Workshop Manual
FOX 2004 ➢

3 - Cyl. injection engine									
Engine ID	BMD	CHF B							

Edition 12.2009

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Repair Group

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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.

Contents

00 – Technical data

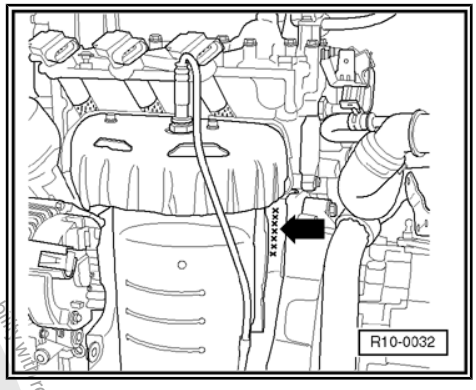
1 Technical Data

Engine number ⇒ page 1

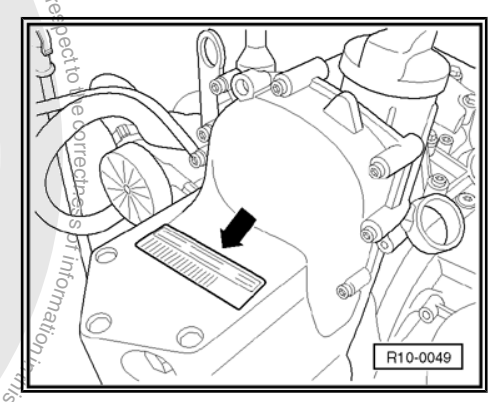
1.1 Engine number

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) is the “serial number”. If more than 999,999 engines with the same engine identification letters are produced, the first of the six digits is replaced by a letter.

Engine number (“engine identification letters” and “serial number”) is located on the engine block front surface, next to the gearbox.



Additionally, there is sticker -arrow- with the “engine identification letters” and the“serial number”on the right engine support.



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

1.2 Engine features

Identification letters		BMD	CHFB
Production		05.04 ▸	03.09 ▸
Cylinder volume	cm^3	1198	1198
Power	cv (kW)/rpm	55(40)/4750	55(40)/4750
Torque	Nm (mkgf)/rpm	106(10,9)/3000	106(10,9)/3000
Diameter	Ø mm	76,5	76,5
Stroke	mm	86,9	86,9
Compression rate		10,3	10,3
Valves per cylinder		2	2
Octane rating	at least	95 lead-free [1)]	95 lead-free [1)]
Injection, ignition		Simos 3PG[2)]	Simos 9.1
Knock control		1 knock sensor	1 knock sensor
Lambda adjustment		2 probes	2 probes
Catalyst		yes	yes
Recirculation of exhaust gases		no	no

Identification letters	BMD	CHFB
Overcharge	no	no

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

2) Simons 3 PG installed up to May/2006, Simons 9.1 stared as of June/2006.

10 – Cylinders, engine block, support, protector

1 Engine - remove and install

Removal ⇒ page 4 .

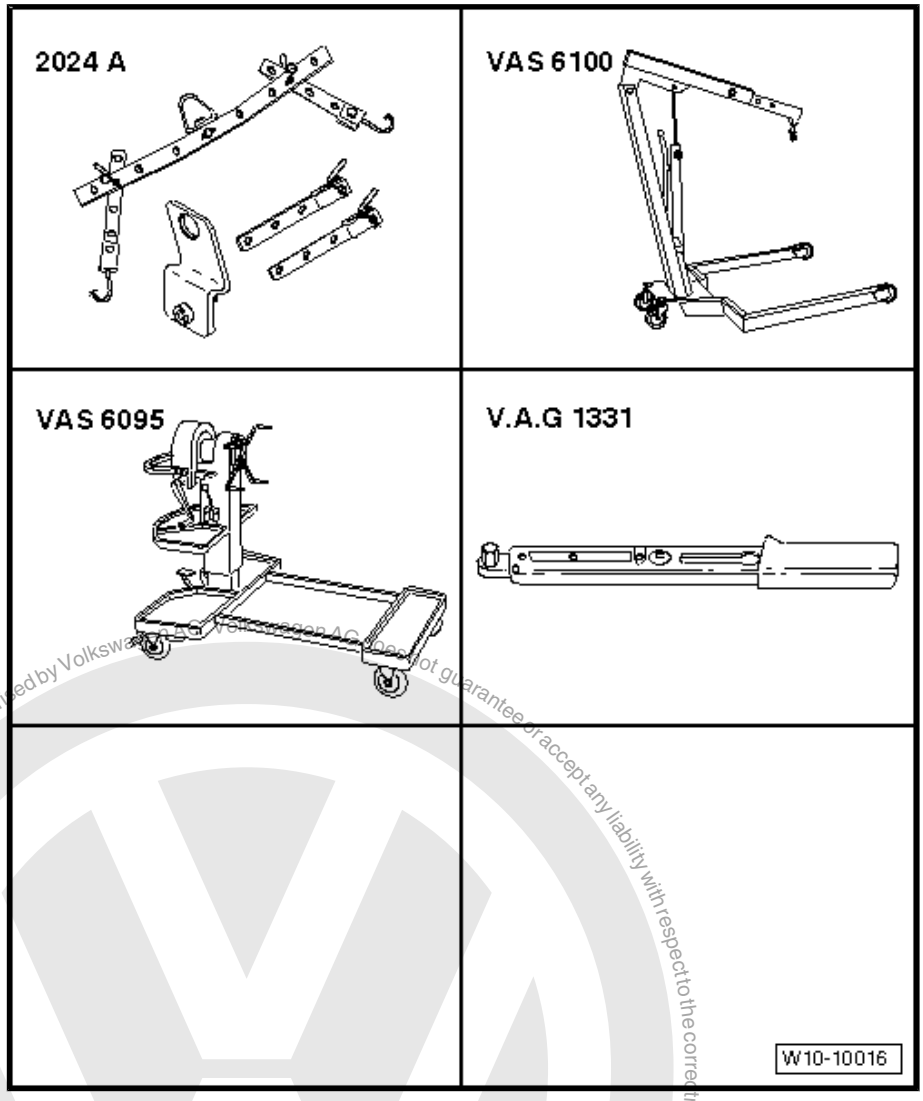
Additional notes and mounting works in vehicles with air conditioning ⇒ page 7 .

Installing ⇒ page 7 .

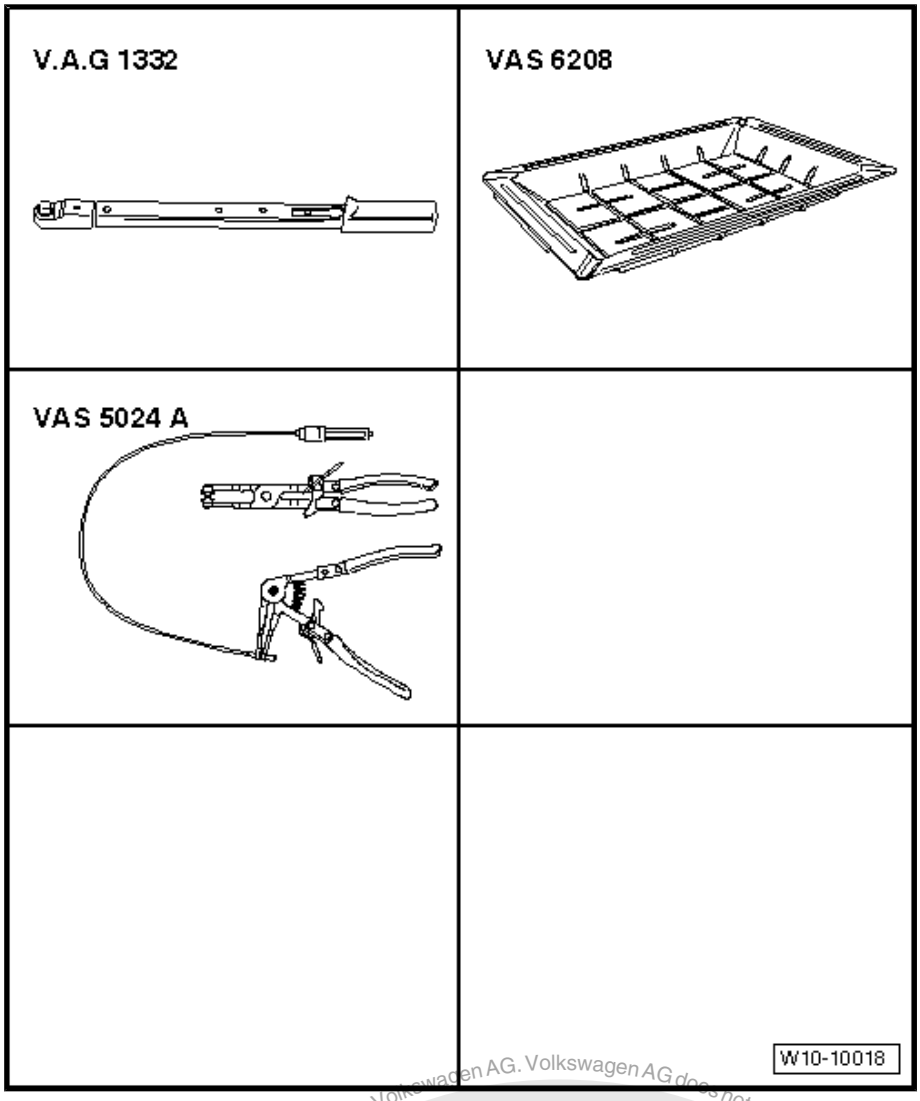
Tightening torque ⇒ page 8 .

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-



- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- Container -VAS 6208-
- VW 5162 or Standart-type clamp pliers -VAS 5024A-
- Grease -G 000 100-
- Clamp



1.1 Removal - indications

Note

Disconnect the Battery -A- earth strap for carrying out the operation sequence below. Check if the vehicle has code radio. If positive, request the anti-theft code before disconnecting earth strap from the Battery -A- .

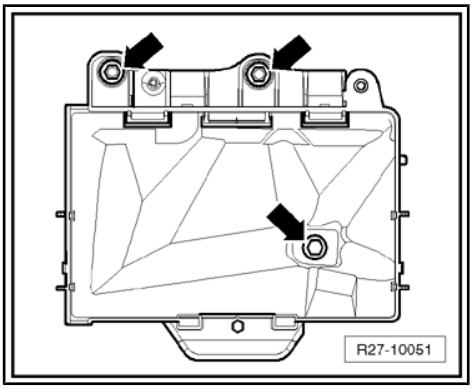
– The engine is removed from the front along with the transmission.

– With the ignition switched off, disconnect the Battery -A- earth strap.

– All clamps loosened or cut during engine removal must be placed in the same position again during engine installation.

– Remove air filter set ⇒ page 91 .

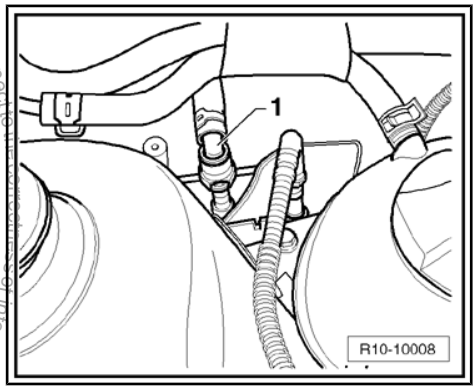
– Remove the Battery -A- and the Battery support -A- -arrows- ⇒ Electrical equipment; Rep. Gr. 27 ; Starter, generator, battery .
– Open and close the coolant reservoir lid to depressurize the cooling system.
– Release/separate all transmission electric cables of the Generator (Alternator) -C- and Starter -B- .
– Loosen/separate all of the remaining necessary engine electric cables.



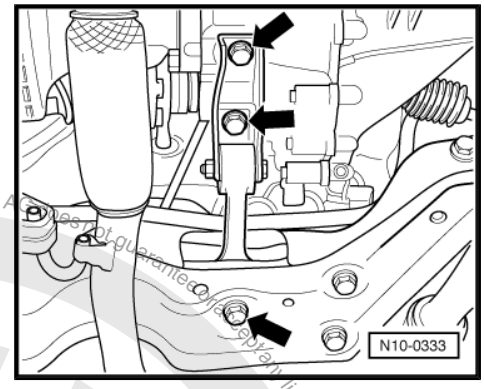
WARNING

Fuel supply tube is under pressure! Wear protective goggles and gloves to prevent injuries and avoid contact with the skin. Before loosening tube junctions, place a cloth around them. Eliminate pressure, pulling the tube carefully.

– Loosen the fuel supply pipes -1- (press the unlock key).
– Remove the Electromagnetic valve for activated charcoal filter -N80- hose on the intake manifold.
– Close the hoses so as to prevent impurities from entering the fuel system.
– Follow cleaning rules ⇒ page 65 .
– Remove vacuum and vent hoses from the engine.
– Disengage the connectors from the Radiator fan thermal switch -F18- and from the Radiator fan -V7- .
– Remove fastening screw from front exhaust tube support strap in the transmission.
– Loosen front exhaust tube from catalytic converter ⇒ page 106 .



– Remove transmission pendulum support -arrows-.



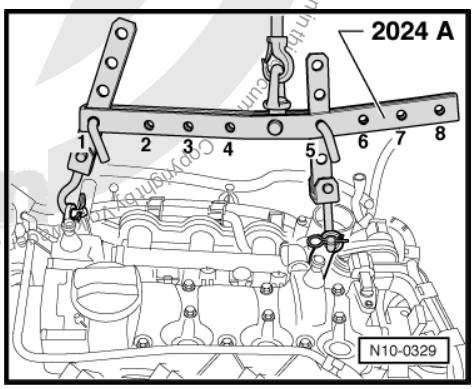
– Remove clutch actuator hydraulic cylinder: ⇒ Automatic / mechanical transmission ; Rep. Gr. 30 ; Clutch - command system .
– Remove transmission gearshift command: ⇒ Automatic/mechanical transmission; Rep. Gr. 34 ; Drive, housing .
– Drain the cooling system ⇒ page 56 .
– Remove engine cooling system hoses with VW 5162 or Standard type clamp pliers - VAS 5024A- .
– Remove the Poly-V belt ⇒ page 13 .
– Put front panel in the work position: ⇒ Body - Repair ; Rep. Gr. 50 ; Body - Front part .

Vehicles with air conditioning

– Remove air conditioning compressor: ⇒ Aeration system; Rep. Gr. 87 ; Air conditioning and anchor to the body with a wire.
– Observe additional indications and assembly works ⇒ page 7

Continued for all vehicles.

– Remove drive shafts, on the left and right side of the transmission, and fasten them on top: ⇒ Chassis; Rep. Gr. 40 ; Front suspension .
– Install the Hanger or VW 055 -2024A- and lift it with a hydraulic hoister.



Pulley side: position 1 of the vertical rod. Orifice on the sustaining bar in position 1.

Steering wheel side: position 2 of the vertical rod. Orifice on the sustaining bar in position 5.

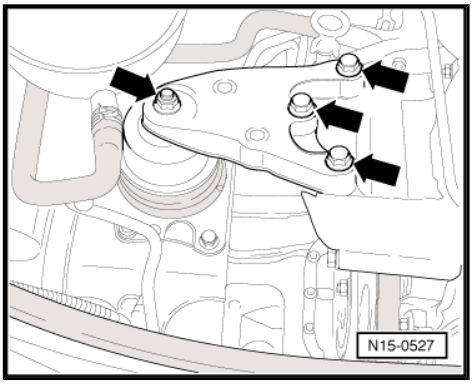
Caution

Use safety pins on fitting hooks and pins so as to prevent damages to the engine and vehicle.

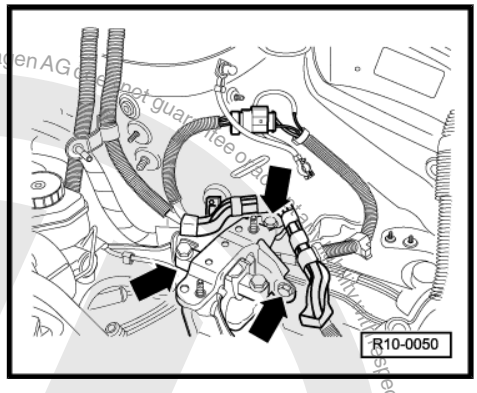
Note

- *Positions numbered 1...8 on suspension bar face the pulley side.*
- *The holes in the supports are counted from the hook.*

– Remove power-drive group support, engine-arrows-.



– Remove power-drive group support, transmission -arrows-.
– Remove the assembly from the front. For that, move the assembly and lift it little by little until passing it over the front panel.



Note

The assembly must be guided carefully when lifted to prevent damages to the body.

For removal works, the engine must be anchored to the Rotary stand for engine and transmission -VAS 6095- .

– Remove engine flange transmission.
– Fasten the engine to the Rotary stand for engine and transmission -VAS 6095- .

1.2 Additional notes and assembly works in vehicles with air conditioning.

Note

To avoid damage to the condenser and cooling gas hoses, do not kink, twist nor overstretch the hoses.

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

– Remove cooling gas hose clamps.
– Remove the Poly-V belt ⇒ page 13 .
– Remove air conditioning compressor from support with cooling gas pipes connected: ⇒ Heating - ventilation ; Rep. Gr. 87 ; Air conditioning .

1.3 Installation

Installation is carried out in removal reversed order, considering the following:

– Check clutch bearing for wear and replace it, if necessary.
– Slightly lubricate clutch bearing, guide roller bearing and primary shaft with Grease - G 000 100- .
– Check if guides for engine coupling and transmission are placed on the engine block and, if necessary, install them.
– When lowering the subframe, make sure it will not hit the drive shafts.

– Adjust engine supports with no tension.

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: ⇒ Heating - ventilation ; Rep. Gr. 87 ; Air conditioning .

Continued for all vehicles.

– Electrical connections and installation: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Install Poly-V belt ⇒ page 13 .

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

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

Continued for all vehicles.

– Fill cooling system ⇒ page 56 .

– Install air filter set ⇒ page 91 .

– Adapt Engine control unit -J623- to the Accelerator butterfly valve control unit -J338- ⇒ Vehicle diagnosis, testing and information system VAS 5051.

– Perform test drive and check fault memory ⇒ page 102 .

1.4 Tightening torques

Location		Tightening torque
Screws and nuts	M 6	10 Nm
	M 8	20 Nm
	M 10	45 Nm
	M 12	60 Nm
Exhaust tube to manifold		40 Nm

Support for the power-drive group

Note

The power-drive group support fastening screws are expansion screws and must be mandatorily replaced.

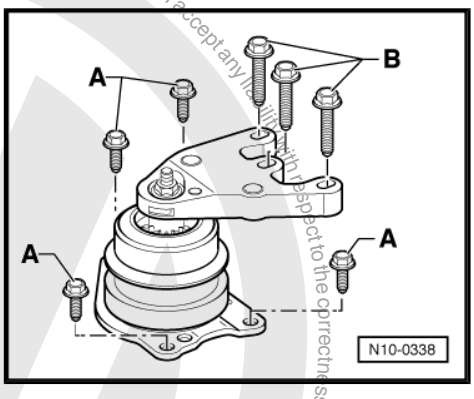
WARNING

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

Power-drive group support, engine

A = 20 Nm + 90°

B = 30 Nm +90°

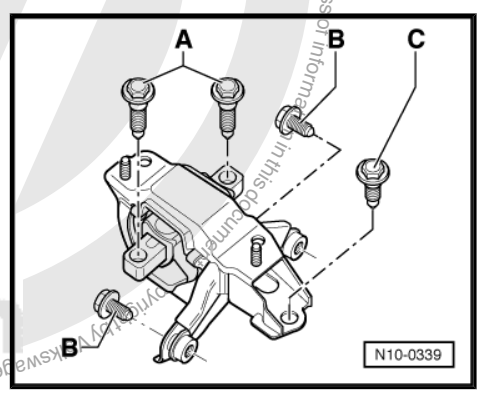


Power-drive group support, transmission

A = 40 Nm + 90°

B = 50 Nm +90°

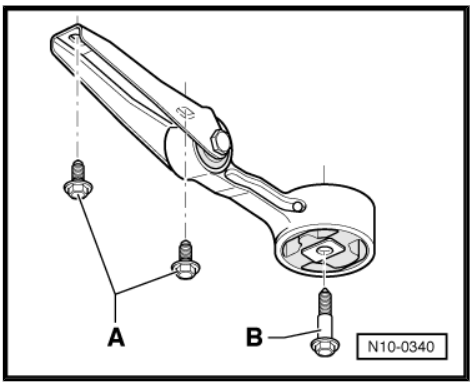
C = 50 Nm +90°



Pendular support

A = 30 Nm + 90°

B = 40 Nm +90°



13 – Crankshaft, pistons

1 Engine - disassemble and assemble

For disassembling works, the engine must be fastened to the Support -VW 540- or Rotary stand for engine and transmission -VAS 6095- .

Part I - Operating the belt ⇒ page 11 .

Part II - Operating the chain ⇒ page 11 .

Remove and install Poly-V belt ⇒ page 13 .

Remove and install control box ⇒ page 15 .

Caution

Crankshaft cannot be removed. Simply loosen crankshaft bearing cover bolts for the engine block bearing shells not to be deformed. Such deformation reduces bearing shells clearance. Even if bearing shells are not replaced, there can be damages due to change in the clearance.

If bearing cover bolts are loosened, the entire engine block with the crankshaft will have to be replaced.

The workshop does not have the necessary means to measure the crankshaft radial clearance.

WARNING

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

1.1 Part I - Operating Poly-V belt

1 - 20 Nm

2 - Pulley

- ❑ For water pump.

3 - Cover

4 - Poly-V belt tensioning pulley

5 - 20 Nm + 90°

- ❑ Replace after each removal.

6 - Alternator

7 - Return pulley

8 - Washer

9 - Pulley

- ❑ From the crankshaft.

10 - 90 Nm + 90°

- ❑ Replace after each removal.

11 - Guide bushing

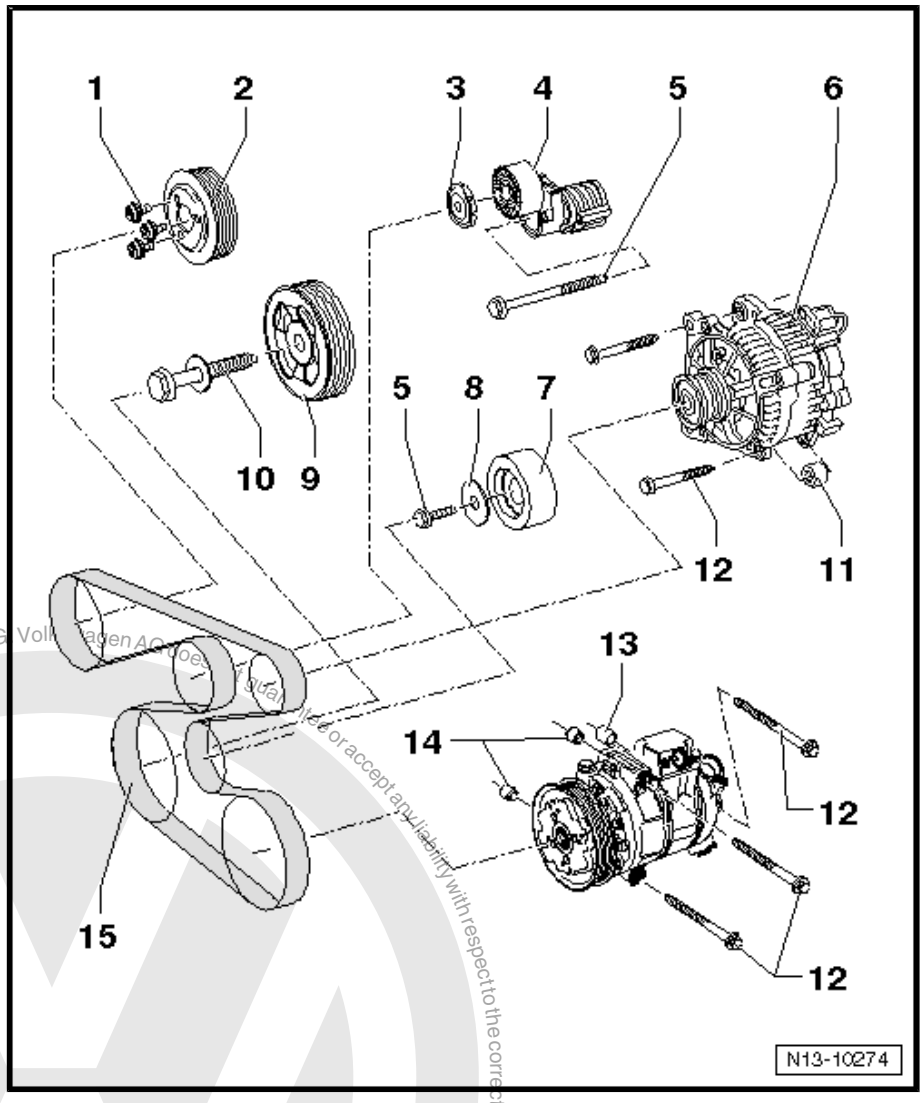
12 - 25 Nm

13 - Guide bushing

14 - Spacer sleeve

15 - Poly-V belt

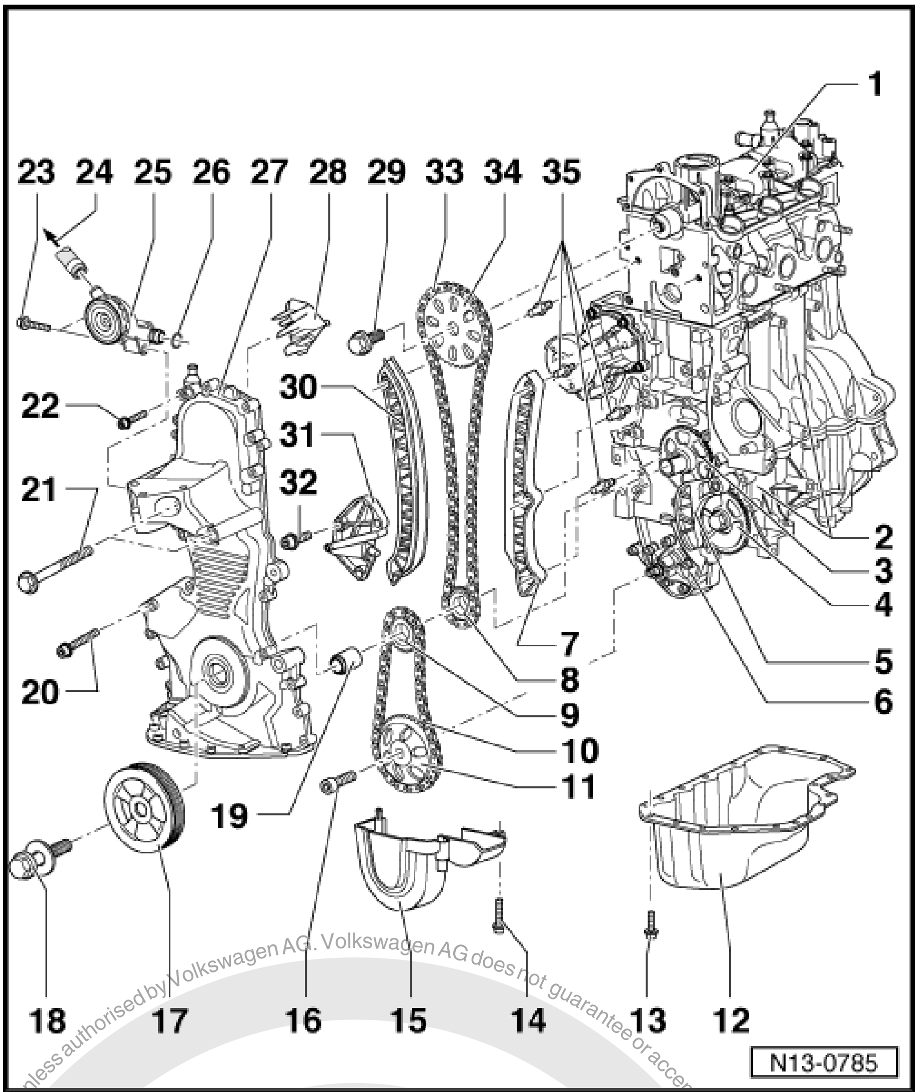
- ❑ Mark rotation direction before removal.
- ❑ Remove and install Poly-V belt ⇒ page 13 .



1.2 Part II - Operating the chain

WARNING

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



1 - Cylinder head cover

- ❑ Sealing surface cannot be ground.
- ❑ With integrated camshaft bearings.
- ❑ Remove residues from the old Sealing putty for engines -AMV 188 001 02- .
- ❑ Before installation, apply a coat of Sealing putty for engines -AMV 188 001 02- .
- ❑ For installation, put it in the vertical position, from up to down, with the adjusting pins into the cylinder head holes.

2 - Engine block

- ❑ 2 parts.
- ❑ The screws cannot be loosened.

3 - Gear

- ❑ From the crankshaft.

4 - Gear

- ❑ From balancing shaft.
- ❑ Fastening screw cannot be loosened.

5 - Chain stretcher with tensioning chute

- ❑ From roller chain ⇒ Item 10 (page 12) .

6 - Oil pump

- ❑ Replace only the complete set.

7 - Sliding chute

- ❑ From roller chain ⇒ Item 33 (page 13) .

8 - Gear

- ❑ From the crankshaft.

9 - Gear

- ❑ From oil pump activation.

10 - Roller chain

- ❑ Mark rotation direction before removal (installation positions).

11 - Gear

- ❑ From oil pump.
- ❑ After installation, adjust distribution times ⇒ page 32 .

12 - Crankcase

- ❑ Remove and install in engines with liquid joint ⇒ page 48 .
- ❑ Clean the Engine silicone sealant -D 176 404 A2- from the surface before installing.
- ❑ Install with Engine silicone sealant -D 176 404 A2- .

13 - 15 Nm

14 - 8 Nm

15 - Cover

16 - 20 Nm + 90°

- ❑ Replace after each removal.

17 - Crankshaft pulley

- ❑ Remove and install Poly-V belt ⇒ page 13 .

18 - 90 Nm + 90°

- ❑ Replace after each removal..
- ❑ Fit lubricated.
- ❑ Immobilise crankshaft pulley with the Spanner -3415- .
- ❑ The additional angle torque can be measured with a spanner, e.g. Hazet 6690.

19 - Supporting bushing

20 - 25 Nm

21 - 45 Nm

22 - 10 Nm

23 - 10 Nm

24 - To intake manifold

25 - Oil separator

- ❑ With depression valve.

