

Audi 100 1991 ➤

6-cyl. Injection Engine (2-val.), Mechanical Components

Engine ID	AAH	ABC	ACZ	AEJ					
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Edition 12.2001

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6-cyl. Injection Engine (2-val.), Mechanical Components

Repair Group

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

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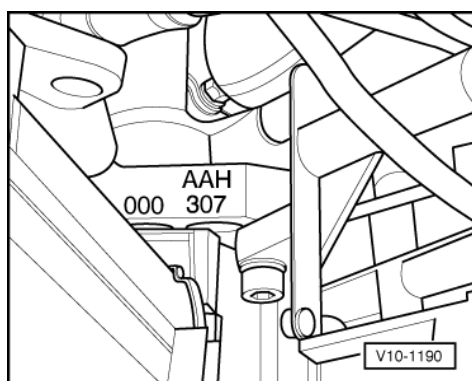
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00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



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

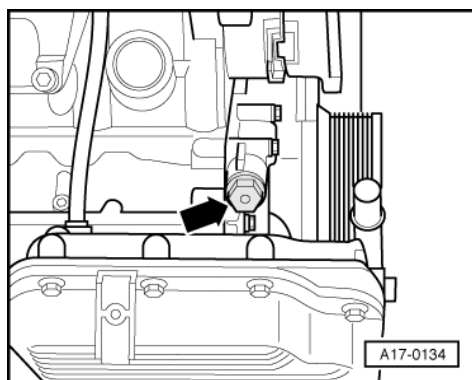
There is also a sticker on the toothed belt guard or cylinder head cover showing the engine code and serial number.

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

1.3 - Changes during the production period

In the Audi 100 1991 > generation I and II six-cylinder engines are installed.

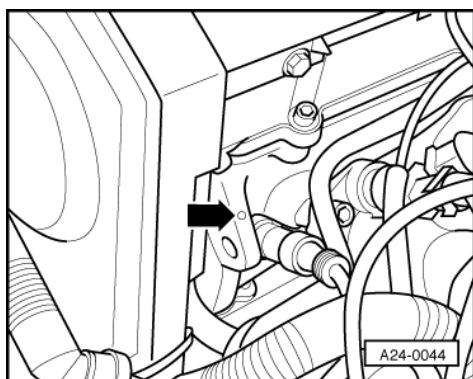
Distinguishing features





Engine generation I:

- ♦ -> Vehicles up to ident. no. 4A S_ 026 714 have a screw cap on the oil pump -arrow-. These vehicles have the "old valve gear" (identification code "M") with no marking.



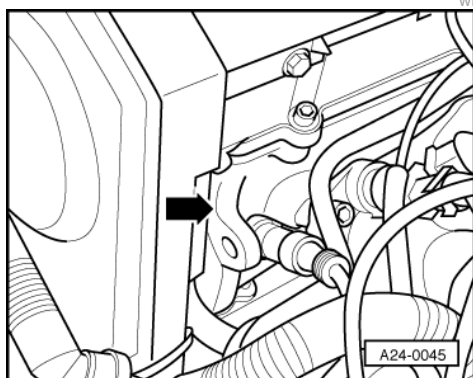
Engine generation II:

- ♦ On vehicles as of ident. no. 4A S_ 026 715 the oil circuit has been changed and there is no longer a screw cap on the oil pump. These vehicles have the "light valve gear" (identification code "S") with marking:

-> 1st marking version:

Centre punch marks -arrow- on the cylinder head lifting eye.

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-> 2nd marking version:

Recess -arrow- on the cylinder head lifting eye.

Note:

The lifting eye is visible when the engine cover is removed

1.4 - Engine data

Code letters		AAH	AAH	ABC
Production		> approx. 08.94	approx. 08.94 >	>approx. 08.94
Capacity	l	2.771	2.771	2.598
Output	kW at rpm	128/5500	128/5500	110/5750
Torque	Nm at rpm	250/3000	250/3000	225/3500
Bore	øin mm	82.5	82.5	82.5
Stroke	mm	86.4	86.4	81.0

Code letters	AAH	AAH	ABC
Compression	10.3	10.3	10.0
Recommended RON	98	98	95
Minimum RON	95 1)	95 1)	91 1)
Injection-/Ignition system	Multi Point Injection	Multi Point Injection	Multi Point Fuel Injection
Knock control	yes	yes	yes
Lambda control	yes	yes	yes
Catalytic converter	yes	yes	yes
Intake manifold changeover	yes	yes	no

1) Reduced power.

Code letters	AAH	AAH	ABC
Valve timing 2)			
Inlet opens after TDC	4°	10.5°	4°
Inlet closes after BDC	44°	45° 45`	44°
Exhaust opens before BDC	40°	37.5°	40°
Exhaust closes before TDC	0°	2.55°	0°

2) with 1 mm valve lift and 0 mm valve play

Code letters	ABC	ACZ	AEJ
Production	approx. 08.94 >	05.95 >	05.95 >
Capacity l	2.598	2.598	2.771
Output kW at rpm	110/5750	102/5750	120/5400
Torque Nm at rpm	225/3500	210/3500	235/3000
Bore ø in mm	82.5	82.5	82.5
Stroke mm	81.0	81.0	86.4
Compression	10.0	9.2	9.2
Recommended RON	95	88	88
Minimum RON	91 1)	88	88
Injection-/Ignition system	Multi Point Fuel Injection	Multi Point Fuel Injection	Multi Point Injection
Knock control	yes	yes	yes
Lambda control	yes	yes	no
Catalytic converter	yes	no	no
Intake manifold changeover	yes	no	no

1) Reduced power.

Code letters	ABC	ACZ	AEJ
Valve timing 2)			
Inlet opens after TDC	10.5°	10.5°	10.5°
Inlet closes after BDC	45°, 45`	45°, 45`	45°, 45`
Exhaust opens before BDC	37.5°	37.5°	37.5°
Exhaust closes before TDC	2.55°	2.55°	2.55°

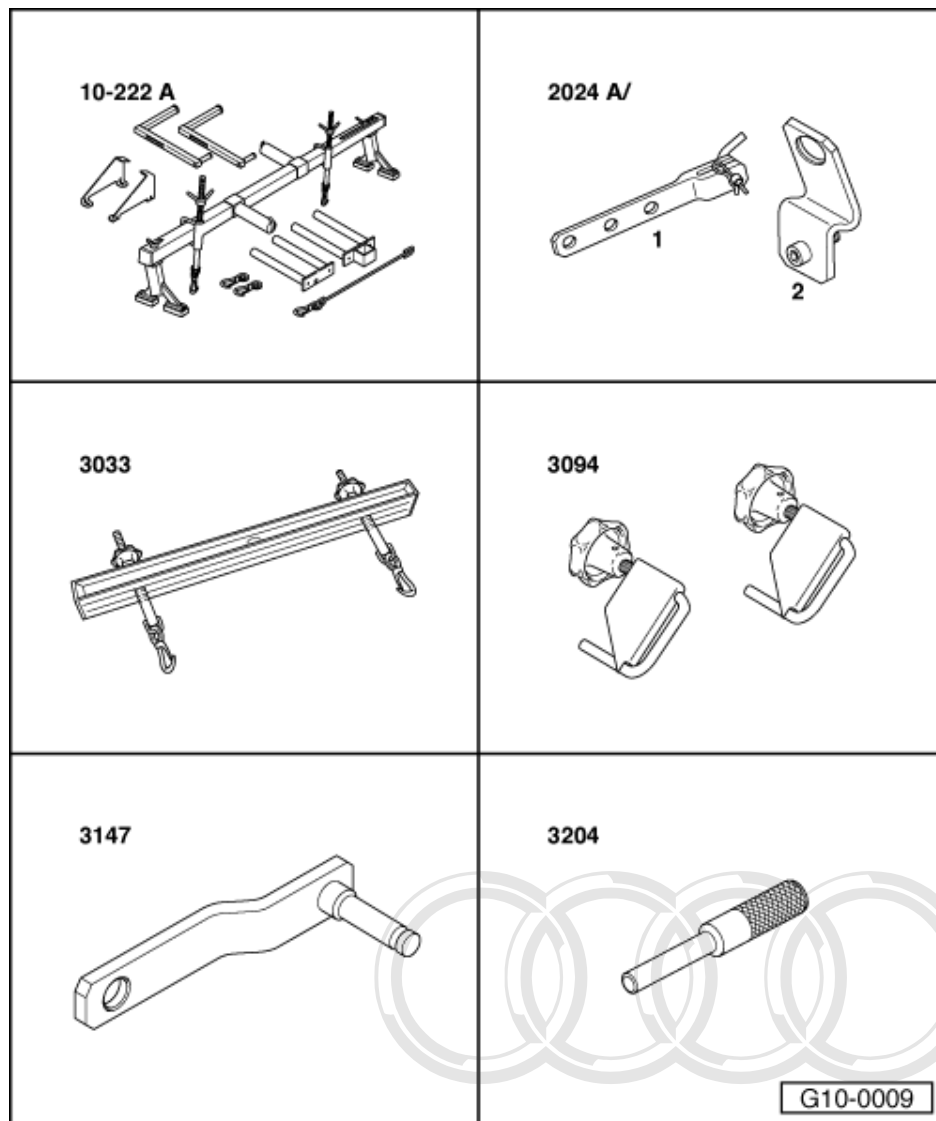
2) with 1 mm valve lift and 0 mm valve play



10 - Removing and installing engine

1 - Removing and installing engine

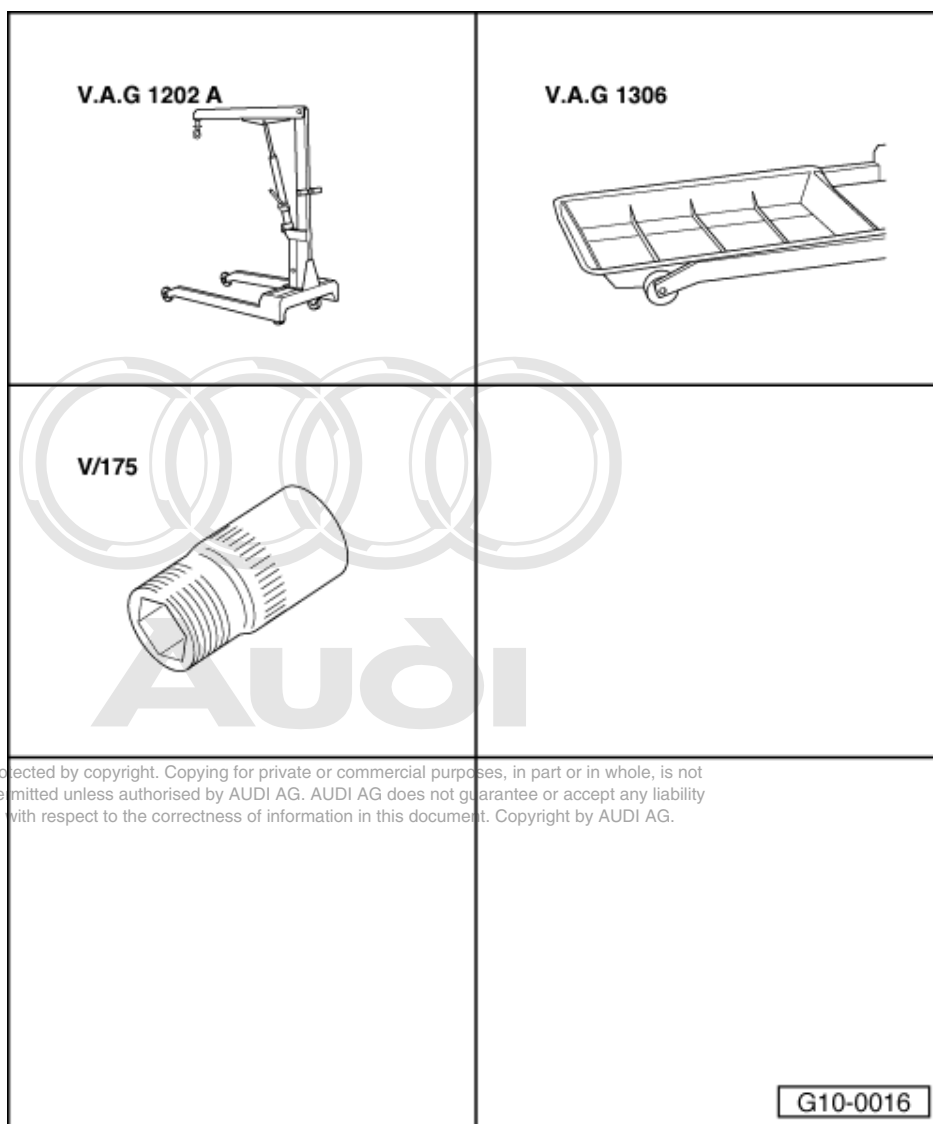
1.1 - Removing and installing engine



Special tools and workshop equipment required

- ♦ Support bar 10-222A
- ♦ Bracket 2024 A/2
- ♦ Lifting tackle 3033
- ♦ Hose clamps 3094
- ♦ Special tool 3147
- ♦ Special tool 3204 (on vehicles with air conditioner and/or automatic gearbox)

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- ♦ Workshop crane V.A.G 1202 A

or

- ♦ Workshop crane VAS 6100
- ♦ Drip tray V.A.G 1306
- ♦ Special tool Matra V/175
(Vehicles with automatic gearbox)

1.2 - Removing

Notes:

- ♦ The description below is representative of the removal and installation for vehicles with 2.8 litre engine. Vehicles with 2.6 litre engines do not require some of the operating steps.
- ♦ Remove engine upwards top without gearbox.
- ♦ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- ♦ Heat insulating sleeves removed during removal of the engine must be refitted in the same position when installing the engine.



- ♦ Collect drained coolant in a clean container for re use or disposal.
- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

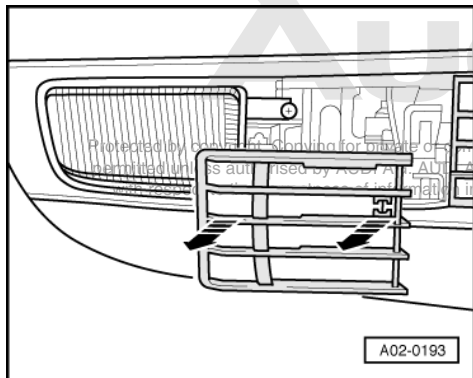
=> General Body Assembly; Repair group 72

- Disconnect earthing strap at battery with ignition switched off.

Important

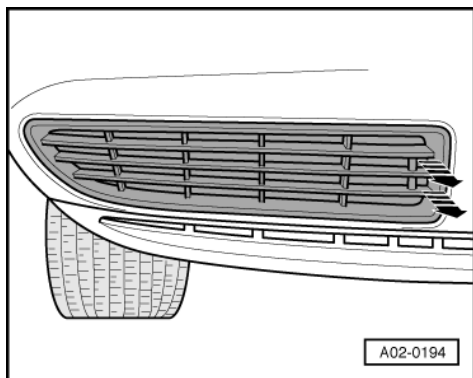
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank



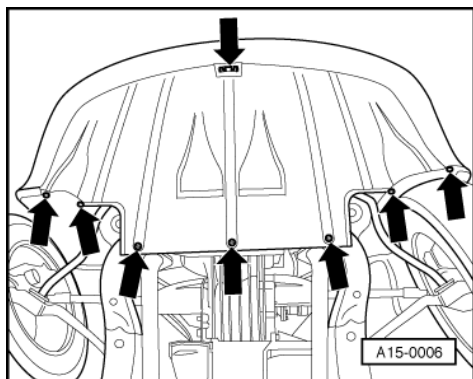
Audi 100:

- -> Unclip the air intake grille to the lower right of the bumper -arrows-.



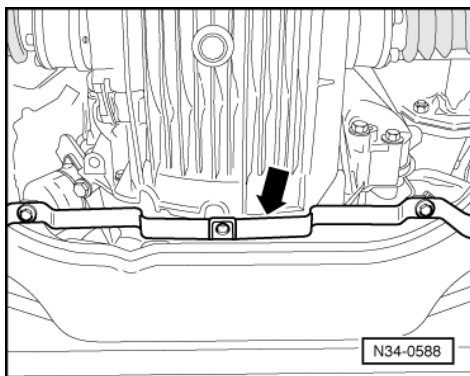
Audi A6

- -> Pull back retainer catch -arrows- and remove air intake grille.

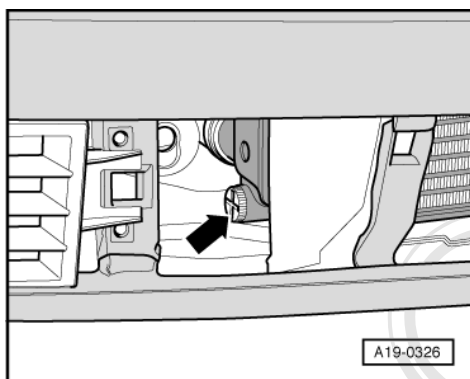


All models:

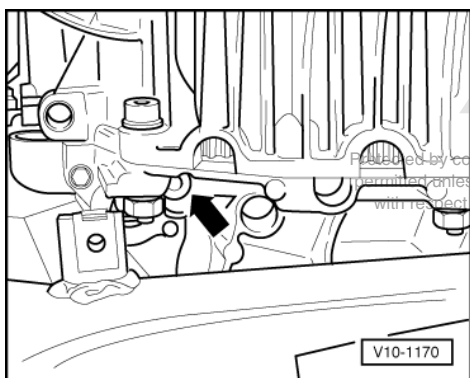
- -> Remove the noise insulation -arrows-.



- -> Unbolt the bracket for the noise insulation -arrow-.



- Place drip tray V.A.G 1306 under engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.

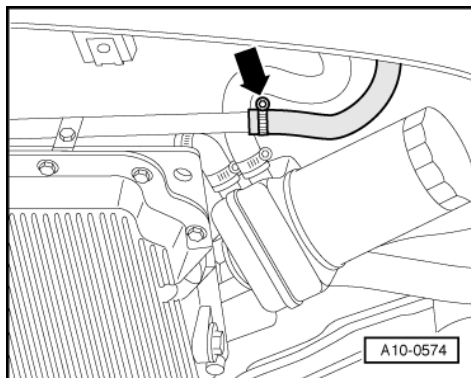


- -> Also open the coolant drain plug on rear left of engine -arrow-.

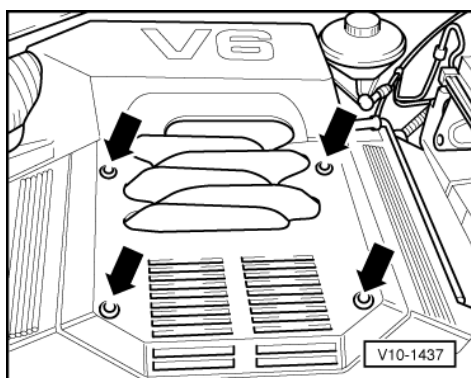
Note:

Renew O-ring.

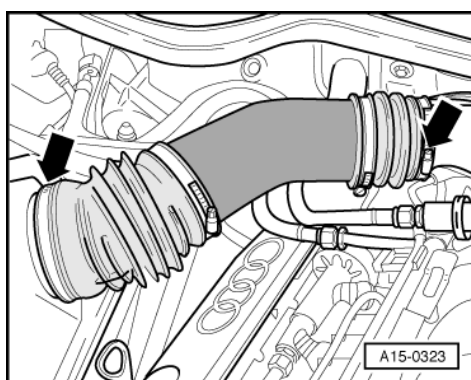
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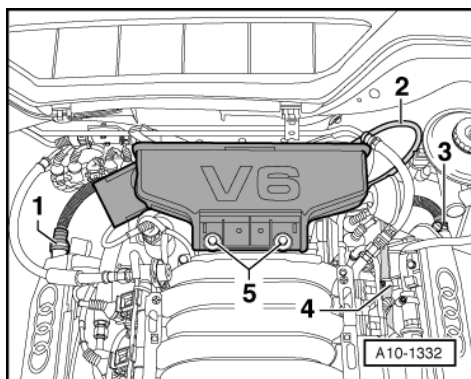
- -> Also disconnect coolant hose -arrow-, and drain off remaining coolant.



- -> Remove engine cover-arrows-.



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



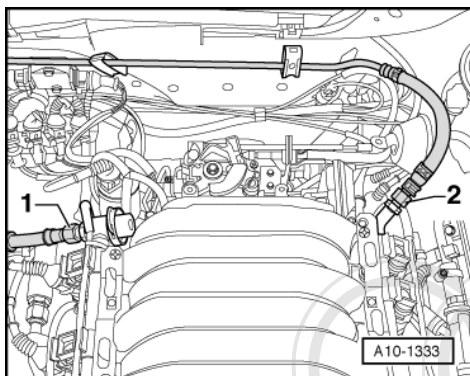
- -> Disconnect crankcase breather hoses -1- and -3- at cylinder heads.
- Disconnect vacuum hose -2- from throttle valve body.
- Detach hose -4- to crankcase breather.



Audi

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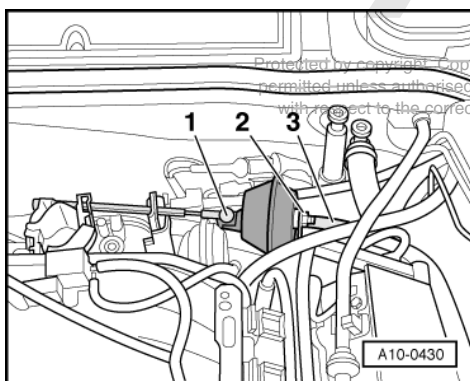
- Remove screws -5- and press air duct to the rear.
- Detach air duct.



Important

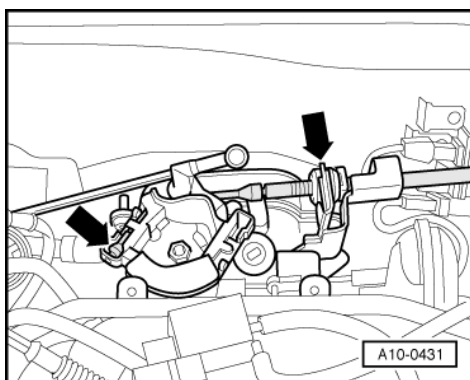
The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- -> Unscrew the fuel supply pipe -2- and the fuel return pipe -1-.



Vehicles with cruise control system

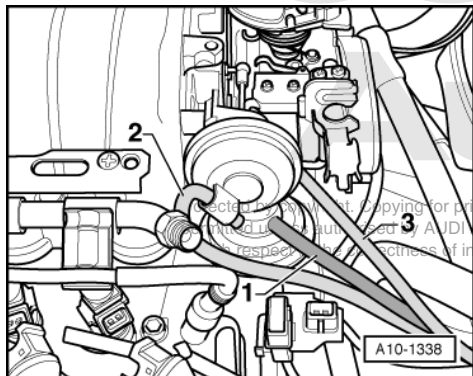
- -> Disengage the operating rod -1- on the vacuum unit.
- Detach vacuum hose -3- from vacuum unit.
- Unscrew nut -2- and remove vacuum unit.



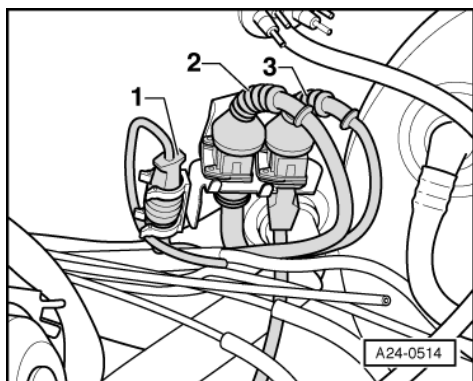


All models:

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



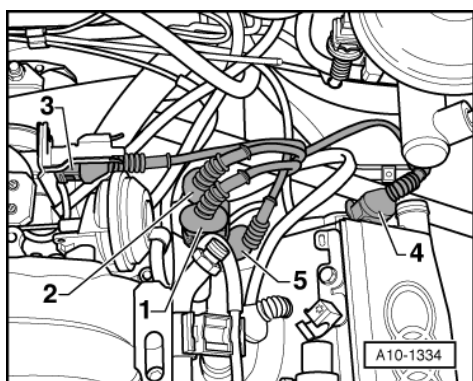
- -> Mark and remove vacuum pipes -1...3- (if fitted).



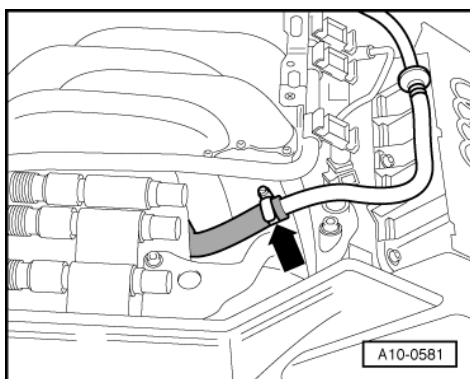
- -> Unplug the following connectors from the left of the bulkhead:

- 1 - Lambda probe -G108
- 2 - Knock sensor -G66
- 3 - Lambda probe heating -Z28

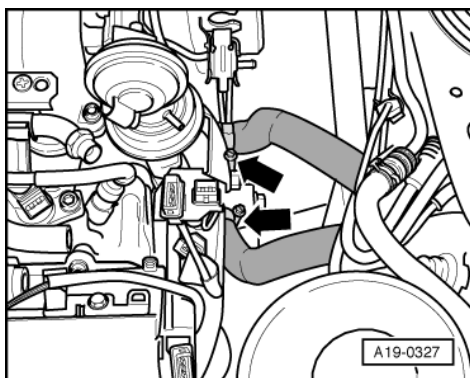
- Remove connectors -1...3- from the bracket and expose the wiring.



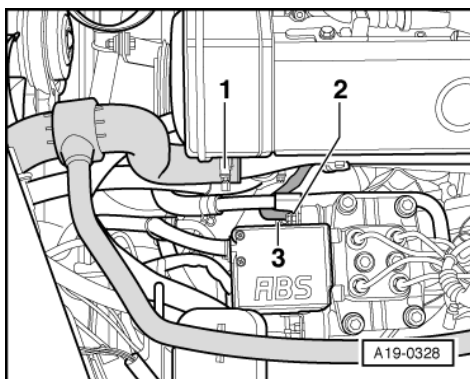
- -> Detach electrical connectors -1 ... 5-.



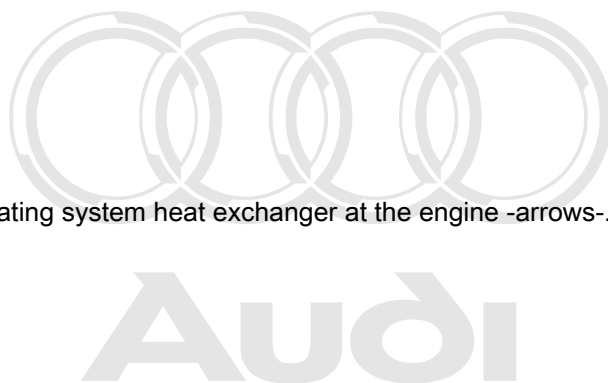
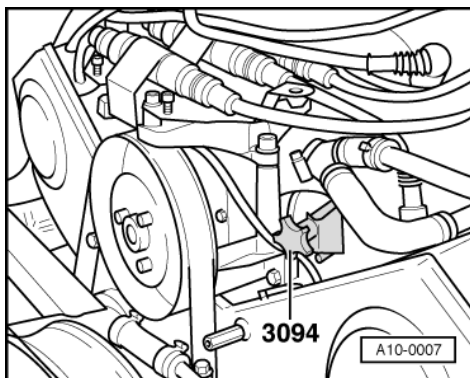
- -> Detach the vacuum pipe -arrow- to the brake servo.



- -> Detach the coolant hoses leading to the heating system heat exchanger at the engine -arrows-.



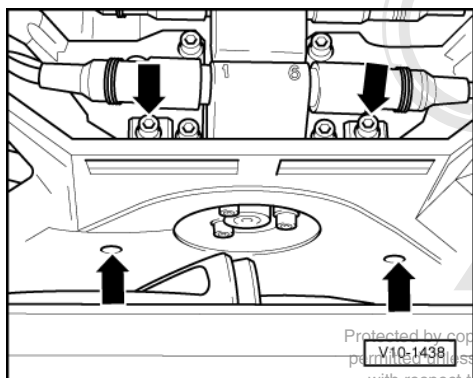
- -> Disconnect coolant hose -1-.
- Unscrew the earth connection -2- and the coolant pipe -3- at the ABS hydraulic unit.



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- -> Clamp off supply pipe to hydraulic pump with hose clamp 3094, unfasten the screw-type clip and the securing bolt on the supply pipe bracket on bottom left of engine.
- Pull through pipe with mounted hose clamp 3094 downwards between toothed belt guard and cylinder head.
- Place a cloth under the hydraulic pump to catch any fluid leaks.

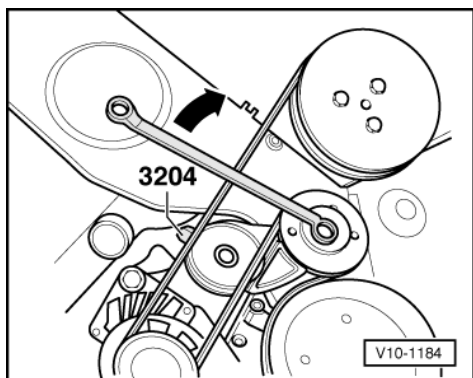


Vehicles with air conditioner and/or automatic gearbox:

- -> Remove ribbed belt cover -arrows-.

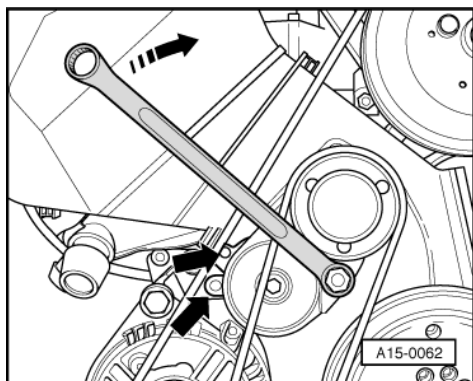
Note:

Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



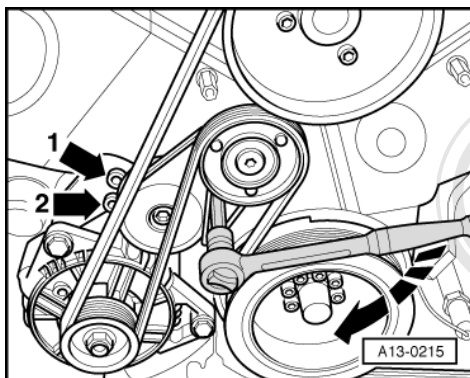
Tensioning roller without hexagon flat:

- -> To slacken ribbed belt, turn tensioner in direction of arrow using ring spanner (15 mm A/F).
- Insert mandrel 3204 into securing holes to lock tensioner in position.
- Remove ribbed V-belt.

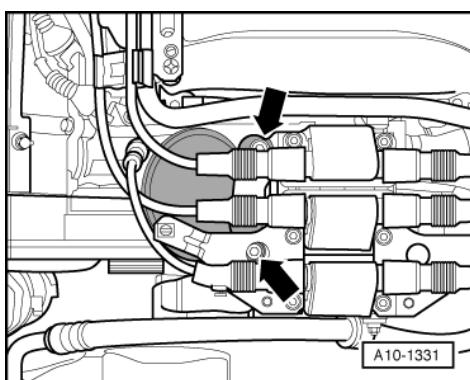


Tensioning roller with external hexagon:

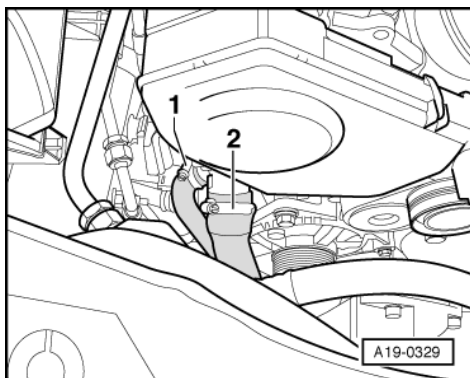
- -> To slacken ribbed belt, turn tensioner in direction of arrow using ring spanner (17 mm A/F).
- Insert mandrel 3204 into holes -arrows- to stop tensioner from turning.
- Remove ribbed V-belt.

**Tensioning roller with hexagon socket:**

- -> To slacken ribbed belt, turn tensioner in direction of arrow using Allen key (10 mm A/F).
- Insert mandrel 3204 into holes -1- and -2- to stop tensioner from turning.
- Remove ribbed V-belt.

**All models:**

- -> Unscrew bolts -arrows- and detach vacuum unit.
- Detach vacuum hose from vacuum unit.

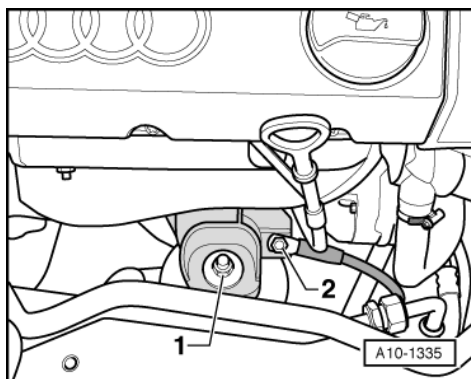


- -> Disconnect coolant hose -2-.



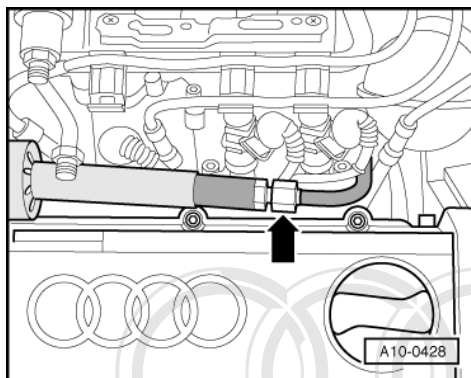
Vehicles with automatic gearbox:

- Disconnect coolant hose -1-.

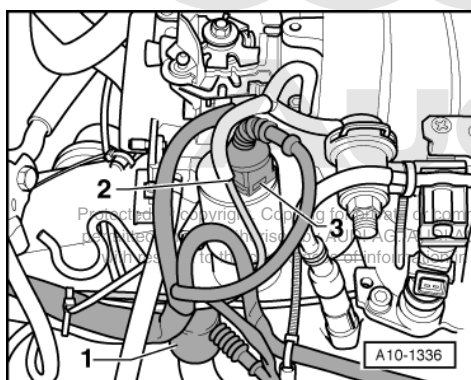


All models:

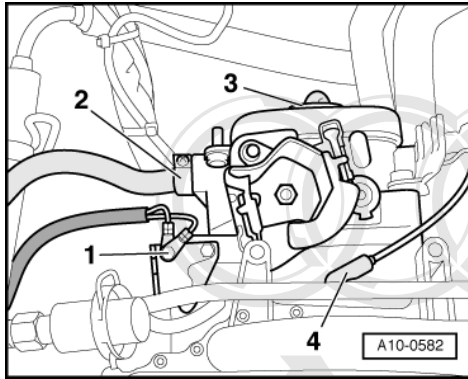
- -> Unscrew earth wire -2- at right engine support.
- Unscrew nut -1- to upper right of engine mounting.



- -> Detach the hydraulic pump pressure pipe -arrow-.



- Remove connectors from injectors and expose wiring.
- -> Detach vacuum pipe -2-.
- Detach electrical connector -3- at idling stabilisation valve -N71.
- Detach electrical connector -1- at coolant temperature sender -G62.



- -> Unscrew earth wires -1-.

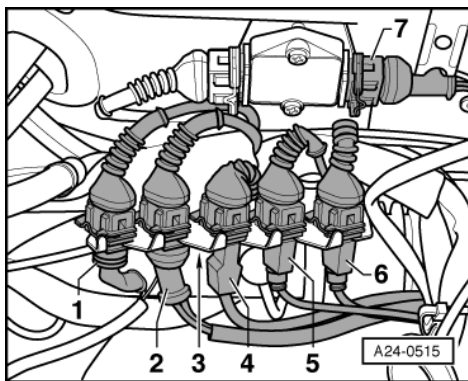
Note:

Depending on the version, the earth wires may be connected at a different location.

- Detach vacuum hose -2- to ACF valve.
- Detach connector -3- at throttle valve body.

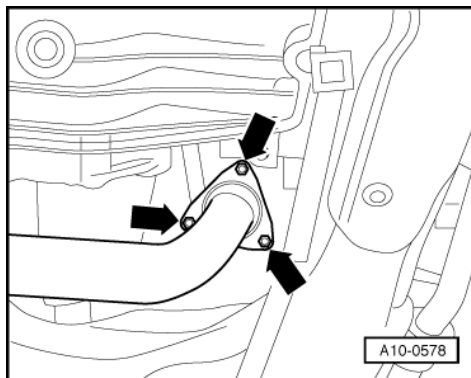
Vehicles with 2.6 litre engine:

- Detach vacuum hose -4- to engine control unit at throttle valve body.

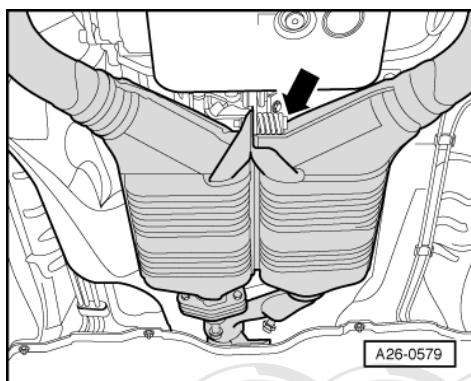


All models:

- -> Remove the following connectors from the centre of the bulkhead:
 - 1 - Lambda probe heating -Z19
 - 2 - Ignition coil power supply
 - 3 - Lambda probe -G39
 - 4 - Knock sensor -G61
 - 5 - Engine speed sender -G28
 - 6 - Ignition timing sender -G4
 - 7 - Ignition coil signal wiring
- Remove connectors from retainer and expose wiring.
- Unscrew upper engine/gearbox securing bolts. Leave one bolt in place (hand tight).



- -> Unscrew nuts on left and right of exhaust manifold/front exhaust pipe -arrows-.

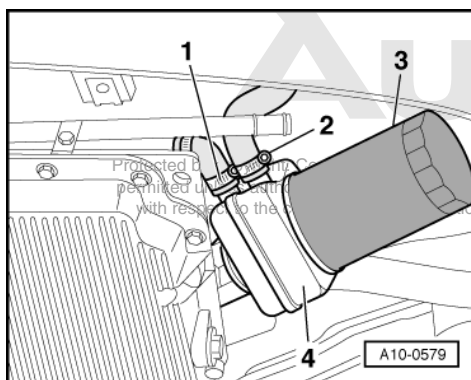


- -> Unbolt exhaust system from bracket -arrow- at gearbox.

Note:

Illustration shows vehicle with two catalytic converters.

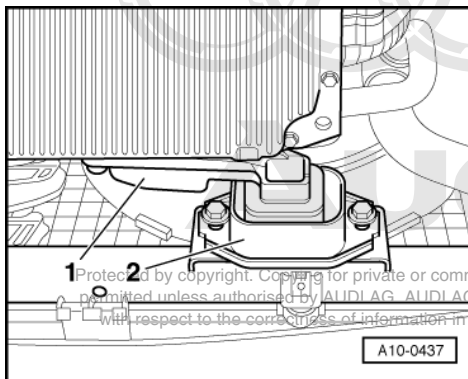
- Detach exhaust system from exhaust manifolds.



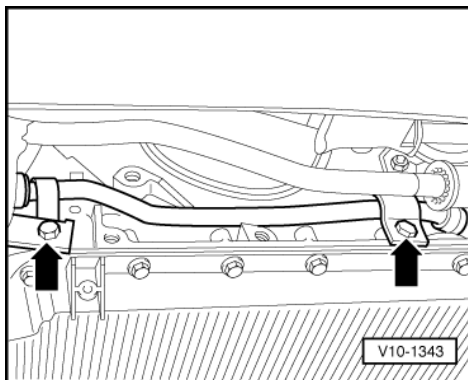
- Place drip tray under engine to catch engine oil.
- Drain engine oil.
- -> Remove oil filter -3-.

Vehicles with air conditioner:

- Place drip tray V.A.G 1306 under engine.
- Detach coolant hoses -1- and -2- from oil cooler.
- Remove oil cooler -4-.

**All models:**

- -> Unscrew torque reaction support -1- and the torque reaction support stop -2-.

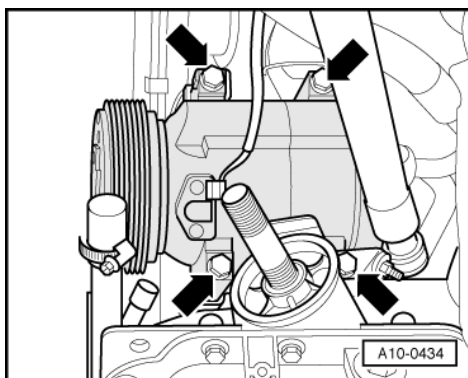
**Vehicles with air conditioner:**

Important
The air conditioner refrigerant circuit must not be opened.

- -> Unscrew front refrigerant pipe holder at sump -right arrow-.

Vehicles with automatic gearbox:

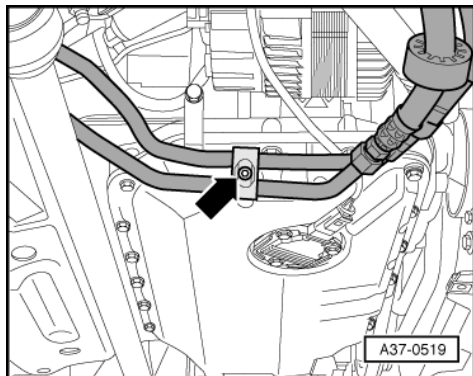
- Remove refrigerant pipe from sump -arrow, left and right-.





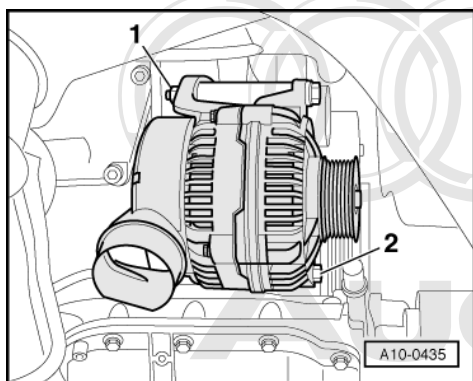
Vehicles with air conditioner:

- Unfasten refrigerant pipe heat insulating sleeve
- -> Unbolt A/C compressor from bracket -arrows-.
- Hook air conditioner compressor onto longitudinal member, leaving hoses connected.

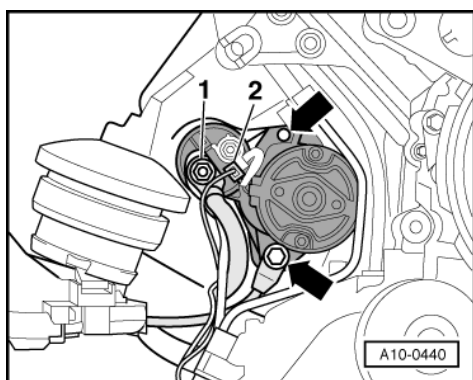


Vehicles with automatic gearbox:

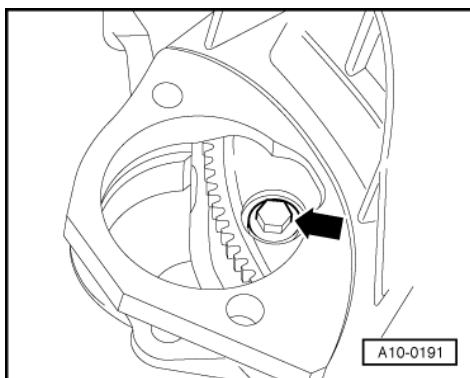
- -> Unscrew the ATF line at the sump -arrow-.



- Unclip the alternator air duct.
- -> Unscrew bolt -2-.
- Loosen the nut -1-.
- Swing the alternator to one side and unscrew the pipes.
- Remove alternator.



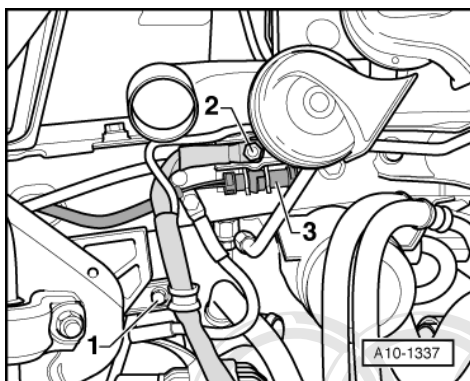
- -> Remove wiring -1- and -2- from starter, remove insulator from positive connection of starter.
- Unscrew starter bolts -arrows- working from gearbox side, and remove starter.



- -> Use Matra V/175 socket attachment (15 mm A/F) to screw out 3 bolts or nuts of torque converter in opening in removed starter (give crankshaft 1/3 of a turn in each case).

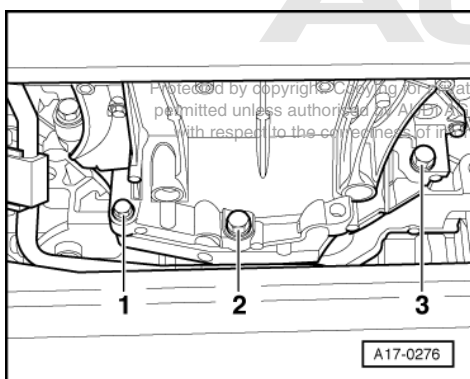
Note:

When loosening torque converter bolts, counterhold crankshaft by applying spanner to central bolt on vibration damper.



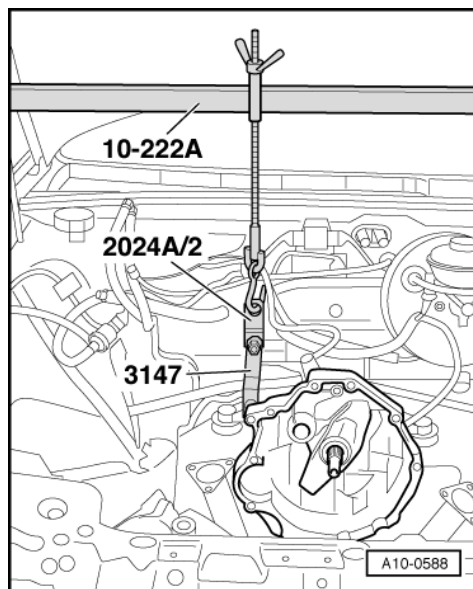
Vehicles with manual gearbox:

- -> Unclip connector -3- and unplug.
- Unclip cover for line connections.
- Unbolt line connection -2-.
- Unscrew cable clamp -1- and expose electrical wiring.



All models:

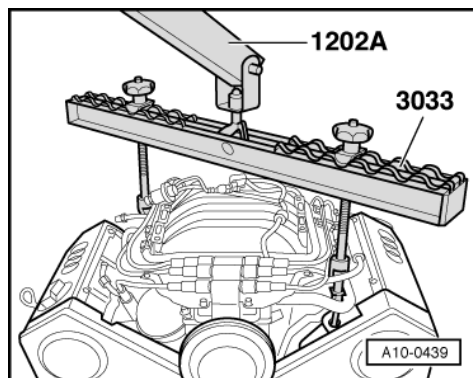
- -> Unscrew engine/gearbox connecting bolts accessible from below -1...3-.



- -> Set up support bar 10-222 A behind gas pressure spring onto wing bolt edge. Spindle is at front.
- Engage gearbox support 3147 in bolt hole in bell housing as shown in the illustration.
- Connect gearbox support 3147 to support bar 10-222 A using lug 2024 A/2. Secure bolt with nut and washer.

Note:

Shown in illustration with engine removed.

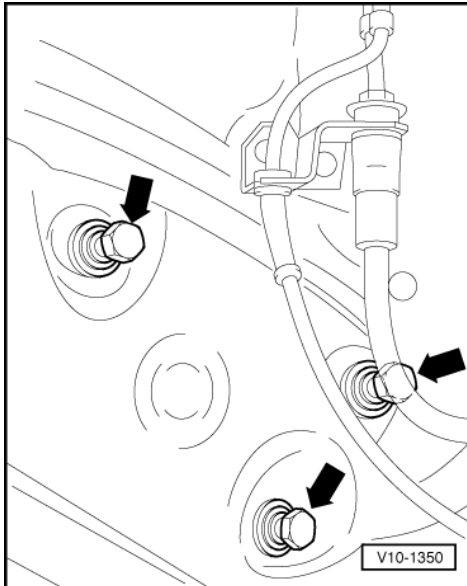


- -> Attach lifting tackle 3033 to engine and workshop crane VAS 6100 or V.A.G 1202 A, as shown in the illustration.
- Slightly raise engine.
- Unscrew last engine/gearbox securing bolt.

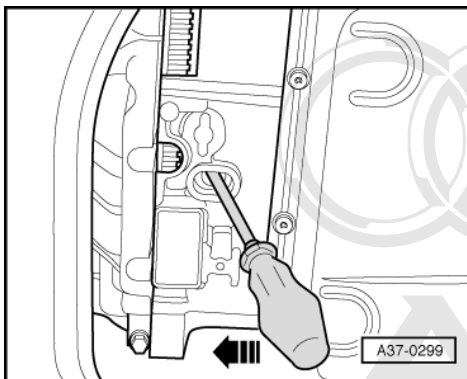
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Note:

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



- Loosen left wheel housing liner at the front.
- -> Unscrew engine console from body on left -arrows-.
- Lift engine over studs of right engine mount.
- Tighten spindle of support bar 10-222 A.



Vehicles with automatic gearbox:

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- -> Push gearbox off engine. At the same time, push torque converter off the drive plate.

All models:

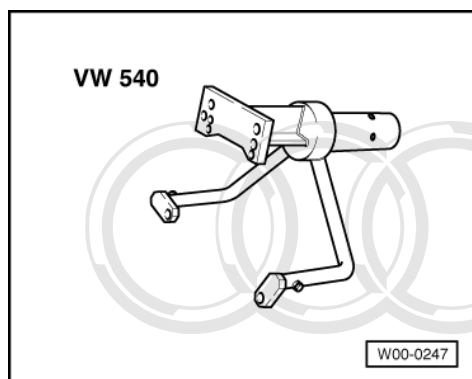
- Pull engine from gearbox and raise it until arm of workshop crane is just below the bonnet.
- Guide the engine carefully while lifting it to avoid damaging bonnet, radiator and lock carrier.

Vehicles with automatic gearbox:

- If necessary, secure torque converter in gearbox with wire to prevent it falling out.

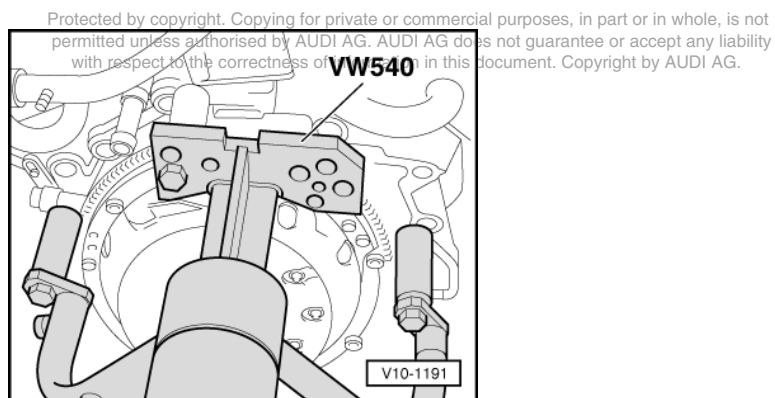


1.3 - Attaching engine to engine stand



Special tools and workshop equipment required

- ♦ Engine and gearbox support VW 540



- -> For work on the engine, attach engine to repair stand using engine mount VW 540 and special tool VW 540/1.

1.4 - Installing

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

Notes:

- ♦ When installing the engine all cable ties must be fitted in the same position.
- ♦ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ♦ Heat insulating sleeves removed during removal of the engine must be refitted in the same position when installing the engine.
 - ♦ When performing installation procedures always replace self-locking nuts and bolts.
 - ♦ Replace seals, gaskets, 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 fitting the engine onto the gearbox ensure that the 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.

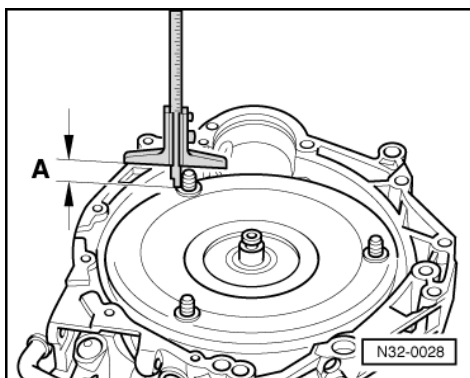
- Check clutch release bearing for wear, renew if necessary.
- If necessary, check that clutch plate is properly centred.
- A needle bearing must be fitted in the flywheel on vehicles with manual gearbox. Install needle bearing if necessary => Page 63.

Vehicles with automatic gearbox:

- Short engines are supplied without bushes in the crankshaft. Before installing the drive plate drive in the bush => Fig. 70.
- To secure torque converter on drive plate only use correct nuts and bolts as specified in parts catalogue (same as original equipment).

=> Parts List

- Secure nuts and bolts of torque converter with special tool Matra V/175.

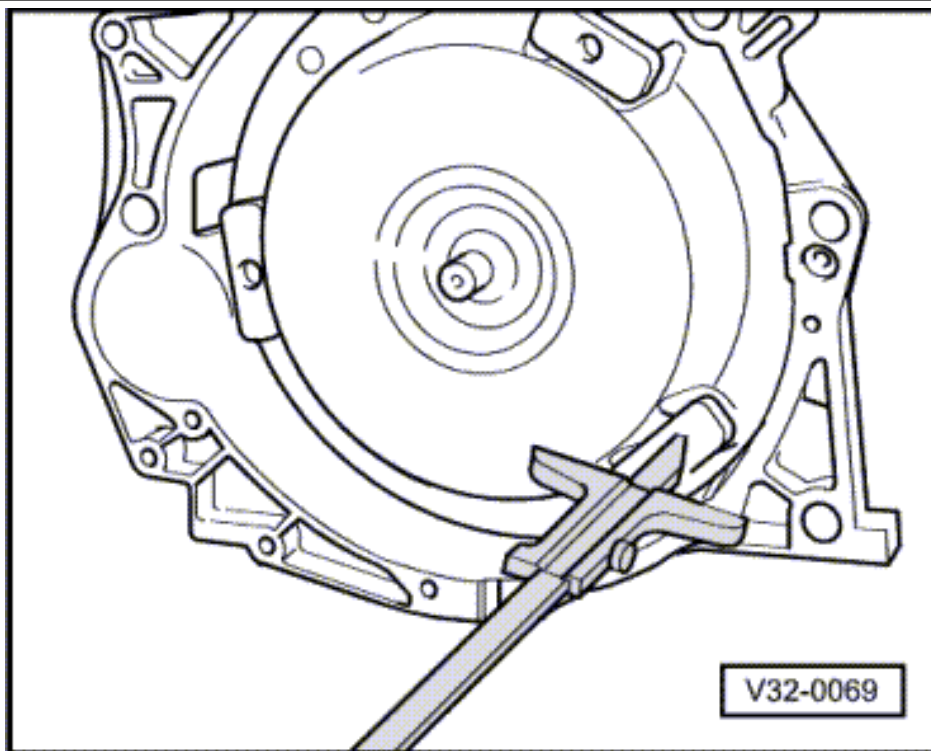


Checking position of torque converter

-> If the torque converter is correctly installed, the distance -A- between the contact surfaces at the bottom of the studs on the torque converter and the contact surface of the torque converter bell housing is about 23 mm. If the torque converter has not been completely inserted, this distance will be approx. 13 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.





Checking the installation dimension of torque converter - Automatic gearbox 01F/01K

-> 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 at least 19 mm.

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

Important

On vehicles with automatic gearbox 01F/01K, continually check that the torque converter behind the drive plate can be turned before and during tightening of bolts at engine/gearbox flange. If the converter cannot be turned, it must be assumed that it has not been installed correctly and the drive plate of the converter or the ATF pump will be damaged during final tightening of bolted connections.

All models:

- Adjust the bracket of the engine speed sender -G28 => Page 64, if the bracket or the flywheel have been loosened.
- Attach gearbox to engine => Page 25 onwards.
- Installing engine mounts free of stress. Ensure that engine mounts are free of stress by shaking engine to align it before tightening engine mounts.
- 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.
- Install alternator => Page 30.
- Install the A/C compressor => Page 28.
- Installing exhaust system and aligning it stress-free => Page 218.
- On vehicles up to 07.91, if the air conditioner compressor has been detached, the alignment of the ribbed belt must be checked => Page 37.
- Install ribbed belt => Page 37.

- Check throttle cable setting

=> Fuel Supply - Petrol Engines; Repair group 20

- Electrical connections and routing:

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

Notes:

- ♦ If the battery is reattached make sure that the vehicle equipment (radio, clock, electrical window lifter) is actuated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Fuel Injection and Ignition System; Repair group 24

- Check oil level => Page 160.
- Top up coolant => Page 166.

Notes:

- ♦ Drained 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 power steering fluid and bleed steering system:

=> Running Gear, FWD and 4WD; Repair group 48; Checking oil level, bleeding steering system, checking for leaks

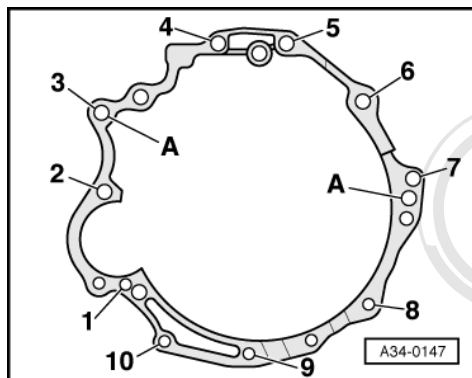
Important

Do not use charging unit for boost starting. There is danger of damaging the vehicle control units.

1.5 - Tightening torques

Notes:

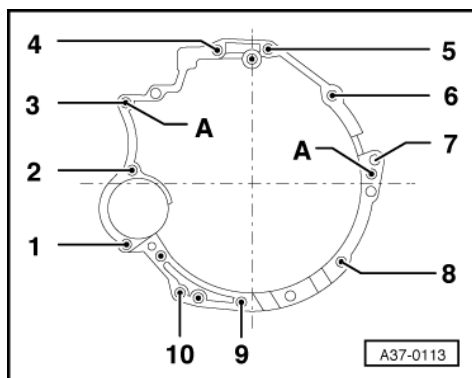
- ♦ The tightening torques listed on this page apply only to lightly greased, oiled, phosphated, or black finished nuts and bolts.
- ♦ Additional lubricant such as engine or gearbox oil may be used, but do not use graphite lubricant.
- ♦ Do not use degreased parts.
- ♦ Tightening torque tolerance $\pm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



-> Engine/gearbox mountings (manual gearbox)

Item	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

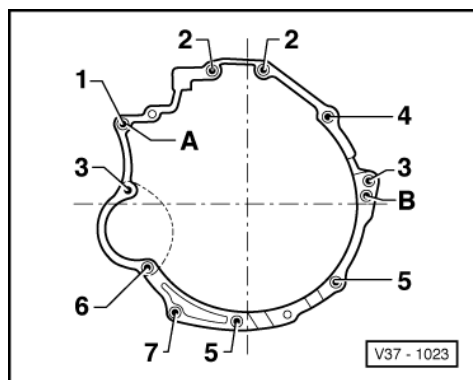


-> Fastening engine to gearbox in vehicles with automatic gearbox 097



Item	Bolt	Nm
1	M12 x 75	65
2	M12 x 110	65
3...5	M12 x 67	65
6	M12 x 80	65
7	M12 x 67	65
8...10	M10 x 45	45

A: Centring sleeves



-> Securing engine to gearbox in vehicles with automatic gearbox 01F/01K

Item	Bolt	Nm
1	M12 x 50	65
2	M12 x 67	65
3	M12 x 80	65
4	M12 x 100	65
5	M10 x 38	45
6	M10 x 80	45
7	M8 x 40	20

A, B: Centring sleeves

Component		Nm
Bolts/nuts	M6	10
	M8	20
	M10	45
	M12	65
Except for the following:		
Drive plate to torque converter	M10 x1	85
Coolant drain plug to cylinder block		20
Alternator to engine	M8	22
	M10	45
Engine console to longitudinal member		45
Engine mounting to engine support		25
ATF line to oil sump		10
A/C compressor to bracket		25
Oil cooler to engine		30

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Buffer for torque reaction support to lock carrier	40
--	----

Component	Nm
Torque rod to engine	42
Power steering pressure line to pressure hose	40
Fuel lines to fuel rail or fuel pressure regulator	25
CCS unit to bracket	15
Air duct to intake manifold	10
Hose clamps for coolant hoses	2



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13 - Crankshaft group

1 - Dismantling and assembling engine

1.1 - Dismantling and assembling engine

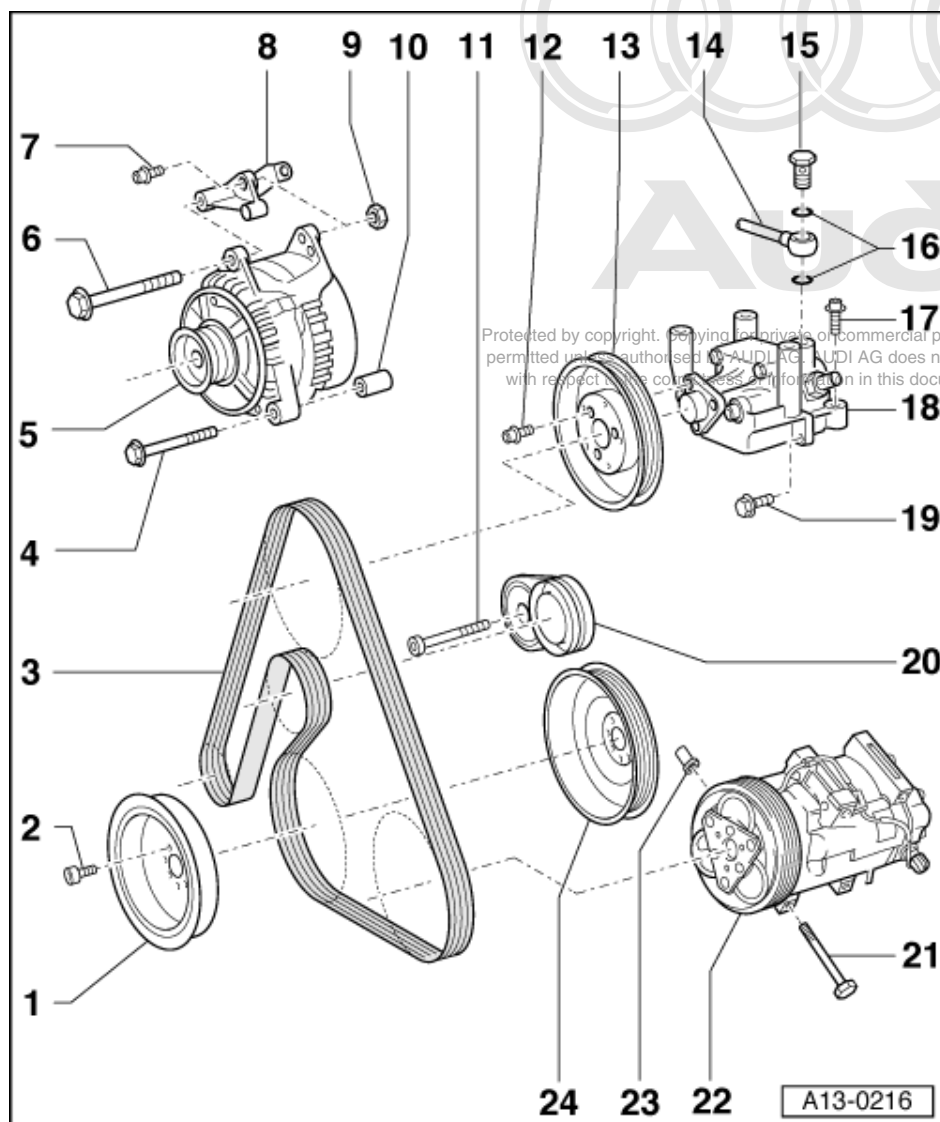
1.2 - Ribbed belt drive for vane pump, alternator and air conditioner

Notes:

- ♦ Mark the running direction with chalk or felt pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage. Ensure that the belt is properly seated in the pulleys when installing.
- ♦ The illustration shows the ribbed belt drive as of 08.94.
- ♦ Ribbed belt routing => Page **37**.
- ♦ On vehicles up to 07.91, if the air conditioner compressor has been detached, the alignment of the ribbed belt must be checked => Page **37**.



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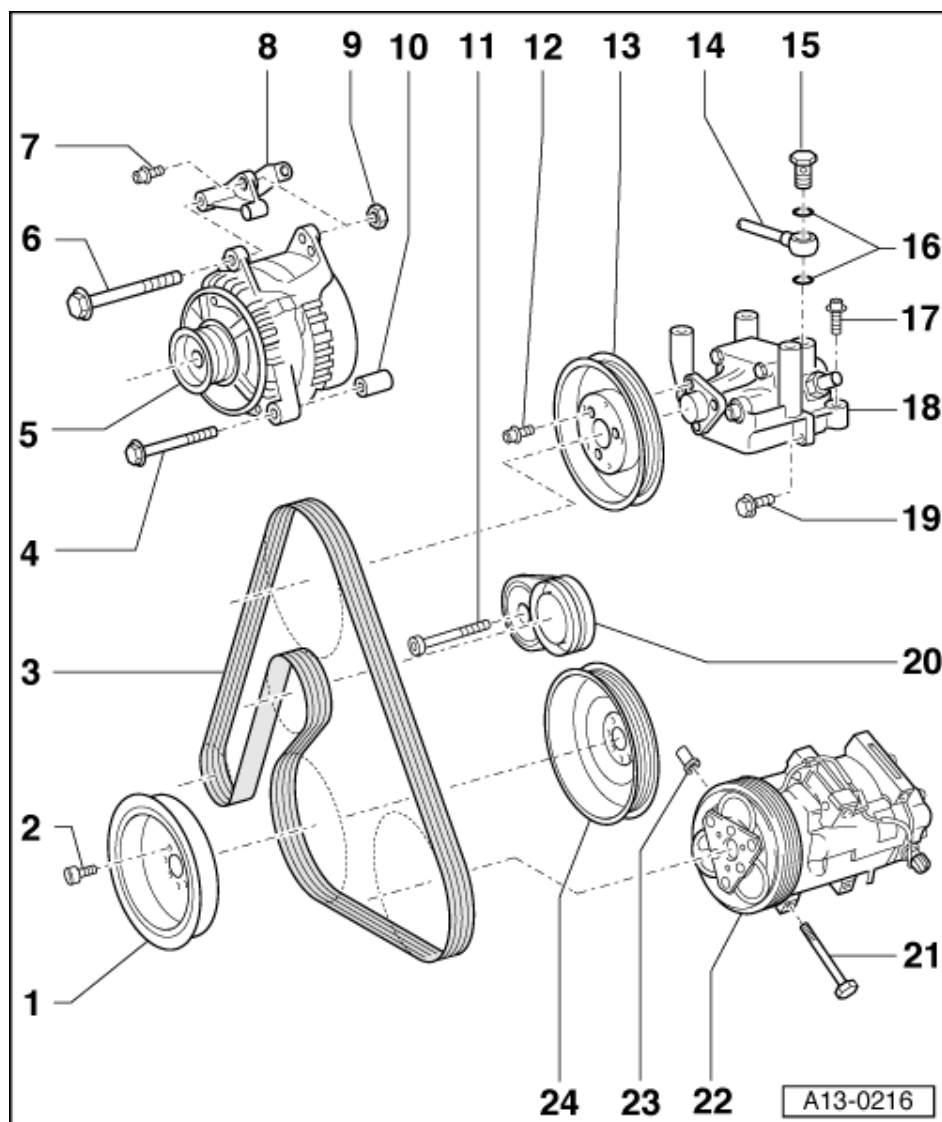
**1 Vibration damper**

- ♦ 2.8 litre engines only
- ♦ Removing and installing
=>Page 39.

2 22 Nm**3 Ribbed belt**

- ♦ Ribbed belt routing on vehicles up to 07.91 =>Fig. 34
- ♦ Ribbed belt routing on vehicles from 08.91 to 07.94 =>Fig. 34
- ♦ Ribbed belt routing on vehicles as of 08.94 => Fig. 34
- ♦ Check for wear
- ♦ Do not kink
- ♦ Removing and installing
=>Page 35.

4 22 Nm

**5 Alternator**

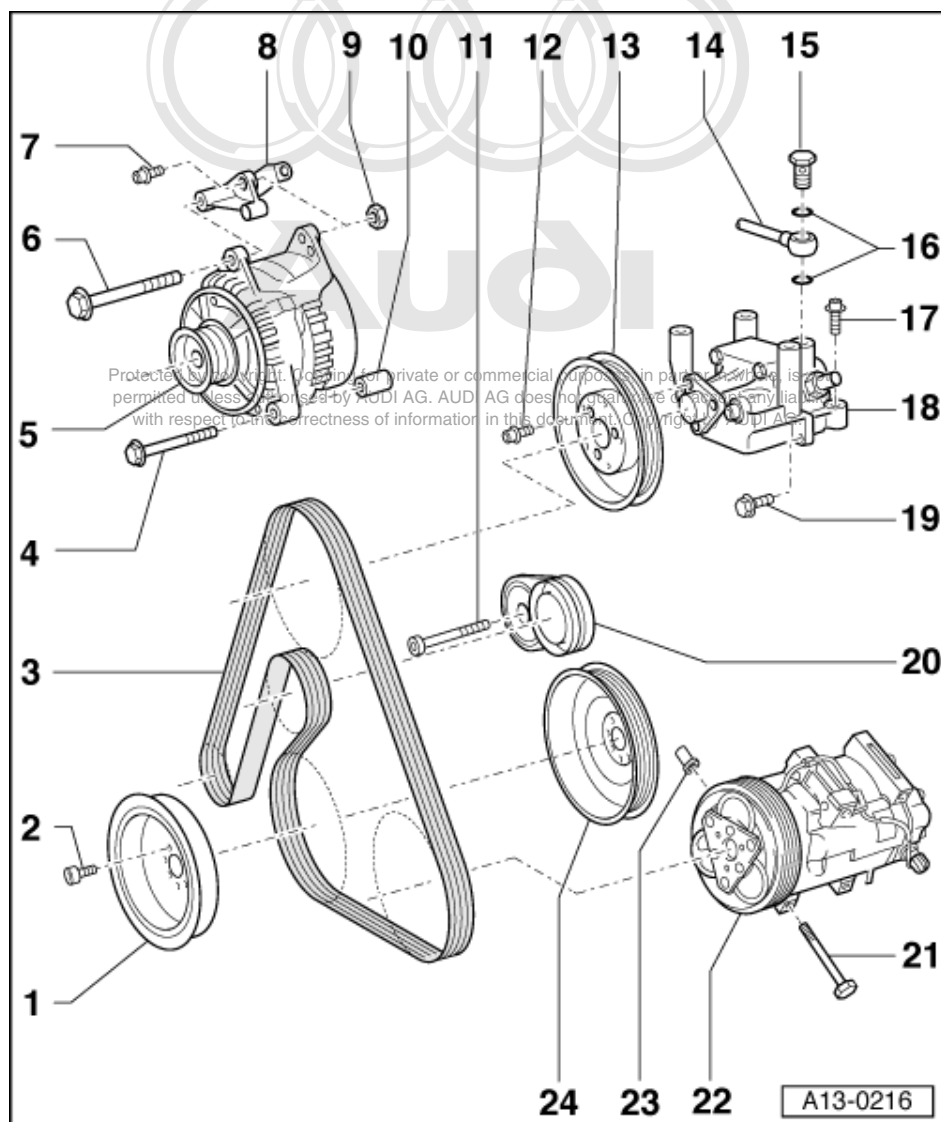
- ♦ Removing:
- Remove rear seat bench.

