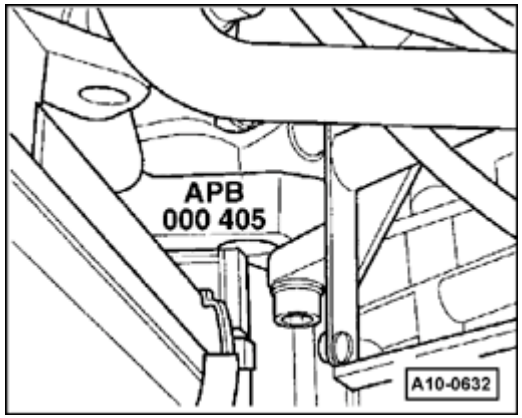
Technical data

Engine number



The engine number (engine code and serial number) is on the machined surface on the cylinder block, at the front of the right cylinder bank.

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

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Engine data

Engine code		**APB**
Manufactured		09.99 ➢
Capacity	cm^3	2671
Power output	Hp at RPM	250/5800
Torque	ft lb at RPM	258/1800-4500
Bore	dia. mm	81
Stroke	dia. mm	86.4
Compression ratio		9.3
RON	min.	98 RON[1)]
Firing order		1-4-3-6-2-5
Fuel injection system		Motronic
On Board Diagnostic		yes
Oxygen sensor closed-loop control		yes
Secondary air injection		no
Camshaft timing control		yes

1) Fuel with less than 95 RON can also be used, but this will cause a loss of power.

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Engine code	**APB**
Catalytic converter	yes
Exhaust gas recirculation	no
Turbo charging	yes
Valve timing	
At 1 mm valve lift and 0 mm valve clearance, camshaft timing control not active	
Inlet opens after TDC	10°
Inlet closes after BDC	20°
Exhaust opens before BDC	38°
Exhaust closes before TDC	8°

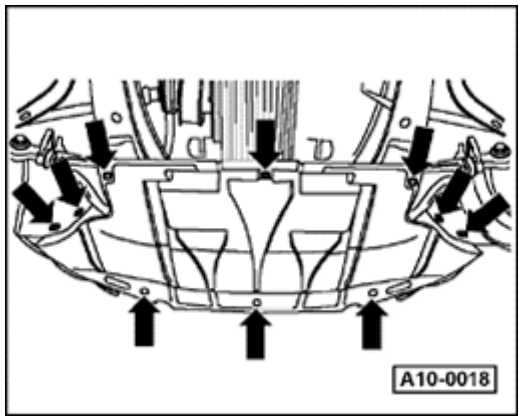
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13-1

Engine, disassembly and assembly

Ribbed belt, removing and installing

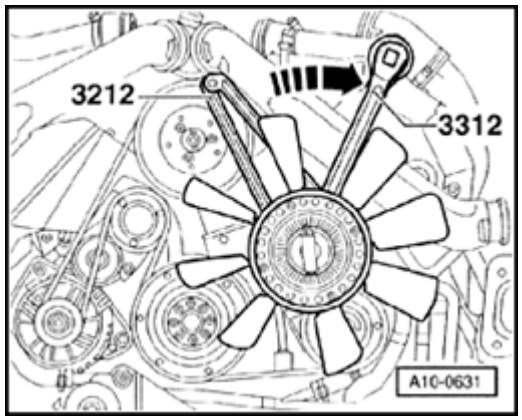
Removing



- Remove noise insulation -arrows-.
- Remove bumper

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position



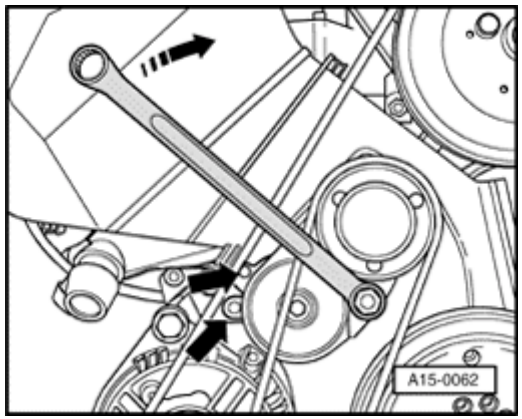
- Remove viscous fan (counter-hold with pin wrench 3212).

Note:

Viscous fan has left-hand thread: turn in direction indicated.

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13-2



- Mark direction of rotation of ribbed belt.

- To slacken ribbed belt, turn to the right using a 17 mm ring spanner until the two holes are aligned with each other -arrow- and hold in position with mandrel 3204.

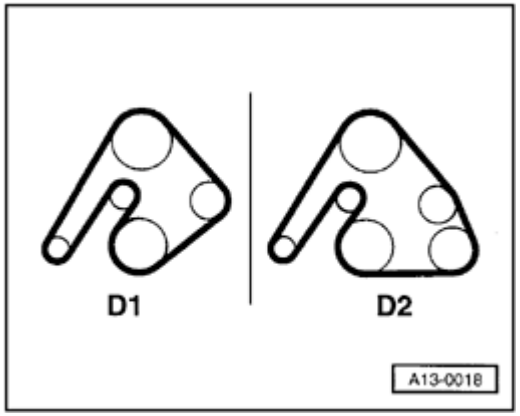
Note:

Mark the direction of rotation of the ribbed belt with chalk or felt pen before removing. A used belt can break if it rotates in the opposite direction when reinstalled.

- Take off ribbed belt.

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13-3



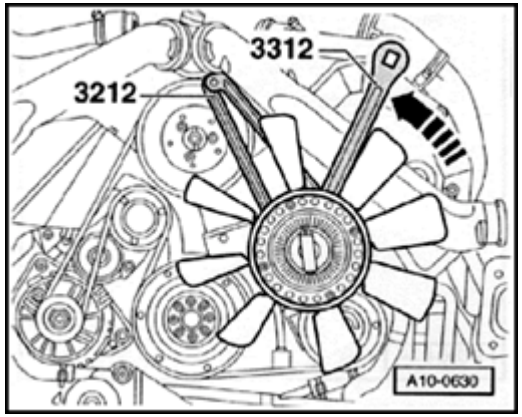
Installing

- Install ribbed belt onto crankshaft pulley and idler wheel first, and push belt onto tensioning roller last.

Routing of ribbed belt

- D1 - vehicles without air conditioner
- D2 - vehicles with air conditioner

- Take out mandrel 3204.



- Counter-hold belt pulley for viscous fan using spanner wrench 3212 and tighten viscous fan using open end spanner 3312 and torque wrench 1331 (left hand thread).

Note:

Viscous fan has left-hand thread: turn against direction indicated.

- Install lock carrier.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Install bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Install noise insulation.

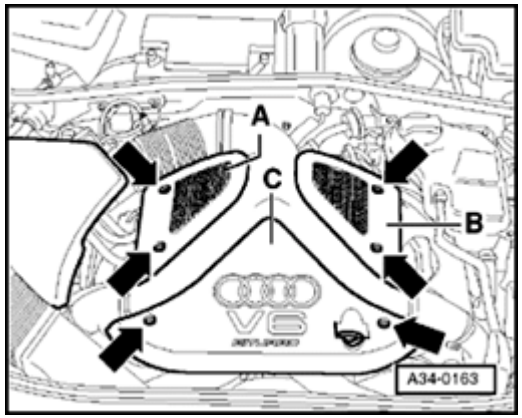
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13-4

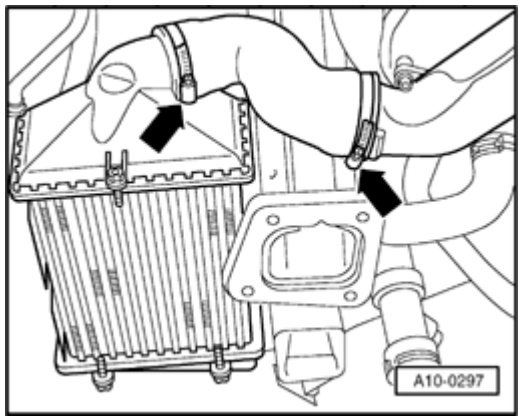
Toothed belt, removing and installing

Removing

- Remove ribbed belt ⇒ Page 13-1 .

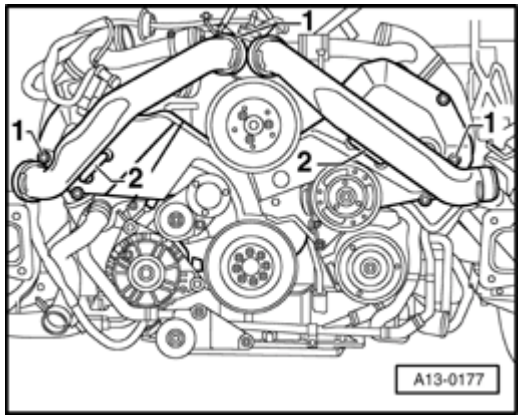


- Remove bolts -arrows- and remove engine cover panel -C-.



- Remove pressure hoses -arrows- between charge air coolers and pressure pipes (left and right sides).

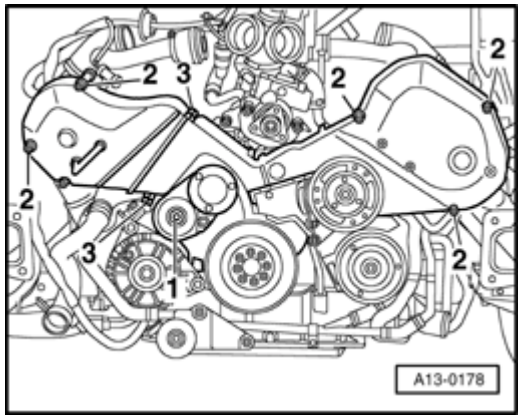
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- Remove pressure pipes -1-.

Note:

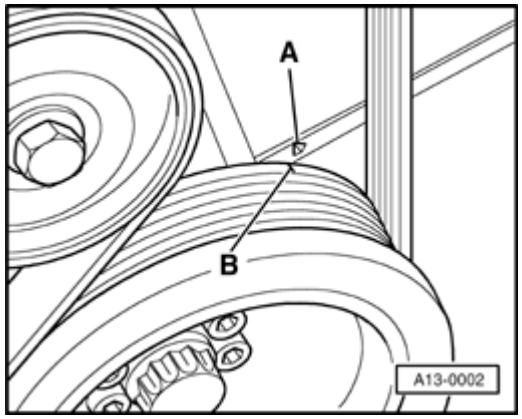
Watch position of retaining strips -2-.



- Remove tensioner -1- for ribbed belt.
- Remove left and right toothed belt guards -2-.
- Remove center toothed belt guard -3-.

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13-6



- Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

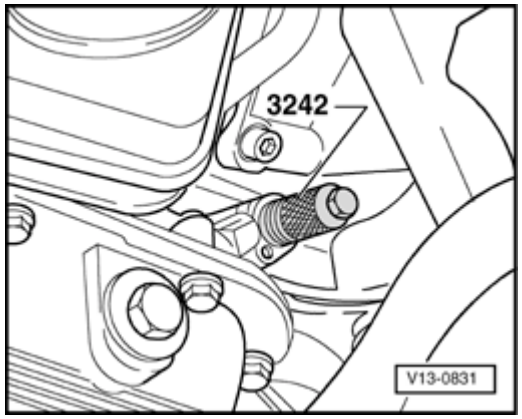
Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: larger holes in securing plates on camshaft sprockets must align opposite one another on inside. If not, turn crankshaft one revolution further.
- Remove sealing plug from cylinder block, left.
- The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.

CAUTION!

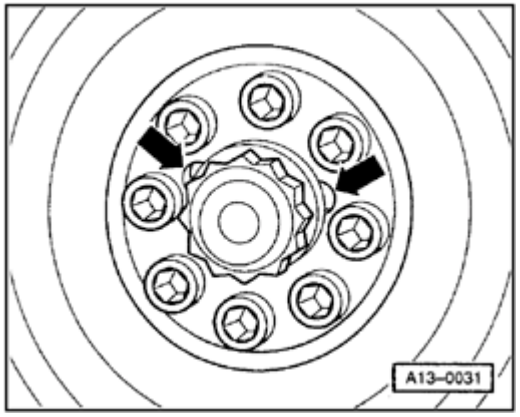
Injury risk - do not turn engine while feeling for TDC drilling.



- Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.

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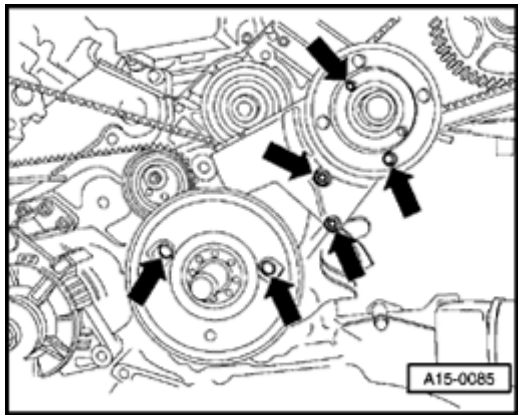
13-7



- Remove vibration damper on crankshaft.

Note:

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



- Remove idler wheel for ribbed belt -arrows-.
- Remove toothed belt guard behind vibration damper -arrows-.

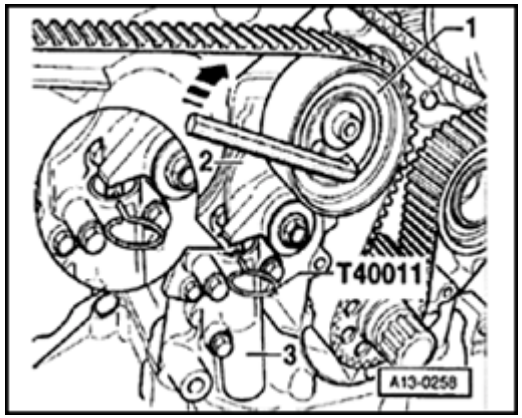
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13-8

Note:

- *Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when reinstalled.*

- *The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.*



- Using a hex key, turn toothed belt tensioning roller -1- clockwise 8 mm in direction of arrow until tensioning lever -2- compresses tensioning element -3- sufficiently to enable special tool T 400 11 to be fitted in drilling and in plunger.
- Insert special tool T 400 11, release toothed belt tensioning roller.
- Take off toothed belt.

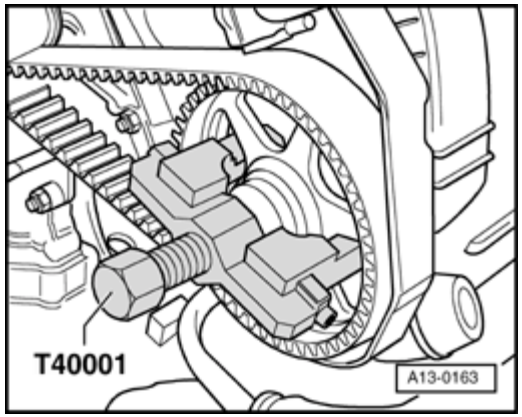
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Installing

- Insert camshaft clamp 3391 in securing plates of two camshafts.

- Slacken both camshaft bolts and remove approx. 5 turns.

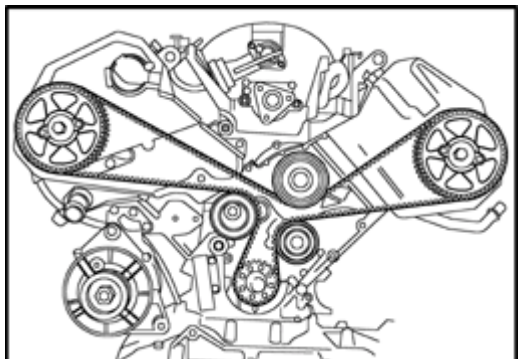
- Take out camshaft clamp 3391.



- Pull off both camshaft sprockets with special tool T40001.
- Reinstall both camshaft sprockets with securing plates and tighten hand-tight again.

Note:

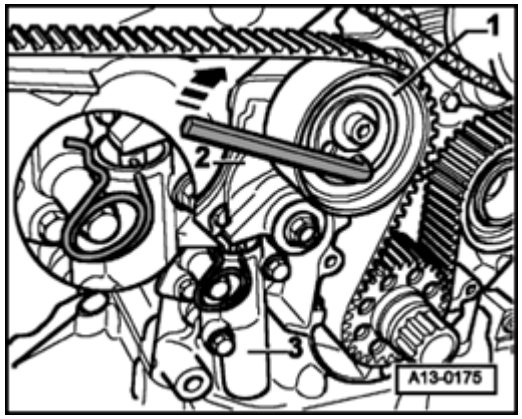
The camshaft sprockets should be just tight enough on the camshaft tapers so that they can still be turned but do not move axially.



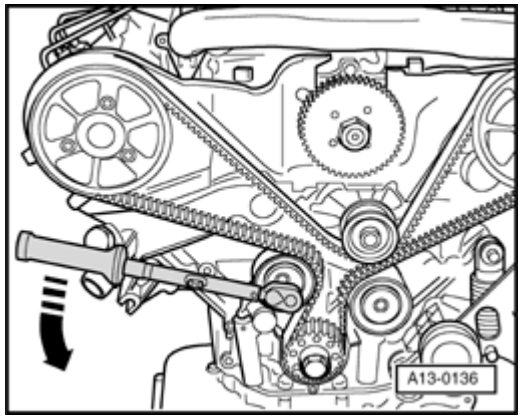
- Install toothed belt on all sprockets as illustrated.
- Install camshaft clamp 3391.

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13-10

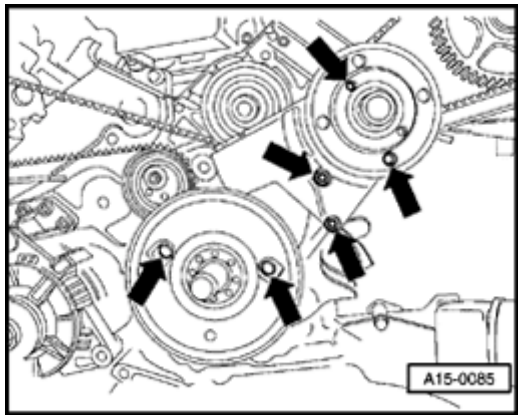


- Using a hex key, turn toothed belt tensioning roller -1- clockwise 8 mm in direction of arrow until special tool T 400 11 can be removed.

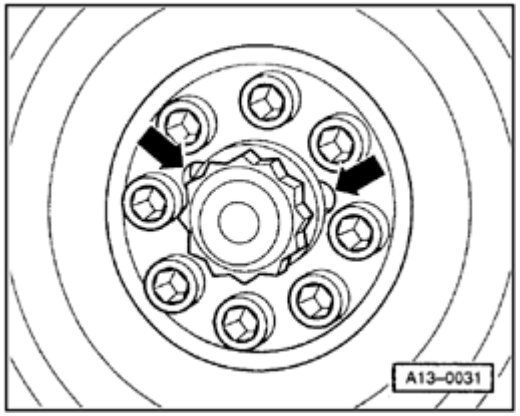


- Pre-tension toothed belt by a turning in direction of arrow with a torque of 15 Nm using a torque wrench.
- Tighten bolts on camshaft sprockets.

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- Install idler wheel for ribbed belt -arrows-.
- Install toothed belt guard behind vibration damper -arrows-.



- Install vibration damper. Note positions of locating lugs -arrows- on belt sprocket.

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- Install toothed belt guard.

- Install ribbed belt ⇒ Page 13-3 .

Tightening torques	
Toothed belt sprocket to camshaft	55 Nm
Idler wheel	45 Nm
Toothed belt tensioning roller	20 Nm
Pulley to crankshaft	20 Nm
Toothed belt tensioning element	10 Nm
Central bolt 1) to crankshaft	200 Nm + 180 ° 2)

1) The central bolt must always be replaced.

2) Turning in two stages of 90 ° is also permissible.

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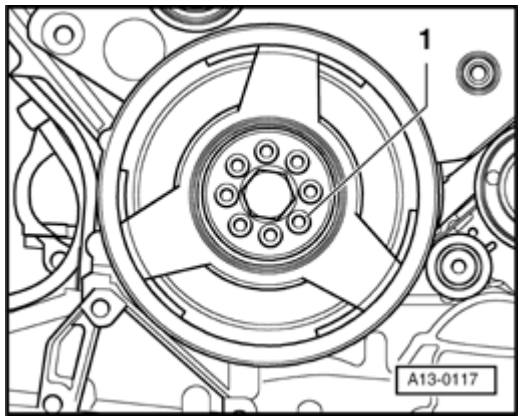
13-13

Vibration damper, removing and installing

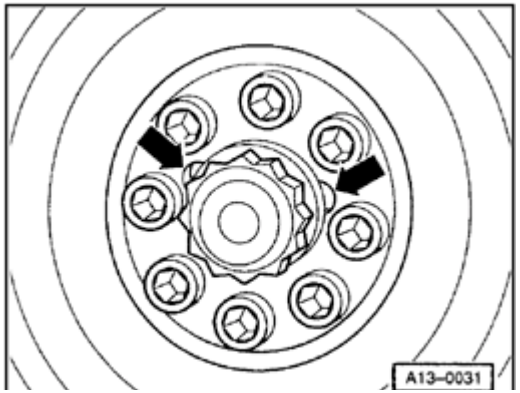
- Remove ribbed belt ⇒ Page 13-1 .

Note:

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



- Remove vibration damper.

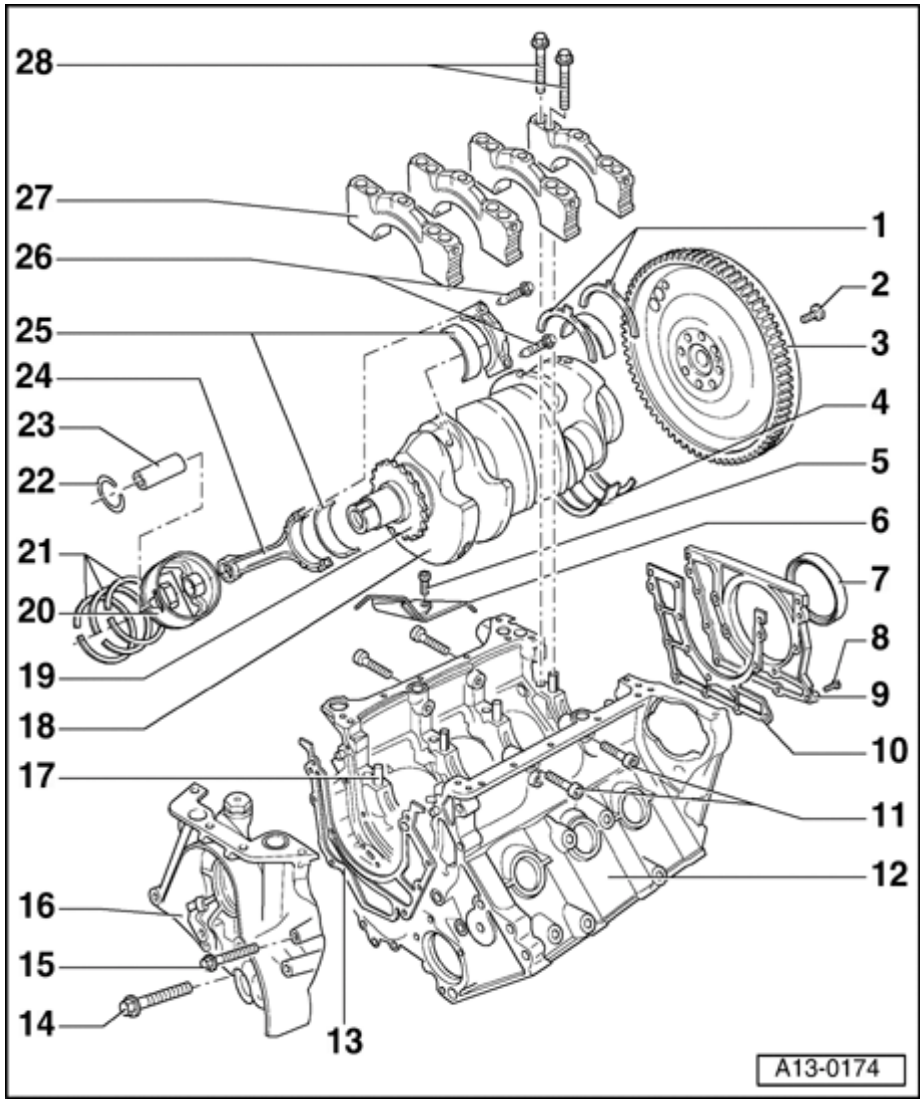


- When installing, ensure that notches -arrows- in vibration damper are aligned with locating lugs on toothed belt sprocket.

  Tightening torque: 25 Nm

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13-14



Cylinder block, crankshaft and flywheel, disassembly and assembly

Note:

Replace all gaskets and seals.

1 - Thrust washers

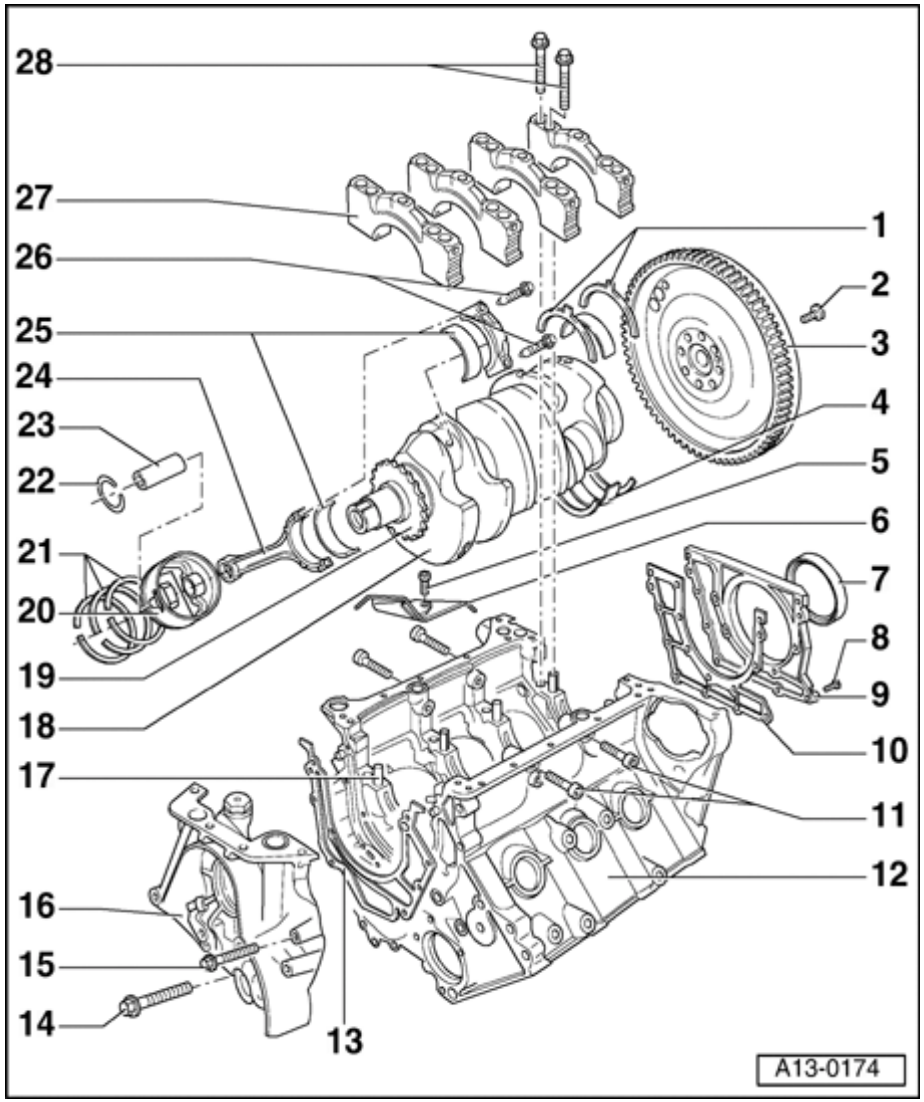
- Measuring axial clearance of crankshaft ⇒ Page 13-21
- Thrust washer only fitted on 4th crankshaft bearing

2 - Special bolt (double hex)

- Replace
- Dual-mass flywheel: 60 Nm + 180 ° (1/2 turn)

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13-15



3 - Dual-mass flywheel

- Removing and installing ⇒ Page 13-29
- Removing and installing needle bearing ⇒ Page 13-35

4 - Crankshaft bearing

- Checking axial and radial clearance ⇒ Page 13-21

5 - Bolt, tightening torque 10 Nm

6 - Oil spray jet

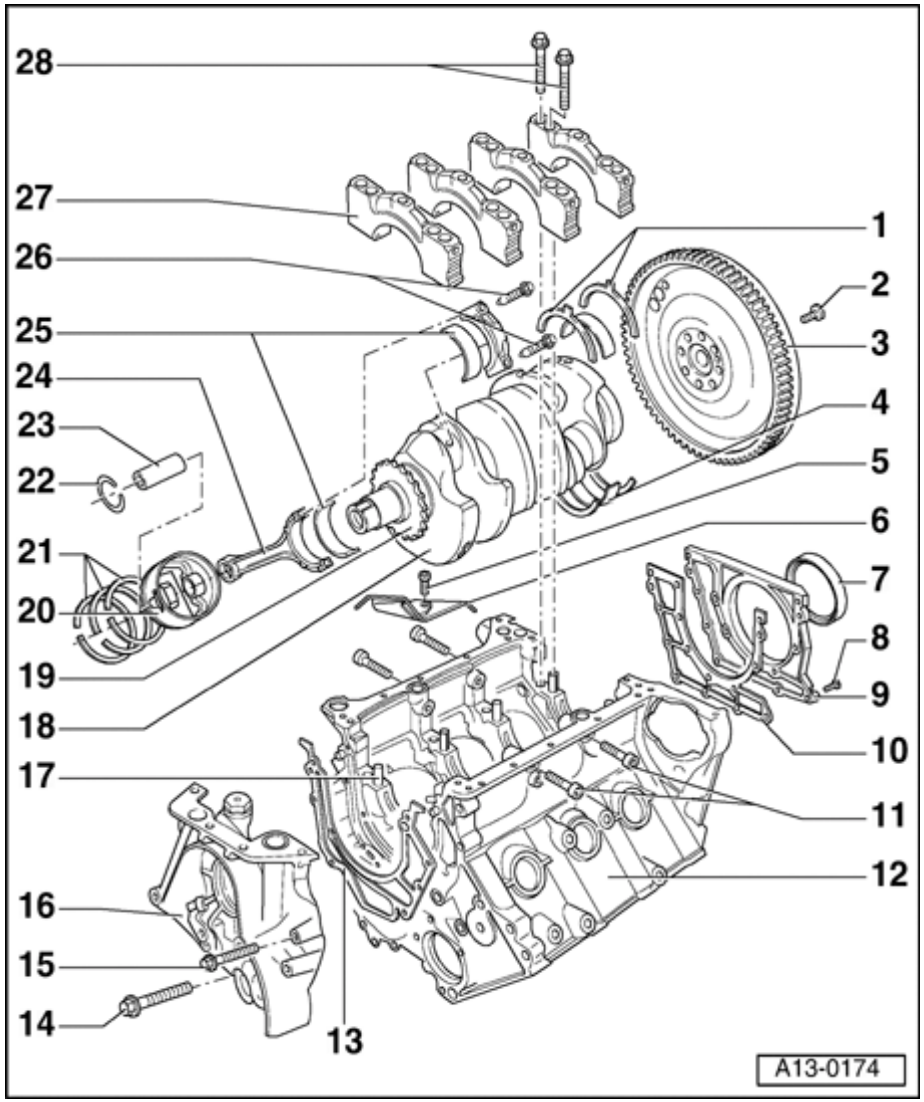
- For piston cooling

7 - Oil seal for rear sealing flange

- Replacing ⇒ Page 13-23

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13-16



8 - Bolt, tightening torque 10 Nm

9 - Rear sealing flange

10 - Gasket

11 - Bolt, tightening torque 25 Nm

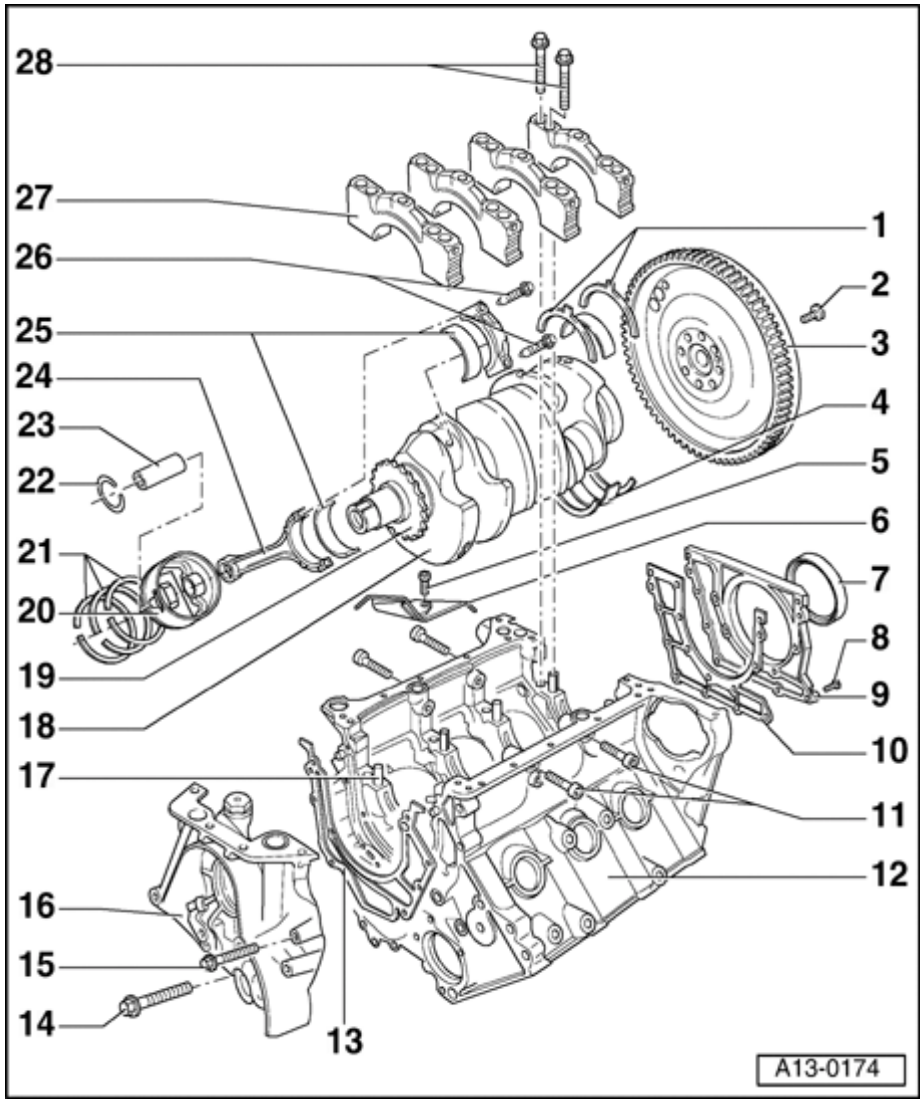
- Screw in bolts on left and right sides finger-tight before tightening bolts on main bearing caps.

12 - Cylinder block

13 - Gasket

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13-17



14 - Collar bolt, tightening torque 30 Nm

- Apply Loctite ™ when installing

15 - Bolt, tightening torque 10 Nm

16 - Front sealing flange

17 - Expansion pins

18 - Crankshaft

- Checking ⇒ Page 13-21

19 - Chain sprocket for oil pump

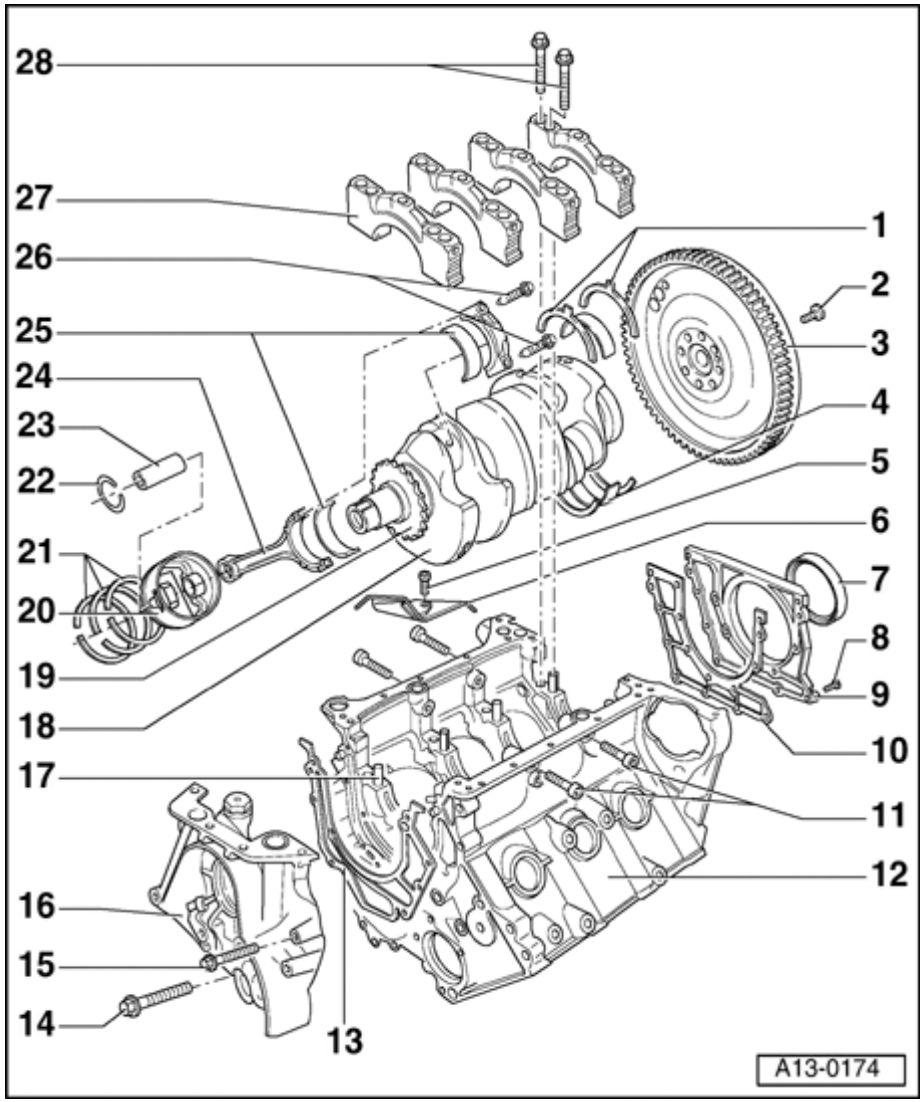
- Removing and installing ⇒ Page 17-62 .

20 - Pistons

- Checking ⇒ Page 13-36

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13-18



21 - Piston rings

- Checking ⇒ Page 13-36

22 - Circlip for piston pin

23 - Piston pin

24 - Connecting rod

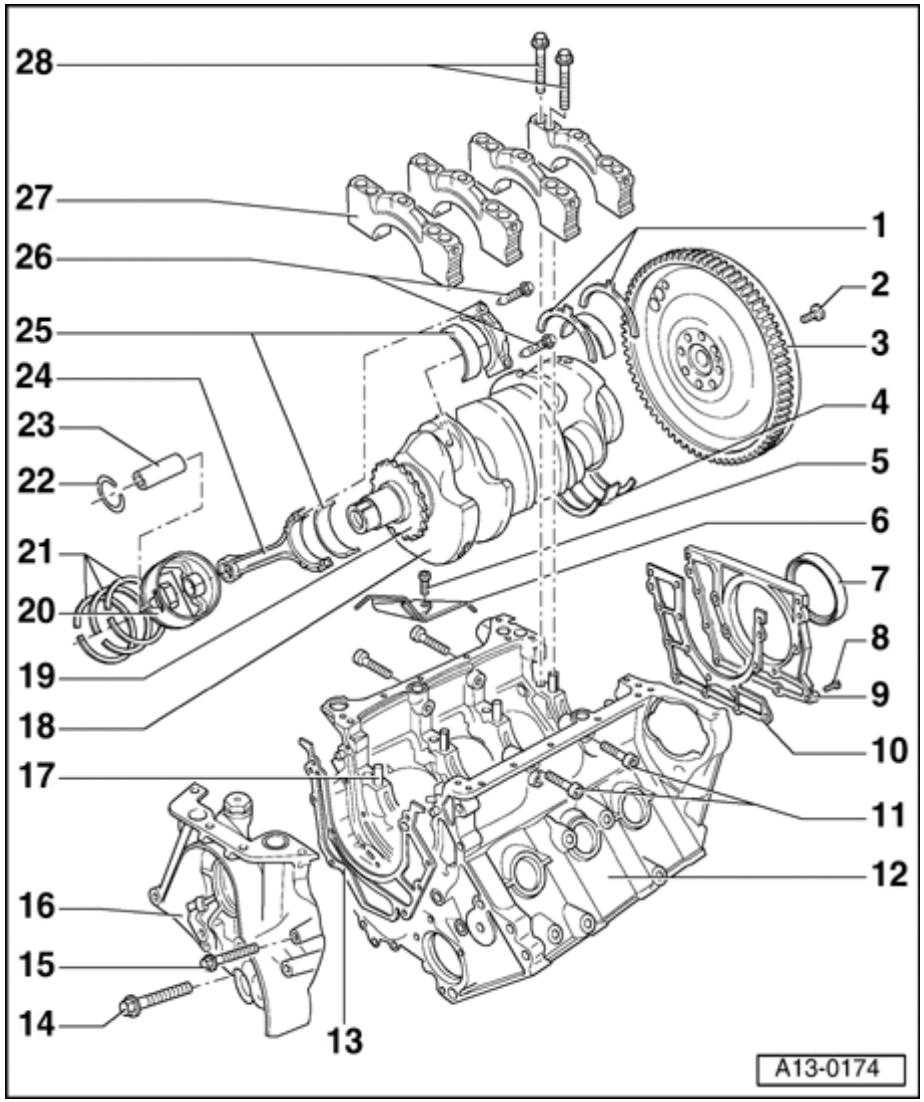
- Mark cylinder number and installation position of matching connecting rods and bearing caps before removing
- Installation position: wider, slightly convex machined surfaces on the same side

25 - Connecting rod bearing

- Do not interchange used bearing shells.
- Connecting rods, connecting rod bearings ⇒ Page 13-39

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13-19



26 - Connecting rod bearing bolts

- Always replace
- Tightening torque: 30 Nm + 90° ($^1/_4$turn)
- When measuring radial clearance, tighten to 20 Nm but do not turn further.

27 - Main bearing cap

- Marking -1- on oil pump side
- Replace bolts for main bearing caps
- Watch position of dowel sleeves
- Checking bearing clearance ⇒ Page 13-21

28 - Bolts for main bearing caps

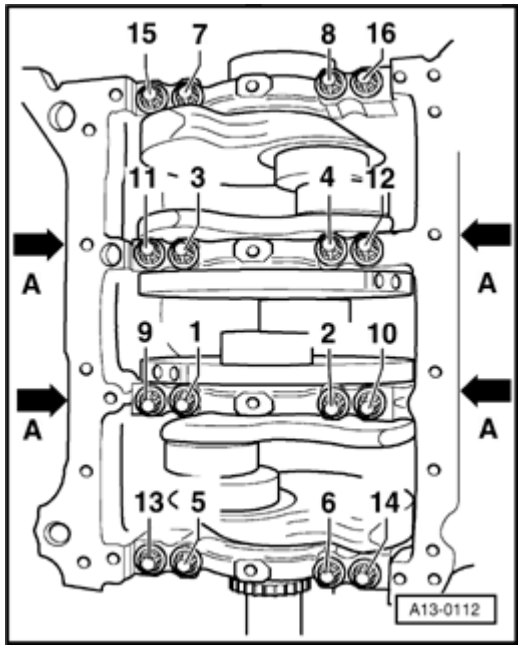
- Always replace
- Tightening torque ⇒ Page 13-20
- Tightening sequence ⇒ Page 13-20

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13-20

Crankshaft bearing caps, installing

- Bearing -1- is at the toothed belt end; bearing -4- is at the flywheel end.



Tightening sequence:

- Stage 1 Tighten all bolts in the sequence shown (1 - 16) to 30 Nm.
- Stage 2 Tighten all bolts in the sequence shown (1 - 16) to 60 Nm.
- Stage 3 Using a fixed wrench, turn all bolts in the sequence shown (1 - 16) 90° further.
- Tighten bolts -A- to 25 Nm.

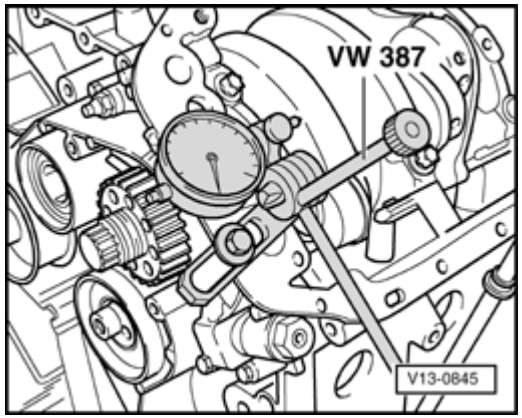
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Crankshaft axial and radial clearance, measuring

Axial clearance

Note:

Do not interchange used bearings.



- Attach dial gauge with universal dial gauge bracket VW 387 to oil pump and bring it into contact with crank web.
- Press crankshaft against dial gauge by hand and set gauge to -0-.
- Press crankshaft away from dial gauge.
- Note reading:

Clearance when new	Wear limit
0.090 ... 0.251 mm	0.28 mm

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Radial clearance

Measure radial clearance with Plastigage™.

- Read value:

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

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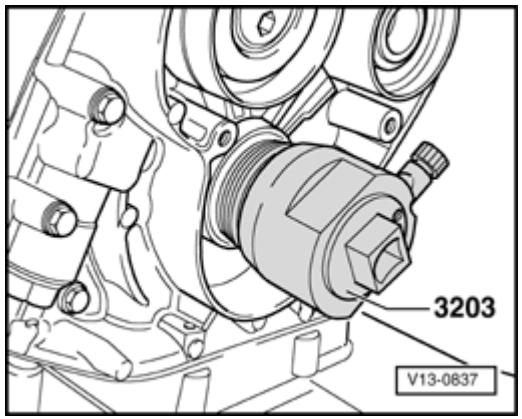
13-23

Crankshaft oil seals, replacing

A - Toothed belt end

- Remove toothed belt ⇒ Page 13-4 .

- Remove toothed belt sprocket from crankshaft

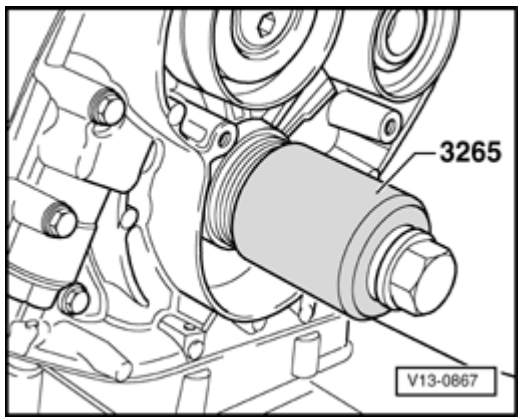


- Pull out oil seal with oil seal extractor 3203.
- Clean contact surface and sealing surface.

Note:

Do not lubricate sealing lip or outer circumference of seal before pressing in.

- Push on seal using fitting sleeve 3202/1.



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

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13-24

B - Flywheel end

Note:

Replace oil seal together with sealing flange.

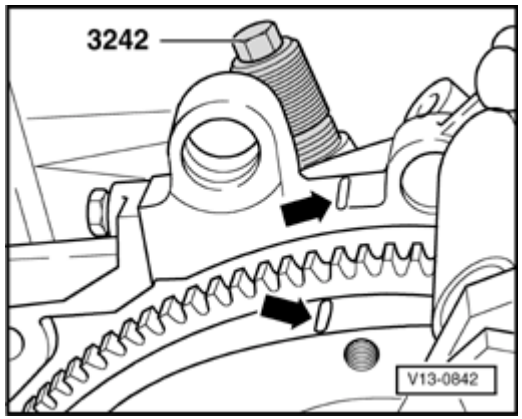
Vehicles with manual transmission

- Drain off coolant ⇒ Page 19-19 .

- Remove transmission.

⇒ *Repair Manual, 6 Spd. Manual Transmission 01E, Repair Group 34*

- Remove clutch.



- With crankshaft at TDC, screw in clamping bolt 3242.
- Mark position of flywheel relative to engine -arrows-.
- Remove dual-mass flywheel.
- Remove sealing flange.

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13-25

Installing

- Install sealing flange.

- Install dual-mass flywheel with new bolts.

Note:

Always replace securing bolts for dual-mass flywheel.

- Install clutch.

⇒ *Repair Manual, 6 Spd. Manual Transmission 01E, Repair Group 30*

Tightening torques	
Dual-mass flywheel to crankshaft	60 Nm + 180°
Clutch to dual-mass flywheel	20 Nm

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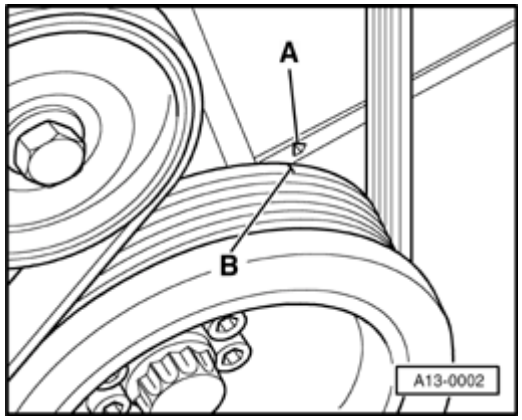
13-26

Vehicles with automatic transmission

- Remove transmission.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*

- Drain off coolant ⇒ Page 19-19 .



- Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

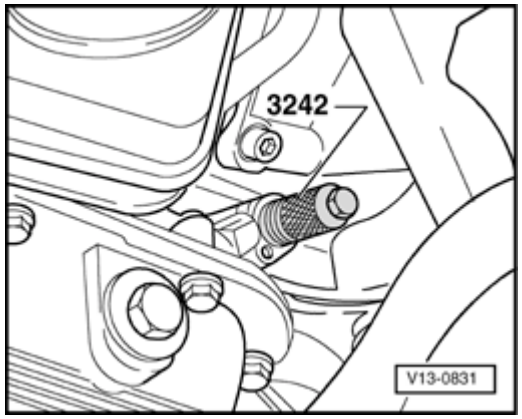
- Check position of camshafts: larger holes in securing plates on camshaft sprockets must align opposite one another on inside. If this is not the case, turn crankshaft one revolution further.
- Remove sealing plug from cylinder block, left.
- The TDC drilling in crankshaft must be visible (or able to be felt) in line with sealing plug hole.

CAUTION!

Injury risk - do not turn engine while feeling for TDC drilling.

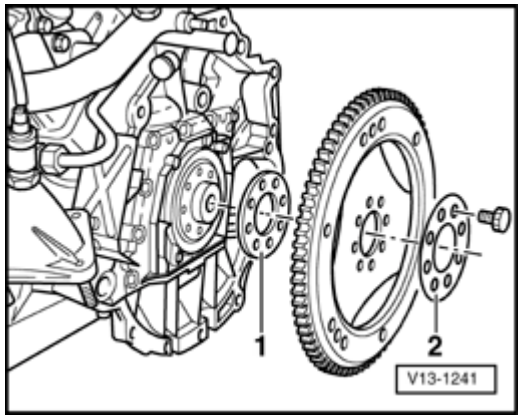
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13-27



- Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.
- Mark positions of holes in drive plate, shim -1- and washer -2- in relation to crankshaft.
- Mark positions of shim -1- in front of drive plate and washer -2- behind drive plate.

Installing



- Install drive plate with washer -2- and shim -1- (3.0 mm or 4.0 mm).

Note:

- *Short engines and exchange engines are supplied without bush in crankshaft. On vehicles with automatic transmission, always knock in new bush before installing drive plate.*
- *Always replace drive plate securing bolts.*

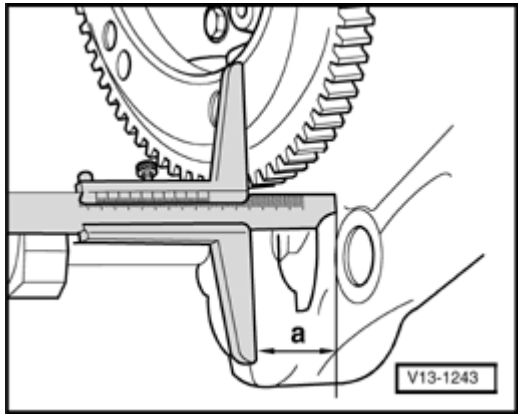
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13-28

Tightening torques	
Drive plate to crankshaft	60 Nm + 90°

Note:

Always replace securing bolts for drive plate.



- Measure distance -a- at three points and calculate average value.
  - ♦ Distance -a- = approx. 29.9 mm.
- Install a different shim if necessary.

Note:

Before installing the transmission, check that the dowel sleeves for locating engine/transmission are fitted in the engine flange.

- Install transmission.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*

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13-29

Dual-mass flywheel / drive plate, installation dimensions, removing and installing

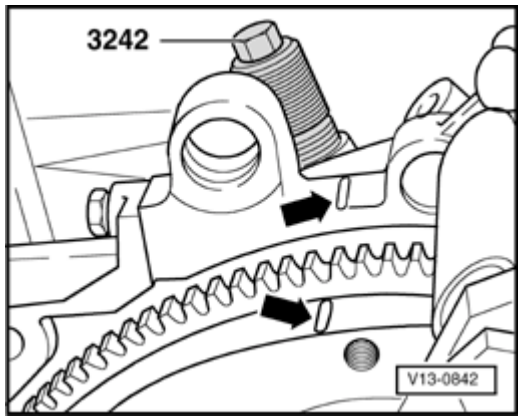
A - Flywheel

Removing

- Remove transmission.

⇒ Repair Manual, 6 Spd. Manual Transmission 01V, Repair Group 34

- Remove clutch.



- With crankshaft at TDC, screw in clamping bolt 3242.
- Mark position of flywheel relative to engine -arrows-.
- Remove bolts (bolts must be replaced).

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13-30

Note:

The needle bearing is located in the flywheel and must be pressed in if a new flywheel is installed ⇒ *Page 13-35* .

Installing

- Install dual-mass flywheel.

Note:

Always replace flywheel securing bolts.

- Install clutch.

⇒ *Repair Manual, 6 Spd. Manual Transmission 01E, Repair Group 30*

- Install transmission.

⇒ *Repair Manual, 6 Spd. Manual Transmission 01E, Repair Group 34*

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13-31

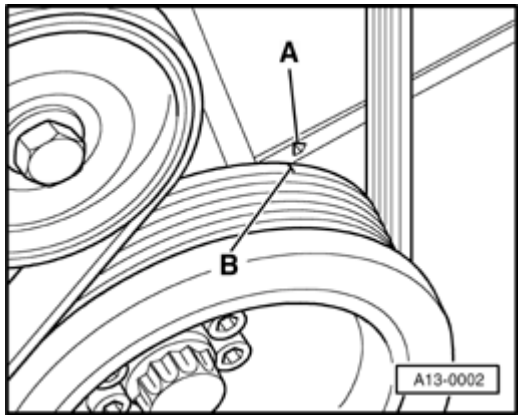
Tightening torques	
Dual-mass flywheel to crankshaft	60 Nm + 180°
Clutch to dual-mass flywheel	20 Nm

B - Drive plate

Removing

- Remove transmission.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*



- Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: larger holes in securing plates on camshaft sprockets must align opposite one another on inside. If this is not the case, turn crankshaft one revolution further.
- Remove sealing plug from cylinder block, left.

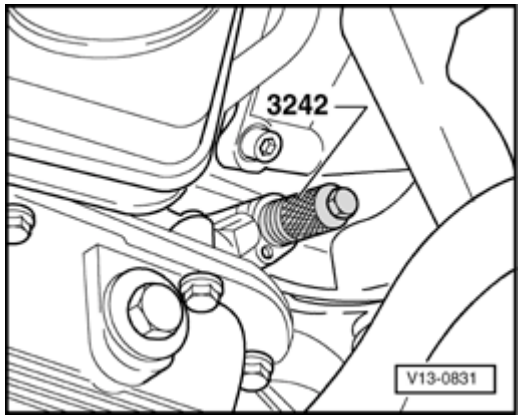
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13-32

- TDC drilling in crankshaft must be visible (or able to be felt) in line with sealing plug hole.

CAUTION!

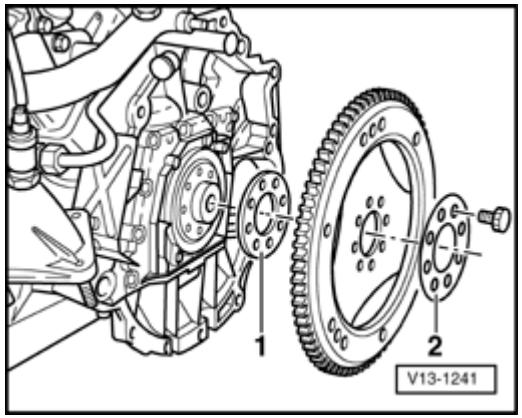
Injury risk - do not turn engine while feeling for TDC drilling.



- Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.
- Mark positions of holes in drive plate, shim -1- and washer -2- in relation to crankshaft.
- Mark positions of shim -1- in front of drive plate and washer -2- behind drive plate.

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13-33



Installing

- Install drive plate with washer -2- and shim -1- (3.0 mm or 4.0 mm).

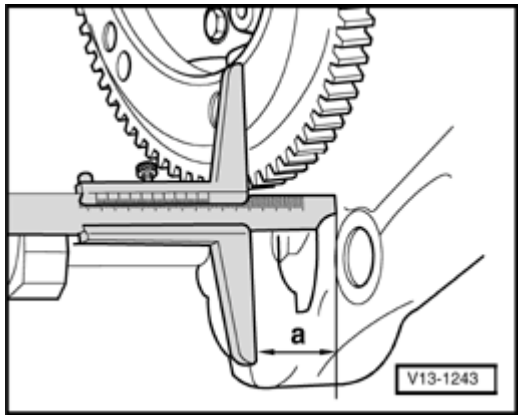
Note:

- *Short engines and exchange engines are supplied without bush in crankshaft. On vehicles with automatic transmission, always knock in new bush before installing drive plate.*
- *Always replace drive plate securing bolts.*

Tightening torques	
Drive plate to crankshaft	60 Nm + 90°

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13-34



- Measure distance -a- at three points and calculate average value.
  - ♦ Distance -a- = approx. 12.3 mm.
- Install a different shim if necessary.

Note:

Before installing the transmission, check that the dowel sleeves for locating engine/transmission are fitted in the engine flange.

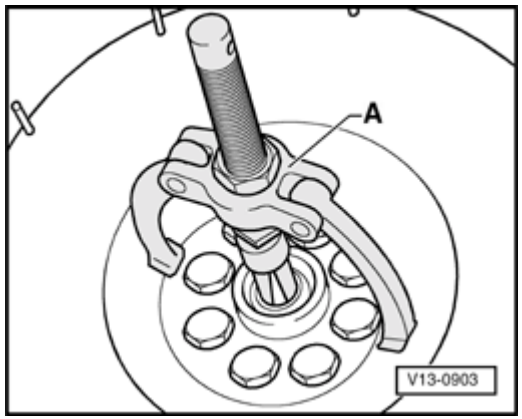
- Install transmission.

⇒ *Repair Manual, 5 Spd. Automatic Transmission 01V, Repair Group 37*

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13-35

Needle bearing in dual-mass flywheel, removing and installing

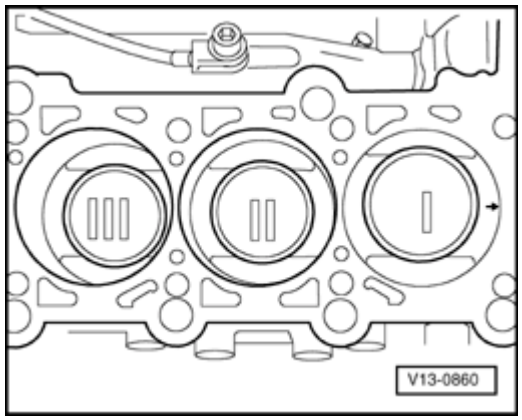


- Pull out with puller, such as KUKKO 21/2 and KUKKO 22-1.
- Drive in with drift 3264.

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Pistons and piston rings, installing

Pistons



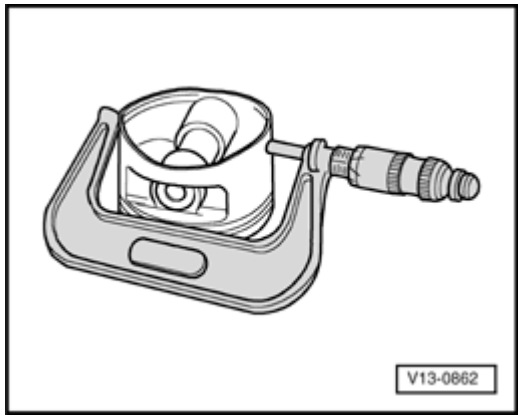
➢ Position: arrow on piston crown must always face in direction of travel.

- Mark cylinder number on piston crown with waterproof felt pen.

Note:

Do not use a center-punch or similar, as pistons have a special coating.

Checking piston diameter

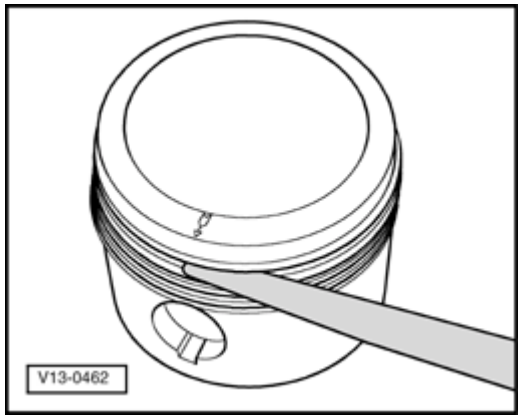


➢

- Measure pistons approx. 10 mm from bottom of skirt, at 90° to piston pin axis.
  - ♦ Difference between actual and nominal diameter: not more than 0.04 mm.

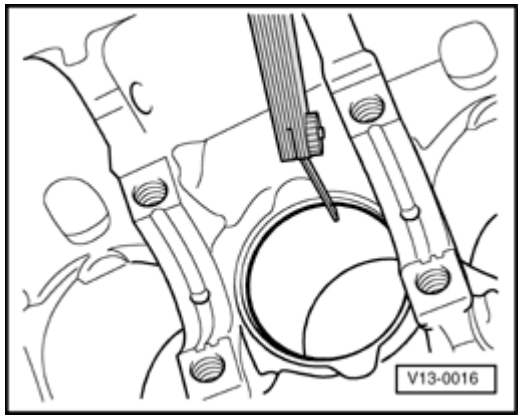
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13-37



Ring-to-groove clearance

Clearance when new	Wear limit
0.02 ... 0.08 mm	0.10 mm



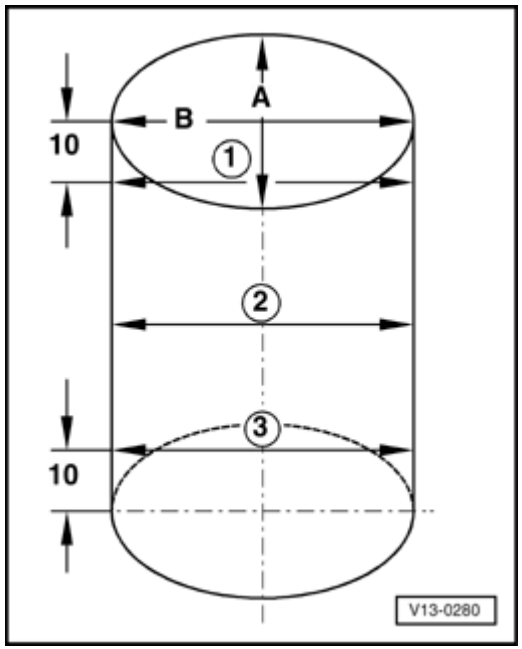
Checking piston ring gap

- Push ring in squarely to a position approx. 15 mm from bottom end of cylinder.

Piston ring	Gap when new	Wear limit
1	0.35 ... 0.50 mm	1.0 mm
2	0.50 ... 0.70 mm	1.4 mm
3	0.25 ... 0.50 mm	0.8 mm

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13-38



Cylinder bores, checking

- Measure bores at three points in both directions: across engine -A- and in line with crankshaft -B-.

  Use internal dial gauge 50 to 100 mm.

  - Difference between actual and nominal diameter: not more than 0.08 mm.

Piston and cylinder dimensions

Honing dimension	Piston dia.	Cyl. bore dia.
Basic dimension	80.95 mm	81.01 mm

Note:

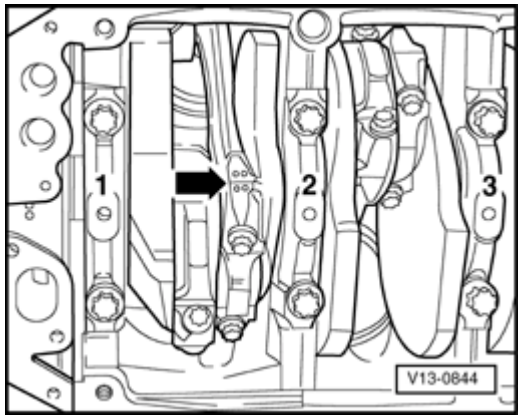
Replacement pistons are only available with basic dimension.

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Connecting rods and connecting rod bearings, installing

Note:

- *Only replace complete sets of connecting rods*
- *Do not interchange connecting rod bearings.*



- Before removing, mark positions of connecting rod bearing caps with a felt pen or similar.

