



Workshop Manual Fox 2004 ➤

3 - Cyl. diesel engine								
Engine ID	BNM							

Edition 02.2009



List of Workshop Manual Repair Groups

Repair Group

- 00 - Technical data
- 10 - Cylinders, engine block, support, cover
- 13 - Crankshaft, pistons
- 15 - Cylinder head, valve control mechanism
- 17 - Lubrication system
- 19 - Cooling system
- 20 - Supply system - Fuel tank, fuel pump
- 21 - Overcharge - turbo
- 23 - Supply system - mechanical injection (diesel)
- 26 - Exhaust system
- 28 - Chamber pre-heating system

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

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00 – Technical data

1 Technical data

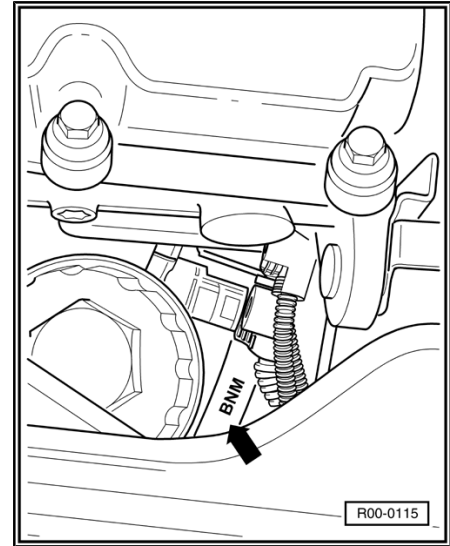
1.1 Engine number

Engine number ("identification letters" and "serial number") is engraved on the flange between the engine and the transmission.

The engine number comprises a maximum nine digits (alphanumeric). The first part (max. of three identification letters) represents the "the engine ID letters"; the second part (six characters) represents the "serial number". If more than 999,999 engines are manufactured under the same identification letters, the first digit of the 6-digit group is replaced by a letter.

Additionally a sticker is found on the upper cover of the mechanical distribution system -arrow- with the "engine identification letters" and the "serial number".

The "engine identification letters" are also indicated on the vehicle data plate.



1.2 Engine features

Engine codes		BNM
Production		11.04
Cylinder volume	l	1,4
Power	kW / rpm	51/4000
Torque	Nm / rpm	155/1600 to 2800
Bore	Ø mm	79,5
Stroke	mm	95,5
Compression rate		19,5
Octanage	at least	49
Firing order		1-2-3
Catalytic converter		yes
Recirculation of exhaust gases		yes
Charged		yes
Intercooler		yes

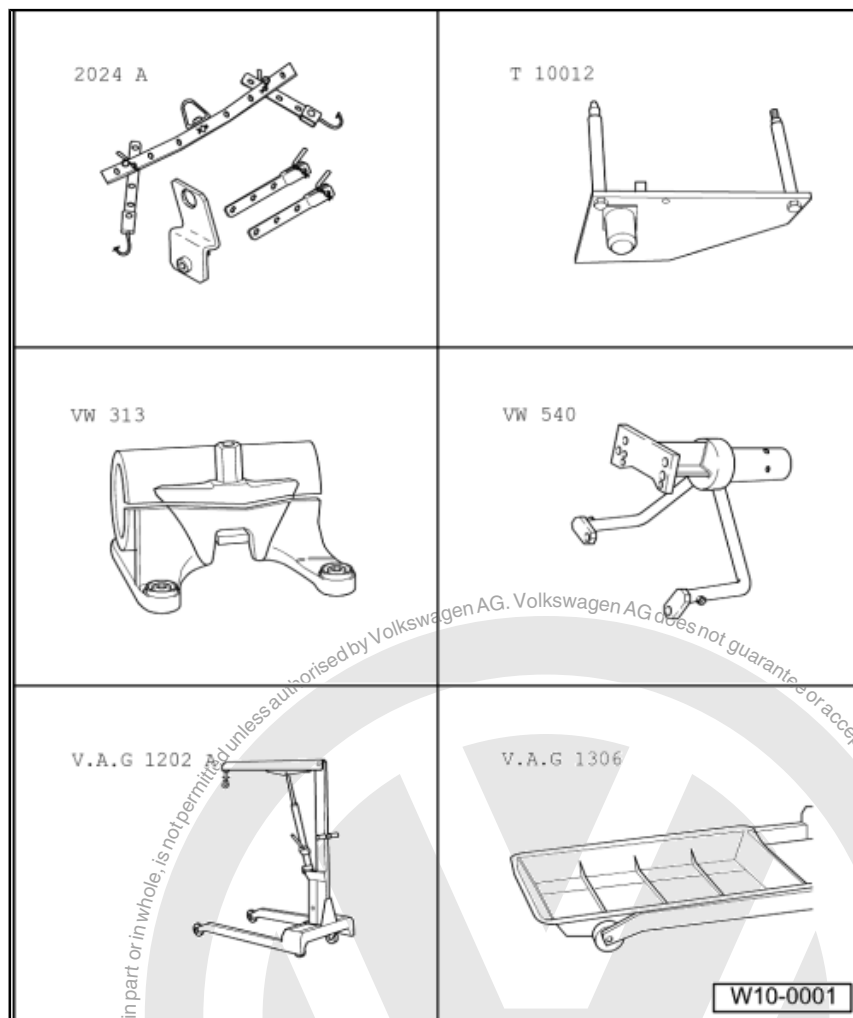


10 – Cylinders, engine block, support, cover

1 Engine - remove and install

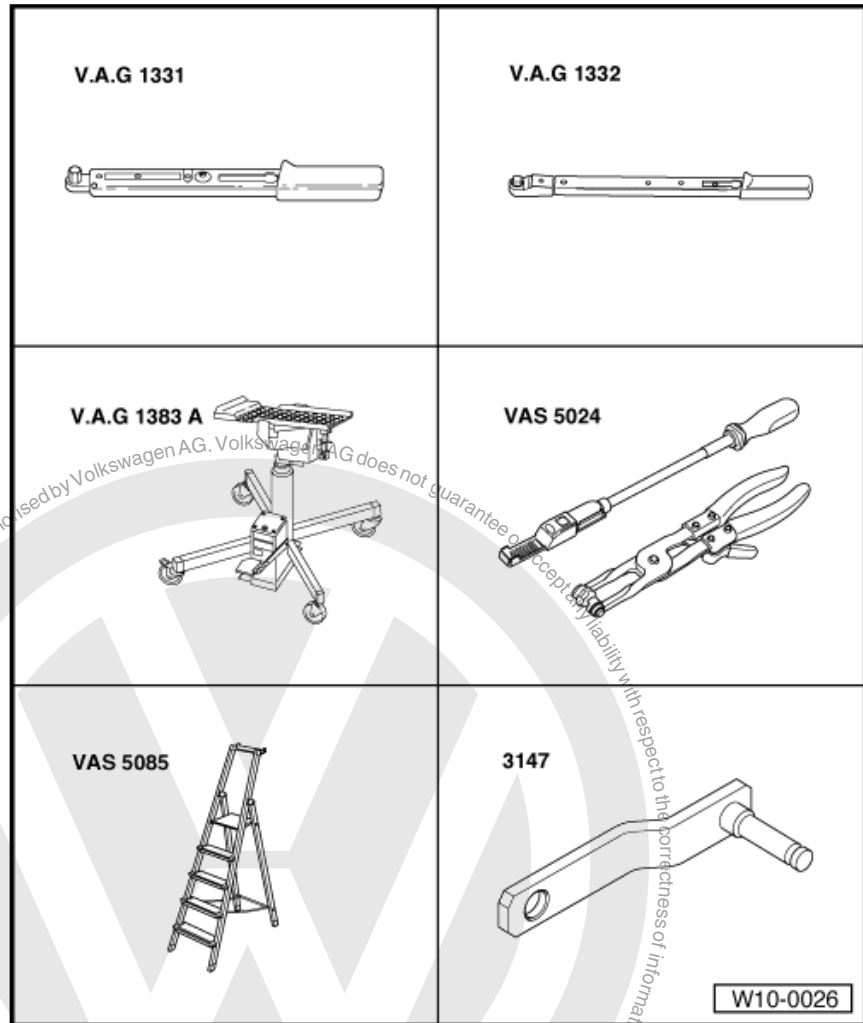
Special tools and workshop equipment required

- ◆ Lifting tackle -2024A-
- ◆ Engine and gearbox support -T10012-
- ◆ Engine and gearbox support -VW 313-
- ◆ Engine and gearbox support -VW 540-
- ◆ Workshop winch - V.A.G 1202 A-
- ◆ Oil sump -V.A.G 1306-

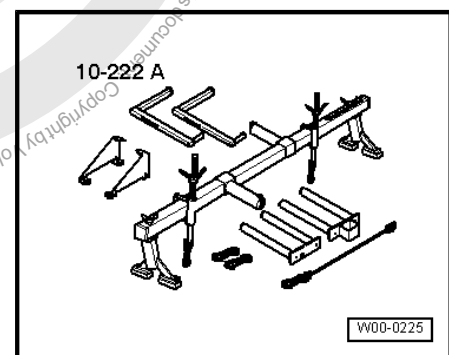




- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ◆ Jack for Gearbox or engine + gearbox combo -VAG 1383A-
- ◆ Standart-type clamp pliers - VAS 5024A-
- ◆ Stepladder -VAS 5085-
- ◆ Engine and gearbox support -3147-
- ◆ 3 Washers A13 X 24 X 2.5
- ◆ 2 Washers A10.5 X 21 X 2
- ◆ Cable tie



- ◆ Support bracket -10-222A- with Rack -10-222A/1-

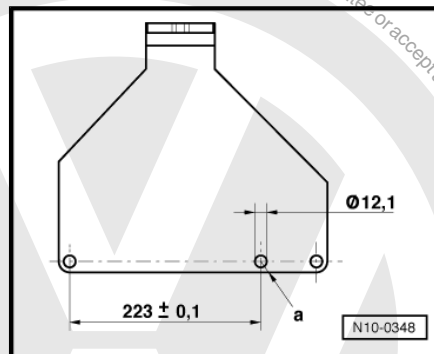


- ◆ Adapter -10-222A/18-



Modifying Engine bracket -T10012-

- If the modification has not yet been carried out, drill an additional hole -a- to the prescribed dimensions at the same height as the other holes.



1.1 Removal - indications



Note

Check whether vehicle has code radio, if so obtain the anti-theft code before disconnecting earth lead from battery.

- The engine is removed downwards, along with transmission.



WARNING

For installation jobs, especially in the engine compartment, due to reduced existing space, consider the following:

- ◆ ***All hoses (fuel, hydraulics, activated charcoal filter system, cooling fluid and gas, brake fluid, vacuum) and electric cables must be restored to original positions.***
- ◆ ***Provide easy access to all the moving or hot parts.***

- With ignition switched off, disconnect battery earth lead.
- All cable ties that open or break during engine removal should be replaced and installed at the same locations when engine is installed.
- Release the supply and return hoses in the cylinder head.



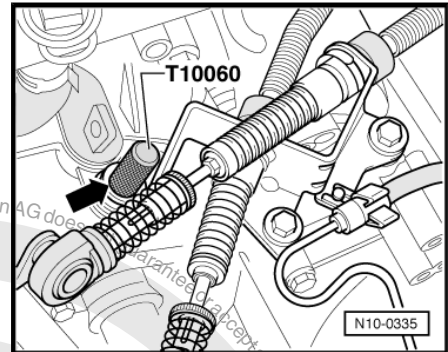
WARNING

- ◆ ***The fuel and the fuel system hoses may be very hot (burn risk)!***
- ◆ ***Fuel system is under pressure!***
- ◆ ***Use protective gloves and goggles when performing any repairs on the fuel system!***

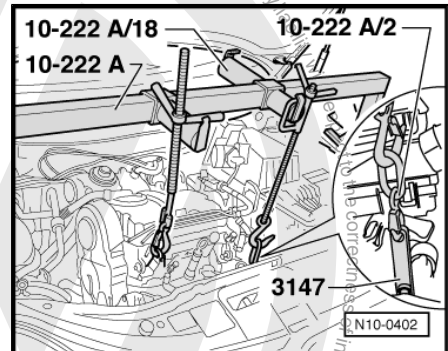
- Remove connecting pipe between intercooler and intake connecting flange.
- Remove air mass meter hose from turbocharger.
- Remove lower noise insulation from engine ⇒ Rep. Gr. 50
- Remove intercooler/turbocharger hose.
- Remove Poly-V belt ⇒ [page 14](#) .
- Drain the cooling system ⇒ [page 76](#) .



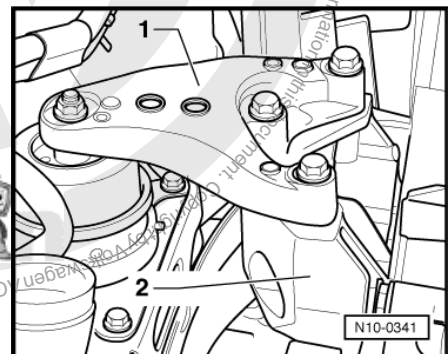
- Release the radiator cooling system hoses from the engine by using Hose clamp pliers -V.A.G 1921- or Standart-type clamp pliers -VAS 5024A- .
- Remove/disconnect all the electric connections from the engine where necessary.
- Remove all the cooling, vacuum and intake system hoses from the engine.
- Remove securing bolt of the cable support bracket and secure clutch release lever by inserting a Locking pin -T10060 A- -arrow-.
- Remove securing bolts from the top of engine/gearbox.
- Remove cooling fluid container.
- Unbolt starter motor and move it back until the Support -3147- can be inserted.



- Install the Support bracket -10-222A- and support engine and gearbox as shown in diagram.



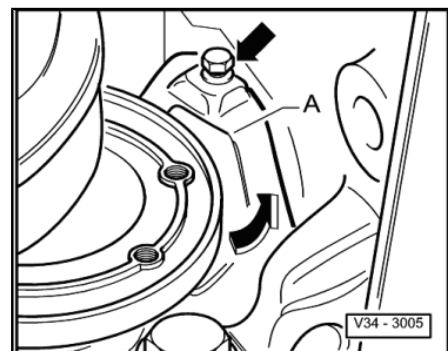
- Remove engine support -1- and engine console -2-.
- Disconnect right-hand drive shaft⇒ Rep. Gr. 40 .
- Loosen front exhaust pipe from turbocharger. Loosen double clamp and push exhaust pipe backwards ⇒ [page 118](#) .



- Remove the protection plate behind the drive shaft flange.

Vehicles with air conditioning:

- For removal, refer to the additional information and instructions ⇒ [page 8](#) .



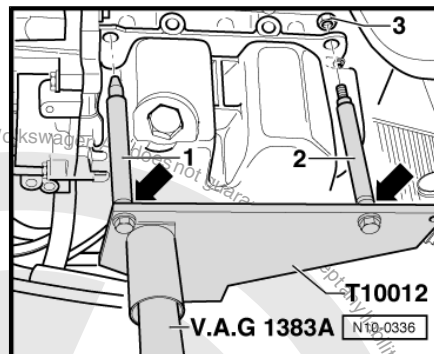


- Install support pin to the engine bracket-1- with one washer and the pin -2- with two A13 X 24 X 2.5 washers as shown in the illustration -arrows-.
- Then, secure the Engine bracket -T10012- with nut -3- and securing bolt from the compact bracket on the engine block.



Note

Place two A 10.5 X 21 X 2 Washers between engine bracket and compact bracket so that the engine bracket lies flat on the compact bracket.



- Remove securing bolts from the bottom of engine/gearbox.
- Lift engine and gearbox lightly using the Gearbox or Engine + gearbox combo jack -VAG 1383A-
- Remove the spindle of the Support bracket -10-222A- on the engine side.



Note

Use Stepladder -VAS 5058- to remove the spindle.

- Separate engine from gearbox by carefully lowering it and using the Gearbox or Engine + gearbox combo jack -VAG 1383A;- remove it from below.



Note

When lowering, handle the engine carefully to prevent damaging the body.

1.2 Engine - fix on assembly stand

To perform the assembly work, the Engine and gearbox support -VW 540- must be fastened on the assembly stand -VW 313- .



Work sequence

- Attach with Lifting tackle -2024A- as follows and lift a little with the Engine/gearbox combo jack -VAG 1383A- .

Pulley side: 4th hole of the bar in position 1.

Engine flywheel side: 2nd hole of the bar in position 8.



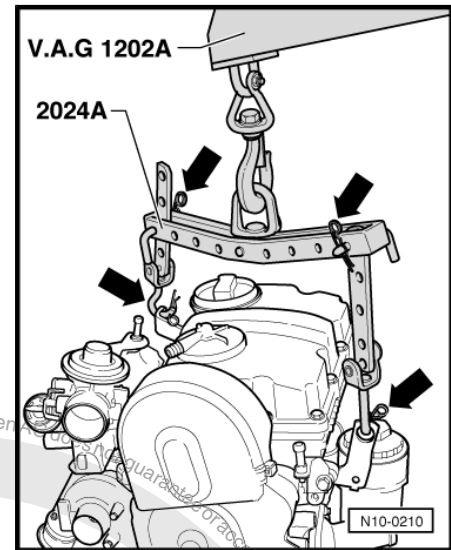
WARNING

On hooks and pins, use safety locks -arrows-.



Note

- ◆ Positions numbered 1...4 on suspension bar face toward the pulley.
- ◆ Drilled holes on supports are counted from the hook.
- Fasten the engine with the Support -VW 540- on the Stand -VW 313- .



1.3 Notes regarding installation

Installation is carried out by reversing the removal sequence, considering the following:

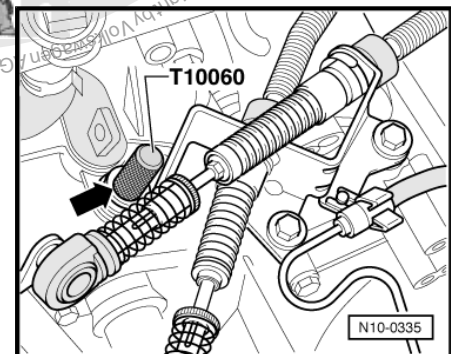
- Check clutch bearing for wear, replace if necessary.
- Apply a light coat of Lubricating grease -G 000 100 - on the clutch bearing and on the primary shaft bearing guide sleeve.
- Check if guides for fastening engine and transmission are placed on the engine block and, if necessary, install them.
- Align engine, moving it slightly so that the supports are seated without stress.



Note

Assembly support tightening torques ⇒ [page 8](#) .

- Electrical connections and installation ⇒ Rep. Gr. 97 :
- Remove Locking pin -T10060- -arrow- and replace securing bolt.
- Install drive shaft ⇒ Rep. Gr. 40 .
- Install the front exhaust pipe ⇒ [page 118](#) .
- Install Poly-V belt ⇒ [page 14](#) .
- Install air filter/turbocharger, intercooler/turbocharger and intercooler/intake flange hoses.
- Fill cooling system ⇒ [page 76](#) .
- Install engine noise insulation ⇒ Rep. Gr. 50 .
- Perform test drive and check fault memory ⇒ [page 115](#) .





1.4 Tightening torque

Location		Tightening torque
Screws, nuts	M 6	10 Nm
	M 8	20 Nm
	M 10	45 Nm
	M 12	60 Nm
Different tightening torques		
Front exhaust and turbocharger pipe		25 Nm

1.5 Supports for the power drive group

Tightening torque



WARNING

Always replace self-locking nuts and screws subject to angular torque

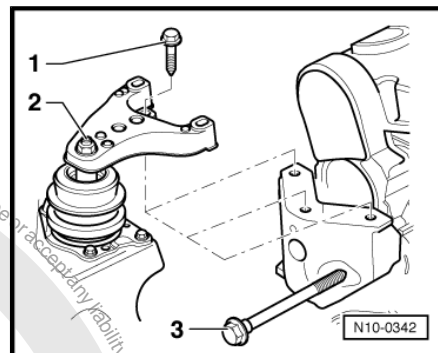
Power drive group suport, engine

1 - ¹⁾ = 30 Nm + 90°.

2 - ¹⁾ = 40 Nm + 90°.

3 - 45 Nm.

1) Replace.



1.6 Additional removal information and instructions for vehicles with air conditioning



Note

- ♦ *The air conditioning cooling gas circuit must be opened in order to remove the engine.*
- ♦ *To prevent damages to condenser and cooling gas hoses, do not fold, twist or overstretch the hoses.*
- Remove air conditioning compressor and anchor it to the body.
⇒ Rep. Gr. 87 .
- Purge the cooling gas from air conditioning circuit and open the gas circuit ⇒ Rep. Gr. 87 .



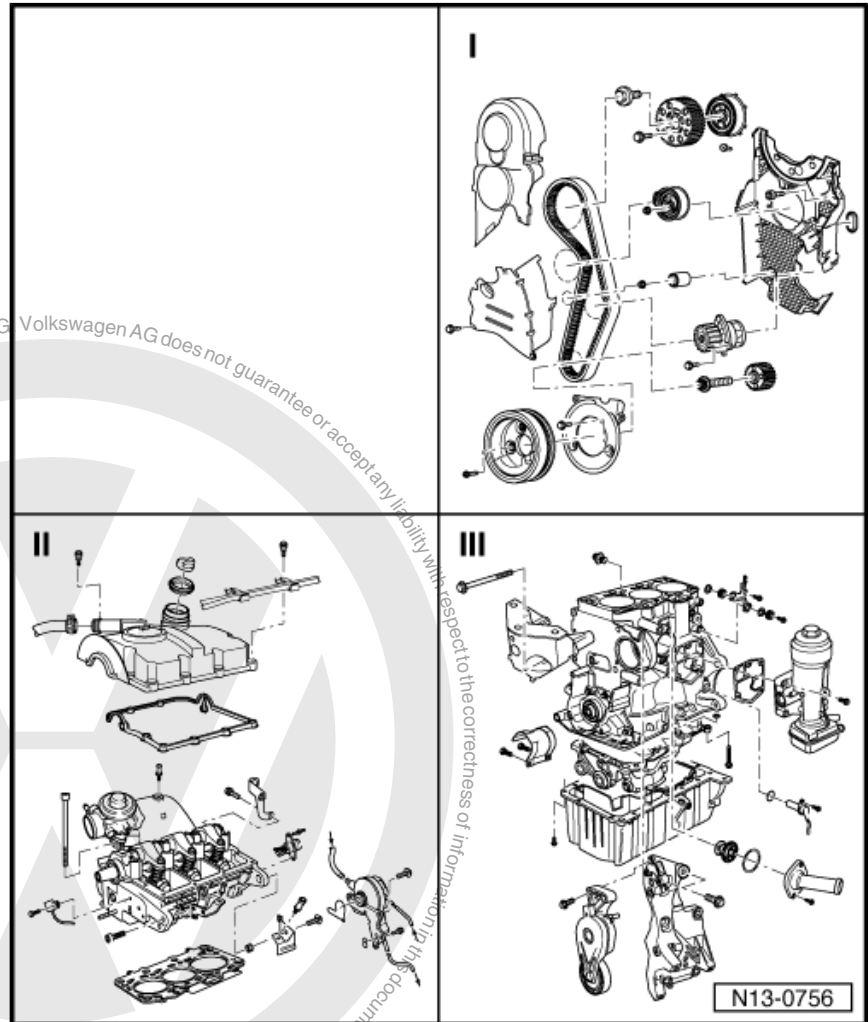
Note

The air conditioning compressor may remain fitted in its place.



13 – Crankshaft, pistons

1 Engine - dismantle and assemble



Note

- ◆ Where large quantities of metal shavings and filings are detected in the engine oil during repair required as a result of crankshaft and connecting rod bearing wear, the oil filter must be replaced and the oil channels carefully cleaned.
- ◆ All bearing and running surfaces must be lubricated before assembly.



WARNING

Always replace self-locking nuts and screws subject to angular torque



I ➤ [page 10](#)

II ➤ [page 11](#)

III ➤ [page 12](#)

Part I

1 - Timing belt guard - upper part

2 - Timing belt

- ☐ Mark rotation direction before removal.
- ☐ Check wear.
- ☐ Do not bend.
- ☐ Remove, install, and adjust ➤ [page 41](#).

3 - 20 Nm +45°

- ☐ Replace after each removal.

4 - Timing belt tension pulley

5 - 100 Nm

6 - 25 Nm

7 - Camshaft gear

8 - Pulley

- ☐ Engine speed sensor.
- ☐ Immobilise with Counter-hold tool -T10051- to loosen or tighten.
- ☐ To remove, use Extractor -T10052-.
- ☐ Remove and install ➤ [page 58](#).

9 - 10 Nm

10 - Mechanical distribution rear cover

11 - Sealing ring

- ☐ Replace if damaged.

12 - Pulley

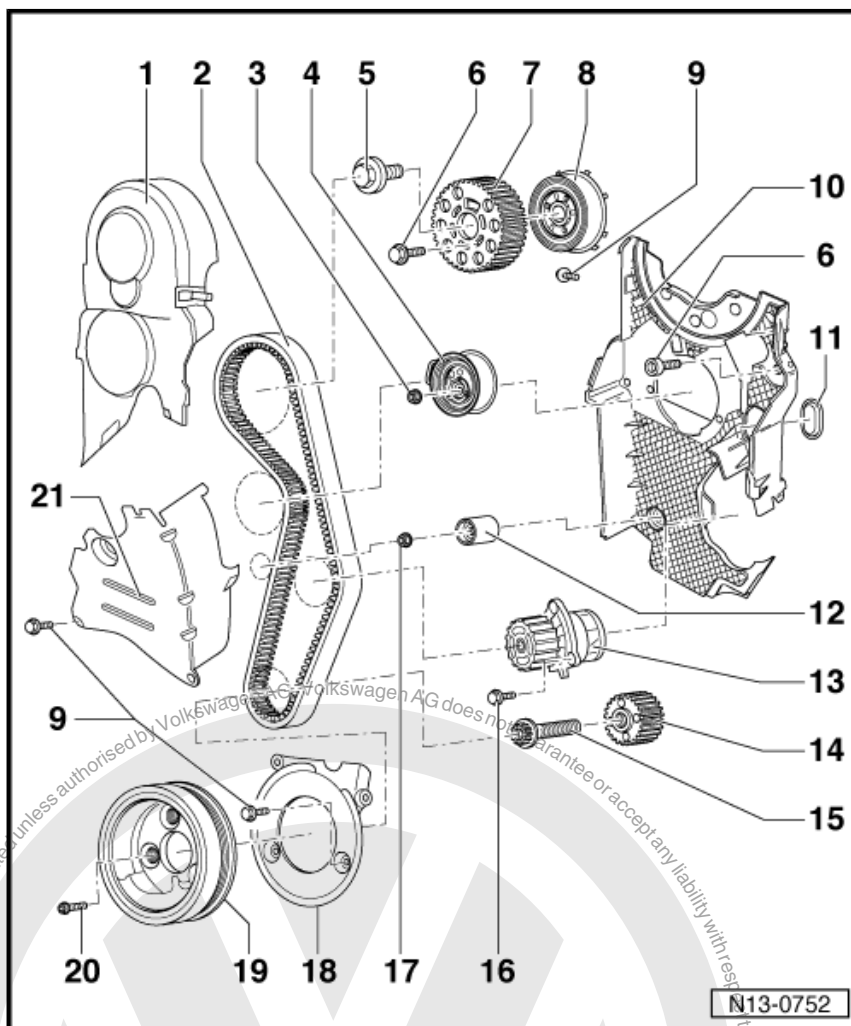
13 - Water pump

- ☐ Remove and install ➤ [page 80](#).

14 - Crankshaft gear

15 - 120 Nm + 90°

- ☐ Replace after each removal..
- ☐ Immobilise with Lock -3415- to loosen or tighten.
- ☐ Do not apply additional oil or grease to the threads and recess/flanges.
- ☐ The angular torque can be performed in several stages.

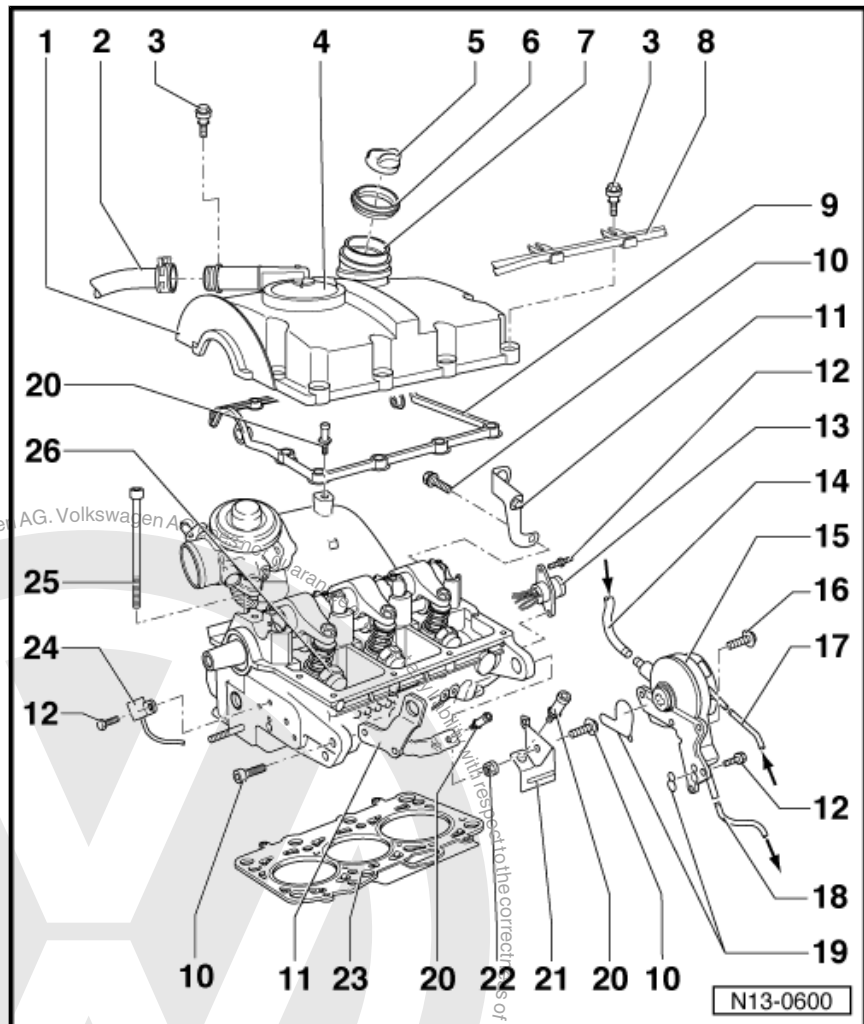




- 16 - 15 Nm
- 17 - 20 Nm
- 18 - Lower part of mechanical distribution cover
- 19 - Vibration cushioning pulley
 - ☐ It can be installed in one position only. The holes are displaced.
- 20 - 10 Nm + 90°
 - ☐ Replace after each removal.
- 21 - Timing belt guard - centre part

Part II

- 1 - Cylinder head cover
 - ☐ With oil filler nozzle.
 - ☐ Replace oil filling nozzle if cylinder head cover is damaged.
 - ☐ Before installation, carefully clean the cylinder head sealing surface with a clean cloth.
- 2 - To turbocharger
- 3 - 10 Nm
 - ☐ First, hand tighten all bolts.
 - ☐ Then, tighten both top and remaining bolts from the inside out, diagonally, to specified tightening torque.
- 4 - Pressure regulating valve
 - ☐ To crankcase vent.
- 5 - Cover
 - ☐ Replace seal if damaged.
- 6 - Gasket
 - ☐ Replace if damaged.
- 7 - Oil filling nozzle
 - ☐ Replace.
- 8 - Engine and gearbox support
 - ☐ With fuel tube.
- 9 - Cylinder head cover gasket
 - ☐ Replace if damaged.
- 10 - 20 Nm
- 11 - Lifting eye
- 12 - 10 Nm
- 13 - Central connector
 - ☐ To injector
- 14 - From servo brake





15 - Tandem pump

- ☐ For supplying fuel and vacuum.
- ☐ Remove and install ⇒ [page 97](#) .
- ☐ Check ⇒ [page 95](#) .

16 - 25 Nm

17 - Supply hose

- ☐ From fuel filter ⇒ [Item 1 \(page 87\)](#) .
- ☐ White or with white marking.
- ☐ Check that it is securely installed.
- ☐ Fasten with spring braces.

18 - Return hose

- ☐ To fuel filter ⇒ [Item 1 \(page 87\)](#) .
- ☐ Blue or blue marked.
- ☐ Check that it is securely installed.
- ☐ Fasten with spring braces.

19 - Gasket

- ☐ Replace.

20 - Pin 10 Nm

- ☐ To engine cover.

21 - Engine and gearbox support

22 - Hexagonal nut

23 - Cylinder head gasket

- ☐ Replace.
- ☐ Observe identification ⇒ [page 35](#) .
- ☐ When replacing, use completely new coolant.

24 - Hall Sensor -G40-

- ☐ To the camshaft position.
- ☐ Loosen to remove sealing ring from the mechanical distribution rear cover.

25 - Cylinder head securing bolt

- ☐ Replace.
- ☐ Follow the installation and removal sequence ⇒ [page 46](#) .
- ☐ Insert washers into cylinder head before installing.

26 - Injectors

- ☐ Remove and install ⇒ [page 112](#) .

Part III



WARNING

Always replace self-locking nuts and screws subject to angular torque



1 - 45 Nm

2 - Engine bracket

3 - Engine block

- ☐ Removing and installing sealing flange and fly-wheel ⇒ [page 17](#) .
- ☐ Disassemble and assemble pistons and connecting rods ⇒ [page 32](#)

4 - Connection, 40 Nm

- ☐ To turbocharger oil return pipe .
- ☐ Replace.

5 - Spacer sleeve

6 - Rubber bushing

7 - Engine and gearbox support

- ☐ To the Sensor Hall - G40- connector of the camshaft position and Engine speed sensor - G28- .

8 - 10 Nm

9 - Gasket

- ☐ Replace.

10 - Oil filter bracket

- ☐ Disassemble and assemble ⇒ [page 64](#) .

11 - 15 Nm + 90°

- ☐ Replace after each removal.
- ☐ First, install upper left and lower right bolts, then tighten the four bolts diagonally.

12 - Sealing ring

- ☐ Replace.

13 - 20 Nm

14 - Engine speed sensor -G28-

15 - Connection

- ☐ To temperature sensor.

16 - 15 Nm

17 - Coolant temperature sensor

- ☐ Remove and install ⇒ [page 82](#) .

18 - 45 Nm

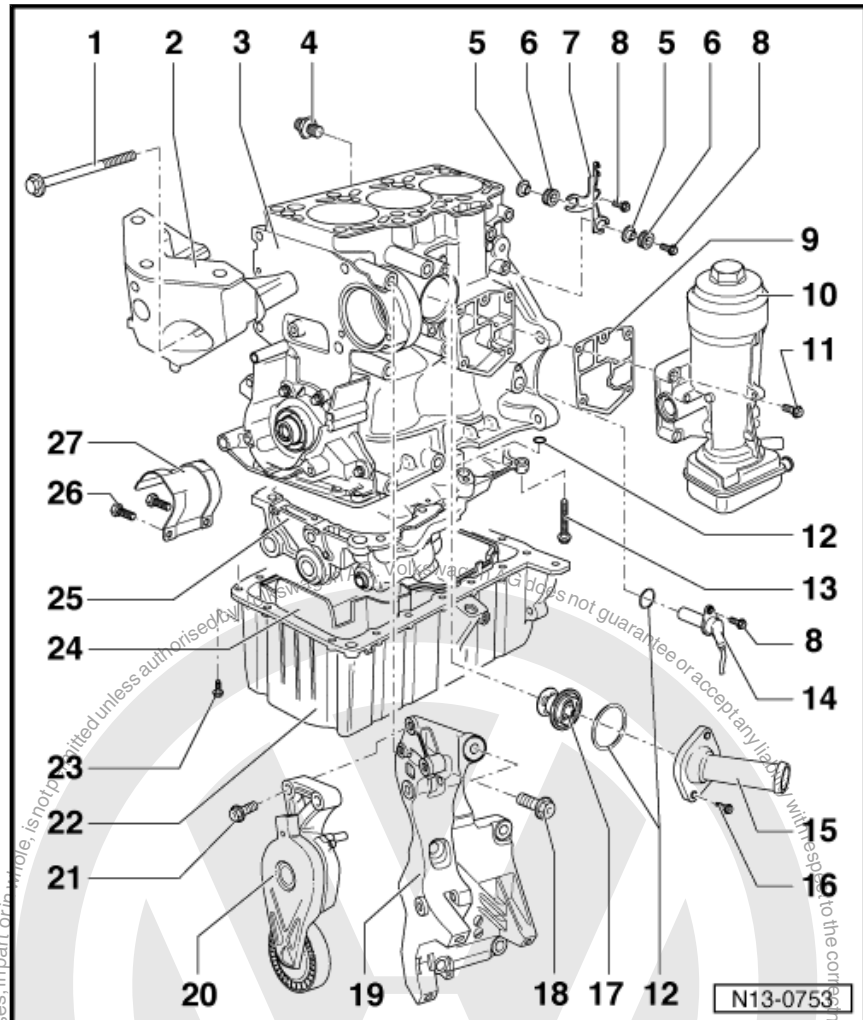
- ☐ Torque sequence: from inside out.

19 - Compact bracket

- ☐ To alternator, air conditioning compressor and Poly-V belt tensioning element.
- ☐ See the locating guide between compact bracket and engine block.

20 - Tensioning element

- ☐ To Poly-V belt.





21 - 25 Nm

22 - Oil crankcase

- ☐ Clean sealing surface before installation.
- ☐ Install with Silicone sealant -D 176 404 A2 - ➔ [page 68](#)
- ☐ To remove crankcase, first remove the transmission ➔ Rep. Gr. 34 .

23 - 15 Nm

- ☐ To remove the rear bolts close to the transmission, it first must be removed ➔ Rep. Gr. 34 .

24 - Cover

- ☐ With sealing tape.
- ☐ Clean filter if dirty.

25 - Mounting frame

- ☐ Before installing, check whether the fixing guides for centralizing on the engine block are in their place, and that the fuel distribution ring is inserted in the mounting frame.
- ☐ Remove and install ➔ [page 23](#) .

26 - 40 Nm

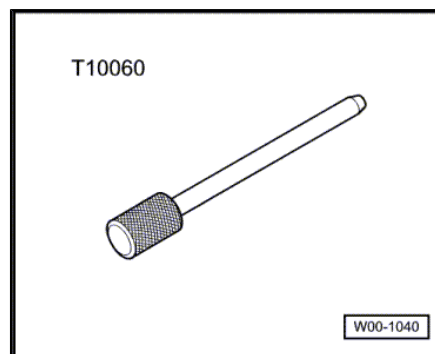
27 - Protective cover

- ☐ To drive shaft.

