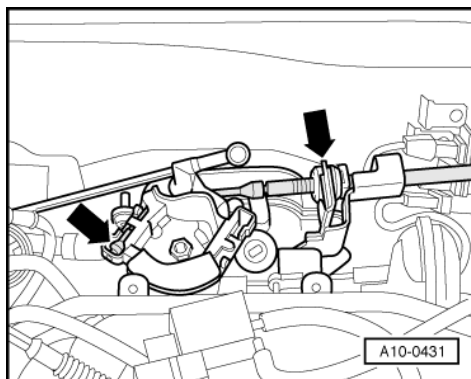
Vehicles with cruise control system



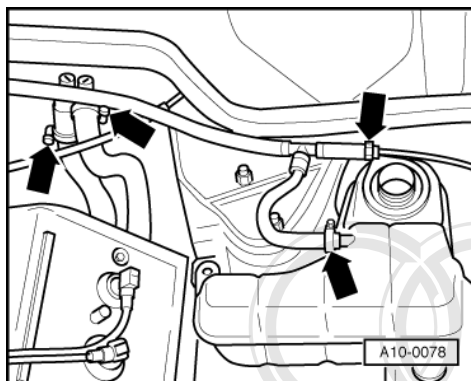
- -> Disengage actuator rod -1- at vacuum unit.
- Pull vacuum hose -3- off vacuum unit.
- Unscrew nut -2- and remove vacuum unit.



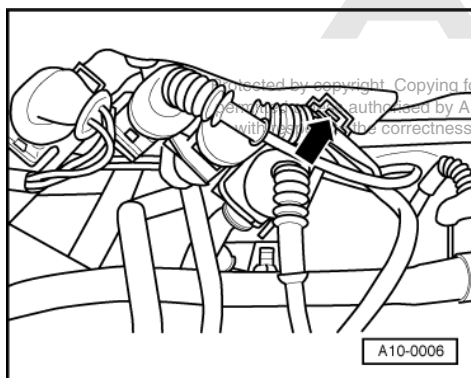
All models



- -> Detach throttle cable at the throttle valve housing and at support bracket -arrows- (do not remove throttle cable retainer). Move throttle cable clear to the side.

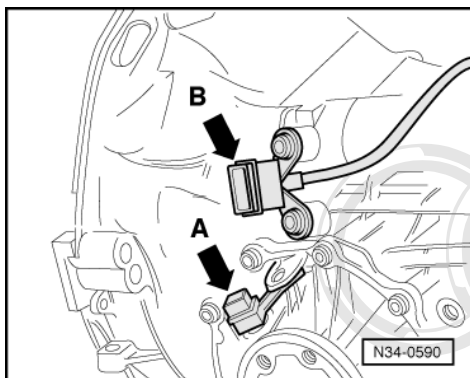


- -> Disconnect coolant hose between coolant pipe and expansion tank at expansion tank and at metal pipe -right arrows-.
- Disconnect coolant hoses between engine and heater at heat exchanger connection -left arrows-.
- Detach coolant hose at right-hand side of engine.



- -> Unclip all electrical connectors at bulkhead from their retainers. To do this, press tabs in direction shown -arrows-.
- Unplug connectors for lambda probes.
- Guide wiring for lambda probes downwards.
- Place complete wiring harness on engine.

Vehicles with manual gearbox



- -> Pull connector off sender for speedometer -arrow A-.
- Pull off connector on reversing light switch (multi-function sender) -arrow B-.

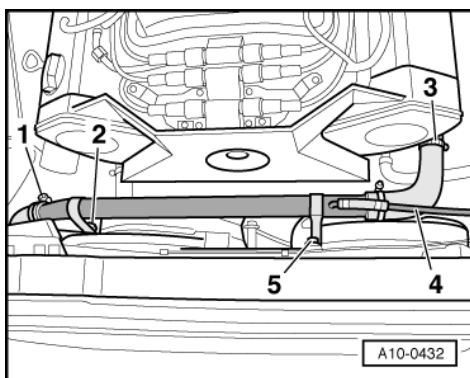
Note:

Shown in illustration with gearbox removed.

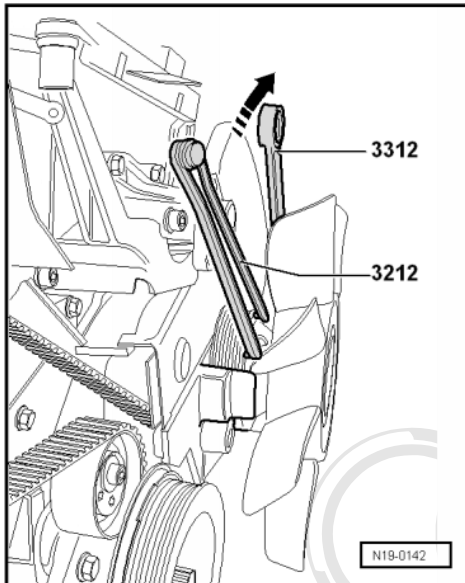
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

All models

- Unscrew nuts accessible from above securing front exhaust pipe to exhaust manifold (left and right sides).
- Unscrew upper engine/gearbox securing bolts. Leave one bolt in place (hand-tight).



- -> To remove front coolant pipe:
 - Detach hoses -1- and -3-.
 - Unscrew bolts -2- and -5-.
 - Move wiring -4- clear.



Vehicles with electric radiator fan:

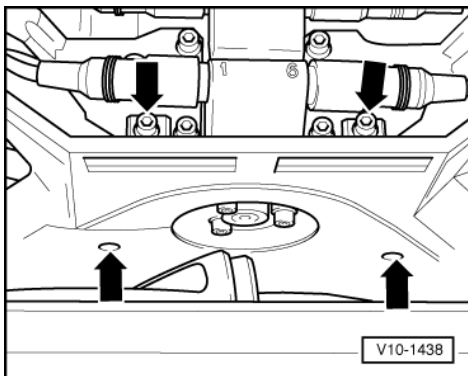
- Detach right-hand electric radiator fan from radiator and move it clear to one side with wiring connected.

Vehicles with viscous fan:

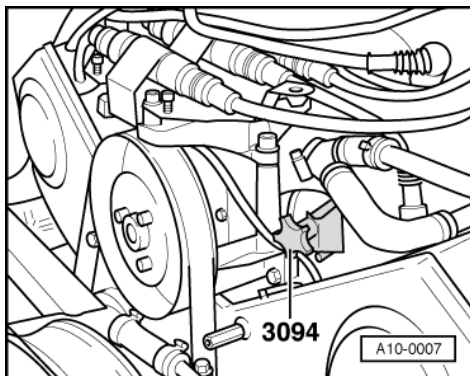
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Unbolt viscous fan cowl.
- -> Hold viscous fan pulley with pin wrench 3212 and unscrew viscous fan with open-end spanner 3312 (left-hand thread).
- Lift viscous fan up and out.

All models

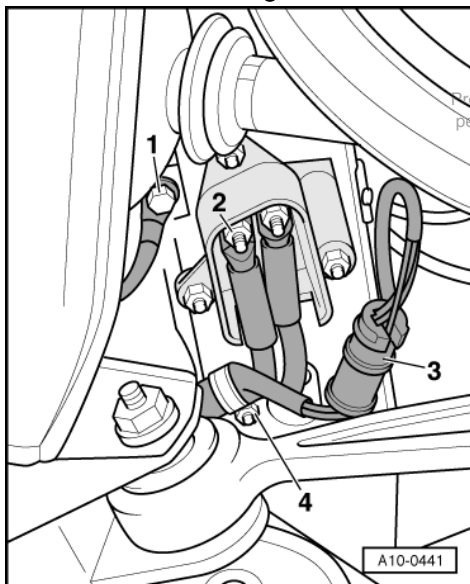


- -> Remove ribbed belt cover -arrows-.



- -> Fit hose clamp 3094 on hydraulic pump supply hose, open screw-type clip and unscrew securing bolt of supply hose bracket at bottom left of engine.
- With hose clamp 3094 still installed, pull hose downwards, guiding it between toothed belt guard and cylinder head.
- Place a cloth beneath the hydraulic pump to catch escaping fluid.

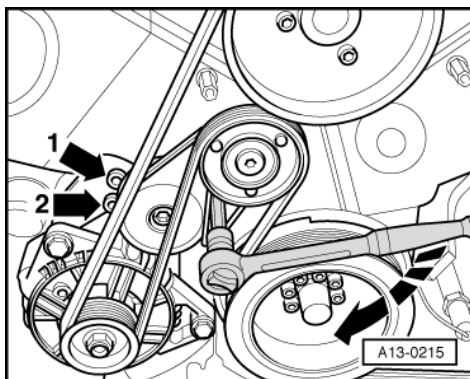
Vehicles with manual gearbox



- -> Unclip and disconnect connector -3-.
- Unclip cover for wiring connections.
- Unscrew earth strap -1-.
- Unscrew connection -2-.
- Unscrew wiring clamp -4- and move wiring clear.

Vehicles with air conditioner and/or automatic gearbox:

Note:

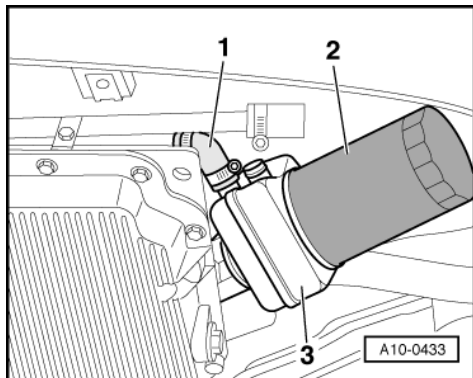




Mark the direction of rotation with chalk or felt pen before removing the ribbed belt. If the belt rotates in the wrong direction when it is refitted, it may break.

- -> To slacken ribbed belt, turn tensioning element in direction of arrow with Allen key (10 mm).
- Insert mandrel 3204 into locating holes -1- and -2- to stop tensioning element from turning.
- Remove ribbed belt.

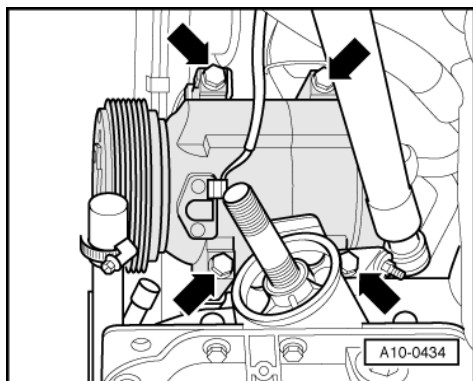
Vehicles with air conditioner:



- Place drip tray V.A.G 1306 below engine.
- To drain engine oil, unscrew oil drain plug or extract engine oil .
- -> Remove oil filter -2-.
- Detach rear hose -1- from oil cooler -3-.
- Remove oil cooler.

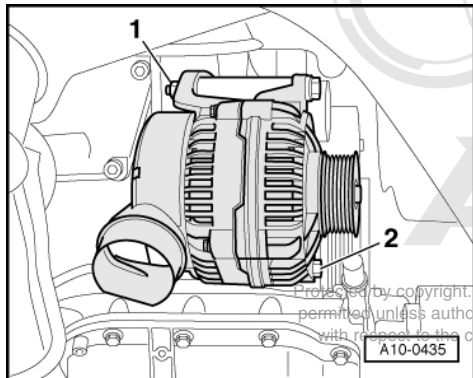
Warning!

The air conditioner refrigerant circuit must not be opened.



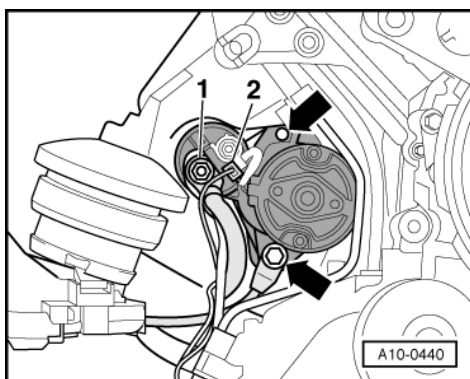
- Move wiring to magnetic clutch for air conditioner compressor clear.
- -> Unbolt A/C compressor from bracket -arrows-.
- Tie up A/C compressor to longitudinal member with pipes connected.

Vehicles with automatic gearbox

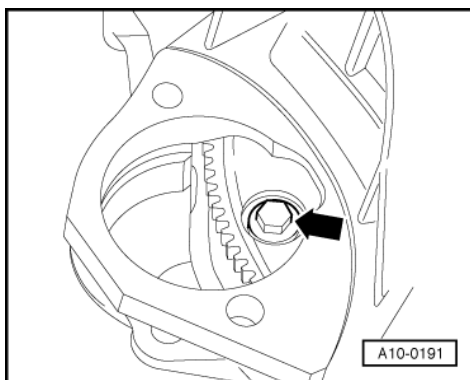


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Unscrew bolt -2-.
- Slacken nut -1-.
- Swivel alternator to the side and disconnect wiring.
- Remove alternator.



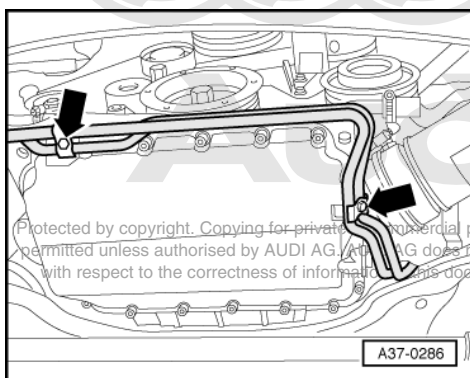
- -> Disconnect wires -1- and -2- from starter; remove insulator from positive connection on starter.
- Unscrew starter bolts -arrows- working from gearbox side, and remove starter.



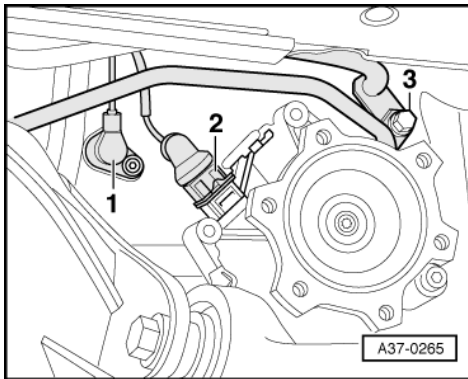
- -> Unscrew 3 torque converter bolts through starter opening using Matra V/175 15 mm A/F socket attachment (turn crankshaft 1/3 turn each time).

Note:

To remove the torque converter bolts, counter-hold the main bolt on the vibration damper.



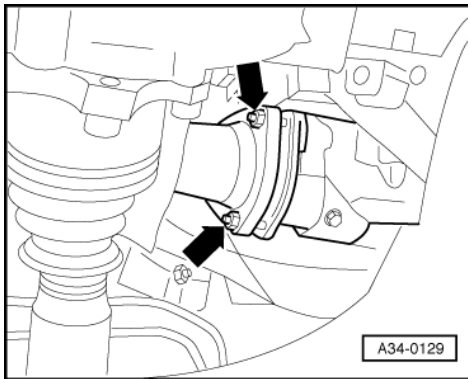
- -> Unbolt brackets for ATF pipes -arrows-.



- -> If fitted, unbolt engine speed sender -G28 -1- from front left of gearbox.
- Unplug connector -2- from speedometer sender.
- Remove bolt -3- and detach ATF pipes from gearbox.
- Move ATF pipes clear to one side.

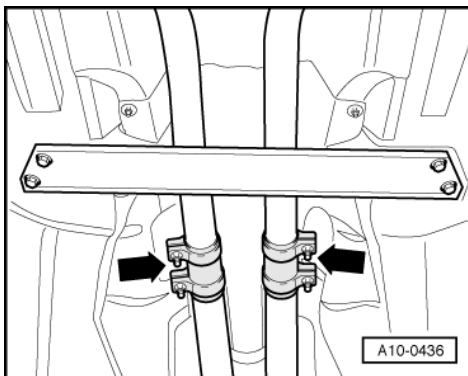
Note:

Observe rules for cleanliness when working on automatic gearbox:



All models

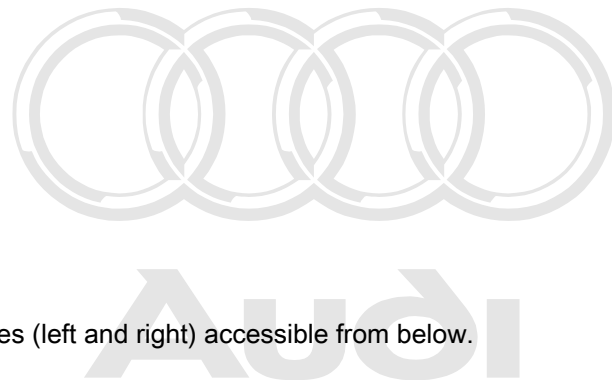
- -> Unscrew securing nuts on front exhaust pipes (left and right) accessible from below.



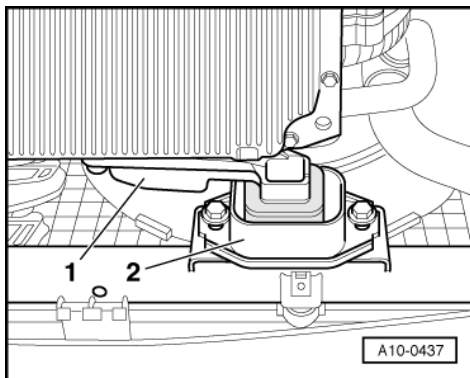
- -> Loosen clamps -arrows-.
- Detach front exhaust pipes together with catalytic converters and lambda probes.

Note:

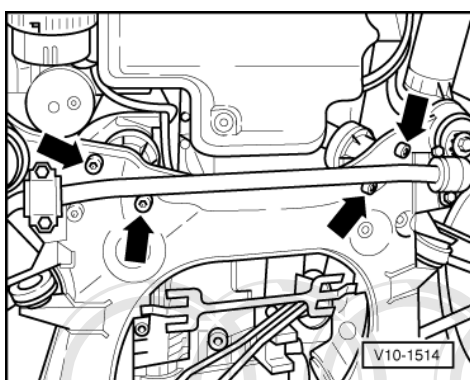
Ensure that connectors for lambda probes are clear.



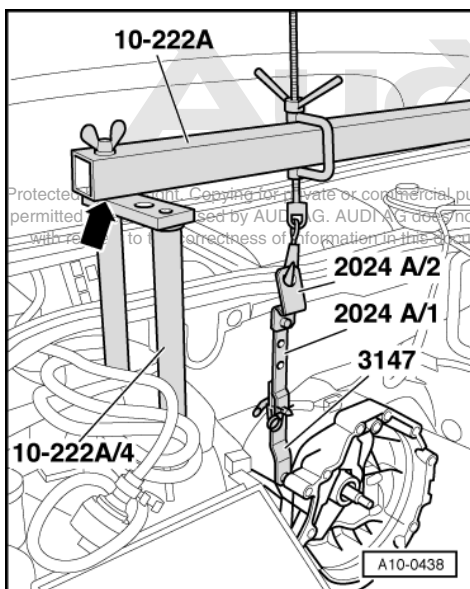
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unbolt torque reaction support -1- and stop for torque reaction support -2-.
- Unscrew engine/gearbox securing bolts accessible from below



- -> Remove lower securing bolts -arrows- at engine mountings.
- Prepare left adapter 10-222 A/4 of support bar 10-222 A as follows:



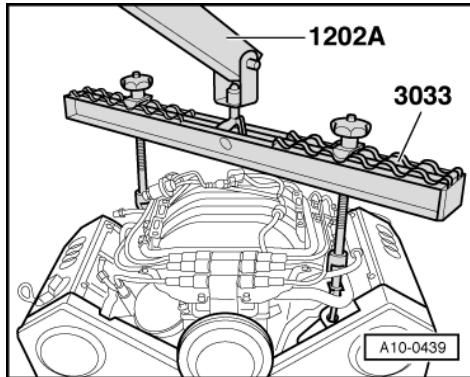
- -> Rebore rear hole of adapter bearing surface -arrow- to 10.2 mm and tap a thread of M12 into drilling. Place support bar 10-222 A on suspension strut mountings. The spindle points to the rear as shown in this figure.
- Secure support bar by fastening it in the rebores hole.
- Engage gearbox support 3147 in bolt hole in bell housing on gearbox.
- Connect gearbox support 3147 to support bar 10-222 A using extension 2024 A/1 and bar 2024 A/2 (secure bolt with nut and washer).



Note:

Shown in illustration with engine removed.

- Disengage gas-filled bonnet struts at the top.
- Raise bonnet to vertical position and secure with suitable tool.

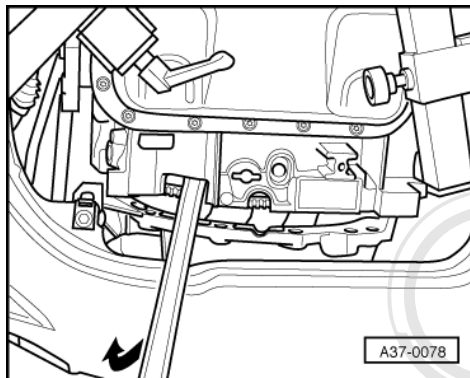


- -> Attach lifting tackle 3033 to engine and hook onto workshop crane 1202 A, as shown in this figure.
- Remove the last engine/gearbox securing bolt.

Note:

Check that all hoses and other connections between engine and body have been detached.

Vehicles with automatic gearbox



- -> Lever off torque converter from engine drive plate.

All models

- Tighten spindle of support bar 10-222 A.
- Lift engine carefully.
- Pull engine away from gearbox and lift engine out of engine compartment.

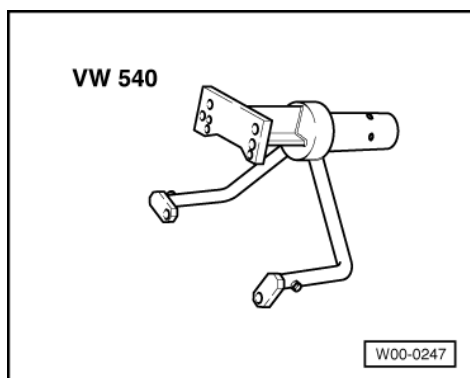
Vehicles with automatic gearbox

- Secure torque converter in gearbox to prevent it falling out.

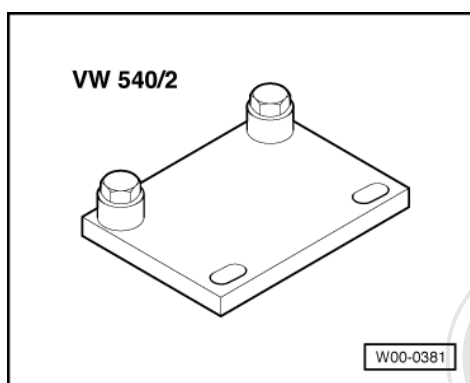
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.3 - Attaching engine to repair stand

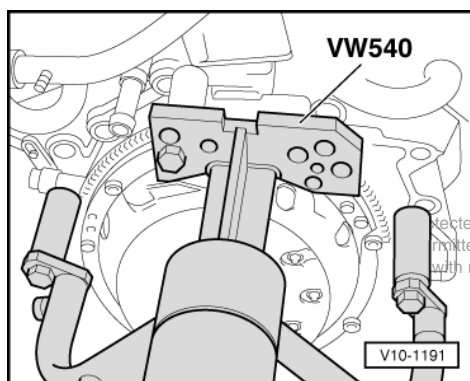
Special tools and workshop equipment required



- ♦ Engine and gearbox support VW 540



- ♦ Special tool VW 540/2



- -> To work on the engine, attach engine to repair stand using engine/gearbox support VW 540 and special tool VW 540/2.

1.4 - Installing

Install in reverse sequence; note the following points:

Note:

When performing repairs, renew seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.

- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.
- When pushing the engine onto the gearbox, make sure that the engine speed sender is not damaged.

Vehicles with manual gearbox

- Clean input shaft splines and (in the case of used clutch plates) the hub splines. Remove corrosion and apply only a very thin coating of grease G 000 100 to the splines. Do not grease guide sleeve.
- Check clutch release bearing for wear and renew if necessary.
- Check that clutch plate is properly centred in vehicles with manual gearbox.
- A needle bearing must be fitted in the flywheel on vehicles with manual gearbox. Install needle bearing if necessary => Page 55 .

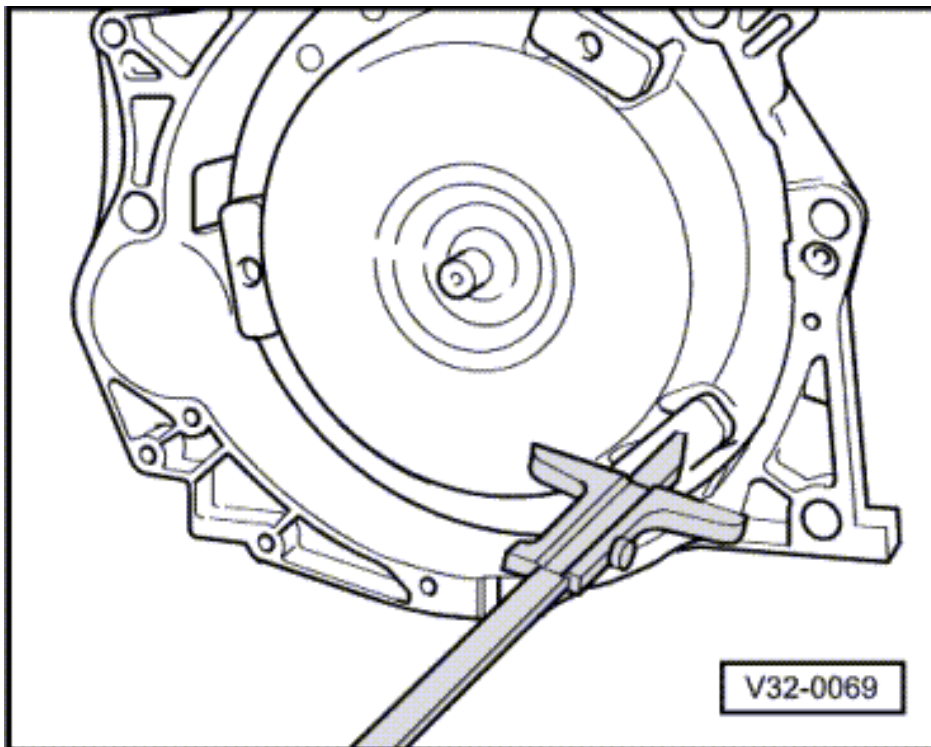
Vehicles with automatic gearbox

- Short engines are supplied without bush in crankshaft. Before installing drive plate, drive in bush =>Fig. 62 .
- To secure torque converter on drive plate, only use correct bolts as specified in parts catalogue (same as original equipment).

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

=> Parts catalogue

- Tighten torque converter bolts with 15 mm A/F socket attachment (Matra V/175).

Checking position of torque converter

-> If the torque converter has been correctly installed, the distance between the bottom contact surfaces at the threaded holes in the torque converter and the contact surface of the torque converter bell housing (with automatic gearbox) is approx. 19 mm.

If the torque converter has not been completely inserted, this distance will be approx. 14 mm.

Important

If the torque converter is not installed correctly, the torque converter drive plate or the ATF pump will be seriously damaged when the gearbox is joined to the engine.

- Secure ATF pipes to ATF cooler
- Check ATF level:

All models

- Ensure that engine mounts are free of stress by shaking engine to align it before tightening engine mounts.
- Install ribbed belt =>Page **31** .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts to 40 Nm.

- Adjust bracket for engine speed sender -G28=>Page **56** if bracket or flywheel mountings have been slackened.
- Check throttle cable setting

=> Fuel supply system - Petrol engines; Repair group 20; Servicing accelerator mechanism - Vehicles with mechanical accelerator linkage Servicing accelerator mechanism - Vehicles with mechanical accelerator linkage

- Fill up with coolant=> Page **150** .

Notes:

- ◆ Drained-off coolant may only be used again if the original cylinder head and cylinder block are re-installed.
- ◆ Coolant must not be used again if it is dirty.

- Top up PAS fluid and bleed steering system:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 48; Checking fluid level, bleeding steering system, testing for leaks Checking fluid level, bleeding steering system, testing for leaks

- Fill up with engine oil and check oil level.
- Stress-free alignment of exhaust system => Page **182** .
- Electrical connections and routing:

=> Current flow diagrams, Electrical fault-finding and Fitting locations

- After connecting battery, enter anti-theft code for radio

=> Radio operating instructions

- Close windows fully using electric window switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Check oil level before starting engine.
- Interrogate fault memory:

=> MPI Injection and ignition system; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

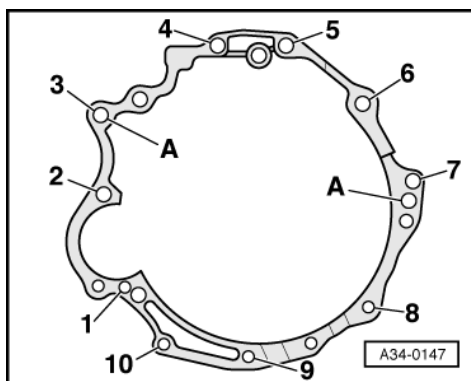
Note:

Faults will have been stored in the memory because connectors have been unplugged. Therefore interrogate and erase fault memory after installing engine.

1.5 - Tightening torques

Notes:

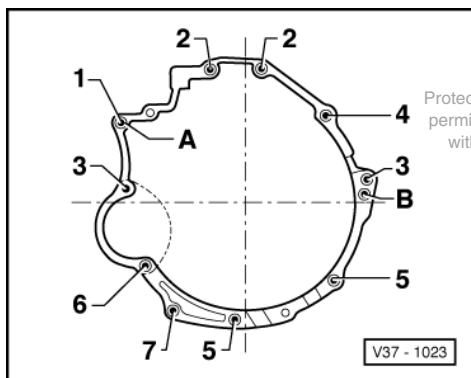
- ♦ The tightening torques listed on this page apply only to lightly greased, oiled, phosphated, or black-finished nuts and bolts.
- ♦ Additional lubricant such as engine or gearbox oil may be used, but do not use graphite lubricant.
- ♦ Do not use degreased parts.
- ♦ Tolerance for tightening torques is $\pm 15\%$.



-> Engine/gearbox mountings (manual gearbox)

| Item No. | Bolt | Nm |
|----------|-------------|----|
| 1 | M10 x 135 | 45 |
| 2 | M12 x 110 | 65 |
| 3, 4, 5 | M12 x 67 | 65 |
| 6 | M12 x 90 1) | 65 |
| 7 | M12 x 80 | 65 |
| 8 | M10 x 50 | 45 |
| 9 | M10 x 38 | 45 |
| 10 | M8 x 40 | 20 |

- 1) Bolt with washer
A: centring sleeves



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Engine/gearbox mountings (automatics)

| Item No. | Bolt | Qty | Nm |
|----------|----------|-----|----|
| 1 | M12 x 50 | 1 | 65 |
| 2 | M12 x 67 | 2 | 65 |

| | | | |
|---|-----------|---|----|
| 3 | M12 x 80 | 2 | 65 |
| 4 | M12 x 100 | 1 | 65 |
| 5 | M10 x 38 | 2 | 45 |
| 6 | M10 x 80 | 1 | 45 |
| 7 | M8 x 40 | 1 | 25 |

A, B: centring sleeves

| Component | | Nm |
|---|-----|----|
| Bolts/nuts | M6 | 10 |
| | M8 | 20 |
| | M10 | 45 |
| | M12 | 65 |
| Except for the following: | | |
| Coolant drain plug to cylinder block | | 20 |
| Fuel pipe to fuel rail or fuel pressure regulator | | 25 |
| Air duct to intake manifold | | 22 |
| PAS pressure pipe to pressure hose | | 40 |
| CCS-unit to bracket | | 15 |
| Front exhaust pipe to exhaust manifold | | 25 |
| Radiator cowl for electric fan to radiator | | 10 |
| Viscous fan to bearing (using special tool 3312) | | 37 |

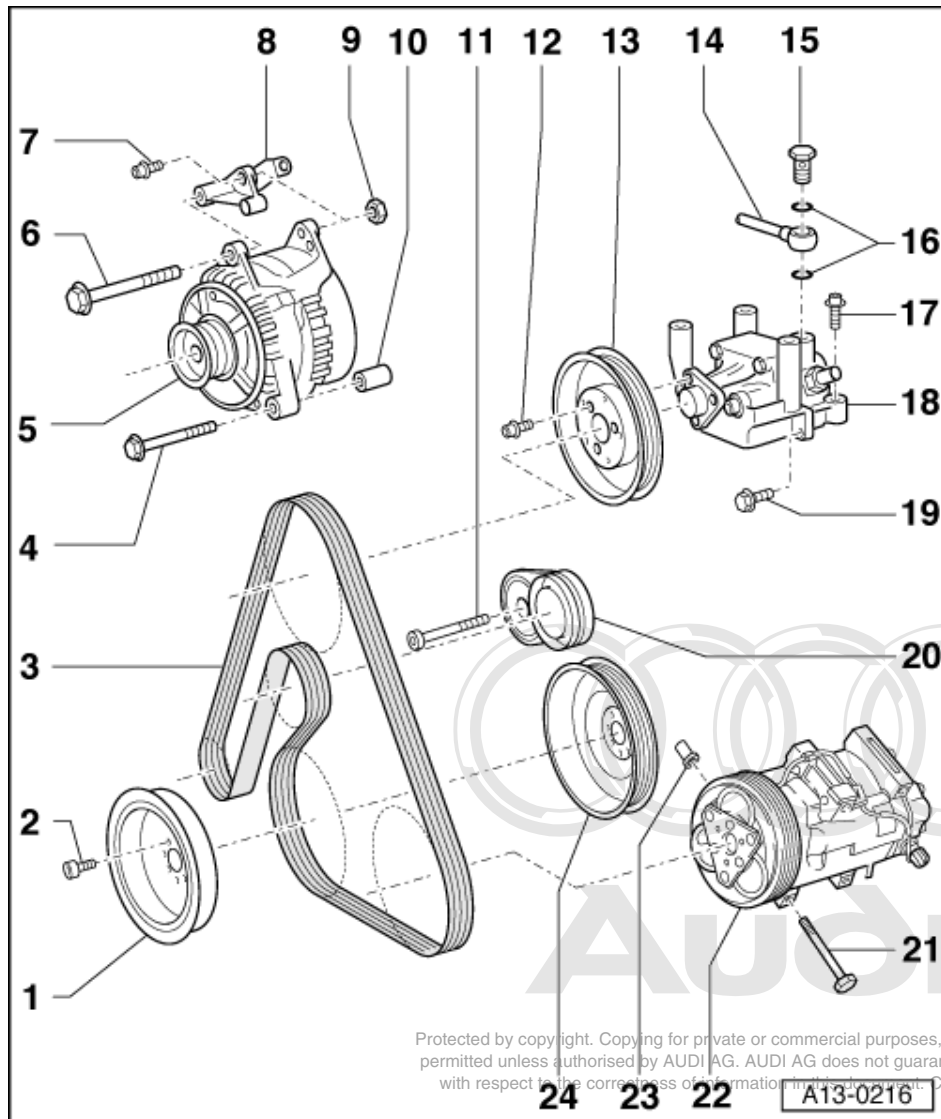
| Component | | Nm |
|--|-----|----|
| Hydraulic pump supply pipe to bracket | | 10 |
| A/C compressor to bracket | | 25 |
| Alternator to engine | M8 | 22 |
| | M10 | 45 |
| Drive plate to torque converter M10 x1 | | 85 |
| Engine speed sender to gearbox | | 10 |
| ATF pipe to gearbox | | 20 |
| Clamp for exhaust pipe | | 40 |
| Stop for torque reaction support to lock carrier | | 40 |
| Torque reaction support to engine | | 42 |
| Engine mount to subframe | | 25 |

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

13 - Crankshaft group

1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine



1.2 - Ribbed belt drive for vane pump, alternator and air conditioner

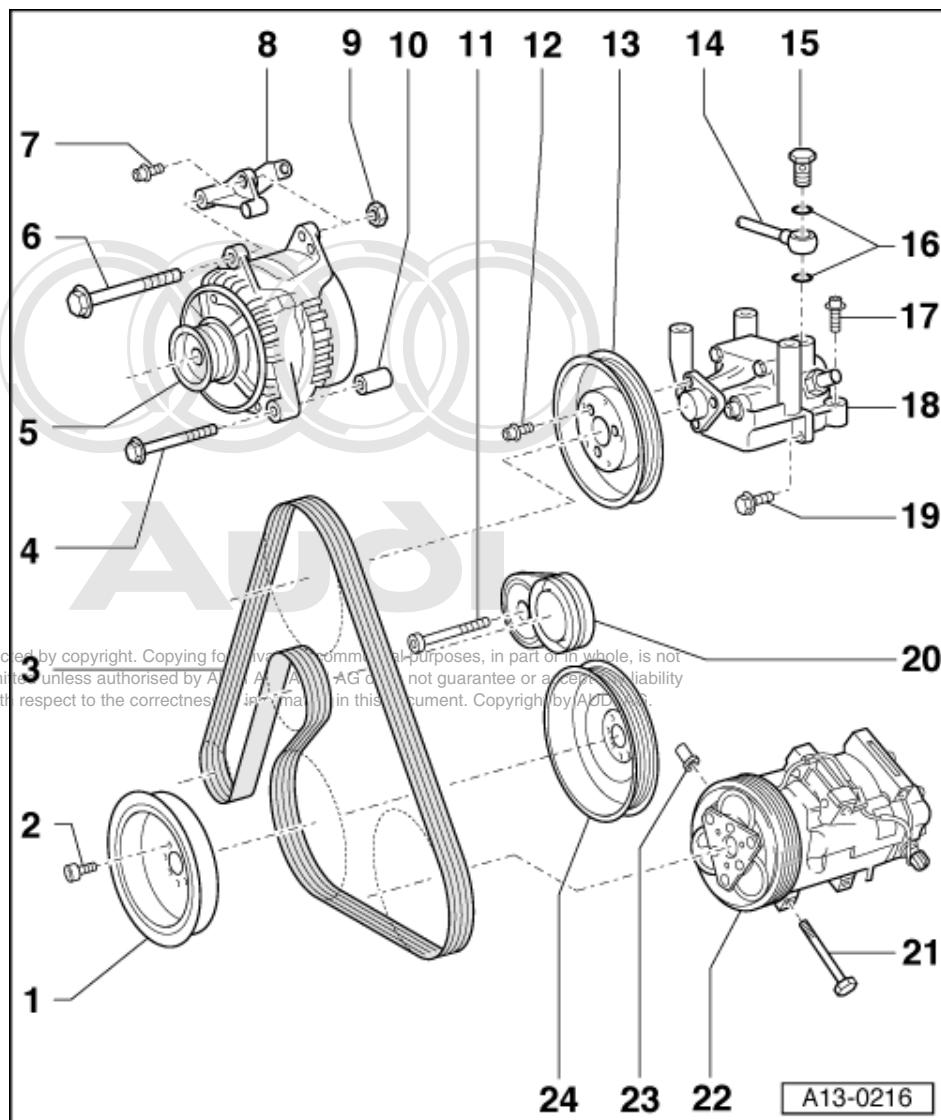
Notes:

- ♦ Before removing ribbed belt, mark direction of rotation with chalk or a felt pen. A used belt can break if it runs in the wrong direction.
- ♦ Ribbed belt routing
=>Page 31 .
- ♦ Figure shows version without viscous fan.
- ♦ Removing and installing viscous fan

=>Page 29 .

1 Vibration damper

- ♦ Removing and installing
 => Page 33



2 22 Nm

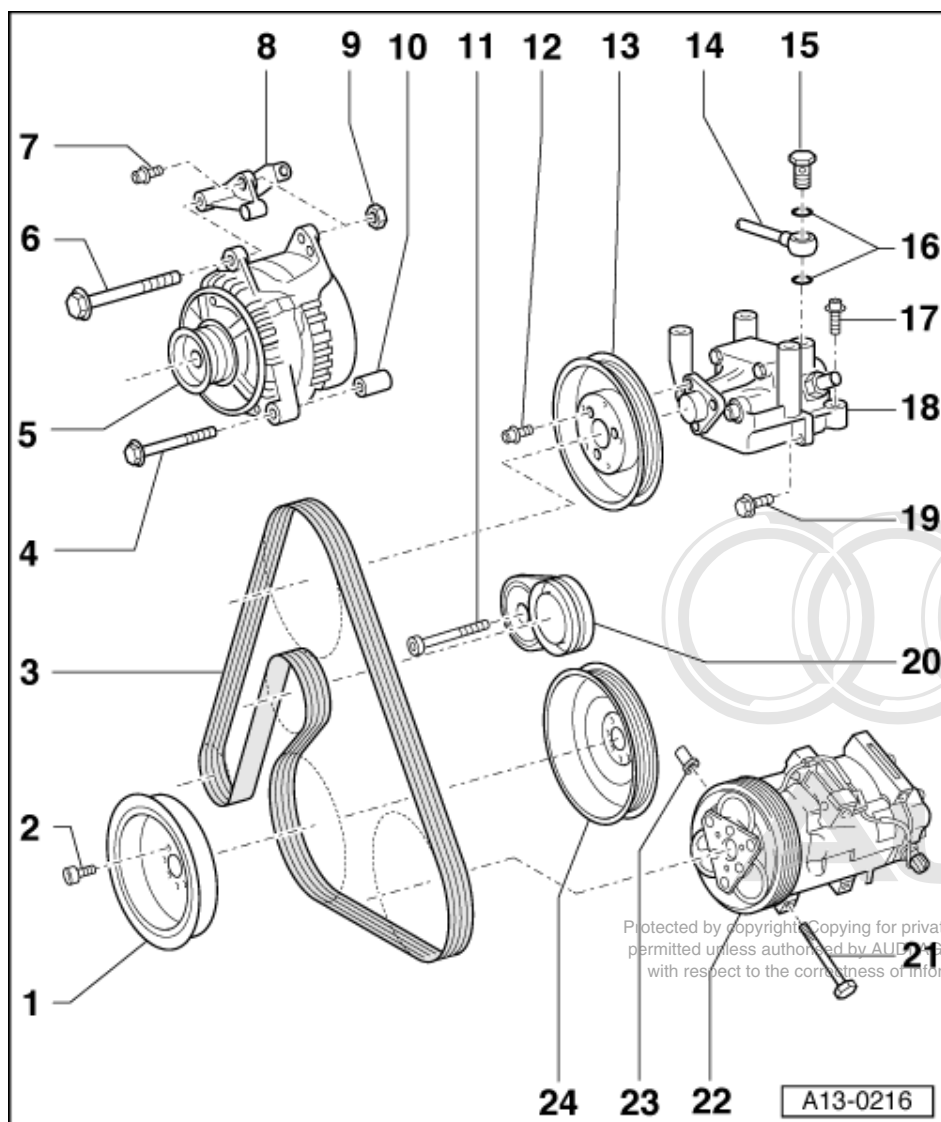
3 Ribbed belt

- ♦ Removing and installing
 => Page 30

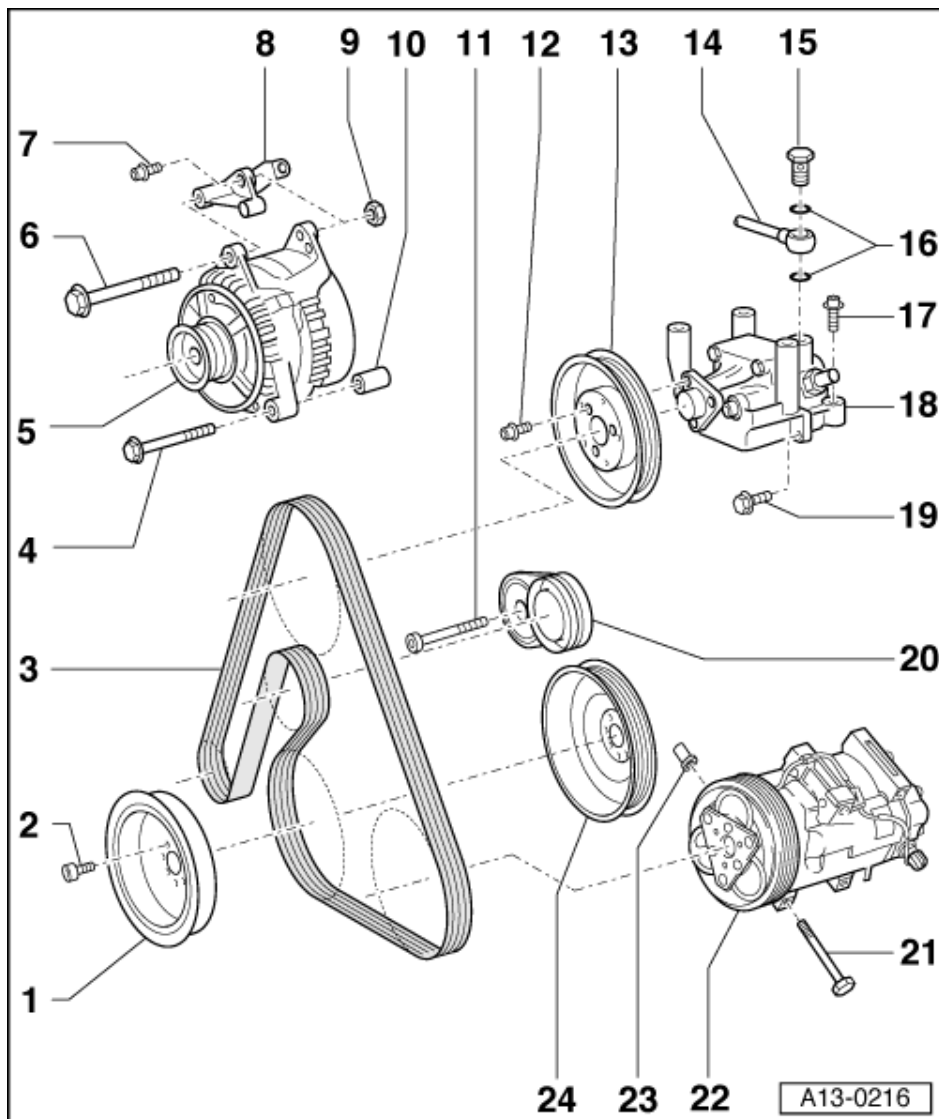
4 22 Nm

5 Alternator

- ♦ Removing:
 - Disconnect battery earth strap
 - Remove ribbed belt
 =>Page 30
 - Remove noise insulation.
 - Detach air duct between alternator and lock carrier.
 - Unbolt bottom mounting
 - Disconnect wiring from alternator
 - Unbolt alternator at top and remove.



- 6 45 Nm
- 7 22 Nm
- 8 Bracket
 - ♦ For alternator
- 9 45 Nm
- 10 Spacer sleeve
- 11 55 Nm
- 12 22 Nm
- 13 Pulley
 - ♦ For vane pump
 - ♦ To remove and install, brace with special tool 3212
- 14 Pressure pipe
 - ♦ For power steering



15 Banjo bolt, 40 Nm

16 Seal

- ♦ Renew

17 22 Nm

18 Vane pump with bracket

- ♦ For power steering
- ♦ Removing and installing:

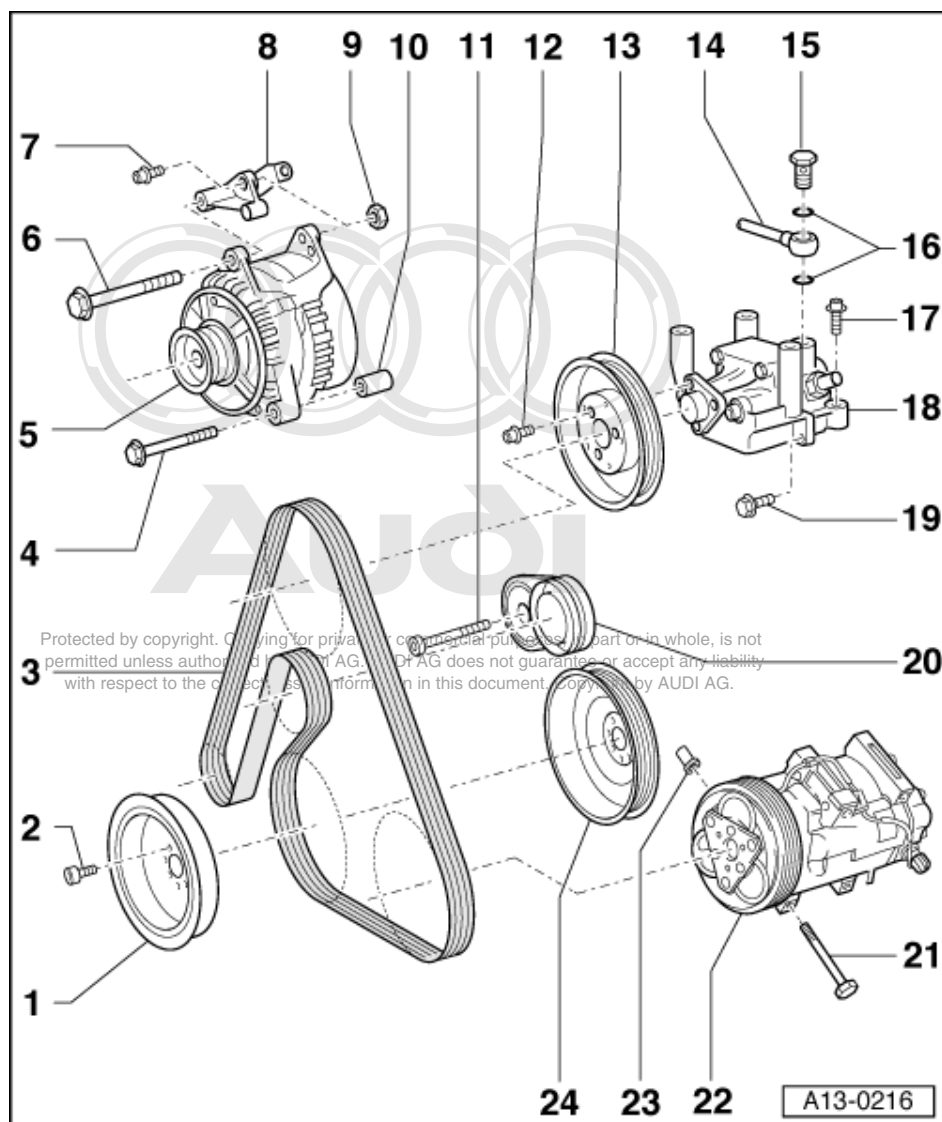
=> Running gear, Front-wheel drive and four-wheel drive; Repair group 48; Assembly overview: Power steering hydraulic fluid circuit for 6-cylinder engine Assembly overview: Power steering hydraulic fluid circuit for 6-cylinder engine

19 22 Nm

20 Tensioning element for ribbed belt

21 25 Nm

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



22 A/C compressor

- ♦ Do not unscrew or disconnect refrigerant hoses or pipes.
- ♦ After detaching compressor from mountings, secure it to longitudinal member with wire or similar. Do not leave it suspended from refrigerant pipes.

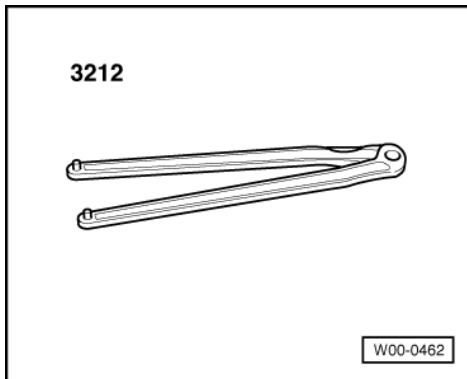
23 Nut (special type) -25 Nm

24 Pulley

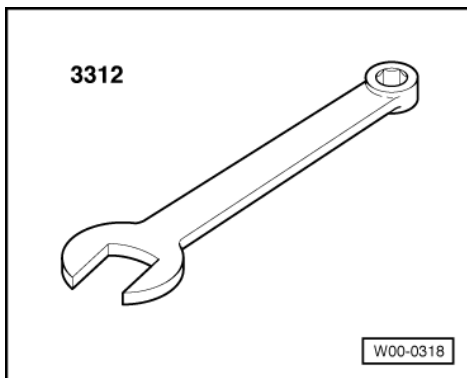
- ♦ For ribbed belt
- ♦ Can only be installed in one position.

1.3 - Removing and installing viscous fan

Special tools and workshop equipment required



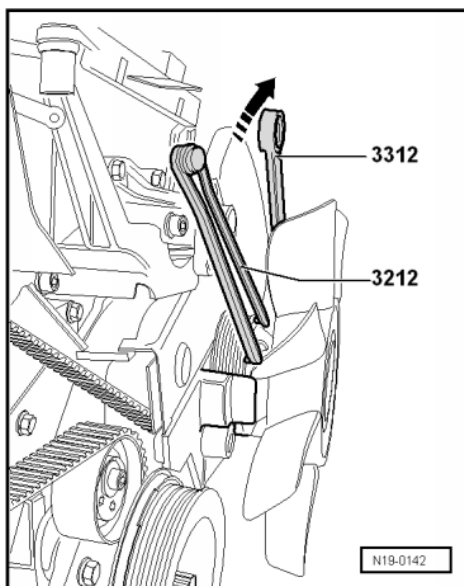
- ◆ Special tool 3212



- ◆ Special tool 3312

Work sequence

- Unbolt cowl for viscous fan



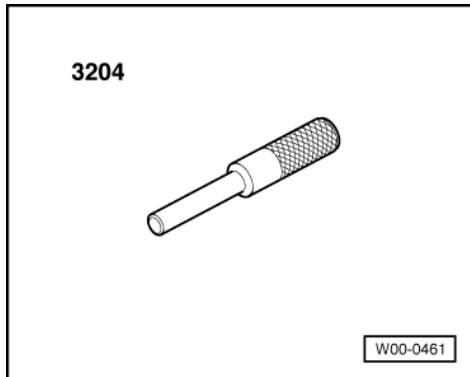
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Hold viscous fan pulley with pin wrench 3212 and unscrew viscous fan with open-end spanner 3312 (left-hand thread).
- Lift out viscous fan.
- When installing viscous fan, tighten to 37 Nm using open-end spanner 3312.

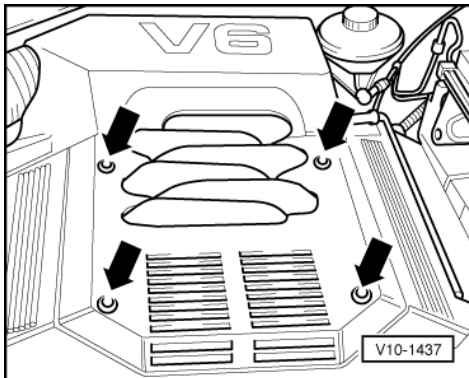
1.4 - Removing and installing ribbed belt

Special tools and workshop equipment required



- ♦ Mandrel 3204

Removing

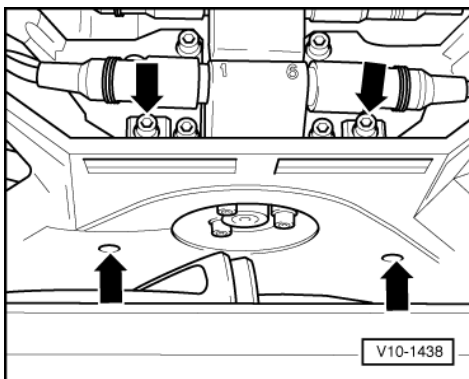


Vehicles with viscous fan:

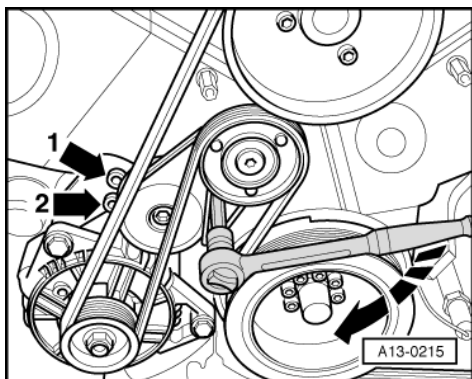
- Remove viscous fan => Page 29 .

All models

- -> Remove engine cover panel -arrows-.



- -> Remove ribbed belt cover -arrows-.



- -> To slacken ribbed belt, turn tensioning element in direction of arrow with hexagon key (10 mm).
- Insert mandrel 3204 into holes -1- and -2- to stop tensioning element from turning.

Note:

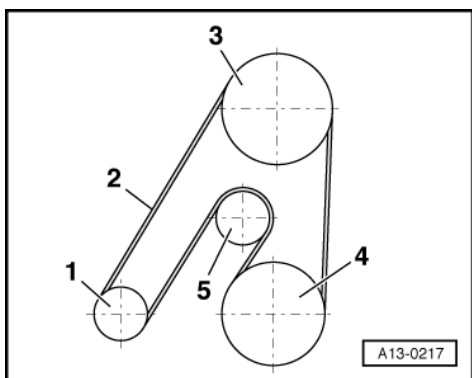
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Mark the direction of rotation with chalk or felt pen before removing the ribbed belt. If the belt rotates in the wrong direction when it is refitted, it may break.

- Remove ribbed belt.

Installing

Install in reverse sequence; note the following points:

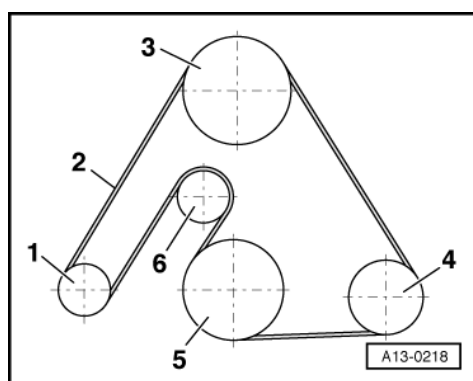


- Place ribbed V-belt onto crankshaft pulley first. Slide belt onto tensioning roller last.