Checking radial clearance

- Remove connecting rod bearing cap. Clean bearing cap and bearing journal.
- Place a length of Plastigage corresponding to width of bearing on bearing journal or bearing shell.
- Install connecting rod bearing cap and tighten to 20 Nm. Do not rotate crankshaft.
- Remove connecting rod bearing cap again.
- Compare width of Plastigage with calibrated scale.

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

- Install new connecting rod bearing bolts.

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15-1

Valve gear, servicing

Notes:

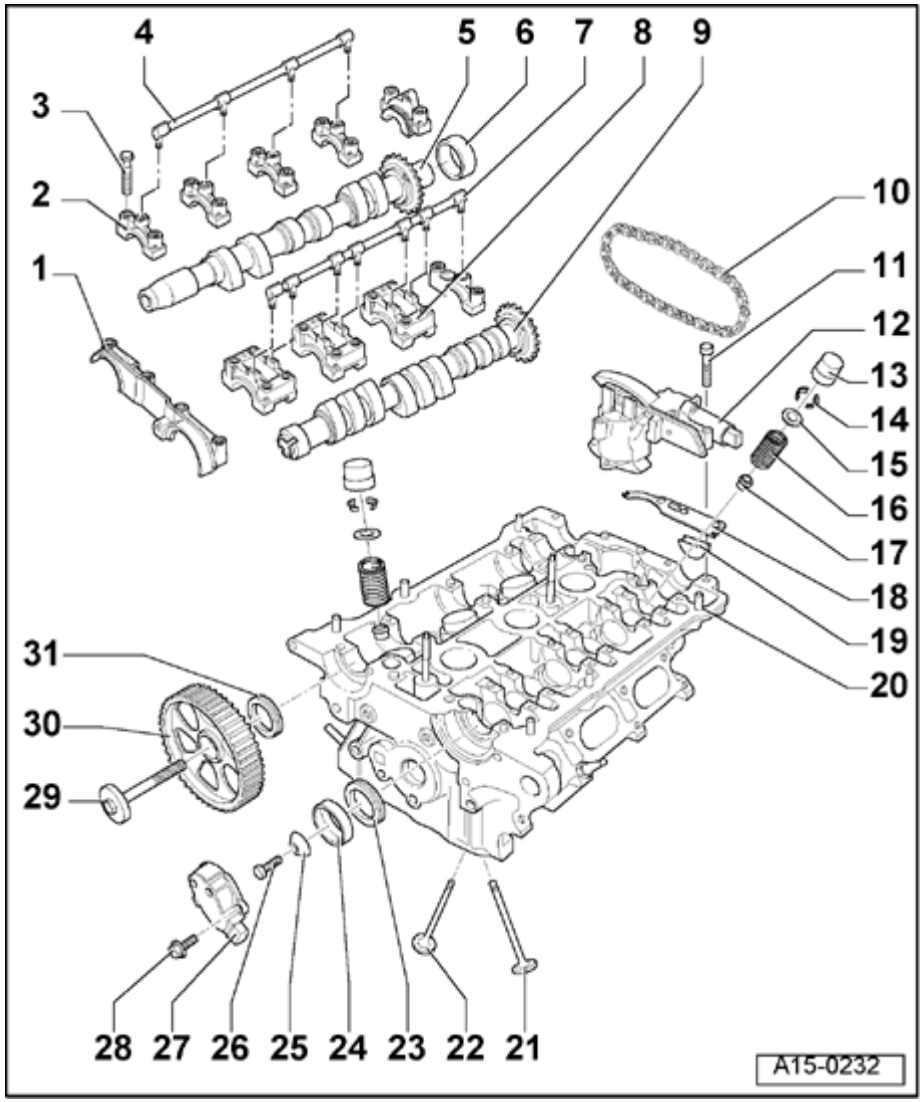
- *Cylinder heads which have cracks between the valve seats or between valve seat inserts and the spark plug thread can be used further without reducing service life, provided the cracks do not exceed a maximum of 0.3 mm in width, or when no more than the first 4 turns of the spark plug threads are cracked.*

- *After installing new lifters the engine must not be started for about 30 minutes (otherwise valves will strike pistons). Turn crankshaft two complete revolutions before starting.*

- *Carefully apply a small amount of sealant D 454 300 A2 at the four end points of the sealing surfaces on the cylinder head, using a small screwdriver ⇒ Fig. ⇒ 1 .*

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15-2



1 - Double bearing cap

- Lightly coat with sealant 454 300 A2 before installing ⇒from Page ⇒ Page 15-16

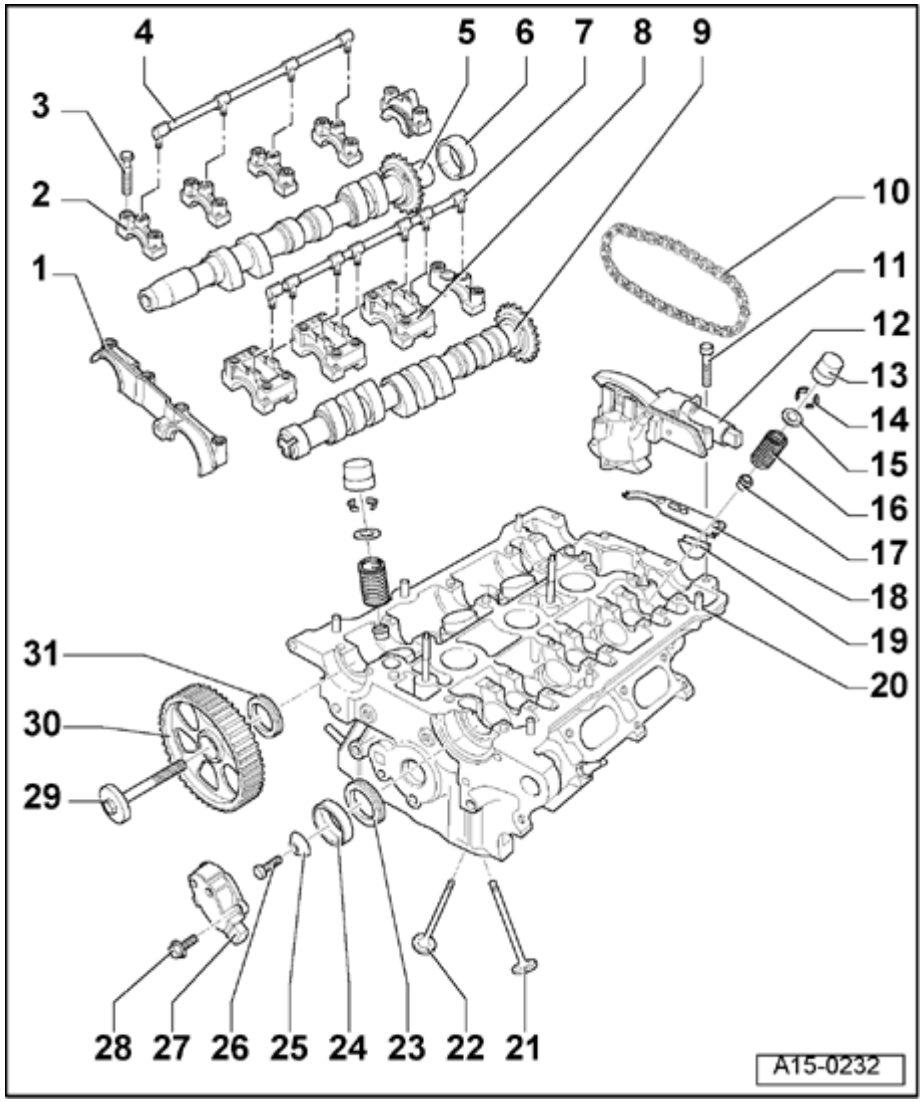
2 - Exhaust camshaft bearing cap

- With connection for oil feed line
- Watch position of dowel sleeve
- Note installation position and numbering ⇒ Page 15-75
- Lightly coat last bearing cap (after the chain) with sealant D 454 300 A2 before installing

3 - 10 Nm

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15-3



4 - Oil line outlet side

- For lubricating bearing cap
- Note installation position ⇒ Fig. ⇒ 3

5 - Exhaust camshaft

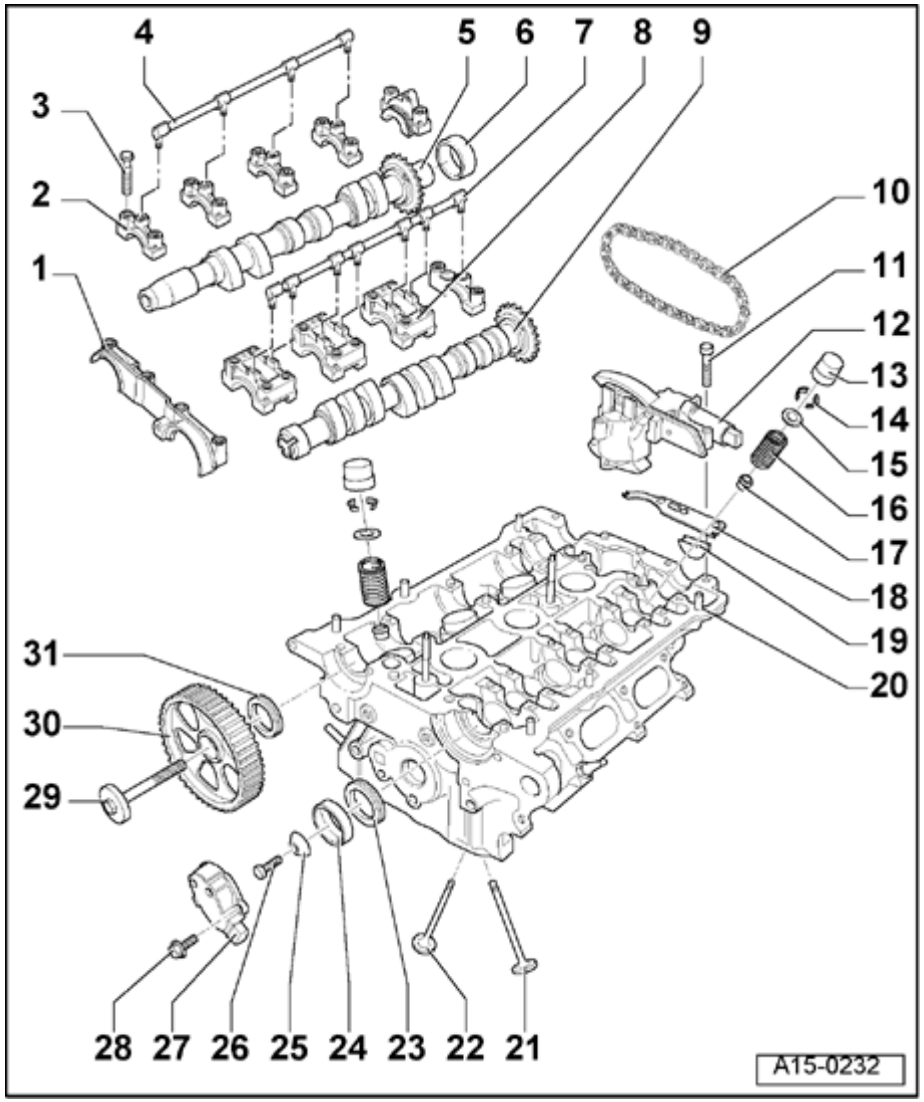
- Checking axial clearance ⇒ Page 15-86
- Removing and installing ⇒ Page 15-75
- Check radial clearance with Plastigage (lifters removed) Wear limit: 0.1 mm Run-out: 0.01 mm (maximum)

6 - Cap

- Always replace

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15-4



7 - Oil line, inlet side

- Note installation position ⇒ Fig. ⇒ 2
- For lubricating bearing cap

8 - Inlet camshaft bearing cap

- With connection for oil feed line
- Note installation position and numbering ⇒ Page 15-75

9 - Inlet camshaft

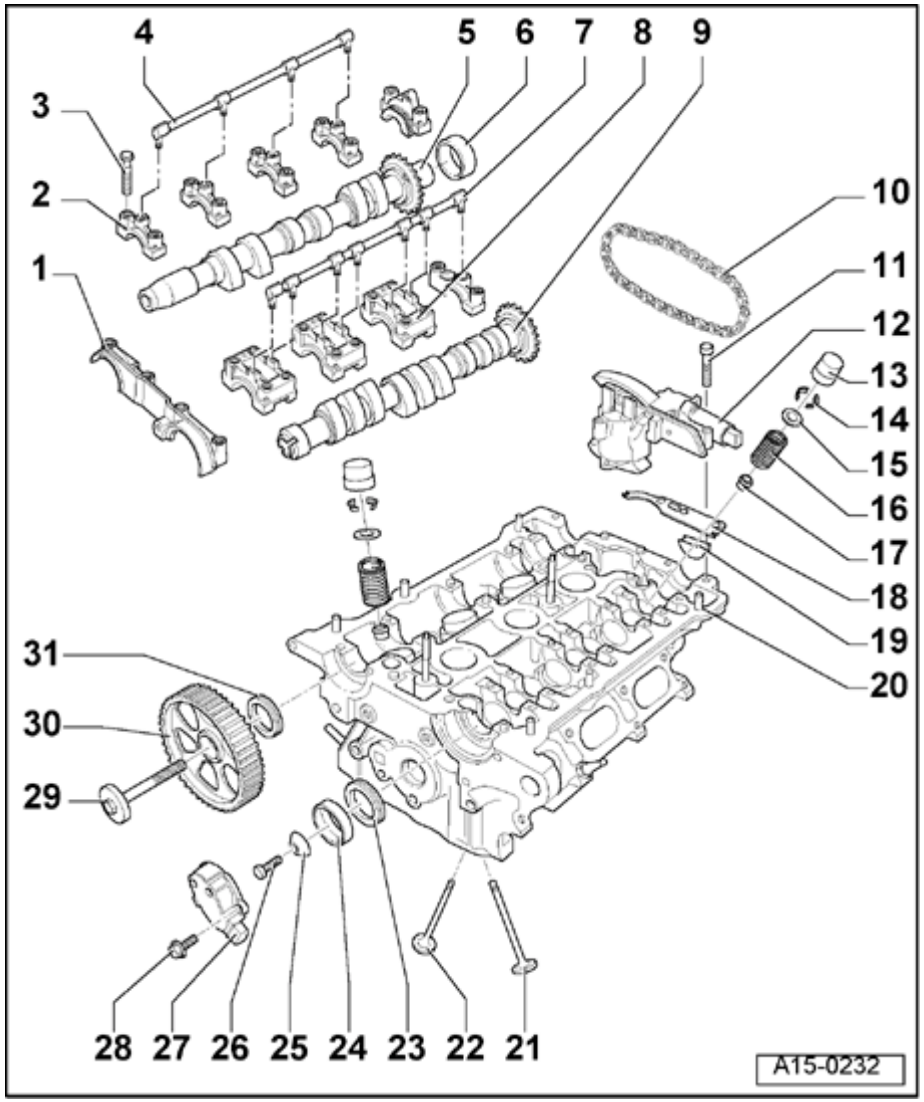
- Checking axial clearance ⇒ Page 15-86
- Removing and installing ⇒ Page 15-75
- Check radial clearance with Plastigage (lifters removed) Wear limit: 0.1 mm Run-out: 0.01 mm (maximum)

10 - Drive chain

- Installing ⇒ Page 15-75

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15-5



11 - 10 Nm

12 - Mechanical camshaft adjuster

- With camshaft adjustment valve -N205
- Secure with special tool 3366 before removing ⇒ Page 15-75

13 - Hydraulic lifter

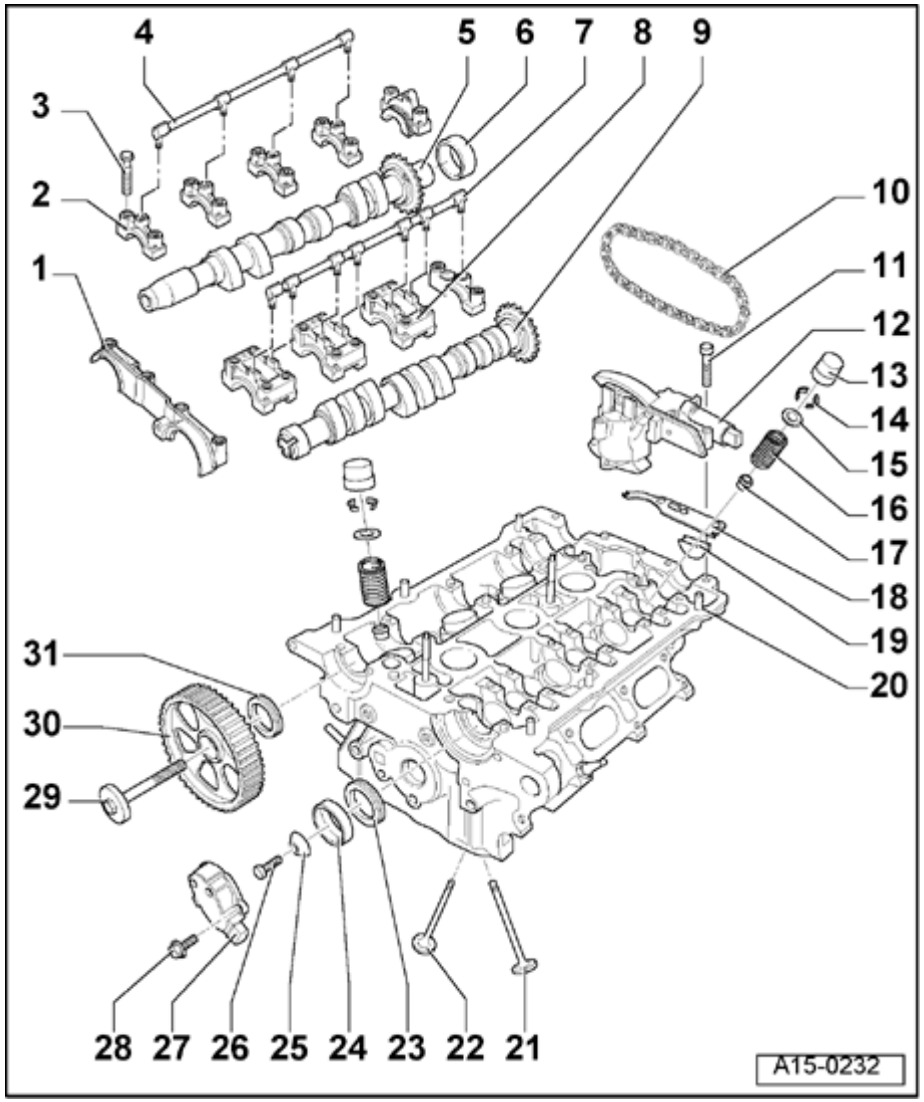
- Notes ⇒ Page 15-88
- Removing and installing with cylinder head installed ⇒ Page 15-75

14 - Valve cotters

15 - Valve spring plate

16 - Valve spring

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17 - Valve stem seal

- Replacing with cylinder head installed ⇒ Page 15-90

18 - Rubber/metal gasket

- Always replace

19 - Seal

- Always replace

20 - Cylinder head

- Checking for distortion ⇒ Page 15-56
- Reworking ⇒ Page 15-57

21 - Exhaust valve

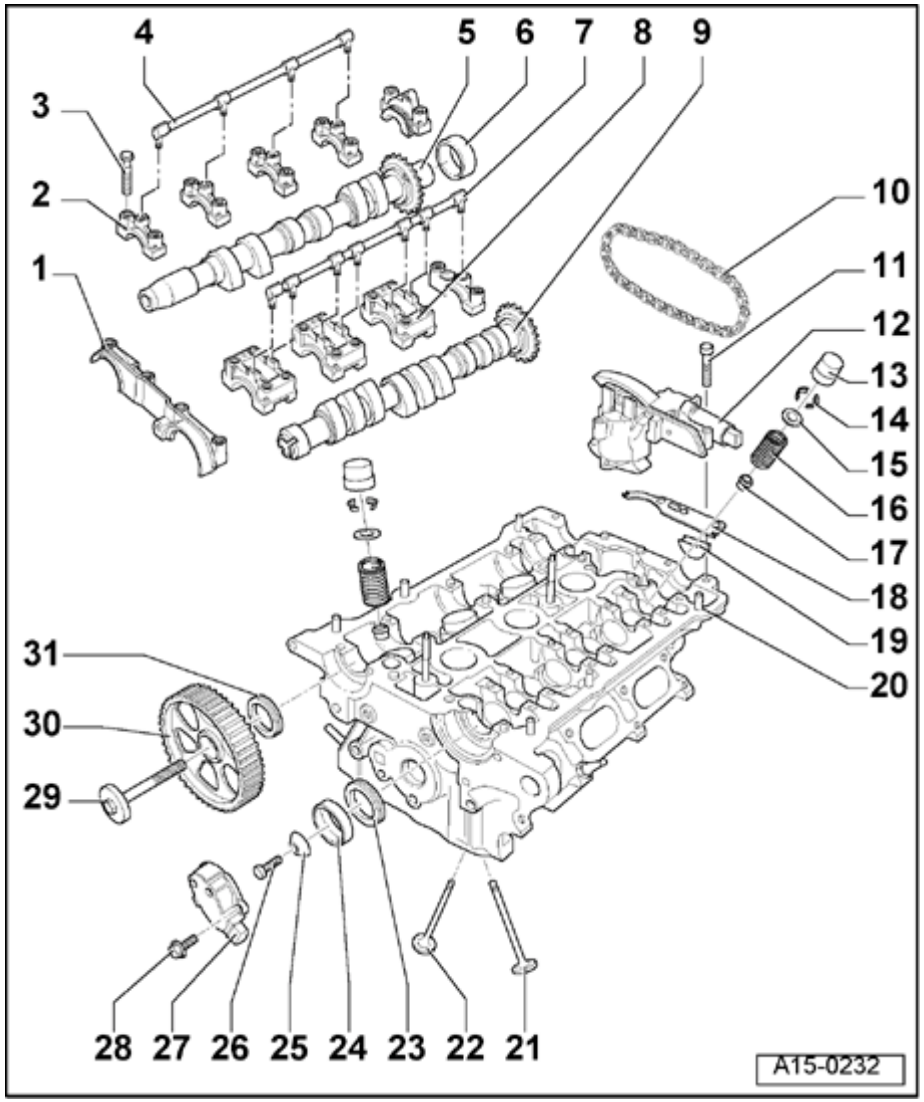
22 - Inlet valve

23 - Oil seal (Hall sensor end)

- Always replace ⇒ Page 15-10

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15-7



24 - Rotor for Hall sensor

- Note position (notch on camshaft)

25 - Washer

- Conical

26 - 25 Nm

27 - Hall sensor

28 - 10 Nm

29 - 30 Nm +180° (1/2 turn)

30 - Camshaft sprocket

31 - Oil seal (toothed belt end)

- Replacing ⇒ Page 15-10

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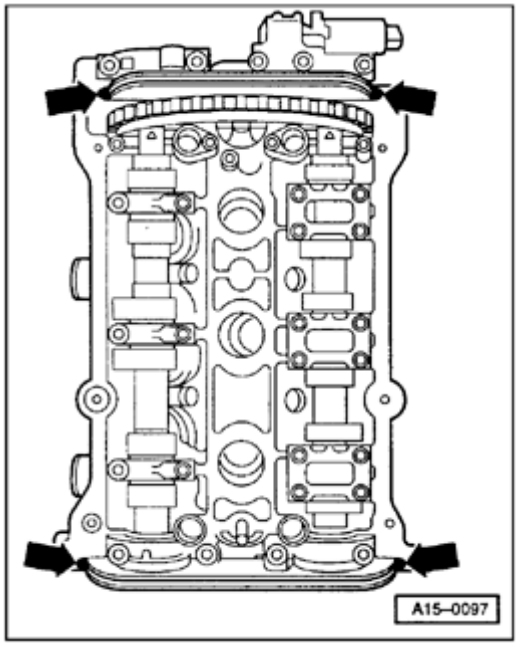


Fig. 1 Sealing end points of joints between bearing caps and cylinder head

Carefully apply a small quantity of sealant D 454 300 A2 at the four end points of the sealing surfaces on the cylinder head -arrows-, using a small screwdriver.

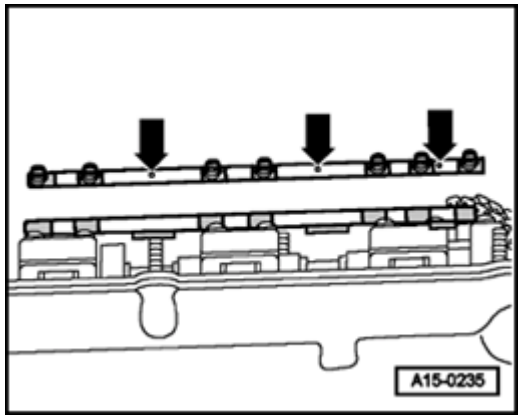


Fig. 2 Installation position of the oil line for the inlet camshaft

When connections are incorrectly allocated, bore holes in the oil line are exposed (arrows).

To mount correctly, turn the oil line 180° and slide connections over bore holes.

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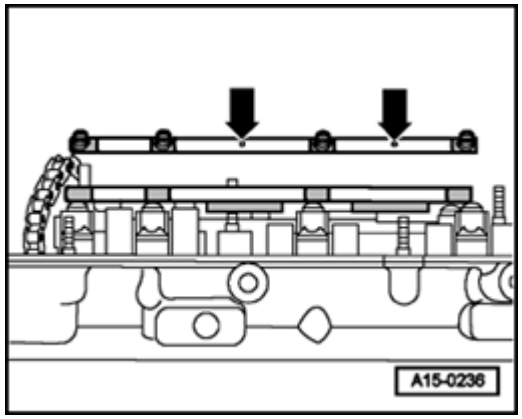


Fig. 3 Installation position of the oil line for the outlet camshaft

When connections are incorrectly allocated, bore holes in the oil line are exposed (arrows).

To mount correctly, turn the oil line 180° and slide connections over bore holes.

CAUTION!

If the oil lines are mounted incorrectly, lubrication of the camshaft bearing is no longer possible and the cylinder head must be replaced.

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15-10

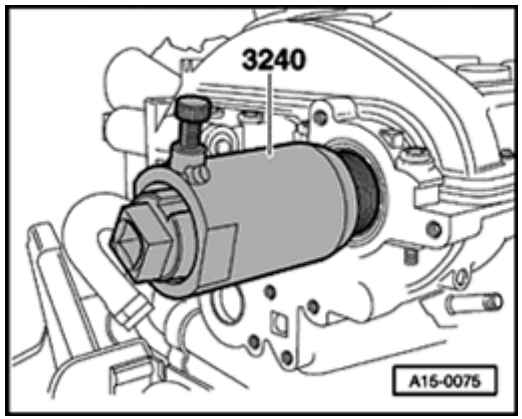
Oil seals in cylinder heads, replacing

Oil seal for camshaft drive (left and right cylinder heads)

Note:

If the oil seal on one side is leaking it is advisable to replace the seals on both sides.

- Remove ribbed belt ⇒ Page 13-1 .
- Remove toothed belt ⇒ Page 13-4 .
- Remove rear toothed belt guard.



- Pull out oil seal with oil seal extractor 3240.
- Clean contact surface and sealing surface.
- Do not apply oil to sealing lip or outer circumference of seal.
- Install guide sleeve 3241/2 (from tool set 3241) onto camshaft.

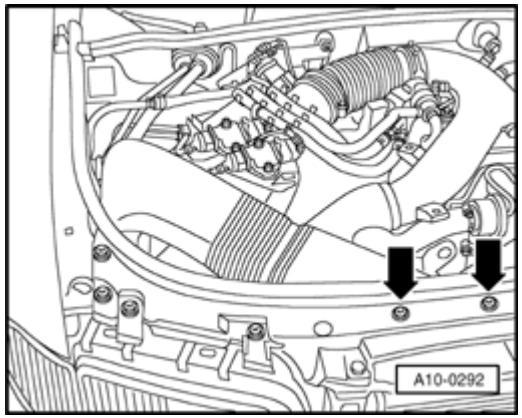


- Press seal flush into cylinder head using press sleeve 3241/1 and bolt 3241/3.

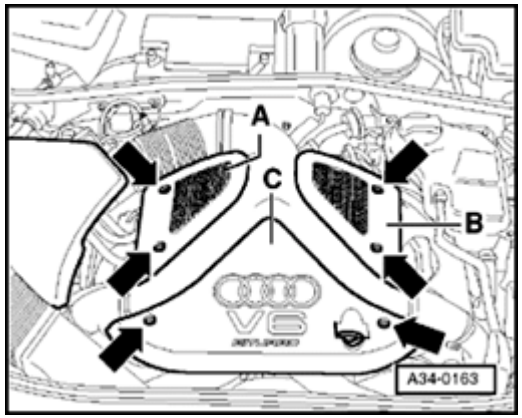
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15-11

Oil seal at Hall sensor (right cylinder head)



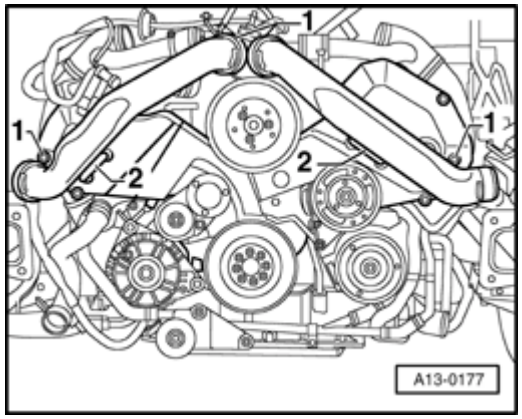
- Remove intake hose going to air cleaner (arrows).



- Remove bolts -arrows- and remove engine cover panel -C-.

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15-12

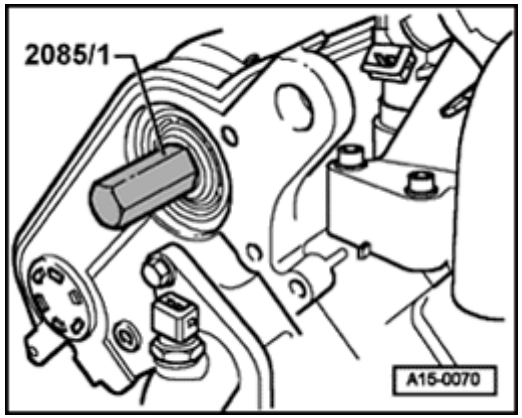


- Remove pressure line -1- (right side).

Note:

Watch position of retaining strip -2-.

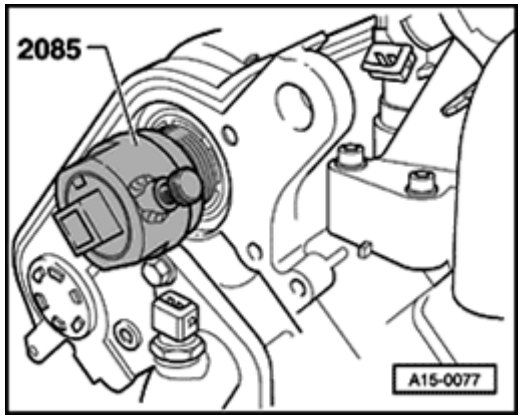
- Unbolt Hall sensor housing (10 Nm).
- Remove bolt securing Hall sensor rotor (20 Nm) and carefully lever off rotor with a screwdriver.



- Screw in bolt from oil seal extractor 2085/1.

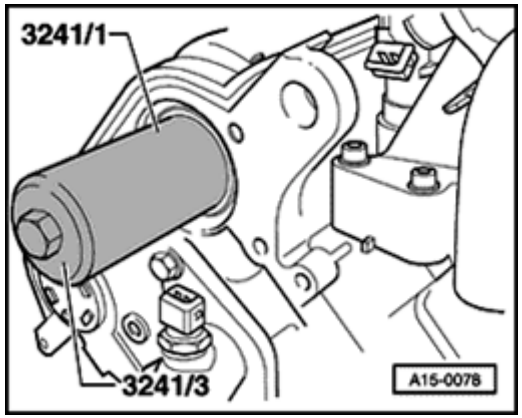
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15-13



- Pull out seal with oil seal extractor 2085 and bolt 2085/1.
- Clean contact surface and sealing surface.

  Do not apply oil to sealing lip or outer circumference of seal before installing.
- Install guide sleeve (from tool set 3241) onto camshaft.



- Press in seal until flush using press sleeve 3241/1 and bolt 3241/3.

Installing

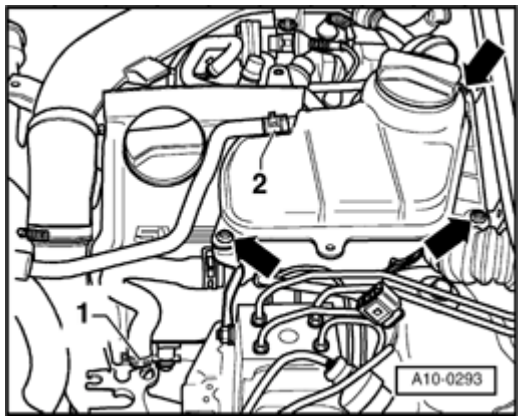
Install in reverse sequence.

Note:

When installing Hall sensor rotor, ensure that locating lug engages in slot in camshaft.

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Removing oil seal at Hall sensor (left cylinder head)

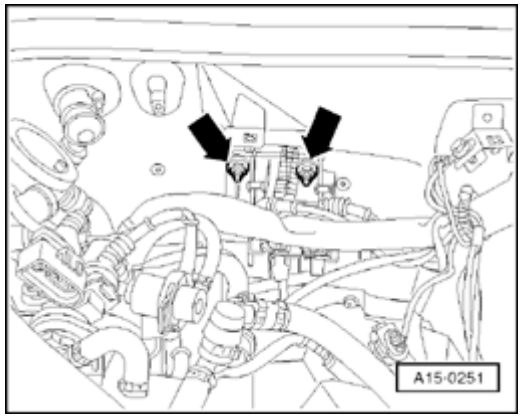


- Detach coolant reservoir -arrows- and move clear to side.

Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.
- Move wiring harness clear at bulkhead.



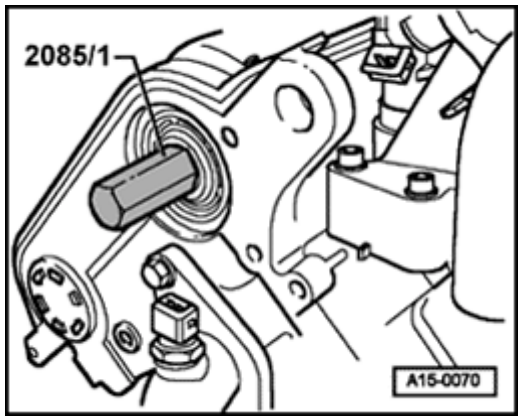
- Unbolt bracket -arrows- for plug connectors on bulkhead and move clear to side.

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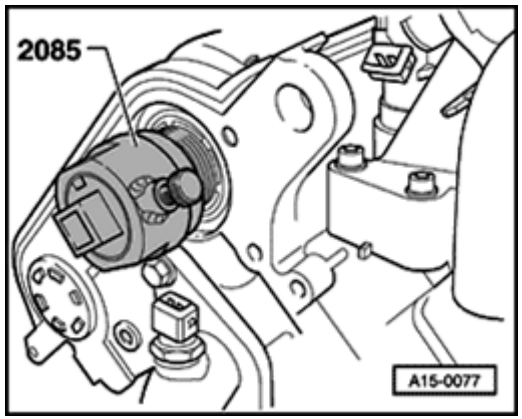
15-15

- Unbolt Hall sensor housing (10 Nm).

- Unbolt Hall sensor rotor (20 Nm) and carefully lever off rotor using a screwdriver.



- Screw in bolt from 2085/1 oil ring extractor.

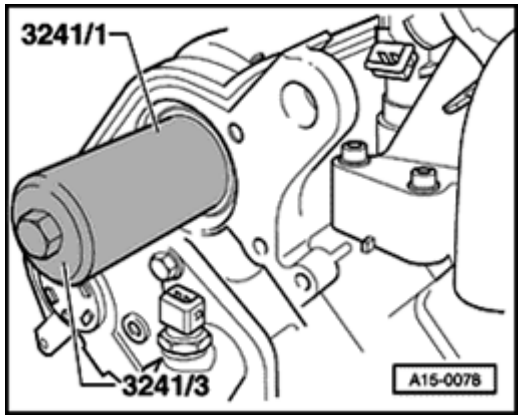


- Pull out seal with oil seal extractor 2085 and bolt 2085/1.
- Clean contact surface and sealing surface.

  Do not apply oil to sealing lip or outer circumference of seal before installing.
- install guide sleeve (from tool set 3241) onto camshaft.

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15-16



- Press in seal until flush using press sleeve 3241/1 and bolt 3241/3.

Installing

Install in reverse sequence.

Note:

When installing Hall sensor rotor, ensure that locating lug engages in slot in camshaft.

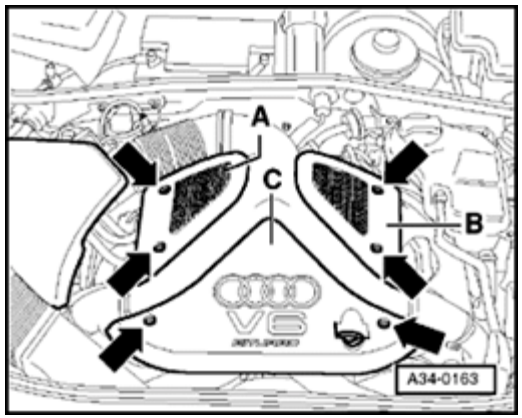
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15-17

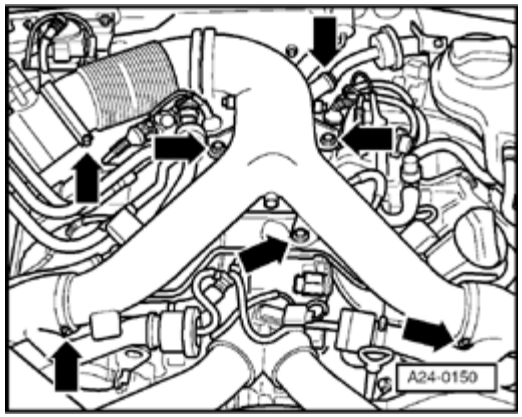
Rear oil seal and sealing flange (left cylinder head)

Note:

Rear sealing flange and oil seal on left-hand cylinder head must be replaceed together as follows:

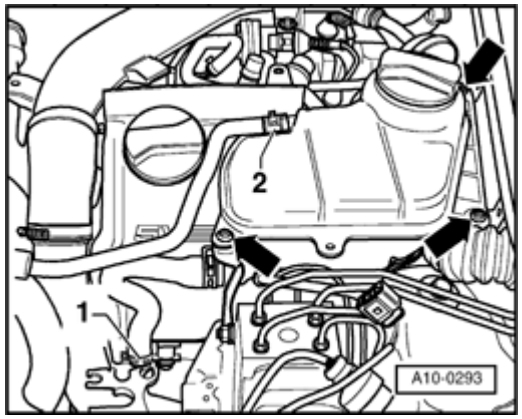


- Remove bolts -arrows- and remove engine cover panels -A...C-.



- Remove air duct -arrows-.

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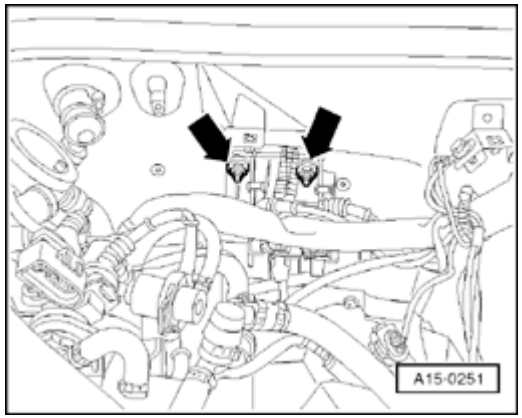


- Remove coolant reservoir -arrows- and move it clear to the side.

Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.
- Move wiring harness clear at bulkhead.

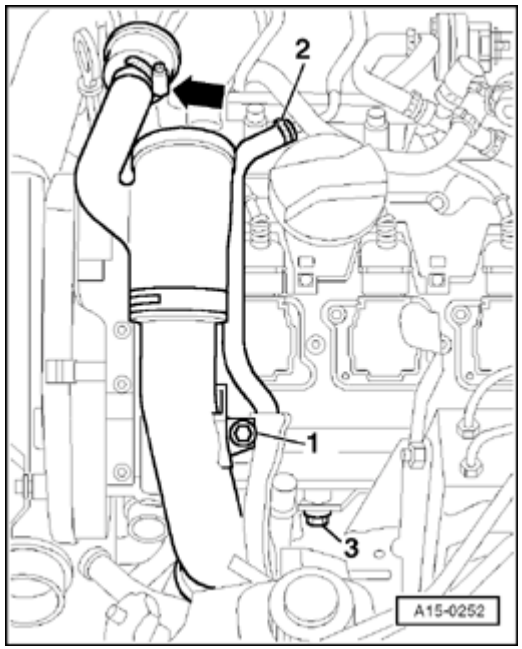


- Unbolt bracket -arrows- for plug connectors on bulkhead and move clear to the side.
- Unbolt Hall sensor housing (10 Nm).
- Remove bolt securing Hall sensor rotor (20 Nm) and carefully lever off rotor using a screwdriver.

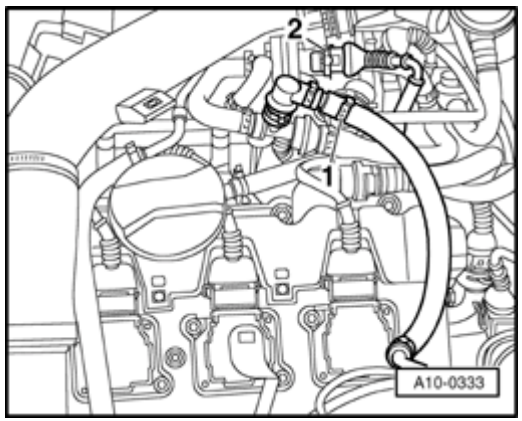
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15-19

- Remove cover panel from cylinder head cover (cylinder bank 4-6).



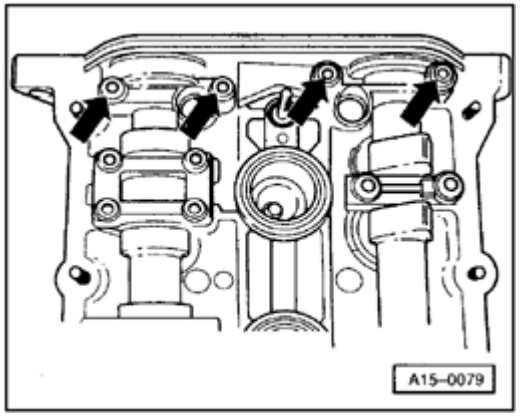
- Release hose clamp -arrow-.
- Remove upper section of intake line -1-.
- Disconnect hose -2-.



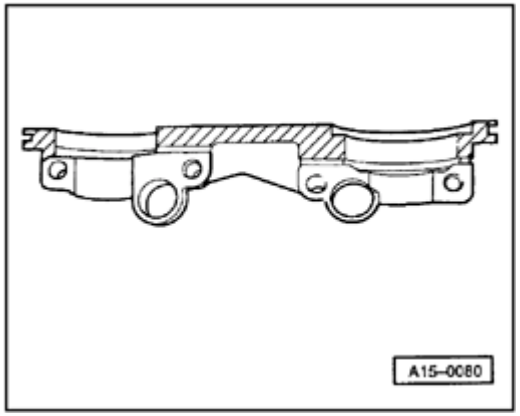
- Disconnect hose (arrow).
- Remove bolt securing toothed belt guard from cylinder head cover.
- Pull plug connectors off ignition coils.
- Pull crankcase breather off cylinder head cover.
- Remove cylinder head cover.

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15-20



- Remove double bearing cap -arrows-.
- Take out oil seal and sealing flange.
- Clean contact surfaces and sealing surfaces of double bearing cap.

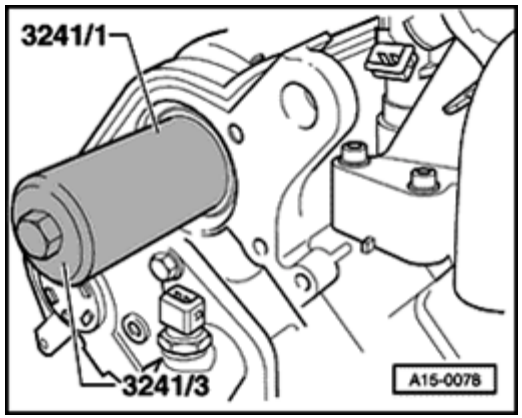


- Apply a thin coating of sealant 454 300 A2 to shaded areas on double bearing cap (see illustration), install bearing cap and tighten bolts to 10 Nm.

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15-21

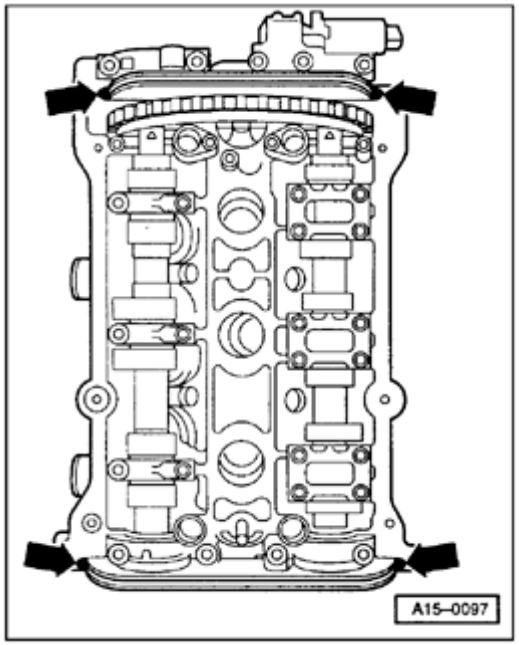
- Install guide sleeve (from tool set 3241) onto camshaft.



- Press in oil seal until flush using press sleeve 3241/1 and bolt 3241/3.
- Carefully knock in sealing flange against stop using 3202 and a plastic hammer.

Installing

Install in reverse sequence; note the following points:



- Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at four end points of sealing surfaces on cylinder head -arrows-, using a small screwdriver.

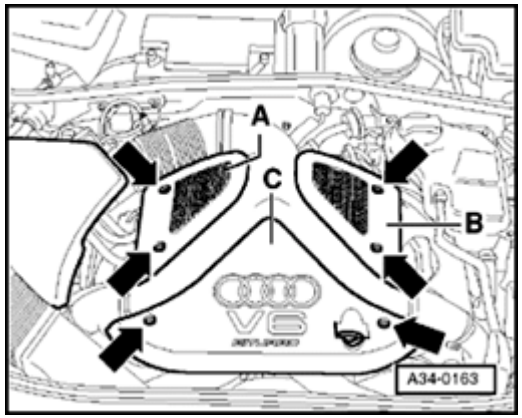
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15-22

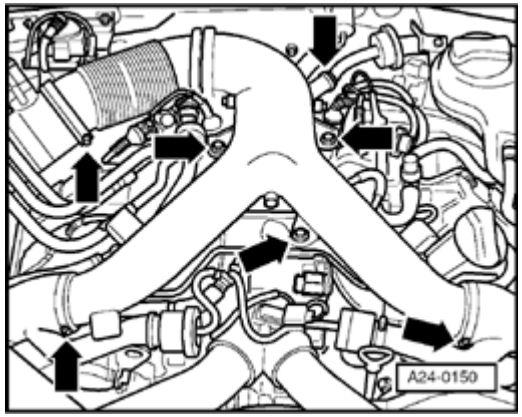
Cylinder head covers, removing and installing

Removing and installing left cylinder head cover

Removing



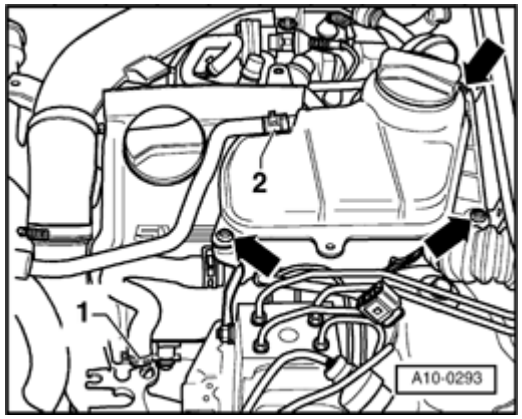
- Remove bolts -arrows- and remove engine cover panels -A...C-.



- Remove air duct -arrows-.

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15-23

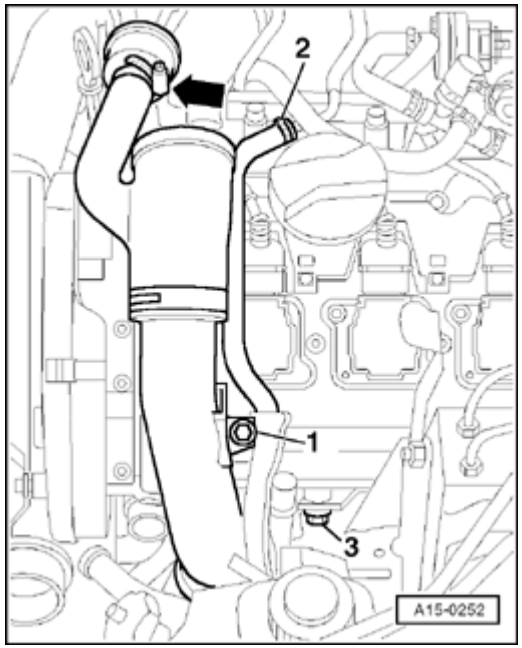


- Remove coolant reservoir -arrows- and move it clear to the side.

Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.
- Remove cover panel from cylinder head cover (cylinder bank 4 - 6).

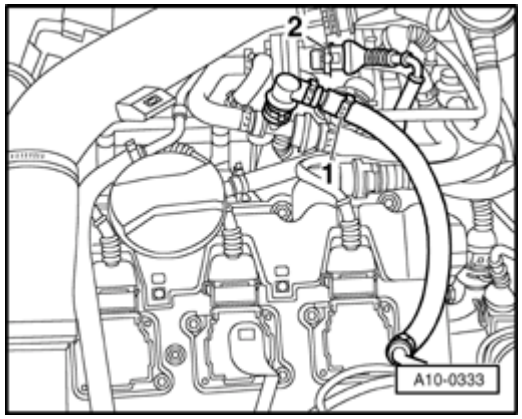


- Release hose clamp -arrow-.
- Remove intake line -1-.
- Disconnect hose -2-.
- Detach water line -3-.

Note:

Plug lower section of intake line.

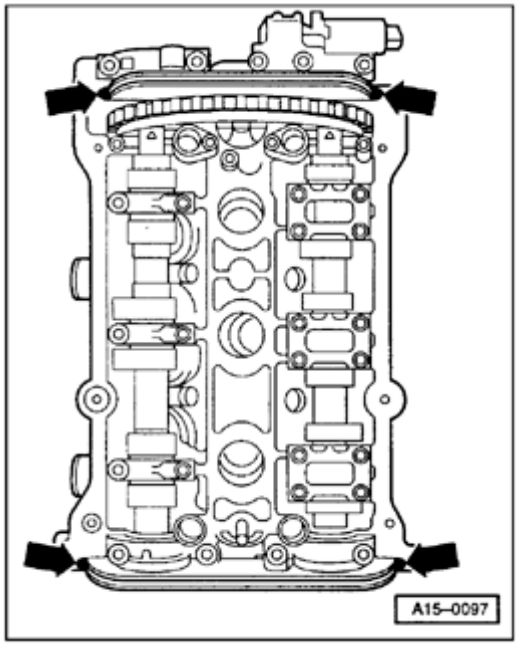
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- Pull off hose -1-.
- Pull plug connectors off ignition coils.
- Pull crankcase breather off cylinder head cover.
- Remove ignition coils.
- Remove cylinder head cover.

Installing

Install in reverse sequence; note the following points:



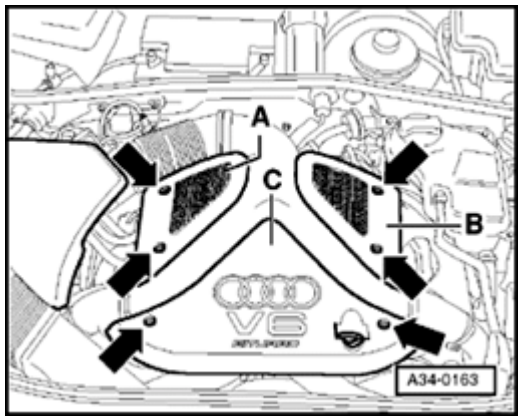
- Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at four end points of sealing surfaces on cylinder head -arrows-, using a small screwdriver.

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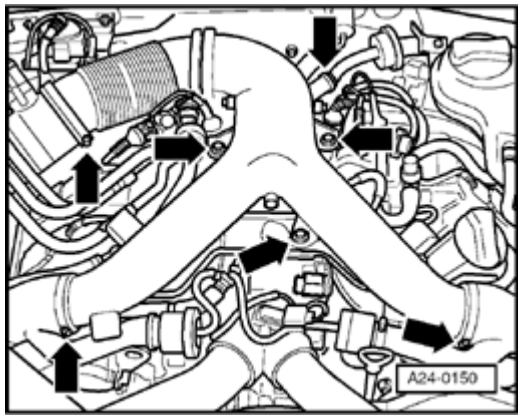
15-25

Removing and installing right cylinder head cover

Removing



- Remove bolts -arrows- and remove engine cover panels -A...C-.
- Remove cover above air cleaner.



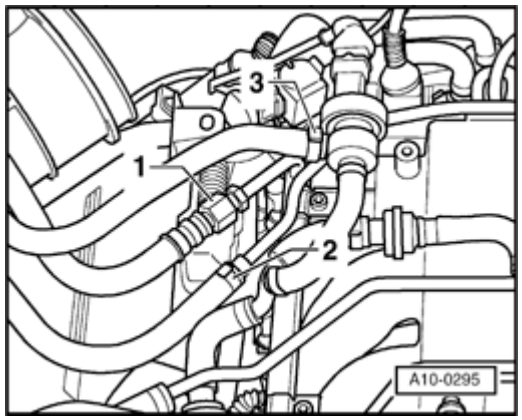
- Remove air duct -arrows-.

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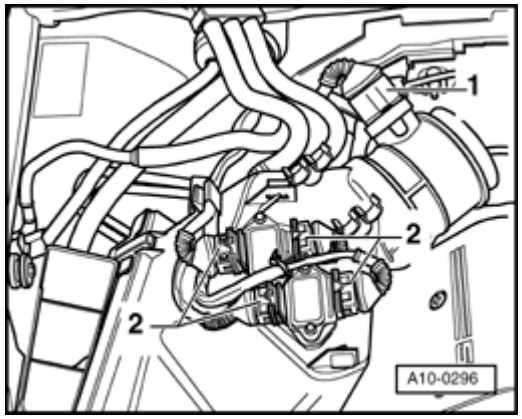
15-26

WARNING!

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

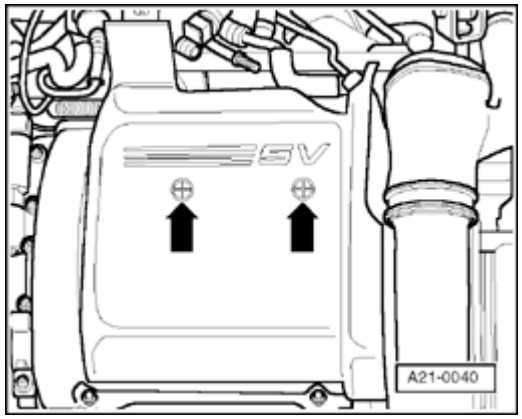


- Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off EVAP valve -3-.

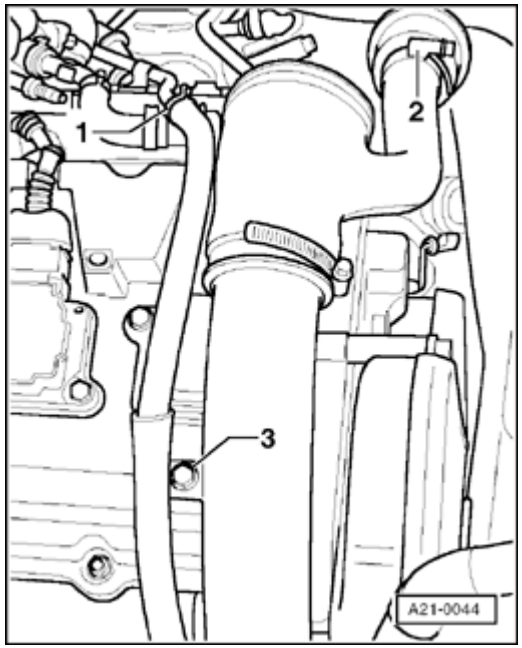


- Unplug connector -1- from air mass meter.
- Unplug connectors -2- from ignition output stages, and move wiring clear.
- Remove air cleaner.

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- Remover cover panel from right-hand cylinder head cover -arrows-.



- Disconnect hose -1-.
- Disconnect hose -2-.
- Detach upper section of intake line -3-.

Note:

Plug lower section of intake line.

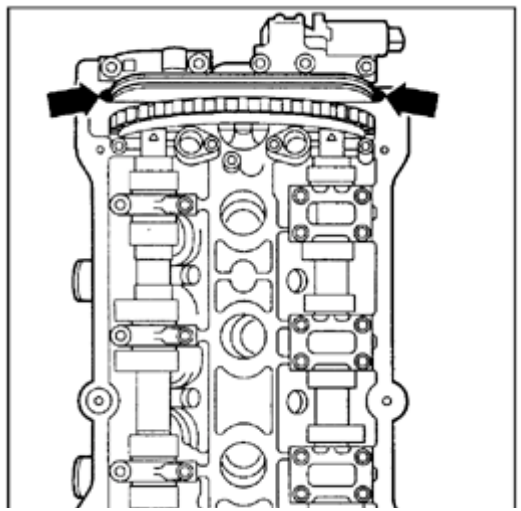
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15-28

- Remove bolt securing toothed belt guard from cylinder head cover.
- Unplug connectors from ignition coils.
- Pull crankcase breather off cylinder head cover.
- Remove ignition coils.
- Remove cylinder head cover.

Installing

Install in reverse sequence; note the following points.



- Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at four end points of sealing surfaces on cylinder head -arrows-, using a small screwdriver.

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15-29

Cylinder head, removing and installing

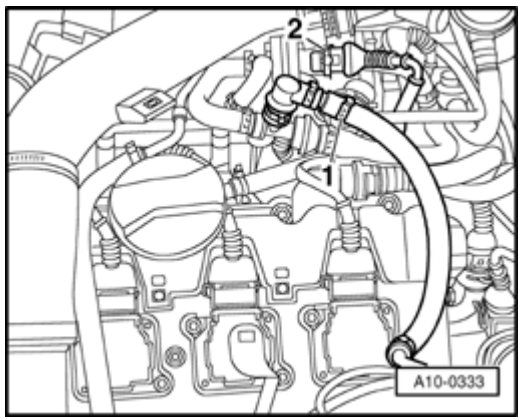
Removing and installing left cylinder head

Notes:

- *All hose connections are secured with clips.*
- *Charge air system must be free of leaks.*
- *Replace all seals and gaskets*

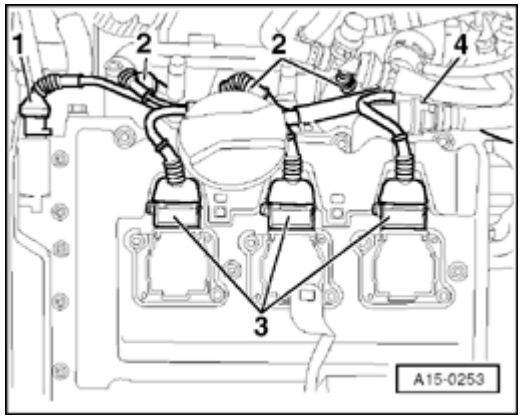
Removing

- Remove engine ⇒ Page 10-1 .

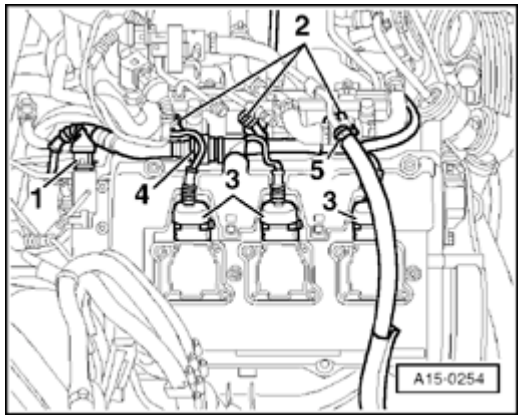


- Unplug connector from air recirculation valve -2-.

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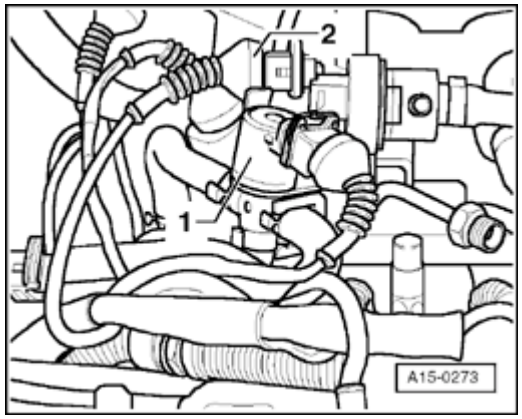


- Unplug connector for camshaft timing control -1- (cylinder bank 4..6).
- Unplug connectors from injectors -2- (cylinder bank 4..6).
- Unplug connectors from ignition coils -3- and move wiring harness clear (cylinder bank 4..6).
- Pull crankcase breather -4- off cylinder head cover (cylinder bank 4..6).
- Remove ignition coils.

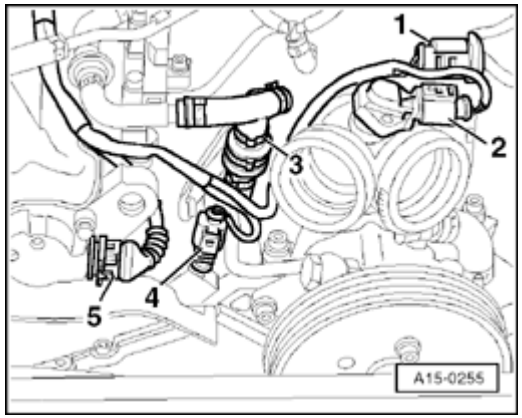


- Unplug connectors from injectors -2- (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.

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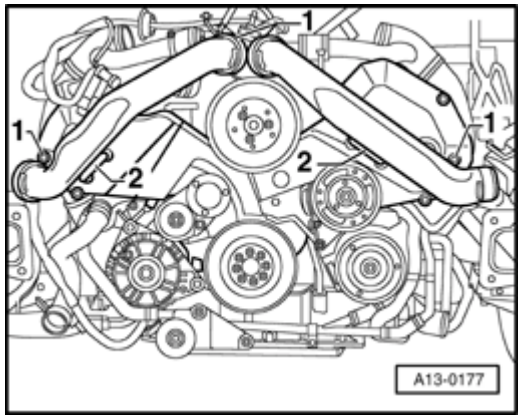
- Unclip solenoid valve for charge pressure control -1-.
- Pull connector off EVAP valve -2-.



- Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sensor -4-.

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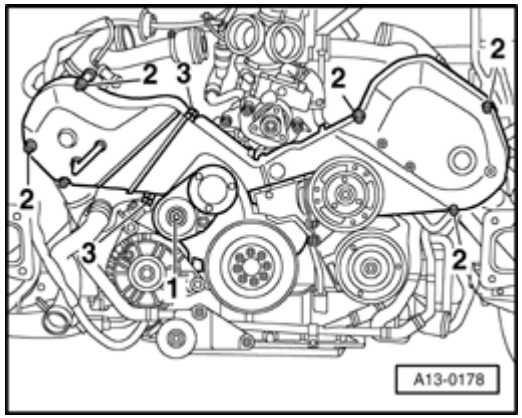
15-32



- Remove pressure lines -1-.

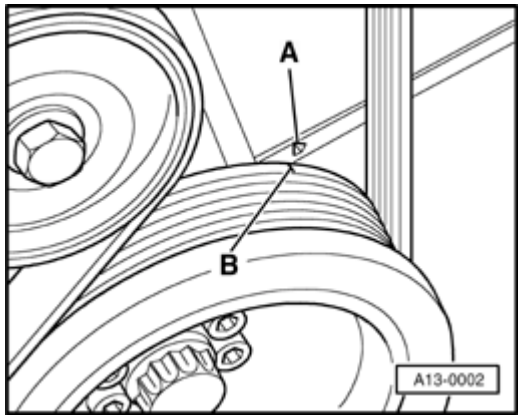
Note:

Watch position of retaining strips -2-.



- Remove tensioner -1- for ribbed belt.
- Remove toothed belt guards -2- (left and right).
- Remove toothed belt guard -3- (center).

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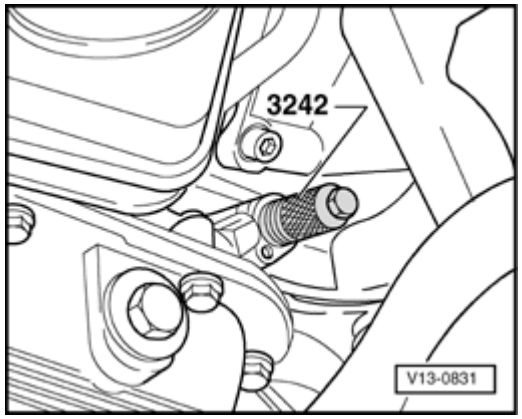
- Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: larger holes in securing plates on camshaft sprockets must align opposite one another on inside. If this is not the case, turn crankshaft one revolution further.
- Remove sealing plug from cylinder block, left.