1.1 Poly-V belt - remove and install

Special tools and workshop equipment required

- ◆ Retaining pin -T10060 A-
- ◆ Spanner 15 mm AF

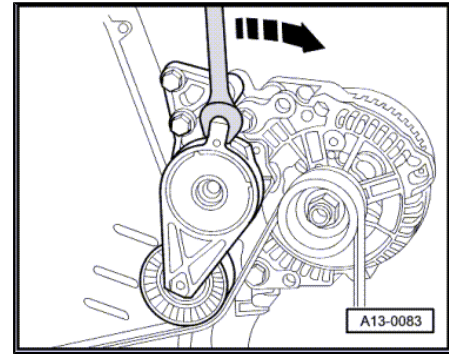


1.1.1 Removal

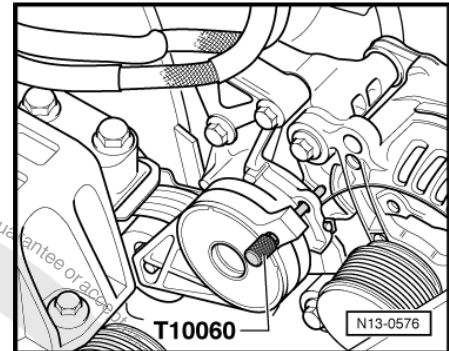
- Remove lower noise insulation from engine ➔ Rep. Gr. 50 .
- Remove the hose between intercooler/intake flange and the air mass meter.
- Mark Poly-V belt rotation direction.



- Turn tensioning element in arrow direction to relieve tension on Poly-V belt.



- Lock tensioning element with Retaining pin -T10060A- .
- Remove Poly-V belt.



1.1.2 Installation

- The installation is carried out by inverting the removal sequence.



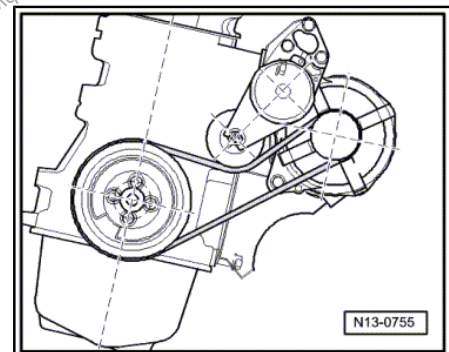
Note

- ◆ *Make sure before installing Poly-V belt that all the ancillaries (alternator, air conditioning compressor) are tightly secured .*
- ◆ *When fitting Poly-V belt, observe the direction in which it functions and check it is seated correctly on the pulley.*
- ◆ *In vehicles without air conditioning, installation of Poly-V belt on the alternator must be the last step.*
- ◆ *In vehicles with air conditioning, installation of Poly-V belt last on the air conditioning compressor.*

When the job is finished, always:

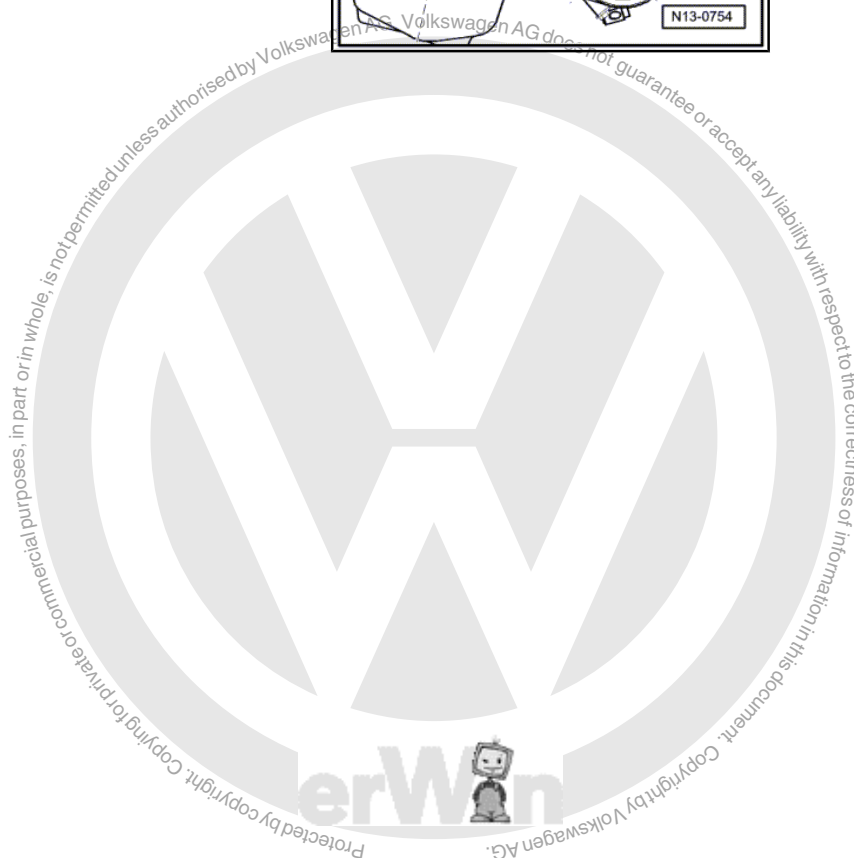
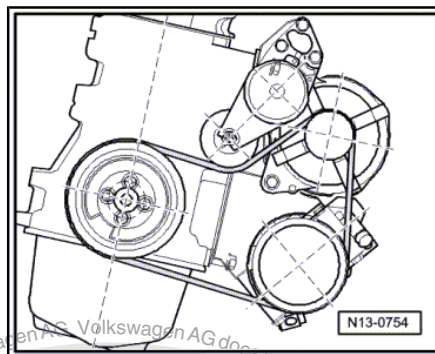
- Start the engine and check belt movement.

Belt path for vehicles without air conditioning.





Belt path for vehicles with air conditioning.





2 Crankshaft flanges and flywheel - remove and install



Note

Clutch repairs: ⇒ Rep. Gr. 30.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Seal

- ☐ Do not apply additional lubricant or grease to the seal lip.
- ☐ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- ☐ Replace crankshaft oil seal - pulley side
⇒ [page 18](#)

2 - Sealing flange

- ☐ Must be positioned on the fixing guides.
- ☐ Remove and install
⇒ [page 20](#).
- ☐ Install with Silicone seal -D176404 A2-
⇒ [page 20](#).

3 - Engine block

- ☐ Removing and installing crankshaft ⇒ [page 29](#)
- ☐ Disassemble and assemble pistons and connecting rods
⇒ [page 32](#)

4 - Engine flywheel

- ☐ To remove and install the flywheel, immobilise with the Flywheel lock -3386-

5 - 60 Nm + 90°

- ☐ Replace after each removal.

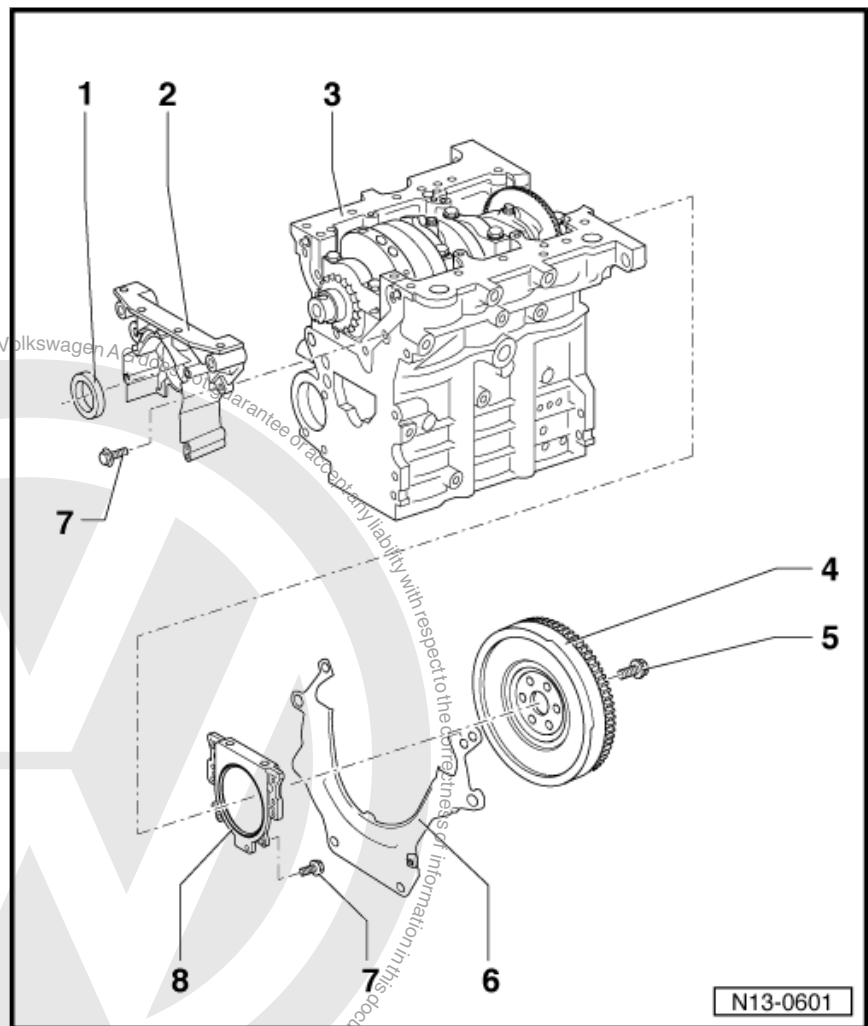
6 - Intermediate plate

- ☐ Must be positioned on fixing guides.
- ☐ Do not damage / bend during assembly

7 - 15 Nm

8 - Sealing flange with seal

- ☐ Complete replacement only.



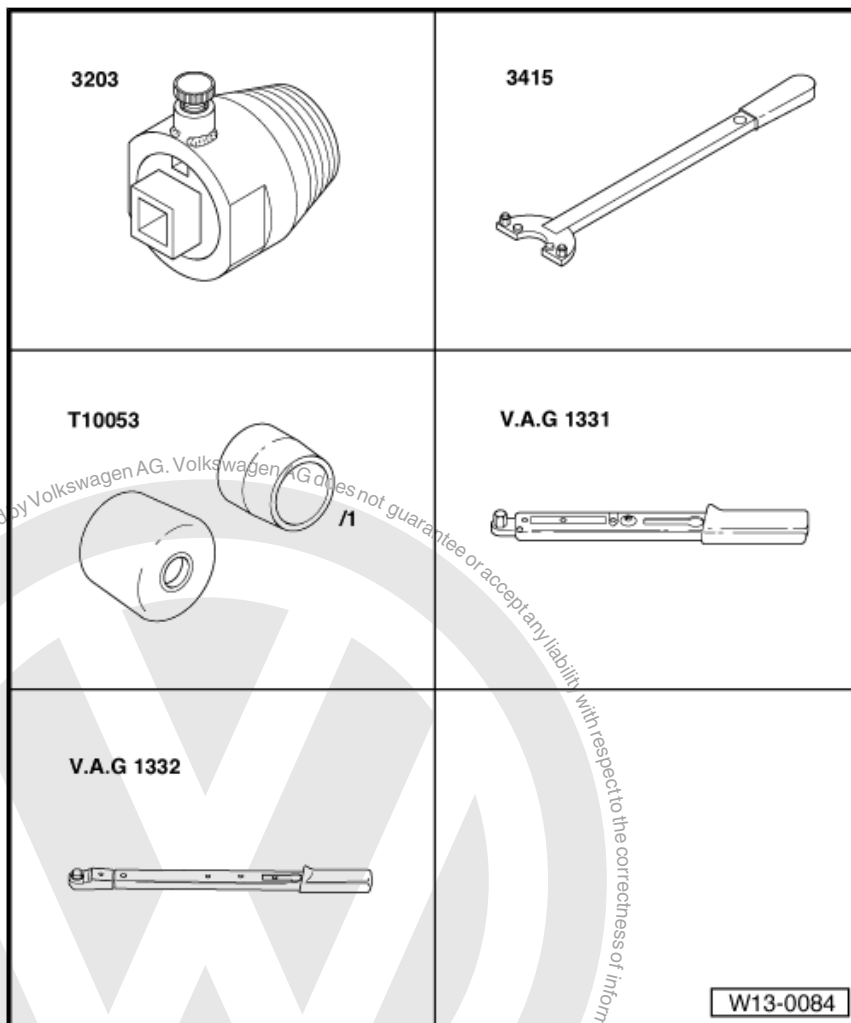


- ☐ Do not apply additional lubricant or grease to the seal lip.
- ☐ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- ☐ Use protective sleeve supplied when installing.
- ☐ First, remove the protective sleeve after installing the sealing flange on the crankshaft trunnion.

2.1 Crankshaft oil seal, pulley side - replace

Special tools and workshop equipment required

- ◆ Extractor -3203-
- ◆ Lock -3415-
- ◆ Assembly sleeve -T10053-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-

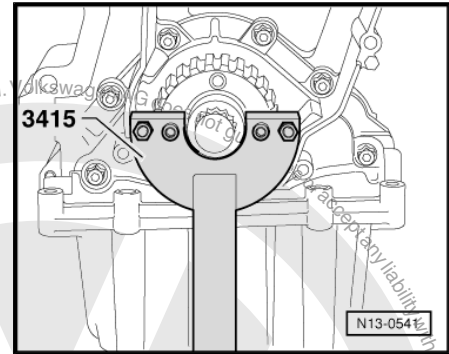


2.1.1 Removal

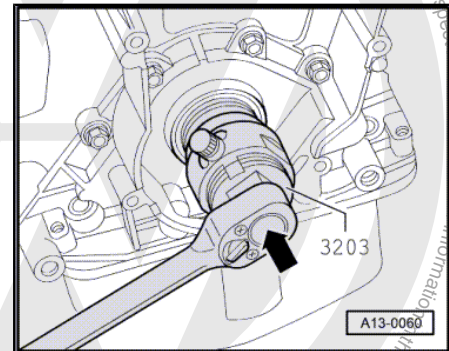
- Remove Poly-V belt ➔ [page 14](#) .
- Remove timing belt ➔ [page 41](#) .



- Remove crankshaft gear. To do this, immobilise gear with the Lock -3415- .
- To guide the seal Extractor -3203- , install the gear fastening screw manually up to the crankshaft stop.
- Give the inside part of the Extractor -3203- two turns (approx. 3 mm) from the external side, and lock with the slotted bolt.



- Lubricate the threaded head of the oil seal Extractor, -3203- install and screw as firmly as possible onto the seal.
- Loosen the slotted screw and turn the inner part against the crankshaft until the seal is extracted.



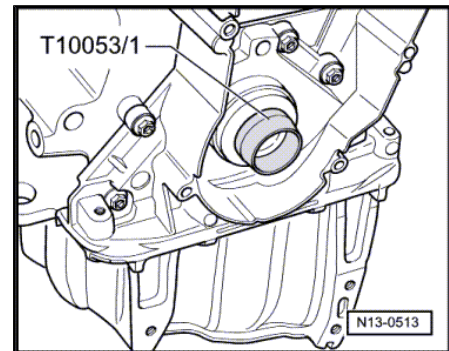
2.1.2 Installation



Note

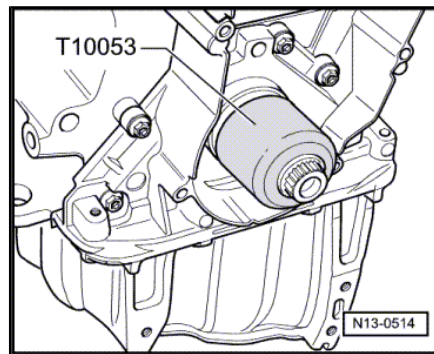
Do not apply additional lubricant or grease to the sealing lip of the oil seal.

- Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- Fit the Guide sleeve -T10053/1- onto the crankshaft trunnion.
- Slide oil seal over the Guide sleeve -T10053/1- and over the end of the crankshaft.





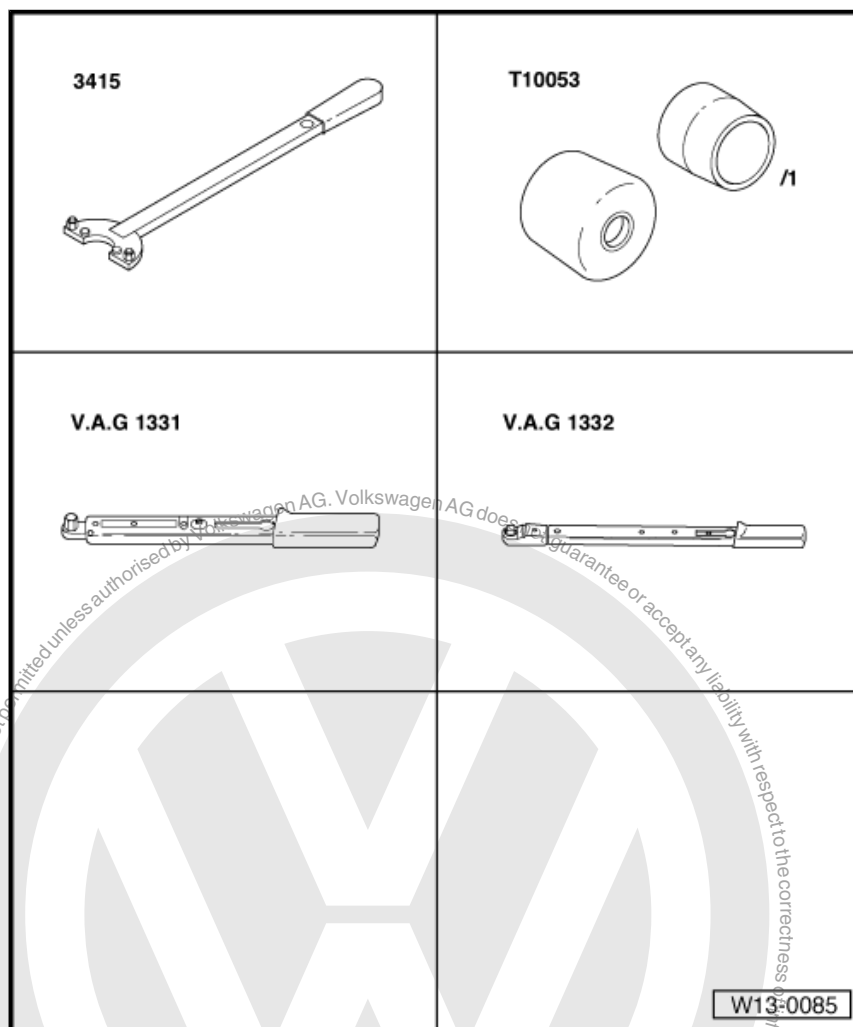
- Compress the oil seal up to the stop using Press sleeve of the Assembly sleeve -T10053- and the Centre bolt -T10053/2 - or Centre bolt -T10053/3- .
- Install and adjust timing belt ➔ [page 41](#) .



2.2 Crankshaft seal flange - replace

Special tools and workshop equipment required

- ◆ Lock -3415-
- ◆ Assembly sleeve -T10053-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ◆ Hand drill plastic brush
- ◆ Silicone seal -D176404 A2-
- ◆ Flat spatula

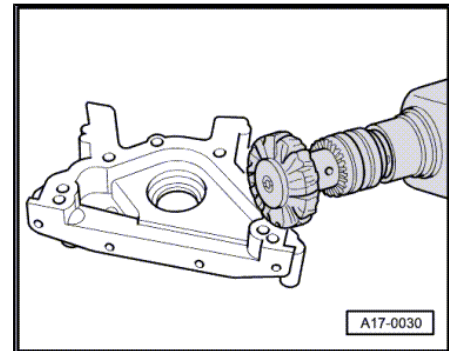
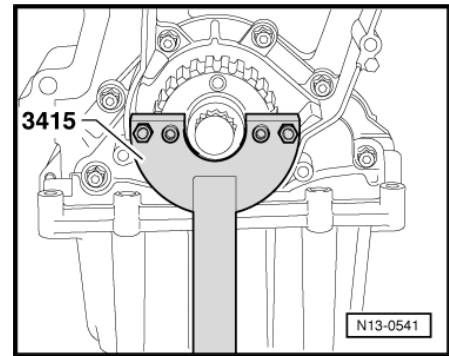


2.2.1 Removal

- Remove Poly-V belt ➔ [page 14](#) .
- Remove timing belt ➔ [page 41](#) .



- Remove crankshaft gear. To do this, lock gear with the Lock -3415- .
- Drain engine oil.
- Remove crankcase → [page 68](#) .
- Loosen front seal flange.
- Remove sealing flange, and release by tapping slightly with a rubber headed hammer, if necessary.
- Remove seal residues on engine block with a flat spatula.
- Cover oil seal with a clean cloth.
- Remove the sealant residues from the sealing flange with a rotary plastic brush (use eye protection).
- Clean the sealing surfaces. They must be free of oil and grease.



2.2.2 Installation



Note

- ◆ *Observe the sealant expiration date.*
- ◆ *The sealing flange must be installed within 5 minutes after applying the sealant.*





- Cut the tube injector on front marking ($\varnothing$ of injector is approx. 3 mm) .
- Apply silicone sealant, as shown, on the clean sealing surface of the sealing flange. The sealing compound bead must:
 - ♦ Have a thickness of -arrows-: 2...3 mm.



Note

- ♦ *The sealant bead cannot be thicker, otherwise, the excess sealant could pass to the crankshaft and block the strainer of the oil suction tube, as well as run along the sealing surface of the oil seal in the crankshaft.*
- ♦ *Before applying the sealant, cover the oil seal with a clean cloth.*
- Fasten the sealing flange immediately and lightly tighten all screws.



Note

Use the Guide sleeve -T10053/1- to fit the sealing flange with the oil seal already installed.

- Tighten fastening screws of sealing flange by using an alternating tightening sequence. Tightening torque: 15 Nm.
- Remove excess sealant.
- Install crankcase ➤ [page 68](#) .

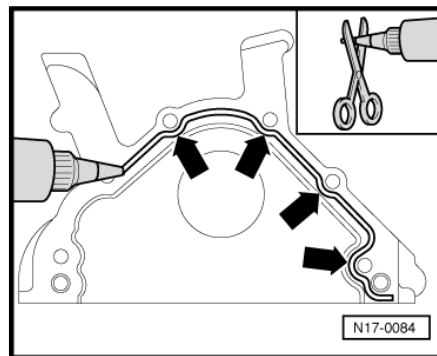


Note

After installation, the sealant should dry for approx. 30 minutes before replenishing the engine with oil.

Install timing belt and adjust distribution times ➤ [page 41](#) .

- Install Poly-V belt ➤ [page 14](#) .





3 Counterbalance shaft and retaining frame - remove and install



Note

All bearing and running surfaces must be lubricated before assembly.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Chain

- ❑ Observe fastening position ⇒ [page 25](#).

2 - 100 Nm +90°

- ❑ Replace after each removal.
- ❑ The angular torque could be undertaken in several stages.
- ❑ To loose and tighten, use Multi-point spanner -T10061-.

3 - Counterbalance

- ❑ It can be installed in one position only. The holes are displaced.

4 - Gear

- ❑ For counterbalance shaft.
- ❑ It can be installed in one position only. The holes are displaced.

5 - Fastening sleeve

6 - 20 Nm + 90°

- ❑ Replace after each removal.

7 - Gear

- ❑ For oil pump.
- ❑ It can be installed in one position only. The holes are displaced.

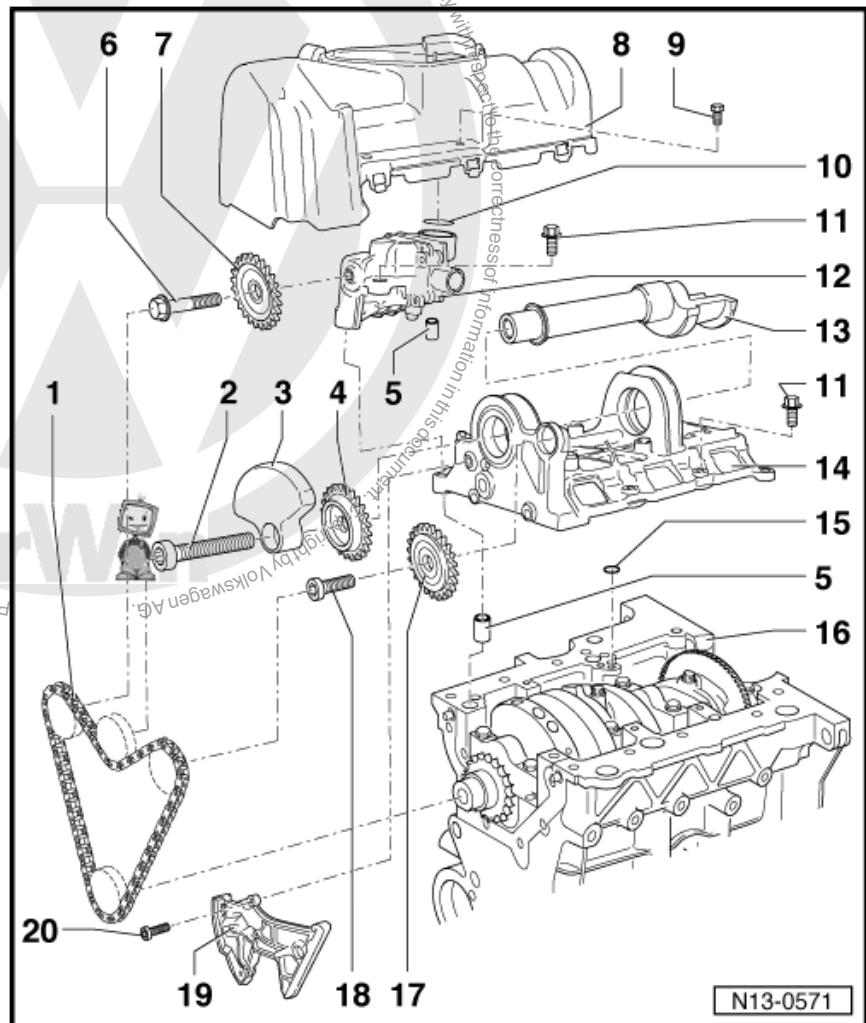
8 - Cover

- ❑ With sealing tape.
- ❑ Clean strainer if soiled.

9 - 5 Nm

10 - Sealing ring

- ❑ Replace.



N13-0571



- ☐ Check it is securely seated.
- ☐ Lubricate lightly when fitting.

11 - 20 Nm

12 - Oil pump

- ☐ With 11.5-bar pressure relief valve.
- ☐ Before installing, check that both centering fastening sleeves are installed.

13 - Counterbalance shaft

- ☐ Remove and install ⇒ [page 25](#) .

14 - Mounting frame

- ☐ Before installing, check that the securing guides for centralizing in the engine block are in their positions, and the sealing ring is inserted in the mounting frame.
- ☐ Remove and install ⇒ [page 25](#) .

15 - Sealing ring

- ☐ Replace.
- ☐ Check that it is firmly seated on the mounting frame.

16 - Engine block

17 - Gear

18 - 20 Nm

19 - Chain tensioning element with tensioning plate.

- ☐ To remove, immobilise with Locking pin -T10060- .
- ☐ Remove and install ⇒ [page 25](#) .

20 - 8 Nm + 90°

- ☐ Replace after each removal.

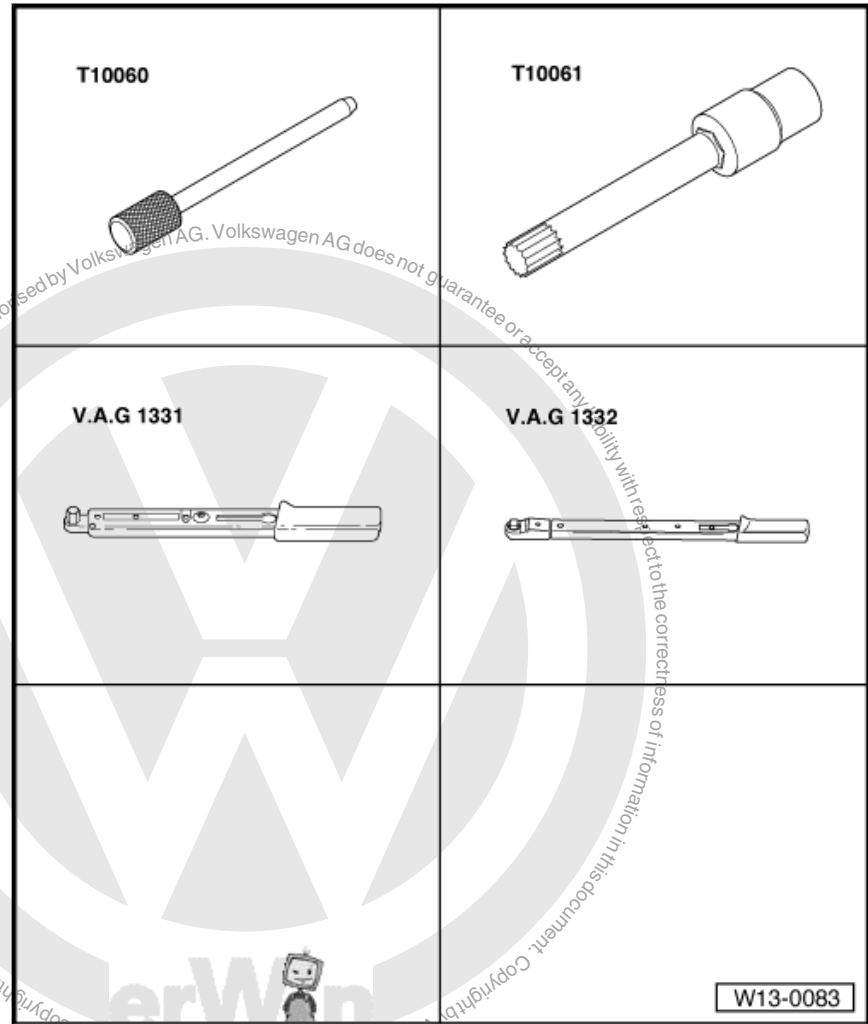




3.1 Counterbalance shaft - remove and install

Special tools and workshop equipment required

- ◆ Pin -T10060-
- ◆ Multi-point spanner - T10061-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ◆ Spanner (24/27 mm AF)

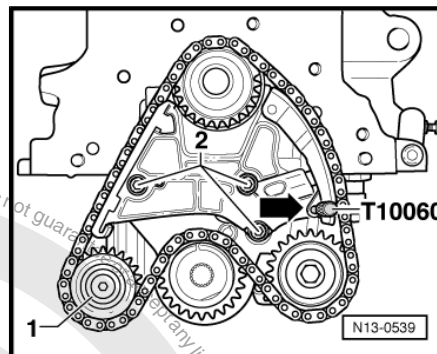


3.1.1 Removal

- Remove Poly-V belt ⇒ [page 14](#) .
- Remove timing belt ⇒ [page 41](#) .
- Remove crankcase ⇒ [page 68](#) .
- Remove sealing flange, pulley side ⇒ [page 17](#) .
- Remove cover securing bolts.
- Remove cover from mounting frame.



- Immobilise chain tensioning element with Retaining pin - T10060 A- -arrow-.
- Loosen the gear -1- from mounting frame.
- Remove securing bolt --2-- from chain tensioning element and remove it.
- Remove the chain and put it on a clean surface.



- Immobilise counterbalance shaft, as shown, with a Spanner (24/27 mm AF) -1-.

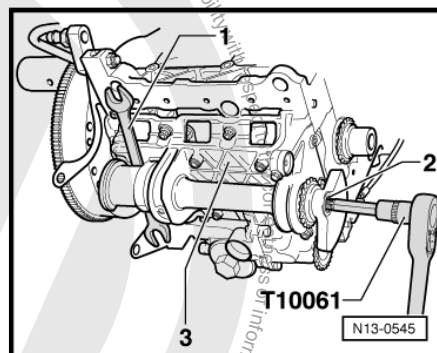
i Note

When immobilizing the counterbalance shaft, make sure that the spanner is centred on the counterbalance and at right angles to counterbalance shaft.

- Loosen fastening bolt -2- of the counterbalance.

i Note

Only loosen the fastening bolt -2- of the counterbalance; do not remove.



- Unbolt mounting frame --3-- from engine block and remove it with counterbalance shaft.
- Put the mounting frame on a clean surface.
- Remove counterbalance securing bolts.
- Remove counterbalance and counterbalance shaft gear.
- Turn the counterbalance shaft so that it can be removed from the bearing.

3.1.2 Installing

- Sliding surfaces of the bearing oil.
- Set counterbalance shaft in bearing.
- Fit the gear and counterbalance on counterbalance shaft.

i Note

Installing the gear and counterbalance is only possible in a single position.

- Hand tighten securing bolt for counterbalance weight and gear.
- Tighten mounting frame to engine block by hand so that there is no play.



Note

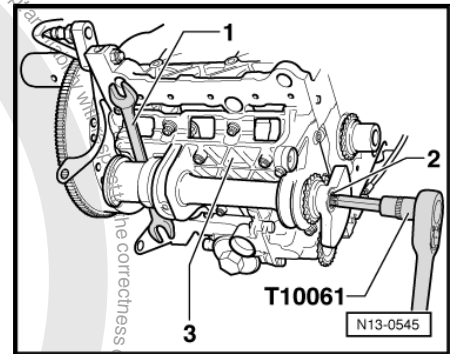
- ◆ *When positioning the frame, make sure that the fastening guide is inserted into the engine block and the O-ring is fitted in the mounting frame.*
- ◆ *Align the mounting frame so that it fits flush with the outer edge of the engine block on the pulley end.*
- Bolt mounting frame with counterbalance shaft to engine block. Tightening torque: 20 Nm.
- Check that mounting frame aligns flush with outer edge of engine block on the pulley end.
- Immobilise counterbalance shaft, as shown, with a Spanner (24/27 mm AF) -1-.



Note

When immobilizing the counterbalance shaft, make sure that the spanner is centred on the counterbalance and at right angles to counterbalance shaft.

- Tighten fastening bolt -2- of the counterbalance. Tightening torque: 100 Nm +90°.



Note

The fastening bolt is a tensioning bolt and must always be replaced.

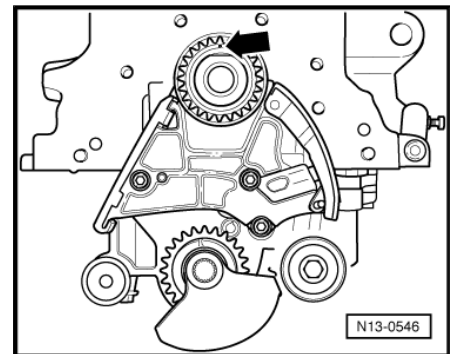
- Install chain tensioning element. Tightening torque: 8 Nm + 90°.



Note

The fastening bolts of the chain tensioning element are tensioning bolts and must always be replaced.

- Clean chain with a lint-free cloth.
- Ensure that mark on crankshaft sprocket -arrow- is at top.





- Lay chain over crankshaft sprocket, oil pump sprocket and counterbalance shaft sprocket. Make sure that the marks on the crankshaft sprocket and counterbalance sprocket align with the colour-coded chain links -arrows-.

i Note

The colour-coded chain links are marked with a notch.

- Fit the free sprocket in the chain and tighten the free sprocket to the mounting frame. Tightening torque: 20 Nm.
- Remove Locking pin -T10060- from chain tensioning element.
- Make sure that the marks on the crankshaft sprocket and counterbalance shaft sprocket align with the colour-coded chain links -arrows-.

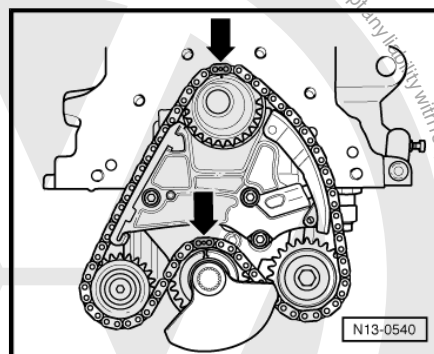
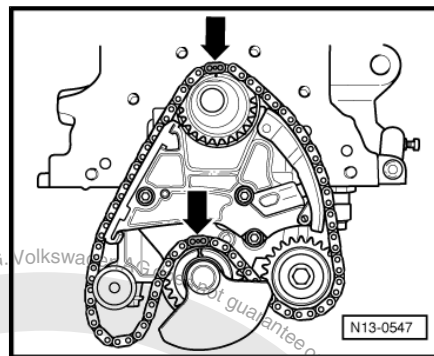
i Note

The colour-coded chain links are marked with a notch.

- Install pulley end sealing flange ➔ [page 17](#) .
- Install counterbalance shaft cover. Tightening torque: 5 Nm.

i Note

- ◆ *Before installing cover, lubricate O-ring of oil pump, as well as shaft on inside of cover*
- ◆ *Make sure of the proper seating of sealing strip in cover.*
- ◆ *When installing cover, ensure that cover engages in mounting frame.*
- Install crankcase ➔ [page 68](#) .
- Install and adjust timing belt ➔ [page 41](#) .
- Install Poly-V belt ➔ [page 14](#) .





4 Crankshaft - remove and install



Note

- ◆ Before removing crankshaft, make sure that a proper surface has been prepared to ensure that the speed sensor rotor is not damaged, or does not touch another item.
- ◆ All bearing and running surfaces must be lubricated before assembly.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Bearing shells 1, 2 and 4

- ☐ For bearing shells with-out oil groove.
- ☐ For engine block with oil groove.
- ☐ Do not interchange used bearing shells (mark)

2 - 65 Nm + 90°

- ☐ Replace after each removal.
- ☐ To measure radial clearance, tighten to 65 Nm, and no further.

3 - Bearing cap

- ☐ Bearing cap 1: Pulley side.
- ☐ Bearing shell retaining tabs (block/bearing cap)

4 - Bearing shell 3

- ☐ For bearing cap without oil groove.
- ☐ For engine block with oil groove.