26 - Sealing ring

- ❑ Replace if damaged

27 - Control box

- ❑ Install with Engine silicone sealant -D 176 404 A2- .
- ❑ For better alignment in assembly, install two vertical bolts -M6x75- into the cylinder head and engine block.
- ❑ For better alignment of the control box, install oil crankcase with two bolts.

28 - Cover

29 - 20 Nm + 90°

- ❑ Replace after each removal.

30 - Tensioning chute

31 - Chain stretcher

32 - 15 Nm

33 - Roller chain

34 - Gear

- ❑ From Camshaft
- ❑ Immobilise the gear with the Special wrench -3036 -

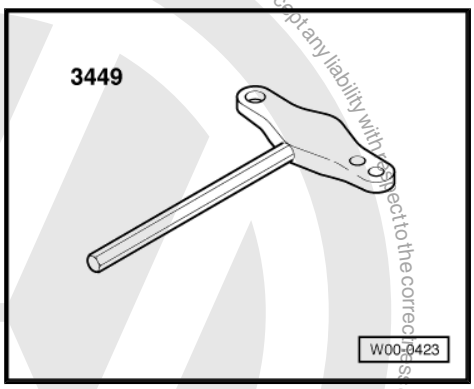
35 - Guide pin

- ❑ Tightening torque: 20 Nm

1.3 Poly-V belt - remove and install

Special tools and workshop equipment required

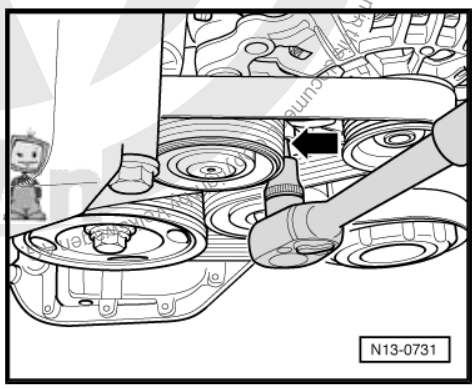
♦ Hexagonal wrench -3449-



Operation sequence

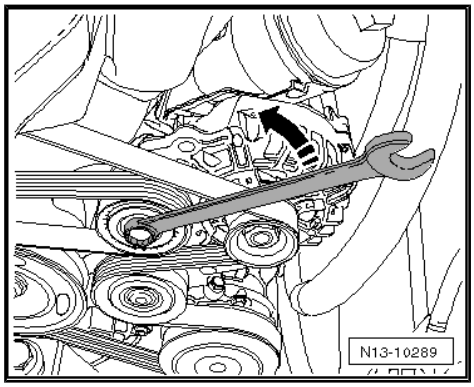
– Mark the Poly-V belt turning direction.

– Move tensioning element in the arrow direction, until the hole is visible. Retain tensioning element with an Hexagonal wrench -3449- .



– Move the tensioning element towards -arrow- with socket and spanner. Secure the tensioning element with a Hexagonal wrench -3449- .

– Remove or install Poly-V belt .



Note

When installing Poly-V belt, ensure the proper seating of the belt on the pulleys.

Poly-V belt travel

Belt operation without ar conditioning compressor

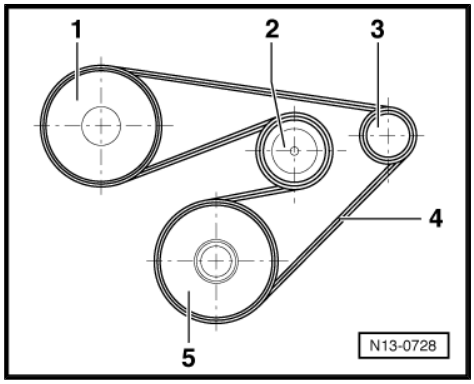
1 - Water pump pulley

2 - Tensioning pulley

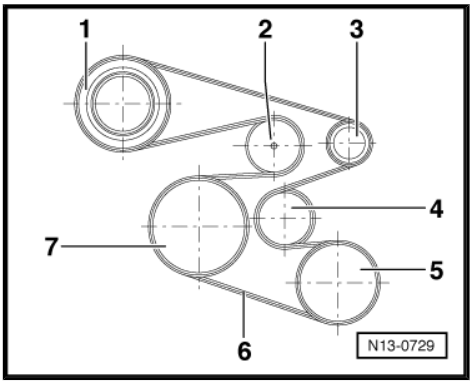
3 - Generator (Alternator) -C- pulley

4 - Poly-V belt

5 - Crankshaft pulley



Belt operation with ar conditioning compressor



1 - Water pump pulley

2 - Tensioning pulley

3 - Generator (Alternator) -C- pulley

4 - Pulley

5 - Air conditioning compressor pulley

6 - Poly-V belt

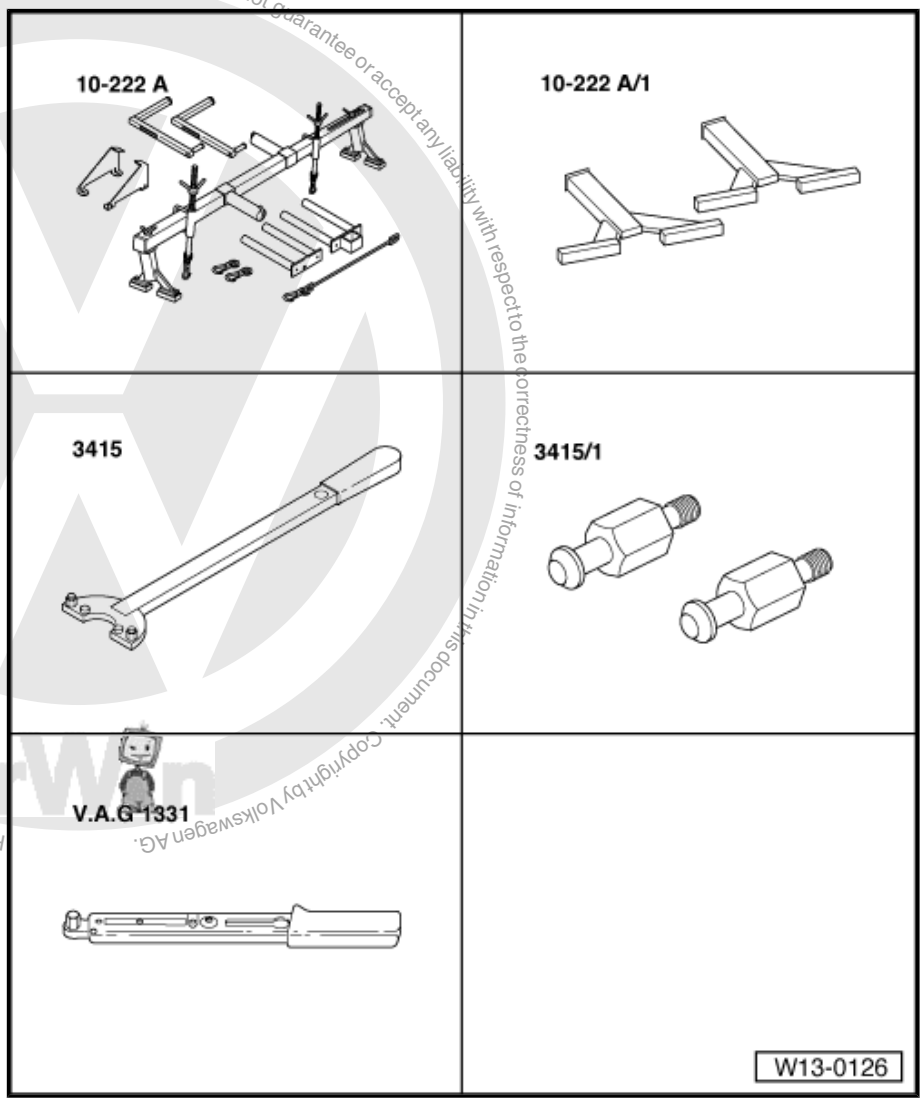
7 - Crankshaft pulley

The rest of the installation is carried out in removal reverse order.

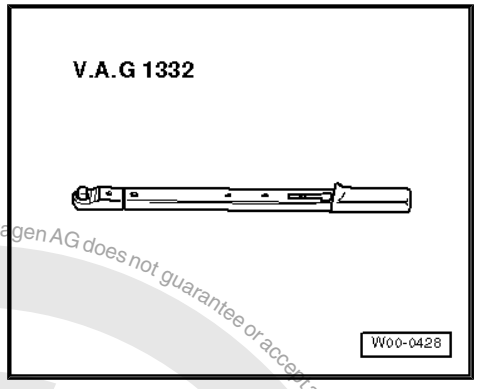
1.4 Control box - remove and install

Special tools and workshop equipment required

- Support or 10-222A -VW 061-
- Hooks -10-222A/10-
- Wrench -3415-
- Pins -3415/1-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-



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



1.4.1 Removal

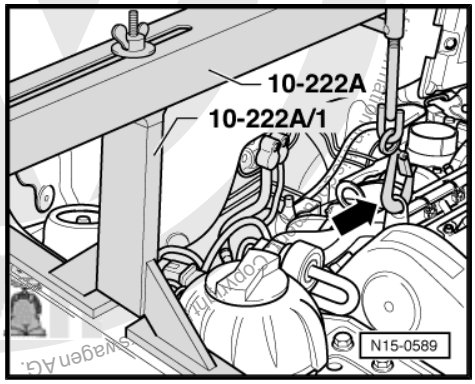
– Remove the front right wheel case protector: ⇒ Body - External assembly repairs; Rep. Gr. 66 ; External equipment .

– Mark the Poly-V belt operating direction and remove it ⇒ page 13 .

– Remove air conditioning compressor from support with pipes connected: ⇒ Heating - ventilation ; Rep. Gr. 87 ; Air conditioning .

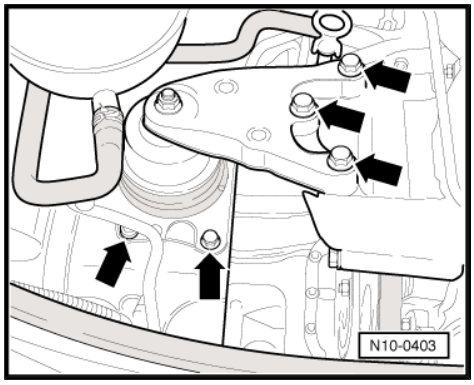
– Remove Generator (Alternator) -C- .

– Install Support -10-222 A- with Rack -10 - 222 A /1- , as illustrated, and install on lifting eye-arrow-.

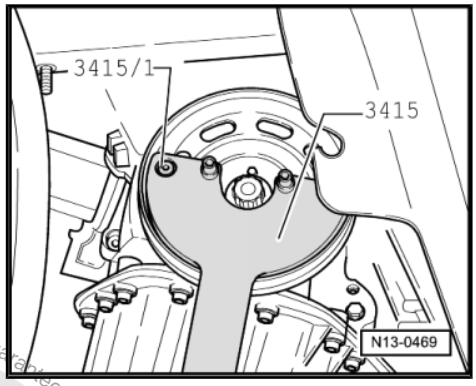


– Pre-tension the engine slightly and loosen fastening bolts -arrows-.

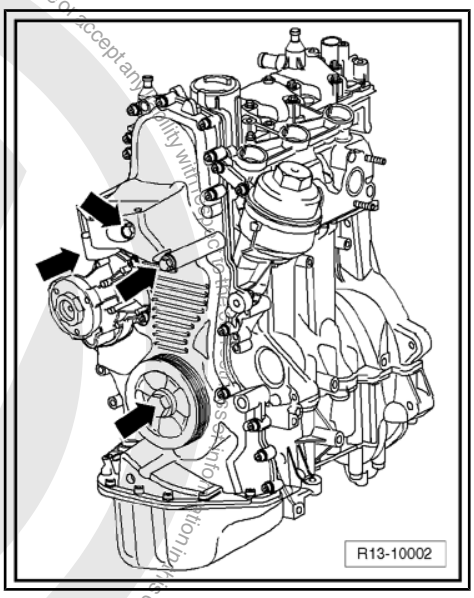
– Remove oil crankcase ⇒ page 48 .



– Remove the fastening bolts from the crankshaft pulley. Immobilise the pulley with the Spanner -3415- and -3415/1- .



– Remove fastening bolts from control box and bolts designated by the -arrows-.
– Remove control box.



Note

Ensure that the crankshaft support pin remains on sealing flange.

1.4.2 Installation

– Clean sealing surfaces thoroughly. They must be free from oil and grease.
– Seat the new gasket on adjusting pin.
– To facilitate alignement, install two Bolts -M6x80- on cylinder head and engine block.
– Install control box and crankshaft support, simultaneously on threaded-end pins, adjusting pins and crankshaft crankpin.
– Tighten fastening bolts on control box evenly and in a cross pattern.

Make sure the camshaft housing is not gripped.

Tightening torque:

Bolt M 6 to 10 Nm.

Bolt M 10 to 50 Nm.

Resume the installation in the removal reverse order.

2 Engine block, seals

Remove and Install ⇒ page 18

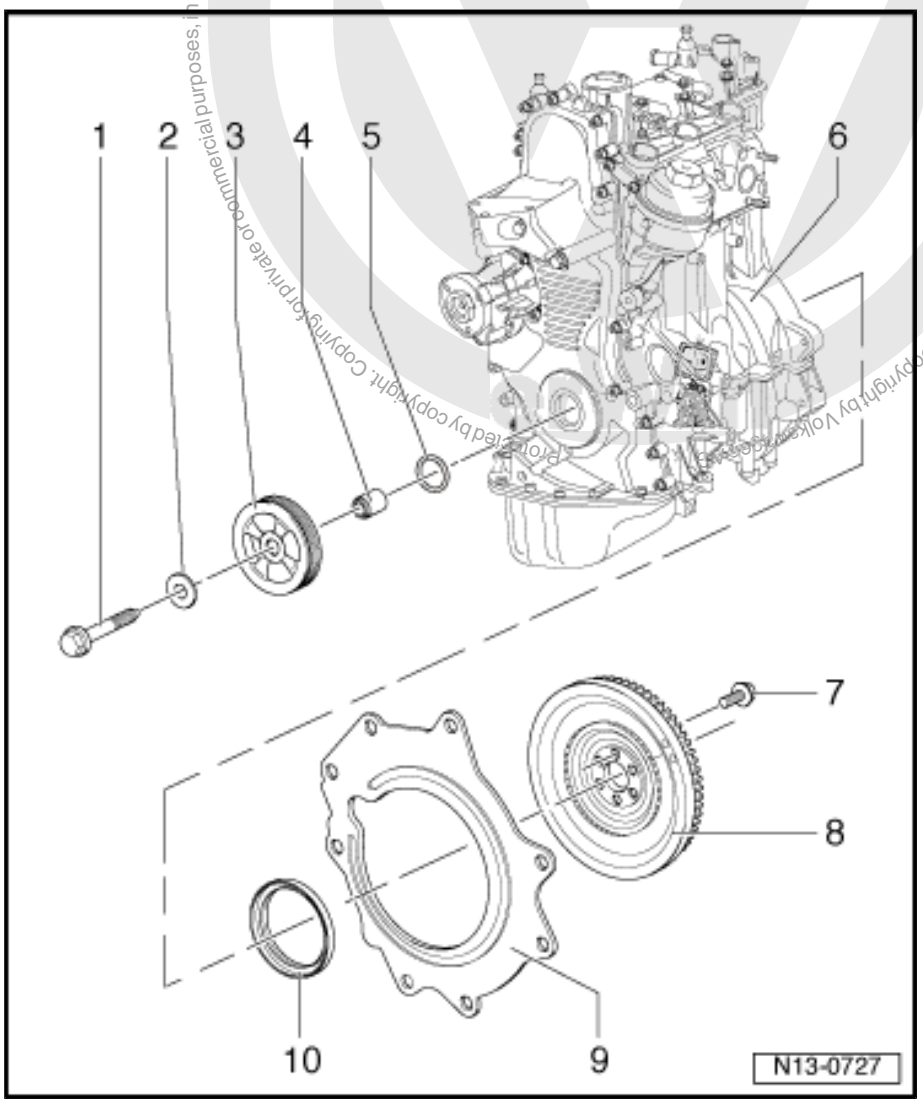
Replace crankshaft seal - pulley side ⇒ page 19

Replace crankshaft seal - engine flywheel side ⇒ page 21

WARNING

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

2.1 Crankshaft seals



1 - 90 Nm + 90°

- ❑ Replace after each removal..
- ❑ Fit lubricated.
- ❑ Immobilise crankshaft pulley with the Spanner -3415- .
- ❑ The additional angle torque can be measured with a spanner, e.g. Hazet 6690.

2 - Washer

3 - Crankshaft pulley

- ❑ Remove and install Poly-V belt ⇒ page 13 .

4 - Support sleeve

5 - Crankshaft seal (pulley side)

- ❑ Replace ⇒ page 19 .

6 - Engine block

7 - 60 Nm + 90°

- ❑ Replace after each removal.

8 - Flywheel

9 - Intermediate plate

- ❑ Must seat on adjusting guide.
- ❑ Do not damage/twist while removing and installing

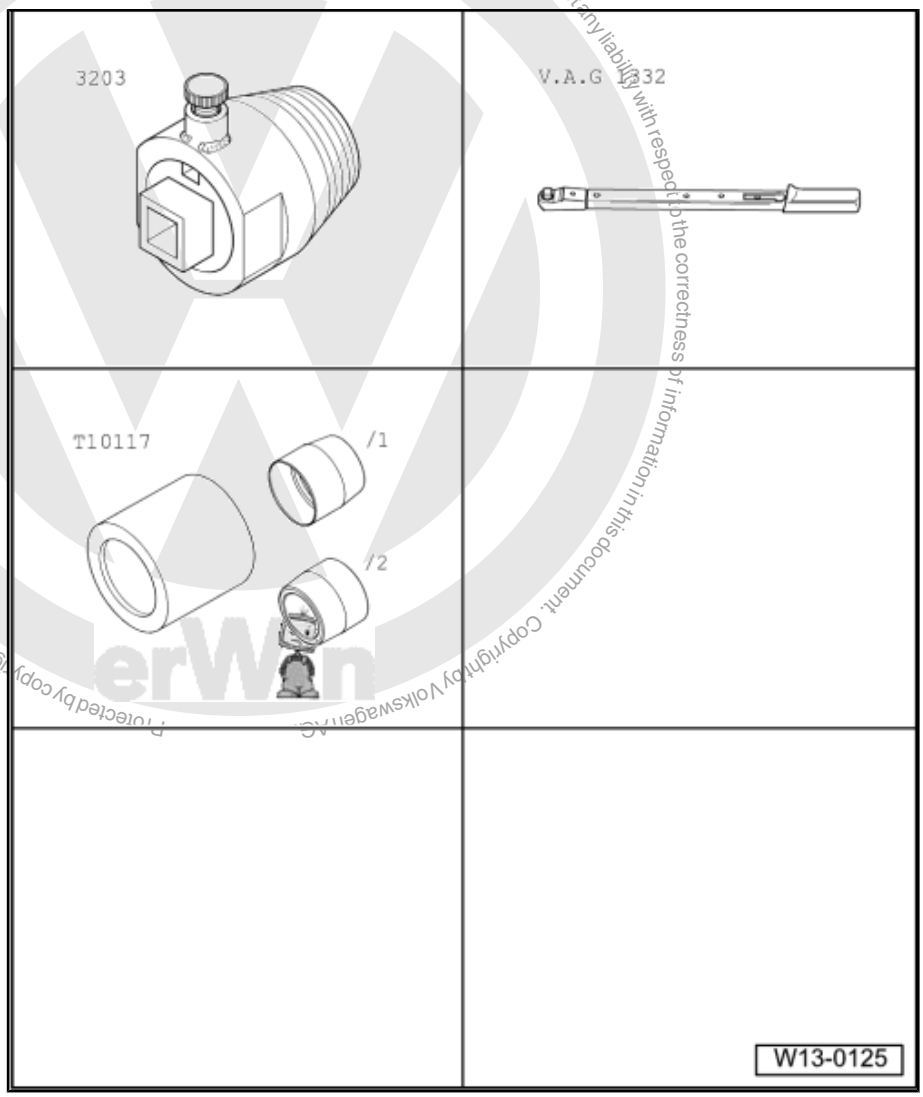
10 - Crankshaft seal (flywheel side)

- ❑ Replace ⇒ page 21 .

2.2 Crankshaft seal (pulley side) - replace

Special tools and workshop equipment required

- Puller -3203-
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- Assembly device -T10117-



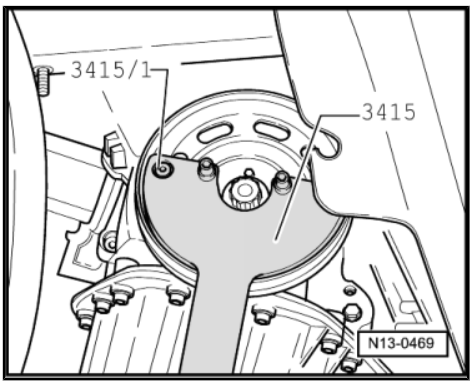
2.2.1 Removal

– Remove the Poly-V belt ⇒ page 13 .

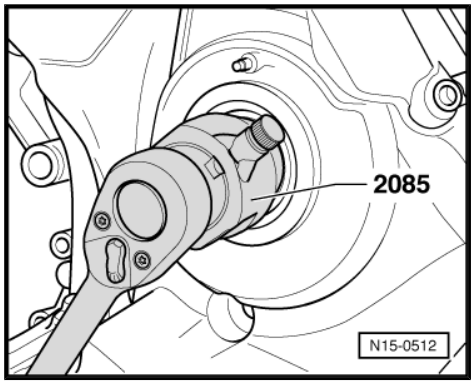
– Remove the fastening bolts from the crankshaft pulley. Immobilise crankshaft pulley with the Spanner -3415- and -3415/1- .

– Remove centre bolt and crankshaft pulley.

– Turn inner part of Puller -2085- three turns (around 5 mm) from external part and lock with knurled bolt.

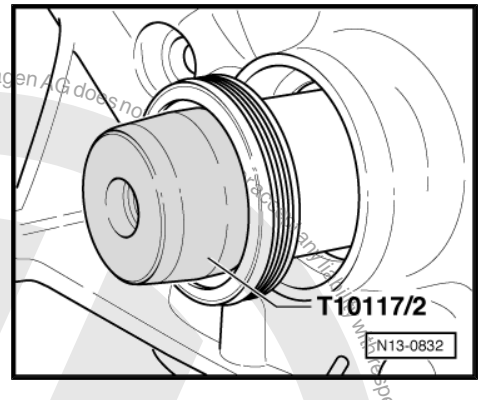


– Lubricate puller threaded head, seat it and thread it as firmly as possible onto the seal.
– Loosen the knurled bolt and turn the inner part against the crankshaft until the seal is extracted.



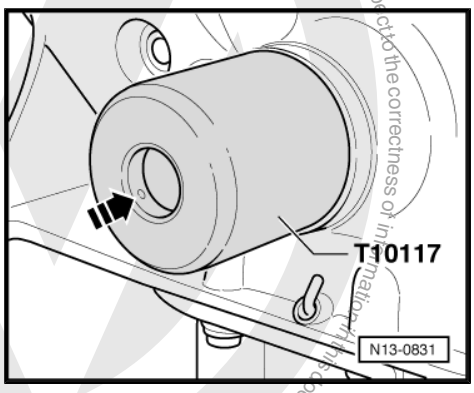
2.2.2 Installation

– Seat Sleeve -T 10117/2- on trunnion and move seal.
– Remove Sleeve -T 10117/2- .



– Press seal with Pressure sleeve -T10117- up to control box stop, through uniform tappings.

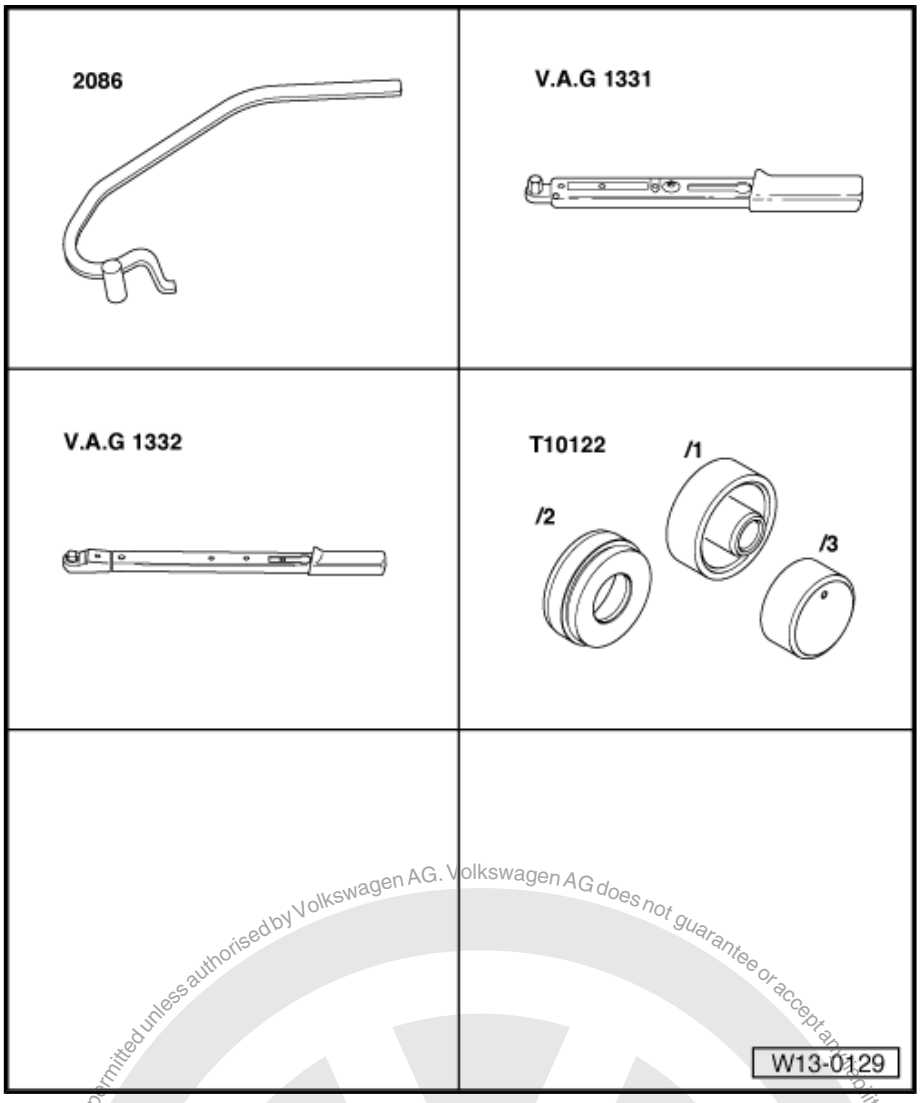
Resume the installation in the removal reverse order.



2.3 Crankshaft seal (flywheel side) - replace

Special tools and workshop equipment required

- Extraction hook -2086-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- Insertion device -T10122-



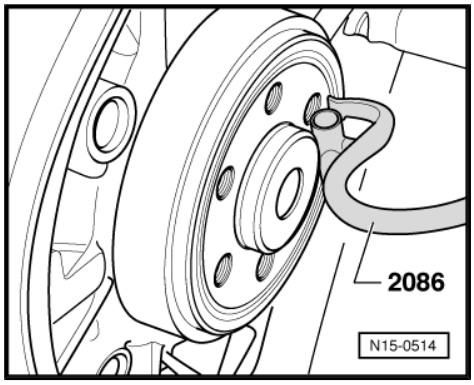
Note

- *In order to better represent the operation sequences, tthey are carried out with the engine removed.*
- *The operation sequences with both engine and transmission removed are identical.*

2.3.1 Removal

– Remove clutch assembly and engine flywheel.

– Remove seal with the Extraction hook -2086 - .

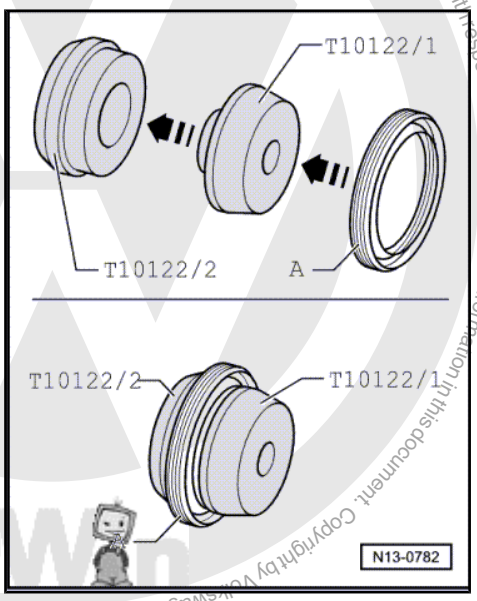


2.3.2 Installation

Note

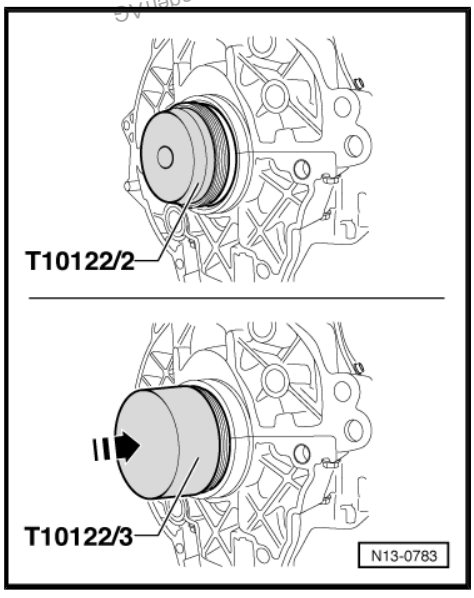
Only remove support ring from seal right before its installation.

– Join Assembly bearing shells -T 10122/1- and -T10122/2- .
– Move the seal -A- on Assembly bearing shell -T 10122/2- up to the stop.
– Separate both assembly bearing shells.



– Install Assembly bearing shell -T 10122/2- with seal on crankshaft flange.
– Press the seal with the Pressure bearing shell -T 10122/3- to the stop.

Resume the installation in the removal reverse order.



15 – Cylinder head, valve control mechanism

1 Cylinder head

Note

- *When assembling a new cylinder head, it is necessary to lubricate with oil all stop surfaces between supporting elements, roller rockers and camshaft eccentrics, before installing cylinder head cover.*
- *Plastic holders supplied for protecting open valves can only be removed immediately before installing the cylinder head.*
- *When you replace engine cylinder head, it is necessary to replace cooling system liquid.*
- *Remove and install intake manifold and injection valves* ⇒ page 89 .

Cylinder head - remove and install ⇒ page 25 .