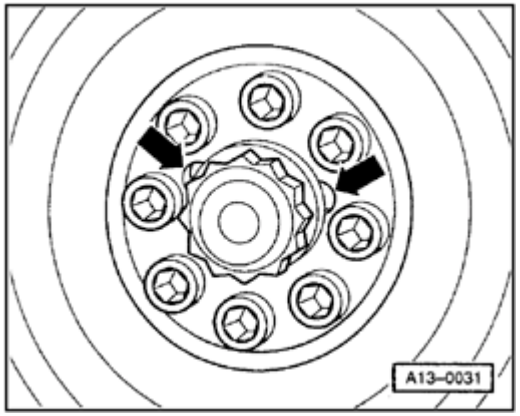
  TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.



- Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.

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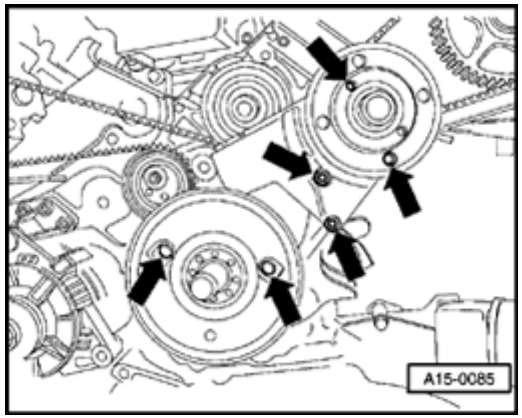
15-34



- Remove vibration damper on crankshaft.

Note:

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



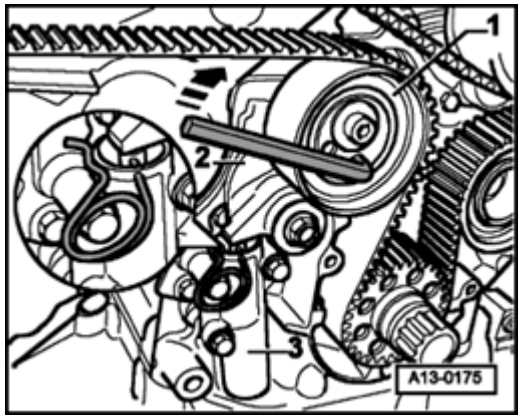
- Remove idler wheel for ribbed belt -arrows-.
- Remove toothed belt guard behind vibration damper -arrows-.

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15-35

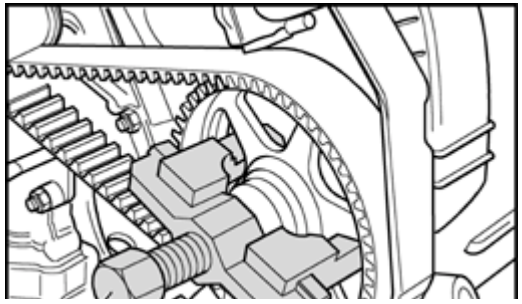
Notes:

- *Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when reinstalled.*
- *The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.*



- Using a hexagon key, turn toothed belt tensioning roller -1- clockwise 8 mm in direction of arrow until tensioning lever -2- compresses tensioning element -3- sufficiently to enable a 2mm dia. spring pin to be installed in the drilling and in the plunger.
- Insert spring pin and release toothed belt tensioning roller.

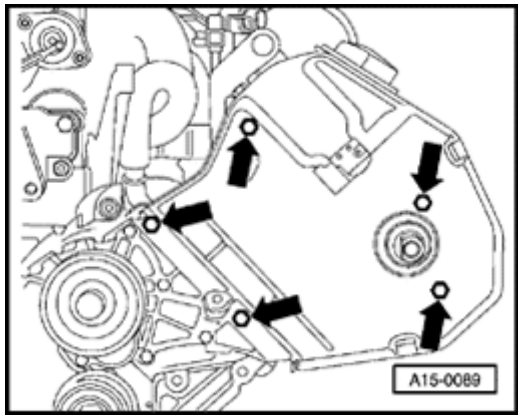
  Use spring pin from 2024 A.
- Insert camshaft clamp 3391 in securing plates of two camshafts.
- Loosen both camshaft bolts and remove approx. 5 turns.
- Take out camshaft clamp 3391.



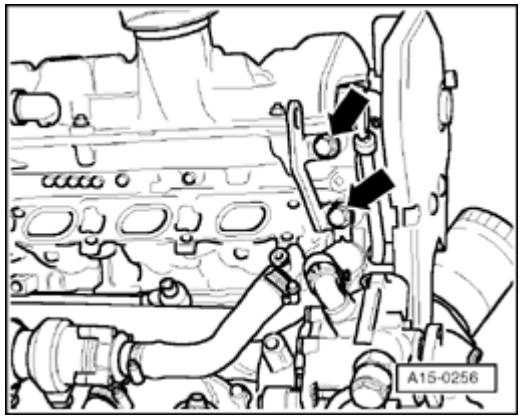
- Pull off both camshaft sprockets with special tool T40001.

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15-36

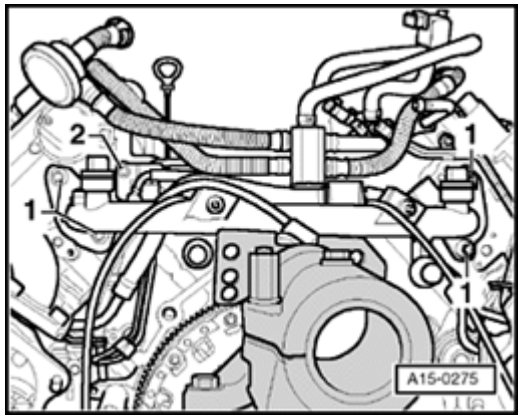


- Unbolt rear left toothed belt guard -arrows-.
- Detach intake manifold using special tool 3249.

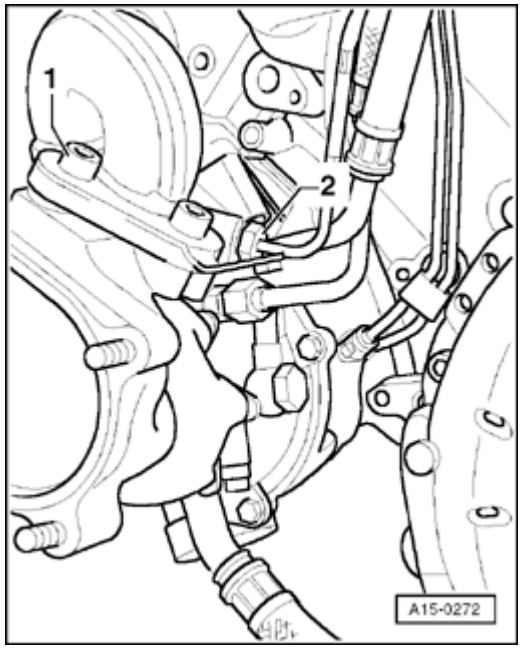


- Unbolt cylinder head lifting bracket with coolant line -arrows- from cylinder head.

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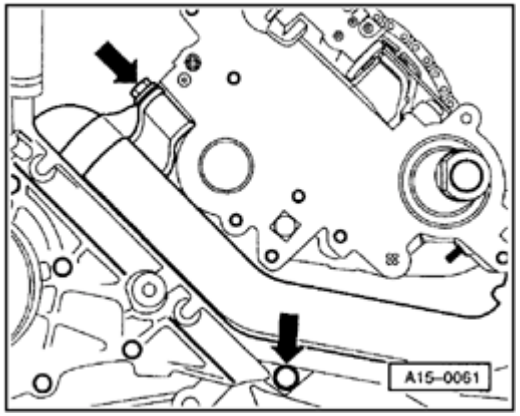


- Unbolt water line -1- and pull it towards the rear.
- Unbolt bracket -2- from cylinder head.
- Remove heat sensor -2-.



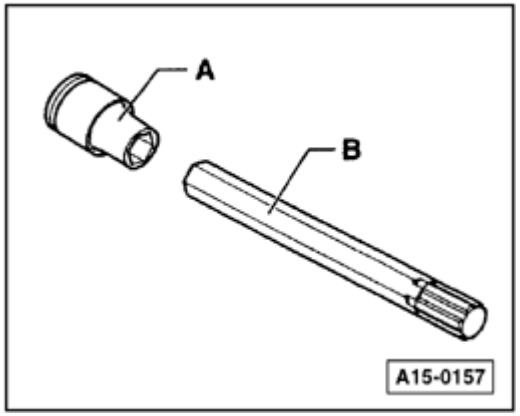
- Unbolt turbocharger -1- from exhaust manifold (3 bolts).

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- Unbolt coolant line at front of cylinder head -arrows-.
- Unbolt cylinder head cover.
- Loosen and remove cylinder head bolts in opposite sequence to tightening sequence using special tool 3452 (Polidrive).
- Carefully lift off cylinder head.

Note:



Use special tool 3452 together with a normal commercial 10 mm socket when removing and installing.

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Installing

Notes:

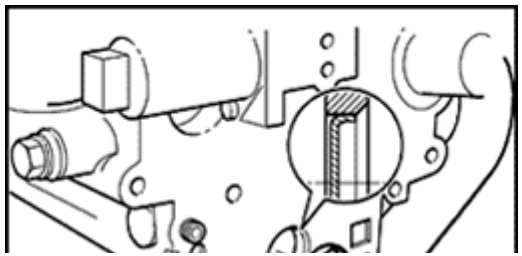
- *Do not allow any oil or coolant to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *Replace cylinder head bolts.*
- *Connecting vacuum hoses* ⇒ *Page 10-28* .

When installing a new cylinder head:

- Screw in centering pin for intake manifold.

The cylinder head supplied as a replacement part can be used on both sides (left or right). But a sealing cap (core plug) must be installed in the front end of the cylinder head in each case.

- Coat outside circumference of sealing cap (core plug) with sealant AMV 188 001 02.



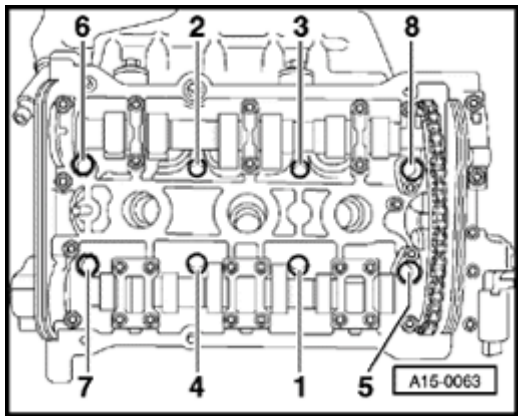
- Using drift VW 295, knock in sealing cap (core plug) until outside rim is flush with end of chamfer in cylinder head.

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- Before installing cylinder head in position, turn crankshaft and camshafts to TDC of No. 3 cylinder.

- Install cylinder head gasket on dowel sleeves. The marking "oben" (top) or part number must face towards cylinder head.

- Install cylinder head, insert cylinder head bolts and tighten finger-tight.

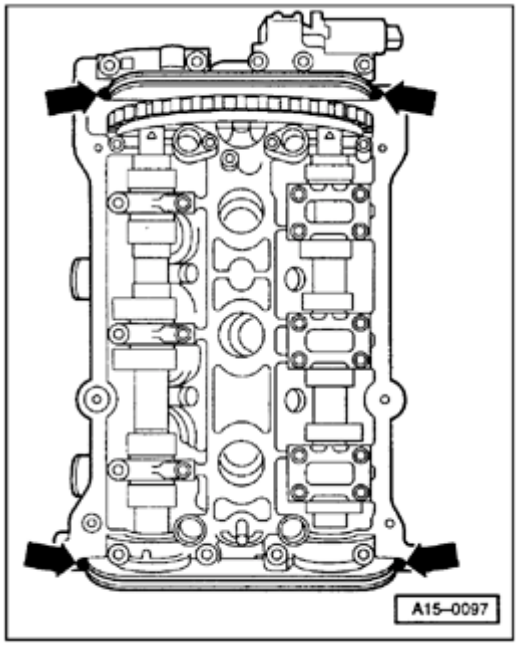


- Tighten cylinder head bolts in two stages in sequence shown, as follows:
  - Stage 1 = 60 Nm.
  - Stage 2 = turn a further $^{1}/_{2}$ turn (180 °) with a rigid wrench (turning 2 x 90 ° is also permissible).

It is not necessary to torque down cylinder head bolts again after repairs have been completed.

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15-41



- Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at four end points of sealing surfaces on cylinder head -arrows-, using a small screwdriver.

Tightening torques

Component		Nm
Bolts	M6	10
Bolts	M8	20
Camshaft bearing caps and camshaft adjuster		10
Exhaust manifold to cylinder head		25
Front exhaust pipe to exhaust manifold		25
Oxygen sensor		50
Spark plugs		25
Toothed belt sprocket to camshaft		55
Intake manifold to cylinder head		10
Cylinder head cover		10

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15-42

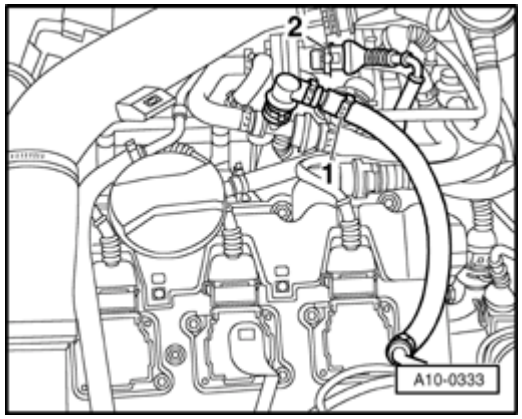
Removing and installing right cylinder head

Notes:

- *All hose connections are secured with clips.*
- *Charge air system must be free of leaks.*
- *Replace all seals and gaskets*

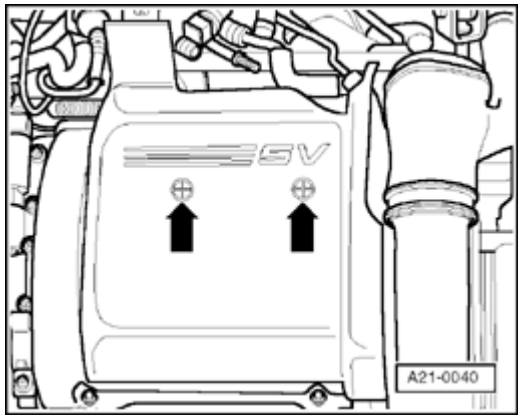
Removing

- Remove engine ⇒ Page 10-1 .

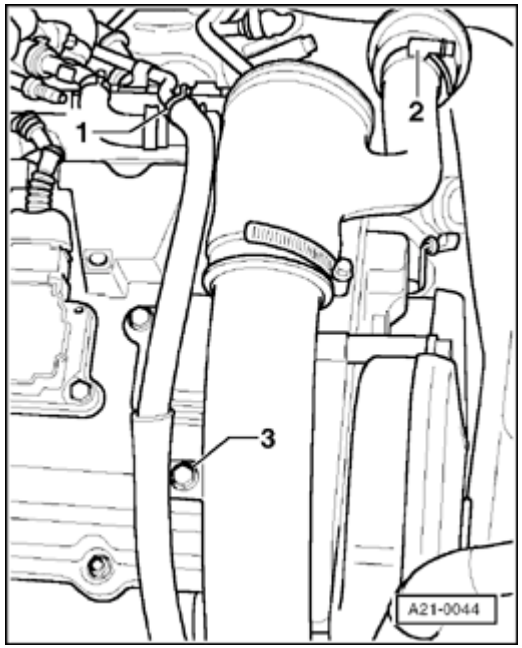


- Unplug connector from air recirculation valve -2-.

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- Remove cover panel from right-hand cylinder head cover -arrows-.

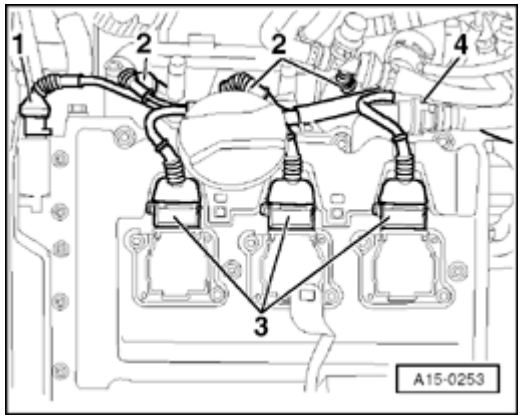


- Disconnect hose -1-.
- Disconnect hose -2-.
- Unbolt upper section of intake line -3-.

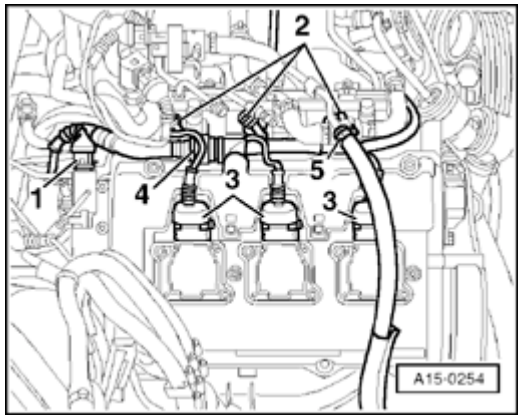
Note:

Plug lower section of intake line.

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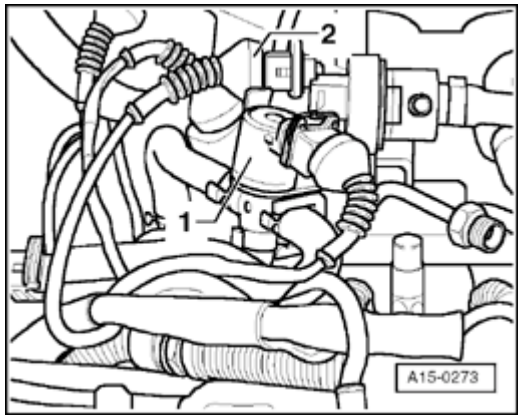


- Unplug connectors from injectors -2- (cylinder bank 4..6).

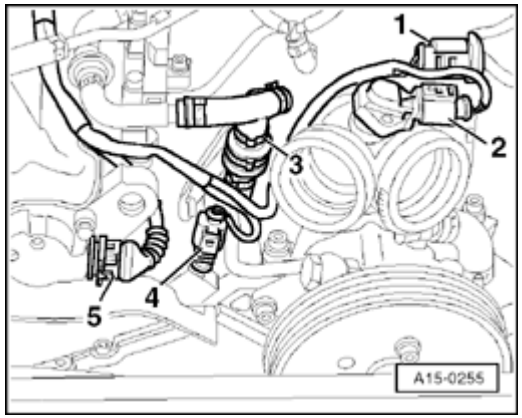


- Unplug connector for camshaft timing control -1- (cylinder bank 1..3).
- Unplug connectors from injectors -2- (cylinder bank 1..3).
- Unplug connectors from ignition coils -3- and move wiring harness clear (cylinder bank 1..3).
- Pull crankcase breather -4- off cylinder head cover (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.
- Remove ignition coils.

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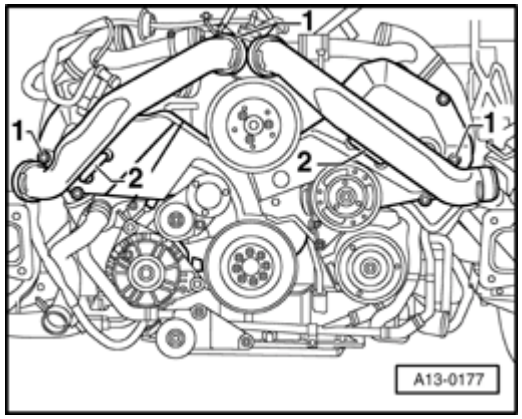
- Unclip solenoid valve for charge pressure control -1-.
- Pull connector off EVAP valve -2-.



- Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sensor -4-.
- Pull connector -5- off Hall sensor.

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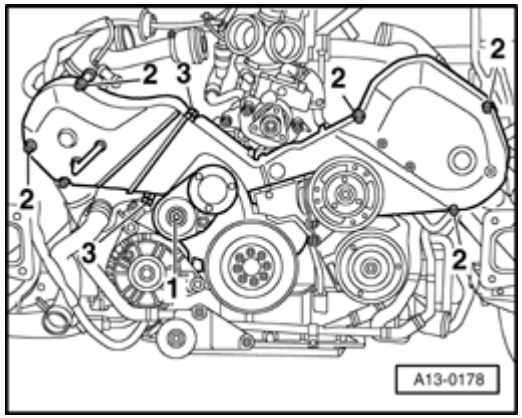
15-46



- Remove pressure lines -1-.

Note:

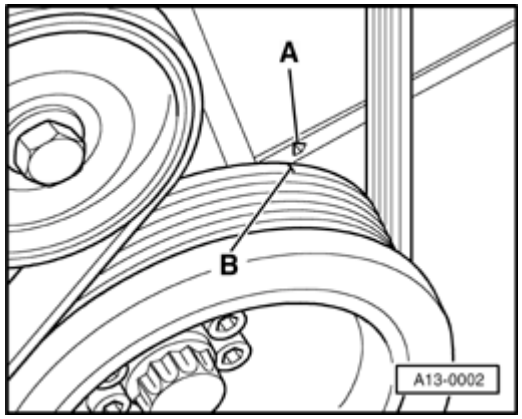
Watch position of retaining strips -2-.



- Remove tensioner -1- for ribbed belt.
- Remove toothed belt guards -2- (left and right).
- Remove toothed belt guard -3- (center).

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15-47



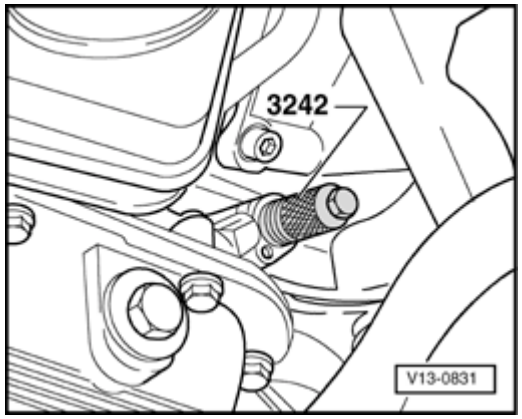
- Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: larger holes in securing plates on camshaft sprockets must align opposite one another on inside. If this is not the case, turn crankshaft one revolution further.
- Remove sealing plug from cylinder block, left.

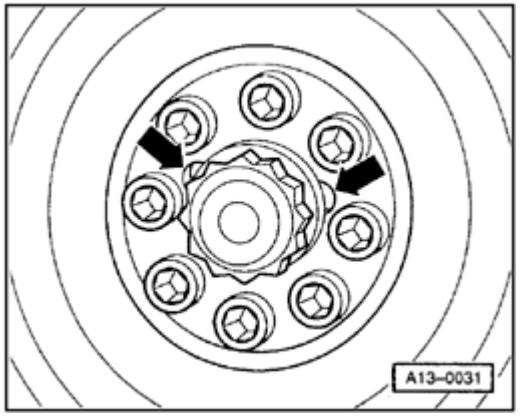
  The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.



- Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.

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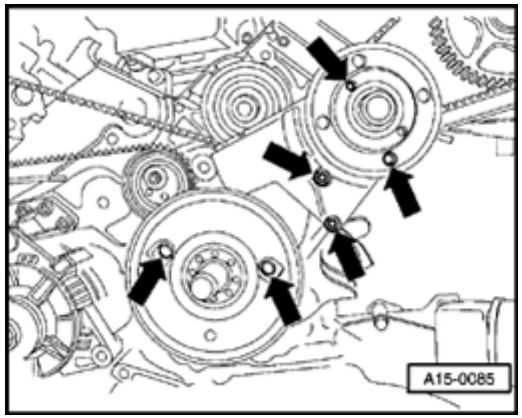
15-48



- Remove vibration damper on crankshaft.

Note:

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



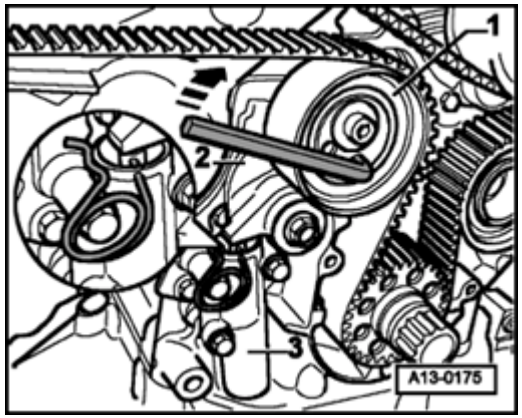
- Remove idler wheel for ribbed belt -arrows-.
- Remove toothed belt guard behind vibration damper -arrows-.

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15-49

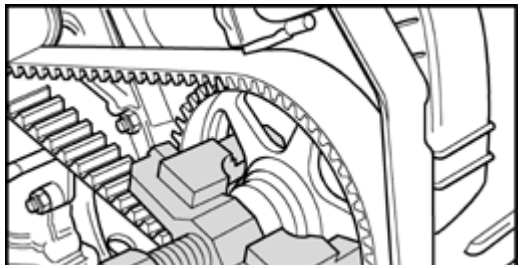
Notes:

- *Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when reinstalled.*
- *The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.*



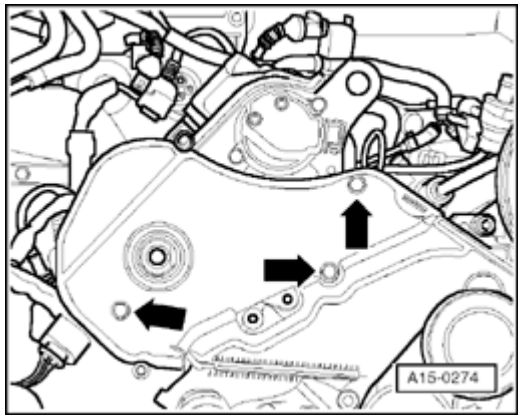
- Using a hexagon key, turn toothed belt tensioning roller -1- clockwise 8 mm in direction of arrow until tensioning lever -2- compresses tensioning element -3- sufficiently to enable a 2mm dia. spring pin to be installed in drilling and in plunger.
- Insert spring pin and release toothed belt tensioning roller.

  Use spring pin from 2024 A.
- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Loosen both camshaft bolts and remove approx. 5 turns.
- Take out camshaft clamp 3391.

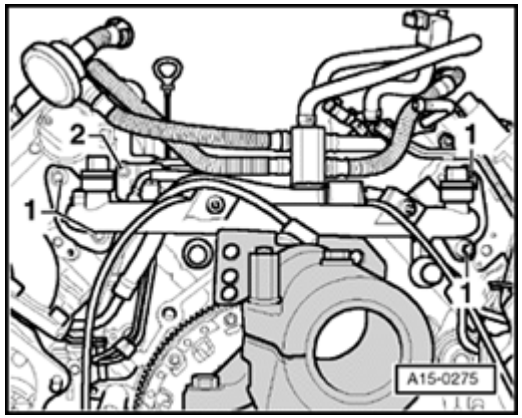


- Pull off both camshaft sprockets with special tool T40001.

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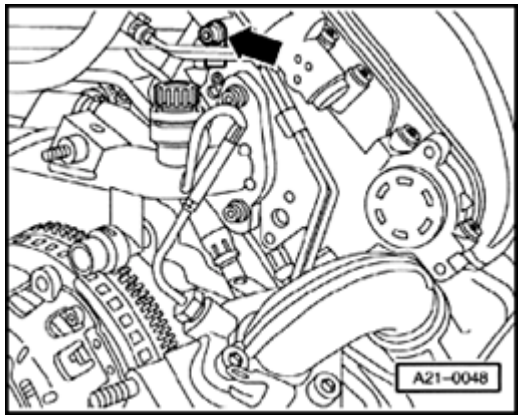


- Unbolt rear right toothed belt guard -arrows-.
- Detach intake manifold using special tool 3249.

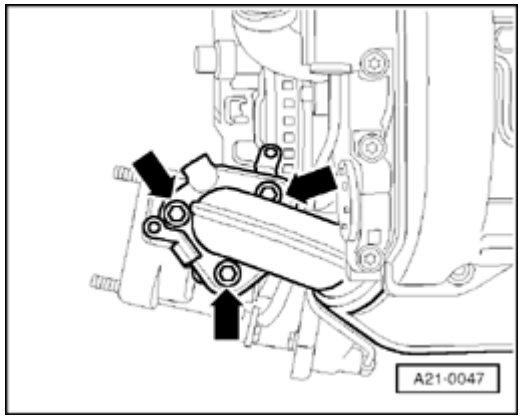


- Unbolt water line -1- and pull it towards the rear.
- Unbolt bracket -2- from cylinder head.

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- Detach line -arrow- from cylinder head.
- Detach line -2-.



- Remove turbocharger -arrows-.

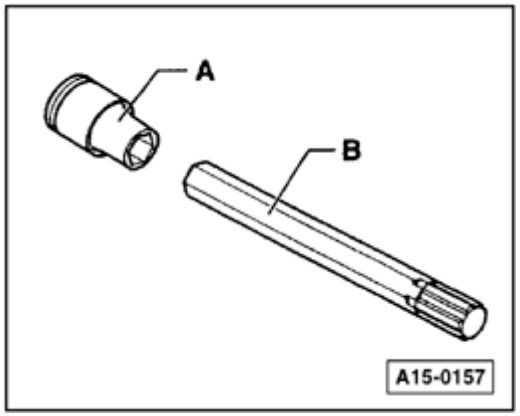
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- Unbolt cylinder head cover.

- Loosen and remove cylinder head bolts in opposite sequence to tightening sequence using special tool 3452 (Polidrive).

- Carefully lift off cylinder head.

Note:



Use special tool 3452 together with a normal commercial 10 mm socket when removing and installing.

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15-53

Installing

Notes:

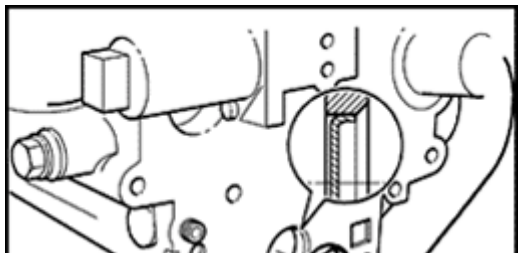
- *Do not allow any oil or coolant to remain in the blind holes for the cylinder head bolts in the cylinder block.*
- *Install new cylinder head bolts.*
- *Connecting vacuum hoses* ⇒ *Page 10-28* .

When installing a new cylinder head:

- Screw in centering pin for intake manifold.

The cylinder head supplied as a replacement part can be used on both sides (left or right). But a sealing cap (core plug) must be installed in the front end of the cylinder head in each case.

- Coat outside circumference of sealing cap (core plug) with sealant AMV 188 001 02.



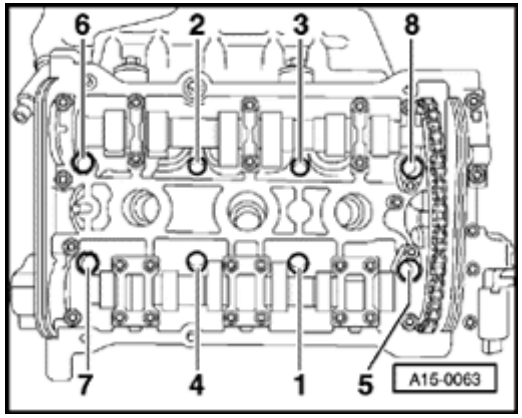
- Using drift VW 295, knock in sealing cap (core plug) until outside rim is flush with end of chamfer in cylinder head.

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- Before installing cylinder head in position, turn crankshaft and camshafts to TDC of No. 3 cylinder.

- Install cylinder head gasket on dowel sleeves. Marking "oben" (top) or part number must face towards cylinder head.

- Install cylinder head, insert cylinder head bolts and tighten finger-tight.

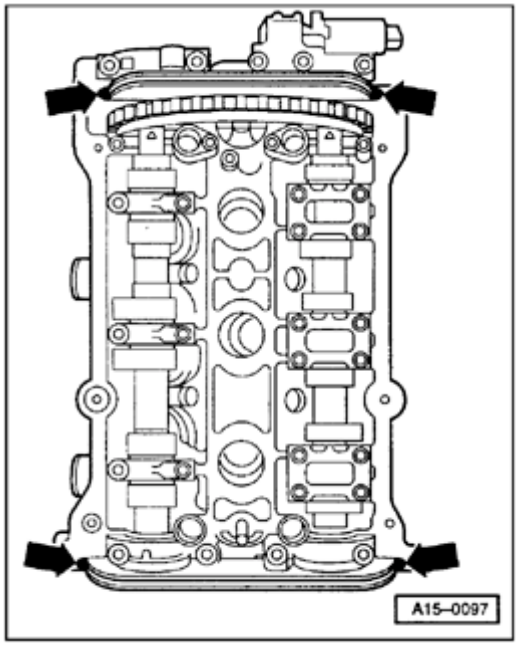


- Tighten cylinder head bolts in two stages in sequence shown, as follows:
  - Stage 1 = 60 Nm.
  - Stage 2 = turn a further $^{1}/_{2}$ turn (180 °) with a rigid wrench (turning 2 x 90 ° is also permissible).

It is not necessary to torque down cylinder head bolts again after repairs have been completed.

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15-55



- Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at four end points of sealing surfaces on cylinder head -arrows-, using a small screwdriver.

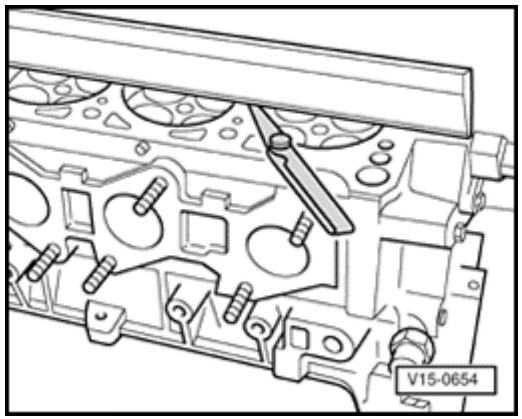
Tightening torques

Component		Nm
Bolts	M6	10
Bolts	M8	20
Camshaft bearing caps and camshaft adjuster		10
Exhaust manifold to cylinder head		25
Front exhaust pipe to exhaust manifold		25
Oxygen sensor		50
Spark plugs		25
Toothed belt sprocket to camshaft		55
Intake manifold to cylinder head		10
Cylinder head cover		10

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15-56

Cylinder head, checking for distortion

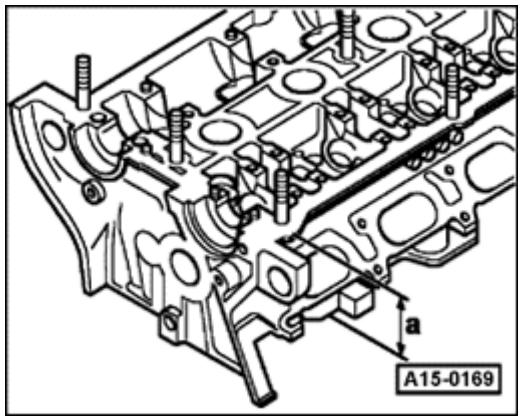


- Measure at several points with straight-edge.

♦ Maximum permissible distortion: 0.1 mm.

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Cylinder head, reworking



Reworking cylinder head (skimming) is only permissible down to a minimum dimension of a =139.25 mm.

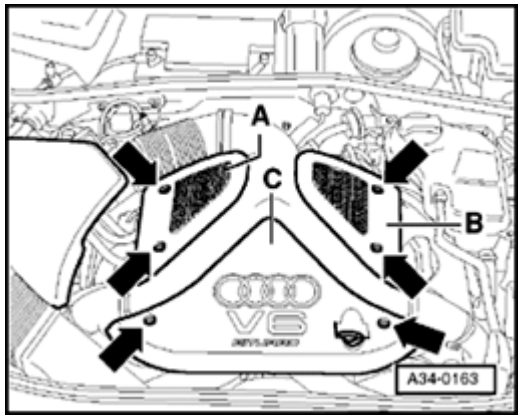
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15-58

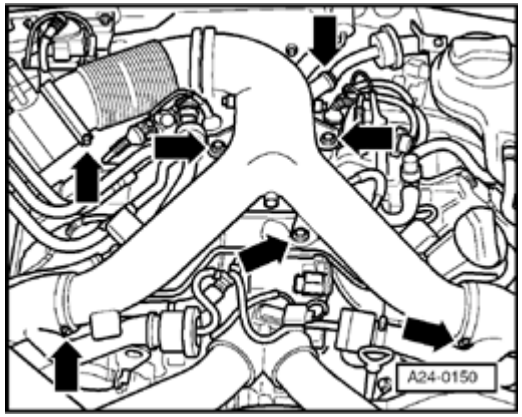
Compression, checking

Test requirements:

- Engine oil temperature at least 30 ° C.
- Battery fully charged.

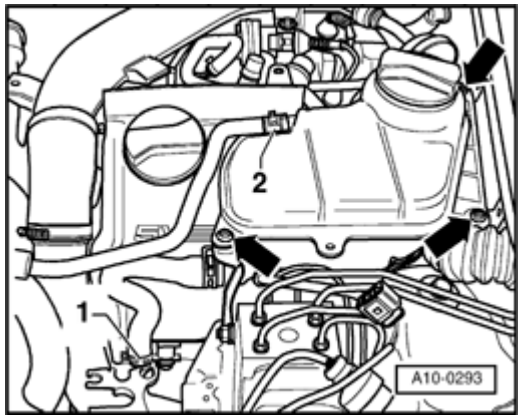


➢ - Remove bolts -arrows- and remove engine cover panels -A...C-.



➢ - Remove air duct -arrows-.

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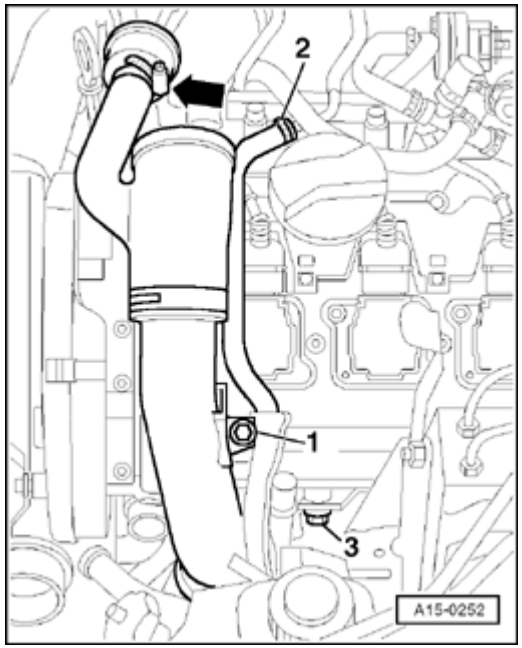


- Remove coolant reservoir -arrows- and move it clear to the side.

Note:

Leave coolant hoses connected.

- Unplug connector from coolant level monitor.
- Remove cover panel from cylinder head cover (cylinder bank 4 - 6).

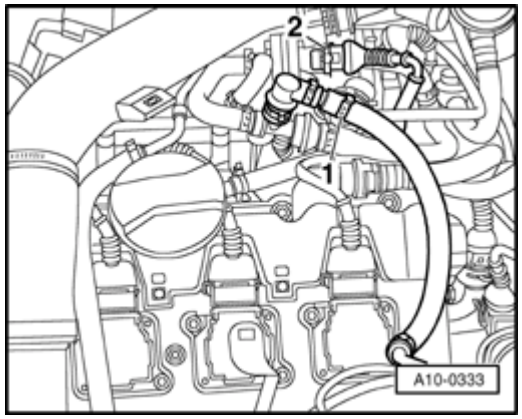


- Release hose clamp -arrow-.
- Remove intake line -1-.
- Disconnect hose -2-.
- Detach water line -3-.

Note:

Plug lower section of intake line.

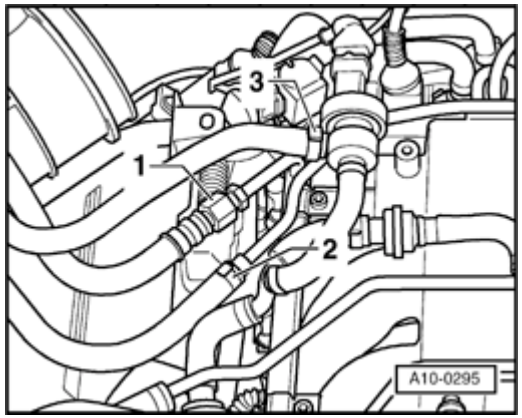
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- Pull off hose -1-.

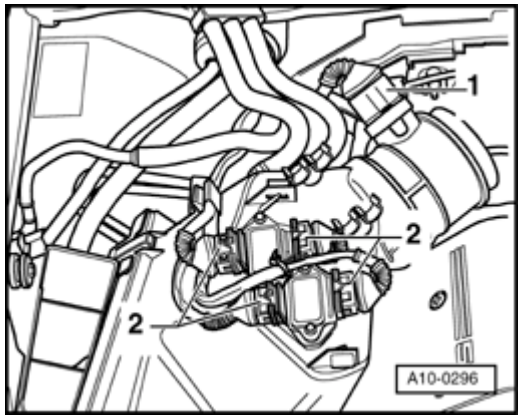
WARNING!

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

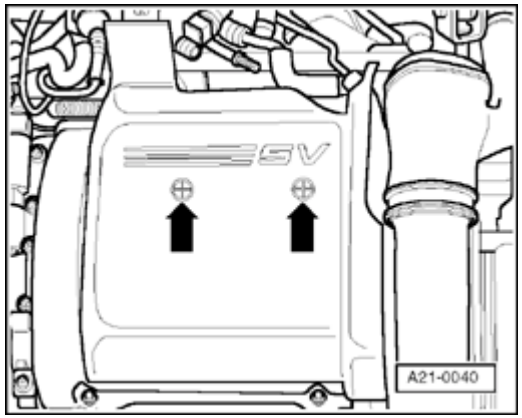


- Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off EVAP valve -3-.

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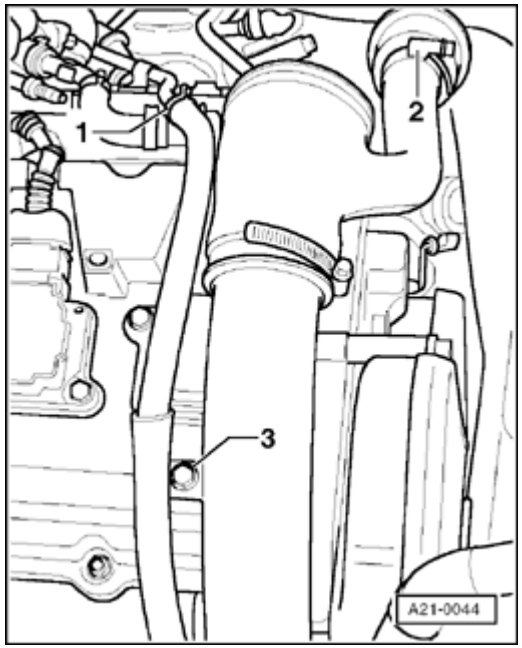


- Unplug connector -1- from air mass meter.
- Unplug connectors -2- from ignition output stages, and move wiring clear.
- Remove air cleaner.



- Remover cover panel from right-hand cylinder head cover -arrows-.

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- Disconnect hose -1-.
- Disconnect hose -2-.
- Detach upper section of pressure line -3-.

Note:

Plug lower section of pressure line.

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- Pull crankcase breathers off cylinder head covers.

- Pull plug connectors off ignition coils.

- Remove ignition coils.

- Unplug connectors from all 6 injectors.

- Disconnect 5-pin connecter at power output stage of ignition coils.

- Open throttle fully.

- Use compression tester VAG 1381 or VAG 1763.

- Operate starter until pressure reading on tester no longer rises.

Compression pressure values

New	Wear limit	Max. permissible difference between cylinders
9 ... 13 bar	7 bar	3 bar

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Installing

Install in reverse sequence; note the following points.

- install fuse No. 28 (for fuel pump).

- Erase Diagnostic Trouble Code (DTC) memory.

Note:

Malfunctions will have been stored in the memory because the connector to the Hall sensor has been unplugged. Therefore interrogate and erase the DTC memory after the test.

Tightening torque

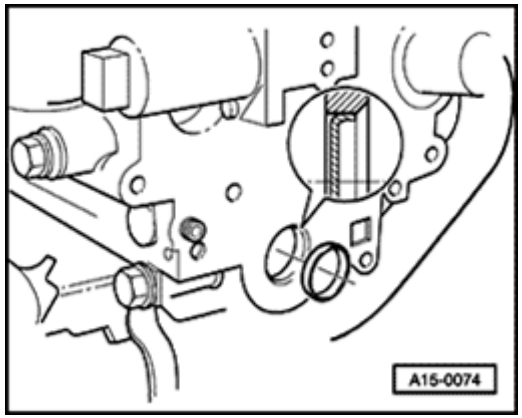
Component	Nm
Ignition coils to cylinder head	10
Spark plugs in cylinder head	30

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Sealing cap (core plug) in cylinder head, installing

The cylinder head supplied as a replacement part can be used on both sides (left or right). But a sealing cap (core plug) must be installed in the front end of the cylinder head in each case.

- Coat outside circumference of sealing cap (core plug) with sealant AMV 188 001 02.



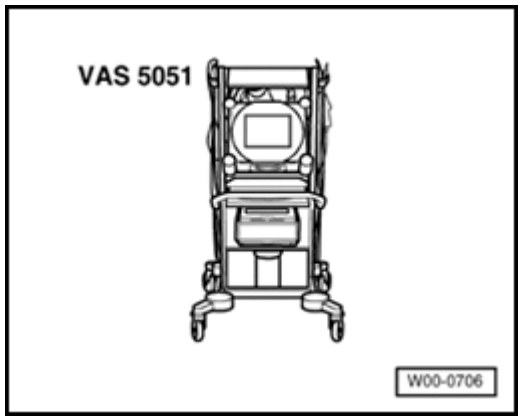
- Using drift VW 295, knock in sealing cap (core plug) until outside rim is flush with end of chamfer in cylinder head.

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15-66

Camshaft adjustment, checking function

Special tools and equipment



- VAS 5051 with VAG 5051/1

or

- VAG 1551 with VAG 1551/3A

Test requirement:

- Coolant Temperature at least 80 ° C.

WARNING!

- ***During a road test in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.***
- ***When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.***

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15-67

Test sequence

- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle for this.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

Rapid data transfer HELP Select Function XX	When indicated on display

- Press buttons -0- and -4- to select "Initiate basic setting" and press -Q- button to confirm input.

Initiate basic setting Q Input display group number XXX	When indicated on display

- Press buttons -0-, -9- and -4- to select "display group number 094" and press -Q- button to confirm input.

System in basic setting 94 → 1 2 3 4	When indicated on display

Camshaft adjustment is checked for function.

- Increase engine speed to above 2000 RPM.

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15-68

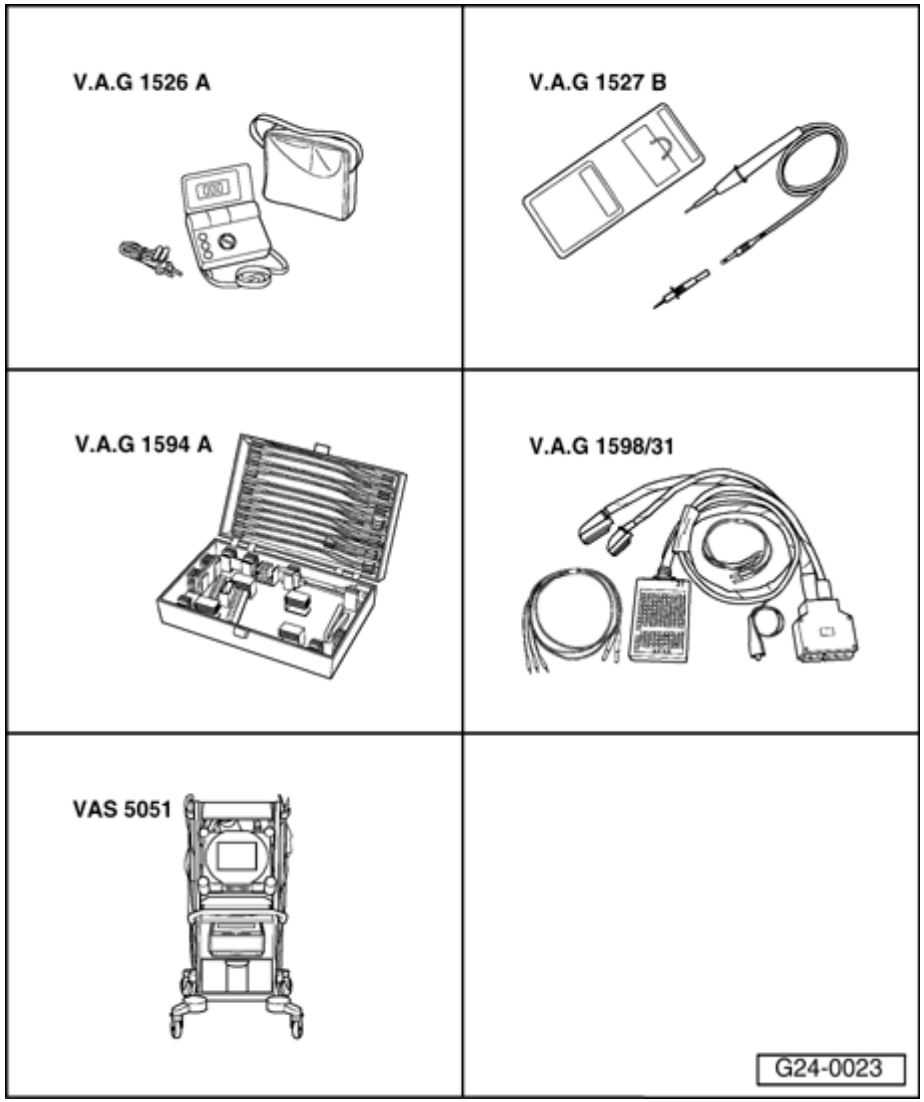
	Display fields			
	1	2	3	4
Display group 94: Function of camshaft adjustment				
Display	1 RPM	Text	Text	Text
Indicated	Engine speed (RPM)	Camshaft adjustment	Test result, Bank 1	Test result, Bank 2
Specified value	>2000	Cs-CM. ON	Test ON Sys. OK	Test ON Sys. OK
Note:				

If "not OK" is indicated in display field 3 and/or 4:

- Check solenoid valve for camshaft adjustment.

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15-69



Solenoid valve for camshaft adjustment, checking

Special tools and equipment

- VAG 1526A
- VAG 1527B
- VAG 1594A
- VAG 1598/31
- VAS 5051

- or

- VAG 1551 with VAG 1551/3A

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15-70

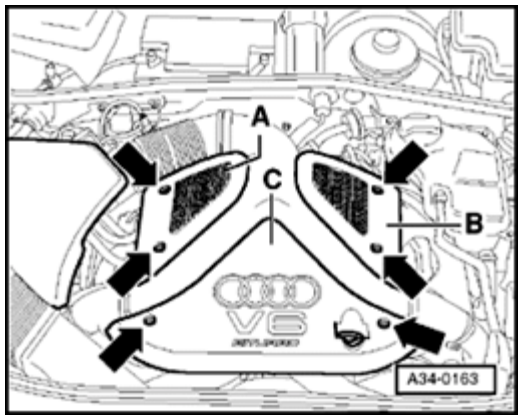
- Initiate output Diagnostic Test Mode (DTM) and activate the valve for camshaft adjustment.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

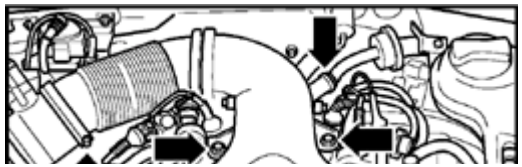
If valves do not click during output Diagnostic Test Mode (DTM):

Checking internal resistance

- Switch ignition off.



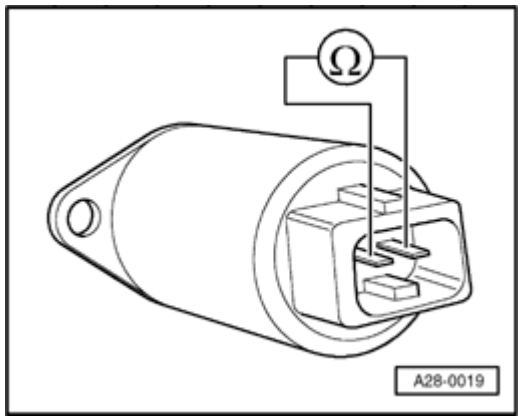
- Remove bolts (arrows) and remove engine covers -A- and -B-.



- Remove air distributor (arrows).

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- Disconnect connector from solenoid valve.



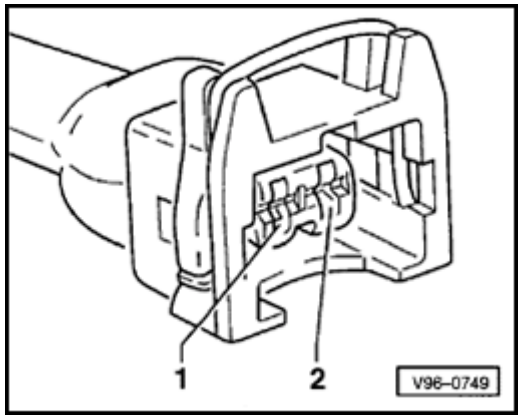
- Connect multimeter at valve for resistance measurement.
  - ♦ Specified value: 10 ... 18 Ω

If specified value is not obtained:

- Replace valve.

Checking voltage supply

- Disconnect connector from solenoid valve.



- Connect VAG 1527B voltage tester as follows:

Harness connector terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly.
  - ♦ LED must light.

If LED does not light:

- Perform following tests marked with dots:

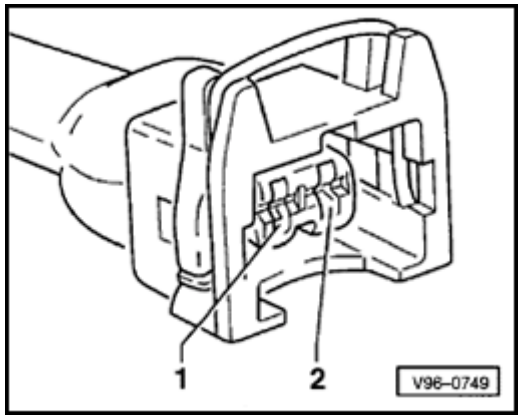
• Check fuse of solenoid valves for camshaft adjustment.

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⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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15-72



- Check wire connection from terminal 1 of connector via fuse -S234- (in fuse holder, socket 34) to Fuel Pump (FP) relay for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Repair open circuit if necessary.

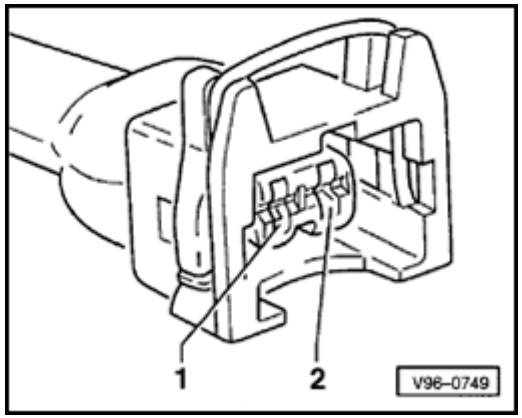
If no malfunctions are detected:

- Check Fuel Pump (FP) relay.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

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15-73



Checking activation

- Connect VAG 1527B voltage tester between terminal 1 (+) and 2.
- Initiate output Diagnostic Test Mode (DTM) and activate valve for camshaft adjustment.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

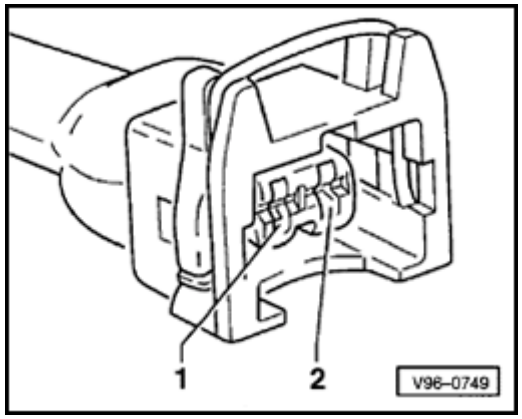
♦ LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect VAG 1598/31 test box at wiring harness to ECM, do not connect ECM.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

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- Check following wire connections for open circuit and short circuit to Ground (GND) and B+:

Valve 1 for camshaft adjustment -N205- and valve 2 for camshaft adjustment -N208-

Harness connector terminal	VAG 1598/31 or test box Bushing
2	⇒ *Electrical Wiring Diagrams, Troubleshooting &Component Locations*

- Repair Ground (GND) connection or open circuit if necessary.

If wire connection is OK:

- Replace Engine Control Module (ECM).

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

If no malfunctions are detected:

- Replace mechanical camshaft adjuster.

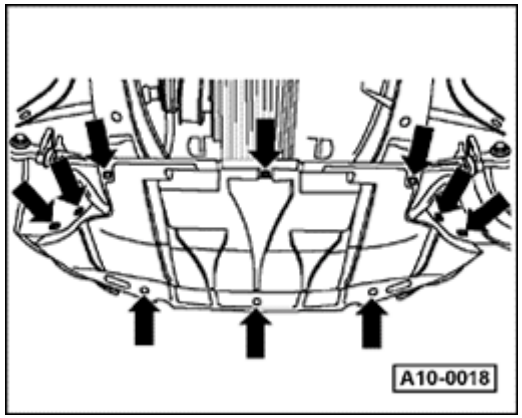
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15-75

Camshafts and camshaft adjusters, removing and installing

Removing

- Cylinder head installed



- Remove noise insulation panel -arrows-.
- Remove front bumper

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Remove ribbed belt ⇒ Page 13-1 .
- Remove toothed belt ⇒ Page 13-4 .

Left cylinder head

- Remove left-hand cylinder head cover ⇒ Page 15-22 .

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15-76

Right cylinder head

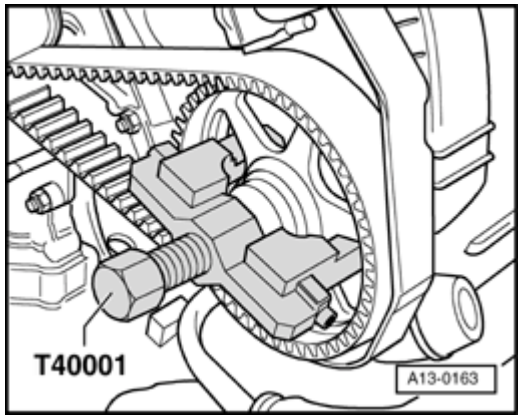
- Remove right-hand cylinder head cover ⇒ Page 15-25

All:

- Unbolt Hall sensor housing (10 Nm).
- Remove bolt securing Hall sensor rotor (20 Nm) and carefully lever off rotor using a screwdriver.
- Insert camshaft clamp 3391 in securing plates of two camshafts.
- Loosen both camshaft bolts and remove approx. 5 turns.
- Take out camshaft clamp 3391.

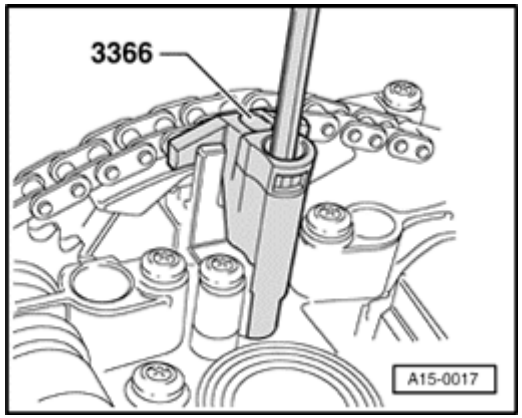
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15-77



- Pull off both camshaft sprockets with special tool T40001.
- Using a screwdriver, carefully pry oil feed lines for camshaft bearings out of camshaft bearings.

Make sure that the retaining catches do not break off when levering out the oil lines.



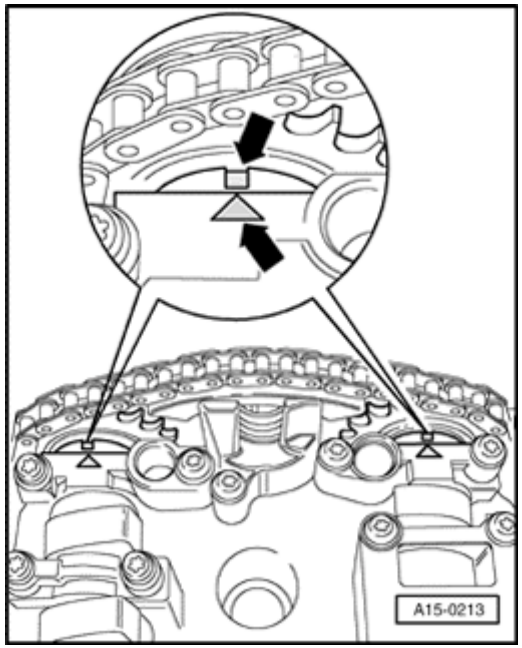
- Secure camshaft adjuster using retainer for chain tensioner 3366.

Note:

Do not over tighten retainer for chain tensioner, otherwise camshaft adjuster can be damaged.

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15-78



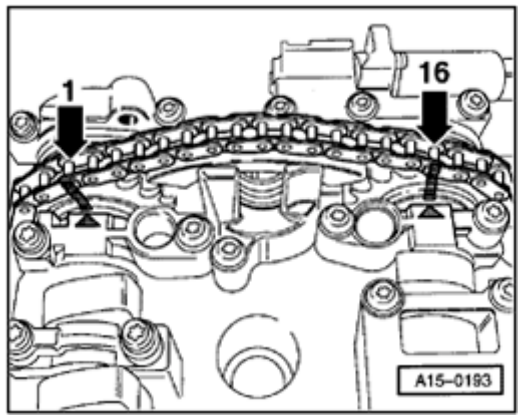
- Check TDC position of camshafts once again.

Note:

The two markings on the camshafts must be in line with the two arrows on the bearing caps.

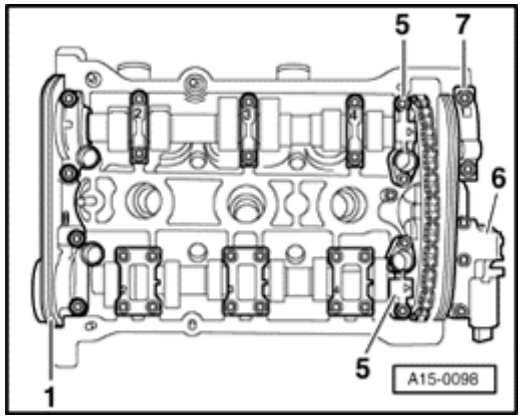
- Clean drive chain and camshaft chain sprockets in vicinity of arrows on bearing caps and mark position of chain on sprockets with paint opposite two arrows.

Notes:



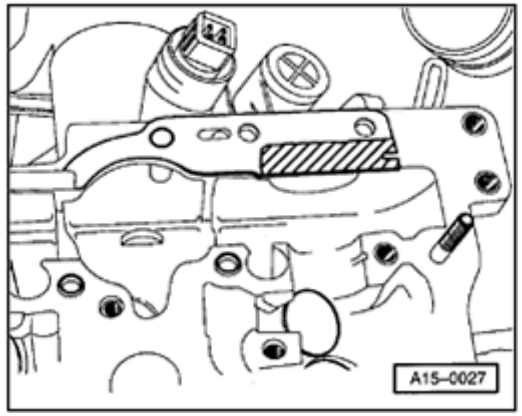
- *The distance between the two arrows (and thus between the paint markings) is 16 rollers on the chain.*
- *The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.*
- *Do not mark the chain with a center punch or by making a notch or similar.*

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- Remove bolts securing camshaft adjuster -6-.
- Remove bearing caps 1, 3, 5 and 7 from inlet and exhaust camshafts and place them in correct order on a clean surface.
- Loosen bearing caps 2 and 4 alternately and in diagonal sequence, and remove from both camshafts.
- Take out both camshafts together with camshaft adjuster.

Installing

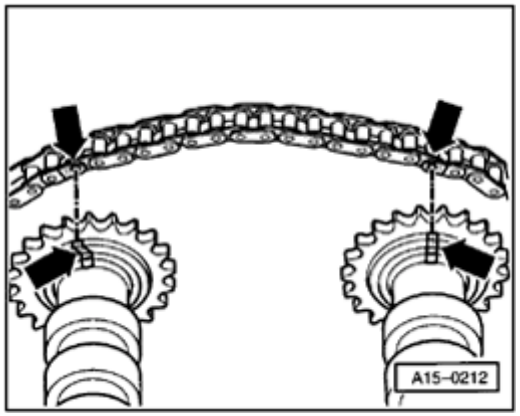


- Replace rubber/metal gasket for camshaft adjuster and apply a thin coat of sealant D 454 300 A2 to the shaded area.

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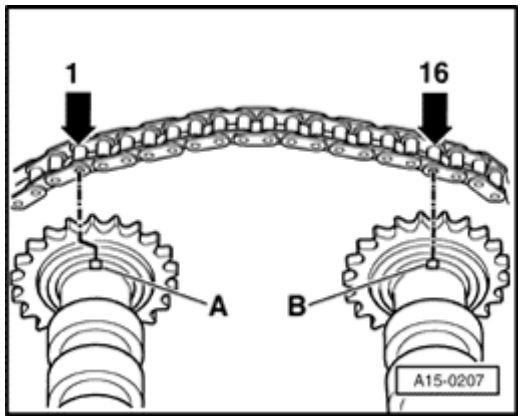
15-80

- Install drive chain on camshaft sprockets as follows:



➢

- When the old chain is being used again, install the chain so that the paint markings (arrow) are in line.



➢

- When a new chain is being installed, the distance between the notches -A- and -B- on the camshafts must be 16 rollers on the chain. The illustration shows the exact positions of the 1st and 16th rollers on the sprockets.
- Notch -A- is offset slightly towards the inside in relation to chain roller -1-.

