

Audi A8 1994 ➤

8-cyl. Engine, Mechanical Components

Engine ID	ABZ	AEW	AHC	AKG	AKH	AKJ			
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Edition 08.1996

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List of Workshop Manual Repair GroupsList of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups Audi A8 1994 ➤

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Repair Group

- 00 - Technical data
- 10 - Removing and installing engine
- 13 - Crankshaft group
- 15 - Cylinder head, Valve gear
- 17 - Lubrication
- 19 - Cooling system
- 26 - Exhaust system

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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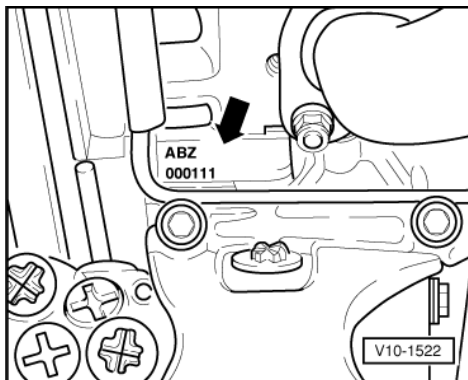
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00 - Technical data

1 - Technical data

1.1 - Technical data

1.2 - Engine number



-> The engine number (engine code and serial number) is stamped on the left side of the cylinder block immediately above the hydraulic pump.

Additionally there is a sticker on the toothed belt guard showing the engine code and serial number.

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

1.3 - Engine data

Code letters		ABZ	AEW	AHC	AKG
Capacity	l	4.172	3.697	4.172	4.172
Output	kW at rpm	220/6000	169/5500	250/6600	220/6000
Torque	Nm at rpm	400/3300	315/2700	410/3500	400/3300
Bore	ø in mm	84.5	84.5	84.5	84.5
Stroke	mm	93.0	82.4	93.0	93.0
Compression		10.8	10.6	11.3	10.8
RON/BON 98/88 recommended min. RON		95	95	98	95
Injection system		Motronic	Motronic	Motronic	Motronic
Ignition		Motronic	Motronic	Motronic	Motronic
Knock control		yes	yes	yes	yes
Self-diagnosis		yes	yes	yes	yes
Lambda control		yes	yes	yes	yes
Catalytic converter		yes	yes	yes	yes
Turbocharging		no	no	no	no
Emission standard		EU 2	EU 2	EU 2	D 3



Code letters	ABZ	AEW	AHC	AKG
Valve timing				
with 1 mm valve lift and 0 mm valve play				
Inlet opens after TDC	10°	10°	7°	10°
Inlet closes after BDC	40°	25°	46°	40°
Exhaust opens before BDC	30.5°	30°	31°	30.5°
Exhaust closes before TDC	2°	2°	2°	2°

Code letters		AKJ	AKH
Capacity	l	3.696	4.172
Output	kW at rpm	169/5500	250/6600
Torque	Nm at rpm	315/2700	410/3500
Bore	ø in mm	84.5	84.5
Stroke	mm	82.4	93.0
Compression		10.6	11.3
RON/BON 98/88 recommended min. RON		95	98
Injection system		Motronic	Motronic
Ignition		Motronic	Motronic
Knock control		yes	yes
Self-diagnosis		yes	yes
Lambda control		yes	yes
Catalytic converter		yes	yes
Turbocharging		no	no
Emission standard		D3	D3

Code letters	AKJ	AKH
Valve timing		
with 1 mm valve lift and 0 mm valve play		
Inlet opens after TDC	10°	7°
Inlet closes after BDC	25°	46°
Exhaust opens before BDC	30°	31°
Exhaust closes before TDC	2°	2°

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10 - Removing and installing engine

1 - Removing and installing engine, engine code ABZ, AEW, AKG, AKJ

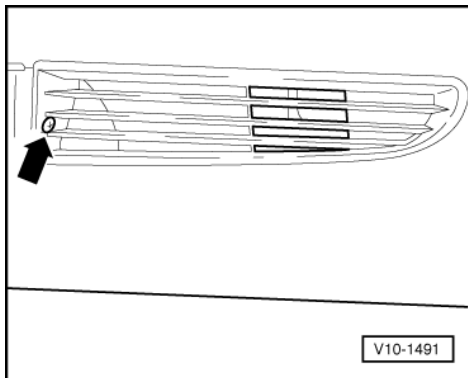
1.1 - Removing and installing engine, engine code ABZ, AEW, AKG, AKJ

1.2 - Removing

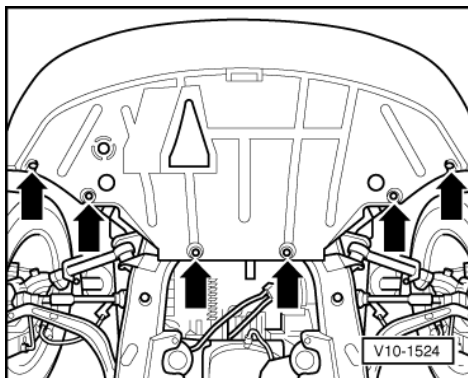
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Notes:

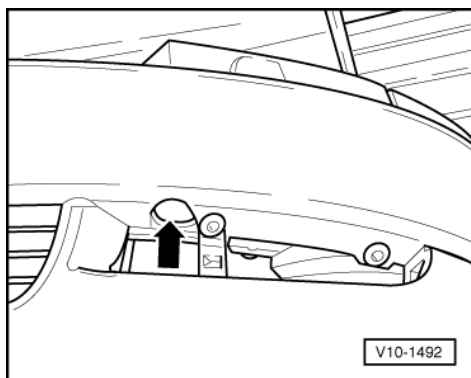
- ◆ Take out engine forwards together with gearbox.
- ◆ Ask customer for radio anti-theft code.
- ◆ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- ◆ Battery is located on right of luggage compartment under the cover.



- With the ignition switched off disconnect the battery earth strap.
- -> Unscrew vent grille on left; unclip vent grille on right.



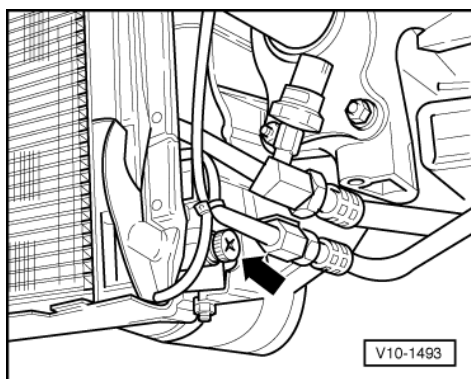
- -> Remove noise insulation.



- -> Unscrew bumper on left and right.

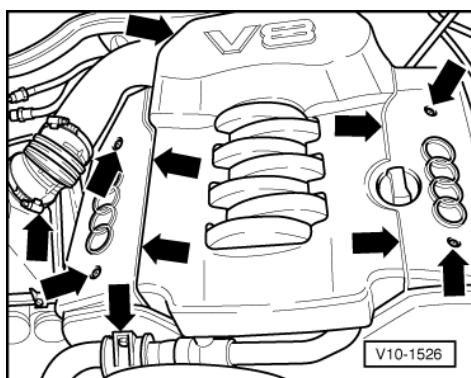
Vehicles with headlamp washer system:

- Disconnect hose to jets at bumper (in vent grille on right).

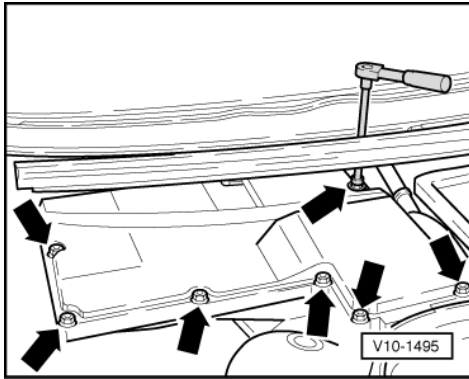


- -> Drain coolant at bottom left of radiator.

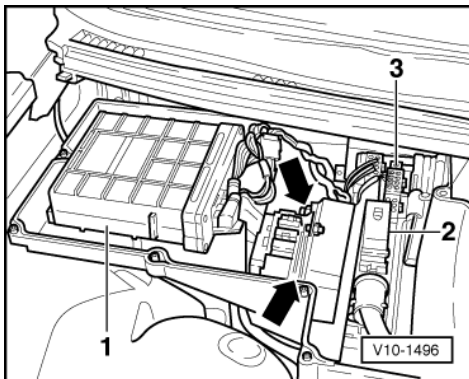
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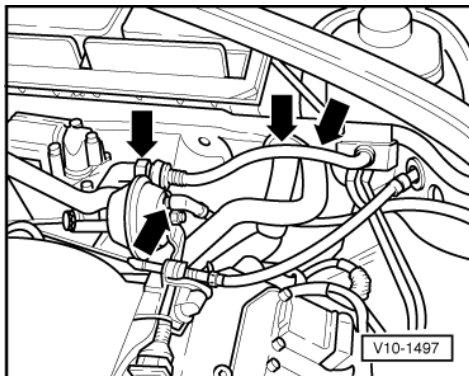
- Remove air intake pipe between air filter and throttle valve unit.
- -> Unscrew engine cover.
- Remove clips for coolant hose at toothed-belt guard on right.



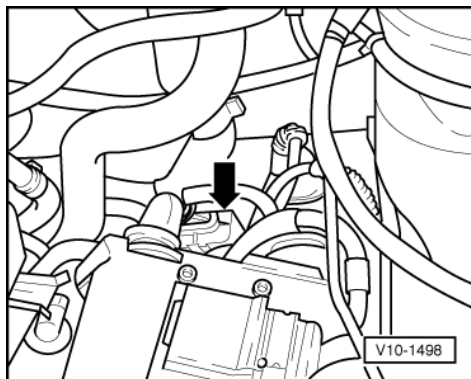
- -> Open electronics box; for this purpose, unscrew 7 screws -arrow-. Unclip hole cover for top left screw.



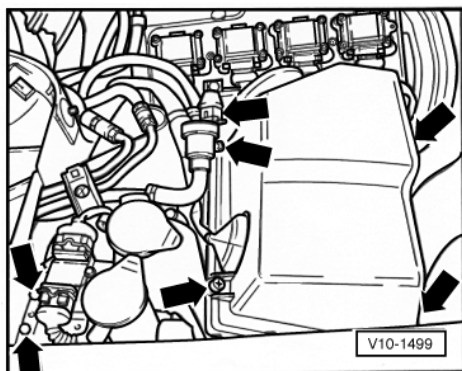
- -> Disconnect all connectors from engine control unit -1- and gearbox control unit -2- at bulkhead -3-.
- Unscrew cruise control system control unit with relay and fuse box -arrows-.
- Detach weather strip between engine compartment and plenum chamber.
- Cut cable ties at engine wiring harness -2x-.
- Unscrew wiring harness from bulkhead, remove spacer sleeves, expose wiring and set down on engine.



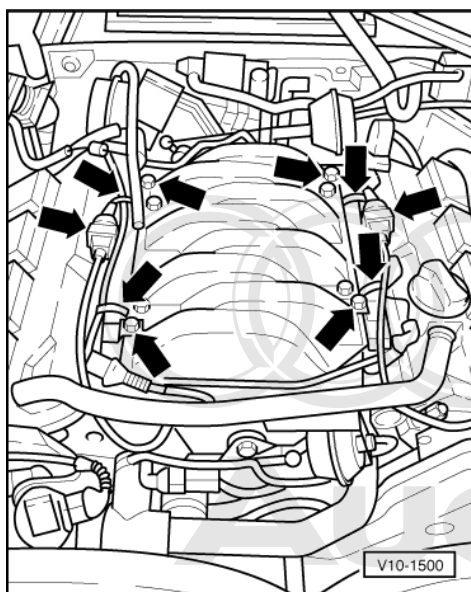
- -> Detach pipe of brake servo.
- Disconnect off vacuum pipe from cruise control unit.
- Detach and set aside accelerator cable.
- Detach coolant pipe to heating system heat exchanger (supply and return) at bleeder valves.



- -> Disconnect connectors of lambda probes on left and right, push out of holder and expose wiring.

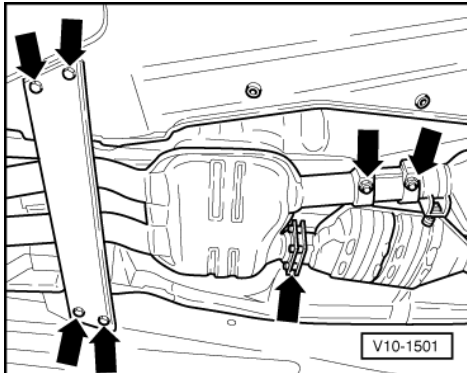


- -> Unscrew output stage.
- Unscrew top part of air filter.
- Detach connector from air mass meter.
- Disconnect connector from ACF valve.
- Expose wiring to engine.
- Unscrew coolant bleeder pipe to expansion tank at radiator.
- Unscrew feed pipe at expansion tank; for this purpose, pull out hydraulic fluid reservoir.

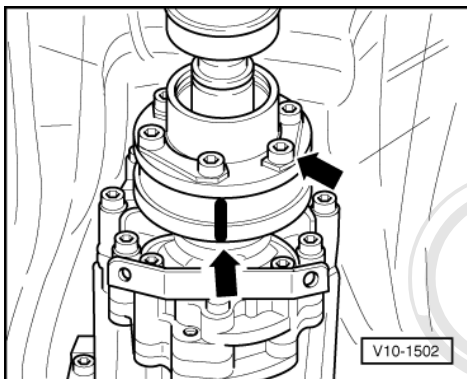


- Detach vacuum pipe for intake manifold switching in front of left headlight.
- -> Detach connectors for knock sensors on left and right at fuel manifold.
- Cut the four cable ties.
- Pull connectors off injectors on left and right.
- Unscrew fuel distributor, pull off carefully with injectors and set aside.

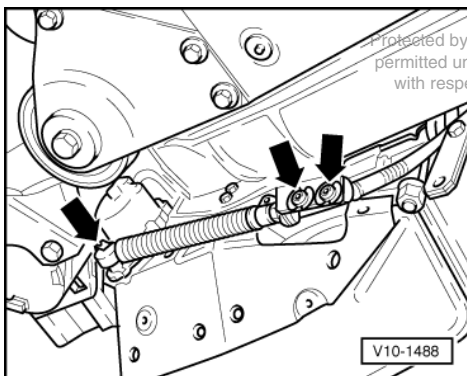
- Use clean rags to cover openings on engine.
- Unscrew bolts at exhaust manifold front pipe on left and right (one bolt each).



- -> Unscrew cross member.
- Unfasten screw-type clips.
- Remove catalytic converter on left.
- Detach exhaust system at retainers and lift out exhaust system.
- Unscrew front exhaust pipe on left and right at exhaust manifold.
- Unscrew catalytic converter bracket with spring.
- Lift out catalytic converter with front exhaust pipe.

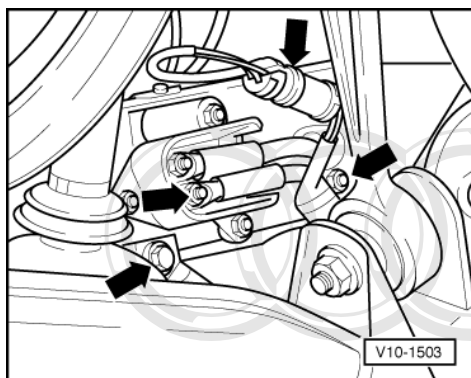


- Remove heat shield beneath catalytic converter.
- Unscrew heat shield for selector lever cable at transmission oil sump.
- -> Mark propshaft with gearbox output.
- Unscrew propshaft.
- Install support for propshaft.



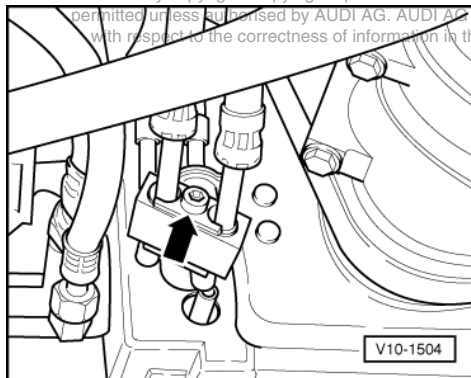
- -> Unscrew selector lever cable at bracket.
- Unclip fastener at bracket and set aside.
- Unscrew drive shaft on left and right.
- Unscrew shield for drive shaft on left.

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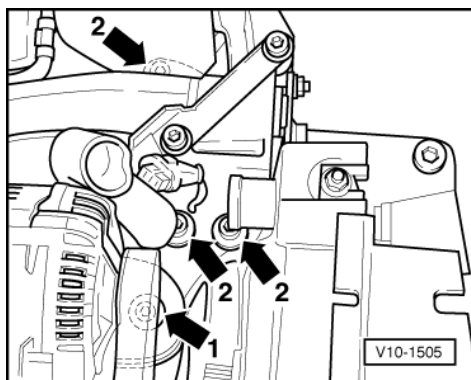


- -> Unclip connector at distribution box at right-hand longitudinal member for starter cable and detach.
- Unclip cover of distribution box.
- Disconnect connectors.
- Unscrew starter wire in distribution box and at bracket.
- Remove air duct for alternator.

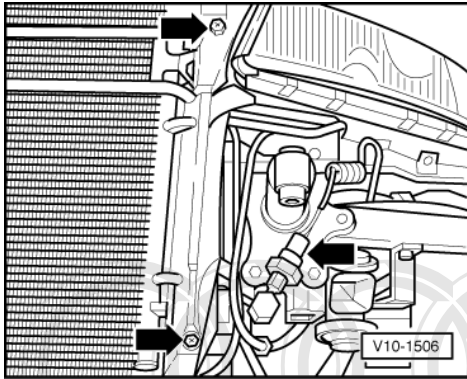
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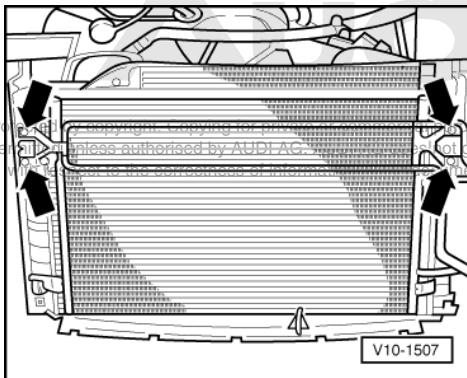
- Place ATF-fluid collector beneath pipes.
- -> Detach pipes to gearbox oil cooler.
- Unscrew coolant hose at bottom right of radiator.
- Disconnect thermo switch above hose.



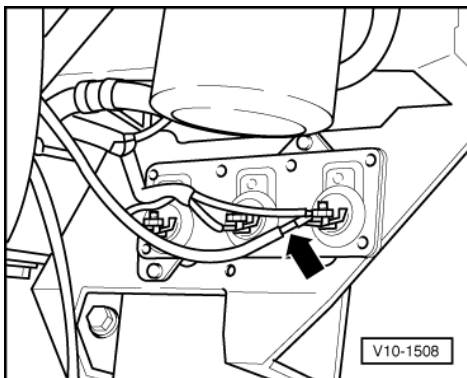
- -> Unscrew torque reaction support; take care not to lose shims.



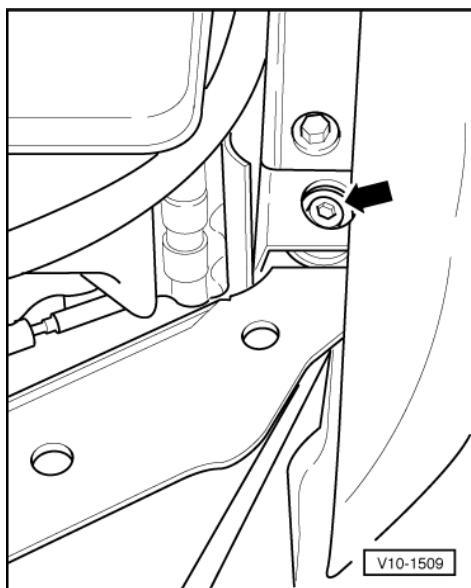
- -> Unscrew air duct for radiator on left and right.
- Pull off connector for high-pressure switch.
- Pull off connector for headlight on left and right.
- Remove left headlight.



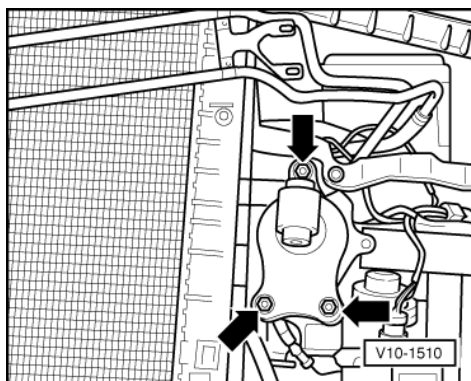
- Unclip outside temperature sender in front of catalytic converter at bottom and cut open cable clamp; expose wiring.
- -> Unscrew hydraulic-fluid cooling coil and move clear.
- Detach AC condenser and suspend at side to relieve strain on pipe and radiator.



- -> Unscrew radiator fan wiring.
- Cut three cable ties.



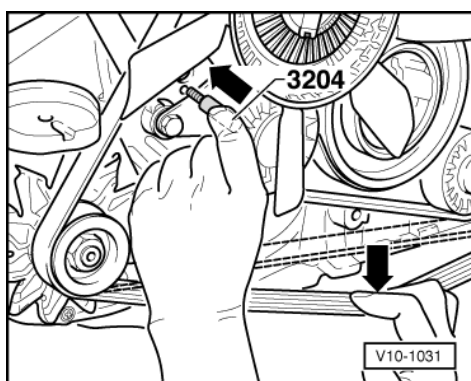
- Detach bonnet rest at both front wings.
- -> Unscrew bolts for lock carrier beneath bonnet rest; take care not to lose washers.



- -> Unscrew impact absorber for bumper on left and right.
- Remove front end with radiator.



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- -> Slacken off ribbed belt; pulling belt by hand downwards from below, and insert mandrel 3204.
- Remove belt.

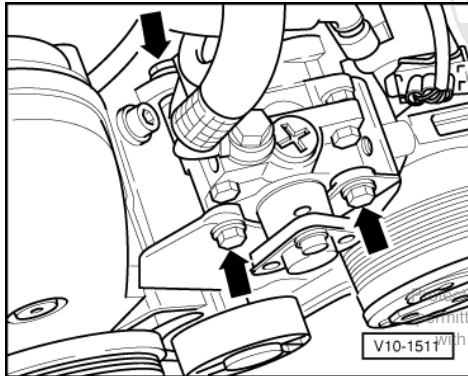
Note:

Mark running direction of ribbed belt. Running the belt in opposite direction can lead to damage.

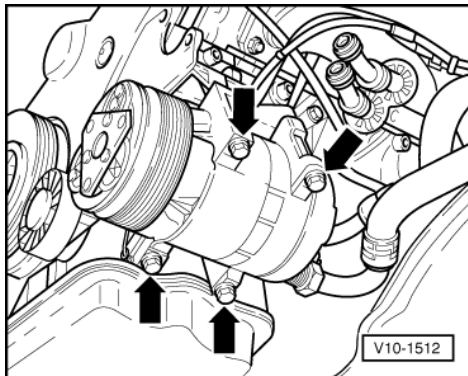
- Unbolt ribbed belt pulley on hydraulic pump, using pin wrench 3212 to counterhold.

Note:

Take care with shims behind ribbed belt sprocket. Re-use on assembly.



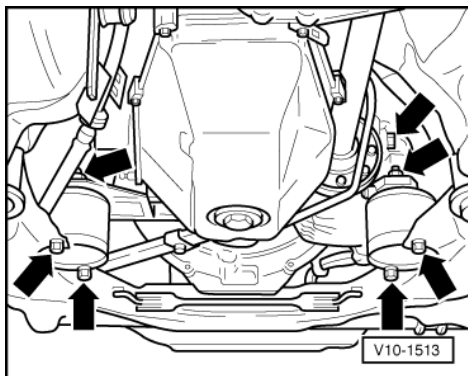
- -> Unscrew hydraulic pump from bracket and set down at longitudinal member.



- -> Unscrew AC compressor and suspend at side.

Notes:

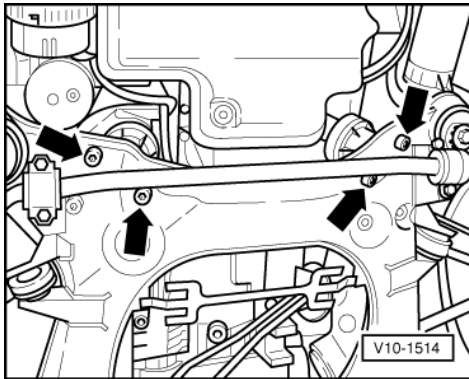
- ◆ Do not open hydraulic connections.
- ◆ Take care not to bend pipes.
- ◆ Take care with dowel sleeves for guiding AC compressor at bracket.
- Unscrew torque reaction support with bonded rubber bush at front left of engine.



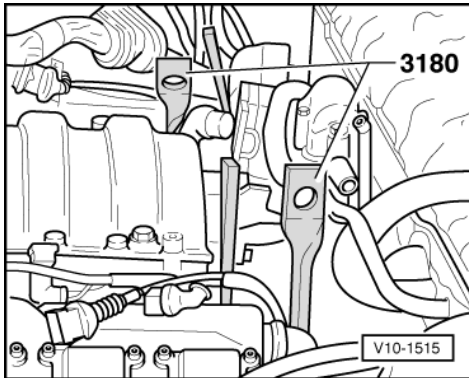
- Use gearbox lifter V.A.G 1383 to raise gearbox.
- -> Unscrew gearbox mounting on right and left.
- Remove gearbox support bracket on left.



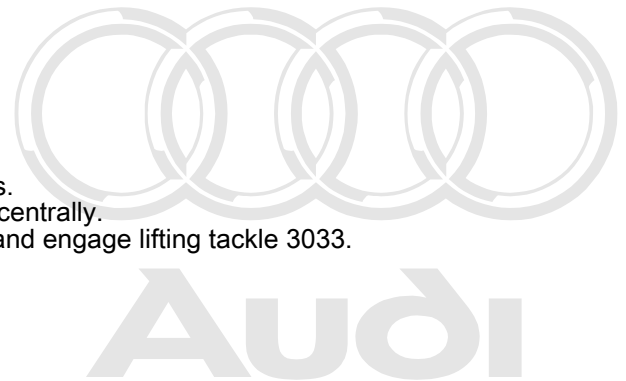
- Lower and remove gearbox lifter.



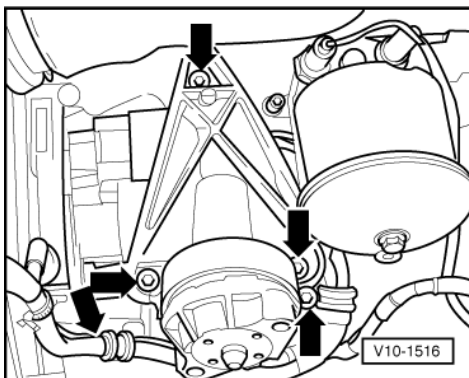
- -> Unscrew engine mounting on left and right.
- Detach both gas-filled struts for bonnet at bonnet.
- Move bonnet into vertical position, support with auxiliary tool.



- -> Screw in holder V.A.G 3180 at both rear engine mounts.
- Fit lifting tackle 3033 in position at both holders and align centrally.
- Place assembly crane V.A.G 1202 A (500 kg) in position and engage lifting tackle 3033.
- Carefully raise engine and pull it out forwards.

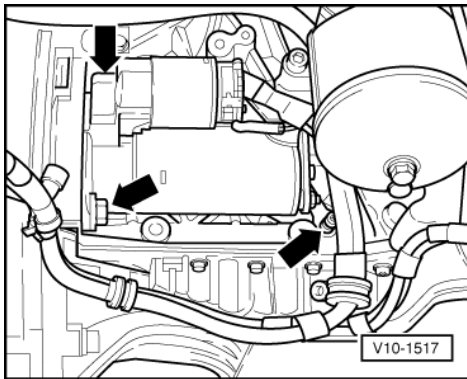


1.3 - Stripping down engine

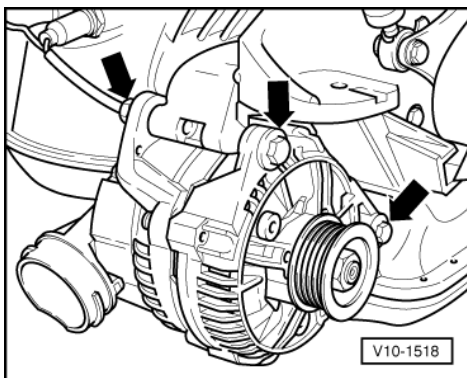


- -> Unscrew engine support on right.
- Set down engine with gearbox; for example on workbench; leave suspended from crane; if appropriate set down on two old tyres in order to be able to separate engine from gearbox.
- Unscrew both earth wires from engine.

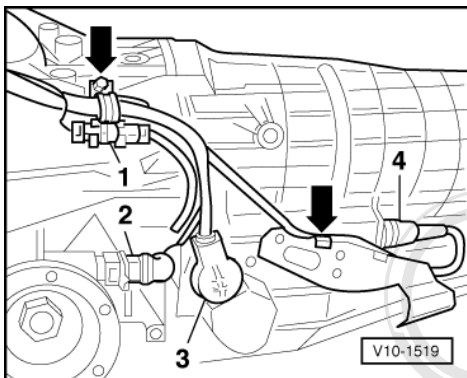
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- -> Unscrew both brackets for starter.
- Remove starter; leave electric wires connected.

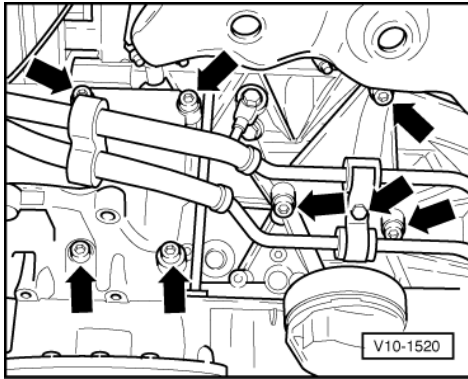


- -> Remove alternator; leave wires connected.



- -> Detach connectors 1 to 4.
- Unscrew bracket.
- Unscrew wire locator at engine support bracket on left.
- Expose wiring harness.

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- -> Unscrew bracket for AC compressor and hydraulic pump.
- Unscrew engine support bracket on left.

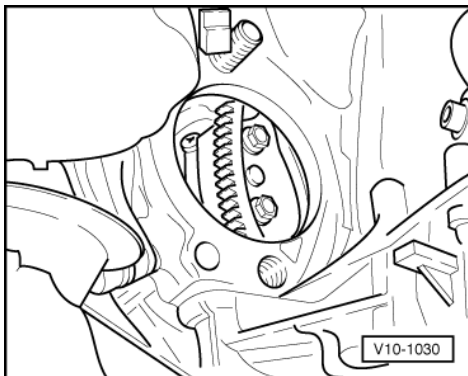
Note:

Before unscrewing converter from drive plate, mark respective position of both components.

If engine or gearbox is replaced:

- With the two assemblies separated, turn engine to TDC and align mark on gearbox bell housing with mark on converter.

Engine codes ABZ, AKG

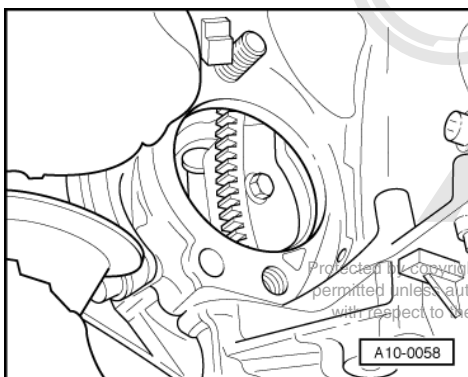


- -> Unscrew converter from drive plate, 6 bolts.

Tightening torque 35 Nm.

- Separate gearbox from engine.

Engine codes AEW, AKJ



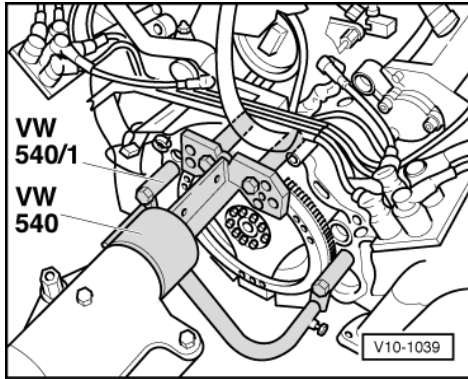
- -> Unscrew converter from drive plate, 3 bolts.

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Tightening torque 85 Nm.

- Separate gearbox from engine.

1.4 - Attaching engine to repair stand



- -> When performing assembly work, attach engine with engine mount VW 540/1 to repair stand.

1.5 - Installing

Installation is carried out in the reverse order to removal, noting the following:

Important

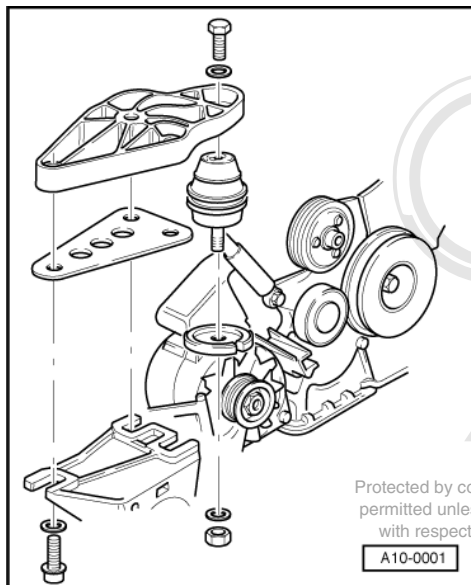
To avoid contact corrosion use is only to be made of approved bolts, nuts and washers etc. These feature a special surface coating and can be recognised by their greenish colour.

- Check clutch release bearing for wear, renew if necessary.
- Vehicles with automatic gearbox have no needle bearing in the crankshaft.
- In the case of exchange engines with manual gearbox, check whether needle bearing has been fitted in crankshaft and install if necessary.
- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.
- Renew all self locking nuts.
- Stress-free alignment of exhaust system.

Engine codes ABZ, AKG =>Page 109 .

Engine codes AEW, AKJ =>Page 117 .

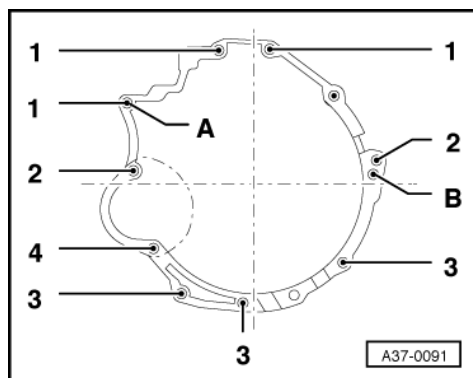
- Check hydraulic fluid level and top up, if necessary.



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- Top up coolant => Page 100 .
- Check oil level before starting engine.
- Check fluid level in automatic gearbox.
- -> Carry out stress-free installation of torque reaction support; fit shims, if necessary.
- Rock engine mount to carry out stress-free alignment.

1.6 - Tightening torques, engine codes ABZ, AEW, AKG and AKJ



- -> Engine/gearbox attachment (gearbox flange layout).

Item	Bolt	Quant.	Nm
1	M 12x75	3	65
2	M 12x90	2	65
3	M 10x45	3	45
4	M 10x80	1	65

Dowel sleeves for centring (A and B).

Bolted joint	Tightening torques
Torque converter to drive plate:	
Engine Code ABZ	35 Nm
Engine code AEW	85 Nm
Front right engine support to engine	45 Nm

Bolted joint	Tightening torques
Alternator to engine M10 M 8	40 Nm 25 Nm
Vibrator damper to crankshaft: without special tool 2079	450 Nm
with special tool 2079	350 Nm
Exhaust manifold to cylinder head	25 Nm
A/C compressor to bracket	25 Nm
Bracket for central hydraulic pump and AC compressor to engine	25 Nm
Drive shafts to flanged shafts M 8	45 Nm
M 10	80 Nm
Exhaust pipe to manifold	40 Nm
Engine carrier to bodywork	50 Nm

2 - Removing and installing engine, engine codes AHC and AKH

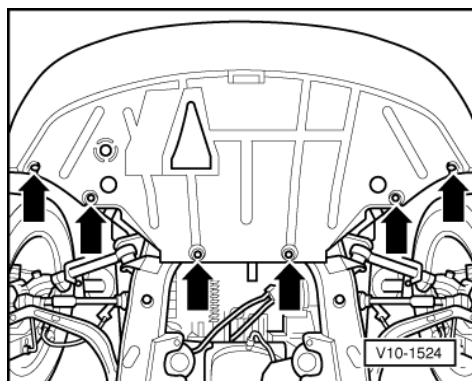
2.1 - Removing and installing engine, engine codes AHC and AKH

2.2 - Removing

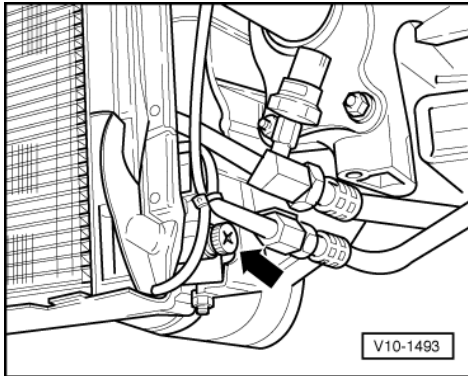
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Notes:

- ◆ Take out engine forwards without gearbox.
- ◆ Ask customer for radio anti-theft code.
- ◆ Renew all cut and defective cable ties. Refit cable ties in the same position when installing the engine.
- ◆ Battery is located on right of luggage compartment under the cover.



- With the ignition switched off disconnect the battery earth strap.
- -> Remove noise insulation.



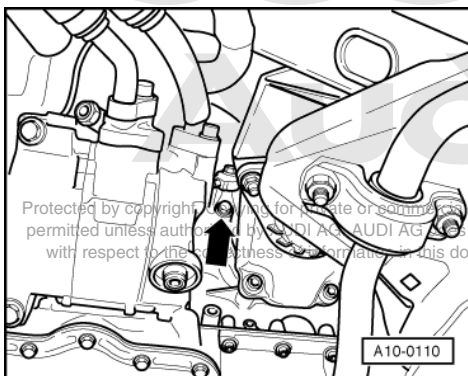
- Removing bumper

=> General Body Assembly; Repair group 63; Removing and installing front bumper Removing and installing front bumper

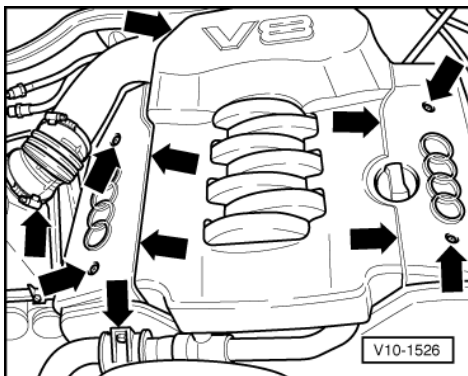
- -> Drain coolant at bottom left of radiator.