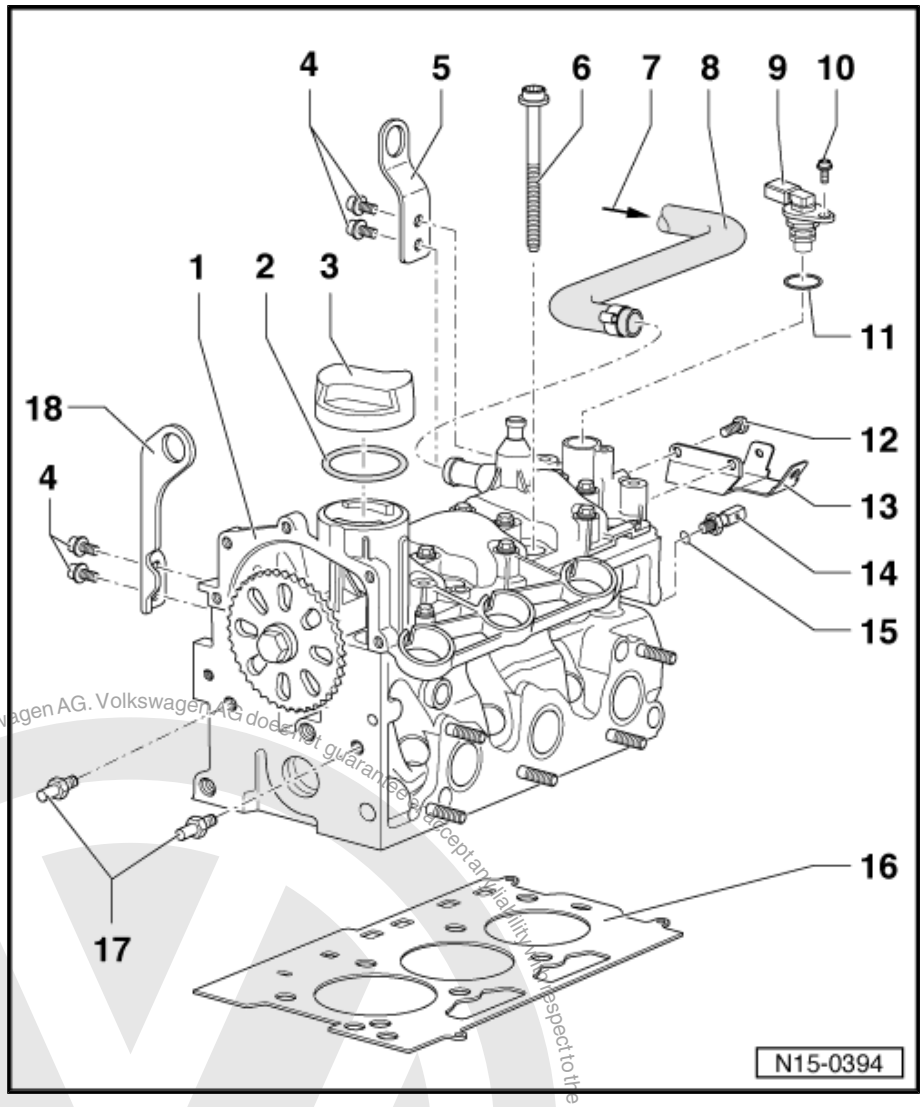
Distribution times - check ⇒ page 28 .

Roller chains - remove and install ⇒ page 30 .

Distribution times - adjust ⇒ page 32 .

Compression - check ⇒ page 35 .

1.1 Cylinder head - disassemble and assemble



1 - Cylinder head cover

- ❑ Sealing surface cannot be ground.
- ❑ With integrated camshaft bearings.
- ❑ Remove residues from old gasket.
- ❑ Before installation, apply a coat of Sealing putty for engines -AMV 188 001 02- .
- ❑ For installation, put it in the vertical position, from up to down, with the adjusting pins into the cylinder head holes.

2 - Sealing

- ❑ Replace if damaged.

3 - Oil filler cap

4 - 20 Nm

5 - Lifting eye

6 - Engine cylinder head screw

- ❑ Replace.
- ❑ Observe installation instructions and sequence for loosening and tightening ⇒ page 25 .

7 - From air filter set

8 - Vacuum tube

9 - Hall Sensor -G40-

10 - 10 Nm

11 - Sealing ring

- ❑ Replace if damaged.

12 - 10 Nm

13 - Support

- ❑ For harnesses.

14 - Oil pressure switch - F1- 0.3...0.6 bar, 25 Nm

- ❑ Check ⇒ page 50 .

15 - Sealing

16 - Cylinder head sealing gasket

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

17 - Guide bolts

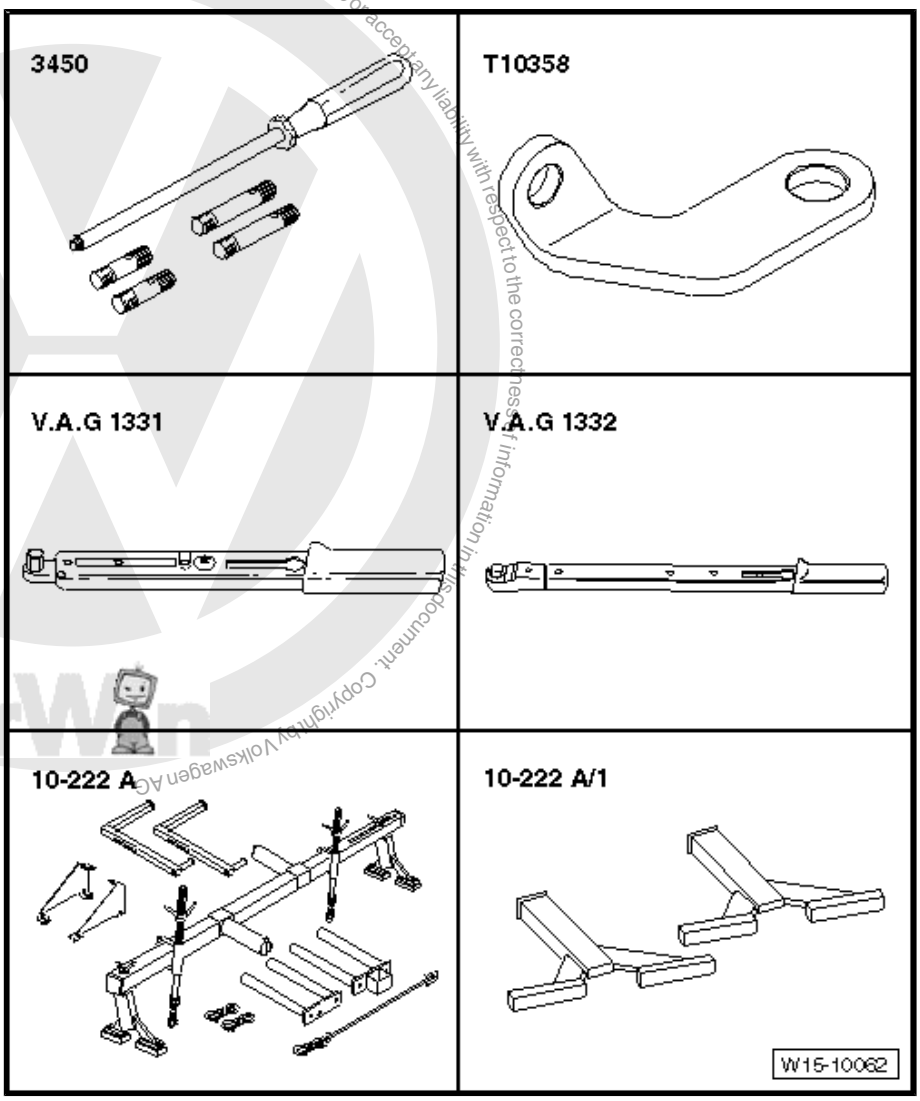
- ❑ Tightening torque: 20 Nm

18 - Lifting eye

1.2 Cylinder head - remove and install

Special tools and workshop equipment required

- Guides -3450-
- Support -T10358-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- "Torque wrench - 40 to 200 Nm (enc. 1/2")" - VAG 1332-
- Support or VW 061 -10-222A-



- The engine must be warm, at most.

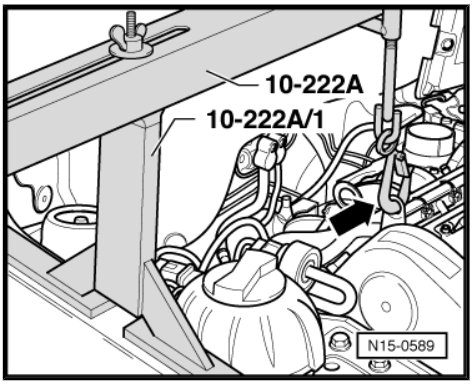
1.2.1 Removal

– Dismount the engine cover by pulling on the places marked with -arrows-.

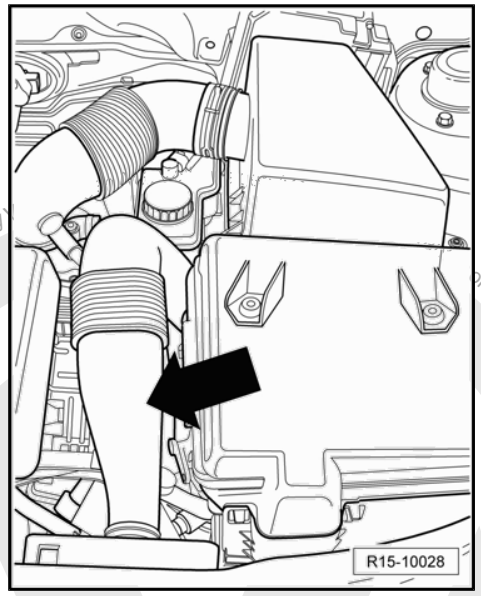
– Install Support or VW 061 -10-222A- , as illustrated, and install on lifting eye-arrow-.

– Remove control box ⇒ page 15 .

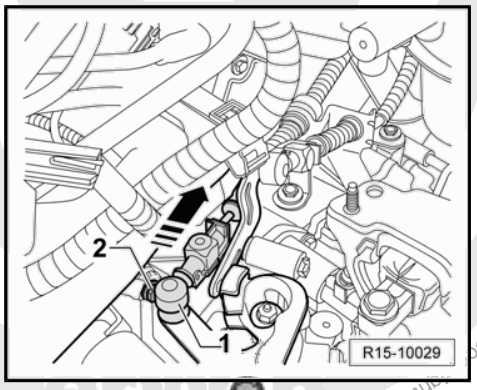
– Remove water pump pulley.



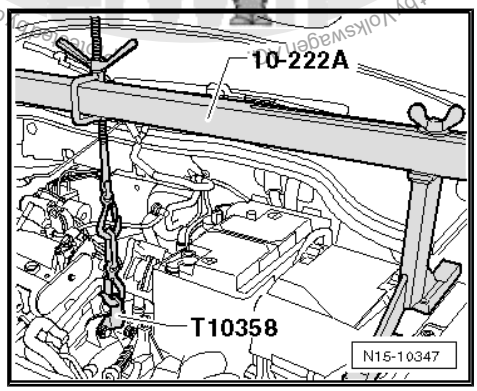
– Pull out the intake air duct of the air filter-arrow-.



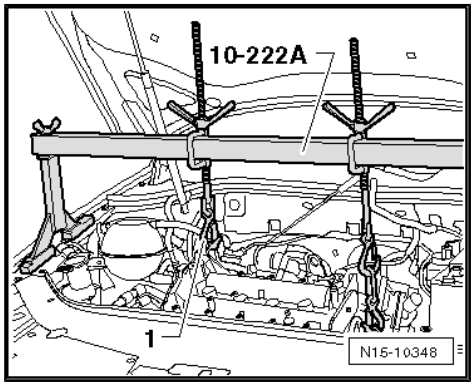
Engage the first gear so that the fastening element of the gear selection cable -1- allows access to the transmission fastening nut -2- and battery earth strap.



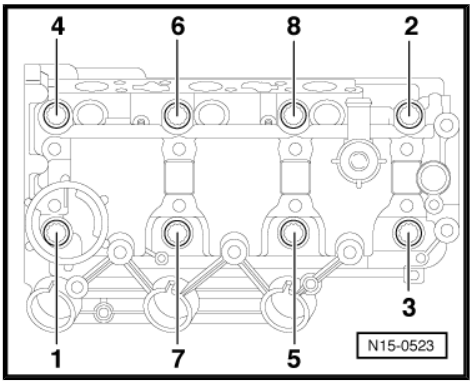
– Loosen the transmission fastening nut and battery earth strap and install the Support -T10358- , as illustrated.
– Engage the hooks on the Support or VW 061 -10-222A - to the Support -T10358- , as illustrated.
– Turn the spindle until the hooks are subjecto to a slight tension.



– Disengage hook -1-from the left lifting eyelet and move the left spindle on the Support or VW 061 -10-222A- .
– Remove intake manifold ⇒ page 89 .
– Remove the roller chains ⇒ page 30 .
– Remove the engine cylinder head cover.
– Remove entire fuel distributor, with all injection valves, from the engine cylinder head.
– Disconnect all the other connection tubes of the cooling, vacuum and intake systems from the engine cylinder head.
– Loosen front exhaust pipe from exhaust manifold.



– Loosen and remove screws from the engine cylinder head according to the sequence indicated.
– Remove engine cylinder head carefully.

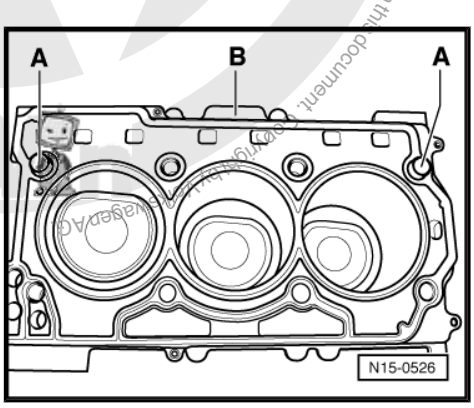


1.2.2 Installation

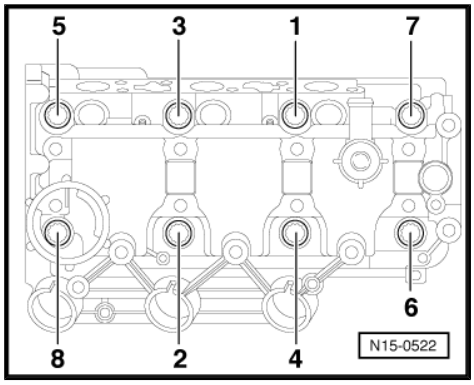
Note

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

– Place clean cloths on the cylinders so as to prevent polishing impurities and residues from entering the cylinders and pistons.
– Prevent polishing impurities and residues from entering cooling system.
– Carefully clean engine cylinder head and engine block sealing surfaces. Make sure no sores or burrs are produced (when using sandpaper, the grain shall not be lower than 100).
– Carefully remove polishing and sand paper residues as well as the cloths.
– Place cylinder 1 piston in TDC and quickly return crankshaft.
– Install new cylinder head gasket on centering guides-A-. Inscription (part number) -B- must be visible.
– Install engine cylinder head, install the 8 bolts manually.



– Tighten engine cylinder head bolts in the indicated tightening sequence.
– Tighten screws to 30 Nm.
– Then, tighten the bolts at 90° with a hard spanner.
– Then, tighten 90° further.



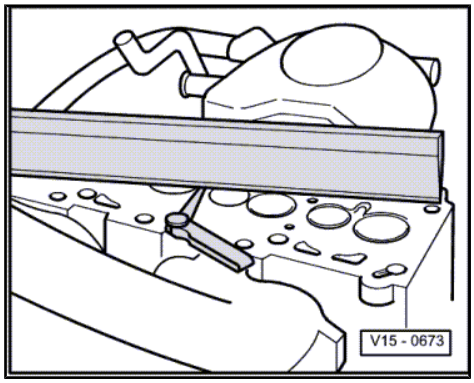
Note

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

– Adjust distribution times ⇒ page 28 .
– The remaining assembly steps are made by inverting the disassembly sequence, paying attention to the following:
– Fill cooling system ⇒ page 56 .

Check engine cylinder head for bending.

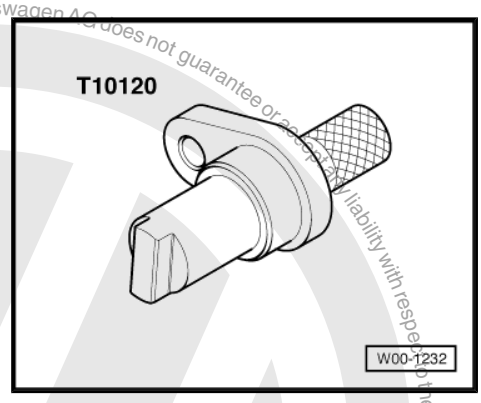
Max. permissible bending: 0.05 mm



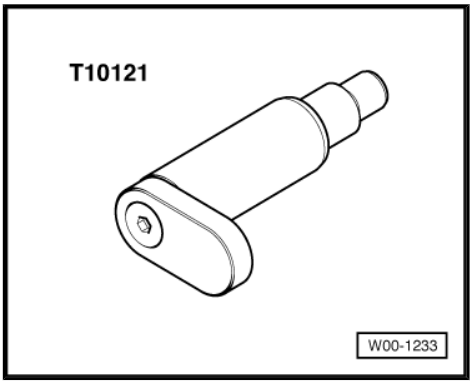
1.3 Distribution times - check

Special tools and workshop equipment required

♦ Fastening pins -T10120-

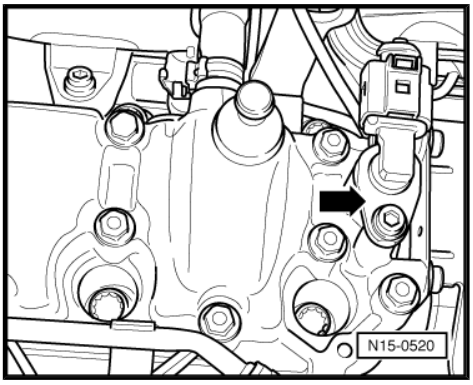


♦ Fastening pins -T10121-

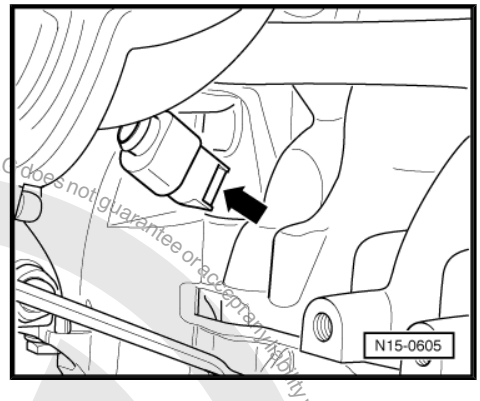


Test sequence

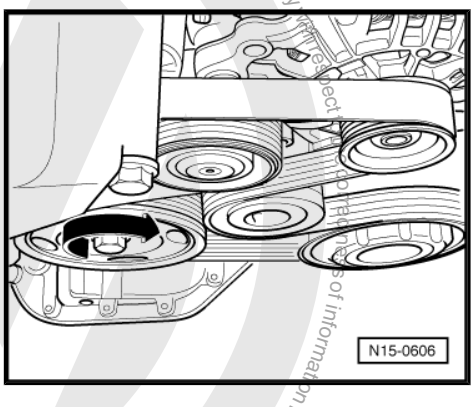
– Remove Hall Sensor -G40- -arrow-.



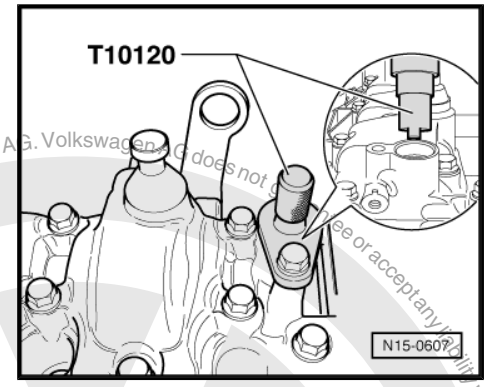
– Remove Engine speed sensor -G28- -arrow-.



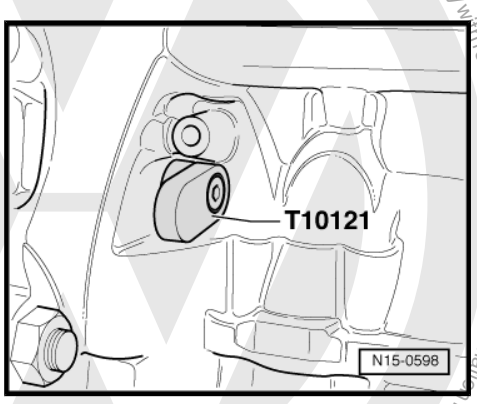
– Turn crankshaft by the pulley fastening bolt in the engine speed direction, until the camshaft groove is visible in the hole designated to the Hall Sensor -G40- .



– The Pin -T10120- should fit into the camshaft easily.



– Lock crankshaft by fitting the Pin -T10121- into flywheel hole.



Note

If the Pin -T10121- does not fit easily, remove the Pin -T10120- from camshaft. Turn crankshaft in the engine speed direction (360°) and repeat the operation.

If it is not possible to insert both fastening pins:

– Synchronize distribution times ⇒ page 32 .

If it is possible to insert both fastening pins:

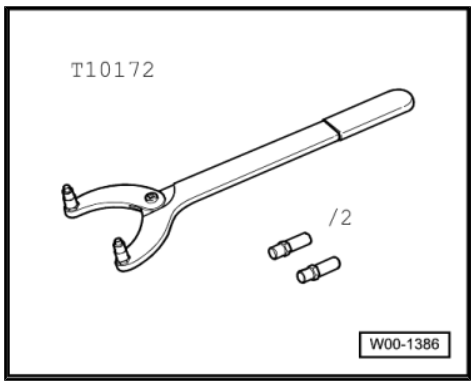
– Remove both fastening pins from the holes and install both sensors again.

Resume the installation in the removal reverse order.

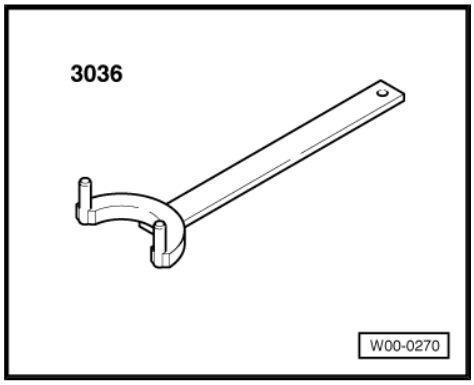
1.4 Roller chains - remove and install

Special tools and workshop equipment required

♦ Wrench -T10172-



♦ Special wrench -3036-



1.4.1 Removal

– Remove control box ⇒ page 15 .

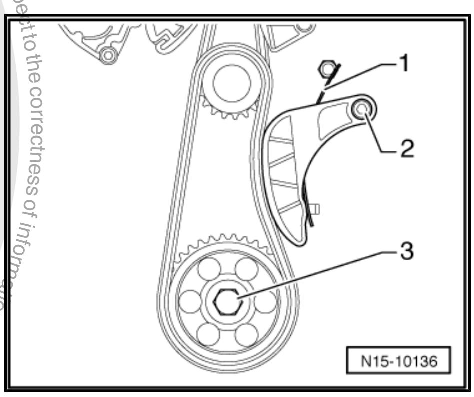
– Fasten camshaft and crankshaft ⇒ page 28 .

– Remove torsion spring -1- with a screwdriver from threaded-end bolt.

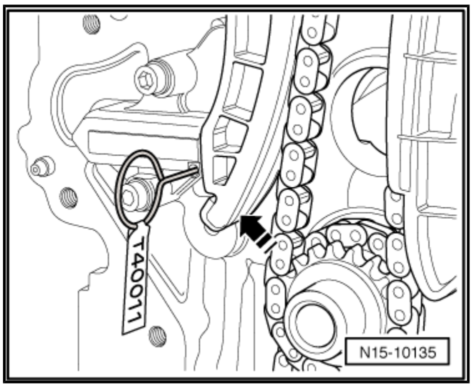
– Remove fastening bolt -2- and remove chain stretcher.

– Loosen fastening bolt -3-. To immobilise the gear, use the Spanner -T10172- .

– Remove oil pump gear, roller chain and primary gear as a set.



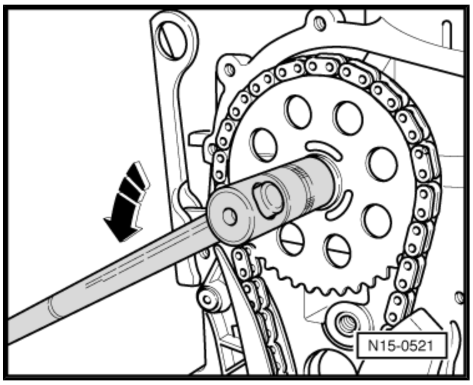
– Press tensioning chute manually in the -arrow direction- and lock chain stretcher with the Pin -T40011-



– Loosen fastening screw. To do so, use the Special spanner -3036- .

– Remove tensioning chute and sliding chute from guide pins by pulling them forwards.

– Remove roller chains from the gears.



1.4.2 Installation

– Run roller chain on crankshaft gear and camshaft gear.

– Push tensioning chute and sliding chute forwards on the guide pins.

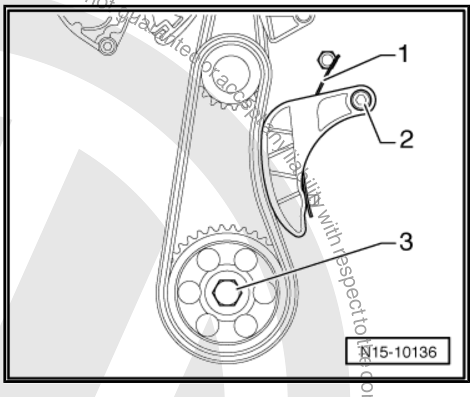
– Install camshaft gear with a new fastening bolt.

Tighten fastening bolts to 20 Nm + 90°.

– To do so, use the Special spanner -3036- .

– Put the oil pump roller chain together with the two chain gears.

– Screw oil pump gear with the new fastening bolt.



Tighten fastening bolts-3- to 20 Nm + 90°

– Assemble oil pump activation chain stretcher.

Tightening torque -2- for the chain stretcher fastening bolt: 15 Nm

– To do so, use the Spanner -T10172- .

– Install the torsion spring -1- with a screwdriver on the threaded-end bolt.

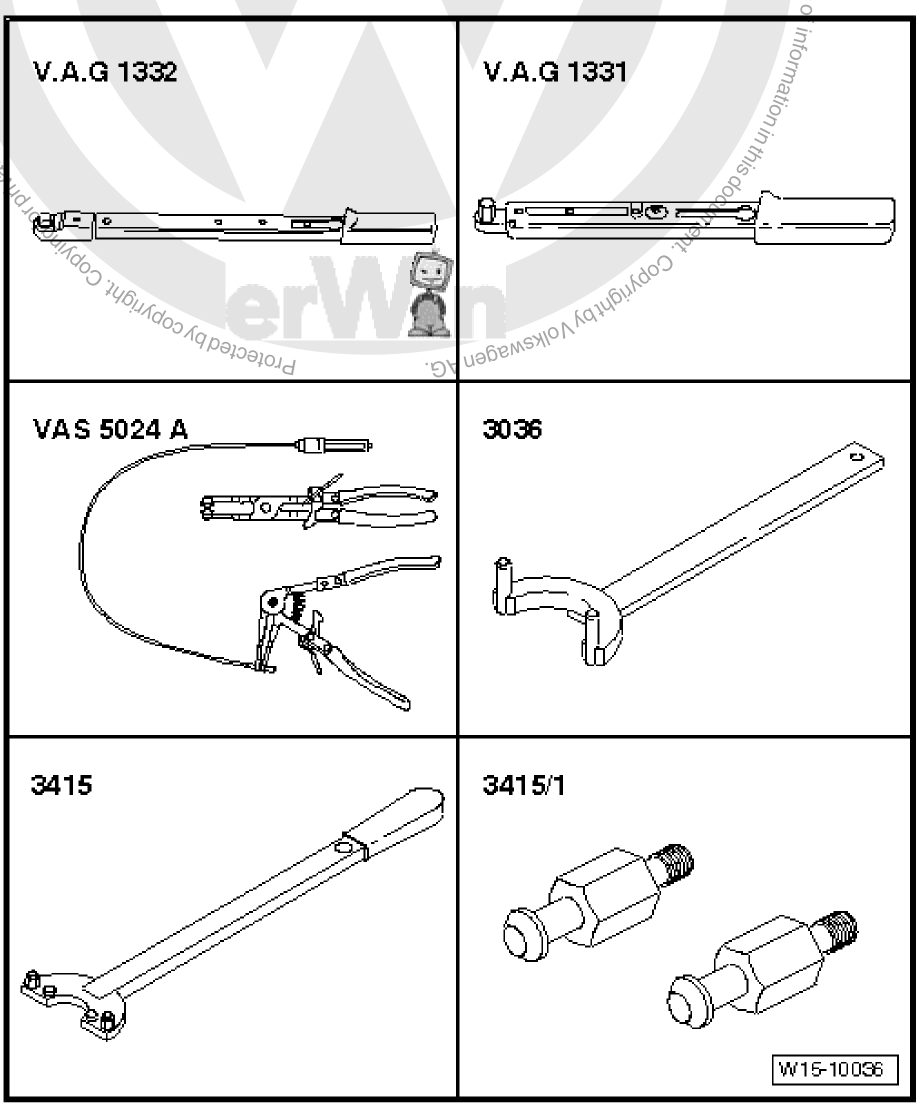
– Adjust distribution times ⇒ page 32 .

– Install control box ⇒ page 15 .

1.5 Distribution times - adjust

Special tools and workshop equipment required

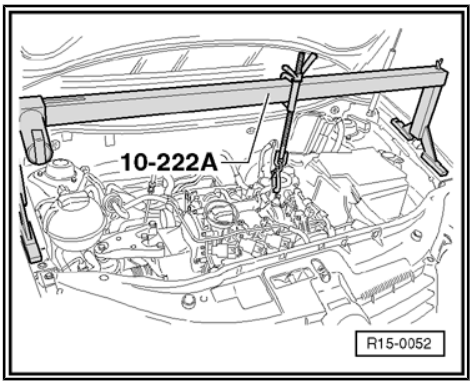
- ♦ Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-
- ♦ Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- ♦ Standart-type clamp pliers - VW 5162- or Standart-type clamp pliers -VAS 5024A-
- ♦ Special wrench -3036-
- ♦ Wrench -3415-
- ♦ Pins -3415/1-



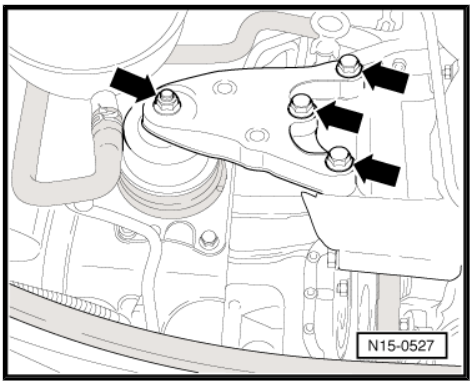
Operation sequence

– Install the Support -VW 061- or Support -10-222A- with Hooks - 10-222A/10- , as indicated.

