Workshop Manual
Fox 2004 ➤

4 - Cyl. injection engine									
Engine ID	BKR								

Edition 05.2010

Service

List of Workshop Manual Repair GroupsList of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Repair Group

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.

BRA5R007620

Contents

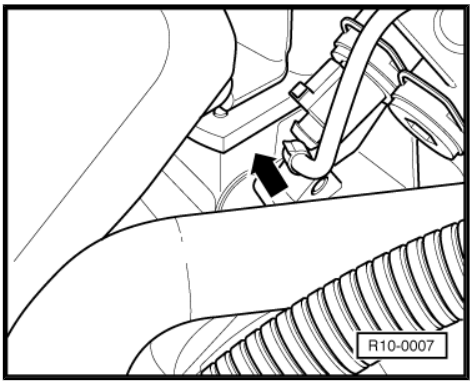
00 – Technical data

1 Technical data

1.1 Engine number

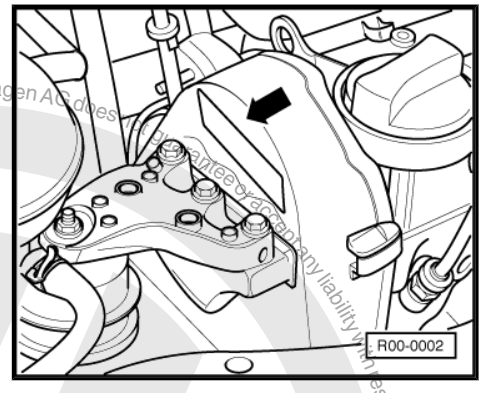
Engine number (“identification letters” and “serial number”) is engraved on the engine block, below the thermostat valve body.

The engine number is comprised of nine digits (alphanumerical) at most. The first part (max. of three identification letters) represents “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 identification letters		BKR
Production		.12.04 ▸
Cylinder volume	cm^3	1390
Power output	kW / rpm	55,0/5000
Torque	Nm / rpm	124,0/2750
Diameter	∅Ø mm	76,5
Stroke	mm	75,6
Compression rate		10,5:1
Octane rating	at least	[1]95 lead-free
Injection, ignition		MARELLI 4EV
Knock control		1 knock sensor
Self-diagnosis		yes
Lambda adjustment		2 probes
Catalytic converter		yes

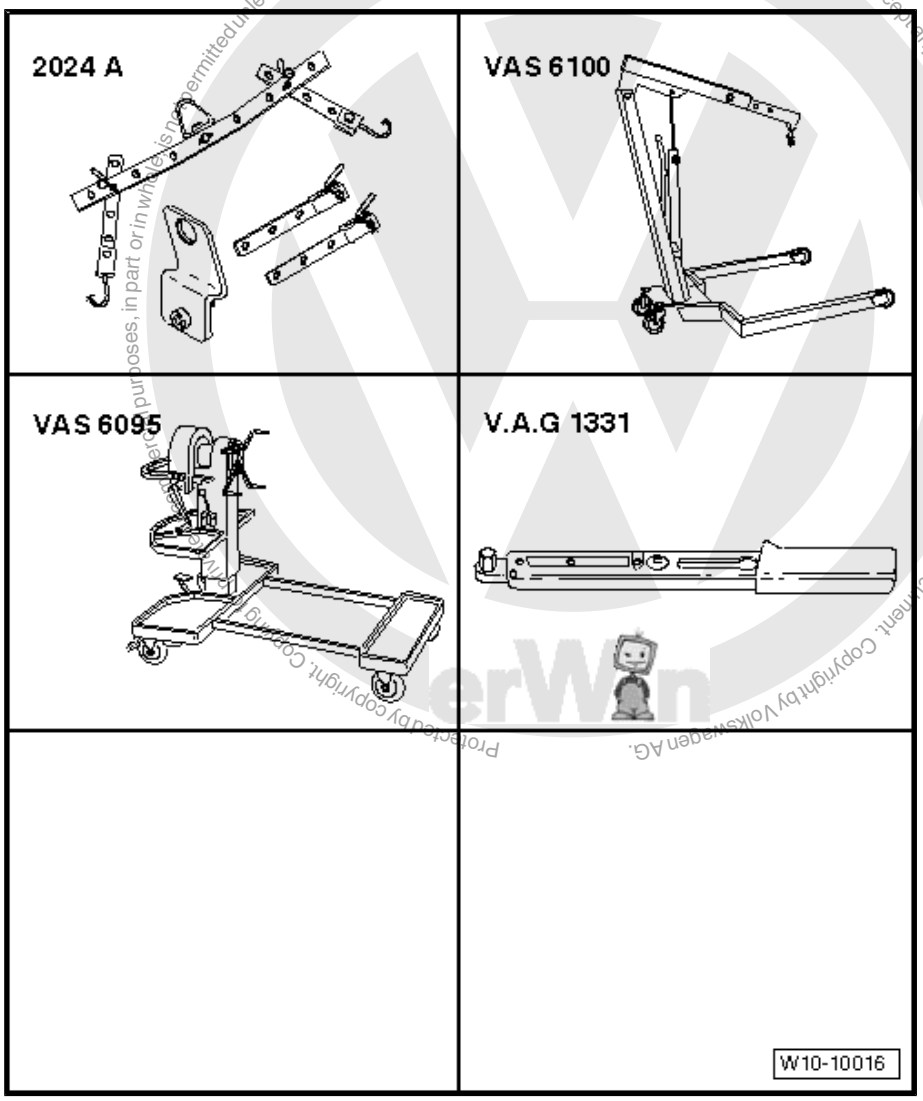
1) in exceptional cases, octane rating of at least 91, but with reduced power output.

10 – Cylinders, engine block, support, protector

1 Engine - remove and install

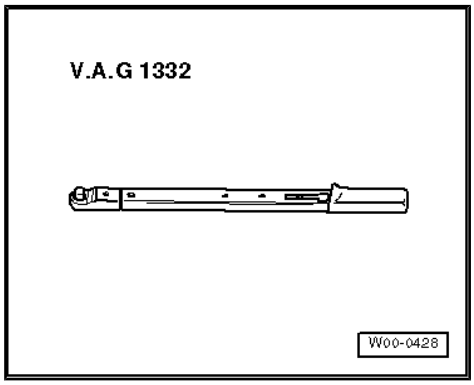
Special tools and workshop equipment required

- Hanger or 2024A -VW 055-
- Hydraulic moving hoist - 500Kg or VAS 6100 -EQ 7025-
- Rotary stand for engine and transmission -VAS 6095-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-

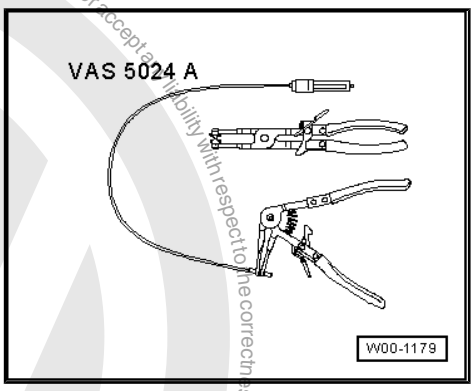


No illustration:

Lifting eyes -030 103 390 F- (on pulley side), -030 103 390 G- (on inertial flywheel side).



- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- VAS 5024A or Standart type clamp pliers -VW 5162-
- Lubricating grease -G 000 100- (vehicles with mechanical transmission)
- Cable tie



1.1 Removal - indications

Note

Check whether vehicle has code radio, if so check the anti-theft code before disconnecting the battery earth strap.

– The engine is removed from the front together with the transmission.

– With ignition switched off, disconnect battery earth strap.

– All cable ties that open or break during engine removal should be replaced and installed at the same location when engine is installed.

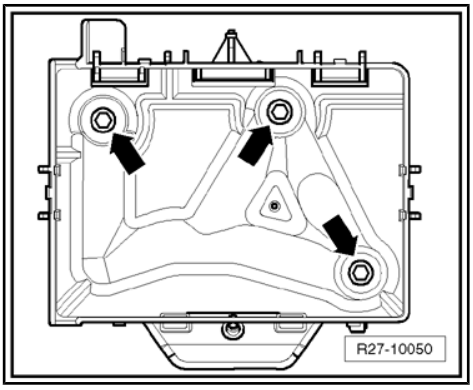
– Remove air filter cover ⇒ page 116 .

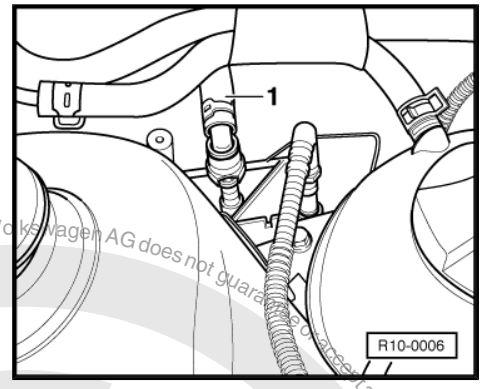
– Remove battery and battery bracket -arrows- ⇒ Electric equipment; Rep. Gr. 27 ; Starter, generator, battery .

– Open and close the coolant reservoir lid to depressurize the cooling system.

WARNING

Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure by removing hose carefully.

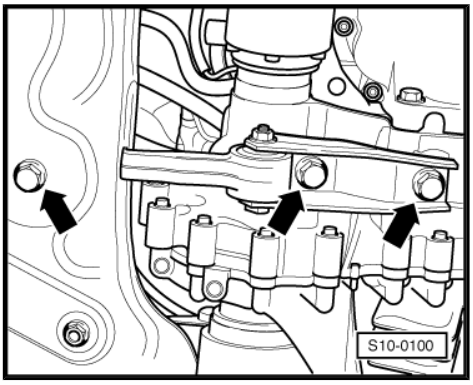




– Loosen the fuel supply pipes -1- (press the unlock key).
– Loosen the hose of the Magnetic valve for activated charcoal filter -N80- on the intake manifold.
– Close the pipes so as to avoid any dirt from coming into the fuel supply system.
– Follow cleaning rules ⇒ page 92 .
– Disconnect or loosen the following components:

♦ Intake manifold vacuum hose to the servo break.
♦ Connector for the Engine speed sensor -G28- and Intake manifold pressure sensor -G71- with Air intake temperature sensor -G42- .
♦ Connector for the Ignition transformer -N152- , Sensor Hall -G40- and Accelerator butterfly valve control unit -J338- .
♦ Connector for the Coolant temperature sensor -G62- and Oil pressure switch -F1- .
♦ Injection valve connectors.
♦ Lambda probe -G39- connector.
♦ Double connector for the Knock sensor 1 -G61- .

– Remove/disconnect and loosen all transmission electric cables, Generator (Alternator) -C- and Starter -B- .
– Remove/disconnect and loosen all the other necessary engine electric cables.
– Remove vacuum and vent hoses from the engine.
– Remove lower noise insulation from engine: ⇒ Body – Repair ; Rep. Gr. 50 ; Body - Front part .
– Loosen exhaust tube from the exhaust manifold ⇒ page 132 .



– Loosen pendulum support -arrows-.
– Loosen transmission gearshift mechanism: ⇒ Automatic/mechanical transmission; Rep. Gr. 34 ; Drive, housing .
– Loosen hydraulic clutch actuator cylinder: ⇒ Automatic/mechanical transmission; Rep. Gr. 30 ; Clutch - control system .

Note

Clutch pedal must not be pressed.

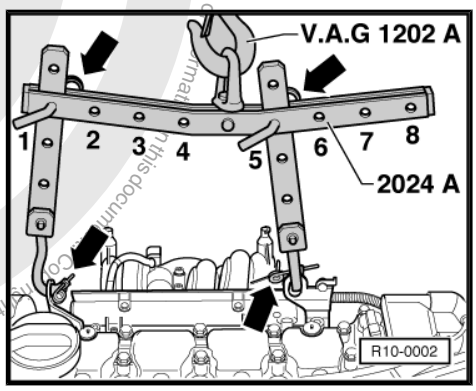
– Drain the cooling system ⇒ page 82 .
– Remove the engine cooling system hoses with the VAS 5024A or Standart type clamp pliers -VW 5162- .

Vehicles with air conditioning

– Remove Poly-V belt ⇒ page 14 .
– Loosen air conditioning compressor: ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning .
– Observe additional notes and installation work ⇒ page 9 .

Continued for all vehicles

– Remove the power steering oil pump and put it aside, together with the local hoses⇒ Chassis; Rep. Gr. 48 ; Steering .
– Loosen right and left drive shafts in the transmission and secure them on top :⇒ Chassis; Rep. Gr. 40 ; Front suspension .
– Remove front panel and its components, supporting them ⇒ General body repairs, exterior; Rep. Gr. 50 ; Body - Front part .
– Loosen cooling system pipes from the engine cylinder head.
– Install lifting eyes in place of the cylinder head coolant pipes. Tightening torque: 25 Nm.
– Attach with the Lifting tackle -2024A- as follows and lift a little with the hoist:



Belt pulley side: Drilled horizontal bar holes in -position 1-.

Engine flywheel side: Drilled horizontal bar hole in -position 5-.

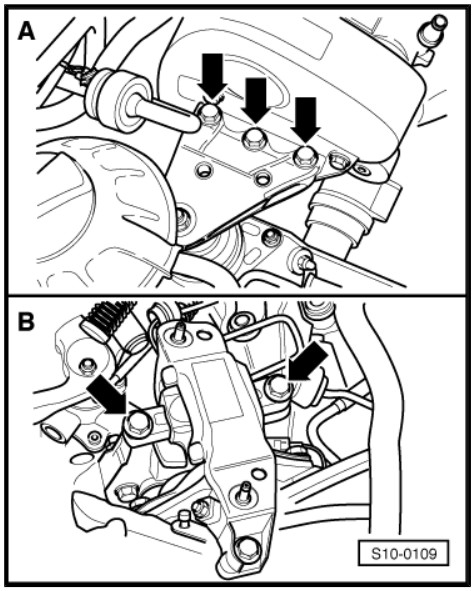
WARNING

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.*

– Loosen the assembly on transmission support -B- and on engine support -A- -arrows-.
– Lower assembly until it comes out of the transmission housing.
– Remove the assembly from the front. In this case, the assembly must be quickly turned and lowered, if necessary.



Note

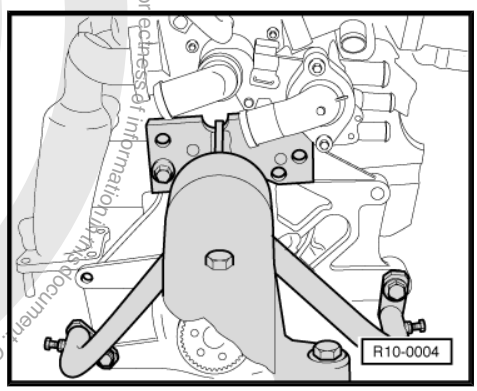
The assembly must be carefully carried when removed, so as to avoid damages to the body.

1.2 Engine - fasten on assembly stand

To perform the assembly work, the Support -VW 540- must be fastened on the Assembly stand support -VW 313- or Rotary stand for engine and transmission -VAS 6095- .

Operation sequence

– Remove transmission flange.
– Remove thrust plate.
– Remove flywheel.
– Remove intermediate plate.
– Fasten the engine with the Support -VW 540- on the Support -VW 313- or Rotary stand for engine and transmission -VAS 6095- .



1.3 Notes regarding installation

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

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.***

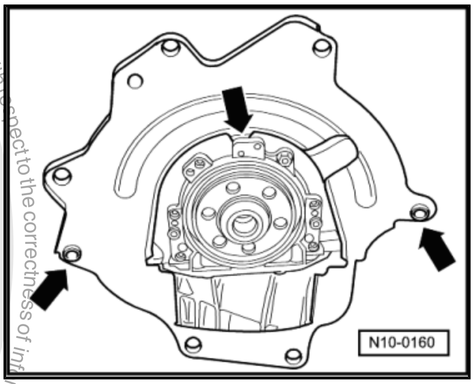
– Check clutch bearing for wear, replace if necessary.

– Lightly lubricate the clutch bearing and the primary shaft bearing guide sleeve with Lubricating grease -G 000 100- .

– If necessary, examine the clutch disc centralization.

– Check if guides for coupling engine and transmission are installed on the engine block and, if necessary, install them.

– Engage the intermediate plate on the sealing flange and move it towards the sleeves -arrows-.



– When the assembly is installed, watch for the free passage of the drive shafts.

– Align engine, moving it slightly so that the supports are seated without stress.

Note

Tightening torque for the assembly *⇒ page 8* *.*

– Install drive shaft: ⇒ Chassis; Rep. Gr. 40 ; Front suspension .

Vehicles with air conditioning

– Install air conditioning compressor.

– Install power steering pump.

– Install Poly-V belt ⇒ page 14 .

Continued for all vehicles:

– Electrical connections and their arrangement: ⇒ Electrical equipment; Rep. Gr. 97 ; Cables and wiring harnesses .

– Install hydraulic clutch actuator cylinder: ⇒ Automatic/mechanical transmission; Rep. Gr. 30 ; Clutch - control system .

– Install gearshift mechanism: ⇒ Automatic/mechanical transmission; Rep. Gr. 34 ; Drive, housing .

– Install front exhaust tube on exhaust manifold ⇒ page 132 .

– Install engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .

– Fill cooling system ⇒ page 82 .

– Loosen lifting eyes from the engine cylinder head.

– Install cooling system pipes on the engine cylinder head. Tightening torque: 25 Nm.

– Install air filter body ⇒ page 118 .

– Adjust the Engine control unit -J623- to the Accelerator butterfly valve control unit -J338- ⇒ page 129 .

– Perform test drive and check fault memory ⇒ page 129 .

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

Location	Tightening torque
Different tightening torques	
Exhaust tube on exhaust manifold	40 Nm

Note

Tightening torque for the assembly housing ⇒ page 8 .

1.5 Supports for the power-drive group

1.5.1 Tightening torque

Note

The assembly housing fastening screws are expansion screws and must be mandatorily replaced.

WARNING

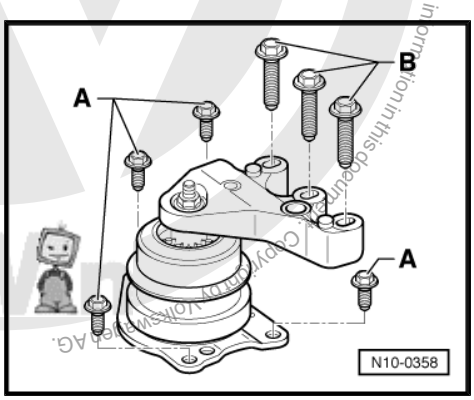
Always replace self-locking nuts and screws subject to angular torque

Power-drive group support, engine

A[2)] = 20 Nm + 90°

B[2)] = 30 Nm + 90°

2) Replace.

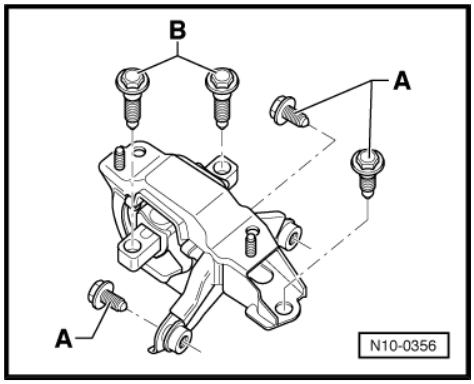


Power-drive group support, transmission

A[3)] = 50 Nm + 90°.

B[3)] = 40 Nm + 90°.

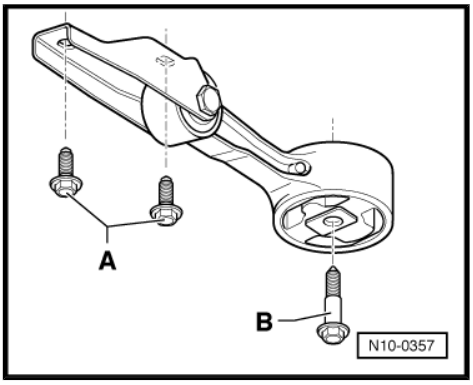
3) Replace.



Pendulum support

A[4] = 30 Nm + 90°. B[4] = 40 Nm + 90°.

4) Replace.



1.6 Additional notes and installation works in vehicles with air conditioning

WARNING

Air conditioning cooling gas circuit should not be opened.

Note

To prevent damages to condenser and cooling gas hoses, do not fold, twist or overstretch the hoses.

To remove and install the engine without opening the cooling gas circuit:

- Remove cooling gas hose clamp(s).
- Remove Poly-V belt ⇒ page 14 .
- Remove front panel and its components ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .
- Move the panel with the radiator and condenser to the side in such a way that the cooling gas hoses are not stretched.
- Remove air conditioning compressor and anchor it to the body. ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning .

13 – Crankshaft, pistons

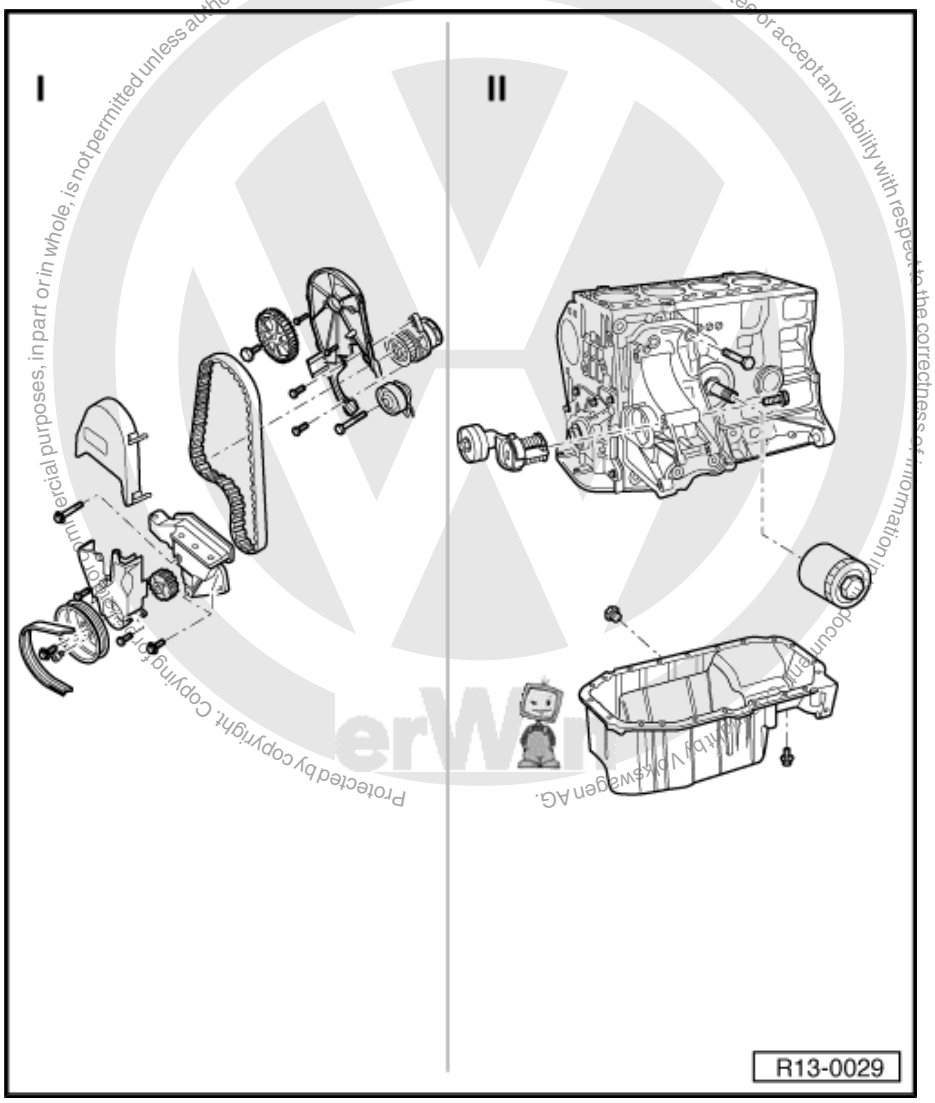
1 Engine - disassemble and assemble

Note

For the assembly, fasten the engine to the assembly stand by using the Support -VW 540- .

WARNING

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



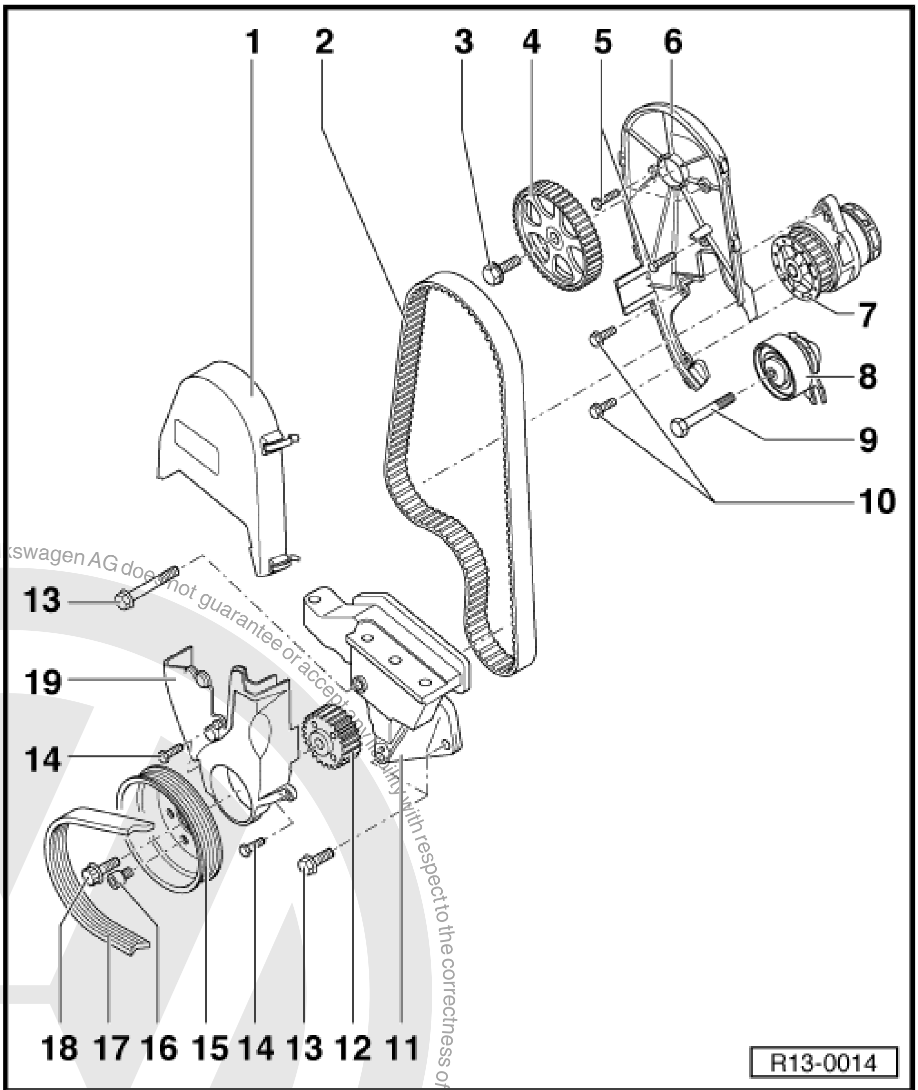
Note

- *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.*
- *All contact and bearing surfaces must be lubricated with oil before assembly.*

I ⇒ page 11

II ⇒ page 12

Part I



1 - Upper part of mechanical distribution cover

2 - Timing belt

- ❑ Mark rotation direction before removal.
- ❑ Check wear.
- ❑ Do not bend.
- ❑ Remove, install, and adjust ⇒ page 41 .

3 - Tighten to 20 Nm + 90°

- ❑ Replace after each removal.
- ❑ To loosen and tighten, immobilise the camshaft gear with the Special wrench -3036- .

4 - Camshaft gear

- ❑ Observe fastening during installation.
- ❑ Check installation position of timing belt ⇒ page 41 .

5 - 10 Nm

- ❑ Apply with -D/00600/ A2/- .

6 - Mechanical distribution rear cover

7 - Water pump

- ❑ With integrated sealing gasket.
- ❑ The sealing gasket must not be separated from the water pump.
- ❑ In case of damages and leaks, replace the entire pump together with the sealing.
- ❑ Check if it rotates smoothly.
- ❑ Remove and Install ⇒ page 87 .

8 - Timing belt tensioning pulley

- ❑ Check ⇒ page 38 .
- ❑ Timing belt: Remove, install, and adjust ⇒ page 41 .

9 - 20 Nm

10 - 20 Nm

11 - Engine bracket

12 - Crankshaft gear

- ❑ Check installation position of timing belt ⇒ page 41 .

13 - 50 Nm

14 - 10 Nm

15 - Crankshaft pulley

16 - 20 Nm

17 - Poly-V belt

- ❑ Mark rotation direction before removal.
- ❑ Remove and install Poly-V belt ⇒ page 14 .
- ❑ Poly-V belt travel ⇒ page 16

18 - 90 Nm + 90°

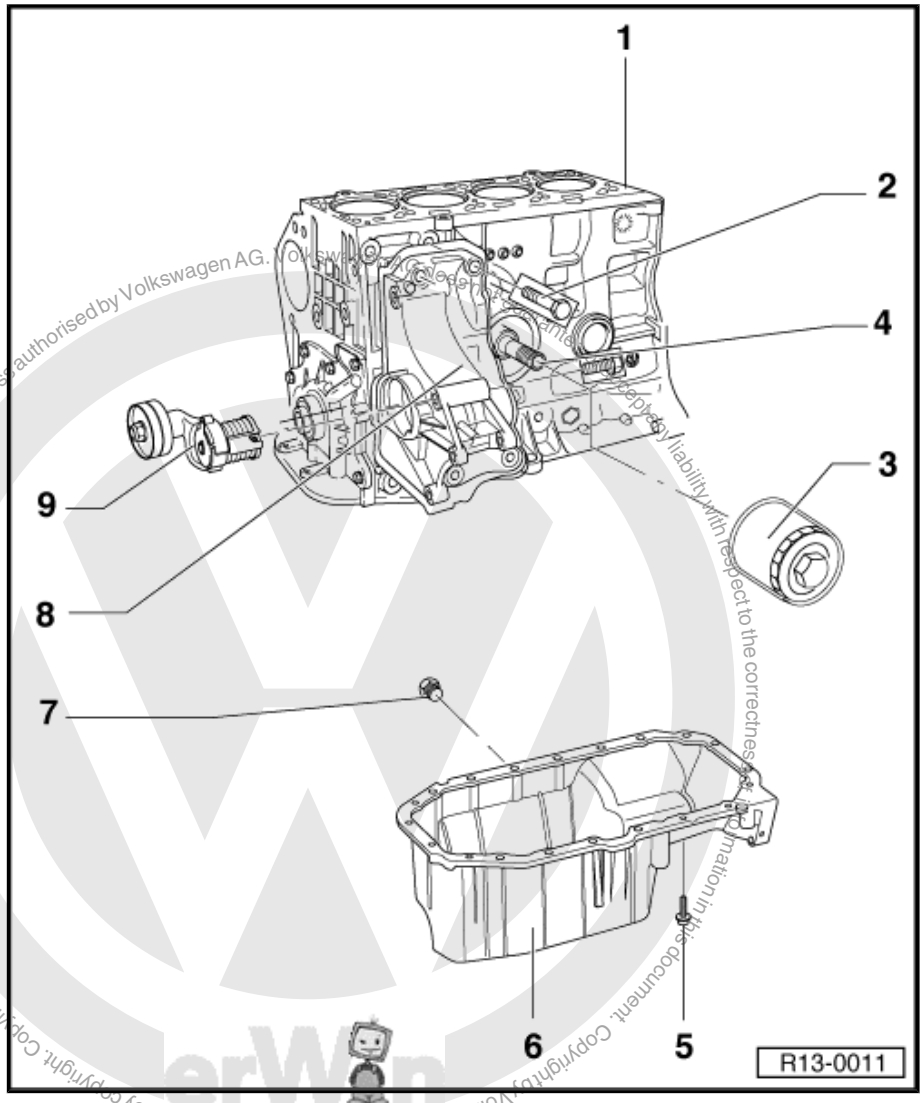
- ❑ Replace after each removal.
- ❑ To loosen and tighten, use Spanner -3415- .
- ❑ Tightening continuation can be carried out in various steps.
- ❑ Tightening continuation angle can be measured with the common angle disk meter, for example, Hazet 6690.

19 - Mechanical distribution lower cover

Part II

Note

Clutch repairs: ⇒ Automatic/mechanical transmission; Rep. Gr. 30 ; Clutch - control system .



1 - Engine block

- ❑ Removing and installing crankshaft ⇒ page 29
- ❑ Remove and install pistons and connecting rods ⇒ page 32 .

2 - 50 Nm

- ❑ Tightening sequence: first tighten the upper right screw, then the lower right screw, and finally the left screw (seen from the front, towards the vehicle movement).

3 - Oil filter

- ❑ Loosen it on the hex body or with the special oil filter assembly tool Sacador de filtro de óleo (14 faces) -VW 5005P- .
- ❑ Tighten manually.
- ❑ Observe instructions for installing the oil filter.

4 - M 8 20 Nm + 90°, M 10: 45 Nm

- ❑ Replace after each removal.

5 - 10 Nm + 90°

- ❑ Replace after each removal.
- ❑ Loosen fastening screws from the engine block oil crankcase located next to the pulley (4 units) on the inner side of the oil crankcase.

6 - Oil crankcase

- ❑ Clean sealing surface before installation.
- ❑ Install with Silicone sealant -D 176 404 A2- .
- ❑ Remove and install ⇒ page 69 .

7 - Oil drainage plug, 30 Nm

- ❑ With integrated sealing ring.
- ❑ Replace.

8 - Compact bracket

- ❑ To the Generator (Alternator) -C- , air conditioning compressor and Poly-V belt fastening element.
- ❑ Remove and install compact support in vehicles with air conditioning: ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning .

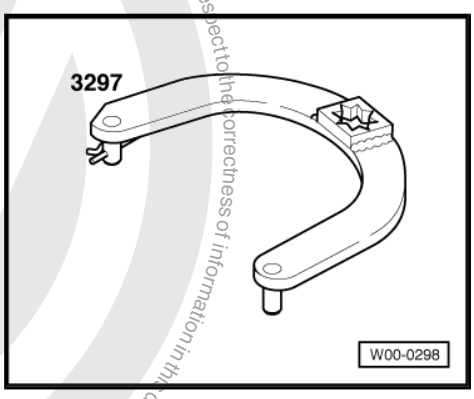
9 - Tensioning pulley

- ❑ For Poly-V belts.
- ❑ Vehicles with air conditioning only.
- ❑ To loosen the Poly-V belt, turn with 16-mm spanner.
- ❑ Remove and install Poly-V belt ⇒ page 14 .

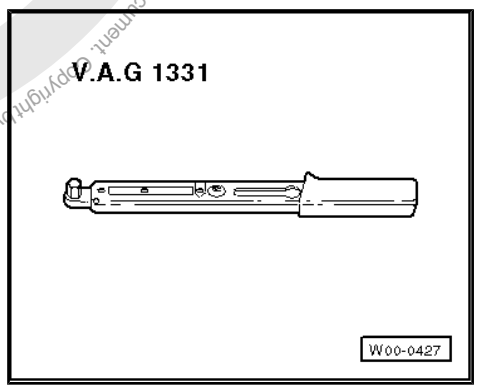
1.1 Poly-V belt - remove and install

Special tools and workshop equipment required

- 16-mm spanner
- Lever -3297-



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



1.1.1 Removal

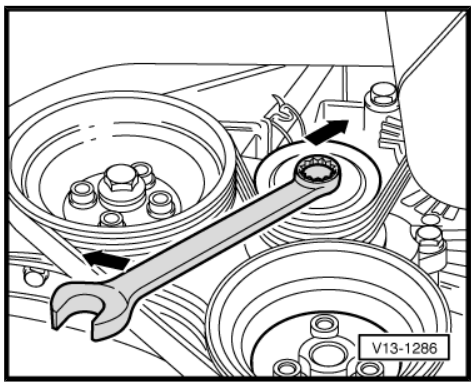
Vehicles with air conditioning

– Remove engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .

– Mark Poly-V belt operation direction.

– To loosen Poly-V belt, turn the belt tensioning element in the arrow direction, with the 16-mm spanner .

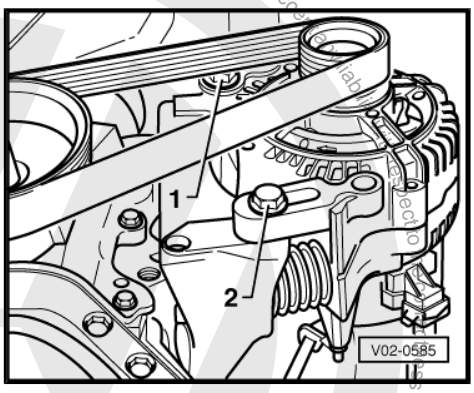
– Remove Poly-V belt.



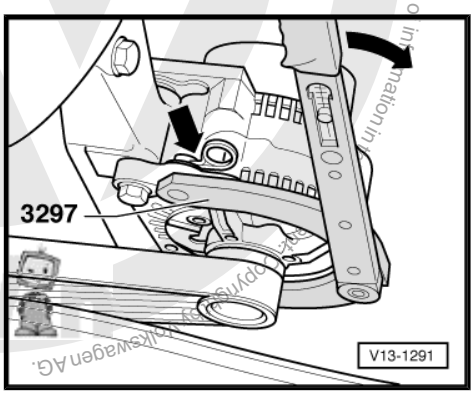
Vehicles without power steering and air conditioning

– Mark Poly-V belt operation direction.

– Loosen fastening screws -1- and -2- from , at least one turn.



– Position the Lever -3297- , lock with fitting pin and turn the Generator (Alternator) -C- downwards (with the Lever -3297- operation, use for example the torque wrench).
– Remove Poly-V belt.



1.1.2 Installing

Note

- *Before installing the Poly-V belt, make sure all assemblies (Generator (Alternator) -C- , air conditioning compressor) are properly installed.*
- *While installing the Poly-V belt, observe the proper operation and seating direction of the belt on the pulley.*

Vehicles with air conditioning

– First, place the Poly-V belt on crankshaft pulley. Then, place the belt on the tensioning element.

Install in reverse order to removal sequence.

When the job is finished, always:

– Start the engine and check belt movement.

Vehicles without power steering and air conditioning

– Press the Generator (Alternator) -C- up to the tensioning spring stop with the Lever -3297- at least three times, to ensure optimized rotation.
– Then press the Generator (Alternator) -C- with the Lever -3297- against the belt tensioning element until the Poly-V belt can be installed on the pulley.
– After placing the Poly-V belt, turn the engine several times with the Generator (Alternator) -C- loosen.(approx. 11 engine rotations). For that, slightly start the Engine -B- .

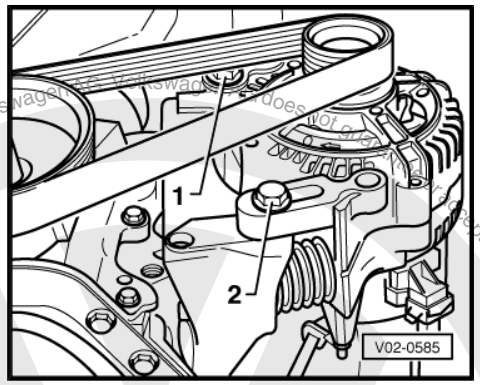
Note

When tightening the Generator (Alternator) -C- screws, observe the tightening sequence and do not touch the Poly-V belt.

– First tighten fastening screw -2- with 25 Nm, and then fastening screw -1- with 25 Nm.

When the job is finished, always:

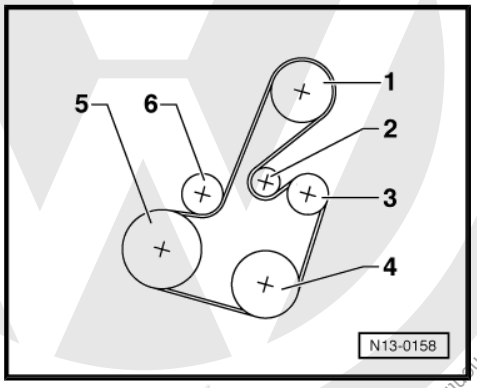
– Start the engine and check belt movement.



1.1.3 Poly-V belt travel

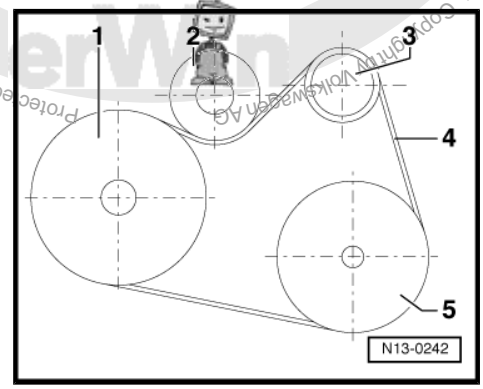
Belt travel with air conditioning and power steering

1 - Power steering pump pulley
2 - Return pulley
3 - Generator (Alternator) -C- pulley
4 - Air conditioning compressor pulley
5 - Crankshaft pulley
6 - Tensioning pulley



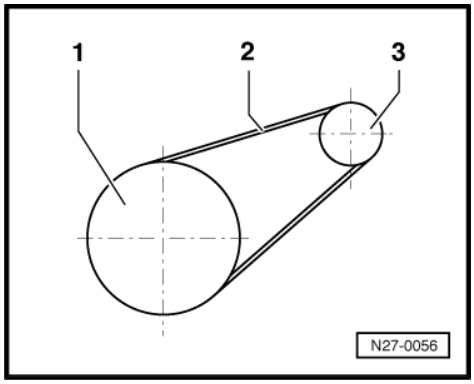
Belt travel without air conditioning and with power steering

1 - Crankshaft pulley
2 - Tensioning pulley
3 - Generator (Alternator) -C- pulley
4 - Poly-V belt
5 - Power steering pump pulley



Belt travel without air conditioning and without power steering

1 - Crankshaft pulley
2 - Poly-V belt
3 - Generator (Alternator) -C- pulley



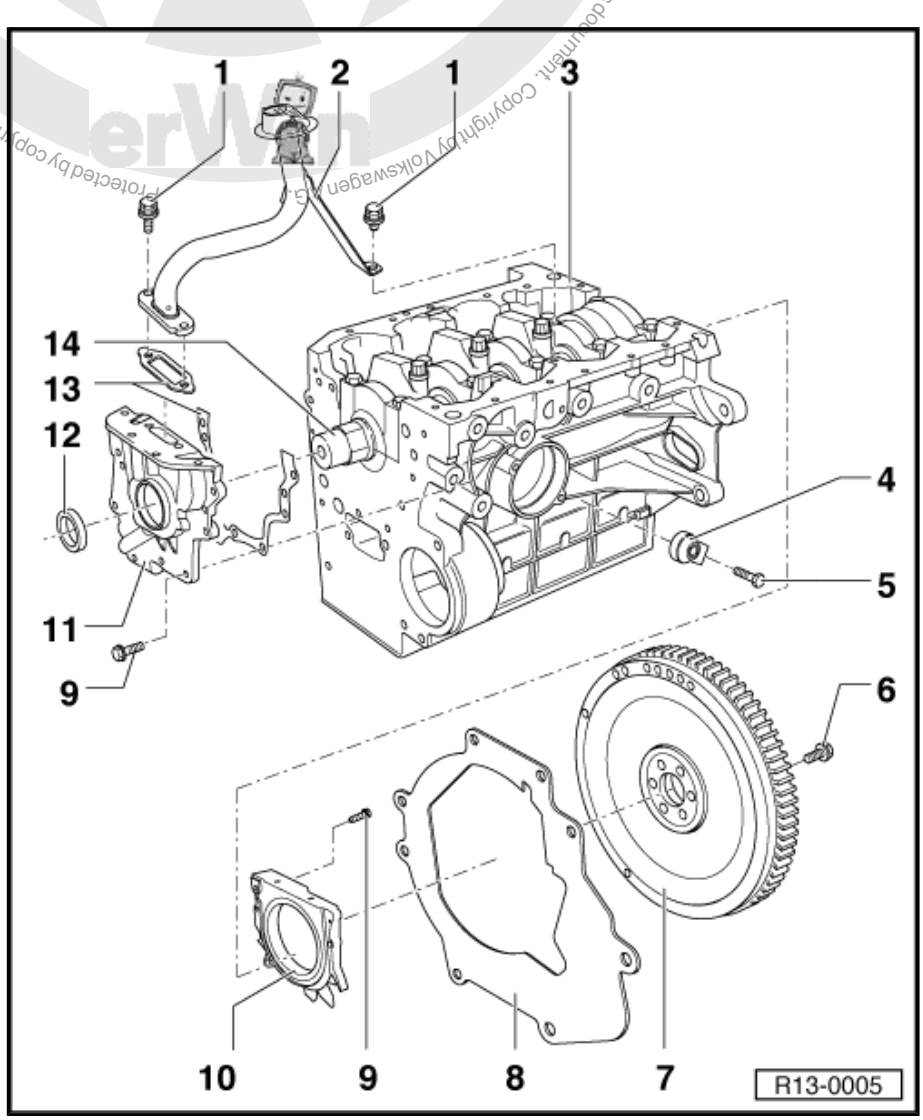
2 Crankshaft flanges - remove and install

Note

Clutch repairs: ⇒ Automatic/mechanical transmission; Rep. Gr. 30 ; Clutch - control system .

WARNING

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



1 - 10 Nm

2 - Aspiration duct

3 - Engine block

- ❑ Removing and installing crankshaft ⇒ page 29
- ❑ Disassemble and assemble pistons and connecting rods ⇒ page 32

4 - Knock sensor 1 -G61-

5 - 20 Nm

- ❑ Tightening torque influences Knock Sensor 1 - G61- operation.

