

Workshop Manual

Octavia 1997 ➤

1.9 I/74 kW (TDI) Engine - Mechanics
Edition 02.01

Engine code	ATD								
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List of Supplements to Workshop Manual

Octavia 1997 ➤

1.9 l/74 kW (TDI) Engine - Mechanics

Edition 02.01

Supple- ment	Edition	Subject	Article Number
	02.01	Basic Edition	S00.5138.50.20
1	04.02	Supplement to Basic Edition	S00.5138.51.20

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00 – Technical data

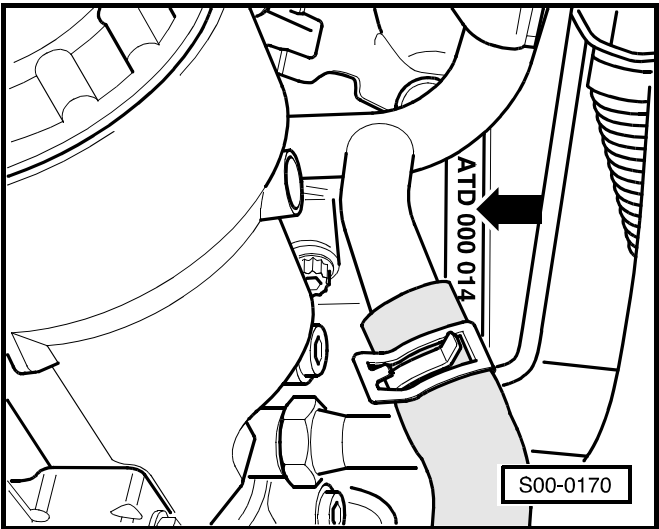
00-1 Technical data

Engine number

The engine number („engine identification characters“ and „serial number“) is located in the front at the engine/ gearbox joint -arrow-.

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

The engine identification characters are also indicated on the vehicle data stickers.



Engine characteristics

Engine identification characters		ATD
Manufactured		08.00 >
Exhaust limits conforming to		EU-3
Displacement	l	1,896
Power output	kW at rpm	74/4000
Torque	Nm at rpm	240/1800-2400
Bore	Ø mm	79,5
Stroke	mm	95,5
Compression		19,0: 1
Firing order		1-3-4-2
min. CN		49
Catalytic converter		yes
Exhaust gas recirculation		yes
Turbocharging		yes
Charge air cooler		yes

10 – Removing and Installing Engine

10-1 Removing and Installing Engine

Special tools, test and measuring equipment and auxiliary items required

- ◆ Workshop crane (e.g. -V.A.G. 1202 A-)
- ◆ Catch pan (e.g. -V.A.G 1306-)
- ◆ Torque wrench
- ◆ Bushing -T30010-
- ◆ Engine mount -MP 1-202-
- ◆ Assembly stand -MP 9-101-
- ◆ Lifting device -MP 9-201-
- ◆ Pliers for spring strap clips
- ◆ Snap hook
- ◆ Grease -G 000 100-
- ◆ Hot screw paste -G 052 112 A3-
- ◆ Wire
- ◆ Adhesive tape

Removing engine

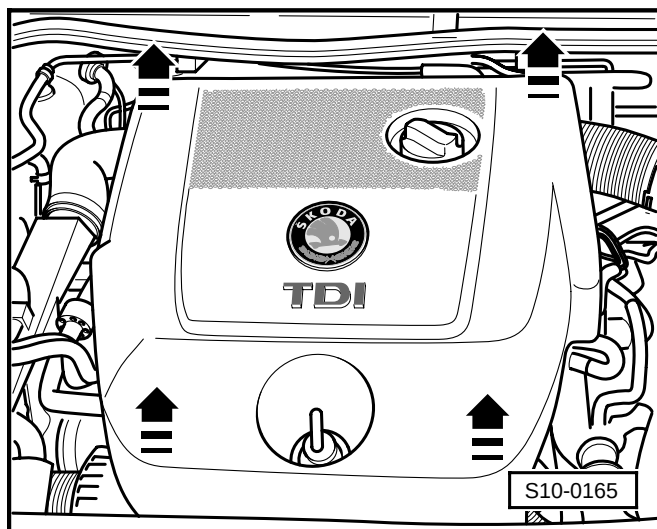


Note

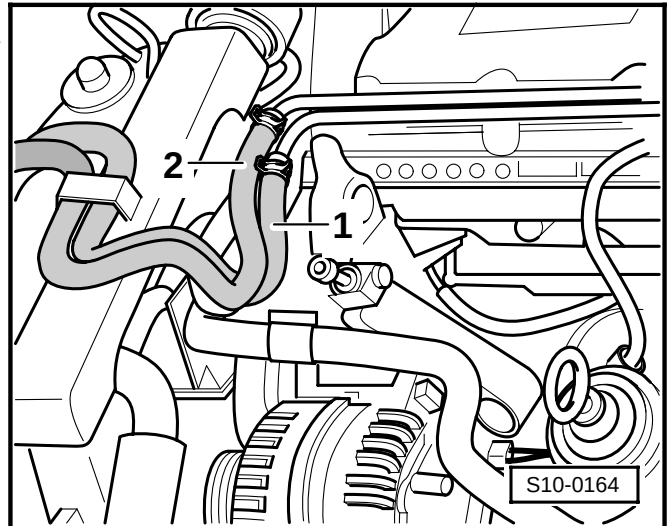
- ◆ The engine is removed towards the front together with the gearbox.
- ◆ If the battery is disconnected and reconnected, carry out additional operations ⇒ Electrical System; Rep. Gr. 27.
- ◆ The hose connections are secured with screw-type clips, spring-type clips or clamp-type clips. Always replace warm-type clamps with spring strap clips or screw clamps.
- ◆ Fuel hoses 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 to fit the spring strap clips.
- ◆ Pay attention to the correct assignment of the connectors, if necessary mark.

Procedure

- On models fitted with a coded radio set, pay attention to the coding; determine if necessary.
- Removing the engine bonnet ⇒ Body Work; Rep. Gr. 55.
- Remove engine trim panel in direction of -arrows-.
- Disconnect the battery-earth strap with the ignition off.



- Raise vehicle with the lift platform ⇒ Inspection and Maintenance.
- Drain coolant ⇒ Inspection and Maintenance
- Remove hose at the bottom and the charge air connection hose ⇒ Chapter 21-1.
- Remove battery and battery tray ⇒ Electrical System; Rep. Gr. 27.
- Remove air filter with intake hose ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23.
- Disconnect the fuel-intake hose -1- and the fuel-return hose -2- from the pipes. ►
- Remove pipe at bottom and the charge air connection pipe ⇒ Chapter 21-1.
- Remove bracket for power-assisted steering pipe.
- Remove power steering fluid reservoir, do not detach hoses however, and place down to the side.
- Detach coolant hose from reservoir to distribution line and coolant hose at bottom of radiator.

**Note**

After the hoses are separated, remaining coolant may flow out; place the drip tray below for this purpose.

- Remove the V-ribbed belt ⇒ Chapter 13-1.
- Remove the valve holder -N18- and -N75- above the brake servo unit. Disconnect the plug connector and electrical lines for each part.
- Detach coolant hose from connection to cylinder head.
- Pull off the coolant hoses to the heat exchanger.
- Detach brake vacuum hose from the brake servo unit.

For vehicles fitted with optional equipment:

- Separate connector from the coolant heater plugs (heater plugs are located next to the tandem pump in left of engine compartment).

Continued for all vehicles:

- Separate hinged shift rods and bracket at gearbox ⇒ Gearbox 02M; Rep. Gr. 34.
- Unbolt PAS pipe from engine and gearbox.
- Disconnect earth strap from the vehicle body.
- Disconnect the following plug connections:
 - ◆ Starter plug connection
 - ◆ Plug connection for reversing light switch
 - ◆ Plug connection for AC compressor (only on vehicles with air conditioning)
 - ◆ Plug connection for alternator
- Separate electric cable from alternator.

**Note**

The assembly is removed together with the cable harness.

- Remove the cooling water tank cover ⇒ Body work; Rep. Gr. 66.
- Unplug connector of engine control unit, unclip wiring harness from the supports in the water channel.
- Open engine wiring harness cover in left of engine compartment.
- Unclip wiring harness from the cover.
- Take connector for main engine wiring harness together with secondary engine wiring harness out of the fixture in left of engine compartment and unplug.
- Separate + cable from starter.
- Unclip wiring harness from supports, separate plug connections (if fitted) and suspend freely at engine.
- Separate hose line for brake fluid from clutch bleeder ⇒ Gearbox 02M; Rep. Gr. 30.

**Note**

Do not depress the clutch pedal. Risk of damage to clutch ⇒ Gearbox 02M; Rep. Gr. 30.

- Disconnect drive shafts from gearbox ⇒ Running Gear; Rep. Gr. 40.
- Disconnect propshaft from gearbox ⇒ Gearbox 02C; Rep. Gr. 39.
- Removing exhaust pipe ⇒ Chapter 26-1.
- Remove pendulum support -arrows-.

For vehicles with air conditioning**Warning!**

Refrigerant circuit of the air conditioning system must not be opened.

- Remove AC compressor and hang on the vehicle body.

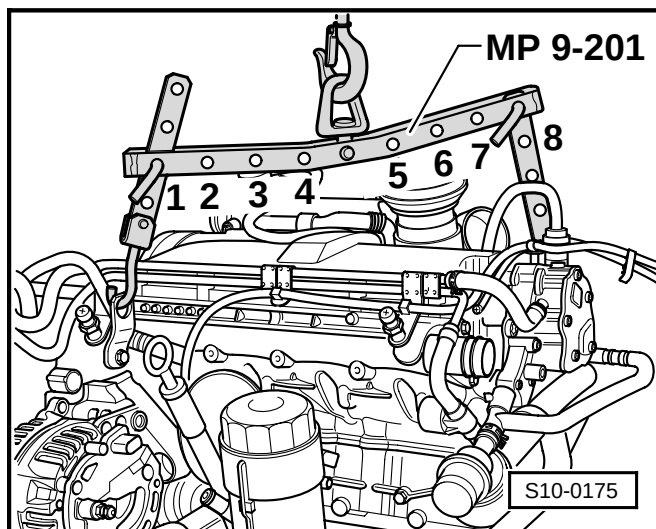
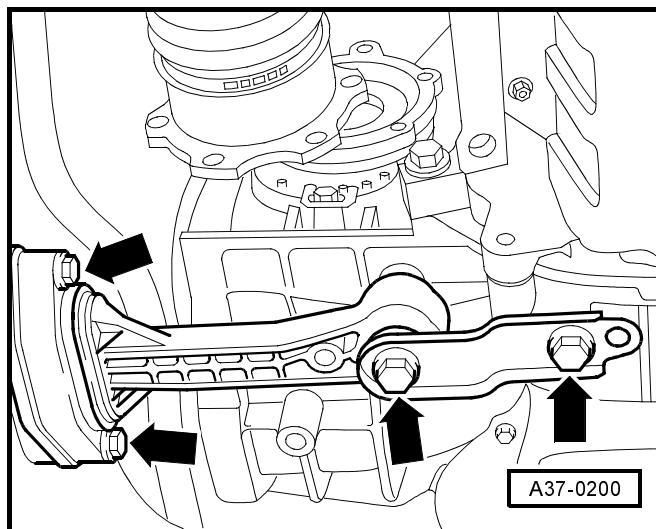
Continued for all vehicles

- Attach the suspension device -MP 9-201- as shown in the figure and take up the weight of the assembly.

**Warning!**

Use securing pins on the hooks and rig pins to prevent release.

- Remove engine and gearbox mounts.
- Raise engine/gearbox and take out to the front.



**Note**

Take care when pulling out engine and gearbox. Ensure adequate clearance to other components.

Attaching engine to assembly stand

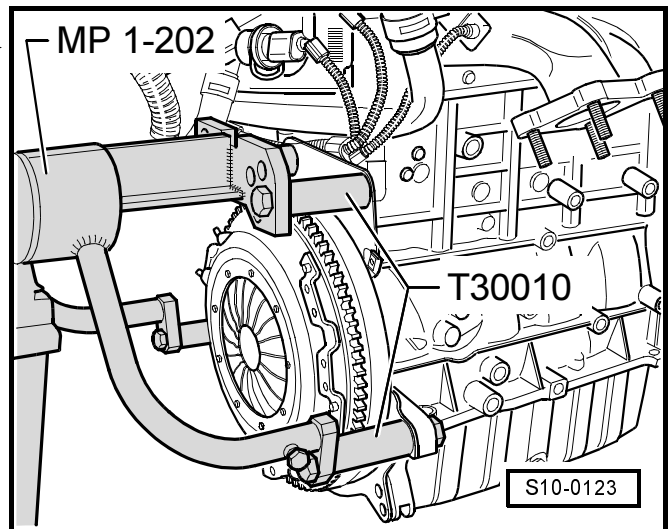
The engine should be attached to the repair stand -MP 9-101- for carrying out removal and installation operations.

**Note**

The engine must not be attached to repair stand for measuring the cylinder bore (⇒ Chapter 13-4).

Procedure

- Unbolt gearbox from engine ⇒ Manual Gearbox 02M; Rep. Gr. 34.
- Attach engine with engine holder -MP 1-202- and sleeves -T30010- to repair stand -MP 9-101-. (The figure shows the 1.9 l/47 kW SDI engine; the fixing system is the same).



Installing the engine

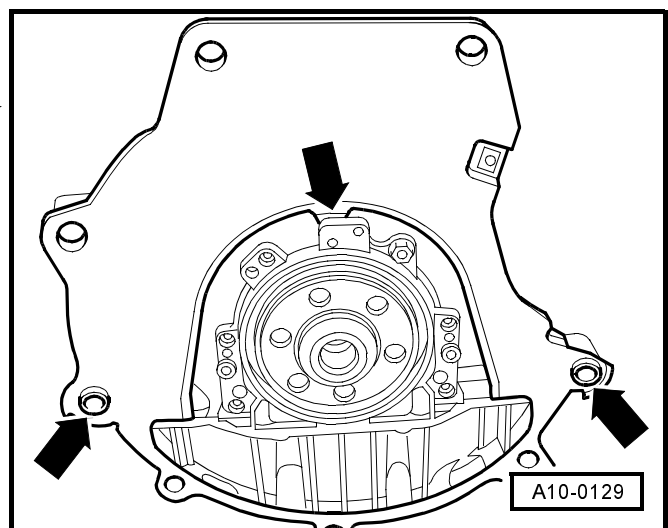
**Note**

- ♦ Always replace the seals and gaskets during assembly work.
- ♦ Always replace self-locking nuts.
- ♦ Coat stud bolts of exhaust manifold with hot bolt paste -G 052 112 A3- before installing.
- ♦ Tightening torques ⇒ **10-1** page 5.
- ♦ Assembly bracket ⇒ **10-1** page 6.

Procedure

Installation is performed in the reverse order. Pay attention to the following points:

- Check whether the dowel sleeves for centering the engine/gearbox are present in the cylinder block; insert if necessary.
- Check whether intermediate plate is hanging at sealing flange and is pushed onto the dowel sleeves -arrows-.
- If necessary check the centering of the clutch disc.
- Inspect clutch release bearing for wear, replace if necessary.
- Lightly lubricate spline of input shaft with grease -G 000 100-.
- When installing engine/gearbox unit, ensure adequate clearance to other components.



- Align the engine/gearbox unit free of stress and attach firmly.

When tightening the bolts for engine and gearbox mounts, engine and gearbox holders must be resting fully against mount.

Tightening torques ⇒ **10-1** page 5.

- Connect hose line for bleeding clutch, bleed system if necessary ⇒ Manual Gearbox 02M; Rep. Gr. 30.
- Attach shift mechanism and adjust shift cables ⇒ Manual Gearbox 02M; Rep. Gr. 34.
- Electrical connections and proper routing ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations.
- Install coolant hoses ⇒ Chapter 19-1.



Note

Only re-use drained coolant if none of the following components has been replaced: Engine block, cylinder head, radiator, heat exchanger.

- Check oil level before starting the engine.
- Interrogate fault memory and erase ⇒ 1.9-ltr./74 kW (TDI) - Engine, Fuel Injection and Ignition System; Rep. Gr. 01.
- Perform a test drive.

Tightening torques



Note

- ♦ *Tightening torques apply only for lightly greased, oiled, phosphatized or blackened nuts and screws.*
- ♦ *Other lubricants such as engine and gearbox oil are allowed. Do not use Molykote.*
- ♦ *Do not use degreased parts.*
- ♦ *Unless otherwise indicated the following tightening torques apply:*

Component		Nm
Screws/nuts	M6	9
	M7	13
	M8	20
	M10	40
	M12	70
In variation of this:		
Engine mounting, gear-box mount, pendulum support	Assembly bracket ⇒	
Engine to gearbox connecting screws	M10	40
Engine to gearbox connecting screws	M12	80
Drive shaft to gearbox mounting flange	⇒ Chassis; Rep. Gr. 40	
AC compressor on bracket	25	

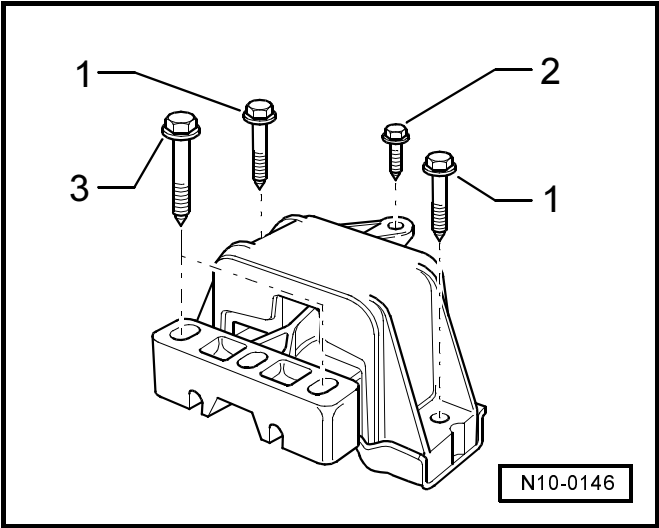
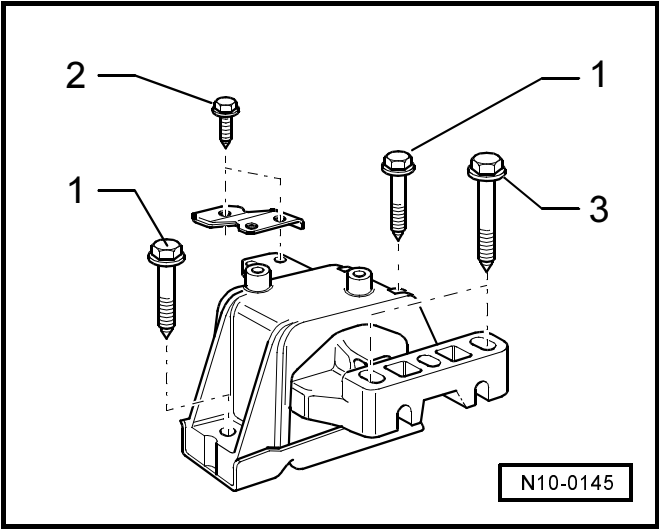
Assembly bracket

Engine mounting

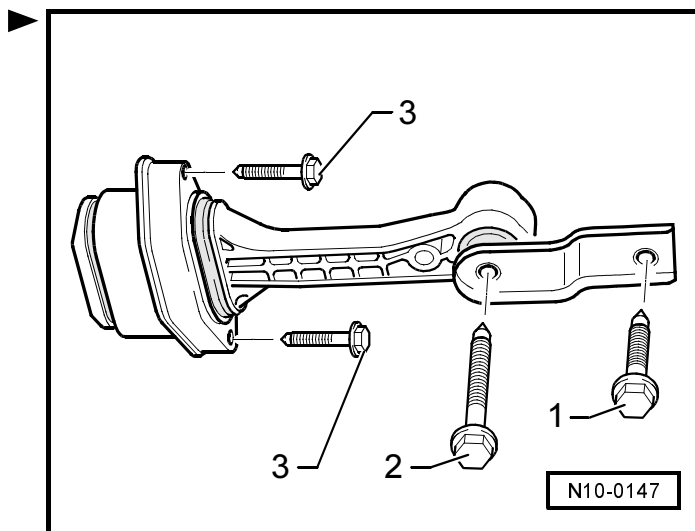
- 1 - 40 Nm + 90° (1/4 turn) ¹⁾
- 2 - 25 Nm
- 3 - 100 Nm ¹⁾

Gearbox mounting

- 1 - 40 Nm + 90° (1/4 turn) ¹⁾
- 2 - 25 Nm
- 3 - 100 Nm¹⁾



¹⁾ Replace bolts

Hinged bracket1 - 40 Nm +45° ¹⁾2 - 40 Nm +45° ¹⁾3 - 20 Nm + 90° ($\frac{1}{4}$ turn) ¹⁾

13 – Crankgear

13-1 Removing and installing V-ribbed belt

Summary of components



Note

- ♦ The following illustration shows the ribbed belt drive of vehicles not fitted with the air conditioning.
- ♦ Mark the rotation direction before removing the V-ribbed belt. Reversing the rotation direction of an already used belt may destroy it.
- ♦ Pay attention to the correct position of the ribbed V-belt in the belt pulley when installing it.

- 1 - V-ribbed belt**
 - ☐ removing ⇒ **13-1** page 3
 - ☐ installing ⇒ **13-1** page 3
- 2 - 10 Nm + torque a further $\frac{1}{4}$ turn (90°)**
- 3 - Belt pulley with vibration damper**
 - ☐ Assembly only possible in one position - holes offset
- 4 - 25 Nm**
- 5 - Tensioner for V-ribbed belt**
- 6 - Generator**
 - ☐ push in threaded bushes for retaining bolts slightly in order to more easily position the alternator against bracket
- 7 - Bracket**
 - ☐ for alternator, hydraulic pump and AC compressor
 - ☐ Fitting sleeve ⇒ Fig. 1 in **13-1** page 2
- 8 - 45 Nm**
- 9 - Hollow screw, 45 Nm**
- 10 - Gasket**
 - ☐ replace
- 11 - Pressure line**
- 12 - Hydraulic pump for power-assisted steering**
 - ☐ removing and installing ⇒ Chassis; Rep. Gr. 48
- 13 - Belt pulley for hydraulic pump**

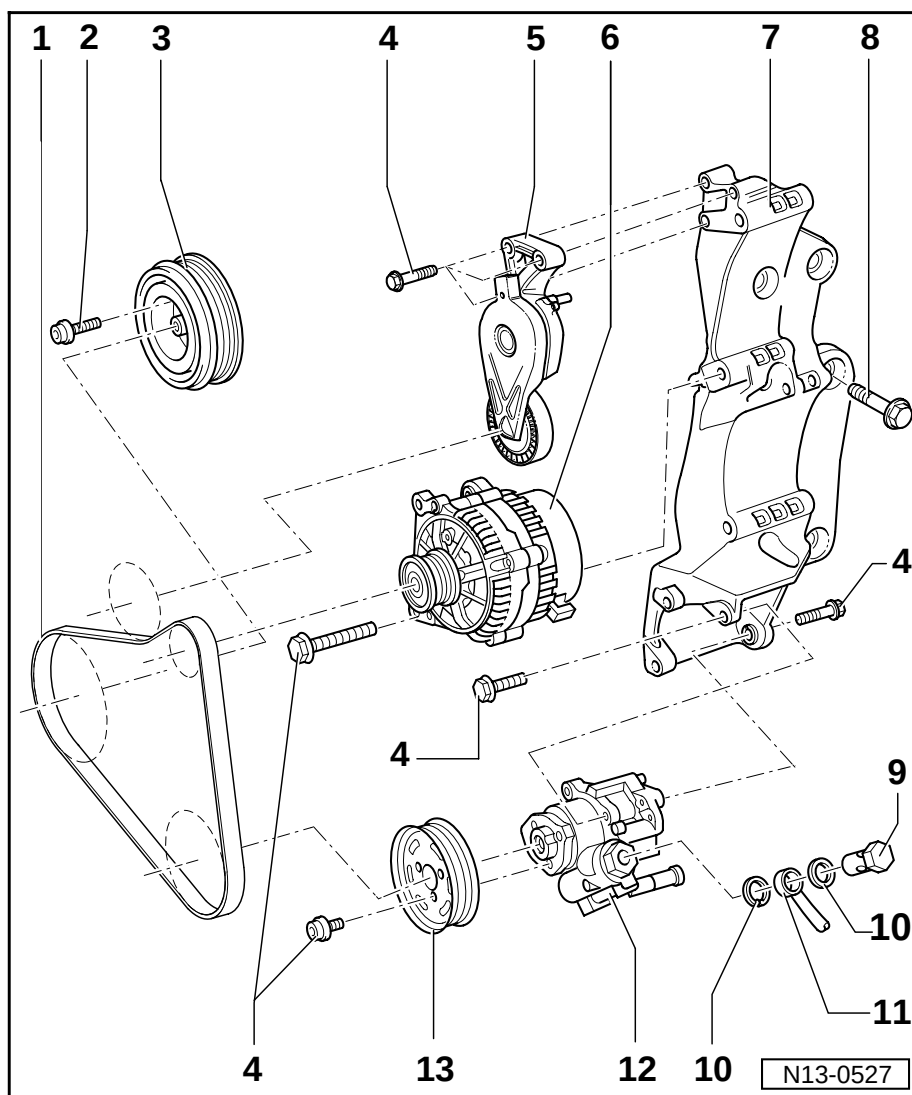
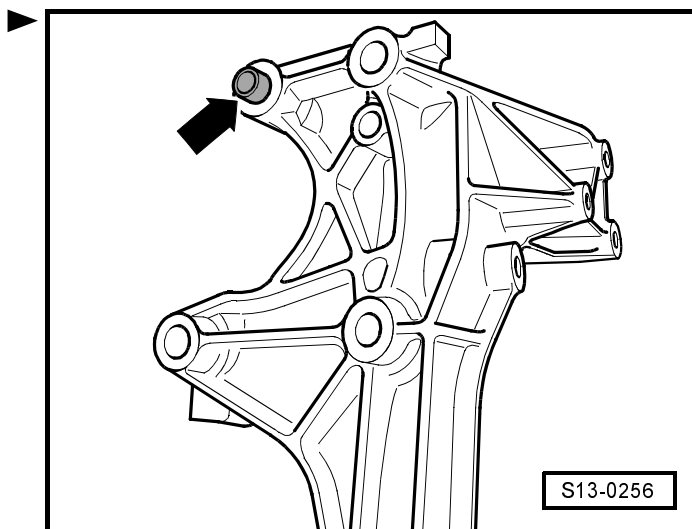
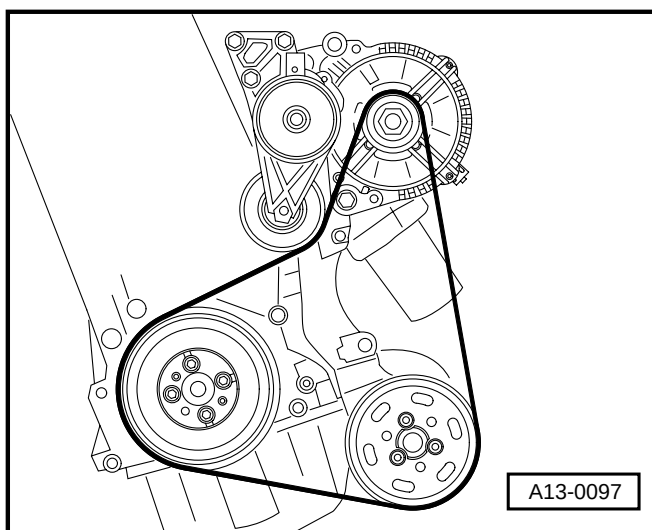
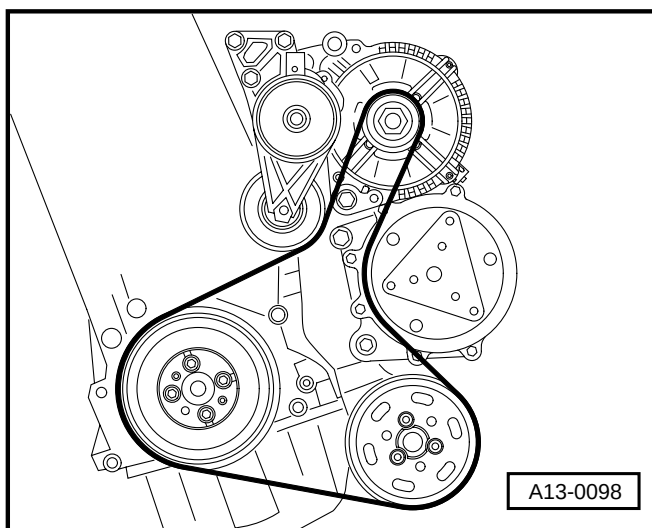


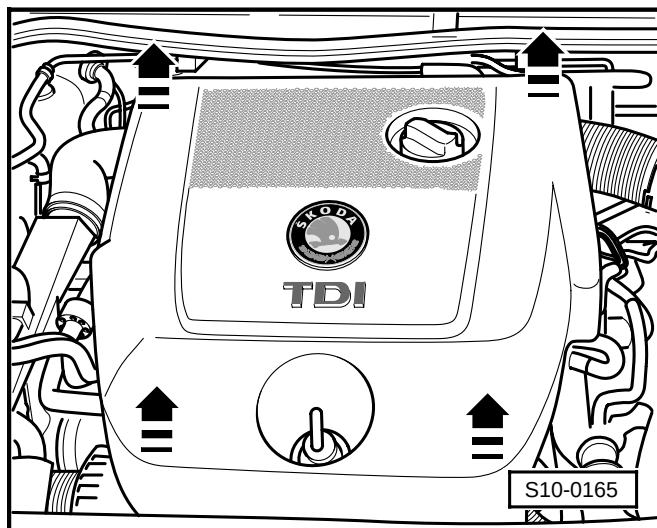
Fig. 1: Fitting sleeve

- Before installing bracket, check whether the dowel sleeve is inserted -arrow-.