- Insert camshaft adjuster inside chain (second mechanic required).
- Locate camshafts with chain and camshaft adjuster in cylinder head.
- Oil camshaft bearing surfaces.

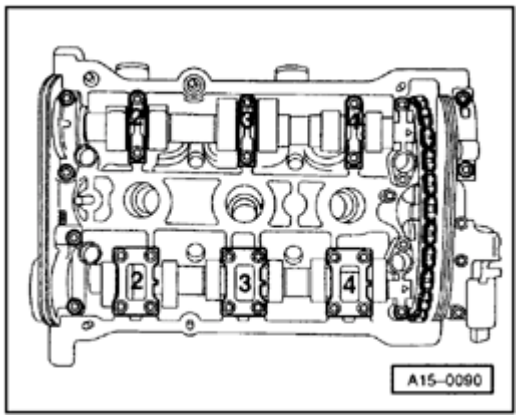
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15-81

Notes:

- *The dowel sleeves for the bearing caps and camshaft adjuster must be in the cylinder head.*
- *Install the bearing caps so that the markings on the bearing caps can be read from the inlet side of the cylinder head.*

- Tighten bolts securing chain tensioner (watch position of dowel sleeves).

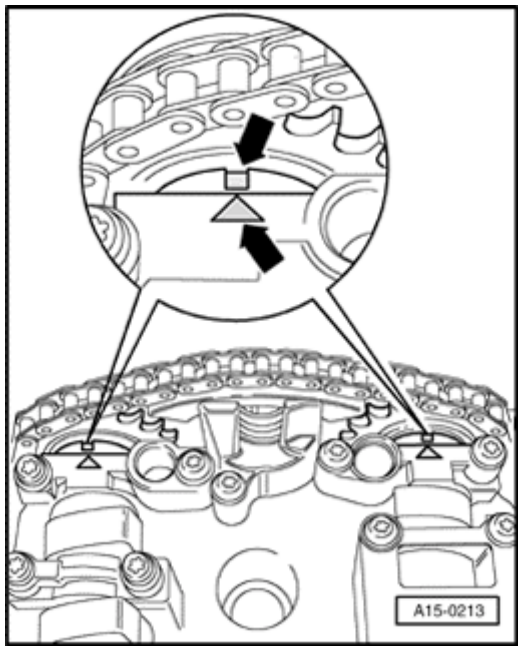


- Tighten bearing caps 2 and 4 of inlet and exhaust camshafts alternately and in diagonal sequence (watch position of dowel sleeves).
- Install two bearing caps next to chain sprockets on inlet and exhaust camshafts.

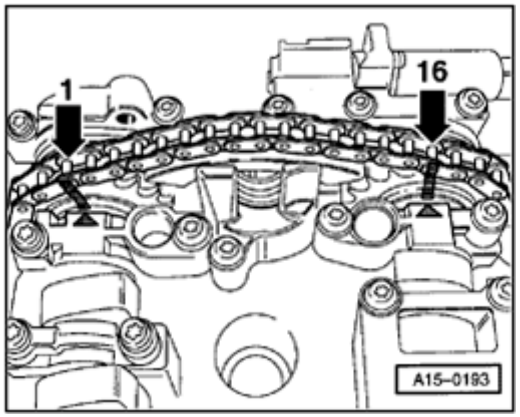
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15-82

- Check correct setting of camshafts:



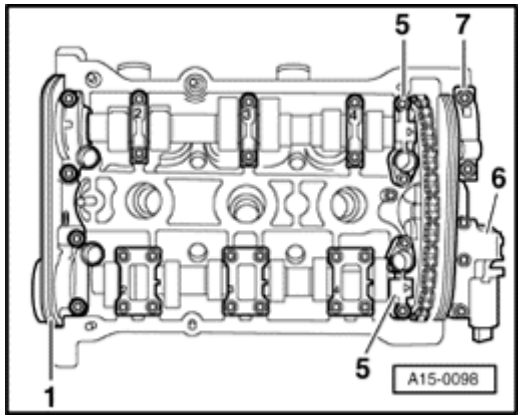
- The two markings on the camshafts must be in line with the two arrows on the bearing caps -arrows-.



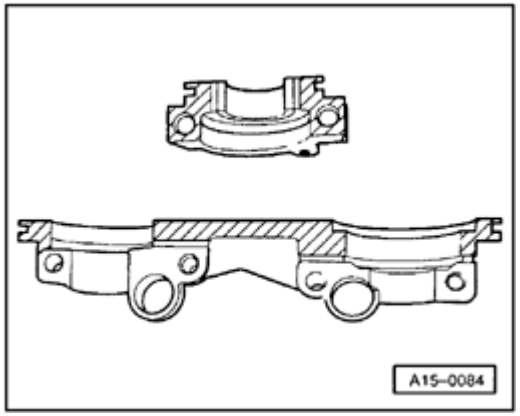
- The distance between the two arrows on the bearing caps (or between the paint markings) is 16 rollers on the chain.
- The notch on the exhaust camshaft is offset slightly towards the inside in relation to chain roller -1-.

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15-83



- Prepare shaded areas on double bearing cap -1- and bearing cap -7-.



.... by applying a thin coat of sealant D 454 300 A2 and install bearing caps (watch position of dowel sleeves).

- Install remaining bearing caps (watch position of dowel sleeves).
- Install new oil feed lines for camshaft bearings.
- Install new oil seals for inlet and exhaust camshafts; installing ⇒ Page 15-10 .
- Remove retainer for chain tensioner 3366.

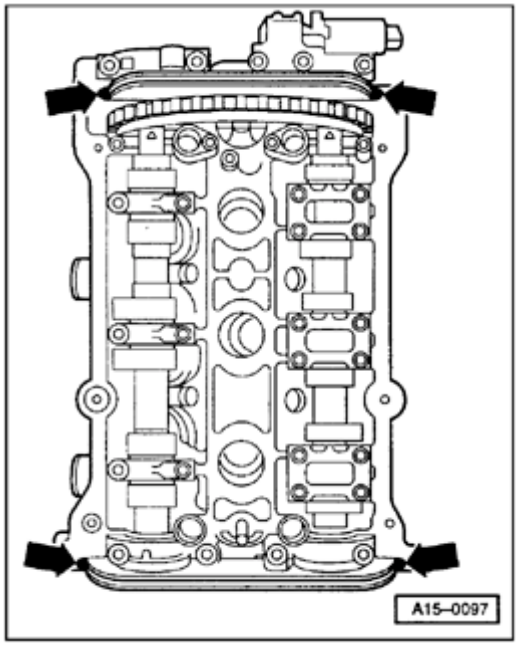
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15-84

Notes:

- *When new lifters have been installed the engine must not be started for about 30 minutes. The hydraulic compensation elements must settle (otherwise valves will strike pistons). Then turn crankshaft two full revolutions before starting.*

- *After working on the valve gear, turn over the engine carefully at least two revolutions by hand to ensure that none of the valves make contact when the starter is operated.*



- Seal end points of joints between bearing caps and cylinder head.
- Before installing cylinder head cover and gasket, carefully apply a small quantity of sealant D 454 300 A2 at four end points of sealing surfaces on cylinder head -arrows-, using a small screwdriver.

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- Install cylinder head covers ⇒ Page 15-22 .

- Install toothed belt ⇒ Page 13-4 .

- Install ribbed belt ⇒ Page 13-1 .

Tightening torques

Component		Nm
Bolts	M6	10
	M8	20
Except for the following:		
Bearing caps to cylinder head		10
Camshaft adjuster to cylinder head		10
Hall sensor rotor to camshaft		25
Hall sensor housing to cylinder head		10
Camshaft sprocket to camshaft		55
Camshaft bearing cap and camshaft adjuster		10
Cylinder head cover		10

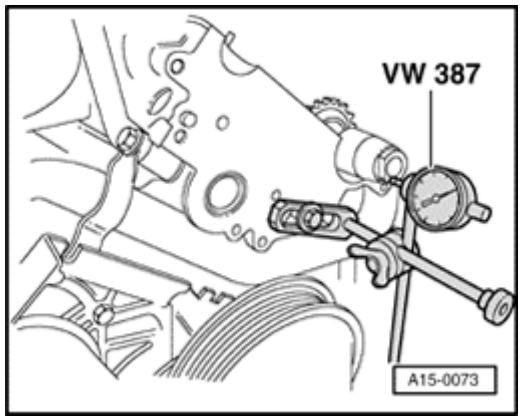
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Camshaft axial clearance, checking

- Remove camshafts ⇒ Page 15-75 .

- Remove lifters.

- Install camshafts in cylinder head without drive chain and secure by tightening bearing caps 2 and 4.

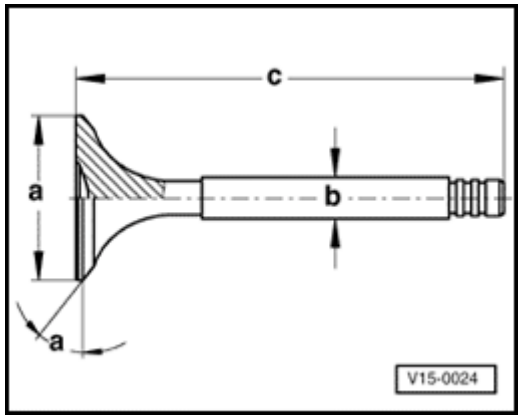


- Attach dial gauge to cylinder head with universal dial gauge bracket VW 387.
- Press camshaft against dial gauge by hand.
- Set dial gauge to -0-.
- Press camshaft away from dial gauge.
- Note reading on gauge:

New	Wear limit
0.05 ... 0.15 mm	0.20 mm

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15-87



Valve dimensions, checking

Note:

Valves must not be reworked. Only grinding-in (lapping) is permitted.

Dimension	Inlet valve	Exhaust valve
a = diameter mm	26.8 ... 27.0	29.8 ... 30.0
b = diameter mm	5.96 ... 5.97	5.94 ... 5.95
c = mm	104.84 ... 105.34	103.64 ... 104.14
$\alpha = \angle\,°$	45	45

WARNING!

Worn sodium-cooled exhaust valves must be treated as follows before disposal:

- ***Saw the valves into two sections with a metal saw at a point between the center of the valve stem and the valve head. The valves 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) and step back, because a chemical reaction occurs when the sodium filling burns. After this treatment the valves can be disposed of in the normal way.***

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15-88

Hydraulic lifters, checking

Notes:

- *Replace malfunctioning lifters completely (lifters cannot be adjusted or repaired).*
- *When new lifters have been installed the engine must not be started for about 30 minutes (otherwise valves will strike pistons).*
- *Irregular valve noises when starting engine are normal.*

- Start engine and run until coolant temperature reaches approx. 80 ° C.

- Increase engine speed to about 2500 RPM for approx. 2 minutes: if necessary, perform road test.

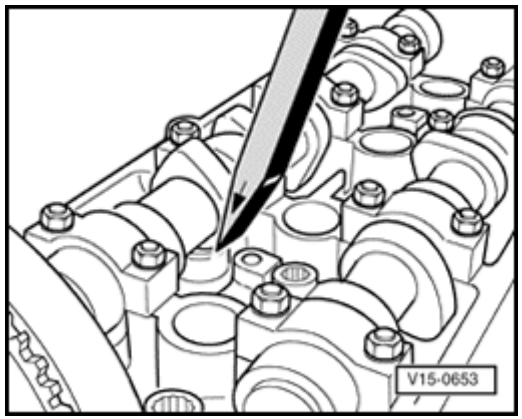
If the hydraulic lifters are still noisy, locate malfunctioning lifters as follows:

- Remove cylinder head cover.

- Rotate crankshaft clockwise by turning securing bolt for toothed belt sprocket until cams of lifters to be checked are pointing upward.

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15-89



- Measure clearance between cam and lifter.

- Push lifter down with a wooden or plastic wedge. If a 0.20 mm feeler gauge can then be inserted between camshaft and lifter, replace lifter: removing and installing camshafts and camshaft adjuster ⇒ Page 15-75

Note:

If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be replaceed ⇒ Page 17-12 .

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Valve stem seals, replacing

- Cylinder head installed

- Remove ribbed belt ⇒ Page 13-1 .

- Remove toothed belt ⇒ Page 13-4 .

- Remove camshafts ⇒ Page 15-75 .

- Remove lifters and put them down with the contact surface downwards. Ensure that lifters are not interchanged.

- Remove spark plugs.

- Set piston of relevant cylinder to bottom dead center (BDC).

Note:

Tight cotters can be released by tapping lightly on the valve lever with a hammer.

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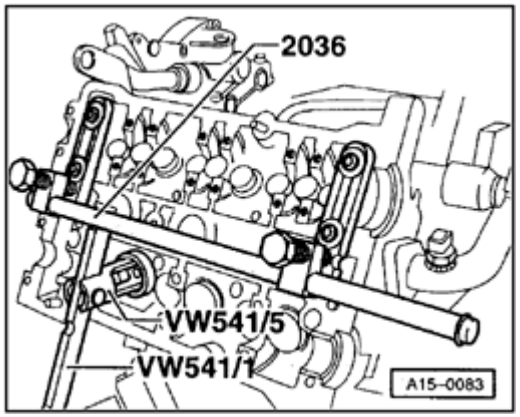
15-91

Exhaust side

Note:

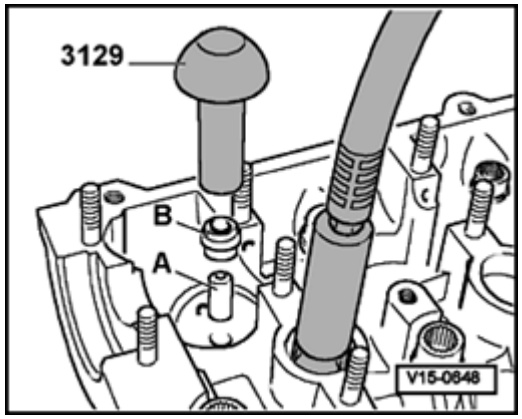
Before attaching the valve assembly appliance, remove the two studs in the center of the cylinder head and the three upper studs (inlet side) for securing the cylinder head cover.

- Screw pressure hose VW 653/3 with sealing ring finger-tight into spark plug thread of relevant cylinder, and maintain a constant pressure of at least 6 bar.



- Attach valve assembly appliance 2036 as illustrated: use M6 x 40 bolts with large washers.
- Remove valve spring using valve lever VW 541/1 and thrust piece VW 541/5.
- Take out valve spring and valve spring plate.
- Pull off valve stem seal with 3047 A.

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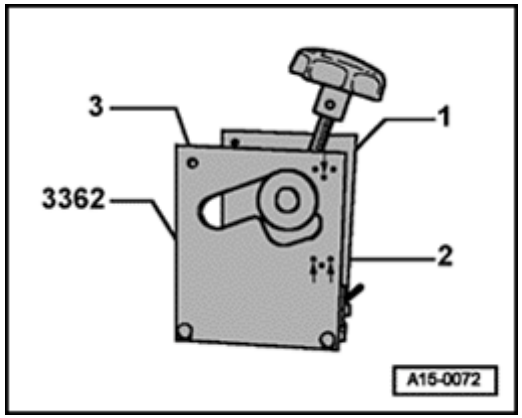


- To prevent damage to the new valve stem seals, place plastic sleeve -A- on the valve stem.
- Lightly oil sealing lip.
- Insert valve stem seal -B- (without oiling outside of seal) into installing tool 3129 and carefully push it down onto the valve guide.
- When installing new valves, lightly oil valve stems before installing.

Inlet side

Note:

The inlet valves are installed in the cylinder head at different angles.



Valve spring compressor 3362 can be set accordingly to two different positions:

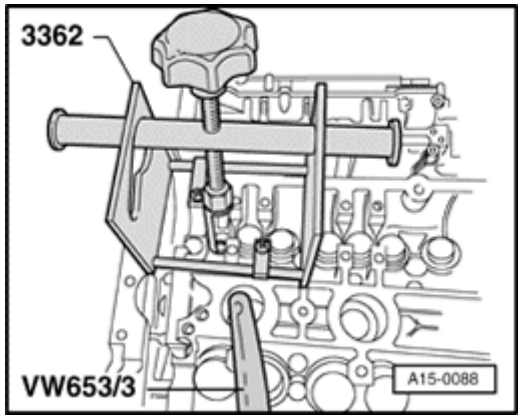
1 - Upper position for center valve

2 - Lower position for the two outer valves

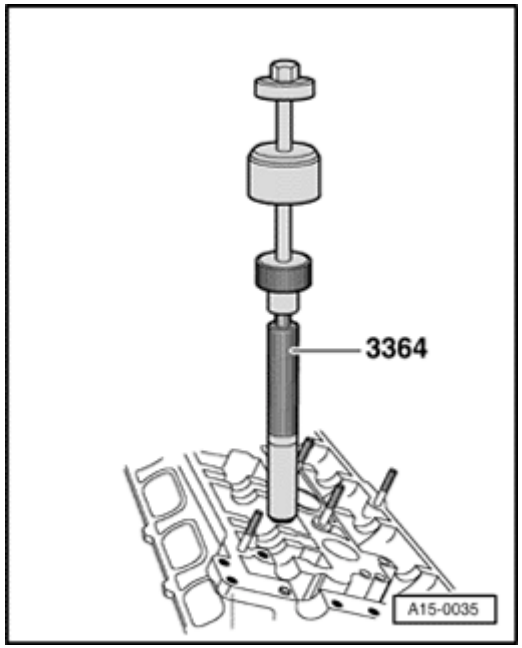
3 - Threads on each side to take M6 x 25 bolts for securing spring compressor to cylinder head

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15-93



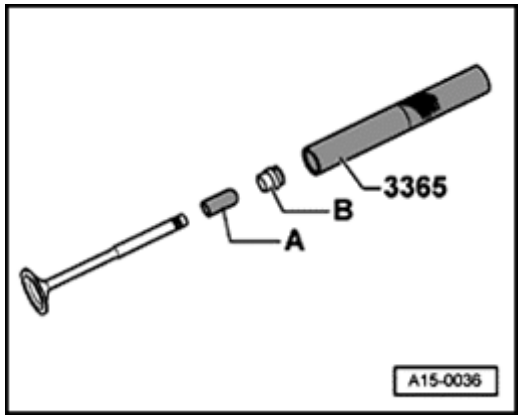
- Mount spring compressor 3362 on cylinder head with two bolts supplied, as in illustration.
- Screw pressure hose VW 653/3 with sealing ring finger-tight into spark plug thread of relevant cylinder, and maintain a constant pressure of at least 6 bar.
- Set position of spring compressor for relevant valve, and remove valve spring using threaded spindle.



- Pull off valve stem seal using 3364.

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15-94



- To prevent damage to new valve stem seals, place plastic sleeve -A- on valve stem.
- Lightly lubricate sealing lip with oil.
- Insert valve stem seal -B- (without oiling outside of seal) into installing tool 3365 and carefully push it down onto valve guide.
- When installing new valves, lightly oil valve stems before installing.

Reworking valves

Valves must not be reworked. Only grinding-in (lapping) is permitted.

WARNING!

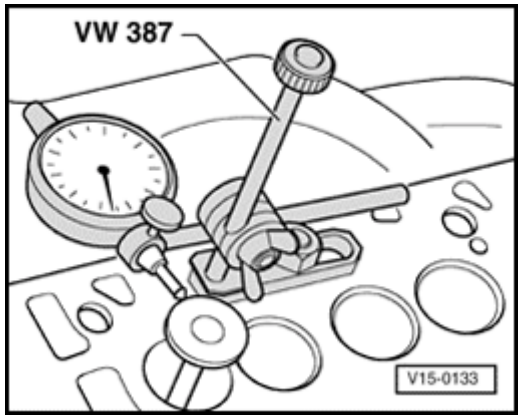
Note precautions required when disposing of sodium-cooled exhaust valves ⇒ ***Page 15-87*** **.**

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15-95

Valve guides, checking

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



- Insert valve into valve guide so that end of valve stem is flush with end of guide. The valve stems have different diameters, so only use an inlet valve in an inlet guide and an exhaust valve in an exhaust guide.
- Measure amount of rock.

Wear limit

Inlet valve guide	Exhaust valve guide
0.8 mm	0.8 mm

If the wear limit is exceeded, replace cylinder head.

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15-96

Valve seats, reworking (refacing)

Notes:

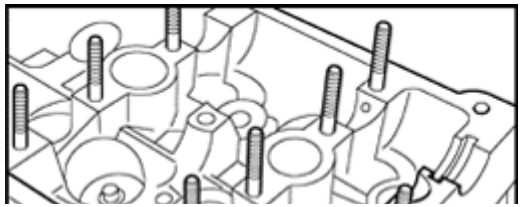
- *The valve seats should only be reworked just enough to produce a good seating pattern.*
- *Calculate the maximum permissible reworking dimension before reworking.*
- *If the reworking dimension is exceeded, the function of the hydraulic lifters can no longer be guaranteed and the cylinder head should be replaced.*

Calculating maximum permissible reworking dimension

- Insert valve and press firmly against valve seat.

Note:

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



- Measure distance between end of valve stem and top surface of cylinder head (illustration shows a 4-valve head).
- Calculate maximum permissible reworking dimension from measured

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distance and minimum dimension.

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Minimum dimensions		
Outer inlet valve	Center inlet valve	Exhaust valve
32.2 mm	33.2 mm	33.0 mm

Measured distance minus minimum dimension = maximum permissible reworking dimension.

Example	
Center inlet valve	
Measured distance	33.0 mm
Minimum dimension	- 32.2 mm
Maximum permissible reworking dimension	= 0.8 mm

Note:

If the measured distance is less than the minimum dimension, repeat the measurement with new valves, or replace cylinder head.

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17-1

Lubrication system components, removing and installing

Notes:

- *If large quantities of metal particles or other deposits (caused, for example, by partial seizure of the crankshaft or connecting rod bearings) are found in the engine oil when performing repairs, clean the oil passages thoroughly and replace the oil cooler in order to prevent further damage from occurring later.*

- *Always replace O-rings, gaskets and oil seals when performing repairs.*

- *The oil level must not be above the max. mark - otherwise this can cause damage to the catalytic converter. Markings* ⇒ *Page 17-67*

Viscosity grades and oil specifications

⇒ *Repair Manual, Maintenance*

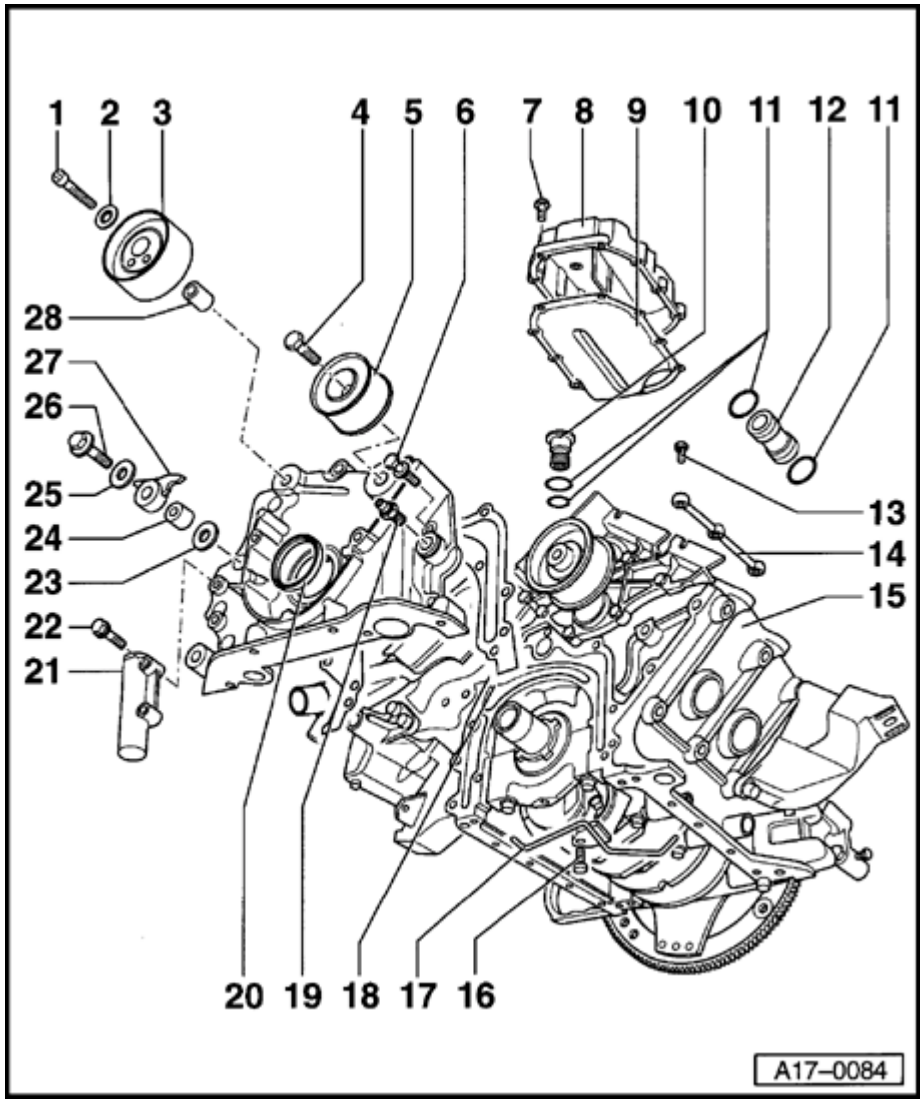
Oil capacities

⇒ *Repair Manual, Maintenance*

Checking oil pressure ⇒ Page 17-65

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17-2



Crankcase breather and oil spray jets, removing and installing

Removing and installing oil pump, oil pan, oil filter and oil cooler ⇒ Page 17-32

1 - Bolt, tightening torque: 20 Nm

2 - Washer

3 - Tensioning roller

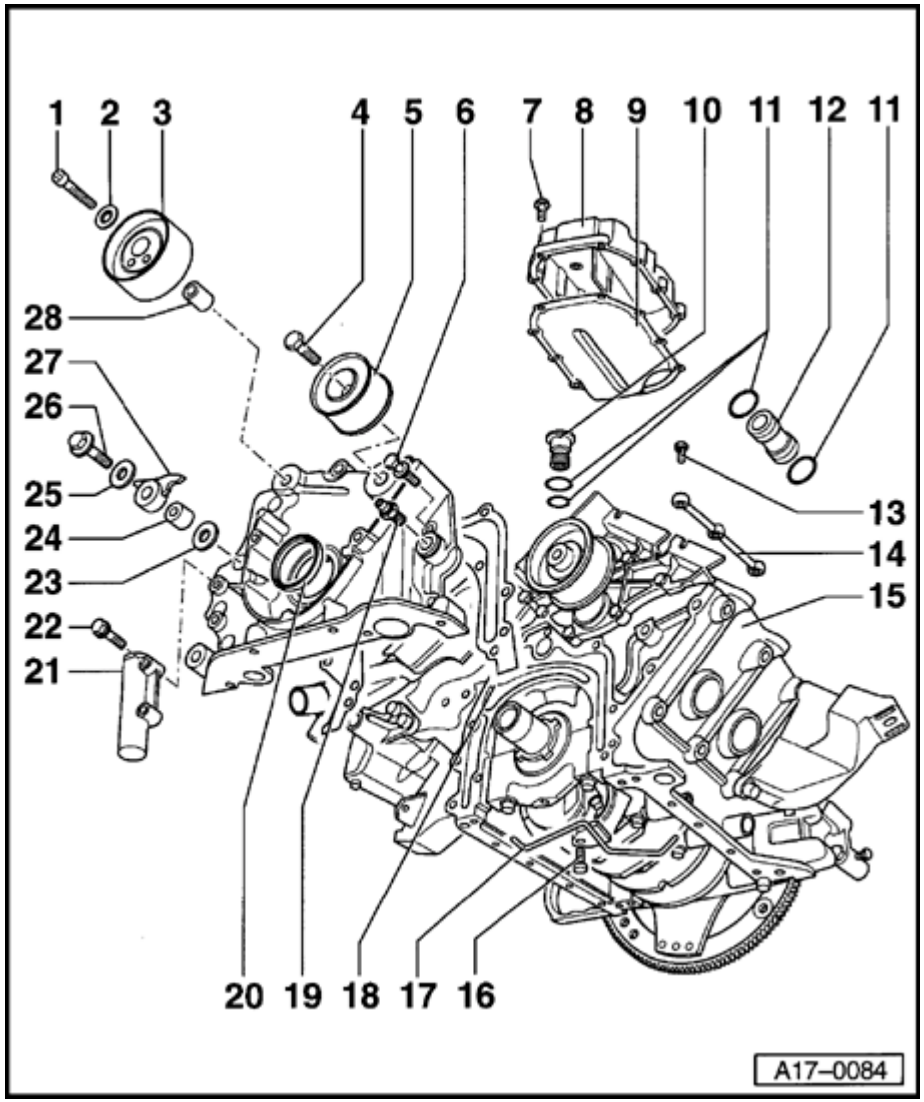
4 - Bolt, tightening torque: 45 Nm

5 - Idler wheel

- For toothed belt

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17-3



6 - Bolt

- M6 Tightening torque: 10 Nm
- M8 Tightening torque: 20 Nm

7 - Bolt, tightening torque 10 Nm

8 - Breather housing

9 - Gasket/breather plate

- Always replace

10 - Oil check valve

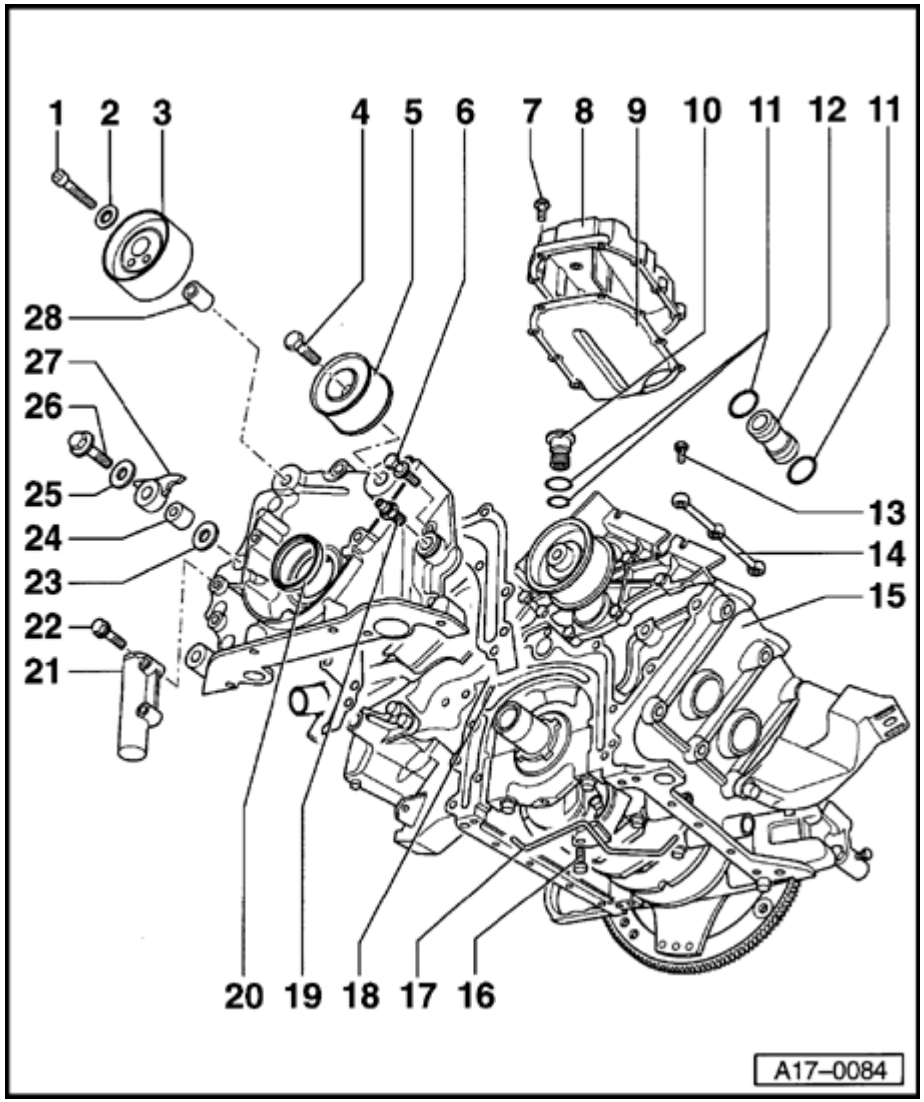
- Tightening torque: 25 Nm

11 - Oil seal

12 - Connector

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17-4



13 - Banjo bolt

- Tightening torque: 15 Nm

14 - Oil distribution line

- For oil spray jets for piston cooling

15 - Cylinder block

16 - Bolt, tightening torque 10 Nm

- Apply locking fluid D6 when installing

17 - Oil spray jet

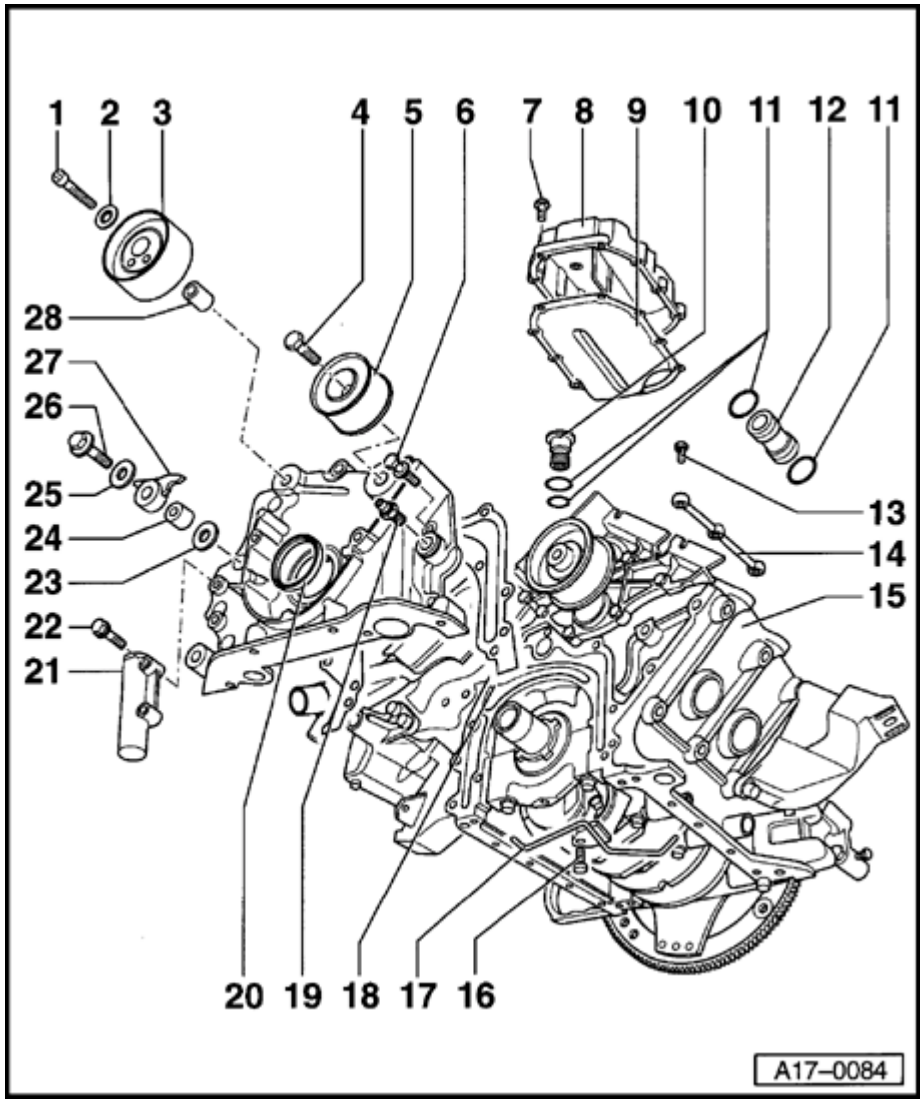
- For piston cooling

18 - Gasket

- Metal gasket
- Always replace

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17-5



19 - Oil temperature sender (-G8-), tightening torque 10 Nm

- For oil temperature gauge
- White
- If seal is leaking, cut open with pliers and replace.

20 - Oil seal

- Replacing ⇒ Page 15-10

21 - Tensioner

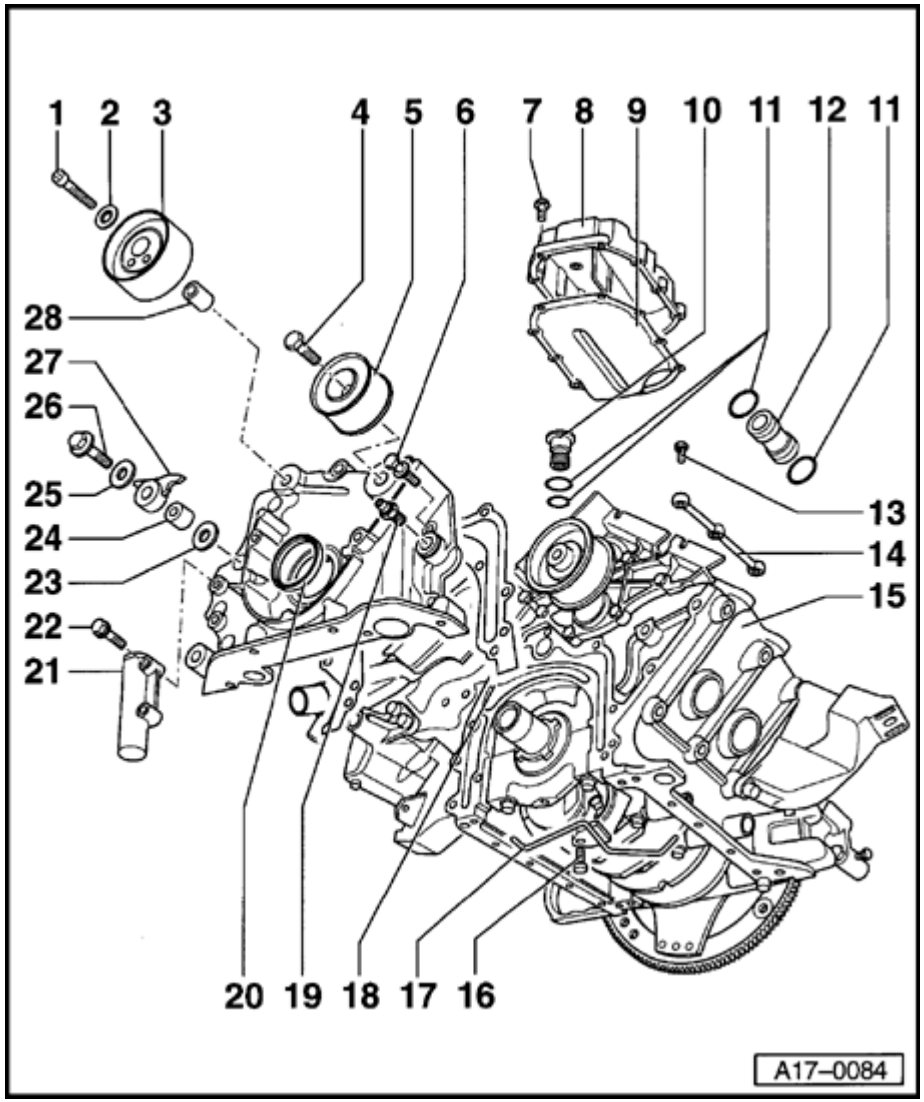
- Secure in position before removing ⇒ Fig. ⇒ 1

22 - Bolt, tightening torque: 10 Nm

- Apply locking fluid D6 when installing

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17-6



23 - Washer

24 - Bearing bush

- For tensioning lever

25 - Washer

26 - Bolt, tightening torque: 25 Nm

27 - Tensioning lever

28 - Bearing bush

- For tensioning roller

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17-7

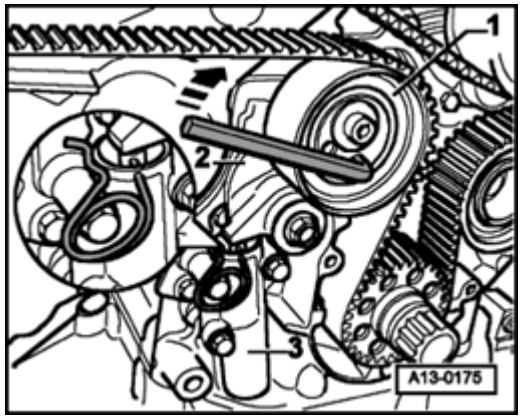


Fig. 1 Securing tensioner in position before removing

- Using a hex key, turn toothed belt tensioning roller -1- clockwise 8 mm in direction of arrow until tensioning lever -2- compresses tensioner -3- far enough to enable a 2 mm dia. spring pin to be inserted in drilling and in plunger.

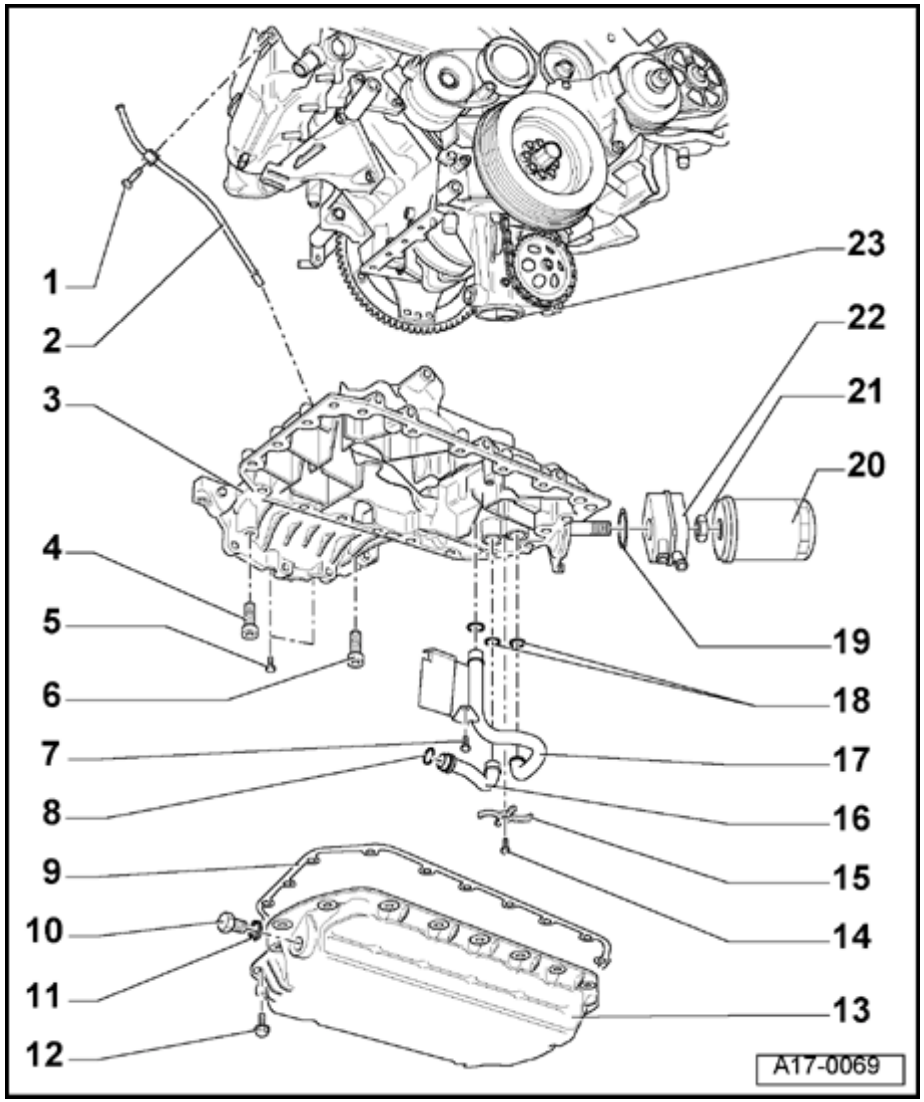
Notes:

- *The toothed belt tensioner is oil-damped and can only be compressed slowly by applying gradual pressure.*
- *Use spring pin from 2024 A.*

- Insert spring pin and release toothed belt tensioning roller.

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17-8



Oil pump, oil pan, oil filter and oil cooler, removing and installing

1 - Bolt for dipstick guide tube

- Tightening torque: 25 Nm

2 - Dipstick guide tube

- Replace O-ring

3 - Oil pan - upper section

- There is no gasket between engine block and upper section of pan. Only use silicone sealant D 454 300 A2.

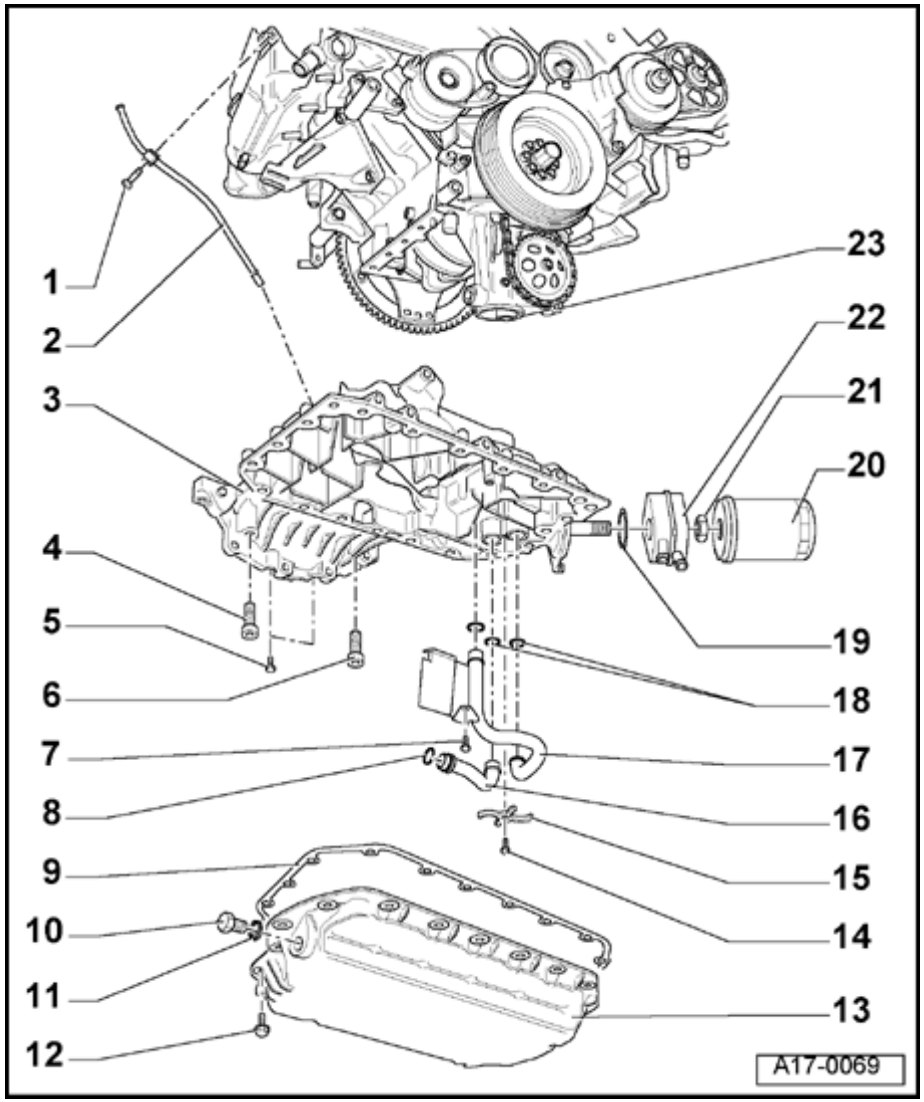
4 - Hex socket head bolt M8

- Tightening torque: 20 Nm

5 - Hex bolt M6

- Tightening torque: 15 Nm

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6 - Hex socket head bolt M8

- Tightening torque: 20 Nm
- The coolant drain screw is next to this bolt

7 - Hex bolt M6

- Tightening torque: 10 Nm

8 - O-ring

- Always replace

9 - Gasket for lower section of pan

- Sealing surfaces should be clean and dry

10 - Oil drain plug

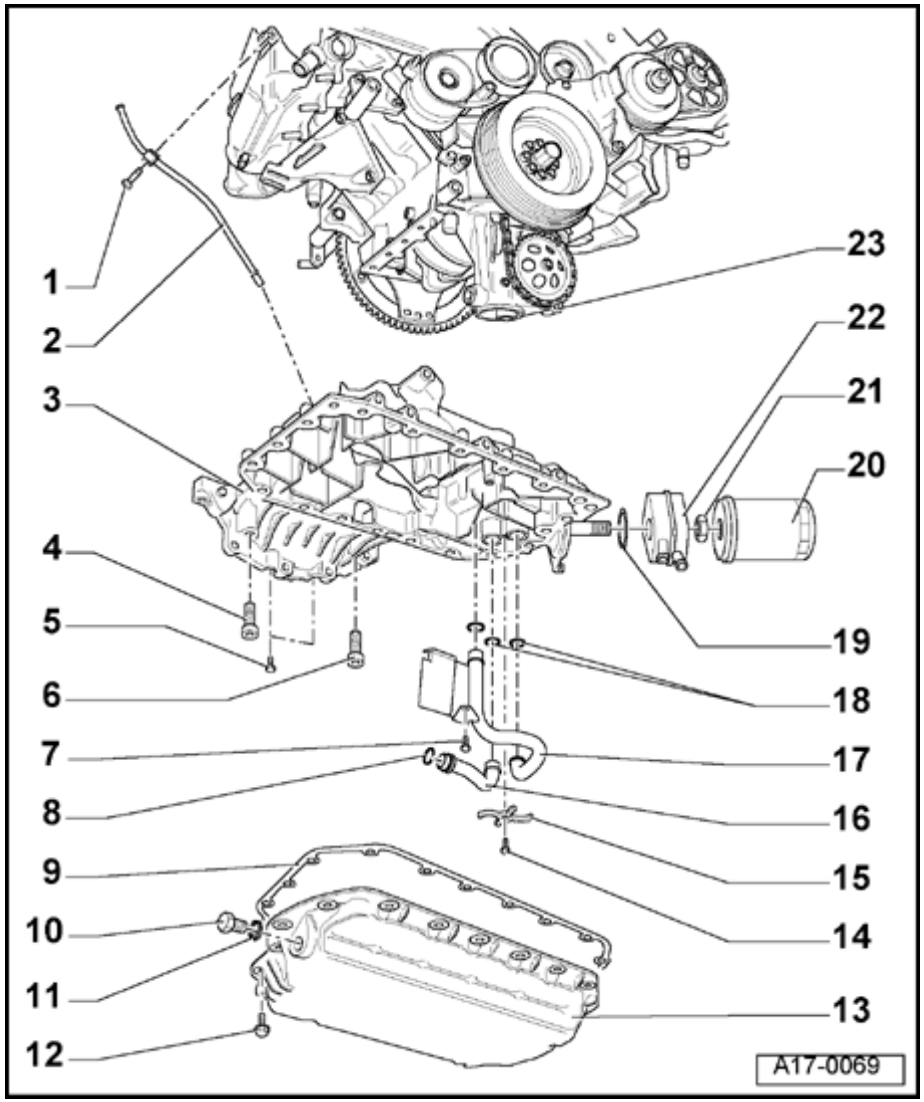
- Tightening torque: 30 Nm

11 - Seal for oil drain plug

- Always replace

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17-10



12 - Hex bolt M6

- Tightening torque: 10 Nm

13 - Oil pan - lower section

14 - Hex bolt M6

- Tightening torque: 10 Nm

15 - Retainer for oil lines

16 - Oil supply line

- From pump to oil filter

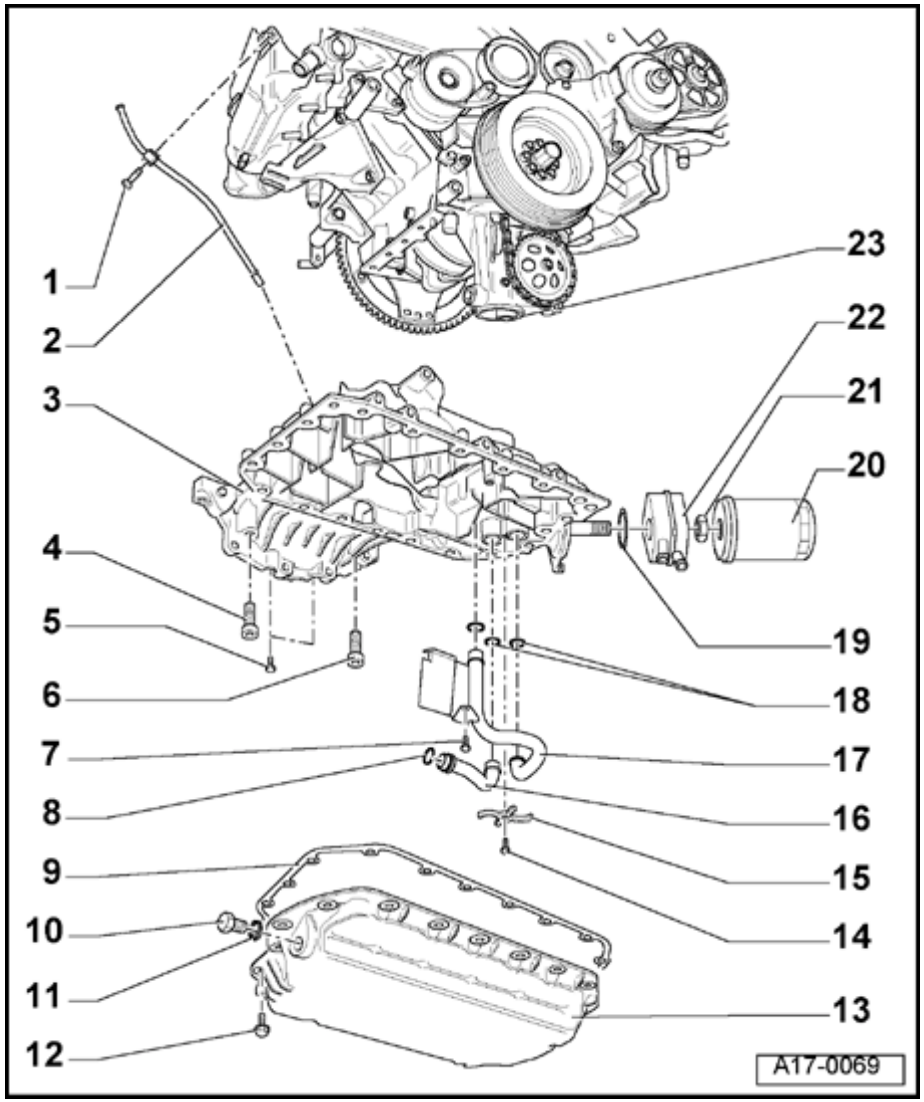
17 - Oil supply line

- From oil filter to engine oil system

18 - O-ring

- Always replace

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19 - O-ring

- Always replace

20 - Oil filter

21 - Hex nut

- Tightening torque: 30 Nm
- Threaded line for oil cooler and oil filter is screwed into upper section of pan with 20 Nm tightening torque.

22 - Oil cooler

- Ensure O-ring is installed correctly when installing

23 - Oil pump

- Driven off crankshaft via chain
- Tightening torque of chain sprocket to oil pump: 25 Nm
- Tightening torque of oil pump to engine block: 25 Nm

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17-12

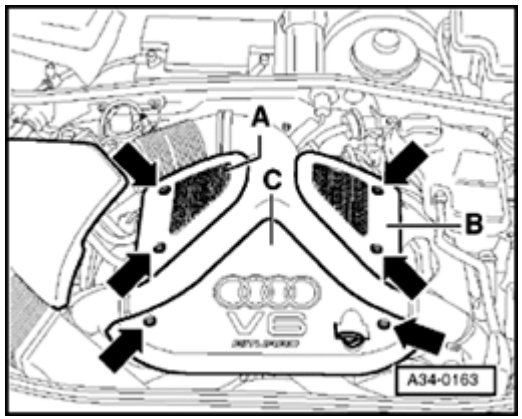
Oil check valves, replacing

Note:

If irregular valve noise occurs repeatedly during short journeys and disappears after extended driving, the oil check valves must be replaced.

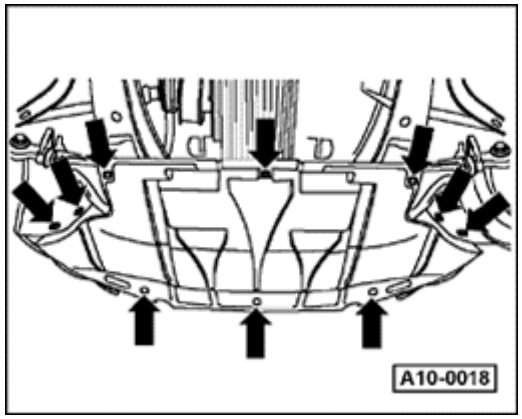
- *All cable ties which are released or cut open when removing the engine must be replaced in the same position when installing the engine.*
- *Catch drained-off coolant in a clean container for re-use or disposal.*
- *Replace all gaskets and seals.*

Removing



- Remove bolts -arrows- and remove engine cover panels -A...C-.
- Remove cover above air cleaner.

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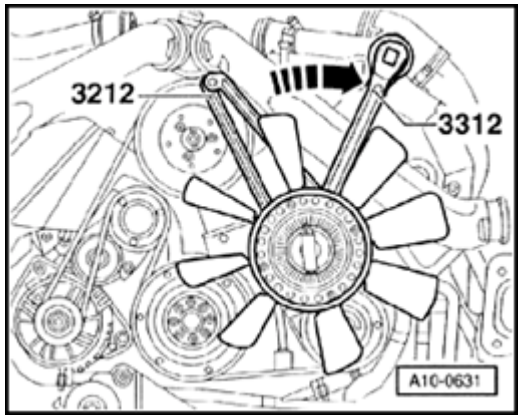


- Remove noise insulation -arrows-.
- Drain coolant ⇒ Page 19-19
- Remove bumper

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position

⇒ *Repair Manual, Body Exterior, Repair Group 50*



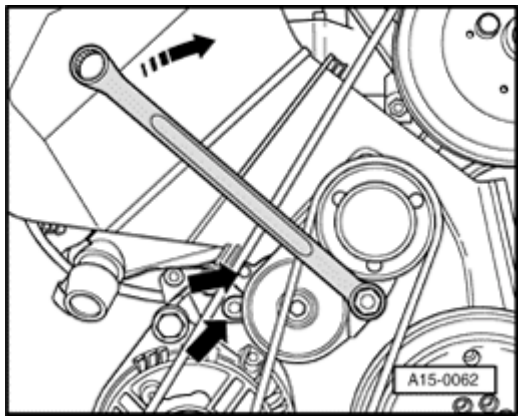
- Remove viscous fan (counter-hold with pin wrench 3212).

Note:

Viscous fan has left-hand thread.

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- Mark direction of rotation of ribbed belt.

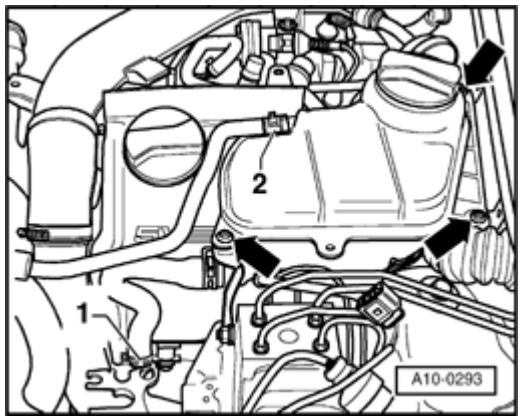


- To slacken ribbed belt, turn to the right using a 17 mm ring spanner until the two holes are aligned with each other -arrow- and hold in position with mandrel 3204.

Note:

Mark direction of rotation of ribbed belt. The belt can break if it runs in the opposite direction when reinstalled.

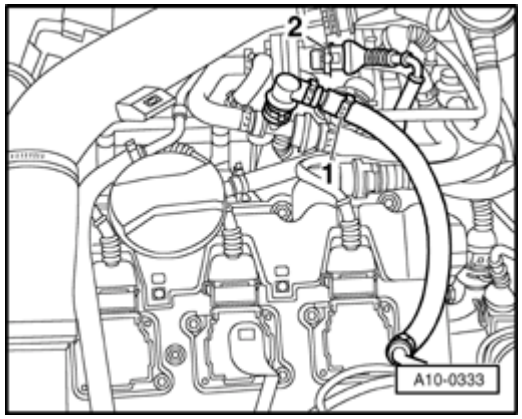
- Take off ribbed belt.



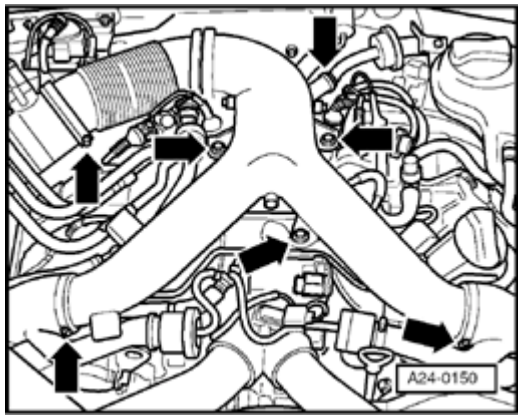
- Disconnect water hoses -1- and -2-.
- Remove coolant reservoir (arrows).
- Disconnect connector for coolant level monitor.
- Remove cover panel from cylinder head cover (cylinder bank 4-6).

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17-15



- Pull off hose -1- going to vacuum reservoir.



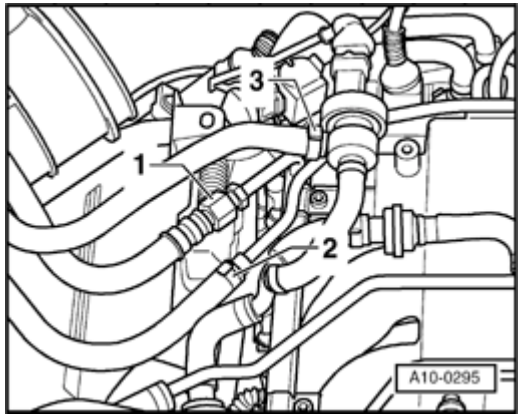
- Remove air duct -arrows-.

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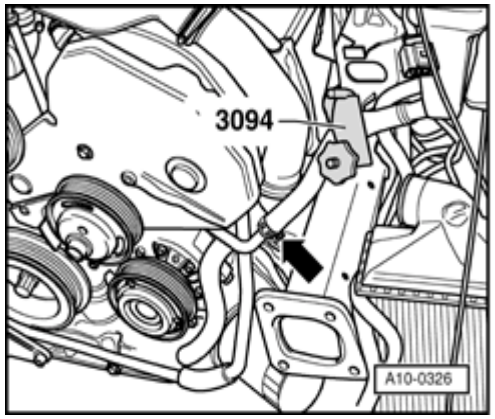
17-16

WARNING!

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



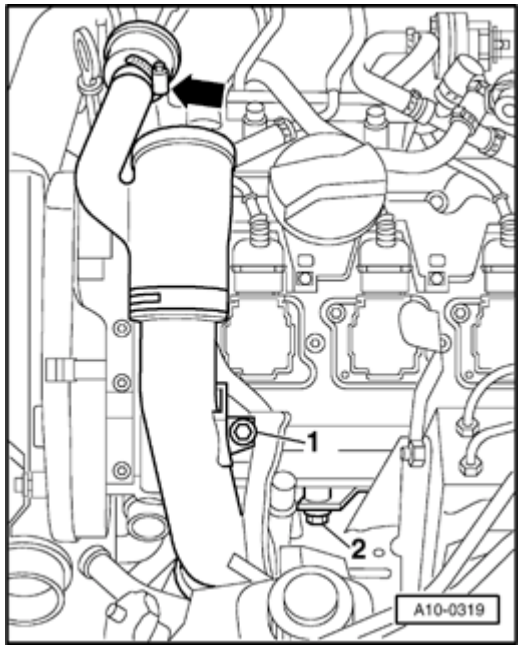
- Disconnect fuel supply line and fuel return line -1- and -2-, and move fuel lines clear.
- Pull hose off EVAP valve -3-.



- install clamp (special tool 3094) on hose from power steering reservoir to power steering pump.
- Disconnect power steering hose -arrow-.

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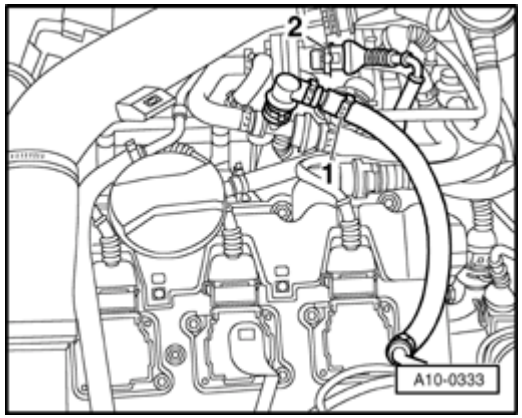
17-17



- Release hose clamp -arrow-.
- Remove intake line -1-.

Notes:

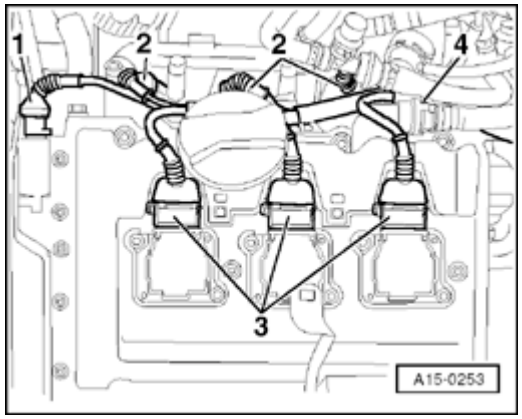
- *All hose connections are secured with clips.*
- *Charge air system must be free of leaks.*
- *Replace all seals and gaskets.*



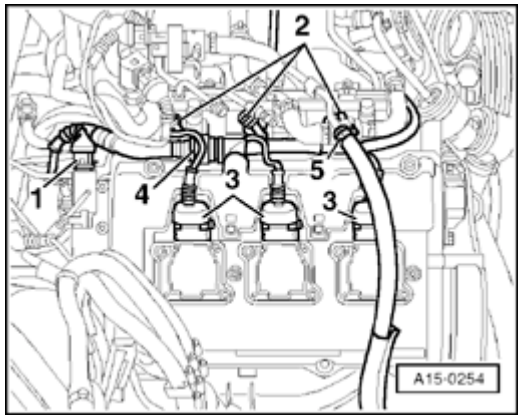
- Disconnect connector from air recirculation valve -2-.