– Remove the Poly-V belt ⇒ page 13 .



– Remove power-drive group support, engine-arrows-.

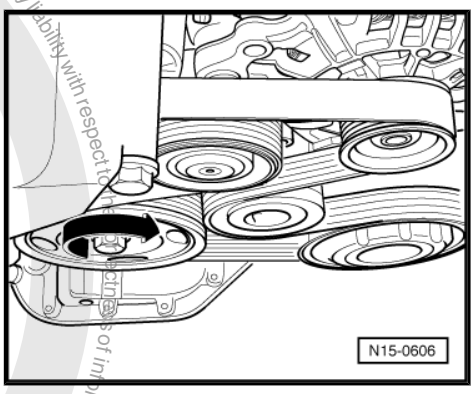


Remove or disconnect the following components:

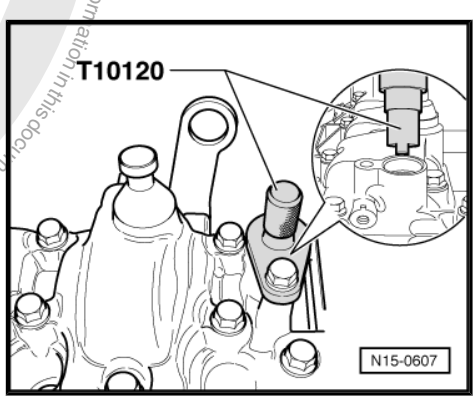
- Water pump pulley
- Tensioning element pulley
- Tensioning roll
- Generator (Alternator) -C-
- Air conditioning compressor
- Crankshaft pulley
- Oil dipstick
- Crankcase
- Control box chain drive

– Install crankshaft pulley fastening bolt up to crankshaft stop.

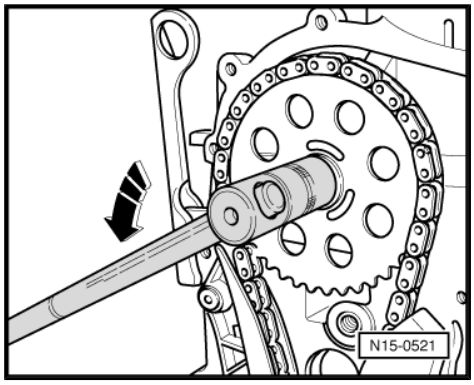
– Turn crankshaft by the pulley fastening bolt in the engine speed direction, until the camshaft groove is visible in the hole designated to the Hall Sensor -G40- .



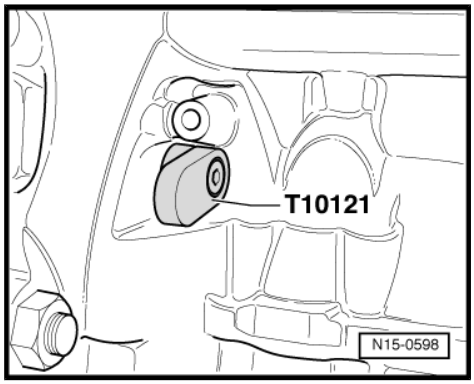
– The Pin -T10120- should fit into the camshaft easily.



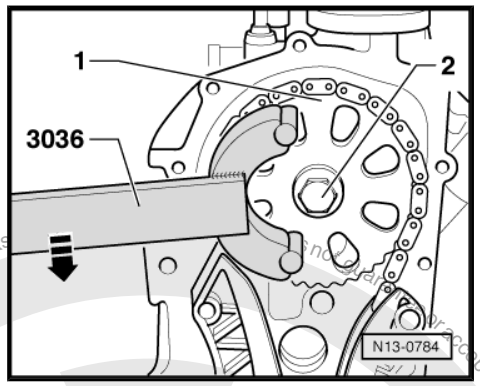
– Loosen the bolt fastening the camshaft gear (use a Special wrench - 3036-) .



– Turn crankshaft by the pulley fastening bolt in the engine rotation direction until it is possible to insert the Pin -T10121- into engine flywheel.



– Tighten new bolt fastening the -2- camshaft gear-1- to 20 Nm (use the Special wrench -3036-).
– Finally, turn the bolt 90° further with a hard spanner.
– Remove two fastening pins from camshaft and engine flywheel.
– Give the crankshaft two turns in engine rotation direction and check distribution times again ⇒ page 28 .

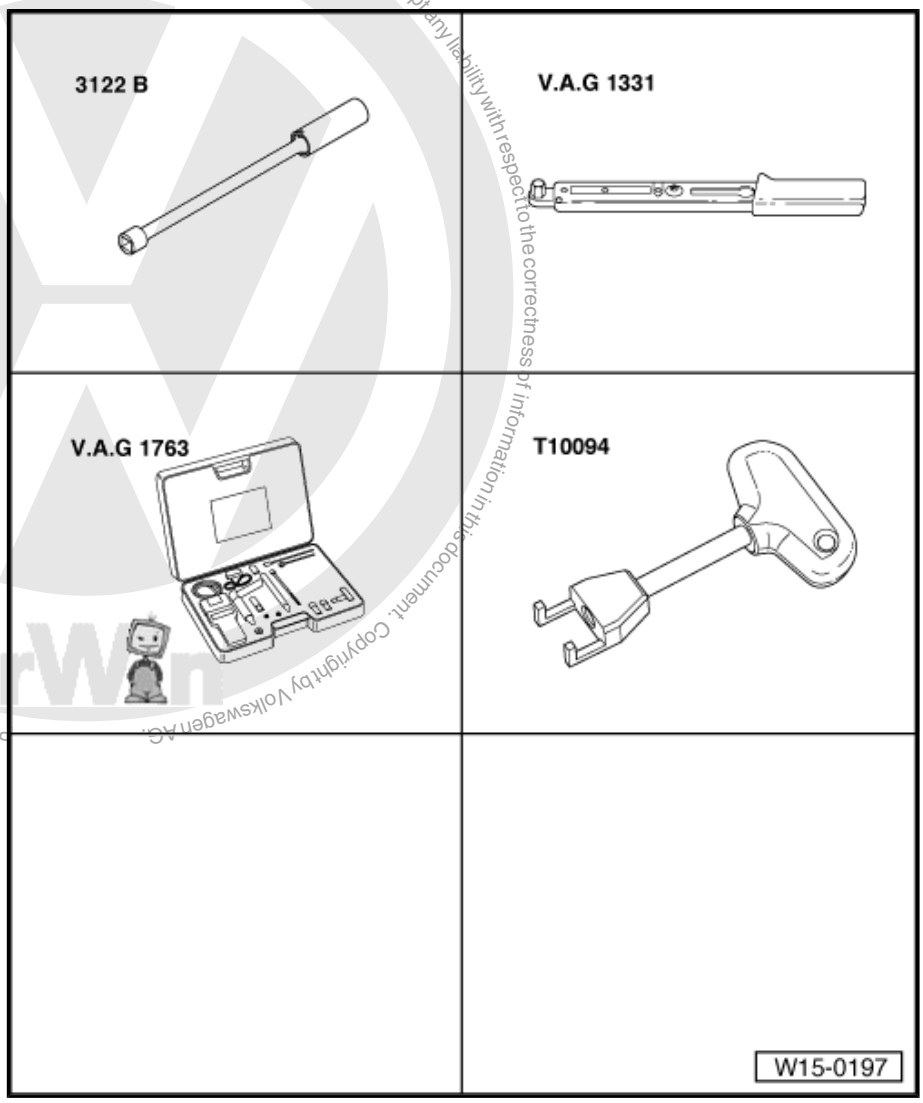


Resume the installation in the removal reverse order.

1.6 Compression - check

Special tools and workshop equipment required

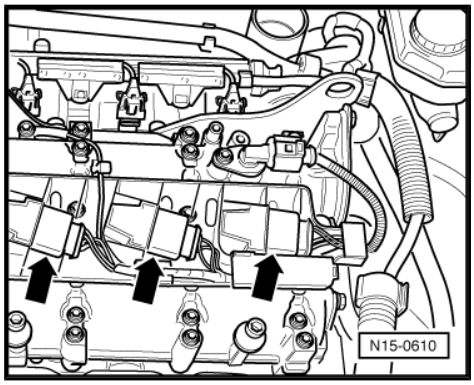
- Spark plug wrench -3122B-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Cylinder compression gauge - petrol/alcohol - VAG 1763-
- Puller -T10094-



Test conditions

- Engine oil temperature must be at least 30°C.

Operation sequence



– Disengage 4-pole connectors from Ignition coil 1 with final power stage -N70- , Ignition coil 2 with final power stage -N127- and Ignition coil 3 with final power stage -N291- -arrows-.
– Remove all ignition coils with the Puller -T10094- .
– Remove Spark plugs -Q- with Spark plug wrench -3122B- .
– Remove fuse 44 from injection valves.
– Check compression with the Cylinder compression meter - gasoline/alcohol -VAG 1763- .

Note

How to handle the testing device is described in the respective operation instructions.

– Operate starting motor until the testing device does not indicate any increase in pressure.

Compression value:

Engine prefix		BMD/CHFB
Cylinder compression	bar	10.0 to 15.0
Wear limit	bar	7,0
Maximum compression difference between cylinders	bar	3,00

– Install Spark plugs -Q- with Spark plug wrench -3122B- and tighten to 30 Nm.

2 Camshaft mechanism - repair

Camshaft - check axial clearance ⇒ page 40 .

Valve seat - grind ⇒ page 40 .

Valve guides - check ⇒ page 42 .

Valve stem seal - replace ⇒ page 43 .

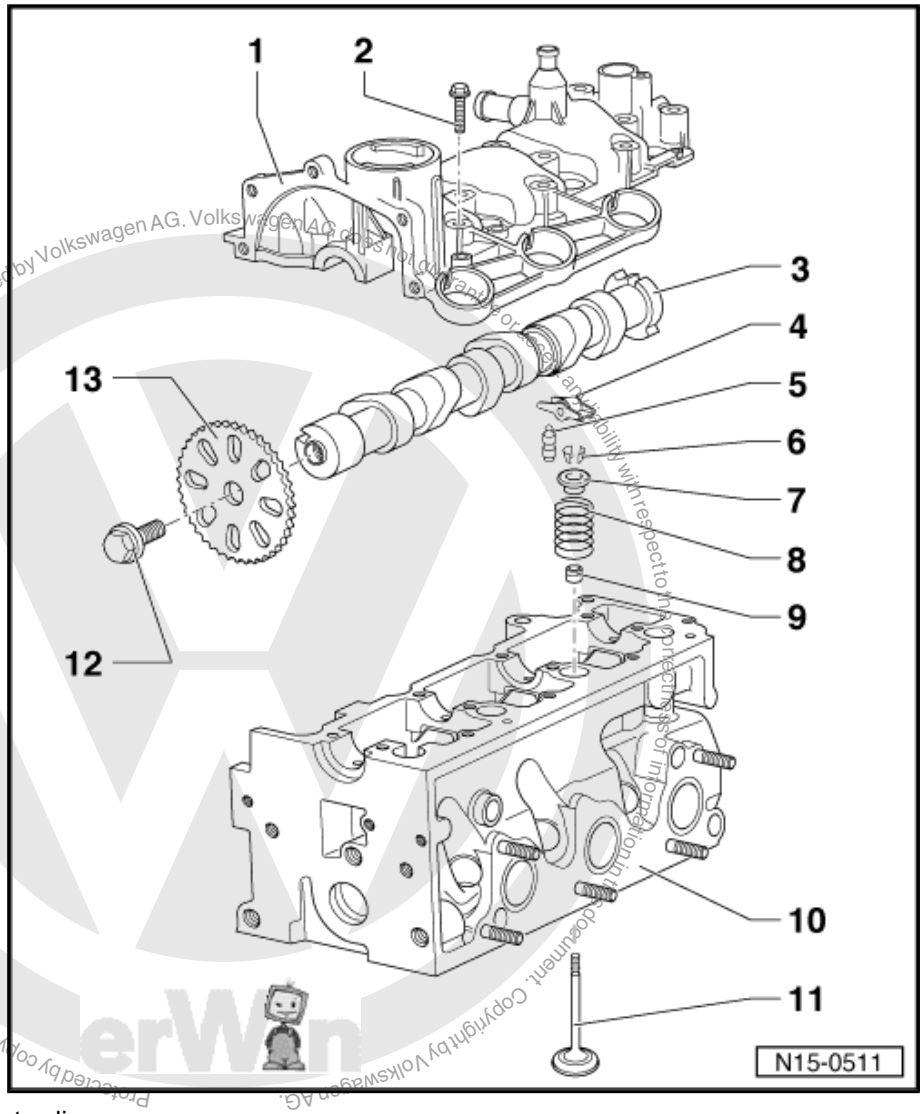
2.1 Camshaft mechanism - repair

Note

Engine head cylinder with fractures between valves seats or between valve seat and Spark plug - Q- thread can still be used without reducing the useful life, provided that the fractures are 0.5 mm wide at most or are located on the first 4 turns of the Spark plug -Q- thread only.

WARNING

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



1 - Cylinder head cover

- ❑ Sealing surface cannot be ground.
- ❑ With integrated camshaft bearings.
- ❑ Remove residues from old gasket.
- ❑ Before installation, apply a coat of Sealing putty for engines -AMV 188 001 02- .
- ❑ For installation, put it in the vertical position, from up to down, with the adjusting pins into engine cylinder head holes.

2 - 6 Nm + 90°

- ❑ Replace after each removal.
- ❑ Tighten from inside out.

3 - Camshaft

- ❑ Check axial clearance ⇒ page 40 .
- ❑ Check radial clearance with plastigage, wear limit 0.1 mm.
- ❑ Runout: max. 0.05 mm.

4 - Roller rockers

- ❑ Check roller rockers for mobility.
- ❑ Lubricate sliding surface.
- ❑ For installation, fit to the support element with safety clip.

5 - Support element

- ❑ Do not change positions.
- ❑ With valve clearance hydraulic offsetting.

6 - Keys

7 - Valve spring plate

8 - Valve spring

- ❑ With engine cylinder head removed, use the Compression device -2037- .
- ❑ With engine head installed ⇒ page 43 .

9 - Valve stem seal

- ❑ Replace ⇒ page 43 .

10 - Engine cylinder head

- ❑ Sealing surface on camshaft side cannot be ground.
- ❑ Grind valve seats ⇒ page 40 .
- ❑ Grind sealing surface on engine block side ⇒ page 39

11 - Valves

- ❑ Do not grind, may be seated only.
- ❑ Valve specifications ⇒ page 40

12 - 20 Nm + 90°

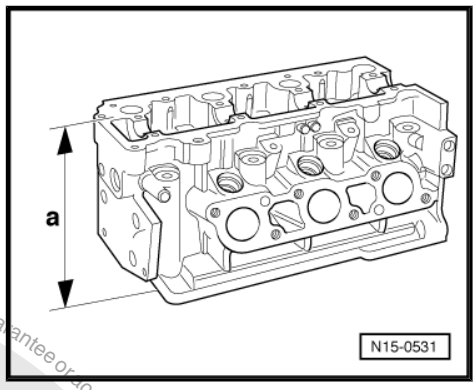
- ❑ Replace after each removal.

13 - Gear

- ❑ From Camshaft
- ❑ Immobilise the gear with the Special wrench -3036 - .

Grind sealing surface on the engine block side

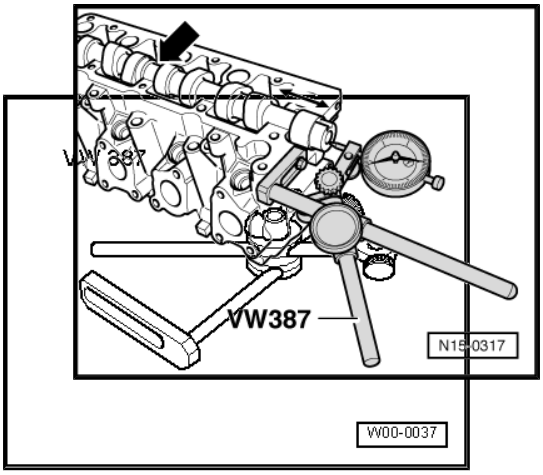
Cylinder head grinding specification: -a- = at least 135.6 mm.



2.2 Camshaft - check axial clearance

Special tools and workshop equipment required

- Centesimal dial gauge
- Support -VW 387-



Camshaft, check axial clearance

Measure with support elements and camshaft cover removed.

– Press camshaft central bearing -arrow-, and check axial clearance by moving the camshaft.

Wear limit: max. 0.20 mm.

Camshaft identification, distribution times

Codes between intake and exhaust cams of cylinder 1 - BMD/ CHFB Engine	
Cylinder 1	03DF

Distribution times for 1-mm valve clearance

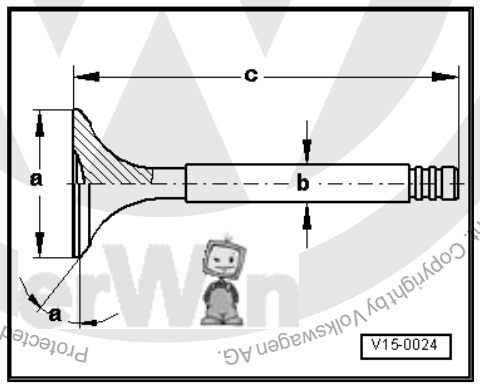
BMD/CHFB engine

		Intake valve	Exhaust valve
Then opens	TDC	11° 48`	--------
Then closes	BDC	27° 26`	--------
Opens before	BDC	---------	36° 28`
Closes before	TDC	---------	1° 46`

Valve specifications

Note

Valves cannot be ground. They may be seated only.



Specification		Intake valve	Exhaust valve
Ø a	mm	34,5	28,0
Ø b	mm	5,98	5,96
c	mm	99,25	99,25
a	?°	45	45

2.3 Valve seat - trim

Special tools and workshop equipment required

- Depth vernier caliper
- Device for grinding valve seats

Note

- *In case of repairs to engines with leaking valves, simply grinding or replacing the seats and valves is not enough. Especially in engines with high kilometres traveled, the valve guides must also be checked for wear.* ⇒ page 42 .
- *Grind valve seats until obtaining a perfect seating. Before grinding, determine the maximum grinding elevation allowed. If grinding elevation is exceeded, hydraulic offsetting of valve clearance is no longer ensured and the engine cylinder head must be replaced.*

Calculating maximum trimming specification allowed

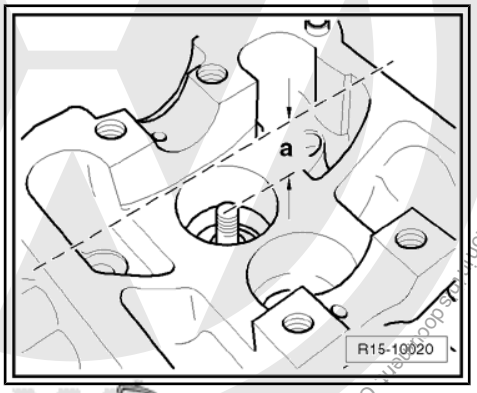
– Install the valve and press it strongly against its seat.

Note

If the valve is replaced upon repair, use the new valve for measurement.

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

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



Minimum measurements: Intake valve = 7.6 mm and exhaust valve = 7.6 mm.

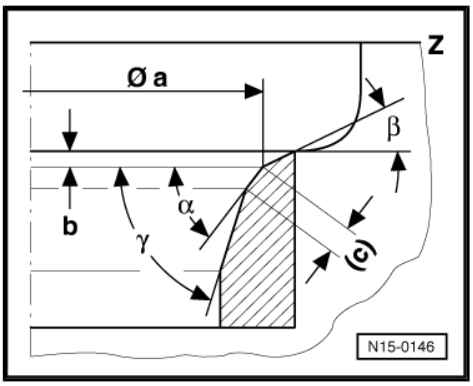
Measured distance minus minimum distance = Maximum grinding measurement allowed.

Example:

Measured distance	8,0 mm
- minimum specification	7,6 mm
Maximum allowable grinding specification	0,4 mm

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

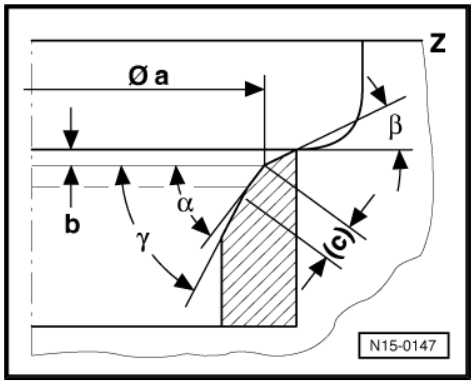
Grind intake valve seats



a = Ø32,9 mm
b = max. trimming specification allowed
c = max. 1.8...2.0 mm
Z = Lower cylinder head edge
a = 45° Valve seat angle
ß = 30° Upper correction angle
? = 60° Lower correction angle

3) Calculating maximum grinding measurement allowed ⇒ page 40 .

Grind exhaust valve seats



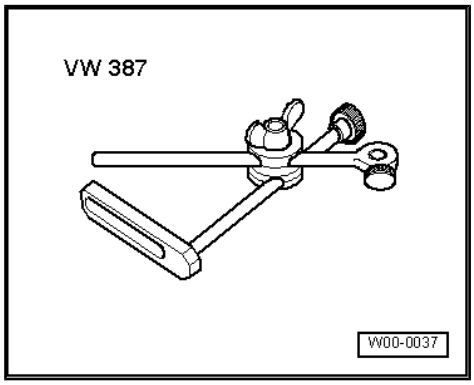
a = Ø26.6 mm
b = max. trimming specification allowed
c = max. 1.8...2.0 mm
Z = Lower cylinder head edge
a = 45° Valve seat angle
ß = 30° Upper correction angle
? = 60° Lower correction angle

4) Calculating maximum grinding measurement allowed ⇒ page 40 .

2.4 Valve guides - check

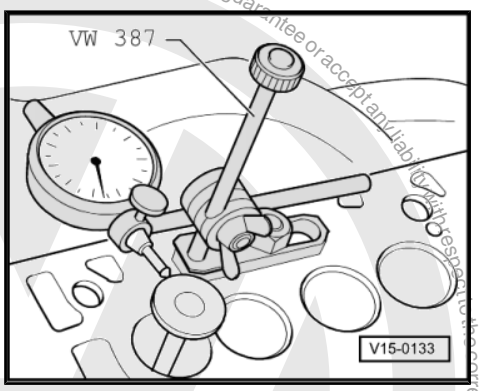
Special tools and workshop equipment required

- Centesimal dial gauge
- Support -VW 387-



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.



– Measure tilting clearance. Wear limit: 0.8 mm.

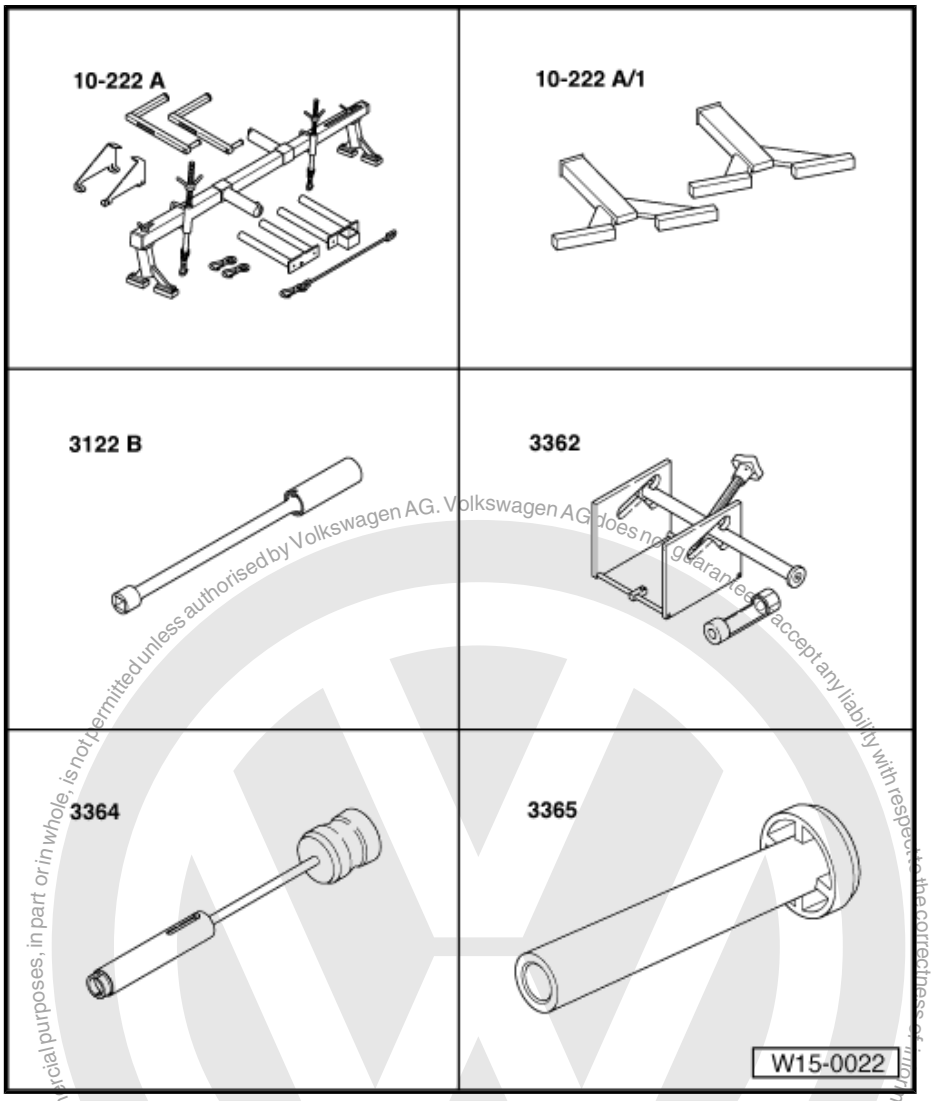
In case the clearance is exceeded:

– Replace engine cylinder head.

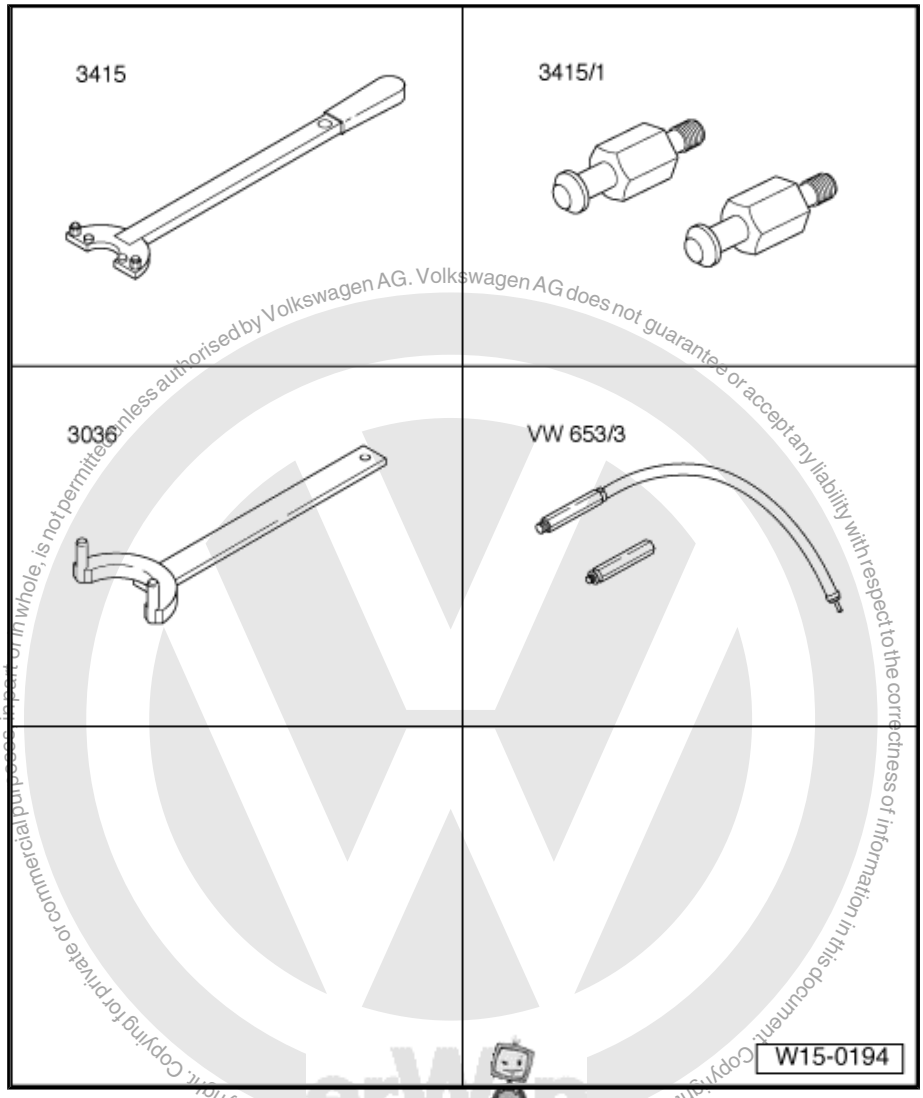
2.5 Valve stem seal - replace

Special tools and workshop equipment required

- Support -VW 061- or Support -10-222A-
- Support -10 - 222 A /1-
- Spark plug wrench -3122B-
- Valve spring compressor -3362- with Pressure part -3362/1-
- Seal fitter -3365-



- Wrench -3415-
- Pins -3415/1-
- Special wrench -3036-
- Flexible tube -VW 653/2A- or Flexible tube -VW 653/3-



2.5.1 Removal

(with engine head installed)

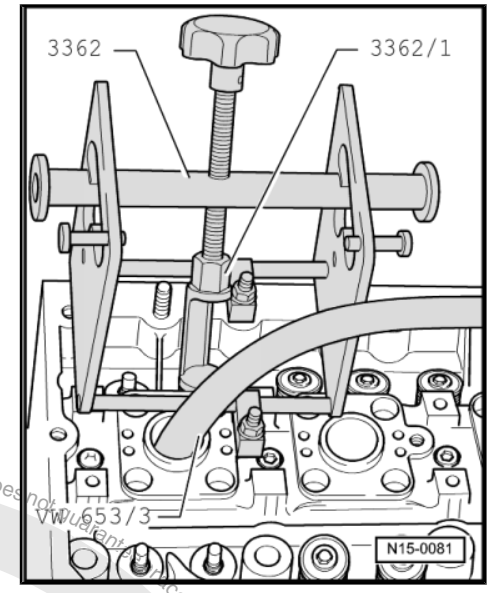
– Remove cylinder head cover ⇒ page 24 .