6 - 60 Nm + 90°

- ❑ Replace after each removal.

7 - Engine flywheel

- ❑ For removing and installing the flywheel, immobilise it with the Lock -3067- .

8 - Intermediate plate

- ❑ It must be seated on the coupling guides.
- ❑ Do not damage / bend during assembly

9 - 10 Nm

10 - Crankshaft flange (flywheel side) with the rotor and seal of the Engine speed sensor -G28- .

- ❑ Fully replace with the rotor and seal of the Engine speed sensor -G28- .
- ❑ Use the support sleeve supplied for installation.
- ❑ To remove and install, the oil crankcase must be removed.
- ❑ Do not lubricate nor apply oil to the seal lip.
- ❑ Before installation, remove oil residues from crankshaft trunnion with a clean cloth.

- ❑ The support sleeve will only be able to be removed after moving the flange over the crankshaft trunnion.
- ❑ Remove and install the flange ⇒ page 21 .

11 - Crankshaft flange (pulley side)/ oil pump

- ❑ Substitute only the complete set.
- ❑ It must be seated on the guides.
- ❑ To remove and install, the oil crankcase must be removed.
- ❑ Pay careful attention to the crankshaft trunnion position during installation, ⇒ Item 14 (page 18) .
- ❑ Removing and installing oil pump ⇒ page 71 .

12 - Crankshaft seal (pulley side)

- ❑ Replace ⇒ page 18 .

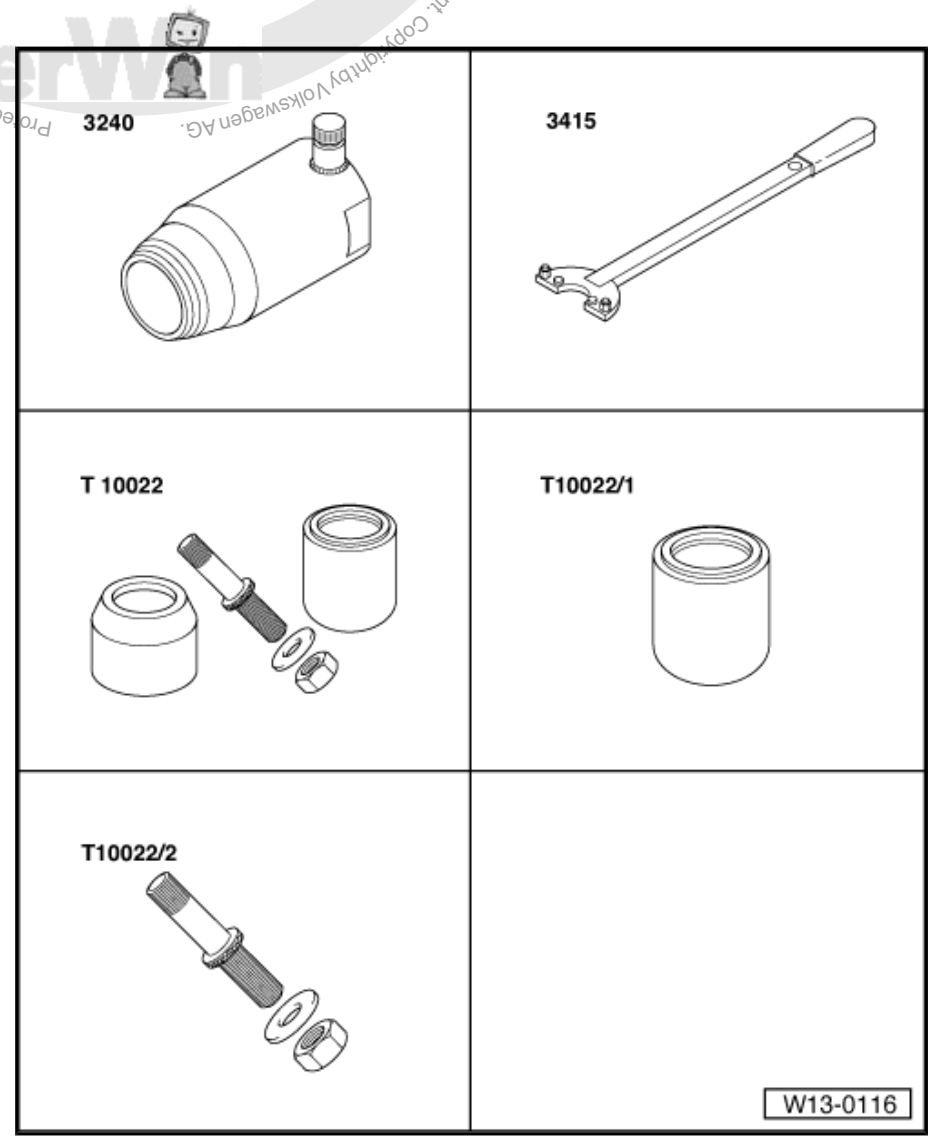
13 - Sealing gasket

- ❑ Replace.

14 - Crankshaft trunnion

- ❑ Apply oil before installing the oil pump.

2.1 Crankshaft seal (pulley side) - replace



Special tools and workshop equipment required

- Puller -3240-
- Spanner -3415-
- Assembly sleeve -T10022-
- Sleeve -T10022/1-
- Spindle -T10022/2-

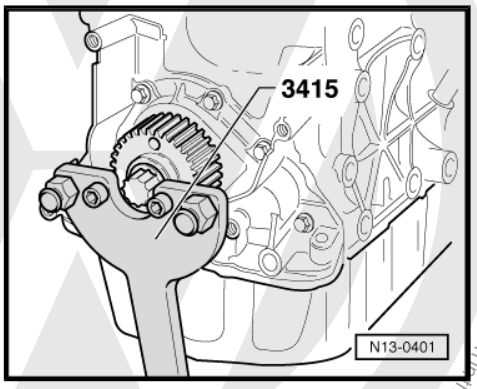
2.1.1 Removal

– First remove timing belt ⇒ page 41 .

– Remove crankshaft gear. To do this, immobilise gear with the Spanner -3415- .

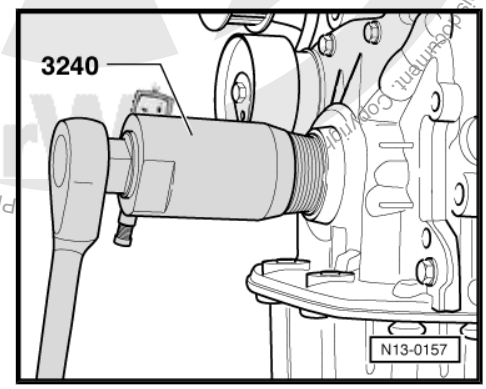
– To guide the seal Puller -3240- , install the gear fastening screw up to the crankshaft stop.

– Give the inside part of the Puller -3240- two turns (approx. 3 mm) from the external side, and lock with the splined bolt.



– Lubricate the threaded head of the Puller -3240- , seat it and screw it applying as much force to the seal as possible.

– Loosen the splined bolt and turn the inner part against the crankshaft until the seal is extracted.

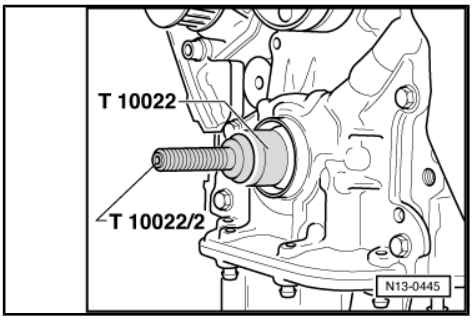


2.1.2 Installing

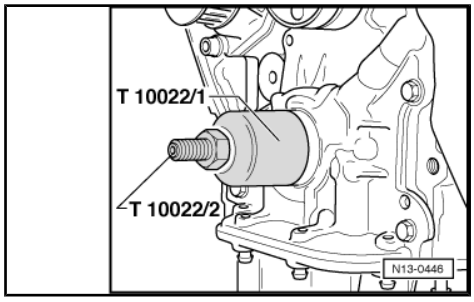
– Quickly lubricate with oil the seal lip.

– Apply the Assembly sleeve -T10022- on the crankshaft trunnion and screw with the threaded part up to the stop.

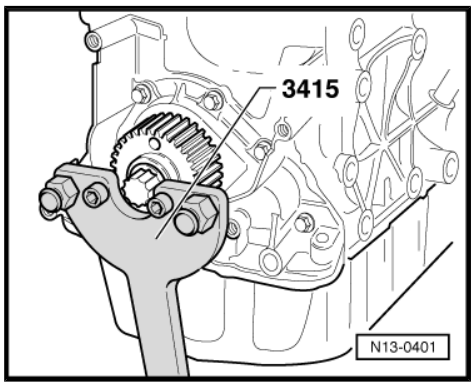
– Move the seal through the guide sleeve.



– Press the seal with the Sleeve -T10022/1- up to the stop.

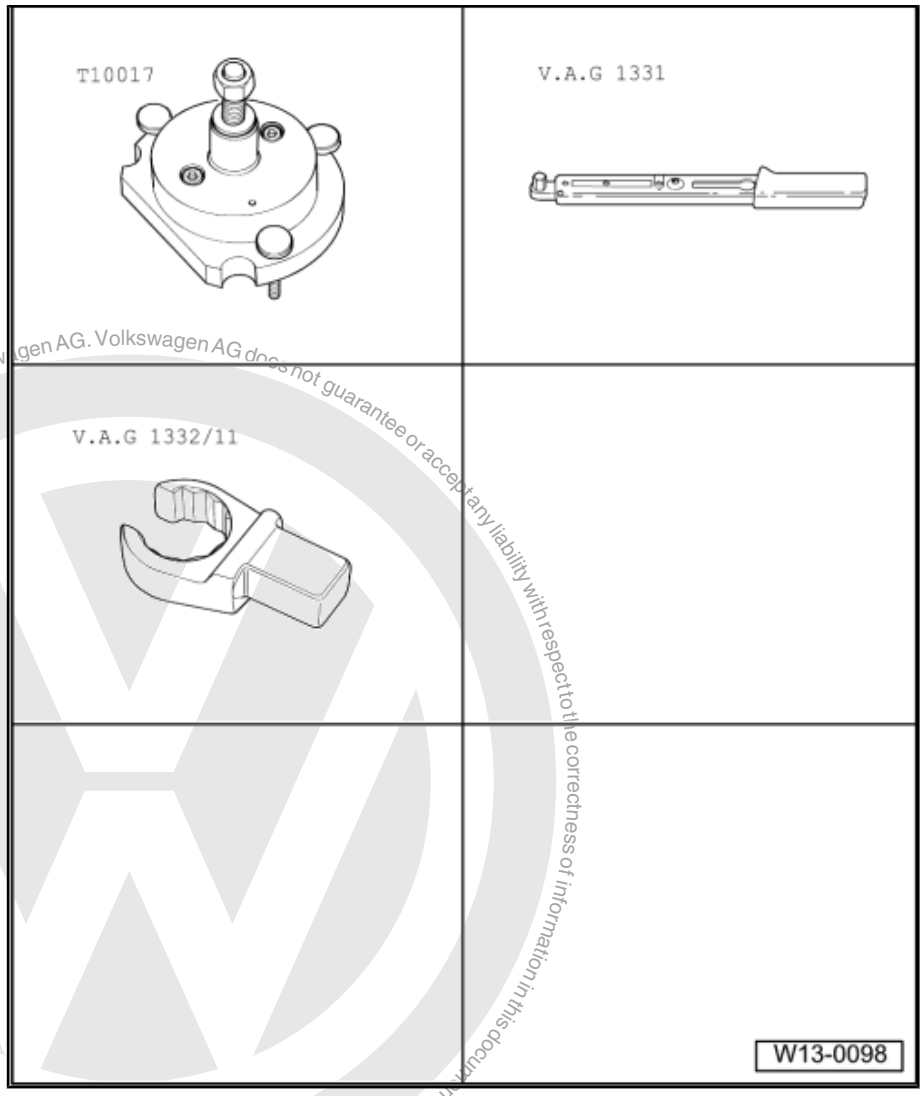


– Install the crankshaft gear and immobilise with the Spanner -3415- .
– Tighten the new screw with 90 Nm and turn it 90° further (tightening continuation can be carried out in a number of steps).



Installing the timing belt and regulating command times
⇒ page 41 .

2.2 Crankshaft flange (flywheel side) - replace



Special tools and workshop equipment required

- Fitter -T10017- or Fitter -T10017K- or Fitter -T 10134- .
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Open socket SW 24 -VAG 1332/11-
- Three hexagonal head screws M 6 × 35 mm
- Feeler gauge
- Gauge shifter

Note

For SABÓ flange, use the Fitter -T10017K- or Fitter -T 10134- ,and for Freudenberg flange, use the Fitter -T10017- the method is the same for both tools. The reference for installing the flange with a rotor on the tool is: SABÓ upper part and Freudenberg lower part.

2.2.1 Remove crankshaft flange (flywheel side) with the rotor of the Engine speed sensor -G28- .

Note

- *In order to better show the work sequence, these are carried out with the engine removed.*
- *The work sequence with both engine and transmission removed are identical.*

Operation sequence

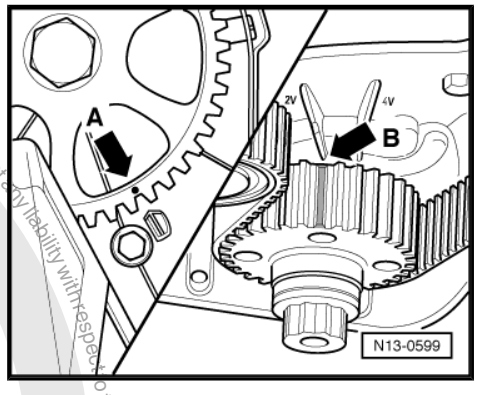
– Remove flywheel.

– Remove intermediate plate.

– Put the camshaft gear on the mark -arrow A-.

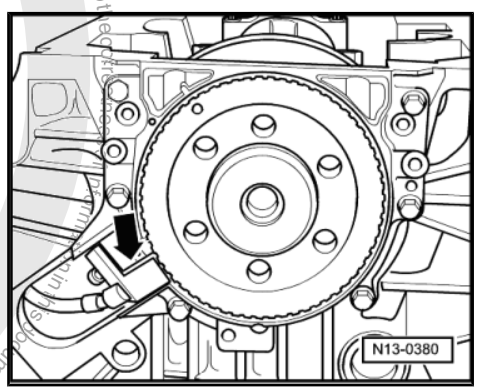
– Put the crankshaft in cylinder 1 TDC. The tooth marked on the camshaft gear must align with the mark “2V” on the flange -arrow B-.

– Remove crankcase ⇒ page 69 .



– Remove the Engine speed sensor -G28- -arrow-.

– Loosen the flange fastening screws.

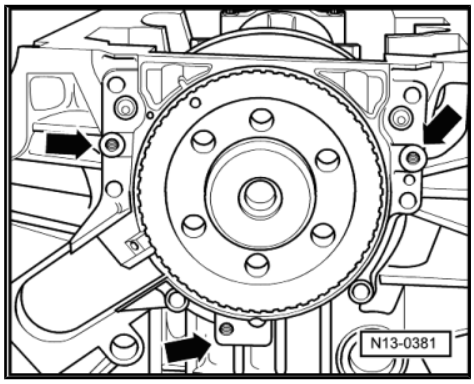


Note

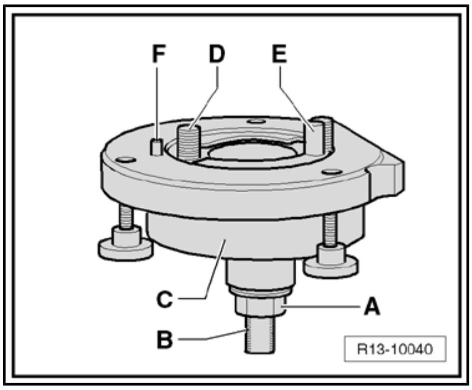
The flange and the rotor are extracted near the crankshaft with three screws M 6 × 35 mm.

– Screw the three screws M 6 × 35 mm in the flange threaded holes -arrows-.

– Turn the screws alternately (max. one $^{1}/_{2}$ turn (180°) per screw) in the flange and remove from the crankshaft the flange with the rotor of the Engine speed sensor -G28- .



2.2.2 Install the flange with the rotor of the Engine speed sensor -G28-



Note

- *For SABÓ flange, use the Fitter -T10017K- or Fitter -T 10134- ,and for Freudenberg flange, use the Fitter -T10017- the method is the same for both tools. The reference for installing the flange with a rotor on the tool is: SABÓ upper part and Freudenberg lower part.*
- *The flange with PTFE sealing ring comes with sealing lip thrust ring. This thrust ring works as an installation sleeve and cannot be removed before installation.*
- *The flange and rotor of the Engine speed sensor -G28- can not longer be separated or turned after being removed from the spare part packaging.*
- *The rotor of the Engine speed sensor -G28- reaches its installation position after being secured to the Fitter fastening pin.*
- *The flange and seal form a unit and can only be replaced together with the rotor of the Engine speed sensor -G28- .*
- *The Fitter has its installation position relative to the crankshaft through a guide pin, which is guided through a crankshaft threaded hole.*

A - Hexagonal nut

B - Threaded spindle

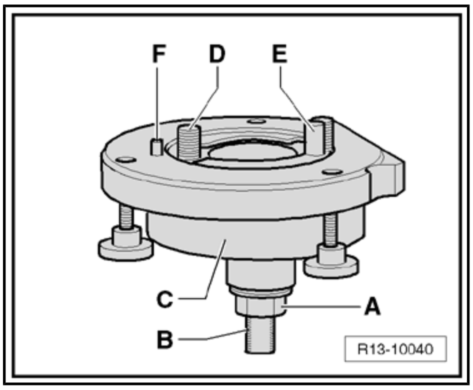
C - assembly case

D - Allen screw

E - Guide pin

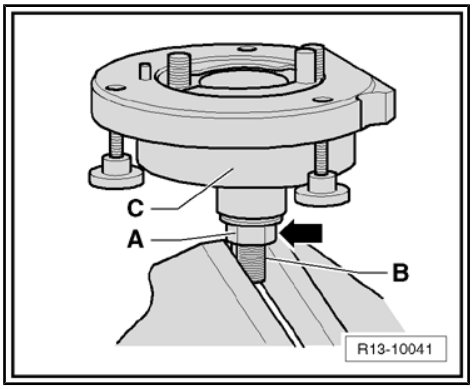
F - fastening pin

A - Install the flange with the rotor of the Engine speed sensor -G28- in the Fitter



– Screw the hexagonal nut -A- up to a little before the tightening flat surface -B- of the threaded spindle.

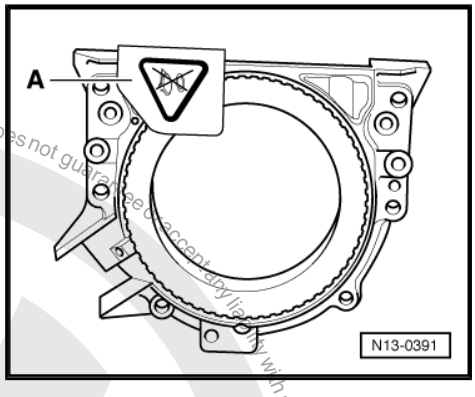
– Fasten the Fitter on the tightening surface -B- of the part threaded in a vise.
– Press the assembly case -C- downwards, so that it is lies on the hexagonal nut -A- -arrow-.



Note

The inner part of the Fitter and the assembly case must be on the same plane.

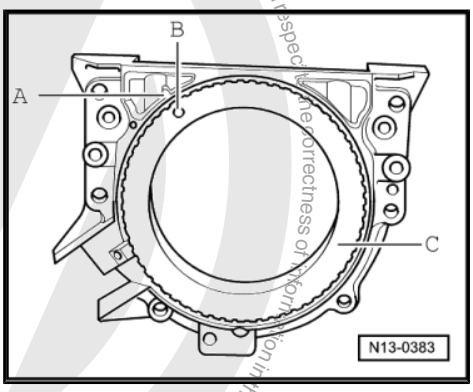
– Remove the safety clip -A- from the new flange.



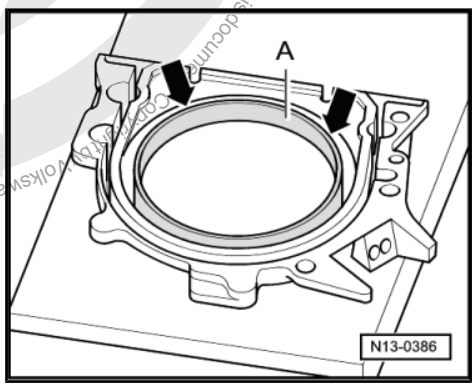
Note

The rotor of the Engine speed sensor -G28- cannot be removed from the flange nor turned.

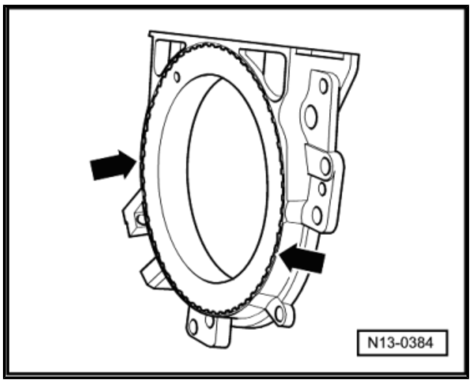
The fastening hole -B- on the Engine speed sensor -G28- -C- rotor must be aligned with the mark -A- in the flange.



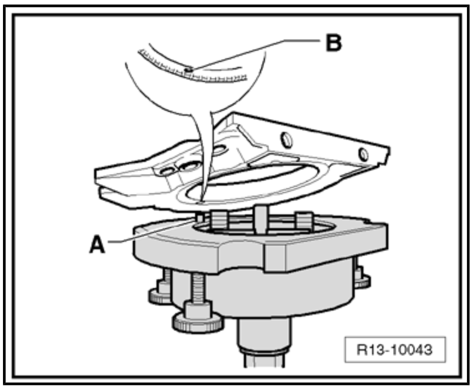
– Place the flange with the front part on a flat and clean surface.
– Press the seal lip thrust ring -A- downwards in the arrow direction until it lies on the flat surface.



The upper corner of the Engine speed sensor -G28- rotor and the upper corner of the flange must be aligned -arrows-.



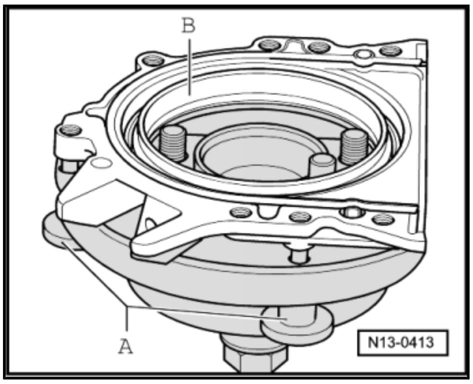
– Place the flange on the Fitter , with the front part facing it, in such a way that the fastening pin -A- is inserted into the -B- hole of the Engine speed sensor -G28- rotor.



Note

Make sure the flange is flat on the Fitter .

– Press the seal lip thrust ring -B- while tightening the three threaded screws -A- against the Fitter surface, so that the fastening pin can no longer escape from the hole at the Engine speed sensor -G28 rotor- .



Note

Make sure the Engine speed sensor -G28- rotor remains fastened to the Fitter during flange installation.

B - Install the Fitter with the flange on the crankshaft.

Conditions

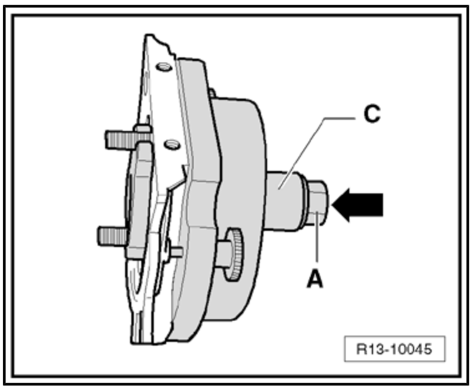
- The crankshaft trunnion must be oil and lubricant free.
- The engine is in TDC for cyl. 1.

Operation sequence

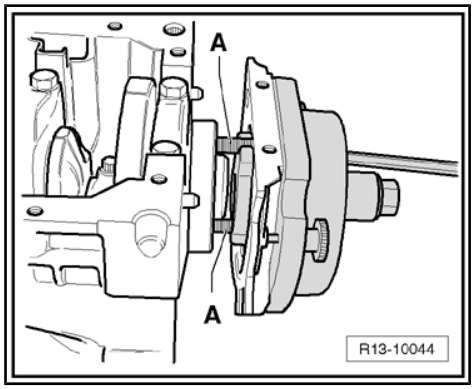
– Screw the hexagonal nut -A-up to the end of the threaded part.

– Press the threaded part of the Fitter in the direction of the arrow until the hexagonal nut -A- touches the assembly case -C-.

– Align the flat side of the assembly case with the seal surface on the side of the block oil crankcase.



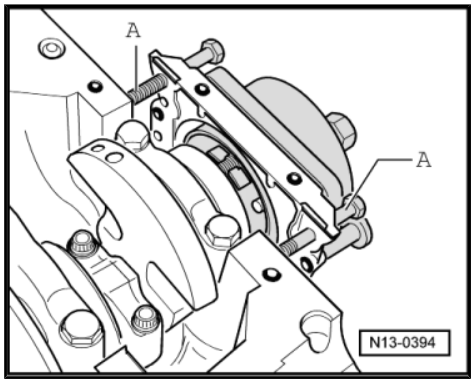
– Screw the Fitter with Allen screws -A- to the crankshaft trunnion.



Note

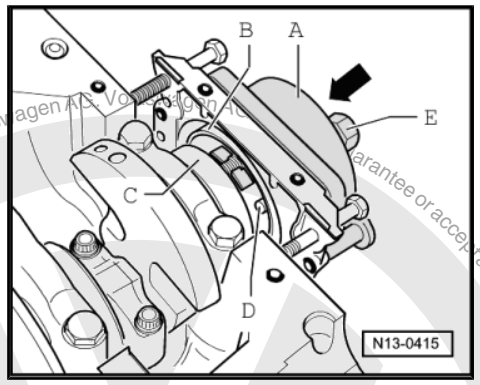
Insert the Allen screws -A- into approx. 5 threads on the crankshaft trunnion.

– Screw two screws M 6 × 35 mm -A- to guide the flange on the engine block.



C - Screw the Fitter to the crankshaft flange.

– Move the assembly housing -A- manually in the arrow direction until the seal lip thrust ring -B- touches the crankshaft flange -C-.



Note

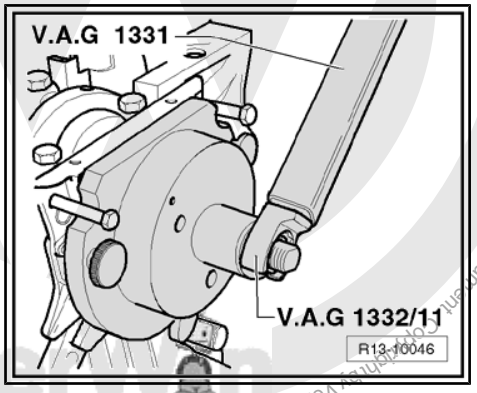
The -D- Fitter guide pin is inserted into a threaded hole on the crankshaft during assembly. This way the Engine speed sensor -G28- rotor reaches the definite assembly position.

– Keep the assembly housing in this position and manually screw both Allen screws of the assembly device.

– Screw the hexagonal nut -E- manually to the threaded part until it lies on the assembly housing -A-.

D - Install the Engine speed sensor -G28- rotor with the Fitter on the crankshaft flange.

– Tighten the Fitter hexagonal nut with the Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331- and Open socket SW 24 -VAG 1332/11- . Tightening torque: 35 Nm.

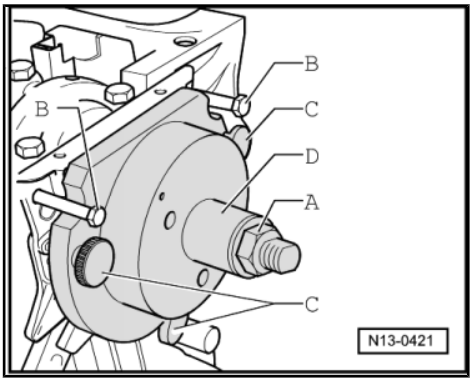


Note

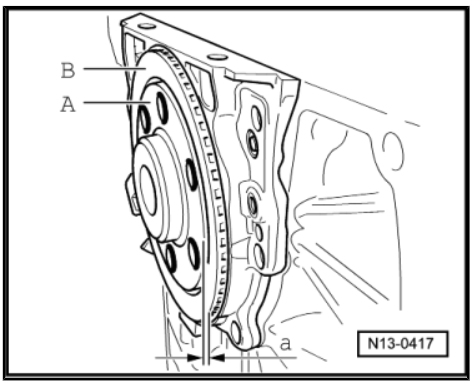
After tightening the hexagonal nut with 35 Nm, there must still be a small clearance between the engine block and the flange.

E - Check the installation position of the Engine speed sensor -G28- rotor on the crankshaft

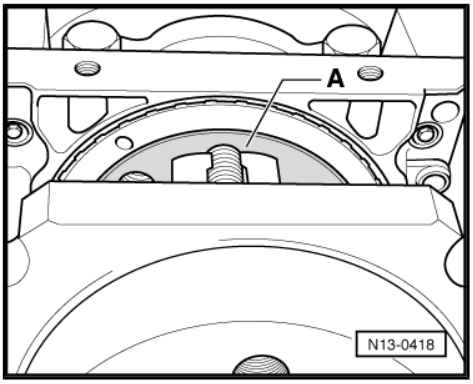
– Screw the hexagonal nut -A-up to the end of the threaded part.
– Screw both screws M 6 × 35 mm -B- to the engine block.
– Loosen the three threaded screws-C- from the flange.
– Remove the Fitter .
– Remove the seal lip thrust ring.



The Engine speed sensor -G28- rotor is in the exact assembly position on the crankshaft when there is a distance -a- of 0.5 mm between the flange -A- and the rotor sensor -B-.



– Place the Vernier caliper rod or a steel ruler against the crankshaft flange -A- (threaded surface).



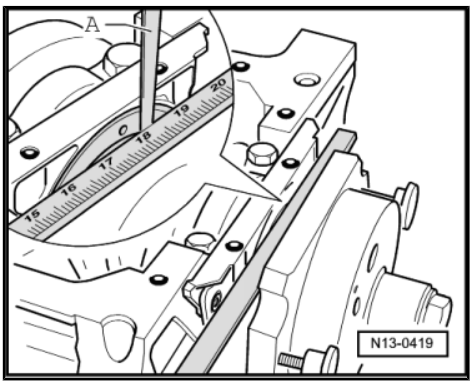
– Measure with a feeler gauge -A- the distance -a- between the Vernier caliper rod and the Engine speed sensor -G28- rotor.

If the measure -a- is to little:

– Press the Engine speed sensor -G28- ⇒ page 28 rotor further.

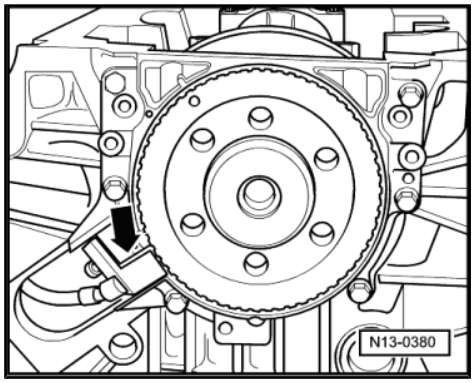
If the measure -a- is reached:

– Remove the Fitter .
– Screw the flange fastening screws alternately in a cross pattern. Tightening torque: 10 Nm.

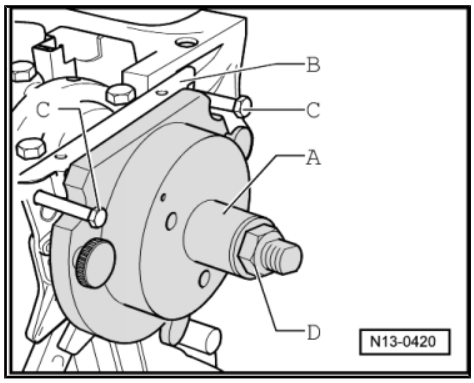


– Install the Engine speed sensor -G28- -arrow-. Tightening torque: 5 Nm.
– Install crankcase ⇒ page 69 .
– Install the intermediate plate.
– Install the flywheel with new screws.

F - Press the Engine speed sensor -G28- rotor further.



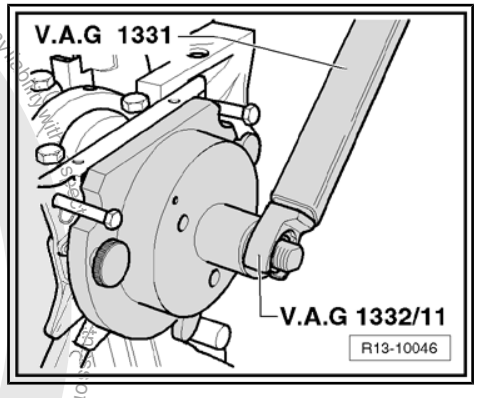
– Move the assembly housing -A- manually in the flange direction -B-.
– Screw two screws M 6 × 35 mm -A- to guide the flange - B - on the engine block.
– Screw the hexagonal nut -D- manually to the threaded part until it lies on the assembly housing -A-.



– Tighten the Fitter hexagonal nut with the Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331- and Open socket SW 24 -VAG 1332/11- . Tightening torque: 40 Nm.
– Check again the installation position of the Engine speed sensor -G28- rotor on the crankshaft ⇒ page 26

If the measure -a- is to little again:

– Tighten the fitter hexagonal nut with 45 Nm once more.
– Check again the assembly position of the Engine speed sensor -G28- rotor on the crankshaft.



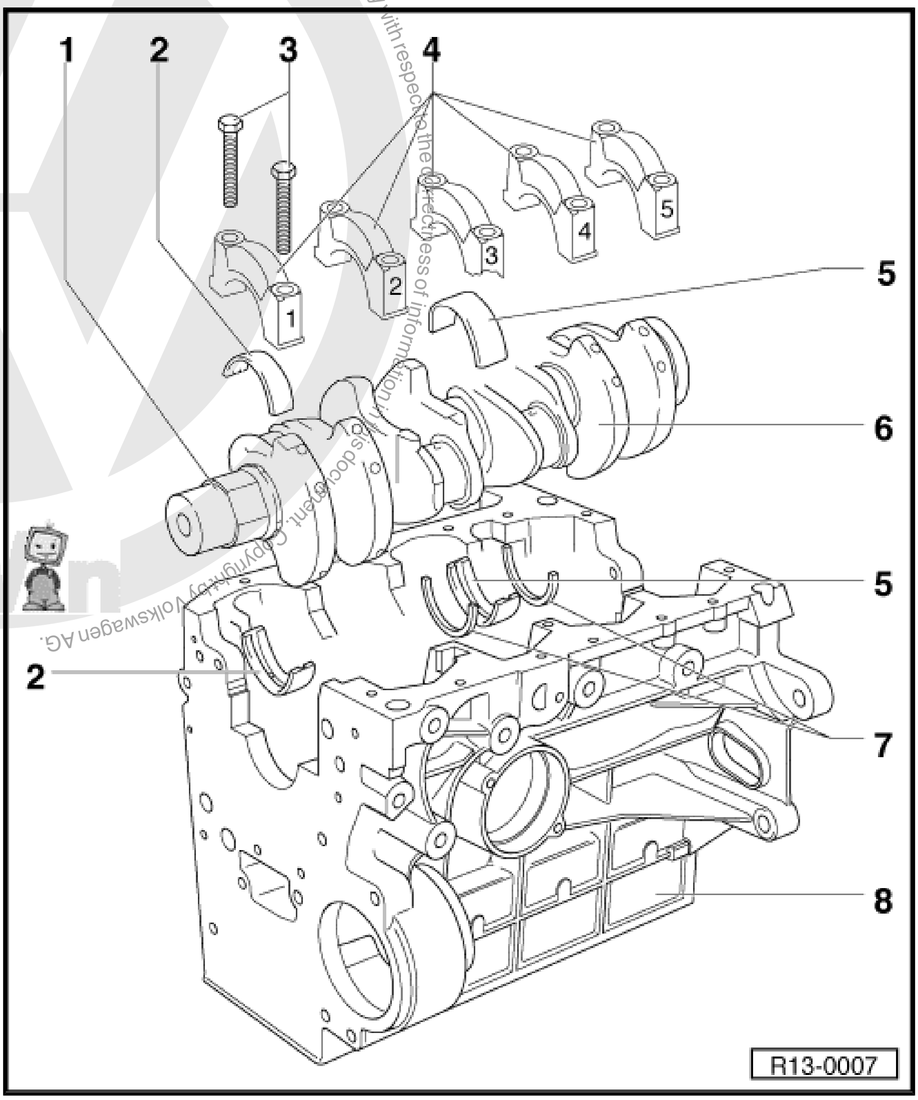
3 Crankshaft - remove and install

Note

- *For carrying out assembly works, the engine must be fastened with the Support -VW 540- or Rotating stand for engine and transmission -VAS 6095- to the assembly stand.*
- *All contact and bearing surfaces must be lubricated with oil before assembly works.*

WARNING

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



1 - Dragging element
- ❑ To activate oil pump.
- ❑ Apply oil before installing the oil pump.

2 - Bearing shells 1, 2, 3, 4 and 5
- ❑ Rating for spare part order ⇒ page 30 .
- ❑ For bearing cover without lubrication groove.
- ❑ For block with lubrication groove.
- ❑ Do not mix the bearing shells if they are used (mark)

3 - 65 Nm
- ❑ Replace after each removal.

4 - Bearing cap
- ❑ Bearing cap 1: Pulley side.
- ❑ Bearing cap 3: With notches for adjusting rings.
- ❑ Block bearing cap / bearing cap retainers must oppose each other

5 - Bearing shell 3
- ❑ ⇒ Item 2 (page 29) .
- ❑ Do not mix the bearing shells if they are used (mark)

6 - Crankshaft
- ❑ Axial clearance new: 0.070...0.243 mm wear limit: 0.263 mm.
- ❑ Measure radial clearance with new Plastigage: 0.016...00.036mm wear limit: 0.070 mm.
- ❑ Do not rotate crankshaft while measuring radial clearance.
- ❑ Crankshaft dimensions ⇒ page 30 .

7 - Adjusting ring

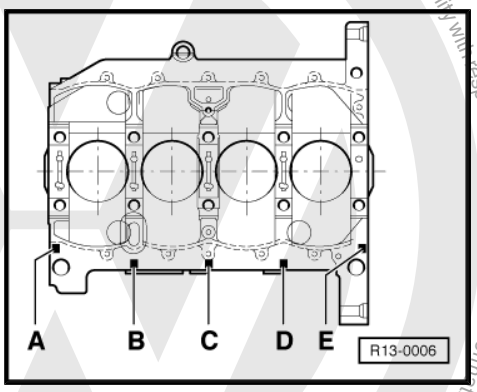
- ❑ For bearing block 3.

8 - Engine block

3.1 Identifying engine bearing shells

– Crankshaft bearing shells are classified at the plant and marked on the engine block and crankshaft, as indicated. To identify the bearing shells, the oil crankcase must be removed so that the code can be read.

3.1.1 Crankshaft upper bearing shell code

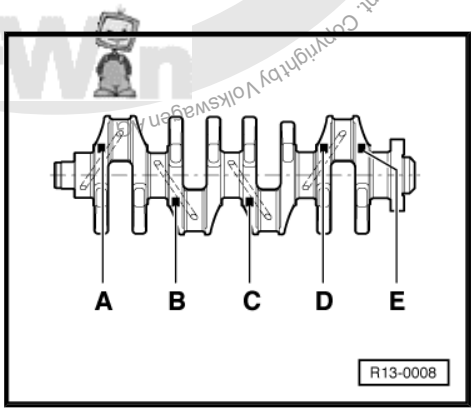


Note

- *Engravings may be also grouped in region D of the illustration above.*
- *When there is no engraving, use yellow bearing shell (color code G).*

A	=	Code for bearing 1
B	=	Code for bearing 2
C	=	Code for bearing 3
D	=	Code for bearing 4
E	=	Code for bearing 5

3.1.2 Crankshaft lower bearing shell code



Note

It may be also engraved on the supporting face of the flywheel.

A	=	Code for bearing 1
B	=	Code for bearing 2
C	=	Code for bearing 3
D	=	Code for bearing 4
E	=	Code for bearing 5

3.1.3 Color codes

R	=	red
G	=	yellow
B	=	blue

3.2 Crankshaft dimensions

(dimensions in mm)

Grinding measures	Crankshaft bearing Trunnion-Ø	Connecting rod bearing Crankpin-Ø
Basic measure	-0,022 54,00 -0,037	-0,022 47,80 -0,037
First grinding (0.25)	-0,022 53,75 -0,037	-0,022 47,55 -0,037

Grinding measures	Crankshaft bearing Trunnion-Ø	Connecting rod bearing Crankpin-Ø
Second grinding (0.50)	-0,022 53,50 -0,037	-0,022 47,30 -0,037
Third grinding (0.75)	-0,022 53,25 -0,037	-0,022 47,05 -0,037

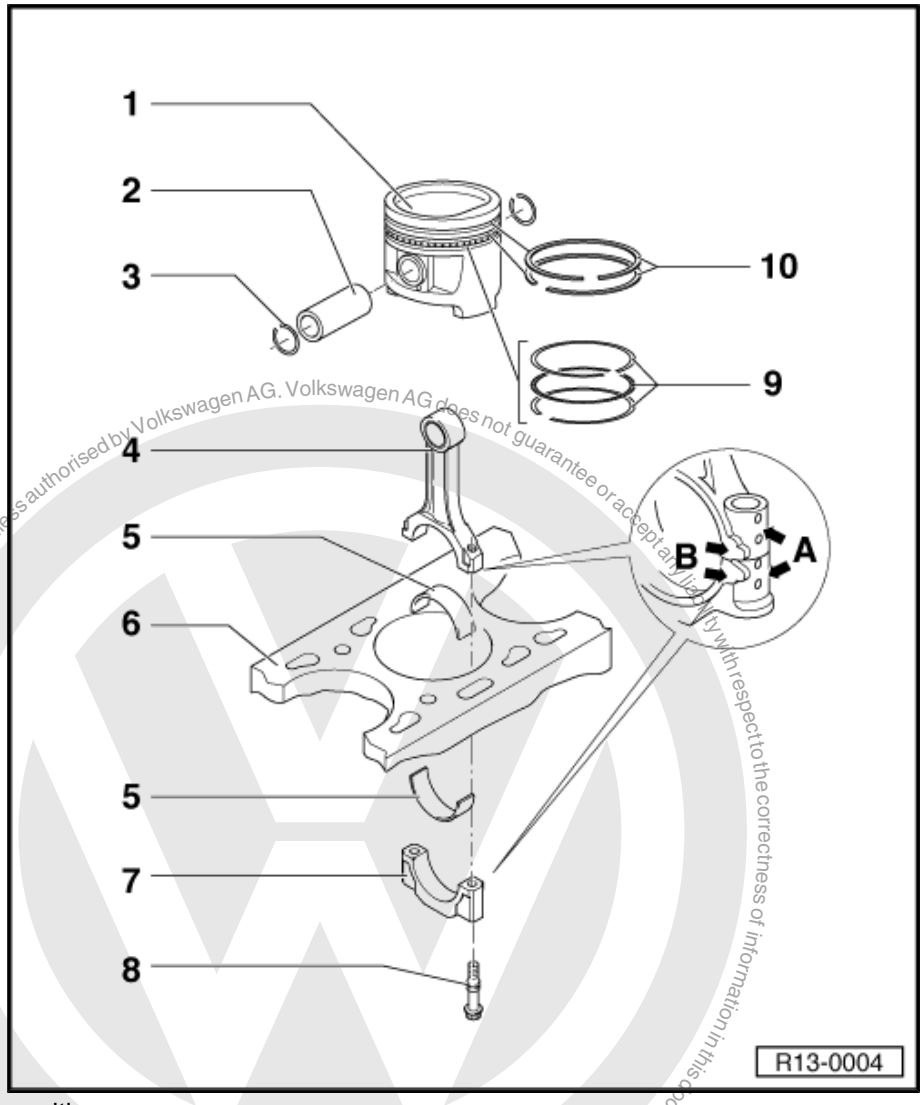
4 Pistons and connecting rods - remove and install

Note

All housing and bearing surfaces must be lubricated with oil before assembly.

WARNING

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



1 - Piston

- ❑ Check ⇒ page 34
- ❑ Mark assembly position and correspondence with the cylinder.
- ❑ Arrow on piston head points to the pulley side.
- ❑ Assembly with piston ring tension belt.

2 - Piston pin

- ❑ In case of difficulties in the removal, heat the piston to 60 °C.
- ❑ Remove and install with Expander -10-206-

3 - Piston pin retaining ring

- ❑ Replace.

4 - Connection rod

- ❑ Replace it in pairs only.
- ❑ Mark correspondence with cylinder -A-.
- ❑ Assembly position: marks -B- point to the flywheel side.
- ❑ Piston / connecting rod axial clearance; 0.20...0.40 mm wear limit 0.50 mm.

5 - Bearing shell

- ❑ Check assembly position.
- ❑ Do not mix used bearing shells in case they are reused. Check assembly position.
- ❑ Install bearing shells centrally.
- ❑ Measure radial clearance with Plastigage: new: 0.020...0Crankpin.061 mm wear limit: 0.091 mm. Do not rotate crankshaft while measuring radial clearance.

6 - Engine block

- ❑ Check cylinder diameter ⇒ page 34 .

- ❑ Piston and cylinder dimensions ⇒ page 34 .

7 - Connecting rod cap

- ❑ Check assembly position.
- ❑ Thanks to the rupture process applied to the connecting rods, the cap can be assembled in one position only and on the respective connecting rod only.

