

Workshop Manual OCTAVIA

**1.9-ltr./66 kW (TDI) Engine,
Mechanical Components**

List of Supplements to OCTAVIA Workshop Manual

Edition: 04.04

1.9 l/66 kW (TDI) Engine, Mechanical Components

Replaces List of Supplements - Edition: 11.02

Supplement	Edition	Subject	Article Number
	08.96	Basic Edition	S00.5110.50.20
1	11.96	Supplement to Basic Edition	S00.5110.51.20
2	03.98	Modifications to Engines from 08.97	S00.5110.52.20
3	06.99	Supplement for 4 x 4 Models	S00.5110.53.20
4	03.00	Modifications to Repair Groups 10, 13, 15, 19, 21, 26	S00.5110.54.20
5	05.01	Modifications to Vehicles MJ01	S00.5110.55.20
6	11.02	Modifications to Repair Groups 00, 10, 13, 15, 17, 19, 20	S00.5110.56.20
7	04.04	Modifications to Repair Groups 10, 13, 15, 17, 19, 21, 26	S00.5110.57.20
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Contents ⇒ next page.

Contents

00	Technical Data	Page
	Technical data	00-1
	- Engine number	00-1
	- Engine features	00-1
10	Removing and installing Engine	Page
	Removing and installing engine	10-1
	- Removing engine	10-1
	- Attaching engine to repair stand	10-12
	- Installing engine	10-12
	- Tightening torques	10-14
	- Aligning engine/gearbox mounting	10-15
	- Engine/gearbox mounting	10-16
13	Crank Assembly	Page
	Disassembling and assembling engine	13-1
	- Removing and installing ribbed V-belt	13-1
	- Removing and installing toothed belt	13-4
	- Inspecting semi-automatic toothed belt tensioning pulley	13-11
	- Rotating crankshaft to TDC when engine removed	13-11
	Removing and installing crankshaft	13-12
	- Replacing crankshaft seal -belt pulley side-	13-15
	- Removing and installing flywheel	13-16
	- Removing and installing driven plate	13-16
	- Removing and installing front sealing flange	13-18
	Disassembling and assembling pistons and connecting rod	13-21
	- Inspecting piston projection at TDC	13-24
15	Cylinder Head, Valve Gear	Page
	Removing and installing cylinder head	15-1
	- Removing cylinder head	15-4
	- Installing cylinder head	15-6
	- Testing compression	15-8
	Servicing valve gear	15-10
	- Grinding in valve seats	15-12
	- Inspecting valve guides	15-14
	- Replacing valve stem seals	15-14
	- Removing and installing camshaft	15-16
	- Inspecting hydraulic bucket tappets	15-18
	- Replacing valve guides	15-19
17	Lubrication System	Page
	Removing and installing parts of the lubrication system	17-1
	- Disassembling and assembling oil filter holder	17-2
	- Removing and installing oil pan	17-3
	- Testing oil pressure and oil pressure switch	17-5

19	Cooling System	Page
	Removing and installing parts of the cooling system	19-1
	- Parts of the cooling system fitted to body	19-2
	- Parts of the cooling system attached to engine	19-2.2
	- Connection diagram for coolant hoses	19-2.4
	- Draining and filling system with coolant	19-3
	- Removing and installing coolant pump	19-5
	- Removing and installing coolant thermostat	19-7
	- Inspecting cooling system for leaks	19-8
	- Removing and installing radiator	19-9
	- Removing and installing fan	19-12
20	Fuel Supply System	Page
	Removing and installing parts of the fuel supply system	20-1
	- Removing and installing fuel tank with attached parts	20-1
	- Removing and installing fuel cooler	20-2
	- Safety precautions when working on fuel supply system	20-3
	- Rules for cleanliness	20-3
	- Removing and installing fuel gauge sender	20-4
	- Removing and installing fuel tank	20-4
	Removing and installing parts of the fuel supply system - 4 x 4 models	20-6
	- Removing and installing fuel tank with attached parts - 4 x 4 models	20-6
	- Removing and installing fuel gauge sender - 4 x 4 models	20-8
	- Removing and installing fuel tank - 4 x 4 models	20-9
21	Turbocharging	Page
	Charge air system with turbocharger	21-1
	- Rules for cleanliness	21-1
	- Removing and installing turbocharger for the engine AGR with attached parts	21-2
	- Removing and installing turbocharger for the engine ALH with attached parts	21-3.1
	- Connection diagram of charge pressure control	21-4
	- Testing charge pressure control valve pressure unit	21-5
	- Removing and installing turbocharger	21-6
	- Removing and installing parts of the charge air cooling system	21-9
	- Removing and installing charge air cooler	21-10
26	Exhaust system	Page
	Removing and installing parts of the exhaust system	26-1
	- Replacing centre silencer or rear silencer	26-2
	- Aligning exhaust system free of stress	26-3
	Removing and installing parts of the exhaust system - 4 x 4 models	26-4.1
	- Replacing centre silencer or rear silencer - 4 x 4 models	26-4.2
	Exhaust gas recirculation system	26-5
	- Connection diagram of exhaust gas recirculation control	26-5
	- Testing mechanical exhaust gas recirculation valve	26-7
	- Removing and installing parts of the exhaust gas recirculation system	26-8

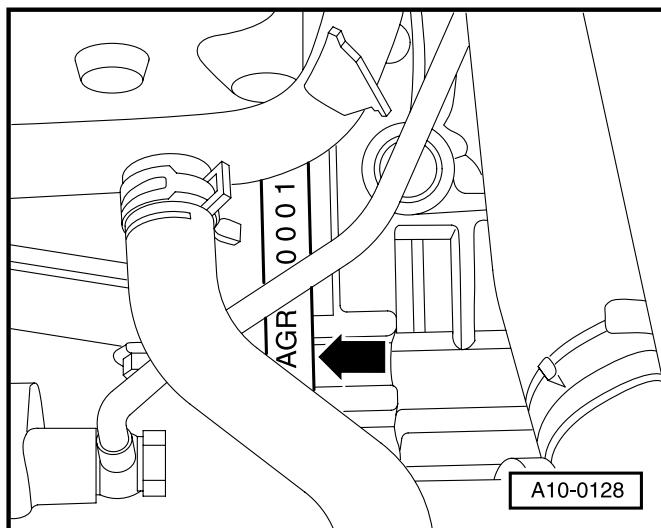
Technical data

Engine number

- ◀ The engine number („engine code“ and „serial number“) is located at the front at the connection of the engine/gearbox.

In addition, a sticker with „engine code“ and „serial number“ is affixed to the toothed belt guard.

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



Engine features

Engine code	AGR	ALH
Manufactured	10.96 ➤	08.00 ➤
Displacement l	1.896	1.896
Power output kW at rpm	66/4000	66/3750
Torque Nm at rpm	210/1900	210/1900
Bore Ø mm	79.5	79.5
Stroke mm	95.5	95.5
Compression ratio	19.5 : 1	19.5 : 1
min. CN	49	49
Injection order	1-3-4-2	1-3-4-2
Catalytic converter	yes	yes
Exhaust gas recirculation	yes	yes
Turbocharging	yes	yes
Charge air cooling	yes	yes
Complies with emission limits	EU2	EU3

Removing and installing engine

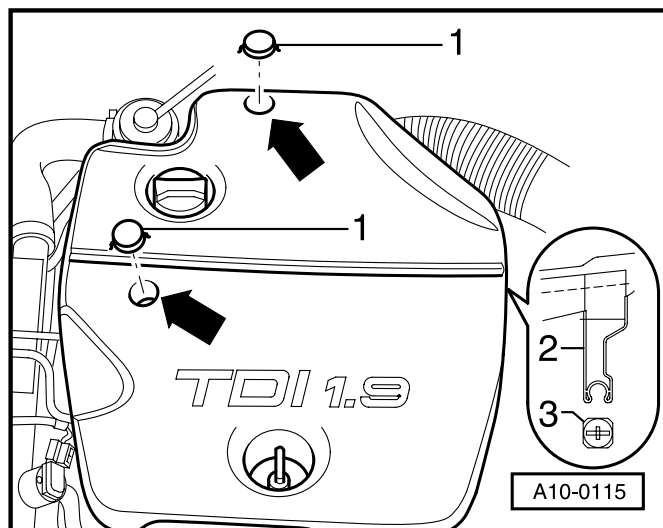
Special tools, testers and aids required

- ◆ Workshop crane (e.g. V.A.G 1202 A)
- ◆ Catch pan (e.g. V.A.G 1306)
- ◆ Torque wrench
- ◆ Pliers for spring strap clips
- ◆ Engine mount MP 1-202
- ◆ Engine mount T 10012
- ◆ Bolt M10 x 25/8.8
- ◆ Engine/gearbox jack (e.g. V.A.G 1383 A)
- ◆ Double ladder (e.g. VAS 5085)
- ◆ Lifting device MP 9-201
- ◆ Grease G 000 100
- ◆ Cable strap
- ◆ Wire
- ◆ Adhesive tape

Removing

Notes:

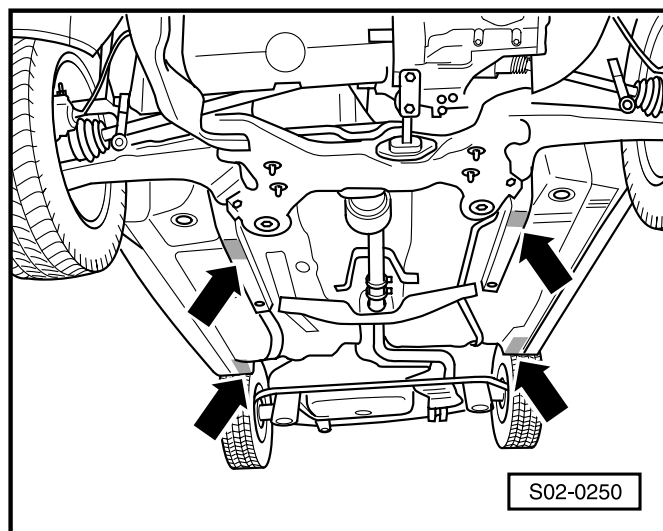
- ◆ *The engine is removed downwards together with the gearbox.*
- ◆ *All cable straps that have to be loosened when the engine was removed must be fitted again in the same location.*
- ◆ *The hose connections are secured with screw-type clips, spring-type clips or clamp-type clips.*
- ◆ *Always replace clamp-type clips with spring-type clips or screw -type clips.*
- ◆ *Fuel lines at the engine must only be secured with spring-type clips. The use of clamp-type or screw-type clips is not allowed.*
- ◆ *Use pliers for spring strap clips for installing the spring strap clips.*



- ♦ Pay attention to the correct assignment of the connectors; mark if necessary.

Procedure

- Pay attention to code of vehicles fitted with a coded radio set; determine if necessary.
- Switch off ignition (if not already off) and disconnect earth strap at the battery.
- ◀ - Remove engine trim panel:
 - Lift out plug -1- and slacken nuts -arrows-.
 - Pull clip -2- off pin -3-.

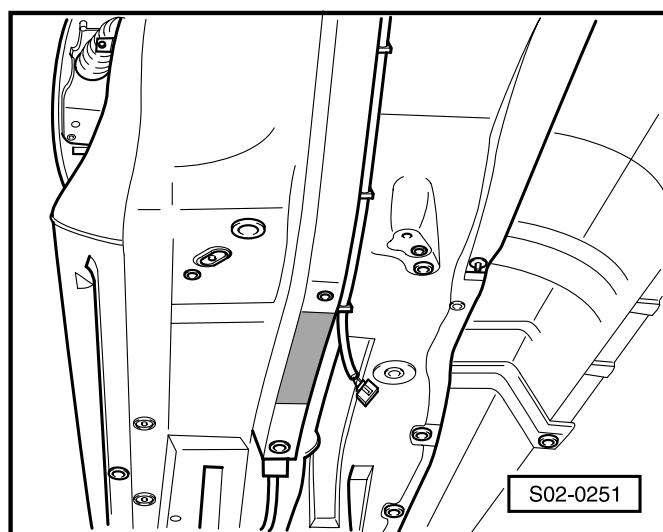


- Raise vehicle with lift platform; pay attention to the following points:

- ◀ The arms of the lift platform must be positioned only below the side members.

Warning!

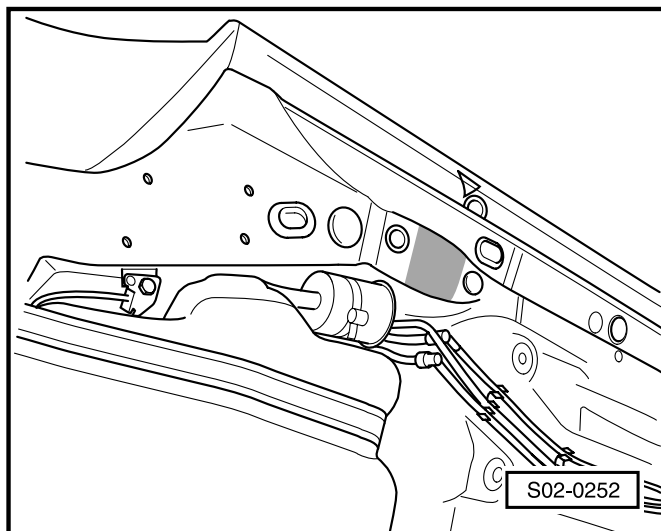
On no account may the arms of the lift platform be positioned below the sills, the front or rear suspension.



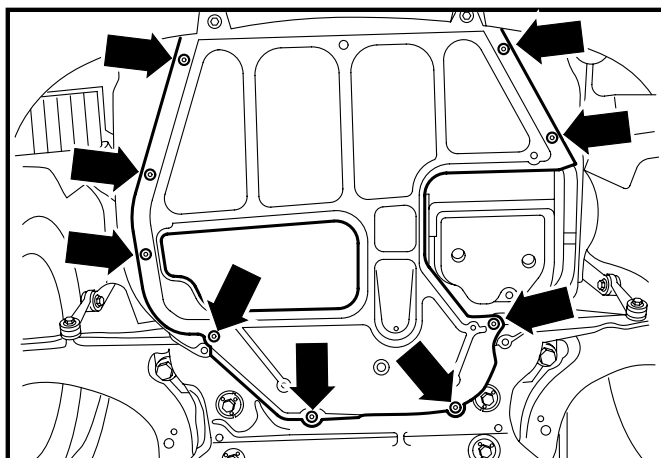
- ◀ The two front jacking points are located at the side members at the front at the level of the marking on the sill.

Warning!

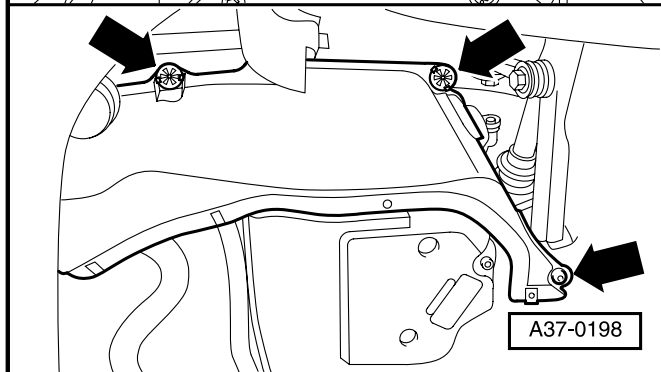
Never start the engine when the vehicle is raised and engage a gear so long as only one driven gear is making contact with the ground.



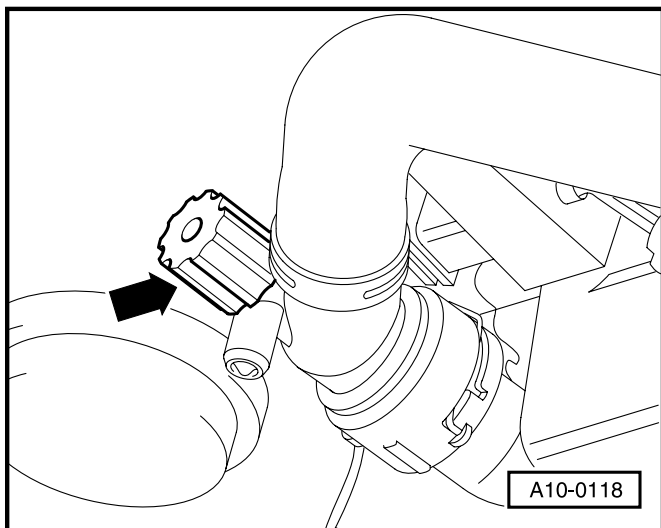
- ◀ The two rear jacking points are located at the rear longitudinal members at the level of the marking at the sill.



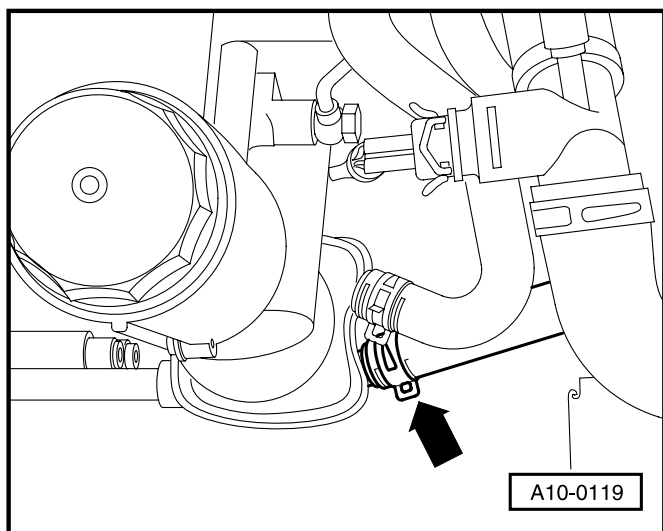
- ◀ - Remove noise insulation panel in the middle and also on the left and right -arrows-.



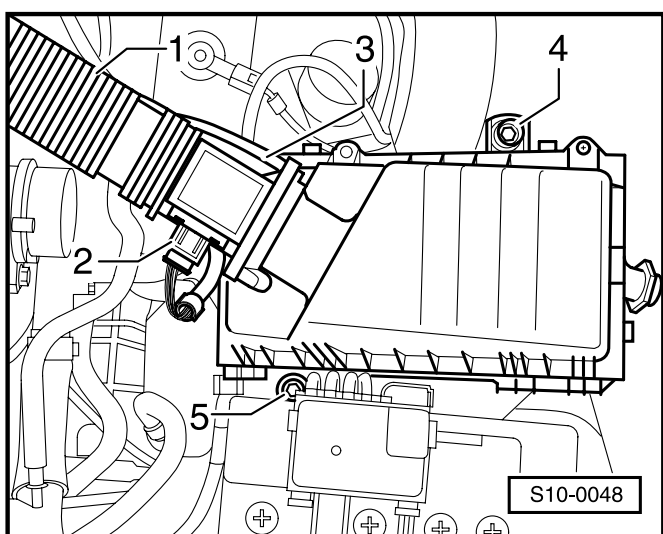
- Open cap of coolant expansion reservoir.



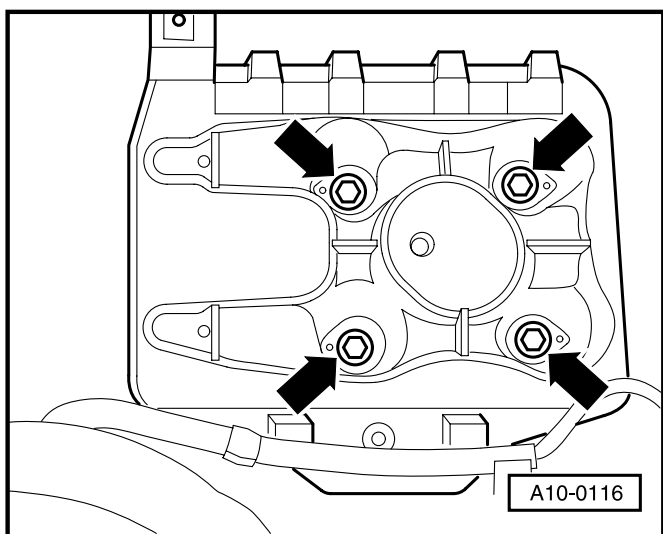
- ◀ - Turn drain plug -arrow- at the radiator to the left or fit hose onto connection, as appropriate.



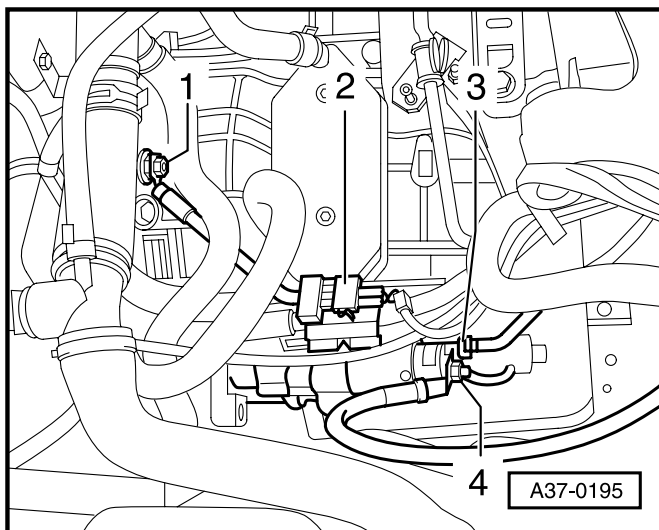
- ◀ - In addition, detach coolant hose at bottom of oil cooler -arrow- and allow remaining coolant to flow out.



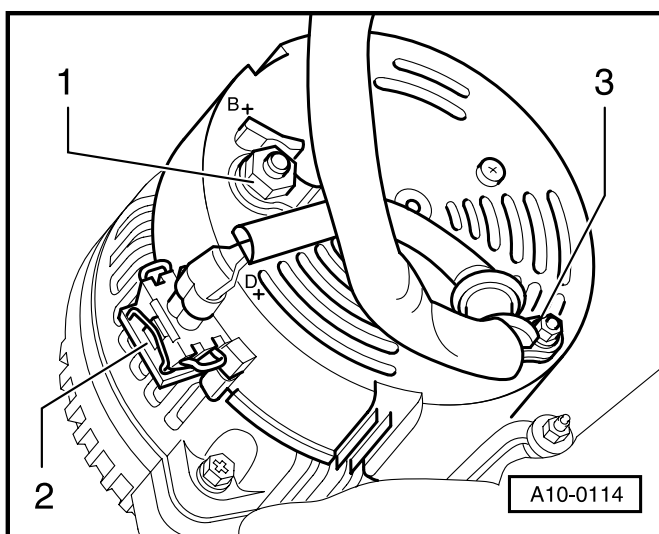
- ◀ - Detach air guide hose -1-.
- Detach vent hose -3- and connector for air mass meter -2-.
 - Slacken bolts -4- and -5- and remove air filter housing.



- ◀ - Remove battery and battery cradle -arrows-.



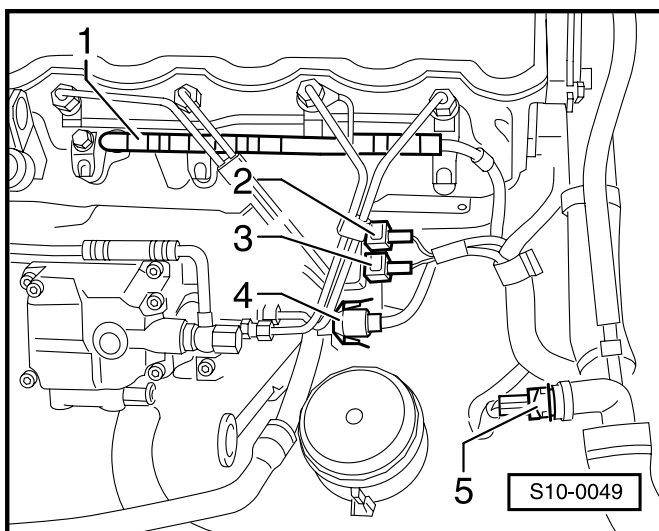
- ◀ - Unbolt earth cable -1-.
- Detach cables -3- and -4- at the starter.
- Separate connector -2- and pull out of the holder.
- Detach cables from the holder at the starter and place to the side. Unbolt holder.



- ◀ - Unbolt terminal 30/B+ cable -1- at the alternator.
- Unplug connector -2- from terminal D+.
- Unscrew cable clamp -3-.

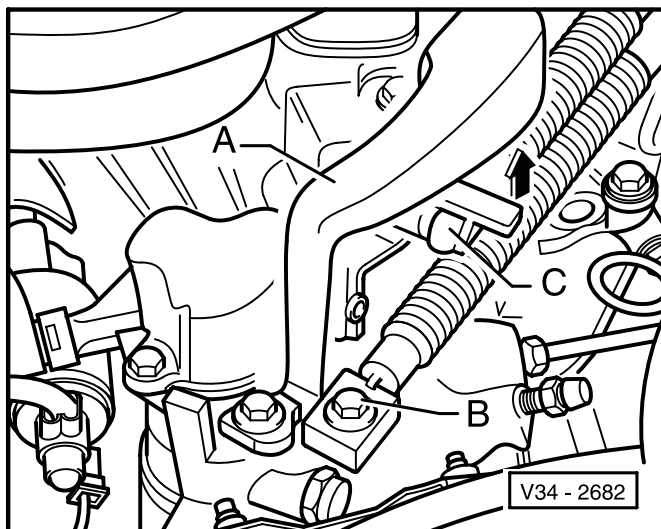
Models with air conditioning

- Unplug connector at the AC compressor.



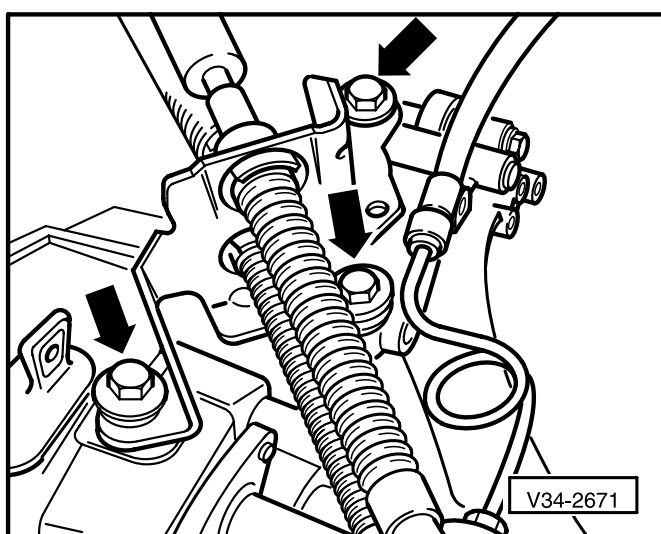
All models

- ◀ - Disconnect/unplug the following cables/connectors:
 - 1 - Connector strip for glow plugs
 - 2 - Plug connection for needle lift sender (G80) (brown, black connector)
 - 3 - Plug connection for engine speed sender (G28) (black)
 - 4 - Plug connection for injection pump
 - 5 - Connector for electronic thermoswitch (F14) (black; only with AC)
- Unplug connector for coolant temperature sender (G62) (black) at flange of cylinder head.
- Unplug connector for oil pressure switch (F1) at oil filter holder.
- Pull wiring loom out of the holders and run out to the side.

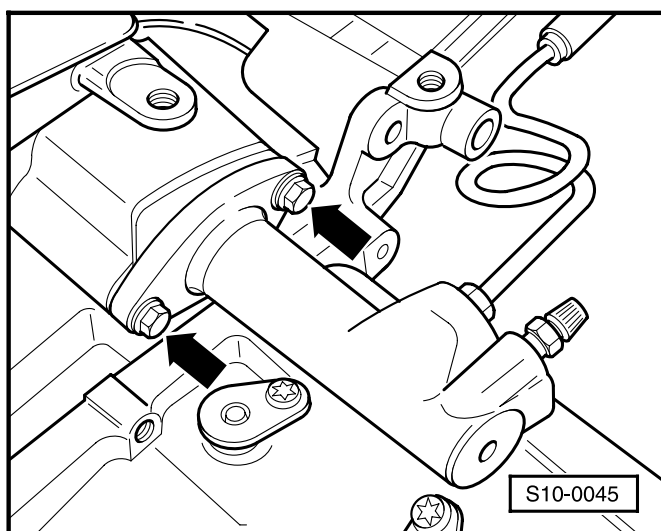


Models fitted with manual gearbox

- ◀ - Mark installation position of the shift cable -B- relative to the gearbox shift lever.
- Take off balancing weight -A- and shift cable -B- at shift lever.
- Pull selector cable off relay lever driver -C-; raise lug in direction of arrow for this step.
- Unclip hose line of slave cylinder at cable support.



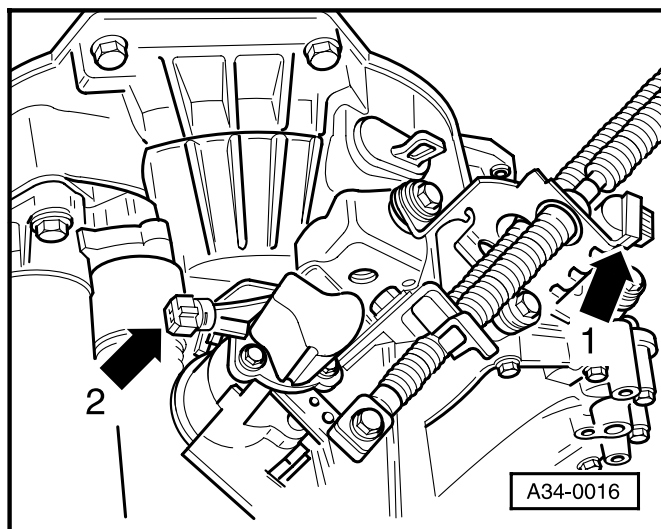
- ◀ - Take cable support of gearbox -arrow- and place down to the side.



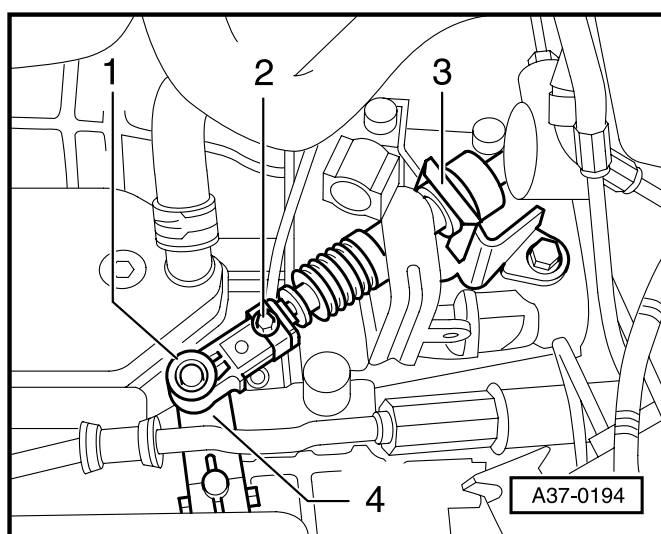
- ◀ - Remove slave cylinder -arrow- and place down to the side, secure with wire, do not open line system.

Note:

Do not depress clutch pedal.

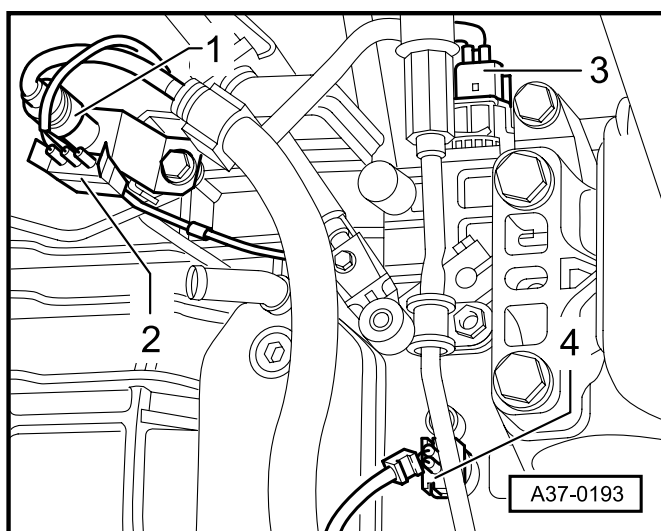


- ◀ - Unplug the following connectors:
 - 1 - Speedometer sender (G22)
 - 2 - Reversing lights switch (F4)

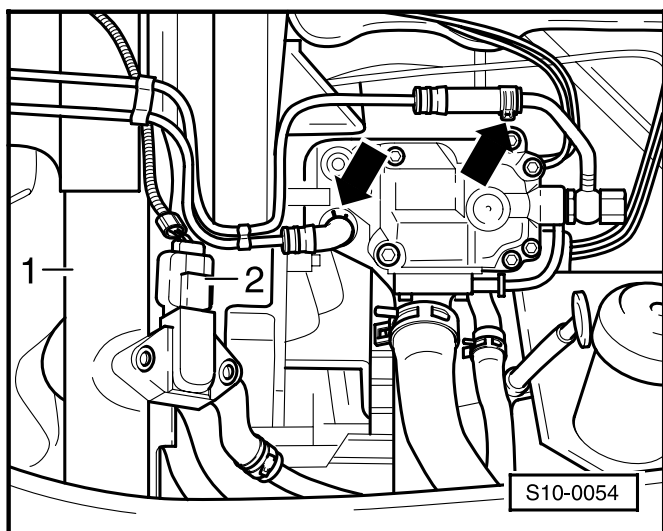


Models fitted with automatic gearbox

- ◀ - Use a screwdriver to press off selector lever cable -1- at gearbox selector lever -4- and pull locking clasp -3- off at cable support.
- Take off selector lever cable and place to the side.
- Unbolt bracket for power steering pressure line at gearbox support.

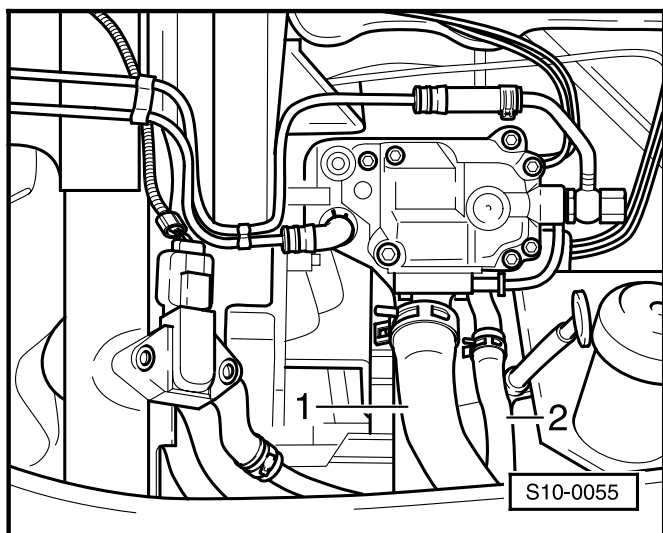


- ◀ - Unplug the following connectors:
 - 1 - to solenoid valves
 - 2 - to speedometer sender -G22-
 - 3 - at multifunction switch -F125-
 - 4 - at wheel speed sensor -G38-

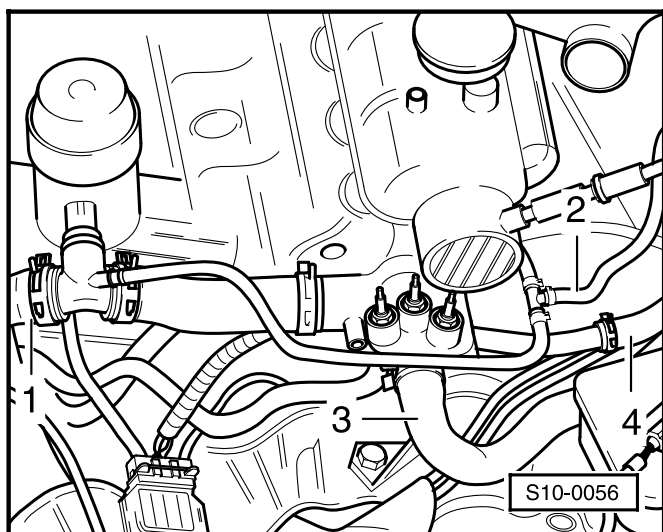


Continued for all models

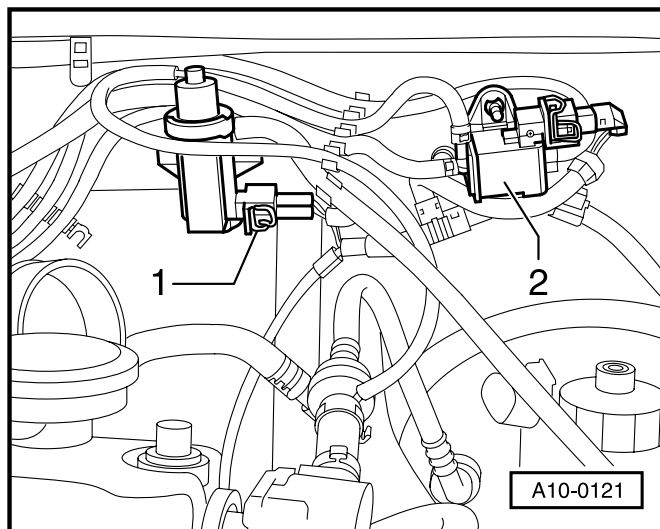
- ◀ - Detach fuel hoses -arrow- at the injection pump, seal with a clean plug and place to the side.
- Unplug connector -2- at the intake manifold temperature sender (G72) with intake manifold pressure sender (G71).
- Remove air guide pipe -1-.



- Use pliers for spring strap clips to detach the following coolant hoses:
- ◀ 1 - Bottom coolant hose at coolant thermostat housing and at radiator (remove hose).
- 2 - Coolant hose to expansion reservoir.



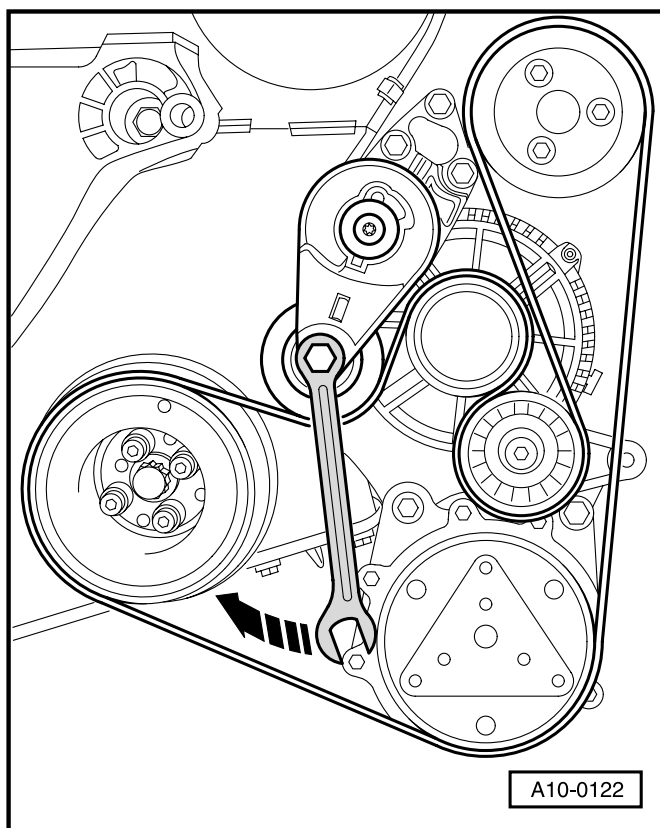
- ◀ 1 - Top coolant hose at branch
- 2 - Coolant hose to expansion reservoir and heat exchanger from cylinder head
- 3 - Coolant hose to heat exchanger
- 4 - Coolant hose from heat exchanger at coolant pipe
- Detach the following vacuum hoses:
- at the vacuum pump
- at the mechanical exhaust gas recirculation valve



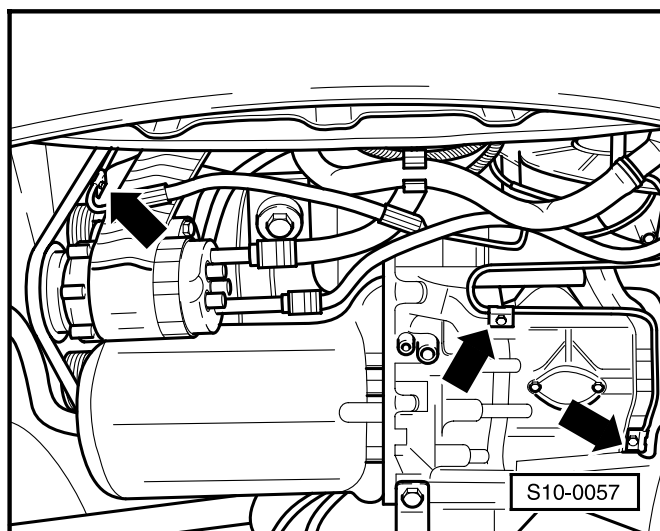
- ◀ - Unplug connector -1- at the exhaust gas recirculation valve (N18).
- Unplug connector from the charge pressure control solenoid valve (N75) -2-.
- Pull the charge pressure control solenoid valve (N75) -2- off the bracket and place down on the engine (hoses remain connected, they have to be detached from the fixtures).
- Unplug connector of intake manifold flap solenoid valve (N239).
- Detach vacuum hose from the intake manifold flap solenoid valve.
- Remove air guide pipe between charge air cooler and turbocharger ⇒ page 21-9, item 9.

Note:

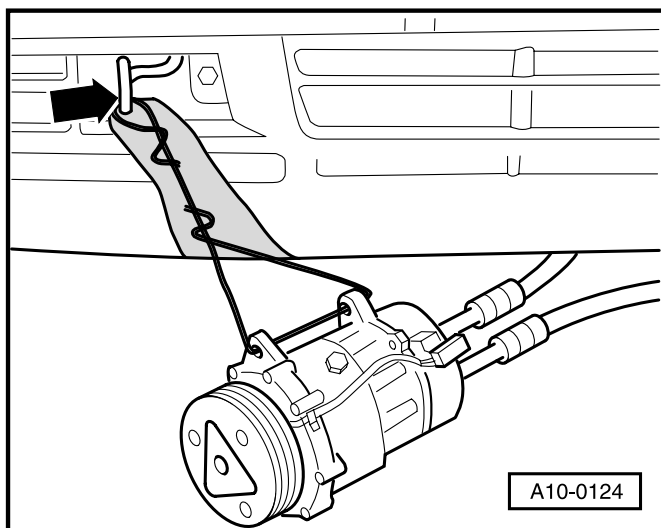
Before removing the ribbed V-belt, mark direction of running. If an already used belt is fitted on to run in the opposite direction, it may be destroyed. When installing the belt, ensure that it is correctly located in the belt pulleys.



- Position flat ring wrench, waf 16, at the hexagon of the tensioning pulley.
- ◀ - Swivel tensioning pulley in direction of arrow in order to slacken the ribbed V-belt.
- Take off ribbed V-belt.



- ◀ - Unscrew 3 fixtures for power steering pressure line -arrows-.
- Remove belt pulley of power steering hydraulic pump.
- Unbolt power steering hydraulic pump and tie up at the body. The lines remain connected.



Models fitted with air conditioning

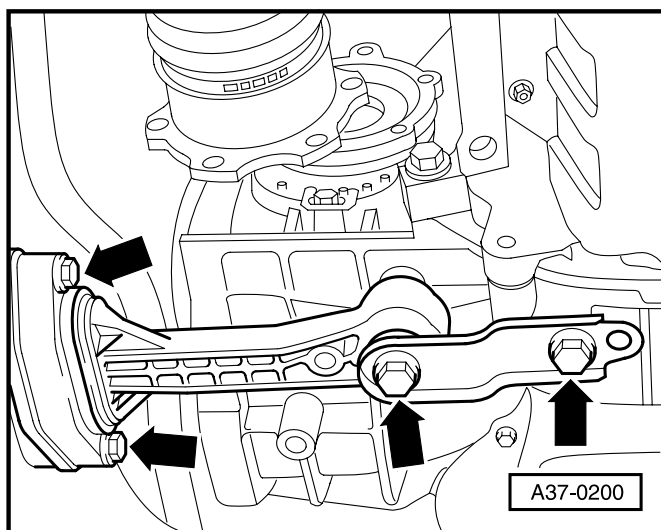
Warning!

Refrigerant circuit of air conditioning system must not be opened.

- Remove AC compressor and tie up with wire at the towing eye -arrow- together with the connected hoses.

Note:

Protect bumper with adhesive tape from scratches.



Continued for all models

- Remove pendulum support -arrow-.
- Unbolt drive shafts from the flange of the gearbox and attach to body with wire.

4 x 4 models

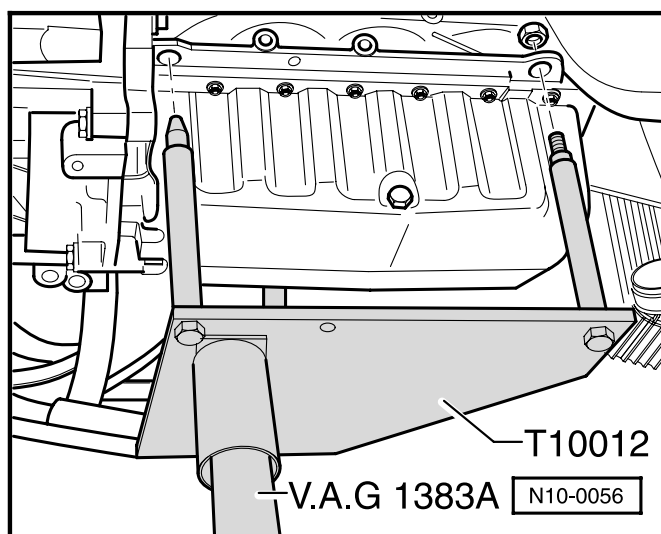
- Detach propeller shaft from gearbox ⇒ Gearbox 02C, Repair Group 39.

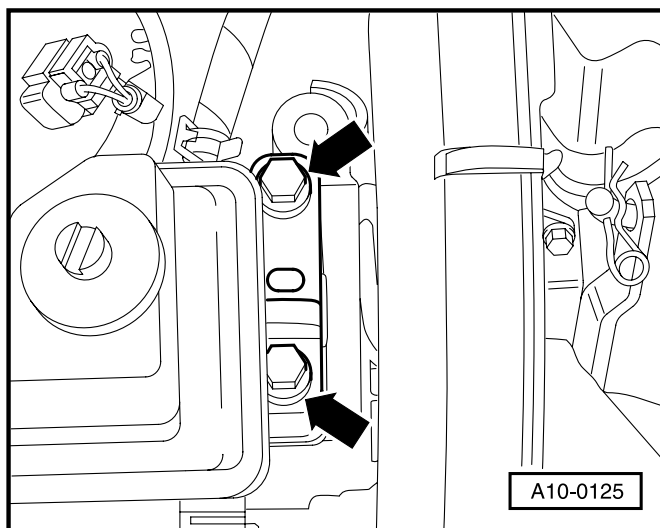
Models with heavy-duty cooling system

- Remove right-hand electric fan (smaller fan wheel diameter) ⇒ page 19-12.

Continued for all models

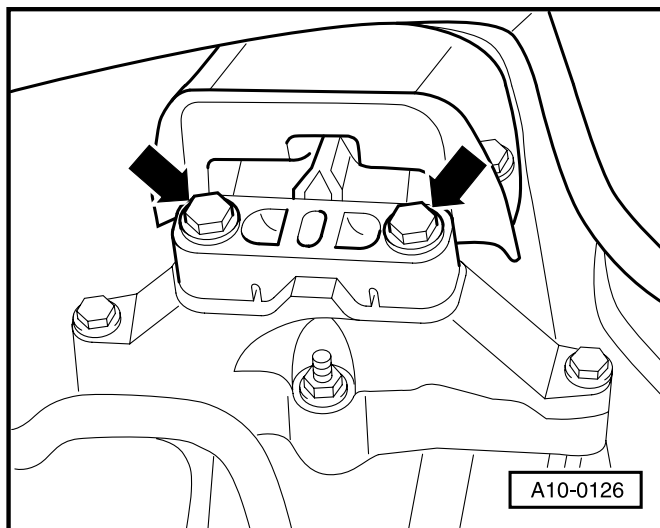
- Remove front part of exhaust system ⇒ page 26-1.
- Attach engine holder T10012 to cylinder block with nut and M10 bolt; tighten to 40 Nm.
- Raise engine and gearbox slightly with engine/gearbox lifter.



**Note:**

Use a ladder, e.g. V.A.S 5085, to remove the bolts attaching the engine and gearbox brackets.

- ◀ - Unscrew bolts from engine bracket -arrows-.



- ◀ - Unscrew bolts from gearbox bracket -arrow-.
- Carefully lower engine together with gearbox.

Note:

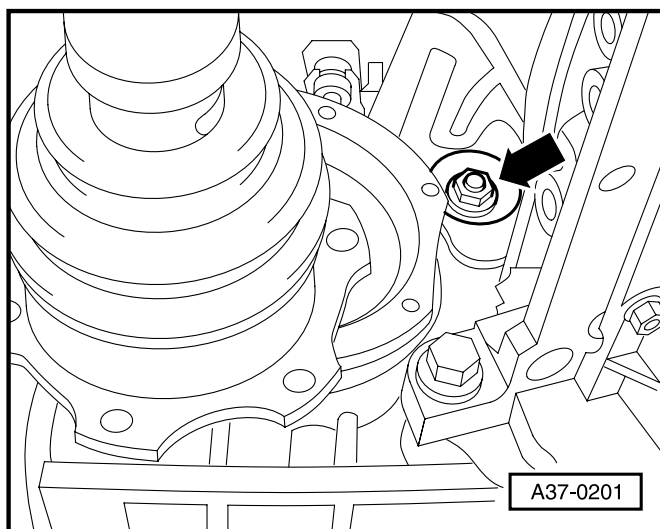
It is essential to have a second person guide the engine/gearbox assembly when lowering it in order to avoid any damage to the body because of the tight clearance. At the same time, ensure that the boots of the joint shafts are not damaged.