5 - Speed sensor rotor

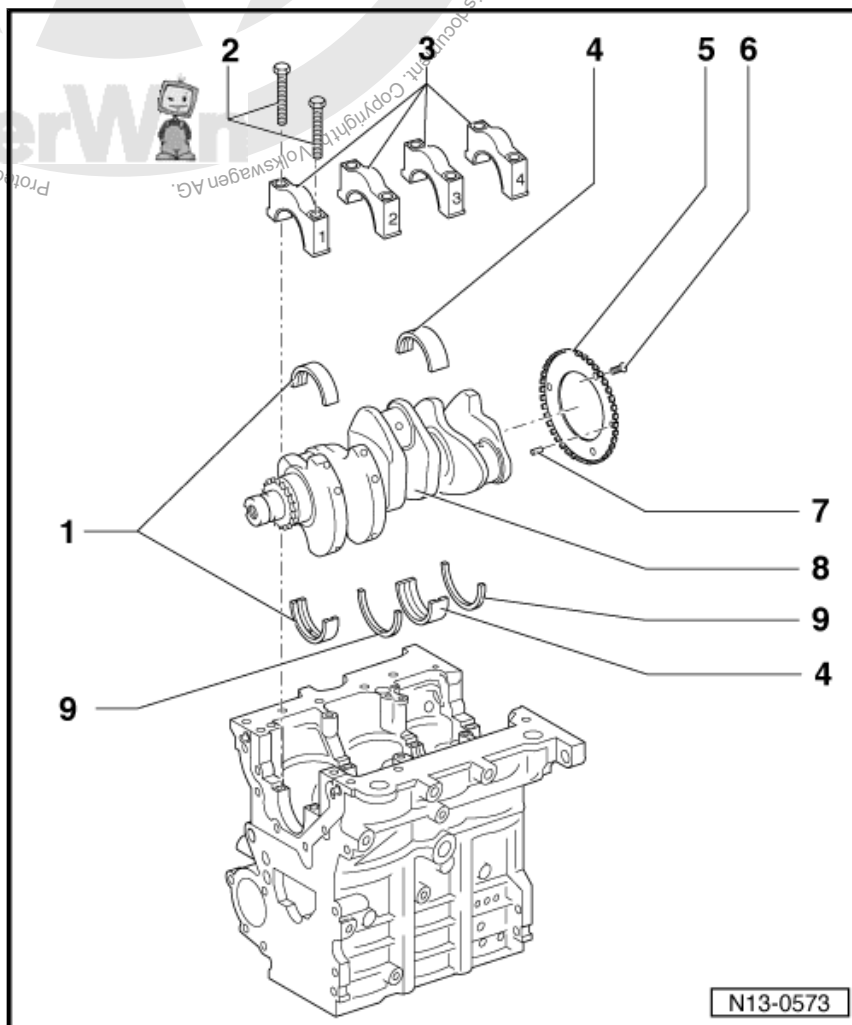
- ☐ To Engine speed sensor - G28-
- ☐ Replace if damaged.
- ☐ Replace sensor rotor each time bolts are loosened
- ☐ Remove and install.
⇒ [page 30](#)

6 - 10 Nm + 90°

- ☐ Replace after each removal.

7 - Fitted pin

- ☐ Check the projection from crankshaft ⇒ [page 30](#)





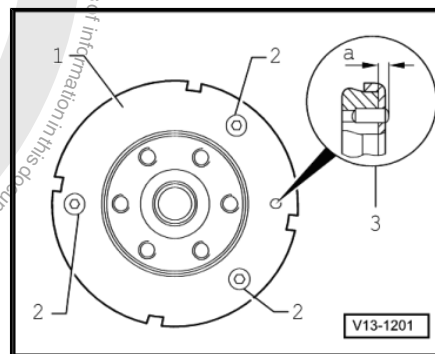
8 - Crankshaft

- ☐ See notes before removing ⇒ [page 29](#) .
- ☐ Axial clearance new: 0.07...0.17 mm. Wear limit: 0.37 mm.
- ☐ Check radial clearance with Plastigage. New: 0.03...0.08 mm. Wear limit: 0.17 mm.
- ☐ Do not rotate crankshaft while measuring radial clearance.
- ☐ Crankshaft dimensions ⇒ [page 30](#) .

9 - Stop ring

- ☐ To engine block, bearing 3.

Check fitted pin projection out of crankshaft



Special tools and workshop equipment required

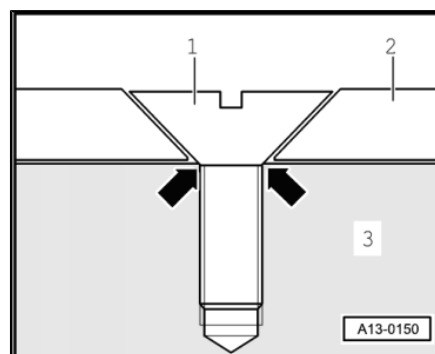
- ◆ Depth gauge

Test sequence

- Use Depth gauge to check projection -a- of fitted pin, with speed sensor wheel -1- removed.
- 1 - Speed sensor rotor.
 - 2 - Securing bolt.
 - 3 - Projection of fitted pin -3- out of crankshaft $a = 2.5...3.0$ mm.

Removing and installing speed sensor rotor

- Replace speed sensor rotor -2- each time the bolts -1- are loosened. Tightening torque: 10 Nm + 90°.



Note

When the bolts are tightened for the second time, the contact point on the speed sensor rotor is sufficiently deformed to enable the bolt head to touch -arrows- on the crankshaft -3-, thus enabling the speed sensor wheel to remain loose under the bolts.

4.1 Crankshaft dimensions

(in mm)

Dimension for finishing	Crankshaft trunnion -Ø	Connecting rod pin-Ø
Basic dimension	-0,022 54,00 -0,042	-0,022 47,80 -0,042
First rework	-0,022 53,75 -0,042	-0,022 47,55 -0,042



Dimension for finishing	Crankshaft trunnion -Ø	Connecting rod pin-Ø
Second rework	-0,022 53,50 -0,042	-0,022 47,30 -0,042
Third rework	-0,022 53,25 -0,042	-0,022 47,05 -0,042





5 Pistons and connecting rods - dismantle and assemble



Note

All bearing and running surfaces must be lubricated before assembly.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Piston ring

- ☐ Displace the apertures in 120°.
- ☐ Remove and install using the piston ring pliers.
- ☐ The mark "TOP" should face the piston head.
- ☐ Check ring gap
- ☐ Check ring to groove clearance

2 - Piston

- ☐ With combustion chamber.
- ☐ Mark installation position and correspondence with respective cylinder ➔ [page 34](#)
- ☐ The arrow on the piston head should be pointed in the direction of the pulley.
- ☐ Install by using a piston ring compressing tool.
- ☐ Replace piston in case of cracks on its skirt.
- ☐ Check the piston projection at TDC ➔ [page 34](#)

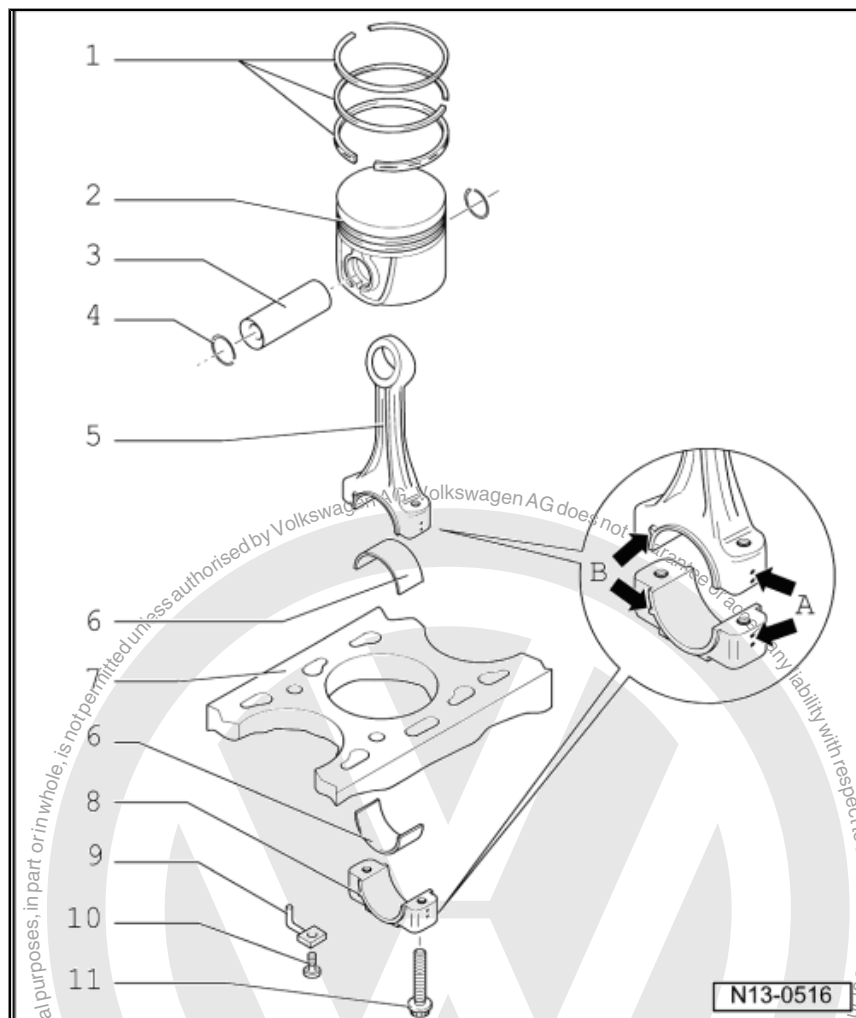
3 - Piston pin

- ☐ In case of difficulties in the removal, heat the piston to 60 °C.
- ☐ Remove and install with Puller and fitter -VW 222 A- .

4 - Piston pin retaining ring

5 - Connection rod

- ☐ Only replace as a set.
- ☐ Mark correspondence with cylinder -A-
- ☐ Mounting position: Marks -B- shall point towards the pulley.





6 - Bearing shell

- ☐ Check installation position.
- ☐ Check version: Top bearing shell (nearest to the piston) is made with wear-resistant material. Identification: Black line on the bearing shell surface, in the union area.
- ☐ Do not interchange used bearing shells.
- ☐ Insert bearing shells centrally.
- ☐ Distance from the bearing shell edge to the external edge of connecting rod/connecting rod cap: 2.5 mm, measured from one side.
- ☐ Check it is securely seated.
- ☐ Axial clearance. Wear limit: 0.37 mm.
- ☐ Check radial clearance with Plastigage: Wear limit: 0.08 mm. Do not rotate crankshaft while checking radial clearance.

7 - Engine block

- ☐ Check cylinder diameters ⇒ [page 34](#)
- ☐ Piston and cylinder dimensions ⇒ [page 36](#).

8 - Connecting rod cap

- ☐ Check installation position.

9 - Oil ejector

- ☐ For piston cooling.
- ☐ Check assembly position: Install by turning the oil ejector in counterclockwise direction up to the end.

10 - 25 Nm

- ☐ Insert without sealant.

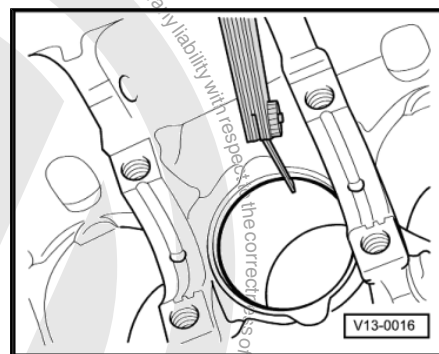
11 - Connecting rod screw, 30 Nm + 90°

- ☐ Replace after each removal.
- ☐ Lubricate threads and contact surface.
- ☐ First tighten evenly to 5 Nm.
- ☐ To measure radial clearance, use old bolts.

Check piston ring gap

- Push ring firmly from above down to approx. 15 mm from bottom end of cylinder.

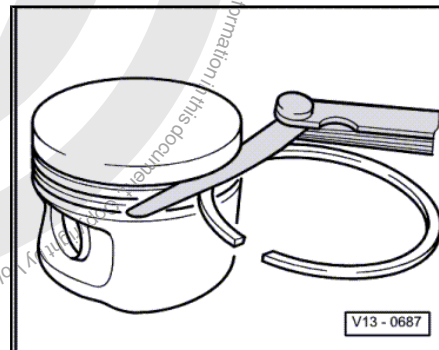
Piston ring Dimensions in mm	New	Wear limit
1. compression ring	0,25...0,40	1,0
2. compression ring	0,20...0,40	1,0
Oil scraper ring	0,25...0,50	1,0



Checking ring to groove clearance

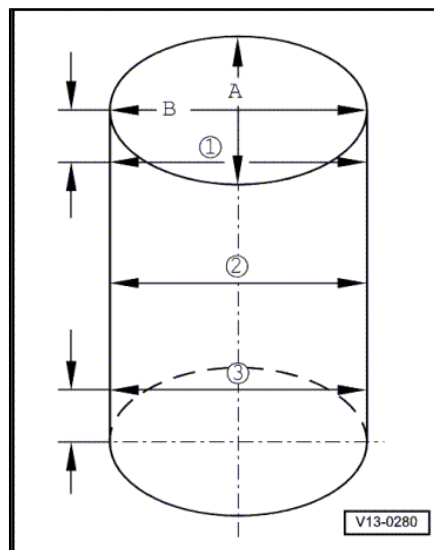
Clean groove before check.

Piston ring Dimensions in mm	New	Wear limit
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





Check cylinder diameters



Special tools and workshop equipment required

- ◆ Precision internal micrometer 50...100 mm
- Take measurements at three different cross positions, in both lateral -A- and longitudinal -B- directions, as illustrated. Max. nominal dimension deviation 0.10 mm.



Note

The cylinder diameter cannot be measured while the engine block is secured to the assembly stand with the Engine and gearbox support -VW 540-, for in this case inaccurate measurements are possible.

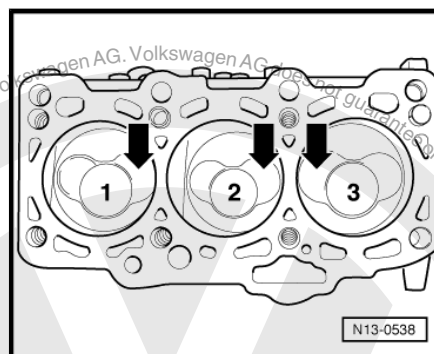
Installation position and correspondence to respective cylinder

Piston in cylinders 1 and 2.

Larger intake valve chamber towards the flywheel -arrows-.

Piston in cylinder 3.

Larger intake valve chamber towards the pulley -arrow-.



Note

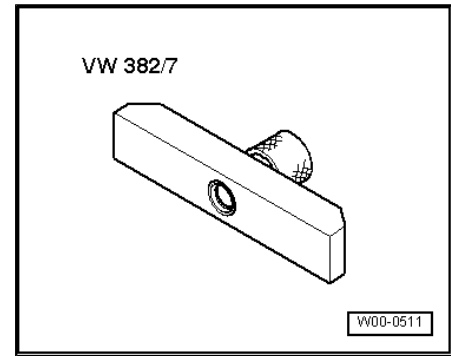
- ◆ *The new correspondence between pistons and cylinders is indicated by color marking on the piston head.*
- ◆ *Piston for cylinders 1 and 2: marking 1/2.*
- ◆ *Piston for cylinder 3: marking 3.*

Check the piston projection at TDC

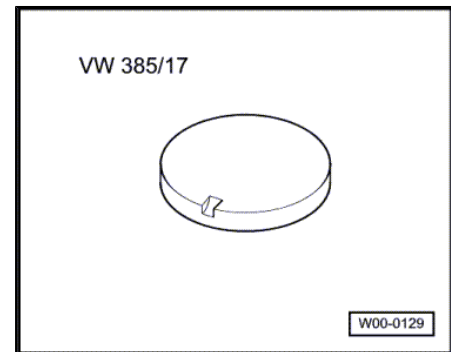
Special tools and workshop equipment required



- ◆ Measurement tool -VW 382/7-



- ◆ Universal measurement tool -VW 385/17-



Test sequence

- The piston projection at TDC must be measured when installing the new pistons. Depending on the piston projections, install the corresponding head gasket, in compliance with the table below:



Note

Turn the engine clockwise to check the piston projections in TDC.

Piston projection	Identification Holes/grooves
0.91 mm...1.00 mm	1
1.01 mm...10.10 mm	2
1.11 mm...10.20 mm	3

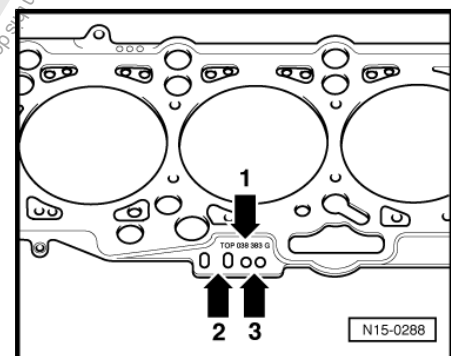
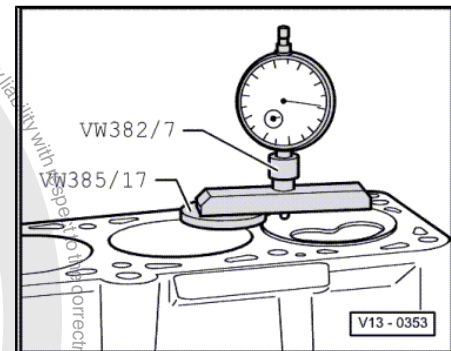
Identification of cylinder head gasket

- ◆ Part number = -arrow 1-
- ◆ Production control code = -arrow 2- (can be disregarded).
- ◆ Holes = -arrow 3-



Note

If different figures are obtained when measuring piston projection, the highest figure should be taken when selecting the head gasket.





5.1 Piston and cylinder dimensions

Dimension for finishing		Ø Piston	Ø cilinder
Basic dimension	mm	79,47	79,51
1. rework	mm	79,97	80,01





15 – Cylinder head, valve control mechanism

1 Cylinder head - remove and install

Check compression ⇒ [page 49](#) .



Note

- ◆ *When mounting a replacement head with the camshaft mounted, lubricate all the contact surfaces between tappets and cams before installing the head cover.*
- ◆ *All bearing and running surfaces must be lubricated before assembly.*
- ◆ *The plastic shims provided for protecting the open valves should not be removed until immediately before fitting cylinder head.*
- ◆ *When replacing head, the cooling liquid should be totally replaced too.*



WARNING

Always replace self-locking nuts and screws subject to angular torque

**1 - Mechanical distribution upper cover****2 - Timing belt**

- ☐ Before removing, mark operation direction.
- ☐ Check wear.
- ☐ Do not bend.
- ☐ Remove, install, and adjust ⇒ [page 41](#).

3 - 10 Nm**4 - 25 Nm****5 - 100 Nm****6 - Camshaft gear****7 - Pulley**

- ☐ With engine phase sensor wheel.
- ☐ Use Counter-hold tool - T10051- to loosen and tighten.
- ☐ To remove, use the Puller - T10052-.
- ☐ Remove and install ⇒ [page 58](#).

8 - Mechanical distribution rear cover**9 - Sealing ring**

- ☐ Replace if damaged.

10 - Hall Sensor -G40-

- ☐ To the camshaft position.
- ☐ To remove, remove sealing ring.

11 - Cylinder head securing bolt

- ☐ Replace.
- ☐ Check the sequence when loosening or tightening ⇒ [page 46](#).
- ☐ Before installing, set washers in cylinder head.

12 - Pin 10 Nm

- ☐ To engine cover.

13 - Cylinder head cover

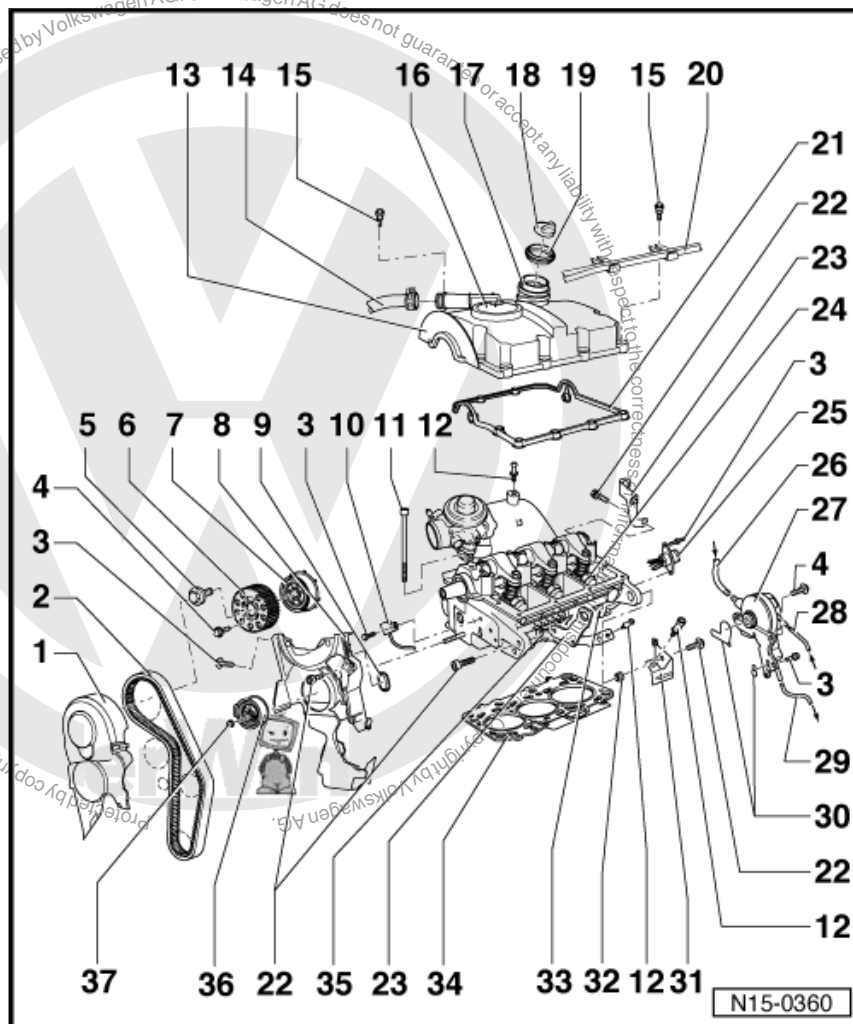
- ☐ With oil filler nozzle.
- ☐ Replace oil filling nozzle if cylinder head cover is damaged.
- ☐ Before installing, carefully clean the cylinder head sealing surface with a clean cloth.

14 - To turbocharger**15 - 10 Nm**

- ☐ First hand tighten all bolts.
- ☐ Then tighten both top bolts and thereafter the remainder from the inside outwards, diagonally, according to the specified tightening torque.

16 - Pressure regulating valve

- ☐ To crankcase vent.





- 17 - Oil filling nozzle**
 - ☐ Replace.
- 18 - Cover**
 - ☐ Replace seal if damaged.
- 19 - Gasket**
 - ☐ Replace if damaged.
- 20 - Support**
 - ☐ With fuel tube/hose.
- 21 - Cylinder head cover gasket**
 - ☐ Replace if damaged.
- 22 - 20 Nm**
- 23 - Lifting eye**
- 24 - Injection unit**
 - ☐ Remove and install ⇒ [page 112](#) .
- 25 - Central connector**
 - ☐ To injector.
- 26 - From servo brake**
- 27 - Tandem pump**
 - ☐ For supplying fuel and vacuum.
 - ☐ Remove and install ⇒ [page 97](#) .
 - ☐ Check ⇒ [page 95](#) .
- 28 - Supply hose**
 - ☐ From fuel filter ⇒ [Item 1 \(page 87\)](#) .
 - ☐ White or with white marking.
 - ☐ Check that it is securely installed.
 - ☐ Fasten with spring braces.
- 29 - Return hose**
 - ☐ To fuel filter ⇒ [Item 1 \(page 87\)](#) .
 - ☐ Blue or blue marked.
 - ☐ Check that it is securely installed.
 - ☐ Fasten with spring braces.
- 30 - Gasket**
 - ☐ Replace.
- 31 - Support**
- 32 - Hexagonal nut**
- 33 - Cylinder head**
 - ☐ Remove and install ⇒ [page 46](#) .
 - ☐ When replacing, renew the complete coolant.
- 34 - Cylinder head gasket**
 - ☐ Replace.
 - ☐ Check marking ⇒ [page 40](#)
 - ☐ When replacing, renew the complete coolant.
- 35 - Glow plug**
 - ☐ 15 Nm.



36 - Tensioning element

37 - 20 Nm +45°

- ❑ Replace after each removal

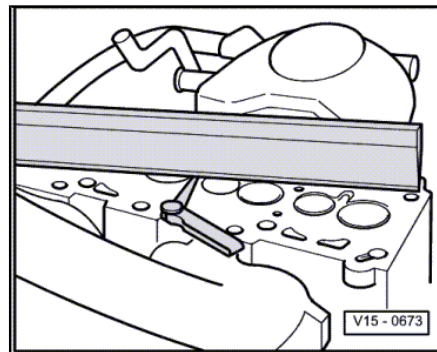
Check the cylinder head for bending.

Max. permissible bending: 0.1 mm.



Note

Diesel engine head rework is not permitted.



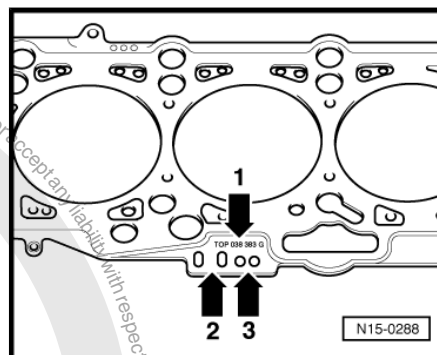
Identification of cylinder head gasket

- ◆ Part number = -arrow 1-
- ◆ Production control code = -arrow 2- (can be disregarded).
- ◆ Holes = -arrow 3-



Note

Different cylinder head gasket thicknesses are mounted, depending on the piston projection. When replacing the cylinder head gasket, install a new part with the same identification.

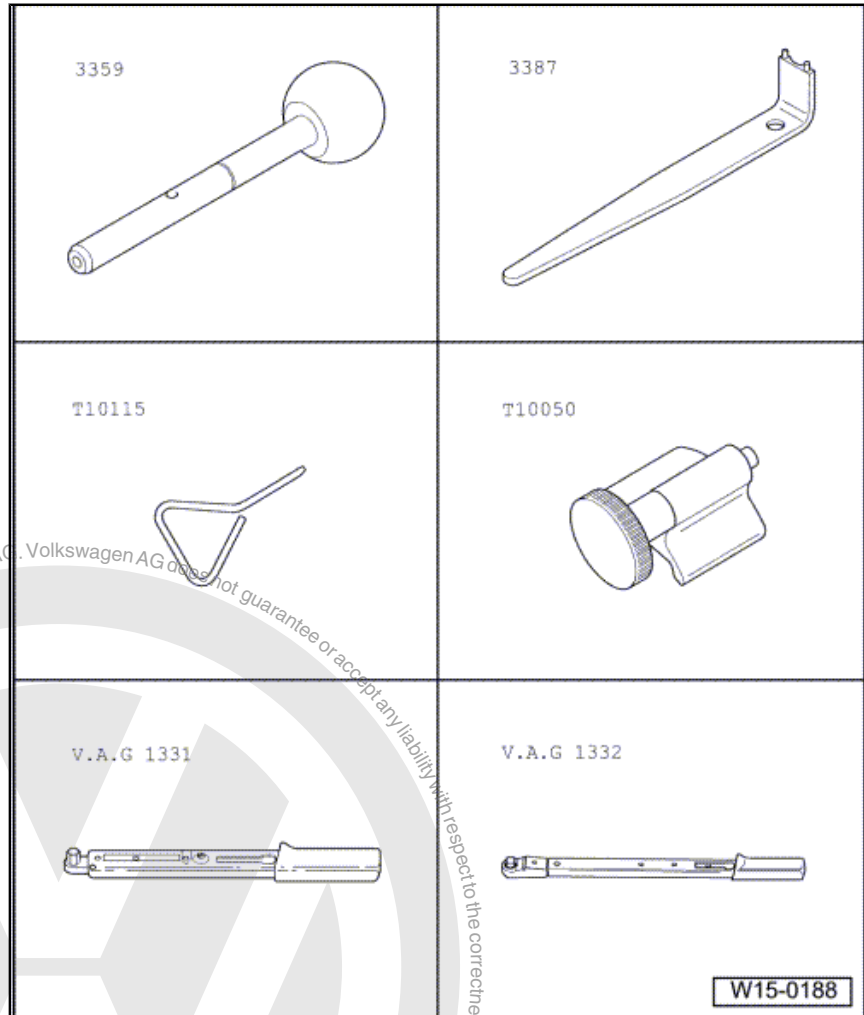




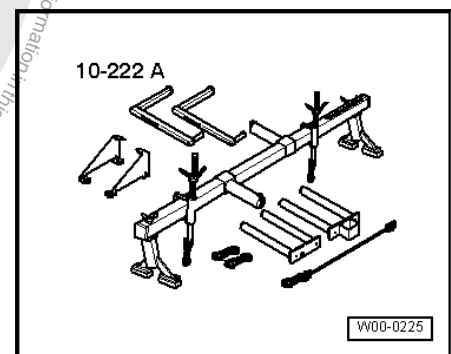
1.1 Timing belt - remove and install, adjust

Special tools and workshop equipment required

- ◆ Diesel injection pump locking pin -3359-
- ◆ Pin wrench -3387-
- ◆ Crankshaft stop -T10050-
- ◆ Fitter -T10015-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-



- ◆ Support bracket -10-222A- with Rack -10-222 A/1-





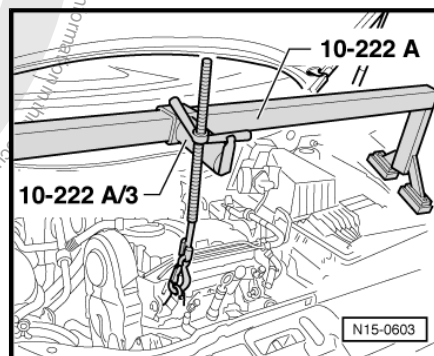
1.1.1 Removal



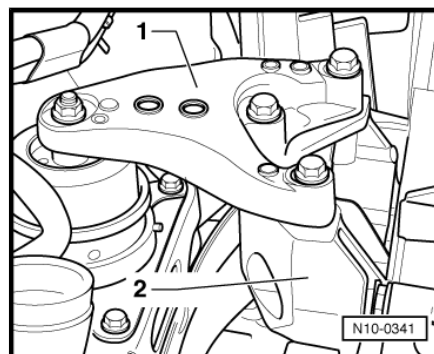
Note

Adjustment work on timing belts should only be carried out on cold engines, as the indicator on the tensioning element changes depending on the engine temperature.

- Remove the engine cover.
- Remove the hose between intercooler and intake connecting flange.
- Fit Support bracket -10-222 A- as shown and support the engine in its installation position.



- Remove engine support -1- and engine console -2-.
- Remove Poly-V belt ➔ [page 14](#) .
- Remove Locking pin -T10060- from tensioning element.
- Remove mechanical distribution upper cover.
- Remove lower noise insulation from engine ➔ Rep. Gr. 50 .
- Remove the hose between turbocharger and intercooler.
- Carefully cover or seal open ends.
- Remove vibration absorber.
- Remove centre cover of the mechanical distribution.
- Remove mechanical distribution lower cover.
- Rotate the crankshaft to TDC for cylinder 1.



**Note**

Turn the crankshaft until the mark on the crankshaft pulley is facing up and the arrow on the rear section of the timing belt aligns with shoulder on the phase sensor wheel hub -arrows-.

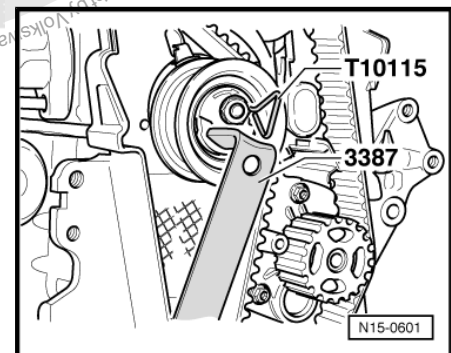
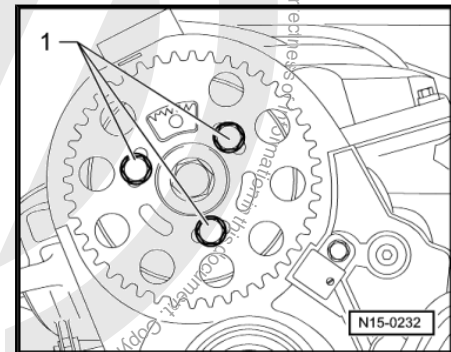
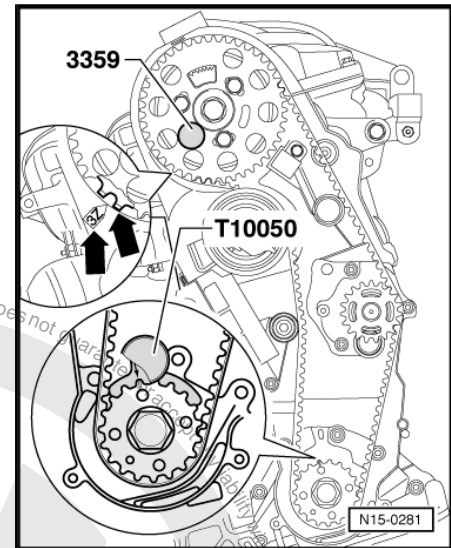
- Immobilise hub with Mandrel -3359- . To do this, slide mandrel through free elongated hole on left side and into hole in cylinder head.
- Lock timing belt gear at crankshaft, using Crankshaft stop - T10050- . To do this, push crankshaft stop from the face side of the gear into the gear teeth.

**Note**

The marks on the crankshaft gear and the crankshaft stop must align. At the same time, the shaft of the crankshaft stop must engage into the hole in the sealing flange.

- Mark timing belt operation direction.
- Loosen securing nut of the tensioning element.
- Loosen the fastening bolts of the camshaft gear -1-, until the gear can be moved into the elongated holes.

- Turn Pin wrench -3387- counterclockwise (opposite direction of arrow) until the timing belt tensioning element can be fixed in place using Locking pin -T10115- .
- Now, turn Pin wrench -3387- clockwise in direction of -arrow- until stop and remove timing belt first from the water pump, and then from the remaining gears.



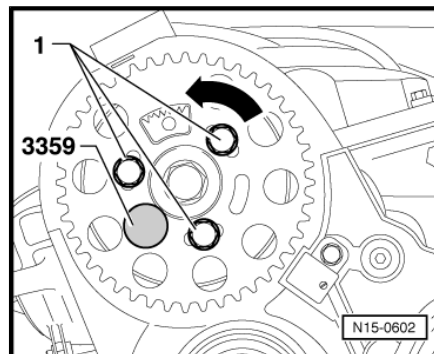
1.1.2 Installation

**Note**

Adjustment work on timing belts shall only be carried out on cold engines, as the indicator on the tensioning element changes depending on the engine temperature.



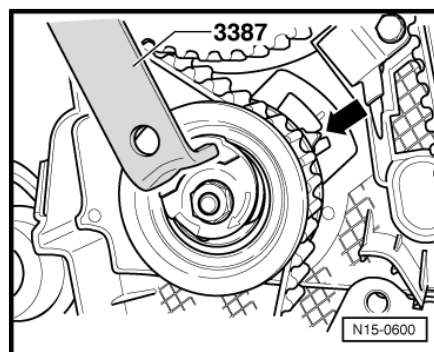
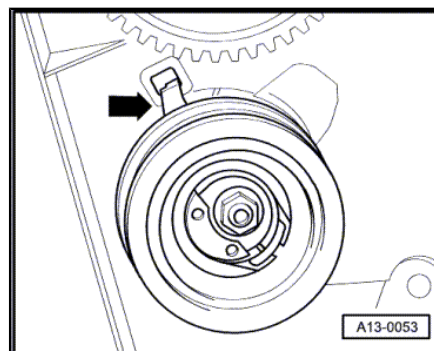
- Turn camshaft gear counterclockwise in the elongated holes - in the direction of arrow - until reaching stop.
- Install timing belt at crankshaft gear, tensioning element and camshaft gear.



Note

Make sure the tensioning element is correctly seated in rear mechanical distribution guard -arrow-.

- Now, turn the tensioning element, using the Pin wrench -3387- in the direction of -arrow- until reaching the stop, and fit timing belt on the water pump.
- Relieve the tension from the tensioning element by turning it with the Pin wrench -3387- in opposite direction of arrow.
- Now, carefully turn tensioning element with Pin wrench -3387- in the direction of arrow until the indicator is in the middle of the gap in the base plate -arrow-.
- Secure the tensioning element in this position and tighten the fastening nut with: 20 Nm +45°.
- Tighten fastening screws of the camshaft gear to 25 Nm.
- Remove Mandrel -3359- and Crankshaft stop -T10050-.
- Turn crankshaft twice in the engine rotation direction until it is again in the TDC of cylinder 1.

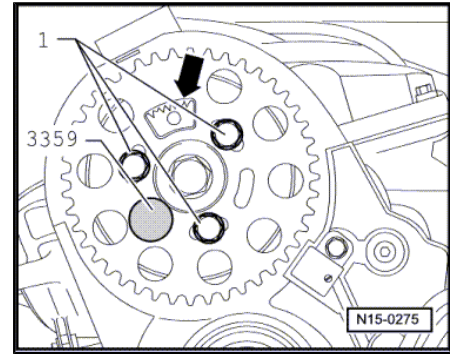


Note

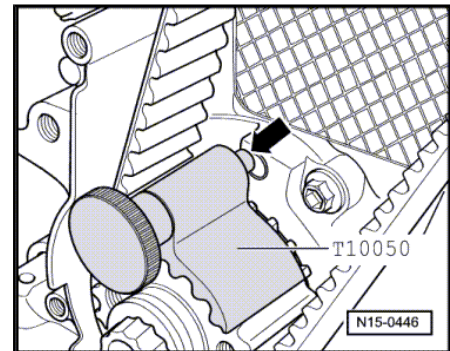
- ◆ *When doing this, the crankshaft stop end shall engage in the sealing flange while turning the engine.*
 - ◆ *When the crankshaft is turned beyond the TDC of cylinder 1 and the crankshaft stop is not engaged in the sealing flange, turn the crankshaft 1/4 turn in the reverse direction in order to readjust TDC of cylinder 1. No correction is allowed while the engine is turning, so as to ensure the correct operation of the crankshaft stop.*
 - Once the Crankshaft stop -T10050- has engaged, check whether the gear can be locked by using the Locking pin -3359-.
- If the hub cannot be locked:
- Pull the Crankshaft stop -T10050- out of the hole in the sealing flange and turn the crankshaft until the gear can be locked with the Locking pin -3359-.



- Loosen fastening screws of camshaft gear -1-.



- Turn slightly the crankshaft in the opposite direction of the engine rotation until the Crankshaft stop -T10050- is positioned in front of the hole at sealing flange -arrow-
- Now, turn the crankshaft in the engine rotation direction until the crankshaft stop pin locks in the sealing flange while turning.
- Tighten fastening screws of the camshaft gear to 25 Nm.
- Remove mandrel -3359- and Crankshaft stop -T10050- .
- Turn crankshaft twice in the engine turn direction until it is in the TDC of cylinder 1 again.



Note

- ◆ *When doing this, the crankshaft stop end shall engage in the sealing flange while turning the engine.*
- ◆ *When the crankshaft is turned beyond the TDC of cylinder 1 and the crankshaft stop is not engaged in the sealing flange, turn the crankshaft $\frac{1}{4}$ turn in the reverse direction in order to readjust TDC of cylinder 1. No correction is allowed while the engine is turning, so as to ensure the correct operation of the crankshaft stop.*
- Repeat checking.
- Install the lower cover of the mechanical distribution and the vibration absorber.
- Install mechanical distribution centre cover.
- Install mechanical distribution upper cover.
- Install engine support and console. Torque setting ⇒ [page 8](#) .
- Install Poly-V belt ⇒ [page 14](#) .
- Install the hoses between intercooler and turbocharger, and between intercooler and intake connecting flange.
- Install engine noise insulation ⇒ Rep. Gr. 50 .