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17-18



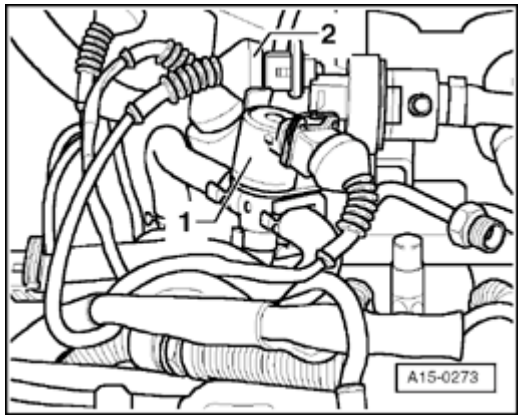
- Disconnect connector for camshaft timing control -1- (cylinder bank 4..6).
- Disconnect connectors from injectors -2- (cylinder bank 4..6).
- Pull crankcase breather -4- off cylinder head cover (cylinder bank 4..6).



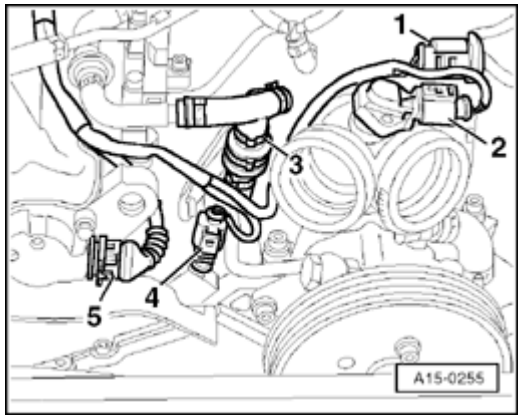
- Disconnect connectors from injectors -2- (cylinder bank 1..3).
- Pull off hose -5- going to turbocharger intake side.

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17-19



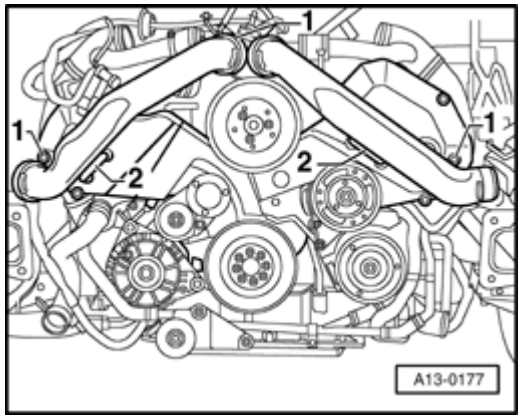
- Unclip solenoid valve for charge pressure control -1-.
- Pull connector off EVAP valve -2-.



- Pull connector off throttle unit -1-.
- Pull connector off charge air sensor -2-.
- Pull off crankcase breather -3-.
- Pull connector off intake air temperature sender -4-.

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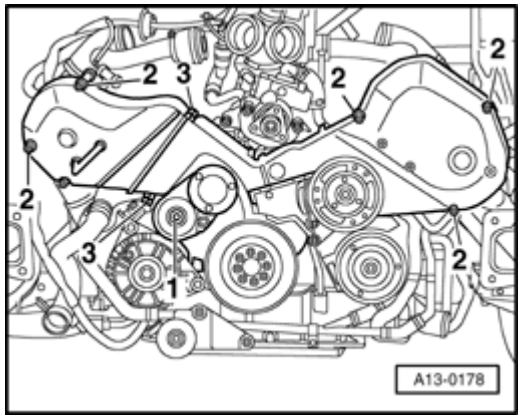
17-20



- Remove pressure lines -1-.

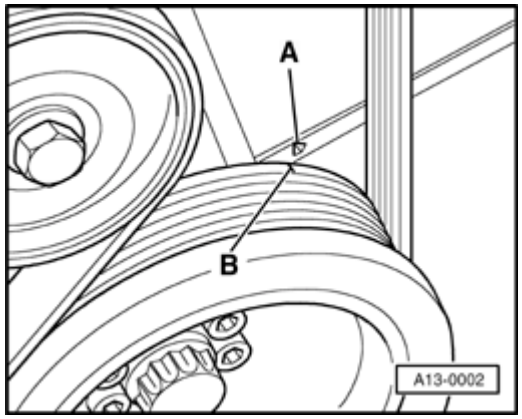
Note:

Watch position of retaining strips -2-.



- Remove tensioner -1- for ribbed belt.
- Remove toothed belt guards -2- (left and right).
- Remove toothed belt guard -3- (center).

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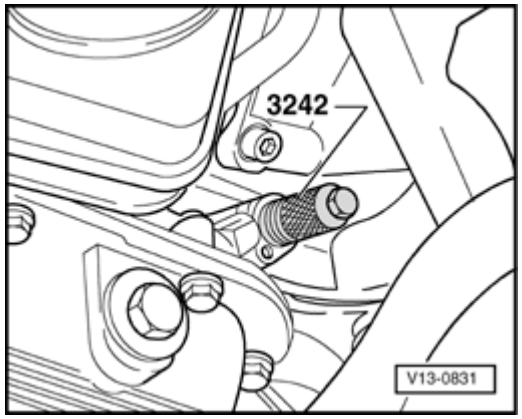
- Turn crankshaft to TDC by hand. Marks -A- and -B- must be aligned.

Note:

Turn over the engine at the central bolt on the crankshaft.

- Check position of camshafts: larger holes in securing plates on camshaft sprockets must align opposite one another on inside. If this is not the case, turn crankshaft one revolution further.
- Remove sealing plug from cylinder block, left.

  The TDC drilling in the crankshaft must be visible (or able to be felt) in line with the sealing plug hole.



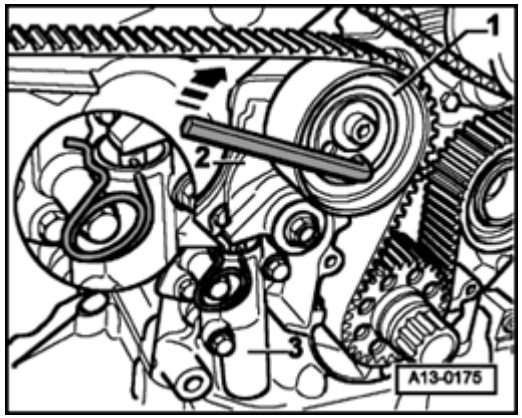
- Screw clamping bolt 3242 for crankshaft into sealing plug hole and tighten.

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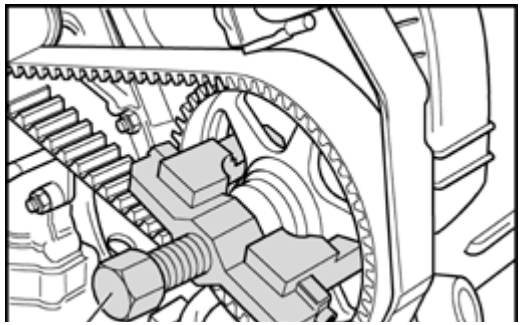
17-22

Notes:

- *Mark the direction of rotation of the toothed belt with chalk or felt pen before removing. A used belt can break if it rotates in the wrong direction when reinstalled.*
- *The toothed belt tensioning element is oil-damped and can therefore only be compressed slowly by applying constant pressure.*



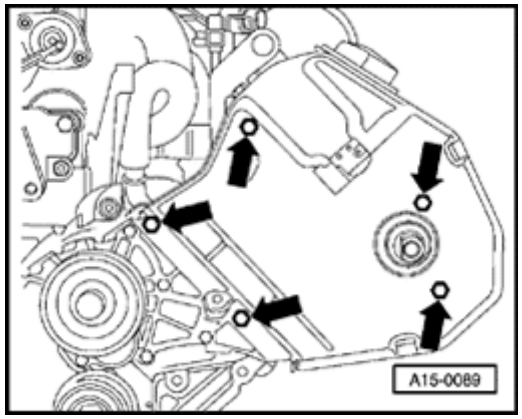
- Using a hex key, turn toothed belt tensioning roller -1- clockwise 8 mm in direction of arrow until tensioning lever -2- compresses tensioning element -3- sufficiently to enable special tool T 400 11 to be installed in drilling and in plunger.
- Insert special tool T 400 11 and release toothed belt tensioning roller.
- Insert camshaft clamp 3391 in the securing plates of the two camshafts.
- Loosen both camshaft bolts and remove approx. 5 turns.
- Take out camshaft clamp 3391.



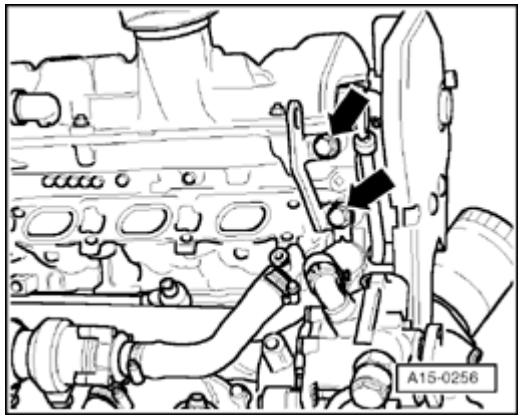
- Pull off both camshaft sprockets with special tool T40001.

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17-23



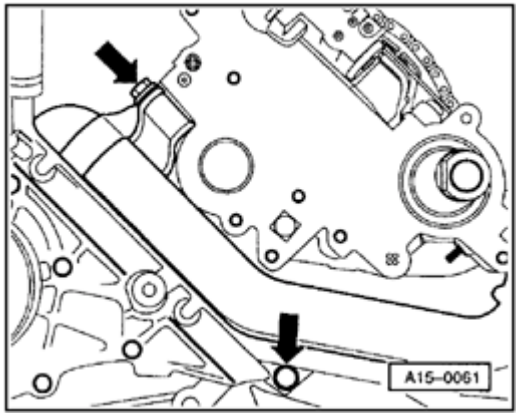
- Unbolt rear left toothed belt guard -arrows-.
- Detach intake manifold using special tool 3249.



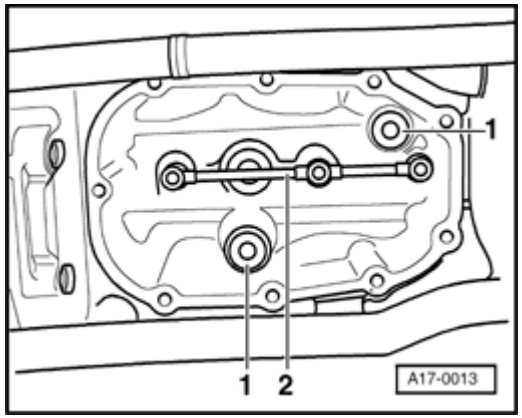
- Unbolt cylinder head lifting bracket with coolant line -arrows- from cylinder head.

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17-24



- Unbolt coolant line at front of cylinder head -arrows- and remove.
- Remove water line and auxiliary water pump.
- Remove cover on oil check valves.



- Replace oil check valves -1- (25 Nm).

Note:

The oil distribution line -2- for the spray jets for piston cooling is also located in the opening.

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17-25

Installing

Install in the opposite order to removing. When installing, note the following points:

- Install lock carrier

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Install bumper

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Fill with coolant ⇒ Page 19-19 .

Component		Nm
Bolts	M6	10
Bolts	M8	20
Toothed belt sprocket to camshaft		55
Intake manifold to cylinder head		10
Oil check valves		25

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Cover for oil check valves	10

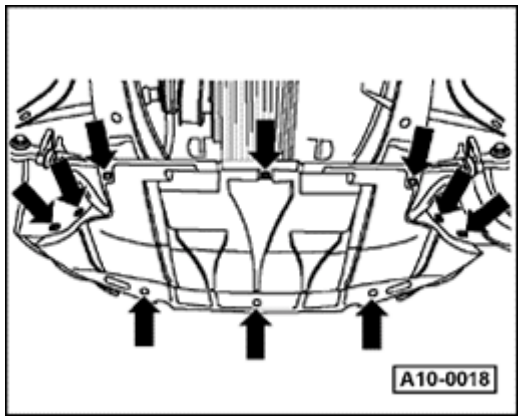
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17-26

Lower section of oil pan, removing and installing

Special tools, testers and auxiliary items

- Drip tray VAG 1306



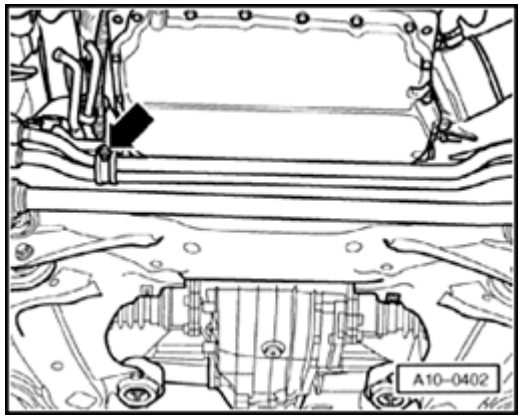
- Remove noise insulation panel -arrows-.
- Remove bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Remove ribbed belt ⇒ Page 13-1 .



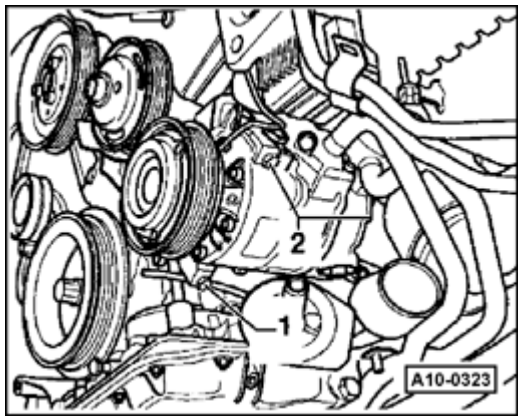
- Unbolt air conditioner lines from pan -arrow-.

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17-27

WARNING!

Do not open air conditioner refrigerant circuit.



- Detach air conditioner compressor -1...2-.

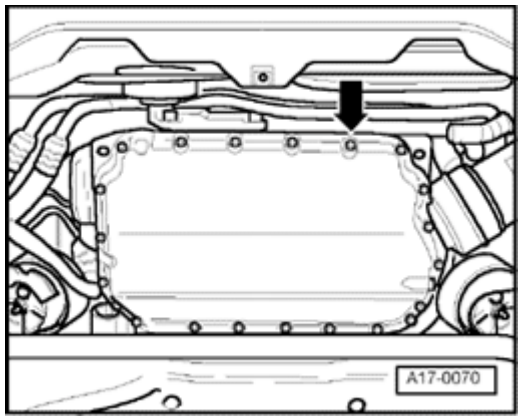
Notes:

- *Watch position of guide bushes when installing.*
- *When installing, insert bolt -1- in the compressor first.*
- *To prevent damage to the condenser and refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.*

- Drain engine oil.

Note:

Use a separate container to collect the engine oil.



- Remove lower section of oil pan.

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Installing

Install in the opposite order to removing. When installing, note the following points:

Note:

Do not use any adhesive or sealant.

- Clean sealing surfaces; ensure that they are free of oil and grease.

- Install new gasket on lower section of oil pan and install on upper section of oil pan with two diagonally opposite bolts.

- Tighten all securing bolts hand-tight.

- Tighten bolts to 10 Nm with torque wrench, working from center outward.

- install new seal on oil drain plug and tighten to 30 Nm.

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17-29

- Fill engine with oil.

⇒ *Repair Manual, Maintenance*

- Install lock carrier in normal position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Install bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

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17-30

Chain tensioner for oil pump, checking

The chain tensioner incorporates a leaf spring. To check the spring tension, the lower section of the oil pan must be removed.

- Remove bumper

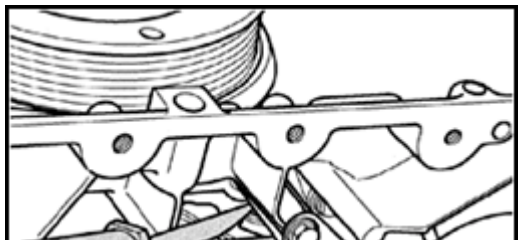
⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Remove ribbed belt ⇒ Page 13-1 .

- Remove lower section of oil pan ⇒ Page 17-26



- Insert a screwdriver between chain and chain tensioner and press screwdriver against chain tensioner.

If no spring tension can be felt and the chain is not being tensioned, this means the chain tensioner is malfunctioning and must be replaced.

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To replace oil pump chain tensioner, remove front sealing flange ⇒ Page 17-55 .

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17-31

Installing

Install in the opposite order to removing. When installing, note the following points:

- Fill up engine oil.

⇒ *Repair Manual, Maintenance*

- Install lock carrier in normal position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Install bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

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17-32

Upper and lower sections of oil pan, removing and installing

Special tools, testers and equipment required

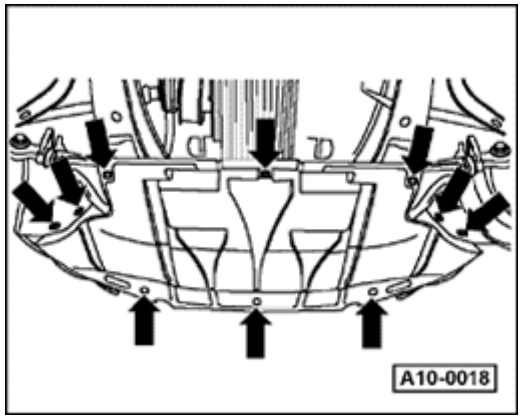
- Engine support bracket 10-222A with adapter 10-222A/3
- Drip tray VAG 1306
- Electric drill with plastic brush attachment
- Silicone sealant D 176 404 A2
- Torque wrench 10 Nm/ 45 Nm

- Obtain radio theft code on vehicles with coded radio.
- With ignition switched off, disconnect battery Ground strap.
- Pull out dipstick.

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17-33

- Unbolt dipstick guide tube at front of cylinder head (right side), and pull out of oil pan from the top.



- Remove noise insulation panel -arrows-.
- Remove bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

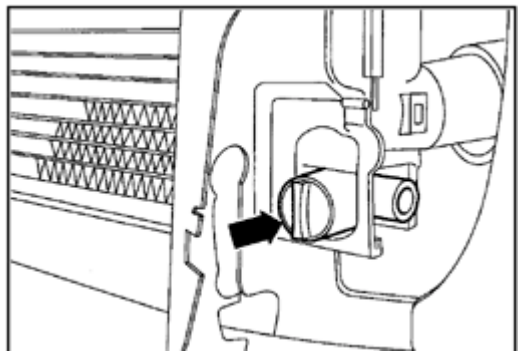
- Move lock carrier to service position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

WARNING!

Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and remove it carefully.

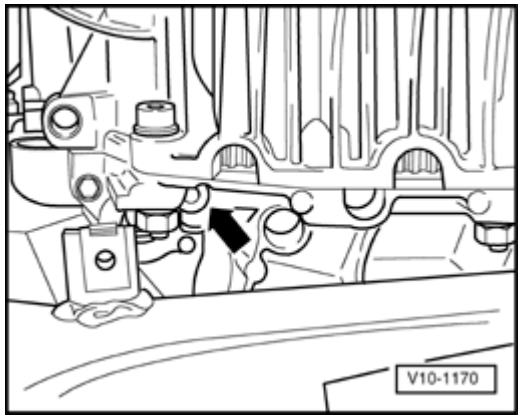
- Remove cap on coolant expansion tank.
- Place drip tray VAG 1306 below engine.



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

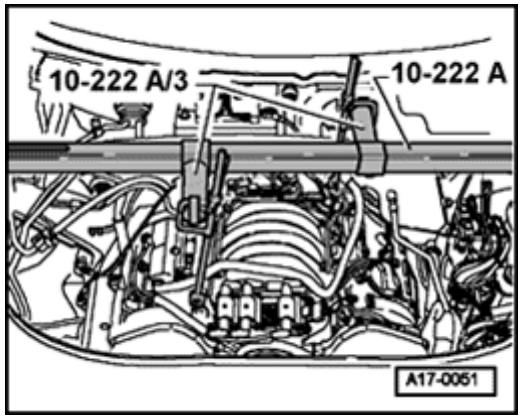
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17-34



- Also open coolant drain screw -arrow- at rear right of oil pan.
- Draining off and filling up coolant ⇒ Page 19-19 .
- Drain off engine oil.

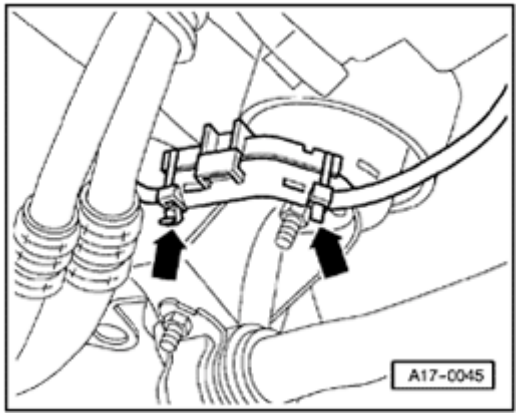
  Use a separate container to collect the engine oil.



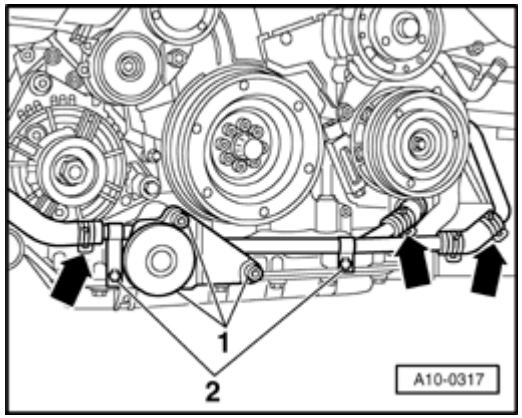
- Set up support bracket 10-222A with adapter 10-222A/3 on bolted flanges for wing panels.
- Attach support bracket to front and rear lifting eyes on engine.
- Raise engine as far as possible with spindles of support bracket.

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17-35



- Cut open cable ties -arrows-, open retainer for starter cable and take out cable.
- Unbolt torque reaction support at front of oil pan.
- Unbolt coolant line from oil pan.
- Disconnect connector from oil pressure switch on left of oil pan.



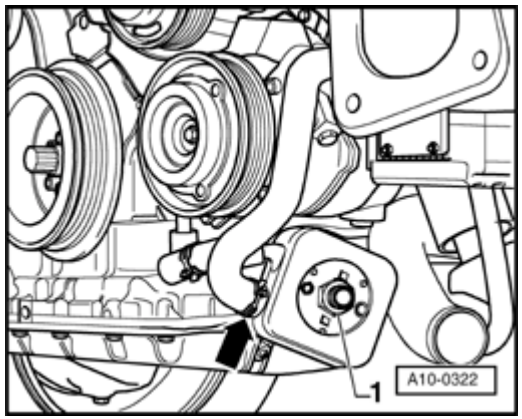
- Remove torque reaction support -1-.
- Release hose clamps -arrows-.
- Remove water line -2-.

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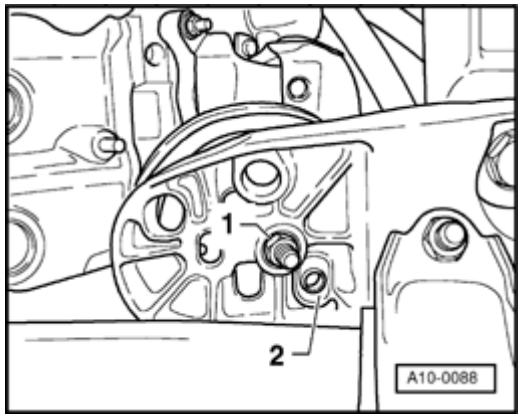
17-36

- Place drip tray VAG 1306 under engine.

- Remove oil filter.



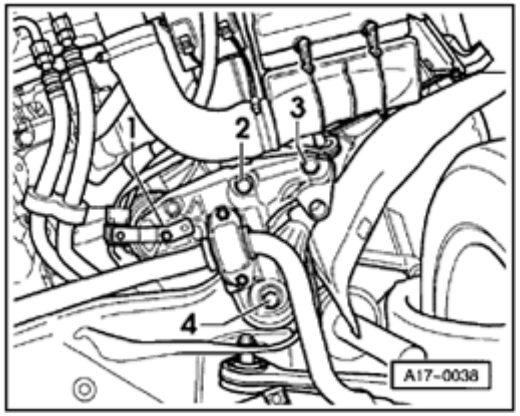
- Release hose clamps -arrows-.
- Remove oil cooler -1-.



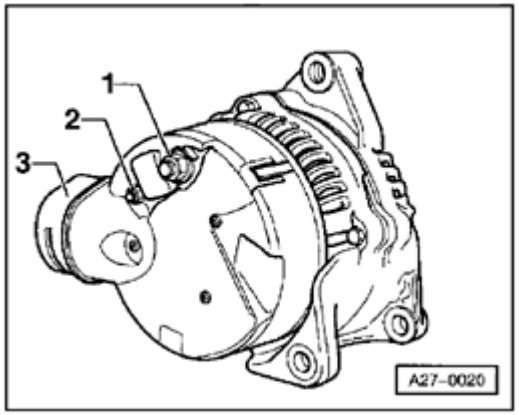
- Remove bottom nuts on engine mountings -1- (left and right sides).
- Mark positions of securing points -1- and locating sleeves -2- under engine mountings on left and right sides.

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17-37



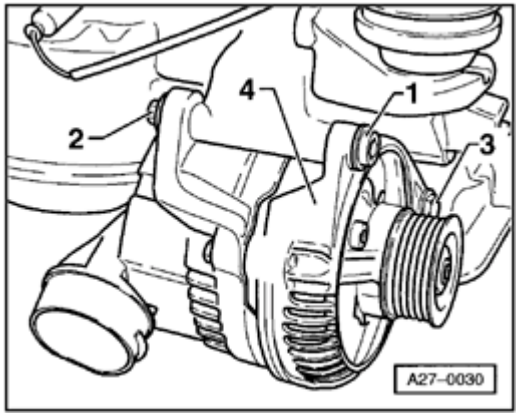
- First remove front subframe bolts -2- and -3- (left and right). Then remove bolts -4-.
- Move anti-roll bar downward.
- Remove charge air cooler -2- on right side (release hose connection at top, and 3 rubber mountings).



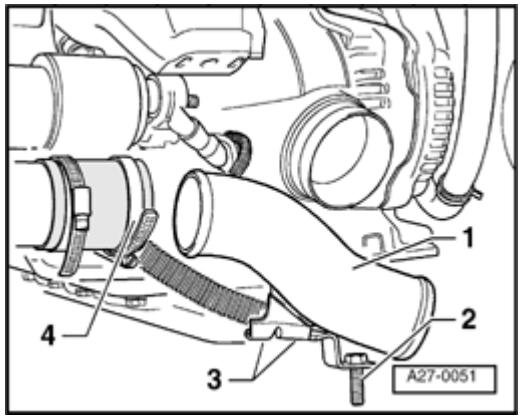
- Remove air duct from connector elbow on alternator -3-.
- Disconnect cable from terminal 30/B+ -1-. Tightening torque: 16 Nm
- Disconnect cable from terminal D+ -2-. Tightening torque: 4 Nm

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17-38



- Remove hex socket head bolt -1- and securing nut -2-. Tightening torque: 45 Nm
- Loosen bolt -3-. Tightening torque: 22 Nm.
- Take out alternator -4- from below.



1 - Remove air line -1-.

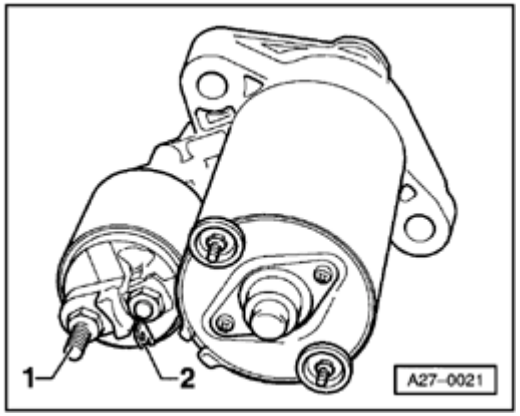
2 - Mounting for oil line and air conditioner lines

3 - Mounting on cylinder block

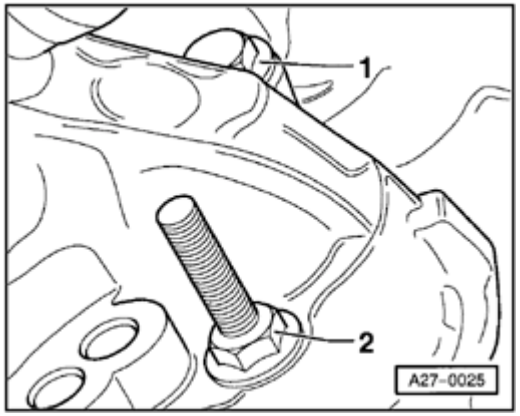
4 - Release hose clamp

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17-39



- Disconnect cable from terminal 30/B+ -1-. Tightening torque: 16 Nm
- Disconnect connector for terminal 50 -2-.
- Remove right wheel



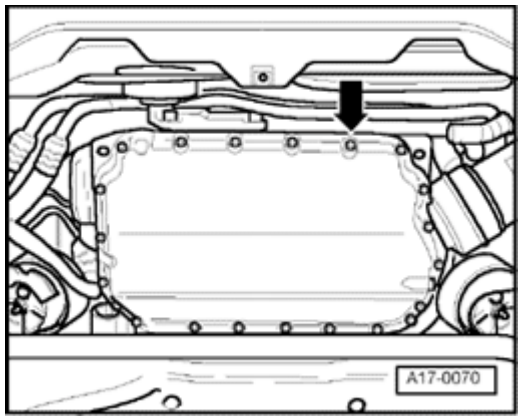
- remove top bolt -1- from right wheel housing. Tightening torque: 65 Nm
- Remove lower bolt (accessible from engine side). Tightening torque: 65 Nm
- Remove starter from front of vehicle.

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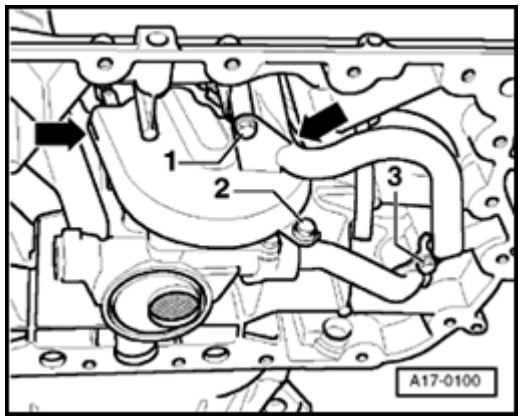
17-40

Note:

To avoid having to check and adjust wheel alignment, only loosen the front subframe mountings and lower the subframe at the front.



- Remove lower section of oil pan.
- Disconnect return lines for turbocharger from upper section of oil pan.



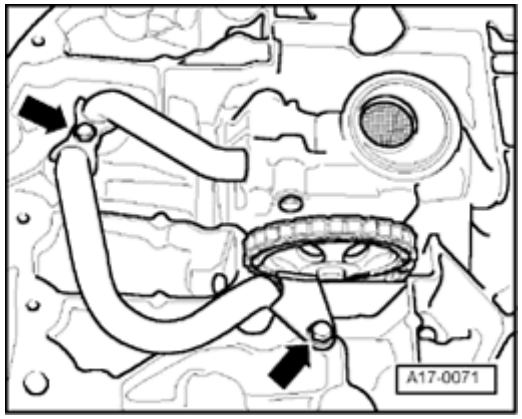
- Unbolt cover plate -2- for oil pump sprocket.

Notes:

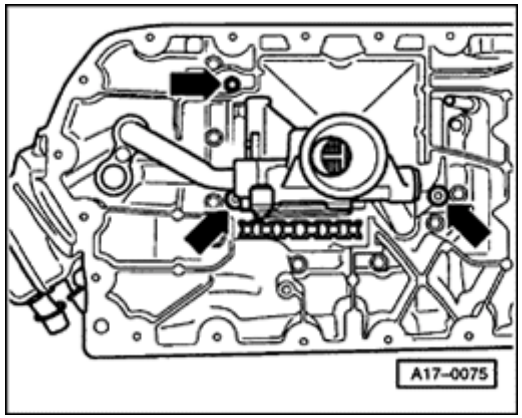
- *When loosening bolt -2- securing cover plate, counter-hold at welded nut.*
- *When installing, make sure that the plate engages in position -arrows-.*

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17-41



- Unbolt two oil supply lines, and pull longer of two lines downward to disconnect from upper section of oil pan.



- Unbolt oil pump from engine so that shorter oil supply line can be disconnected (do not remove oil pump).
- Remove bolts securing upper section of oil pan to transmission.
- Unbolt upper section of oil pan from engine.

Note:

Two M6 bolts and two M8 bolts are located vertically at rear of oil pan upper section (in front of joint between engine and transmission).

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17-42

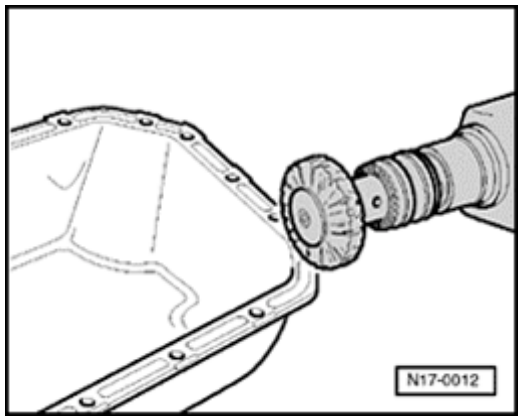
Installing:

Install in the opposite order to removing. When installing, note the following points:

- Clean sealing surfaces; ensure that they are free of oil and grease.

WARNING!

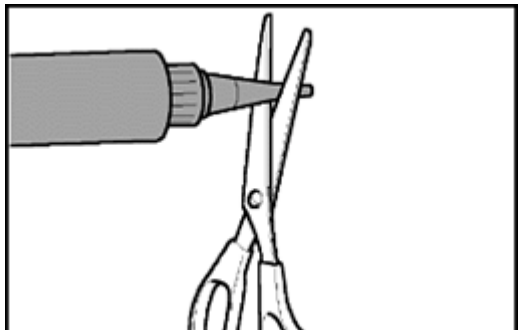
Wear protective goggles.



- Remove any residues of sealant on oil pan and engine block using plastic brush attachment, or similar.

Note:

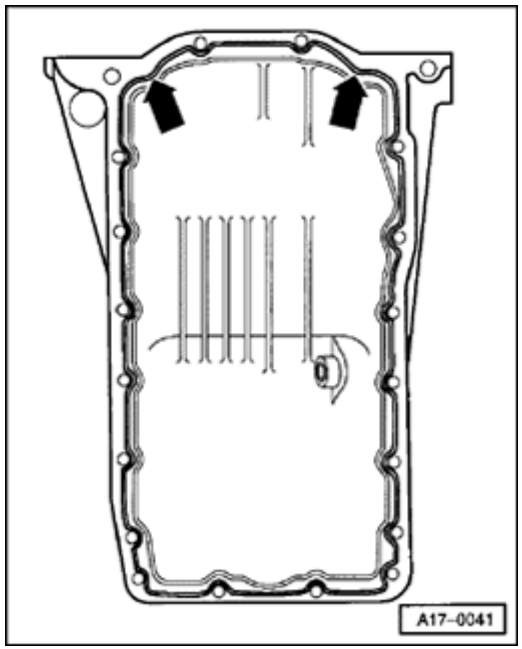
The oil pan must be installed within 5 minutes after applying silicone sealant D 454 300 A2.



- Cut off nozzle of tube at front marking (diameter of nozzle approx. 3 mm).
  - Thickness of sealant bead: 2 ... 3 mm

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17-43



Note:

The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant may enter the oil pan and block the strainer in the oil intake line.

- Make sure sealing surface is clean and then apply silicone sealant on sealing surface of oil pan, as shown in illustration. (Illustration shows position of sealant on cylinder block.)

Note:

Be particularly careful when applying the sealant around the rear sealing flange -arrows in illustration-.

- Locate oil pan in position immediately, and tighten all bolts securing oil pan to cylinder block to 5 Nm initially.
- Tighten bolts securing oil pan to transmission to 45 Nm.
- Tighten bolts securing oil pan to cylinder block in diagonal sequence in 2 stages; tighten to 10 Nm when tightening second time.
- Tighten M10 bolts securing oil pan to cylinder block to 45 Nm.

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- Clean both sealing surfaces for lower section of oil pan; ensure that they are free of oil and grease.

Note:

Do not use any adhesive or sealant.

- Install new gasket on lower section of oil pan and install on upper section of oil pan with two diagonally opposite bolts.

- Tighten all securing bolts hand-tight.

- Tighten bolts to 10 Nm with torque wrench, working from center outward.

- Install new seal on oil drain plug and tighten to 30 Nm.

Notes:

- *When installing the upper section of the oil pan with the engine removed from the vehicle, ensure that the oil pan is positioned flush with the cylinder block at the flywheel end.*

- *The sealant must be left to dry for about 30 minutes after installing the oil pan before engine*

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oil can be put in.

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17-45

- Fill with coolant ⇒ Page 19-19 .

- Fill engine with oil.

⇒ *Repair Manual, Maintenance*

- Install subframe.

⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

- Install lock carrier in normal position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Install bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

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- Install noise insulation.

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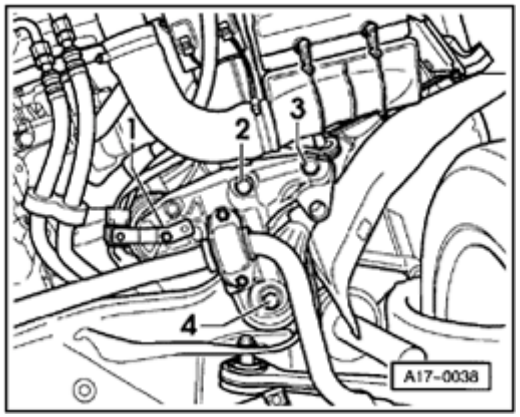
Tightening torques

Component		Nm
Upper section of oil pan to cylinder block	M6	10
	M8	20
Lower section of oil pan to upper section of oil pan		10
oil pan to transmission	M8	25
	M10	45
Coolant line to oil pan		10
Oil drain plug in lower section of oil pan		30
Dipstick guide tube to cylinder head		25
Oil pump to cylinder block		25
Oil pump supply lines to upper section of oil pan		10
Front sealing flange	M6	10
Collar bolt	M8	30
Bracket for coolant lines to oil pan		10
Coolant drain screw on engine		20

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17-47

Component	Nm
Stop for torque reaction support to bracket on engine	25
Engine mounting to subframe	25
Torque reaction support to front of oil pan	25
Engine mounting to engine support	25
Chain sprocket to oil pump	25



Other tightening torques

Nut for engine mounting -1-	25
Bolts -2- and -3-	60
Combi bolt -4- **	110 + 90°

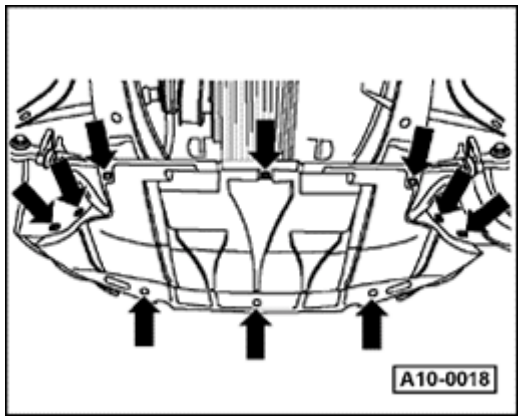
** Combi bolt -4- must be replaced after removing.

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17-48

Oil pump, removing and installing

Removing

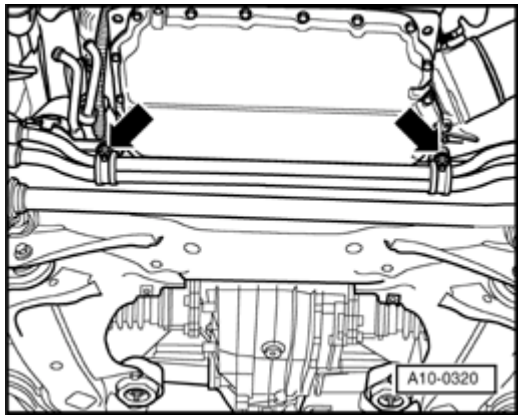


- Remove noise insulation panel -arrows-.
- Remove bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*



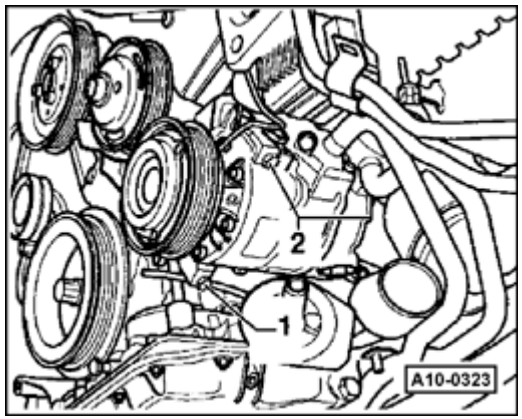
- Unbolt air conditioner lines from oil pan -arrows-.

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17-49

WARNING!

Do not open air conditioner refrigerant circuit.



- Detach air conditioner compressor -1...3-.

Notes:

- *Watch position of guide bushes when installing.*
- *When installing, insert bolt -1- in the compressor first.*
- *To prevent damage to the condenser and refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.*

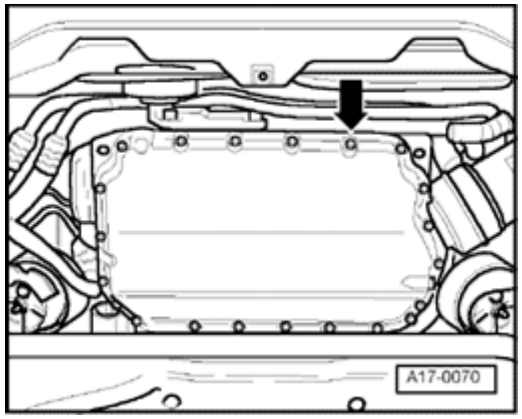
- Drain engine oil.

Note:

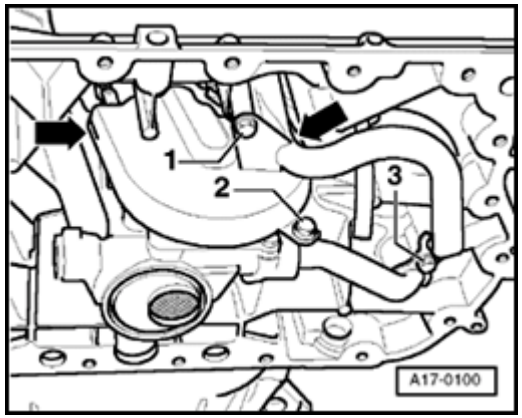
Use a separate container to collect the engine oil.

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17-50



- Remove lower section of oil pan.



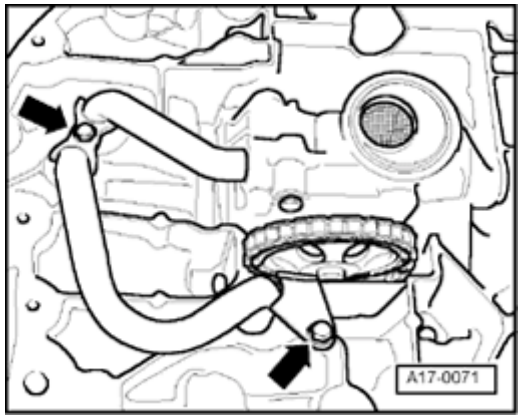
- Unbolt cover plate -2- for oil pump sprocket.

Notes:

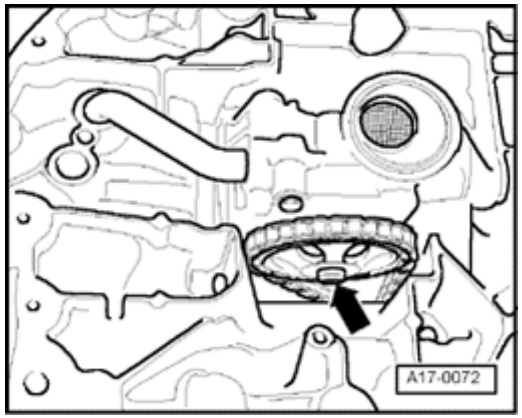
- *When loosening bolt -2- securing cover plate, counter-hold at welded nut.*
- *When installing, make sure that the plate engages in position -arrows-.*

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17-51



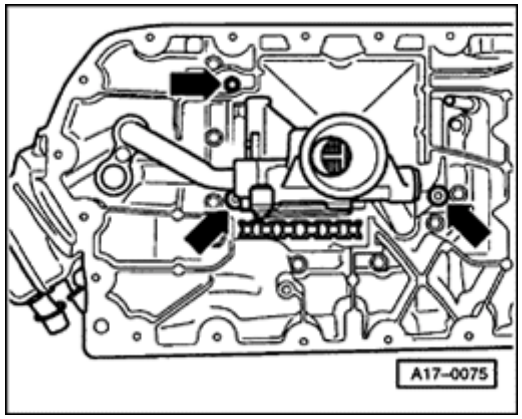
- Unbolt brackets for oil supply lines -arrows- and pull front (longer) oil supply line away downward.



- Remove bolt securing chain sprocket to oil pump using Torx T45, and pull sprocket off oil pump.

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17-52

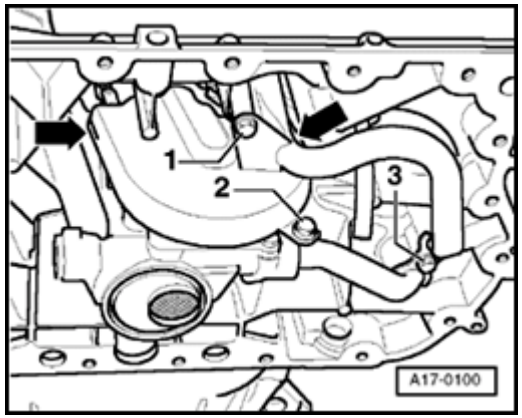


- Remove oil pump together with shorter oil supply line.

Installing

Install in the opposite order to removing. When installing, note the following points:

- Before bolting on oil pump, install short oil supply line into pump and upper section of oil pan with new O-rings.



- Bolt on cover plate -2- for oil pump sprocket.

Notes:

- *When installing, make sure that the plate engages in position -arrows-.*
- *When tightening bolt -2- securing cover plate, counter-hold at welded nut.*

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- Clean both sealing surfaces for lower section of oil pan; ensure that they are free of oil and grease.

Note:

Do not use any adhesive or sealant.

- Install new gasket on lower section of oil pan and install on upper section of oil pan with two diagonally opposite bolts.

- Tighten all securing bolts hand-tight.

- Tighten bolts to 10 Nm with torque wrench, working from the center outwards.

- Install new seal on oil drain plug and tighten to 30 Nm.

- Fill up engine oil.

⇒ *Repair Manual, Maintenance*

- Install subframe.

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⇒ *Repair Manual, Suspension, Wheels, Steering, Repair Group 40*

- Install lock carrier in normal position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Install bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

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Tightening torques

Component	Nm
Chain sprocket to oil pump	25
Lower section of oil pan to upper section of oil pan	10
Oil drain plug in lower section of oil pan	30
Oil pump to cylinder block	25
A/C compressor to bracket	25
Oil pump supply lines to upper section of oil pan	10
Bracket for A/C lines to oil pan	10

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17-55

Front sealing flange and oil pump drive chain, removing and installing

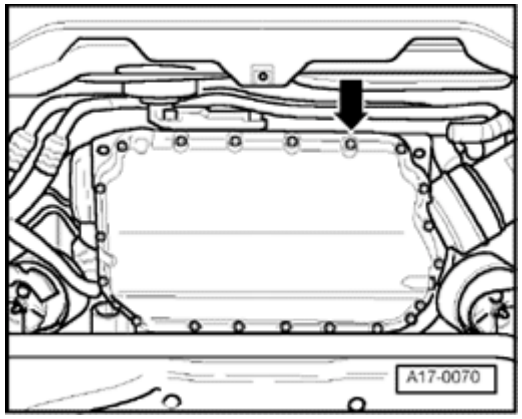
Removing

- Remove ribbed belt ⇒ Page 13-1 .
- Remove toothed belt ⇒ Page 13-4 .
- Drain engine oil.

  Use a separate container to collect the engine oil.

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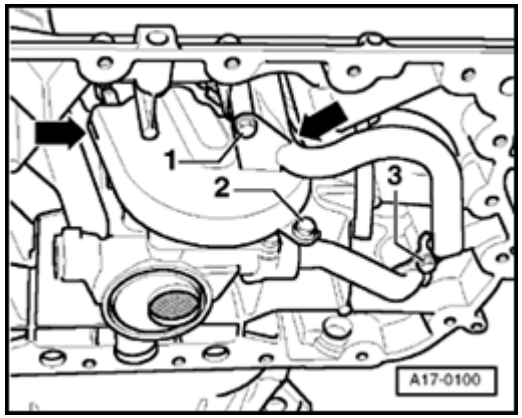
17-56



- Remove lower section of oil pan.
- Unbolt cover plate for oil pump sprocket (-2-).

Notes:

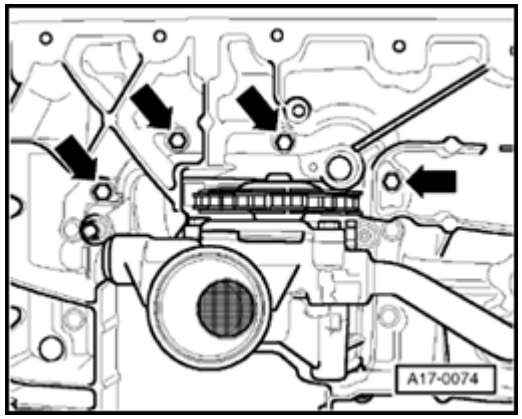
- *When loosening bolt -2- securing cover plate, counter-hold at welded nut.*
- *When installing, make sure that the plate engages in position -arrows-.*



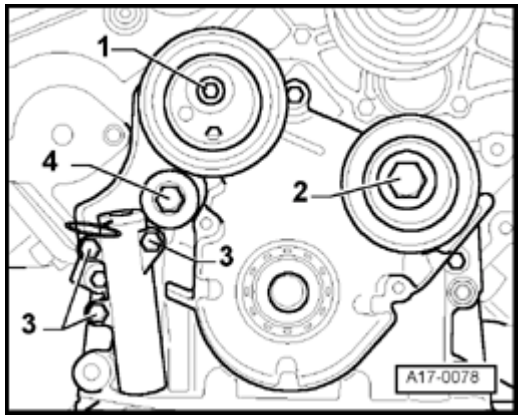
- Unbolt both oil supply lines -1- and -3- from upper section of oil pan and pull longer of two lines away downward.

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17-57



- Remove 4 bolts from upper section of oil pan.



- Remove following components before unbolting front sealing flange:

1 - Tensioning roller for toothed belt: 20 Nm

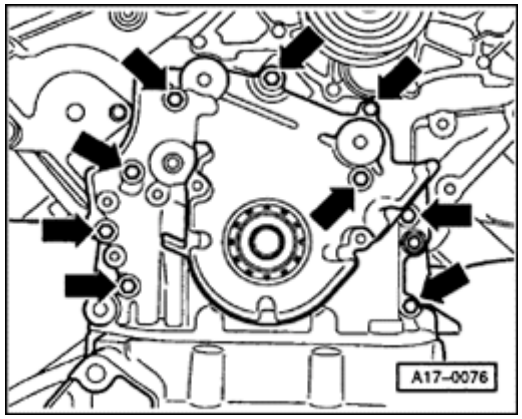
2 - Idler wheel: 45 Nm

3 - Toothed belt tensioner: 10 Nm

4 - Lever for toothed belt tensioner: 20 Nm

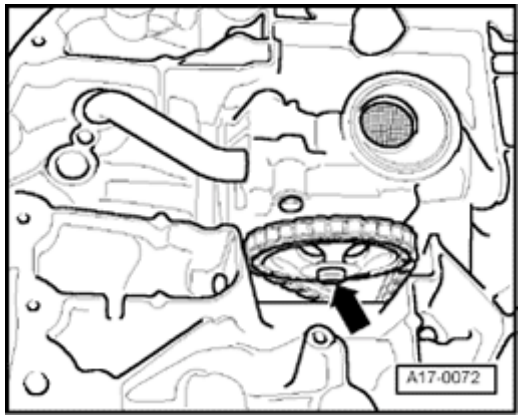
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17-58



- Unbolt front sealing flange and take off gasket for front sealing flange
  M6 bolts: 10 Nm M8 collar bolt: 30 Nm

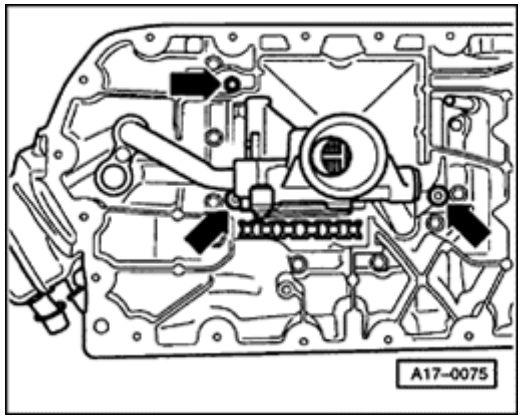
Replacing oil pump drive chain



- Remove bolt securing chain sprocket to oil pump using Torx T45, and pull sprocket off oil pump.

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17-59



- Remove oil pump together with shorter oil supply line.
- Take out oil pump sprocket and remove drive chain from crankshaft.

Removing and installing chain sprocket on crankshaft ⇒ Page 17-62 .

Installing

Install in the opposite order to removing. When installing, note the following points:

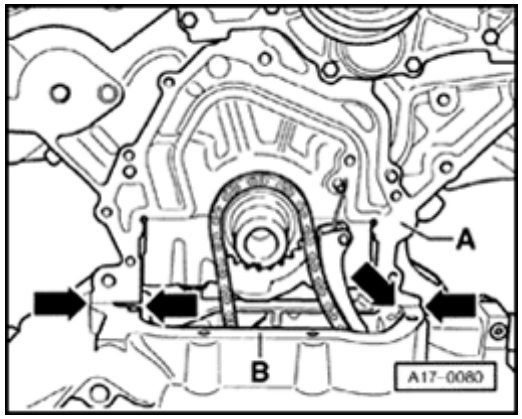
- Remove any residues of sealant on front of oil pan or engine block, if necessary.
- Clean sealing surfaces; ensure that they are free of oil and grease.

Note:

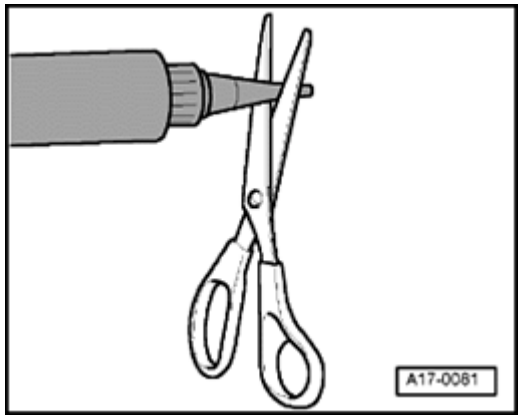
The front sealing flange must be installed within 5 minutes of applying silicone sealant D 454 300 A2.

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17-60



- Do not apply any sealant on sealing surface -A- of the cylinder block.
- After installing gasket on sealing surface -A-, apply a small quantity of sealant to joints between two arrows -left and right-.



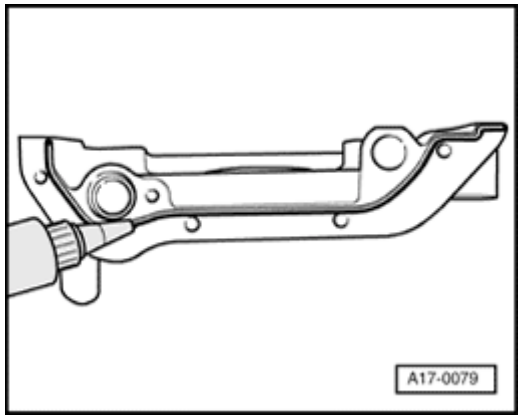
- Cut off nozzle of tube at front marking (diameter of nozzle approx. 3 mm).
  - Thickness of sealant bead: 2 ... 3 mm

Note:

The bead of sealant must not be thicker than 3 mm, as otherwise excess sealant may enter the oil pan and block the strainer in the oil intake line.

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17-61



- Make sure sealing surface is clean and then apply silicone sealant on sealing surfaceof front sealing flange, as shown in illustration. (Illustration shows where bead of sealant is applied.)
- Use installing sleeve 3202/1 to install sealing flange. Locate sealing flange in position immediately and tighten all 4 bolts in oil pan hand-tight initially.
- Tighten bolts securing sealing flange Tightening torque: Front sealing flange: M6 10 Nm, M8 20 Nm 4 bolts in oil pan: 10 Nm

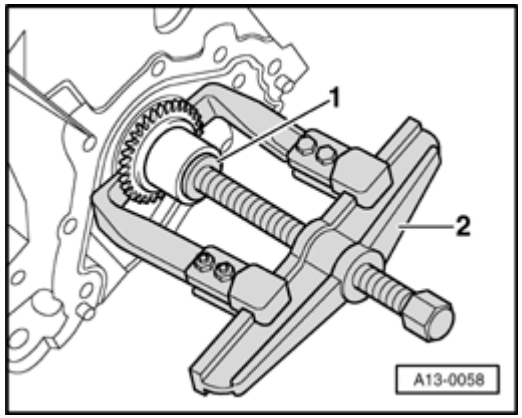
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17-62

Chain sprocket for oil pump on crankshaft, removing and installing

Removing

Removing and installing front sealing flange and oil pump drive chain ⇒ Page 17-55 .



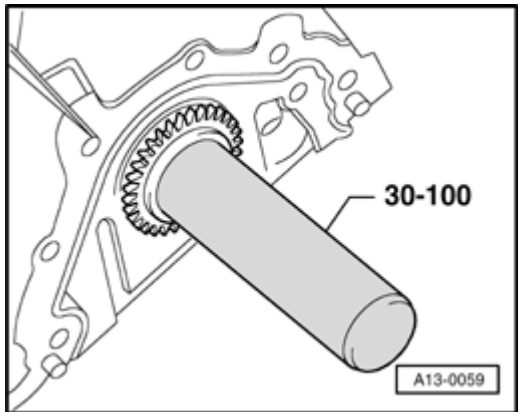
- Pull chain sprocket off crankshaft using a normal commercial-type puller -2-: use a suitable washer -1- to protect end of crankshaft.

Installing

- Heat chain sprocket in oven for about 15 minutes at 220 ° C.

Notes:

- *Wear protective gloves.*
- *Installation position: it should be possible to read the lettering on the chain sprocket.*



- Using pliers, install chain sprocket on end of crankshaft and push against stop on crankshaft with drift sleeve 30-100. If necessary knock on carefully using a plastic hammer.

Removing and installing front sealing flange and oil pump drive chain ⇒ Page 17-55 .

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17-63

Crankshaft oil seal - pulley end, replacing

Removing

- Remove bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

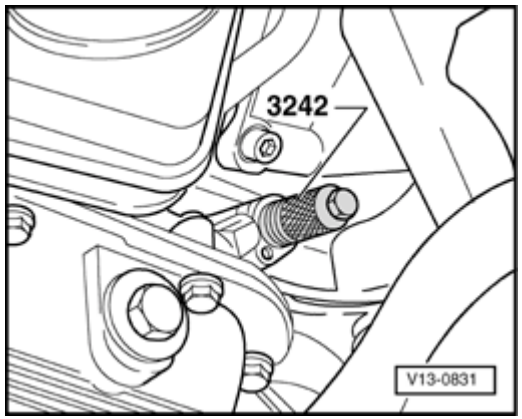
- Move lock carrier to service position

⇒ *Repair Manual, Body Exterior, Repair Group 50*

- Remove ribbed belt ⇒ Page 13-1 .
- Remove toothed belt ⇒ Page 13-4 .
- Remove sealing plug from hole in cylinder block (left side).
- Position crankshaft to TDC of No. 3 cylinder. Crankshaft TDC drilling should be visible (or it should be possible to feel the drilling) in sealing

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plug hole.



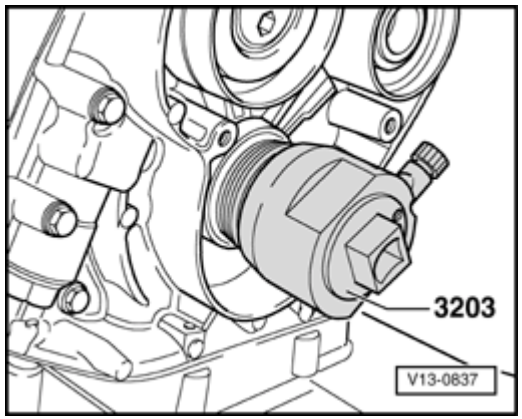
- Screw clamping bolt 3242 into hole so that crankshaft is secured against turning.

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17-64

- Remove crankshaft toothed belt sprocket.

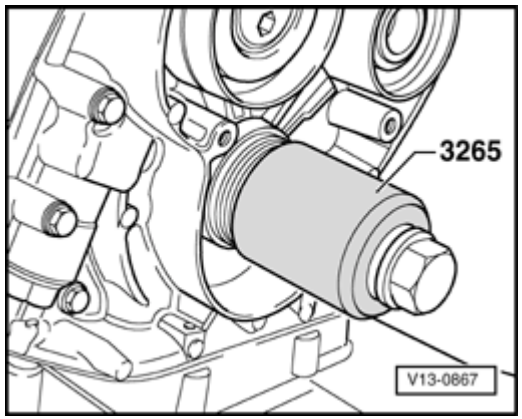
- Remove inner part of oil seal extractor 3203 two turns (approx. 3 mm) out of outer part and lock with knurled screw.



- Lubricate threaded head of oil seal extractor, place it in position and, exerting firm pressure, screw it in as far as possible into oil seal.
- Loosen knurled screw and turn inner part against crankshaft until oil seal is pulled out.

Installing

- Place guide sleeve 3202/1 onto crankshaft journal.
- Slide dry seal over guide sleeve.



- Press oil seal in flush with installing sleeve 3265.

Then proceed as for removing, performing steps in reverse order.

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17-65

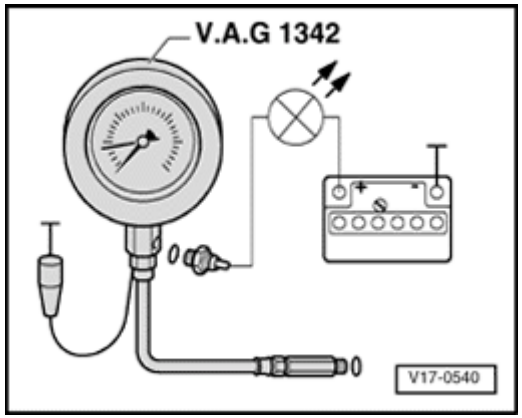
Oil pressure and oil pressure switch, checking

Note:

Servicing and checking function of oil pressure warning lamp and buzzer:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

Test procedure



- Remove oil pressure switch (F1) and screw oil pressure switch into tester.
- Screw tester into oil pan in place of oil pressure switch.
- Connect brown wire of tester to ground (GND) (-).
- Using test leads from VAG 1594, connect diode test lamp VAG 1527 between positive battery terminal (+) and oil pressure switch.
- Start engine and gradually increase engine speed.

  LED should light up at 1.2...1.6 bar, otherwise replace oil pressure switch.
- Increase engine speed further.

  At 2000 RPM and an oil temperature of 80 ° C oil pressure should be at least 2.0 bar.

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17-66

Engine oil, specifications

A high-quality multigrade oil is put in at the factory: this can be used all year round, except in extremely cold climates.

Viscosity grades and oil specifications

Viscosity grades and oil specifications

⇒ *Repair Manual, Maintenance*

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Oil level, checking

Test conditions

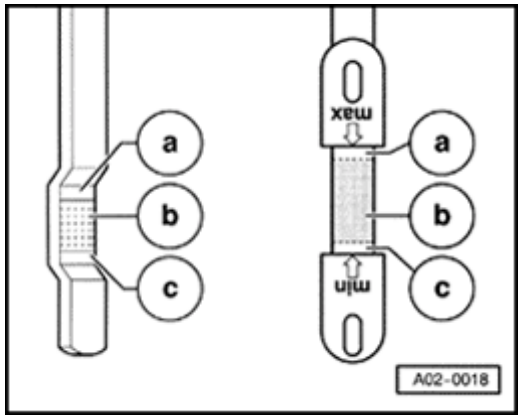
- Oil temperature above 60 ° C.
- Vehicle level.
- The vehicle must be standing on level ground when checking the oil level. Wait for a few minutes after switching off the engine to allow the oil to flow back into the oil pan.

Test sequence

- Pull out dipstick, wipe off with a clean cloth and insert it again as far as it will go.
- Pull out dipstick again and read oil level.

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17-68



Markings on oil dipstick:

a - Do not top up oil.

b - Oil can be topped up. The oil level may rise as far as area -a- after topping up.

c - Oil must be topped up. It is sufficient if the oil level is somewhere in area -b- (grooved area on dipstick) after topping up.