Notes:

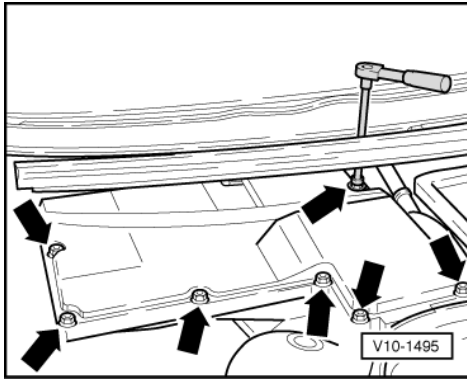
- ♦ Collect coolant for re-use.
- ♦ For draining coolant at radiator, attach hose to coolant drain cock.
- ♦ Only use clean vessel to collect coolant.



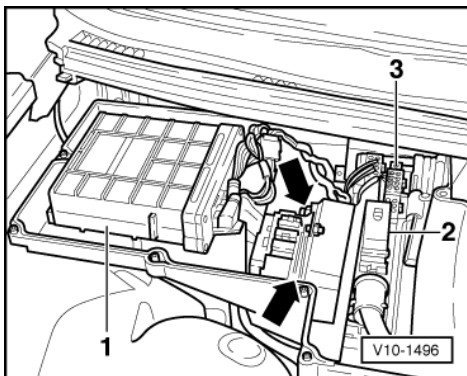
- -> Drain coolant at engine block on left beneath knock sensor and on right above oil filter.



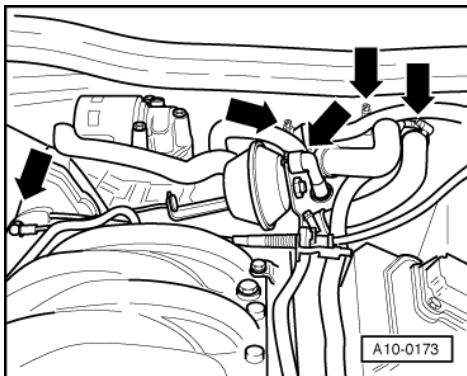
- Remove air intake pipe between air filter and throttle housing.
- -> Unscrew engine cover.
- Remove clip for coolant hose at toothed-belt guard on right.
- Remove cover in front of E-box in plenum chamber.



- -> Open electronics box; for this purpose, unscrew 7 screws -arrow-. Unclip hole cover for top left screw.



- -> Pull all connectors off engine control unit -1- and gearbox control unit -2- at bulkhead -3-.
- Unscrew cruise control system control unit with relay and fuse box -arrows-.
- Detach weather strip between engine compartment and plenum chamber.
- Cut cable ties at engine wiring harness -2x-.
- Unscrew wiring harness from bulkhead, remove spacer sleeves, expose wiring and set down on engine.

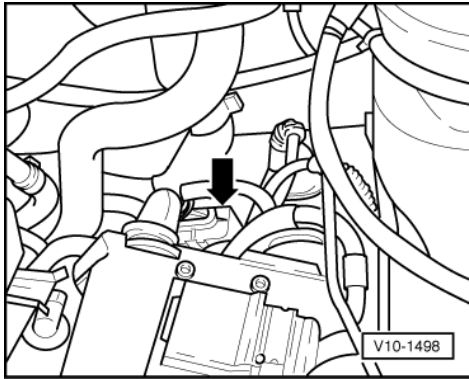


- -> Detach pipe of brake servo.
- Disconnect vacuum pipe from cruise control unit.
- Disconnect linkage for cruise control system.
- Detach and expose accelerator cable by unfastening clips.
- Unscrew both coolant hoses to heat exchanger.

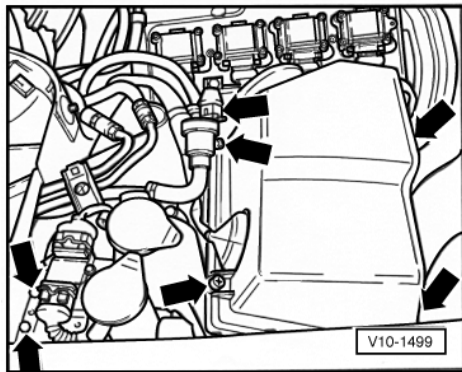
Note:

Take care not to interchange supply and return hose.

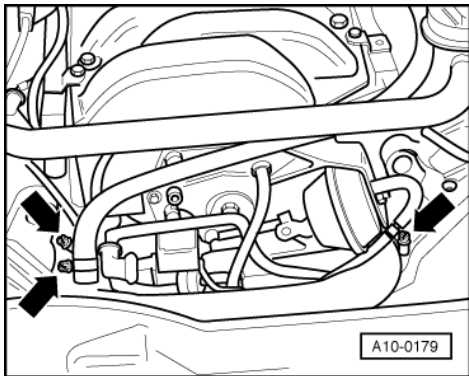
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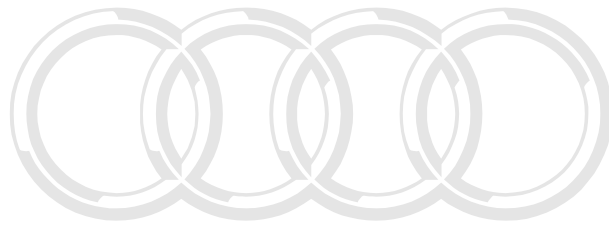
- -> Pull off connectors of lambda probes on left and right, push out of holder and expose wiring.



- -> Unscrew output stage.
- Unscrew top part of air filter.
- Pull connector off air-mass meter and pull cable out of top part of air filter.
- Pull connector off ACF valve and expose wiring to engine.
- Pull hose off ACF valve.
- Remove bottom part of air filter.

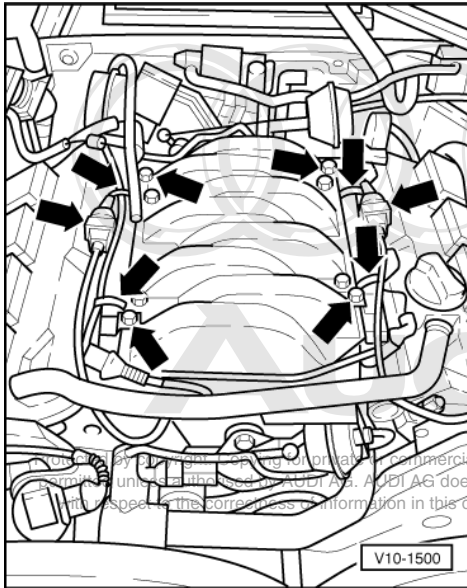


- -> Unscrew coolant bleeder pipe to expansion tank at water hose.
- Unscrew coolant hoses at engine.
- Unscrew coolant feed pipe at expansion tank.
- Detach vacuum pipe for intake manifold switching in front of left headlight.



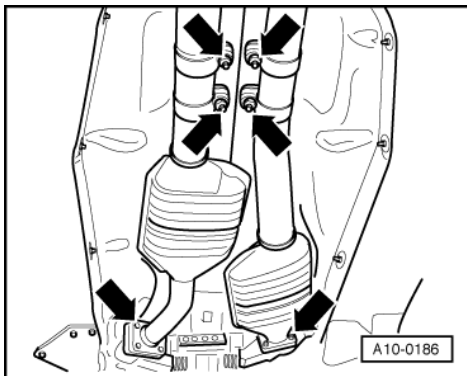
Audi

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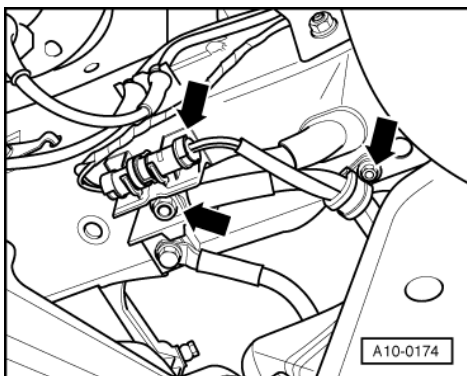


- -> Detach connectors for knock sensors on left and right at fuel manifold.
- Cut the four cable ties.
- Pull connectors off injectors on left and right.
- Disconnect vacuum hose for fuel-pressure regulator.
- Unscrew fuel distributor and set aside carefully together with injectors.
- Use clean rags to cover openings on engine.

- Unscrew bolts at exhaust manifold front pipe at top left and right (one bolt each).



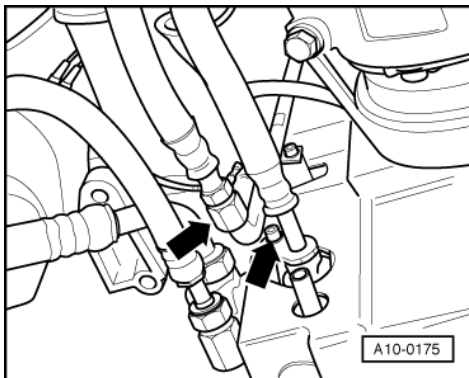
- -> Unfasten double clamp.
- Remove catalytic converter on left and right.
- Unscrew front exhaust pipe on left and right at exhaust manifold and at gearbox mounting and then remove.
- Unscrew all connection bolts engine/gearbox except top bolts.



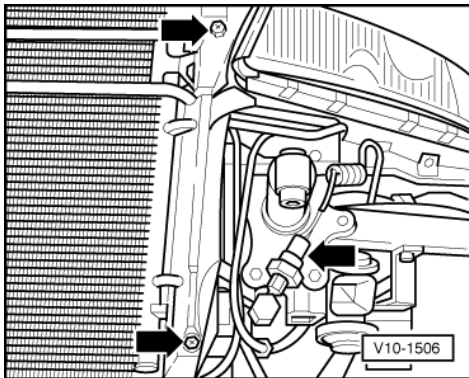
- -> Unclip connector at distribution box at right-hand longitudinal member for starter cable and detach.
- Unclip cover of distribution box.
- Unscrew starter wire in distribution box and at bracket.



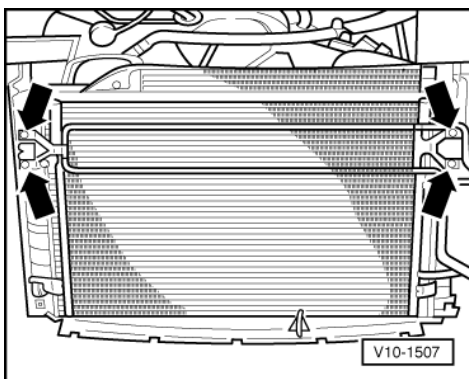
- Unscrew earth wire at engine.
- Remove air duct for alternator.



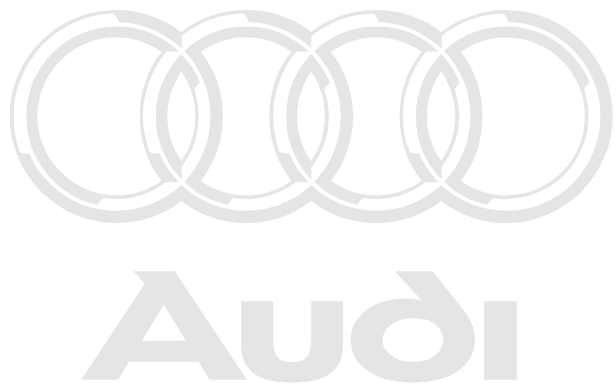
- Place ATF-fluid collector beneath pipes.
- -> Detach pipes to gear oil cooler.
- Unfasten oil pipes for manual gearbox at engine support bracket and at bottom of gearbox.
- Unscrew coolant hose at bottom right of radiator.
- Disconnect thermo switch above coolant hose.



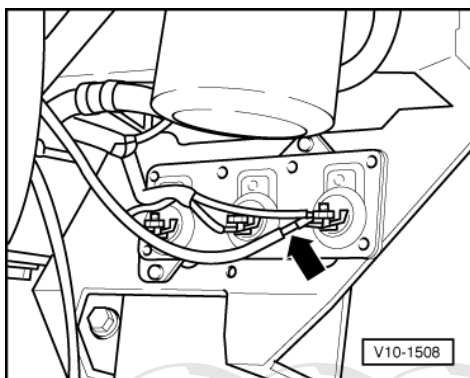
- Remove strip beneath headlight.
- Remove bracket for headlight.
- -> Unscrew air duct for radiator on left and right.
- Pull off connector for high-pressure switch.
- Detach connector for headlight on left and right.



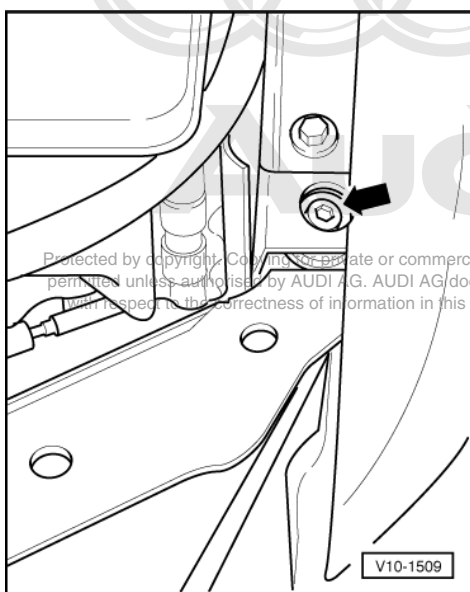
- Unclip outside temperature sender for AC at bottom in front of catalytic converter, cut open cable clamp and expose wiring.
- Detach hydraulic fluid cooling coil.
- -> Unscrew hydraulic fluid cooling coil and place to one side.
- Detach cooler for AC compressor and suspend to one side to relieve strain on pipes and cooler.



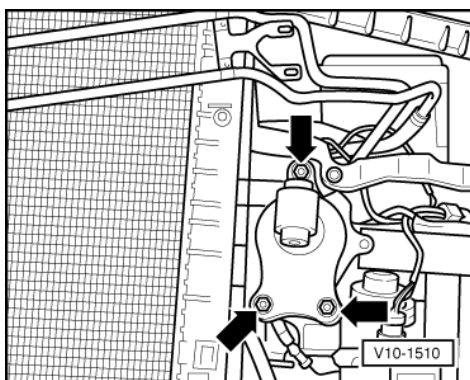
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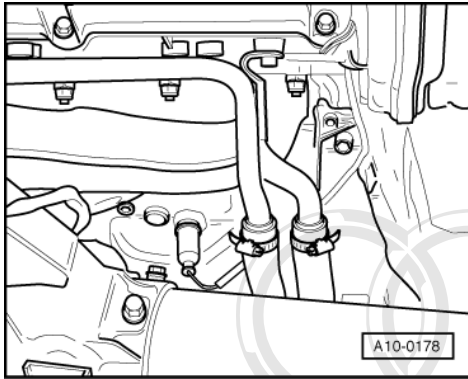
- -> Unscrew positive wire for electric radiator fan at series resistor between longitudinal member and bottom left of wing.
- Unscrew earth cable at front left of side member.
- Cut the two cable ties.



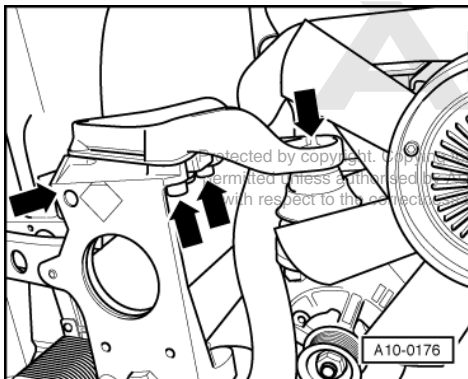
- Detach bonnet lock release cable.
- Detach bonnet rest at both front wings.
- -> Unscrew bolts for lock carrier beneath bonnet rest; take care not to lose washers.



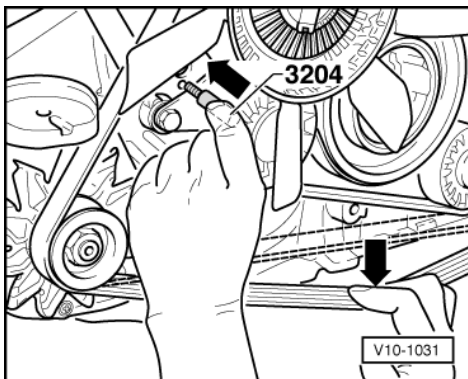
- -> Unscrew impact absorber for bumper on left and right.
- Remove lock carrier with radiator.



- -> Detach water hoses to auxiliary heater.



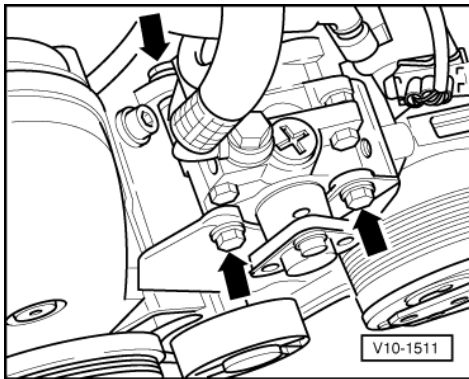
- -> Unscrew torque reaction support at bottom (3 bolts).
- Unscrew torque reaction support at top (1 bolt).



- -> Slacken off ribbed belt; pulling belt by hand downwards from below, and insert mandrel 3204.
- Remove ribbed V-belt.

Notes:

- ♦ Mark running direction of ribbed belt. Running the belt in opposite direction can lead to damage.
- ♦ Belt routing =>Page 29 .

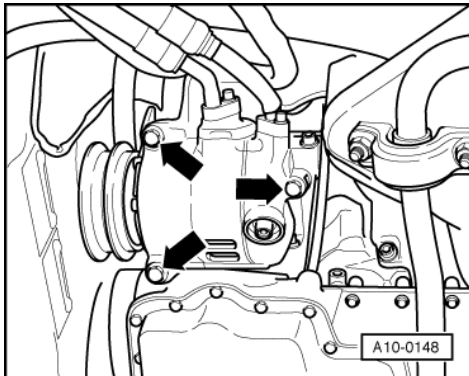


- Unbolt ribbed belt pulley on hydraulic pump, using pin wrench 3212 to counterhold.

Note:

Take care with shims behind ribbed belt sprocket. Re-use on assembly.

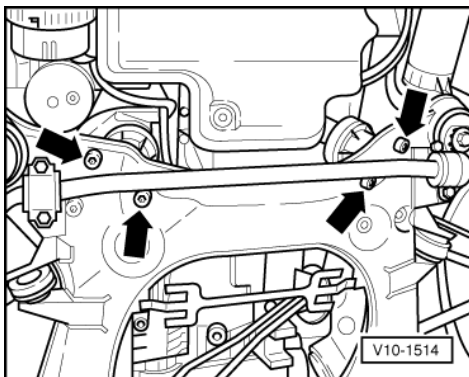
- -> Unscrew hydraulic pump from bracket and set down at longitudinal member.



- -> Unscrew AC compressor and suspend at side.

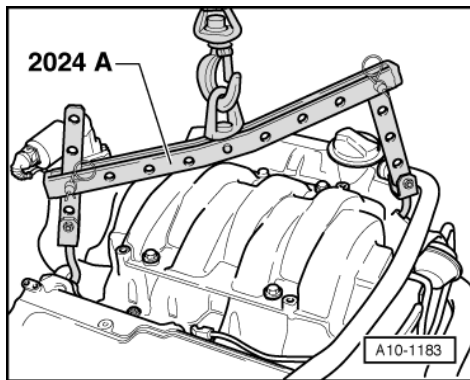
Notes:

- ◆ Do not open hydraulic connections.
- ◆ Take care not to bend pipes.
- ◆ Take care with dowel sleeves for guiding AC compressor at bracket.



- -> Unscrew engine mounting on left and right.

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- -> Attach lifting tackle 2024 A at front right and rear left and secure.

Note:

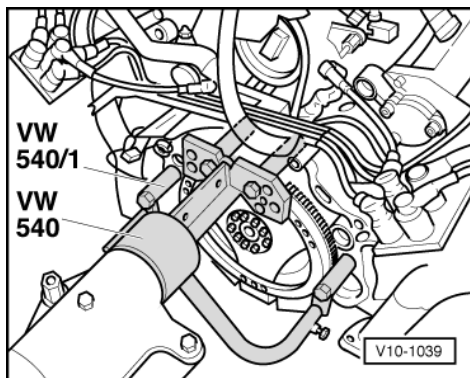
The perforated rails of the lifting hooks must be inserted as shown in the illustration in order to match up with the centre of gravity of the engine.

- Move assembly crane into position (pay attention to AC compressor).
- Attach lifting tackle 2024 A to assembly crane.
- Screw out top bolt of engine/gearbox connection.
- Carefully raise engine.

Note:

Careful guidance of the engine is necessary on removal in order to avoid damage.

2.3 - Attaching engine to engine stand



- -> When performing assembly work, attach engine with engine mount VW 540 and supplementary parts VW 540/1 to repair stand.

2.4 - Installing

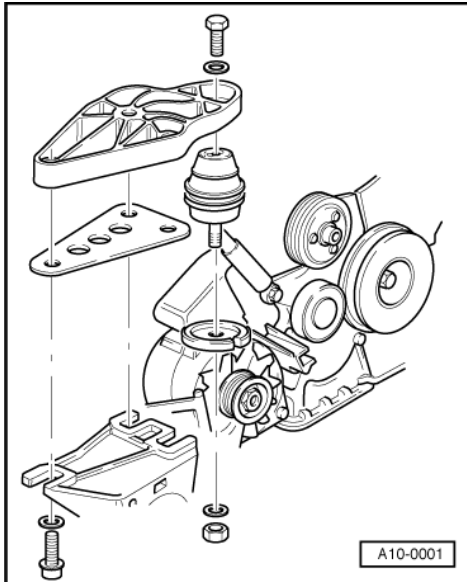
Installation is carried out in the reverse order to removal, noting the following:

Important

To avoid contact corrosion use is only to be made of approved bolts, nuts and washers etc. These feature a special surface coating and can be recognised by their greenish colour.

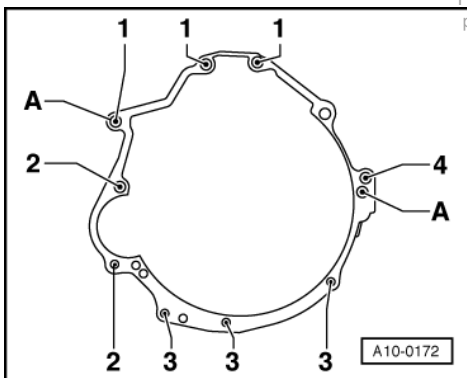
- Check whether the dowel sleeves for centralising engine/gearbox are in the cylinder block, install if necessary.
- In the case of exchange engines with manual gearbox, check whether needle bearing has been fitted in crankshaft and install if necessary.

- Check clutch release bearing for wear, renew if necessary.
- Renew all self locking nuts.
- Screw both coolant drain screws on engine back in.
- Check whether spacers have been fitted between ribbed belt sprocket and hydraulic pump; check alignment of ribbed belt if necessary.
- Check whether dowel sleeves have been fitted between engine block and AC compressor bracket, as well as between AC compressor bracket and AC compressor.



- Check hydraulic fluid level and top up, if necessary.
- Top up coolant => Page **100**.
- Check oil level before starting engine.
- Stress-free alignment of exhaust system => **109**
- -> Carry out stress-free installation of torque reaction support; fit shims, if necessary.
- Rock engine mount to carry out stress-free alignment.

2.5 - Tightening torques, engine codes AHC and AKH



- -> Engine/gearbox attachment (gearbox flange layout).

Item	Bolt	Quant.	Nm
1	M 12x75	3	65
2	M 12x110	2	65
3	M 10x45	3	45
4	M 12x90	1	65



Dowel sleeves for centring (A).

Bolted joint		Tightening torques
Bolts, nuts	M6	10 Nm
	M8	20 Nm
	M10	45 Nm
	M12	60 Nm
With the exception of		
Engine support brackets to side member left and right		45 Nm
Front right engine support to engine		45 Nm
Bracket for tandem pump and AC compressor		30 Nm
Tandem pump to bracket		25 Nm
AC compressor to bracket		20 Nm
Subframe to body		65 Nm + 90° turn further ¹⁾

- 1) Always replace screws.

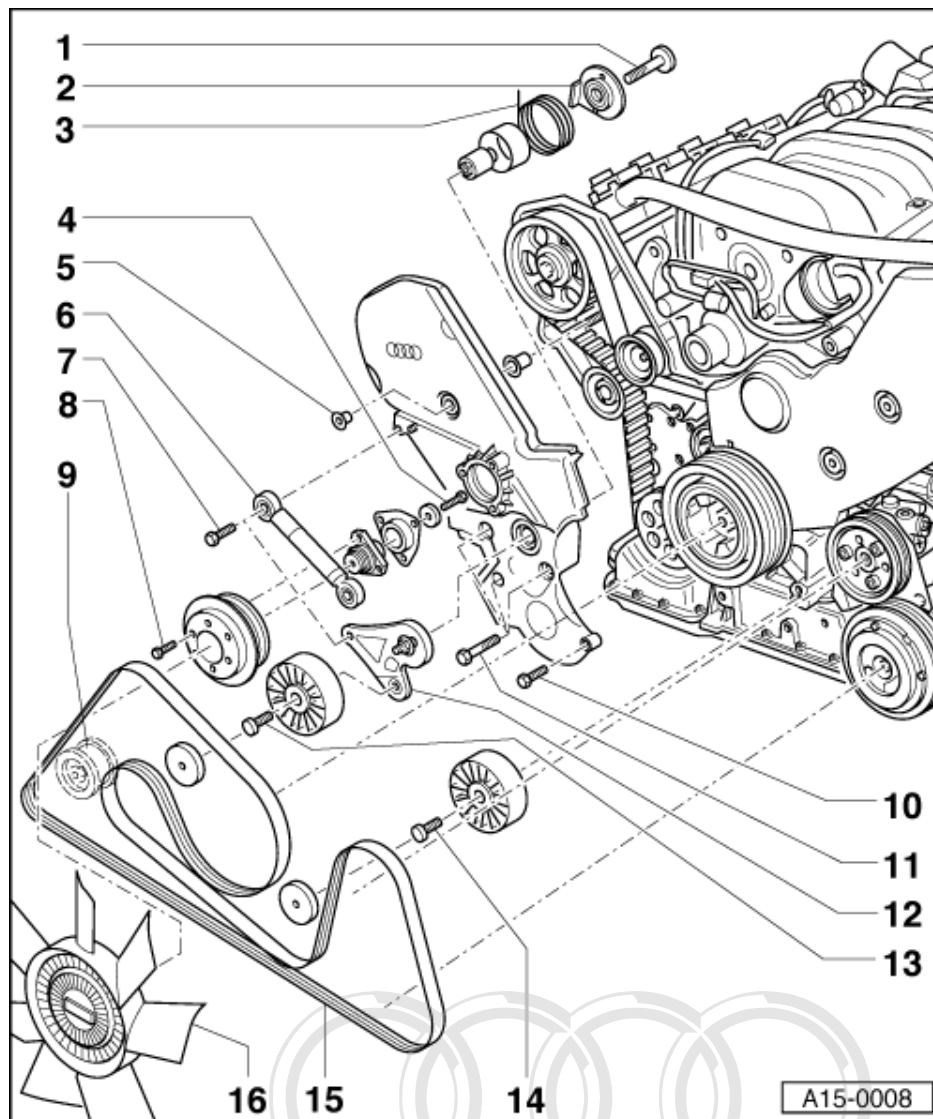


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13 - Crankshaft group

1 - Belt drive

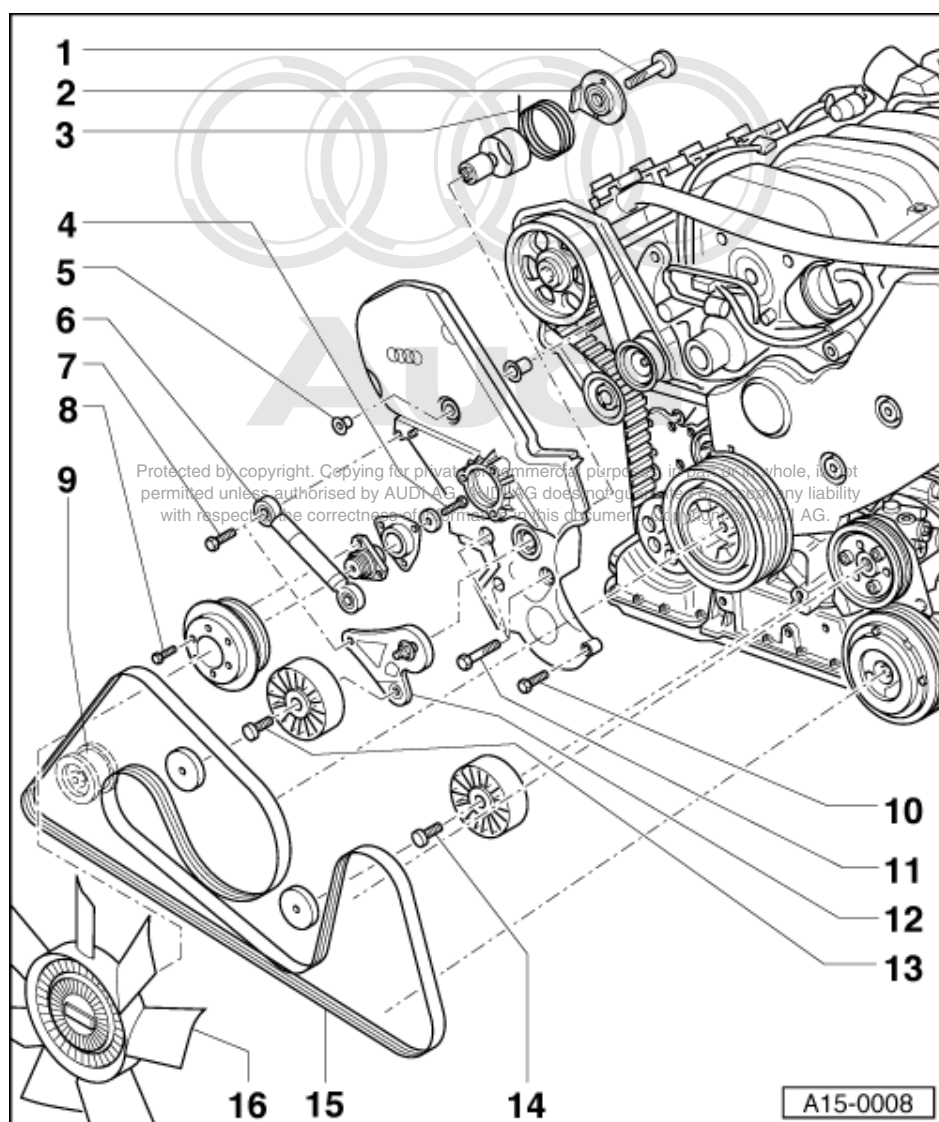
1.1 - Belt drive



1.2 - Removing and installing ribbed belt

- 1 35 Nm
- 2 Retaining plate
- 3 Long-arm spring
- 4 25 Nm
- 5 Flange nut, 10 Nm
- 6 Ribbed belt tensioner
- 7 25 Nm
- 8 25 Nm

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9 Alternator

10 25 Nm

11 45 Nm

12 Swivel bracket

13 Screw M8 x 28 = 25 Nm

14 Screw M8 x 35 = 25 Nm

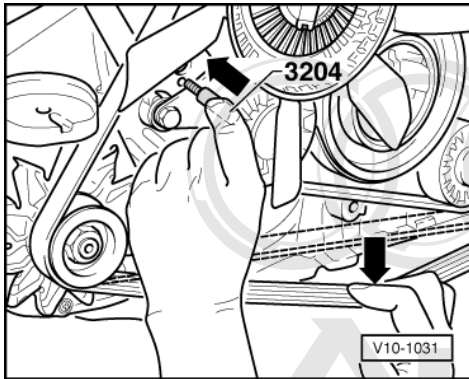
15 Ribbed V-belt

- ♦ Mark running direction of ribbed belt. Running the belt in opposite direction can lead to damage.
- ♦ Check alignment of ribbed belt => Page 31

16 Viscous fan

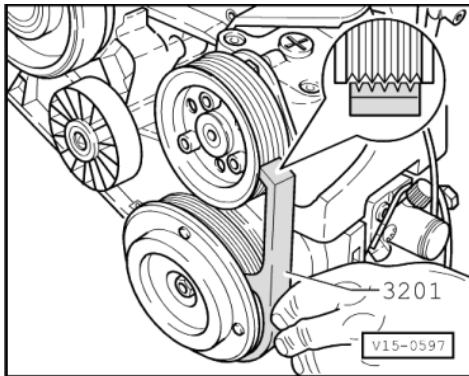
- ♦ Removing and installing=>Page 96

Checking and adjusting ribbed belt alignment.



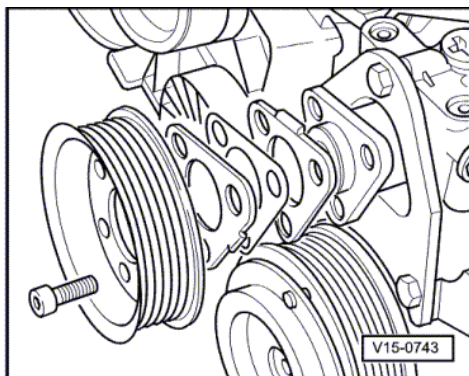
Check alignment of ribbed belt between AC compressor and hydraulic pump so as to avoid the possibility of ribbed belt damage.

- -> Remove ribbed belt, firmly pressing down belt at bottom in centre by hand and insert mandrel 3204.



- -> Position alignment gauge 3201 on ribbed belt pulley of AC compressor. Ribbed belt pulley of central hydraulic pump must align with that of AC compressor.

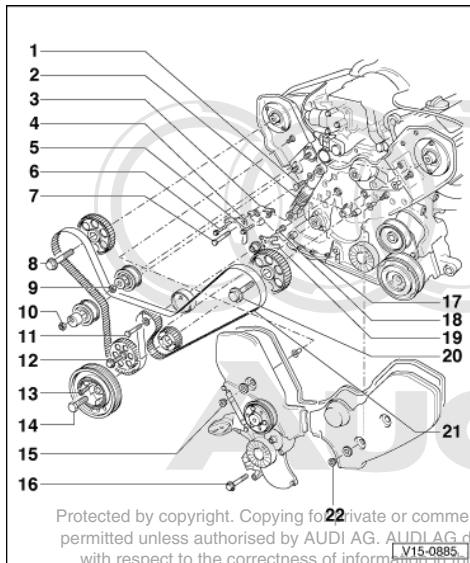
If the two pulleys do not coincide:



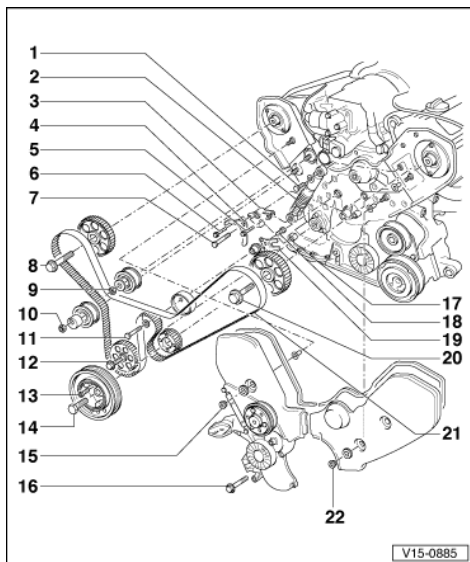
- -> Unscrew ribbed belt pulley of central hydraulic pump. Adjust with 0.5, 1.0 and 1.5 mm thick shims, available as replacement parts, until the two pulleys coincide.



1.3 - Removing and installing toothed belt



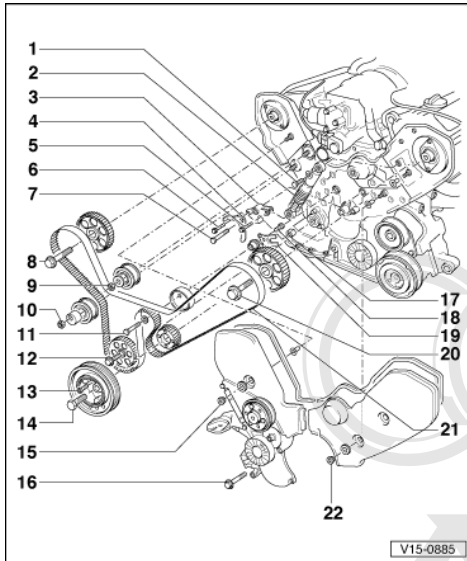
- 1 25 Nm
- 2 Damper
 - ♦ Adjusting => Page 38
- 3 Tensioning lever
- 4 TDC indicator
- 5 Collar bolt
- 6 Collar bolt
- 7 25 Nm
- 8 Combi bolt, 55 Nm
- 9 25 Nm



- 10 25 Nm
- 11 25 Nm
- 12 80 Nm
- 13 25 Nm
- 14 Central bolt
 - ♦ With special tool 2079, 350 Nm
 - ♦ Without special tool 2079, 450 Nm
 - ♦ Use holding tool 3197 => Page 35
 - ♦ Replace bolt after loosening.

- ♦ Install using locking fluid.

=> Parts List



15 Flange nut, 10 Nm

16 45 Nm

17 Slide block

18 10 Nm

19 Lever for tensioner

20 55 Nm

21 Toothed belts

- ♦ Removing and installing => Page **33**

22 Flange nut, 10 Nm

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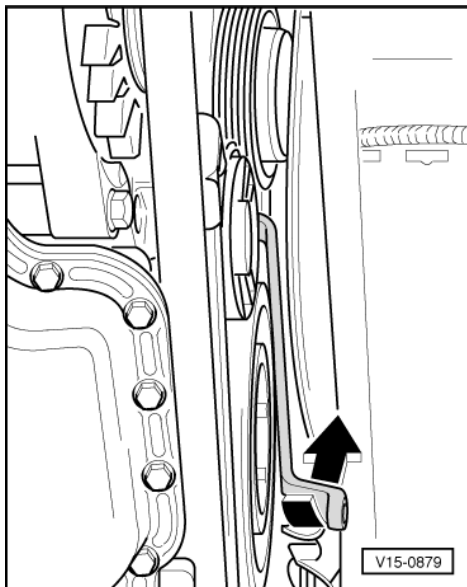
Removing and installing toothed belt

(with engine installed)

Removing

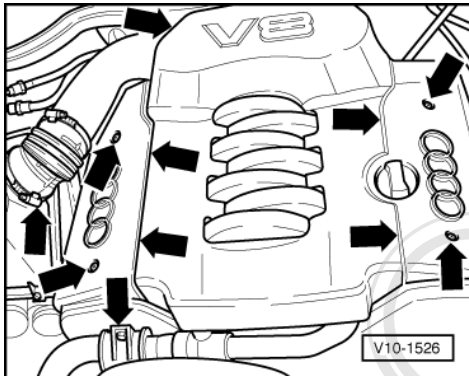
Note:

Ask customer for radio anti-theft code.