Vehicles without viscous fan:

-> Belt routing without air conditioning system

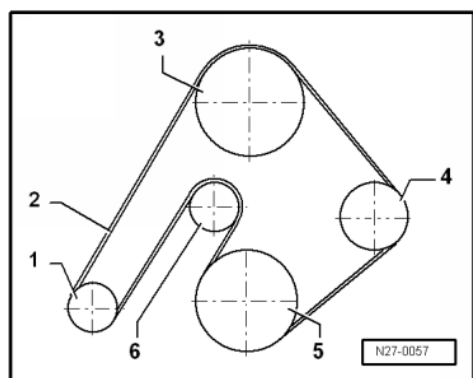
- 1 - Alternator
- 2 - Ribbed V-belt
- 3 - P.A.S. vane pump
- 4 - Crankshaft
- 5 - Tensioning roller



-> Belt routing with air conditioning

- 1 - Alternator
- 2 - Ribbed V-belt
- 3 - P.A.S. vane pump
- 4 - Air conditioner compressor
- 5 - Crankshaft
- 6 - Tensioning roller

Vehicles with viscous fan:

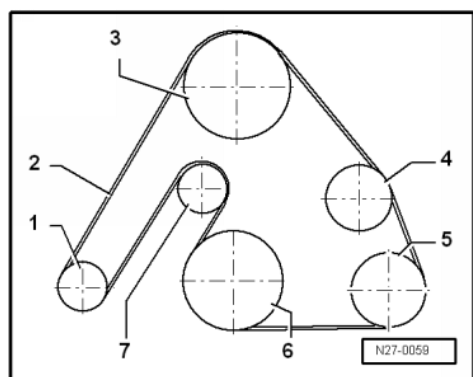


-> Belt routing without air conditioning system

- 1 - Alternator
- 2 - Ribbed V-belt
- 3 - P.A.S. vane pump
- 4 - Viscous fan
- 5 - Crankshaft
- 6 - Tensioning roller



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



-> Belt routing with air conditioning

- 1 - Alternator
- 2 - Ribbed V-belt
- 3 - P.A.S. vane pump
- 4 - Viscous fan
- 5 - Air conditioner compressor
- 6 - Crankshaft
- 7 - Tensioning roller

- Install viscous fan => Page 29 .

All models

Note:

Ensure that the ribbed belt is properly seated in the pulleys when installing.

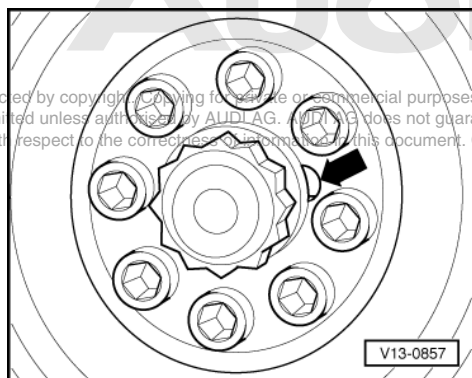
- Start engine and check belt running.

1.5 - Removing and installing vibration damper

- Ribbed belt must be removed => Page 30 .
- Unbolt vibration damper.

Note:

The central bolt does not have to be loosened to remove the vibration damper.



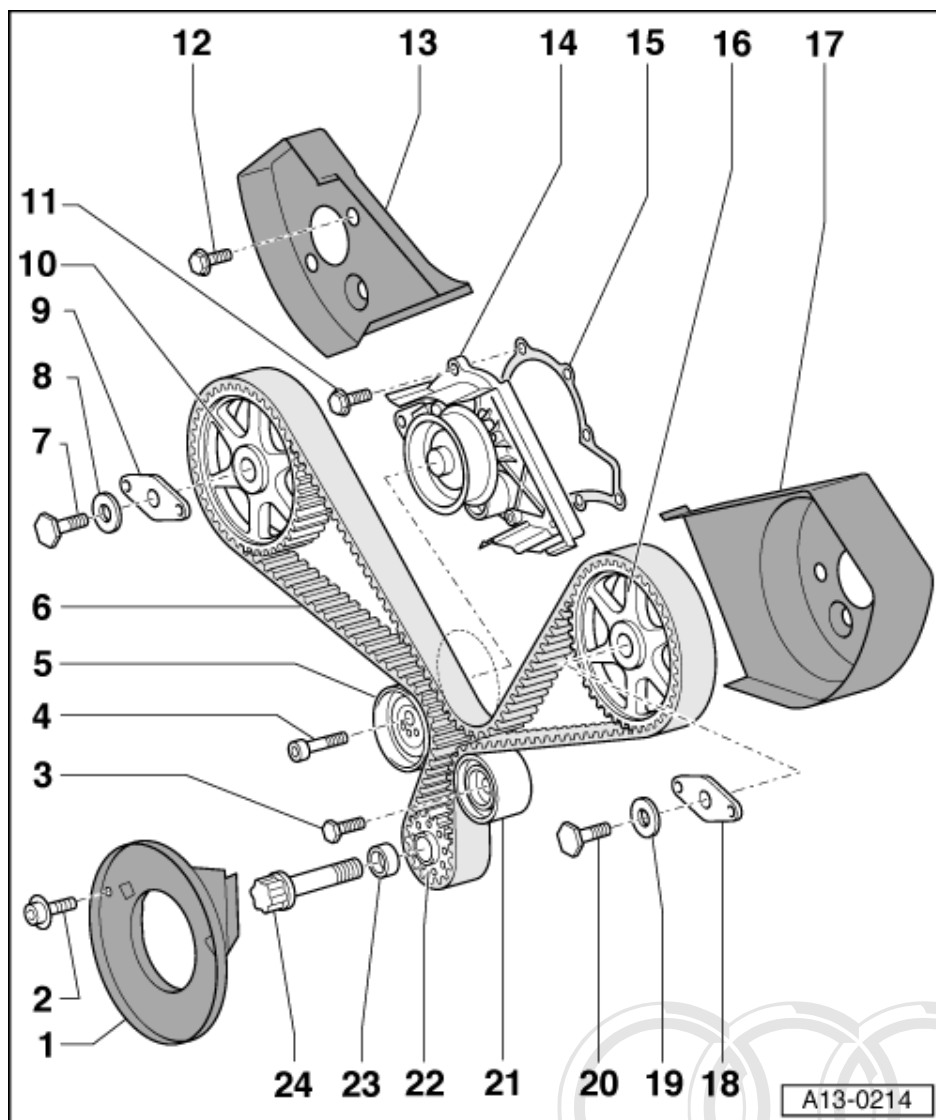
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> When installing, ensure that notch -arrow- in vibration damper is aligned with locating lug on toothed belt sprocket.

Tightening torque

| Component | Nm |
|--------------------------------|----|
| Vibration damper to crankshaft | 22 |

1.6 - Toothed belt drive

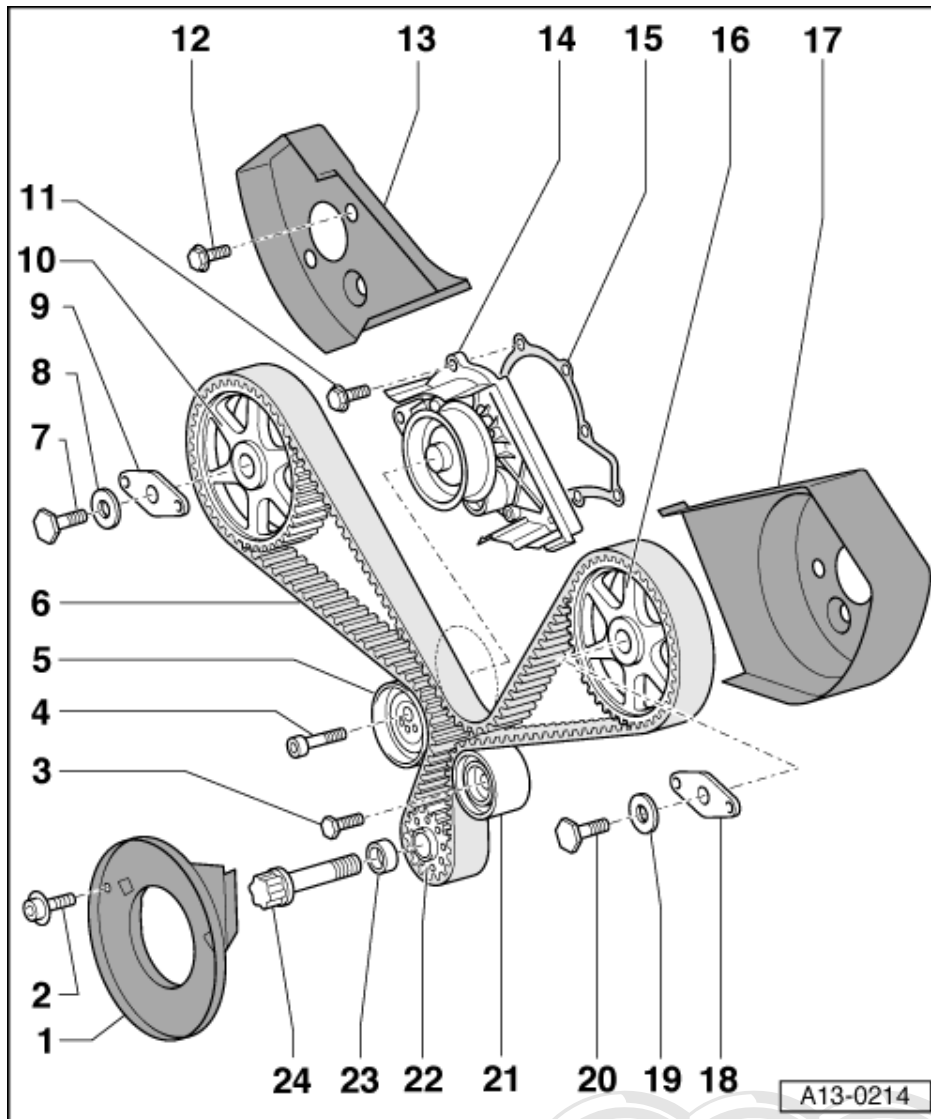


Note:

Mark the direction of rotation with chalk or felt pen before removing the toothed belt. If a used belt rotates in the wrong direction when refitted, this can result in breakage.

- 1 Toothed belt guard - bottom
 - ♦ To remove, unbolt vibration damper
- 2 10 Nm
- 3 43 Nm
- 4 22 Nm
- 5 Tensioner

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



6 Toothed belt

- ◆ Mark direction of rotation with chalk or felt pen before removing
- ◆ Check for wear
- ◆ Removing => Page 39
- ◆ Installing (adjusting valve timing)
=> Page 42

7 70 Nm

- ◆ Renew

8 Washer

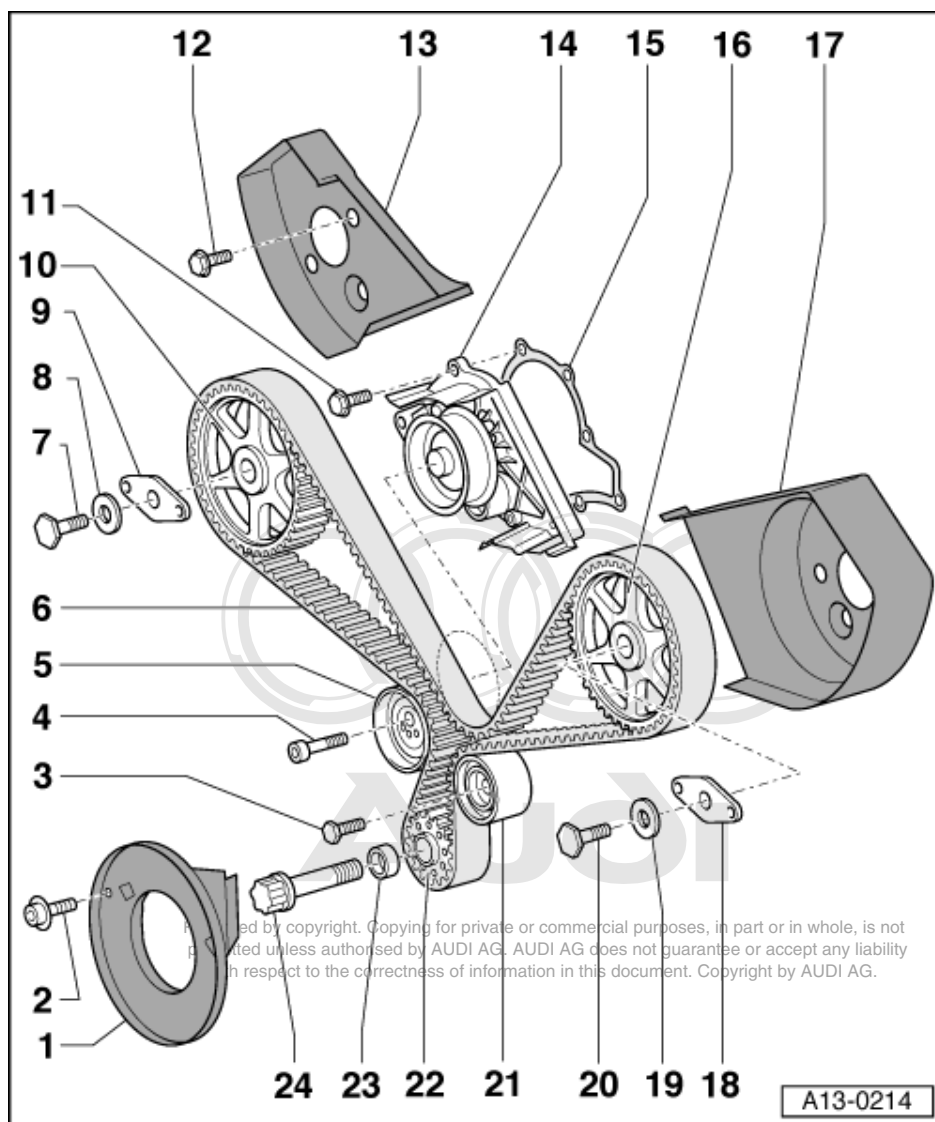
9 Securing plate

- ◆ The side inscribed "front vorne" should always be installed facing forward.

10 Camshaft sprocket (right)

- ◆ To remove and install, first remove toothed belt from camshaft sprockets => Page 39
- ◆ Pull off with special tool T40001

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the written permission of Audi AG. Audi AG does not accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



11 10 Nm

12 10 Nm

13 Toothed belt guard - rear right

14 Coolant pump

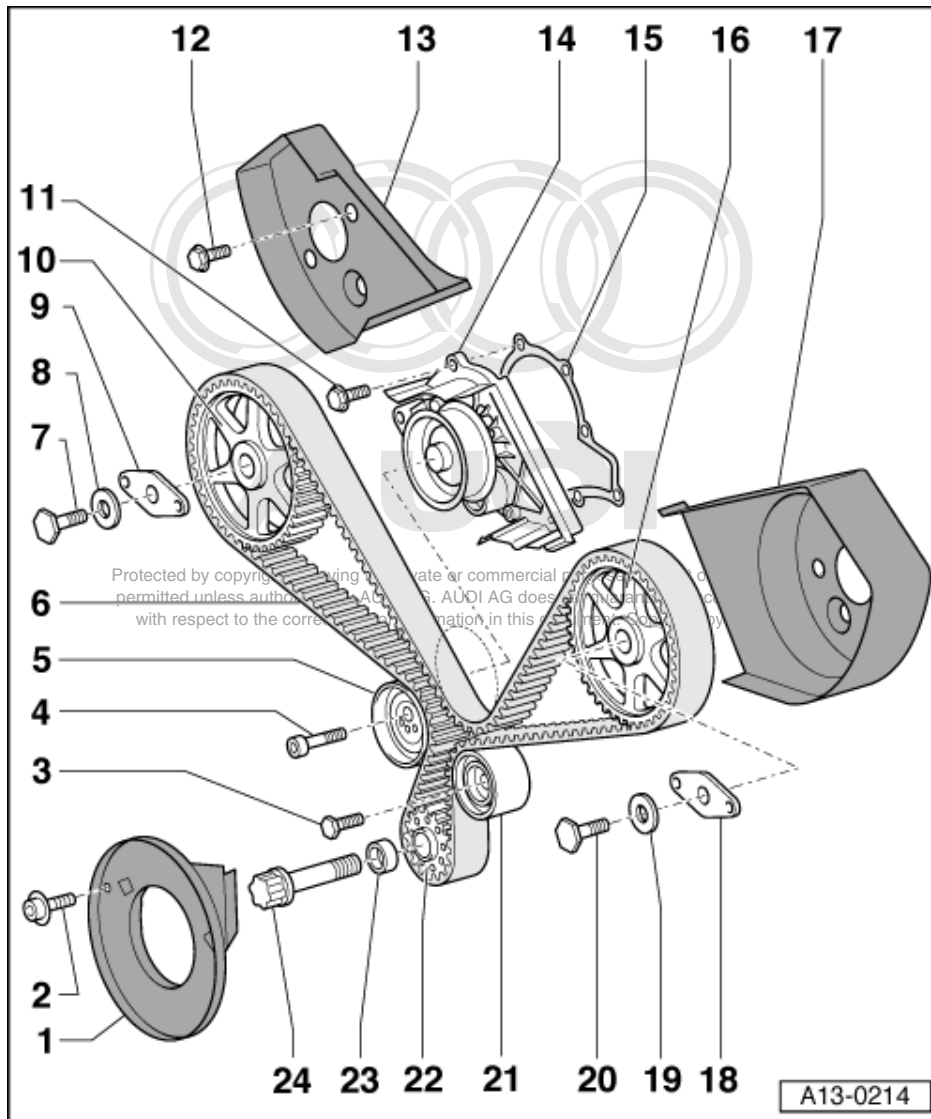
- ♦ Removing and installing
=> Page 152

15 Gasket

- ♦ Renew

16 Camshaft sprocket (left)

- ♦ To remove and install, first remove toothed belt from camshaft sprockets=>Page 39
- ♦ Pull off with special tool T40001



17 Toothed belt guard - rear left

18 Securing plate

- ♦ The side inscribed "front vorne" should always be installed facing forward.

19 Washer

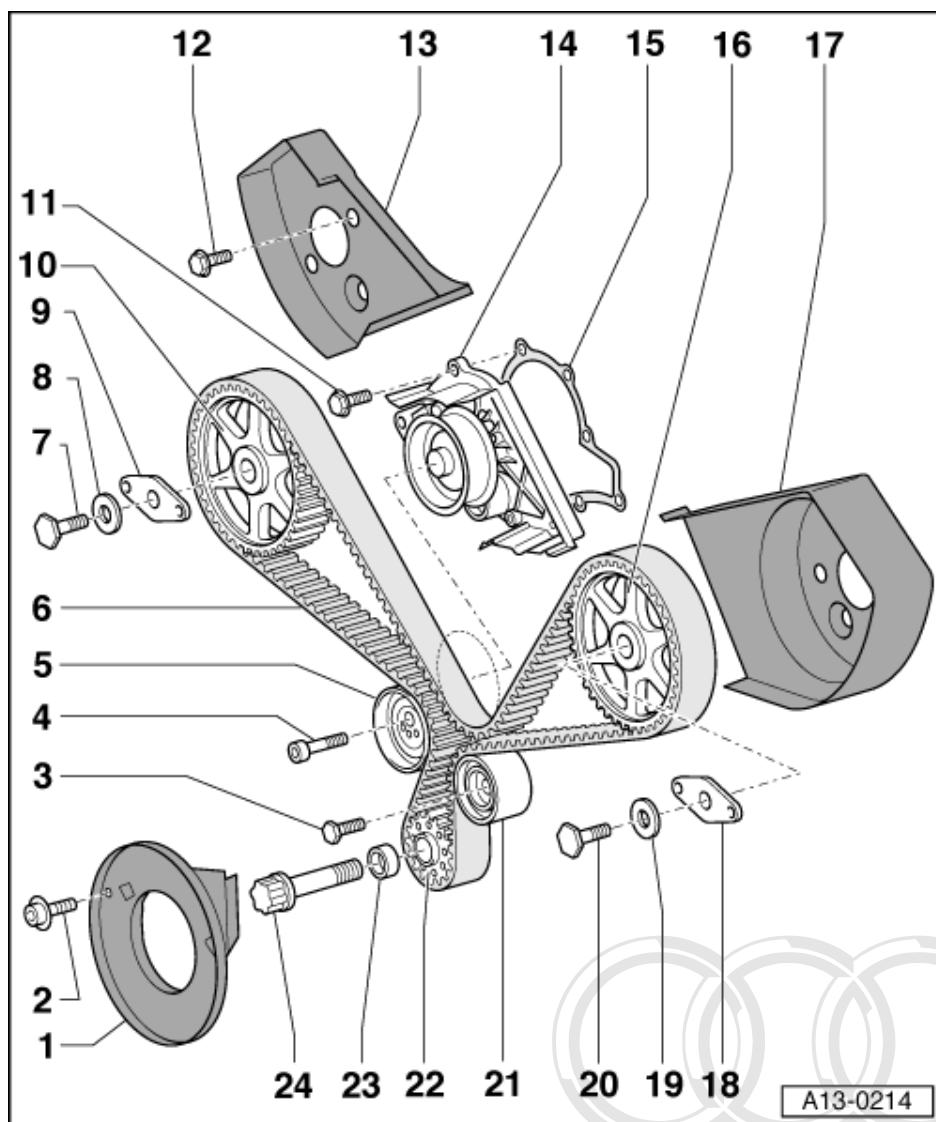
20 70 Nm

- ♦ Renew

21 Idler roller

22 Crankshaft sprocket

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



23 Spacer washer

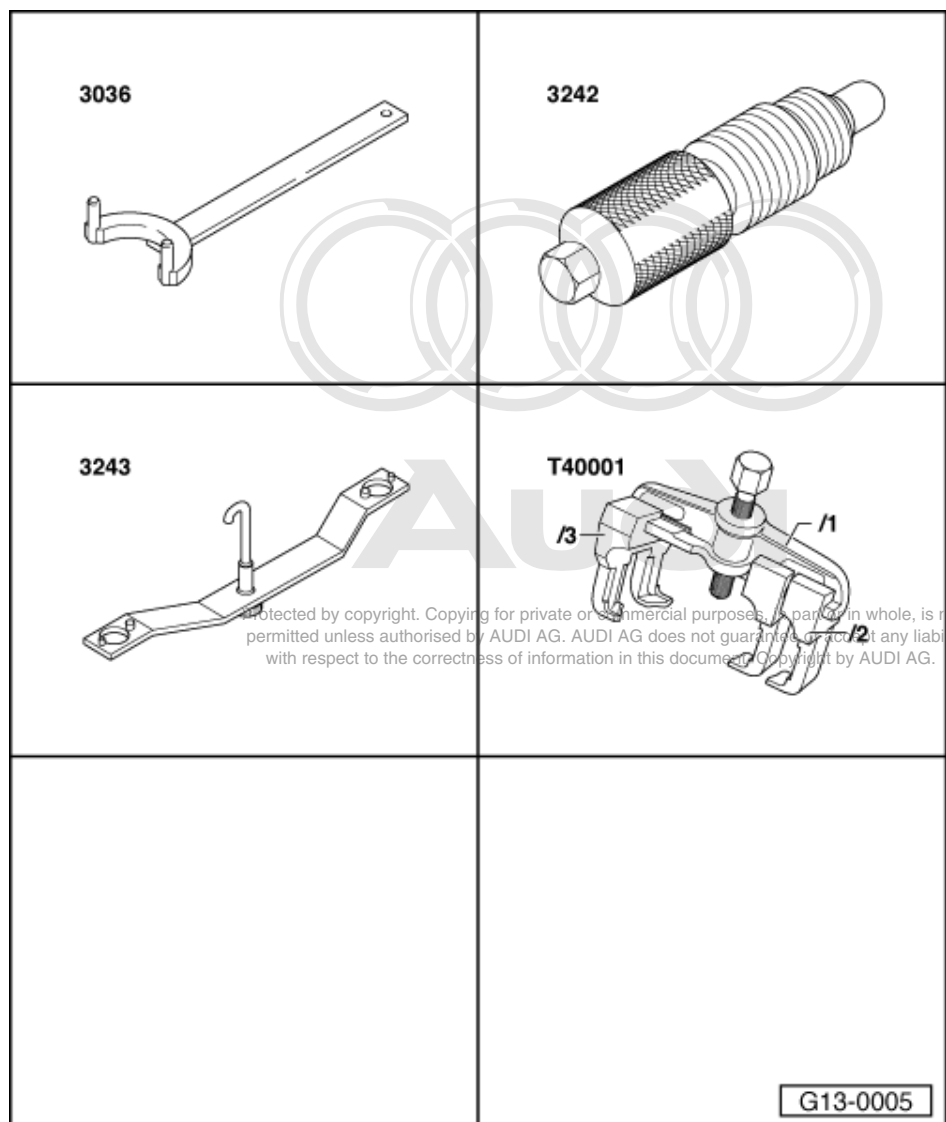
24 200 Nm + 1/2 turn (180 °) further

- ◆ Renew
- ◆ Do not apply additional lubrication
- ◆ Use clamping bolt 3242 when loosening and tightening
- ◆ Screwing in clamping bolt 3242

=> Page 50

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.7 - Removing and installing toothed belt

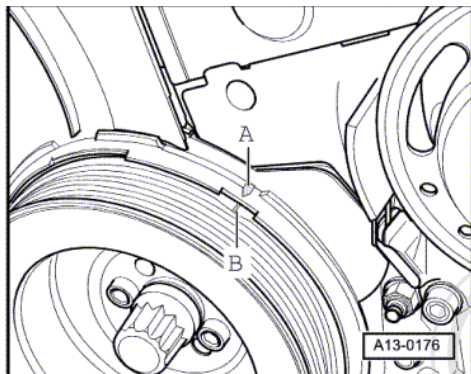


Special tools and workshop equipment required

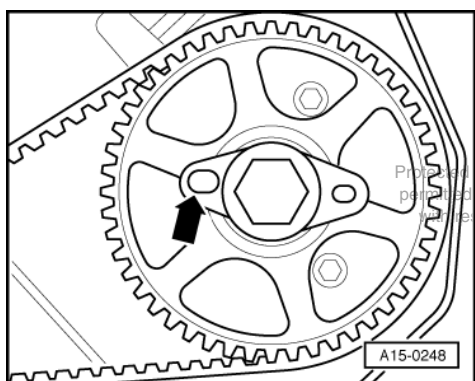
- ◆ Special tool 3036
- ◆ Special tool 3242
- ◆ Special tool 3243
- ◆ Special tool T40001
with jaws T40001/2

Removing toothed belt

- Engine in vehicle
- Remove ribbed belt => Page 30.
- Remove tensioning element for ribbed belt.
- Remove toothed belt guard on left and right.
- Mark direction of rotation of toothed belt. The belt can break if it rotates in the opposite direction when refitted.
- Set crankshaft to markings for TDC of No. 1 cylinder by turning central bolt on crankshaft sprocket in direction of rotation.

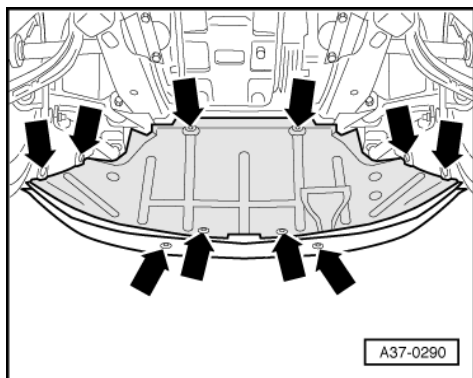


- -> Notch -B- aligned with marking -A-.
- Check position of camshafts:



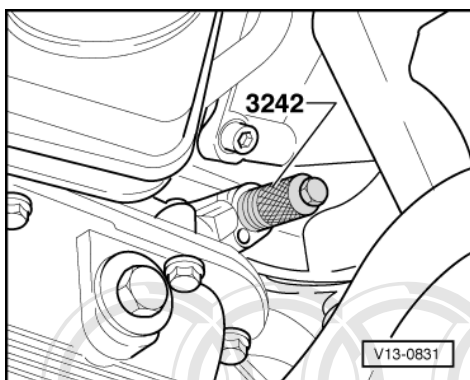
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> The larger holes -arrow- in the securing plates on the camshaft sprockets should point inwards. If this is not the case, turn the crankshaft one complete revolution.



- -> Remove noise insulation -arrows-.
- Remove ignition timing point sender -G4 from left-side of cylinder block.

Note:



There is a TDC drilling in the crankshaft exactly in line with the sender.

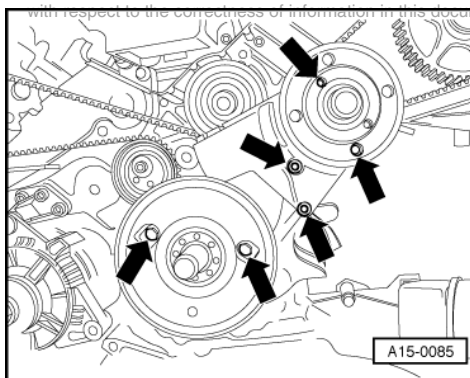
The drilling can be felt with a finger.

Warning

Injury risk - do not turn the crankshaft while feeling for the TDC drilling with a finger.

- -> Screw crankshaft clamping bolt 3242 into hole where sender was removed, and tighten clamping bolt.

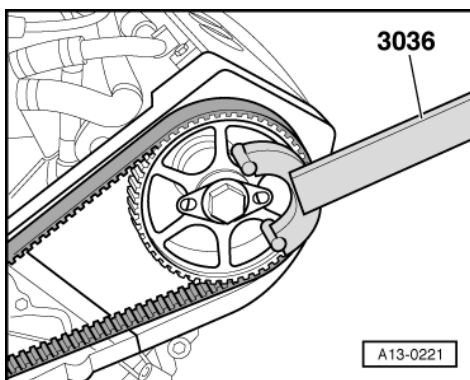
Remove vibration damper => Page 33
 Protected by copyright. All rights reserved. This document, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unbolt bottom section of toothed belt guard and idler roller for ribbed belt -arrows-.

Note:

Shown in illustration on vehicle with viscous fan.

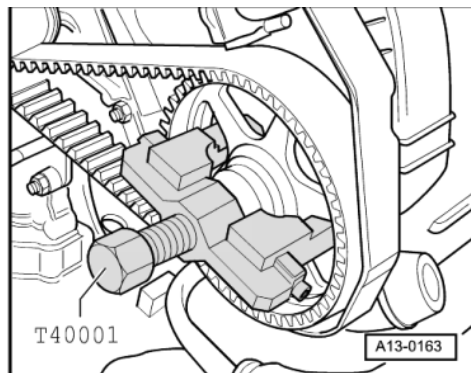


- -> Loosen bolts on both camshaft sprockets, using special tool 3036 to brace sprockets.

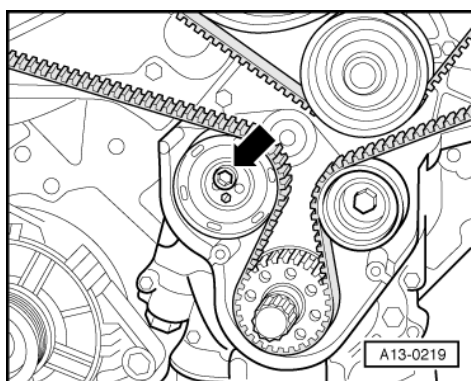


Note:

Loosen bolts but do not remove.



- -> Pull left and right camshaft sprockets off their tapers using special tool T40001 with jaws T40001/2.

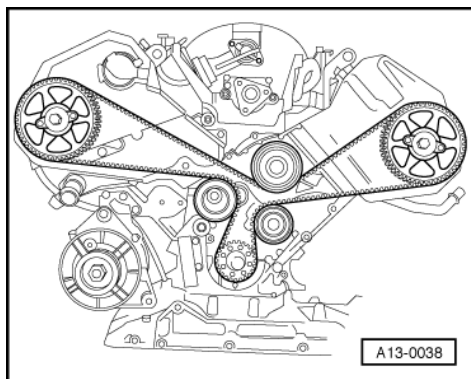


- -> Slacken bolt -arrow- of tensioning roller.
- Take off toothed belt.

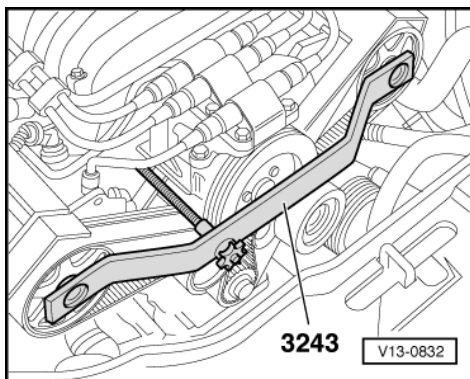
Installing (adjusting valve timing)

Notes:

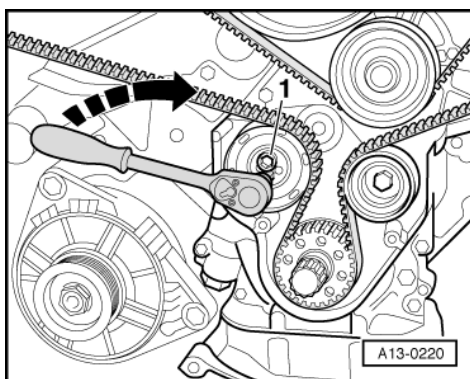
- ♦ The crankshaft must not be at TDC at any cylinder when the camshaft is turned. Otherwise there is a risk of damage to valves and piston crowns.
 - ♦ After repairs, the valve timing must be adjusted as described below, even if the belt has only been taken off the camshaft sprocket.
- Crankshaft locked in position with 3242.
 - Camshaft sprockets able to turn.
- Replace bolts for camshaft sprockets.
 - Refit both camshaft sprockets with securing plates, washers and bolts.
- Tighten the two camshaft sprocket bolts until the sprockets can still just be turned, but do not move axially.



- -> Fit toothed belt on all sprockets as illustrated (fit over tensioning roller last).

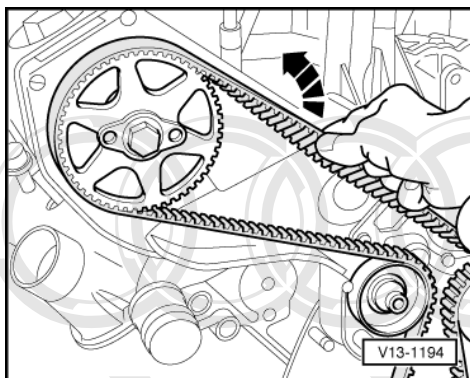


- -> Fit camshaft clamp 3243.



- -> Using 8 mm hexagon key, turn toothed belt tensioning roller in direction shown -arrow-.
- Using a second 8 mm hexagon key, tighten bolt -1- of toothed belt tensioning roller (22 Nm).

- Check toothed belt tension between right-hand camshaft sprocket and coolant pump:



- -> It should just be possible to turn the toothed belt through 90° with thumb and index finger midway between camshaft sprocket and coolant pump.

Tighten camshaft sprocket bolts to 30 Nm.

Remove camshaft retainers 3243.

Tighten camshaft sprocket bolts to final torque of 70 Nm, using special tool 3036 to brace sprockets.

Remove crankshaft clamping bolt 3242.

- Screw ignition timing point sender with new O-ring into cylinder block.
- Install ribbed belt => Page 31 .
- Install viscous fan => Page 29 .

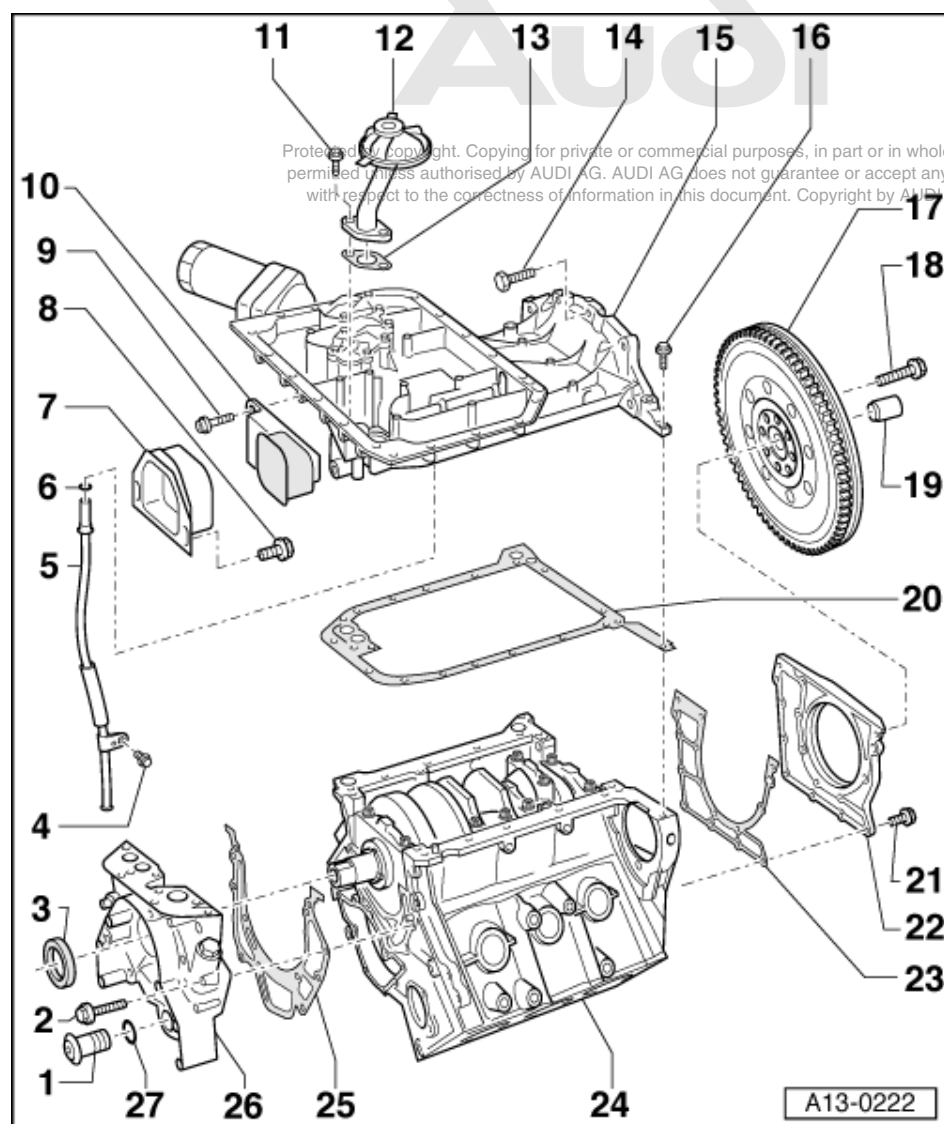
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the content of this document. Copyright by AUDI AG.

Tightening torques

| Component | Nm |
|--|----|
| Camshaft sprocket to camshaft | 70 |
| Vibration damper to crankshaft sprocket | 22 |
| Ribbed belt tensioner to cylinder block | 55 |
| Ignition timing point sender to cylinder block | 10 |
| Bottom section of toothed belt guard to cylinder block | 10 |
| Viscous fan bracket to | M6 |
| cylinder block | M8 |
| Toothed belt tensioning roller to oil pump | 22 |

2 - Removing and installing sealing flange and flywheel/drive plate

2.1 - Removing and installing sealing flange and flywheel/drive plate



Note:

For repairs to the clutch:

=> 5-Speed manual gearbox 012/01W, Front-wheel drive; Repair group 30; Servicing clutch Servicing clutch

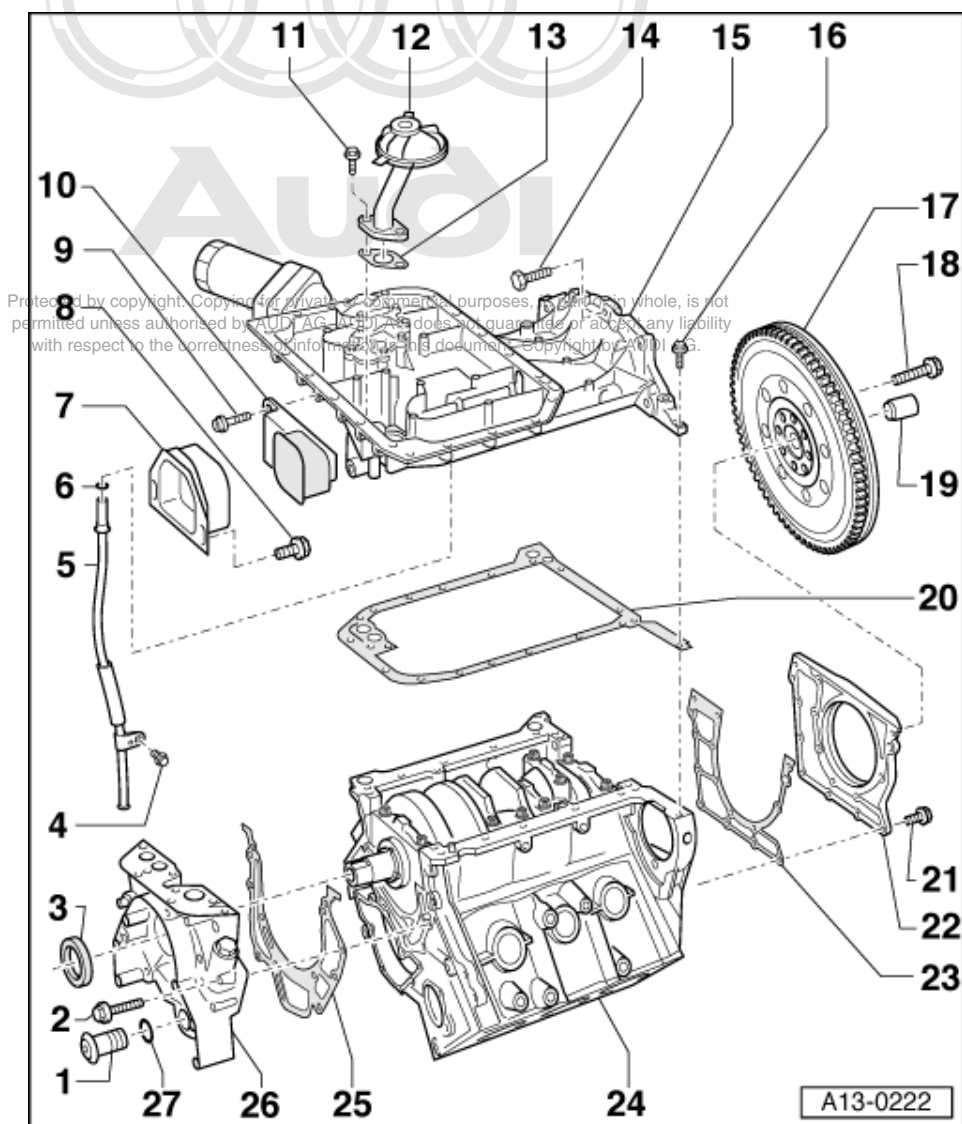
=> 5-Speed manual gearbox 01A, Four-wheel drive; Repair group 30; Servicing clutch Servicing clutch

1 Screw plug - 30 Nm

2 10 Nm

3 Oil seal

- ♦ For crankshaft
- ♦ Removing and installing
=> Page 50



4 10 Nm

5 Guide tube for oil dipstick

6 O ring

- ♦ Renew

7 Stop plate

- ♦ For torque reaction support

8 40 Nm



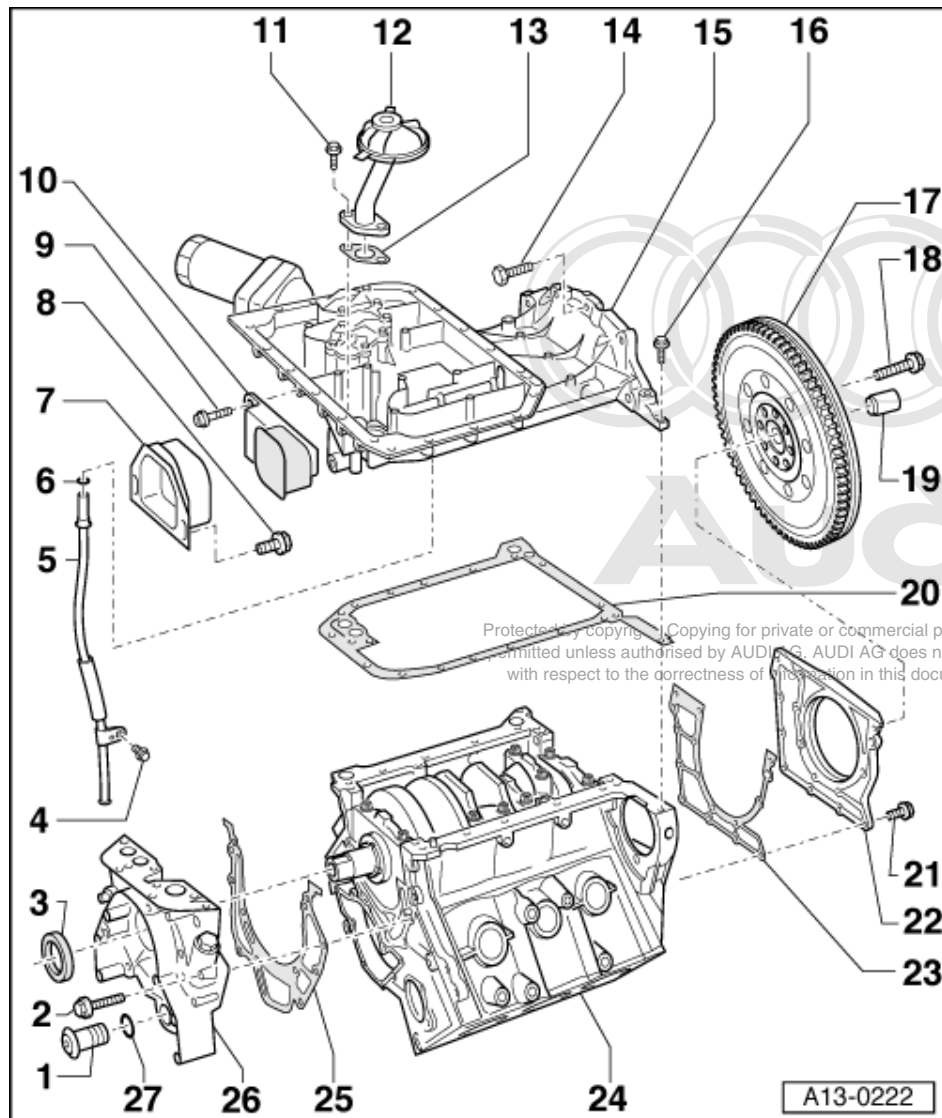
9 42 Nm

10 Torque reaction support

11 10 Nm

12 Suction pipe

- ♦ With inlet connection
- ♦ Up to VIN 4D S_ 000 496



13 Gasket

- ♦ Up to VIN 4D S_ 000 496
- ♦ Renew

14 M8 - 25 Nm

M10 - 45 Nm

15 Sump (upper section)

- ♦ Removing and installing
=> Page 129
- ♦ Install dry
- ♦ No additional sealant required

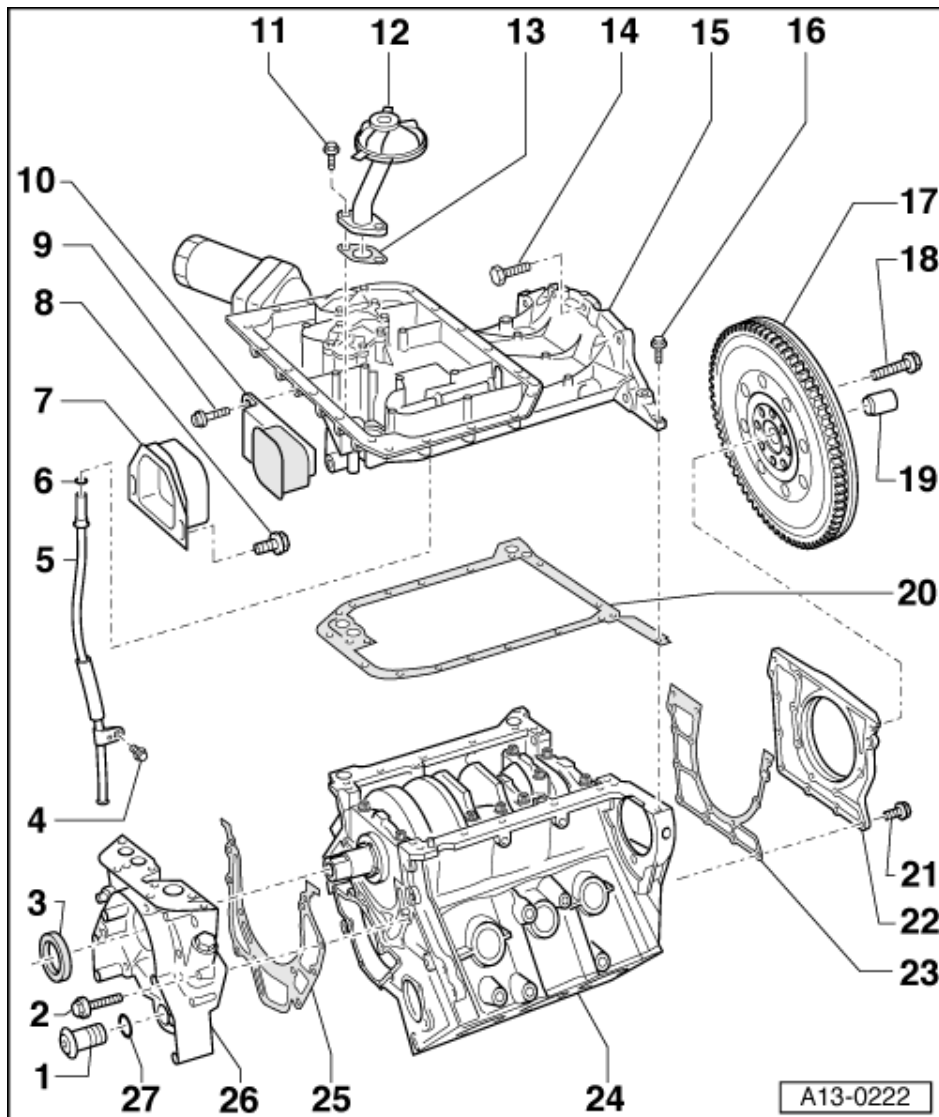
16 10 Nm

- ♦ Install two bolts with locking fluid D 000 600 A2=>Page 135

17 Dual-mass flywheel/drive plate

- ♦ Removing and installing dual-mass flywheel =>Page 52

- ♦ Removing and installing drive plate =>Page 54



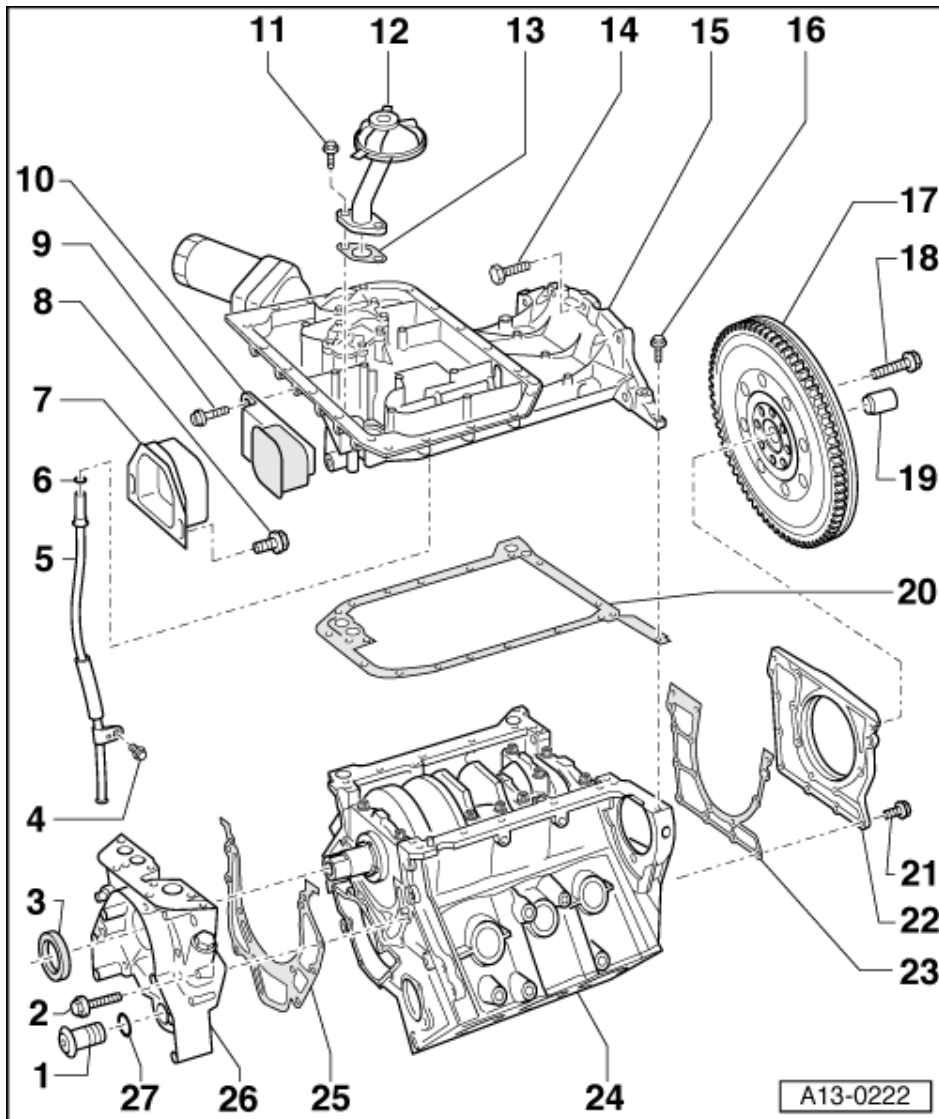
18 Securing bolt for dual-mass flywheel or drive plate

- ♦ Renewing
- ♦ Tightening torque for dual-mass flywheel: 60 Nm + 1/2 turn (180°) further
- ♦ Tightening torque for drive plate (vehicles with automatic gearbox): 60 Nm + 1/4 turn. (90°) further

19 Needle bearing

- ♦ With manual gearbox only
- ♦ Pulling out and driving in
=> Page 55
- ♦ On vehicles with automatic gearbox: instead of fitting the dual-mass flywheel with a needle bearing, a bearing bush is pressed into the crankshaft.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



20 Gasket

- ◆ Renew
- ◆ Install dry
- ◆ No additional sealant required

21 10 Nm

22 Rear sealing flange with oil seal

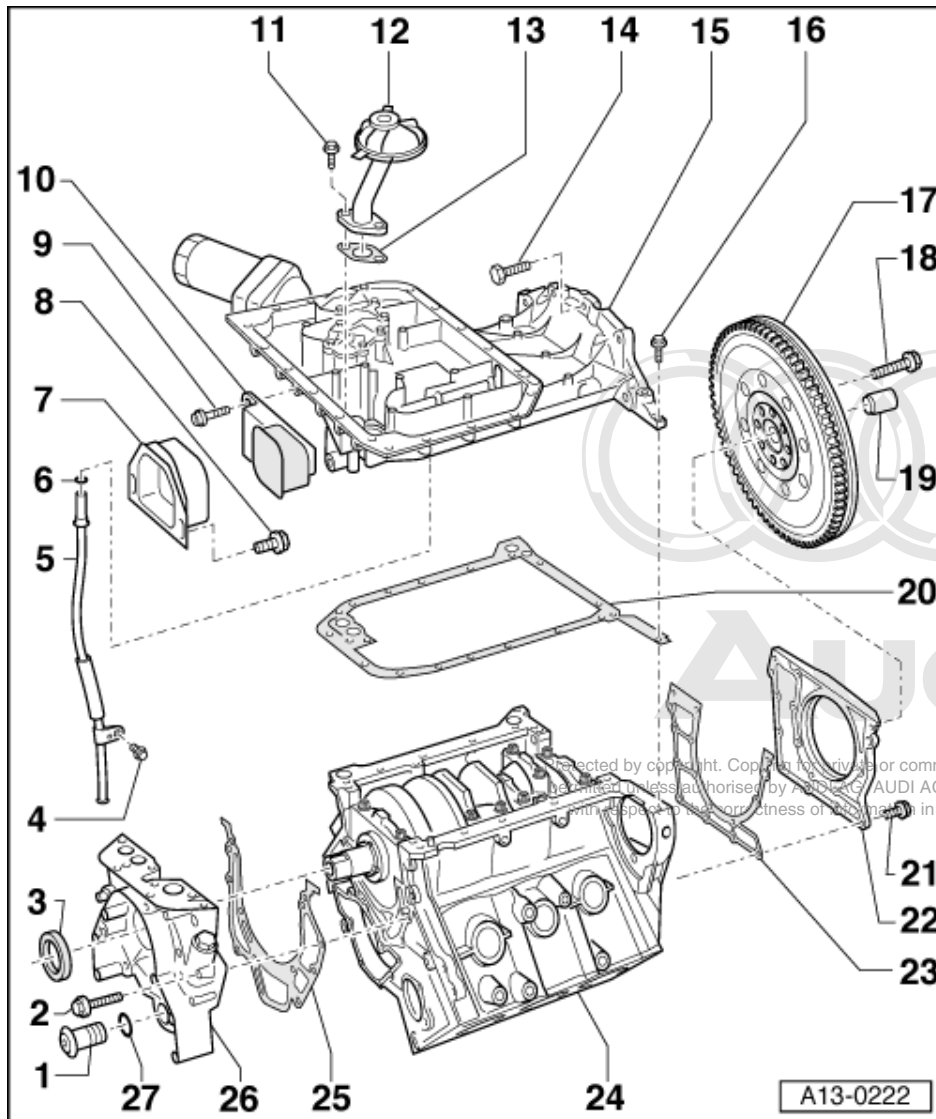
- ◆ Remove upper section of sump in order to remove and install
=> Page 129
- ◆ Lightly oil sealing lip of oil seal
- ◆ When installing, push guide sleeve from repair kit onto crankshaft.