=> General Body Assembly; Repair group 72

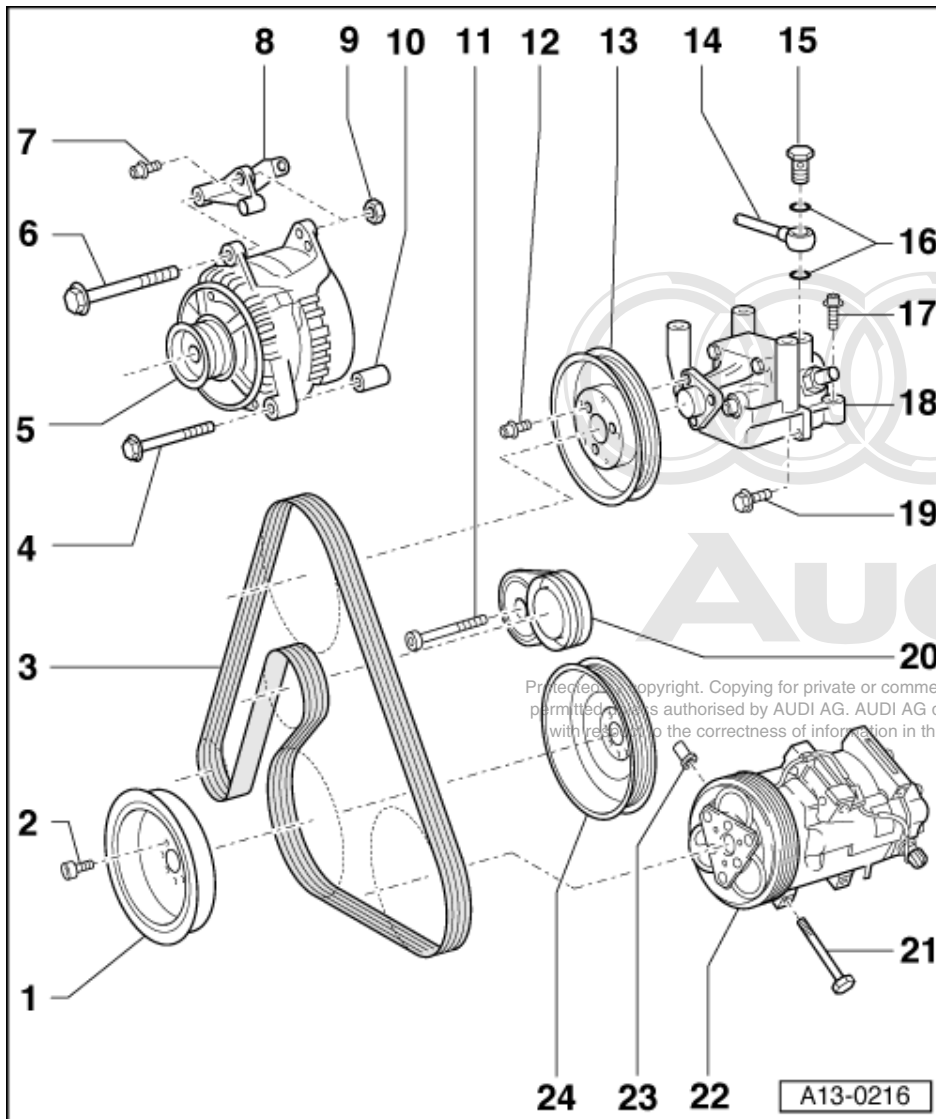
- Disconnect battery earthing strap
- Remove engine cover.
- Remove ribbed belt
=>Page 35.
- Remove noise insulation panel.
- Disconnect air duct between alternator and lock carrier.
- Unscrew earth wire at right engine support.
- Unscrew electrical wire at engine mount and/or oil sump.
- Loosen screwed connections at top and bottom.
- Disconnect wiring from alternator
- Remove alternator



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- 6 45 Nm
 7 22 Nm
 8 **Bracket**
 ♦ For alternator
 9 45 Nm
 10 **Spacer sleeve**
 11 55 Nm
 12 22 Nm
 13 **Belt pulley**
 ♦ For vane pump
 ♦ To remove and install, counterhold with special tool 3212 => Fig. 35



14 Pressure pipe

- ♦ to power steering

15 Banjo bolt - 40 Nm

16 Sealing ring

- ♦ Replace

17 22 Nm

18 Vane pump with bracket

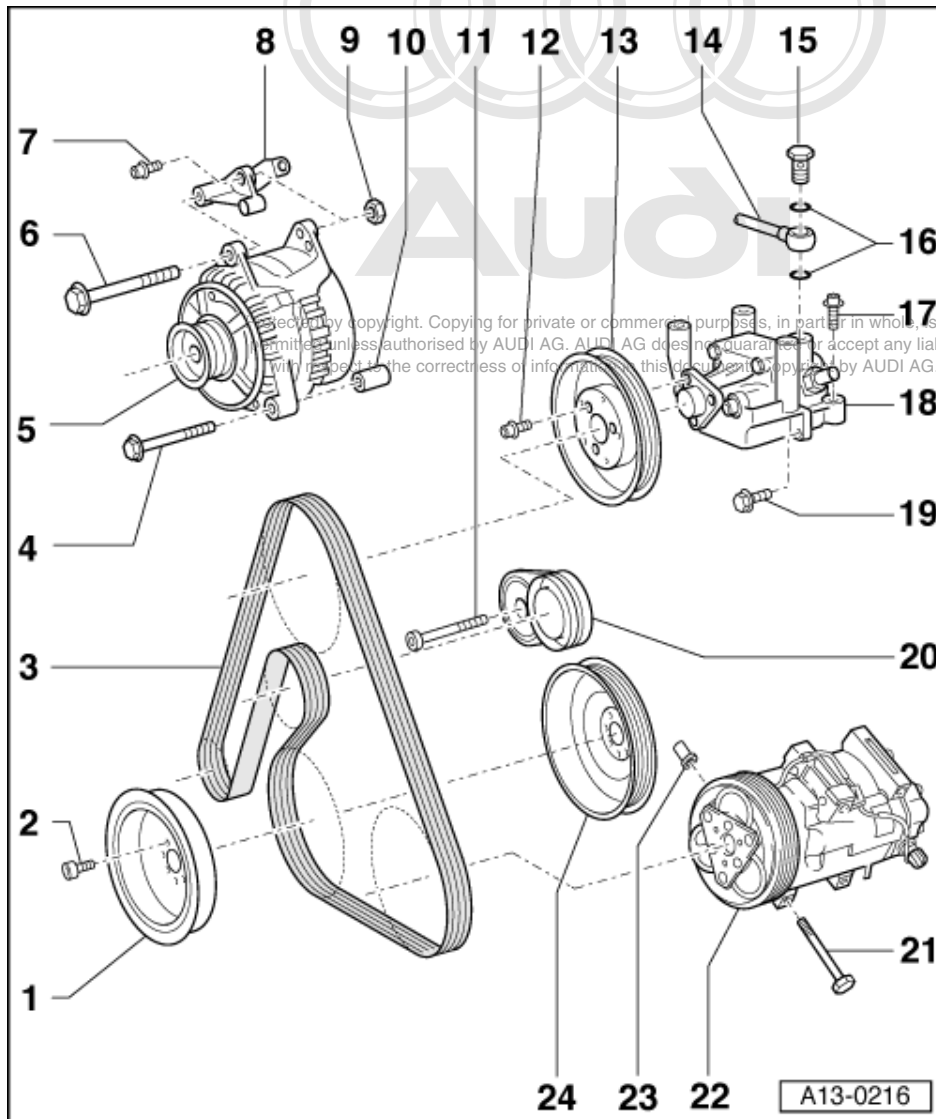
- ♦ For power steering
- ♦ Removing and installing:

=> Running Gear, FWD and 4WD; Repair group 48

19 22 Nm

20 Tensioner for ribbed belt

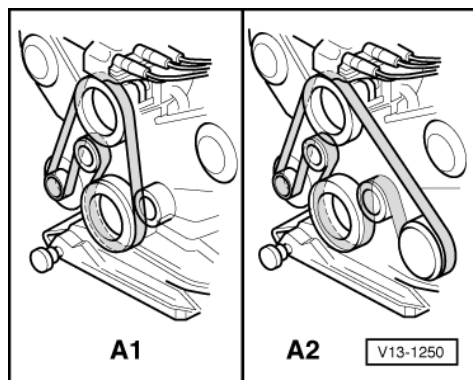
21 25 Nm

**22 Air conditioner compressor**

- ◆ Do not unscrew or disconnect refrigerant hoses or pipes.
- ◆ After removing compressor from mountings, secure to chassis side member with wire or similar. Do not leave compressor suspended on refrigerant hoses.
- ◆ On vehicles up to 07.91, if the air conditioner compressor has been detached, the alignment of the ribbed belt must be checked => Page 37

23 Special nut - 25 Nm**24 Belt pulley**

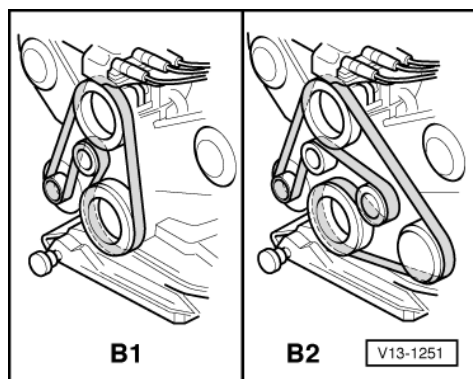
- ◆ For ribbed belt
- ◆ Can only be installed in one position
- ◆ Removing and installing
=>Page 39.



-> Fig.1 Ribbed belt routing on vehicles up to 07.91

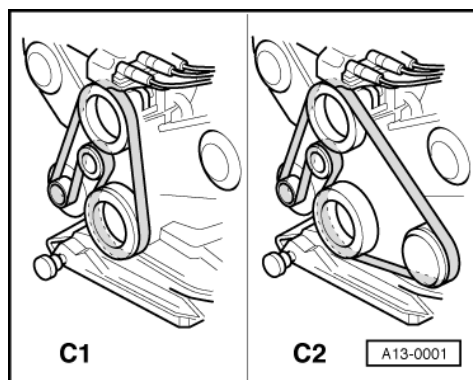
- A1 - without air conditioner
- A2 - with air conditioner

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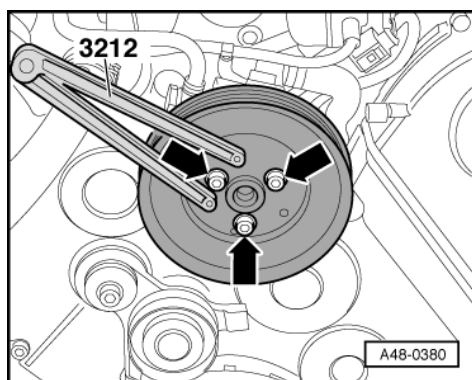
-> Fig.2 Ribbed belt routing on vehicles from 08.91 to 07.94

- B1 - without air conditioner
- B2 - with air conditioner



-> Fig.3 Ribbed belt routing on vehicles as of 08.94

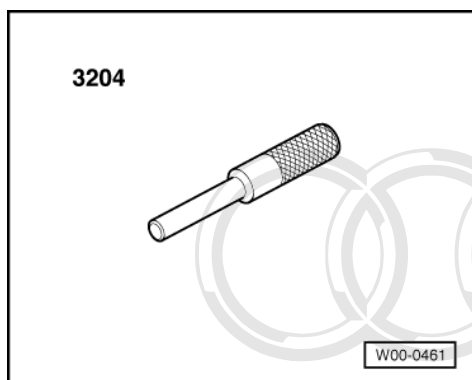
- C1 - without air conditioner
- C2 - with air conditioner



-> Fig.4 Removing and installing pulley for vane pump

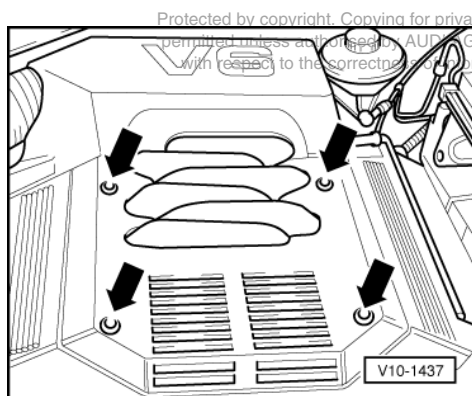
- To remove and install counterhold with 2-hole pin wrench 3212.

1.3 - Removing and installing ribbed belt



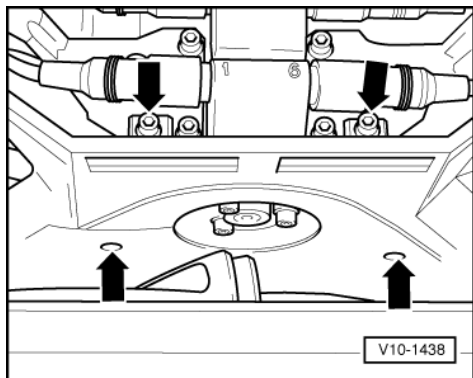
Special tools and workshop equipment required

- ♦ Mandrel 3204



Removing

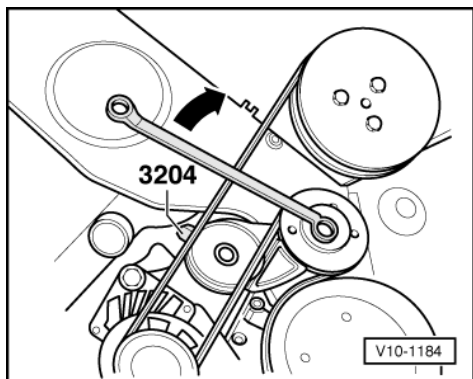
- -> Remove engine cover-arrows-.



- -> Remove ribbed belt cover -arrows-.

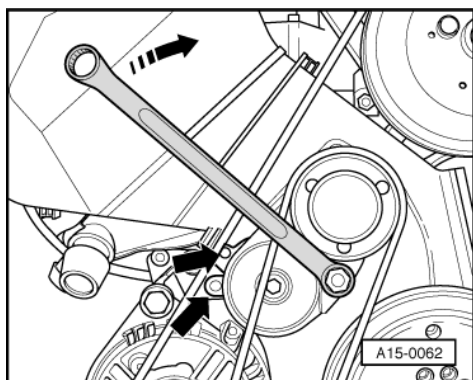
Note:

Mark the running direction with chalk or a felt-tipped pen before removing the ribbed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.



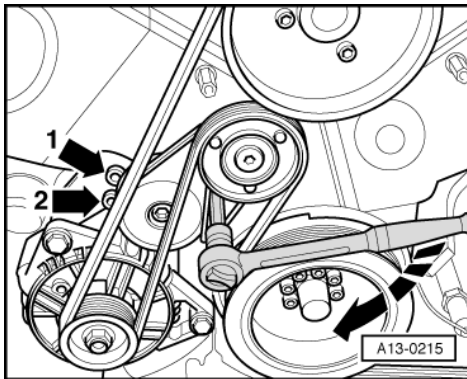
Tensioning roller without hexagon flat:

- -> To slacken ribbed belt, turn tensioner in direction of arrow using ring spanner (15 mm A/F).
- Insert mandrel 3204 into securing holes to lock tensioner in position.
- Remove ribbed V-belt.



Tensioning roller with external hexagon:

- -> To slacken ribbed belt, turn tensioner in direction of arrow using ring spanner (17 mm A/F).
- Insert mandrel 3204 into holes -arrows- to stop tensioner from turning.
- Remove ribbed V-belt.



Tensioning roller with hexagon socket:

- -> To slacken ribbed belt, turn tensioner in direction of arrow using Allen key (10 mm A/F).
- Insert mandrel 3204 into holes -1- and -2- to stop tensioner from turning.
- Remove ribbed V-belt.

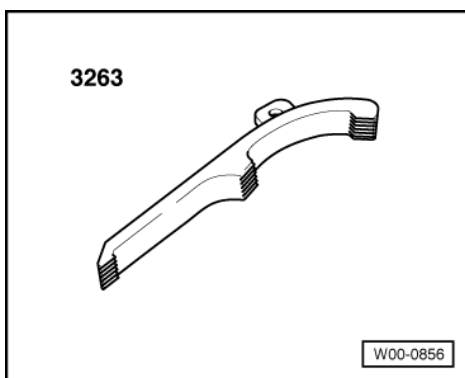
Installing

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

Notes:

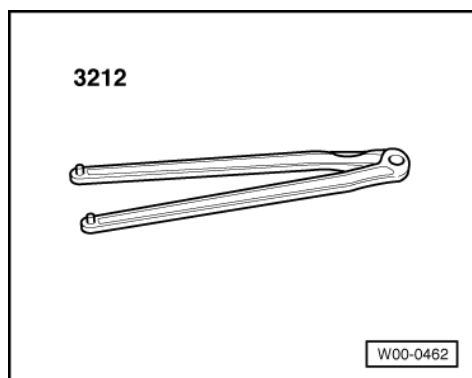
- ◆ Before fitting the ribbed belt ensure that all mechanical units (alternator, air conditioner compressor, vane pump) are tight.
- ◆ Ensure that the ribbed belt is properly seated on the pulleys when installing.
- First place ribbed belt over crankshaft pulley. Then push belt onto tensioning roller.
- Check that ribbed belt is properly seated.
 - Ribbed belt routing => Fig. 1, Page 2 and Fig. 3
- Start engine and check belt running.

1.4 - Checking alignment of ribbed belt - Vehicles up to 07.91

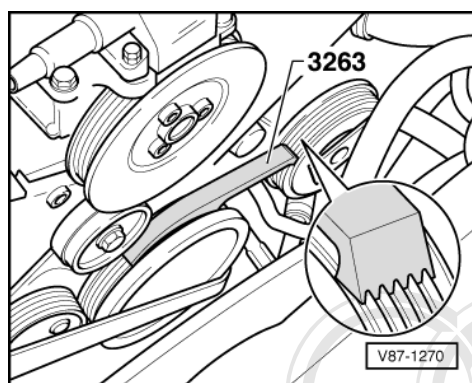


Special tools and workshop equipment required

- ◆ Alignment gauge 3263



♦ Pin wrench 3212



Note:

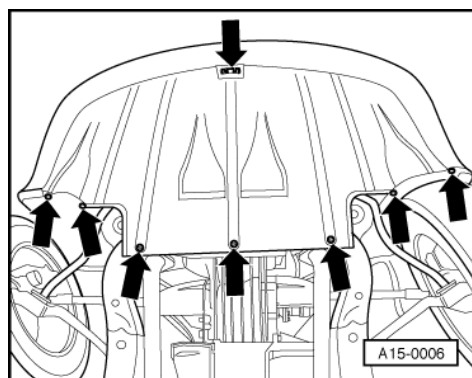
Check alignment of ribbed belt between vibration damper, crankshaft and air conditioner compressor to avoid the ribbed belt being damaged.

Test sequence

- Ribbed belt must be removed =>Page 35 .
- -> Place alignment gauge 3263 on the ribbed belt pulley of the vibration damper as shown in the illustration.
- The ribbed belt pulley of the vibration damper must align with the ribbed belt pulley of the air conditioner compressor

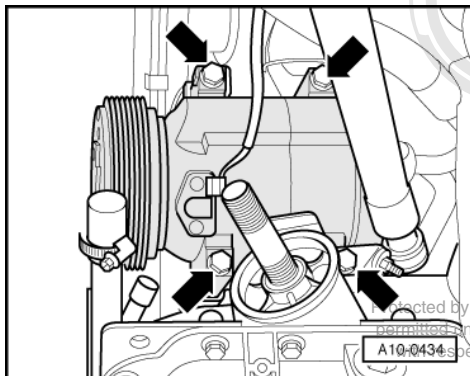
Note:

Misalignment of more than 0.4 mm causes belt wear and noise.



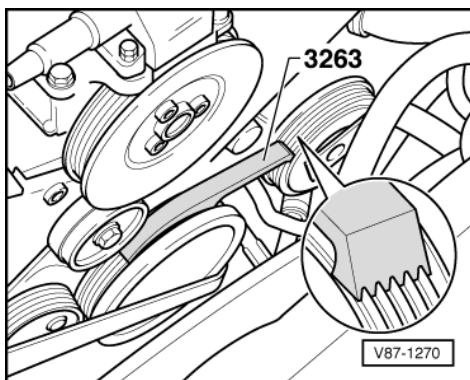
If the misalignment exceeds 0.4 mm:

- -> Remove the noise insulation -arrows-.



Important
The air conditioner refrigerant circuit must not be opened.

- -> Loosen the securing bolts -arrows- of the air conditioner compressor by a few turns.



- -> Move the air conditioner compressor until alignment gauge 3263 can be inserted in the grooves of the air conditioner compressor.
- Retighten the securing bolts on the air conditioner compressor.

Tightening torque

Component	Nm
A/C compressor to bracket	25

1.5 - Removing and installing vibration damper/pulley

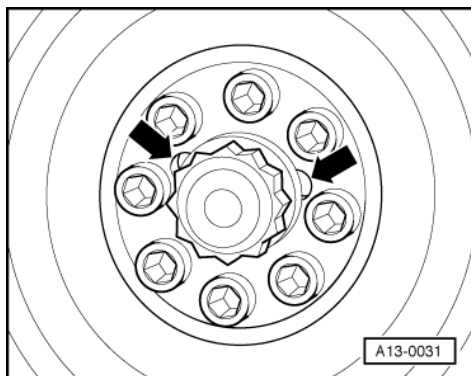
Removing

- Ribbed belt must be removed =>Page 35 .
- Unbolt vibration damper/pulley.



Note:

To loosen and tighten the vibration damper/pulley counterhold with ring spanner on central bolt.



Installing

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

- -> When installing ensure that the notches -arrows- in the vibration damper are aligned with the locking lugs on the toothed belt sprocket.

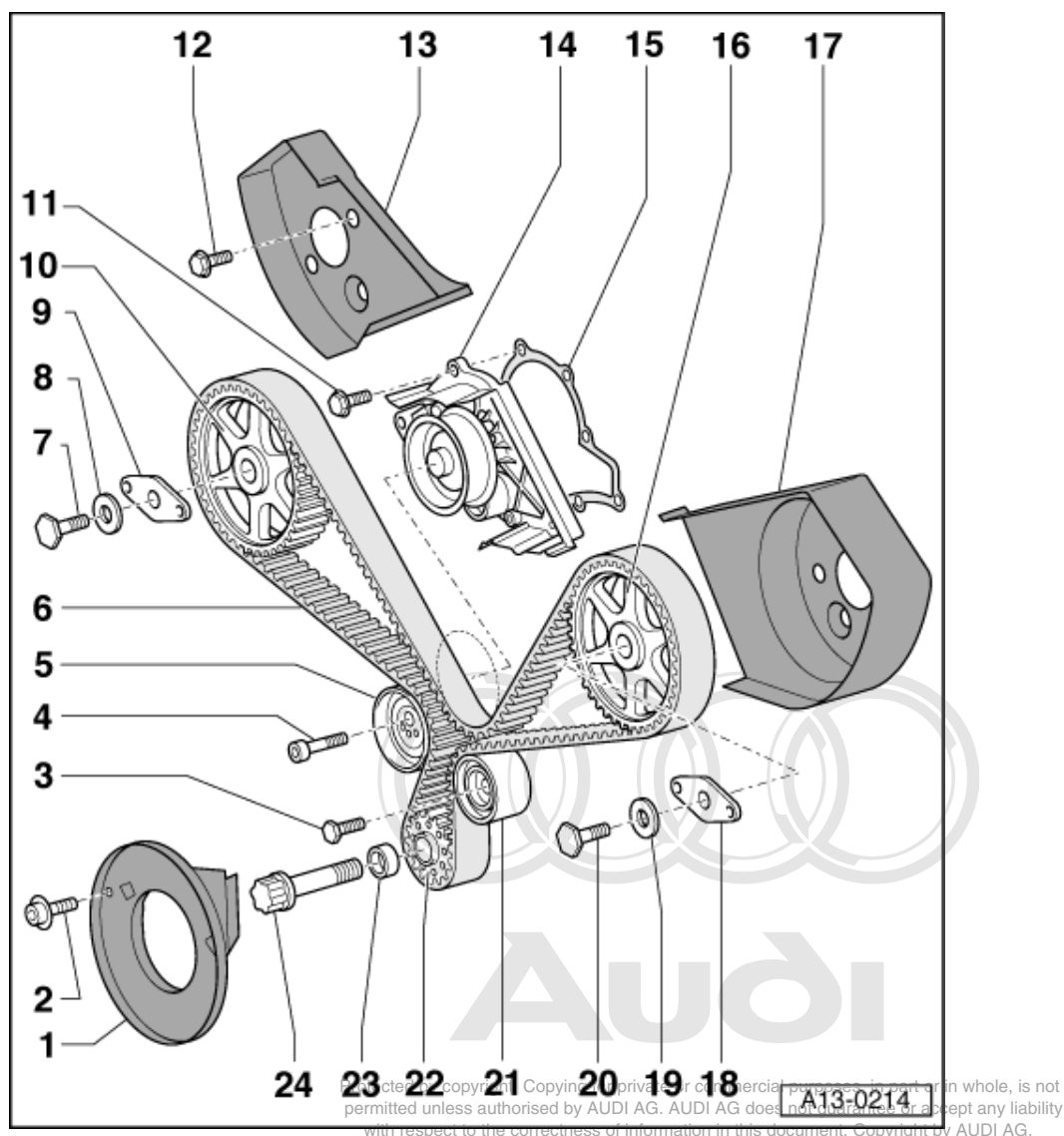
Tightening torque

Component	Nm
Vibration damper/pulley to crankshaft	22



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1.6 - Toothed belt drive

**Note:**

Mark the running direction with chalk or felt pen before removing the toothed belt. If the belt runs in the opposite direction when it is refitted, this can cause breakage.

1 Toothed belt guard - lower

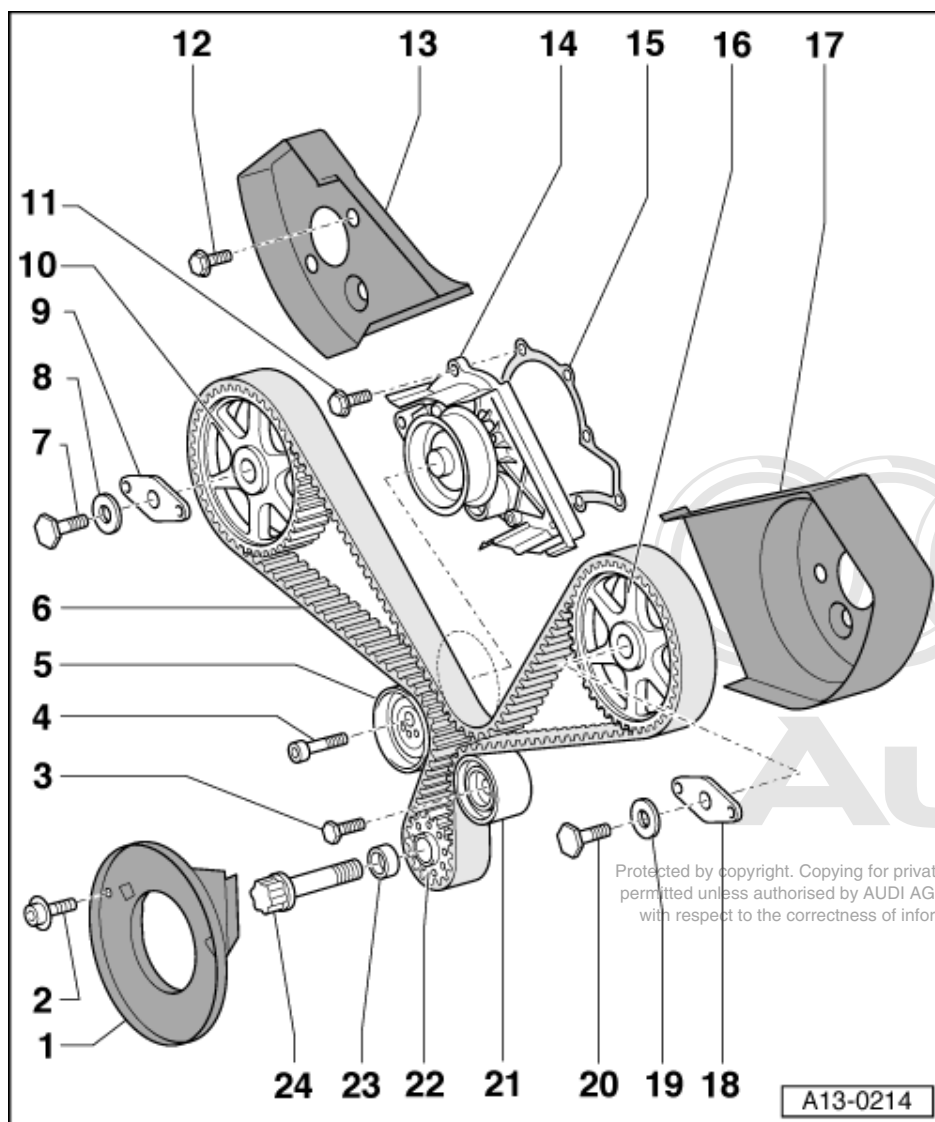
- ♦ To remove, unbolt vibration damper/pulley => Page 39

2 10 Nm

3 M8 - 22 Nm
M10 - 43 Nm

4 M8 - 22 Nm
M10 - 43 Nm

5 Tensioning roller



6 Toothed belts

- ♦ Mark running direction with chalk or felt pen before removing
- ♦ Check for wear
- ♦ Removing => Page 46
- ♦ Install (adjust valve timing) => Page 49 .

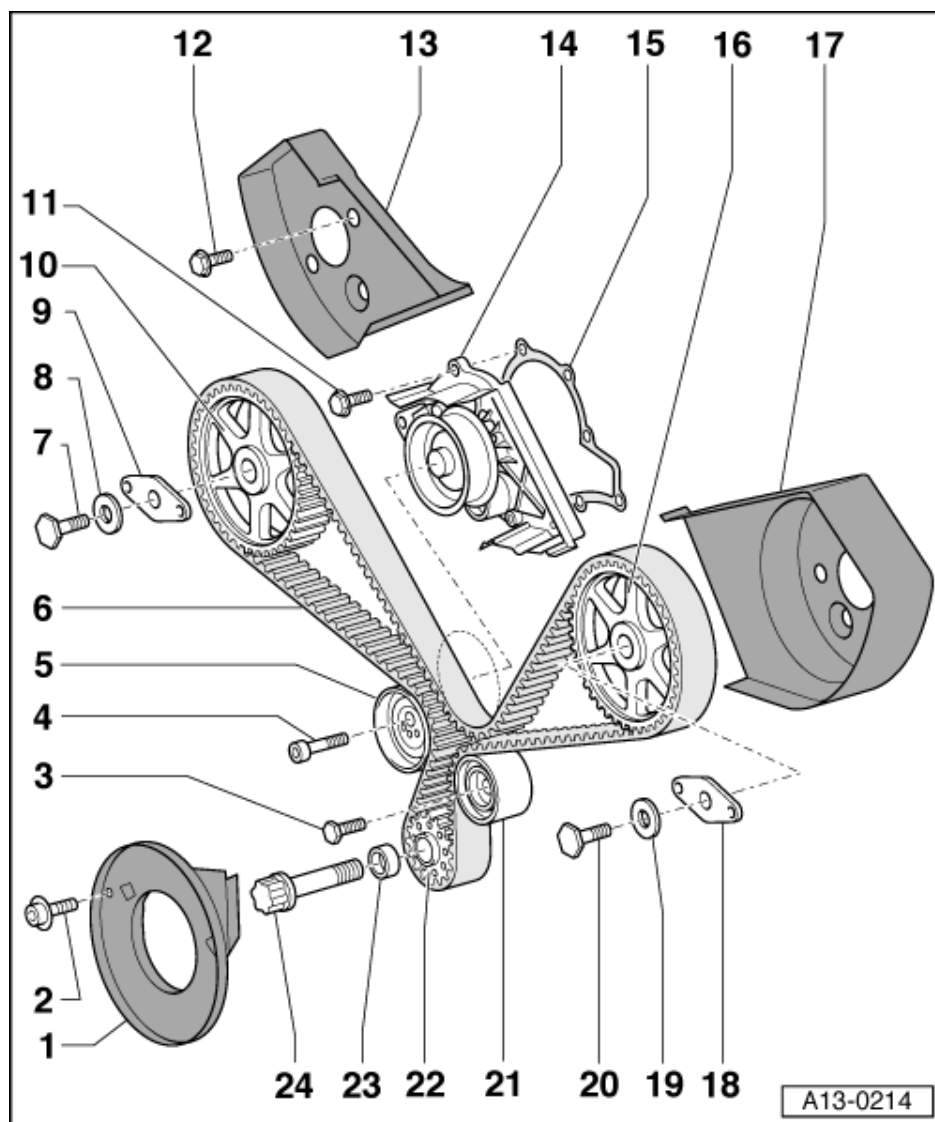
7 70 Nm

- ♦ Replace

8 Washer

9 Fixing plate

- ♦ labelled side "front vorne" points forwards
or
- ♦ labelled side "rear hinten" points backwards

**10 Right camshaft sprocket**

- ♦ To remove and install, remove toothed belt (from camshaft sprockets only) => Page 46
- ♦ Detach with special tool T40001

11 10 Nm**12 10 Nm**

- ♦ Install using locking compound
- ♦ Locking compound

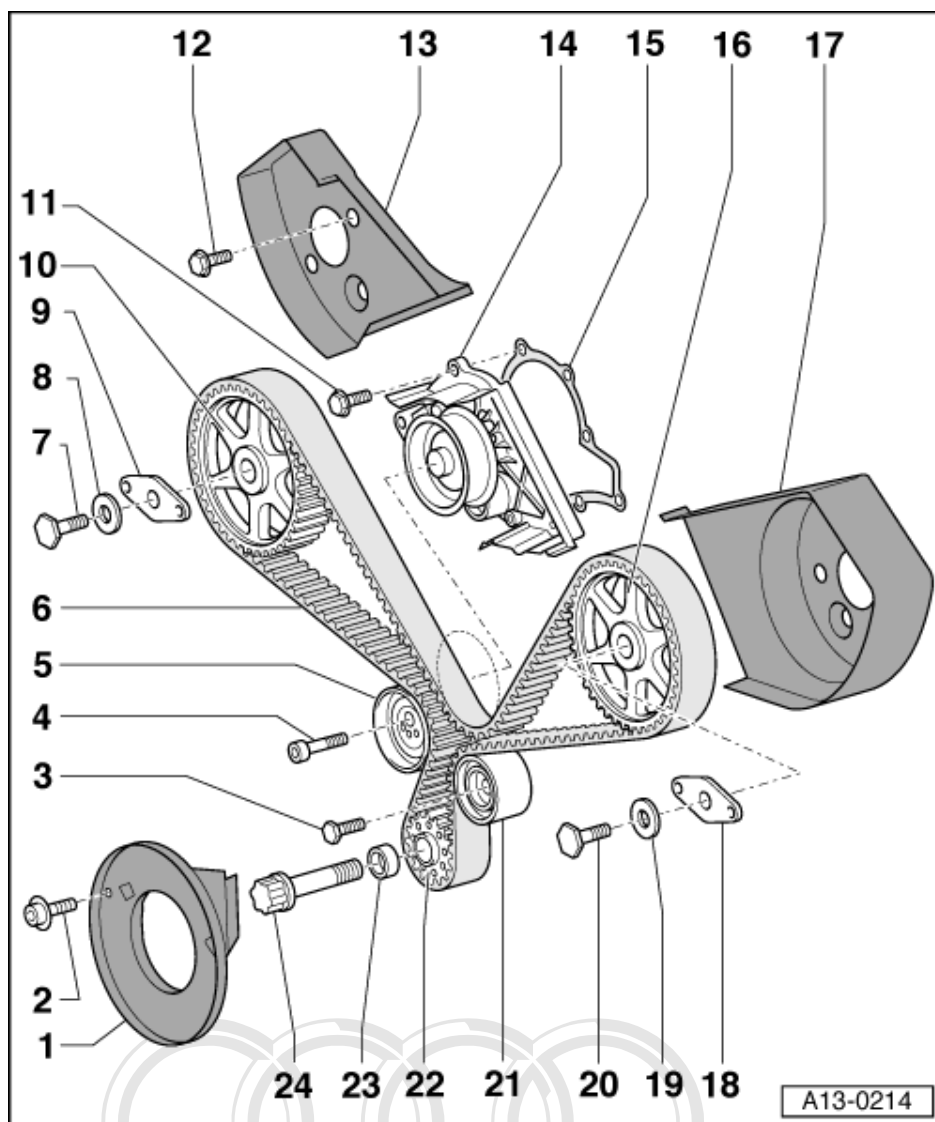
=> Parts List

13 Toothed belt guard, rear right**14 Coolant pump**

- ♦ Removing and installing
=> Page 169

15 Gasket

- ♦ **Replace.** Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. This document is 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.

**16 Left camshaft pulley**

- ♦ To remove and install, remove toothed belt (from camshaft sprockets only) => Page 46
- ♦ Detach with special tool T40001

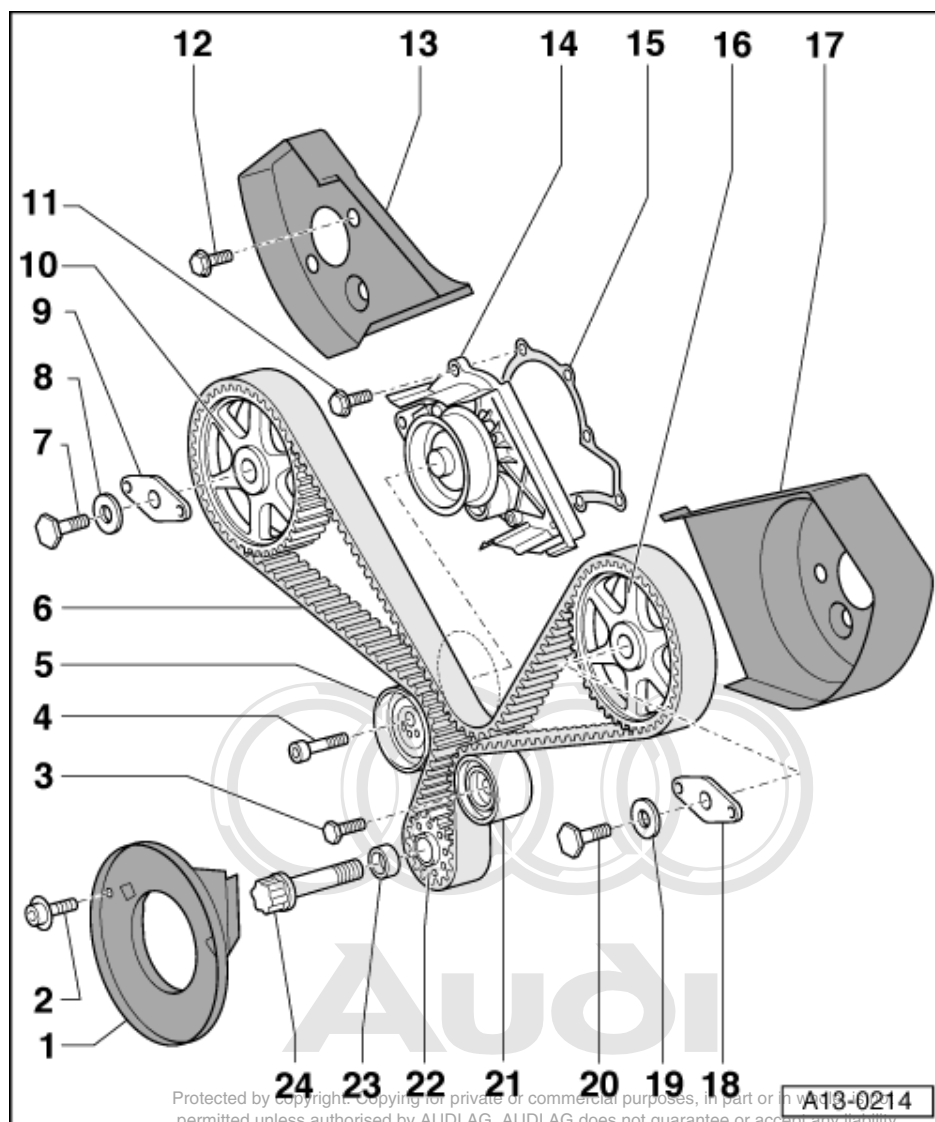
17 Toothed belt guard, rear left**18 Fixing plate**

- ♦ labelled side "front vorne" points forwards or
- ♦ labelled side "rear hinten" points backwards

19 Washer**20 70 Nm**

- ♦ Replace

21 Idler roller



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22 Crankshaft sprocket

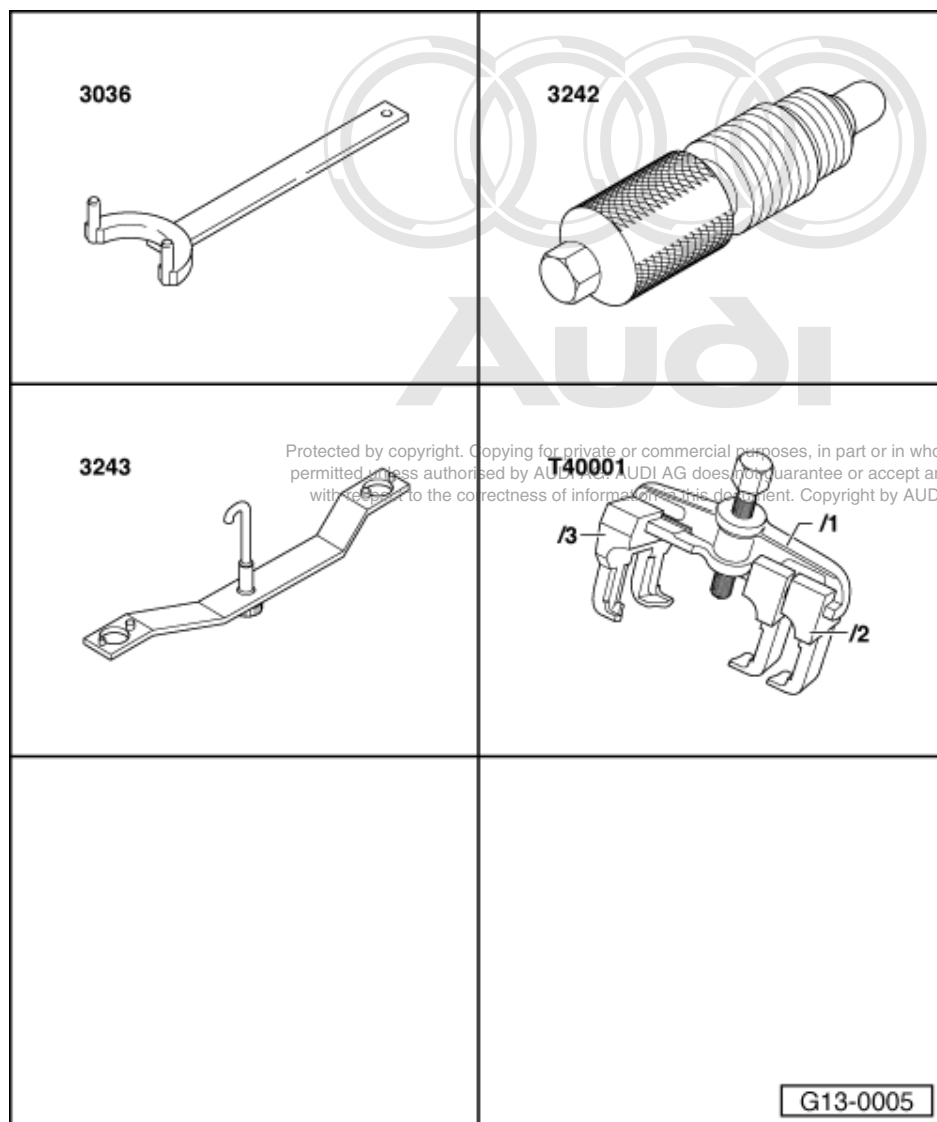
- ◆ Contact surface between sprocket and crankshaft must be free of oil
- ◆ Can only be installed in one position

23 Spacer

24 200 Nm + 1/2 turn (180°) further

- ◆ Replace
- ◆ Do not use additional oil
- ◆ Use clamping bolt 3242 to loosen and tighten
- ◆ Screwing in clamping bolt 3242 => Page 57

1.7 - Removing and installing toothed belt



Special tools and workshop equipment required

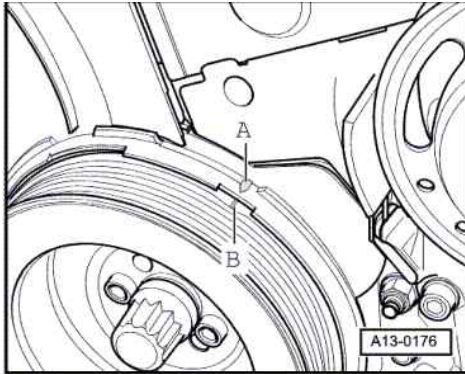
- ♦ Holding tool 3036
- ♦ Clamping bolt 3242
- ♦ Special tool 3243
- ♦ Special tool T40001 with claws T40001/2

Removing toothed belt

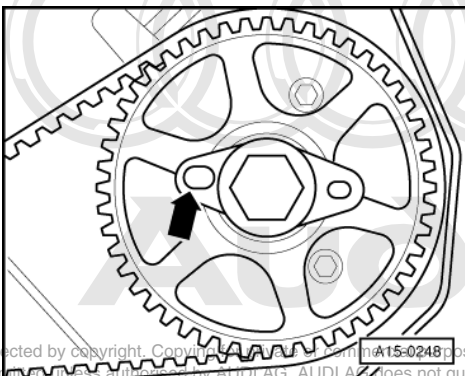
- Engine in vehicle
- Remove ribbed belt => Page 35 .
- Remove tensioner for ribbed belt.
- Remove left and right toothed belt guard.
- Mark running direction of belt with chalk or felt pen.

Note:

The belt can break if it runs in the opposite direction when refitted.

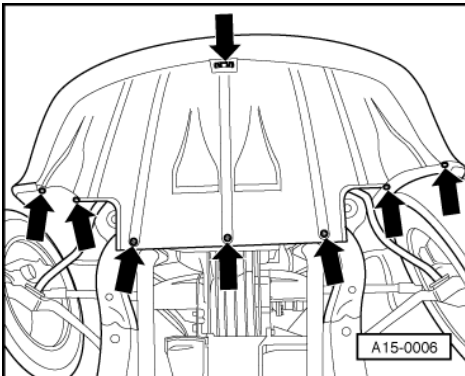


- Set crankshaft to TDC marking of No. 1 cylinder, by turning at central bolt of crankshaft toothed belt sprocket in direction of engine rotation.
- -> Notch -B- opposite mark -A-



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- Check the position of the camshafts.
- -> The large holes -arrow- for the fixing plates at the camshaft sprockets must face each other inwards
- Otherwise turn crankshaft one revolution further.



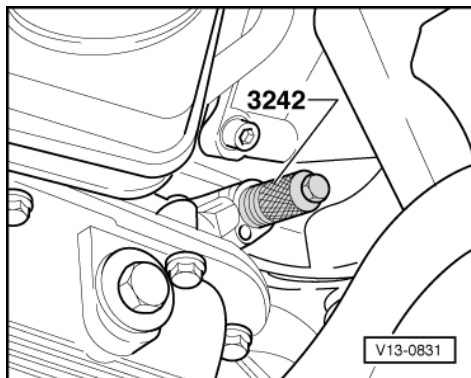
- -> Remove the noise insulation -arrows-.
- Unscrew ignition timing sender -G4 from the cylinder block on the left.

Note:

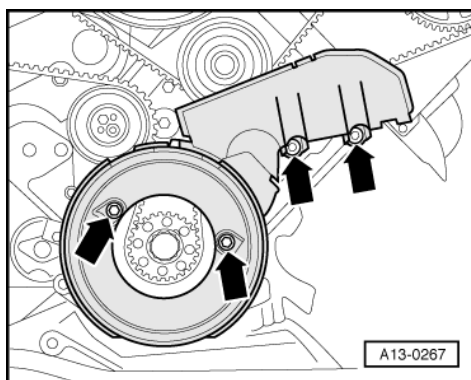
TDC hole is located exactly behind the sender in the crankshaft (can be felt).

Important

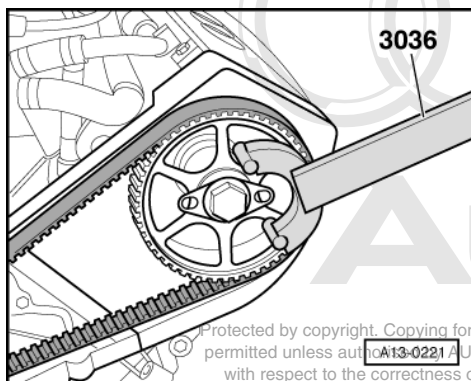
Do not rotate the crankshaft whilst feeling for the TDC hole with your finger - risk of injury.



- -> Screw clamping bolt 3242 into the hole of the removed sender and tighten.
- Remove vibration damper/pulley => Page 39 .



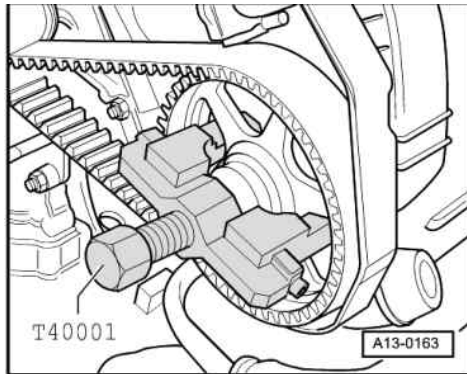
- -> Unbolt lower and lower left toothed belt guard -arrows-.



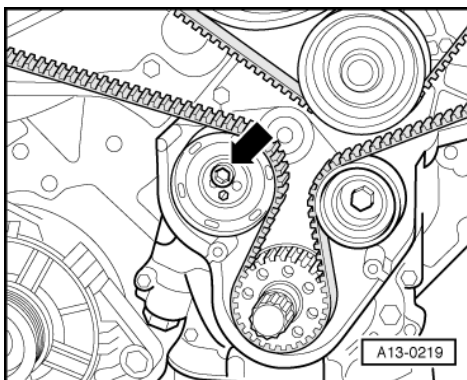
- -> Loosen bolts on both camshaft sprockets, using special tool 3036 as a brace.

Note:

Loosen bolts but do not remove.



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



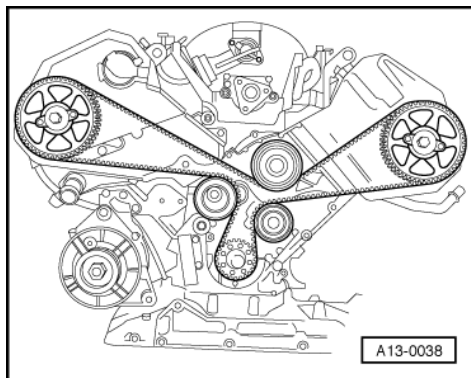
- -> Unscrew bolt -arrow- of tensioning roller.
- Remove toothed belt.

Installing (adjusting valve timing)

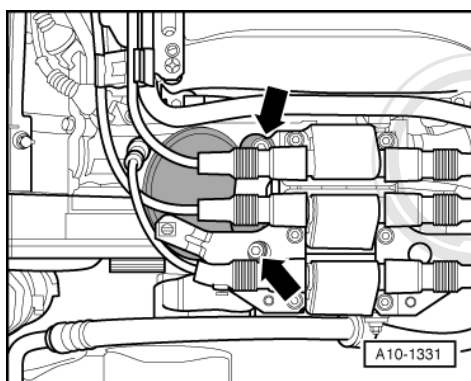
Notes:

- ♦ When turning the camshaft, the crankshaft must not be at TDC at any cylinder. Danger of damage to valves/ piston crown.
- ♦ After repairs, the valve timing must be adjusted as described below, even if the toothed belt has only been taken off the camshaft sprocket:
- Crankshaft held in position with clamping bolt 3242.
- Camshaft sprockets are able to turn.
- Fit new bolts for camshaft sprockets.
- Attach both camshaft sprockets with fixing plates, washers and bolts.
 - Installation position of fixing plates:
labelled side "front vorne" points forwards
or
labelled side "rear hinten" points backwards
- Tighten the two camshaft sprocket bolts until the sprockets can still just be turned, but do not move axially.

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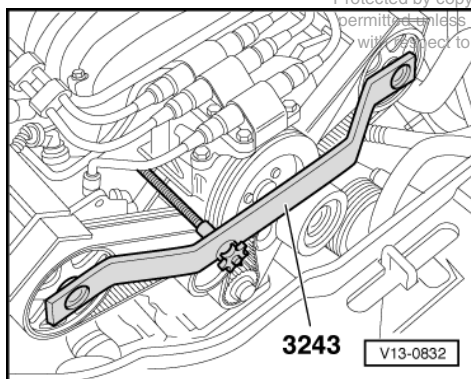


- -> Place toothed belt, as shown in the illustration, on all wheels, lastly on the tensioning roller.

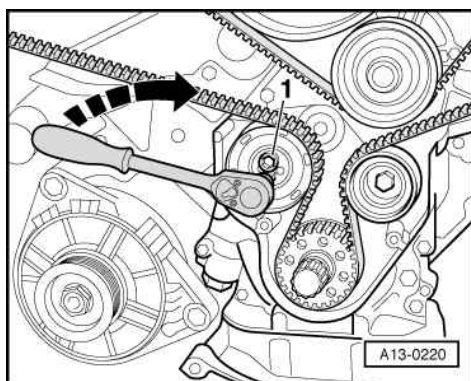


- -> Unscrew bolts -arrows- and detach vacuum unit.
- Detach vacuum hose from vacuum unit.

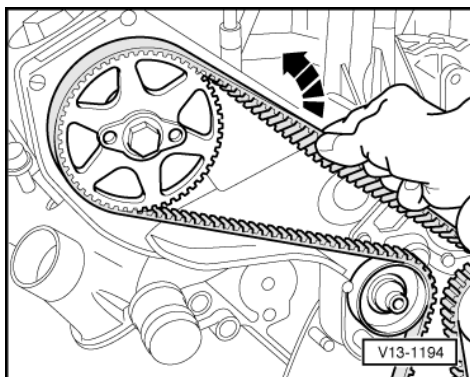
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- -> Insert camshaft retainer 3243.



- -> Turn toothed belt tensioning roller in direction of arrow using 8 mm Allen key.
- Tighten bolt -1- of toothed belt tensioning roller using second 8 mm Allen key.
 - M8 tightening torque: 22 Nm
 - M10 tightening torque: 43 Nm



- Check tension of toothed belt between right camshaft sprocket and coolant pump:
 - -> It should still be possible to turn the toothed belt approx. 90° centrally between camshaft sprocket and coolant pump with thumb and index finger.
- Tighten the camshaft sprockets to 30 Nm.
- Remove camshaft retainer 3243.
- Finally tighten the camshaft sprockets (to 70 Nm). Counterhold with counterhold tool 3036.
- Remove clamping bolt 3242.
- Installing vibration damper/pulley => Page 39
- Screw ignition timing sender -G4 into cylinder block with new O-ring.
- Install ribbed belt => Page 37.

Tightening torques

Component	Nm
Toothed belt tensioning pulley M8	22
M10	43
Camshaft sprocket to camshaft	70 1)
Lower section of toothed belt guard to cylinder block	10
Lower left toothed belt guard to cylinder block	22
Ignition timing sender in cylinder block	10
Vibration damper/pulley to crankshaft sprocket	22
Ribbed belt tensioner to cylinder block	55

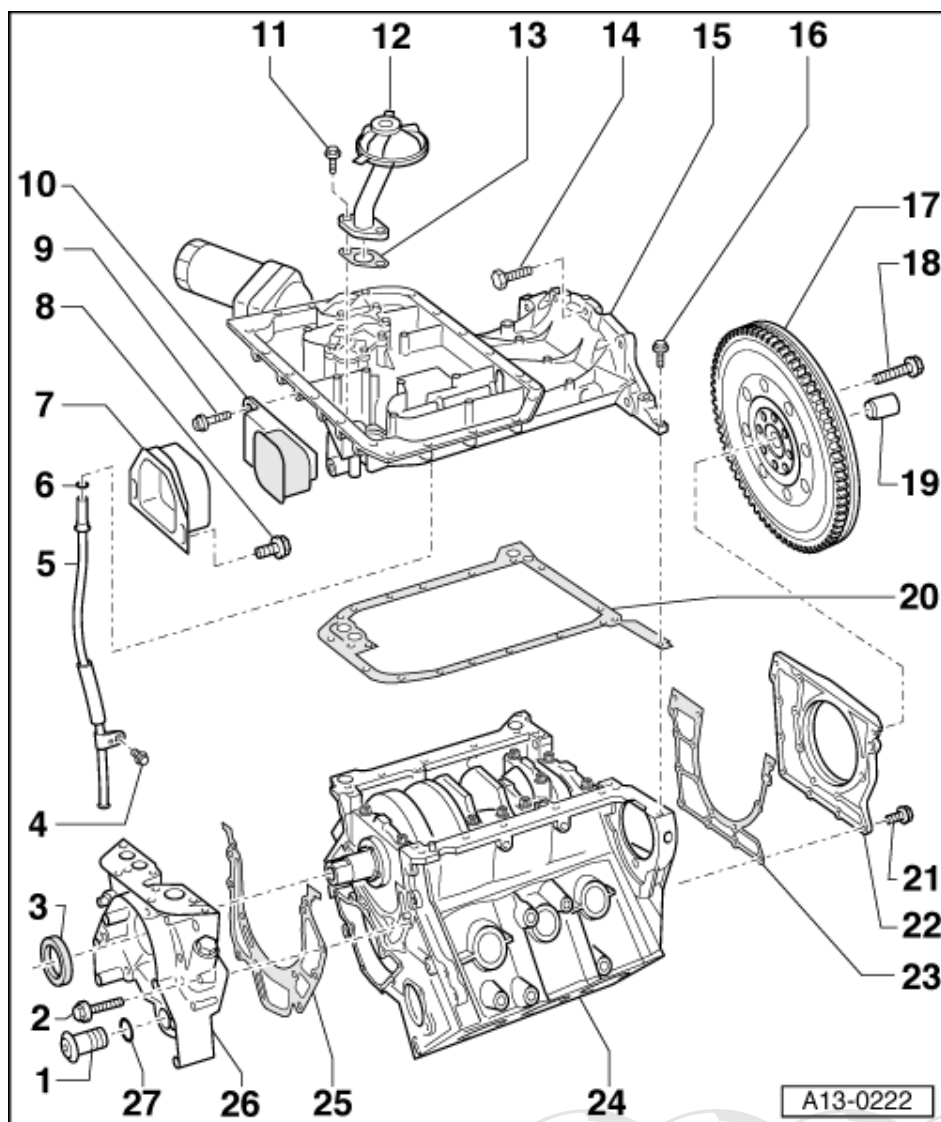
- 1) Replace bolt

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

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

Notes:

- ♦ The illustration showing engine generation I version is representative of both engine generations.
- ♦ Attention is drawn in the text to components relating to engine generation II. For further information on the engine generations refer to => Page 132 onwards.
- ♦ For repairs to the clutch:

**1 Screw plug/spray nozzle valve**

- ♦ Screw plug - 30 Nm
only for engine generation I
- ♦ Spray nozzle valve - 40 Nm
only for engine generation II

2 10 Nm**3 Sealing ring**

- ♦ For crankshaft
- ♦ Removing and installing
=>Page 57.

4 10 Nm**5 Guide tube for oil dipstick****6 O-ring**

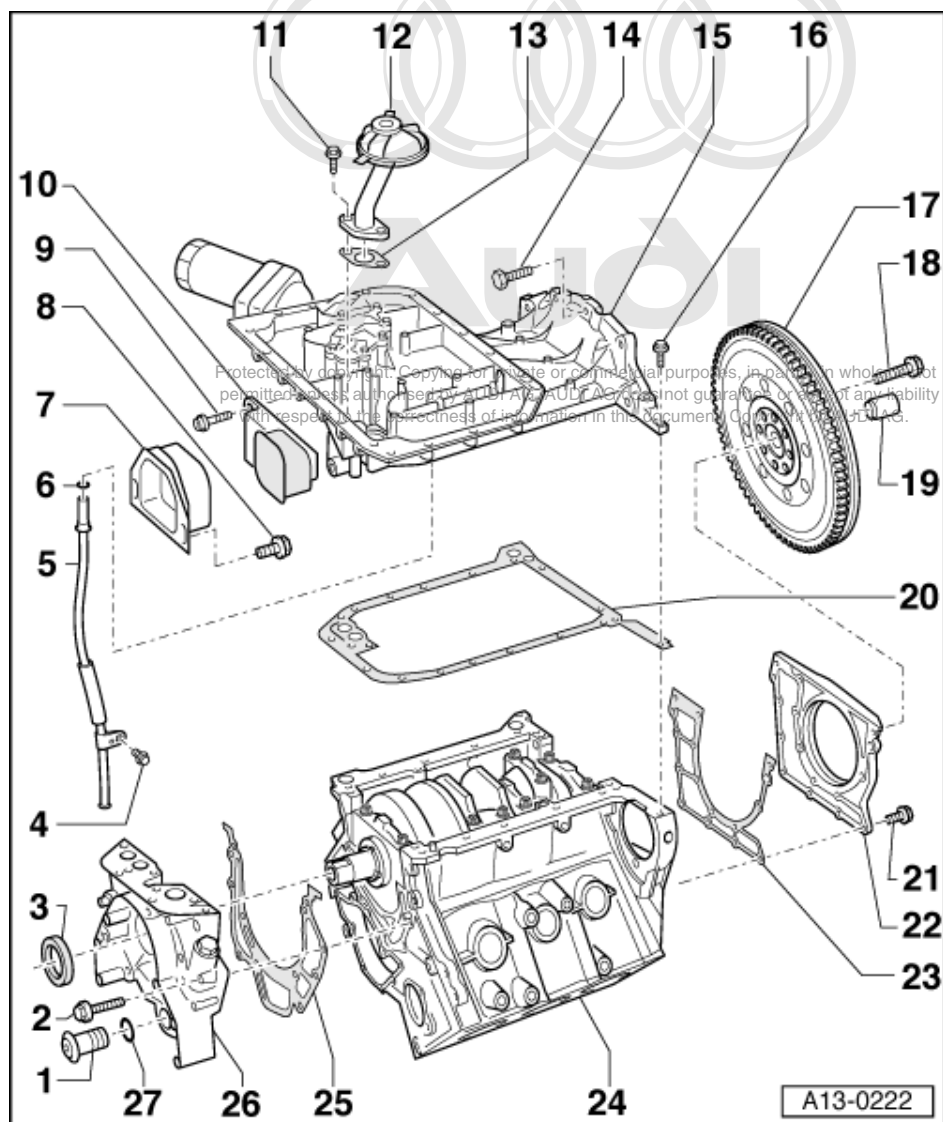
- ♦ Replace

7 Stop plate

- ♦ For torque reaction support

8 40 Nm

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9 42 Nm

10 Torque reaction support

11 10 Nm

12 Suction pipe

- ♦ with inlet connection
- ♦ only for engine generation I

13 Gasket

- ♦ Replace
- ♦ only for engine generation I

14 M8 - 25 Nm

M10 - 45 Nm

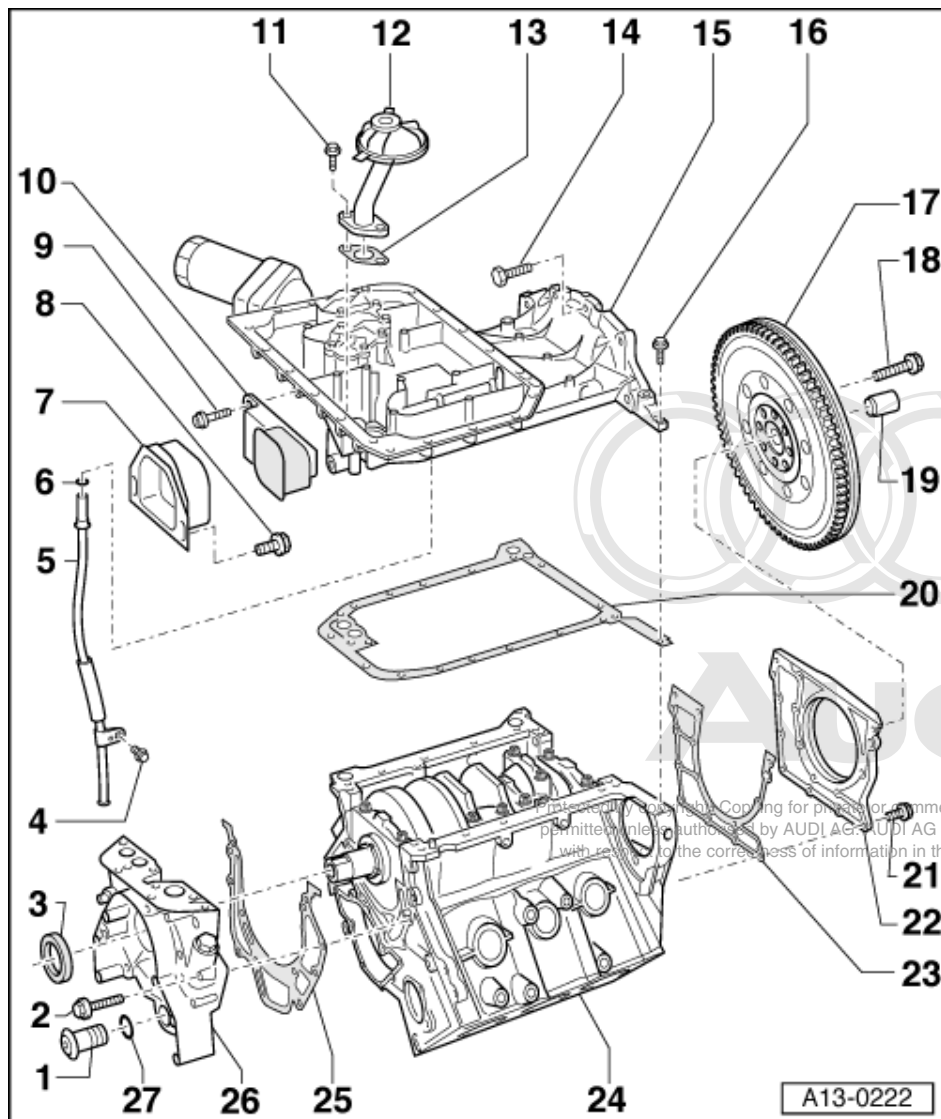
15 Sump (upper section)

- ♦ Removing and installing
=>Page 147 .

16 M6 = 10 Nm

M7 = 16 Nm

M8 = 20 Nm



17 Flywheel or drive plate

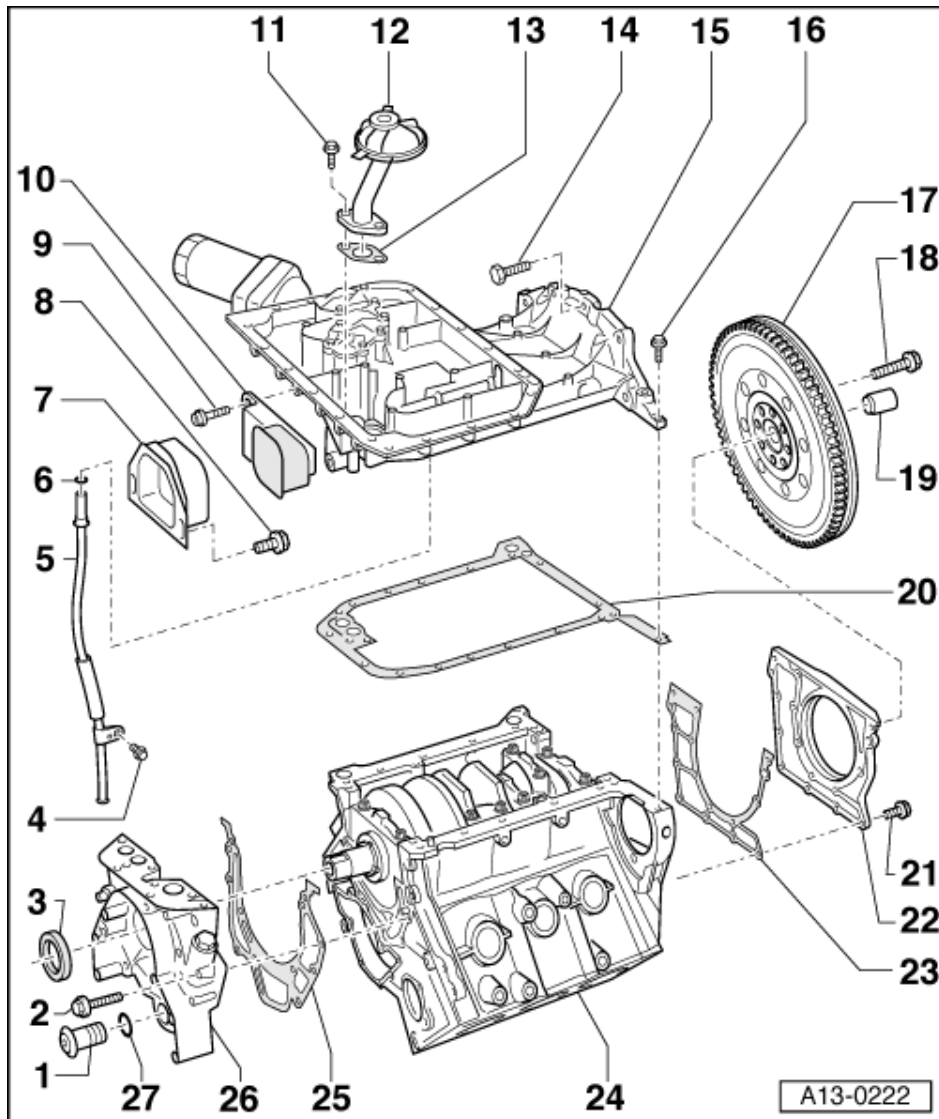
- ♦ Vehicles with manual gearbox up to approx. 09.91 have a flywheel fitted and vehicles from approx. 10.91 a dual-mass flywheel
- ♦ Removing and installing flywheel => Page 59
- ♦ Removing and installing drive plate => Page 61

18 Bolt (special type)

- ♦ Replace
- ♦ Tightening torque =>Page 62

19 Needle bearing

- ♦ Pressed into flywheel on vehicles with manual gearbox
- ♦ Pulling out and driving in
=>Page 63 .
- ♦ For automatic gearboxes, instead of the needle bearing in the flywheel, a bearing bush is pressed into the crankshaft => Fig. 70

**20 Gasket**

- ♦ Replace

21 10 Nm**22 Rear sealing flange with oil seal**

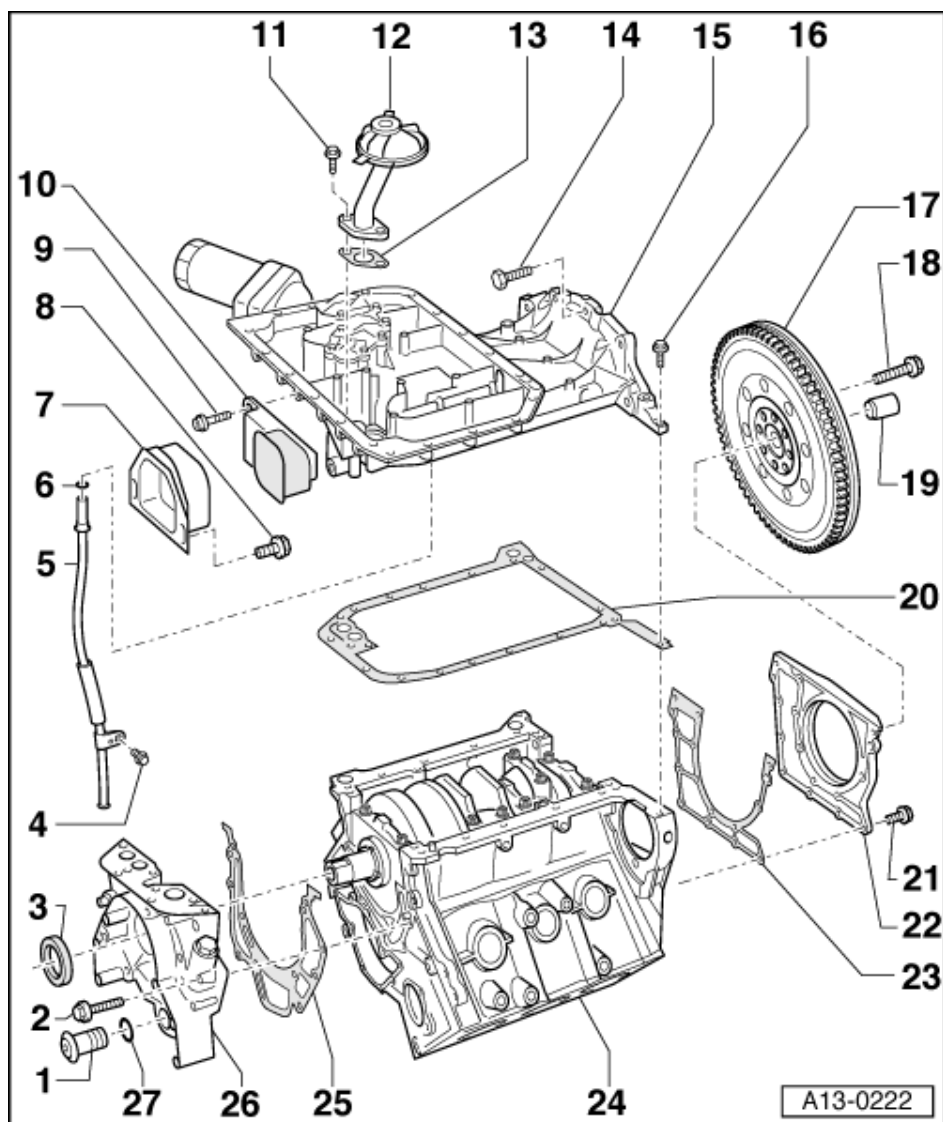
- ♦ Remove upper section of sump in order to remove and install
=>Page **147**.
- ♦ When installing, push guide sleeve from repair kit onto crankshaft.