8 - 30 Nm + 90°

- ❑ Replace after each removal.
- ❑ Lubricate threads and stop surfaces.
- ❑ Tighten with 30 Nm to measure the radial clearance, but do not keep turning.

9 - Oil scraper ring

- ❑ Remove and install manually and carefully oil scraper rings of 3 parts.
- ❑ The mark “TOP” must point towards the piston head.
- ❑ Check opening between ends ⇒ page 33
- ❑ Check clearance on piston channel ⇒ page 33

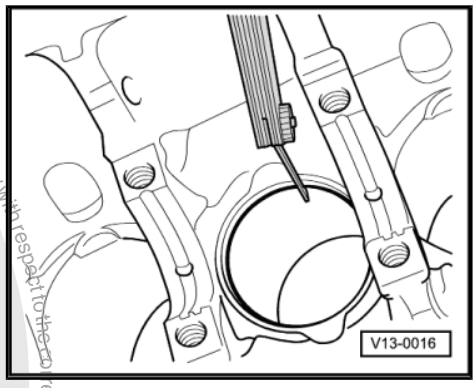
10 - Compression ring

- ❑ Position the apertures in 120°.
- ❑ Remove and install compression rings with compression ring pliers.
- ❑ Mark “TOP” points towards the piston head.
- ❑ Check opening between ends ⇒ page 33
- ❑ Check ring clearance in the piston channel ⇒ page 33

Opening of piston ring ends - check

– Insert the ring in right angle from top up to the cylinder lower opening, with a distance of approx. 15 mm up to cylinder edge.

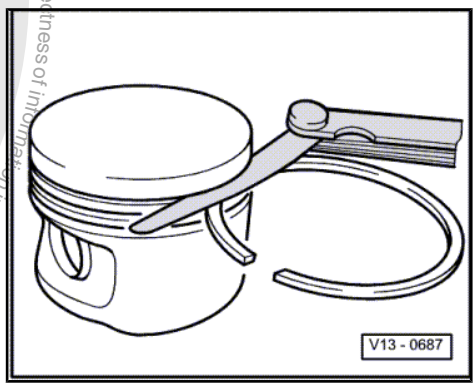
Piston ring	Wear limit
1. Compression ring	1.0 mm
2. Compression ring	1.0 mm
Oil scraper ring	1.0 mm



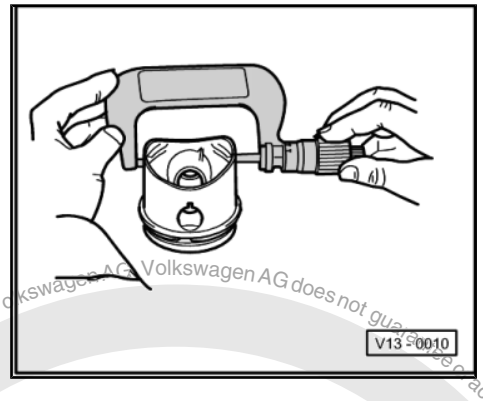
Check ring clearance in the piston channel

Clean ring groove before the test.

Piston ring	Wear limit
1. Compression ring	0.250 mm
2. Compression ring	0.150 mm
Oil scraper ring	0.150 mm



Check piston

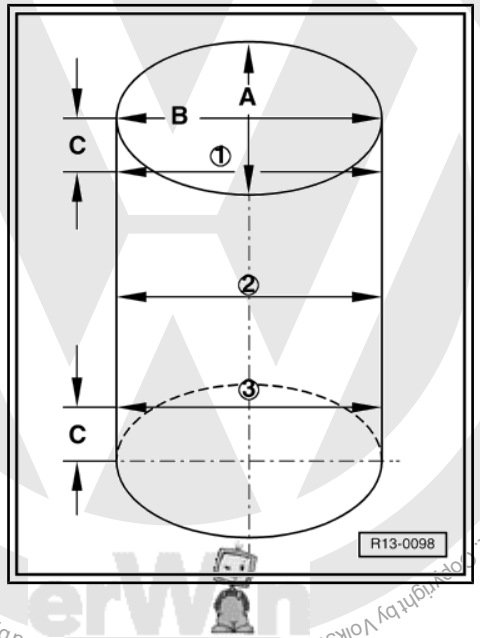


Special tools and workshop equipment required

- ♦ External micrometer 60...90 mm

– Measure at approx. 10 mm from lower corner, moving in 90° in relation to the piston pin axis. Divergence in max. nominal measure 0.07 mm. Nominal measure ⇒ page 34 .

Check cylinder diameters



Special tools and workshop equipment required

- ♦ Precision internal micrometer 50...100 mm

– Measure three places, in cross pattern, in transversal -A- and longitudinal -B- directions with a distance of 10.0 mm from upper and lower edges-C-. Tolerances in relation to max. nominal measure 0.08 mm ⇒ page 34

Note

The cylinder diameter cannot be measured while the engine block is secured to the assembly stand with the Support -VW 540- or Rotating stand for engine and transmission -VAS 6095- , because that can lead to incorrect measures.

4.1 Piston and cylinder specifications

Grinding specifications		Piston-Ø[5)]	Ø cylinder interior
Manufacturer		Mahle	
Basic specification	mm	76,465	76,51
Grinding I	mm	76,715	76,76
Grinding II	mm	76,965	77,01

Grinding specifications		Piston-Ø[5)]	Ø cylinder interior
Grinding III	mm	77,215	77,26

5) Specifications indications apply to non-lubricated pistons. Pistons lubricated on measuring point may be higher up to 0.030 mm at ∅, according to the mileage.

15 – Cylinder head, valve control mechanism

1 Cylinder head - disassemble and assemble

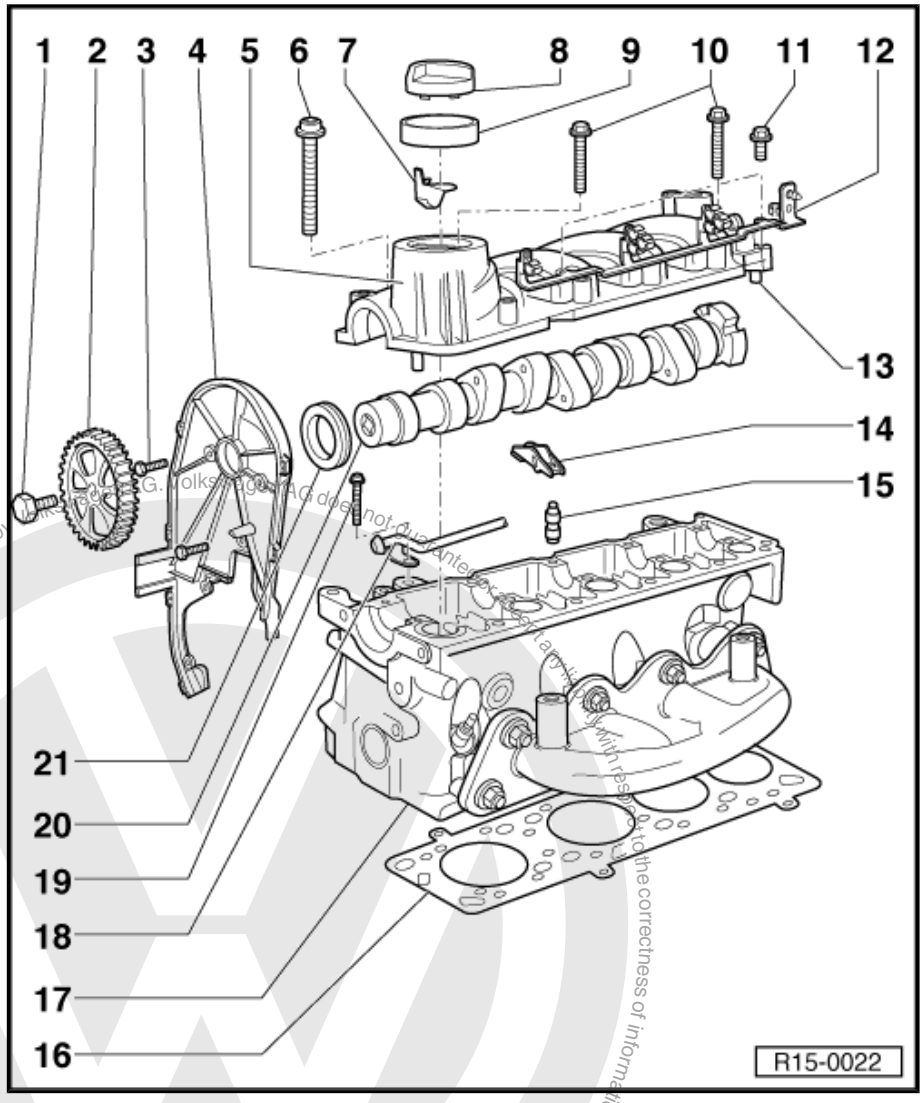
Check compression ⇒ page 51 .

Note

- *When a replacement cylinder head is assembled, it is necessary to lubricate all contact surfaces between support elements and valve seats, before assembling cylinder head.*
- *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 - 20 Nm + 90°

- ❑ Replace after each removal.
- ❑ To loosen and tighten, immobilise the camshaft gear with the Special wrench -3036- .

2 - Camshaft gear

- ❑ Observe fastening during assembly.
- ❑ Check installation position of timing belt ⇒ page 41 .

3 - 10 Nm

- ❑ Apply -D/00600/A2/- .

4 - Mechanical distribution front cover

5 - Cylinder head cover

- ❑ Sealing surfaces cannot be ground.
- ❑ With integrated camshaft bearings.
- ❑ Remove all sealant remains.
- ❑ Apply -AMV 188 001 02- before positioning.
- ❑ For assembly, place in vertical position from top with pins in cylinder head holes.
- ❑ Disassembly and assembly ⇒ page 59 .

6 - Engine head screw

- ❑ Replace.
- ❑ Observe assembly and sequence instructions when loosening and tightening ⇒ page 46 .

7 - Protector

- ❑ Check assembly position.

8 - Oil supply cover

- ❑ Replace seal if damaged.

9 - Packing

- ❑ Replace if damaged.

10 - 6 Nm + 90°

- ❑ Replace after each removal.
- ❑ Observe installation and sequence instructions when loosening and tightening ⇒ page 59 .

11 - 10 Nm

12 - Support

- ❑ For ignition cables.

13 - Guide pin

14 - Roller rockers

- ❑ Check roller bearing.
- ❑ Lubricate bearing surface with oil.

- ❑ For installation, fasten the safety clip to the support element.

15 - Support element

- ❑ Do not confuse.
- ❑ With valve clearance hydraulic offsetting.
- ❑ Lubricate contact surface with oil.

16 - Cylinder head sealing gasket

- ❑ Metal gasket.
- ❑ Replace.
- ❑ After replacement, replace the cooling system fluid.

17 - Engine cylinder head

- ❑ It is not allowed to grind the sealing surface on the camshaft side.
- ❑ Check bending ⇒ page 38
- ❑ After replacement, replace the cooling system fluid.
- ❑ Disassembly and assembly ⇒ page 53 .

18 - Tubing

19 - 25 Nm

20 - Camshaft

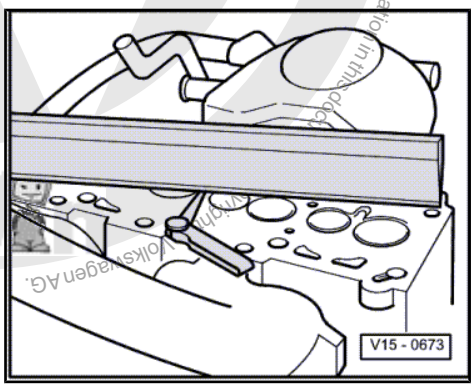
- ❑ Camshaft repair ⇒ page 53 .
- ❑ Remove and Install ⇒ page 59 .

21 - Camshaft seal

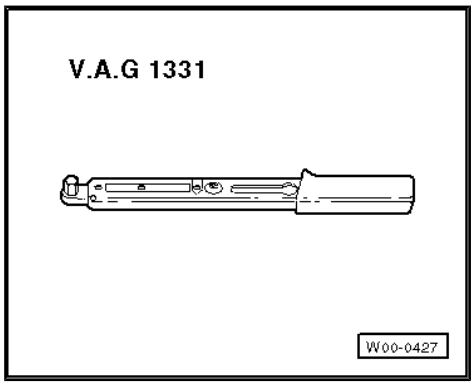
- ❑ Quickly lubricate with oil the seal lip.
- ❑ Replace ⇒ page 58 .

Check whether there is bending in the cylinder head

Max. permissible bending: 0.05 mm.



1.1 Timing belt semi-automatic tensioning pulley - check



Special tools and workshop equipment required

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

Test sequence

– Remove air filter body ⇒ page 117 .

– Remove engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .

– Remove the front right wheel case protector: ⇒ General body repairs, external; Rep. Gr. 66 ; External equipment .

– Mark the Poly-V belt operating direction and remove it ⇒ page 14 .

– Remove heat baffle off the exhaust manifold

Vehicles with air conditioning

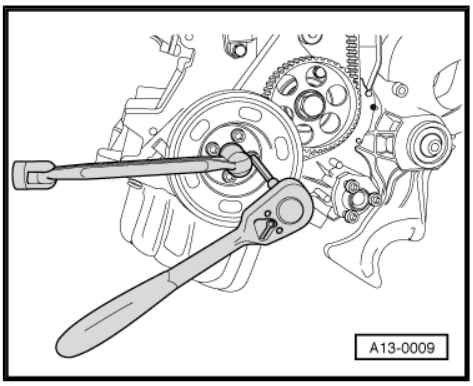
– Remove the tensioning pulley from the Poly-V belt.

Continued for all vehicles

– Remove crankshaft pulley.

– Remove mechanical distribution lower and upper cover.

– Turn crankshaft twice in the engine rotation direction until it is in cylinder 1 TDC.



– Memorize the position of the belt tensioning element indicator -arrow-. Press the timing belt with the thumb. The indicator should move.
– Loosen the timing belt once again.
– Turn the crankshaft twice in the engine rotation direction.
– Check the position of the indicator. It should go back to the original position.

If the indicator does not go back to its original position:

– Replace the belt tensioning element.

If the belt tensioning element is ok:

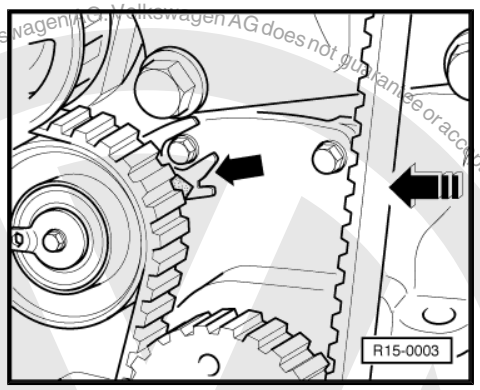
– Install the mechanical distribution lower and upper cover.
– Install the crankshaft pulley (observe fastening). Tightening torque: 20 Nm.

Vehicles with air conditioning

– Install Poly-V belt tensioning element. Tightening torque: M 8 Tighten to 20 Nm + 90°, M 10: 45 Nm.

Continued for all vehicles

– Install exhaust manifold heat baffle. Tightening torque: 10 Nm.
– Install Poly-V belt ⇒ page 14 .

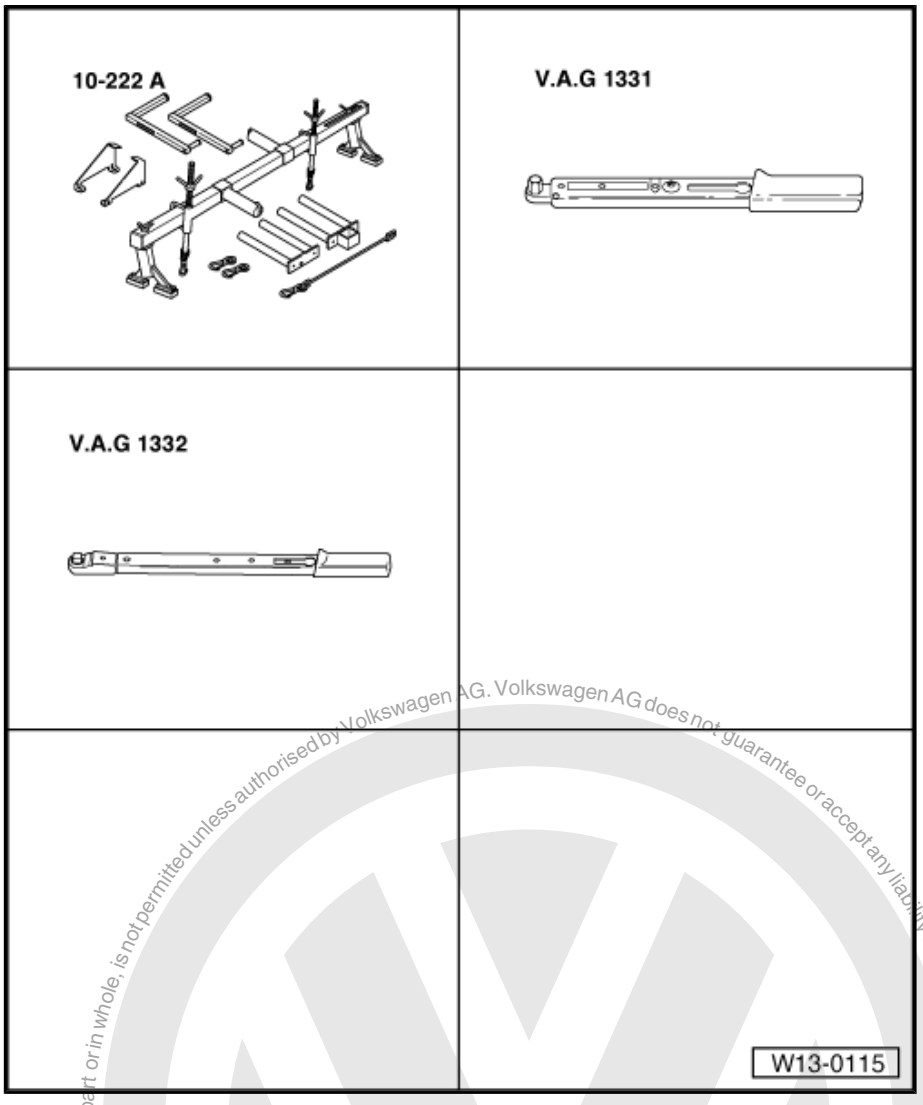


Note

While installing the Poly-V belt, carefully observe the proper seating of the belt on the pulley.

– Install the front right wheel case protector: ⇒ General body repairs, external; Rep. Gr. 66 ; External equipment .
– Install engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .
– Install air filter body ⇒ page 117

1.2 Timing belt - remove and install, adjust



(Adjust command times)

Special tools and workshop equipment required

- Support or 10-222A -VW 061-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-

No illustration:

- Lifting eyes No. of replacement part: Lifting tackle -030.103.390.F- (on pulley side), Lifting tackle -030.103.390.G- (on flywheel side).
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- -Chave sextavada-

1.2.1 Removal

– Remove air filter body ⇒ page 117 .

– Remove right front wheel case cover ⇒ General body repairs, external; Rep. Gr. 66 ; External equipment .

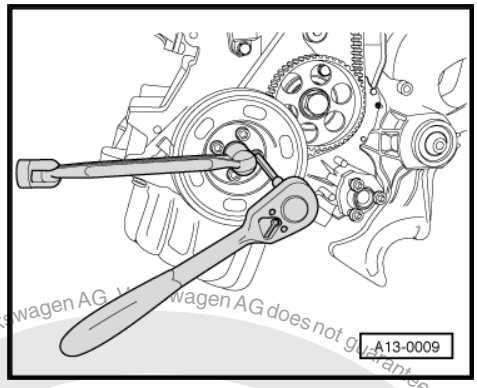
– Mark the position of the Poly-V belt rotation direction and remove it ⇒ page 14 .
– Remove heat baffle off the exhaust manifold

Vehicles with air conditioning

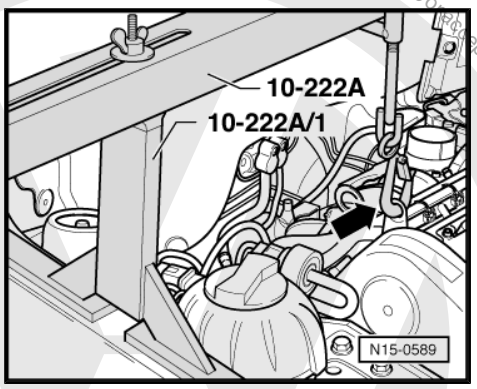
– Remove the tensioning pulley from the Poly-V belt.

Continued for all vehicles

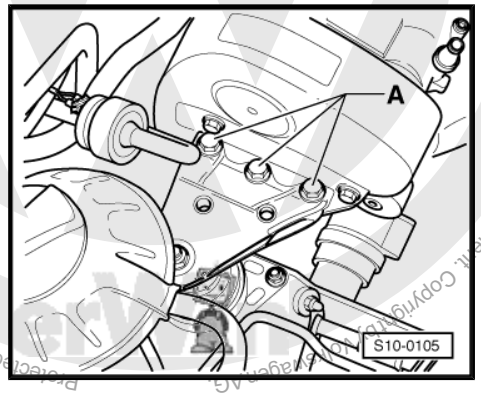
– Remove mechanical distribution upper cover.
– Remove crankshaft pulley.
– Remove mechanical distribution lower cover.
– Loosen cooling system pipes from the engine cylinder head.
– Screw lifting eyes in the place of the cylinder head cooling system pipes. Tightening torque: 25 Nm.



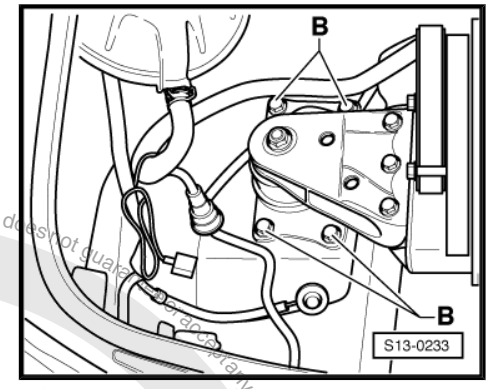
– Install the Support or 10-222A -VW 061- as illustrated and support the engine in the assembly position.
– Remove cooling fluid container (hoses remain connected).



– Secure the engine a little and loosen fastening screws -A-.

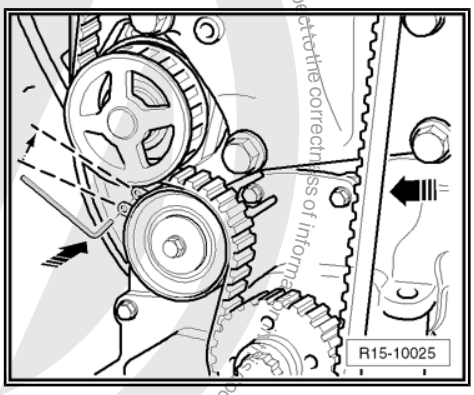


– Loosen fastening screws -B- and also the power-drive group support, entire engine.
– Remove power-group support, engine in engine block.
– Mark timing belt operation direction.
– Loosen belt tensioning element and remove the timing belt.



1.2.2 Tensioning element without adjustment

– Press the timing belt in the direction of the -arrow-, on the right side.
– With the bearings aligned, install the lock pin (Allen 2.5 mm).
– Remove the tensioning element.
– Remove the timing belt and mark the direction of rotation.



1.2.3 Installing

Conditions

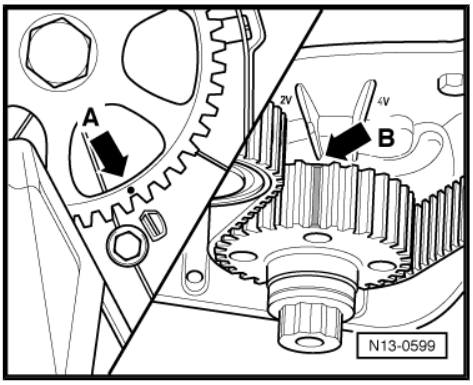
- The engine must be warm, at most.
- Pistons cannot be in the TDC.

Note

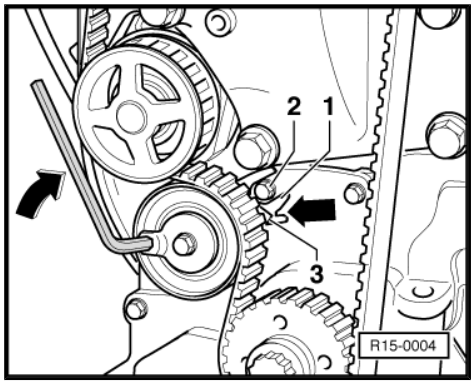
When turning the camshaft, the valves may hit the pistons located in the TDC.

Operation sequence

– Put the camshaft gear on the mark - arrow A -.
– Put the crankshaft in the TDC for cylinder 1. The tooth marked on the camshaft gear must match the mark “2V” on the flange / oil pump -arrow B-.
– Install timing belt . Check operation direction on used timing belts.

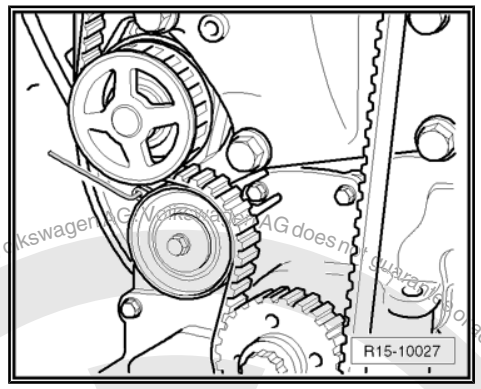


– Tighten manually the fastening screw of the belt tensioning element. The base plate notch -1- must reach over the fastening screw -2-.
– Stretch the timing belt by turning the belt tensioning element in the arrow direction until the indicator -3- reaches the mark on the base plate -arrow-.
– Tighten belt tensioning element fastening screw. Tightening torque: 20 Nm.
– Now, turn crankshaft twice in the engine turn direction until it is in cylinder 1 TDC again.
– Then, check again the adjustment of the timing belt and the position of the belt tensioning element.

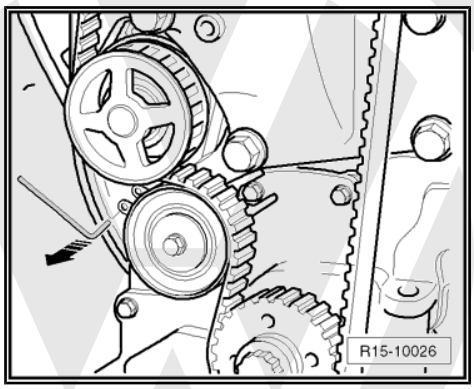


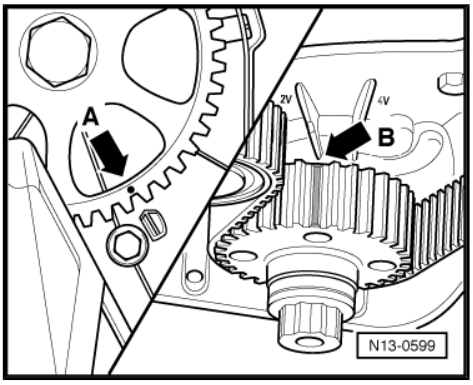
1.2.4 Tensioning element without adjustment

– Install the timing belt on the camshaft and water pump gear.
– Install the tensioning element with the lock pin (Allen 2.5 mm) installed.
– Apply a torque of 20 Nm on the fastening screw.
– Install the belt on the crankshaft gear.



– Remove the lock pin (Allen 2.5 mm) from the tensioning element.
– Turn the crankshaft twice in the direction of engine rotation until reaching top dead centre for cylinder 1.
– Then, check gear positions again.





– If necessary, repeat adjustment of the timing belt.
– Install the power-group support, engine in engine block. Tightening torque: 50 Nm.
– Install mechanical distribution lower cover.
– Install the crankshaft pulley (observe fastening). Tightening torque: 20 Nm.

Vehicles with air conditioning

– Install Poly-V belt tensioning pulley. Tightening torque: M 8 Tighten to 20 Nm + 90°, M 10: 45 Nm.

Continued for all vehicles

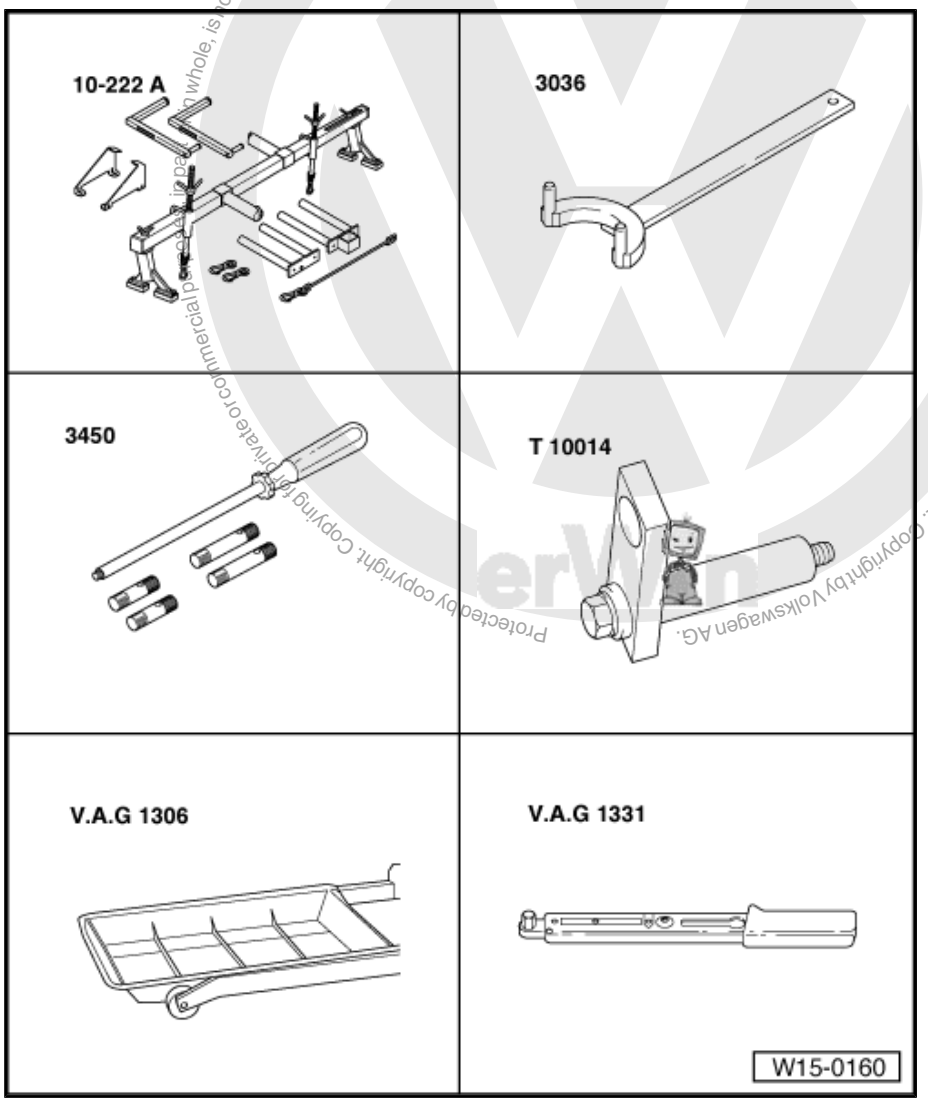
– Install exhaust manifold heat baffle. Tightening torque: 10 Nm.
– Install power-drive group support, engine Tightening torque ⇒ page 8 .
– Install mechanical distribution upper cover.
– Install Poly-V belt ⇒ page 14 .

Note

While installing the Poly-V belt, carefully observe the proper seating of the belt on the pulley.

– Install the front right wheel case protector: ⇒ General body repairs, external; Rep. Gr. 66 ; External equipment .
– Install engine compartment lower noise insulation ⇒ Body Repair; Rep. Gr. 50 ; Body - Front part .
– Install coolant reservoir.
– Remove lifting eye from engine cylinder head.
– Install cooling system pipes on the engine cylinder head. Tightening torque: 25 Nm.
– Install air filter body ⇒ page 117

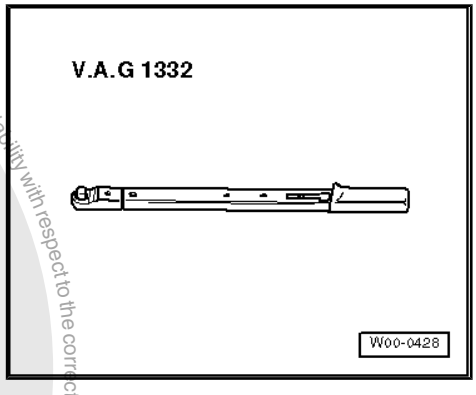
1.3 Cylinder head - remove and install

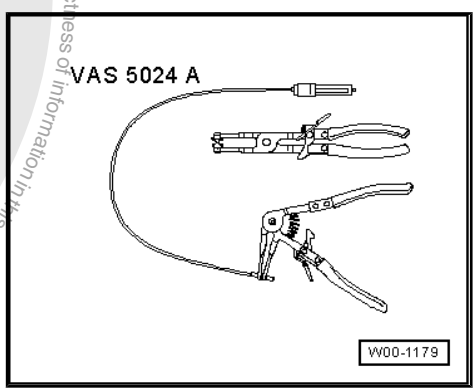


Special tools and workshop equipment required

- Support or 10-222A -VW 061-
- Special wrench -3036-
- Guides -3450-
- Support -T10014-
- Oil sump -VAG 1306-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-

No illustration:





- ◆ Lifting eyes No. of replacement part: Lifting tackle -030.103.390.F- (on pulley side), Lifting tackle -030.103.390.G - (on flywheel side).
- ◆ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ◆ VAS 5024A or Standart type clamp pliers -VW 5162-

Initial conditions

- Engine warm, at most.

1.3.1 Removal

Note

In order to perform these jobs, it is necessary to disconnect the battery earth strap. For that, check if the vehicle has code radio; if so, request respective anti-theft code.

– With the ignition switched off, disconnect battery earth strap.

– Remove air filter body ⇒ page 117 .

– Loosen cooling system pipes from the engine cylinder head.

– Screw lifting eyes in the place of the cylinder head cooling system pipes. Tightening torque: 25 Nm.

– Loosen right front wheel case cover ⇒ General body repairs, external; Rep. Gr. 66 ; External equipment .

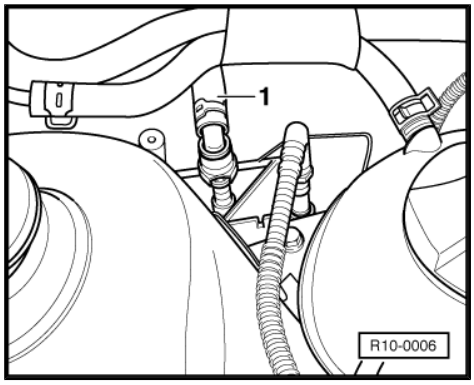
– Remove timing belt ⇒ page 41 .

– Remove camshaft gear to loosen the screw and immobilise the camshaft gear with the Special wrench -3036- .

WARNING

Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure by removing hose carefully.

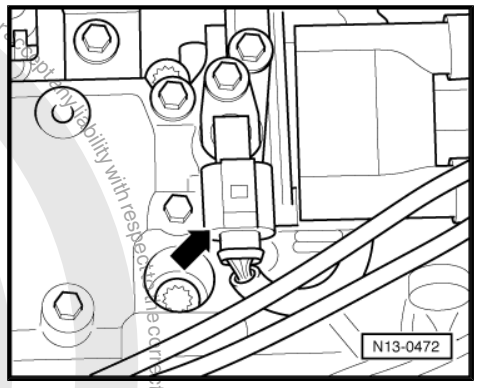
– Disconnect the fuel supply pipes -1- (press the unlock key).



– Loosen the hose for the Magnetic valve for activated charcoal filter -N80- -1- on the intake manifold.
– Close the pipes so as to avoid any dirt from coming into the supply system.
– Disconnect or loosen the following components:

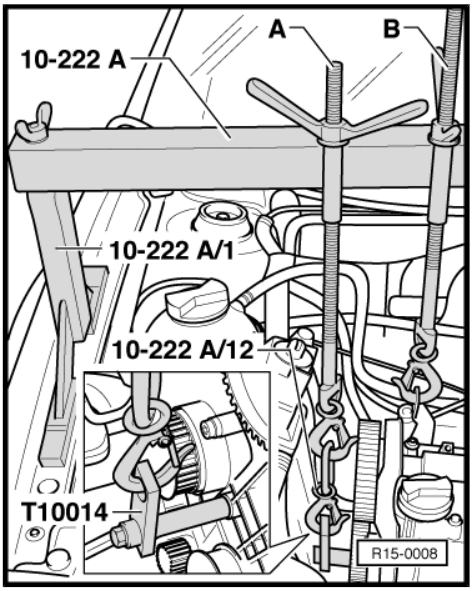
♦ intake manifold vacuum hose for the servo break.
♦ the fitting connector for the Ignition transformer -N152- and Accelerator butterfly valve control unit -J338- .
♦ injection valve connectors.
♦ connector for the Engine speed sensor -G28- and Intake manifold pressure sensor -G71- with Air intake temperature sensor -G42- .
♦ the double-sided connector for the Knock sensor 1 -G61- (behind the block).
♦ the connector for the Coolant temperature sensor -G62- and Oil pressure switch -F1- .

– Disconnect the Sensor Hall 3-pole connector -G40- -arrow-.



– Fully remove the fuel distributor with all injectors ⇒ page 116 .
– Open and close once more the coolant reservoir lid to depressurize the cooling system.
– Drain the cooling system ⇒ page 82 .
– Remove the water pump together with the mechanical distribution rear cover ⇒ page 87 .
– Remove the clip on the cooling system thermostat valve body, which holds the cooling system tube on the pump.
– Remove the thermostat valve body from the engine cylinder head.
– Disconnect all connection, cooling system, vacuum and suction hoses from the engine cylinder head.
– Loosen exhaust tube from the exhaust manifold ⇒ page 132 .
– Loosen the intake manifold dipstick guide tube.

– Then, slightly raise the engine with the threaded part -B-.



Note

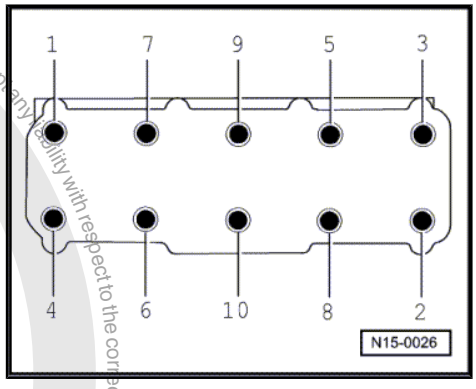
Since the lifting eye is screwed to the engine cylinder head, an additional support must be secured to the engine block to support the engine.

– Screw, as indicated, the Lock -T10109- into the threaded hole in the cooling system pump area on the engine block. Tightening torque: 20 Nm.

– Slightly raise the engine with the second threaded part -A- until the threaded part -B- is relieved.

– Remove threaded part -B-.

– Loosen the engine cylinder head screws in the indicated sequence and remove them.



– Raise the engine cylinder head carefully.

1.3.2 Installing

Note

- *Remove the new cylinder head sealing gasket from the package immediately before installation only.*
- *Handle the new gasket as carefully as possible. Damages cause leaks.*

– Put a clean cloth in the cylinder so as to prevent any dirt or sandpaper residues from coming in between the cylinders and the pistons.

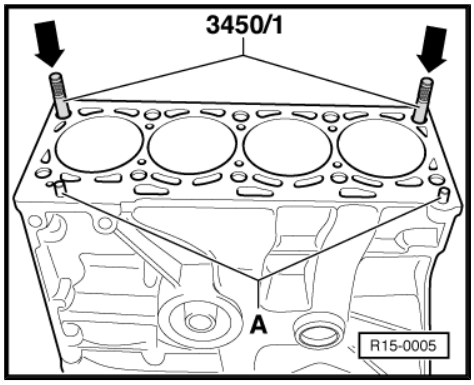
– Also prevent dirt and sand paper residues from coming into the cooling system.

– Carefully clean engine cylinder head and engine block sealing surfaces. Make sure that no longitudinal sore or scratches are produced in this operation (when using sand paper, the grain shall never be lower than 100).

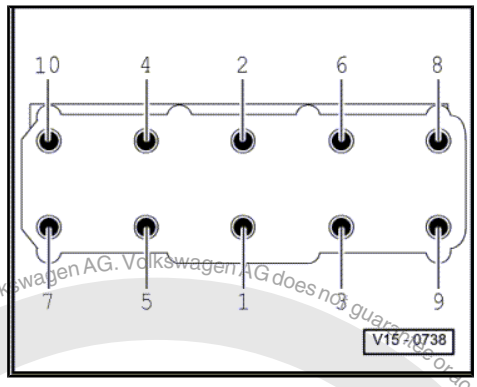
– Remove sand paper residues with a cleaning cloth carefully.

– Put cylinder 1 piston in TDC and turn the crankshaft slightly backwards.

- To centralize the engine cylinder head, screw the Guides -3450- into the external rear holes of engine cylinder head bolts -arrows-.
- Put new cylinder head sealing gasket on the centering pins -A-. The inscription (spare part number) must be legible.
- Install engine cylinder head and the 8 remaining cylinder head bolts and tighten manually.
- Loosen the Guides -3450- with the Puller -3450/3- through the bolt holes. For that, turn the Puller -3450/3- to the left until the guides are loose.
- Insert the two remaining cylinder head bolts and tighten them manually.



- Tighten the cylinder head bolts in the indicated tightening sequence, as follows:
- Tighten all bolts to 30 Nm.
- Then tighten all bolts at 180° with a hard spanner.



Note

There is no need to tighten the engine cylinder head bolts again after the repairs.

- Continue installation in removal reversed order.

Note

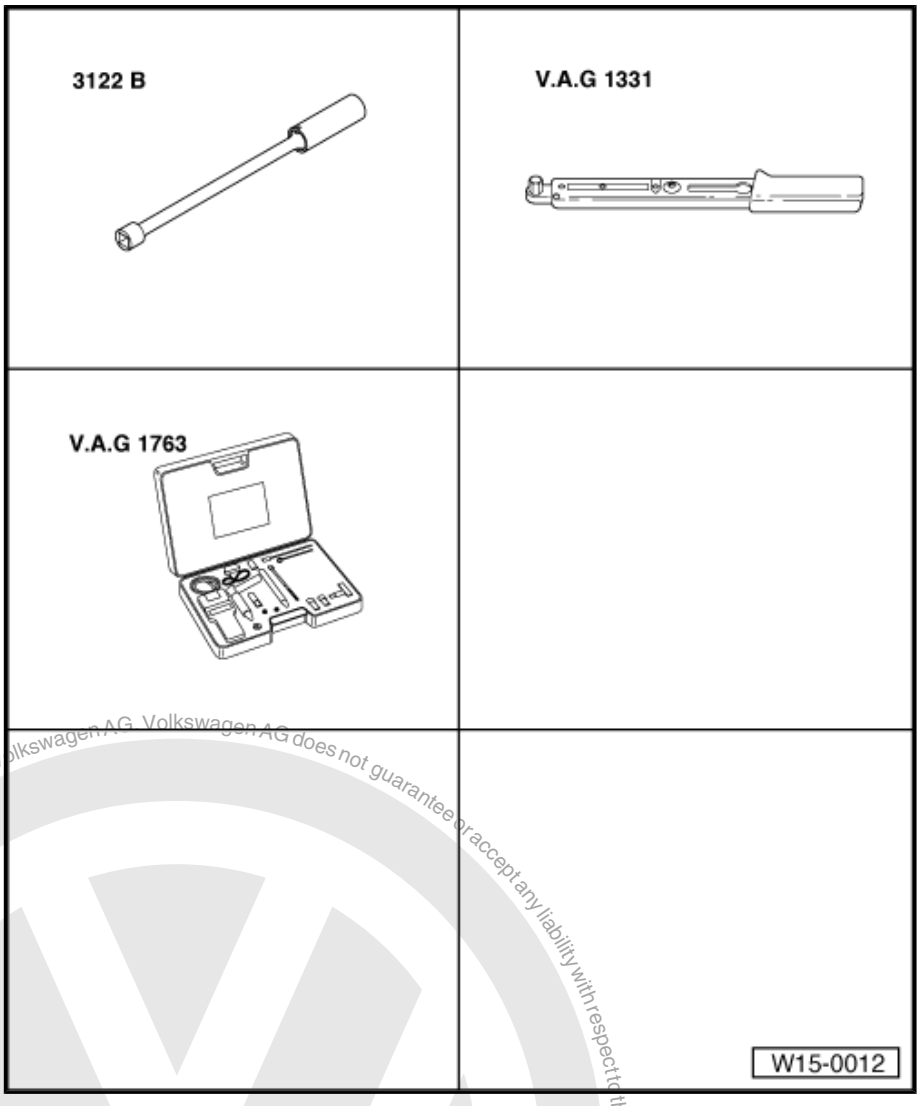
When turning the camshaft, the crankshaft cannot be in TDC. Risk of damages to the piston head/valves.

Installing the timing belt and adjusting the command times ⇒ page 41 .

Fill cooling system ⇒ page 82 .

- Refer to the failure memory ⇒ page 129 .