23 Gasket

- ◆ Renew



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



24 Cylinder block

- ♦ Removing and installing crankshaft => Page 58
- ♦ Dismantling and assembling pistons and conrods
=> Page 64

25 Gasket

- ♦ Renew

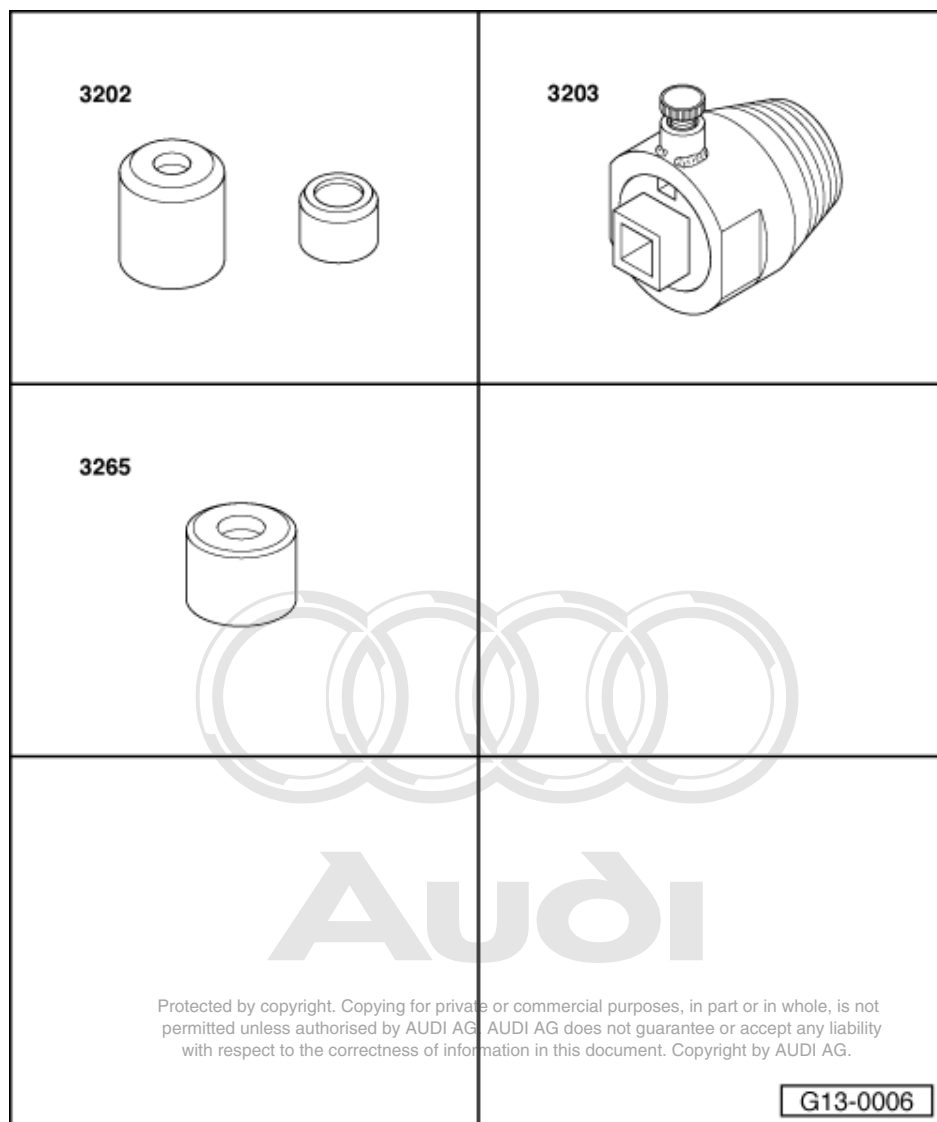
26 Oil pump

- ♦ Removing and installing
=> Page 136

27 O ring

- ♦ Renew

2.2 - Renewing crankshaft oil seal - pulley end

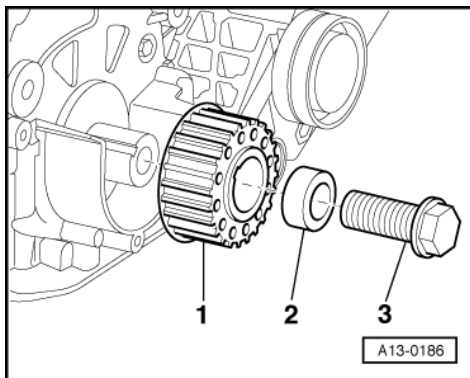


Special tools and workshop equipment required

- ♦ Special tool 3202/1
- ♦ Special tool 3203
- ♦ Special tool 3265

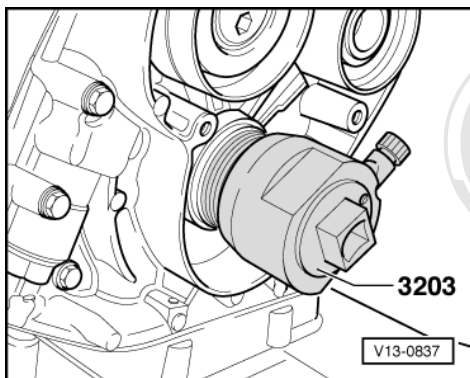
Removing

- Engine in vehicle



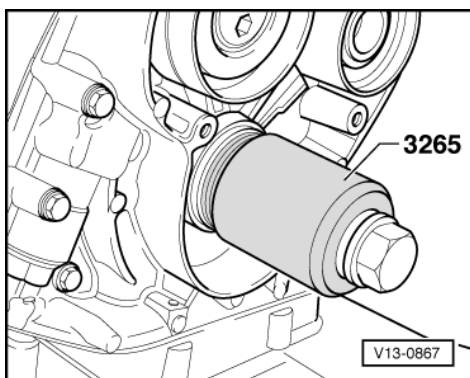
- Remove toothed belt => Page 39 .
- -> Unscrew central bolt -3- for crankshaft sprocket -1-.
- Remove spacer -2- and toothed belt sprocket.

- Unscrew inner part of oil seal extractor 3203 six turns out of the outer part and lock with knurled screw.



- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure screw it as far as possible into oil seal.
- Loosen knurled screw and turn inner part against crankshaft until the oil seal is pulled out.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.

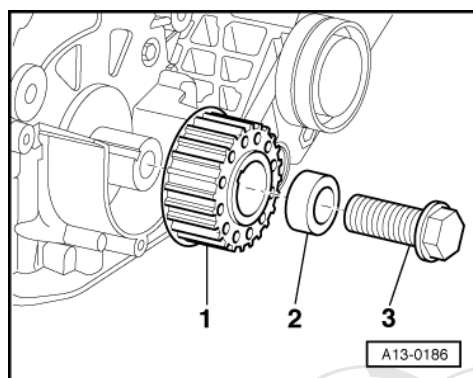
Installing



- Do not lubricate sealing lip or outer circumference of seal before pressing in.
- Push on seal using fitting sleeve 3202/1.
- -> Press in seal until flush using fitting sleeve 3265 and central bolt.

Note:

Fit spacer on central bolt.



- -> Install crankshaft sprocket -1- with spacer -2- and new central bolt -3-.

Notes:

- ♦ Contact surface between toothed belt sprocket and crankshaft must be free of oil.
- ♦ Do not apply additional lubricant to bolt for crankshaft sprocket.

- Install toothed belt => Page 42 .

Tightening torque

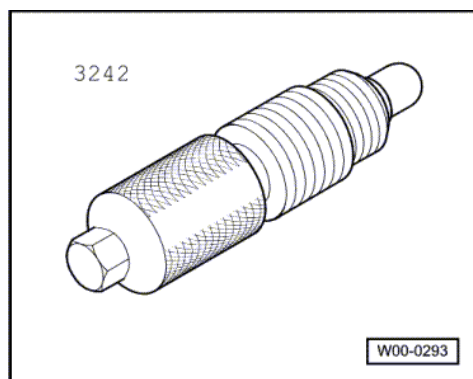
| Component | Nm |
|-------------------------------------|-----------------|
| Toothed belt sprocket to crankshaft | 200 + 180°1) 2) |

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1) Renew bolt

2) 180°= 1/2turn

2.3 - Removing and installing dual mass flywheel/ drive plate

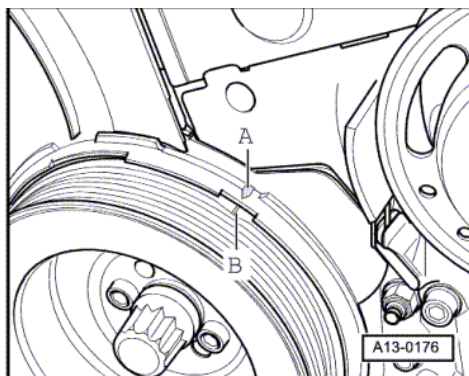


Special tools and workshop equipment required

- ♦ Clamping bolt 3242

Removing

- Gearbox removed



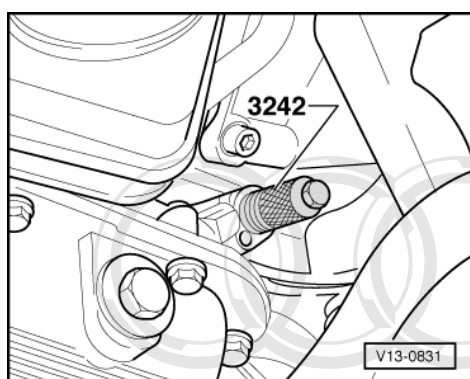
- -> Set crankshaft to markings for TDC of No. 1 cylinder by turning in direction of rotation (notch B faces mark A).
- Remove ignition timing point sender -G4- from left side of cylinder block.

Note:

There is a TDC drilling in the crankshaft exactly in line with the sender.

The drilling can be felt with a finger.

Warning
 Injury risk - do not turn the crankshaft while feeling for the TDC drilling with a finger.



- -> Screw crankshaft clamping bolt 3242 into hole where sender was removed, and tighten clamping bolt.
- Unbolt flywheel.

Installing

Install in reverse sequence, note the following points:

- Renew bolts.

Note:

The needle bearing is located in the flywheel and must be pressed in if a new flywheel is installed

=> Page **55**.

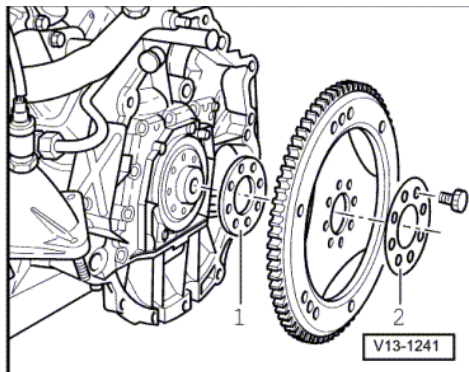
Tightening torque

| Component | Nm |
|----------------------------------|-------------|
| Dual-mass flywheel to crankshaft | 60 + 180°1) |

1) $180^\circ = 1/2\text{turn}$

Drive plate

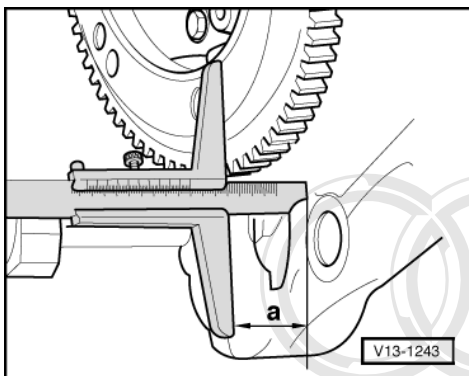
Removing



- Mark position of drive plate relative to engine.
- Unbolt drive plate.

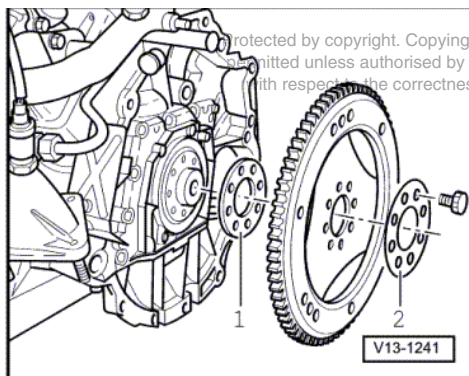
Installing

- -> Fit drive plate with packing plate -2- and 3.0 mm or 4.0 mm shim -1-.
- Insert at least 3 old securing bolts and tighten to 30 Nm.



- -> Measure distance -a- at three points and calculate average value.
- Specification for automatic gearbox 01F/01K:
18.1 ... 19.7 mm

If the specification is not attained:



- -> Remove drive plate again and install with different shim -1-. Tighten bolts to 30 Nm again.
- Measure distance again.

If the specification is attained:

- Fit new bolts and tighten.

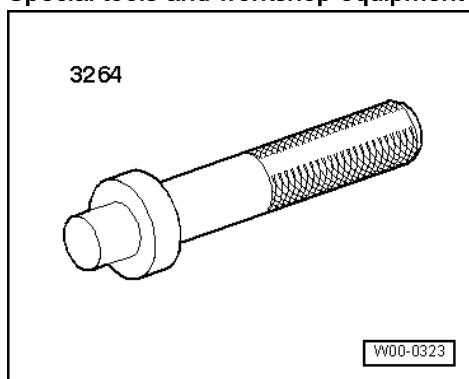
Tightening torque

| Component | Nm |
|---------------------------|------------|
| Drive plate to crankshaft | 60 + 90°1) |

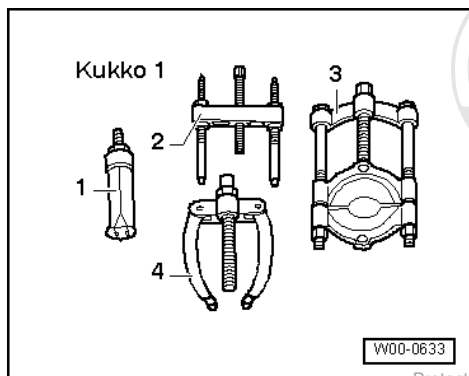
1) 90° = 1/4 turn

2.4 - Removing and installing needle bearing in dual-mass flywheel

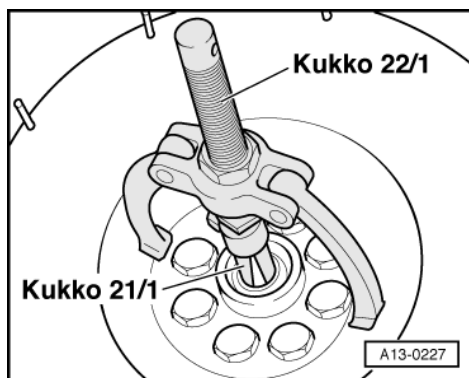
Special tools and workshop equipment required



- ♦ Fitting drift 3264



- ♦ Special tool Kukko 21/1 (Item 4) and Kukko 22/1 (Item 1)

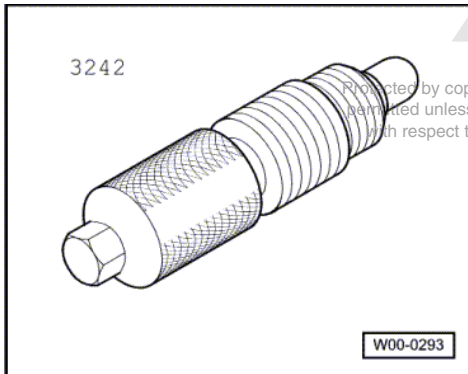




- -> Pull out needle bearing using Kukko 21/1 and Kukko 22/1.
- Drive in until flush using fitting drift 3264.

2.5 - Adjusting engine speed sender bracket

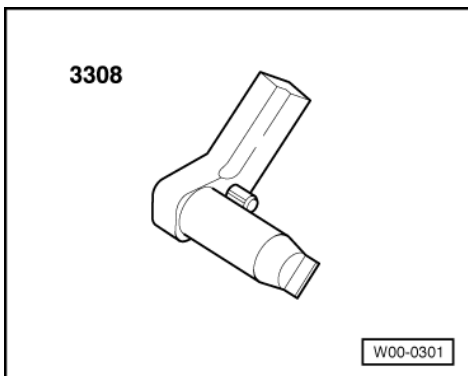
Notes:



- ♦ The engine speed sender bracket can be moved in the elongated holes. Its position is factory adjusted and must not be changed.
- ♦ If the bolts have been slackened accidentally and the bracket has been moved, adjust to correct position as follows:

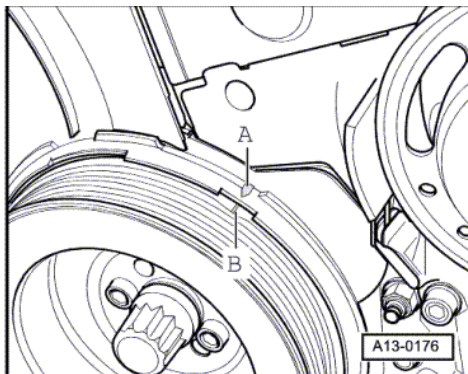
Special tools and workshop equipment required

- ♦ Special tool 3242



- ♦ Special tool 3308

Work sequence



- -> Set crankshaft to markings for TDC of No. 1 cylinder by turning in direction of rotation (notch B faces mark A).
- Remove ignition timing point sender -G4 from left side of cylinder block.

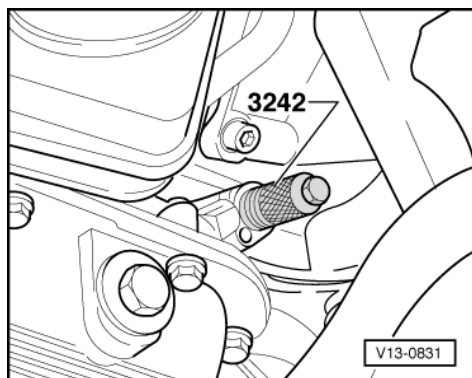
Note:

There is a TDC drilling in the crankshaft exactly in line with the sender.

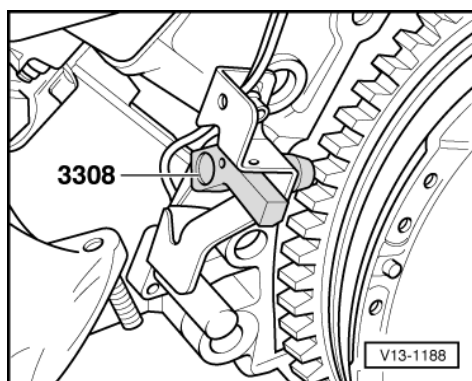
The drilling can be felt with a finger.

Warning

Injury risk - do not turn the crankshaft while feeling for the TDC drilling with a finger.



- -> Screw crankshaft clamping bolt 3242 into hole where sender was removed, and tighten clamping bolt.
- Remove heat shield above engine speed sender.
- Remove engine speed sender and slacken bracket.



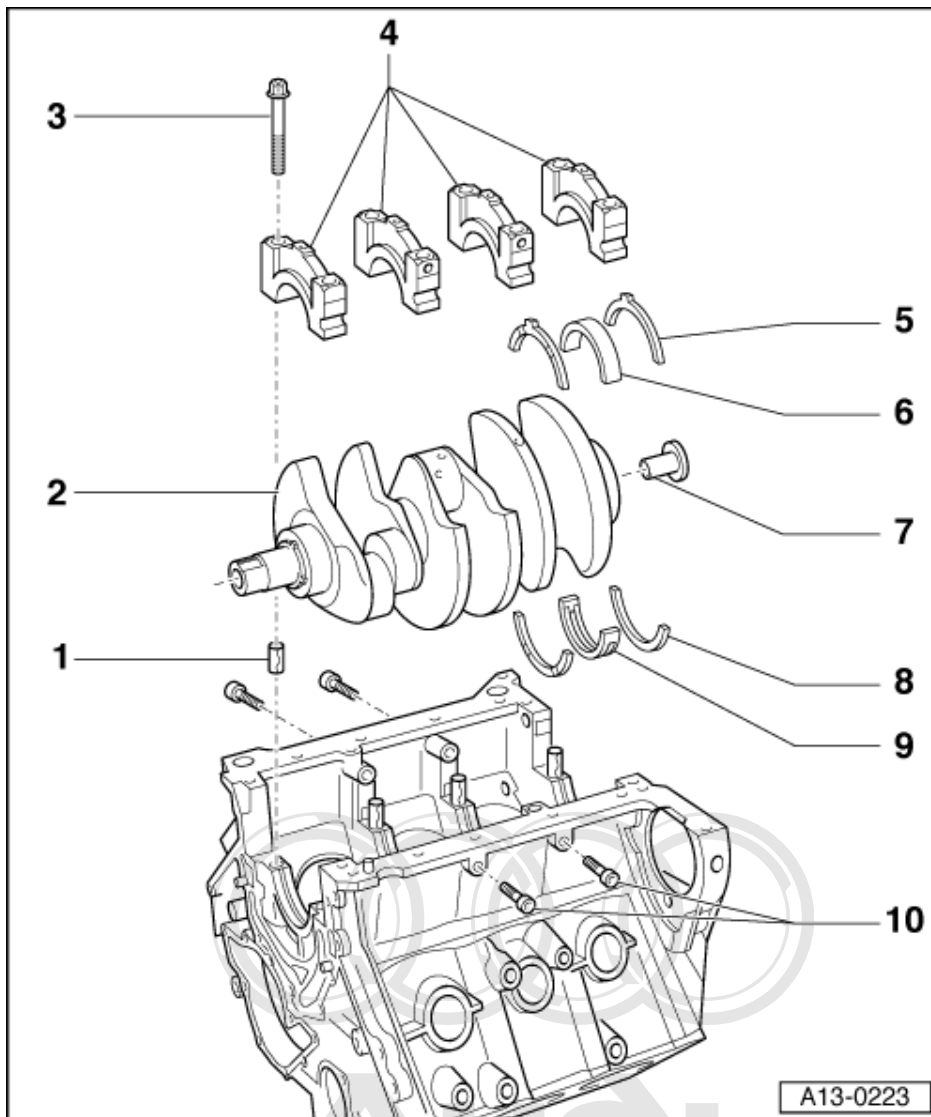
- -> Insert special tool 3308 where sender was removed so that it locks into starter ring gear.
- Re-tighten bracket.

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



3 - Removing and installing crankshaft

3.1 - Removing and installing crankshaft



Note:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability.

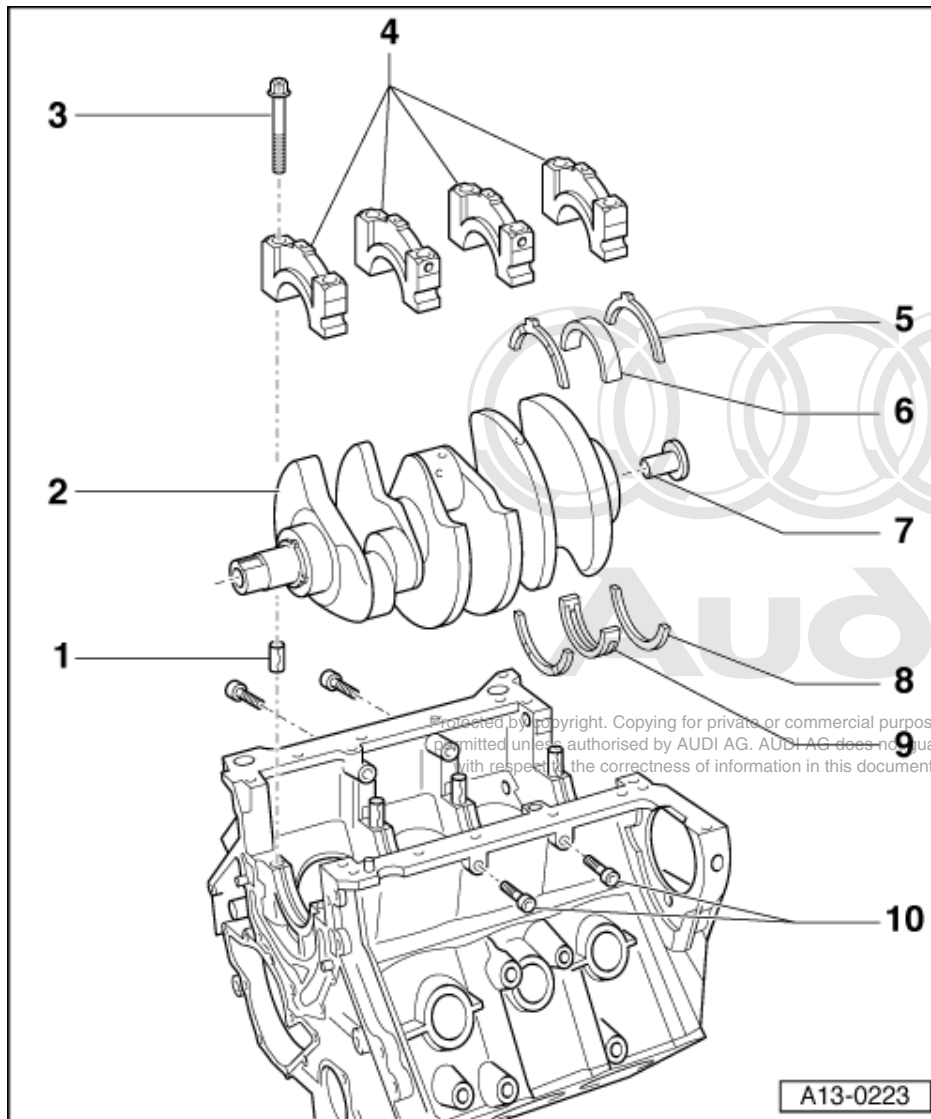
Secure engine to engine bracket VW 540 on assembly stand when dismantling/assembling engine.

1 Dowel sleeve

- ♦ Insert in cylinder block

2 Crankshaft

- ♦ Measuring axial and radial clearance => Page 62
- ♦ Do not rotate the crankshaft when checking the radial clearance
- ♦ Crankshaft dimensions
=> Page 62



3 Bolts

- ◆ For bearing cap
- ◆ Renew
- ◆ Tightening sequence
=> Fig. 2

4 Bearing cap

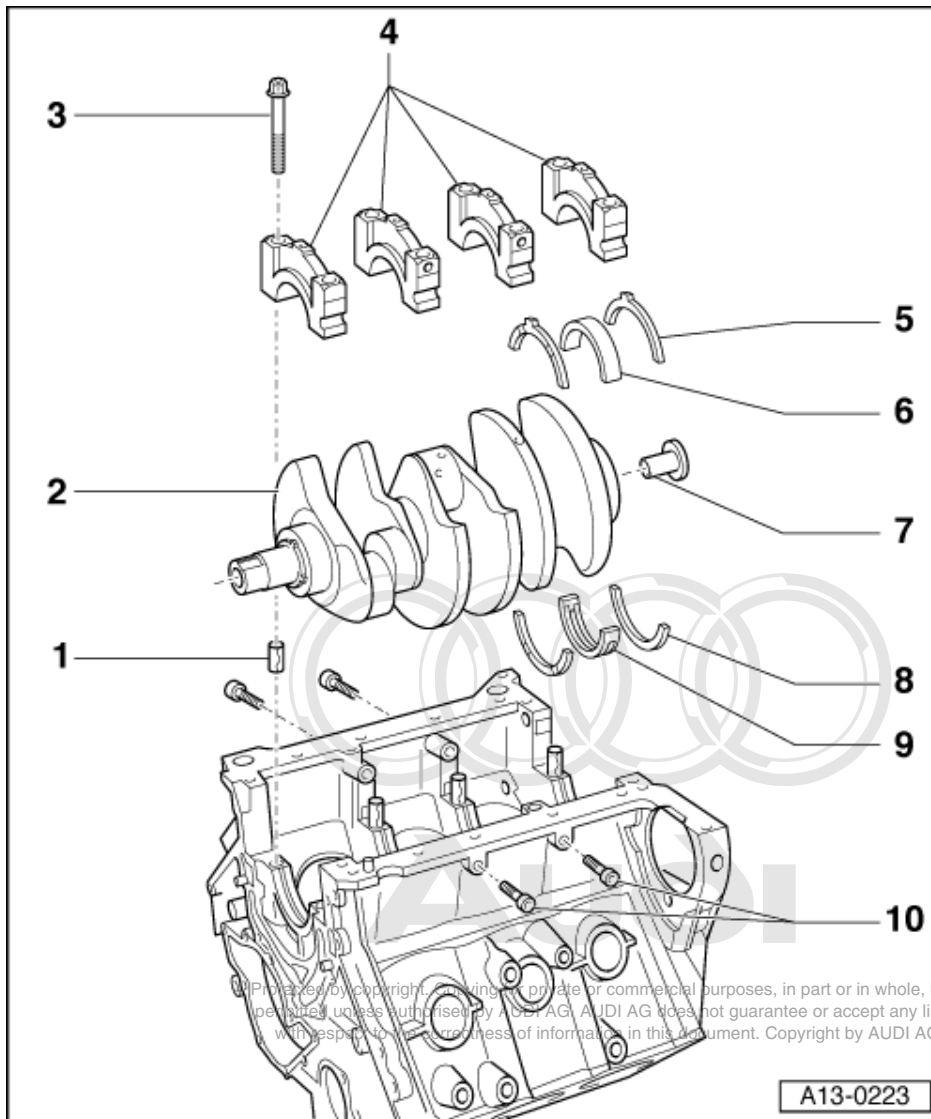
- ◆ Note markings
=> Fig. 1
- ◆ Installing => Fig. 2

5 Thrust washer

- ◆ Thrust washer only fitted on 4th crankshaft bearing
- ◆ Oil grooves face outwards
- ◆ Note fixing arrangement
- ◆ Measuring axial clearance of crankshaft =>Page 62

6 Bearing shell

- ◆ For bearing cap without oil groove
- ◆ Do not interchange used bearing shells (mark)



7 Bush

- ◆ Only with automatic gearbox
- ◆ Driving in => Fig. 3

8 Thrust washer

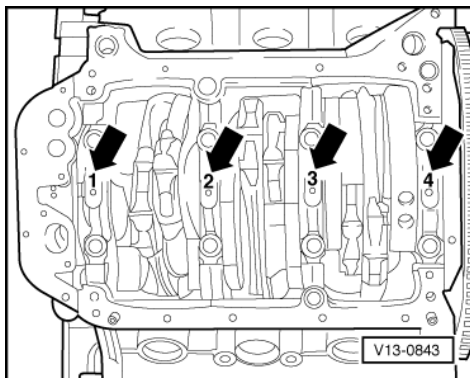
- ◆ Thrust washer only fitted on 4th crankshaft bearing
- ◆ Oil grooves face outwards
- ◆ Measuring axial clearance of crankshaft =>Page 62

9 Bearing shell

- ◆ For cylinder block with oil groove
- ◆ Do not interchange used bearing shells (mark)

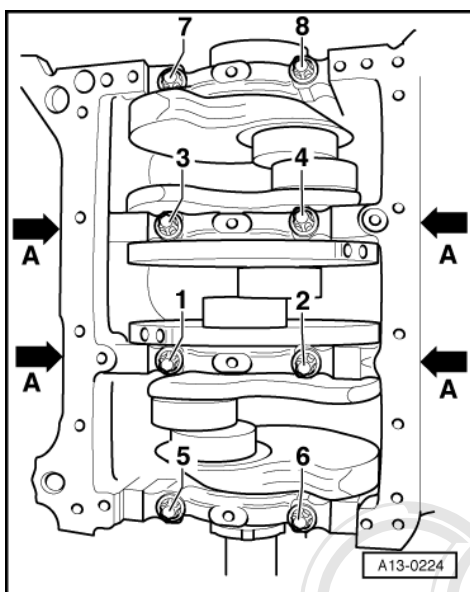
10 Bolts

- ◆ For bearing cap
- ◆ Tightening sequence
=> Fig. 2



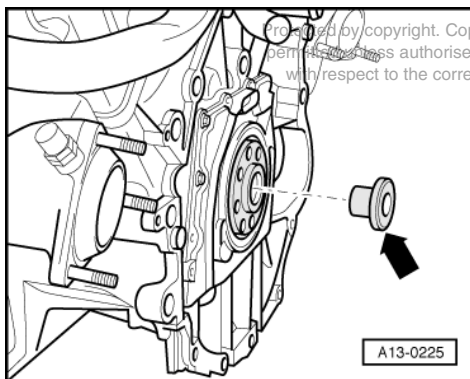
→ Fig.1 Markings on crankshaft bearing caps

- ◆ Bearing 1 is on pulley end
- ◆ Bearing 4 is on flywheel end



→ Fig.2 Installing crankshaft bearing caps

- Fit new bolts -1 ... 8-
- Insert dowel sleeves in cylinder block
- Tighten bearing cap bolts in following sequence:
 1. - Screw in bolts -A- and tighten lightly
 2. - Tighten bolts -1 ... 8- to 60 Nm.
 3. - Tighten bolts -1 ... 8- 180° (1/2 turn) further using a rigid wrench
 4. - Tighten bolts -A- to 25 Nm.



-> Fig. 3 Bearing bush for torque converter

Note:

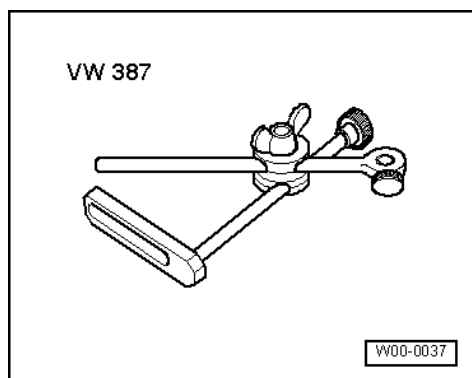
Short engines and exchange engines are supplied without a bush -arrow-. The same applies to new and exchange crankshafts. On vehicles with automatic gearbox, the bush must therefore be driven in before installing the drive plate. The bush must not be installed on vehicles with manual gearbox.

3.2 - Crankshaft dimensions

(in mm)

| Honing dimension | Main journal dia. | Conrod journal dia. |
|------------------|--------------------------|--------------------------|
| Basic dimension | - 0.022 65.00 - 0.042 | - 0.022 54.00 - 0.042 |
| 1st undersize | - 0.022 64.75 - 0.042 | - 0.022 53.75 - 0.042 |
| 2nd undersize | - 0.022 64.50 - 0.042 | - 0.022 53.50 - 0.042 |
| 3rd undersize | - 0.022 64.25 - 0.042 | - 0.022 53.25 - 0.042 |

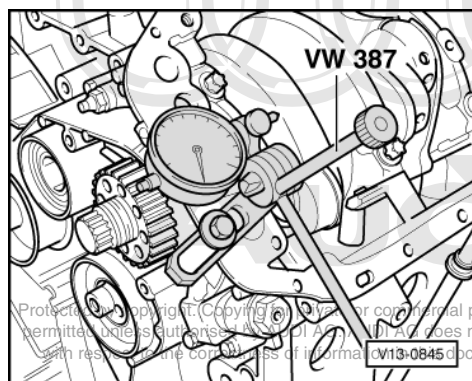
3.3 - Measuring axial and radial clearance



Special tools and workshop equipment required

- ♦ Universal dial gauge bracket VW 387
- ♦ Dial gauge

Axial clearance



Protected by copyright. Copying or distribution for commercial purposes, in part or in whole, is not permitted. Unless otherwise stated, Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Bolt dial gauge onto cylinder block with universal dial gauge bracket VW 387 and bring into contact with crank web.
- Press crankshaft against dial gauge by hand and set gauge to -0-.
- Press crankshaft away from dial gauge.
- Note reading:

| Clearance when new | Wear limit |
|--------------------|------------|
| 0.07 ... 0.23 mm | 0.25 mm |

Radial clearance

Note:

Do not interchange used bearings.

Special tools, workshop equipment and other material required

♦ Plastigage

- Remove crankshaft bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or in the bearing shells.
- Fit crankshaft bearing cap and tighten to 30 Nm. Do not rotate crankshaft.
- Remove crankshaft bearing cap again.
- Compare width of Plastigage with calibrated scale.
- Note reading:

| Clearance when new | Wear limit |
|--------------------|------------|
| 0.018 ... 0.045 mm | 0.10 mm |

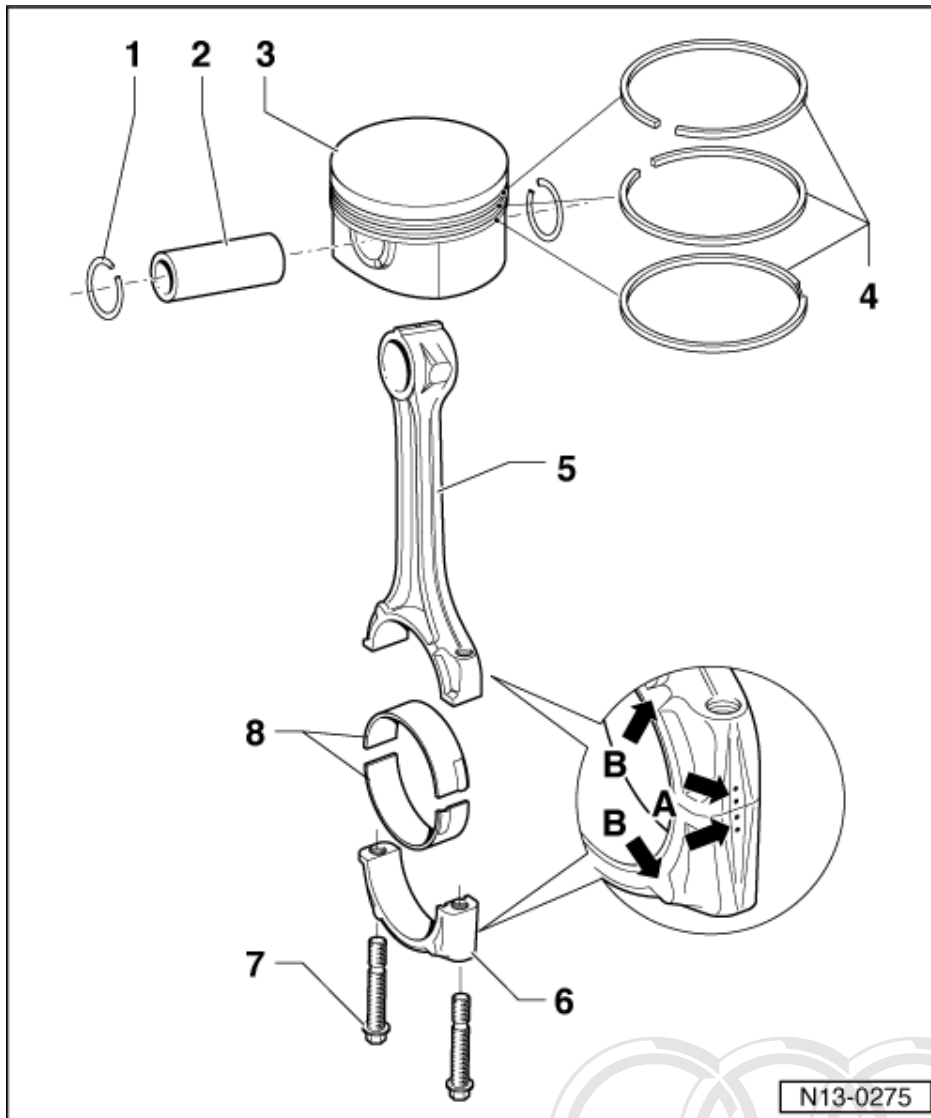


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



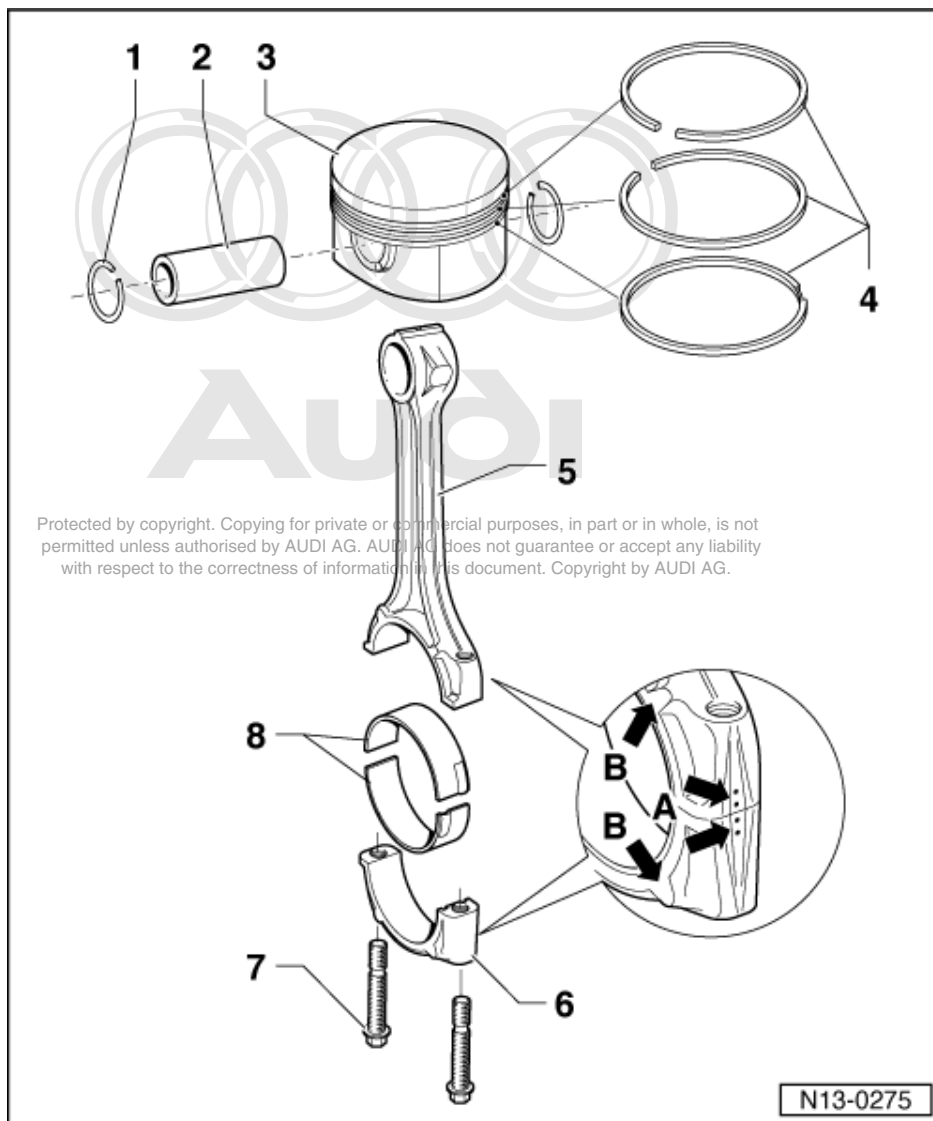
4 - Dismantling and assembling pistons and conrods

4.1 - Dismantling and assembling pistons and conrods



- 1 Circlip
- 2 Piston pin
 - ♦ If difficult to move, heat piston to approx. 60 °C
 - ♦ Remove and install with VW 222a
- 3 Piston
 - ♦ Mark installation position and cylinder number
 - ♦ Arrow on piston crown points to pulley end
 - ♦ Checking => Fig. 3
 - ♦ Install using piston ring clamp
 - ♦ Piston and cylinder dimensions
 - =>Page 69
 - ♦ Checking cylinder bores
 - =>Fig. 4

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



4 Piston ring

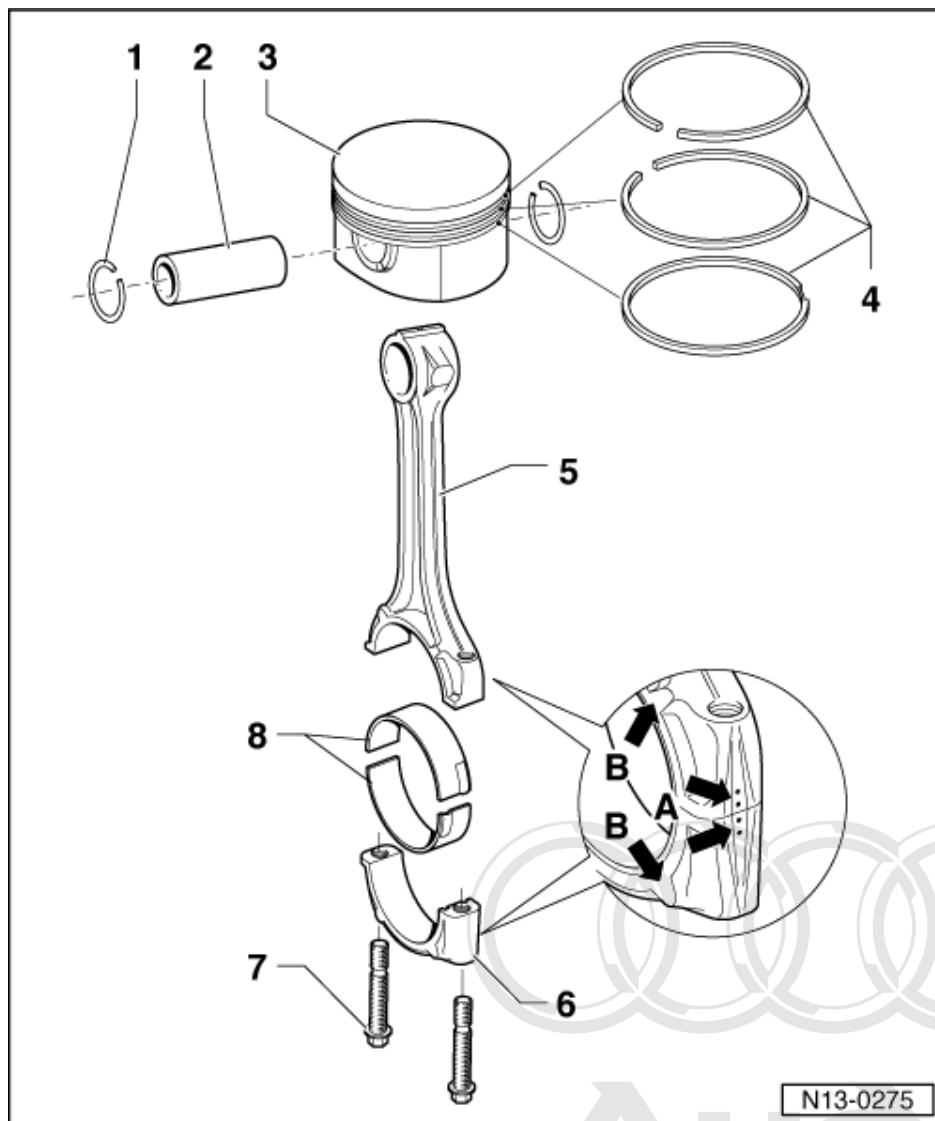
- ◆ Offset gaps by 120 °
- ◆ Remove and install with piston ring pliers
- ◆ "TOP" must face towards piston crown
- ◆ Checking ring gap=> Fig. 1
- ◆ Checking ring to groove clearance
=> Fig. 2

5 Conrod

- ◆ Only renew as a set
- ◆ Mark cylinder number -A-
- ◆ Installation position:
Mark -B- faces:
Cyls. 1...3 to belt pulley side
Cyls. 4...6 to flywheel side

6 Conrod bearing cap

- ◆ Note installation position

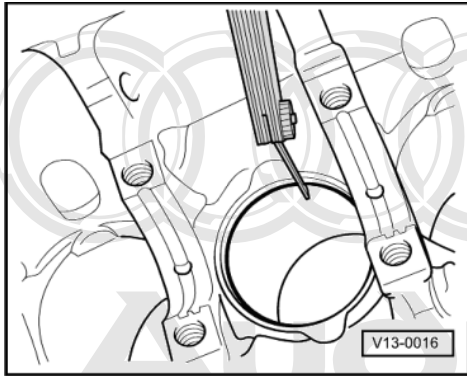


7 30 Nm +1/4turn (90°) further

- ◆ Renew
- ◆ Oil threads and contact surface
- ◆ To measure radial clearance **tighten to 30 Nm but not further**

8 Bearing shell

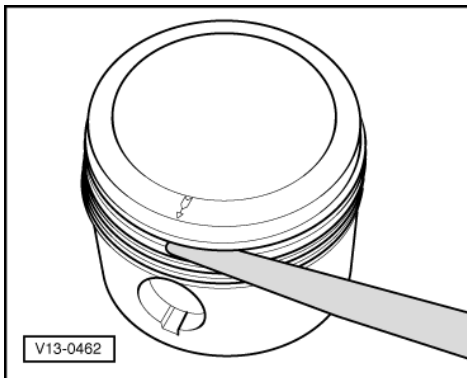
- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark)
- ◆ Measuring radial clearance
=> Page 69
- ◆ When measuring radial clearance, tighten bolts -Item 7 - to 30 Nm but do not turn further



→ Fig. 1 Checking piston ring gap

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. Push rings squarely from above down to approx. 15 mm from bottom end of cylinder.

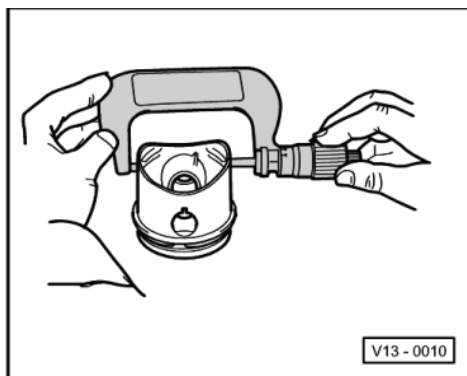
| Piston ring Dimensions in mm | New | Wear limit |
|---------------------------------|-------------|------------|
| 1st compression ring | 0.35...0.50 | 1.0 |
| 2nd compression ring | 0.50...0.70 | 1.4 |
| Oil scraper ring | 0.25...0.50 | 0.8 |



→ Fig. 2 Checking ring to groove clearance

- Clean groove before checking clearance.

| Piston ring Dimensions in mm | New | Wear limit |
|---------------------------------|-------------|------------|
| Compression rings | 0.02...0.08 | 0.10 |
| Oil scraper ring | 0.02...0.08 | 0.10 |

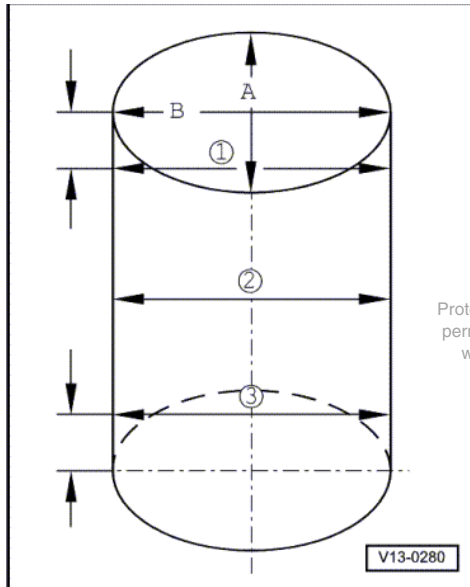


-> Fig. 3 Checking piston

Special tools and workshop equipment required

- ♦ Micrometer 75...100 mm
- Measure pistons approx. 10 mm from lower edge of skirt, at 90° to the piston pin axis.
 - Deviation from nominal dimension not more than 0.04 mm

Nominal dimension => Page 69 ; Piston and cylinder dimensions



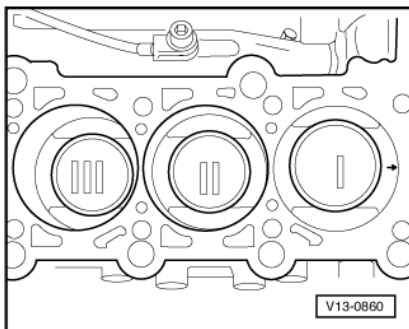
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Fig. 4 Checking cylinder bores

Special tools and workshop equipment required

- ♦ Internal dial gauge 50...100 mm
- Take measurements at 3 positions in both lateral -A- and longitudinal -B- directions.
 - Deviation from nominal dimension not more than 0.08 mm

Nominal dimension => Page 69 ; Piston and cylinder dimensions



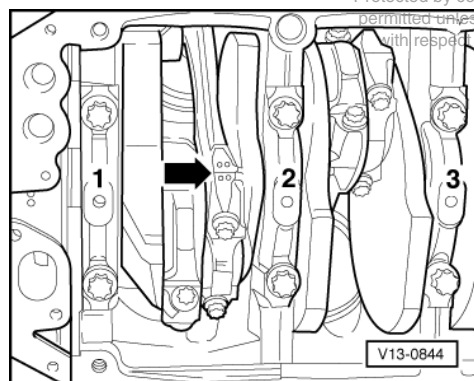
-> Fig.5 Piston installation position and piston/cylinder allocation

- Mark cylinder No. on piston crown with waterproof felt pen.

Note:

Do not mark with a centre punch or similar, as this can cause damage (cracks).

- Installation position:
Arrow on piston crown points to pulley end



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express authorisation by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Fig.6 Marking conrods

Notes:

- ♦ Only renew conrods as a complete set.
- ♦ Do not interchange conrod bearings.
- Before removing, mark mating positions of conrods and conrod bearing caps with coloured pen -arrow-.

4.2 - Piston and cylinder dimensions

| Honing dimension | Piston dia. | Cylinder bore dia. |
|------------------|-------------|--------------------|
| Basic dimen. mm | 82.485 | 82.51 |
| 1st oversize mm | 82.735 | 82.76 |
| 2nd oversize mm | 82.985 | 83.01 |

Note:

Replacement pistons are only available with basic dimension.

4.3 - Checking radial clearance of conrods

Special tools, workshop equipment and other material required

- ♦ Plastigage

Test sequence

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage corresponding to the width of the bearing on the bearing journal or bearing shell.