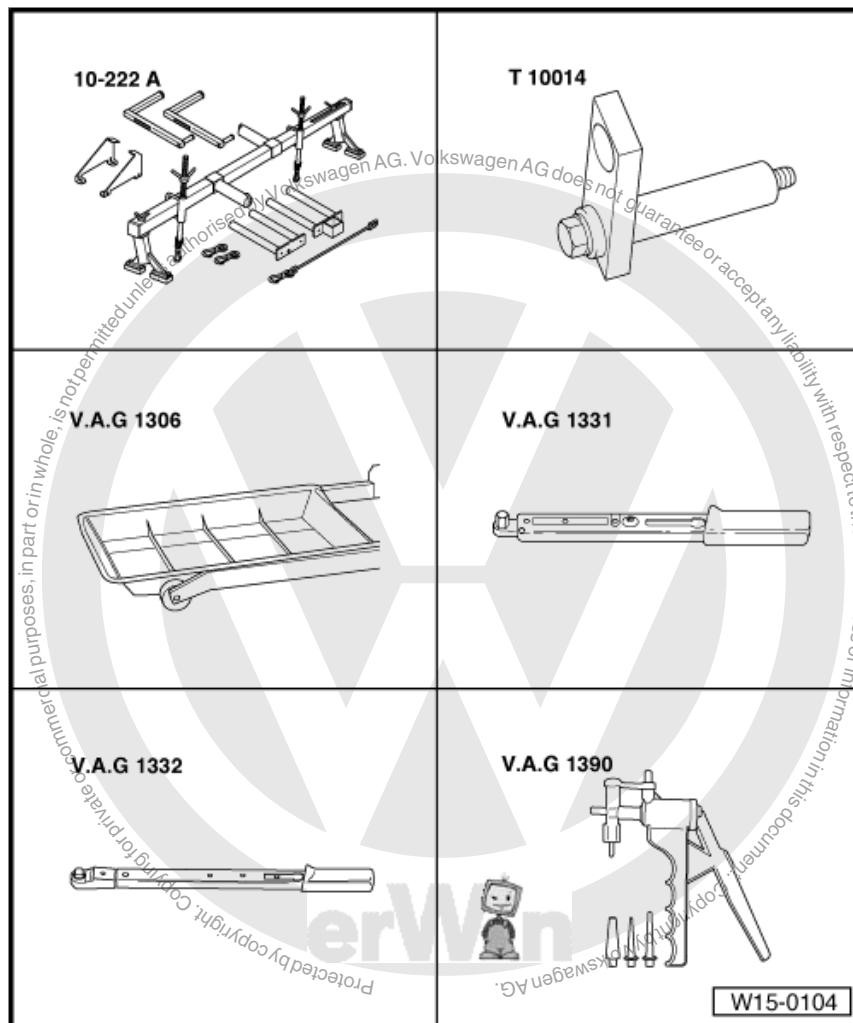




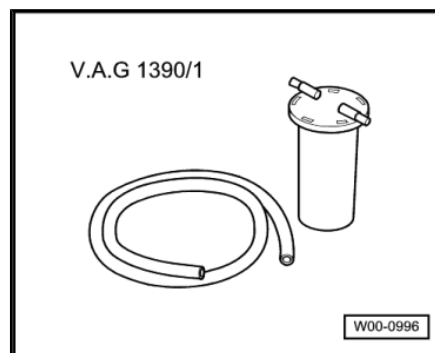
1.2 Cylinder head - remove and install

Special tools and workshop equipment required

- ◆ Support -10-222A-
- ◆ Support -T10014-
- ◆ Tray -VAG 1306-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ◆ Vacuum pump - V.A.G 1390-



- ◆ Fluid receptacle -V.A.G 1390/1-



1.2.1 Removal

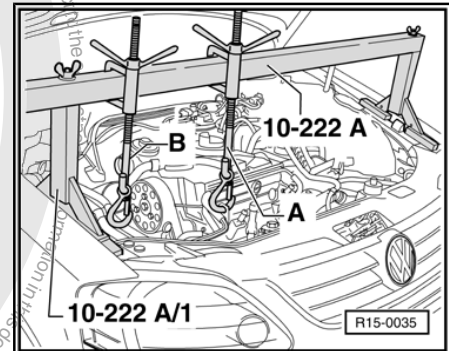
- Remove timing belt ➔ [page 41](#) .

**Note**

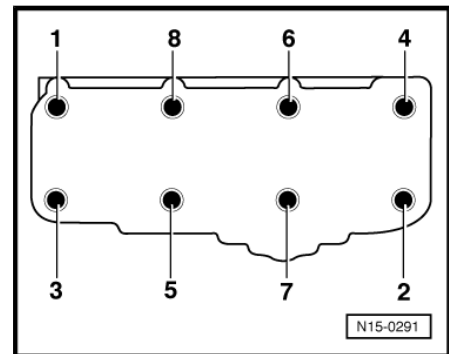
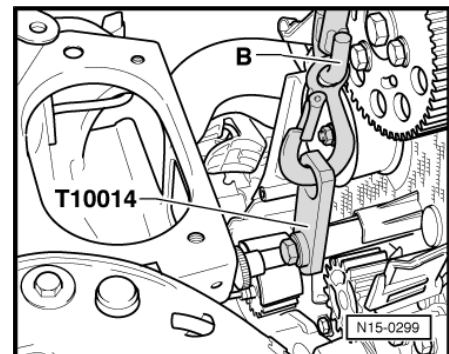
Since the lifting eyes are located on the cylinder head, an additional support should be fastened to the engine block for removing the cylinder head.

Fit Support bracket -10-222A- as shown and support the engine in its installation position.

Carefully lift the engine slightly with spindle -A-.



- Attach Retainer -T10014- to engine block using the threaded hole in the vicinity of water pump, as illustrated. Tightening torque: 20 Nm.
- Lift engine slightly using second spindle -B- until spindle -A- is relieved.
- Remove spindle -A-.
- Before removing cylinder head, drain fuel at auxiliary pump using Manual vacuum pump -V.A.G 1390- with the Fluid receptacle -V.A.G 1390/1- ➔ [page 97](#) .
- Follow the sequence indicated when loosening or tightening the cylinder head screws.





1.2.2 Installation



Note

- ◆ Always replace head screws.
 - ◆ In cases of repair, carefully remove gasket remains from cylinder head and engine block. Ensure that no long grooves or scratches are created. When using sand paper, do not use less than 100 grade.
 - ◆ Carefully remove emery and abrasive remains.
 - ◆ Only remove new cylinder head gasket from packaging prior to installation.
 - ◆ Handle gasket extremely carefully. Damage to the silicone layer or the indented area will cause leakage.
- Turn the crankcase to the TDC marking before installing the cylinder head.
 - Turn crankshaft in the opposite direction of engine rotation until all the pistons are approximately equally placed below TDC.
 - Place head gasket.
 - Fit cylinder head and hand tighten all its bolts.
 - Tighten the cylinder head in four stages, as follows:
 - 1. Previous tightening with torque meter:

1st stage (torque)	40 Nm
2nd stage (torque)	60 Nm

- 2. Tighten with normal spanner:

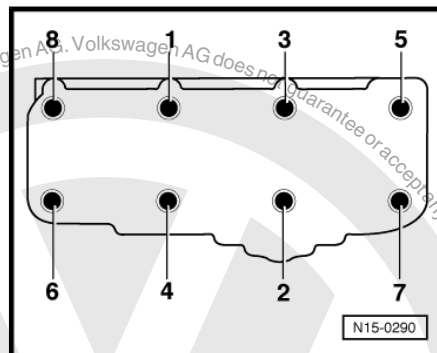
3rd stage (angular torque)	90°
4th stage (angular torque)	90°



Note

No retightening of the cylinder head is required after repairs.

- After tightening the cylinder head, turn the camshaft so that all the cams in cylinder 1 are turned equally upwards. Before mounting the cylinder head, turn the crankshaft in the engine rotation direction until TDC ⇒ [page 41](#).
- Perform test drive and check fault memory ⇒ [page 115](#).

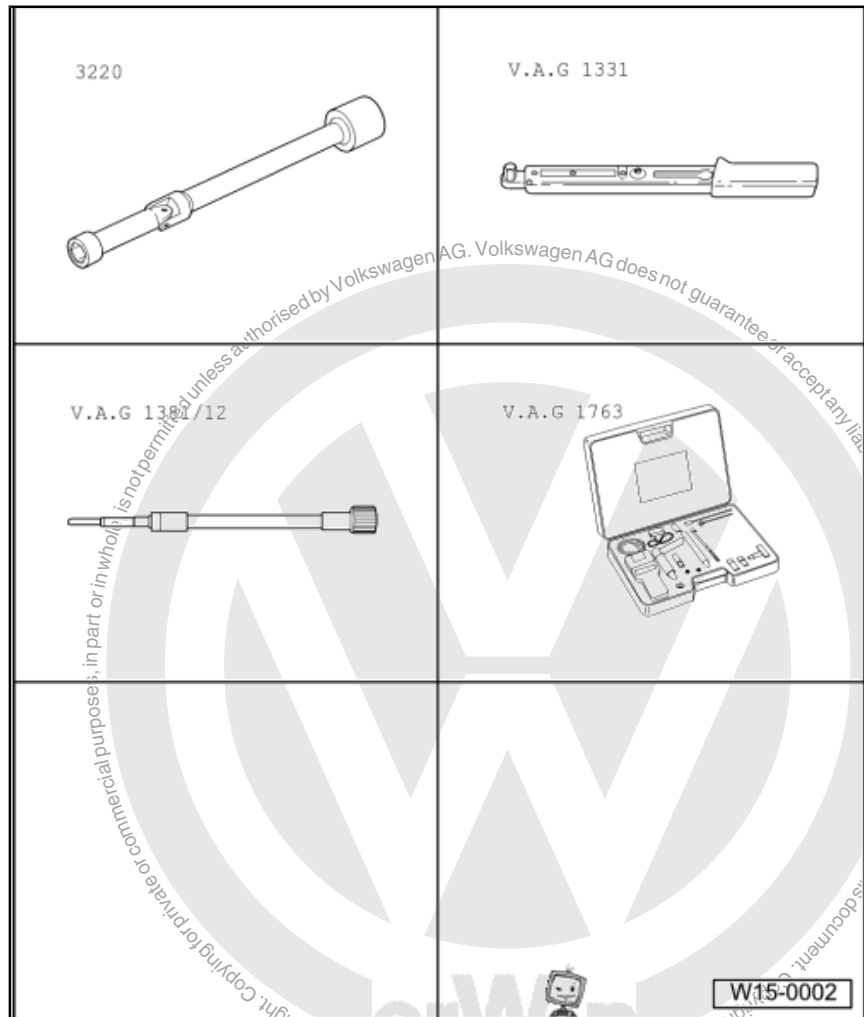




1.3 Compression - check

Special tools and workshop equipment required

- ◆ U/J extension and socket, 10 mm -3220-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Adapter -V.A.G 1381/12-
- ◆ Compression meter - V.A.G 1763-



Test conditions

- Minimum engine oil temperature 30 °C.

Test sequence

- Remove central connector from unit injectors.
- Remove all glow plugs, using U/J extension and socket, 10 mm -3220- .



- Install the Adapter -V.A.G 1381/12- in place of the glow plugs.
- Check compression with the Compression meter - V.A.G 1763- .



Note

How to use the compression meter ⇒ Instruction Manual .

- Operate the starter motor until the meter does not indicate further increase in pressure.

Compression pressure:

New: 25...31 bar. Wear limit: 19 bar.

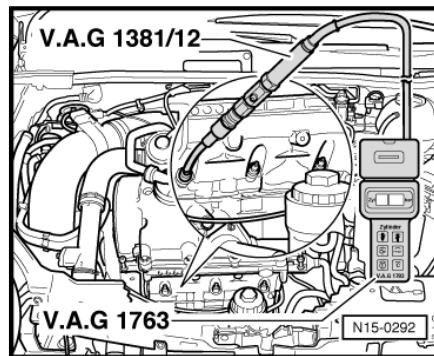
Permissible difference between all cylinders: 5 bar.

- Install glow plugs with U/J extension and socket, 10 mm -3220- . Tightening torque: 15 Nm.
- Check fault memory, eliminate possible present failures and, then, erase fault memory ⇒ [page 115](#) .



Note

Removing the central connector from unit injectors causes faults to be recorded. Therefore, check the fault memory and erase it, when required.





2 Valve command - repair



Note

- ◆ *Cylinder heads with cracks between the valve seats can still be used without reducing their useful life when such cracks are small, maximum 0.5 mm wide.*
- ◆ *All bearing and running surfaces must be lubricated before installing.*



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - 20 Nm + 90°

- ☐ Replace after each removal.
- ☐ Loosen and tighten in the proper order
⇒ [page 58](#)

2 - Injector drive arm shaft

3 - Cylinder head securing bolt

- ☐ Replace.
- ☐ Loosen and tighten in the proper order
⇒ [page 46](#)
- ☐ Before installing, set washers in cylinder head.

4 - Washer

- ☐ For head screws.

5 - Tappet

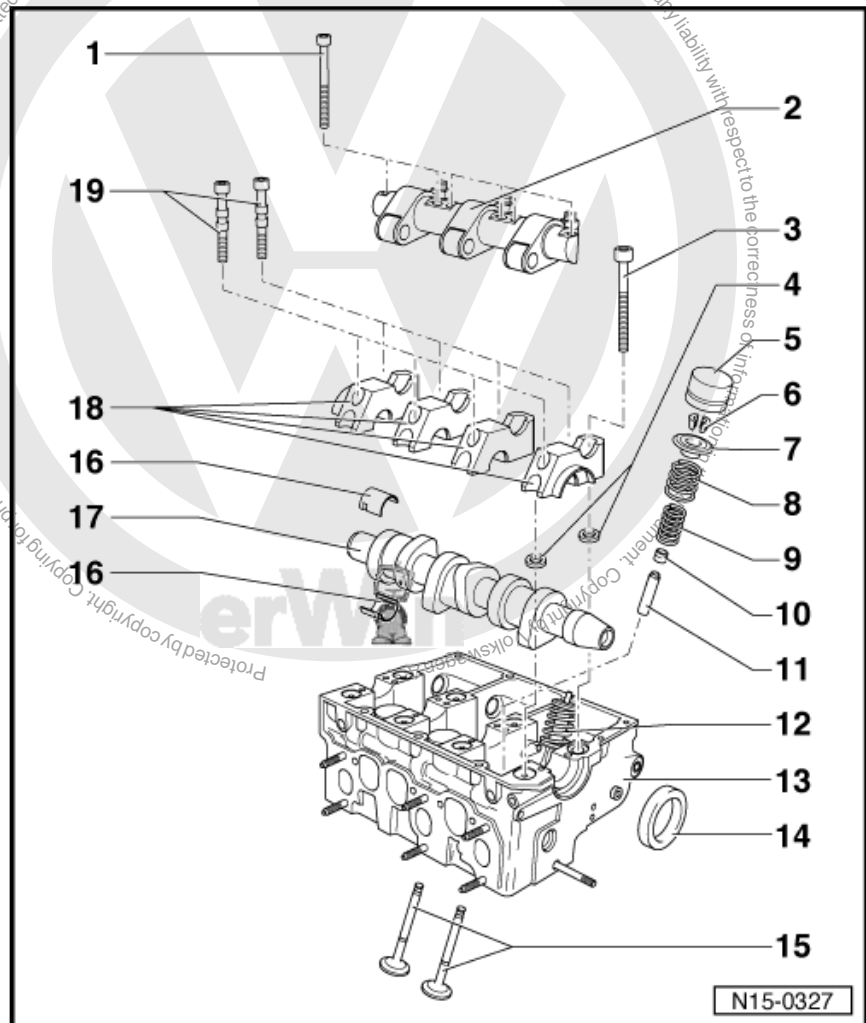
- ☐ Do not interchange.
- ☐ With hydraulic offsetting of valve gap.
- ☐ Store with cam lobe contact surface downwards.
- ☐ Check camshaft axial clearance before installing ⇒ [page 52](#)
- ☐ Lubricate contact surface.
- ☐ Before removing, remove the camshaft bearing caps.

6 - Keys

7 - Valve spring upper plate

8 - Valve spring

- ☐ Removing and installing: Cylinder head removed: with Compressor device -2037- mounted
⇒ [page 56](#).





9 - Valve internal spring

- ☐ Removing and installing: Cylinder head removed: with Compressor device -2037- mounted:
⇒ [page 56](#) .
- ☐ Install in the cylinder head before putting the bearing caps.

10 - Valve stem seal

- ☐ Replace ⇒ [page 56](#) .

11 - Valve guide

- ☐ Check ⇒ [page 55](#) .

12 - Injection unit

- ☐ Remove and install ⇒ [page 112](#) .

13 - Cylinder head

- ☐ See note ⇒ [page 51](#)
- ☐ Rework valve seats ⇒ [page 53](#)

14 - Oil seal

- ☐ Do not apply additional lubricant or grease to the seal lip.
- ☐ Before installation, remove oil residues from crankshaft trunnion with clean cloth.
- ☐ For installation, cover the groove in the camshaft tapered section with adhesive tape.
- ☐ Remove and install.

15 - Valves

- ☐ Valve dimensions ⇒ [page 53](#)

16 - Bearing shell

- ☐ Do not interchange used bearing shells (mark)
- ☐ Ensure proper seating of retaining clips in bearing caps and cylinder head.

17 - Camshaft

- ☐ Check axial clearance ⇒ [page 52](#)
- ☐ Remove and install ⇒ [page 58](#) .
- ☐ Check radial clearance with Plastigage. Wear limit: 0.11 mm.
- ☐ Excentricity: max. 0.01 mm.
- ☐ Valve identification and synchronization ⇒ [page 53](#)

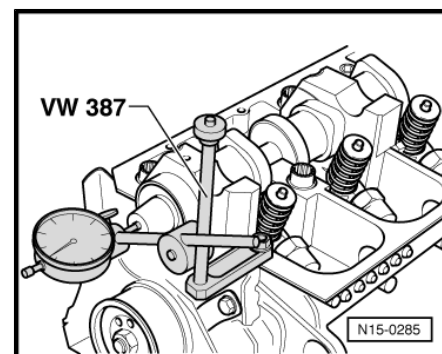
18 - Bearing cap

- ☐ Installation sequence ⇒ [page 58](#) .
- ☐ Bearing cap 4 is identified as bearing cap 5.
- ☐ When installing, use Sealant -AMV 17400401- to seal surfaces of bearing caps 1 and 4, which contact cylinder head

19 - 8 Nm + 90°

- ☐ Replace after each removal .

Check camshaft axial clearance





Special tools and workshop equipment required

- ◆ Support -VW 387-
- ◆ Dial gauge

Check with tappets removed and with bearing caps installed.

Wear limit: max. 0.15 mm.

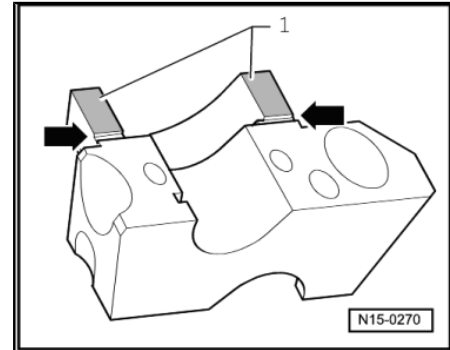
Seal the contact surfaces of bearing caps 1 and 4 of camshaft, with Sealant -AMV 17400401- .

Apply Sealant -AMV 17400401- thin and evenly on surfaces -1-.



Note

- ◆ Ensure that no sealant enters grooves -arrows-.
- ◆ Bearing cap 4 is identified as bearing cap 5.



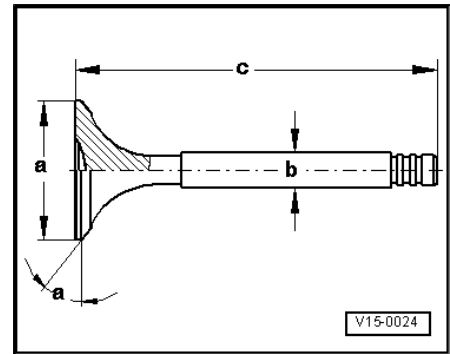
Valve dimensions



Note

Valves cannot be reworked. Only lapping-in is permitted.

Dimension		Intake valve	Escape valve
Ø a	mm	35,95	31,45
Ø b	mm	6,980	6,956
c	mm	89,95	89,95
α	°	45	45



Valve identification and synchronization

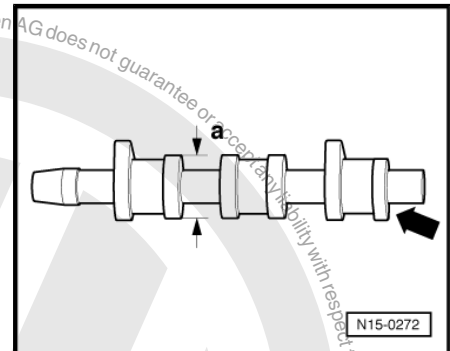
Identification

- ◆ Cam base diameter: -a- = Ø 52.8 mm.
- ◆ Identification via numbers and letters on the external cam surface of the escape valve at cylinder 3:

Cylinder 3 -arrow-	1 R
--------------------	-----

Valve synchronization in the opening of 1-mm valve

Intake opens after TDC	15,8°
Intake closes after BDC	25,3°
Exhaust opens before BDC	28,2°
Exhaust closes before TDC	18,7°



2.1 Valve seats - rework

Special tools and workshop equipment required

- ◆ Depth gauge
- ◆ Valve seat recovery tool



Note

- ◆ In case of repairs to engines with leaking valves, simply reworking or replacing the seats and valves is insufficient. Especially in engines with high mileage, the valve guides must also be checked for wear.
- ◆ The valve seats should only be sufficiently reworked to produce a perfect seating pattern. The maximum reworking dimension must be calculated before undertaking the tasks. When the rework measurement is exceeded, the hydraulic compensation function of the tappets will not be guaranteed, and the engine head must be replaced.

2.1.1 Calculating the maximum reworking dimension allowed

- Install valve and firmly press it against seat.



Note

In case the valve is replaced during repairs, use new valve for measurement.

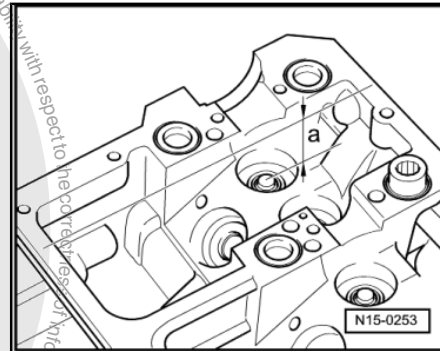
- Measure the distance -a- between valve stem end and engine head upper edge.
- Calculate max. permissible reworking dimension from measured distance -a- and minimum dimension.

Minimum dimensions: Intake valve 43.4 mm Escape valve 43.2 mm.

Distance measured minus minimum distance = maximum permitted reworking dimension.

Example:

Measured distance	44,1 mm
Minimum dimension	43,4 mm
= Max. reworking dimension perm.	0,7 mm



2.1.2 Reworking intake valve seat

a = 35.7 mm

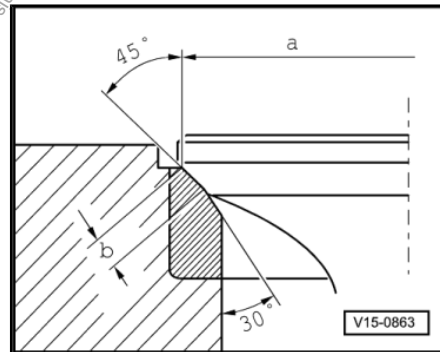
b = 1.6 mm

45° = Valve seat angle



Note

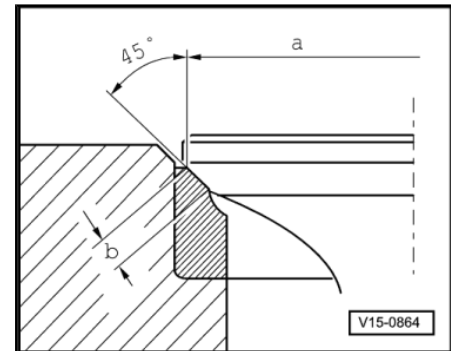
The 30° angle in the valve seat base is crucial for ensuring the correct gas flow.



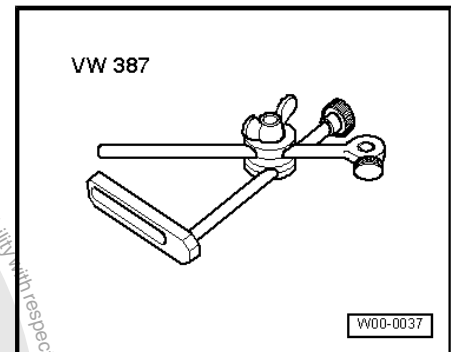


2.1.3 Reworking escape valve seat

- a = $\varnothing 31.4$ mm
- b = 2.7 mm
- 45° = Valve seat angle



2.2 Valve guides check

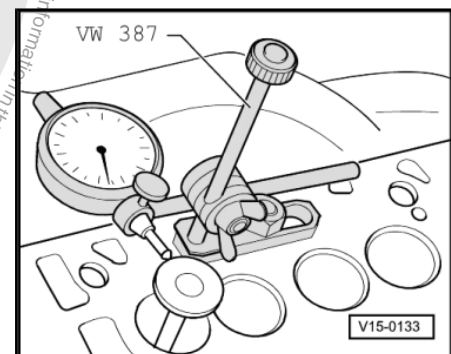


Special tools and workshop equipment required

- ◆ Support -VW 387-
- ◆ Dial gauge

Test sequence

- Place a new valve on the guide. Valve stem end shall be aligned with guide. Due to differences in valve stem diameters, fit intake valves in the intake guides and exhaust valves in exhaust guides.
- Determine tilting clearance. Wear limit: max. 1.3 mm.
- Cylinder head shall be replaced if the clearance is greater than wear limit.

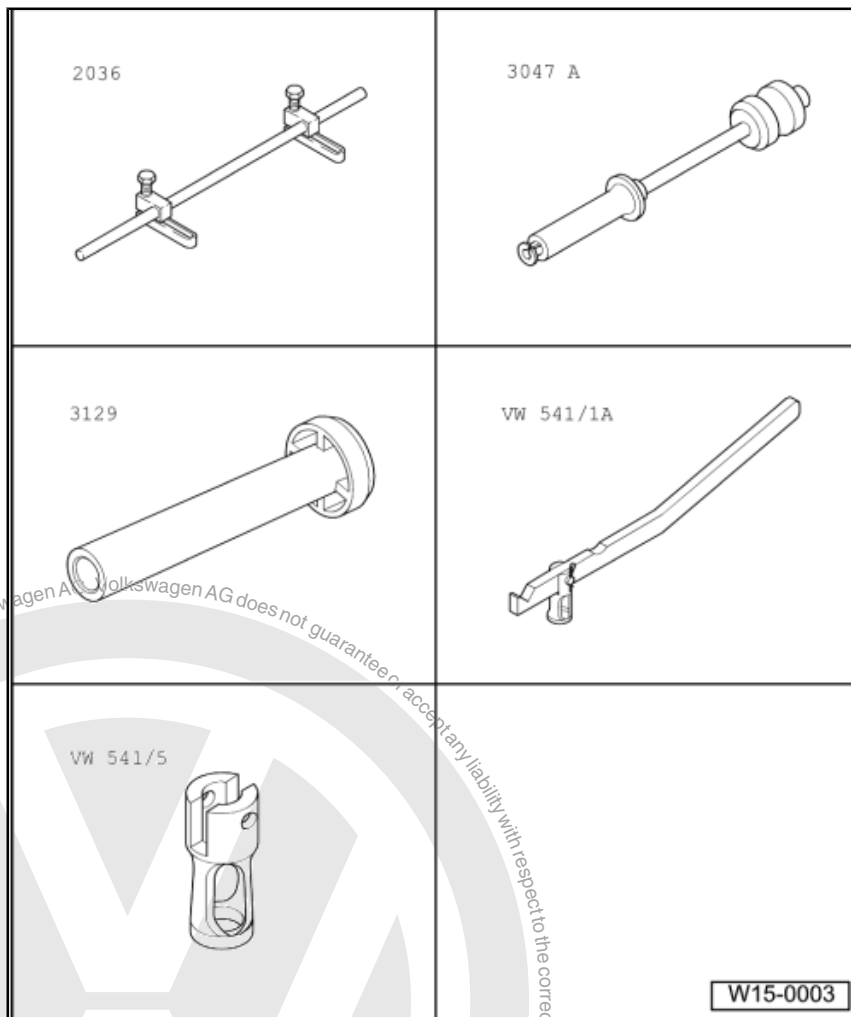




2.3 Valve stem seal - replace

Special tools and workshop equipment required

- ◆ Device -2036-
- ◆ Extractor -3047A-
- ◆ Fitter -3129-
- ◆ Lever -VW 541/1A-
- ◆ Supporting part -VW 541/5-



2.3.1 Removal

(with engine head installed).

- Remove camshaft ➤ [page 58](#) .
- Remove tappets and place them with contact surface turned downwards. When doing this, ensure that the tappets are not interchanged.
- Adjust piston of respective cylinder to top dead centre (TDC).

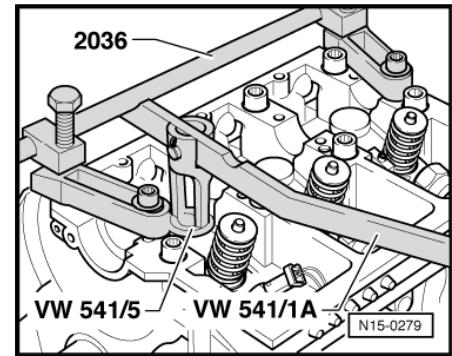


- Fit the Device -2036- and adjust to height of plates.
- Remove valve springs with Lever -VW 541/1A- and Supporting piece -VW 541/5- .

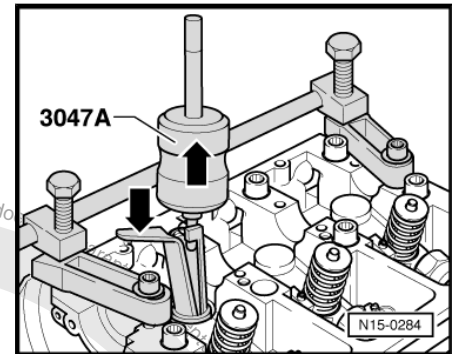


Note

Valves then will lean against piston head.

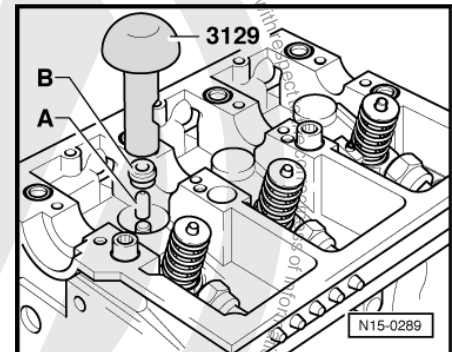


- Pull off valve stem seals with Puller -3047 A- .



2.3.2 Installing

- Install the plastic sleeve -A- supplied in the respective valve stem. This will prevent the new valve stem -B- from being damaged.
- Insert the new valve stem seal in the Fitter -3129- .
- Lubricate the seal lip at valve stem and tighten it carefully on the valve guide.



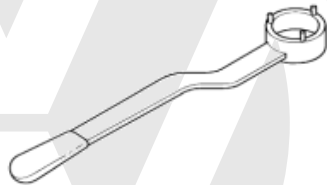


2.4 Camshaft - remove and install

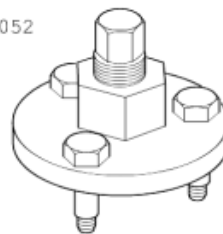
Special tools and workshop equipment required

- ◆ Blocking device -T10051-
- ◆ Extractor -T10052-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ◆ Seal -AMV 17400401-

T10051



T10052



V.A.G 1331



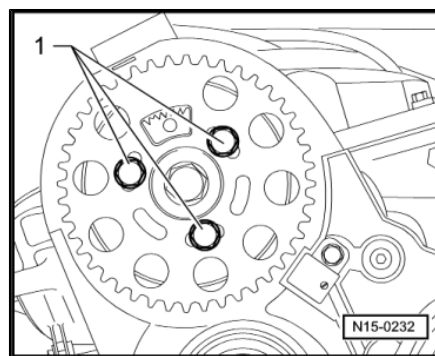
V.A.G 1332



W15-0083

2.4.1 Removal

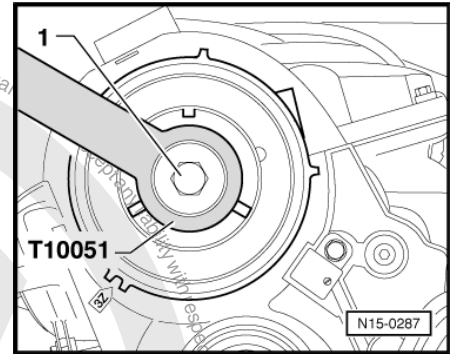
- Remove Poly-V belt ➔ [page 14](#) .
- Remove timing belt ➔ [page 41](#) .
- Remove fastening screws of camshaft gear -1-.
- Remove hub camshaft gear.



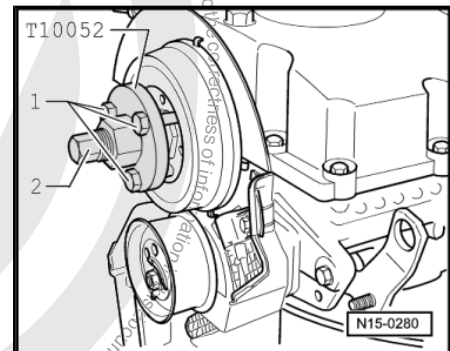
N15-0232



- Loose hub fastening screw -1-.
- Use Blocking device -T10051-.
- Loosen hub securing screw about 2 turns.



- Install Puller -T10052- and align it with holes in hub.
- Install securing screws -1- into hub.
- Apply effort to the hub by tightening evenly screw -2- until the hub is separated from the tapered section of the camshaft.

**Note**

Hold puller with a spanner while doing the above operation.

- Remove the camshaft hub.
- Remove cylinder head cover.
- Remove injector drive arm shaft.

**Note**

First, loosen the outer securing bolts, then one bolt of each pair of inner securing bolts, and lastly the other bolt of each pair.

- Remove auxiliary pump ⇒ [page 97](#) .
- First, remove bearing caps 2 and 3. Then, loosen bearing caps 1 and 4 alternately and diagonally.

**Note**

Bearing cap 4 is identified as bearing cap 5.

2.4.2 Installation

**Note**

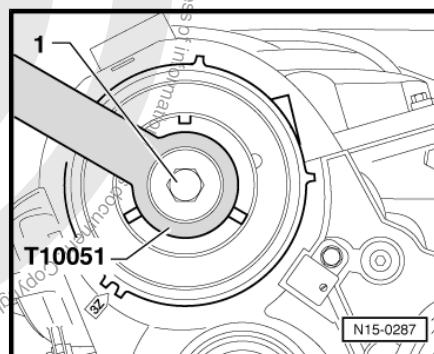
- ◆ *When installing the camshaft, the cams for cylinder 1 should point upwards.*
- ◆ *Do not interchange used bearing shells (mark them).*
- ◆ *When installing the camshaft, ensure the proper clip seating on the bearing caps and cylinder head.*
- ◆ *Before installing bearing caps, ensure that cylinder head bolt washers are fitted in the cylinder head.*
- Lubricate contact surfaces of shell bearings.



- Tighten bearing caps 2 and 3 alternately and diagonally to 8 Nm + 90° (replace).
- Install bearing caps 1 and 4, and also tighten to 8 Nm + 90° (replace).

i Note

- ◆ *Bearing cap 4 is identified as bearing cap 5.*
- ◆ *Apply Sealant -AMV 17400401- to seal surfaces of bearing caps 1 and 4, which are in contact with the cylinder head*
- ◆ *Bearing cap 4 must align flush with outer edge of cylinder head, because otherwise leaks may develop at the auxiliary pump.*
- Install the camshaft seal.
- Fit injector drive arm shaft and tighten first one bolt of each of the inner pairs, then the other bolt of each pair, and finally the outer securing bolts, evenly and alternately until there is no more play in bearing, and finally tighten to torque. Tightening torque: 20 Nm + 90° (replace).
- Install the hub on camshaft.
- Tighten hub fastening screw -1-. Tightening torque: 100 Nm.
- Use Blocking device -T10051- .

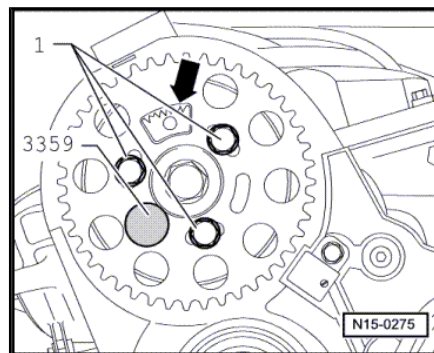


- Install camshaft gear on the hub.

i Note

Toothed segment -arrow- of camshaft shall be on the top.

- Align camshaft gear in central position on elongated holes.
- Tighten manually the fastening screws -1- of the camshaft gear in order not to have play.
- Immobilise hub with Mandrel -3359- .
- Install and adjust timing belt ⇒ [page 41](#) .
- Install auxiliary pump ⇒ [page 97](#) .



i Note

When new tappets have been installed, do not start the engine for about 30 minutes. Hydraulic compensation elements must knit together (otherwise, valves will knock pistons).



17 – Lubrication system

1 Lubrication system components - remove and install



Note

- ◆ *When a significant number of metal chips and shavings appear in the engine oil during engine repair due to crankshaft and rod bearing wear, the oil filter must be replaced and the oil gallery must be carefully cleaned.*
- ◆ *The oil level should not exceed the maximum marking - risk of damage to the catalytic converter!*
- ◆ *All bearing and running surfaces must be lubricated before assembly.*



WARNING

Always replace self-locking nuts and screws subject to angular torque

Check oil pressure ⇒ [page 70](#) .

Oil system capacity:

with oil filter 4.2 l.

Engine oil specification:

Only use engine oils as per VW 505.01 specification.

Part I assembly overview ⇒ [page 61](#) .

Part II oil filter support disassembly ⇒ [page 64](#) .

Part III: oil supply tube removal and installation ⇒ [page 65](#) .