1.4 Compression - check



Special tools and workshop equipment required

- ♦ Spark plug wrench -3122B-
- ♦ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ♦ Cylinder compression meter - gasoline/alcohol -VAG 1763-

Test conditions

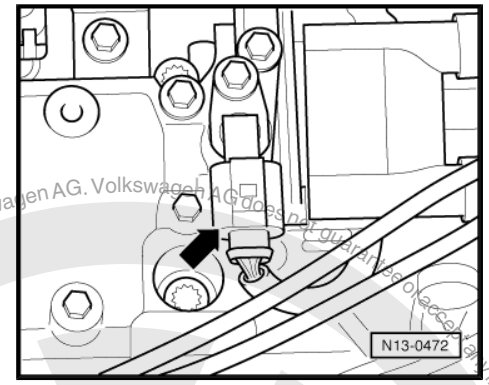
- The engine oil temperature must be at least 30°C.
- The battery voltage must be at least 11.5 volts.
- All electrical components, such as lights and rear window, must be turned off.
- If the vehicle is equipped with air conditioning, turn it off.

1.4.1 Checking

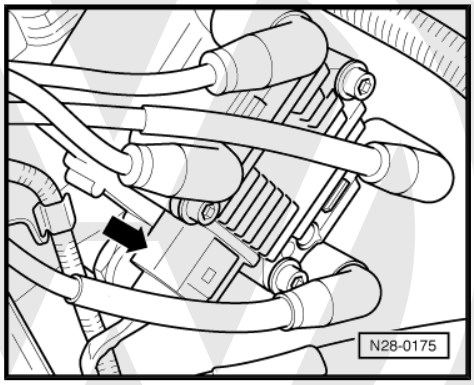
– Remove air filter body ⇒ page 117 .

– Remove the spark plugs with the Spark plug wrench -3122B- .

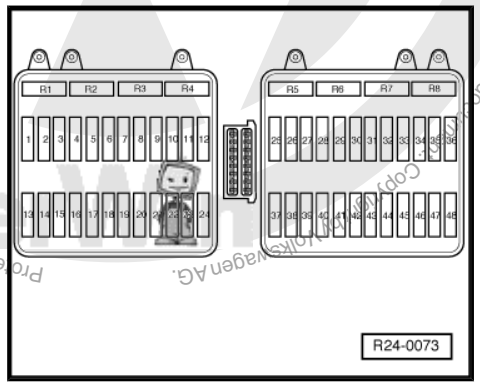
– Disconnect the Sensor Hall 3-pole connector -G40- -arrow-.



– Disconnect the Ignition transformer 4-pole connector -N152- -arrow-.



– Remove fuse 44 from fuse case.



Note

When fuse 44 is removed, power supply to injectors is interrupted.

– Request another mechanic to step on the accelerator pedal, in such a way that the accelerator valve (butterfly) is completely open.

– Check compression with the Cylinder compression meter - gasoline -VAG 1763- or -VAG 1381- .

Note

The testing device operation is described in the respective operation instructions.

– Operate the starter until there is no more increase in the pressure of the testing device.

Compression values

Engine prefix		BKR
Cylinder compression	bar	15.17 to 17.93
Wear limit	bar	10,62
Maximum compression difference between cylinders	bar	3,00

– Screw the spark plugs with the Spark plug wrench -3122B- and tighten with 30 Nm.

– Check fault memory, eliminate possible present failures and, then, erase fault memory ⇒ page 129 .

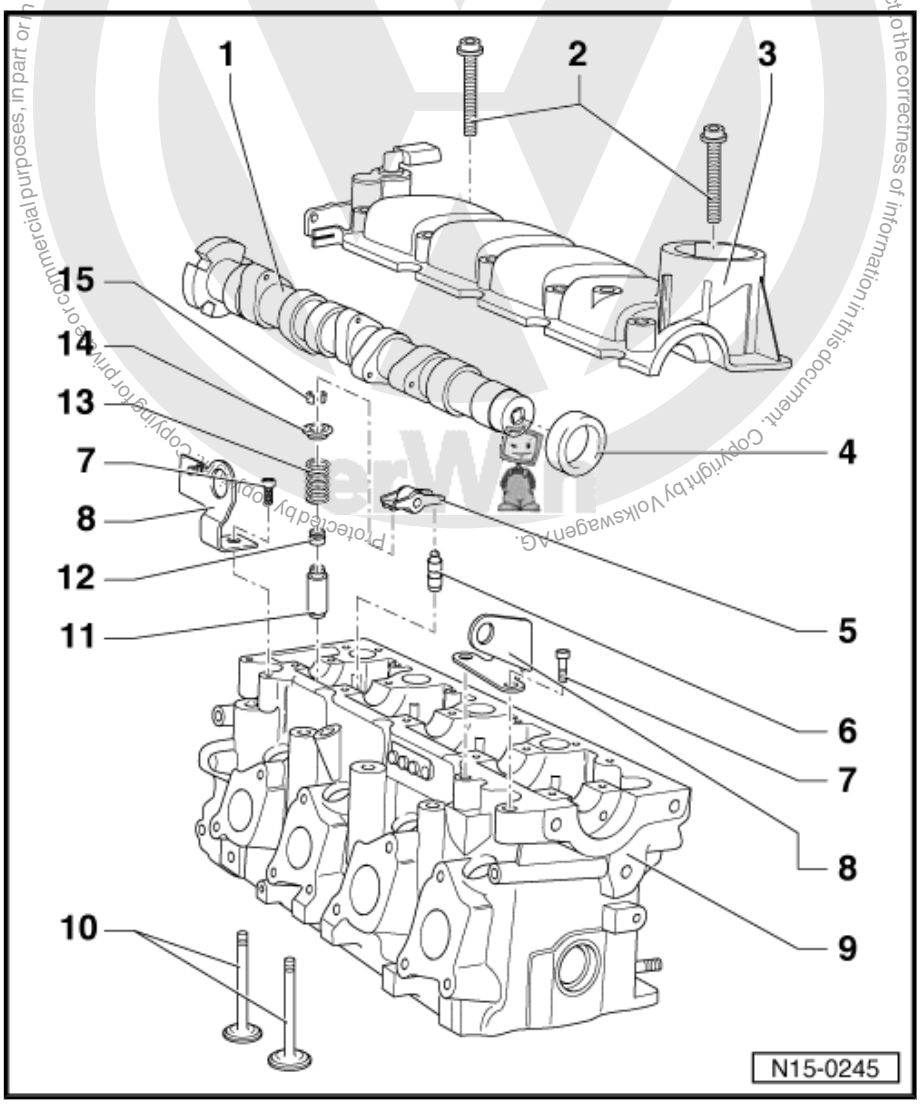
2 Valve command - repair

Note

- *Cylinder heads with cracks between the valve seats or between a valve seat and the spark plug thread can still be used without reducing the useful life, provided that such cracks are small, maximum 0.5 mm wide or when only the first spark plug threads have cracks.*
- *Before performing assembly works, it is necessary to lubricate support and contact surfaces.*

WARNING

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



1 - Camshaft

- ❑ Check axial clearance ⇒ page 54 .
- ❑ Remove and Install ⇒ page 59 .
- ❑ Measure radial clearance with Plastigage, wear limit: 0.1 mm.
- ❑ Eccentricity: max. 0.05 mm.
- ❑ Code ⇒ page 55

2 - 6 Nm + 90°

- ❑ Replace after each removal.
- ❑ Observe installation and sequence instructions when loosening and tightening ⇒ page 59 .

3 - Cylinder head cover

- ❑ It is not allowed to grind the sealing surface.
- ❑ With integrated camshaft bearings.
- ❑ Remove all sealant remains.
- ❑ Apply -AMV 188 001 02- before positioning.
- ❑ For installation, put it from top in vertical position in the engine cylinder head with guide pins.
- ❑ Remove and install ⇒ page 59 .

4 - Seal

- ❑ Quickly lubricate with oil the seal ring lip.
- ❑ Replace ⇒ page 58 .

5 - Roller rockers

- ❑ Check roller bearing.
- ❑ Lubricate bearing surface with oil.
- ❑ For installation, loosen the safety clip on the support element.

6 - Support element

- ❑ Do not confuse.
- ❑ With valve clearance hydraulic offsetting.
- ❑ Lubricate contact surface with oil.

7 - 25 Nm

8 - Lifting tackle / eye

- ❑ Spare part numbers: Lifting tackle -030.103.390.F- (on pulley side), Lifting tackle -030.103.390.G- (on flywheel side).

9 - Engine cylinder head

- ❑ It is not allowed to grind the sealing surface on the camshaft side.
- ❑ Grind valve seat ⇒ page 56 .
- ❑ Grind sealing surface on the engine block side. ⇒ page 54

10 - Valves

- ❑ Do not grind, only seating is allowed.
- ❑ Valve dimensions ⇒ page 55

11 - Valve guide

- ❑ Check ⇒ page 62 .

12 - Valve stem seal

- ❑ Replace ⇒ page 63 .

13 - Valve spring

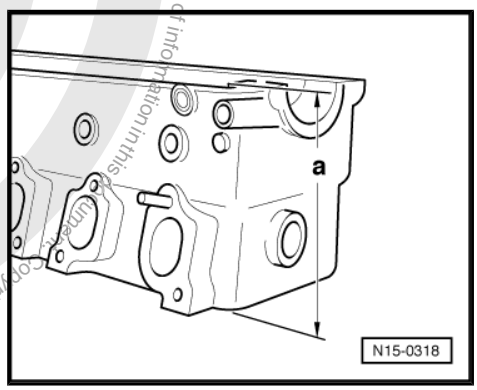
- ❑ Remove and install ⇒ page 36 .

14 - Spring dish

15 - Keys

Grind sealing surface on the engine block side

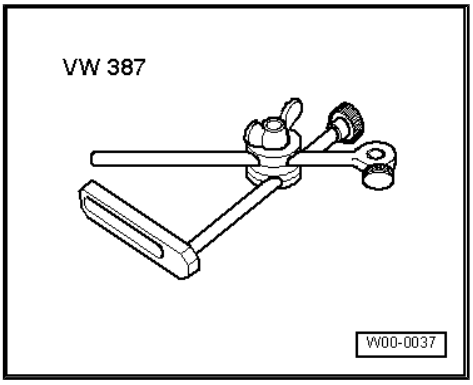
Engine cylinder head grinding measure: a = at least 135.6 mm.



2.1 Camshaft - check axial clearance

Special tools and workshop equipment required

♦ Support -VW 387-



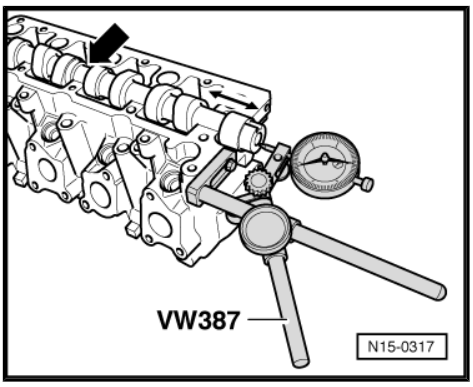
♦ Dial gauge

– Camshaft - check axial clearance

Measure with support elements and camshaft cover removed.

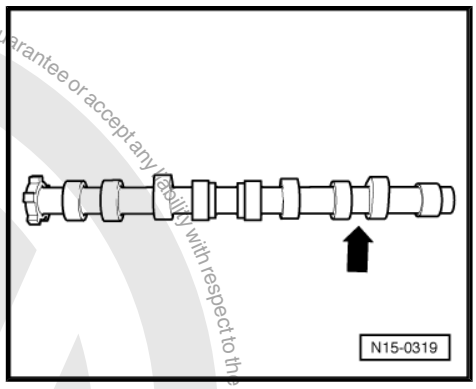
– Pressure the camshaft on central bearing-arrow-, and check axial clearance moving the camshaft.

Wear limit: max. 0.15 mm.



Crankshaft codes

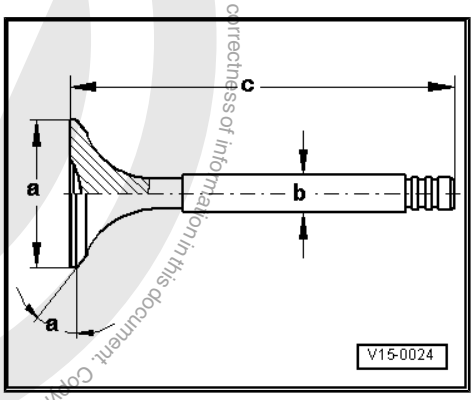
Code between intake and exhaust cams of cylinder 1	
Cylinder 1 -arrow-	030 CG



Valve dimensions

Note

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



Dimensions		Intake valve	Exhaust valve
∅ a	mm	34,5	28,0
∅ b	mm	5,98	5,96
c	mm	99,25	99,25
α	∠°	45	45

2.1.1 Distribution times for 1-mm valve clearance

		Intake valve	Exhaust valve
Then opens	TDC	1,0°	--------

	Intake valve	Exhaust valve
Then closes BDC	26,0°	--------
Opens before BDC	---------	38,0°
Closes before TDC	---------	13,0°

2.2 Valve seat - grind

Special tools and workshop equipment required

- -Depth measure-
- -Valve seat grinder-

Note

- *In case of repairs to engines with leaking valves, simply grinding or replacing the seats and valves is insufficient. Especially in engines with high mileage, the valve guides must also be checked for wear.* *⇒ page 62* *.*
- *Grind the valve seat only until a correct image is presented. Calculate the maximum grinding measurement before grinding. When the grinding measurement is exceeded, the hydraulic offsetting is no longer guaranteed, and the engine head must be replaced.*

2.2.1 Calculating maximum allowable grinding specification

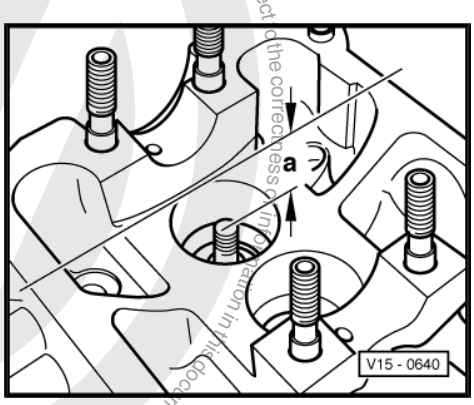
– Install valve and firmly press it against the valve seat.

Note

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

– Measure the distance -a- between valve end and engine head upper edge.

– Calculate maximum and minimum grinding measurement of the measured distance.



Minimum measurements: Intake valve and exhaust valve 32.1 mm.

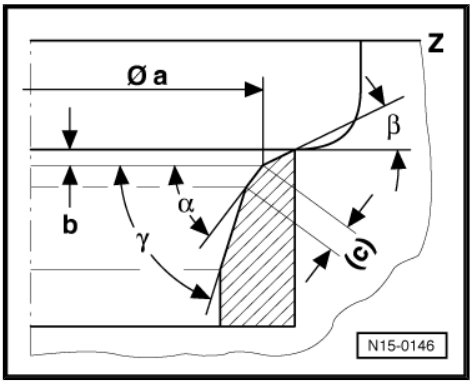
Measured distance minus minimum distance = Maximum grinding measurement allowed.

For example:

- Measured distance	32,5	mm
Minimum specification:	32,1	mm
= Max. grinding specification allowed[6)]	0,4	mm

6) The max. allowable grinding measurement is shown in the illustrations to grind the valve seats as per measurement “b”.

2.2.2 Intake valve seat - grind

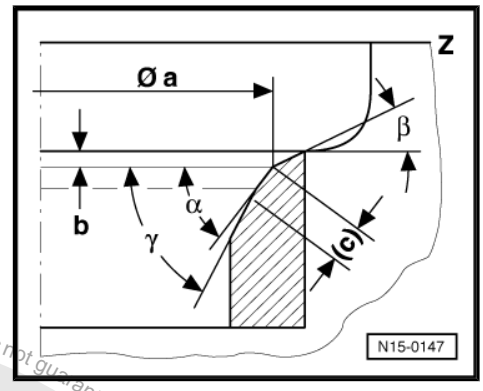


a = ∅ 32.9 mm
b = max. grinding specification allowed
c max. 1.8 ...2.0 mm
Z = Lower cylinder head edge
α = 45° Valve seat angle
β = 30° Upper correction angle
γ = 60° Lower correction angle

Note

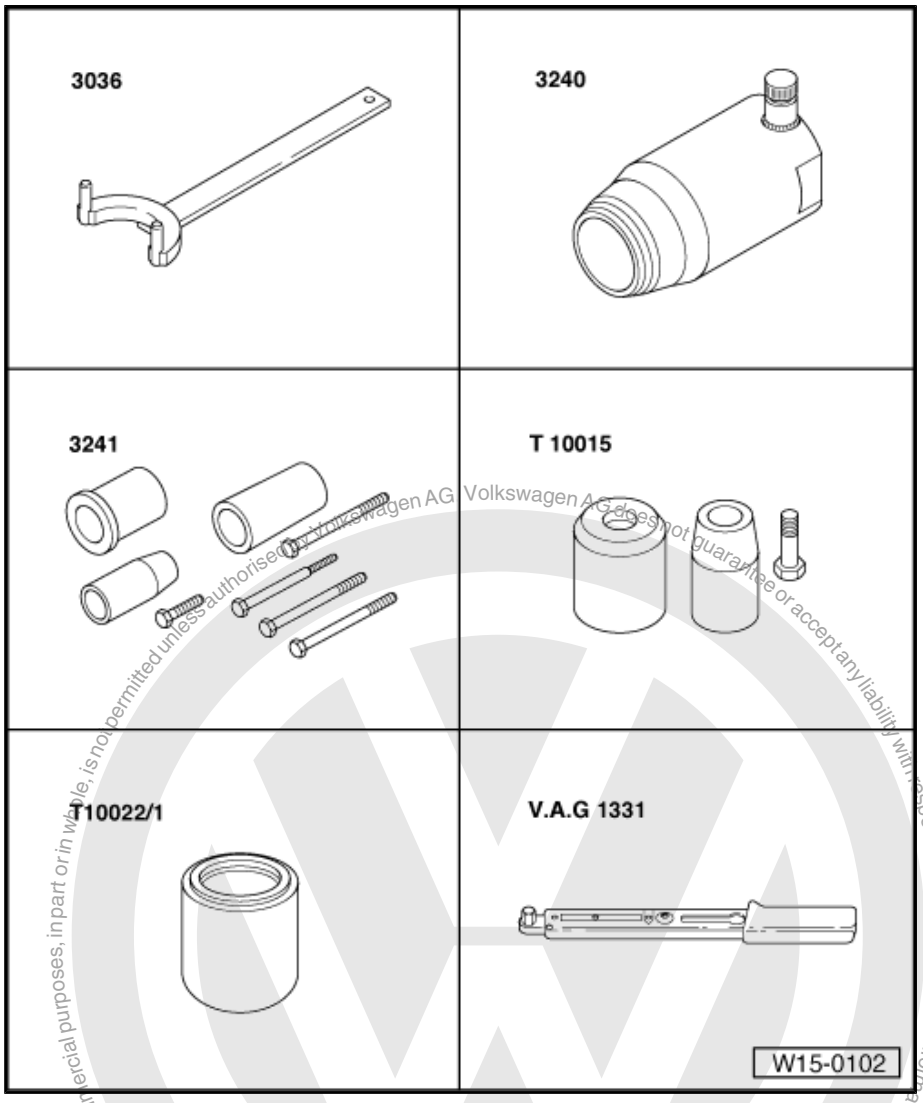
Valve seating rings (seats) may be repaired, provided that this grinding does not damage them.

2.2.3 Grinding exhaust valve seat



a = ∅ 26.6 mm
b = max. grinding specification allowed
c = max. 1.8 ...2.0 mm
Z = Lower cylinder head edge
α = 45° Valve seat angle
β = 30° Upper correction angle
γ = 60° Lower correction angle

2.3 Camshaft seal - replace



Special tools and workshop equipment required

- Special wrench -3036-
- Puller -3240-
- Fitting sleeves -3241-
- Fitter -T10015/3-
- Sleeve -T10022/1-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-

2.3.1 Removal

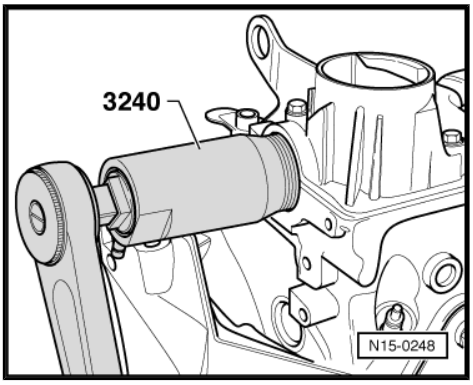
– Remove timing belt ⇒ page 41 .

– Remove camshaft gear. To loosen the bolt, immobilise the camshaft gear with the Special wrench -3036- .

– Remove mechanical distribution rear cover.

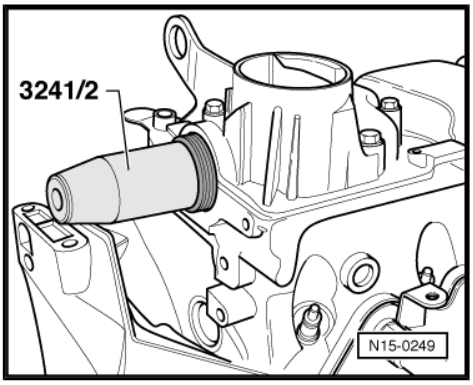
– For seal puller guide, fasten camshaft bolt manually up to the stop on the camshaft.

– Give the inside part of the Puller -3240- two turns (approx. 3 mm) from the external side, and lock with the splined bolt.
– Lubricate the puller threaded head, seat it and screw it applying as much force to the seal as possible.
– Loosen the splined bolt and turn the inner part against the camshaft until the seal is extracted.
– Loosen fastening screw used in the camshaft gear.



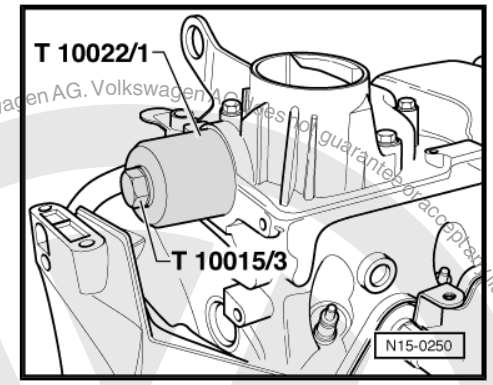
2.3.2 Installing

– Quickly lubricate with oil the seal lip.
– Install the Fitting sleeves -3241- on the camshaft trunnion.
– Move the seal through the guide sleeve.
– Remove guide sleeve.



– Press the seal with the Sleeve -T10022/1- and the Fitter -T10015/3- screw up to the stop. Insert a washer between the pressure sleeve and hexagonal head screw.
– Install the camshaft gear and tighten the new bolt (use the Special wrench -3036-) .Tightening torque: 20 Nm + 90°.
– Continue installation in removal reversed order.

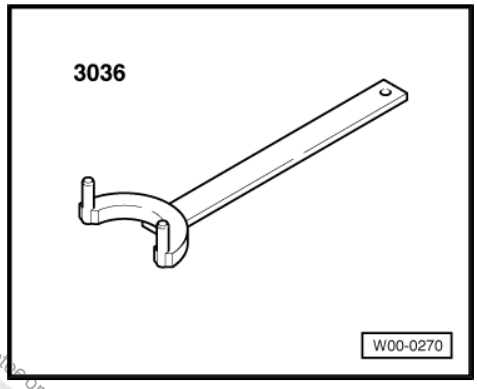
Installing the timing belt and adjusting the command times ⇒ page 41 .



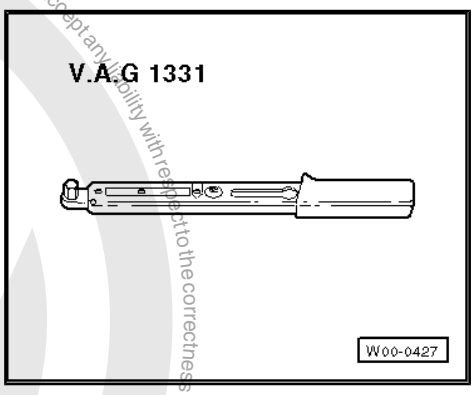
2.4 Camshaft and cylinder head cover - remove and install

Special tools and workshop equipment required

- Special wrench -3036-



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



- Seal -AMV 188 001 02-

2.4.1 Removal

Note

- *The sealing surfaces on cylinder head cover and on engine cylinder head cannot be worked.*
- *The camshaft bearings are integrated to the engine cylinder head and its cover. Before removing the cylinder head cover, loosen the timing belt.*
- *When loosing the cylinder head cover, replace the camshaft seal.*

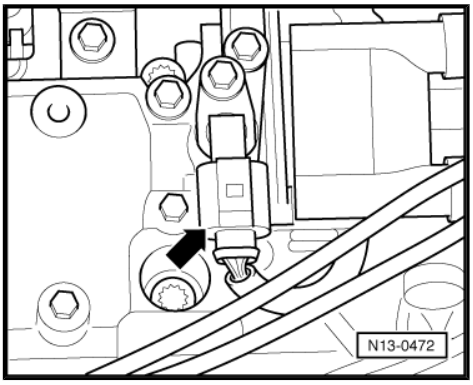
Operation sequence

Note

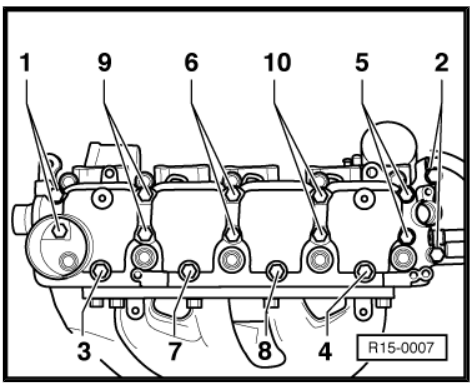
During the works, disconnect the battery earth strap. Check if the vehicle has code radio; if so, request respective anti-theft code.

– With the ignition switched off, disconnect the battery earth strap.
– Remove timing belt ⇒ page 41 .
– Remove camshaft gear. To loosen the bolt, immobilise the camshaft gear with the Special wrench -3036- .
– Loosen the three upper fastening bolts on the mechanical distribution rear cover.
– Loosen the ignition transformer bolts from the cylinder head cover.

– Disconnect the 3-pole connector for the Lambda Probe -G39- -arrow-.
– Remove the oil supply cover from the cylinder head cover, disengage and remove the protector.



– Loosen cylinder head cover screws in the indicated sequence, -Position 9- and -position 10-must be loosened alternately and in a cross pattern.
– Carefully remove cylinder head cover.
– Carefully remove the camshaft and place it on a clean surface.
– Remove the rockers together with the support elements and place them on a clean surface.
– Make sure the rockers and support elements are not mixed up.

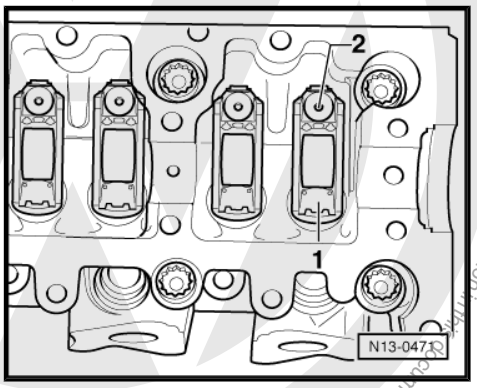


2.4.2 Installing

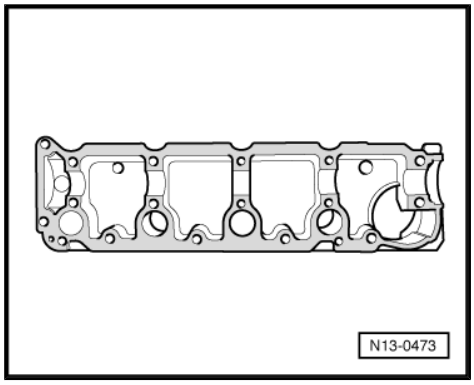
Conditions

- Prevent dirt and sealant residues from coming into the engine cylinder head.
- The sealing surfaces must be free from grease and oil.
- The cams in cylinder 1 must be facing upwards when installing the cylinder head cover into the camshaft.
- Pistons cannot be in the TDC.

– Remove sealant residues in the engine cylinder head and in its cover by using an ordinary sealant remover.
– Lubricate with oil the camshaft contact surfaces.
– Install support elements on the engine cylinder head and respective rockers.
– Make sure the rockers are properly positioned on the valve ends -1- and that the respective support elements -2- are properly coupled.
– Carefully install the camshaft on the engine cylinder head bearings.



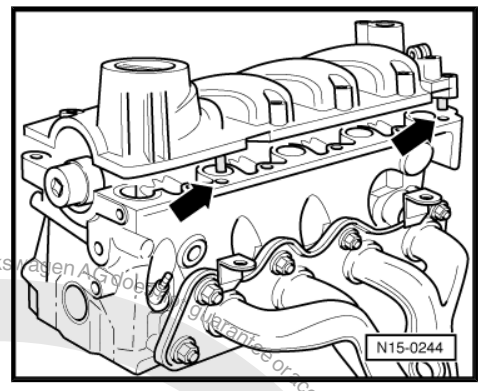
– Apply a thin and uniform film of sealant on the clean sealing surface of the cylinder head cover.



Note

Do not apply a thick film of sealant, otherwise, excessive sealant may penetrate in the lubricating channels or camshaft bearings, causing damages to the engine.

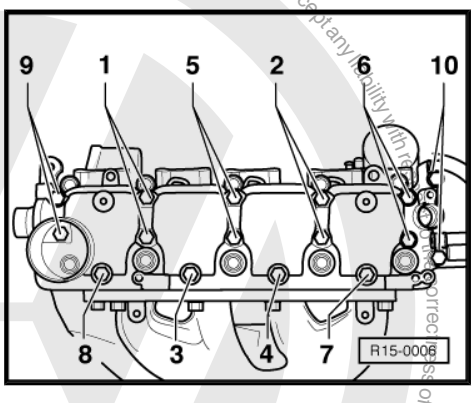
– Place the cylinder head cover carefully in the vertical position from top with the guide pins in the engine cylinder head holes -arrows-.



Note

- *The cylinder head must be fit and fastened without interruptions, as the sealing surfaces start to harden as soon as they contact each other.*
- *The cylinder head screws must be replaced.*

– First tighten the screws in -Position 1- and -Position 2- alternately and in cross pattern with 6 Nm.
– Then, tighten the other screws in the indicated sequence with 6 Nm.
– Then, tighten all screws 90° further.



Note

After installing the cylinder head cover, the sealant must dry for approx. 30 minutes.

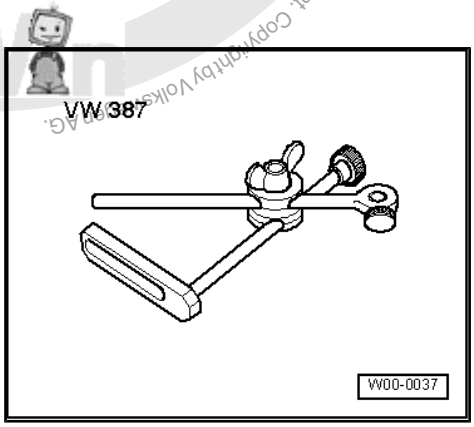
– Install ne new camshaft seal ⇒ page 58 .
– Continue installation in removal reversed order.

Installing the timing belt and regulating command times ⇒ page 41 .

2.5 Valve guides - check

Special tools and workshop equipment required

- Support -VW 387-



♦ Dial gauge

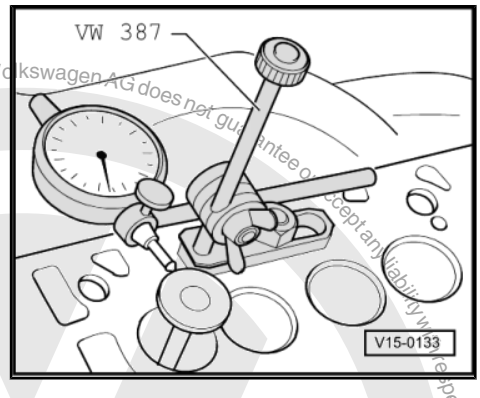
Test sequence

– Place a new valve on the guide. Valve end shall be aligned with guide. Due to the various valve guide diameters, we recommend using only one intake valve on intake guide and one exhaust valve on escape guide.

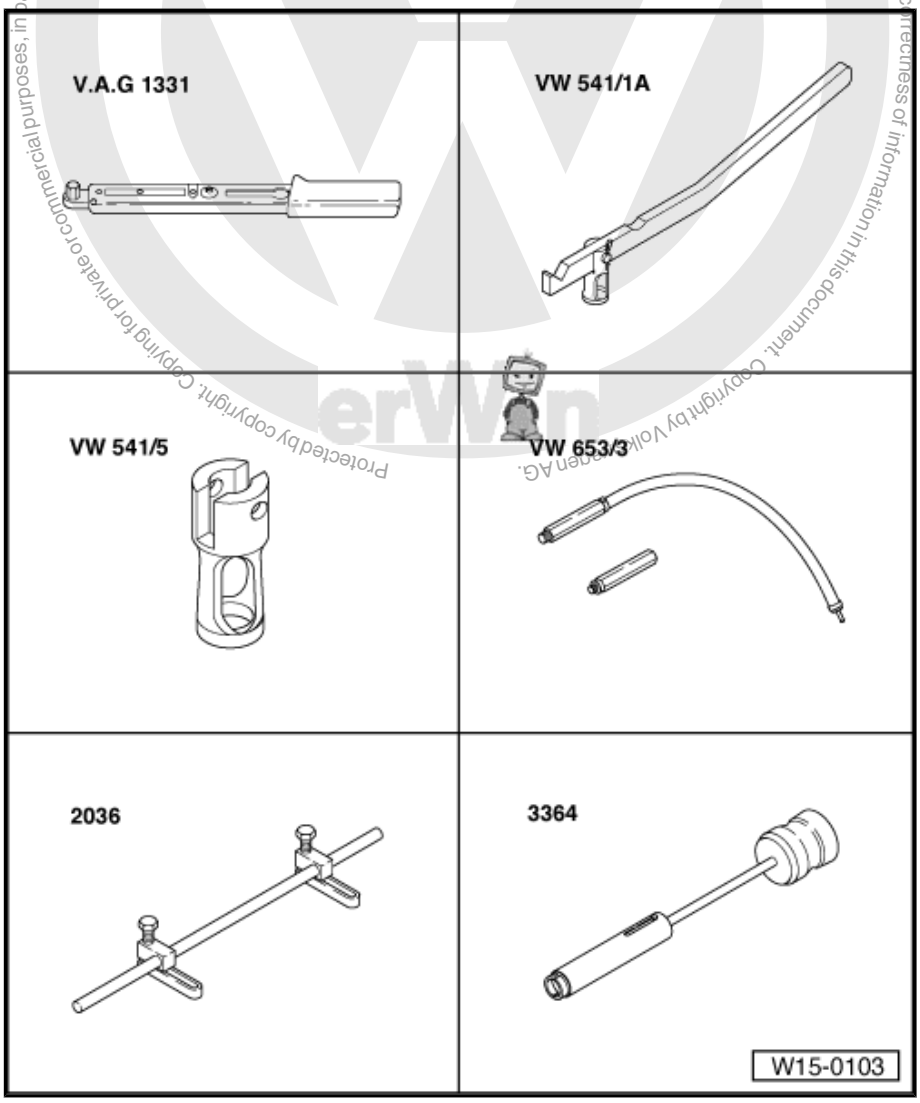
– Determine the tilting gap. wear limit: 0.8 mm.

In case the clearance is exceeded:

– Replace engine cylinder head.



2.6 Valve stem seal - replace

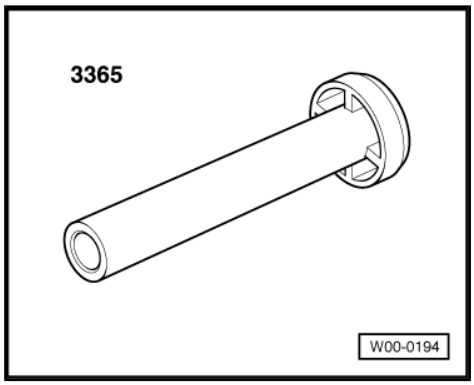


Special tools and workshop equipment required

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

♦ Lever -VW 541/1A-

- Flexible tube -VW 653/3-
- Device -2036-
- Impact extractor -3364-
- Seal fitter -3365-



2.6.1 Removal

– Remove timing belt ⇒ page 41 .

– Remove camshaft ⇒ page 59 .

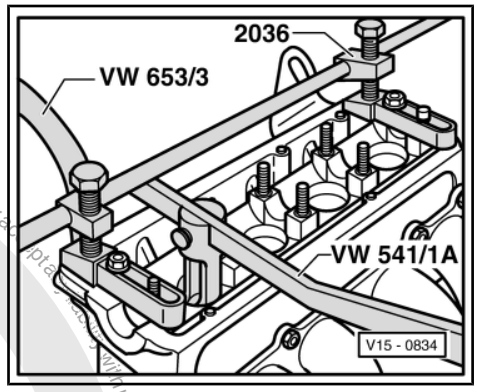
– Remove the rockers together with the support elements and place them on a clean surface.

– Make sure the rockers and support elements are not mixed up.

– Loosen spark plugs.

– Put the piston of the respective cylinder in the “Bottom Dead Centre”.

– Fasten the Device -2036- to the cylinder head with the used screws of the cylinder head cover.



– Screw the Flexible tube -VW 653/3- to the spark plug thread.

– Connect the pressure hose with at least 6-bar compressed air.

– Remove valve springs with the Lever -VW 541/1A- and Device -2036- .

Note

Stuck valve keys can be loosened by tapping slightly on the installation lever.

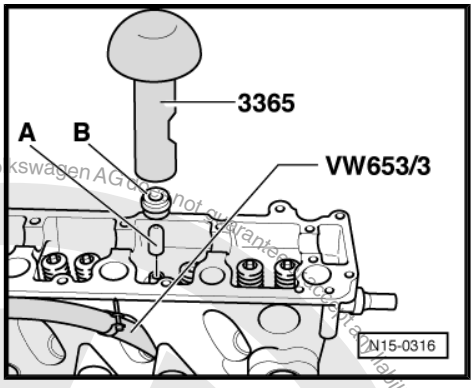
– Remove the valve seal with the Impact extractor -3364- .

2.6.2 Installing

– Install the plastic sleeve -A- supplied in the respective valve guide. This measure avoids damages to the new valve seal -B-.

– Put the new valve seal on the compressor with the Seal fitter -3365- .

– Lubricate the seal lip and carefully move the valve guide.



17 – Lubrication system

1 Lubrication system components - remove and install

Note

Oil level should not exceed the Max marking due to the risk of damages to the catalytic converter! Marks. *⇒ page 69*

WARNING

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

Check oil pressure ⇒ page 74 .

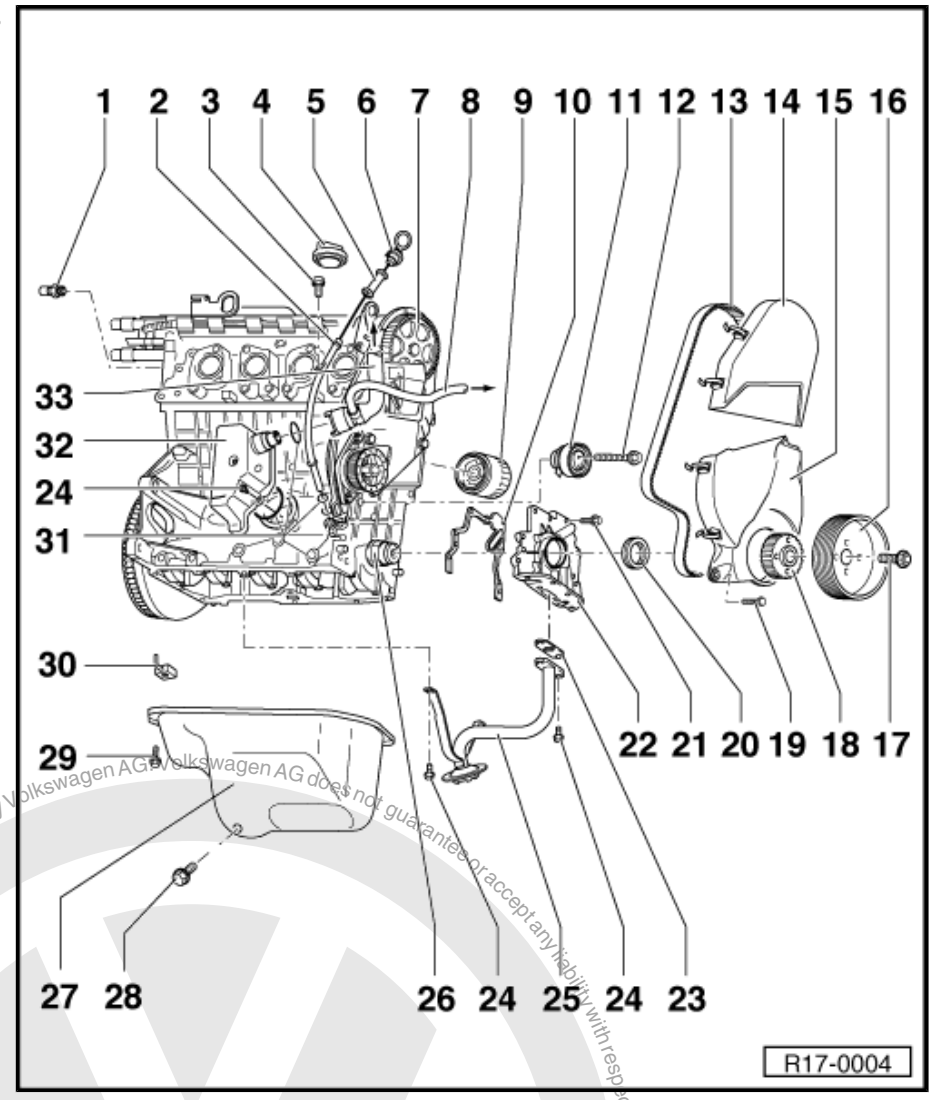
Oil supply quantities:

with oil filter 3.3 l.

Engine oil specification:

Use oils with high lubricating capacity as per VW 502 00 specification ⇒ Chemical Materials Manual .

1.1 Lubrication system - assembly overview



1 - Oil pressure switch -F1- , 25 Nm

- ❑ In case of leakage, cut and replace the sealing ring.
- ❑ Refer to ⇒ page 74 .

2 - Guide tube

3 - Self-tapping screw, 3 Nm

- ❑ Maximum rotation: 200 rpm.
- ❑ Fastened to the intake manifold.

4 - Oil supply cover

- ❑ Replace gasket, if damaged.

5 - Guide tube funnel

- ❑ Remove it in case of oil drainage by absorption.

6 - Oil dipstick

- ❑ Oil level shall not exceed the max. mark!
- ❑ Marks ⇒ page 69

7 - Camshaft gear

- ❑ Check installation position of timing belt .

8 - Up to the intake manifold.

9 - Oil filter

- ❑ Loosen it on the hex body or with the special oil filter assembly tool Sacador de filtro de óleo (14 faces) -VW 5005P- .
- ❑ Tighten manually.
- ❑ Follow installation instructions printed on the filter.

10 - Joint

- ❑ Replace.
- ❑ It must be installed on the guides.

11 - Tensioning pulley

- ❑ Check ⇒ page 38 .
- ❑ Timing belt: remove and install: adjust ⇒ page 41

12 - 20 Nm

13 - Timing belt

- ❑ Before removing, mark operation direction.
- ❑ Check the wear.
- ❑ Do not bend.
- ❑ Remove and install, adjust ⇒ page 41 .

14 - Mechanical distribution upper cover

15 - Mechanical distribution lower cover

16 - Crankshaft pulley

- ❑ Observe fastening while installing.
- ❑ Remove and install ⇒ page 41 .
- ❑ Remove and install Poly-V belt ⇒ page 14 .

17 - 90 Nm + 90°

- ❑ Replace after each removal.
- ❑ To loosen and tighten, use Spanner -3415- .
- ❑ Retightening can be performed in several stages.
- ❑ Retightening angle can be measured with the Hazet 6690.

18 - Crankshaft gear

- ❑ Check position while installing the timing belt ⇒ page 41 .

19 - 10 Nm

20 - Crankshaft seal (pulley side)

- ❑ Replace ⇒ page 18 .

21 - 10 Nm

22 - Front flange / oil pump

- ❑ Always replace complete set.
- ❑ Should fit on the adjustment guides.
- ❑ To remove and install, remove crankcase.
- ❑ While installing, observe the crankshaft dragging element.
- ❑ Oil pump, remove and install ⇒ page 71 .

23 - Joint

- ❑ Replace.

24 - 10 Nm

25 - Oil suction tube

- ❑ Clean strainer if soiled.

26 - Dragging element

- ❑ Lubricate with oil before installing the oil pump.

27 - Crankcase

- ❑ Remove and install ⇒ page 69 .
- ❑ Before installation, clean seating surface.
- ❑ With Silicone sealant -D 176 404 A2/A3- ⇒ page 69 .

28 - Oil drainage plug, 30 Nm

- ❑ With sealing ring.
- ❑ Replace.

29 - 15 Nm

- ❑ Replace.

30 - Oil injector and valve

- ❑ Not applicable.

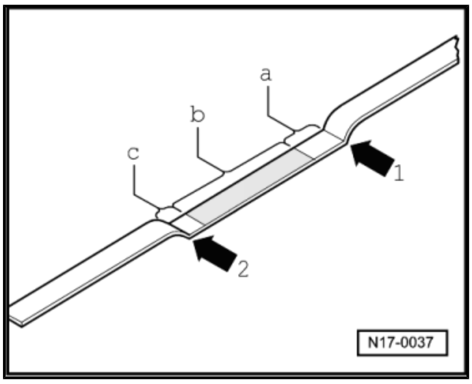
31 - Sealing ring

- ❑ Replace.

32 - Crankcase ventilation device.