Models fitted with automatic gearbox

- Detach coolant hoses at the ATF cooler.
- Remove plug in the hole of the torque converter panel.
- ◀ - Unscrew 3 nuts -arrow- from the torque converter; rotate crankshaft 1/3 turn for each step.
- After separating engine and gearbox, secure torque converter in the gearbox to prevent it dropping out.

Continued for all models

- Unscrew the bolts connecting engine/gearbox.
- Separate gearbox from engine.

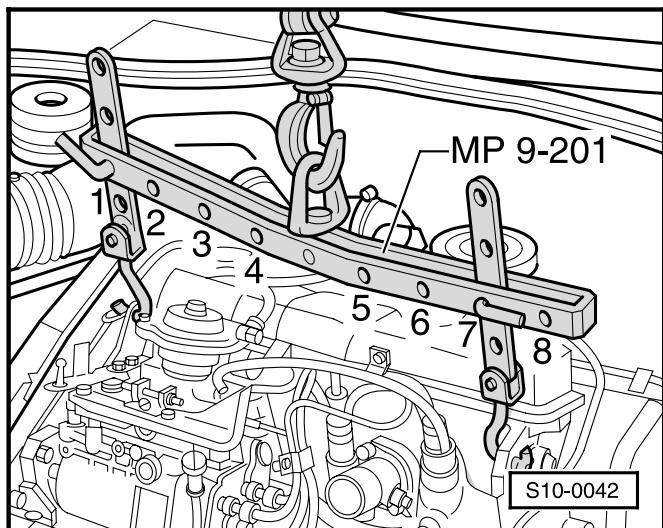


Attaching engine to repair stand

The engine should be attached with the engine holder MP 1-202 to the repair stand for carrying out removal and installation operations.

Note:

The engine must not be attached to the repair stand for measuring the cylinder bore ⇒ page 13-23.



- ◀ - Attach suspension device MP 9-201 to the plates at the engine and take up weight of engine with a workshop crane, e.g. V.A.G 1202 A:

- ◆ Belt pulley side:
2nd hole in rail - item 1
- ◆ Flywheel side:
2nd hole in rail - item 7

Warning!

Use locking pins at the hooks and at the rig pins to prevent them slipping out.

- Attach engine to repair stand with engine holder MP 1-202.

Installing

Notes:

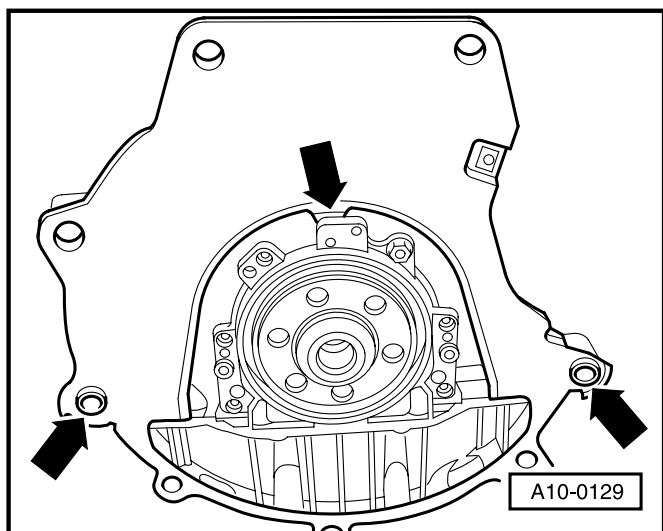
- ◆ Always install new seals and gaskets when carrying out removal and installation work.
- ◆ Always install new self-locking nuts.

Installation is carried out in the reverse order; pay attention to the following points:

- Check whether dowel sleeves for centering engine/gearbox are inserted in the cylinder block.
- ◀ - Attach intermediate plate to sealing flange and push onto the dowel sleeves -arrows-.

Models fitted with manual gearbox

- Check centering of the clutch driven plate.
- Check clutch release bearing for wear, replace if necessary.
- Apply a thin film of grease G 000 100 to the splines of the input shaft.



- Install slave cylinder of hydraulic clutch:
⇒ 5-Speed Manual Gearbox 02J; Repair Group 30; Clutch, Mechanism.
- Align engine/gearbox mounting ⇒ page 10-15.
- Attach shift mechanism:
⇒ 5-Speed Manual Gearbox 02J; Repair Group 34; Shift Mechanism, Housing.
- Adjust shift mechanism, if necessary:
⇒ 5-Speed Manual Gearbox 02J; Repair Group 34; Shift Mechanism, Housing.

Models fitted with automatic gearbox

- Replace lock washer at support of selector lever cable.
- Use only nuts which are approved in the Parts List for attaching the torque converter at the driven plate.
- Install selector lever cable at gearbox, adjust if necessary:
⇒ Automatic Gearbox; Repair Group 37; Servicing shift mechanism.

Models fitted with air conditioning

- Install AC compressor:
⇒ Heating and Air Conditioning; Repair Group 87; Detaching and attaching compressor at bracket.

Continued for all models

- Install power steering hydraulic pump:
⇒ Running Gear; Repair Group 48; Removing and installing power steering hydraulic pump.
- Install ribbed V-belt ⇒ page 13-3.
- Install drive shafts:
⇒ Running Gear; Repair Group 40; Removing and installing drive shafts.
- Align exhaust system free of stress ⇒ page 26-3.
- Fit on coolant hoses ⇒ page 19-1, Parts of cooling system.

Note:

Do not re-use drained coolant if the cylinder block, cylinder head, cylinder head gasket, radiator, or heat exchanger, has been replaced.

- Fill system with coolant ⇒ page 19-3.

- Hoses and valves to mechanical exhaust gas recirculation valve, charge pressure control and intake manifold flap valve (N239)
- ⇒ page 21-4, Connection diagram for charge pressure control
- ⇒ page 26-5; Connection diagram for exhaust gas recirculation system.
- Electrical connections and routing of cables:
- ⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations.

Note:

If the battery earth strap is disconnected and re-connected, it is then necessary to carry out additional Operations ⇒ Electrical System: Repair Group 27.

- Inspecting engine oil level:
- ⇒ Inspection and Maintenance

Tightening torques**Notes:**

- ♦ *Tightening torques apply only to nuts and bolts which are lightly greased, oiled, phosphatized or blackened.*
- ♦ *Additional lubricants such as engine or gear oils are permissible, but not Molykote.*
- ♦ *Do not use parts which have been degreased.*
- ♦ *Tolerance of tightening torques $\pm 15\%$*

Component		Nm
Nuts/bolts	M6	9
	M7	13
	M8	20
	M10	40
	M12	70
In variation of this:		
Driven plate to torque converter		60
Engine/gearbox mounting, Pendulum support		⇒ page 10-16
Bolts connecting engine to gearbox		
⇒ 5-speed Manual Gearbox 02J; Repair Group 34		
⇒ Automatic Gearbox; Repair Group 37		

Aligning engine/gearbox mounting

Warning!

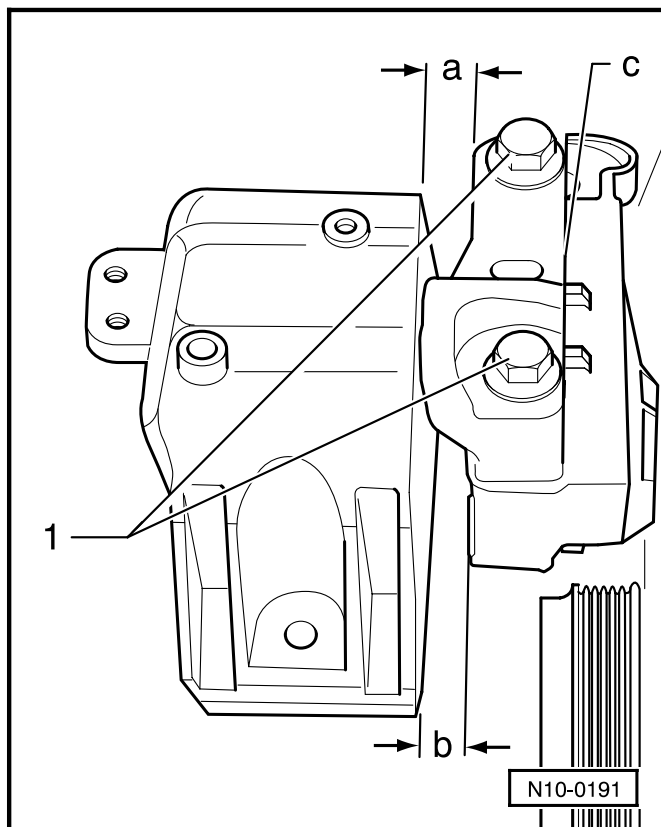
Before slackening the bolts, the engine/gearbox assembly must be secured with the supporting device MP 9-200.

◀ Engine mounting

a = 14.0 mm

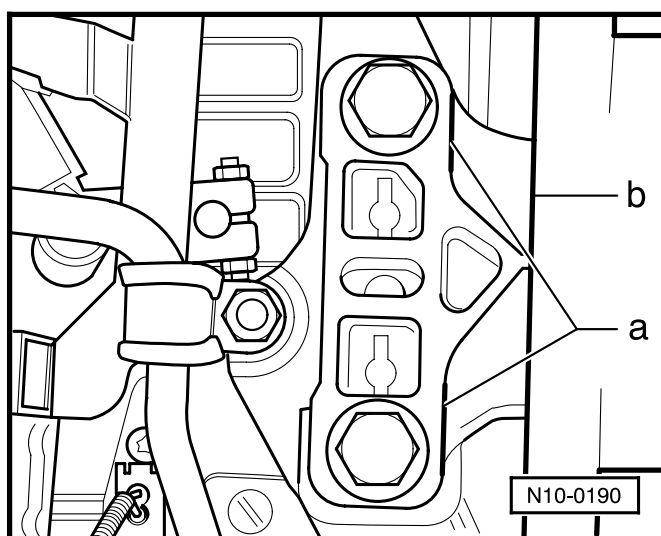
b = at least 10.0 mm

Both bolt heads -1- must finish flush with the edge -c-.



◀ Gearbox mounting

The edges -a- and -b- must be parallel to each other.

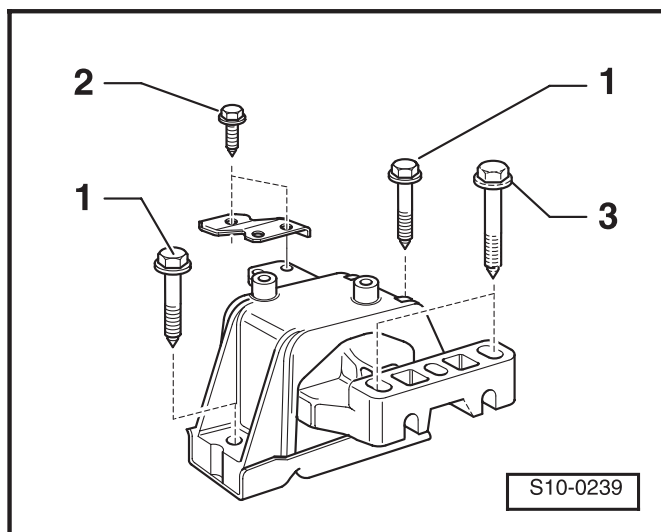


Assembly bracket

Tightening torques

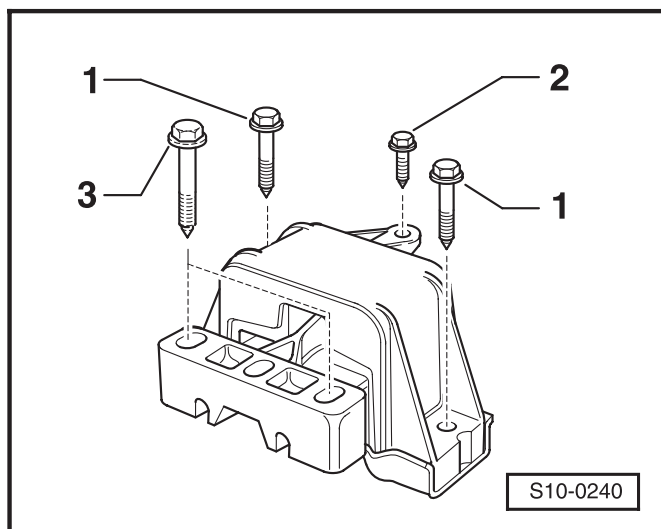
◀ Engine assembly bracket

- 1 - 40 Nm + 90° ($\frac{1}{4}$ turn) - replace
- 2 - 25 Nm
- 3 - 60 Nm + 45° ($\frac{1}{8}$ turn) - replace



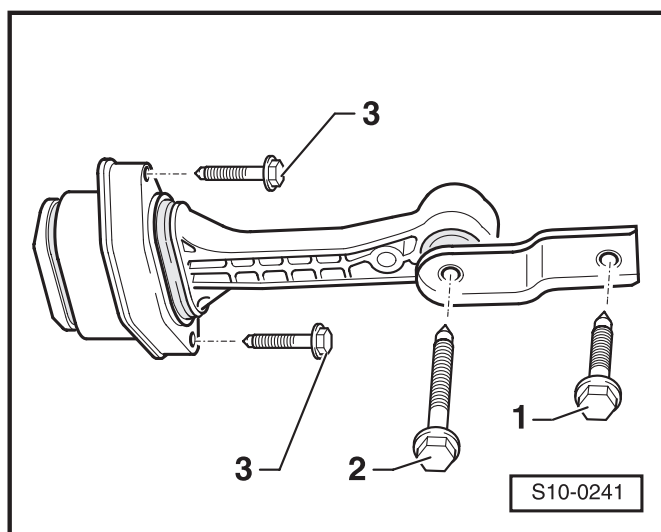
◀ Gearbox assembly bracket

- 1 - 40 Nm + 90° ($\frac{1}{4}$ turn) - replace
- 2 - 25 Nm
- 3 - 60 Nm + 45° ($\frac{1}{8}$ turn) - replace



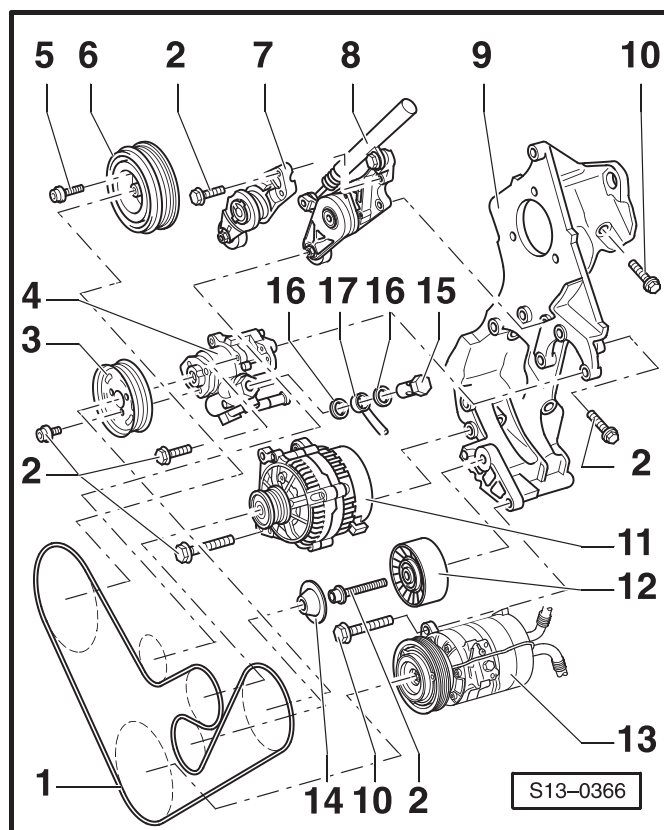
◀ Pendulum support

- 1 - 40 Nm + 90° ($\frac{1}{4}$ turn) - replace
- 2 - 40 Nm + 90° ($\frac{1}{4}$ turn) - replace
- 3 - 20 Nm + 90° ($\frac{1}{4}$ turn) - replace



Disassembling and assembling engine

Removing and installing ribbed V-belt



Notes:

- ♦ The illustration shows the belt drive of models not fitted with air conditioning.
- ♦ Before removing the ribbed V-belt, mark the direction of running. If an already used belt is fitted on again to run in the opposite direction, it may be destroyed. When installing the belt, ensure it is correctly located in the belt pulleys.

1 - Ribbed V-belt

- ♦ removing and installing ⇒ page 13-3

2 - 25 Nm

3 - Belt pulley of hydraulic pump

4 - Hydraulic pump

- ♦ removing and installing ⇒ Running Gear; Repair Group 48

5 - 10 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ♦ always replace

6 - Belt pulley

- ♦ can be installed only in one position - holes are positioned opposite

7 - Tensioning element

- ♦ up to 07.97

8 - Tensioning element with vibration damper

- ♦ from 08.97

9 - Bracket

- ♦ for injection pump, alternator, hydraulic pump and AC compressor

10 - 45 Nm

11 - Alternator

12 - Guide pulley

13 - AC compressor

- ♦ do not open refrigerant circuit

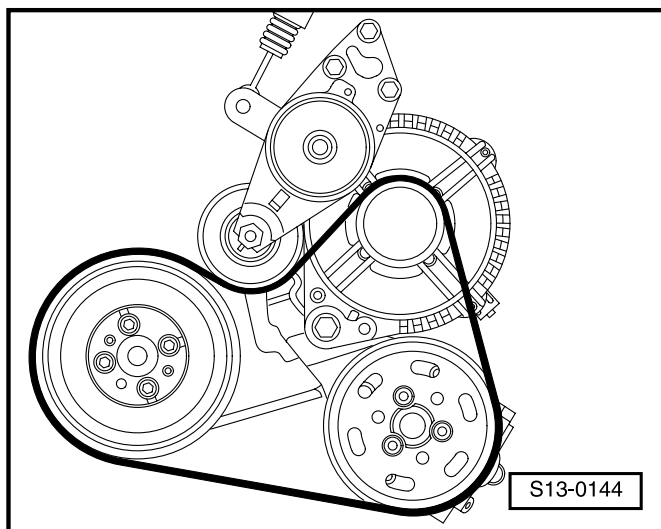
14 - Cover

15 - Banjo bolt, 30 Nm

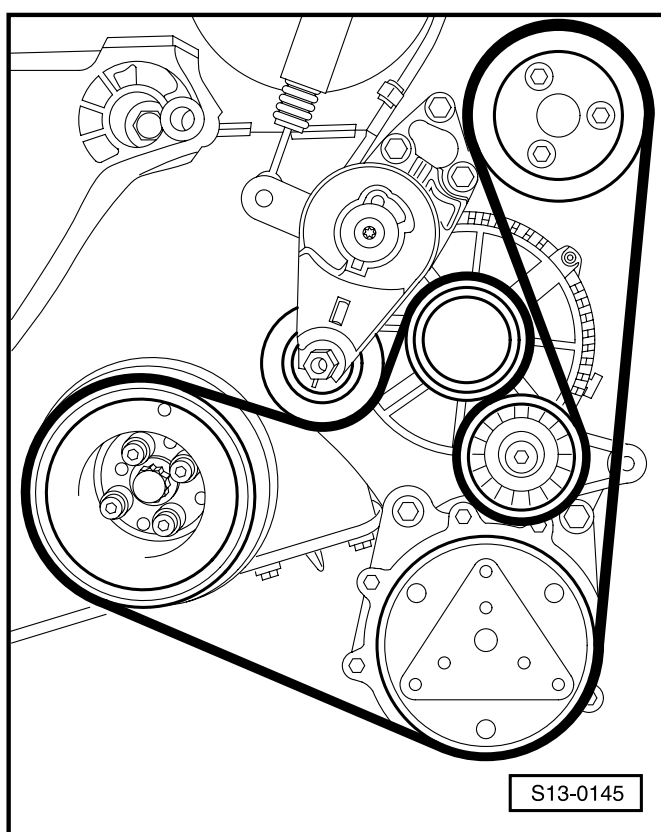
16 - Seal

- ♦ replace

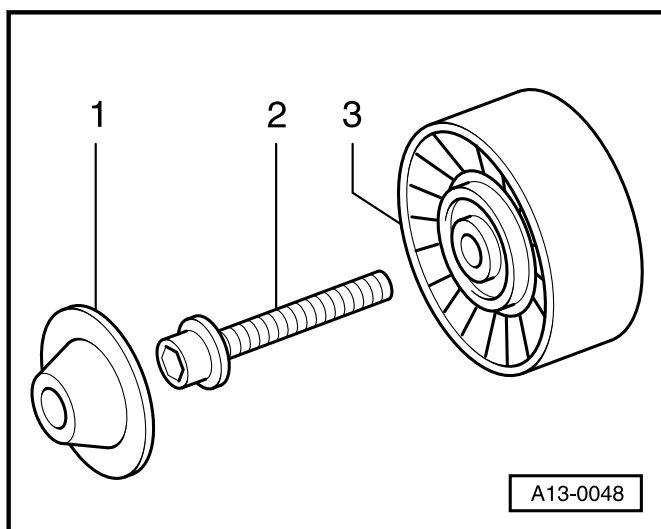
17 - Pressure line



◀ Fig. 1 Routing of ribbed V-belt on vehicles without air conditioning



◀ Fig. 2 Routing of ribbed V-belt on vehicles with air conditioning



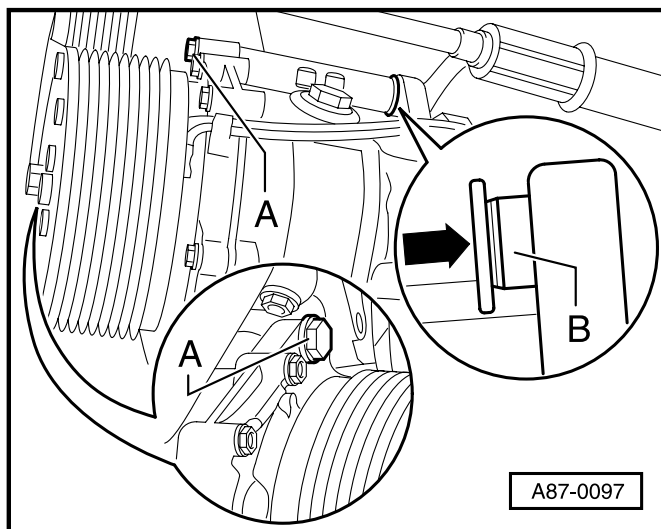
◀ Fig. 3 Attaching guide pulley of ribbed V-belt

Only on vehicles fitted with AC

1 - Cover

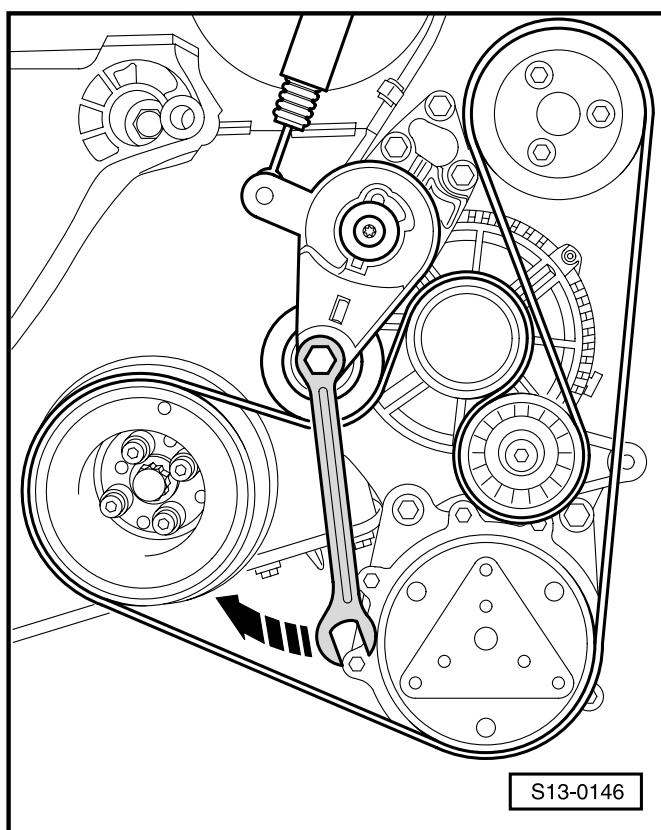
2 - 25 Nm

3 - Guide pulley



◀ Fig. 4 Install AC compressor

- To facilitate the positioning of the AC compressor, drive the threaded bushings -B- for fixing screws -A- slightly backwards in direction of the arrow.
- Tighten bolts to 45 Nm.



Remove ribbed V-belt

Note:

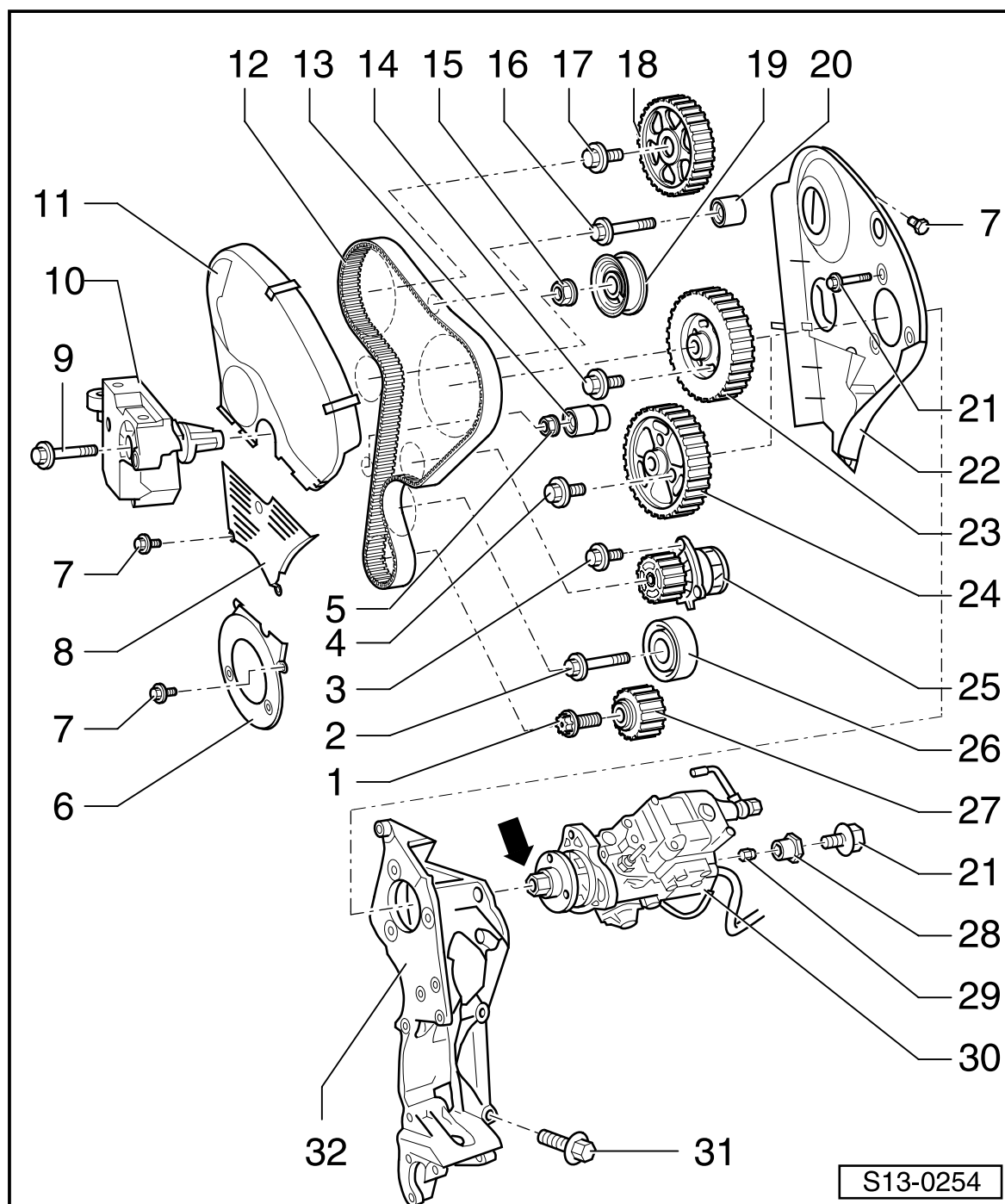
On vehicles fitted with AC remove guide pulley for ribbed V-belt with belt pulley ⇒ Fig. 3 page 13-2.

- Remove noise insulation on bottom right.
- Remove air guide pipe between charge air cooler and turbocharger ⇒ page 21-9, item. 9.
- Position flat ring spanner SW 16 on hexagon of tensioning pulley.
- ◀ - Swivel tensioning pulley in direction of arrow in order to slacken the ribbed V-belt.
- Remove ribbed V-belt.

Install ribbed V-belt

- Raise tensioning pulley for ribbed V-belt with flat ring spanner SW 16 and fit ribbed V-belt.

Removing and installing toothed belt



Note:

Mark the direction of running of the toothed belt before removing it. If an already used belt is fitted on again to run in the opposite direction, it may be destroyed.

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Counterholder MP 1-216
- ◆ Locking pin 3359
- ◆ Adjusting straightedge MP 1-312
- ◆ Wrench for toothed belt-tensioning pulley (e.g. Matra V159, Hazet 2587 or Stahlwille 127-17)
- ◆ Supporting device MP 9-200
- ◆ Feeler gauges
- ◆ Puller T40001 with hook T40001/2 and T40001/3

1 - 120 Nm + torque a further ¼ turn (90°)

- ◆ Use counterholder MP 1-310 or lever T30004 for slackening and tightening
- ◆ Always replace
- ◆ Thread and contact surface must be free of oil and grease
- ◆ Torquing further by 90° can be carried out in several stages

2 - 40 Nm + torque a further ¼ turn (90°)

- ◆ Always replace
- ◆ Torquing further by 90° can be carried out in several stages

3 - 15 Nm**4 - 23 Nm****5 - 22 Nm****6 - Bottom toothed belt guard****7 - 10 Nm****8 - Middle toothed belt guard****9 - 45 Nm****10 - Engine support****11 - Top toothed belt guard****12 - Toothed belt**

- ◆ Mark direction of running before removing
- ◆ Inspect for wear
- ◆ Do not kink
- ◆ Removing and installing ⇒ page 13-6

13 - Guide pulley

- ◆ From 08.97

14 - 20 Nm + torque a further ¼ turn (90°)

- ◆ Replace
- ◆ Torquing further by 90° can be carried out in several stages

15 - 20 Nm**16 - Bolt for guide pulley**

- ◆ 17 Nm with mounting bracket -item 31-; Part No. 038 903 143 E/F
- ◆ 20 Nm with mounting bracket -item 31-; Part No. 038 903 143 A/B

17 - 45 Nm

- ◆ Hold camshaft sprocket with counterholder MP 1-216 for slackening and tightening

18 - Camshaft sprocket

- ◆ Use special tool T40001 for pulling off taper of camshaft

19 - Semi-automatic tensioning pulley

- ◆ Inspecting semi-automatic toothed belt tensioning pulley ⇒ page 13-11
- ◆ Fitting location ⇒ Fig. 1

20 - Guide pulley**21 - 30 Nm****22 - Rear toothed belt guard**

- ◆ Insert at lower edge behind sealing flange at front

23 - Injection pump gear

- ◆ From 08.97

24 - Injection pump gear

- ◆ Up to 07.97

25 - Coolant pump

- ◆ Removing and installing
⇒ page 19-5

26 - Guide pulley

- ◆ Unbolt in order to remove coolant pump

27 - Crankshaft toothed belt sprocket

- ◆ There must not be any oil on contact surface between toothed belt sprocket and crankshaft
- ◆ Fitting location: flats on toothed belt sprocket and crankshaft must be aligned

28 - Bush**29 - Nut**

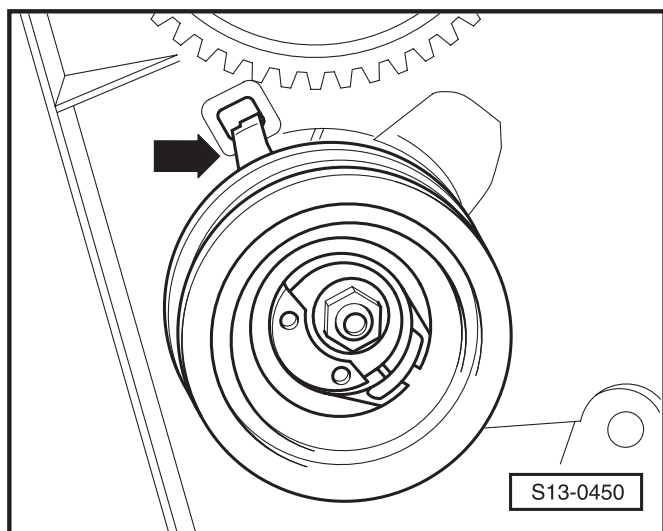
- ◆ Insert into bush -item 28-

30 - Injection pump

- ◆ On no account slacken central nut -arrow-
- ◆ Removing and installing
⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

31 - 45 Nm**32 - Mounting bracket**

- ◆ For models without AC
- ◆ For injection pump, alternator and hydraulic pump



◀ **Fig. 1** **Installation position of the semi-automatic tensioning pulley**

The holding claw -arrow- must engage in the recess on the rear toothed belt guard.

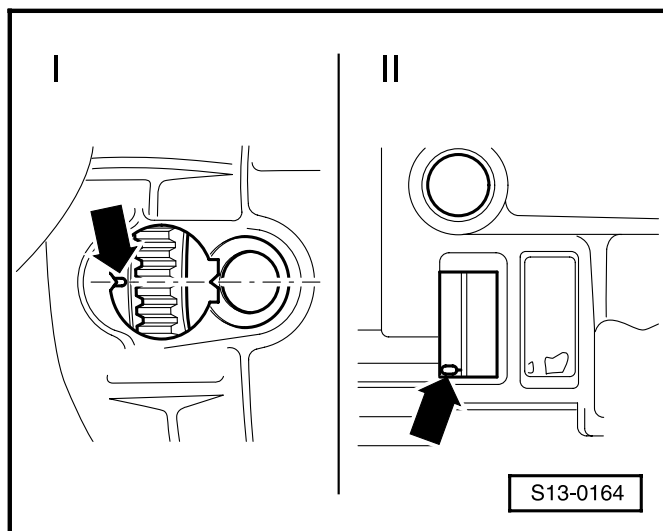
Removing toothed belt

Engine installed in the vehicle

- Remove right headlights ⇒ Electrical System; Repair Group 94, Removing and installing headlights.
- Remove engine cover ⇒ page 10-2.
- Remove plug from the intake manifold pressure sender (G71) and intake manifold temperature sender (G72).
- Remove the air guide pipe between the charge air cooler and the intake manifold.
- Unbolt coolant expansion reservoir and place to the side.
- Unbolt power steering reservoir and place to the side.
- Unbolt washer fluid reservoir and place to the side.
- Unbolt fuel filter and place to the side.
- Remove the noise insulation.
- Remove the air guide pipe between the charge air cooler and the exhaust turbocharger ⇒ page 21-9.

For all vehicles

- Remove top toothed belt guard and cylinder head cover.
- Remove vacuum pump for brake servo unit ⇒ page 15-3.
- Remove the V-ribbed belt ⇒ page 13-1.

**Engine installed**

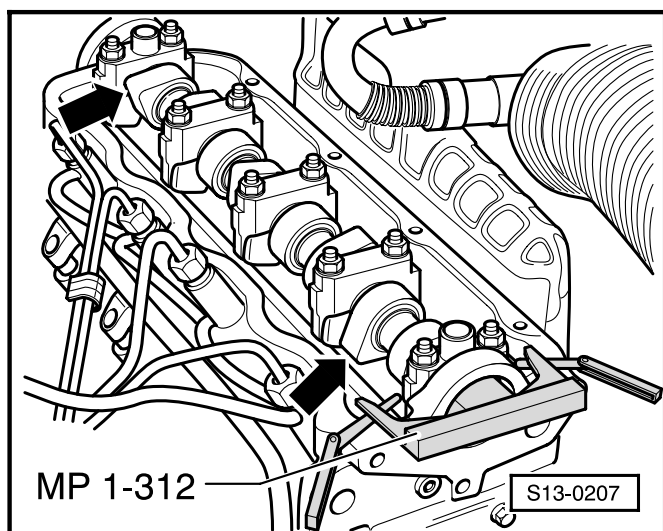
- Rotate crankshaft to TDC of cylinder 1 -arrow-.

- ◀ - Check whether TDC marking on flywheel and driven plate with reference mark are aligned -arrow-.

I - Manual gearbox
II - Automatic gearbox

Note:

Rotating crankshaft to TDC of cylinder 1 with the engine removed ⇒ page 13-11.

**Continued for all models**

- ◀ - Lock camshaft position with setting straight-edge MP 1-312.

Note:

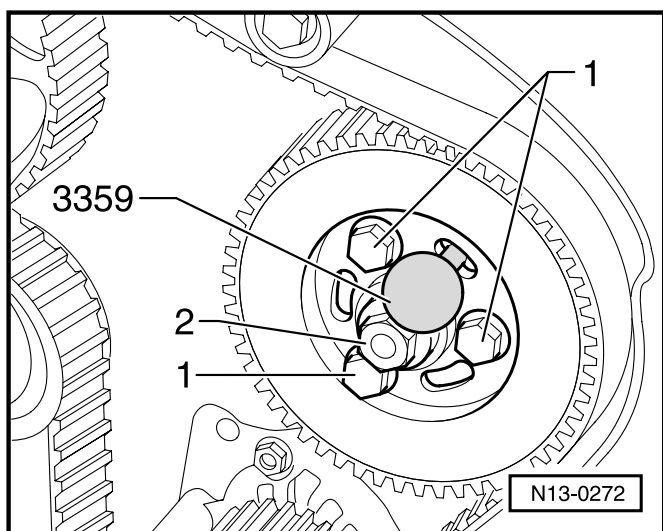
The valves of cylinder 1 must be closed and the valves of cylinder 4 at overlap -arrows-.

- Centre setting straightedge as follows:
Rotate locked camshaft until one end of the straightedge strikes the cylinder head. Use a feeler gauge to measure the gap produced at the other end of the straightedge. Insert a feeler gauge of half this value between straightedge in cylinder head. Now, rotate camshaft until the straightedge is resting on the feeler gauge. Insert the second feeler gauge with the same value between straightedge in cylinder head.

- Lock injection pump gear with locking pin 3359.

Note:

Always moisten locking pin with oil. It is recommended to use a mirror for inserting the locking pin.

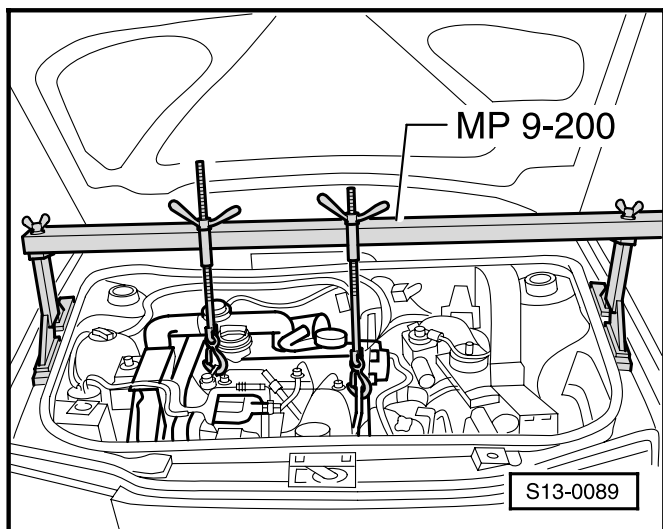


- ◀ - Slacken bolts -1- attaching injection pump gear and replace with new bolts.

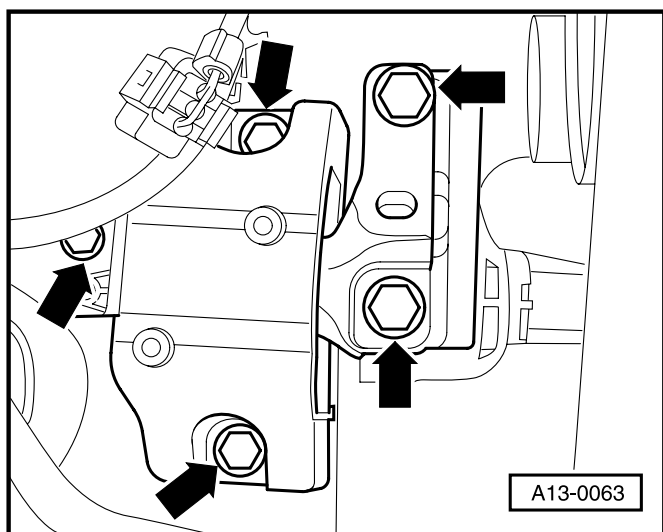
- Tighten bolts lightly so that it is still possible to rotate the gear.

Note:

On no account, slacken central nut -2- of the injection pump gear otherwise this will alter the basic setting of the injection pump and it can no longer be set with workshop tools.



- Slacken tensioning pulley.
- Remove vibration damper/belt pulley.
- ◀ - Insert supporting device MP 9-200 and take up weight of engine and gearbox in this position.



- ◀ - Unbolt engine mounting bracket from engine support and engine support from body -arrows-.
- Unbolt engine mounting bracket from engine.

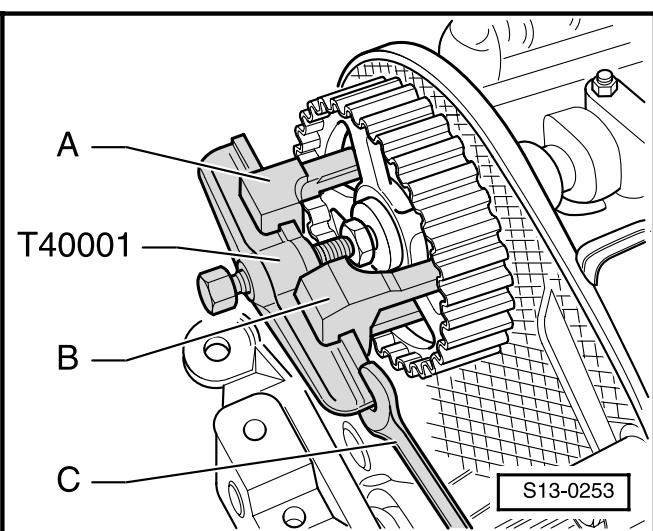
Note:

To slacken the front bolt of the engine mounting bracket, raise engine slightly with spindle of supporting device MP 9-200.

- Detach ribbed V-belt pulley from crankshaft.
- Remove toothed belt guard in middle and at bottom.
- Mark direction of running of toothed belt.
- Take off toothed belt.

Installing toothed belt

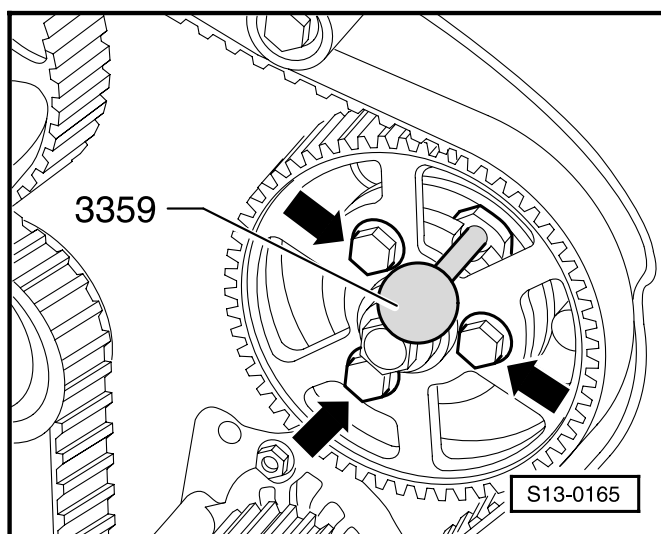
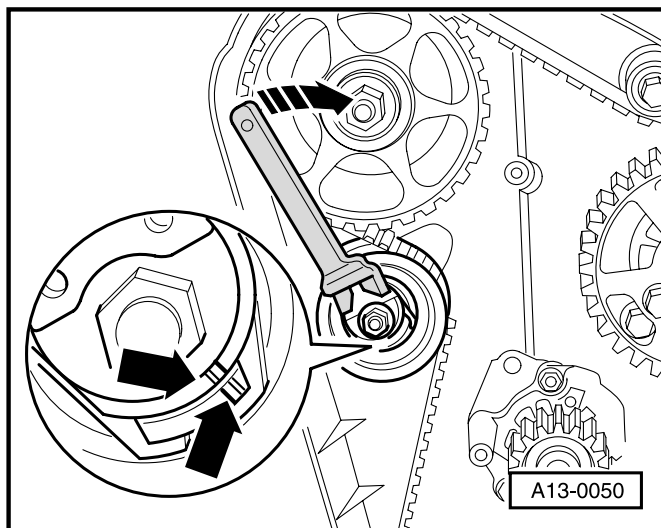
- Check whether TDC marking on flywheel and reference mark are aligned.
- Slacken bolt attaching camshaft sprocket 1/2 turn. Counterhold camshaft sprocket with special tool MP 1-216 for this step.



Warning!

When slackening and tightening camshaft sprocket, never use adjusting straightedge as a counterholder. Counterhold camshaft sprocket with special tool MP 1-216.

- ◀ - Insert puller T40001 and hook T40001/2 -A- and T40001/3 -B- into belt pulley. Use open-end wrench -C- as a counterholder and detach belt pulley from the taper of the camshaft.



- Fix in position the bolt for attaching the camshaft sprocket (camshaft sprocket can still be rotated).
- Align injection pump gear to centre position in the slots.
- Fit toothed belt onto crankshaft toothed belt sprocket, guide pulley, coolant pump, injection pump gear and tensioning pulley (pay attention to direction of running).
- ◀ Use nut turner (e.g. Matra V159) to turn tensioning pulley to the right until the notch and raised section -arrows- are opposite each other.
- Tighten the clamping nut at the tensioning pulley to a final torque of 20 Nm.
- Once again check whether TDC marking on the flywheel and reference mark are aligned.
- Tighten bolt for attaching camshaft sprocket and torque finally to 45 Nm. Counterhold camshaft sprocket with MP1-216.

- ◀ - Replace bolts for attaching injection pump gear -arrows- and tighten to a final torque of 20 Nm.
- Remove adjusting straightedge.
- Remove locking pin 3359.
- Rotate crankshaft a further two revolutions in direction of rotation of engine and position again at TDC of cylinder 1.
- Check whether it is possible to block the injection pump gear with locking pin 3359.

If it is not possible to block the injection pump gear:

- Rotate crankshaft until it is possible to block the injection pump gear with locking pin 3359.
- Block injection pump gear with locking pin 3359.
- Slacken bolts for attaching injection pump gear.
- Rotate crankshaft until the help marking on the flywheel is aligned with the edge of the adjusting device.

- Tighten bolts attaching injection pump gear to 20 Nm and then torque a further 1/4 turn (90°).

- Remove locking pin 3359.

If it is possible to lock the injection pump gear:

- Tighten bolts attaching injection pump gear 1/4 turn (90°).
- Install centre part and top part of toothed belt guard.
- Install engine mount ⇒ page 13-4.
- Install engine bracket, tightening torque ⇒ page 10-16.
- Remove supporting device MP 9-200.
- Install vacuum pump for brake servo unit ⇒ page 15-1, Removing and installing cylinder head.
- Install vibration damper/belt pulley.
- Install ribbed V-belt ⇒ page 13-1.
- Install air guide pipe between charge air cooler and intake manifold.
- Plug in connector at intake manifold pressure sender (G71) and at intake manifold temperature sender (G72).
- Attach expansion reservoir for coolant, power steering, windshield washer system and fuel filter.
- Install camshaft housing.
- Install top toothed belt guard.
- Install top engine trim panel ⇒ page 10-2, Fig. A10-0115.
- Install air guide pipe between charge air cooler and turbocharger ⇒ page 21-9, item 9.

- Install the noise insulation.
- Install right headlights ⇒ Electrical System; Repair Group 94, Removing and installing headlights.
- Dynamically test and set commencement of injection:
⇒ 1.9l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System, Repair Group 23; Dynamically test and set commencement of injection.

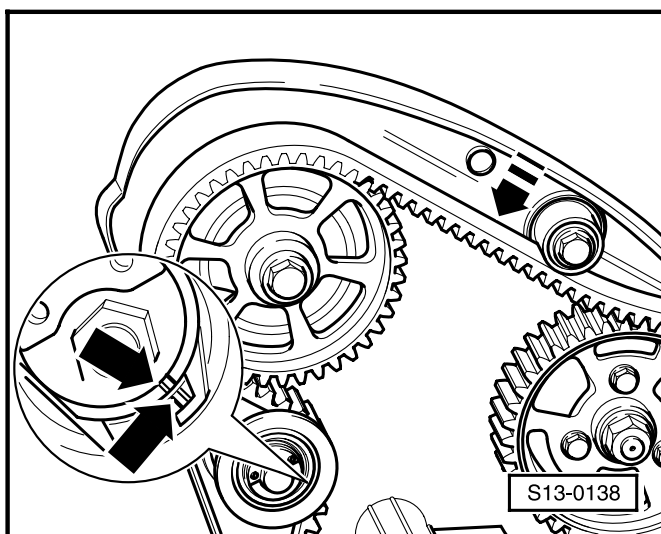
Inspecting semi-automatic toothed belt-tensioning pulley

Test conditions

- Engine oil temperature not above 40 °C

Test procedure

- Position engine to top TDC of cylinder 1.
- ◀ - Use your thumbs to forcefully press on the toothed belt. The markings on the tensioning pulley must move -arrows-.
- Relieve the toothed belt and turn the crankshaft two turns in the direction of rotation of the engine, until the engine is again positioned at TDC of cylinder 1. When doing this, it is important that the last 45° ($\frac{1}{8}$ turn) are rotated without any interruption.
- The tensioning pulley must return to its initial position. (Notch and lobe are again opposite one another).