**Fig. 2: Routing of ribbed V-belt on vehicles without air conditioning****Fig. 3: Routing of ribbed V-belt on vehicles with air conditioning**

Removing the V-ribbed belt

- Remove engine trim panel in -direction of the arrow- ►
- Mark the rotation direction of the ribbed V-belt.



- Swivel tensioning pulley in -direction of arrow- in order to slacken the V-ribbed belt. ►
- Remove ribbed V-belt; take off first of all at belt pulley of alternator.



Note

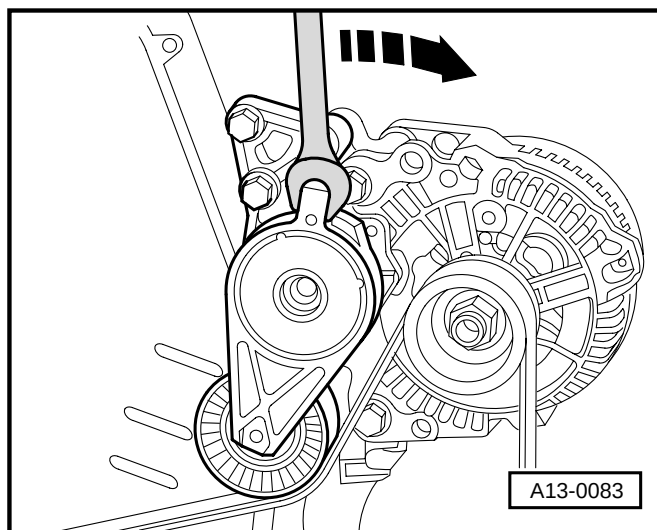
Tensioning pulley can be secured e.g. with a 3 mm hexagonal wrench.

Installing the V-ribbed belt



Note

- ♦ *Inspect ribbed V-belt ⇒ Inspection and Maintenance.*
- ♦ *Before installing the ribbed V-belt, ensure that all components (alternator, AC compressor, hydraulic pump) are properly installed.*
- ♦ *Ensure belt pulley and tensioning pulley run freely.*
- First of all, fit ribbed V-belt onto alternator and slacken the tensioning device.
- Start engine and inspect running of belt.



13-2 Removing and installing, tightening the timing belt

Summary of components



Note

Before removing the timing belt, mark direction of running. Reversing the rotation direction of an already used belt may destroy it.

1 - Top part of timing belt guard

2 - Timing belt

- ☐ before removing mark running direction
- ☐ check for wear
- ☐ do not kink
- ☐ removing and installing
⇒ **13-2** page 2

3 - 20 Nm + torque a further $\frac{1}{8}$ turn (45°)

4 - Tensioning pulley

5 - 100 Nm

6 - 25 Nm

7 - Camshaft sprocket

8 - Hub

- ☐ with pulse rotor
- ☐ to release and tighten use counterholder -T10051 -
- ☐ to remove use extractor -T10052-
- ☐ removing and installing
⇒ Chapter 15-3

9 - 10 Nm

10 - Timing belt guard rear

11 - Grommet

- ☐ replace if damaged

12 - Tensioning device for timing belt

13 - Guide pulley

14 - Coolant pump

- ☐ removing and installing
⇒ Chapter 19-2

15 - Timing belt gear - crankshaft

- ☐ contact surface between crankshaft timing belt sprocket and crankshaft must be clean and free of grease
- ☐ Fitting position: flats on timing belt sprocket and crankshaft must be aligned

16 - 120 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ☐ to release and tighten use counterholder -MP 1-310 - or -T30004-
- ☐ replace
- ☐ install bolt in original state, do not moisten with oil and do not remove grease

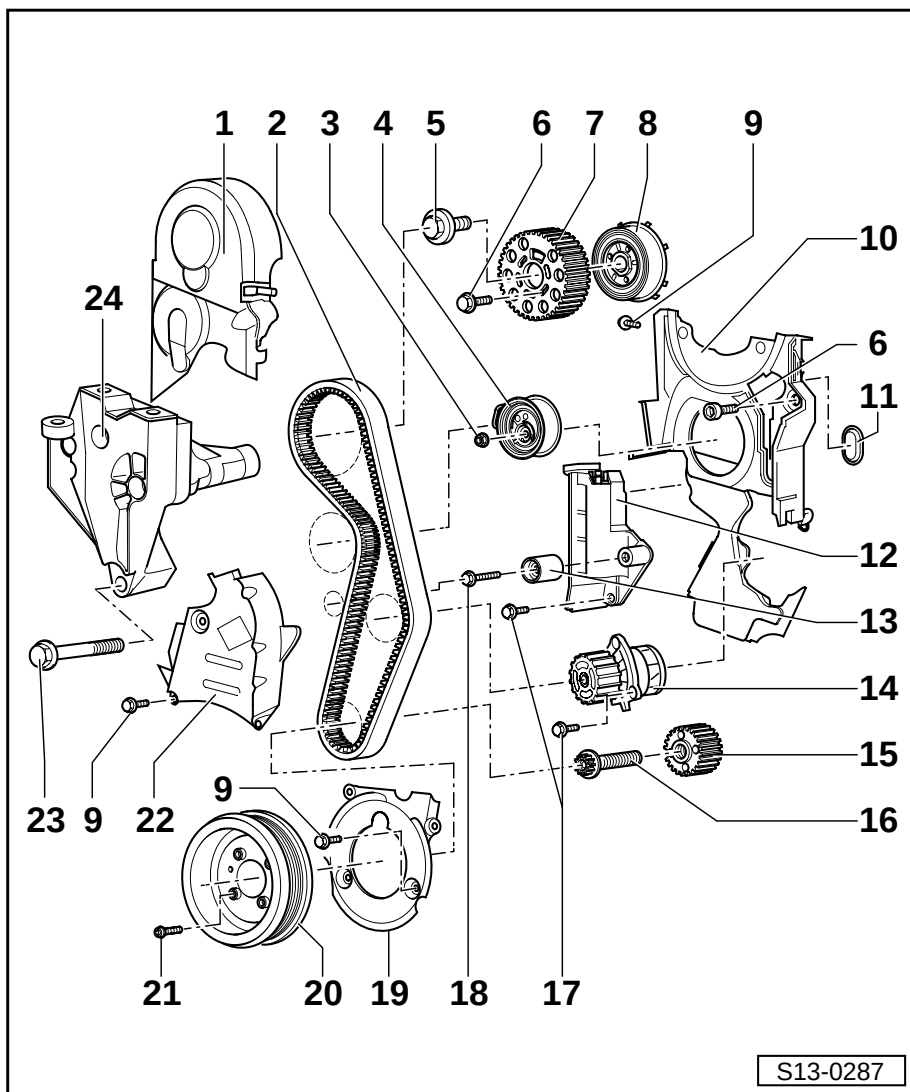
17 - 15 Nm

18 - 20 Nm

19 - Bottom part of timing belt guard

20 - Belt pulley with vibration damper

- ☐ Assembly only possible in one position - holes offset



- 21 - 10 Nm + torque a further $\frac{1}{4}$ turn (90°)
- 22 - Middle part of timing belt guard
- 23 - 45 Nm
- 24 - Engine support bracket

Removing and installing, tightening the timing belt

Special tools, test and measuring equipment and auxiliary items required

- ♦ Torque wrench
- ♦ Arrester pin for the injection pump -MP 1-301-
- ♦ Supporting device -MP 9-200- with adapter -MP 9-200/3-
- ♦ Securing plate -T10008-
- ♦ Locking device -T10050-
- ♦ Wrench for tensioning pulleys (e. g. -Matra V 159-, -T10020-, -Hazet 2587- or -Stahlwille 127-17-)

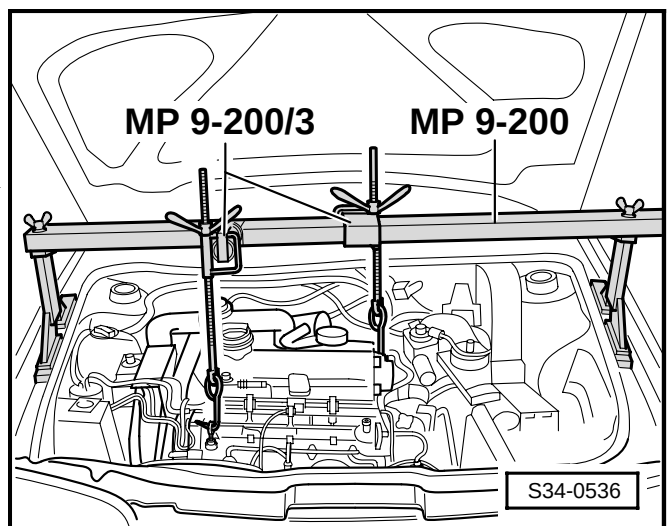
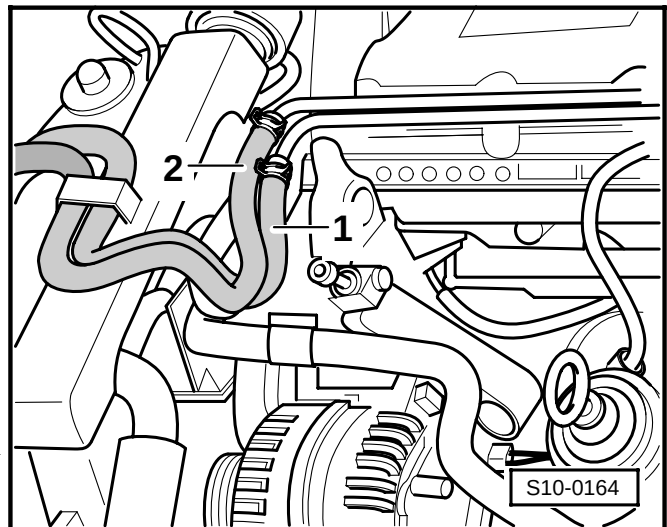
Removing

- Remove the V-ribbed belt ⇒ Chapter 13-1.
- Remove the front right wheelhouse liner ⇒ Body work; Rep. Gr. 66.
- Remove belt pulley with vibration damper.
- Remove middle and bottom timing belt guard.

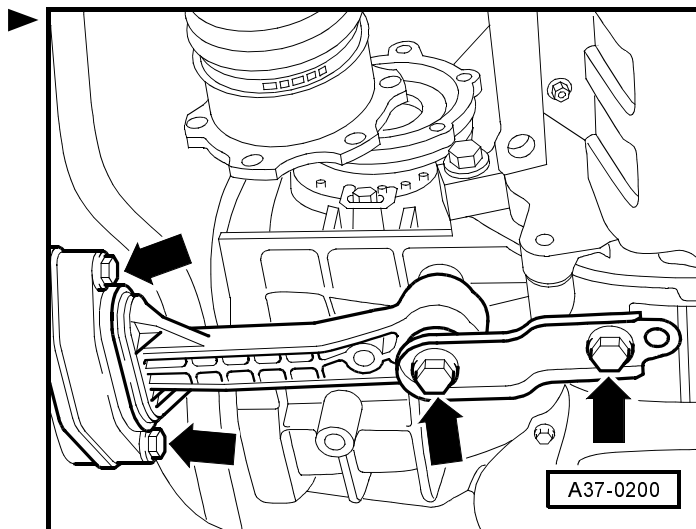
Caution!

Fuel line is under pressure. Place cleaning cloths around the connection point before detaching hose connections. Reduce pressure by carefully removing the hose.

- Detach fuel feed hose -1- and fuel return-flow hose -2- from pipes. ➡
- Remove top charge air pipe ⇒ Chapter 21-1.
- Remove expansion reservoir and place down to the front with coolant hoses connected.
- Remove power steering fluid reservoir, do not detach hoses however, and place down to the side.
- Fit on supporting device -MP 9-200- with adapter -MP 9-200/3-. ➡
- Remove engine mounts.



- Remove pendulum support -arrows-.
- Remove top part of timing belt guard.
- Raise engine.
- Remove engine support ⇒ item 24 in **13-2** page 2.
- Lower engine again into normal position.
- Position crankshaft on TDC cylinder 1.



- Rotate crankshaft until the marking on the top of the timing belt sprocket and the arrow on the rear timing belt guard are positioned opposite the lugs on the hub of the impulse rotor -arrows A-.
- Lock hub with locking pin -MP 1-301-.

Insert locking pin through the left slot into the hole at the cylinder head.

- Secure crankshaft timing belt sprocket with locking device -T10050-.

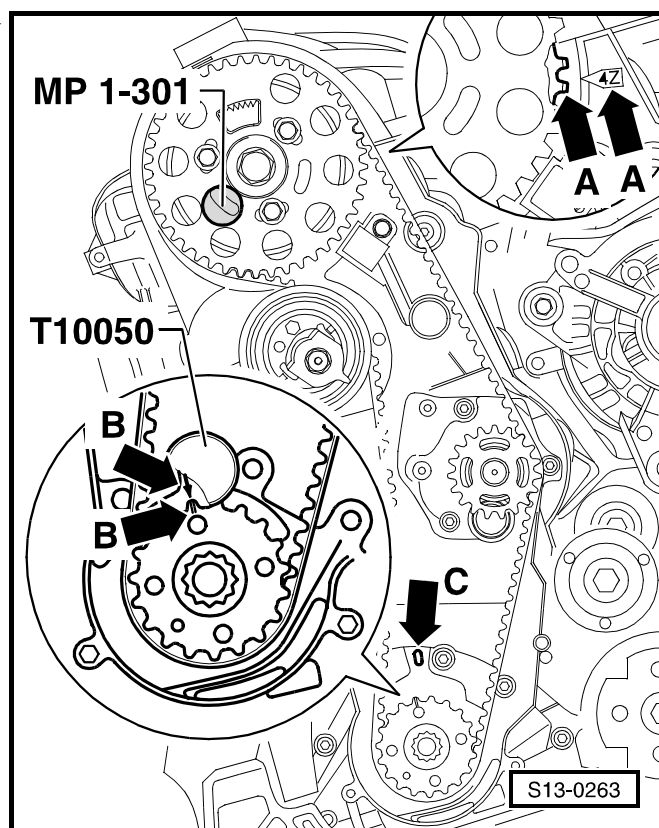
Insert locking device from the front of the timing belt sprocket into the teeth.

To facilitate this step, it is recommended to colour the TDC marking on the crankshaft timing belt sprocket and on the locking device -T10050- with white paint -arrows B-.



Note

- ♦ The marking on the crankshaft timing belt sprocket and the marking on the locking device -T10050- must be positioned opposite -arrows B-. Pin of locking device must engage in the hole of the sealing flange -arrow C-.
- ♦ Locking device -T10050- must never be used for securing when slackening or tightening the bolt of the crankshaft timing belt sprocket!



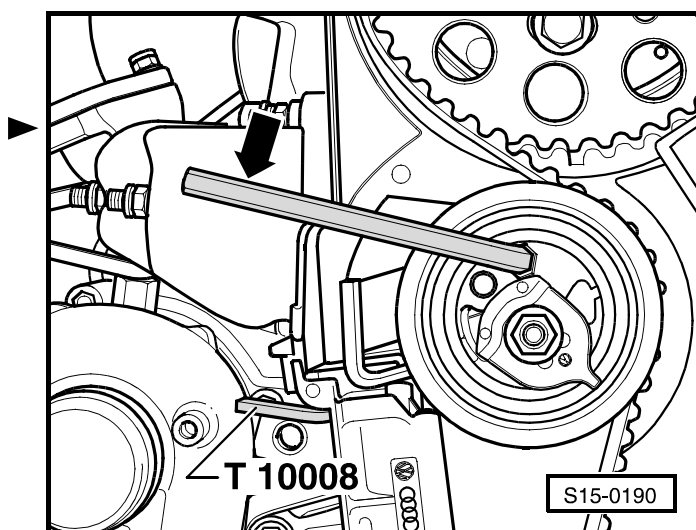
- Mark the rotation direction of the timing belt.
- Insert wrench fully into the hexagon socket bolt and press in anti-clockwise direction onto the tensioning pulley -arrow- long enough until it is possible to secure the timing belt tensioning device with the locking plate -T10008-.



Note

If the wrench is inserted only slightly, there is a risk of it dropping out.

- Slacken nut of tensioning pulley.



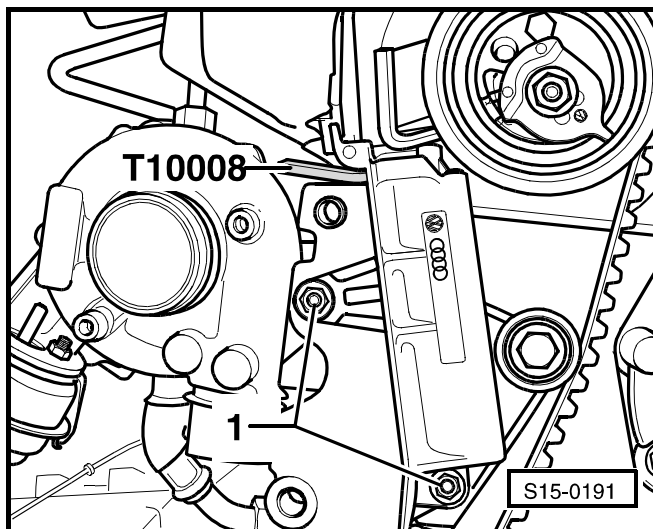
- Unscrew bolts -1- of timing belt tensioning device and take out tensioning device.
- Remove timing belt.

Installing and tensioning

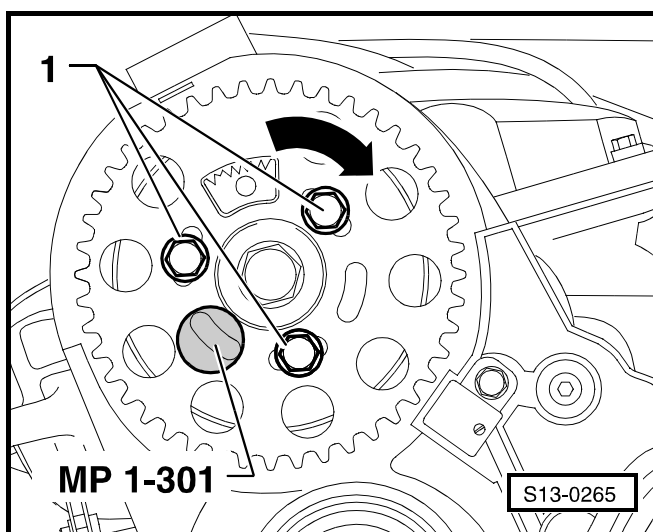


Note

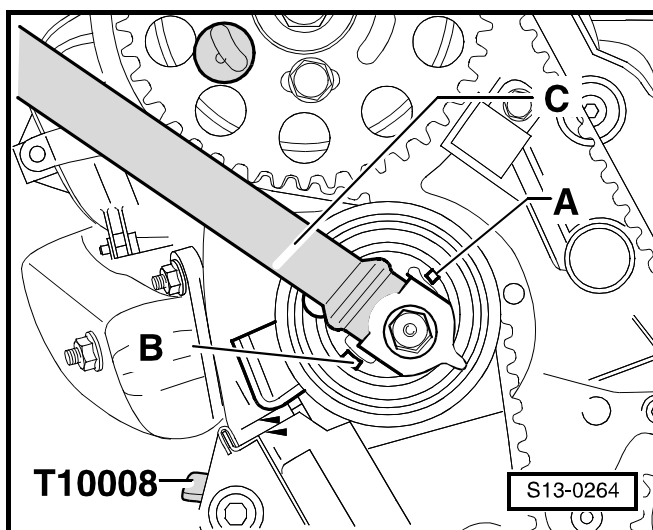
Tensioning work at the timing belt must only be carried out when engine is cold.



- Slacken bolts of camshaft sprocket -1- sufficiently so that the camshaft sprocket can be turned in the area of the slots.
- Turn camshaft sprocket clockwise in the slots -arrow- as far as the stop.



- Carefully turn eccentric in clockwise direction with the wrench for tensioning pulleys -C- sufficiently until the lug on the eccentric is right in front of stop -B-.
- Fit timing belt onto camshaft sprocket, tensioning pulley, crankshaft timing belt sprocket and, last of all, onto the timing belt sprocket of the coolant pump.
- Install tensioning device for timing belt.
- Carefully turn eccentric in anti-clockwise direction with the wrench for tensioning pulleys -C- (the lug on the eccentric moves toward the stop -A-) until it is possible to move the locking plate -T10008- away slightly.
- Slacken wrench in clockwise direction long enough until gap size -a- is achieved. (The lug on the eccentric moves toward the stop -B-).



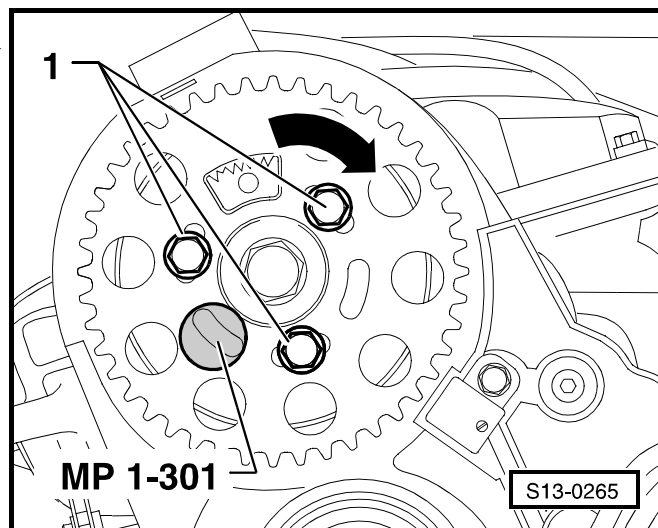
Specification -a-: 4 ± 1 mm.

**Note**

- ◆ A $\varnothing 4$ mm twist drill can also be used for setting the gap -a-.
- ◆ Gap -a- becomes smaller after the tensioning pulley is tightened. This fact should therefore be taken into account when setting with $\varnothing 4$ mm drill bit.
- ◆ When the engine is warm, the gap -a- may become as little as 1 mm wide.
- Hold tensioning pulley in this position and tighten nut of tensioning pulley as follows:
20 Nm + torque a further $\frac{1}{8}$ turn (45°)
- Tighten bolts of camshaft sprocket -1- to tightening torque of 25 Nm.
- Remove locking pin -MP 1-301- and locking device -T10050-.
- Tighten crankshaft two revolutions in the direction of rotation of engine and position again to TDC of piston for cylinder 1.

**Note**

- ◆ Pin for locking device must engage in the sealing flange. (Locking device should be inserted just ahead of TDC on timing belt sprocket.)
- ◆ If the crankshaft is positioned after TDC of the piston for cylinder 1 and the pin of the locking device does not engage in the sealing flange, rotate the crankshaft back by no more than $\frac{1}{4}$ revolution and once again set the crankshaft to the TDC of the piston for cylinder 1 by turning in direction of rotation of engine.
- After inserting the pin for locking device -T10050- check dimension -a- 4 ± 1 mm and determine whether the hub can be secured with locking pin -MP 1-301-.



If dimension -a- is not reached:

- Tension tensioning pulley further.

Hold the tensioning pulley with the wrench, slacken the nut, and slacken the wrench until dimension -a- is achieved.

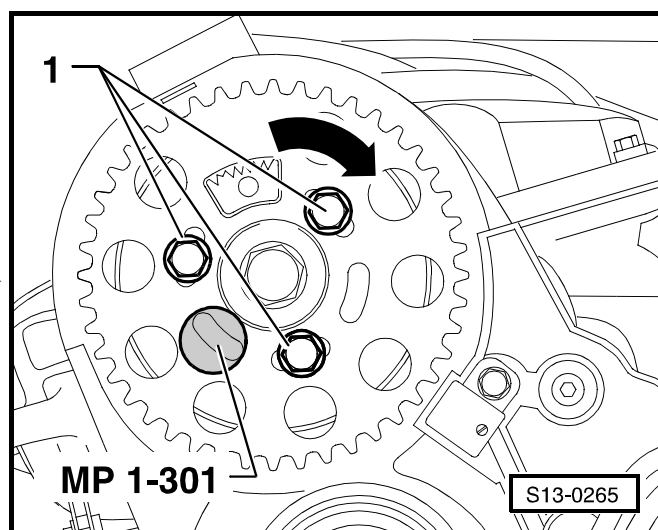
Specification -a-: 4 ± 1 mm.

- Again tighten the nut:

20 Nm + torque a further $\frac{1}{8}$ turn (45°)

Hub cannot be secured:

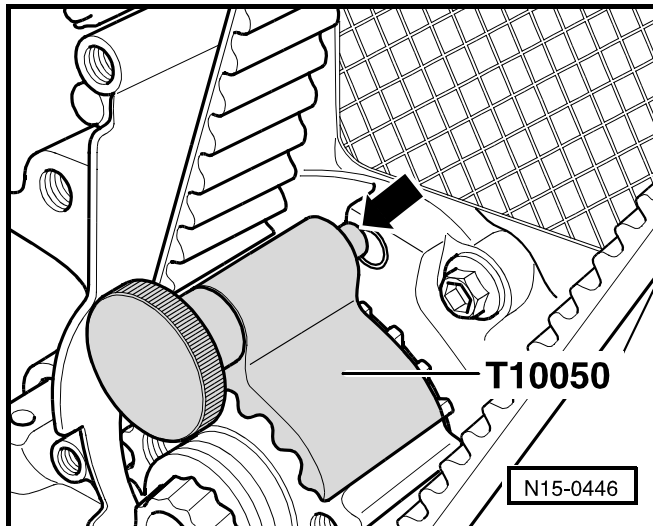
- Remove pin for locking device from the hole at the sealing flange and rotate the crankshaft until the hub can be secured with locking pin.
- Slacken bolts of camshaft sprocket -1-.



- Rotate crankshaft in opposite direction of rotation of engine long enough until the pin for locking device in the sealing flange is positioned close to the hole -arrow-.
- Rotate crankshaft in direction of rotation of engine long enough until the pin for locking device engages in the sealing flange.
- Tighten bolts of camshaft sprocket to a tightening torque of 25 Nm.

Once the dimension -a- is achieved and the hub can be secured:

- Remove locking pin -MP 1-301- and locking device -T10050-.
- Rotate crankshaft on a further two revolutions in direction of rotation of the engine until the crankshaft is again positioned at TDC of piston of cylinder 1.



i Note

- ♦ *Pin for locking device must engage in sealing flange when this is done.*
 - ♦ *If the crankshaft is positioned after TDC of the piston for cylinder 1 and the pin of the locking device does not engage in the sealing flange, rotate the crankshaft back no more than $\frac{1}{4}$ revolution and once again set the crankshaft to the TDC of the piston for cylinder 1 by turning in direction of rotation of engine.*
 - ♦ *It is not permitted to carry out the correction by turning in the opposite direction of rotation of the engine in order to insert the locking device.*
- Repeat check.

Further installation occurs in reverse order.

Tightening torques for engine mounts and pendulum support ⇒ Chapter 10-1.

13-3 Removing and installing sealing flange and flywheel



Note

- ♦ Repairs to clutch ⇒ Manual Gearbox 02M; Rep. Gr. 30.
- ♦ The engine should be attached with engine holder -MP 1-202- and spacer bushes -T30010- to the repair stand -MP 9-101- for carrying out removal and installation operations.