33 - Up to the air filter

Marks on oil dipstick



1 - max. mark

2 - min. marks

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

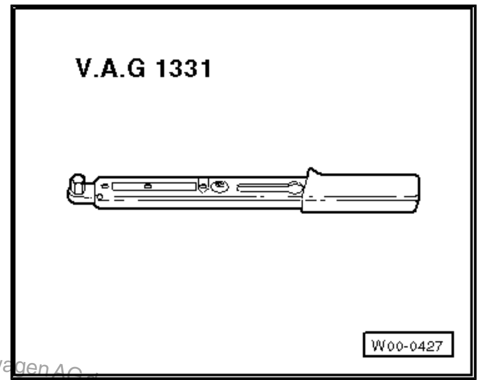
b - Oil level in the marked field: May be filled with oil

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

1.2 Oil crankcase - remove and install

Special tools and workshop equipment required

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



- ♦ Portable drill with plastic brush
- ♦ Flat spatula
- ♦ Goggles
- ♦ Silicone sealant -D 176 404 A2/A3-

1.2.1 Removal

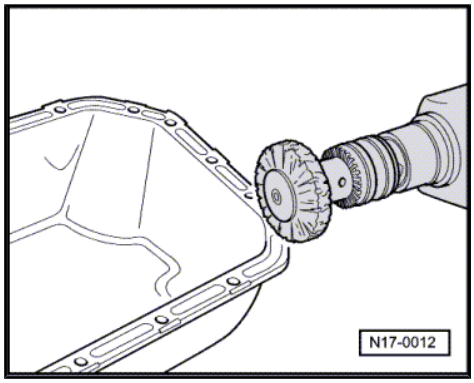
- – Remove engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .
- – Remove heat baffle off the exhaust manifold
- – Loosen front exhaust tube from exhaust manifold ⇒ page 132 .
- – Remove the clutch compartment cover.
- – Drain engine oil.

Note

Comply with the regulation regarding oil wear!

- – Remove the four internal fastening bolts in the oil crankcase, on the pulley side.
- – Loosen the other fastening bolts in the oil crankcase.
- – 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 goggles).
– Clean the sealing surfaces. They must be free of oil and grease.

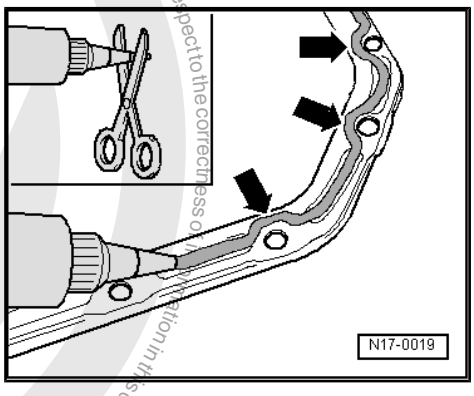


1.2.2 Installing

Note

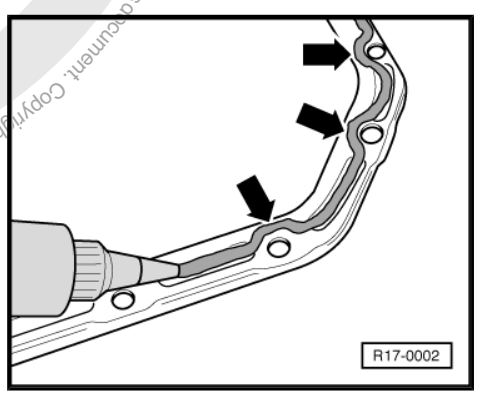
- *Check the sealant expiration date.*
- *The crankcase must be installed within 5 minutes after applying the silicone sealant.*
- *The oil crankcase may be easily and safely installed by putting threaded pins M6 in two points in the engine block flange.*

– Cut the tube injector on front marking (∅ 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

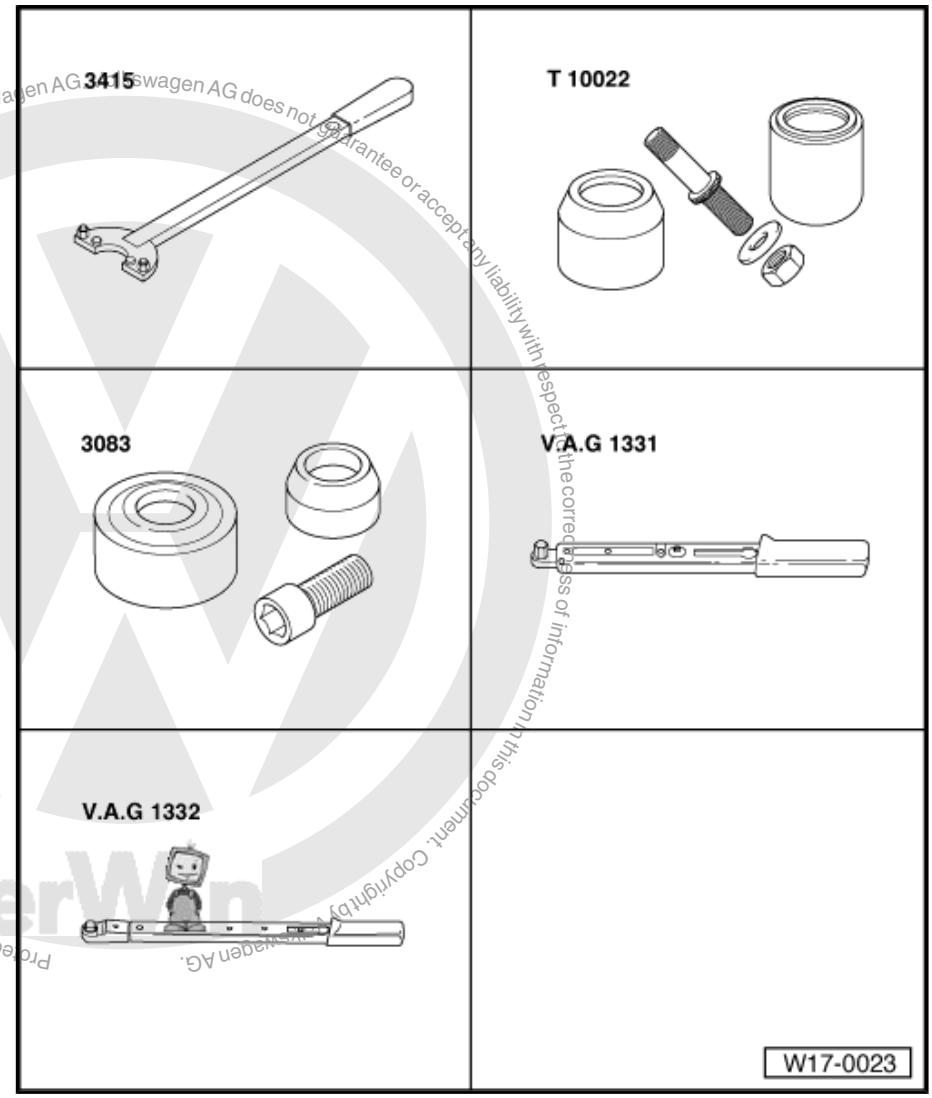
Sealing cord may not be thicker, otherwise excess sealant may drop into crankcase and block suction tube strainer.

– Install crankcase immediately and slightly tighten all the bolts.
– Tighten bolts to 15 Nm.

Note

After installing the oil crankcase, seal must dry for approximately 30 minutes. After this period, the oil may be refilled

1.3 Oil pump - remove and install



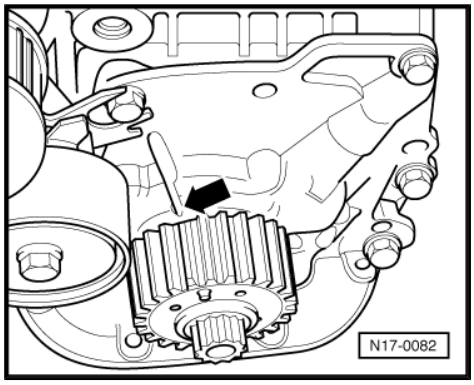
Special tools and workshop equipment required

- Spanner -3415-
- Assembly sleeve -T10022-
- Fitting Device -3083-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-

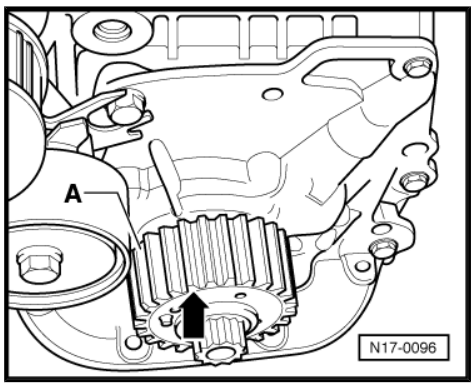
1.3.1 Removal

– Remove timing belt ⇒ page 41 .

– Put the crankshaft in cylinder 1 TDC -arrow-: The chamfered tooth on the crankshaft gear must match the mark “2V” on the oil pump.



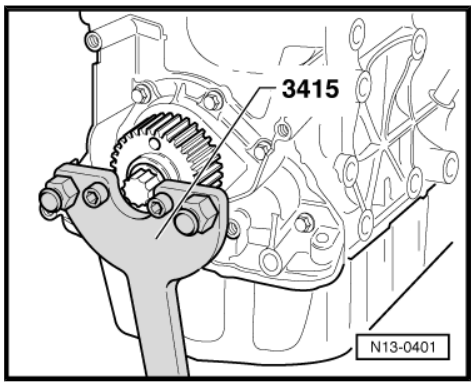
– Turn the crankshaft or gear in the TDC, three teeth in counter clockwise direction: On the right side of the gear flat -A-tooth, the third tooth -arrow-must be aligned with the TDC mark “2V” on the oil pump housing.



Note

With this adjustment, the crankshaft is in the position for installing the oil pump. One of the four dragging polygonal cams on the crankshaft will be on top.

– Remove the crankshaft gear. For that, immobilise it with the Spanner -3415- .
– Remove timing belt tensioning element.
– Remove oil crankcase ⇒ page 69 .
– Remove oil suction tube ⇒ Item 25 (page 68) .
– Remove oil pump.
– Remove the sealing gasket.
– Remove seal residues on engine block with a flat spatula.
– Clean the sealing surfaces, which must be free from grease and oil.

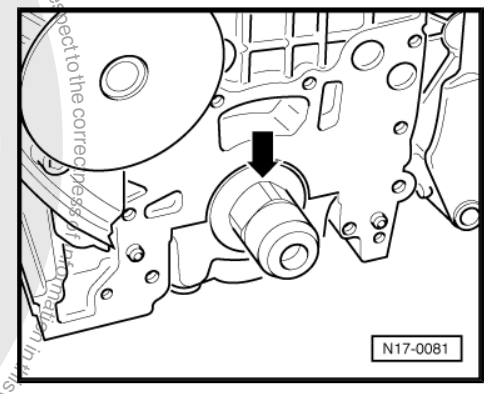


1.3.2 Installing

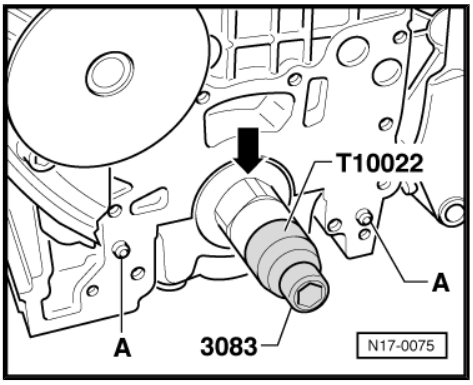
Conditions

- One of the four dragging polygonal cams on the crankshaft should be on top.

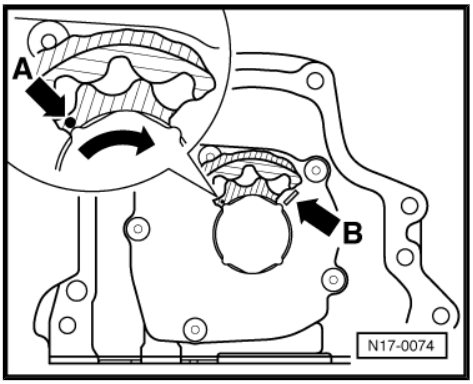
Operation sequence



– Position the Allen screw of the Fitting Device -3083- with an Assembly sleeve -T10022- on the crankshaft and tighten manually.
– Install the new sealing gasket on the guides -A-.

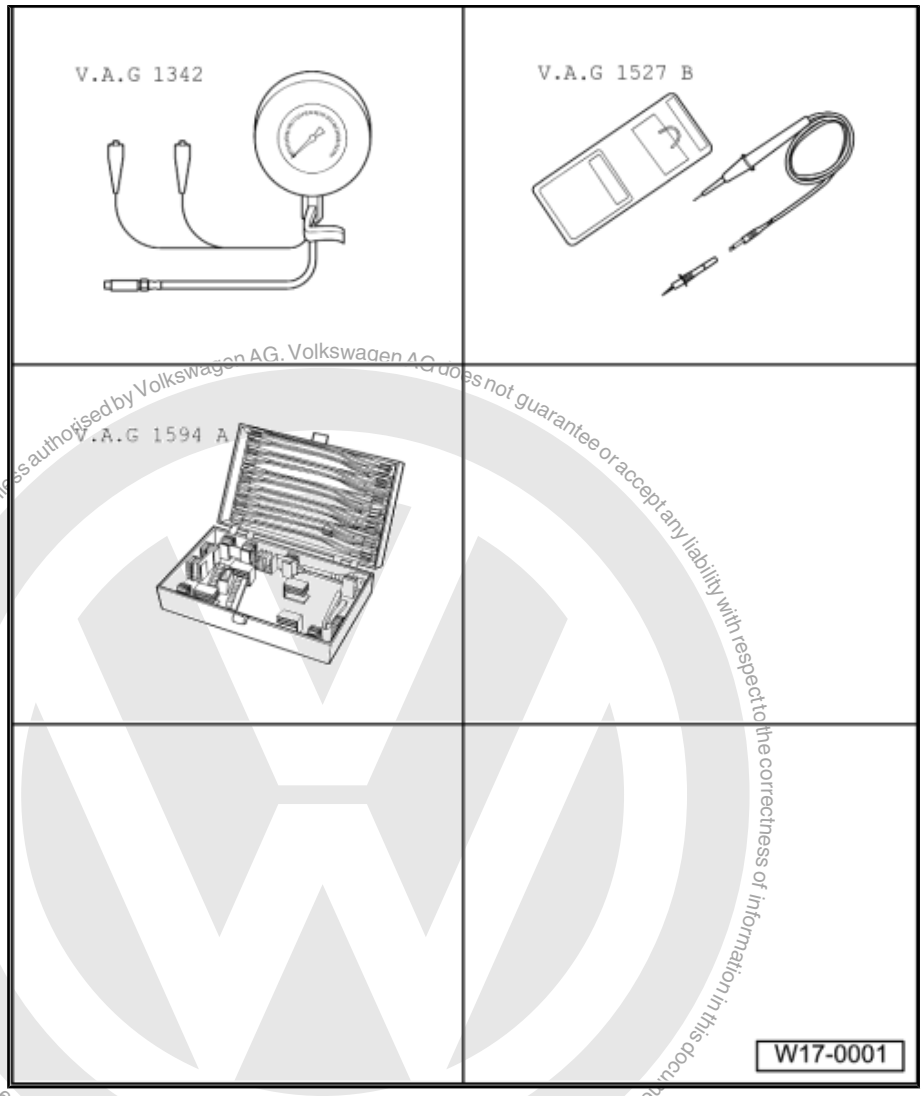


– Put the mark -arrow A-for the oil pump inner rotor in the installation position - mark -arrow B- for the oil pump housing cover.
– Apply oil on the for dragging polygonal cams on the crankshaft.
– Carefully place the oil pump on the four dragging polygonal cams on the crankshaft.
– If necessary, align the inner rotor by slightly turning the four dragging polygonal cams on the crankshaft.
– Then carefully move the oil pump over the guides.
– Screw the oil pump. Tightening torque: 10 Nm.
– Remove assembly sleeve -T10022- .
– Install oil suction tube ⇒ Item 25 (page 68) .
– Install crankcase ⇒ page 69 .



Installing the timing belt and adjusting the command times ⇒ page 41 .

1.4 Oil pressure and Oil pressure switch -F1- - check



Special tools and workshop equipment required

- Oil pressure gauge -VAG 1342-
- Test probe or VAG 1527B -EQ 7300-
- Auxiliary measuring cable set -VAG 1594C-

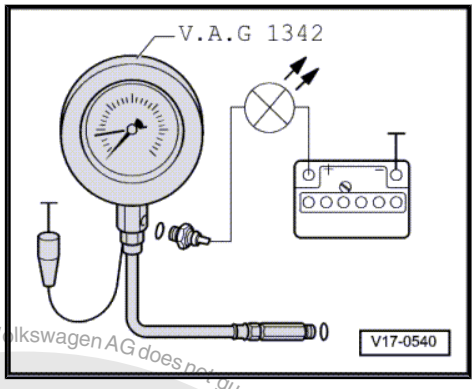
Test conditions

- Engine oil level ok, check ⇒ page 69
- Engine oil temperature must be at least 80°C (cooling system fan must have worked once).

Note

Operation and repair 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 engine cylinder head.
– Put tester brown wire on the earth (-).
– Connect the Test probe or VAG 1527B -EQ 7300- using Aux. measuring cable set -VAG 1594C- to battery positive (+) terminal and oil pressure switch. The LED shall not light up.
– If it the LED lights up, replace the Oil pressure switch -F1- .

If LED does not light up:

– Operate the engine and increase the speed slowly. with 0.3...0.6-bar pressure, the LED should light up, 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 7.0 bar.

19 – Cooling system

1 Cooling system components - remove and install

⚠ 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.*

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 the VAS 5024A or Standart-type clamp pliers -VW 5162- or the Clamp pliers -VAG 1921- .*
- *The cooling system hoses should be installed without tension and without coming into contact with other components (observe the marks on the cooling system connection on the hose).*

Check the cooling system leaks with the Engine cooling system tester -VAG 1274- e com o Adapter for VAG 1274 -VAG 1274/8- and the Adapter for VAG 1274 -VAG 1274/9- .

Cooling system components, body side ⇒ page 77 .

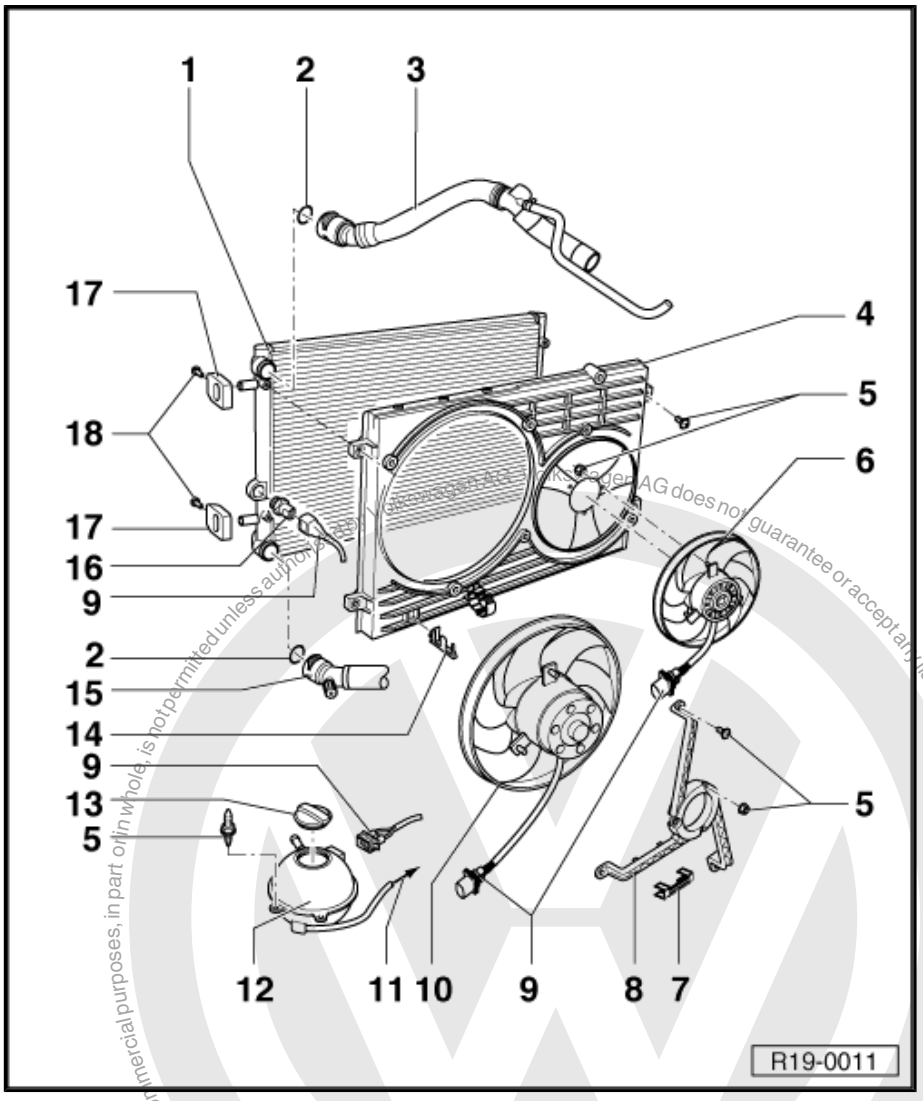
Cooling system components, engine side ⇒ page 78 .

Cooling system hose connection diagram ⇒ page 81 .

Drain and replenish the cooling system ⇒ page 82 .

Instructions for coolant mixture ⇒ page 83 .

1.1 Cooling system components, body side



1 - Radiator

- ❑ Remove and install ⇒ page 85 .
- ❑ After replacement, exchange all coolant.

2 - Fastening pin

- ❑ Replace.

3 - Upper cooling system hose

- ❑ Fastened to the radiator through a clip.
- ❑ Make sure it is well fastened.
- ❑ Cooling system hose connection diagram ⇒ page 81 .

4 - Wind deflector

5 - 10 Nm

6 - Right radiator fan. -V35-

- ❑ In vehicles with air conditioning up to 20/03/2006.

7 - Clip

- ❑ Make sure it is well fastened.

8 - Support

- ❑ For electric fan.

9 - Connector

- ❑ For Radiator fan -V7- .
- ❑ Not applicable.

10 - Radiator fan -V7-

11 - For cooling system thermostat valve body

- ❑ Cooling system hose connection diagram ⇒ page 81 .

12 - Coolant reservoir

Check for cooling system leaks using the Engine cooling system tester -VAG 1274- and the Adapter for VAG 1274 -VAG 1274/8- .

13 - Cover

Check for cooling system leaks using the Engine cooling system tester - VAG 1274- and the Adapter for VAG 1274 - VAG 1274/9- .

- ❑ Test pressure 1.4 ... 1.6 bar.

14 - Support

- ❑ For radiator fan connector -V7- .

15 - Lower cooling system hose

- ❑ Fastened to the radiator with retaining clip.
- ❑ Make sure it is well fastened.
- ❑ Cooling system hose connection diagram ⇒ page 81 .

16 - Radiator fan thermal switch -F18- , 35 Nm

- ❑ For Radiator fan -V7- .
- ❑ Not applicable.

17 - Support

- ❑ For radiator.
- ❑ Observe installation position.
- ❑ Observe various models.

18 - 10 Nm

1.2 Cooling system components, engine side

1 - Flange

2 - 9 Nm

3 - Fastening pin

- ❑ Replace.

4 - Thermostat valve

- ❑ Check the operation: Heat the valve in water. The thermal element pin should move outwards.
- ❑ Temperature test: Opening start (approx. 84 °C) and opening end (approx. 98 °C) cannot be performed.

5 - For heat exchanger

- ❑ Cooling system hose connection diagram ⇒ page 81 .

6 - For coolant reservoir

- ❑ Cooling system hose connection diagram ⇒ page 81 .

7 - Thermostat valve body

8 - From the heat exchanger

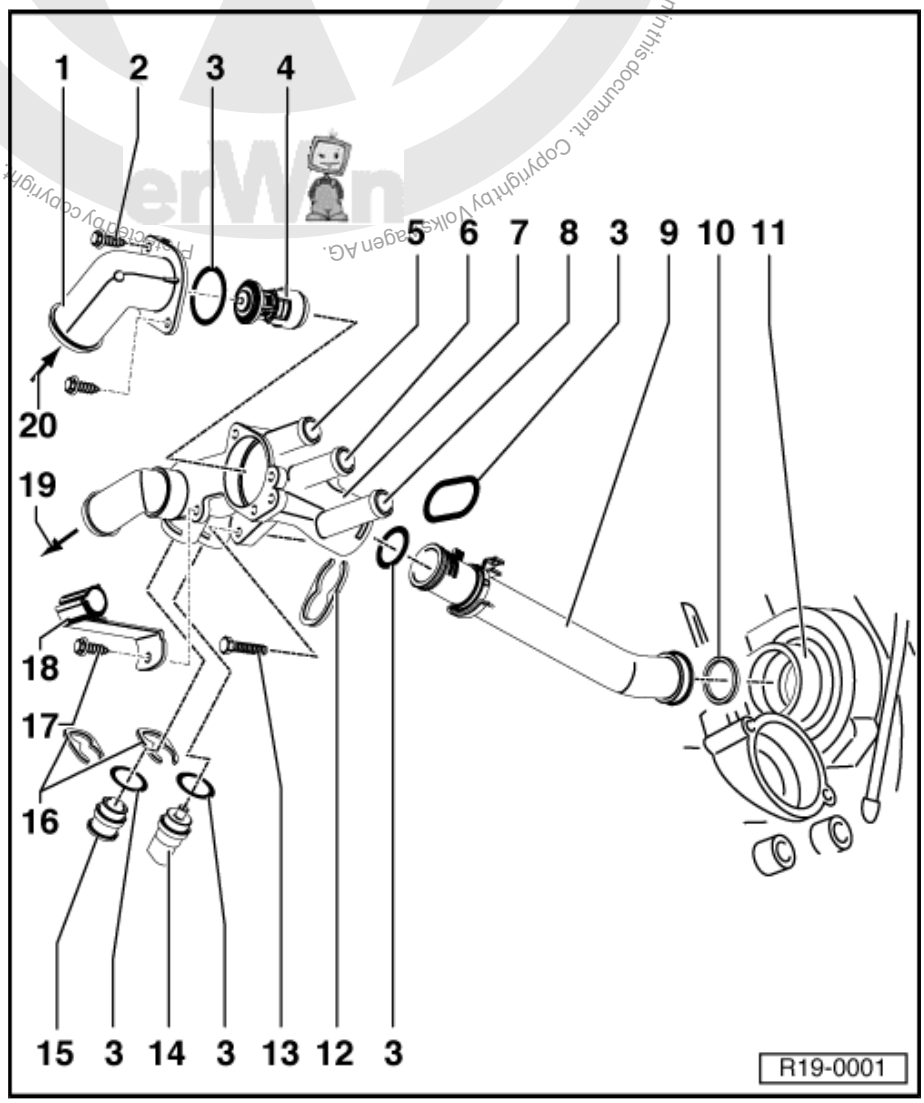
- ❑ Cooling system hose connection diagram ⇒ page 81 .

9 - Cooling system pipe

- ❑ Cooling system hose connection diagram ⇒ page 81 .

10 - Sealing ring

- ❑ Replace.



11 - Engine block water pump housing

12 - Clip

- ❑ Make sure it is well fastened.

13 - 10 Nm

14 - Cooling system temperature sensor -G62-

- ❑ For Engine control unit -J623- .

❑ If necessary, depressurize the system before removal.

15 - Plug

❑ If necessary, depressurize the system before removal.

16 - Clip

❑ Make sure it is well fastened.

17 - 6 Nm

18 - Support

19 - For the radiator, below

❑ Cooling system hose connection diagram ⇒ page 81 .

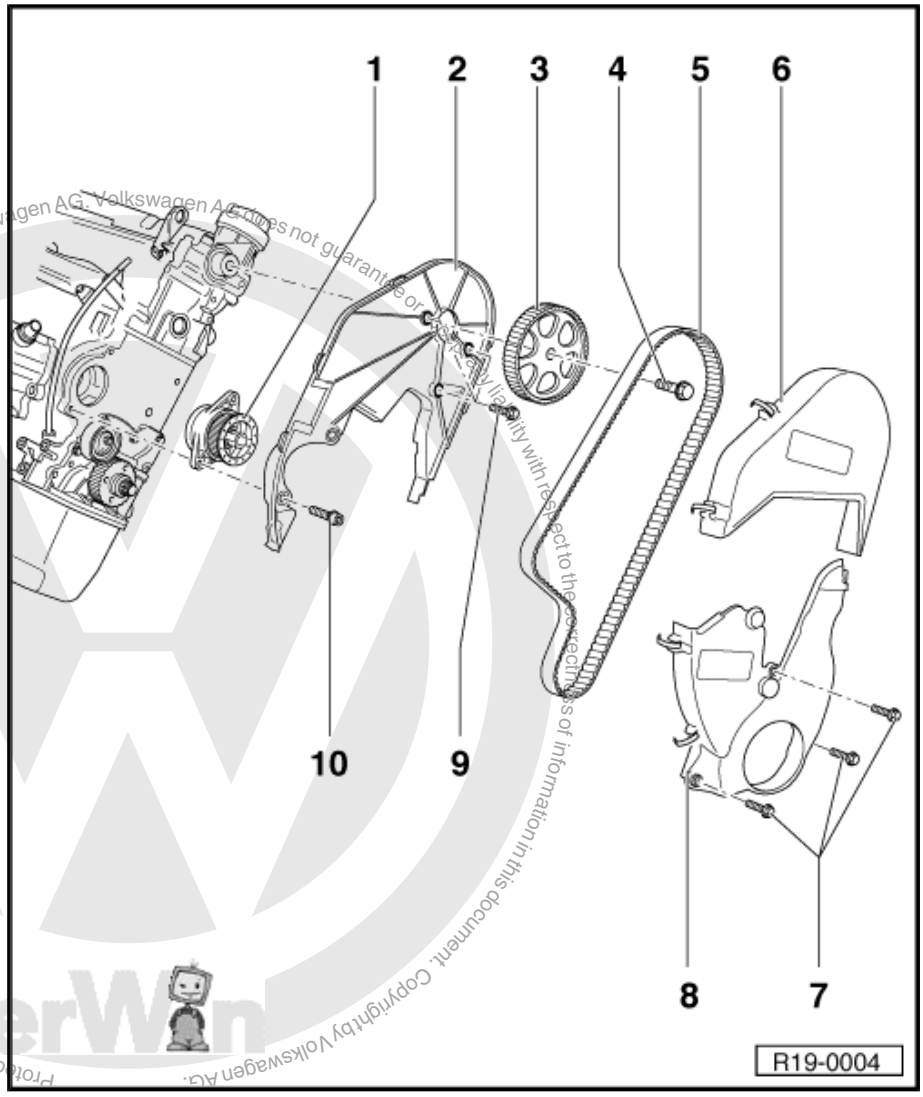
20 - For the radiator

❑ Cooling system hose connection diagram ⇒ page 81 .

1.2.1 Water pump side

WARNING

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



1 - Water pump

- ❑ With integrated sealing gasket.
- ❑ The sealing gasket must not be separated from the water pump.
- ❑ In case of faults and leaks, replace the entire pump together with the sealing.
- ❑ Check smooth operation.
- ❑ Remove and install ⇒ page 87 .

2 - Mechanical distribution rear cover

3 - Camshaft gear

- ❑ Observe fastening during installation.
- ❑ Check installation position of timing belt ⇒ page 41 .

4 - 20 Nm + 90°

- ❑ Replace after each removal.
- ❑ To loosen and tighten, immobilise the camshaft gear with the Special wrench -3036- .

5 - Timing belt

- ❑ Mark rotation direction before removal.
- ❑ Check the wear.
- ❑ Do not bend.
- ❑ Remove and install, adjust ⇒ page 41 .

6 - Mechanical distribution upper cover

7 - 10 Nm

8 - Mechanical distribution lower cover

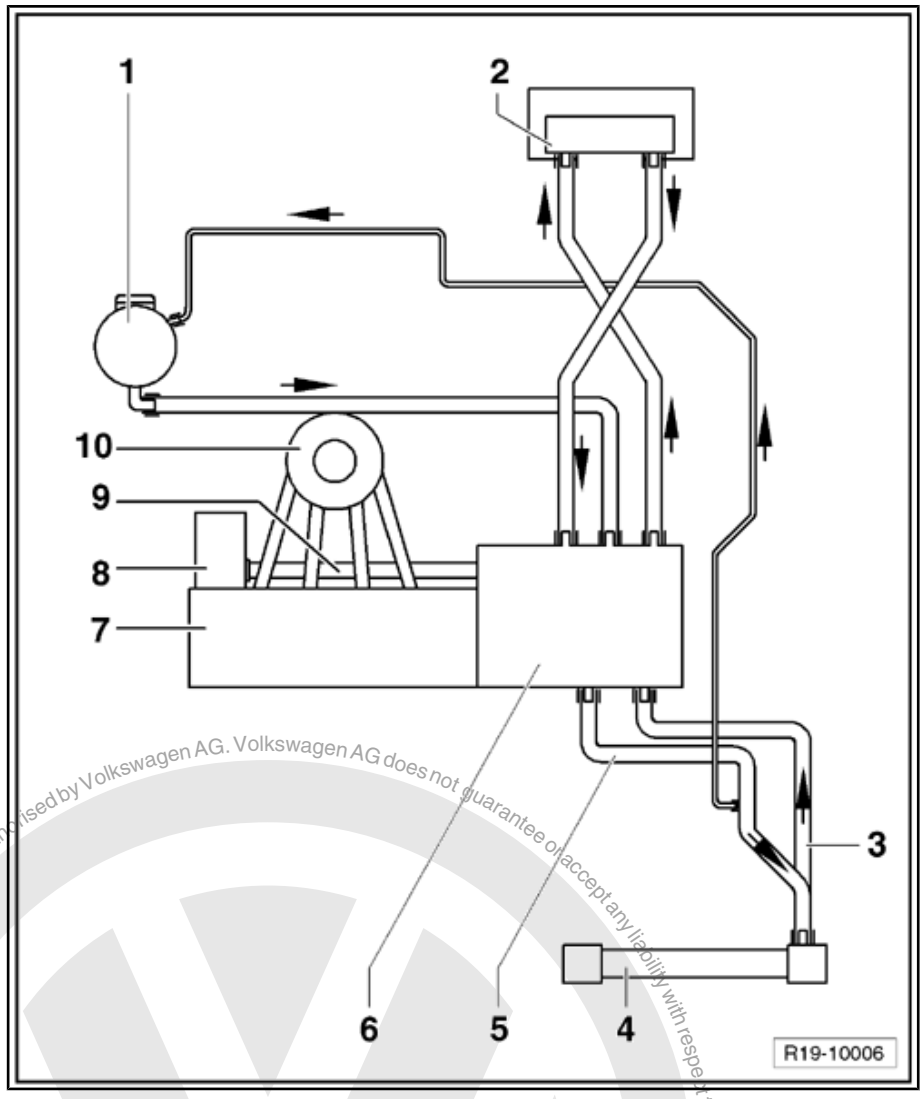
9 - 10 Nm

- ❑ Apply with -D/00 600/A2- .

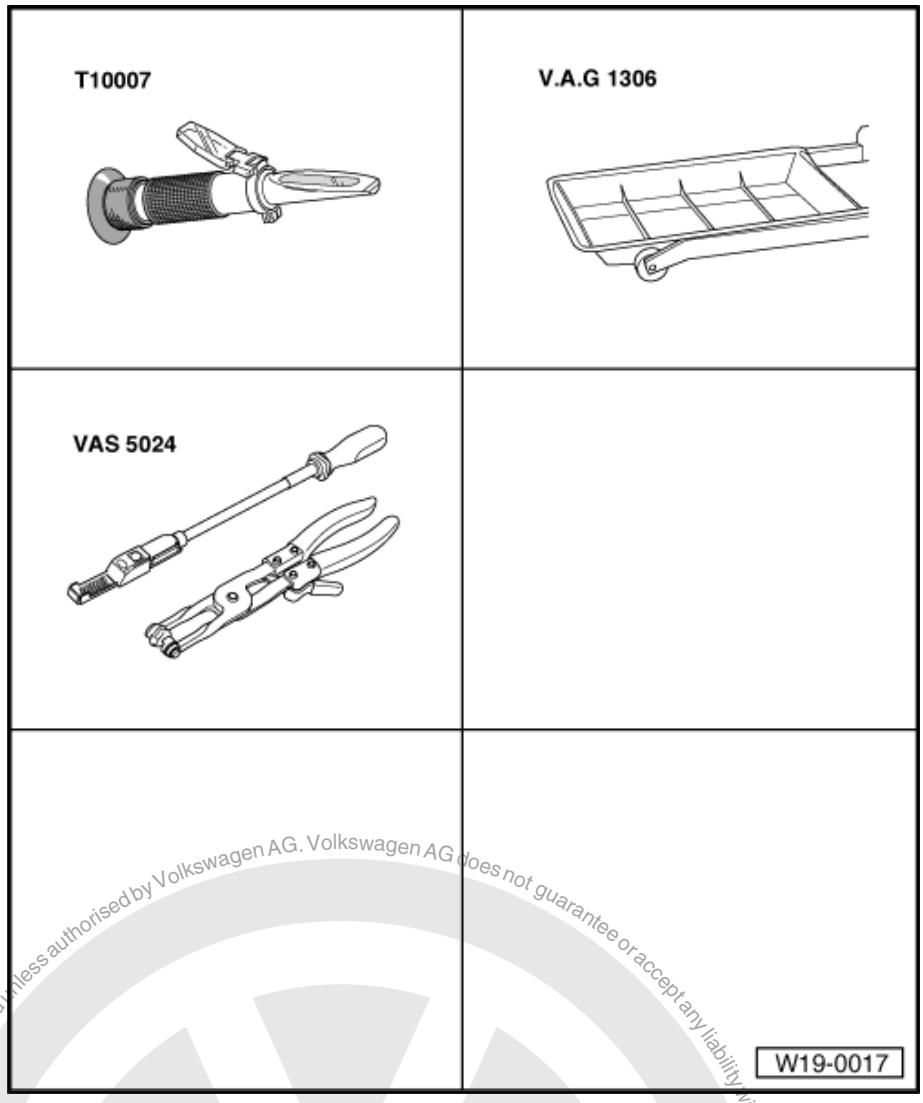
10 - 20 Nm

1.3 Cooling system hose connection diagram

1 - Coolant reservoir
2 - Heat exchanger
3 - Lower cooling system hose
4 - Radiator
5 - Upper cooling system hose
6 - Thermostat valve body
7 - Engine cylinder head / engine block
8 - Water pump
9 - Cooling system pipe
10 - Suction tube



1.4 Cooling system - drain and replenish



Special tools and workshop equipment required

- Refractometer for T 10007 or cooling system fluid analysis -EQ 7093-
- Oil sump -VAG 1306-
- VAS 5024A or Standart type clamp pliers -VW 5162-

No illustration:

- Cooling system supply unit -VAS 6096-

1.4.1 Drain

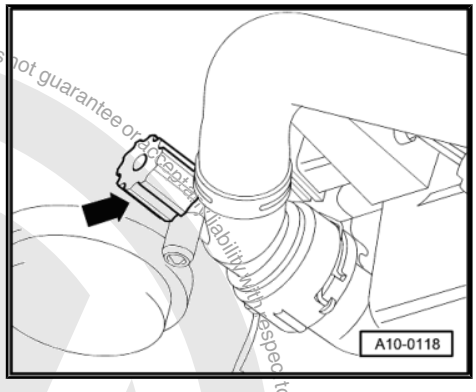
WARNING

Hot vapours may escape when the coolant reservoir is opened; cover it with a cloth and open carefully.

– Open coolant reservoir cover.

– Remove engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .

– Loosen the radiator coolant drainage plug -arrow-.



Note

Follow the recommendations for coolant disposal!

1.4.2 Replenish

Note

- *Only antifreeze additive G12 is allowed, according to TL VW 774 D standard. It is identified by the colour red.*
- *Never mix G12 with other antifreeze additives.*
- *If fluid in reservoir is brown, that indicates it has been mixed with other antifreeze. In that case, replace the whole coolant.*
- *G12 and antifreeze additives "in compliance with TL VW 774 D" indication prevent damages due to corrosion, freezing or sludge formation, increasing even more the coolant boiling temperature . For these reasons, cooling system must always have the prescribed mix of antifreeze and anti-corrosion products.*
- *Especially in tropical countries, antifreeze helps, due to the high boiling temperature it provides, to ensure operation safety when engine is submitted to heavy-duty operation.*
- *Antifreeze protection must be ensured until nearly -25 °C (in arctic climate countries, until nearly -35 ° C).*
- *Coolant concentration must not be reduced by adding water during hot seasons, or in hot countries. Antifreeze proportion shall be at least 40 %.*
- *If the climate requires more antifreeze protection, G12 percentage may be increased, but only until 60 % (antifreeze protection up to -40 °C). The higher protection lowers cooling capacity and antifreeze protection.*
- *To determine the antifreeze protection density, use the Refractometer for cooling system liquid analysis or T 10007 -EQ 7093- .*
- *When replacing the radiator, heat exchanger, cylinder head or cylinder head gasket, used coolant should not be reused.*

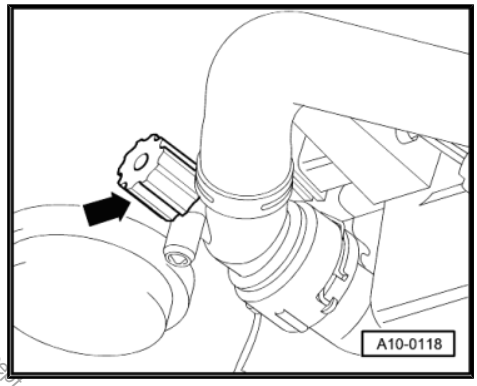
Recommended mixture proportions:

Antifreeze protection until	Antifreeze proportion	G 12[7)]	Water[7)]
-25 °C -35 °C	40 % 50 %	2.25 l 2.8 l	3.35 l 2.8 l

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

– Close the cooling system -arrow- drainage plug.

– Install engine compartment lower noise insulation ⇒ Body – Repair; Rep. Gr. 50 ; Body - Front part .

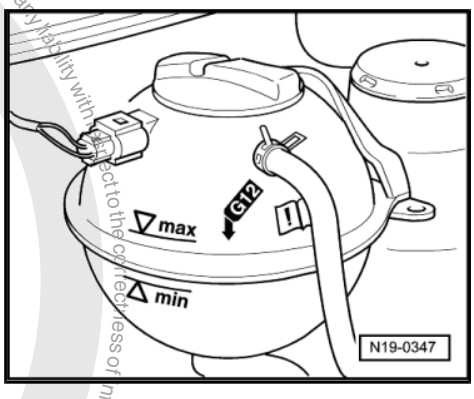


With Cooling system supply unit -VAS 6096-

– 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-

– Fill with coolant up to the -max.- mark on the coolant reservoir.



With or without the Cooling system supply unit -VAS 6096-

– Close the coolant reservoir.

– Turn off heating system.

– Start engine and maintain a speed of about 2,000 rpm for approx. 3 minutes.

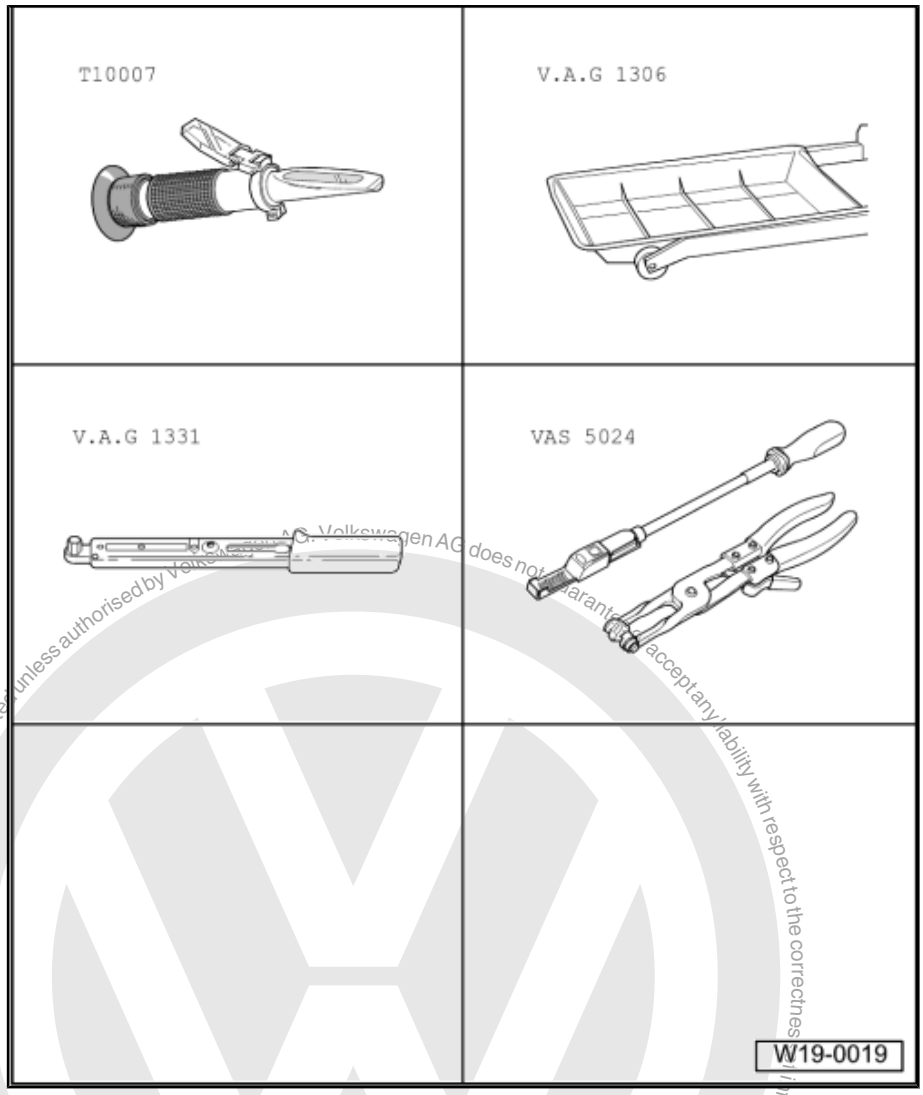
– Run engine until the radiator fan starts.