Position crankshaft when engine is removed to TDC of cylinder 1

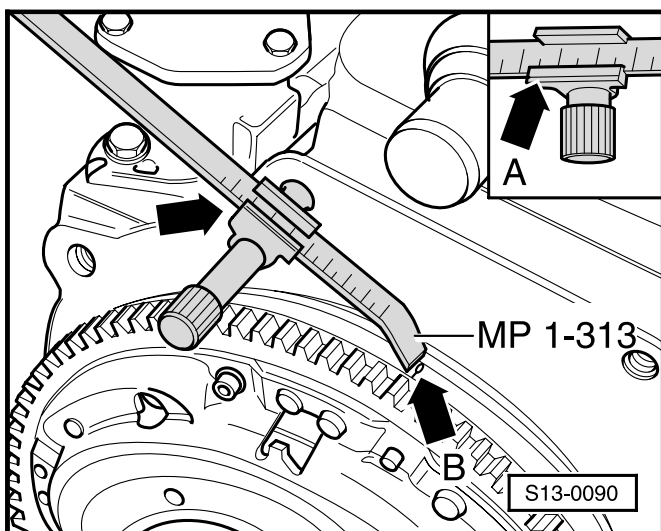
Special tools, testers and aids required

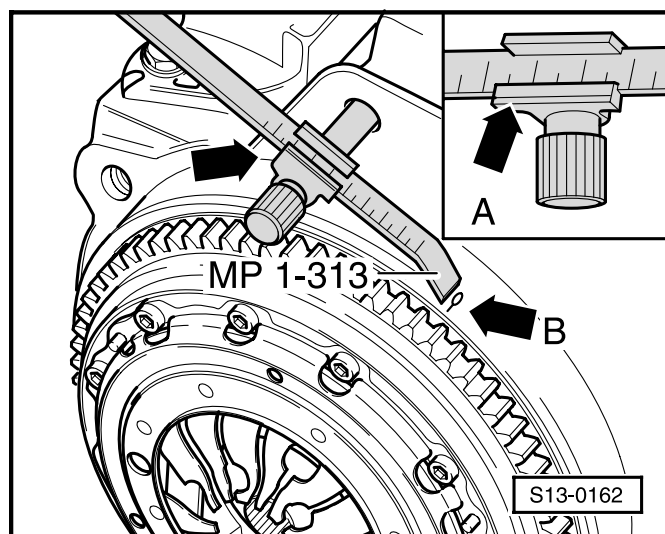
- ◆ Adjusting device for TDC MP 1-313

The engine is lying on the work surfaces (vehicles with manual gearbox):

For vehicles ► 07.97

- ◀ - Screw in adjusting device for TDC MP 1-313 according to the illustration.

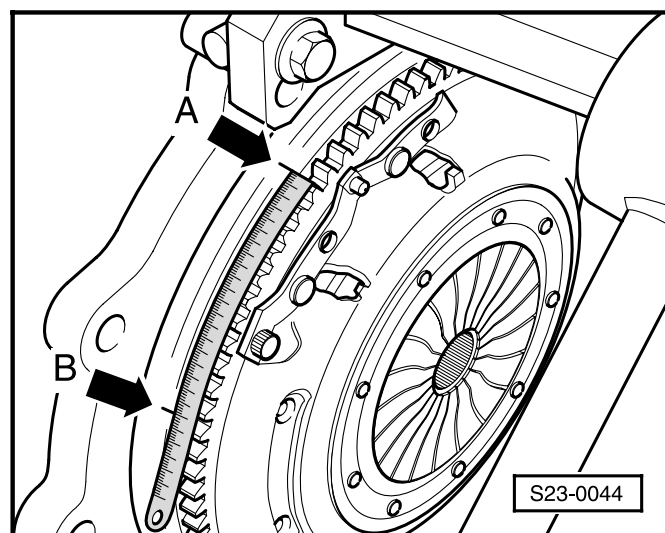




- Set adjusting device to 96 mm -arrow- (the left-hand notch of the vernier -arrow A- is the reference point).
- Rotate crankshaft until TDC marking -arrow B- on the flywheel is aligned with the edge of the adjusting device.

Models 08.97 ►

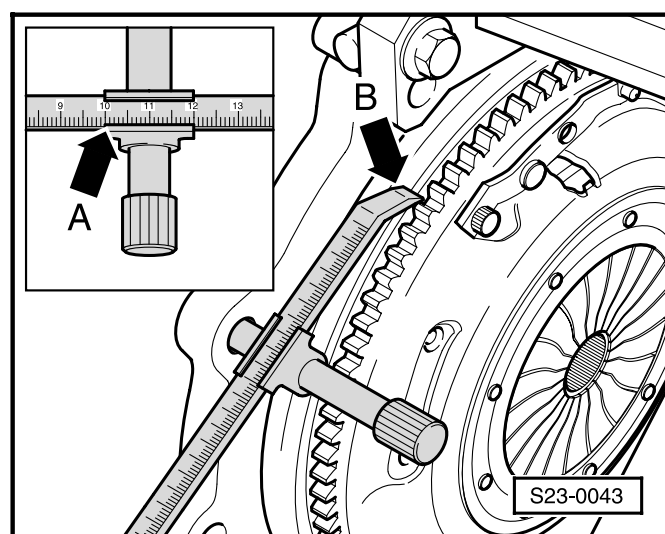
- ◄ - Screw in adjusting device for TDC MP 1-313, as shown in the illustration.
- Set adjusting device to 100.4 mm -arrow- (the left-hand notch of the vernier -arrow A- is the reference point).
- Rotate crankshaft until TDC marking -arrow B- on the flywheel is aligned with the edge of the adjusting device.



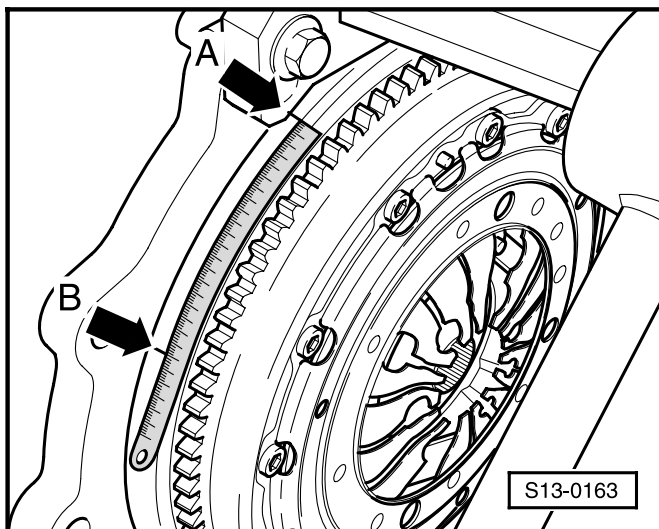
Engine attached to engine holder MP 1-202

Models ► 07.97

- ◄ - Place flexible steel rule (marking tool) on circumference of flywheel.
- Measure exactly 100 mm from the TDC marking -arrow A- and make a help marking -arrow B- with the marking tool.



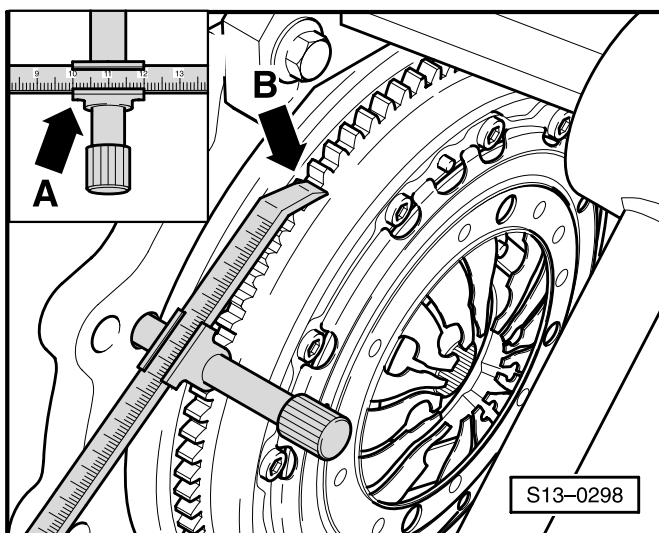
- ◄ - Screw in adjusting device for TDC MP 1-313, as shown in the illustration.
- Set adjusting device to 91.4 mm -arrow- (the left-hand notch of the vernier -arrow A- is the reference point).



- Rotate crankshaft until the TDC marking on the flywheel is aligned with the edge of the setting device -arrow B-.

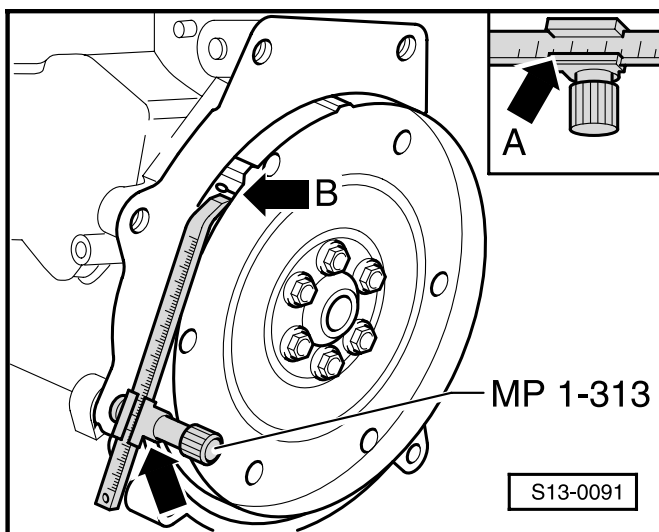
Models 08.97 ➤

- ◀ - Place flexible marking steel straightedge around circumference of flywheel.
- Measure exactly 100 mm from the TDC marking -arrow A- and make an auxiliary marking -arrow B- with the scribe point.

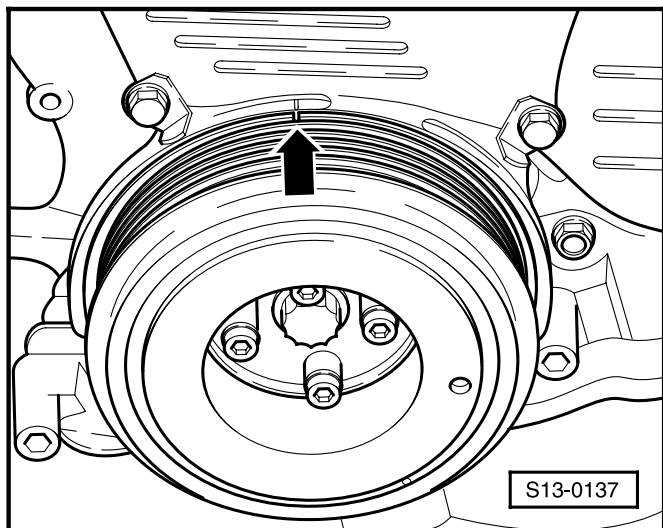


- ◀ - Screw in setting device MP 1-313, as shown in illustration.
- Position setting device to 96 mm (left notch of vernier -arrow A- is the reference point).
- Rotate crankshaft until the TDC marking on the flywheel is aligned with the edge of setting device -arrow B-.

Models fitted with automatic gearbox

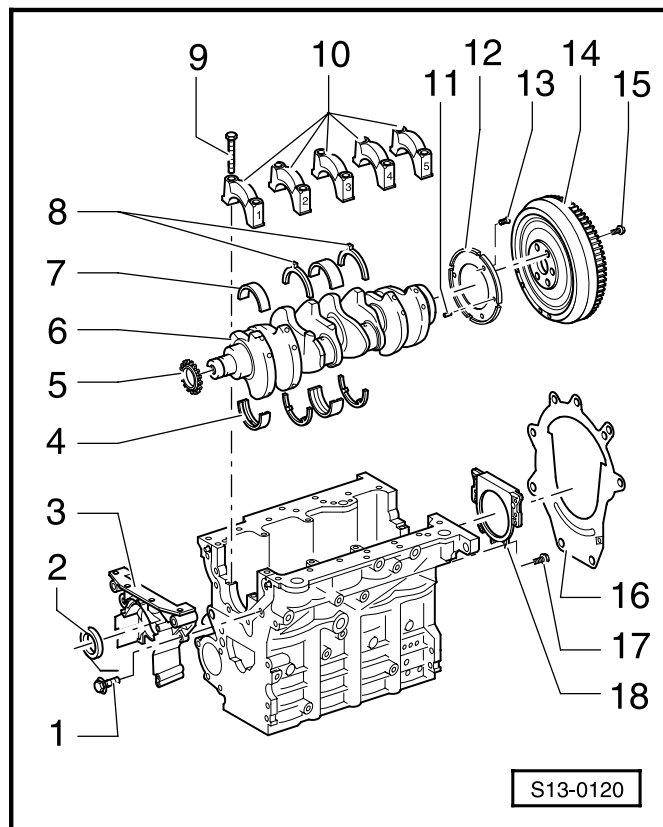


- ◀ - Screw in setting device MP 1-313, as shown in illustration.
- Position setting device to 30 mm (left notch of vernier -arrow A- is the reference point).
- Rotate crankshaft sufficiently until the TDC marking -arrow B- on the driven plate is aligned with the edge of setting device.

**With crankshaft ribbed V-belt pulley installed**

- ◀ - Align marking for TDC on ribbed belt pulley of crankshaft with marking on bottom toothed belt cover.

Removing and installing crankshaft



Note:

Servicing clutch:

⇒ 5-speed Manual Gearbox 02J; Repair Group 30; Servicing clutch

1 - 15 Nm

2 - Seal

- ◆ pay attention to different versions
⇒ Fig. 3
- ◆ replacing ⇒ page 13-15

3 - Front sealing flange

- ◆ removing and installing ⇒ page 13-18

4 - Bearing shell

- ◆ do not mix up used bearing shells (mark)

5 - Chain sprocket

- ◆ for oil pump chain

6 - Crankshaft

- ◆ axial play of new part:
0.07....0.17 mm
wear limit: 0.37 mm
- ◆ main bearing journal: $\varnothing$ 54.00 mm
- ◆ conrod bearing journal: $\varnothing$ 47.80 mm

7 - Bearing shell

- ◆ for bearing cap without lubricating groove
- ◆ do not mix up used bearing shells (mark)

8 - Thrust washers

- ◆ for bearing 3
- ◆ pay attention for different version for cylinder block and bearing cap
- ◆ pay attention to locating element of washers

9 - 65 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ◆ replace

10 - Bearing cap

- ◆ bearing cap 1: belt pulley side
- ◆ bearing cap 3: with recesses for thrust washers
- ◆ installation position: retaining lugs of bearing shells of cylinder block/bearing cap must be positioned one above the other

11 - Dowel pin

- ◆ inspecting projection out of crankshaft
⇒ Fig. 1

12 - Sensor rotor

- ◆ for wheel speed sensor

13 - 10 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ◆ replace

14 - Flywheel/driven plate

- ◆ removing and installing flywheel
⇒ page 13-16
- ◆ removing and installing driven plate
⇒ page 13-16
- ◆ installation dimension for driven plate
⇒ page 13-17

15 - 60 Nm + torque a further $\frac{1}{4}$ turn (90°)

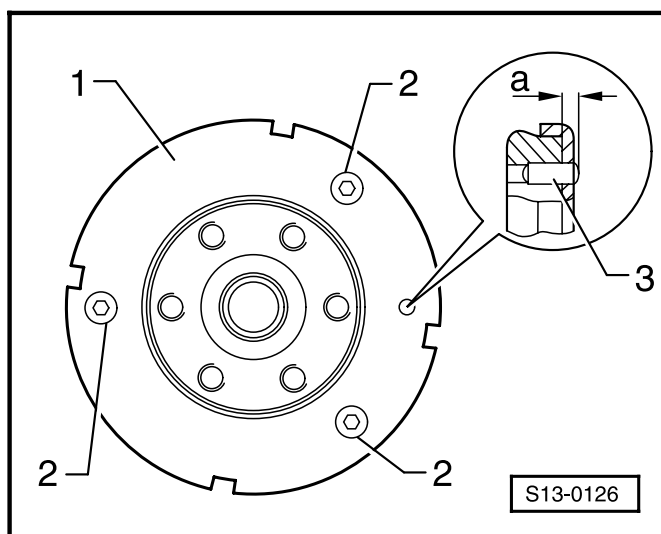
- ♦ replace

16 - Intermediate plate

- ♦ is attached to sealing flange $\Rightarrow$ Fig. 2
- ♦ must be located on dowel sleeves
- ♦ do not damage or bend when carrying out removal and installation work

17 - 15 Nm**18 - Rear sealing flange with seal**

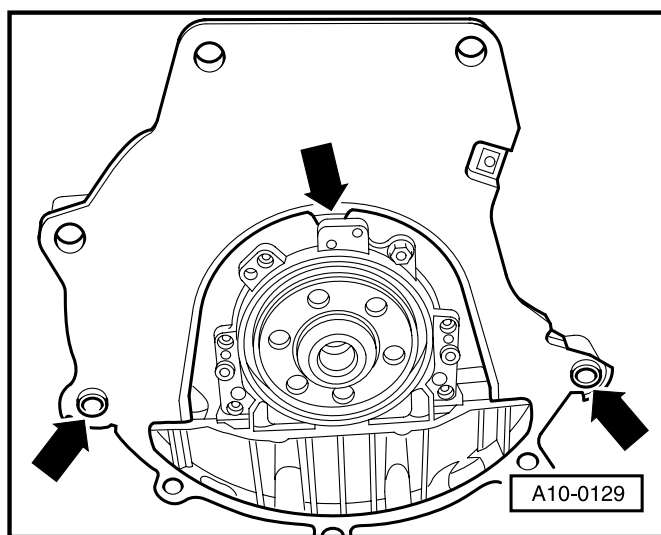
- ♦ always replace complete
- ♦ must be located on dowel sleeves
- ♦ take off oil pan for removing $\Rightarrow$ page 17-3
- ♦ clean sealing surface before installing
- ♦ sealing flange is supplied as replacement part with PTFE seal
- ♦ install seal dry, crankshaft journal must be free of grease
- ♦ install new sealing flange with sleeve (do not pull sleeve off seal before installing)



◀ Fig. 1 Inspecting projection of dowel pin out of crankshaft

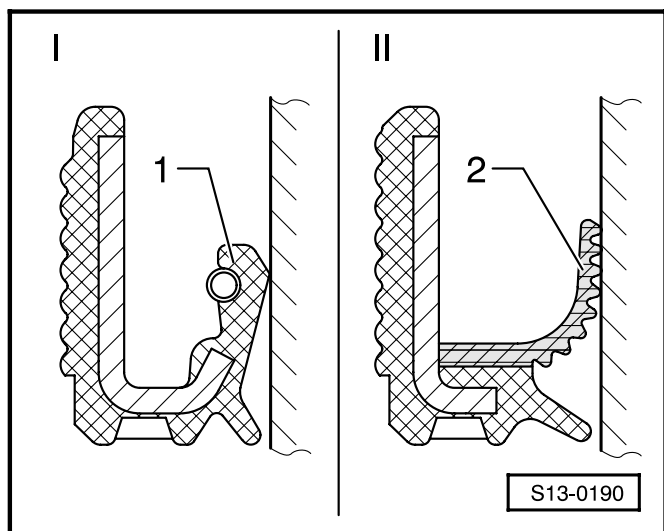
Projection of dowel pin -3- out of crankshaft

- ♦ $a = 2.5 \dots 3.0 \text{ mm}$



◀ Fig. 2 Installing intermediate plate

- Attach intermediate plate to the sealing flange and push it onto dowel sleeves -arrows-.



◀ Fig. 3 Seal versions

I Elastomer seal

Sealing lip -1-; with worm spring

II PTFE seal

Several sealing lips -2-; without worm spring

Notes:

- ◆ *Do not moisten PTFE seal with oil before installing. The shaft must also be free of oil and grease.*
- ◆ *Never replace a PTFE seal (new version) with an elastomer seal (old version).*
- ◆ *A PTFE seal can be installed in place of an elastomer seal.*

Replace seal for crankshaft/belt pulley side

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Gasket ring extractor MP 1-226
- ◆ Guide sleeve MP 1-231/1
- ◆ Pressure sleeve MP 1-314
- ◆ Guide sleeve T10053/1
- ◆ Pressure sleeve T10053
- ◆ Counterholder MP 1-310 or Lever T 30004
- ◆ Pressure sleeve MP 1-315

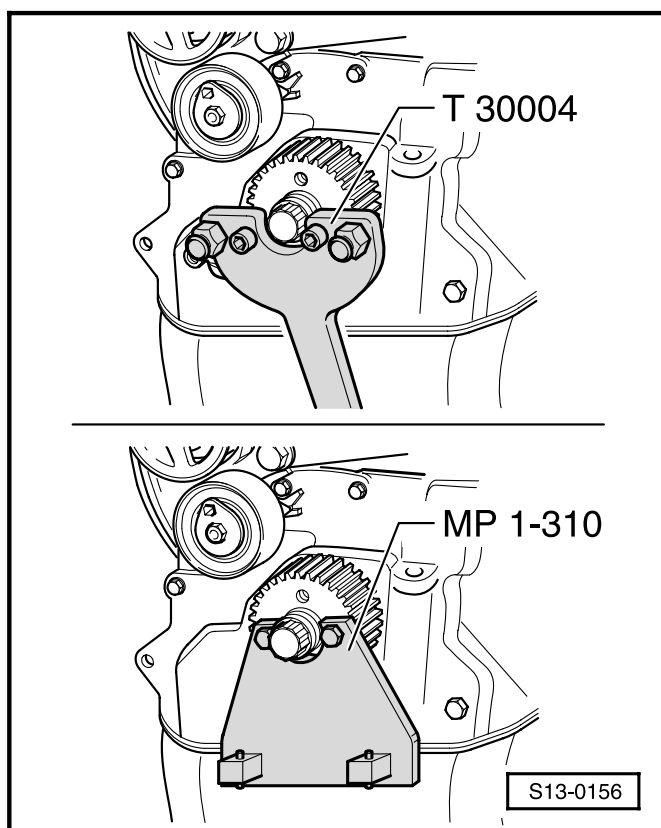
Removing

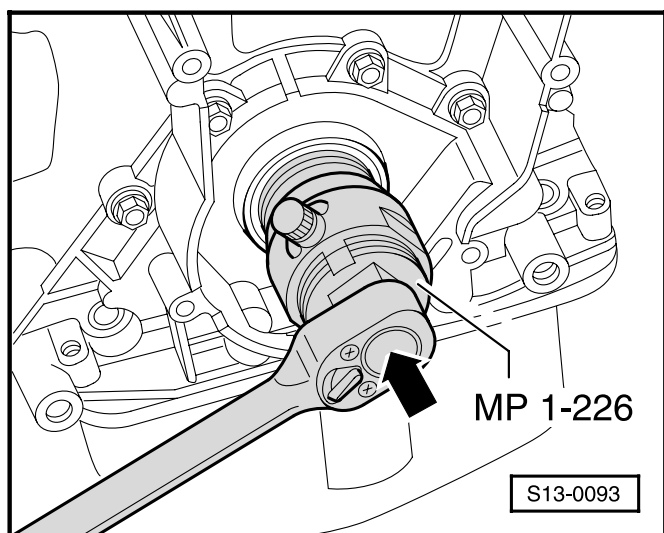
- Removing ribbed V-belt ⇒ page 13-3.
- Removing toothed belt ⇒ page 13-6.
- ◀ - Removing toothed belt sprocket of crankshaft. To this end lock toothed belt sprocket with counterholder MP 1-310 or lever T 30004.

Note:

When screwing on the counterholder MP-310, two washers are placed between the toothed belt sprocket and the counterholder.

- Screw in central screw of the toothed belt sprocket in the crankshaft.
- Unscrew inner part of the gasket ring extractor MP 1-226 two turns (approx. 3 mm) out of the outer part and lock with knurled screw.





- ◀ - Oil threaded head of seal extractor MP 1-226, fit on and screw as far as possible into the seal using considerable pressure.
- Slacken knurled screw and turn inner part against the crankshaft until the seal is pulled out.

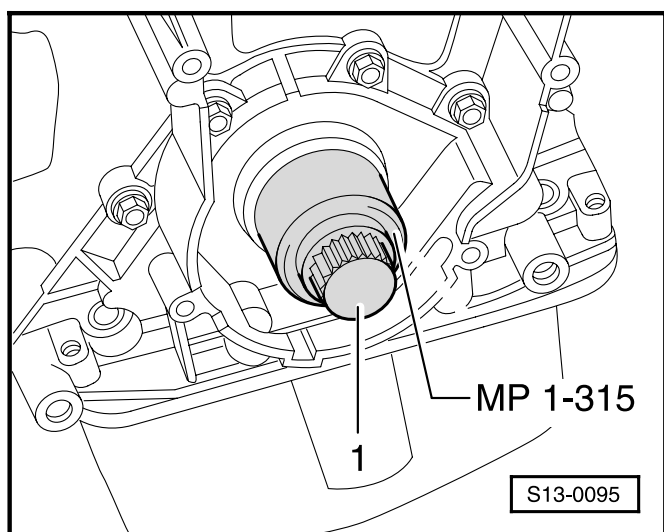
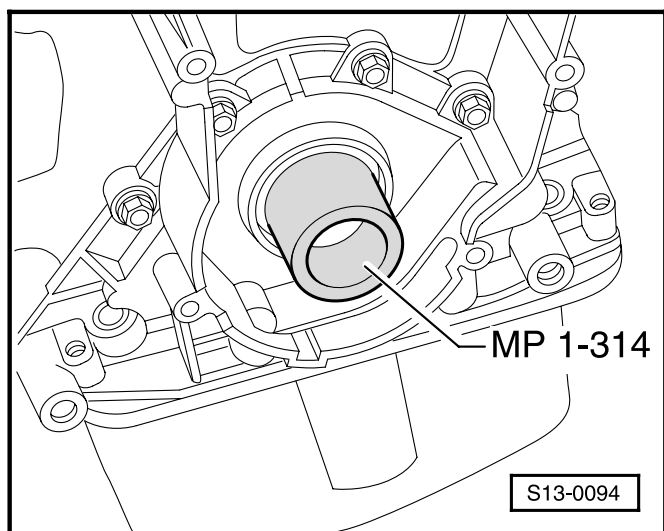
Installing

Notes:

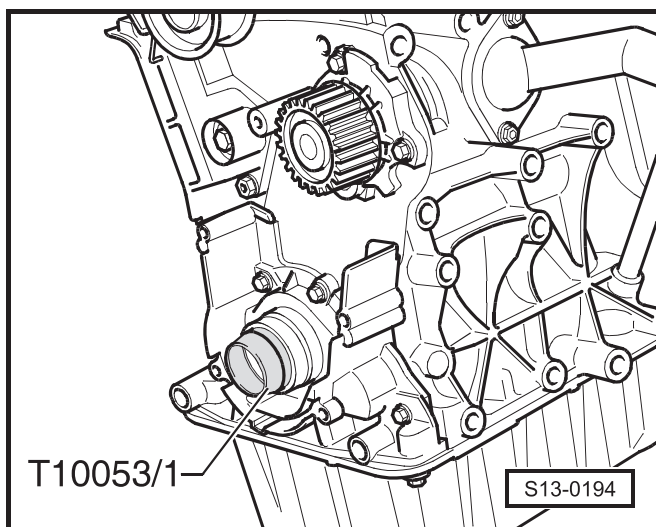
- ♦ Different seal versions ⇒ page 13-14, Fig. 3.
- ♦ Never install an elastomer seal (old version) if a PTFE seal (new version) was fitted.
- ♦ A PTFE seal can be installed if an elastomer seal was previously fitted.

Installing elastomer seal

- ◀ - Inspect crankshaft for traces of wear from seal.
- Lightly oil sealing lip of seal.
- Fit guide sleeve with MP 1-314 onto the crankshaft journal.
- Push seal over guide sleeve.



- ◀ - Use thrust sleeve from MP 1-315 to press in seal flush.
- 1 - Central bolt of toothed belt sprocket

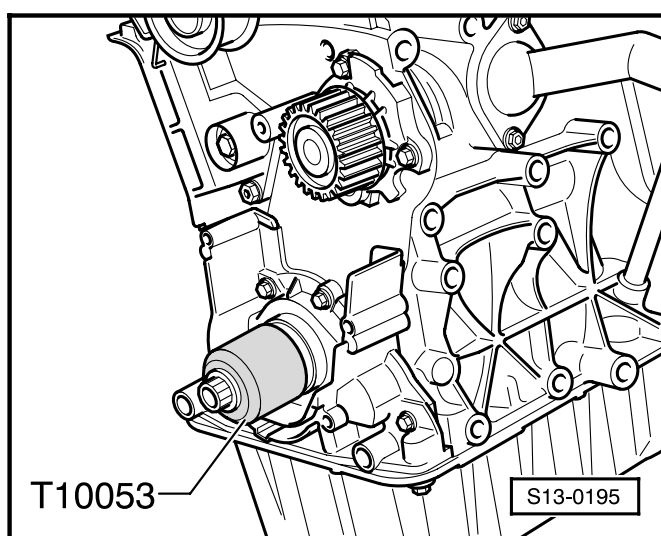


Installing PTFE seal

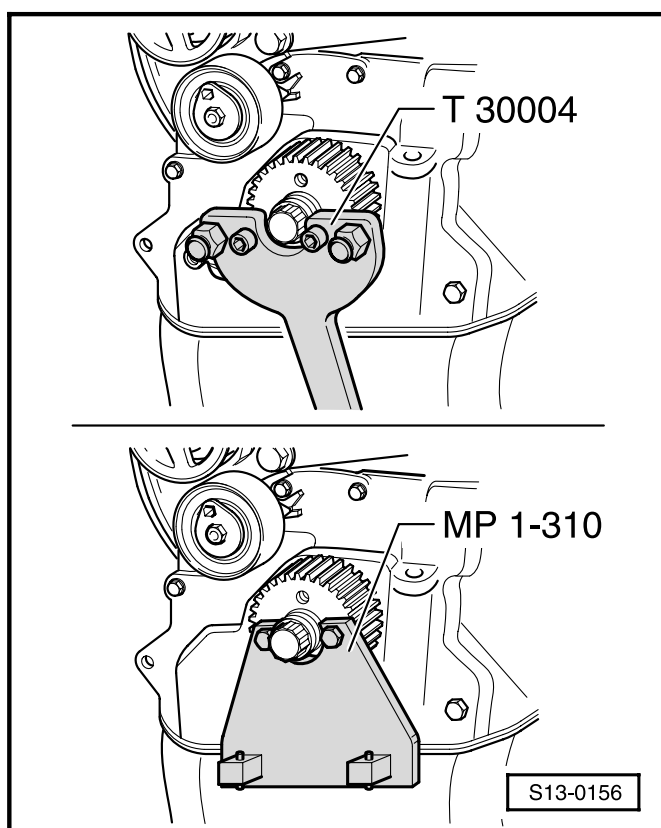
Note:

The sealing lips of the seal must not be oiled or greased.

- Use a clean cloth to remove oil residues on the crankshaft journal.
- ◀ - Fit guide sleeve T10053/1 onto the crankshaft journal.
- Push seal over guide sleeve onto the crankshaft journal.



- ◀ - Use thrust sleeve T10053 to press in seal as far as the stop. Use old central bolt of crankshaft toothed belt sprocket for this step.



Continued for both versions

- ◀ - Install crankshaft toothed belt sprocket and lock with counterholder T30004 or MP 1-310.

Note:

- ◆ When screwing on the counterholder MP 1-310 place 2 washers between the toothed belt sprocket and the counterholder.
- ◆ Replace central bolt for toothed belt-tensioning pulley.
- ◆ When tightening the central bolt, the crankshaft must not turn.
- Tighten the new central bolt for toothed belt sprocket to 120 Nm + torque a further $\frac{1}{4}$ turn (90°).
- Install toothed belt ⇒ page 13-4.
- Install ribbed V-belt ⇒ page 13-3.

Removing and installing flywheel

Special tools, testers and aids required

- ♦ Torque wrench
- ♦ Counterholder MP 1-223

- ◀ - Insert counterholder MP 1-223 into the hole in the cylinder block and lock the flywheel.

Note:

Fitting position of counterholder:

- A - for tightening
- B - for slackening

- Release bolts for flywheel.

Note:

Replace flywheel bolts.

- Tighten the bolt to 60 Nm + torque a further $\frac{1}{4}$ turn (90°).

Removing and installing drive plate

Special tools, testers and aids required

- ♦ Torque wrench
- ♦ Counterholder MP 1-221
- ♦ Depth gauge

Removing

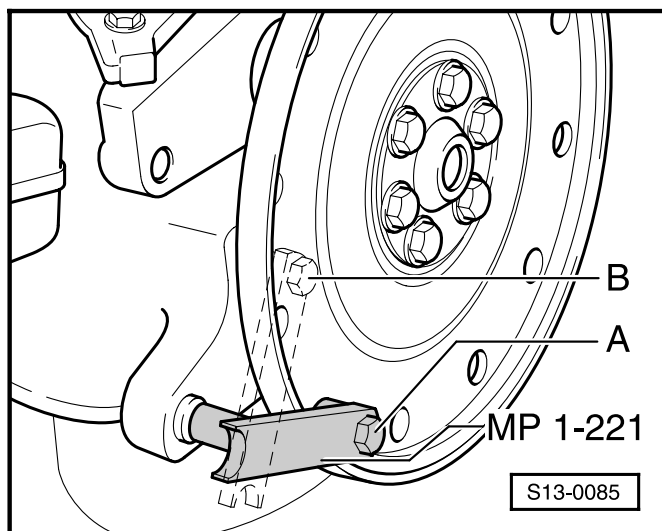
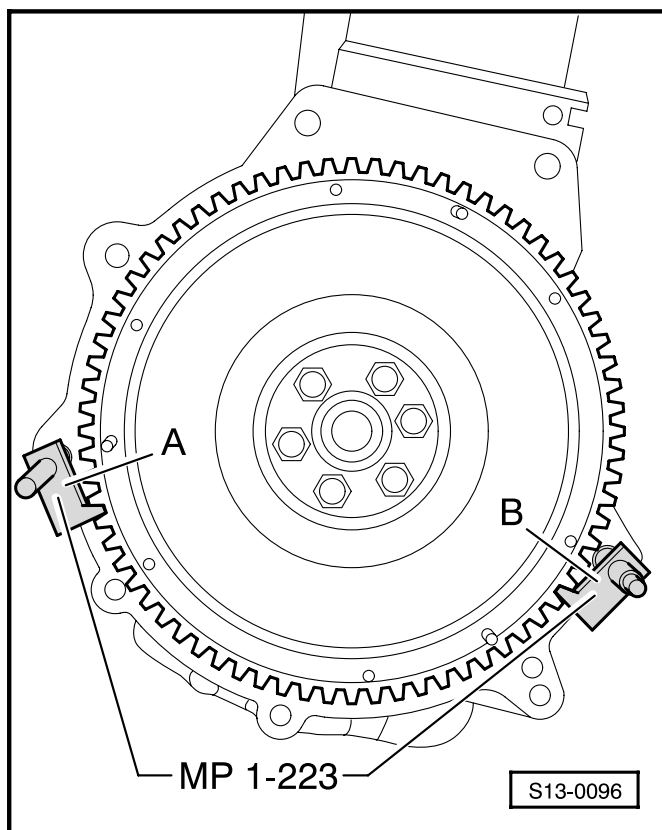
- ◀ - Attach counterholder MP 1-221 with bolt M8 x 45 to the drive plate. Insert two M10 nuts between the counterholder and the drive plate.

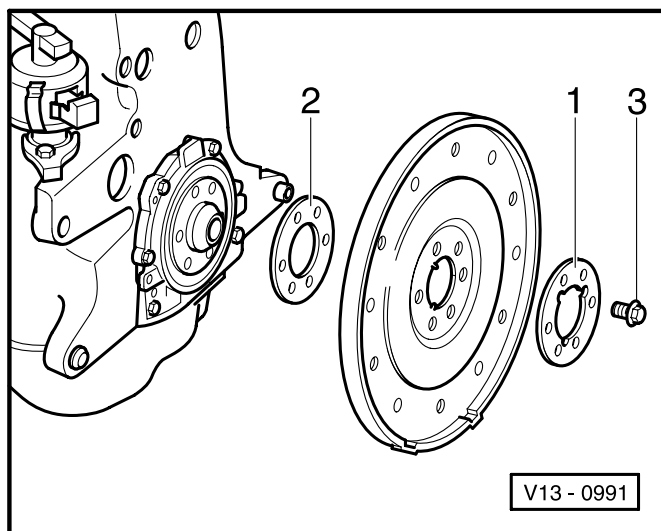
Note:

Fitting position of counterholder:

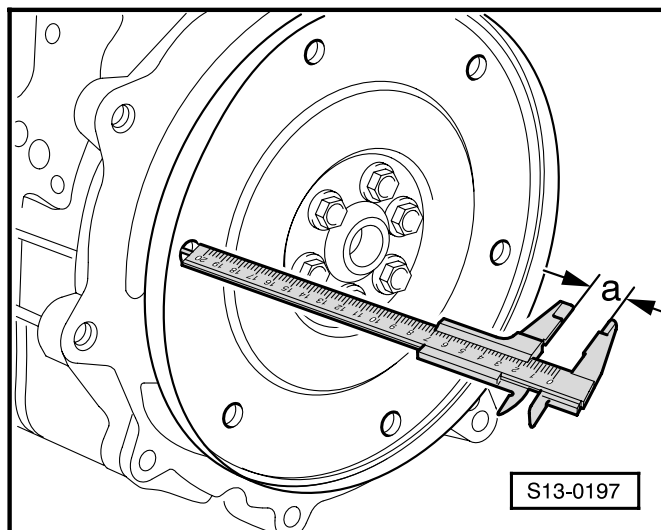
- A - for tightening
- B - for slackening

- Release bolts for drive plate.



**Installing**

- ◀ - Position driven plate using the washer with recesses -1-.
- Insert new bolts -3- and tighten to 30 Nm.

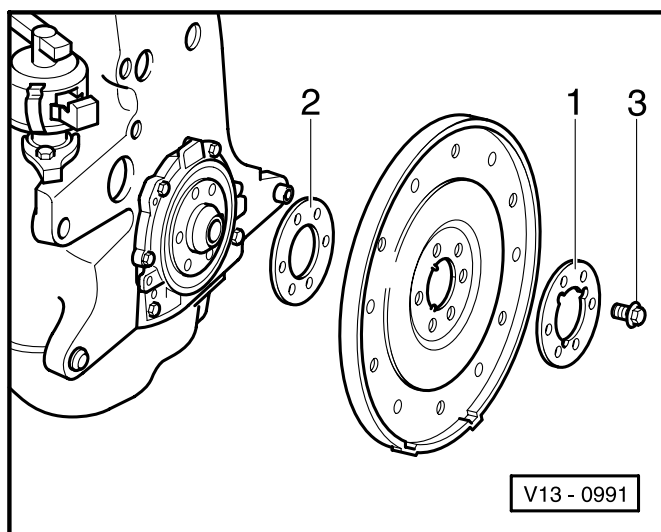


- ◀ - Check installed dimension at three points of driven plate and calculate average value.

◆ Specification -a-: 19.5...21.1 mm

Note:

The measurement is made through the hole of the driven plate as far as the cylinder block.



If the measurement obtained is less than the specification:

- ◀ - Once again remove driven plate and fit shim -2-. Re-tighten bolts -3- to 30 Nm.

Note:

Replace bolts of driven plate.

- Tighten bolts -3- to 60 Nm and torque a further 1/4 turn (90°).

Removing and installing front sealing flange

Special tools, testers and aids required

- ♦ Counterholder MP 1-310 or T 30004
- ♦ Guide sleeve from MP 1-314
- ♦ Silicone sealant D176 404 A2

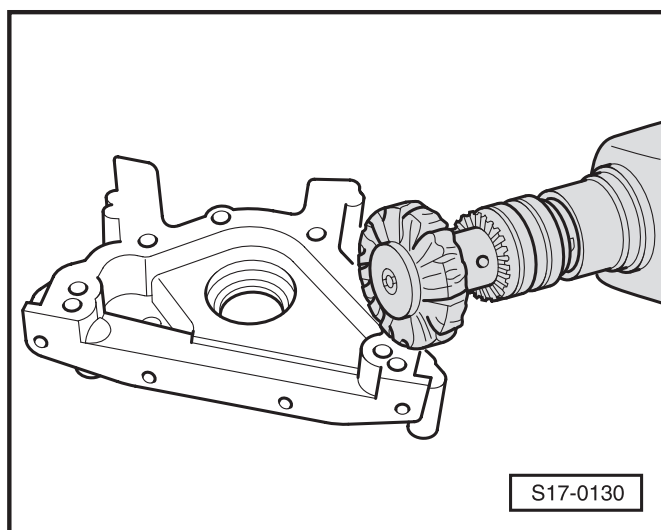
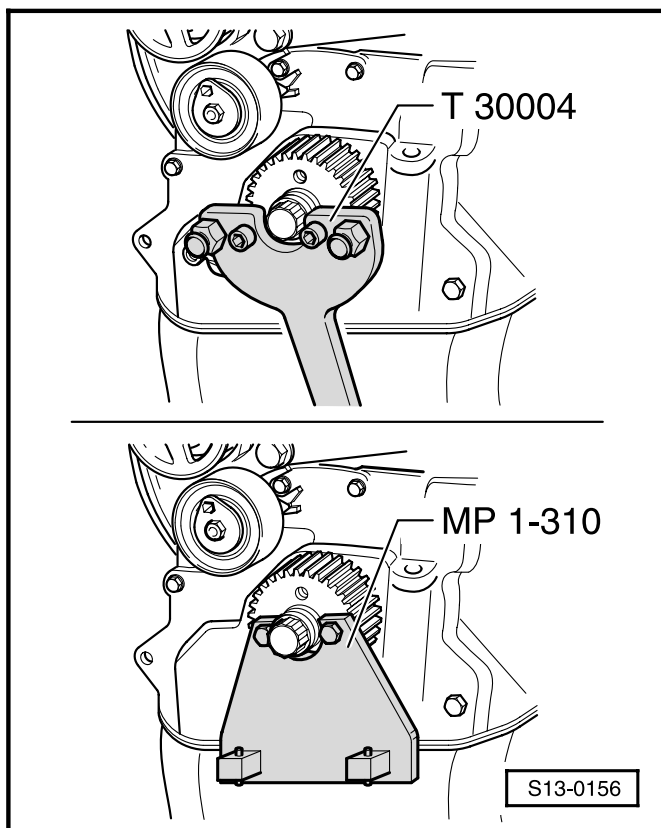
Removing

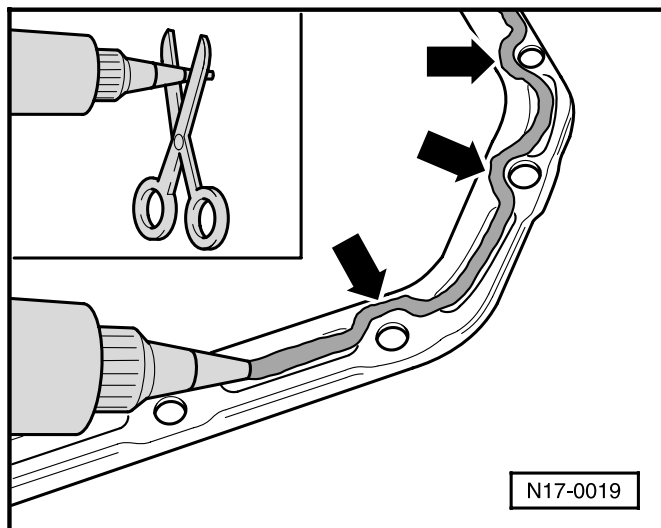
- Remove ribbed V-belt ⇒ page 13-1.
- Remove toothed belt ⇒ page 13-4.
- ◀ - Remove crankshaft toothed belt sprocket. Lock toothed belt sprocket with counterholder MP 1-310 or T30004.

Note:

When screwing on the counterholder MP 1-310 place 2 washers between the toothed belt sprocket and the counterholder.

- Drain engine oil.
- Remove oil pan ⇒ page 17-3
- Unscrew front sealing flange.
- Remove sealing flange, if necessary release by applying slight blows with a rubber-headed hammer.
- Remove sealant residues on cylinder block with a flat scraper.
- ◀ - Use a rotating plastic brush to remove sealant residues on the front sealing flange (wear protective goggles).
- Clean sealing surfaces, they must be free of oil and grease.



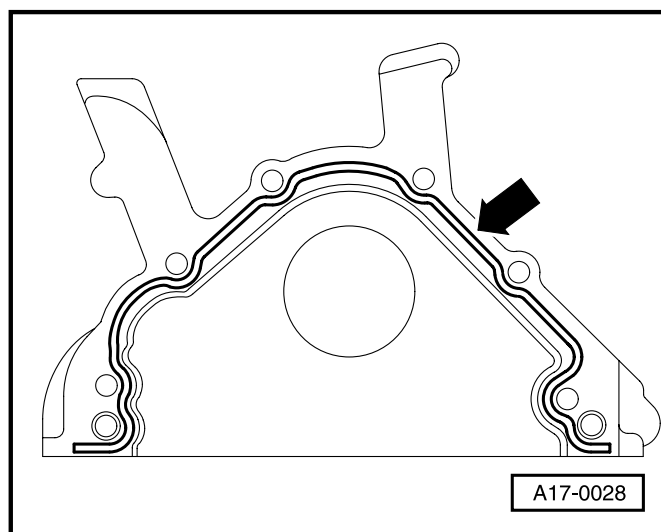
**Installing****Note:**

The sealing flange must be installed within 5 minutes after applying the silicone sealant.

- ◀ - Cut off tube nozzle at the front marking (Ø of tube approx. 3 mm).
 - ◆ Thickness of sealant bead -arrows-:
2 ... 3 mm

Note:

The sealant bead must not be thicker than 3 mm otherwise excess sealant may get into the oil pan and clog the oil intake pipe.



- ◀ - Apply the silicone sealant to the clean sealing surface of the sealing flange, as shown in the illustration.
- Fit on sealing flange immediately and tighten all the bolts slightly.

Notes:

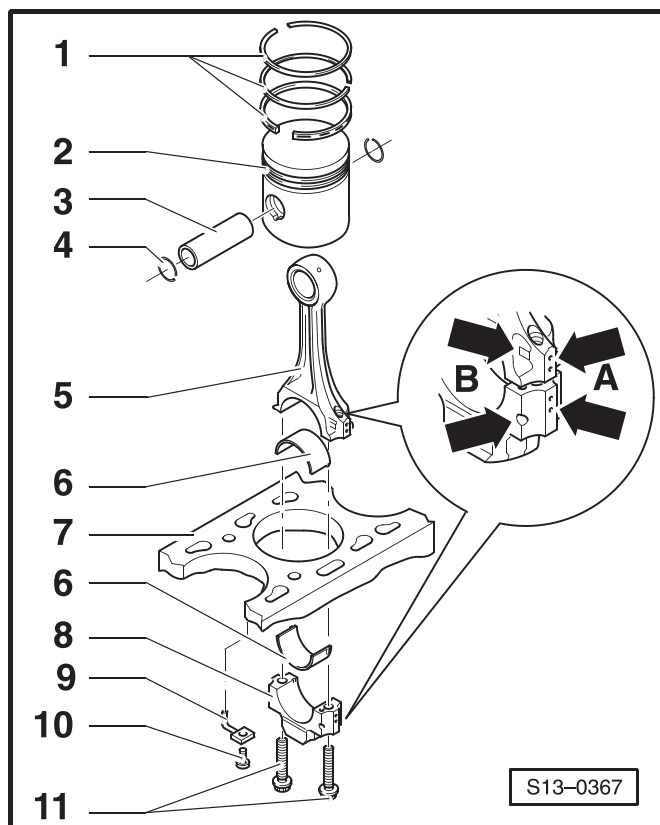
- ◆ If a PTFE seal is fitted, the crankshaft journals must be free of oil and grease and the seal must not be oiled.
- ◆ Use the following devices for fitting on the sealing flange with seal installed:
 - Elastomer seal - MP 1-314
 - PTFE seal - T10053/1
- Tighten bolts to 15 Nm.
- Install oil pan ⇒ page 17-3.

Note:

After installing, allow the sealant to dry for about 30 minutes. Do not pour in engine oil until after this waiting period.

- Install toothed belt ⇒ page 13-4.