- Fit conrod bearing cap and tighten to 30 Nm. Do not rotate crankshaft.
- Remove conrod bearing cap again.
- Compare width of Plastigage with calibrated scale.

| Clearance when new | Wear limit |
|--------------------|------------|
| 0.015 ... 0.062 mm | 0.12 mm |

- Fit new conrod bearing bolts.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

15 - Cylinder head, Valve gear

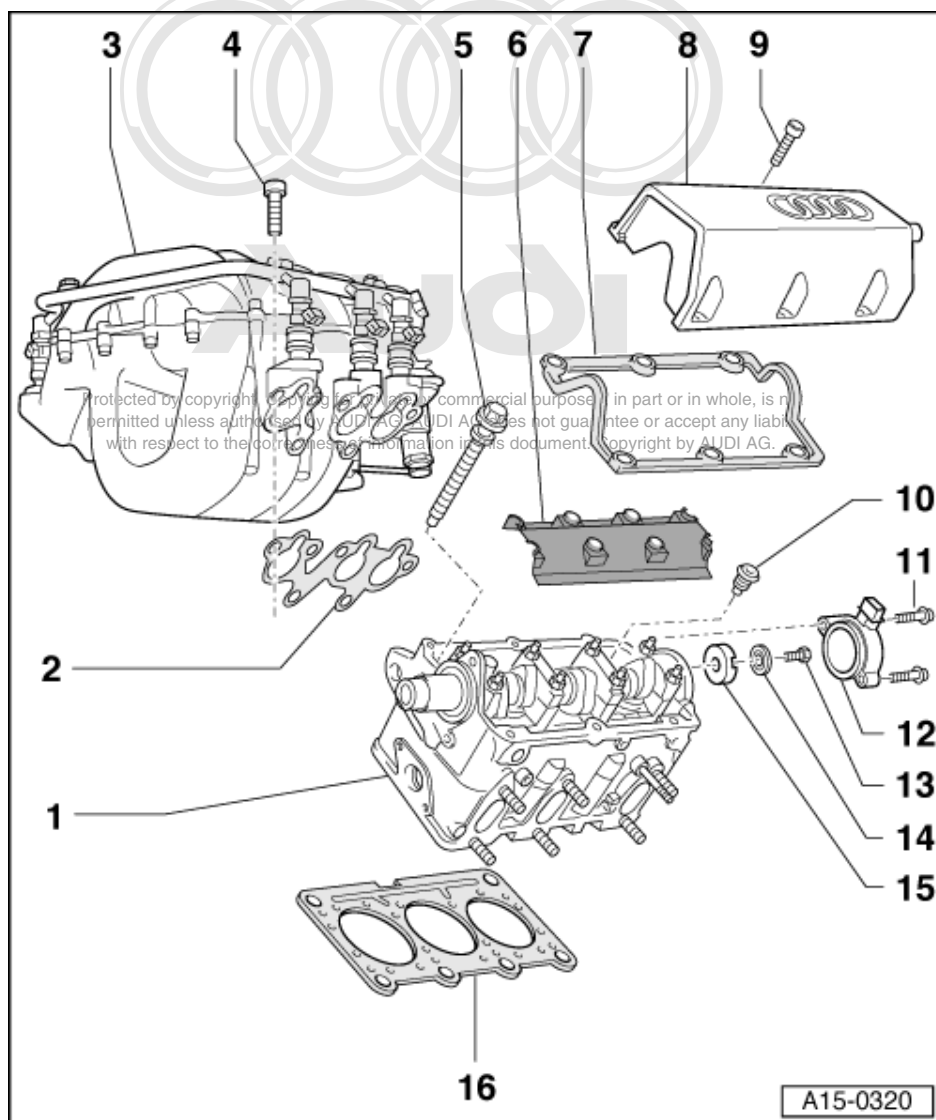
1 - Removing and installing cylinder head

1.1 - Removing and installing cylinder head

Notes:

- ◆ Renew the cylinder head bolts.
- ◆ When performing repairs, renew seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ◆ When installing an exchange cylinder head with the camshafts fitted, the contact surfaces between bucket tappet and cam running surface must be oiled after installation of the cylinder head.
- ◆ The plastic protectors fitted to protect the open valves should not be removed until the cylinder head is ready to be fitted.
- ◆ When fitting a new cylinder head or cylinder head gasket, drain off all the old coolant and re-fill with new coolant.
- ◆ When renewing a cylinder head a sealing cover (core plug) must be driven into the front of the cylinder head on each side=>Fig. 4.
- ◆ Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



1 Cylinder head

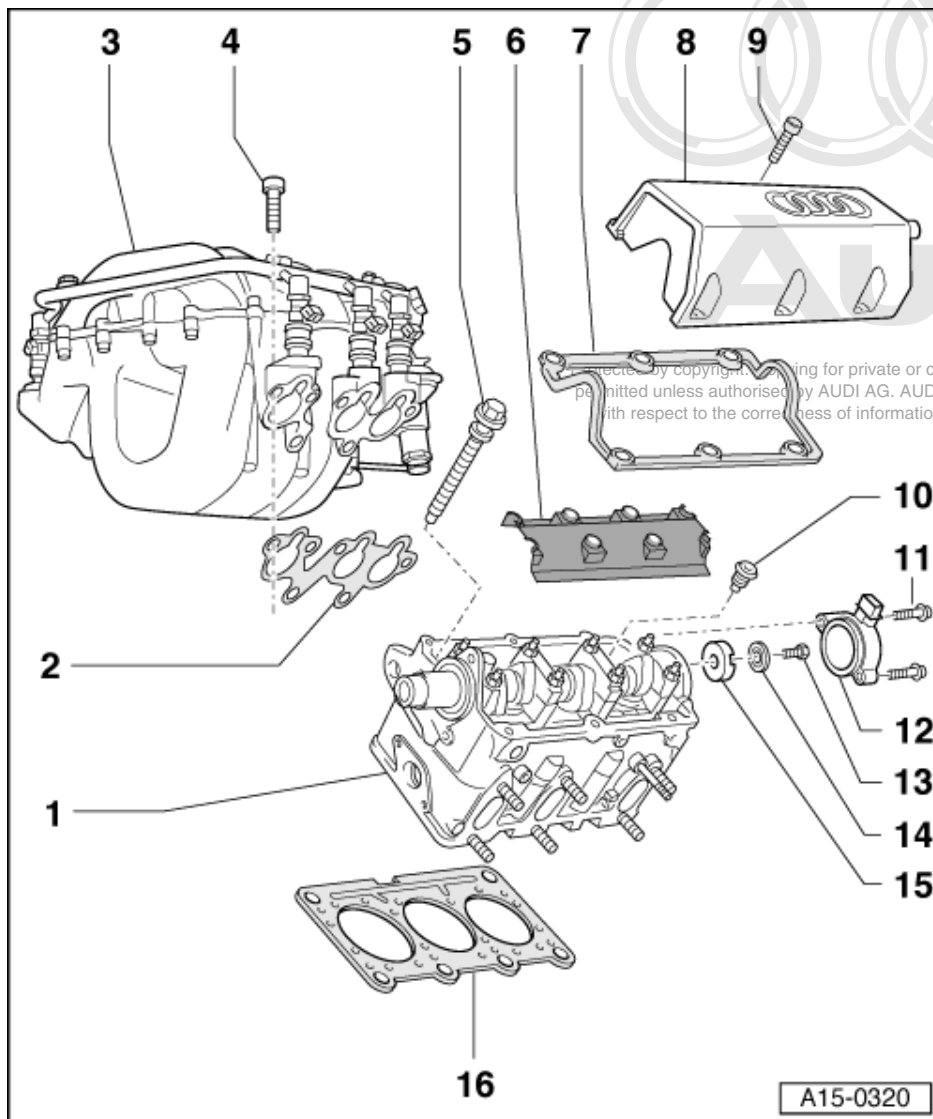
- ◆ Removing left cylinder head
=> Page 84
- ◆ Removing right cylinder head
=> Page 86
- ◆ Check for distortion => Fig. 1
- ◆ Reworking limit => Fig. 2
- ◆ Knocking sealing cap (core plug) into cylinder head => Fig. 4
- ◆ Installing => Page 88
- ◆ After replacing, fill with fresh coolant

2 Gasket

- ◆ Renew

3 Intake manifold (with change-over function)

- ◆ Removing and installing
=> Page 77
- ◆ After removing the intake manifold securing bolts, all cylinder head bolts must be re-tightened by turning them 1/4 turn (90°) further.



4 20 Nm

- ◆ Tighten in stages and in diagonal sequence
- ◆ After removing the intake manifold securing bolts, all cylinder head bolts must be re-tightened by turning them 1/4 turn (90°) further.

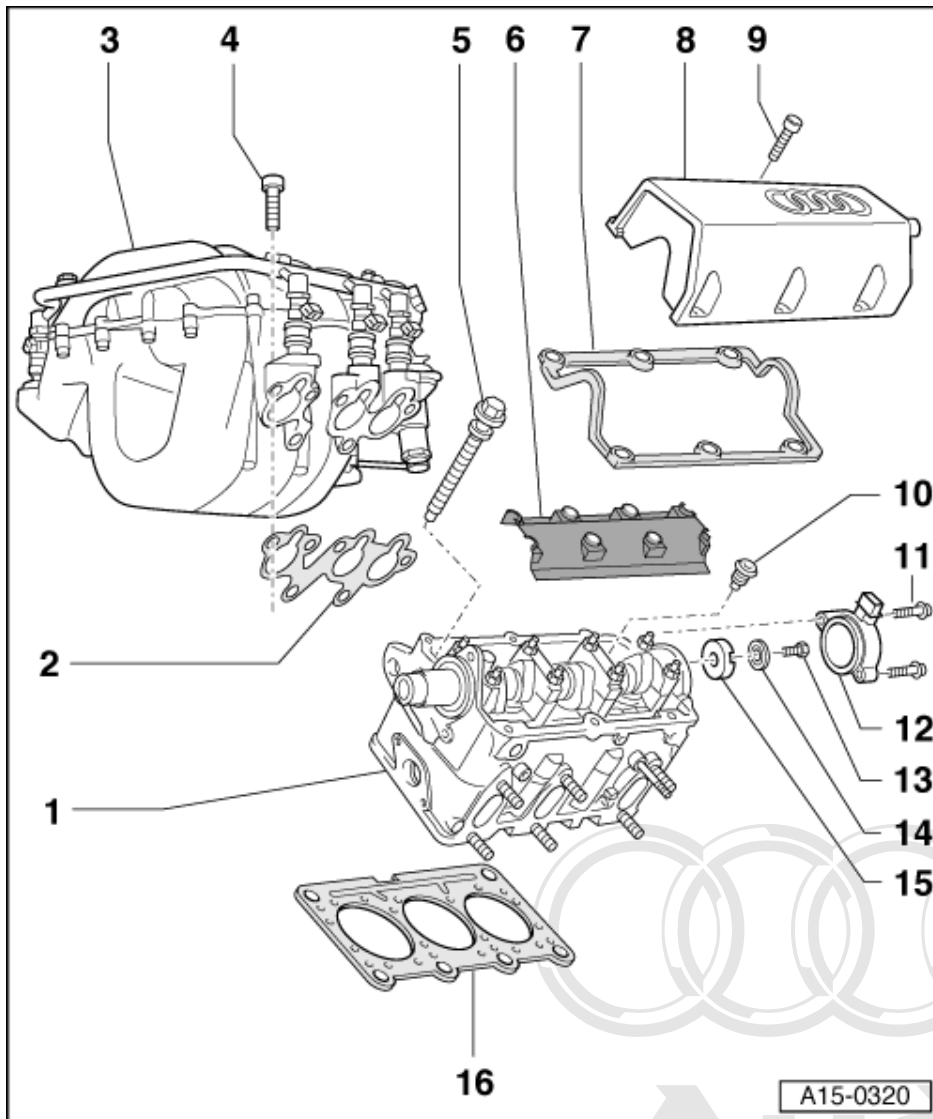
5 Cylinder head bolt

- ◆ Renew
- ◆ Note sequence when loosening
=> Page 86
- ◆ Note sequence when tightening
=> Page 90

6 Oil deflector

7 Cylinder head cover gasket

- ◆ Renew if damaged or leaking
- ◆ Before fitting gasket spray inside and outside with silicon lubricant D 007 000 A2.
- ◆ Before fitting gasket apply D 454 300 A2 at sealing points
=> Fig. 3

**8 Cylinder head cover**

- ♦ Removing and installing left cylinder head cover=> Page 81
- ♦ Removing and installing right cylinder head cover=> Page 83

9 10 Nm

- ♦ Tighten in stages and in diagonal sequence

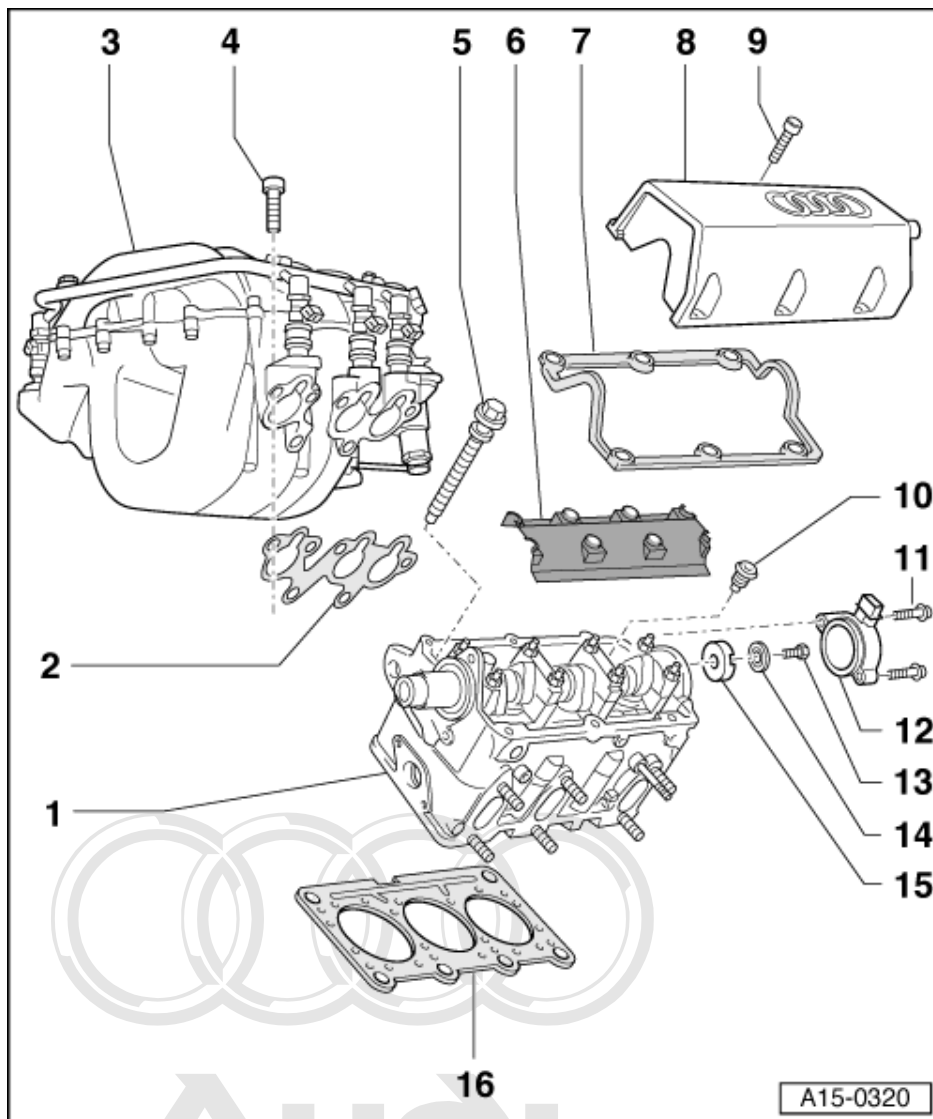
10 Pressure limiting valve

- 2.7 bar

- ♦ Replace pressure limiting valve if all valves on one cylinder bank are noisy
- ♦ If pressure limiting valve has come loose it must be replaced. Do not re-tighten a loose valve.
- ♦ Install with locking fluid
- ♦ "D 185 400 A2"
- ♦ Tighten to 25 Nm

11 10 Nm

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



12 Housing for Hall sender -G40

- ♦ Removing and installing Hall sender on left-hand cylinder head=>Fig. 100
- ♦ Removing and installing sealing cap on right-hand cylinder head=>Fig. 100

13 22 Nm
 Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for the correctness of information in this document. Copyright by AUDI AG.

14 Washer

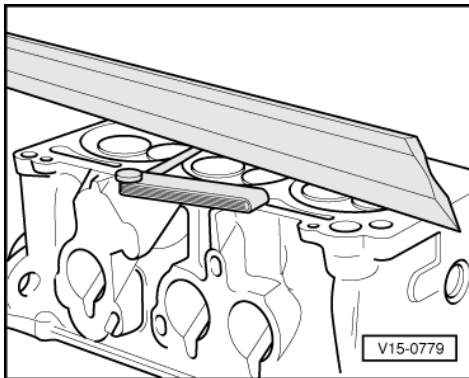
- ♦ Conical
- ♦ Note installation position

15 Rotor

- ♦ For Hall sender
- ♦ When installing note fixing arrangement

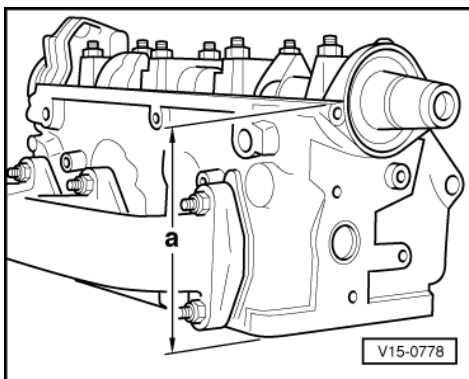
16 Cylinder head gasket

- ♦ Renew => Removing cylinder head, from Page 84 onwards
- ♦ Position: Part No. towards cylinder head
- ♦ After replacing, fill with fresh coolant



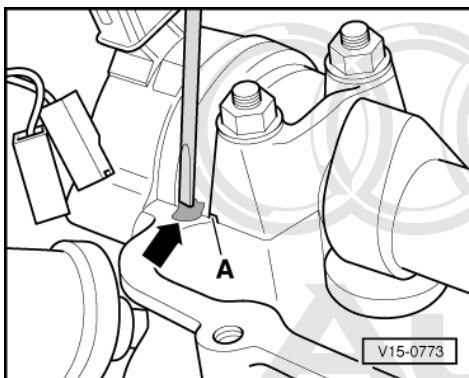
-> Fig. 1 Checking cylinder head for distortion

- Use knife-edge straightedge and feeler gauge to measure at several points.
 - Max. permissible distortion: 0.1 mm



-> Fig.2 Cylinder head reworking limit

- Reworking the cylinder head (skimming) is only permitted down to minimum dimension a.
 - Minimum dimension a = 132.75 mm



-> Fig. 3 Sealing points for bearing caps on cylinder head

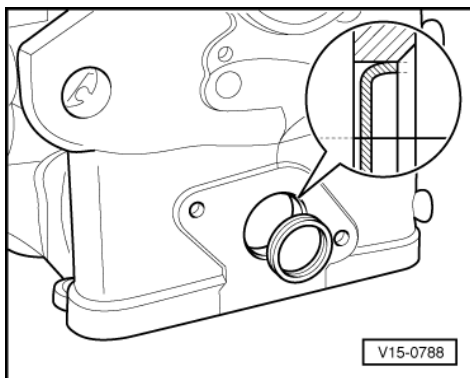
permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG

- Apply a small quantity of sealant D 454 300 A2 to sides of joints -arrows- on upper sealing surface of cylinder head.

Note:

- ♦ Oil drilling -A- must not be obstructed with sealant.

- ♦ Before fitting cylinder head cover gasket, spray inside and outside with silicon lubricant D 007 000 A2.



-> Fig.4 Knocking sealing cap (core plug) into cylinder head

Special tools and workshop equipment required

- ♦ Drift VW 295

The cylinder head supplied as a replacement part can be used both on the left and on the right-hand side. But a sealing cap (core plug) must be fitted in the front end of the cylinder head in each case.

- Coat outside circumference of sealing cap (core plug) with sealant AMV 188 001 02.
- Using drift VW 295, knock in sealing cap (core plug) until the outside rim is flush with the end of the chamfer in the cylinder head.

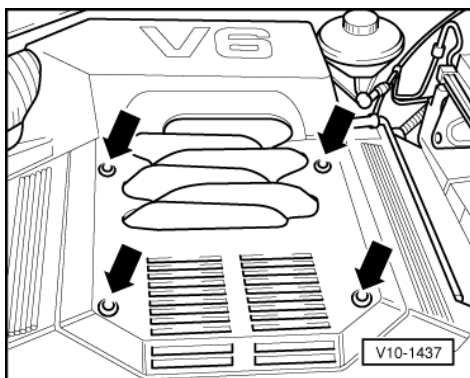
1.2 - Removing and installing intake manifold (with change-over function)

Removing

Note:

All cable ties which are released or cut open when removing must be fitted in the same position when installing.

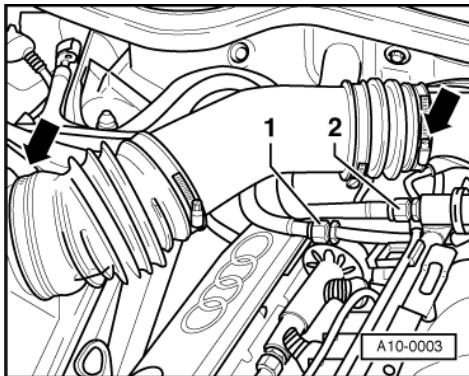
- Obtain radio code on vehicles with coded radio.
- With ignition switched off disconnect battery earth strap.



- -> Remove engine cover panel -arrows-.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



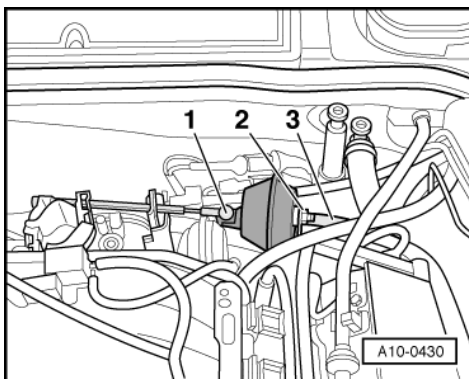
- -> Remove air hose between air mass meter and intake manifold -arrows-.

Warning

Fuel system is under pressure. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

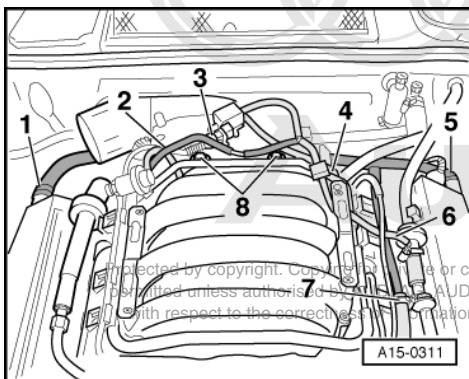
- Disconnect fuel supply line -1- and fuel return line -2-.

Vehicles with cruise control system



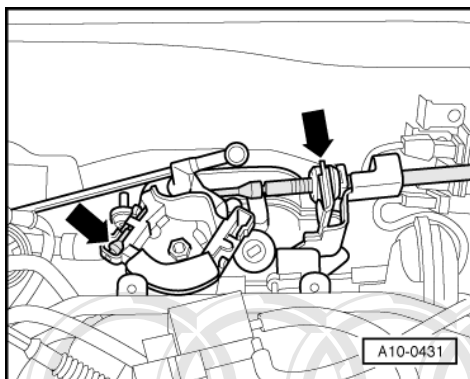
- -> Disengage actuator rod -1- at vacuum unit.
- Pull vacuum hose -3- off vacuum unit.
- Unscrew nut -2- and remove vacuum unit.

All models

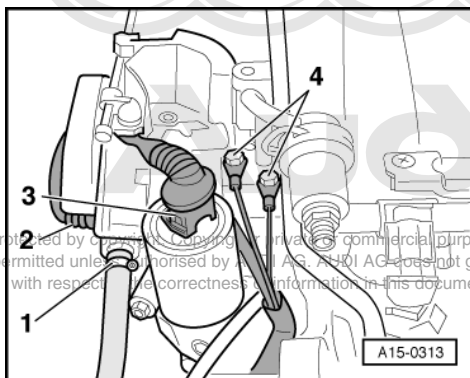


- -> Detach crankcase breather hoses -1- and -5- from left and right cylinder head cover.
- Unplug connector -3- at intake manifold change-over valve.
- Ease off vacuum hoses -2-, -4- and -6-.
- Disconnect vacuum hose -7-.

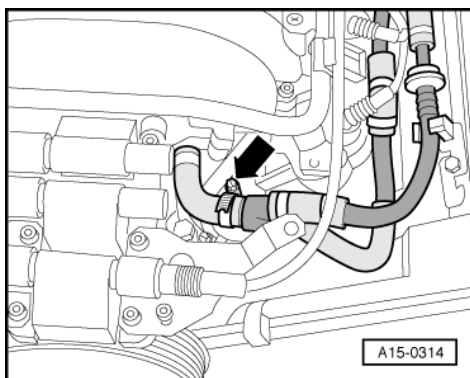
- Remove bolts -8- and detach air duct from throttle valve housing.



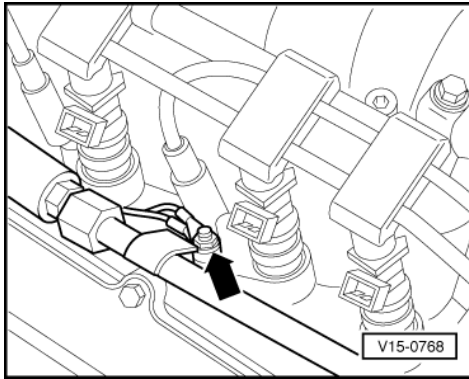
- -> Detach throttle cable at the throttle valve housing and at support bracket -arrows- (do not remove throttle cable retainer). Move throttle cable clear to the side.



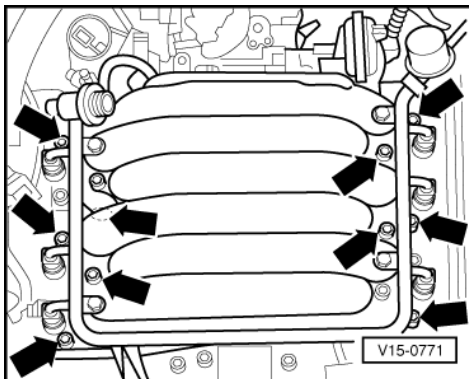
- -> Disconnect vacuum hose -1- for ACF valve.
- Unplug connector -2- from throttle valve housing.
- Unplug connector -3- from idle speed stabilisation valve.
- Unscrew earth wiring -4-.



- -> Detach vacuum hose -arrow- from front of intake manifold.



- -> Unbolt hydraulic pipe retainer bracket (with earth wires if applicable) at intake manifold.



- -> Unbolt intake manifold -arrows- and remove.

Note:

Plug intake ports on cylinder heads with clean cloths.

Installing

Install in reverse sequence; note the following points:

Note:

Always renew self-locking nuts, seals and gaskets.

°) further.

- Check throttle cable setting

=> Fuel supply system - Petrol engines; Repair group 20; Servicing accelerator mechanism - Vehicles with mechanical accelerator linkage. Servicing accelerator mechanism - Vehicles with mechanical accelerator linkage.

- After connecting battery, enter anti-theft code for radio

=> Radio operating instructions

- Close windows fully using electric window switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

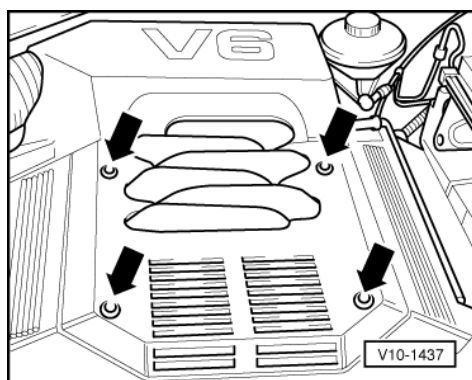
- Set clock to correct time.

Tightening torques

| Component | Nm |
|---|----|
| Intake manifold to cylinder head | 20 |
| Fuel pipes to fuel rail/fuel pressure regulator | 25 |
| CCS-unit to bracket | 15 |
| Air duct to intake manifold | 22 |
| Power steering pressure pipe to intake manifold | 10 |
| Earth wires to intake manifold | 10 |

1.3 - Removing and installing left cylinder head cover

Note:

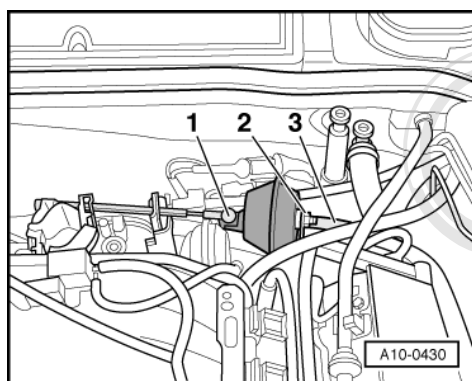


All cable ties which are released or cut open when removing must be fitted in the same position when installing.

Removing

- -> Remove engine cover panel -arrows-.

Vehicles with cruise control system

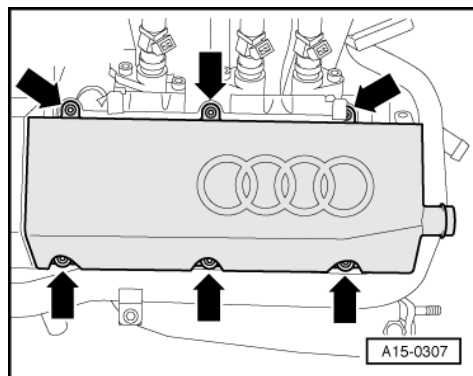


- -> Disengage actuator rod -1- at vacuum unit.
- Pull vacuum hose -3- off vacuum unit.
- Unscrew nut -2- and remove vacuum unit.

Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

All models

- Disconnect crankcase breather hose from cylinder head cover.
- Unclip brake servo vacuum hose from retainers.
- Release cable tie and move electrical wiring clear.



- -> Loosen bolts -arrows- on cylinder head cover and remove cylinder head cover.

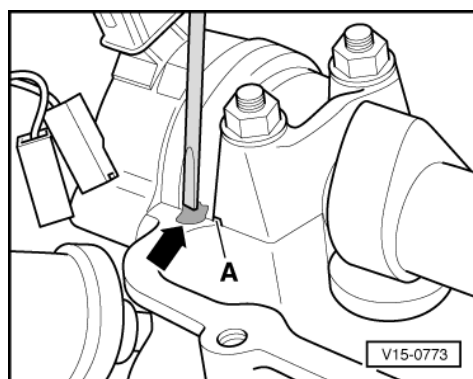
Installing

Install in reverse sequence; note the following points:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Notes:

- ♦ Renew cylinder head cover gasket if damaged.
- ♦ Before fitting cylinder head cover gasket, spray inside and outside with silicon lubricant "D 007 000 A2".



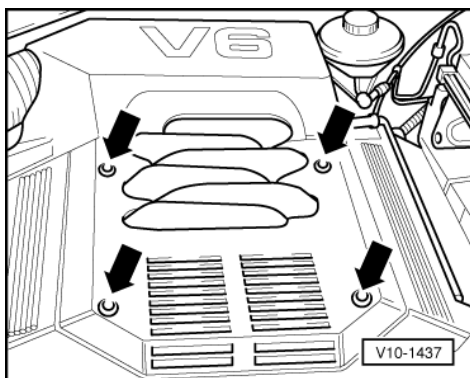
- -> Apply a small quantity of sealant D 454 300 A2 to sides of joints -arrows- on upper sealing surfaces on cylinder head.
- Tighten bolts for cylinder head cover crosswise and in stages.

Tightening torque

| Component | Nm |
|--------------------------------------|----|
| Cylinder head cover to cylinder head | 10 |
| CCS-unit to bracket | 15 |

1.4 - Removing and installing right cylinder head cover

Note:

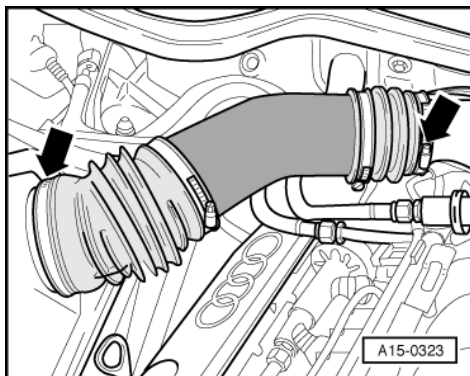


All cable ties which are released or cut open when removing must be fitted in the same position when installing.

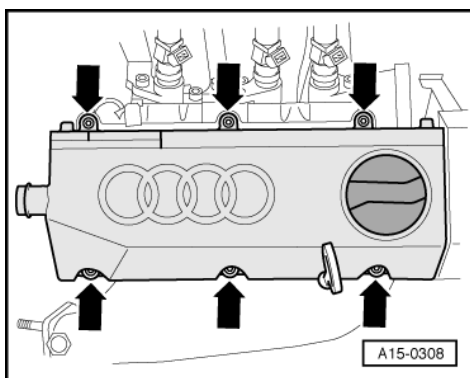
Removing

- -> Remove engine cover panel -arrows-.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Remove air hose between air mass meter and intake manifold -arrows-.
- Disconnect crankcase breather hose from cylinder head cover.
- Release cable tie and move electrical wiring clear.



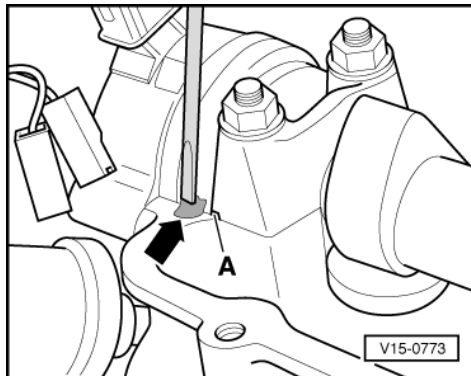
- -> Loosen bolts -arrows- on cylinder head cover and remove cylinder head cover.

Installing

Install in reverse sequence; note the following points:

Notes:

- ♦ Renew cylinder head cover gasket if damaged.
- ♦ Before fitting cylinder head cover gasket, spray inside and outside with silicon lubricant D 007 000 A2.



- -> Apply a small quantity of sealant D 454 300 A2 to sides of joints -arrows- on upper sealing surfaces on cylinder head.
- Tighten bolts for cylinder head cover crosswise and in stages.

Tightening torque

| Component | Nm |
|--------------------------------------|----|
| Cylinder head cover to cylinder head | 10 |

1.5 - Removing left cylinder head

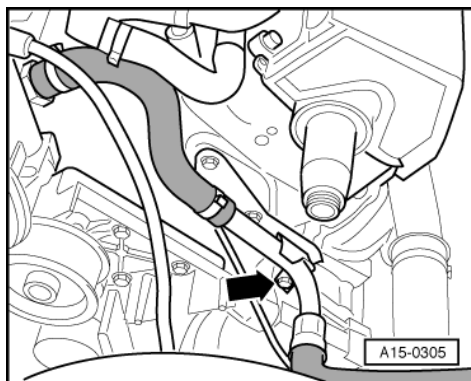
- Engine in vehicle

Notes:

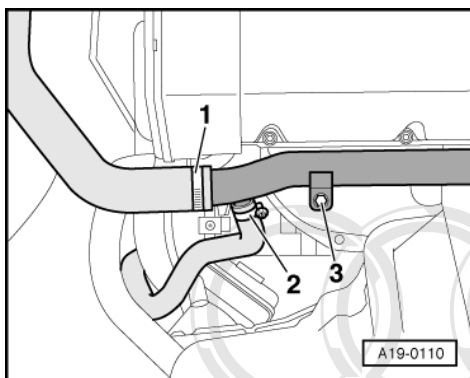
- ♦ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

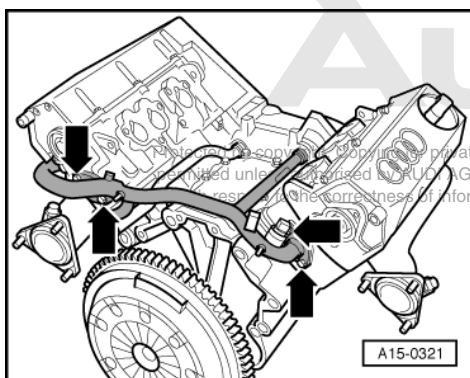
- ♦ All cable ties which are opened or cut open when removing must be replaced in the same position when installing.
- Obtain radio code on vehicles with coded radio.
- With ignition switched off disconnect battery earth strap.
- Drain cooling system=> Page 148 .
- Remove front exhaust pipe (left side)
=> Page 180 .
- Take toothed belt off camshaft sprockets=>Page 39 .
- Remove rear left section of toothed belt guard.



- -> Unscrew bolt -arrow- securing bracket for hydraulic pump supply pipe.
- Remove intake manifold => Page 77 .
- Unplug spark plug connectors at cylinder 4 ... 6 and move clear to one side.



- -> Disconnect coolant hose -1- at coolant pipe. Do not disconnect hose -2-.
- Remove bolt -3-.

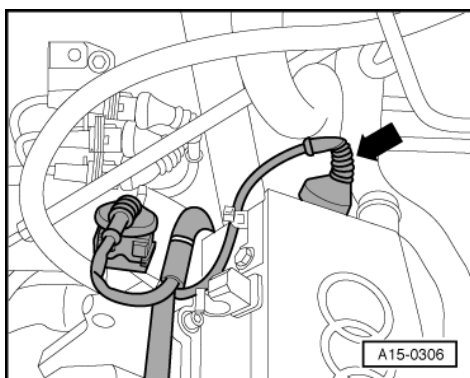


- -> Unscrew coolant pipe bolts -arrows- at rear of cylinder heads.

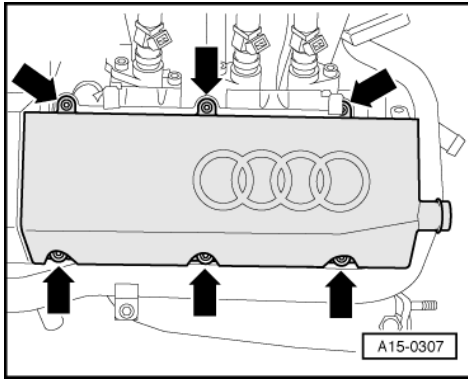
Note:

Illustration shows coolant pipe with engine removed.

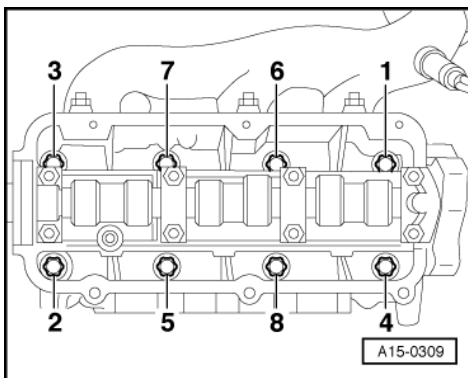
- Pull coolant pipe back slightly.



- -> Unplug connector -arrow- at Hall sender.
- Move wiring harness on cylinder head cover clear to one side.



- -> Loosen bolts -arrows- on cylinder head cover and remove cylinder head cover.
- Remove oil deflector from below cylinder head cover.



- -> Keep to specified sequence when loosening cylinder head bolts.
- Take off cylinder head and place it on a soft surface (such as foam plastic).

1.6 - Removing right cylinder head

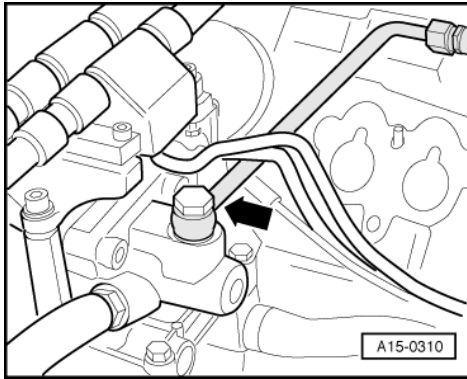
- Engine in vehicle

Notes:

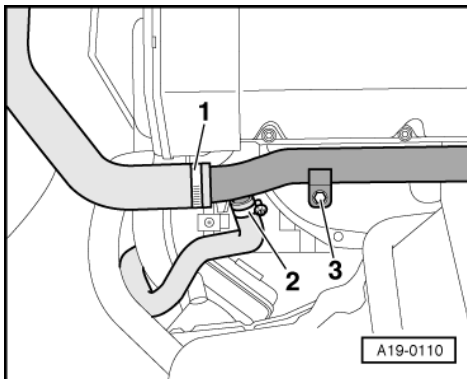
- ♦ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

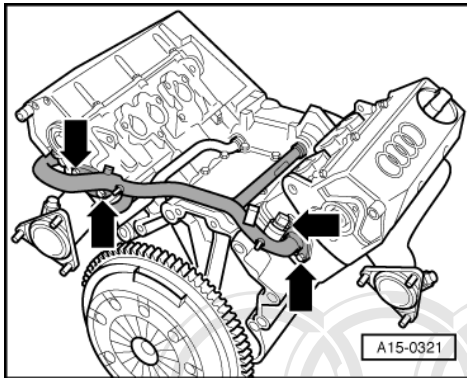
- ♦ All cable ties which are opened or cut open when removing must be replaced in the same position when installing.
- Obtain radio code on vehicles with coded radio.
- With ignition switched off disconnect battery earth strap.
- Drain cooling system=> Page 148.
- Remove right front exhaust pipe=>Page 181.
- Take toothed belt off camshaft sprockets=>Page 39.
- Remove rear right section of toothed belt guard.
- Remove intake manifold => Page 77.
- Unplug spark plug connectors at cylinders 1 ... 3 and move clear to one side.



- -> Disconnect pressure pipe -arrow- from hydraulic pump.



- -> Disconnect coolant hose -1- at large coolant pipe. Do not disconnect hose -2-.
- Remove coolant pipe bolt -3- (at left cylinder head).



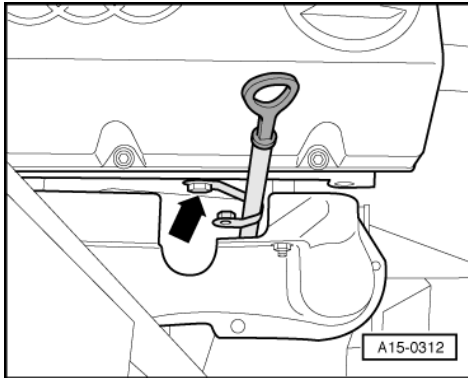
- -> Unscrew coolant pipe bolts -arrows- at rear of cylinder heads.

Note:

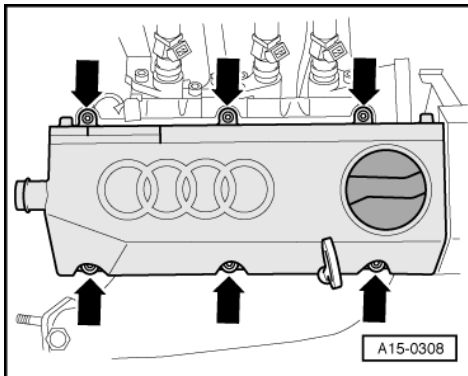
Illustration shows coolant pipe with engine removed.

- Pull coolant pipe back slightly.

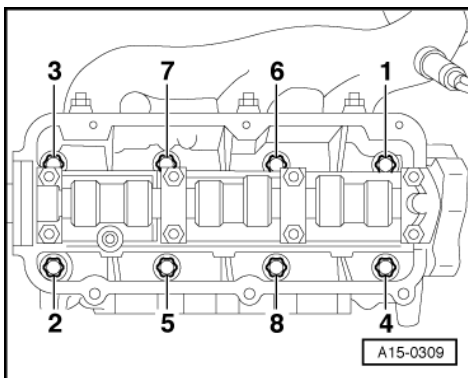
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unbolt dipstick guide tube on cylinder head -arrow- and pull out from above.
- Move wiring harness on cylinder head cover clear to one side.



- -> Loosen bolts -arrows- on cylinder head cover and remove cylinder head cover.
- Remove oil deflector.



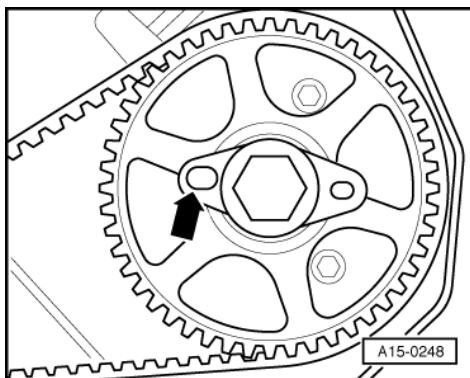
- -> Keep to specified sequence when loosening cylinder head bolts.
- Take off cylinder head and place it on a soft surface (such as foam plastic).

1.7 - Installing cylinder head

Notes:

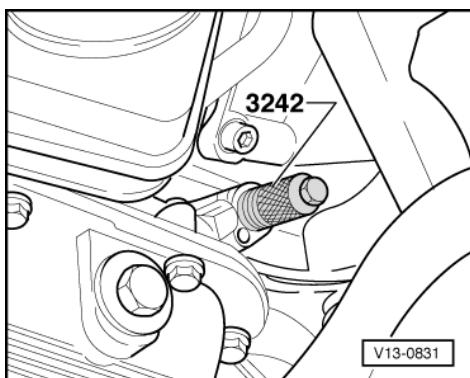
- ♦ Always renew cylinder head bolts when assembling.
- ♦ When performing repairs, renew seals, gaskets, self-locking nuts and bolts which have a specified tightening angle.
- ♦ If repairing, carefully remove any remains of gasket material from the cylinder head and cylinder block. Make sure that no long scores or scratches are made on the surfaces.
- ♦ Carefully remove any remaining emery and abrasive material.
- ♦ No oil or coolant must be allowed to remain in the blind holes for the cylinder head bolts in the cylinder block.

- ◆ Remove new cylinder head gasket from packaging just before installation.
- ◆ Handle gasket extremely carefully. Damaging the silicone layer or the indented area will lead to leaks.
- ◆ Position cylinder head gasket on dowel pins. The word "oben" (top) or the Part No. should face towards cylinder head.
- ◆ When renewing a cylinder head a sealing cover (core plug) must be driven into the front of the cylinder head => Fig. 77.
- ◆ After working on the valve gear, turn the engine carefully at least 2 full rotations by hand to ensure that none of the valves make contact when the starter is operated.

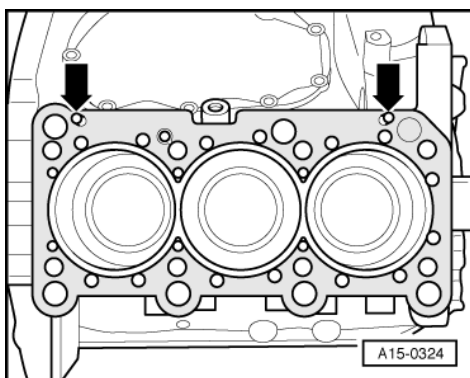


Install in reverse sequence; note the following points:

- -> Turn crankshaft and camshaft to TDC of cylinder No. 1 before fitting cylinder head. The large holes - arrow- in the securing plates on the camshaft sprockets should face inwards.



- -> Screw in clamping bolt 3242.

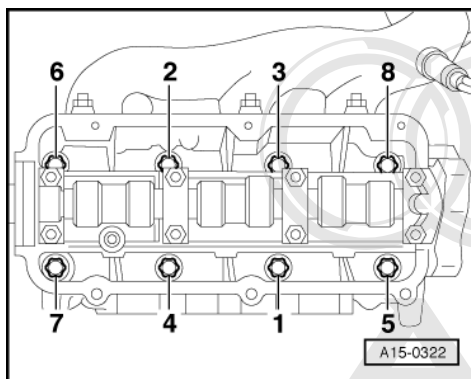


- -> Place cylinder head gasket in position.
- Note position of centring pins -arrows- in cylinder block.
- Check installation position of cylinder head gasket: the word "oben" (top) or the Part No. should face towards the cylinder head.
- Place cylinder head on.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Insert cylinder head bolts and tighten by hand.



- -> Tighten cylinder head bolts in two stages in sequence shown as follows:
- Tighten using torque wrench:
 - 1st stage: 60 Nm
- Tighten with normal fixed wrench:
 - 2nd stage: 1/2 turn (180°) further

Notes:

- ♦ It is also permissible to turn bolts 2 x 90 °.
- ♦ Cylinder head bolts do not have to re-tightened later after repairs.
- Install intake manifold => Page 80 .
- Install cylinder head cover => Pages 84 .
- When installing right cylinder head, renew O-ring at base of dipstick guide tube.
- Install toothed belt (adjust valve timing) => Page 42 .

Note:

Follow all instructions for removing and installing toothed belt =>Page 39 .

- Install ribbed belt =>Page 31 .
- Install exhaust manifold => Pages 181 .
- Aligning exhaust system free of stress => Page 182 .
- Fill cooling system with fresh coolant => Page 150 .
- After connecting battery, enter anti-theft code for radio

=> Radio operating instructions

- Close windows fully using electric window switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.
- Top up PAS fluid and bleed steering system:

=> Running gear, Front-wheel drive and four-wheel drive; Repair group 48; Checking fluid level, bleeding steering system, testing for leaks Checking fluid level, bleeding steering system, testing for leaks

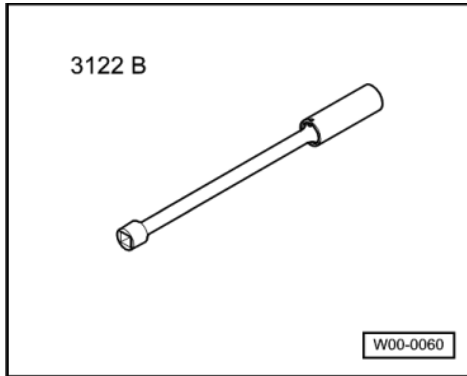
Tightening torques

| Component | Nm |
|---|----|
| Hydraulic pump supply pipe to bracket | 10 |
| Coolant pipe (large) to cylinder head or retainer bracket | 10 |
| Dipstick guide tube to cylinder head | 10 |
| Power steering pressure pipe to hydraulic pump | 40 |

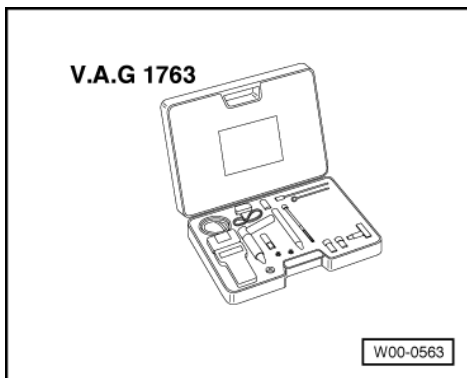
| Component | Nm |
|--|----|
| Rear toothed belt guard to cylinder head | 10 |

1.8 - Checking compressions

Special tools and workshop equipment required



- ♦ Spark plug spanner 3122 B

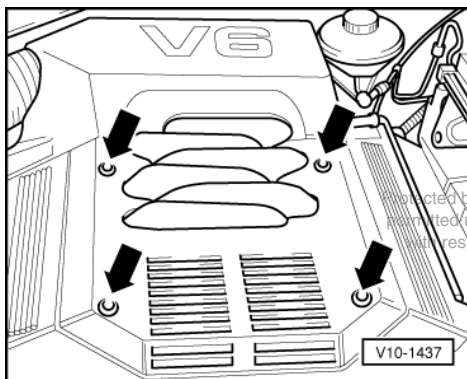


- ♦ Compression tester V.A.G 1381 or V.A.G 1763

Requirements for test:

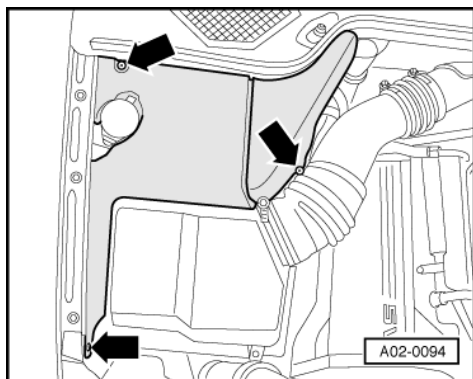
- Engine oil temperature not less than 30 °C
- Battery voltage not less than 12 V

Test sequence

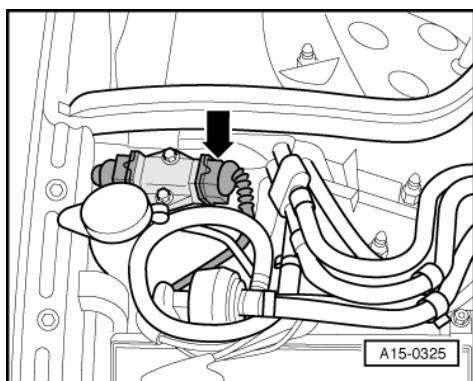


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Remove engine cover panel -arrows-.



- -> Remove cover on right side of engine compartment -arrows-.



- -> With the ignition switched off, unplug connector from ignition coil output stage -arrow-.
- Unplug connectors from all injectors
- Remove spark plugs with spark plug spanner 3122B.
- Fully open throttle valve.
- Check compressions with compression tester V.A.G 1381/V.A.G 1763.

Note:

Using the compression tester

=> Operating instructions

- Operate starter until tester shows no further pressure increase.

Compression pressure:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for the use of the information contained in this document. Copyright by AUDI AG.

| New bar | Wear limit bar | Permissible difference between cylinders bar |
|--------------|----------------|--|
| 9.0 ... 14.0 | 7.5 | max. 3.0 |

- Install spark plugs.
- Interrogate fault memory:

=> MPI Injection and ignition system; Repair group 01; Interrogating and erasing fault memory Interrogating and erasing fault memory

Note:

Faults will have been stored in the memory because connectors have been unplugged. Therefore interrogate and erase fault memory after installing engine.