WARNING

Hot vapours may escape when the coolant reservoir is opened; cover it with a cloth and open carefully.

– 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 T 10007 or cooling system fluid analysis - EQ 7093-
- Oil sump -VAG 1306-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- VAS 5024A or Standart type clamp pliers -VW 5162-

1.5.1 Removal

– Remove bumper cover ⇒ General body repairs, exterior; Rep. Gr. 63 ; Bumpers .

– Remove front panel ⇒ General body repairs, exterior; Rep. Gr. 50 ; Body - Front part .

– Drain the cooling system ⇒ page 82 .

– Loosen quick couplings from the radiator cooling system hoses.

– Remove the radiator fan connector - V7- .

– Loosen radiator securing bolts and remove the radiator with Radiator fan -V7- .

Vehicles with air conditioning

– Observe additional indications and installation works ⇒ page 86 .

1.5.2 Installing

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

– Fill cooling system ⇒ page 82 .

– Install front panel ⇒ General body repairs, exterior; Rep. Gr. 50 ; Body - Front part .

– Install bumper cover ⇒ General body repairs, exterior; Rep. Gr. 63 ; Bumpers .

1.5.3 Additional notes and installation works in vehicles with air conditioning

WARNING

Air conditioning cooling gas circuit should not be opened.

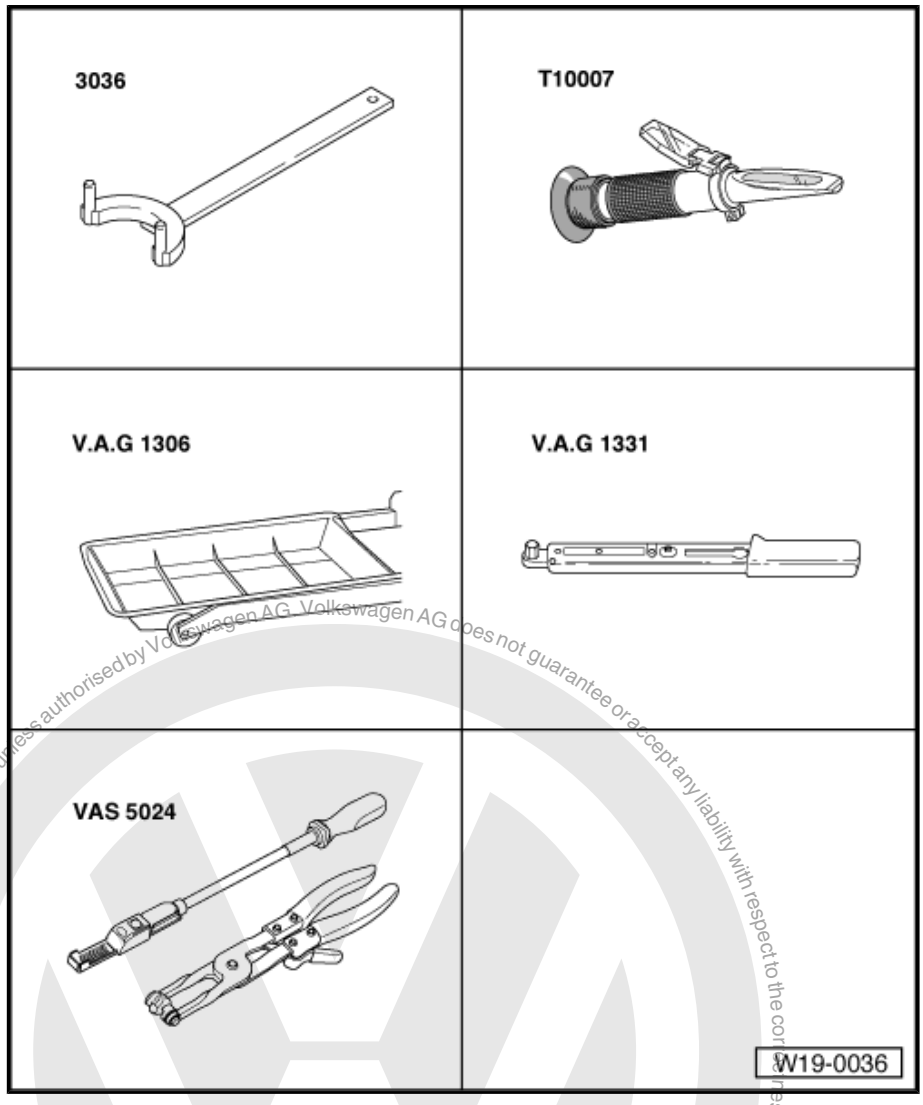
Note

To prevent faults in the cooling gas hoses and condenser, make sure the hoses are not stretched, bent or crushed.

– Loosen cooling gas hose retaining clamp(s).

– Loosen radiator condenser and support it.

1.6 Water pump - remove and install



Special tools and workshop equipment required

- Special wrench -3036-
- Refractometer for T 10007 or cooling system fluid analysis - EQ 7093-
- Oil sump -VAG 1306-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- VAS 5024A or Standart type clamp pliers -VW 5162-

Note

- *Water pump integrated sealing may not be separate from the pump.*
- *In case of faults and leaks, replace the entire pump together with the sealing.*

1.6.1 Removal

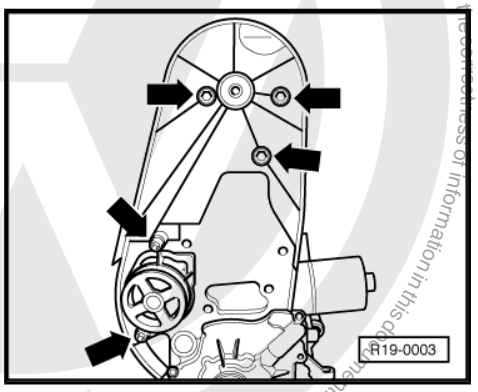
– Drain the cooling system ⇒ page 82 .

– Remove timing belt ⇒ page 41 .

– Remove the camshaft gear. To loosen the bolt, immobilise the gear with the Special wrench -3036- .

– Loosen fastening bolts-arrows- from the water pump and mechanical distribution rear cover.

– Remove the water pump together with the engine block mechanical distribution rear cover .



1.6.2 Installing

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

– Install the water pump with the mechanical distribution rear cover and tighten the lower fastening bolts. Tightening torque: 20 Nm.

– Tighten the three upper fastening bolts on the mechanical distribution rear cover. Tightening torque: 10 Nm (put with -D/ 00 600/A2/-).

– Install the camshaft gear and tighten the new bolt (use the Special wrench -3036 -). Tightening torque: 20 Nm + 90°.

Installing the timing belt and regulating command times ⇒ page 41 .

Replenish the system with new coolant ⇒ page 82 .

20 – Supply system - Fuel tank, fuel pump

1 Fuel supply system components - remove and install

Note

- *The hose connections are fastened by spring clamps and quick coupling.*
- *To fasten the fuel hoses to the engine, use spring clamps only. Using tightening or bolted clamps is not allowed.*
- *To install spring clamps, we recommend using the VAS 5024A or Standart-type clamp pliers -VW 5162- or the Clamp pliers -VAG 1921- .*

Follow safety measures ⇒ page 92 .

Follow cleaning rules ⇒ page 92 .

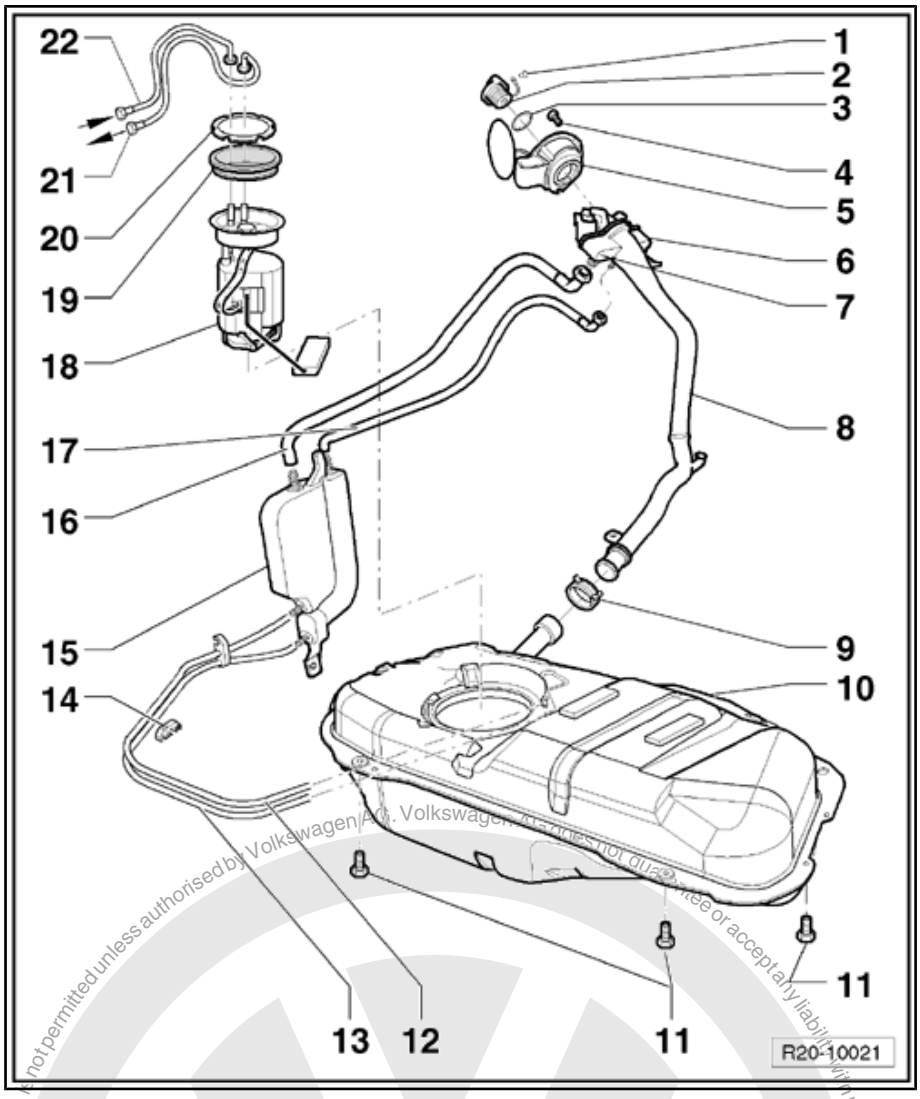
Remove and install fuel tank ⇒ page 95 .

Remove and install accessories and fuel filter from/in the fuel tank. ⇒ page 90 .

Repair engine power electronic adjustment parts (electronic accelerator) ⇒ page 105 .

Repair the activated charcoal filter system components ⇒ page 108 .

1.1 Fuel tank components with accessories and fuel filter - remove and install



1 - Fastening clip

2 - Tank lid

3 - Sealing ring

- ❑ Replace if damaged.

4 - Fastening bolt

5 - Fuel supply nozzle compartment cover

- ❑ With rubber bellows.
- ❑ Remove and install⇒ General body repairs, exterior; Rep. Gr. 55 ; Hoods .

6 - Vent valve

7 - Gravity valve

- ❑ Remove rear right wheel case protector.
- ❑ Remove the cover from fuel tank nozzle compartment with bellows.
- ❑ Check valve passage continuity. Perpendicular valve: open. Valve inclined 45°: closed.

8 - Fuel supply tube

9 - Spring-type clamp

10 - Fuel reservoir

- ❑ Remove using the Engine / gearbox or VAG 1383A jack. -EQ 7081- .
- ❑ Remove and install ⇒ page 95 .

11 - 23...29 Nm

12 - Pipes

- ❑ Anti-choke for fuel tank up to expansion tank.

13 - Pipes

- ❑ Venting for fuel tank up to expansion tank.

14 - Bearing

15 - Expansion tank

16 - Pipes

- ❑ Anti-choke for the fuel tank supply nozzle housing.

17 - Pipes

- ❑ Venting for the fuel tank supply nozzle housing.

18 - Fuel pump (pre-supply pump) -G6-

- ❑ Remove and install ⇒ page 93 .
- ❑ Clean the filter, in case it is dirty.
- ❑ Fuel pump (pre-supply pump) -G6- - check ⇒ page 98 .
- ❑ Observe the flange installation position in the fuel tank ⇒ page 91

19 - Sealing gasket Fuel pump (pre-supply pump) -G6-

- ❑ Remove and install ⇒ page 93 .

20 - Circlip (sliding)

21 - Supply pipes

- ❑ Black.
- ❑ Make sure it is well fastened.
- ❑ For fuel distributor.

22 - Return pipes

- ❑ Blue.
- ❑ Fastened laterally in the fuel tank.
- ❑ Make sure it is well fastened.

1 - For the fuel tank supply nozzle housing.

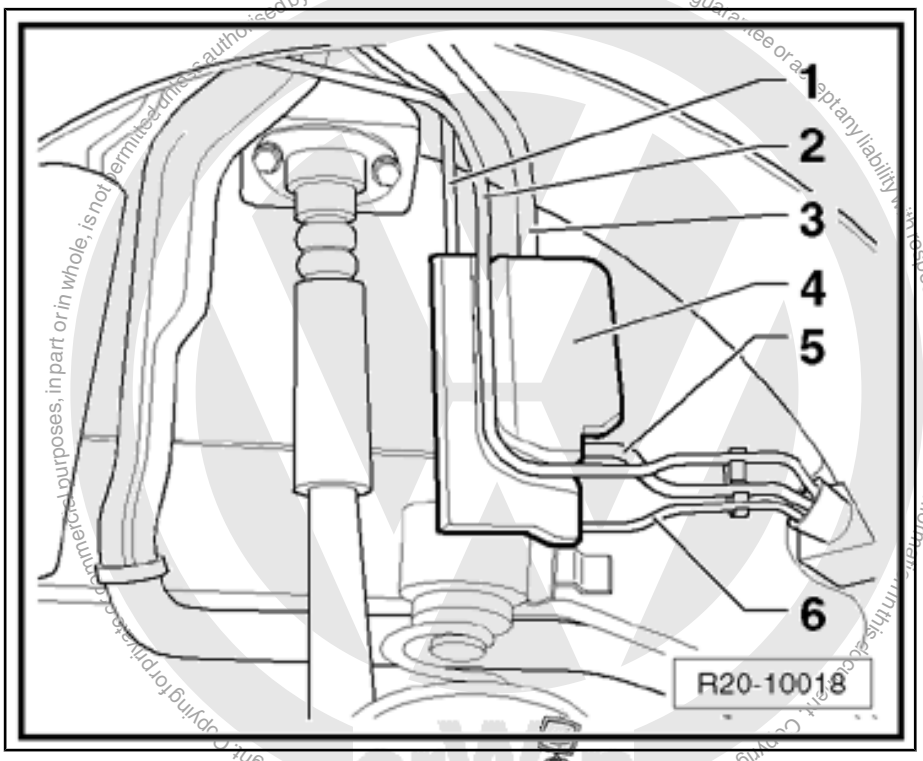
2 - For activated charcoal filter

3 - For the fuel tank supply nozzle housing.

4 - Expansion tank

5 - For expansion tank

6 - For expansion tank



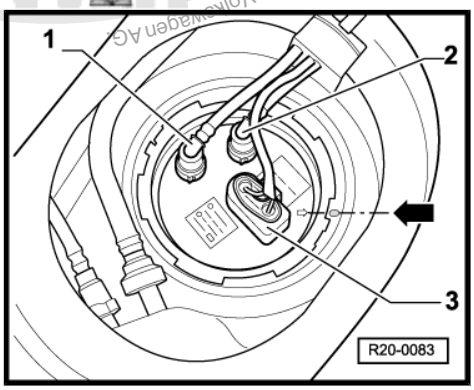
Installation position of the Fuel pump (pre-supply pump) -G6- flange.

The arrow on the sensor should coincide with the yellow mark on the right side of the housing.

Blue return pipes -1- in the connection.

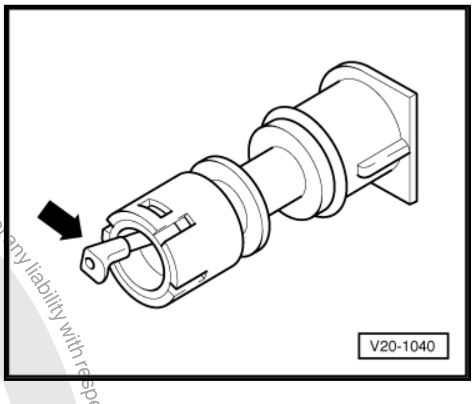
Supply pipes -2- in the connection.

Electrical connector for the Fuel pump (pre-supply pump) -G6- -3-.



Note

After installing the Fuel pump (pre-supply pump) -G6- flange, check if supply, return and vent pipes are fastened to the fuel tank.



Check vent valve

Lever in rest position: closed.

Lever pushed in the arrow direction: open.

Note

Before vent valve installation, remove fuel tank cover.

1.2 Safety measures in fuel supply works

WARNING

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

While removing or installing the Fuel level indicator sensor -G- or Fuel pump (pre-supply pump) -G6- , when the fuel tank is full or partially full, observe the following:

WARNING

Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure by removing hose carefully.

- Before starting installation works, place near the fuel tank opening, a suction hose for extracting equipment in operation, to absorb gases released by the fuel. If extracting equipment is unavailable, use a radial fan (the engine must be out of air flow) with air movement rate higher than 15 m^3/ hour.
- Avoid skin contact with fuel! Use fuel resistant gloves!
- For safety reasons, before opening the system, remove supply fuse number 33 of the Fuel pump (pre-supply pump) -G6-

1.3 Cleaning rules

For jobs on the fuel / injection system, strictly observe the following “5 cleaning” rules:

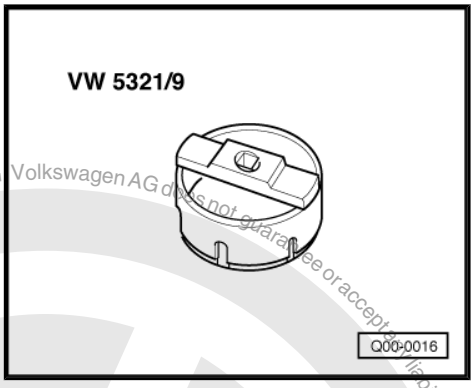
- Clean thoroughly the connections and surrounding areas before disconnecting them.
- Place parts on clean surface and cover them. Do not use cloth that releases lint!
- If repair work is not to be carried out immediately, open components opened must be covered up or carefully preserved.
- Install only clean components. Remove spare parts from packaging only before 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.

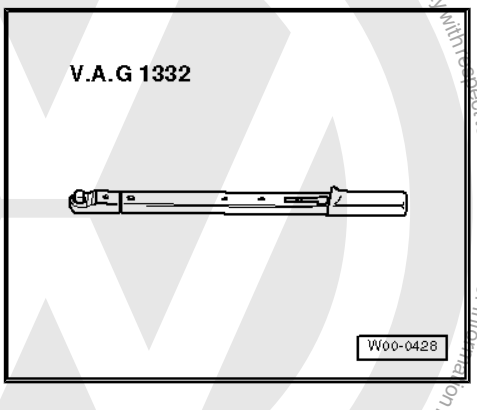
1.4 Fuel pump (pre-supply pump) -G6- - remove and install

Special tools and workshop equipment required

- Spanner or T 10334 -VW 5321/9-



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



1.4.1 Removal

– Take safety precautions before starting removal jobs ⇒ page 92 .

– Follow cleaning rules ⇒ page 92 .

– Check if the vehicle has code radio; if so, request respective anti-theft code.

– With ignition switched off, disconnect battery earth strap.

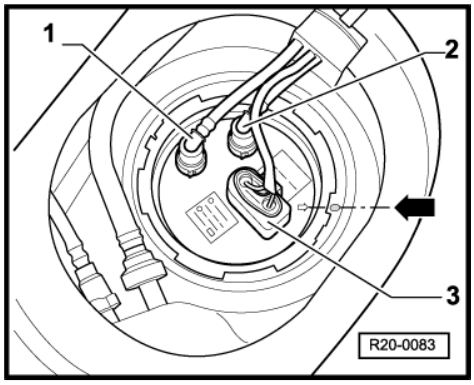
– Fold rear seat forwards.

– Remove Fuel pump (pre-supply pump) -G6- access cover.

WARNING

Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure by removing hose carefully.

– Remove return-1-, supply -2- pipes and flange-3- connector.

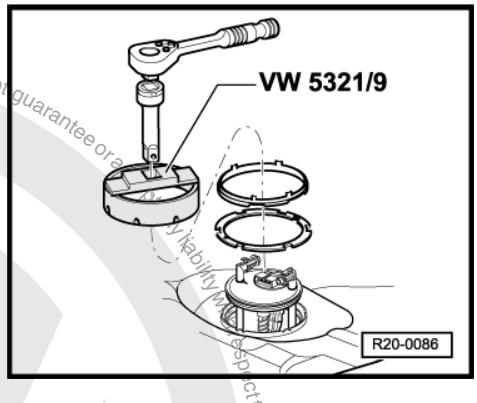


Note

To remove fuel hoses, press the safety ring located under the connection.

– Remove the lock with the Spanner or T 10334 -VW 5321/9- .

– Remove the Fuel pump (pre-supply pump) -G6- and the seal from the opening in the fuel tank.

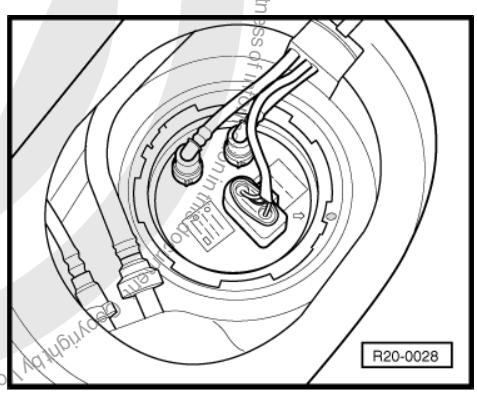


Note

In case of replacing the Fuel pump (pre-supply pump) -G6- , empty the old Fuel pump (pre-supply pump) -G6- before disposing it.

1.4.2 Installing

– Fuel pump (pre-supply pump) -G6- must be installed in removal reversed order.



Note

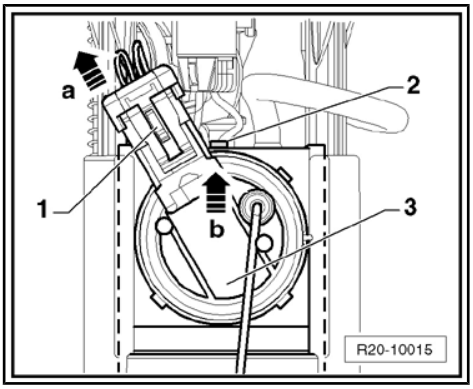
- *Try not to bend the Fuel level indicator sensor -G- during installation.*
- *Put the Fuel pump (pre-supply pump) -G6- sealing dry on fuel tank opening.*
- *Lubricate the sealing with fuel only for installing the Fuel pump (pre-supply pump) -G6- .*
- *Observe installation position of the Fuel pump (pre-supply pump) flange -G6- -arrow-: The mark on the flange must align with the mark on the housing.*
- *Check the firm seating of the fuel hoses.*
- *Do not confuse the supply and return hoses.*
- *After installing the Fuel pump (pre-supply pump) -G6- , check if supply, return and vent pipes are still fastened to the fuel tank.*

1.5 Fuel level indicator sensor -G- - remove and install

1.5.1 Removal

– Remove the Fuel pump (pre-supply pump) -G6- ⇒ page 93 .

– Disengage the connector for the Fuel level indicator sensor -G- by displacing the lock-1-and moving the connector in -arrow a-direction.
– Press lock -2- and move the Fuel level indicator sensor -G- -3- upwards-arrow b-.



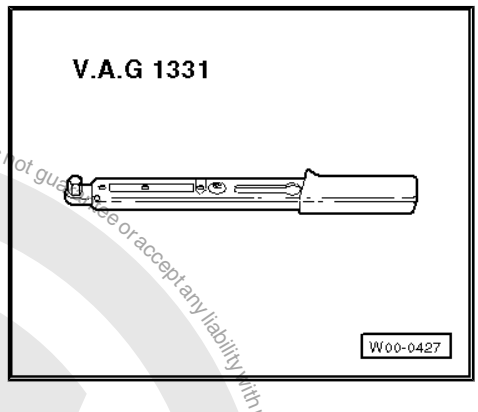
1.5.2 Installing

– Position the Fuel level indicator sensor -G- on the Fuel pump (pre-supply pump) guides -G6- and press it downwards until it fits.
– Install the Fuel level indicator sensor -G- connector.

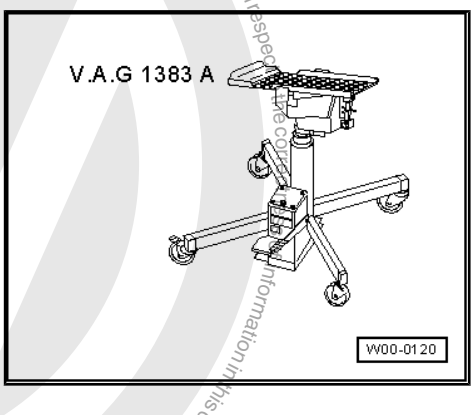
1.6 Fuel tank - remove and install

Special tools and workshop equipment required

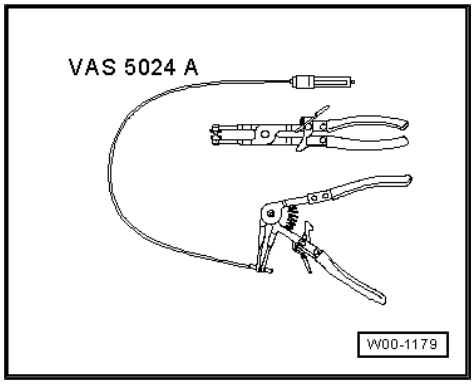
♦ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-



♦ Engine / gearbox or VAG 1383A jack. -EQ 7081-



- VAS 5024A or Standart-type clamp pliers -VW 5162- or Pliers -VAG 1921-



1.6.1 Removal

Conditions

- Fuel tank can be only half filled.

Note

- *Empty fuel tank with the Fuel aspirator and reservoir -VAS 5190- .*
- *Take safety precautions before starting removal jobs* *⇒ page 92* .

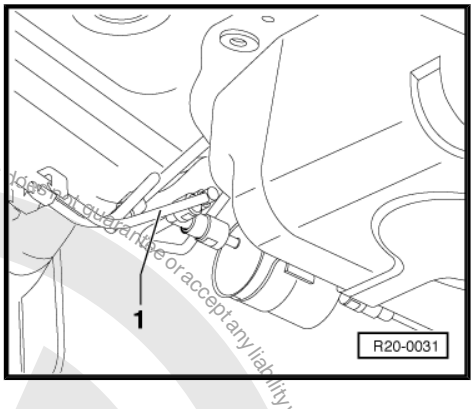
– Check if the vehicle has code radio; if so, request respective anti-theft code.
– With ignition switched off, disconnect battery earth strap.
– Remove tank cover.
– Empty fuel tank and clean around the fuel nozzle.
– Fold rear seat forwards.
– Remove Fuel pump (pre-supply pump) -G6- access cover.
– Disconnect flange 4-pole connector.
– Remove fuel tank hoses next to the Fuel pump (pre-supply pump) -G6- .
– Loosen the exhaust system. This system must be fastened to the body with wire and a bit lowered.
– Remove heat deflector between the exhaust tube and the fuel tank.

– Loosen filter supply hose-1-.

– Remove clamp from supply tube near the tank with VAS 5024A or Standart-type clamp pliers -VW 5162- or Pliers -VAG 1921- .

– Remove fastening bolts, supporting the fuel tank with the Engine / gearbox or VAG 1383A jack. -EQ 7081- .

– Lower fuel tank.



WARNING

Fuel supply hose is under pressure! Before loosening hose junctions, place a cloth around them. Next, eliminate pressure by removing hose carefully.

1.6.2 Installing

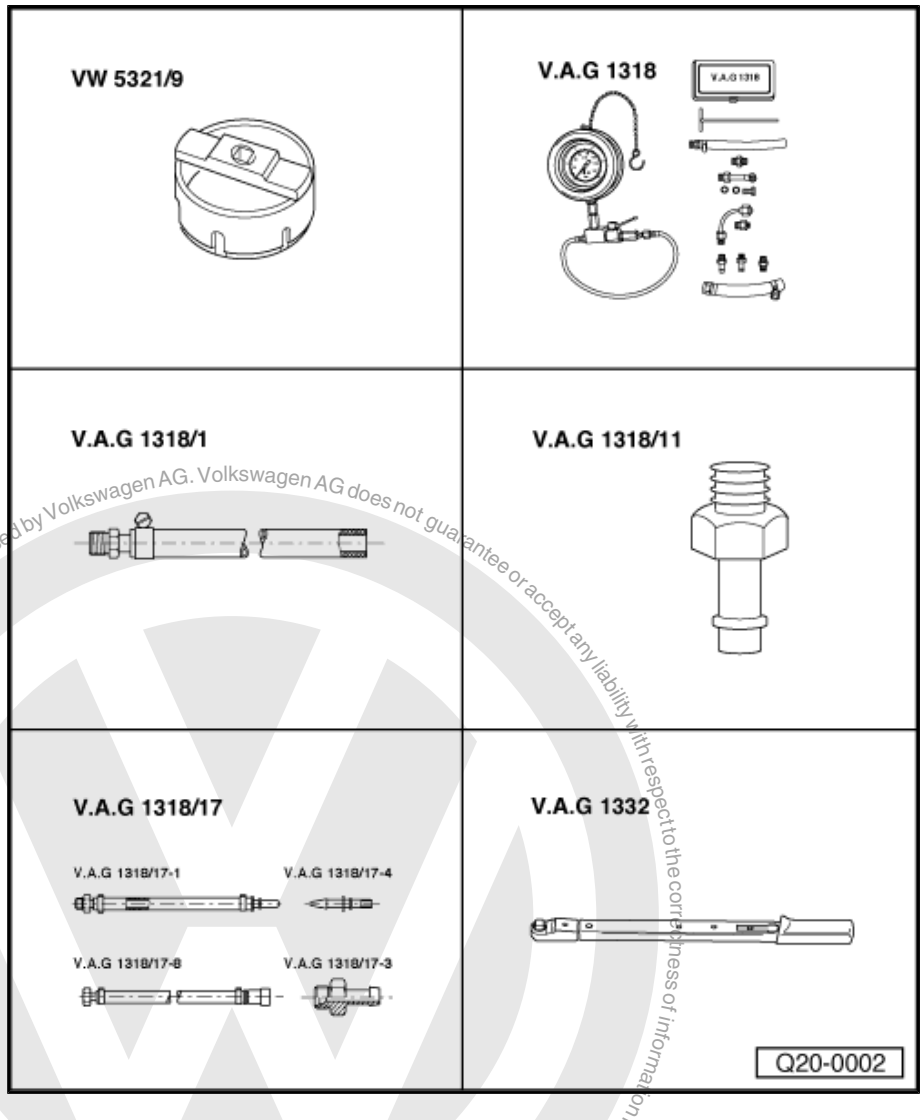
Installation is carried out by reversing the removal sequence, considering the following:

- Place vent and fuel hoses without bending them.
- Check the firm seating of the fuel hoses.

Note

Once the fuel tank is installed, check if supply, return and vent hose sets are still fixed.

1.7 Fuel pump (pre-supply pump) -G6- - check

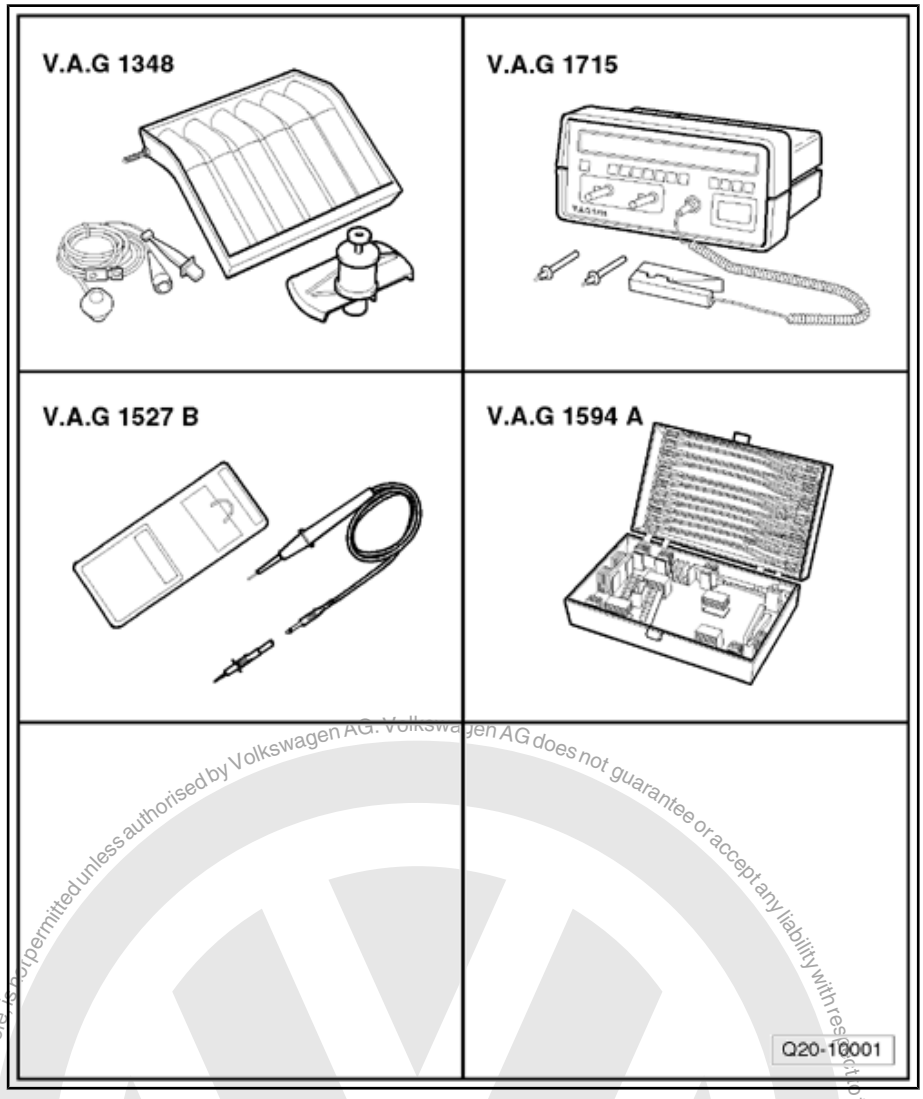


Special tools and workshop equipment required

- Spanner or T 10334 -VW 5321/9-
- Pressure gauge -VAG 1318-
- Adapter -VAG 1318/1-
- Adapter -VAG 1318/11-
- Adapter -VAG 1318/17-
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- Flow comparison meter -VAG 1348-

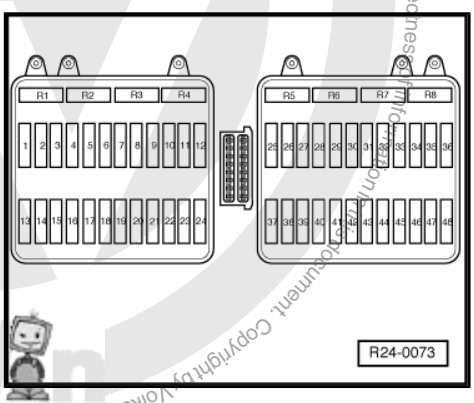
Special tools and workshop equipment required

- Adapting cable -VAG 1348/3-2-
- Test probe -EQ 7300- or Test probe -VAG 1527B-
- Auxiliary measuring set -VAG 1594A-
- Multimeter -VAG 1715-
- -Recipiente graduado-
- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations



Check conditions

- Fuse number 33, ok
- Battery voltage, 11.5 V minimum
- All power consuming components, like lights and rear window demister, must be off.
- If the vehicle is equipped with air conditioning, turn it off.



1.7.1 Operation of power supply - check

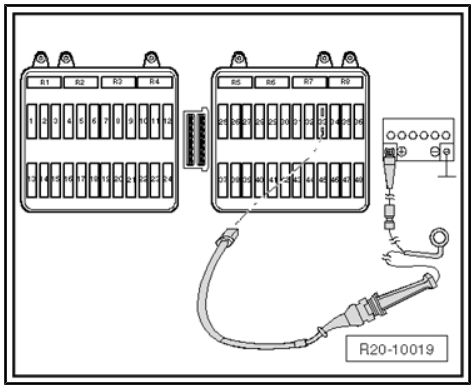
Note

In the following operation sequence, it might be necessary to disconnect the battery earth strap. Therefore, check whether a code radio is fitted. If this is case, obtain the anti-theft code first.

– Fold rear seat forwards.
– Remove the cover beneath the seat.
– Switch ignition on. The Fuel pump (pre-supply pump) -G6- has to work audibly for approx. 1 second.

If the Fuel pump (pre-supply pump) -G6- does not work:

– Switch ignition off.
– Remove fuse case lid.
– Remove fuse 33 from the (Fuel pump (pre-supply pump) -G6-) fuse case.
– Connect the Remote control -VAG 1348/3A- and Adapting cable -VAG 1348/3-2- to the lower contact of fuse 33 for activating Fuel pump (pre-supply pump) -G6- and to the battery positive terminal (+).
– Activate the remote control.

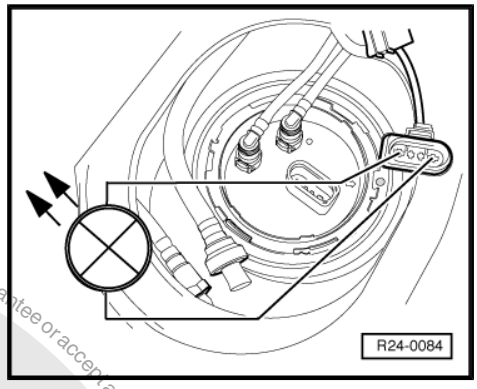


If the Fuel pump (pre-supply pump) -G6- works:

– Check operation of Fuel pump relay -J17- , according to ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

If the Fuel pump (pre-supply pump) -G6- does not work:

– Disengage the 4-pole connector for the Fuel pump (pre-supply pump) -G6-
– Connect the Test probe -EQ 7300- or Test probe -VAG 1527B- with Auxiliary cables -VAG 1594A- with Auxiliary cables to the connector external contacts.
– Activate the remote control.

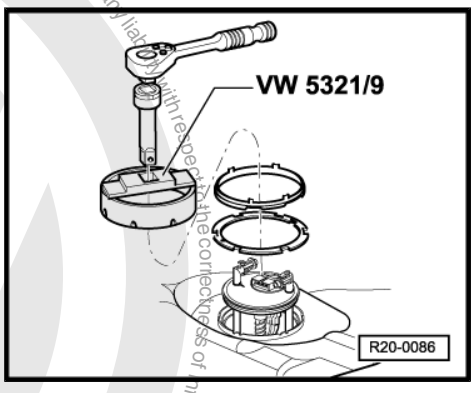


The LED should light up.

– If LED does not light up:
– Locate and eliminate cable interruption, according to⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

The LED lights up (correct power supply):

– Remove the Fuel pump (pre-supply pump) -G6- with the Spanner -VW 5321/9- or Spanner -T10334- .
– Check if cables are connected between flange and fuel pump -G23- .



In case there is no cable interruption:

– Fuel pump (pre-supply pump) -G6- - damaged, replace.

1.7.2 Fuel flow - check

Check conditions

- The Fuel pump (pre-supply pump) -G6- supply does not present any irregularities.
- Remote control -VAG 1348/3A- installed.
- Fuel pump (pre-supply pump) pressure and fuel pressure adjuster ⇒ page 124 ok.

Checking process

Note

Fuel pressure is measured at 3.0 bar. Because of that, fuel pressure must be checked before measuring the flow.

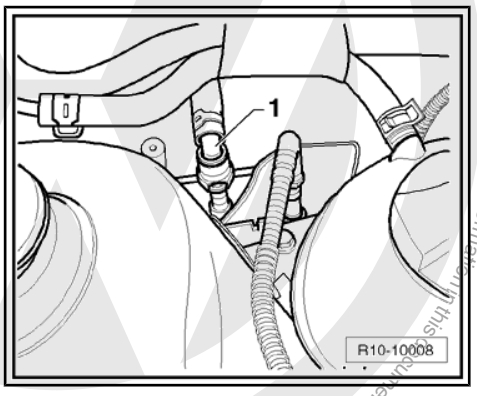
– Remove fuel filling nozzle cover.

WARNING

Fuel supply tubing is under pressure. Before loosening hose joints, place a cloth around them. Next, eliminate pressure by disassembling hose carefully.

– Disconnect fuel hose coupling-1- and clean the spilled fuel with a cloth.

– Couple the Pressure gauge -VAG 1318- to the fuel supply tube, by using the adapters Connector -VAG 1318/23- and Adapter -VAG 1318/17- .



– Couple the Pressure gauge -VAG 1318- hose to the pressure gauge Adapter -VAG 1318/11- and Adapter -VAG 1318/1- and place its end inside a graduated container with at least 3.0 liter-capacity.

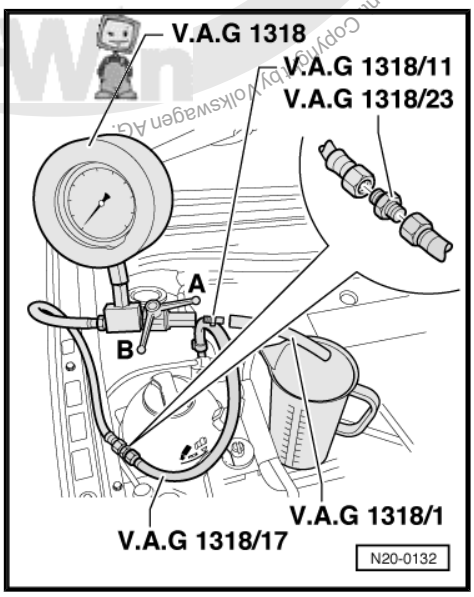
– Open pressure gauge cock. The lever will point towards flow direction-A-.

– Activate the Remote control -VAG 1348A- , closing the cock slowly, until the pressure gauge indicates a positive 3.0-bar pressure. From this moment on, do not change cock position.

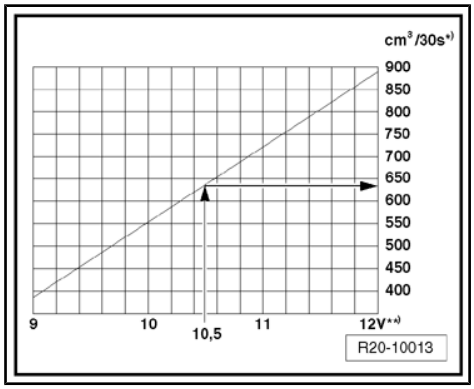
– Empty measuring container.

– The Fuel pump (pre-supply pump) -G6- flow depends on the battery voltage. Because of that, connect the Multimeter -VAG 1715- to the vehicle battery, using the Auxiliary cables -VAG 1594A- .

– Activate remote control for 30 seconds, measuring the battery voltage.



– Compare the fuel flow with the theoretical value.



8) Minimum amount cm^3/30 s

9) Voltage in the Fuel pump (pre-supply pump) -G6- with the engine stopped and the pump working (approx. 2 volts less than battery voltage).

Examples of reading:

During the test, a voltage of 12.5 volts is measured on the battery. As in the Fuel pump (pre-supply pump) -G6- the voltage is 2 V less than in the battery, the result is a supply flow of at least 633 cm ^{3}/30 s.

If the minimum flow is not reached:

– Check if the supply pipes to the filter present folds or obstructions.

If fuel pipes are ok.

– Check fuel flow before fuel filter.

WARNING

Fuel supply pipes are under pressure! Before loosening hose connections, put a cleaning cloth on connection points. Then depressurize by carefully pulling the hose.

Note

For that, press the keys on hose latches.

– Remove supply hose-1- from fuel filter inlet and connect it to Adapting set -VAG 1318/17- .

– Pressure gauge -VAG 1318- with Adapting set -VAG 1318/17- as shown.

– Install the adapter -V.A.G 1318/16- on the pressure gauge adapter -V.A.G 1318/11- and put its end in a graduated container with at least 3.0-liter capacity.

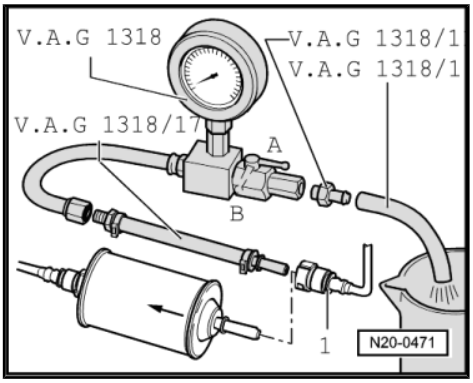
– Open pressure gauge blocking cock. The lever points towards the fuel passage-A-.

– Adapting cable -VAG 1348/3A- . Activate the Remote control -VAG 1348/3A- , closing the cock slowly, until the pressure gauge indicates a positive 3.0-bar pressure. Do not change the position of the blocking cock.

– Empty measuring container.

– Check flow again.

– Activate the Remote control -VAG 1348/3A - once more for 30 seconds. Compare the flow value with the one obtained in the first measurement.



If the minimum flow is not reached:

– Remove the Fuel pump (pre-supply pump) -G6- and check whether there is dirt in the screen filter.