1 - PTFE gasket ring

- ☐ replace ⇒ **13-3** page 2
- ☐ do not moisten with oil before inserting

2 - Front sealing flange

- ☐ must be positioned on dowel sleeves
- ☐ removing and installing ⇒ **13-3** page 4

3 - Cylinder block

- ☐ removing and installing crankshaft ⇒ Chapter 13-4
- ☐ disassembling and assembling pistons and conrod ⇒ Chapter 13-4

4 - Flywheel

- ☐ Assembly only possible in one position - holes offset
- ☐ to remove and install flywheel, secure with device -MP 1-504- ⇒ Fig. 1 in **13-3** page 2

5 - 60 Nm + torque a further 90° (1/4 turn)

- ☐ replace
- ☐ tightening may occur in successive stages

6 - Intermediate plate

- ☐ must be positioned on dowel sleeves
- ☐ do not damage and do not kink when carrying out removal and installation work

- ☐ hang on the sealing flange ⇒ Fig. 2 in **13-3** page 2

7 - 15 Nm

8 - Sealing flange with PTFE gasket ring

- ☐ to remove and install, take off oil pan ⇒ Chapter 17-2
- ☐ must be replaced completely
- ☐ install gasket ring dry, the crankshaft stub must be free of grease
- ☐ install new sealing flange with guide sleeve (do not pull guide sleeve off the ring seal before installing)

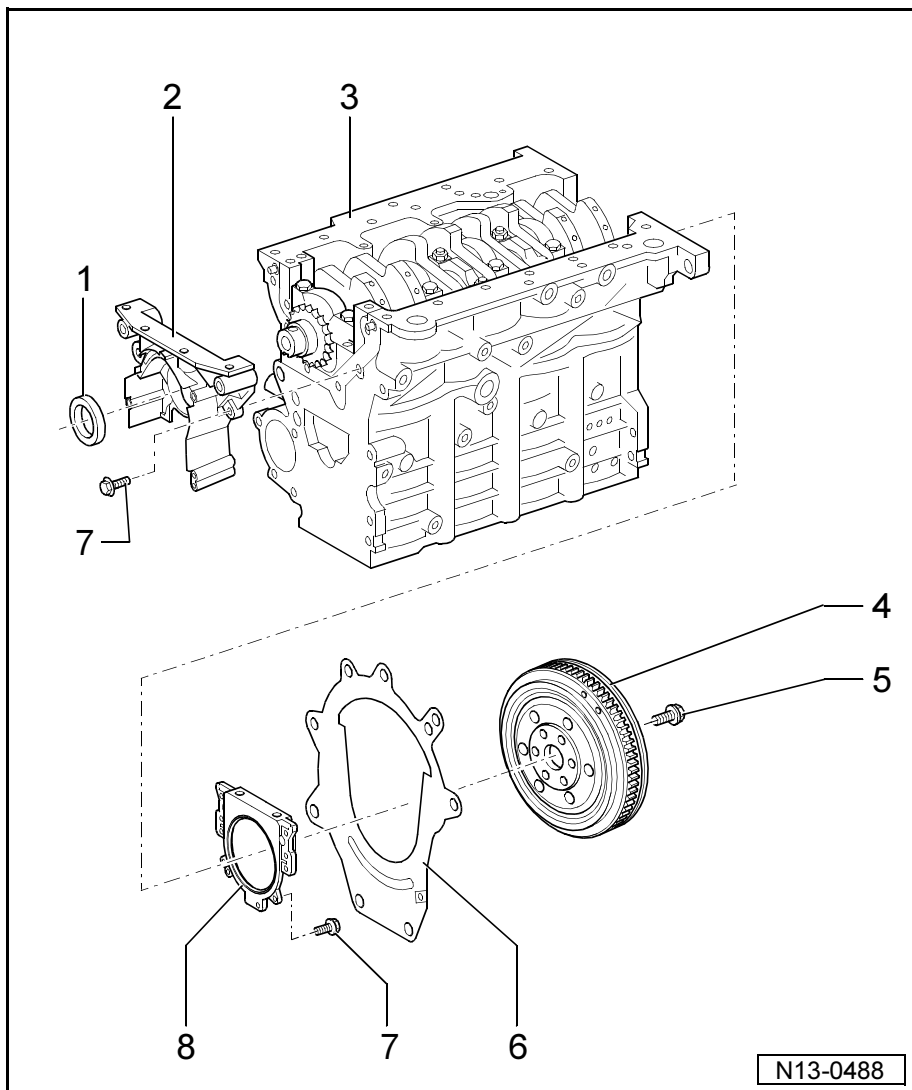
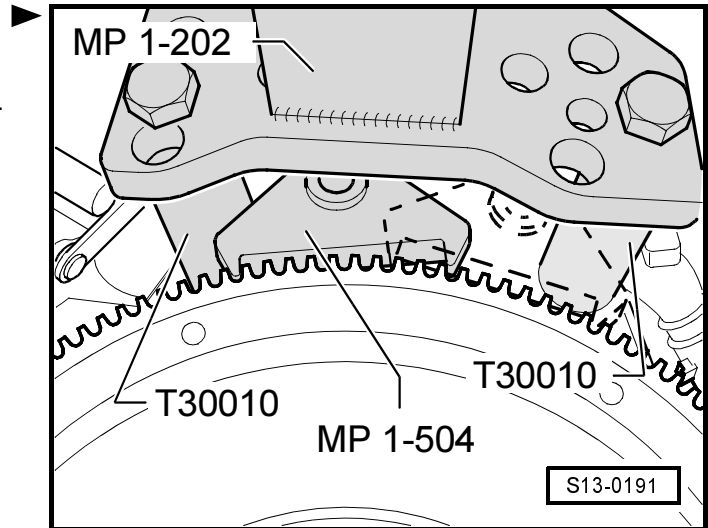
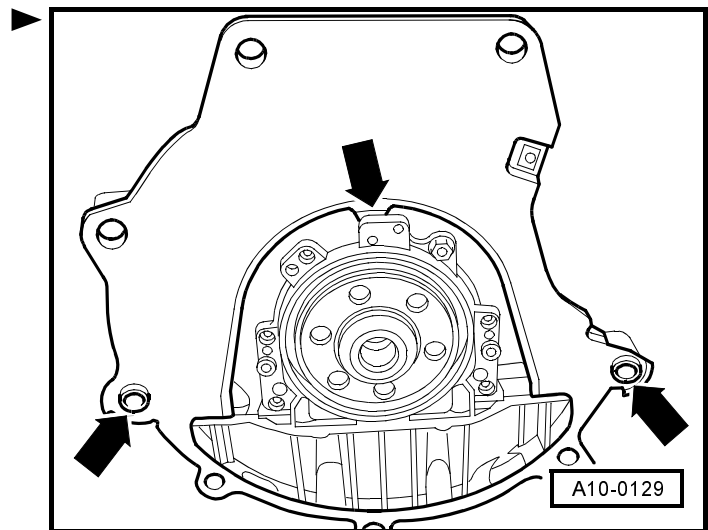


Fig. 1: Secure flywheel

- Mount device -MP 1-504- onto the splines and turn sufficiently until it touches the spacer bush -T30010 -.

**Fig. 2: Installing intermediate plate**

- Insert intermediate plate on sealing flange and push onto the dowel sleeves -arrows-.

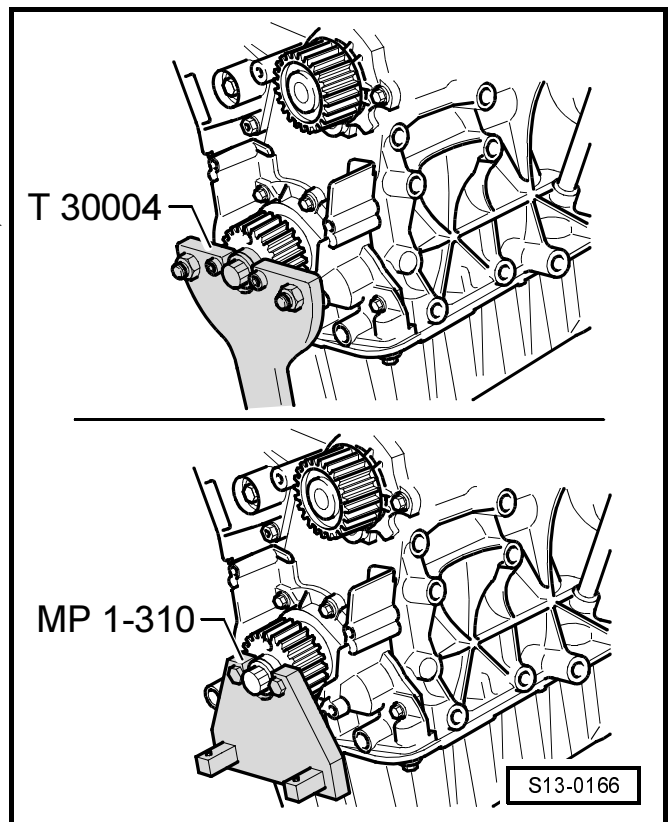


Replacing crankshaft seal on belt pulley side

Removing

Special tools, test and measuring equipment and auxiliary items required

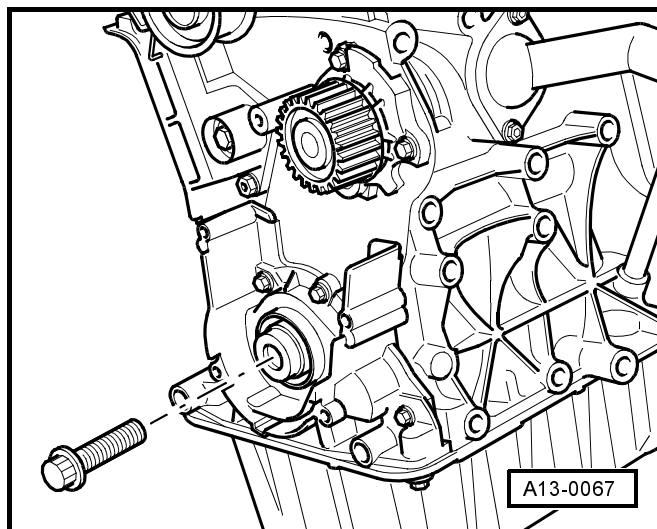
- ♦ Torque wrench
 - ♦ Gasket ring extractor -MP 1-226-
 - ♦ Assembly device -T10053-
 - ♦ Bushing -T10053/1-
 - ♦ Bolt (M16 x 1.5 x 60) -T10053/2-
 - ♦ Counterholder -T30004- or -MP 1-310 -
- Remove the V-ribbed belt ⇒ Chapter 13-1.
 - Remove the timing belt ⇒ Chapter 13-2.
 - Remove crankshaft timing belt sprocket. Lock timing belt sprocket with counterholder -T30004- or -MP 1-310-.



Note

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

- Screw the bolt by hand into the crankshaft as far as the stop. ►
- Unscrew inner part of the gasket ring extractor -MP 1-226- nine turns (approx. 17 mm) out of the outer part and lock with knurled screw.



- Oil the thread head of the gasket ring extractor -MP 1-226-, position and forcibly screw into the gasket ring as far as possible. ►
- Release knurled screw and turn the inner side against the crankshaft until the gasket ring is pulled out.

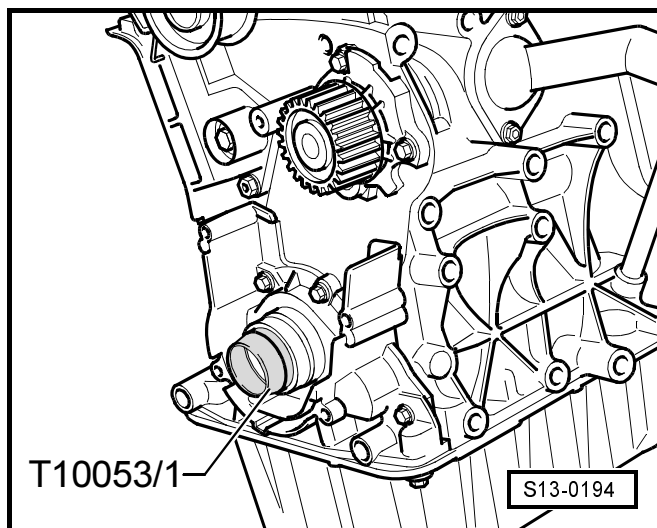
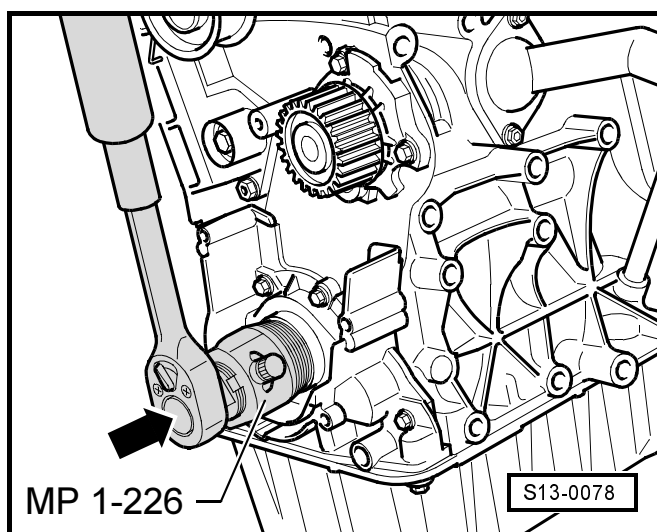
Installing



Note

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

- Use a clean cloth to remove oil residues on the crankshaft journal. ►
- Insert bushing -T10053/1- on the crankshaft stub.
- Slide gasket ring over the bushing onto the crankshaft stub.



- Push in gasket ring with assembly device -T10053- and bolt (M16 x 1.5 x 60) -T10053/2- up to the stop. ▶
- Install timing belt gear - crankshaft and lock with counterholder -T30004- or -MP 1-310-.
- Tighten new screw for timing belt gear - crankshaft to 120 Nm and turn a further 90° (1/4 turn).
- Install the timing belt ⇒ Chapter 13-2.
- Install the V-ribbed belt ⇒ Chapter 13-1.

Removing and installing the front sealing flange

Special tools, test and measuring equipment and auxiliary items required

- ♦ Torque wrench
- ♦ Bushing -T10053/1-
- ♦ Counterholder -T30004- or -MP 1-310 -
- ♦ Hand drill with plastic brush attachment
- ♦ Flat scraper
- ♦ Silicone sealant -D 176 404 A2-

Removing

- Remove the V-ribbed belt ⇒ Chapter 13-1.
- Remove the timing belt ⇒ Chapter 13-2.
- Remove crankshaft timing belt sprocket. Lock timing belt sprocket with counterholder -T30004- or -MP 1-310-. ▶

Note

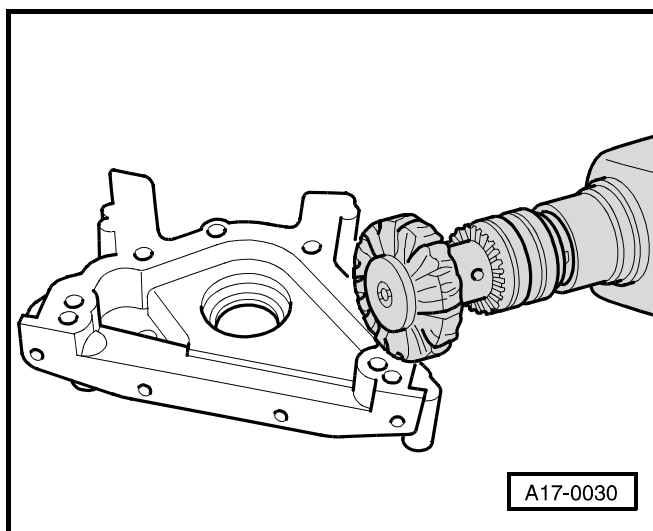
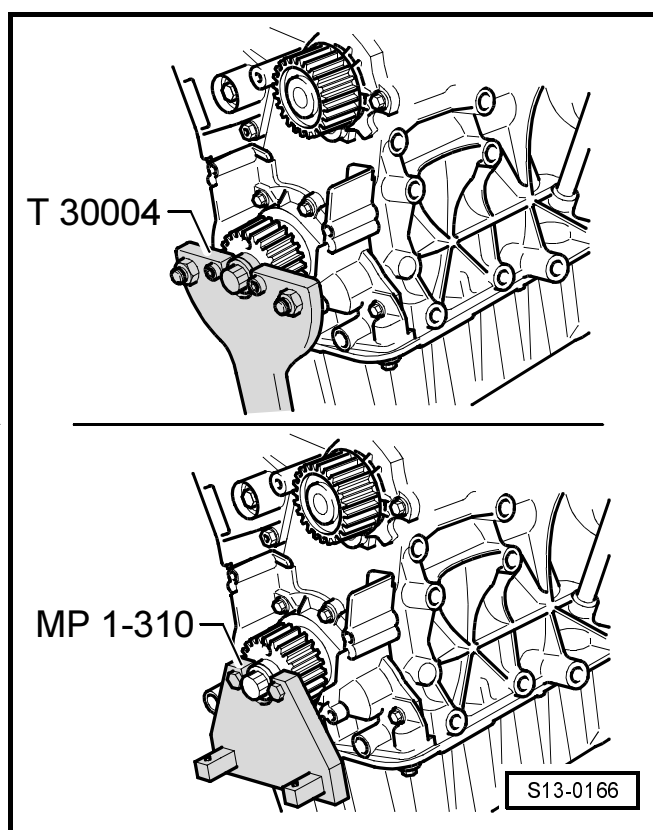
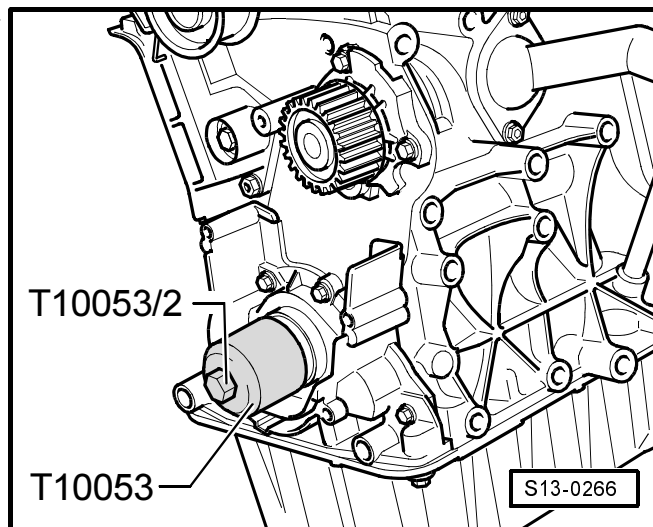
When screwing on the counterholder -MP 1-310- place 2 washers between the timing belt gear and the counterholder.

- Drain engine oil ⇒ Inspection and Maintenance.
- Remove oil pan ⇒ Chapter 17-2.
- Unscrew front sealing flange.
- Remove sealing flange, if necessary release by applying slight blows with a rubber-headed hammer.
- Use a flat scraper to remove sealant residues on the cylinder block.
- Use a rotating plastic brush to remove sealant residues on the sealing flange (wear protective goggles). ▶
- Clean sealing surfaces, they must be free of oil and grease.

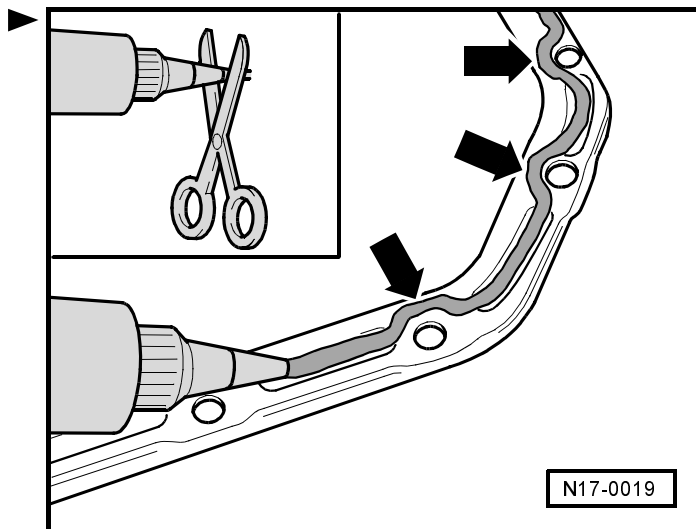
Installing

Note

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



- Cut off nozzle of tube of silicone sealant -D 176 404 A2- at the front marking ($\varnothing$ of nozzle approx. 3 mm).



- Apply silicone sealant bead to the clean sealing surface of the sealing flange, as shown in the illustration.

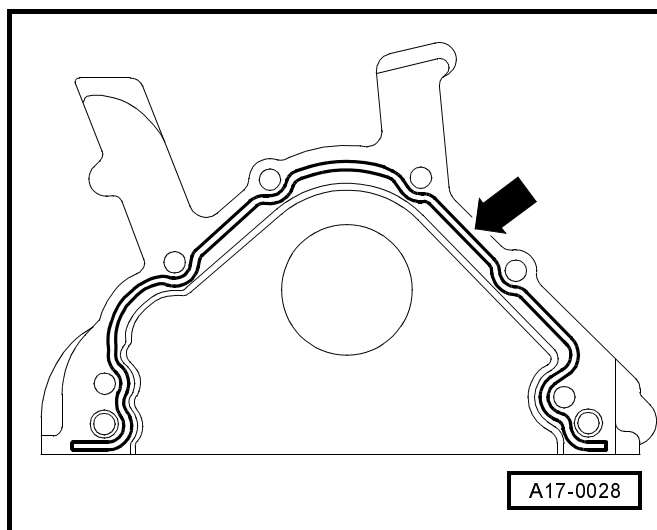
Thickness of sealant bead -arrow-: 2...3 mm



Note

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

- Fit sealing flange immediately and lightly tighten all bolts.



Note

When installing the sealing flange with the gasket ring fitted use the bushing -T10053/1-.

- Tighten the fixing screws of the sealing flange cross-wise.

Tightening torque: 15 Nm

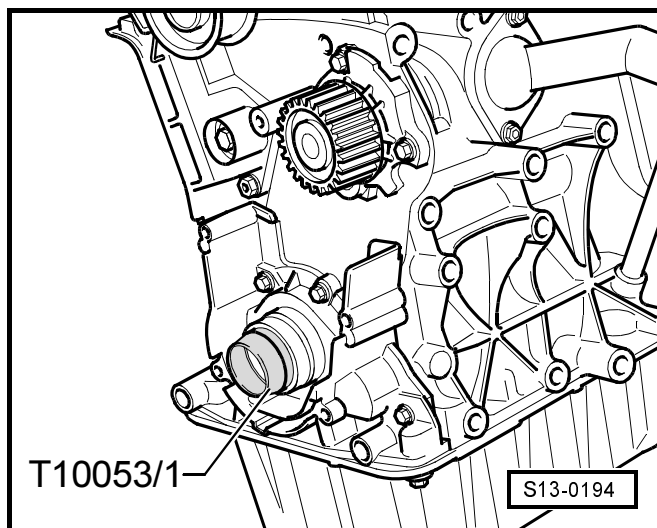
- Install oil pan ⇒ Chapter 17-2.



Note

After installing, allow the sealant to dry for about 30 minutes. Only then may engine oil be filled in.

- Install the timing belt ⇒ Chapter 13-2.
- Install the V-ribbed belt ⇒ Chapter 13-1.



13-4 Crankshaft, Piston and Conrod

Removing and installing crankshaft

1 - Bearing shell

- ☐ for bearing cap without lubricating groove
- ☐ for cylinder block with lubricating groove
- ☐ do not mix up used bearing shells (mark)

2 - 65 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ☐ replace
- ☐ tighten thread

3 - Bearing caps

- ☐ bearing cap 1: on the belt pulley side
- ☐ bearing cap 3: with recesses for thrust washers
- ☐ retaining lugs of the bearing shells of the cylinder block/bearing cap must be on top of one another

4 - Bearing shell 3

- ☐ for bearing cap without lubricating groove
- ☐ for cylinder block with lubricating groove

5 - Stop disc

- ☐ for bearing cap 3
- ☐ pay attention to locating element

6 - Rotor

- ☐ for engine speed sender -G28-

7 - 10 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ☐ replace

8 - Fit pin

- ☐ Checking projection from crankshaft $\Rightarrow$ Fig. 1 in **13-4** page 2

9 - Crankshaft

- ☐ Axial clearance for new part: 0,07...0,17 mm
wear limit: 0,37 mm
- ☐ Crankshaft dimensions:
 - Ø Crankshaft bearing journal -54,00 mm
 - Ø Conrod bearing journal -47,80 mm

10 - Stop disc

- ☐ for cylinder block, bearing 3

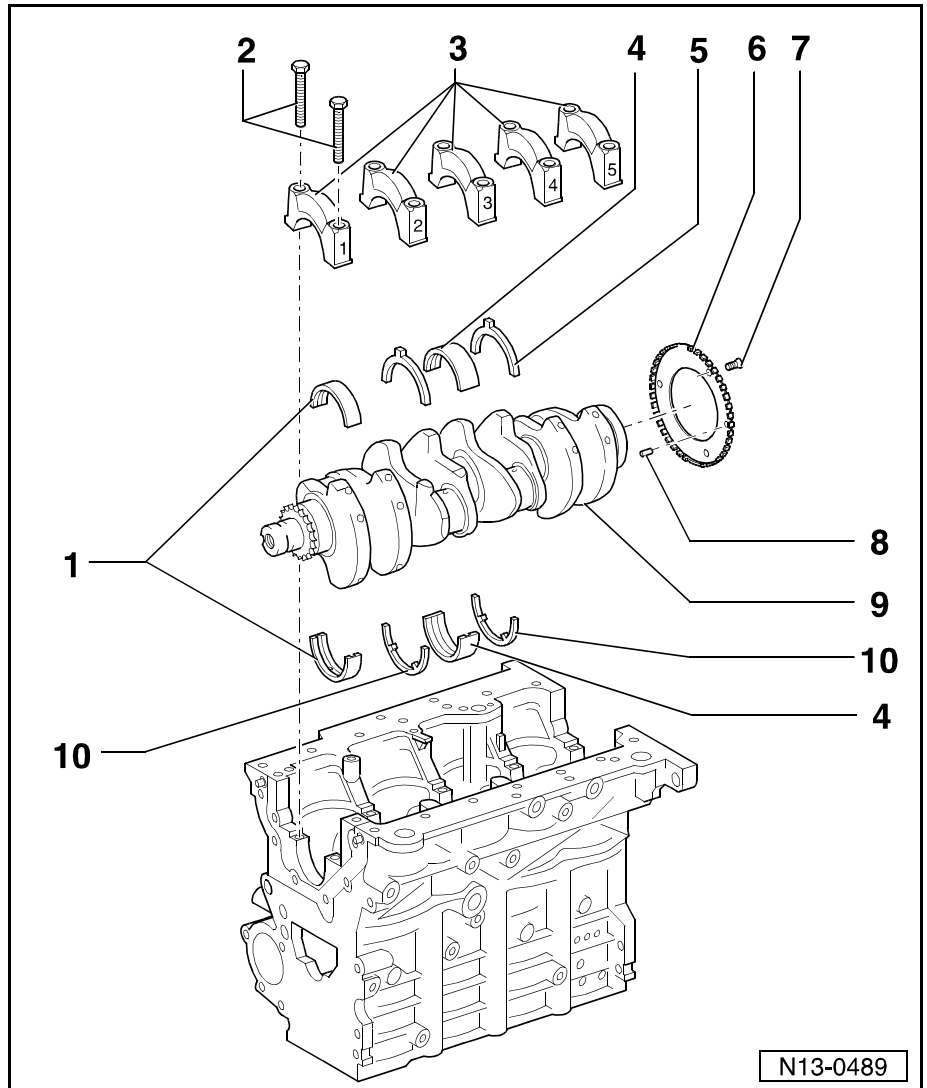


Fig. 1: Checking projection of fit pin from crankshaft

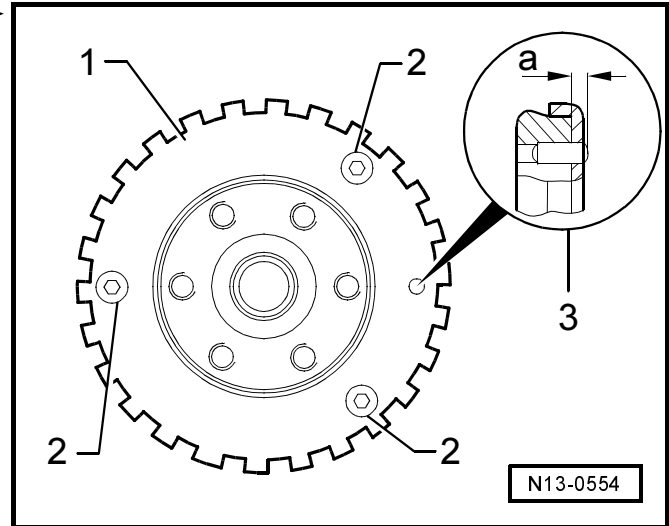
Special tools, test and measuring equipment and auxiliary items required

- ♦ Depth gauge

Test sequence:

- Use depth gauge to inspect projection -a- of dowel pin when pulse rotor -1- is removed.