Tightening torque

| Component | Nm |
|------------------------------|----|
| Spark plugs in cylinder head | 30 |

2 - Servicing valve gear

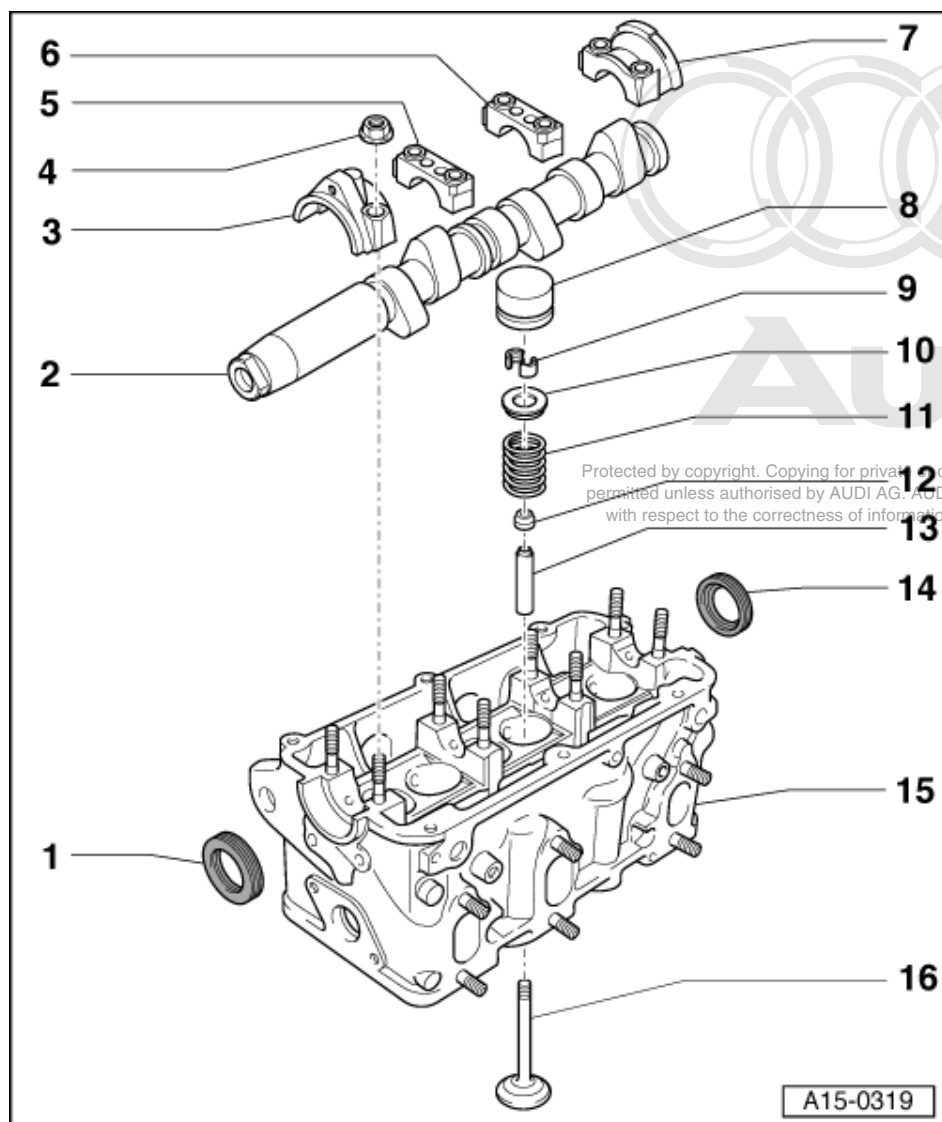
2.1 - Servicing valve gear

Notes:

- ♦ Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.
- ♦ After installing camshafts wait for approx. 30 minutes before starting engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 full rotations by hand to ensure that none of the valves make contact when the starter is operated.
- ♦ Renew all gaskets and seals.
- ♦ The following illustration shows the left cylinder head.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

**1 Oil seal**

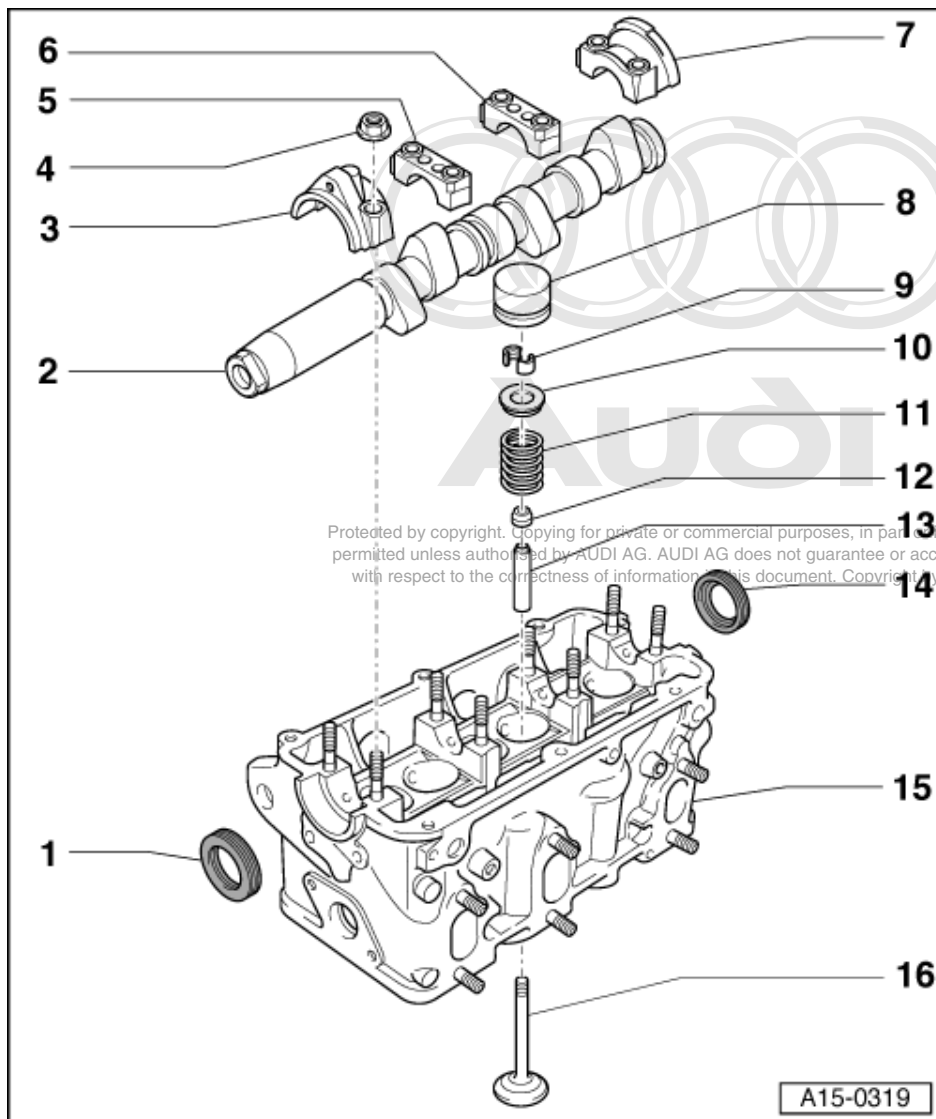
- ♦ Renewing=> Page 101

2 Camshaft

- ♦ Removing and installing
=> Page 105
- ♦ Checking axial clearance
=> Page 100
- ♦ Checking radial clearance with plastigage
Wear limit: 0.1 mm
- ♦ Run-out: max. 0.01 mm

3 Bearing cap No. 1

- ♦ For left cylinder head
- ♦ Installation sequence
=>Page 105, removing and installing camshaft
- ♦ Installation position => Fig. 2
- ♦ Sealing points=>Fig. 76



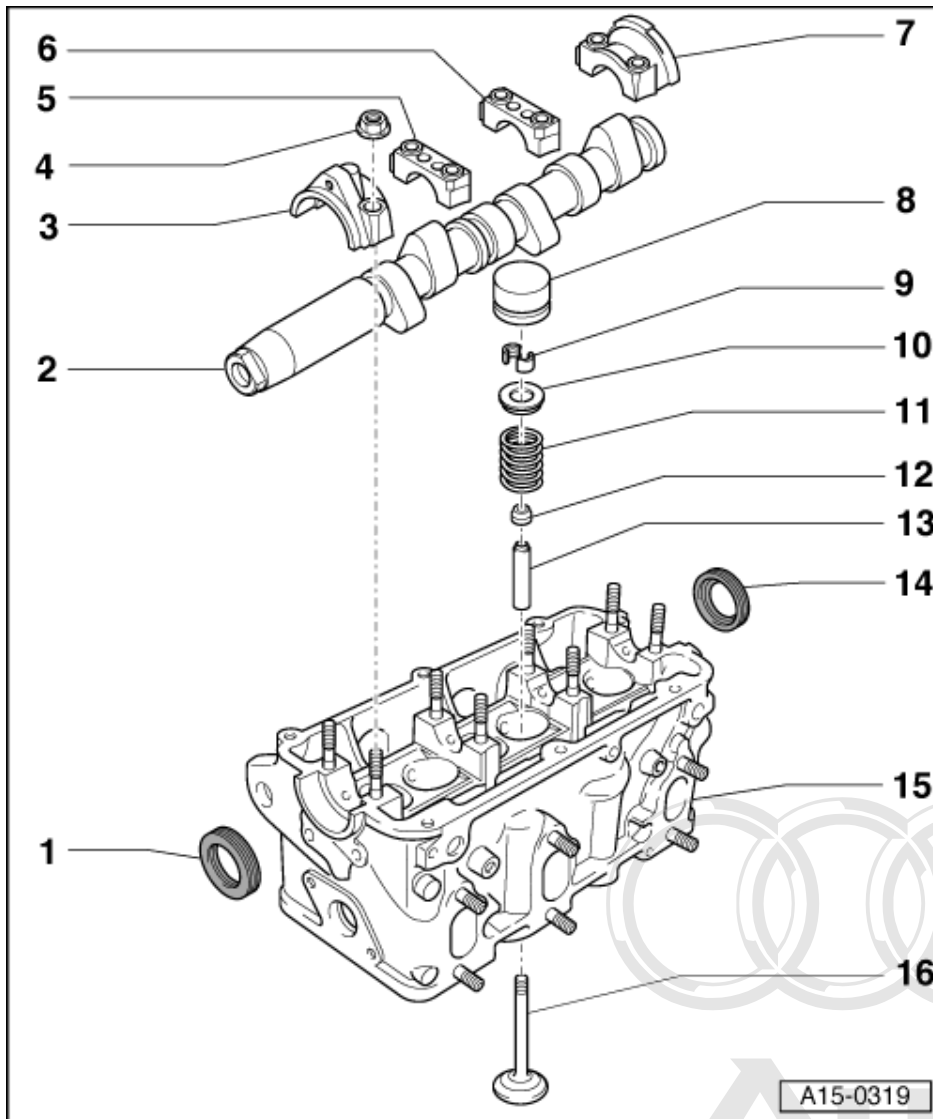
4 20 Nm

5 Bearing cap No. 2

- ◆ For left cylinder head
- ◆ Camshaft bearing cap No. 2 on left cylinder head is a combined radial and axial bearing (identified by ground surfaces on the sides)
- ◆ Mark fitting location
- ◆ Installation sequence
=>Page 105, removing and installing camshaft
- ◆ Installation position => Fig. 2

6 Bearing cap No. 3

- ◆ For left cylinder head
- ◆ Camshaft bearing cap No. 3 on right cylinder head is a combined radial and axial bearing (identified by ground surfaces on the sides)
- ◆ Mark fitting location
- ◆ Installation sequence
=>Page 105, removing and installing camshaft
- ◆ Installation position => Fig. 2

**7 Bearing cap No. 4**

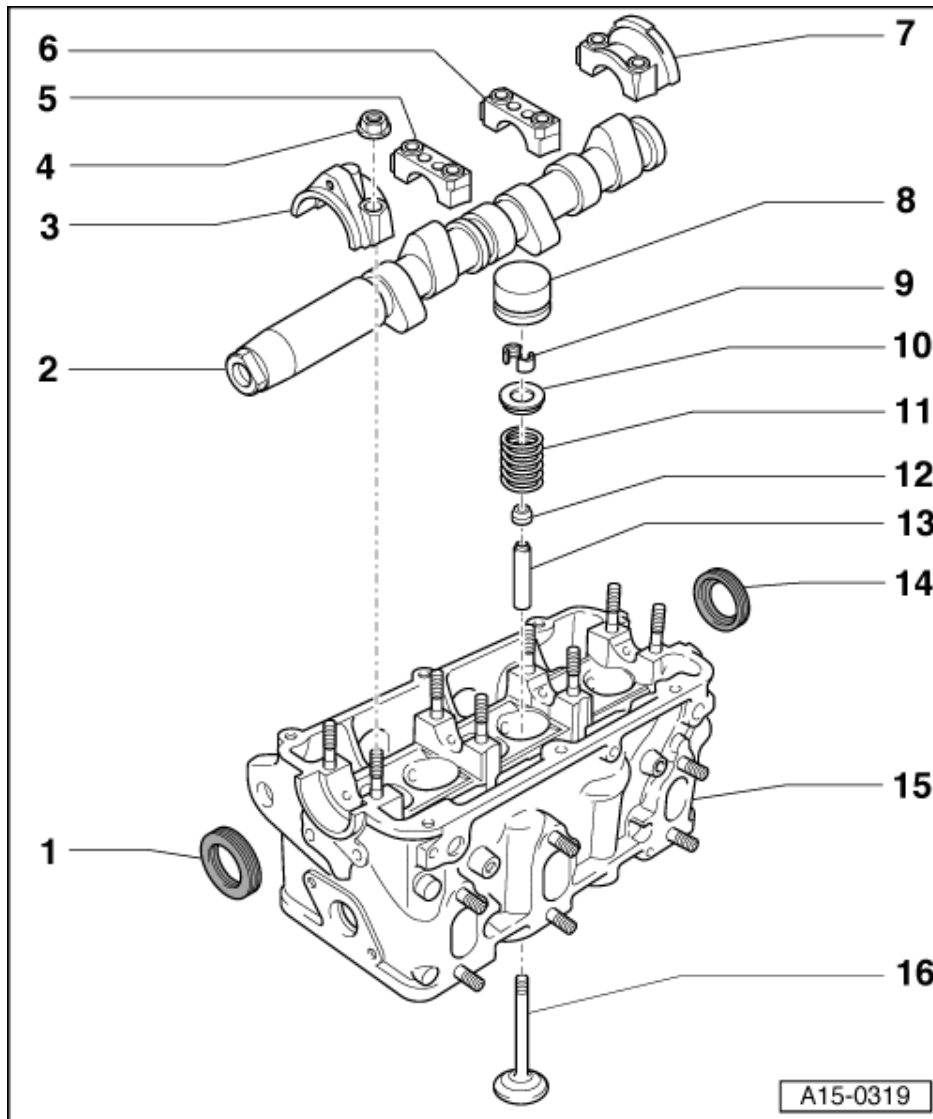
- ◆ For left cylinder head
- ◆ Installation sequence
=> Page 105, removing and installing camshaft
- ◆ Sealing points=>Fig. 76
- ◆ Installation position => Fig. 2

8 Hydraulic bucket tappet

- ◆ Checking => Page 106
- ◆ Removing and installing
=> Page 108
- ◆ Do not interchange
- ◆ Store with cam contact surface downwards
- ◆ Check camshaft axial clearance before installing => Fig. 100
- ◆ Oil contact surface

9 Valve cotters

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express written permission of Audi AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



10 Valve spring plate

11 Valve spring

- ◆ Removing and installing:
with head installed => Page 108
- with head removed:
use 2037

12 Valve stem seal

- ◆ Renewing => Page 108

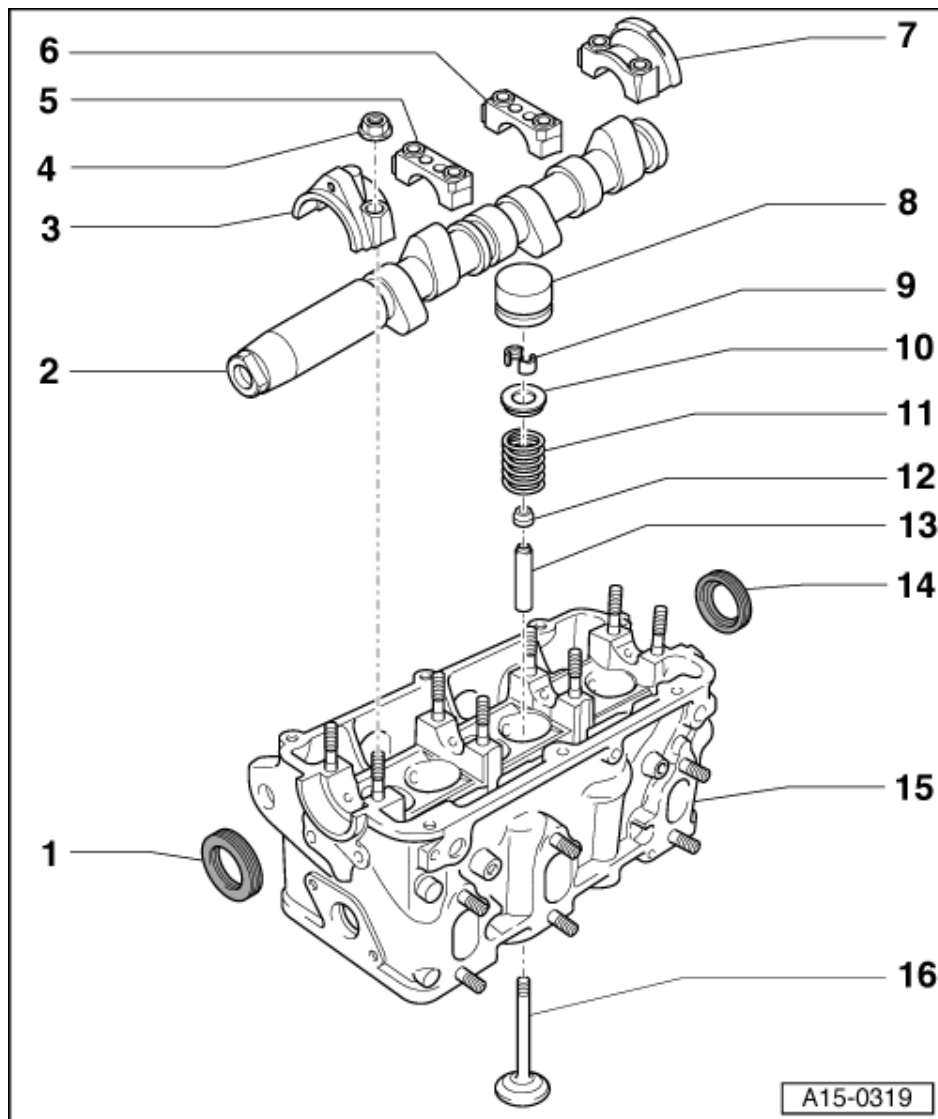
13 Valve guide

- ◆ Checking => Page 111
- ◆ Renewing => Page 112
- ◆ Service version with collar

14 Oil seal

Protected by Audi AG. All rights reserved. Audi AG does not guarantee or accept any liability for the correctness of information in this document. Copyright by Audi AG.

- ◆ Installed on left cylinder head only
- ◆ For replacement with engine installed, remove Hall sender => Fig. 4 and bearing cap No. 4 - Item 7 -



15 Cylinder head

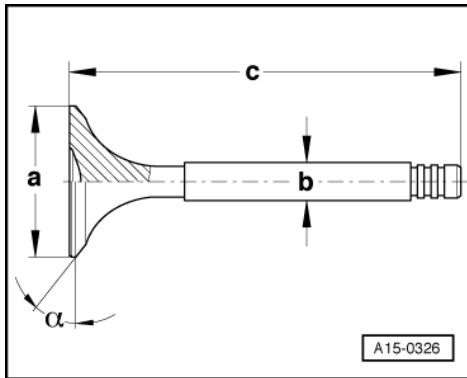
- ♦ See note
=> Page 93
- ♦ Checking valve guides, grinding-in valve seats => Page 111
- ♦ Reworking valve seats
=> Page 113

16 Valve

- ♦ Do not rework, only grinding-in is permitted
- ♦ Valve dimensions => Fig. 1
- ♦ Checking valve guides, grinding in valve seats => Page 111

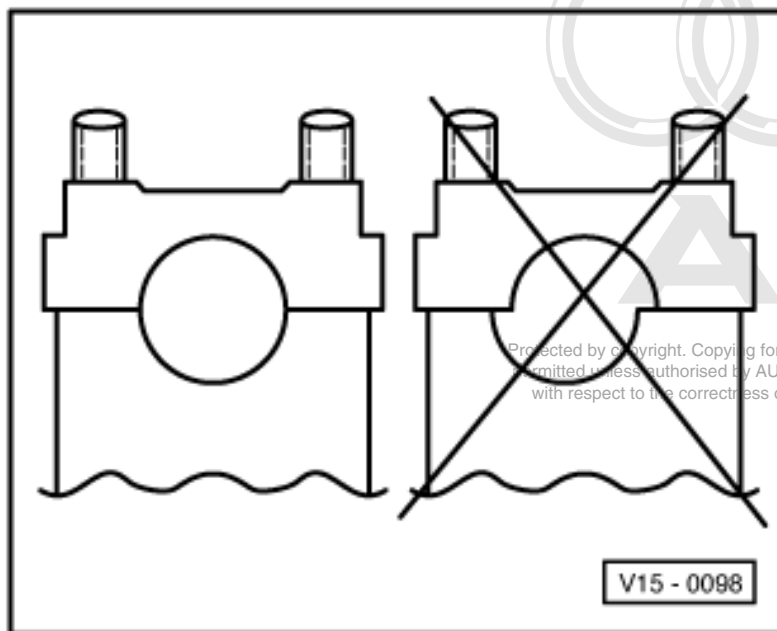


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



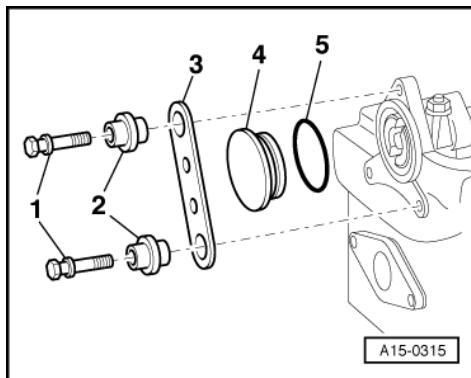
→ Fig. 1 Valve dimensions

| Dimension | | Inlet valve | Exhaust valve |
|-----------|----|-------------|---------------|
| dia. a | mm | 39.5 ±0.15 | 32.9 ±0.15 |
| dia. b | mm | 6.92 ±0.02 | 6.92 ±0.02 |
| c | mm | 91.85 | 91.15 |
| α | <° | 45 | 45 |



→ Fig. 2 Fitting position of camshaft bearing caps

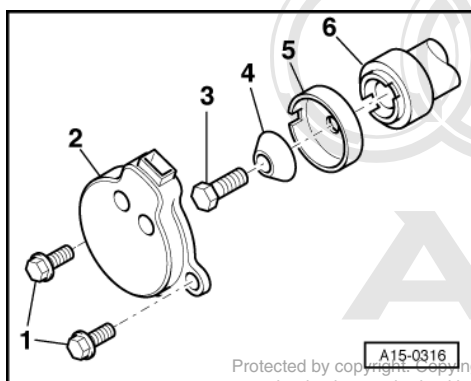
Note offset. Before installing camshaft fit bearing caps and determine fitting position.



-> Fig.3 Rear sealing cap for right cylinder head

- 1 - 10 Nm
- 2 - Spacer bush
- 3 - Spacer plate
- 4 - Sealing cap
- 5 - O-ring

-replace



-> Fig.4 Hall sender on left cylinder head

- 1 - 10 Nm
- 2 - Hall sender housing -G40
- 3 - 22 Nm
- 4 - Washer

-With taper

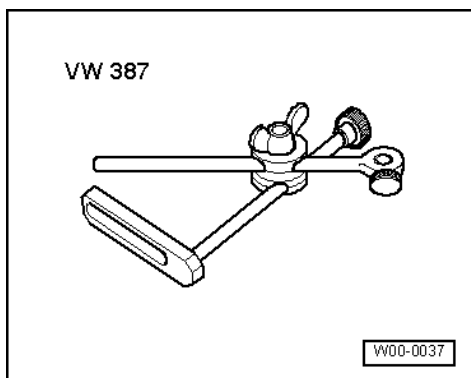
-Note fitting position

- 5 - Rotor for Hall sender

-Fit lug into notch on camshaft.

- 6 - Camshaft

2.2 - Checking camshaft axial clearance

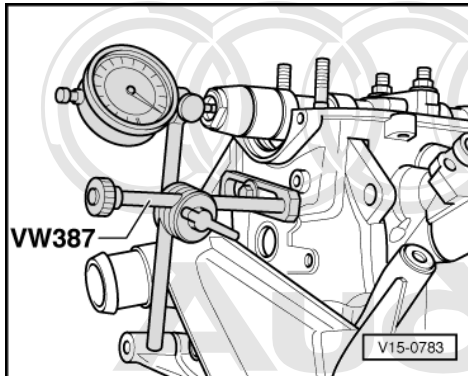


Special tools and workshop equipment required

- ♦ Universal dial gauge bracket VW 387
- ♦ Dial gauge

Test sequence

- Bucket tappets removed



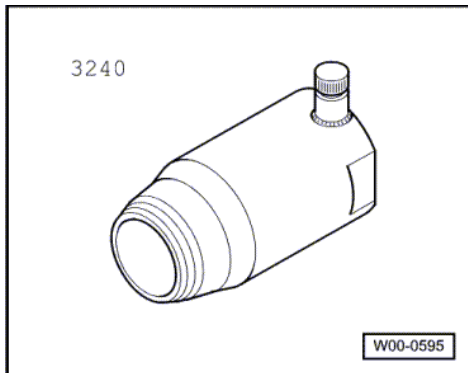
- -> Attach dial gauge with universal dial gauge holder VW 387 to cylinder head:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information published here. Copyright by AUDI AG.

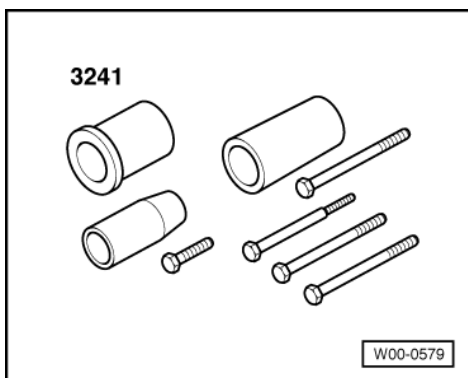
| | Axial clearance |
|------------|------------------|
| New | 0.04 ... 0.15 mm |
| Wear limit | 0.35 mm |

2.3 - Renewing front camshaft oil seals

Special tools and workshop equipment required



- ♦ Special tool 3240





- ♦ Fitting tool 3241

Removing

- Take toothed belt off camshaft sprockets=>Page 39 .

Note:

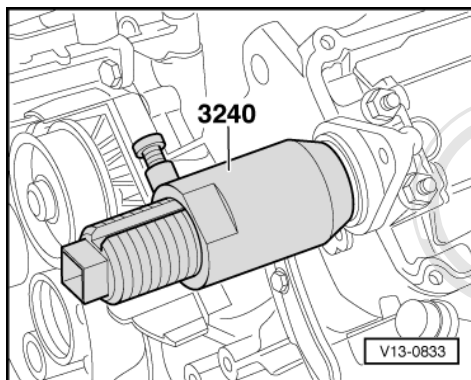
If one of the oil seals is leaking, replace seals on both cylinder heads.

- Adjust inner part of oil seal extractor 3240 so it is flush with outer part.

Left cylinder head:

- Turn inner part of oil seal extractor 28 turns outwards and lock in position with knurled screw.

Right cylinder head:



- Turn inner part of oil seal extractor 14 turns outwards and lock in position with knurled screw.

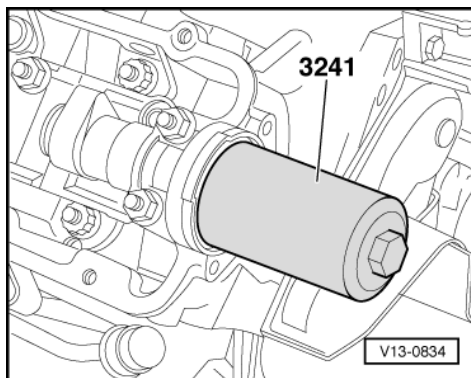
All models

- -> Lubricate threaded head of oil seal extractor 3240, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.
- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.

Installing

- Lightly oil sealing lip of oil seal.
- Slide oil seal over taper on camshaft.

Left cylinder head:



- -> Press in oil seal until flush using pressure sleeve 3241/1 and bolt M10 x 1.25 x 40 (part of special tool kit 3241).

Right cylinder head:

- Insert 4 nuts (M12) between bolt 3241/7 (M10 x 1.25 x 100) and pressure sleeve 3241/1.
- Press in oil seal until flush using pressure sleeve 3241/1 and bolt 3241/7.

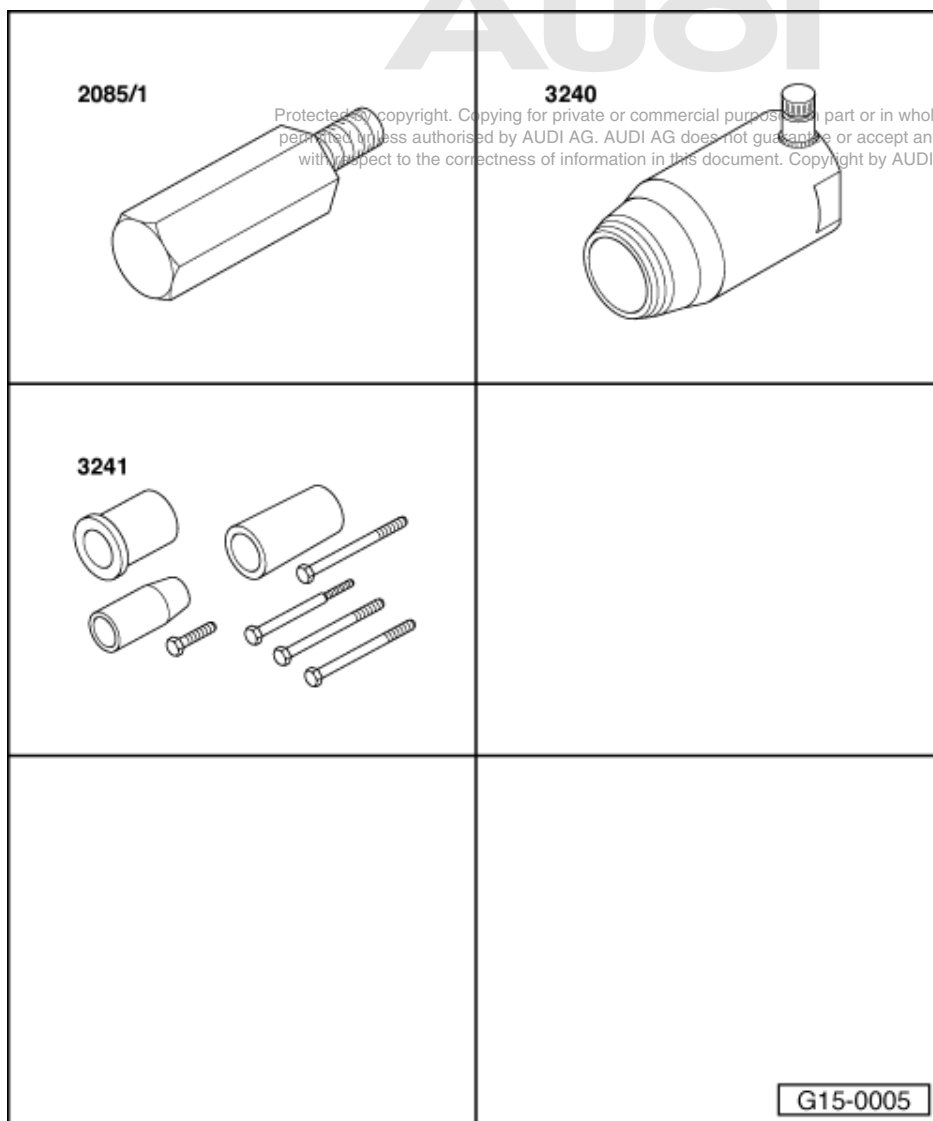
All models

- Install toothed belt (adjust valve timing) => Page 42 .

Note:

Follow all instructions for removing and installing toothed belt =>Page 39 .

2.4 - Renewing rear oil seal for left camshaft

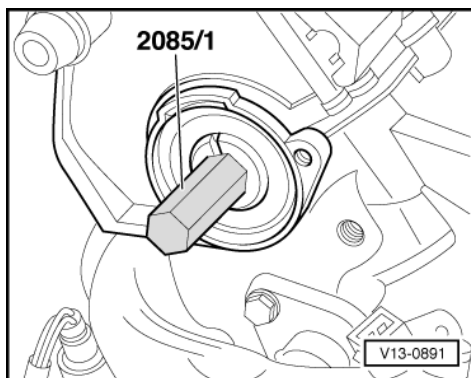


Special tools and workshop equipment required

- ◆ Special tool 2085/1
- ◆ Special tool 3240
- ◆ Special tool 3241

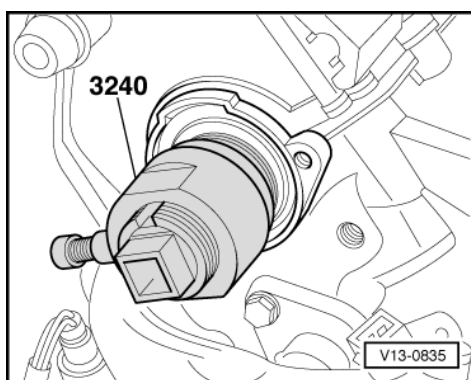
Note:

For replacing the oil seal with engine installed, remove camshaft bearing cap No. 4 -Item **96**. With engine removed, replace as follows:



Removing

- Remove Hall sender=>Fig. **100**.
- -> Screw in bolt of oil seal extractor 2085/1.
- Adjust inner part of oil seal extractor 3240 so that it is level with the outer part.
- Turn inner part of oil seal extractor 9 turns outwards and lock in position with knurled screw.



- -> Lubricate threaded head of oil seal extractor 3240, place it in position and, exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part of extractor against camshaft until oil seal has been extracted.

Note:

Oil seal extractor 2085 can be used as well.

- Clamp flats of oil seal extractor in vice. Remove oil seal with pliers.
- Clean contact surface and sealing surface.

Installing

Install in reverse sequence; note the following points:

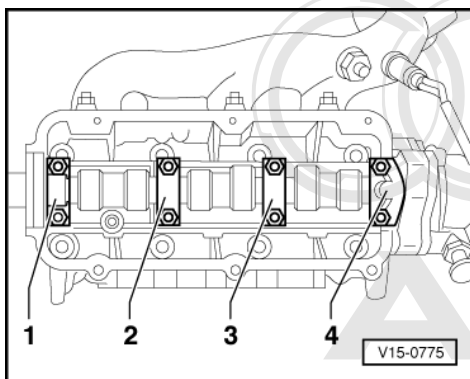
- Lightly oil sealing lip of oil seal.
- Press in oil seal until flush using pressure sleeve 3241/1 and bolt 3241/3 (M8 x 105).

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

2.5 - Removing and installing camshafts

Removing

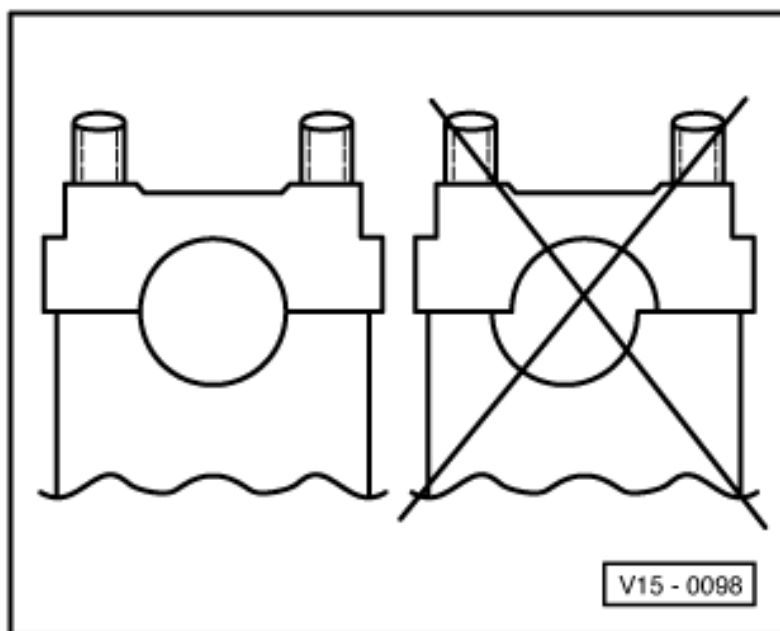
- Take toothed belt off camshaft sprockets=>Page 39 .
- Remove cylinder head cover =>Pages 83 .
- Remove Hall sender on left cylinder head=>Fig. 100 .
- Remove camshaft sprocket.
- Mark the installation position of the bearing caps.



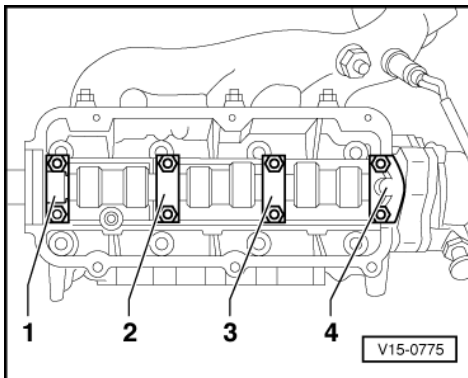
- -> First remove bearing caps 2 and 3.
- Slacken bearing caps 1 and 4 in stages and in diagonal sequence and remove.

Installing

Install in reverse sequence; note the following points:



- -> Note that bearing caps are not symmetrical. Before installing camshaft, fit bearing caps and determine correct position for installation.



- -> Tighten bearing caps 1 and 3 in stages and in diagonal sequence.
- Tighten the other bearing caps.
- Install toothed belt (adjust valve timing) => Page 42 .

Note:

Follow all instructions for removing and installing toothed belt =>Page 39 .

- Install cylinder head cover =>Pages 84 .

Notes:

- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. The hydraulic valve compensating elements must settle (otherwise the valves will strike the pistons).
- ♦ After working on the valve gear, turn the engine carefully at least 2 full rotations by hand to ensure that none of the valves make contact when the starter is operated.

Tightening torque

| Component | Nm |
|------------------------------|----|
| Bearing cap to cylinder head | 20 |

2.6 - Checking hydraulic bucket tappets**Special tools and workshop equipment required**

- ♦ Feeler gauge
- ♦ Wood or plastic wedge

Notes:

- ♦ Hydraulic tappets cannot be adjusted or repaired.
 - ♦ Irregular valve noises when starting engine are normal.
- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- Start engine and run until coolant temperature reaches approx. 80 °C.
 - Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note:

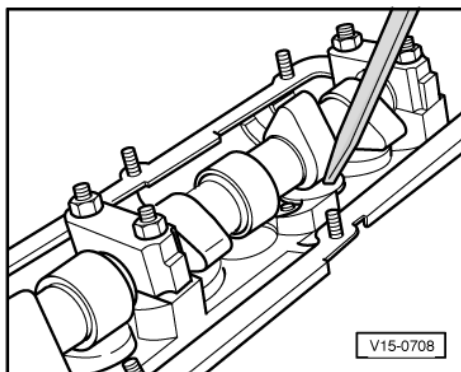
If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. The oil retention valve is located under the cover below the intake manifold=>Page 139 .

If the hydraulic tappets are still noisy, locate defective tappets as follows:

- Remove cylinder head cover =>Pages 83 .
- Rotate crankshaft in clockwise direction by turning central bolt on crankshaft sprocket until cams of cylinder to be checked are pointing upwards.



- Determine play between cam and bucket tappet.



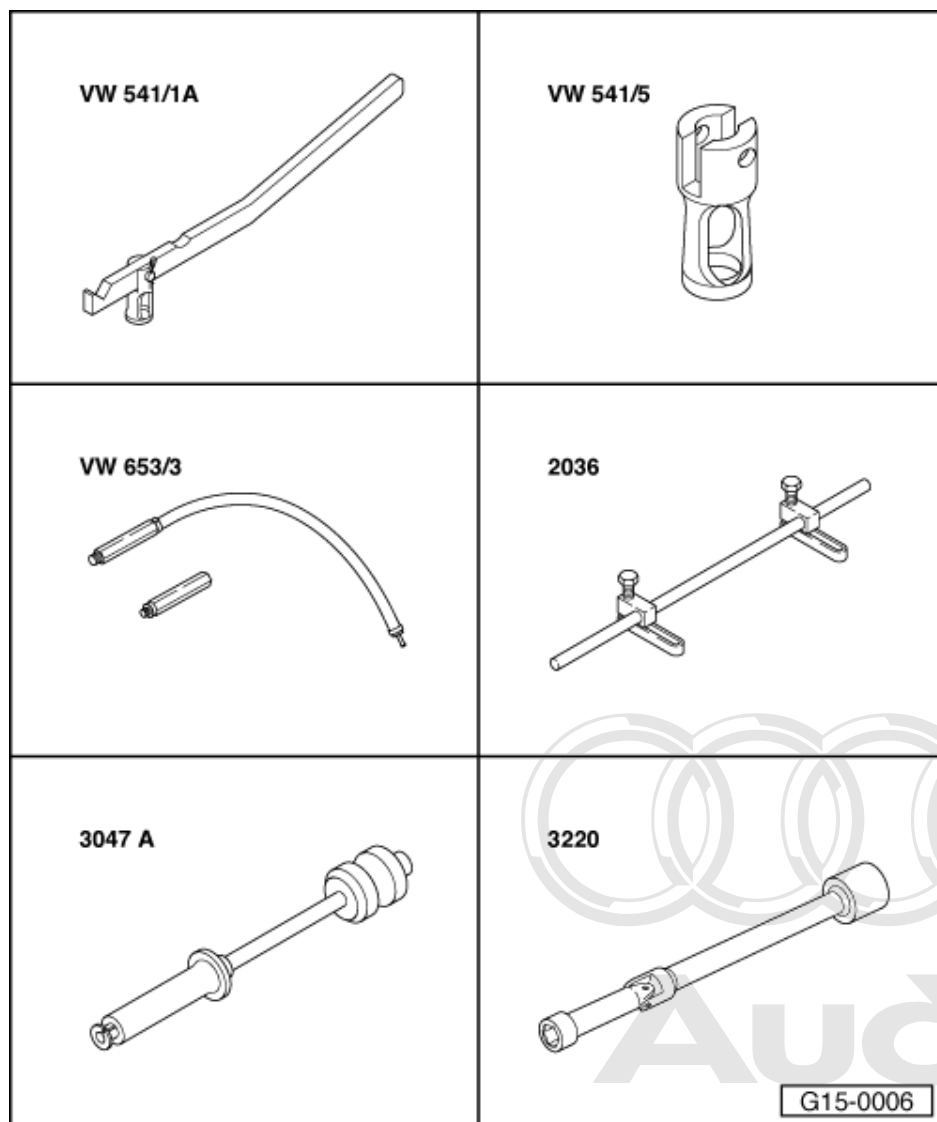
- -> Press tappet down with a wooden or plastic wedge. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Renewing tappets,=>Removing camshaft, Page 105 .

Notes:

- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. The hydraulic tappets must be allowed to settle, otherwise the valves will contact the pistons.
- ♦ After working on the valve gear, turn the engine carefully at least 2 full rotations by hand to ensure that none of the valves make contact when the starter is operated.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

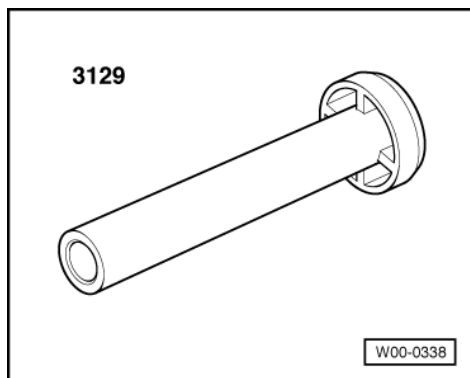
2.7 - Renewing valve stem seals



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Special tools and workshop equipment required

- ♦ Special tool VW 541/1A
- ♦ Special tool VW 541/5
- ♦ Special tool VW 653/3
- ♦ Special tool 2036
- ♦ Special tool 3047 A
- ♦ Special tool 3220

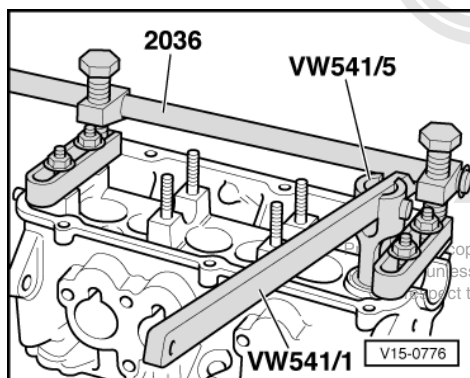


- ◆ Fitting tool 3129

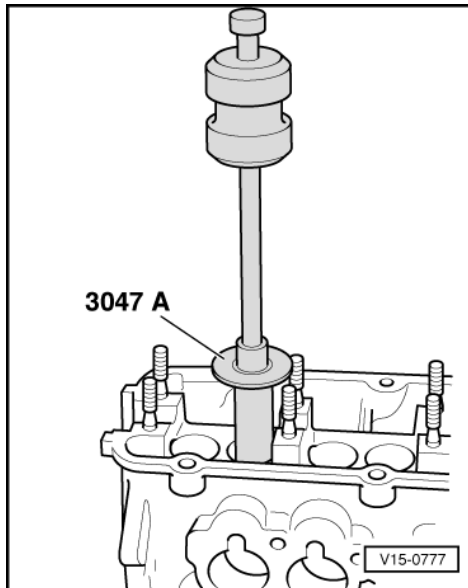
- Cylinder head installed

Removing

- Remove camshaft=>Page 105 .
- Remove the bucket tappets and put them down with the contact surface downwards. When doing this ensure that the tappets are not interchanged.
- Remove spark plugs.
- Set piston of appropriate cylinder to "bottom dead centre".



- -> Position fitting tool 2036 with shaft parallel to sealing edge of cylinder head cover. Tighten bolts to secure fitting tool.
- Adjust shaft of fitting tool so that it is level with the studs for the bearing caps.
- Screw compressed air hose VW 653/3 into spark plug thread and apply a continuous pressure of at least 6 bar.
- Remove valve springs with lever VW 541/1A and press piece VW 541/5.

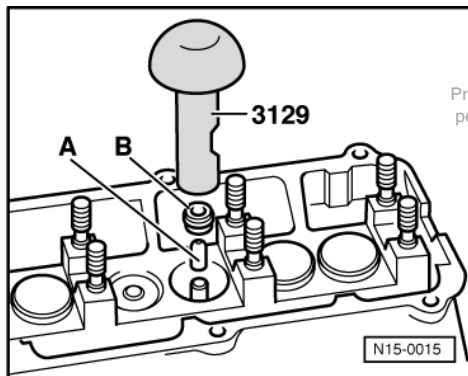


Note:

Tight cotters can be loosened by tapping lightly on the lever.

- -> Pull off valve stem seals with 3047 A.

Installing



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

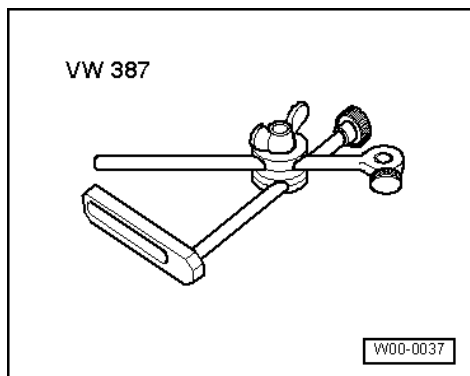
- -> To prevent damage to the new valve stem seals, place plastic sleeve -A- on valve shaft.
- Lightly oil sealing lip of valve stem seal.
- Insert valve stem seal in the tool 3129 and push it down carefully onto the valve guide.
- Remove plastic sleeve.
- Install camshaft => Page 105 .

Notes:

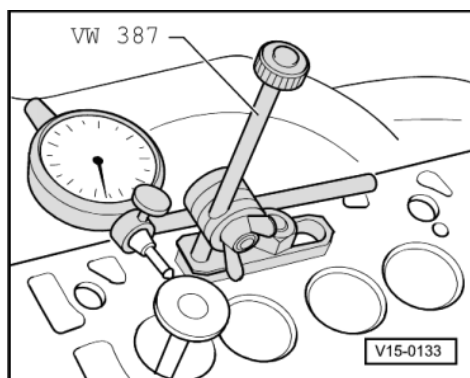
- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. The hydraulic tappets must be allowed to settle, otherwise the valves will contact the pistons.
- ♦ After working on the valve gear, turn the engine carefully at least 2 full rotations by hand to ensure that none of the valves make contact when the starter is operated.

2.8 - Checking valve guides

Special tools and workshop equipment required



- ♦ Universal dial gauge bracket VW 387
- ♦ Dial gauge



- -> Insert valve into valve guide until end of valve stem is flush with end of guide. Due to the different valve stem diameters, use only an inlet valve in the inlet guide and an exhaust valve in the exhaust guide.
- Measure the amount of sideways play (lateral play).

Wear limit

| Inlet valve guide | Exhaust valve guide |
|-------------------|---------------------|
| 1.00 mm | 1.30 mm |

Notes:

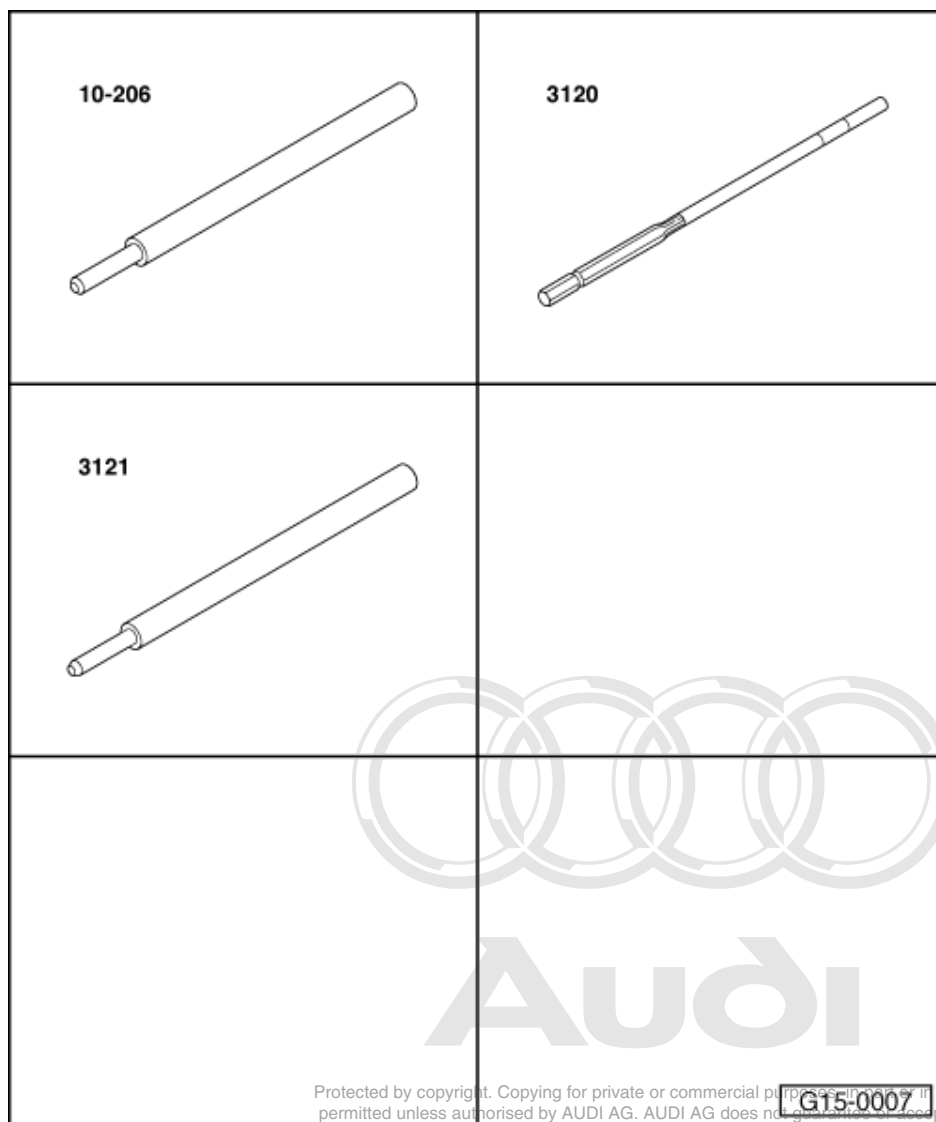
- ♦ If the wear limit is exceeded, repeat the measurement with new valves. If the wear limit is again exceeded, renew the valve guide.
- ♦ If the valve is to be renewed as part of a repair, use a new valve for the calculation.

2.9 - Checking valves

- Visual inspection for scoring on valve stems and valve seat surfaces. Renew valves if severe scoring is visible.



2.10 - Replacing valve guides



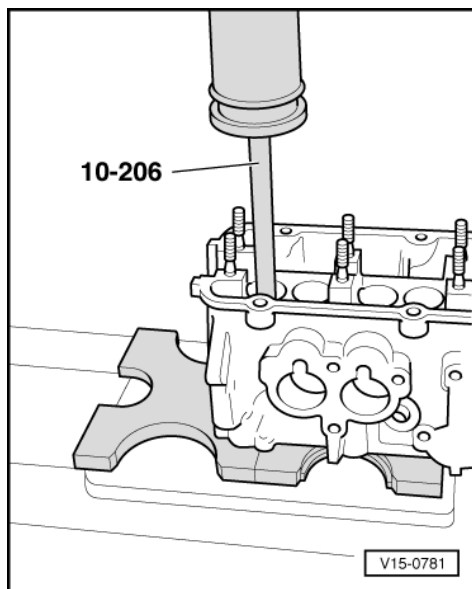
Protected by copyright. Copying for private or commercial purposes in whole or in part, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Special tools and workshop equipment required

- ♦ Special tool 10-206
- ♦ Special tool 3120
- ♦ Special tool 3121
- ♦ Hand reamer and cutting fluid

Removing

- Clean and check cylinder head. Cylinder heads in which the valve seats can no longer be reworked, or cylinder heads which have already been machined to the minimum dimension, should not have the valve guides replaced.
- Press out worn valve guides with 10-206 as follows:



- -> Valve guides without shoulder:
from the camshaft side
- Valve guides with shoulder (repair version):
from the combustion chamber side

Installing

- Lightly oil new valve guides and press in with 3121 from the camshaft side (cylinder head cold) until shoulder makes contact.

Note:

When the shoulder on the valve guide makes contact, the pressure must not exceed 10 kN (approx. 1.0 t) otherwise the shoulder can break off.

- Ream guides out with hand reamer 3120 using plenty of cutting fluid.
- Rework valve seats => Page 113 .
- Renew valve stem seals => Page 108 .

2.11 - Reworking valve seats

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written permission of AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Note:

If a good seating pattern cannot be obtained by grinding the valve seats (lapping), they must be refaced (re-worked):

Special tools and workshop equipment required

- ◆ Depth gauge
- ◆ Valve seat refacing tool

Notes:

- ◆ When repairing engines with leaking valves, it is not sufficient to reface the valve seats and renew the valves. The valve guides must also be checked for wear. This is particularly important on high mileage engines =>Page 111 .
- ◆ The valve seats should only be reworked just enough to produce a perfect seating pattern.
- ◆ Calculate the maximum permissible reworking dimension before reworking.

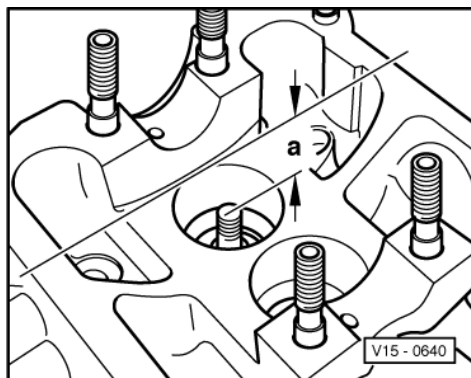
- ♦ If the reworking dimension is exceeded, the function of the hydraulic tappets can no longer be guaranteed and the cylinder head should be renewed.

Calculating max. permissible reworking dimension

- Insert valve and press it firmly against valve seat.

Note:

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



- -> Measure distance -a- between end of valve stem and upper edge of cylinder head.

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

Minimum dimensions:

Inlet valve 33.8 mm

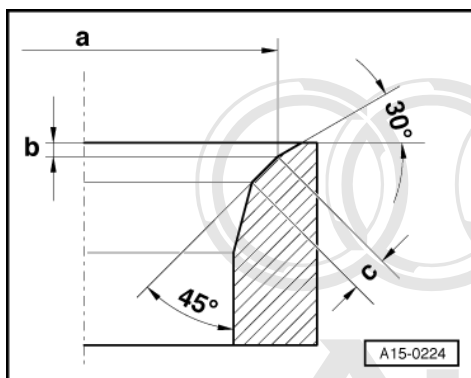
Exhaust valve 34.1 mm

Example:

| | |
|-------------------------------|---------|
| - Measured distance -a- | 35.1 mm |
| - Minimum dimension | 34.1 mm |
| = max. perm. rework dimension | 1.0 mm |

Note:

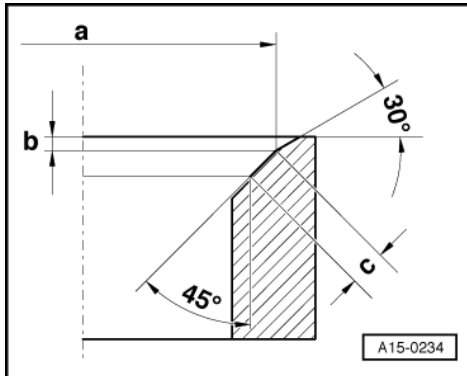
If the maximum permissible reworking dimension is 0 mm or less than 0 mm, repeat the measurement with a new valve. If the measured result is again 0 mm or less than 0 mm, renew the cylinder head.



-> Reworking inlet valve seat

| Dimension | Inlet valve seat |
|-----------|------------------|
| dia. a mm | 39.2 |

| | | |
|-----|----|---------------------------------|
| b | mm | max. permissible reworking dim. |
| c | mm | approx. 2.0 |
| 45° | | Valve seat angle |
| 30° | | Upper correction angle |



-> Reworking exhaust valve seat

| Dimension | Exhaust valve seat |
|-----------|---------------------------------|
| dia. a mm | 32.4 |
| b mm | max. permissible reworking dim. |
| c mm | approx. 2.4 |
| 45° | Valve seat angle |
| 30° | Upper correction angle |

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



17 - Lubrication

1 - Removing and installing parts of lubrication system

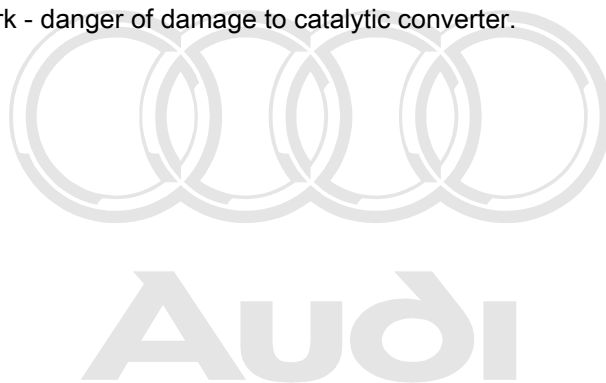
1.1 - Removing and installing parts of lubrication system

Notes:

- ♦ If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler renewed in order to prevent further damage occurring later.
- ♦ The oil level must not be above the max. mark - danger of damage to catalytic converter.

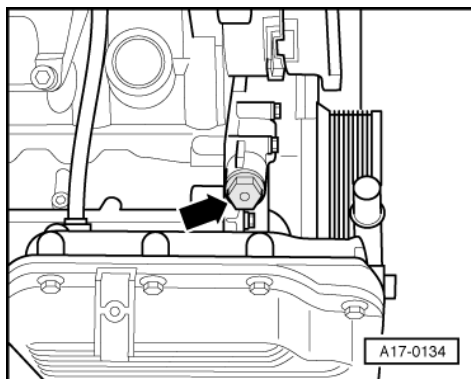
Oil system capacity:

=> Binder "Emissions test"



1.2 - Different oil circuits

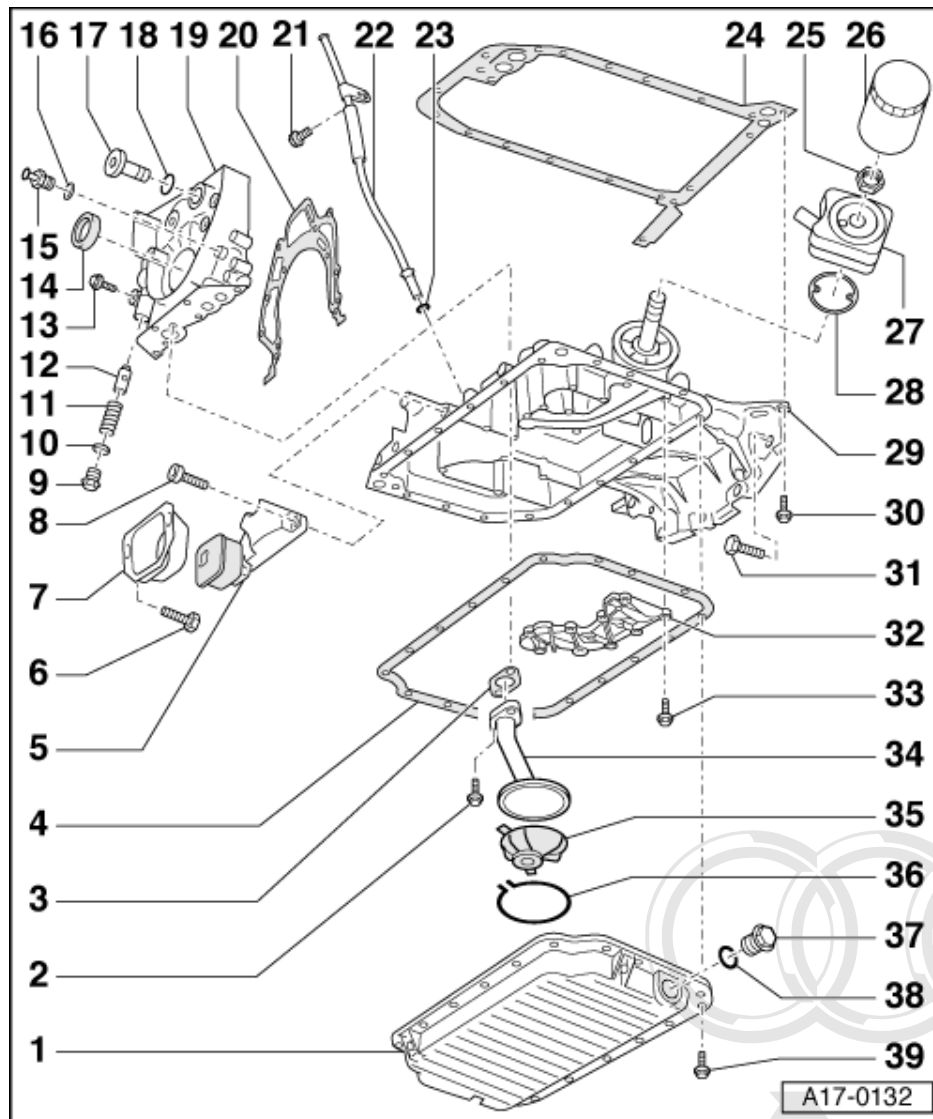
Distinguishing features



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

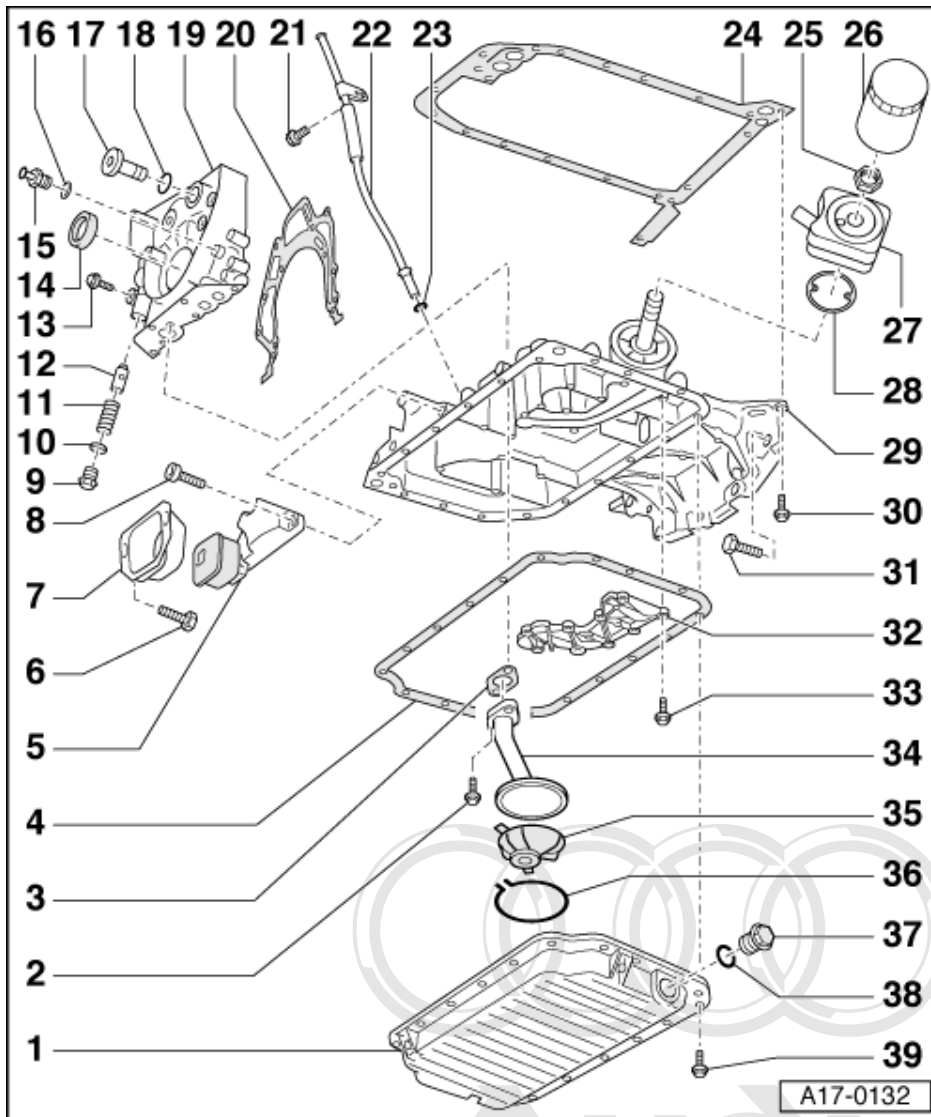
- ♦ -> Vehicles up to VIN 4D S_ 000 496: the oil pump is equipped with a screw plug -arrow-.
- ♦ Vehicles from VIN 4D S_ 000 497 onwards: the oil circuit was modified; the oil pump is not equipped with a screw plug.