Note:

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

Oil capacities ⇒ *Repair Manual, Maintenance*

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19-1

Cooling system components, removing and installing

WARNING!

Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and unscrew it carefully.

Notes:

- *When the engine is hot the cooling system is under pressure. Carefully open filler cap on expansion tank to release pressure before starting repair work.*
- *Hoses are secured with spring-type clips. When repairing only use spring-type clips.*
- *VAG 1921 pliers are recommended when installing spring-type clips.*
- *The O-rings fitted at the quick-release connections must be replaceed if damaged or leaking.*
- *When installing coolant hoses, ensure that they are free of stress and do not come into contact with other components (observe markings on coolant connection and hose).*

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Perform leak test on cooling system with cooling system tester VAG 1274 and adapter VAG 1274/8.

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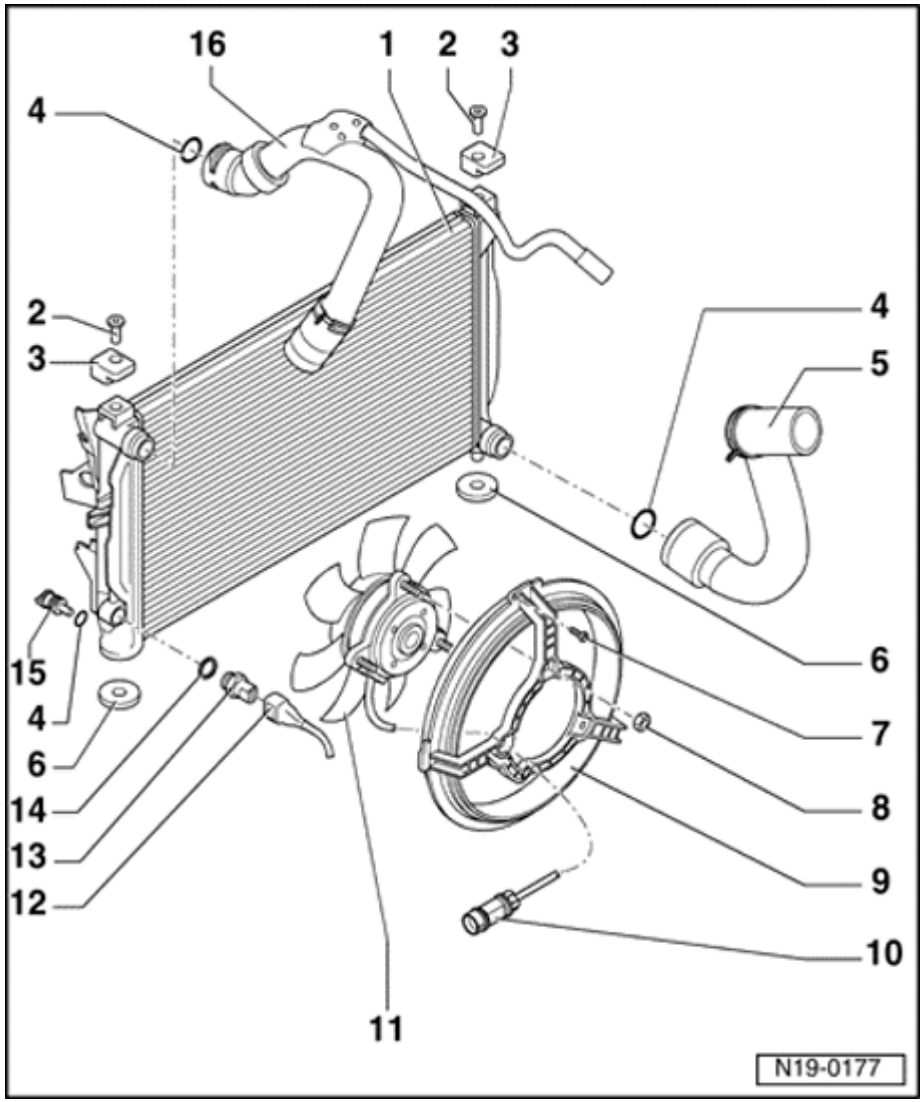
Cooling system components (on body), removing and installing

Notes:

- *Parts of cooling system on engine ⇒ Page 19-8 .*
- *Diagram of coolant hose connections ⇒ Page 19-17 .*
- *Draining and filling with coolant ⇒ Page 19-19 .*
- *Coolant mixture ratios ⇒ Page 19-19 , draining and filling cooling system.*

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19-3



1 - Radiator

- Removing and installing ⇒ Page 19-26
- After replacing, replace coolant in complete system

2 - Securing clip

3 - Securing rubber

4 - O-ring

- Replace if damaged

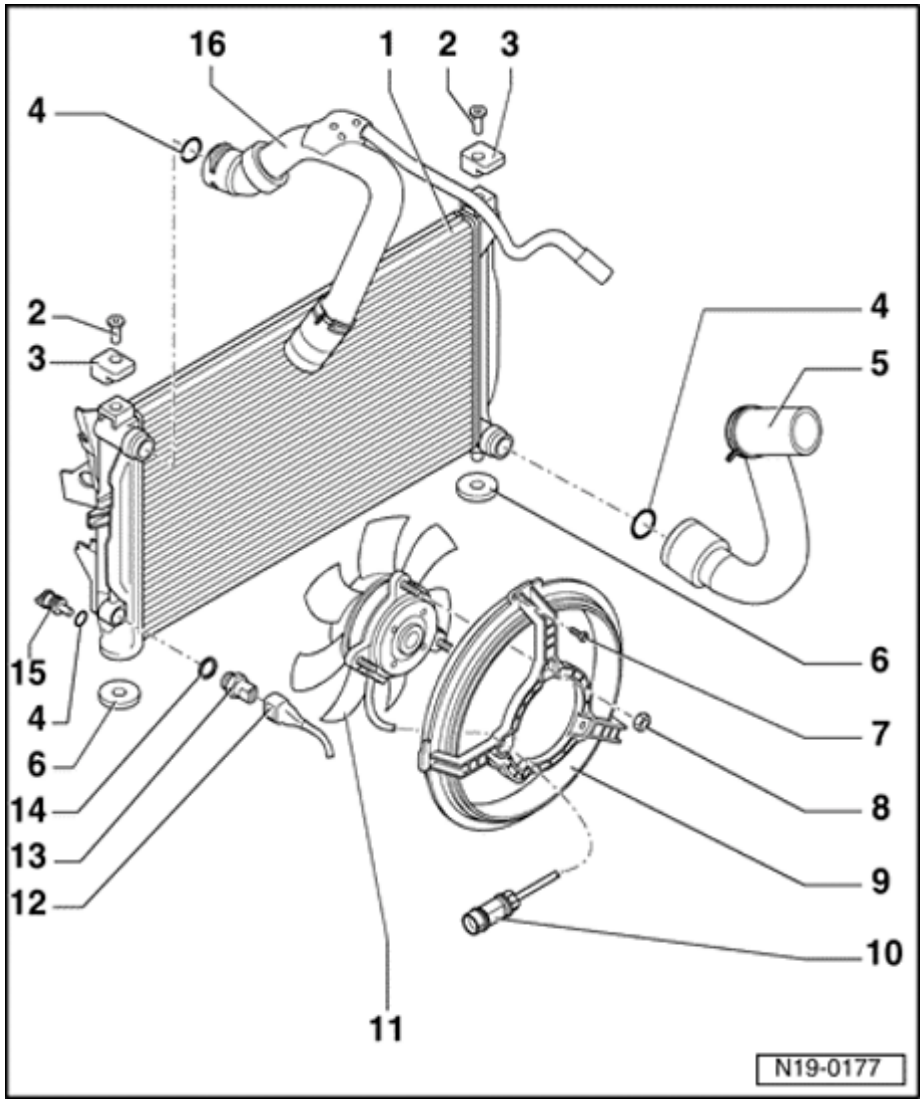
5 - Bottom coolant hose

- Secured to radiator with retaining clip
- Check for secure seating
- Diagram of coolant hose connections ⇒ Page 19-17

6 - Rubber washer

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19-4



7 - Retaining bolt

8 - Nut

- Tightening torque: 10 Nm

9 - Fan ring

- Clipped into air ducting and secured with retaining bolt -Item 7 -

10 - 2-pin connector

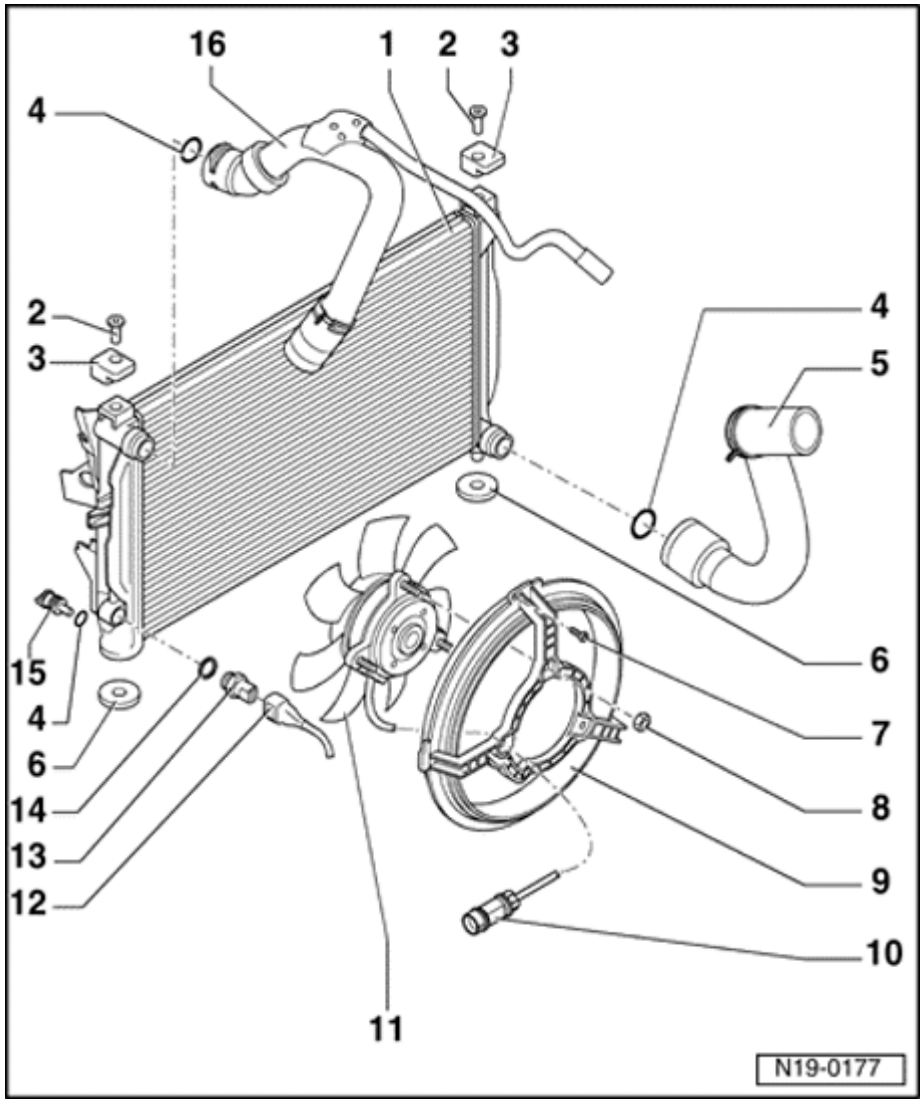
11 - Radiator fan (-V7-)

12 - Connector

- Black, 3-pin
- For radiator fan thermoswitch

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19-5



13 - Radiator fan thermoswitch (-F18-), 35 Nm

- For electric fan

Switching temperatures: Stage 1

- on: 92...97 °C
- off: 84...91 °C

Switching temperatures: Stage 2

- on: 99...105 °C
- off: 91...98 °C

14 - Seal

- Always replace

15 - Drain screw

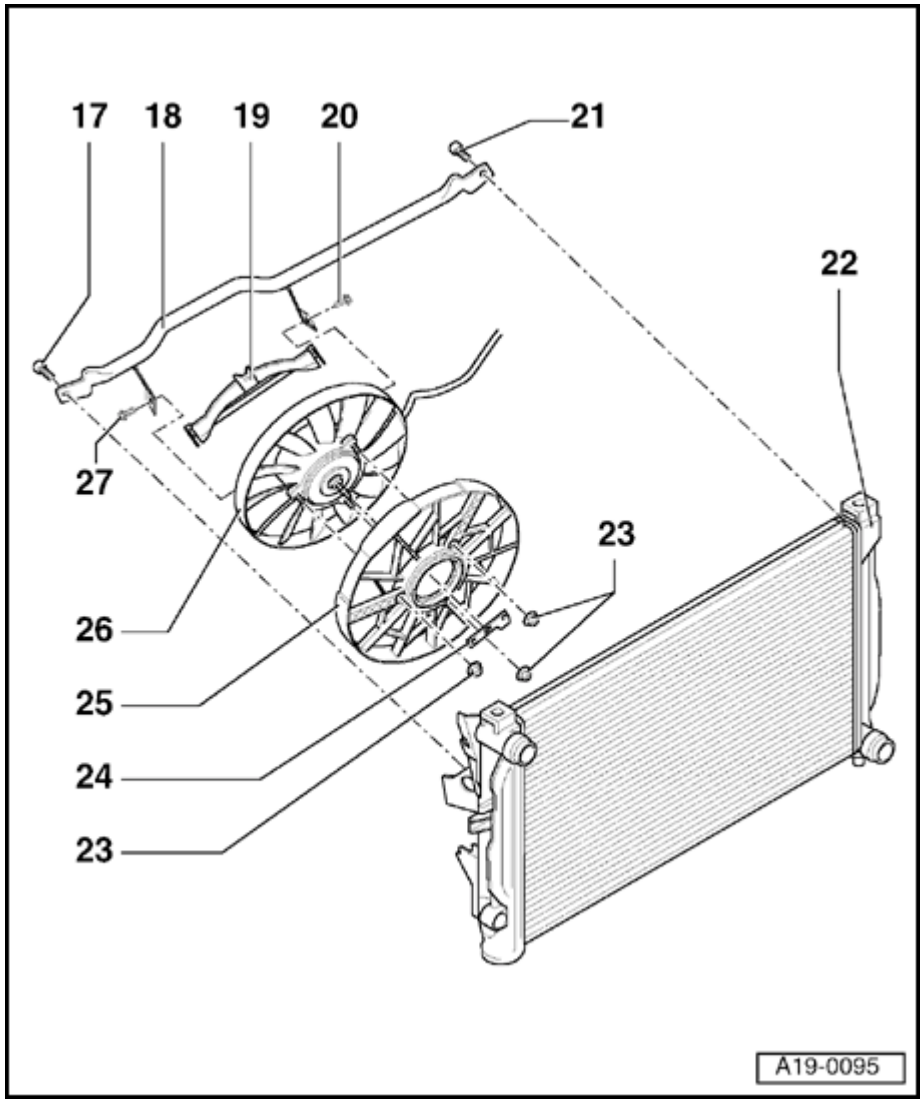
- Tightening torque: 10 Nm

16 - Top coolant hose

- Secured to radiator with retaining clip
- Check for secure seating
- Diagram of coolant hose connections ⇒ Page 19-17

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19-6



17 - Bolt

- Tightening torque: 5 Nm

18 - Mounting rod

19 - Guard plate

20 - Bolt

- Tightening torque: 5 Nm

21 - Bolt

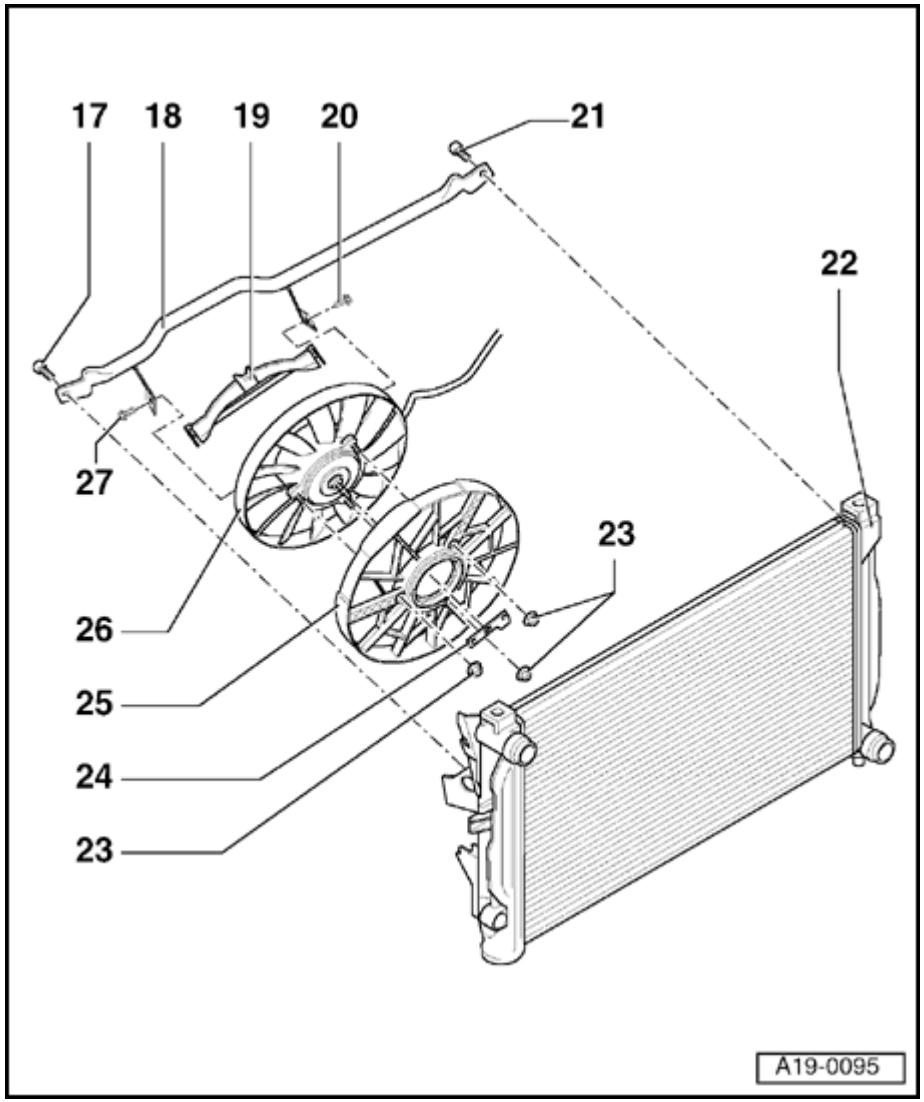
- Tightening torque: 5 Nm

22 - Radiator

- Removing and installing ⇒ Page 19-26
- After replacing, replace coolant in complete system

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19-7



23 - Nut

- Tightening torque: 5 Nm

24 - Bracket

25 - Fan ring

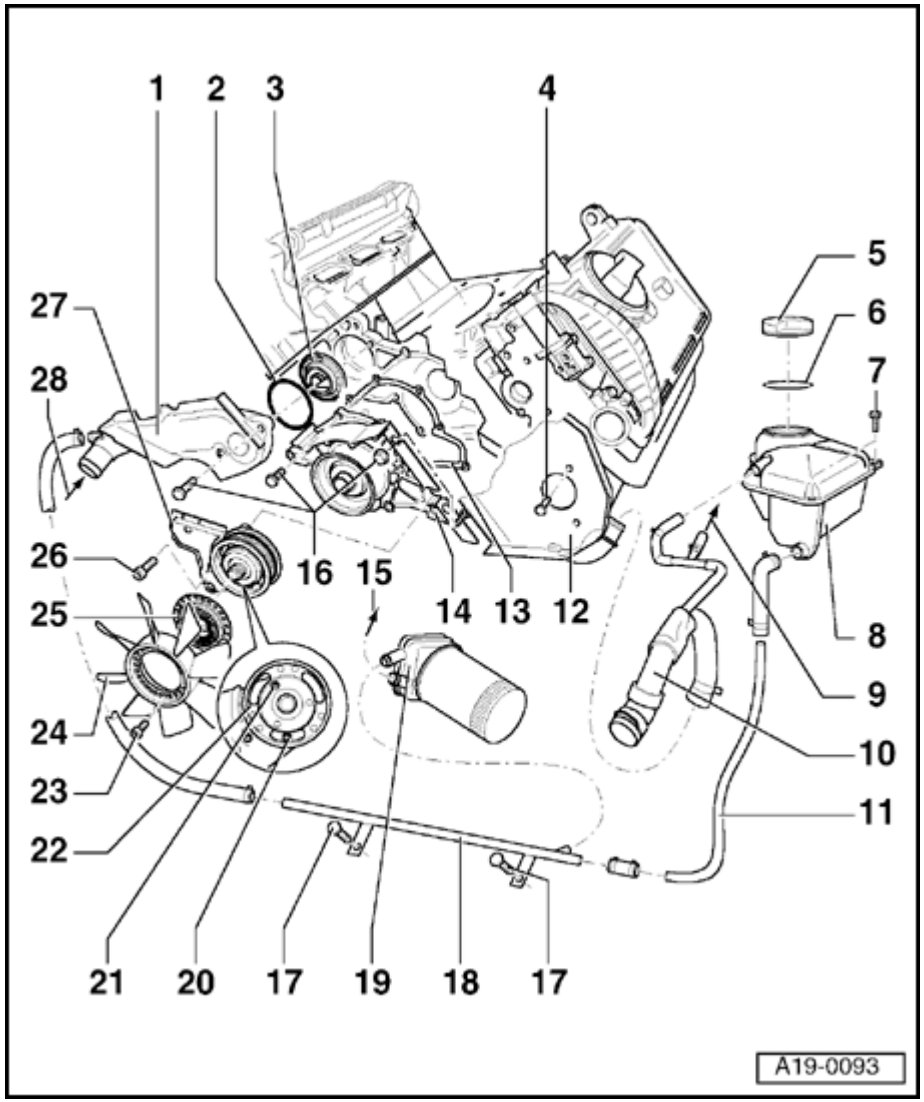
26 - Pressurizing fan

27 - Bolt

- Tightening torque: 5 Nm

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19-8



Cooling system components (on engine, front), removing and installing

1 - Connection

- For thermostat

2 - O-ring

- Always replace

3 - Thermostat

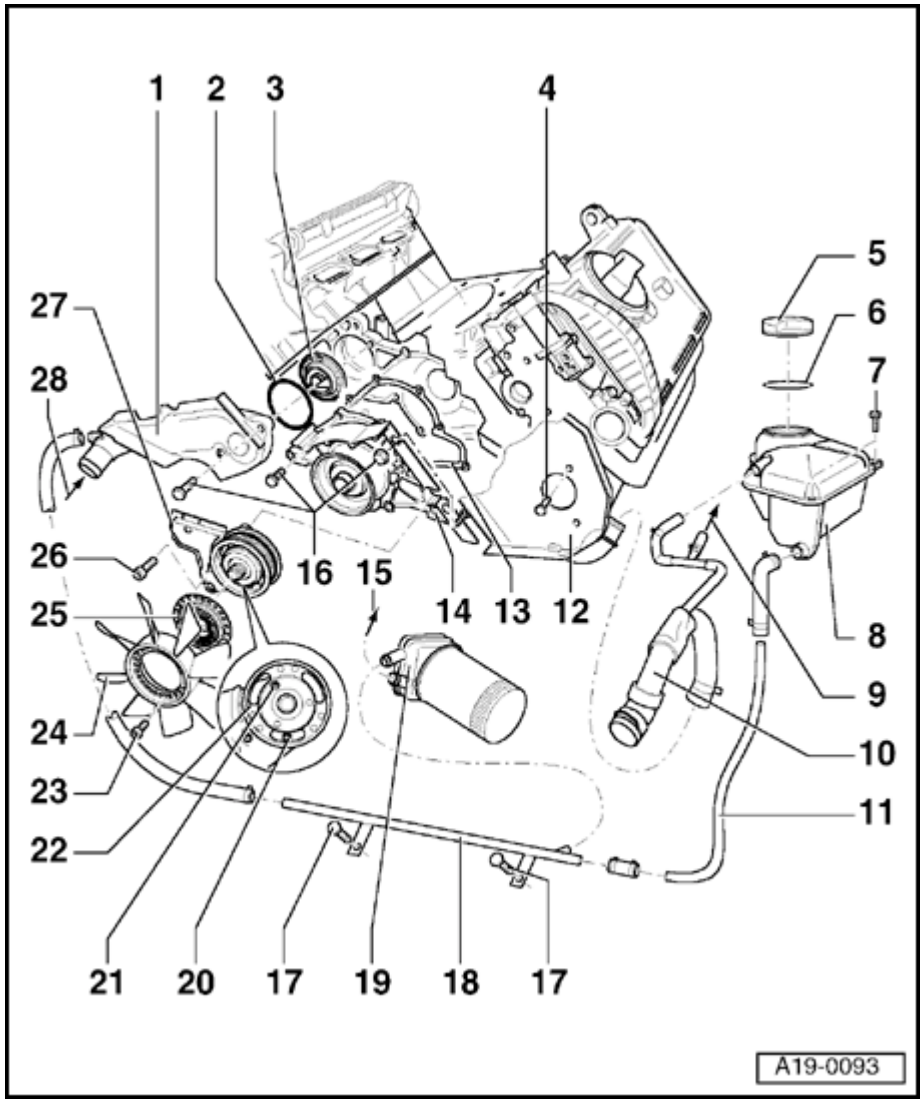
- Checking: heat the thermostat in water
- Starts to open at about 86 ° C
- Opening travel: at least 7 mm

4 - Bolt

- Tightening torque: 10 Nm

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19-9



5 - Filler cap

- Test with cooling system tester VAG 1274 and adapter VAG 1274/9
- Test pressure 1.4...1.6 bar

6 - O-ring

- Replace if damaged

7 - Bolt

- Tightening torque: 10 Nm

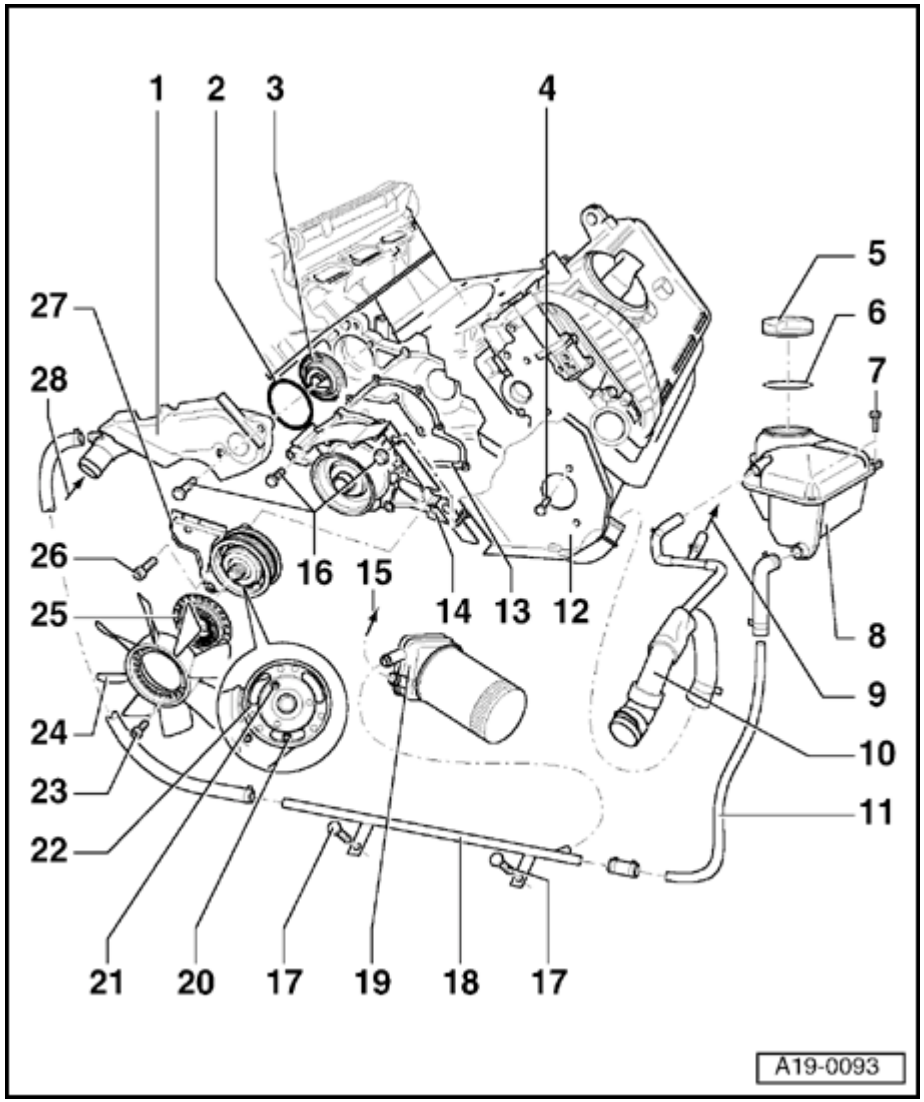
8 - Expansion tank

- Carry out leak test of cooling system with cooling system tester VAG 1274 and adapter VAG 1274/8

9 - To rear water line

- Diagram of coolant hose connections ⇒ Page 19-17

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10 - Top coolant hose

- Secured to radiator with retaining clip
- Check for secure seating
- Diagram of coolant hose connections ⇒ Page 19-17

11 - Coolant line

- Diagram of coolant hose connections ⇒ Page 19-17

12 - Rear toothed belt guard

13 - Gasket

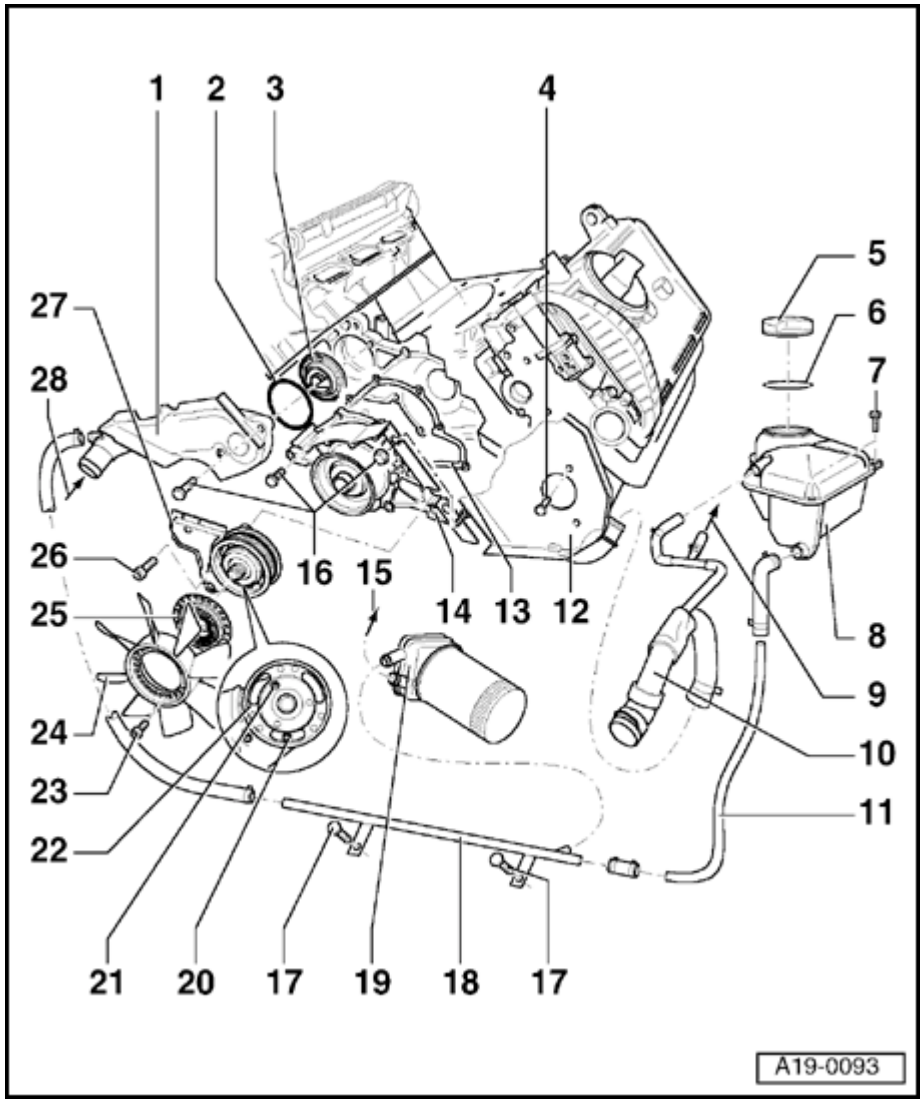
- Always replace

14 - Coolant pump

- Check that pump runs freely
- If damaged or leaking replace complete
- Removing and installing ⇒ Page 19-29

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19-11



15 - To front coolant line

- Diagram of coolant hose connections ⇒ Page 19-17

16 - Bolt

- Tightening torque: 10 Nm

17 - Bolt

- Tightening torque: 25 Nm

18 - Lower coolant line

- Diagram of coolant hose connections ⇒ Page 19-17

19 - Oil cooler

20 - Bolt

- Tightening torque: 25 Nm

21 - Bolt

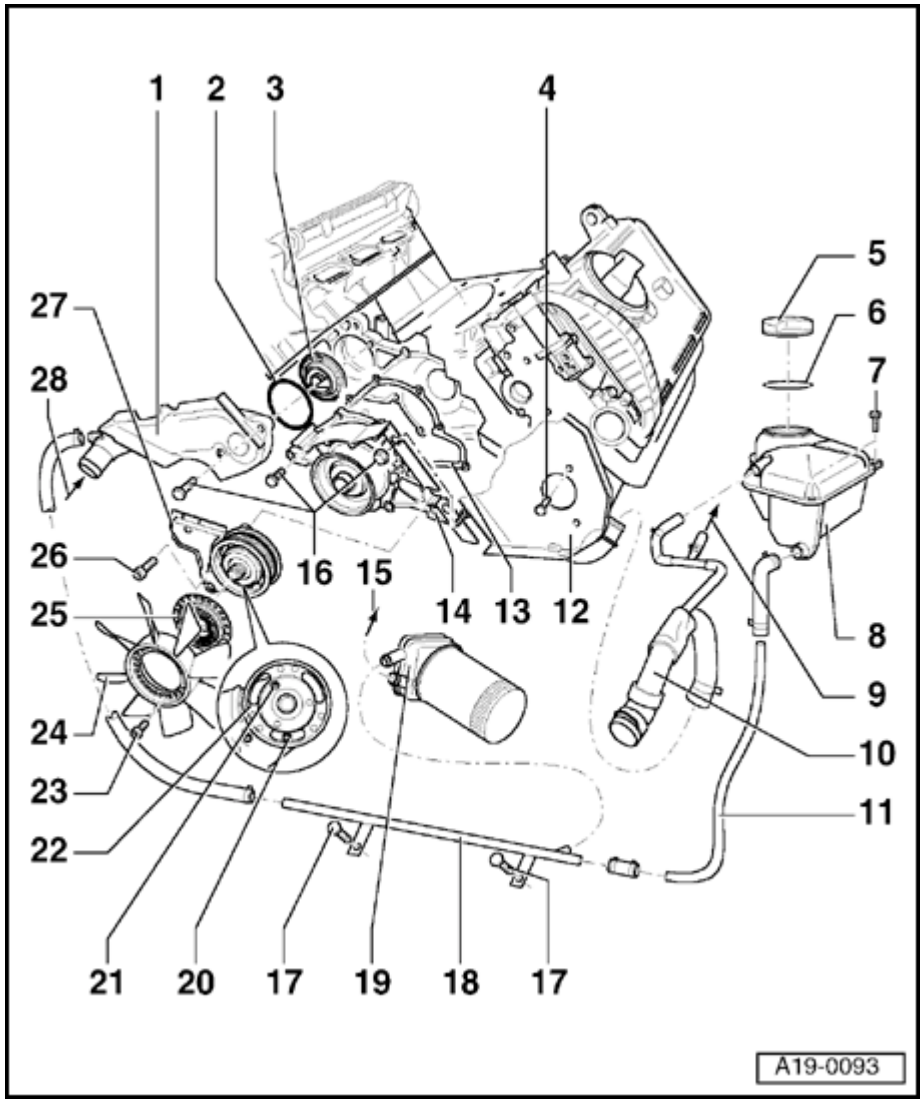
- Tightening torque: 10 Nm

22 - Belt pulley

- For viscous fan

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19-12



23 - Bolt

- Tightening torque: 10 Nm

24 - Fan wheel for viscous fan

25 - Viscous fan coupling

- Note left-hand thread
- Tightening torque only applicable when using open-end spanner 3312
- Tighten to 37 Nm

26 - Bolt

- Tightening torque: 25 Nm

27 - Bracket

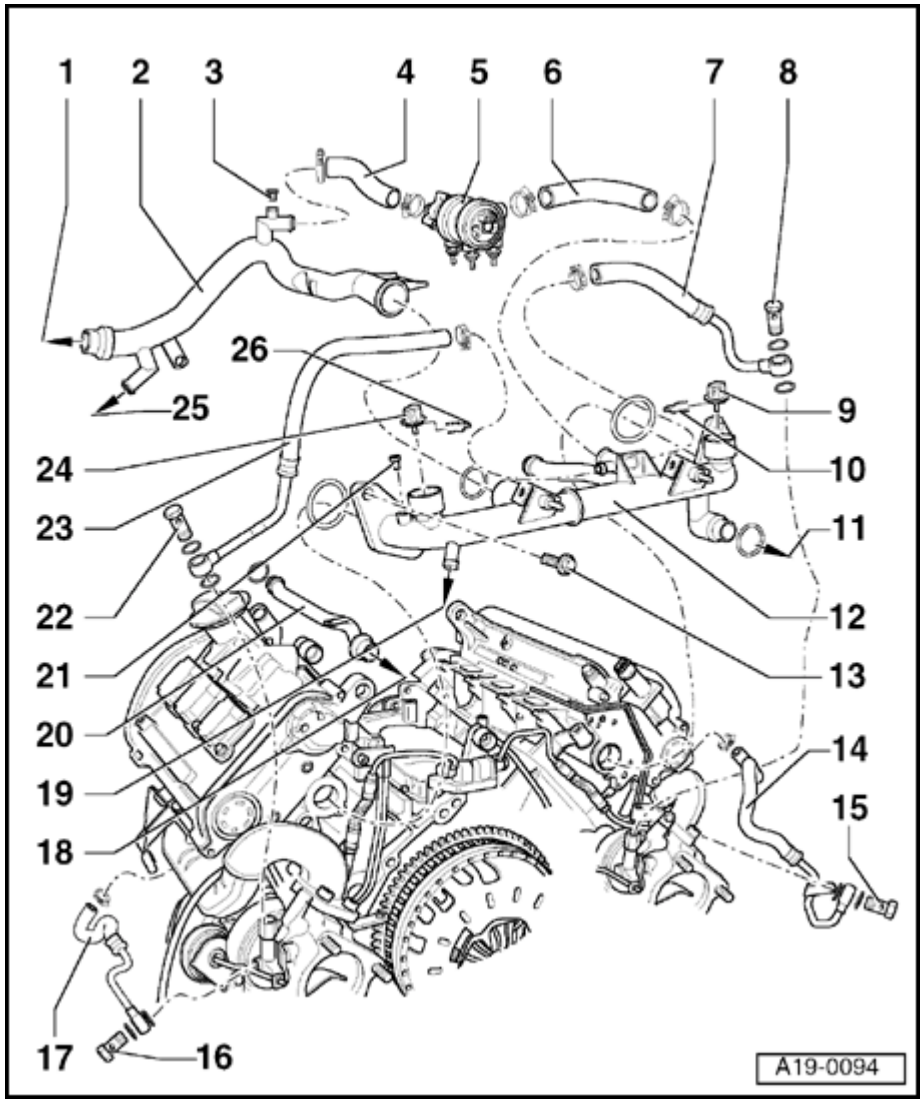
- For viscous fan

28 - From bottom of radiator

- Diagram of coolant hose connections ⇒ Page 19-17

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19-13



Cooling system components (on engine, rear), removing and installing

1 - To front water hose

2 - Front coolant line

- Diagram of coolant hose connections ⇒ Page 19-17

3 - Bleeder screw

- Tightening torque: 20 Nm

4 - Coolant hose

- From auxiliary water pump to front coolant line

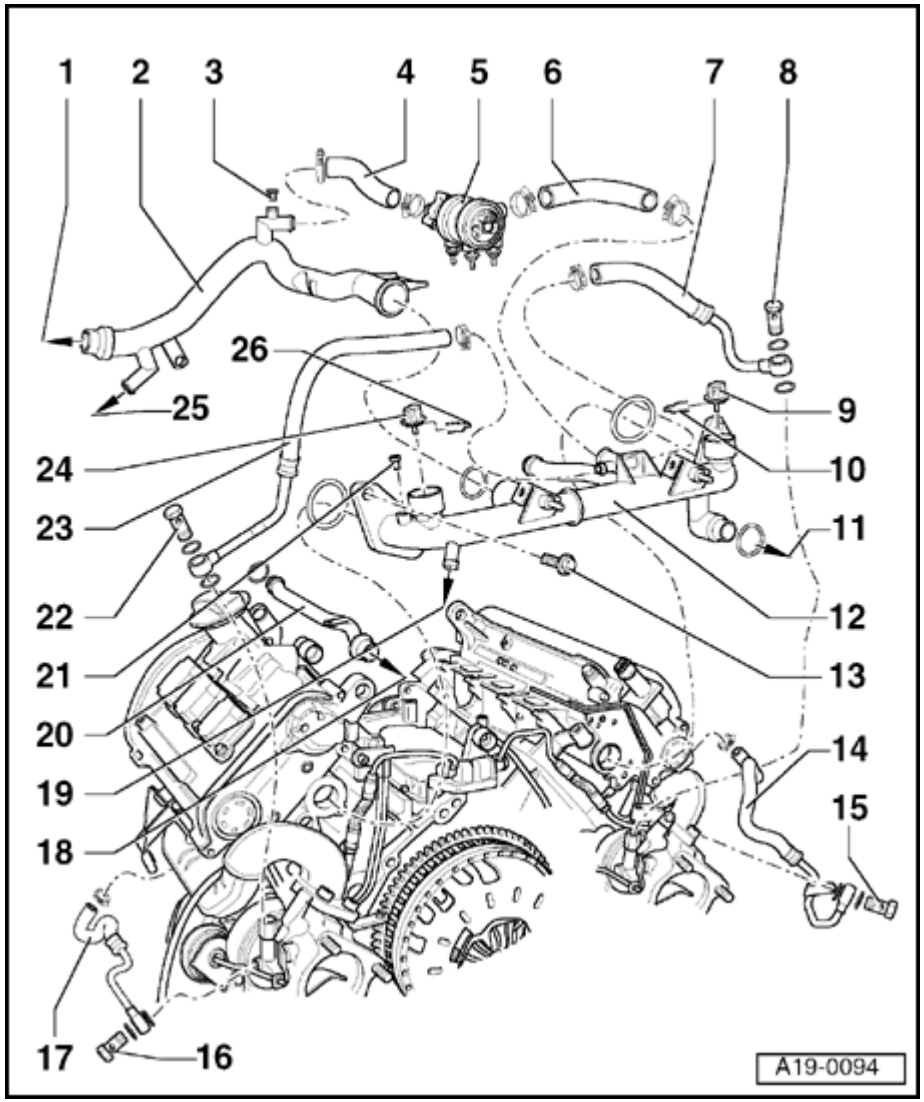
5 - Auxiliary water pump

6 - Coolant hose

- From rear coolant line to auxiliary water pump

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19-14



7 - Right coolant line

- From turbocharger to rear coolant line

8 - Banjo bolt

- Tightening torque: 35 Nm

9 - Coolant temperature sender (-G62-)

- For engine control module
- If necessary, release pressure in cooling system before removing
- Checking:

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

10 - Retaining clip

- Check for proper seating

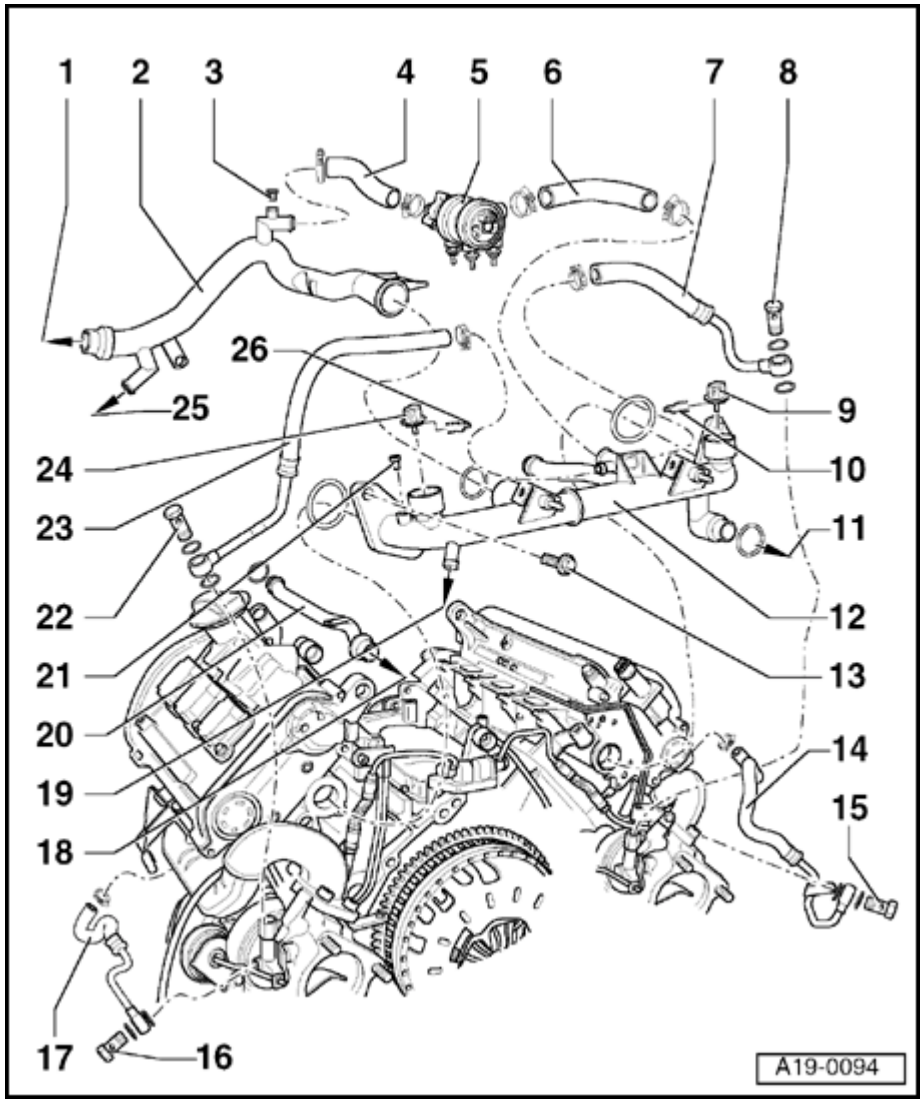
11 - To heat exchanger

12 - Rear coolant line

- Diagram of coolant hose connections ⇒ Page 19-17

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19-15



13 - Bolt

- Tightening torque: 10 Nm

14 - Right coolant line

- From engine block to turbocharger

15 - Banjo bolt

- Tightening torque: 35 Nm

16 - Banjo bolt

- Tightening torque: 35 Nm

17 - Right coolant line

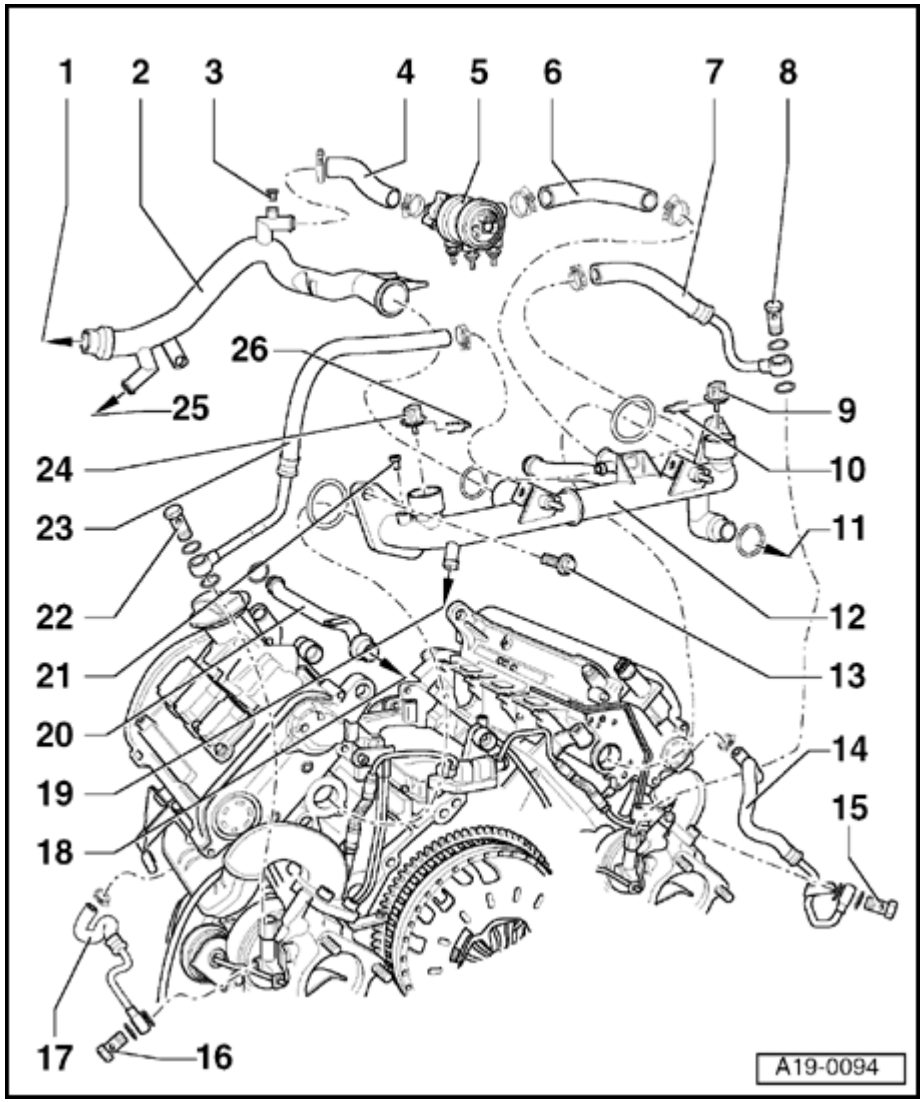
- From engine block to turbocharger

18 - From heat exchanger

19 - To front coolant hose

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19-16



20 - Coolant line

- Diagram of coolant hose connections ⇒ Page 19-17

21 - Bleeder screw

- Tightening torque: 20 Nm

22 - Banjo bolt

- Tightening torque: 35 Nm

23 - Left coolant line

- From turbocharger to rear coolant line

24 - Sender for auxiliary water pump

- 2-pin
- If necessary, release pressure in cooling system before removing

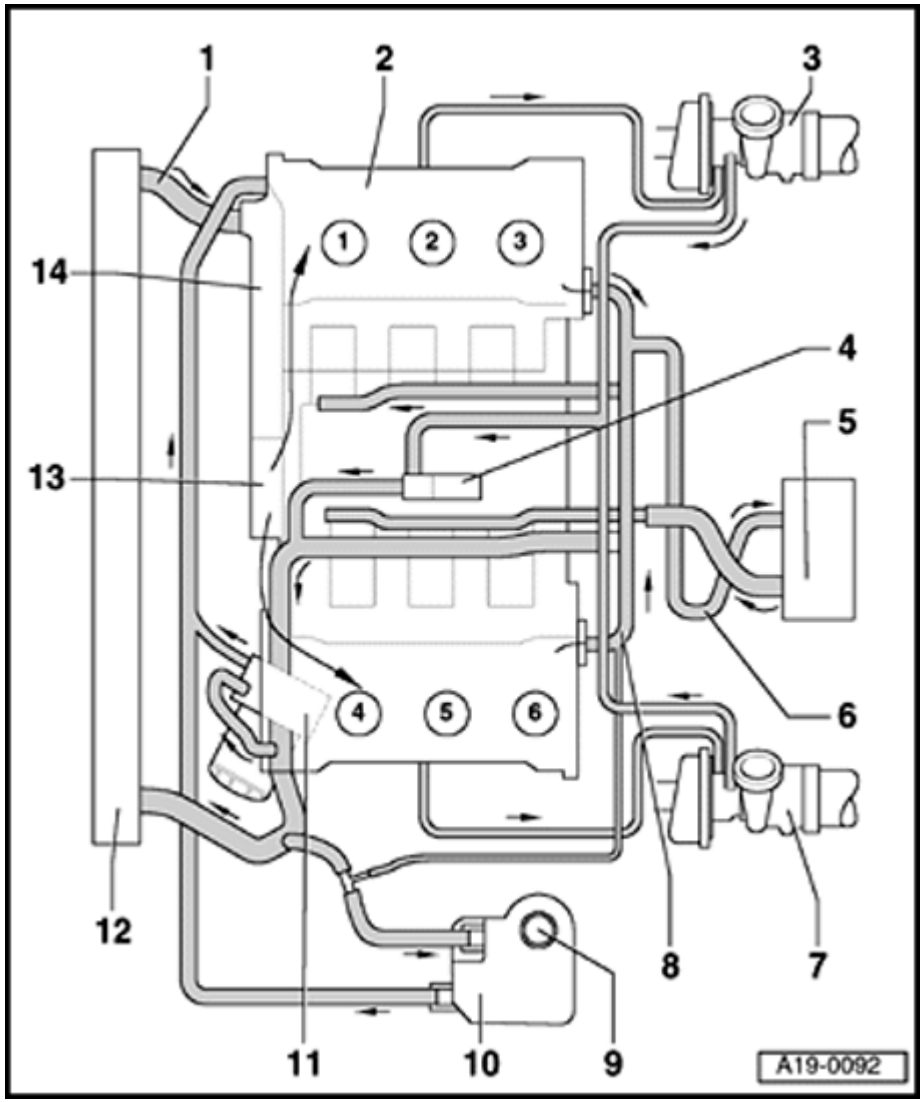
25 - To oil cooler

26 - Retaining clip

- Check for proper seating

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19-17



Coolant hose connections, diagram

1 - Bottom coolant hose

- From radiator to engine

2 - Cylinder head/ cylinder block

3 - Right turbocharger

4 - Auxiliary water pump

5 - Heat exchanger for heater system

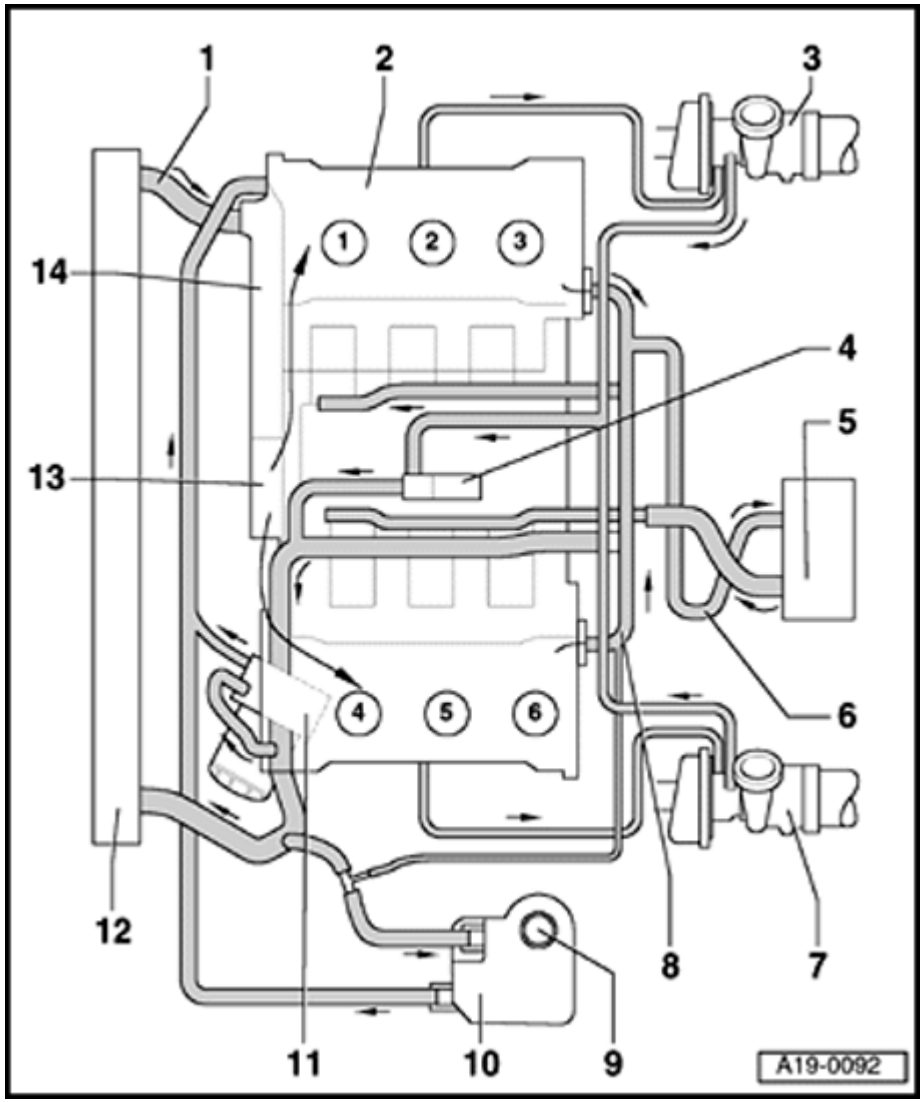
6 - Coolant hose

- To heat exchanger

7 - Left turbocharger

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19-18



8 - Rear coolant line

9 - Cap for expansion tank

10 - Expansion tank

11 - Oil cooler

12 - Radiator

- Removing and installing ⇒ Page 19-26
- After replacing, replace coolant in complete system

13 - Coolant pump

14 - Connection

- For thermostat

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19-19

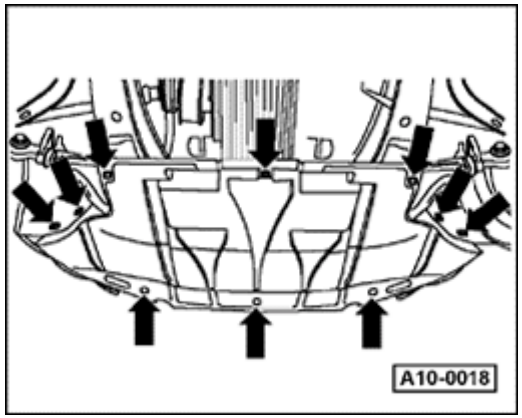
Cooling system, draining and filling

Draining

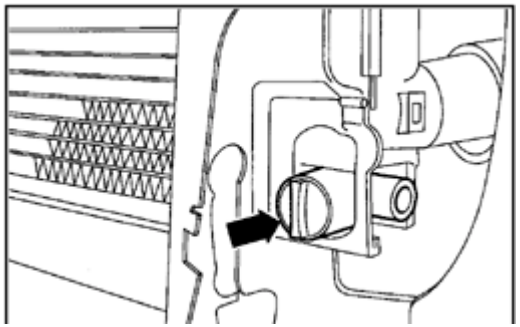
WARNING!

Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and remove it carefully.

- Remove filler cap on coolant expansion tank.



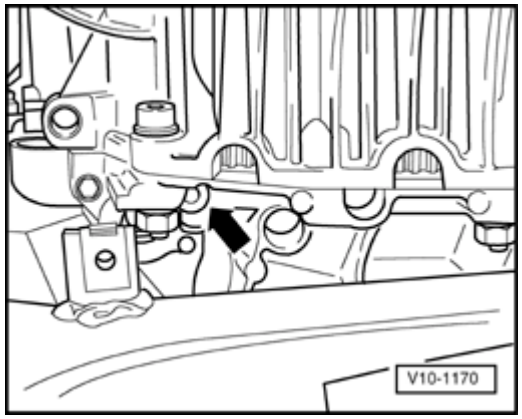
- Remove noise insulation panel.
- Place drip tray VAG 1306 under the engine.



- If bumper has been removed from vehicle, open drain tap -arrow- on bottom of radiator (left side) by turning anti-clockwise. Fit drain hose on connection if necessary.
- If bumper has not been removed from vehicle, pull out retaining clip on bottom hose going from radiator to engine (right side), and pull hose off radiator.

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19-20



- Drain coolant from engine at drain screw -arrow-.

Note:

Observe disposal regulations for coolant.

Filling

Notes:

- *Use only coolant additive G 12 - meeting specification VW 774 D. Identification: colored red.*
- *G 12 must not be mixed with any other additives.*
- *If the fluid in the expansion tank is brown, this is an indication that G 12 has been mixed with another type of coolant. In this case the coolant must be changed.*

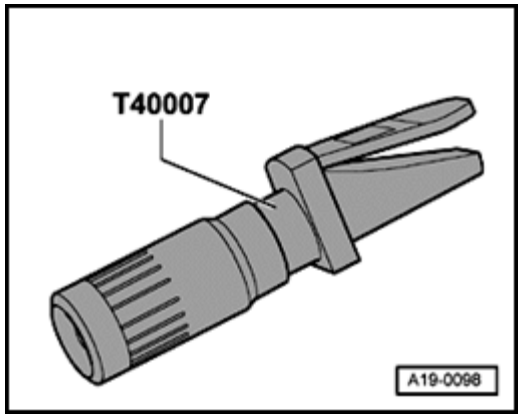
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19-21

- *G 12 and coolant additives complying with specification "VW 774 D" prevent frost and corrosion damage, scaling and also raise the boiling point of the coolant. For this reason the system must be filled all year round with the correct additive for frost and corrosion protection.*

- *Particularly in countries with tropical climates, the higher boiling point of the coolant improves engine reliability when working under heavy load.*

- *The system must be protected against frost to about -25 ° C (in arctic climates to about -35 ° C).*



- *Use special tool T40007 to test coolant concentration and antifreeze protection.*

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- *The coolant concentration should not be reduced by adding plain water, even in warmer seasons and in warmer countries. The concentration must be at least 40 %.*

- *If extra antifreeze protection is required in cold climates, the concentration of G 12 can be increased, but only up to a maximum of 60 % (frost protection to about -40 ° C); if this concentration is exceeded, the antifreeze protection will be reduced again and cooling effectiveness will also be impaired.*

- *Do not reuse the old coolant if the radiator, heat exchanger, cylinder head or cylinder head gasket have been replaced.*

Recommended mixture ratios:

Frost protection to	**Antifreeze concentration**	**G 12[1)]**	**Water[1)]**
-25 ° C	40 %	2.5 ltr.	3.5 ltr.
-35 ° C	50 %	3.0 ltr.	3.0 ltr.

[1)] The capacity of the cooling system can vary depending on the equipment installed on the

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vehicle.

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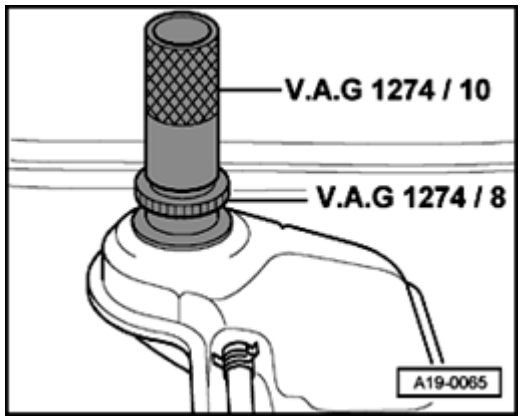
19-23

- Replace O-ring on coolant drain screw and screw drain screw back into engine.

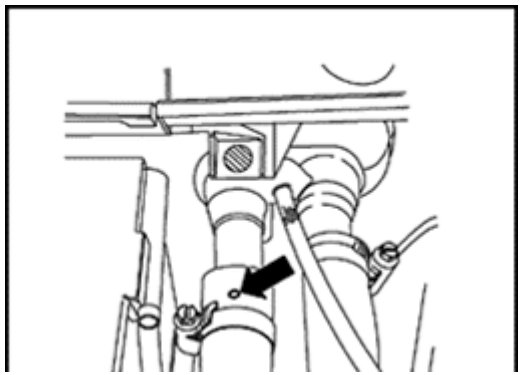
  Tightening torque: 20 Nm

- Install bottom coolant hose and secure.

- Close coolant drain tap on radiator.



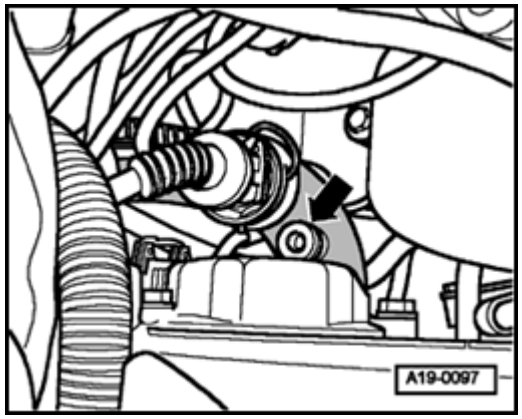
- Screw adapter VAG 1274/8 onto expansion tank and insert extension VAG 1274/10 into the adapter.



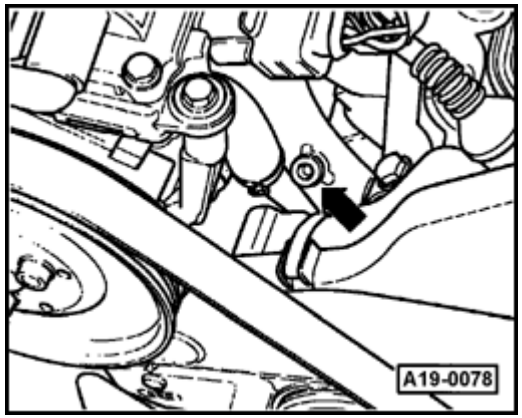
- Loosen coolant hose on heat exchanger and pull back hose far enough so that bleeder hole in hose -arrow- is no longer covered by connection.
- Fill up coolant until it comes out at bleeder hole in coolant hose.
- Push coolant hose onto connection and tighten.