If the minimum flow is reached:

– Replace the fuel filter.

If the minimum flow is not reached again:

Only if no irregularities have been found so far:

– Fuel pump (pre-supply pump) -G6- - damaged, replace it ⇒ page 93 .

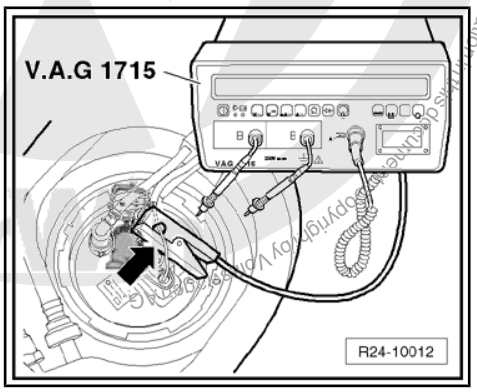
If the desired fuel flow is reached, but at great cost, we may conclude that the fuel supply presents irregularities (i.e.: a momentary fault in the fuel supply):

– Connect the fuel tubes removed again.

– By using the current leakage clamp meter, connect the Multimeter -VAG 1715- to contact 1 (blue/white) 4-pole connection socket box cable -arrow- from cable harness.

– Run the engine and have it operate in idling speed.

– Measure current draw of the Fuel pump (pre-supply pump) -G6- . Theoretical value: 6.8 amperes at the most



If the current draw is excessive:

– Fuel pump (pre-supply pump) -G6- - damaged, replace it ⇒ page 93 .

1.7.3 Verify Fuel pump (pre-supply pump) -G6- check valve

Check conditions

• Adapting cable -VAG 1348/3A- and Adapting cable -VAG 1348/3-2- connected.

Checking process

WARNING

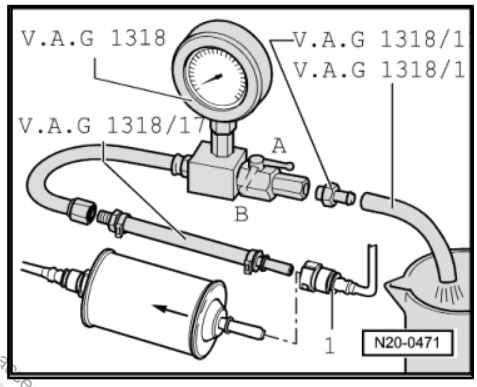
Fuel supply pipes are under pressure! Before loosening hose connections, put a cleaning cloth on connection points. Then depressurize by carefully pulling the hose.

Note

This test must check simultaneously the tightness of joints on the fuel supply tube sets, from the fuel pump up to the joint on the Pressure gauge -VAG 1318- .

– Remove supply hose -1- from fuel filter inlet and connect it to the Adapting set -VAG 1318/17- and the Pressure gauge -VAG 1318- .

– Install the Adapter -VAG 1318/16- on the pressure gauge Adapter -VAG 1318/11- and put the hose end in a graduated container with at least 3-liter capacity.



Note

For that, press the keys on hose connectors.

– Close the cock on the pressure gauge (transverse lever in relation to the flow direction - position -B-) .

– Activate the remote control in quick consecutive intervals, until reaching a pressure of approx. 3.0 bar.

WARNING

Risk of sprinkles when opening the blocking cock; keep a container in front of the free end of the pressure gauge.

– Reduce the excessive pressure by opening the cock carefully.

– Observe the pressure drop on the pressure gauge. After 10 minutes, the pressure must not drop below 2.5 bar.

If the pressure keeps dropping:

– Check hose connections for leaks.

If no irregularities are found in the cables:

– Fuel pump (pre-supply pump) -G6- - damaged, replace it ⇒ page 93 .

2 Engine power electronic adjustment (electronic accelerator)

Operation ⇒ page 105 .

Engine power electronic adjustment (electronic accelerator) - check ⇒ page 106 .

2.1 Operation

The butterfly valve is not activated by a cable in the electronic accelerator. There is no mechanical connection between the accelerator and the butterfly valve.

The position of the accelerator is transmitted to the Engine control unit -J623- by two accelerator position sensors (variable resistance; stored in a case), which are connected to the accelerator.

The accelerator position (at the driver's criterion) is the main input value for the Engine control unit -J623- .

The butterfly valve is activated by an electric engine (butterfly element) incorporated to the Accelerator butterfly valve command unit -J338- , in all load and rotation intervals.

The butterfly valve is activated by a butterfly element, due to the data provided by the Engine control unit -J623-.

With the engine turned off and the ignition connected, the Engine control unit -J623- activates the butterfly element, due to the data provided by the Accelerator pedal position sensor -G79- . This means that if the accelerator is half activated, the butterfly element will open proportionally, that is, the butterfly valve will be half opened.

With the engine running (loaded), the Engine control unit -J623- may open or close the butterfly, regardless of the Accelerator pedal position sensor -G79- .

This way, the butterfly valve may, for instance, be completely open already, even if the accelerator is only half activated. The advantage is avoiding losses for chocking, caused by the butterfly valve.

Also, this enables lower pollutant consumption and emissions for certain load conditions.

The necessary torque may be obtained by the Engine control unit -J623- , through an optimum combination between the butterfly valve opening and the over-supply pressure.

Believing that the “electronic accelerator” comprises only one or two components would be a mistake. The electronic accelerator is a system comprised of all the components that contribute to determining the position of the butterfly valve, in order to adjust it and activate it, such as for example, the Accelerator pedal position sensor -G79- , the Accelerator butterfly valve command unit -J338- , the "E-gas" system fault warning light -K132- , the Engine control unit -J623- , etc).

2.2 Engine power electronic adjustment (electronic accelerator) - check

1 - Pedal bracket

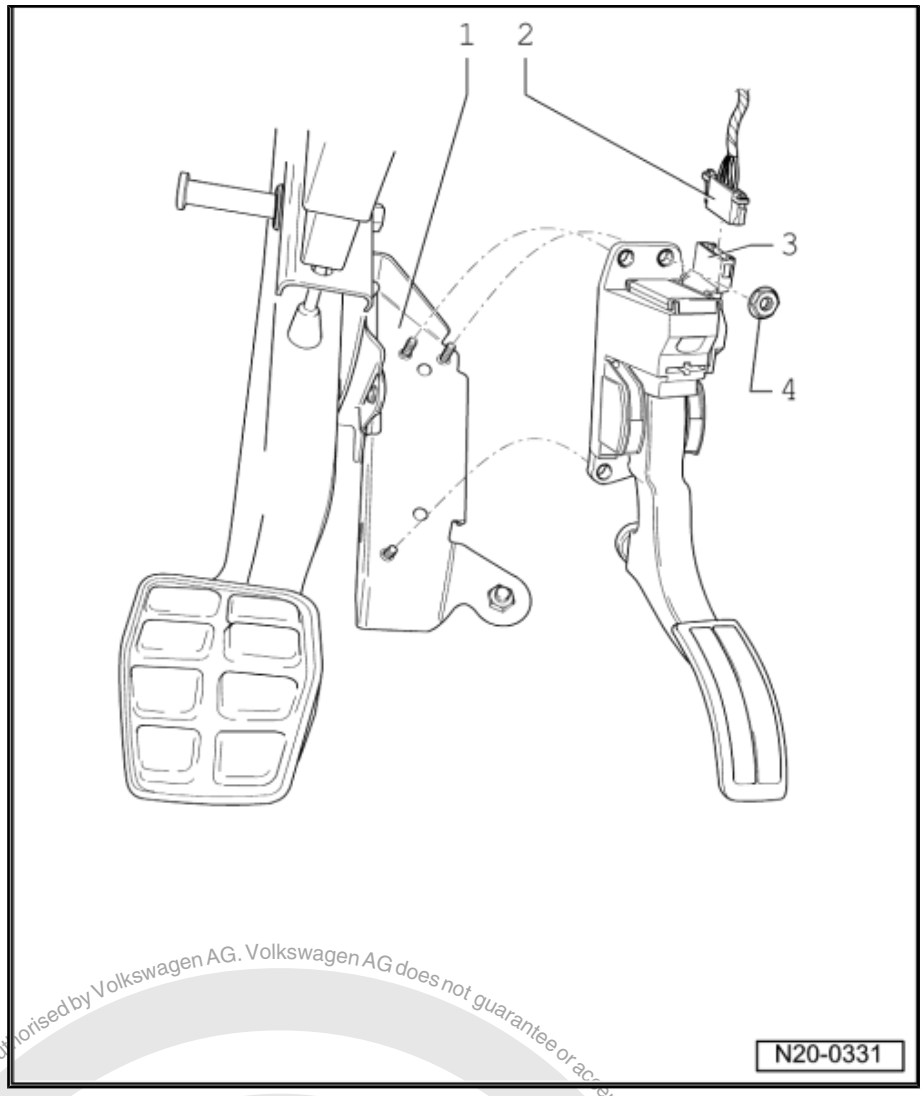
2 - Connector

- ❑ Black, 6 poles

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

- ❑ To remove, loosen the fastenings and disconnect the connector.

4 - 10 Nm



3 Activated charcoal filter system

3.1 Operation

Depending on the local air temperature and pressure, fuel vapours form over the tank fuel surface.

Activated charcoal filter systems prevents these hydrocarbon emissions from reaching the air we breathe.

Limited amounts of fuel vapours reach the activated charcoal filter, located in the highest point of the tank, through a gravity valve (which closes at a 45° inclination) and the pressure retention valve.

The activated charcoal absorbs these vapours like a sponge.

During the vehicle operation and with the lambda adjustment active (hot engine), the Magnetic valve I for activated charcoal filter -N80- , also known as regeneration valve) is activated cyclically by the engine command unit, due to its load and engine speed (rpm) regime. The opening period depends on the input signals.

Intake manifold vacuum aspirates fresh air through the vent opening on the lower part of the activated charcoal filter, during the purging procedure (activated charcoal regeneration). The fuel vapours stored in the activated charcoal and the fresh air are fed for combustion in dosed quantities.

The pressure retention valve prevents the fuel vapours from being aspirated directly from the tank, when the Magnetic valve I for activated charcoal filter -N80- is opened and there is vacuum in the intake manifold, . This ensures that the activated charcoal filter is primarily drained.

When no current is applied (e.g. wiring harness opened), the electromagnetic valve remains closed. The activated charcoal filter will not be purged.

Note

- *Hose connections are fastened by spring clamps.*
- *To install spring clamps, we recommend using the VAS 5024A or Standart-type clamp pliers -VW 5162- .*

Follow safety measures ⇒ page 92 .

Follow cleaning rules ⇒ page 92 .

3.2 Activated charcoal filter system components - repair

1 - Fuel vapours pipes

- ❑ Make sure they are well fastened.

2 - Pressure retention valve with connection hose.

- ❑ Make sure it is well fastened.
- ❑ From the gravity valve in the fuel tank.

3 - Activated charcoal filter

- ❑ Installation location: in the right rear wheel housing.

4 - Vent connection

- ❑ Visible from below.

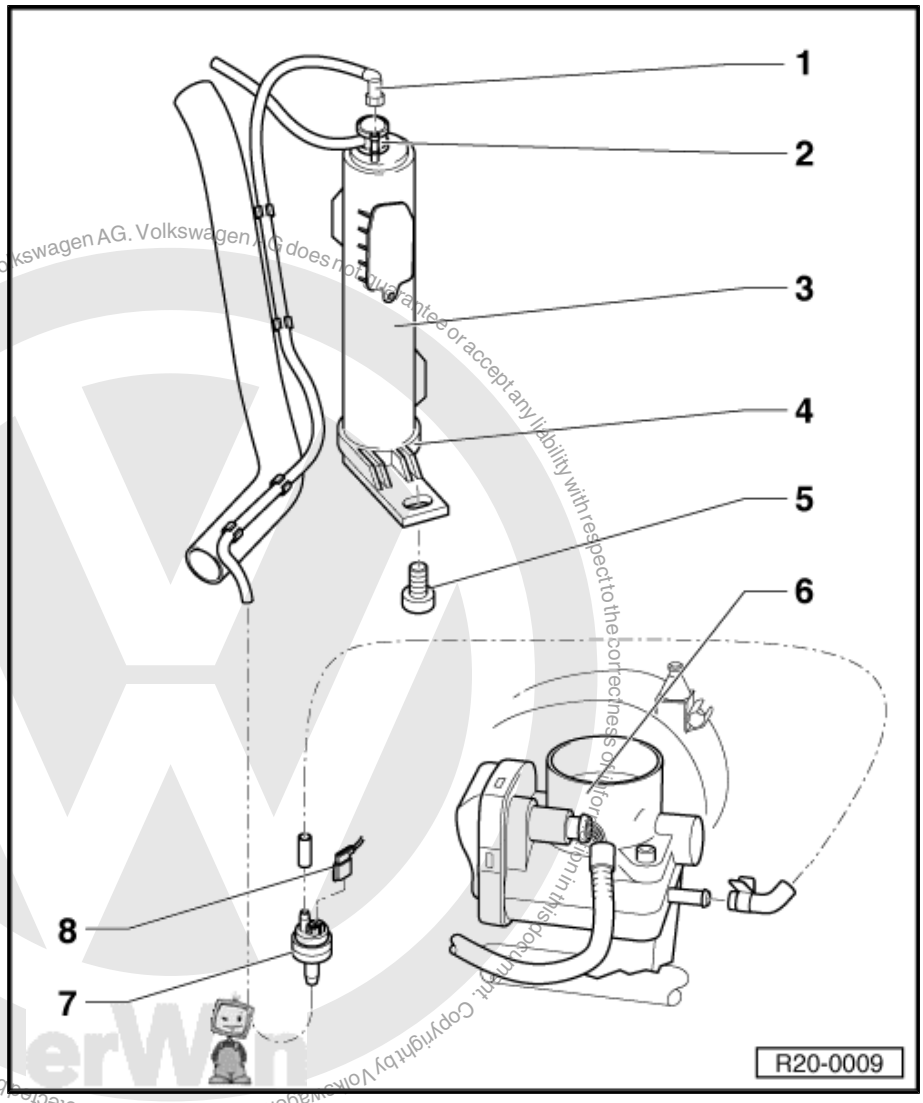
5 - 10 Nm

6 - Intake manifold with Accelerator butterfly valve control unit -J338-

7 - Magnetic valve I for activated charcoal filter -N80-

- ❑ The valve closes when the ignition is off.
- ❑ The valve is activated (by pulses) by the Engine control unit -J623- , when the engine is in the operation temperature.

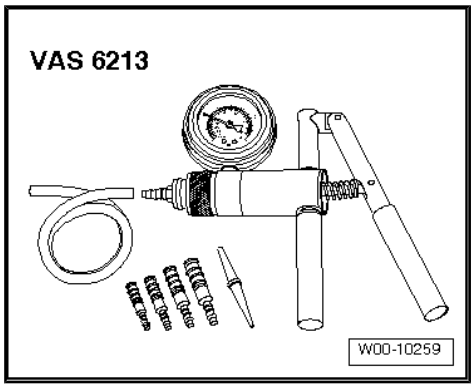
8 - Connector



3.3 Fuel tank ventilation - check

Special tools and workshop equipment required

♦ Vacuum pump -VAG 1390- or Vacuum pump -VAS 6213-



3.3.1 Test conditions

- The ignition must be off.

3.3.2 Test sequence

– Remove the regeneration flexible hose-1- from the activated charcoal filter in the electromagnetic valve 1 of the activated charcoal filter -N80- -2-.

– Install the Vacuum pump -VAG 1390- or Vacuum pump -VAS 6213- as illustrated, the flexible hose-1-.

– Operate the Vacuum pump -VAG 1390- or Vacuum pump -VAS 6213- several times. No vacuum can be generated.

If vacuum is generated:

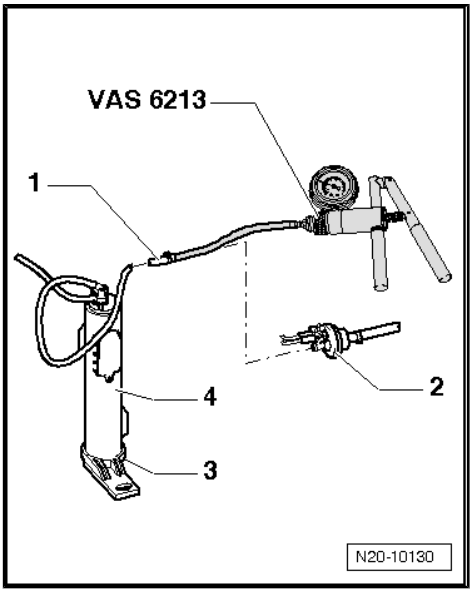
– Check the ventilation opening -3- in the lower part of the activated charcoal filter -4- for impurities and, if necessary, clean it.

If vacuum is not generated:

– Cover the ventilation opening -3- and operate the vacuum pump several times again. Vacuum has to be generated.

If vacuum is not generated:

– Replace the activated charcoal filter.



24 – Fuel supply system - fuel injection

1 Injection system - repair

1.1 General indications related to injection

- The Engine control unit -J623- is equipped with self-diagnosis. Before performing repairs, and for fault location, refer to the fault memory. Likewise, check vacuum hoses and connections (air infiltration).
- Fuel hoses in the engine compartment should be fastened with spring clamps only. Using retaining clamps or bolted clamps is not allowed.
- Minimum voltage of 11.5V is necessary for the perfect operation of electric components.
- Do not use silicone-based sealants. Silicone residues aspired by the engine are not burned and damage the Lambda Probe -G39- .

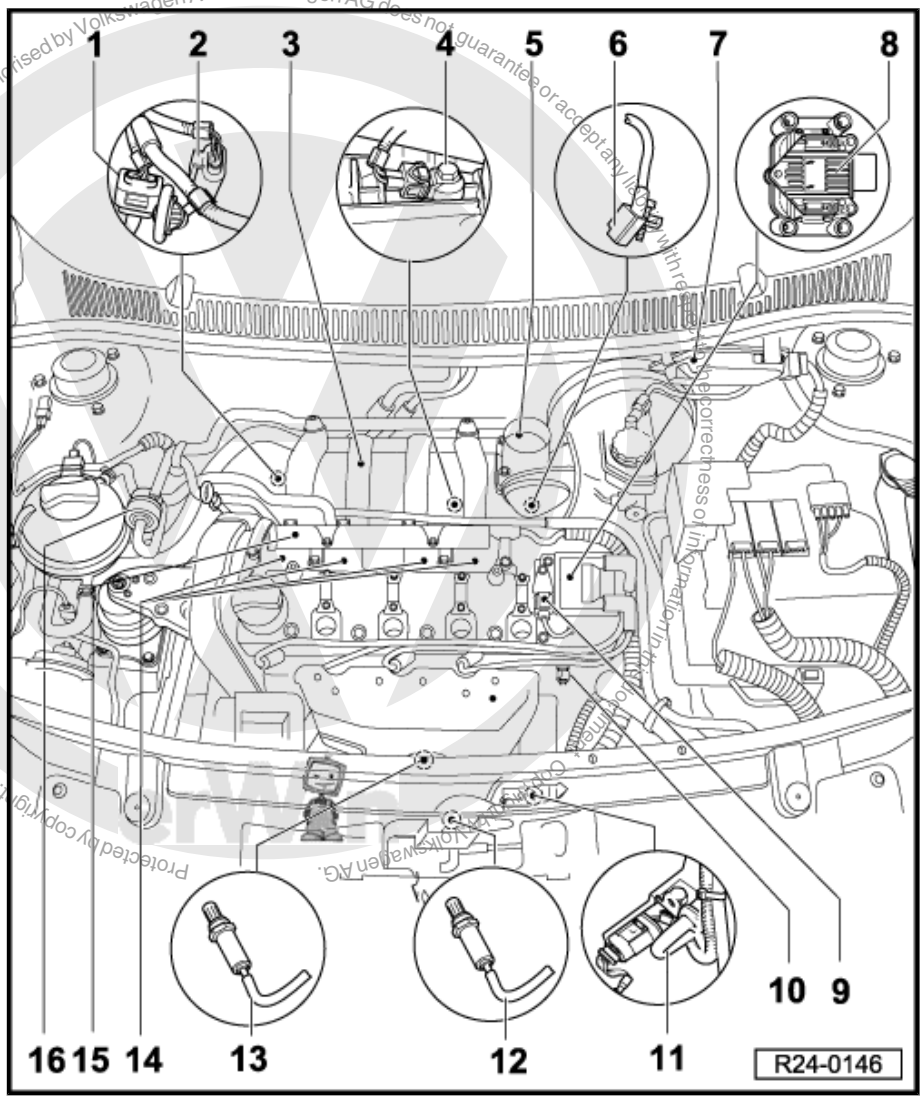
Safety measures ⇒ page 118 .

Cleaning rules ⇒ page 119 .

Technical data ⇒ page 119 .

1.2 Component location

Components A to D are not represented in the illustration.



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

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

B - Accelerator pedal position sensor -G79- 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

- ❑ On the Fuel pump (pre-supply pump) -G6- .

1 - 3-pole connector

- ❑ Black.
- ❑ To Engine speed sensor - G28- .

2 - 4-pole connector

- ❑ Black.
- ❑ To the Intake manifold pressure sensor -G71- with the Air intake temperature sensor -G42- .

3 - Intake manifold

- ❑ Remove and install ⇒ page 116 .

4 - Knock sensor 1 -G61-

- ❑ Installation location: On engine block, intake side.

5 - Accelerator butterfly valve control unit -J338-

6 - Engine speed sensor -G28-

- ❑ Installation location: On the crankshaft flange (flywheel side)

7 - Engine control unit -J623-

- ❑ Fit or remove the connector only with ignition switched off.
- ❑ Unlock to uncouple.

8 - Ignition transformer -N152-

- ❑ With codes for ignition cables, do not confuse.
- ❑ ⇒ Item 2 (page 136) .

9 - Hall Sensor -G40-

10 - Coolant temperature sensor -G62-

11 - 4-pole connectors

- ❑ Black.
- ❑ To the Lambda probe -G39- 1 before the catalytic converter Lambda probe heating -Z19- .
- ❑ Brown.
- ❑ To the Lambda probe after the catalytic converter -G130- .

12 - Lambda probe after the catalytic converter -G130- , 50 Nm

- ❑ Installation location: On the exhaust tube, front part.

13 - Lambda probe -G39-

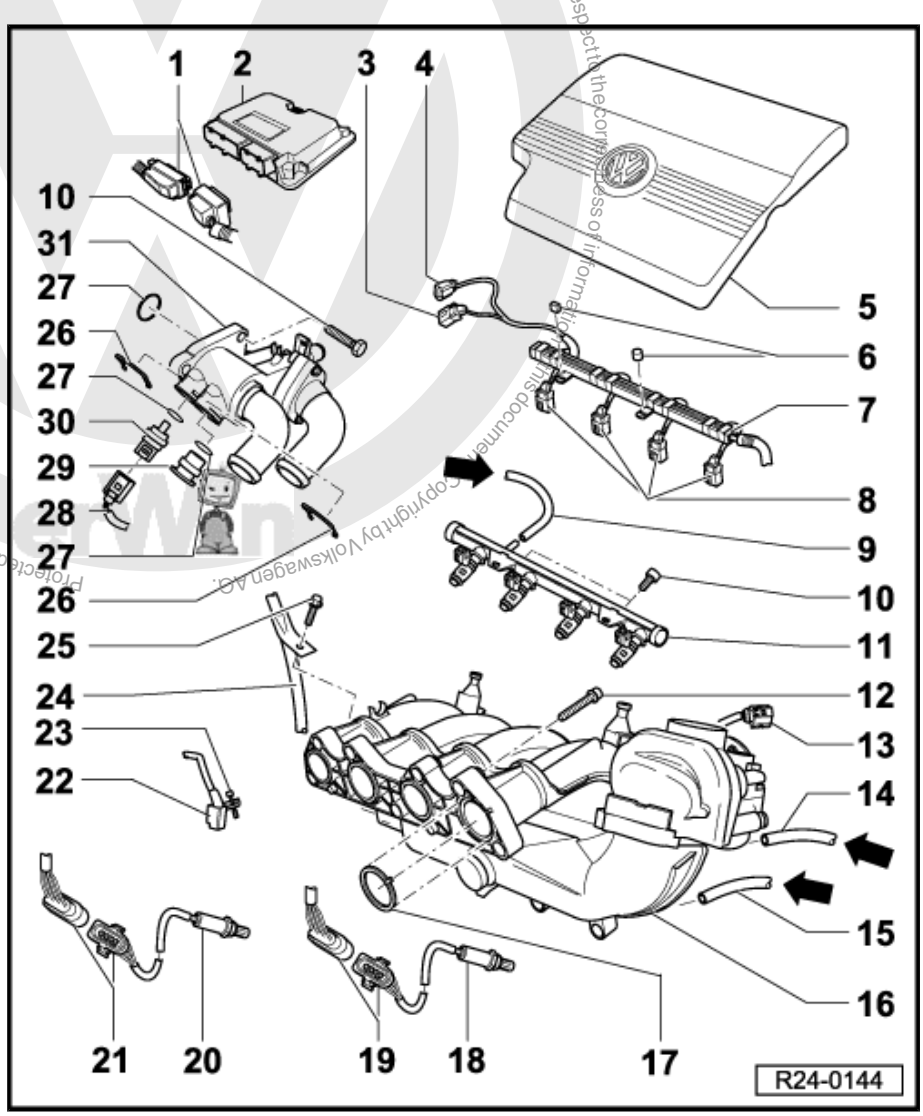
- ❑ On the exhaust manifold.

14 - Cylinder 1 injector -N30- , Cylinder 2 injector -N31- , Cylinder 3 injector -N32- and Cylinder 4 injector -N33-

15 - Fuel distributor

16 - Magnetic valve I for activated charcoal filter tank -N80-

1.3 Fuel injection components - remove and install



1 - Connector

- ❑ For Engine control unit -J623- .
- ❑ Connect or disconnect the connector only with ignition switched off.
- ❑ Unlock to uncouple.

2 - Engine control unit -J623-

- ❑ For the injection system, lambda adjustment, Pre-resistance for the evaporator fan -N81- , knock adjustment, speed limit, ignition and self-diagnosis.
- ❑ In case of replacement, it is necessary to adapt the Engine control unit -J623- to the electronic immobiliser ⇒ page 129 .

3 - Connector

- ❑ Black, 4 poles.
- ❑ To Intake manifold pressure sensor -G71- with Air intake temperature sensor -G42- .
- ❑ Gold plated connector contacts.

4 - Connector

- ❑ Black, 3 poles.
- ❑ To Engine speed sensor -G28- .

5 - Air filter set

- ❑ Remove and install the air filter set ⇒ page 117
- ❑ Disassemble and assemble ⇒ page 116 .

6 - Fastening clip

- ❑ Observe model.

7 - Cable guide

- ❑ Fastened to the fuel distributor.

8 - Connector

- ❑ Black, 2 poles.
- ❑ From Cylinder 1 injector -N30- , Cylinder 2 injector -N31- , Cylinder 3 injector -N32- and Cylinder 4 injector -N33- .

9 - Fuel supply pipes

- ❑ Black with white mark.
- ❑ Fasten with spring braces.
- ❑ Make sure they are well fastened.
- ❑ From the fuel filter.

10 - 10 Nm

11 - Fuel distributor with injectors

- ❑ Remove and install ⇒ page 116 .

12 - 20 Nm

13 - Connector

- ❑ Black, 6 poles.
- ❑ From Accelerator butterfly valve command unit -J338- .
- ❑ Gold plated connector contacts.

14 - From Magnetic valve I for activated charcoal filter -N80-

- ❑ Fasten with spring braces.

15 - From servo brake

16 - Intake manifold

- ❑ Remove and install ⇒ page 115 .

17 - Sealing ring

- ❑ Replace.
- ❑ Check installation position.

18 - Lambda probe -G39- , 50 Nm

- ❑ Lubricate the thread with -G 052 112 A3- only; the -G 052 112 A3- cannot penetrate the grooves of the probe body.
- ❑ Remove and install with the Set of sockets for Lambda probe -3337- .
- ❑ Power supply for probe heating through the Fuel pump relay -J17- .

19 - 4-pole connector

- ❑ Black.
- ❑ To the Lambda probe -G39- Lambda probe heating -Z19- .
- ❑ Contacts 3 and 4 gold plated.

20 - Lambda probe after the catalytic converter -G130- , 50 Nm

- ❑ Lubricate the thread with -G 052 112 A3- only; the -G 52 112 A3- cannot penetrate the grooves of the probe body.
- ❑ Remove and install with the Set of sockets for Lambda probe -3337- .

21 - 4-pole connector

- ❑ Black.
- ❑ From Lambda probe after catalytic converter -G130- .

22 - Engine speed sensor -G28-

- ❑ Installation location: On engine block, intake side.

23 - 5 Nm

24 - Guide tube

- ❑ To oil dipstick.

25 - 3 Nm

26 - Clip

- ❑ Make sure it is well fastened.

27 - Sealing ring

- ❑ Replace.

28 - Connector

- ❑ Black, 2 poles.
- ❑ From Coolant temperature sensor -G62- .
- ❑ Gold plated connector contacts.

29 - Plug

- ❑ If necessary, depressurize the system before removal.

30 - Cooling system temperature sensor -G62-

- ❑ From Engine control unit -J623- .
- ❑ If necessary, depressurize the system before removal.
- ❑ Resistance values between contact 1 and 2 ⇒ page 114

31 - Cooling system thermostat valve body

Resistance values of the Cooling system temperature sensor - G62-

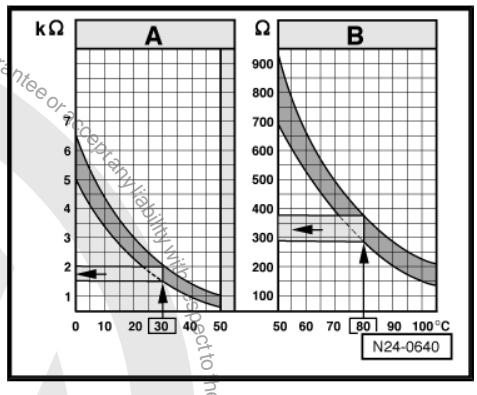
The diagram is divided into two temperature regions:

A - from 0...50 °C

B - from 50..0.105 °C

Example of reading:

- ♦ 30 °C in region A corresponds to resistance from 1.5...2.0 kΩ.
- ♦ 80 °C in region B corresponds to resistance from 275..375 kΩ.



1.4 Intake manifold - remove and install

1 - Sealing ring

- ❑ Replace if damaged.

2 - Accelerator butterfly valve command unit -J338-

- ❑ When replacing, adjust the Accelerator butterfly valve command unit -J338- to the Accelerator butterfly valve control unit -J338-
⇒ page 129 .

3 - 10 Nm

4 - 20 Nm

5 - Intake manifold

- ❑ Remove and install
⇒ page 115 .

6 - Sealing ring

- ❑ Replace.
- ❑ Observe installation position.

7 - Sealing ring

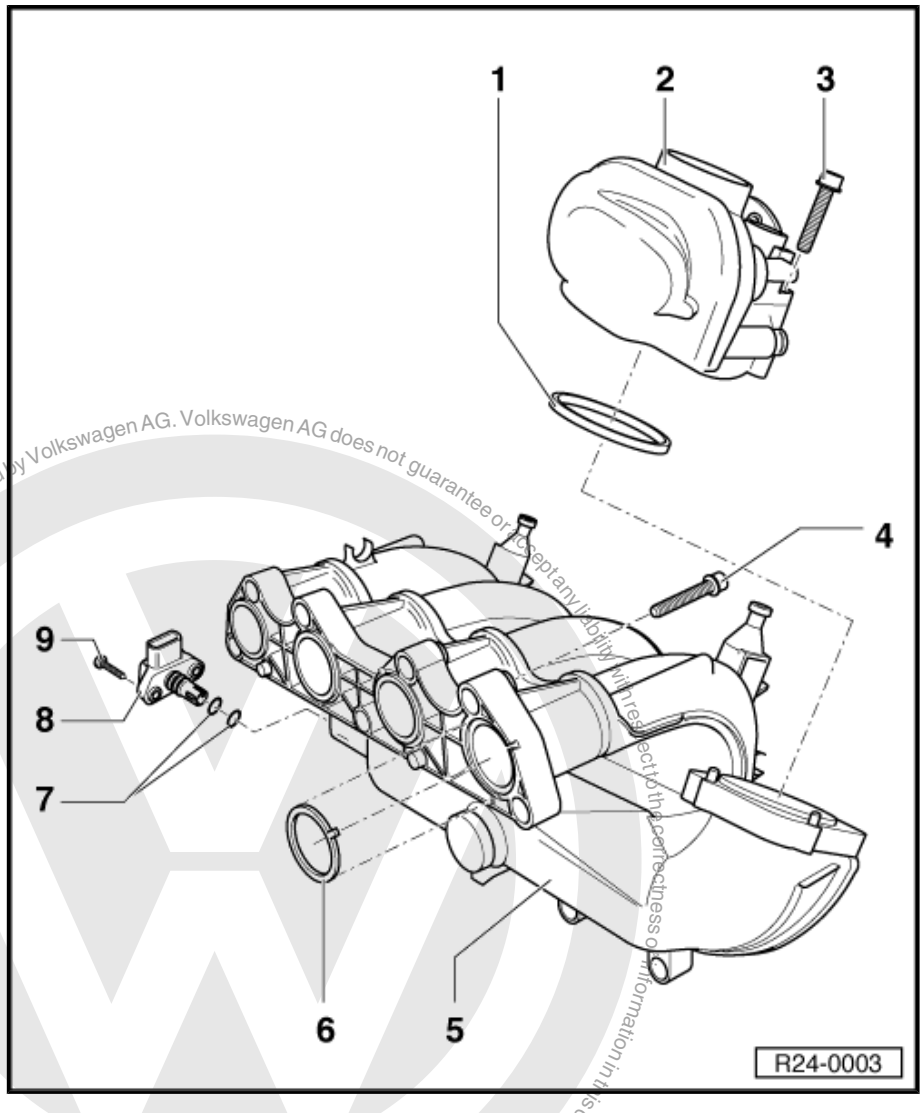
- ❑ Replace if damaged.

8 - Intake manifold pressure sensor -G71- with Air intake temperature sensor -G42-

- ❑ Resistance values of the Air intake temperature sensor -G42- contact 1 and 2
⇒ page 115

9 - 3 Nm

- ❑ Observe indications on installation
⇒ page 118 .



Resistance values for the Air intake temperature sensor -G42-

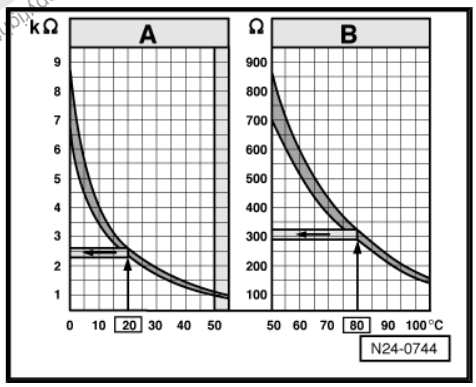
The diagram is divided into two temperature regions:

A - from 0...50 °C.

B - from 50..0.105 °C.

Example of reading:

- ♦ 20 °C in region A corresponds to resistance from 2.3...20.6 kΩ.
- ♦ 80 °C in region B corresponds to resistance from 290...330 kΩ.



1.5 Fuel distributor with injectors - remove and install

1 - Fuel distributor

- ❑ Remove and install ⇒ page 116 .
- ❑ Check fuel pressure regulator ⇒ page 124 .

2 - 10 Nm

3 - Clip

- ❑ Make sure it is well fastened.
- ❑ Observe the proper seating in the fuel distributor and injector.

4 - Sealing ring

- ❑ Replace if damaged.
- ❑ Quickly lubricate with engine clean oil before installation.

5 - Cylinder 1 injector -N30- , Cylinder 2 injector -N31- , Cylinder 3 injector -N32- and Cylinder 4 injector -N33 -

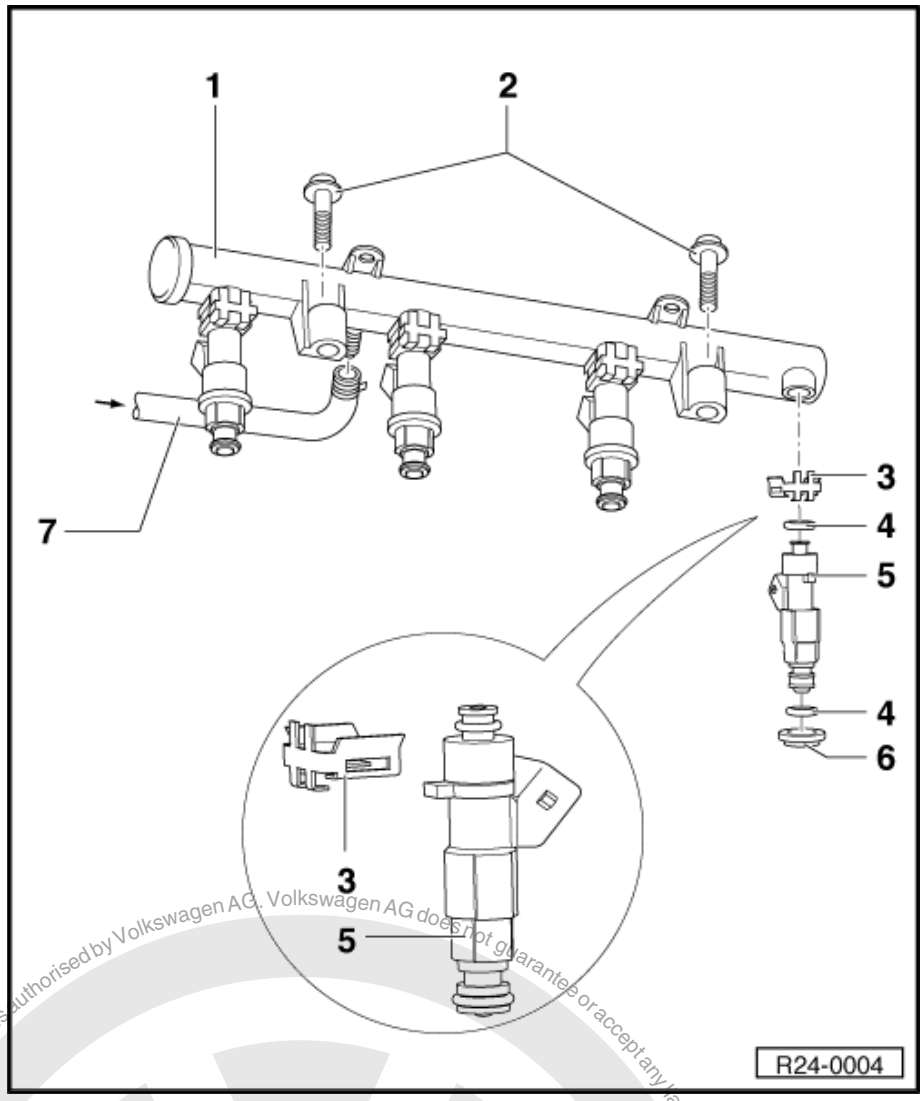
- ❑ Resistance between valve contacts: 7...17 Ω.

6 - Sealing ring

- ❑ Observe installation position.
- ❑ Replace when damaged.

7 - Fuel supply pipes

- ❑ Black with white mark.
- ❑ Fasten with spring braces.
- ❑ Make sure it is well fastened.
- ❑ From the fuel filter.



1.6 Air filter set - disassemble and assemble

Remove and install the air filter case ⇒ page 117

1 - Air intake nozzle

2 - Sealing ring

- ❑ Ensure firm seating.
- ❑ Replace when damaged.

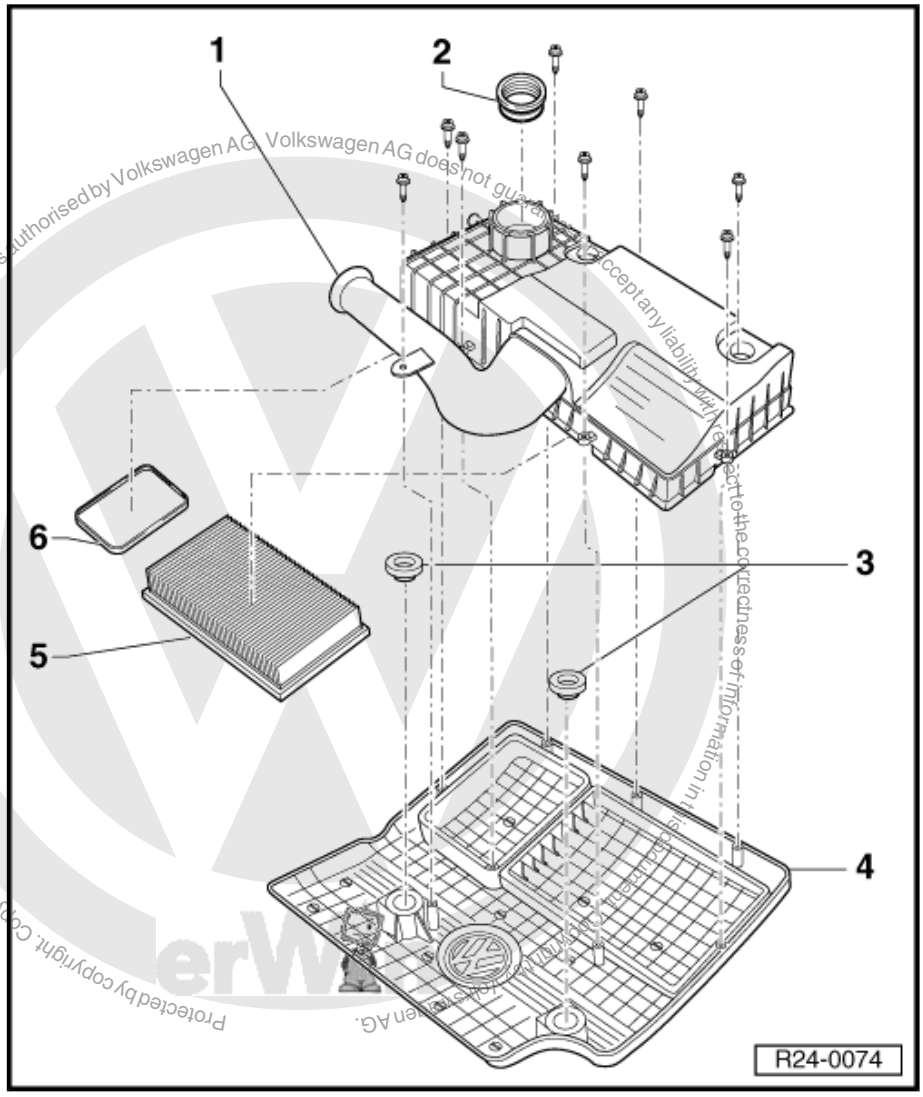
3 - Rubber support

4 - Upper part of the air filter case

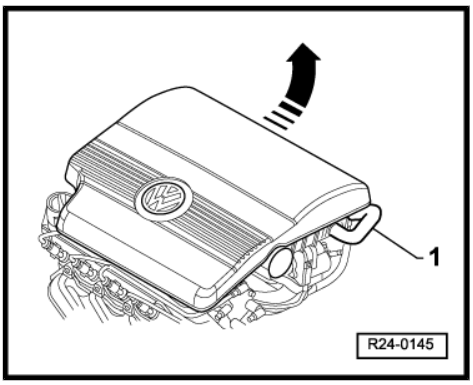
5 - Filtering element

6 - Sealing gasket

- ❑ Observe installation position.
- ❑ Replace when damaged.



Remove and install air filter case



1.6.1 Removal

– Remove the crankcase venting hose -1- from the air filter case.

– First, remove the air filter case from its supports and the Accelerator butterfly valve control unit -J338- and finally from the front supports -arrow-.

1.6.2 Installing

– The air filter case installation is initially carried out by fitting the Accelerator butterfly valve control unit -J338- nozzle, side supports and then the front supports.

– Apply neutral soap or coolant additive to the fastening bearings and to the Accelerator butterfly valve control unit -J338- nozzle packing during installation.

Note

- *To fasten the filter upper part to the filter base as well as the air intake nozzles and the Intake manifold pressure sensor -G71- with Air intake temperature sensor -G42- , serial self-locking bolts are used. If these bolts are loosened or tightened with a power screwdriver, the threads on the upper part of the air filter case can be damaged.*
- *For that reason, using a power screwdriver is only allowed when:*
- *The power screwdriver speed is 200 rpm at most.*
- *A torque of 3 Nm at most is adjusted.*

1.7 Safety measures

WARNING

Fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around them. Then, eliminate the pressure, carefully removing the hose and loosening the closing screw.

To avoid personal injuries and/or injection and ignition system damages, observe the following:

- For safety reasons, fuse 33 must be removed from the fuse case before opening the fuel system.
- Do not touch nor remove ignition cables while the engine is running or when starting the engine.
- Only connect or disconnect the injection and ignition system cables (and measuring device cables) with the ignition switched off.

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.***

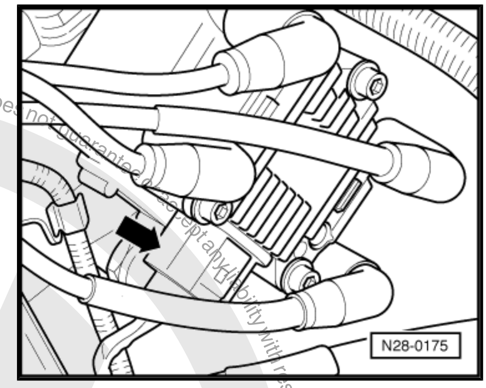
If during a test drive it is necessary to use test and measuring equipment, observe the following:

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

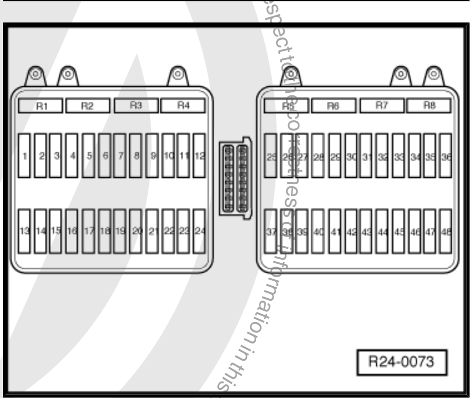
If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

♦ If the engine is to be turned over at starting speed, without starting:

– Disconnect the Ignition transformer 4-pole connector -N152- -arrow-.