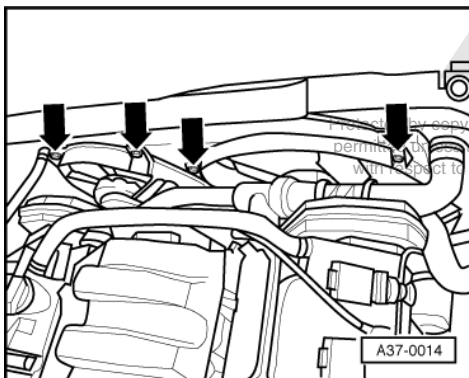




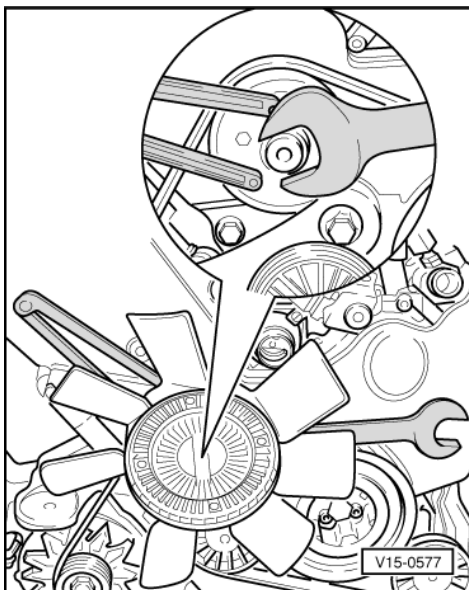
- Battery is located on right of luggage compartment under the cover.
- With the ignition switched off disconnect the battery earth strap.
- Remove noise insulation panel.
- Remove vent grille in bumper on left.
- Attach approx. 12 mm dia. hose to coolant drain cock at bottom left of radiator.
- Drain coolant and collect for re-use.
- -> Slacken ribbed belt; position ring spanner on hexagon of tensioner and slowly press upwards.



- -> Unscrew engine cover.
- Unscrew support clamp for coolant hose at toothed-belt guard on right.
- Remove air intake between air filter and throttle housing.



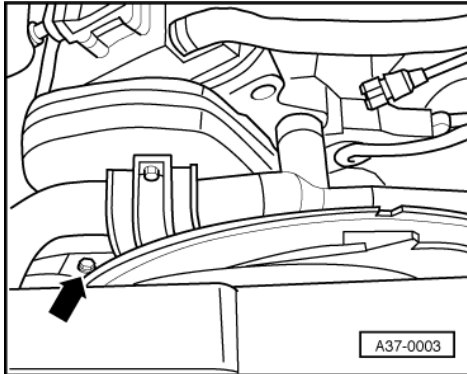
- -> Unscrew air duct for viscous fan and electric fan at top left of radiator, pull out upwards and place to one side in engine compartment. Leave wiring connected.



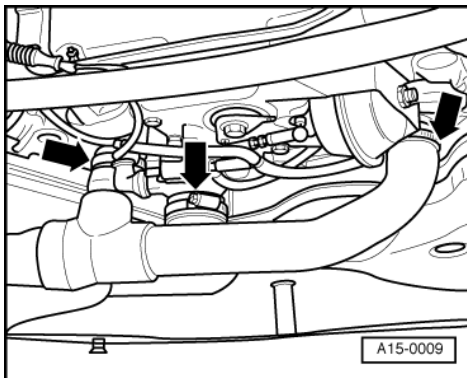
- -> Unscrew viscous fan; counterhold with 2-hole pin wrench 3212.

Notes:

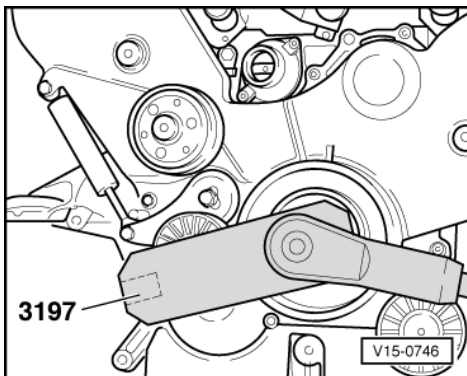
- ♦ Viscous fan has left-hand thread; turn clockwise to unfasten.
- ♦ For ease of illustration, the Fig. shows the viscous fan on the removed engine.
- Lift out viscous fan and air duct upwards.



- -> Unscrew front right engine mounting.



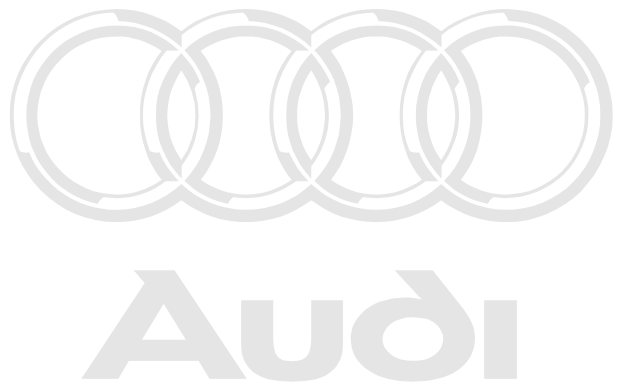
- -> Unscrew coolant hoses at engine.
- Unfasten coolant hose at top right of radiator and turn hose clockwise.



- -> Loosen central bolt for vibration damper approx. 1 turn, using counterhold 3197.

Notes:

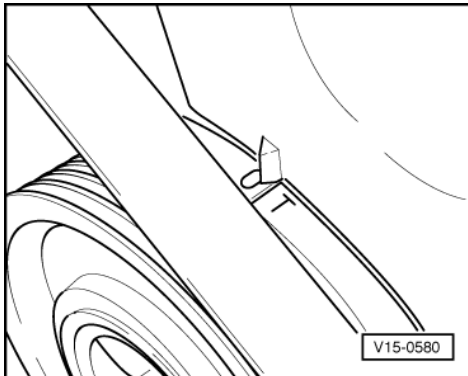
- ♦ For ease of illustration, the Fig. shows the engine removed.



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- ♦ Unfastening and subsequent removal of the vibration damper with toothed belt sprocket are only necessary if the toothed belt is replaced or removal is required for other operations.

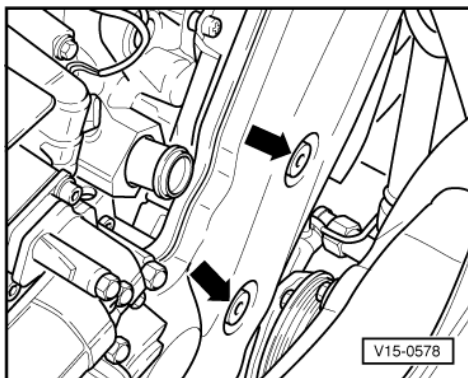


- -> Turn engine to TDC; mark at front of vibration damper).

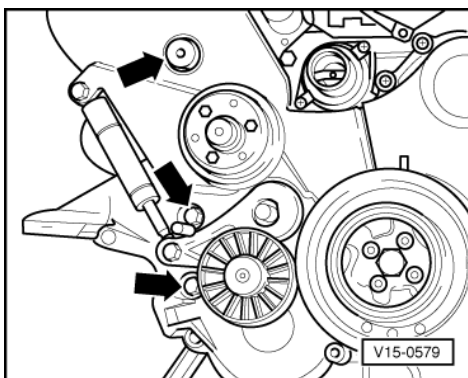
Note:

With vibration damper bolt unfastened, use holding tool 3197 to turn engine.

- Unscrew Hall sender housing at rear left and camshaft cover flange at cylinder head on right.

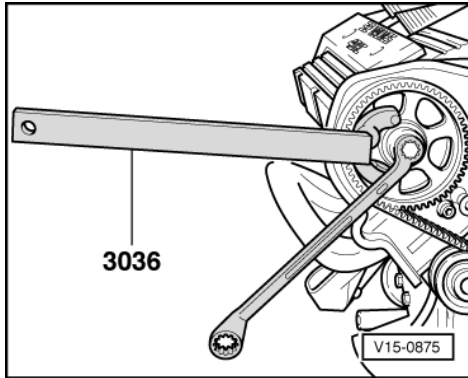


- Hall sender must be positioned behind window of barrier; if not, turn engine through 360°.
- Disconnect plug from switch for intake manifold changeover.
- -> Remove left toothed belt guard.
- Unclip cap at pulley for ribbed belt at toothed-belt guard on right.
- Unscrew pulley.

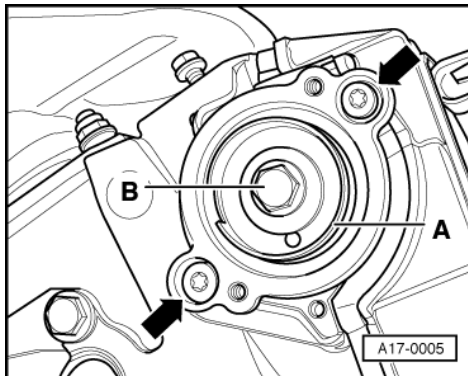


- -> Unscrew 6 securing bolts for right toothed-belt guard.
- Carefully remove right toothed-belt guard upwards.

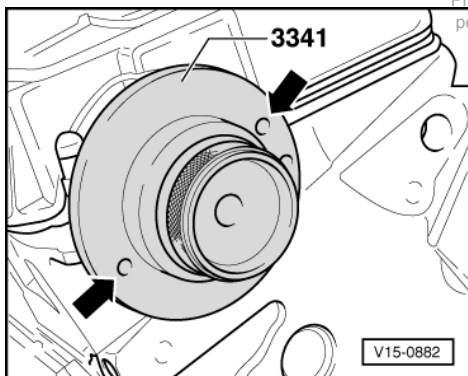
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- -> Loosen securing bolts for camshaft sprockets, using counterhold 3036.



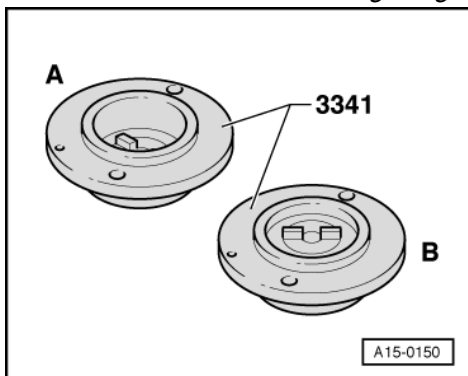
- -> Unscrew Hall vane switch -B- and housing -arrows- at cylinder head on left.



- -> Insert camshaft retainer 3341 at each cylinder head and secure.

Note:

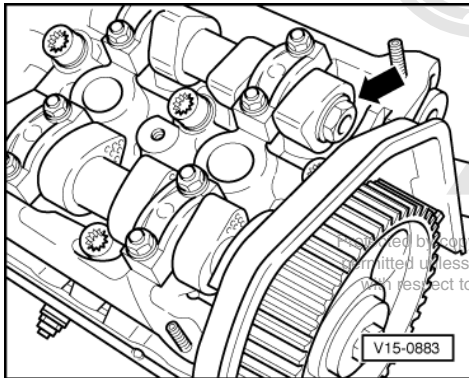
Do not use the camshaft locking flanges as holding tools.



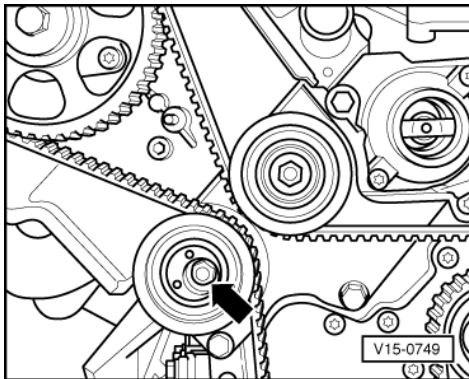


-> Camshaft locking flange -A- at cylinder bank 5 - 8.

Camshaft locking flange -B- at cylinder bank 1 - 4.



- -> To turn camshaft, remove cylinder head cover and turn at hexagon of camshaft.
- With toothed belt sprocket not yet loosened and toothed belt removed, use counterhold 3036 only to turn camshaft. Never turn at securing bolt for toothed belt sprocket.



- -> Loosen tensioning roller with eccentric and turn to lowest point with 2-hole pin wrench (e.g. Matra V/159).
- Squeeze together damper for toothed-belt tensioner by hand and pull off tensioner.

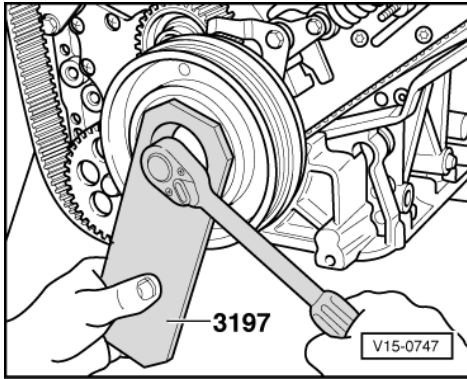
Note:

Mark running direction of toothed belt with felt-tip pen or wax marker. Running the belt in opposite direction can lead to damage.

- Remove toothed belt from camshaft sprockets.
- Tap gently on rim of camshaft sprockets with plastic-headed hammer to release tapered connections.
- Unscrew four vibration damper/toothed belt sprocket connecting bolts.
- Unscrew central bolt.
- Remove vibration damper; do not pull gear wheel off crankshaft.
- Take off toothed belt.

Installing and tensioning

- Place toothed belt on crankshaft toothed-belt sprocket.
- Fit vibration damper at crankshaft.
- Screw in and hand-tighten the four vibration damper/toothed belt sprocket connecting bolts.



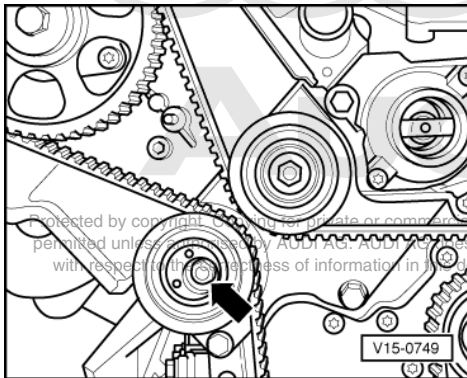
Note:

Replace central bolt.

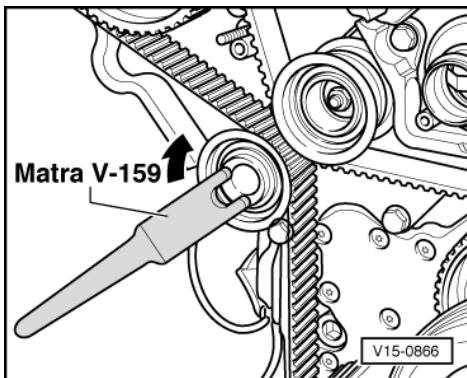
- Install central bolt using sealant

=> Parts List

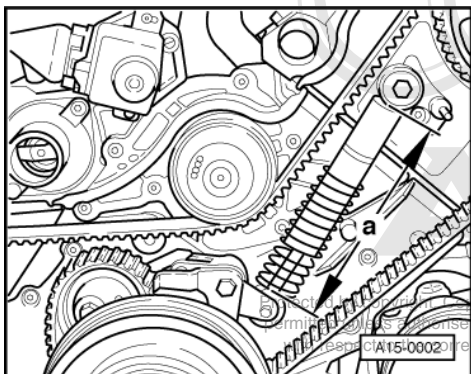
- -> Screw in and hand-tighten central bolt using counterhold 3197.
- Fit camshaft sprockets; the sprockets should be loose on the taper of the camshaft. The securing bolts are slackened approx. one turn.



- Position toothed belt on all toothed belt sprockets and pulleys, as well as water pump impeller. Belt routing =>Page 32 .
- -> Push on toothed belt with tensioning roller and eccentric insert at threaded pin and tighten nut so that eccentric insert can just be turned.
- Tighten the four toothed belt sprocket/vibration damper securing bolts.
Tightening torque 25 Nm.



- -> For basic setting of toothed-belt tensioner, turn eccentric insert of tensioning roller in clockwise direction using commercially available 2-hole pin wrench (e.g. Matra V/159) until ...

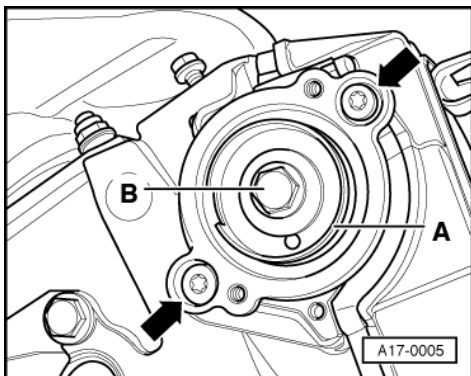


- -> ... damper length -a- is obtained.

Damper length -a-

When cold	136 -139 mm
When warm	126 -129 mm

- Secure tensioner 25 Nm.
- Secure camshaft sprockets (55 Nm) making use of holding tool 3036.
- Remove camshaft locking flanges.



- -> Install housing behind Hall sender -arrows-.
(10 Nm)
- Hall vane switch -A- must engage with locking lug in camshaft -B- 20 Nm.
- Turn engine by at least two turns.
- Secure central bolt (bolt must always be replaced).

Tightening torque

with special tool 2079	350 Nm
without special tool 2079	450 Nm

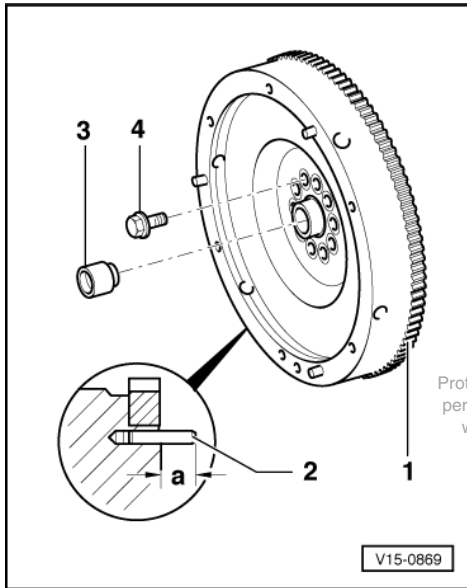
- Check and, if necessary, adjust damper length.
- Perform further installation of toothed belt in reverse order of removal.

2 - Dismantling and assembling engine

2.1 - Dismantling and assembling engine

Important
Repairs must not be carried out on the crank assembly.

2.2 - Servicing flywheel



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1 - Starter ring gear

- ◆ Heat to 200 °C before installing.

2 - Straight pin for TDC sender

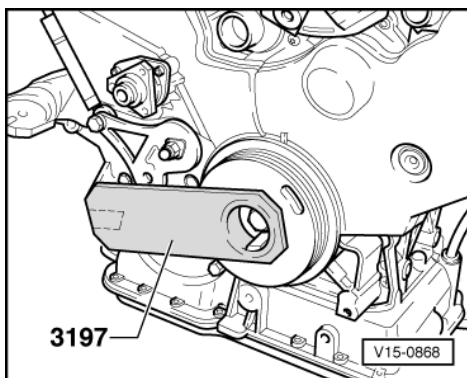
- ◆ Installation dimension 21 mm

3 - Needle bearing bush

- ◆ Removing and installing => Page 42

4 - Bolt for flywheel

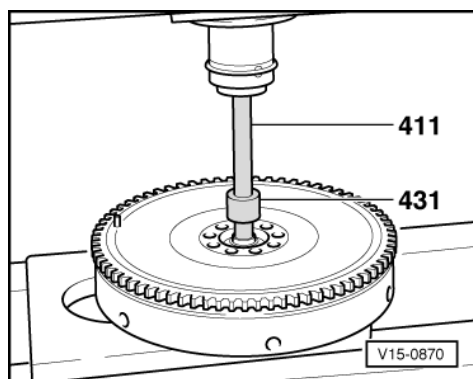
- ◆ Always replace
- ◆ Without dual-mass flywheel (60 Nm) and turn + 90° further
- ◆ With dual-mass flywheel
- Bolt length 22.5 mm
60 Nm and turn 90° further
- Bolt length 43 mm
60 Nm and turn +180° further



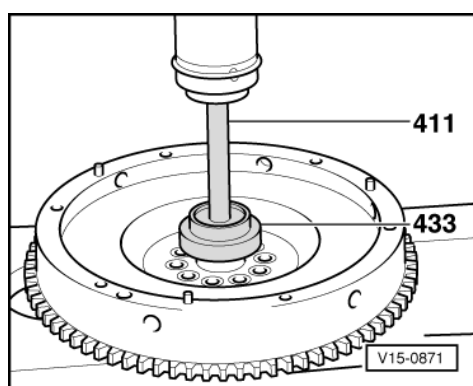
- -> Loosen flywheel bolts using counterhold tool 3197.
- Install in reverse order.



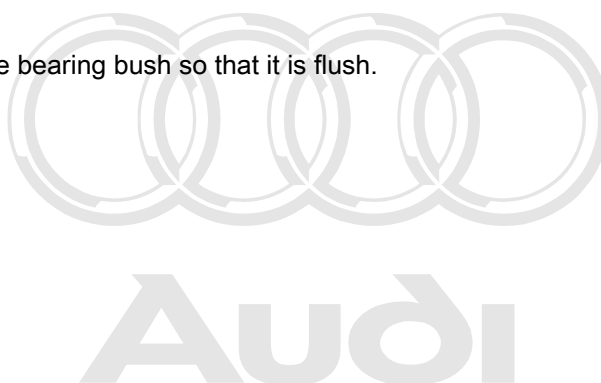
2.3 - Removing and installing needle bearing bush



- -> Press out needle bearing bush using VW 411 and VW 431.

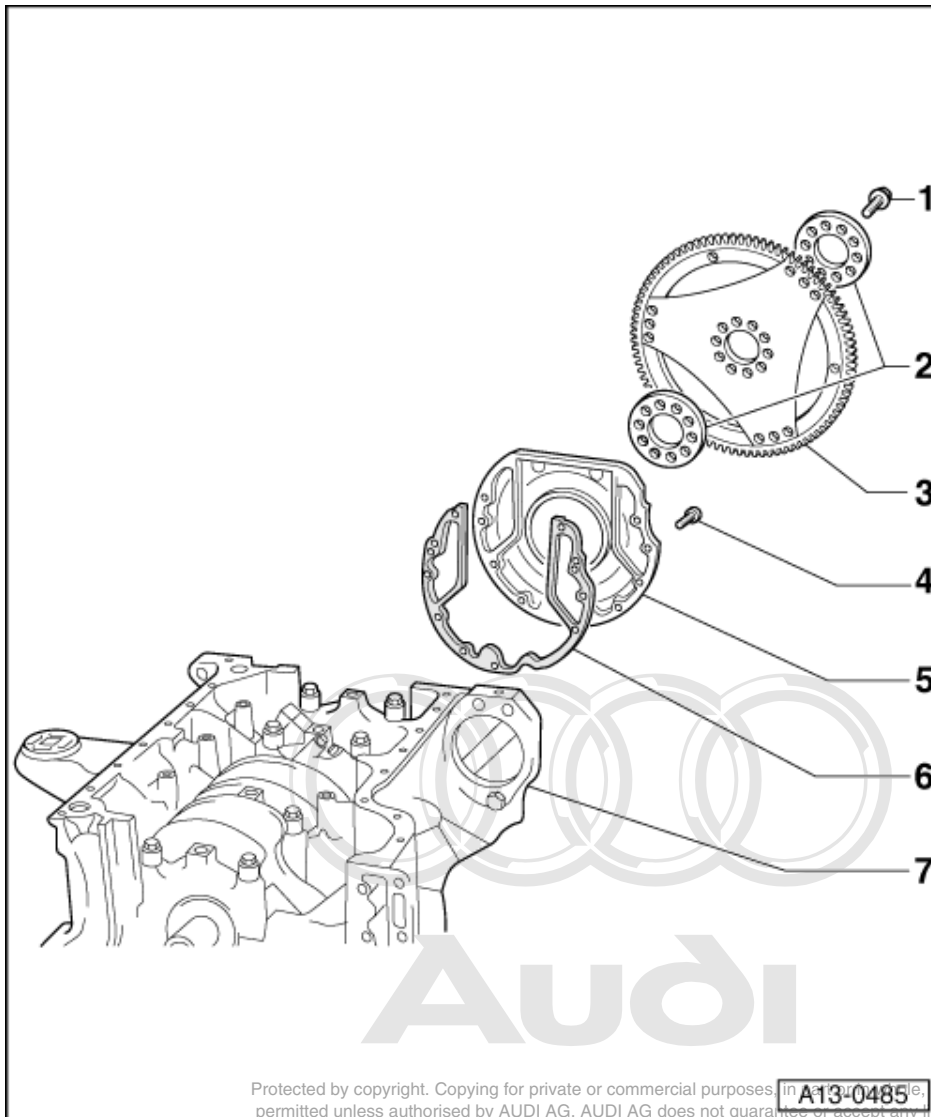


- -> Use VW 411 and VW 433 to press in needle bearing bush so that it is flush.



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2.4 - Drive plate



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1 60 Nm + 90° further turn

- ♦ Install using locking fluid

=> Parts List

- ♦ Always replace

2 Washer

3 Drive plate

- ♦ On assembly, make sure drive plate has been fitted with pin for ignition point
- ♦ Pin length 20 to 22 mm from drive plate

4 10 Nm

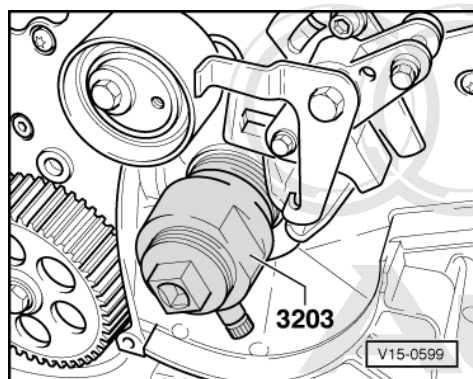
5 Rear sealing flange with oil seal

6 Gasket

7 Engine block



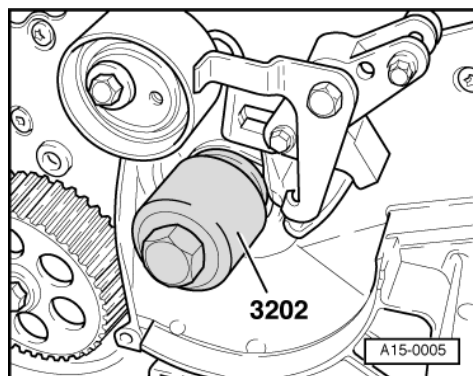
2.5 - Replacing crankshaft seal



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Toothed belt side

- Remove toothed belt => Page 32 .
- Remove vibration damper.
- -> Pull out sealing ring with sealing ring puller 3203.

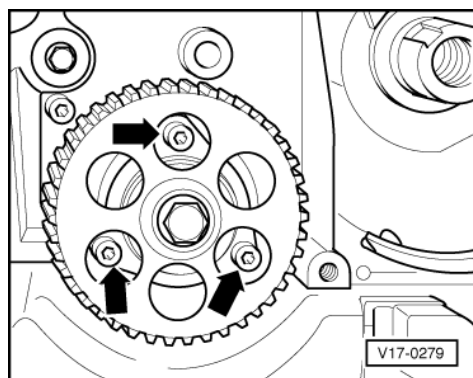


- Position seal over fitting tool from 3202.
- -> Press sealing ring in flush with insertion sleeve 3202 and securing bolt of vibration damper.

Note:

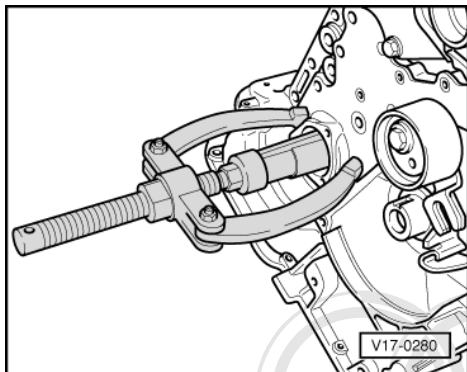
Press in seal as far as it will go if crankshaft reveals running-in marks.

2.6 - Replacing seal for oil pump drive

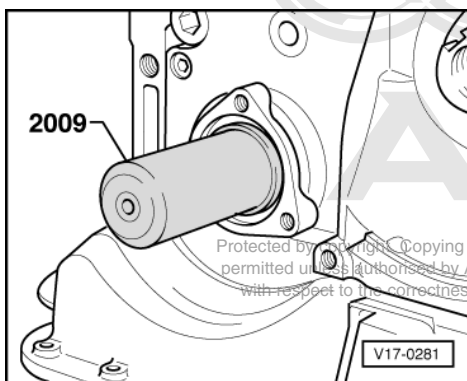


Removing

- Remove toothed belt => Page 32 .
- Remove vibration damper.
- -> Remove oil pump drive.



- -> Use commercially available extractor to pull out oil pump seal, e.g. Kukko No. 21/6, 37-46 mm into seal. Hand-tighten and carefully pull out with extractor Kukko 22-2.



- -> Drive in sealing ring with fitting sleeve 2009. Prior to assembly, make sure bearing of oil pump drive is running smoothly. If not: Replace oil pump drive.

Installing

- Install the oil pump drive.
- Install toothed belt =>Page 38 .

Tightening torque

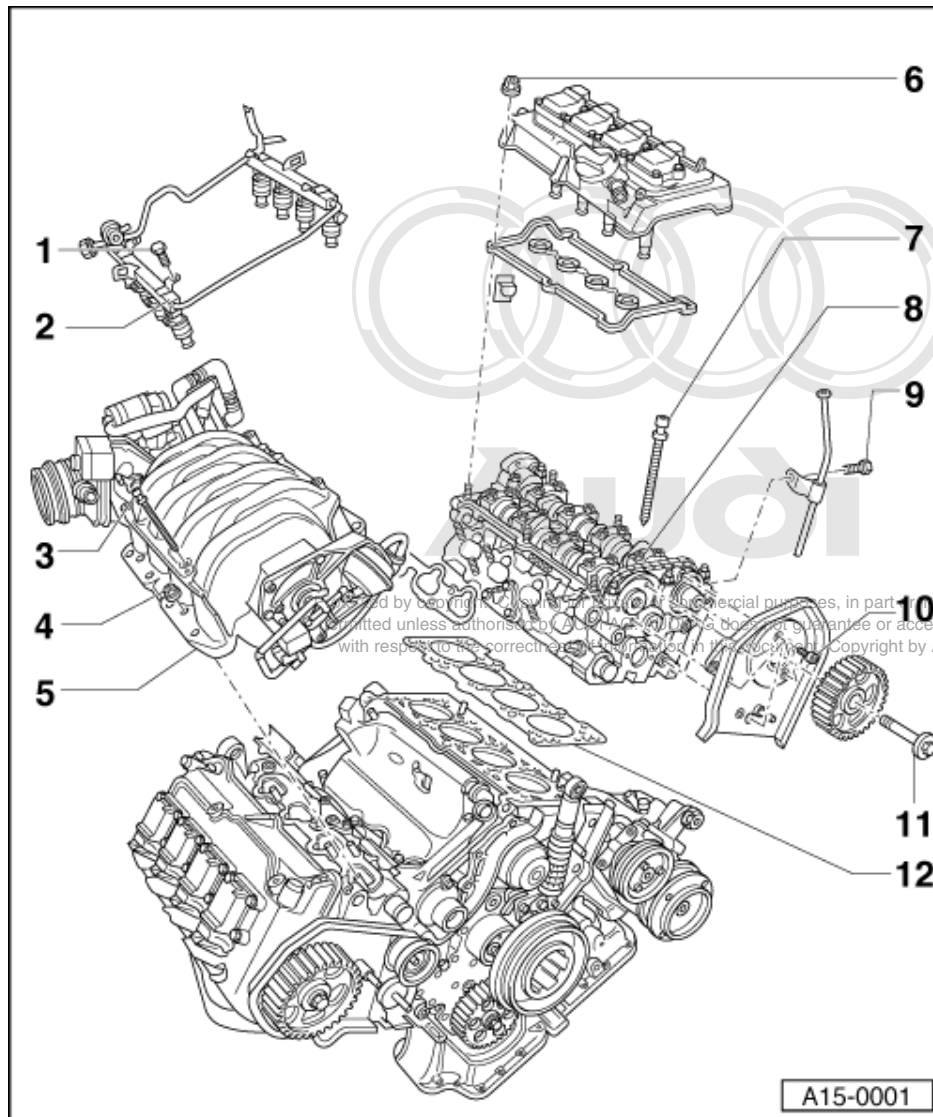
Component	Nm
Drive for oil pump	10



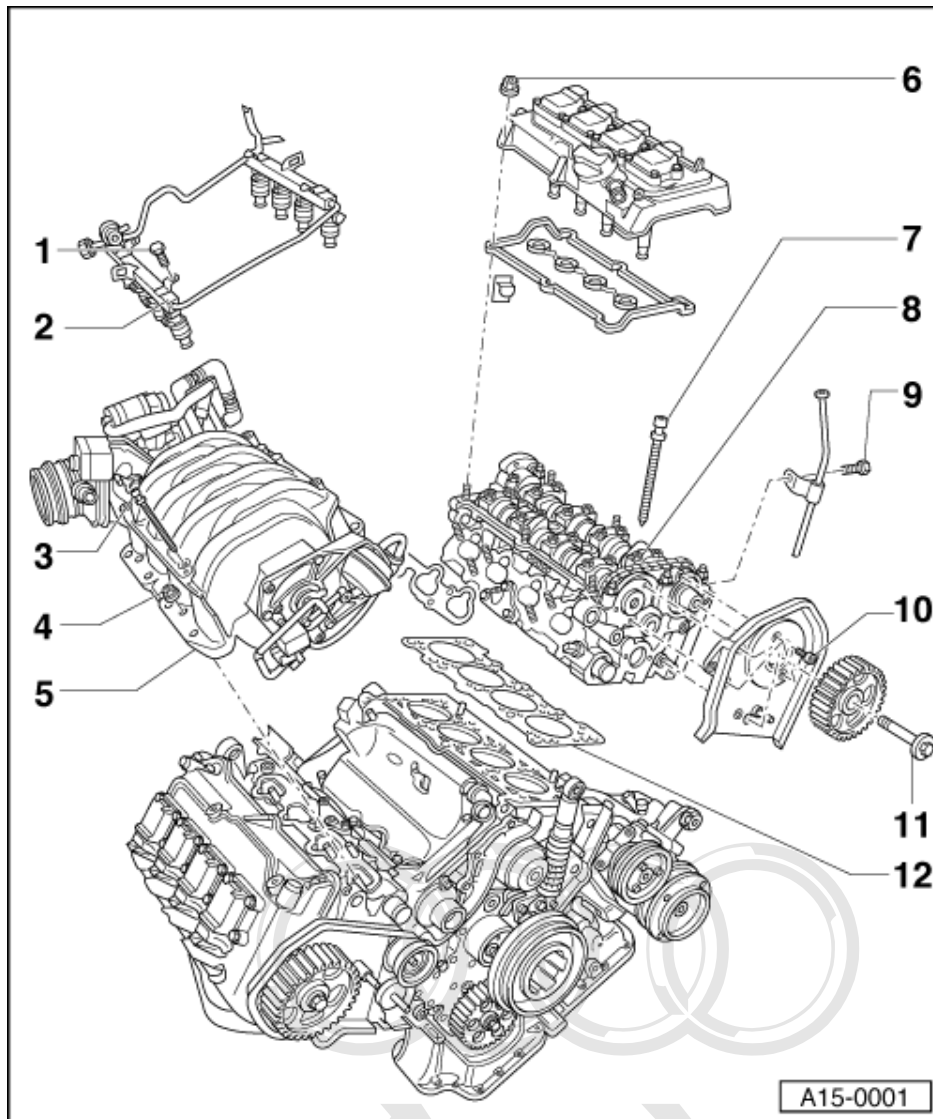
15 - Cylinder head, Valve gear

1 - Removing and installing cylinder head

1.1 - Removing and installing cylinder head



- 1 10 Nm
- 2 Fuel manifold
- 3 20 Nm
- 4 20 Nm
- 5 Intake manifold
- 6 10 Nm
- 7 Cylinder head bolts
 - ♦ Replace
 - ♦ Tightening method =>Page 51



8 Cylinder head

- ♦ Check for distortion =>Page 50
- ♦ Reworking dimension =>Page 50.

9 10 Nm

10 10 Nm

11 55 Nm

- ♦ Use holding tool 3036

12 Cylinder head gasket

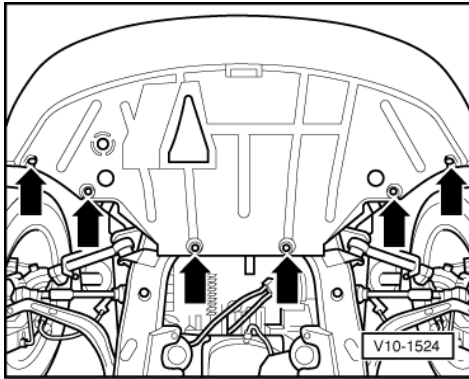
- ♦ Identification: Lettering must face upwards.

Removing

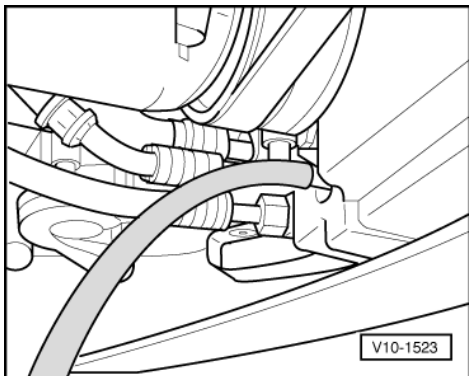
with engine in situ

Notes:

- ♦ Ask customer for radio anti-theft code.
- ♦ Battery is located on right of luggage compartment under the cover.
- ♦ With the ignition switched off disconnect the battery earth strap.



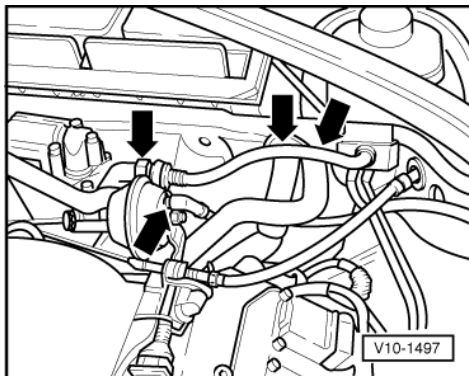
- ♦ All cable ties which are released or cut open when removing must be fitted in the same position when installing.
- ♦ Renew all gaskets and seals.
- -> Remove noise insulation.
- Unscrew front exhaust pipe on left and right at exhaust manifold.
- Remove vent grille in bumper on left.



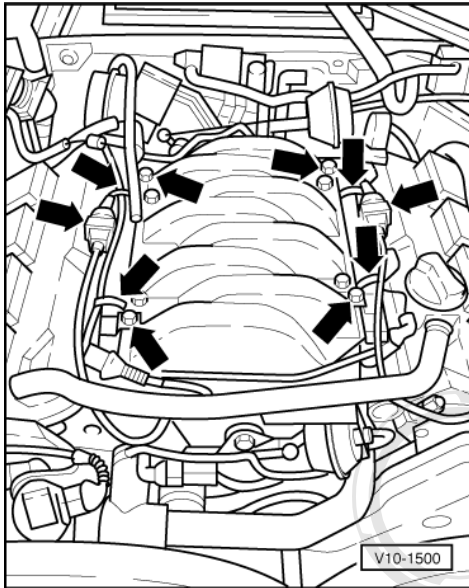
- -> Drain off coolant by attaching hose to drain cock.
- Removing and installing toothed belt => Page 32.