Disassembling and assembling pistons and connecting rod



1 - Piston rings

- ◆ offset joints 120°
- ◆ use piston ring pliers for removing and installing
- ◆ marking „TOP“ faces piston crown
- ◆ inspecting gap clearance ⇒ Fig. 1
- ◆ inspecting end clearance ⇒ Fig. 2

2 - Piston

- ◆ with combustion chamber
- ◆ mark installation position and matching cylinder
- ◆ installation position and assignment of piston/cylinder ⇒ Fig. 4
- ◆ arrow on piston crown points toward belt pulley side
- ◆ use piston ring tensioning strap for installing
- ◆ if cracks present on piston stem, replace piston
- ◆ inspecting piston projection at TDC ⇒ page 13-24
- ◆ $\varnothing$ of piston = 79.47 mm

3 - Piston pin

- ◆ heat piston to 60 °C if stiff
- ◆ use MP 3-400 for removing and installing

4 - Circlip

5 - Conrod

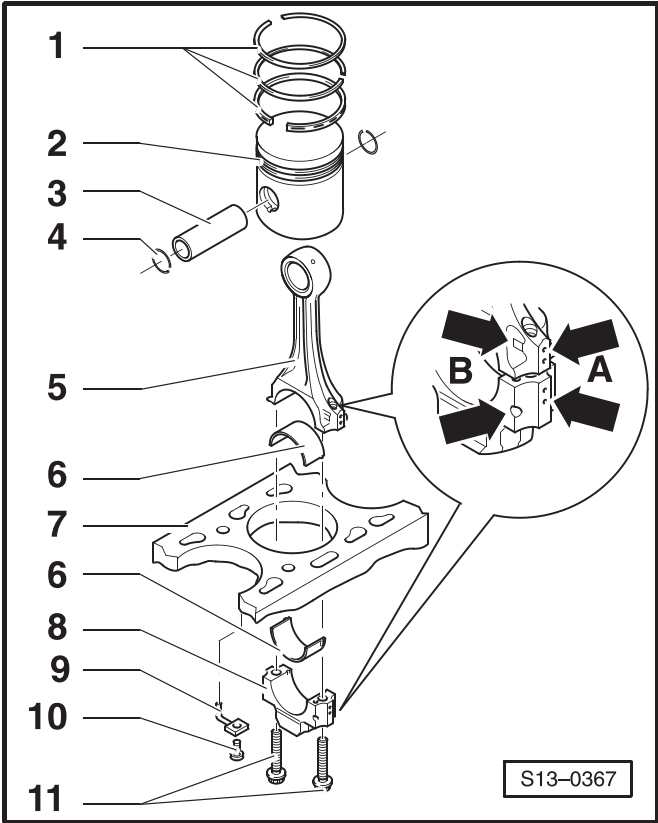
- ◆ always replace as a set
- ◆ mark relevant cylinder -A-
- ◆ installation position: markings -B- point toward belt pulley side

6 - Bearing shell

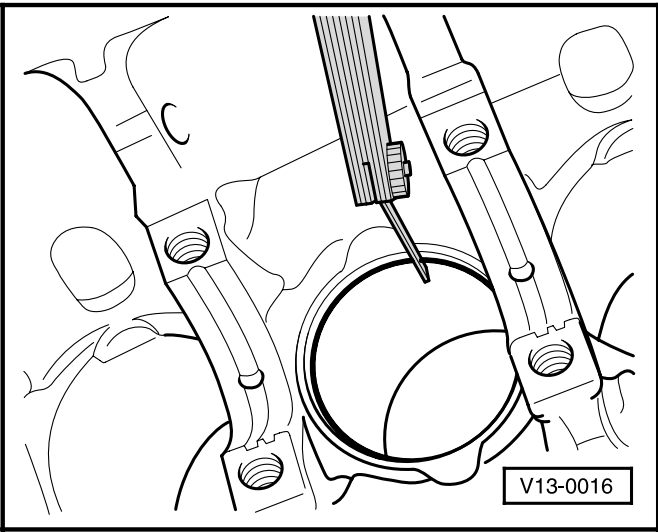
- ◆ pay attention to correct installation position
- ◆ do not mix up used bearing shells
- ◆ ensure tightly seated in retaining lugs
- ◆ axial play wear limit: 0.37 mm

7 - Cylinder block

- ◆ inspecting cylinder bore ⇒ Fig. 3
- ◆ $\varnothing$ piston = 79.51 mm



- 8 - Conrod cap**
 - ♦ mark matching cylinder -A-
 - ♦ installation position: marking -B- points toward belt pulley side
- 9 - Oil spray nozzle**
 - ♦ for cooling system
- 10 - 25 Nm**
 - ♦ with pressure relief valve
 - ♦ insert without sealant
- 11 - 30 Nm + torque a further 1/4 turn (90°)**
 - ♦ replace
 - ♦ oil thread and bolt contact surface



◀ Fig. 1 Inspecting piston ring gap clearance

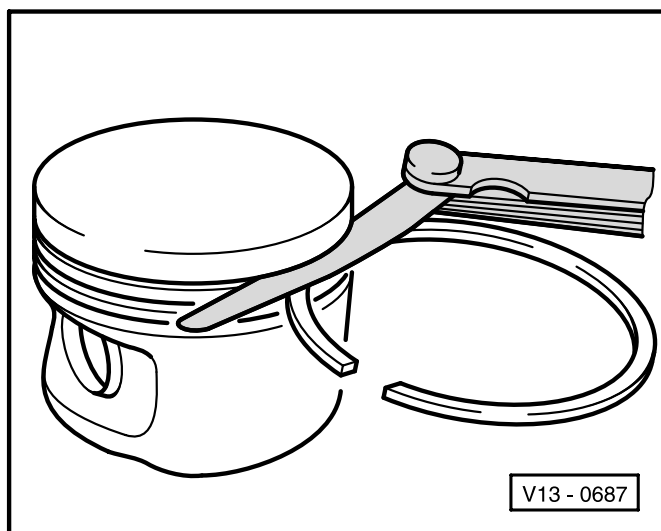
Special tools, testers and aids required

- ♦ Feeler gauge

Inspection procedure

- Insert ring at right angles to cylinder wall, from above as far as the lower cylinder opening, about 15 mm away from edge of cylinder.

Piston ring Dims. In mm	new	wear limit
1st compression ring	0.25...0.40	1.0
2nd compression ring	0.25...0.40	1.0
Oil scraper ring	0.25...0.50	1.0

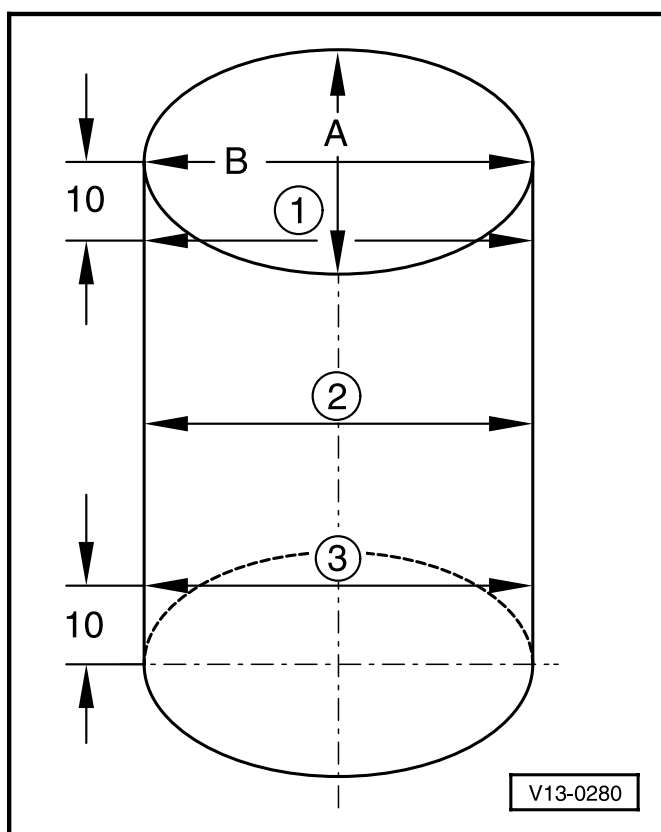


◀ Fig. 2 Inspecting piston ring end clearance

Special tools, testers and aids required

- ♦ Feeler gauge
- Clean annular groove before inspecting

Piston ring Dimensions in mm	New	Wear limit
1st compression ring	0.06 .. 0.09	0.25
2nd compression ring	0.05 .. 0.08	0.25
oil scraper ring	0.03 .. 0.06	0.15



◀ Fig. 3 Inspecting cylinder bore

Special tools, testers and aids required

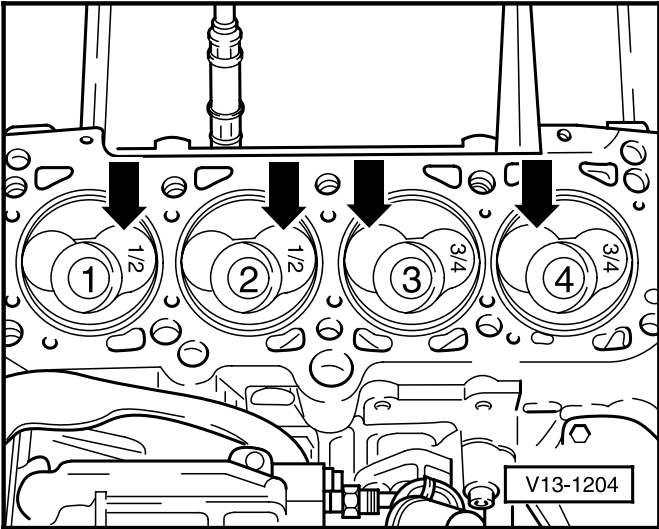
- ♦ Internal precision measuring instrument 50...100 mm

Inspection procedure

- Measure at 3 points diagonally opposite in transverse direction -A- and in longitudinal direction -B-.
- ♦ Differences compared to nominal size max. 0.10 mm

Note:

The measurement of the cylinder bore must not be carried out when the cylinder block is attached to the repair stand with the engine holder MP 1-202 as incorrect measurements may result.



◀ Fig. 4 Installation position of pistons and matching piston/cylinder

Special tools, testers and aids required

- ♦ Electric pen

Procedure

- Mark installation position and matching piston on the inside of piston (not on piston crown) with electric pen or felt pen.

Pistons in cylinders 1 and 2:

Large valve pocket for inlet valve facing flywheel side -arrows-

Pistons in cylinders 3 and 4:

Large valve pocket for inlet valve facing belt pulley side -arrows-

Note:

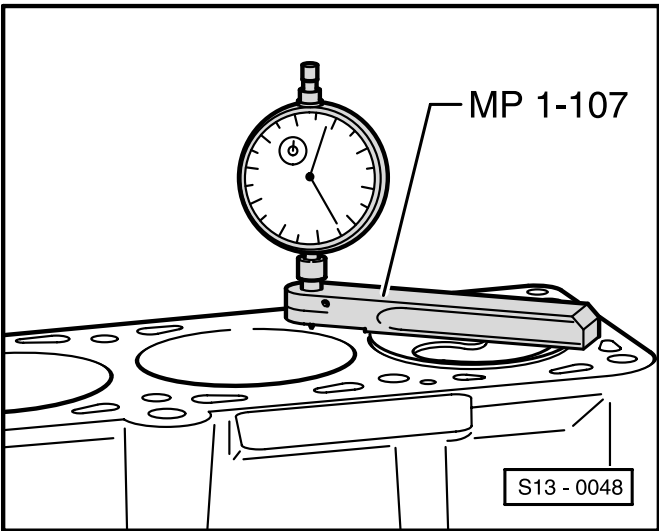
If the pistons are new, the assignment to the cylinder is stamped with ink on the piston crown.

- ♦ Pistons for cylinders 1 and 2:
marking $\frac{1}{2}$
- ♦ Pistons for cylinders 3 and 4:
marking $\frac{3}{4}$

Inspecting piston projection at TDC

Special tools, testers and aids required

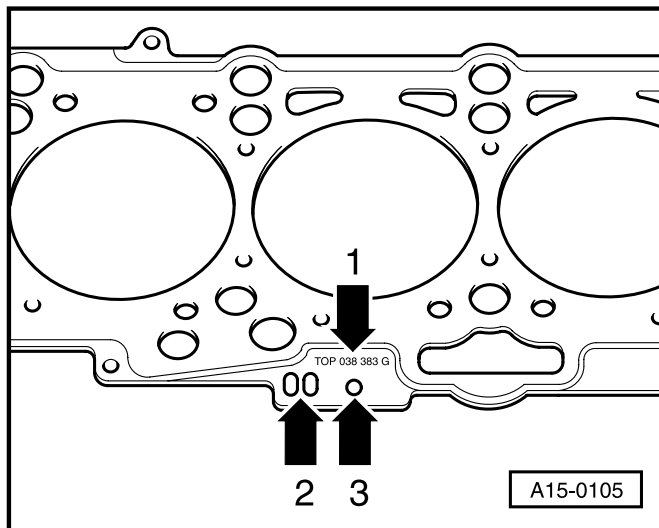
- ♦ Measuring instrument for piston projection
MP 1-107



Procedure

- ◀ When installing new pistons or a short engine, inspect piston projection at TDC. Install the appropriate cylinder head gasket as shown in the table below depending on the piston projection.

Piston projection beyond top edge of cylinder block	Identification holes
0.91 mm ... 1.00 mm	1
1.01 mm ... 1.10 mm	2
1.11 mm ... 1.20 mm	3

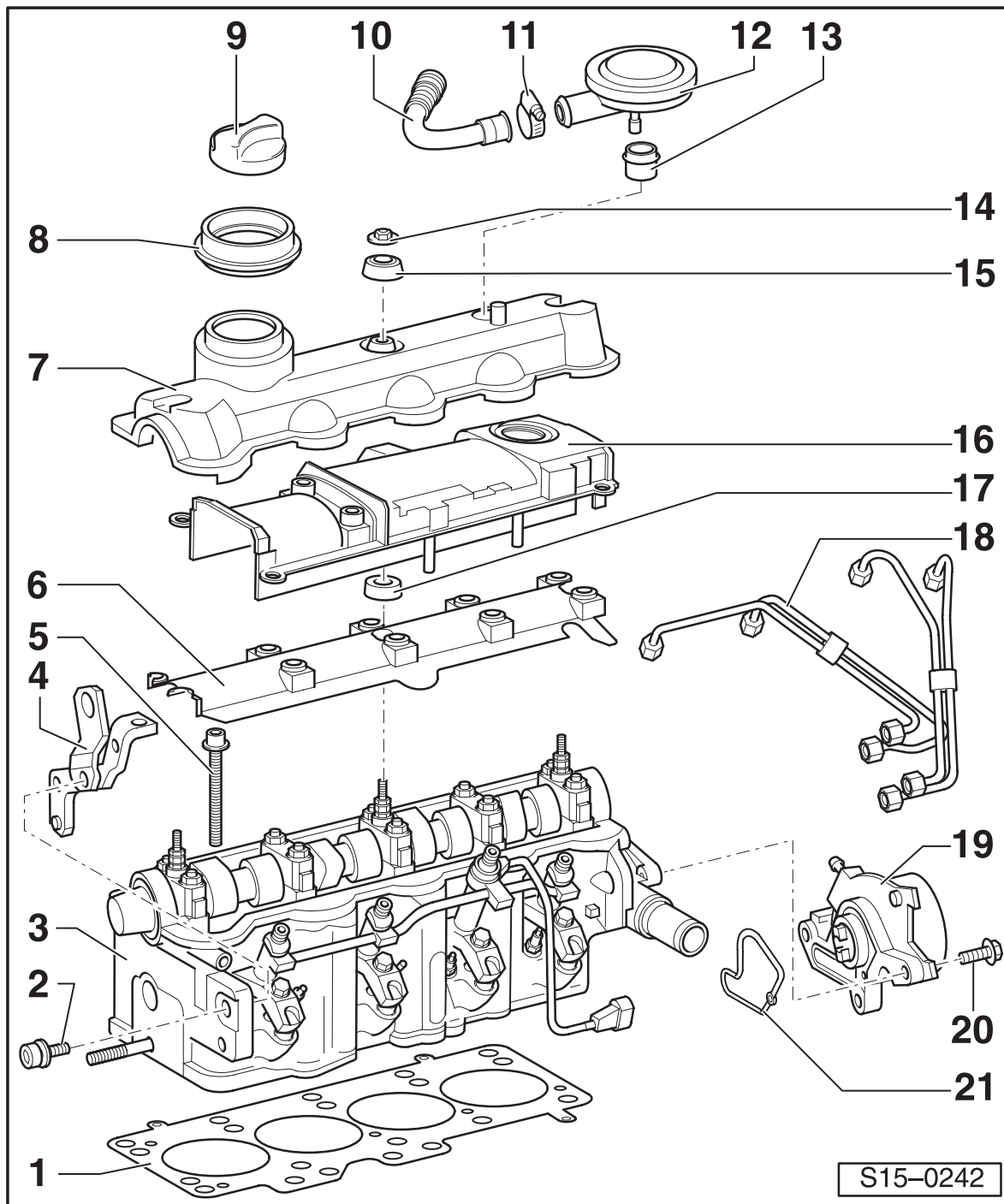
**Marking of cylinder head gasket**

- ◆ Part No. = arrow 1
- ◆ Control code = arrow 2 (ignore!)
- ◆ Openings = arrow 3

Note:

If different measurements are obtained when measuring the piston projection, the highest measurement applies for assigning the gasket.

Removing and installing cylinder head



Removing and installing toothed belt
⇒ page 13-4

Testing compression pressure ⇒ page 15-8

Notes:

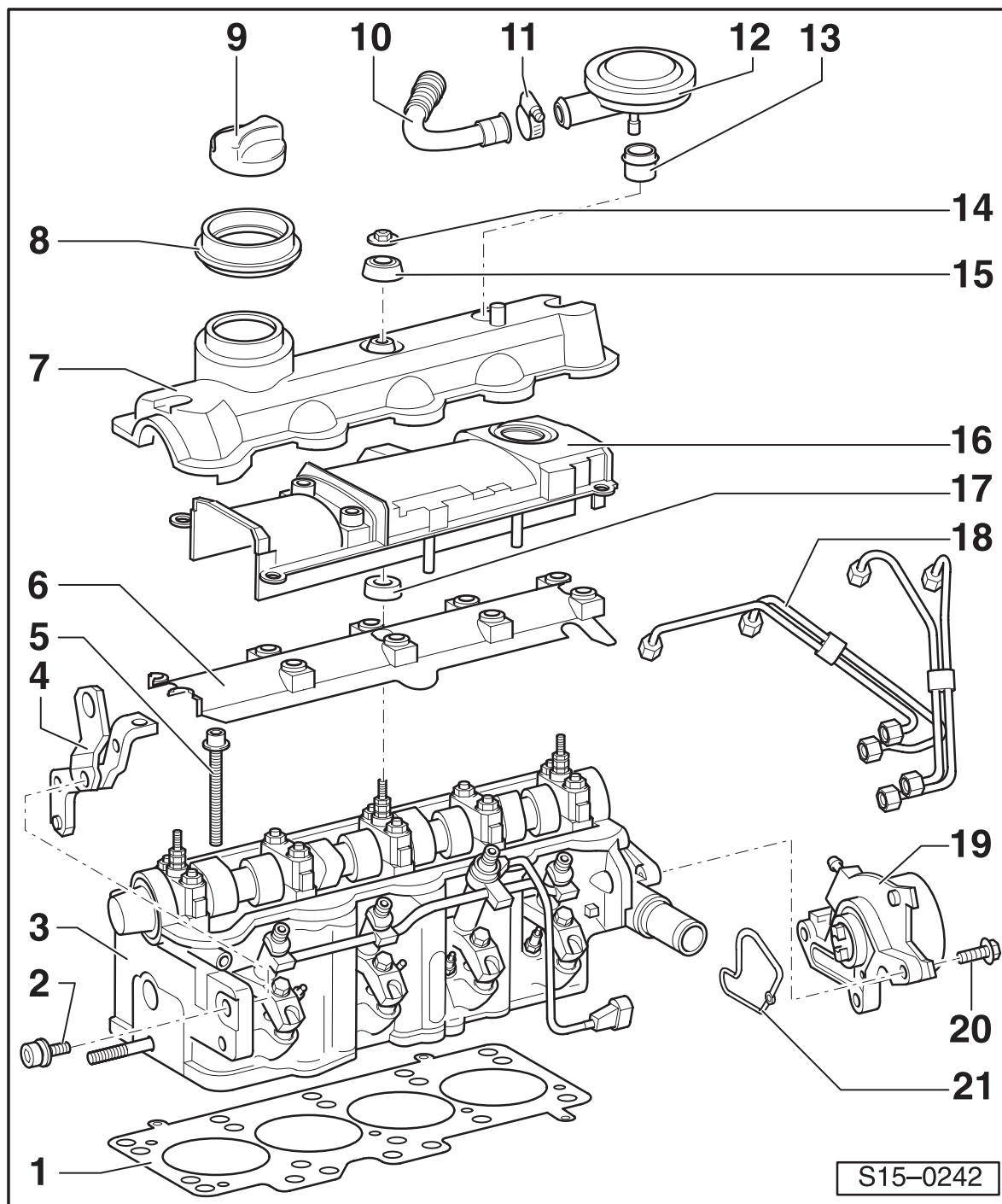
- ◆ When installing an exchange cylinder head with the camshaft installed, it is necessary to oil the contact surfaces between the bucket tappets and the cam track.
- ◆ Do not remove the plastic washers supplied as a protection for the open valves until just before fitting on the cylinder head.

- ◆ If the cylinder head is replaced, the entire coolant system must be replaced.
- ◆ It is not allowed to rework the cylinder heads of the diesel engines.

1 - Cylinder head gasket

- ◆ replace
- ◆ pay attention to marking ⇒ Fig. 2

2 - 20 Nm



S15-0242

3 - Cylinder head

- ◆ inspecting for distortion ⇒ Fig. 1
- ◆ removing cylinder head ⇒ page 15-4
- ◆ installing cylinder head ⇒ page 15-6
- ◆ after replacing, fill entire system with coolant

4 - Lifting eye**5 - Cylinder head bolt**

- ◆ replace
- ◆ pay attention to order for loosening ⇒ page 15-4
- ◆ pay attention to order for tightening ⇒ page 15-6

6 - Oil deflector

- ◆ from 07.97

7 - Cylinder head cover

- ◆ with vulcanized gasket
- ◆ if gasket has been damaged replace cylinder head cover

8 - Collar**9 - Cap**

- ◆ replace seal if damaged

10 - Ventilation tube

- ◆ to air guide pipe

11 - Retaining clip**12 - Pressure control valve**

- ♦ for crankcase ventilation

13 - Gasket

- ♦ replace if damaged

14 - Collar nut, 10 Nm**15 - Seal**

- ♦ replace if damaged

16 - Oil deflector

- ♦ from 08.97

17 - Sealing cone**18 - Injection lines**

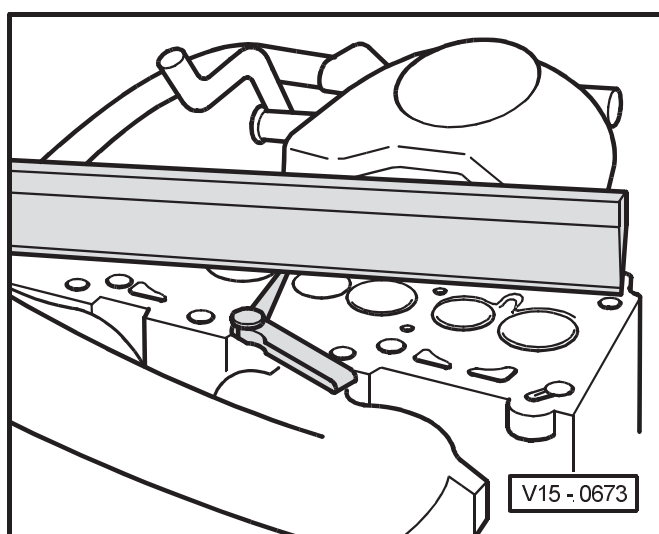
- ♦ tighten with 25 Nm
- ♦ use wrench (e.g. 3035) for removing
- ♦ replace complete wiring harness if damaged
- ♦ do not change bending shape

19 - Vacuum pump

- ♦ for brake booster

20 - 20 Nm**21 - Gasket**

- ♦ replace



◀ **Fig. 1** Inspecting cylinder head for distortion

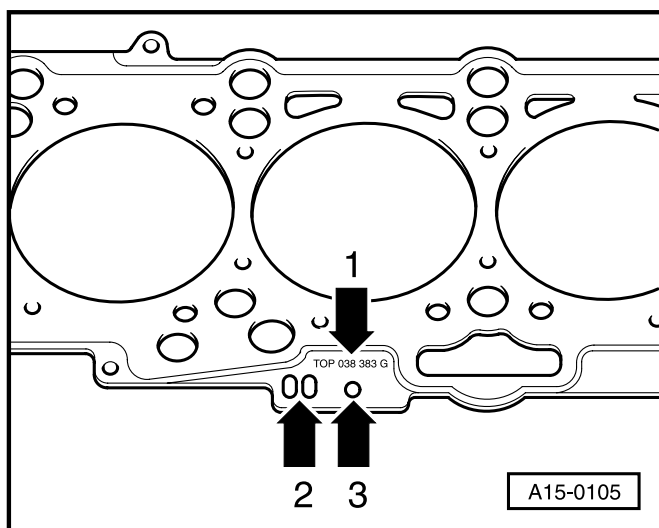
Special tools, testers and aids required

- ♦ Feeler gauge
- ♦ Knife-edge straightedge

Maximum permissible distortion: 0.1 mm

Note:

Reworking of cylinder heads on diesel engines is not allowed.



◀ **Fig. 2** Identification of cylinder head gasket

- ♦ Spare Parts no. = arrow 1
- ♦ Control code = arrow 2 (disregard!)
- ♦ Bores = arrow 3

Note:

Differing thickness of cylinder head gaskets are inserted according to the piston projection ⇒ page 13-24. When replacing a gasket use a new gasket with the same designation.

Remove cylinder head

Note:

All cable straps that have been loosened or cut open when removed must be fitted again in the same location when installed.

Special tools, testers and aids required

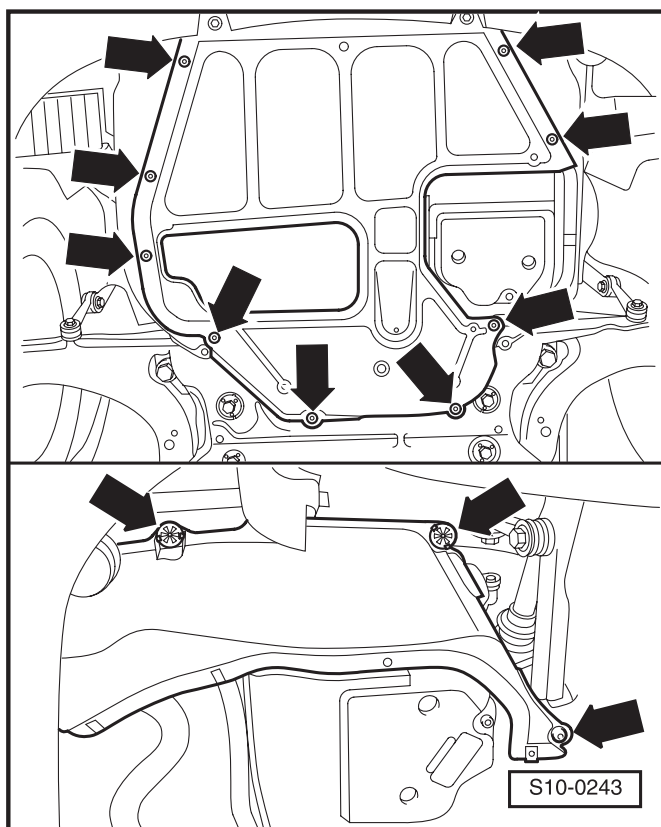
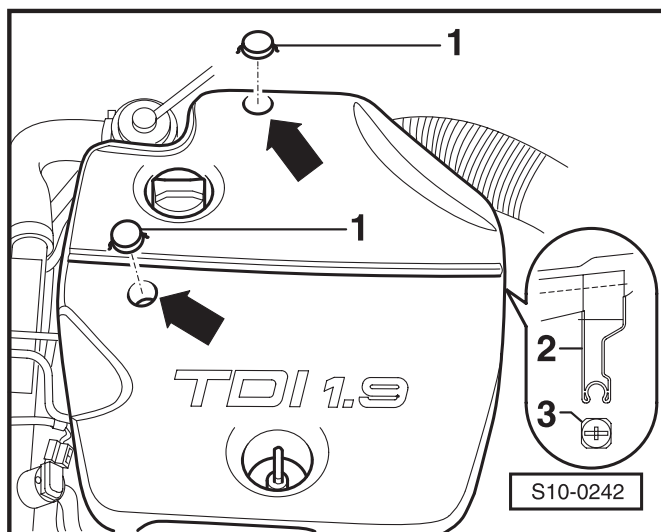
- ♦ Workshop crane (e.g. V.A.G 1202 A)
- ♦ Catch pan (e.g. V.A.G 1306)
- ♦ Pliers for spring strap clips
- ♦ Lifting device MP 9-201
- ♦ Wrench for injection lines (e.g. 3035)

Work procedure

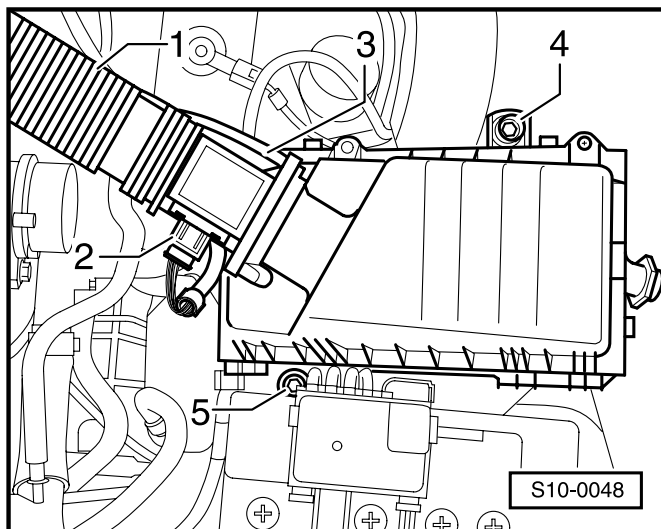
Note:

If the battery is disconnected and reconnected, carry out certain additional operations ⇒ *Electrical System; Repair Group 27*.

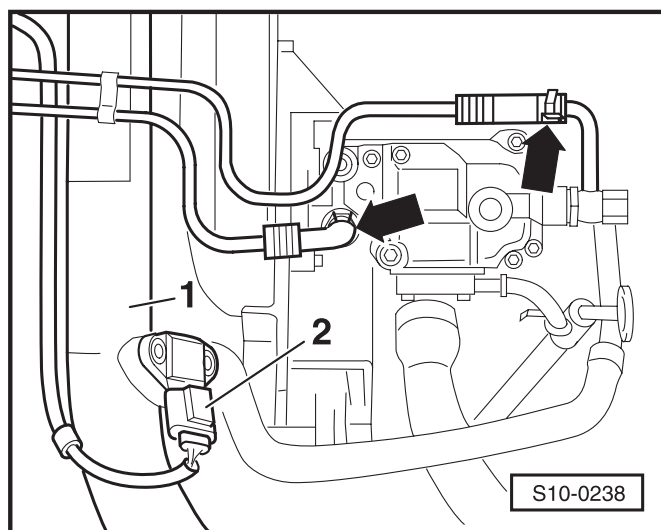
- Disconnect the earth strap from the battery with the ignition off.
- ◀ - Remove engine cover ⇒ page 10-2.



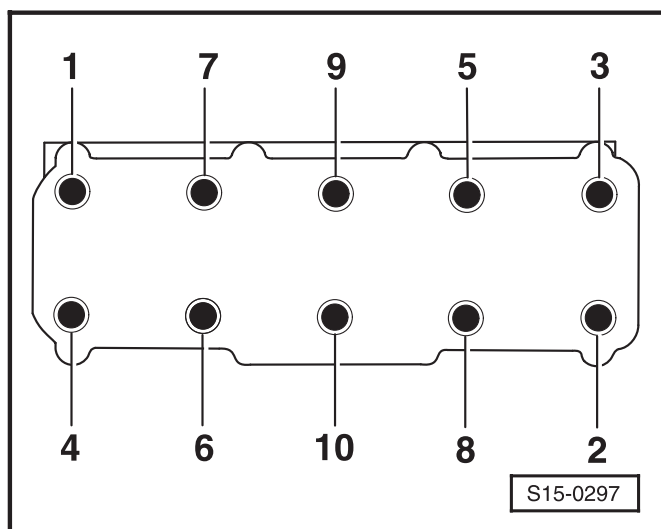
- ◀ - Remove noise insulation in the middle as well as on left -arrows-.
- Remove the air guide pipe between the charge air cooler and the intake manifold.
- Unscrew the oil return-flow line from the turbocharger at the cylinder block.
- Unscrew the oil feed line from the turbocharger.
- Unscrew bracket for oil feed line to turbocharger from intake manifold.
- Remove exhaust pipe from turbocharger.
- Remove the V-ribbed belt ⇒ page 13-1.
- Drain coolant ⇒ page 19-3.



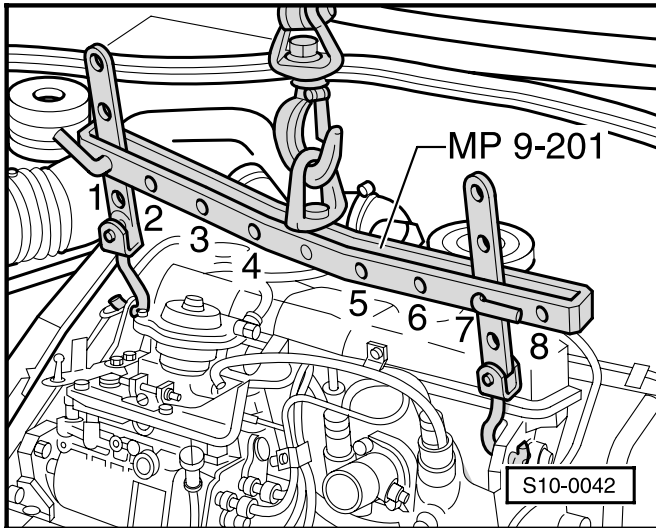
- ◀ - Remove air guide hose -1-.
- Detach vent hose -3- and unplug connector for air mass meter -2-.
- Release screws -4- and -5-. Remove air filter housing.
- Unscrew and remove air guide hose for air filter/turbocharger at induction pipe.
- Remove injection lines with wrench 3035.
- Remove return flow lines from injection nozzles to the injection pump.
- Unplug glow plug edge connector.
- Detach line at needle lift sender and pull the plug from the holder.



- Detach coolant hose at cylinder head and unscrew coolant flange.
- Unscrew oil feed line for turbocharger at the brackets and unscrew from turbocharger.
- Remove coolant pipe at the brackets and detach to the left.
- ◀ - Remove fuel hoses from the injection pump, close with plugs and lay aside.
- Remove plug -2- at the intake manifold temperature sender (G72) with intake manifold pressure sender (G71) and remove air guide pipe -1-.
- Take off top toothed belt guard.



- Position engine on TDC of cylinder 1, remove toothed belt from camshaft sprocket and remove camshaft sprocket ⇒ page 13-4.
- Unscrew 2 screws for the rear toothed belt guard (on both sides of the cylinder head).
- Unscrew nut for tensioning pulley.
- ◀ - Release the cylinder head bolts in the order 1...10.
- Unscrew bolts in the given sequence and take out of the holes.



- ◀ - Hang the lifting device MP 9-201 at the cylinder head.

Note:

Attach the induction pipe with a wire to the carrier lug of the lifting device in order to achieve a stable centre of gravity for the cylinder head.

- Slightly raise the cylinder head with the workshop crane.
- Swivel the cylinder head to the left out of the rear toothed belt guard and simultaneously remove the tensioning pulley.

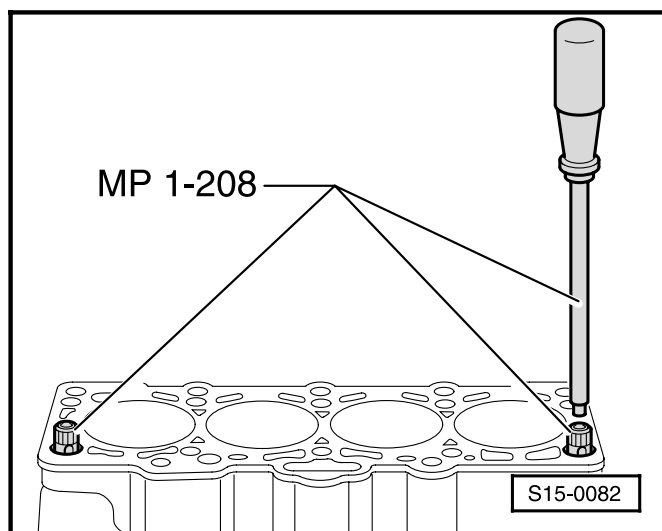
Installing cylinder head

Notes:

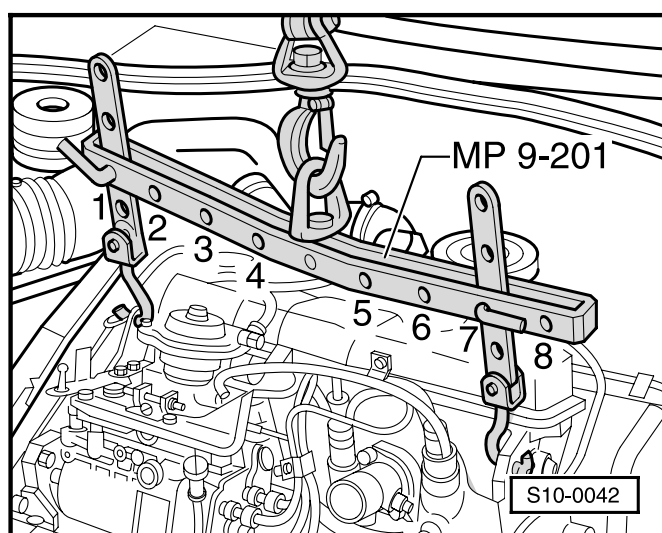
- ◆ Always replace cylinder head bolts.
- ◆ Carefully remove residual sealant from the cylinder head and cylinder block using a chemical cleaner. Make sure this does not cause any extended scoring or scratching.
- ◆ Carefully remove all abrasive residue.
- ◆ Remove the new cylinder head seal from its wrapping immediately before fitting.
- ◆ Treat the new gasket with the utmost care. Damage to the silicone layer and in the area of the bead results in leakages.
- ◆ There must be no oil or coolant in the blind holes of the cylinder head bolts in the cylinder block.

Special tools, testers and aids required

- ◆ Workshop crane (e.g. V.A.G 1202 A)
- ◆ Torque wrench
- ◆ Pliers for spring strap clips
- ◆ Guide bolts MP 1-208
- ◆ Adjusting straightedge MP 1-312
- ◆ Lifting device MP 9-201
- ◆ Wrench for injection lines (e.g. 3035)
- ◆ Wire
- ◆ Wrench for cylinder head bolts (e.g. 3452)

**Work procedure**

- Before fitting the cylinder head position the crankshaft on TDC marking of cylinder 1 ⇒ page 13-7. The adjusting straightedge MP 1-312 must allow itself to be used in the camshaft.
- Fit on the cylinder head gasket.
- To centre it, screw in the guide bolts MP 1-208 into the outer holes on the suction side.

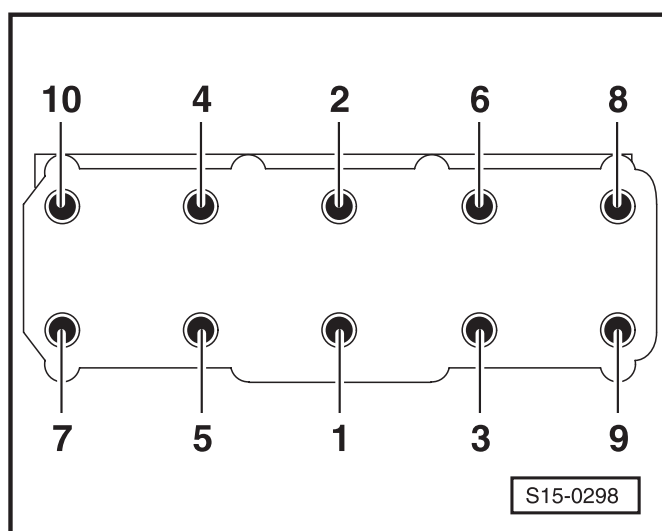


- ◀ - Hang the lifting device MP 9-201 at the cylinder head.

Note:

Attach the induction pipe with a wire to the carrier lug of the lifting device in order to achieve a stable centre of gravity for the cylinder head.

- Swivel cylinder head into rear toothed belt guard.
- While swivelling the cylinder head into the rear toothed belt guard, simultaneously push the tensioning pulley.
- When inserting the cylinder head, pay attention to the position of the rear lugs on the cylinder head gasket. When inserting they must not be buckled up by the heat shield of the exhaust manifold.



- Insert 8 new cylinder head bolts and tighten manually.
- Remove the guide bolts by screwing out with a bolt tightener from MP 1-208 and screw in the cylinder head bolts by hand.
- ◀ - Tighten cylinder head bolts in the order shown:
- 1st pre-tighten with the torque wrench to:
Stage I = 40 Nm
Stage II = 60 Nm

- 2nd torque further with a rigid wrench:
Stage III = 90° ($\frac{1}{4}$ turn)
Stage IV = 90° ($\frac{1}{4}$ turn)

Note:

Tightening up the cylinder head bolts after doing repair work is not necessary.

- Install toothed belt ⇒ page 13-4.

Testing compression pressure**Test conditions**

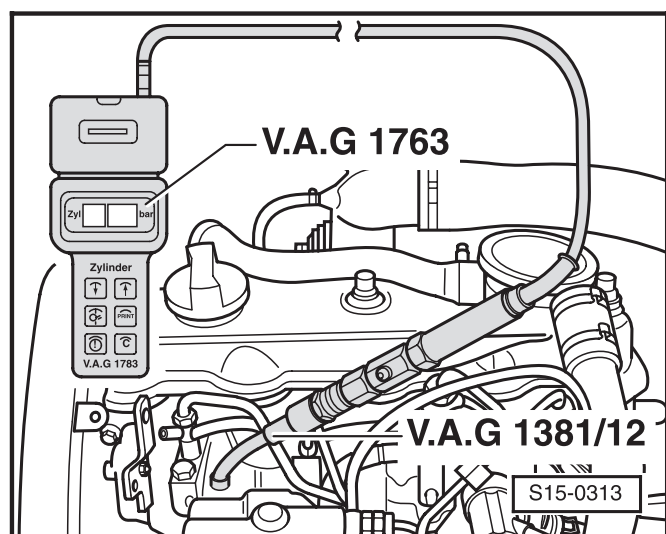
- Engine oil temperature at least 30 °C

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Compression tester (e.g. V.A.G 1381 or V.A.G 1763)
- ◆ Adapter (e.g. V.A.G 1381/12)
- ◆ Flexible-head wrench for glow plugs

Test procedure

- Remove engine cover ⇒ page 10-2.
- Disconnect the 10-pin connector from the injection pump.
- Remove all the glow plugs with the flexible-head wrench.
- ◀ - Screw in adapter (e.g. V.A.G 1381/12) instead of the glow plugs into the respective cylinder.
- Test compression pressure with compression tester (e.g. V.A.G 1381 or V.A.G 1763).



Note:

Use of tester ⇒ operating instructions

- Operate starter until the tester no longer indicates a pressure rise.

Compression readings:

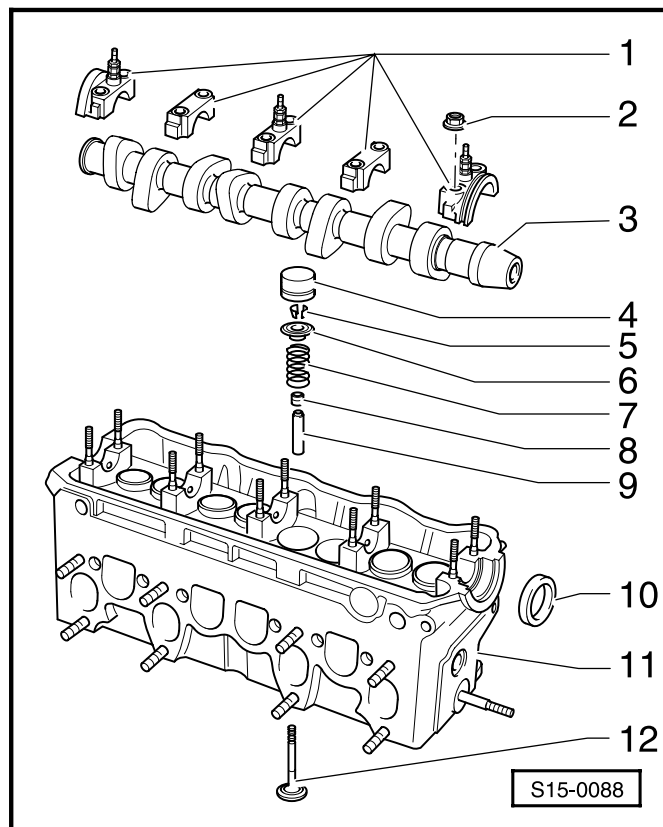
New engine	Wear limit	Pressure difference between individual cylinders
2.5...3.1 MPa (25...31 bar)	1.9 MPa (19 bar)	max. 0.5 MPa (max. 5 bar)

- Screw in glow plugs with flexible-head wrench.
Tightening torque: 15 Nm
- Interrogating fault memory:
⇒ 1.9l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 01.

Note:

Faults are stored when disconnecting the 10-pin plug connection at the injection pump. After the measurement interrogate the fault memory and erase if necessary.

Servicing valve gear



Note:

Cylinder heads with cracks between the valve seats may be re-used without any reduction in life provided these are only slight incipient cracks which are not more than 0.5 mm wide.

1 - Bearing cap

- ◆ installation position ⇒ Fig. 2
- ◆ installation sequence ⇒ page 15-16
- ◆ lightly coat contact surface of bearing cap 1 and 5 with sealant AMV 174 004 01

2 - 20 Nm

3 - Camshaft

- ◆ inspecting axial play ⇒ Fig. 1
- ◆ removing and installing ⇒ page 15-16
- ◆ runout: max. 0.01 mm
- ◆ camshaft marking ⇒ Fig. 5

4 - Bucket tappet

- ◆ do not mix up
- ◆ with hydraulic valve clearance compensation
- ◆ inspecting ⇒ page 15-18
- ◆ place down with contact surface facing down
- ◆ before installing, inspect axial play of camshaft ⇒ Fig. 1
- ◆ oil contact surface

5 - Valve collets

6 - Valve spring retainer

7 - Valve spring

- ◆ removing and installing:
cylinder head removed: use MP 1-218, MP 1-211, MP 1-213
cylinder head installed:
⇒ page 15-14

8 - Valve stem seal

- ◆ replacing ⇒ page 15-14

9 - Valve guide

- ◆ inspecting ⇒ page 15-14
- ◆ replacing ⇒ page 15-19

10 - Seal

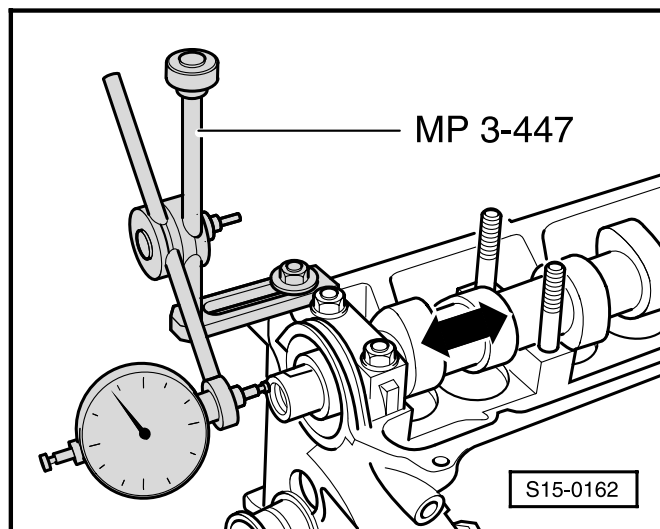
- ◆ pay attention to different versions ⇒ Fig. 4
- ◆ for removing and installing, take off bearing cap and toothed belt sprocket
- ◆ before fitting on, fix in place the groove at the camshaft cone with adhesive tape (e.g. with Sellotape)
- ◆ removing and installing toothed belt sprocket ⇒ page 13-4

11 - Cylinder

- ◆ pay attention to Note ⇒ page 15-10
- ◆ reworking valve seats ⇒ page 15-12

12 - Valve

- ◆ valve dimensions ⇒ Fig. 3



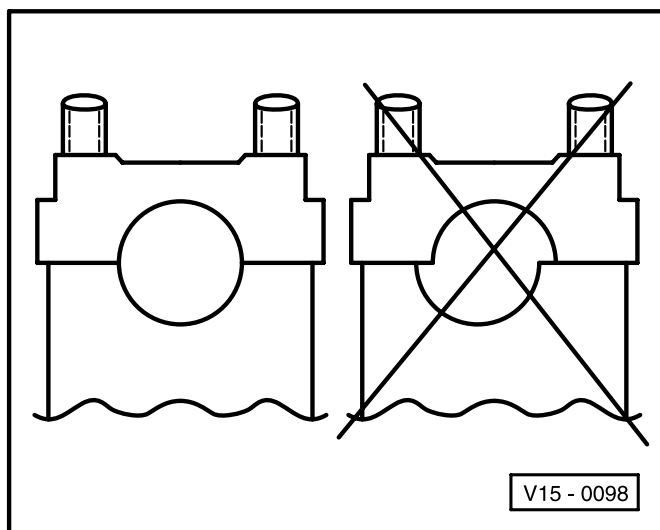
◀ Fig. 1 Inspecting axial play of camshaft

Special tools, testers and aids required

- ♦ Universal dial gauge holder MP 3-447
- ♦ Dial gauge

Wear limit: max. 0.15 mm

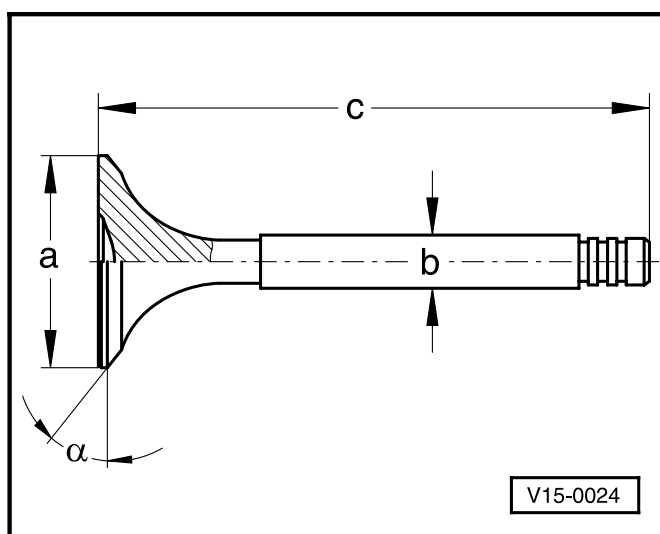
Carry out measurements with bucket tappets removed and first and last bearing caps installed.