Part I



1 - 15 Nm

2 - Flange

- ☐ With sealing ring.
- ☐ Must be located on securing guides.
- ☐ Remove and install ➔ [page 17](#).
- ☐ Install with Silicone sealant -D 176 404 A2 - ➔ [page 17](#).
- ☐ Do not apply additional lubricant or grease to the seal lip.
- ☐ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.
- ☐ Replace crankshaft oil sealing - pulley end ➔ [page 17](#).

3 - Engine block

4 - Gasket

- ☐ Replace.

5 - Oil filter bracket

- ☐ Disassemble and assemble ➔ [page 64](#).

6 - 15 Nm + 90°

- ☐ Replace after each removal.
- ☐ First, fit upper left and lower right bolts; then, tighten the four bolts diagonally.

7 - Oil dipstick

- ☐ The oil level should exceed the maximum marking!
- ☐ Marks ➔ [page 66](#)

8 - Guide

- ☐ Remove to drain oil.

9 - 5 Nm

10 - Guide tube

11 - 10 Nm

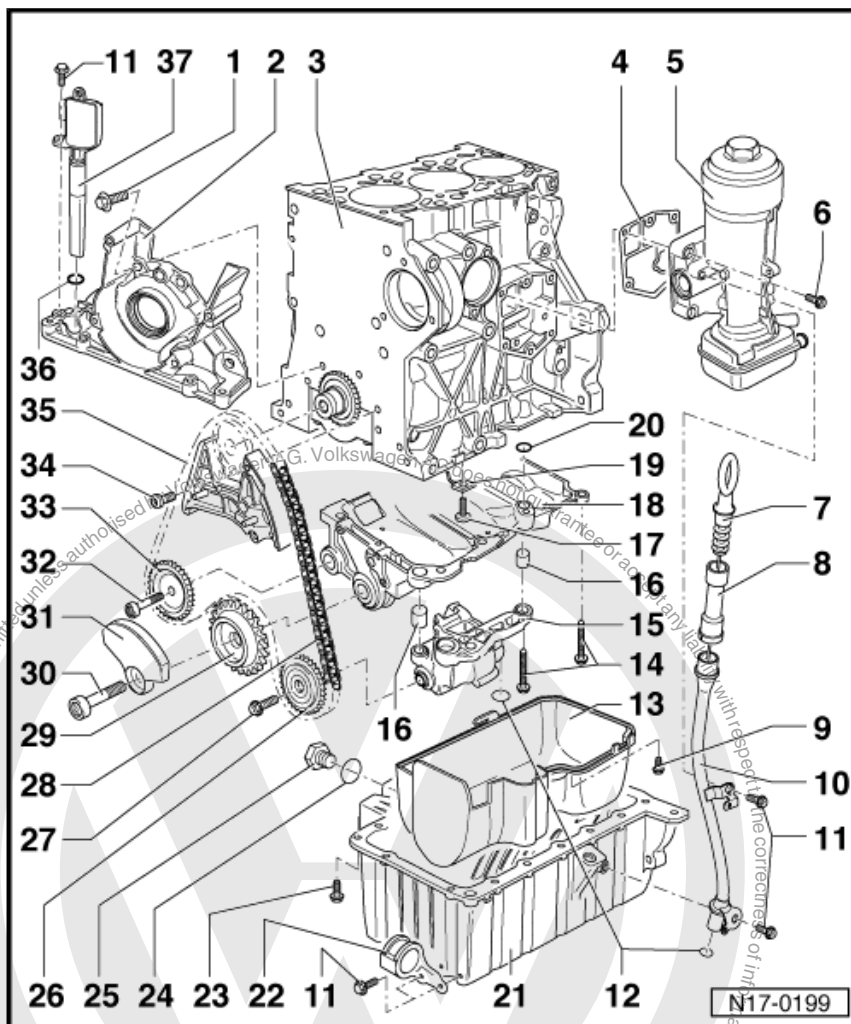
- ☐ Not applicable.

12 - Sealing ring

- ☐ Replace.
- ☐ Check it is securely seated.
- ☐ Lubricate lightly when fitting.

13 - Cover

- ☐ With sealing tape.
- ☐ Clean filter if dirty.



**14 - 20 Nm****15 - Oil pump**

- ☐ With 11.5-bar pressure relief valve.
- ☐ Before installing, check whether the centering guides are mounted.

16 - Fastening sleeve**17 - 25 Nm**

- ☐ Install without sealant.

18 - Mounting frame

- ☐ Before installing, check the centering guides in the engine block are in their positions, and the ring is inserted in the mounting frame.
- ☐ Remove and install ⇒ [page 23](#).

19 - Oil ejector

- ☐ For piston cooling.
- ☐ Check installation position: Install by turning the oil ejector counterclockwise up to the stop.

20 - Sealing ring

- ☐ Replace.

21 - Crankcase

- ☐ Clean sealing surface before installation.
- ☐ Install with Silicone sealant -D 176 404 A2 - ⇒ [page 68](#)
- ☐ To remove crankcase, firstly remove the transmission ⇒ Rep. Gr. 34.

22 - Support

- ☐ For intercooler hose.

23 - 15 Nm

- ☐ To remove the rear bolts near the transmission, the latter must be removed ⇒ Rep. Gr. 34.

24 - Packing

- ☐ Replace.

25 - Plug, 30 Nm

- ☐ Replace the plug with seal.

26 - Gear

- ☐ To oil pump.
- ☐ It can be installed in one position only.

27 - 20 Nm + 90°

- ☐ Replace after each removal.

28 - Chain

- ☐ Observe fastening position ⇒ [page 23](#).

29 - Gear

- ☐ To counterbalance shaft.
- ☐ It can be installed in one position only. The holes are displaced.

30 - 100 Nm + 90°

- ☐ Replace after each removal.
- ☐ The angular torque can be performed in several stages.
- ☐ To loose and tighten, use Multi-point spanner -T10061-

31 - Counterbalance

- ☐ It can be installed in one position only. The holes are displaced.



32 - 20 Nm

33 - Gear

34 - 8 Nm + 90°

- ☐ Replace after each removal.

35 - Chain tensioning element with tensioning plate.

- ☐ To remove, immobilise with Locking pin -T10060- .
- ☐ Remove and install ⇒ [page 23](#) .

36 - Sealing ring

- ☐ Not applicable.

37 - Oil level and temperature sensor -(G266)-

- ☐ Not applicable.

Part II



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - Packing

- ☐ Replace.

2 - 15 Nm + 90°

- ☐ Replace after each removal.
- ☐ First, fit upper left and lower right bolts; then, tighten the four bolts diagonally.

3 - Oil filter bracket

4 - Packing

- ☐ Replace.

5 - Connection, 25 Nm

- ☐ To the turbocharger oil supply tube.

6 - Oil supply tube

- ☐ For the turbocompressor.
- ☐ Remove and install ⇒ [page 65](#) .

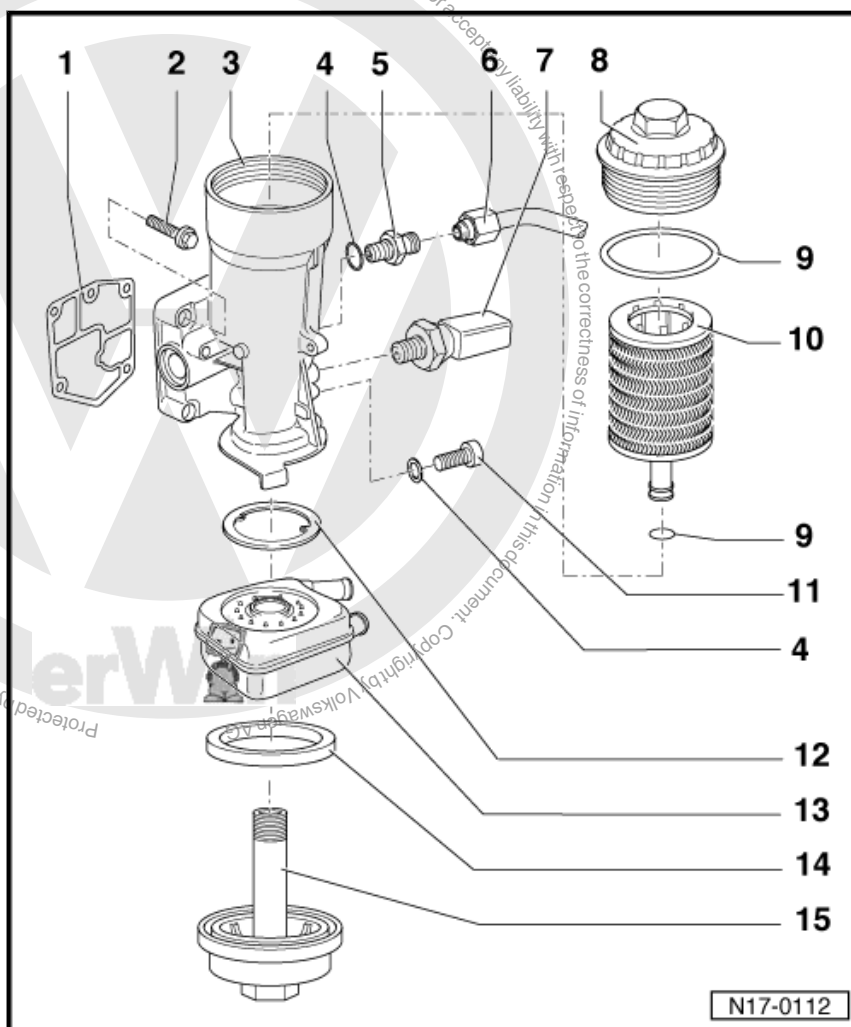
7 - Oil pressure switch -F1- 0.7 bar, 20 Nm

- ☐ In case of leakage, cut and replace the sealing ring.
- ☐ Checking ⇒ [page 70](#) .

8 - Sealing cap, 25 Nm

9 - Sealing ring

- ☐ Replace.

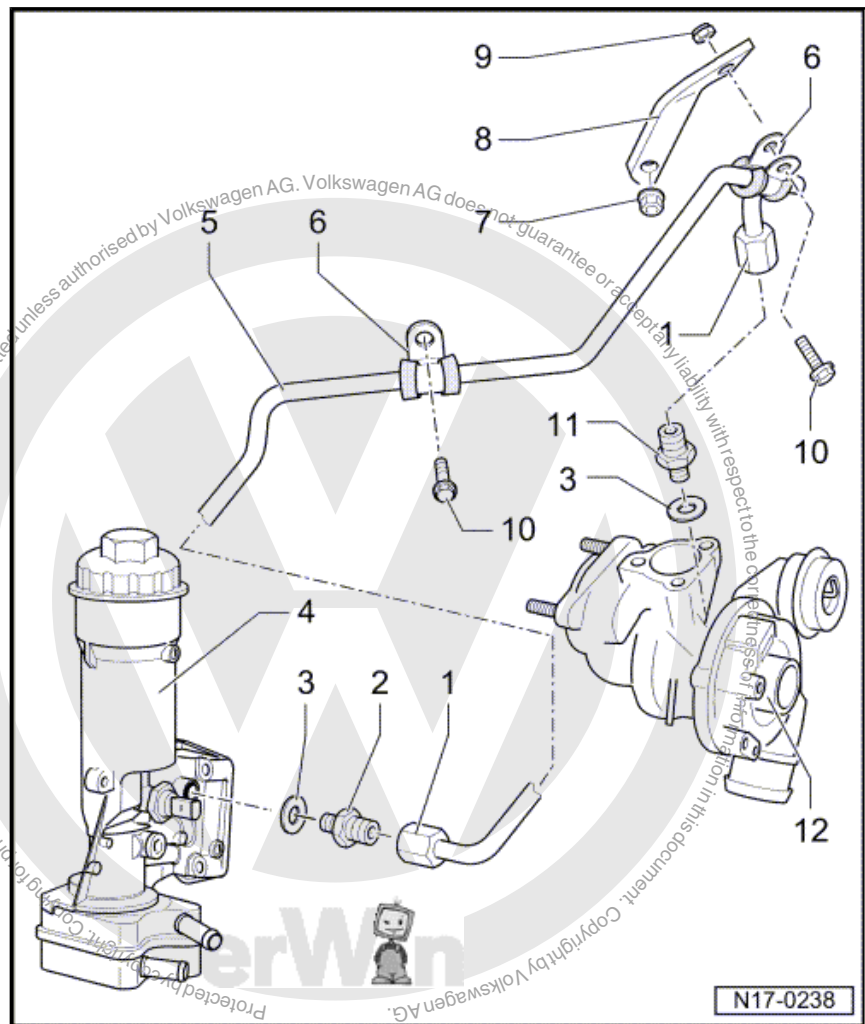




- 10 - Oil filter element
- 11 - Sealing plug, 10 Nm
- 12 - Gasket
 - ☐ Replace.
 - ☐ Install in the oil radiator groove.
- 13 - Oil radiator
 - ☐ Check installation position.
 - ☐ See note ⇒ [page 61](#) .
- 14 - Gasket
 - ☐ Replace.
- 15 - Sealing plug, 25 Nm

Part III

- 1 - Safety nut, 22 Nm
 - ☐ When loosening and tightening, hold the connection.
- 2 - Connection
 - ☐ Remove and install ⇒ [Item 5 \(page 64\)](#) .
- 3 - Packing
 - ☐ Replace.
- 4 - Oil filter bracket
- 5 - Oil supply tube
 - ☐ To the turbocharger.
- 6 - Clip
- 7 - 25 Nm
 - ☐ Replace.
- 8 - Support
- 9 - 10 Nm
- 10 - 10 Nm
- 11 - Connection
 - ☐ Remove and install ⇒ [Item 20 \(page 103\)](#) .
- 12 - Turbocharger





Marks on the oil dipstick

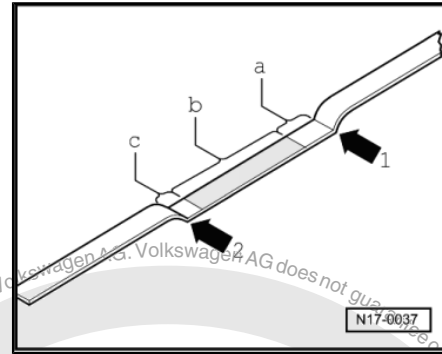
1 - max. mark

2 - min. marks

a - Region between the upper corner of the hachured region and the max. mark: do not replenish with oil.

b - Oil level in the hachured field: May be filled with oil.

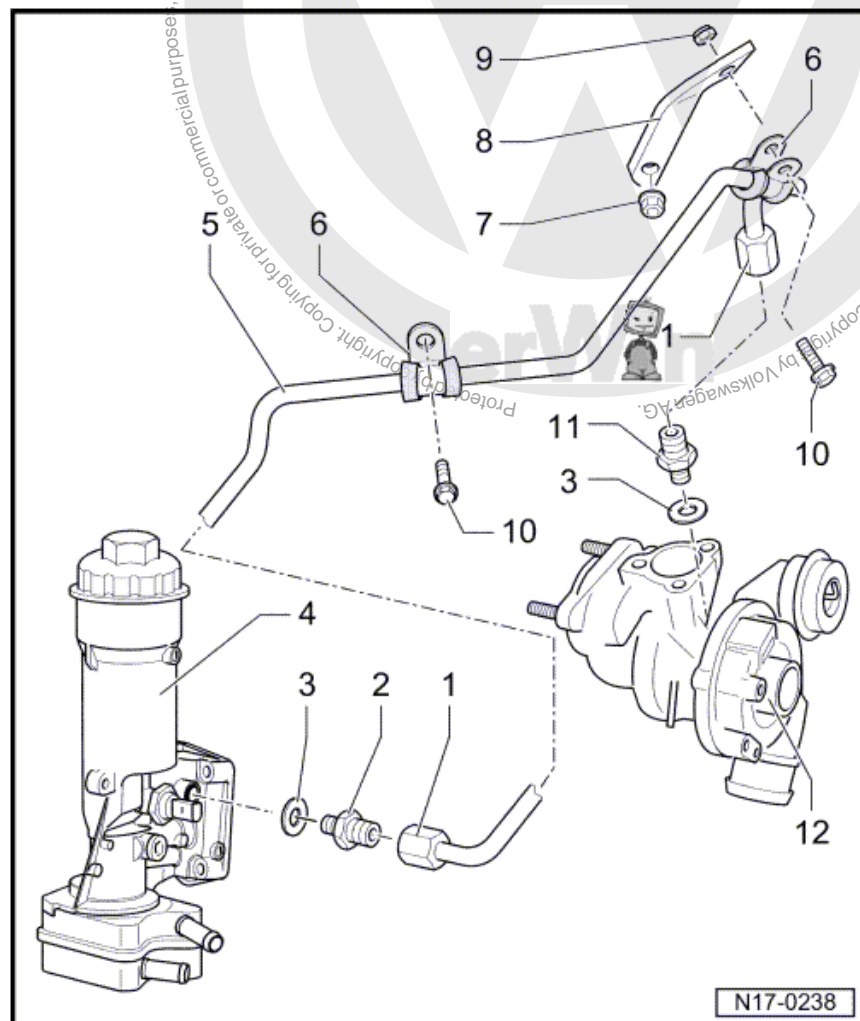
c - Region between min. mark and lower corner of hachured area: Replenish at most 0.5 l of engine oil.



Assembly sequence

Removal

- Remove noise insulation.
- Place Drainage tank -V.A.G 1306- underneath.
- To remove, loosen supply hose clips -6-.
- Disconnect safety nut -1- on oil filter bracket -4-, locking the connection -2-.
- Remove bolt -10- at rear side of engine.





- Remove safety nut -1- on turbocharger -12-, locking the connection -11-.
- Remove bolt -10- from bracket -8-
- Remove nut -7- and take off bracket -8-.
- Remove oil supply tube -5-.

Installing

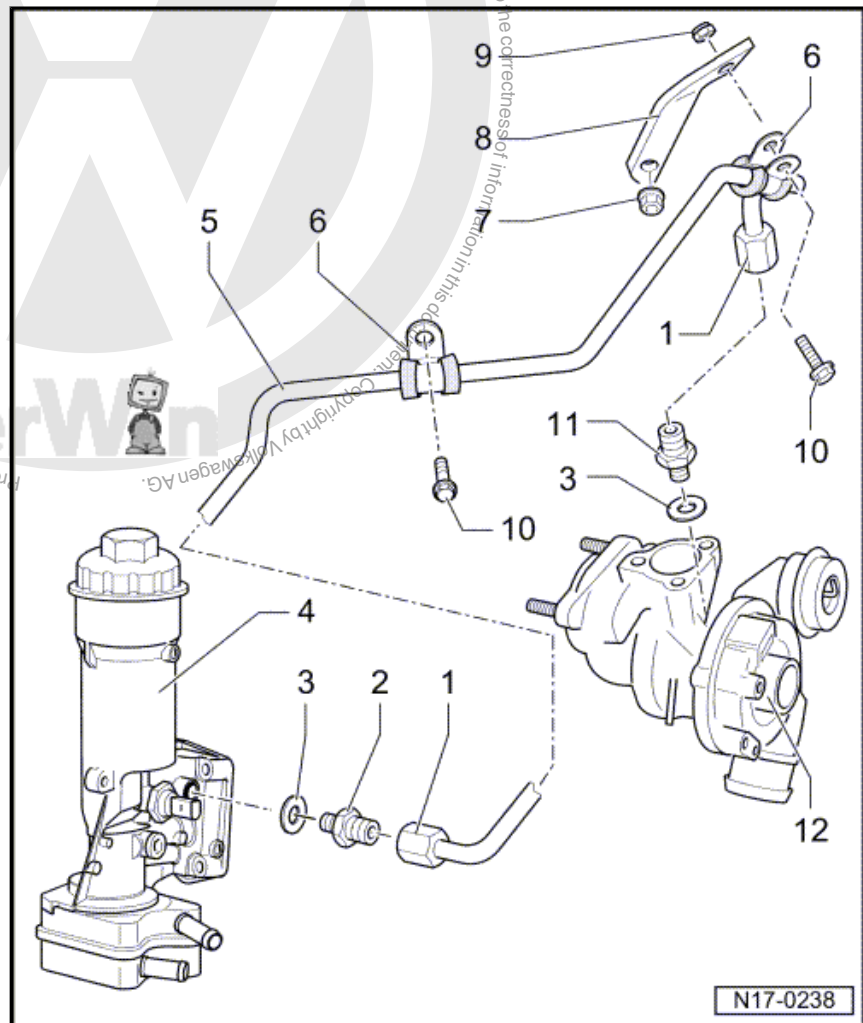
Install in the reverse sequence, observing the following:



WARNING

Oil supply line assembly shall be carried out as described below.

- Screw bracket -8- with nut -7- loosely to exhaust manifold.



- Manually tighten the safety nut -1- on connection -2- of the oil filter bracket -4-.
- Manually tighten the safety nut -1- on connection -11- of turbocharger -12-.



- Tighten safety nut -1- on oil filter bracket -4-, to the tightening torque, locking the connection -2-.
- Tighten safety nut -1- on turbocharger -12-, to the tightening torque, locking the connection -11-.
- Position clips -6- on oil supply tube -5-.
- Tighten bolt -10-.
- Tighten nut -7-.

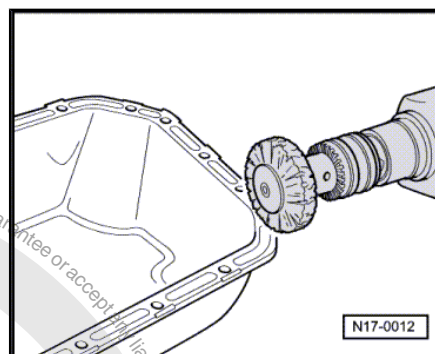
1.1 Crankcase - remove and install

Special tools and workshop equipment required

- ◆ Portable drill with plastic brush
- ◆ Silicone sealant -D176404 A2-
- ◆ Flat spatula

1.1.1 Removal

- Remove lower noise insulation from engine ⇒ Rep. Gr. 50 .
- Drain engine oil.
- Remove gearbox ⇒ Rep. Gr. 34 .
- Remove crankcase.
- If necessary, loosen crankcase by tapping slightly with rubber hammer.
- Eliminate sealing residues that remain on engine block with a flat spatula.
- Eliminate sealant residues from crankcase and its cover with a rotary brush, like a plastic brush attached to a portable drill (wear eye protection).
- Clean the sealing surfaces. They must be free of oil and grease.



1.1.2 Installation



Note

- ◆ *Check the sealant expiration date.*
- ◆ *The crankcase must be installed within 5 minutes after applying the sealant.*



- Cut the tube injector on front marking ($\varnothing$ of injector is approx. 3 mm) .
- Apply silicone sealant, as shown, onto crankcase clean sealing surface. Sealing cord shall:
 - ◆ Be 2...3 mm thick.
 - ◆ Run on inside of bolt holes region -arrows-.

**Note**

Sealing cord may not be thicker, otherwise excess sealant may drop into crankcase and block suction tube strainer.

- Install crankcase immediately and slightly tighten all the bolts.

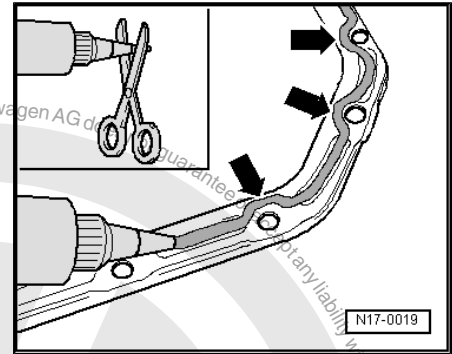
**Note**

Crankcase shall be aligned with engine block.

- Tighten bolts to 15 Nm.
- Install transmission ⇒ Rep. Gr. 34 .
- Tighten crankcase/transmission screws to 45 Nm.

**Note**

After installing the crankcase, the sealant should dry for approximately 30 minutes before replenishing with engine oil.

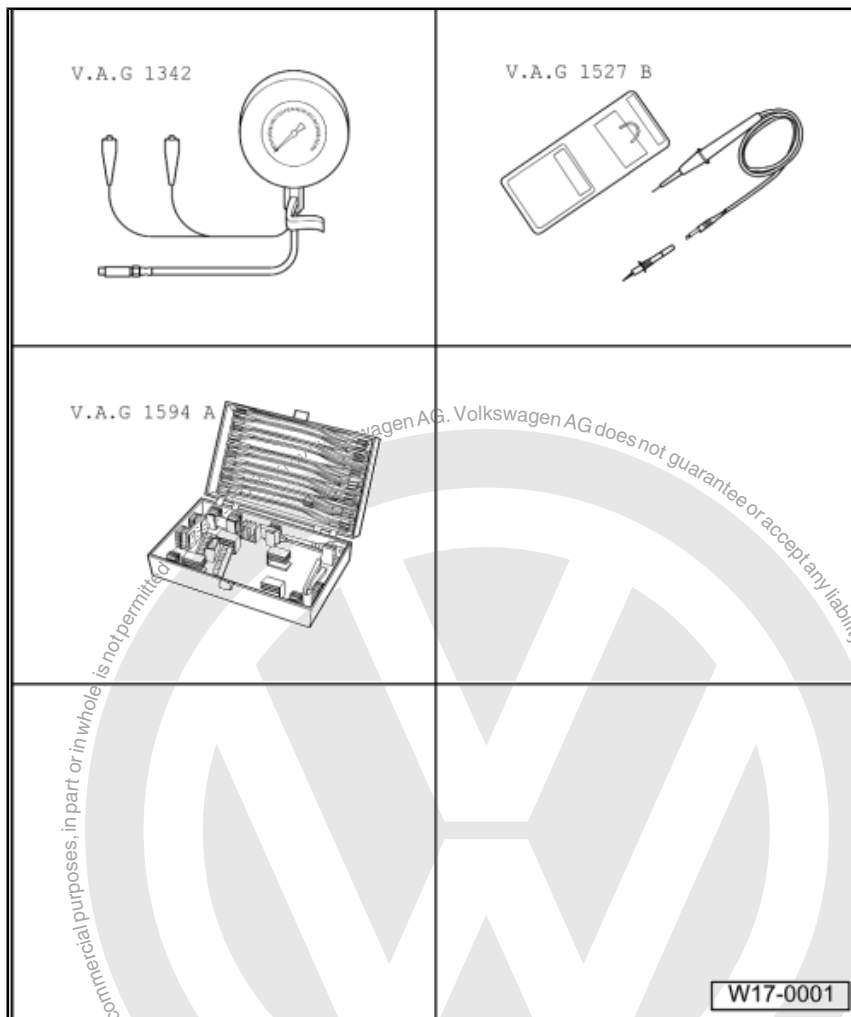




1.2 Checking the oil pressure and the oil pressure switch

Special tools and workshop equipment required

- ◆ Oil pressure meter - V.A.G 1342-
- ◆ Test probe -VAG 1527B-
- ◆ Auxiliary measuring cable set -VAG 1594C-



Note

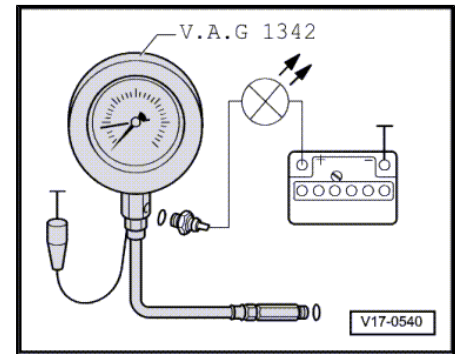
Operation and maintenance test of visual and acoustic oil pressure indicator → Current flow diagrams, Electrical fault finding and Fitting locations



Test sequence

- Remove the Oil pressure switch -F1- and screw it to the test equipment.
- Install test equipment in place of the oil pressure switch on the oil filter support.
- Connect brown wire of tester to earth (-).
- Connect Test probe -VAG 1527B-, using Aux. measuring cable set -VAG 1594C-, to battery positive (+) terminal and Oil pressure switch -F1-.
- Start engine and increase speed slowly. In 0.55...0.85 bar, the LED shall light OFF; otherwise, replace the Oil pressure switch.
- Continue increasing speed. At 2000 rpm and an oil temperature of 80°C, the oil pressure should be at least 2.0 bar.

At higher speeds, oil pressure may not exceed 5.8 bar. If necessary, replace the oil filter support.





19 – Cooling system

1 Cooling system components - remove and install



Note

- ♦ *The cooling system is under pressure when the engine is hot. Thus, it is necessary to reduce the pressure before doing repairs.*
- ♦ *Hose junctions are fastened by spring clamps. When doing repairs, use spring clamps only.*
- ♦ *To install spring clamps, we recommend using Standard-type clamp pliers -VAS 5024A - or Hose clip pliers -VAG 1921- .*

Check the cooling system tightness with the Engine cooling system tester -VAG 1274- and the Adapter for VAG 1274 -VAG 1274/8- and the Adapter for VAG 1274 -VAG 1274/9- .

Cooling system components in the body ⇒ [page 73](#) .

Cooling system components in the engine ⇒ [page 74](#) .

Cooling system - drain and replenish ⇒ [page 76](#) .

Coolant mixture proportions ⇒ [page 76](#) .

1 - Radiator

- ## 2 - Sealing ring

- ### 3 - Upper cooling system hose

- 4 - Cover**

- ## 5 - Connector

- 6 - 5 Nm**

- ## 7 - Coolant reservoir

8 - Air ducts

- 9 - 5 Nm**

- 10 - Fan ring**

- 11 - 10 Nm

- ## 12 - Radiator fan

- ## 13 - Support

- 14 - Lower cooling system hose**

- 15 - Radiator fan thermal switch -F18- , 35 Nm**

- ☐ For electric fan.

- ☐ Starting temperatures: Stage 1 ON: 92...97 °C OFF: 84...91 °C. Stage 2 ON: 99...105 °C OFF: 91...98 °C.

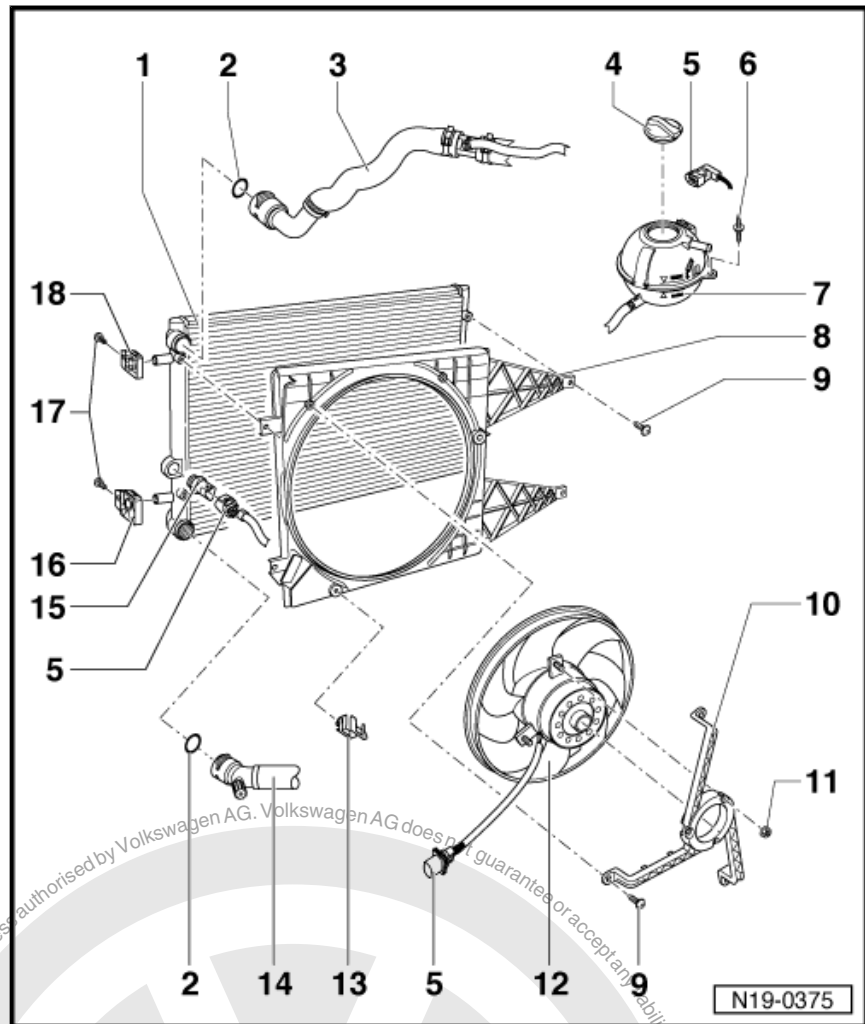
- ## 16 - Radiator lower support

- Black.

- 17 - 5 Nm

- ## 18 - Radiator upper support

- ☐ White.





1.2 Cooling system components in the engine

1 - Hose

- ☐ To heat exchanger.

2 - Connection

3 - 10 Nm

4 - Hose

- ☐ From the heat exchanger.
- ☐ Hose connection diagram ➔ [page 75](#).

5 - 25 Nm

6 - Hose

- ☐ To the lower side of the coolant reservoir.
- ☐ Hose connection diagram ➔ [page 75](#).

7 - Fastening support

8 - Cooling system pipe

- ☐ Hose connection diagram ➔ [page 75](#).

9 - Sealing ring

- ☐ Replace.

10 - Hose

- ☐ To upper side of the expansion reservoir.
- ☐ Hose connection diagram ➔ [page 75](#).

11 - Hose

- ☐ To upper side of radiator.
- ☐ Hose connection diagram ➔ [page 75](#).

12 - Hose

- ☐ From lower side of radiator.
- ☐ Hose connection diagram ➔ [page 75](#).

13 - Connection

- ☐ For thermostat.

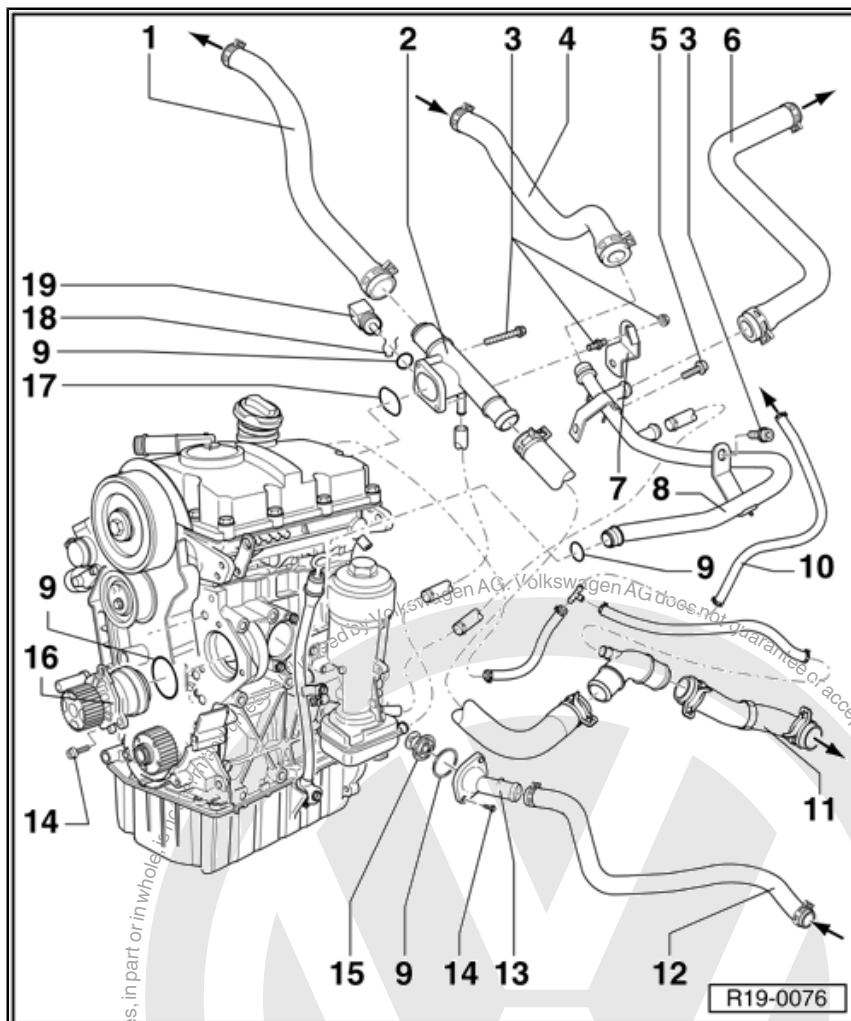
14 - 15 Nm

15 - Thermostat

- ☐ Remove and install ➔ [page 82](#).
- ☐ Check installation position ➔ [page 82](#).
- ☐ Checking: heat thermostat in water.
- ☐ The opening starts at approximately 85°C.
- ☐ And ends at approximately 105 °C.
- ☐ Min. open lifting 7 mm.

16 - Water pump

- ☐ Check ease of movement.
- ☐ Check installation position.





- ☐ Remove and install ⇒ [page 80](#)

17 - Sealing ring

- ☐ Check it is securely seated.
- ☐ Replace.

18 - Clip

- ☐ Check it is securely seated

19 - Coolant temperature sensor -G62- .

- ☐ With the Coolant temperature sensor -G2- .

1.3 Cooling system hose connection diagram

1 - Coolant reservoir

2 - Intake manifold

3 - Engine block/cylinder head

4 - Heating system heat exchanger

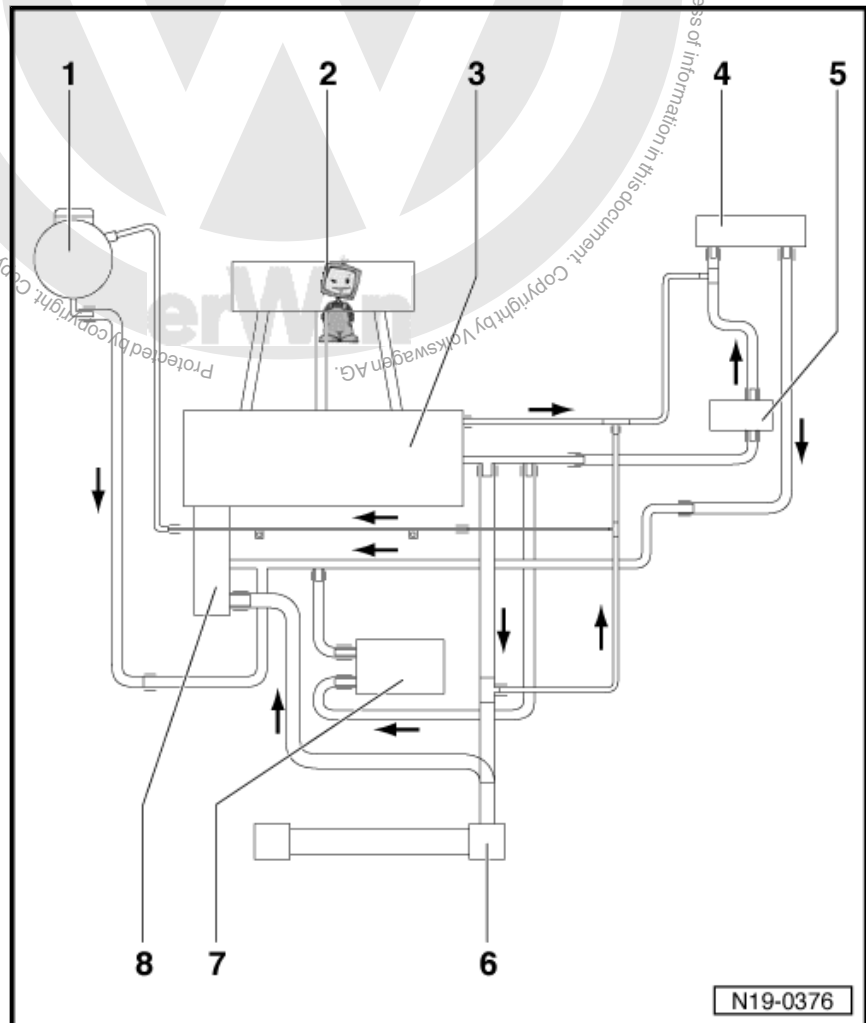
5 - Radiator

- ☐ For exhaust gas recirculation.