– Remove roller rockers and place them on a clean surface. Make sure roller rockers are not touched.

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

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

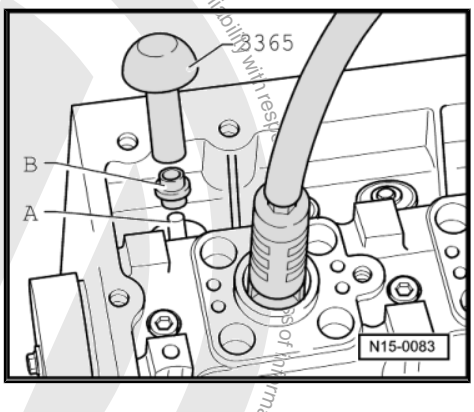
– Install Valve spring compressor -3362- with the -3362/1- .
– Screw the Flexible tube -VW 653/2A- or Flexible tube -VW 653/3- to the spark plug thread.
– Connect pressure tube to compressed air with, at least, 6-bar positive pressure and remove valve springs.
– Remove valve stem seals with the Impact extractor -3364- .



2.5.2 Installation

– Install the supplied plastic bushing on the respective valve stem. This way, damages to the valve steam seal are prevented.
– Install the new valve steam sealant in the Seal fitter -3365- .
– Lubricate the valve stem seal lip and carefully install on valve guide.
– Install cylinder head cover ⇒ page 24 .

Resume the installation in the removal reverse order.



17 – Lubrication system

1 Lubrication system components - remove and install

Note

Oil level shall not exceed the max. mark! - risk of damages to the catalytic converter! Marks ⇒ page 48

WARNING

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

Engine oil (filling capacities, engine oil specification) ⇒ page 46 .

Oil crankcase - remove and install ⇒ page 48 .

Oil pressure and Oil pressure switch -F1- - check ⇒ page 50 .

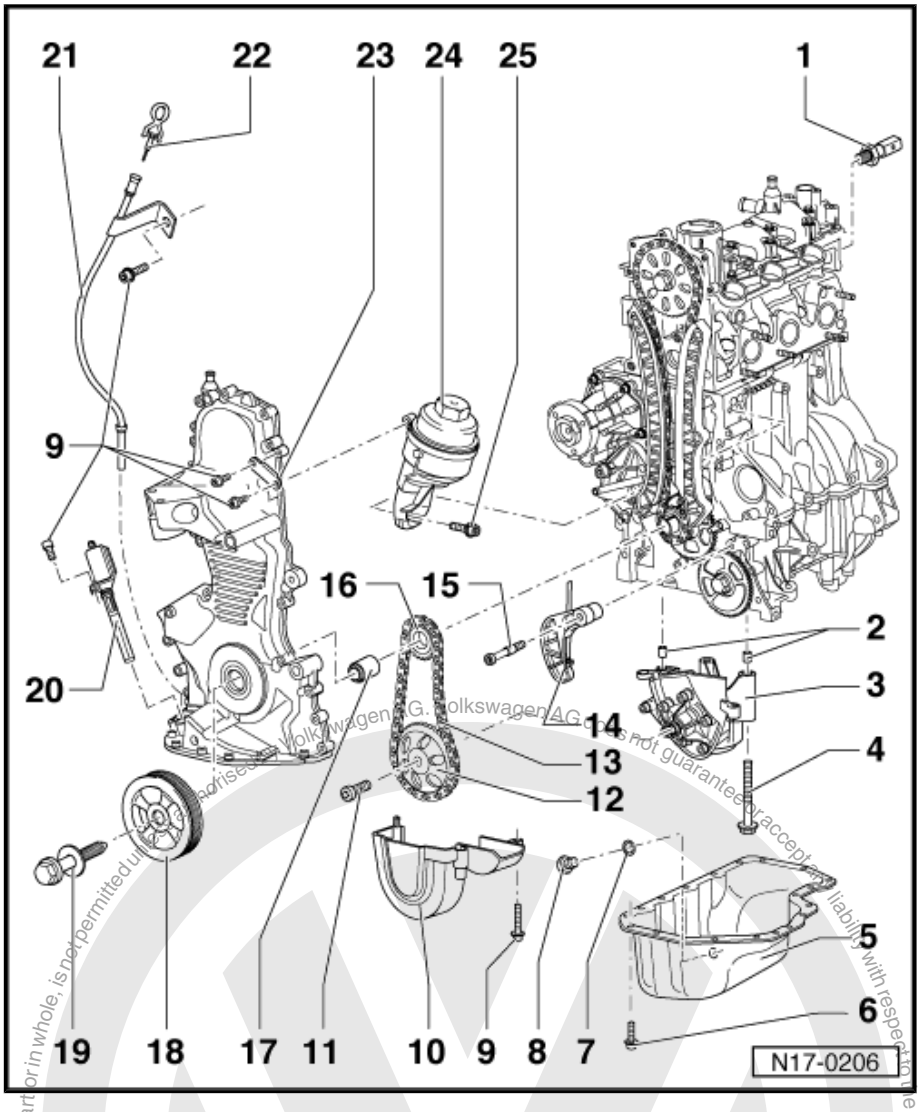
1.1 Engine oil

Oil supply capacities

With oil filter 2.85 l.

Engine oil specification

Use oils with high lubrication grade, according to the specifications in Lubricant oil for engines -VW 502 00- .



1 - Oil pressure switch - F1- 0.3...0.6 bar, 25 Nm

2 - Guide bushing

3 - Oil pump

- ❑ Replace only the complete set.

4 - 25 Nm

5 - Crankcase

- ❑ Remove and install with liquid joint ⇒ page 48 .
- ❑ Clean sealing surface before installation.
- ❑ Install with Silicone sealant -D 176 404 A2 - ⇒ page 48 .

6 - 15 Nm

7 - Sealing ring

- ❑ Replace.

8 - Oil draining plug, 30 Nm

- ❑ With sealing ring.
- ❑ Replace.

9 - 8 Nm

10 - Cover

11 - 20 Nm + 90°

- ❑ Replace after each removal.

12 - Gear

- ❑ From roller chain ⇒ Item 13 (page 47) .
- ❑ After installation, adjust distribution times ⇒ page 32 .

13 - Roller chain

- ❑ Mark rotation direction before removal (installation positions).

14 - Chain stretcher with tensioning chute

- ❑ From roller chain ⇒ Item 13 (page 47) .

15 - 15 Nm

16 - Chain gear

- ❑ From roller chain ⇒ Item 13 (page 47) .

17 - Supporting bushing

18 - Crankshaft pulley

- ❑ Remove and install Poly-V belt ⇒ page 13 .

19 - 90 Nm + 90°

- ❑ Replace after each removal.
- ❑ Fit lubricated.
- ❑ Immobilise crankshaft pulley with Spanner -3415- .
- ❑ The additional angle torque can be measured with a spanner, e.g. Hazet 6690.

20 - Oil level and temperature sensor -G266-

- ❑ Not applicable.

21 - Guide tube

22 - Oil dipstick

- ❑ Oil level shall not exceed the max. mark! !
- ❑ Marks ⇒ page 48

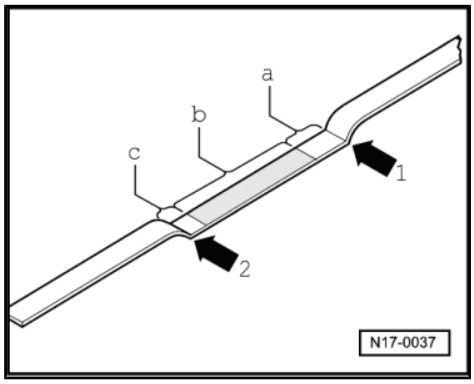
23 - Support

24 - Oil Filter

- ❑ Tighten manually.

25 - 25 Nm

Marks on the oil dipstick



1 - max. - marks.

2 - min. - marks.

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

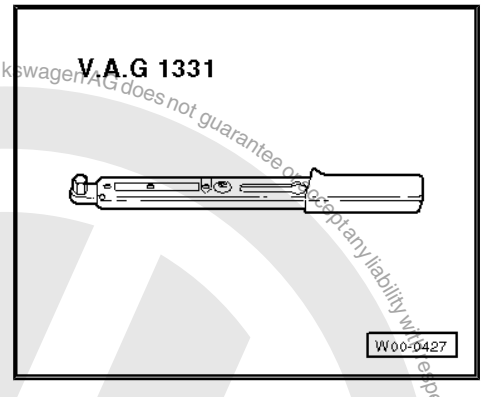
4 - -b- - Level is on the engraved area: the oil may be refilled.

5 - -c- - Area between min. mark and lower corner of engraved area: refill, at most, 0.5 l of 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 drilling machine with plastic brush
- ♦ Flat spatula
- ♦ Silicone sealant for engine -D 176 404 A2-
- ♦ Goggles

1.2.1 Removal

– Drain engine oil.

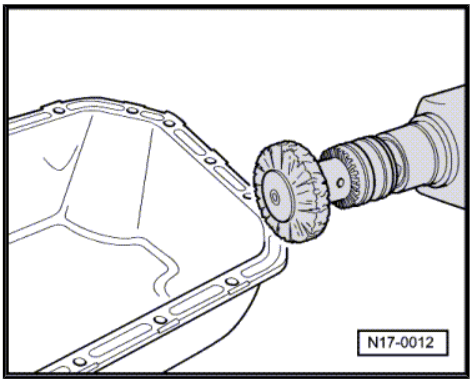
– Remove fastening nuts from exhaust front tube on catalytic converter and from support strap on transmission.

– Move front tube away.

– Remove crankcase fastening bolts.

– Remove oil crankcase. If necessary, loosen oil crankcase by tapping slightly with a rubber hammer.

– Remove with a flat spatula the residues of Engine silicone sealant -D 176 404 A2- present on the engine block.
– Remove Engine silicone sealant -D 176 404 A2- residues from oil crankcase with a portable drill and plastic brush (wear goggles).
– Clean the sealing surfaces. Must be lubricating oil free.



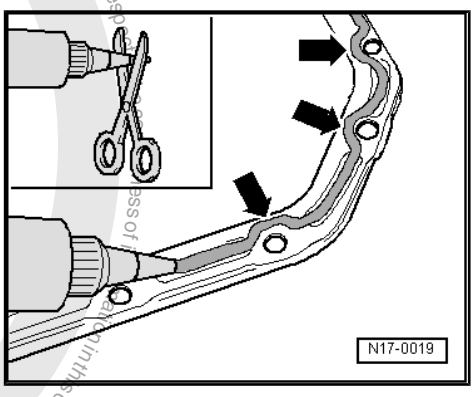
1.2.2 Installation

Note

- *Observe the expiry date for the Engine silicone sealant -D 176 404 A2- .*
- *Oil crankcase must be installed within five minutes after applying the Engine silicone seal - D 176 404 A2- .*
- *The oil crankcase is more easily and safely installed if threaded bolts M6 are used as guides in two points of the engine block flange.*

– Cut the tube nozzle by the front mark (Ø nozzle approx. 3 mm).
– Apply the Engine silicone sealant -D 176 404 A2- , as shown, onto clean sealing surface of oil pan. The cord of Engine silicone sealant -D 176 404 A2- must be:

- 2...3 mm thick
- Circle from inside the bolt holes -arrows-.



Note

The Engine silicone sealant - D 176 404 A2- cord should not be thicker, otherwise, the excess Engine silicone sealant -D 176 404 A2- may reach the oil pan and clog the filter in the oil suction tube.

– Immediately install the oil crankcase and tighten bolts in the indicated sequence.
– Tighten oil crankcase bolts to 15 Nm torque.

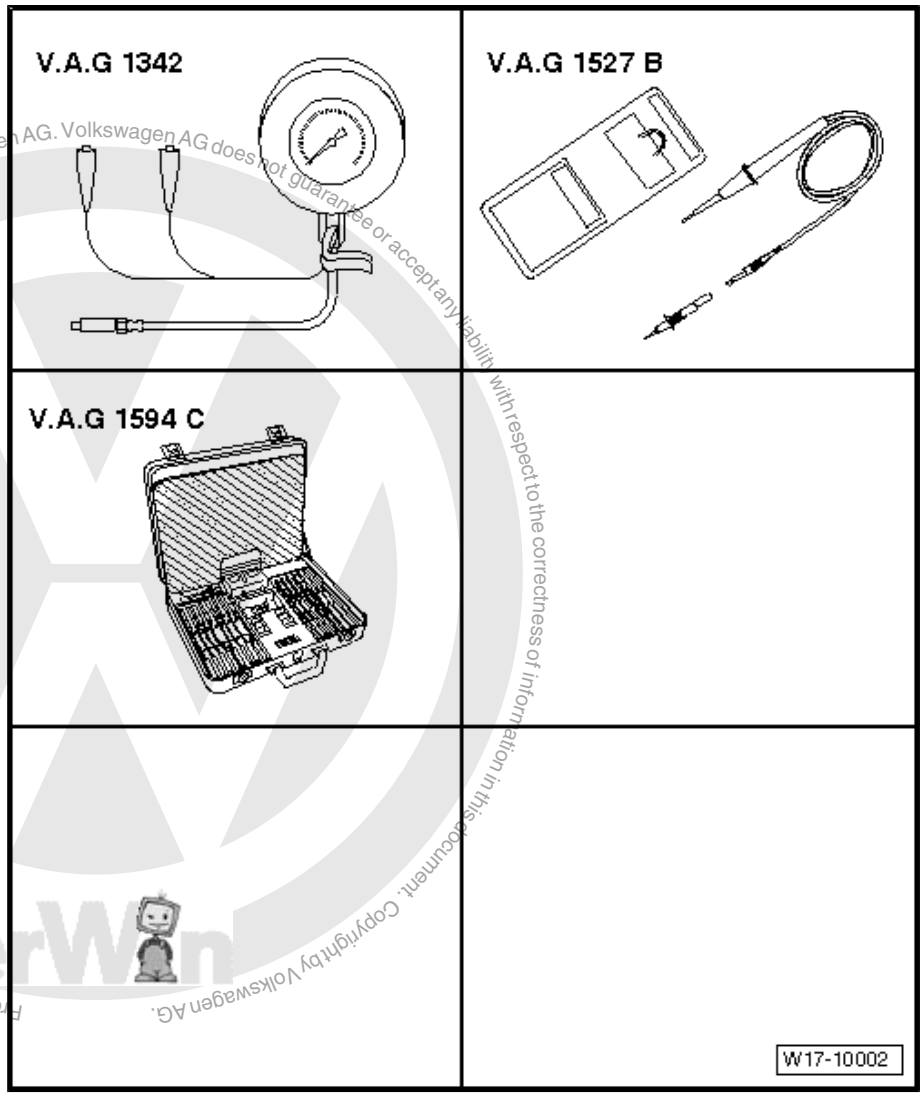
Note

After installing the crankcase, the Engine silicone sealant -D 176 404 A2- must dry within approximately 30 minutes. After that, the engine may be replenished with engine oil.

1.3 Oil pressure and Oil pressure switch -F1- - check

Special tools and workshop equipment required

- Oil pressure gauge -VAG 1342 -
- Voltage control -VAG 1527 B-
- Auxiliary measuring cable set - VAG 1594 C-



1.3.1 Check conditions

- Oil level OK - check ⇒ page 48
- Engine oil temperature, at least 176 °F (the Radiator fan -V7- must have been activated at least once).

Note

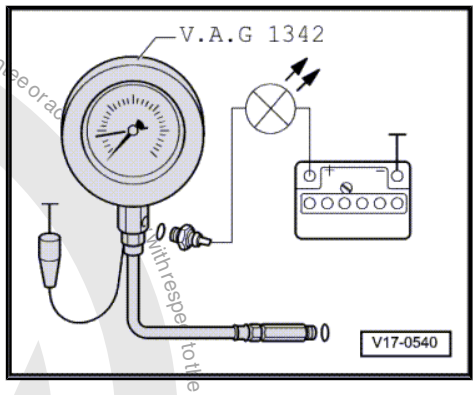
Operation and repair test of oil pressure visual and acoustic indicators. ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

1.3.2 Oil pressure and Oil pressure switch - F1- - check

Note

Operation and repair test of oil pressure visual and acoustic indicator: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

Test sequence



- Remove Oil pressure switch -F1- and install it on the Oil pressure gauge -VAG 1342-
- Install the Oil pressure meter -VAG 1342- in place of the Oil pressure switch -F1- on the engine head.
- Put tester brown cable on the earth (-).
- Connect the Voltage control -V.A.G 1527 B- with Auxiliary cable -V.A.G 1594 A- to the Battery -A- positive terminal (+) and Oil pressure switch -F1- . The LED shall not light up.
- If it the LED lights up, replace the Oil pressure switch -F1- .
- Run the engine and slowly increase the speed (rpm). With a 0.3...0.6-bar positive pressure, the LED should light up, otherwise, replace the Oil pressure switch -F1- .
- Keep on increasing the speed. At 2000 rpm and an oil temperature of 80°C, the positive oil pressure should be at least 2.0 bar.

At higher speeds, positive oil pressure may not exceed 7.0 bar.

19 – Cooling system

1 Cooling system components - remove and install

WARNING

During the works, especially within the engine compartment, due to the shortage of space, take the following into account:

- *All hoses (e.g. fuel, hydraulics, activated charcoal filter system, cooling system and cooling gas, brake fluid, vacuum) and electric cables must be restored to their original positions.*
- *Provide easy access to all 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 connection are fastened by spring clamps. When doing repairs, use spring clamps only.*
- *To remove and install spring clamps, we recommend using the VAS 5024A or Standart-type clamp pliers -VW 5162- or Pliers -V.A.G 1921- .*
- *The cooling system hoses should be installed without tension and without coming into contact with other components (observe the marks on the hose connections).*
- *With hot engine, the cooling system is under pressure. Eliminate pressure before carrying out repairs.*

Check for cooling system leaks using the Engine cooling system tester -V.A.G 1274 - or Engine cooling system tester -VAG 1274B- with the Adapter -V.A.G 1274/8 - and Adapter -V.A.G 1274/9- .

Cooling system components, body side ⇒ page 53 .

Cooling system components, engine side ⇒ page 54 .

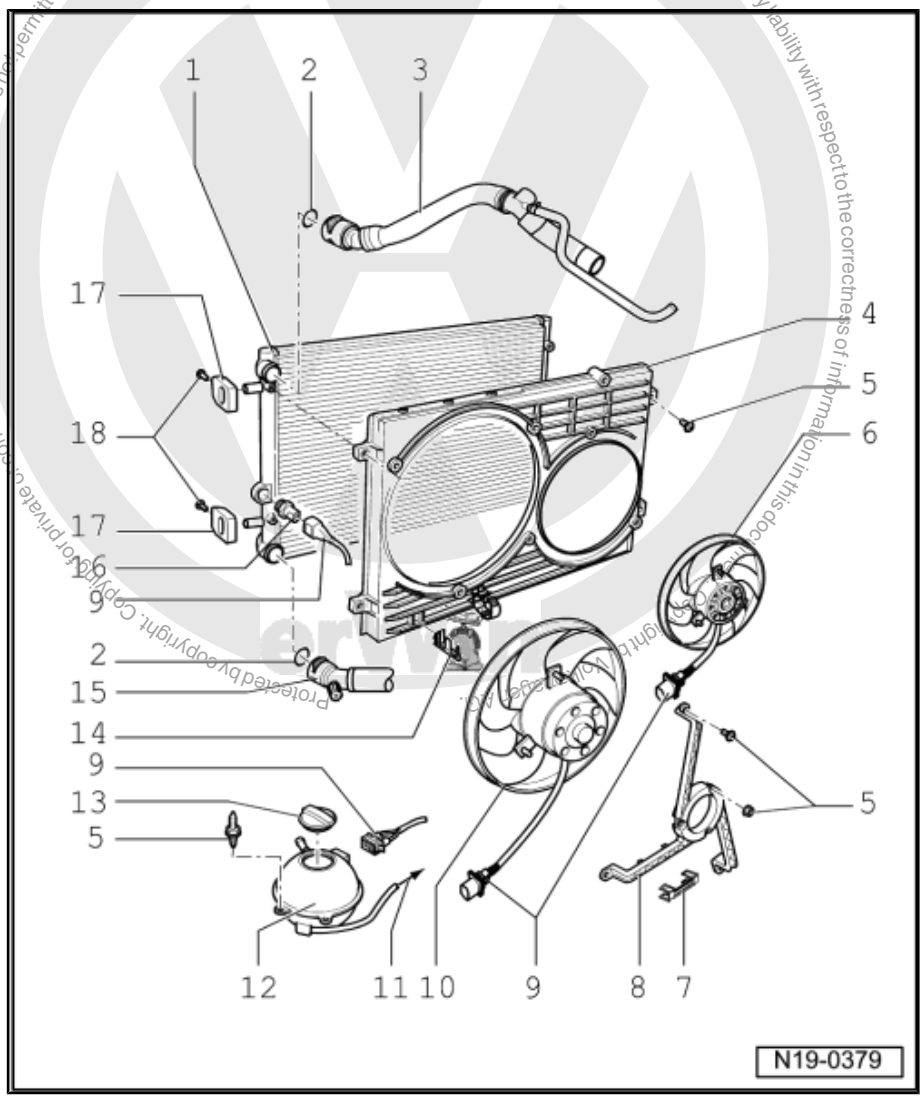
Cooling system - drain and replenish ⇒ page 56 .

Radiator - remove and install ⇒ page 59 .

Water pump - remove and install ⇒ page 60 .

Proportion for coolant mixture ⇒ page 56 .

1.1 Cooling system components on body side



1 - Radiator

- ❑ Remove and install ⇒ page 59 .
- ❑ After replacement, exchange all coolant.

2 - Sealing ring

- ❑ Replace.

3 - Upper cooling system hose

- ❑ Fixed to the radiator with retaining clip.
- ❑ Check for proper seating.
- ❑ Cooling system hose connection diagram ⇒ page 55 .

4 - Air deflector

5 - 10 Nm

6 - Right radiator fan. -V35-

- ❑ Vehicles with air conditioning only.

7 - Retaining clip

- ❑ Check for proper seating.

8 - Support

- ❑ For Radiator fan -V7- .

9 - Connectors

- ❑ From cooling system fans.

10 - Radiator fan -V7-

11 - For cooling system thermostat valve body

- ❑ Cooling system hose connection diagram ⇒ page 55 .

12 - Coolant reservoir

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

13 - Lid

- ❑ Check with the Engine cooling system tester -VAG 1274- or Engine cooling system tester -VAG 1274B- and Adapter for VAG 1274 -VAG 1274/9- .
- ❑ Test pressure 1.4 ... 1.6 bar.

14 - Support

- ❑ From radiator fan coupling connector -V7- .

15 - Lower cooling system hose

- ❑ Fixed to the radiator with retaining clip.
- ❑ Check for proper seating.
- ❑ Cooling system hose connection diagram ⇒ page 55 .

16 - Thermal switch -F18- , 35 Nm

- ❑ For Radiator fan -V7- .

Switch temperatures:

- ❑ Speed 1: on: 95º C; off: 84º C.
- ❑ Speed 2: on: 102° C; off: 91º C.

17 - Support

- ❑ For the radiator
- ❑ Check installation position.
- ❑ Observe different versions.

18 - 10 Nm

1.2 Cooling system components, engine side

Thermostat valve body side

1 - 10 Nm

2 - Sealing ring

- ❑ Replace.

3 - Clip

- ❑ Check for proper seating.

4 - To upper side of radiator.

- ❑ Cooling system hose connection diagram.

5 - From lower side of radiator.

- ❑ Cooling system hose connection diagram.

6 - Thermostat valve body

- ❑ Thermostat valve - Initial opening temperature 87...102° - final 130°C.
- ❑ Thermostat valve - Initial opening 8 mm - final 12 mm.

7 - Clip

- ❑ Check for proper seating.

8 - For heat exchanger

- ❑ Cooling system hose connection diagram.

9 - From the heat exchanger

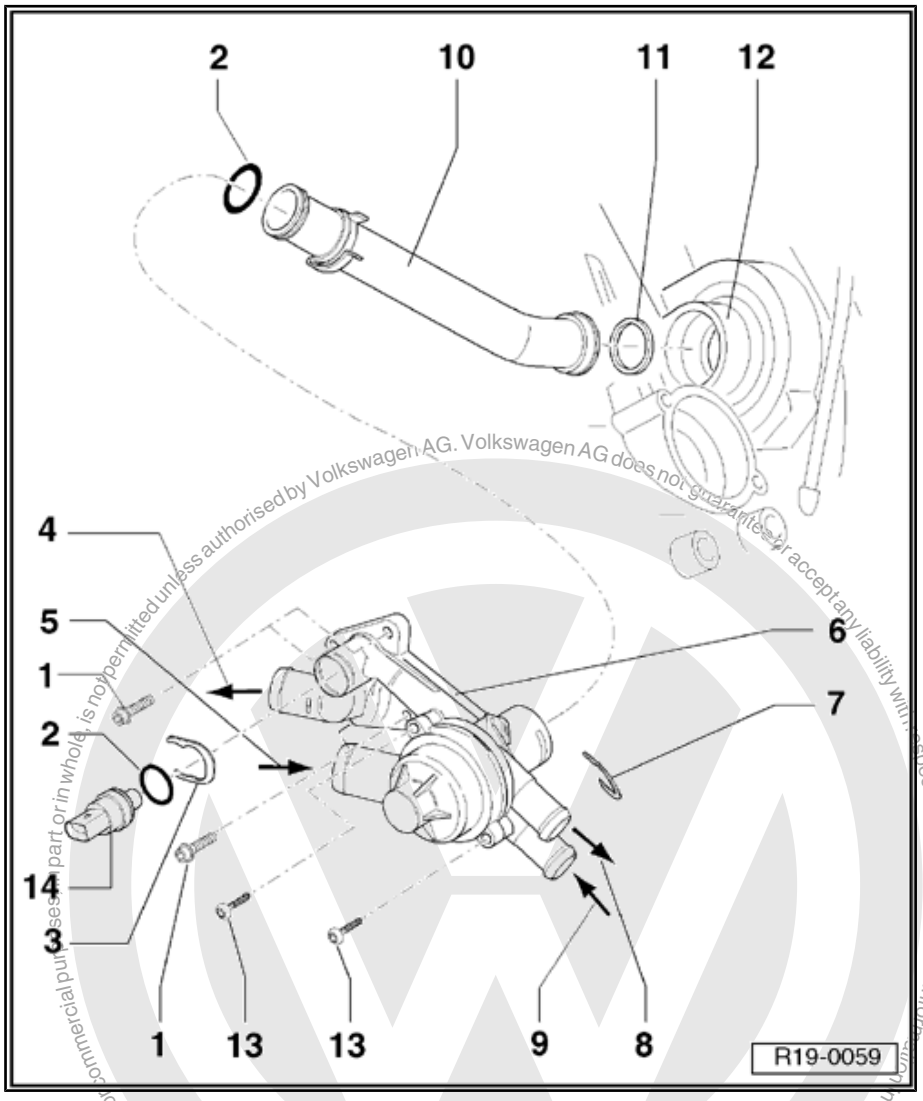
- ❑ Cooling system hose connection diagram.

10 - Cooling system pipe

- ❑ Cooling system hose connection diagram.

11 - Sealing ring

- ❑ Replace.



12 - Engine block water pump housing

13 - 10 Nm

14 - Coolant temperature sensor -G62-

❑ Before removing, eliminate, if necessary, cooling system pressure.