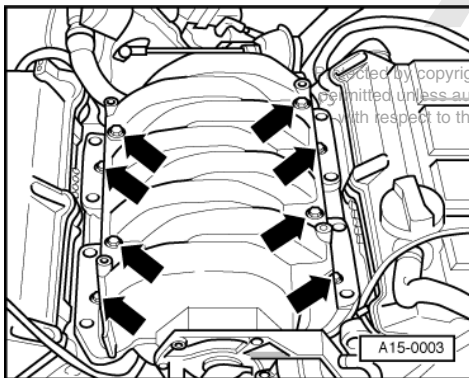
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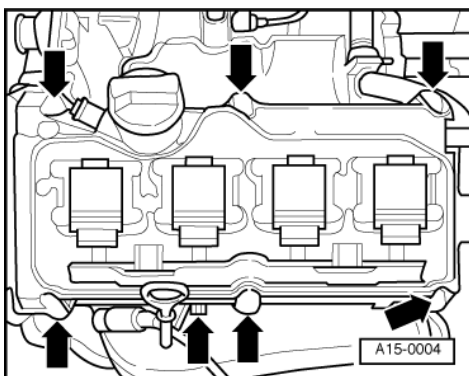
- -> Detach pipe to brake servo.
- Disconnect vacuum pipe at cruise control unit.
- Detach accelerator cable.
- Detach coolant pipe to heating (supply and return) at bleeder valves.



- -> Detach knock sensor connector on left and right of fuel manifold; cut the four cable ties.
- Pull off connectors at injectors.
- Unscrew fuel manifold and set aside carefully together with injectors.



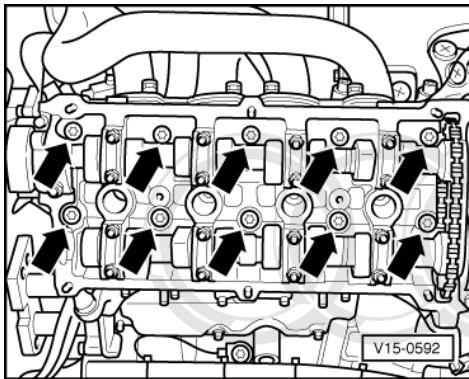
- -> Unscrew and lift out intake manifold.
- Unscrew top manifold/front pipe connection.
- Pull off connectors at ignition coils.
- Unscrew coolant pipe at rear between the two cylinder heads on left and right and pull out.



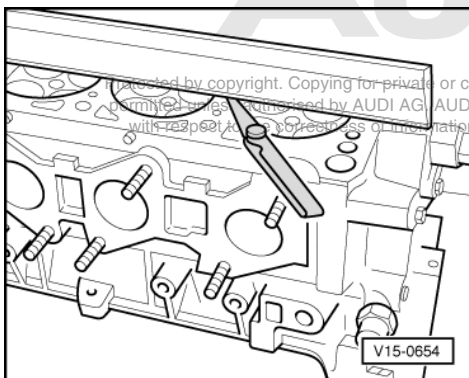
- -> Remove cylinder head covers.

Only when removing left cylinder head:

- Unscrew and pull out guide tube for dipstick.

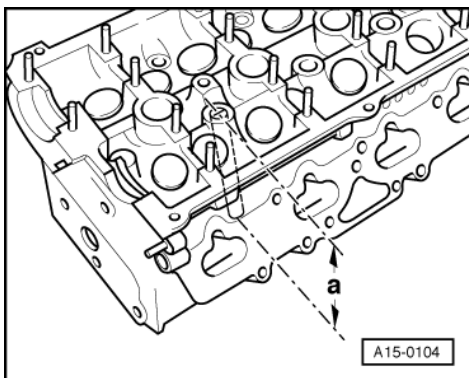


- ➔ Loosen cylinder head bolts. This is to be done in the reverse order of tightening => Page 51.
- Remove cylinder head and place on a soft surface.



➔ Checking cylinder head for distortion

- Measure at several points with bevelled rule.
Distortion: no more than 0.1 mm



➔ Reworking cylinder head

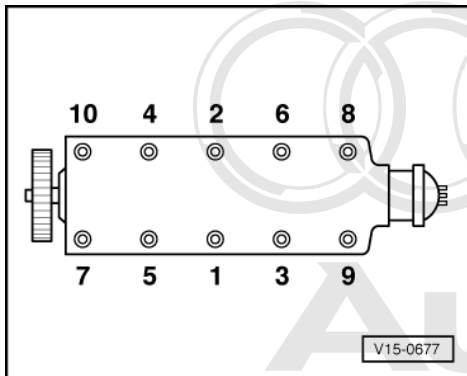
- Reworking of cylinder head (face grinding) is only permitted to minimum dimension $a = 139.25$ mm.

Installing

- Clean sealing surfaces.
- Cylinder head gasket: Mark "top" must face cylinder head.
- Fit cylinder head, paying attention to centring pins in cylinder block.
- Always replace cylinder head bolts.

- Insert cylinder head bolts and tighten by hand.

Cylinder head tightening method



- -> Sequence-see illustration

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Tightening torque (engine cold)

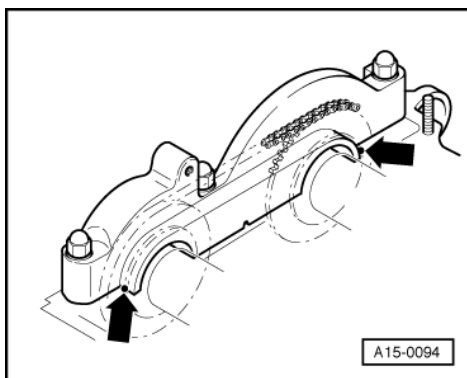
1st Stage	40 Nm
2nd Stage	60 Nm
3rd Stage	1/2 turn (180°)

- Continue tightening in one operation using fixed wrench, 2 x 90° further turning is permitted.

Notes:

- ◆ Cylinder head bolts do not have to be retightened when performing standard service or following repairs.
- ◆ Before installing intake manifold, first attach front breather hose beneath intake manifold to engine.
- ◆ Installing cylinder head covers => Page **51**.

1.2 - Installing cylinder head bolts



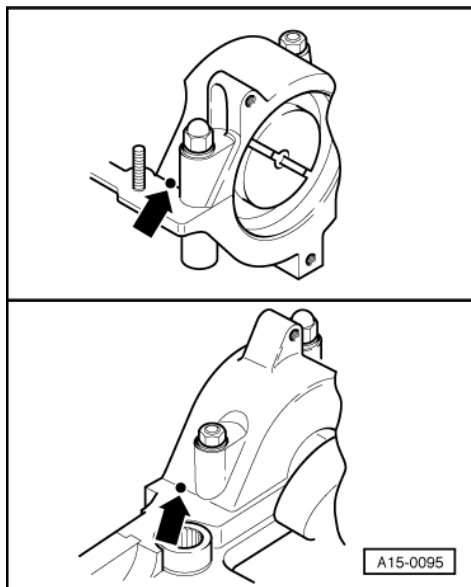
Note:

Before fitting, coat inside and outside of gasket for cylinder head cover with small quantity of silicone lubricant.

- ◆ Lubricant

=> Parts List

- -> Use a small screwdriver to carefully apply sealant to the two edges -arrows- at the sealing surfaces of the cylinder head opposite the timing chain end.



◆ Sealants

=> Parts List

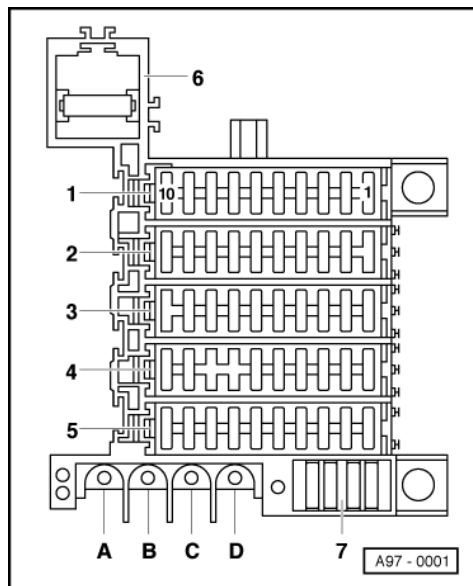
- -> Use a small screwdriver to carefully apply sealant to the two edges -arrows- at the sealing surfaces of the cylinder head on the timing chain end.

◆ Sealants

=> Parts List

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1.3 - Checking compression



Test requirements

- Engine oil temperature at least 30 °C

- Throttle valve fully open.
- -> Remove fuse 1 in fuse carrier 4 (at A pillar on right); fit fuse again on completion of test.
- Test compression pressure using compression pressure tracer V.A.G 1381 and adapter V.A.G 1381/5.

Note:

Refer to operating instructions for how to use tracer.

- Actuate starter until measuring instrument shows no further increase in pressure.

Compression pressure in bar over pressure		
Engine code letters	New	Wear limit
ABZ	10 - 15 bar	7.5 bar
AEW	10 - 15 bar	7.5 bar
AHC	14 bar	9 bar

- Permissible difference between all cylinders: 3 bar

2 - Servicing valve gear

2.1 - Servicing valve gear

Engine code ABZ up to engine number

-014 737 => Page **53**

Engine code ABZ as of engine number

-014 738=> Page **55**

Engine codes AKG, AEW and AKJ =>Page **55** .

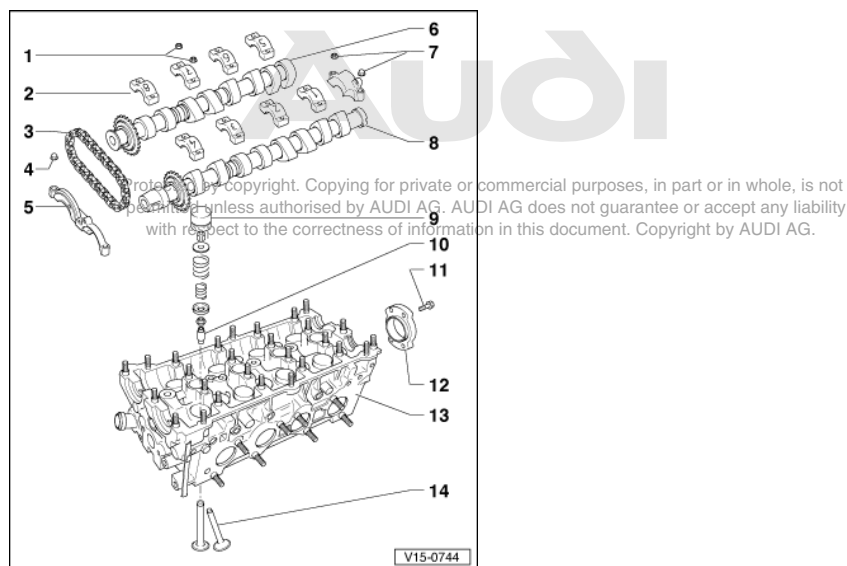
Engine codes AHC and AKH =>Page **58** .

Engine code ABZ up to engine number

-014 737

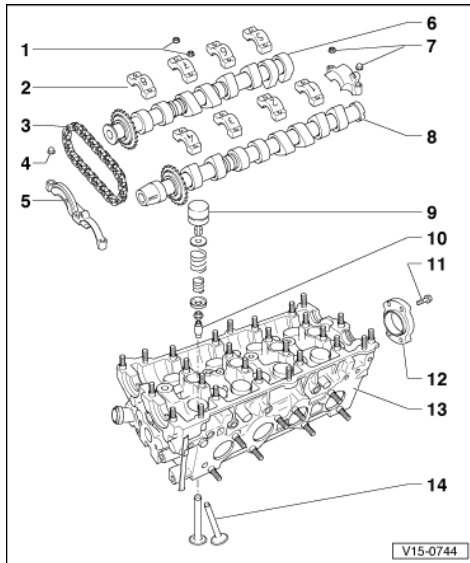
Notes:

- ◆ Cylinder heads with cracks between the valve seats or between a valve seat ring and the spark plug thread can still be used without any reduction in service life, provided that these are only incipient cracks not more than 0.3 mm in width or provided that only the first four turns of the spark plug thread are cracked.
- ◆ After installing new bucket tappets engine is not to be started for approx. 30 minutes (otherwise valves will strike pistons); then turn crankshaft twice.
- ◆ Check valve guides for wear => Page **68** .

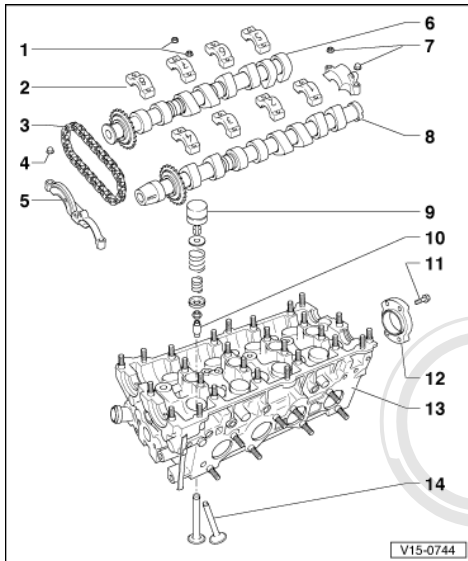




- 1 15 Nm
 - 2 Bearing cap
 - ♦ Installation position => Page 65
 - ♦ Installation sequence => Installing camshaft, Page 63
 - 3 Drive chain
 - 4 15 Nm
 - 5 Bearing cap in front of chain
 - 6 Inlet camshaft
 - ♦ Checking axial play => Page 65
 - ♦ Removing and installing => Page 63 .
 - ♦ Check radial play with Plastigage: Wear limit 0.1 mm
 - 7 15 Nm
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- 8 Exhaust camshaft
 - ♦ Check as for inlet camshaft
- 9 Hydraulic bucket tappets
 - ♦ Checking => Page 65 .
 - ♦ Lubricate bearing surface before installing
 - ♦ Set down with cam bearing surface facing downwards.
- 10 Valve guide
 - ♦ Checking for wear => Page 68 .
- 11 10 Nm
- 12 Flange
 - ♦ Replace shaft seal
- 13 Cylinder head
 - ♦ Rework valve seats => Page 70 .



14 Valves

- ◆ Checking=>Page **68**
- ◆ Exhaust valve is sodium-filled and cannot simply be scrapped.

Important

Worn sodium-filled exhaust valves cannot simply be scrapped. They must be cut in two with a metal saw between centre of stem and valve disc. They must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at a time). Then step back because a chemical reaction occurs when the sodium filling burns. Following such treatment, the parts can then be handled as normal scrap.

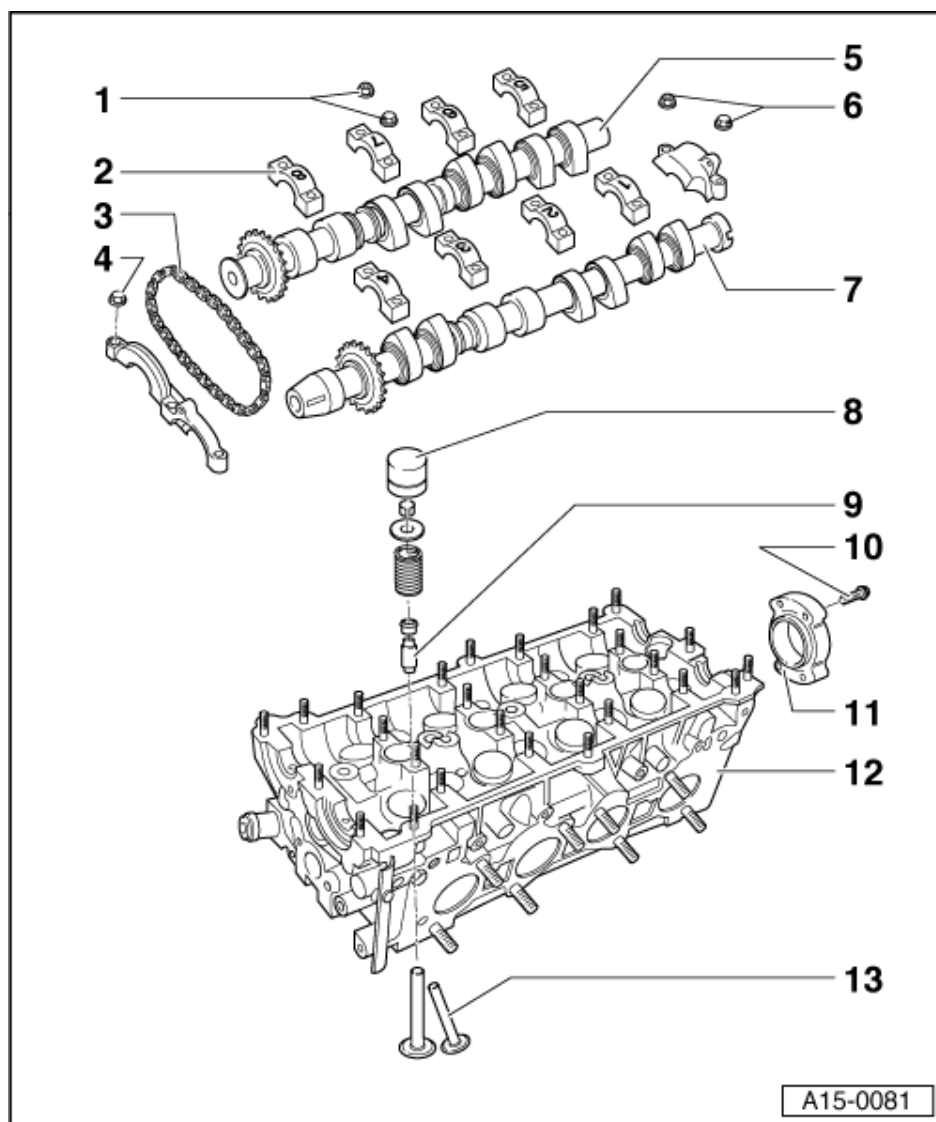
Engine code ABZ as of engine number

-014 738

Engine codes AKG, AEW and AKJ

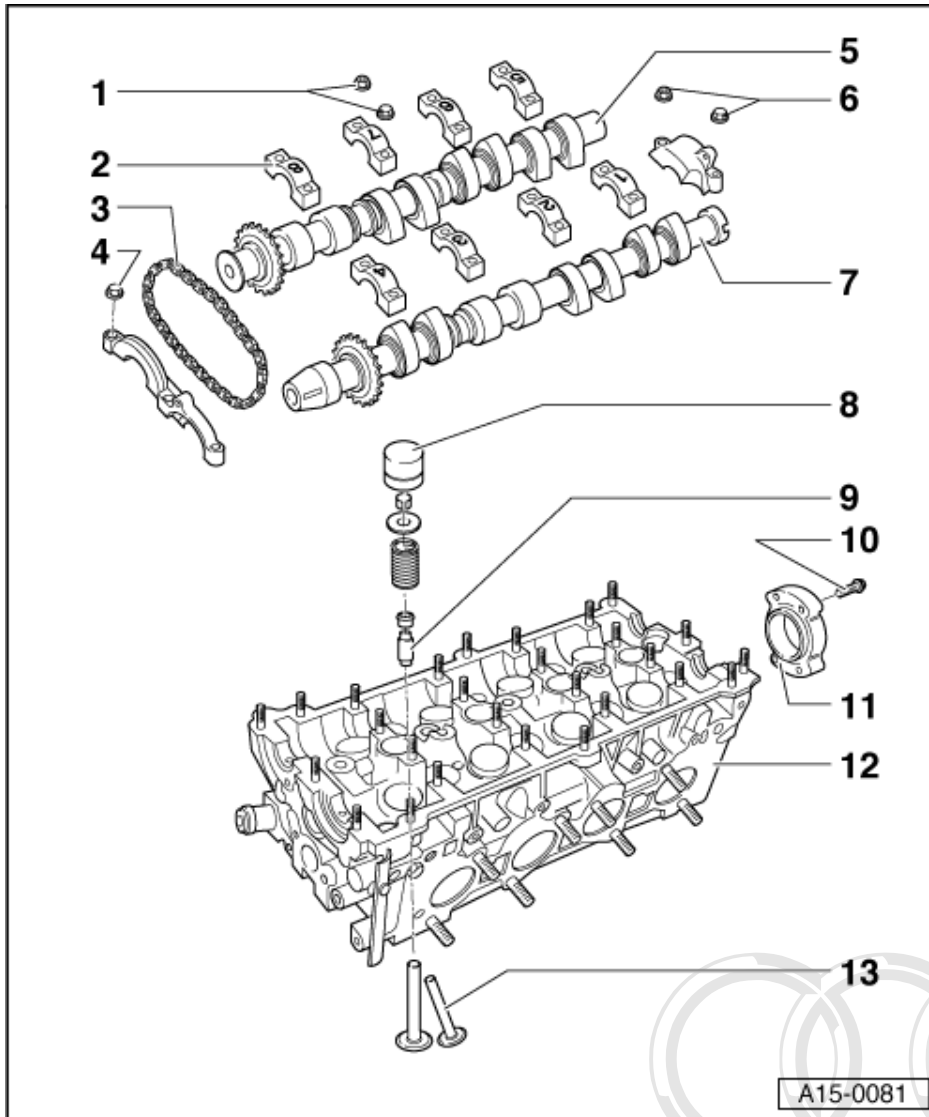
Notes:

- ◆ Cylinder heads with cracks between the valve seats or between a valve seat ring and the spark plug thread can still be used without any reduction in service life, provided that these are only incipient cracks not more than 0.3 mm in width or provided that only the first four turns of the spark plug thread are cracked.
- ◆ After installing new bucket tappets engine is not to be started for approx. 30 minutes (otherwise valves will strike pistons); then turn crankshaft twice.
- ◆ Check valve guides for wear => Page **68** .



- 1 15 Nm
- 2 Bearing cap
 - ♦ Installation position => Page 65
 - ♦ Installation sequence => Installing camshaft, Page 63
- 3 Drive chain
- 4 15 Nm
- 5 Inlet camshaft
 - ♦ Checking axial play => Page 65
 - ♦ Removing and installing => Page 63 .
 - ♦ Check radial play with Plastigage: Wear limit 0.1 mm
 - ♦ Runout 0.01 mm
- 6 15 Nm

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7 Exhaust camshaft

- ♦ Check as for inlet camshaft

8 Hydraulic bucket tappets

- ♦ Checking => Page 65 .
- ♦ Lubricate bearing surface before installing
- ♦ Set down with cam bearing surface facing downwards.

9 Valve guide

- ♦ Checking for wear =>Page 68 .

10 10 Nm

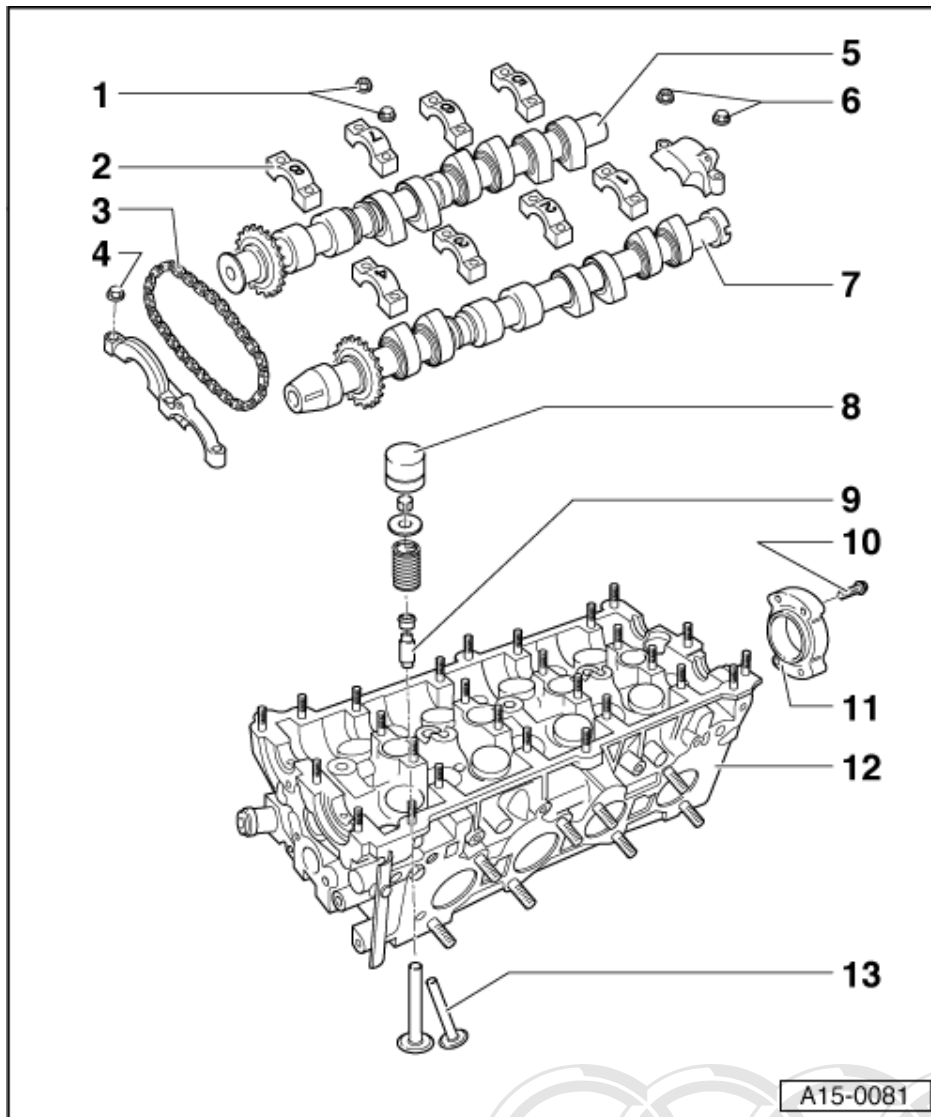
11 Flange

- ♦ Replace shaft seal

12 cylinder head

- ♦ Rework valve seats
=>Page 70 .

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**13 Valves**

- ♦ Checking=>Page 68
- ♦ Exhaust valve is sodium-filled and cannot simply be scrapped.

Important

Worn sodium-filled exhaust valves cannot simply be scrapped. They must be cut in two with a metal saw between centre of stem and valve disc. They must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at a time). Then step back because a chemical reaction occurs when the sodium filling burns. Following such treatment, the parts can then be handled as normal scrap.

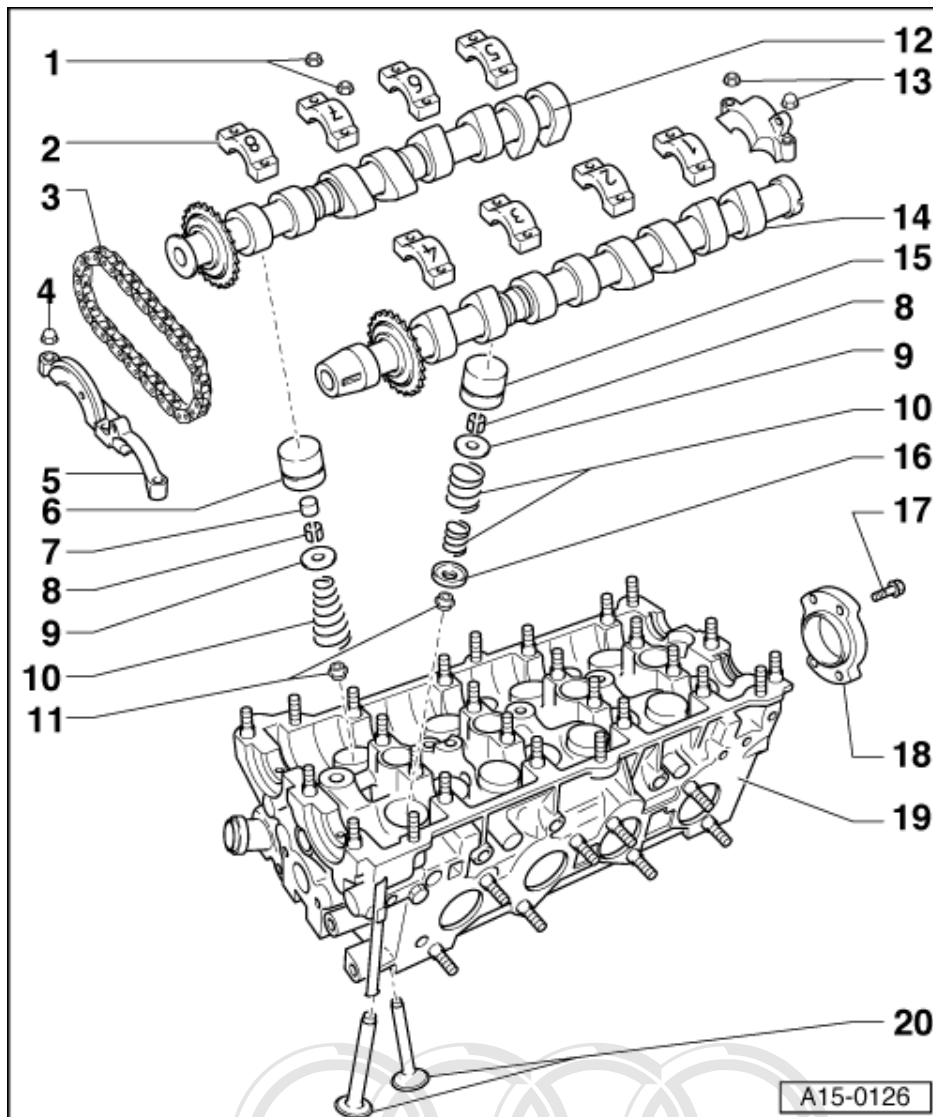
Servicing valve gear, engine codes AHC and AKH

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Notes:

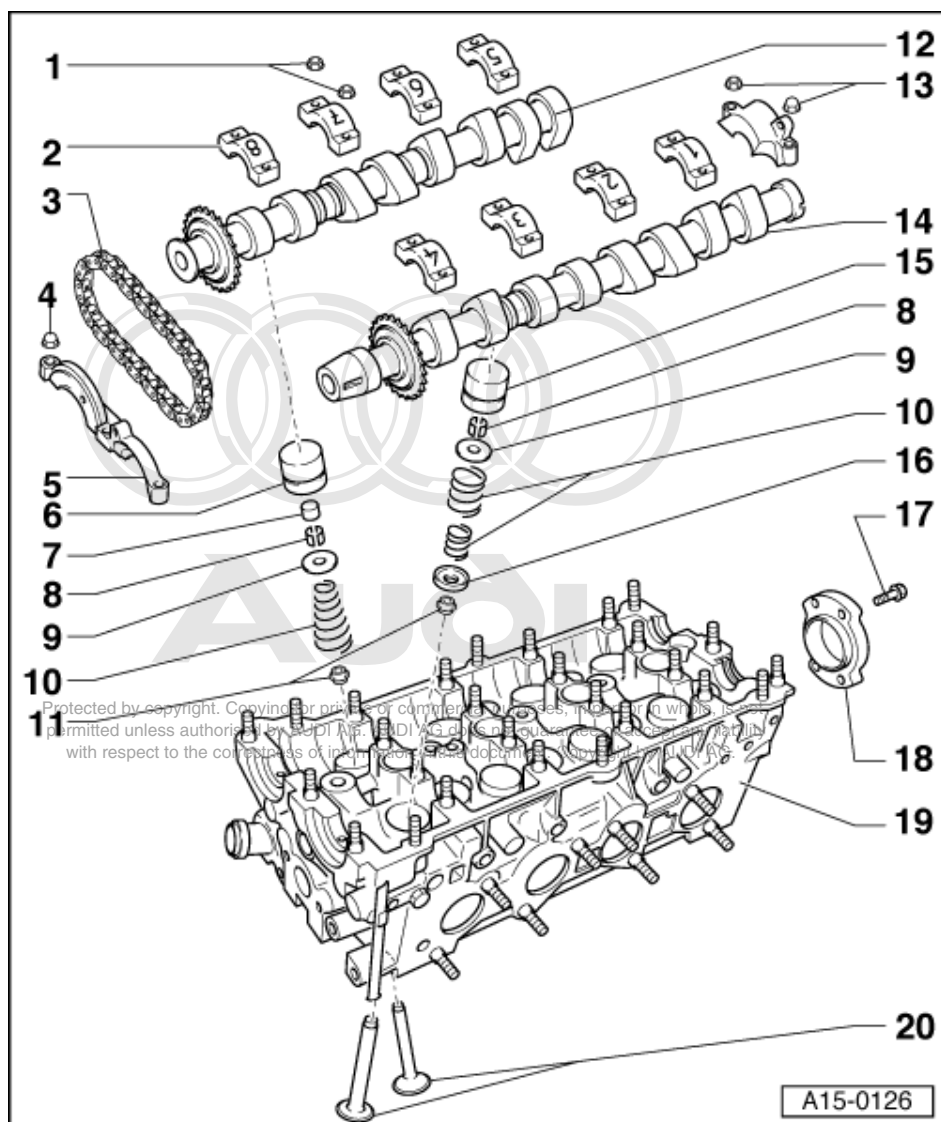
- ♦ Cylinder heads with cracks between the valve seats or between a valve seat ring and the spark plug thread can still be used without any reduction in service life, provided that these are only incipient cracks not more than 0.3 mm in width or provided that only the first four turns of the spark plug thread are cracked.
- ♦ After installing new bucket tappets engine is not to be started for approx. 30 minutes (otherwise valves will strike pistons); then turn crankshaft twice.

- ♦ Check valve guides for wear => Page 68 .



- 1 15 Nm
- 2 Bearing cap
 - ♦ Installation position =>Page 65
 - ♦ Installation sequence => Installing camshaft, Page 63
- 3 Drive chain
- 4 15 Nm
- 5 Bearing cap in front of chain
- 6 Tappet
- 7 Compensating element
- 8 Cotter
- 9 Upper valve spring bracket

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**10 Valve springs****11 Valve stem seal**

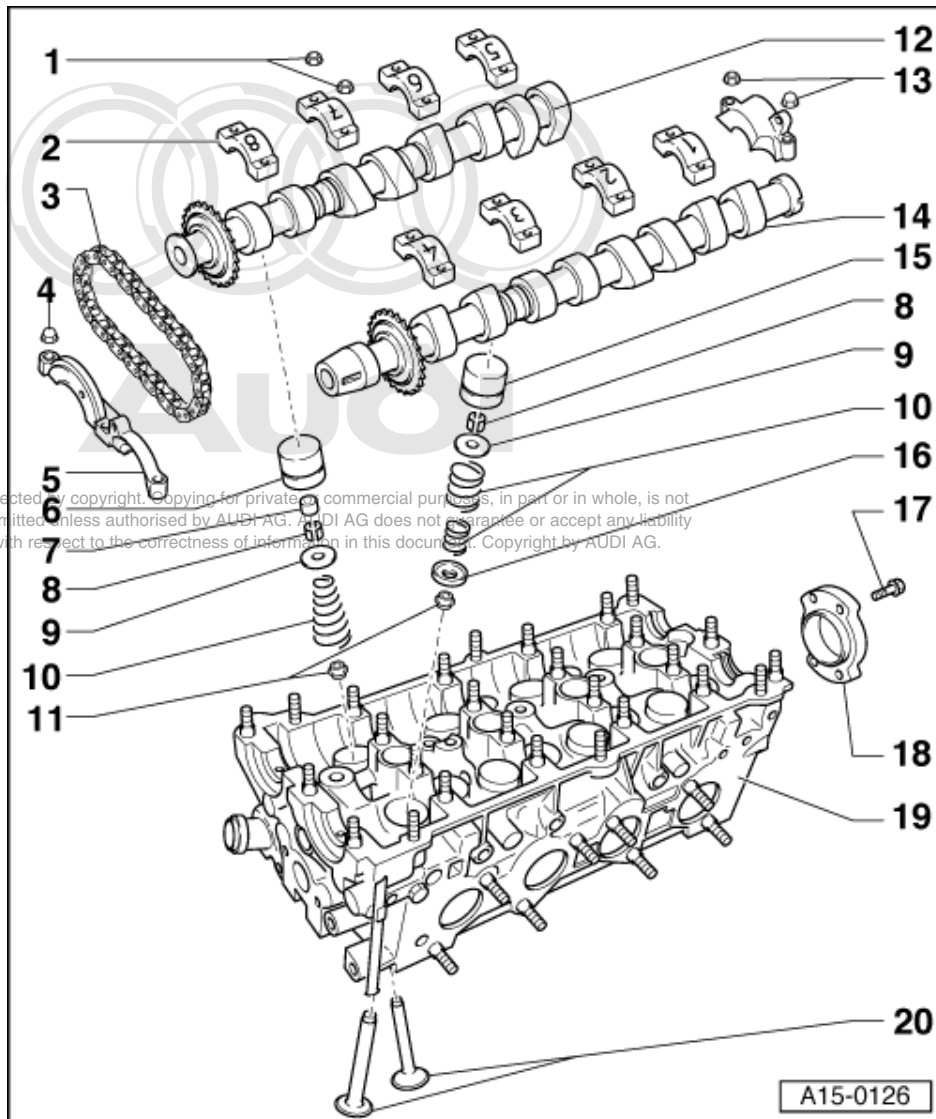
- ♦ Replacing => Page 66 .

12 Inlet camshaft

- ♦ Checking axial play => Page 65
- ♦ Removing and installing => Page 63 .
- ♦ Check radial play with Plastigage: Wear limit 0.1 mm
- ♦ Runout 0.01 mm

13 15 Nm**14 Exhaust camshaft**

- ♦ Check as for inlet camshaft



15 Hydraulic bucket tappets

- ♦ Checking => Page 65.
- ♦ Lubricate bearing surface before installing
- ♦ Set down with cam bearing surface facing downwards.