- 1 - Pulse rotor
- 2 - Fixing screw
- 3 - Projection of the fit pin -3- from crankshaft ---
2.5...3.0 mm



Disassembling and assembling piston and conrod

1 - Piston rings

- ☐ offset joint 120°
- ☐ use piston ring pliers for removing and installing
- ☐ marking „TOP“ faces up
- ☐ inspect gap clearance
⇒ Fig. 2 in **13-4** page 3
- ☐ inspect end clearance
⇒ Fig. 3 in **13-4** page 4

2 - Piston

- ☐ with combustion chamber
- ☐ mark installation position and matching cylinder
- ☐ installation position and assignment of piston/cylinder
⇒ Fig. 5 in **13-4** page 4
- ☐ arrow on piston crown faces towards the belt pulley side
- ☐ use piston ring tensioning strap for installing
- ☐ if cracks present on piston stem - replace piston
- ☐ inspect piston projection at TDC ⇒ **13-4** page 5
- Ø Piston -79.47 mm

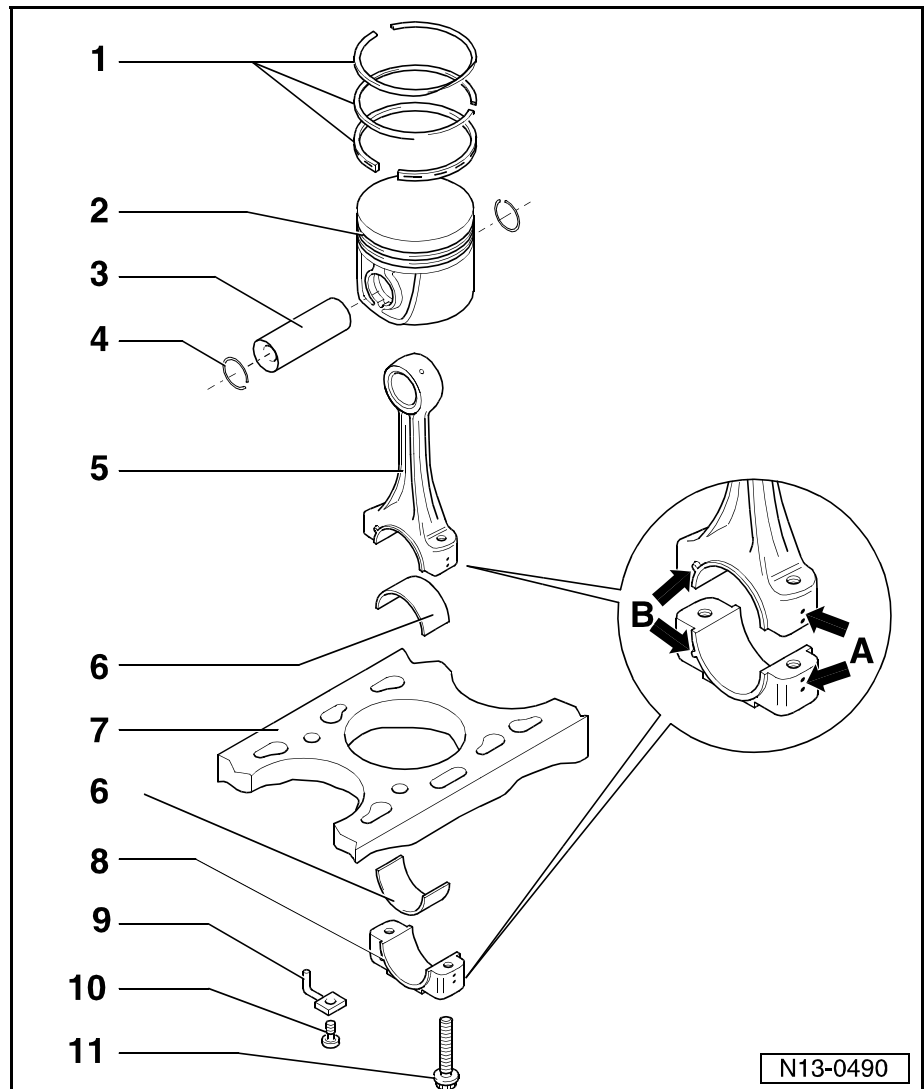
3 - Piston pin

- ☐ if stiff, heat piston to 60 °C
- ☐ use drift -VW 222A- for removing and installing

4 - Circlip

5 - Conrod

- ☐ replace as a set only
- ☐ mark assignment to cylinder, refer to -A-
- ☐ Fitting position: markings -B- point towards the belt pulley side



6 - Bearing shell

- ☐ check fitting position
- ☐ note the different version:
Top bearing shell (on piston side) is subject to less stress
Distinguishing feature:
Black streak on working surface close to separation cut
- ☐ insert bearing shell in the middle of the conrod bearing cap
- ☐ do not mix up used bearing shells (mark)
- ☐ check for correct fitting
- ☐ Axial clearance:
wear limit: 0.37 mm

7 - Cylinder block

- Ø Cylinder -79.51 mm
- ☐ Inspecting cylinder bore ⇒ Fig. 4 in **13-4** page 4

8 - Conrod bearing cap

- ☐ check fitting position

9 - Oil injection nozzle

- ☐ for piston cooling
- ☐ note the SP No. (right-angle bend)

10 - 27 Nm

- ☐ replace without sealant

11 - Conrod bolt, 30 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ☐ replace
- ☐ oil thread and head contact surface

Fig. 2: Inspecting piston ring gap clearance**Special tools, test and measuring equipment and auxiliary items required**

- ♦ Feeler gauge

Test sequence

- Push in ring at right angles to the cylinder wall from the top through to the bottom cylinder opening, about 15 mm from the cylinder edge. To insert use piston without rings.

Piston ring	new (mm)	Wear limit (mm)
1. Compression ring	0,20...0,40	1,0
2. Compression ring	0,20...0,40	1,0
Oil scraper ring	0,25...0,50	1,0

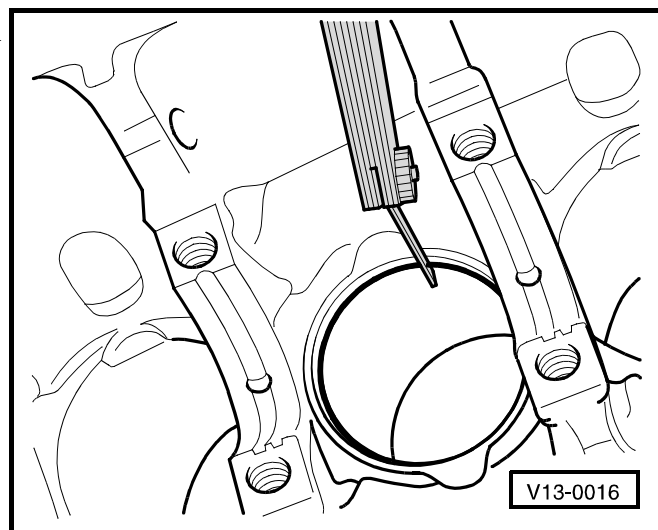
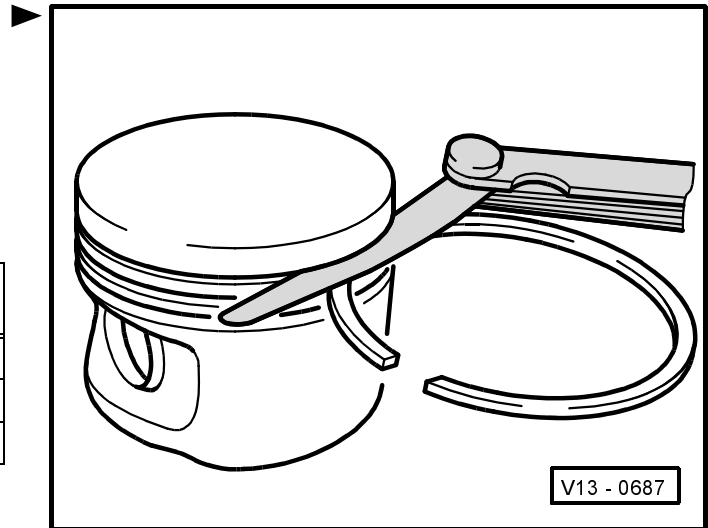


Fig. 3: Inspect piston ring end clearance**Special tools, test and measuring equipment and auxiliary items required**

- ♦ Feeler gauge
- Clean ring groove before inspecting.

Piston ring	new (mm)	Wear limit (mm)
1. Compression ring	0,06...0,09	0,25
2. Compression ring	0,05...0,08	0,25
Oil scraper ring	0,03...0,06	0,15

**Fig. 4: Inspecting cylinder bore****Special tools, test and measuring equipment and auxiliary items required**

- ♦ Internal precision measuring instrument 50 to 100 mm

Piston dimension ⇒ item 2 in **13-4** page 2.

Cylinder dimension ⇒ item 7 in **13-4** page 3.

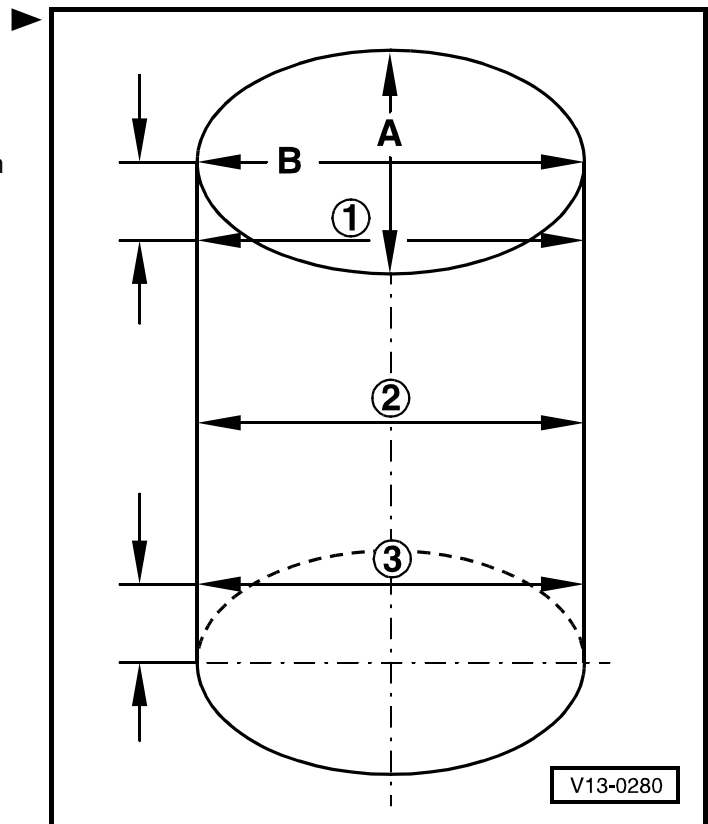
Test sequence

- Measure at 3 points crosswise in a transverse direction -A- and lengthwise -B-.

Deviations from specified dimension: max. 0.10 mm

**Note**

Do not measure the cylinder bore if the cylinder block is fixed to the assembly stand with the engine mount -MP 1-202-, as this may result in incorrect measurements.

**Fig. 5: Piston fitting position and assignment of the piston/cylinder****Special tools, test and measuring equipment and auxiliary items required**

- ♦ e. g. electric stylus

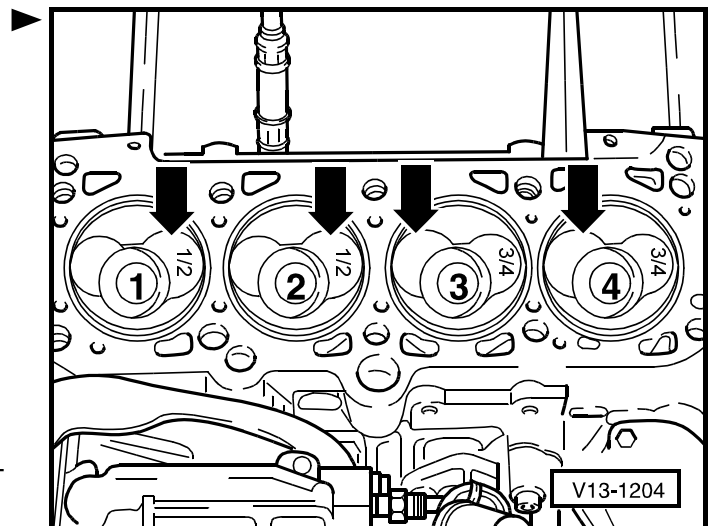
Procedure

- Mark installation position and assignment on inside of piston (not on piston crown), e.g. with an electric stylus.

Pistons in cylinders 1 and 2:

Large piston relief for inlet valve to flywheel side -arrows-

Pistons in cylinders 3 and 4:



Large piston relief for inlet valve to belt pulley side -arrows-



Note

- ◆ Pistons in cylinders 1 and 2: Identification 1/2
- ◆ Pistons in cylinders 3 and 4: Identification 3/4

Checking piston projection in TDC

Special tools, test and measuring equipment and auxiliary items required

- ◆ Measuring tool for piston projection -MP 1-107-

Procedure

- When installing new pistons or a short engine, inspect the piston projection at TDC. Depending on the piston projection fit the relevant cylinder head seal in accordance with the table below:

Piston projection over cylinder block - top side	Marking of bore
0.91 mm...1.00 mm	1
1.01 mm...1.10 mm	2
1.11 mm...1.20 mm	3

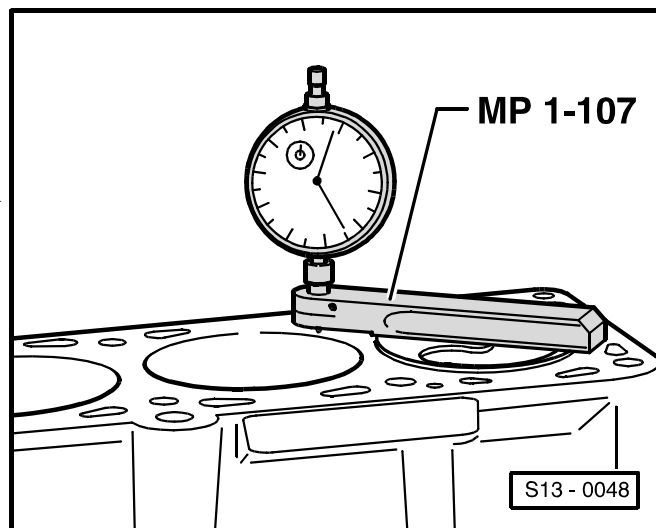


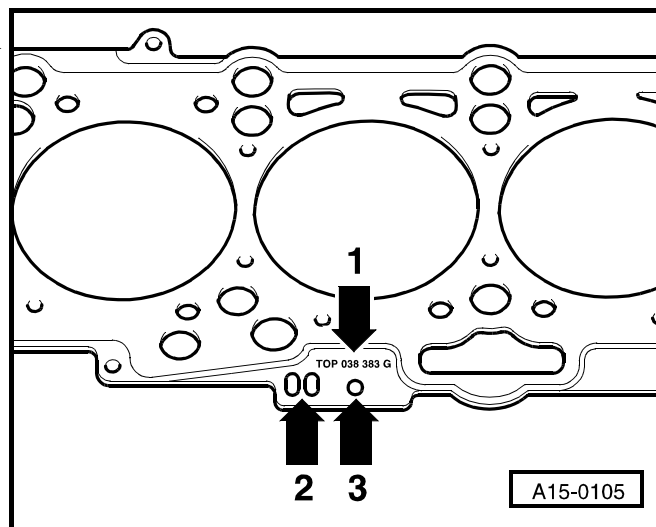
Fig. 6: Identification of the cylinder head seal

- ◆ Spare parts No. = -arrow 1-
- ◆ Control code = -arrow 2- (ignore)
- ◆ Bores = -arrow 3-



Note

Cylinder head seals of different thicknesses are fitted depending on the piston projection from the cylinder block. If only the gasket is replaced, then it must be replaced with a gasket with the same marking.



15 – Cylinder head, valve gear

15-1 Removing and installing cylinder head

Summary of components

Removing and installing toothed belt ⇒ Chap. 13-2

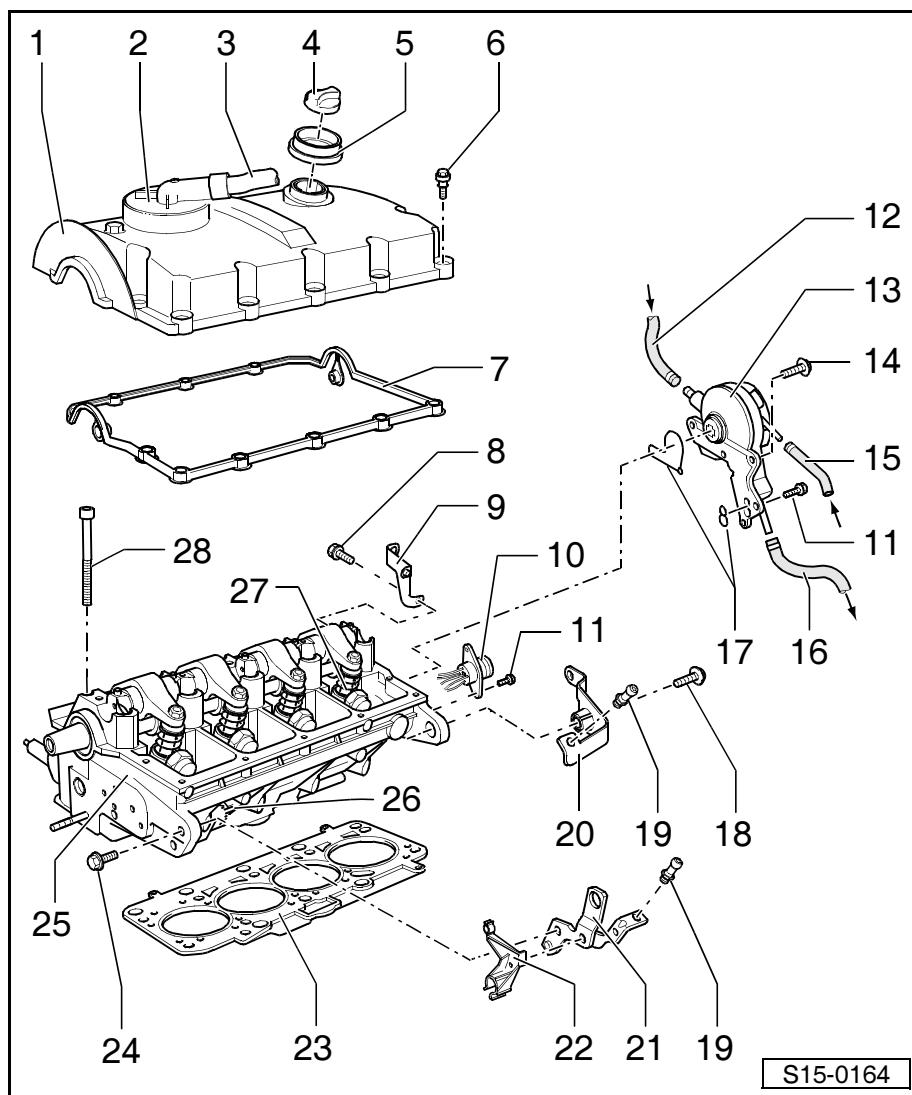
Testing compression pressure ⇒ **15-1** page 5.



Note!

- ◆ When installing an exchange cylinder head with the camshaft installed, it is necessary to oil the contact surfaces between bucket tappets and the cam track.
- ◆ Do not remove the plastic covers 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 must be replaced.
- ◆ It is not permissible to rework the cylinder head of diesel engines.

- 1 - Cylinder head cover**
 - ☐ before fitting on, thoroughly clean sealing surface with a clean cloth
- 2 - Pressure control valve**
 - ☐ for crankcase, bleed
- 3 - to turbocharger**
- 4 - Closing cover**
 - ☐ replace seal if damaged
- 5 - Sealing cup**
 - ☐ replace if damaged
- 6 - Bolt with guide sleeve, 10 Nm**
 - ☐ tighten all bolts first of all by hand
- 7 - Gasket for cylinder head cover**
 - ☐ replace if damaged
- 8 - 20 Nm**
 - ☐ replace
- 9 - Lifting eye**
- 10 - Central plug connection**
 - ☐ for unit injection
- 11 - 10 Nm**
- 12 - from brake servo unit**
- 13 - Tandem pump**
 - ☐ for fuel and vacuum supply
 - ☐ removing and installing ⇒ Chap. 20-1
 - ☐ inspecting ⇒ Chap. 20-1
- 14 - 25 Nm**
- 15 - intake hose**
 - ☐ from fuel filter ⇒ Chap. 20-1
 - ☐ white marking
 - ☐ check tightness
 - ☐ secure with spring band clamps



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16 - Return-flow hose

- ☐ to fuel filter ⇒ Chap. 20-1
- ☐ blue marking
- ☐ check tightness
- ☐ secure with spring band clamps

17 - Gasket

- ☐ replace

18 - 20 Nm**19 - Conical bolt, 8 Nm****20 - Bracket**

- ☐ engine trim panel

21 - Lifting eye

- ☐ with engine trim panel holder

22 - Bracket

- ☐ coolant hose

23 - Cylinder head gasket

- ☐ replace
- ☐ pay attention to marking ⇒ Chap. 13-4

24 - 20 Nm**25 - Cylinder head**

- ☐ check for distortion ⇒ Fig. 1 in **15-1** page 2
- ☐ removing and installing ⇒ **15-1** page 3
- ☐ after replacing, fill entire system with fresh coolant

26 - Glow plug

- ☐ 15 Nm
- ☐ testing ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 28

27 - Unit injector

- ☐ removing and installing ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23

28 - Cylinder head bolt

- ☐ replace
- ☐ pay attention to specified order when slackening and tightening ⇒ **15-1** page 3
- ☐ if bearing caps of the camshaft are removed, insert special bases into the cylinder block before installing the cylinder head bolts ⇒ Chap. 15-2

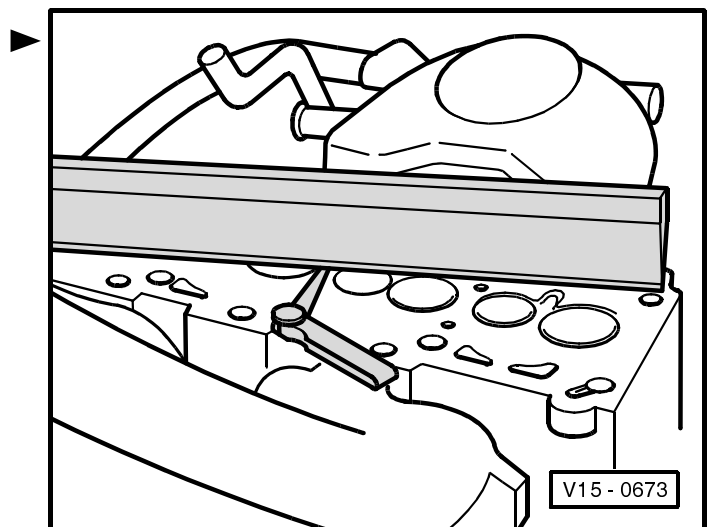
Fig. 1: Inspecting cylinder head for distortion**Special tools, test and measuring equipment and auxiliary items required**

- ♦ Feeler gauge
- ♦ Knife-edge straightedge

Max. permissible variation: 0.1 mm

**Note!**

It is not permissible to rework the cylinder heads of diesel engines.



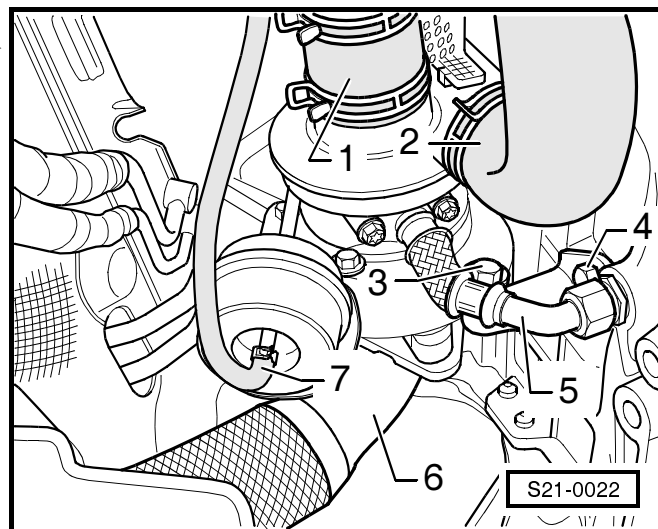
Removing and installing cylinder head

Special tools, test and measuring equipment and auxiliary items required

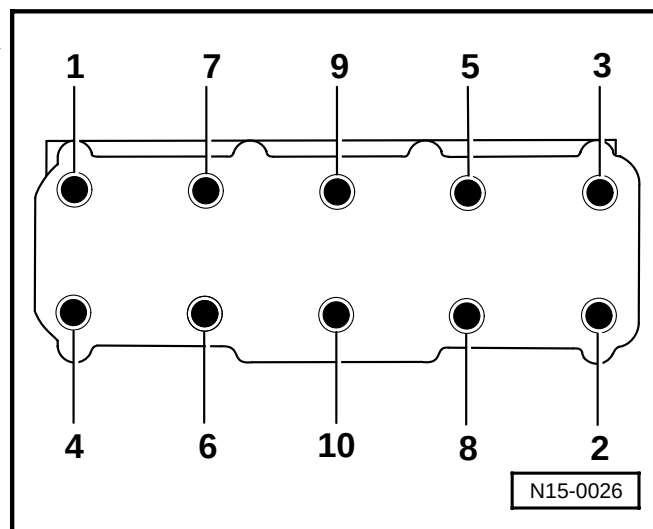
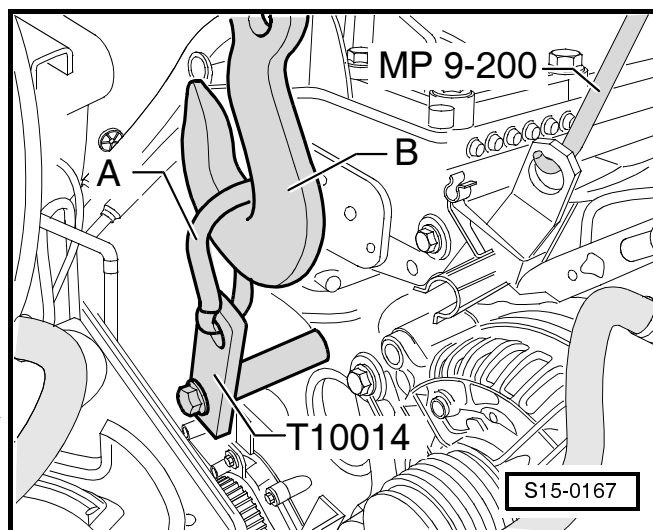
- ◆ Drip tray (e.g. -V.A.G 1306 -)
- ◆ Lifting device -MP 9-200-
- ◆ Bracket -T10014-
- ◆ Torque wrench
- ◆ Pliers for spring strap clips
- ◆ Snap hook
- ◆ Workshop crane

Removing

- On models fitted with a coded radio set, pay attention to the coding; determine if necessary.
- Disconnect the earth strap from the battery with the ignition off.
- Remove the noise insulation.
- Remove air filter with intake hose ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23.
- Remove battery and battery tray ⇒ Electrical System; Rep. Gr. 27.
- Remove top line and charge air connection line ⇒ Chap. 21-1.
- Separate connector of the glow plugs.
- Remove front exhaust pipe together with catalytic converter -6-.
- Detach hoses -1- and -2- from turbocharger. First of all, unbolt the charge air line from the bracket at the bottom of the engine ⇒ Chap. 21-1.
- Unbolt oil return-flow line at cylinder block -5-.
- Unscrew support bolt -3-, slacken bolt -4- and tilt the support down.
- Remove the vacuum hose -7- from the vacuum unit for charge pressure control.
- Drain coolant ⇒ Inspection and Maintenance
- Unbolt inlet connection from intake manifold and place to the side with hoses connected ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System ; Rep. Gr. 23.
- Slacken the bolts of the cylinder head cover.
- Use hand vacuum pump and bleeding bottle to extract the fuel from the return-flow hose of the tandem pump ⇒ Chap. 20-1.
- Detach fuel hoses from fuel pipes at cylinder head.
- Detach coolant hoses from cylinder head.
- Remove the central plug connection for unit injector.
- Unplug connector at fuel temperature sender - G81-.



- Unbolt oil feed line at the brackets for oil filter, turbo-charger and from the mounts.
- Unplug connector from coolant temperature sender -G62-.
- Separate vacuum hose from the tandem pump
⇒ item 13 in **15-1** page 1.
- Removing the toothed belt ⇒ Chap. 13-2.
- Turn the crankshaft back slightly out of the TDC position.
- Remove the camshaft timing gear and the hub
⇒ Chap. 15-3.
- Removing camshaft position sensor -G40- and toothed belt guard at rear ⇒ Chap. 13-2.
- After engine support is removed, screw bracket -T10014- with spring lock -A- into the threaded hole at front in the top part of coolant pump and take up weight of engine with workshop crane -B-.
- Remove supporting device -MP 9-200-.
- Slacken cylinder head bolts in the specified order and unscrew.
- Carefully remove the cylinder head.



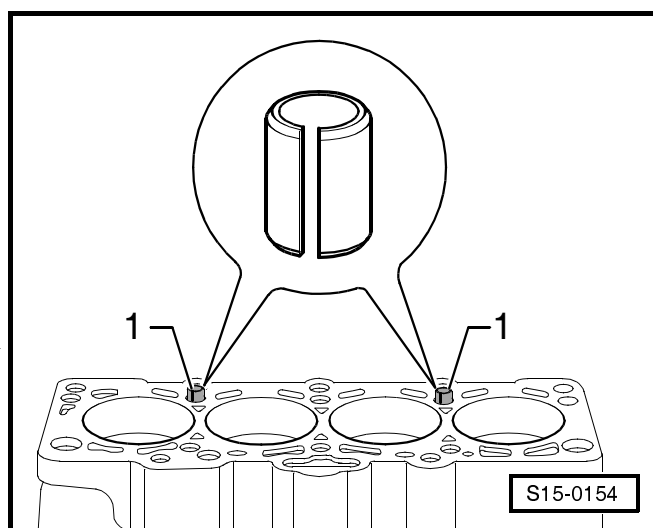
Note!

A second person is required for taking off and fitting on the cylinder head.

Installing

Note!

- ♦ Always replace the cylinder head bolts.
- ♦ There must not be any oil or coolant present in the holes for the cylinder head bolts.
- ♦ Remove the new cylinder head seal from its wrapping immediately before fitting.
- ♦ Carefully remove any gasket residues when carrying out repairs. When doing this, ensure that no scores or scratches are produced. When using emery paper the grain must not be less than 100.
- ♦ Carefully remove any emery and sanding residues.
- ♦ Treat the new seal with the utmost care. Any damage will result in leaks.
- Before fitting on the cylinder head, rotate crankshaft to the TDC marking.
- Turn the crankshaft in opposite direction of rotation of engine to the point where all the pistons are at the same level before TDC.
- Check whether both roll pins -1- intended for the lines at the cylinder head, are inserted into the cylinder block; insert if necessary.
- Fit on new cylinder head gasket. Text (part number) must be visible.