23 Gasket

- ♦ Replace

24 Cylinder block

- ♦ Removing and installing crankshaft=> Page **66**
- ♦ Dismantling and assembling pistons and conrods => Page **72**



25 Gasket

- ♦ Replace

26 Oil pump

- ♦ Removing and installing
=>Page 152 .

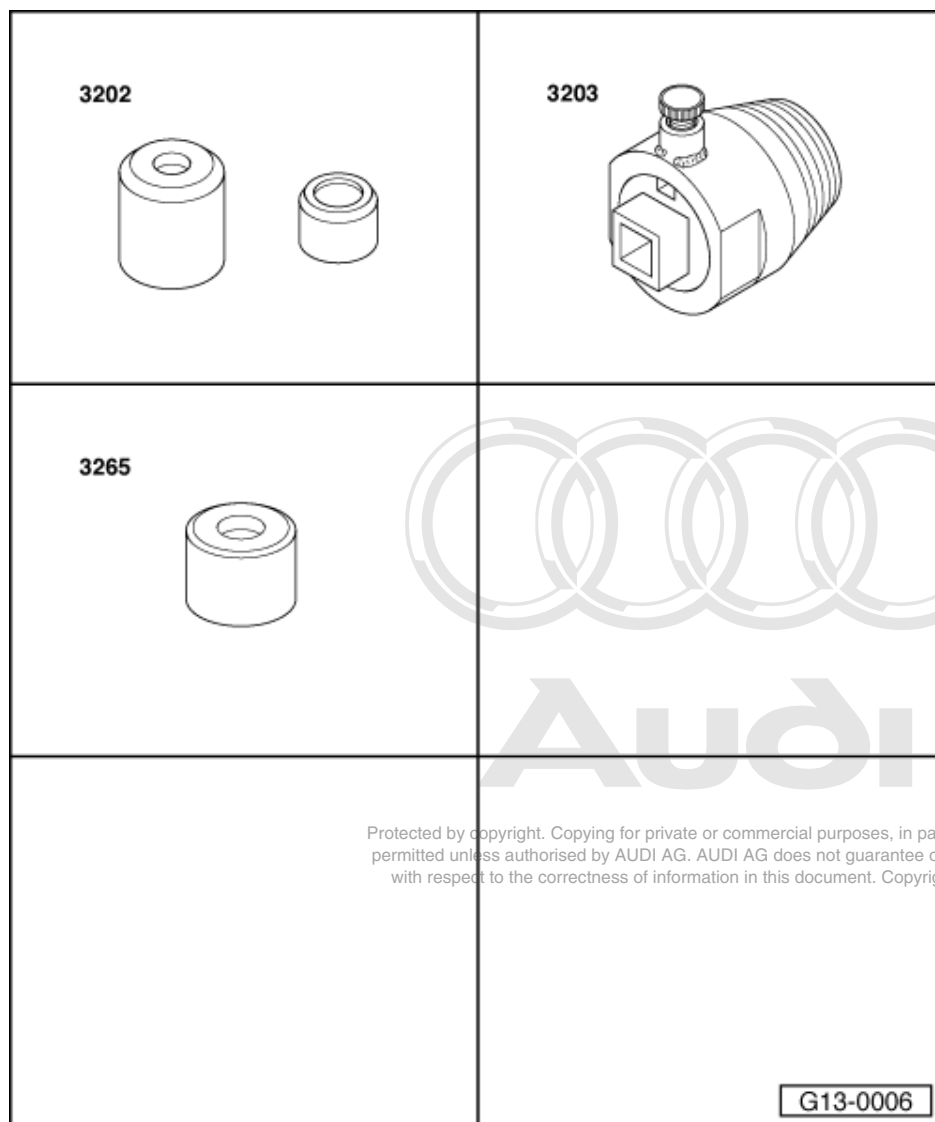
27 O-ring

- ♦ Replace



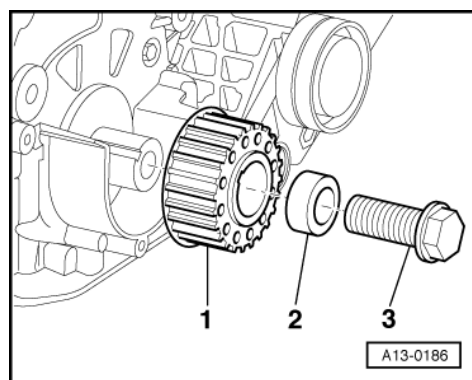
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2.2 - Replacing crankshaft oil seal on pulley end



Special tools and workshop equipment required

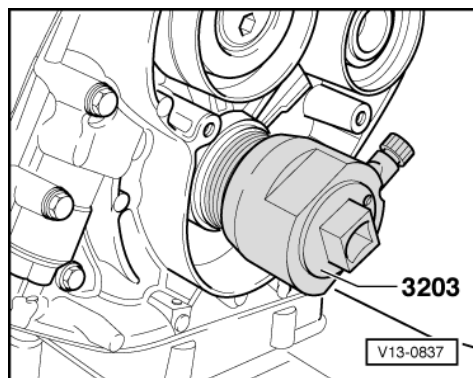
- ◆ Fitting sleeve 3202/1
- ◆ Oil seal extractor 3203
- ◆ Insertion sleeve 3265



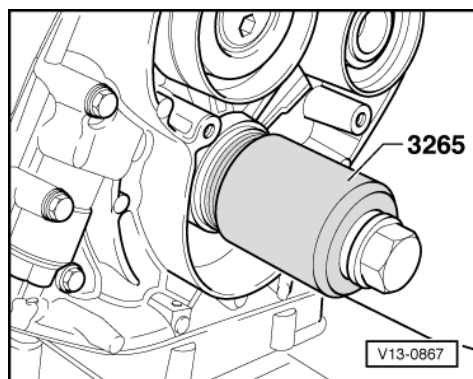


Removing

- Engine in vehicle
- Remove toothed belt => Page 46 .
- -> Unscrew central bolt -3- for crankshaft toothed belt sprocket -1-.
- Remove spacer -2- and toothed belt sprocket.

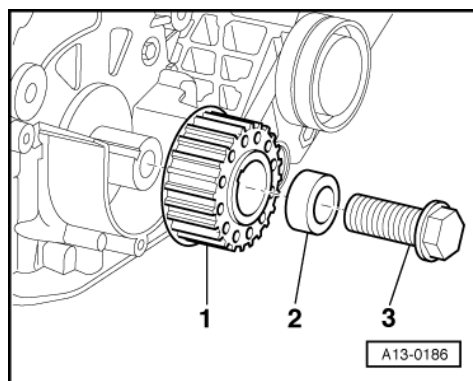


- Screw inner section of oil seal extractor 3203 six turns out of outer section and lock with knurled screw.
- -> Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure, screw it into oil seal as far as possible.
- Loosen knurled screw and turn inner part against crankshaft until the sealing ring 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 sealing ring using fitting sleeve 3202/1.
- -> Press in sealing ring flush with insertion sleeve 3265 and central bolt.



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

Notes:

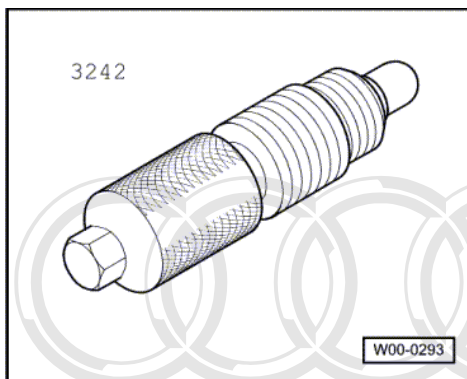
- ◆ Contact surface between sprocket and crankshaft must be free of oil.
- ◆ Do not use additional oil on bolt for crankshaft toothed belt sprocket.
- Install toothed belt (adjust valve timing) => Page 49 .

Tightening torque

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

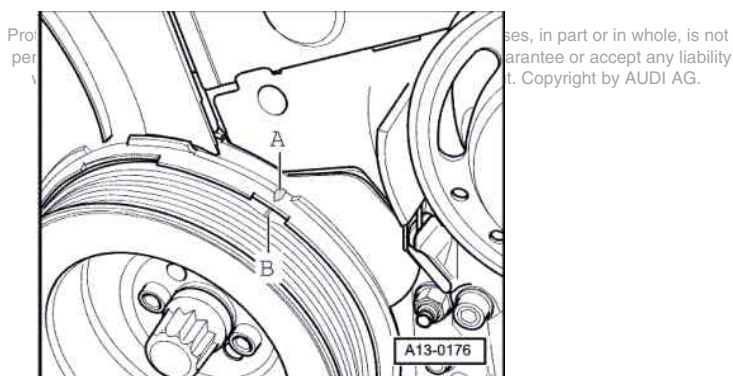
- 1) Replace bolt
- 2) 180°equivalent to half a turn

2.3 - Removing and installing flywheel/drive plate



Special tools and workshop equipment required

- ◆ Clamping bolt 3242



Removing flywheel

- Gearbox removed
- Set crankshaft to TDC marking of No. 1 cylinder by turning at central bolt of toothed belt sprocket in direction of engine rotation.



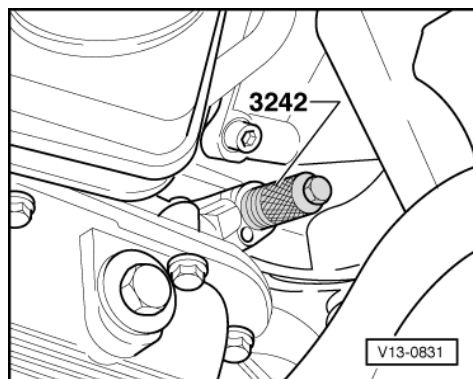
- -> Notch -B- opposite mark -A-
- Unscrew ignition timing sender -G4 from the cylinder block on the left.

Note:

TDC hole is located exactly behind the sender in the crankshaft (can be felt).

Important

Do not rotate the crankshaft whilst feeling for the TDC hole with your finger - risk of injury.



- -> Screw clamping bolt 3242 into the hole of the removed sender and tighten.
- Mark position of flywheel relative to engine.
- Unbolt flywheel.

Installing

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

Note:

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

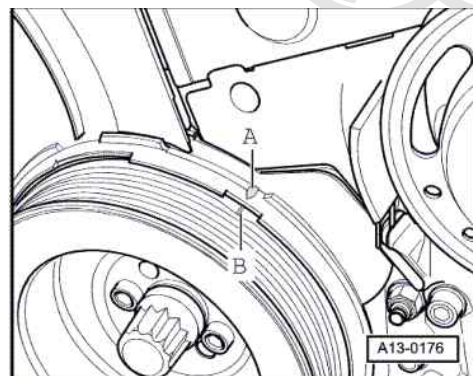
=>Page 63.

- Remove clamping bolt 3242.
- Screw ignition timing sender -G4 into cylinder block with new O-ring.

Tightening torques

Component		Nm
Flywheel to crankshaft		
Bolt length	19.5 mm	60 + 90°1)2)
Bolt length	43.0 mm	60 + 180°2)3)
Ignition timing sender in cylinder block		10

- 1) 90°corresponds to a quarter of a turn
- 2) Replace bolts
- 3) 180°equivalent to half a turn



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Remove drive plate

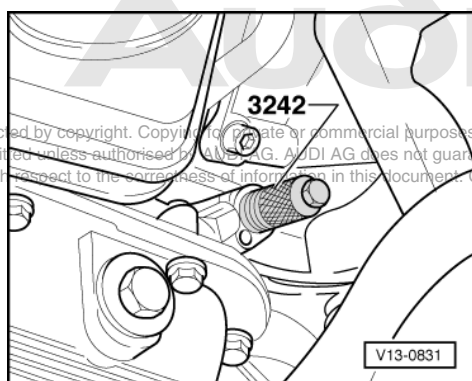
- Gearbox removed
- Set crankshaft to TDC marking of No. 1 cylinder by turning at central bolt of toothed belt sprocket in direction of engine rotation.
 - -> Notch -B- opposite mark -A-
- Unscrew ignition timing sender -G4 from the cylinder block on the left.

Note:

TDC hole is located exactly behind the sender in the crankshaft (can be felt).

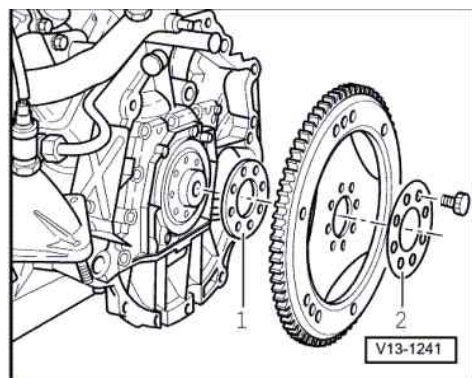
Important

Do not rotate the crankshaft whilst feeling for the TDC hole with your finger - risk of injury.



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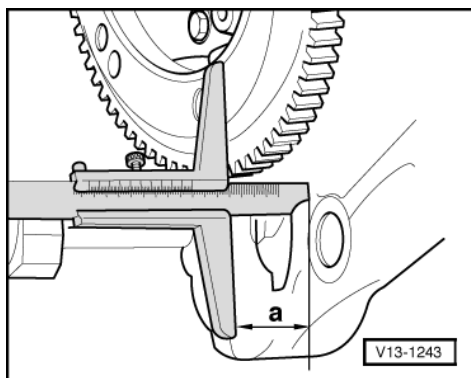
- -> Screw clamping bolt 3242 into the hole of the removed sender and tighten.
- Mark position of drive plate relative to engine.
- Unbolt drive plate.



Installing

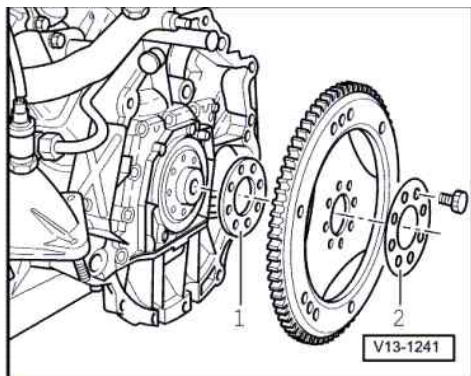
Installation is carried out in the reverse order; note the following:

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



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- -> Measure dimension -a- at three points and calculate average value.
- Specification for automatic gearbox 097:
21.3...22.9 mm
- Specification for automatic gearbox 01F/01K:
18.1...19.7 mm



If specified value is not attained:

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

If specified value is attained:

- Fit new bolts and tighten.
- Remove clamping bolt 3242.
- Screw ignition timing sender -G4 into cylinder block with new O-ring.

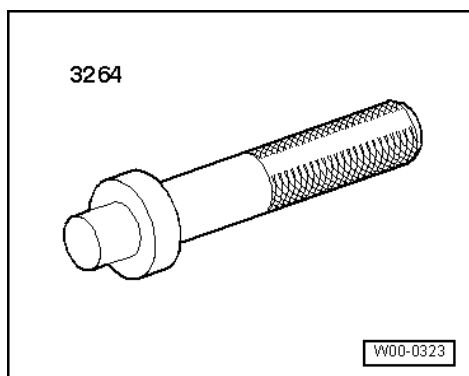
Tightening torques

Component	Nm
Drive plate to crankshaft	$60 + 90^\circ 1) 2)$
Ignition timing sender in cylinder block	10

1) 90° corresponds to a quarter of a turn

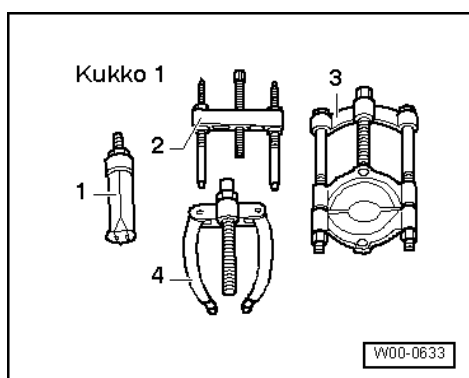
2) Replace bolts

2.4 - Removing and installing needle bearing in flywheel

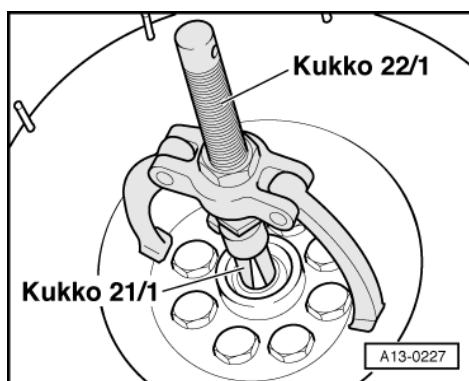


Special tools and workshop equipment required

- ♦ Fitting drift 3264



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



Procedure

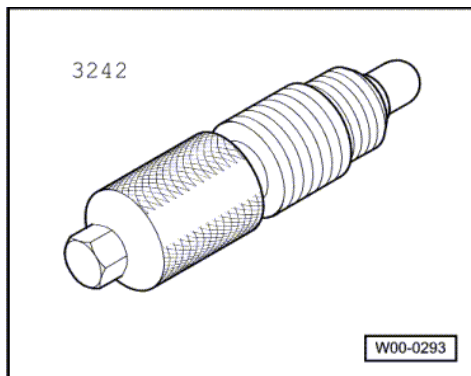
- -> Pull out needle bearing with Kukko 21/1 and Kukko 22/1.
- Drive in until flush using fitting drift 3264.



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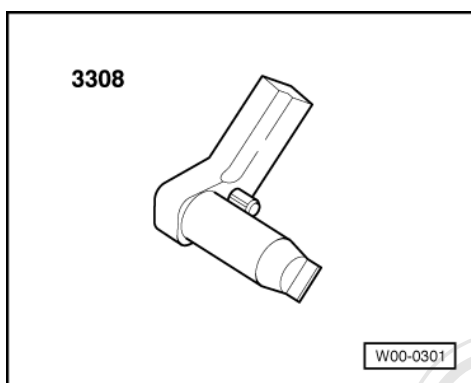


2.5 - Adjusting bracket of engine speed sender

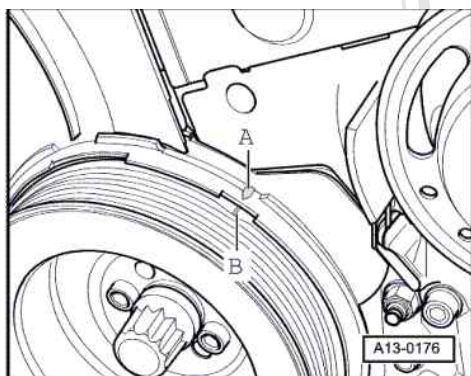


Special tools and workshop equipment required

- ♦ Clamping bolt 3242



- ♦ Adjustment appliance 3308



Notes:

- ♦ The holder for the engine speed sender can be moved in slots. The position is set at the factory and must not be altered.
- ♦ If the bolts have been accidentally loosened and the holder moved, carry out the adjustment as follows:

Procedure

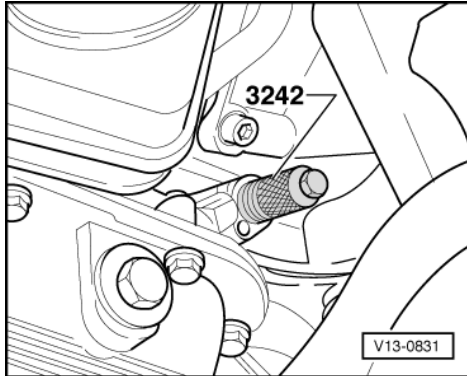
- -> Set crankshaft to TDC marking of No. 1 cylinder in direction of engine rotation (notch -B- facing mark - A-).
- Unscrew ignition timing sender -G4 from the cylinder block on the left.

Note:

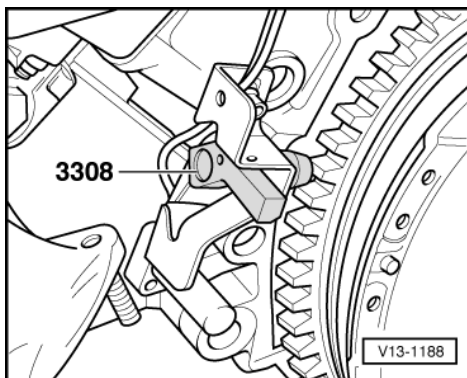
TDC hole is located exactly behind the sender in the crankshaft (can be felt).

Important

Do not rotate the crankshaft whilst feeling for the TDC hole with your finger - risk of injury.



- -> Screw clamping bolt 3242 into the hole of the removed sender and tighten.



- Unscrew heat shield over engine speed sender.
- Remove engine speed sender and unfasten holder.
- -> Insert special tool 3308 in place of sender, so that it engages in ring gear.
- Screw on holder.

Installing

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

Note:

Renew O-ring.

- Remove clamping bolt 3242.
- Screw ignition timing sender -G4 into cylinder block with new O-ring.

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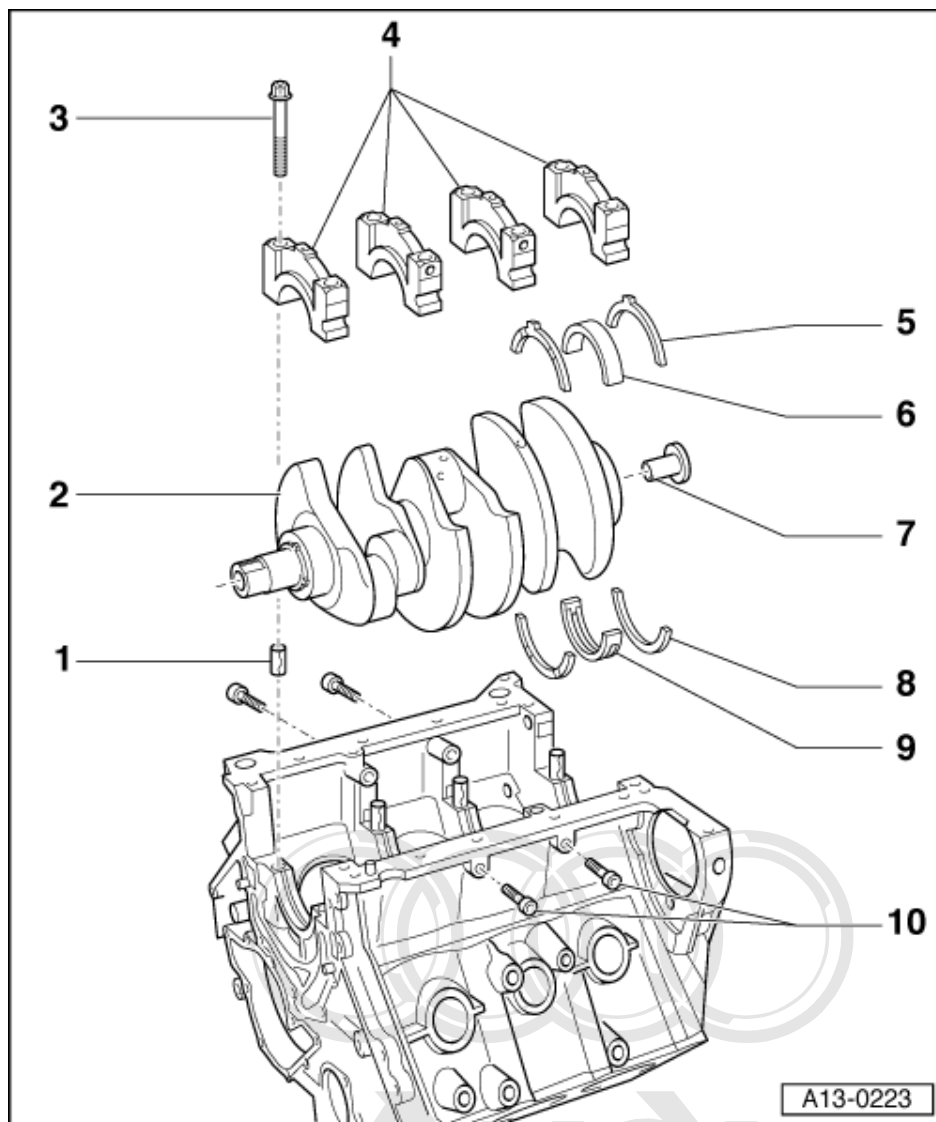
Tightening torque

Component	Nm
Ignition timing sender in cylinder block	10



3 - Removing and installing crankshaft

3.1 - Removing and installing crankshaft



Note:

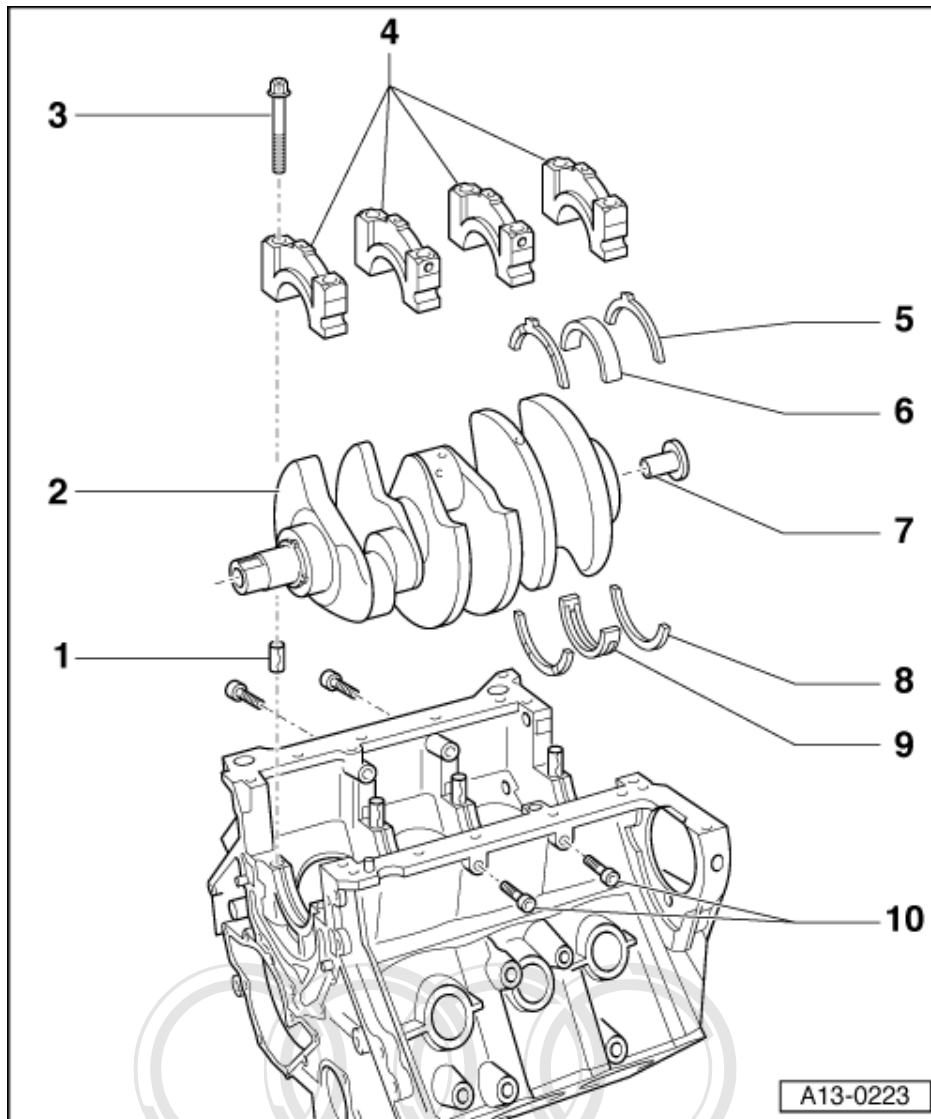
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When working on the engine, it should be secured to the engine stand using the engine bracket VW 540.
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1 Dowel sleeve

- ◆ Insert in cylinder block

2 Crankshaft

- ◆ Measuring axial and radial play =>Page 70
- ◆ Do not rotate the crankshaft when checking the radial play.
- ◆ Crankshaft dimensions
=>Page 70 .

**3 Bolts**

- ◆ For bearing cap
- ◆ Replace
- ◆ Tightening sequence
=> Fig. 69

4 Bearing cap

- ◆ Note identification markings
=> Fig. 69

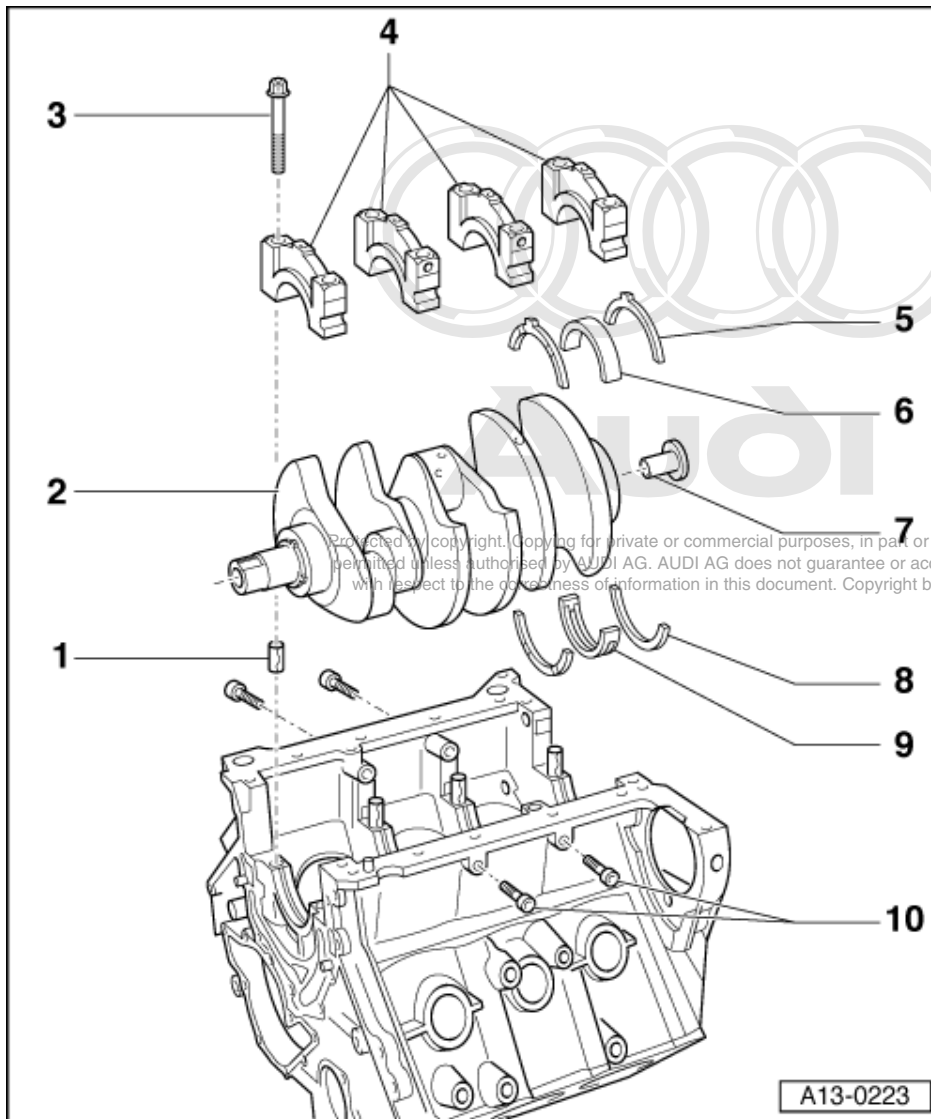
- ◆ Installing
=> Fig. 69
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5 Thrust washer

- ◆ On 4th crankshaft bearing only
- ◆ Oil grooves face outwards
- ◆ Note fixing arrangement
- ◆ Measuring axial play of crankshaft =>Page 70

6 Bearing shell

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



7 Bush

- ♦ only for automatic gearboxes
- ♦ Driving in
=> Fig. 70

8 Thrust washer

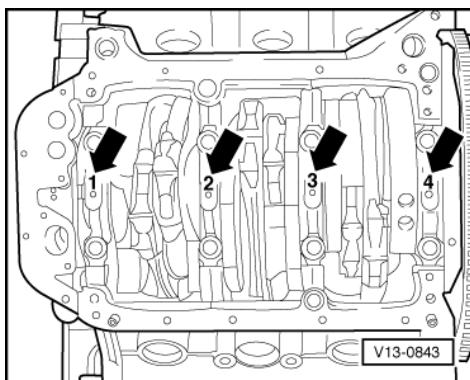
- ♦ On 4th crankshaft bearing only
- ♦ Oil grooves face outwards
- ♦ Measuring axial play of crankshaft =>Page 70

9 Bearing shell

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

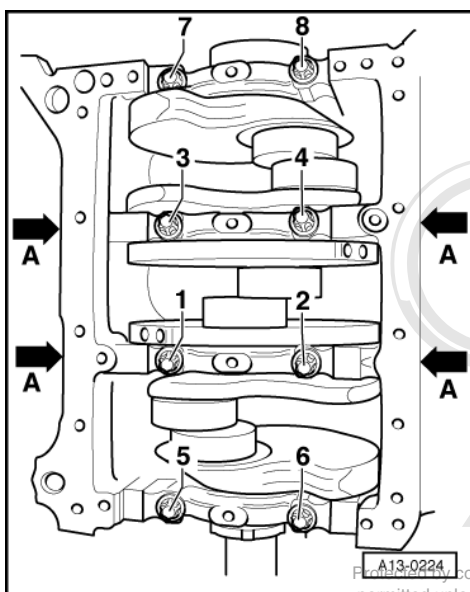
10 Bolts

- ♦ For bearing cap
- ♦ Tightening sequence
=> Fig. 69



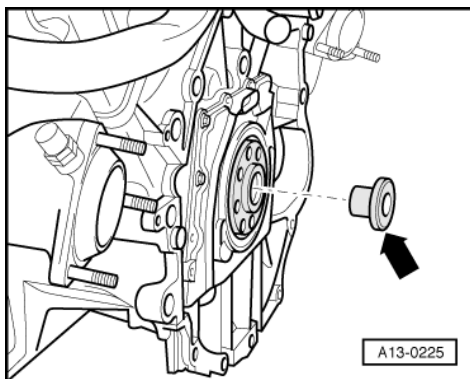
-> Fig.1 Markings on crankshaft bearing caps

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



-> Fig.2 Installing crankshaft bearing cap

- Tighten bolts -1... 8-
- Insert dowel sleeves in cylinder block.
- Tighten bearing cap bolts in the following sequence:
 1. - Screw in bolts -A- hand-tight.
 2. - Tighten bolts 1... 8 to 60 Nm.
 3. - Tighten bolts 1... 8 90°(1/4 turn) further using a rigid wrench.
 4. - Tighten bolts -A- to 25 Nm.





-> Fig. 3 Bearing bush for torque converter

Note:

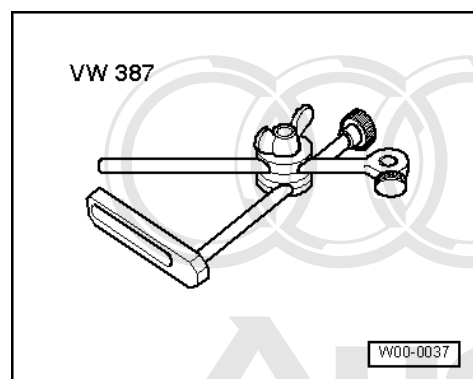
Short-blocks and replacement engines as well as new and replacement crankshafts are supplied without a bush -arrow-. Before installing the drive plate vehicles with automatic gearboxes must have the bush fitted. The bush must not be fitted to vehicles with manual gearboxes.

3.2 - Crankshaft dimensions

(in mm)

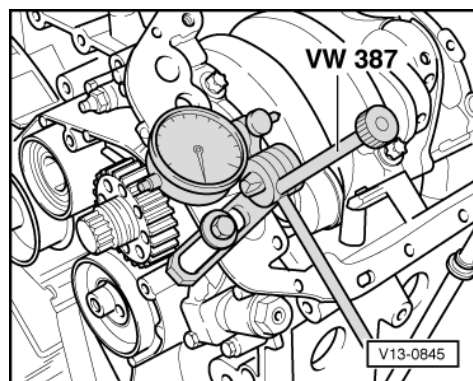
Honing dimension	Crankshaft pivot pin $\varnothing$	Crankshaft con-rod pin $\varnothing$
Basic dimension	- 0.022 65.00 - 0.042	- 0.022 54.00 - 0.042
Step 1	- 0.022 64.75 - 0.042	- 0.022 53.75 - 0.042
Step 2	- 0.022 64.50 - 0.042	- 0.022 53.50 - 0.042
Step 3	- 0.022 64.25 - 0.042	- 0.022 53.25 - 0.042

3.3 - Measuring axial and radial play



Special tools and workshop equipment required

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

- -> 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 front dial gauge.
- Note dial gauge reading:

Play when new	Wear limit
0.07...0.23 mm	0.25 mm

Radial play

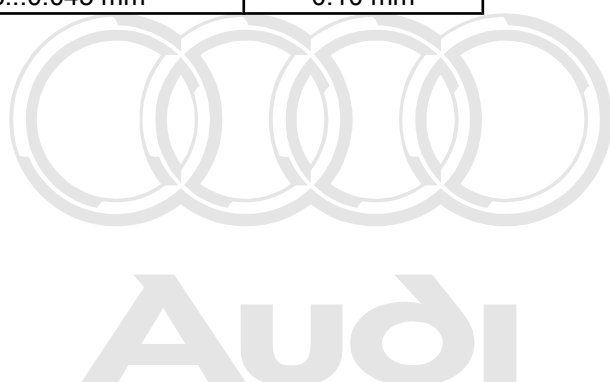
Note:

Do not interchange used bearing shells.

Auxiliary equipment required

- ♦ Plastigage
- Remove crankshaft bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage of corresponding width on the bearing journal or in the bearing shells
 - The length of Plastigage must rest in the middle of the bearing shell
- 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 dial gauge reading:

Play when new	Wear limit
0.018...0.045 mm	0.10 mm

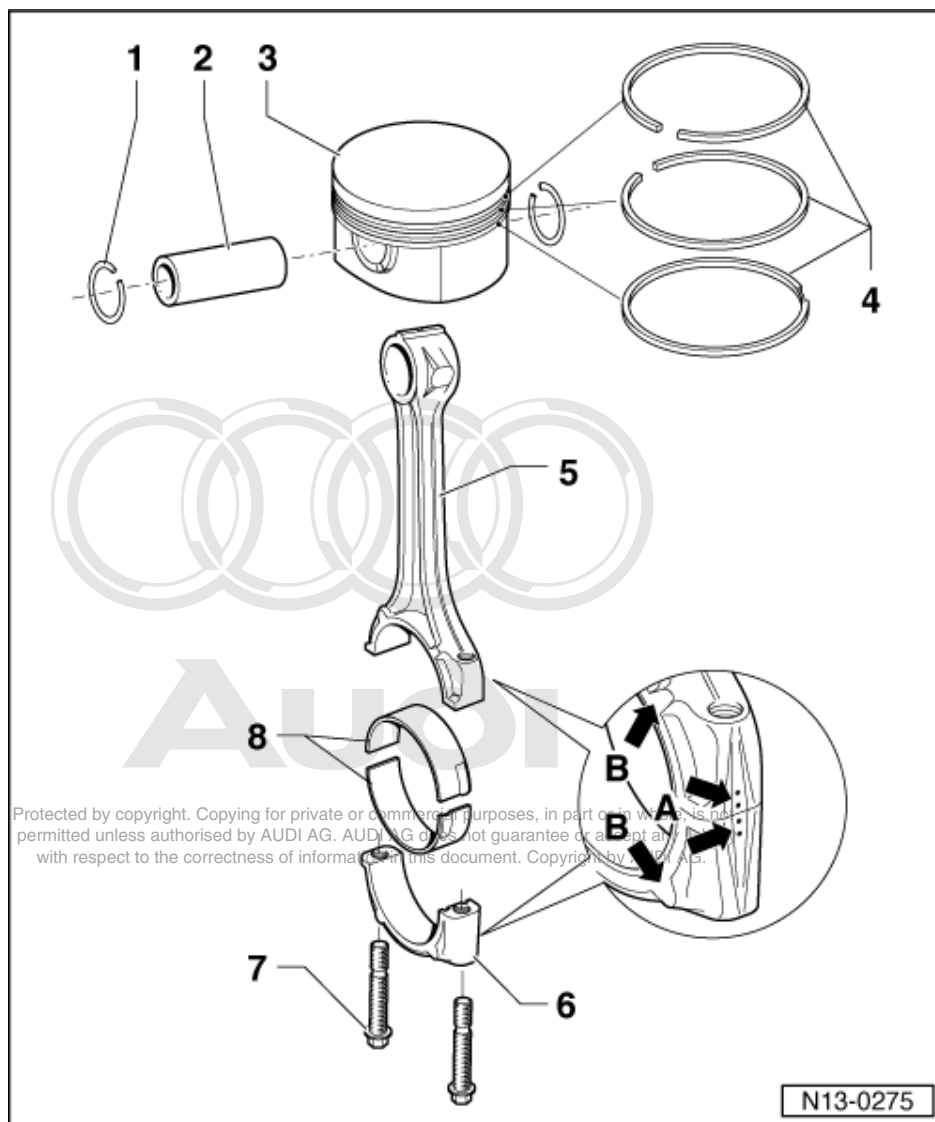


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4 - Dismantling and assembling pistons and conrods

4.1 - Dismantling and assembling pistons and conrods



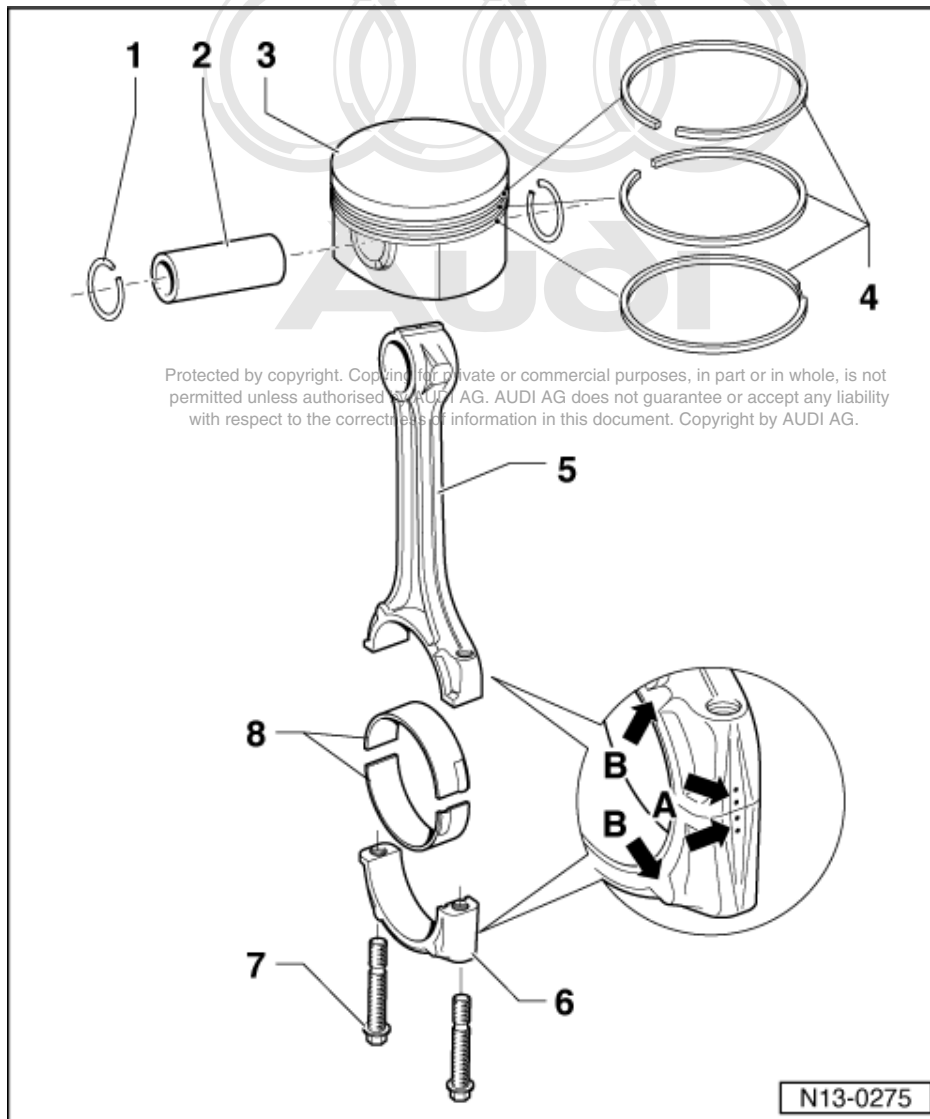
1 Circlip

2 Piston pin

- ♦ If difficult to remove, heat piston to approx. 60°C.
- ♦ Remove and install with VW 222a

3 Piston

- ♦ Installation position and arrangement of piston/cylinder
=> Fig. 76
- ♦ Arrow on piston crown points to pulley end.
- ♦ Checking => Fig. 76
- ♦ Install using piston ring clamp.
- ♦ Piston and cylinder dimensions
=>Page 77 .
- ♦ Checking cylinder bore
=> Fig. 76



4 Piston rings

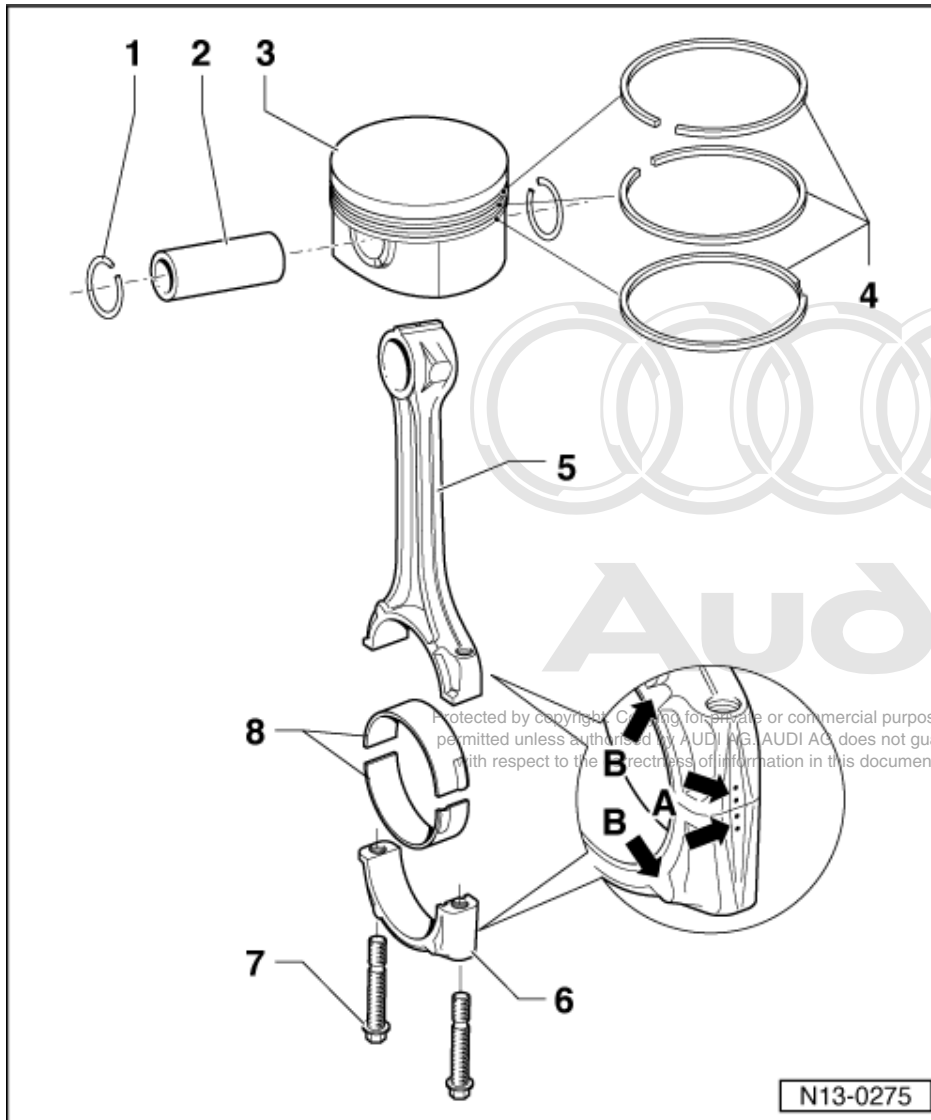
- ◆ Offset gaps by 120 °
- ◆ Remove and install with piston ring pliers.
- ◆ "TOP" must face piston crown.
- ◆ Checking ring gap
=> Fig. 75
- ◆ Checking ring to groove clearance
=> Fig. 75

5 Conrod

- ◆ Only renew as a set
- ◆ Mark cylinder allocation -A-
=> Fig. 77
- ◆ Installation position:
Show markings -B-:
Cyl 1...3 to pulley end
Cyl 4...6 to flywheel end

6 Conrod bearing cap

- ◆ Note installation position

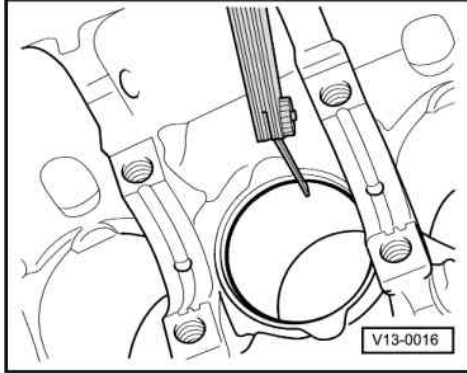


7 Conrod bolt - 30 Nm + 1/4 turn (90°) further

- ◆ Replace
- ◆ Oil threads and contact surface
- ◆ To measure radial play tighten to 30 Nm but not further

8 Bearing shell

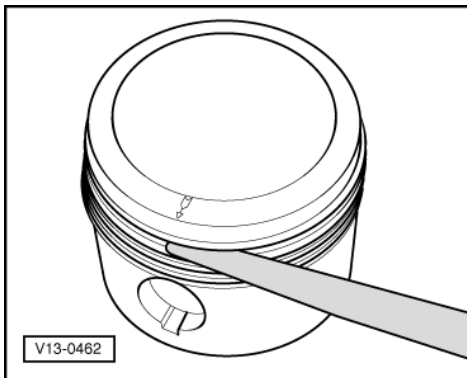
- ◆ Note installation position
- ◆ Do not interchange used bearing shells (mark).
- ◆ Measuring radial play
=>Page 77.
- ◆ When measuring radial play, tighten bolts -Item 7 - to 30 Nm but do not turn further



→ Fig. 1 Checking piston ring gap

- Push ring into cylinder seated squarely on cylinder wall from top down up to approx. 15 mm before bottom edge of cylinder. Use a piston without rings.

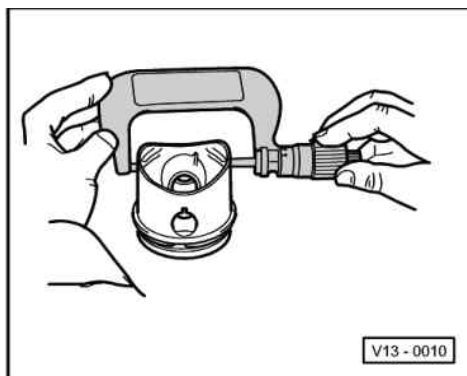
Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.35...0.50	1.0
2nd compression ring	0.50...0.70	1.4
Oil scraper ring	0.25...0.50	0.8



→ 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

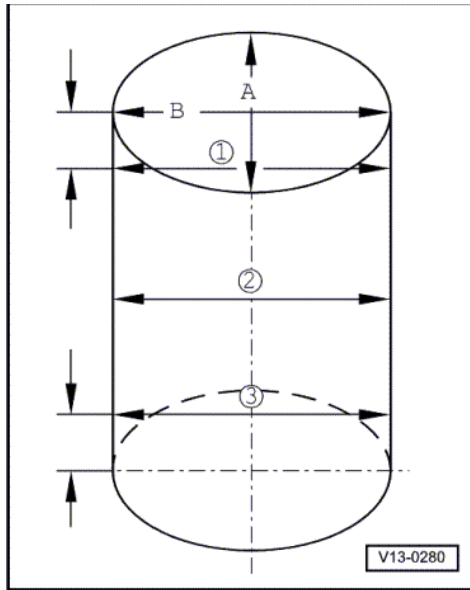


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-> Fig. 3 Checking piston

Special tools and workshop equipment required

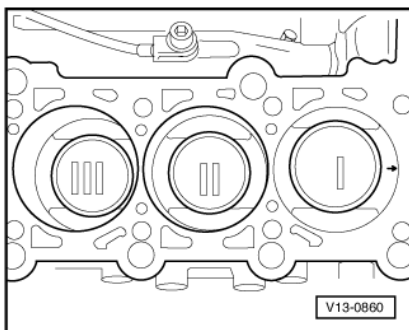
- ♦ Outer micrometer 75...100 mm
- Measure approx. 10 mm from the lower edge, offset by 90 ° to the piston pin axis.
 - Permissible deviation from nominal dimension: no more than 0.04 mm.



-> Fig. 4 Checking cylinder bores

Special tools and workshop equipment required

- ♦ Use internal dial gauge 50...100 mm.
- Take measurements at 3 positions in both lateral direction -A- and longitudinal direction -B-.
 - Permissible deviation from nominal dimension: no more than 0.08 mm.



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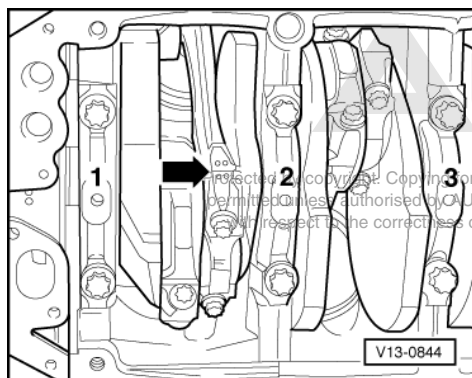
-> Fig.5 Piston installation position and arrangement of piston/cylinder

- Mark installation position and cylinder assignment on piston crown with chalk or waterproof felt tip.

Note:

Do not use centre punch or scribe as this would damage the coating of the piston crown.

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



→ Fig.6 Marking conrods

Notes:

- ♦ Only replace conrods as a set.
- ♦ Do not interchange conrod bearings.
- Before removing, mark positions of conrods and conrod bearing caps in relation to each other and to the cylinder with coloured pen -arrow-.

4.2 - Piston and cylinder dimensions

Honing dimension	Piston-ø	Cylinder bore-ø
Basic dimension mm	82.485	82.51
1st undersize mm	82.735	82.76
2nd undersize mm	82.985	83.01

4.3 - Checking radial play of conrods

Auxiliary equipment required

- ♦ Plastigage

Test sequence

- Remove conrod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage of corresponding width on the bearing journal or in the bearing shells
 - The length of Plastigage must rest in the middle of the 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.

Play when new	Wear limit
0.015...0.062 mm	0.12 mm



- Replace bolts for conrod bearings.



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15 - Cylinder head, Valve gear

1 - Removing and installing cylinder head

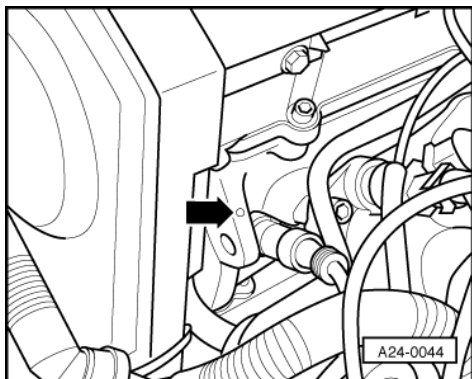
1.1 - Removing and installing cylinder head

Notes:

- ◆ Replace the cylinder head bolts.
- ◆ When performing installation procedures always replace self-locking nuts and bolts.
- ◆ Replace seals, gaskets, and bolts which have a specified tightening angle.
- ◆ When installing a replacement 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 installing a replacement cylinder head, drive in a sealing cap on the appropriate front side of the head => Fig. 86.
- ◆ 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.

1.2 - Different valve gear designs

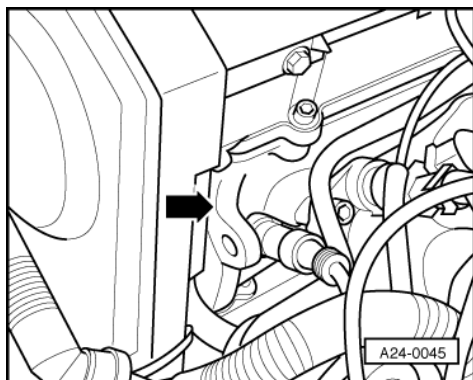
From approx. 08.94 (as of vehicle ident. no. 4A S_026 715) the "light valve gear" (identification code "S") is fitted instead of the "old valve gear" (identification code "M").



- ◆ The old valve gear "M" has no marking.
- ◆ There are two different marking versions for the light valve gear "S":

-> 1st Marking version:

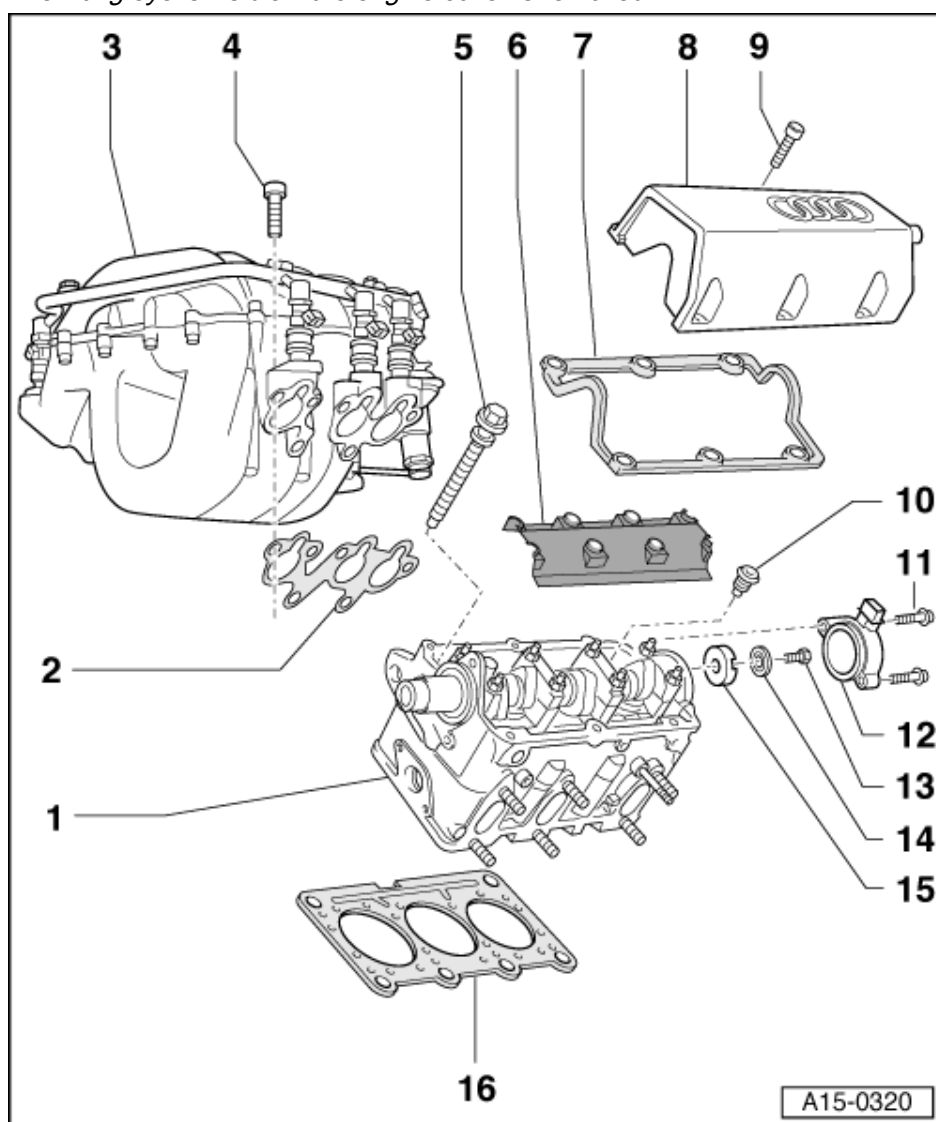
Centre punch marks -arrow- on the cylinder head lifting eye.



-> 2nd Marking version:
Recess -arrow- on the cylinder head lifting eye.

Note:

The lifting eye is visible if the engine cover is removed



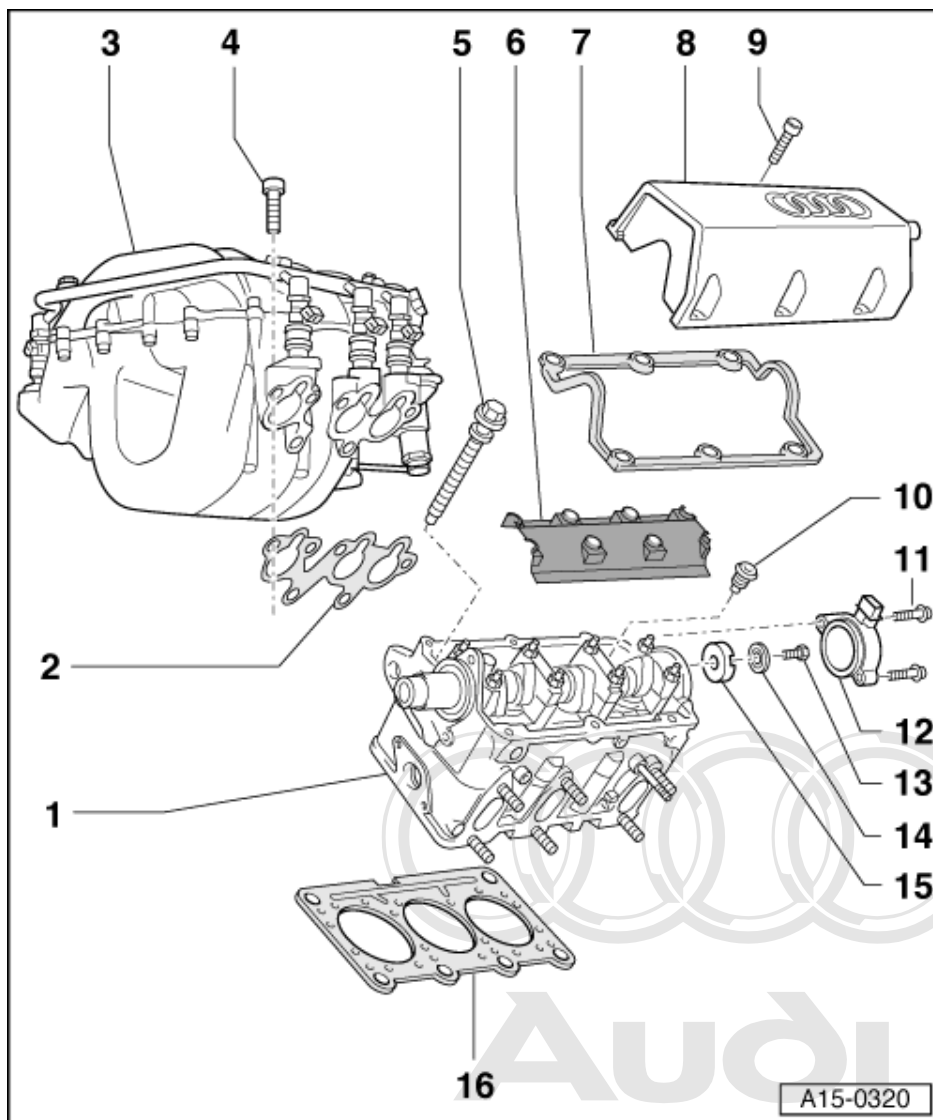
1 Cylinder head

- ◆ Removing left cylinder head => Page 95
- ◆ Removing right cylinder head => Page 99
- ◆ Checking for distortion

- => Fig. 85
- ♦ Reworking dimension => Fig. 85
- ♦ Driving sealing cap into cylinder head => Fig. 86
- ♦ Installing => Page 102
- ♦ After replacing, fill with fresh coolant

2 Gasket

- ♦ Replace



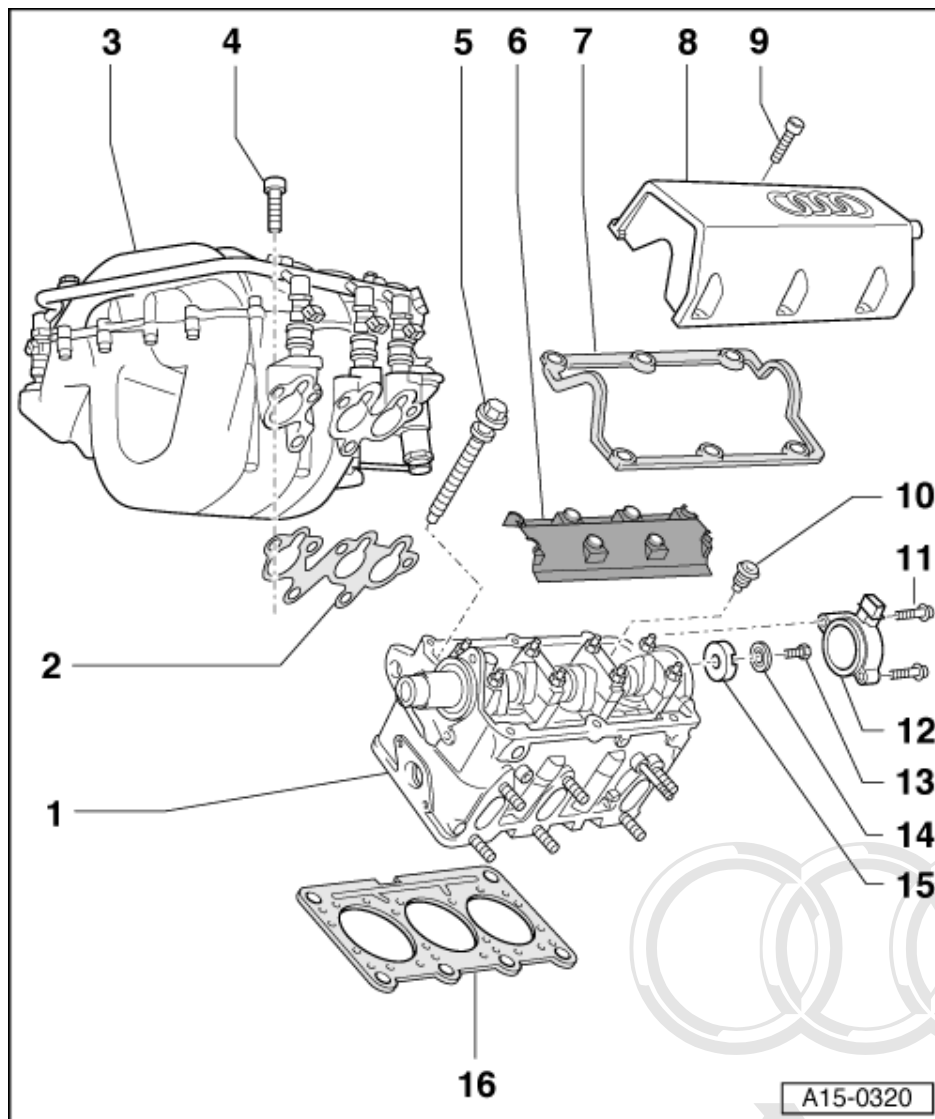
3 Intake manifold

- ♦ Removing and installing => Page 86
- ♦ After the intake manifold securing bolts have been loosened, all cylinder head bolts must be tightened by another 1/4 turn (90°).

4 20 Nm

- ♦ Tighten in stages and in diagonal sequence
- ♦ After the intake manifold securing bolts have been loosened, all cylinder head bolts must be tightened by another 1/4 turn (90°).