◀ Fig. 2 Installation position of camshaft bearing caps

Note:

Pay attention to off-centre position. Before installing the camshaft, fit on bearing caps and determine installation position.

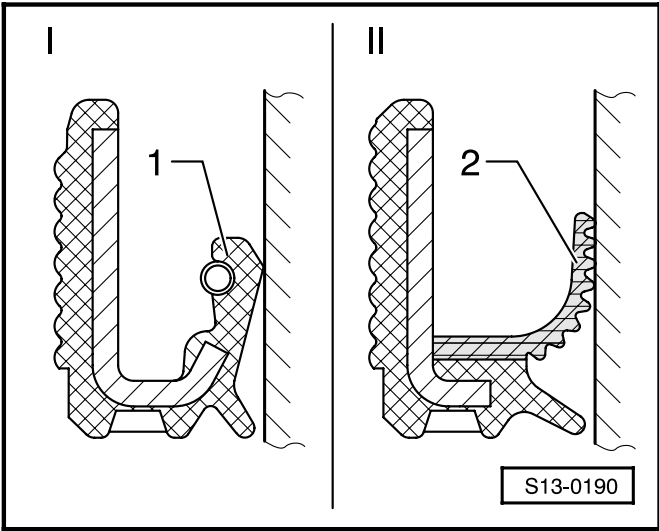


◀ Fig. 3 Valve dimensions

Note:

Valves must not be reworked. Only grinding-in is permissible.

Dimension		Inlet valve	Exhaust valve
Ø a	mm	35.95	31.45
Ø b	mm	6.963	6.943
c	mm	96.85	96.85
α	∠°	45	45

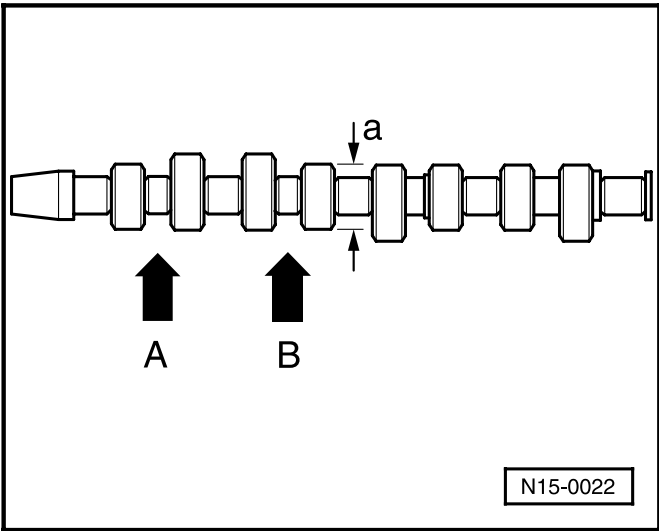


◀ Fig. 4 Seal versions

- I **Elastomer seal**
Sealing lip -1-; with worm spring
- II **PTFE seal**
Several sealing lips -2-; without worm spring

Notes:

- ◆ Do not moisten PTFE seal with oil before installing. The shaft must also be free of oil and grease.
- ◆ Never replace a PTFE seal (new version) with an elastomer seal (old version).
- ◆ A PTFE seal can be installed in place of an elastomer seal.



◀ Fig. 5 Camshaft marking

- ◆ Base circle of cam: $a = \varnothing 38 \text{ mm}$
- ◆ Marking by means of stamped numbers and letters between inlet cam and exhaust cam

Cylinder 1 -arrow A-	38A
Cylinder 2 -arrow B-	DE

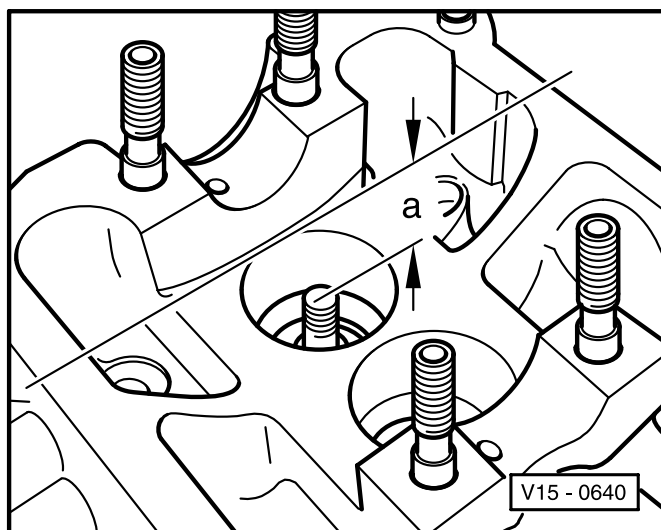
Grinding in valve seats

Special tools, testers and aids required

- ◆ Grinding paste

Notes:

- ◆ When repairing engines with leaking valves, it is not adequate to only machine or replace the valve seats and valves. It is also necessary to inspect the valve guides for wear, particularly on engines with high mileage $\Rightarrow$ page 15-14.
- ◆ Rework valve seats only sufficiently to obtain a proper contact pattern. Before commencing reworking, calculate the maximum permissible reworking dimension $\Rightarrow$ page 15-13. If the reworking dimension is exceeded, proper operation of the hydraulic clearance compensation is no longer assured. In this case, a new cylinder head should be installed.



Calculating maximum permissible reworking dimension

- Insert valve and press firmly against the valve seat.

Note:

If the valve is replaced as part of repair work, use a new valve for the measurement.

- Measure the distance -a- between end of valve stem and top edge of cylinder head.
- Calculate maximum permissible reworking dimension from the distance -a- measured and the minimum dimension.

Minimum dimensions:

Inlet valve	35.8 mm
Exhaust valve	36.1 mm

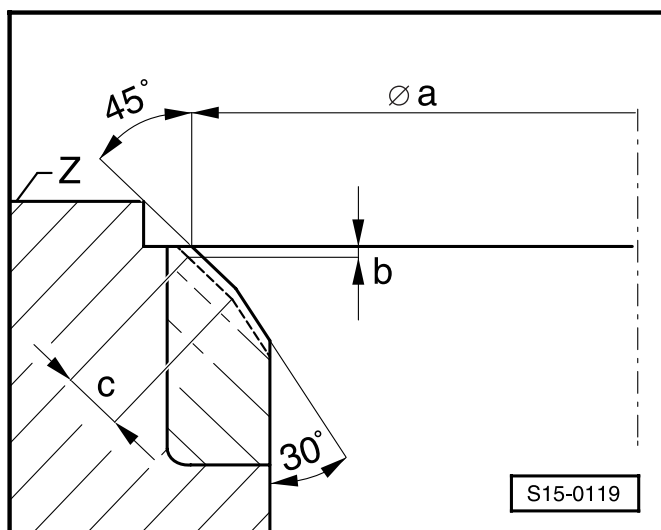
Distance measured less minimum dimension
= maximum permissible reworking dimension.

Example:

Distance measured	36.5 mm
- Minimum dimension	35.8 mm
= Max. perm. reworking dimension	0.7 mm

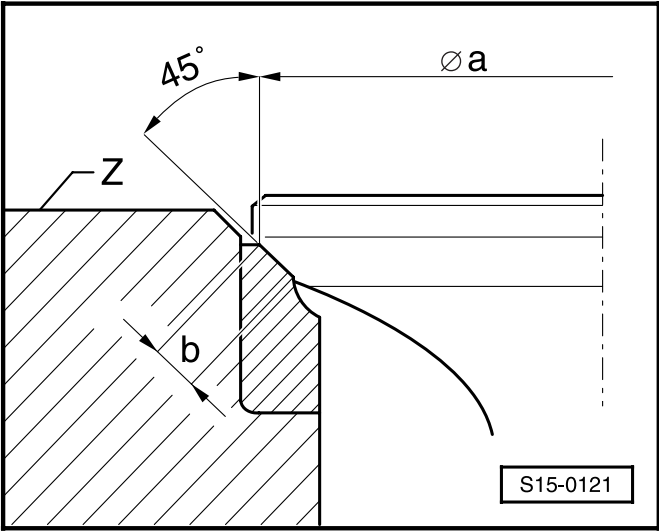
Note:

If the maximum permissible reworking dimension is 0 mm, repeat measurement with a new valve. If the maximum permissible reworking dimension is still 0 mm, replace cylinder head.



◀ Reworking inlet valve seat

Dimension		Valve seats
Ø a	35.7 mm	Valve seat diameter
b		max. perm. reworking dimension
c	1.6 mm	Valve seat width
Z		Cylinder head bottom edge
45°		Valve seat angle
30°		Bottom correction angle



◀ Reworking exhaust valve seat

Dimension		Valve seats
Ø a	31.4 mm	Valve seat diameter
b		max. perm. reworking dimension
c	2.7 mm	Valve seat width
Z		Cylinder head bottom edge
45°		Valve seat angle

Procedure

Reworking can be carried out with a machine or by hand. It is essential that the following conditions are met:

- Wear limit of the valve guides must not exceed the permissible dimension
⇒ page 15-14.
- Use NAC milling tool with carbide metal tips (min. 90 HRC).

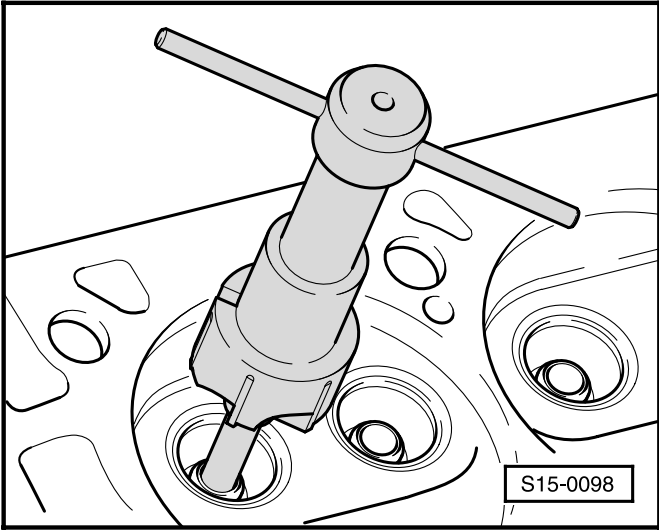
◀ Reworking valve seats with NAC hand milling tool

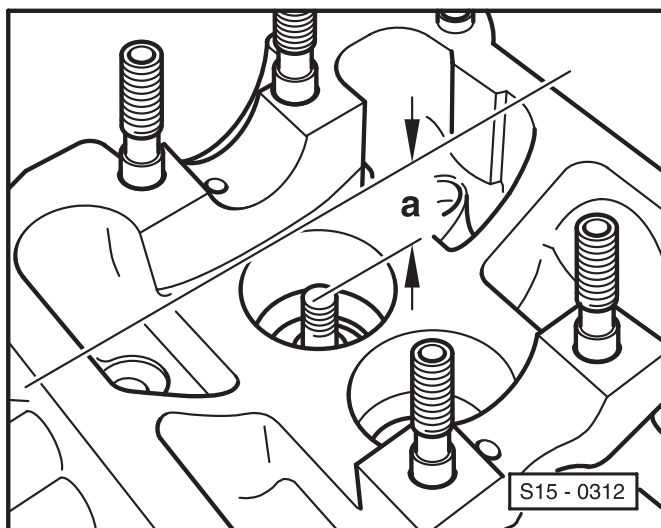
- Place cylinder head down on a felt base and secure against turning.
- Adapt diameter of guide drift to diameter of valve guide.

Valve guide	Guide drift Ø mm
Inlet valve	7.0 -0.01
Exhaust valve	

- Match diameter of milling tool to diameter of valve seat.

Valve seat	Milling tool Ø mm	
	90°	60°
Inlet valve	37	34
Exhaust valve	32	-





Calculating maximum permissible reworking dimension

- Insert valve and press firmly against the valve seat.

Note:

If the valve is replaced when carrying out repair work, use a new valve for the measurement.

- Measure distance -a- between the valve stem end and the upper face of the cylinder head.
- Calculate max. permissible reworking dimension from the distance -a- and measure the minimum dimension.

Minimum dimension:

Inlet valve	35.8 mm
Outlet valve	36.1 mm

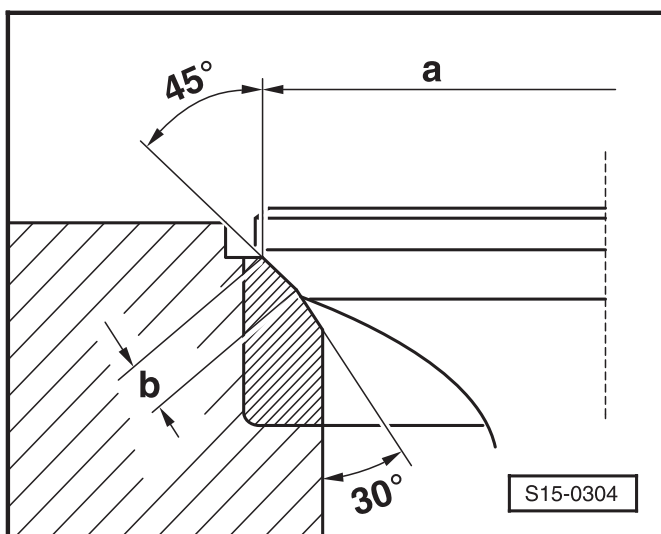
Minimum dimensions less distance measured
= max. permissible reworking.

Example:

distance measured -a-	36.5 mm
- Minimum dimension	35.8 mm
= max. permissible reworking dimension	0.7 mm

Note:

If the max. permissible reworking dimension is 0 mm, repeat measurement with a new valve. If the max. permissible reworking dimension is again 0 mm, replace cylinder head.



◀ Reworking inlet valve seat

a = 35.7 mm

b = 1.6 mm

45° = Valve seat angle

Note:

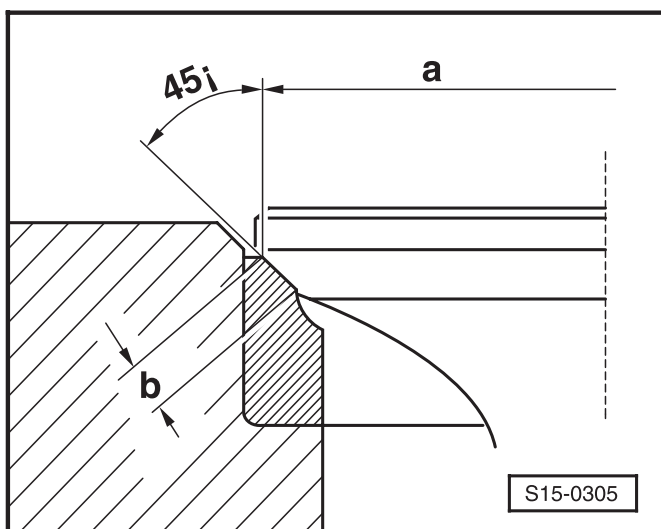
The 30° rear milled section on the valve seat is absolutely essential due to the flow characteristics in the inlet canal.

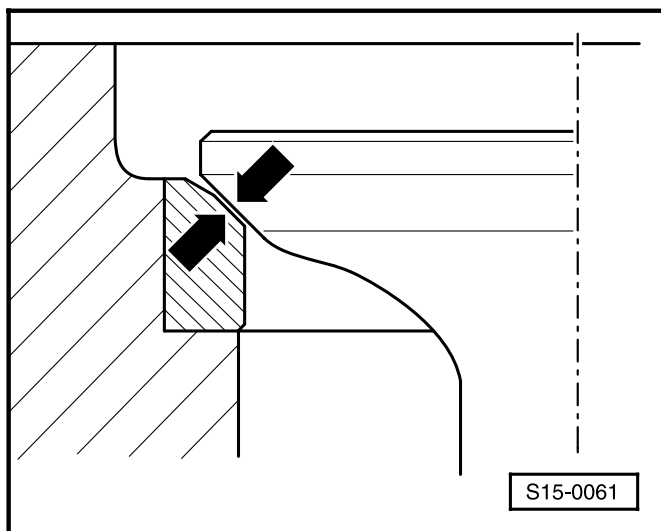
◀ Reworking outlet valve seat

a = 31.4 mm

b = 2.7 mm

45° = Valve seat angle





◀ - Grind in valve/valve seat with fine grinding paste so as to achieve a perfect contact pattern -arrows-.

- Inspect valve for leaks.

The inspection can be carried out with water colour (perfect contact pattern over entire circumference) or by filling fuel into the combustion chamber (no fuel must flow out at the valve seat).

Note:

After installing the cylinder head, check the hydraulic bucket tappets ⇒ page 15-18.

Inspecting valve guides

Special tools, testers and aids required

- ♦ Universal dial gauge holder MP 3-447
- ♦ Dial gauge

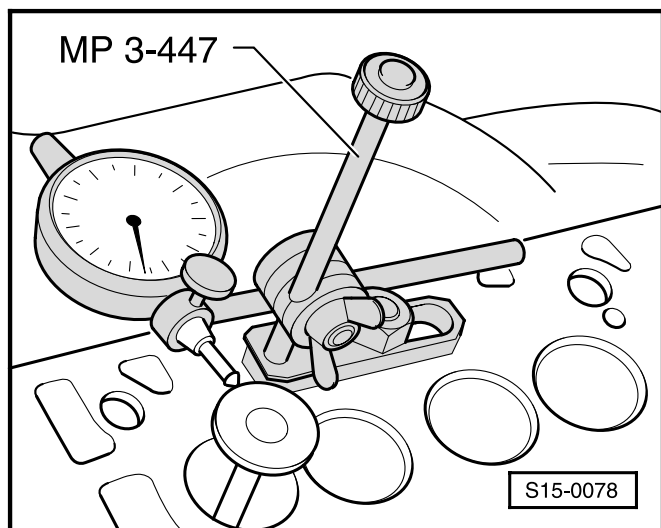
Test procedure

◀ - Insert valve into valve guide. End of valve stem must be flush with guide.

Valve rock: max. 1.3 mm

Notes:

- ♦ *If the wear limit is exceeded, repeat measurement with new valves. If the wear limit is again exceeded, replace valve guides ⇒ page 15-19.*
- ♦ *If the valve is replaced when carrying out repair work, use a new valve for the measurement.*

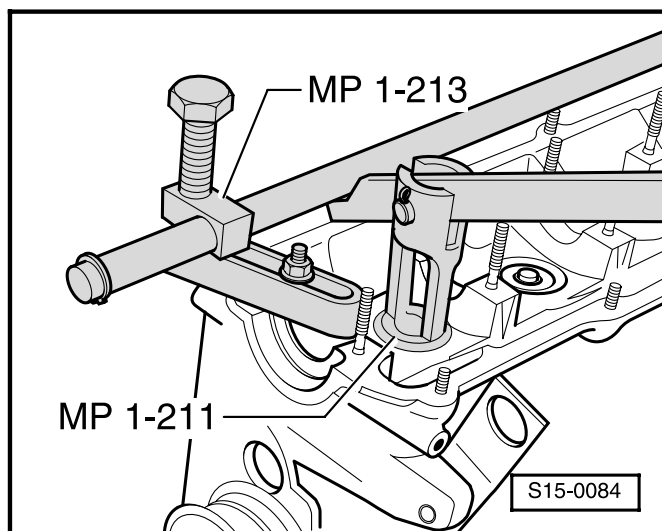


Replacing valve stem seals

(cylinder head installed)

Special tools, testers and aids required

- ♦ Assembly lever with pressure plate MP 1-211
- ♦ Assembly device MP 1-213
- ♦ Gasket ring extractor MP 1-206
- ♦ Insertion tool MP 1-306

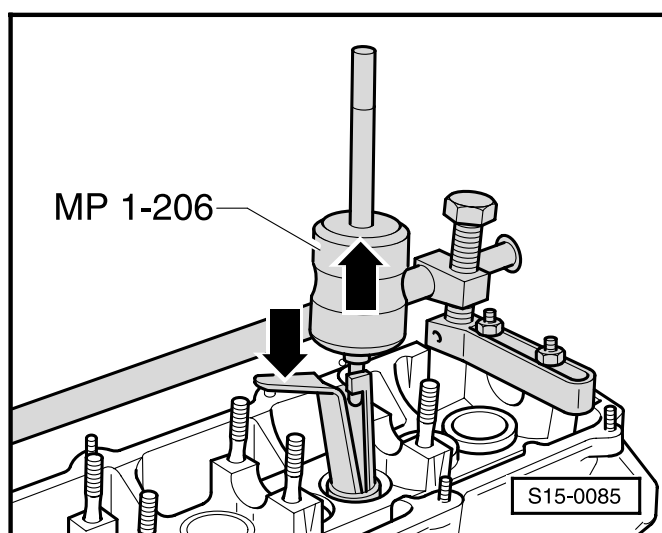


Removing

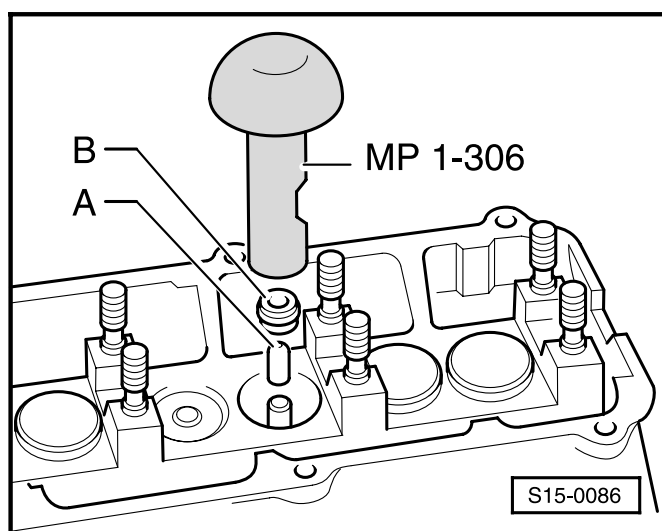
- Remove camshaft ⇒ page 15-16.
- Remove bucket tappets (do not mix up) and place down with running surface facing down.
- Move piston of the relevant cylinder into top dead centre (TDC).
- ◀ - Insert assembly device MP 1-213 and set mounting at height of stud bolt.
- Use assembly lever and thrust piece MP 1-211 to remove valve springs.

Note:

The valves are supported on the piston crown when carrying out this step.



- ◀ - Use MP 1-206 to pull off valve stem seals.



Installing

- ◀ - Fit plastic sleeve -A- onto the valve stem in order to avoid damaging the new valve stem seals.
- Oil valve stem seal -B-, insert into the fitting tool MP 1-306 and carefully push onto the valve guide.

Notes:

- ♦ *Wait about 30 minutes before starting the engine after installing the camshaft. The hydraulic compensating elements have to settle (otherwise valves will strike the piston).*

- ◆ After carrying out work on the valve gear, carefully crank engine at least 2 revolutions to ensure that no valve touches the piston when the engine is started.

Removing and installing camshaft

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Counterholder MP 1-216
- ◆ Adjusting straightedge MP 1-312
- ◆ Puller T40001 with hook T40001/2 and T40001/3

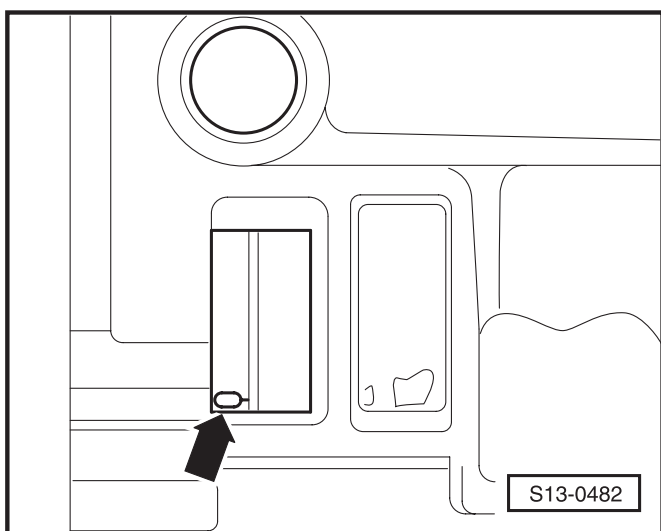
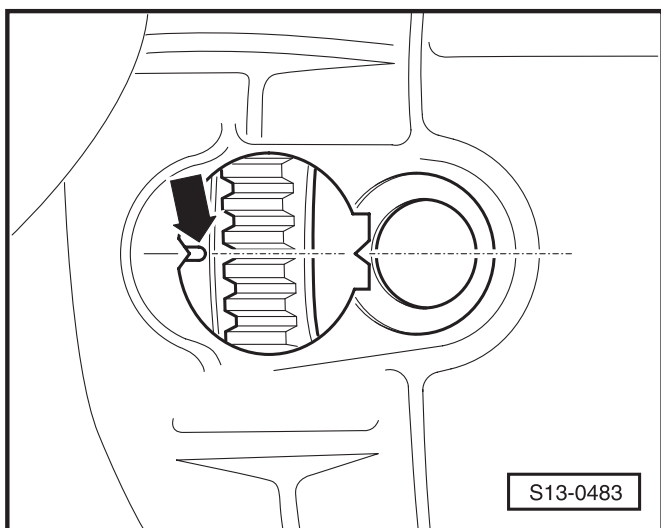
Removing

- Remove top toothed belt guard, cylinder head cover and vacuum pump.

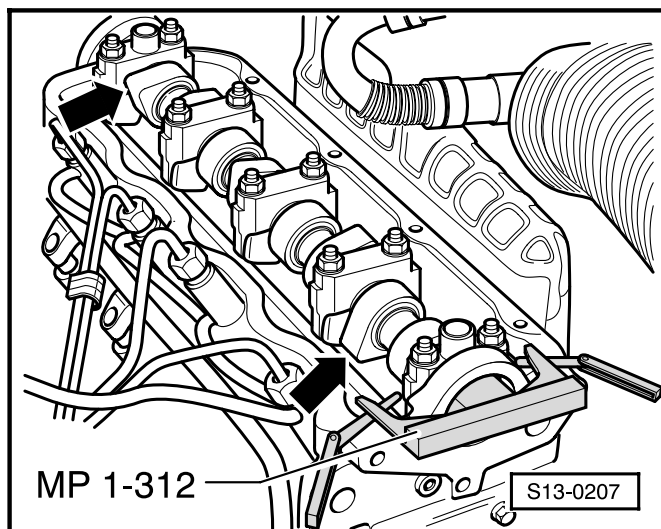
- ◀ - Position crankshaft on TDC of cylinder 1 (vehicles with manual gearbox).

Note:

Position crankshaft on TDC of cylinder 1 when engine was removed ⇒ page 13-11.



- ◀ - Position crankshaft on TDC of cylinder 1 -arrows- (vehicles with automatic gearbox).



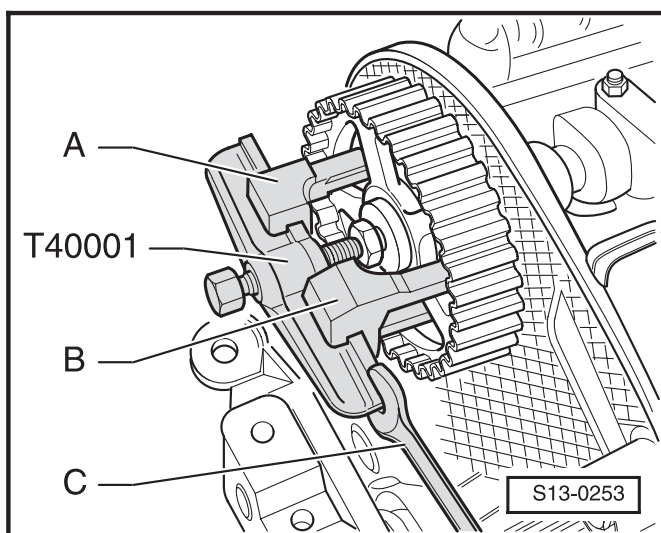
- At the same time the adjusting straightedge MP 1-312 must be inserted easily into the slot at the rear of the camshaft (without the illustrated gauges).

Notes:

- If the adjusting straightedge cannot be inserted, rotate the crankshaft 1 further turn (360°).
- The valves of cylinder 1 must be closed and the valves of cylinder 4 must overlap -arrows-.
- Loosen tensioning pulley.
- Remove toothed belt.

Notes:

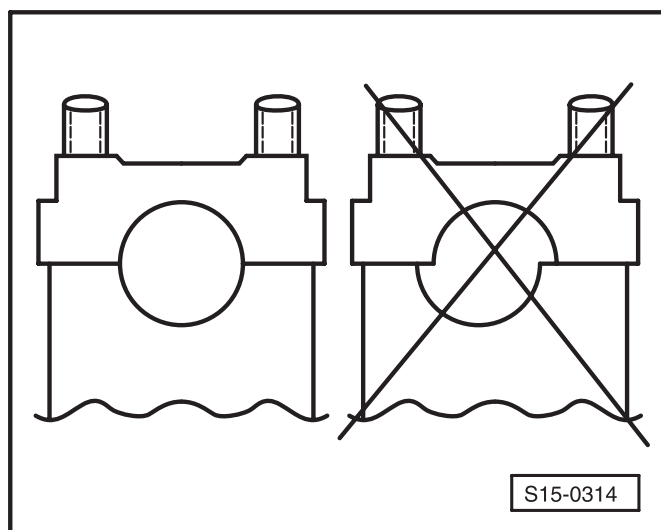
To loosen and tighten the fixing bolt for the camshaft sprocket never use the adjusting straightedge as counterholder ! Counterhold with counterholder MP 1-216.



- Loosen the fixing bolt on the camshaft sprocket by 1 turn.
- Place puller T40001 with hook T40001/2 -A- and T40001/3 -B- on the camshaft. Use open-end wrench as counterholder and loosen the camshaft sprocket from the cone of the camshaft.
- Remove camshaft sprocket.
- First of all remove bearing caps 5, 1 and 3. Loosen bearing caps 2 and 4 alternately diagonally across.

Installing**Notes:**

- When fitting the camshaft the cams of cylinder 1 must point upwards.
- When installing the bearing caps, pay attention to the centre displacement of the bore, before installing insert bearing cap and determine fitting position.
- Oil contact surfaces of camshaft.
- Tighten bearing caps 2 and 4 alternately crosswise to 20 Nm.
- Install bearing caps 5, 1 and 3 and likewise tighten to 20 Nm.
- Fit on the camshaft sprocket and tighten by hand.
- Installing toothed belt ⇒ page 13-4.



Notes:

- ◆ After installing the camshaft, the engine must not be started for about 30 minutes. The hydraulic valve clearance compensating elements have to settle (otherwise valves will strike the pistons).
- ◆ After carrying out work on the valve gear, carefully crank engine at least 2 revolutions to ensure that no valve strikes the piston when the engine is started.

Inspecting hydraulic bucket tappets**Notes:**

- ◆ Always replace the bucket tappets complete (cannot be adjusted or repaired).
- ◆ Irregular valve noises when starting are normal.

Special tools, testers and aids required

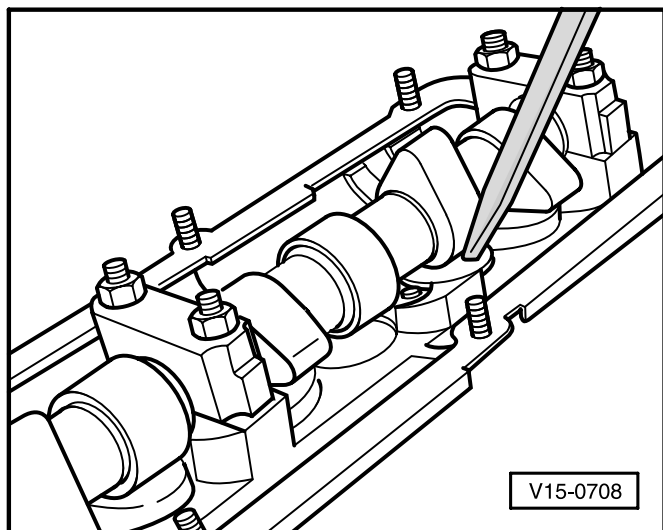
- ◆ Feeler gauge
- ◆ Wooden or plastic wedge

Inspection procedure

- Start engine and continue running until the radiator fan has cut in once.
- Increase engine speed to about 2500 rpm for 2 minutes; carry out a road test if necessary.

If the hydraulic bucket tappets are still loud, determine the faulty tappet as follows:

- Remove cylinder head cover.
- Rotate crankshaft clockwise until the cams of the bucket tappets to be inspected are facing up.
- Determine clearance between cam and bucket tappet.
- ◀ - Use a wooden or plastic wedge to press bucket tappet down. If it is possible to insert a 0.20 mm feeler gauge between camshaft and bucket tappet, replace tappet.



Notes:

- ◆ *After installing the camshaft, the engine must not be started for about 30 minutes. The hydraulic valve clearance compensating elements have to settle (otherwise valves will strike the pistons).*
- ◆ *After carrying out work on the valve gear, carefully crank engine at least 2 revolutions to ensure that no valve strikes the piston when the engine is started.*

Replacing valve guides**Special tools, testers and aids required**

- ◆ Driver MP1-205
- ◆ Hand reamer MP1-204 and diluted soluble oil

Removing

- Clean cylinder head and inspect. Cylinder heads which have valve seat rings which can no longer be reworked, or cylinder heads which have already been machined to their minimum dimension, are not suitable for replacing the valve guides.
- Use MP1-205 to press out worn valve guides from the camshaft side (valve guide with shoulder, repair versions - from the combustion chamber side).

Installing

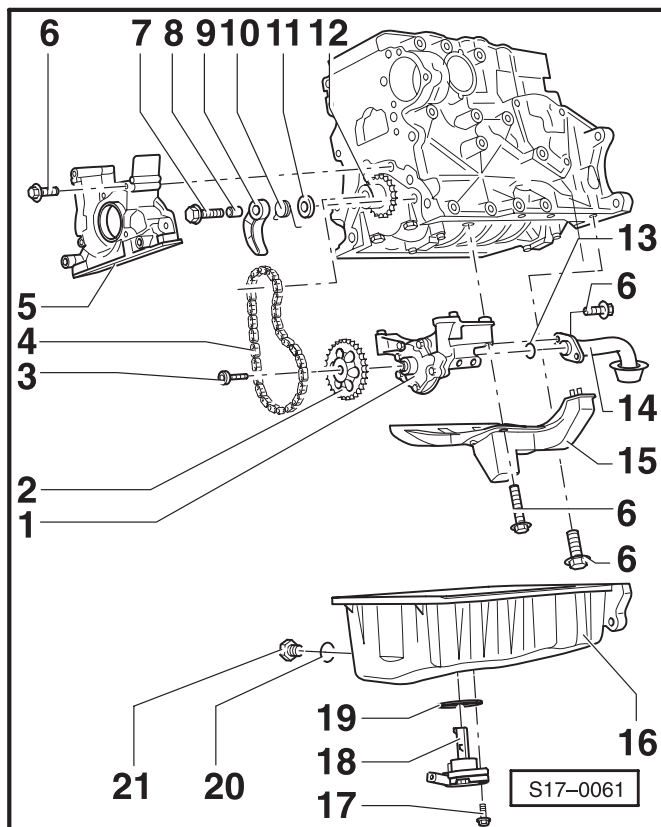
- Moisten new valve guides with oil and press into the cold cylinder head with MP 1-205 from the camshaft side as far as the shoulder.

Note:

After the guide makes contact with the shoulder, the pressure applied must not be increased beyond 10 kN otherwise the shoulder may shear off.

- Use hand reamer MP1-204 to ream open valve guide. It is essential to use diluted soluble oil for this step.
- Rework valve seats ⇒ page 15-12.

Removing and installing parts of the lubrication system



Notes:

- ♦ If considerable quantities of metal swarf or abrasion are found in the engine oil when carrying out repair work in the engine, it is then necessary to carefully clean the oil galleries and in addition to replace the oil cooler in order to avoid any consequential damage.
- ♦ The oil level must not extend beyond the max. marking - risk of damage to catalytic converter!
- ♦ To extract oil, remove filler funnel on dipstick guide tube.
- ♦ Testing compression ⇒ page 17-5.

Inspecting oil level, oil quantity, oil specification
⇒ Inspection and Maintenance

1 - Oil pump

- ♦ Duocentric pump
- ♦ with 1.2 MPa pressure relief valve
- ♦ before installing, check whether the two dowel sleeves for centering oil pump/cylinder block are fitted
- ♦ if scores present on running surfaces and gears, replace
- ♦ torque for attaching oil pump cover to oil pump housing: 10 Nm

2 - Chain sprocket for oil pump

- ♦ pay attention to installation position
- ♦ can be fitted onto oil pump shaft only in one position

3 - 25 Nm

4 - Chain for oil pump

- ♦ before removing, mark running direction

5 - Sealing flange

- ♦ removing and installing ⇒ page 13-18
- ♦ replacing crankshaft seal ⇒ page 13-15

6 - 15 Nm

7 - Collar bolt, 15 Nm

8 - Bush

9 - Chain tensioner

10 - Spring

11 - Washer

12 - Chain sprocket

13 - O-ring

- ♦ replace

14 - Suction line

- ♦ clean strainer if soiled

15 - Splash plate

16 - Oil pan

- ♦ removing and installing ⇒ page 17-3

17 - 10 Nm

18 - Oil level and oil temperature sender -G266

- ♦ only for models with extended service interval
- ♦ testing ⇒ Electrical system; Repair Group 90

19 - Gasket

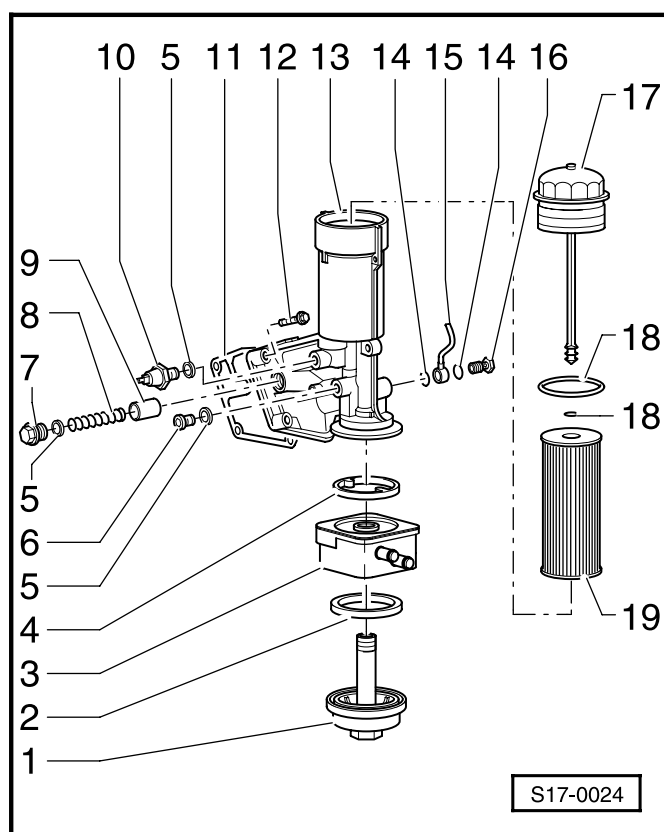
- ♦ replace if damaged

20 - Seal

- ♦ replace

21 - Oil drain plug, 30 Nm

Disassembling and assembling oil filter holder



1 - Screw plug, 25 Nm

2 - Gasket

- ◆ replace

3 - Oil cooler

- ◆ ensure clearance to surrounding components
- ◆ pay attention to Note ⇒ page 17-1

4 - Gasket

- ◆ replace
- ◆ fit into the grooves on the oil cooler

5 - Seal

- ◆ up to 03.01
- ◆ cut open and replace if leaking

6 - Screw plug, 10 Nm

- ◆ up to 03.01

7 - Screw plug

- ◆ up to 03.01
- ◆ must not be opened

8 - Spring

- ◆ up to 03.01
- ◆ for pressure relief valve 0.5 MPa (5 bar)

9 - Piston

- ◆ up to 03.01
- ◆ for pressure relief valve 0.5 MPa (5 bar)

10 - 0.09 MPa (0.9 bar) Oil pressure switch F1, 25 Nm

- ◆ grey
- ◆ inspecting ⇒ page 17-5

11 - Gasket

- ◆ replace

12 - 15 Nm + torque a further 1/4 turn (90°)

- ◆ replace

13 - Oil filter holder

14 - Seal

- ◆ replace

15 - Oil feed line

- ◆ to turbocharger

16 - Banjo bolt, 20 Nm

17 - Cap, 25 Nm

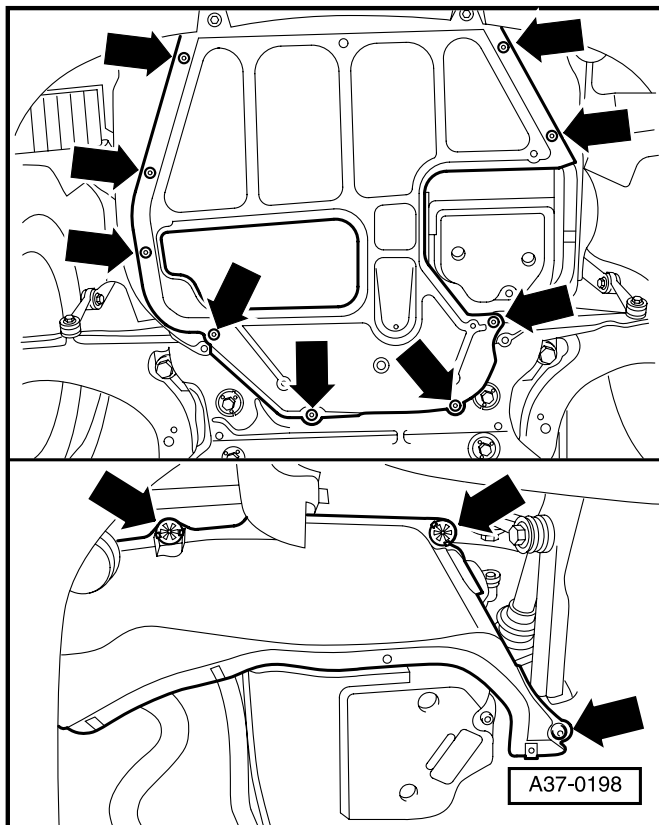
- ◆ slacken and tighten with oil filter wrench 3417

18 - O-ring

- ◆ replace

19 - Oil filter element

- ◆ pull off from cap -item. 17-
- ◆ when changing oil filter replace O-rings -item. 18-



Removing and installing oil pan

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Silicone sealant D176 404 A2
- ◆ Hand drill with rotating plastic brush attachment
- ◆ Flat scraper

Removing

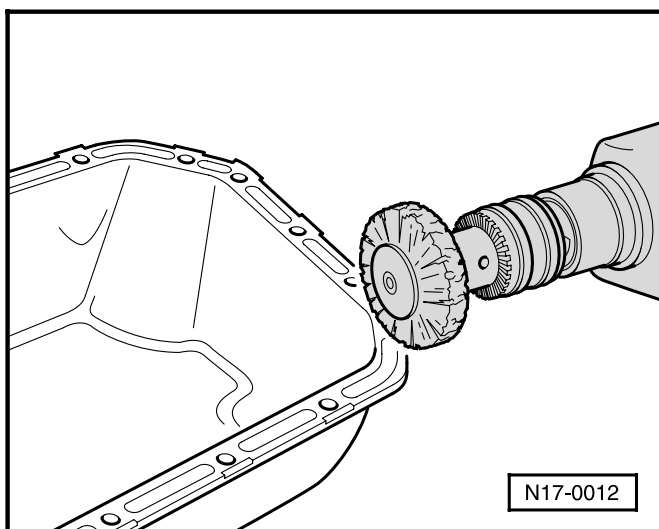
- ◀ - Remove noise insulation panel in middle as well as on left and right -arrows-.

- Drain engine oil.
- Unbolt oil pan.

Notes:

- ◆ Use wrench to slacken and tighten oil pan bolts.
- ◆ On models with extended service interval, unplug connector from oil level and oil temperature sender -G266.

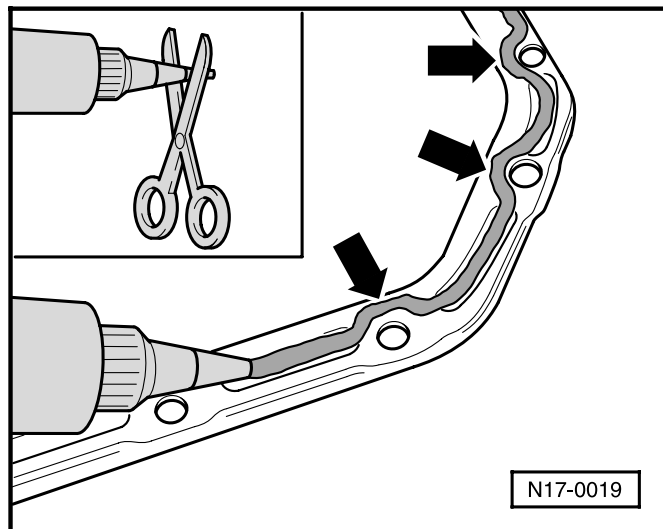
- Take off oil pan; detach with light blows from a rubber-headed hammer if necessary.
- Use a flat scraper to remove sealant residues on cylinder block.
- ◀ - Use rotating plastic brush to remove sealant residues on oil pan (wear eye protection).
- Clean sealing surfaces; they must be free of oil and grease.



Installing

Note:

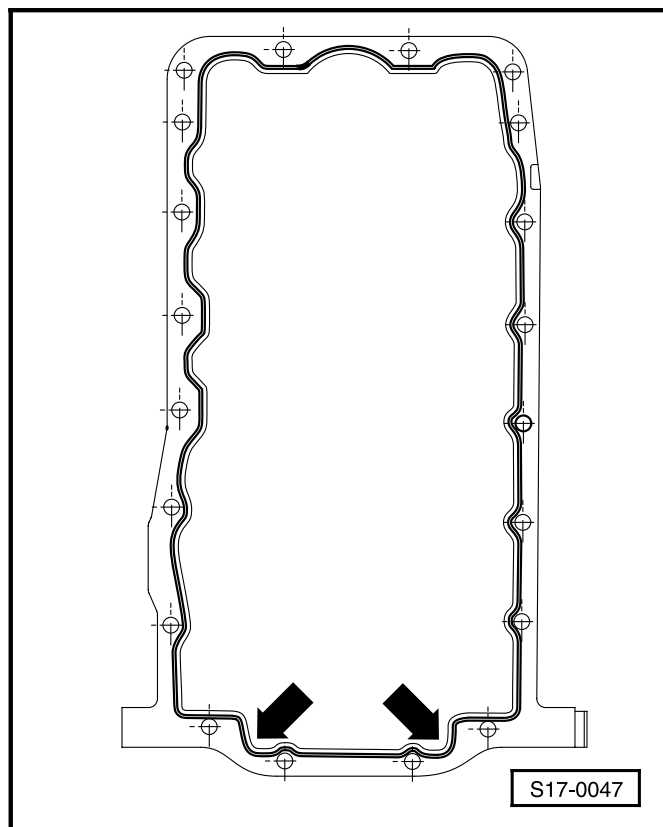
The oil pan must be installed within 5 minutes after applying the silicone sealant.



- ◀ - Cut off tube nozzle at the front marking (Ø of tube about 3 mm).
- ◆ Thickness of sealant bead:
2 ... 3 mm

Note:

The sealant bead must not be thicker than 3 mm otherwise excess sealant may get into the oil pan and block the strainer in the oil intake pipe.



- ◀ - Apply silicone sealant to the clean sealing surface of the oil pan, as shown in the illustration.

Note:

Apply sealant bead with particular care in the area of the rear sealing flange -arrows-.

- Fit on oil pan immediately and slightly tighten all the bolts of oil pan/cylinder block.
- Tighten 3 bolts of oil pan/gearbox to 45 Nm.
- Tighten bolts of oil pan/cylinder block diagonally across in 2 stages, the last stage to 15 Nm.