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

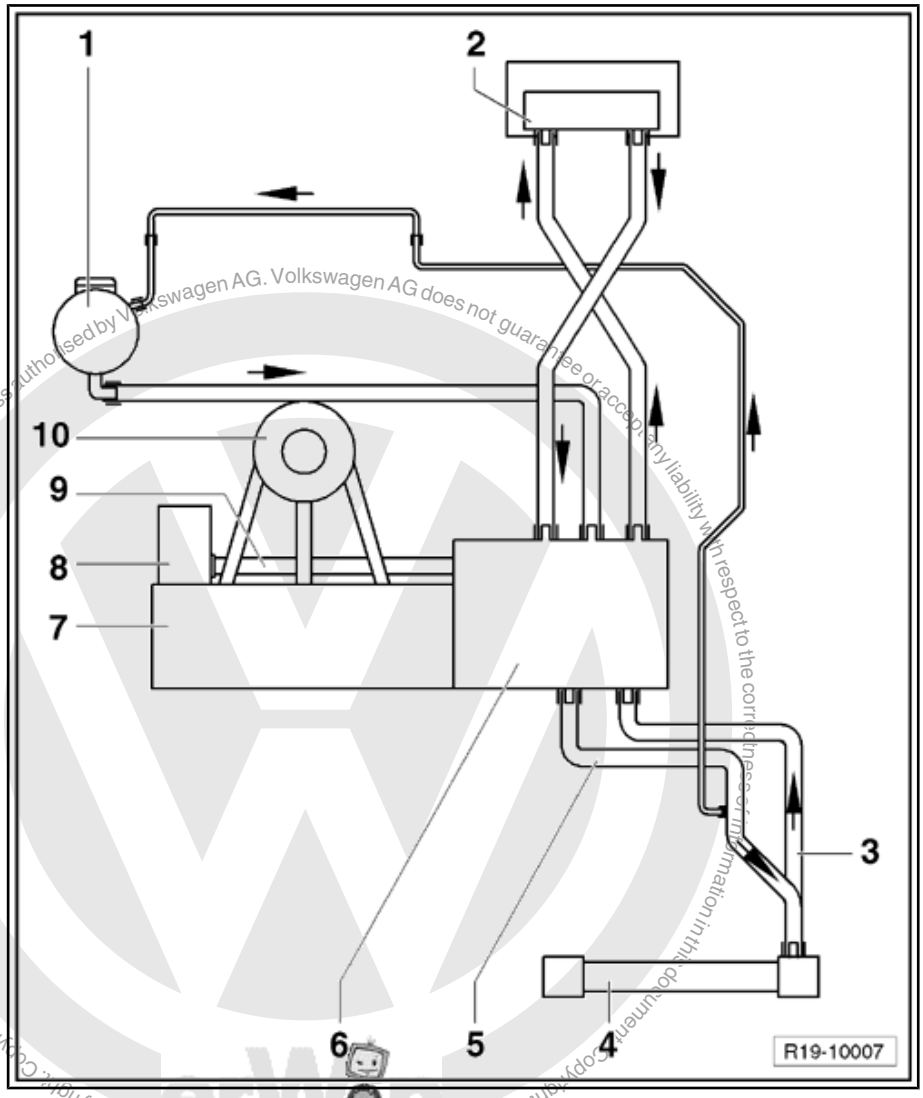
6 - Thermostat valve body

7 - Engine cylinder head / engine block

8 - Water pump

9 - Cooling system pipe

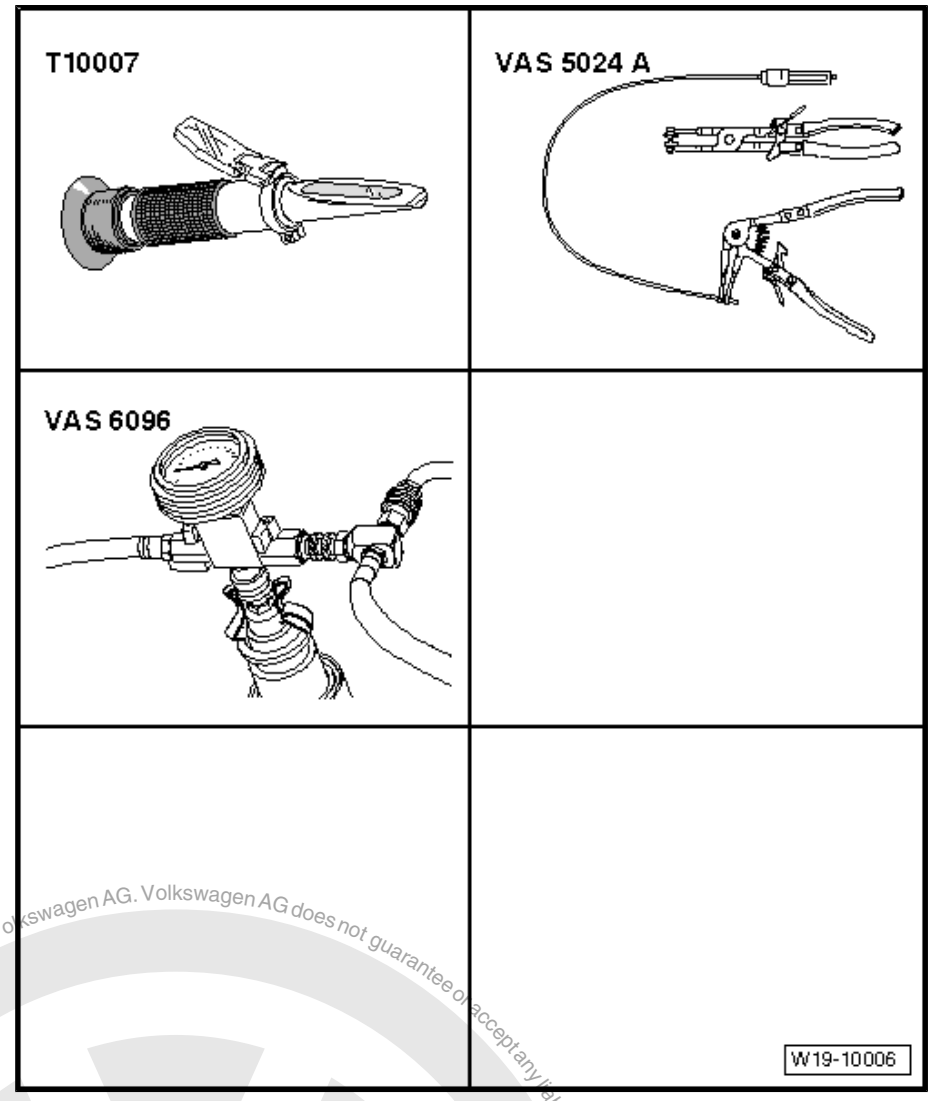
10 - Intake manifold



1.4 Cooling system - drain and replenish

Special tools and workshop equipment required

- Refractometer for T 10007 or coolant analysis -EQ 7093-
- VAS 5024A or Standart-type clamp pliers -VW 5162-
- Cooling system supply unit -VAS 6096 -



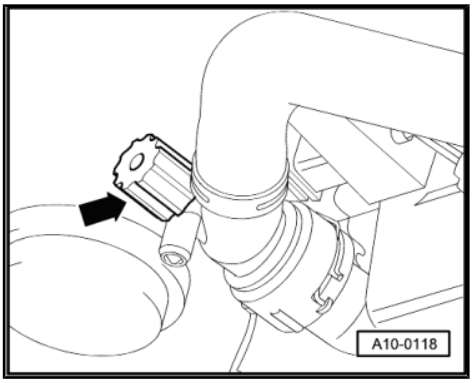
1.4.1 Drain

WARNING

Hot vapours may escape from the coolant reservoir when opening it. Wear protective clothing and goggles to prevent injuries to the eyes and burns. Place a cloth on the cover and open it carefully.

– Remove lower noise insulation from engine compartment.
– Remove coolant reservoir lid.

– Open the drainage device on the radiator cooling system -arrow-.



Note

Observe the waste disposal standards!

Checking

Note

- *Only G 12 may be used as coolant additive, as per "TL VW 774 F" standard Identification feature: lilac colour*
- *Lilac G12, according to "TL VW 774 F" standard, may be mixed with the previous red G 12 coolant additive!*
- *G 12 and coolant additives with the "TL VW 774 F" indication prevent damages caused by freezing and corrosion, as well as calcareous build-ups and also increase boiling temperature. Because of that, the cooling system must be contain coolant with additive all year round.*
- *Especially in tropical countries, the coolant contributes to the safe engine operation, when heavily stressed, by elevating boiling temperature.*
- *Antifreeze protection must be ensured up to around -25°C (in arctic climate countries, up to -35°C).*
- *Coolant concentration may not be reduced, by adding water, not even in hot seasons or warm countries. Coolant additive percentage must be at least 40%.*
- *If, due to climate reasons, further antifreeze protection is required, G 12 percentage may be increased, but only up to 60% (antifreeze protection of around -40°C), otherwise, this protection is reduced again and hinders cooling efficiency.*
- *If radiator, heat exchanger, engine cylinder head or engine cylinder head gasket have been replaced, do not apply the used coolant again.*

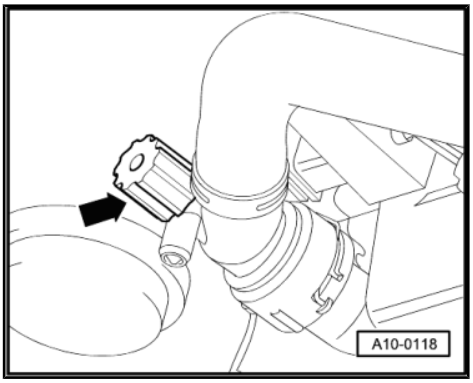
Recommended mixture proportion:

Antifreeze up to	Antifreeze percentage	G 12 (l) 5)	G 12 (gal) 5)	Water (l) 5)	Water (gal) 5)
-13 °F	40 %	2,25 l	0,59 gal	3,35 l	0,88 gal
-31 °F	50 %	2,8 l	0,74 gal	2,8 l	0,74 gal

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

– Close the drainage device for the cooling system -arrow-.

– Install engine compartment lower noise insulation.



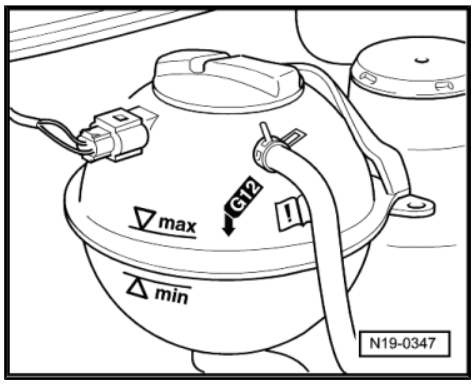
1.4.2 Refill

With Cooling system supply unit -VAS 6096-

– Fill cooling system circuit with Cooling system supply unit -VAS 6096- : ⇒ Instructions for using cooling system supply unit near VAS 6096.

Without the Cooling system supply unit -VAS 6096-

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



With or without Cooling system supply unit -VAS 6096-

– Close the coolant reservoir.

– Turn off heating command.

– Operate the engine and keep engine speed for 3 minutes at approx. 2000 rpm.

– Let the engine running until starting the Radiator fan -V7- operation.

WARNING

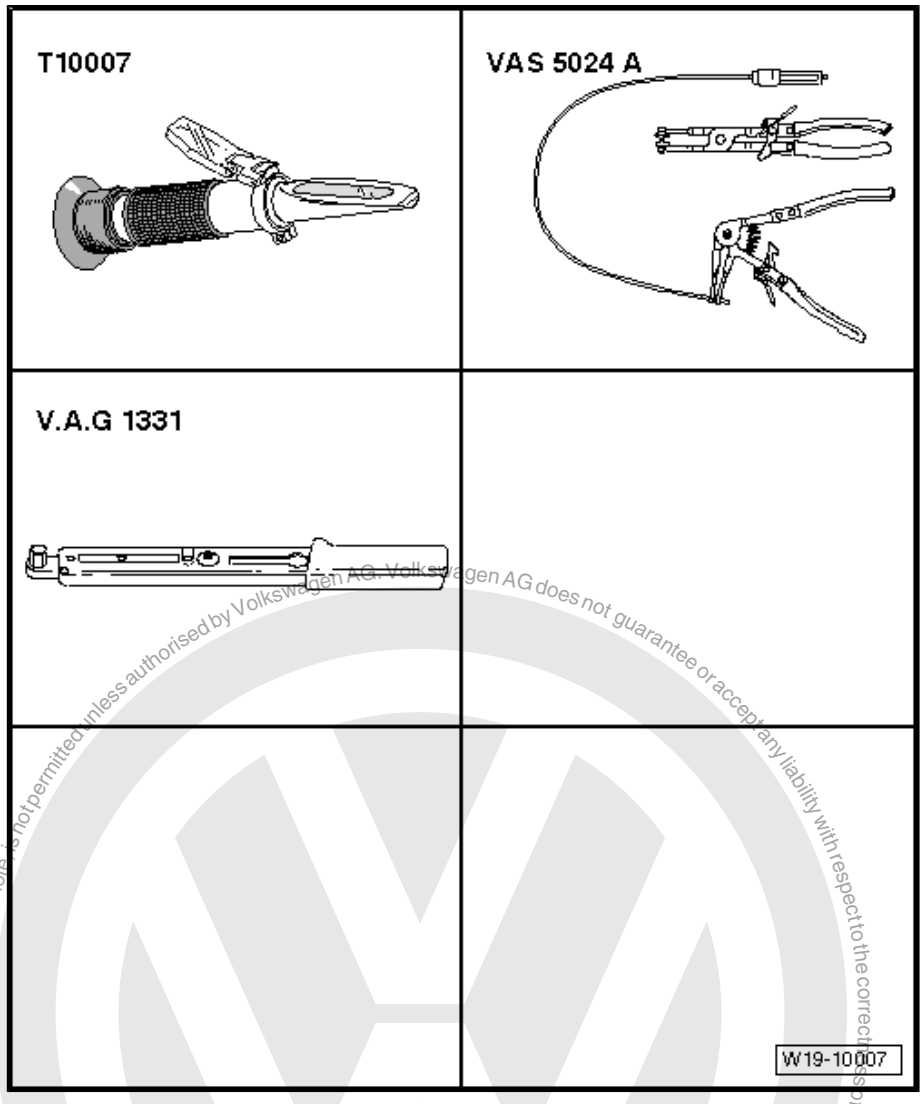
Hot vapours may escape from the coolant reservoir when opening it. Wear protection goggles and clothing to prevent injuries to the eyes and burns. Place a cloth on the cover and open it carefully.

– Check coolant level, and if necessary, add more coolant. When the engine is hot, the level of coolant in the reservoir must be in the max. mark; when it is cool, in the medium level, between min. and max. marks.

1.5 Radiator - remove and install

Special tools and workshop equipment required

- Refractometer for T 10007 or coolant analysis -EQ 7093-
- VAS 5024A or Standart-type clamp pliers -VW 5162-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-



1.5.1 Removal

– Put front panel in the work position: ⇒ Body - external assembly works; Rep. Gr. 50 ; Body - front part

– Drain the cooling system ⇒ page 56 .

– Loosen cooling system hoses from radiator

– Disengage the connectors from the Radiator fan thermal switch -F18- and from the Radiator fan -V7- .

– Remove radiator securing scrrews and remove radiator with Radiator fan -V7- from below.

Vehicles with air conditioning

Observe additional indications and installation works

Note

To prevent damages to the condenser, as well as to the cooling gas pipes, it is necessary to ensure the hoses are not stressed, bent or deformed.

– Loosen cooling gas pipes brace(s).
– Loosen radiator condenser and fasten it to the front panel.

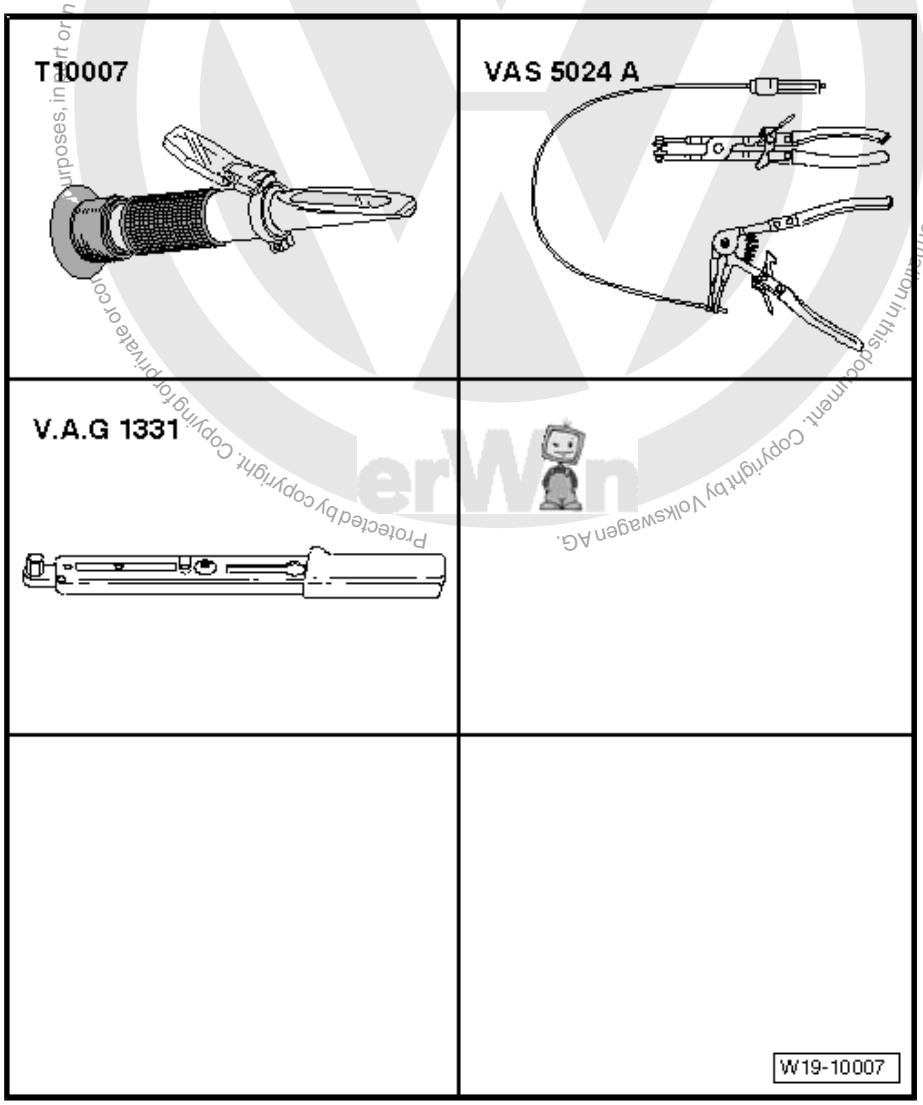
1.5.2 Installation

Install in reversed order, considering the following:

Fill cooling system ⇒ page 56 .

– Electrical connections and installation: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

1.6 Water pump - remove and install

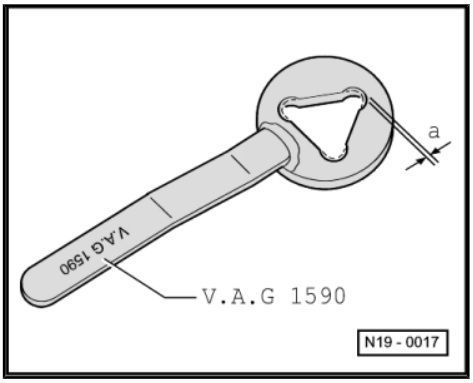


Special tools and workshop equipment required

- Refractometer for T 10007 or coolant analysis -EQ 7093-
- VAS 5024A or Standart-type clamp pliers -VW 5162-
- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-

Water pump wrench -VAG 1590-

– Due to changes in water pump pulley fastening bolts, file the three round shoulders at least: -a = 1 mm-.



Note

- *Water pump integrated gasket may not be separated from the pump.*
- *In case of damages and leaks, replace the entire pump together with the gasket.*

1.6.1 Remove

– Drain the cooling system ⇒ page 56 .
– Remove the Poly-V belt ⇒ page 13 .
– Remove water pump pulley.
– Remove water pump fastening bolts.
– Remove water pump

1.6.2 Installation

Install in reversed order, considering the following:

– Install the crankcase water pump.
– Tighten the fastening screws with 25 Nm.
– Tighten water pump pulley fastening bolts to 20 Nm.
– Install Poly-V belt ⇒ page 13 .
– Fill cooling system ⇒ page 56 .

20 – Supply system - tank, Fuel pump (pre-supply pump) -G6-

1 Fuel supply system components - remove and install

Note

- *Always replace fastening clamps with spring clamps.*
- *Fuel tubes in the engine may be fastened with spring clamps only. Using tightening clamps and bolted clamps is not allowed.*
- *To install spring clamps, we recommend using VAS 5024A or Standart-type clamp pliers -VW 5162- .*

Fuel supply system components - remove and install ⇒ page 63 .

Safety measures for working on the fuel supply system ⇒ page 65 .

Follow cleaning rules ⇒ page 65 .

Fuel pump (pre-supply pump) -G6- - remove and install ⇒ page 66 .

Fuel level indicator sensor -G- - remove and install ⇒ page 67 .

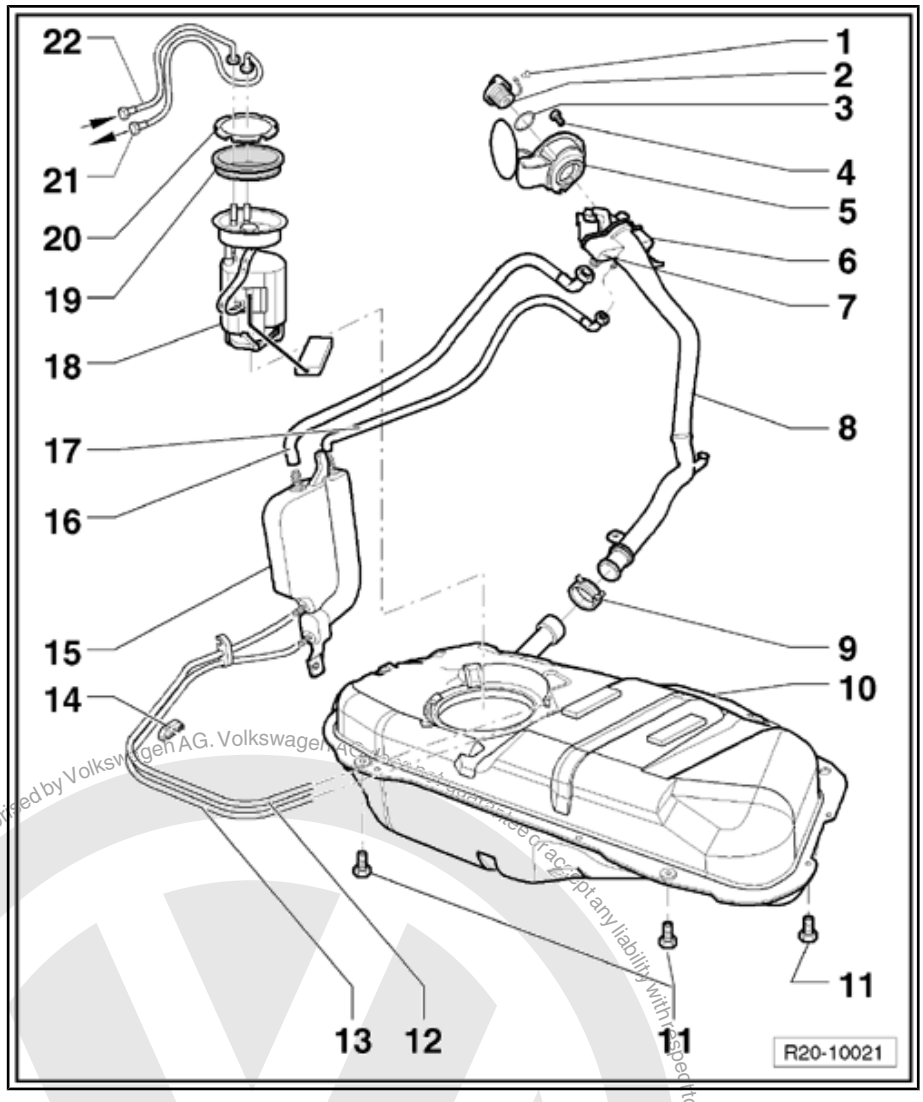
Fuel tank - remove and install ⇒ page 68 .

Fuel shut off in case of accident ⇒ page 70 .

Fuel pump (pre-supply pump) -G6- - check ⇒ page 71 .

Supply system - drain the air ⇒ page 78 .

1.1 Fuel supply system components - remove and install



1 - Fastening clip

2 - Reservoir lid

3 - Sealing ring

- ❑ Replace if damaged.

4 - Fastening screw

5 - Fuel supply nozzle compartment cover

- ❑ With rubber bellows.
- ❑ Remove and install⇒ Body - External assembly works; 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 clamp

10 - Fuel reservoir

- ❑ Remove using the Engine / gearbox or VAG 1383A jack. -EQ 7081- .
- ❑ Remove and install ⇒ page 68 .

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 reservoir

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 66 .
- ❑ Clean the filter, in case it is dirty.
- ❑ Fuel pump (pre-supply pump) -G6- - check ⇒ page 71 .
- ❑ Observe the flange installation position in the fuel tank ⇒ page 64

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

- ❑ Remove and install ⇒ page 66 .

20 - Circlip (sliding)

21 - Supply pipes

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

22 - Return pipes

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

1 - For the fuel tank supply nozzle housing.

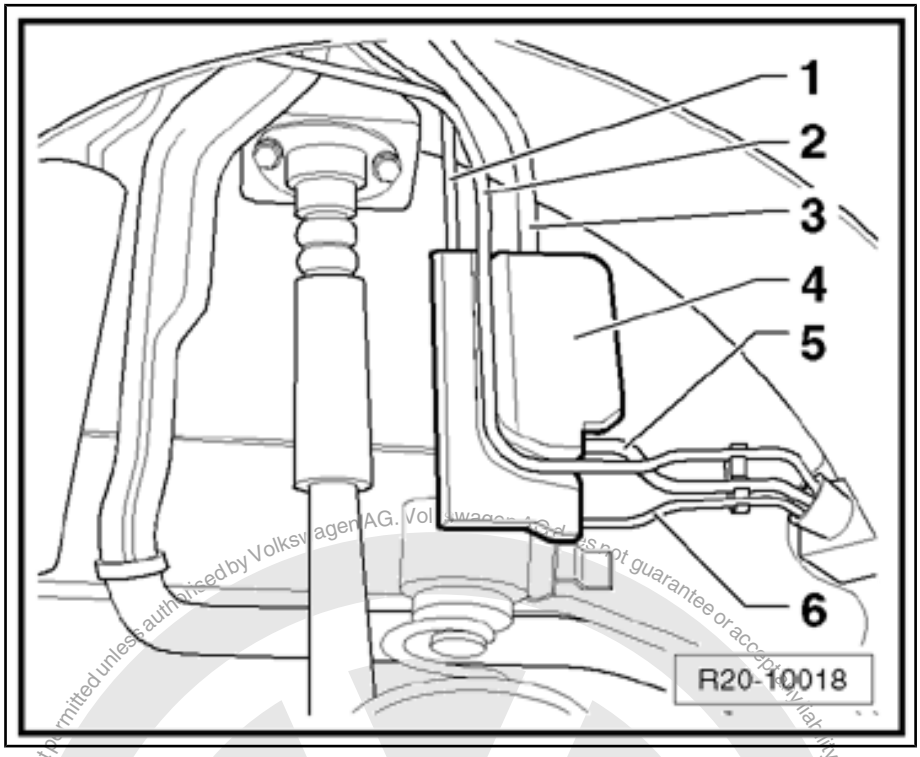
2 - For activated charcoal filter

3 - For the fuel tank supply nozzle housing.

4 - Expansion reservoir

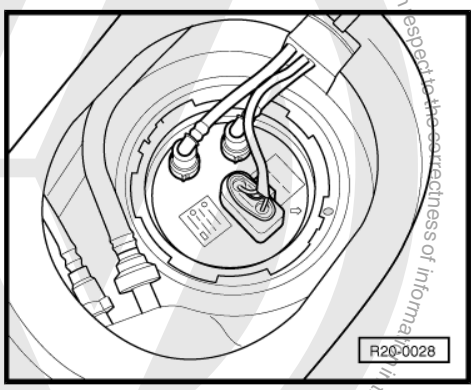
5 - For expansion tank

6 - For expansion tank



Installation position for Fuel pump (pre-supply pump) -G6-

The -arrow- on the Fuel pump (pre-supply pump) -G6- shall match to that on the reservoir.



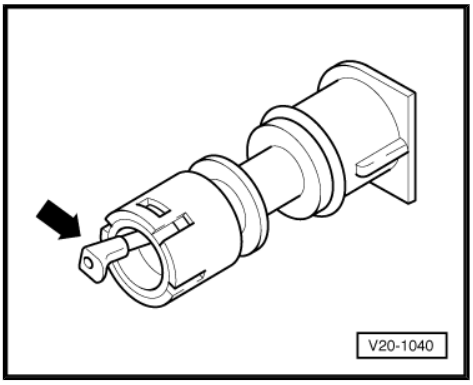
Note

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

Check vent valve

Lever in rest position: closed

Lever pushed in the direction of arrow: open



Note

Before vent valve installation, remove fuel tank cover.

1.2 Safety measures in fuel supply works

WARNING

Fuel supply tube is under pressure! Wear protective goggles and gloves to prevent injuries and avoid contact with the skin. Before loosening tube junctions, place a cloth around the union point. Then, eliminate pressure by pulling the tube carefully.

Caution

In all assembly works, especially in engine compartment, due to lack of space, consider the following:

- ***All pipes (e.g. fuel, hydraulic, activated charcoal filter, cooling system and cooling gas, break fluid, vacuum) and electric cables must be restored to original interconnection.***
- ***Ensure enough space in relation to all moving or hot components to avoid damages to the connections.***

When removing and installing Fuel pump (pre-supply pump) -G6- with fuel tank full or partially full, consider the following:

- Before starting installation works, place near the fuel reservoir 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 the fuel! Wear fuel resistant gloves!
- For safety reasons, before opening the fuel system, remove fuse number 33 from fuse holder, as the Fuel pump (pre-supply pump) -G6- can be activated.

1.3 Cleaning rules

To carry out fuel supply/injection works, consider the following “5 cleaning” rules thoroughly:

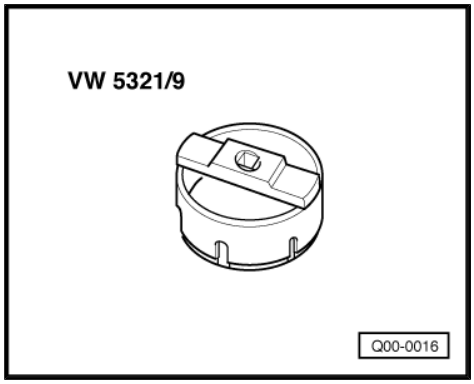
- Carefully clean union points and respective surrounding areas before disconnecting them.
- Place parts on clean surface and cover them. Do not use cloth that releases lint!
- Carefully cover or close open parts, in case repair is not carried out immediately.

- Install clean parts only: Remove parts from the packaging immediately before installation. Do not use parts that have been kept out of the packaging (for example, in tool boxes).
- With system open: Do not work wit compressed air. Do not move the vehicle.

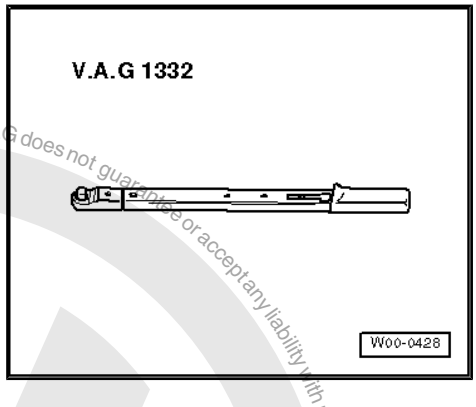
1.4 Fuel pump (pre-supply pump) -G6- - remove and install

Special tools and workshop equipment required

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



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



1.4.1 Removal

– Take safety precautions before starting removal works ⇒ page 65 .

– Follow cleaning rules ⇒ page 65 .

– First, check if the vehicle has code radio; if so, check the respective anti-theft code.

– With ignition off, disconnect earth strap from Battery -A- .

– Fold rear seat forwards.

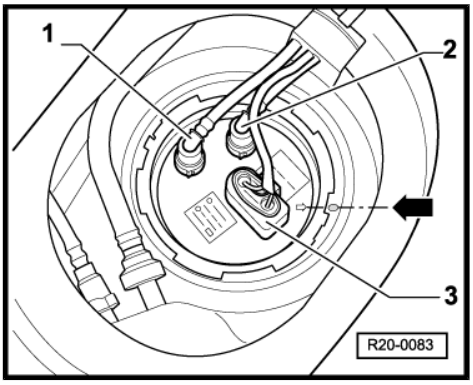
– Remove Fuel pump (pre-supply pump) -G6- access cover.