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**5 Cylinder head bolt**

- ◆ Replace
- ◆ Different bolt heads
- ◆ Use wrench 3452 for Polydrive bolt head
- ◆ Note sequence when loosening => Page 99
- ◆ Note sequence when tightening => Page 104

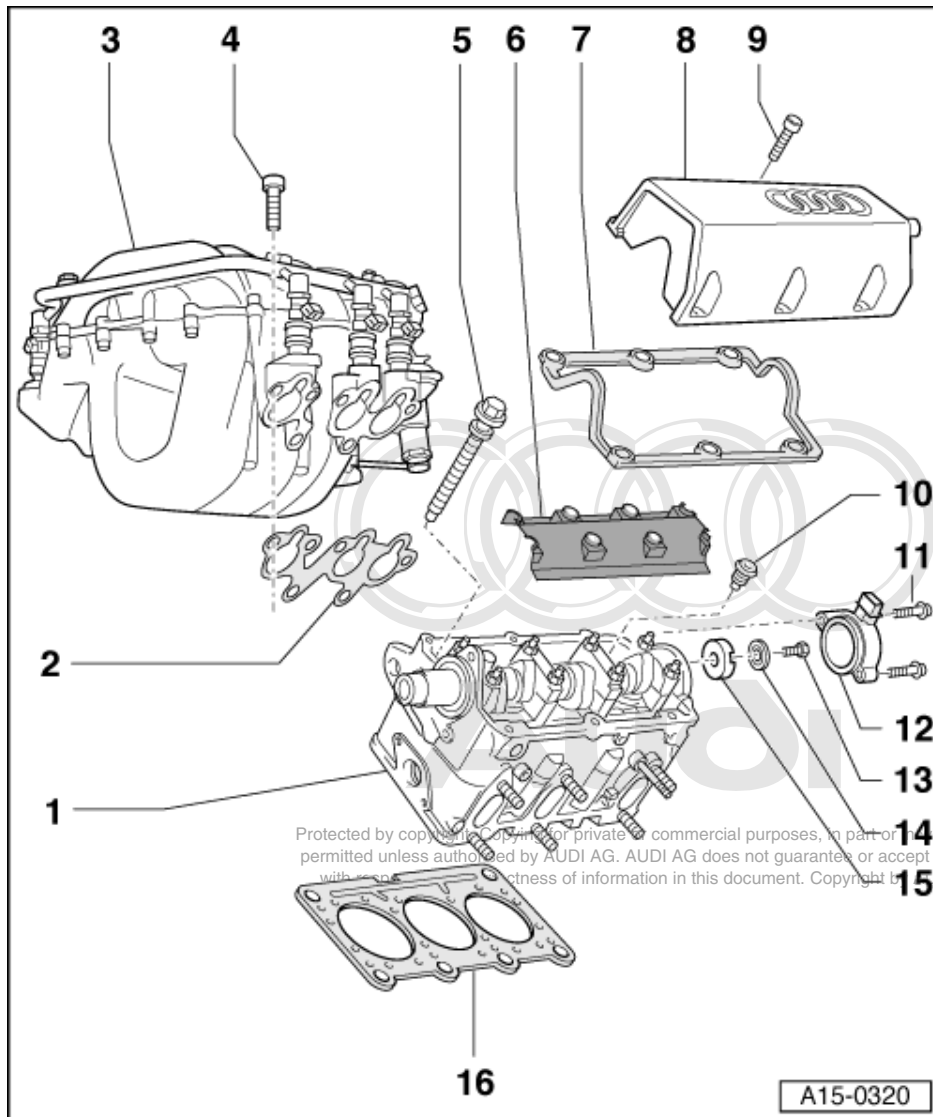
6 Oil deflector**7 Cylinder head cover gasket**

- ◆ Renew if damaged or leaking
- ◆ Spray inner and outer side with silicone lubricant before fitting
- ◆ Lubricant

=> Parts List

- ◆ before fitting gasket apply sealant at sealing points => Fig. 85
- ◆ Sealants

=> Parts List

**8 Cylinder head cover**

- ♦ Removing and installing left cylinder head cover => Page 91
- ♦ Removing and installing right cylinder head cover => Page 93

9 10 Nm

- ♦ Tighten in stages and in diagonal sequence

10 Pressure limiting valve

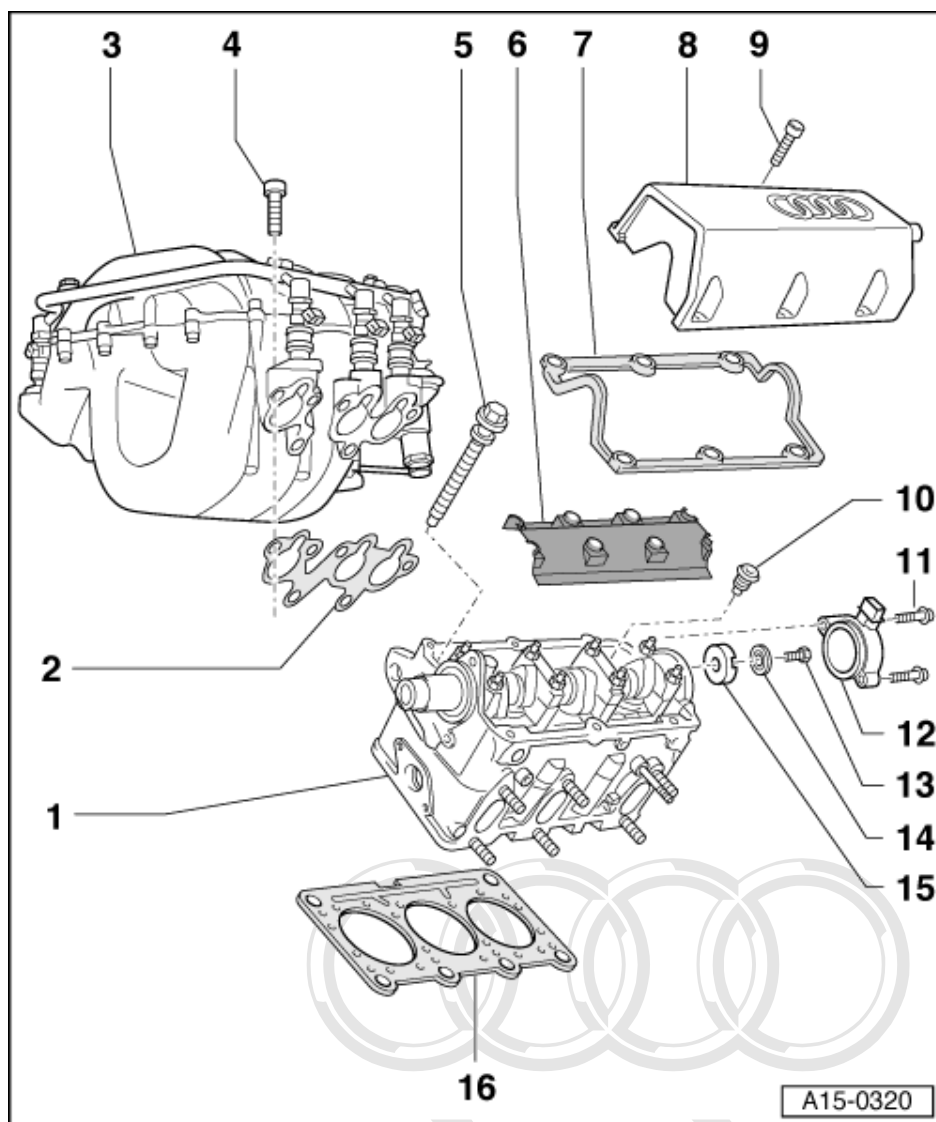
- 2.7 bar

- ♦ In the event of loud valve noises in an entire bank of cylinders, replace the pressure limiting valve.
- ♦ Do not tighten valves that have become loose, replace them.
- ♦ install using locking compound
- ♦ Locking compound

=> Parts List

- ♦ Tighten to 25 Nm

11 10 Nm



12 Hall sender -G40

- ♦ Removing and installing left cylinder head Hall sender => Fig. 115
- ♦ Removing and installing sealing cap on right of cylinder head => Fig. 115

13 22 Nm

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14 Washer

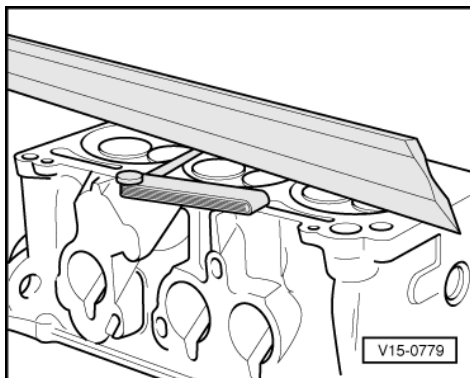
- ♦ Tapered
- ♦ Note installation position

15 Panel

- ♦ For Hall sender
- ♦ Pay attention to locating element on assembly

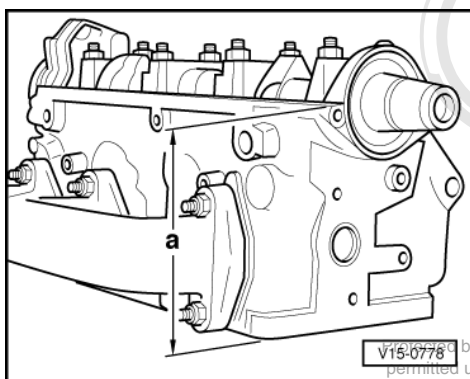
16 Cylinder head gasket

- ♦ Replace => Removing cylinder head. from Page 95 onwards
- ♦ Installation position: Part No. to cylinder head
- ♦ After replacing, fill with fresh coolant



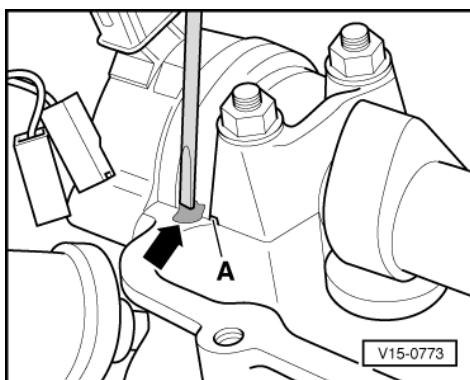
-> Fig.1 Check cylinder head for distortion

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



-> Fig.2 Reworking dimension for cylinder head

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



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

- Apply a small quantity of sealant to connections -arrow- on upper sealing surface of cylinder head.

♦ Sealants

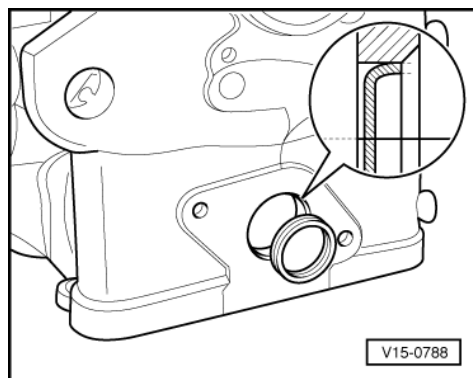
=> Parts List

Notes:

- ♦ Before fitting, spray inside and outside of gasket for cylinder head cover with silicone lubricant.
- ♦ Lubricant

=> Parts List

- ♦ The oil bore - A- must not be blocked.



-> Fig.4 Drive sealing cap into cylinder head

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Special tools and workshop equipment required

- ♦ Drift VW 295

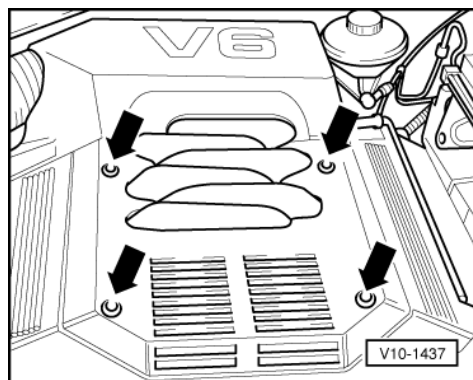
The cylinder heads available as spare parts can be used both left and right and must be fitted with a sealing cap on the appropriate front side.

- Coat the edge of the sealing cap with sealing paste.
 - Sealing paste

=> Parts List

- Use drift VW 295 to knock in sealing cap until the outer edge of the sealing cap is flush with the chamfered end on the cylinder head.

1.3 - Removing and installing intake manifold

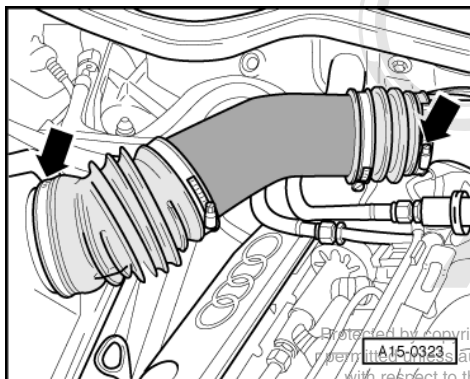


Removing

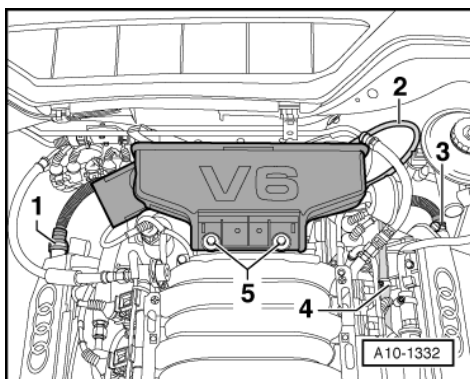
Note:

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

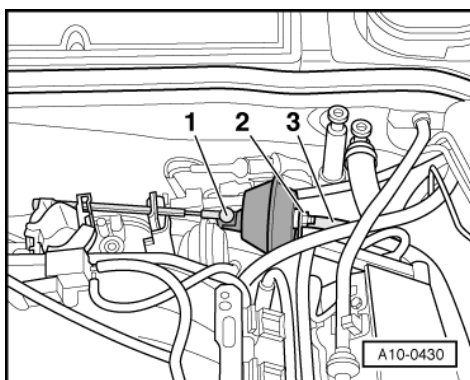
- -> Remove engine cover -arrows-.



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



- -> Disconnect crankcase breather hoses -1- and -3- at cylinder heads.
- Disconnect vacuum hose -2- from throttle valve body.
- Detach hose -4- to crankcase breather.
- Release screws -5- and press air duct to the rear.
- Detach air duct.

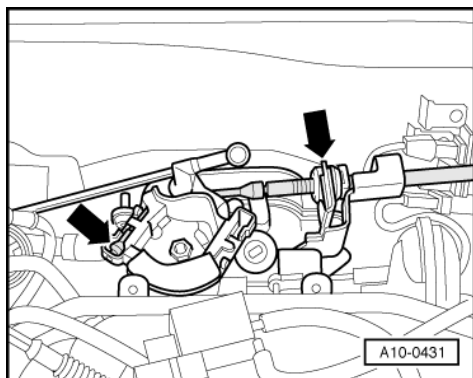


Vehicles with cruise control system

- -> Disengage the operating rod -1- on the vacuum unit.
- Detach vacuum hose -3- from vacuum unit.

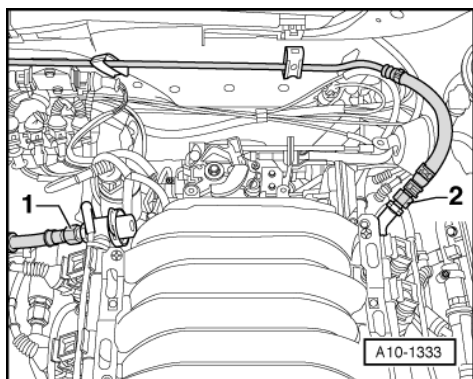


- Unscrew nut -2- and remove vacuum unit.



All models:

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

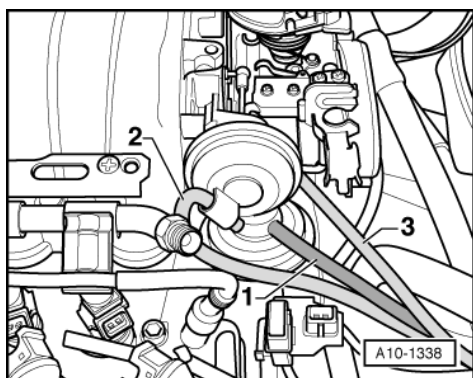


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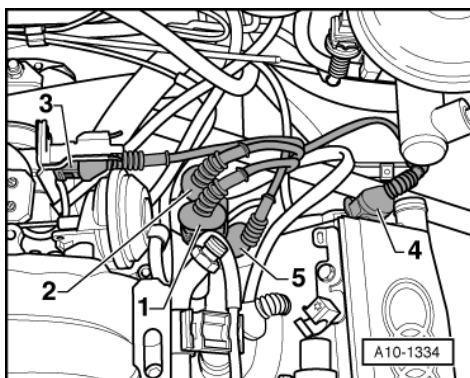
Important

The fuel system is pressurised. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Unscrew the fuel supply pipe -2- and the fuel return pipe -1-.



- -> Mark and remove vacuum pipes -1...3- (if fitted).

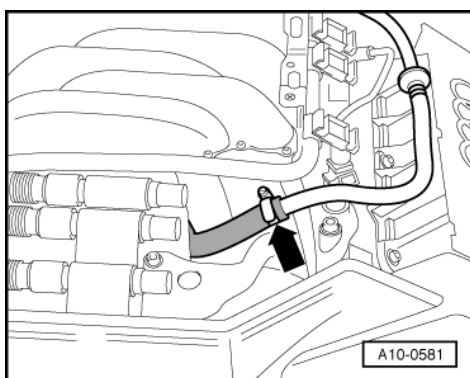


- -> Detach connector -3-.

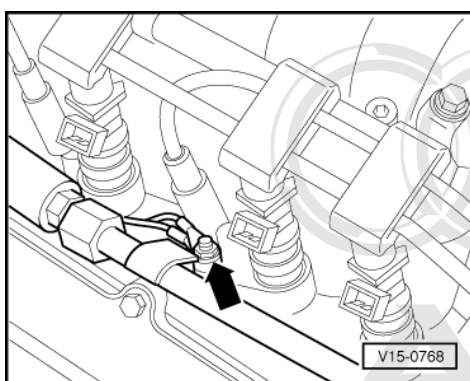
Note:

Electrical connectors -1-, -2-, -4- and -5- remain connected.

- Unplug connectors from all injectors.
- Detach the two rear spark plug connectors on left and right bank of cylinders.
- Move wiring a side.



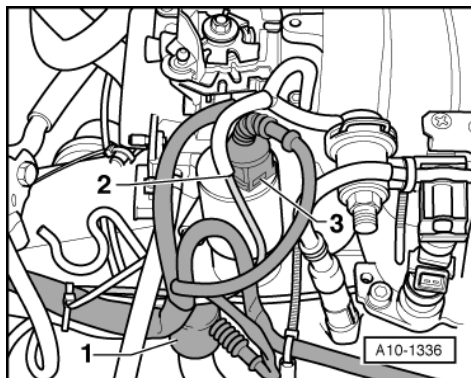
- -> Detach the vacuum pipe -arrow- to the brake servo.

**All models:**

- -> Unscrew hydraulic line bracket (with earth wire, if applicable) -arrow-.

Note:

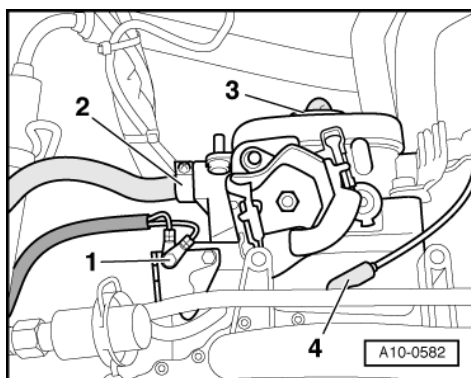
Depending on the version, the earth wire may be connected to the rear of the intake manifold.



- -> Detach vacuum pipe -2-.
- Detach electrical connector -3- at idling stabilisation valve -N71.

Note:

Electrical connector -1- remains plugged in.



- -> Unscrew earth wires -1-.

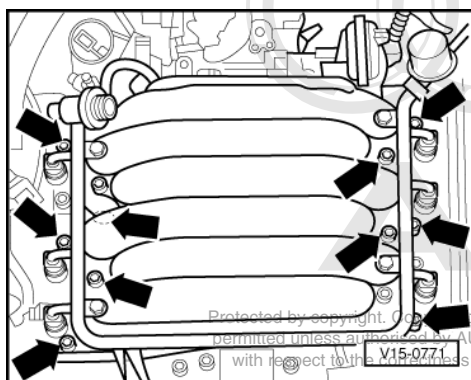
Note:

Depending on the version, the earth wires may be connected at a different location.

- Detach vacuum hose -2- to ACF valve.
- Detach connector -3- at throttle valve body.

Vehicles with 2.6 litre engine:

- Detach vacuum hose -4- to engine control unit at throttle valve body.



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All models:

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

Note:

Plug intake ports on cylinder heads with clean cloths.

Installing

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

Note:

Always replace self-locking nuts, seals and gaskets.

Important

After the intake manifold securing bolts have been loosened, all cylinder head bolts must be tightened by another 1/2 turn (90°).

- Check throttle cable setting

=> Fuel Supply - Petrol Engines; Repair group 20

Notes:

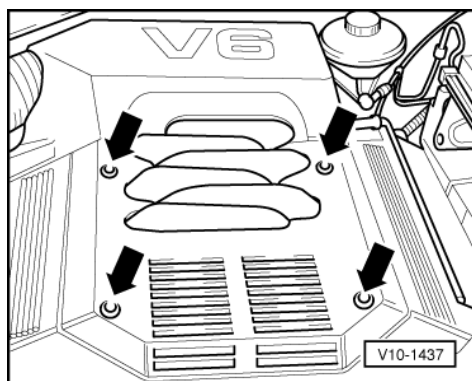
- ♦ If the battery is reattached make sure that the vehicle equipment (radio, clock, electrical window lifter) is actuated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Fuel Injection and Ignition System; Repair group 24

Tightening torques

Component	Nm
Intake manifold to cylinder head	20
Earth wires to intake manifold	10
Power steering pressure line to intake manifold	10
CCS unit to bracket	15
Fuel lines to fuel rail or fuel pressure regulator	25
Air duct to intake manifold	10

1.4 - Removing and installing left cylinder head cover



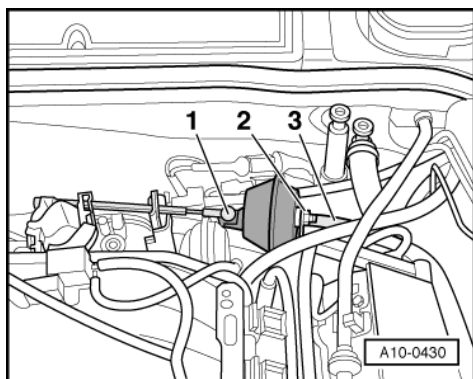


Note:

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

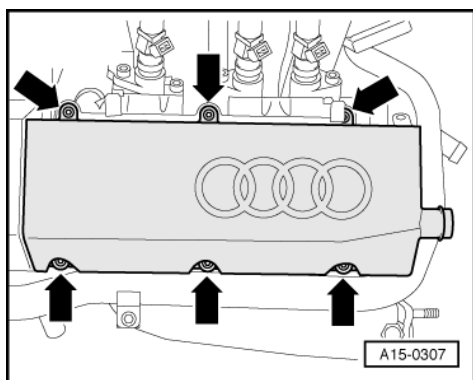
Removing

- -> Remove engine cover-arrows-.



Vehicles with cruise control system

- -> Disengage the operating rod -1- on the vacuum unit.
- Detach vacuum hose -3- from vacuum unit.
- Unscrew nut -2- and remove vacuum unit.



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All models:

- Remove hose of crankcase breather from cylinder head cover.
- Unclip the vacuum pipe to the brake servo from the brackets.
- Loosen cable tie and expose electrical wiring.
- -> Loosen bolts -arrows- for cylinder head cover and remove cylinder head cover.

Installing

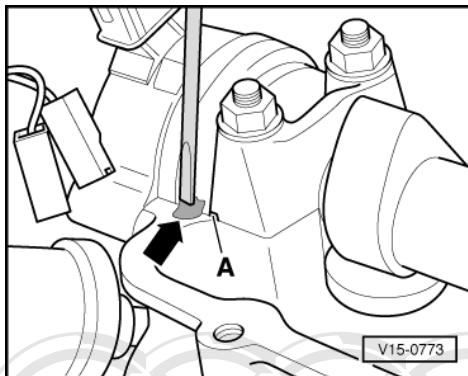
Installation is carried out in the reverse order; note the following:

Notes:

- ♦ Replace cylinder head cover gasket if damaged.
- ♦ Before fitting, spray inside and outside of gasket for cylinder head cover with silicone lubricant.
- ♦ Lubricant

=> Parts List

- ♦ The oil bore - A- must not be blocked.



- -> Apply a small quantity of sealant to connections -arrow- on upper sealing surface of cylinder head.

- ♦ Sealants

=> Parts List

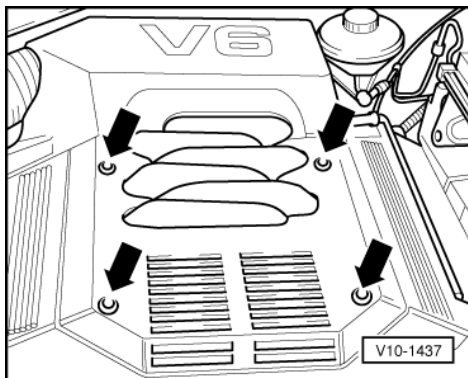
- Tighten bolts for cylinder head cover crosswise and in stages.

Tightening torques

Component	Nm
Cylinder head cover to cylinder head	10
CCS unit bracket to cylinder head cover	10

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1.5 - Removing and installing right cylinder head cover

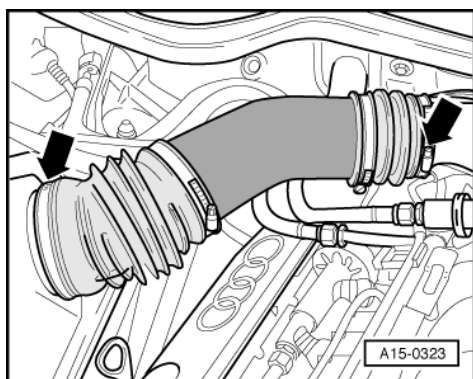


Note:

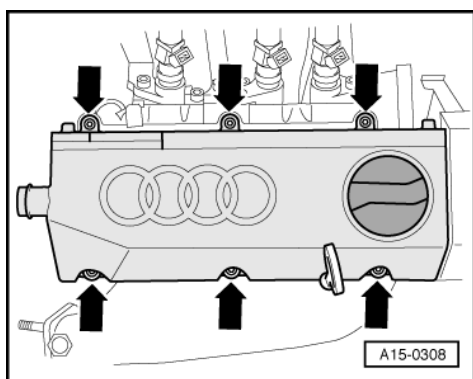
All cable ties which are released or cut open when removing must be fitted in the same position when installing.

Removing

- -> Remove engine cover -arrows-.



- -> Remove air duct hose between air mass meter and intake manifold -arrows-.
- Remove hose of crankcase breather from rear of cylinder head cover.
- Loosen cable tie and expose electrical wiring.



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

Installing

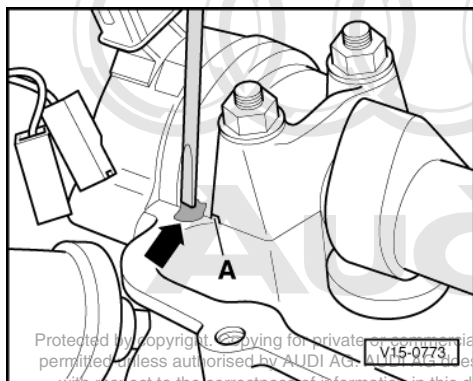
Installation is carried out in the reverse order; note the following:

Notes:

- ♦ Replace cylinder head cover gasket if damaged.
- ♦ Before fitting, spray inside and outside of gasket for cylinder head cover with silicone lubricant.
- ♦ Lubricant

=> Parts List

- ♦ The oil bore -A- must not be blocked.



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- -> Apply a small quantity of sealant to connections -arrows- on upper sealing surface of cylinder head.

♦ Sealants

=> Parts List

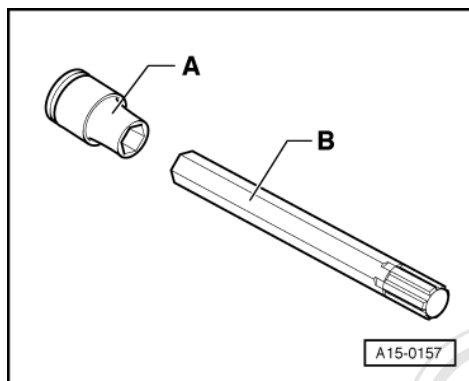
- Tighten nuts for cylinder head cover crosswise and in stages.

Tightening torque

Component	Nm
Cylinder head cover to cylinder head	10

1.6 - Removing left cylinder head

- Engine in vehicle



Note:

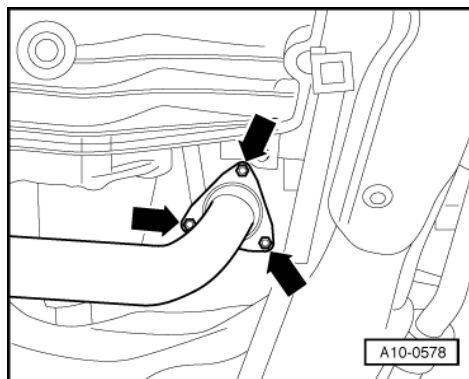
The cylinder head bolts have been progressively superseded by Polydrive. To Loosen or tighten cylinder head bolts with Polydrive bolt heads use:

- ♦ -> A - Socket attachment, 10 mm (commercially available)
- ♦ B - Special tool 3452

- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

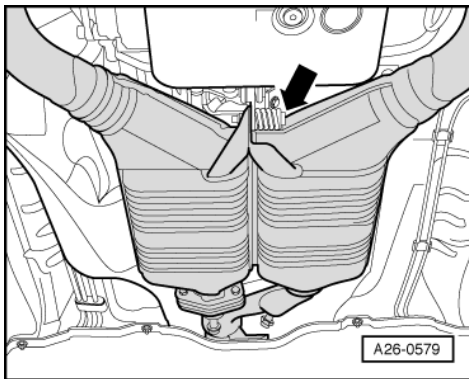
=> General Body Assembly; Repair group 72

- Disconnect earthing strap at battery with ignition switched off.
- Drain coolant => Page 165 .





- -> Unscrew nuts on left and right of exhaust manifold/front exhaust pipe -arrows-.

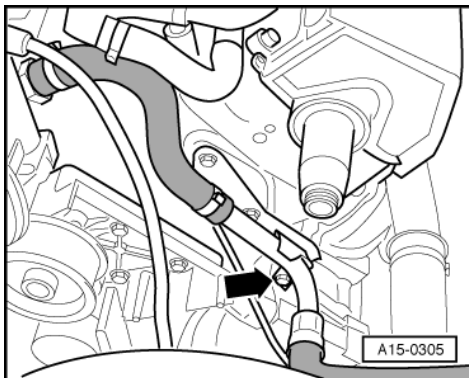


- -> Unbolt exhaust system from bracket -arrow- at gearbox.

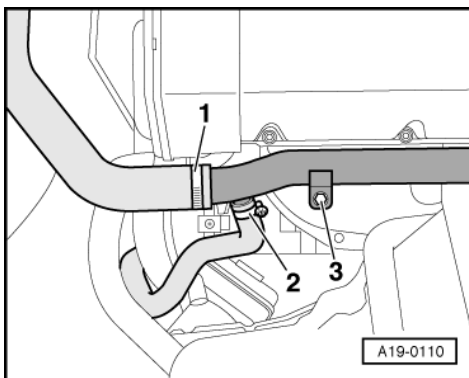
Note:

Illustration shows vehicle with two catalytic converters.

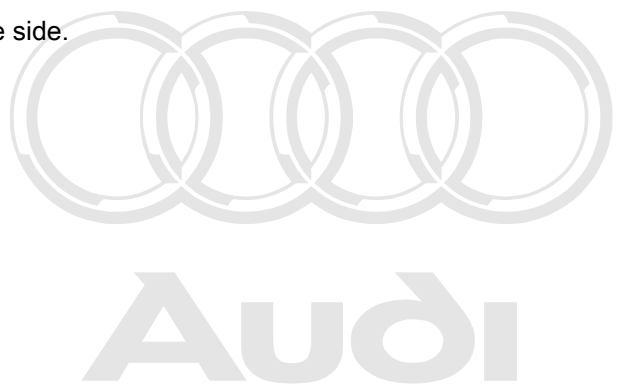
- Detach exhaust system from exhaust manifolds.



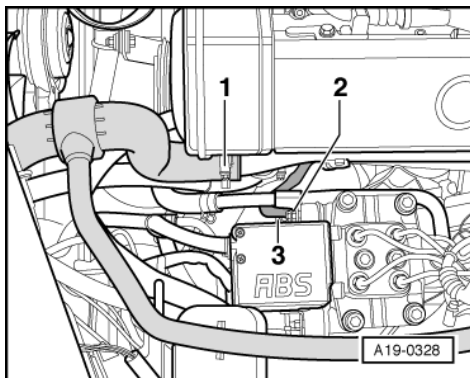
- Removing toothed belt (from camshaft sprockets only) => Page 46 .
- Remove rear left toothed belt guard.
- -> Unscrew bolt -arrow- from hydraulic pump supply pipe bracket.
- Remove intake manifold => Page 86 .
- Unplug spark plug connectors and move clear to one side.



- -> Disconnect coolant hose -1- from large coolant pipe. Hose -2- may remain connected.
- Unscrew bolt -3-.



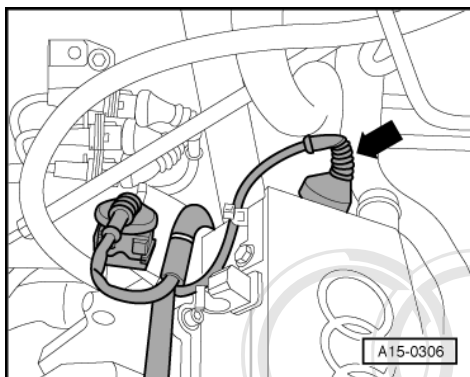
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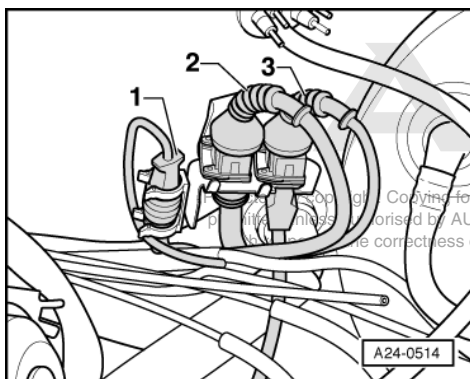
- -> Unscrew earth wire -2-

Note:

Items -1- and -3- remain installed.



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

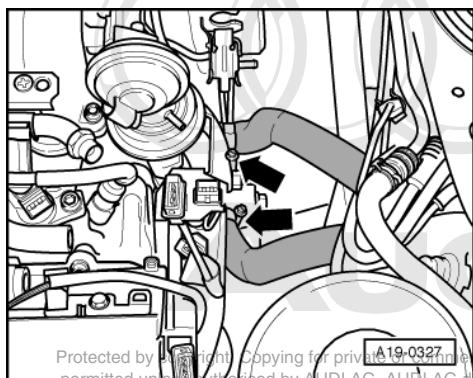


- -> Unplug the connectors -1- and -3- to lambda probe.

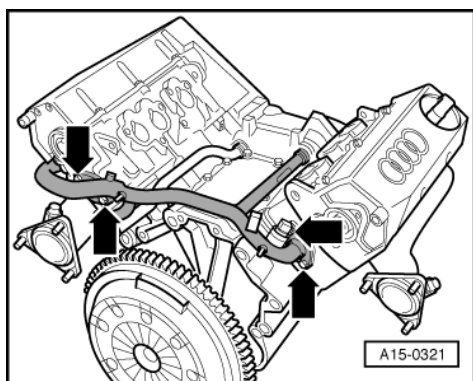
Note:

It is not necessary to unplug connector -2-.

- Expose wiring.



- -> Detach the coolant hoses leading to the heating system heat exchanger at the engine -arrows-.

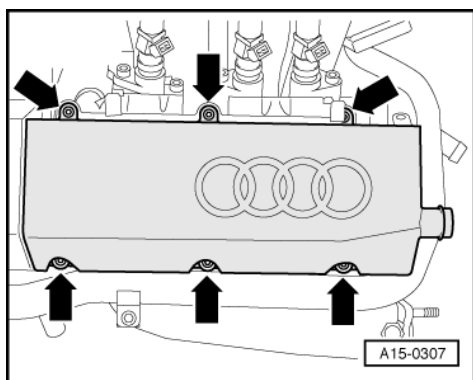


- -> Remove rear bolts -arrows- of coolant pipe from cylinder heads.

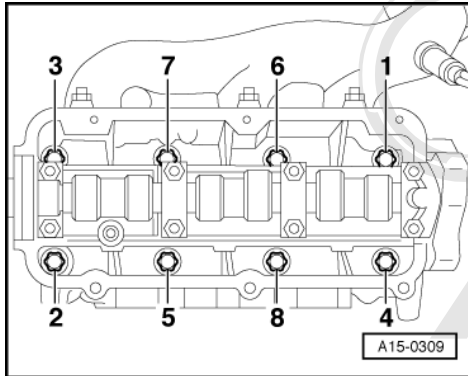
Note:

The coolant pipe is shown in illustration with engine removed.

- Pull coolant pipe back slightly.



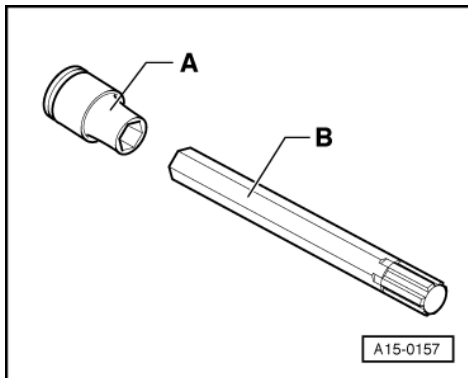
- -> Loosen bolts -arrows- for cylinder head cover and remove cylinder head cover.
- Remove oil deflector under cylinder head cover.



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

1.7 - Removing right cylinder head

- Engine in vehicle



Note:

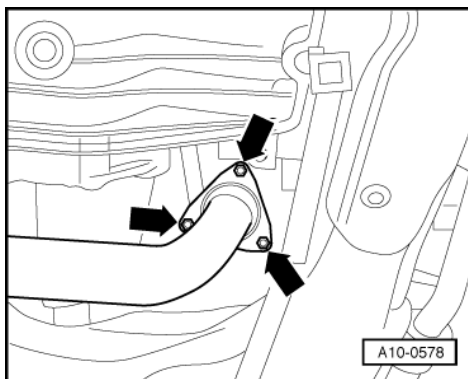
The cylinder head bolts have been progressively superseded by Polydrive. To Loosen or tighten cylinder head bolts with Polydrive bolt heads use:

- ♦ -> A - Socket attachment, 10 mm (commercially available)
- ♦ B - Special tool 3452

- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

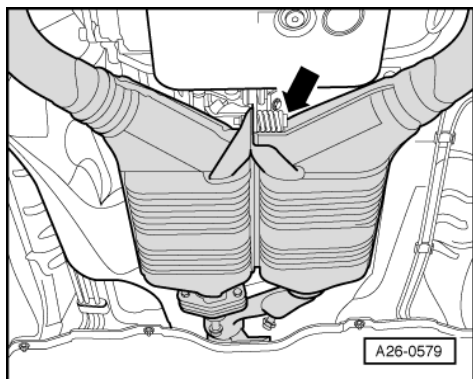
=> General Body Assembly; Repair group 72

- Disconnect earthing strap at battery with ignition switched off.
- Drain coolant => Page 165 .





- -> Unscrew nuts on left and right of exhaust manifold/front exhaust pipe -arrows-.

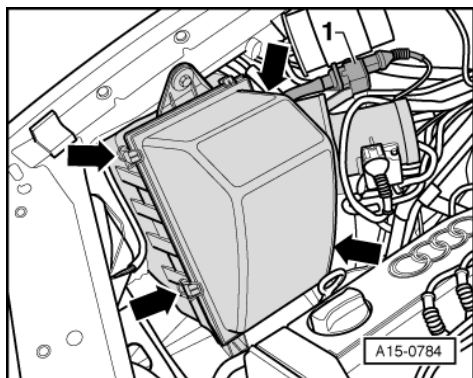


- -> Unbolt exhaust system from bracket -arrow- at gearbox.

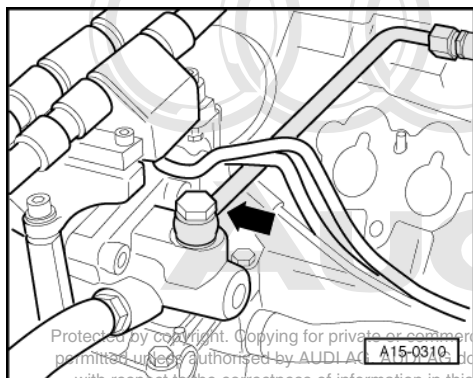
Note:

Illustration shows vehicle with two catalytic converters.

- Detach exhaust system from exhaust manifolds.

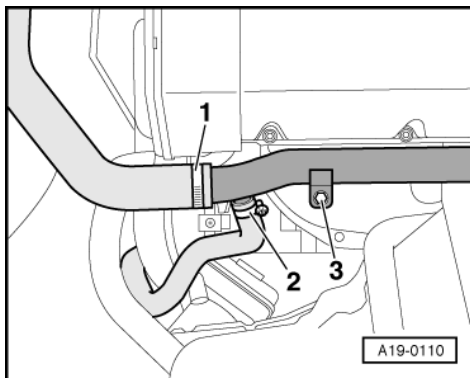


- Removing toothed belt (from camshaft sprockets only) => Page 46 .
- Remove rear right toothed belt guard.
- Remove intake manifold => Page 86 .
- -> Disengage ACF valve -1- from air cleaner housing.
- Open retaining clips -arrows- and remove upper section of air cleaner and place to rear.

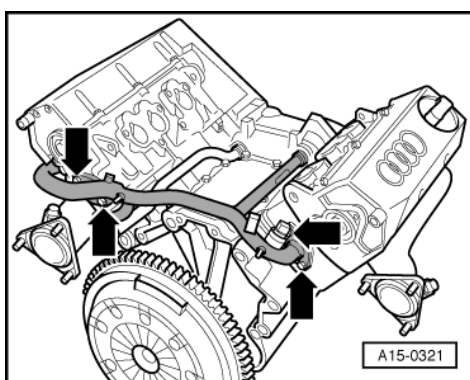


- Unplug spark plug connectors and move clear to one side.
- -> Unscrew pressure line -arrow- from hydraulic pump.

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- -> Disconnect coolant hose -1- from large coolant pipe. Hose -2- may remain connected.
- Remove coolant pipe bolt -3- (on left cylinder head).

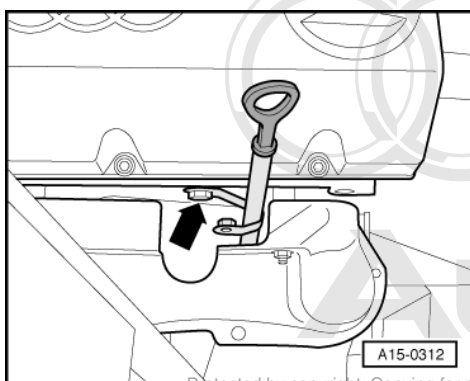


- -> Remove rear bolts -arrows- of coolant pipe from cylinder heads.

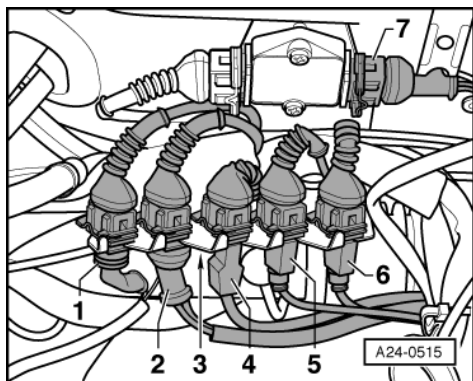
Note:

The coolant pipe is shown in illustration with engine removed.

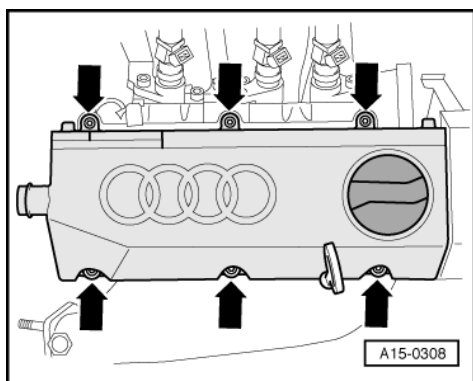
- Pull coolant pipe back slightly.



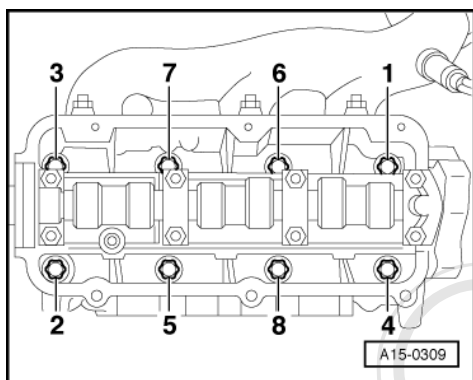
- -> Unbolt dipstick guide tube on cylinder head -arrow- and lift up and out.
- Move wiring harness on cylinder head cover clear to one side.



- -> Unplug the connectors -1- and -3- to lambda probe.
- Expose wiring.



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



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

1.8 - Installing cylinder head

Notes:

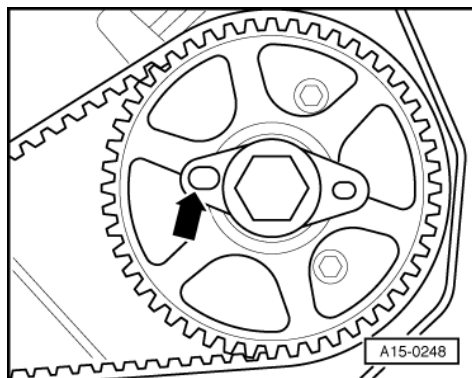
- ♦ Replace the cylinder head bolts.
- ♦ When performing installation procedures always replace self-locking nuts and bolts
- ♦ Replace seals, gaskets, and bolts which have a specified tightening angle
- ♦ If repairing, carefully remove any remains of gasket material from the cylinder head and cylinder 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 head.

- ◆ 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. Marking -top- or part number must face cylinder head
- ◆ When installing a replacement cylinder head, drive in a sealing cap on the appropriate front side of the head => Fig. 86 .

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

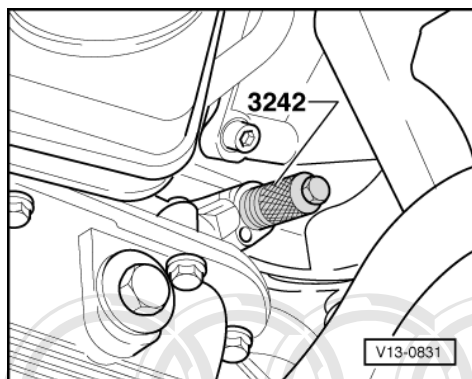
=> Parts List

- ◆ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

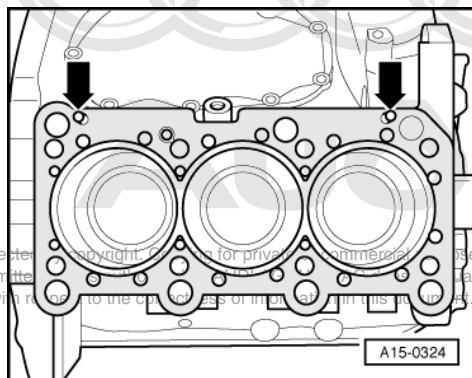


Installation is carried out in the reverse order; note the following:

- -> Before positioning cylinder head, set crankshaft and camshaft to TDC of No. 1 cylinder: The large holes -arrow- for the fixing plates at the camshaft sprocket must face each other inwards...



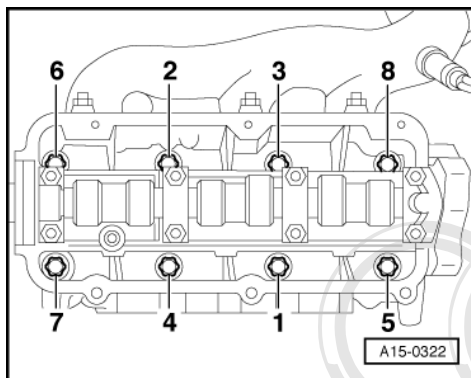
- -> ...and clamping bolt 3242 must be screwed in.



- -> Place cylinder head gasket in position.
- Note position of centring pins in cylinder block -arrows-.
- Check installation position of cylinder head gasket: mark "top" or the part No. must face cylinder head.



- Position cylinder head.
- 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 rigid wrench:
 - 2nd Stage: 180°(1/2 turn) further)

Notes:

- ♦ It is permissible to torque by 2 x 90 °
 - ♦ It is not necessary to re-tighten the cylinder head bolts
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- Install intake manifold => Page 91 .
 - Install cylinder head cover => Page 94 .
 - When installing the right cylinder head replace the O-ring on bottom of oil dipstick guide tube.
 - Install toothed belt (adjust valve timing) => Page 49 .

Note:

Note all instructions on removing and installing the toothed belt =>Page 46 .

- Install ribbed belt =>Page 37 .
- Installing exhaust system and aligning it stress-free => Page 218 .

Notes:

- ♦ If the battery is reattached make sure that the vehicle equipment (radio, clock, electrical window lifter) is actuated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

=> Fuel Injection and Ignition System; Repair group 24

- Replace coolant => Page 166 .
- Top up power steering fluid and bleed steering system:

=> Running gear, FWD and 4WD; Repair group 48; Checking oil level, bleeding steering system, checking for leaks Checking oil level, bleeding steering system, checking for leaks

Tightening torques

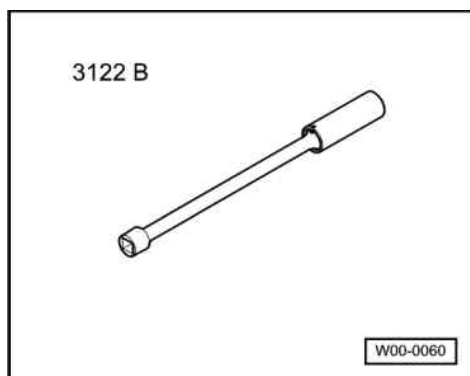
Component	Nm
Rear toothed belt guard to cylinder head	10 1)
Large coolant pipe to cylinder head or bracket	10
Dipstick guide tube to cylinder head.	10
Power steering pressure pipe to hydraulic pump	40

- 1) Install using locking compound;

locking compound

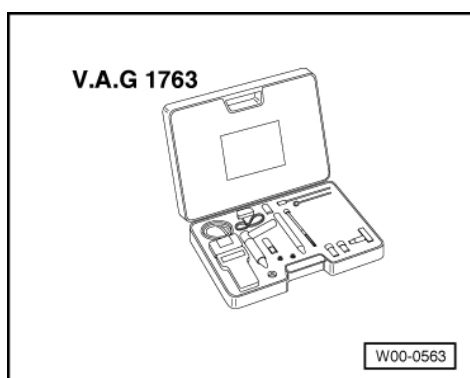
=> Parts List

1.9 - Checking compression

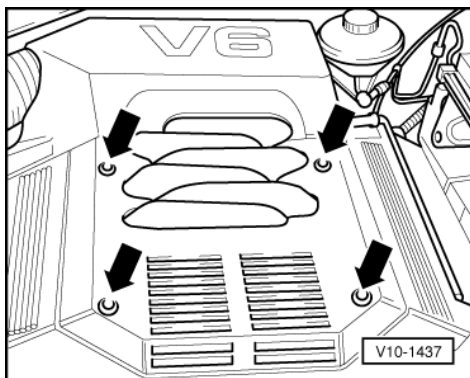


Special tools and workshop equipment required

- ♦ Spark plug socket 3122 B



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



Test conditions:

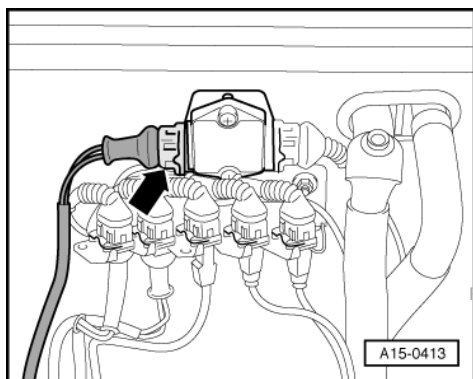
- Engine oil temperature at least 30 °C
- Battery voltage at least 12.7 V

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Test sequence

- -> Remove engine cover-arrows-.



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- -> With ignition switched off, remove connector from ignition coil output stage -arrow-.
- Unplug connectors from all injectors.
- Unplug spark plug connectors and move clear to one side.
- Remove spark plugs with spark plug spanner 3122B.
- Fully open throttle valve.
- Check compression 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 values:

New excess pressure in bar	Wear limit excess pressure in bar	Permissible difference between cylinder excess pressure in bar
9.0...14.0	7.5	max. 3.0

- Install spark plugs.
- To interrogate fault memory:

=> Fuel Injection and Ignition System; Repair group 01

Note:

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

Tightening torque

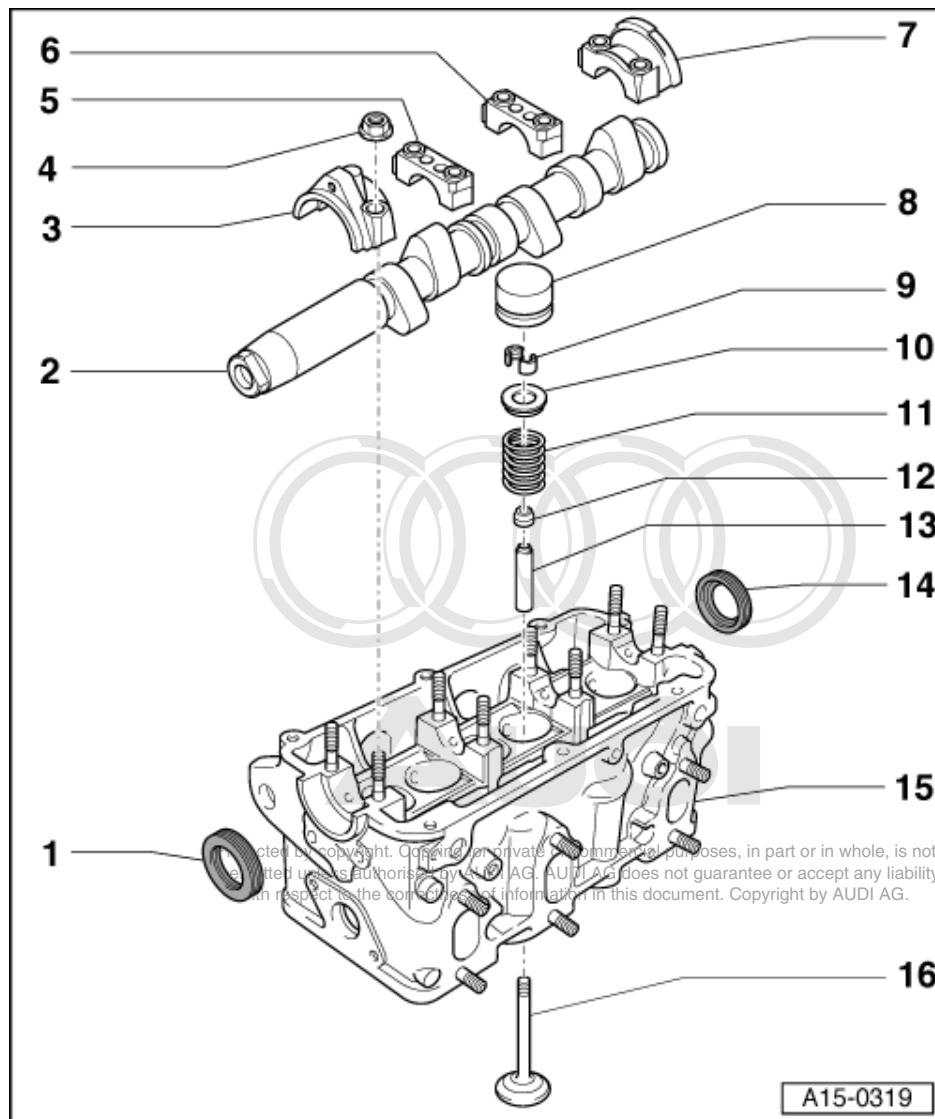
Component	Nm
Spark plugs in cylinder head	30

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.
- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.
- ♦ Replace seals and gaskets.
- ♦ The left cylinder head with light valve gear "S" is shown in the following illustration.



1 Sealing ring

- ♦ Replacing => Page 116 .

2 Camshaft

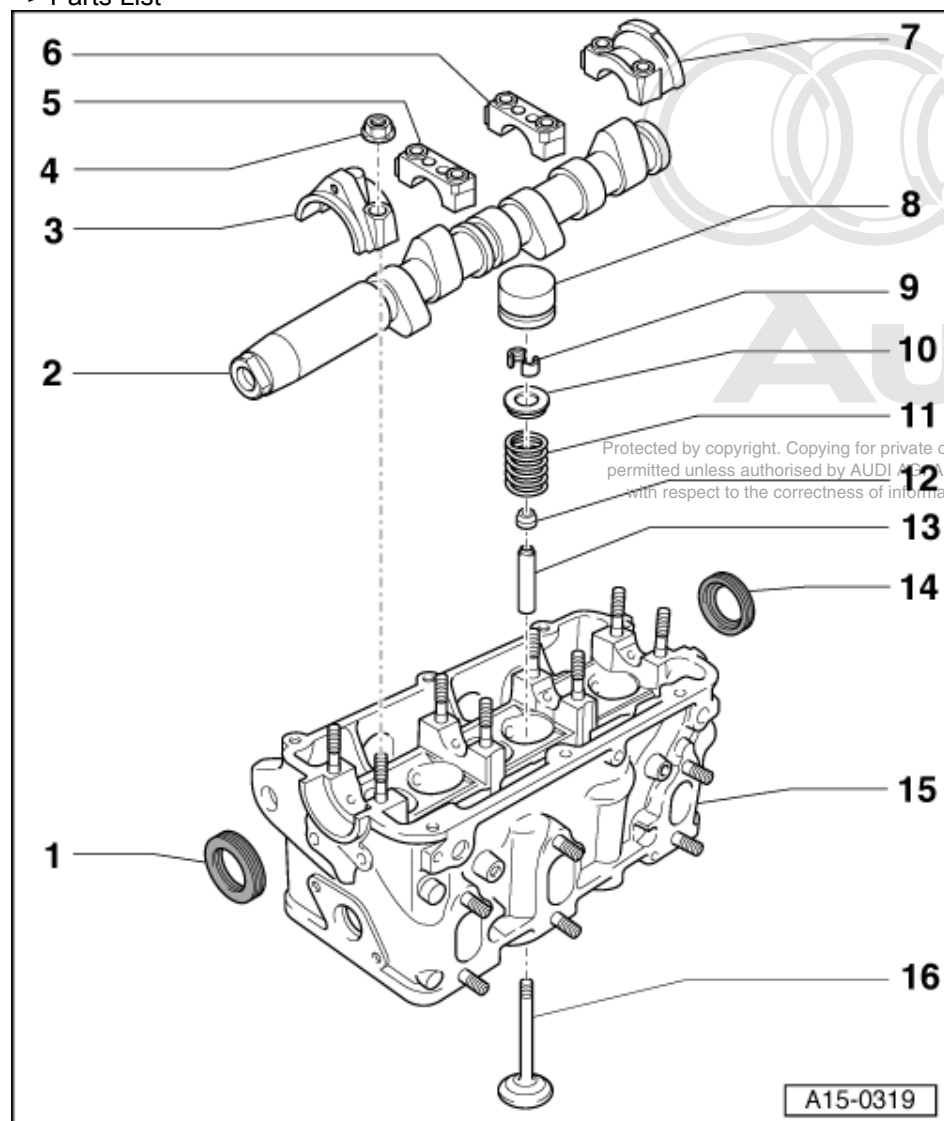
- ♦ Removing and installing
=>Page 120 .
- ♦ Checking axial play
=>Page 116 .
- ♦ Checking radial clearance with Plastigage

- ◆ Run-out: no more than 0.01 mm

3 Bearing cap no. 1

- ◆ for left cylinder head
- ◆ Installation sequence
=> Page 120 , Removing and installing camshaft
- ◆ Installation position
=> Fig. 114
- ◆ Sealing connections with sealant => Fig. 85
- ◆ Sealants

=> Parts List



4 20 Nm

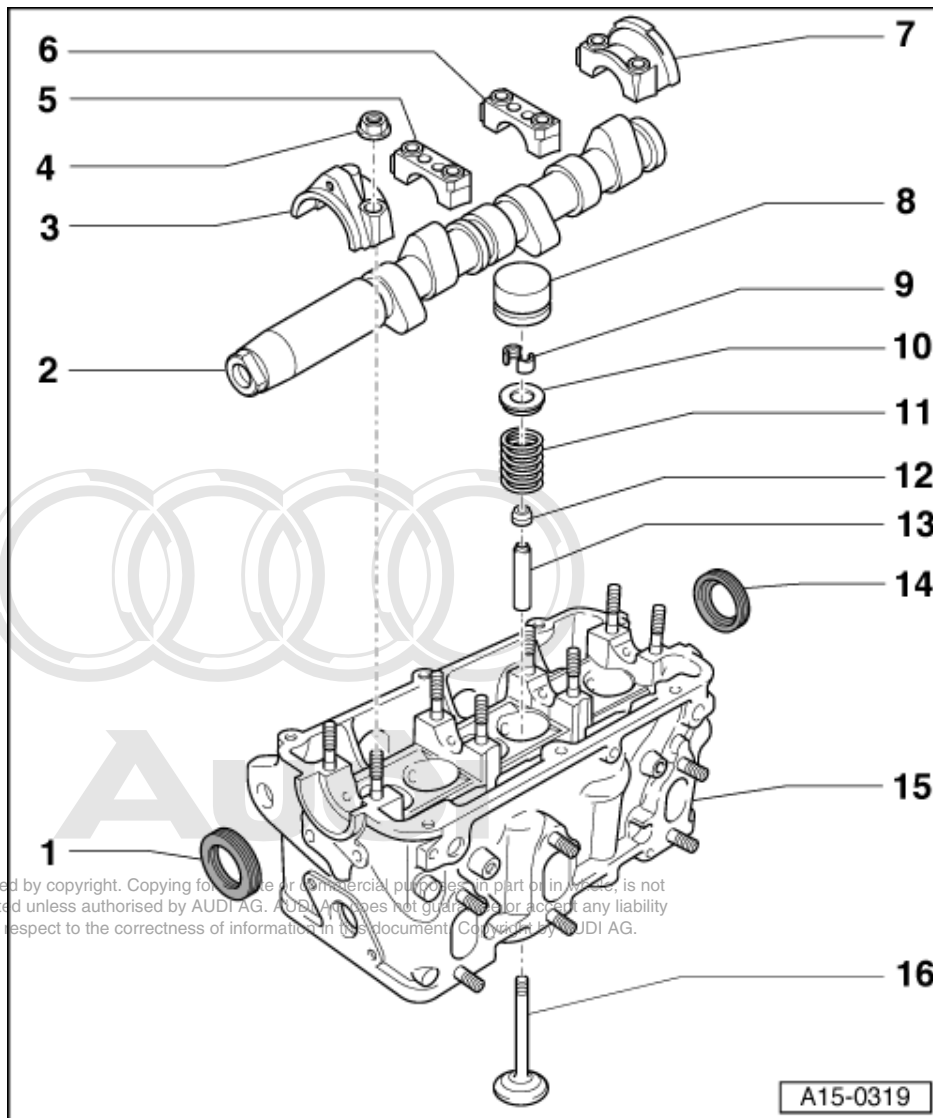
5 Bearing cap no. 2

- ◆ For left cylinder head
- ◆ On left cylinder head with camshaft axial bearing (can be recognised by the ground edges)
- ◆ Mark
- ◆ Installation sequence
=> Page 120 , Removing and installing camshaft
- ◆ Installation position
=> Fig. 114

6 Bearing cap no. 3

- ◆ for left cylinder head
- ◆ On right cylinder head with camshaft axial bearing (can be recognised by the ground edges)

- ♦ Mark
- ♦ Installation sequence
=> Page 120 , Removing and installing camshaft
- ♦ Installation position
=> Fig. 114



7 Bearing cap no. 4

- ♦ For left cylinder head
- ♦ Installation sequence
=> Page 120 , Removing and installing camshaft
- ♦ Sealing connections with sealant => Fig. 85
- ♦ Sealants

=> Parts List

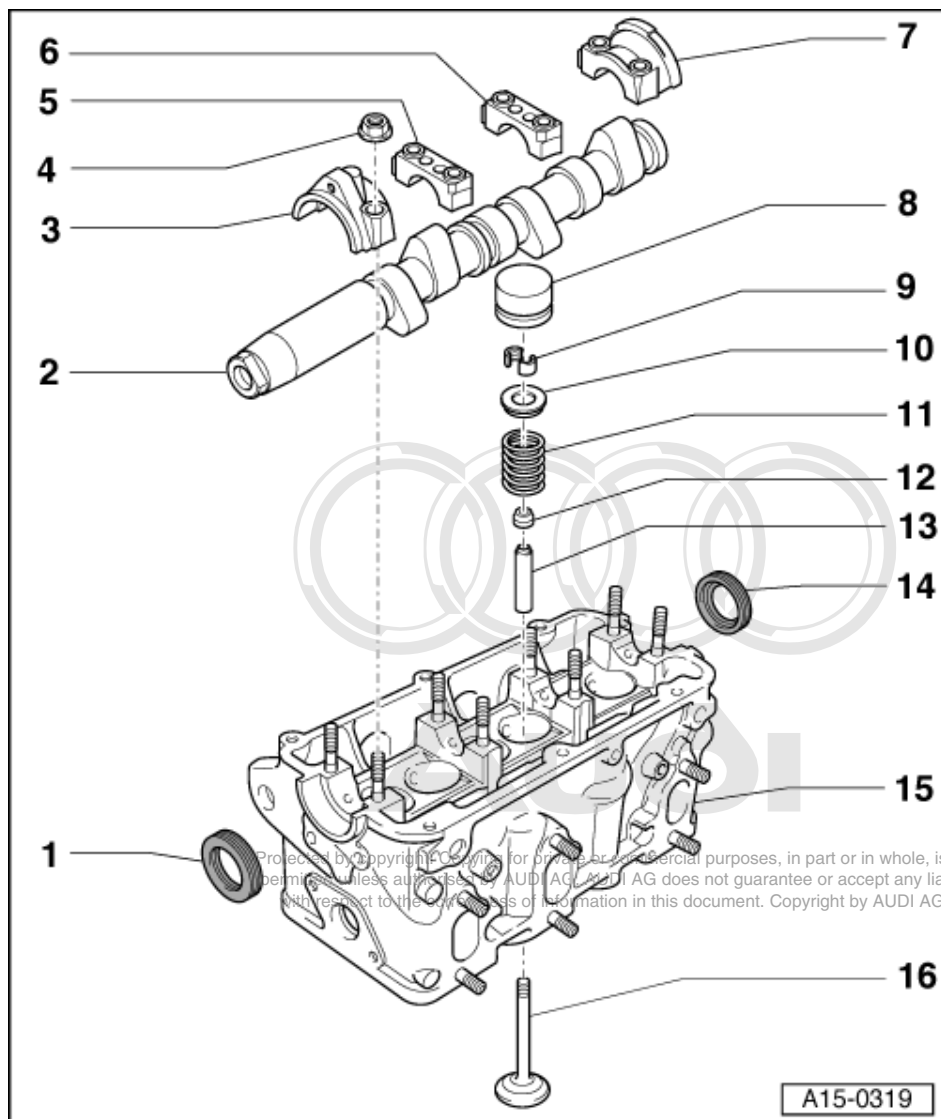
- ♦ Installation position
=> Fig. 114

8 Hydraulic bucket tappet

- ♦ Checking => Page 122
- ♦ Removing and installing
=>Page 123 .
- ♦ Do not interchange
- ♦ Store with cam contact surface downwards
- ♦ Before installing check camshaft axial play
=>Page 116 .



- ♦ Oil contact surface



9 Valve cotters

10 Valve spring plate

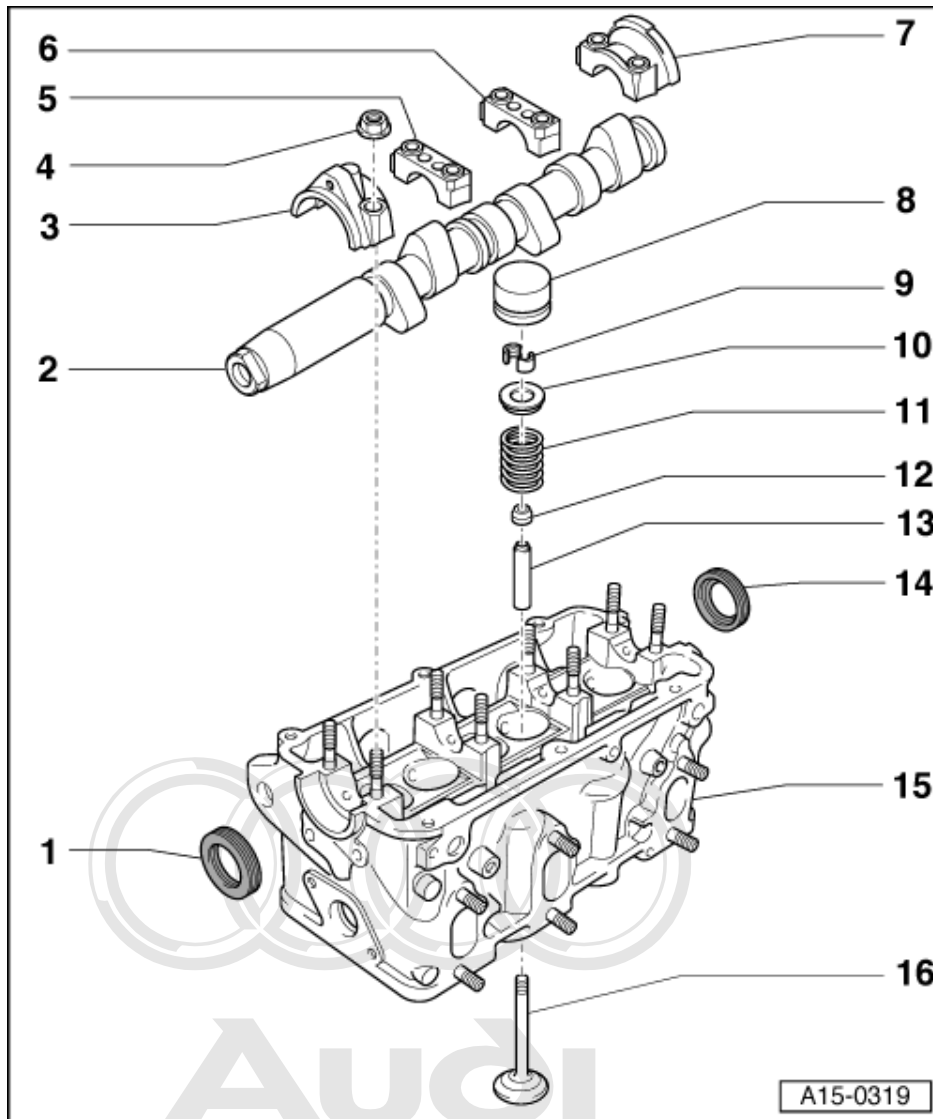
- ♦ For light valve gear "S"
 - ♦ Valve spring plate for old valve gear "M"
- => Fig. 113

11 Valve springs

- ♦ For light valve gear "S"
- ♦ Valve springs for old valve gear "M" => Fig. 113
- ♦ Removing and installing:
with cylinder head installed => Page 123
with cylinder head removed with 2037

12 Valve stem seal

- ♦ Replacing => Page 123 .