16 Lower valve spring retainer

- ♦ Exhaust side only

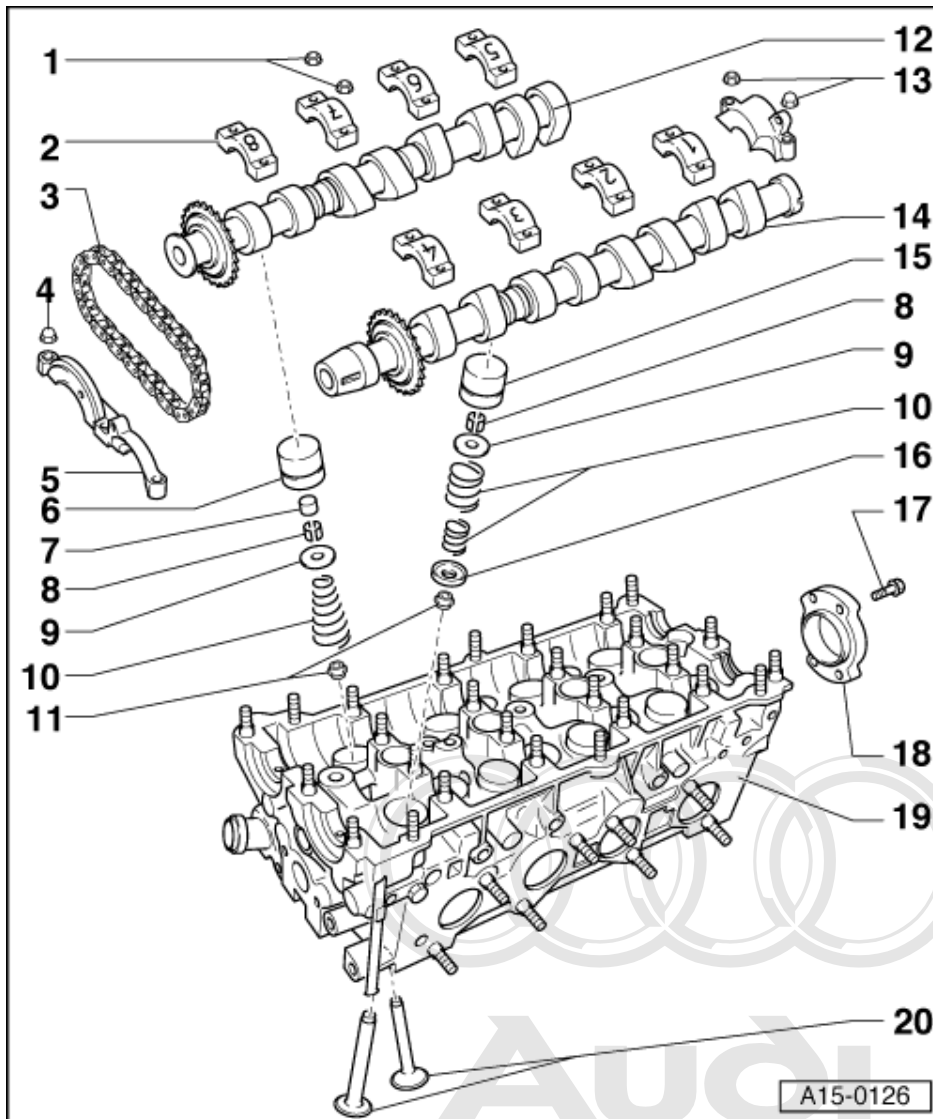
17 10 Nm

18 Flange

- ♦ Replace shaft seal

19 Cylinder head

- ♦ Rework valve seats
=>Page 70.

**20 Valves**

- ♦ Adjusting, inlet side only => Page 62
- ♦ Checking=>Page 68
- ♦ Exhaust valve is sodium-filled and cannot simply be scrapped.

Important

Worn sodium-filled exhaust valves cannot simply be scrapped. They must be cut in two with a metal saw between centre of stem and valve disc. They must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at a time). Then step back because a chemical reaction occurs when the sodium filling burns. Following such treatment, the parts can then be handled as normal scrap.

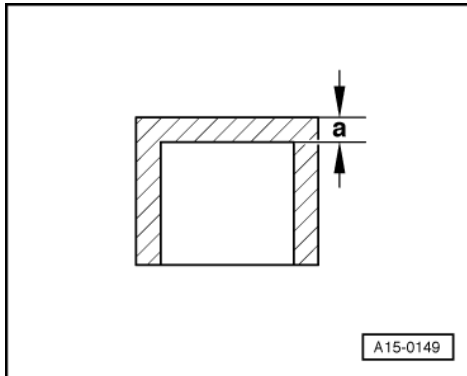
Adjusting valve clearance**Note:**

Valve clearance only has to be checked/adjusted following valve gear repairs and can only be adjusted at the inlet camshaft.

- Turn crankshaft until cam pair of inlet camshaft of cylinder to be adjusted is facing upwards.
- Check valve clearance between camshaft and tappet.

Setting dimension 0.10 ... 0.20 mm

- Note down test values of valves which are outside setting dimension tolerance.
- Removing camshafts => Page 63 .
- Remove tappet.



- -> Remove compensating element from valve stem and measure using commercially available micrometer caliper with offset measuring faces \varnothing max. 6 mm.
- Replace compensating element by one to match the difference measured.

Example:	
Measured setting dimension	0.30 mm
Prescribed setting dimension	-0.15 mm
Difference	0.15 mm

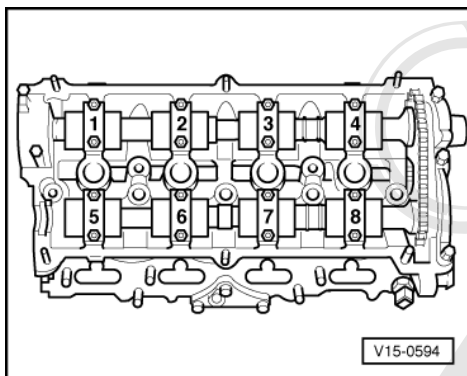
0.15 mm thicker compensating element must be fitted.

2.2 - Removing and installing camshafts

Removing

- Remove toothed belt => Page 32 .
- Remove cylinder head cover.
- Remove camshaft sprocket.

Outlet camshaft:



- -> Unscrew intermediate flange and ignition distributor bearing cap. Remove bearing cap in front of chain as well as bearing caps 2 and 3.
- Loosen bearing caps 1 and 4 alternately and diagonally.

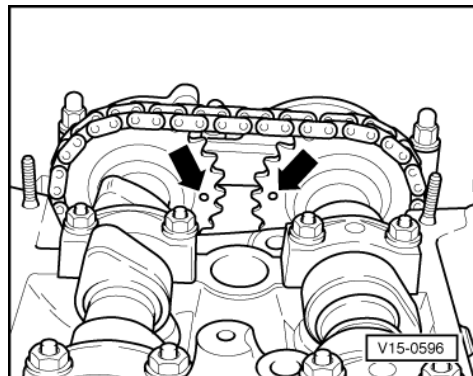
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Inlet camshaft:

- Remove bearing caps 6 and 7.
- Loosen bearing caps 5 and 8 alternately and diagonally.

Installing



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- -> Install camshafts with chain such that marks on chain sprockets align -arrows-.

Notes:

- ♦ When installing the bearing cap, ensure that numbers stamped on are legible from intake end.
- ♦ Before fitting, apply thin coat of sealant to the contact surfaces of the two outer bearing caps.

- ♦ Sealants

=> Parts List

Inlet camshaft:

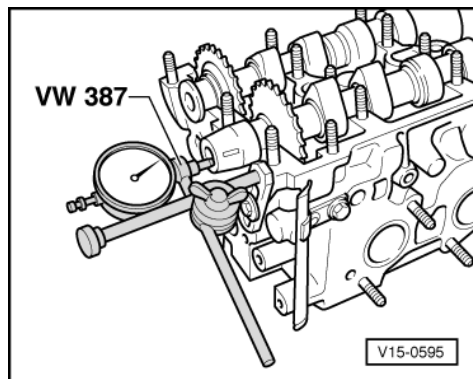
- Secure bearing caps 5 and 8 alternately and diagonally.

Outlet camshaft:

- Secure bearing caps 1 and 4 alternately and diagonally.
- Install other bearing caps.

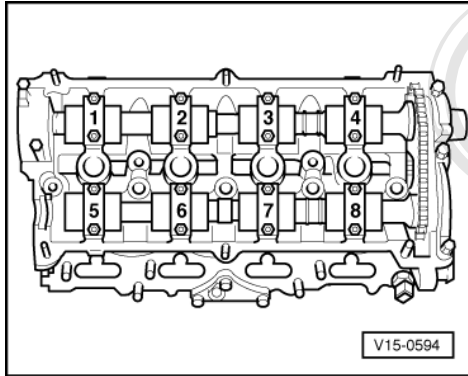
Tightening torque

Tightening torque bearing cap 15 Nm.



-> Checking camshaft axial clearance

- Wear limit: 0.15 mm
- Take measurements with bucket tappets removed and first and last bearing caps fitted.



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-> Fitting location of camshaft bearing caps

- The numbers on the bearing caps must be legible from the intake end.

Checking hydraulic bucket tappets

Notes:

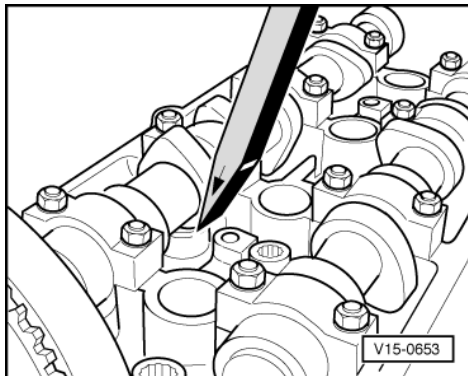
- ◆ After installing new bucket tappets engine is not to be started for roughly 30 minutes (otherwise valves will strike pistons).
 - ◆ Set down removed bucket tappets on a clean surface with bearing surface (camshaft side) facing downwards.
 - ◆ Bucket tappets cannot be adjusted.
 - ◆ After working on valve gear, carefully turn engine at least twice to stop valve striking when starting.
 - ◆ Irregular valve noise during starting is normal.
- Start engine and run until the radiator fan has switched on once.
 - Increase engine speed for 2 minutes to approx. 2500 rpm.

Note:

If irregular valve noise disappears but is repeatedly encountered when travelling short distances, replace oil retention valves => Page 17-12.

If hydraulic bucket tappets are still loud determine the defective tappets as follows:

- Remove cylinder head cover.
- Turn crankshaft in clockwise direction until cam of bucket tappet to be tested is at top.





- -> Press bucket tappet down using wood or plastic wedge. Replace tappet if it is possible to insert a 0.20 mm feeler gauge between camshaft and bucket tappet.

Note:

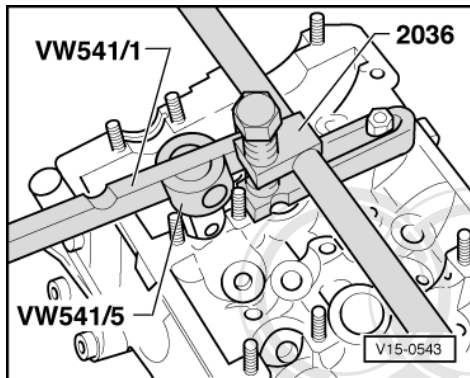
After installing new bucket tappets engine is not to be started for roughly 30 minutes (otherwise valves will strike pistons).

2.3 - Renewing valve stem seals

(with cylinder head in situ)

- Removing camshafts and bucket tappets => Page 63 .
- Unscrew spark plugs.
- Set piston of respective cylinder to BDC.
- Screw pressure hose VW 653/3 with seal into spark plug thread so as to be hand-tight and apply constant pressure (min 6 bar over pressure).

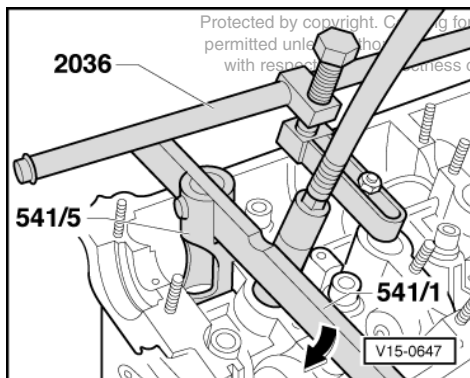
Inlet side:



- -> Insert assembly device 2036 and set bearing to stud height.
- Use assembly lever VW 541/1 and thrust pad VW 541/5 to remove valve spring.

Note:

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



Exhaust side:

- -> Insert assembly device 2036 and set bearing to stud height.
- Use assembly lever VW 541/1 and thrust pad VW 541/5 to remove valve spring.

Note:

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

Engine code ABZ up to engine number

-014 737 => Page **67** .

Engine code ABZ as of engine number

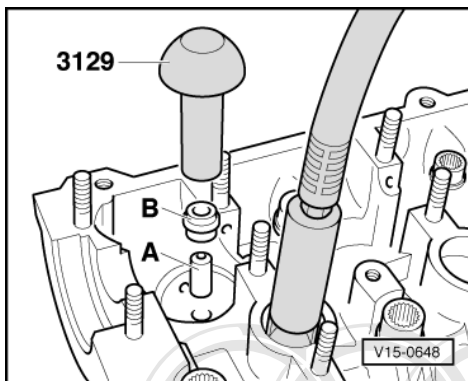
-014 738 => Page **67** .

Engine codes AKG, AEW and AKJ =>Page **67** .

Engine codes AHC and AKH =>Page **67** .

Engine code ABZ up to engine number

-014 737



- Use 3047 A to remove valve stem seals.
- -> Install valve stem seals. Attach plastic sleeve -A- to valve stem. Lubricate valve stem seal -B- insert in pressing-on tool 3129 and slip carefully onto valve guide.

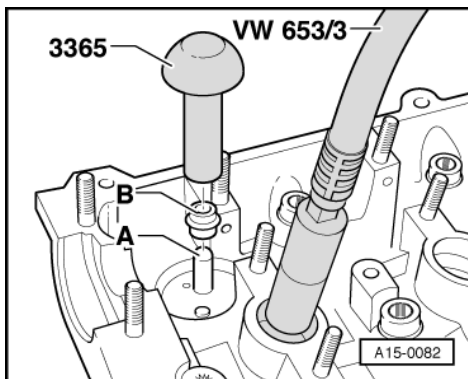
Note:

Always make use of plastic sleeve when installing valve stem seals so as to avoid damage.

Engine code ABZ as of engine number

-014 738

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- Use 3364 to remove valve stem seals.
- -> Install valve stem seals. Attach plastic sleeve -A- to valve stem.
- Lubricate valve stem seals -B-, insert in pressing-on tool 3365 and slip carefully onto valve guide.

Note:

Always make use of plastic sleeve when installing valve stem seals so as to avoid damage.

Checking valves

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

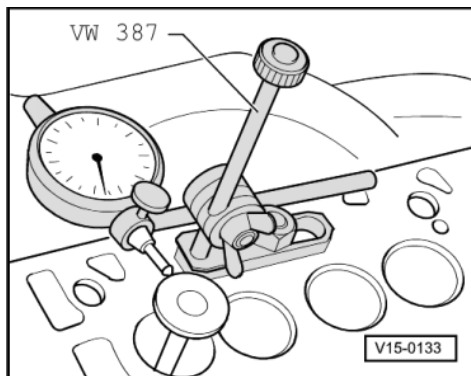
Important

Worn sodium-filled exhaust valves cannot simply be scrapped. They must be cut in two with a metal saw between centre of stem and valve disc. They must not come into contact with water when this is done. Then throw the valves into a bucket of water (not more than ten at a time). Then step back because a chemical reaction occurs when the sodium filling burns. Following such treatment, the parts can then be handled as normal scrap.

2.4 - Checking valve guides

Check valve guide

When repairing engines with leaking valves, it is not sufficient to reface the valve seats and renew the valves. The valve guide must also be checked for wear. This is particularly important on high-mileage engines.



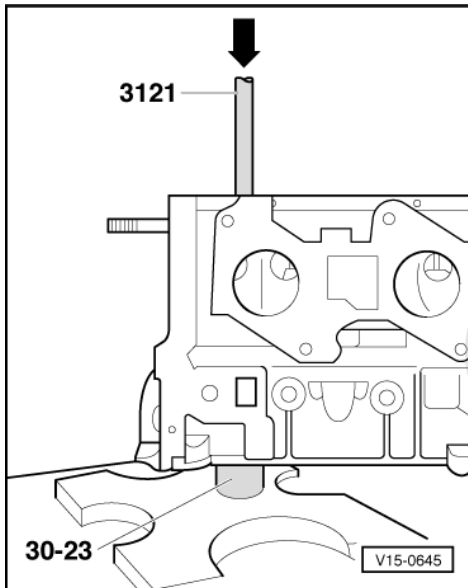
- -> Set valve in guide. Valve stem end must be flush with guide. Due to the slight difference in stem diameters. Ensure that only an inlet valve is used in the inlet guide and an exhaust valve in the exhaust guide.
- Determine rock.

Wear limit:	
Inlet valve guide	1.0 mm
Exhaust valve guide	1.3 mm

2.5 - Renewing valve guides

Note:

Valve guide replacement is not performed on engines with code ABZ as of engine number 014 738 or in the case of codes AEW, AKG, AKJ, AKH and AHC.



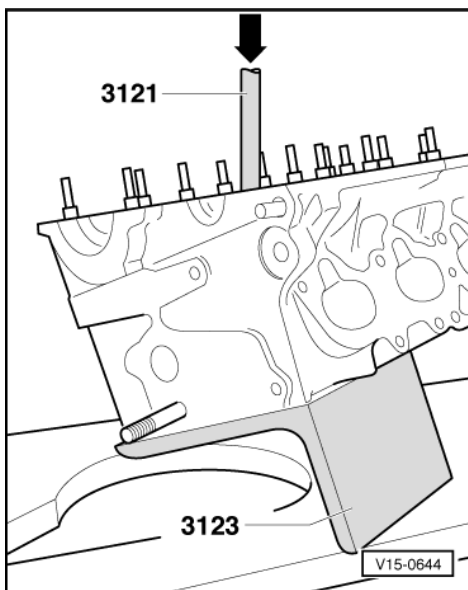
Engine code ABZ up to engine number

-014 737.

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Replace cylinder heads where valve seat rings can no longer be reworked, as well as those where minimum reworking dimension has already been reached.

- -> Use special tool 3121 to press out worn valve guides from combustion chamber side. Employ sleeve 30-23 for support.



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

Notes:

- ◆ Use rest 3123 when pressing in inlet valve guides.
- ◆ Once guides have made contact with collar in cylinder head insertion pressure is not to be increased to in excess of 1.0 t as otherwise collar could break off.
- Ream valve guides with hand reamer 3120. Always use drilling fluid.
- Reworking valve seats.



Note:

When reworking valve seats pay attention to minimum dimension => Page 70.

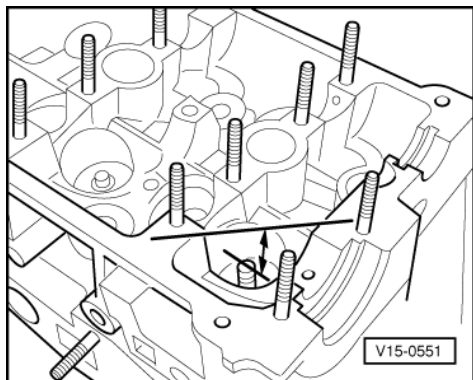
2.6 - Reworking valve seats

Notes:

- ♦ Valve seats are only to be reworked to the extent necessary to achieve a proper appearance of the bearing surface. Before starting to rework the valve seats, calculate the maximum permissible reworking dimension.
- ♦ Hydraulic valve clearance compensation function is no longer guaranteed if reworking dimension is exceeded.

Calculate max. perm. reworking dimension.

- Insert valve in valve seat and press firmly against valve seat.

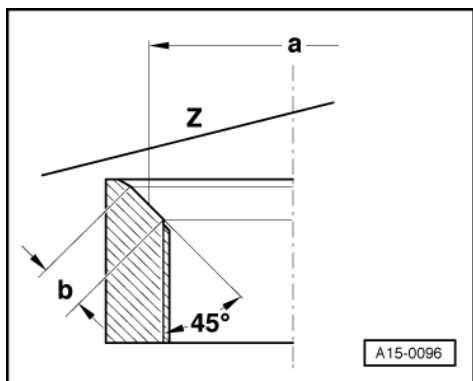


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- -> Measure distance between centre of valve stem endcentre and top edge of cylinder head.

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

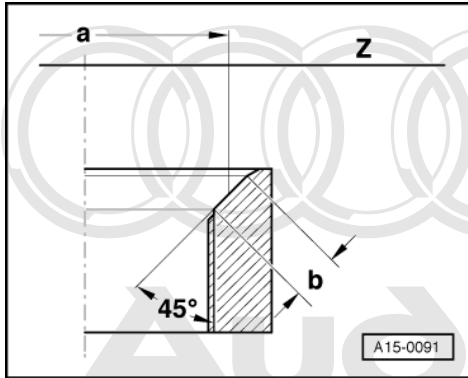
Minimum dimension	ABZ, AKG	AEW, AKG	AHC, AKH
Inlet valve	36.0 mm	36.4 mm	25.7 mm
Exhaust valve	36.3 mm	36.4 mm	36.4 mm



- > Rework inlet valve seat

	ABZ and AKG	AEW and AKJ	AHC and AKH
a =	ø 31.2 mm centre chamfer	ø 31.9 mm centre chamfer	ø 31.6 mm centre chamfer

	ABZ and AKG	AEW and AKJ	AHC and AKH
b =	1.5 mm - 1.8 mm; rework valve seat ring, if appropriate with 45° taper milling tool		
Z =	Lower edge of cylinder head		
45° =	Valve seat angle1)		



-> Rework exhaust valve seat

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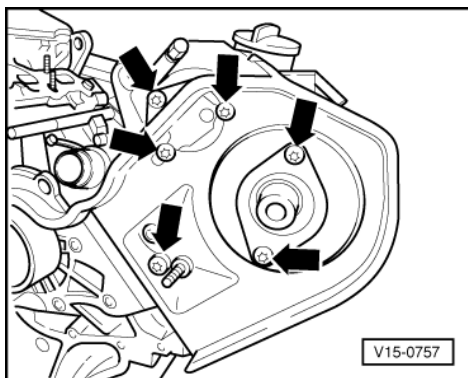
	ABZ, AKG	AEW, AKJ	AHC, AKH
a =	ø 27.6 mm centre chamfer	ø 26.0 mm centre chamfer	ø 25.2 mm centre chamfer
b =	1.5 - 1.8 mm		1.1 - 1.8 mm
	Rework valve seat ring, if appropriate, with 45° taper milling tool		
Z =	Lower edge of cylinder head		
45° =	Valve seat angle1)		

- 1) Pay attention to max. perm. reworking dimension
=>Page 70 .

2.7 - Renewing camshaft oil seals

Toothed belt side

Removing



- Remove toothed belt => Page 32 .



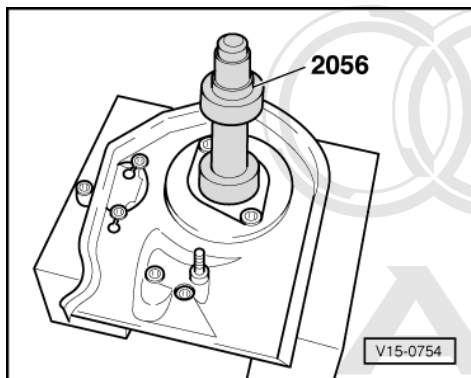
Note:

The vibration damper does not have to be unbolted or removed.

- Remove left and right camshaft sprockets.
- -> Remove toothed belt guard on rear left and right.

Note:

There are two sealing rings and a shaft seal in the left toothed belt guard. The right toothed belt guard features one sealing ring and one shaft seal.

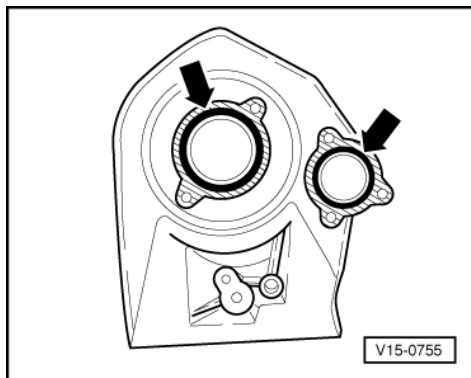


- -> Use mandrel 2056 to drive out shaft seal.
- On insertion make sure shaft seal is flush with front edge of toothed belt guard.

Note:

Replace both sides if one shaft seal is leaking.

- Fit camshaft sprocket.
- Install toothed belt =>Page 32 .



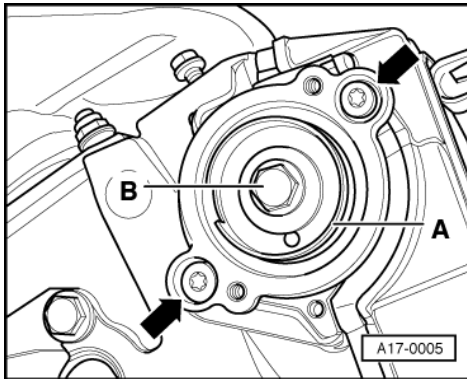
- -> Clean sealing surface on back and on cylinder head.
- Replace sealing ring.
- Apply thin coat of sealant to sealing ring.

♦ Sealants

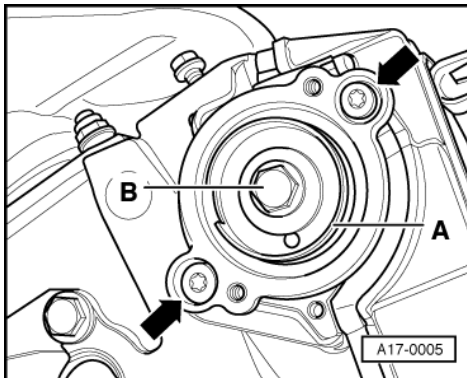
=> Parts List

- Fit rear toothed-belt cover.
- Tightening torque: 10 Nm

Hall sender side



- Remove Hall sender.
- -> Unscrew Hall-effect device -B- and housing -arrows- on cylinder head.
- Prise out shaft sealing ring using mandrel 2065.
- Press shaft sealing ring in, ensure that sealing ring is flush with front edge of housing.
- Clean sealing surface on back and at cylinder head.
- Replace sealing ring.



- Apply thin coat of sealant to sealing ring.

◆ Sealants

=> Parts List

- -> Install housing behind Hall sender -arrows-.
- Hall orifice plate -A- must engage with retainer tab in camshaft -B-.
- Install Hall sender.

Tightening torque

Component	Nm
Hall sender housing	10
Hall orifice plate	20
Hall sender	10



17 - Lubrication

1 - Removing and installing parts of the lubrication system

1.1 - Removing and installing parts of the lubrication system

Notes:

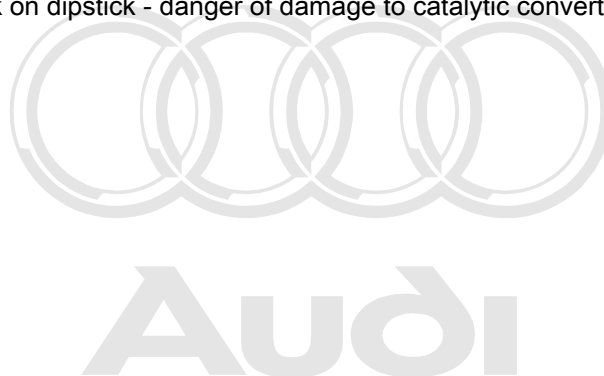
- ♦ If large quantities of metal shavings or particles are found in the engine oil when repairing the engine, the oil passages must be cleaned carefully, and the oil cooler renewed in order to prevent further damage occurring later.
- ♦ The oil level must not be above max. mark on dipstick - danger of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

Viscosity grades and oil specifications:

=> Maintenance Manual

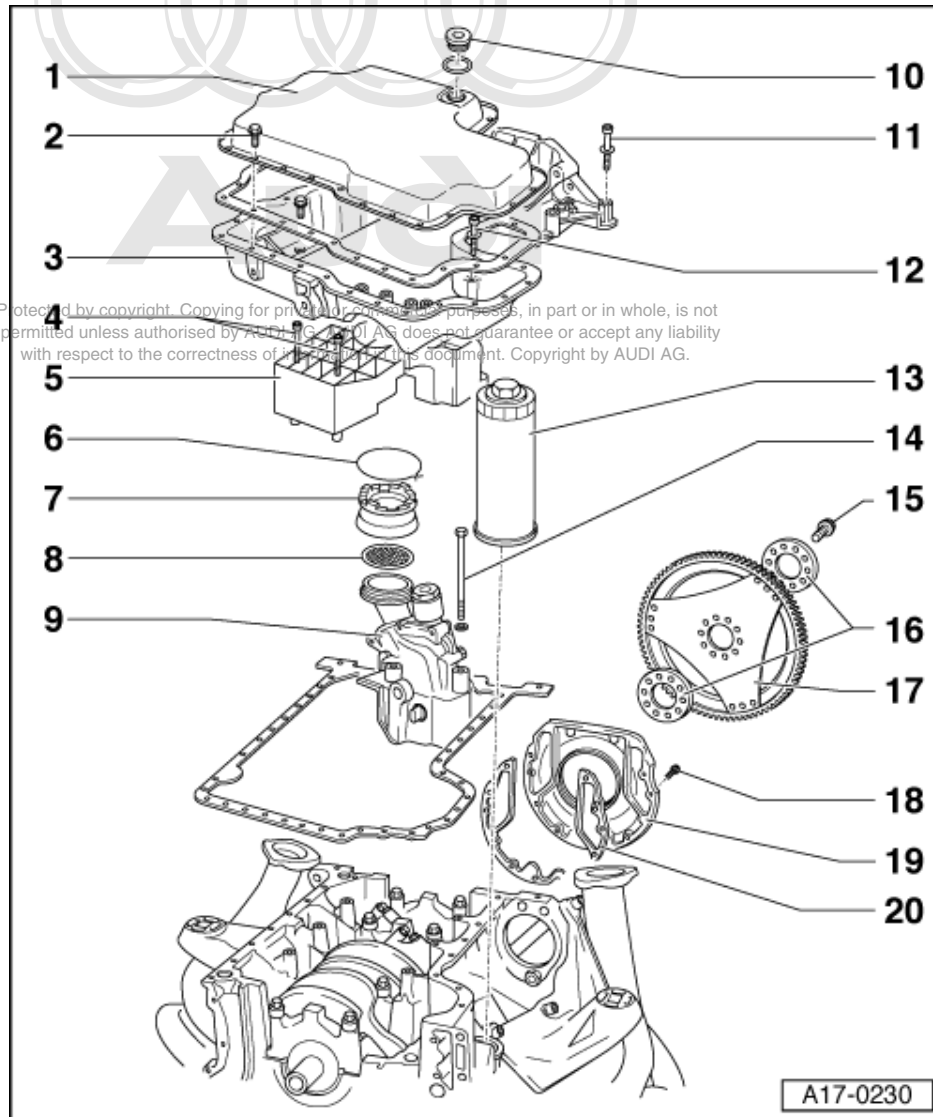
Oil system capacity:

=> Exhaust Emissions Test binder



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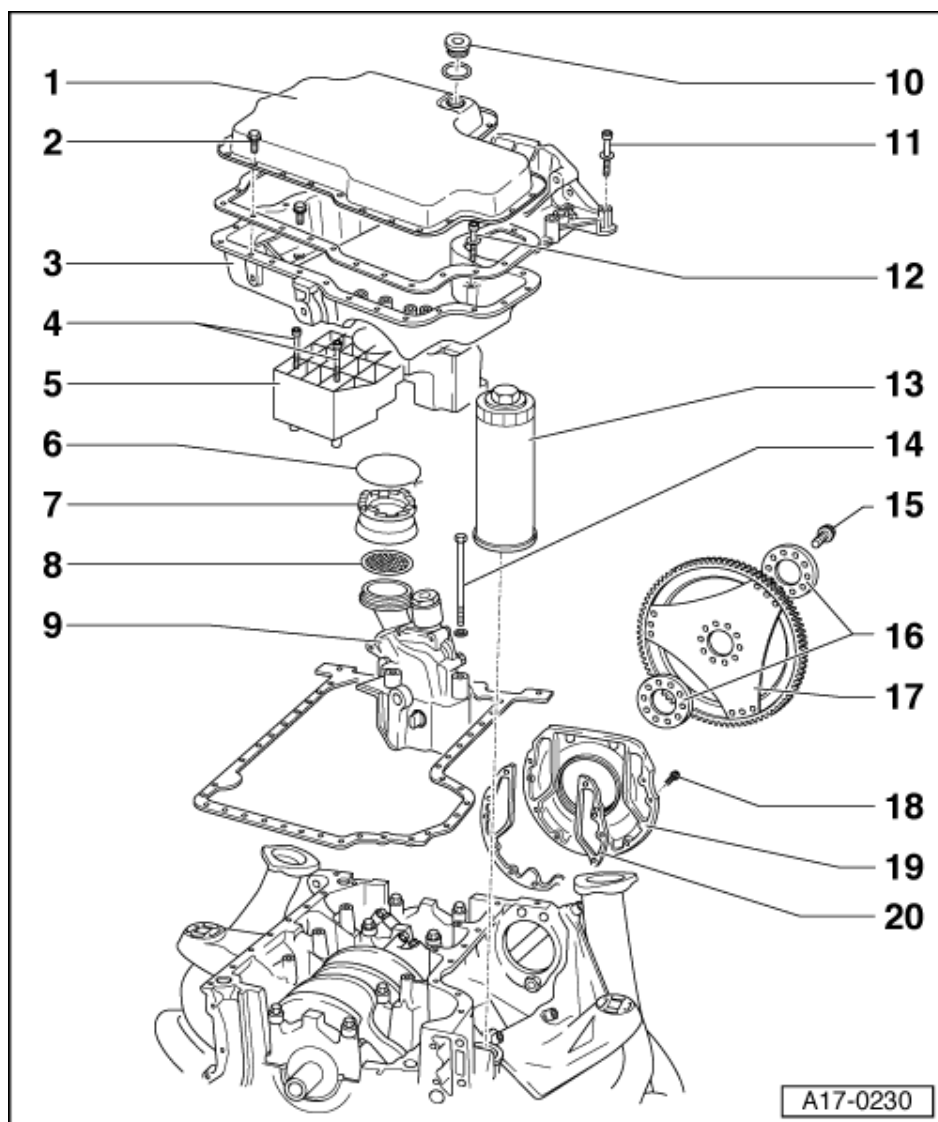
1.2 - Oil sump/oil pump, engine codes ABZ, AKG, AHC and AKH



Note:

Always replace seals and gaskets.

- 1 Bottom part of oil sump
- 2 10 Nm
- 3 Top part of oil sump
- 4 10 Nm
- 5 Honeycomb insert
- 6 Circlip



- 7 Rubber intake piece
- 8 Strainer
- 9 Oil pump
 - ◆ Removing => Page 86
 - ◆ Replace only as complete unit

10 35 Nm

11 25 Nm

12 10 Nm

13 Oil filter, 15 Nm

14 25 Nm

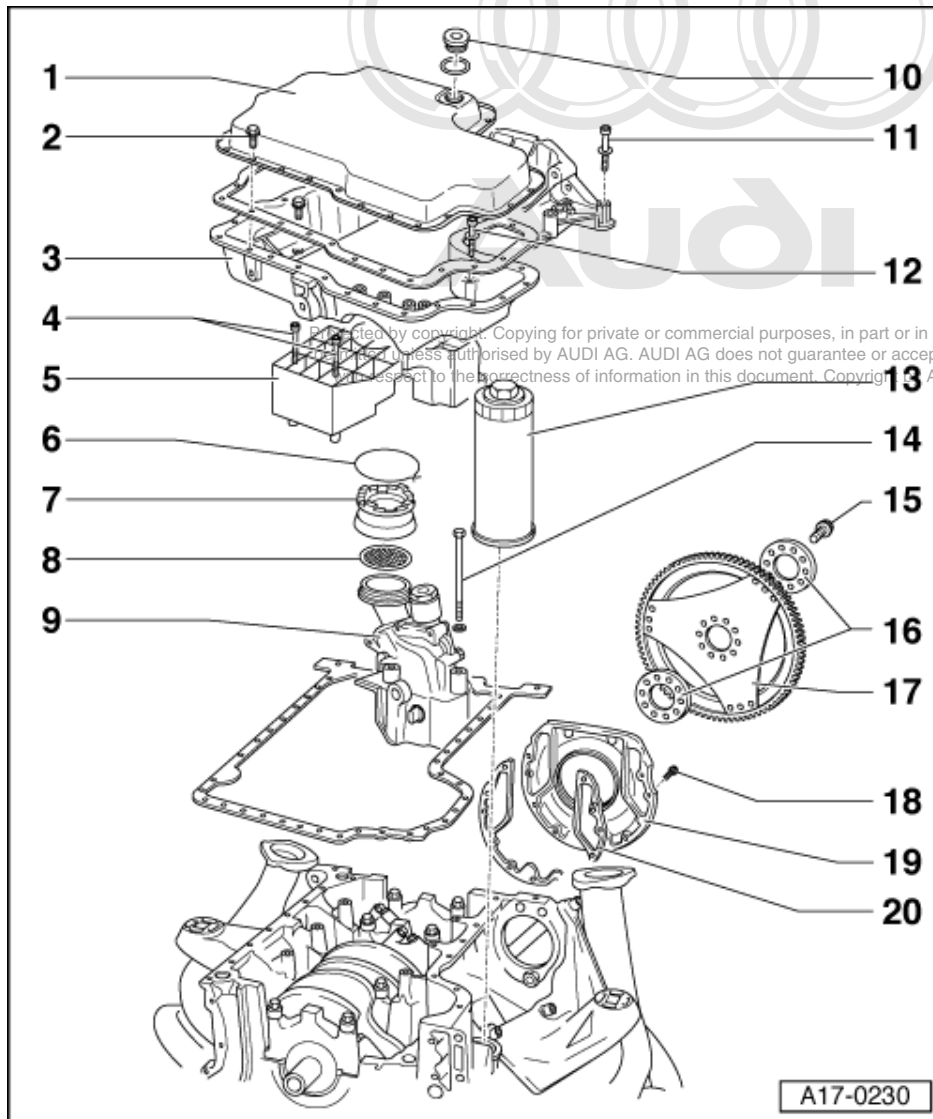
15 60 Nm + 90° further turn

- ◆ Install using locking fluid

=> Parts List

- ◆ Always replace

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16 Washer

17 Drive plate

- ♦ On assembly, ensure that drive plate has been fitted with pin for ignition point
- ♦ Pin length 20 to 22 mm from drive plate

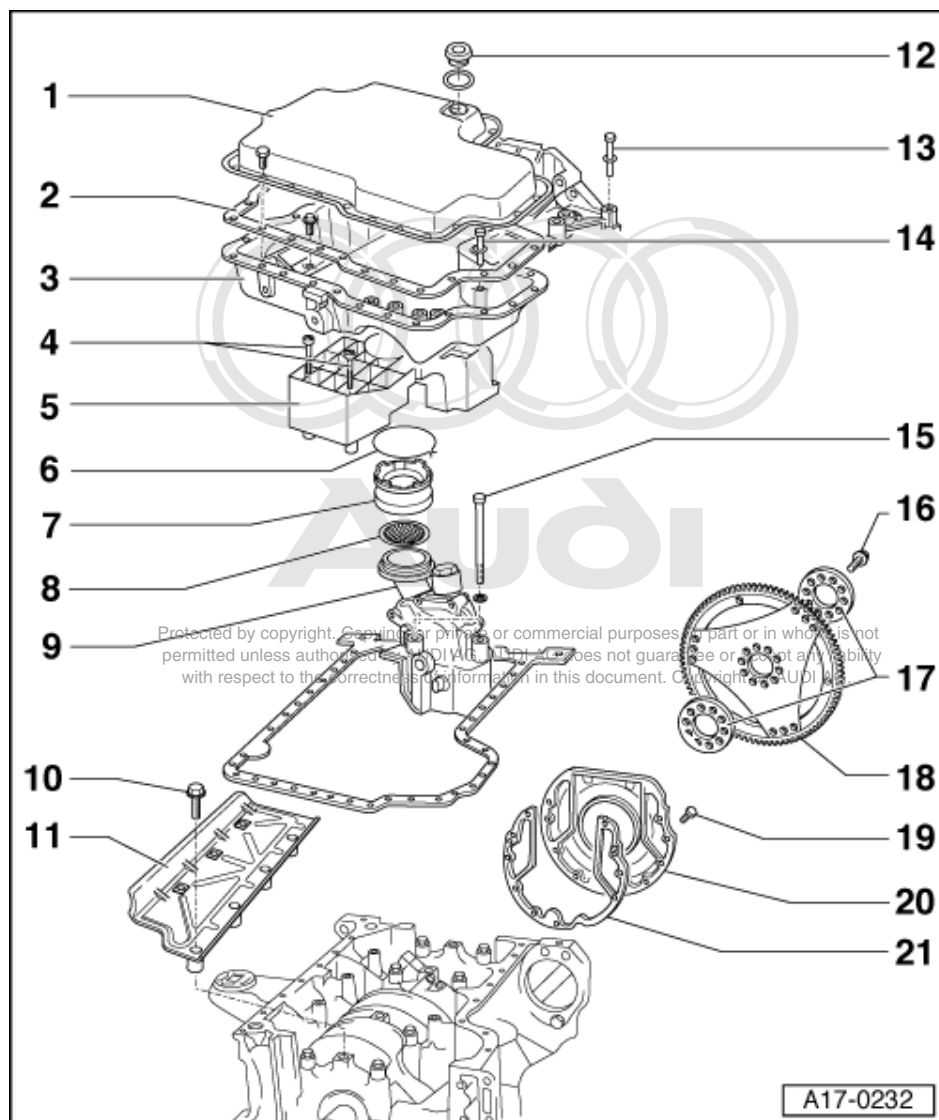
18 10 Nm

19 Rear sealing flange with oil seal

20 Gasket



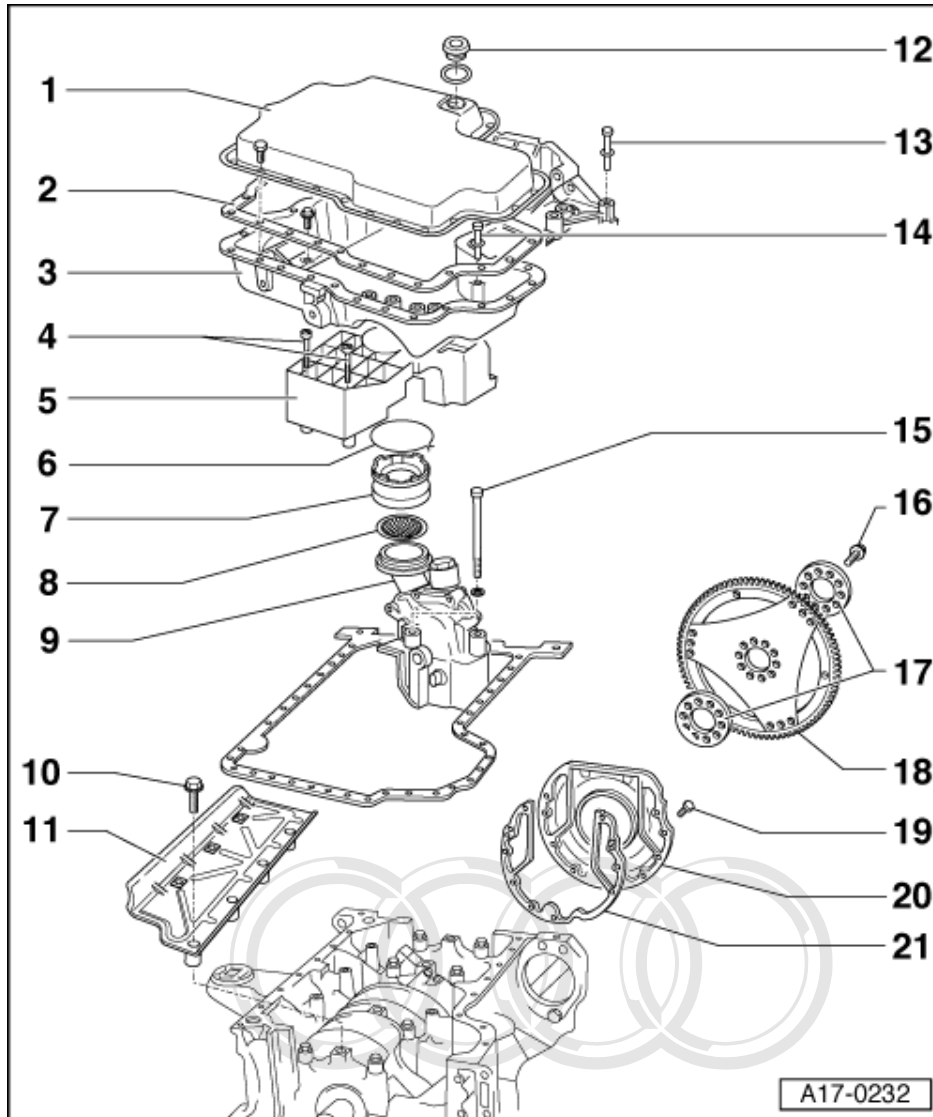
1.3 - Oil sump/oil pump, engine codes AEW and AKJ



Note:

Always replace seals and gaskets.