6 - Radiator

7 - Oil radiator

8 - Water pump/thermostat

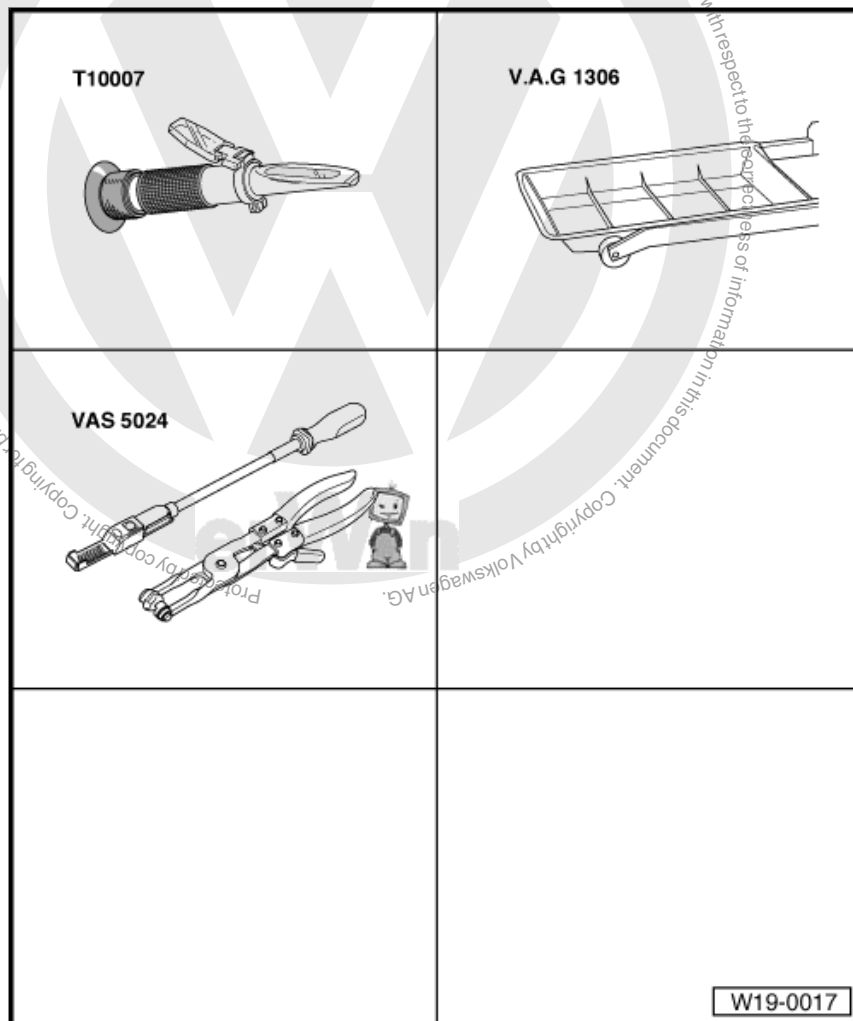




1.4 Cooling system - drain and replenish

Special tools and workshop equipment required

- ◆ Refractometer for cooling system fluid analysis - T10007-
- ◆ Tray -V.A.G 1306-
- ◆ Standart-type clamp pliers - VAS 5024A-



No illustration:

- ◆ Cooling system supply unit -VAS 6096-

1.4.1 Drain

- Remove coolant reservoir cover.

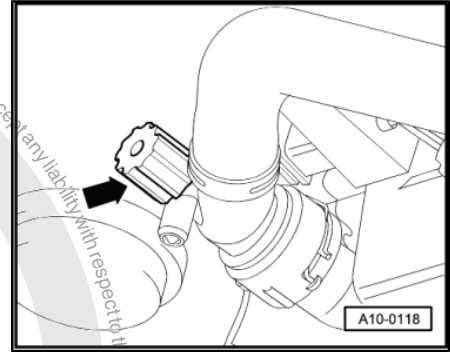


WARNING

Steam may be released when the coolant reservoir cover is removed. Cover it with a cloth and open carefully.

- Remove lower noise insulation from engine ⇒ Rep. Gr. 50 .

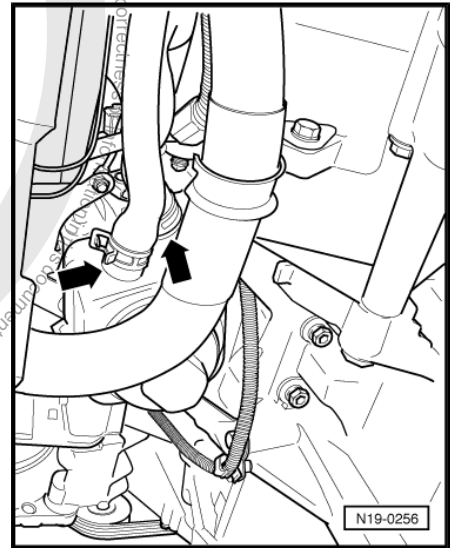
- Remove plug -arrow- for draining the cooling system



- Also, disconnect the oil radiator hose -arrows-.

**Note**

Follow the recommendations for coolant disposal!





1.4.2 Replenish



Note

- ◆ Use only purple-colour Additive -G12- for the cooling system, in compliance with TL VW 774 F.
- ◆ The Additive -G12- and the additives for the cooling system which indicate "compliant with TL VW 774 D", prevent damages due to corrosion, freezing or mould formation, further increasing the boiling temperature of the coolant. For this reason, the cooling system should always (all the year round) contain the described antifreeze and anti-corrosive product mixture.
- ◆ The purple Additive -G12- (as per TL VW 774 F) can be mixed with the previous red Additive -G12- !
- ◆ Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- ◆ Antifreeze protection must be ensured to approximately -25°C (in arctic climate countries, to approximately -35°C).
- ◆ The coolant concentration must not be reduced by adding water during hot seasons or in countries with hot climates. The antifreeze proportion shall be at least 40%.
- ◆ If because of climatic conditions, greater antifreeze protection is necessary, the percentage of Additive -G12- may be increased; however, only upto the limit of 60 % (anti-freeze protection up to -40°C). Where the proportion is greater, the cooling capacity and antifreeze protection will diminish.
- ◆ When replacing the radiator, heat exchanger, cylinder head or cylinder head gasket, used coolant should not be reused.

Recommended mixture proportions:

Antifreeze protection until	Antifreeze proportion	G 12 ²⁾	Water ²⁾
-25°C	40 %	2.0 l	3.0 l
-35°C	50 %	2.5 l	2.5 l

2) The coolant volume may vary according to the equipment on each vehicle.

- Close the cooling system drainage plug.
- Connect cooling fluid hose to oil radiator.
- Install engine noise insulation ⇒ Rep. Gr. 50

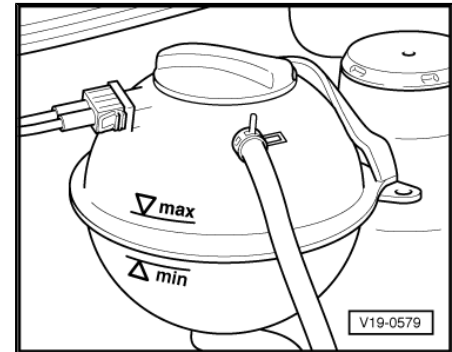
With Cooling system supply unit -VAS 6096- :

- Install the Engine cooling system tester -VAG 1274- adapter, according to the vehicle, in the coolant reservoir.
- Fill the cooling system circuit with the Cooling system supply unit -VAS 6096- ⇒ Operation instructions for the Cooling system supply unit -VAS 6096- .



Without Cooling system supply unit VAS 6096 -VAS 6096- :

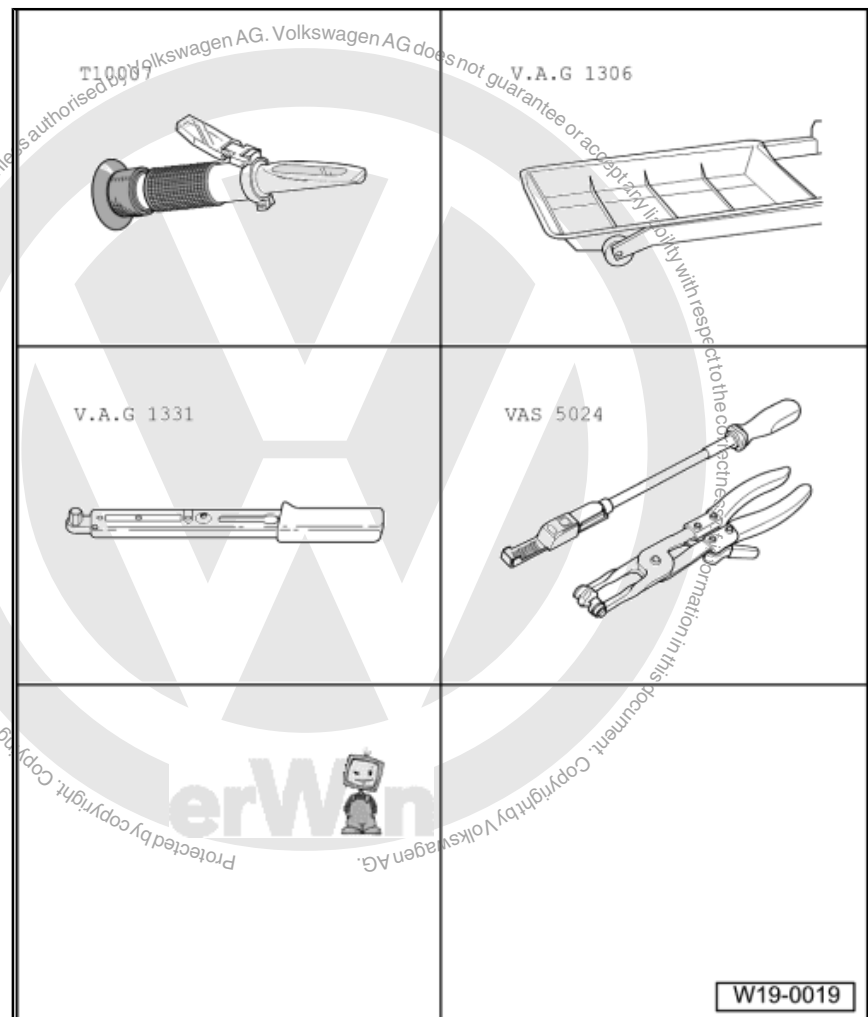
- Fill with coolant up to the maximum mark on the expansion reservoir.
- Replace the coolant reservoir cover.
- Turn off heating start device.
- Start engine and maintain an speed of about 2000 rpm for approx. 3 minutes.
- Run engine until the radiator fan starts.
- Check coolant level and, if necessary, replenish. With engine hot, the coolant level shall be on max. marking; with engine cold, it must be between the max. and min. marks.



1.5 Radiator - remove and install

Special tools and workshop equipment required

- ◆ Refractometer for cooling system fluid analysis - T10007-
- ◆ Tray -V.A.G 1306-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Standart-type clamp pliers - VAS 5024A-



1.5.1 Removal

- Remove front bumper ⇒ Rep. Gr. 63 .
- Put front panel in the work position: ⇒ Rep. Gr. 50 .
- Drain the cooling system ⇒ [page 76](#) .



- Remove cooling system hoses from radiator
- Disconnect thermal switch and fan connectors from radiator.
- Remove radiator securing bolts and remove radiator with fan from downwards.

Vehicles with air conditioning system:

- For removal, refer to the additional information and instructions ➔ [page 8](#) .

1.5.2 Installing

Installation is carried out by inverting the removal sequence, observing the following:

- Fill cooling system ➔ [page 76](#) .

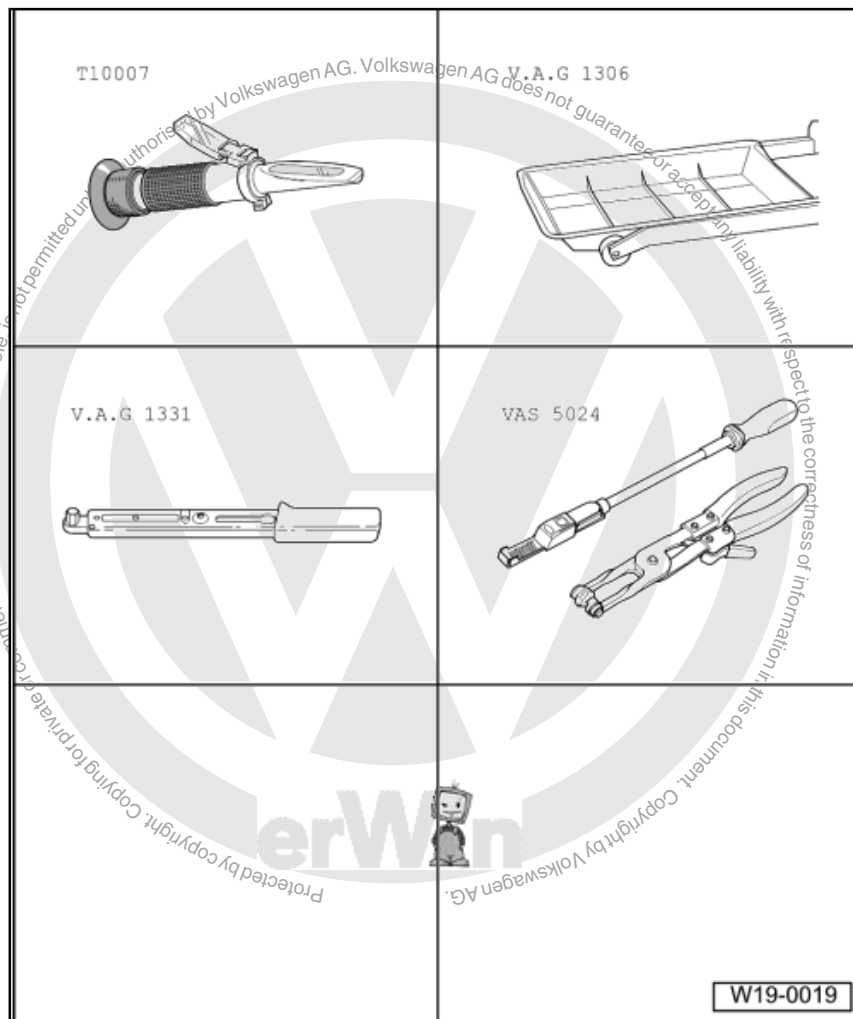
Vehicles with air conditioning system:

- For removal, refer to the additional information and instructions ➔ [page 8](#) .

1.6 Water pump - remove and install

Special tools and workshop equipment required

- ◆ Refractometer for cooling system fluid analysis - T10007-
- ◆ Tray -V.A.G 1306-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Standart-type clamp pliers - VAS 5024A-





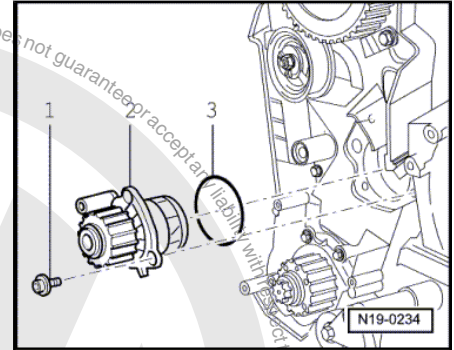
1.6.1 Removal



Note

Always replace seals and gaskets.

- Drain the cooling system ⇒ [page 76](#) .
- Remove Poly-V belt ⇒ [page 14](#) .
- Remove timing belt ⇒ [page 41](#) .
- Loosen securing bolts -1- and carefully remove the pump -2-.



1.6.2 Installing

The installation is carried out in removal reverse order, considering the following:

- Moisten new O-ring -3- with coolant.
- Insert the pump -2- into engine block and tighten securing bolts -1-. Tightening torque: 15 Nm.



Note

The pump plug must face downwards.

- Install and adjust timing belt ⇒ [page 41](#) .
- Install Poly-V belt ⇒ [page 14](#) .
- Fill cooling system ⇒ [page 76](#) .



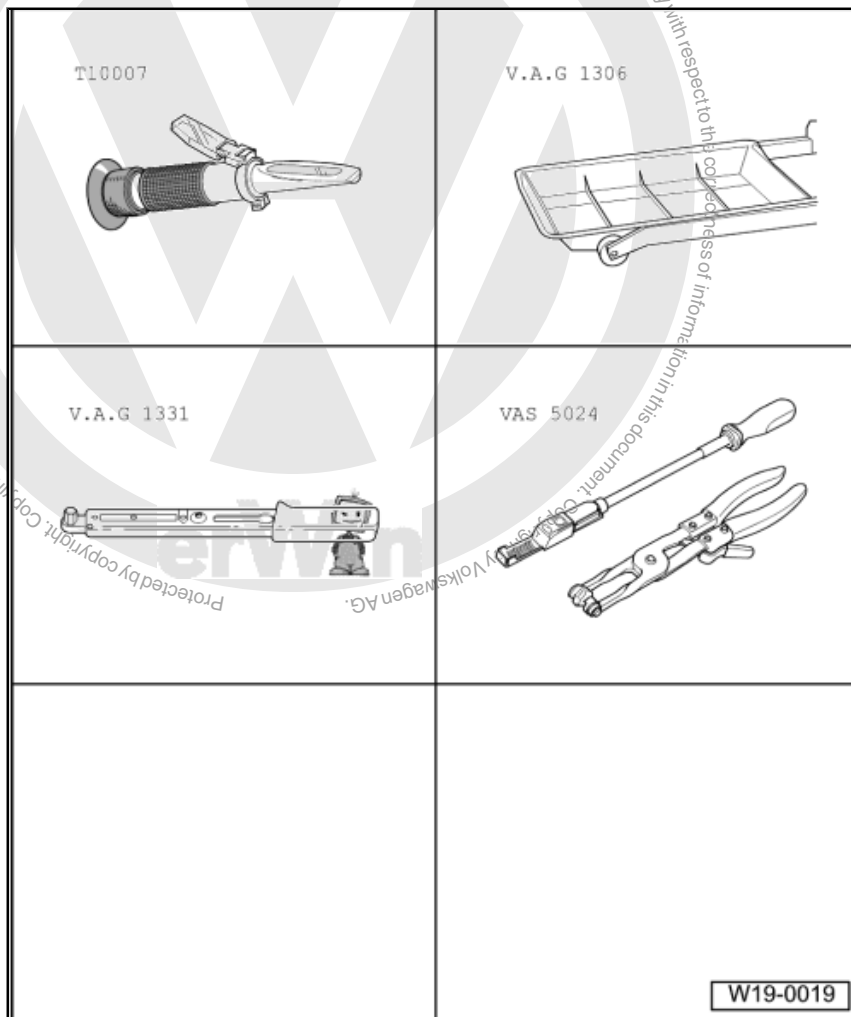
Protected by copyright. Copyright by Volkswagen AG.



1.7 Thermostat - remove and install

Special tools and workshop equipment required

- ◆ Refractometer for cooling system fluid analysis - T10007-
- ◆ Tray -V.A.G 1306-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG-1331-
- ◆ Standart-type clamp pliers - VAS 5024A-



1.7.1 Removal

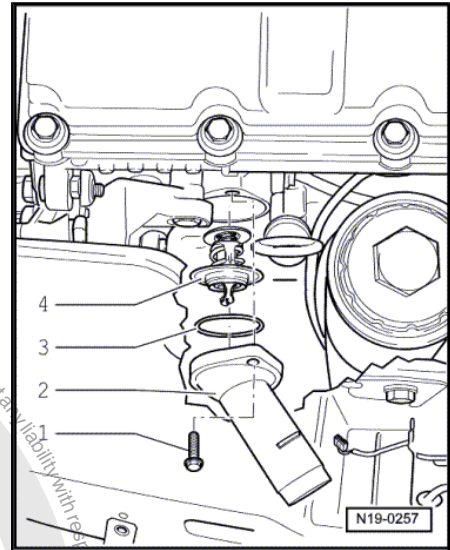


Note

Always replace seals and gaskets.

- Drain the cooling system ⇒ [page 76](#) .
- Remove alternator ⇒ Rep. Gr. 27 .
- Remove the cooling system hose from the connection flange.

- Loosen fastening screws -1- from connection flange -2- and remove connection flange -2- with thermostat -4-.
- Rotate the thermostat -4- $\frac{1}{4}$ of turn (90 °) to left and remove it from connection flange -2-.



1.7.2 Installing

Installation is carried out by inverting the removal sequence, observing the following:

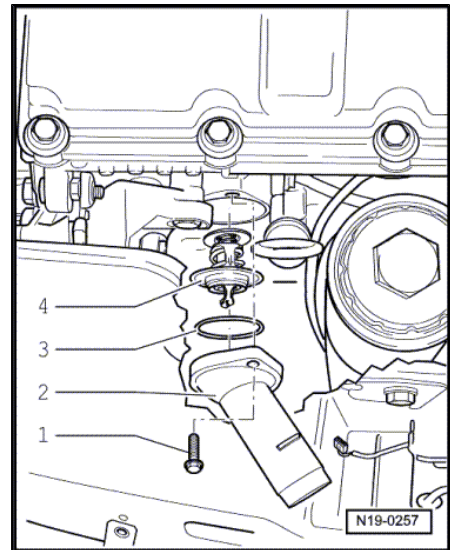
- Moisten new O-ring -3- with coolant.
- Insert thermostat -4- into connection flange -2- and rotate $\frac{1}{4}$ of turn (90°) to right.



Note

The support on the thermostat must be almost vertical.

- Mount the connection flange -2- with thermostat -4- into engine block.
- Tighten securing bolts -1-. Tightening torque 15 Nm.
- Fill cooling system ⇒ [page 76](#) .





20 – Supply system - Fuel tank, fuel pump

1 Fuel supply system components - remove and install



Note

- ◆ The hose connections are fastened by spring clamps or braces.
- ◆ Always replace fastening clamps with spring-type clamps.
- ◆ To install spring clamps, we recommend using the Standard-type clamp pliers -VAS 5024A-.

Follow safety measures ➔ [page 88](#) .

Observe rules for cleanliness ➔ [page 88](#) .

Repair fuel filter ➔ [page 87](#) .

Servicing accelerator mechanism ➔ [page 94](#) .

1.1 Fuel tank components with accessories - remove and install

1 - Securing clip

2 - Cover

3 - Sealing ring

- ☐ With rubber bellows.
- ☐ Remove and install.

4 - Securing bolt

5 - Fuel tank cover

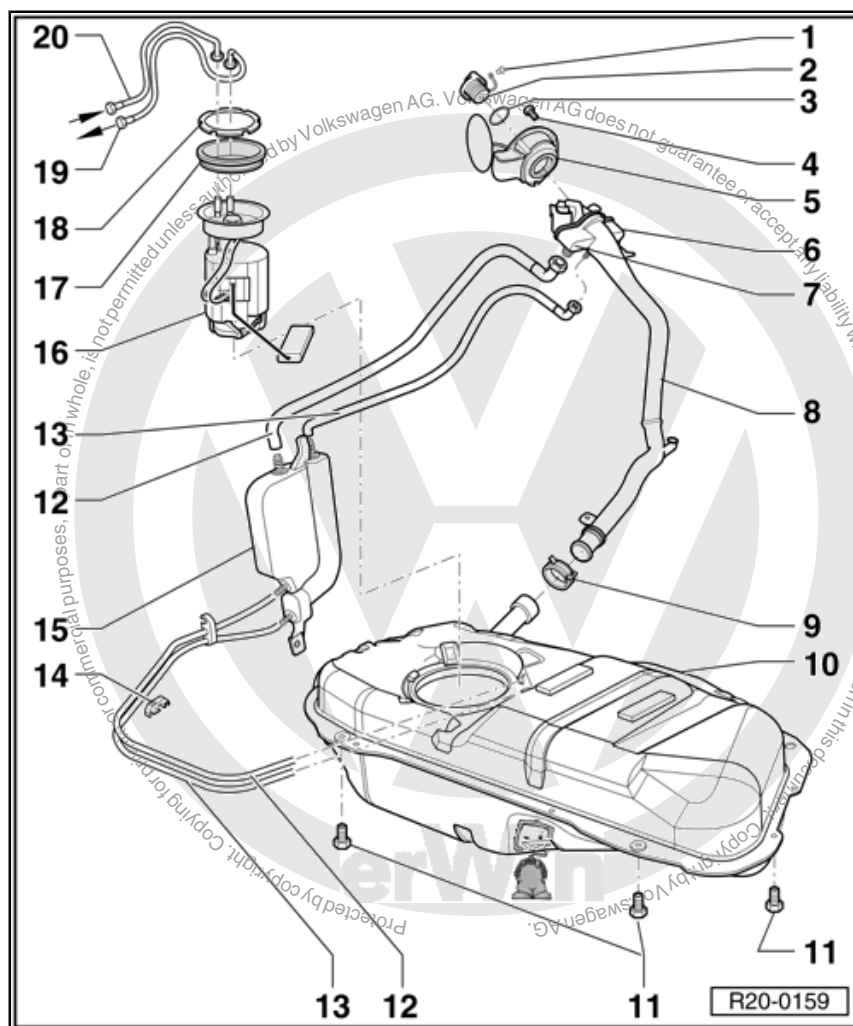
- ☐ With rubber bellows.
- ☐ Remove and install ➔ Rep. Gr. 55 .

6 - Vent valve

- ☐ Checking ➔ [page 86](#)
- ☐ To remove valve, open the clip sideways to the outside of the support.
- ☐ To remove and install, remove the fuel filling pipe.

7 - Gravity valve

- ☐ To remove, remove the right rear wheel case cover.
- ☐ To remove, release locking tab and loosen the valve upwards out of filler nozzle.
- ☐ Check valve passage. Vertical valve: open, valve inclined at 45°: closed.



**8 - Fuel supply tube****9 - Spring-type clamp****10 - Fuel tank**

- ☐ Support with Engine/gearbox jack -VAG 1383A- when removing.
- ☐ Remove and install ⇒ [page 88](#) .

11 - 26 ± 3 Nm**12 - Vent hose**

- ☐ Check that it is securely connected.

13 - Vent hose

- ☒ To gravity valve.
- ☐ Check that it is securely connected.

14 - Bearing**15 - Expansion tank****16 - Fuel pump**

- ☐ Check the flange installation position in the fuel tank ⇒ [page 86](#)
- ☐ Remove and install ⇒ [page 91](#) .
- ☐ Check fuel pump ⇒ [page 92](#) .
- ☐ With fuel gauge sensor -G-.
- ☐ Remove and install fuel meter sensor ⇒ [page 92](#) .
- ☐ Clean strainer if soiled.

17 - Sealing ring

- ☐ Replace if damaged.
- ☐ Moisten with fuel when installing the pump.

18 - Circlip

- ☐ Remove and install with Spanner -VW 5321/9-

19 - Supply tube

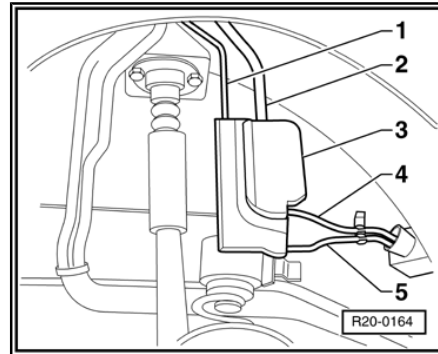
- ☐ To fuel filter ⇒ [Item 1 \(page 87\)](#) .
- ☐ Secured with clip to the fuel tank.
- ☐ Check that it is securely connected.
- ☐ Black.
- ☐ Press the release button in the connection piece for removing the flange.

20 - Return pipe

- ☐ Blue or blue marked.
- ☐ Secured with clip to the fuel tank.
- ☐ Check that it is securely connected.
- ☐ To remove the flange, press the release button in the connection piece.



- 1 - To pressure relief valve.
- 2 - To gravity valve.
- 3 - Expansion tank.
- 4 - Vent hose (From the fuel tank).
- 5 - Anti-choke hose (From the fuel tank).



Fuel pump installation position

Flange mark shall be aligned with fuel tank mark -arrow-.

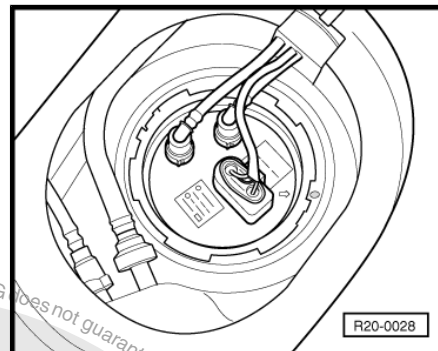
Blue or blue marked return pipe -1- connected to connection with mark -R-.

Black supply pipe -2- connected to connection with mark -V-.



Note

After fuel pump flange installation, check if supply, return and vent pipes are still fastened to fuel tank.



Check vent valve

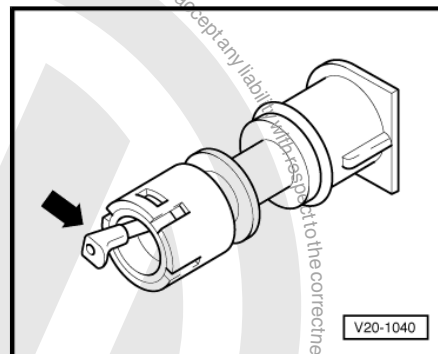
Lever in rest position: closed.

Lever pushed in the direction of arrow: open.



Note

Before vent valve installation, remove fuel tank cover.





1.2 Fuel filter - repair

1 - Supply tube

- ☐ From the fuel tank.
- ☐ White or with white marking.
- ☐ Check that it is securely connected.

2 - Return pipe

- ☐ Blue or blue marked.
- ☐ Check that it is securely connected.

3 - Control valve

- ☐ Assembly position: the arrow must point to fuel tank.
- ☐ When replacing the filter, remove the fastening clip and completely remove the control valve along with the fuel pipes.
- ☐ Below +15 °C: Passage to filter open.
- ☐ Over +31 °C: Passage to filter closed.

4 - Supply tube

- ☐ To auxiliary pump.
- ☐ Check that it is securely connected.
- ☐ White or with white marking.

5 - Return pipe

- ☐ From auxiliary pump.
- ☐ Check it is securely seated.
- ☐ Blue or blue marked.

6 - Fuel pipe

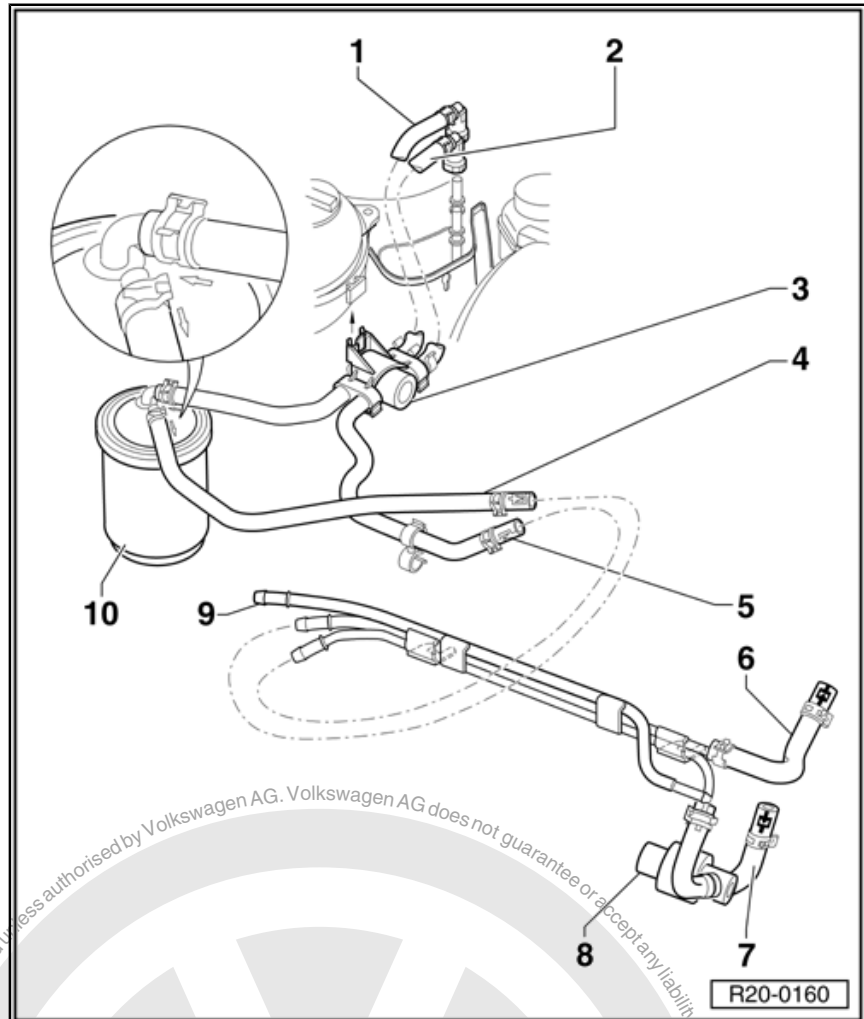
7 - Cooling system hose

8 - Fuel temperature sensor -G81-

9 - Cooling system hose

10 - Fuel filter

- ☐ Fill with diesel before installing.
- ☐ Flow direction is identified with an arrow.
- ☐ Do not interchange the connections.
- ☐ Replace if damaged.





1.3 Safety measures for working on the fuel supply system



WARNING

During assembly work especially within the engine compartment, due to the lack of space, bear in mind the following:

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *To provide easy access to all the moving or hot parts.*

When removing or installing fuel level sensor or fuel pump, with fuel tank full or partially full, observe the following:

When removing or installing fuel level sensor or fuel pump, in the fuel tank full or partially full, observe the following:



WARNING

- ◆ *The fuel and hoses in the fuel system may be very hot (risk of burns)!*
- ◆ *Fuel system is under pressure!*
- ◆ *Use protective gloves and eyewear when carrying out any repairs to the fuel system!*

- ◆ Before starting installation work, place a gas exhaust hose of a switched on gas exhaust system near the fuel tank opening, so as to absorb gases released by the fuel. If exhaust equipment is unavailable use a radial fan (the motor must be out of air flow) with air movement rate higher than 15 m³/hour.
- ◆ Avoid skin contact with fuel! Use fuel resistant gloves!

1.4 Cleanliness rules

For jobs on the fuel / injection system, strictly observe the following "6 cleaning" rules:

- ◆ Carefully clean all the connections and surrounding areas before disconnecting them.
- ◆ Place all the parts removed on clean surface and cover them. Do not use cloth that releases lint!
- ◆ If repair work is not to be carried out immediately, open components must be covered up or carefully preserved.
- ◆ Install only clean components. Only remove spare parts from packaging just prior to installation. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ With system open: If possible, avoid using compressed air. If possible, do not move the vehicle.
- ◆ Also, ensure that no diesel runs onto the cooling system hoses. Hoses that may come into contact with fuel must be cleaned immediately. Damaged hoses should be replaced.

1.5 Fuel tank - remove and install

Special tools and workshop equipment required



- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-

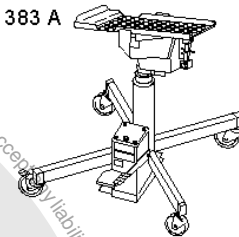
V.A.G 1331



W00-0427

- ◆ Jack - Gearbox or engine + gearbox -VAG 1383A-

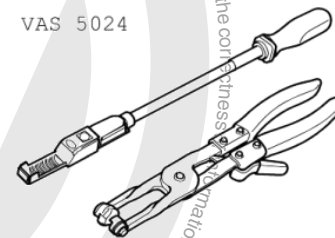
V.A.G 1383 A



W00-0120

- ◆ Standart-type clamp pliers -VAS 5024A-

VAS 5024



W00-0495

- ◆ Fuel extractor -VAS 5190-

1.5.1 Removal

- Follow safety precautions before starting work ⇒ [page 88](#).
- Follow cleanliness rules ⇒ [page 88](#).
- Check if the vehicle has code radio; if so, request respective anti-theft code.
- With ignition switched off, disconnect battery earth strap.
- Fold rear seat forwards.
- Remove fuel pump access cover.



WARNING

- ◆ *The fuel and hoses in the fuel system may be very hot (risk of burns)!*
- ◆ *Fuel system is under pressure!*
- ◆ *Use protective gloves and eyewear when performing any repairs on the fuel system!*

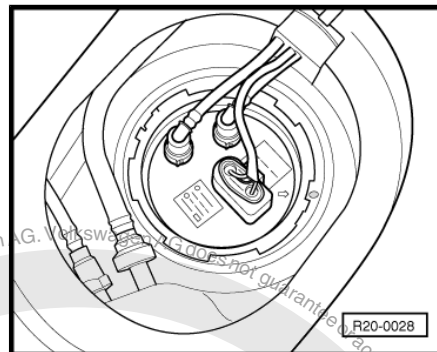
- Drain fuel tank.
- Disconnect return -1- and supply -2- pipes, and the fuel tank connector -3-.



Note

Press locks on pipe connectors to disconnect them.

- Exhaust system must be lowered a bit, and fastened to the body with a metallic wire.
- Remove heat deflector between the exhaust tube and the fuel tank.
- Remove fastening clips from the supply pipe by using the Standart-type clamp pliers -VAS 5024A-
- Support the fuel tank by using the Engine/gearbox combo jack -VAG 1383A- .
- Remove fuel tank securing bolts.
- Lower fuel tank.



1.5.2 Installation

Installation is carried out by inverting the removal sequence, observing the following:

- ◆ Vent and fuel hoses are to be installed kink-free.
- ◆ Check the firm seating of the fuel hoses.
- ◆ Do not interchange supply and return lines (return hose blue or with blue marking, supply line black)



Note

After installing fuel meter sensor, check that supply, return and vent pipes are still fixed to the fuel tank.

Flange mark shall be aligned with fuel tank mark -arrow-.