**13 Valve guide**

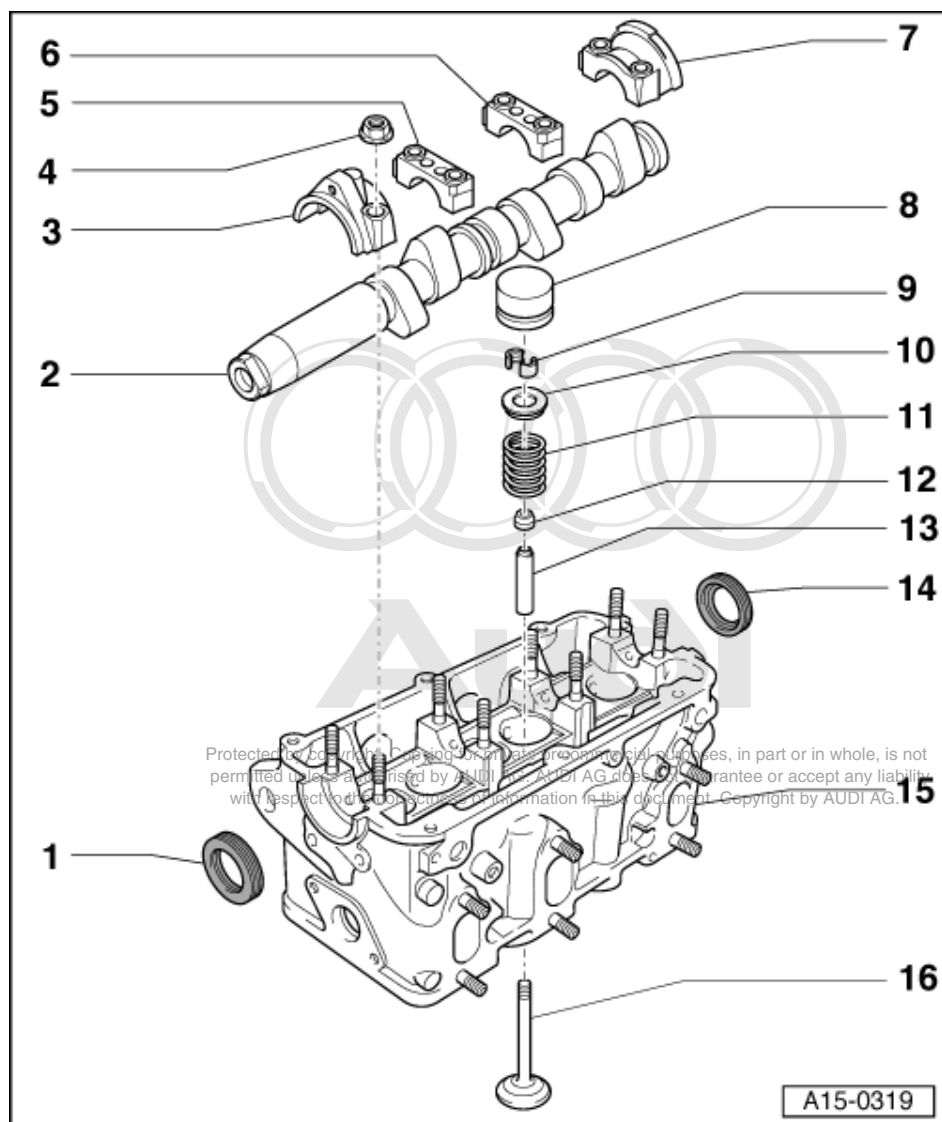
- ◆ Checking => Page 127
- ◆ Replacing => Page 128
- ◆ Repair version with collar

14 Sealing ring

- ◆ only present on left cylinder head
- ◆ Removing Hall sender to replace with engine installed => Fig. 115 and unscrewing bearing cap no. 4 - Item 7 -

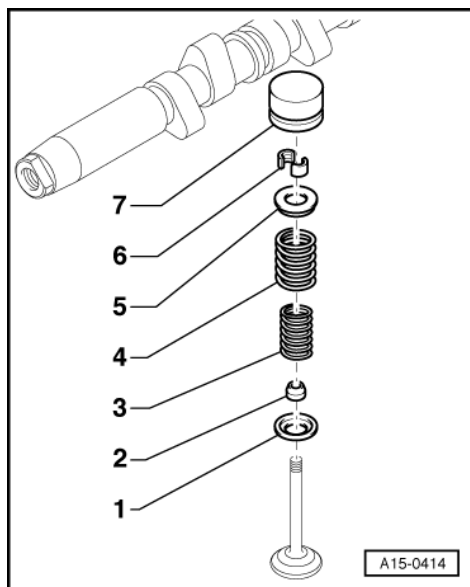
15 Cylinder head

- ◆ See note
=>Page 107 .
- ◆ Checking valve guides
=>Page 127 .
- ◆ Rework valve seats
=>Page 130 .



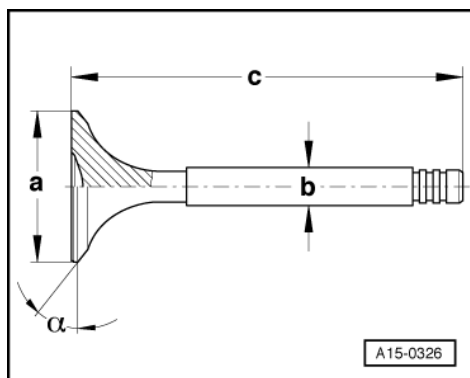
16 Valve

- ♦ Do not rework, only grinding in is permitted
- ♦ Valve dimensions for old valve gear "M"
=> Fig. 113
- ♦ Valve dimensions for light valve gear "S"
=> Fig. 114



-> Fig.1 Old valve gear "M"

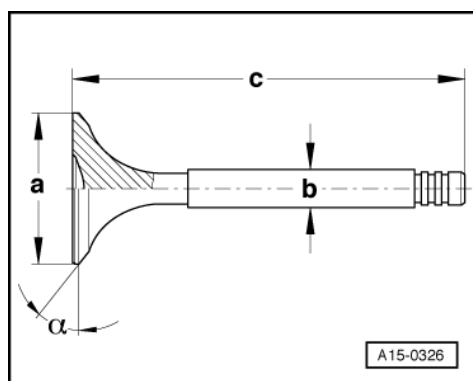
- 1 - Lower valve spring plate
- 2 - Valve stem seal
- 3 - Inner valve spring
- 4 - Outer valve spring
- 5 - Upper valve spring plate
- 6 - Valve cotter
- 7 - Hydraulic tappet



-> Fig. 2 Valve dimensions for old valve gear "M"

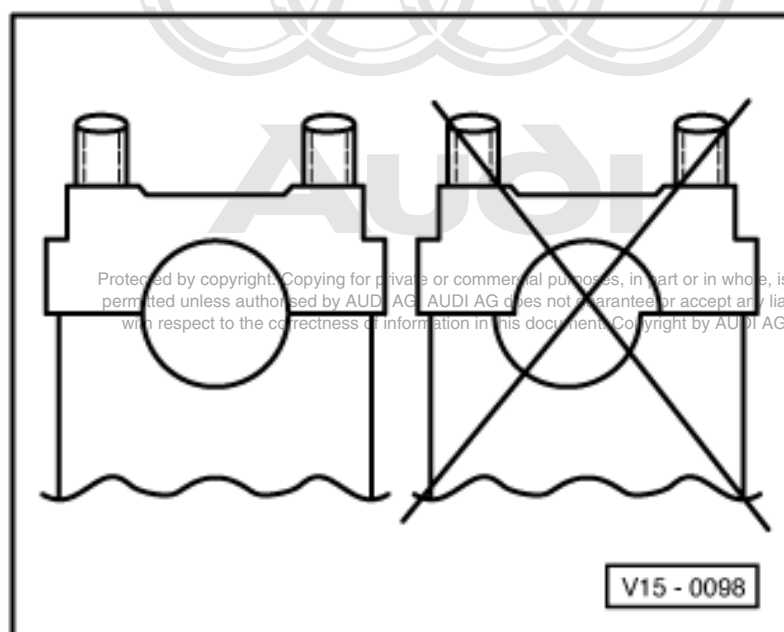
Dim.	Inlet valve	Exhaust valve
øa mm	39.5 ±0.15	32.9 ±0.15
øa mm	7.97 ±0.02	7.95 ±0.02
c mm	91.85	91.15
α <°	45	45

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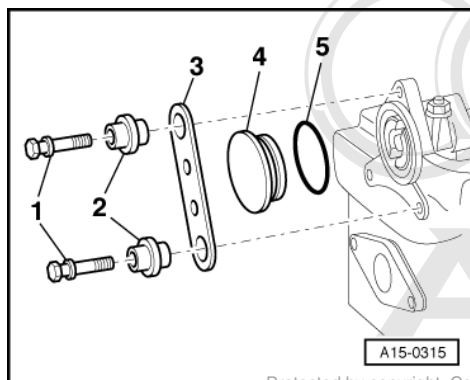
-> Fig. 3 Valve dimensions for light valve gear "S"

Dim.	Inlet valve	Exhaust valve
øa mm	39.5 ±0.15	32.9 ±0.15
øa mm	6.92 ±0.02	6.92 ±0.02
c mm	91.85	91.15
α <°	45	45



-> Fig. 4 Installation position of camshaft bearing caps

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



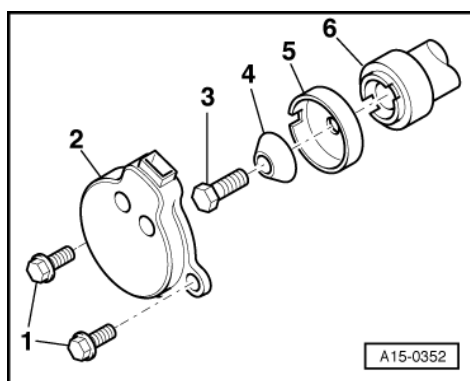
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-> Fig.5 Rear sealing cap for right cylinder head

- 1 - 10 Nm
 - 2 - Bush
 - 3 - Clasp
 - 4 - Sealing cap
 - 5 - O-ring
- Replace

Note:

The sealing cap shown in the illustration has been progressively superseded by a sealing cap with vulcanised seal. Push in sealing cap with vulcanised seal using assembly lever.

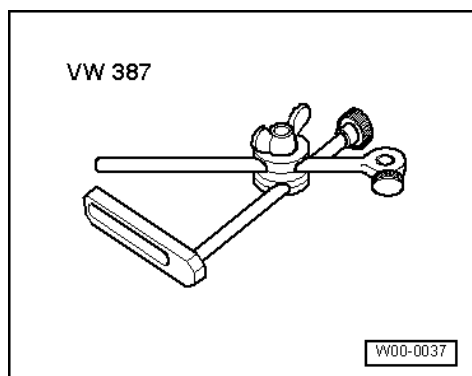


-> Fig.6 Hall sender to left cylinder head

- 1 - 10 Nm
 - 2 - Hall sender housing -G40
 - 3 - 22 Nm
 - 4 - Plate
- with taper
- Note installation position
- 5 - Hall sender trim
- Insert lug in notch of camshaft
- 6 - Camshaft

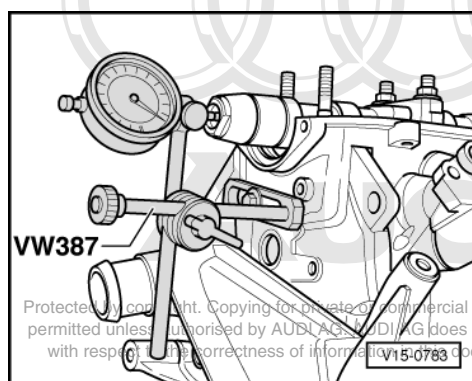


2.2 - Checking camshaft axial clearance



Special tools and workshop equipment required

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



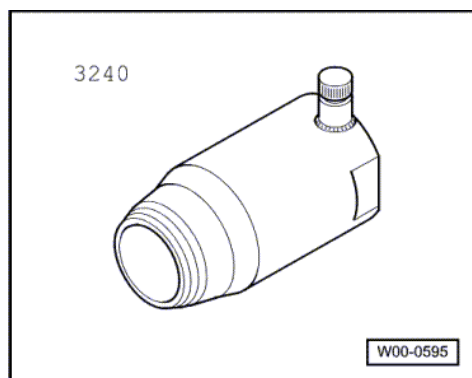
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Test sequence

- Removing camshafts => Page **120** .
- Remove bucket tappets.
- Insert camshafts in cylinder head and fit bearing cap.
- -> Attach universal dial gauge bracket VW 387 with dial gauge to cylinder head.

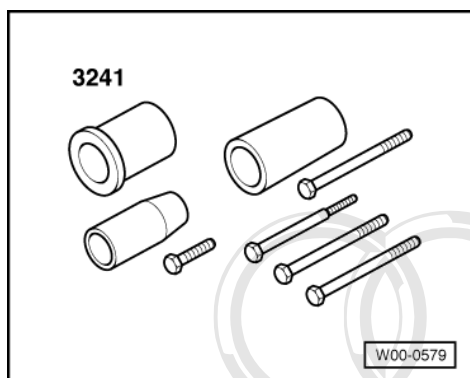
New	Wear limit
0.04...0.15 mm	0.35 mm

2.3 - Replacing front camshaft oil seals



Special tools and workshop equipment required

- ♦ Special tool 3240



- ♦ Fitting tool 3241

Removing

- Removing toothed belt (from camshaft sprockets only) => Page 46 .

Note:

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

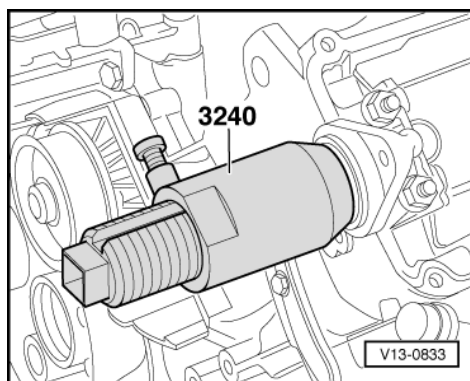
- Adjust inner section of oil seal extractor 3240 until it is flush with the outer section.

Left cylinder head:

- Unscrew inner section of oil seal extractor 28 turns and lock with knurled screw.

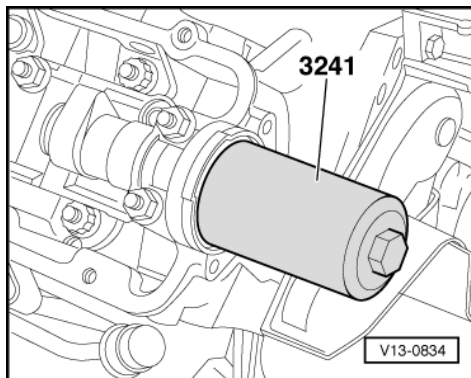
Right cylinder head:

- Unscrew inner section of oil seal extractor 14 turns and lock 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

- Do not lubricate sealing lip of oil seal.
- Slide oil seal over taper on camshaft.

Left cylinder head:

- -> Press oil seal in until flush with press sleeve 3241/1 and M10 x 1.25 x 40 bolt (included with special tool 3241).

Right cylinder head:

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

All models:

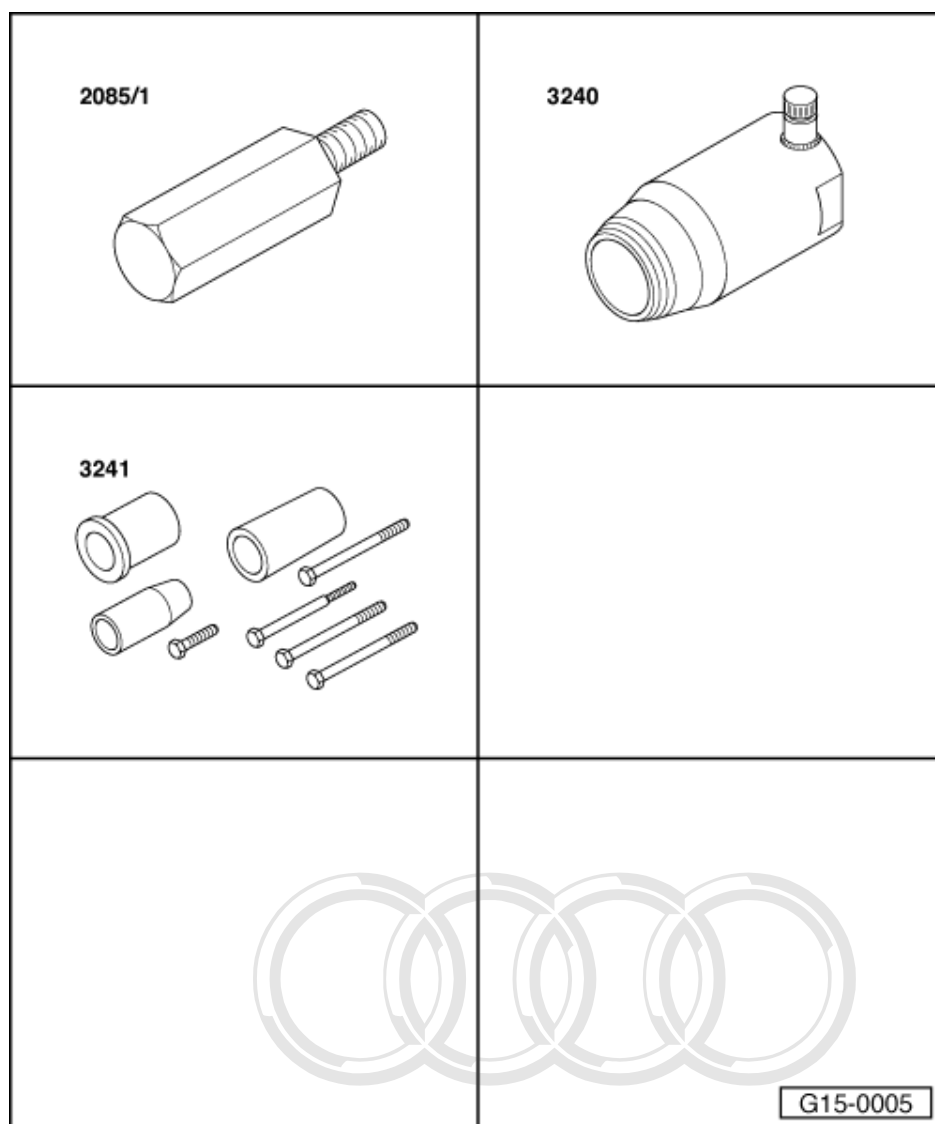
- Install toothed belt (adjust valve timing) => Page 49 .

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Note:

Note all instructions on removing and installing the toothed belt =>Page 46 .

2.4 - Replacing rear oil seal of left camshaft



Special tools and workshop equipment required

- ◆ Special tool 2085/1
- ◆ Oil seal extractor 3240
- ◆ Special tool 3241

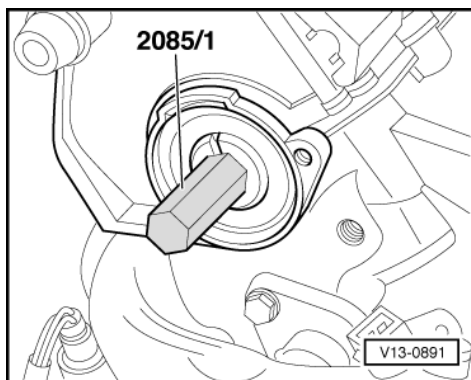
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Removing

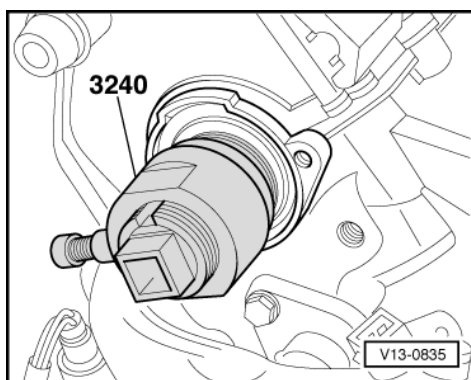
Note:

To replace the oil seal with engine installed, camshaft bearing cap no. 4 -Item 109 must be removed. Replacement with the engine removed is described below.

- Remove Hall sender => Fig. 115 .



- -> Screw in bolts for oil seal extractor 2085/1.



- Adjust inner section of oil seal extractor 3240 until it is flush with the outer section.
- Unscrew inner section of oil seal extractor 9 turns and lock 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 also be used.

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

Installing

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

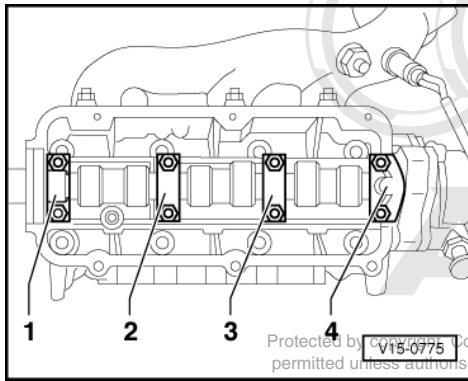
- Do not lubricate sealing lip of oil seal.
- Press in oil seal until flush using press sleeve 3241/1 and bolt 3241/3 (M8 x 105).

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2.5 - Removing and installing camshafts

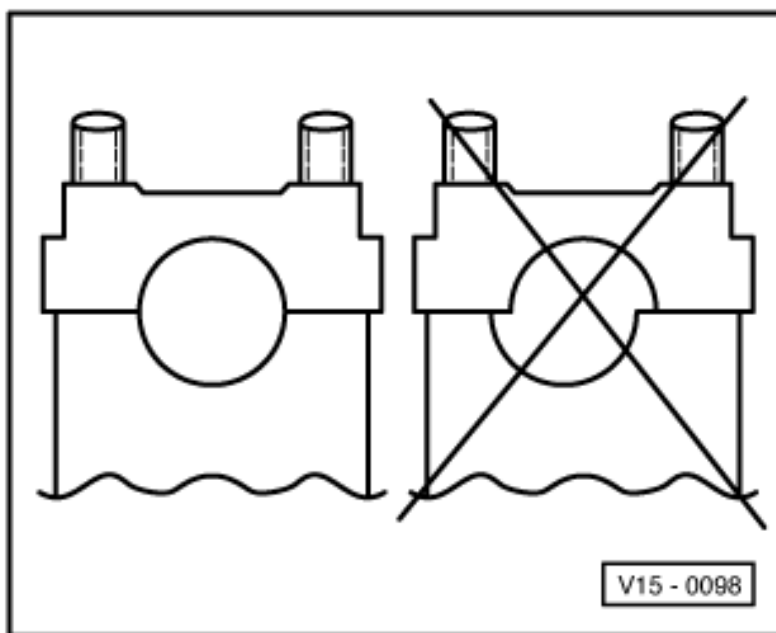
Removing

- Removing toothed belt (from camshaft sprockets only) => Page 46 .
- Remove cylinder head cover => Page 93 .
- Remove Hall sender from left cylinder head => Fig. 115 .
- Remove camshaft sprocket.
- Mark the installation position of the bearing cap.



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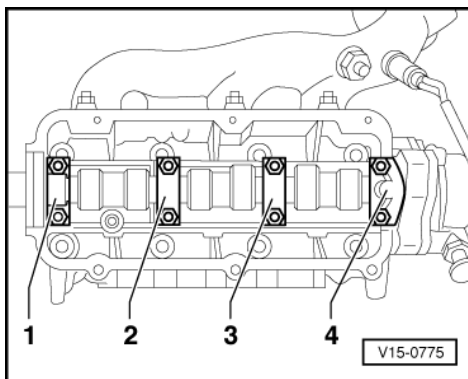
- -> Remove bearing cap 2 and 3 first.
- Loosen and remove bearing caps 1 and 4 alternately and diagonally.



Installing

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

- -> Note offset. Before installing camshaft fit bearing caps and determine installation position.





- -> Tighten bearing caps 1 and 3 alternately and diagonally.
- Tighten the other bearing caps.
- Install toothed belt (adjust valve timing) => Page 49 .

Note:

Note all instructions on removing and installing the toothed belt =>Page 46 .

- Install cylinder head cover => Page 94 .

Right cylinder head:

- Press in the sealing cap with an assembly lever.

All models:

Notes:

- ♦ Wait about 30 minutes after installing the camshafts before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations 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:

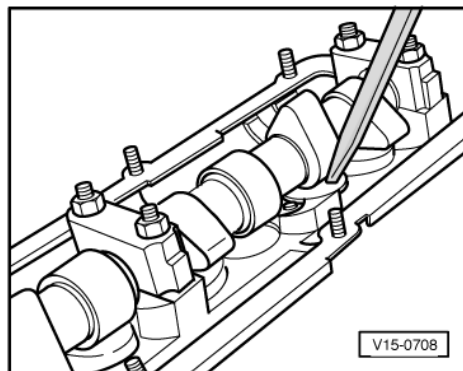
- ♦ Hydraulic tappets cannot be adjusted or repaired.
- ♦ Irregular valve noise during starting is normal.
- Start engine and leave it running until coolant temperature has reached approx. 80 °C.
- Increase engine speed to about 2500 rpm for 2 minutes (perform road test if necessary).

Note:

If the irregular valve noises stop but recur repeatedly during short journeys, a new oil retention valve must be fitted. Oil retention valve fitting location: Under the cover on the intake manifold => Page 156 .

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

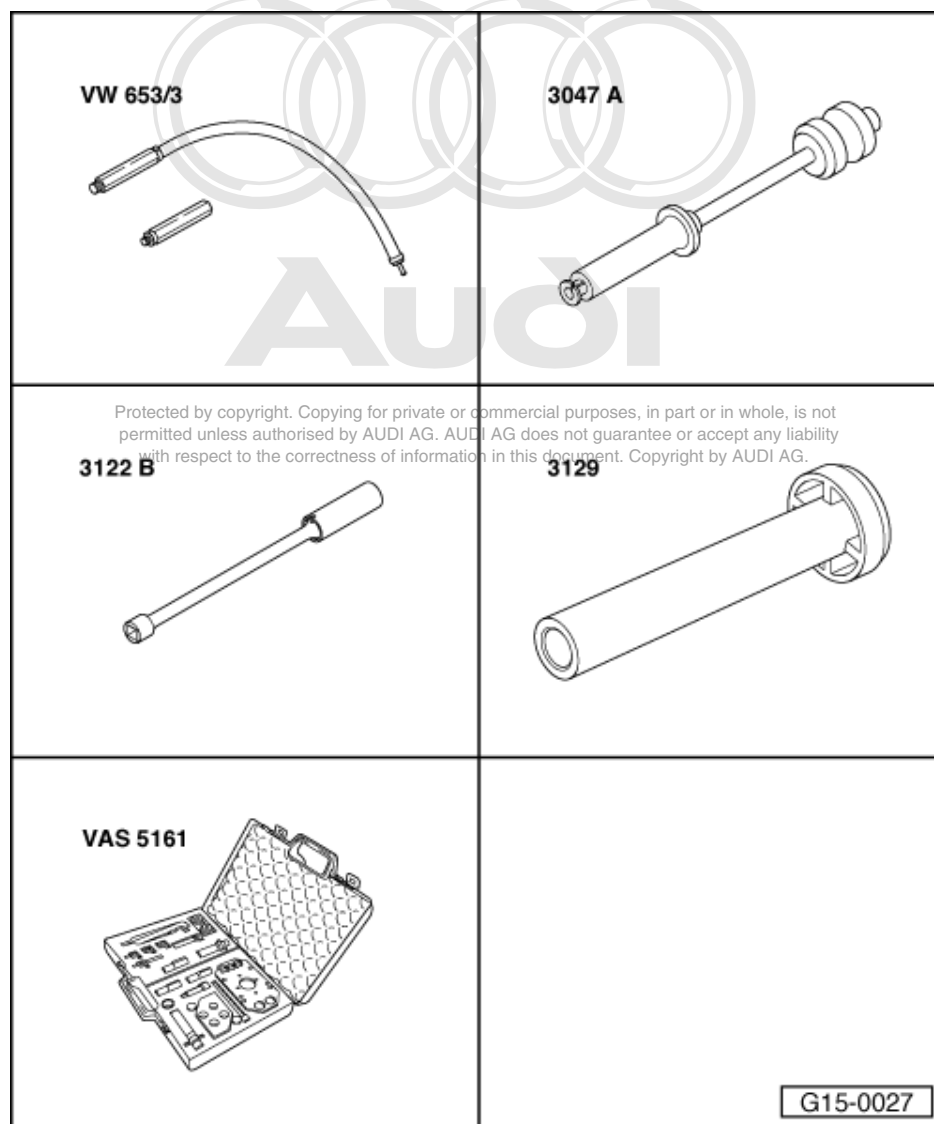
- Remove cylinder head cover => Page 93 .
- Rotate crankshaft at the central bolt of crankshaft toothed belt sprocket in clockwise direction until the cams of the cylinder to be checked are facing upwards.
- Determine play between cam and tappet.



- -> Use a wooden or plastic wedge to push down bucket tappet. If an 0.20 mm feeler gauge can be inserted between camshaft and tappet, renew tappet.
- Replacing bucket tappet => Removing camshaft, Page 120 .

Notes:

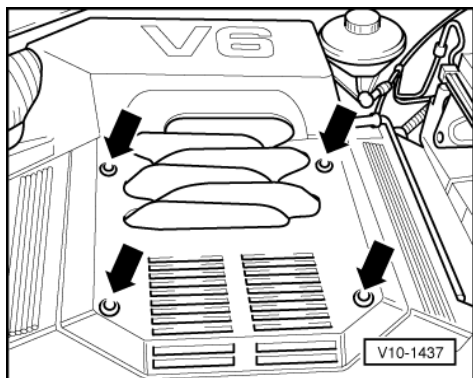
- ◆ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ◆ When working on the valve gear, turn the engine carefully at least 2 rotations to ensure that none of the valves make contact when the starter is operated.

2.7 - Replacing valve stem seals**Special tools and workshop equipment required**

- ◆ Pressure hose VW 653/3
- ◆ Puller 3047 A
- ◆ Spark plug socket 3122 B
- ◆ Fitting tool 3129

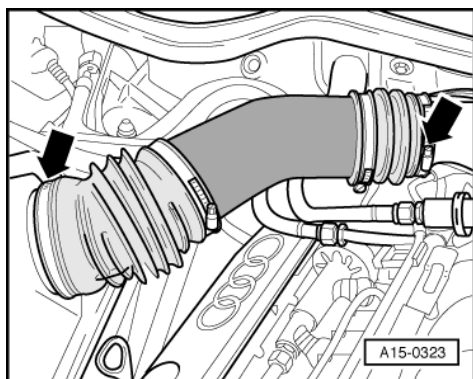


- ♦ Disassembly and assembly tool VAS 5161

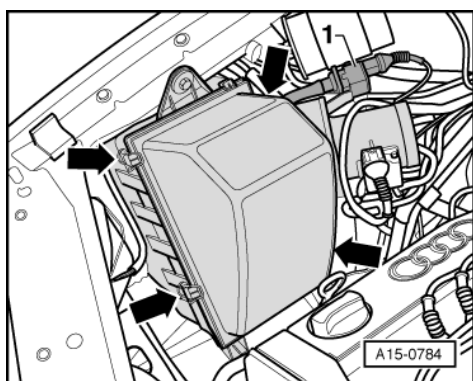


Removing

- Cylinder head installed
- -> Remove engine cover -arrows-.



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



Right cylinder head:

- -> Disengage ACF valve -1- from air cleaner housing.
- Open retaining clips -arrows- and remove upper section of air cleaner and place to rear.

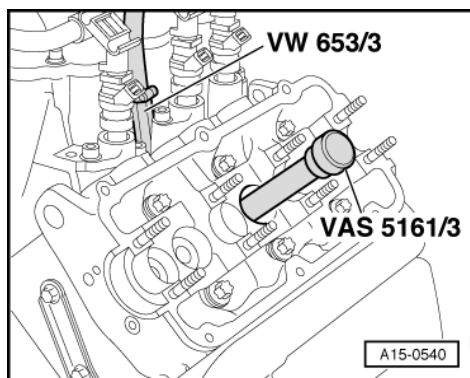
All models:

- Removing camshaft => Page **120**.
- Remove the bucket tappets and put them down with the contact surface downwards. Ensure that the tappets are not interchanged.

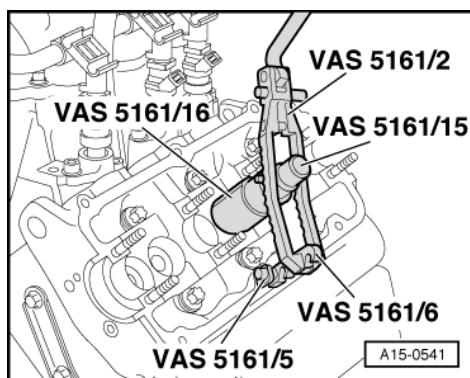


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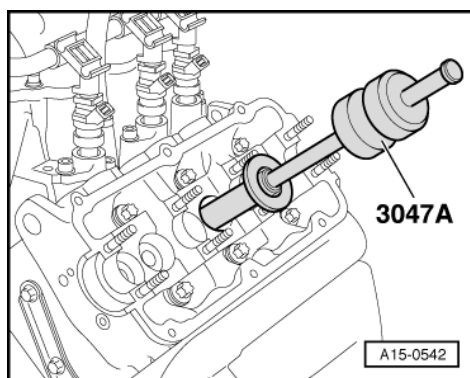
- Remove spark plugs with spark plug spanner 3122B.



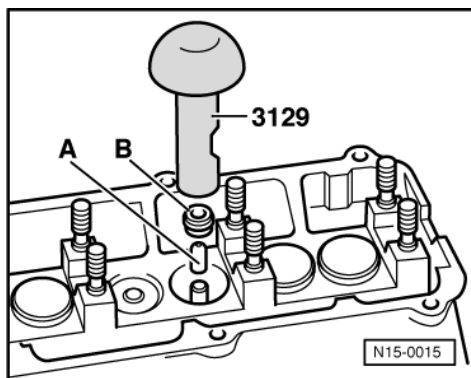
- Set piston of appropriate cylinder to "bottom dead centre".
- -> Screw in the pressure hose VW 653/3 into spark plug thread and put under constant pressure; at least 6 bar excess pressure.
- Install pin VAS 5161/3 into bucket tappet guide.
- Knock tightly fitting valve wedges of both valves loose using a plastic hammer.



- -> Screw in catch part VAS 5161/6 with attachment fork (M6) VAS 5161/5 into a threaded bore on the cylinder head.
- Push guide bush VAS 5161/16 into bucket tappet guide of the valve to be removed until limit stop.
- Installation position: Hatched areas face driving direction
- Push assembly cartridge VAS 5161/15 into guide bush.
- Attach pressure fork VAS 5161/2 to catch part VAS 5161/6 and push assembly cartridge down.
- At the same time turn knurled screw of assembly cartridge towards the right until the tips of the valve wedges engage.
- Slightly move the knurled screw back and forth. This causes the valve wedges to be pressed apart and taken into the cartridge.
- Release the pressure fork.
- Remove assembly cartridge, guide bush, valve plate and valve springs.



- -> Use 3047 A to remove valve stem seals.

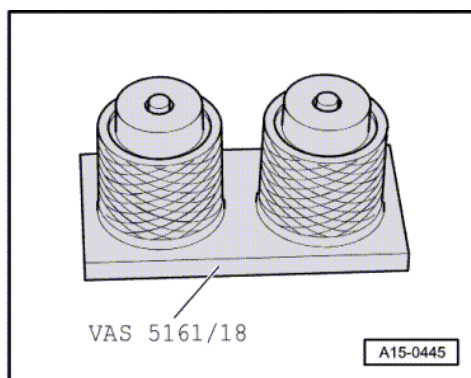


Installing

Note:

A plastic sleeve -A- is included with the new valve stem seals.

- -> To prevent damage to the new valve stem seals -B-, place plastic sleeve -A- on valve stem.
- Lightly lubricate sealing lip of valve stem seal.
- Push valve stem seal onto plastic sleeve.
- Carefully press the valve stem seal onto valve guide using press tool 3129.
- Remove plastic sleeve again.



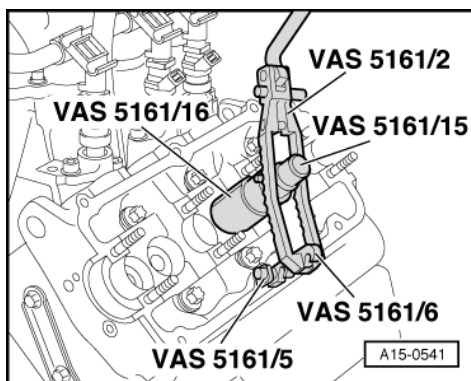
- -> If the valve wedges were taken out of the assembly cartridge they must first be inserted into the installing tool VAS 5161/18.

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Note:

The large diameter of the valve wedges points upwards.

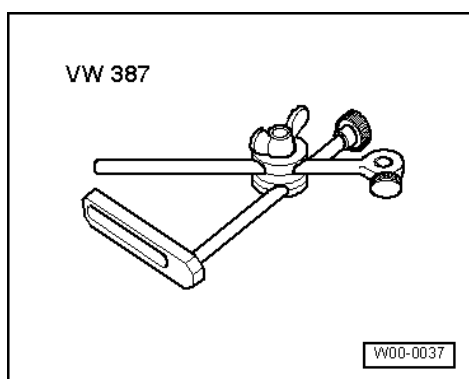
- Push assembly cartridge VAS 5161/15 from the top onto installing tool and take up the valve wedges.



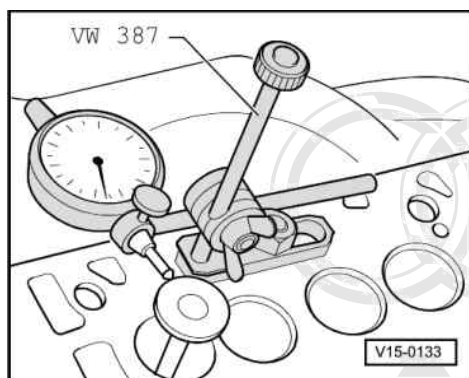
- -> Reinstall the assembly cartridge VAS 5161/15 into guide bush VAS 5161/16.
- Push pressure fork down and pull knurled screw upwards by turning to left and right - thus the valve wedges are installed.
- Take load of the pressure fork when knurled screw is still tight.
- Insert bucket tappet.
- Installing camshaft =>Page 121 .

Notes:

- ♦ After installing the camshaft, wait for about 30 minutes before starting the engine. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons).
- ♦ When working on the valve gear, turn the engine carefully at least 2 rotations 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

**Test sequence**

- -> Set valve in guide. Valve stem end must be flush with guide.
- Determine rock.

Wear limit

Inlet valve guide	Exhaust valve guide
-------------------	---------------------



1.00 mm	1.30 mm
---------	---------

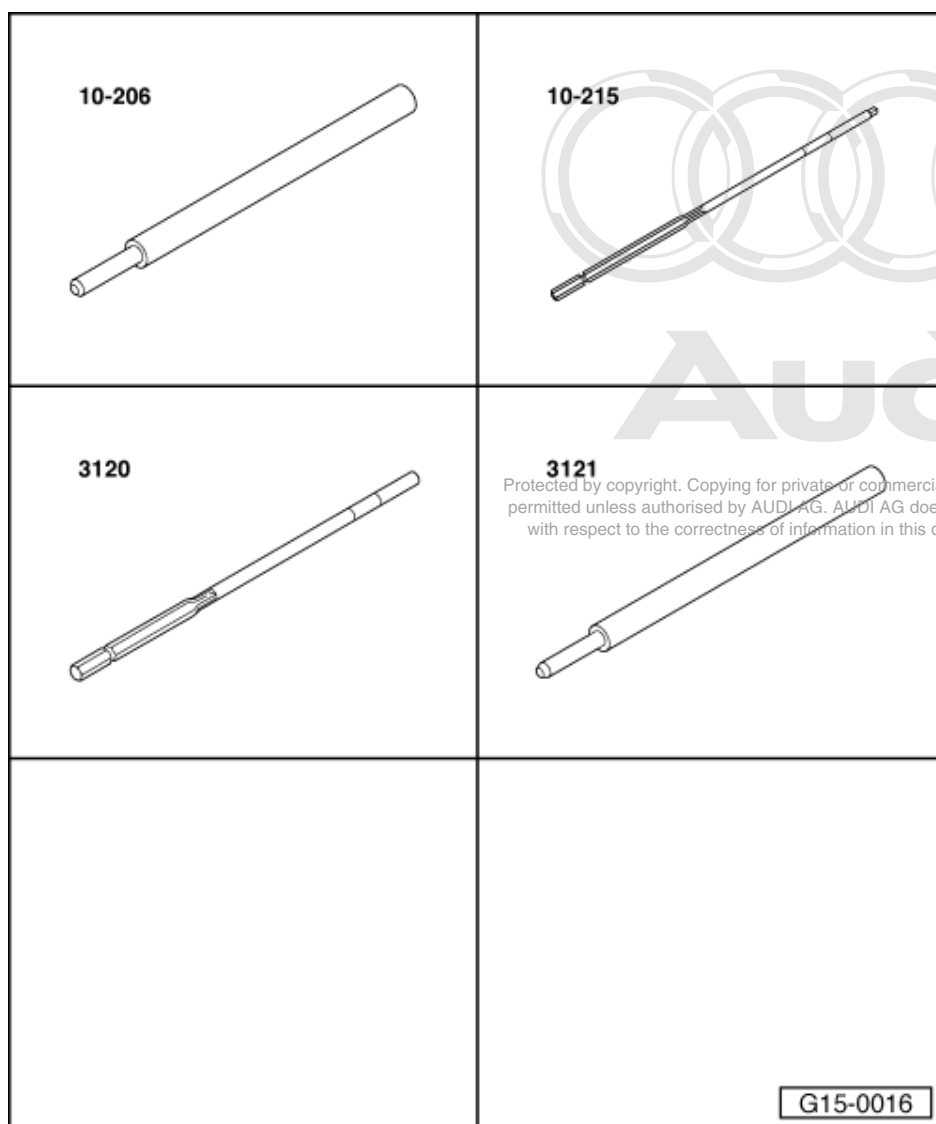
Notes:

- ♦ If the wear limit is exceeded, repeat the measurement with new valves. Replace valve guide if wear limit is still exceeded.
- ♦ If the valve must be renewed as part of a repair, use a new valve for the calculation.

2.9 - Checking valves

- Visually inspect stem and seat for scoring. Replace valves in the case of severe scoring.

2.10 - Replacing valve guides



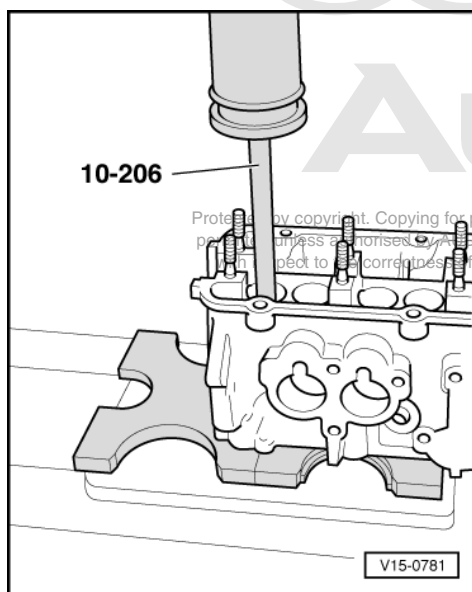
Special tools and workshop equipment required

- ♦ Driver 10-206
- ♦ Hand reamer 10-215
(for old valve gear "M")

- ♦ Hand reamer 3120
(for light valve gear "S")
- ♦ Drift 3121
- ♦ 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 collar:
from the camshaft side
- Valve guides with collar (repair version):
from the combustion chamber side

Installing

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

Note:

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

Old valve gear "M":

- Ream valve guide with hand reamer 10-215. Use plenty of cutting fluid.

Light valve gear "S":

- Ream guides out with hand reamer 3120. Use plenty of cutting fluid.

All models:

- Reworking valve seats => Page 130 .
- Replacing valve stem seals => Page 123 .

2.11 - Reworking valve seats

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 machining 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 127.
- ♦ Only rework the valve seats as far as is necessary to ensure a good seating pattern.
- ♦ Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.
- ♦ If the maximum reworking dimension is exceeded, the hydraulic tappets will not work properly and the cylinder head will have to be renewed.

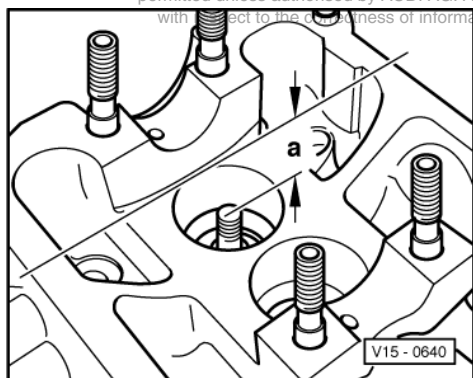
Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

Note:

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

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- -> Measure distance -a- between valve shaft end (upper edge) and upper cylinder head area with a depth gauge.
- Calculate max. permissible reworking dimension from measured distance and minimum dimension.

Minimum dimensions	
Inlet valve	Exhaust valve
33.8 mm	34.1 mm

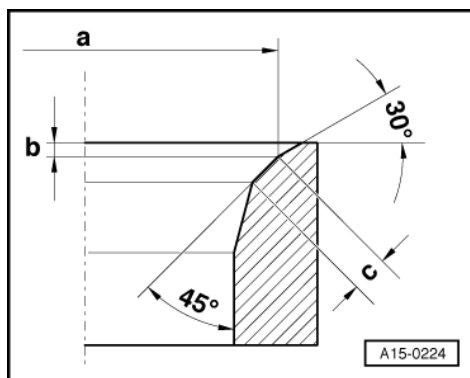
Measured distance a in relation to minimum dimension.
= max. permissible reworking dimension.

Example:

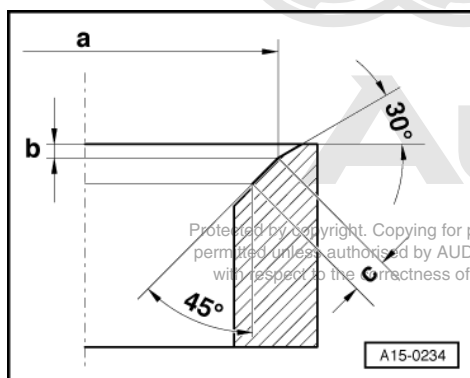
- Measured distance a	35.1 mm
Minimum dimension	34.1 mm
= max. permissible reworking dim.	1.0 mm

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.

**-> Rework inlet valve seat**

Dim.	Inlet valve seat
øa mm	39.5
b mm	Max. permissible reworking dim.
c mm	approx. 2.0
45°	Valve seat angle
30°	Upper correction angle

**-> Rework exhaust valve seat**

Dim.	Exhaust valve seat
øa mm	32.9
b mm	Max. permissible reworking dim.
c mm	approx. 2.4
45°	Valve seat angle
30°	Upper correction angle

17 - Lubrication

1 - Removing and installing parts of the lubrication system

1.1 - Removing and installing parts of the 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 max. mark on dipstick - danger of damage to catalytic converter.
- ♦ Oil spray jet for piston cooling
=> Fig. 144 .

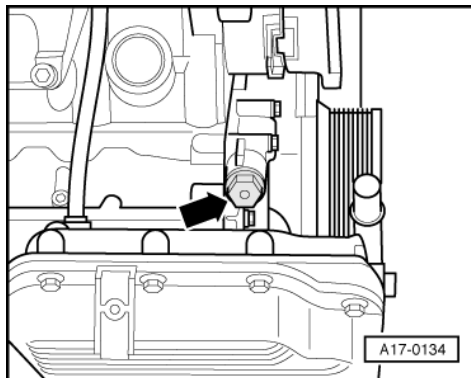
Viscosity grades and oil specifications:

=> Maintenance Manual

Oil system capacity:

=> Exhaust Emission Test binder

1.2 - Different oil circuits



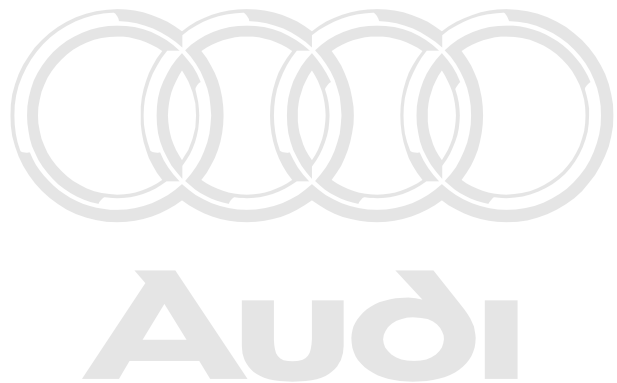
Distinguishing features

Engine generation I:

- ♦ -> Vehicles up to ident. no. 4A S_ 026 714 have a screw cap on the oil pump -arrow-.

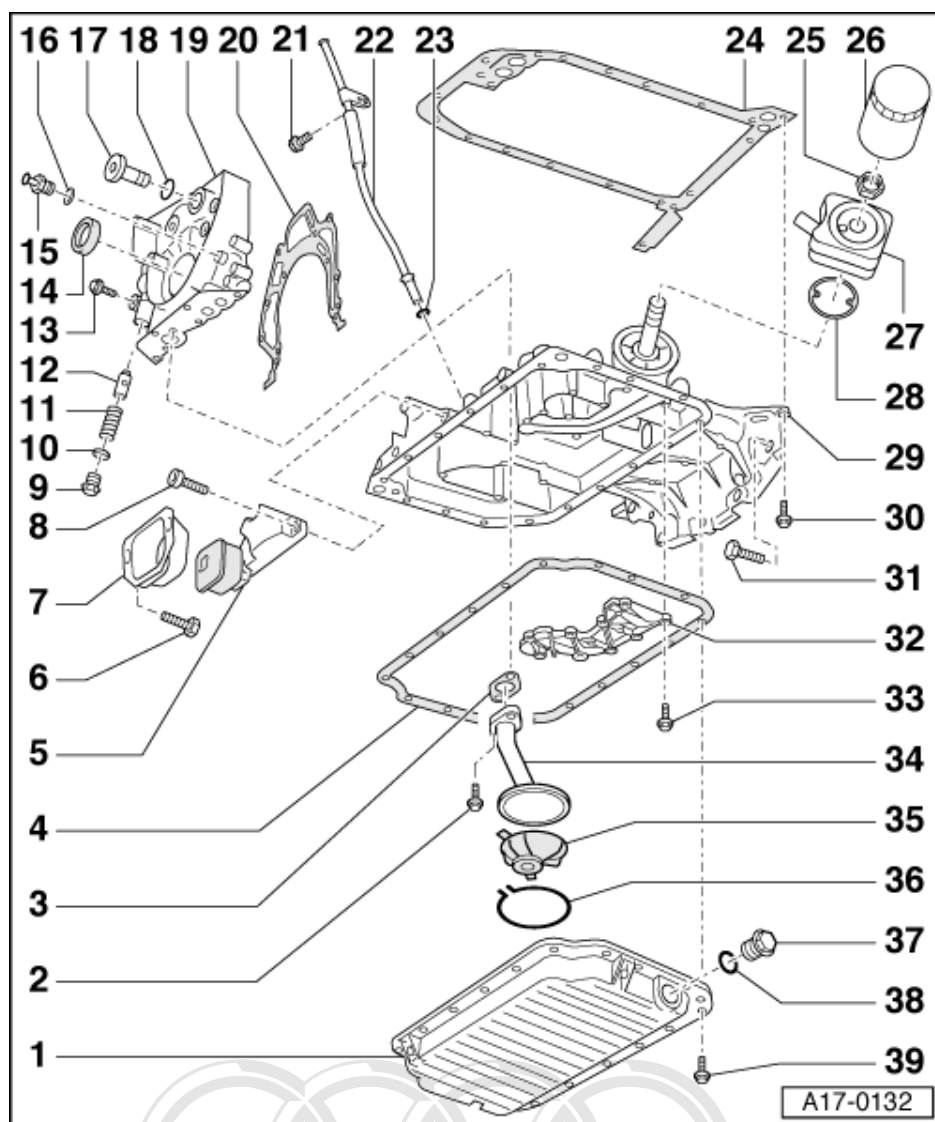
Engine generation II:

- ♦ On vehicles as of ident. no. 4A S_ 026 715 the oil circuit has been changed and there is no longer a screw cap on the oil pump.



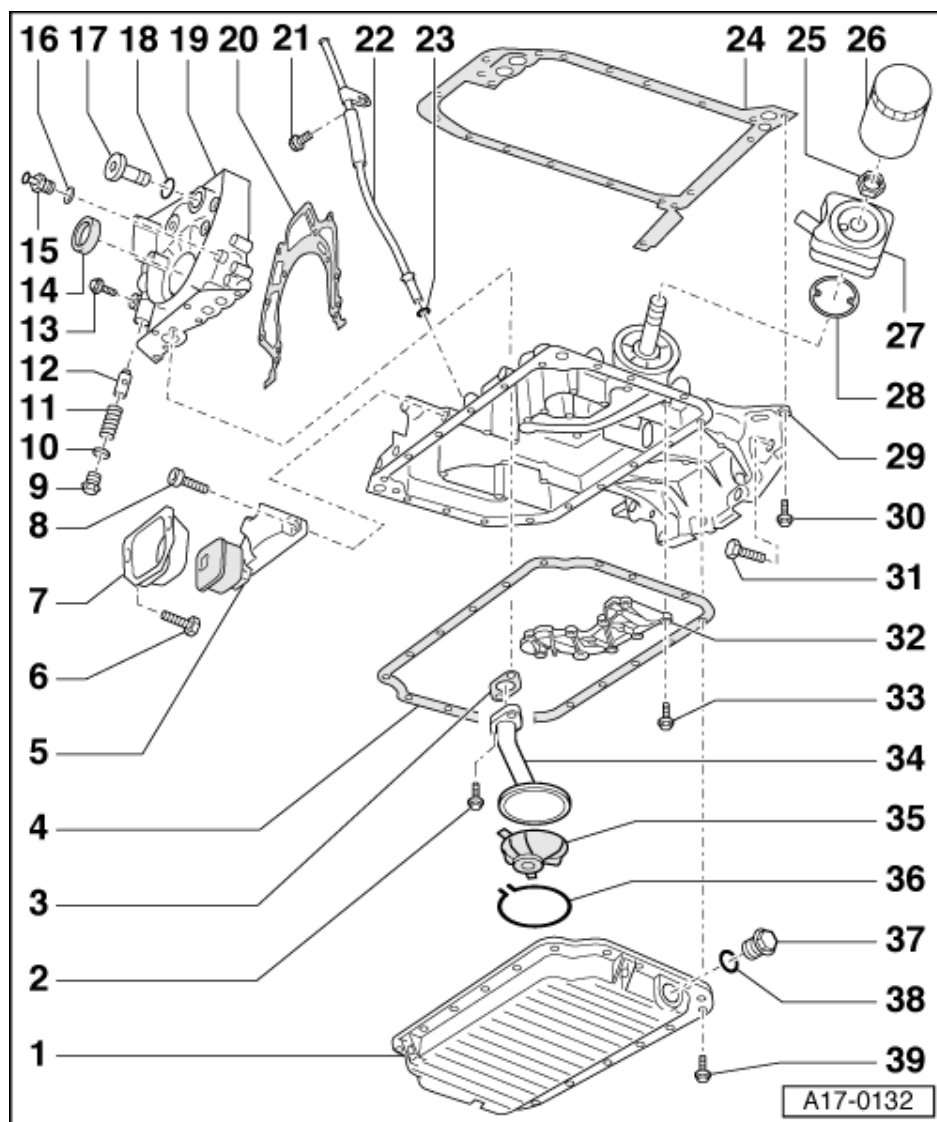
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1.3 - Engine generation I



- 1 Sump (lower section)
 - ♦ Removing and installing
=>Page 144.
- 2 10 Nm
- 3 Gasket
 - ♦ Replace
- 4 Gasket
 - ♦ Replace
- 5 Torque reaction support
- 6 40 Nm

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**7 Stop plate**

- ◆ For torque reaction support
- ◆ Adjusting:
 - 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.

8 42 Nm**9 Screw plug - 45 Nm****10 Sealing ring**

- ◆ Replace

11 Spring

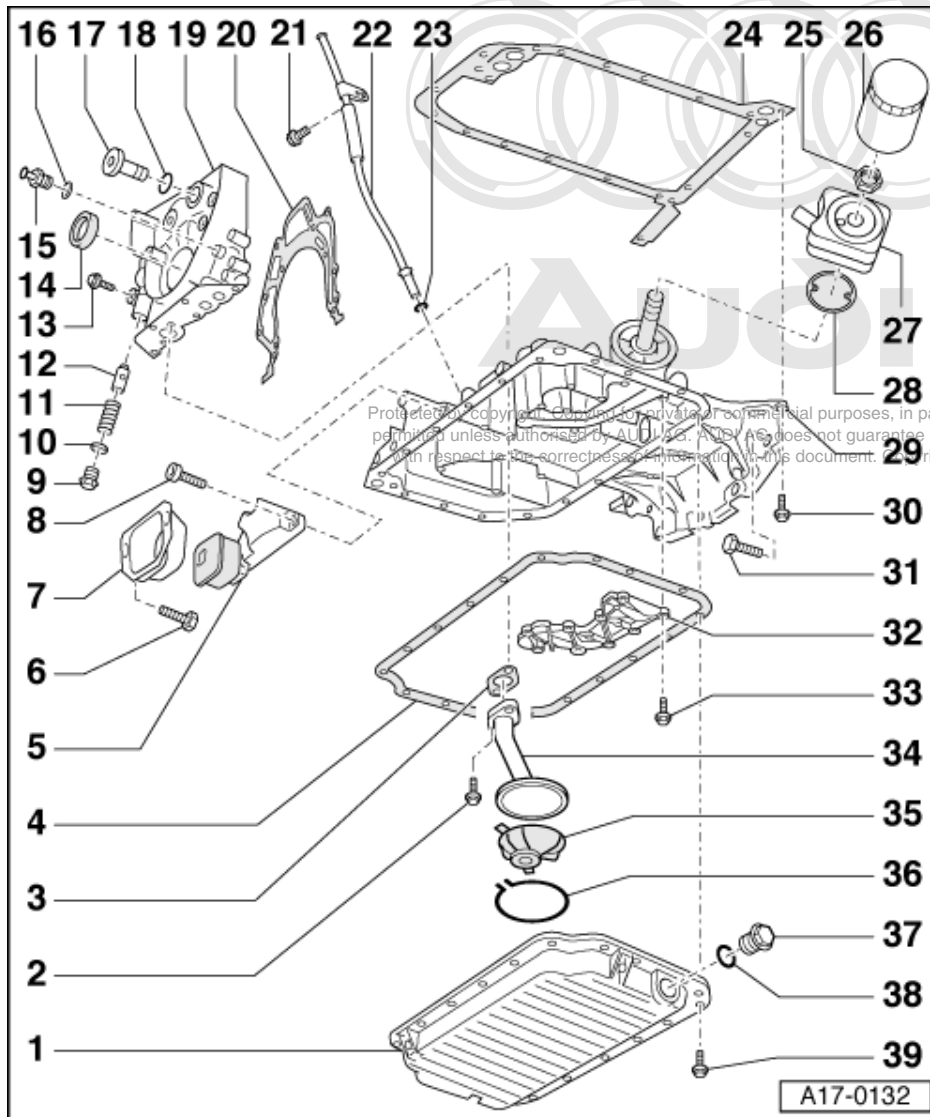
- ◆ for pressure relief valve

12 Piston

- ◆ for pressure relief valve

13 10 Nm

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**14 Sealing ring**

- ♦ For crankshaft
- ♦ Removing and installing
=>Page 57 .

15 Oil temperature sender -G8 - 10 Nm**16 Sealing ring**

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

17 Screw plug - 30 Nm**18 O-ring**

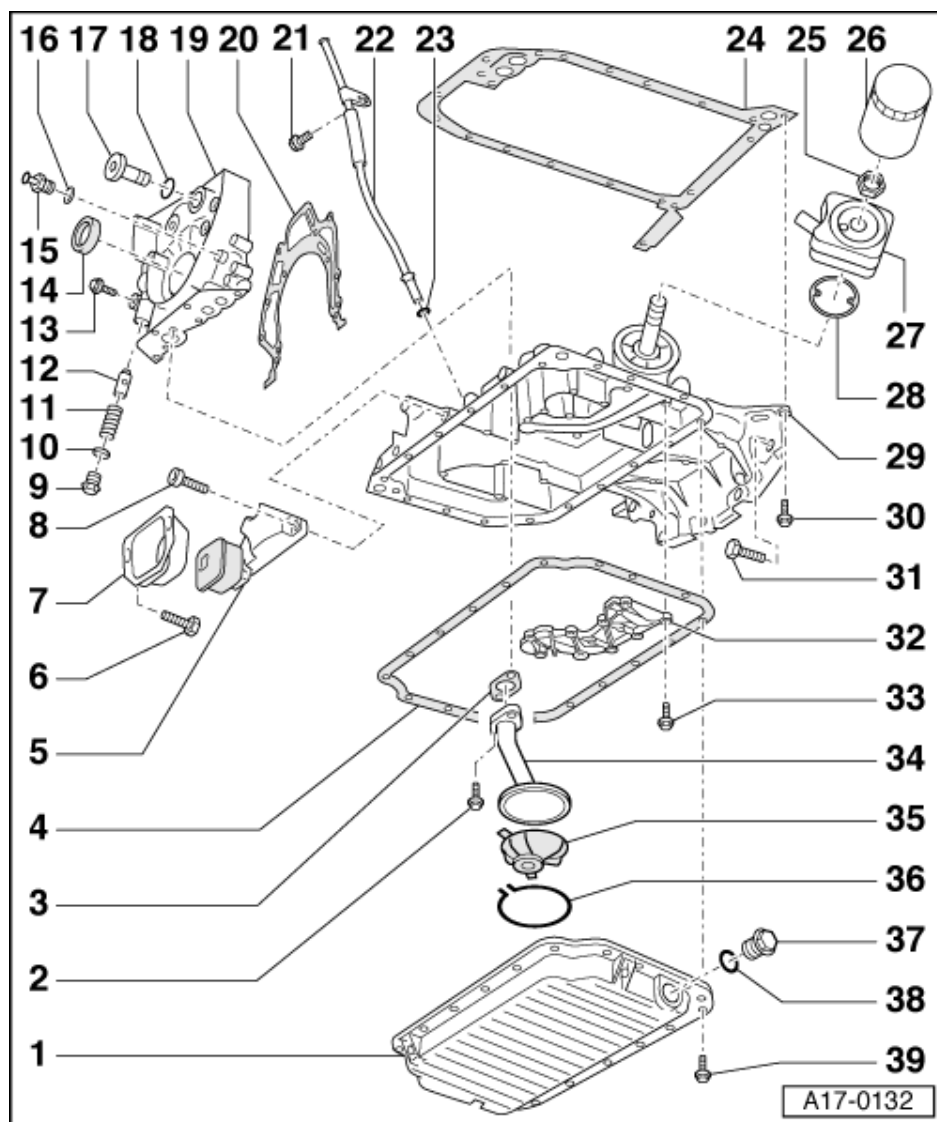
- ♦ Replace

19 Oil pump

- ♦ Removing and installing
=>Page 152 .

20 Gasket

- ♦ Replace



21 10 Nm

22 Guide tube

- ♦ For dipstick

23 O-ring

- ♦ Replace

24 Gasket

- ♦ Replace
- ♦ Install dry
- ♦ no additional sealant is required

25 30 Nm

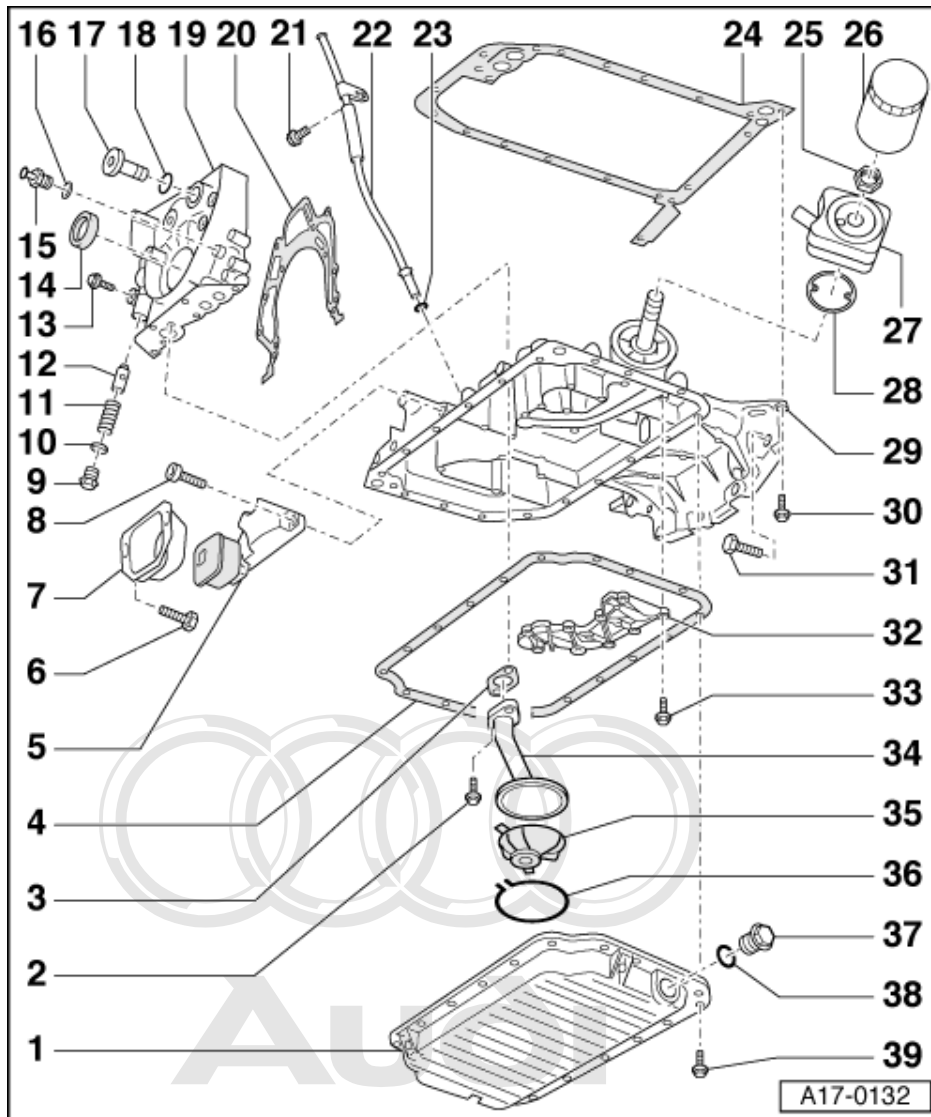
26 Oil filter

- ♦ Observe change intervals

=> Maintenance Manual

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

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27 Oil cooler

- ♦ See note
=>Page 132.

28 Gasket

- ♦ Replace
- ♦ Engage in projections on oil cooler

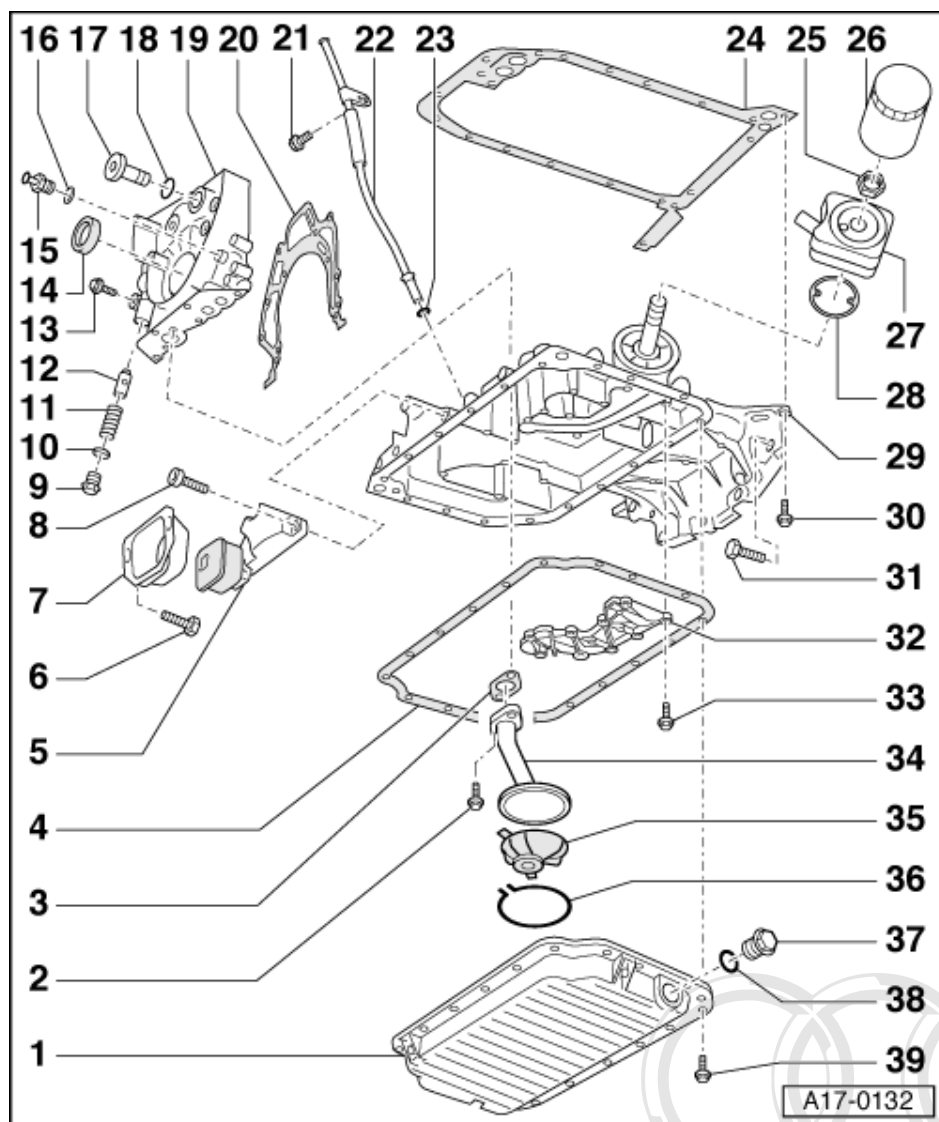
29 Sump (upper section)

- ♦ Removing and installing
=>Page 147.

30 10 Nm

- ♦ Tighten in stages and in diagonal sequence
- ♦ Inserting 2 bolts with locking compound => Page 152
- ♦ Locking compound

=> Parts List



31 M8 - 25 Nm
M10 - 45 Nm

32 Cap

33 10 Nm

34 Suction pipe

35 Inlet connection

36 Retaining ring

37 Oil drain plug, 40 Nm

38 Sealing ring

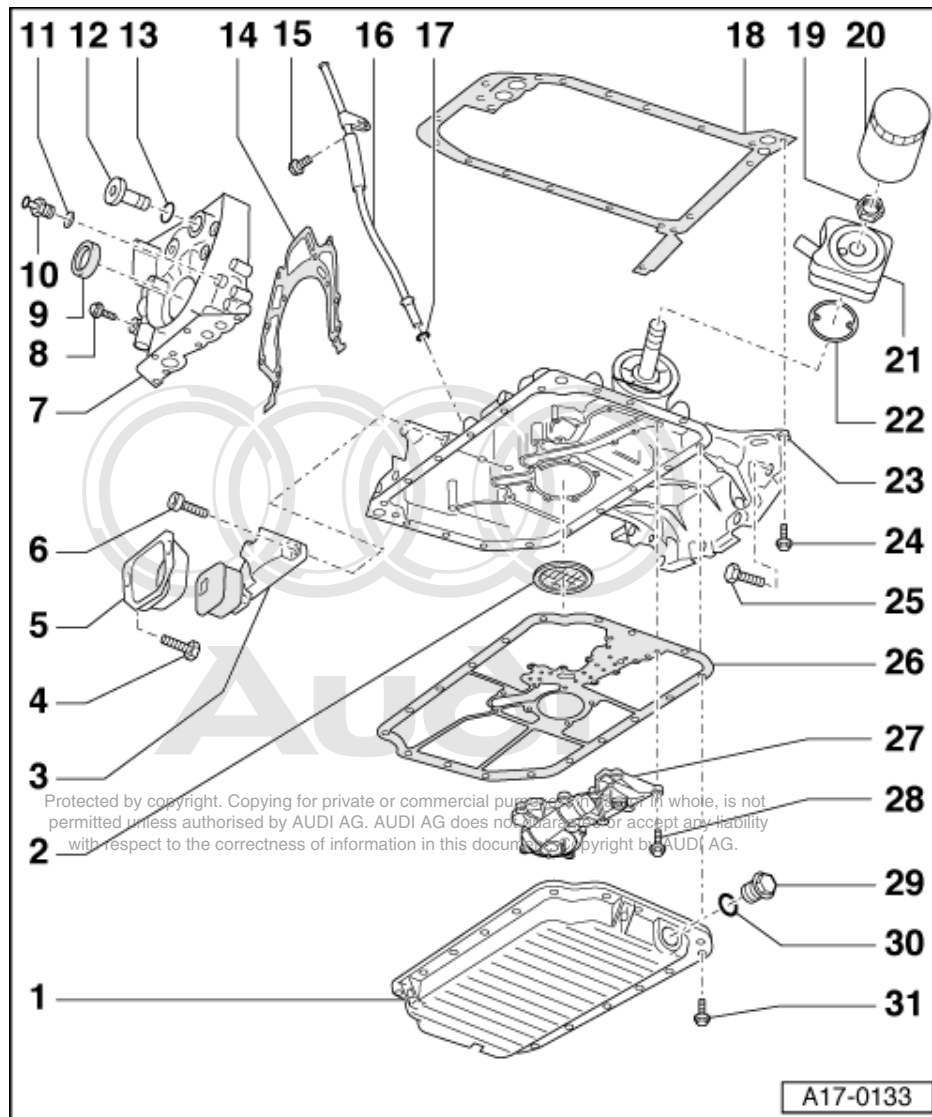
♦ Replace

39 10 Nm

♦ Tighten in stages and in diagonal sequence

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1.4 - Engine generation II

**1 Sump (lower section)**

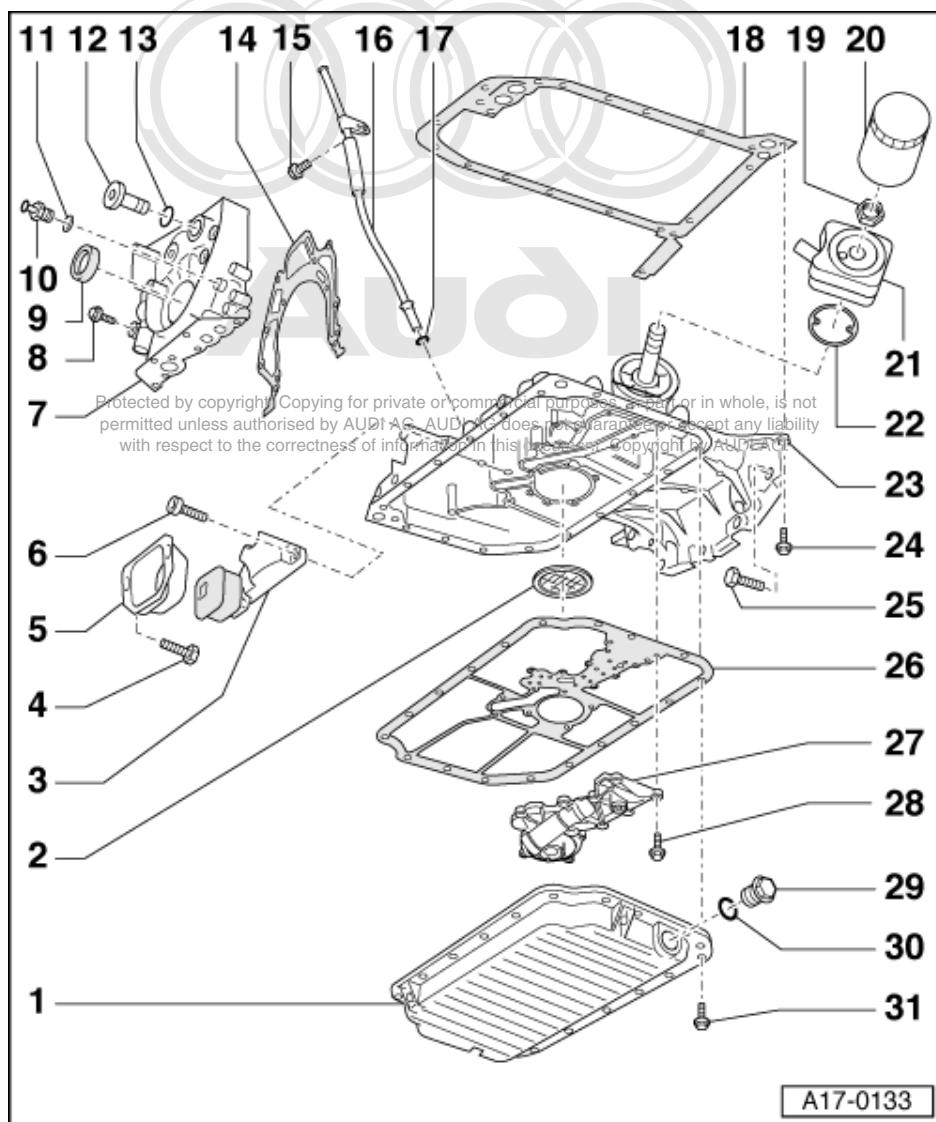
- ♦ Removing and installing
=>Page 144.