- 1 Bottom part of oil sump
- 2 10 Nm
- 3 Top part of oil sump
- 4 10 Nm
- 5 Honeycomb insert
- 6 Circlip



7 Rubber intake piece

8 Strainer

9 Oil pump

♦ Removing => Page 86

♦ Replace **only as complete unit**

10 25 Nm

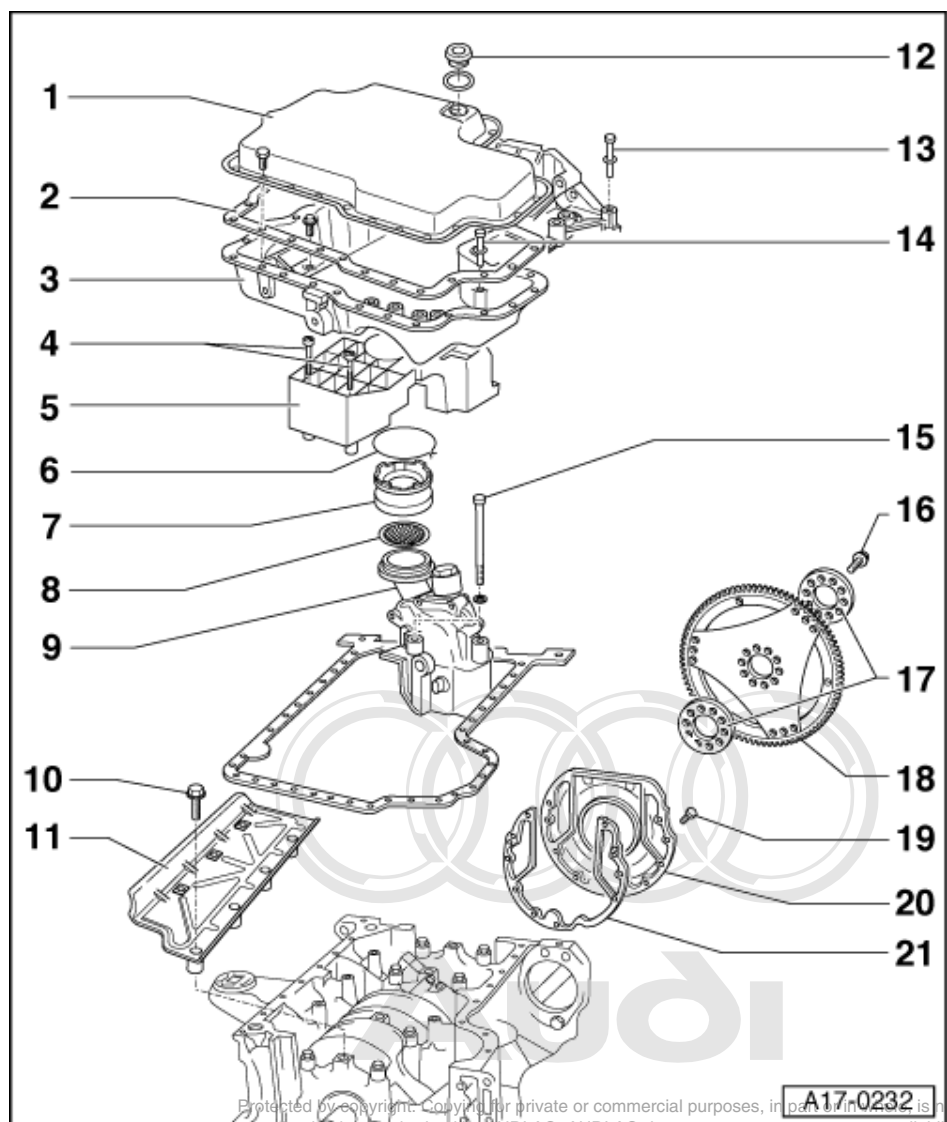
11 Oil splash guard

12 35 Nm

13 25 Nm

14 10 Nm

15 25 Nm



16 60 Nm + 90° further turn

- ♦ Install using locking fluid

=> Parts List

- ♦ Always replace

17 Washer

18 Drive plate

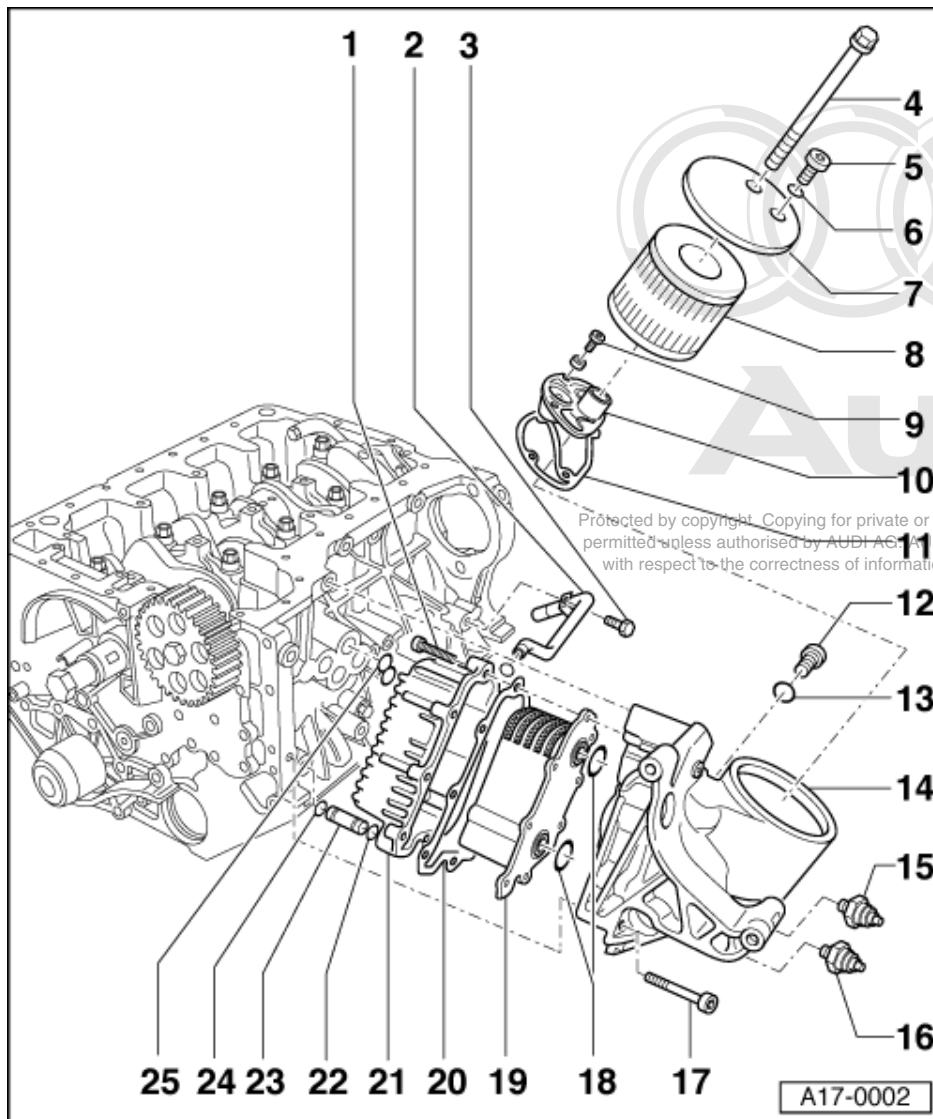
- ♦ On assembly, ensure that drive plate has been fitted with pin for ignition point
- ♦ Pin length 20 to 22 mm from drive plate

19 10 Nm

20 Rear sealing flange with oil seal

21 Gasket

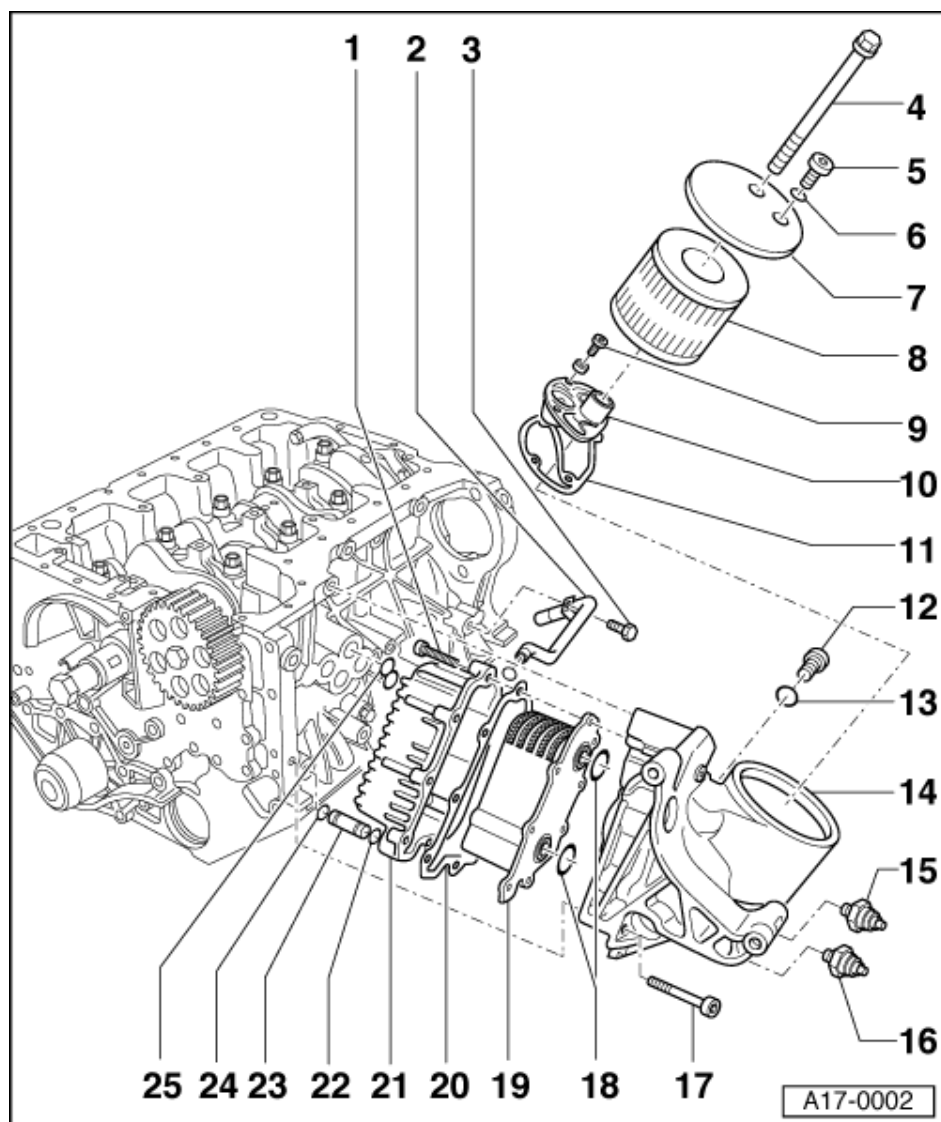
1.4 - Oil filter/oil cooler



Note:

Always replace seals and gaskets.

- 1 20 Nm
- 2 Coolant pipe, outlet
- 3 10 Nm
- 4 25 Nm
- 5 50 Nm
- 6 Sealing ring
- 7 Oil filter cover
- 8 Oil filter element



9 10 Nm

10 Valve plate with

- ♦ Relief valve for oil filter and oil cooler

11 Gasket

12 50 Nm

13 Gasket

14 Housing for oil filter and oil cooler

15 Oil pressure switch

- ♦ White 1.8 bar

16 Oil pressure switch

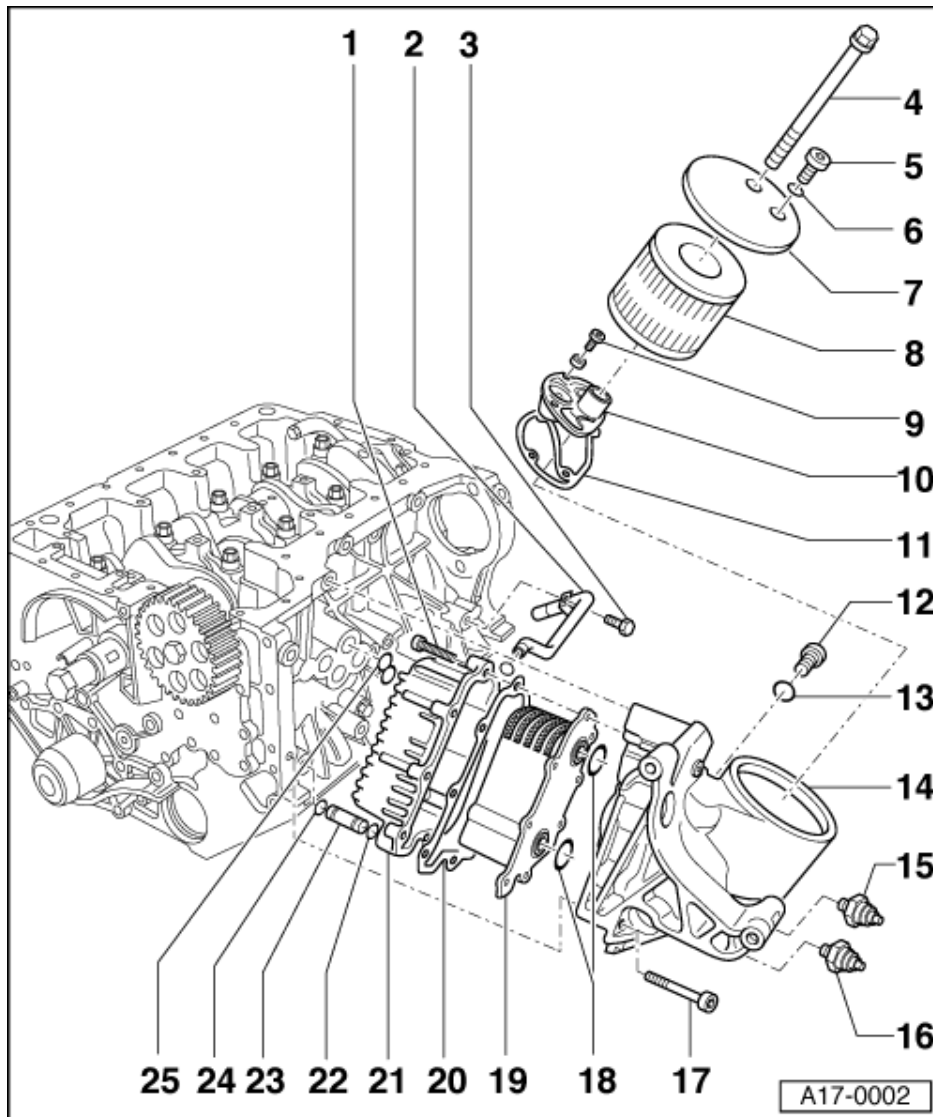
- ♦ Brown 0.3 bar
- ♦ Up to model year 95 only

17 25 Nm

18 Sealing ring



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19 Oil cooler

- ♦ 4.2 l engine only
- ♦ With coolant circulation

20 Gasket

21 Housing for oil cooler

- ♦ With coolant drain screw

22 Sealing ring

23 Pipe connection

- ♦ Coolant inlet

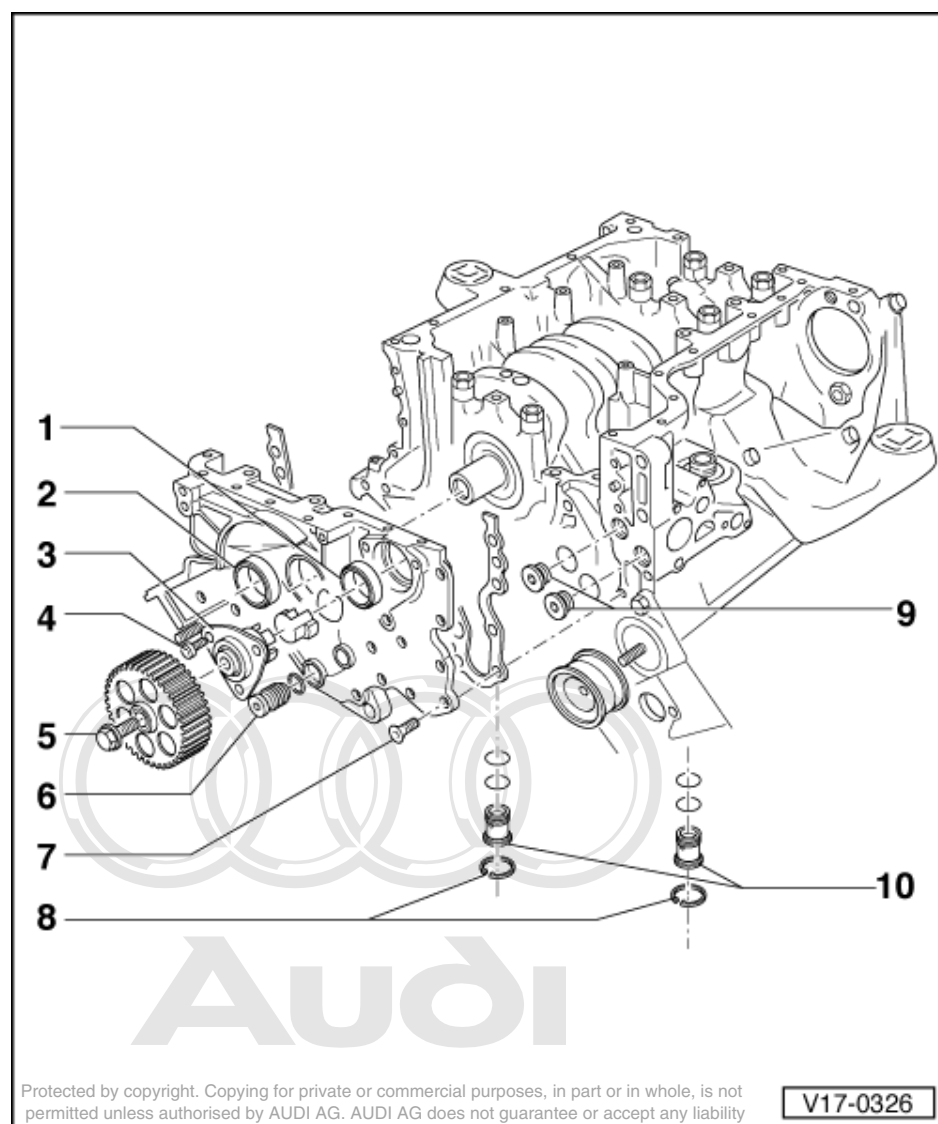
24 Sealing ring

25 Gasket

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1.5 - Oil pump drive



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V17-0326

Note:

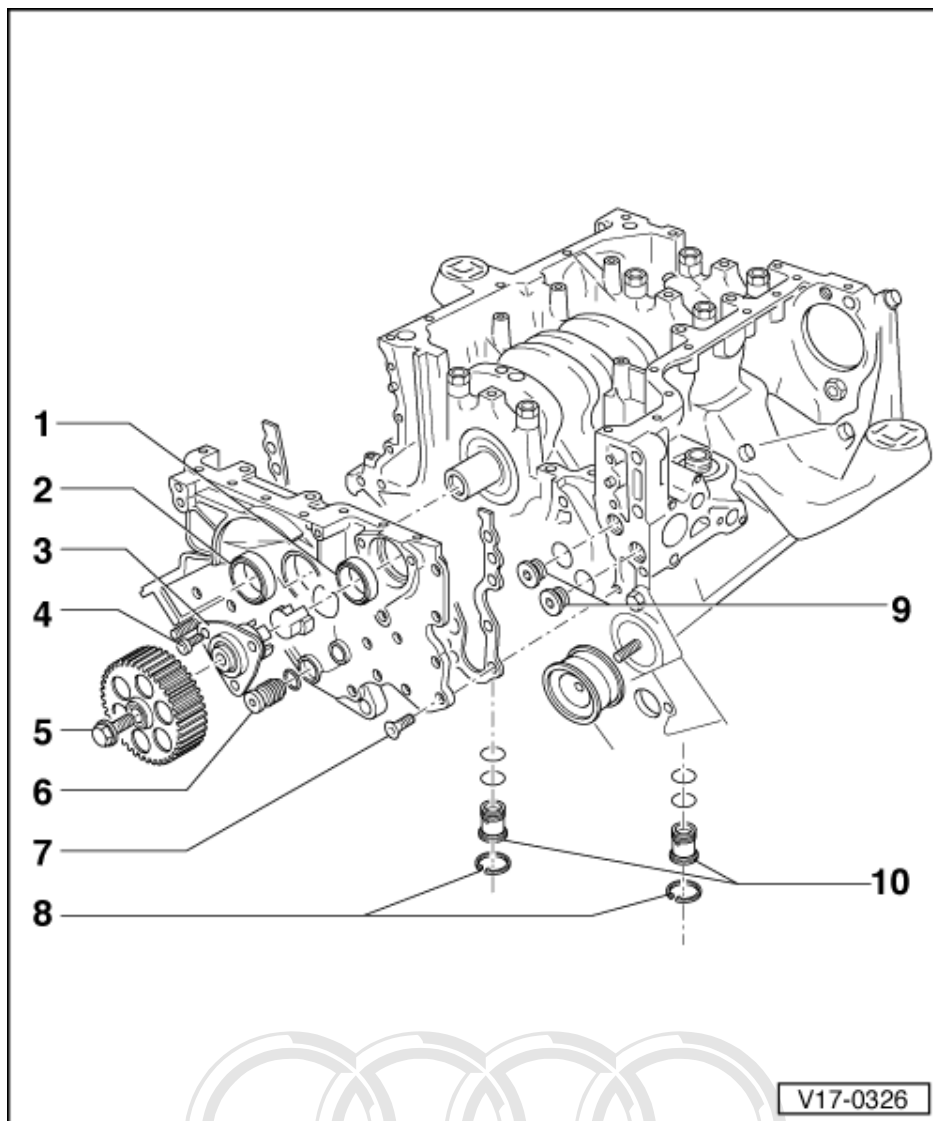
- ♦ All the components illustrated can be removed and installed without taking out the engine.
- ♦ Always replace seals and gaskets.

1 Seal for oil pump drive

- ♦ Replacing => Page 44 .

2 Crankshaft seal

- ♦ Replacing => Page 44 .



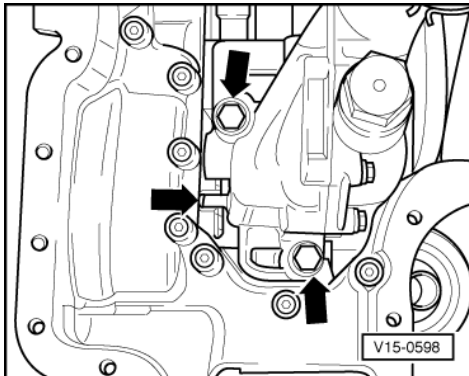
- 3 Oil pump drive
- 4 10 Nm
- 5 80 Nm
- 6 35 Nm
- 7 10 Nm
- 8 Circlip
- 9 Plug, 35 Nm
- 10 Oil retention valve

♦ Replacing => Page 86 .

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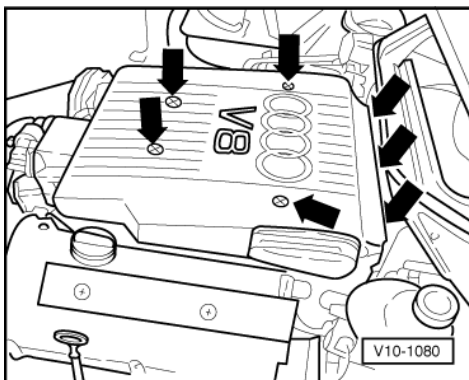


1.6 - Removing oil pump



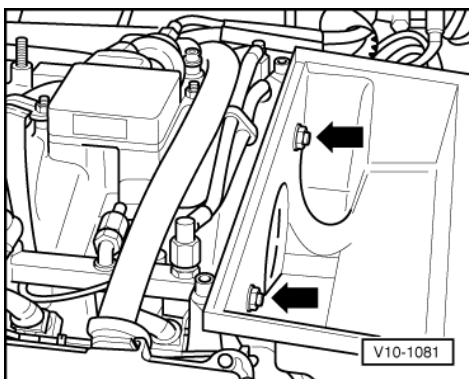
- Pull out dipstick.
- Drain engine oil.
- Unscrew bottom part of oil sump.
- -> Turn engine until opening (centre arrow) in oil pump drive is at bottom.
- Unscrew oil pump and pull out downwards.

1.7 - Replacing oil retention valves

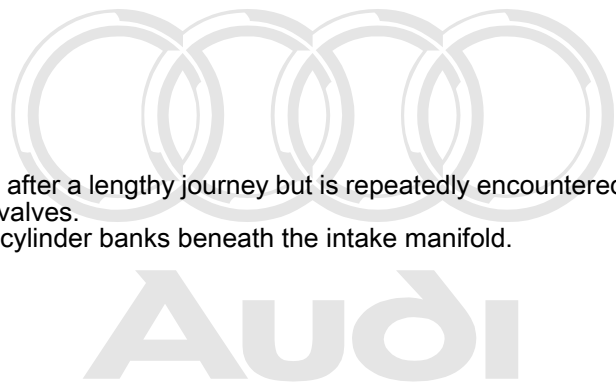


Notes:

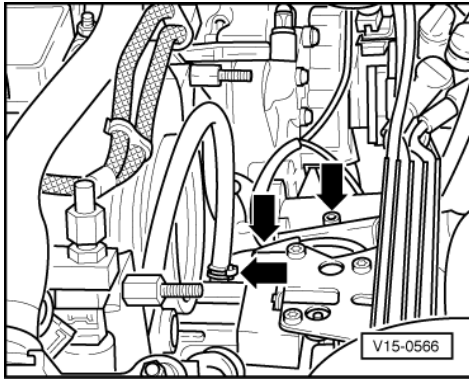
- ♦ In the event of irregular valve noise which disappears after a lengthy journey but is repeatedly encountered when travelling short distances, replace oil retention valves.
- ♦ The oil retention valves are located between the two cylinder banks beneath the intake manifold.
- -> Unscrew top part of air cleaner housing.



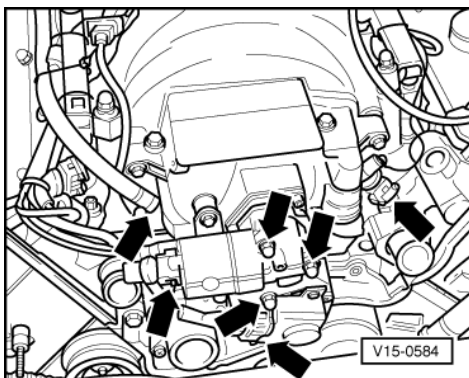
- -> Unscrew bottom part of air cleaner housing, press to rear and lift out upwards.



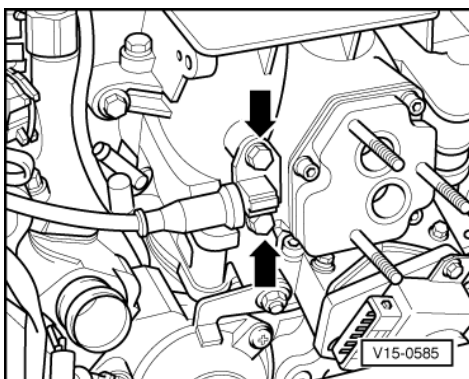
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- -> Disconnect breather hose from intake manifold at rear.
- Disconnect vacuum pipe.
- Unscrew upper part of support clamp for engine wiring harness.



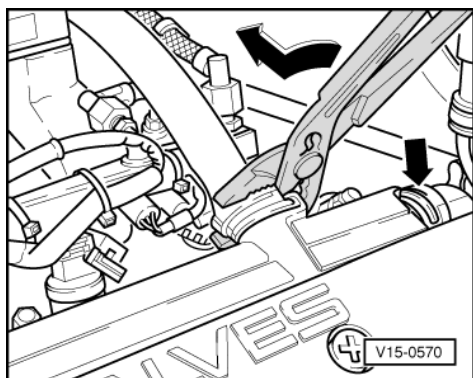
- -> Detach knock sensor connector on left and right.
- Pull connector off hot-wire air-mass meter.
- Pull connector off throttle valve potentiometer.
- Pull connector off thermo switch.
- Remove connector at idling speed stabilisation valve.
- Remove idling speed stabilisation valve.
- Disconnect hose to activated charcoal filter (ACF).



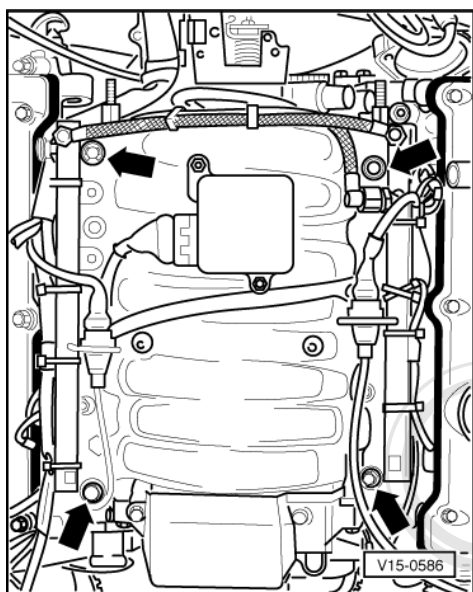
- -> Remove air temperature sensor.



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- -> Remove breather hose at top (use pliers to turn hose until retaining lug disengages).
- Remove breather hose at rear left of cylinder head.

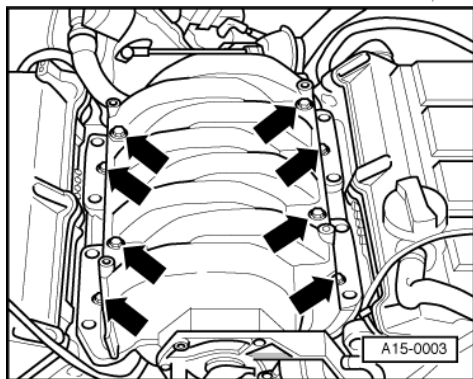


- -> Unscrew fuel manifold completely, pull out upwards complete with injectors and set aside on plenum chamber.

Note:

On installation, take care not to damage O-rings at injectors.

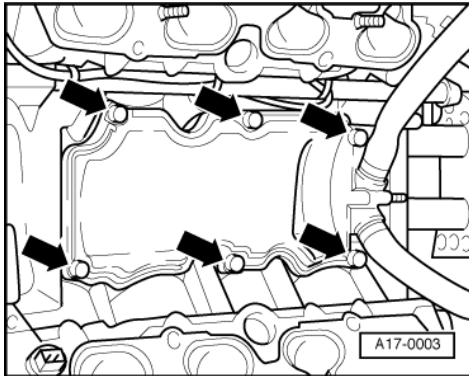
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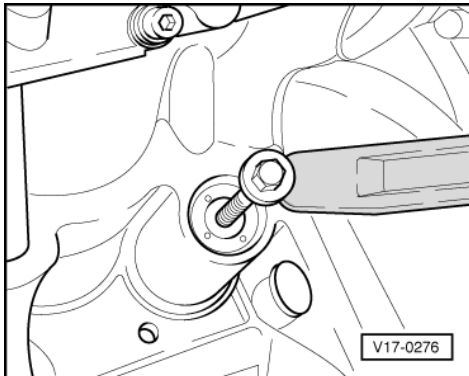
- -> Unscrew and lift out intake manifold (pay attention to front breather hose beneath intake manifold).

Note:

When installing intake manifold, first attach breather hose to engine.



- -> Unscrew cover for crankcase breather.
- Remove cover and bulkhead.
- Remove retaining rings of all retention valves.
- Screw M6 x 50 bolt with large washer into oil retention valves.



- -> Lift out oil retention valves.

Note:

Before installing intake manifold, first attach front breather hose beneath intake manifold to engine.

1.8 - Checking oil pressure switch and oil pressure

Checking oil pressure switch

Visual and acoustic oil pressure indicator

Read measured value block, Audi A8 Workshop Manual, Electrical System

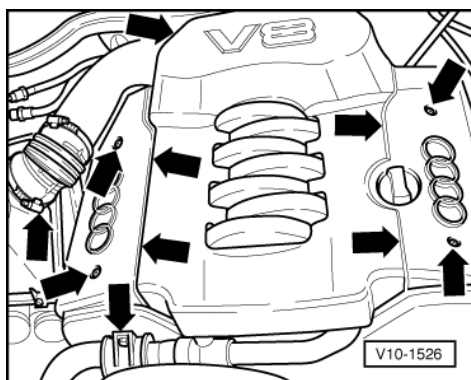
=> Electrical System >01.99; Repair group 01; Dash panel insert self-diagnosis Dash panel insert self-diagnosis

Test requirements

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- Measured value block OK
- Oil level OK
- Oil pressure warning lamp (K3) must light with ignition switched on.
- OK symbol must light (call up symbol) on vehicles with autocheck system.

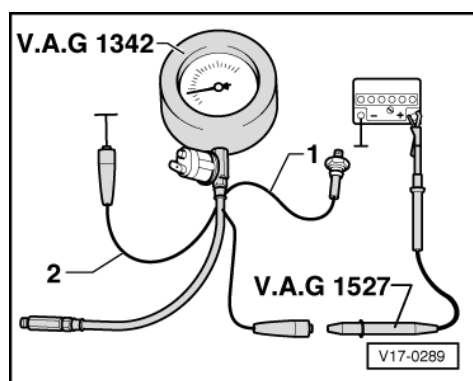


- Engine oil temperature approx. 80 °C (radiator fan must have been in operation once).



Checking oil pressure switch.

- -> Unscrew engine cover.
- Unscrew and set aside top part of air filter.
- Remove bottom part of air filter.



- -> Unscrew oil pressure switch and screw in Adapter V.A.G 1342/3.
- Screw V.A.G 1342 to adapter V.A.G 1342/3.
- Connect wire -2- (brown) to earth (-).
- Connect wire -1- (blue) to oil pressure switch.
- Attach diode test lamp V.A.G 1527 to line -1- and battery positive (+).
- Fit bottom part of air filter.
- Fit top part of air filter.
- Start engine and check switching points with the necessary engine speed.