Notes:

- ◆ *When attaching the oil pan to the removed engine, ensure that the oil pan finishes flush with the cylinder block at the flywheel side.*
- ◆ *After installing the oil pan, allow the sealant to dry for about 30 minutes. Do not pour in engine oil until after this waiting period.*
- ◆ *On models fitted with extended service interval, unplug connector of oil level and oil temperature sender -G266 and erase fault memory ⇒ 1.9 l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 01; Interrogating and erasing fault memory.*

Testing oil pressure and oil pressure switch

Special tools, testers and aids required

- ◆ Oil pressure tester (e.g. V.A.G 1342)
- ◆ Diode test lamp (e.g. V.A.G 1527)
- ◆ Adapter cable set (e.g. V.A.G 1594)
- ◆ Current flow diagram

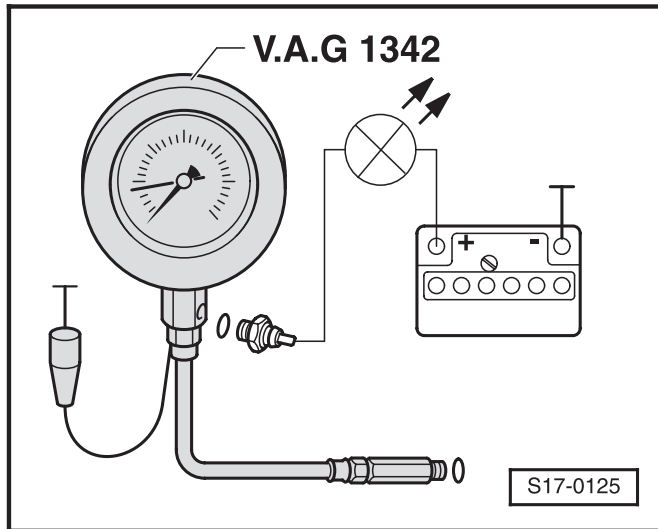
Operation of dynamic oil pressure warning system

Testing warning lamp

The oil pressure warning lamp flashes after ignition on („terminal 15 on“) and engine not running.

Warning criteria

- Engine not running and oil pressure switch closed
- Coolant temperature higher than 60 °C, engine speed greater than 1500 rpm and oil pressure switch open
- Coolant temperature less than 60 °C, engine speed greater than 300 rpm and oil pressure switch open
- At engine speed greater than 5000 rpm, an active oil warning is not cancelled, irrespective of the status of the oil pressure switch.
- If the voltage supply of the control unit is o.k. (terminal 15) and the oil pressure switch is open for more than 0.5 seconds and engine speed greater than 1500 rpm, this is stored. If this condition occurs 3 times during „terminal 15 on“, the warning becomes or remains activate even at engine speeds lower than 1300 rpm.



Test conditions

- Inspect engine oil level to ensure that it is OK ⇒ Inspection and Maintenance.
- Warning light for oil pressure (K3) must light up briefly when switching on the ignition.
- Engine oil temperature must be at least 80 °C (radiator fan must run once).

Testing oil pressure switch

- Detach cable from oil pressure switch.
- ◀ - Unscrew oil pressure switch and screw in oil pressure tester (e.g. V.A.G 1342)
- Screw oil pressure switch into the tester V.A.G 1342.
- Connect brown cable of tester to earth (-).
- Connect diode test lamp (e.g. V.A.G 1527) to oil pressure switch -2- and to the battery positive (+).
- Start engine and slowly increase engine speed.
- At a pressure of 0.075...0.105 MPa (0.75...1.05 bar) the LED must come on. If it does not come on, replace oil pressure switch.

Testing oil pressure

- Unscrew oil pressure switch and screw in V.A.G 1342.
- Screw oil pressure switch into V.A.G 1342.
- Start engine (engine oil temperature at least 80 °C).
 - ♦ Oil pressure when engine idling: min. 0.1 MPa (1.0 bar)
 - ♦ Oil pressure at 2000 rpm: min. 0.2 MPa (2.0 bar)

At a higher engine speed the oil pressure must not be greater than 0.7 MPa (7.0 bar). Otherwise replace oil pump cover with pressure relief valve.

Engine oil

The engine is factory-filled with a branded multigrade oil which can also be used as an all-seasons oil - except in extremely cold climatic zones.

The specifications stated below must be indicated individually or together with other specifications on the can.

A - Multigrade high-lubricity oils, specification VW 500 00 ¹⁾ (only in combination with specification VW 505 00 ¹⁾)

B - Multigrade oils, specification VW 505 00 ¹⁾

- Multigrade oils, specification VW 501 01 ¹⁾ (only in combination with specification VW 505 00 ¹⁾)

- Multigrade oils, specification ACEA B3-96 ²⁾ (only exceptionally for topping up)

- Multigrade oils, specification VW 502 00 ³⁾ (only in combination with specification VW 505 00 ¹⁾)

- ¹⁾ A date not earlier than 11.92 must be indicated after this VW Standard.
- ²⁾ This oil must only be used once for topping up within the specified oil change interval if no approved engine oil is available.
- ³⁾ A date not earlier than 01.97 must be indicated after this VW Standard.

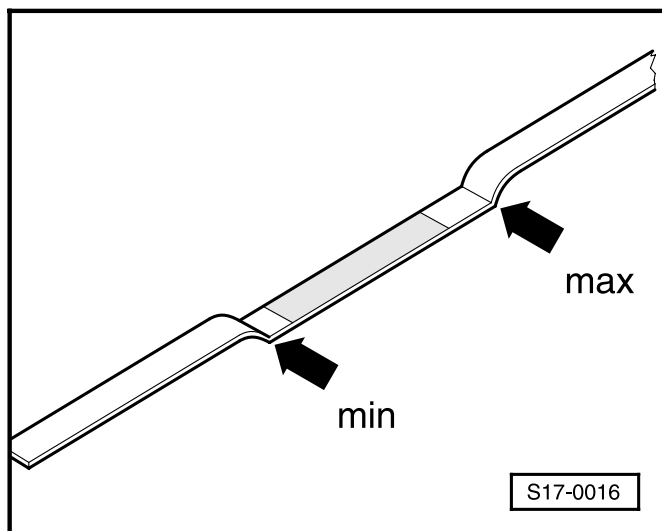
The oils may also be intermixed when topping up.

Inspecting engine oil level

- Carry out measurement of oil level only when engine at normal operating temperature (oil temperature higher than 60°C).
- The vehicle must be standing on level ground when measuring the oil level. Wait a few minutes after switching off the engine to allow the oil to flow back into the oil pan.

Inspection procedure

- Withdraw dipstick, wipe off with a clean cloth and re-insert the dipstick fully.



- Then, remove dipstick again and read off oil level.

◀ Markings on dipstick:

The engine oil should be maintained at the level within the range between the "min" and "max" markings. The "max" marking corresponds to an engine oil quantity of about 5.2 ltr.

Note:

The oil level must not extend beyond the max. marking of the dipstick.

Removing and installing parts of the cooling system

Notes:

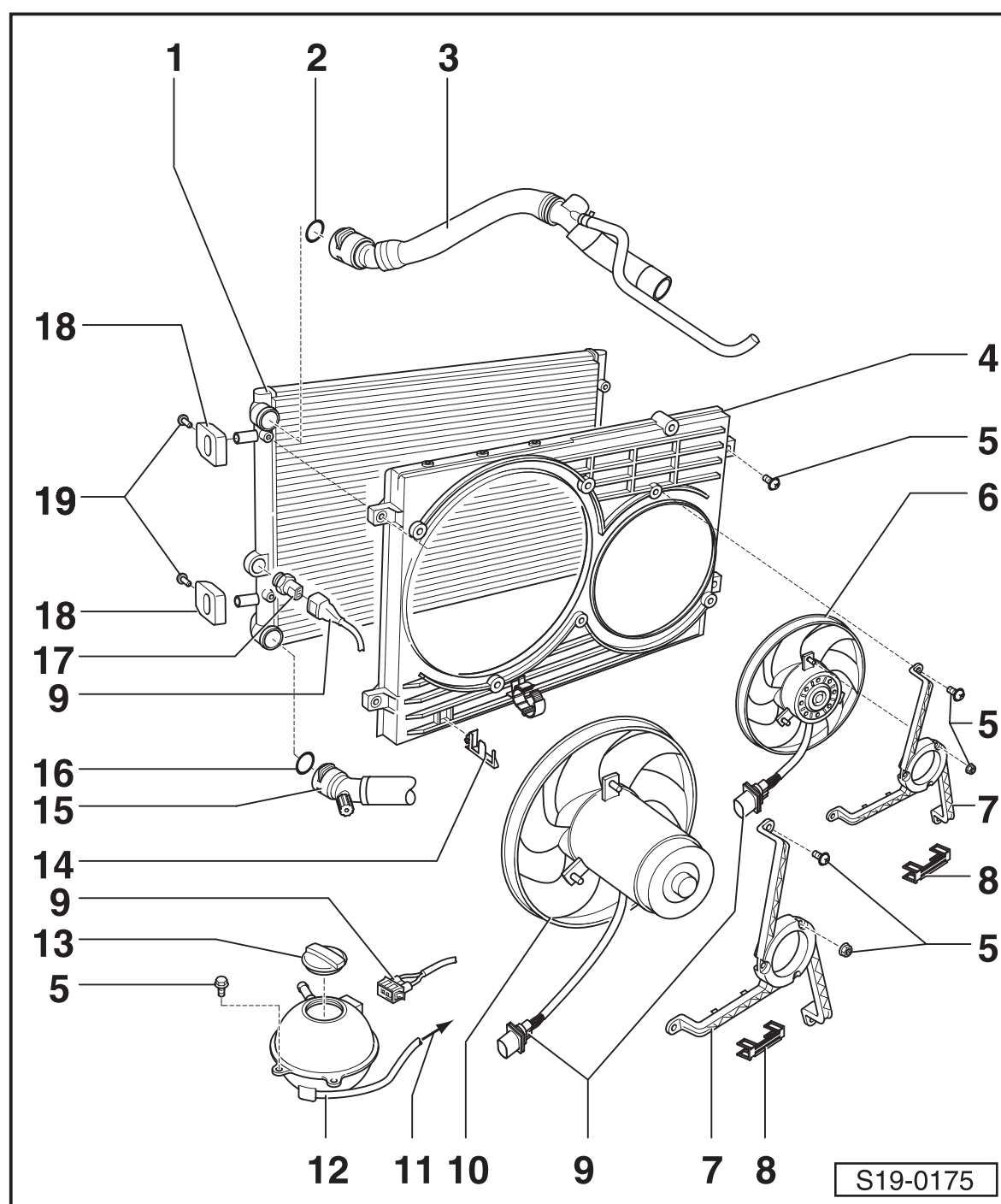
- ◆ *When the engine is warm the cooling system is under pressure. If necessary reduce pressure before repairs.*
- ◆ *The hose connections are secured with spring strap clips. In the event of repairs only use spring strap clips.*
- ◆ *Use pliers for spring strap clips to fit the spring strap clips.*
- ◆ *Always replace seals and gasket rings.*
- ◆ *The arrows which are on the coolant pipes and the coolant hoses must stand opposite to each other.*

Draining and filling up coolant ⇒ page 19-3.

Coolant mixing ratio ⇒ page 19-4.

Inspect cooling system for leaks ⇒ page 19-8.

Parts of the cooling system fitted to body

**1 - Radiator**

- ◆ after replacing fill entire system with fresh coolant
- ◆ removing and installing ⇒ page 19-9

2 - O-ring

- ◆ replace

3 - Top coolant hose

- ◆ secured using a retaining clip
- ◆ connection diagram for coolant hoses ⇒ page 19-2.4

4 - Fan shroud

5 - 10 Nm

6 - Auxiliary fan

- ◆ on vehicles with air conditioning, or additional equipment

7 - Fan holder

8 - Retaining clips

- ◆ for fan cable
- ◆ check tightness

9 - Connector**10 - Radiator fan****11 - To coolant pipe**

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

12 - Expansion reservoir

- ◆ inspect cooling system for leaks with the tester V.A.G 1274 and adapter V.A.G 1274/8

13 - Cap

- ◆ inspect with the tester V.A.G 1274 and adapter V.A.G 1274/9
- ◆ Overpressure from 1.4...1.6 bar

14 - Holder

- ◆ for connector of fan

15 - Bottom coolant hose

- ◆ attached to radiator using a retaining clip
- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

16 - O-ring

- ◆ replace

17 - Thermostwitch (-F18-), 35 Nm

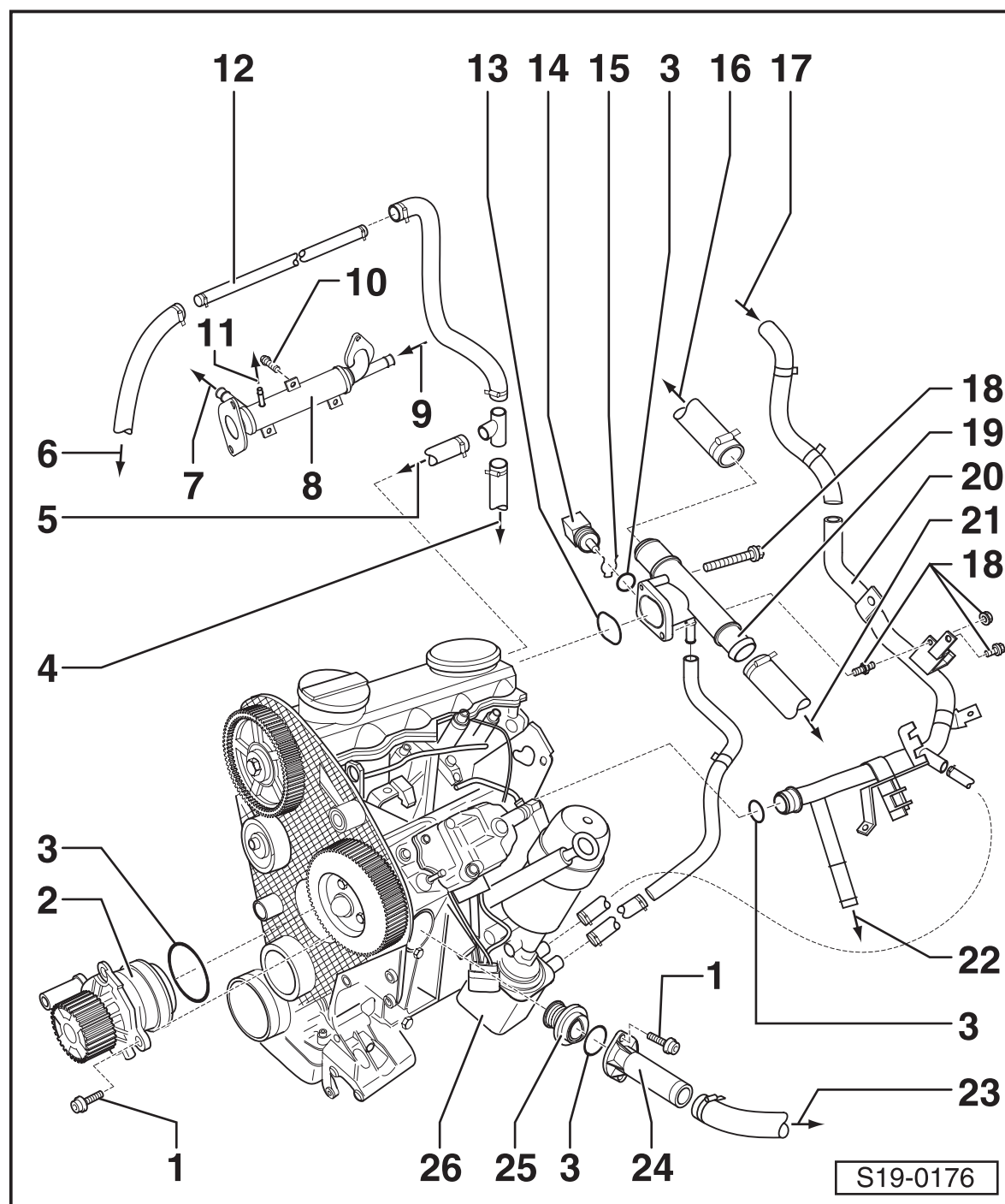
- ◆ for radiator fan
- ◆ switching temperatures:
1st stage
on: 92...97 °C
off: 84...91 °C
2nd stage
on: 99...105 °C
off: 91...98 °C

18 - Holder

- ◆ for radiator
- ◆ pay attention to fitting position
- ◆ pay attention to different version

19 - 10 Nm

Parts of the cooling system attached to engine



1 - 15 Nm

2 - Coolant pipe

- ♦ inspect for smooth operation
- ♦ pay attention to fitting position
- ♦ removing and installing ⇒ page 19-5

3 - O-ring

- ♦ replace

4 - To top radiator

- ♦ connection diagram for coolant hoses
⇒ page 19-2.4

5 - To cylinder head

- ♦ connection diagram for coolant hoses
⇒ page 19-2.4

6 - To top expansion reservoir

- ♦ connection diagram for coolant hoses
⇒ page 19-2.4

7 - To heat exchanger for heating

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

8 - Radiator for exhaust gas recirculation

- ◆ only on engines ALH with automatic gearbox

9 - From connection fitting

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

10 - 10 Nm**11 - To expansion reservoir**

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

12 - Top coolant hose

- ◆ attached to bulkhead
- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

13 - O-ring

- ◆ check tightness
- ◆ replace

14 - Coolant temperature sender -G62-

- ◆ with sender for coolant temperature display -G2-

15 - Retaining clips

- ◆ check tightness

16 - To heat exchanger for heating

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

17 - From heat exchanger for heating

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

18 - 10 Nm**19 - Connection fitting****20 - Coolant pipe**

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

21 - To top radiator

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

22 - To bottom expansion reservoir

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

23 - To bottom radiator

- ◆ connection diagram for coolant hoses
⇒ page 19-2.4

24 - Connection fitting

- ◆ for coolant regulator

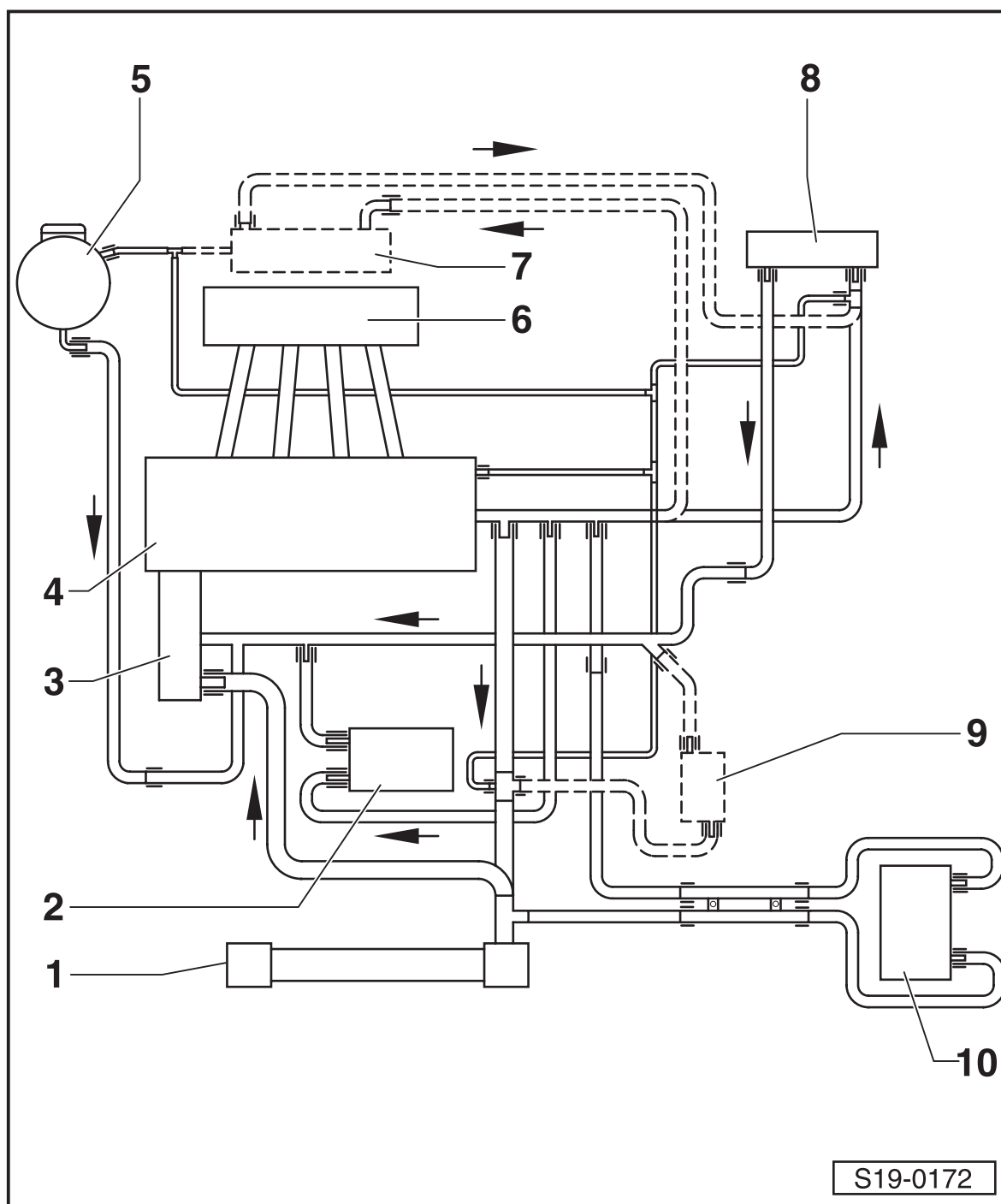
25 - Coolant regulator

- ◆ removing and installing ⇒ page 19-7
- ◆ pay attention to fitting position
- ◆ inspecting: Heat thermostat in water bath
- ◆ opening start approx. 85 °C
- ◆ End approx. 105 °C
- ◆ Opening stroke at least 7 mm

26 - Oil cooler

- ◆ removing and installing ⇒ page 17-2

Connection diagram for coolant hoses



1 - Radiator

- ◆ after replacing fill entire system with fresh coolant
- ◆ removing and installing ⇒ page 19-9

2 - Oil cooler

- ◆ removing and installing ⇒ page 17-2

3 - Coolant pump, coolant regulator

- ◆ removing and installing coolant pipe ⇒ page 19-5
- ◆ inspect for smooth operation
- ◆ removing and installing coolant pipe ⇒ page 19-7

4 - Cylinder block

5 - Expansion reservoir

6 - Intake manifold

7 - Radiator for exhaust gas recirculation

- ♦ only on engines ALH with automatic gearbox

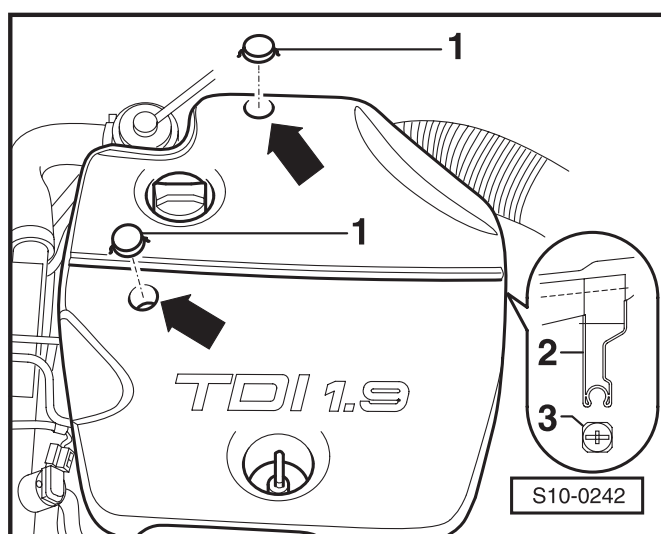
8 - Heat exchanger for heating

9 - ATF radiator

- ♦ only on vehicles with automatic gearbox

10 - Heater for coolant

- ♦ only on vehicles with special equipment



Draining and filling up coolant

Special tools, testers and aids required:

- ♦ Catch pan (e.g. V.A.G 1306)
- ♦ Pliers for spring strap clips

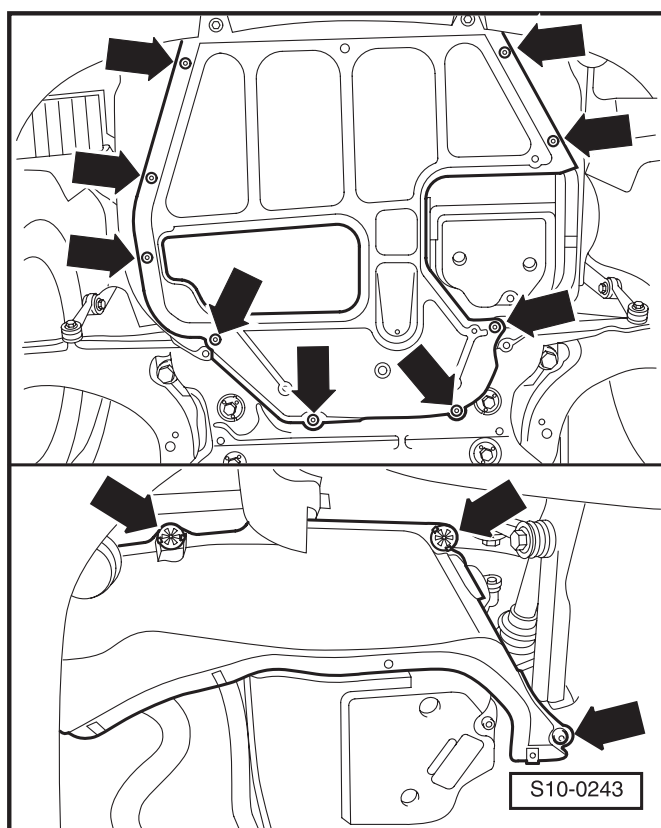
Draining

- Open cap of coolant expansion reservoir

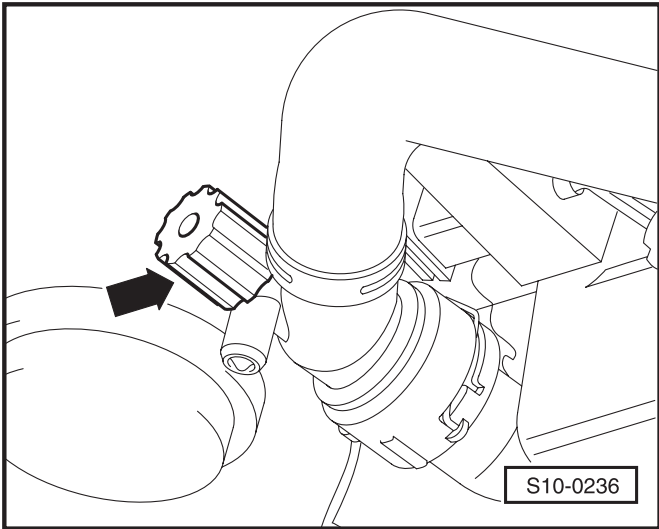
Caution!

Hot steam may escape when the expansion reservoir is opened; cover the cap with a cloth and open carefully.

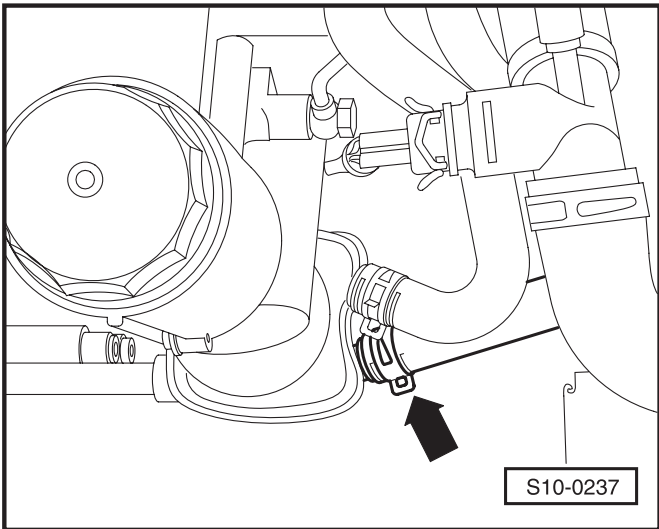
- ◀ - Remove engine cover ⇒ page 10-2.



- ◀ - Remove the left noise insulation and in the middle -arrows-.



- ◀ - Turn drain plug -arrow- on the radiator to the left, if necessary fit auxiliary hose onto connection.



- ◀ - In addition remove coolant hose at bottom on the oil cooler -arrow- and drain residual coolant.

Filling up

Select the appropriate coolant additive from the original spare parts catalogue Škoda or from the list of allowed coolant additives ⇒ Inspection and Maintenance; change coolant.

Recommended mixture ratios:

Antifreeze protection down to	Antifreeze concentration ¹⁾²⁾	Drinking water ²⁾
-25° C	40 % (2.7 l)	60 % (4.1 l)
-35° C	50 % (3.4 l)	50 % (3.4 l)

- 1) Because of inadequate corrosion protection, the antifreeze concentration must not be under 30 % and must not exceed 60 %, the antifreeze protection and cooling efficiency are reduced as the concentration increases.
- 2) The coolant amount may differ according to the version of the vehicle.

- ◆ *If the two coolants are mixed, the coolant turns brown in colour. Brown coolant should be drained immediately, the cooling system flushed out with drinking water and filled with fresh coolant. If this is not done, there is a risk of damage to the engine and the cooling system.*
- ◆ *If bluish-green coolant (G11) is replaced with the red coolant (G12), the entire cooling system should be flushed out with drinking water.*
- ◆ *Coolant which complies with the standard TL VW 774 C (G11) -bluish-green in colour- should not be added to a cooling system of the vehicle unless this system is already filled with this coolant.*
- ◆ *If the cooling system of the vehicle is filled with red coolant (G12), only red coolant (G12) may be used for refilling or topping up the cooling system.*

Coolant additives from the Škoda Genuine Parts Catalogue which comply with the standard TL VW 774 D:

Coolant additives	Manufacturer
Glysantin G 30-72	BASF AG
XT 4030	ELF OIL AG
Coolant ETX 6280	TEXACO
FROSTOX SF-D 12	HENKEL HEARTOL GmbH

Note:

The coolant additives stated can also be inter-mixed.

Recommended mixing ratios:

Antifreeze protection down to	Antifreeze concentration ¹⁾²⁾	Water ²⁾
-25 °C	40 % (2.0 ltr.)	60 % (3.0 ltr.)
-35 °C	50 % (2.5 ltr.)	50 % (2.5 ltr.)

- ¹⁾ Do not exceed an antifreeze concentration of 60 %; the antifreeze protection and cooling efficiency are reduced at higher concentrations.
- ²⁾ Quantity of coolant may differ according to equipment of vehicle.

- Fill with coolant gradually up to „max“ marking on the expansion reservoir.
- Start engine and run for max. 2 minutes at approx. 1500 rpm; fill up coolant to overflow opening of expansion reservoir.
- Close expansion reservoir.
- Run engine until the fan starts.
- Inspect coolant level. If the engine is warm the coolant level must be on the „max“ marking, if the engine is cold the level must lie between the „min“ and „max“ marking.

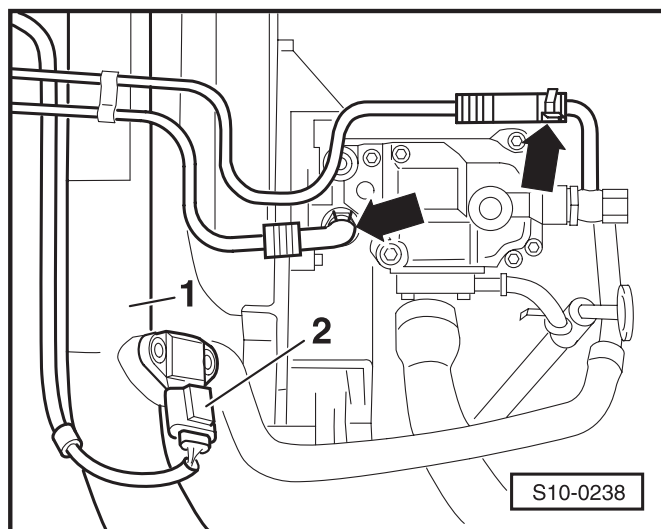
Removing and installing coolant pump

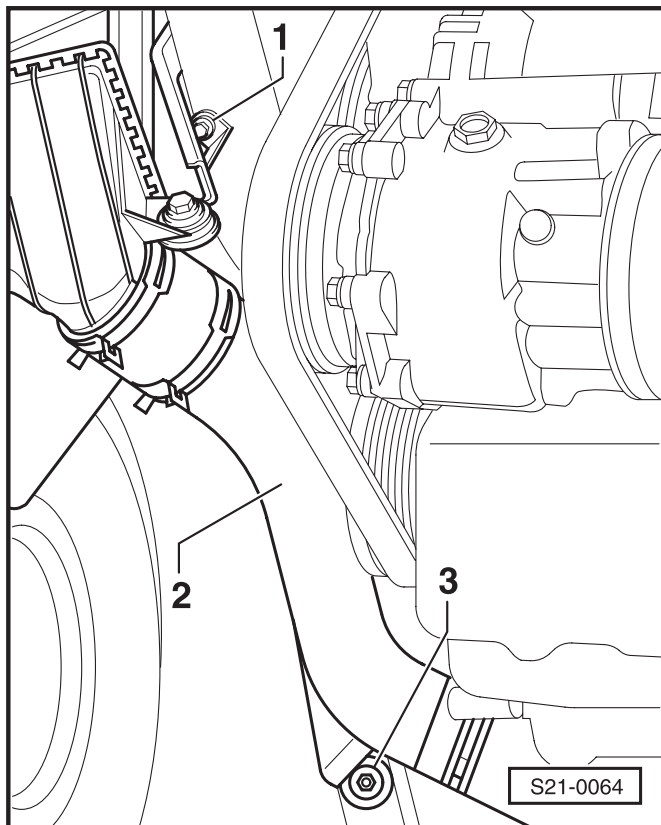
Special tools, testers and aids required

- ◆ Torque wrench

Removing

- Drain coolant ⇒ page 19-3.
- Remove right noise insulation.
- ◀ - Detach fuel hoses -arrows- to the injection pump, seal with a clean plug and place to the side.
- Disconnect plug -2- at intake manifold temperature sender -G72 and intake manifold pressure sender -G71.
- Remove air guide pipe -1-.

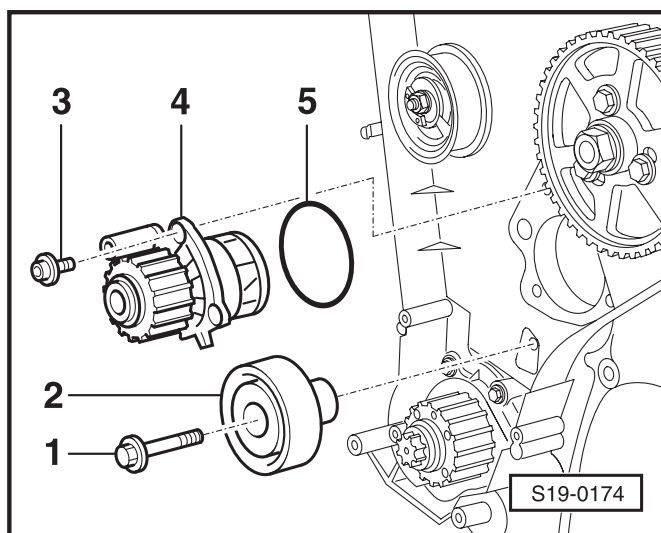




- ◀ - Unbolt fixing nut -3- for air guide pipe -2-.
- Remove air guide pipe -2-.
- Remove the V-ribbed belt ⇒ page 13-1.
- Remove tensioning pulley ⇒ page 13-1.
- Remove top and middle toothed belt guard ⇒ page 13-4.
- Remove toothed belt from camshaft sprocket and from injection pump gear ⇒ page 13-4.

Notes:

- ♦ The vibration damper and the bottom toothed belt guard can remain installed.
- ♦ The timing belt remains fitted onto the crankshaft timing belt sprocket.
- ♦ Pay attention to all the notes for removal and installation of the toothed belt ⇒ page 13-4.



- ◀ - Unscrew screw -1- for guide pulley and press down the guide pulley -2- approx. 30 mm.
- Unscrew coolant pump -4- and carefully remove engine support and toothed belt guard.

Installing

- Clean sealing surface for O-ring or smoothen.
- Replace O-ring -5- and moisten with coolant.
- Insert coolant pump. Fitting position: Plug in housing points down.
- Tighten screws -3- of coolant pump to 15 Nm.
- Replace screw -1- for guide pulley, tighten to 40 Nm and turn a further 90° (1/4 turn).

- Install toothed belt ⇒ page 13-4.
- Install the V-ribbed belt ⇒ page 13-1.
- Fill coolant ⇒ page 19-3.

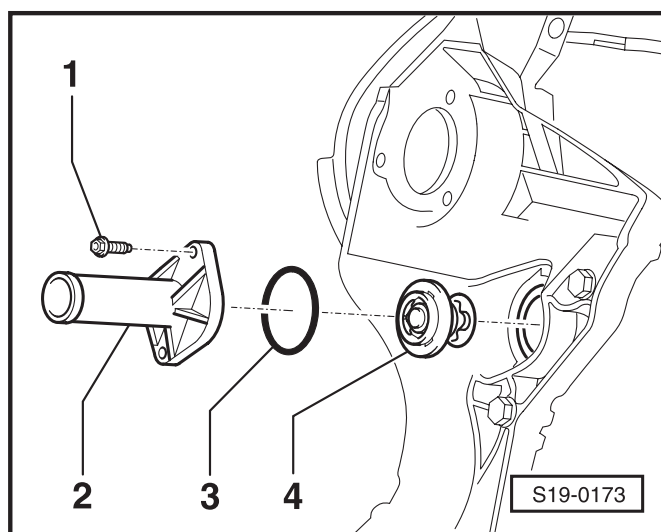
Removing and installing coolant regulator

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Pliers for spring strap clips

Removing

- Drain coolant ⇒ page 19-3.
- ◀ - Remove coolant hose from connection fitting -2-.
- Unscrew screws -1- and remove connection fitting -2- together with O-ring -3- and coolant regulator -4-.
- Turn the coolant regulator 90° ($\frac{1}{4}$ turn) to the left and detach from connection fitting.



Installing

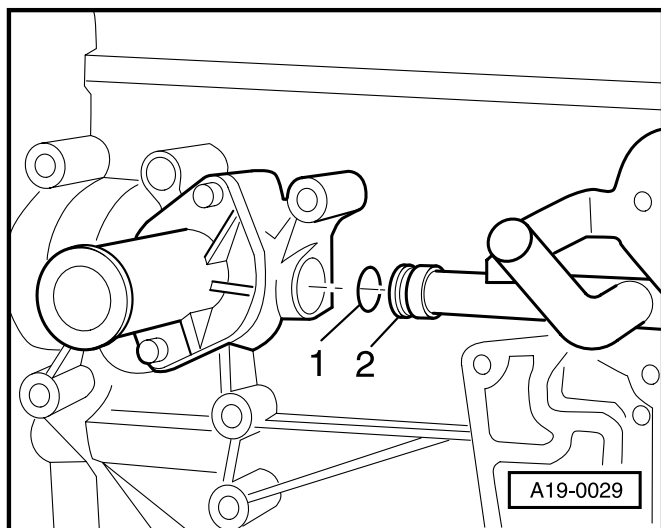
- Clean sealing surface for O-ring.
- Replace O-ring and moisten with coolant.
- Insert coolant pump into the connection fitting and turn 90° ($\frac{1}{4}$ turn) to the right. Inspecting: The clamp of the coolant thermostat must be positioned vertically.
- Tighten screws -1- to 15 Nm.
- Filling system with coolant ⇒ page 19-3.

Test coolant regulator

- Heat thermostat in water bath.

Opening start	Opening start	Opening stroke
approx. 87 °C	approx. 102 °C ¹⁾	at least 7 mm

¹⁾ cannot be tested



Installing coolant pipe

- Before installing, clean or smooth sealing surface for O-ring.
- ◀ - Moisten O-ring -1- with coolant and fit onto coolant pipe -2-.
- Insert coolant pipe into the hole on the cylinder block.
- Bolt bracket for coolant pipe tight to 10 Nm-

Testing cooling system for leaks

Special tools, testers and aids required

- ◆ Cooling system tester (e.g. V.A.G 1274)
- ◆ Adapter (e.g. V.A.G 1274/8)
- ◆ Adapter (e.g. V.A.G 1274/9)

Test condition

- Engine at operating temperature

Test procedure

Important!

Hot vapours may escape when the expansion reservoir is opened. Cover over cap with cleaning rags and open carefully.

- Mount tester V.A.G 1274 with adapter V.A.G 1274/8 onto the expansion reservoir.
- Use the priming pump of the tester to produce a pressure of about 0.1 MPa.
- If the pressure drops, locate the leakage point and rectify fault.

Testing pressure relief valve in cap

- Screw cap onto the tester using adapter V.A.G 1274/9.
- Operate the priming pump of the tester to produce a pressure of about 0.15 MPa.
- The pressure relief valve should open at a pressure of 0.12 ... 0.15 MPa.

Removing and installing the radiator

Notes:

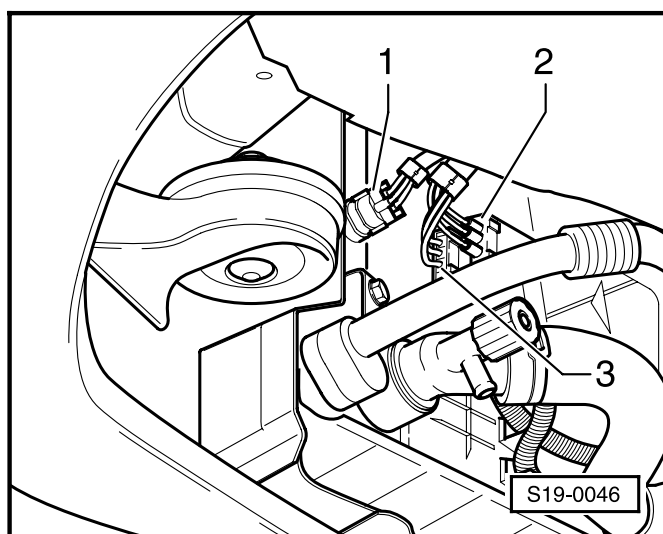
- ◆ Always replace gasket rings and seals.
- ◆ Raise vehicle with lift platform ⇒ page 10-1.

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Wire

Removing

- Drain coolant ⇒ page 19-3.
- ◀ - Disconnect connector -1- from thermoswitch (-F18-) and separate plug connections -2- and -3- at fan shroud (press catches).
- Disconnect coolant hoses at connection fittings of radiator (pull off retaining clips).



Vehicles with air conditioning

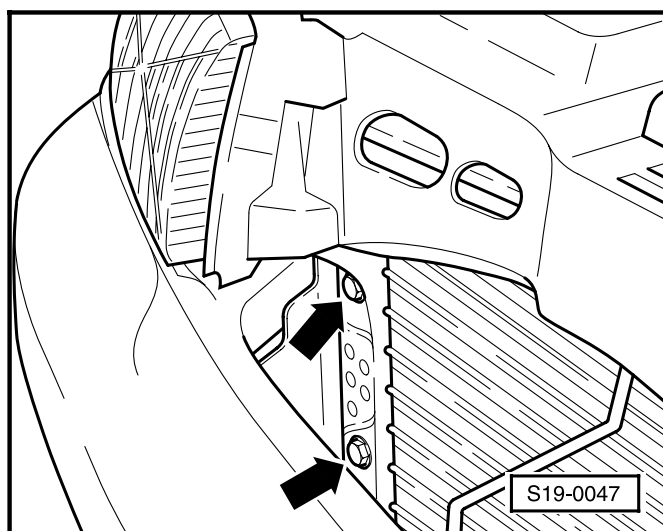
- ◀ - Unscrew the 4 fixing bolts -arrows- attaching the condenser.

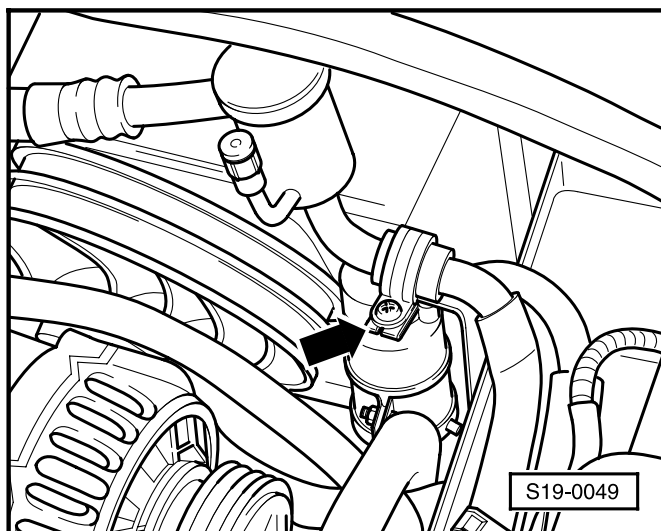
Caution!

Do not open the refrigerant circuit of the air conditioning system.

Note:

The refrigerant lines/hoses must not be overstretched, kinked or bent in order to avoid damage to the condenser.

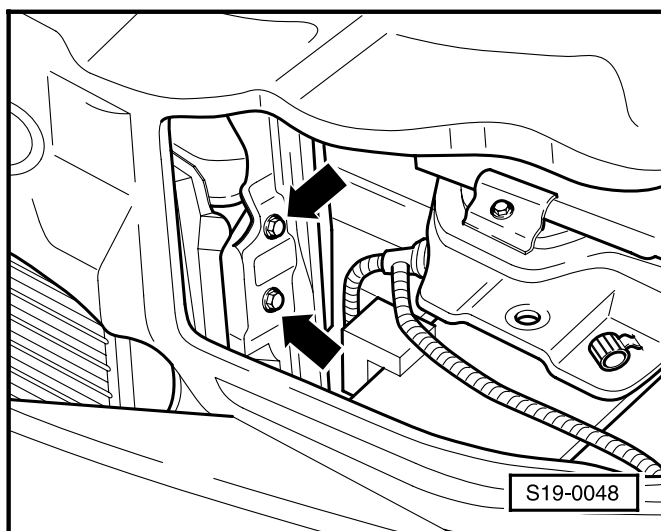




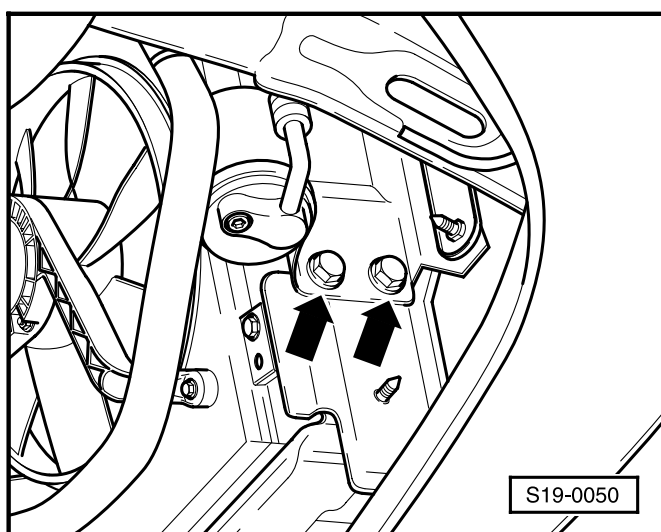
- ◀ - Detach bracket -arrow- for refrigerant pipe.

Continued for all models

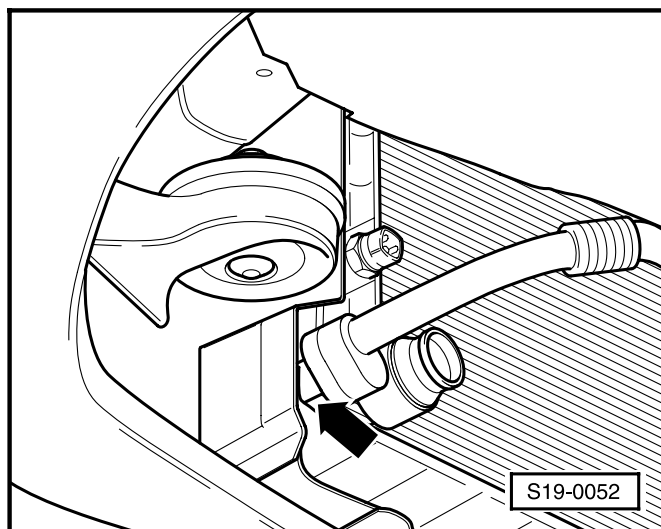
- Remove both headlights:
⇒ Electrical System; Repair Group 94; Removing and installing headlights



- ◀ - Remove the 4 bolts -arrows- for attaching the top radiator mount.



- ◀ - Remove the 4 bolts -arrows- for attaching the bottom radiator mount.



Models with air conditioning

- Pull out radiator slightly together with condenser.
- ◀ - Detach clip -arrow- for attaching refrigerant pipe.

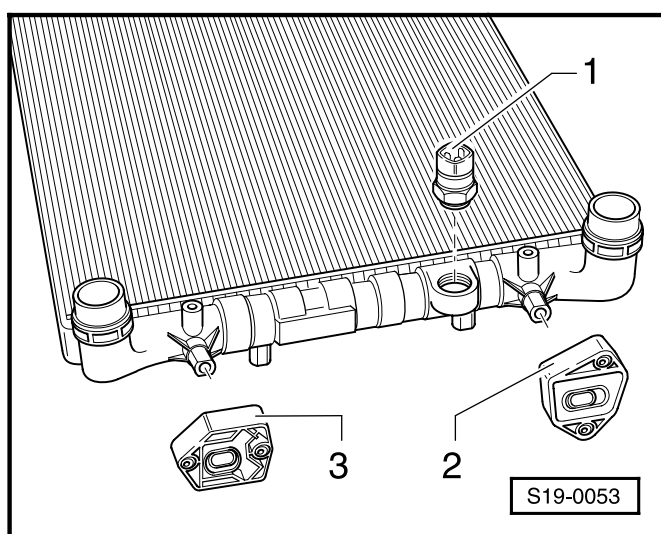
Continued for all models

- Remove fan shroud (4 bolts).

Note:

When removing and installing the fan shroud, ensure that the radiator ribs are not damaged.

- Carefully take out the radiator downward.