- Fit on cylinder head, insert all the cylinder head bolts and tighten by hand.
- Tighten cylinder head in four stages in the following order: ►

1. Pre-tension with torque wrench:

Stage I = 40 Nm
Stage II = 60 Nm

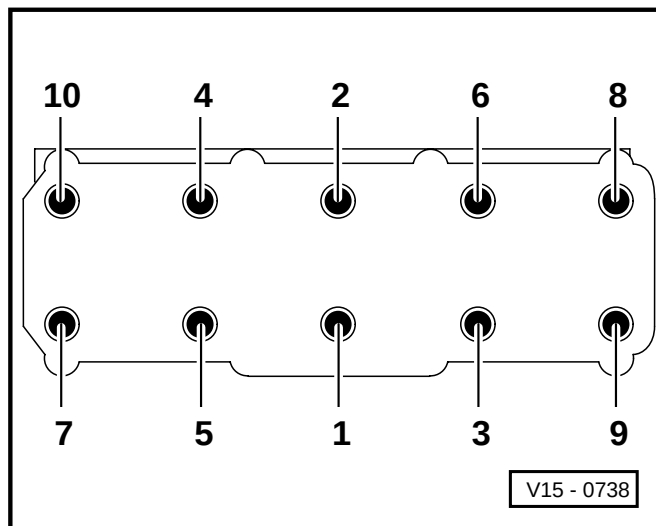
2. Tighten further with a rigid wrench:

Stage III = $\frac{1}{4}$ turn (90°)
Stage IV = $\frac{1}{4}$ turn (90°)

- After attaching the cylinder head or the camshaft sprocket, respectively, rotate camshaft so that the cams of cylinder 1 face up.

The further assembly is carried out in reverse order.

- Interrogate fault memory and erase $\Rightarrow$ 1.9-ltr./74 kW (TDI) - Engine, Fuel Injection and Ignition System; Rep. Gr. 01.



Testing compression

Test condition

- Engine oil temperature at least 30°C .

Special tools, test and measuring equipment and auxiliary items required

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

Test sequence

- Remove the noise insulation.
- Remove the central plug connection for unit injector.
- Remove all glow plugs with flexible-head wrench.
- Screw in adapters -V.A.G 1381/12- one after the other in place of the glow plugs. ►
- Test compression pressure with compression tester -V.A.G 1763-.

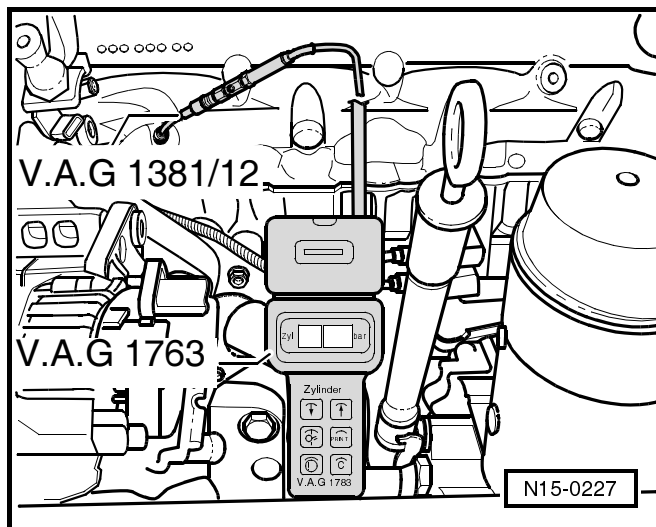


Note!

Use of tester $\Rightarrow$ Operating Instructions.

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

Compression readings:



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

- Install glow plugs with flexible-head wrench.
Tightening torque: 15 Nm
- Interrogate fault memory and erase ⇒ 1.9-ltr./74 kW (TDI) - Engine, Fuel Injection and Ignition System; Rep. Gr. 01.

**Note!**

Faults are stored as a result of separating the plug connection to the unit injector.

15-2 Repairing valve gear



Note!

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

1 - 20 Nm + torque a further $\frac{1}{4}$ turn (90°)

- ☐ replace

2 - Rocker arm support

- ☐ removing and installing
⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23

3 - Cylinder head bolt

- ☐ pay attention to sequence for slackening and tightening
⇒ Chap. 15-1
- ☐ before installing, insert washers ⇒ item 4 into the cylinder head

4 - Washer

- ☐ for cylinder head screws
- ☐ before installing the bearing cap, insert into the cylinder head

5 - Bucket tappets

- ☐ do not interchange
- ☐ with hydraulic valve clearance compensation
- ☐ lay aside with contact surface facing down
- ☐ before installing check axial play of the camshaft ⇒ Fig. 1 in **15-2** page 2
- ☐ oil contact surface
- ☐ before removing, take off camshaft bearing shell

6 - Collets

7 - Valve spring retainer

8 - Outer valve spring

- ☐ removing and installing:
 - ♦ Cylinder head removed ⇒ Chap. 15-1
 - ♦ Cylinder head installed ⇒ Chap. 15-4

9 - Inner valve spring

- ☐ removing and installing:
 - ♦ Cylinder head removed ⇒ Chap. 15-1
 - ♦ Cylinder head installed ⇒ Chap. 15-4

10 - Valve stem seal

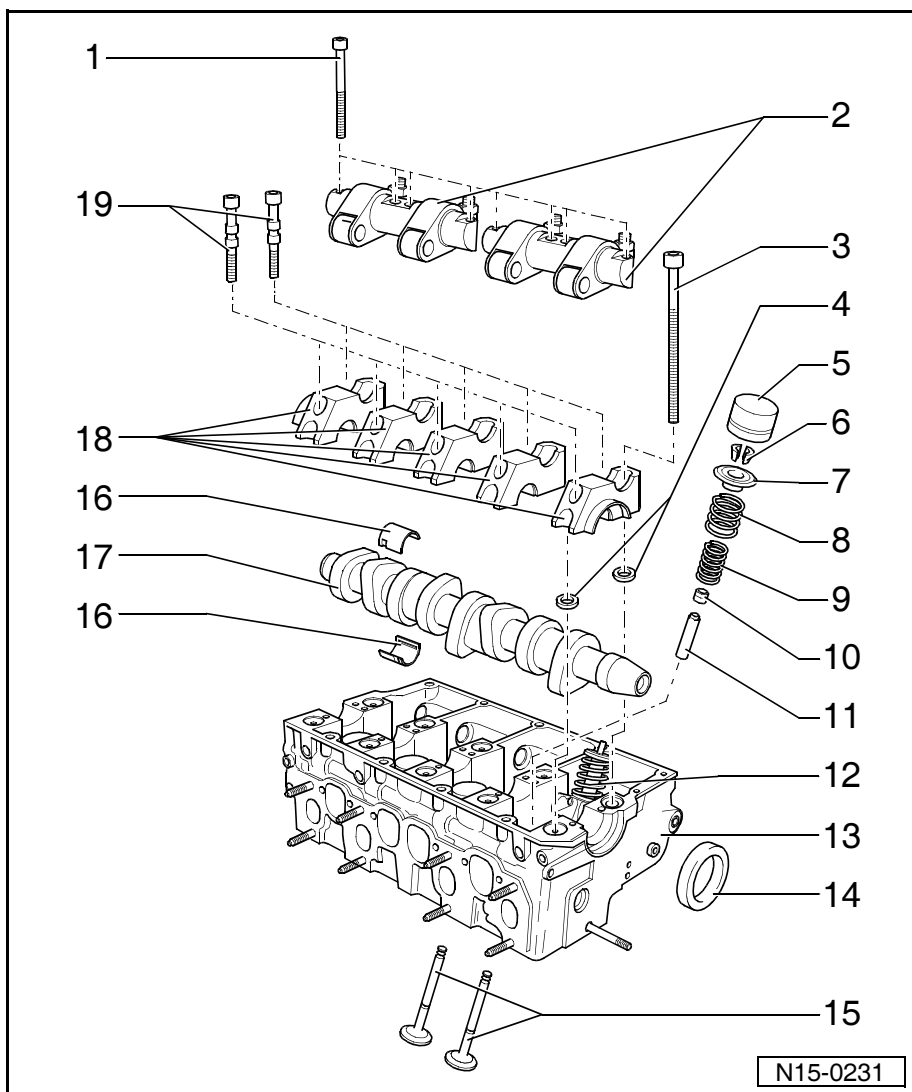
- ☐ replacing ⇒ Chap. 15-4

11 - Valve guide

- ☐ inspecting ⇒ Chap. 15-4
- ☐ if the wear limit is exceeded, replace cylinder head

12 - Unit injector

- ☐ removing and installing ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23



13 - Cylinder head

- ☐ pay attention to note ⇒ **15-2** page 1
- ☐ removing and installing ⇒ Chap. 15-1

14 - PTFE gasket ring

- ☐ do not lubricate and do not oil sealing lip of PTFE seal
- ☐ before installing, remove grease residues on the camshaft journal with a clean cloth
- ☐ before fitting on, fix in place the groove at the camshaft cone with adhesive tape (e. g. with Sellotape)
- ☐ removing and installing ⇒ Chap. 15-3

15 - Valves

- ☐ valve dimensions ⇒ Fig. 3 in **15-2** page 3

16 - Bearing shell

- ☐ do not mix up used bearing shells (mark)
- ☐ ensure the retaining lugs are correctly located in the bearing caps and in cylinder head

17 - Camshaft

- ☐ inspecting axial play ⇒ Fig. 1 in **15-2** page 2
- ☐ removing and installing ⇒ Chap. 15-3
- ☐ check radial clearance with Plastigage
- ☐ Wear limit: 0.11 mm
- ☐ slack: max. 0.04 mm
- ☐ Identification ⇒ Fig. 4 in **15-2** page 3

18 - Bearing caps

- ☐ Fitting sequence ⇒ Chap. 15-3
- ☐ seal contact surface of bearing caps 1 and 5 with sealant -AMV 174 004 01- ⇒ Fig. 2 in **15-2** page 3

19 - 8 Nm + torque a further 1/4 turn (90°)

- ☐ replace

Fig. 1: Inspecting axial play of camshaft**Special tools, test and measuring equipment and auxiliary items required**

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

Perform measurement with the bucket tappets removed and the first, third and last bearing cap fitted.

Wear limit: max. 0.15 mm.

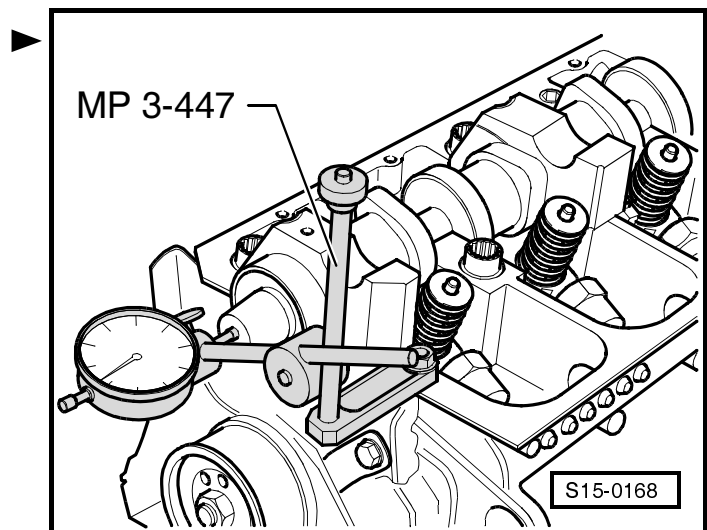
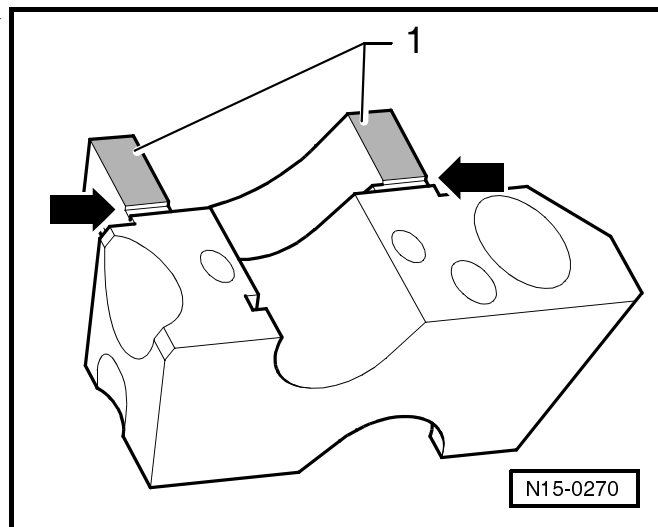


Fig. 2: Seal contact surface of bearing caps 1 and 5 with sealant -AMV 174 004 01-

- Apply a thin layer of sealant -AMV 174 004 01- evenly to the sealing surfaces -1-.

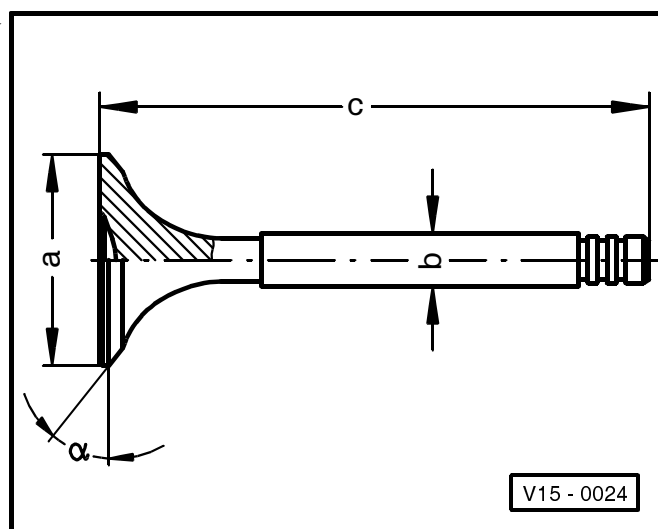
**Note!**

Ensure that no sealant gets into the slots -arrows-.

**Fig. 3: Valve dimensions****Note!**

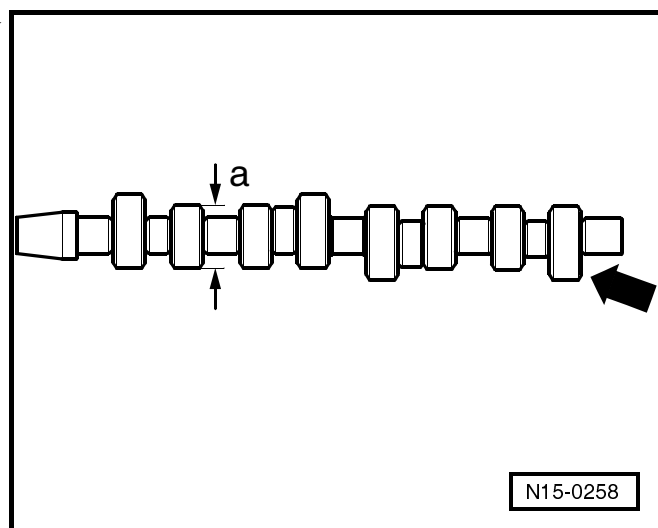
Valves must not be reworked. Only grinding in is permissible.

Di- men- sion		Inlet valve	Outlet valve
$\varnothing a$	mm	35,95	31,45
$\varnothing b$	mm	6,980	6,956
c	mm	89,95	89,95
α	$^{\circ}$	45	45

**Fig. 4: Camshaft identification****Camshaft identification**

- Base circle of cam: $a = \varnothing 52.8$ mm
- Camshaft is marked on the face of the cam for exhaust valve cylinder 4 by stamped numbers and letters.

Cylinder 4 -arrow-	038 R or 858 R
--------------------	----------------------



15-3 Camshaft

Removing and installing camshaft

Special tools, test and measuring equipment and auxiliary items required

- ◆ Pressure pad -T10051-
- ◆ Extractor -T10052-
- ◆ Torque wrench
- ◆ Sealant -AMV 174 004 01-

Removing

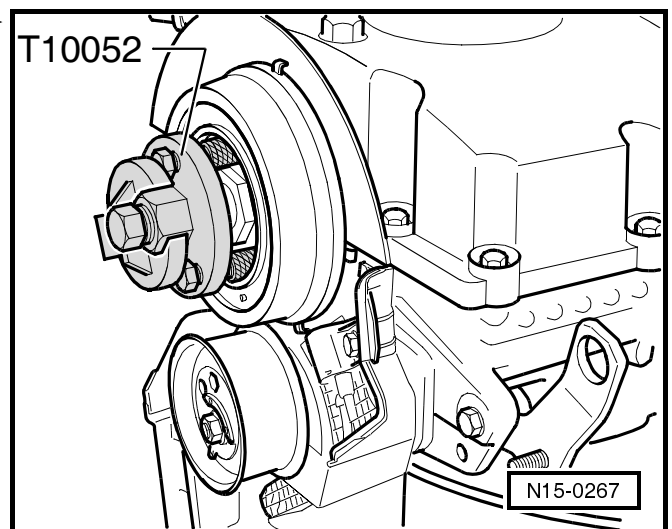
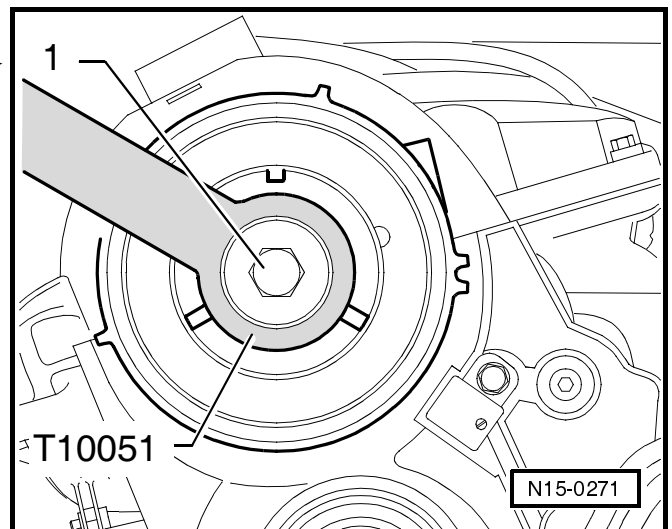
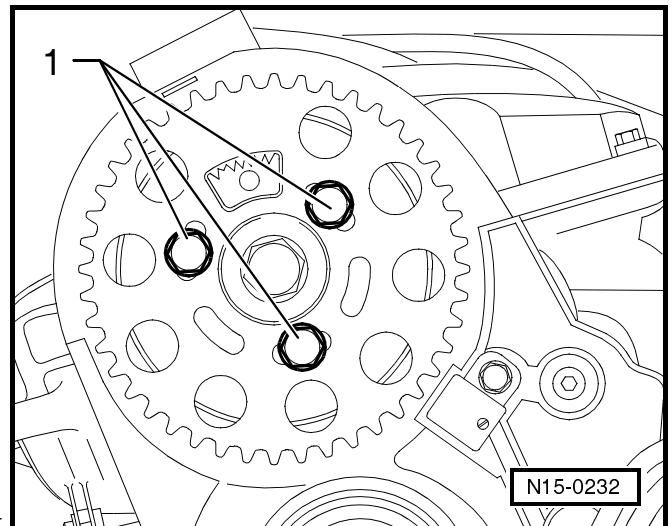
- Removing the toothed belt ⇒ Chap. 13-2.
- Unscrew bolts -1- attaching camshaft sprocket. ▶
- Take camshaft sprocket off the hub.
- Use counterholder -T10051- to slacken the bolt -1- attaching the hub. ▶
- Turn bolt attaching the hub out about 2 turns.
- Fit on pulling device -T10052- and centre hub holes. ▶
- Detach hub from taper of camshaft by evenly tightening the pulling device.



Note!

Hold pulling device with the wrench OK 30.

- Remove hub from taper of camshaft.
- Remove cylinder head cover.
- Remove rocker arm support ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23.
- Remove tandem pump ⇒ Chap. 20-1.
- First remove bearing caps 5, 1 and 3. Detach bearing caps 2 and 4 alternately (diagonally across).



Installing

Note!

- ◆ When fitting the camshaft the cams of cylinder 1 must point upwards.
- ◆ Do not mix up used bearing shells (mark)
- ◆ When installing the camshaft, ensure it is correctly located in the retaining lugs of the bearing shells in the bearing caps and in the cylinder head.
- ◆ Before installing the bearing cap, ensure that the washers for the cylinder head bolts at the cylinder head are fitted on.

- Oil the contact surfaces of the bearing shells.
- Tighten bearing caps 2 and 4 alternately diagonally across and tighten to a final torque of 8 Nm and torque a further $\frac{1}{4}$ (90°).
- Install bearing caps 5, 1 and 3 and likewise tighten to 8 Nm and torque a further $\frac{1}{4}$ (90°).

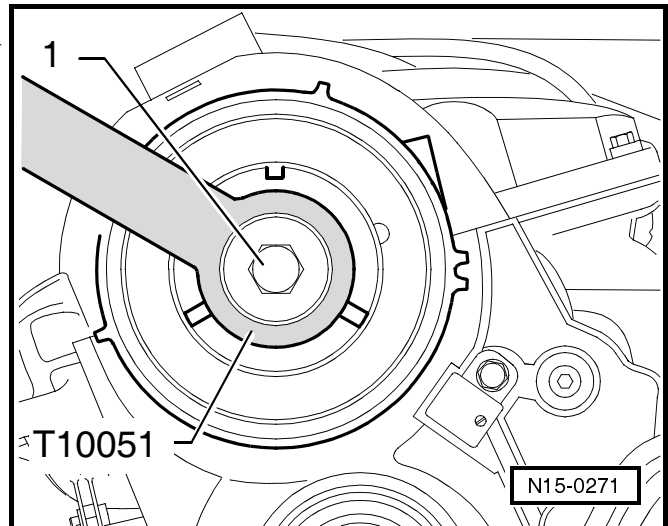
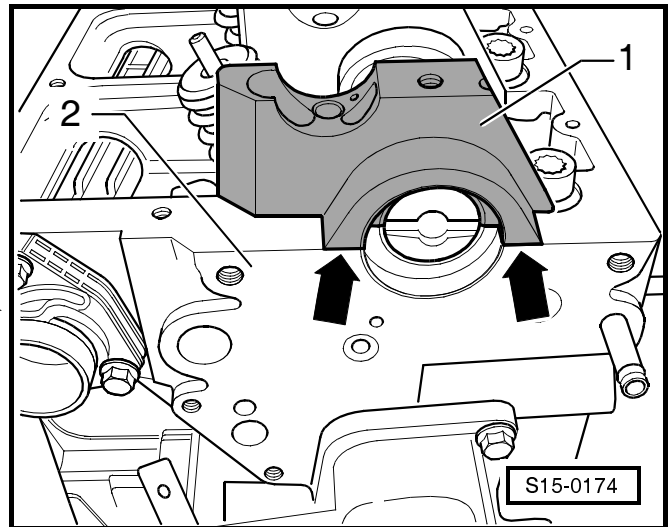
Note!

- ◆ Seal contact surface of bearing caps 1 and 5 with sealant -AMV 174 004 01- ⇒ Chap. 15-2.
- ◆ Bearing cap 5 -1- must be aligned with outer edge of cylinder head -2- -arrows-, if not, this can result in leaks in the tandem pump.

- Install camshaft seal ⇒ **15-3** page 3.
- Install rocker arm support ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23.
- Fit hub onto camshaft.
- Use counterholder -T10051- to tighten the bolt -1- attaching the hub.

Tightening torque: 100 Nm.

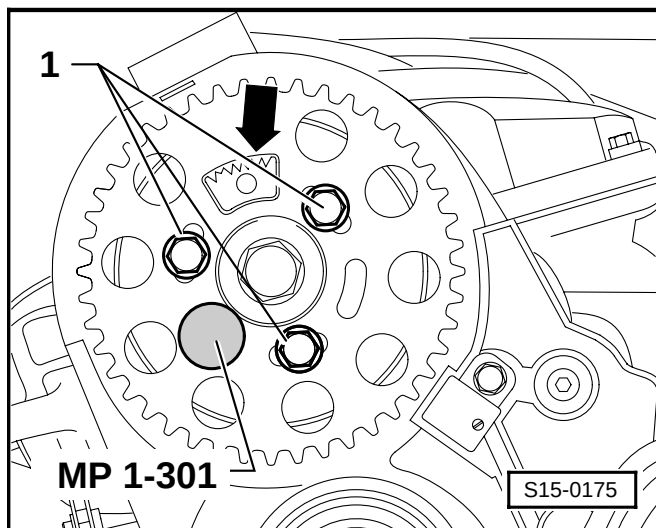
- Push camshaft sprocket onto hub.



Note!

Tooth segment -arrow- of camshaft sprocket must be facing up. ►

- Align belt pulley at the camshaft so that the slots are in the middle position.
- Fit the bolts -1- attaching the camshaft sprocket on by hand so that no play exists.
- Lock hub with locking pin -MP 1-301-.
- Tighten bolts -1- attaching camshaft sprocket to 20 Nm + torque a further $\frac{1}{8}$ turn (45°).
- Install toothed belt and tension ⇒ Chap. 13-2.
- Install tandem pump ⇒ Chap. 20-1.

**Note!**

After installing new bucket tappets, the engine must not be started for about 30 minutes. The hydraulic clearance compensation elements must settle (otherwise valves would strike the pistons).

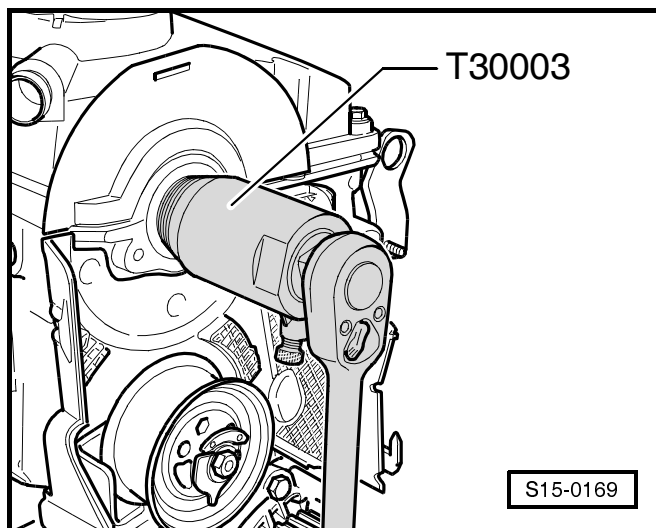
Removing and installing gasket ring for camshaft

Special tools, test and measuring equipment and auxiliary items required

- ◆ Seal installation tool - MP 1-214-
- ◆ Seal extractor -T30003-
- ◆ Torque wrench
- ◆ Screw -M12x65-

Removing

- Removing the toothed belt ⇒ Chap. 13-2.
- Remove camshaft sprocket and hub ⇒ **15-3** page 1.
- Turn inner part of gasket ring extractor -T30003- two turns (approx. 3 mm) out of the outer part and lock with knurled screw.
- Oil the thread head of the gasket ring extractor, position and forcibly screw into the gasket ring as far as possible. ►
- Slacken knurled screw and turn inner part of seal extractor against the camshaft until the seal is pulled out.



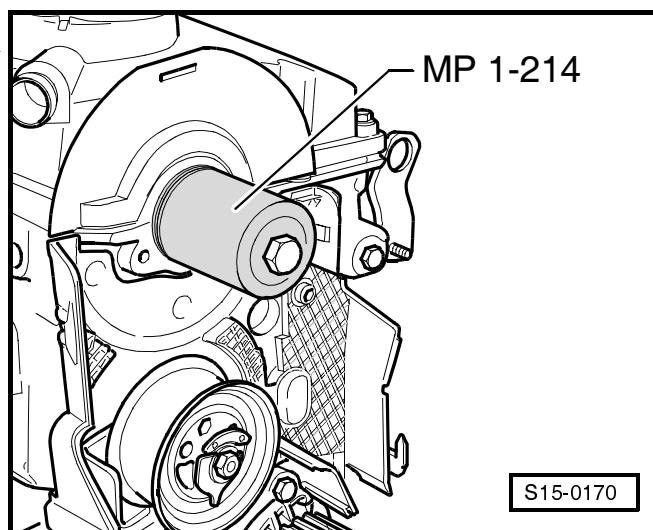
Installing

Note!

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

- Remove residues of oil on the camshaft with cleaning cloth.

- Stick over groove on camshaft cone with adhesive tape (e. g. with Sellotape).
- Carefully fit seal onto camshaft.
- Install seal with seal installation tool -MP 1-214- and bolt -M12x65- as far as the stop. ►
- Install camshaft sprocket and hub ⇒ **15-3** page 2.
- Install toothed belt and tension ⇒ Chap. 13-2.



15-4 Valve seats, valves guides, valve stem seals

Grinding in valve seats



Note!

- ♦ Inspecting valve guides ⇒ **15-4** page 2. If the wear limit is exceeded, repeat measurement with new valves. If the wear limit is again exceeded, replace cylinder head.
- ♦ Calculating max. permissible reworking dimension ⇒ **15-4** page 1. If the wear limit is exceeded, repeat measurement with new valves. If the wear limit is again exceeded, replace cylinder head.
- ♦ Do not re-mill valve seats. Only grinding in of valves is permissible.