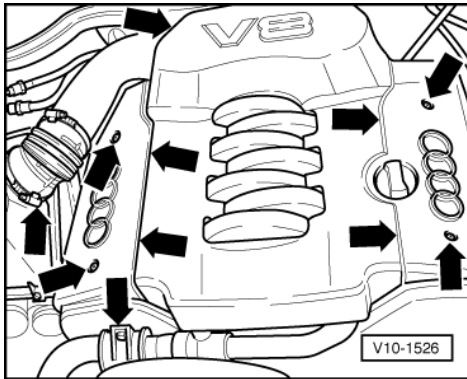
Oil pressure at idling speed	1 to 2.5 bar
Oil pressure at 3000 rpm	3 to 5 bar

Notes:

- ♦ 0.3 bar oil pressure switch (brown insulation), switch opens as of 0.15 to 0.45 bar
- ♦ 1.8 bar oil pressure switch (white insulation), switch closes as of 1.6 to 2.0 bar

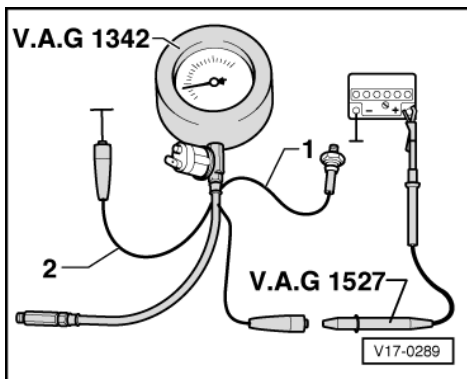
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Checking oil pressure



- -> Unscrew engine cover.
- Unscrew and set aside top part of air filter.

- Remove bottom part of air filter.



- -> Unscrew oil pressure switch and screw in oil pressure tester V.A.G 1342.
- Screw V.A.G 1342 to adapter V.A.G 1342/3.
- Screw oil pressure switch into V.A.G 1342.
- Fit bottom part of air filter.
- Fit top part of air filter.

- Start engine.
- Engine oil temperature at least 80 °C

Oil pressure at idling speed	1 to 2.5 bar
Oil pressure at 3000 rpm	3 to 5 bar

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Note:

If the oil pressure is far too high (relief valve sticking or incorrectly installed) too much pressure will be exerted on the hydraulic tappets. The engine cuts out shortly after being started and the next time starting is attempted, it is turned at a noticeably higher speed by the starter due to lack of compression.

1.9 - Engine oil

Viscosity grades and oil specifications

Viscosity grades and oil specifications:



=> Maintenance Manual

Oil system capacity:

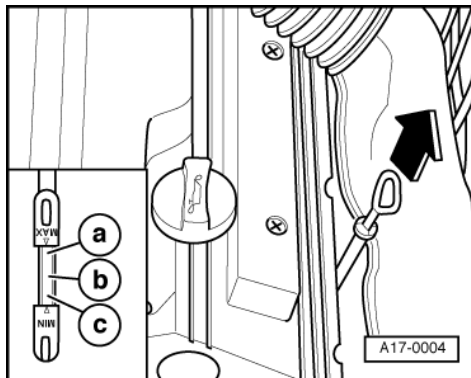
=> Exhaust Emissions Test binder



1.10 - Check oil level

Notes:

- ♦ Engine must be warm (oil temperature greater than 60 °C) when checking oil level.
 - ♦ The vehicle must be standing on level ground when checking the oil level.
 - ♦ After switching off the engine wait a few minutes to allow the oil to flow back into the sump.
- Pull out dipstick, wipe with a clean cloth and insert it again as far as it will go.



- Pull out the dipstick again and read off the oil level.

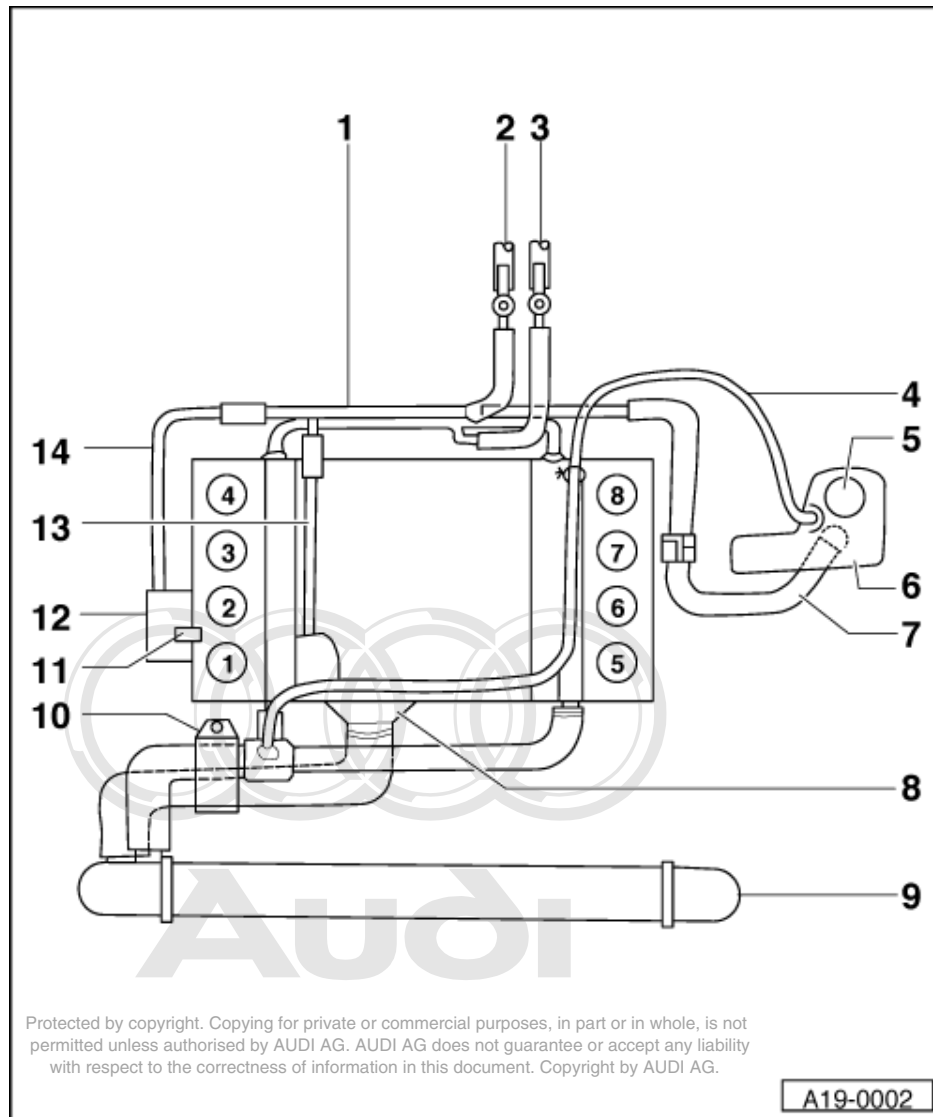
-> Markings on oil dipstick:

- a- - Oil must not be topped up.
 - b- - Oil may be topped up.
- After doing so, it may be that the oil level is then in range a.
- c- - Oil must be topped up.
- After topping up it is sufficient for the oil level to be somewhere in the range b (knurled area).

19 - Cooling system

1 - Removing and installing parts of the cooling system

1.1 - Removing and installing parts of the cooling system



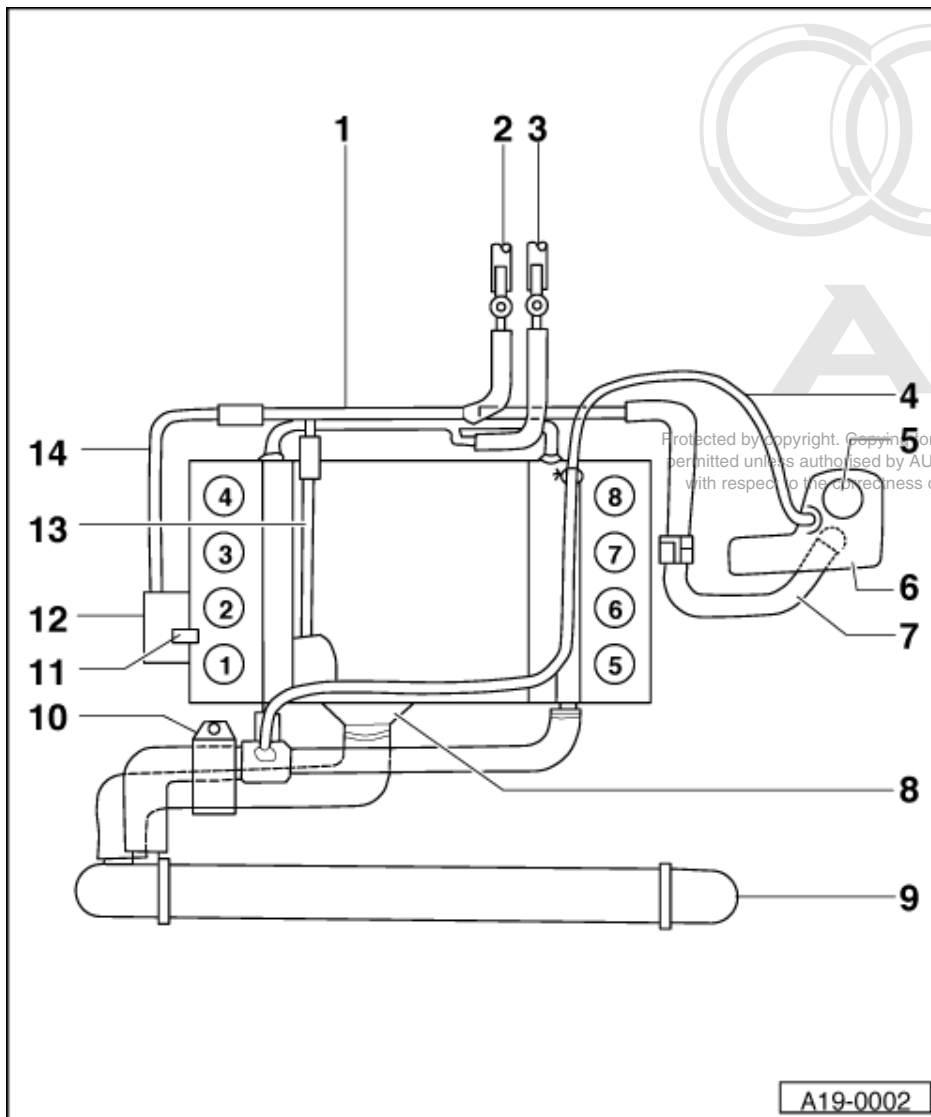
Notes:

- ◆ Renew all gaskets and seals.
- ◆ Drain off and top up coolant =>Page 99 .
- ◆ Checking cooling system for leaks => Page 102 .

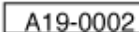
- 1 Coolant pipe, rear
- 2 From heating-system heat exchanger
 - ◆ With bleeder valve
- 3 To heating-system heat exchanger



- ♦ With bleeder valve



- 4 Return hose
- 5 Cap for expansion tank
 - ♦ Checking => Page 102
- 6 Expansion tank
- 7 Filler hose
- 8 Thermostat
 - ♦ Replacing =>Page 99
 - ♦ Start of opening approx. 87°
 - ♦ End of opening approx. 102°
 - ♦ Opening stroke approx. 8 mm
- 9 Radiator
- 10 Bracket for coolant hoses

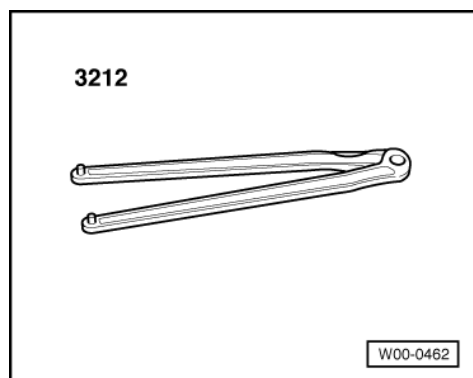


1.1 - Removing and installing parts of the cooling system 95

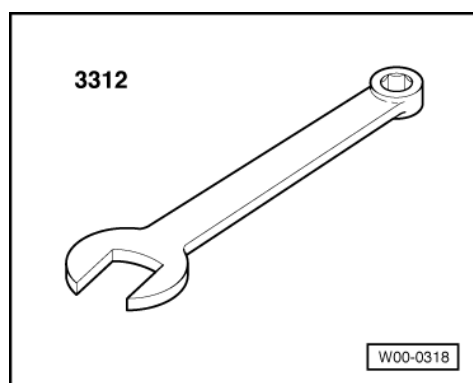


1.2 - Removing and installing viscous fan

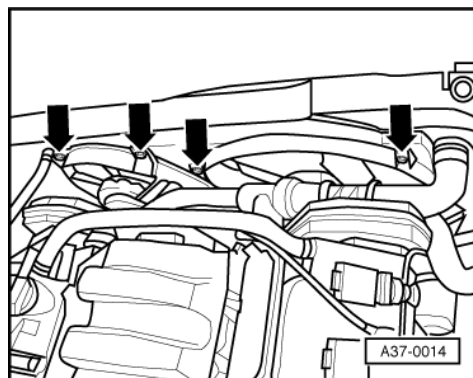
Special tools, testers and auxiliary items required



- ♦ Special tool 3212



- ♦ Special tool 3312

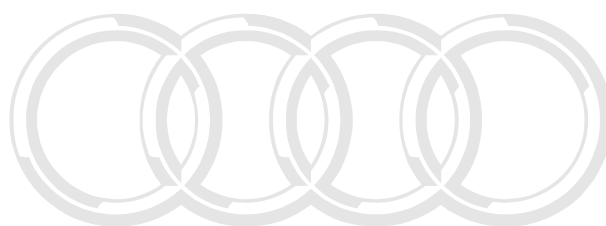


Removing

- -> Unscrew air duct for viscous fan and electric fan at top left of radiator, pull out upwards and place to one side in engine compartment. Leave wiring connected.

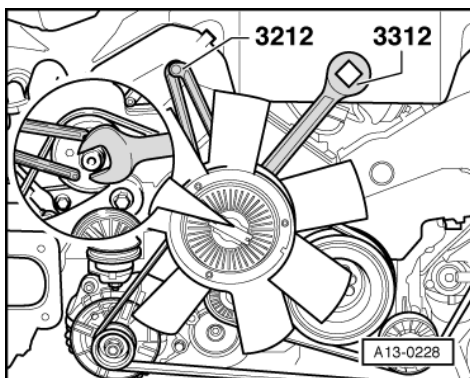
Notes:

- ♦ Viscous fan has left-hand thread; turn clockwise to release.
- ♦ For ease of illustration, the Fig. shows the viscous fan on the removed engine.



Audi

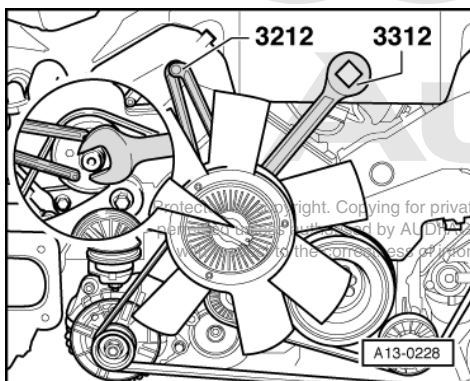
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- -> Counterhold pulley for viscous fan with 2-hole pin wrench 3212 and unscrew viscous fan with claw wrench 3312 (left-hand thread).
- Remove viscous fan with fan ring.

Installing

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



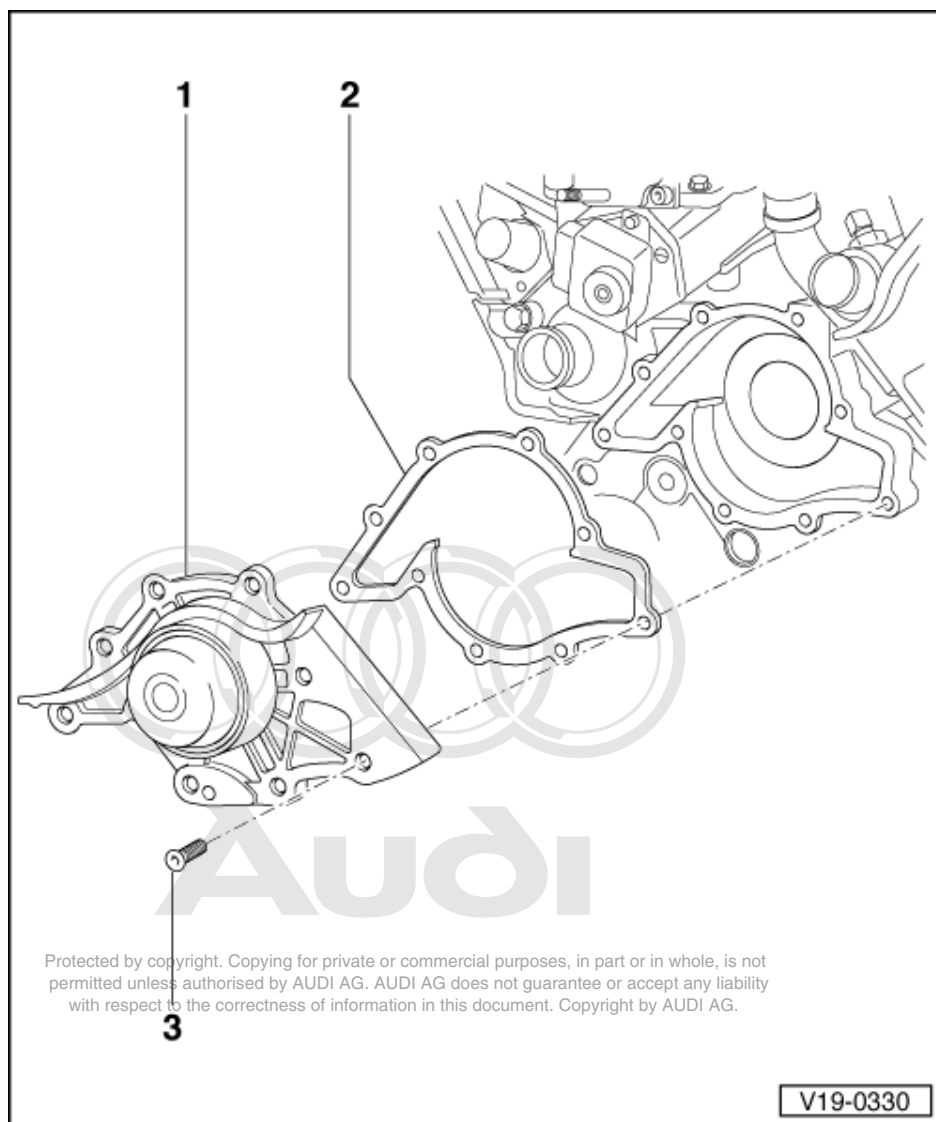
- Install viscous fan with fan ring (left-hand thread).
- -> Counterhold pulley for viscous fan with 2-hole pin wrench 3212 and unscrew viscous fan with clamp wrench 3312 (left-hand thread).

Tightening torques

Component	Nm
Viscous fan with torque wrench 1331 and open-end wrench 3312	37
Viscous fan with torque wrench without open-end wrench 3312	70
Fan ring to radiator	10



1.3 - Coolant pump



Notes:

- ♦ Always replace seals and gaskets.
- ♦ Drain off and top up coolant =>Page 99 .

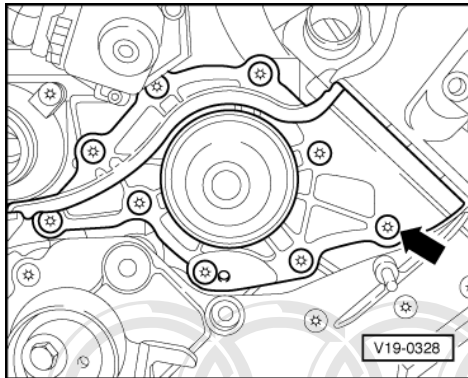
1 Coolant pump

- ♦ Removing => Page 99

2 Gasket

3 10 Nm

Removing coolant pump



- Remove toothed belt => Page 32 .

Note:

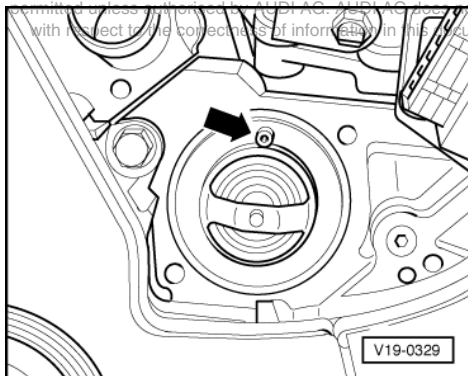
The vibration damper does not have to be unbolted or removed.

- Unscrew toothed-belt tensioner.
- -> Remove coolant pump (9 x Torx screws).

Replacing thermostat.

The thermostat is located at the front right of the engine beneath the intake manifold.

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- -> Installation position of thermostat

Note:

Install with bleeder valve facing upwards.

Starts to open	87°
Fully open	102°
Opening travel	8 mm

1.4 - Draining and filling cooling system

Notes:

- ◆ To prevent frost damage and corrosion and to raise the boiling point of the coolant, the specified coolant additive must be used in the cooling system at all times of the year.
- ◆ The coolant additive used up to 06.96 was -G11- V8B (green).
- ◆ As of 07.96 exclusive use has been made of the coolant additive -G12- A8D TL 774D (red).
- ◆ As opposed to -G11- -G12- offers lifetime protection.



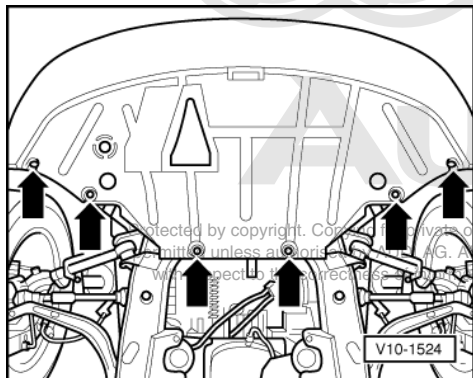
- ♦ Recommended mixture ratio: 50:50
- ♦ Capacity approx. 9.0 l

Important

The coolant additives -G11- and -G12- are not to be mixed. Otherwise, this can result in serious damage to the engine.

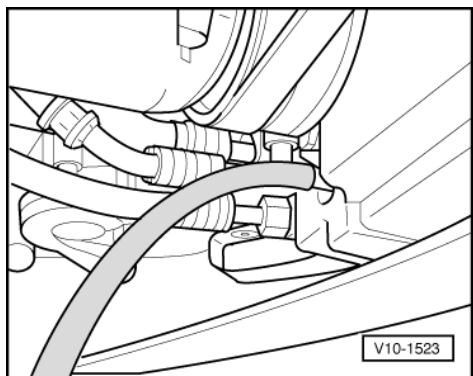
Identifying coolant additive		
-G11-	Colour	Green
-G12-	Colour	Red
Mixed	Colour	Brown1)

- 1) Replace coolant immediately

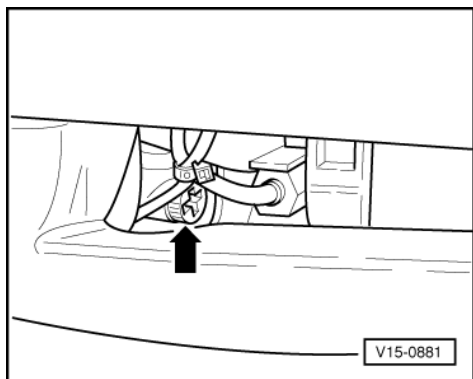


Draining coolant

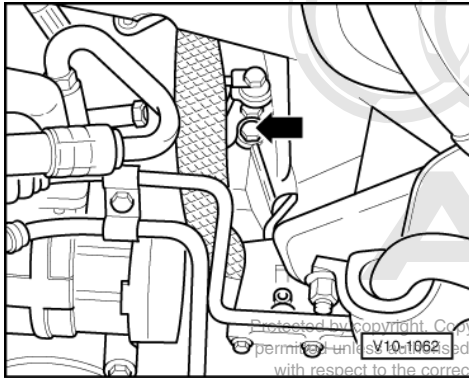
- Carefully unscrew filler cap on expansion tank to relieve pressure.
- -> Remove noise insulation.



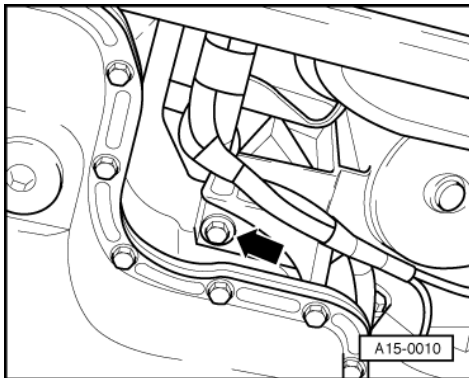
- Remove vent grille in bumper on left.
- Place drip tray V.A.G 1306 under vehicle.
- -> Attach auxiliary hose ø approx. 12 mm (inside) to radiator drain cock and drain off coolant.



- -> Open coolant drain plug through vent grille in bumper on left.



- -> Open drain plug on engine on left beneath knock sensor.



- -> Open drain plug at oil cooler housing behind oil filter.
- Unscrew return pipe from radiator to expansion tank at radiator.
- Close off pipe connection at radiator with finger.
- Blow compressed air into the detached return pipe until no further coolant emerges at any of the three drain openings.
- Reconnect bleeder pipe to radiator.
- Close drain cock at radiator and pull hose off connection piece.
- Screw in (20 Nm) the two coolant drain screws on the left and right of the engine block. Replace gaskets.

The following operations are only to be performed when replacing coolant -G11- with -G12-.

- Fill engine with clean water and allow it to run for approx. 2 minutes. This process is designed to largely remove any residual coolant.
- Drain off coolant again.
- Unscrew return pipe from radiator to expansion tank at radiator.
- Close off pipe connection at radiator with finger.
- Blow compressed air into the detached return pipe until no further coolant emerges at any of the three drain openings.
- Reconnect bleeder pipe to radiator.
- Close drain cock at radiator and pull hose off connection piece.
- Screw in (20 Nm) the two coolant drain screws on the left and right of the engine block. Replace gaskets.

Filling

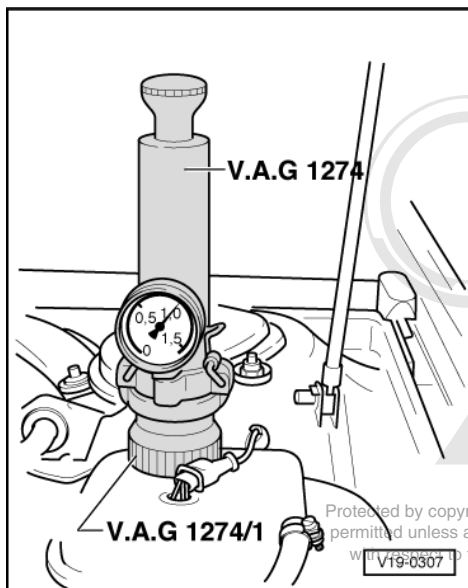
Important
 The coolant additives -G11- and -G12- are not to be mixed. Otherwise, this can result in serious damage to the engine.

- Switch ignition on.



- Set air conditioner to HI.
- Switch off ignition.
- Open bleeder screw at heating-system heat exchanger approx. 2 turns.
- Put in coolant. Squeezing the top hose several times will help to force out the air.
- Allow engine to warm up. Leave AC set to HI until a coolant temperature of slightly less than 100 °C is indicated. The engine is to be warmed up at a speed of between 2000 and 3000 rpm with several brief increases to 4000 and 5000 rpm.
- Stop engine. Wait for about 5 - 10 minutes and then carefully open filler cap on expansion tank (system will be under pressure).
- Top up coolant to max. mark.
- Close filler cap on expansion tank.
- Run engine and repeat topping up procedure as necessary.

1.5 - Checking cooling system for leaks



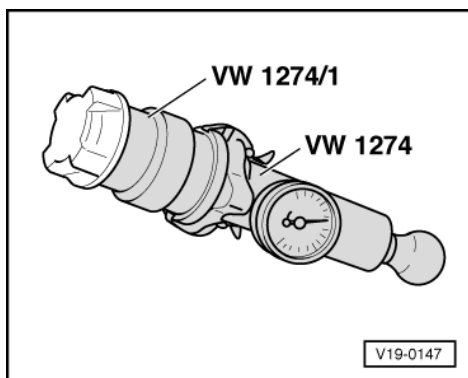
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Note:

Engine must be at operating temperature.

- -> Fit tester VW 1274 with adapter VW 1274/1 on 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.

1.6 - Checking relief valve in cap



- -> Fit filler cap on tester.
- Build up pressure with hand pump.

Pressure relief valve should open at an overpressure of 1.2 - 1.5 bar.



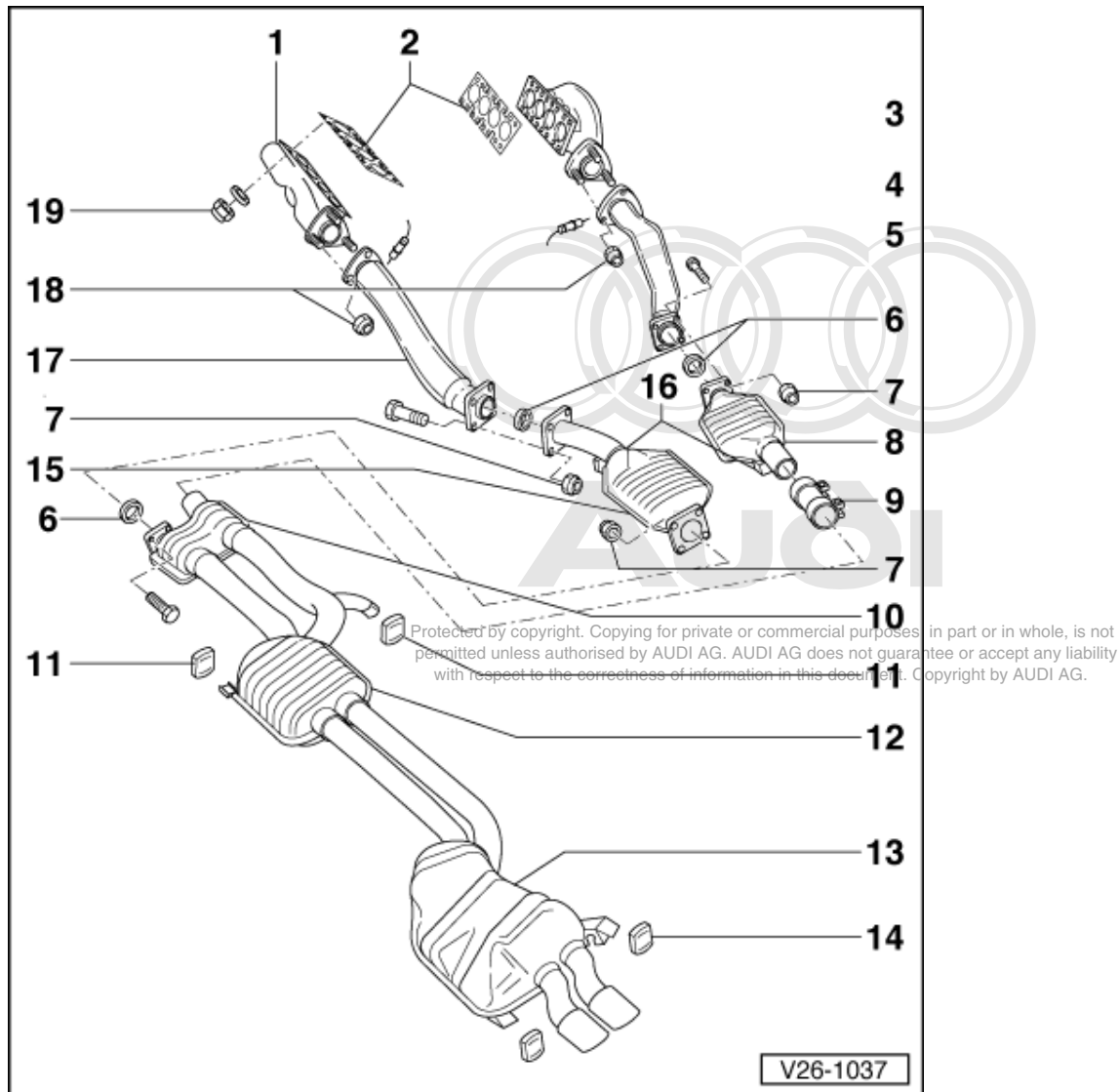
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26 - Exhaust system

1 - Exhaust system, engine codes ABZ, AHC, AKG and AKH

1.1 - Exhaust system, engine codes ABZ, AHC, AKG and AKH



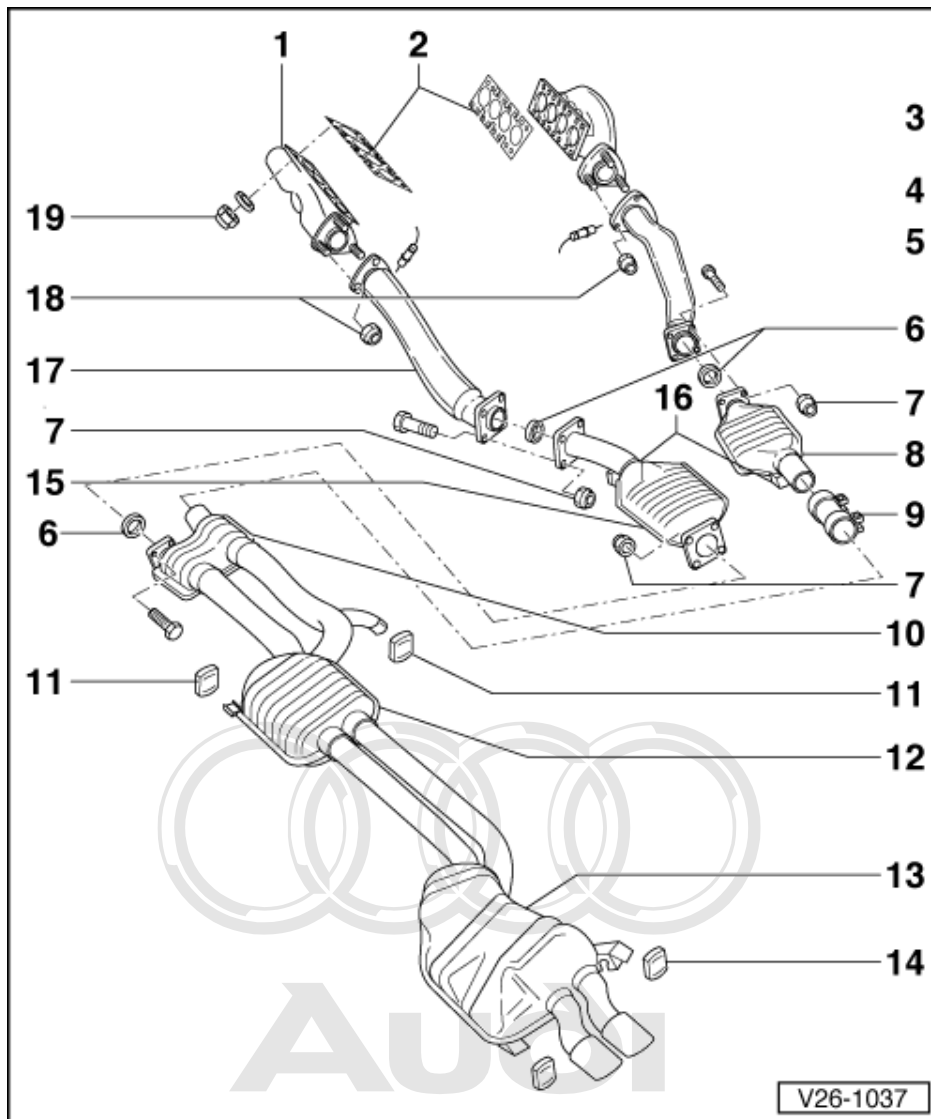
1.2 - Removing and installing exhaust system

Notes:

- ♦ Stress-free alignment of exhaust system,=> Page 109
- ♦ Checking exhaust system for leaks
=>Page 111
- ♦ Joint between centre and rear silencer
=>Fig. 1
- ♦ Renew all gaskets and hexagon nuts.

- ♦ Tightening torque for cross member/floor group, 25 Nm.

1 Exhaust manifold, left



2 Exhaust manifold gasket

- ♦ Metal side of gasket must face cylinder head

3 Exhaust manifold, right

4 Lambda probes, 50 Nm

- ♦ Check

=> Motronic Fuel Injection and Ignition System; Repair group 24; Checking lambda control Checking lambda control

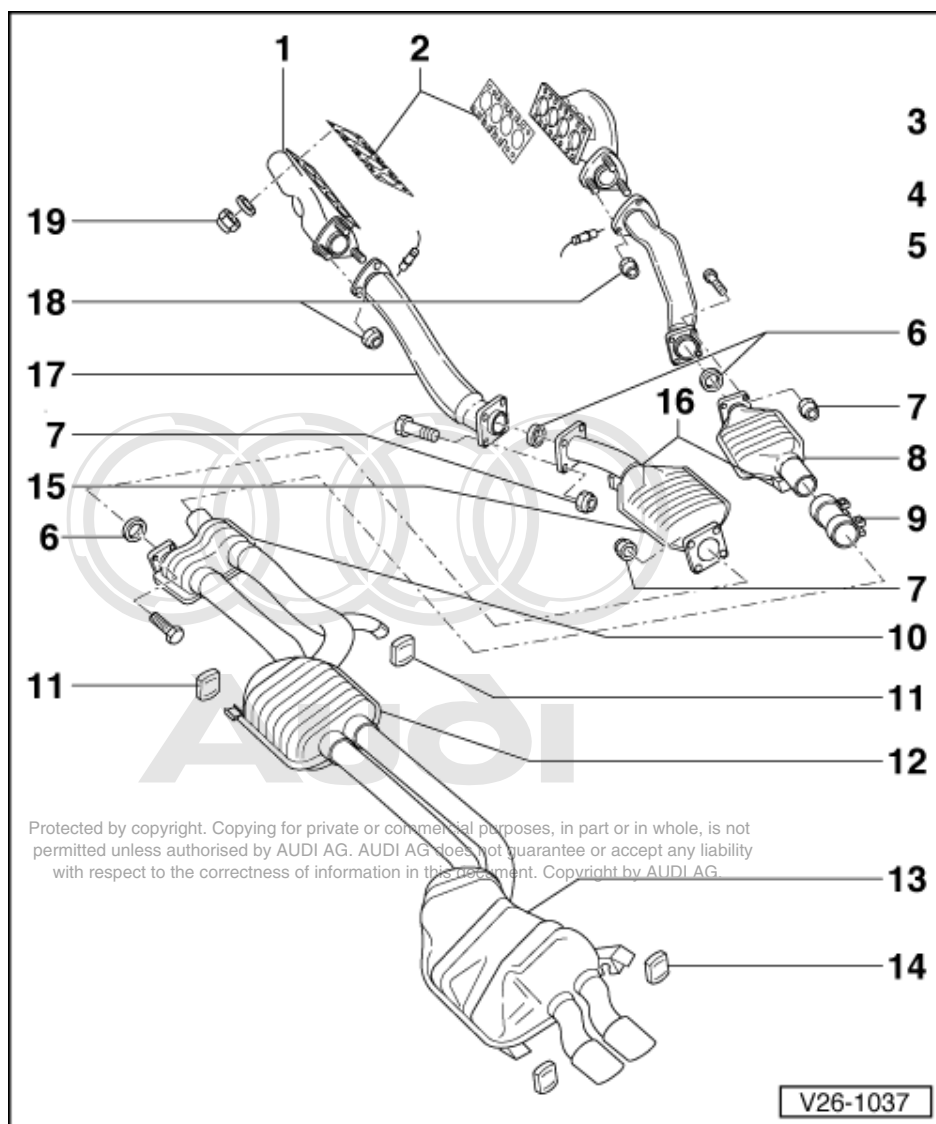
- ♦ Grease thread with G5. Keep grease away from slits in probe body.