2 Oil strainer

- ♦ Held in upper section of sump with three lugs

3 Torque reaction support**4 40 Nm****5 Stop plate**

- ♦ For torque reaction support
- ♦ Adjusting:
 - 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.



6 42 Nm

7 Oil pump

- ♦ Removing and installing
=>Page 152 .

8 10 Nm

9 Sealing ring

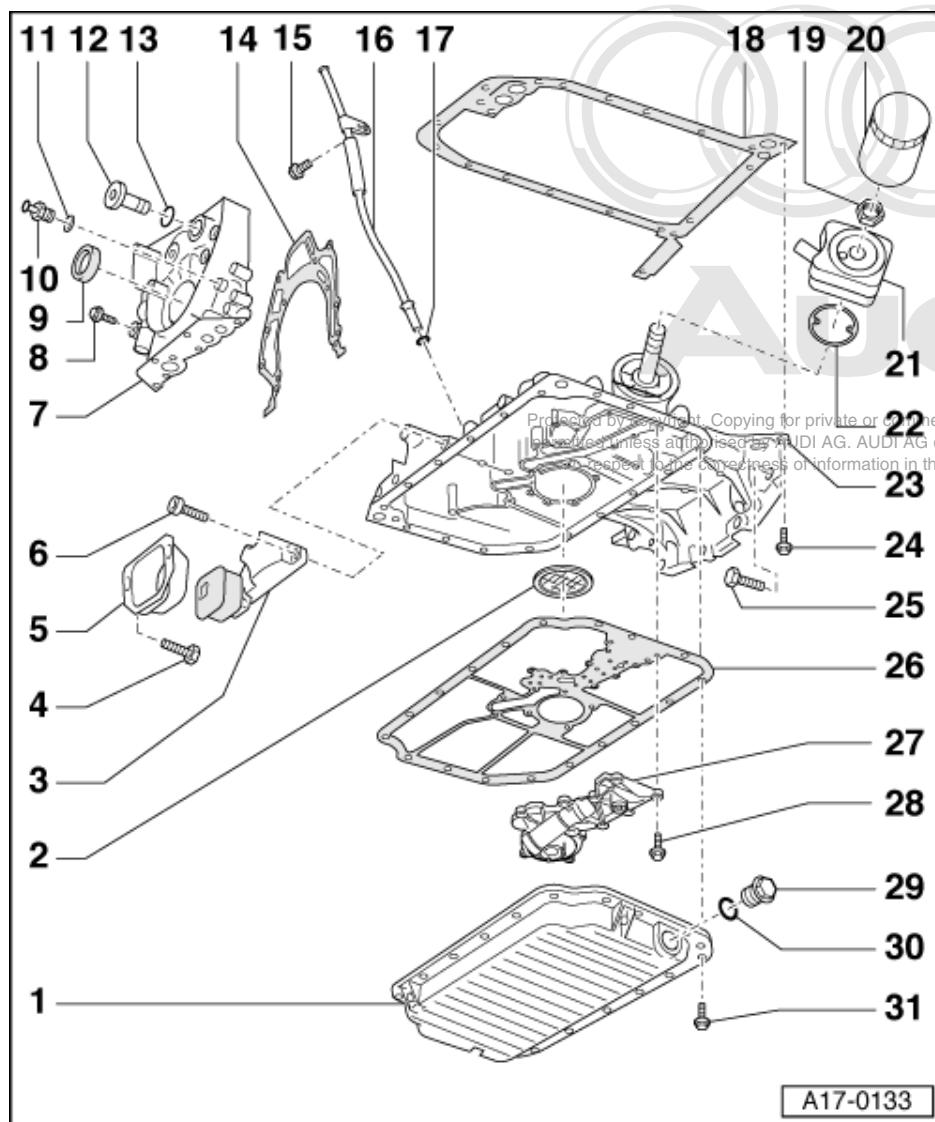
- ♦ For crankshaft
- ♦ Removing and installing
=>Page 57 .

10 Oil temperature sender -G8 - 10 Nm

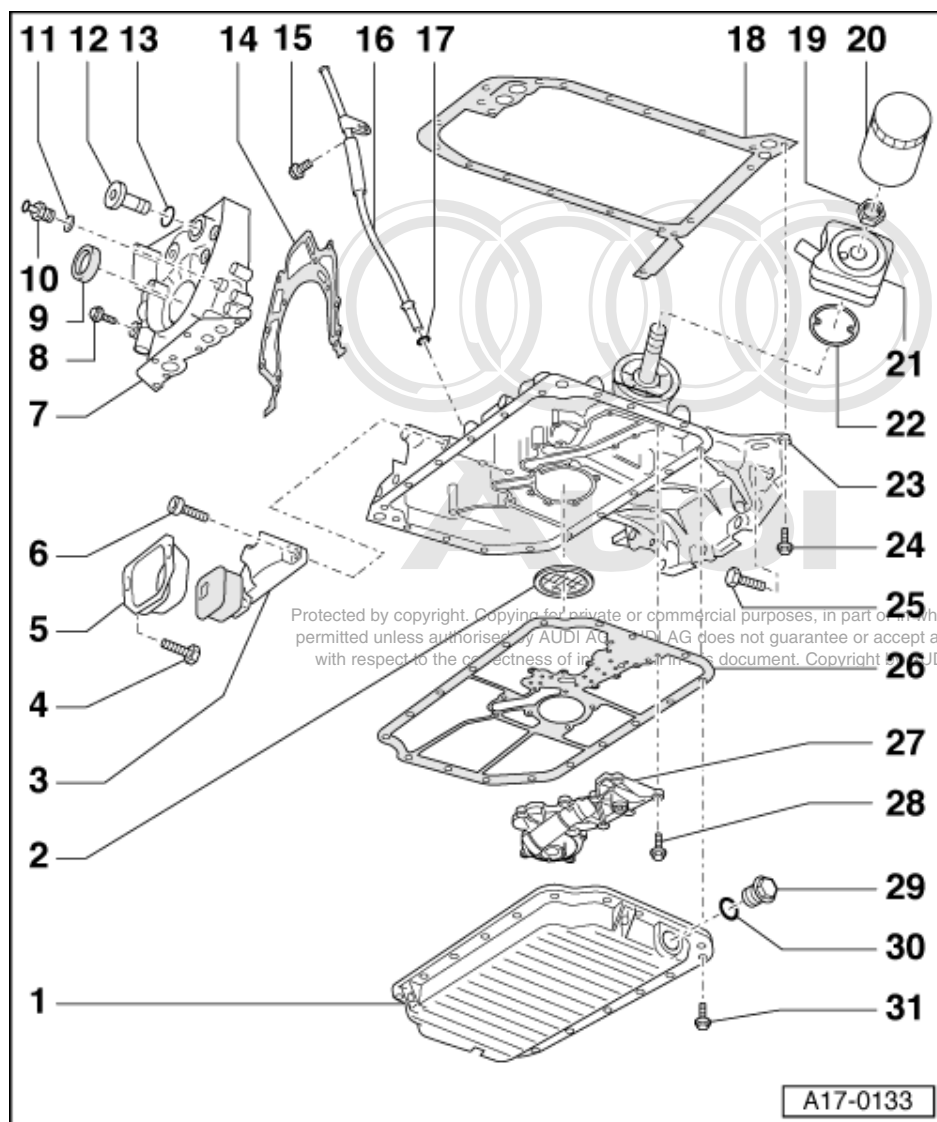
11 Sealing ring

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

12 Spray nozzle valve - 40 Nm



- 13 O-ring
♦ Replace
- 14 Gasket
♦ Replace
- 15 10 Nm
- 16 Guide tube
♦ For dipstick
- 17 O-ring
♦ Replace
- 18 Gasket
♦ Replace
♦ Install dry
♦ no additional sealant is 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

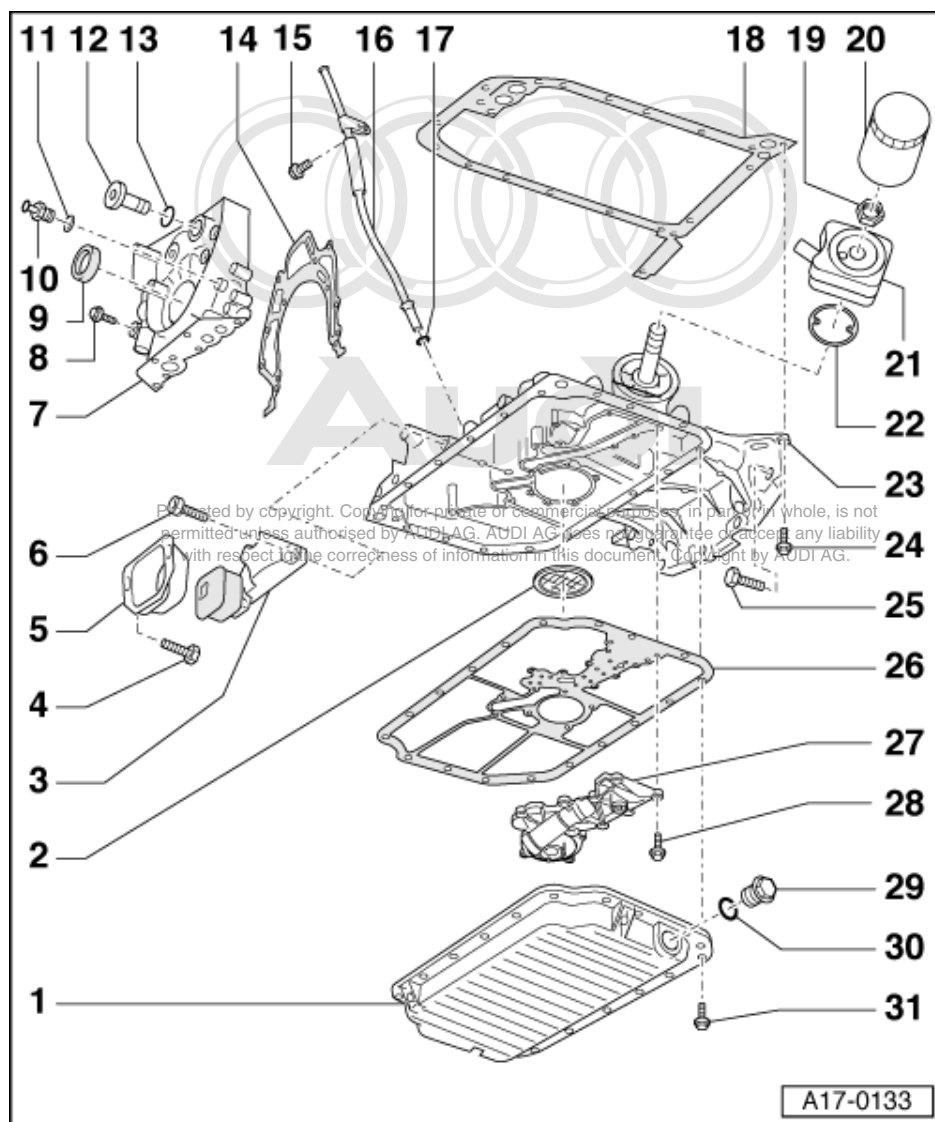
- ♦ See note
=>Page 132 .

22 Gasket

- ♦ Replace
- ♦ Engage in projections on oil cooler

23 Sump (upper section)

- ♦ Removing and installing
=>Page 147 .



24 10 Nm

- ♦ Tighten in stages and in diagonal sequence

25 M8 - 25 Nm

M10 - 45 Nm

26 Gasket

- ♦ Replace
- ♦ to replace, remove -Item 27 -

27 Cap

28 10 Nm

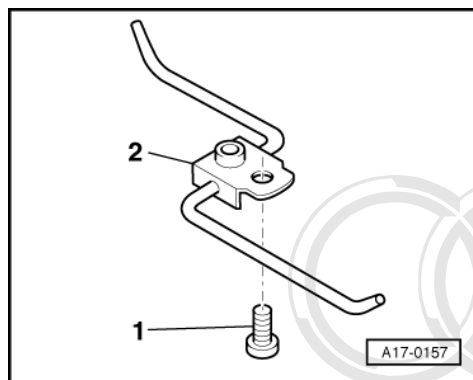
29 Oil drain plug, 40 Nm

30 Sealing ring

- ♦ Replace

31 10 Nm

- ♦ Tighten in stages and in diagonal sequence

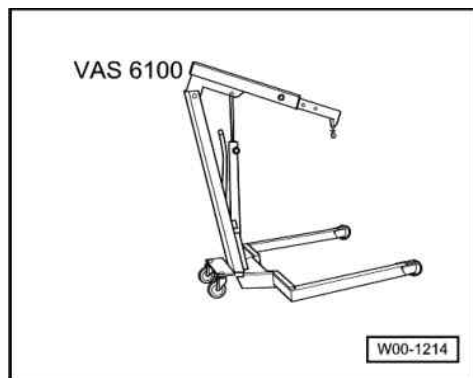


-> Fig.1 Oil spray jet for piston cooling

- 1 - Bolt - 10 Nm
- 2 - Oil spray jet for piston cooling

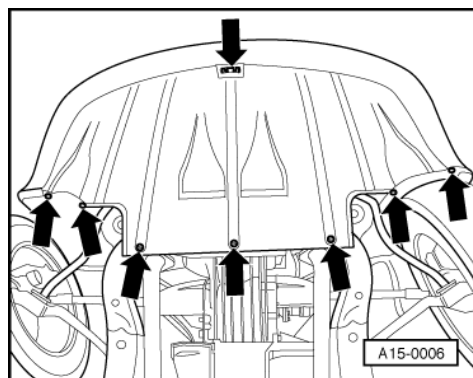
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1.5 - Removing and installing lower section of sump



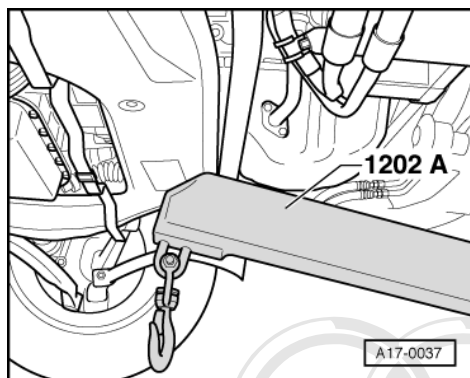
Special tools and workshop equipment required

- ♦ Workshop crane VAS 6100
- or
- ♦ Workshop crane V.A.G 1202 A

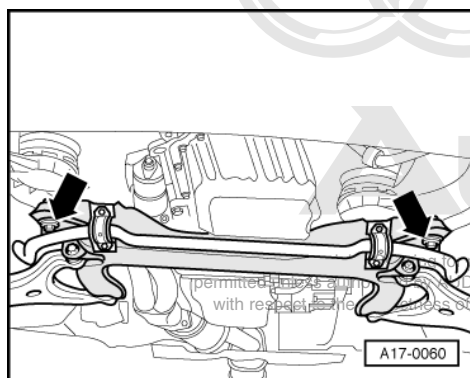


Removing

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



- -> Support subframe with workshop crane VAS 6100 or V.A.G 1202 A.



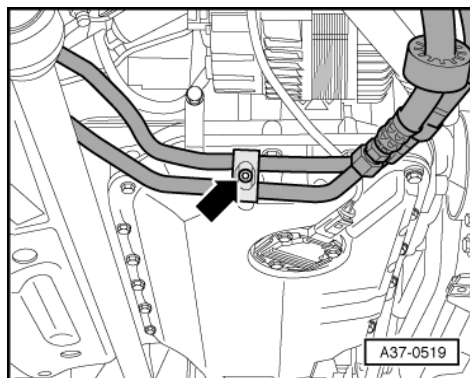
- -> Unscrew front bolts -arrows- of subframe.
- Slowly lower subframe with workshop crane VAS 6100 or V.A.G 1202 A.

Important

The subframe is lowered by releasing the bolts approx. 100 mm.

Note:

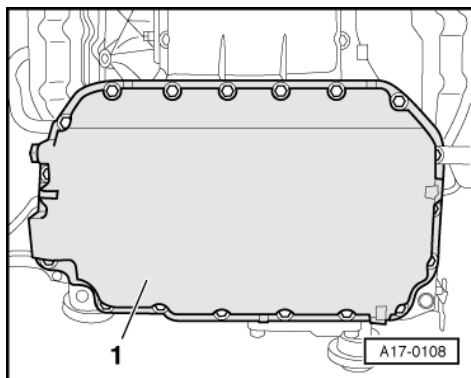
The subframe should be detached and lowered at the front only, otherwise it will be necessary to check wheel alignment.





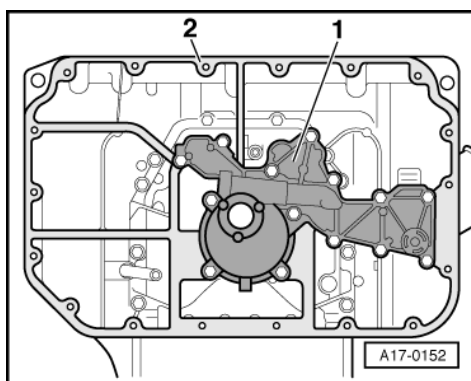
Vehicles with automatic gearbox:

- -> Unscrew the ATF line at the sump -arrow-.



All models:

- -> Unbolt lower section of sump -1- and remove carefully.



Vehicles with engine generation II:

- Place drip tray underneath to collect oil.
- -> Remove sealing cap -1-.
- Remove seal -2-.

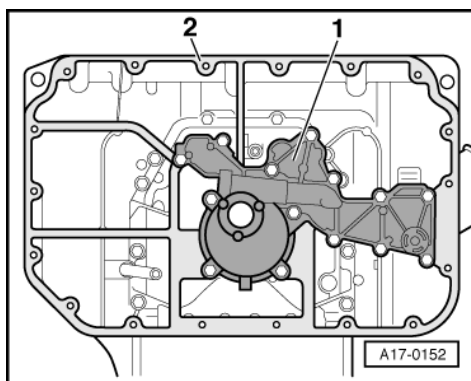
Installing

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

Note:

Replace seals and gaskets.

- Clean sealing surfaces before installing lower section of sump.



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Vehicles with engine generation II:

- -> Apply seal -2- for lower section of sump.
- Screw on sealing cap -1-.

All models:

- 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.
- Fitting subframe with new bolts:

=> Running Gear, FWD and 4WD; Repair group 40

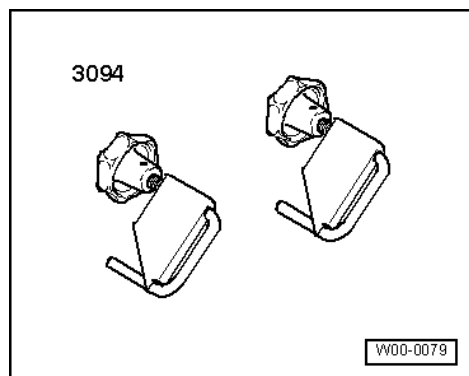
- Fill up with engine oil and check oil level.

Tightening torques

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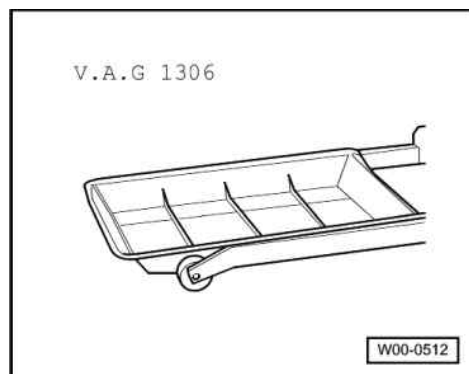
Component	Nm
Sealing cap to upper section of sump	10
Lower section of sump to upper section of sump	10
Oil drain plug	40

1.6 - Removing and installing upper section of sump



Special tools and workshop equipment required

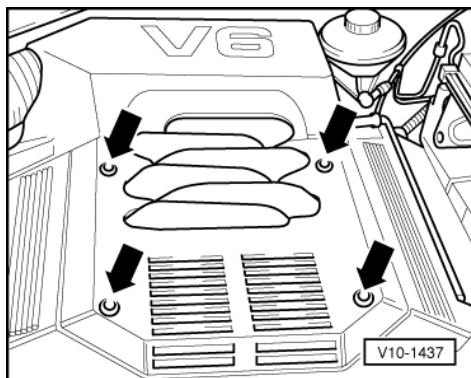
- ♦ Hose clamps 3094



- ♦ Drip tray V.A.G 1306



- ♦ Drip tray

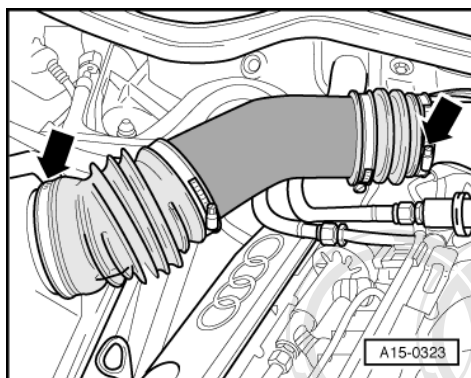


Removing

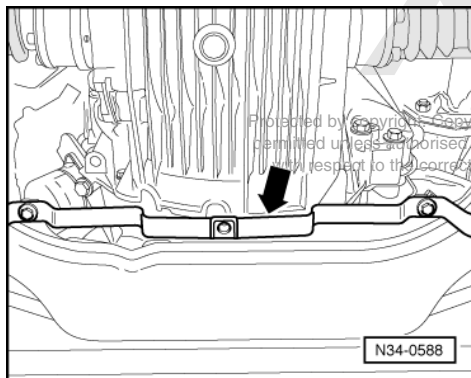
- Observe or obtain radio code on vehicles with coded radio.
- Remove rear bench seat.

=> General Body Assembly; Repair group 72

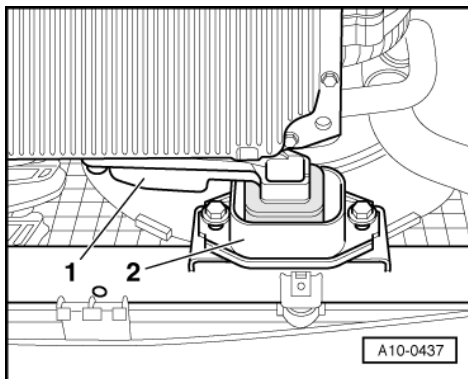
- Disconnect earthing strap at battery with ignition switched off.
- -> Remove engine cover-arrows-.



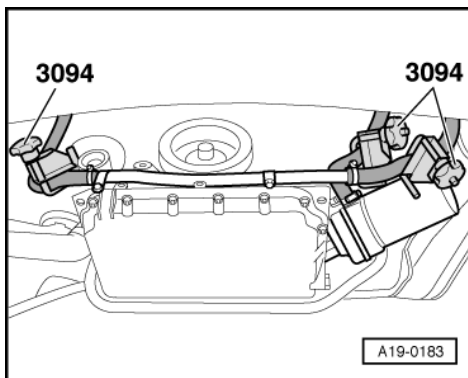
- -> Remove air duct hose between air mass meter and intake manifold -arrows-.
- Loosen upper starter securing bolt a few turns - do not unscrew.
- Pull out oil dipstick.
- Remove lower section of sump =>Page 145 .



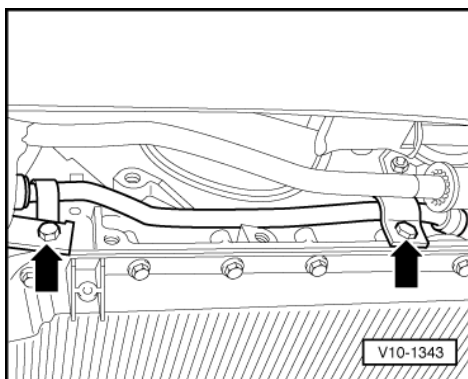
- -> Unbolt the bracket for the noise insulation -arrow-.



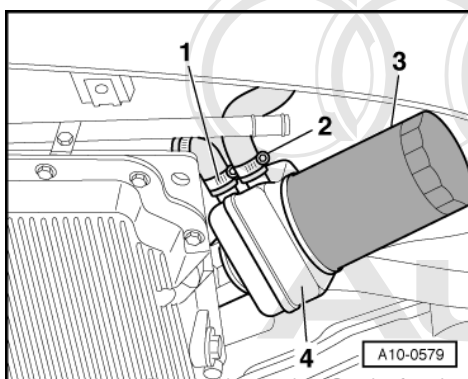
- -> Unscrew torque reaction support -1- and the torque reaction support stop -2-.



- -> Clamp off coolant hoses to oil cooler and coolant pipe using 3 hose clamps 3094.



- -> Unscrew coolant pipe from sump -arrows-.



- Place drip tray V.A.G 1306 under engine.

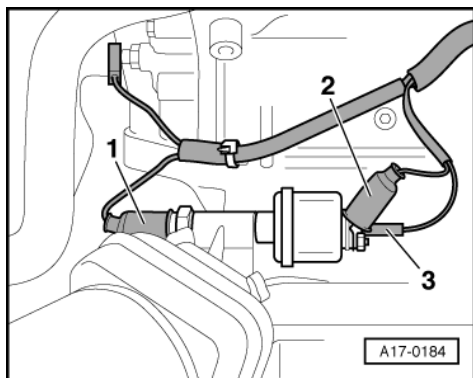


- -> Detach hoses -1- and -2- from oil cooler -4-.

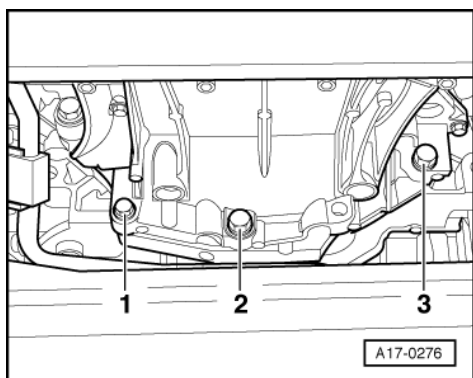
Note:

If the same sump upper section is re-installed, the oil filter and oil cooler need not be removed. Otherwise:

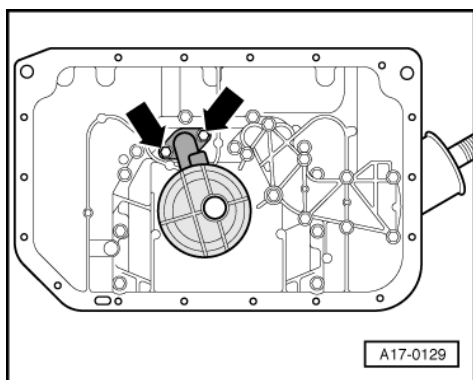
- Place drip tray underneath to collect oil.
- Remove oil filter -3-.
- Remove oil cooler.
- Unscrew lower starter securing bolt and leave starter suspended from upper securing bolt.



- -> Disconnect wires -1...3-.

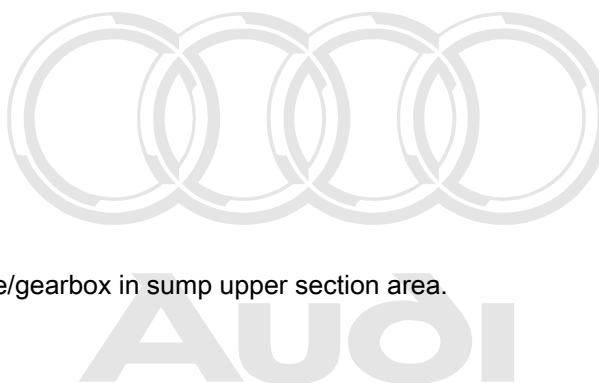


- -> Unscrew connecting bolts -1... 3- for engine/gearbox in sump upper section area.

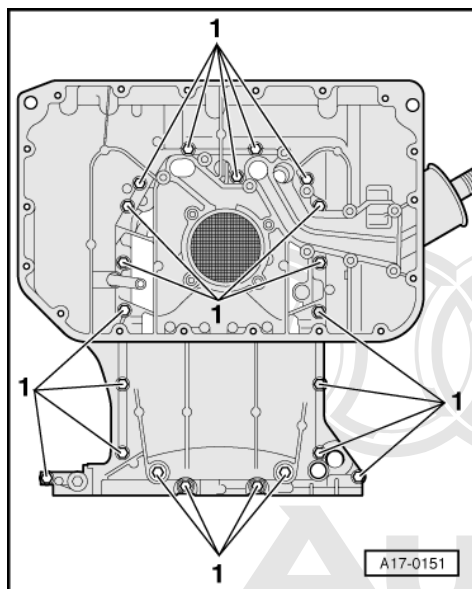


Vehicles with engine generation I:

- -> Unscrew oil pump suction pipe -arrows-.



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**All models:**

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- -> Unscrew bolts -1- for upper section of sump.
 - Press upper section of sump off dowel sleeves on cylinder block.
 - Remove upper section of sump.

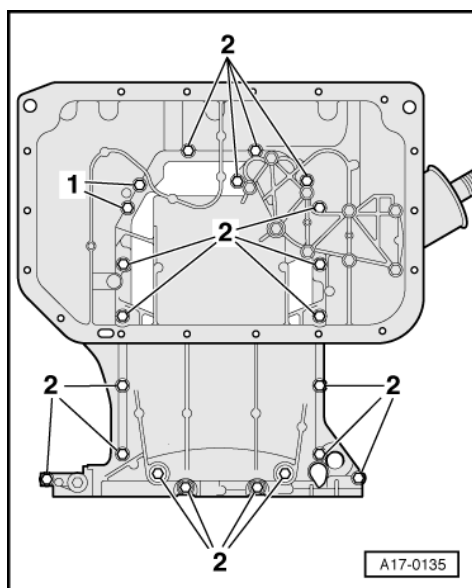
Installing

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

Note:

Always replace self-locking nuts, seals and gaskets.

- Clean sealing surfaces before installing upper section of sump.
- Replace the O-ring on the dipstick guide tube.





Vehicles with engine generation I:

- -> Apply locking compound to bolts -1- and insert them.
- ♦ Locking compound

=> Parts List

All models:

- 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.
- Check that the dipstick guide tube is correctly located in the sump upper section.
- Tighten bolts securing sump upper section to gearbox.
 - Tightening torque for bolts M8: 25 Nm
 - M10 bolt tightening torque: 45 Nm
- Tighten bolts on upper section of sump/cylinder block in diagonal sequence to 10 Nm.
- Install lower section of sump =>Page 146 .
- 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.
- Top up coolant => Page 166 .

Notes:

- ♦ If the battery is reattached make sure that the vehicle equipment (radio, clock, electrical window lifter) is actuated according to the operating instructions.
- ♦ Further measures after reconnection of voltage supply:

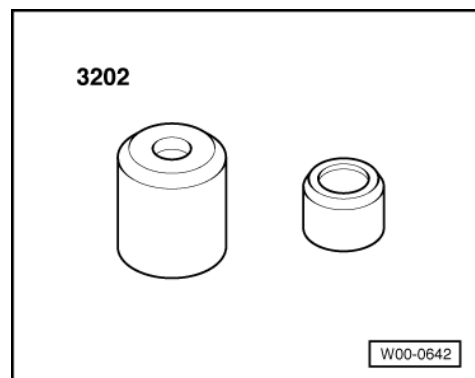
=> Fuel Injection and Ignition System; Repair group 24

Tightening torques

Component		Nm
Upper section of sump to cylinder block		10
Upper section of sump to gearbox	M8	25
	M10	45
Oil cooler to upper section of sump		30
Torque reaction support to upper section of sump		42
Torque reaction support limit stop to body		40
Starter to engine/gearbox	M10	45
	M12	65

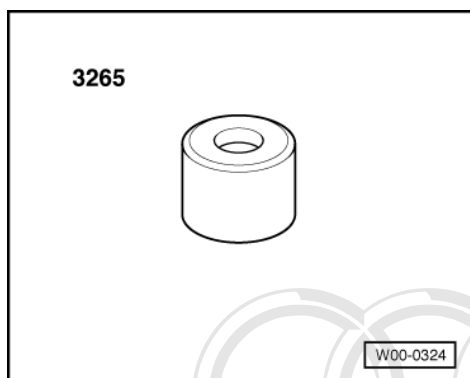
1.7 - Removing and installing oil pump

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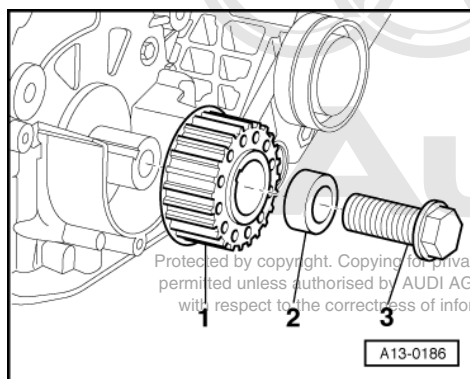


Special tools and workshop equipment required

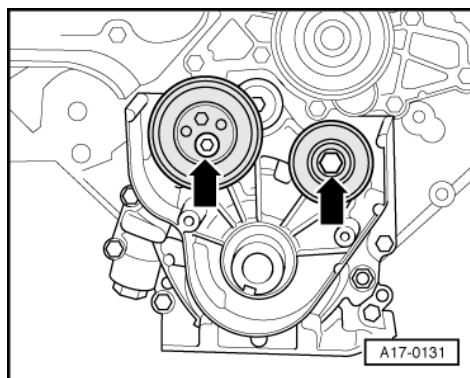
- ♦ Fitting sleeve 3202/1



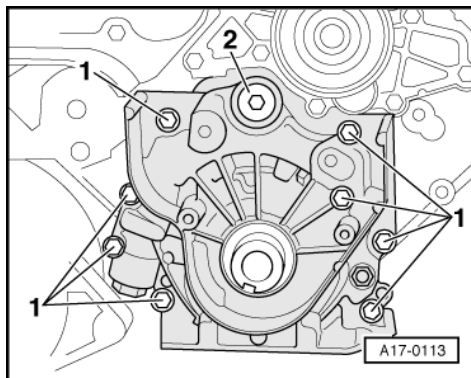
- ♦ Insertion sleeve 3265

**Removing**

- Remove toothed belt => Page 46 .
- -> Unscrew central bolt -3- for crankshaft toothed belt sprocket -1-.
- Remove spacer -2- and toothed belt sprocket.
- Remove upper section of sump =>Page 147 .



- -> Unscrew the idler wheel and tensioning roller -arrows-.



- -> Remove bolts -1- and -2-.
- Detach front oil pump.
- Drive out oil seal with oil pump removed.

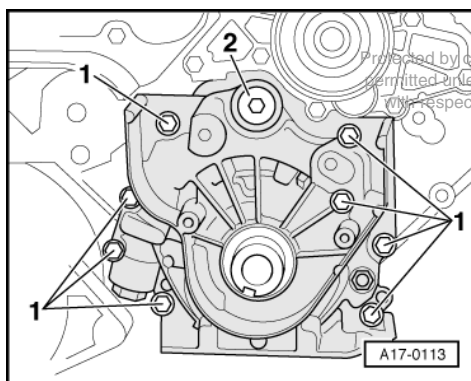
Installing

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

Note:

If the oil pump is installed with the oil seal already fitted, place fitting sleeve 3202/1 on end of crankshaft before installing oil pump.

- Clean sealing surfaces before installing oil pump.
- Set up oil pump, so that it engages in the actuating arms on the crankshaft.



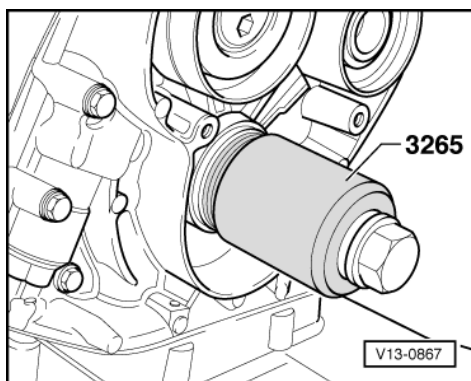
- -> Tighten bolts -1- and -2-:

1 - 10 Nm

2 - Engine generation I (screw cap): 30 Nm

Engine generation II (spray nozzle valve): 40 Nm

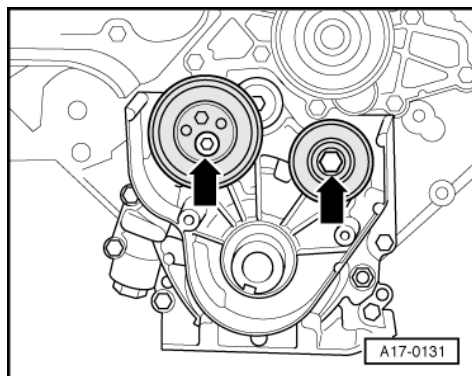
- Do not lubricate sealing lip or outer circumference of seal before pressing in.
- Push on sealing ring using fitting sleeve 3202/1.



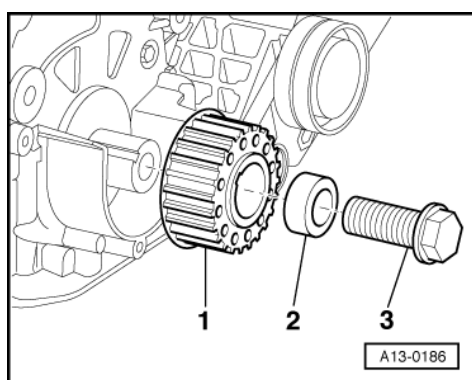
- -> Press in sealing ring flush with insertion sleeve 3265 and central bolt.

Note:

Fit spacer under central bolt.



- -> Install tensioning roller -left arrow-.
- Install idler wheel -right arrow-.
- Installation position: recess in mounting hole (for bolt head) faces to front.



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

Notes:

- ◆ Contact surface between sprocket and crankshaft must be free of oil.
- ◆ Do not use additional oil on bolt for crankshaft toothed belt sprocket.
- Install toothed belt =>Page 49.
- Install upper section of sump =>Page 151.

Tightening torques

Component		Nm
Oil pump to cylinder block	M6	10
	Screw plug	30
	Spray nozzle valve	40
Toothed belt sprocket to crankshaft		200 + 180° (1)2)
Toothed belt tensioning pulley	M8	22
	M10	43
Idler roller	M8	22



Component	Nm
M10	43

- 1) Replace bolt
- 2) 180°equivalent to half a turn

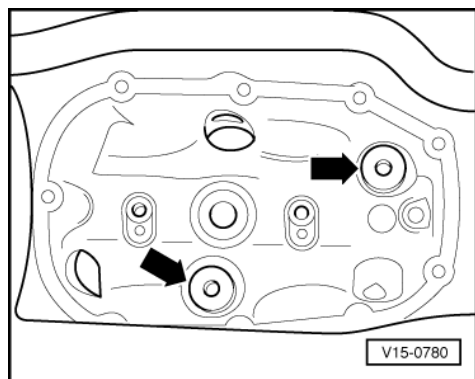
1.8 - Replacing oil retention valves

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.

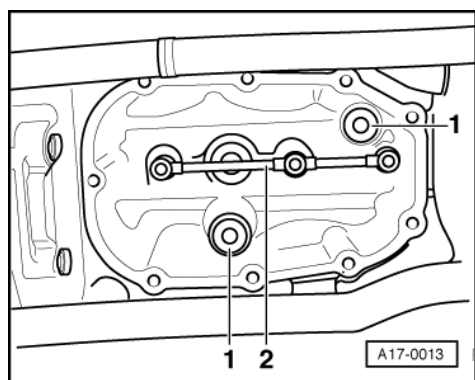
Removing

- Remove intake manifold => Page 86 .
- Unscrew cover under intake manifold.



Engine generation I

-> Arrows - Oil retention valve (25 Nm)



Engine generation II

- 1 - -> Oil retention valve - 25 Nm
- 2 - Oil pipe of spray nozzle valve for spray jets of piston cooling - 15 Nm



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Installing

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

Note:

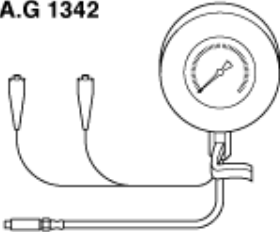
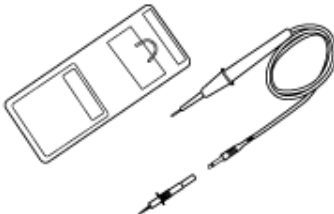
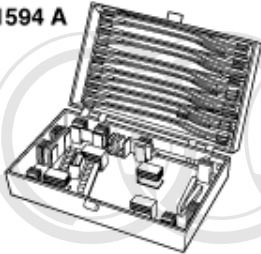
Fit new O-rings.

- Install intake manifold => Page 91 .

Tightening torque

Component	Nm
Cover to cylinder block	10

1.9 - Checking oil pressure and oil pressure switch

V.A.G 1342 	V.A.G 1527 B 
V.A.G 1594 A 	
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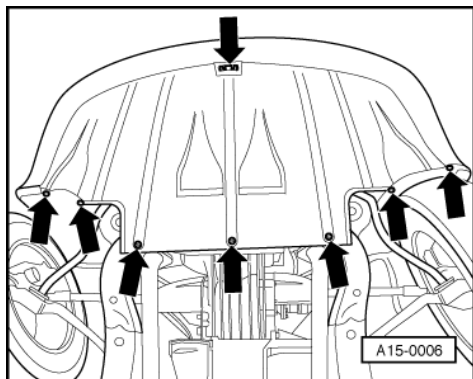
Special tools and workshop equipment required



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

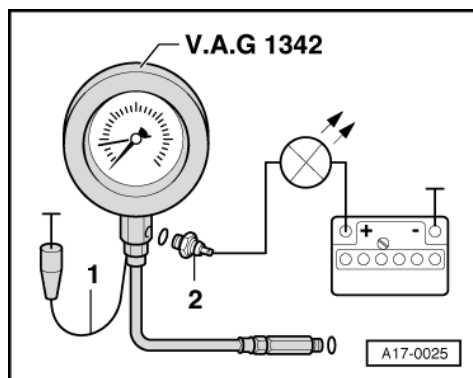
Test requirements:

- 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.



Procedure

- -> Remove the noise insulation -arrows-.



Check 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 illuminate.
- If the LED does not illuminate, fit a new oil pressure switch.
- Start the engine.

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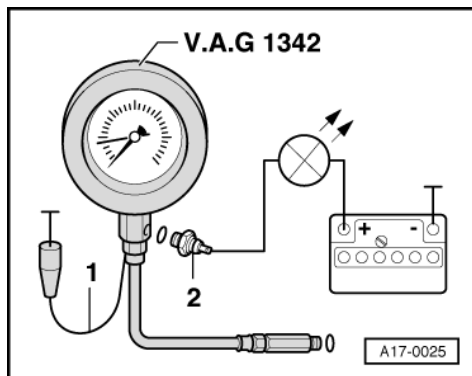
Note:

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 LED while starting the engine.

- at 0.15... 0.45 bar the LED should go out
- If the LED does not go out, fit a new oil pressure switch.

Note:

As a replacement for the 0.3 bar oil pressure switch (brown) a 0.25 bar oil pressure switch (blue) is supplied.



Check 1.4 bar (black), 1.8 bar (white) and 2.5 bar (red) oil pressure switches

- 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.
- LED should not illuminate.
- If the LED lights up, fit a new oil pressure switch.
- Start the engine.

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 LED while starting the engine.

Red oil pressure switch:

- The LED should illuminate at 2.3... 2.7 bar.

White oil pressure switch:

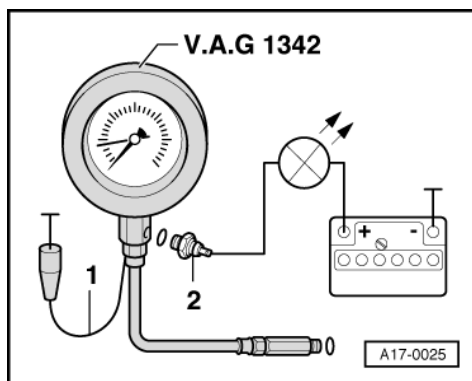
- The LED should illuminate at 1.6... 2.0 bar.

Black oil pressure switch:

- The LED should illuminate at 1.2... 1.6 bar.

All models:

- If the LED does not illuminate, fit a new oil pressure switch.



Checking 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 approx. 80°C).
 - Oil pressure at idling speed: 1.0...2.5 bar
 - Oil pressure at 3000 rpm: 3.0...5.0 bar

If the specified values are not obtained:

- Pressure relief valve or oil pump defective, replace oil pump => Page **152**.

Note:

If the fault "no oil pressure" occurs, check the contact surfaces of cylinder 1 camshaft bearing, crankshaft bearing no. 4 and both thrust washers for damage. If no damage can be found, fit a new oil pump.

1.10 - Engine oil

The engine is filled with a high quality multigrade oil at the factory which can be used all year round, except in extremely cold climates.

Viscosity grades and oil specifications

Viscosity grades and oil specifications:

=> Maintenance Manual

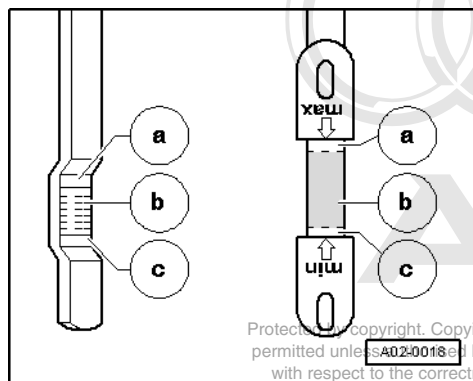
1.11 - Check oil level

Test requirements:

- Engine oil temperature at least 60 °C
- Vehicle must be level (horizontal)
- Wait a few minutes after switching off the engine to allow the oil to flow back into the sump.

Test sequence

- Pull out the dipstick, wipe with a clean cloth and insert again to stop.
- Pull out the dipstick again and read off the oil level.



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-> Markings on oil dipstick:

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

Note:

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

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19 - Cooling system

1 - Removing and installing parts of the cooling system

1.1 - Removing and installing parts of the cooling system

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open 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 clamps (same as original equipment):

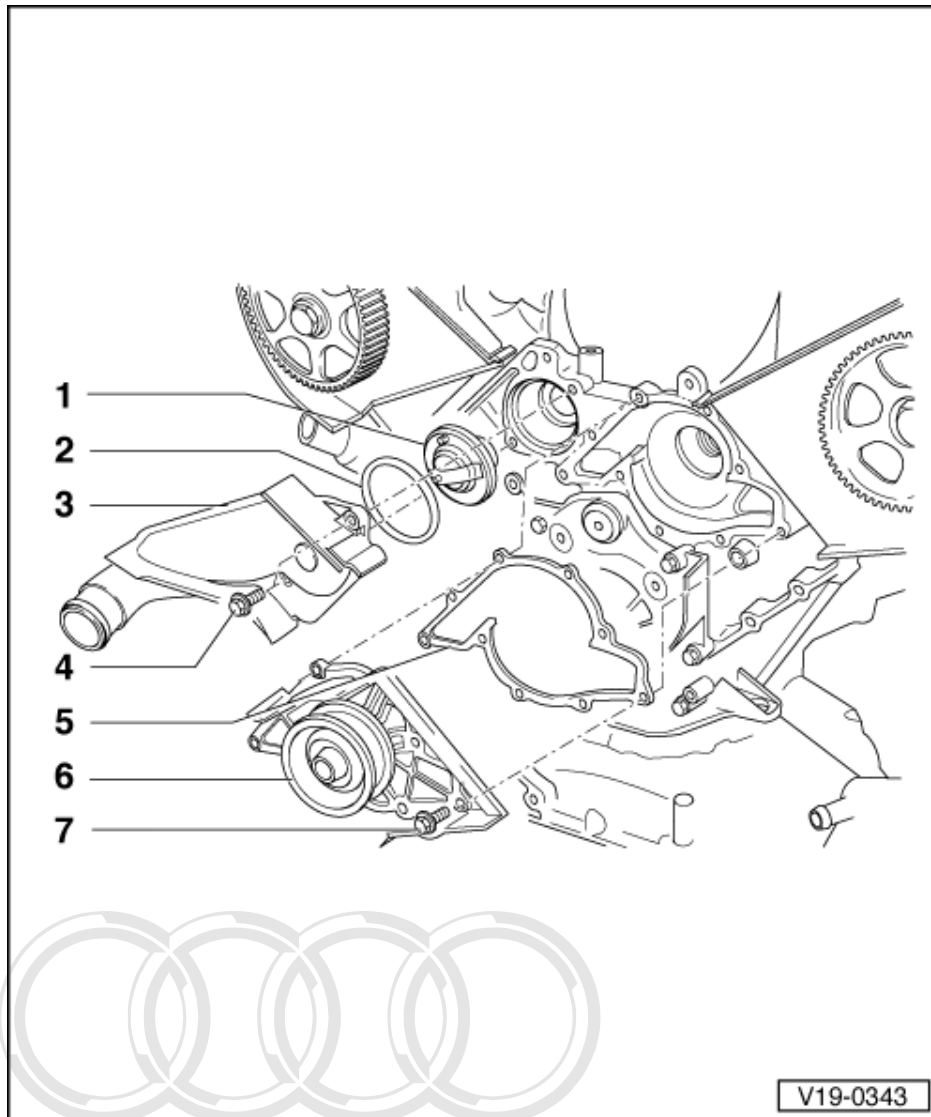
=> Parts List

- ♦ Hose clamp pliers V.A.G 1921 are recommended when installing spring type clips.
- ♦ Tightening torque for screw-type clips: 2 Nm.
- ♦ Replace seals and gaskets.
- ♦ The arrow markings on the coolant pipes and on the ends of the hoses must align.



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1.2 - Coolant pump and coolant thermostat



1 Thermostat

- ♦ Removing and installing
=>Page 170
- ♦ Checking => Page 172
- ♦ Installation position
=> Fig. 164

2 Sealing ring

- ♦ Replace

3 Coolant thermostat housing

4 10 Nm

5 Gasket

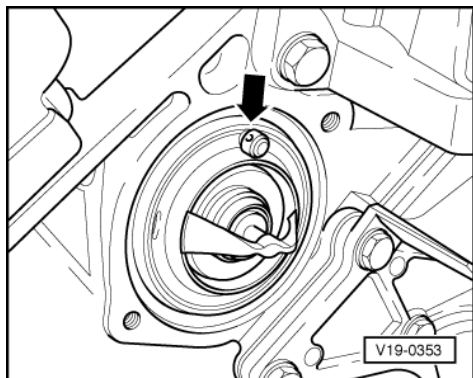
- ♦ Replace

6 Coolant pump

- ♦ Removing and installing
=> Page 169
- ♦ Check for ease of movement

7 10 Nm

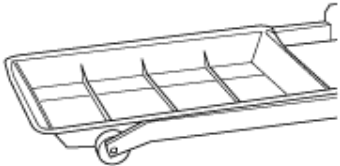
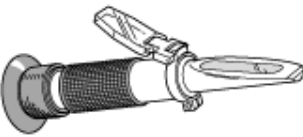
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-> Fig.1 Installation position of thermostat

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

1.3 - Draining and filling cooling system

V.A.G 1274 	V.A.G 1274/10 
V.A.G 1306 	T10007 
	G19-0003

Special tools and workshop equipment required

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

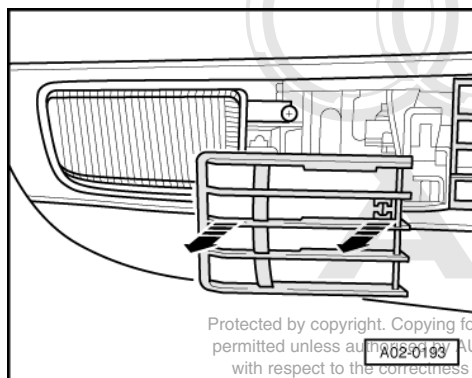
Draining**Notes:**

- ◆ Collect drained coolant in a clean container for re use or disposal.
- ◆ Only use clean drinking water to mix the coolant.

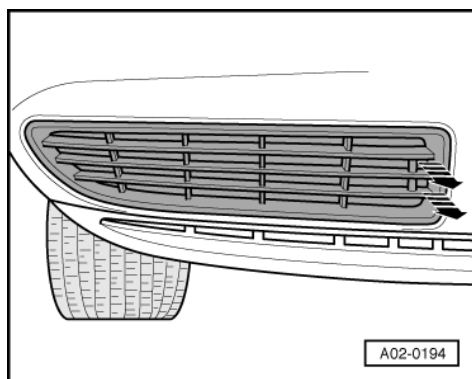
Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

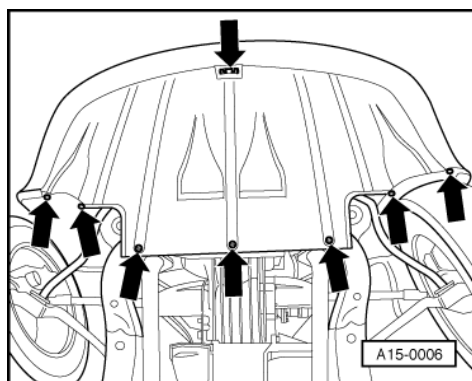
- Open the cover of the coolant expansion tank

**Audi 100:**

- -> Unclip the air intake grille to the lower right of the bumper -arrows-.

**Audi A6**

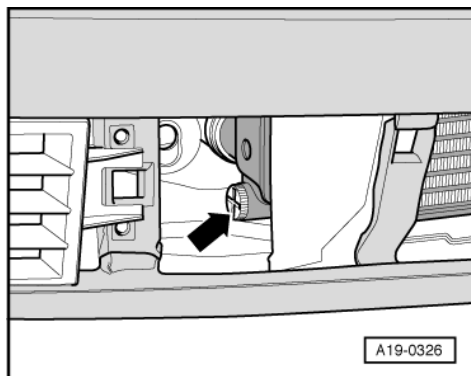
- -> Pull back retainer catch -arrows- and remove air intake grille.





All models:

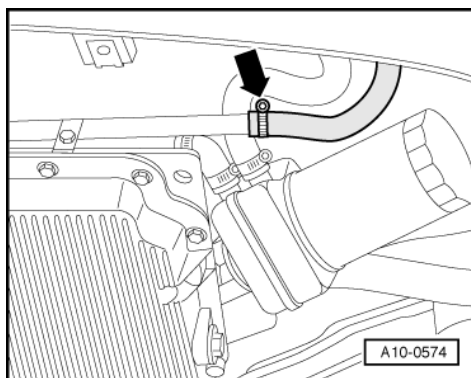
- -> Remove the noise insulation -arrows-.



- Place drip tray V.A.G 1306 under engine.
- -> Turn drain plug-arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.



- -> Also open the coolant drain plug on rear left of engine -arrow-.



- -> Also disconnect coolant hose -arrow-, and drain off remaining coolant.



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Filling

Notes:

- ♦ The cooling system is filled all year round with a mixture of water and antifreeze/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.

Important

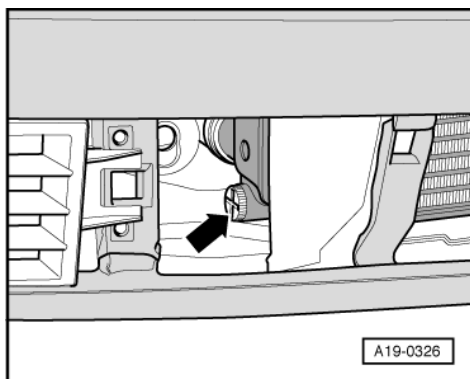
The two different coolant additives G 011 A8 C and G 012 A8 D must not be mixed together. Otherwise, this can result in serious damage to the engine.

- ◆ 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 fill with fresh coolant. To flush the system, fill it with clean water and run the engine for about 2 minutes. This should remove as much of the old coolant as possible.
- ◆ 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 an arctic climate 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 011 A8 C or G 012 A8 D can be increased, but only up to 60 % (this gives frost protection to around -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.

Recommended mixture ratios:

Frost protection to	Antifreeze concentration	G11/G12 1)	Water1)
-25 °C	40 %	3.0 l	4.0 l
-35 °C	50 %	3.5 l	3.5 l

- 1) Coolant quantity: 7.0 litres (may vary depending upon the vehicle equipment)



- -> Close drain plug -arrow- on radiator.



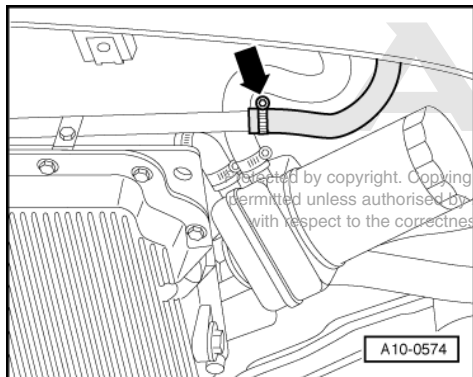
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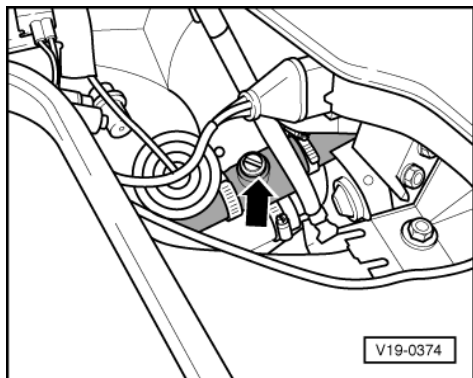
- -> Close coolant drain plug on rear left of engine -arrow- (20 Nm).

Note:

Renew O-ring.



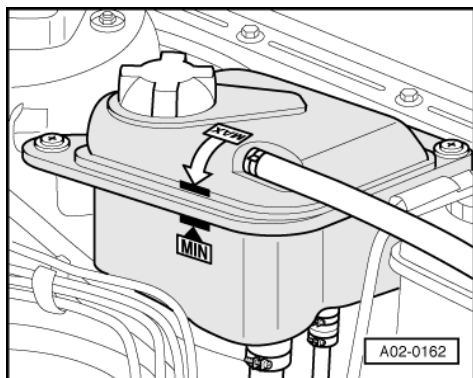
- -> Connect coolant hose -arrow-.



- Remove plenum chamber cover.
- -> Open bleed screw -arrow- on heating hose to heat exchanger approx. 2 turns.
- Top up coolant until it runs out at the bleed screw.
- Close the bleed screw.
- Fit expansion tank cap.
- Start engine and maintain an engine speed of about 2000 rpm for approx. 30 seconds.
- Then allow engine to run at idling speed until the lower coolant hose on radiator becomes hot.

Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.



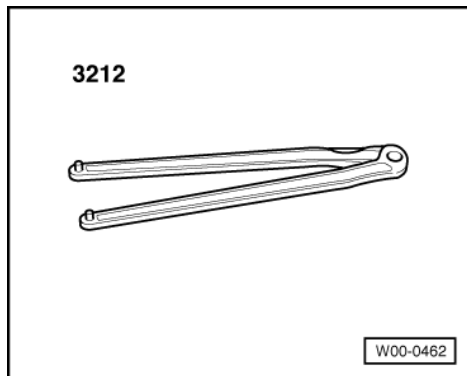
- -> Check the coolant level and top up if necessary. If the engine is warm, the coolant level should be at the max. mark; if cold, between the min. and max. marks.

- Stop engine.

Tightening torque

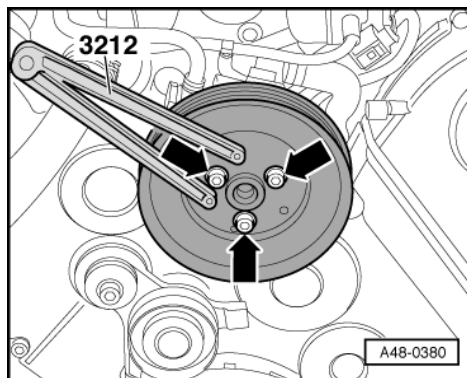
Component	Nm
Drain plug to cylinder block.	20

1.4 - Removing and installing coolant pump



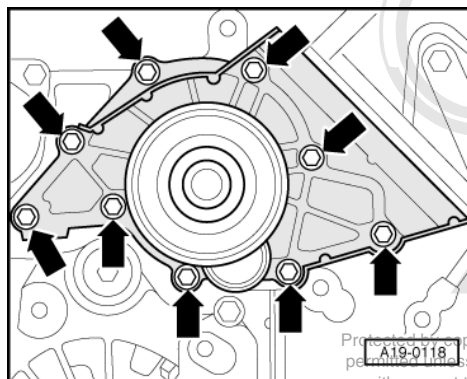
Special tools and workshop equipment required

- ♦ Pin wrench 3212



Removing

- Drain coolant => Page 165 .
- Remove ribbed belt => Page 35 .
- -> Counterhold hydraulic pump pulley with 2-hole pin wrench 3212 and unscrew pulley.
- Removing toothed belt (from camshaft sprockets only) => Page 46 .



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

Installing

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

Note:

Replace seals and gaskets.

- Clean sealing surfaces before installing coolant pump.
- Install toothed belt (adjust valve timing) => Page 49 .

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Note all instructions on removing and installing the toothed belt =>Page 46 .

- Top up coolant => Page 166 .

Tightening torques

Component	Nm
Coolant pump to cylinder block	10
Pulley to hydraulic pump	25

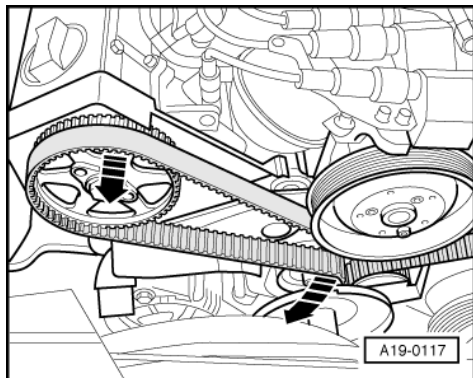
1.5 - Removing and installing, checking coolant thermostat

Removing

- Drain coolant => Page 165 .
- Remove ribbed belt => Page 35 .
- Remove tensioner for ribbed belt.
- Remove left and right toothed belt guard.
- Mark direction of rotation of toothed belt. The belt can break if it rotates in the opposite direction when refitted.
- Apply load to toothed belt near right camshaft toothed belt sprocket and turn crankshaft to and fro a few times at central bolt of crankshaft toothed belt sprocket.

Note:

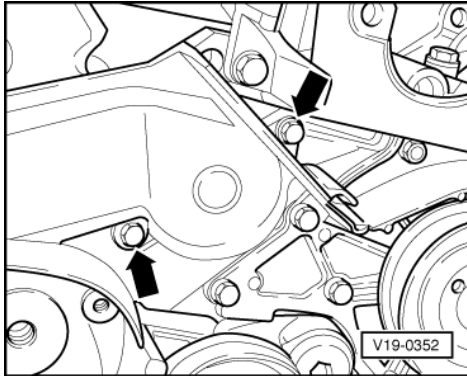
This to some extent slackens the toothed belt on the right side, and this can then be pushed forwards more easily.



- -> Pull toothed belt forward slightly on tensioning roller and right camshaft toothed belt sprocket -arrows- - do not pull off completely.

Important

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 46

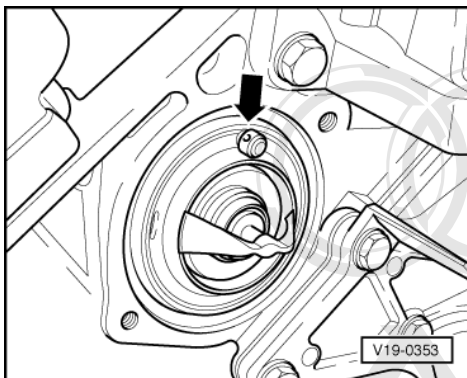


- -> Detach thermostat housing -arrows-.

Note:

The illustration shows the thermostat housing with the toothed belt removed.

- Remove oil seal and thermostat.

**Installing**

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

Note:

Replace gaskets and seals.

- Before installing, clean and smooth down oil seal sealing surface as required.
- Install thermostat.
 - -> Installation position:
 - Vent valve -arrow- faces upwards
 - Sealing ring to housing
- Install thermostat housing.

Important

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 46

- Push toothed belt towards the rear.



- Fit left and right toothed belt guard.
- Install ribbed belt tensioner.
- Install ribbed belt =>Page **37** .
- Top up coolant => Page **166** .

Tightening torques

Component	Nm
Housing for thermostat to cylinder block	10
Ribbed belt tensioner to cylinder block	55

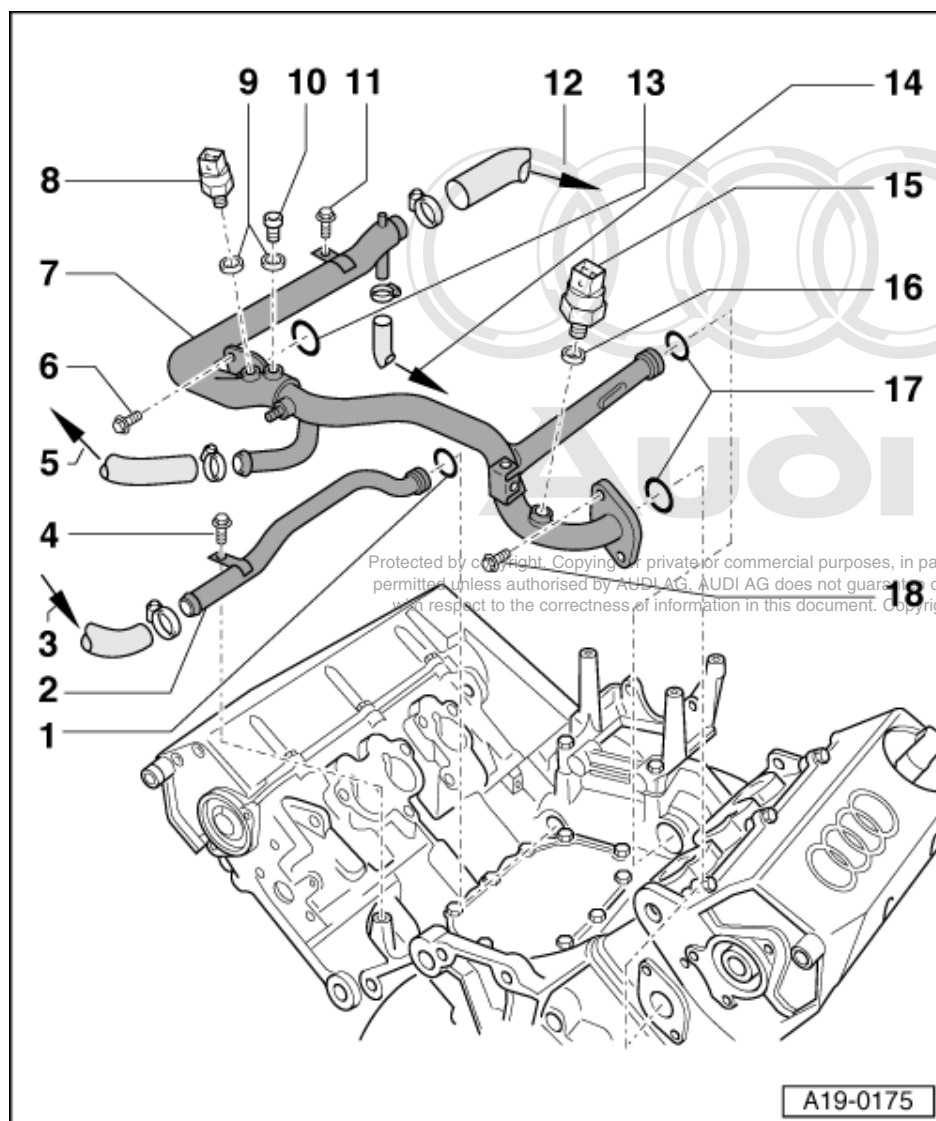
Check coolant thermostat

- Heat thermostat in water bath.