– Remove fuse 44 from fuse case.



Note

When fuse 44 is removed, power supply to injectors is interrupted.

1.8 Cleaning rules

For jobs on the fuel / injection system, strictly observe the following "5 cleaning" rules:

♦ Clean thoroughly the connections and surrounding areas before disconnecting them.

♦ Place parts 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. Remove spare parts from packaging only before 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.

1.9 Technical data

Engine identification letters		BKR
Idle speed check Idle speed operation	rpm	670...770[10] 700...800[12]
Engine control unit[11] System Replacement part number		4EV Marelli ⇒ Replacement part CD

Engine identification letters		BKR
Speed limit	rpm	From approximately 6200

10) Not adjustable. Values for vehicles without air conditioning.

11) Replace Engine control unit -J623- ⇒ page 128 .

12) Not adjustable. Values for vehicles with air conditioning.

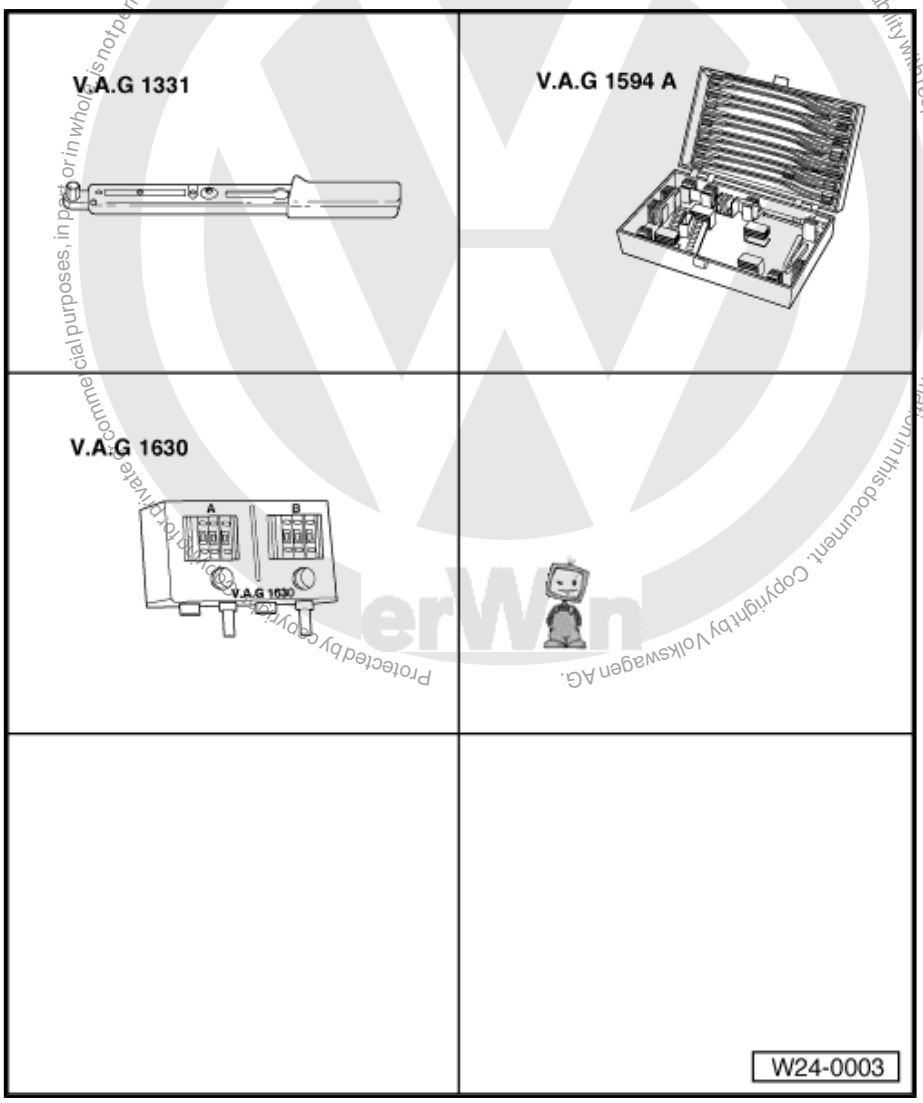
2 Component checking

2.1 Injection valves - check

Check sealant and jet form

Special tools and workshop equipment required

- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Auxiliary measuring cable set -VAG 1594C-
- Digital potentiometer (included in VAG 1594C) -VAG 1630-
- Graduated container



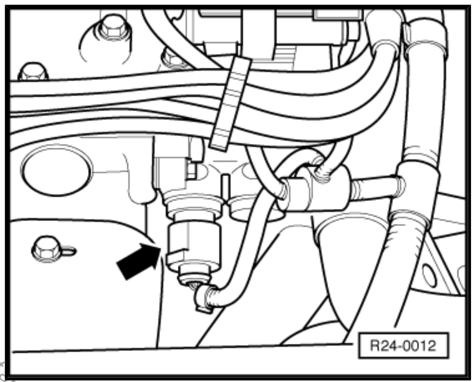
Test conditions

- The fuel pressure must be OK, check ⇒ page 124 .

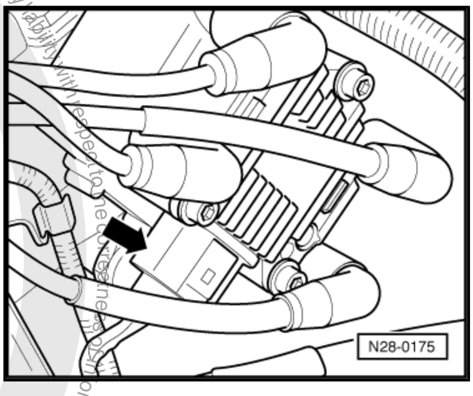
Test sequence

– Remove air filter set ⇒ page 117

– Disconnect the 2-pole connector from the Cooling system temperature sensor -G62- -arrow-.



– Disconnect the Ignition transformer 4-pole connector -N152- -arrow-.

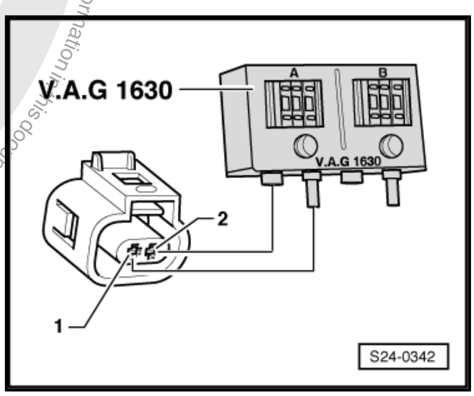


– Connect the Digital potentiometer (included at VAG 1594 C) -VAG 1630- with the Auxiliary measuring cable set -VAG 1594A- to connector contacts 1+2 and adjust the connected side to 15 kΩ.

– Disconnect the injection valve harness in the fuel distributor.

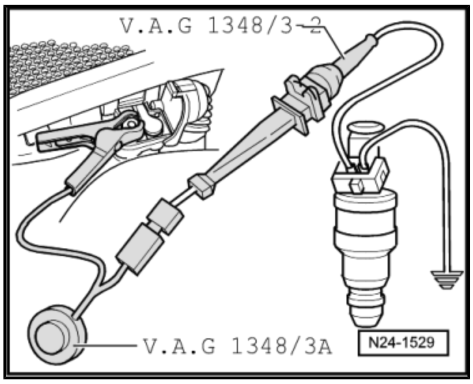
– Remove fuel distributor with all injection valves from engine cylinder head (fuel pipes remain connected).

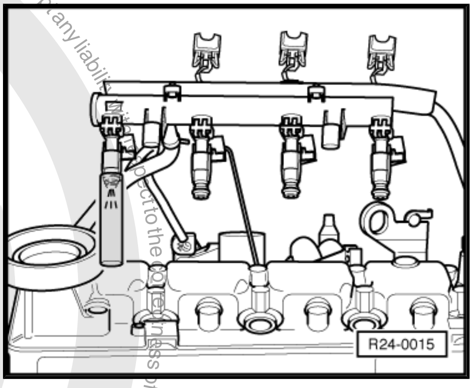
– Connect one injection valve contact, to be checked, to the motor earth strap with Auxiliary measuring cable set -VAG 1594C- .



– Connect the other injection valve contact with Remote control -VAG 1348/3A- and Adapting cable -VAG 1348/3-2- to the Battery -A- positive terminal.

– Turn ignition on; Fuel pump (pre-supply pump) -G6- does not work:





– Keep a small graduated container under the injection valve to be tested and remove the connectors from the remaining injection valves.

– Activate the Remote control -VAG 1348/3A- once more for 30 seconds.

– Repeat test on the other injection valves. Ensure that only the injection valve being tested is connected.

– Then check the injector valve sealant. Fuel loss cannot exceed 2 drops a minute.

If the fuel loss is greater:

– Switch ignition off.

– Replace damaged injection valve.

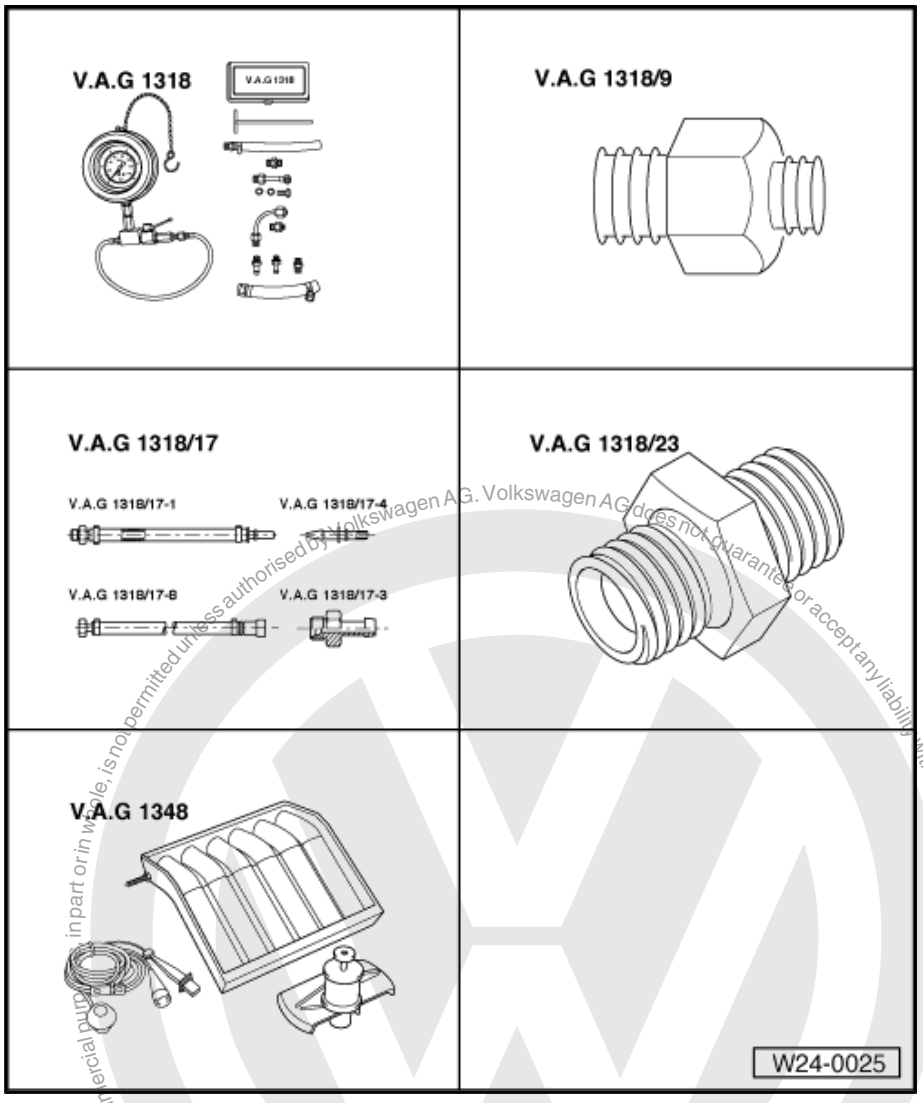
Injection valve is installed in the reverse sequence, observing the following:

♦ Rings on all injection valves must be replaced and quickly lubricated with clean engine oil.

♦ Place the injection valves in the vertical and proper position in the fuel distributor and fasten with safety clips.

♦ Install fuel distributor with injection valves on engine cylinder head and press in a uniform way.

2.2 Residual pressure and fuel pressure regulator - check



Special tools and workshop equipment required

- Pressure gauge -VAG 1318-
- Adapter -VAG 1318/1-
- Adapter -VAG 1318/17-
- Adapter -VAG 1318/23-
- Flow comparison meter -VAG 1348-

2.2.1 Pressure - check

Note

- *Fuel pressure regulator adjusts fuel pressure to around 3 bar.*
- *The fuel pressure regulator is on the Fuel pump (pre-supply pump) -G6- .*

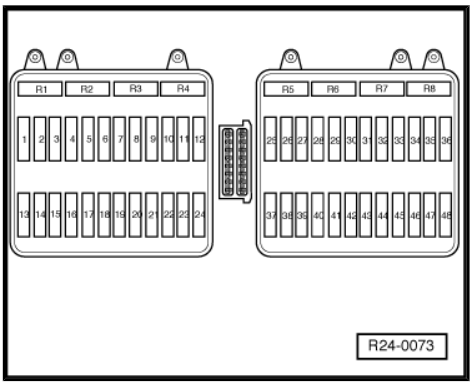
2.2.2 Checking process

– Remove fuse case lid.

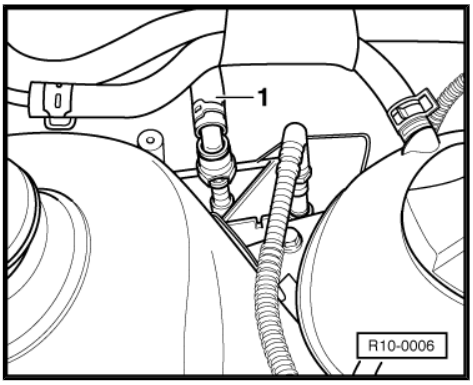
– Remove fuse 33 from the (Fuel pump (pre-supply pump) -G6-) fuse case.

WARNING

Fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around them. Then, eliminate the pressure, carefully removing the hose and loosening the closing screw.



– Disconnect fuel supply pipes connection -1- and clean spilled fuel with a cloth.



Note

To unlock fuel pipes, press the safety key.

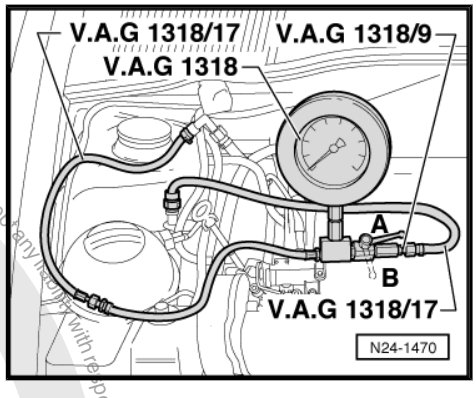
– Install Pressure gauge -VAG 1318- with Adapting set -VAG 1318/17- and Adapter -VAG 1318/9- .

– Open pressure gauge cock. The lever will point towards flow direction-A-.

– Put fuse 33 (Fuel pump (pre-supply pump) -G6-) in the fuse case again.

– Start engine and let it run in idle speed.

– Measure fuel pressure. Theoretical value: approx. 3.0 bar.



If the nominal value is not obtained:

– Switch ignition off.

– Verify Fuel pump (pre-supply pump) -G6- ⇒ page 98 check valve.

If nominal value is obtained:

– Switch ignition off.

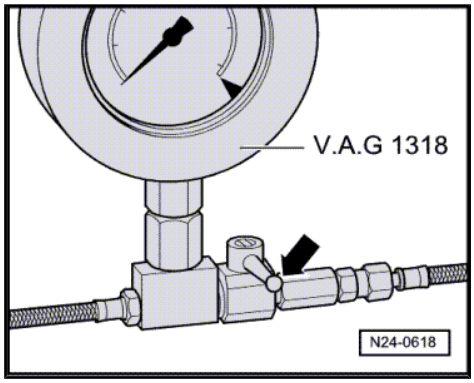
– Check tightness and residual pressure (of the whole system). For that, check pressure drop on gauge. After 10 minutes, there must still be a positive pressure of at least 2.0 bar.

If retaining pressure drops below 2.0 bar:

– Start the engine and run it at idle speed.

– Upon reaching the pressure, turn ignition off, closing the passage switch at the same time Pressure gauge -VAG 1318- (lever transverse to the blocking direction-arrow-) .

– Observe the pressure drop on the pressure gauge.



If pressure keeps dropping:

– Check hose connections and Fuel pump (pre-supply pump) -G6- .

– Check pressure gauge for leaks.

If the pressure does not drop:

– Check sealing rings between fuel distributor and injection valves and the hose between pressure gauge and fuel distributor.

– Verify Fuel pump (pre-supply pump) -G6- check valve.

Note

Before removing the pressure gauge, put cloths around the hose connections again.

2.2.3 Fuel pressure regulator - check

2.2.4 Check conditions

- Fuel pump (pre-supply pump) -G6- check valve ok: check ⇒ page 103 .

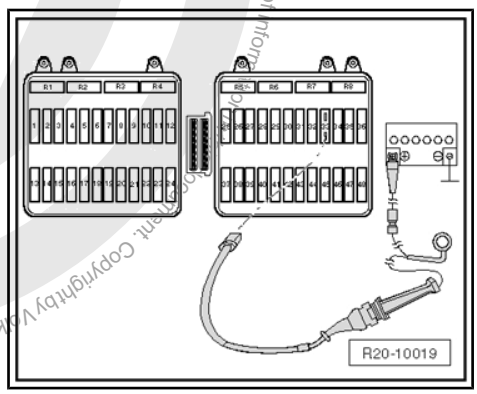
2.2.5 Checking process

– Switch ignition off.

– Remove fuse case lid.

– Remove fuse 33 from the (Fuel pump (pre-supply pump) -G6-) fuse case.

– Connect the Remote control -VAG 1348/3A- and Adapting cable -VAG 1348/3-2- to the lower contact of fuse 33 for activating Fuel pump (pre-supply pump) -G6- and to the battery positive terminal (+).



WARNING

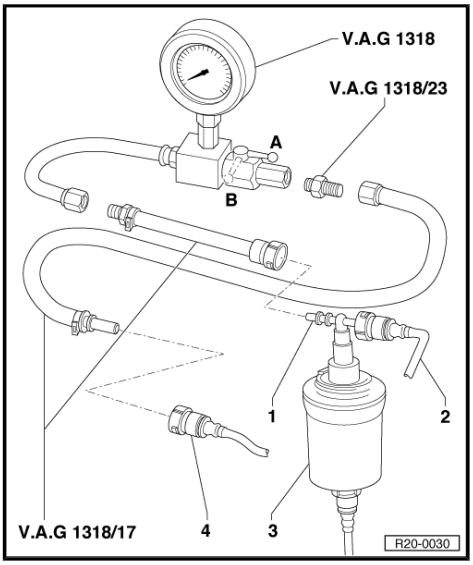
Fuel system is under pressure. Before loosening hose connections or opening checking junction, place a cloth around them. Next, eliminate pressure by removing hose carefully.

– Loosen supply pipes -1- from fuel filter outlet.

– Return pipes-2- (blue), keep connected.

– Fuel filter-3- with inlet hose.

– Fuel supply pipes (from filter outlet to engine)-4-, connect to the measuring equipment outlet.



Note

To unlock fuel pipes, press the safety key.

– Connect Pressure gauge -VAG 1318- with Adapting set -VAG 1318/17- and Connector -VAG 1318/23- as illustrated.
– Close pressure gauge blocking cock (lever transversal to blocking direction position - B-).
– Activate the Remote control -VAG 1348/3A- for approximately 10 seconds to fill the fuel tank and generate system pressure of approximately 3 bar.
– Observe the pressure drop on the pressure gauge. After 10 minutes, the pressure must not drop below 2.5 bar.

If the pressure drops further:

– Check pipes connections for leaks.

If no fault is found in the pipes:

– Replace fuel pressure regulator.

3 Engine control unit -J623-

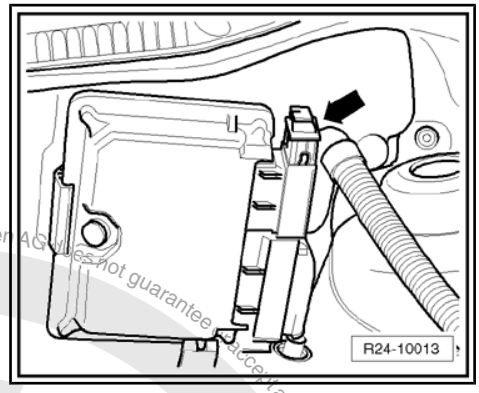
3.1 Engine control unit -J623- - remove and install

– Before removing the Engine control unit -J623- first check its identification as well as the coding ⇒ page 129 .

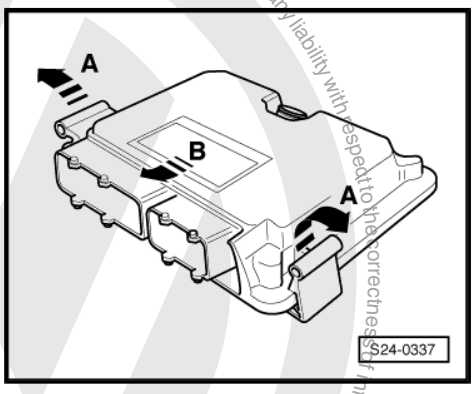
3.1.1 Removal

– Switch ignition off.

– Disconnect fitting connector from Engine control unit -J623- and remove it.



– Press clips -arrows- outwards and pull the Engine control unit -J623- to the sides.



3.1.2 Installing

– Place the new Engine control unit -J623- and press it to the left.

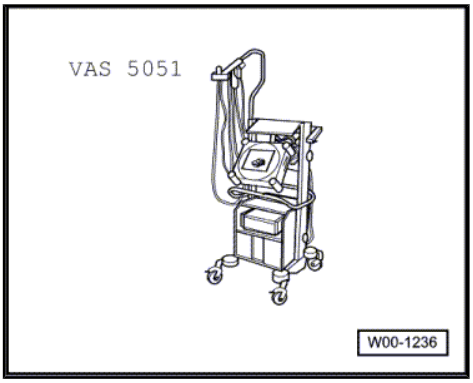
– Connect the connector and lock.

– Adjust the Engine control unit -J623- ⇒ page 129 .

– Refer to the fault memory of the new Engine control unit -J623- and, if necessary, erase the fault memory ⇒ page 129 .

– Perform a test cycle.

– Check the fault memory in the Engine control unit -J623- again.



3.2 Adjust components

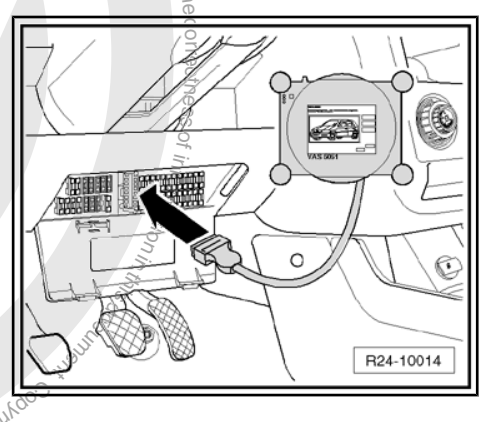
Special tools and workshop equipment required

- Diagnosis, Measurement and Information System -VAS 5051A/52- .
- Replacement cable 5 M -VAS 5051/3 - or Diagnosis cable -VAS 5051/1-

Operation sequence

– Connect the Vehicle Diagnosis, Measurement and Information System -VAS 5051A/52- as follows:

– Connect cable connector Diagnosis cable -VAS 5051/1- or Replacement cable 5 M -VAS 5051/3- to the diagnosis connection -arrow-.



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 `systems with self-diagnosis`.

– Select `engine control`.

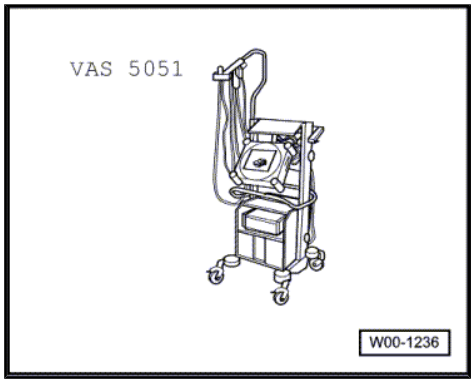
– Select `functions`.

– Select `function or component`.

3.3 Check the fault memory in the Engine control unit -J623- and erase

Special tools and workshop equipment required

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



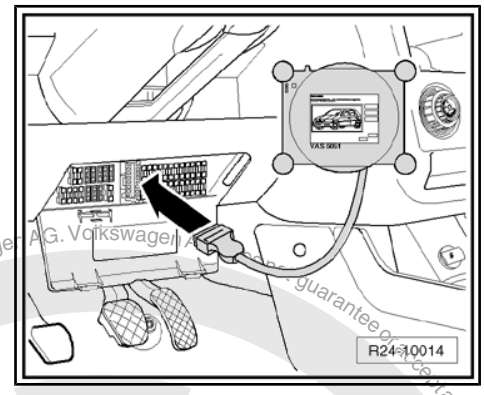
- Replacement cable 5 M -VAS 5051/3 - or Diagnosis cable - VAS 5051/1-

Operation sequence

– Connect the Vehicle Diagnosis, Measurement and Information System -VAS 5051A/52- as follows:

– Connect the Diagnosis cable -VAS 5051/1- or Replacement cable 5 M -VAS 5051/3- -arrow-.

– Start the engine and run it at idle speed.



Only when engine does not run:

– Switch ignition on.

Select operation mode:

– Press `Vehicle self-diagnosis` on the display.

Select the vehicle system:

– Press `01 Engine electronic system` on the display.

The display shows command unit identifications and the Engine control unit -J623- code.

Select diagnosis function:

– Press `02 Query fault memory` on the display.

– If no faults are stored in the Engine control unit -J623- , the display shows “0 faults found”.

– If there are faults stored in the Engine control unit -J623- , they will be shown sequentially on the display.

– Press ← key.

– Press `05 Erase fault memory` on the display.

– Press `06 End the test` function key.

26 – Exhaust system

1 Exhaust system components - remove and install

Note

- *After installation works, make sure the exhaust system is not tensioned and that there is a suitable distance from the body. If necessary, loosen double and retaining clamps and align the muffler and exhaust tube in a way that there is always a suitable distance from the body and that the supports have a uniform load.*
- *Always replace self-locking nuts.*

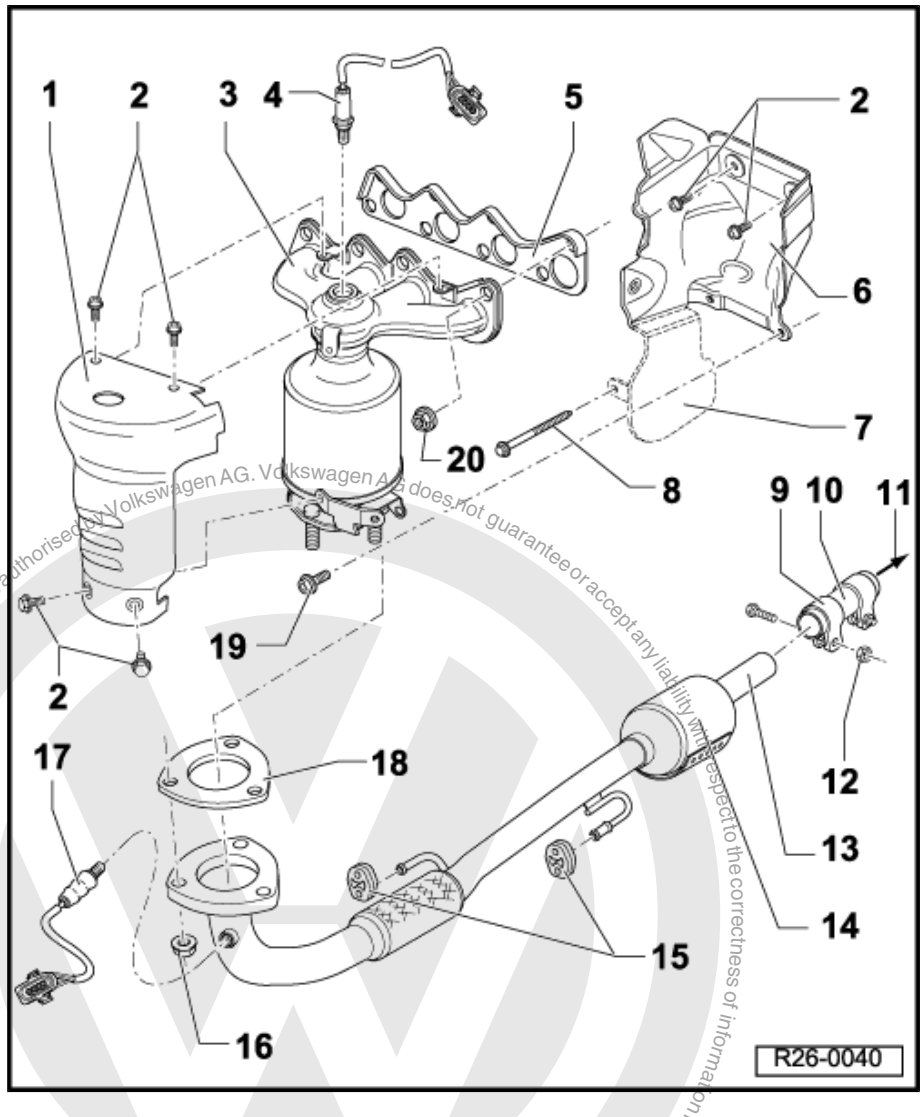
WARNING

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

Exhaust manifold, catalytic converter and front exhaust tube with intermediate muffler and installation parts ⇒ page 132 .

Rear muffler with supports ⇒ page 133 .

1.1 Exhaust manifold, catalytic converter and front exhaust tube with intermediate muffler



1 - Heat deflector

- ❑ Install without tension.

2 - 10 Nm

3 - Exhaust manifold

- ❑ For removal, remove heat deflector and loosen front tube.

4 - Lambda probe -G39- , 50 Nm

- ❑ Lubricate the thread with -G 052 112 A3- only; the -G 052 112 A3- cannot penetrate the grooves of the probe body.
- ❑ Remove and install with the Set of sockets for Lambda probe -3337- .
- ❑ In case of leakage, cut and replace the sealing ring.

5 - Joint

- ❑ Replace.

6 - Heat deflector

7 - Heat deflector

- ❑ From alternator.

8 - 20 Nm

9 - Double clamp

10 - Tube

11 - For rear muffler

12 - Self-locking nut

- ❑ 25 Nm
- ❑ Replace after each removal.

13 - Front tube with intermediate muffler

14 - Intermediate muffler

15 - Support strap

- ❑ Replace if damaged

16 - Self-locking nut

- ❑ 40 Nm
- ❑ Replace after each removal.

17 - Lambda probe after the catalytic converter -G130 - , 50 Nm

- ❑ Lubricate the thread with -G 052 112 A3- only; the -G 052 112 A3- cannot penetrate the grooves of the probe body.
- ❑ Remove and install with the Set of sockets for Lambda probe -3337- .
- ❑ In case of leakage, cut and replace the sealing ring.

18 - Joint

- ❑ Replace.

19 - 10 Nm

20 - Self-locking nut

- ❑ 25 Nm
- ❑ Replace after each removal.

1.2 Rear muffler with supports

1 - Rear exhaust tube

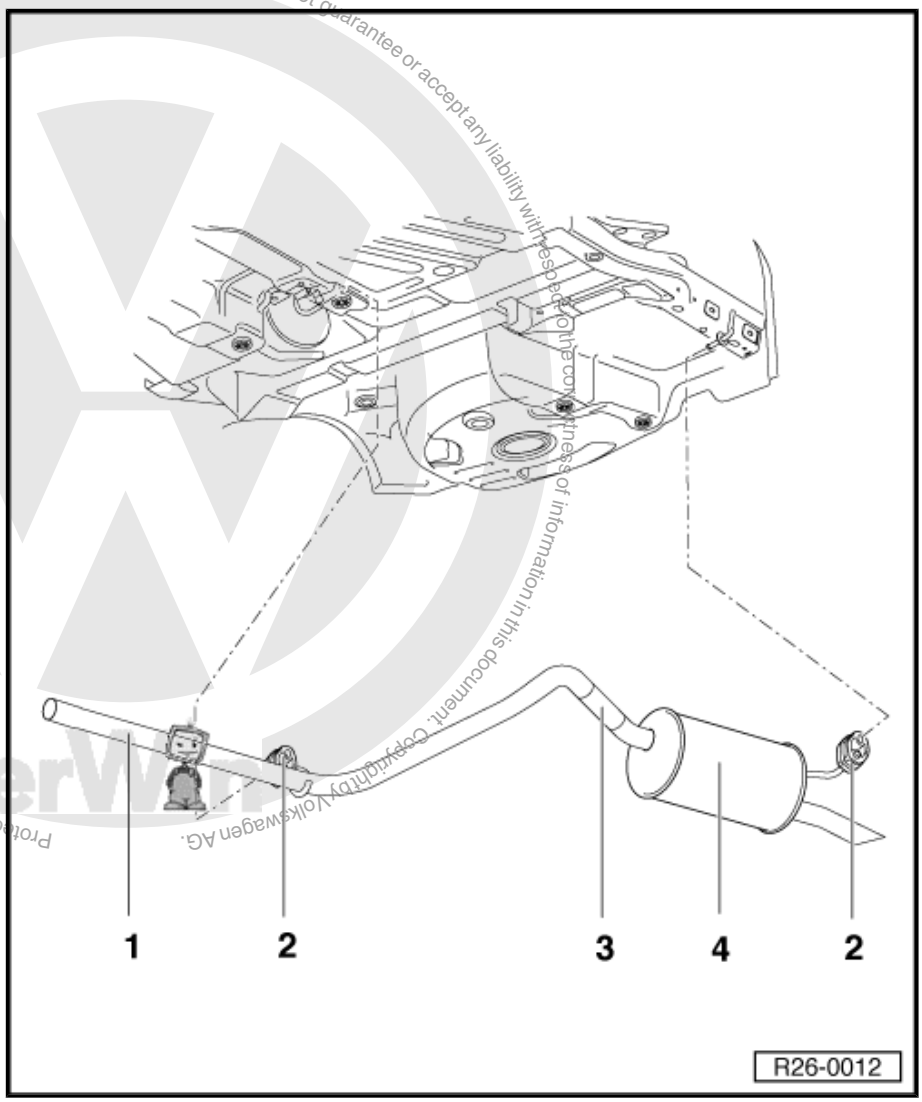
2 - Support strap

- ❑ Replace when damaged

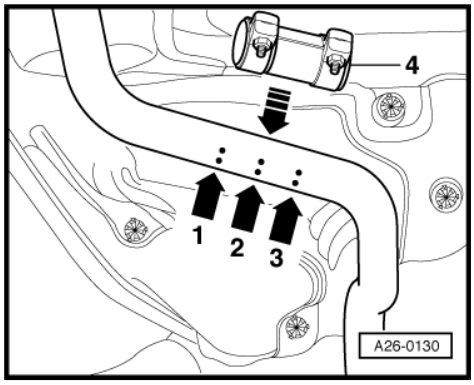
3 - Separation point

- ❑ Identified by points on connection tube.
- ❑ As standard items, the rear muffler with exhaust tube as one part are mounted. For repair, the rear muffler is supplied individually with one double clamp.
- ❑ Separate perpendicularly the connection tube at the separation point with one VAG 1523A or Pneumatic Saw -EQ 7415- ⇒ page 134

4 - Rear muffler



Separation point on the exhaust tube

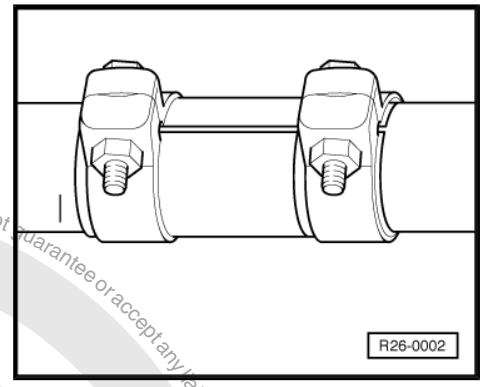


Clamp mounting position

Operation sequence:

– Apply sealing paste at the junctions and, then, install the sleeve and clamps on the exhaust pipe.

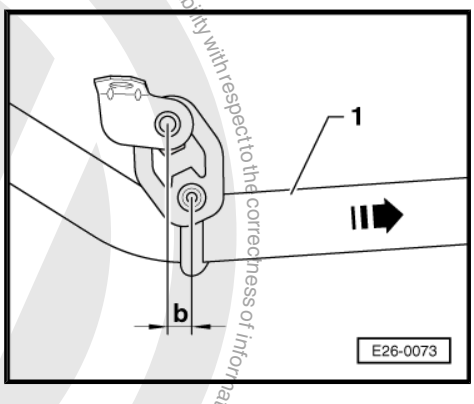
– Align the sleeve so that the junction is exactly in the centre of the sleeve.



Support bearing position

Operation sequence:

– The distance -b- between the clamp and the exhaust tube support -1- should be approx. 4 mm.



WARNING

Wear protection goggles and clothing to prevent injuries caused by metallic filings.

– Cut exhaust tube in right angle on the -arrow 2- separation point.

– When installing, position the repair double clamp -4- on the side marks-arrows 1 and 3-. Tightening torque 25 Nm.

28 – Ignition system

1 Ignition system - repair

1.1 General indications about the ignition system

- This chapter addresses especially ignition system related components. Other injection and ignition system components ⇒ page 110 .
- Minimum voltage of 11.5V is necessary for the perfect operation of electric components.
- In some tests, the Engine control unit -J623- may detect and record a fault. Thereby, once all tests and repairs are complete, check fault memory and erase it if necessary ⇒ page 129 .
- If after troubleshooting, repair and component checking, the engine starts for a moment and stops, the immobiliser may be blocking the Engine control unit -J623- . In this case, check the fault memory and, if necessary, adjust the Engine command unit -J623- ⇒ page 129 .

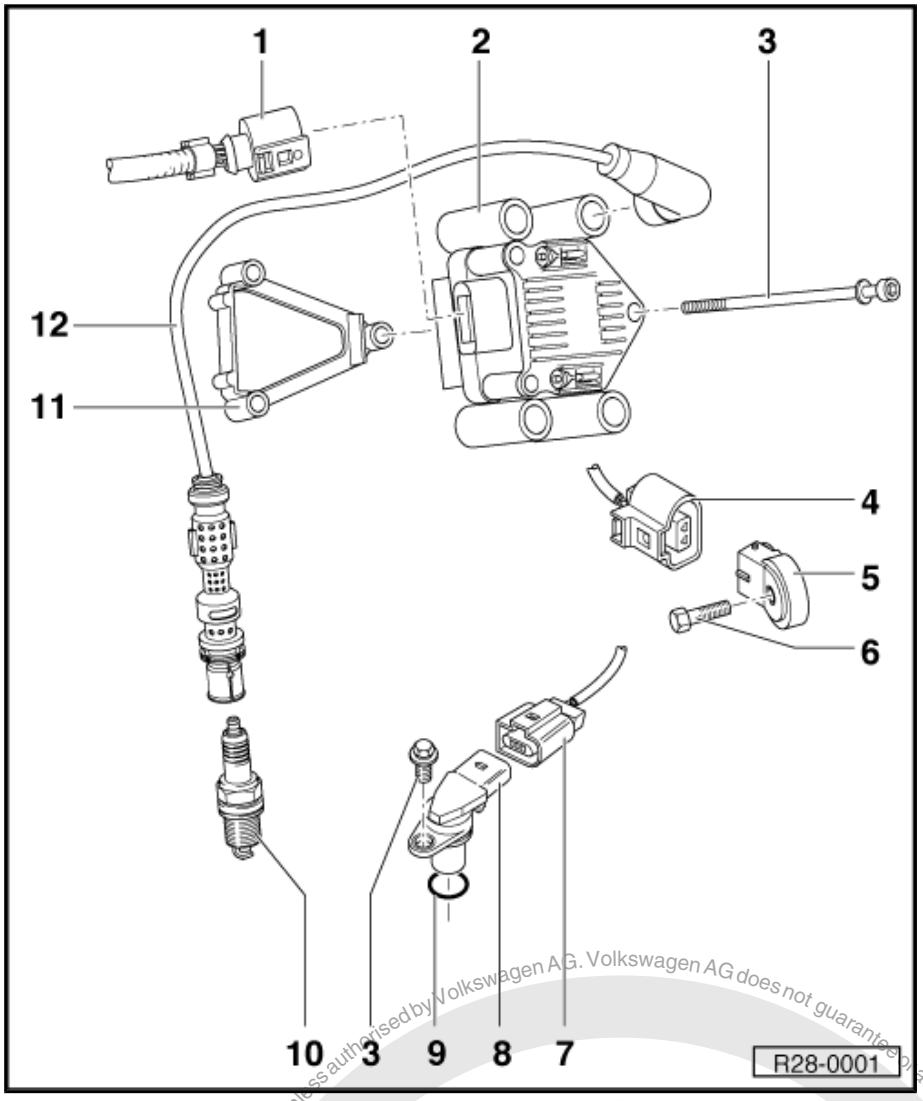
Safety measures ⇒ page 136 .

Checking data, spark plugs ⇒ page 137 .

1.2 Ignition system components - remove and install

Note

Engine control unit -J623- with connectors ⇒ Item 7 (page 111) .



1 - Connector

- ❑ Black, 4 poles.
- ❑ To the Ignition transformer -N152- .

2 - Ignition transformer -(152)-

- ❑ Installation location ⇒ page 110 .
- ❑ With codes for spark plug cables: A = cylinder 1. B = cylinder 3. C = cylinder 2. D = cylinder 4.

3 - 10 Nm

4 - Connector

- ❑ Black, 2 poles.
- ❑ To the Knock sensor 1 - G61- .
- ❑ Gold plated connector and sensor contact.

5 - Knock sensor 1 -G61-

- ❑ Installation location ⇒ page 110 .
- ❑ Gold plated connector and sensor contact.

6 - 20 Nm

- ❑ Tightening torque influences Knock Sensor 1 - G61- operation.

7 - Connector

- ❑ Black, 3 poles.
- ❑ To Hall Sensor -G40- .
- ❑ Gold plated connector contacts.

8 - Hall Sensor -G40-

- ❑ Installation location ⇒ page 110 .

9 - Washer

- ❑ Replace when damaged.

10 - Spark plug, 30 Nm

- ❑ Remove and install with Spark plug wrench -3122B- .
- ❑ Type and inter-electrode gap ⇒ page 137

11 - Support

- ❑ To the Ignition transformer - N152- .

12 - Spark plug cable

- ❑ With interference suppression and spark plug connector.
- ❑ Resistance 4.8...7.2 kΩ.

1.3 Safety measures

To avoid personal injuries and/or injection and ignition system deterioration, observe the following:

- Do not touch nor disconnect ignition wires with the engine running or in starting speed.
- Loosen and connect injection and ignition system cables, including the measuring equipment cables, only with ignition off.

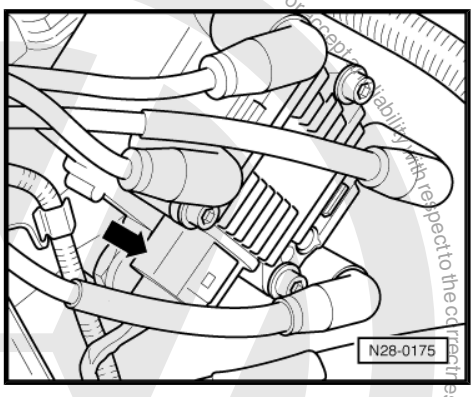
If during a test cycle, it is necessary to use test and measuring equipment, consider the following:

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

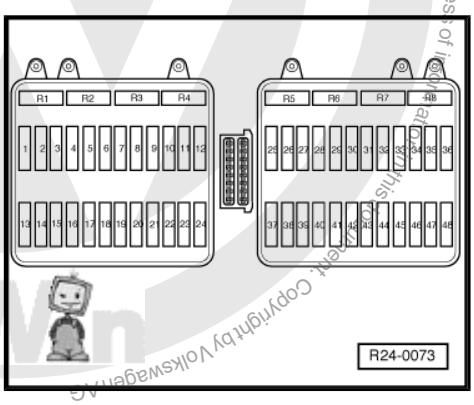
If test and measuring equipment are operated from the passenger seat, the person seated there may be injured should the airbag activate in case of accident.

- If the engine is to be turned over at starting speed, without starting:

– Disconnect the Ignition transformer 4-pole connector -N152- -arrow-.



– Remove fuse 44 from fuse case.



Note

When fuse 44 is removed, power supply to injectors is interrupted.

1.4 Test data, spark plugs

Engine identification letters		BKR
Firing sequence		1-3-4-2
Spark plug[13) , 2) 14)]		
	VW	101/000 062/AB//
	Manufacturer denomination	NGK PZFR5D -11
	Inter-electrode gap	max. 1,0 ... 1.1 mm
	Tightening torque	30 Nm

13) Current values and replacement intervals of the spark plugs: ⇒ Exhaust gas Test Folder .

14) Remove and install spark plugs with SPARK PLUG WRENCH -3122B- .

05.10