5 Front exhaust pipe

6 Sealing ring

7 Hexagon nut, 25 Nm

8 Catalytic converter, right



9 Double clamps

- ◆ Tighten evenly, 40 Nm
- ◆ Installation position => Page 111
- ◆ Always replace after unfastening union.

10 Front silencer

- ◆ Installation position =>Page 110

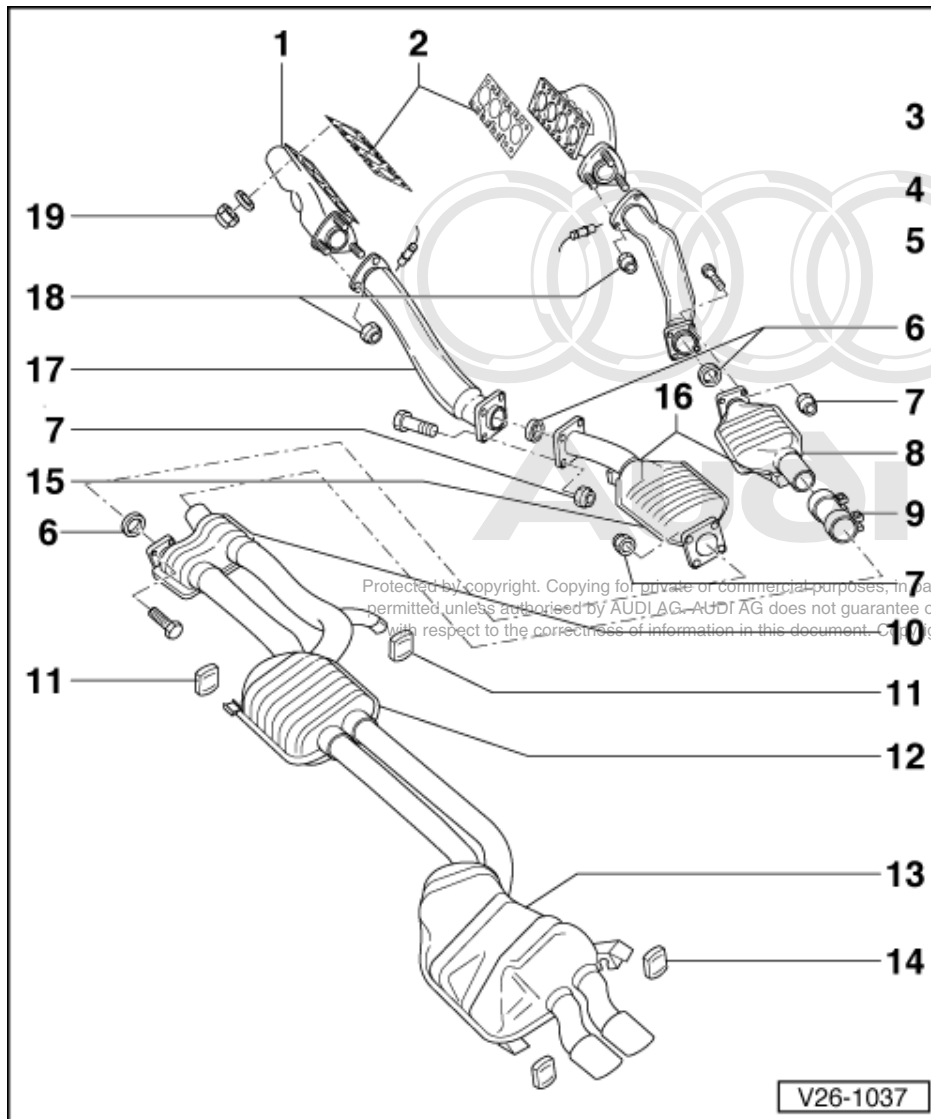
11 Retainer

- ◆ Hexagon bolts for attaching bracket to floor group, 25 Nm

12 Centre silencer

13 Rear silencer

- ◆ Checking pretension of exhaust system =>Page 110
- ◆ Aligning tailpipes =>Page 110 .



14 Retainer

- ♦ Hexagon nuts for attaching bracket to floor group, 25 Nm

15 Catalytic converter, left

16 Catalytic converter mounting

- ♦ Component layout =>Page 108 .

17 Exhaust pipe, front left

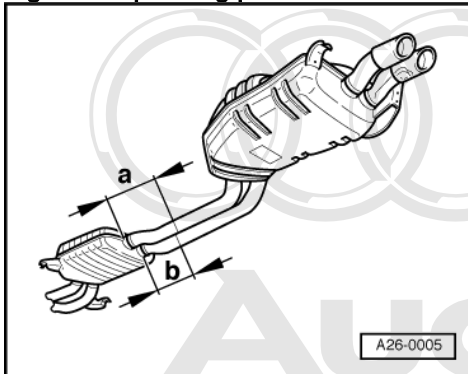
18 Exhaust manifold/front exhaust pipe flange connection

- ♦ Tighten hexagon nuts evenly in several stages, 25 Nm
- ♦ Component layout =>Page 109

19 Hexagon nut, 25 Nm



Fig.1 Separating point between centre and rear silencers



- -> A cutting point is provided for replacing the centre/rear silencer.

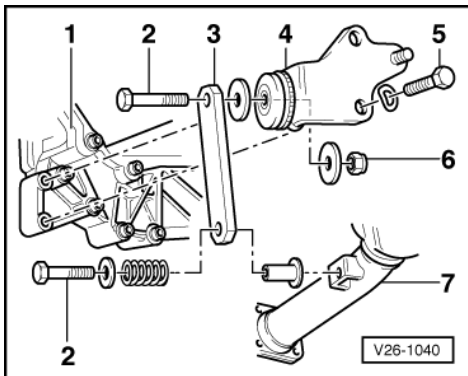
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Dimension -a- 240 mm

Dimension -b- 200 mm

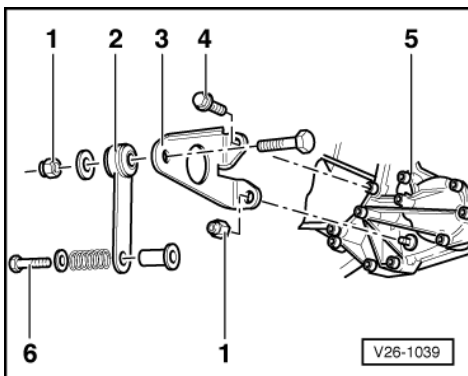
- For performance of repairs two short twin clamps are provided for connection of centre and rear silencer.
- Double clamps are to be installed horizontally.
- Tailpipe alignment =>Page 110 .
- Rear silencer alignment => Page 109

1.3 - Catalytic converter mounting



-> Fig.2 Component layout, left side

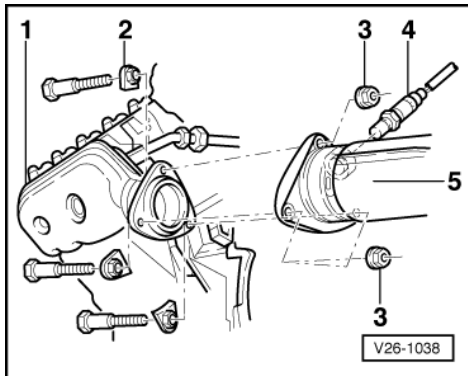
- 1 - Gearbox
- 2 - Hexagon bolt, 25 Nm
- 3 - Links (4 off)
- 4 - Bracket
- 5 - Hexagon bolt, 25 Nm
- 6 - Hexagon nut, 25 Nm
- 7 - Exhaust pipe, front left



-> Fig.3 Component layout, right side

- 1 - Hexagon nut, 25 Nm
- 2 - Link
- 3 - Bracket
- 4 - Hexagon bolt, 25 Nm
- 5 - Gearbox
- 6 - Hexagon bolt, 25 Nm

1.4 - Flange connection between catalytic converter and exhaust pipe, front



-> Fig.4 Component layout

- 1 - Exhaust manifold
- 2 - Locking element
- 3 - Hexagon nut, 25 Nm
- 4 - Lambda probe, 50 Nm
- 5 - Exhaust pipe, front left

Note:

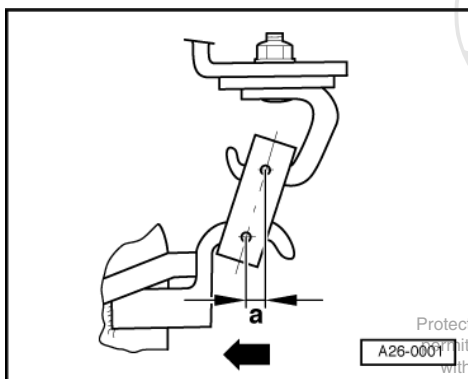
Hexagon nuts (item 3) are to be tightened evenly in several stages.

1.5 - Stress free alignment of exhaust system

Perform stress-free alignment of exhaust system as follows to avoid noise and corrosion.

Notes:

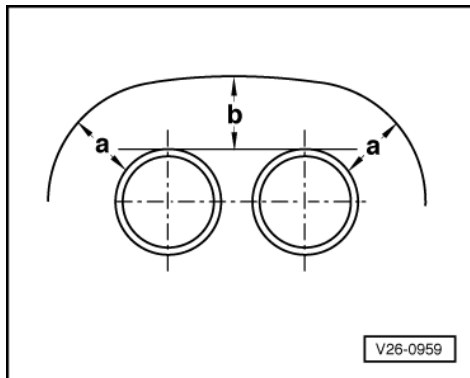
- ◆ Unfasten all screw connections of exhaust system (except exhaust manifold) including catalytic converter mounting.
- ◆ The dimensions illustrated are approximate.
- ◆ The exhaust system is aligned when cold.
- ◆ The following work must be performed in the specified sequence.



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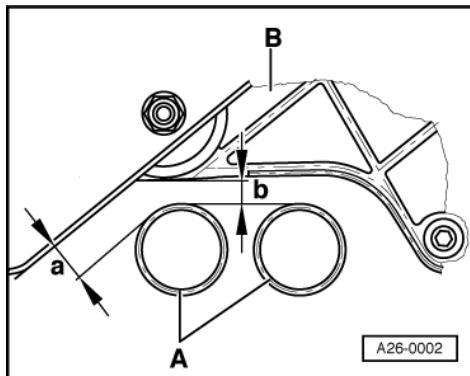


- -> Check pretension at left retainer at rear silencer; dimension -a- approx. 10 mm. Arrow faces in direction of travel.



- -> Perform tailpipe alignment as illustrated; spacing -a- right = distance -a- left
distance -b- from bumper recess to top approx. 20 mm.

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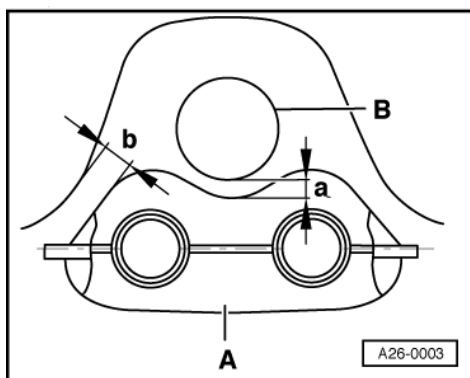
- -> Distance of exhaust pipes -A- from rear axle -B- between centre and rear silencer to rear axle -B-.

Dimension -a- approx. 27 mm

Dimension -b- approx. 20 mm

Note:

Exhaust pipes -A- are shown from rear in direction of travel.



- -> Align front silencer -A- as shown. Distance between front silencer -A- and floor group; dimension -b- approx. 25 mm. Distance from prop shaft -B-; dimension -a- approx. 20 mm.

Note:

Front silencer -A- is shown from rear in direction of travel.

- Tighten catalytic converter/front silencer flange connection, 25 Nm.

Note:

Screw connections of flanges must be tightened such that the flanges are the same all-round distance apart. 25 Nm.

- Tighten (40 Nm) twin clamp between catalytic converter/front silencer. Screw connection must be aligned on right, horizontally to exhaust pipe.
- Evenly tighten (25 Nm) flange connection between exhaust manifold and front exhaust pipes in several stages.
- Tighten (25 Nm) flange connections between front exhaust pipes and catalytic converter.
- Perform stress-free tightening (25 Nm) of catalytic converter mountings.

1.6 - Checking exhaust system for leaks

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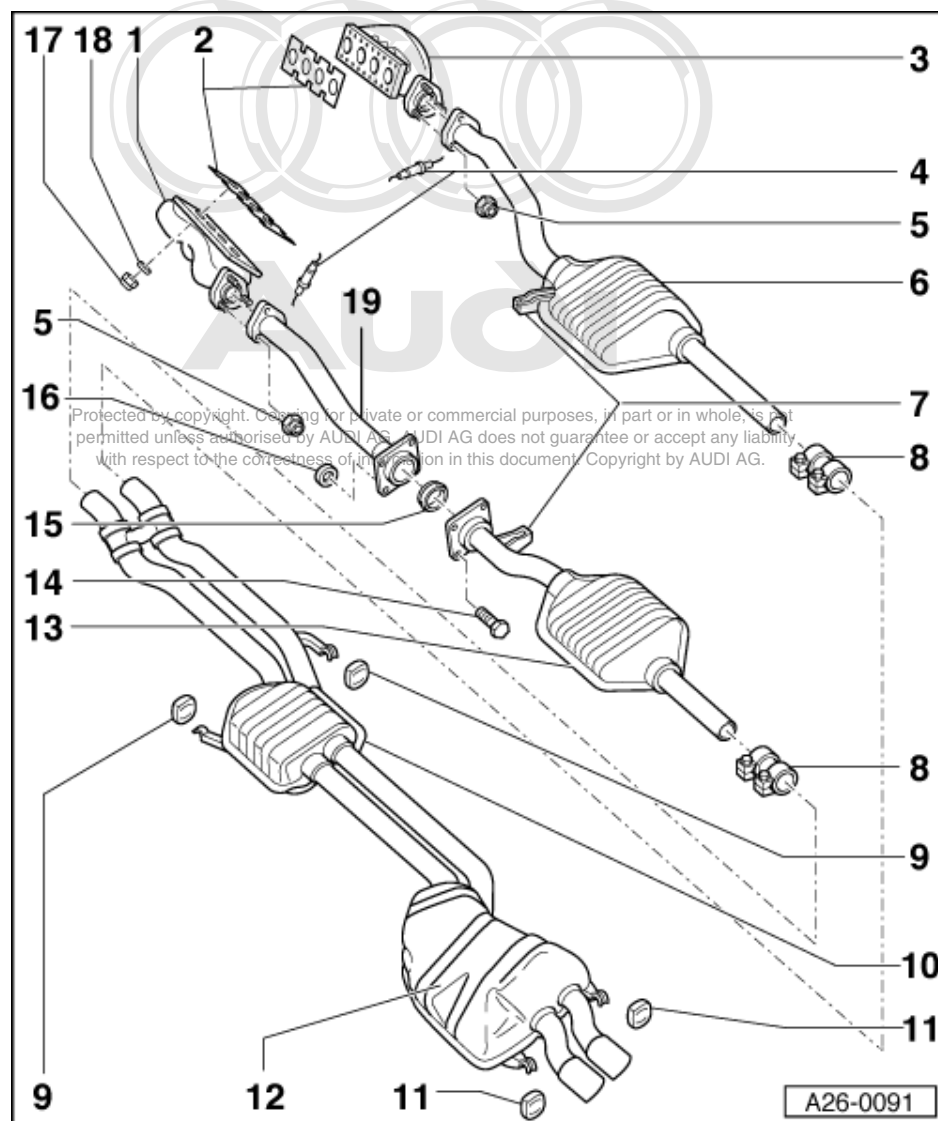
The exhaust system is to be checked for leaks as follows:

- Run engine.
- Plug tailpipes (with rags or stoppers, etc.) until check is completed.
- Connection points:
Check cylinder head/manifold, manifold/front exhaust pipe etc. for leaks by listening.
- Rectify any leaks that are found.



2 - Exhaust system, engine codes AEW and AKJ

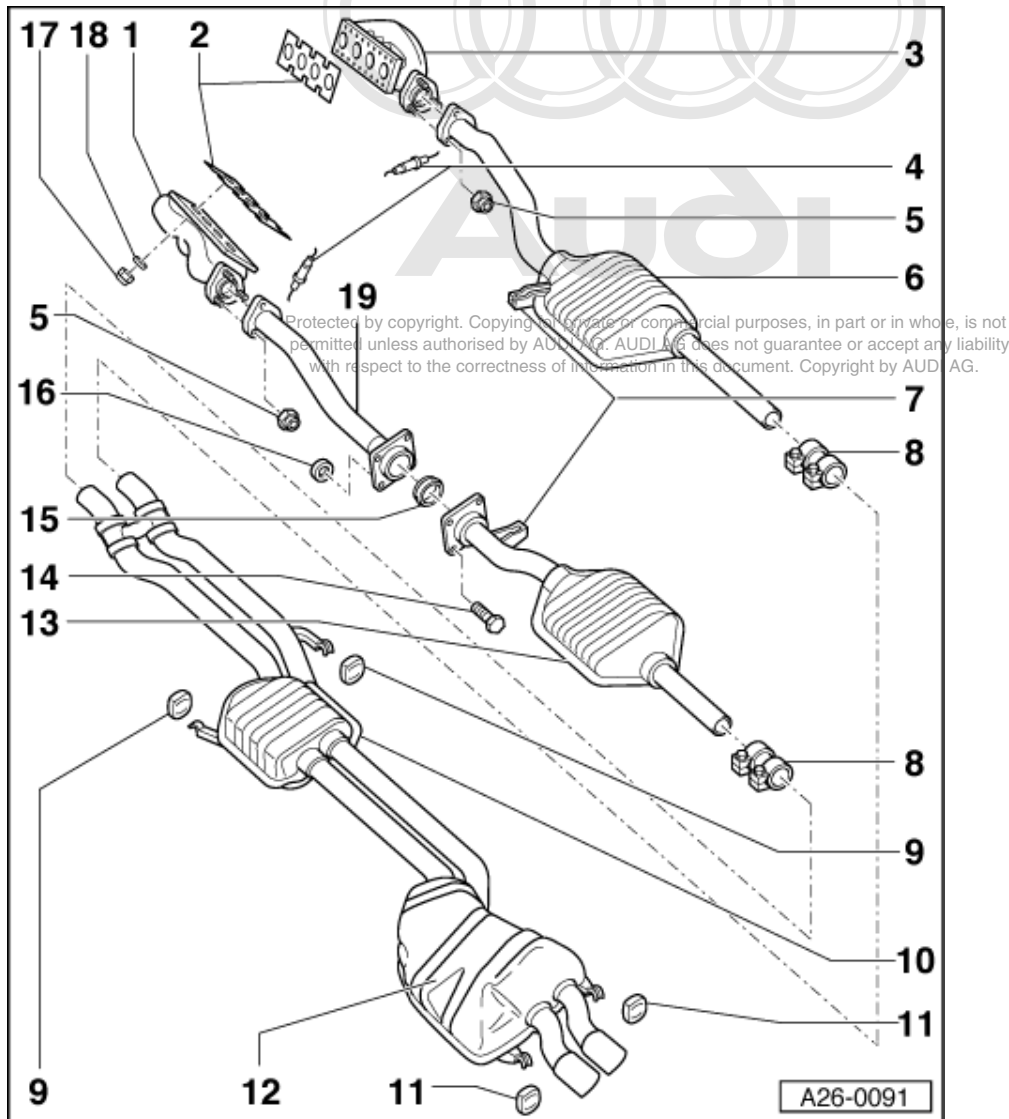
2.1 - Exhaust system, engine codes AEW and AKJ



2.2 - Removing and installing exhaust system

Notes:

- ♦ Stress-free alignment of exhaust system, => Page 117
- ♦ Checking exhaust system for leaks => Page 120
- ♦ Joint between centre and rear silencer => Fig. 1
- ♦ Renew all gaskets and hexagon nuts.
- ♦ Tightening torque for cross member/floor group, 25 Nm.
- ♦ Retainers of centre and end silencer are identical but have different elasticity (refer to parts film).

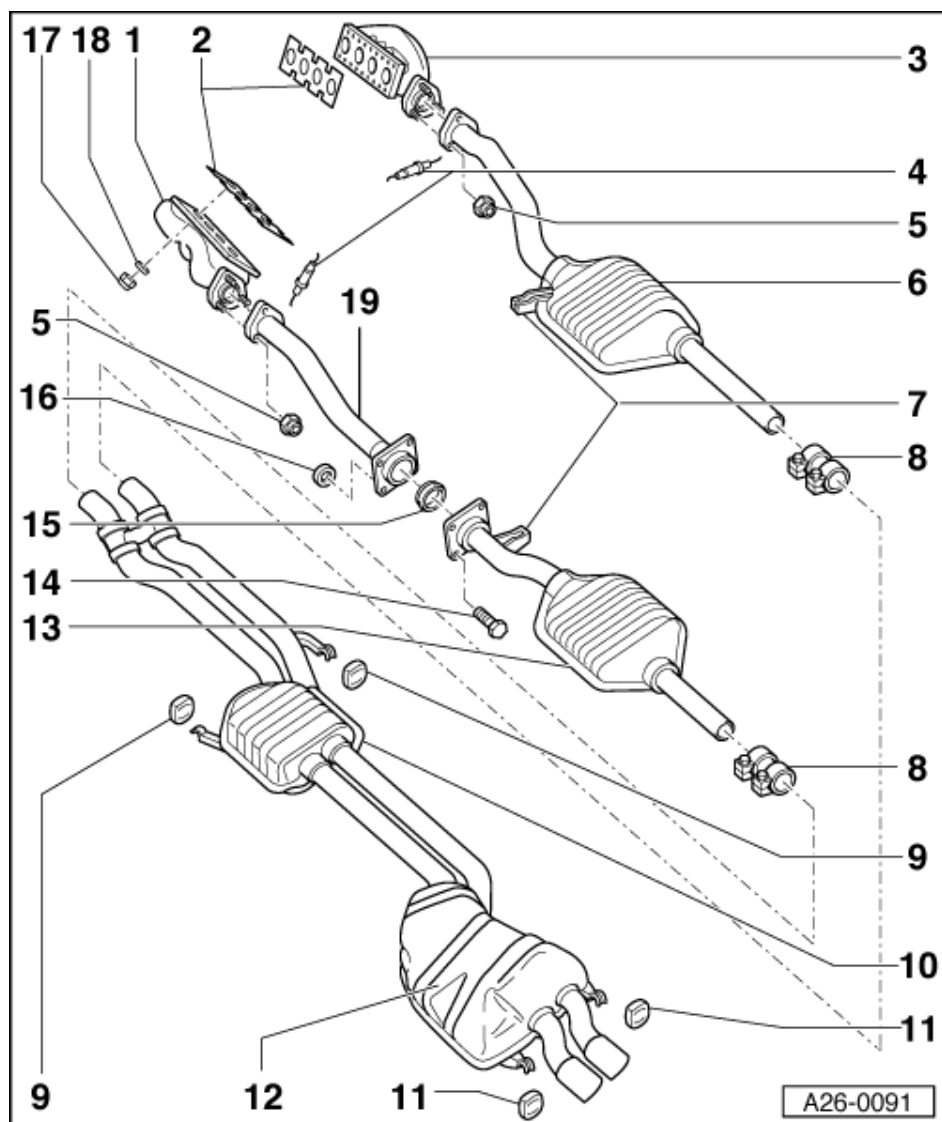


- 1 Exhaust manifold, left
- 2 Exhaust manifold gaskets
 - ♦ Metal side of gaskets must be facing cylinder head
- 3 Exhaust manifold, right
- 4 Lambda probes, 50 Nm
 - ♦ Check

=> Motronic Fuel Injection and Ignition System; Repair group 24; Checking lambda control Checking lambda control

- ♦ Grease thread with G5. Keep grease away from slits in probe body.

- 5 Hexagon nut 25 Nm
 - ♦ Always replace
- 6 Exhaust pipe, front with catalytic converter, right
- 7 Catalytic converter mounting
 - ♦ Component layout => Fig. 2 , 3



8 Double clamp

- ◆ Tighten evenly, 40 Nm
- ◆ Installation position => Page 118
- ◆ Always replace after unfastening union.

9 Retainer

- ◆ Same appearance as retainer (Item 11) but different elasticity
- ◆ Hexagon bolts for attaching bracket to floor group, 25 Nm

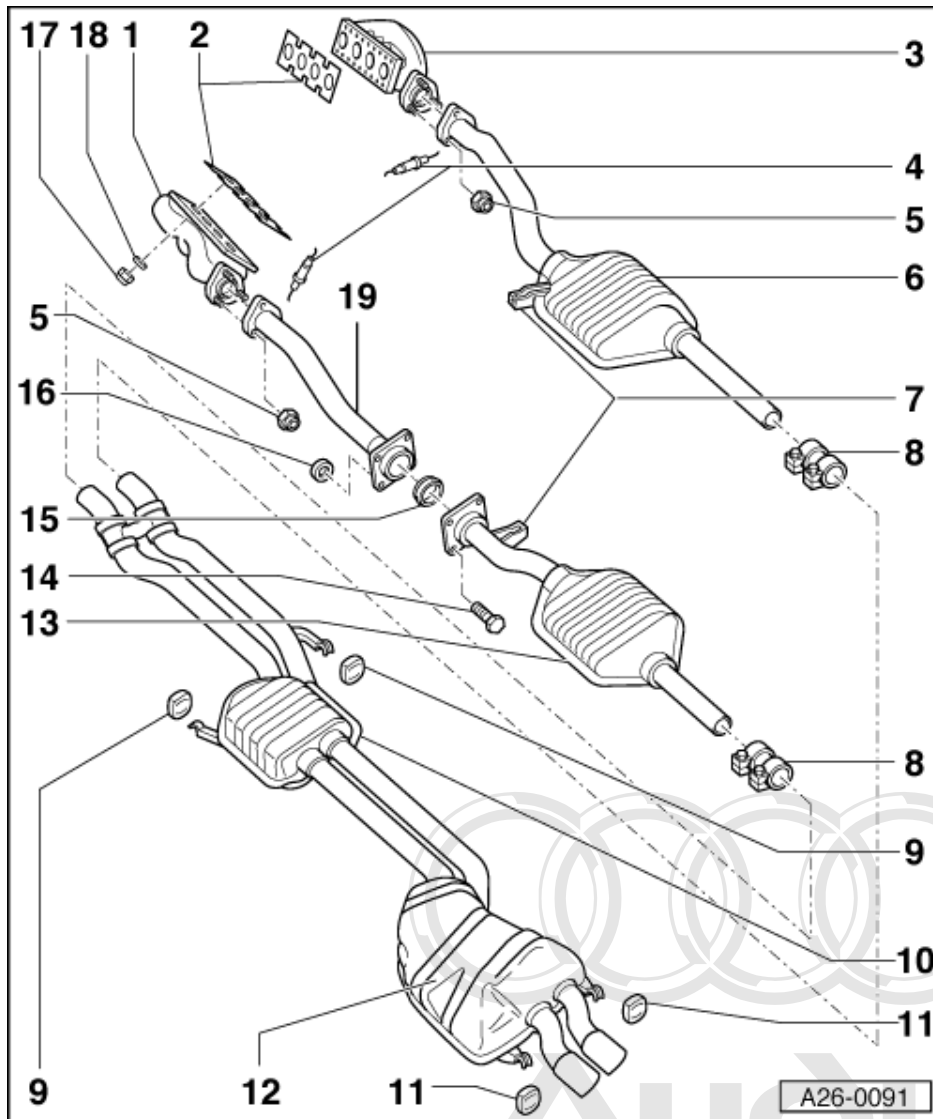
10 Centre silencer

11 Retainer

- ◆ Same appearance as retainer (Item 9) but different elasticity
- ◆ Hexagon bolts for attaching bracket to floor group, 25 Nm



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12 Rear silencer

- ♦ Checking pretension of exhaust system => Page 119 rear silencer alignment
- ♦ Tailpipe alignments => Page 118

13 Catalytic converter, left.

14 Hexagon bolt

15 Sealing ring

16 Hexagon nut 25 Nm

- ♦ Always replace

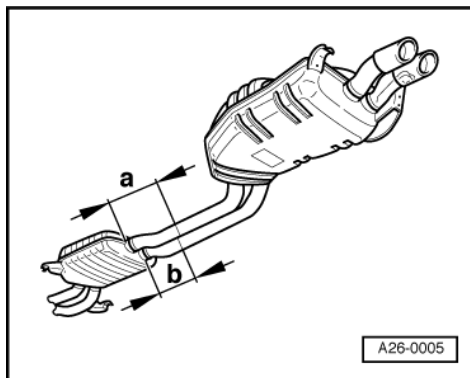
17 Hexagon nut 25 Nm

- ♦ Always replace

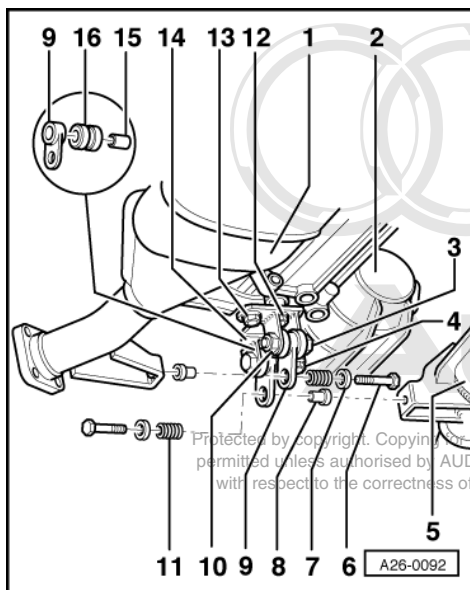
18 Shim

19 Exhaust pipe, front left

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Fig.1 -> Separating point between centre and rear silencers

- A joint is provided for replacing the centre/rear silencer.
- Detach connecting pipe between centre and rear silencer at locations marked by a groove:
- Dimension -a- approx. 240 mm
- Dimension -b- approx. 200 mm
- Two short double clamps are provided for connection of centre and rear silencer.
- Installation position of double clamps at rear => Page 119 .
- Ends of bolts must not be lower than bottom edge of clamping sleeve.
- Tailpipe alignment => Page 118
- Rear silencer alignment => Page 119

Fig.2 -> Catalytic converter mounting


- 1 - Catalytic converter, left
- 2 - Gearbox
- 3 - Hexagon bolt, 25 Nm
- 4 - Bolt with washer M8 x 20, tightening torque 25 Nm
- 5 - Catalytic converter, right
- 6 - Hexagon bolt, M8 x 48
- 7 - Plate
- 8 - Spacer
- 9 - Link
- 10 - Hexagon nut, 25 Nm
- 11 - Pressure spring
- 12 - Bolt with washer M8 x 40, tightening torque 25 Nm
- 13 - Hexagon nut (for securing switching mechanism shield)
- 14 - Bracket
- 15 - Tubular spacer

16 - Buffer

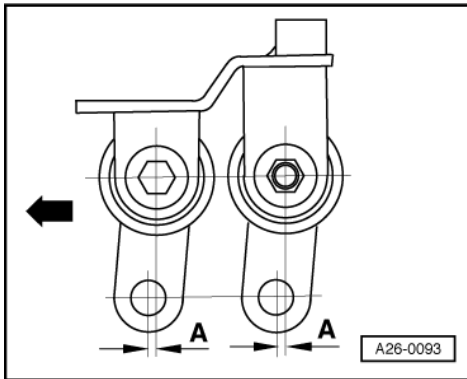


Fig.3 -> Fitting location of links on assembly

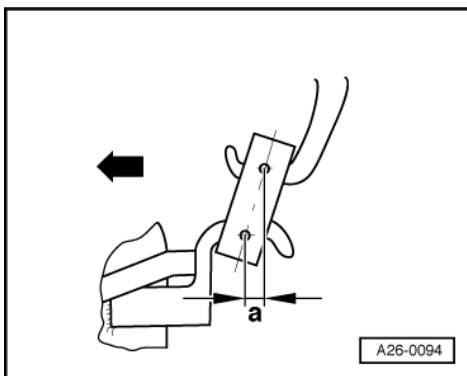
- Arrow faces in direction of travel.
- A = 3 mm

2.3 - Stress free alignment of exhaust system

Perform stress-free alignment of exhaust system as follows to avoid noise and corrosion.

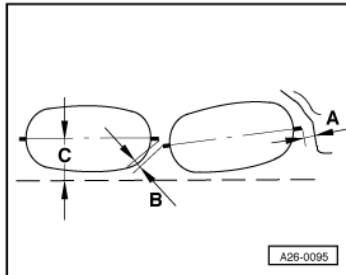
Notes:

- ◆ When performing stress-free exhaust system alignment, make sure that silencer system mounts are fitted free of stress.
- ◆ Unfasten all screw connections of exhaust system (except exhaust manifold) including catalytic converter mounting.
- ◆ The exhaust system is aligned when cold.
- ◆ The following work must be performed in the specified sequence.
- ◆ The dimensions illustrated are approximate.



- -> Check pretension at left retainer on centre silencer.
- Dimension -a- 10 -12 mm
- Arrow faces in direction of travel.

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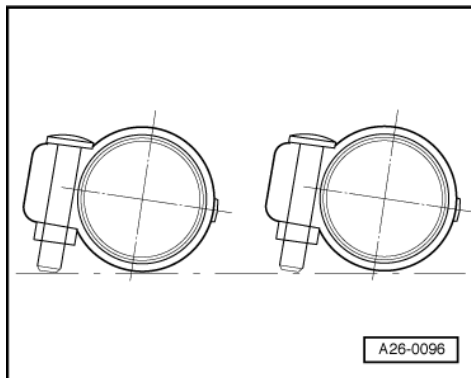
Catalytic converter alignment

- -> Dimension -A- = 13 - 17 mm
- Dimension -B- 9 mm
- -C- parallel with bottom edge of vehicle
- Catalytic converters are shown from rear in direction of travel.

Note:

Distance between pipes and cross member must be at least 34 mm.

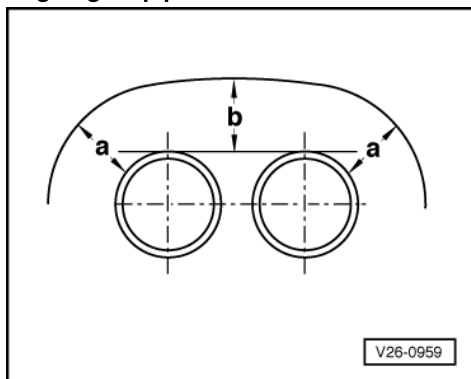
Installation position of double clamps between catalytic converters and centre silencer.



Notes:

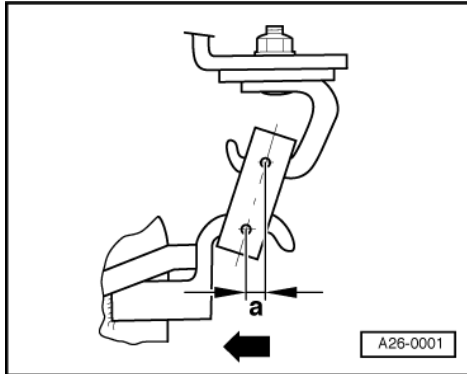
- ♦ Double clamps are to be replaced after unfastening screw connection.
- ♦ Double clamps are shown from rear in direction of travel.
- -> Align screw connection of double clamp as illustrated. End of bolts must not be lower than bottom edge of clamping sleeve.
- Tightening torque of hexagon nut: 40 Nm.

Aligning tailpipes

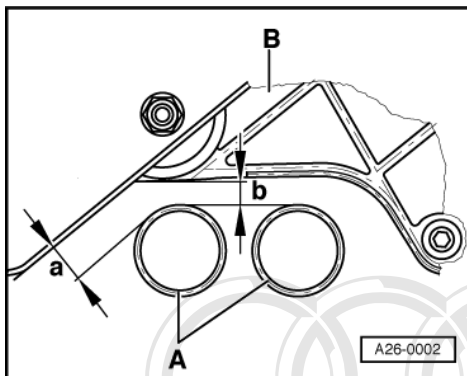


- -> Distance -a- right = Distance -a- left
- Distance -b- between bumper recess at top and tailpipe must be at least 20 mm.

Rear silencer alignment



- -> The illustration shows the rear left mounting on the rear silencer.
- Pretension -a- = 10-12 mm is to be corrected by adjustment in double clamps between centre and rear silencer.
- Arrow faces in direction of travel.



- -> Distance of exhaust pipes -A- from rear axle -B- (between centre and rear silencer):

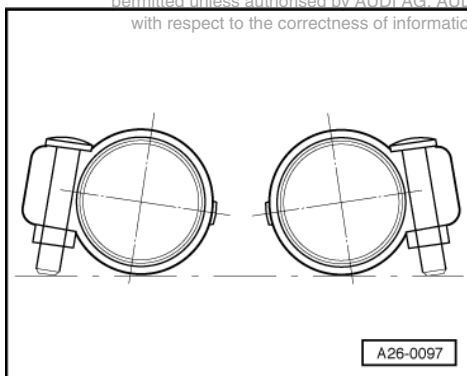
Dimension -a- approx. 27 mm

Dimension -b- approx. 24.5 mm

Note:

Exhaust pipes -A- are shown from rear in direction of travel.

Installation position of double clamps at rear



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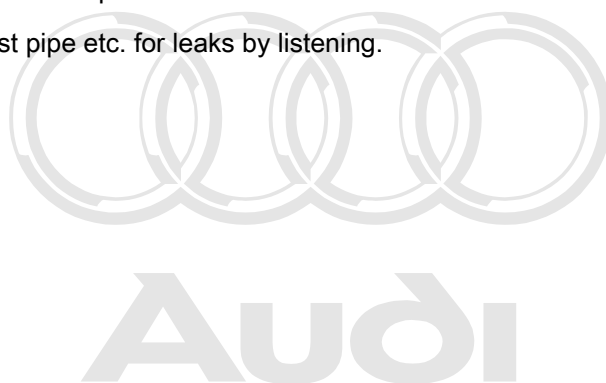
Notes:

- ♦ Squeeze together pipes of centre/end silencer as far as they will go.
- ♦ Double clamps are to be replaced after unfastening screw connection.
- ♦ Double clamps are shown from rear in direction of travel.
- -> Align screw connection of double clamp as illustrated. End of bolts must not be lower than bottom edge of clamping sleeve.
- Tightening torque of hexagon nut: 40 Nm.

2.4 - Checking exhaust system for leaks

The exhaust system is to be checked for leaks as follows:

- Run engine.
- Plug tailpipes (with rags or stoppers, etc.) until check is completed.
- Connection points:
Check cylinder head/manifold, manifold/front exhaust pipe etc. for leaks by listening.
- Eliminate any leaks found.



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