1.3 - Vehicles up to VIN 4D S_ 000 496



- 1 Sump (lower section)
 - ♦ Removing and installing
=> Page **128**
- 2 10 Nm
- 3 Gasket
 - ♦ Renew
- 4 Gasket
 - ♦ Renew
- 5 Torque reaction support
- 6 40 Nm

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

**7 Stop plate**

- ◆ For torque reaction support
- ◆ Adjusting:

- Allow stop plate for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts to 40 Nm.

8 42 Nm**9 Screw plug - 45 Nm****10 Seal**

- ◆ Renew

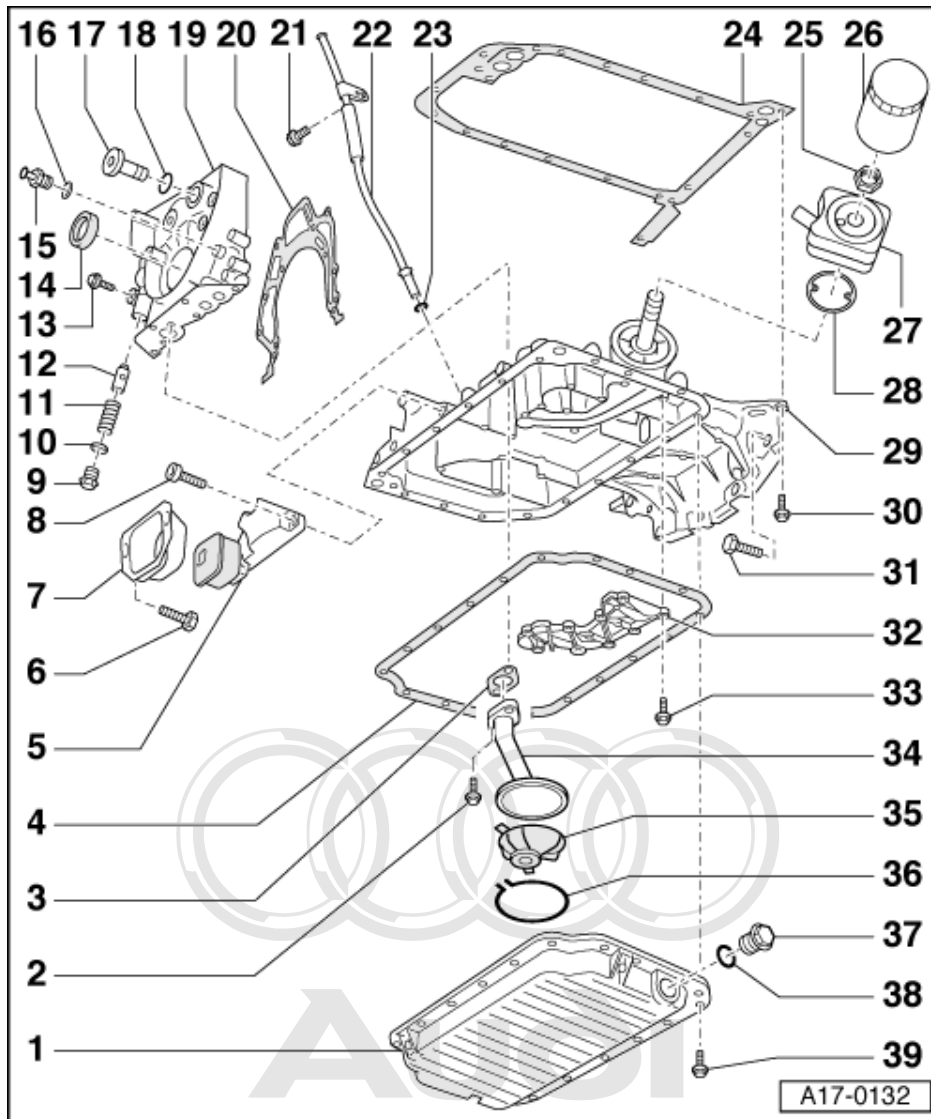
11 Spring

- ◆ For pressure relief valve

12 Piston

- ◆ For pressure relief valve

13 10 Nm



- 14 Oil seal** Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- ♦ For crankshaft
 - ♦ Removing and installing
- => Page 50

- 15 Oil temperature sender -G8**
 -10 Nm

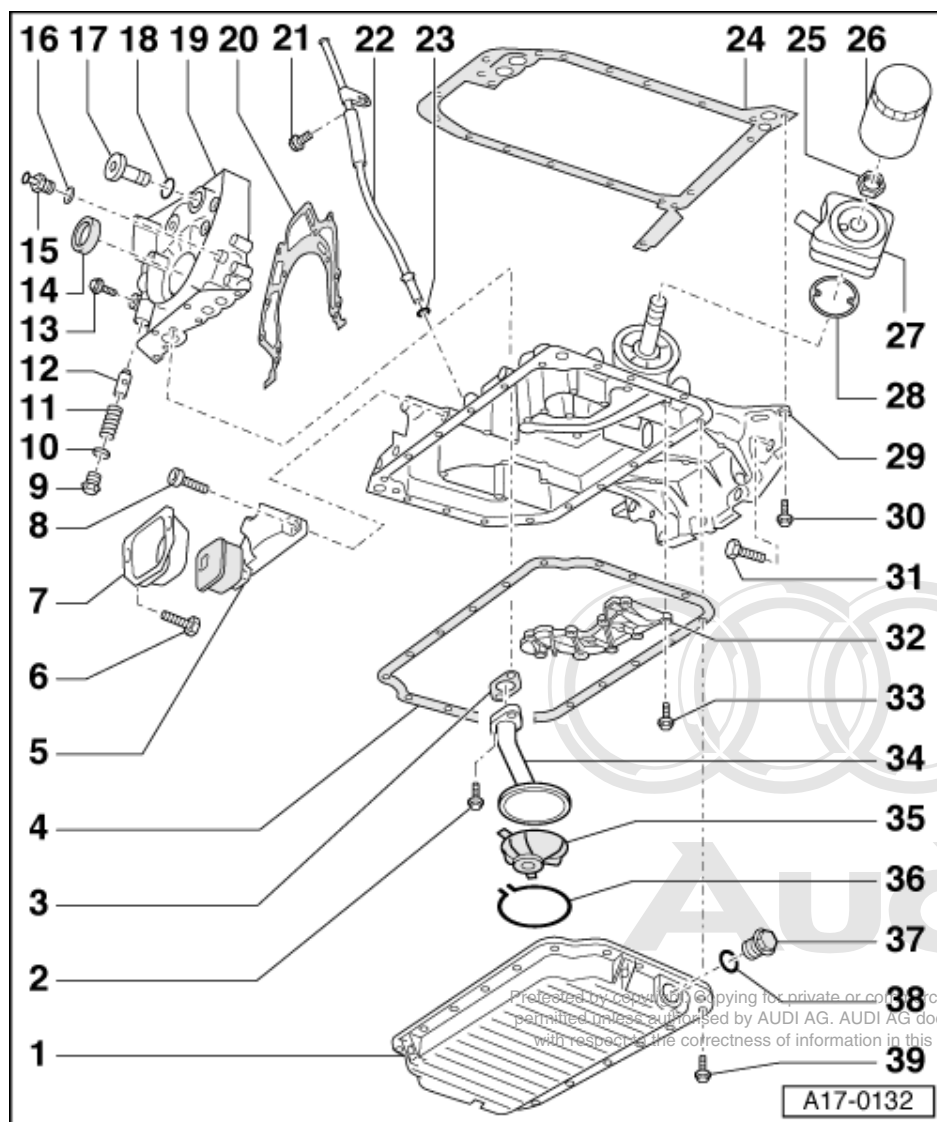
- 16 Seal**
- ♦ If seal is leaking, cut open and renew.

- 17 Screw plug, 30 Nm**

- 18 O ring**
- ♦ Renew

- 19 Oil pump**
- ♦ Removing and installing
- => Page 136

- 20 Gasket**
- ♦ Renew



21 10 Nm

22 Guide tube

- ♦ For dipstick

23 O ring

- ♦ Renew

24 Gasket

- ♦ Renew
- ♦ Install dry
- ♦ No additional sealant required

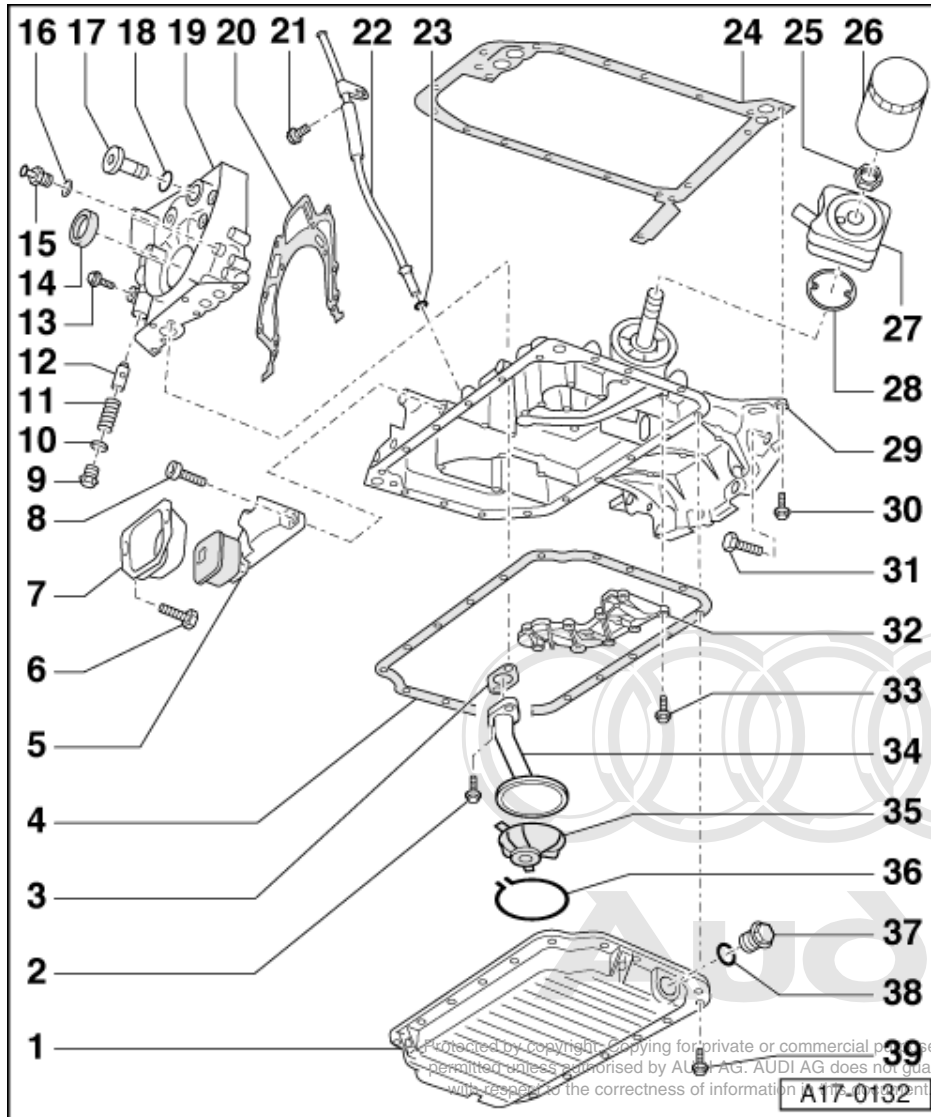
25 30 Nm

26 Oil filter

- ♦ Observe change intervals

=> Maintenance manual

- ♦ Loosen with oil filter wrench 3417
- ♦ Observe installation instructions on oil filter
- ♦ Tighten to 20 Nm



27 Oil cooler

- ♦ See note
=> Page 116

28 Gasket

- ♦ Renew
- ♦ Engage in projections on oil cooler

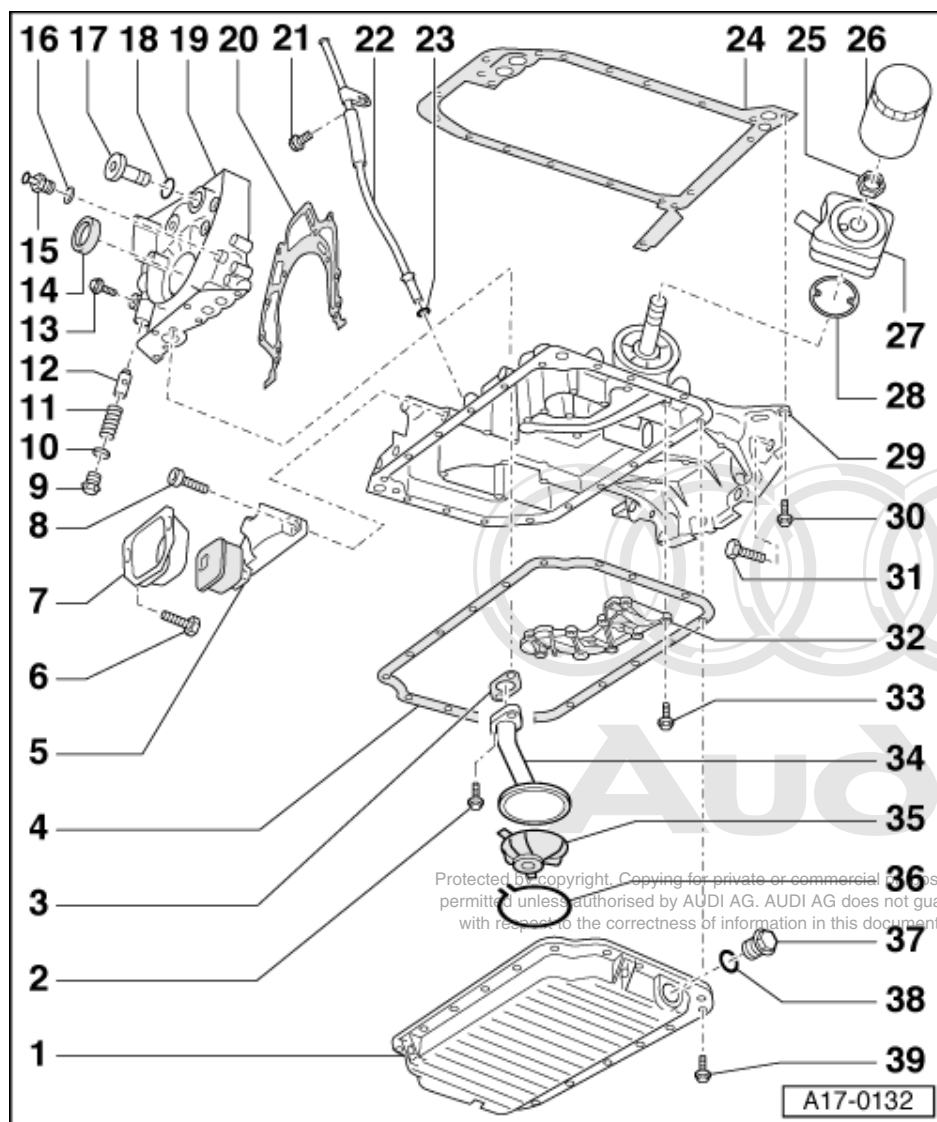
29 Sump (upper section)

- ♦ Removing and installing
=> Page 129

30 10 Nm

- ♦ Tighten in stages and in diagonal sequence
- ♦ Install 2 bolts with locking fluid
D 000 600 A2=>Page 135

31 M8 - 25 Nm M10 - 45 Nm



32 Sealing cap

33 10 Nm

34 Suction pipe

35 Intake housing

36 Retaining ring

37 Oil drain plug - 40 Nm

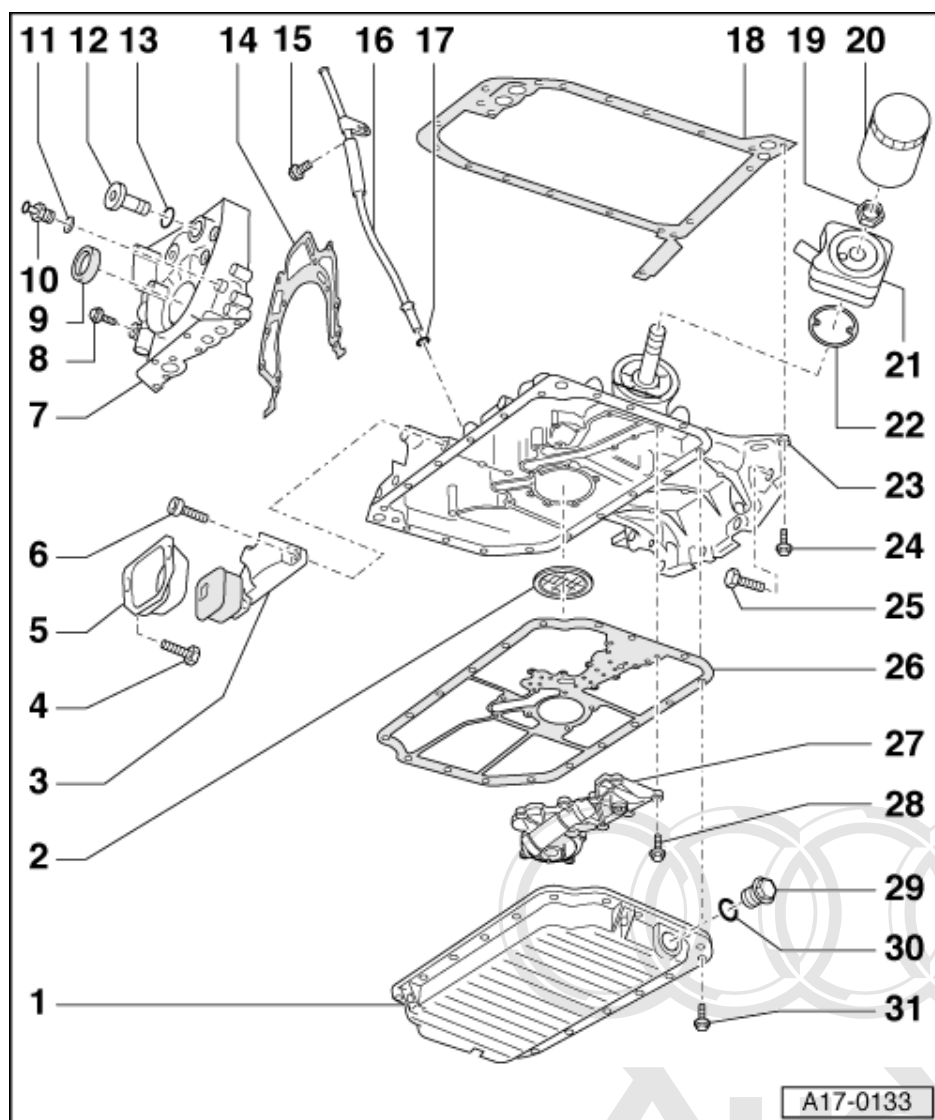
38 Seal

- ♦ Renew

39 10 Nm

- ♦ Tighten in stages and in diagonal sequence

1.4 - Vehicles from VIN 4D S_ 000 497 onwards



1 Sump (lower section)

- ♦ Removing and installing
=> Page 128

2 Oil filter screen

- ♦ Engages in upper section of sump by means of 3 lugs

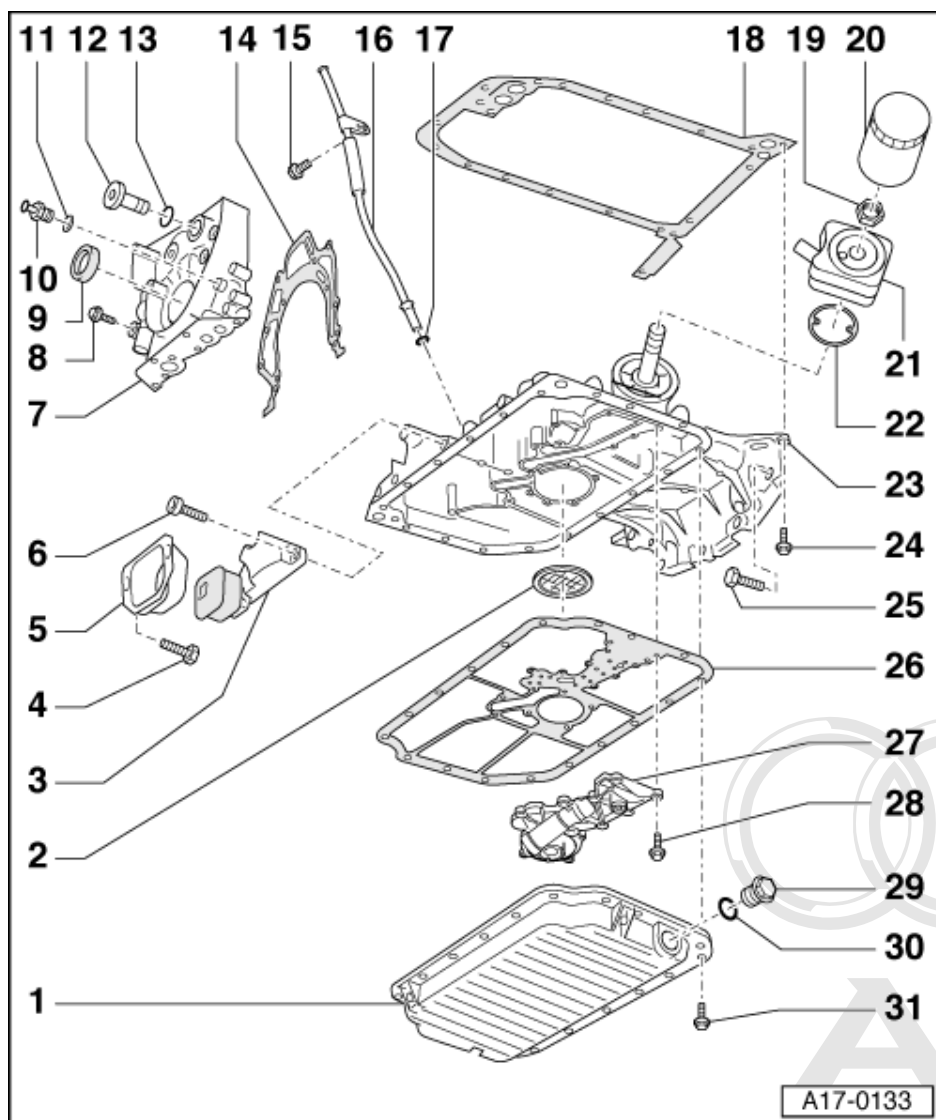
3 Torque reaction support

4 40 Nm

5 Stop plate

- ♦ For torque reaction support
- ♦ Adjusting:
 - Allow stop plate for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts to 40 Nm.

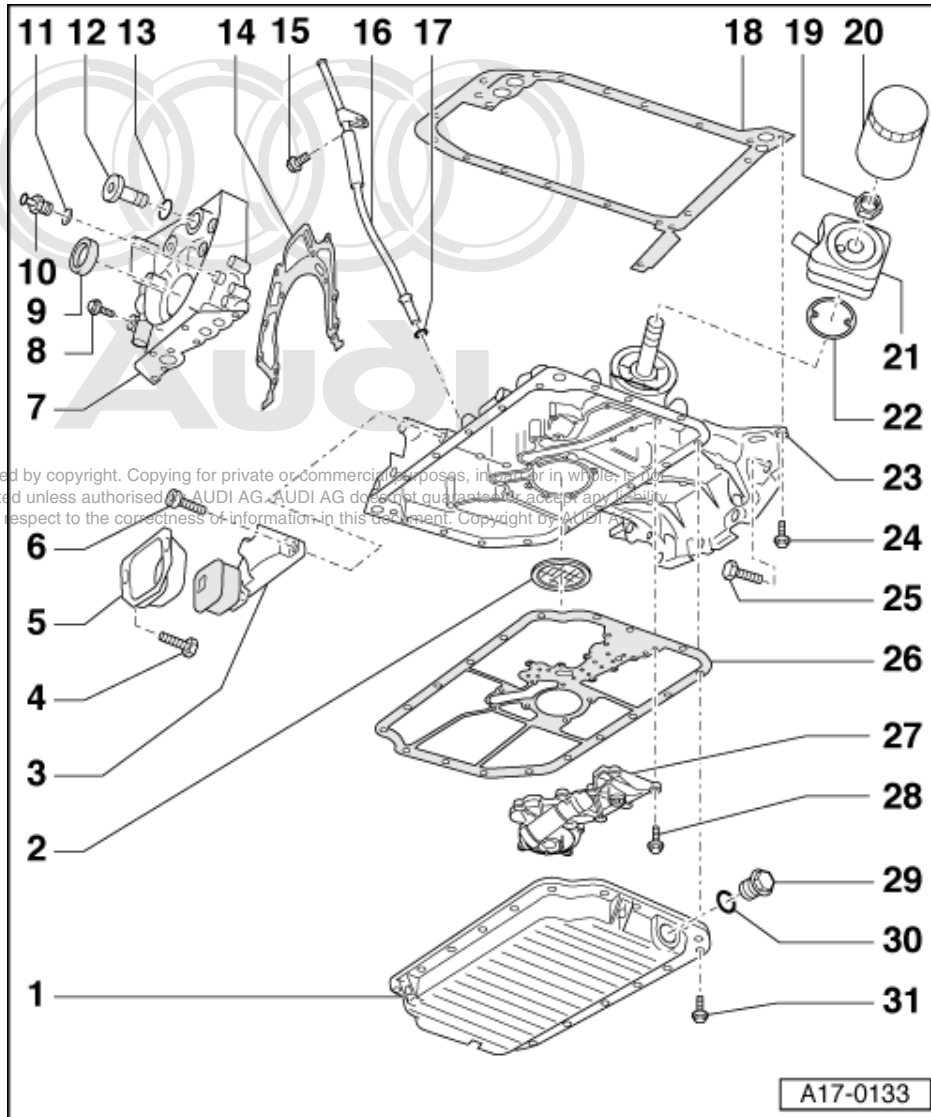
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



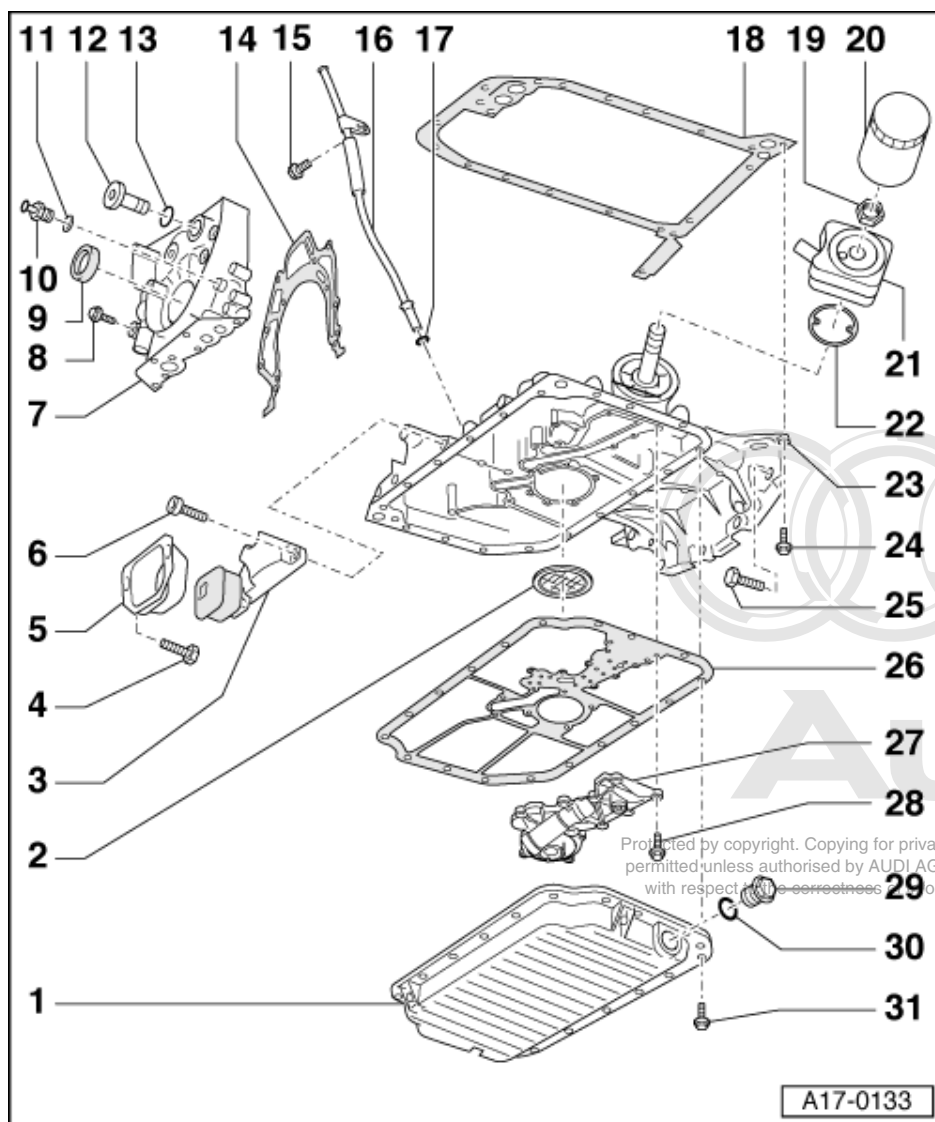
A17-0133

- 6 42 Nm**
- 7 Oil pump**
 - ♦ Removing and installing
=> Page **136**
- 8 10 Nm**
- 9 Oil seal**
 - ♦ For crankshaft
 - ♦ Removing and installing
=> Page **50**
- 10 Oil temperature sender -G8
-10 Nm**
- 11 Seal**
 - ♦ If seal is leaking, cut open and renew.
- 12 Screw plug, 30 Nm**

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- 13 O ring**
 - ◆ Renew
- 14 Gasket**
 - ◆ Renew
- 15 10 Nm**
- 16 Guide tube**
 - ◆ For dipstick
- 17 O ring**
 - ◆ Renew
- 18 Gasket**
 - ◆ Renew
 - ◆ Install dry
 - ◆ No additional sealant required
- 19 30 Nm**



20 Oil filter

- ♦ Observe change intervals

=> Maintenance manual

- ♦ Loosen with oil filter wrench 3417
- ♦ Observe installation instructions on oil filter
- ♦ Tighten to 20 Nm

21 Oil cooler

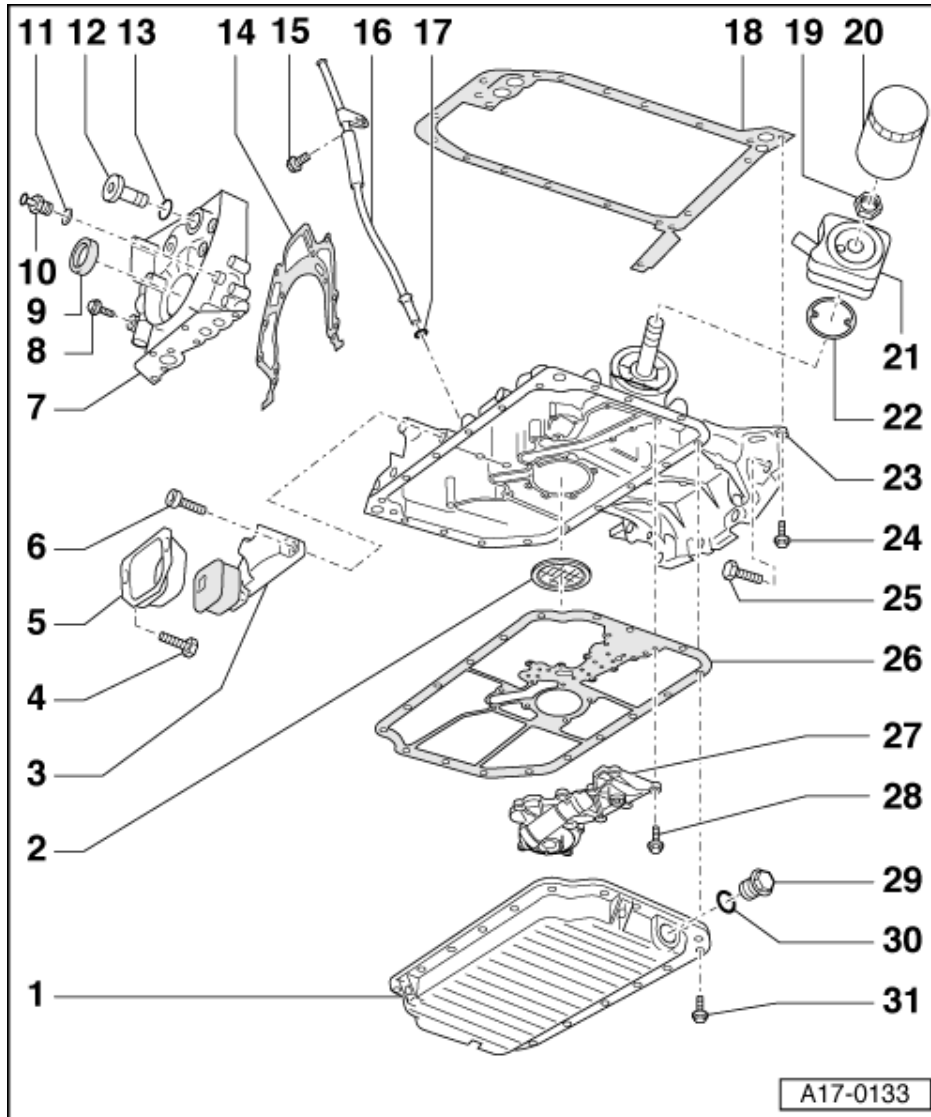
- ♦ See note
=> Page 116

22 Gasket

- ♦ Renew
- ♦ Engage in projections on oil cooler

23 Sump (upper section)

- ♦ Removing and installing
=> Page 129



24 10 Nm

- ♦ Tighten in stages and in diagonal sequence
- ♦ Install 2 bolts with locking fluid
D 000 600 A2=>Page 135

25 M8 - 25 Nm
M10 - 45 Nm

26 Gasket

- ♦ Renew

27 Sealing cap

28 10 Nm

29 Oil drain plug - 40 Nm

30 Seal

- ♦ Renew

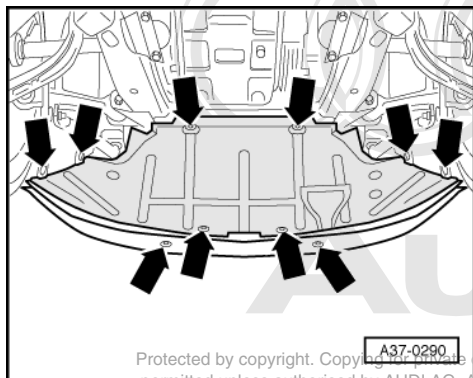
31 10 Nm

- ♦ Tighten in stages and in diagonal sequence

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

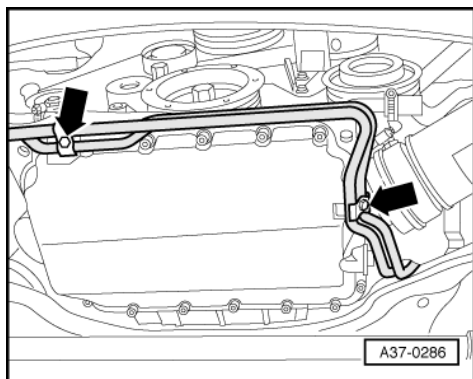
1.5 - Removing and installing lower section of sump

Removing



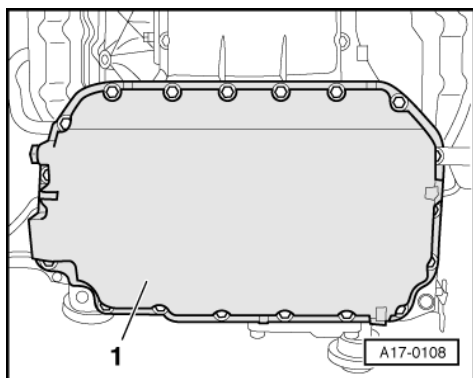
- -> Remove noise insulation -arrows-.
- Drain engine oil.

Vehicles with automatic gearbox



- -> Unbolt brackets for ATF pipes -arrows-.

All models



- -> Unbolt lower section of sump -1-.

Installing

Install in reverse sequence; note the following points:

Note:

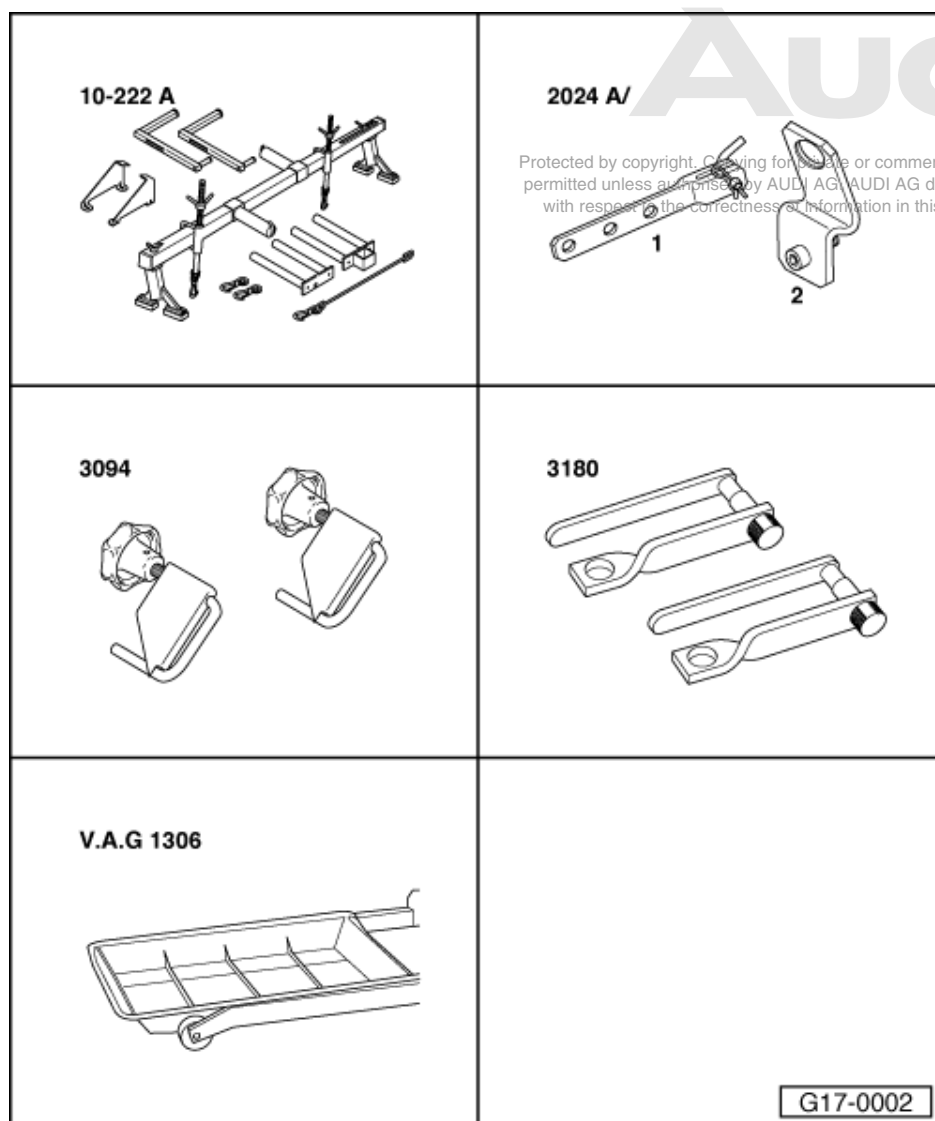
Always renew self-locking nuts, seals and gaskets.

- Clean sealing surfaces before installing lower section of sump.
- Fit lower section of sump and tighten all bolts initially to 5 Nm in diagonal sequence.
- Then tighten bolts securing lower section of sump to 10 Nm in diagonal sequence.
- Fill up with engine oil and check oil level.

Tightening torques

| Component | Nm |
|--|----|
| Lower section of sump to upper section of sump | 10 |
| Oil drain plug | 40 |

1.6 - Removing and installing upper section of sump



Special tools and workshop equipment required

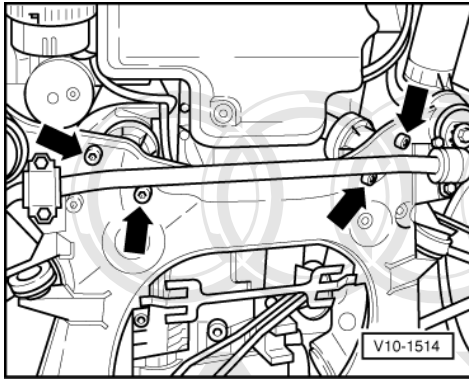
- ♦ Special tool 10-222A and 10-222A/4
- ♦ Special tool 2024 A /2



- ♦ Special tool 3094
- ♦ Special tool 3180
- ♦ V.A.G 1306
- ♦ Drip tray

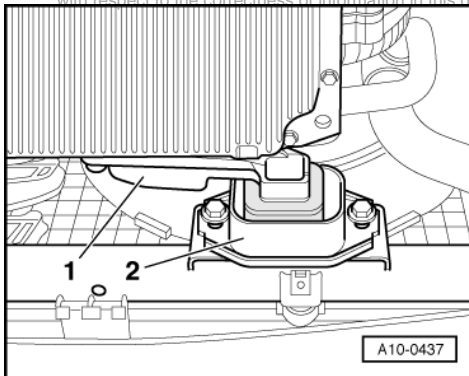
Removing

- Obtain radio code on vehicles with coded radio.

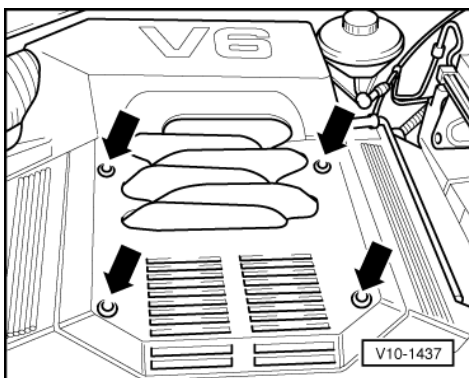


- With ignition switched off disconnect battery earth strap.
- Pull out oil dipstick.
- Remove lower section of sump => 128 .
- -> Remove lower securing bolts -arrows- at engine mountings.

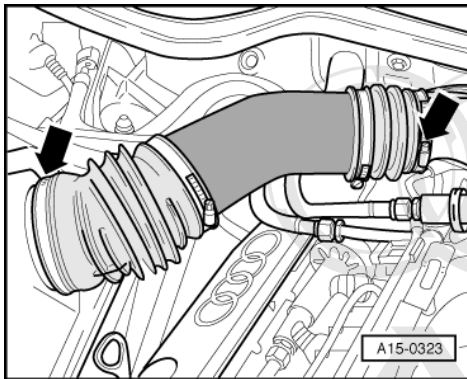
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



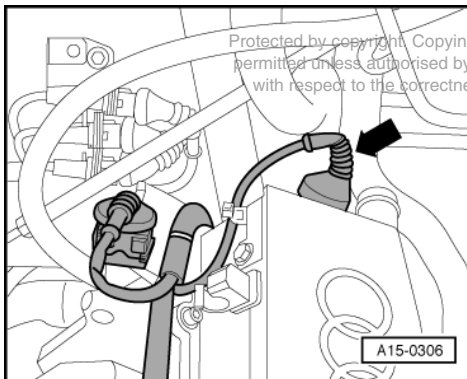
- -> Unbolt torque reaction support -1- and stop for torque reaction support -2-.



- -> Remove engine cover panel -arrows-.

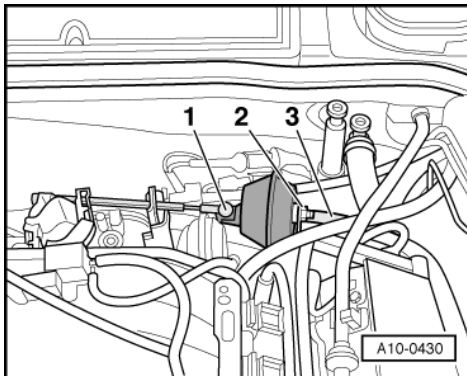


- -> Remove air hose between air mass meter and intake manifold -arrows-.



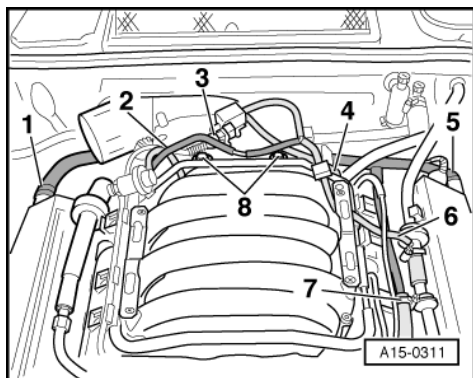
- -> Unplug connector -arrow- at Hall sender.
- Unplug spark plug connector at cylinder 5.

Vehicles with cruise control system

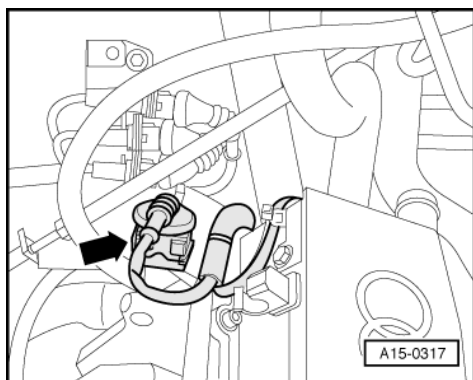


- -> Disengage actuator rod -1- at vacuum unit.
- Pull vacuum hose -3- off vacuum unit.
- Unscrew nut -2- and remove vacuum unit.

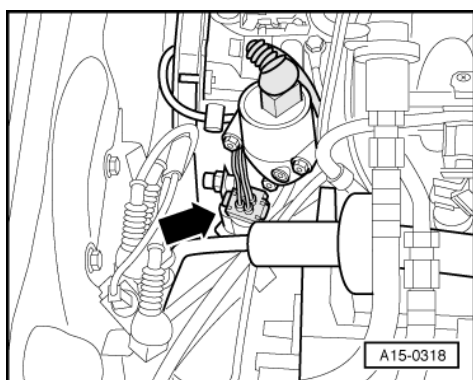
All models



- -> Detach crankcase breather hoses -1- and 5- at left and right cylinder head covers.
- Unplug connector -3- at intake manifold change-over valve.
- Detach vacuum hoses -2-, -4- and -6-.
- Disconnect vacuum hose -7-.
- Remove bolts -8- and remove air duct from throttle valve housing.



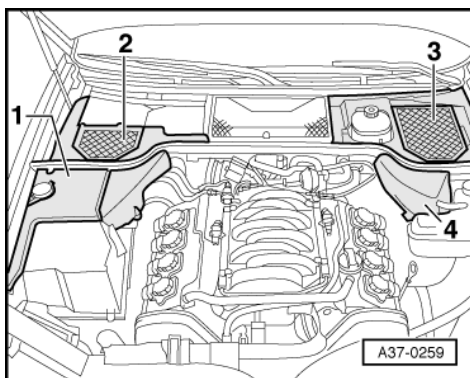
- -> Unplug connector -arrow- and take lower section of connector out of retainer.



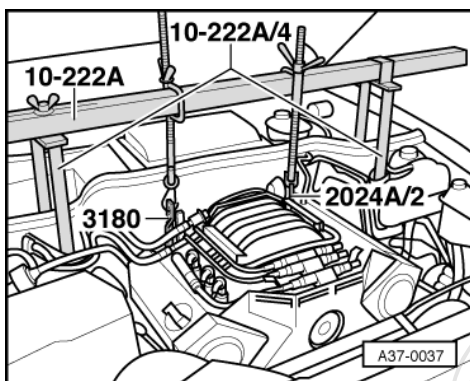
- -> Unplug connector at coolant temperature sender -G2 -arrow-.



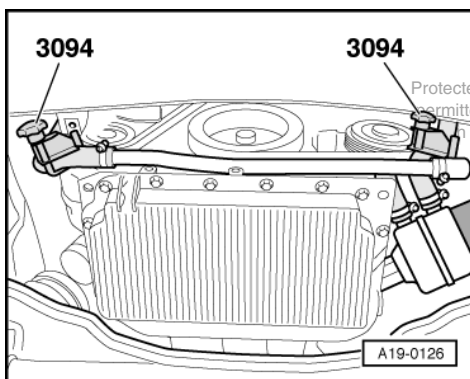
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Remove covers 1 - 4.



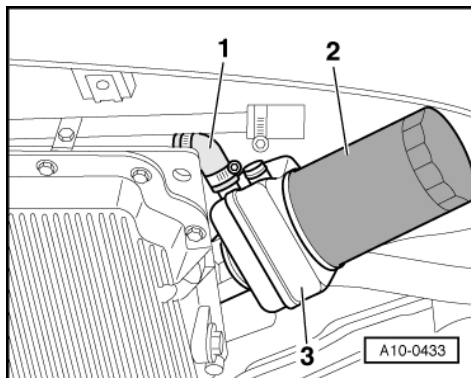
- -> Set up engine support bracket 10-222 A with adapters 10-222 A/4 and spindles.
- Place left spindle in front of support bracket, right spindle behind support bracket.
- Position engine support bracket 10-222 A onto bolts for suspension strut mountings and check stability.
- Fit attachment 3180.
 - Fit rear pin into eye and secure.
- Fit lug 2024/A2.
 - Fit bolt into eye from rear and secure.
- Tighten both spindles evenly and take up weight of engine.



Note:

Do not lift engine too far, as otherwise wiring or coolant hoses could be damaged or stretched.

- -> Clamp off both coolant hoses going to oil cooler using hose clamps 3094.
- Place drip tray V.A.G 1306 below engine.
- Detach front hose from oil cooler.



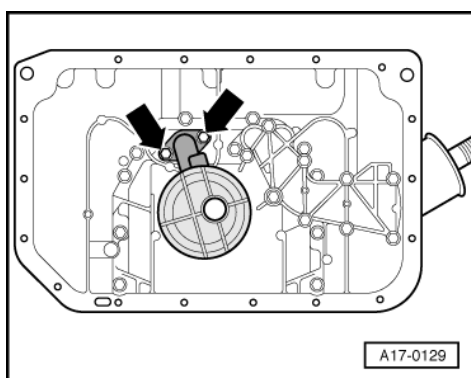
- -> Detach rear hose -1- from oil cooler -3-.

Note:

If the same upper section of sump as before is re-installed, do not remove oil filter and oil cooler.

If upper section of sump has to be renewed:

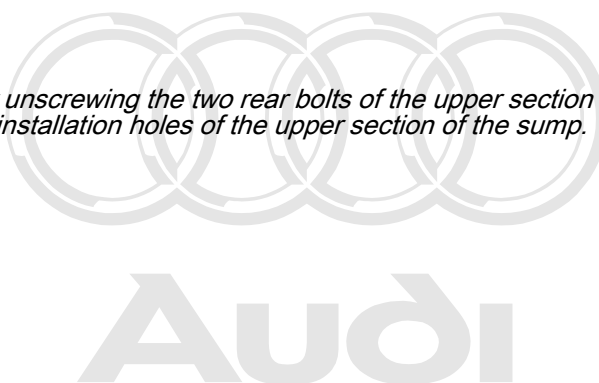
- Place drip tray beneath oil filter and cooler.
- Remove oil filter -2-.
- Remove oil cooler.
- Unscrew bolts securing engine to gearbox near upper section of sump.



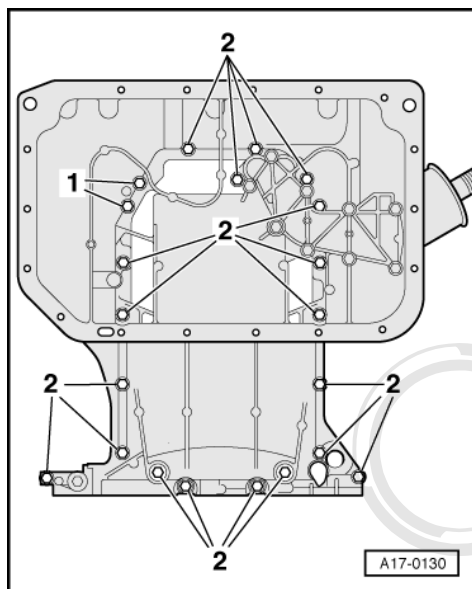
- -> On vehicles up to VIN 4D-S -000 496: unbolt oil pump intake pipe -arrows-.

Note:

In order to insert a socket spanner for unscrewing the two rear bolts of the upper section of the sump, it may be necessary to enlarge (rework) the installation holes of the upper section of the sump.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unscrew bolts -1- and -2- for upper section of sump.
- Press upper section of sump off dowel sleeves on cylinder block.
- Disconnect the electrical wires at the oil pressure switches.
- Move wiring clear.
- Take off upper section of sump.

Installing

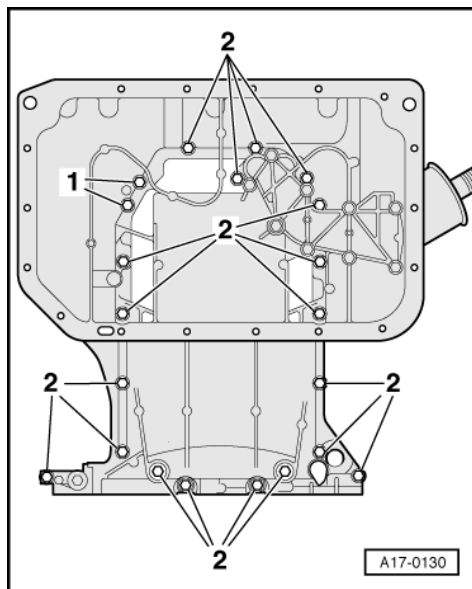
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Install in reverse sequence; note the following points:

Note:

Always renew self-locking nuts, seals and gaskets.

- Clean sealing surfaces before installing upper section of sump.



- -> Apply locking fluid D 000 006 A2 to bolts -1-, and insert.
- Fit upper section of sump and tighten bolts -1- and -2- securing upper section of sump to cylinder block initially to 5 Nm in diagonal sequence.
- Tighten bolts securing upper section of sump to gearbox.
 - Tightening torque of M8 bolts: 25 Nm
 - Tightening torque of M10 bolts: 45 Nm
- Tighten bolts securing upper section of sump to cylinder block to 10 Nm in diagonal sequence.

- Install lower section of sump => Page **128** .
- Allow stop for torque reaction support to rest on rubber buffer for torque reaction support under its own weight, and tighten bolts to 40 Nm.
- Fill up with engine oil and check oil level.
- Fill up with coolant=> Page **150** .
- After connecting battery, enter anti-theft code for radio

=> Radio operating instructions

- Close windows fully using electric window switches.
- Then operate all electric window switches again for at least one second in the "close" direction to activate the automatic one-touch function.
- Set clock to correct time.