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19-24



- Loosen bleeder screw on rear coolant line -arrow- below expansion tank.
- Fill up coolant until it comes out at bleeder screw.
- Screw in bleeder screw (20 Nm).



- Loosen bleeder screw on front coolant line -arrow- between power steering pump and left cylinder head.
- Fill with coolant until it comes out at bleeder screw.
- Screw in bleeder screw (20 Nm).
- Fill coolant up to max. mark.
- Close filler cap on expansion tank.
- Set heater controls to maximum heat setting.

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- Start engine and let it idle for about 10 minutes.

- Maintain an engine speed of about 2000 RPM for about 5 minutes.

- Allow engine to run at idling speed until bottom hose on radiator becomes hot.

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

Note:

When the engine is hot the cooling system is under pressure. Carefully open filler cap on expansion tank to release pressure before starting repair work.

WARNING!

Hot steam can escape from the expansion tank when the filler cap is opened. Cover the filler cap with a cloth and remove it carefully.

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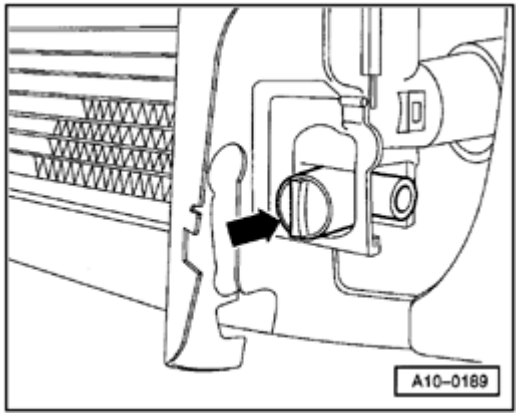
19-26

Radiator, removing and installing

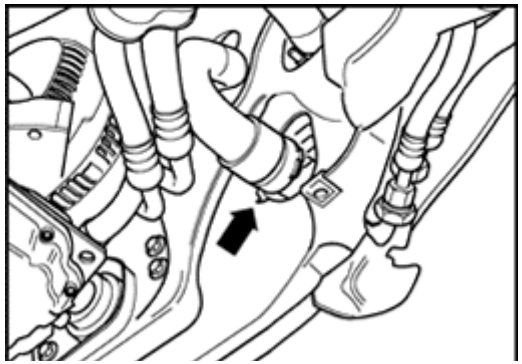
Removing

- Remove front bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*



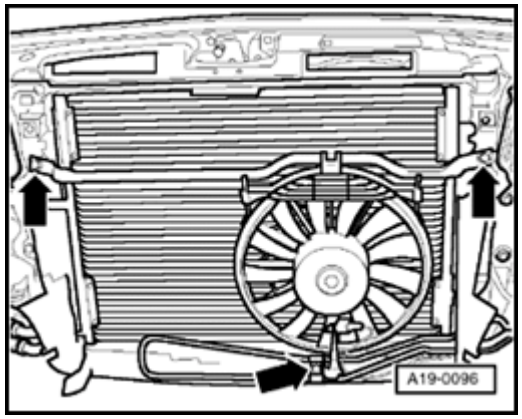
- Drain coolant ⇒ Page 19-19 .



- Disengage retaining clips on connecting flanges -arrow- and pull coolant hoses off radiator.
- Unplug connector from thermoswitch on radiator (bottom left).

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19-27



- Unbolt pressurizing fan and detach cooling lines for power steering hydraulic fluid -arrows-.

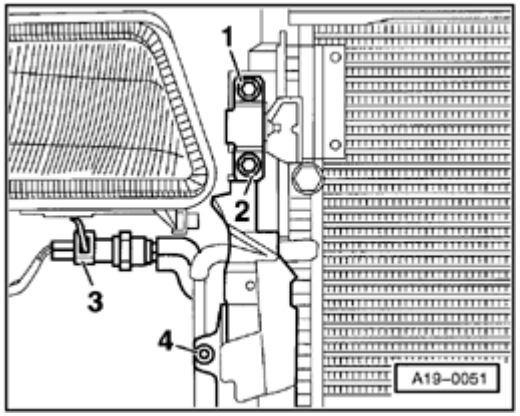
Vehicles with air conditioner

WARNING!

Do not open the air conditioner refrigerant circuit.

Note:

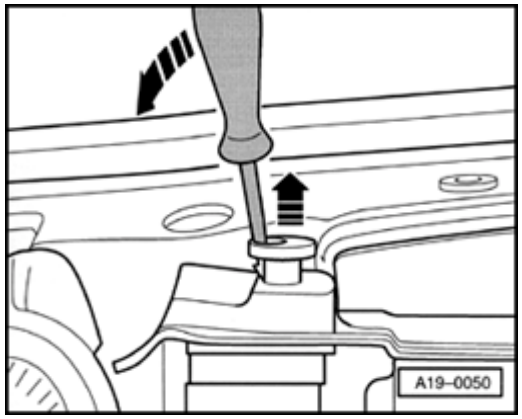
To prevent damage to the condenser and refrigerant lines and hoses, ensure that the lines and hoses are not stretched, kinked or bent.



- Detach air cowls from radiator -4- (left and right).
- Remove securing bolts -1- and -2- for condenser.
- Unplug connector -3- from air conditioner pressure switch -F129.
- Lift condenser up out of its bracket, turn it towards side and secure to right-hand front wheel with wire.

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19-28



- Release two retaining pins for radiator and pull out upward -arrows-.
- Pivot radiator toward front and lift out.

Installing

Install in the opposite order to removing. When installing, note the following points:

- Fill with coolant ⇒ Page 19-19 .

Tightening torques

Component	Nm
Condenser to radiator	10
Cooling lines to radiator	10
Pressurizing fan to radiator	10

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19-29

Coolant pump, removing and installing

Notes:

- *Always replace seals and gaskets.*
- *Cover toothed belt with a cloth to protect it from coolant before removing coolant pump.*

Removing

- Remove front bumper.

⇒ *Repair Manual, Body Exterior, Repair Group 63*

- Move lock carrier to service position.

⇒ *Repair Manual, Body Exterior, Repair Group 50*

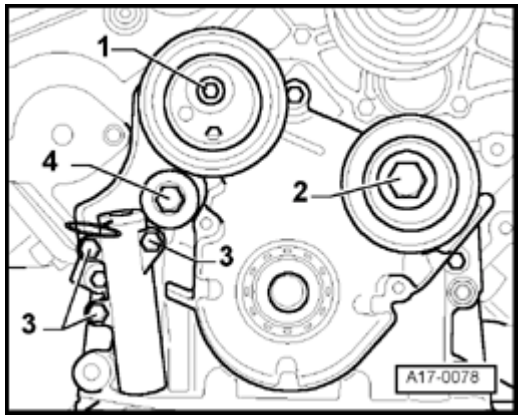
- Remove ribbed belt ⇒ Page 13-1 .
- Remove toothed belt ⇒ Page 13-4 .

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- Drain coolant ⇒ Page 19-19 .

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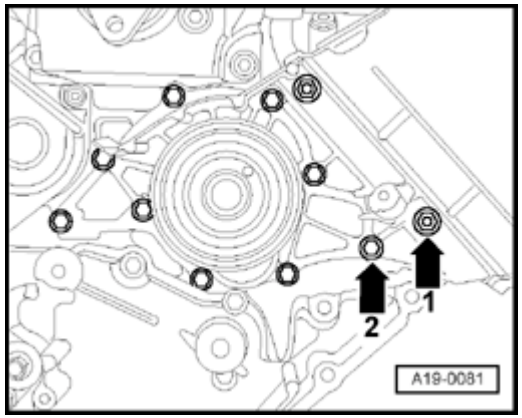
19-30



- Remove following components before unbolting coolant pump:

1 - Tensioning roller for toothed belt: 20 Nm

2 - Idler wheel: 45 Nm



- Unbolt coolant pump from toothed belt guard -1- (2 nuts). Remove securing bolts -2- (9 bolts) for coolant pump and remove coolant pump.

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19-31

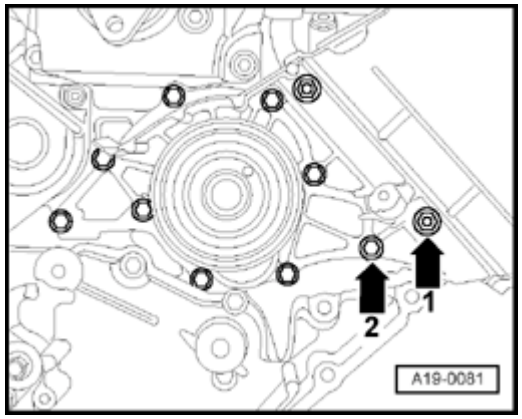
Installing

Install in the opposite order to removing. When installing, note the following points:

- Remove residues of sealant on sealing surfaces of coolant pump and cylinder block.

- Clean sealing surfaces; ensure that they are free of oil and grease.

- Fit new gasket on coolant pump flange.



- Insert coolant pump into cylinder block and tighten all 9 securing bolts -2-.
- Secure rear toothed belt guard at coolant pump housing -1-.

  Tightening torque: 10 Nm.
- Install toothed belt ⇒ Page 13-4 .
- Install ribbed belt ⇒ Page 13-1 .
- Install toothed belt guard.
- Fill cooling system ⇒ Page 19-19 .

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21-1

Charge air system with turbocharger

Turbocharger, removing and installing

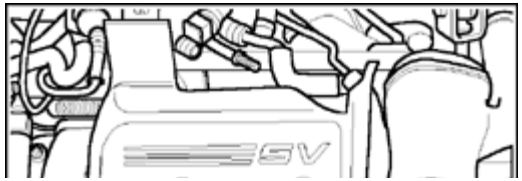
Observe rules for cleanliness ⇒ Page 21-8 .

Notes:

- *Turbochargers must be replaced in pairs. Manufacturing tolerances may prevent matched operation.*
- *All hose connections are secured with clips.*
- *Charge air system must be free of leaks.*
- *Replace self-locking nuts.*
- *Replace all seals and gaskets*

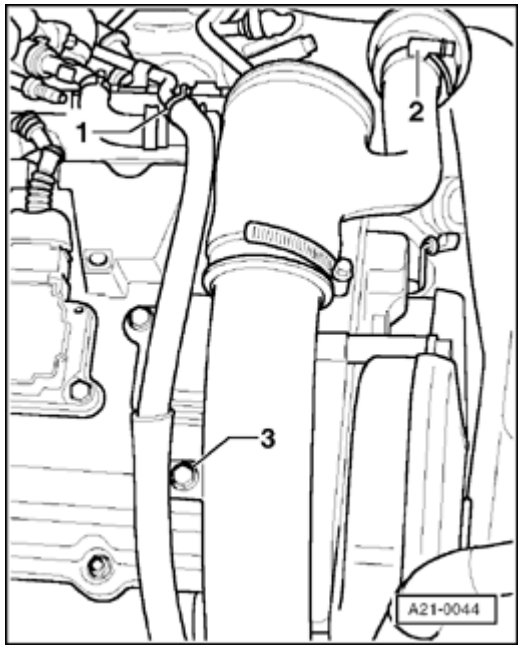
- Remove engine ⇒ Page 10-1 .

Removing right-hand turbocharger



- Remove cover panel from right-hand cylinder head cover -arrows-.

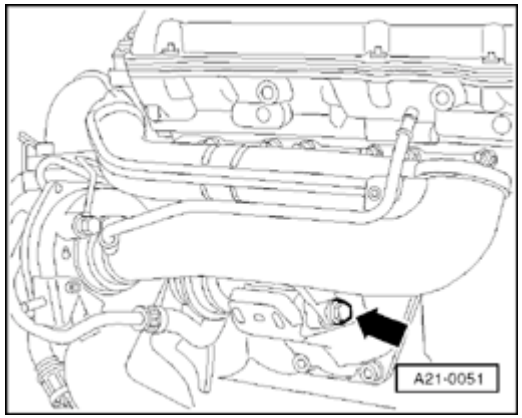
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- Disconnect hose -1-.
- Disconnect hose -2-.
- Unbolt upper section of intake line -3-.

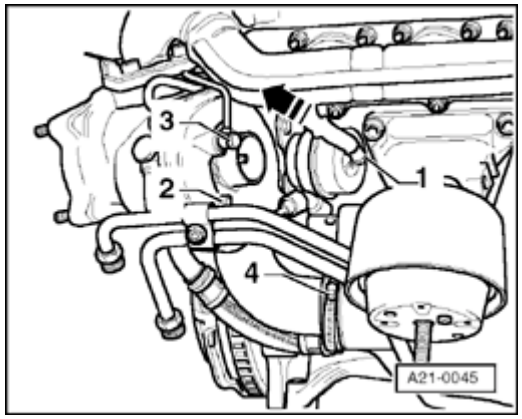
Note:

Plug lower section of intake line.

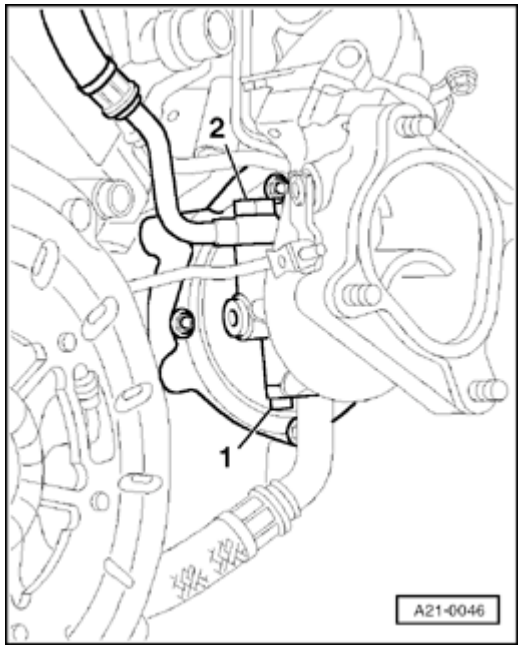


- Remove lower section of intake line -arrow-.

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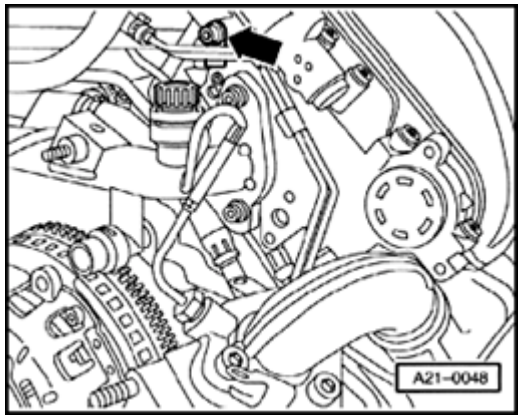


- Push back heat insulation hose in direction of arrow.
- Disconnect vacuum hose -1-.
- Unbolt bracket -2- with gearbox oil lines.
- Disconnect line -3-.
- Disconnect pressure hose -4- from turbocharger.

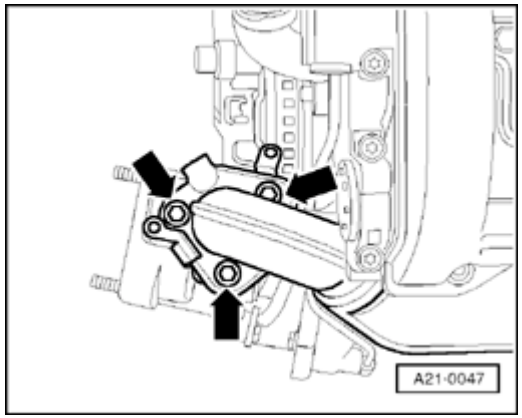


- Disconnect oil return line -1-.
- Disconnect water line -2-.

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- Disconnect hose -arrow- from cylinder head.



- Remove turbocharger -arrows-.

Installing

- Install in reverse sequence.

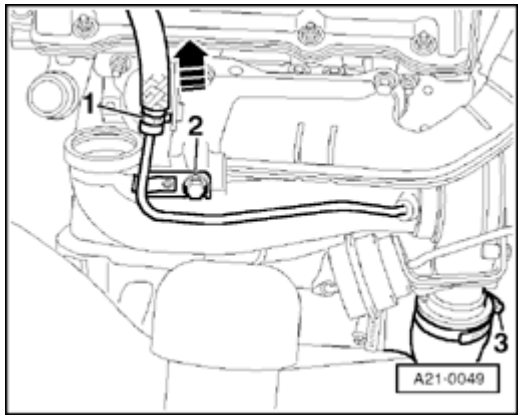
Notes:

When installing turbocharger, ensure that O-ring for oil return is not damaged.

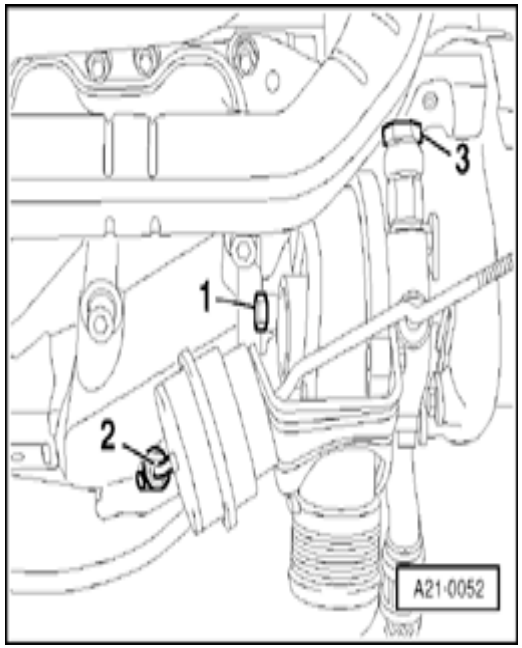
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21-5

Removing left-hand turbocharger

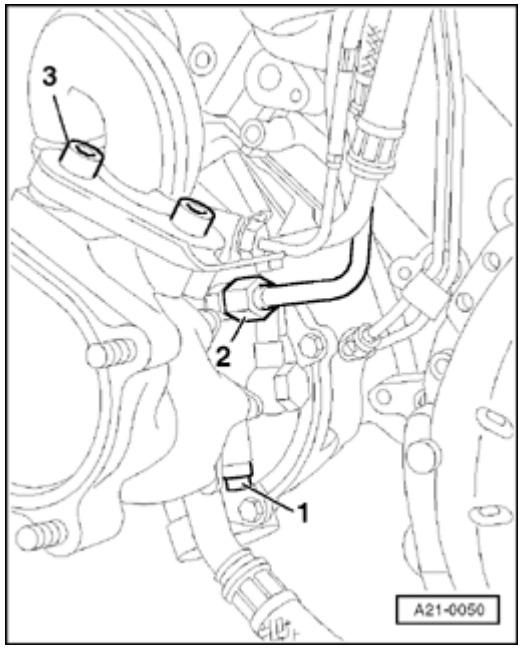


- Push back heat insulation hose in direction of arrow.
- Disconnect vacuum hose -1-.
- Remove lower section of pressure line -2-.
- Disconnect pressure hose -3- from turbocharger.



- Disconnect vacuum line -1-.
- Disconnect vacuum hose -2-.
- Disconnect line -3- going to right-hand turbocharger.

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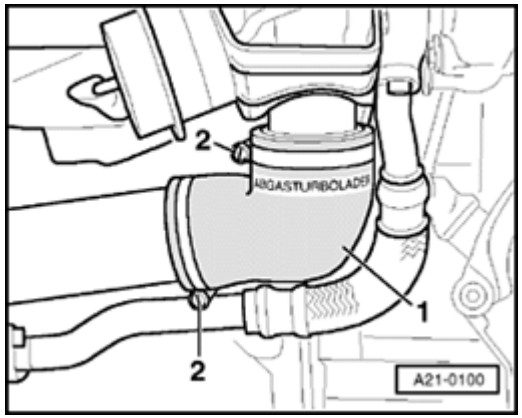
- Disconnect oil return line -1-.
- Disconnect water line -2-.
- Remove turbocharger -3- (3 bolts).

Installing

- Installation is the reverse of removal.

Notes:

When installing turbocharger, be sure that o-ring at connection flange for oil return is not damaged.



The text "Abgasturbocharger" must be readable as shown in illustration, install turbocharger hose -1- properly if necessary.

The hose clamps -2- must be installed as shown in illustration. The bolt-locks on the screw clamps must be placed at the X-marking on the hose.

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Tightening torque

Bolted mountings	Tightening torque
Turbocharger	20 Nm
Intake line to cylinder head	10 Nm
Heat shield to turbocharger	10 Nm
Exhaust manifold to exhaust pipe	25 Nm
Injector pipes	30 Nm
Intake pipe to engine support	10 Nm
Oil pipe to turbocharger	15 Nm
Oil pipe to intake manifold	20 Nm

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21-8

Rules for cleanliness

When working on the exhaust gas turbocharger, pay careful attention to the following 5 rules:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

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21-9

Turbocharger and charge pressure regulating valve, checking

Safety notes

Note the following points if test equipment has to be used during a road test:

WARNING!

- ***Test equipment must always be secured on the rear seat and operated from there by a second person.***

- ***If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.***

Special tools, testers and auxiliary items

- Turbocharger tester VAG 1397 A

- VAG 1551 Scan Tool or VAG 1552 with cable VAG 1551/3

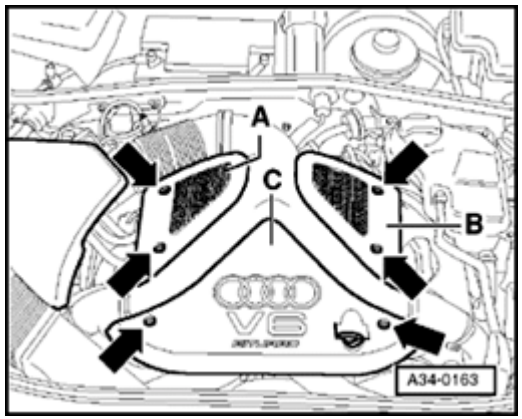
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Requirements for test:

- Diagnostic Trouble Code (DTC) memory has been interrogated

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

- Output Diagnostic Test Mode (DTM) has been performed
- Engine oil temperature at least 60 ° C
- All vacuum connections airtight



- Loosen bolts -arrows- and remove engine cover panel -B-.

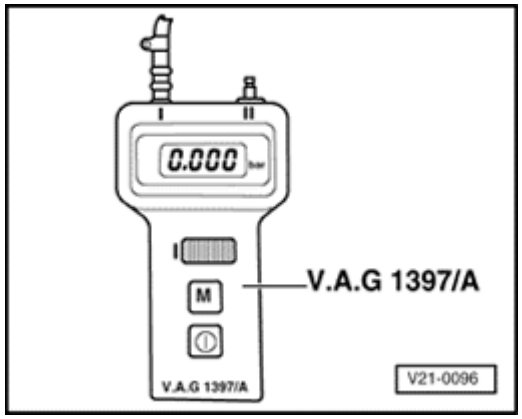
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- Connect T-piece with measuring hose of turbocharger tester VAG 1397 A to fuel pressure regulator -arrow-.
- Route measuring hose under rear edge of hood and into passenger compartment via right-hand window.

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21-11

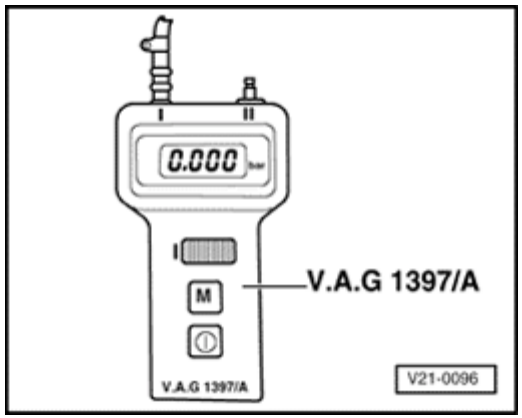


- Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.

Notes:

- *Hose connections must be completely airtight, otherwise measurements will not be correct.*
- *Ensure that measuring hose is not pinched at hood or side window.*
- *Pressing memory key M on turbocharger tester will store the last measured value until memory key M is pressed again or tester is switched off.*
- *The decimal point in the display flashes to indicate that the value is being stored.*
- *If the battery voltage of the turbocharger tester drops below the minimum level, an arrow will appear at the top left of the display.*
- *Before performing the test, drive the vehicle at a brisk speed for at least 3 km (without stopping at traffic lights etc.).*
- *A second mechanic is required to note the readings on the tester when the vehicle is moving.*
- *Observe safety notes* ⇒ *Page 21-9* .

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- Accelerate vehicle from 2000 RPM at full throttle in fourth gear, and watch rev counter.

- Press memory key -M- on turbocharger tester at 3000 RPM.
  - Specification: 1.550 ... 1.650 bar

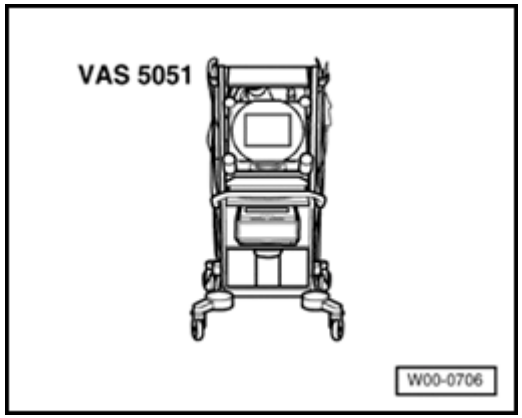
Note:

If no charge pressure is obtained and a throbbing noise can be heard in the engine compartment, the causes can be as follows:

- *Air recirculation valve faulty.*
- *Vacuum line to air recirculation valve leaking or has become disconnected.*

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21-13



Charge air pressure regulation, checking

Special tools and equipment

- VAS 5051 with VAG 5051/1

or

- VAG 1551 with VAG 1551/3A

Test requirement:

- Coolant Temperature at least 80 ° C.

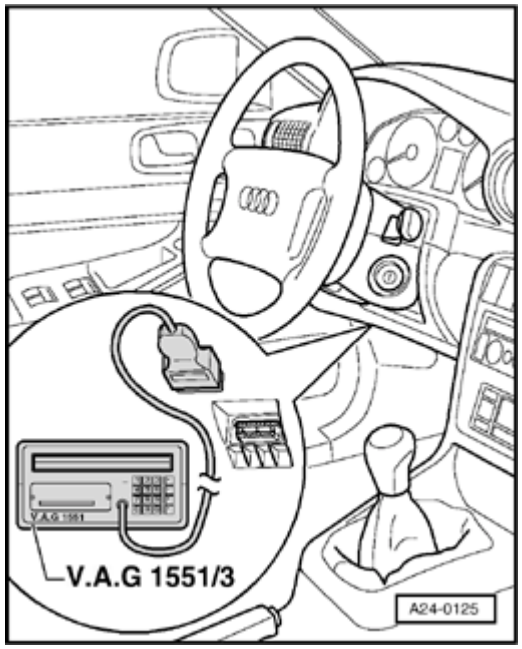
WARNING!

- ***During a road test in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.***
- ***When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.***

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21-14

Test sequence



- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

Rapid data transfer HELP
Select function XX

When indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.

Read measuring value block Q
Input display group number XXX

When indicated on display

- Press buttons -1-, -1- and -5- to select "display group number 115" and press -Q- button to confirm input.

Read Measuring Value Block 115 →

Indicated on display (1...4 = display fields)

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1 2 3 4

- Check charge air pressure regulation.

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21-15

- Road test vehicle.

  - ♦ Wide Open Throttle (WOT) must be reached

- Measurement must be taken at Wide Open Throttle (WOT).

	Display fields			
	1	2	3	4
Display group 115: Charge air pressure regulation				
Display	1 RPM	%	mbar	mbar
Indicated	Engine speed (RPM)	Actual load	Specified pressure	Actual pressure
Specified value			XXX	Must not deviate more than +/- 20 mbar from specified
Note:				

Actual pressure must not deviate from specified pressure by more than ± 20 mbar.

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21-16

- Select measuring value block 117.

- Check function of accelerator pedal in display field 2 by briefly depressing pedal to Wide Open Throttle.

	Display fields			
	1	2	3	4
Display group 117: Charge air pressure regulation				
Display	1 RPM	**%**	%	mbar
Indicated	Engine speed (RPM)	**Accelerator pedal position**	Throttle valve angle	Specified charge air pressure
Specified value		**0...100**		
Note:				

If the specified value 100% is not reached at Wide Open Throttle (WOT):

- Check accelerator pedal.

- Select measuring value block 116.

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- Check correction factors in display fields 2 to 4.

	Display fields			
	1	2	3	4
Display group 116: Charge air pressure regulation				
Display	1 RPM	**%**	%	mbar
Indicated	Engine speed (RPM)	**Correction factor Fuel**	**Correction factor Coolant temp.**	**Correction factor Intake air temp.**
Specified value				
Note:				

If display field 2 indicates a correction factor <0 %, fuel quality is probably incorrect.

- Fill tank with prescribed fuel quality.

If display field 3 indicates a correction factor <0 %, coolant temperature is too high (heat warning lamp lit in instrument cluster) or the Engine Control Module is receiving an incorrect temperature signal from the instrument cluster.

- Check coolant temperature display.

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⇒ *Repair Manual, Electrical Equipment, Repair Group 90*

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21-18

If display field 4 indicates a correction factor <0 %, intake air is too hot or the sensor for intake air temperature is faulty.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

- Select measuring value block 114.

	Display fields			
	1	2	3	4
Display group 114: Charge air pressure regulation				
Display	**%**	**%**	**%**	%
Indicated	**Specified engine load (without correction)**	**Specified engine load (after correction)**	**Actual load**	Duty cycle CAPR-cyclical valve
Specified value	**136,0**	**134,3**	**137,5**	55,2
Note:				

Load values in display fields 1 to 3 can deviate from each other by up to ± 5 %.

If specified values are not achieved in the

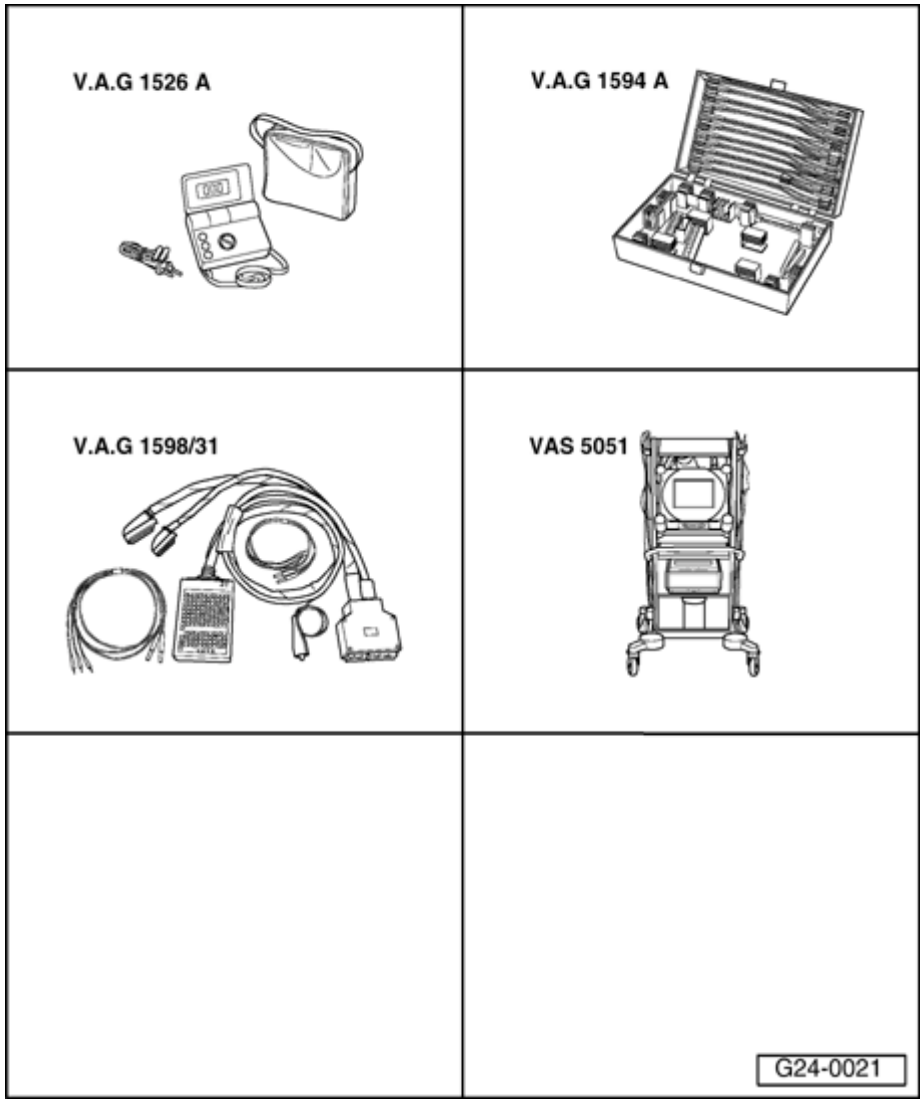
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measuring value blocks:

- Check the charge air pressure sensor -G31-.

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21-19



Recirculating valve for turbocharger - N249-, checking

Special tools and equipment

- VAG 1526A
- VAG 1527B
- VAG 1594A
- VAG 1598/31
- VAS 5051 with VAG 5051/1

- or

- VAG 1551 with VAG 1551/3A

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21-20

Note:

The recirculating valve for turbocharger -N249 and wire connections are monitored by the Engine Control Module (ECM).

- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle for this.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

- Check DTC memory of Engine Control Module (ECM).

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

If a Diagnostic Trouble Code (DTC) relating to the recirculating valve for turbocharger -N249- is displayed:

- Disconnect hoses from valve; harness connector

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remains connected.

- Attach assisting hose to one connection of valve.

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21-21

- Initiate output Diagnostic Test Mode (DTM) and activate recirculating valve for turbocharger -N249-.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

Output diagnostic test mode →

Recr. valve for turbocharger -N249

Indicated on display

Valve must click...

...and must open and close (can be tested by blowing into assisting hose).

If valve does not click:

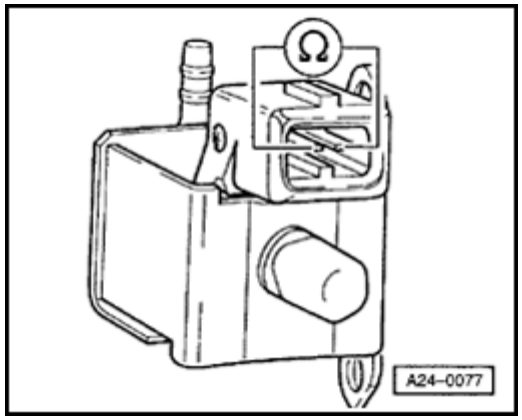
- Check internal resistance of valve.

If valve does not open and close properly:

- Replace recirculating valve for turbocharger -N249-.

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21-22



Checking internal resistance

- Disconnect connector at valve.

- Connect multimeter at valve for resistance measurement.
  - Specified value: 27 ... 30 Ω

If specified value is not obtained:

- Replace recirculating valve for turbocharger -N249-.

If the specified value is met:

- Check voltage supply

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21-23

Checking voltage supply

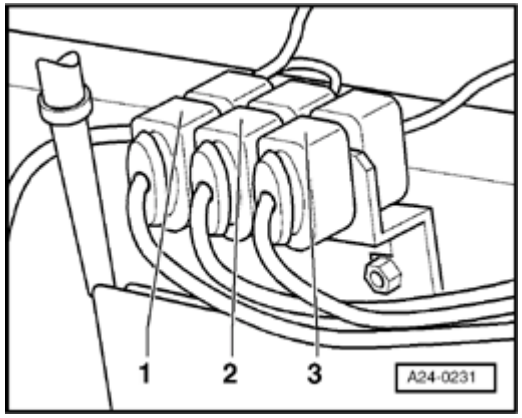
Note:

Voltage is supplied to the recirculation valve via the Fuel Pump (FP) relay.

Test requirement:

- Fuse for recirculation valve OK

- Disconnect connector at valve.



- Connect VAG1527B voltage tester as follows:

Harness connector terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly.
  - LED must light.

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If LED does not light:

- Check wire connection from terminal 1 to Fuel Pump (FP) relay via fuse for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Repair open circuit if necessary.

If wire connection is OK:

- Check Fuel Pump (FP) relay.

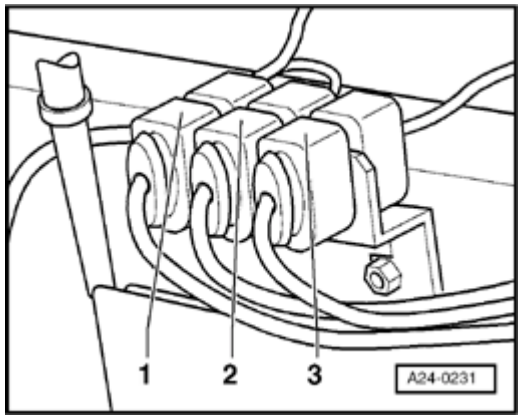
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

If LED lights:

- Check activation, ⇒ Page 21-25 .

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21-25



Checking activation

- Connect VAG 1527B voltage tester to connector terminals 1 (B+) and 2.
- Initiate output Diagnostic Test Mode (DTM) and activate recirculating valve for turbocharger -N249-.

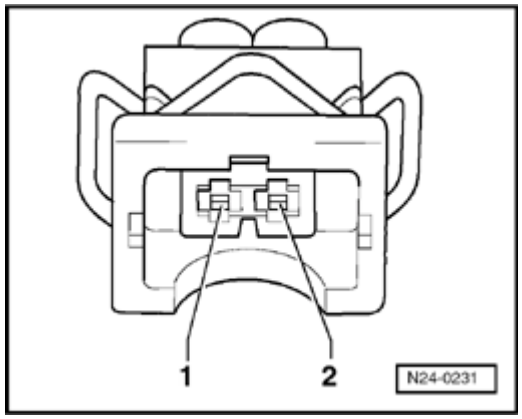
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

- ♦ LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect VAG 1598/31 test box at wiring harness to ECM. Do not connect ECM.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 test box Bushing
2	9

- Repair open circuit or short circuit if necessary.

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21-26

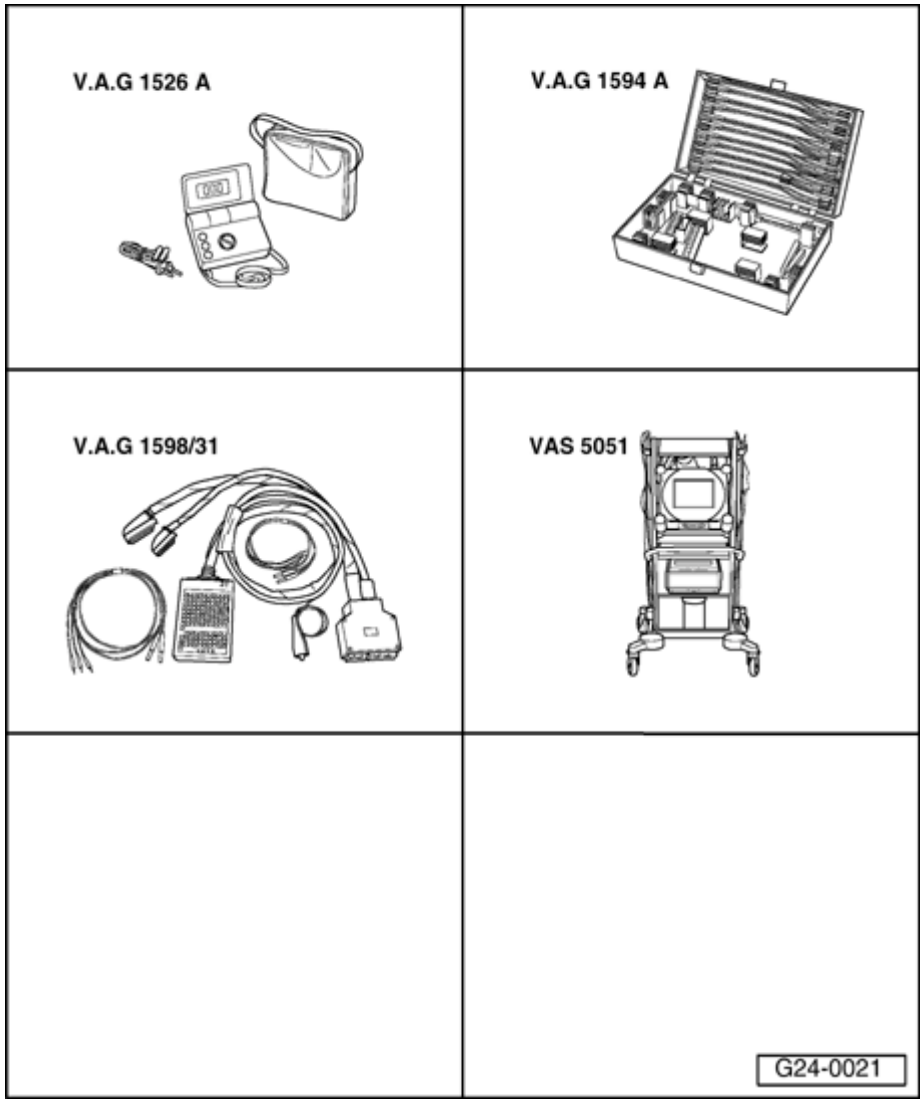
If wire connection is OK:

- Replace Engine Control Module (ECM).

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

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21-27



Charge air pressure sensor -G31-, checking

Special tools and equipment

- VAG 1526A
- VAG 1594A
- VAG 598/31
- VAS 5051 with VAG 5051/1

- or

- VAG 1551 with VAG 1551/3A

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21-28

Note:

The charge air pressure sensor -G31- and wire connections are monitored by the Engine Control Module (ECM).

- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

- Check DTC memory of Engine Control Module (ECM).

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

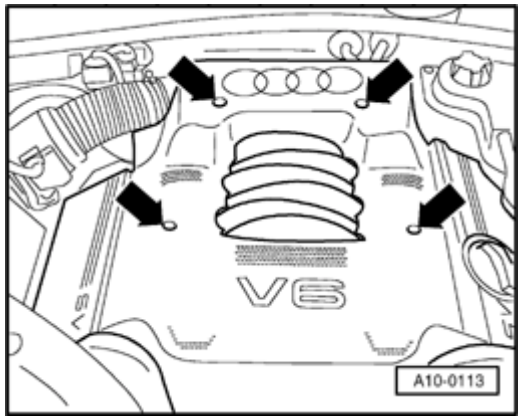
If a Diagnostic Trouble Code (DTC) relating to the charge air pressure sensor -G31- is indicated:

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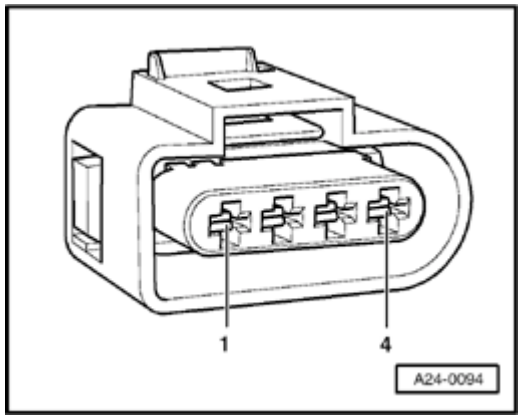
21-29

Checking voltage supply

- Switch ignition off.



- Remove engine cover (arrows).
- Disconnect connector at charge air pressure sensor.



- Connect multimeter between terminal 1 and 3 of harness connector for voltage measurement.
- Switch ignition on.
  - Specification: about 5 V

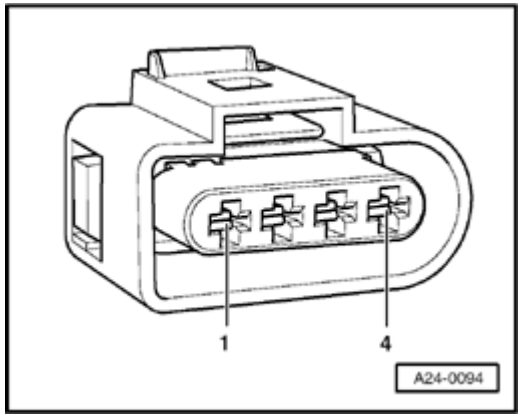
If specified value is not obtained:

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21-30

- Connect VAG 1598/31 test box to wiring harness for Engine Control Module (ECM), also connect ECM -1-.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 or test box Bushing
1	108
3	98

- Repair open circuit or short circuit if necessary.

If the specified value is met:

- Check signal wire, ⇒ Page 21-31 .

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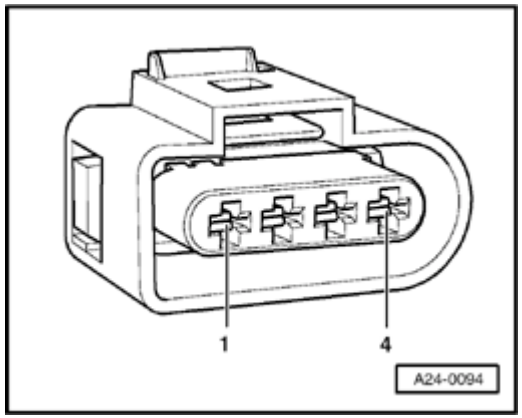
21-31

Checking signal wire

- Disconnect harness connector at charge air pressure sensor.
- Connect multimeter to socket 101 and socket 108 of test box for voltage measurement.
- Start engine and run at idle.
  - Specification: about 1.90 V
- Bring engine to RPM by depressing pedal suddenly.
  - Specification: approx. 2.00 ... 3.00 V

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21-32



If specified values are not obtained:

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 or test box Bushing
4	101

- Repair open circuit or short circuit if necessary.

If wire connection is OK:

- Replace charge air pressure sensor -G31-.

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26-1

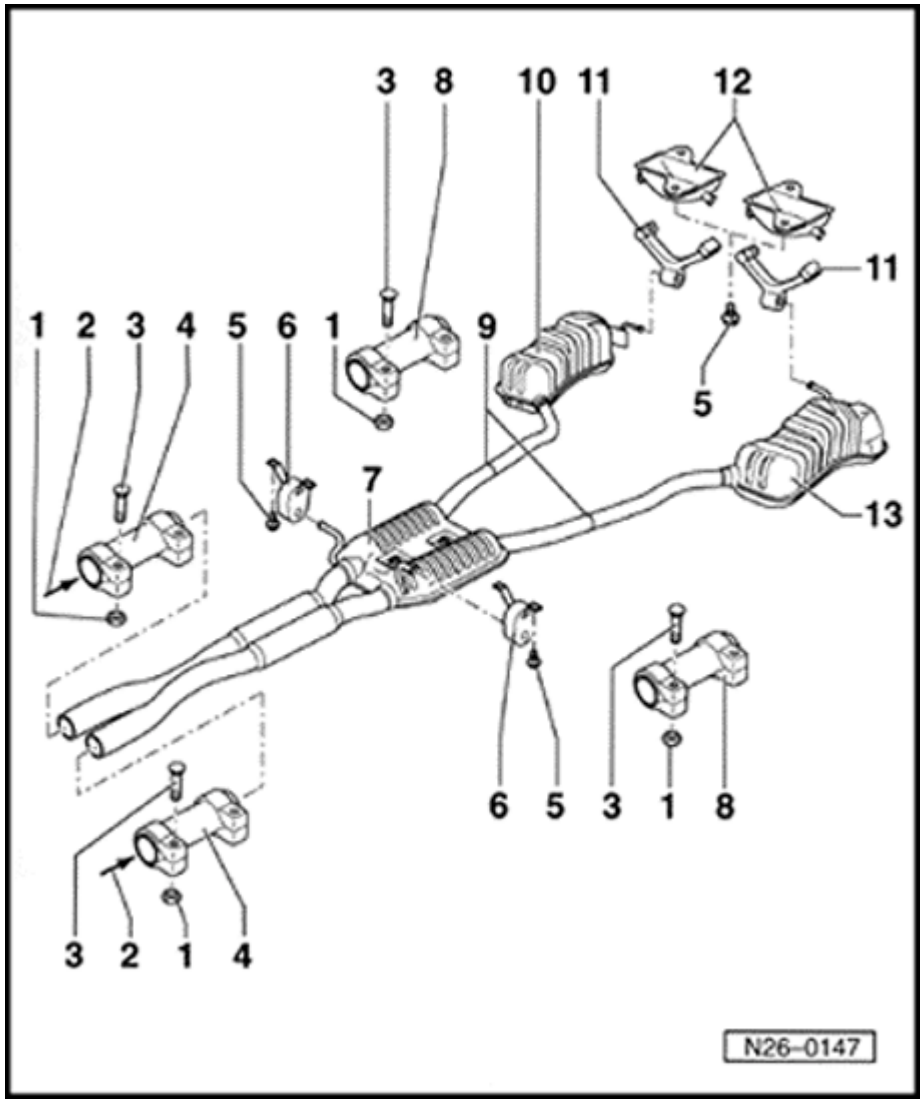
Exhaust system components, removing and installing

Notes:

- *Removing and installing exhaust manifold ⇒ Page 26-17*
- *After working on the exhaust system ensure that the system is not under stress, and that it has sufficient clearance from the bodywork. If necessary, loosen double and single clamps and align muffler and exhaust pipe so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.*
- *Aligning exhaust system free of stress ⇒ Page 26-11*
- *Replace self-locking nuts.*

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26-2



Mufflers with mountings, removing and installing

1 - 40 Nm

2 - From catalytic converter

3 - Flat-head bolt

4 - Double clamp

5 - 25 Nm

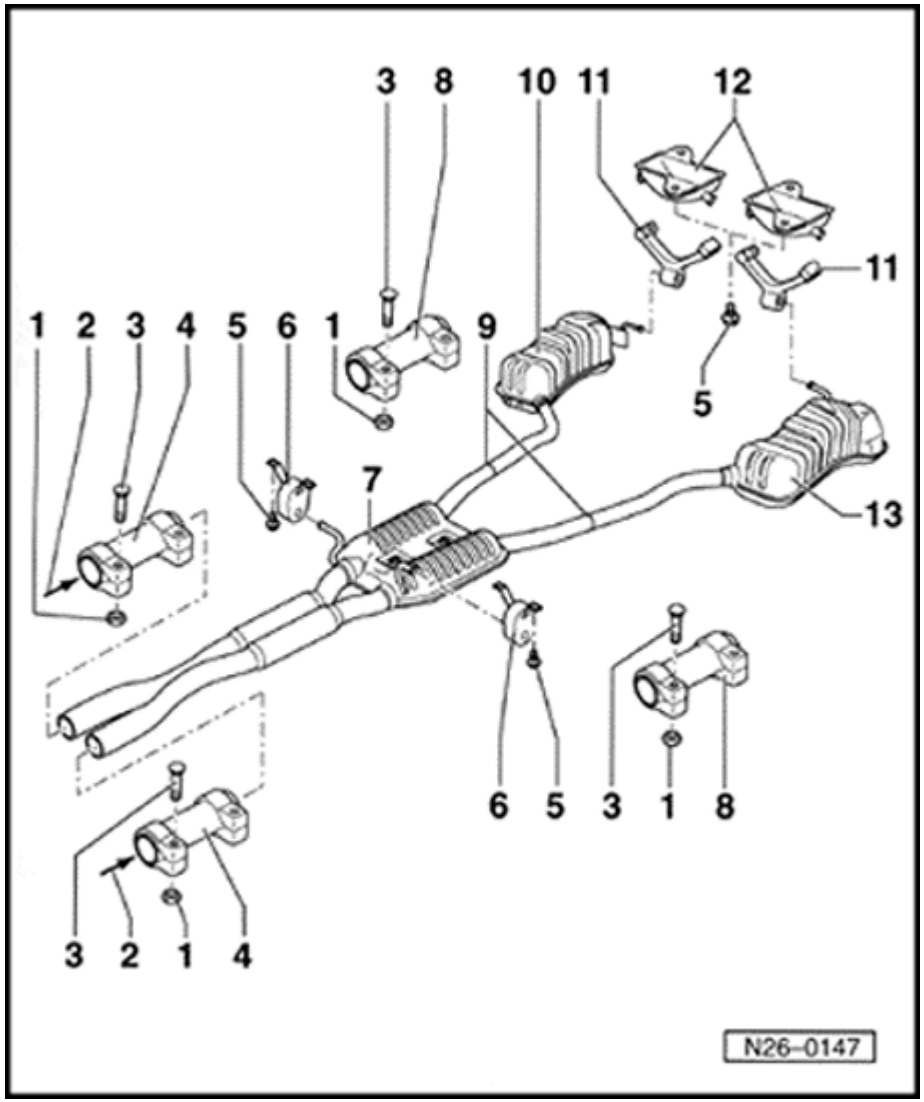
6 - Mounting

- With retaining ring

7 - Front muffler

8 - Double clamp (for repairs)

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9 - Separating point

- Front and rear mufflers are installed as one component when vehicle is built. For repairs, front muffler and rear muffler can be replaced separately and connected with a double clamp.
- Cutting through connecting pipe ⇒Fig. ⇒ 1

10 - Rear muffler (right)

11 - Mounting

12 - Bracket

13 - Rear muffler (left)

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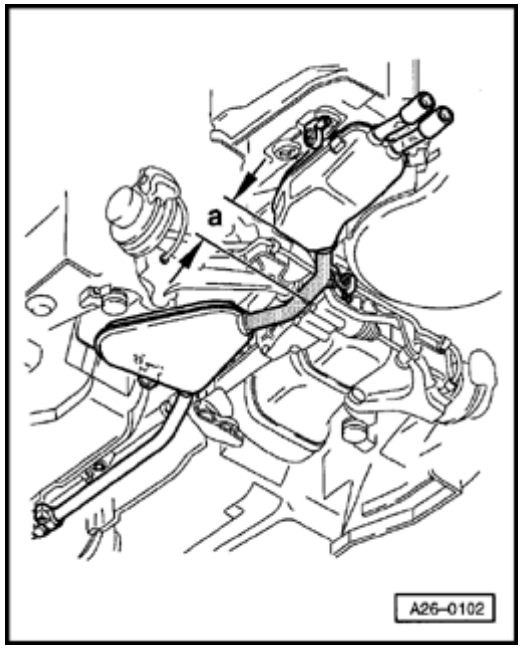


Fig. 1 Separating point between center muffler and rear muffler

Note:

- *A separating point has been provided for replacement of the center muffler or rear muffler in the event that repair work is necessary.*
- *A double clamp is used to attach the center and rear mufflers.*

- Separate connecting pipe between center muffler and rear muffler where indicated by groove.

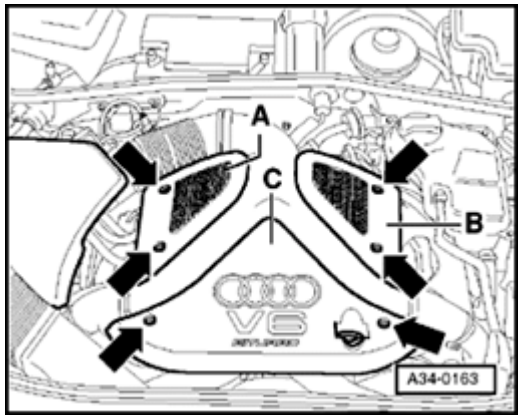
  Dimension - a - approx.160 - 170 mm.

- Adjust exhaust system ⇒ Page 26-11 .

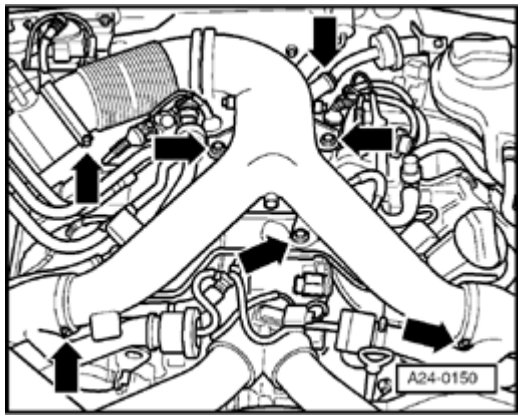
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Catalytic converter, removing and installing

Removing



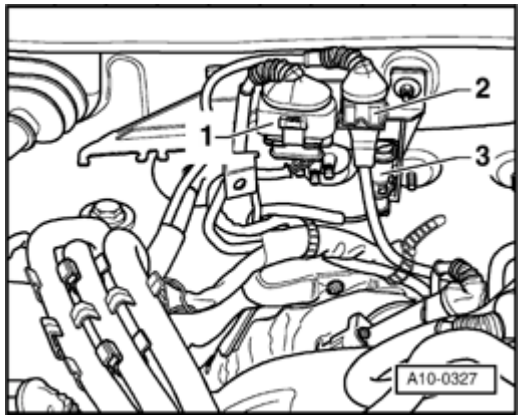
- Remove bolts -arrows- and take off engine cover panels -A ... C-.



- Remove air distributor component -arrows-.

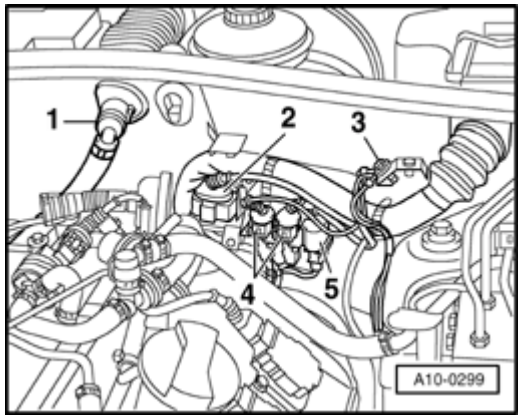
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Right-hand catalytic converter:



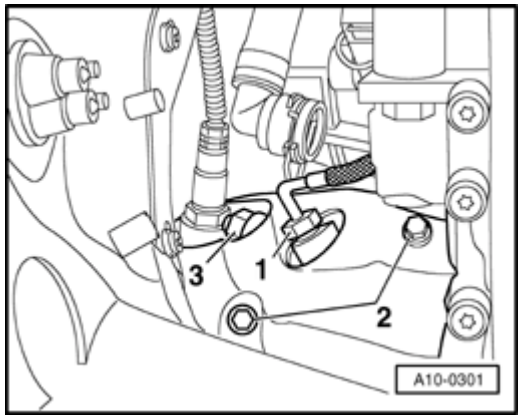
- Disconnect connector -1- for oxygen sensor at bulkhead.

Left-hand catalytic converter:

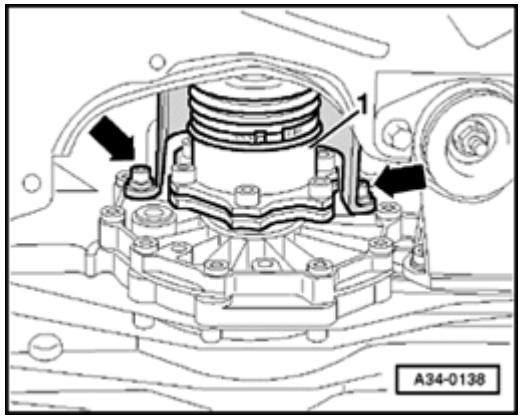


- Disconnect connector -2- for oxygen sensor at bulkhead.

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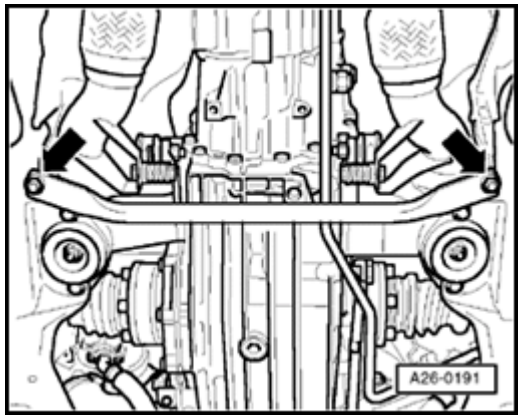


- Unbolt heat shield -2- on turbocharger.
- Remove upper bolt -3- securing front exhaust pipe to turbocharger.

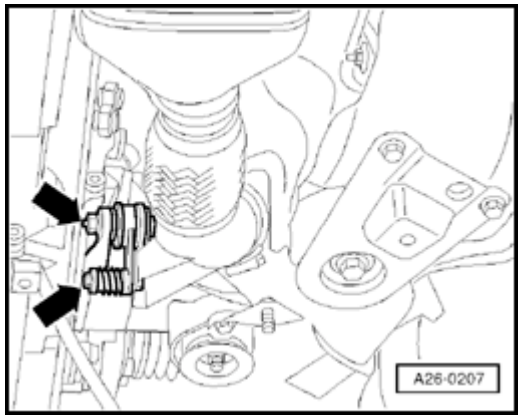


- Unbolt guard plate -arrows- above drive shaft from transmission.
- Unbolt drive shaft -1- at transmission and tie up.

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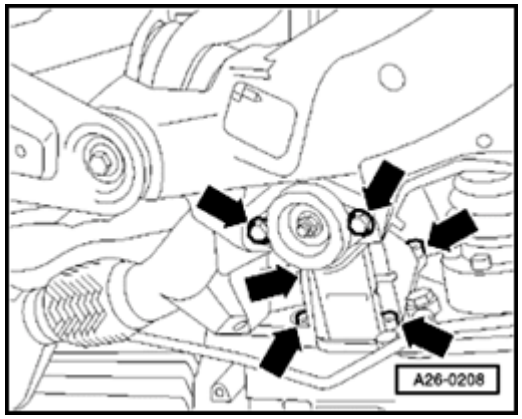


- Remove cross strut -arrows-.

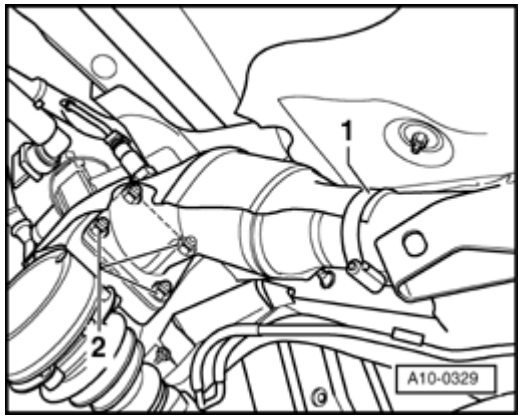


- Remove retainers -arrows-.

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- Remove transmission support -arrows-.
- Loosen exhaust system clamp and push clamp towards muffler.



- Loosen hose clamp -1- on turbocharger heat shield.
- Unbolt exhaust pipe -2- from turbocharger.

Note:

Avoid excessive bending of the flexible pipe connection (de-coupling element) on the front exhaust pipe. The angle between the catalytic converter and the front exhaust pipe must not exceed 10° , otherwise the flexible connection will be damaged.

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Installing

- Install in reverse order.

Note:

The double clamp must be replaced after removeing the bolted connection.

- Adjust exhaust system ⇒ Page 26-11 .

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Exhaust system, aligning free of stress

Align the exhaust system as follows to avoid stresses in the system and prevent the transmission of noise into the body:

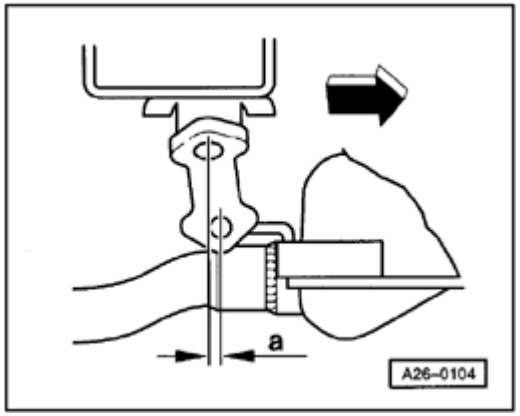
Notes:

- *Before assembling the exhaust system, the front exhaust pipes and the catalytic converters must be aligned accurately and secured.*
- *Loosen all bolted connections on the exhaust system (except exhaust manifold and flange mountings, catalytic converter/intermediate pipe).*
- *The exhaust system must be aligned when it is cold.*
- *Keep to the sequence described below.*
- *The dimensions in the illustrations are approximate.*

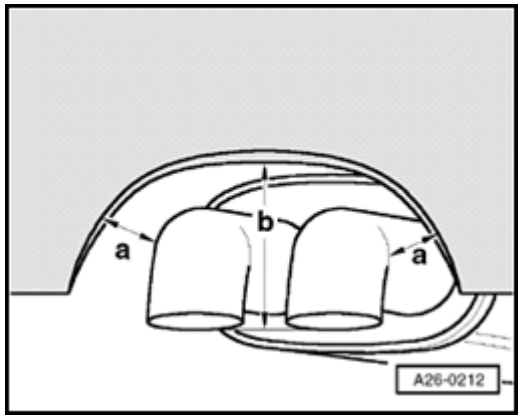
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Vehicles without clamp between center and rear muffler

- Loosen screws of front clamp between catalytic converter and center muffler.



- Push exhaust system far enough forward (arrow) so that pre-tension at retaining loop at rear right of rear muffler is -a- = 9 ... 11 mm.
- Tighten screws of front clamp between catalytic converter and main muffler evenly to 40 Nm, installation position ⇒ Page 26-15 .
- Tailpipes, aligning



- Align tailpipes so that distance -a- (left side) is equal to distance -a- (right side).

Dimension -b- between bumper cutout and lower edge of tailpipes must also equal specification.