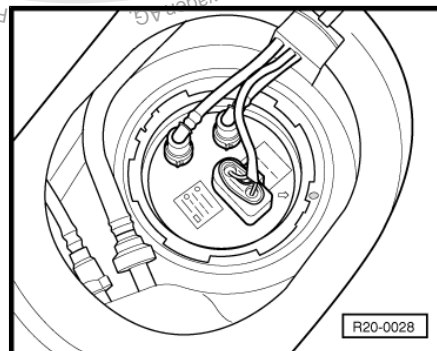
Blue or blue marked return pipe -1- connected to connection with mark -R-.

Black supply pipe -2- connected to connection with mark -V-.



Note

After fuel pump flange installation, check if supply, return and vent pipes are still fixed to fuel tank.

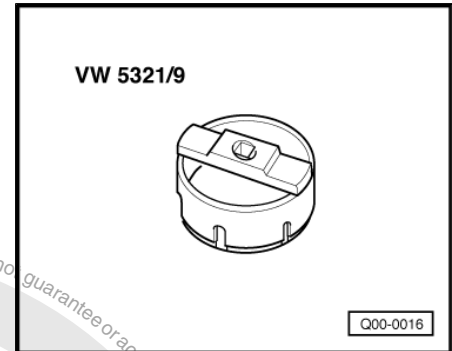




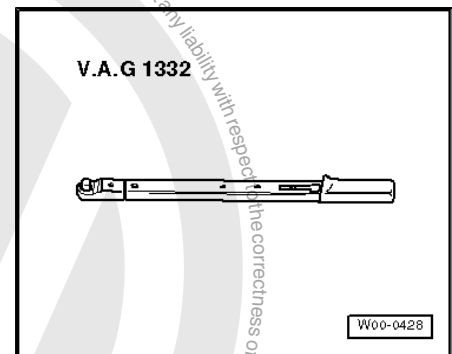
1.6 Fuel pump - remove and install

Special tools and workshop equipment required

- ◆ Spanner -VW 5321/9- or Spanner -T10334-



- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-



1.6.1 Removal

Follow safety measures ⇒ [page 88](#) .

Follow cleanliness rules ⇒ [page 88](#) .

- Check if the vehicle has code radio; if so, request respective anti-theft code.
- With ignition off, disconnect earth strap from battery.
- Fold rear seat forwards.
- Remove fuel pump access cover.
- Disconnect return -1- and supply -2- pipes, and the fuel tank connector -3-.



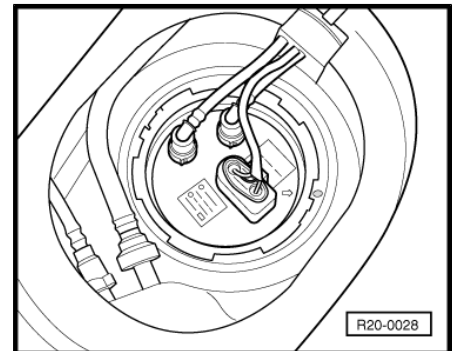
Note

Press locks on pipe connectors to disconnect them.



WARNING

- ◆ *The fuel and hoses in the fuel system may be very hot (risk of burns)!*
- ◆ *Fuel system is under pressure!*
- ◆ *Use protective gloves and eyewear when performing any repairs on the fuel system!*



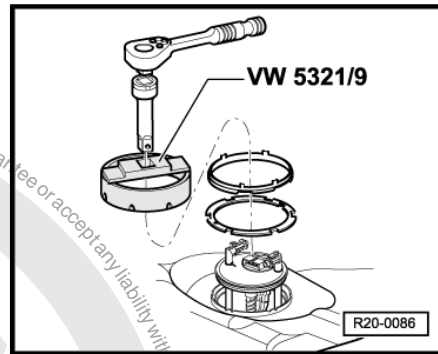


- Loosen the pump with Spanner -VW 5321/9 - or Spanner - T10334- .
- Remove fuel pump and seal fuel tank opening.



Note

When the fuel pump is to be replaced, drain it before discarding.



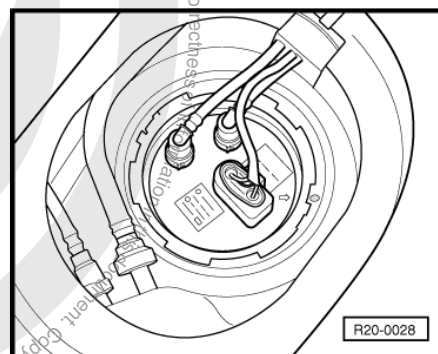
1.6.2 Installation

Installation is carried out by inverting the removal sequence, observing the following:



Note

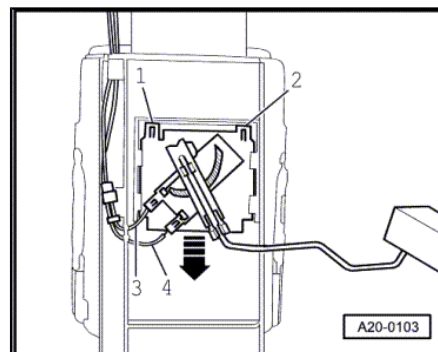
- ◆ Do not fold fuel level sensor when installing.
- ◆ Insert flange sealing or the dry fuel pump into the fuel tank opening.
- ◆ Moisten the seal with fuel only when installing the flange or fuel pump.
- ◆ Make sure the fuel pipes are firmly seated.
- ◆ After installing the fuel pump flange, check whether the supply, return and vent pipes are still fastened onto the fuel tank.
- ◆ Flange mark shall be aligned with fuel tank mark -arrow-.



1.7 Fuel meter sensor - remove and install

1.7.1 Removal

- Remove fuel pump ➔ [page 91](#) .
- Release and remove the terminals of the wires -3- and -4-.
- Raise retaining locks -1- and -2- with a screwdriver and pull the fuel level sensor out and downwards -arrow-.



1.7.2 Installation

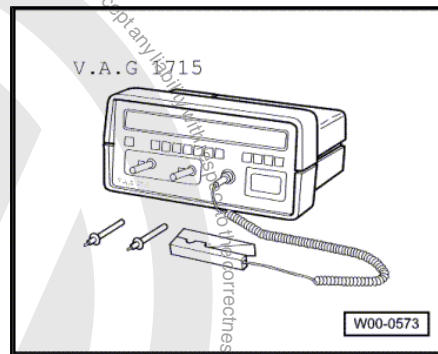
- Insert fuel level sensor in the fuel pump guides and push up until it engages.

1.8 Fuel pump - check

Special tools and workshop equipment required



- ◆ Portable multimeter -VAG 1526C- or Multimeter -V.A.G 1715-



- ◆ Auxiliary cable set -V.A.G 1594 A-

- ◆ Test probe -VAG 1527B-

Test conditions

- The fuses must be in order.
- The battery voltage must be at least 11.5 V.
- All power consuming components, like lights and rear window demister, must be off.

Check operation and power supply voltage

- Fold rear seat forwards.
- Remove fuel pump access cover.
- Briefly operate starting motor. The fuel pump operation must be audible.
- Switch off ignition.

If fuel pump does not work:

- Remove 4-pin connector from the fuel pump flange.
- Connect Test probe -VAG 1527B- to outer contacts of connector using adapter cables from -V.A.G 1594 - .
- Switch ignition on. The LED shall light ON for about 2 seconds.

If the LED does not light ON:

- Locate and repair cable interruption, according to the current circuits scheme. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If the LED lights ON (power supply OK).

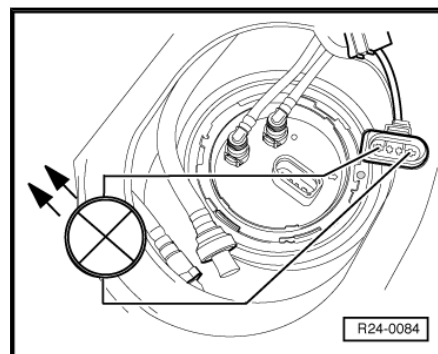
- Remove fuel pump ⇒ [page 91](#) .
- Check if cables are connected between flange and fuel pump.

In case there is no cable interruption:

- Replace fuel pump ⇒ [page 91](#) .

Check current consumption at fuel pump

- Remove 4-pin connector from the fuel pump flange.





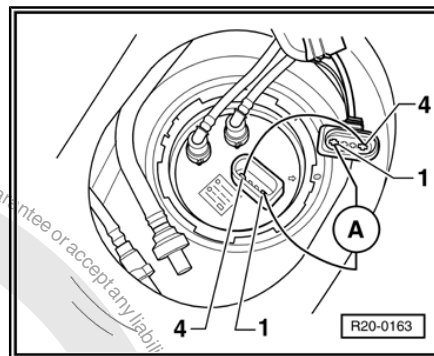
- Set multimeter measuring range to 20 A, and using auxiliary cables from -V.A.G 1594 A- , connect multimeter in series between the contacts -1- of the connector and fuel pump.



Note

The Multimeter -V.A.G 1715- test probe can also be inserted between the contact -1- connector and the fuel pump by using the adapter cables of the Multimeter -V.A.G 1715- .

- Connect contacts -4- of connector and fuel pump by using the adapter cables from -V.A.G 1594 A- .
- Start engine and run at idle speed.
- Measure current at fuel pump. Specification: 6,3...7.8 A.
- If the values measured lie outside the specifications:
- Replace fuel pump ➔ [page 91](#) .



1.9 Accelerator mechanism - repair

1 - Support

- ☐ Remove and install ➔ Rep. Gr. 46 .

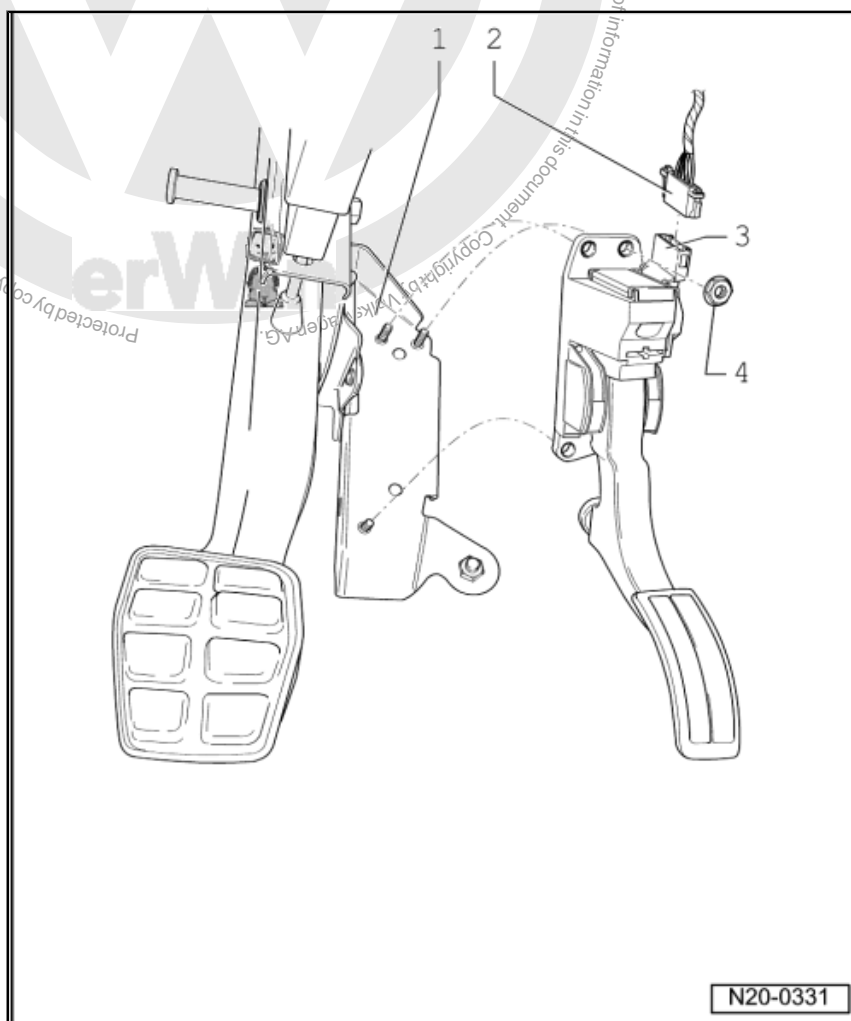
2 - Connector

- ☐ Black, 6-pin.

3 - Accelerator pedal position sensor -G79-

- ☐ Not adjustable.
- ☐ Accelerator pedal position sensor transmits the pedal position to engine command unit.
- ☐ Remove feet rest area cover to remove sensor.

4 - 10 Nm

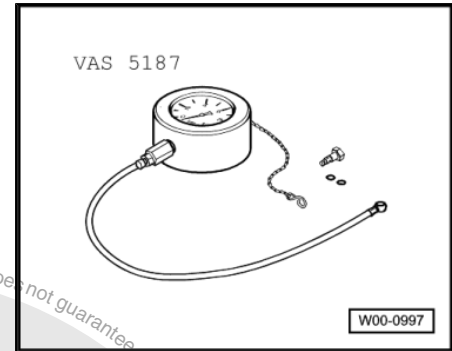




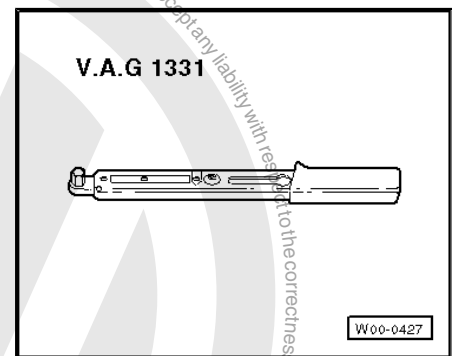
1.10 Auxiliary pump - check

Special tools and workshop equipment required

- ◆ Pressure test equipment -VAS 5187-



- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-



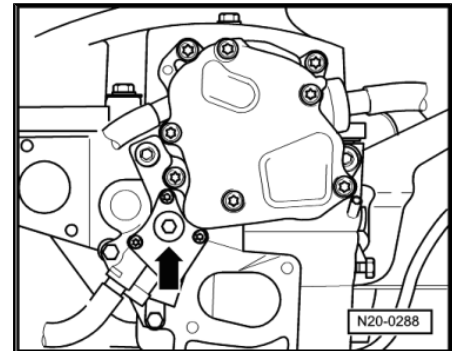
- ◆ Vehicle diagnosis, measurement and information system - VAS 5051A/52- with Diagnostic cable (3 m) -VAS 5051/5-

Test conditions

- Coolant temperature at least 85 °C.
- Injectors must be in order.
- Fuel filter and pipes must not be blocked.
- The check valve in the fuel supply hose must be in order.

Test sequence

- Remove plug -arrow-.





- Connect Auxiliary pump tester -VAS 5187- , as shown.
- Start engine and run at idle speed.
- Connect the Diagnosis, Measurement and Information System -VAS 5051A/52- and select the operation mode Vehicle self-diagnosis. Then, select engine electronic control unit with 01 Engine electronic system.
- Select function 08 Read value block.
- Select screen "2" via numeric keys (on keyboard) and confirm with 0 key.
- Read engine idle speed on field 1.
- Increase engine speed to 1,500 rpm.
- Check pressure on the pressure gauge. Specification: at least 3.5 bar.
- Press the □ key.
- Select function 06 End the test function key.
- Switch off ignition.

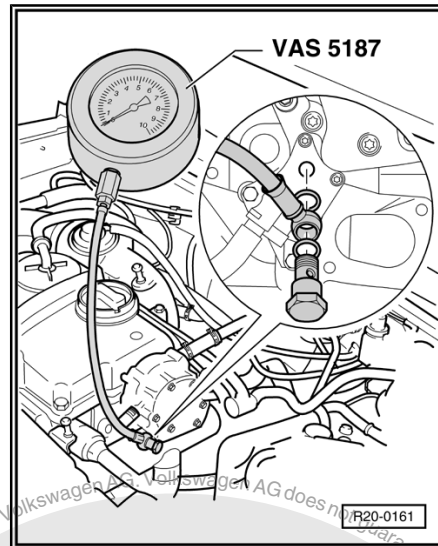
If the specification is not obtained:

- Replace auxiliary pump ⇒ [page 97](#) .



Note

After removing pressure gauge unit, tighten plug at 25 Nm. Always replace seal.

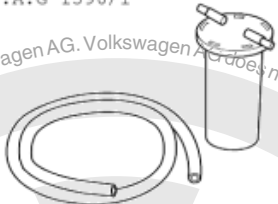




1.11 Auxiliary pump - remove and install

Special tools and workshop equipment required

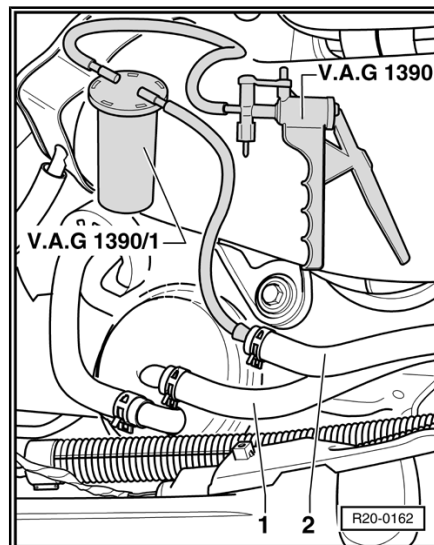
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ◆ Vacuum pump -VAG 1390-
- ◆ Fluid container - V.A.G 1390/1-
- ◆ Standart-type clamp pliers - VAS 5024A-

V.A.G 1331 	V.A.G 1390 
V.A.G 1390/1 	VAS 5024 
W20-0054	

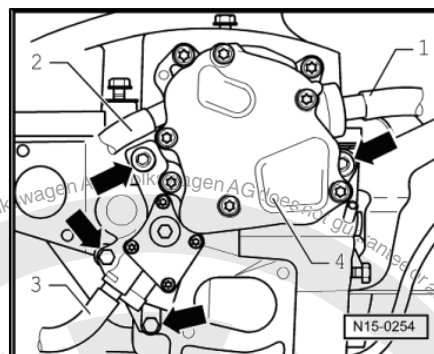


1.11.1 Removal

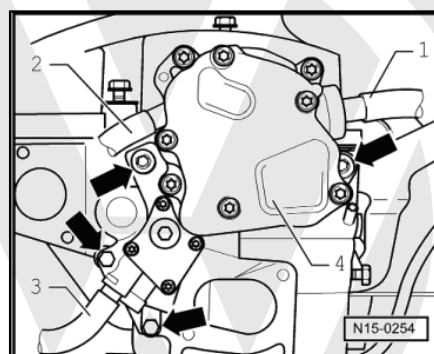
- Remove supply pipe -1- (white marking) and return pipe -2- (blue marking) from the fuel filter.
- Connect the Vacuum pump -VAG 1390- with the Fluid container -VAG 1390/1- to return pipe.
- Activate Vacuum pump -VAG 1390- until no more fuel comes from the return pipe. Take care not to suck fuel into the vacuum pump.



- Remove vacuum hose -1- belonging to the servo brake from auxiliary pump -4-.
- Remove supply pipe -2- (white marked) from auxiliary pump -4-.
- Remove fastening screws -arrows-.
- Remove auxiliary pump -4- from cylinder head..



- Pull auxiliary pump -4- slightly upwards and remove return pipe -3- (blue marking).



1.11.2 Installation

Installation is carried out by inverting the removal sequence, observing the following:

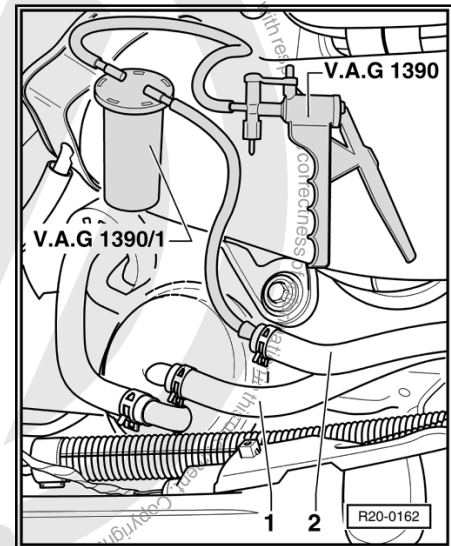


Note

- ◆ Ensure proper seating of auxiliary pump coupling in camshaft.
- ◆ Always replace auxiliary pump seals.
- Fit return pipe -3- (blue marking) to auxiliary pump return connection.



- Install auxiliary pump and tighten upper securing bolts to 20 Nm.
- Tighten lower securing bolts to 10 Nm.
- Fit supply pipe -2- (white marking) to auxiliary pump supply connection and vacuum hose -1- from servo-assisted brake to the auxiliary pump -4-.
- Connect pipe -1- (white marking) to fuel filter.
- Connect the Vacuum pump -VAG 1390- with the Fluid container -VAG 1390/1- to return pipe.
- Activate Vacuum pump -VAG 1390- until no more fuel comes from the return pipe. Take care not to suck fuel into the vacuum pump.
- Fit return pipe -2- (blue marked) in the fuel filter.



1.11.3 Checking for internal leaks

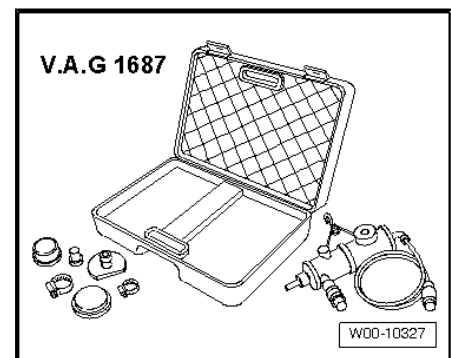


Note

The tandem pump must be checked for internal leaks between fuel side and oil side after reinstalling a used tandem pump, for example after replacing or repairing a cylinder head and/or when installing a "short" engine. When leaking it is possible for the fuel to mix with the oil which may cause the engine to fail.

Special tools and workshop equipment required

- ♦ Tester -V.A.G 1687-



Procedure

- Pull fuel supply hose (white marking) ⇒ [Item 28 \(page 39\)](#) and fuel return hose (blue marking) ⇒ [Item 29 \(page 39\)](#) off tandem pump.
- Seal fuel return union on tandem pump with a plug. Secure sealing plug with a spring-type clamp.

Prepare test unit -V.A.G 1687- as follows:



- Unscrew pressure regulating valve -2- and close valves -3- and -4-.
- Connect test connection -5- to fuel supply union of tandem pump using a commercially available compressed air connection and a section of fuel hose. Use a spring-type clamp to secure.



Note

To turn the pressure regulating valve -2- the knob must be pulled upwards.

- Connect compressed air hose -1- (compressed air source) to tester unit -V.A.G 1687- .



Note

If there is water in the sight glass, drain at water drain screw -6-.

- Open valve -3-.
- Adjust pressure to 1.0 bar with pressure regulating valve -2-.

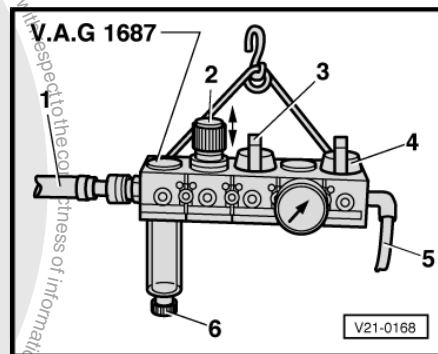
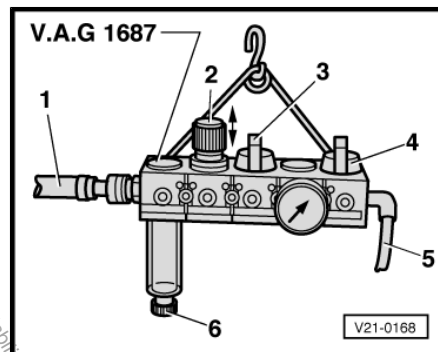


Caution

The maximum test pressure lies by 1.3 bar and this must not be exceed.

- Open valve -4- and wait until the test circuit is filled. If necessary readjust pressure to 1.0 bar.
- Close valve -3- to retain pressure and observe the pressure drop over a period of 1 minute.

If the pressure does not drop the tandem pump can be reused, if the pressure drops the tandem pump must be renewed.





21 – Overcharge - turbo

1 Overcharge system with turbocharger

1.1 Safety measures



WARNING

During assembly work, especially within the engine compartment, due to the lack of space, bear in mind the following :

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to original positions.*
- ◆ *To provide easy access to all the moving or hot parts.*

If during a test drive it is necessary to use test and measuring equipment, observe the following:

- ◆ Always install test and measuring equipment on the back seat to be operated by someone from there.

If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

1.2 Cleanliness rules

When working on the overcharge system, pay careful attention to the following cleanliness rules :

- ◆ Carefully clean all the connections and surrounding areas before disconnecting them.
- ◆ Place all the parts removed on clean surface and cover them. Do not use cloth that releases lint!
- ◆ If repair work is not going to be carried out immediately, open components should be covered up or carefully preserved.
- ◆ Install only clean components. Only remove spare parts from packaging just prior to installing them. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ During repair services, remove oil from hose connections and ends.
- ◆ With system open: If possible, avoid using compressed air. If possible, do not move the vehicle.

1.3 Turbocharger - remove and install

Follow safety measures ⇒ [page 101](#) .

Follow cleanliness rules ⇒ [page 101](#) .



Note

- ◆ All the hoses are fastened with clamps or coupling fittings.
- ◆ When installing spring clamps, use Standard-type clamp pliers -VAS 5024A-.
- ◆ Do not install hoses containing lubricant on its connections.
- ◆ Overcharge system must be free of leaks.
- ◆ Before installing the oil supply pipe, fill the turbocharger, through the connection point, with engine oil.
- ◆ After installing the turbocharger, run the engine during at idle speed for about 1 minute. Do not accelerate the engine. This will ensure the turbocharger is properly lubricated.
- ◆ Always replace self-locking nuts.

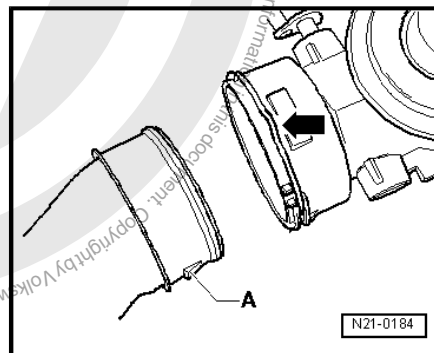
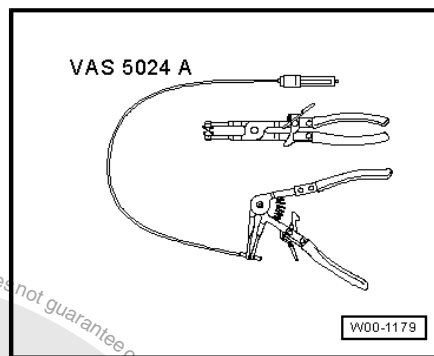
Hoses with coupling connections



Note

All the overcharge system hoses are fastened with spring clamps or connections. Always check the following points in the connections:

- Release the connection by pulling the fixing clip -arrow-, without using tools.
- When assembling, make sure the retaining tabs -A- are firmly secured.





1 - Exhaust manifold

- ☐ With turbocharger of exhaust gases.
- ☐ Full replacement only.
- ☐ To remove, first remove the hose between the turbocharger/air mass meter, intake manifold/intercooler hose, input flange with exhaust gas recirculation valve, and the intake manifold valve motor, as well as the drive shaft right cover.

2 - Intake manifold

3 - From the intercooler

4 - Gasket

- ☐ Replace.
- ☐ Covering (fillet) towards the intake manifold.

5 - 25 Nm

6 - Gasket

- ☐ Check installation position.

7 - From the air filter

8 - Support

- ☐ From heat deflector.

9 - Washer

10 - 25 Nm

11 - Heat deflector

- ☐ Fasten on the bracket

12 - Hollow screw, 15 Nm

13 - Packing

- ☐ Replace.

14 - Hose

- ☐ To Electromagnetic valve for limiting charge pressure -N75-.

15 - Oil return pipe, 30 Nm

- ☐ To engine block.

16 - 15 Nm

17 - Gasket

- ☐ Replace.

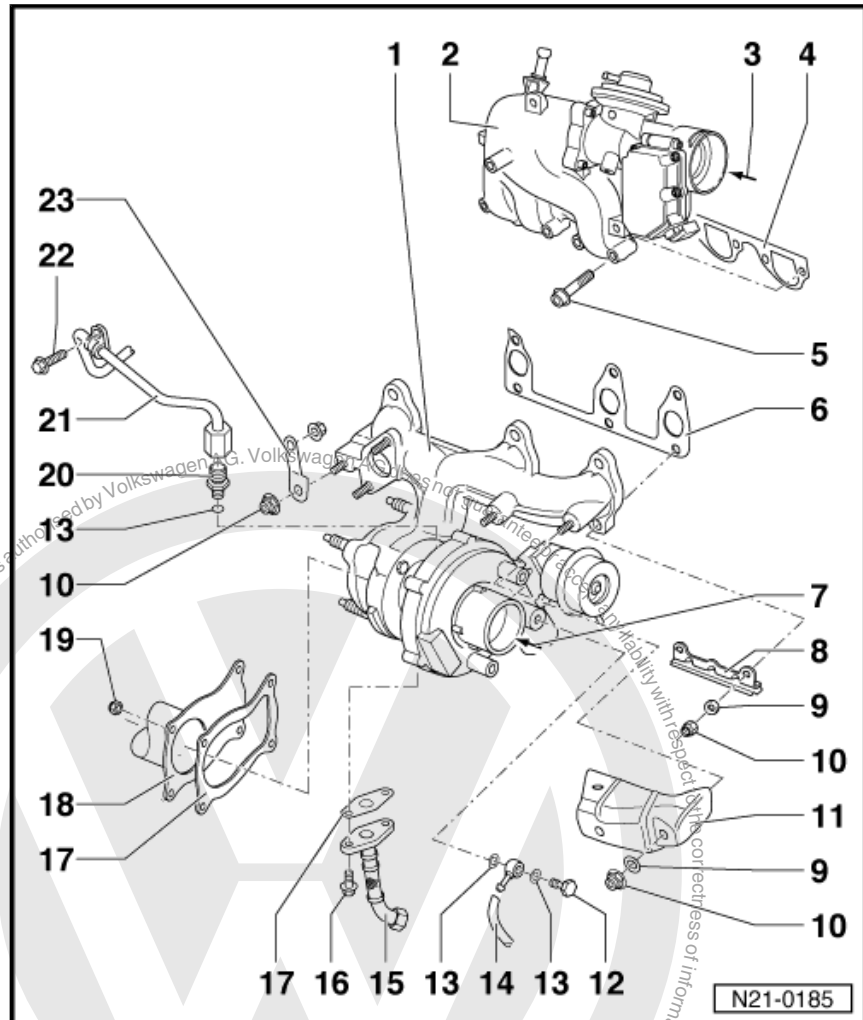
18 - Front exhaust pipe

19 - 25 Nm

- ☐ Replace.

20 - Connection, 30 Nm

- ☐ Replace.
- ☐ Apply -G 052 112 A3- on the threads and contact surface of the screw head.
- ☐ Fill turbocharger with engine oil before installing the oil supply tube.





21 - Oil supply tube

- ☐ From oil filter support.
- ☐ Before installing, check oil supply tube for continuity.
- ☐ Before installing, fill turbocharger with engine oil through the oil supply tube connection.
- ☐ Remove and install ⇒ [page 65](#) .

22 - 10 Nm

23 - Support

1.4 Intake air cooling system (intercooler) components - remove and install



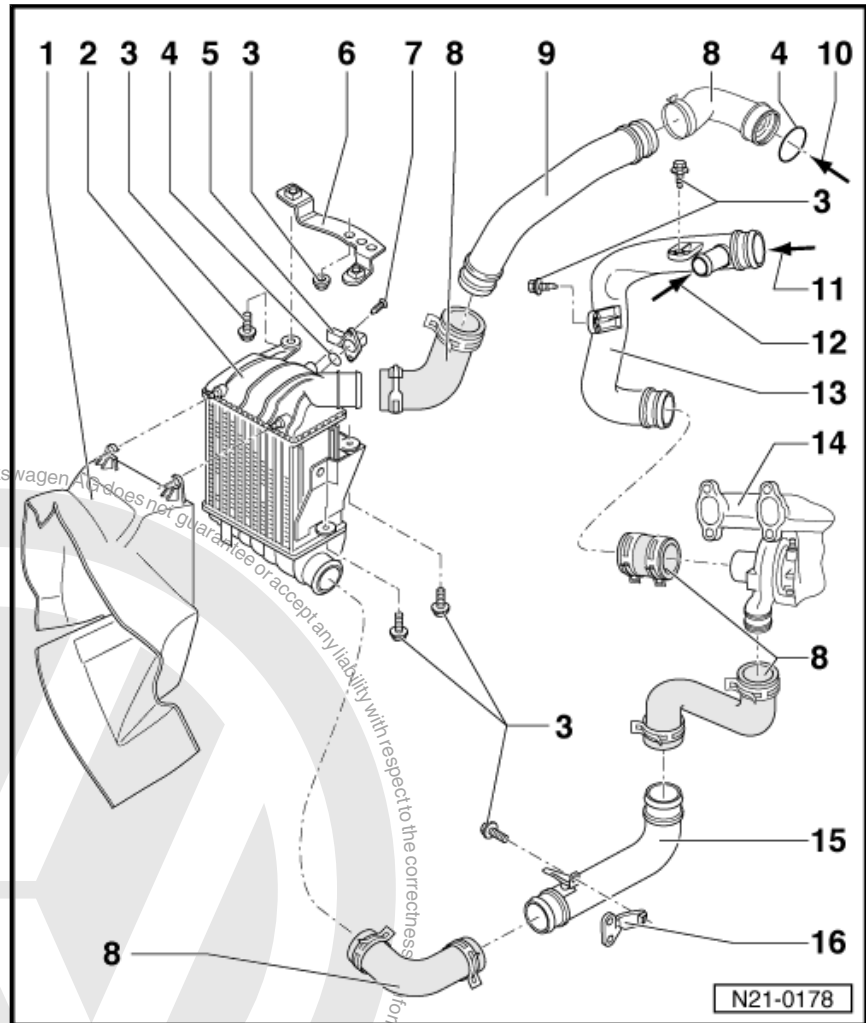
Note

- ◆ *All the hoses are fastened by clamps.*
- ◆ *When required, use sliding agent (water without additive). Do not use sliding agents containing oil.*
- ◆ *When repairing, remove oil from the hose connections and ends.*
- ◆ *Overcharge system must be free of leaks.*





- 1 - Air ducts
- 2 - Intercooler
- 3 - 8 Nm
- 4 - Sealing ring
 - ☐ Replace if damaged.
- 5 - Intake manifold pressure sensor -G71- with Intake manifold temperature sensor -G72-
- 6 - Support
- 7 - 5 Nm
- 8 - Hose
- 9 - Tube
- 10 - From exhaust gas recirculation valve
- 11 - From the air filter
- 12 - From head cover
- 13 - Tube
- 14 - Exhaust manifold
- 15 - Tube
- 16 - Support
 - ☐ From tube.
 - ☐ Bolted to crankcase.





23 – Supply system - mechanical injection (diesel)

1 Maintaining the direct injection Diesel system

The direct injection diesel system command unit has a fault memory. Before performing repairs, and for fault location, refer to the fault memory ➔ [page 115](#) .

Safety measures ➔ [page 107](#) .

Cleaning rules ➔ [page 107](#) .

1.1 Installation locations - overview

Components A to D are not shown in the illustration.

A - Brake pedal switch -F47- or Brake light switch -F-

- ☐ Together in one case, in the feet compartment, on the brake pedal.

B - Accelerator pedal position sensor -G79- and Sensor 2 of accelerator pedal position - G185-

- ☐ At the feet compartment, on the accelerator pedal.

C - Clutch pedal switch -F36-

- ☐ In feet compartment, on clutch pedal.

D - Fuel pressure regulator

- ☐ In fuel pump.

1 - Valve blocking

- ☐ Vacuum hose connection diagram ➔ [page 121](#) .

2 - Exhaust gas recirculation valve (mechanical)

- ☐ With intake manifold valve.

3 - Pressure regulating valve

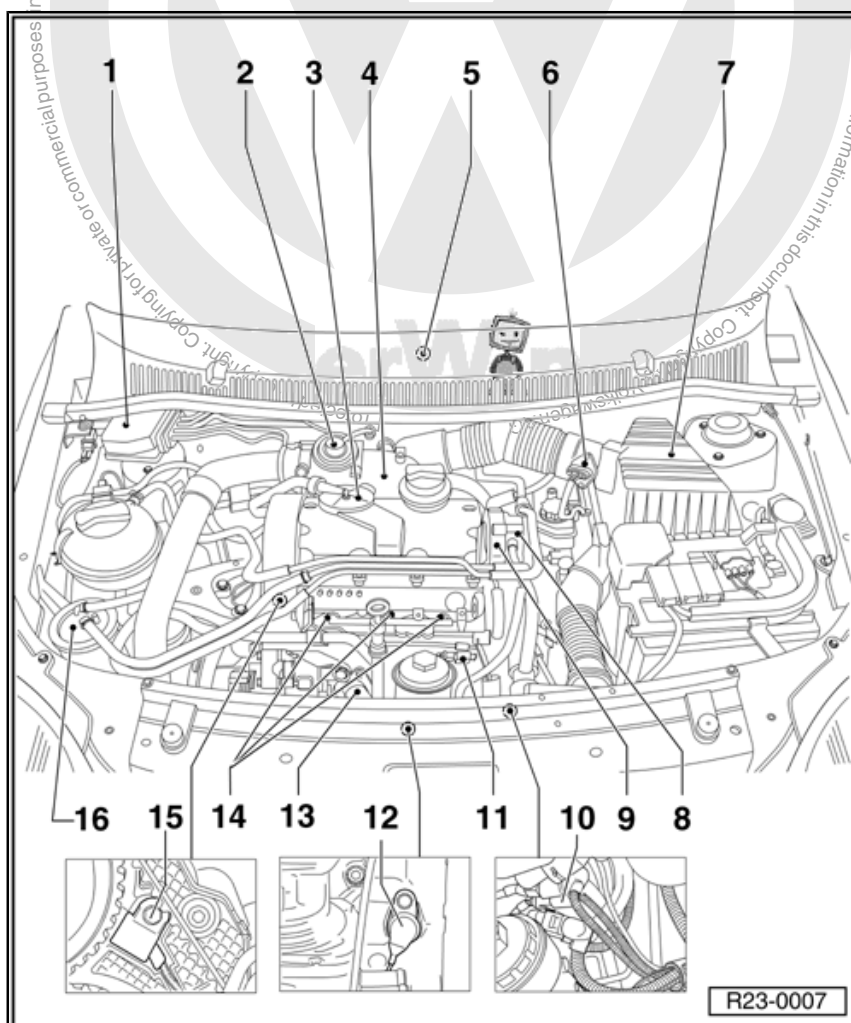
- ☐ To crankcase vent.