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

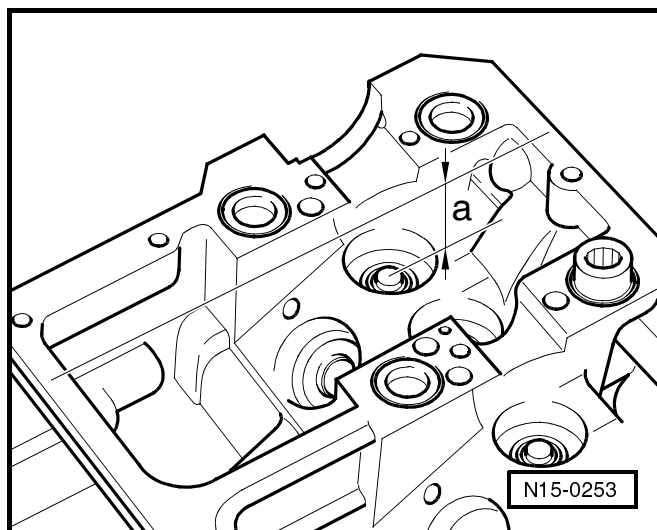
Minimum dimension:

- ♦ Inlet valve 43.4 mm
- ♦ Exhaust valve 43.2 mm

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

Example:

Measured distance	44.1 mm
- Minimum dimension	43.4 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 still 0 mm, replace cylinder head.

Inspecting valve guides

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

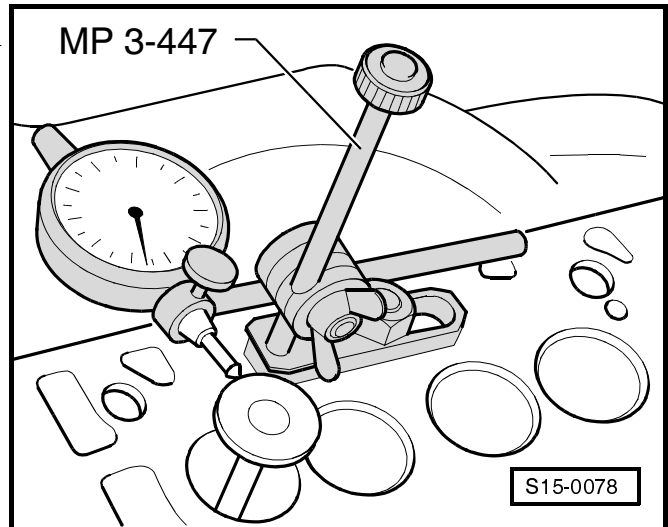
- Insert valve into guide. Valve stem end must be flush with guide. ►

Valve rock: max. 1.3 mm



Note!

- ◆ Because of the different stem diameters only use inlet valve in inlet guide or outlet valve in outlet guide.
- ◆ If the wear limit is exceeded, repeat measurement with new valves. If the wear limit is again exceeded, replace cylinder head.
- ◆ If the valve is replaced when carrying out repair work, use a new valve for the measurement.



Replacing valve stem seals

- Cylinder head fitted

Special tools, test and measuring equipment and auxiliary items required

- ◆ Assembly lever with pressure plate -MP 1-211-
- ◆ Assembly device -MP 1-213-
- ◆ Extractor -MP 1-206-
- ◆ Seal insertion tool -MP 1-306-

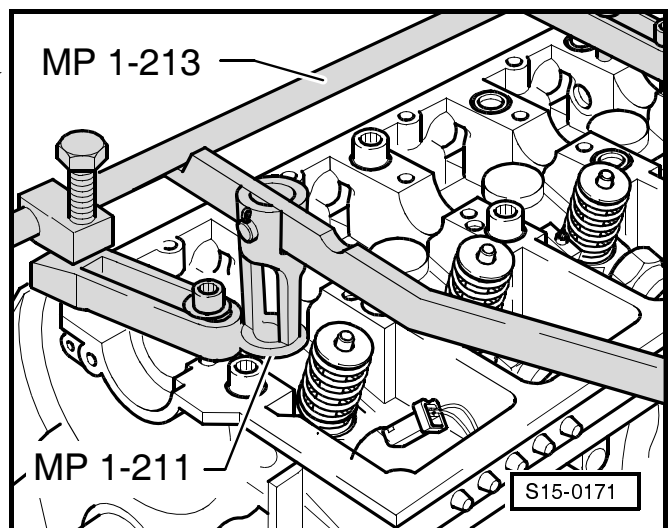
Removing

- Removing camshaft ⇒ Chap. 15-3.
- Remove bucket tappets (do not interchange) and lay aside with the contact surface facing down.
- Position piston of the relevant cylinder to top dead centre.
- Insert assembly device -MP 1-213- and adjust bearing ► to stay bolt height.
- Remove valve springs with assembly lever and thrust piece -MP 1-211-.

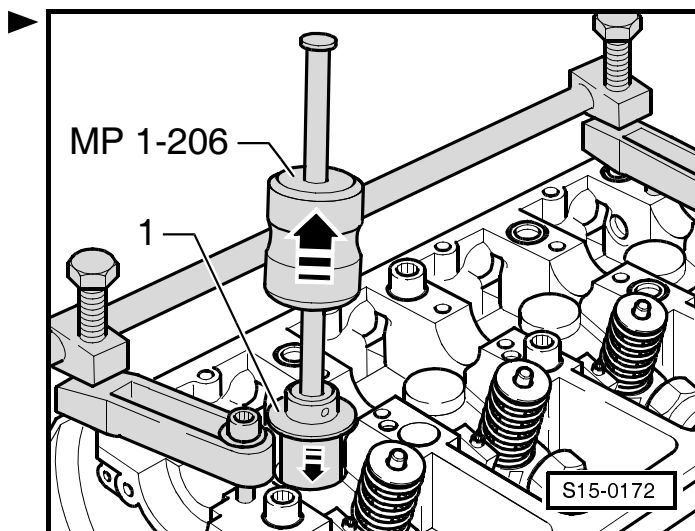


Note!

The valves rest on the piston crown.



- Pull off valve stem seals with -MP 1-206-.
- Press sleeve -1- down slightly during this step.



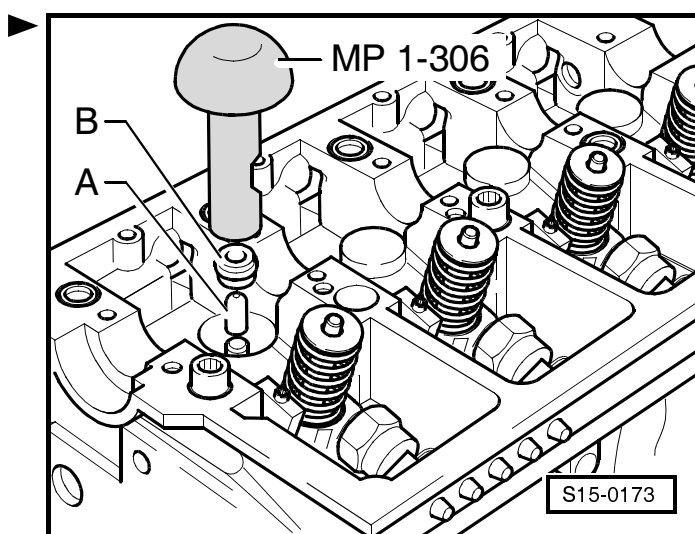
Installing

- 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 insertion tool -MP 1-306- and carefully push onto the valve guide.



Note!

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



17 – Lubrication

17-1 Removing and installing parts of the lubrication system



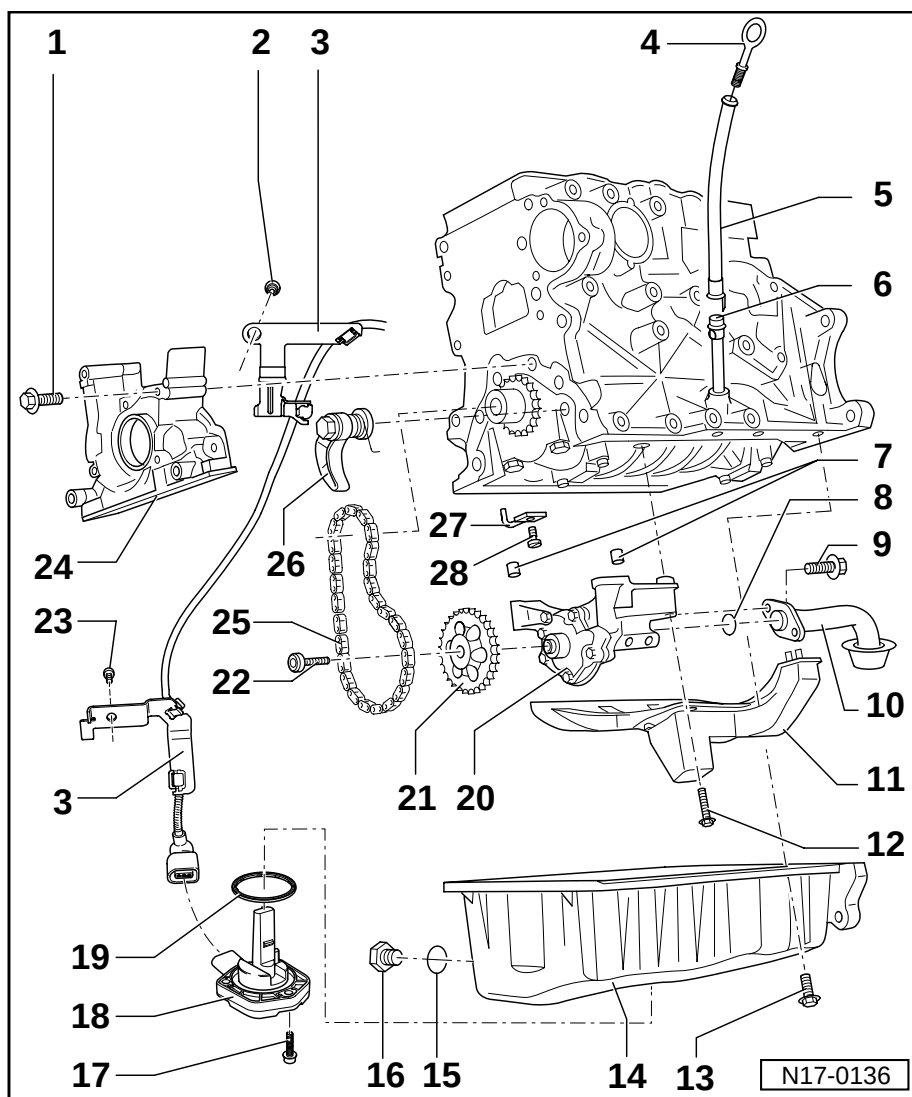
Note

- ♦ If considerable quantities of metal swarf or abrasion is found in the engine oil when carrying out engine repairs, carefully clean the oil galleries in order to avoid consequential damage and additionally replace the oil cooler.
- ♦ Testing oil pressure and oil pressure switch ⇒ Chapter 17-3.
- ♦ The oil level must never exceed the „max“ marking - risk of damage to catalytic converter!

Check the engine oil, amount of oil and oil specification:

⇒ Inspection and Maintenance

- 1 - 15 Nm
- 2 - 15 Nm
- 3 - Bracket
 - ☐ for cable to oil level and oil temperature sender
- 4 - Dipstick
 - ☐ oil level must not exceed „max“ marking!
- 5 - Filler funnel
 - ☐ remove for extracting oil
- 6 - Guide tube
- 7 - Fitting sleeve
 - ☐ for centering oil pump/cylinder block
- 8 - O-ring
 - ☐ replace
- 9 - 15 Nm
- 10 - Intake manifold
 - ☐ clean strainer if dirty
- 11 - Baffle
- 12 - 15 Nm
- 13 - 15 Nm
- 14 - Oil pan
 - ☐ before installing, coat with silicone sealant
 - D 176 404 A2 - ⇒ Chapter 17-2
- 15 - Gasket
 - ☐ replace
- 16 - Oil drain plug, 30 Nm
- 17 - 10 Nm
- 18 - Oil level and oil temperature sender -G266 -
 - ☐ test ⇒ Electrical System; Rep. Gr. 90
- 19 - Gasket
 - ☐ replace



20 - Oil pump

- ☐ with pressure relief valve 1.2 MPa
- ☐ before installing, check whether both dowel sleeves for centering oil pump/cylinder block are present
- ☐ if there is any scoring on contact surfaces and gears, replace

21 - Oil pump sprocket

- ☐ fits onto oil pump shaft in one position only

22 - 25 Nm**23 - 15 Nm****24 - Sealing flange**

- ☐ before installing, it must not be dirty
- ☐ before installing, coat with silicone sealant -D 176 404 A2 - ⇒ Chapter 13-3
- ☐ replacing crankshaft seal ⇒ Chapter 13-3

25 - Oil pump chain**26 - Chain tensioner, 15 Nm**

- ☐ when installing, tension and attach

27 - Oil injection nozzle

- ☐ for piston cooling
- ☐ pay attention to the SP No. (right-angle bend)

28 - 27 Nm

17-2 Removing and installing oil pan

Special tools, test and measuring equipment and auxiliary items required

- ♦ Hinged wrench -3185-
- ♦ Socket insert -3249-
- ♦ Hand drill with plastic brush attachment
- ♦ Flat scraper
- ♦ Torque wrench
- ♦ Silicone sealant - D 176 404 A2-

Removing

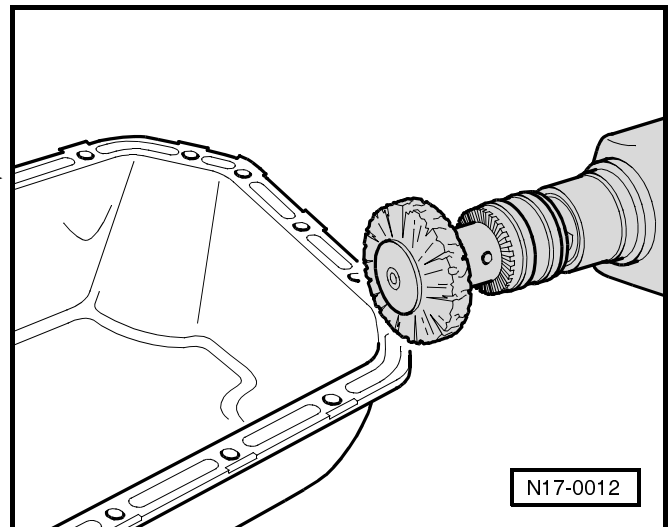
- Remove the noise insulation.
- Drain engine oil ⇒ Inspection and Maintenance.
- Unplug connector of oil level and oil temperature sender.
- Unbolt oil pan.



Note!

Use hinged wrench -3185- to slacken oil pan bolts at fly-wheel side and unscrew with socket insert -3249-.

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

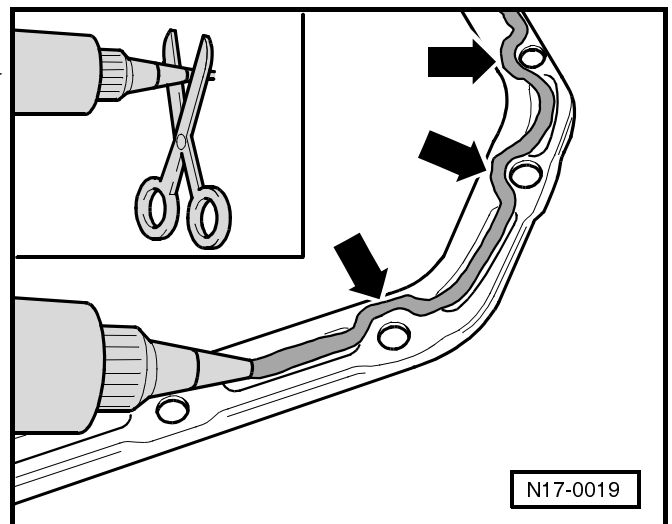


Installing



Note!

- ♦ The oil pan must be installed within 5 minutes after applying the silicone sealant.
- ♦ Use wrench socket -3249- to insert the oil pan bolts at flywheel side and tighten with hinged wrench -3185-.
- Cut off tube of nozzle of silicone sealant D 176 404 A2 at the front marking (Ø of nozzle about 3 mm).
- ♦ Thickness of sealant bead: 2...3 mm.
- ♦ The sealant must be run past on the inside in the area of the bolt holes -arrows-.



Note!

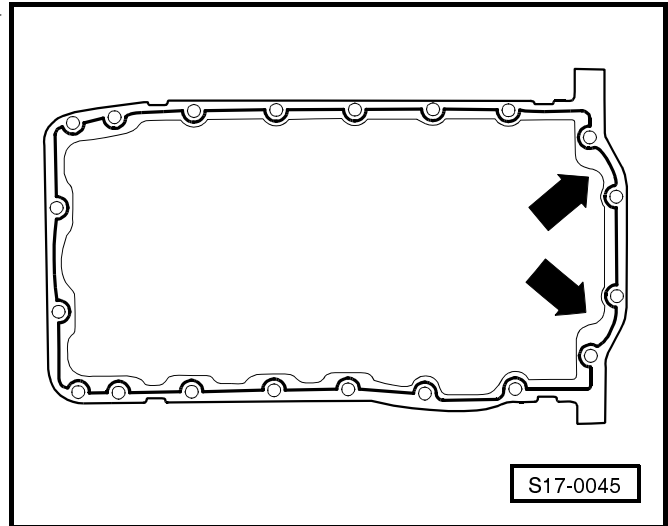
The sealant bead must not be thicker than 3 mm otherwise excess sealant may get into the oil pan and lock the strainer in the oil inlet pipe.

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

i Note!

Take particular care when applying sealant bead in the area of the sealing flange at the rear -arrows-.

- Fit on oil pan immediately and tighten the bolts as follows:
 - 1 - Tighten all the bolts of oil pan/cylinder block slightly diagonally across.
 - 2 - Tighten the three bolts of oil pan/cylinder block slightly.
 - 3 - Tighten all the bolts of oil pan/cylinder block slightly diagonally across.
 - 4 - Tighten the three bolts of oil pan/gearbox fully to 45 Nm.
 - 5 - Tighten all the bolts of oil pan/cylinder block diagonally across to 15 Nm.



i Note!

- ♦ *When installing the oil pan on a removed engine, ensure that the oil pan ends flush at the flywheel side with the cylinder block.*
- ♦ *After installing the oil pan, allow the sealant to dry for about 30 minutes. Only then may engine oil be filled in.*

17-3 Testing oil pressure and oil pressure switch

Special tools, test and measuring equipment and auxiliary items required

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

Function of dynamic oil pressure warning system if oil pressure low

The oil pressure switch is opened when pressureless and closed when the switching pressure is reached.

The oil pressure warning is activated for about 10 seconds after the ignition is switched on („terminal 15 on“). Activation delay of oil pressure warning system: max. 3 seconds De-activation delay of the oil pressure warning system: max. 5 seconds

Test warning light



Note

Not applicable to models with a dot display.

After the ignition is switched on and engine not running, the oil pressure warning light in the dash panel insert must come on for about 3 seconds and then go out. The check is ended when the engine is started.

Warning criteria

The visual oil pressure warning is switched on (oil pressure warning light flashes) and the buzzer sounds 3 times as an audible warning if one of the following conditions exists:

- „Ignition on“, engine not running, oil pressure switch closed
- Engine speed greater than 1500 rpm, oil pressure switch opened
- At an engine speed greater than 5000 rpm, the oil pressure warning is not cancelled, also not if the oil pressure switch is closed. The oil pressure warning is cancelled once engine speed is below 5000 rpm.
- If the oil pressure switch is opened for only 0.5 to 3 seconds at an engine speed of more than 1500 rpm, this is stored in the dash panel insert. If this situation occurs 3 times when the engine is running, the oil pressure warning is immediately activated and is also not cancelled once engine speed is below 1500 rpm. The oil pressure warning is cancelled once the oil pressure switch is closed for more than 5 seconds at an engine speed of more than 1500 rpm, or if the ignition is switched off.

Test conditions

- Inspect engine oil level to ensure that it is OK
⇒ Inspection and Maintenance
- Oil pressure warning light (-K3-) must come on for about 3 seconds when ignition is switched on.
- Engine oil temperature at least 80 °C (radiator fan must have run at least once).

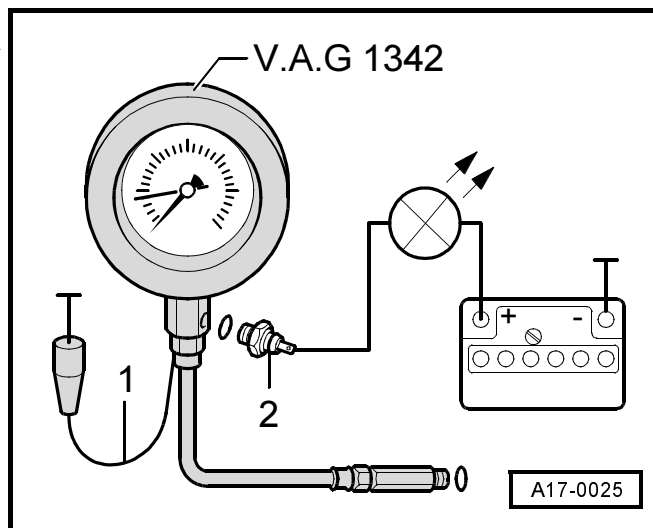
Test sequence

- Unplug connector from oil pressure switch.
- Unscrew oil pressure switch and screw in oil pressure tester (e.g. -V.A.G 1342-). ►
- Screw oil pressure switch -2- into -V.A.G 1342 -.
- Connect brown cable -1- of tester to earth (-).
- Connect diode test lamp to oil pressure switch -2- and to the battery positive (+).

The LED must not light up.

- If the LED lights up, replace the oil pressure switch.
- Start engine and slowly increase engine speed.
- The LED must come on at an overpressure of 0.55...0.85 bar (0.055...0.085 MPa). The oil pressure switch must be replaced if it does not come on.
- Increase engine speed further. At an engine speed of 2000 rpm and oil temperature of 80 °C, the oil pressure must be at least 2 bar (0.2 MPa).

At higher engine speeds the oil pressure must not be greater than 7 bar (0.7 MPa). Replace oil pump bracket together with pressure relief valve, if necessary.



19 – Cooling

19-1 Parts of cooling system - Summary of components



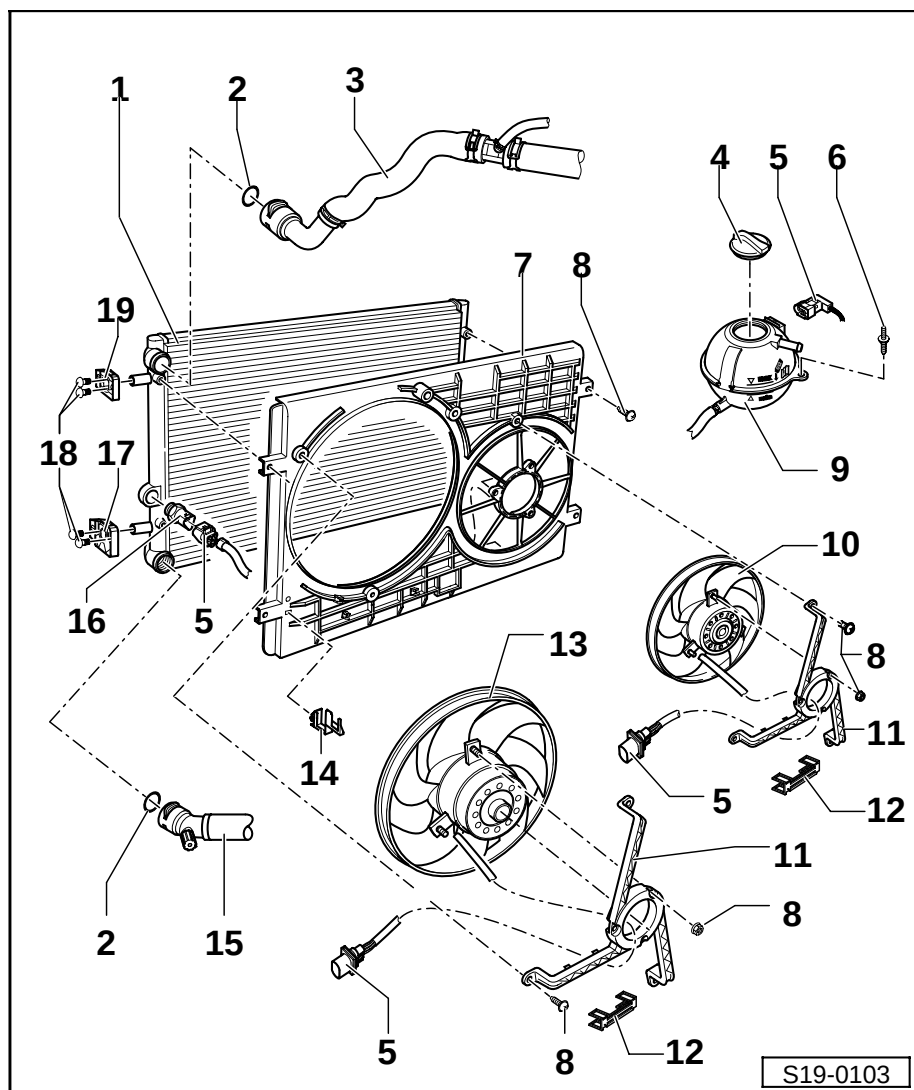
Note!

- ♦ When the engine is warm the cooling system is under pressure. If necessary reduce pressure before repairs.
- ♦ The hose connections are secured with spring-type clips. In the event of repairs only use spring-type clips.
- ♦ Always replace seals and gasket rings.
- ♦ Route coolant hoses free of stress when installing without allowing them to touch other components (pay attention to marking on coolant connection and on hose).