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- and supply -2- pipes and connector -3- from Fuel pump (pre-supply pump) -G6- .

The -arrows- shows the installation position of the Fuel pump (pre-supply pump) flange -G6- .

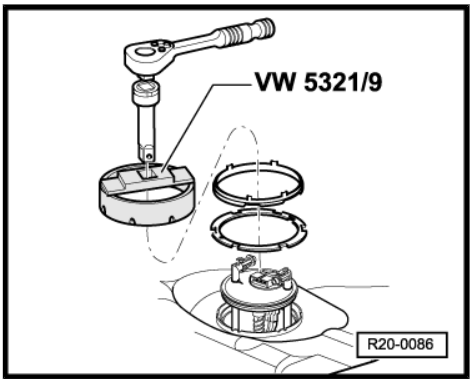


Note

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

– Remove the lock with Wrench -VW 5321/9- or Wrench -T10334- .

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

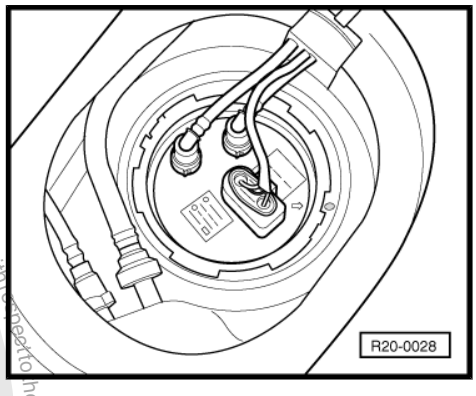


Note

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 Installation

– Fuel pump (pre-supply pump) -G6- must be installed in the reverse sequence to the removal.



Note

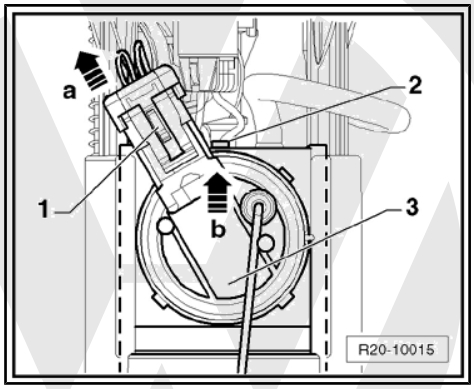
- *Try not to bend the Fuel level indicator sensor -G- during installation.*
- *Install Fuel pump (pre-supply pump) -G6- sealing dry on fuel tank opening.*
- *Lubricate the sealing with fuel only for installing the Fuel pump (pre-supply pump) -G6- .*
- *Observe installation position of the Fuel pump (pre-supply pump) -G6- -arrow-.*
- *The mark on the Fuel pump (pre-supply pump) -G6- shall match that on the body.*
- *Check the firm seating of the fuel hoses.*
- *Do not confuse the supply and return hoses.*
- *After installation of the Fuel pump (pre-supply pump) -G6- , check whether the supply, return and vent pipes are still fastened to the fuel reservoir.*

1.5 Fuel level sensor -G- - remove and install

1.5.1 Removal

– Remove Fuel pump (pre-supply pump) -G6- ⇒ page 66 .

– Disengage the connector from 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-.



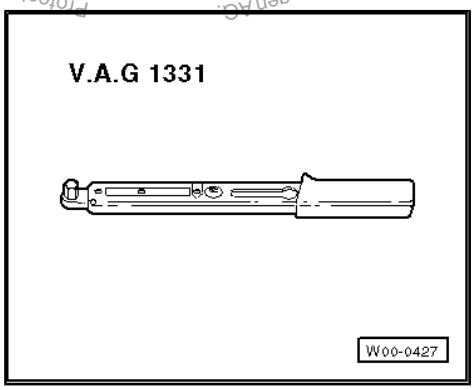
1.5.2 Installation

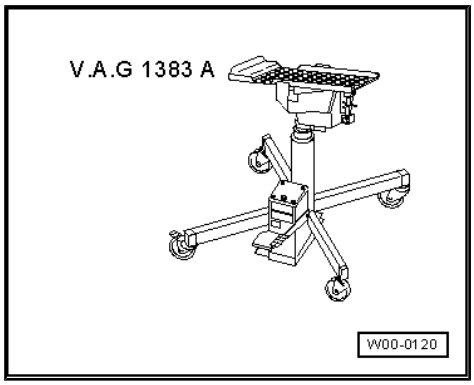
– Position the Fuel level indicator sensor -G- on the Fuel pump (pre-supply pump) guides -G6- and press it downwards until it fits.
– Install the Fuel level indicator sensor -G- connector.

1.6 Fuel reservoir - remove and install

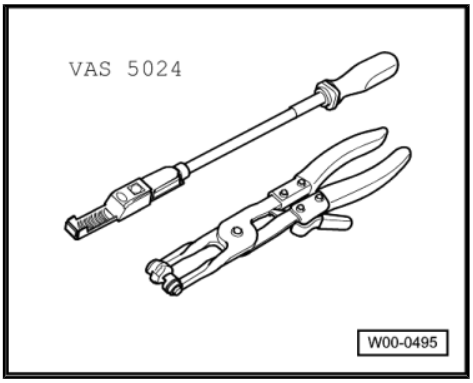
Special tools and workshop equipment required

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



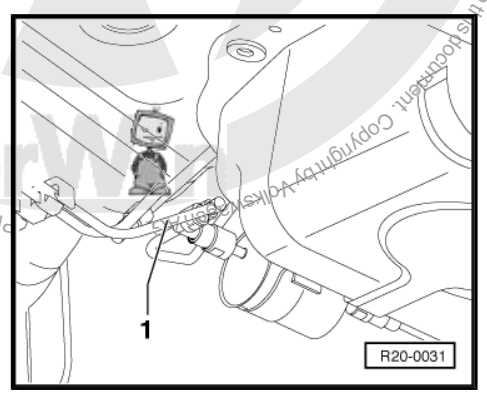


- Transmission jack or engine + transmission set -EQ 7081- or Transmission jack or engine + transmission set -VAG 1383A-
- VAS 5024A or Standart-type clamp pliers -VW 5162-



1.6.1 Removal

– Observe safety precautions before starting removal jobs ⇒ page 65 .
– First, check if the vehicle has code radio; if so, check the respective anti-theft code.
– Remove the fuel reservoir lid.
– With the ignition switched off, disconnect the Battery -A- earth strap.
– Drain the fuel tank with Fuel absorption equipment - VAS 5190- and clean around the fuel nozzle.
– Fold rear seat forwards.
– Remove Fuel pump (pre-supply pump) -G6- access cover.
– Disengage the 4-pole connector from Fuel pump (pre-supply pump) -G6-
– Remove fuel reservoir hoses next to the Fuel pump (pre-supply pump) -G6- .
– Loosen exhaust system. The exhaust system must be fastened to the body with wire, slightly lowered.
– Remove heat deflector between the exhaust tube and the fuel tank.
– Loosen fuel filter -1- supply hose.
– Remove clamp from fuel supply tube near the tank with Standart-type clamp pliers -VW 5162- or Standart-type clamp pliers -VAS 5024A- .
– Remove fastening bolts, supporting the fuel tank with the Engine / gearbox jack -EQ 7081- or Engine / gearbox jack - VAG 1383A- .
– Lower fuel reservoir.



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 Installation

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

- Install vent and fuel hoses without bending them.

- Check the firm seating of the fuel hoses.
- Do not invert supply and return hoses (return hose blue or with blue marking, supply hose black).

Note

- *Once the fuel reservoir is installed, check if supply, return and ventilation hose sets are still fixed.*
- *If fuel tank has been replaced, it is necessary to drain the air from the fuel system* ⇒ page 68 .

1.7 Fuel shut off in case of accident

1.7.1 Operation

The fuel is shut off in case of an accident in order to reduce risk of fire in the vehicle after a collision, in which the Fuel pump (pre-supply pump) -G6- is disconnected by the Fuel pump relay -J17- . At the same time, with this equipment, the engine starts more smoothly.

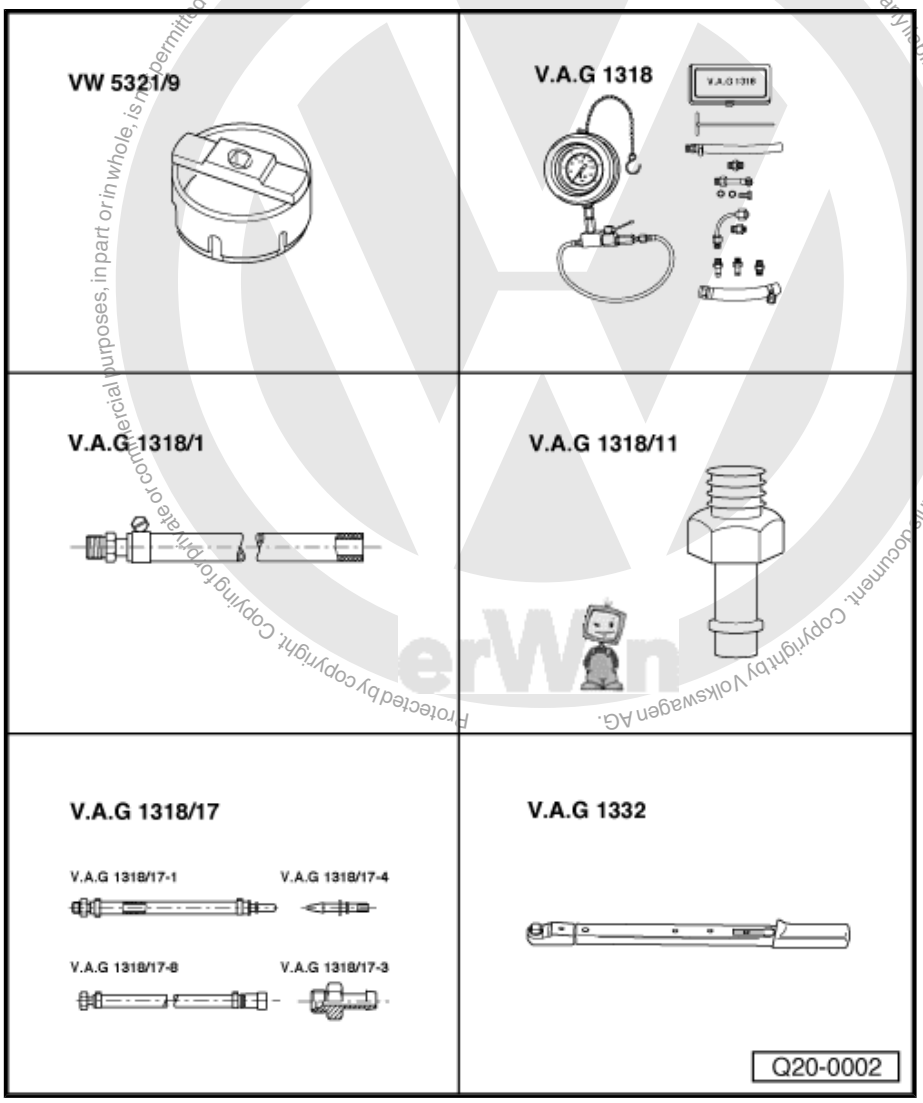
When opening the fuel system, consider the following safety precautions ⇒ page 65 .

– Check the Fuel pump relay -J17- : ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

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

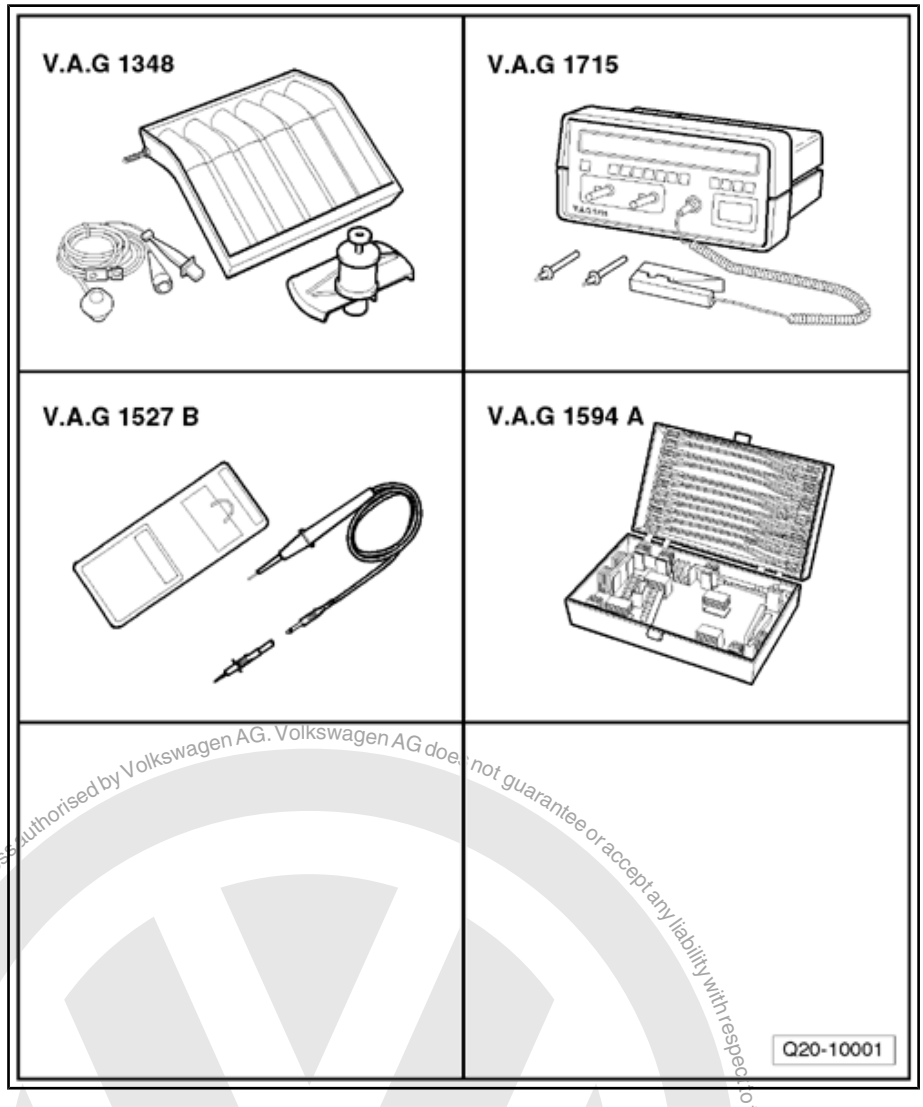
Special tools and workshop equipment required

- Spanner -VW 5321/9- or Spanner -T10334-
- Pressure gauge -VAG 1318-
- Adapter -VAG 1318/13-
- Adapter -VAG 1318/11-
- Adapter -VAG 1318/17-
- Torque wrench - 40 to 200 Nm (enc. 1/2") -VAG 1332-



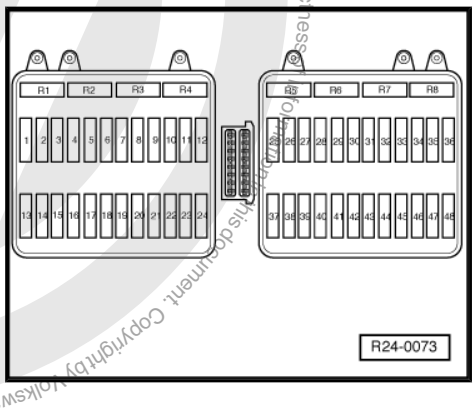
Special tools and workshop equipment required

- 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



1.8.1 Check conditions

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



Note

Observe the description of how fuel is shut off in case of accident *⇒ page 70* *.*

1.8.2 Operation of power supply - check

Note

In the following operation sequence, it might be necessary to disconnect the Battery -A- 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.

– Turn the ignition on. The Fuel pump (pre-supply pump) -G6- has to work audibly for approx. 1 second.

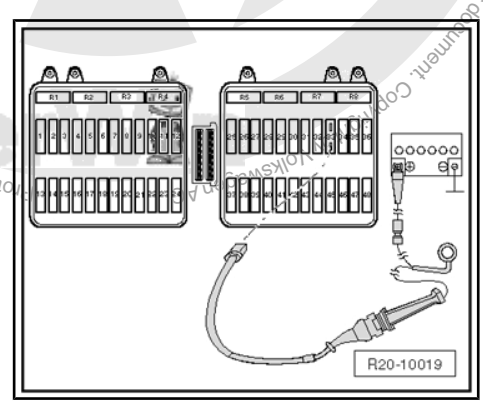
If the Fuel pump (pre-supply pump) -G6- does not work:

– Turn the ignition off.

– Remove fuse holder cover.

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

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



– Activate the Remote control -VAG 1348/3A- .

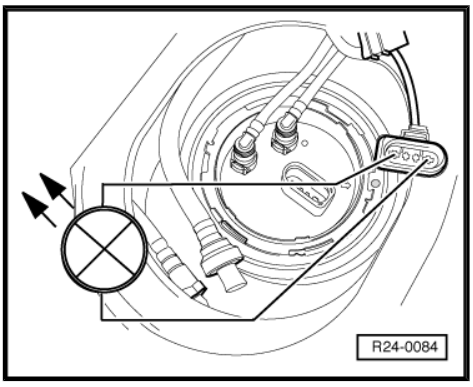
If the Fuel pump (pre-supply pump) -G6- works:

– 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 -VAG 1348/3A- .

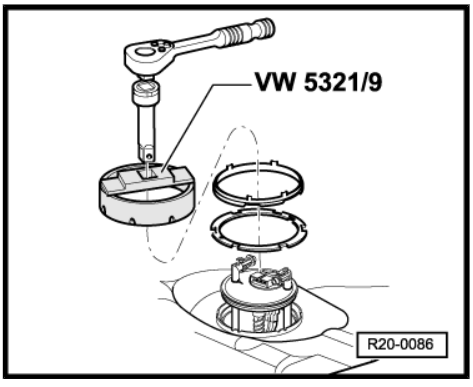
The LED should light up.

– 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 that the cables are connected to the Fuel pump -G23- .

In case there is no cable interruption:

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

1.8.3 Fuel flow - check

1.8.4 Test conditions

- Fuel pump (pre-supply pump) -G6- supply is ok.
- Remote control -VAG 1348/3A- installed.
- Fuel pump (pre-supply pump) -G6- pressure and fuel pressure adjuster OK: ⇒ page 98

1.8.5 Test sequence

Note

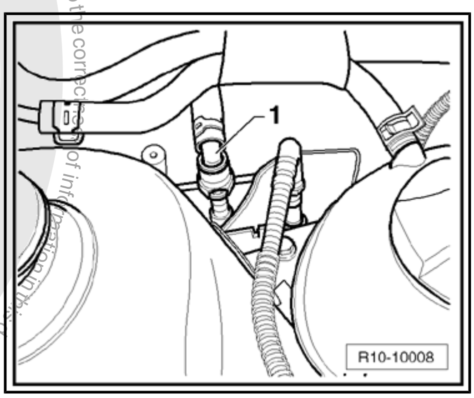
Fuel flow is measured at 3.0 bar for vehicles manufactured until May/2006, and 4.0 bar for vehicles produced as of June/2006. Thereby, fuel pressure must be checked before measuring the flow.

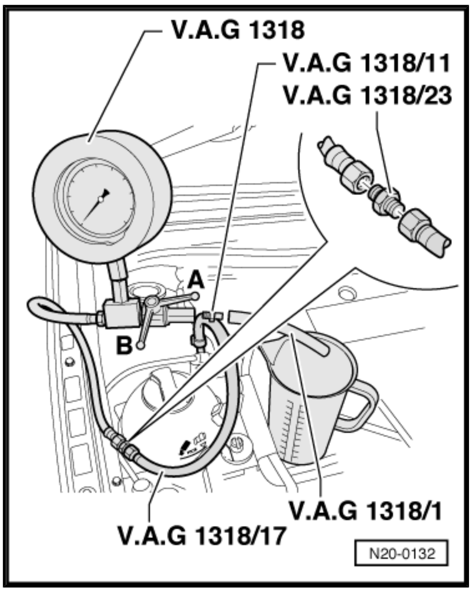
– Remove the fuel reservoir lid.

> **WARNING**
>
> *Fuel supply pipes are under pressure. Before loosening hose connection, place a cloth around them. Next, eliminate pressure by removing 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- .





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

– Open the Pressure gauge -VAG 1318- valve. It will indicate the flow direction-A-.

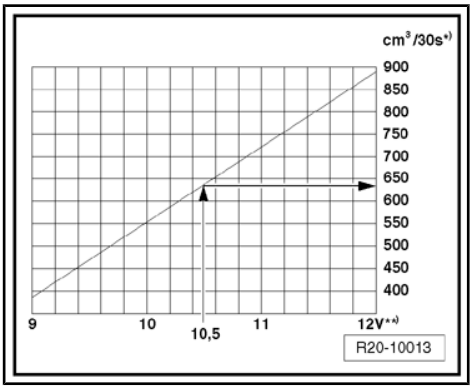
– Activate the Remote control -VAG 1348A- , closing the cock slowly, until the Pressure gauge -VAG 1318- indicates a positive pressure of 3.0 bar for vehicles manufactured until May/2006, and 4.0 bar for those produced as of June/2006. Then, do not change cock position.

– Empty measuring container.

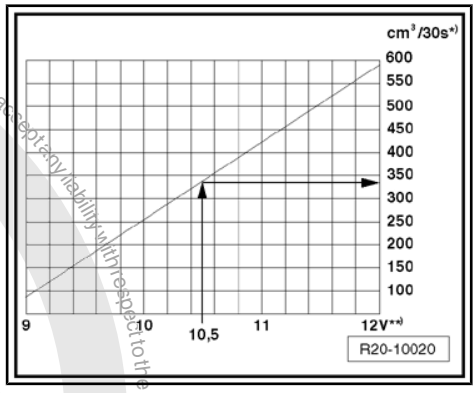
– The Fuel pump (pre-supply pump) -G6- flow depends on the Battery voltage -A- . Because of that, couple the Multimeter -VAG 1715- to the vehicle Battery -A- , by using the Auxiliary cables -VAG 1594A- .

– Activate the Remote control -VAG 1348A- for 30 seconds, measuring the Battery -A- voltage.

– Compare fuel flow with theoretical value for vehicles manufactured until May/2006 (Fuel pump (pre-supply pump) -G6- pressure of 3 bar).



– Compare fuel flow with theoretical value for vehicles manufactured as of June/2006 (Fuel pump (pre-supply pump) -G6- pressure of 4 bar).



6) Minimum amount cm^3/30 s

7) Voltage in the Fuel pump (pre-supply pump) -G6- with engine stopped and Fuel pump (pre-supply pump) -G6- operating (approx. 2 volts less than Battery -A- voltage).

Example of reading:

During the test, a voltage of 12.5 volts is measured on the Battery -A- . As in the Fuel pump (pre-supply pump) -G6- there is a voltage of around 2 volts less than in the Battery -A- , the result is a minimum supply flow of 633 cm^3>/30 s for vehicles manufactured until May/2006 and 333 cm^3/30 s for vehicles produced as of June/2006.

If minimum flow capacity is not reached:

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

If fuel pipes are ok.

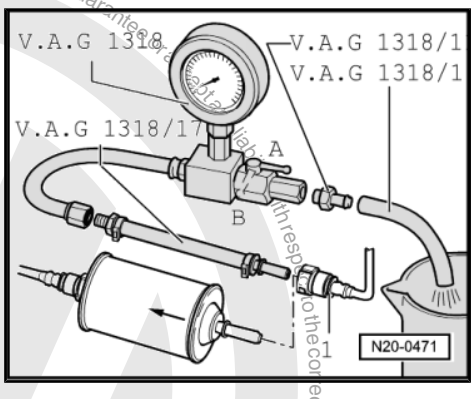
– Check fuel flow before fuel filter.

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 connectors.



– 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 adapter -V.A.G 1318/11- for the Pressure gauge -VAG 1318- and put its end in a graduated container with at least 3.0-liter capacity.
– Open the Pressure gauge -VAG 1318- valve. The cock points towards the fuel passage-A-.
– Activate the Remote control -VAG 1348/3A- , closing the cock slowly, until the Pressure gauge -VAG 1318- indicates a pressure of 3.0 bar for vehicles manufactured until May/2006, and 4.0 bar for those produced as of June/2006. Do not change cock position.
– 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 reached:

– Replace the fuel filter.

If the minimum flow is not reached again:

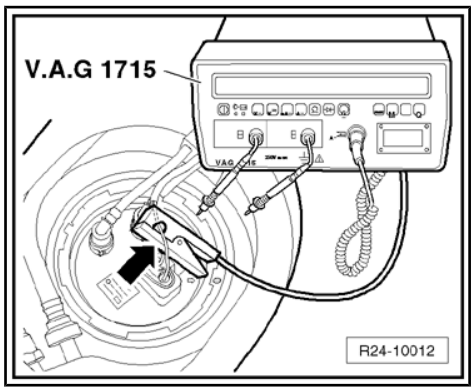
– Remove the Fuel pump (pre-supply pump) -G6- and check whether there is dirt in the screen filter.

Only if no irregularities have been found so far:

– Fuel pump (pre-supply pump) -G6- - damaged, replace it ⇒ page 66 .

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):

– Couple the removed fuel tubes again.



– By using the current leakage clamp meter, couple the Multimeter -VAG 1715- to contact 1 (blue/white) 4-pole connection socket box cable -arrow- from cable harness.
– Start engine and let it run in idle speed.
– Measure current draw of the Fuel pump (pre-supply pump) -G6- .

Theoretical value: 6.8 ampere at most for vehicles manufactured until May/2006 and 7.6 ampere for the ones produced as of June/2006.

Note

If it is a temporary fault in the fuel system, checking can also take place during a test drive, when the presence of a second person will be necessary.

If the current draw is excessive:

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

1.8.6 Fuel pump (pre-supply pump) -G6- check valve - check

1.8.7 Test conditions

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

1.8.8 Test sequence

WARNING

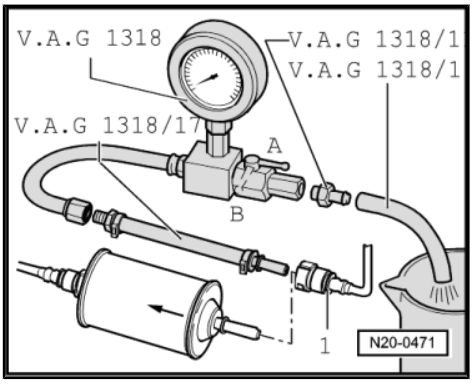
Fuel supply pipes are under pressure! Before loosening hose connections, put a cleaning cloth on connection points. Then depressurize by carefully pulling the hose.

Note

This test must check simultaneously the tightness of joints on the fuel supply tube sets, from the Fuel pump (pre-supply pump) -G6- 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 -VAG 1318/11- Adapter and insert the hose -VAG 1318- end in a measuring container.



Note

For that, press the keys on hose connectors.

– Close the valve on the Pressure gauge -VAG 1318- (transverse valve in relation to the flow direction - position -B-).

– Activate the Remote control -VAG 1348/3A- in quick consecutive intervals, until reaching a pressure of approx. 3.0 bar for vehicles manufactured until May/2006 and 4.0 bar for the ones produced as of June/2006.

WARNING

Risk of splashing when opening the cock; keep a container in front of the free end of the Pressure gauge -VAG 1318- .

– Eliminate eventual excess pressure by opening the valve carefully.

– Check pressure drop on the Pressure gauge -VAG 1318- . After 10 minutes, the pressure must not drop below 2.0 bar.

If the pressure keeps dropping:

– Check the joints for tightness.

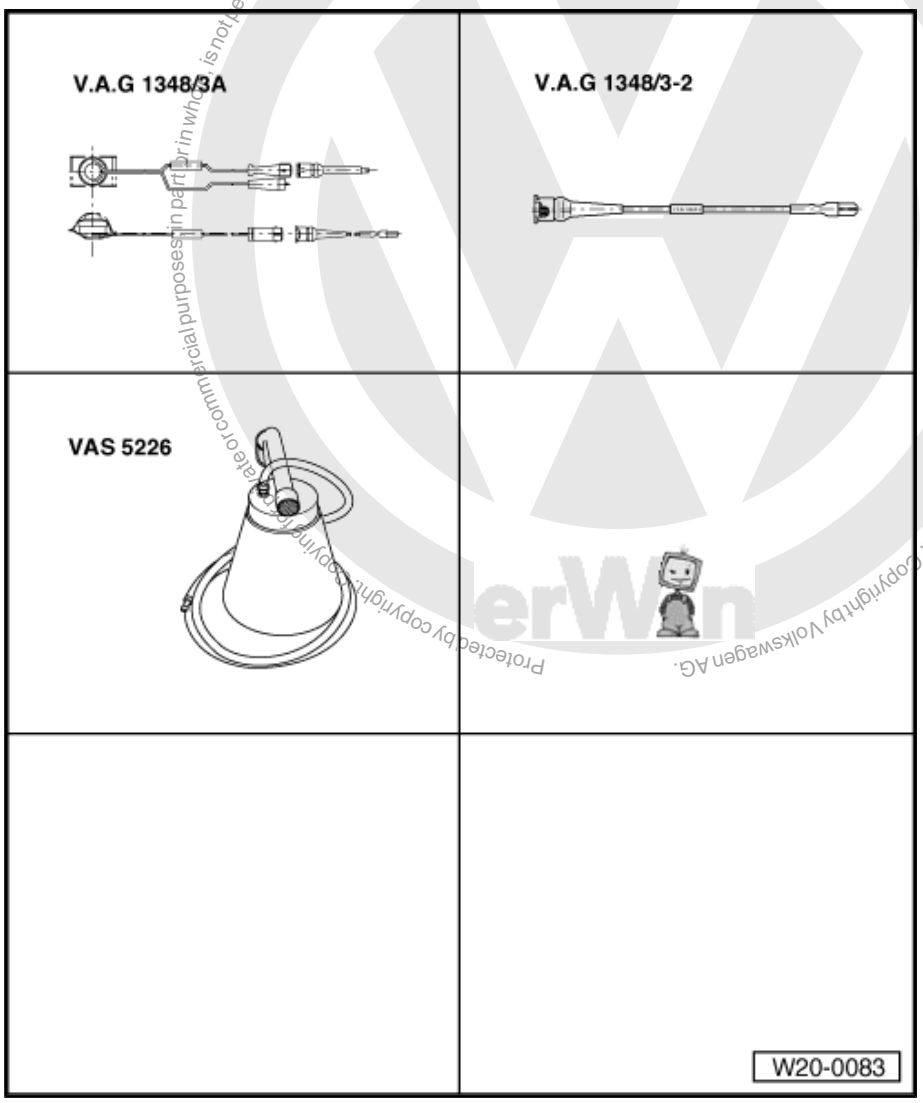
If no irregularities are found in the pipes:

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

1.9 Supply system - drain the air

Special tools and workshop equipment required

- Remote control -VAG 1348/3A- and Adapting cable -VAG 1348/3-2- connected.
- Gasoil aspirator -VAS 5226-
- Adapter -V.A.G 1318/20-
- Adapter -V.A.G 1318/20-1-



1.9.1 Conditions

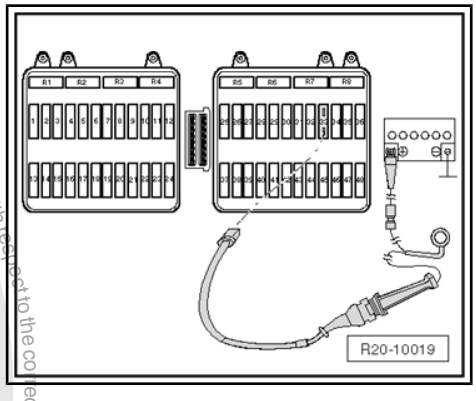
- The fuse must be ok.
- Battery -A- voltage must be at least 11.5 V.
- The Fuel pump relay -J17 - must be ok.