4 - Intake manifold

- ☐ Intake manifold pressure sensor -G71- with Intake manifold temperature sensor -G72- .

5 - Direct injection diesel system control unit -J248-

- ☐ With Altitude sensor -F96- .
- ☐ Replace ➔ [page 115](#) .





6 - Air mass meter -G70-

7 - Air filter

8 - Auxiliary pump

- ☐ Check ⇒ [page 95](#) .

9 - Vacuum pump

10 - Connector

- ☐ For Pump / injector valve of cylinder 1 -N240- ... Pump / injector valve of cylinder 4 -N243- .

11 - Fuel temperature sensor -G81-

12 - Engine speed sensor -G28-

13 - Thermostat valve

14 - Glow plugs

15 - Hall Sensor -G40- Hall (G40) Sensor

- ☐ For the camshaft position.

16 - Fuel filter

1.2 Safety measures



WARNING

During assembly work, especially within the engine compartment, due to the lack of space, bear in mind the following:

- ◆ *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- ◆ *Provide easy access to all moving or hot parts.*

If during a test drive it is necessary to use test and measuring equipment, observe the following:

- ◆ Always install test and measuring equipment on the back seat to be operated by someone from there.

If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

To prevent injuries to persons and/or damages to the injection system and glow plugs, the following must be noted:

- ◆ The ignition must be switched off before connecting or disconnecting test cables for injection and glow plugs.
- ◆ If the engine is to be turned over at starting speed, without starting, e.g. to check compression, disconnect injector connector on cylinder head.
- ◆ Check if the vehicle has code radio; if so, request respective anti-theft code before disconnecting the battery.
- ◆ Only disconnect and connect the battery when the ignition is switched off; otherwise, the direct injection diesel command system unit may be damaged.

1.3 Cleanliness rules

When servicing the fuel supply/injection system, pay attention to the following cleanliness rules:



- ◆ Carefully clean all the connections and surrounding areas before disconnecting them.
- ◆ Place all the parts removed on clean surface and cover them. Do not use cloth that releases lint!
- ◆ If repair work is not to be carried out immediately, open components opened must be covered up or carefully preserved.
- ◆ Install only clean components. Only remove spare parts from packaging just prior to installing them. Do not install components that have been kept out of packaging (i.e. inside the tool box, etc.).
- ◆ With system open: If possible, avoid using compressed air. If possible, do not move the vehicle.
- ◆ Also, ensure that no diesel runs onto the cooling system hoses. Hoses coming in contact with fuel must be cleaned immediately. Damaged hoses should be replaced.

1.4 Intake manifold valve - repair

The intake manifold valve closes for approx. 3 seconds when stopping the engine, and then opens again. This reduces the stop jerking movement.

1 - Intake manifold

2 - Intake connection flange

- ☐ With exhaust gas recirculation valve.

3 - Sealing ring

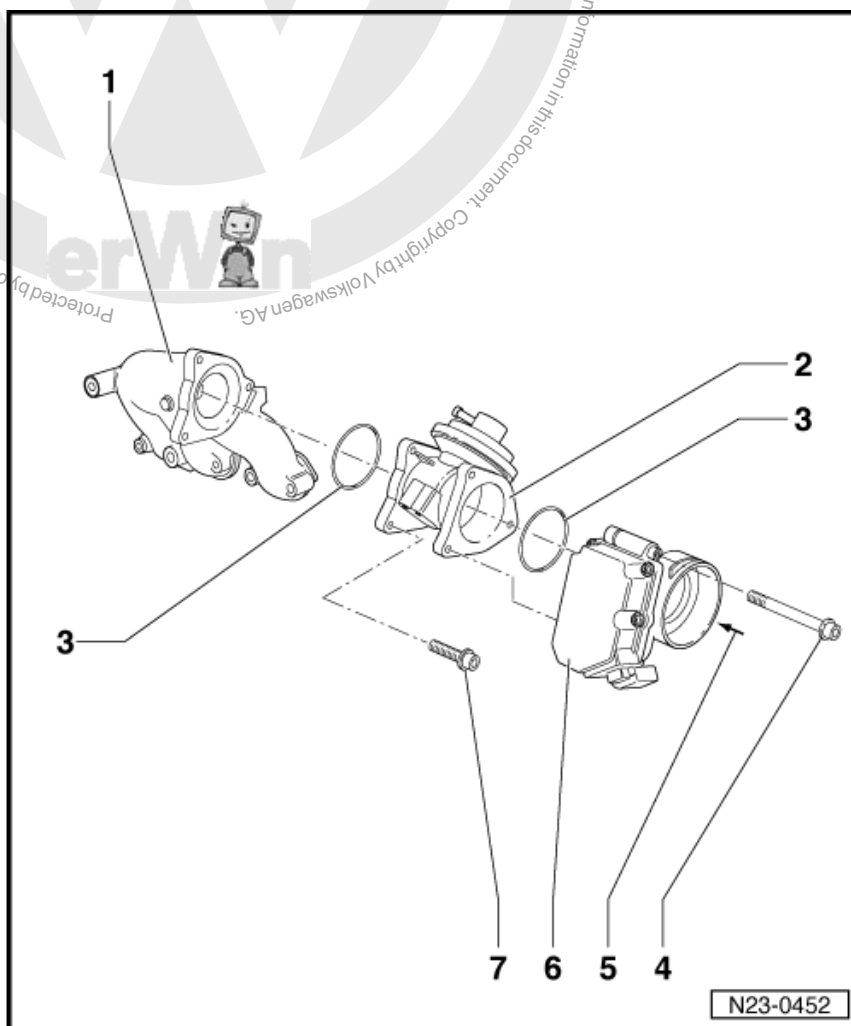
- ☐ Replace.

4 - 10 Nm

5 - From the intercooler

6 - Intake manifold valve motor -V157-

7 - 10 Nm





1.5 Injectors - repair

- ◆ Follow cleanliness rules ⇒ [page 88](#) .
- ◆ Always replace retainers and sealing rings.



WARNING

Always replace self-locking nuts and screws subject to angular torque

1 - 20 Nm + 90°

- ☐ Replace after each removal.

2 - Rocker arm shaft

- ☐ With rocker arm.
- ☐ Remove and install ⇒ [page 112](#) .

3 - Self-locking nut

4 - Set screw

- ☐ Replace.

5 - Ball head pin

- ☐ Replace.

6 - Injectors

- ☐ Remove and install ⇒ [page 112](#) .

7 - Sealing ring

- ☐ Replace ⇒ [page 109](#) .

8 - Sealing ring

- ☐ Replace ⇒ [page 109](#) .

9 - Sealing ring

- ☐ Replace ⇒ [page 109](#) .

10 - Heat insulation sealing

- ☐ Replace.

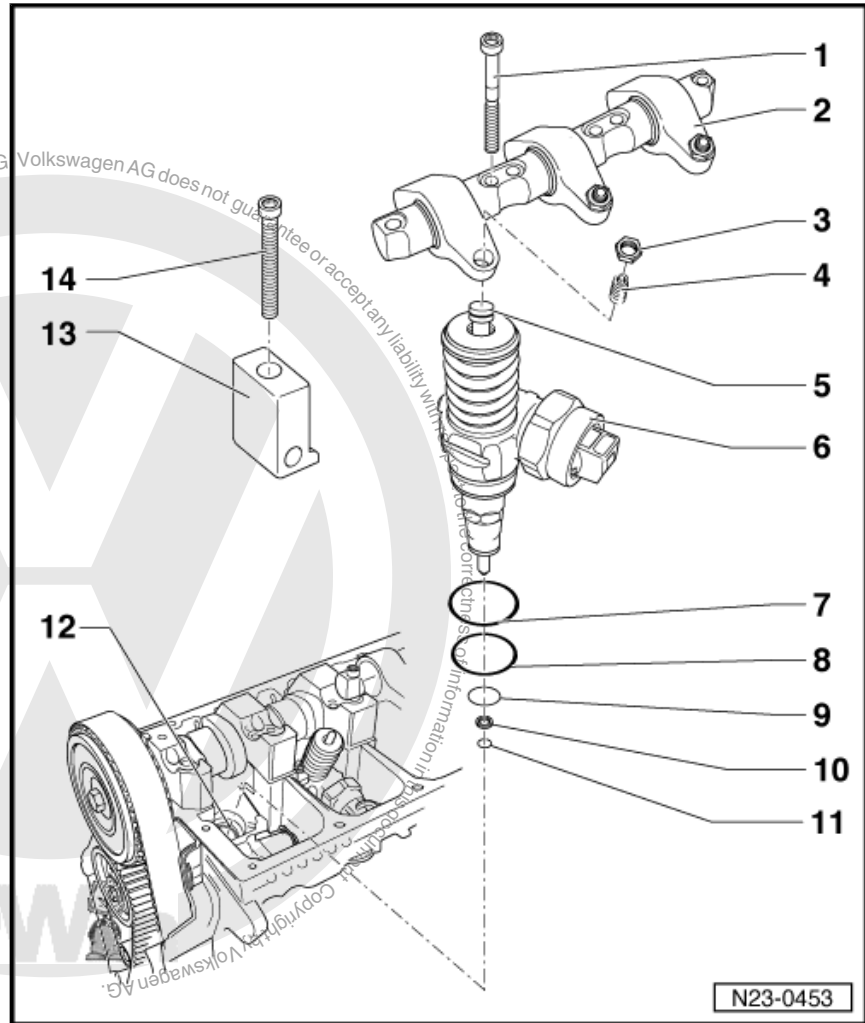
11 - Circlip

12 - Cylinder head

13 - Tensioning block

14 - 12 Nm +270°

- ☐ Replace after each removal.

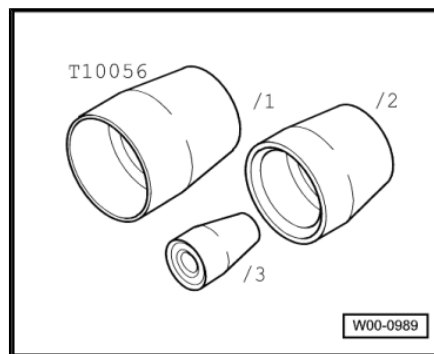


1.6 Sealing ring for injectors - remove and install

Special tools and workshop equipment required



- ◆ Assembly sleeve -T10056-



1.6.1 Removal

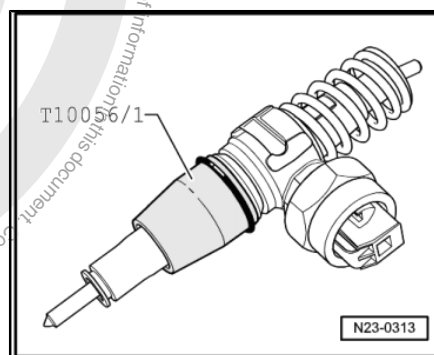
- Remove carefully old rings from injector.
- Ensure that no burrs are formed on the ring seat in the operation above.

1.6.2 Installation



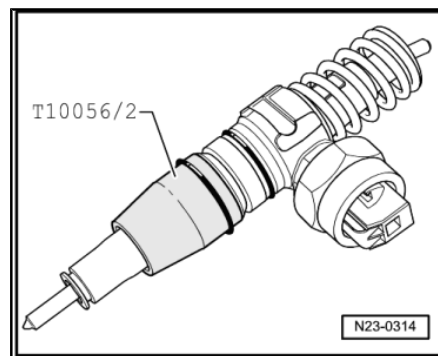
Note

- ◆ *Always use the assembly sleeves to fit the rings. If the assembly sleeves are not used, the rings may be damaged.*
- ◆ *Gradually introduce the rings with no coloured markings. Then check that the rings are correctly positioned in their respective grooves. Ring size decreases towards nozzle.*
- ◆ *Prevent the rings from rolling when sliding them on. The rings must not be twisted when seated on the injector.*
- Pull the heat insulation cover with the fastening clip.
- Carefully clean the seating surfaces of the injector ring.
- Slide Assembly sleeve -T10056/1- to stop position on unit injector.
- Slide upper ring carefully towards assembly sleeve and into injector seat.
- Remove assembly sleeve.

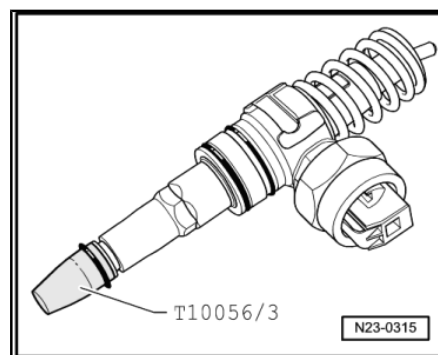




- Slide Assembly sleeve -T10056/2- to stop position on unit injector.
- Slide intermediate ring carefully towards assembly sleeve and into injector seat.
- Remove assembly sleeve.



- Slide Assembly sleeve -T10056/3- to stop position on unit injector.
- Slide lower ring carefully towards assembly sleeve and into injector seat.
- Remove assembly sleeve.
- Install the heat insulation cover with the fastening clip.

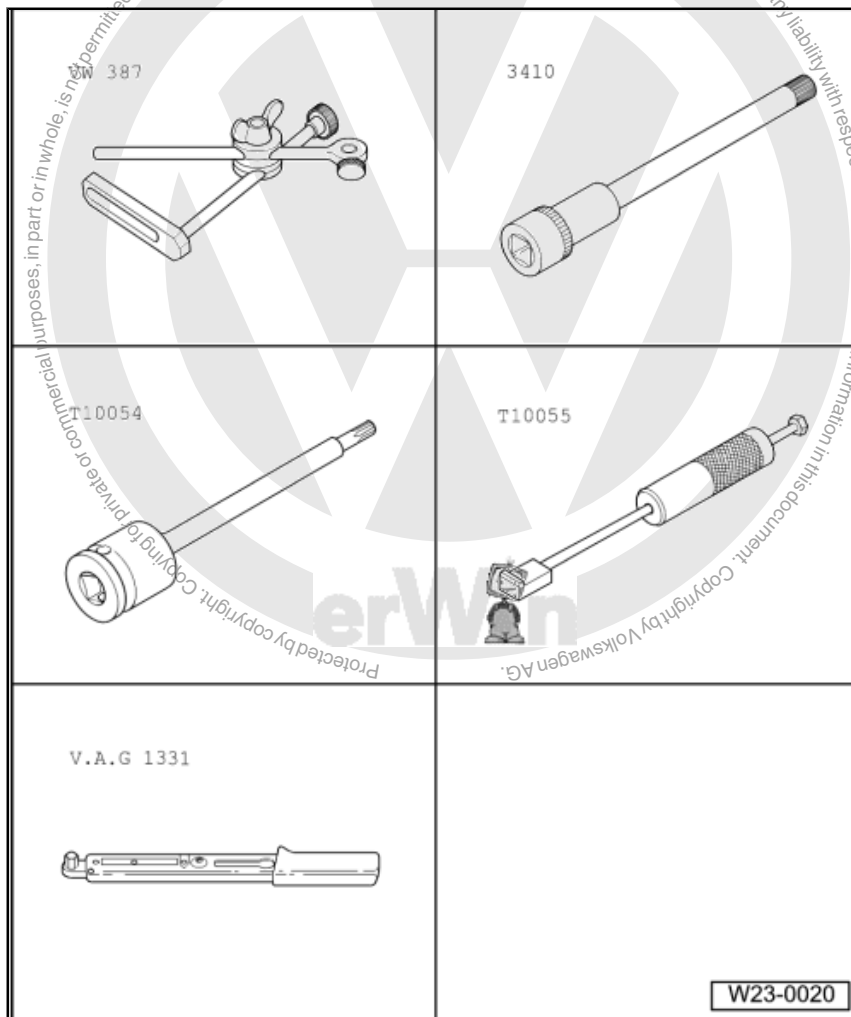




1.7 Injectors - remove and install

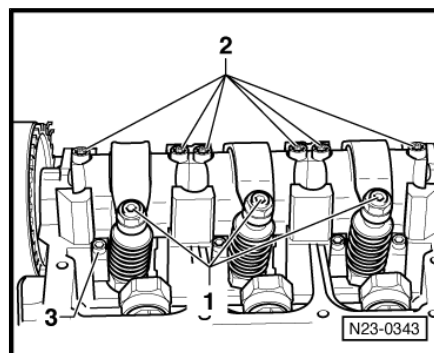
Special tools and workshop equipment required

- ◆ Support -VW 387-
- ◆ Multi-tooth Socket -3410-
- ◆ Special wrench, long reach -T10054-
- ◆ Extractor -T10055-
- ◆ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-



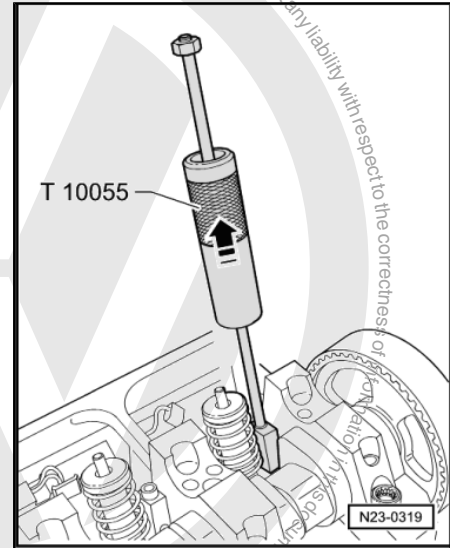
1.7.1 Removal

- Remove the upper cover of the mechanical distribution and the cylinder head cover.
- Turn crankshaft until the cams of the injector to be removed point upwards.
- Loosen self-locking nuts of set screws -1- and remove the screws.
- Remove rocker arm securing bolts -2- (from outwards to inwards) with Multi-tooth socket -3410- and remove rocker arm shaft.
- Remove tensioning block securing bolts -3- with Special long reach wrench, -T10054-, and remove the block.
- Remove injector connector by using a screwdriver. To avoid inclination, support opposite side of connector with light finger pressure.
- Check injector locations.





- Position the Puller -T10055- into the slot on the injector side instead of the tensioning block.
- Pull the injector out of cylinder head seat with gentle taps.



1.7.2 Installation



Note

- ◆ *After each repair, the injector requires adjustment, and the rocker arm set screw and the injector ball head pin need to be replaced.*
- ◆ *The new injectors are supplied with rings and heat insulation cover.*
- The heat insulation cover and rings must be replaced when the old injector is reused ⇒ [page 109](#)
- Check whether the three rings and the heat insulation cover, together with the fastening clip, are correctly seated before installing the injector.



Note

The rings cannot not be twisted.

- Lubricate the rings and carefully set the injector into the cylinder head.
- In a uniform manner push the injector into the cylinder head until it stops.
- Fit the tensioning block into the slot at the injector side.



Note

If the injector is not at a right angle to the tensioning block, the fastening screw may come loose, thus damaging the injector or the cylinder head.

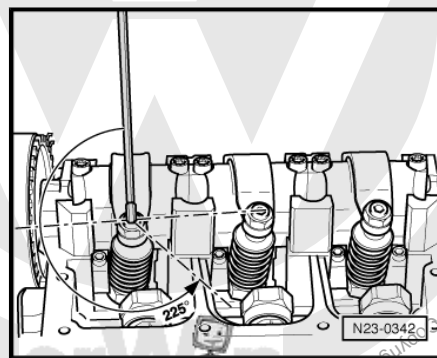
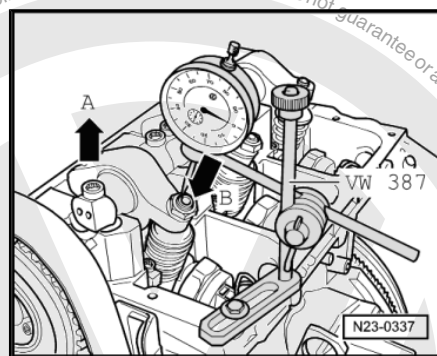
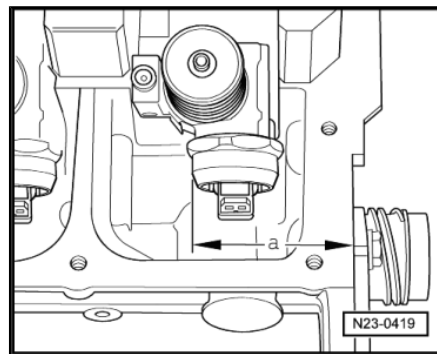
- Align the injector as follows.
- Tighten the new securing bolt into the tensioning block until the injector can still be turned easily.
- Align the injector at a right angle to the camshaft bearing caps.



- Check the dimension “a” from the external edge of the cylinder head to the round edge of the injector, using a Vernier caliper (measurement range at least of 400 mm).

Cylinder	Dimension “a”
1	245.0 ± 0.8 mm
2	157.0 ± 0.8 mm
3	65.6 ± 0.8 mm

- Align the injector and tighten the securing bolt to: 12 Nm + 270° (the angular torque could be made in several stages).
- Fit the rocker arm shaft and tighten the new securing bolts as follows
- Tighten the inner and then both outer bolts manually and evenly. Next, by using the same sequence, tighten to 20 Nm + 90°.
- Fit the Bracket -VW 387- onto the set screw as shown.
- Turn crankshaft in the engine rotation direction until rocker arm roller is at the top of drive cam. Roller side -arrow A- positioned at the highest point of dial gauge -arrow B- positioned at the lowest point.
- Remove dial gauge.
- Turn set screw inwards into rocker arm until a firm resistance is noted (injector positioned at stop).
- Turn set screw 225° back off stop.
- Hold set screw in this position and tighten the self-locking nut to 30 Nm.
- Fit injector connector and install cylinder head cover and timing belt guard.





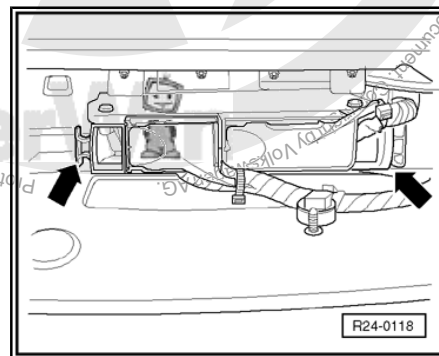
2 Engine command unit

2.1 Engine command unit - remove and install

- Before removing engine command unit, refer to the command unit ID and this respective code ⇒ [page 115](#).

2.1.1 Removal

- Switch off ignition.
- Remove the windscreen wiper blades and the lower coating of the windscreen frame.
- Release the connector on the engine command unit and pull it off.
- Push clips -arrows- outwards and pull command unit out.



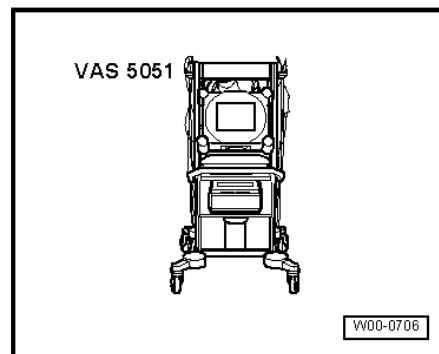
2.1.2 Installing

- Insert new command unit.
- Fit connector and lock in position.
- Check the previous code and encode the new command unit ⇒ [page 116](#).

2.2 Querying and erasing fault memory of the engine command unit

Special tools and workshop equipment required

- ◆ Diagnosis, Measurement and Information System -VAS 5051A/52-



- ◆ Diagnosis cable (3 m) -VAS 5051/1- or Diagnosis cable (5 m) -VAS 5051/3-



Work sequence

- Connect the Vehicle Diagnosis, Measurement and Information System -VAS 5051A/52-, as follows:
- Connect Diagnosis cable (3 m) -VAS 5051/1- or Diagnosis cable (5 m) -VAS 5051/3- to the diagnosis connection.
- Start the engine and run it at idle speed.

Only when engine does not run:

- Switch ignition on.

Select operation mode

- Press on the **Vehicle self-diagnosis**.

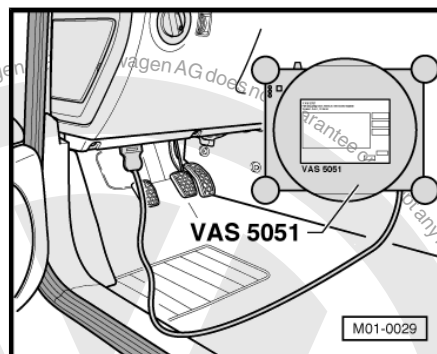
Select vehicle system

- Press on the **01 Engine electronic system**.

The command unit ID and the code will be indicated on the display.

Select diagnosis function:

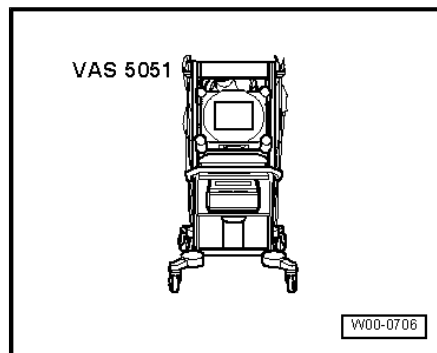
- Press on the **02 Query fault memory** on the display.
- If no faults are stored in engine command unit, the display shows “0 faults found”.
- If there are faults stored in the engine command unit, they will appear sequentially on the display.
- Press **□** key.
- Press on the **05 Erase fault memory** on the display.
- Press **06 End the test** function key.



2.3 Adjusting functions and components

Special tools and workshop equipment required

- ♦ Diagnosis, Measurement and Information System -VAS 5051A/52-



- ♦ Diagnosis cable (3 m) -VAS 5051/1- or Diagnosis cable (5 m) -VAS 5051/3-

Select, in the Diagnosis, Measurement and Information System -VAS 5051A/52- the “Assisted fault finding”.

After querying all the command units:

- Press **Skip** key.
- Select **Function/component selection**.
- Select **Activation**.
- Select **engine identification codes**.



- Select 01 systems with self-diagnosis.
- Select engine control.
- Select functions.
- Select function or component.





26 – Exhaust system

1 Exhaust system components - remove and install



Note

- ◆ *Removing and installing exhaust manifold ➔ [page 101](#)*
- ◆ *After repairing the exhaust system, check that there is no voltage and the clearance with the body is sufficient. When required, loosen double clamp (or clamps) and align silencer and exhaust tube so that sufficient body clearance is maintained, and the weight is evenly distributed on the supports.*
- ◆ *Always replace self-locking nuts.*



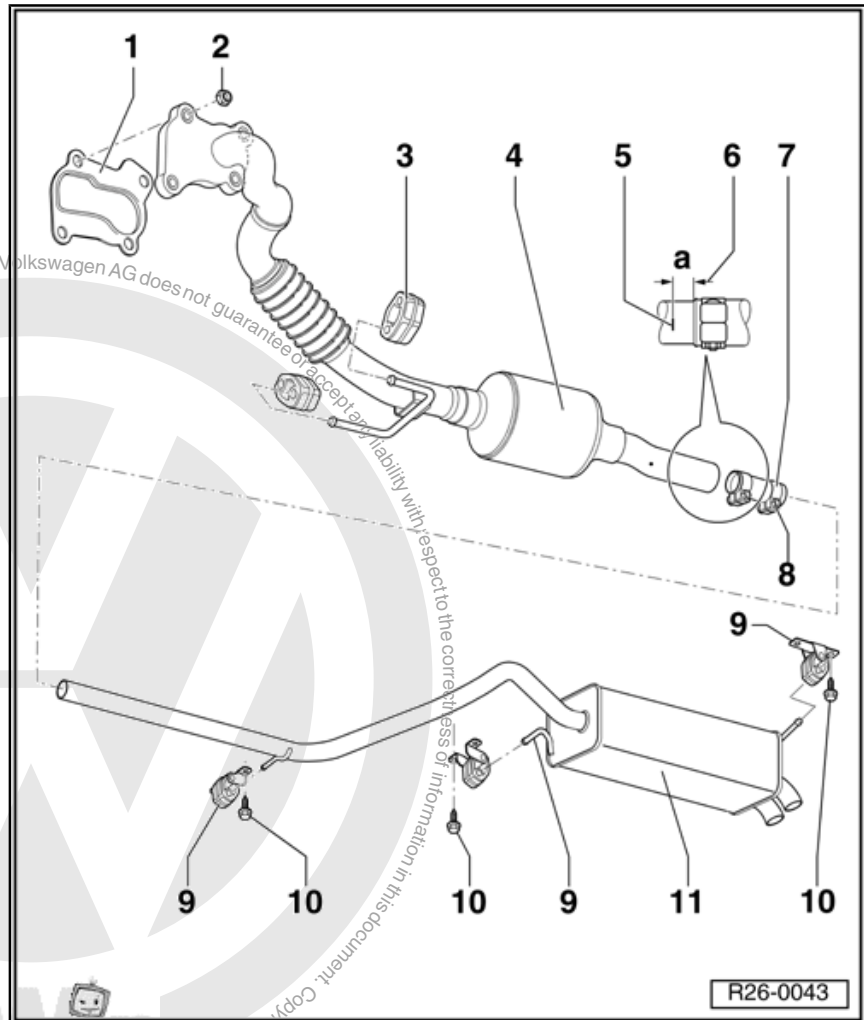
WARNING

Always replace self-locking nuts and screws subject to angular torque





- 1 - Gasket**
☐ Replace.
- 2 - Self-locking nut**
☐ 25 Nm
☐ Replace after each removal.
- 3 - Support strap**
☐ Replace if damaged.
- 4 - Front exhaust pipe with catalytic converter**
- 5 - Marking**
- 6 - Dimension -a- = 5 mm**
- 7 - Double clamp**
- 8 - Self-locking nut**
☐ 40 Nm
☐ Replace after each removal
- 9 - Support**
☐ With support strap.
☐ Replace if damaged.
- 10 - 25 Nm**
- 11 - Rear silencer**





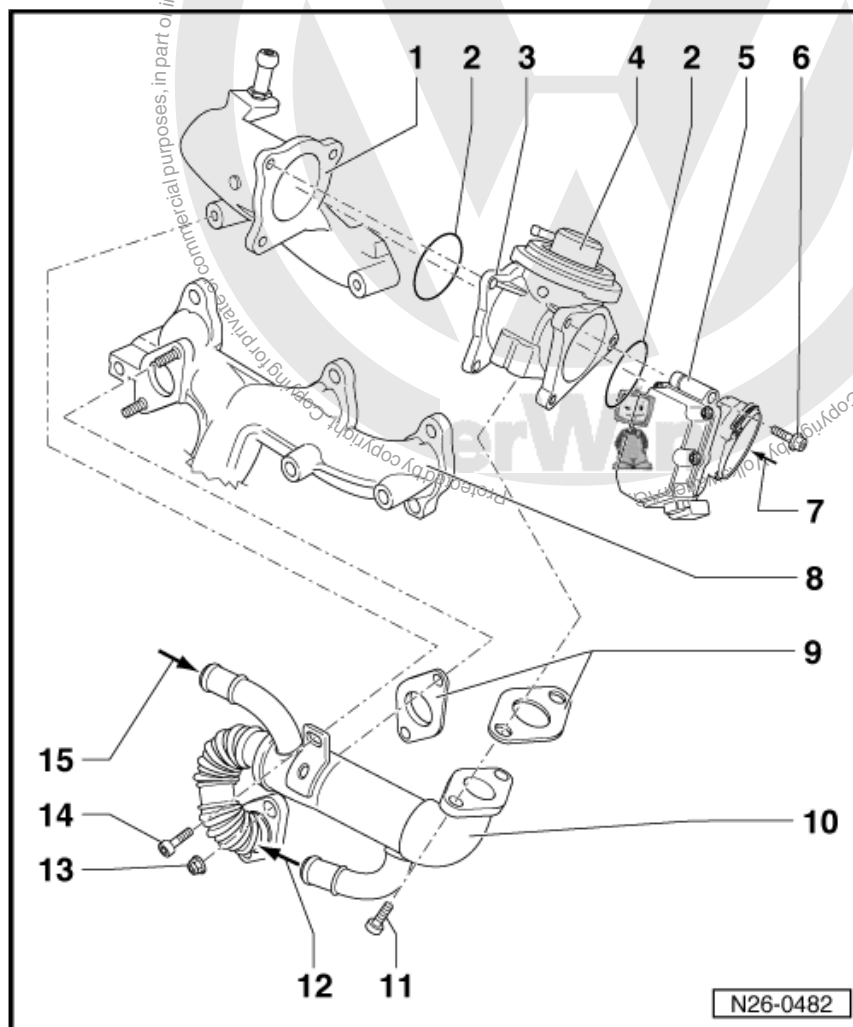
2 Exhaust gas recirculation system

Note

- ♦ The control of the exhaust gas recirculation system is carried out by the Direct injection diesel system control unit -J248- via the Exhaust gas recirculation (EGR) valve -N18-.
- ♦ The tapered plunger of the Exhaust gas recirculation valve -N18- enables the cross-section variation in function of the different plunger positions.
- ♦ The control by pulses makes feasible all the valve opening positions.
- ♦ Always replace self-locking nuts.

2.1 Exhaust gas recirculation system components - remove and install

- 1 - Intake manifold
- 2 - Sealing ring
 - ☐ Replace.
- 3 - Intake connection flange
- 4 - Exhaust gas recirculation valve -N18-
 - ☐ Integral part of intake flange
 - ☐ Can only be replaced together with the intake flange.
- 5 - Intake manifold valve motor -V157-
- 6 - 10 Nm
- 7 - From the intercooler
- 8 - Exhaust manifold
- 9 - Gasket
 - ☐ Replace.
- 10 - Radiator
 - ☐ For exhaust gas recirculation.
- 11 - 25 Nm
- 12 - For heat exchanger
- 13 - 25 Nm
- 14 - 25 Nm
- 15 - From engine head

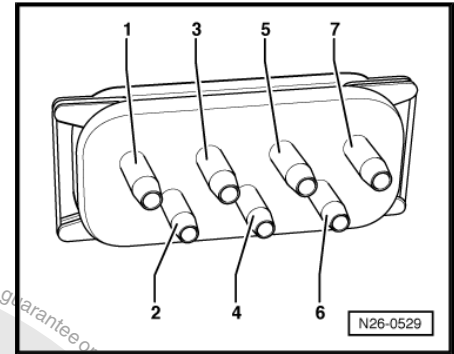




2.2 Vacuum hose connection diagram

Solenoid valve connections

- 1 - Turbocharger air filter hose.
- 2 - Turbocharger vacuum unit.
- 3 - Overcharge pressure connection in the turbocharger.
- 4 - BNM engine code - sealed.
- 5 - Air filter.
- 6 - Vacuum connection (in the non-return valve to servo brake).
- 7 - Exhaust gas recirculation valve.



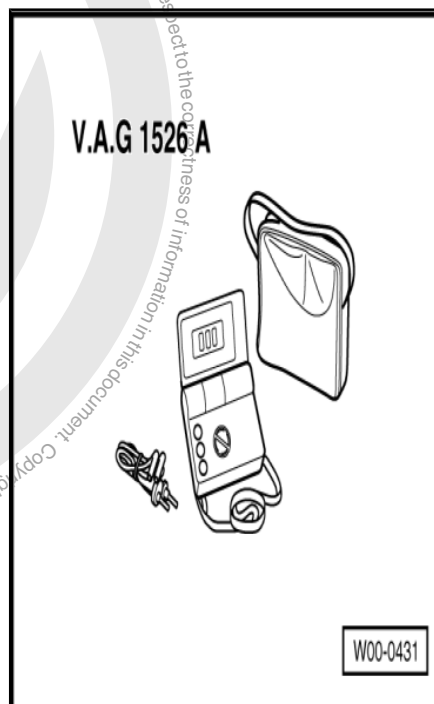


28 – Chamber pre-heating system

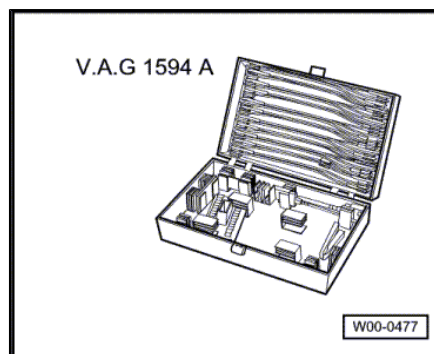
1 Chamber pre-heating system - check

Special tools and workshop equipment required

- ◆ Portable multimeter -VAG 1526C-



- ◆ Auxiliary measuring cable set -VAG 1594C-



Test conditions:

- Battery voltage at least 11.5 V
- Ignition switched off.
- Direct injection diesel system command unit -J248- OK.
- Fuse 4 (30) in the fuse-holder -S176- , Fuse 5 (30) in the fuse-holder -S177- and Fuse 6 (30) the fuse-holder -S178- of the battery OK.

Test sequence

- Remove the connector of the coolant temperature sensor.



Note

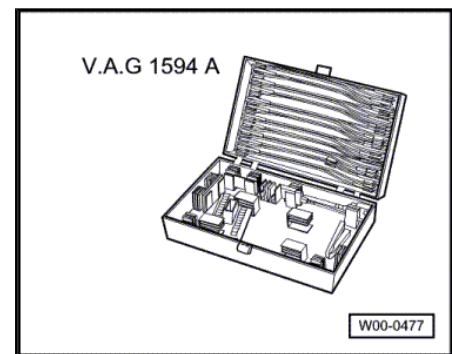
When removing the sensor, the "cold" engine condition is simulated, and when switching the ignition on, the combustion chamber pre-heating period will occur.

- Remove heating plug connectors.
- Connect the multimeter to measure voltage between the heating plug connector and vehicle earth.
- Start the ignition during approx. 20 seconds. The battery voltage shall appear on the panel.
- If no voltage is indicated ⇒ Vehicle diagnosis, testing and information system VAS 5051.

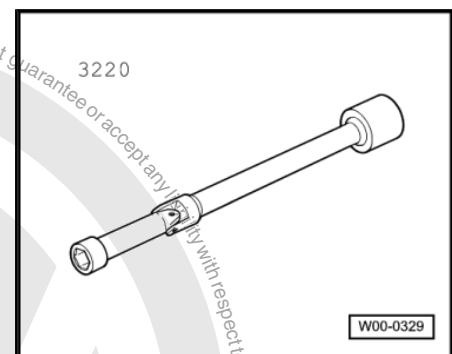
1.1 Checking heating plugs

Special tools and workshop equipment required

- ◆ Auxiliary measuring cable set -VAG 1594C-



- ◆ Spanner -3320-



- ◆ Test probe VAG 1527B-

Test conditions

- Battery voltage at least 11.5 V
- Ignition switched off.

Test sequence

- Remove heating plug connectors.



- Connect the Test probe -VAG 1527B- wire, using the Measurement auxiliary cable set -VAG 1594C- , to the battery positive (+) terminal.
- Position the Test probe -VAG 1527B- on each heating plug, one-by-one. Diode lights up: heating plug OK. If diode does not light up: replace heating plug.
- Remove and install heating plugs with Spanner -3320- . Tightening torque: 15 Nm.

02.09