Installing

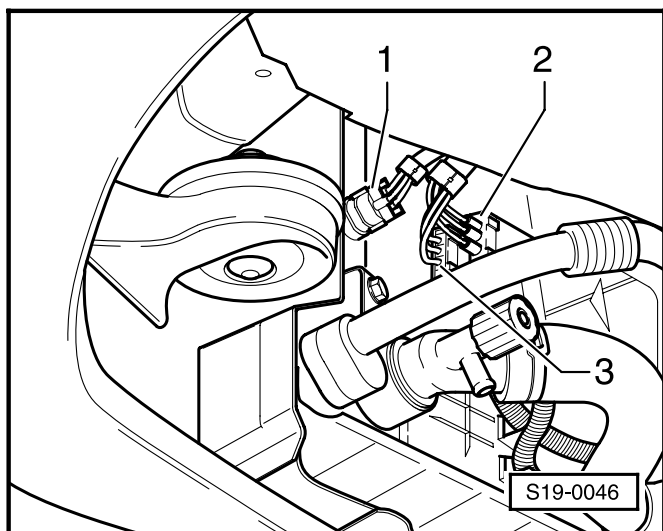
Installation is performed in the reverse order; pay attention to the following points:

- ◀ - Tighten thermostatic switch -1- to 35 Nm.
- Fit on the brackets -2- and -3- at the radiator, as illustrated.
- Tighten the bolts for attaching the fan shroud and radiator mounts to 10 Nm.
- On models with air conditioning, tighten the bolts for attaching condenser and brackets for refrigerant pipes to 10 Nm.
- Replace O-rings in the connection fittings of the coolant hoses.
- Insert drain plug for coolant.
- Fill system with coolant ⇒ page 19-3.
- Install headlights:
⇒ Electrical System; Repair Group 94; Removing and installing headlights
- Electrical connections and routing:
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Removing and installing fan

Note:

- ◆ Raise vehicle with lift platform ⇒ page 10-1, Removing and installing engine.



Special tools, testers and aids required

- ◀ - Separate plug connections -2- and -3- at the fan ring (press catches) and detach plug connections from the holder.
- Detach wiring harness from the holder at the fan ring.

Only for fan V7 (large Ø)

- Remove right headlight
⇒ Electrical System; Repair Group 94; Removing and installing headlights.
- Unscrew bolts (3 in total) for attaching air guide pipe (below right headlight). Detach air guide pipe so that the fan bolt can be unscrewed.

Both fans

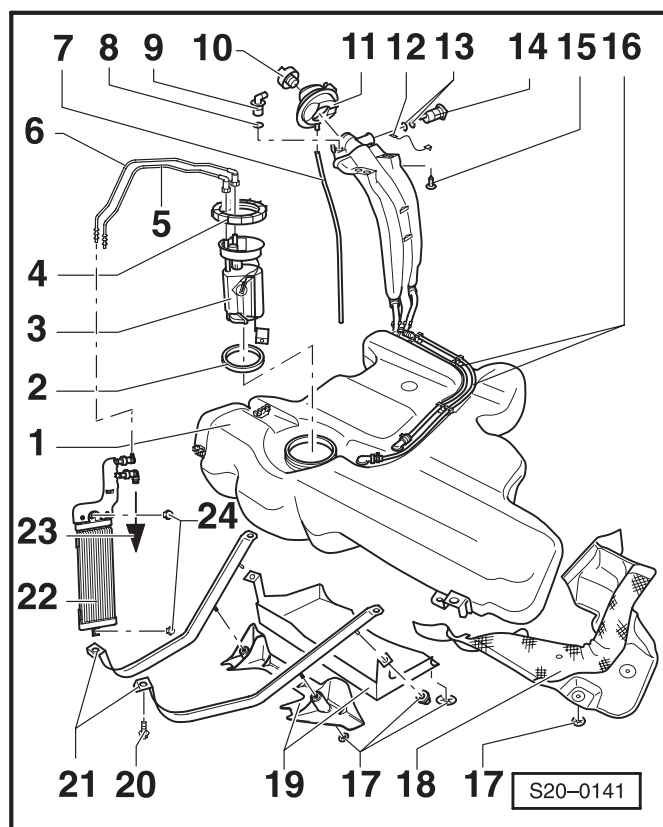
- Unscrew bolts (3 in total) attaching the fan and lift out fan (fan V7 up, fan V35 with smaller Ø down).

Installation

Install in the reverse order.

Removing and installing parts of the fuel supply system

Removing and installing fuel tank with attached parts



Notes:

- ♦ Pay attention to safety precautions ⇒ page 20-3.
- ♦ Pay attention to rules for cleanliness ⇒ page 20-3.
- ♦ Always replace collar-type clamps with screw-type clamps.
- ♦ Always replace all gaskets and seals.
- ♦ Servicing throttle mechanism:
⇒ 1.9 l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 23
- ♦ Servicing fuel filter
⇒ 1.9 l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 23

1 - Fuel tank

2 - Seal

- ♦ moisten with fuel for installing
- ♦ carefully insert seal into the fuel tank before installing fuel gauge sender

3 - Fuel gauge sender

- ♦ with closing flange
- ♦ removing and installing ⇒ page 20-4
- ♦ position of sender with strainer can be moved relative to top part

4 - Union nut, 80 Nm

- ♦ use wrench MP 1-227 for removing and installing

5 - Feed line

- ♦ black
- ♦ is attached to connection marked „V“ at closing flange
- ♦ to detach from closing flange, press unlocking button at connector

6 - Return-flow line

- ♦ blue
- ♦ is attached to connection marked „R“ at closing flange
- ♦ to detach from closing flange, press unlocking button at connector

7 - Overflow hose

8 - O-ring

9 - Gravity valve

- ♦ for removing, unclip valve and lift up and out of filler neck
- ♦ inspecting valve for clearance
valve vertical: open
valve tilted 45°: closed

10 - Cap

11 - Rubber bowl

- ♦ attached with tensioning ring

12 - Earth connection

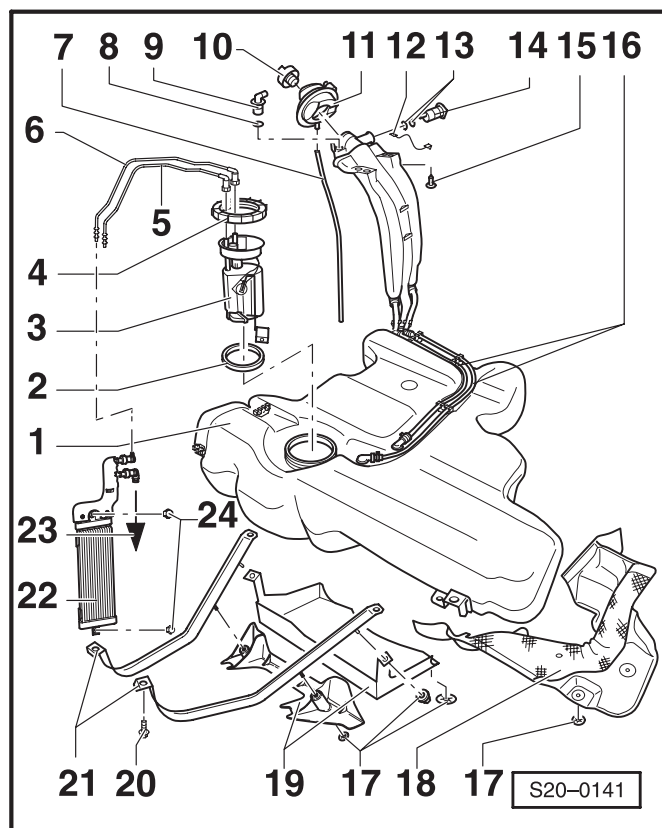
13 - O-rings

14 - Vent valve

- ♦ inspecting ⇒ Fig. 1

15 - 10 Nm

16 - Vent hoses

**17 - Clamping washer**

- ♦ removing: turn to left
- ♦ installing: tighten to 2 Nm

18 - Heat shield

- ♦ for fuel tank

19 - Cover

- ♦ for fuel tank
- ♦ not fitted to all models

20 - 20 Nm + torque a further 1/4 turn (90°)

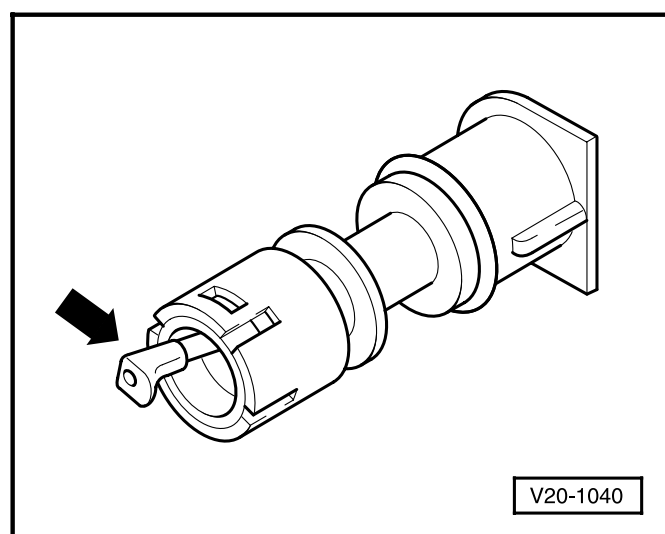
- ♦ replace

21 - Tensioning straps

- ♦ pay attention to different lengths

22 - Fuel cooler

- ♦ only for models fitted with automatic gearbox
- ♦ removing and installing ⇒ page 20-2

23 - To fuel filter**24 - 20 Nm****◀ Fig. 1 Inspecting vent valve**

Lever in off position: closed

Lever pressed in -direction of arrow-: open

Removing and installing fuel cooler**Special tools, testers and aids required**

- ♦ Tightening torque

Removing

Pay attention to rules for cleanliness
⇒ page 20-3.

Note:

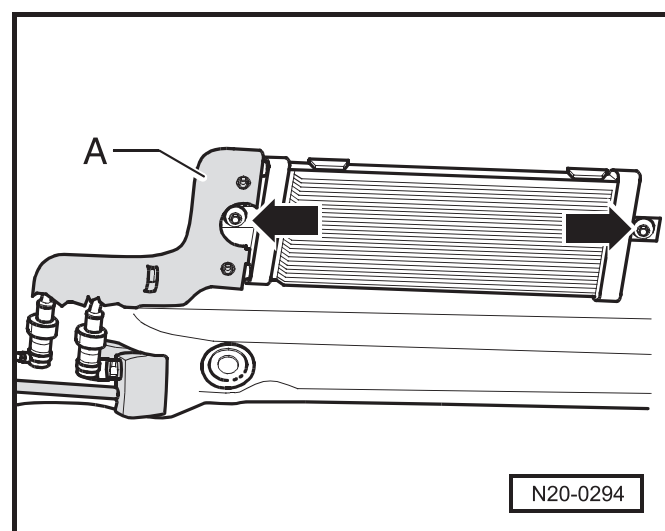
The fuel cooler is located on the return-flow line to the fuel tank. It is fitted on the underbody of the vehicle.

- Remove cover -A-
- Disconnect fuel line on the fuel cooler.
- Unscrew the fixing nuts -arrows-.

Installing

Installation occurs in reverse order while paying attention to the following:

- ♦ Tighten fixing nuts for fuel cooler to 20 Nm.



Safety precautions when carrying out work on fuel supply system

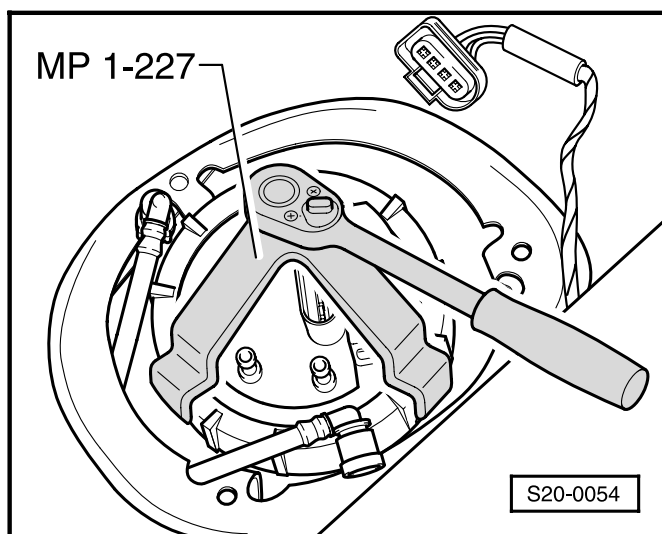
Pay attention to the following points when removing and installing the fuel gauge sender or the fuel pump (fuel delivery unit) from the fuel tank:

- ◆ The extraction hose of an exhaust extraction system should be placed close to the assembly opening of the fuel tank and the extraction system switched on before commencing work in order to extract the fuel vapours which are released.
If no exhaust extraction system is available, it is possible to use a radial fan with a delivery volume of more than 15 m³/h (motor not positioned in the air flow).
- ◆ Avoid skin contact with fuel! Wear fuel-resistant gloves!

Rules for cleanliness

Pay careful attention to the following rules for cleanliness when carrying out work on the fuel supply/fuel injection system:

- ◆ Thoroughly clean connection points and the surrounding area before disconnecting.
- ◆ Place removed parts down on a clean surface and cover over. Do not use fluffing cloths!
- ◆ Carefully cover over or seal opened components if repairs are not carried out immediately.
- ◆ Install only clean parts:
Do not remove replacement parts from their wrapping until just before installing.
Do not use parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ If the system is open:
Avoid working with compressed air, if possible.
Avoid moving the vehicle, if possible.
- ◆ In addition, ensure that no diesel fuel flows onto the coolant hoses. If this happens, the hoses should be cleaned again immediately. Replace any hoses which have suffered damage.



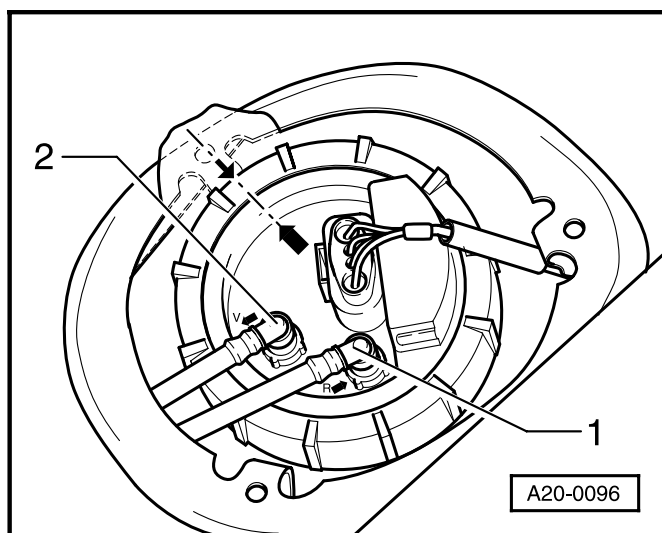
Removing and installing fuel gauge sender

Special tools, testers and aids required

- ◆ Wrench for union nut MP 1-227

Removing

- Unscrew cover (below rear seat).
- Slacken fuel feed line and fuel return-flow line and detach.
- Separate multipin connector for fuel gauge.
- ◀ - Use MP 1-227 to slacken union nut and pull closing flange and sender out of the fuel tank.



Installing

- ◀ - Pay attention to installation position:
 - ◆ Marking on closing flange must be aligned with marking on fuel tank -arrows-.
 - ◆ Blue return-flow line -1- to connection marked with "R".
 - ◆ Black feed line -2- to connection marked with "V".

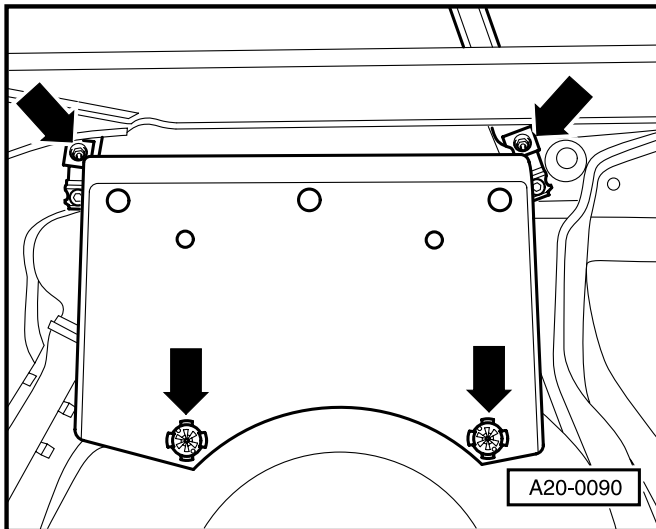
Removing and installing fuel tank

Special tools, testers and aids required

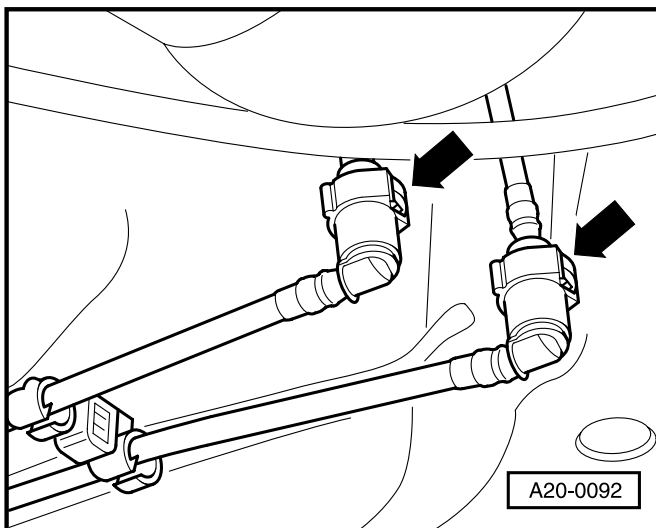
- ◆ Fuel extractor (e.g. V.A.G 1433 A)
- ◆ Engine/gearbox lifter (e.g. V.A.G 1383 A)

Removing

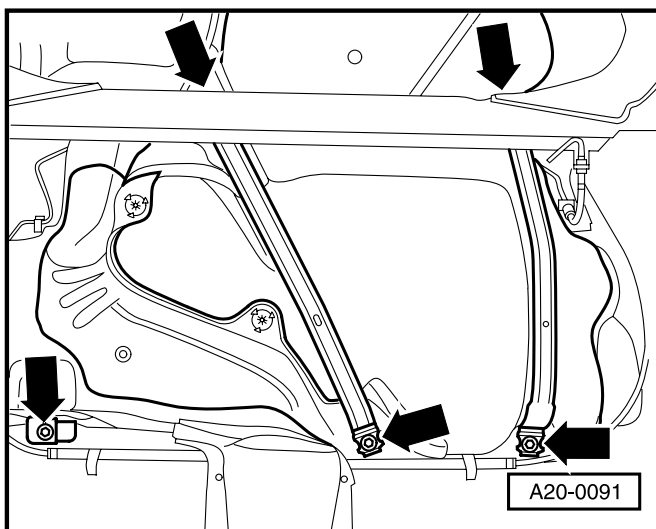
- Use fuel extractor (e.g. V.A.G 1433 A) to empty fuel tank.
- Remove rear axle:
 - ⇒ Running Gear; Repair Group 42; Removing and installing rear axle



- Unbolt cover (below rear seat).
- Unplug multi-pin connector for fuel gauge.
- Open fuel filler cap and lever out tensioning ring in rubber bowl (around filler neck).
- Push rubber bowl through to the inside.
- Remove rear right wheelhouse liner.
- Slacken 2 screws for fuel filler neck working from the wheelhouse.
- ◀ - Remove cover below the fuel tank -arrows- (not fitted to all models).



- Separate 2 fuel pipes at the front right of the fuel tank:
- ◀ - Press buttons on the hose connections for this purpose -arrows-.
- ◆ black = feed pipe
- ◆ blue = return flow pipe
- Position engine/gearbox jack (e.g. V.A.G 1383 A) below the fuel tank for supporting it.



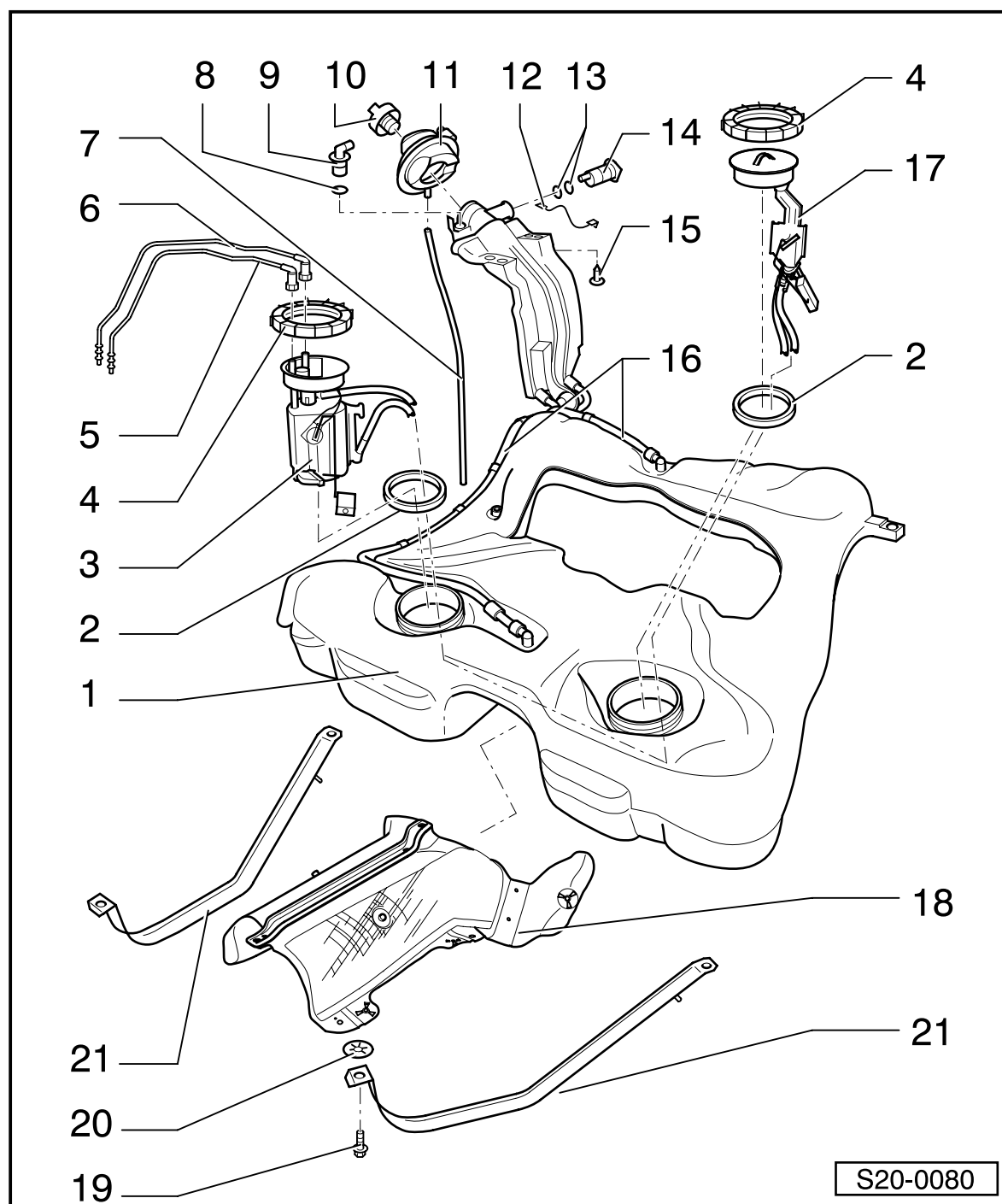
- ◀ - Slacken the bolted connections -arrows- at the front left and at the retaining straps.
- Lower fuel tank.

Installing

- Take heat shield from the old fuel tank and fit onto the new one.

Removing and installing parts of fuel supply system for 4 x 4 models

Removing and installing fuel tank with attached parts for 4 x 4 models



Notes:

- ♦ Pay attention to safety precautions ⇒ page 20-3.
- ♦ Pay attention to rules for cleanliness ⇒ page 20-3.
- ♦ Always replace seals and gaskets.
- ♦ Servicing throttle mechanism:
⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23; Servicing diesel direct injection system; Servicing throttle mechanism

- ♦ Servicing fuel filter:
⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23; Servicing diesel direct injection system; Servicing fuel filter

1 - Fuel tank

- ♦ Removing and installing
⇒ page 20-9

2 - Seal

- ◆ moisten with fuel for installing
- ◆ carefully insert seal into the fuel tank before installing fuel gauge sender

3 - Right fuel gauge sender

- ◆ with pump for pumping over fuel
- ◆ with closing flange
- ◆ removing and installing ⇒ page 20-8
- ◆ position of sender with strainer can be moved relative to top part

4 - Union nut, 80 Nm

- ◆ use wrench MP 1-227 for removing and installing

5 - Feed line

- ◆ black
- ◆ is attached to connection marked „V“ at closing flange
- ◆ to detach from closing flange, press unlocking button at connector

6 - Return-flow line

- ◆ blue
- ◆ is attached to connection marked „R“ at closing flange
- ◆ to detach from closing flange, press unlocking button at connector

7 - Overflow hose**8 - O-ring****9 - Gravity valve**

- ◆ for removing, unclip valve and lift up and out of filler neck
- ◆ inspecting valve for clearance
valve vertical: open
valve tilted 45°: closed

10 - Cap**11 - Rubber bowl****12 - Earth connection****13 - O-rings****14 - Vent valve****15 - 10 Nm****16 - Vent hoses****17 - Left fuel gauge sender**

- ◆ with closing flange
- ◆ removing and installing ⇒ page 20-8
- ◆ position of sender can be moved relative to top part

18 - Heat shield

- ◆ for fuel tank

19 - 20 Nm + torque a further 1/4 turn (90°)

- ◆ replace

20 - Clamping washer**21 - Tensioning straps**

- ◆ pay attention to different lengths

Removing and installing fuel gauge sender for 4 x 4 models

Special tools, testers and aids required

- ◆ Wrench for union nut MP 1-227

Removing fuel gauge sender (on right)

- Unscrew cover (below rear seat).
- Slacken fuel feed line and fuel return-flow line and detach.
- Separate multipin connector for fuel gauge.
- ◀ - Use MP 1-227 to slacken union nut and pull closing flange and sender out of the fuel tank.

Removing fuel gauge sender (on left)

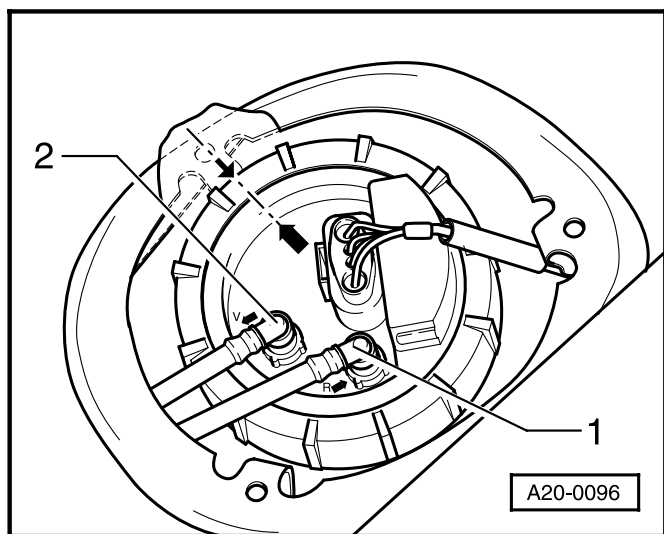
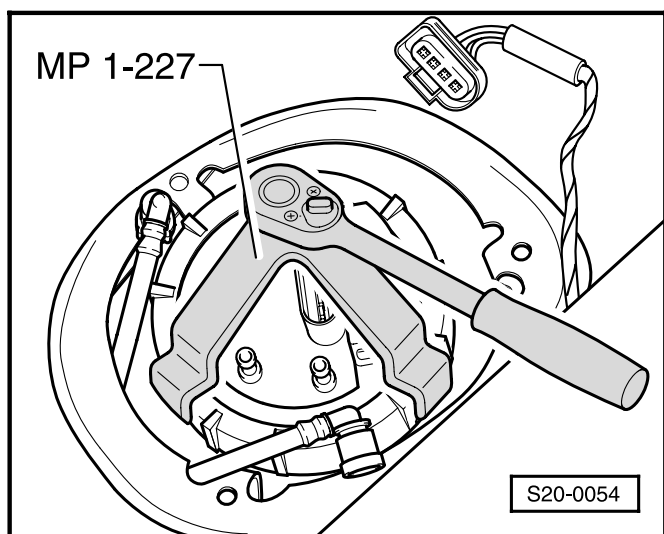
- Unscrew cover (below rear seat).
- Use MP 1-227 to slacken union nut and pull closing flange and sender out of the fuel tank.

Installing fuel gauge sender (on right)

- ◀ - Pay attention to installation position:
 - ◆ Marking on closing flange must be aligned with marking on fuel tank -arrows-.
 - ◆ Blue return-flow line -1- to connection marked with -R-.
 - ◆ Black feed line -2- to connection marked with -V-.

Installing fuel gauge sender (on left)

- Pay attention to installation position:
 - ◆ Marking on closing flange must be aligned with marking on fuel tank -arrows-.



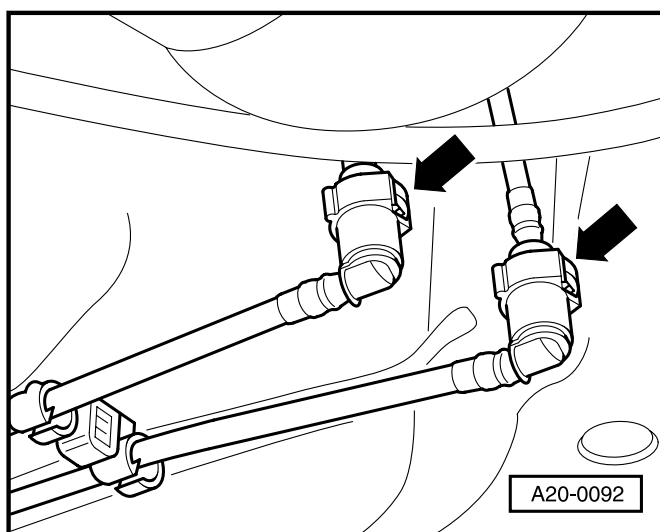
Removing and installing fuel tank for 4 x 4 models

Special tools, testers and aids required

- ◆ Engine/gearbox lifter (e.g. V.A.G 1383 A)
- ◆ Fuel extractor (e.g. V.A.G 1433 A)

Removing

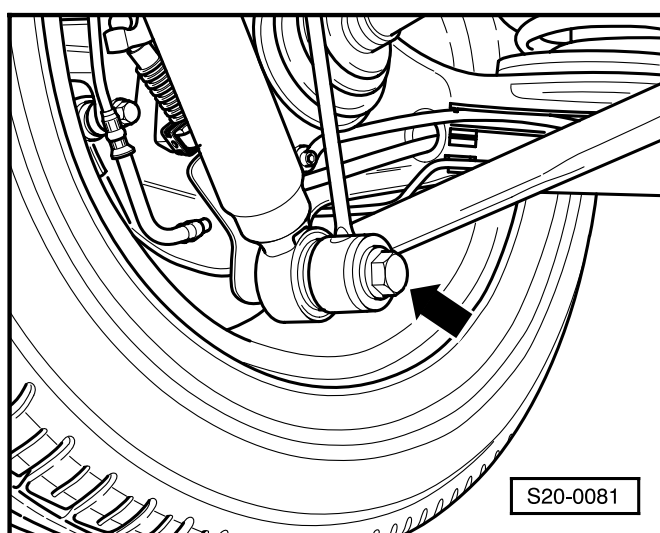
- Use fuel extractor (e.g. V.A.G 1433 A) to empty fuel tank.
- Unscrew cover (below right rear seat).
- Unplug multipin connector for fuel gauge.
- Open fuel filler flap and remove rubber bowl.
- Take off rear right wheel.
- Remove rear right wheelhouse liner.
- Slacken 2 bolts for fuel filler neck from working from wheelhouse.
- Separate 2 fuel lines on front right at fuel tank:
 - ▶ - Press down buttons on hose connectors -arrows- for this step.

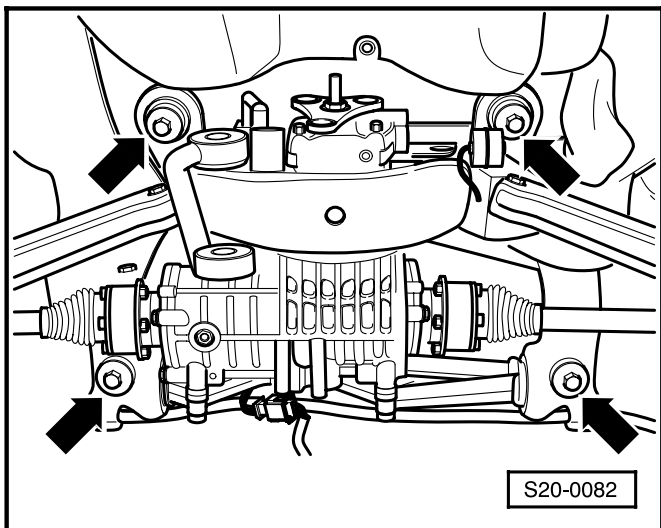


◆ black = feed line

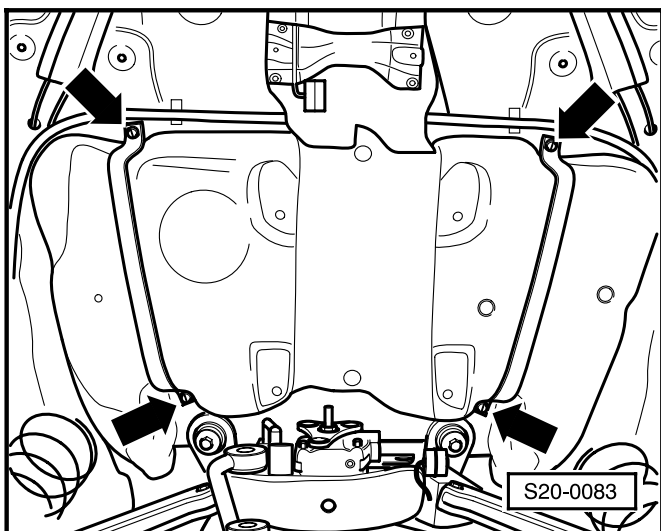
◆ blue = return-flow line

- Remove exhaust (without front exhaust pipe) ⇒ page 26-4.1.
- Remove rear part of propshaft.
 - ⇒ 5-Speed Manual Gearbox 02C; Repair Group 39; Removing and installing propeller shaft.
- ▶ - Unscrew the bottom bolts -arrow- attaching the left and right shock absorbers.





- Separate connector at ABS and Haldex coupling.
- Detach vent hoses of Haldex coupling.
- Support the rear final drive with the engine/ gearbox lifter (e.g. V.A.G 1383 A).
- ◀ - Unscrew bolts at rear axle -arrows-.
- Swivel out rear axle by lowering the lifter.
- Remove guard plate.
- Unscrew 2 bolts of fuel tank mount.



- ◀ - Slacken bolts -arrows- at tensioning straps.
- Lower fuel tank.

Installing

- Installation is carried out in the reverse order.

Charge air system with turbo-charger

Notes:

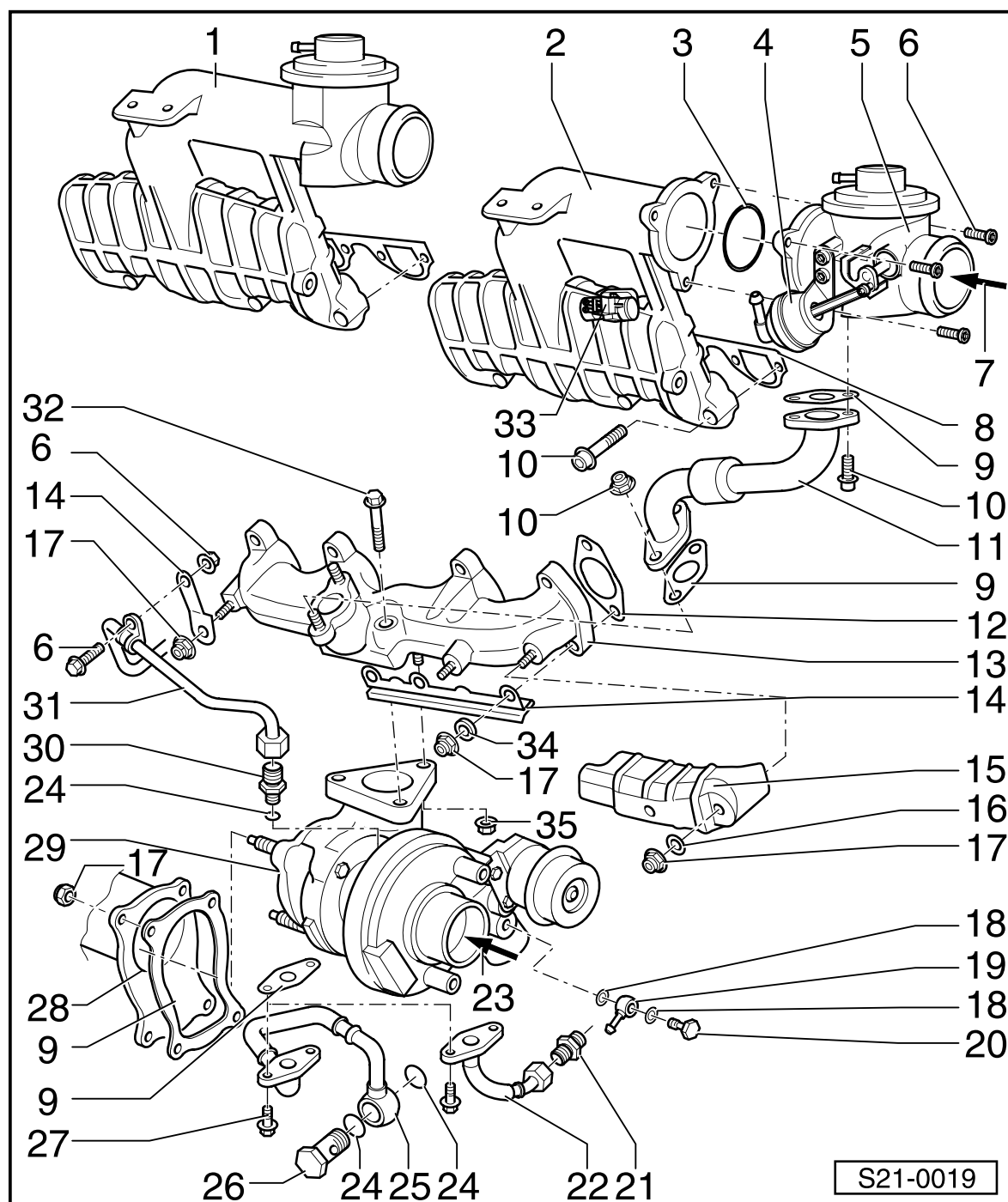
- ◆ *Observe the cleanliness regulations ⇒ page 21-1.*
- ◆ *Connection diagram for charge pressure control ⇒ page 21-4.*
- ◆ *The hose connections are secured with clamps.*
- ◆ *The charge air system must be tight.*
- ◆ *Always replace self-locking nuts.*
- ◆ *Inspecting turbocharger*
⇒ 1.9l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 23.

Rules for cleanliness

Carefully observe the following rules for cleanliness when working on the exhaust turbocharger:

- ◆ Thoroughly clean the connection points and their surroundings before releasing.
- ◆ Place removed parts on a clean surface and cover. Do not use fuzzy cloths!
- ◆ Carefully cover or close opened components if the repair is not completed immediately.
- ◆ Only install clean parts:
Remove spare parts from their wrapping immediately before fitting.
Do not use any parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ When the system is open:
Avoid using compressed air.
Avoid moving the vehicle.

Removing and installing turbocharger for the engine AGR with attached parts



1 - Intake manifold

- ◆ on engines ► 07.97
- ◆ with mechanical exhaust gas recirculation valve

2 - Intake manifold

- ◆ on engines 08.97 ►

3 - O-ring

- ◆ on engines 08.97 ►
- ◆ replace

4 - Vacuum setting element

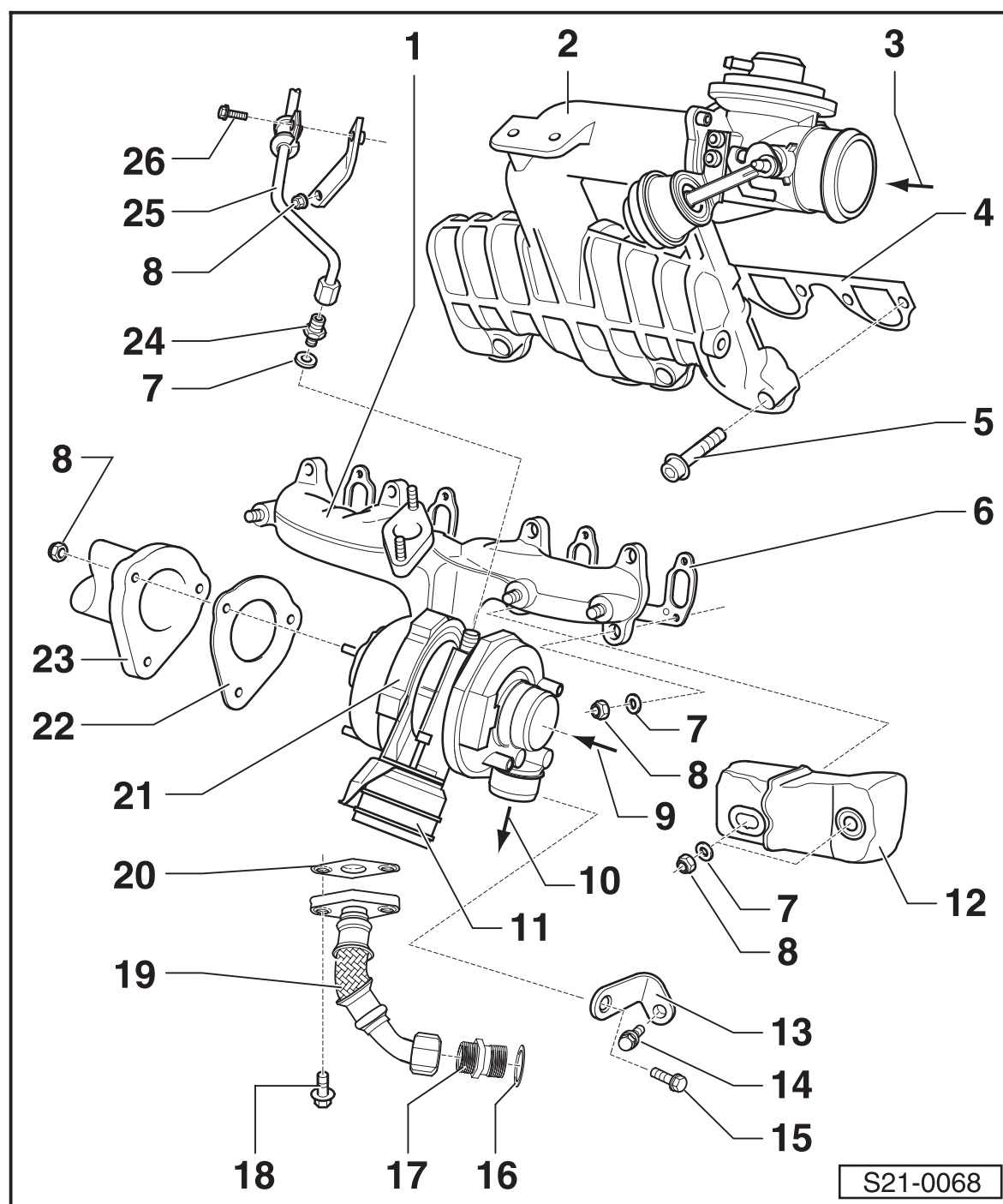
- ◆ on engines 08.97 ►
- ◆ for intake manifold flap

5 - Induction pipe

- ◆ on engines 08.97 ►
- ◆ with mechanical exhaust gas recirculation valve
- ◆ for intake manifold flap

-
- | | |
|---|---|
| <p>6 - 10 Nm</p> <p>7 - From charge air cooler</p> <p>8 - Gasket
♦ fitting position: Bead points towards intake manifold</p> <p>9 - Gasket
♦ Replace</p> <p>10 - 20 Nm</p> <p>11 - Exhaust gas recirculation pipe</p> <p>12 - Gasket
♦ pay attention to fitting position</p> <p>13 - Exhaust manifold</p> <p>14 - Bracket</p> <p>15 - Shield</p> <p>16 - Washer
♦ 1.6 mm thick</p> <p>17 - 25 Nm</p> <p>18 - O-ring
♦ replace</p> <p>19 - Connecting piece
♦ for charge pressure control</p> <p>20 - Banjo bolt, 15 Nm</p> <p>21 - Screwed socket, 40 Nm</p> <p>22 - Oil return- flow line
♦ for vehicles 05.99 ►
♦ to cylinder block</p> <p>23 - From air filter</p> | <p>24 - O-ring
♦ replace</p> <p>25 - Oil return-flow line
♦ for vehicles ► 04.99
♦ to cylinder block</p> <p>26 - Banjo bolt, 40 Nm</p> <p>27 - 15 Nm</p> <p>28 - Front exhaust pipe</p> <p>29 - Turbocharger
♦ removing and installing ⇒ page 21-6</p> <p>30 - Screwed socket
♦ 30 Nm for vehicles ► 02.99
♦ 20 Nm for vehicles 03.99 ►</p> <p>31 - Oil feed line
♦ from oil filter holder
⇒ pos. 15, page 17-2.</p> <p>32 - 30 Nm
♦ replace
♦ coat thread and head contact surface of bolt with hot bolt paste G 052 112 A3</p> <p>33 - Intake manifold flap change-over valve (-N239-)</p> <p>34 - Washer
♦ 4 mm thick</p> <p>35 - 25 Nm
♦ replace
♦ coat thread and contact surface of bolt with hot bolt paste G 052 112 A3</p> |
|---|---|

Removing and installing turbocharger for the engine ALH with attached parts



S21-0068

1 - Exhaust manifold

- ♦ with turbocharger
- ♦ must be replaced completely

2 - Intake manifold

3 - From charge air cooler

4 - Gasket

- ♦ replace

5 - 25 Nm

6 - Gasket

- ♦ pay attention to fitting position

7 - Washer

8 - 25 Nm

- ♦ replace
- ♦ coat stud bolts with hot bolt paste
-G 052 112 A3-

9 - From air filter

- ◆ replace

10 - To charge air cooler**11 - Vacuum setting element**

- ◆ charge pressure control
- ◆ component part of the exhaust turbocharger cannot be replaced separately

12 - Shield**13 - Support**

- ◆ turbocharger - cylinder block

14 - 40 Nm**15 - 25 Nm****16 - O-ring**

- ◆ replace

17 - Connection fitting, 40 Nm**18 - 17 Nm****19 - Oil return-flow line**

- ◆ to cylinder block
- ◆ tighten to 35 Nm

20 - O-ring

- ◆ for oil return-flow line
- ◆ replace

21 - Turbocharger

- ◆ can only be replaced complete with exhaust manifold
- ◆ removing and installing ⇒ page 21-8
- ◆ Inspect vacuum setting element of charge pressure control ⇒ page 21-5
- ◆ charge pressure regulating valve and vacuum setting element are component parts of the exhaust turbocharger and must not be replaced individually.
- ◆ After installing the turbocharger, run engine at idling speed for about 1 minute to ensure that oil is supplied to the turbocharger.