Connection diagram for coolant hoses ⇒ **19-1** page 3

Parts of the cooling system fitted to body

- 1 - Radiator**
 - ☐ removing and installing
⇒ Chap. 19-2
 - ☐ after replacing, fill entire system with fresh coolant
- 2 - O-ring**
 - ☐ replace
- 3 - Top coolant hose**
 - ☐ secured at radiator with clamps
- 4 - Closing cover**
- 5 - Connecting plug**
- 6 - Double screw, 2 Nm**
- 7 - Air guide scoop**
- 8 - 5 Nm**
- 9 - Expansion reservoir**
- 10 - Auxiliary fan**
 - ☐ on vehicles with air conditioning, or additional equipment
- 11 - Ventilator bracket**
- 12 - Retaining clip**
 - ☐ for ventilator cable
 - ☐ check tightness
- 13 - Fan for radiator**
- 14 - Bracket**
 - ☐ fan connector
- 15 - Bottom coolant hose**
 - ☐ secured at radiator with clamps



16 - Thermostwitch for radiator fan -F18-, 35 Nm

☐ Switching temperatures:

1ststage

◆ on: 91...97 °C

◆ off: 84...91 °C

2ndstage

◆ on: 99...105 °C

◆ off: 91...98 °C

17 - Bottom radiator bearing

☐ black

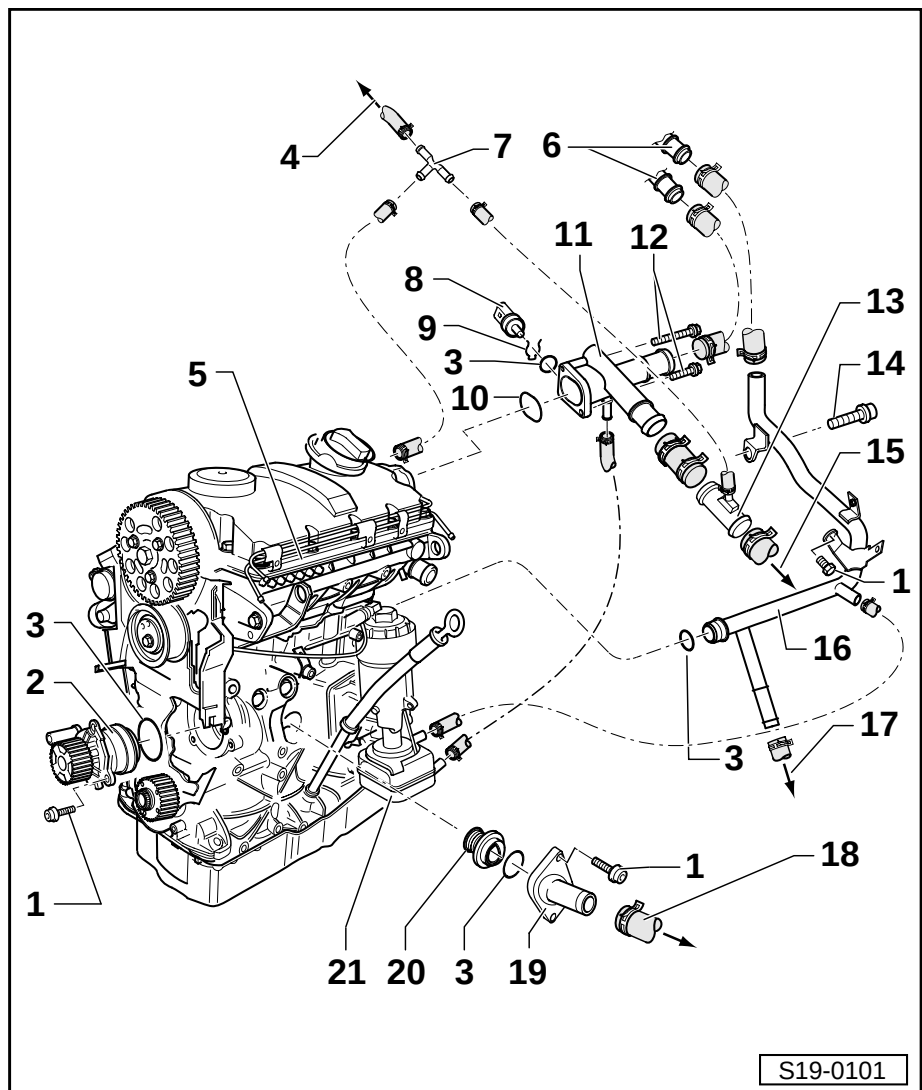
18 - 10 Nm**19 - Top radiator bearing**

☐ white

Parts of cooling system engine side

Connection diagram for coolant hoses ⇒ **19-1** page 3

- 1 - 15 Nm**
- 2 - Coolant pump**
 - ☐ check smooth operation
 - ☐ Check fitting position
 - ☐ removing and installing
⇒ Chap. 19-2
- 3 - O-ring**
 - ☐ replace
- 4 - To expansion reservoir (top)**
- 5 - Top coolant pipe**
 - ☐ screwed onto the cylinder head cover
- 6 - Connection fitting**
 - ☐ for heat exchanger
- 7 - Distributor part**
- 8 - Sender for coolant temperature -G62-**
 - ☐ testing ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 28
- 9 - Retaining clip**
 - ☐ check tightness
- 10 - Seal**
 - ☐ check tightness
 - ☐ replace
- 11 - Connection fitting**
 - ☐ at cylinder head
- 12 - 10 Nm**
- 13 - Distributor part**
- 14 - 40 Nm**
- 15 - Towards top radiator**
- 16 - Coolant pipe**
- 17 - to expansion reservoir (bottom)**



18 - to bottom radiator

19 - Connection fitting

❑ to coolant thermostat

20 - Coolant thermostat

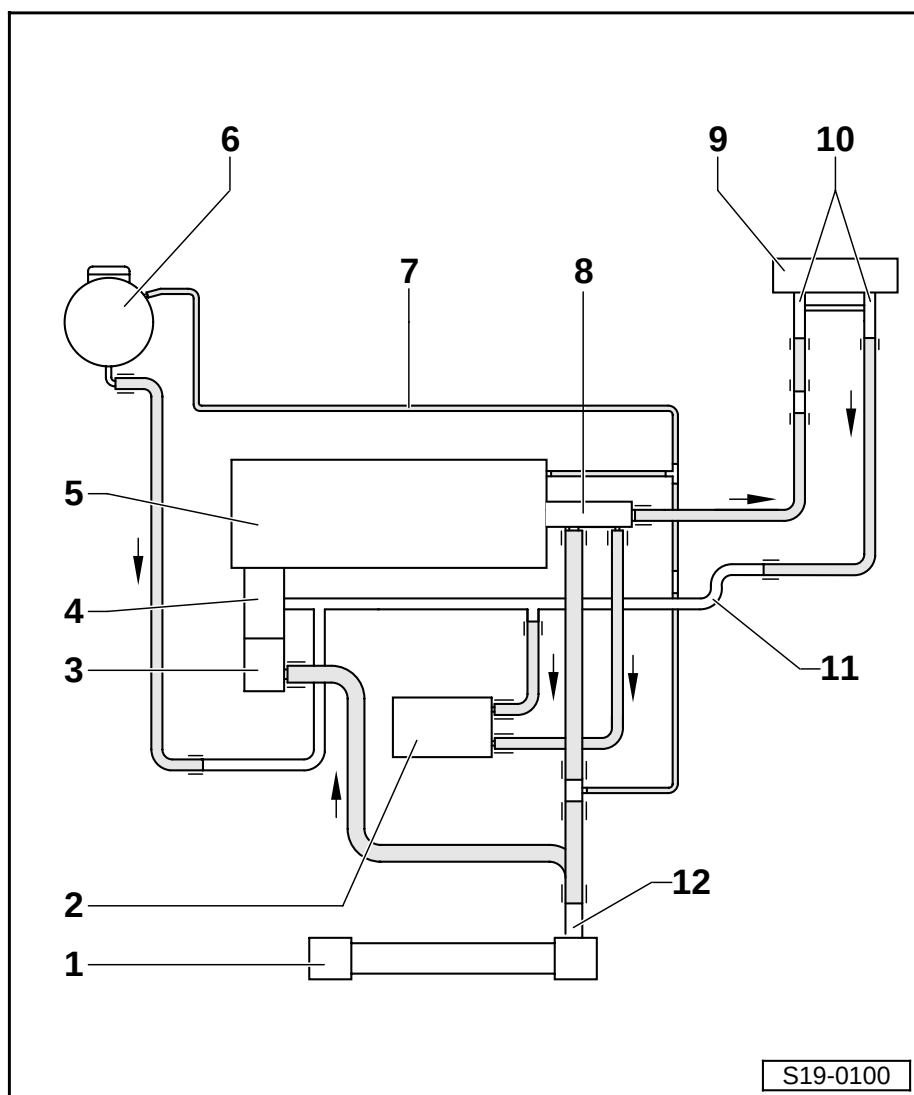
❑ removing and installing ⇒ Chap. 19-2

21 - Oil cooler

❑ removing and installing ⇒ Chap. 17-1

Connection diagram for coolant hoses

- 1 - Radiator
- 2 - Oil cooler
- 3 - Coolant thermostat
- 4 - Coolant pump
- 5 - Cylinder block
- 6 - Expansion reservoir
- 7 - Top coolant pipe
- 8 - Connection fitting
- 9 - heat exchanger for heating
- 10 - Connection fitting
- 11 - Coolant pipe



Draining and filling up coolant

Changing coolant ⇒ Inspection and Maintenance

Checking the coolant system for tightness

⇒ 1.9-ltr./66 kW Engine - Mechanical Components;
Rep. Gr. 19

19-2 Removing and installing radiator, coolant pump and coolant thermostat

Removing and installing radiator

⇒ 1.9-ltr./66 kW Engine - Mechanical Components;
Rep. Gr. 19

Removing and installing coolant pump

Special tools, test and measuring equipment and auxiliary items required

- ◆ Drip tray (e.g. -V.A.G 1306 -)
- ◆ Torque wrench

Removing



Note!

Always replace seals and gasket rings.

- Drain coolant ⇒ Inspection and Maintenance
- Removing the toothed belt ⇒ Chap. 13-2.
- Unscrew bolts -1- attaching coolant pump and carefully remove coolant pump -2-.

Installing

The installation occurs in reverse order, while paying attention to the following:

- Clean sealing surface for O-ring.
- Moisten new O-ring -3- with coolant and fit onto coolant pump.
- Position the coolant pump -2- in the cylinder block and tighten the fixing screws -1-.

Tightening torque: 15 Nm



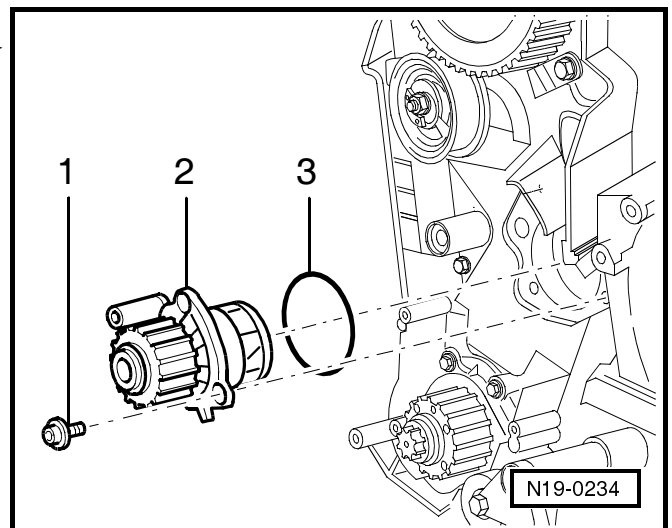
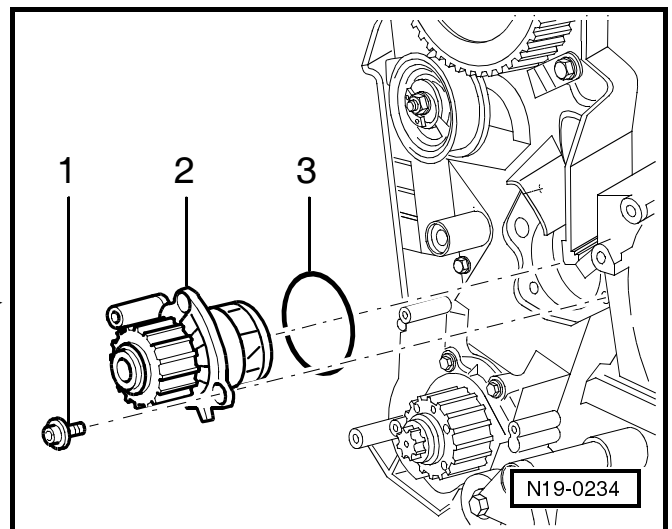
Note!

Plugs of coolant pump point down.

Removing and installing coolant thermostat

Special tools, test and measuring equipment and auxiliary items required

- ◆ Drip tray (e.g. -V.A.G 1306 -)
- ◆ Torque wrench
- ◆ Pliers for spring strap clips



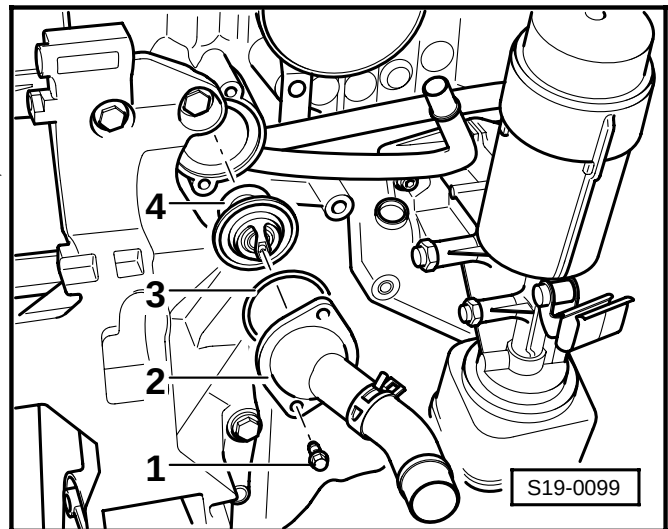
Removing



Note!

Always replace seals and gasket rings.

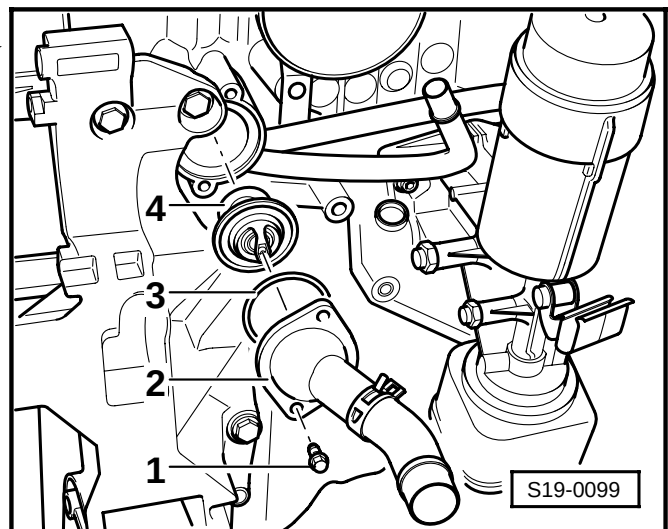
- Drain coolant ⇒ Inspection and Maintenance
- Remove vacuum reservoir.
- Detach coolant hose from connection -2-.
- Unscrew bolts -1- attaching connection and remove connections -2- together with coolant thermostat -4-.
- Turn coolant thermostat -4- $\frac{1}{4}$ turn (90°) to the left and separate plug connection -2-.



Installing

Carry out the installation in the same way in reverse order. Pay attention to the following:

- Clean sealing surface for O-ring.
- Moisten new O-ring -3- with coolant and fit onto connection -2-.
- Insert coolant thermostat -4- into connection -2- and turn $\frac{1}{4}$ turn (90°) to the right.



Note!

Coolant thermostat arms must be practically vertical.

- Insert connection -2- together with coolant thermostat -4- into the cylinder block.
- Tighten securing bolts -1-.

Tightening torque: 15 Nm

20 – Fuel supply

20-1 Removing and installing parts of the fuel supply system

Assembly overview - Fuel tank with attached parts

⇒ 1.9-ltr./66 kW Engine - Mechanical Components;
Rep. Gr. 20

Removing and installing fuel gauge sender

⇒ 1.9-ltr./66 kW Engine - Mechanical Components;
Rep. Gr. 20

Servicing fuel filter

⇒ 1.9-ltr./66 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 23

Removing and installing fuel cooler

Special tools, test and measuring equipment and auxiliary items required

- ◆ Torque wrench

Removing

Pay attention to rules for cleanliness ⇒ 1.9-ltr./66 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 20.

Note!

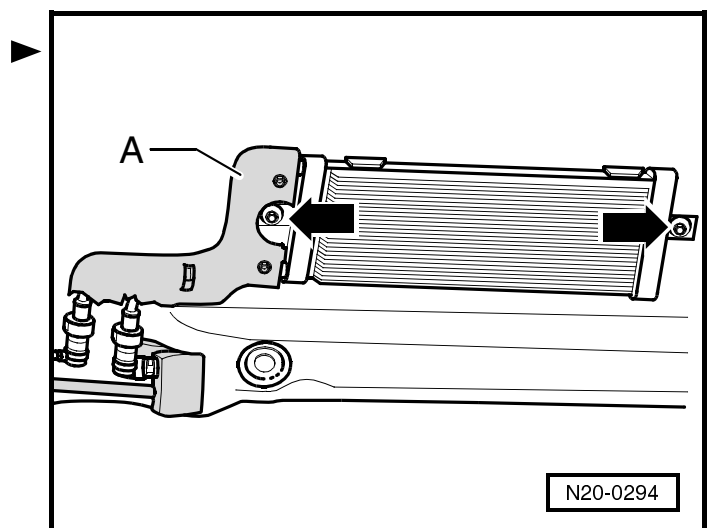
Fuel cooler is located at the return-flow line to the fuel tank. It is attached to the underfloor of the body.

- Take off cover -A-.
- Separate fuel line at fuel cooler.
- Unscrew securing bolts -arrows-.

Installing

Carry out the installation in the same way in reverse order. Pay attention to the following:

- ◆ Tighten nuts attaching fuel cooler to 20 Nm.



Inspecting tandem pump

Special tools, test and measuring equipment and auxiliary items required

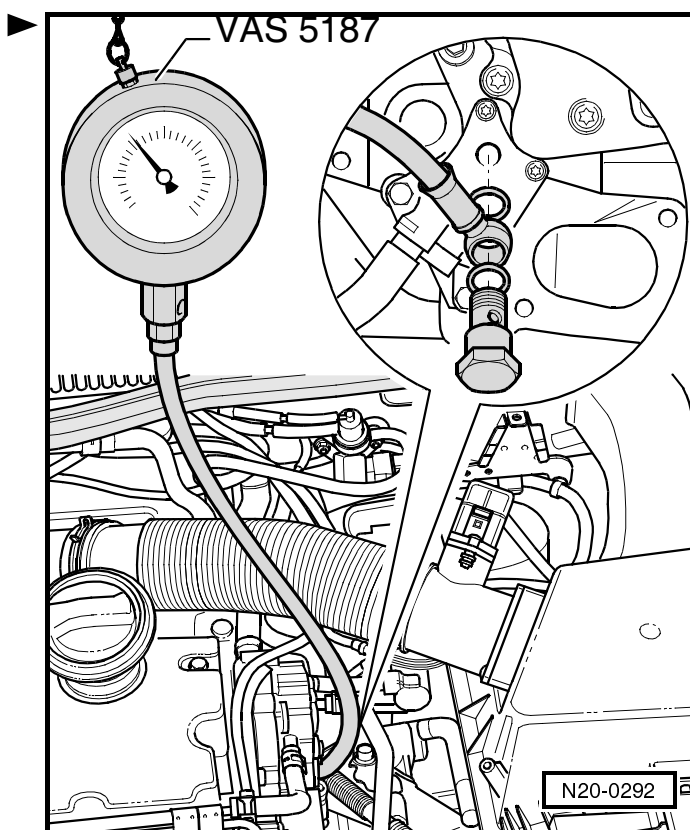
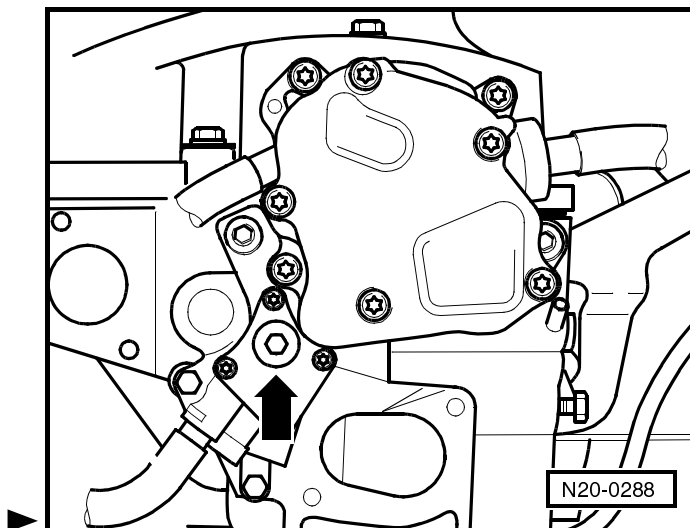
- ◆ Vehicle system tester -V.A.G 1552-
- ◆ Diagnostic cable -V.A.G 1551/3, 3A, 3B, 3C-
- ◆ Torque wrench
- ◆ Pressure gauge (e.g. -VAS 5187 -)

Test conditions

- The coolant temperature must be at least 85 °C.
- Unit injector must be in proper order.
- Fuel filter and fuel line must not be blocked.
- Non-return valve in fuel feed hose must be in proper order.
- Fuel gauge sender must be in proper order.

Procedure

- Remove screw plug -arrow-.
- Connect pressure gauge (e.g. -VAS 5187-) as shown in the Fig.
- Connect vehicle system tester -V.A.G 1552- and select „address word“ 01 Engine electronics. The engine must be idling for this step ⇒ 1.9-ltr./74 kW (TDI) Engine, Fuel Injection and Ignition System; Rep. Gr. 01.



Readout on display:

- Select function **008** for „Reading measured value block“ and confirm the entry with the key **Q**.

Readout on display:

- Select function **0002** for „display group number 002“ and confirm the entry with the key **Q**.

Vehicle system test
Select function XX **HELP**

Reading measured value block
Enter display group number XXX

Readout in display (1...4 = display blocks):

- Read off idle speed value in display block 1.
- The engine speed must increase to more than 1500 rpm.
- Observe the pressure indicated at the pressure gauge.

Specified value: at least 3.5 bar (0.35 MPa).

If the specified value is not reached:

- Replace tandem pump ⇒ **20-1** page 3.



Note!

After disconnecting the pressure gauge, tighten screw plug to 25 Nm. Always replace the seal.

Reading	measured	value	block	2	->
1	2	3	4		

Removing and installing the tandem pump

Special tools, test and measuring equipment and auxiliary items required

- ♦ Torque wrench
- ♦ Hand vacuum pump (e.g. -V.A.G 1390 -)
- ♦ Water drain tank (e.g. -V.A.G 1390/1-)

Removing

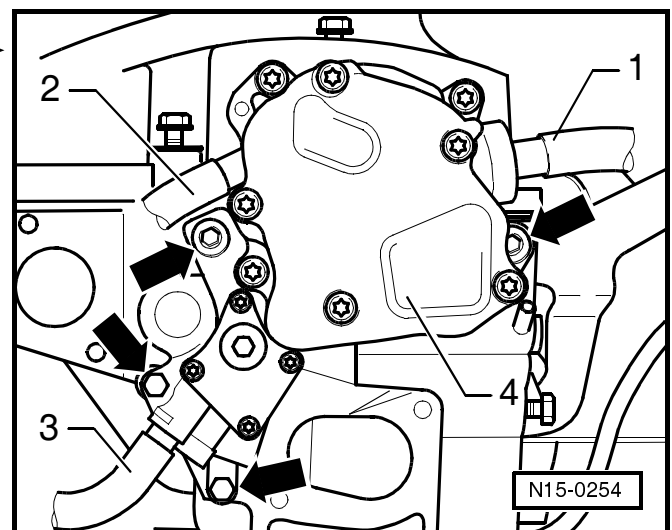
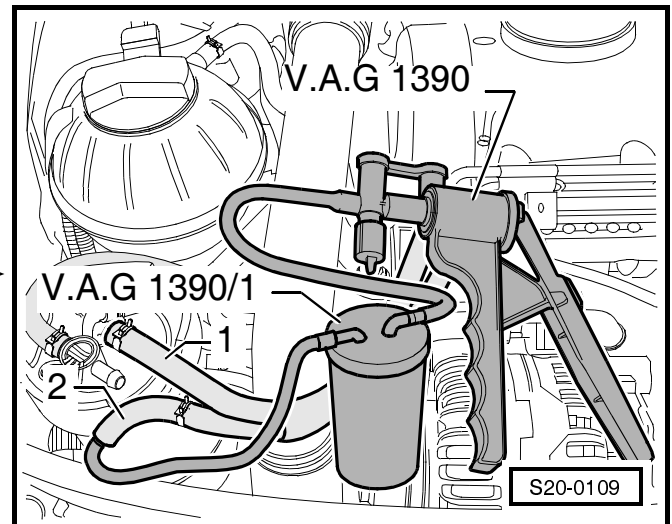
- Separate feed hose -1- (marked in white) and return-flow hose -2- (marked in blue) from the fuel filter.
- Connect hand vacuum pump -V.A.G 1390- with bleeder tank -V.A.G 1390/1- to return-flow hose.
- Build up pressure in hand vacuum pump until no further fuel flows out of the return-flow hose.

Ensure that no fuel is drawn into the hand vacuum pump.

- Separate vacuum hose -1- for brake servo unit from tandem pump -4-.
- Separate feed hose -2- (marked in white) at the tandem pump -4-.
- Unscrew securing bolts -arrows-.
- Remove tandem pump -4- from cylinder head.
- Swivel tandem pump -4- up, separate return-flow hose -3- (marked in blue) and remove tandem pump -4-.

Installing

The installation occurs in reverse order, while paying attention to the following:



i Note!

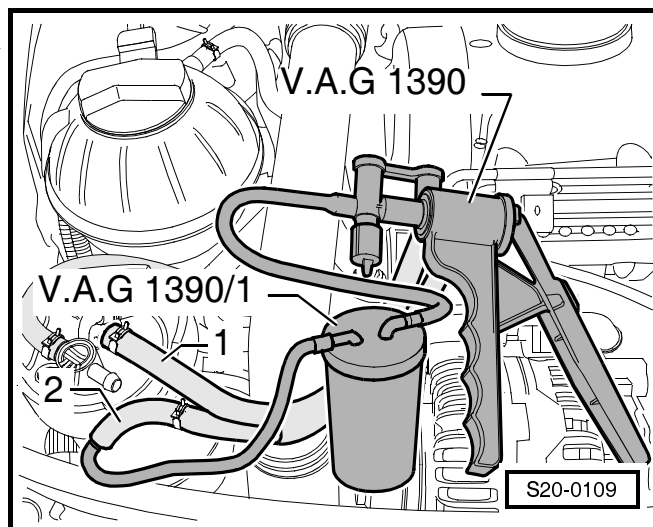
- ◆ *Ensure the coupling/tandem pump is correctly inserted into the camshaft.*
- ◆ *Always replace the gasket of the tandem pump.*

- Connect return-flow hose (marked in blue) to return-flow connection of tandem pump.
- Install tandem pump and tighten the bolts attaching it to the top to 20 Nm.
- Tighten the bolts attaching it to the bottom to 10 Nm.
- Connect feed hose (marked in white) to connection of hose and to vacuum hose of brake servo unit to tandem pump.

- Connect feed hose -1- (marked in white) to fuel filter. ►
- Connect hand vacuum pump (e.g. -V.A.G 1390-) together with water drain tank (e.g. -V.A.G 1390/1-) to return-flow hose -2- (marked in blue) of fuel filter.
- Build up pressure in hand vacuum pump until fuel flows out of the return-flow hose.

Ensure that no fuel is drawn into the hand vacuum pump.

- Connect return-flow hose -2- (marked in blue) to fuel filter.



20-2 Servicing accelerator pedal

⇒ 1.9-ltr./66 kW Engine - Mechanical Components;
Rep. Gr. 20

21 – Turbocharging

21-1 Charge air system with turbocharger I

Removing and installing exhaust turbocharger with component parts

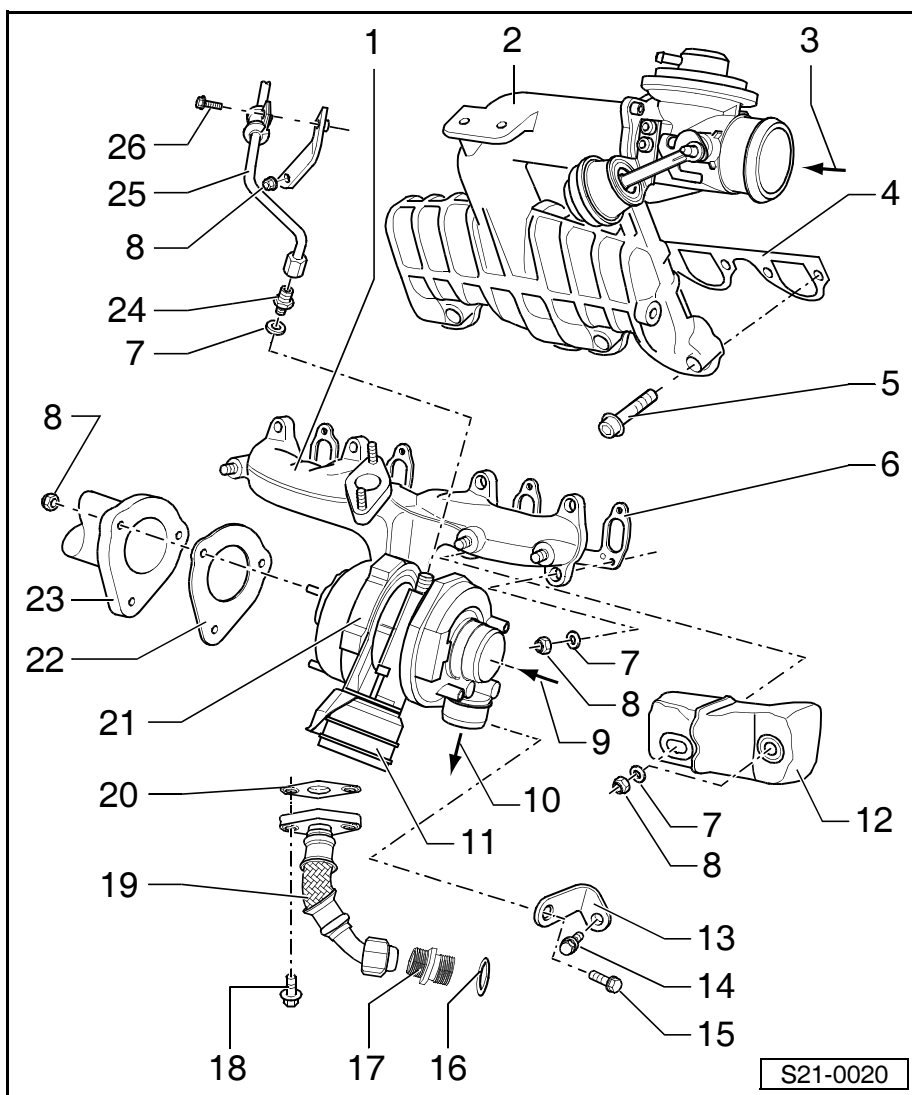
Observe rules for cleanliness ⇒ **21-1** page 4.



Note!

- ♦ The hose connections are secured with clamps.
- ♦ Charge air system must be free of leaks.
- ♦ Always replace self-locking nuts.

- 1 - Exhaust manifold**
 - ☐ with exhaust turbocharger
 - ☐ must be replaced completely
- 2 - Induction pipe**
- 3 - From charge air cooler**
- 4 - Gasket**
 - ☐ replace
- 5 - 25 Nm**
- 6 - Gasket**
 - ☐ Check fitting position
- 7 - Washer**
- 8 - 25 Nm**
 - ☐ replace
 - ☐ Moisten stud bolts with -G 052 112 A3-
- 9 - From air filter**
- 10 - To charge air cooler**
- 11 - Pressure box**
 - ☐ for charge pressure control
 - ☐ part of turbocharger, cannot be replaced separately
- 12 - Shield**
- 13 - Bracket**
 - ☐ Exhaust turbocharger - cylinder block
- 14 - 40 Nm**
- 15 - 25 Nm**
- 16 - Seal**
 - ☐ replace
- 17 - Connection fitting, 40 Nm**
- 18 - 17 Nm**
- 19 - Oil return line**
 - ☐ to cylinder block
 - ☐ tighten to 35 Nm
- 20 - Gasket ring for oil return line**
 - ☐ replace



21 - Exhaust turbocharger

- ☐ can only be replaced complete with exhaust manifold
- ☐ removing and installing ⇒ Chap. 21-2
- ☐ Inspecting charge pressure control ⇒ Chap. 21-2
- ☐ charge pressure control valve and vacuum unit for charge pressure control valve are parts of the turbocharger and cannot be replaced separately
- ☐ After installing the turbocharger, run engine at idling speed for about 1 minute to ensure that oil is supplied to the turbocharger.