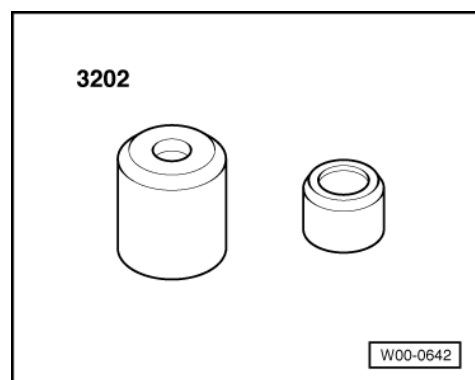
Tightening torques

| Component | Nm |
|--|----|
| Engine mount to subframe | 25 |
| Air duct to intake manifold | 22 |
| CCS-unit to bracket | 15 |
| Oil cooler to upper section of sump | 30 |
| Upper section of sump to cylinder block | 10 |
| Upper section of sump to gearboxM8 | 25 |
| M10 | 45 |
| Intake pipe to oil pump | 10 |
| Torque reaction support to upper section of sump | 42 |
| Stop plate for torque reaction support to body | 40 |

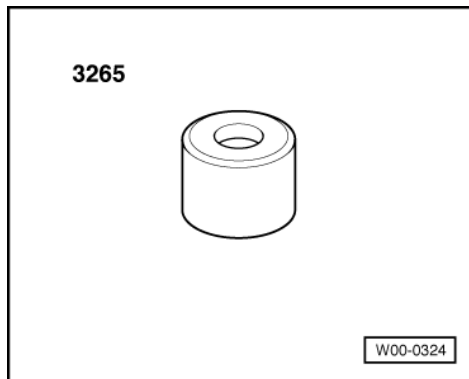
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.7 - Removing and installing oil pump

Special tools and workshop equipment required



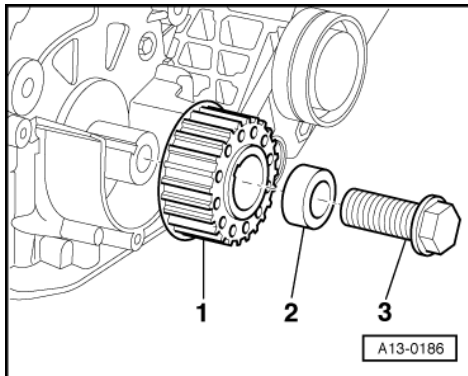
- ♦ Fitting sleeve 3202/1



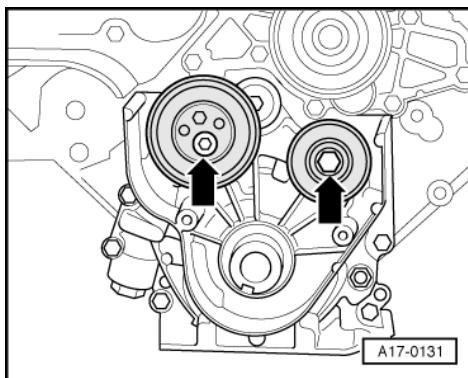
- ♦ Fitting sleeve 3265

Removing

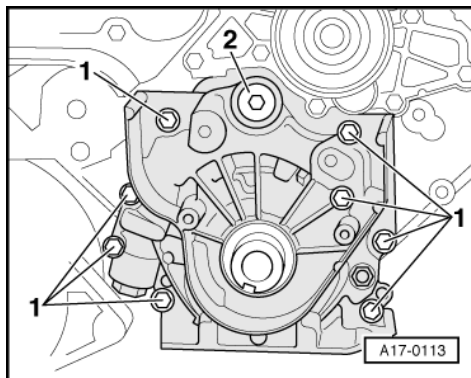
- Remove toothed belt => Page 39 .



- -> Unscrew central bolt -3- for crankshaft sprocket -1-.
- Remove spacer -2- and toothed belt sprocket.
- Remove upper section of sump => Page 129 .



- -> Unbolt idler wheel, and tensioning roller -arrows-.



- -> Unscrew bolts -1- and -2-.
- Pull off oil pump from the front.
- Drive out oil seal with oil pump removed.

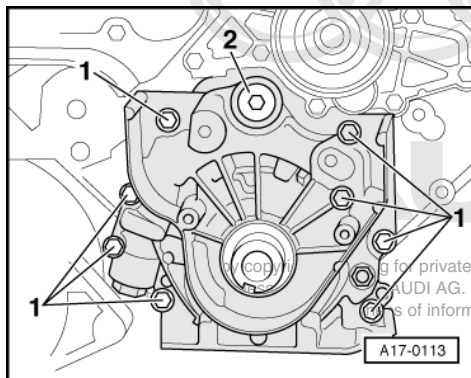
Installing

Install in reverse sequence; note the following points:

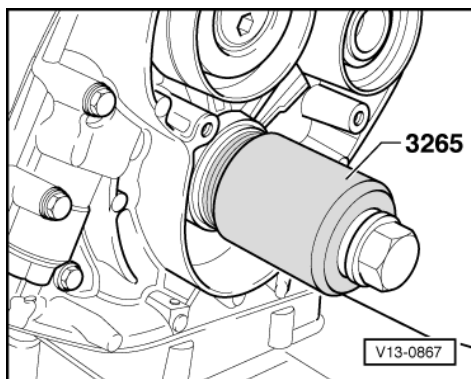
Note:

If the oil pump is to be installed with the oil seal in position, push fitting sleeve 3202/1 over end of crankshaft before installing oil pump.

- Clean sealing surfaces before installing oil pump.
- Fit oil pump so it engages in driver on crankshaft.



- -> Tighten bolts -1- to 10 Nm and bolt -2- to 30 Nm.
- Do not lubricate sealing lip or outer circumference of seal before pressing in.
- Push on seal using fitting sleeve 3202/1.

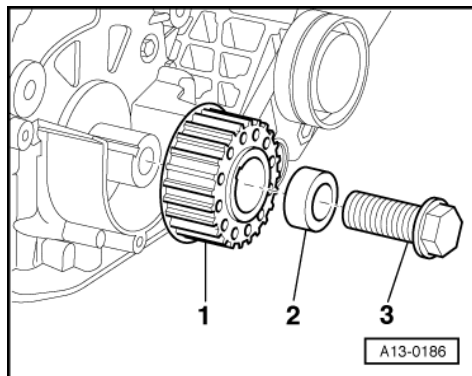


- -> Press in seal until flush using fitting sleeve 3265 and central bolt.

Note:

Fit spacer on central bolt.

- Install idler wheel.
- Installation position: recess in mounting hole (for bolt head) faces outwards.
- Note washers fitted behind tensioning roller and tensioning lever.



- -> Install crankshaft sprocket -1- with spacer sleeve -2- and new central bolt -3-.

Notes:

- ◆ Contact surface between toothed belt sprocket and crankshaft must be free of oil.
- ◆ Do not apply additional lubricant to bolt for crankshaft sprocket.
- Install toothed belt => Page 42 .
- Install upper section of sump => Page 135 .
- Install lower section of sump => Page 128 .

Tightening torques

| Component | | Nm |
|--|-----|-----------------|
| Oil pump to cylinder block | M6 | 10 |
| | M20 | 30 |
| Toothed belt sprocket to crankshaft | | 200 + 180°1) 2) |
| Toothed belt tensioning roller to oil pump | | 22 |
| Idler wheel to oil pump | | 43 |

- 1) Renew bolt

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- 2) 180° = 1/2 turn

1.8 - Renewing oil retention valves

Note:

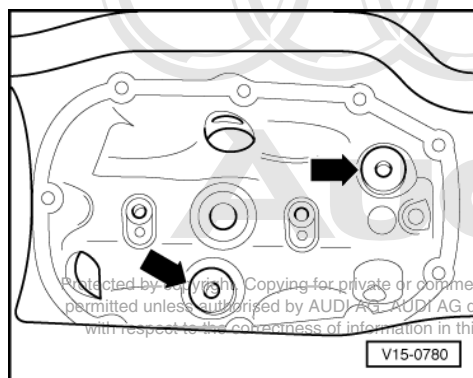
If there are irregular valve noises which stop after the car is driven for a long time, but recur repeatedly during short trips, replace the oil retention valves.

Removing

- Remove intake manifold => Page 77 .



- Unbolt cover below intake manifold.



- -> Remove oil retention valves -arrows-.

Installing

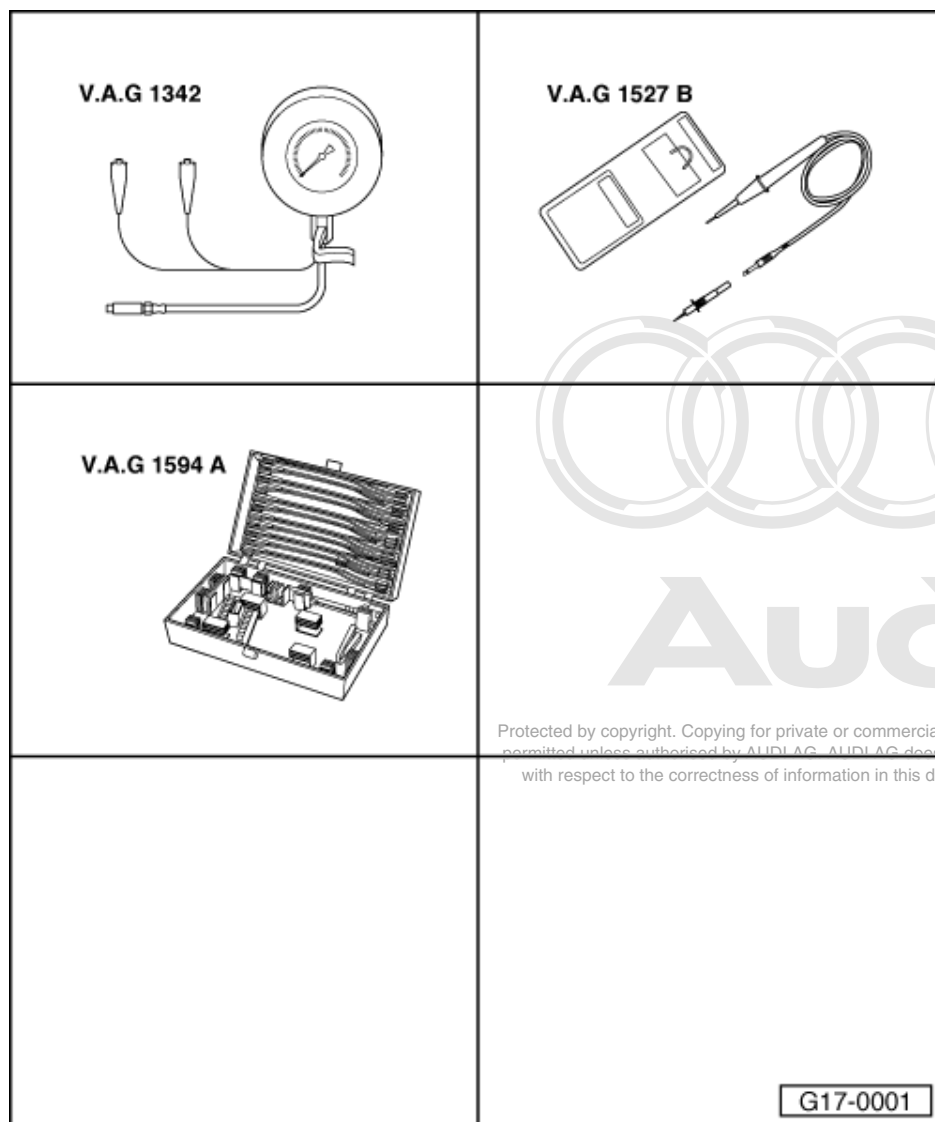
Install in reverse sequence; note the following points:

- ♦ Replace O-rings.

Tightening torque

| Component | Nm |
|---------------------------------------|----|
| Oil retention valve to cylinder block | 25 |
| Cover to cylinder block | 10 |

1.9 - Testing oil pressure and oil pressure switch



Special tools and workshop equipment required

- ◆ V.A.G 1342
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A

Requirements for test:

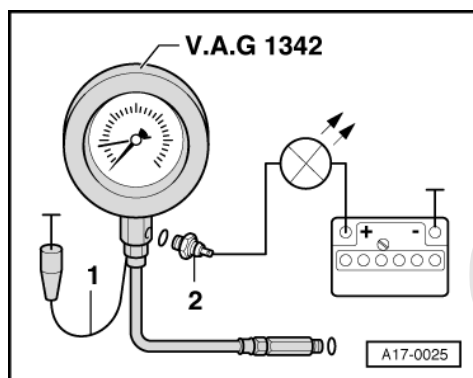
- Oil level ok.
- Oil pressure warning lamp -K3 must come on when ignition is switched on.
- In vehicles with auto-check system the "OK" display must appear (call up symbol).
- Engine oil temperature approx. 80 °C

Testing warning lamp

The oil pressure warning lamp lights up when the ignition is switched on ("terminal 15 on") with the engine not running (this does not apply to vehicles with auto-check system).



Testing oil pressure switch 0.3 bar (brown) or 0.25 bar (blue)



- Disconnect wire from oil pressure switch.
- ➔ Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire -1- of tester to earth (-).
- Connect voltage tester V.A.G 1527 B to oil pressure switch and positive side of battery (+) using test leads from V.A.G 1594 A.
 - The LED should light up.
- If the LED does not light up, **renew oil pressure switch**.
- Start engine

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions of information in this document. Copyright by AUDI AG.

Note:

The switching point of the oil pressure switch can be reached when the engine is cranked on the starter motor, so watch the tester and the test lamp while starting the engine.

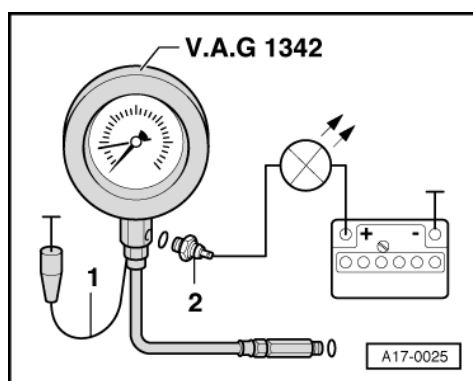
- Test lamp should go out at 0.15 to 0.45 bar.
- If test lamp fails to go out, renew oil pressure switch.

Note:

Blue oil pressure switch (0.25 bar) is supplied to replace brown oil pressure switch (0.3 bar).

Testing oil pressure switch 2.5 bar (red)

- Disconnect wire from oil pressure switch.

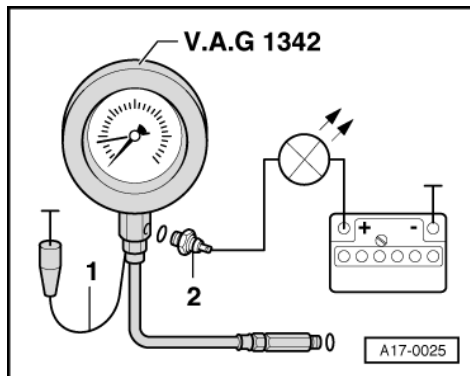


- ➔ Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Connect brown wire -1- of tester to earth (-).
- Connect voltage tester V.A.G 1527 to oil pressure switch and positive side of battery (+) using test leads from V.A.G 1594.
 - Test lamp should not light up
- If test lamp lights up, renew oil pressure switch.
- Start engine
 - Test lamp should light up at 2.3...2.7 bar.

- If test lamp does not light up, renew oil pressure switch.

Testing oil pressure

- Disconnect wire from oil pressure switch.



- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw oil pressure switch -2- into V.A.G 1342.
- Start engine (engine oil temperature at least 80°C).
 - Oil pressure at idling speed: 1.0 ... 2.5 bar
 - Oil pressure at 3000 rpm: 3.0 ... 5.0 bar

If the specifications are not obtained:

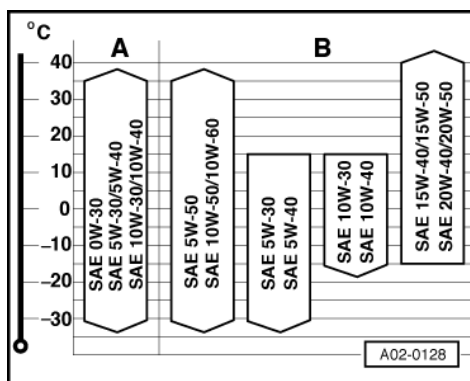
- Pressure relief valve or oil pump defective; renew oil pump => Page **136**.

Note:

If no oil pressure is obtained, check camshaft bearings at No. 1 cylinder and crankshaft bearing No. 4 with both thrust washers for damage on the bearing surface. If no fault is found, replace oil pump.

1.10 - Engine oil

Viscosity grades and oil specifications



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Select the viscosity grade of the oil according to the chart. The oil does not need changing for brief variations of temperature outside the temperature ranges shown.

The specifications listed here must appear on the container - either singly or together with other specifications.

- A - High-lubricity multigrade oils, specification VW 500 00 1) or High-lubricity multigrade oils, specification VW 502 00 2)
- B - Multigrade oils, specification VW 501 011)



- Multigrade oils, specification API-SF3) or API-SG3)

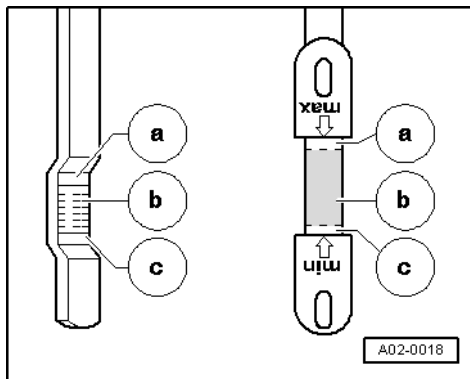
- 1) The date given after the VW specification must be not earlier than 10.91.
- 2) This type of oil is particularly suitable for turbocharged petrol engines.
- 3) Only use these types of oil if the VW-specified grades are not available.

Different types of oil may be mixed if necessary when topping up.

1.11 - Checking oil level

Requirements for test:

- Engine oil temperature at least 60 °C
- Vehicle must be level (horizontal)
- After switching off the engine, wait a few minutes to allow the oil to flow back into the sump.
- Pull out the dipstick, wipe off with a clean cloth and insert it again as far as it will go.
- Pull out the dipstick again and read off the oil level.



-> Markings on oil dipstick:

- a - Do not top up oil.
- b - Oil can be topped up. The oil level may rise as far as area -a- after topping up.
- c - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.

Note:

The oil level must not be above marking -a- on the dipstick.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

19 - Cooling system

1 - Removing and installing parts of cooling system

1.1 - Removing and installing parts of cooling system

Warning!
Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

Notes:

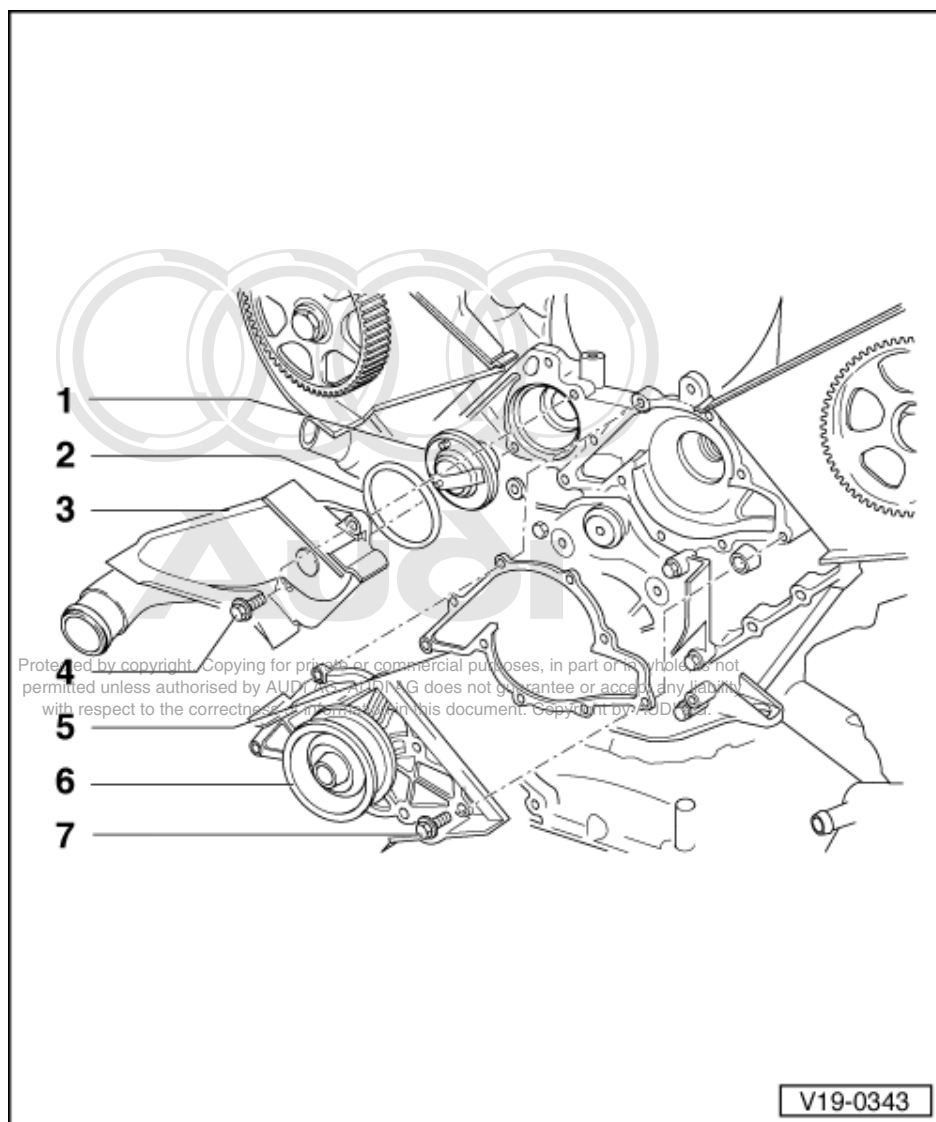
- ◆ When the engine is warm the cooling system is under pressure. If necessary release pressure before commencing repair work.
- ◆ Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

- ◆ V.A.G 1921 hose clip pliers are recommended when installing spring-type clips.
- ◆ Renew all gaskets and seals.
- ◆ The arrow markings on the coolant pipes and on the ends of the hoses must be aligned with each other.
- ◆ Removing and installing viscous fan => Page **29**.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.2 - Coolant pump and coolant thermostat



1 Coolant thermostat

- ♦ Removing and installing
=> Page **153**
- ♦ Checking =>Page **155**
- ♦ Installation position
=> Fig. **1**

2 Seal

- ♦ Renew

3 Coolant thermostat housing

4 10 Nm

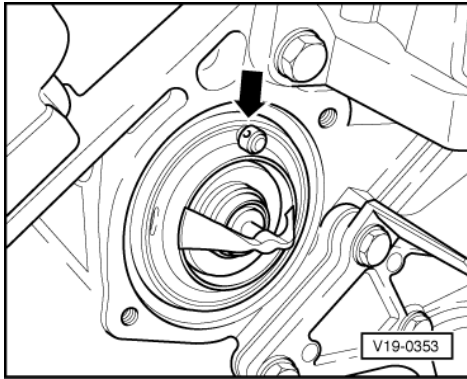
5 Gasket

- ♦ Renew

6 Coolant pump

- ♦ Removing and installing
=> Page **152**
- ♦ Check for ease of movement



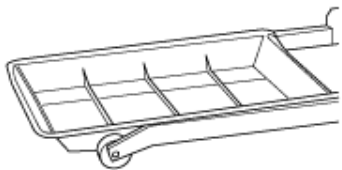
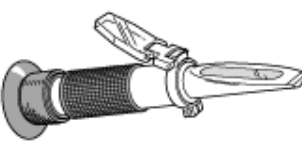
7 10 Nm



-> Fig.1 Installation position of thermostat

- ◆ Vent valve -arrow- faces upwards
- ◆ Seal on housing side

1.3 - Draining and filling cooling system

| | |
|--|--|
| <p>V.A.G 1274</p>  | <p>V.A.G 1274/10</p>  |
| <p>V.A.G 1306</p>  | <p>T10007</p>  |
| | <p>G19-0003</p> |



Special tools and workshop equipment required

- ♦ V.A.G 1274/1
- ♦ V.A.G 1274/10
- ♦ V.A.G 1306
- ♦ Special tool T10007

Draining

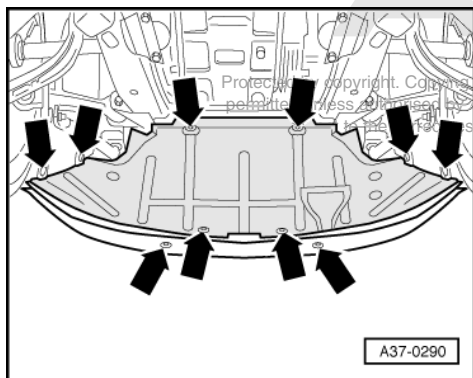
Notes:

- ♦ Catch drained-off coolant in a clean container for re-use or disposal.
- ♦ Only use clean drinking water for mixing coolant.

Warning!

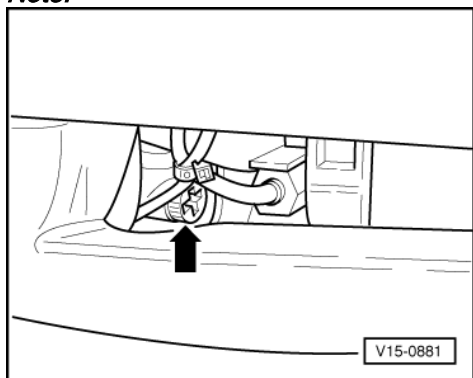
Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

- Open cap on coolant expansion tank.

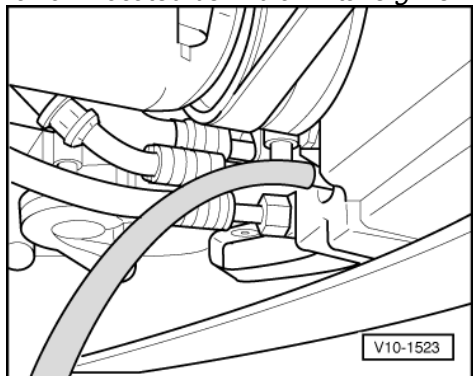


- -> Remove noise insulation -arrows-.
- Place drip tray V.A.G 1306 below engine.

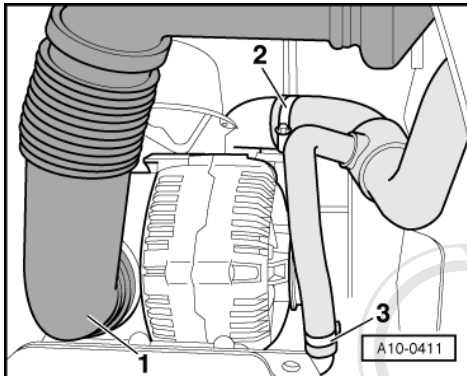
Note:



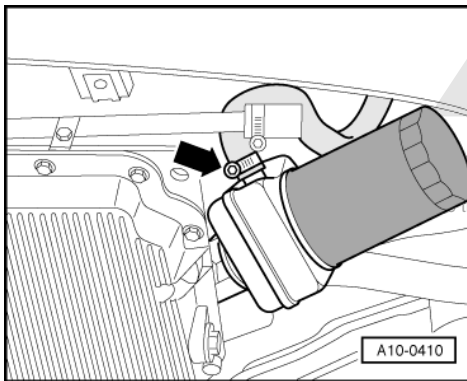
-> If only a small amount of coolant has to be drained, coolant can also be drained from radiator via drain plug -arrow- located behind air intake grille in bumper.



- Attach drain hose to coolant drain tap of radiator.



- -> Detach hose -3- and drain coolant.
- Then detach hose -2- and hold hose end down to drain coolant from radiator.



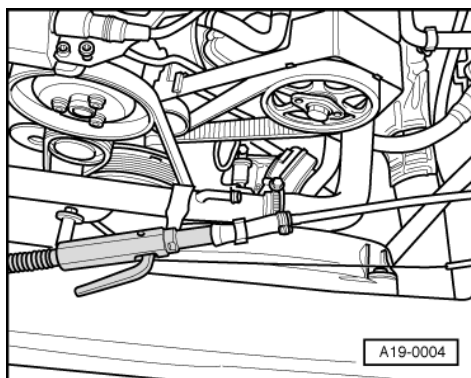
- -> In addition, detach coolant hose from bottom of oil cooler -arrow- and drain off remaining coolant.



- -> Also unscrew coolant drain plug on engine -arrow-.

Note:

Replace O-ring.



- -> To drain coolant expansion tank completely, close filler cap and blow out remaining coolant with compressed air.

Filling

Notes:

- ♦ The cooling system is filled all year round with a mixture of water and coolant additive (combined anti-freeze and corrosion protection agent).
- ♦ Coolant additive G 011 A8 C (green) is used in vehicles up to 06.96.
- ♦ Only coolant additive G 012 A8 D (red) is used in vehicles from 07.96 onwards.

Caution
The two different coolant additives G

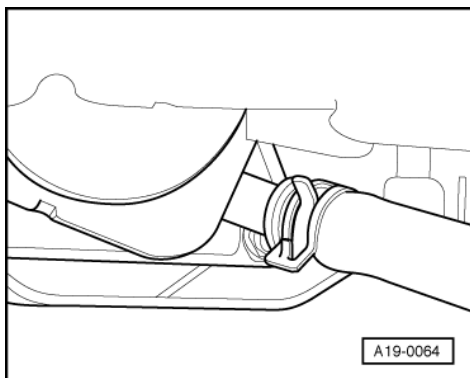
- ♦ If the fluid in the expansion tank is brown, this means G 012 A8 D has been mixed with another type of coolant. In this case, flush out the cooling system and put in fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove very nearly all of the old coolant.
- ♦ G 011 A8 C and G 012 A8 D (and coolant additives marked "meeting specification TL VW 774 C" or "meeting specification TL VW 774 D") prevent frost and corrosion damage, stop scaling and at the same time raise the boiling point of the coolant. For these reasons the cooling system must be filled all year round with the correct anti-freeze and anti-corrosion additive.
- ♦ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ♦ Protection against frost must be assured to about -25 °C (in countries with arctic climate down to about -35 °C).
- ♦ The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40 %.
- ♦ If greater frost protection is required in very cold climates, the amount of G 012 A8 D can be increased, but only up to 60 % (this gives frost protection to about -40 °C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- ♦ If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.
- ♦ Special tool T10007 must be used for testing the anti-freeze concentration if the cooling system contains coolant additive G012 A8 D.

Recommended mixture ratios:

| Frost protection to | Anti-freeze concentration | Quantity of G11/G12 1) | Quantity of water1) |
|---------------------|---------------------------|------------------------|---------------------|
| -25 °C | 40 % | 3.5 ltr | 5.5 ltr |
| -35 °C | 50 % | 4.5 ltr | 4.5 ltr |

1) Cooling system capacity: 9.0 litres (may vary according to equipment fitted to vehicle)

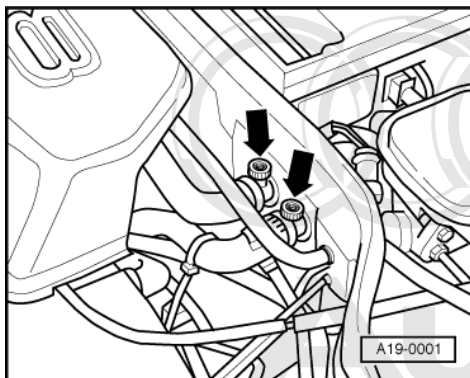
- Replace seal and install drain plug on engine (20 Nm)
- Install coolant hoses and secure.



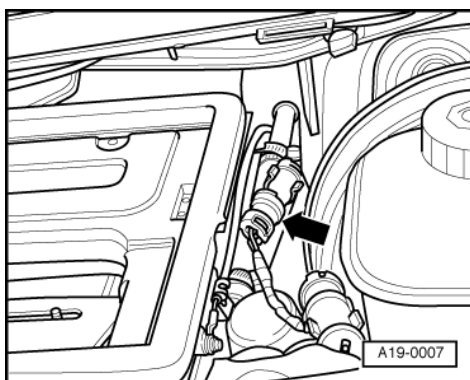
- -> Screw adapter V.A.G 1274/1 onto coolant expansion tank.
- Fit special tool V.A.G 1274/10 onto adapter.

Note:

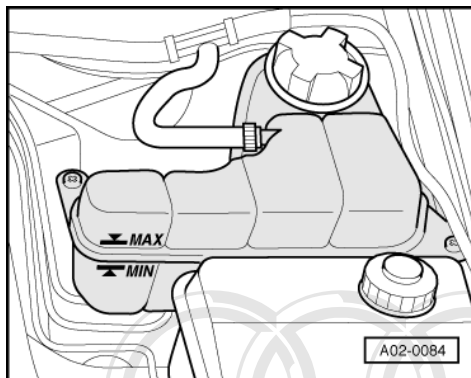
To fill expansion tank without special tools, detach expansion tank and raise it about 100 mm.



- -> Open bleeder screws -arrows- on heater supply and return pipes.
- Top up coolant until it comes out at bleeder screws.
- Close bleeder screws.
- Fit expansion tank cap.



- -> Unplug 2-pin connector -arrow- for pump valve unit.
- Set heater/air conditioner to "LO" on both sides.
- Start engine and maintain an engine speed of about 2000 rpm for approx. 3 minutes.



- -> Check coolant level and top-up if necessary. When the engine is at normal operating temperature, the coolant level must be on the max. mark; when the engine is cold, between the min. and max. marks.

Warning!

Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.

- Stop engine.

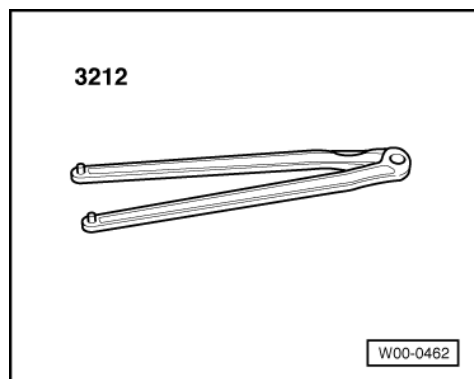
Tightening torque

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. All rights reserved. Copyright © 1998 by AUDI AG.

| Component | Nm |
|------------------------------|----|
| Drain plug to cylinder block | 20 |

1.4 - Removing and installing coolant pump

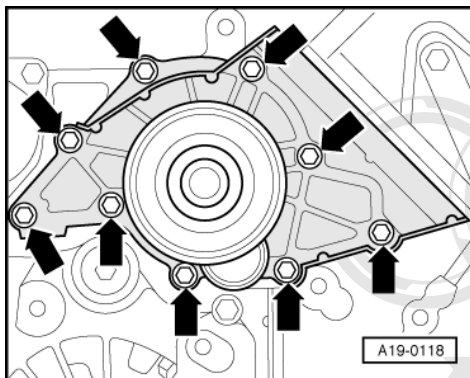
Special tools and workshop equipment required



- ♦ Special tool 3212

Removing

- Drain cooling system=> Page 148 .
- Remove ribbed belt => Page 30 .
- Hold hydraulic pump pulley with pin wrench 3212 and unscrew pulley.
- Take toothed belt off camshaft sprockets=>Page 39 .



- -> Unscrew bolts -arrows- securing coolant pump and remove coolant pump.

Installing

Install in reverse sequence; note the following points:

Note:

Always renew seals and gaskets.

- Install toothed belt (adjust valve timing)
=> Page 42 .

Note:

Follow all instructions for removing and installing toothed belt =>Page 39 .

- Fill up with coolant=> Page 150 .

Tightening torques

| Component | Nm |
|--------------------------------|----|
| Coolant pump to cylinder block | 10 |
| Belt pulley to hydraulic pump | 25 |

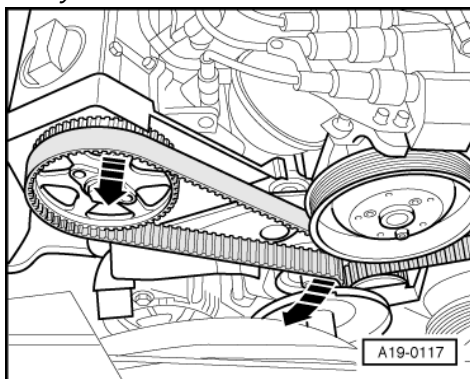
1.5 - Removing and installing, checking coolant thermostat

Removing

- Drain cooling system=> Page 148
- Remove ribbed belt => Page 30 .
- Remove ribbed belt tensioning element.
- Remove toothed belt guard on left and right.
- Mark direction of rotation of toothed belt. The belt can break if it rotates in the opposite direction when refitted.
- Exert pressure on the toothed belt near the right-hand camshaft sprocket and at the same time rotate the crankshaft slightly back and forth by turning the central bolt on the crankshaft sprocket.

Note:

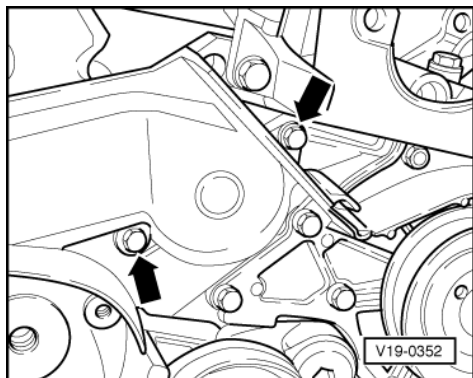
This will slacken the toothed belt slightly on the right-hand side so it can be moved towards the front more easily.



- -> Pull toothed belt forwards slightly on tensioning roller and on right-hand camshaft sprocket -arrows-, but do not take off the belt completely.

Caution

If the toothed belt has slipped off the tensioning roller, the valve timing will have to be adjusted => Installing toothed belt (Adjusting valve timing), Page **39**.



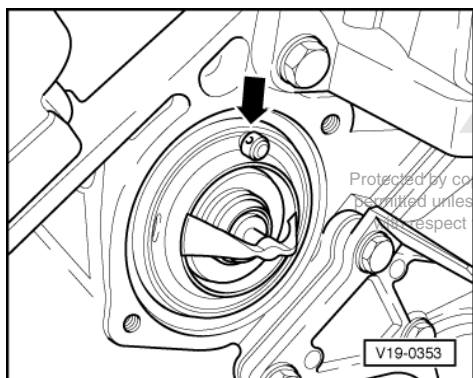
- -> Detach thermostat housing -arrows-.

Note:

Illustration shows thermostat housing with toothed belt removed.

- Remove O-ring and thermostat.

Installing



- Install thermostat.
 - Installation position:
Vent valve -arrow- faces upwards
Seal on housing side
- Install thermostat housing.

Caution

If the toothed belt has slipped off the tensioning roller, the valve timing will have to be adjusted => Installing toothed belt (Adjusting valve timing), Page **39**.

- Push toothed belt towards the rear.
- Install ribbed belt =>Page **31**.
- Fill up with coolant=> Page **150**.

Tightening torque

| Component | Nm |
|-----------|----|
|-----------|----|

| | |
|--------------------------------------|----|
| Thermostat housing to cylinder block | 10 |
|--------------------------------------|----|

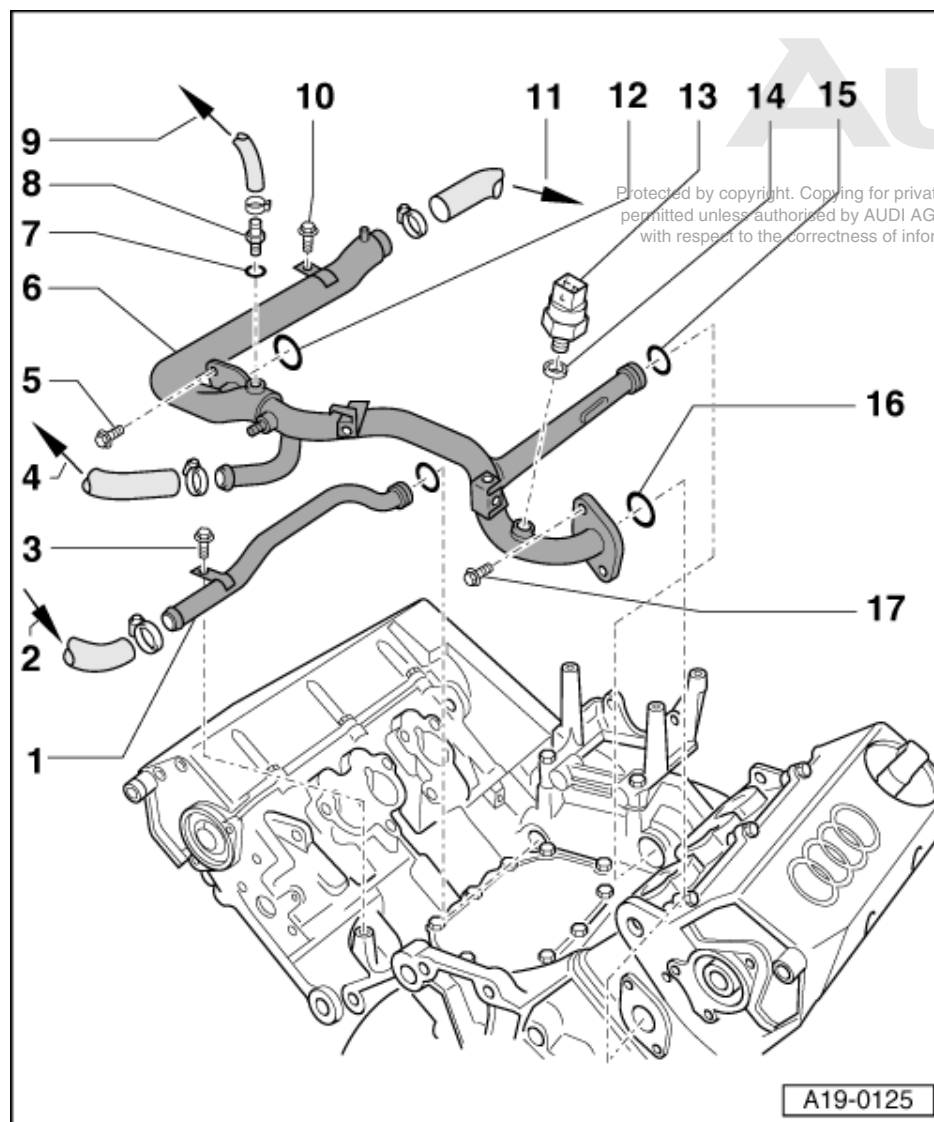
Testing coolant thermostat

- Heat thermostat in water bath.

| Starts to open | Fully open | Opening travel |
|----------------|------------------|----------------|
| approx. 87°C | approx. 102°C 1) | at least 8 mm |

- 1) cannot be tested

1.6 - Coolant pipes - overview



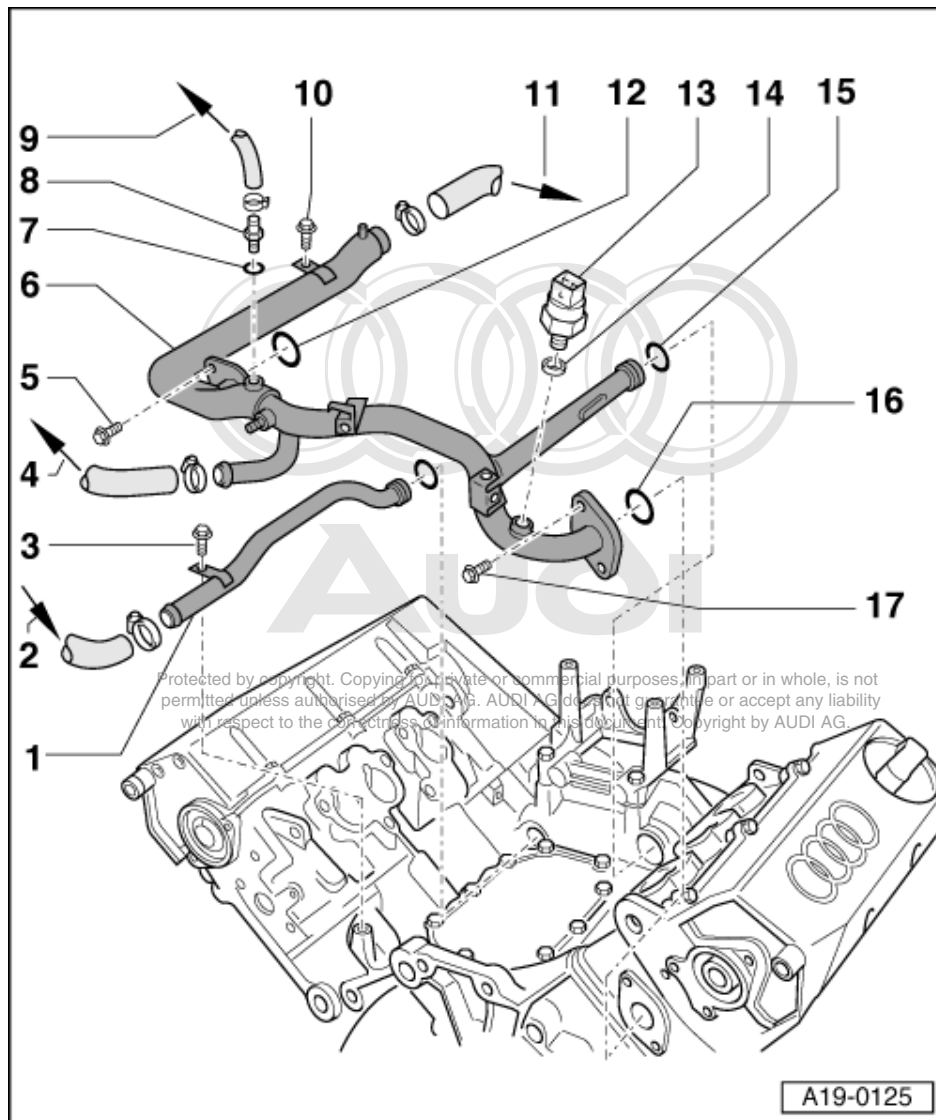
- 1 Small coolant pipe
 - ♦ Removing and installing
=> Page 157
- 2 From heat exchanger
- 3 10 Nm
- 4 To heat exchanger
- 5 10 Nm
- 6 Large coolant pipe

- ♦ Removing and installing
 => Page **157**

7 Seal

- ♦ Renew

8 Screw connection - 15 Nm



9 To expansion tank

10 10 Nm

11 To front coolant pipe

12 O ring

- ♦ Renew

13 Coolant temperature sender
 (-G2/-G62) -15 Nm

14 Seal

- ♦ Renew

15 O ring

- ♦ Renew

16 O ring

- ♦ Renew

17 10 Nm

1.7 - Removing and installing small coolant pipe

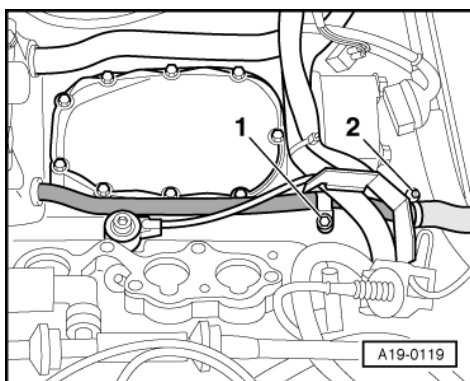
Note:

Secure all hose connections with the correct hose clips (same as original equipment)

=> Parts catalogue

Removing

- Drain cooling system=> Page 148
- Remove intake manifold => Page 77 .



- -> Detach coolant hose -2- from rear of small coolant pipe.
- Remove bolt -1-.
- Pull off small coolant pipe from the rear.
- Swivel coolant pipe and remove.

Installing

Install in reverse sequence; note the following points:

Note:

Always renew seals and O-rings.

- Before installing, clean and smooth down sealing surface for O-ring as required.
- Lubricate new O-ring with G11/G12 and slide onto coolant pipe.
- Push coolant pipe into opening in cylinder block.
- Install intake manifold => Page 80 .
- Fill up with coolant=> Page 150 .

Tightening torque

| Component | Nm |
|--------------------------------------|----|
| Small coolant pipe to cylinder block | 10 |

1.8 - Removing and installing large coolant pipe

Notes:

- ◆ Secure all hose connections with the correct hose clips (same as original equipment)

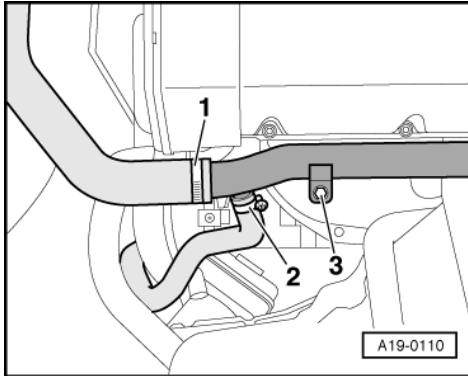


=> Parts catalogue

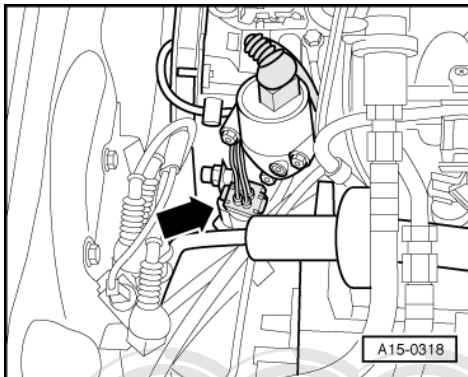
- ♦ All cable ties which are opened or cut open when removing must be replaced in the same position when installing.

Removing

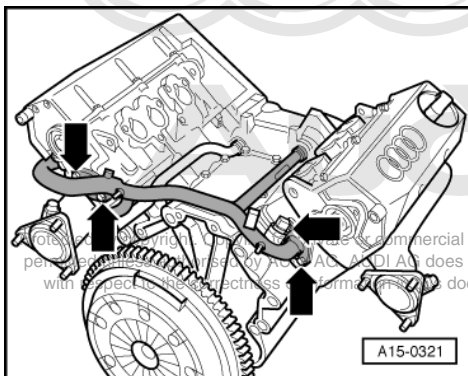
- Drain cooling system=> Page 148
- Remove intake manifold => Page 77 .



- -> Disconnect coolant hoses -1- and -2- at coolant pipe.
- Unscrew bolt -3-.
- Remove coolant hose between large coolant pipe and heat exchanger.



- Disconnect hose going to expansion tank at large coolant pipe.
- -> Unplug connector at coolant temperature sender -G2/-G62 -arrow-.
- Release cable tie at coolant pipe and move wiring clear.



- -> Unbolt coolant pipe from cylinder heads -arrows-.
- Pull coolant pipe back and out of cylinder block.

This document is not intended for commercial purposes, in part or in whole, is not permitted to be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage and retrieval system. Copyright by AUDI AG. All rights reserved. Audi AG does not guarantee or accept any liability for errors or omissions in this document. Copyright by AUDI AG.

Installing

Install in reverse sequence; note the following points:

Note:

Always renew self-locking nuts, seals and O-rings.

- Before installing, clean and smooth down sealing surfaces for O-rings as required.
- Lubricate new O-ring with G11/G12 and slide onto coolant pipe.
- Push coolant pipe into opening in cylinder block.
- Install intake manifold => Page 80 .
- Fill up with coolant=> Page 150 .

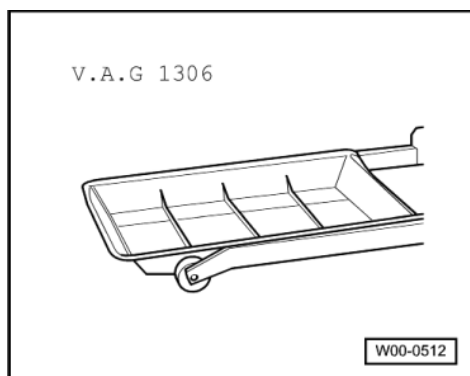
Tightening torque

| Component | Nm |
|-------------------------------|----|
| Coolant pipe to cylinder head | 10 |

1.9 - Removing and installing radiator

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Special tools and workshop equipment required



- ♦ Drip tray V.A.G 1306

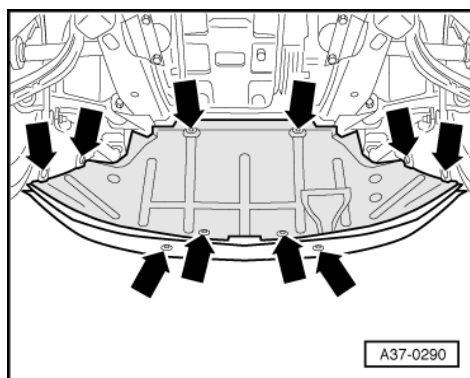
Removing

Note:

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

Warning!

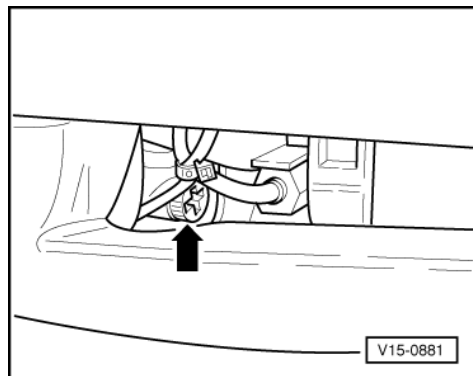
Hot steam can escape when the cap on the expansion tank is opened. Cover the cap with a cloth, and open it carefully.



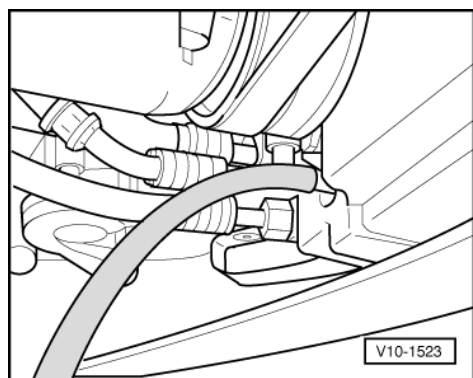
- Open cap on coolant expansion tank.
- Remove front bumper:

=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

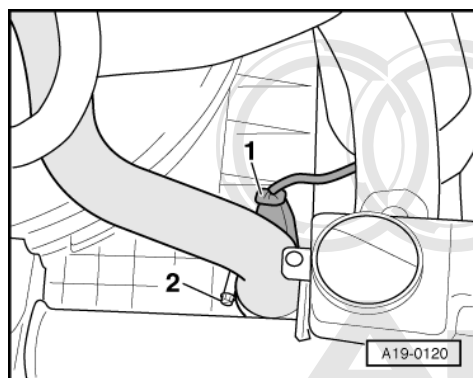
- -> Remove noise insulation -arrows-.
- Place drip tray V.A.G 1306 below engine.



- -> Turn drain screw -arrow- on radiator anti-clockwise, if necessary fit drain hose to connection.

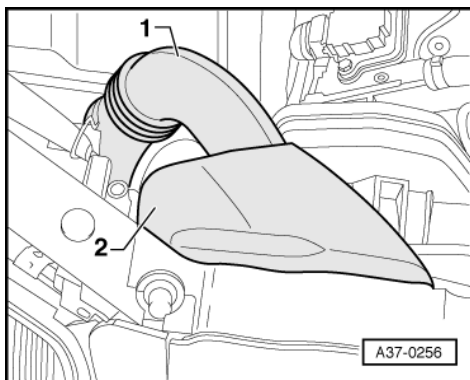


- -> Attach drain hose to drain tap on radiator.



- -> Detach hose -2- and drain coolant.
- Unplug connector -1- from radiator fan thermoswitch -F18/-F54 on radiator (bottom left) and move wiring clear.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unclip cover -2- for air duct at lock carrier.
- Remove air duct -1-.

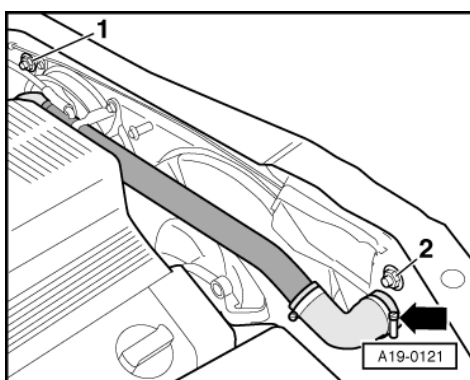
Vehicles with automatic gearbox

- Removing ATF pipes/hoses from radiator:

=> Automatic gearbox 01K, Front-wheel drive; Repair group 37; Removing and installing ATF pipes Removing and installing ATF pipes

=> Automatic gearbox 01F, Four-wheel drive; Repair group 37; Removing and installing ATF pipes Removing and installing ATF pipes

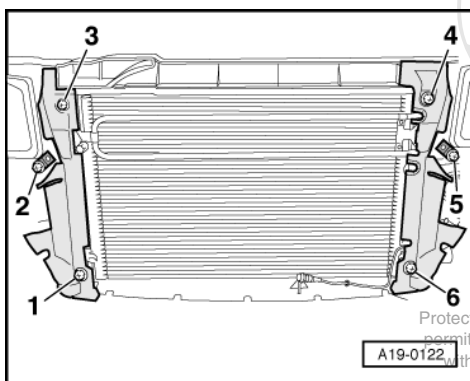
All models



- -> Disconnect coolant hose -arrow-.
- Unscrew nuts -1- and -2-.

- Remove trim mouldings below headlights:

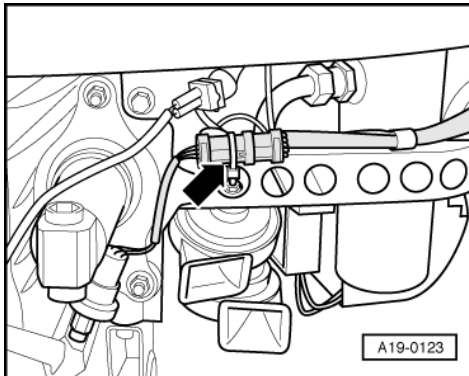
=> Electrical system; Repair group 64; Servicing headlights; Removing and installing headlights Servicing headlights Removing and installing headlights



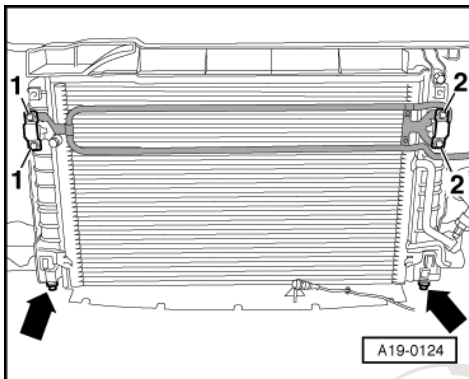
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Unscrew retainers -2- and -5- for trim mouldings from headlights.
- Unbolt air cowls from radiator: -4- and -6- (left); -1- and -3- (right).