22 - O-ring

- ◆ replace

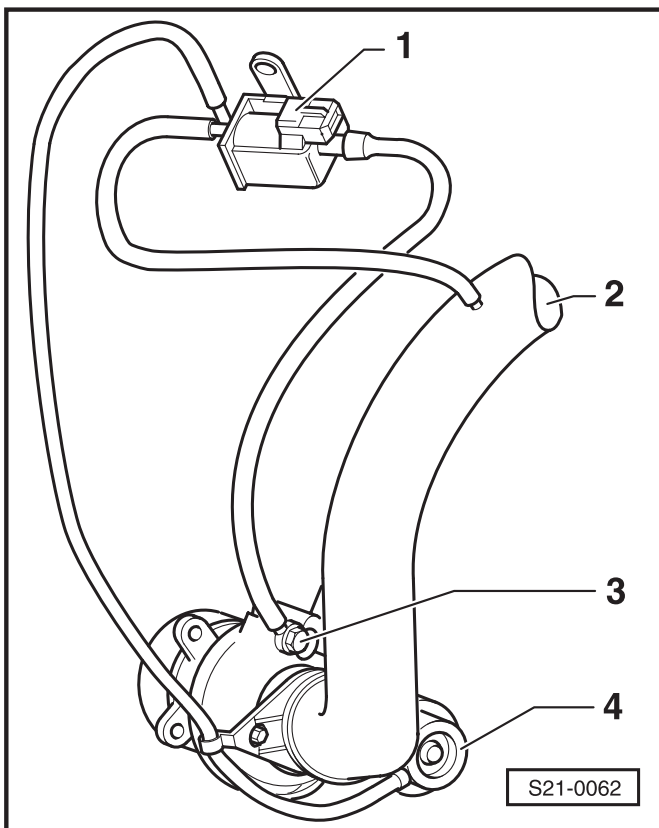
23 - Front exhaust pipe with catalytic converter**24 - Connection fitting, 30 Nm****25 - Oil feed line**

- ◆ tighten to 25 Nm

26 - 10 Nm

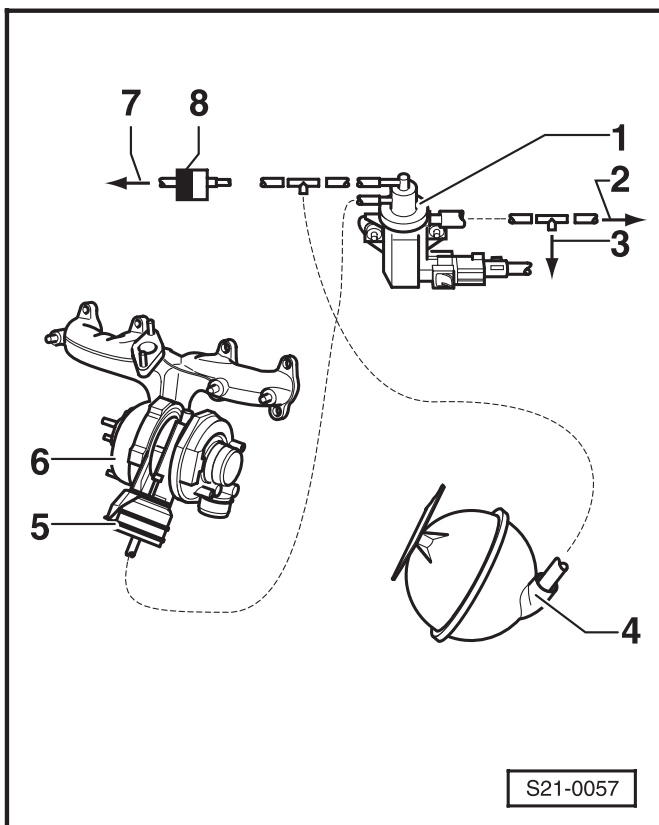
Connection diagram for charge pressure control

Engines AGR:

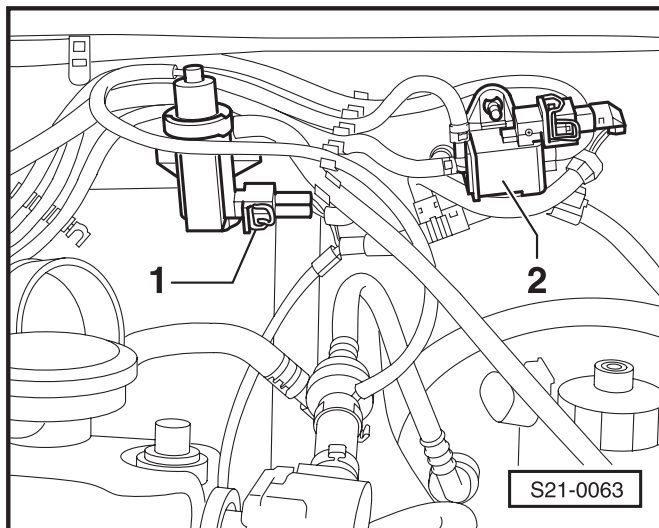


- 1 - Charge pressure control solenoid valve (-N75-)
- 2 - Air guide pipe
 - ♦ from air filter
- 3 - Turbocharger
 - ♦ with pressure connection for charge pressure control
- 4 - Vacuum setting element
 - ♦ for charge pressure control valve

Engines ALH:



- 1 - Charge pressure control solenoid valve (-N75-)
- 2 - To exhaust gas recirculation valve (-N18-)
- 3 - To air filter
- 4 - Vacuum reservoir
- 5 - Vacuum setting element of charge pressure control
- 6 - Turbocharger
- 7 - To intake manifold flap change-over valve (-N239-)
- 8 - Non-return valve, white connection points to charge pressure control solenoid valve (-N75-)



Inspecting vacuum setting element of charge pressure control

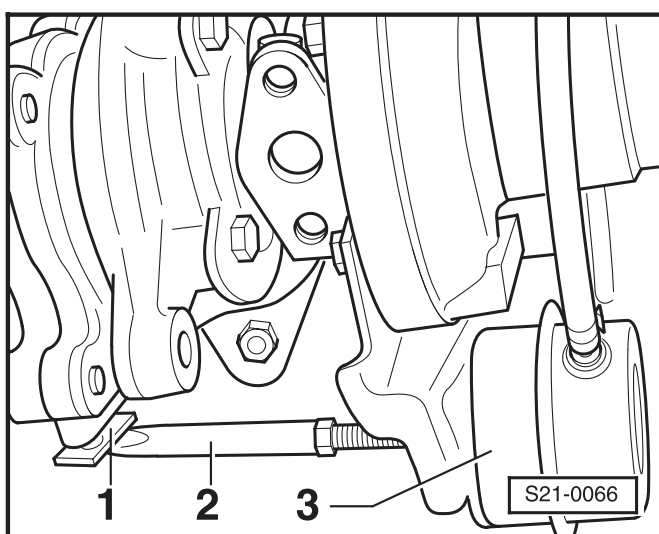
Test conditions:

- Engine oil temperature at least 80 °C

Engines AGR:

Test procedure

- ◀ - Remove plug from charge pressure control solenoid valve -N75 (pos. 2).
- Start the engine and bring the engine up to high revolutions by pressing rapidly on the accelerator pedal.



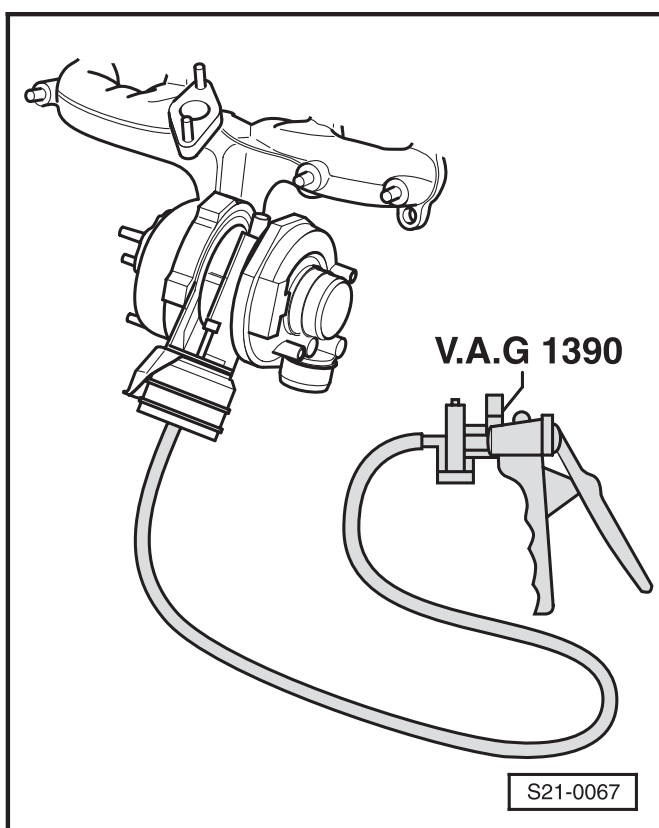
- ◀ - Actuator rod -2- of charge pressure control valve must move.

If the actuator rod does not move:

- Inspect lever of charge pressure control valve -1- for smooth operation. In case of rust, replace turbocharger.

If the actuator rod does not move despite having an easily moving lever:

- Replace vacuum setting element of charge pressure control valve -3-.



Engines ALH:

Special tools, testers and aids required

- ◆ Hand vacuum pump (e.g. V.A.G 1390)

Test procedure

- ◀ - Connect hand vacuum pump to the vacuum setting element for charge pressure control valve and check actuator rod for smooth operation.

If the actuator rod only moves with difficulty or does not move at all:

- Replace turbocharger.

Removing and installing turbo-charger

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Pliers for spring strap clips
- ◆ Hot bolt paste G 052 112 A3

Engines AGR:

Removing

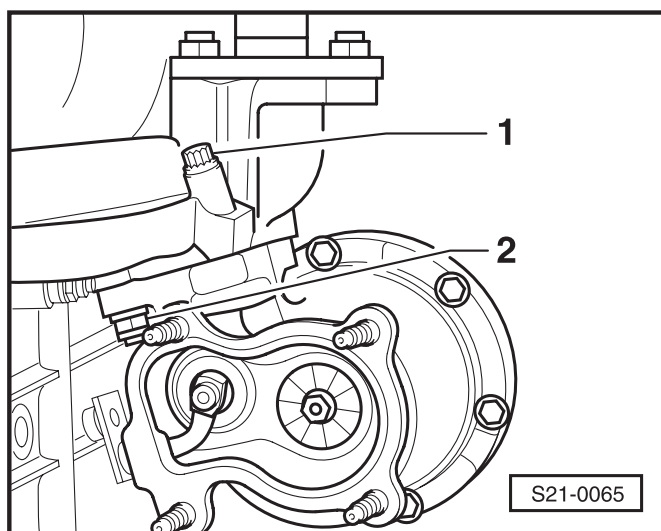
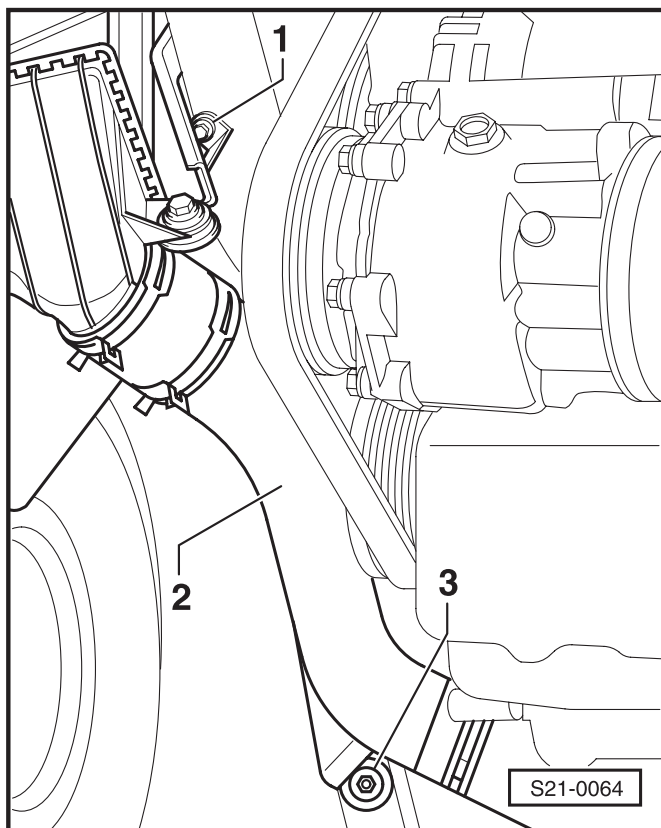
- ◀ - Unbolt fixing nut -3- and air guide pipe -2- together with hose to turbocharger.
- Detach hose to charge pressure control solenoid valve -N75 at turbocharger, and unscrew banjo bolt, as appropriate.
- Detach hose at vacuum setting element for charge pressure control valve.

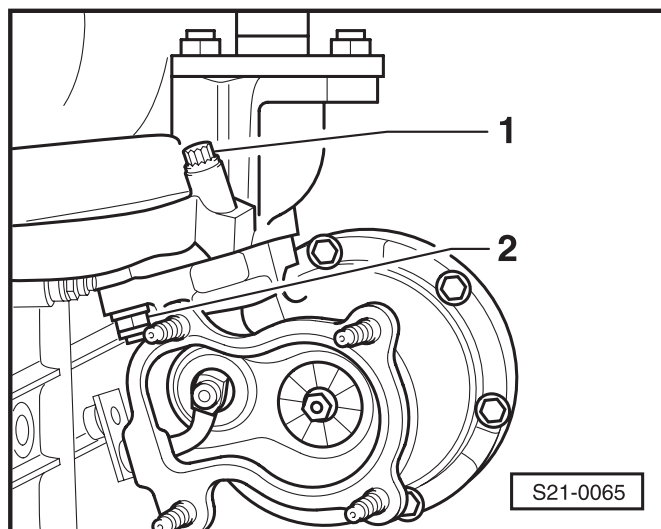
For 4x4 vehicles

- Remove intake manifold and exhaust manifold ⇒ page 21-2.

For all vehicles

- Unbolt front exhaust pipe from turbocharger and tie up at body (max. deflection of decoupling element 10°).
- Unbolt oil feed line from turbocharger and remove clamp securing intake manifold.
- Unbolt oil return-flow line from turbocharger.
- Remove air guide pipe from air filter to turbocharger.
- ◀ - Unscrew fixing nut -2- from below and bolts -1- from above.





For 4x4 vehicles

- Lift turbocharger up and out.

For other vehicles

- Take turbocharger down and out.

Installing

- Fit hose onto vacuum setting element for charge pressure control valve and secure with collar clamp.
- ◀ - Coat thread and head contact surface of fixing bolts -1- with hot bolt paste G 052 112 A3.
- Fit turbocharger onto exhaust manifold and tighten securing bolt -1- by hand.
- Coat nut -2- with hot bolt paste G 052 112 A3 and tighten to 25 Nm.
- Tighten fixing bolts -1- to 30 Nm.

For 4x4 vehicles

- Install intake manifold and exhaust manifold
⇒ page 21-2.

For all vehicles

- Fit on oil return-flow line with new gasket and tighten to 15 Nm.
- Attach front exhaust pipe with new gasket and tighten to 25 Nm.

Note:

Fill the turbocharger with engine oil at connection fitting of oil feed line.

- Fit on oil feed line and tighten to 25 Nm.
- Tighten clamps for oil feed line to 10 Nm.
- Fit hose onto charge pressure control valve and secure with collar clamp.
- Connect hose to charge pressure control solenoid valve -N75 to turbocharger and secure with collar clamp, or screw in banjo bolt with new gasket rings and tighten to 15 Nm as appropriate.

- Install air guide pipe from charge air cooler with hose to turbocharger.
- Install air guide pipe from air filter to turbocharger.

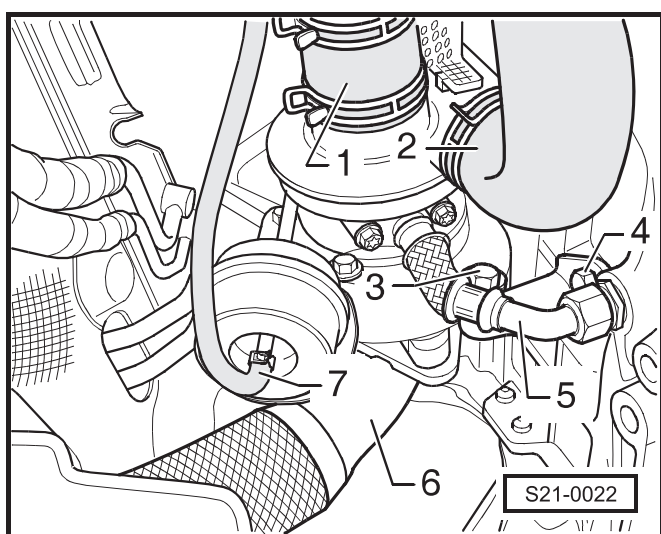
Note:

After installing the turbocharger, run engine at idling speed for about 1 minute but do not yet rev up to ensure proper supply of oil to turbocharger.

Engines ALH:

Removing

- Remove top connection pipe and charge air connection hose.
- Removing intake manifold.
- ◀ - Detach connecting hoses -1- and -2-.
- Remove oil return-flow line -5-.
- Unscrew bolts -3- and -4- and remove support.
- Detach vacuum hose -7- from vacuum setting element for charge pressure control.
- Remove exhaust pipe -6- from turbocharger and lay aside.
- Remove oil feed line from turbocharger.
- Unbolt exhaust manifold from cylinder head.
- Lift turbocharger up and out.



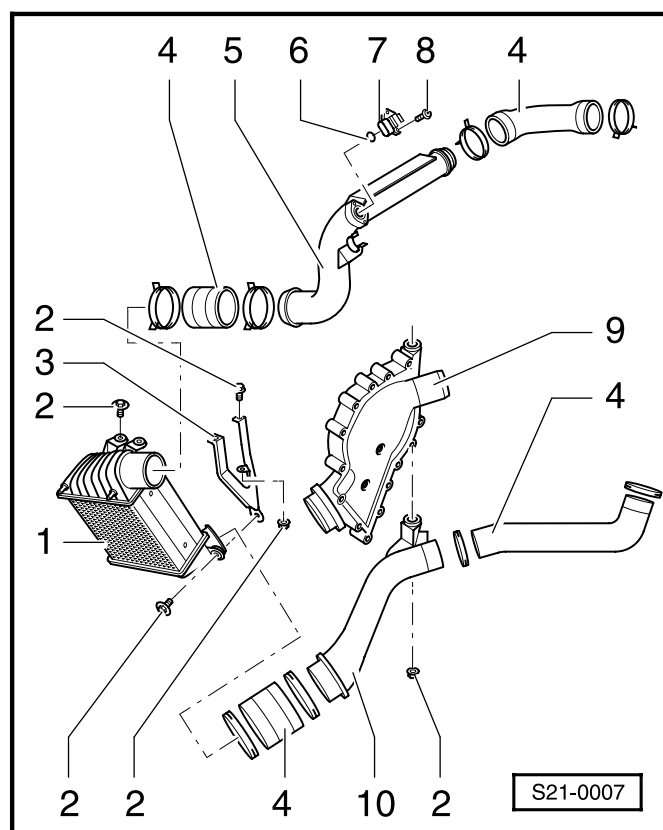
Installing

Further installation is carried out in reverse order. Pay attention to the following:

Note:

After installing the turbocharger, run engine at idling speed for about 1 minute to ensure that oil is supplied to the turbocharger.

Removing and installing parts of the charge air cooling system



Notes:

- ◆ Hose connections are secured with spring strap clips. Only spring strap clips may be used when carrying out repairs.
- ◆ It is recommended to use the pliers for removing and installing the spring strap clips.
- ◆ There must not be any leak in the charge air system.

1 - Charge air cooler

- ◆ Removing and installing
⇒ page 21-10

2 - 10 Nm

3 - Bracket

4 - Hose

5 - Air guide pipe

- ◆ Charge air cooler/intake manifold

6 - O-ring

- ◆ Replace if damaged

7 - Intake manifold temperature sender
-G72

- ◆ With intake manifold pressure sender
-G71

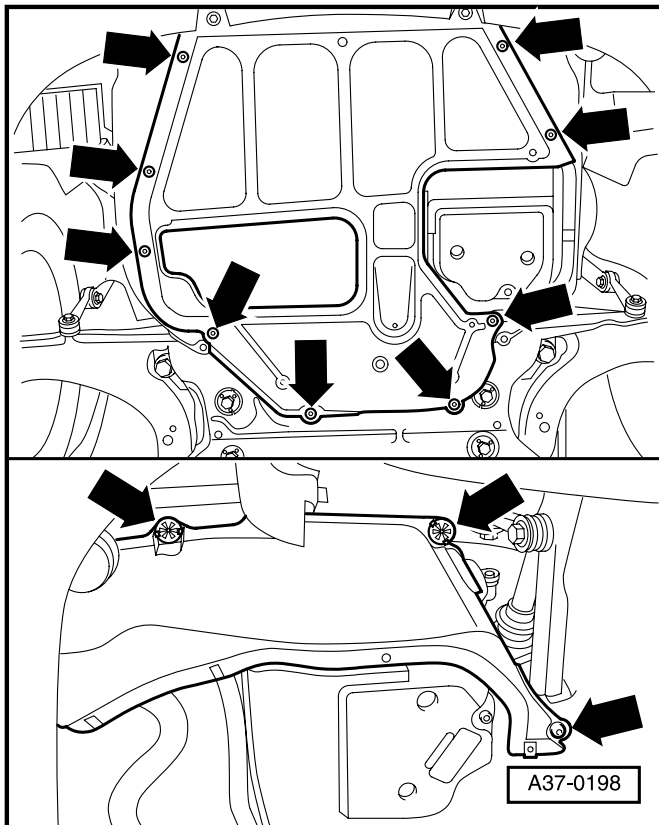
8 - 5 Nm

9 - Air guide pipe

- ◆ For models 08.97 ➤
- ◆ Charge air cooler/turbocharger

10 - Air guide pipe

- ◆ For models ➤ 07.97
- ◆ Charge air cooler/turbocharger

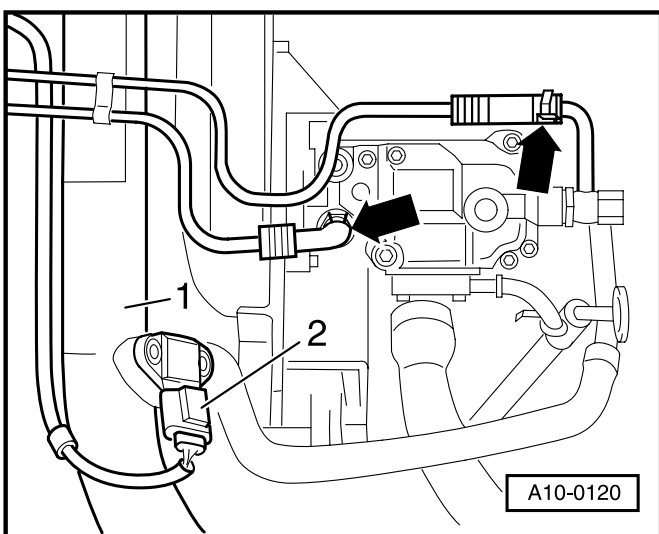


Removing and installing charge air cooler

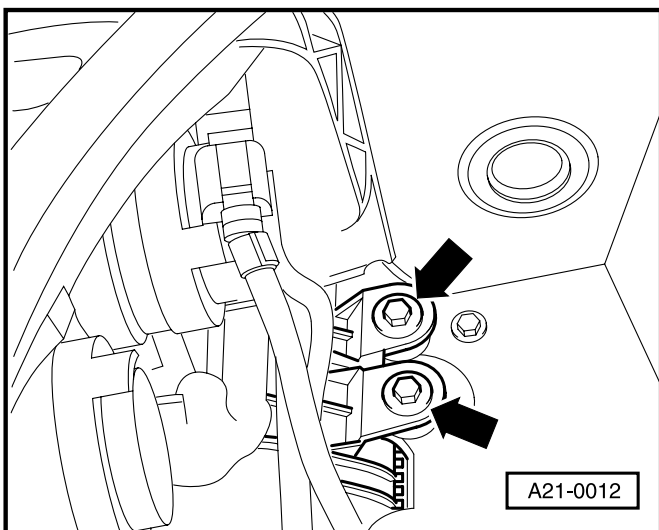
Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Pliers for spring strap clips

- ◀ - Remove noise insulation in middle and on right -arrows-.



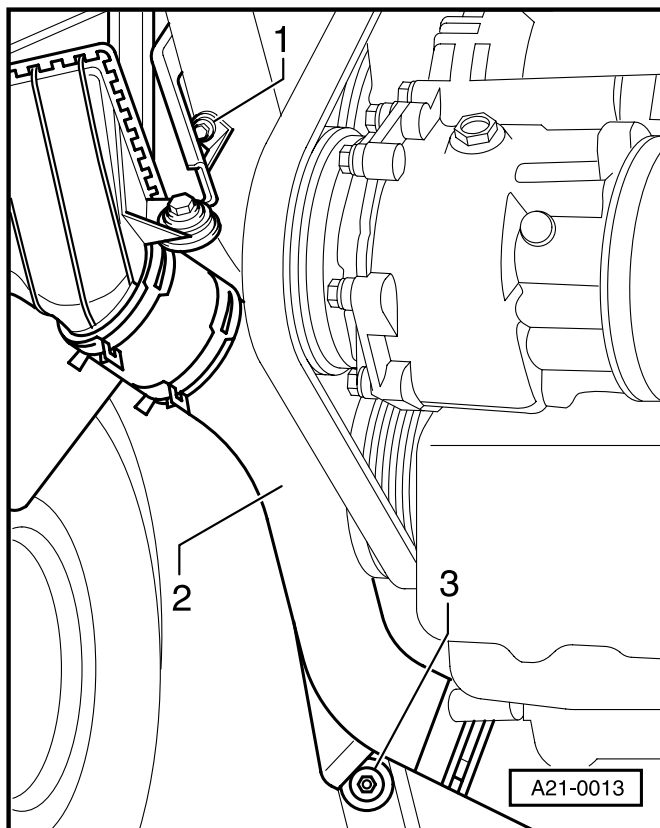
- ◀ - Detach fuel lines -arrows- to injection pump, seal with plugs and place to the side.
- Unplug connector -2- at intake manifold temperature sender -G72 together with intake manifold pressure sender -G71.
- Remove air guide pipe -1-.
- Remove windshield washer fluid reservoir.



- ◀ - Unscrew 2 bolts -arrows- for charge air cooler.

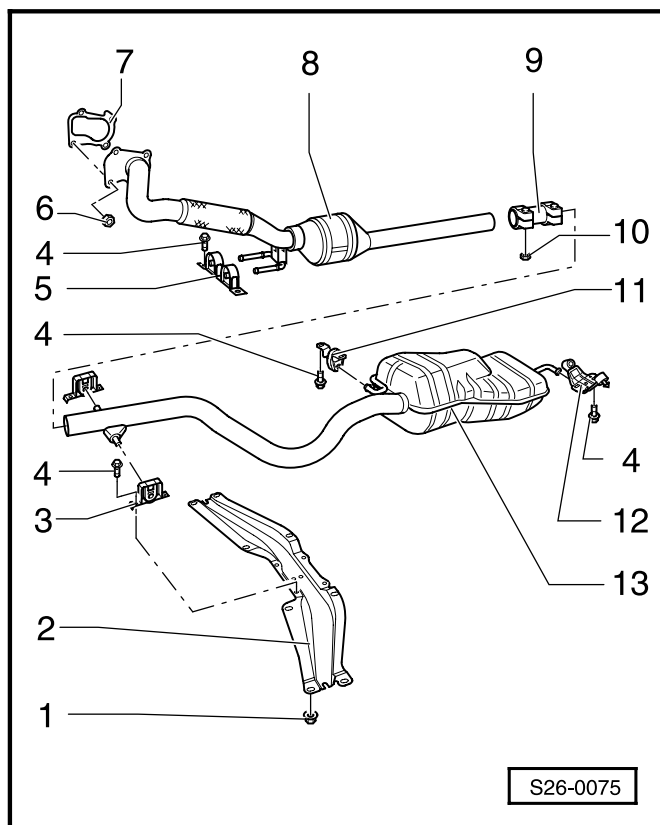
Note:

If the vehicle is equipped with xenon headlights, the right headlight must be removed ⇒ Electrical System; Repair Group 94.



- ◀ - Unscrew nut -3- securing air guide pipe -2-.
- Take off air guide pipe.
- Detach right wheelhouse liner at the front edge.
- Turn down nut -1- at bracket for intercooler.
- Remove intercooler downward.

Removing and installing parts of the exhaust system



Notes:

- ◆ Removing and installing exhaust manifold
⇒ page 21- 2 or page 21-3.1
- ◆ Always replace gaskets and self-locking nuts.

1 - 20 Nm

2 - Tunnel bridge

- ◆ with hole for aligning exhaust system
⇒ page 26-3

3 - Hanger

- ◆ fitting position ⇒ Fig. 2

4 - 25 Nm

5 - Hanger

6 - 25 Nm

- ◆ replace
- ◆ coat stud bolts with hot bolt paste
G 052 112 A3

7 - Gasket

- ◆ replace

8 - Front exhaust pipe

- ◆ with oxidation catalytic converter
- ◆ protect catalytic converter against shocks and blows
- ◆ avoid a large deflection, max. deflection 10°

9 - Double clamp

- ◆ align exhaust system pipe free of stress before tightening ⇒ page 26-3
- ◆ fitting position: bolted connection pointing to left
- ◆ tighten bolted connections evenly

10 - 40 Nm

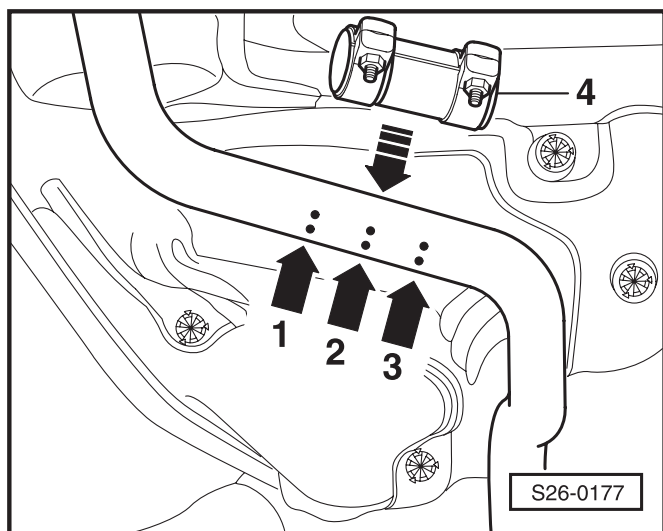
11 - Hanger

- ◆ pay attention to fitting position

12 - Hanger

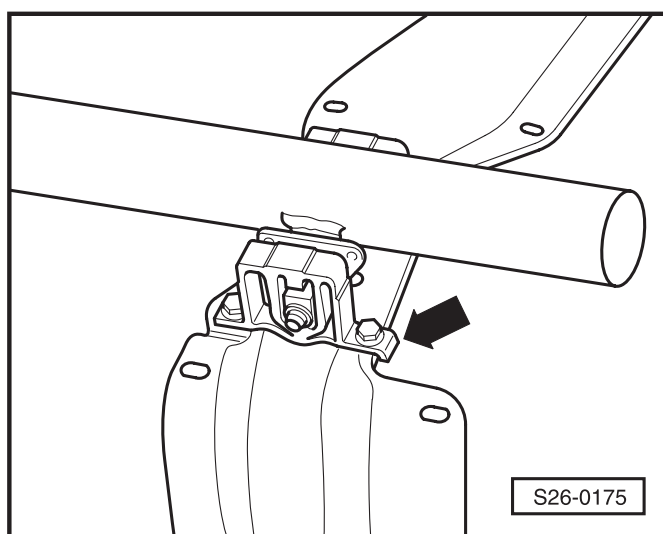
13 - Rear silencer

- ◆ the front and rear silencer are installed as standard as a single part, in the event of repairs the front and rear silencer are delivered separately; to be connected together with a double clamp.
- ◆ align exhaust system free of stress
⇒ page 26-3
- ◆ replace middle or rear silencer ⇒ page 26-2



◀ Fig. 1 Separation point

- ◆ When replacing middle silencer or rear silencer
- ◆ Marked by three recesses around circumference of exhaust pipe



◀ Fig. 2 Fitting position of the hangers

The angled side -arrow- at the base of the hanger points in direction of travel.

Replacing middle silencer or rear silencer

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Body saw (e.g. V.A.G 1523)

Work procedure

- Separate exhaust pipe at the separation point -arrow 2- at right angles with a body saw (e.g. V.A.G 1523).
- When installing double clamp -4- position on the side markings -arrows 1 and 3-.
- Align exhaust system free of stress ⇒ page 26-3.
- Align rear silencer horizontally.
- Tighten bolted connections of double clamp evenly to 40 Nm.
- Fitting position of double clamp: parallel to vehicle floor, bolted connections point toward left.

Align exhaust system free of stress

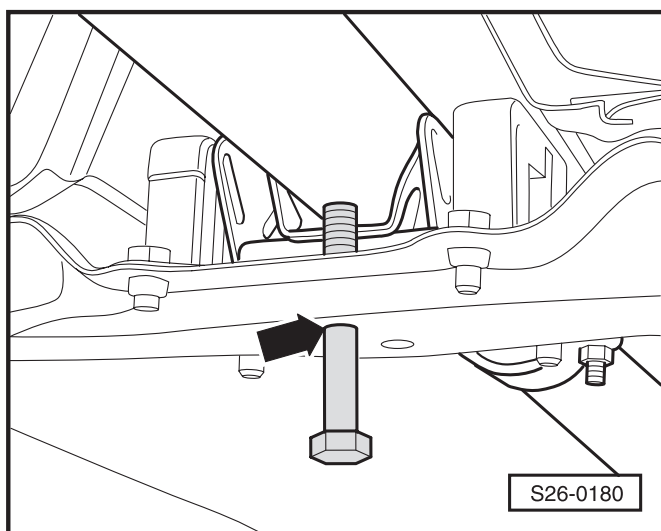
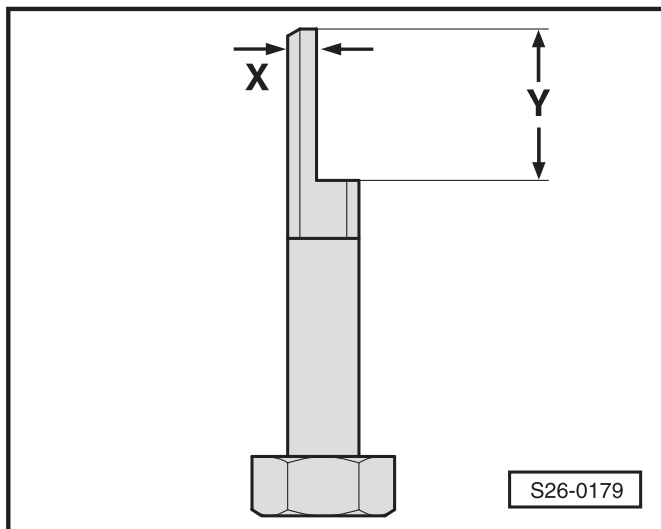
Special tools, testers and aids required

- ◆ Torque wrench
- The exhaust system is aligned when cold

Work procedure

- ◀ - Shop-made tool from an M10 bolt to the dimensions stated for aligning the exhaust system.

- ◆ Dimension x = 4 mm
- ◆ Dimension y = 25 mm



Note:

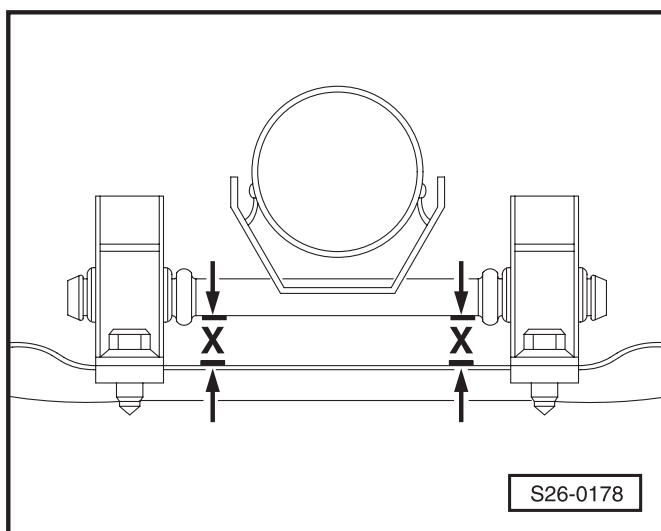
A second person is required for aligning the exhaust system.

- Loosen bolted connections of double clamp
⇒ page 26-1, -pos. 9.
- ◀ - Insert shop-made tool through the rear hole -arrow- of the tunnel bridge, the flat side points toward the hanger pin of the exhaust system.

Note:

The exhaust system is pretensioned in the direction of travel when the shop-made tool is inserted.

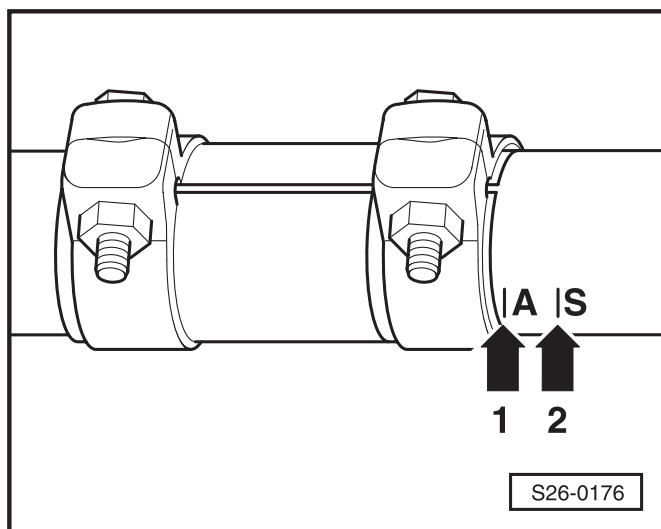
- Align rear silencer horizontally.



- ◀ - The hanger pin at the exhaust pipe must be parallel to the tunnel bridge (dimension -x- on left and right identical).

Note:

On vehicles with separation point ⇒ page 26-2 inspect horizontal position of rear silencer additionally at tail pipes.

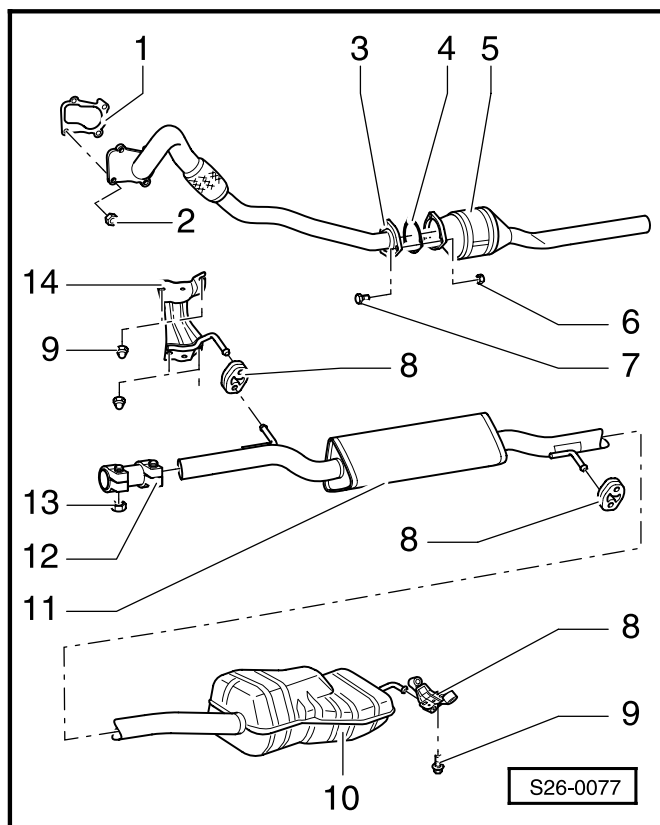


- ◀ - Position double clamp with a distance of about 5 mm to the line of the marking -A- arrow 1- and tighten evenly to 40 Nm in the horizontal position.

Notes:

- ♦ The marking -A- applies to vehicles with manual gearbox and automatic gearbox.
- ♦ The bolted connection of the double clamp points toward left.

Removing and installing parts of the exhaust system for 4x4 vehicles



Notes:

- ◆ Removing and installing exhaust manifold
⇒ page 21- 2 or page 21-3.1
- ◆ Always replace gaskets and self-locking nuts.

1 - Gasket

- ◆ replace

2 - 25 Nm

- ◆ replace
- ◆ coat stud bolts with hot bolt paste
G 052 112 A3

3 - Front exhaust pipe

4 - Gasket

- ◆ replace

5 - Oxidation catalytic converter

- ◆ protect against shocks and blows

6 - 25 Nm

- ◆ replace

7 - Bolt

8 - Retaining strap

9 - 25 Nm

10 - Rear silencer

- ◆ installed as standard with part -11-, in the event of repairs it is delivered separately
- ◆ Exhaust pipe with separation point
⇒ page 26-4.2

11 - Front silencer

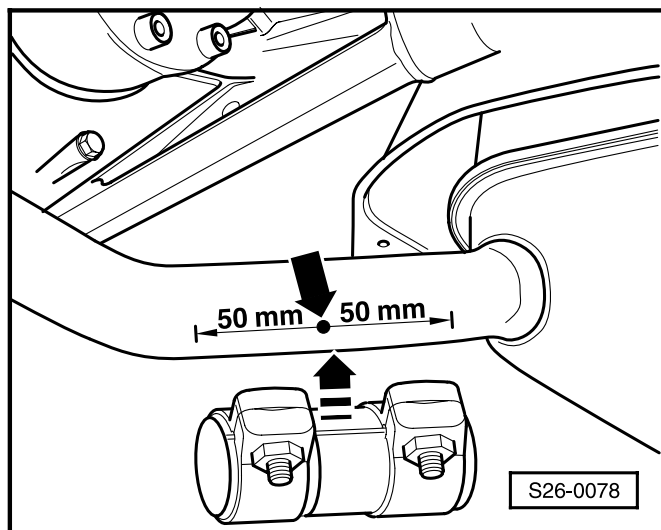
- ◆ installed as standard with part -10-, in the event of repairs it is delivered separately
- ◆ exhaust pipe with separation point
⇒ page 26-4.2
- ◆ align free of stress

12 - Double clamp

- ◆ fitting position: bolted connection pointing to left; fitting position is marked by tree lugs on the front silencer
- ◆ tighten bolted connections evenly

13 - 40 Nm

14 - Bracket



◀ Fig. 1 Separation point

- ◆ When replacing middle silencer or rear silencer
- ◆ Marked by three recesses around circumference of exhaust pipe

Replacing middle silencer or rear silencer for 4x4 vehicles

Special tools, testers and aids required

- ◆ Torque wrench
- ◆ Body saw (e.g. V.A.G 1523)

Work procedure

- Separate exhaust pipe at the separation point -arrow- at right angles with a body saw (e.g. V.A.G 1523).
- Mark on both sides 50 mm from the separation point.
- Position double clamp on both sides of the markings.
- Align exhaust system free of stress.
- Align rear silencer horizontally.
- Tighten bolted connections of double clamp evenly to 40 Nm.
- Fitting position of double clamp: Bolted connection points toward left.

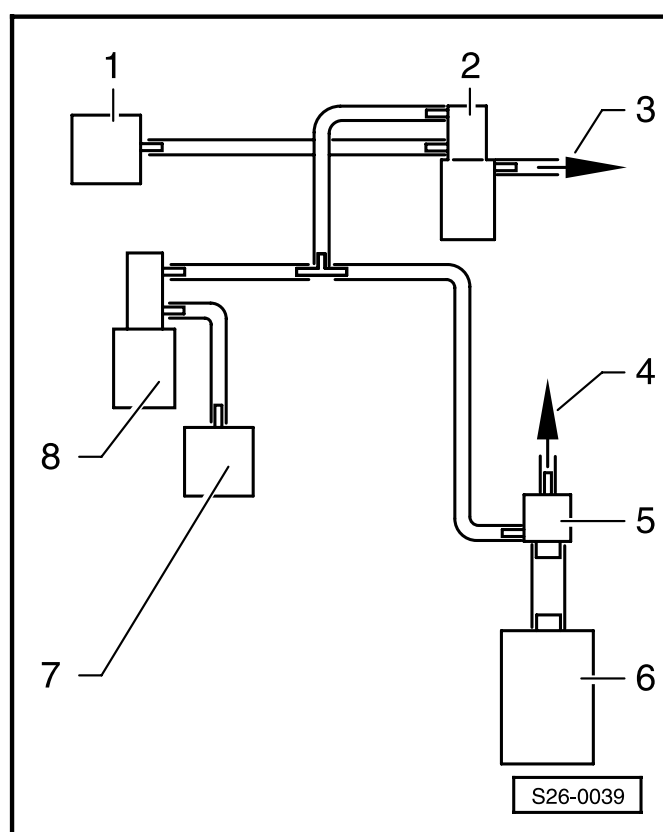
Exhaust gas recirculation system

Notes:

- ◆ The exhaust gas recirculation system is actuated by the diesel direct injection system control unit -J248 through the EGR valve -N18 to the mechanical exhaust gas recirculation valve.
- ◆ Components marked with * are tested by the final control diagnosis
- ⇒ 1.9l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 01; Final control diagnosis.
- ◆ The mechanical exhaust gas recirculation valve with conically shaped valve tappets permits different opening cross-sections at different valve lift.
- ◆ Any desired valve position is possible as a result of the pulsed actuation.
- ◆ Always replace self-locking diagrams.

Connection diagram for control of exhaust gas recirculation system

For vehicles ► 07.00



1 - Mechanical exhaust gas recirculation valve

- ◆ testing ⇒ page 26-7

2 - EGR solenoid valve (-N18-)*

3 - To air filter

4 - To brake servo unit

5 - Non-return valve

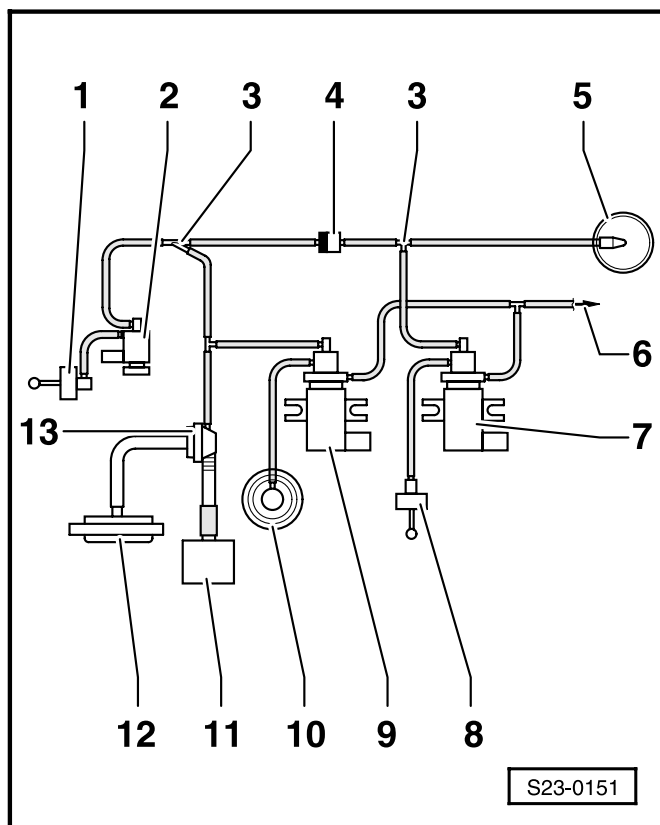
6 - Vacuum pump

7 - Vacuum setting element for intake manifold flap

- ◆ only for models 08.97 ►

8 - Intake manifold flap change-over valve (-N239-)

- ◆ only for models 08.97 ►



For vehicles 08.00 ➤

1 - Vacuum setting element for intake manifold flap

2 - Intake manifold flap change-over valve (-N239-)

3 - Distributor

4 - Non-return valve

- ♦ white connection points to charge pressure control solenoid valve -N75-).

5 - Vacuum unit

6 - To air filter

7 - Charge pressure control solenoid valve (-N75-)*

8 - Vacuum setting element

- ♦ for charge pressure control valve
- ♦ part of turbocharger, cannot be replaced separately

9 - EGR solenoid valve (-N18-)*

10 - Mechanical exhaust gas recirculation valve

- ♦ testing ⇒ page 26-7

11 - Vacuum pump

12 - Brake servo unit

13 - Non-return valve

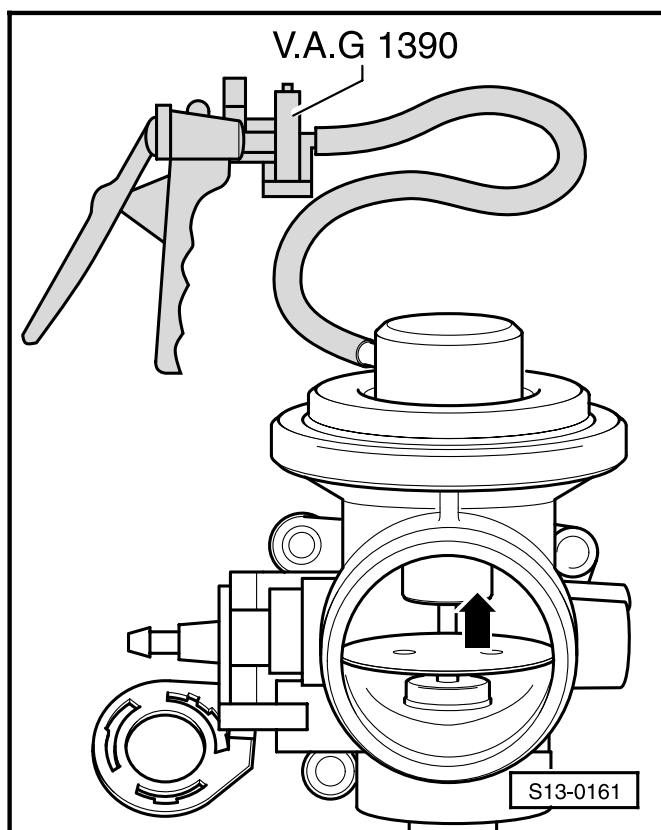
Testing mechanical exhaust gas recirculation valve

Special tools, testers and aids required

- ◆ Hand vacuum pump (e.g. V.A.G 1390)

Test procedure

- Remove engine trim panel.
- Separate air guide pipe between inlet connection and charge air cooler at inlet connection.
- Detach vacuum hose from mechanical exhaust gas recirculation valve.
- ◀ - Connect hand vacuum pump (e.g. V.A.G 1390) to valve.
- Operate pump and observe diaphragm rod.
 - ◆ The diaphragm rod must move in direction of -arrow-.
- Detach hose of hand vacuum pump from exhaust gas recirculation valve.
 - ◆ The diaphragm rod must move back into the initial position in the opposite direction of the arrow.



7 - Gasket

- ◆ replace

8 - 25 Nm**9 - Connecting tube**

- ◆ from radiator to induction pipe
- ◆ only on engines ALH with automatic gearbox

10 - Connecting tube

- ◆ from exhaust manifold to induction pipe

11 - Exhaust manifold**12 - 25 Nm**

- ◆ replace

13 - Connecting tube

- ◆ from exhaust manifold to radiator
- ◆ only on engines ALH with automatic gearbox

14 - To heat exchanger for heating**15 - Radiator for exhaust gas recirculation**

- ◆ only on engines ALH with automatic gearbox

16 - From connection fitting

- ◆ connection of heating

17 - To expansion reservoir