22 - Gasket

- ☐ replace

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

- ☐ tighten to 25 Nm

26 - 10 Nm

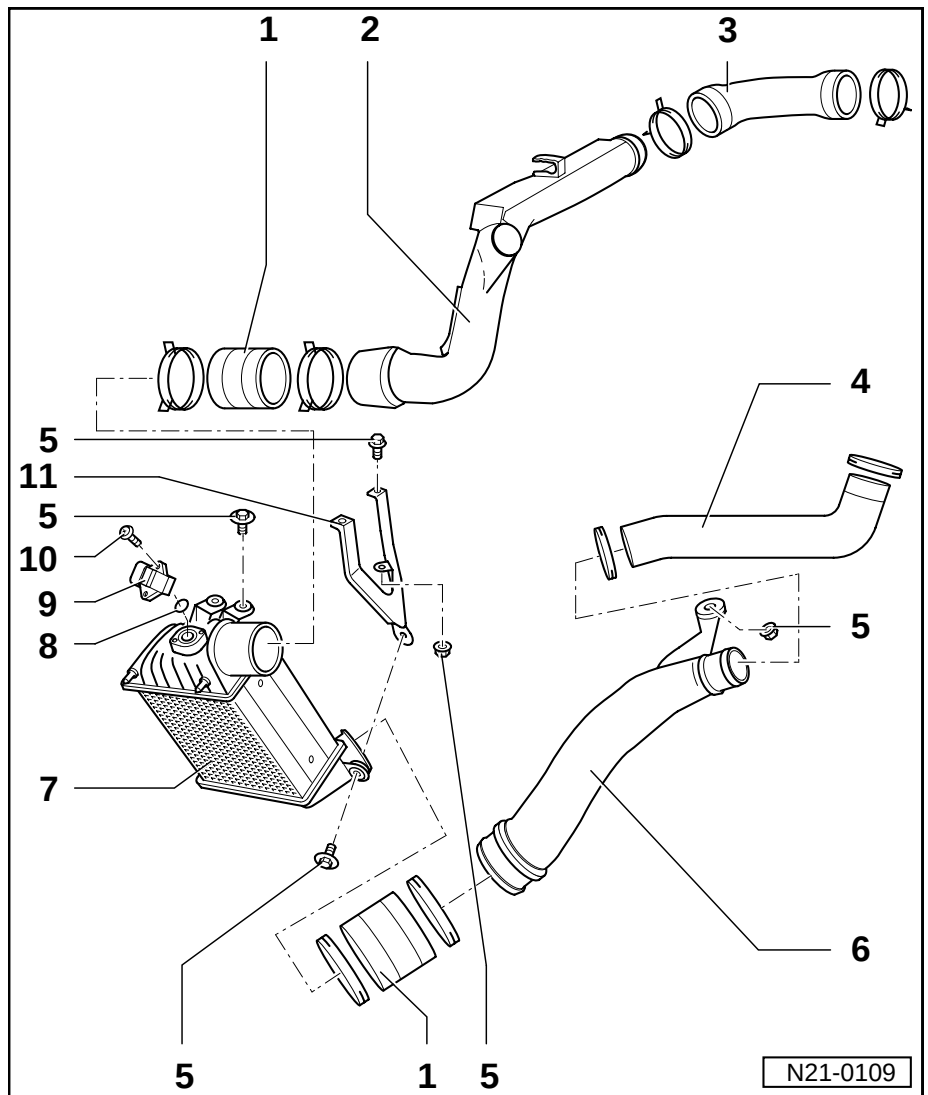
Removing and installing parts of the charge-air cooling



Note!

- ♦ The hose connections are secured with clamps.
- ♦ Charge air system must be free of leaks.
- ♦ Charge pressure hoses and charge pressure pipes and their connections must be free of oil and grease when installed again.

- 1 - Charge air connection hose
- 2 - Top charge-air pipe
- 3 - Charge air connection hose
 - to connection fitting
- 4 - Charge air connection hose
 - from turbocharger
- 5 - 5 Nm
- 6 - Bottom charge-air pipe
- 7 - Charge air cooler
- 8 - O-ring
 - replace if damaged
- 9 - Intake air temperature sender -G72-
- 10 - 5 Nm
- 11 - Bracket



Removing and installing charge air cooler

Special tools, test and measuring equipment and auxiliary items required

- ♦ Torque wrench
- ♦ Pliers for spring strap clips

Removing

- Remove right noise insulation panel.

- Unplug connector at intake air temperature sender -G72-.
- Separate top charge air connection pipe ⇒ item 2
- Separate bottom charge air connection pipe ⇒ item 6
- Unscrew bolts attaching ⇒ item 5 charge air cooler and take out cooler.

Installing

The installation is carried out in the reverse order.

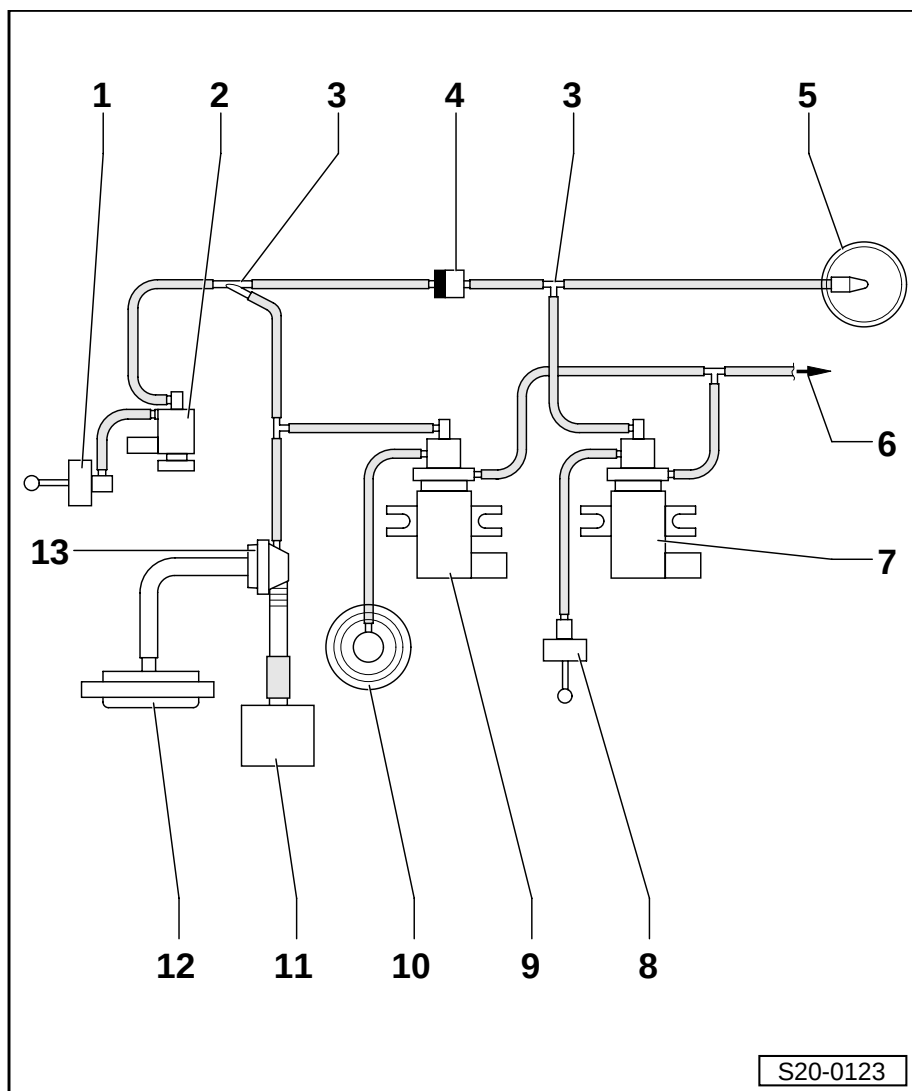
Rules of cleanliness

Carefully observe the following »5 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. Do not remove new parts from their wrapping until just before installing.
- ◆ When the system is open: Do not work with compressed air, do not move the vehicle.

Connection diagram for vacuum hoses

- 1 - Vacuum unit**
☐ of throttle valve
- 2 - Changeover valve for intake manifold flap -N239-**
- 3 - Distributor part**
- 4 - Non-return valve**
☐ white connection points to charge pressure control solenoid valve / to vacuum unit / to switchover valve
- 5 - Vacuum unit**
- 6 - To air filter**
- 7 - Solenoid valve for charge pressure control -N75-**
☐ Inspecting charge pressure control ⇒ Chap. 21-2
- 8 - Vacuum unit**
☐ for charge pressure control
☐ part of turbocharger, cannot be replaced separately
- 9 - Exhaust gas recirculation solenoid valve -N18-**
- 10 - Mechanical exhaust gas recirculation valve**
- 11 - Tandem pump**
- 12 - Brake servo unit**
- 13 - Distributor part**
☐ with non-return valve for brake servo unit



21-2 Charge air system with turbocharger II

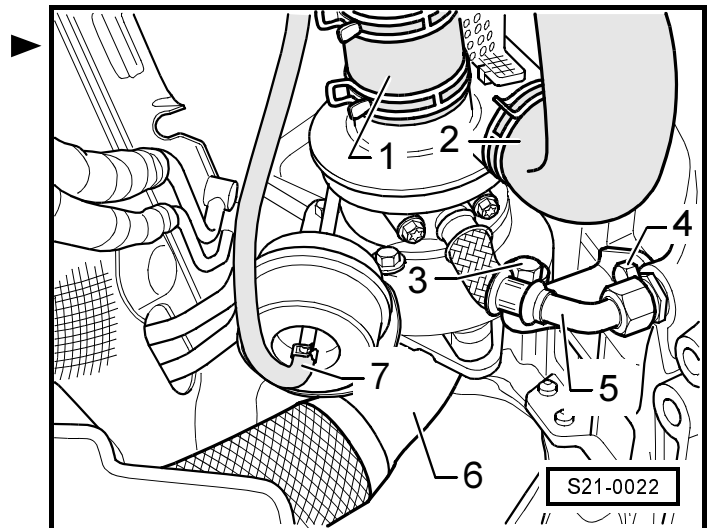
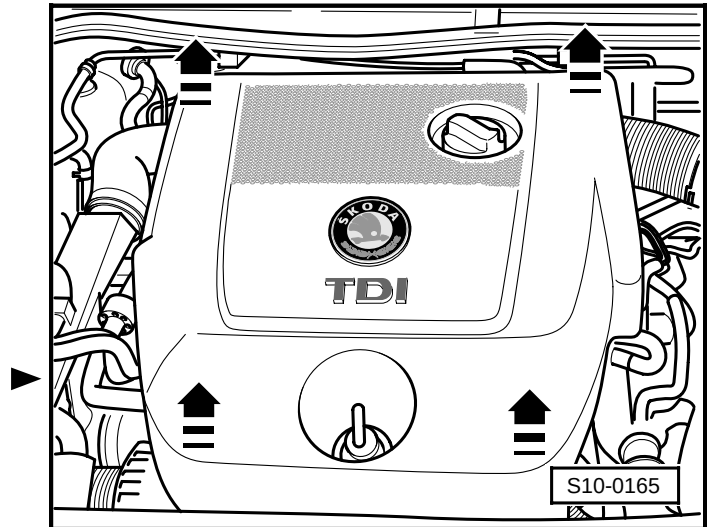
Remove exhaust turbocharger

Special tools, test and measuring equipment and auxiliary items required

- ◆ Torque wrench
- ◆ Pliers for spring strap clips

Removing

- Remove engine guard -arrows-.
- Remove top connection pipe and charge air connection hose ⇒ Chapter 21-1.
- Remove inlet line ⇒ Chapter 21-1.
- Remove the noise insulation.
- Remove connecting hoses -1- and -2-.
- Remove oil return-flow line -5-.
- Unscrew bolts -3- and -4- from support and take out support.
- Remove the vacuum hose -7- from the vacuum unit for charge pressure control.
- Remove front exhaust pipe -6- ⇒ Chapter 26-1 from turbocharger and place down to the side.
- Remove connection pipes for inlet connection - exhaust manifold for exhaust gas recirculation ⇒ Chapter 26-2.
- Remove the oil feed line for the exhaust turbocharger ⇒ Chapter 21-1.
- Unbolt exhaust manifold from cylinder head.
- Lift turbocharger up and out.



Installing

Installation occurs in reverse order. Pay attention to the following:



Note

- ◆ *Tightening torques ⇒ Chapter 21-1.*
- ◆ *After installing the exhaust turbocharger, run engine at idling speed for about 1 minute to ensure that oil is supplied to the exhaust turbocharger.*

Checking charge pressure control

Special tools, test and measuring equipment and auxiliary items required

- ◆ Hand vacuum pump (e.g. -V.A.G. 1390-)
- ◆ Hand multimeter (e.g. -V.A.G 1715 -)

- ♦ Vehicle system tester -V.A.G 1552-
- ♦ Diagnostic cable -V.A.G 1551/3, 3A, 3B, 3C-
- ♦ Adapter cable set (e.g. -V.A.G 1594 C-)
- ♦ Test box -V.A.G 1598/31-

Test conditions

- No fault in the fault memory ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 01
- No leaks on the intake and exhaust side
- No fault on the engine/fuel injection system
- Engine oil temperature at least 80 °C

Test sequence

If test and measuring devices are required during test drives observe the following:

- ♦ Always secure the test and measuring devices on the rear seat and have a second person operate them there.

If the test and measuring equipment is operated from the front passenger seat, this can result in injuries to the persons sitting on that seat in the event of an accident which involves the front passenger airbag being deployed.

- The charge pressure is measured with vehicle system tester - V.A.G 1552- when the engine is idling and during a road test.
- Connect up the Vehicle system tester -V.A.G 1552- and select the address word 01 „Engine electronics“ (the engine must be idling at the time) ⇒ 1.9-ltr./74 kW (TDI) Engine, Fuel Injection and Ignition System; Rep. Gr. 01.
- Select function 0 4 „Initiate basic setting“ and display group 0 1 1.

Readout on display:

Basic setting		11	->
1400 rpm	OFF	200 mbar	99 %



Note

After selecting display group number 011, the idling speed is increased by the engine control unit in display block 1 to 1380...1420 rpm.

Readout in indicator field 2 must change every 10 seconds „OFF“ and „ON“.

The following readouts must change in display fields 3 and 4:

Display field 2: OFF

- ♦ Specified value display field 3: Atmospheric pressure in mbar
- ♦ Specified value display field 4: 98...100 %

Display field 2: ON

- ◆ Specified value display field 3: Atmospheric pressure in mbar +80...250 mbar
- ◆ Specified value display field 4: 0...2 %

Continue the test as follows:

➞ Press.

- Read function **0 8** „Read measured value block“ and select display group **0 1 1**.
- Accelerate vehicle in 3rd gear at full throttle from about 1500 rpm.
- At about 3000 rpm read off value indicated in display block.

Reading measured value block	11	->
3090 rpm	1866 mbar	1917 mbar 62 %

Specified value display field 3: 1850...2250 mbar

If the specified value is not reached:

- Conduct an actuator diagnosis for the charge pressure control solenoid valve ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 01.

Charge pressure control solenoid valve must operate for this test. While doing so the linkage of the charge pressure control vacuum unit at the bottom of the turbocharger must move back and forward. This linkage must move at least 3...4 times as long as a vacuum is present in the vacuum system.

If the linkage moves and the nominal charge pressure is not reached:

- Replace turbocharger

If the linkage does not move because the charge pressure control solenoid valve is not operating:

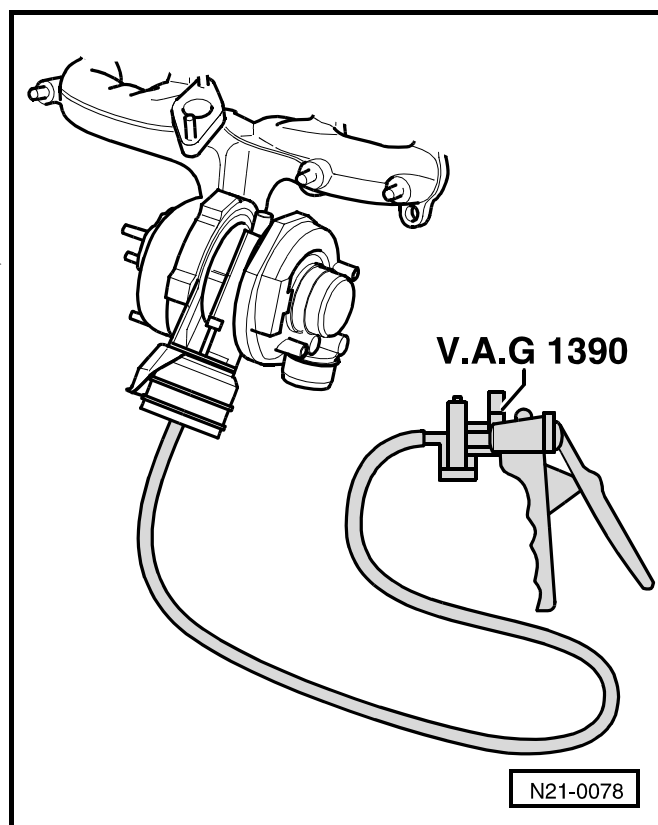
- Test the charge pressure control solenoid valve -N75 - ⇒ 1.9-ltr./74 kW Engine - Fuel Injection and Ignition System; Rep. Gr. 23.
- Inspect vacuum hoses ⇒ Chapter 21-1 .

If the linkage does not move although the charge pressure control solenoid valve is operating:

- Connect hand vacuum pump to charge pressure control valve and inspect linkage for unobstructed movement.

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

- Replace turbocharger.



26 – Exhaust system

26-1 Removing and installing parts of the exhaust system



Note!

- ♦ Removing and installing exhaust manifold ⇒ Chap. 21-1
- ♦ Always replace self-locking nuts.

- 1 - Gasket**
 - ☐ replace
- 2 - 25 Nm**
 - ☐ replace
 - ☐ coat 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 - Screw**
- 8 - Hanger**
- 9 - 25 Nm**
- 10 - Front silencer**
 - ☐ installed as standard with part ⇒ item 11, supplied separately for repairs
 - ☐ exhaust pipe with separation point ⇒ Fig. 1 in **26-1** page 2
- 11 - Rear silencer**
 - ☐ installed as standard with part ⇒ item 10, supplied separately for repairs
 - ☐ exhaust pipe with separation point ⇒ Fig. 1 in **26-1** page 2
- 12 - Double clamp**
 - ☐ fitting position: bolted connection points to the left; installation position: marked by indentation on circumference of exhaust pipe
 - ☐ tighten bolts evenly
- 13 - 40 Nm**
- 14 - Bracket**
- 15 - Bracket**
- 16 - 24 Nm**
- 17 - Exhaust manifold**
 - ☐ part of turbocharger
- 18 - 23 Nm**

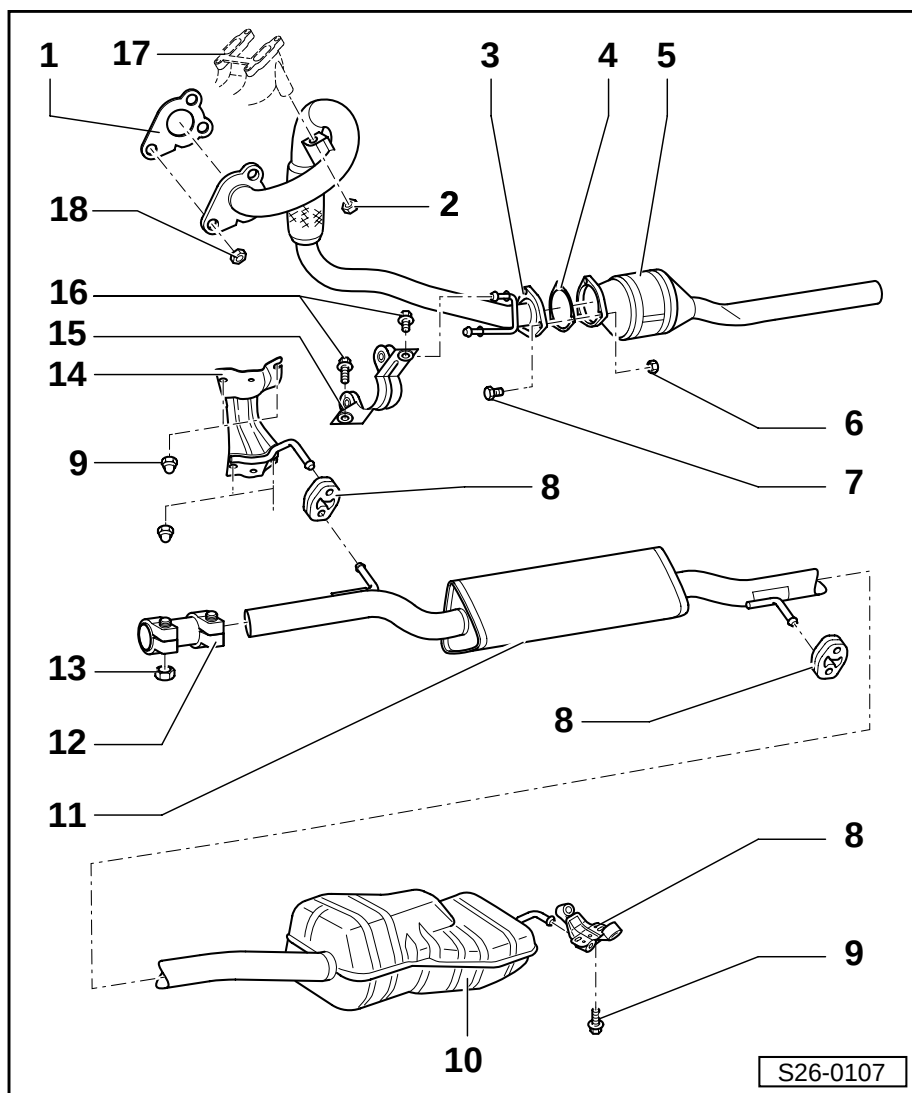


Fig. 1: Separation point

- ♦ when replacing front silencer or rear silencer
- ♦ marked by indentation on circumference of exhaust pipe

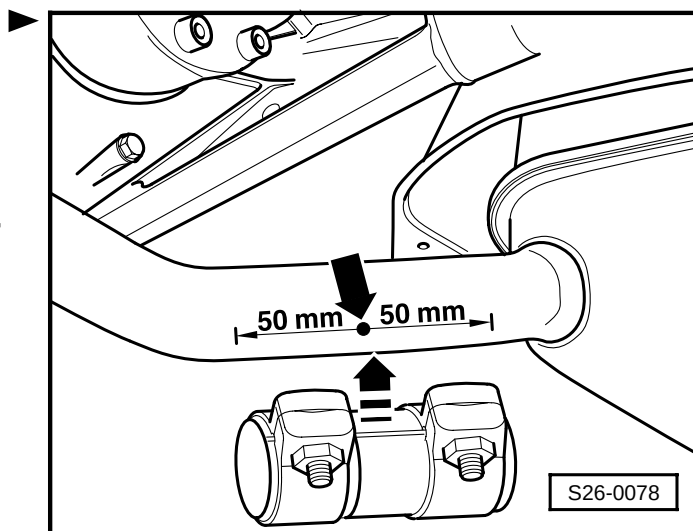
Replacing middle silencer or rear silencer

Special tools, test and measuring equipment and auxiliary items required

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

Procedure

- Use body saw to separate exhaust pipe at right angles at the separation point -arrow-.
- Mark on both sides 50 mm from the separation point.
- Position double clamp at the side markings.
- Align rear silencer horizontally.
- Tighten bolted connections of the double clamp evenly to 40 Nm.
- Installation position of double clamp: bolted connection points to the left.



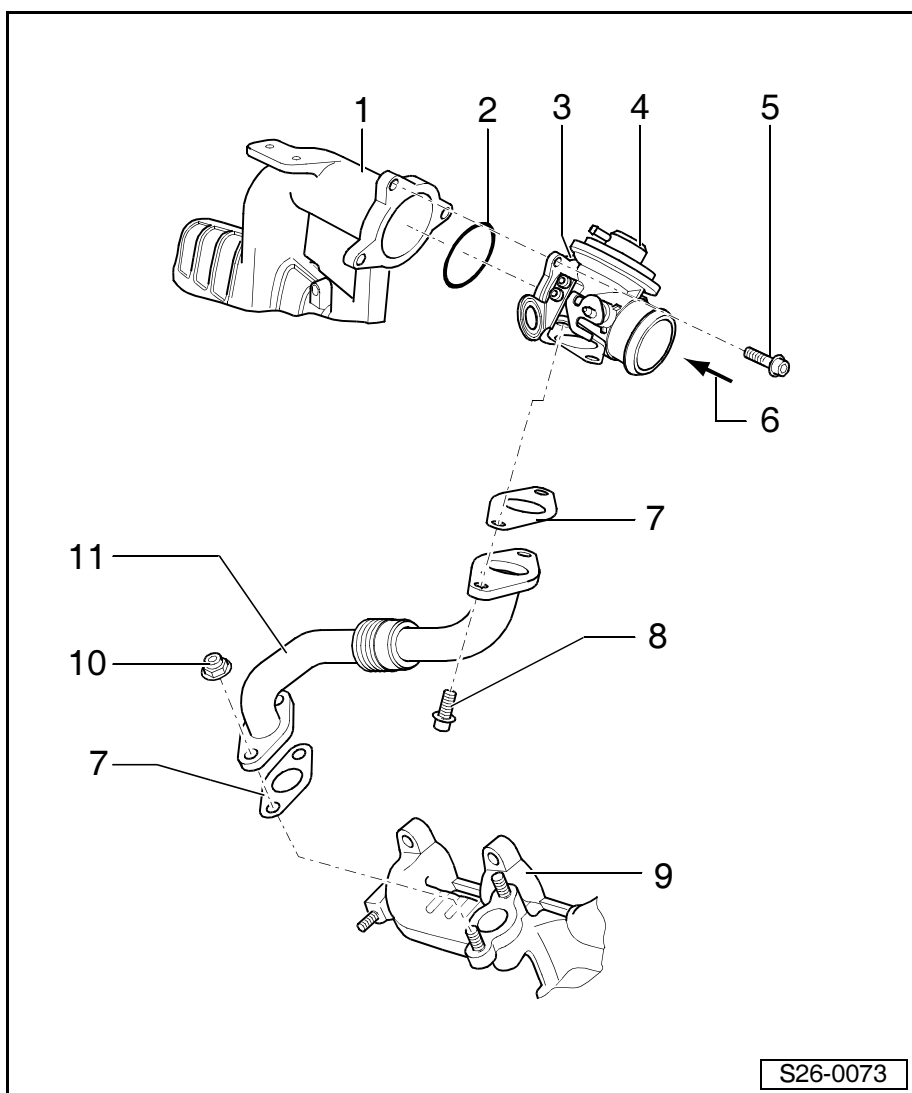
26-2 Exhaust gas recirculation system



Note!

- ♦ The exhaust gas recirculation system is operated by the diesel direct injection system control unit -J248- through the EGR valve -N18- to the mechanical exhaust gas recirculation valve.
- ♦ Testing exhaust gas recirculation and EGR valve -N18- ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 01
- ♦ The mechanical exhaust gas recirculation valve with conically shaped valve tappet makes it possible to achieve different opening cross-sections at different valve strokes.
- ♦ Connection diagram for vacuum hoses ⇒ Chap. 21-1.

- 1 - Intake manifold**
- 2 - O-ring**
 - ☐ replace
- 3 - Inlet connection**
 - ☐ with mechanical exhaust gas recirculation valve and with regulating flap
- 4 - mechanical exhaust gas recirculation valve**
 - ☐ part of inlet connection
 - ☐ always replace complete with inlet connection
 - ☐ check ⇒ **26-2** page 2
 - ☐ testing control ⇒ 1.9-ltr./74 kW (TDI) Engine - Fuel Injection and Ignition System; Rep. Gr. 28
- 5 - 10 Nm**
- 6 - from charge air cooler**
- 7 - Gasket**
 - ☐ replace
- 8 - 25 Nm**
- 9 - Exhaust manifold**
- 10 - 25 Nm**
 - ☐ replace
 - ☐ coat with -G 052 112 A3-
- 11 - Connecting tube**



Testing mechanical exhaust gas recirculation valve

Special tools, test and measuring equipment and auxiliary items required

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

Test sequence

- Remove engine guard -arrows-.
- Disconnect vacuum hose on mechanical exhaust-gas recirculation valve.

- Connect hand vacuum pump to valve and operate pump.

Diaphragm must move in the direction of the pressure connection -arrow-.

- Detach hose of hand vacuum pump from mechanical exhaust gas recirculation valve.

The diaphragm must move back in the opposite -direction of the arrow- into its initial position.