- -> Cut open cable tie securing connector -arrow- on support bracket below left headlight.



- -> Remove condenser securing bolts -1- and -2-.
- Detach cooling pipe for power steering hydraulic fluid and move clear to one side with pipes/hoses connected.
- Unscrew nuts -arrows-.
- Pull condenser up out of its bracket, pivot towards the side and put it down safely.
- Pivot radiator towards the front and lift out.

Installing

Install in reverse sequence; note the following points:

Vehicles with automatic gearbox

- Secure ATF pipes to ATF cooler

=> Automatic gearbox 01K, Front-wheel drive; Repair group 37; Removing and installing ATF pipes Removing and installing ATF pipes

=> Automatic gearbox 01F, Four-wheel drive; Repair group 37; Removing and installing ATF pipes Removing and installing ATF pipes

- Check ATF level:

=> Automatic gearbox 01K, Front-wheel drive; Repair group 37; Checking and renewing ATF; Checking ATF level Checking and renewing ATF Checking ATF level

=> Automatic gearbox 01F, Four-wheel drive; Repair group 37; Checking and renewing ATF; Checking ATF level Checking and renewing ATF Checking ATF level

All models

- Install front bumper:

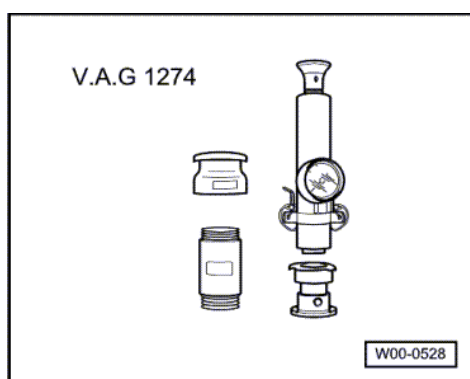
=> General body repairs, Exterior; Repair group 63; Front bumper; Removing and installing front bumper Front bumper Removing and installing front bumper

- Fill up with coolant=> Page 150 .

Tightening torques

| Component | Nm |
|--------------------------|----|
| Condenser to radiator | 10 |
| Radiator to lock carrier | 20 |

1.10 - Checking cooling system for leaks



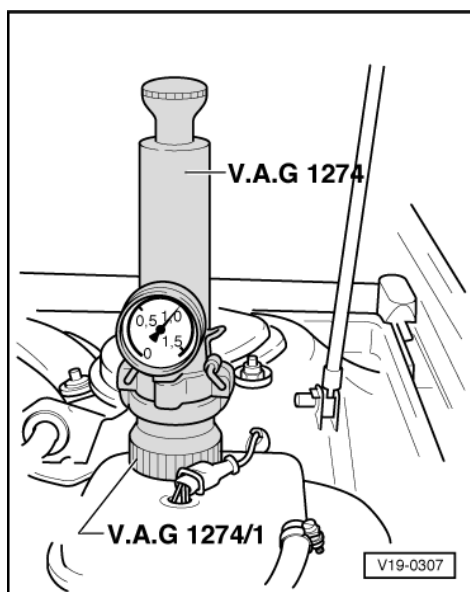
Special tools and workshop equipment required

- ♦ V.A.G 1274 with V.A.G 1274/1

Test requirement:

- Engine at operating temperature.

Test sequence



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

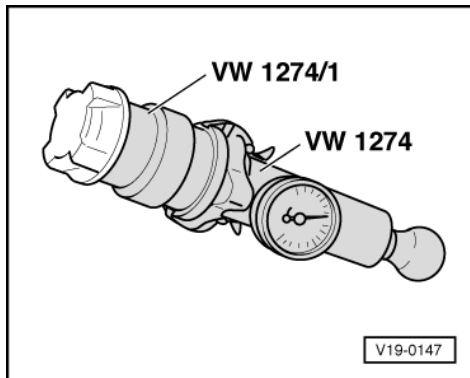


Warning!

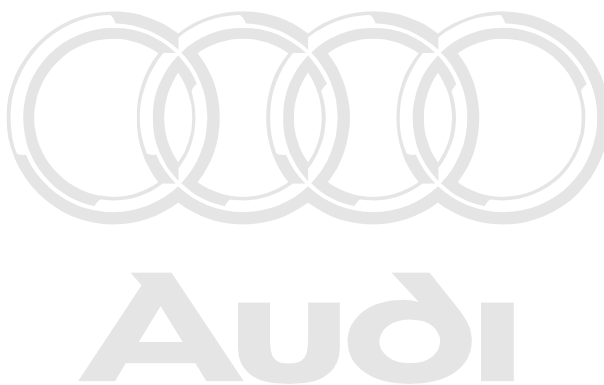
Hot steam can escape when opening cap on expansion tank: Cover cap with a cloth and open carefully.

- Open cap on coolant expansion tank.
- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/1 onto expansion tank.
- Using hand pump on tester, build up a pressure of approx. 1.0 bar.
- If pressure is not maintained, trace leak and rectify fault.

Testing pressure relief valve in filler cap.



- -> Fit tester V.A.G 1274 with adapter V.A.G 1274/1 (2 parts) onto filler cap.
- Operate hand pump.
- Pressure relief valve must open at 1.2 ... 1.5 bar.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

26 - Exhaust system

1 - Removing and installing parts of exhaust system

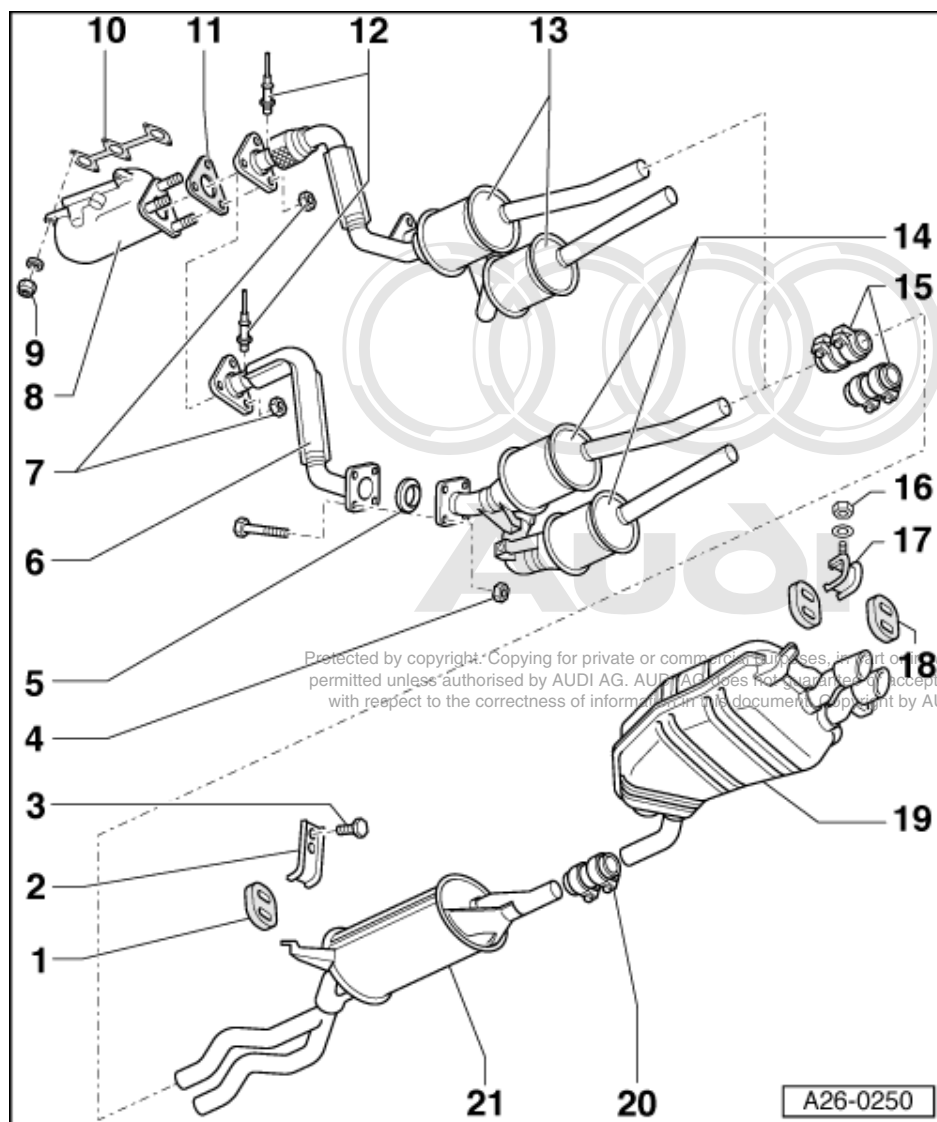
1.1 - Removing and installing parts of exhaust system

Notes:

- ◆ Always renew seals, gaskets and self-locking nuts.
- ◆ After working on the exhaust system, ensure that the system is not under stress and that it has sufficient clearance from the bodywork. If necessary, loosen clamps and align silencers and exhaust pipes so there is sufficient clearance from the bodywork at all points and the mountings are evenly loaded.
- ◆ The flexible pipe connection (de-coupling element) in the front exhaust pipe must not be bent more than 10 ° - otherwise it can be damaged.
- ◆ Removing and installing floor cross member
=>Fig.10.
- ◆ Components of exhaust mountings on vehicles with front-wheel drive and automatic gearbox up to VIN 4D S_ 000 496=>Fig. 7 .
- ◆ Components of exhaust mountings on vehicles with front-wheel drive and automatic gearbox from VIN 4D S_ 000 497 onwards=>Fig. 8 .
- ◆ Components of exhaust mountings on vehicles with four-wheel drive and manual gearbox or automatic gearbox=>Fig. 9 .



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



1 Exhaust mounting

- ♦ Checking preload
=>Aligning exhaust system free of stress Page 182

2 Mounting

3 25 Nm

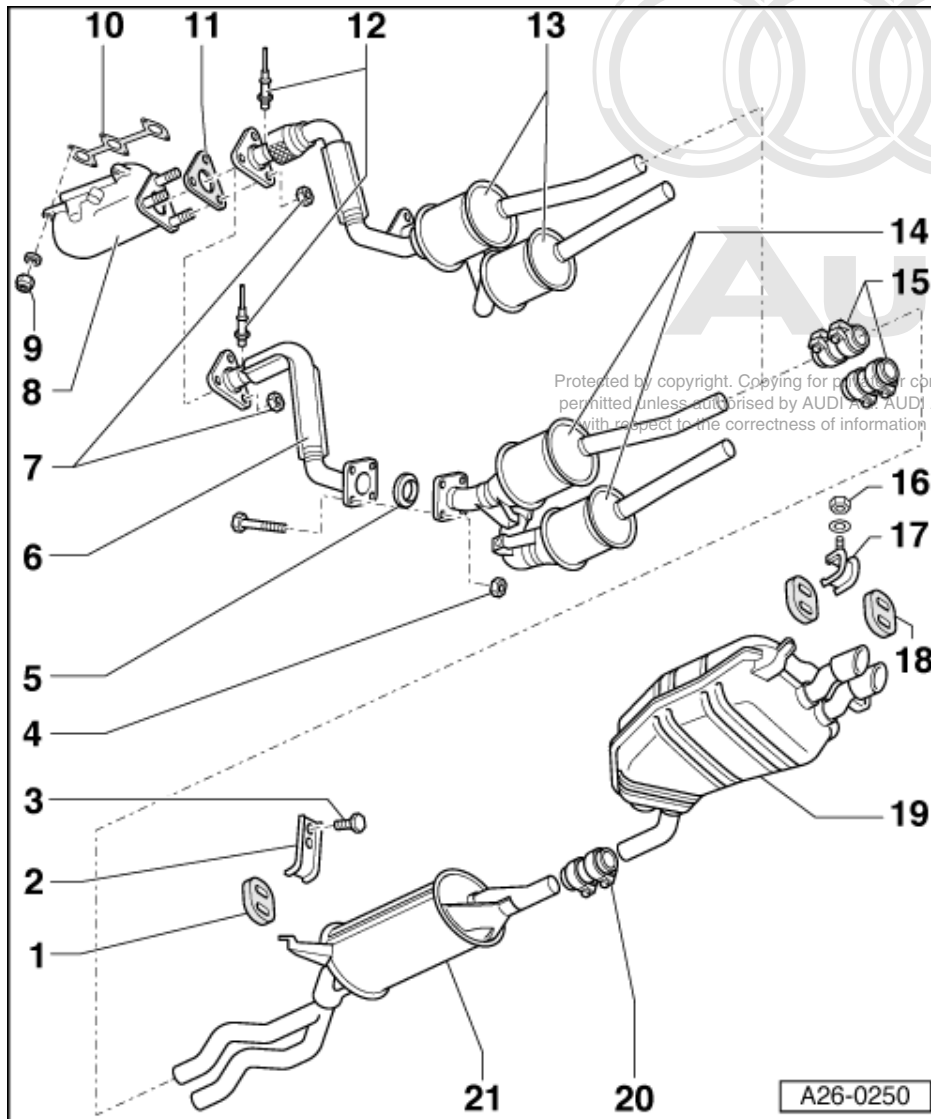
4 25 Nm

5 Seal

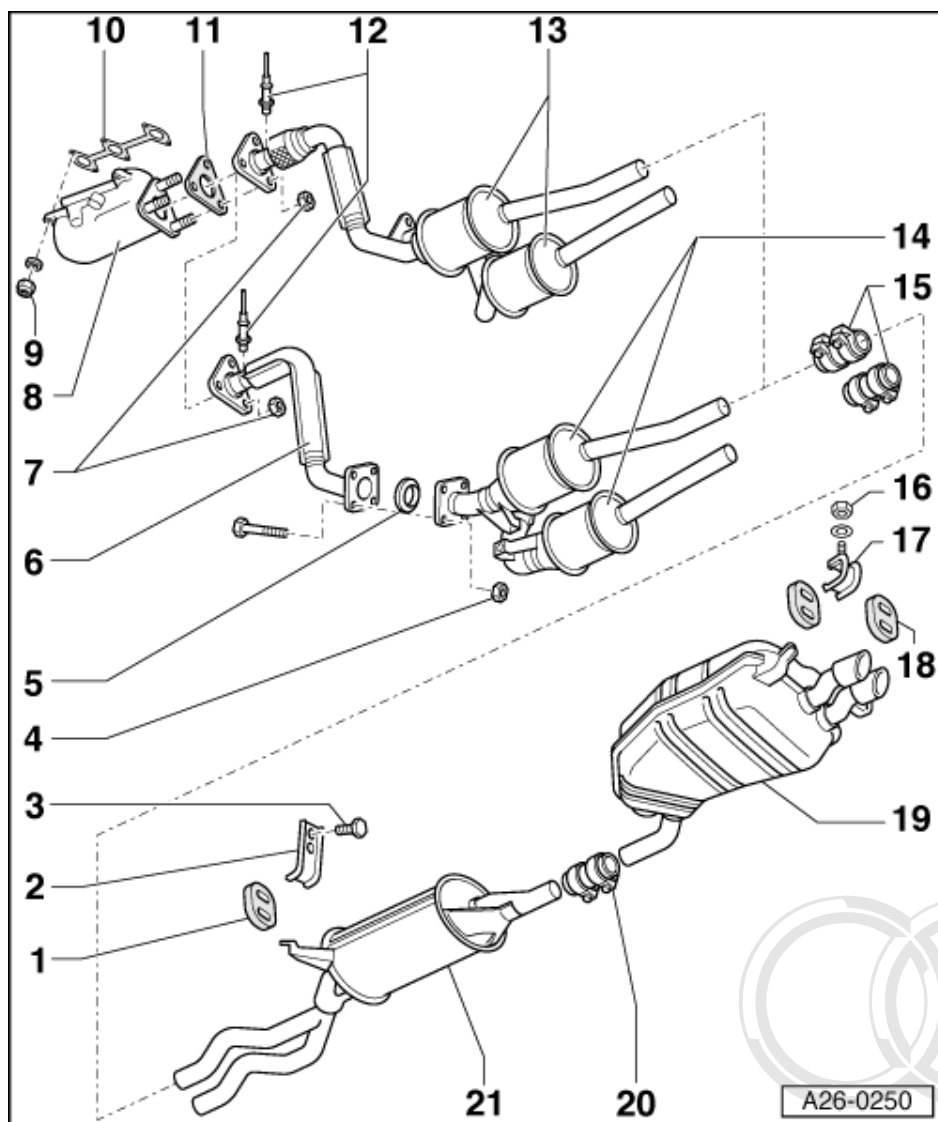
- ♦ Can be damaged by knocks; do not drop on the floor

6 Front exhaust pipe

- ♦ For vehicles with four-wheel drive
- ♦ Different versions for manual gearbox and automatic gearbox
- ♦ Removing and installing front exhaust pipe (left side) => Page 176
- ♦ Removing and installing front exhaust pipe (right side)
=>Page 178
- ♦ Aligning exhaust system free of stress => Page 182



- 7 25 Nm**
 - ◆ Renew
- 8 Exhaust manifold**
 - ◆ Removing and installing exhaust manifold (left side) => Page **180**
 - ◆ Removing and installing exhaust manifold (right side) => Page **181**
- 9 25 Nm**
 - ◆ Renew
- 10 Gasket**
 - ◆ Renew
 - ◆ Installation position: connecting web points downwards
- 11 Gasket**
 - ◆ Renew



12 Lambda probe - 55 Nm

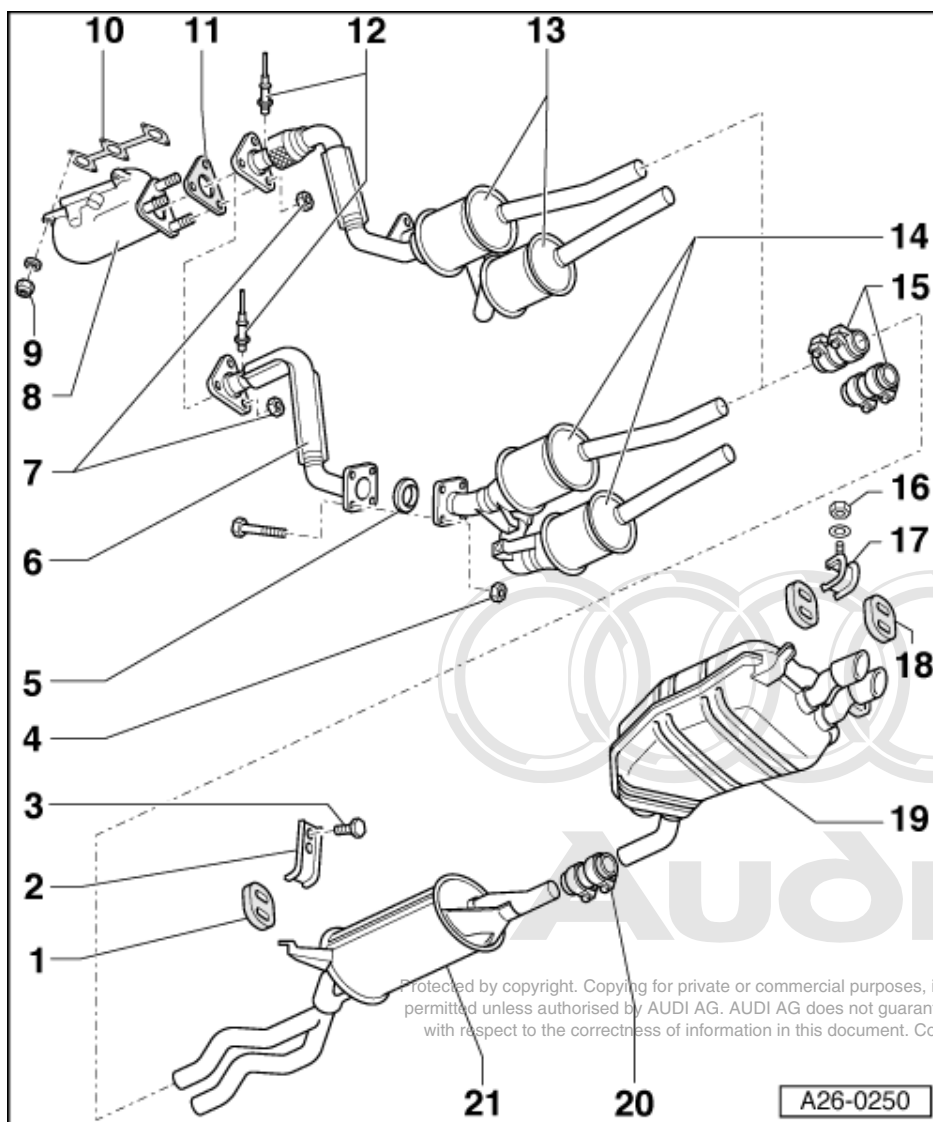
- ◆ Grease only the threads with high-temperature lubricant G 052 112 A3. The lubricant must not get into the slots on the probe body.
- ◆ Checking:

=> MPI injection and ignition system; Repair group 24: Testing lambda control; Testing lambda probe and signal wiring Testing lambda probe and signal wiring

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

13 Catalytic converter

- ◆ For vehicles with front-wheel drive
- ◆ Protect from damage by knocks and impact
- ◆ With flexible connection (de-coupling element)
- ◆ Do not bend flexible connection more than 10° - otherwise it can be damaged
- ◆ Removing and installing catalytic converter (left side) => Page 176
- ◆ Removing and installing catalytic converter (right side) => Page 178
- ◆ Aligning catalytic converters
=> Fig. 1

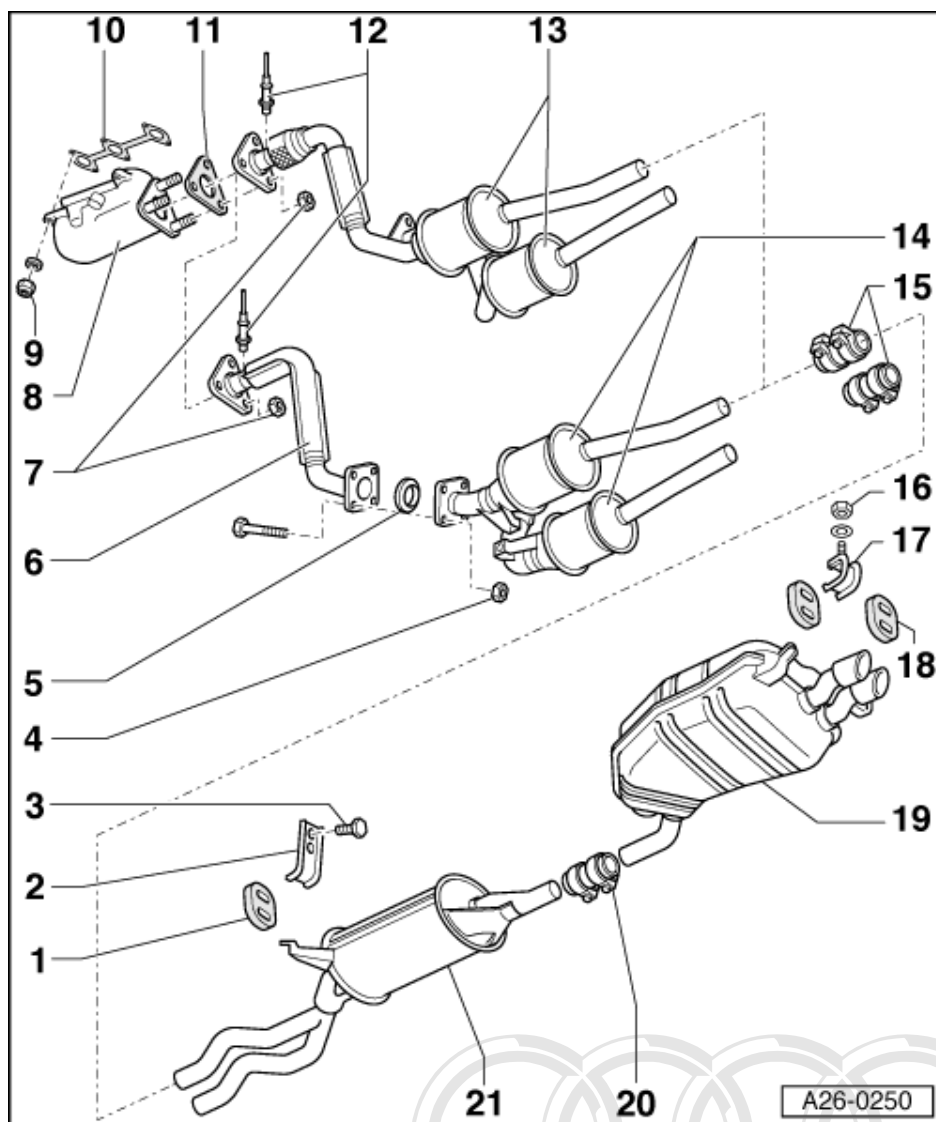


14 Catalytic converter

- ◆ For vehicles with four-wheel drive
- ◆ Protect from damage by knocks and impact
- ◆ Removing and installing catalytic converter (left side) => Page 176
- ◆ Removing and installing catalytic converter (right side) => Page 178
- ◆ Aligning catalytic converters
=> Fig. 1

15 Clamp

- ◆ Installation position on vehicles with front-wheel drive=>Fig. 5
- ◆ Installation position on vehicles with four-wheel drive=>Fig. 6
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 182 .
- ◆ Tighten bolted connections evenly to 40 Nm



16 25 Nm

17 Mounting

- ♦ Illustration shows left mounting

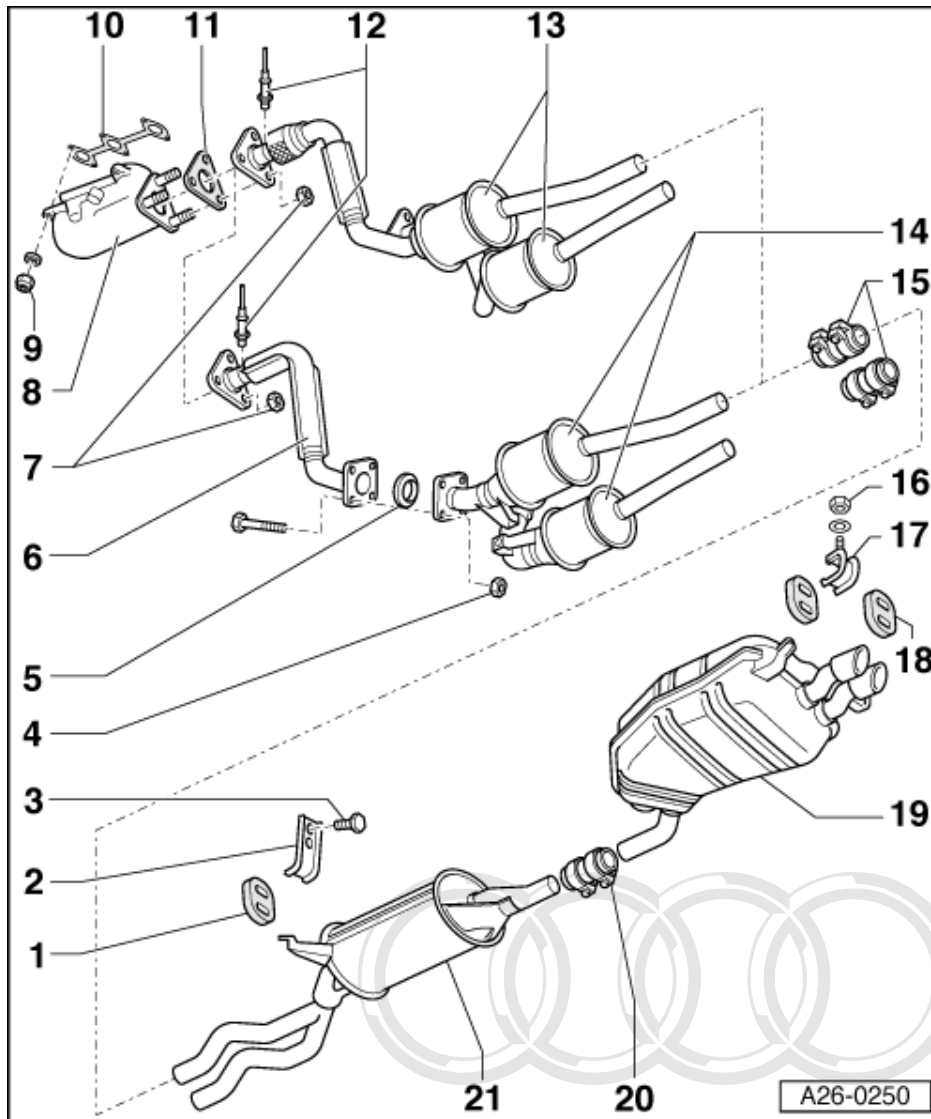
18 Exhaust mounting

- ♦ Checking preload
=>Aligning exhaust system free of stress Page 182

19 Rear silencer

- ♦ Rear silencer and centre silencer are one unit as original equipment, but can be renewed separately for repair purposes
- ♦ Cutting point => Page 176
- ♦ Aligning exhaust system free of stress => Page 182

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

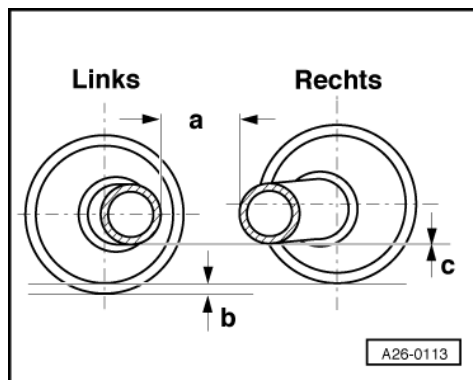


20 Clamp

- ♦ For separate replacement of centre silencer and rear silencer
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 182 .
- ♦ Tighten bolted connections evenly to 40 Nm

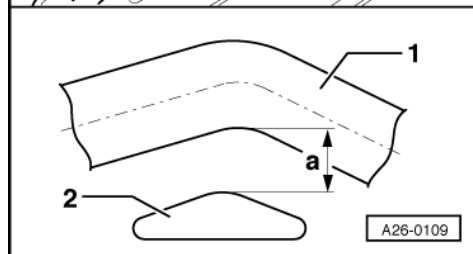
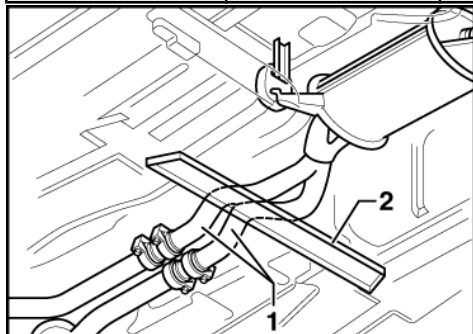
21 Centre silencer

- ♦ Centre silencer and rear silencer are one unit as original equipment, but can be renewed separately for repair purposes
- ♦ Cutting point => Page 176
- ♦ Aligning exhaust system free of stress => Page 182



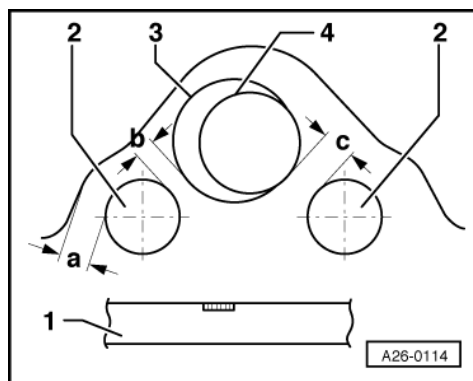
➔ Fig.1 Alignment of catalytic converters

| | Front-wheel drive | Four-wheel drive |
|--|-------------------|------------------|
| Pipe spacinga = | 50 mm | 96 mm |
| Height offset of catalytic convertersb = | approx. 5 mm | approx. 3 mm |
| Height difference between pipesc = | 0 ... 3 mm | 0 ... 3 mm |



➔ Fig.2 Clearance between exhaust pipes and floor cross member

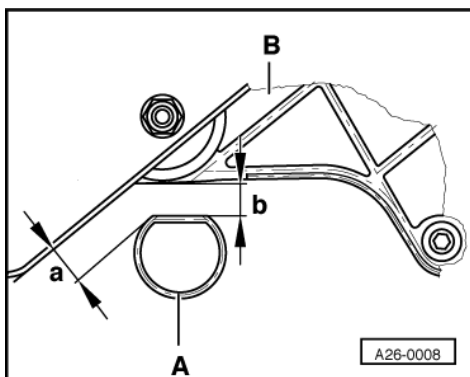
- 1 - Exhaust pipes
- 2 - Floor cross member
- Distance a = 43 mm



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

-> Fig.3 Clearance between exhaust pipes and propshaft / body

- 1 - Floor cross member
- 2 - Exhaust pipes
- 3 - Propshaft for manual gearbox
- 4 - Propshaft for automatic gearbox
- Dimension a = 22 mm
- Dimension b = 20 mm (manual gearbox)
- Dimension c = 17 mm (automatic gearbox)

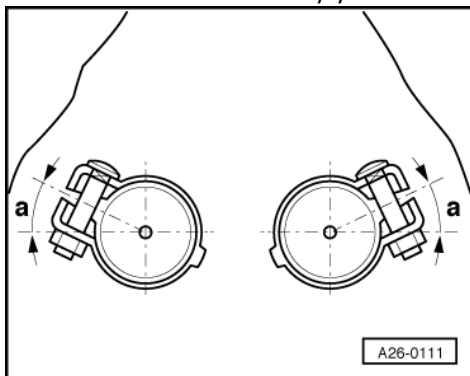


-> Fig.4 Clearance between exhaust pipe and rear axle (at pipe between centre silencer and rear silencer)

- A - Exhaust pipe
- B - Rear axle
- Distance a = 27 mm
- Distance b = 20 mm

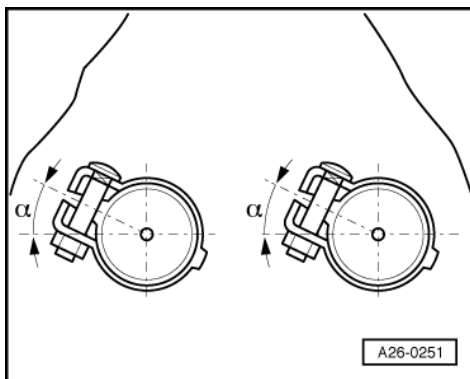
Note:

Illustration shows exhaust pipe as seen from rear of vehicle.



-> Fig.5 Installation position of clamps on vehicles with front-wheel drive

- ◆ Angle $\alpha = 25^\circ$
- Tighten bolted connections on clamp evenly to 40 Nm.



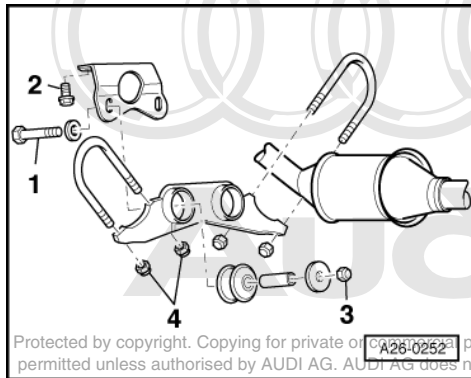
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



-> Fig.6 Installation position of clamps on vehicles with four-wheel drive

♦ Angle $\alpha = 25^\circ$

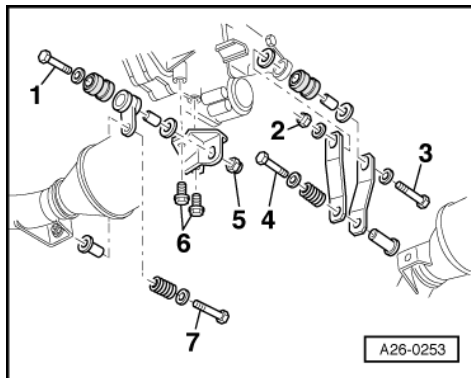
- Tighten bolted connections on clamp evenly to 40 Nm.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

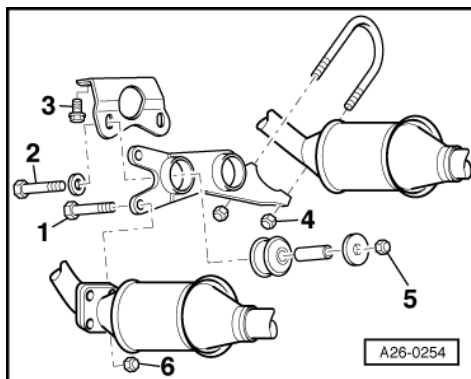
-> Fig.7 Components of exhaust mountings on vehicles with front-wheel drive and automatic gearbox up to VIN4D S_000 496

- 1 - Bolt - 25 Nm
- 2 - Bolt - 25 Nm
- 3 - Nut, self-locking - 25 Nm
- 4 - Nut, self-locking - 2 Nm



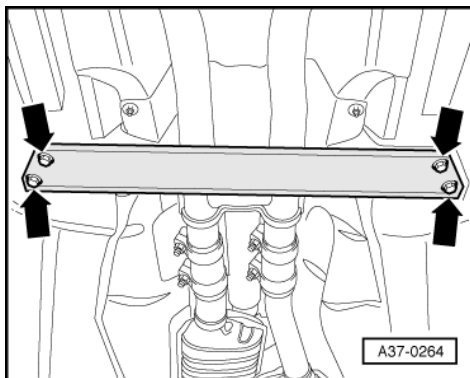
-> Fig.8 Components of exhaust mountings on vehicles with front-wheel drive and automatic gearbox from VIN4D S_000 497onwards

- 1 - Bolt - 25 Nm
- 2 - Nut, self-locking - 25 Nm
- 3 - Bolt - 25 Nm
- 4 - Bolt - 25 Nm
- 5 - Nut, self-locking - 25 Nm
- 6 - Bolt - 25 Nm
- 7 - Bolt - 25 Nm



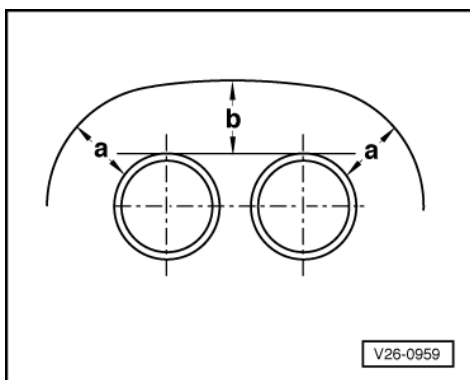
-> Fig.9 Components of exhaust mountings on vehicles with four-wheel drive and manual gearbox or automatic gearbox

- 1 - Bolt - 25 Nm
- 2 - Bolt - 25 Nm
- 3 - Bolt - 25 Nm
- 4 - Nut, self-locking - 2 Nm
- 5 - Nut, self-locking - 25 Nm
- 6 - Nut, self-locking - 25 Nm



-> Fig.10 Removing and installing floor cross member

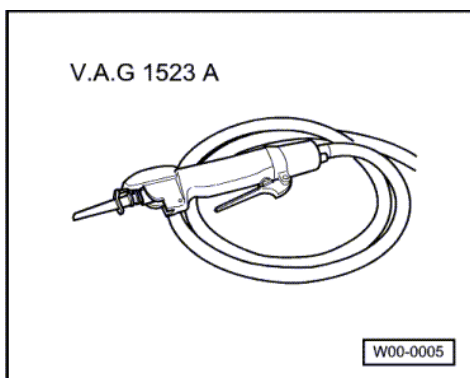
- ◆ Tightening torque: 25 Nm



-> Fig.11 Aligning tailpipes

- Align tailpipes so that distance -a- is the same on both sides.
- At the same time, distance -b- must be obtained between bumper cut-out and tailpipes:
 - Dimension b = 22.5 mm

1.2 - Separating centre and rear silencers



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

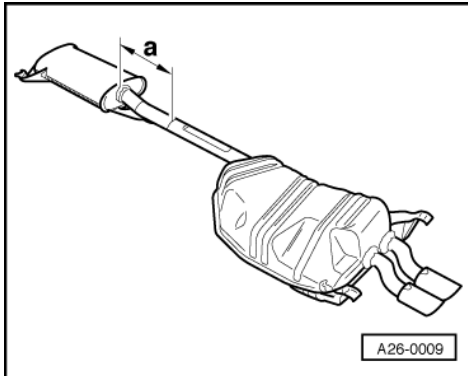


- ♦ The connecting pipe can be cut through at the point marked in order to renew the centre and rear silencers separately.

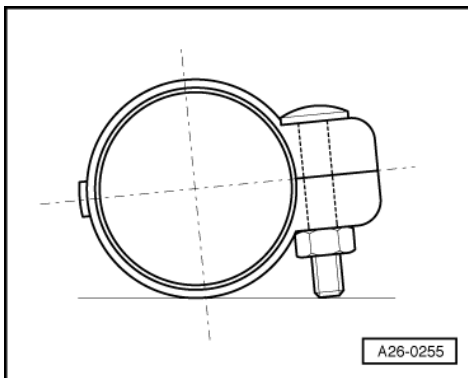
Special tools and workshop equipment required

- ♦ V.A.G 1523 A

Work sequence



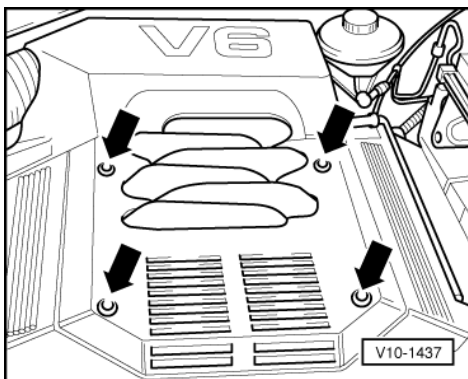
- -> Mark cutting point on exhaust pipe.
- Dimension a = 240 mm
- Cut through exhaust pipe at right angles with body saw (e.g. V.A.G 1523 A) at the position marked.
- When installing, position clamp centrally over saw-cut.



- -> Install clamp so that ends of bolts -arrow- are not below bottom circumference of clamp.
- Aligning exhaust system free of stress =>
Page 182.
- Tighten bolted connections on clamp evenly to 40 Nm.

1.3 - Removing and installing front exhaust pipe with catalytic converter (left side)

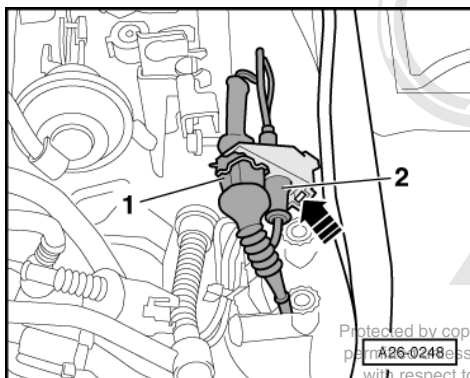
Notes:



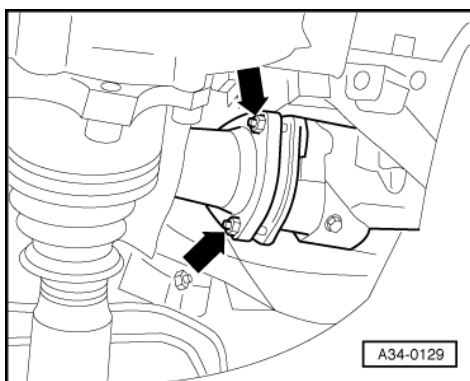
- ♦ Always renew seals, gaskets and self-locking nuts.
- ♦ The flexible pipe connection (de-coupling element) in the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.

Removing

- -> Remove engine cover panel -arrows-.



- -> To unclip connector bracket from front bulkhead, press retainer tab in direction of arrow.
- Unplug lambda probe connectors -1- and -2-.
- Guide out lambda probe wiring from underneath.



- -> Unscrew nuts -arrows- on front exhaust pipe.

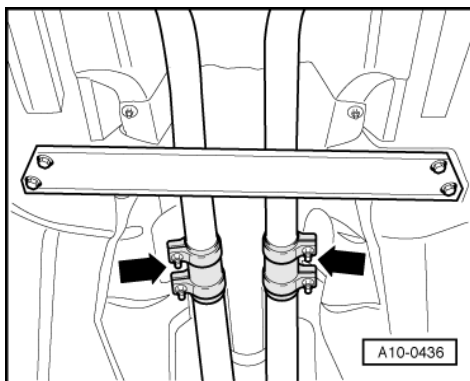
Vehicles with four-wheel drive and automatic gearbox:

- Separate front exhaust pipe from catalytic converter.

Vehicles with exhaust mountings on gearbox

- Unscrew mountings=>Fig. 175 .

All models



- -> Loosen clamp on left side -left arrow-.
- Remove front exhaust pipe (left side) together with catalytic converter and lambda probe.

Note:

Ensure that lambda probe connectors are clear.

Installing

Install in reverse sequence; note the following points:

- Aligning exhaust system free of stress =>
Page 182 .

Note:

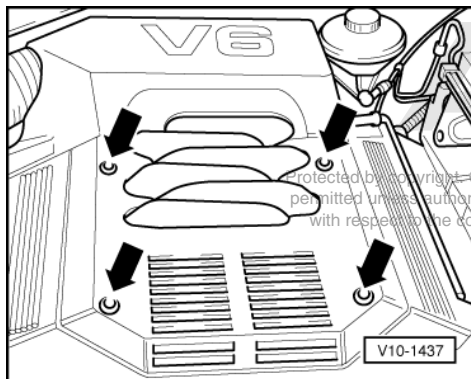
Components of exhaust pipe mountings on gearbox=>Fig. 175

Tightening torques

| Components | Nm |
|---|----|
| Front exhaust pipe and catalytic converter to ex-haust manifold | 25 |
| Front exhaust pipe to catalytic converter | 25 |
| Clamp for exhaust pipe | 40 |

1.4 - Removing and installing front exhaust pipe with catalytic converter (right side)

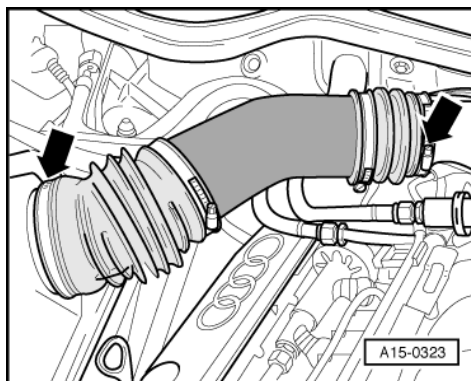
Notes:



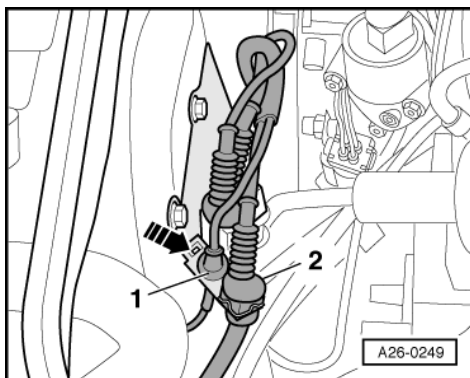
- ♦ Always renew seals, gaskets and self-locking nuts.
- ♦ The flexible pipe connection (de-coupling element) in the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.

Removing

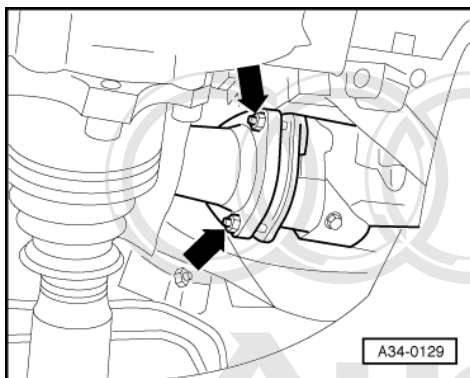
- -> Remove engine cover panel -arrows-.



- -> Remove air hose between air mass meter and intake manifold -arrows-.



- -> To unclip connector bracket from front bulkhead, press retainer tab in direction of arrow.
- Unplug lambda probe connectors -1- and -2-.
- Guide out lambda probe wiring from underneath.

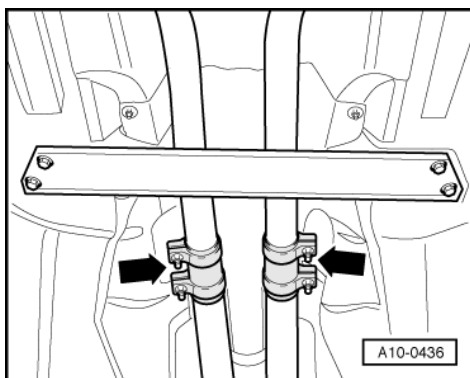


- -> Unscrew nuts -arrows- on front exhaust pipe.

Vehicles with exhaust pipe mountings on gearbox

- Unscrew mountings=>Fig. 175
- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

All models



- -> Loosen clamp on right side -right arrow-.
- Remove front exhaust pipe (right side) together with catalytic converter and lambda probe.

Note:

Ensure that lambda probe connectors are clear.

Installing

Install in reverse sequence; note the following points:

- Aligning exhaust system free of stress =>
Page 182.

Note:

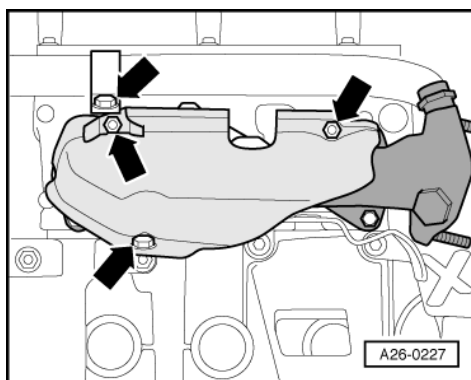
Components of exhaust pipe mountings on gearbox=>Fig. 175.

Tightening torques

| Components | Nm |
|---|----|
| Front exhaust pipe with catalytic converter to exhaust manifold | 25 |
| Clamp for exhaust pipe | 40 |

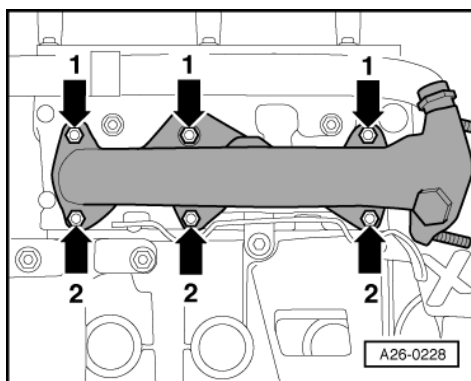
1.5 - Removing and installing exhaust manifold (left side)

Removing



Notes:

- ♦ Always renew seals, gaskets and self-locking nuts.
 - ♦ The flexible pipe connection (de-coupling element) in the front exhaust pipe must not be bent more than 10° - otherwise it can be damaged.
- -> Unbolt heat shield -arrows-.



- -> Remove nuts accessible from above -arrows -1-.
- Remove front exhaust pipe (left side)
=> Page 176 .
- Remove nuts accessible from below -arrows -2-.

Installing

Install in reverse sequence; note the following points:

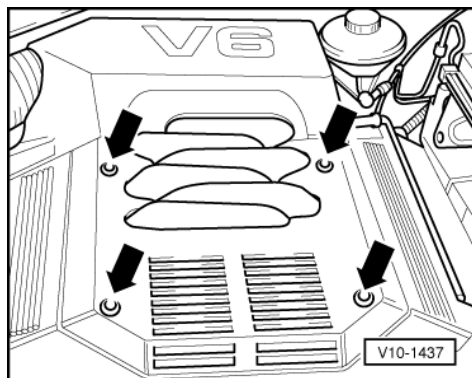
- Note installation position of exhaust manifold gaskets:
 - Connecting web of gasket points downwards
- Aligning exhaust system free of stress =>
Page 182 .

Tightening torques

| Components | Nm |
|-----------------------------------|----|
| Exhaust manifold to cylinder head | 25 |
| Heat shield to exhaust manifold | 25 |

1.6 - Removing and installing exhaust manifold (right side)

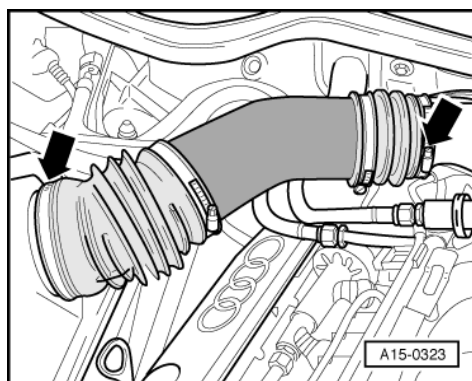
Notes:



- ◆ Always renew seals, gaskets and self-locking nuts.
- ◆ The flexible pipe connection (de-coupling element) in the front exhaust pipe must not be bent more than 10 °- otherwise it can be damaged.

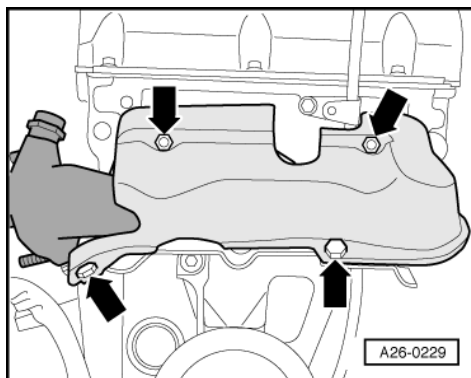
Removing

- -> Remove engine cover panel -arrows-.

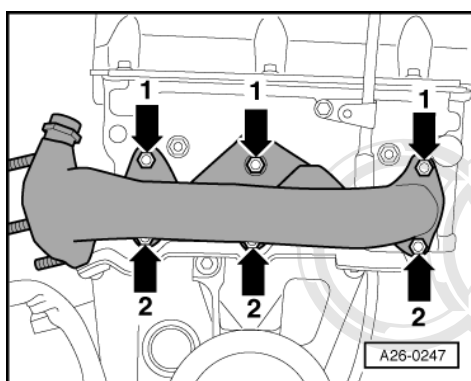


Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- -> Remove air hose between air mass meter and intake manifold -arrows-.



- -> Unbolt heat shield -arrows-.



- -> Remove nuts accessible from above -arrows -1-.
- Remove front exhaust pipe (right side)
=> Page 178 .
- Remove nuts accessible from below -arrows -2-.

Installing

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Install in reverse sequence; note the following points:

- Note installation position of exhaust manifold gaskets:
 - Connecting web of gasket points downwards

Tightening torques

| Components | Nm |
|-----------------------------------|----|
| Exhaust manifold to cylinder head | 25 |
| Heat shield to exhaust manifold | 25 |

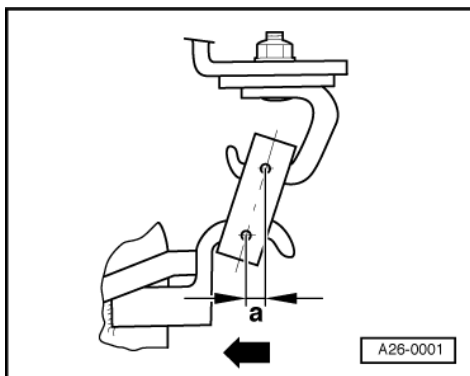
1.7 - Stress-free alignment of exhaust system

Note:

Align the exhaust system when cold.

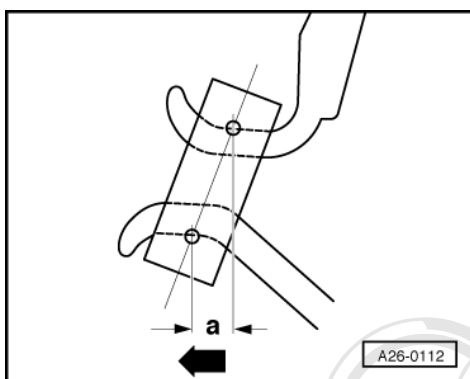
- Vehicles without clamp between centre silencer and rear silencer

- Slacken bolts on clamps -Item **169** .



- -> Push exhaust system towards front of vehicle -arrow- so that rear left mounting on rear silencer is pre-loaded by $a = 10 \text{ mm}$.
- Tighten bolted connections on clamp evenly to 40 Nm.
- Check clearances and installation position
=>Fig. **174** .

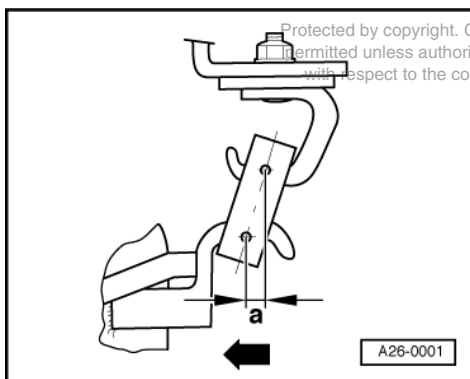
- Vehicles with clamp between centre silencer and rear silencer



Note:

On vehicles with clamp between centre and rear silencer the centre silencer also has to be aligned. (This step is not required on other vehicles).

- Slacken bolts on clamps -Item **171** .
- -> Push exhaust system towards front of vehicle -arrow- until front left mounting of centre silencer is pre-loaded by $a = 10 \text{ mm}$.
- Tighten bolts on front clamp -Item **169** evenly to 40 Nm.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> Push rear silencer towards front of vehicle -arrow- so that rear left mounting on rear silencer is preloaded by $a = 10 \text{ mm}$.
- Tighten bolts on rear clamp -Item **171** evenly to 40 Nm.
- Check clearances and installation position
=>Fig. **174** .

1.8 - Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug tailpipes (with rags or stoppers, etc.) until check is completed.
- Listen for noise at the connection points (cylinder head/manifold, manifold/catalytic converter etc.) to determine whether there are any leaks.
- Rectify any leaks that are found.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.