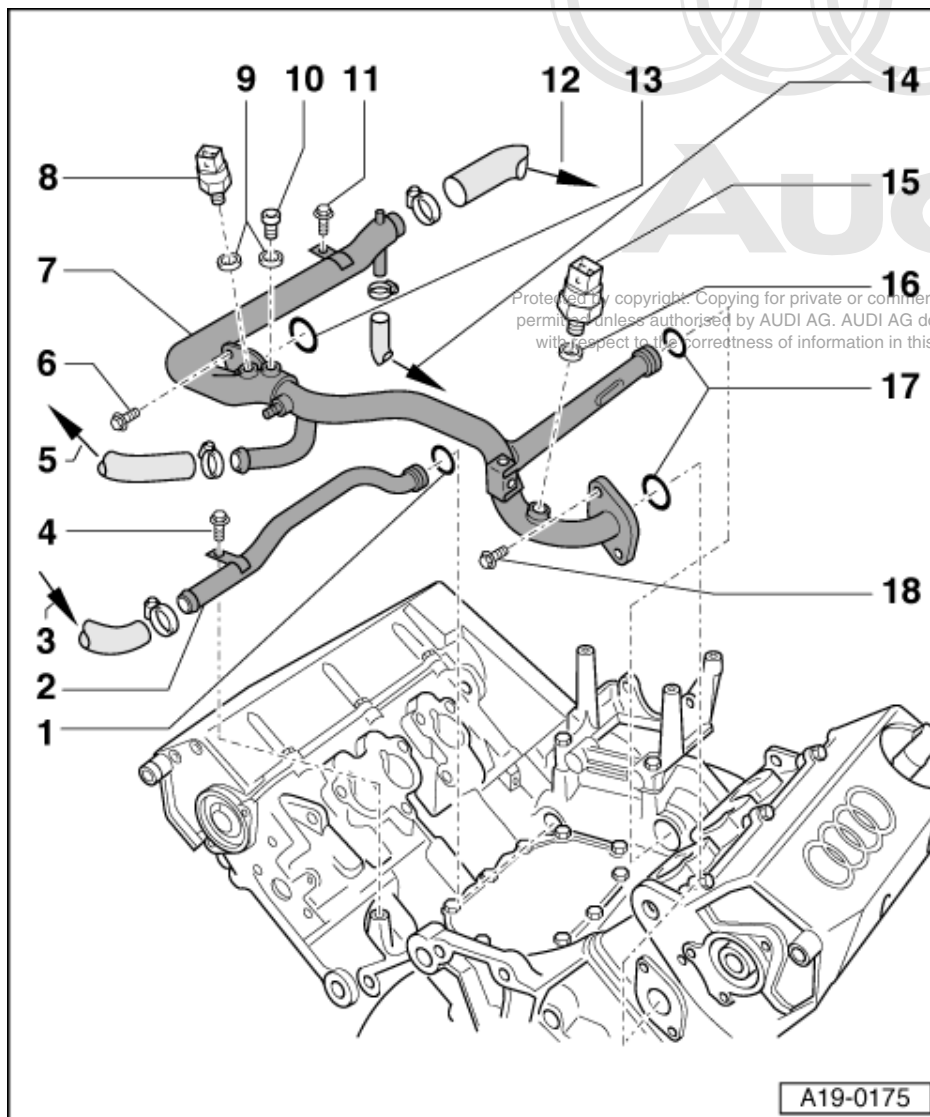
Starts to open	Fully open	Opening travel
approx. 87°C	approx. 102°C 1)	at least 8 mm

1) cannot be tested

1.6 - Coolant pipes - overview



- 1 O-ring
 - ♦ Replace
 - ♦ Lubricate with coolant
- 2 Small coolant pipe
 - ♦ Removing and installing
=>Page 174 .
- 3 From heat exchanger
- 4 10 Nm
- 5 To heat exchanger
- 6 10 Nm
- 7 Large coolant pipe
 - ♦ Removing and installing
=>Page 175 .
- 8 Coolant temperature sender -G62



- 9 Sealing ring
 - ♦ Replace
- 10 Screw plug
- 11 10 Nm
- 12 To top of radiator
- 13 O-ring
 - ♦ Replace

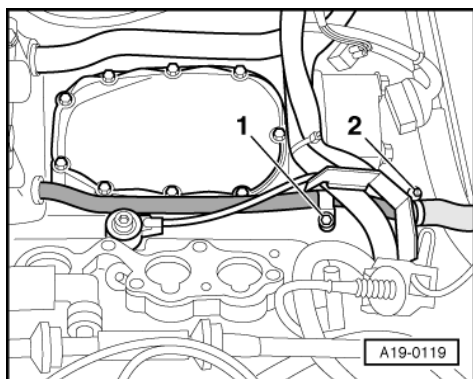


- ♦ Lubricate with coolant
- 14 To oil cooler
- 15 Electronic thermoswitch -F76
- 16 Sealing ring
 - ♦ Replace
- 17 O-rings
 - ♦ Replace
- 18 10 Nm

1.7 - Removing and installing small coolant pipe

Removing

- Drain coolant => Page 165 .
- Remove intake manifold => Page 86 .



- -> Disconnect rear coolant hose -2- from small coolant pipe.
- Screw out bolt -1-.
- Pull small coolant pipe off to rear.
- Swivel coolant pipe and remove it.

Installing

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

Notes:

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

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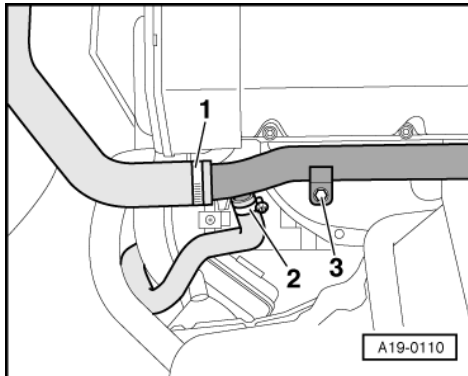
=> Parts List

- ♦ Always replace seals and O-rings.
- Before installing, clean and smooth down sealing surface for O- ring.
- Lubricate new O-ring with G11/G12 and slide onto coolant pipe.
- Push coolant pipe into opening in cylinder block.
- Install intake manifold => Page 91 .
- Top up coolant => Page 166 .

Tightening torque

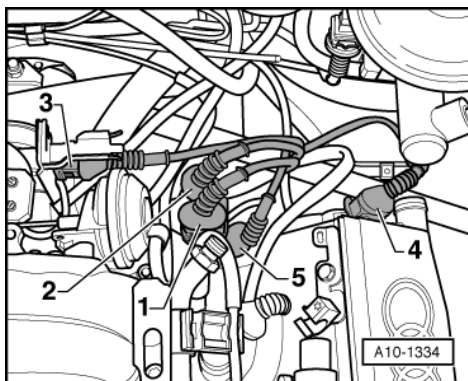
Component	Nm
Small coolant pipe to cylinder block	10

1.8 - Removing and installing large coolant pipe



Removing

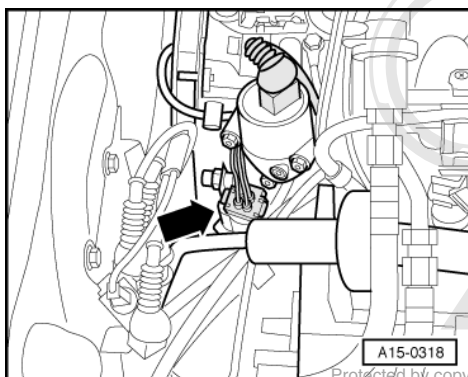
- Drain coolant => Page 165 .
- Remove intake manifold => Page 86 .
- -> Disconnect coolant hoses -1- and -2- at coolant pipe.
- Unscrew bolt -3-.



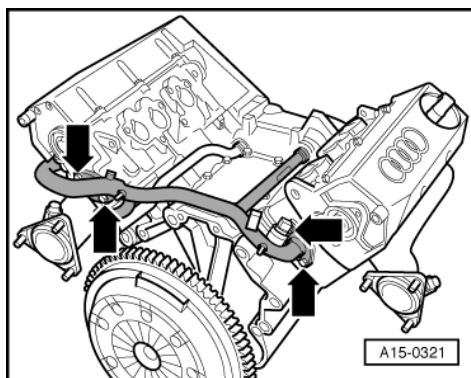
- -> Detach electrical connectors -1-, -2-, -4- and -5-.

Note:

Electrical connector -3- remains plugged in.



- -> Unplug connector from electronic thermoswitch -F76- arrow-
- Unbolt bracket of power steering pressure line from coolant pipe.



- ➔ Unscrew coolant pipe from cylinder heads -arrows-.
- Pull coolant pipe back and out of cylinder block.

Installing

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

Notes:

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

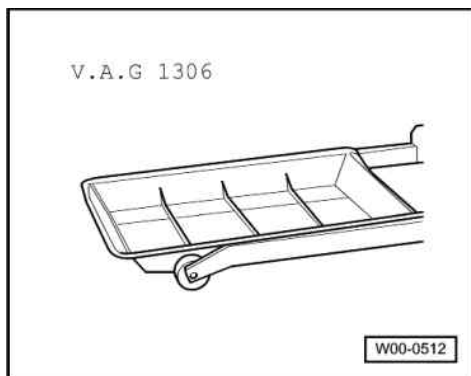
=> Parts List

- ♦ Always replace seals and O-rings.
- ♦ Replace self-locking nuts.
- ♦ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- Before installing, clean and smooth down sealing surface for O-rings as required.
- Lubricate new O-ring with G11/G12.
- Push coolant pipe into opening in cylinder block.
- Install intake manifold => Page 91 .
- Top up coolant => Page 166 .

Tightening torque

Component	Nm
Coolant pipe to cylinder head	10

1.9 - Removing and installing radiator



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Special tools and workshop equipment required

- ♦ Drip tray V.A.G 1306

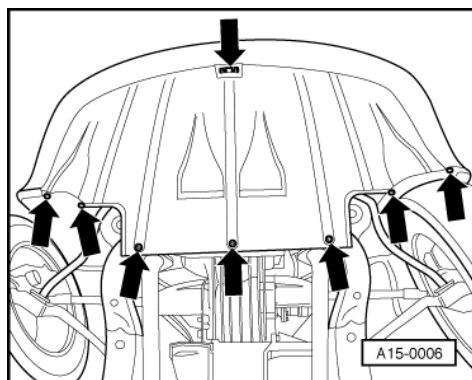
Removing**Note:**

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

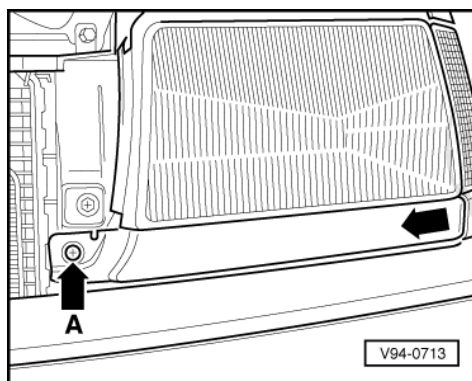
Important

Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the coolant expansion tank



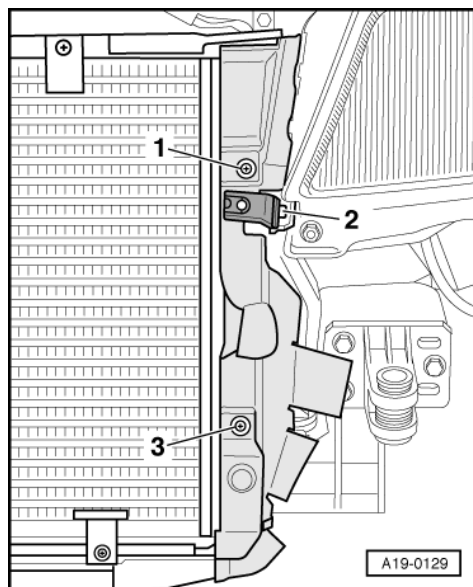
- -> Remove the noise insulation -arrows-.



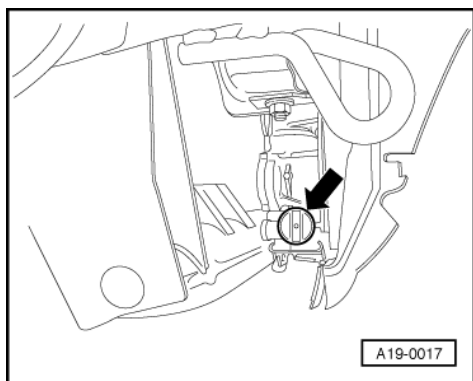
- Remove the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Remove rubber sealing lip from top of lock carrier.
- -> Remove fastening screw -arrow A- and pull out headlight trim in direction of arrow.



- -> Unscrew securing bolt of retaining clip -2- for headlight trim at housing.
- Unscrew air ducts from radiator -1- and -3- (left and right).



- Place drip tray V.A.G 1306 under engine.
- -> Turn drain plug -arrow- on radiator anti-clockwise. If necessary, fit drain hose on connection.
- Detach coolant hose from bottom of radiator.

Vehicles with air conditioner:

Important

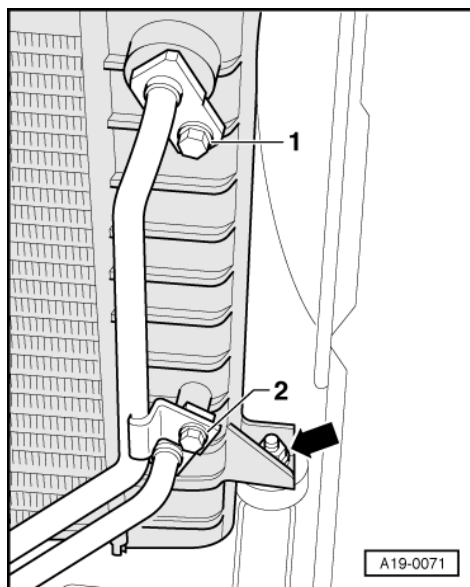
The air conditioner refrigerant circuit must not be opened.

- Remove refrigerant pipe under radiator from brackets.

All models:

- Detach connector from thermoswitch for radiator fan -F54.
- Detach top left coolant hose from radiator.
- Remove air duct to air cleaner at lock carrier.

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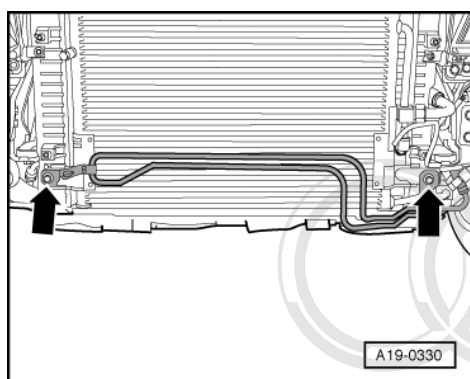
**Vehicles with automatic gearbox:**

- -> Removing ATF lines from radiator (bolts -1- and -2-):

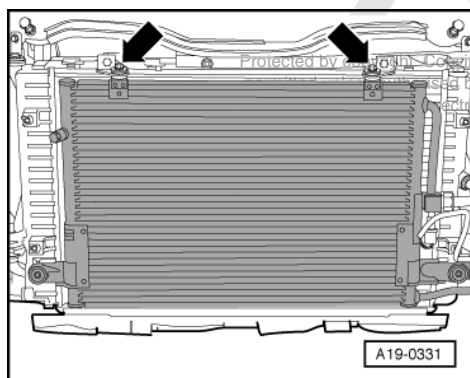
=> Automatic Gearbox; Repair group 37

Note:

The nut -arrow- at lower right radiator anchorage point must not be loosened.

**All models:**

- -> Detach cooling pipes for power steering hydraulic fluid -arrows-.



Vehicles with air conditioner:**Important**

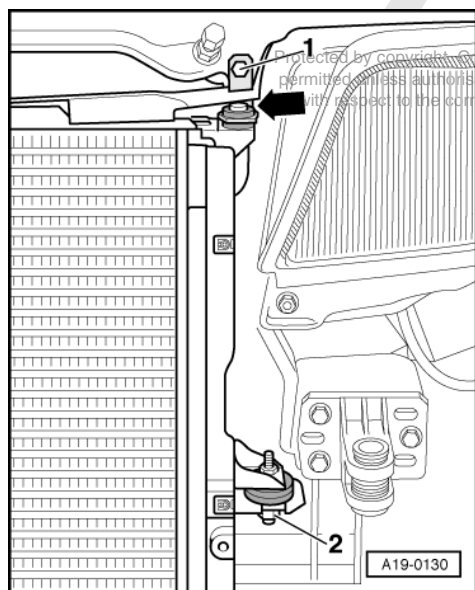
The air conditioner refrigerant circuit must not be opened.

- -> Remove the securing bolts -4- for the condenser.

Note:

To prevent damage to the condenser and refrigerant pipes/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Leave condenser with connected refrigerant pipes/hoses suspended in installation position.
- Unscrew radiator cowl at rear of radiator -arrows-.
- Remove radiator cowl from brackets and tie it to lock carrier.



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- -> Unscrew nuts -2- at bonded rubber mounting.
- Pull radiator forwards at lower edge, so that it can be removed from the support at the top -arrow-.

Note:

On vehicles with air conditioner also unscrew bolt -1- at the top, if applicable.

Installing

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

- Install the front bumper:

=> General Body Assembly; Repair group 63; Front bumper Front bumper

- Top up coolant => Page 166 .

Note:

All coolant must be replaced when a new radiator is fitted.

Vehicles with automatic gearbox:

- Attach ATF lines.

=> Automatic Gearbox; Repair group 37

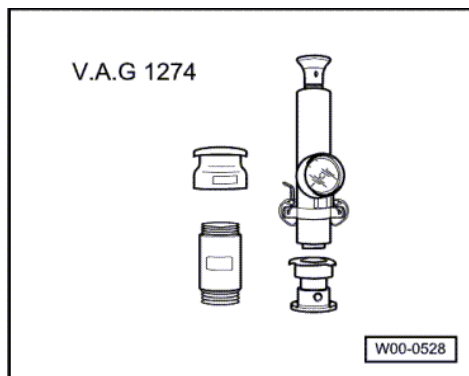
- Check ATF level:

=> Automatic Gearbox; Repair group 37

Tightening torques

Component		Nm
Radiator to lock carrier	M6	10
	M8	20
Radiator cowl to radiator		10
Condenser to radiator		10
Power steering cooling pipes to radiator		10

1.10 - Checking cooling system for leaks



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Special tools and workshop equipment required

- ♦ V.A.G 1274 with V.A.G 1274/1

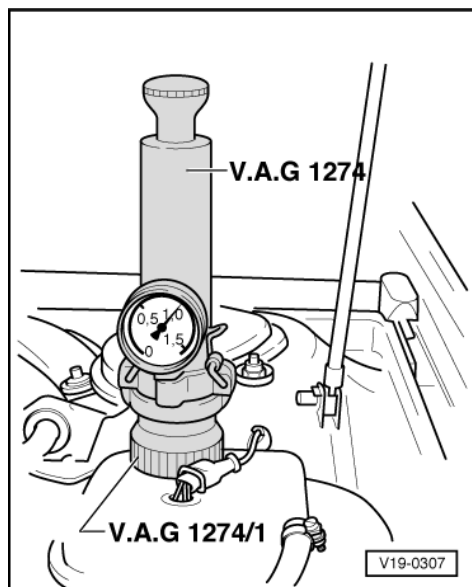
Test requirements:

- Engine at operating temperature.

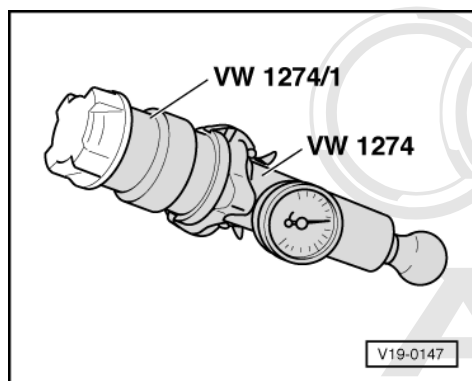
Test sequence

Important
Hot steam or hot coolant can escape when opening expansion tank. Cover cap with a cloth and open carefully.

- Open the cover of the 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 this pressure is not maintained, locate and rectify leaks.



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Checking 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.
 - The pressure relief valve should open at a pressure of 1.2... 1.5 bar.

26 - Exhaust system

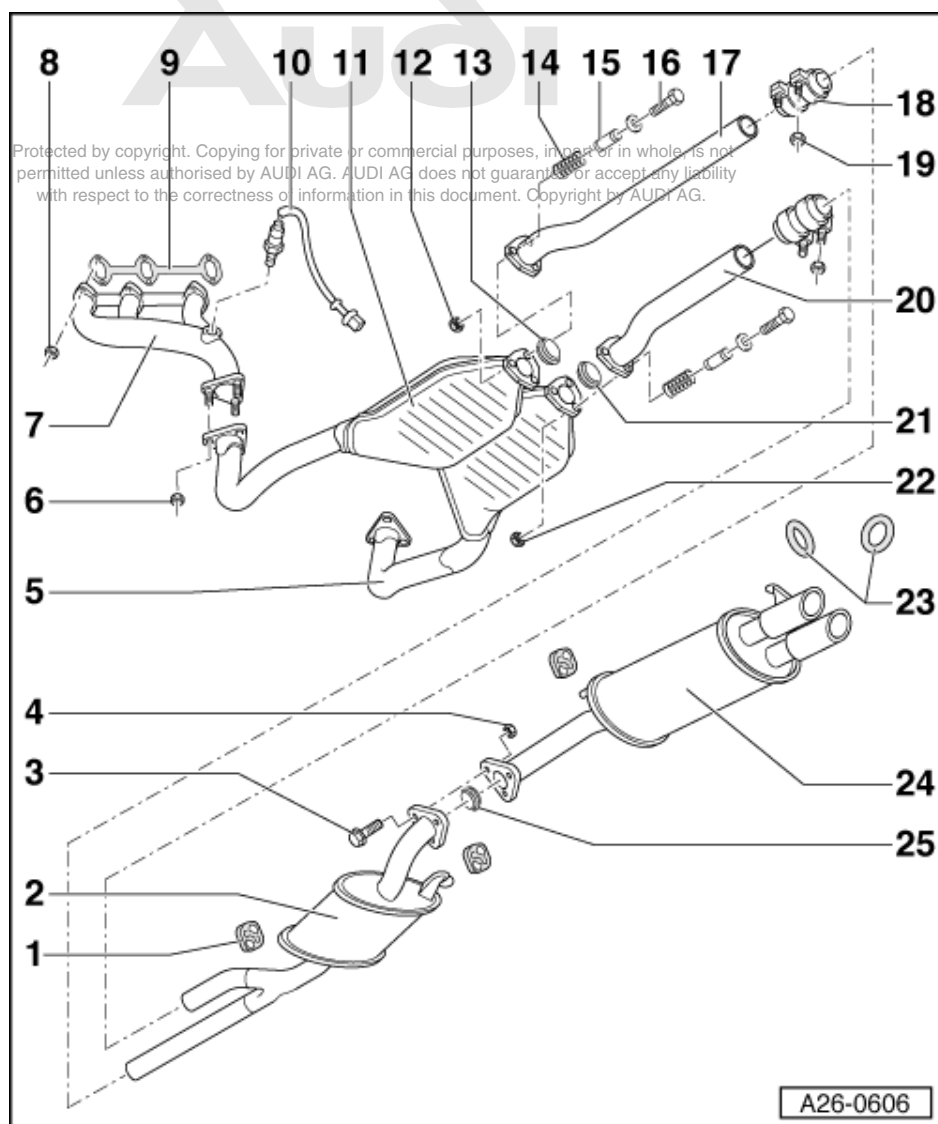
1 - Removing and installing parts of exhaust system

1.1 - Removing and installing parts of exhaust system

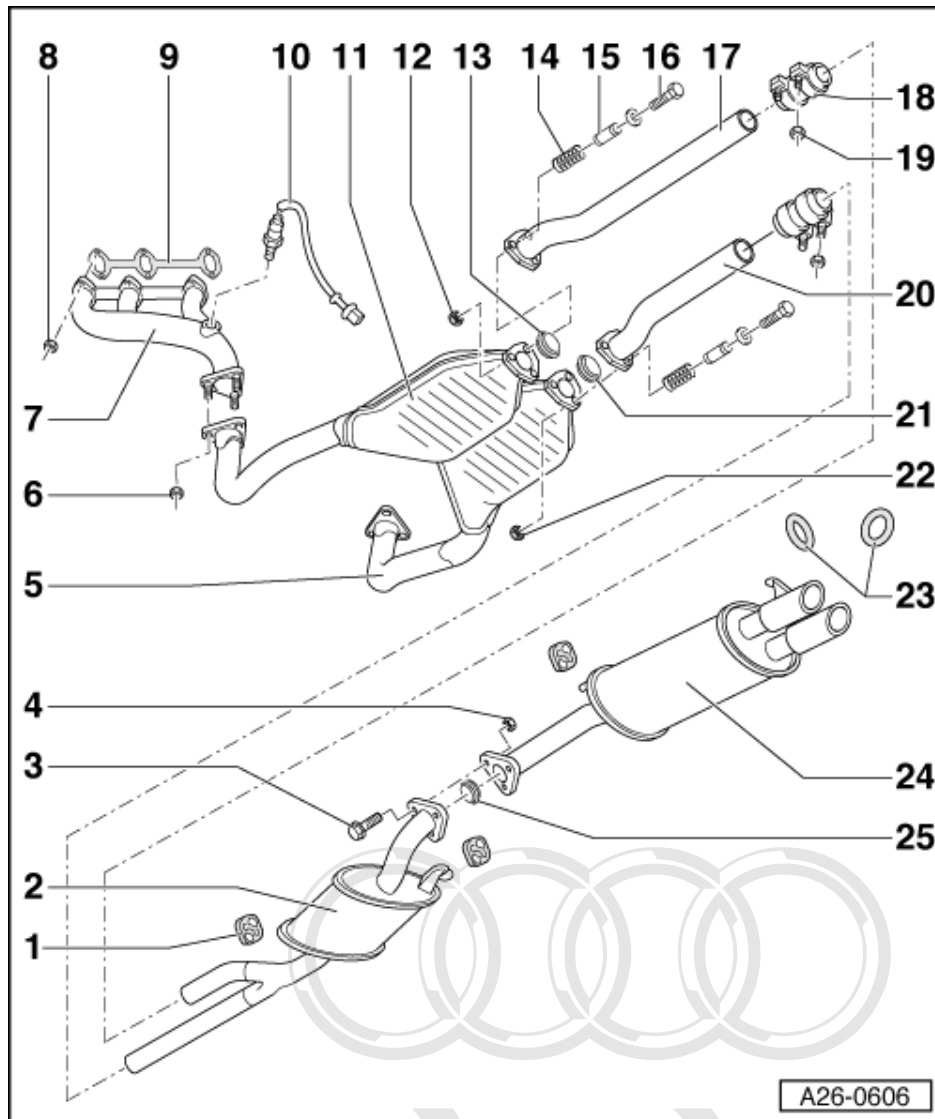
Notes:

- ♦ Always replace 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 body.
- ♦ Installation position of vibration damper for vehicles with two catalytic converters with automatic gearbox 097 => Fig. 190.

1.2 - Vehicles with front-wheel drive and two catalytic converters - manual gearbox or automatic gearbox 097



- 1 Retainer
 - ♦ Replace if damaged
 - ♦ Bending over securing tabs => Fig. 190
- 2 Centre silencer
 - ♦ Installing stress-free
=>Page 190 .
- 3 25 Nm
- 4 25 Nm
 - ♦ Replace
- 5 Right front exhaust pipe
 - ♦ With catalytic converter
 - ♦ Protect from damage by knocks and impacts
 - ♦ Installing stress-free
=>Page 190 .



- ♦ Components of mounting for vehicles with manual gearbox => Fig. 188
- ♦ Components of mounting for vehicles with automatic gearbox 097 =>Fig. 189

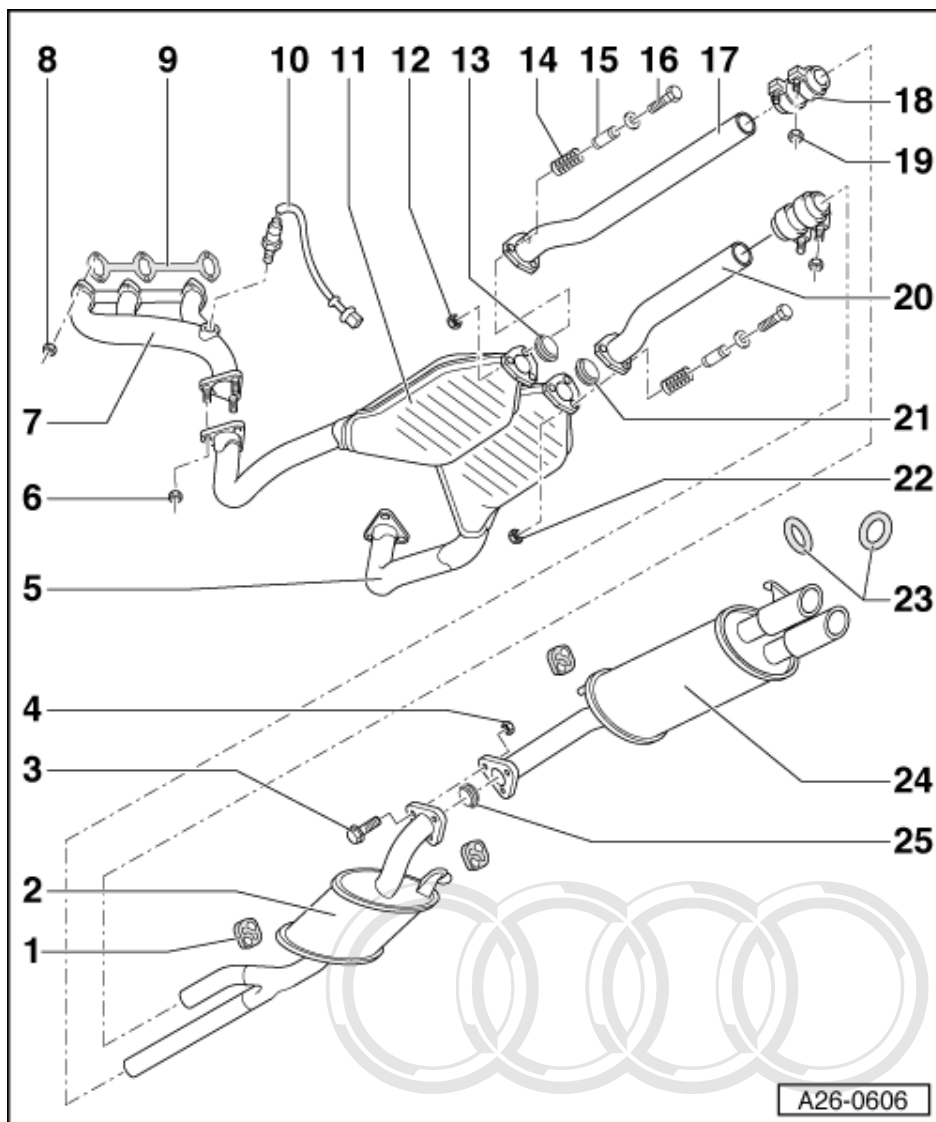
- 6 30 Nm
 - ♦ Replace
 - ♦ Observe the tightening sequence =>Page 190
- 7 Exhaust manifold
 - ♦ Removing and installing left exhaust manifold => Page 222
 - ♦ Removing and installing right exhaust manifold => Page 226

8 25 Nm

- ♦ Replace

9 Gasket

- ♦ Replace
- ♦ Installation position: connecting piece points downwards

**10 Lambda probe - 55 Nm**

- ♦ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

- ♦ Checking:

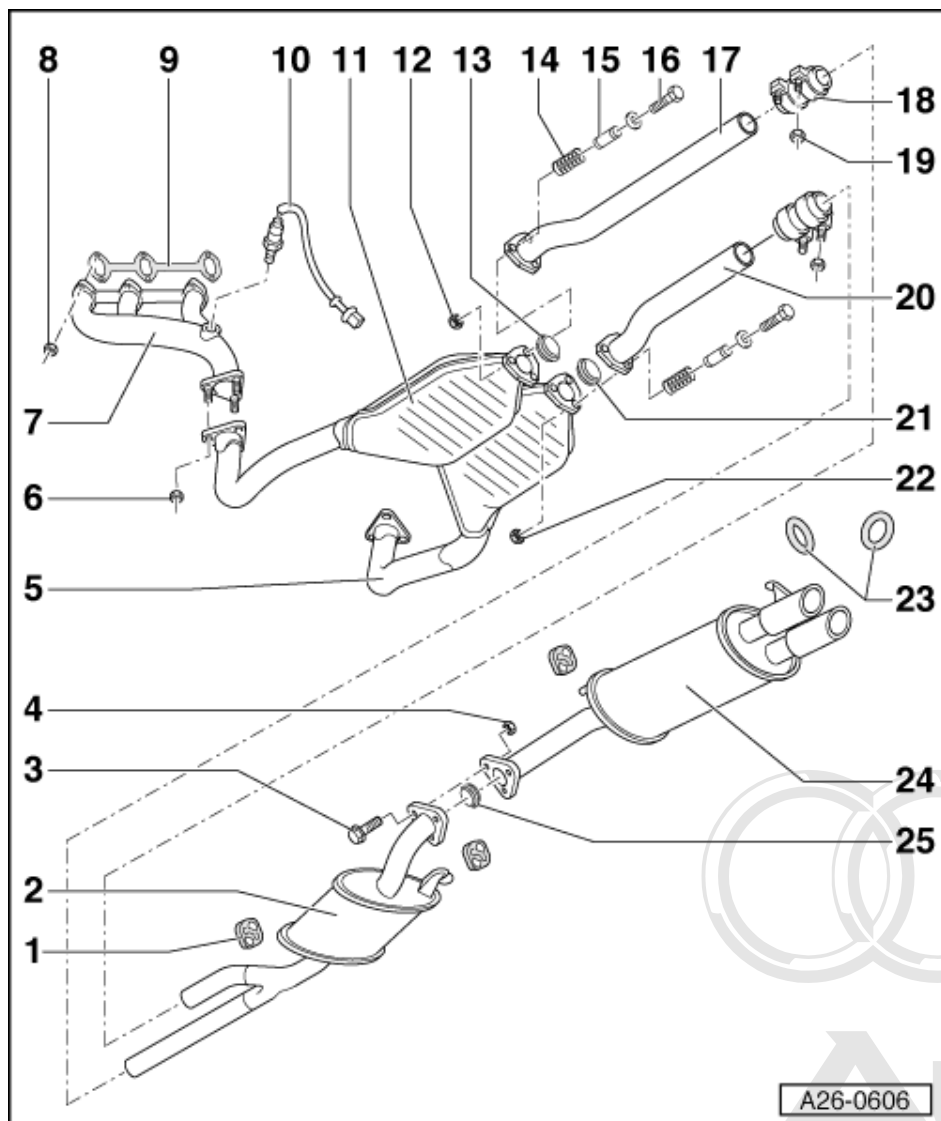
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=> Fuel Injection and Ignition System; Repair group 24**11 Left front exhaust pipe**

- ♦ With catalytic converter
- ♦ Protect from damage by knocks and impacts
- ♦ Installing stress-free
- ♦ Components of mounting for vehicles with manual gearbox => Fig. 188



- ◆ Components of mounting for vehicles with automatic gearbox 097 =>Fig. 189



12 25 Nm

- ◆ Replace

13 Sealing ring

- ◆ Sensitive to impact; take care not to drop

14 Spring

15 Spacer tube

16 25 Nm

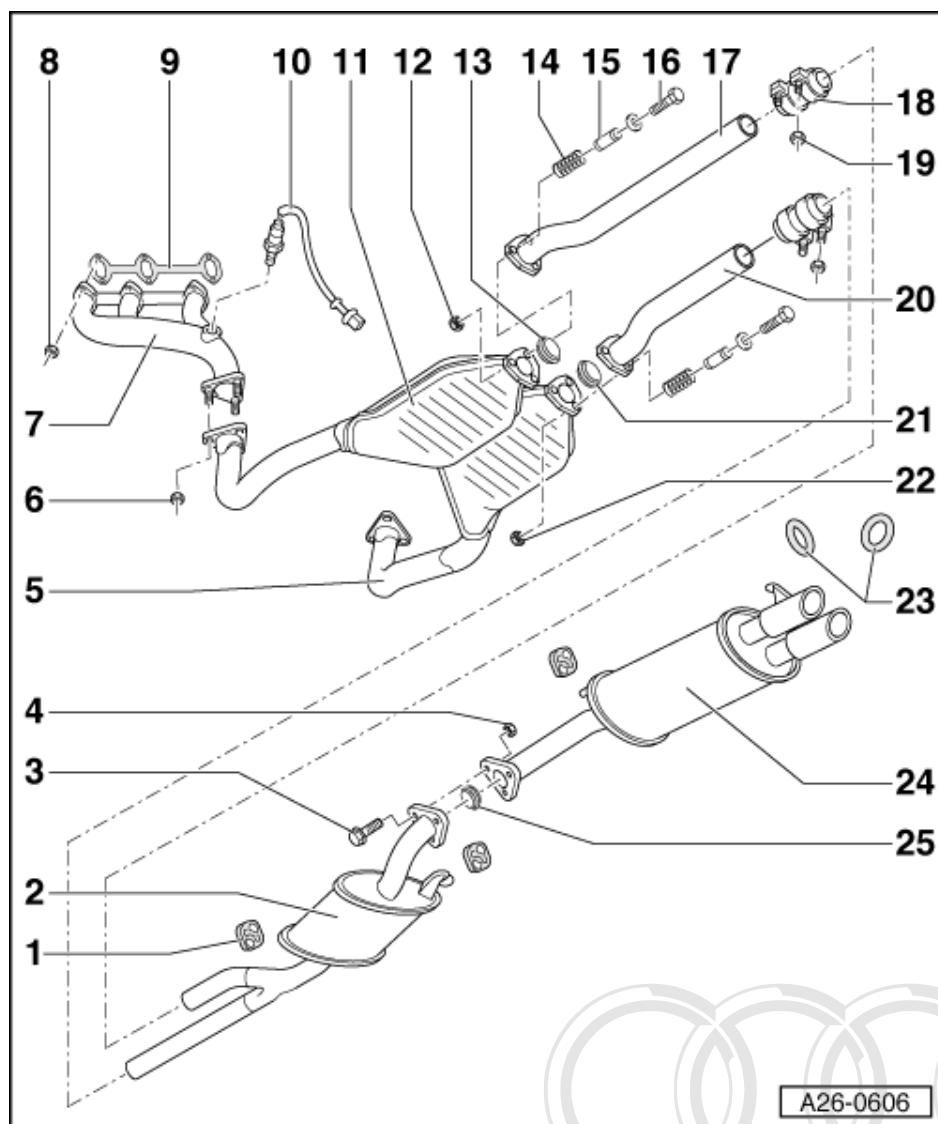
17 Left intermediate pipe

- ◆ Installing stress-free
=>Page 190 .

18 Clamp

- ◆ Installation position => Page 193
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 190
- ◆ Tighten bolted connections evenly to 40 Nm

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19 40 Nm

20 Right intermediate pipe

- ♦ Installing stress-free
=>Page 190 .

21 Sealing ring

- ♦ Sensitive to impact; take care not to drop

22 25 Nm

- ♦ Replace

23 Retaining ring

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 190

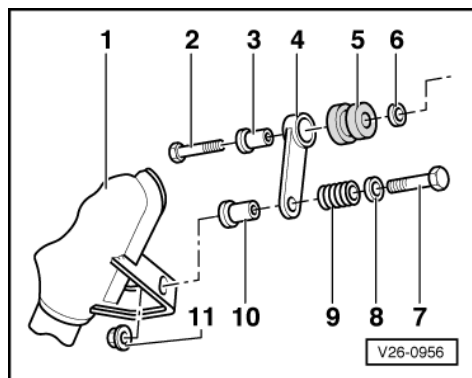
24 Rear silencer

- ♦ Installing stress-free
=>Page 190 .

25 Sealing ring

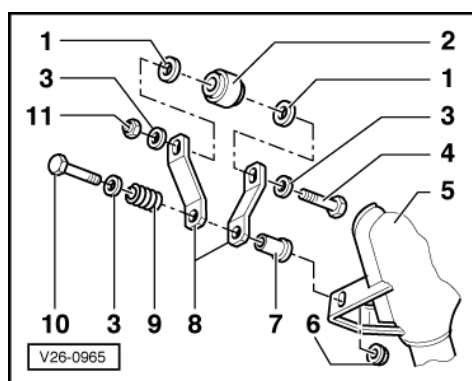
- ♦ Sensitive to impact; take care not to drop

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-> Fig.1 Components of left mounting for vehicles with manual gearbox

- 1 - Catalytic converter
- 2 - Bolt - 25 Nm
- 3 - Spacer
- 4 - Link
- 5 - Buffer
- 6 - Plate
- 7 - Bolt
- 8 - Plate
- 9 - Pressure spring
- 10 - Spacer
- 11 - Nut, self-locking - 25 Nm

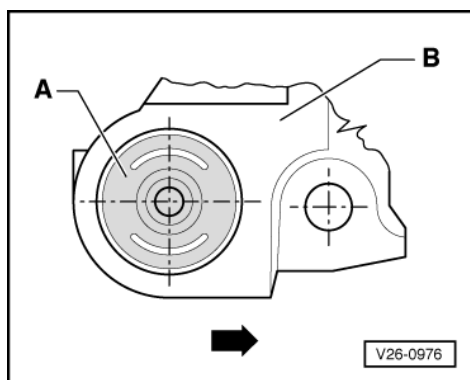


-> Fig.2 Components of right mounting for vehicles with manual gearbox

- 1 - Plate
- 2 - Buffer - Installation position => Fig. 3
- 3 - Plate
- 4 - Bolt
- 5 - Catalytic converter
- 6 - Nut, self-locking - 25 Nm
- 7 - Spacer
- 8 - Plate
- 9 - Pressure spring
- 10 - Bolt
- 11 - Nut, self-locking - 25 Nm



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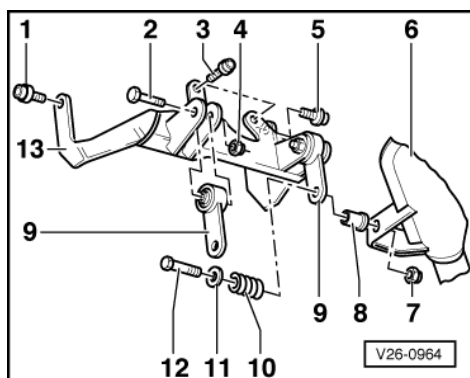


-> Fig.3 Installation position of buffer

- Rubber bush -A- must be pressed into gearbox support -B- until flush, as shown in the illustration.

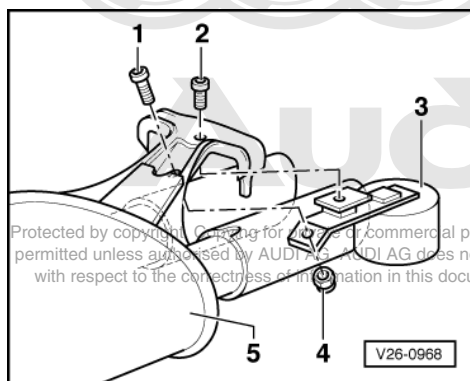
Note:

Arrow points in direction of travel.



-> Fig.4 Components of mounting for vehicles with automatic gearbox 097

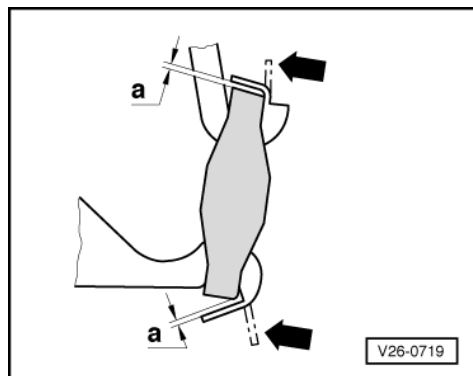
- 1 - Combi screw - 40 Nm
- 2 - Bolt
- 3 - Bolt - 40 Nm
- 4 - Nut, self-locking - 25 Nm
- 5 - Combi screw - 40 Nm
- 6 - Catalytic converter, right
- 7 - Nut, self-locking - 25 Nm
- 8 - Spacer
- 9 - Link
- 10 - Pressure spring
- 11 - Plate
- 12 - Bolt
- 13 - Link



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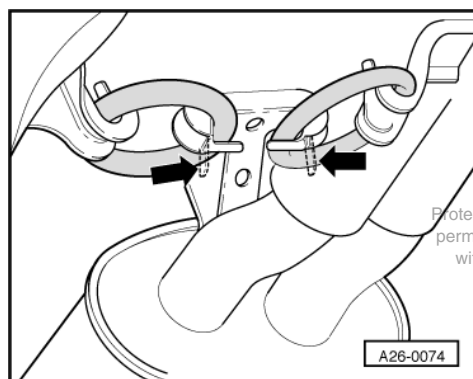
-> Fig.5 Installation position of vibration damper for vehicles with automatic gearbox 097

- 1 - Combi bolt
- 2 - Combi screw - 25 Nm
- 3 - Vibration damper
- 4 - Nut, self-locking - 25 Nm
- 5 - Rear silencer



-> Fig.6 Bending over securing tabs on brackets of front mounting

- Centre and rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm



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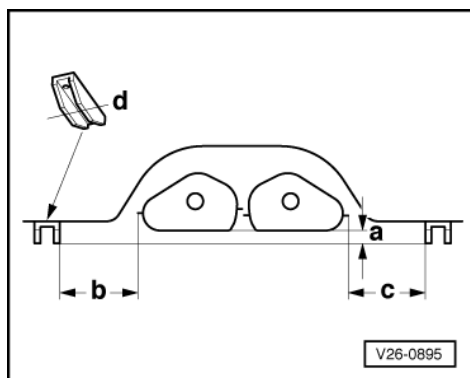
-> Fig.7 Bend over securing tabs on brackets of rear mounting

- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

1.3 - Installing exhaust system stress-free - vehicles with two catalytic converters

- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 189 .
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Front exhaust pipe/exhaust manifold (left and right)
 - Exhaust system intermediate pipe/catalytic converter (left and right)
 - Front clamps

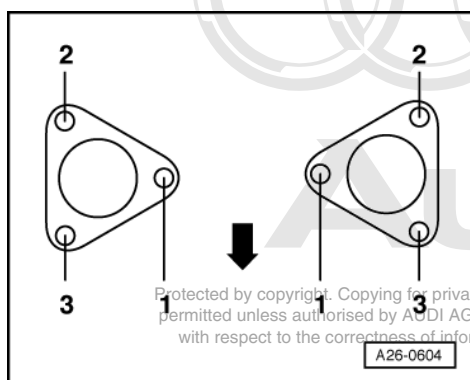
- Flange between centre and rear silencers



- -> Align the catalytic converters to dimensions -a...c-.
 - Dimension a = 8... 12 mm
 - Dimension b = 174... 179 mm
 - Dimension c = 163... 168 mm

Notes:

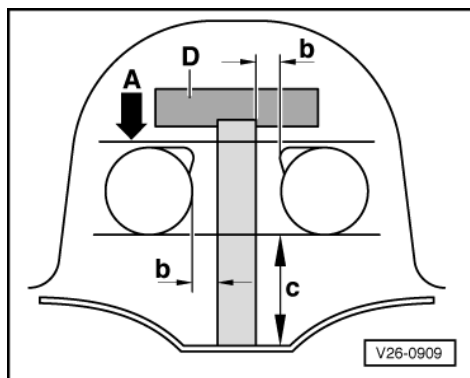
- ♦ The measurements should be carried out in the middle -d- of the catalytic converter collision guard.
- ♦ Illustration shows rear view of catalytic converters.



- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.

Note:

Arrow points in direction of travel.



- -> Align intermediate pipes so that the measuring angles of the intermediate pipes are horizontal and at the same height -arrow A-.



Note:

The bump stop -D- must not be damaged. The exhaust system must not be resting on the bump stop.

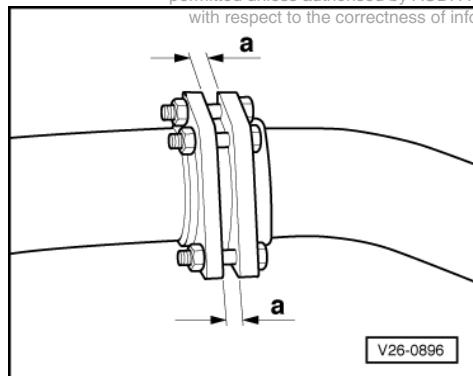
Distances from buffer stop -D-:

- Dimension b = 15 mm

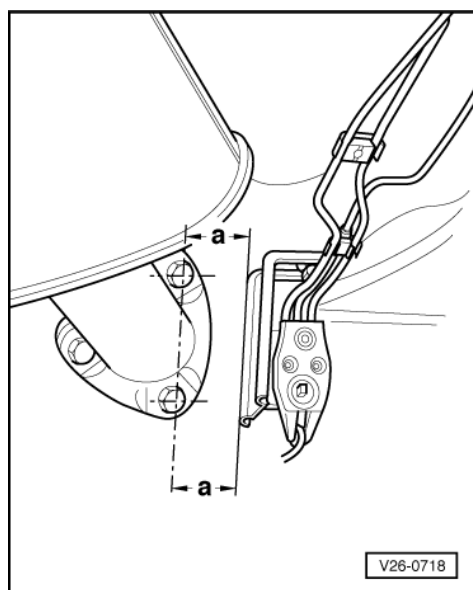
Distance from cross-piece:

- Dimension c = 70 mm

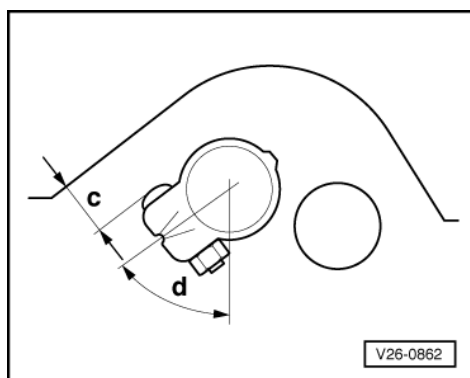
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- -> Tighten the screwed connection at the catalytic converter/intermediate exhaust pipe flange connection (left and right) initially only hand-tight. The flange projections must be the same distance apart all the way round.

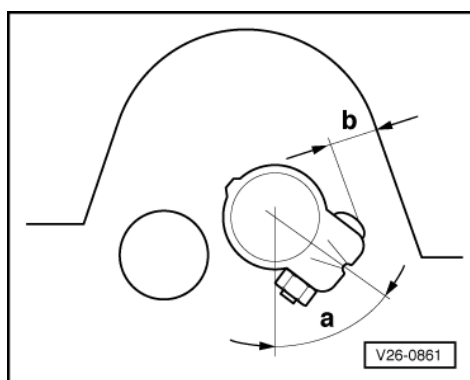


- -> Check that the screwed connections on the flange between centre and rear silencer are parallel to the brake pressure regulator bracket.
- Dimension a at bottom = dimension a at top
- Tighten screwed connections at flange between centre and rear silencers (25 Nm).

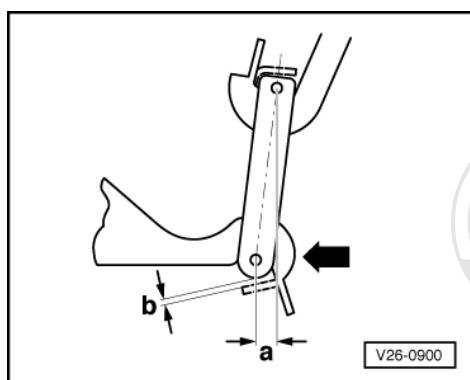


Align clamps as follows:

- -> The bolted connections of left clamp point to left.
- Dimension $c = 25 \pm 5$ mm
- Angle $d = 41^\circ$



- -> The bolted connections of right clamp point to right.
- Angle $a = 60^\circ$
- Dimension $b = 25 \pm 5$ mm
- Tighten the screwed connection at the catalytic converter/intermediate exhaust pipe flange connection (left and right) to final tightening torque (25 Nm).



- -> Push exhaust system towards front of vehicle until front mounting of centre silencer is preloaded by $a = 7 \dots 9$ mm.
- Tighten front bolted connections on clamp evenly to 40 Nm.

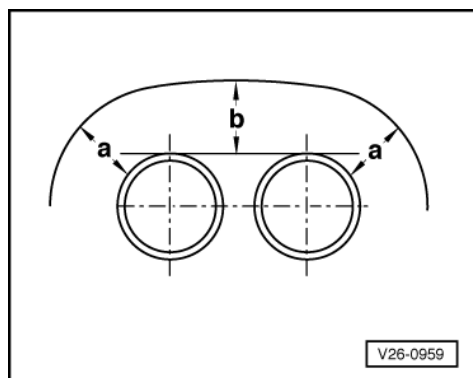
Notes:

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- ♦ The securing tabs at the brackets should be bent over about 90° after installing the retainers.



- ♦ The distance -b- between the retainer and the locking tabs should be at least 2 mm.



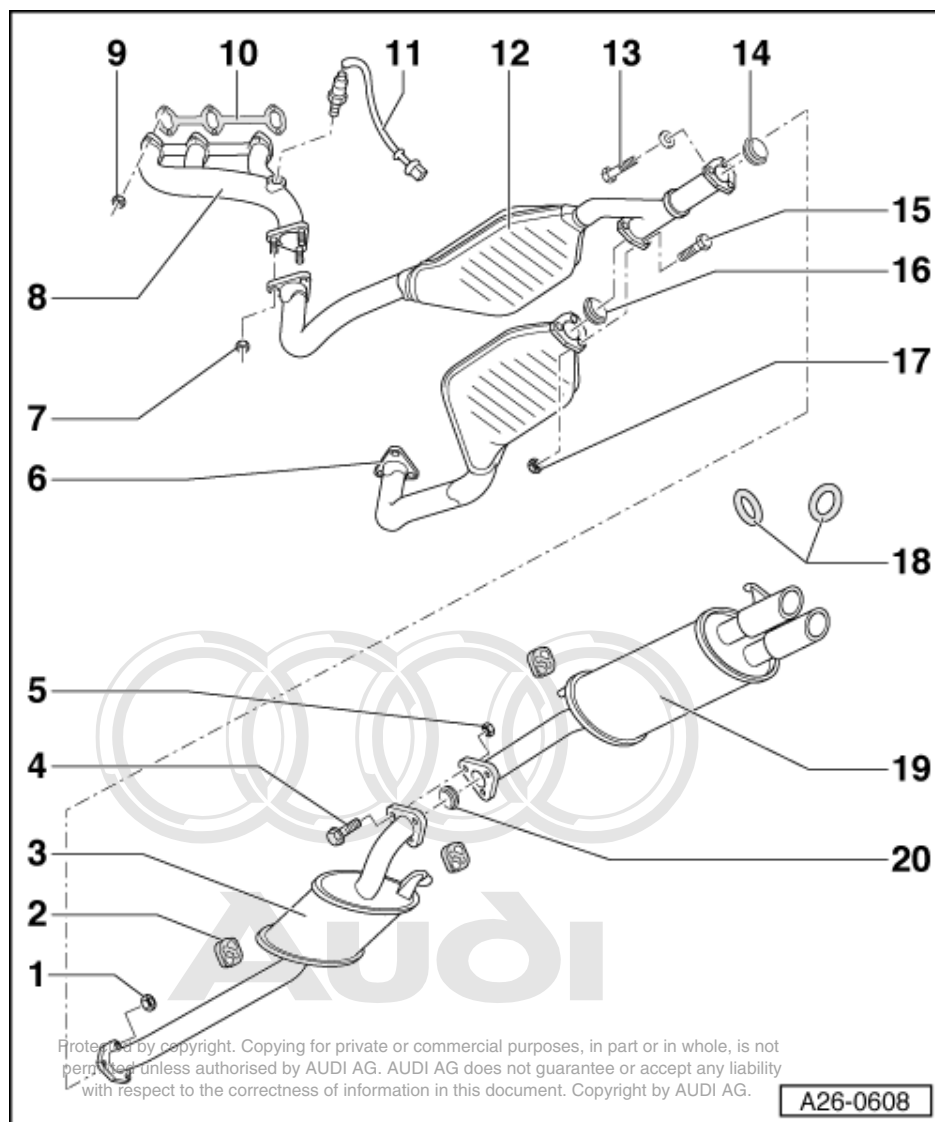
Aligning tailpipes

- -> 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 tailpipe:
 - Dimension b = approx. 38 mm

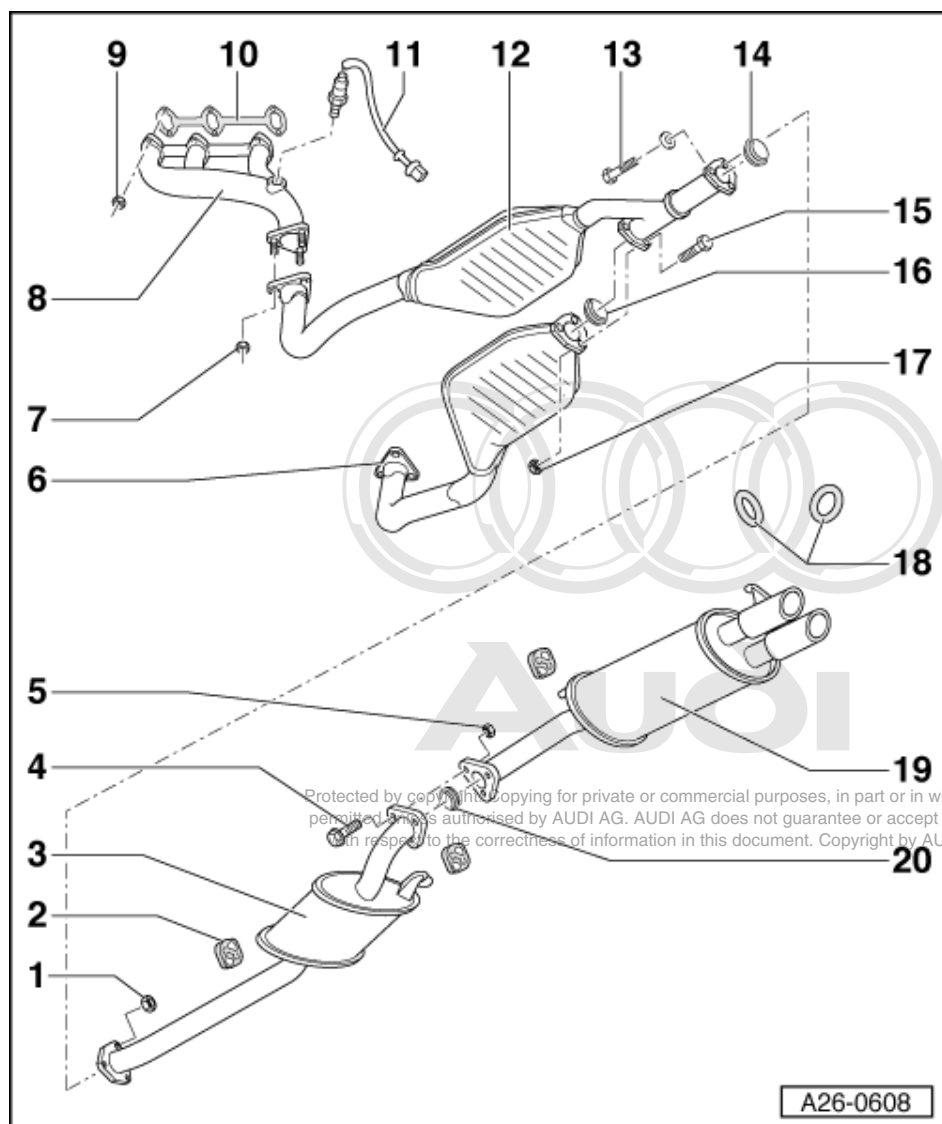


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1.4 - Vehicles with front-wheel drive and two catalytic converters - Automatic gearbox 01K



- 1 25 Nm
 - ♦ Replace
- 2 Retainer
 - ♦ Replace if damaged
 - ♦ Bending over securing tabs => Fig. 199
- 3 Centre silencer
 - ♦ Installing stress-free =>Page 200
- 4 25 Nm
- 5 25 Nm
 - ♦ Replace



6 Right front exhaust pipe

- ◆ With catalytic converter
- ◆ Protect from damage by knocks and impacts
- ◆ Installing stress-free =>Page 200
- ◆ Components of mounting for vehicles with automatic gearbox 01K =>Fig. 189

7 30 Nm

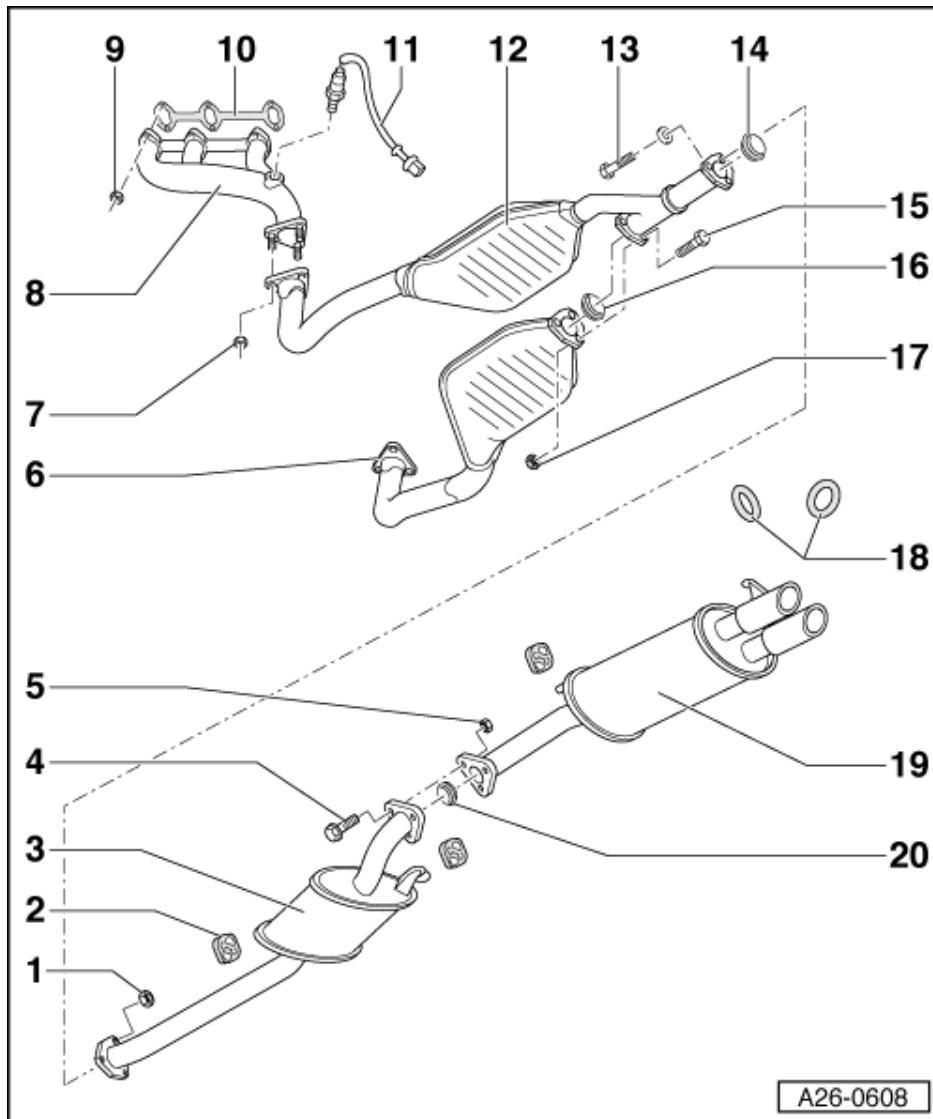
- ◆ Replace
- ◆ Observe the tightening sequence =>Page 200

8 Exhaust manifold

- ◆ Removing and installing left exhaust manifold => Page 222
- ◆ Removing and installing right exhaust manifold => Page 226

9 25 Nm

- ◆ Replace

**10 Gasket**

- ◆ Replace
- ◆ Installation position: connecting piece points downwards

11 Lambda probe - 55 Nm

- ◆ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ◆ High-temperature lubricant

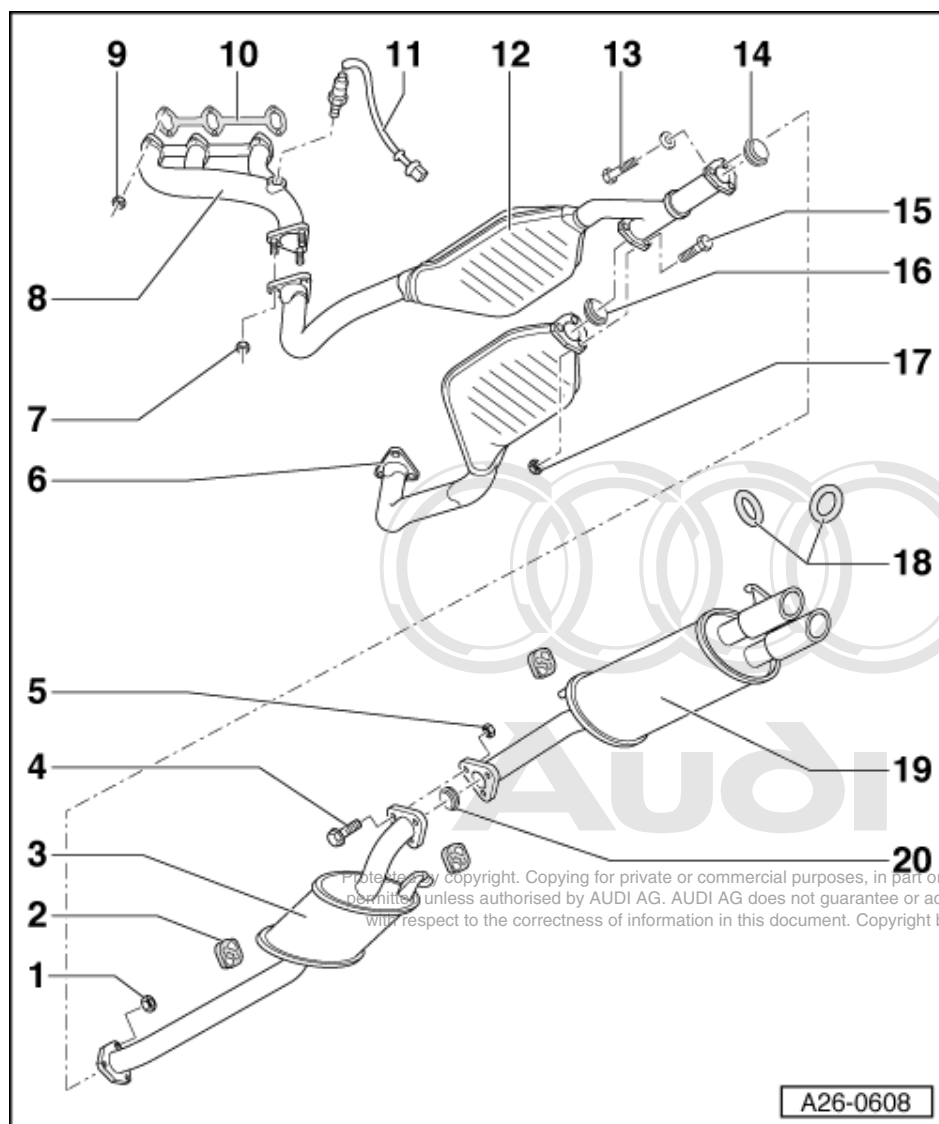
=> Parts List

- ◆ Checking:

=> Fuel Injection and Ignition System; Repair group 24**12 Left front exhaust pipe**

- ◆ With catalytic converter
- ◆ Protect from damage by knocks and impacts
- ◆ Installing stress-free =>Page 200
- ◆ Components of mounting for vehicles with automatic gearbox 01K =>Fig. 189

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13 25 Nm

14 Sealing ring

- ♦ Sensitive to impact; take care not to drop

15 25 Nm

16 Sealing ring

- ♦ Sensitive to impact; take care not to drop

17 25 Nm

- ♦ Replace

18 Retaining ring

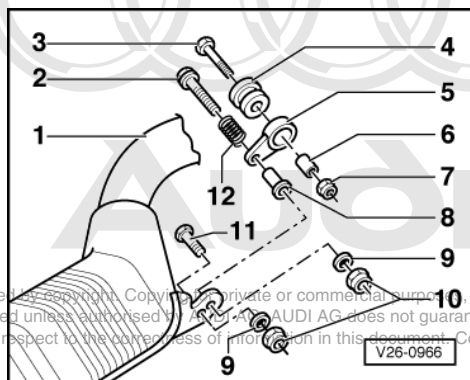
- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 3

19 Rear silencer

- ♦ Installing stress-free =>Page 200

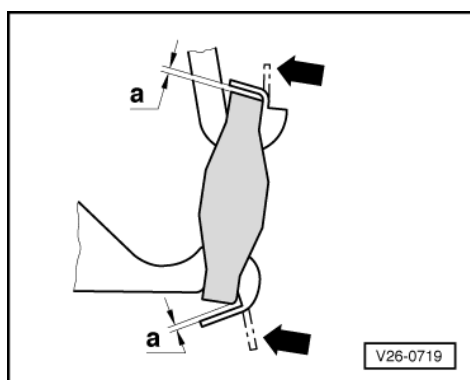
20 Sealing ring

- ♦ Sensitive to impact; take care not to drop



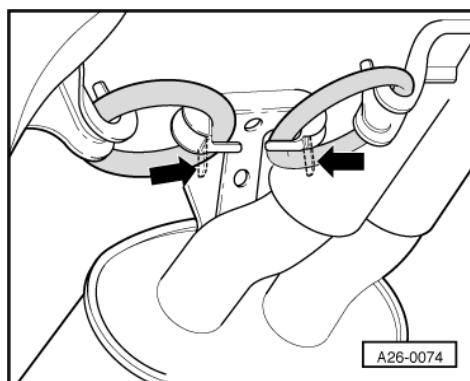
-> Fig.1 Components of front mounting for catalytic converter

- 1 - Catalytic converter
- 2 - Combi bolt
- 3 - Bolt
- 4 - Buffer
- 5 - Link
- 6 - Tubular spacer
- 7 - Nut, self-locking - 25 Nm
- 8 - Spacer
- 9 - Plate
- 10 - Nut, self-locking - 25 Nm
- 11 - Bolt
- 12 - Pressure spring



-> Fig.2 Bending over securing tabs on brackets of front mounting

- Centre and rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm

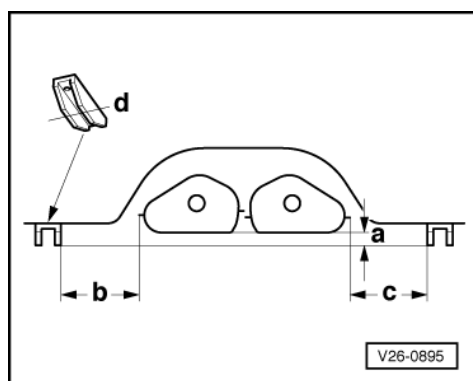


-> Fig.3 Bend over securing tabs on brackets of rear mounting

- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

1.5 - Installing exhaust system stress-free - vehicles with two catalytic converters, automatic gearbox 01K

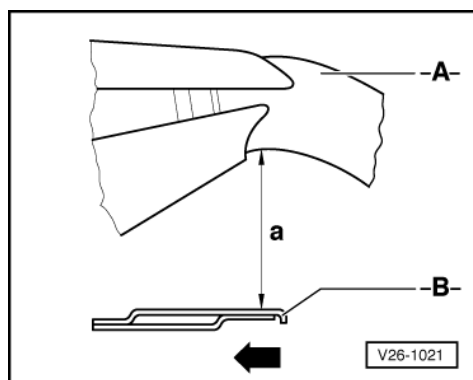
- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 199 .
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Front exhaust pipe/exhaust manifold (left and right)
 - Flange to right catalytic converter
 - Flange between catalytic converter and centre silencer
 - Flange between centre and rear silencers



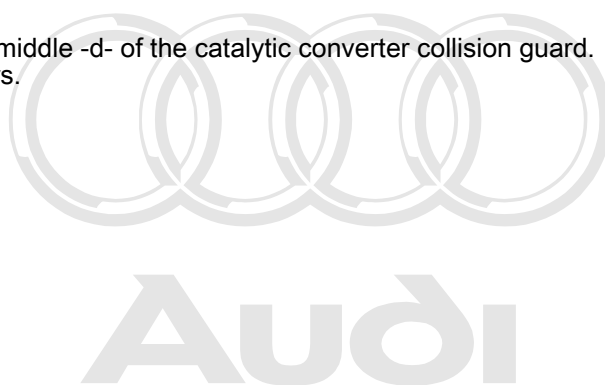
- -> Align the catalytic converters to dimensions -a...c-.
 - Dimension a = 8... 12 mm
 - Dimension b = 182... 185 mm
 - Dimension c = 179... 184 mm

Notes:

- ♦ The measurements should be carried out in the middle -d- of the catalytic converter collision guard.
- ♦ Illustration shows rear view of catalytic converters.



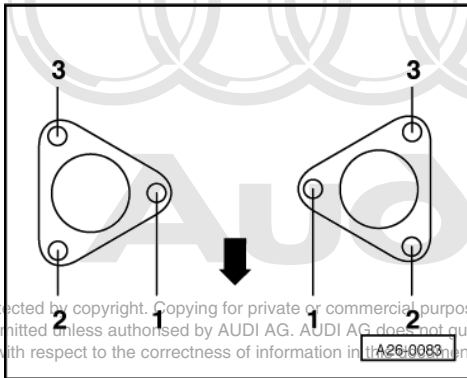
- -> Align catalytic converter outlet pipe -A- at a distance -a- to cross-piece -B-.
 - Dimension a = 42 mm



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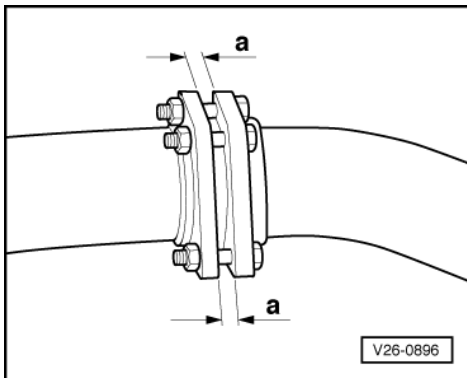
Note:

Arrow points in direction of travel.