- Dimension b = 97 ... 103 mm

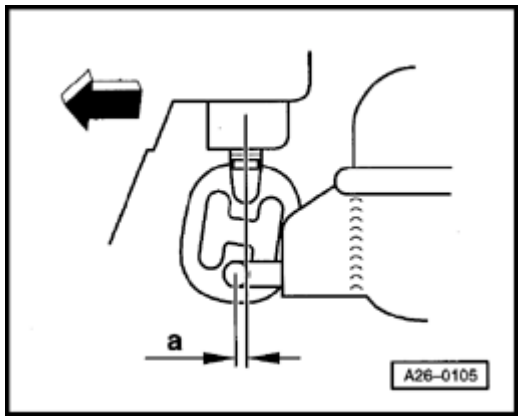
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Vehicles with clamp between front muffler and rear muffler

Note:

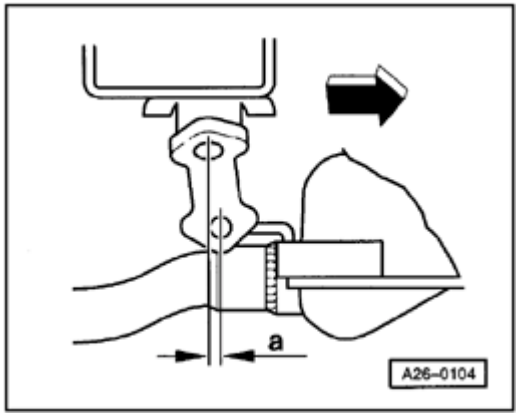
It is only necessary to additionally align the front muffler on vehicles with clamp fitted between front muffler and rear muffler.

- Loosen bolted connections on front clamps between catalytic converters and front muffler.



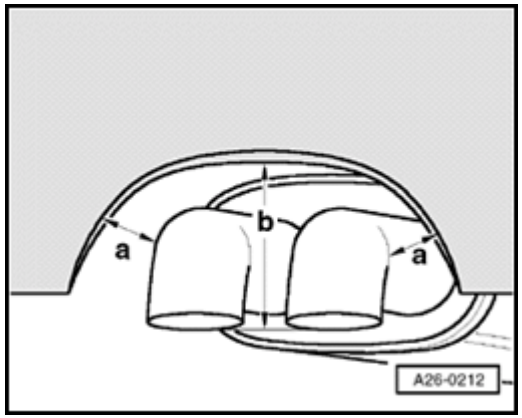
- Push exhaust system towards front of vehicle -arrow- so that rear left mounting on front muffler is pre-loaded by a = 7 - 9 mm.
- Tighten bolts on front clamps between catalytic converters and front muffler evenly to 40 Nm; installation position ⇒ Page 26-15 .

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- Push rear muffler toward front of vehicle -arrow- so that rear right mounting on rear muffler is pre-loaded by a = 9 ... 11 mm.
- Tighten bolted connections on rear clamp between front muffler and rear muffler evenly to 40 Nm; installation position ⇒ Page 26-15 .

Aligning tailpipes

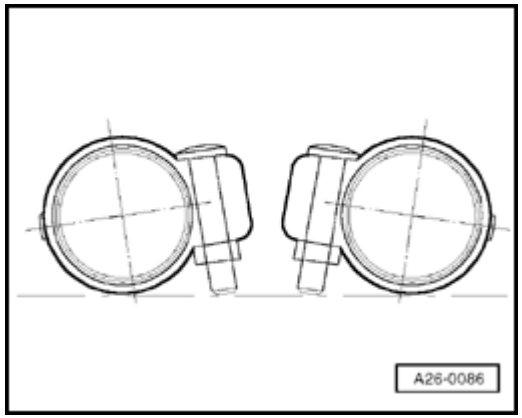


- Align tailpipes so that distance -a- is same on both sides.
- At same time, set distance -b- between bumper cut-out and bottom of tailpipes:
  - Distance b = 97 ... 103 mm

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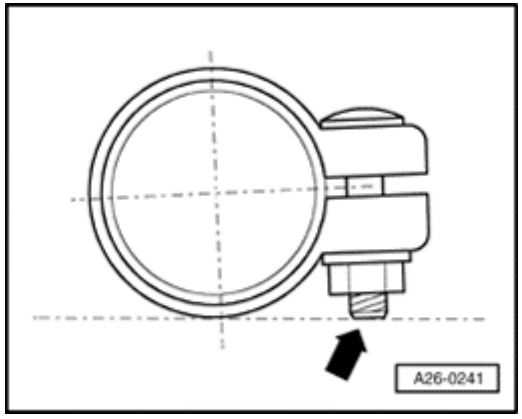
26-15

Installation position of double clamp at front



- The ends of the bolts must not project below the bottom of the clamp.

Installation position of double clamp at rear



- The ends of the bolts must not project below the bottom of the clamp.

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Exhaust system, checking for leaks

- Start engine and run at idling speed.

- Plug tailpipe (e. g. with rag or stopper) and leave plugged until check is complete.

- Listen for noise at connection points (cylinder head/manifold, manifold/turbocharger, turbocharger/catalytic converter, etc.) to locate leaks.

- Correct any leaks that are found.

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Exhaust manifold, removing and installing

Removing

- Remove engine ⇒ Page 10-1 .
- Remove turbocharger ⇒ Page 21-1
- Unbolt exhaust manifold.

Installing

Notes:

- *Replace self-locking nuts.*
- *Replace gaskets.*

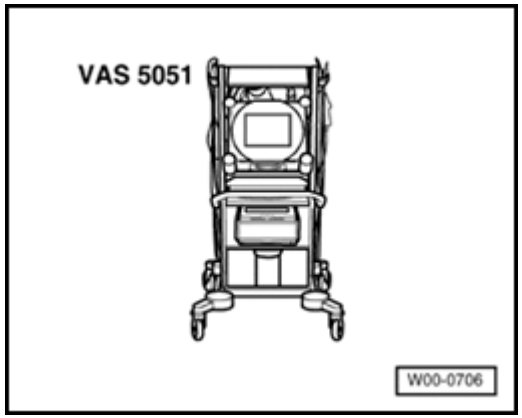
- Install in reverse sequence.

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Tightening torques

Bolted mountings	Tightening torques
Exhaust pipe between exhaust manifold and turbocharger	25 Nm
Exhaust pipe with catalytic converter to turbocharger	25 Nm
Exhaust manifold to cylinder head	25 Nm
Exhaust pipe to transmission	25 Nm
Catalytic converter to front muffler	25 Nm
Heat shield to turbocharger	10 Nm

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Exhaust gas temperature sensor, checking for function

Special tools and equipment

- VAS 5051 with VAG 5051/1

or

- VAG 1551 with VAG 1551/3A

Test requirement:

- Coolant Temperature at least 80 ° C.

WARNING!

- ***During a road test in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.***
- ***When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.***

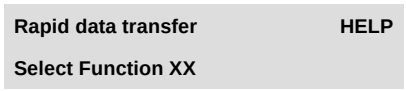
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26-20

Test sequence

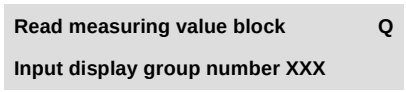
- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle for this.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*



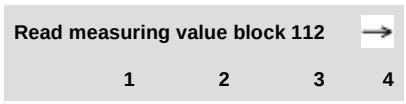
When indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" and press -Q- button to confirm input.



When indicated on display

- Press buttons -1-, -1- and -2- to select "display group number 112" and press -Q- button to confirm input.



Indicated on display (1...4 = display fields)

- Check exhaust gas temperature.

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- Road test vehicle.

  - ♦ Wide Open Throttle (WOT) at engine speeds between 5000...6500 RPM must be reached.

Note:

Exhaust gas temperature must rise to above 980 °C so that regulation sets in. Values below 945 °C are displayed as 945 °C.

	Display fields			
	1	2	3	4
Display group 112: Exhaust temperature				
Display	°C	%	°C	%
Indicated	Exhaust temperature, Bank 1	Enrichment factor, Sensor, Bank 1	Exhaust temperature, Bank 2	Enrichment factor, Sensor, Bank 2
Specified value	980 1)	90 ± 5 2)	980	90 ± 5
Note:	Regulation does not begin until temperatures above 980 °C	If the enrichment factor is above 30%, there is a malfunction	Regulation does not begin until temperatures above 945 °C	If the enrichment factor is above 30%, there is a malfunction

1) During oscillation stage, values around 1025 °C may be displayed briefly.

2) During oscillation stage, values of 25 % may be displayed briefly.

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26-22

If values above 20 % are displayed constantly, then

- fuel pressure may be too low,
- mass air flow sensor signal may be too small.

- Select measuring value block 220.



Indicated on display (1...4 = display fields)

- Check exhaust temperature regulation.

	Display fields			
	1	2	3	4
Display group 220: Exhaust gas temperature regulation				
Display	1 RPM	%	%	Text
Indicated	Engine speed (RPM)	Load	Duty cycle, Sensor, Bank 1	Operating condition, Bank 1
Specified value	> 5000	> 100	42 ± 10	Regulation on
Note:	Increase engine speed and load enough that regulation jumps to "on"			

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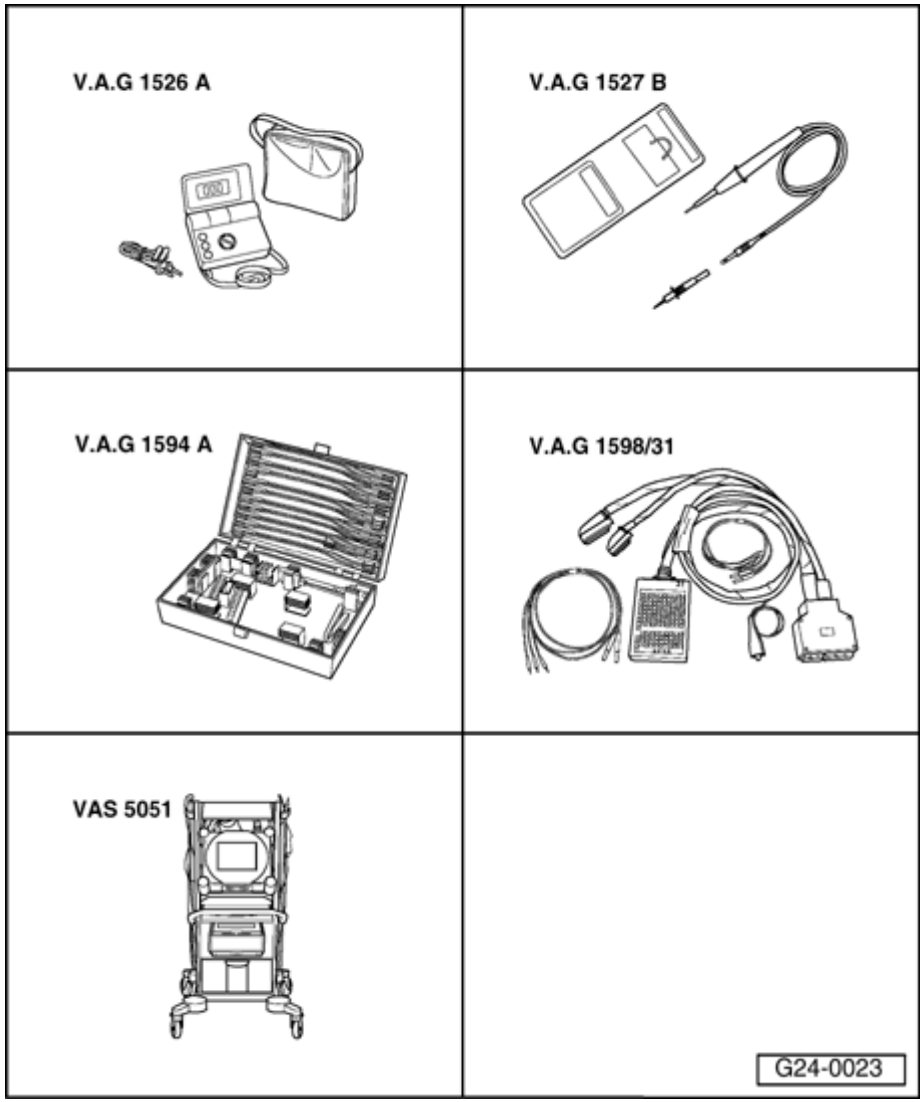
- Repeat test for bank 2 ⇒measuring value block 221

If specified values are not obtained and there is a malfunction stored in the Diagnostic Trouble Code (DTC) memory:

- Check exhaust gas temperature sensor, ⇒ Page 26-24 .

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26-24



Exhaust gas temperature sensor, checking

Special tools and equipment

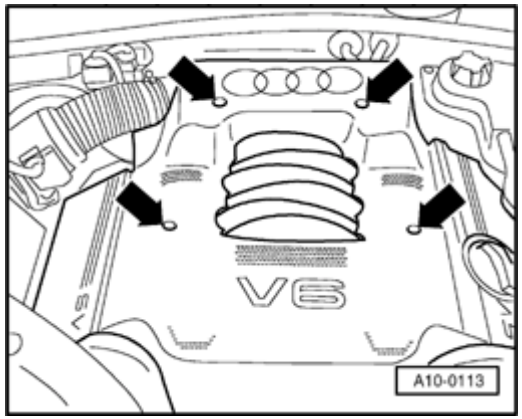
- VAG 1526A
- VAG 1527B
- VAG 1594A
- VAG 1598/31

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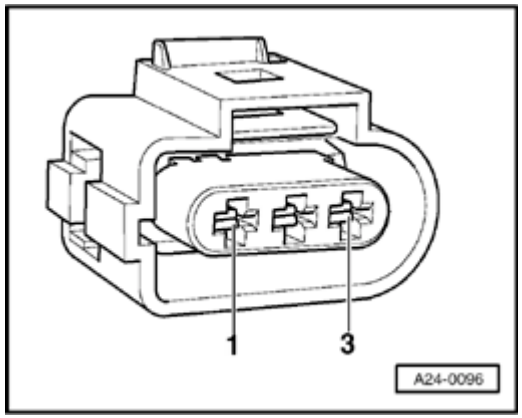
26-25

Checking voltage supply

- Switch ignition off.



- Remove engine cover (arrows).
- Disconnect connector at exhaust gas temperature sensor.



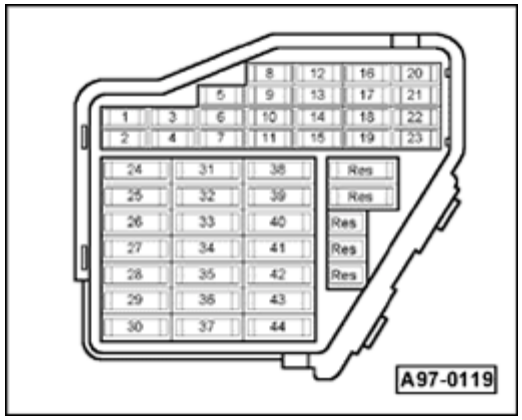
- Connect VAG 1527B voltage tester as follows:

Harness connector terminal	Measure to
3	Engine Ground (GND)

- Operate starter briefly.
  - ♦ LED must light.

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26-26



If LED does not light:

- Perform following tests marked with dots:

- Check fuse -S234- (in fuse holder, position 34).
- Check wire connection from exhaust gas temperature sensor via fuse -S234- (in fuse holder, socket 34) to Fuel Pump (FP) relay for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check Fuel Pump (FP) relay.

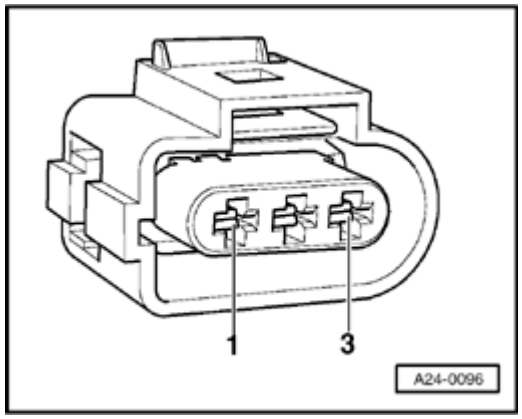
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

- Connect VAG 1598/31 test box at wiring harness to ECM. Do not connect ECM.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

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26-27



- Check following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 test box Bushing
1 (Bank 1)	61
1 (Bank 2)	20
2	50

If wire connection is OK:

- Replace exhaust gas temperature sensor.

If the same malfunction occurs again after replacing the exhaust gas temperature sensor:

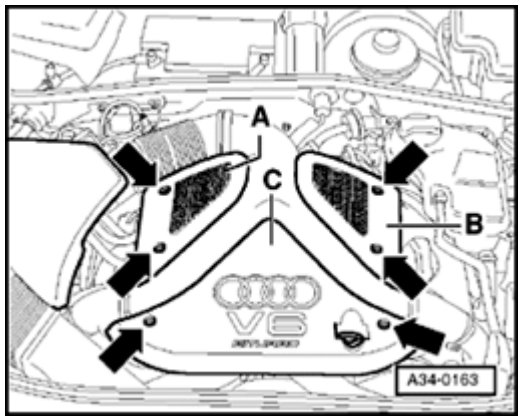
- Replace Engine Control Module (ECM).

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

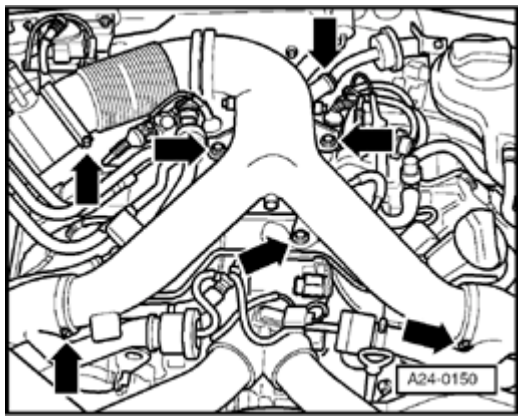
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26-28

Exhaust gas temperature sensor, removing and installing



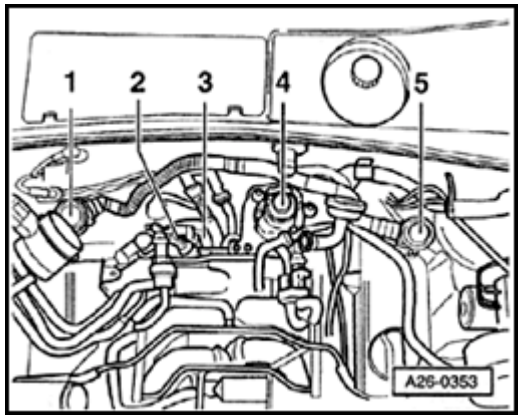
- Remove bolts (arrows) and remove engine covers -A- and -B-.



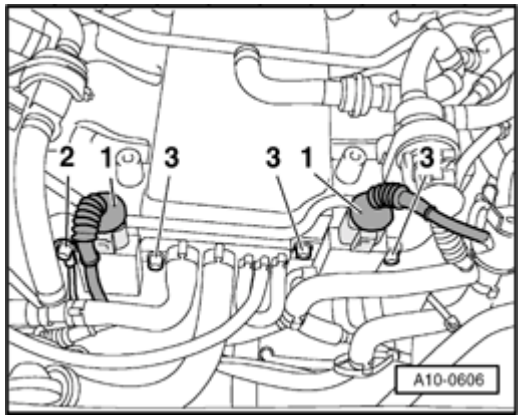
- Remove air distributor (arrows).

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26-29



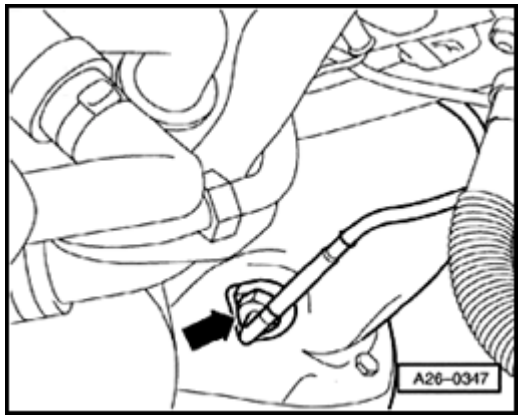
- Disconnect both connectors -2- from control modules for exhaust gas temperature.
- Remove control module from intake manifold and set wires aside.



For vehicles with manual transmission, the control modules for exhaust gas temperature are at rear of intake manifold, on left and right.

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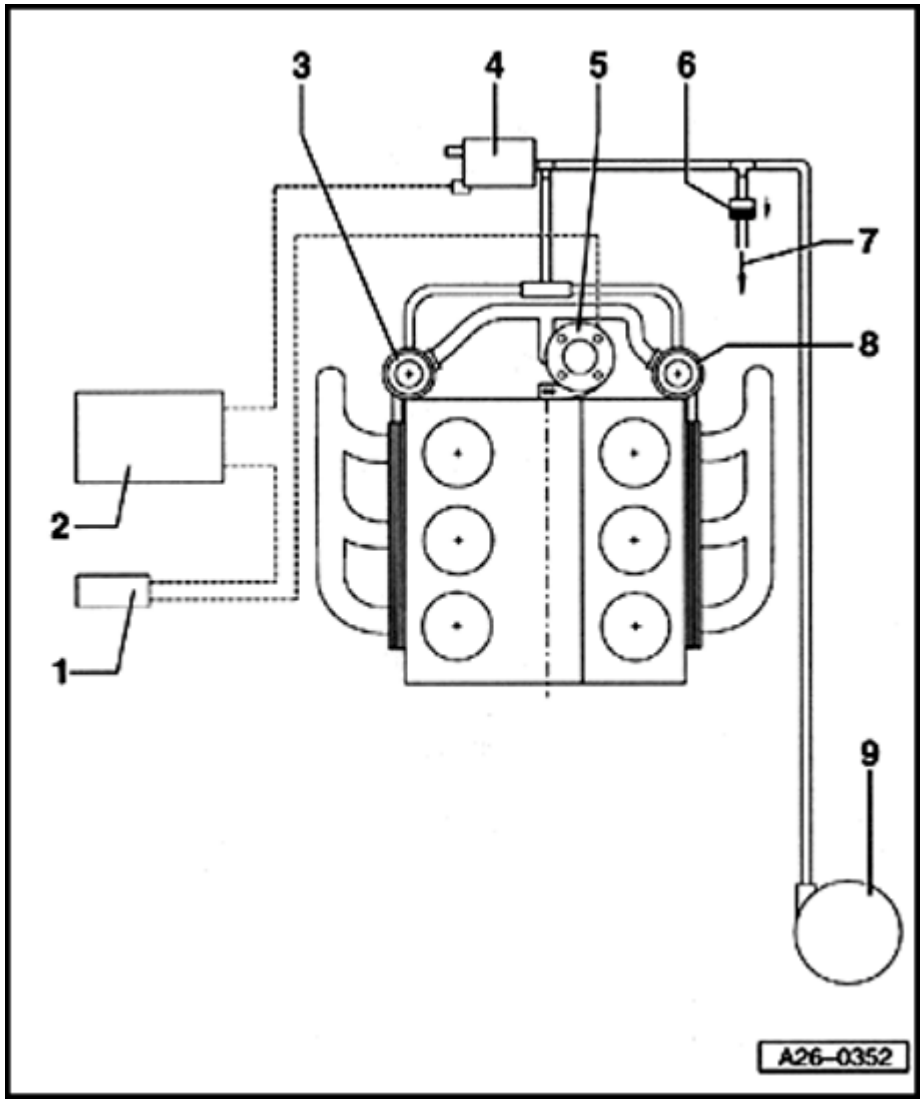
26-30



- Remove exhaust gas temperature sensor from exhaust manifold.

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26-31



Secondary air system

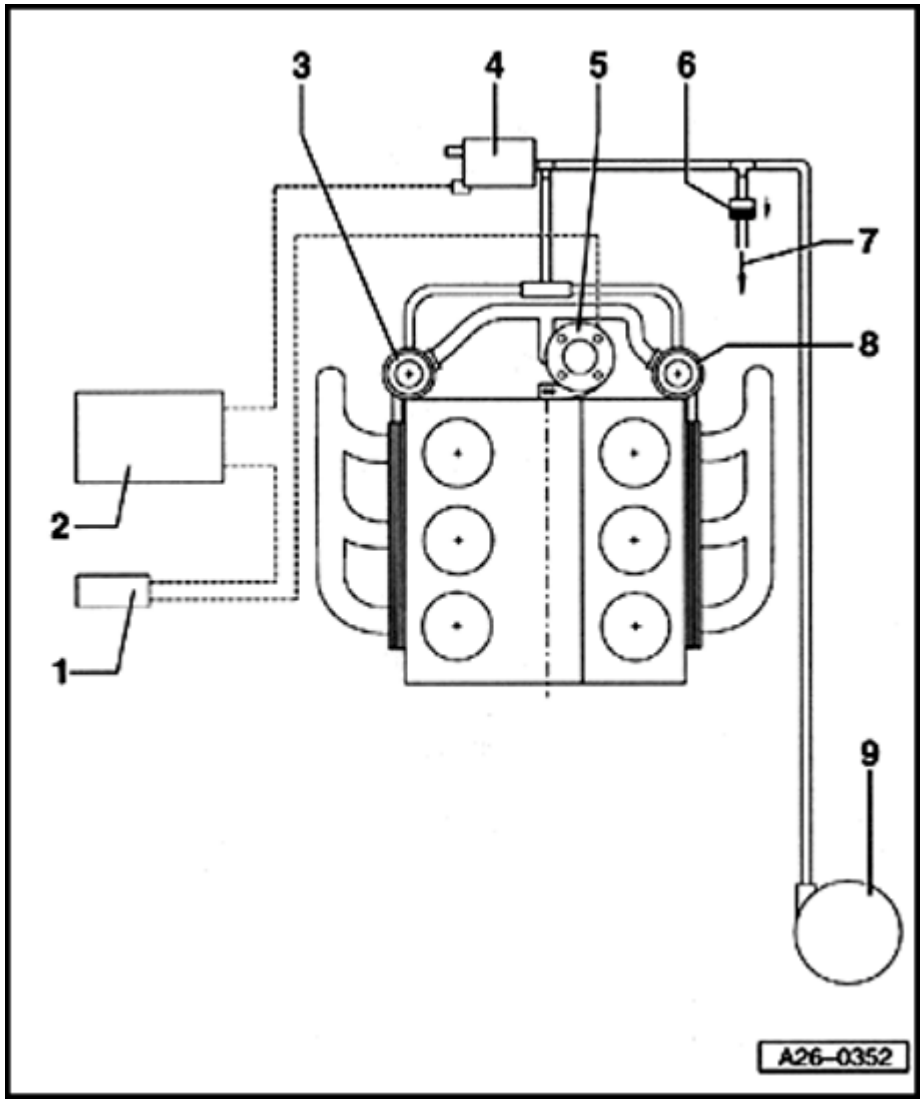
The secondary air system results in quicker heating and therefore earlier operating readiness of the catalytic converter following cold start.

Principle

Due to over-enrichment of the mixture during the cold start phase, there is an increased amount of un-combusted carbon monoxide in the exhaust. Secondary Air Injection (AIR) improves secondary oxidation in the catalytic converter and therefore reduces emissions. The heat produced by secondary oxidation greatly reduces start-up time for the catalytic converter, therefore improving exhaust quality during the cold start phase significantly.

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26-32



Function:

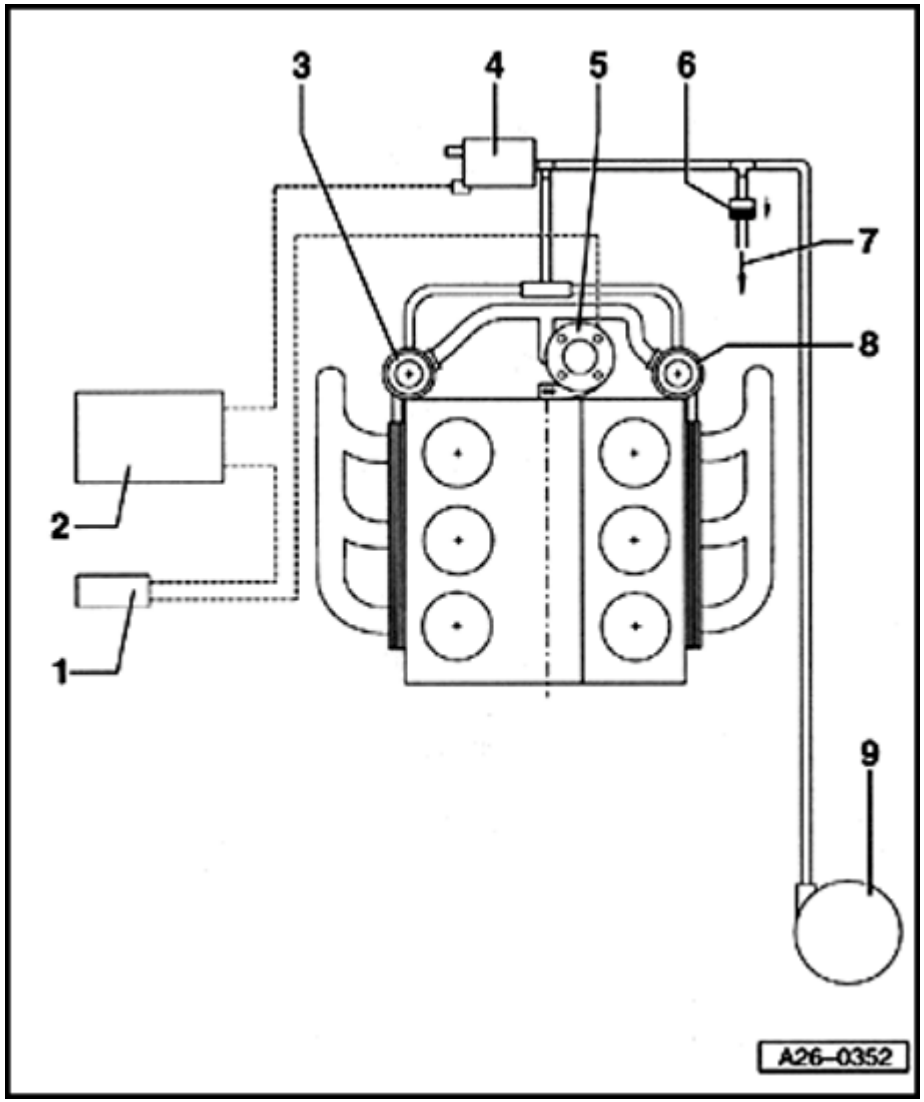
- In the cold start phase, the ECM -4- activates the secondary air pump -2- via the relay for secondary air pump -3-. Air reaches the combination valves for Secondary Air Injection (AIR) -5- and -9-.
- The Secondary Air Injection (AIR) valve -6- is activated in parallel, which allows the vacuum to reach the combination valves for Secondary Air Injection (AIR) -5- and -9-. The appropriate combination valve for Secondary Air Injection (AIR) thereby opens the path for secondary air to the exhaust channels of the cylinder head.

1 - Secondary Air Injection (AIR) pump relay - J299-

- Removing and installing ⇒ Page 26-37
- checking ⇒ Page 26-45

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26-33



2 - Motronic Engine Control Module (ECM) - J220-

3 - Combination valve for secondary air injection (AIR)

4 - Secondary Air Injection (AIR) solenoid valve -N112-

- Installation position ⇒ Fig. ⇒ 1

5 - Secondary Air Injection (AIR) pump motor -V101-

- Installation position ⇒ Fig. ⇒ 2

6 - Check valve

- Installation position (light/dark side): Arrow points in direction of flow, as shown in figure.

7 - To Intake manifold

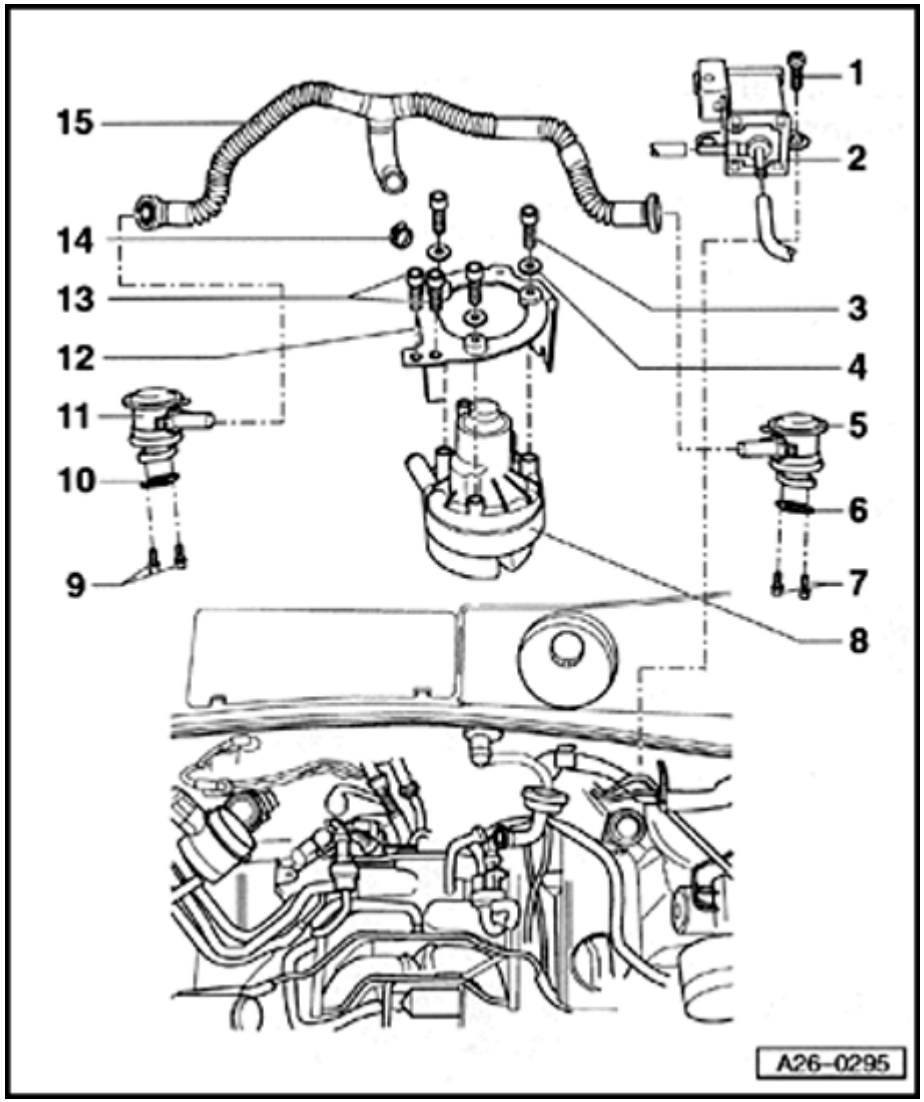
8 - Combination valve for secondary air injection (AIR)

9 - Vacuum reservoir

- Installation location: Under wheel housing liner in wheel housing

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26-34



Secondary Air Injection (AIR) system components, removing and installing

The components for the Secondary Air Injection (AIR) system are located under the air distributor between the intake manifold and the plenum chamber.

1 - 6 Nm

2 - Secondary Air Injection (AIR) solenoid valve -N112-

3 - 10 Nm

4 - Large shim washer

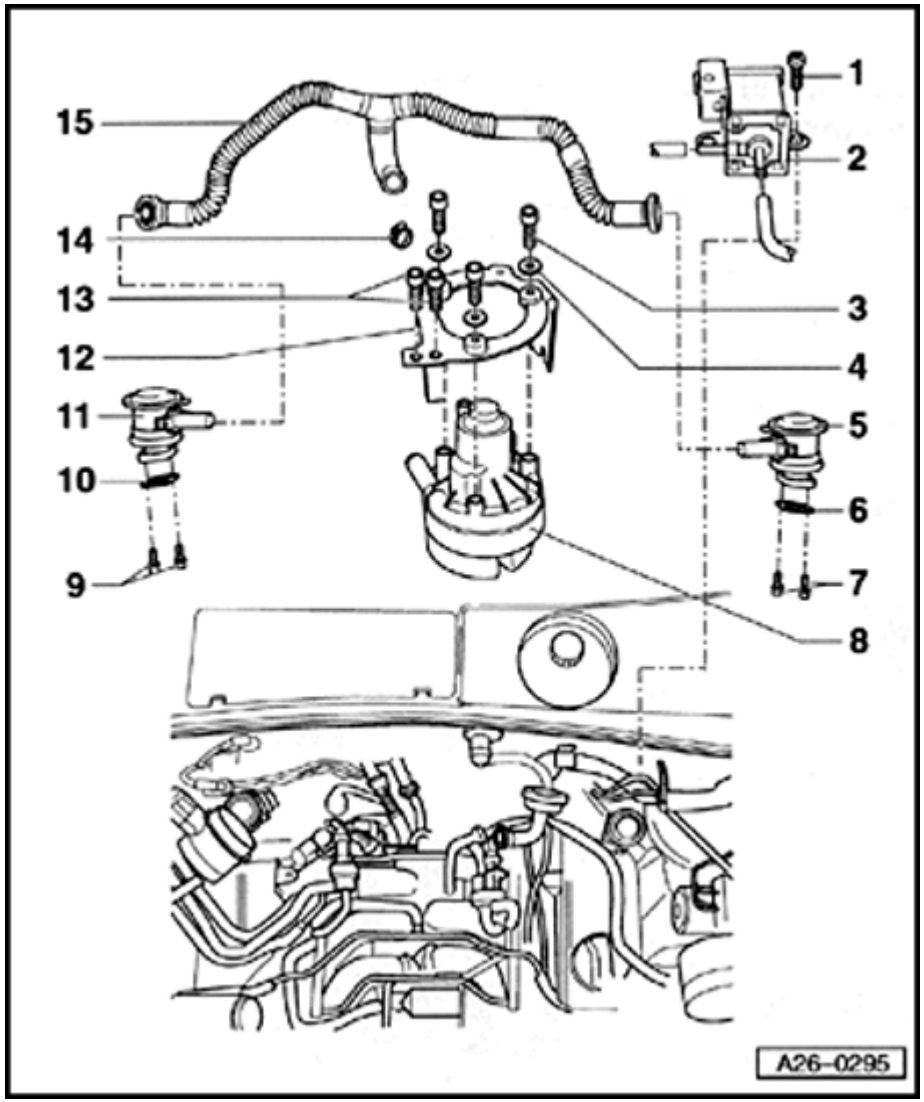
- For all 3 rubber bonded bushings at bracket for Secondary Air Injection (AIR) pump

5 - Combination valve, left

6 - Seal

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26-35



7 - 10 Nm

8 - Secondary Air Injection (AIR) pump with air filter attached

9 - 10 Nm

10 - Seal

11 - Combination valve, right

12 - Bracket for Secondary Air Injection (AIR) pump

- Bolted to rear intake manifold.

13 - 10 Nm

14 - Screw clamp

15 - Connection tube

- Between Secondary Air Injection (AIR) pump and combination valves

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26-36

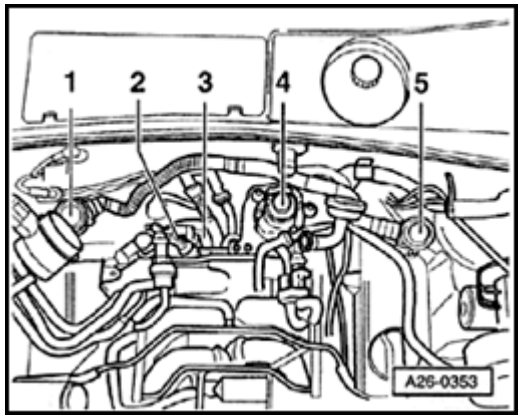


Fig. 1 Installation location of Secondary Air Injection (AIR) solenoid valve -N112-

- Bolted to rear intake manifold at bracket below control modules together with the connector for exhaust gas temperature (to the right of the AIR motor) -3-.

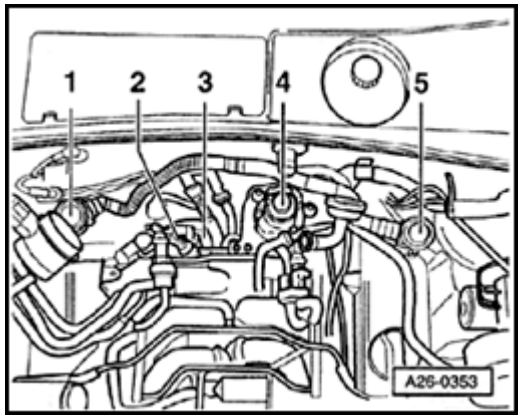


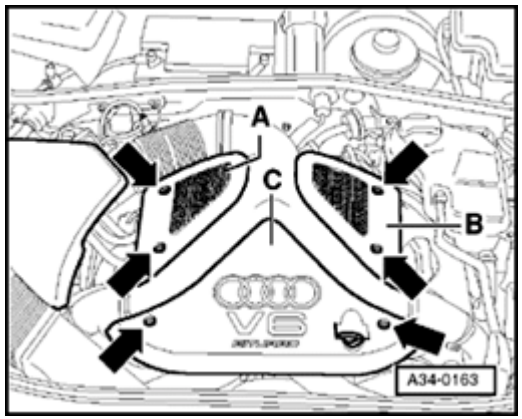
Fig. 2 Installation position of Secondary Air Injection (AIR) pump motor -V101-

- At intake manifold, rear left -4-.

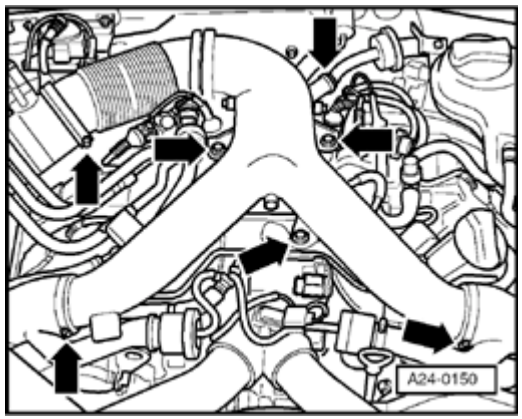
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26-37

Secondary Air Injection (AIR) solenoid valve -N112-, removing and installing



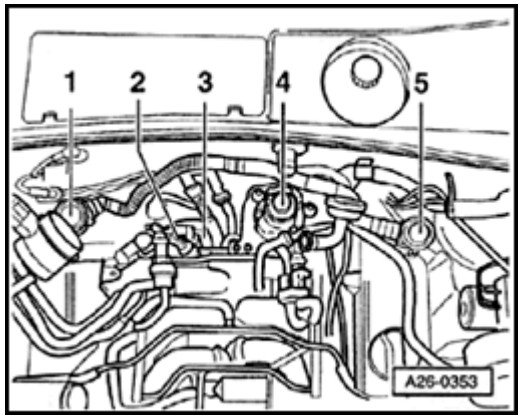
- Remove bolts (arrows) and remove engine covers -A- and -B-.



- Remove air distributor (arrows).

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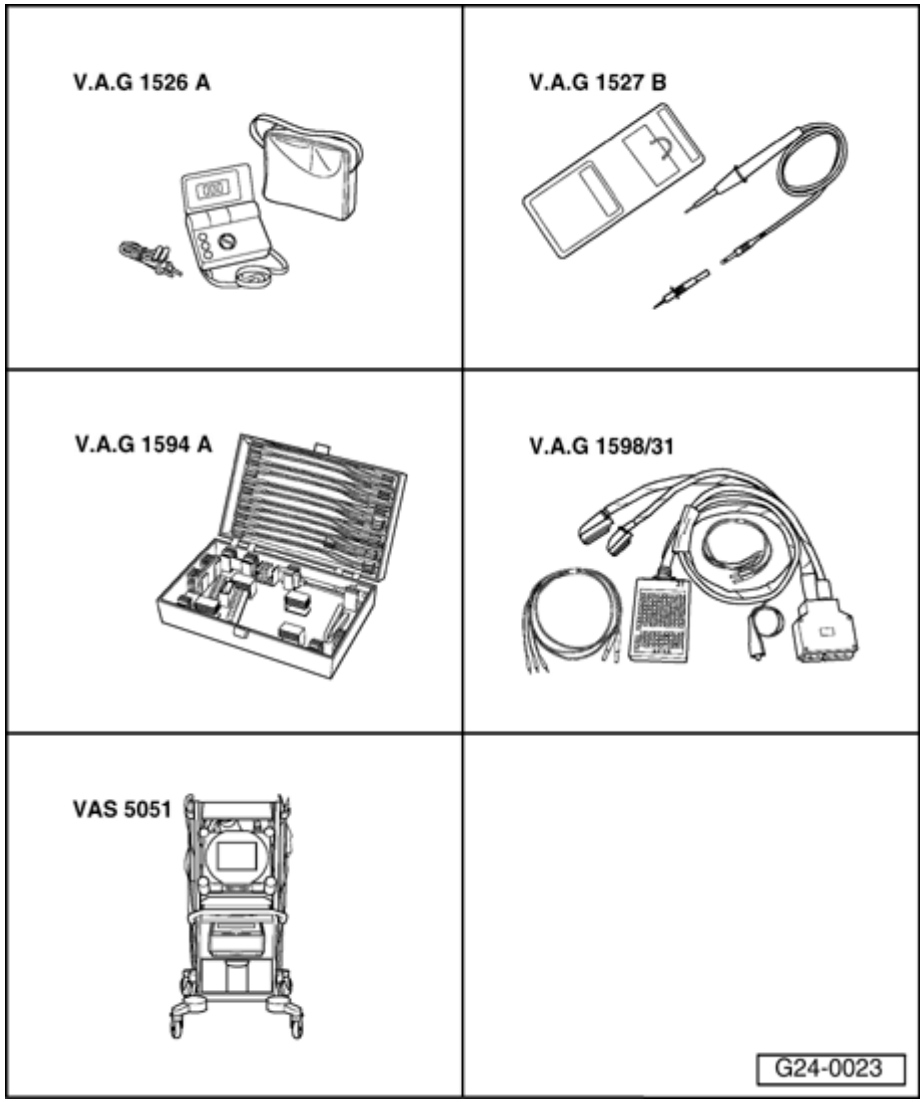
26-38



- Disconnect both connectors -2- from control modules for exhaust gas temperature.
- Remove control modules from intake manifold and set wires aside.
- Secondary Air Injection (AIR) solenoid valve -N112- is secured to a bracket below control modules for exhaust gas temperature sensor.
- Disconnect harness connector from valve and slide bracket off studs at intake manifold with vacuum lines connected.
- Disconnect vacuum lines from Secondary Air Injection (AIR) solenoid valve, remove valve from bracket.

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26-39



Secondary Air Injection (AIR) solenoid valve -N112-, checking

Special tools and equipment

- VAG 1526A
- VAG 1527B
- VAG 1594A
- VAG 1598/31
- VAS 5051

- or

- VAG 1551 with VAG 1551/3A

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26-40

Installation location ⇒ Installation locations-Overview

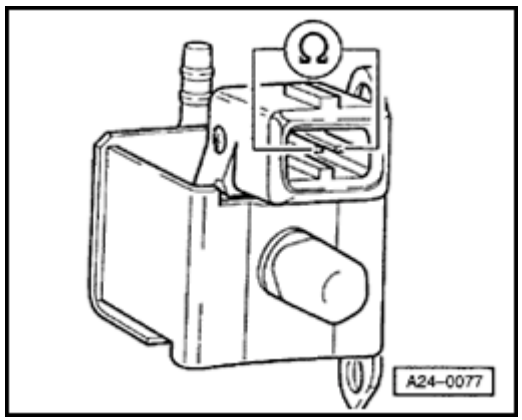
⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

Test requirement:

- Output Diagnostic Test Mode (DTM) performed

Checking internal resistance

- Disconnect harness connector from Secondary Air Injection (AIR) valve -N112-.



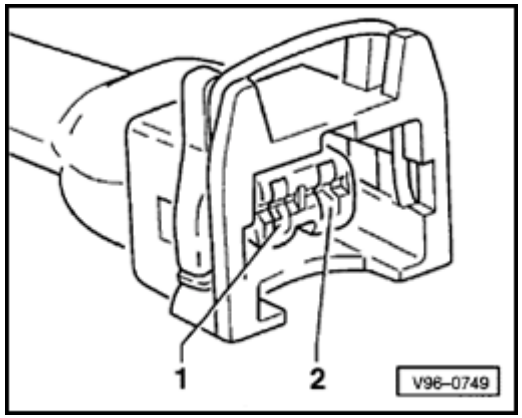
- Connect multimeter at valve for resistance measurement.
  - ♦ Specified value: 25 ... 35 Ω
- If specified value is not obtained, replace Secondary Air Injection (AIR) solenoid valve -N112-.

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26-41

Checking voltage supply

- Disconnect connector from Secondary Air Injection (AIR) solenoid valve -N112-.



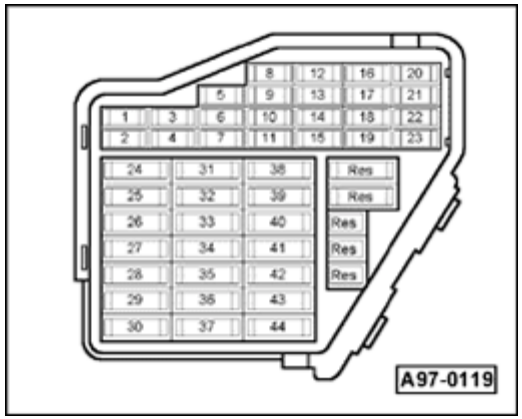
- Connect VAG 1527B voltage tester as follows:

Harness connector terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly.
  - ♦ LED must light.

If LED does not light:

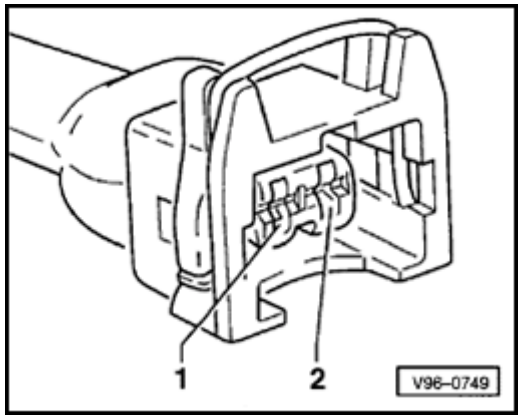
- Perform following tests marked with dots:



- Check fuse -S234- (in fuse holder, position 34).

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26-42



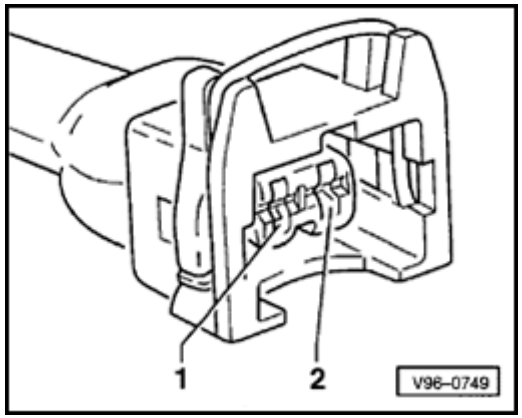
- Check wire connection from terminal 1 of connector via fuse -S234- (in fuse holder, socket 34) to Fuel Pump (FP) relay for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Check Fuel Pump (FP) relay.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

Checking activation



- Connect VAG 1527B voltage tester between terminal 1 and 2.

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26-43

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) solenoid valve -N112

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

Output Diagnostic Test Mode →

Secondary. air. inj. solenoid valve -N112

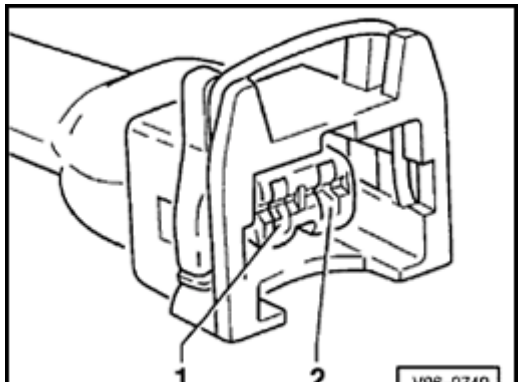
Indicated on display

- ♦ LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect VAG 1598/31 test box at wiring harness to ECM, do not connect ECM.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 test box Bushing
2	44

- Repair open circuit or short circuit if necessary.

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26-44

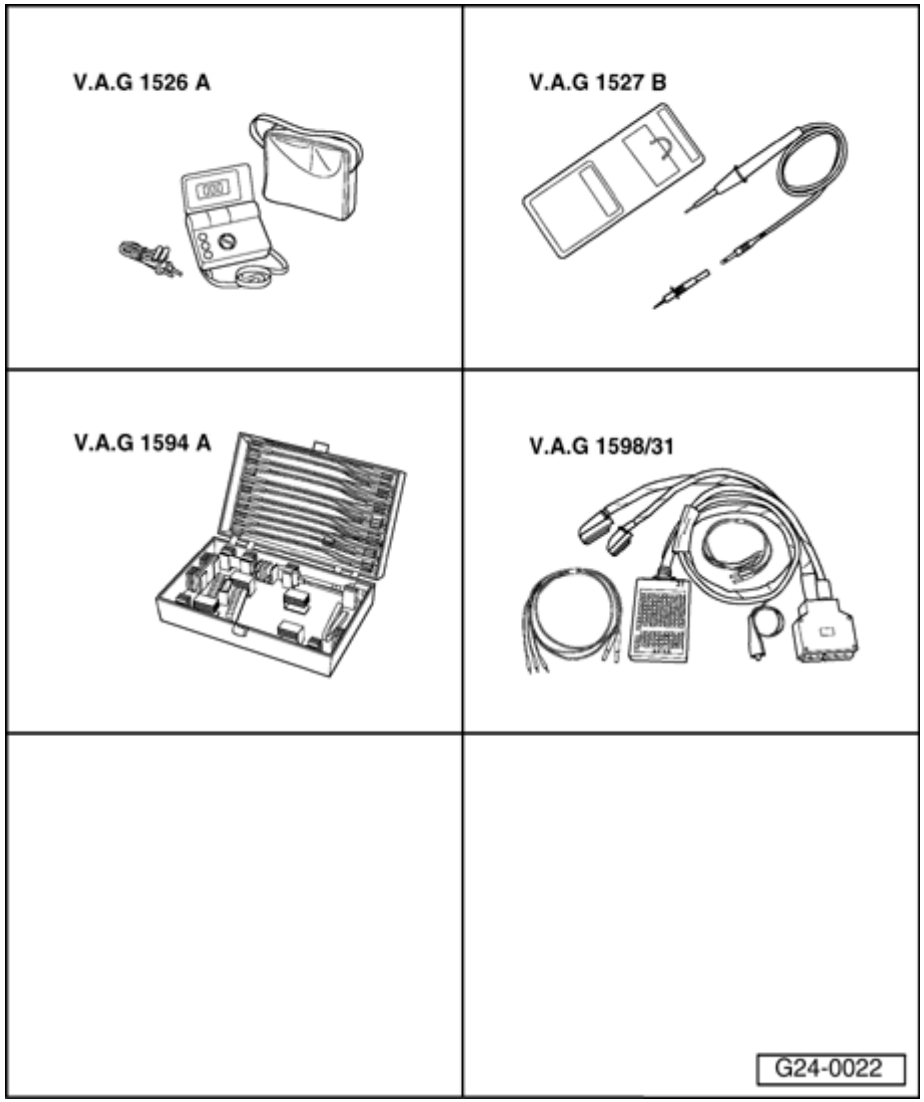
If wire connection is OK:

- Replace Engine Control Module (ECM).

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

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26-45



Secondary Air Injection (AIR) pump relay - J299- and activation, checking

Special tools and equipment

- VAG 1526A
- VAG 1527B
- VAG 1594A
- VAG 1598/31

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26-46

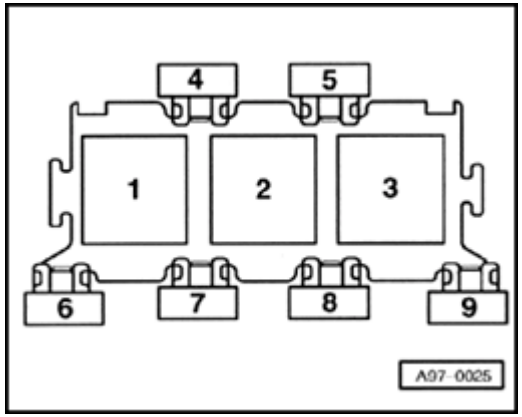
Installation location ⇒ Installation locations-Overview.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

Test sequence

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*



- The Secondary Air Injection (AIR) pump relay (in 3-socket relay carrier in the E-box, at left in plenum chamber, position 2) must engage and the Secondary Air Injection (AIR) pump motor -V101- must run in intervals

A - If relay does not trigger:

- Check voltage supply of Secondary Air Injection (AIR) pump relay ⇒ Page 26-47 .
- Check activation of Secondary Air Injection (AIR) pump relay ⇒ Page

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26-49 .

B - If relay triggers, but Secondary Air Injection (AIR) pump does not run:

- Check voltage supply of Secondary Air Injection (AIR) pump motor ⇒ Page 26-51 .

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26-47

Checking voltage supply of Secondary Air Injection (AIR) pump relay

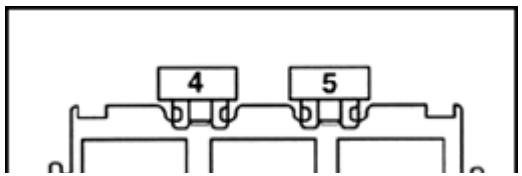
- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay
- Connect multimeter for voltage measurement as follows.

3-socket relay carrier in E-box, plenum chamber, position 2 terminal	Measure to
8	Engine Ground (GND)

♦ Specification: approx. battery voltage

If specified value is not obtained:

- Perform following tests marked with dots:



- Check fuse -S130- (40 A) in 3-socket relay carrier in E-Box, plenum chamber, position 7.

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- Check wire connection from battery + (terminal 30) to Secondary Air Injection (AIR) pump relay -J299- (in 3-socket relay carrier in E-Box, plenum chamber, position 2) for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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26-48

- Connect multimeter for voltage measurement as follows:

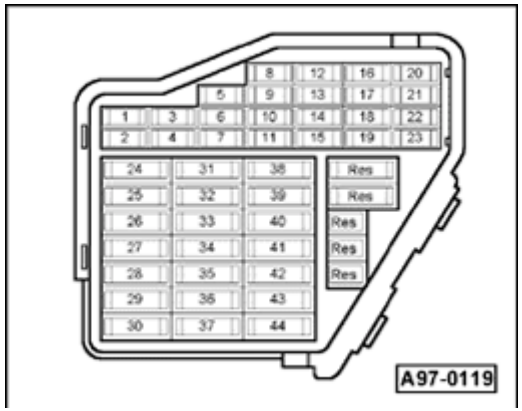
3-socket relay carrier in E-box, plenum chamber, position 2 **terminal**	**Measure to**
4	Engine Ground (GND)

- Operate starter briefly.

  ♦ Specification: approx. battery voltage

If specified value is not obtained:

- Perform following tests marked with dots:



- Check fuse -S234- (in fuse holder, position 34).
- Check wire connection from Secondary Air Injection (AIR) pump relay -J299- (in 3-socket relay carrier in E-box, plenum chamber) via fuse -S234- (in fuse holder, position 34) to Fuel Pump (FP) relay for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

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26-49

Check activation of the Secondary Air Injection (AIR) pump relay

- Switch ignition off.
- Remove Secondary Air Injection (AIR) pump relay.
- Connect VAG 1527B voltage tester as follows:

3-socket relay carrier in E-box, plenum chamber, position 2 terminal	Measure to
6	B+

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

- ♦ LED must blink.

If LED does not blink:

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- Switch ignition off.

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26-50

- Connect VAG 1598/31 test box at wiring harness to ECM, do not connect ECM.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 24*

- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

3-socket relay carrier in E-box, plenum chamber, position 2 **terminal**	**VAG 1598/31 test box** **Bushing**
6	46

- Repair open circuit or short circuit if necessary.

If no malfunctions are detected:

- Replace Secondary Air Injection (AIR) pump relay -J299-.

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26-51

Check voltage supply of the Secondary Air Injection (AIR) pump motor

- Remove connector for Secondary Air Injection (AIR) pump motor -V101-.

- Connect VAG 1527B voltage tester between terminals 1 and 2

- Initiate output Diagnostic Test Mode (DTM) and activate Secondary Air Injection (AIR) pump relay -J299-.

⇒ *Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code(s): APB, Repair Group 01*

- LED must blink

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26-52

If LED does not blink:

- Perform following tests marked with dots:

  - Check wire connection from connector at Secondary Air Injection (AIR) pump motor- V101- to Secondary Air Injection (AIR) pump relay -J299- (in 3-socket relay carrier in E-Box, plenum chamber, position 2) for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

  - Check wire connection from connector at Secondary Air Injection (AIR) pump motor - V101- to Ground (GND) connection 1 in engine compartment wiring harness for open circuit:

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

If no malfunctions are detected:

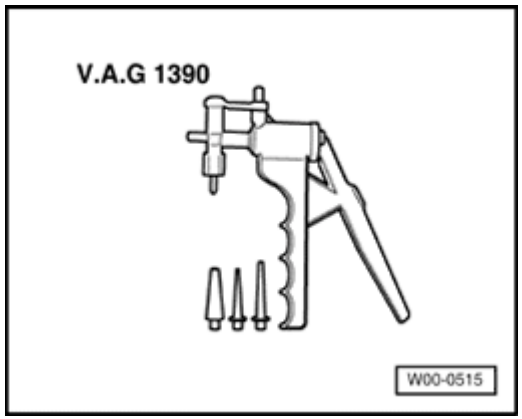
- Replace Secondary Air Injection (AIR) pump motor -V101-.

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26-53

Combination valve, checking

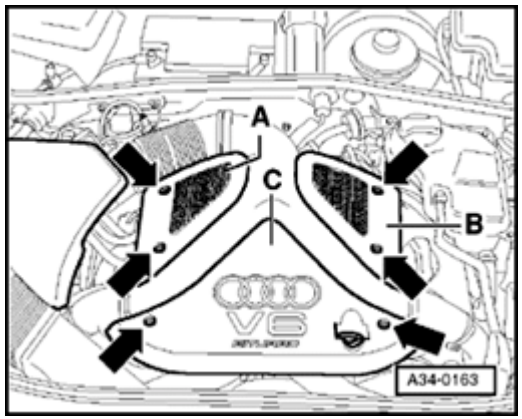
Special tools and equipment



- VAG 1390 Hand Vacuum Pump

Test requirements:

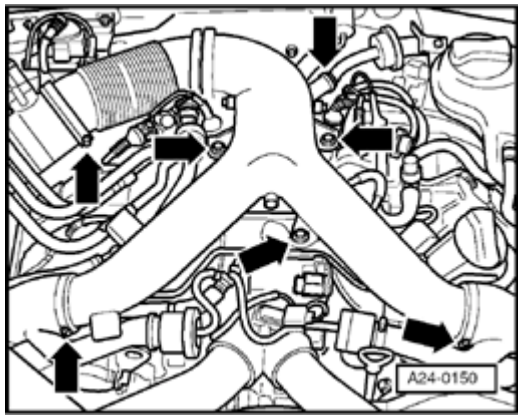
- No leaks in vacuum lines or hose connections.
- Vacuum lines not clogged.



- Remove bolts (arrows) and remove engine covers -A- and -B-.

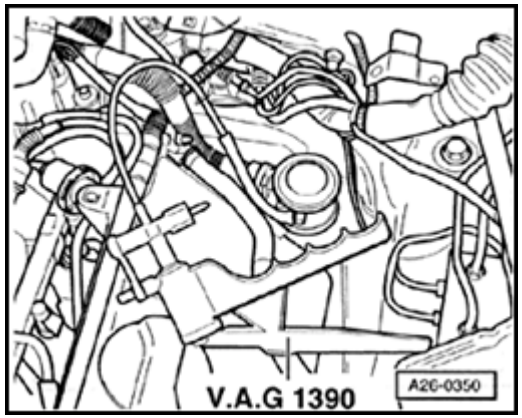
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26-54



- Remove air distributor (arrows).

Leak test



- Pull hose from Secondary Air Injection (AIR) pump motor and blow in with light pressure (do not use pressurized air).

♦ Both combination valves must be closed, it must not be possible to blow through hose

If it is possible to blow through hose:

- Disconnect connecting line from Secondary Air Injection (AIR) pump motor to combination valve at one of the combination valves, close connecting line and blow through again.
- Replace combination valve remaining on connecting line

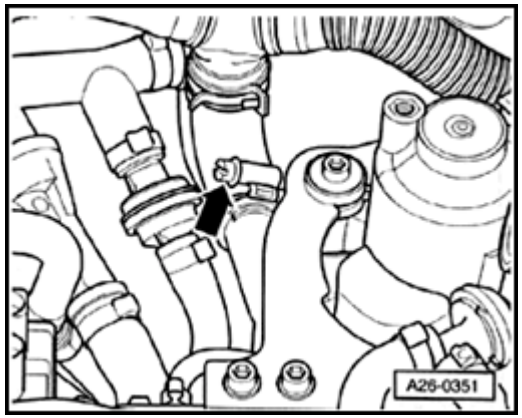
If it is no longer possible to blow through hose:

- Replace combination valve that was removed from connecting line.

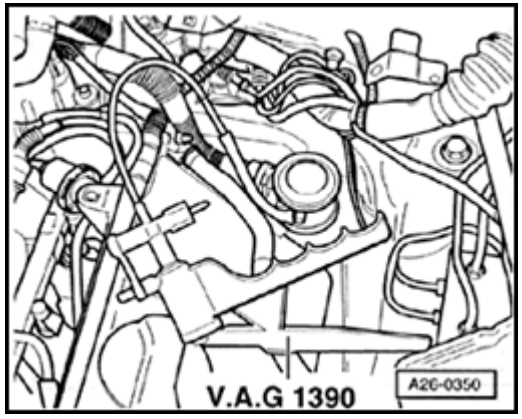
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26-55

Functional check



- Remove vacuum hose of combination valve to be checked and connect VAG 1390 vacuum pump to combination valve.



- Pull hose from Secondary Air Injection (AIR) pump motor and blow in with light pressure (do not use pressurized air).
- Operate hand vacuum pump.

♦ The relevant combination valve must open, it must not be possible to blow through

If the relevant combination valve does not open:

- Replace combination valve.

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26-56

If the relevant combination valve opens:

- Repeat function test at second combination valve.

Note:

- *Use special tool 3231 and the Hazet carburetor adjustment key 4530.*
- *No special tools are necessary for the right combination valve.*

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