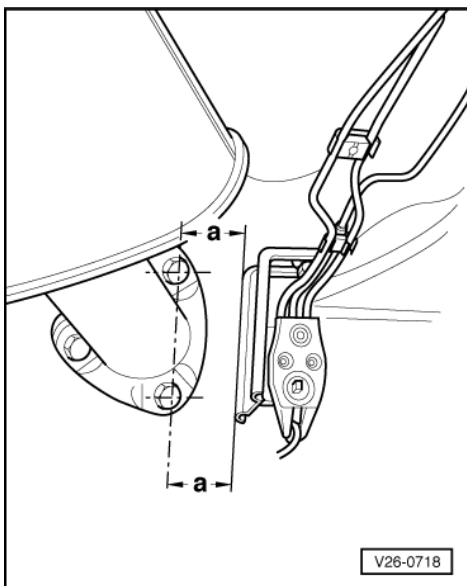


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- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



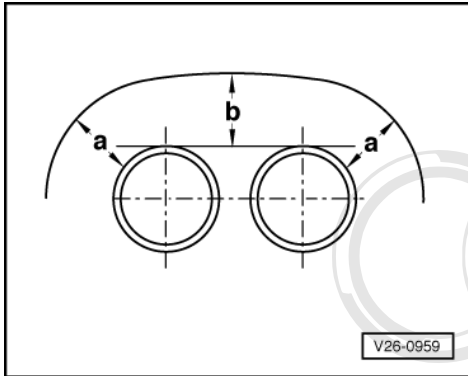
- -> Tighten flange on right catalytic converter (25 Nm). The flange projections must be the same distance apart all the way round.
 - Dimension a = dimension a
- Tighten the catalytic converter/centre silencer flange connection (25 Nm). The flange projections must be the same distance apart all the way round.
 - Dimension a = dimension a



- -> Check that the screwed connections on the flange between centre and rear silencer are parallel to the brake pressure regulator bracket.



- Dimension a at bottom = dimension a at top
- Tighten screwed connections at flange between centre and rear silencers (25 Nm).

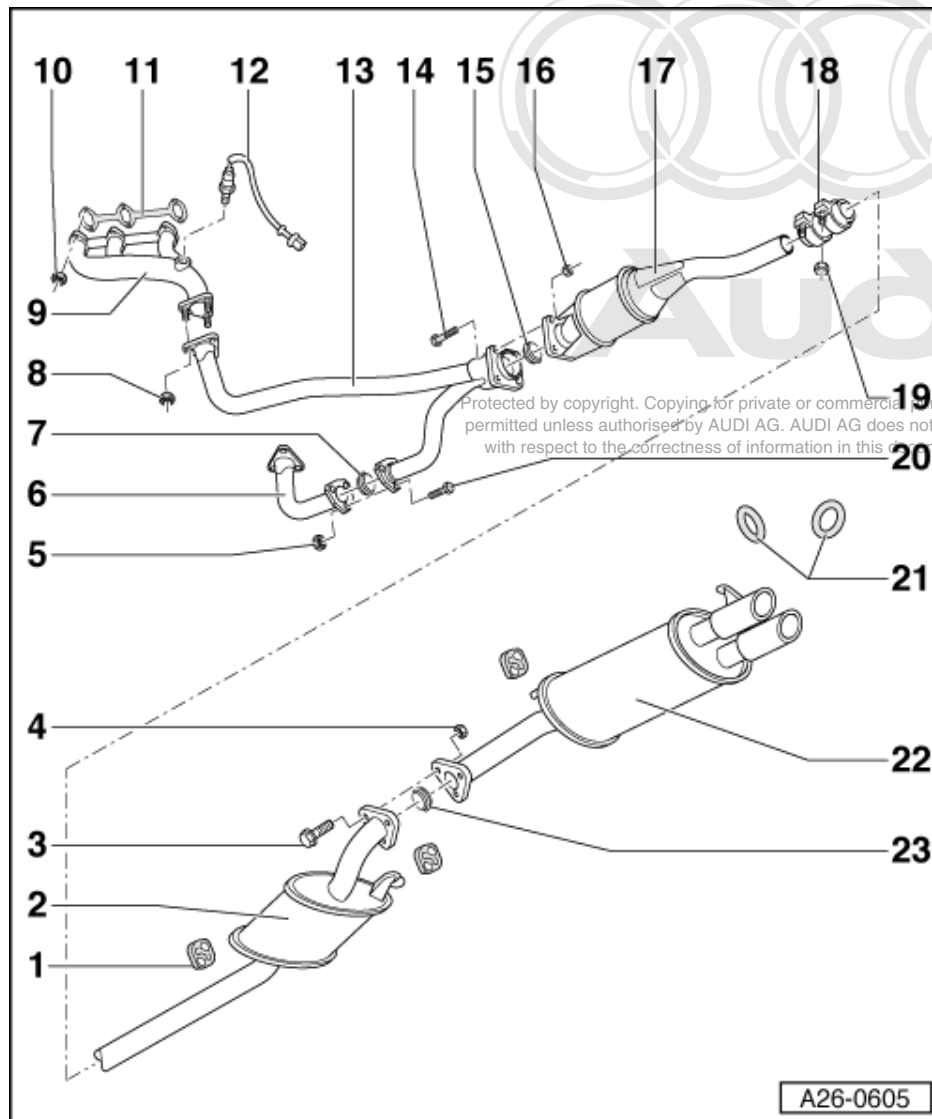


Aligning tailpipes

- -> 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 tailpipe:
 - Dimension b = approx. 38 mm

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1.6 - Vehicles with front-wheel drive and single catalytic converter

**1 Retainer**

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 208

2 Centre silencer

- ♦ Installing stress-free =>Page 208

3 25 Nm**4 25 Nm**

- ♦ Replace

5 25 Nm

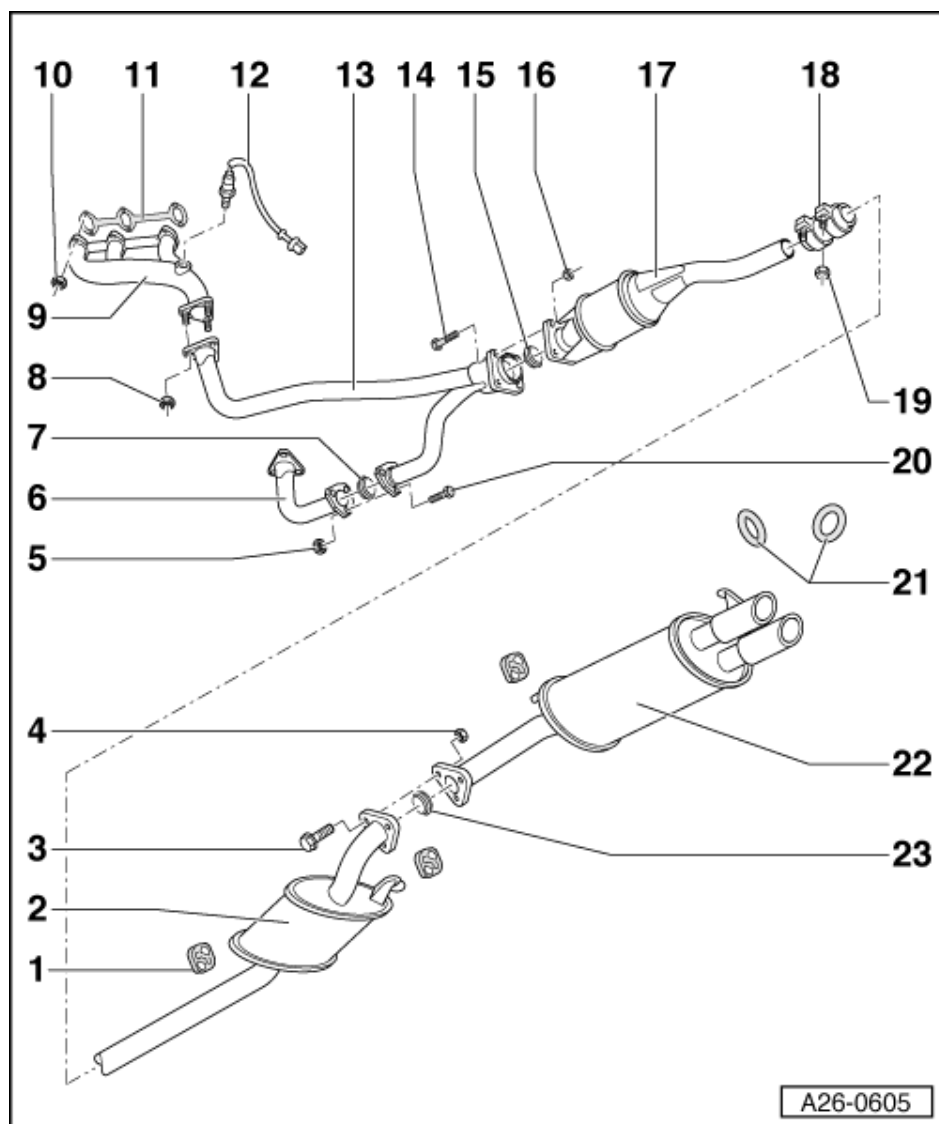
- ♦ Replace

6 Right front exhaust pipe

- ♦ Installing stress-free =>Page 208

7 Sealing ring

- ♦ Sensitive to impact; take care not to drop

**8 30 Nm**

- ♦ Replace
- ♦ Observe the tightening sequence =>Page 208

9 Exhaust manifold

- ♦ Removing and installing left exhaust manifold => Page 222
- ♦ Removing and installing right exhaust manifold => Page 226

10 25 Nm

- ♦ Replace

11 Gasket

- ♦ Replace
- ♦ Installation position: connecting piece points downwards

12 Lambda probe - 55 Nm

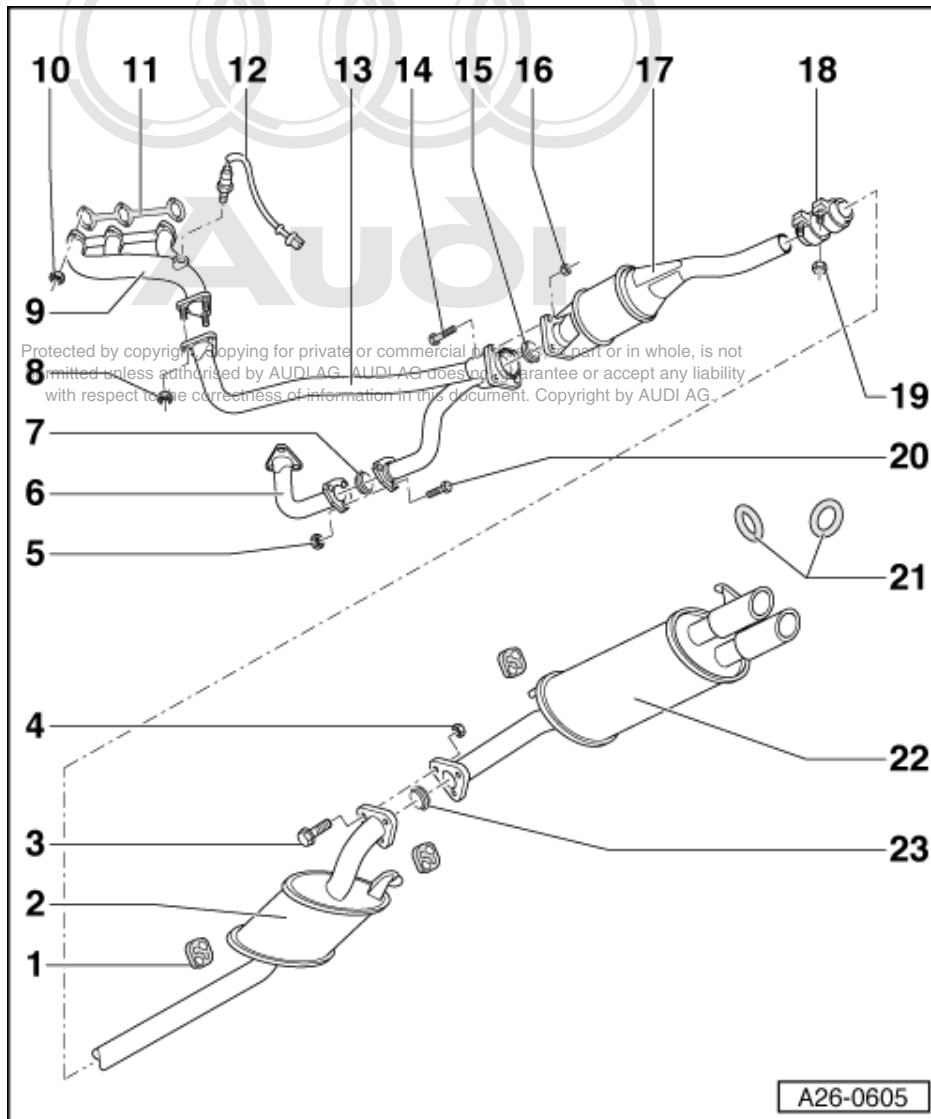
- ♦ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ♦ High-temperature lubricant

=> Parts List

- ♦ Checking:

=> Fuel Injection and Ignition System; Repair group 24

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**13 Left front exhaust pipe**

- ♦ Installing stress-free =>Page 208
- ♦ Components of left mounting for vehicles with manual gearbox => Fig. 207
- ♦ Components of left mounting for vehicles with automatic gearbox 01K =>Fig. 208

14 25 Nm**15 Sealing ring**

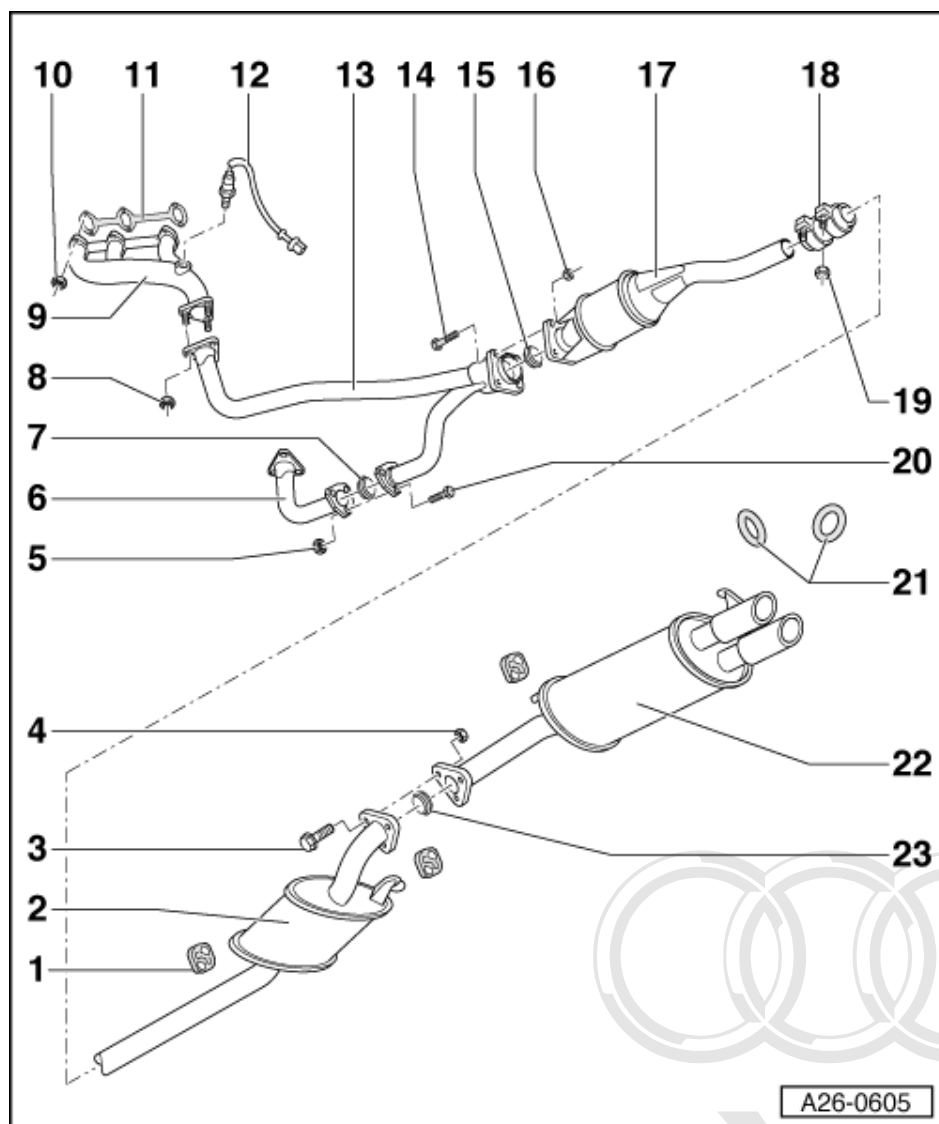
- ♦ Sensitive to impact; take care not to drop

16 25 Nm

- ♦ Replace

17 Catalytic converter

- ♦ Protect from damage by knocks and impacts
- ♦ Aligning catalytic converter => Page 208
- ♦ Installing stress-free =>Page 208



18 Clamp

- ♦ Installation position => Page 211
- ♦ Align exhaust system so it is free of stress before tightening clamp => Page 208
- ♦ Tighten bolted connections evenly to 40 Nm

19 40 Nm

20 25 Nm

21 Retaining ring

- ♦ Replace if damaged
- ♦ Bending over securing tabs => Fig. 208

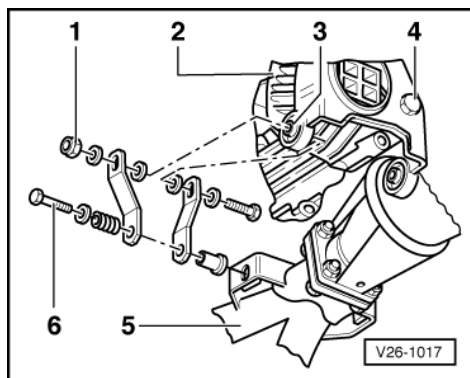
22 Rear silencer

- ♦ Installing stress-free => Page 208

23 Sealing ring

- ♦ Sensitive to impact; take care not to drop

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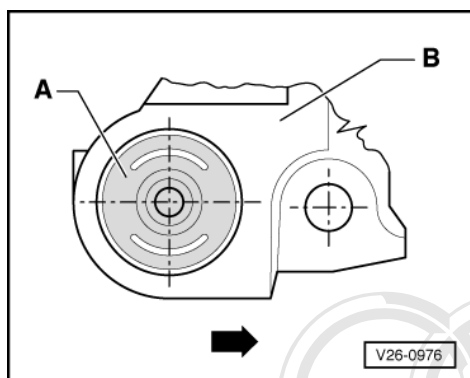


-> Fig.1 Individual parts of mounting for vehicles with manual gearbox

- 1 - Nut, self-locking - 25 Nm
- 2 - Gearbox
- 3 - Buffer - Installation position => Fig. 2
- 4 - Bolt - 25 Nm
- 5 - Front exhaust pipe
- 6 - Bolt - 25 Nm

Note:

The tabs on the left and right sides are secured in exactly the same way.

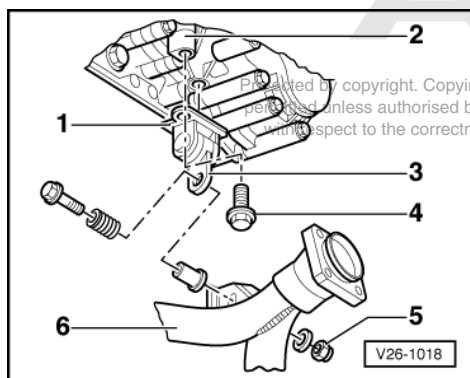


-> Fig.2 Installation position of buffer

- Rubber bush -A- must be pressed into gearbox support -B- until flush, as shown in the illustration.

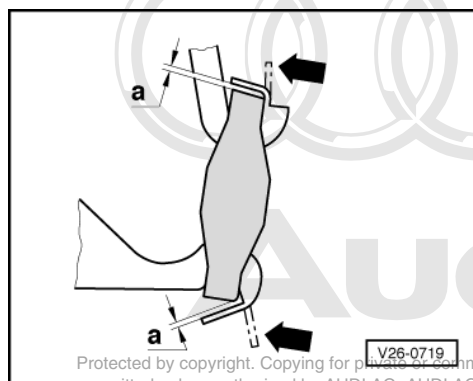
Note:

Arrow points in direction of travel.



-> Fig.3 Components of mounting for vehicles with automatic gearbox 01K

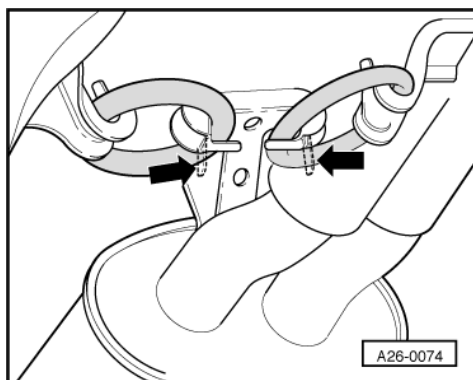
- 1 - Bracket
- 2 - Gearbox
- 3 - Link
- 4 - Bolt - 25 Nm
- 5 - Nut, self-locking - 25 Nm
- 6 - Front exhaust pipe



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-> Fig.4 Bending over securing tabs on brackets of front mounting

- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm

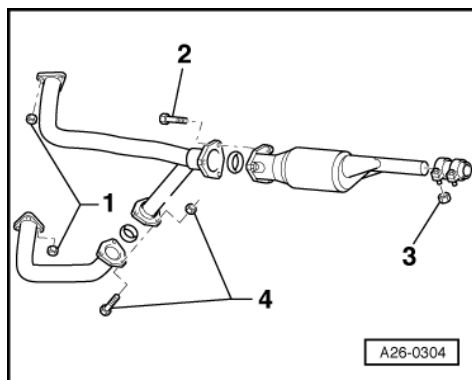


-> Fig.5 Bending over securing tabs on brackets of rear mounting

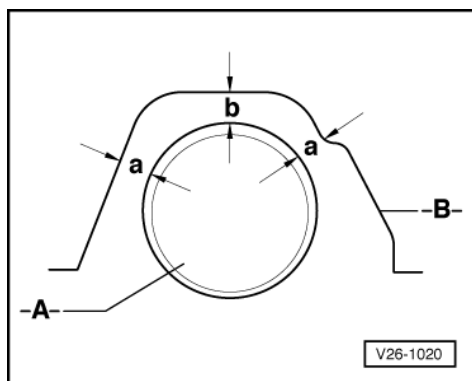
- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

1.7 - Installing exhaust system stress-free - vehicles with single catalytic converter

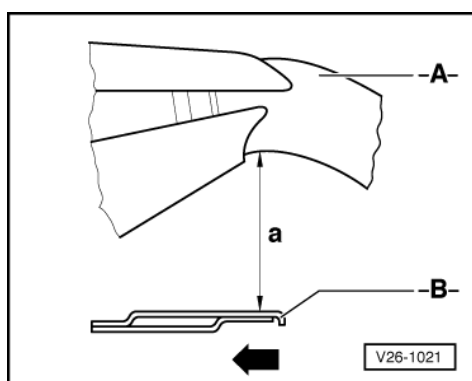
- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 208 .



- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
- 1 - -> Front exhaust pipe/exhaust manifold (left and right)
 - 2 - Left front exhaust pipe/catalytic converter
 - 3 - Front clamp
 - 4 - Right front exhaust pipe/left front exhaust pipe
 - Flange between centre and rear silencers



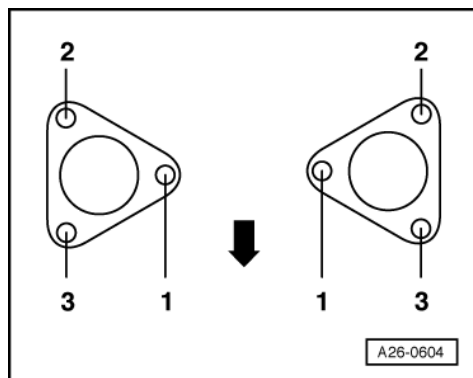
- -> Align catalytic converter -A- to floor panel -B- so that distance -a- on the left is the same as distance -a- on the right.
- Dimension b = 30 mm



- -> Align catalytic converter outlet pipe -A- at a distance -a- to cross-piece -B-.
- Dimension a = 92 mm

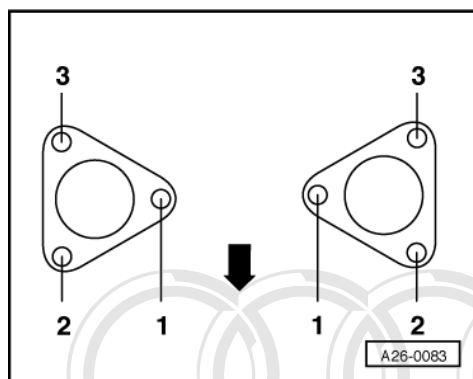
Note:

Arrow points in direction of travel.



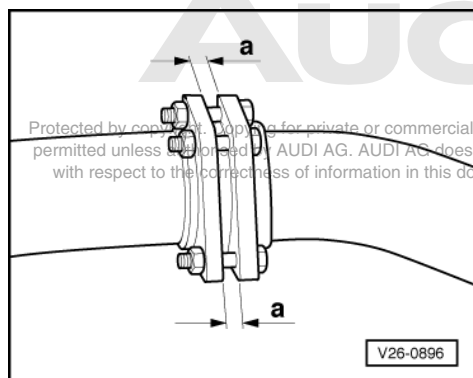
Vehicles with manual gearbox and automatic gearbox 097:

- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



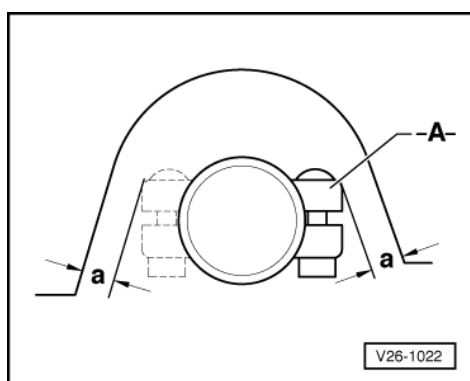
Vehicles with automatic gearbox 01K:

- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



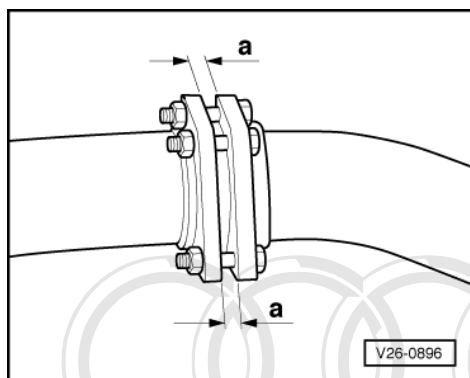
All models:

- -> Tighten screwed connection on right front exhaust pipe/left front exhaust pipe flange (25 Nm). The flange projections must be the same distance apart all the way round.
 - Dimension a = dimension a

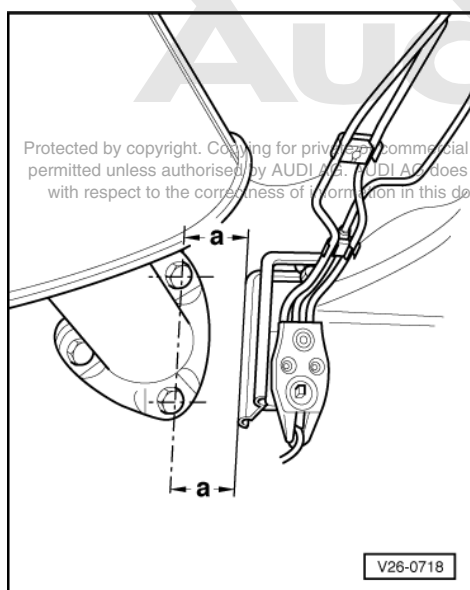


Align clamps as follows:

- -> Bolted connection -A- may point to the left or the right.
- Dimension a = approx. 20 mm



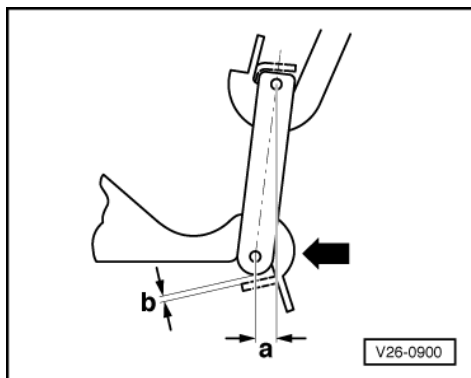
- -> Tighten screwed connection on front exhaust pipe/catalytic converter flange (25 Nm). The flange projections must be the same distance apart all the way round.
- Dimension a = dimension a



- -> Check that the screwed connections on the flange between centre and rear silencer are parallel to the brake pressure regulator bracket.
- Dimension a at bottom = dimension a at top



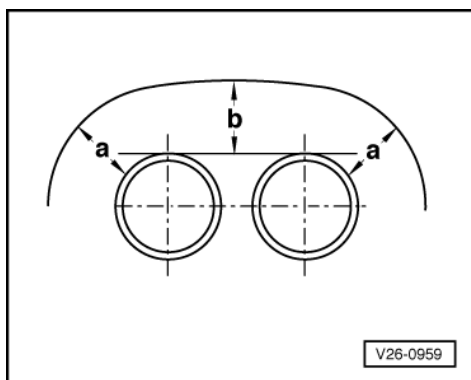
- Tighten bolted connections at flange between centre and rear silencers (25 Nm).



- -> Push exhaust system towards front of vehicle until rear mounting of centre silencer is preloaded by $a = 7 \dots 9 \text{ mm}$.
- Tighten bolted connections on clamp evenly to 40 Nm.

Notes:

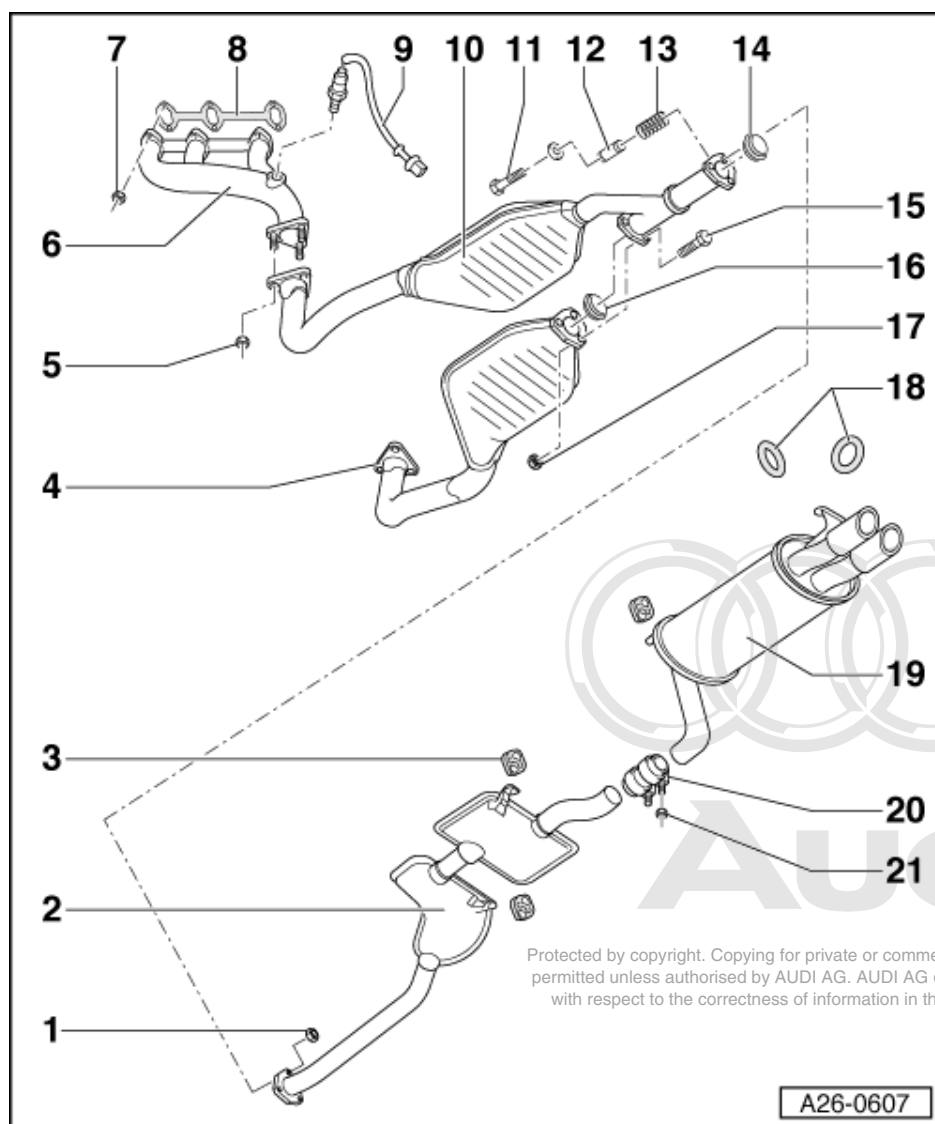
- ♦ The securing tabs at the brackets should be bent over about 90° after installing the retainers.
- ♦ The distance -b- between the retainer and the locking tabs should be at least 2 mm.



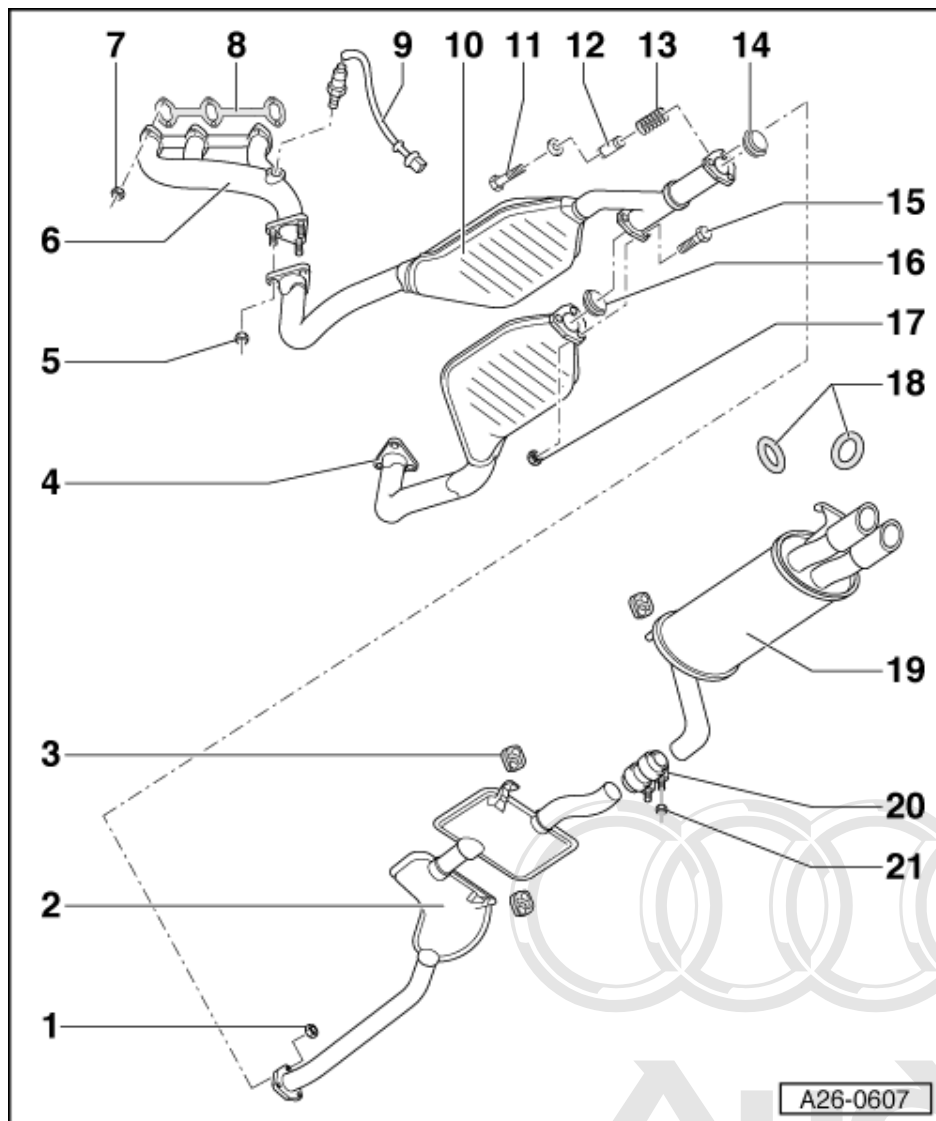
Aligning tailpipes

- -> 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 tailpipe:
 - Dimension b = approx. 38 mm

1.8 - 4WD vehicles



- 1 25 Nm
 - ◆ Replace
- 2 Centre silencer
 - ◆ Centre and rear silencers are one unit as original equipment. In cases of repair renew individually
 - ◆ Cutting point => Page 221
 - ◆ Installing stress-free =>Page 218
- 3 Retainer
 - ◆ Replace if damaged
 - ◆ Bending over securing tabs => Fig. 217
- 4 Right front exhaust pipe
 - ◆ With catalytic converter
 - ◆ Protect from damage by knocks and impacts
 - ◆ Installing stress-free =>Page 218
 - ◆ Components of mounting => Fig. 217

**5 30 Nm**

- ◆ Replace
- ◆ Observe the tightening sequence => Page 218

6 Exhaust manifold

- ◆ Removing and installing left exhaust manifold => Page 222
- ◆ Removing and installing right exhaust manifold => Page 226

7 25 Nm

- ◆ Replace

8 Gasket

- ◆ Replace
- ◆ Installation position: connecting piece points downwards

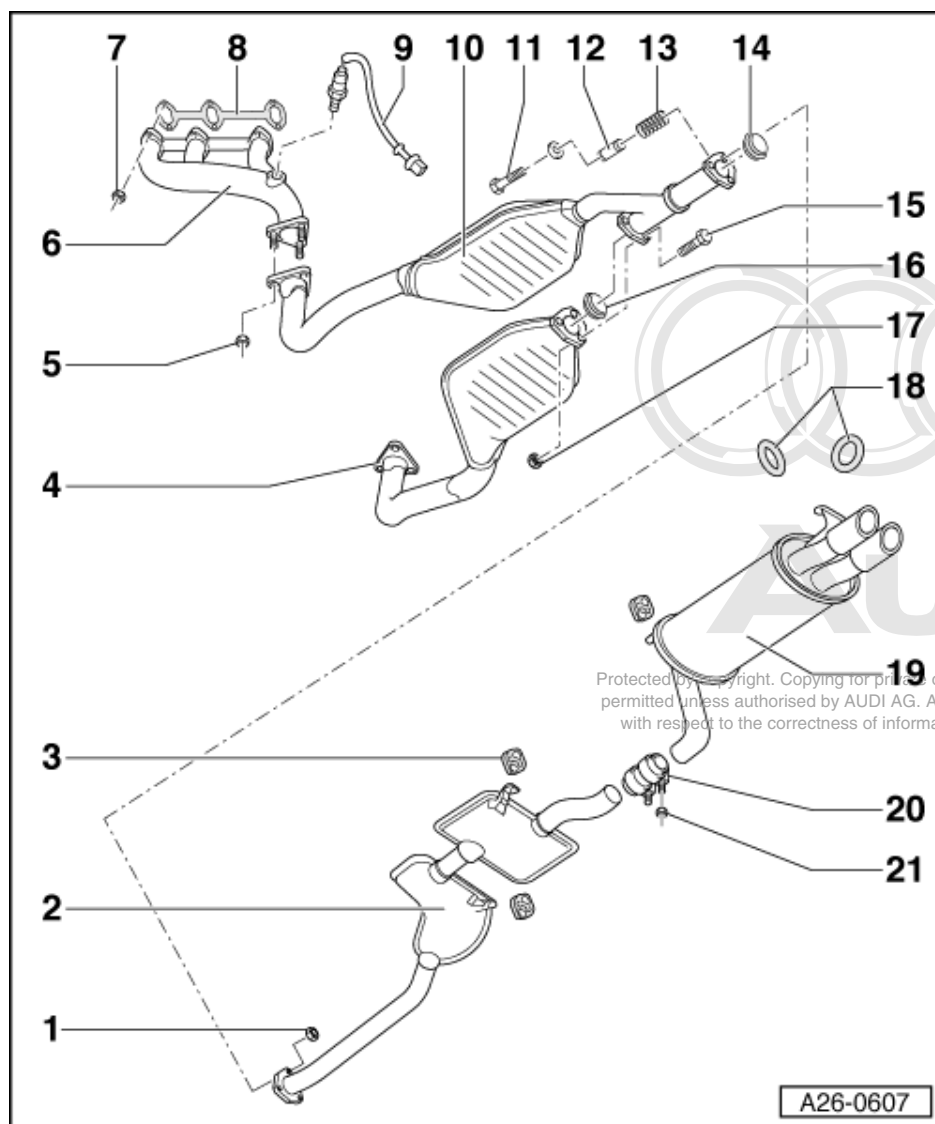
9 Lambda probe - 55 Nm

- ◆ Grease only the threads with high-temperature lubricant. The lubricant must not penetrate into the slots on the probe body.
- ◆ High-temperature lubricant

=> Parts List

- ◆ Checking:

=> Fuel Injection and Ignition System; Repair group 24

**10 Left front exhaust pipe**

- ♦ With catalytic converter
- ♦ Protect from damage by knocks and impacts
- ♦ Installing stress-free
=>Page 218 .
- ♦ Components of mounting =>Fig. 217

11 25 Nm**12 Spacer tube**

- ♦ only in vehicles with manual gearbox

13 Spring

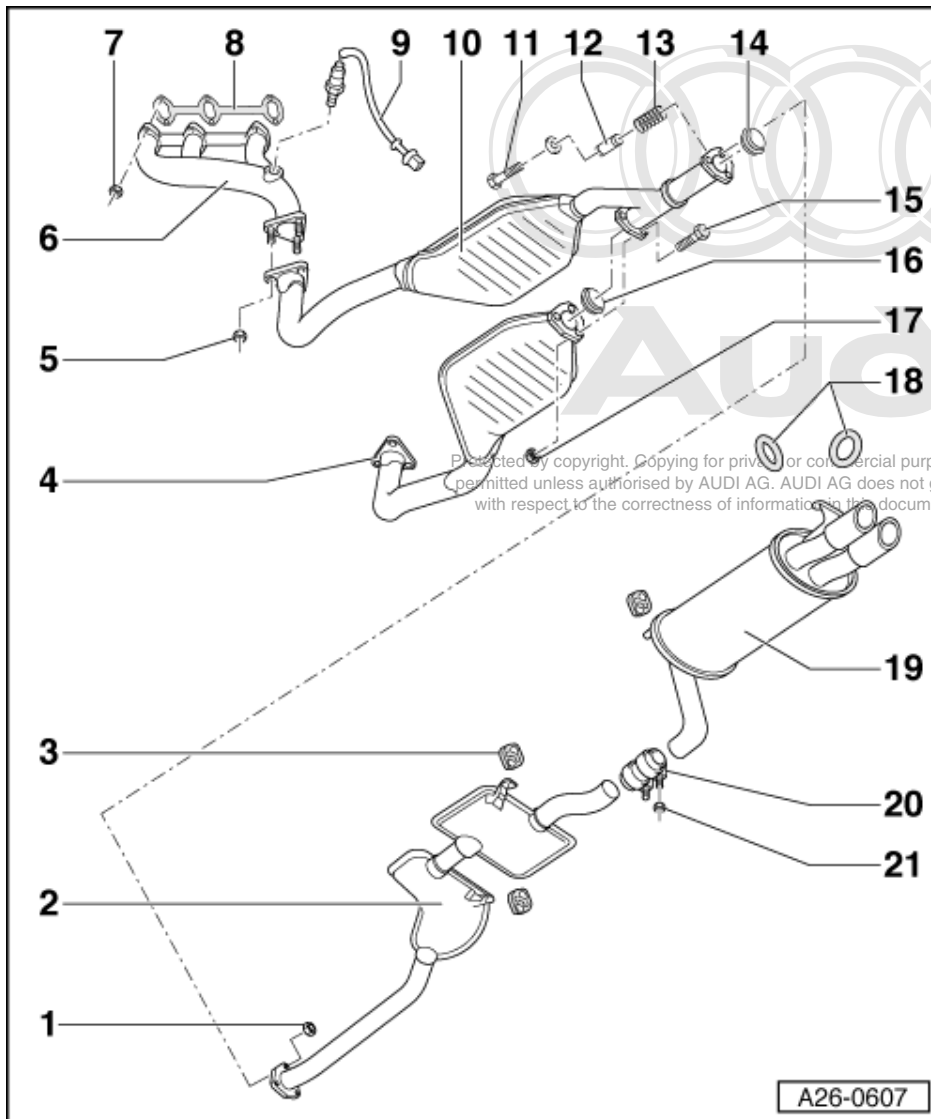
- ♦ only in vehicles with manual gearbox

14 Sealing ring

- ♦ Sensitive to impact; take care not to drop

15 25 Nm**16 Sealing ring**

- ♦ Sensitive to impact; take care not to drop



17 25 Nm

- ◆ Replace

18 Retaining ring

- ◆ Replace if damaged
- ◆ Bending over securing tabs => Fig. 218

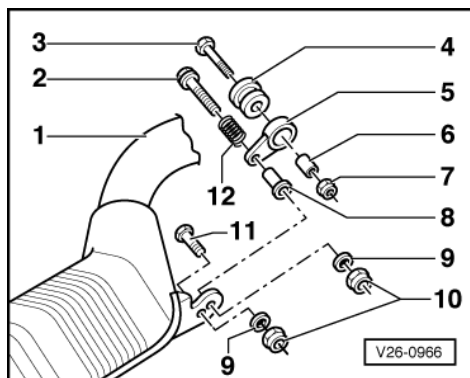
19 Rear silencer

- ◆ Rear and centre silencer are one unit as original equipment. In cases of repair renew individually
- ◆ Cutting point => Page 221
- ◆ Installing stress-free => Page 218

20 Rear clamping sleeve

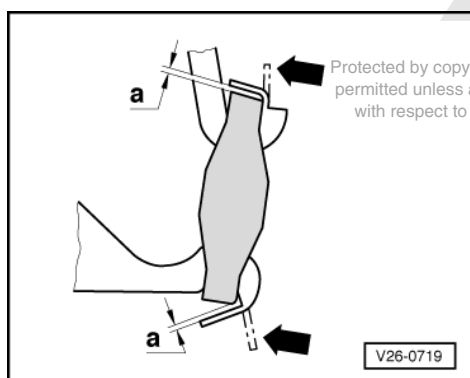
- ◆ Installation position => Page 220
- ◆ Align exhaust system so it is free of stress before tightening clamp => Page 218
- ◆ Tighten bolted connections evenly to 40 Nm

21 40 Nm



-> Fig.1 Components of front mounting for catalytic converter

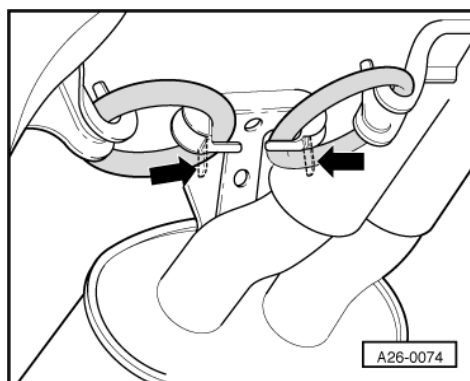
- 1 - Catalytic converter
- 2 - Combi bolt
- 3 - Bolt
- 4 - Buffer
- 5 - Link
- 6 - Tubular spacer
- 7 - Nut, self-locking - 25 Nm
- 8 - Spacer
- 9 - Plate
- 10 - Nut, self-locking - 25 Nm
- 11 - Bolt
- 12 - Pressure spring



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-> Fig.2 Bending over securing tabs on brackets of front mounting

- Centre and rear silencers
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.
- Ensure that a distance corresponding to dimension -a- is maintained between retainer and securing tab.
 - Dimension a = 2 mm



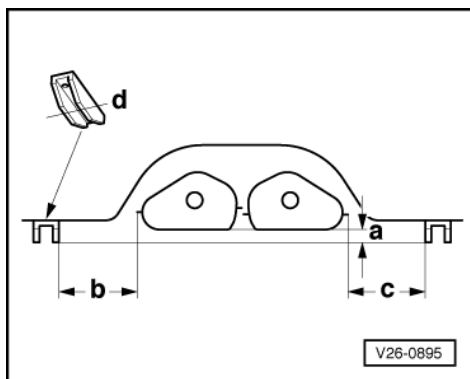


-> Fig.3 Bending over securing tabs on brackets of rear mounting

- Rear silencer
- After installing the exhaust system, bend over the securing tabs -arrows- approx. 90°.

1.9 - Installing exhaust system stress-free - vehicles with four-wheel drive

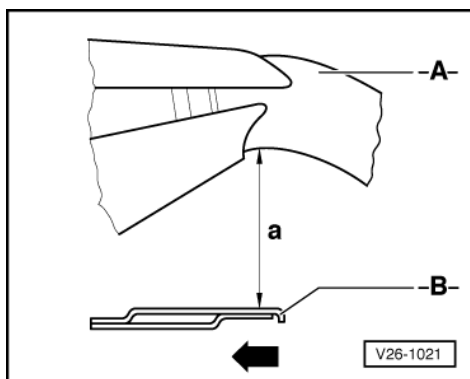
- Centre and rear silencers installed.
- Mountings for exhaust system to gearbox installed => Fig. 217 .
- Release the following bolted connections to the point at which the relevant exhaust system components can move in relation to each other:
 - Front exhaust pipe/exhaust manifold (left and right)
 - Flange to right catalytic converter
 - Flange between catalytic converter and centre silencer
 - Clamp, where applicable



- -> Align the catalytic converters to dimensions -a...c-.
- Dimension a = 8... 12 mm
- Dimension b = 182... 185 mm
- Dimension c = 179... 184 mm

Notes:

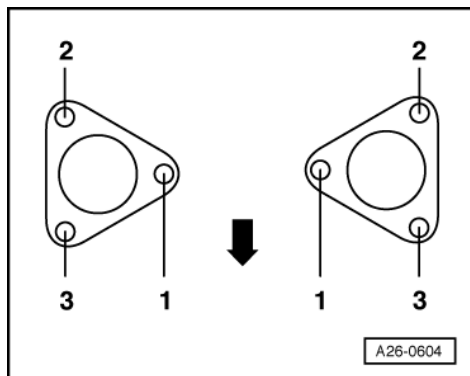
- ♦ The measurements should be carried out in the middle -d- of the catalytic converter collision guard.
- ♦ Illustration shows rear view of catalytic converters.



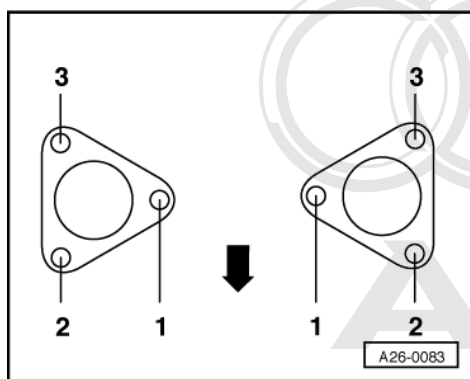
- -> Align catalytic converter outlet pipe -A- at a distance -a- to cross-piece -B-.
- Dimension a = 42 mm

Note:

Arrow points in direction of travel.

**Vehicles with manual gearbox:**

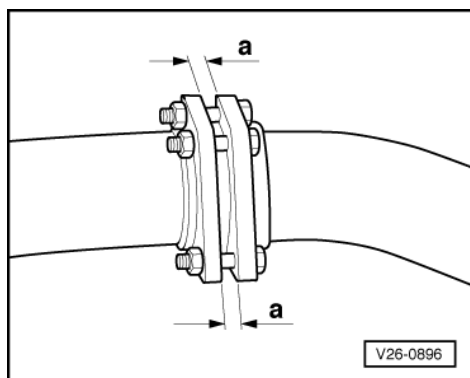
- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



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Vehicles with automatic gearbox 01F:

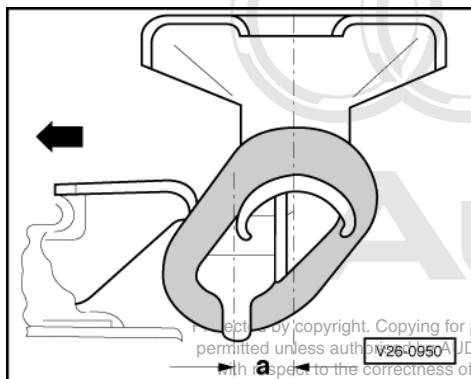
- -> Tighten bolts -1...3- on left and then on right front exhaust pipe to 10 Nm initially, then tighten to their final tightening torque of 30 Nm in the same sequence.



- -> Tighten flange on right catalytic converter (25 Nm). The flange projections must be the same distance apart all the way round.
- Dimension a = dimension a
- Tighten the catalytic converter/centre silencer flange connection (25 Nm). The flange projections must be the same distance apart all the way round.



- Dimension a = dimension a

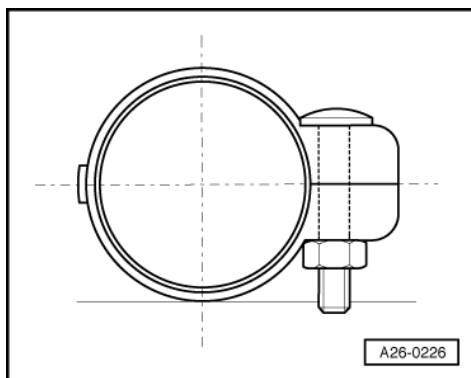


Vehicles with clamp between centre and rear silencers:

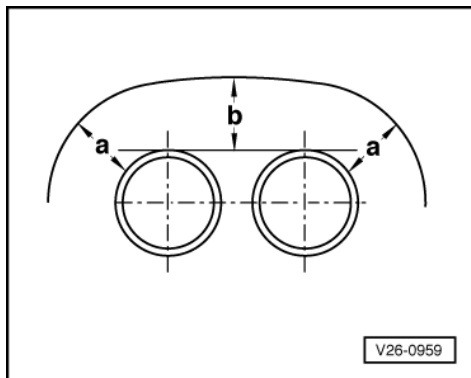
Note:

It is only necessary to additionally align the rear silencer on vehicles with a clamping sleeve between the centre silencer and the rear silencer.

- -> Push rear silencer towards front of vehicle -arrow- until rear mounting on rear silencer is preloaded by a = 12... 14 mm.



- -> Note installation position of clamp at rear:
 - Bolted connection faces right
- Tighten bolted connections on clamp evenly to 40 Nm.

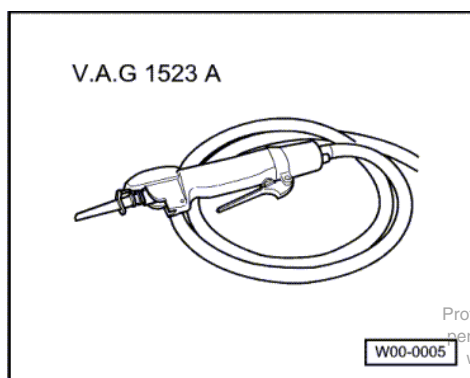


All models:**Aligning tailpipes**

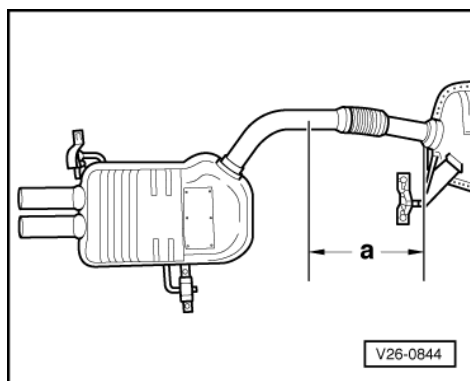
- -> Align tailpipes so that distance -a- is the same on both sides.
- At the same time, distance -b- must be obtained between bumper cut-out and tailpipe:
 - Dimension b = approx. 38 mm

1.10 - Separating centre and rear silencers - vehicles with four-wheel drive

- ♦ The connecting pipe can be cut through at the cutting point in order to replace the centre and rear silencers separately.
- ♦ The cutting point is marked with an indentation on the outside of the exhaust pipe.

**Special tools and workshop equipment required**

- ♦ Body saw V.A.G 1523 A
- ♦ Protective goggles

**Procedure**

Important
Wear protective goggles.

- -> Cut through exhaust pipe at right angles at specified cutting point using body saw e.g. V.A.G 1523 A.
- Dimension a = 220 mm

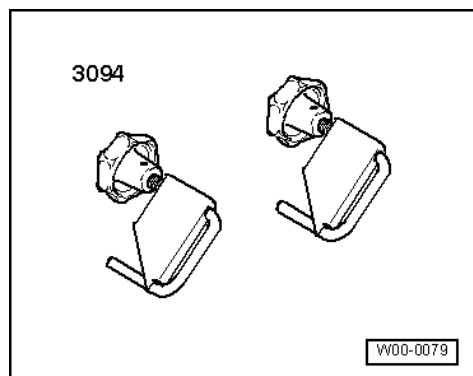
Note:

A short clamp is provided for connecting the main and rear silencers when performing repairs.



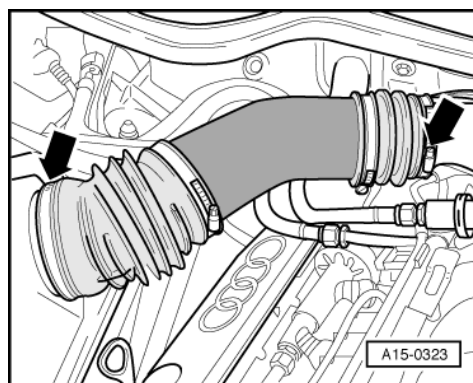
- When installing, position clamping sleeve centrally over saw cut.
 - Installation position of clamp => Page 26-51
- Stress-free alignment of exhaust system => Page 218
- Tighten bolted connections on clamp evenly to 40 Nm.

1.11 - Removing and installing left exhaust manifold



Special tools and workshop equipment required

- ♦ Hose clamps 3094



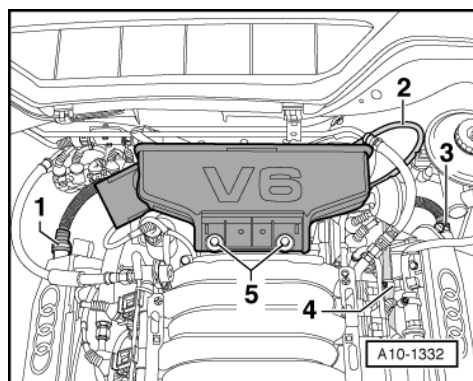
Removing

Vehicles with air conditioner:

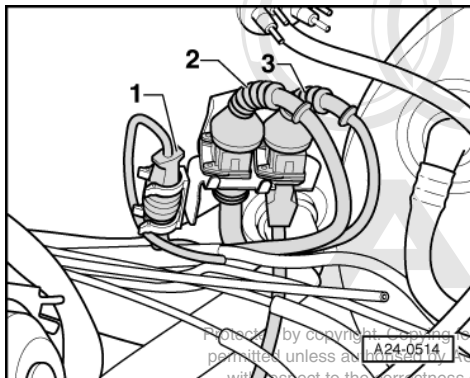
- Remove ribbed belt => Page 35 .

All models:

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



- -> Disconnect crankcase breather hoses -1- and -3- at cylinder heads.
- Disconnect vacuum hose -2- from throttle valve body.
- Detach hose -4- to crankcase breather.
- Unscrew bolts -5- and press air duct to the rear.
- Detach air duct.

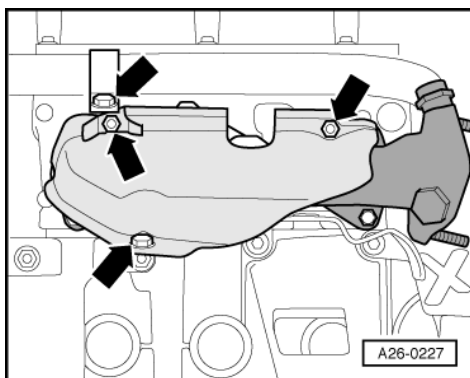


- -> Unplug connectors -1- and -3- to lambda probe.

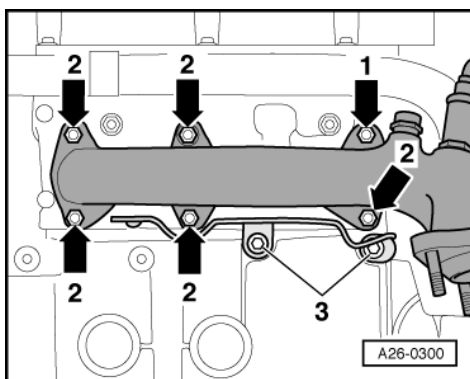
Note:

It is not necessary to unplug connector -2-.

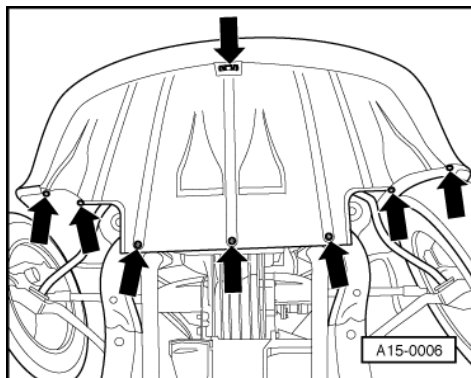
- Take connectors out of retainer.
- Set aside wires for lambda probe downwards.



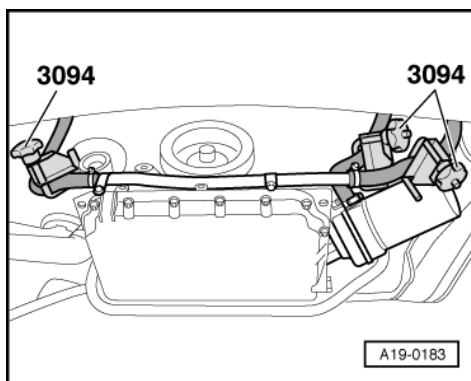
- -> Removing heat shield -arrows-.



- -> Unscrew bolted connection accessible from above -arrow 1-.

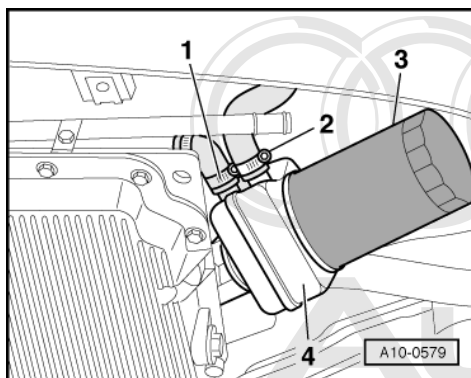


- -> Remove the noise insulation -arrows-.

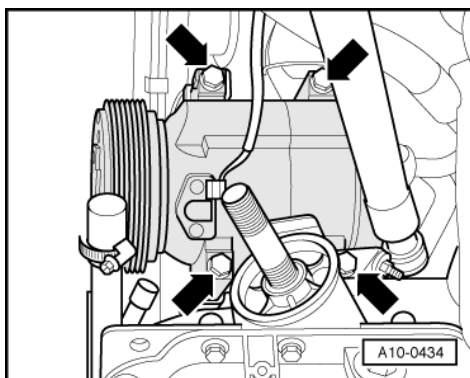


Vehicles with air conditioner:

- -> Clamp off coolant hoses to oil cooler and coolant pipe using 3 hose clamps 3094.



- Place drip tray underneath engine.
- -> Remove oil filter -3-.
- Detach hoses -1- and -2- from oil cooler -4-.
- Remove oil cooler -4-.

**Important**

The air conditioner refrigerant circuit must not be opened.

- Expose electrical wiring to A/C compressor magnetic clutch.
- -> Unbolt A/C compressor from bracket -arrows-.
- Hook air conditioner compressor onto longitudinal member, leaving hoses connected.

Vehicles with single catalytic converter:

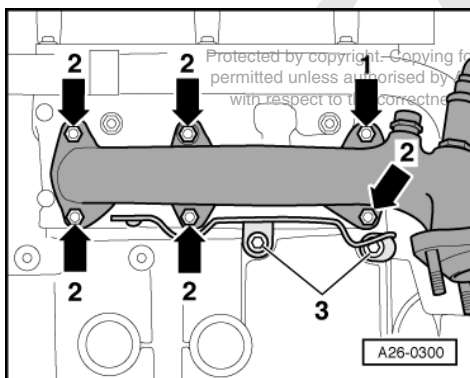
- Remove left front exhaust pipe with catalytic converter.

Vehicles with two catalytic converters:

- Remove left catalytic converter.

All models:

- Unbolt heat shield for drive shaft.
- Unbolt heat shield from left engine mounting.



- -> Unscrew bolts -3-.
- Remove bracket for heat shield.
- Screw out the nuts -arrows 2-.
- Remove exhaust manifold between drive shaft and wheel housing subframe.

Installing

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



Note:

Always replace seals, gaskets and self-locking nuts.

- Note installation position of exhaust manifold gasket:
 - Gasket connecting piece points downwards
- Aligning exhaust system stress-free => Page 218 .
- Install the A/C compressor =>Page 28 .
- Install ribbed belt =>Page 37 .

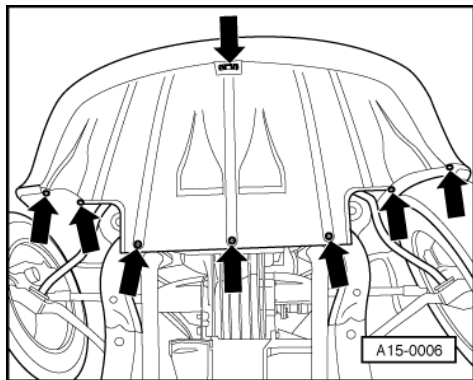
Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25
Bracket for heat shield to engine support	40
Heat shield to engine mounting	10
Heat shield to gearbox	23



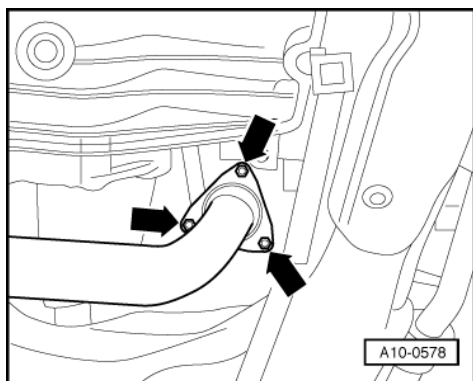
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1.12 - Removing and installing right exhaust manifold

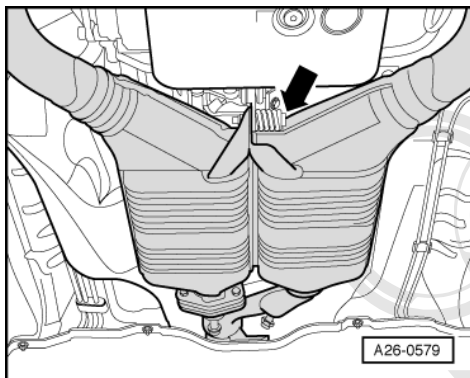


Removing

- -> Remove the noise insulation -arrows-.



- -> Unscrew nuts on left and right of exhaust manifold/front exhaust pipe -arrows-.

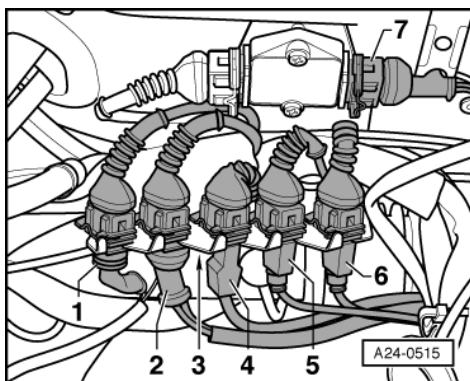


- -> Unbolt exhaust system from bracket -arrow- at gearbox.

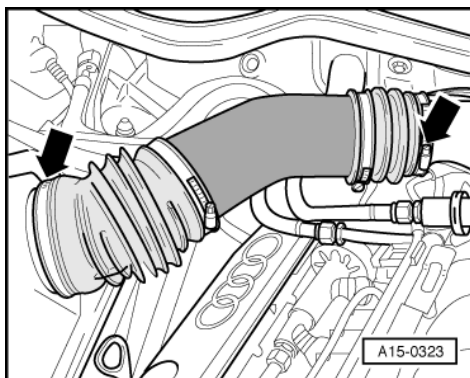
Note:

Illustration shows vehicle with two catalytic converters.

- Detach exhaust system from exhaust manifolds.

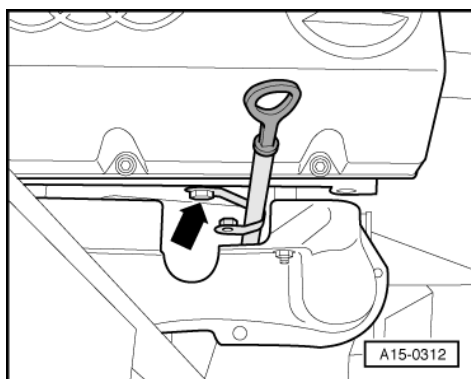


- -> Unplug connectors -1- and -3- to lambda probe.
- Expose wiring.



All models:

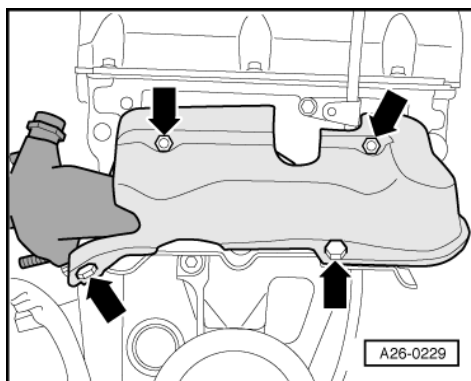
- -> Remove air duct hose between air mass meter and intake manifold -arrows-.



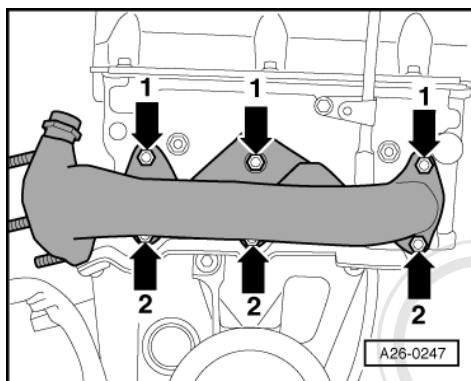
- -> Unbolt dipstick guide tube on cylinder head -arrow-and remove upwards.

Note:

The dipstick guide tube remains installed.



- -> Removing heat shield -arrows-.



- -> Unscrew bolted connections -arrows 1 and 2-.
- Lift out exhaust manifold upwards.

Installing

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

Note:

Always replace seals, gaskets and self-locking nuts.

- Note installation position of exhaust manifold gasket.
 - Gasket connecting piece points downwards

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- Aligning exhaust system stress-free => Page **218** .

Tightening torques

Component	Nm
Exhaust manifold to cylinder head	25
Heat shield for exhaust manifold	25
Heat shield to bracket	5
Dipstick guide tube to cylinder head.	10

1.13 - Checking exhaust system for leaks

- Start engine and run at idling speed.
- Plug the tailpipes (e. g. with rags or stoppers) and leave plugged until the check is complete.
- Listen for noise at the connection points (cylinder head/manifold; manifold/front exhaust pipe; front exhaust pipe/catalytic converter etc.) to locate any leaks.
- Rectify any leaks that are found.

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