1.9.2 Operation sequence

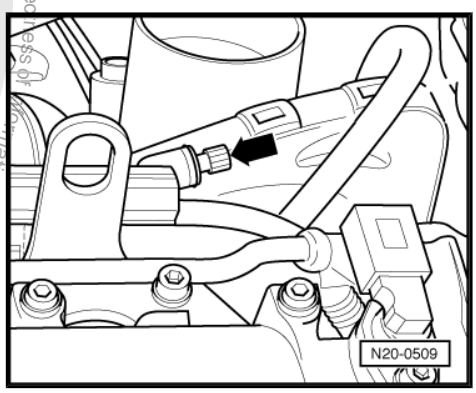
– Remove fuse holder cover.

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

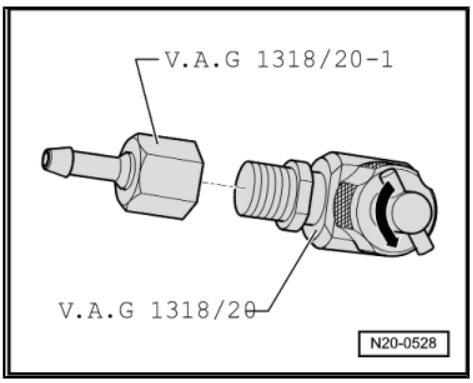
– Connect the Remote control -VAG 1348/3A- and Adapter cable -VAG 1348/3-2- to the lower contact of fuse 33 for activating the Fuel pump (pre-supply pump) -G6- and to the positive terminal of Battery -A- (+).



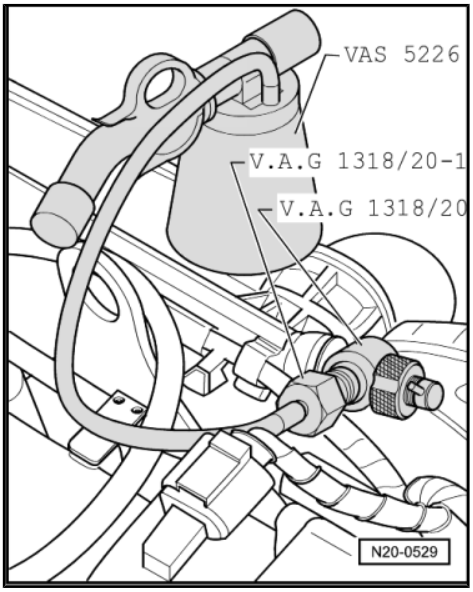
– Remove the protection cover -arrow- from the drainage valve.



– Install the Adapter -VAG 1318/20-1- on the Adapter -VAG 1318/20- .
– Turn the valve (on T-part) counterclockwise until opening it completely.



– Install the Adapter -VAG 1318/20- manually on the drainage valve.
– Connect the Diesel aspirator -VAS 5226- tube, as illustrated.
– Turn the valve (on T-part) clockwise up to the drainage valve stop.
– Check the tube adapters and connections for leaks.
– Activate the Remove control -VAG 1348/3A- until bubble-free fuel comes out of the drainage valve.
– Turn the valve (on T-part) counterclockwise until opening it completely.
– Strangle the Diesel aspirator - VAS 5226- hose (e.g. with up to Ø 25-mm tubing clamps -3094-) and remove it from the Adapter -VAG 1318/20-1- .
– Remove the Adapter -VAG 1318/20- from the drainage valve.



2 Activated charcoal filter system

Operation ⇒ page 80 .

Activated charcoal filter system components - repair ⇒ page 81 .

Check fuel compartment ventilation ⇒ page 81 .

2.1 Operation

Fuel vapours form over the fuel surface on the tank, depending on the atmospheric pressure and ambient temperature.

The activated charcoal filter prevents these hydrocarbon emissions from being released into the atmosphere.

The fuel vapours coming from the highest point of the tank go through the gravity valve (which closes at a 45° inclination) and check valve, strangled in its amount, to the activated charcoal filter.

The activated charcoal absorbs these vapours like a sponge.

While driving and with Lambda adjustment active (hot engine), the electromagnetic valve 1 for activated charcoal filter system -N80- , (also known as regeneration valve) is activated cyclically by the Engine control unit -J623- , due to engine speed and load. 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 activated charcoal regeneration process. 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 into the fuel reservoir, when the Magnetic valve I for activated charcoal filter -N80- is opened and there is vacuum in the intake manifold. This way, the activated charcoal filter regeneration is ensured.

With no current (e.g., driver interruption) the Magnetic valve 1 for activated charcoal filter -N80- remains closed. The activated charcoal filter will not be purged.

Note

- *The flexible tube joints are fixed with a quick coupling.*
- *Always replace fastening clamps with spring clamps.*
- *To install spring clamps, we recommend using the Standart-type clamp pliers -VW 5162 - or Standart-type clamp pliers - VAS 5024A- .*

Follow safety measures ⇒ page 65 .

Follow cleaning rules ⇒ page 65 .

2.2 Activated charcoal filter system components - repair

1 - Activated charcoal filter regeneration system hose

2 - Pressure retention valve with connection hose

- ❑ Make sure it is well fastened.
- ❑ From gravity valve.

3 - Activated charcoal filter

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

4 - Vent connection

- ❑ Ventilation visible from below.

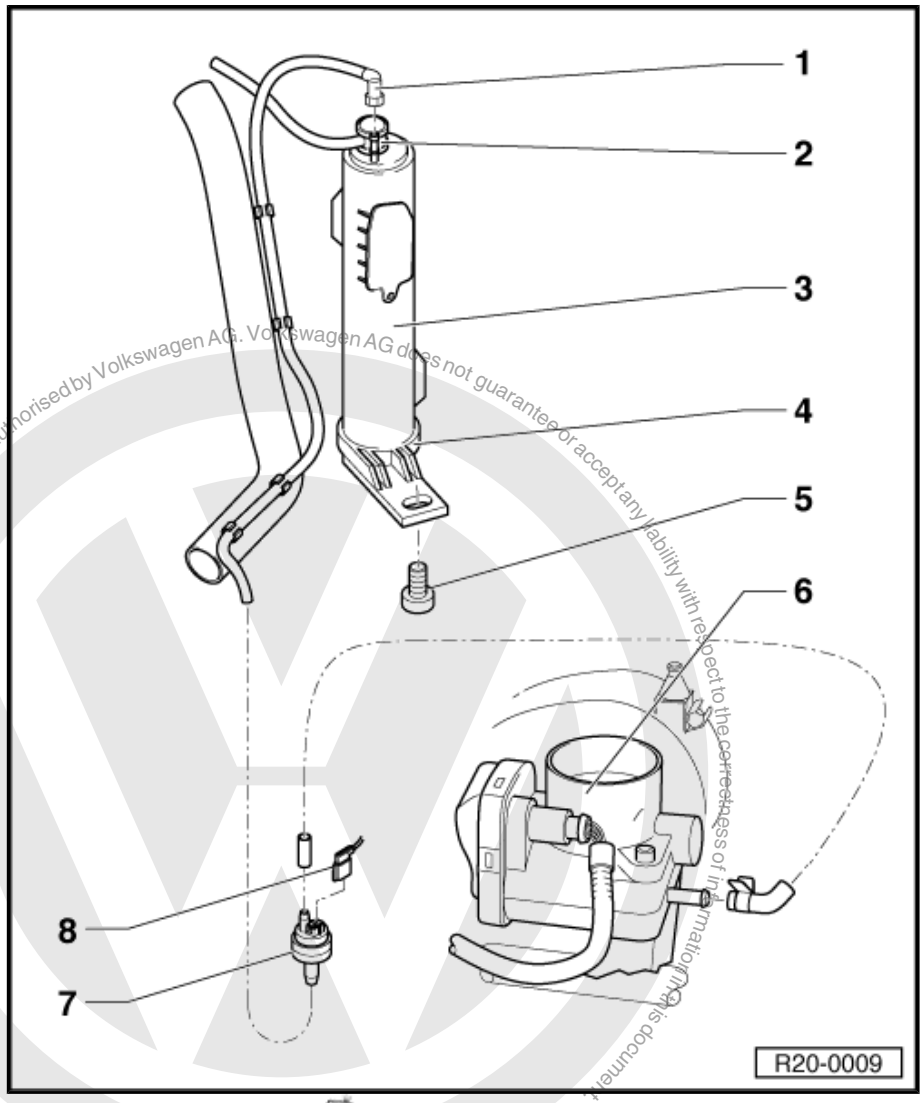
5 - 10 Nm

6 - Accelerator butterfly valve control unit -J338-

7 - Magnetic valve 1 for activated charcoal filter tank -N80-

- ❑ The Magnetic valve 1 for the activated charcoal reservoir -N80- will close when the ignition is off.
- ❑ The Magnetic valve 1 for the activated charcoal reservoir -N80- is activated (by pulses) via Engine control unit -J623- , when the engine is at the operating temperature.

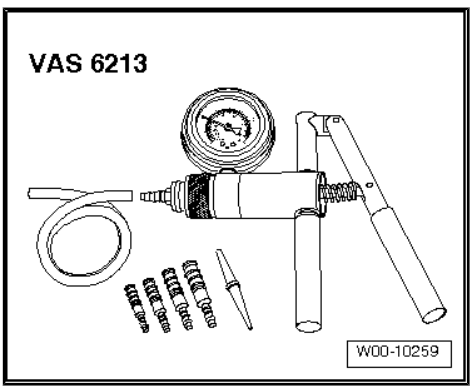
8 - Connector



2.3 Reservoir ventilation - check

Special tools and workshop equipment required

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



2.3.1 Test conditions

- The ignition must be off.

2.3.2 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:

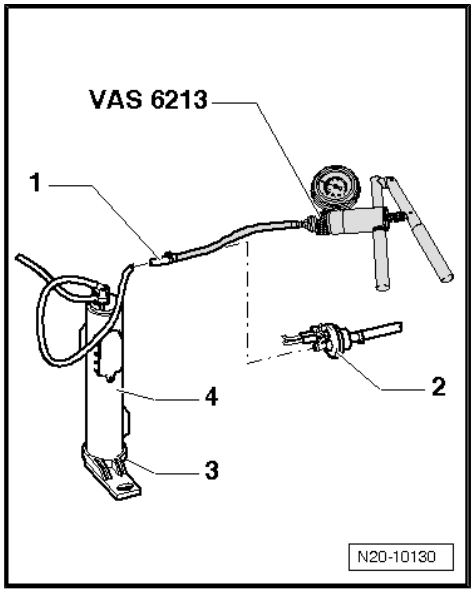
– Check the ventilation opening -3- in the lower part of the activated charcoal filter -4- for impurities and, if necessary, clean it.

If vacuum is not generated:

– Cover the ventilation opening -3- and operate the Vacuum pump -VAG 1390- or Vacuum pump -VAS 6213 - several times again. Vacuum has to be generated.

If vacuum is not generated:

– Replace the activated charcoal filter.



3 Engine power electronic adjustment (electronic accelerator)

Operation ⇒ page 83 .

Engine power electronic adjustment (electronic accelerator) ⇒ page 84 .

3.1 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 Throttle 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 determine the position of the butterfly valve, in order to adjust it and activate it, such as for example, Accelerator pedal position sensor -G79- , Throttle butterfly valve command unit -J338- , "E-gas" system fault warning light -K132- , Engine control unit -J623- , etc).

3.2 Engine power electronic adjustment (electronic accelerator)

1 - Pedal support

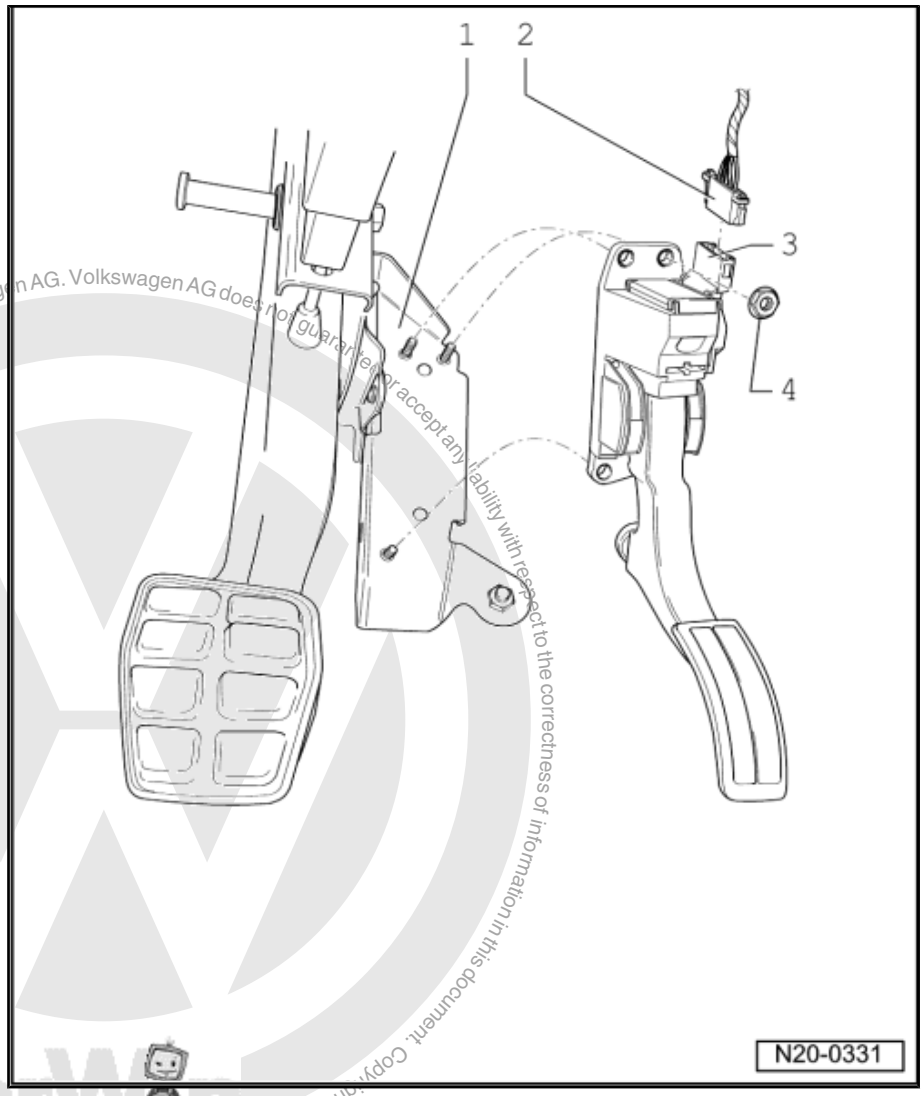
2 - Connector

- ❑ 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



24 – Supply system - fuel injection

1 Injection system - repair

General indications about the injection system

- The Engine control unit -J623- is equipped with self-diagnosis. Before carrying out repairs and troubleshooting, always check the fault memory first. Likewise, check vacuum hoses and connections (air infiltration).
- Minimum voltage of 11.5V is necessary for the perfect operation of electric components.
- Do not use sealants with silicone. Silicone component residues aspired by the engine are not burned and damage the Lambda Probe -G39- .
- Vehicles with airbag have a system for shutting off fuel in case of an accident. This system should prevent fire in the vehicle after an accident by disconnecting the Fuel pump (pre-supply pump) -G6- through the Fuel pump relay -J17- . At the same time, with this equipment, the engine starts more smoothly.

Fuel injection components - remove and install ⇒ page 87 .

Intake manifold - remove and install ⇒ page 89 .

Fuel distributor with injection valves - remove and install ⇒ page 90 .

Air filter set - disassemble and assemble ⇒ page 90 .

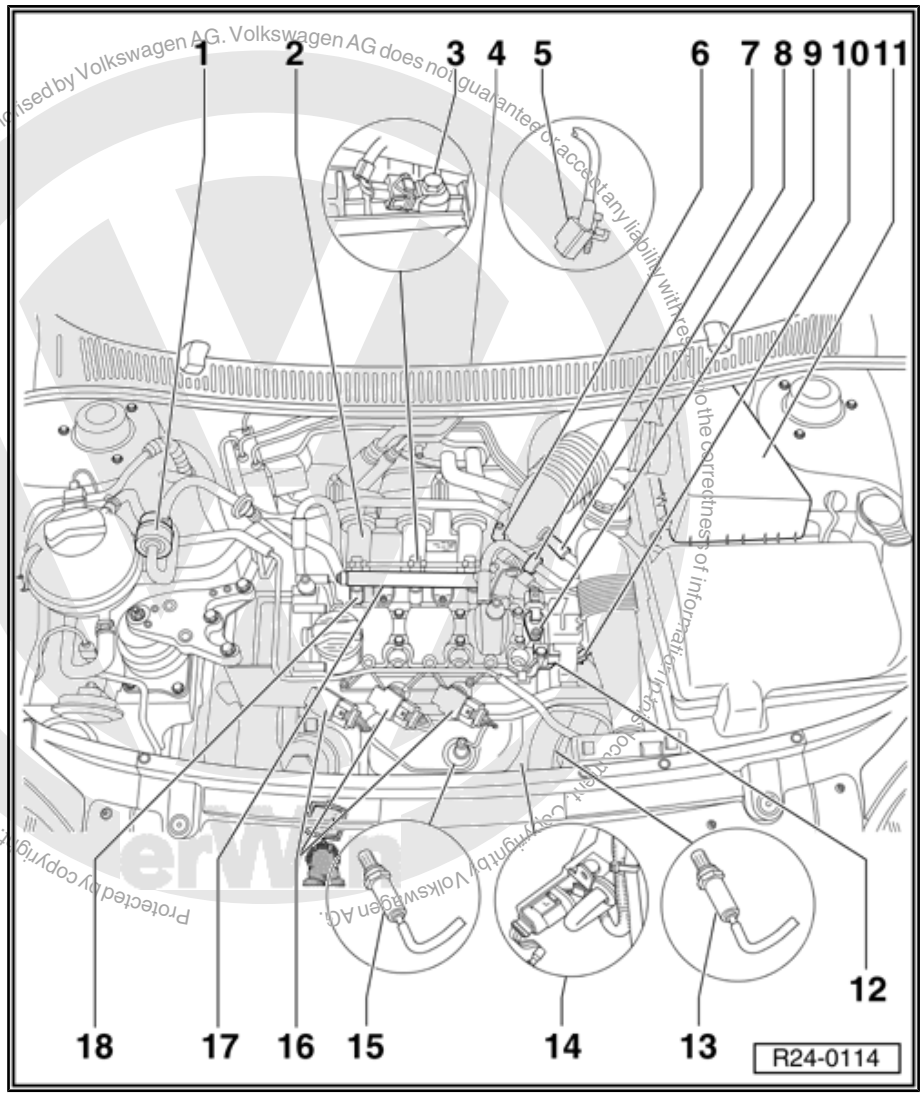
Air filter set - remove and install ⇒ page 91 .

Safety measures ⇒ page 92 .

Cleaning rules ⇒ page 65 .

Technical data ⇒ page 94 .

1.1 Component location



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

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

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

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

C - Clutch pedal switch -F36-

- ❑ In feet compartment, on clutch pedal.

D - Fuel pressure regulator

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

1 - Magnetic valve 1 for activated charcoal filter tank -N80-

- ❑ In the engine compartment.

2 - Intake manifold

- ❑ Remove and install.

3 - Knock sensor 1 -G61-

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

4 - Engine control unit -J623-

- ❑ Below the lower windscreen coating.
- ❑ Remove and install.

5 - Engine speed sensor -G28-

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

6 - Air intake temperature sensor -G42- with the Intake manifold pressure sensor -G71-

7 - Aeration hose valve

8 - Accelerator butterfly valve control unit -J338-

9 - Hall Sensor -G40-

10 - Coolant temperature sensor -G62-

11 - Air Filter

- ❑ Remove and install ⇒ page 91 .

12 - Oil pressure switch -F1-

13 - Lambda probe after the catalytic converter -G130-

14 - 4-pin connector

- ❑ Black
- ❑ To the Lambda probe -G39- Lambda probe heating -Z19- .

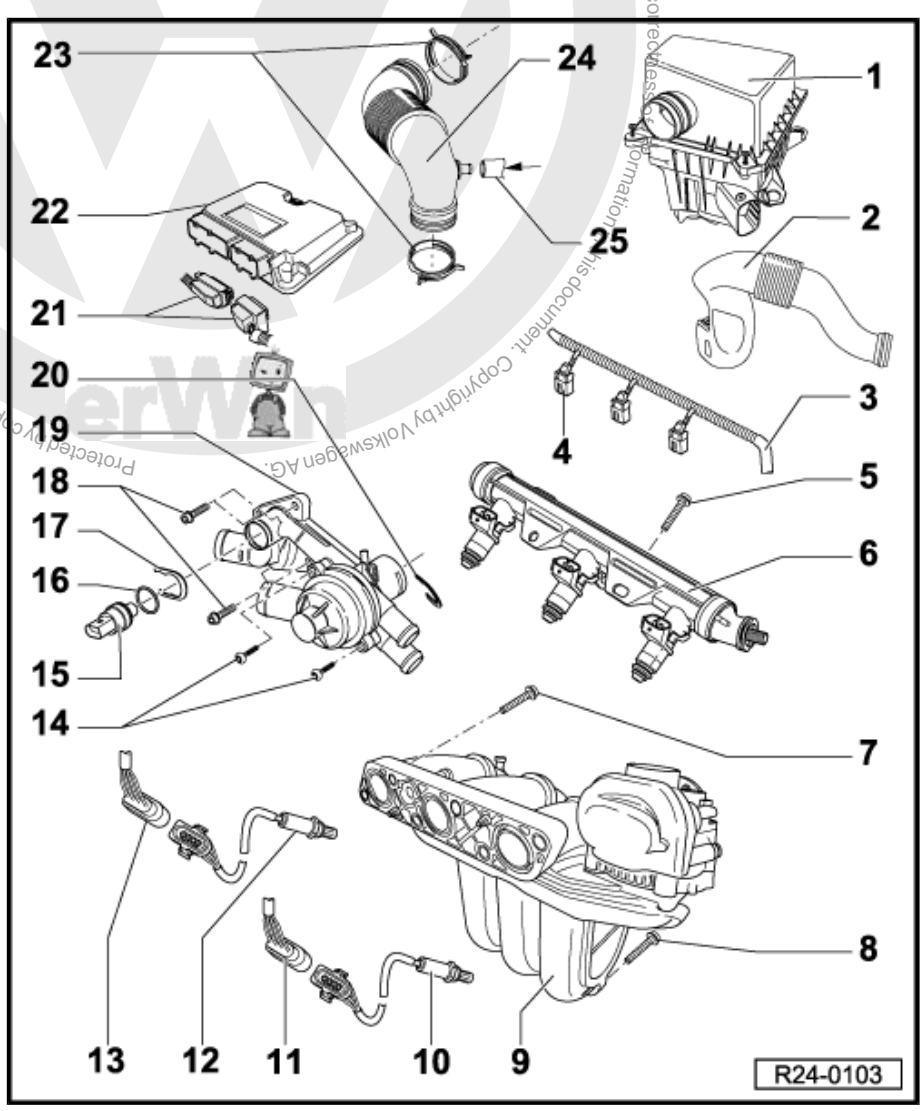
15 - Lambda probe -G39-

16 - Ignition coil 1 with final power stage -N70- , Ignition coil 2 with final power stage -N127- and Ignition coil 3 with final power stage -N291-

17 - Fuel distributor

18 - Cylinder 1 injector - N30- , Cylinder 2 injector -N31- and Cylinder 3 injector -N32-

1.2 Fuel injection components - remove and install



1 - Air filter set

- ❑ With filtering element.
- ❑ Disassemble and assemble ⇒ page 90 .
- ❑ Remove and install ⇒ page 91 .

2 - Duct for air aspiration

3 - Injection valve harnesses.

4 - Connector

- ❑ Black, 2 poles
- ❑ From Cylinder 1 injection valve -N30- .
- ❑ From Cylinder 2 injection valve - N31- .
- ❑ From Cylinder 3 injection valve - N32- .

5 - 10 Nm

6 - Fuel distributor with injection valves

- ❑ Remove and install ⇒ page 90 .

7 - 20 Nm

8 - 20 Nm

9 - Intake manifold

10 - Lambda probe -G39- , 50 Nm

- ❑ Lubricate only the thread with High-temperature paste -G 052 112 A3- ; High-temperature paste -G 052 112 A3- should not enter in the grooves on the Lambda probe -G39- body.
- ❑ Remove and install with the Socket set for Lambda probe -3337- .

11 - Connector

- ❑ Black, 4 poles.
- ❑ From Lambda probe -G39- .

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

- ❑ Lubricate only the thread with High-temperature paste -G 052 112 A3- ; High-temperature paste -G 052 112 A3- should not enter in the grooves on the Lambda probe -G130- body, after the catalytic converter.
- ❑ Remove and install with the Socket set for Lambda probe -3337- .

13 - Connector

- ❑ Black, 4 poles.

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

14 - 10 Nm

15 - Coolant temperature sensor -G62-

- ❑ Before removing, eliminate, if necessary, cooling system pressure.
- ❑ 2-pole connector.

16 - Sealing ring

- ❑ Replace if damaged

17 - Retaining clip

- ❑ Check for proper seating.

18 - 10 Nm

19 - Thermostat valve body

20 - Retaining clip

- ❑ Check for proper seating.

21 - Coupling connector

- ❑ Connect or disconnect the connector with ignition switched off.

22 - Engine control unit -J623-

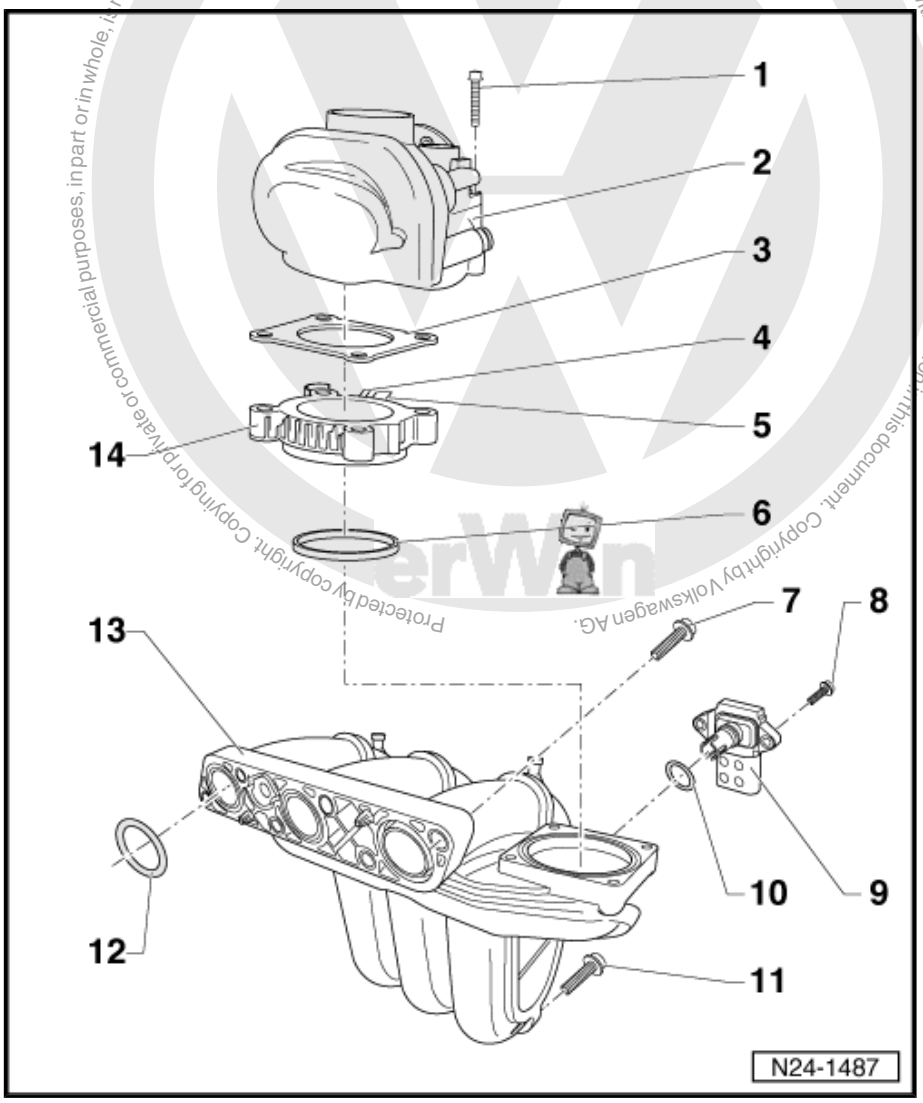
- ❑ In case of replacement, it is necessary to adapt the Engine control unit -J623- to the Immobiliser control unit -J362- ⇒ Vehicle diagnosis, testing and information system VAS 5051.

23 - Spring clamp

24 - Air duct

25 - From head cover

1.3 Intake manifold - remove and install



1 - 10 Nm

2 - Butterfly valve command unit - J338-

- ❑ 6-pole coupling connector.
- ❑ Golden contacts.
- ❑ Warmed Coolant.
- ❑ In case of replacement, adapt the Engine control unit -J623- to the Butterfly valve command unit -J338- ⇒ Vehicle diagnosis, testing and information system VAS 5051.

3 - Gasket

- ❑ Replace.

4 - Coupling nozzle

- ❑ For oil separator.

5 - Coupling nozzle

- ❑ For the Electromagnetic valve 1 for activated charcoal filter -N80- .

6 - Sealing ring

- ❑ Replace if damaged

7 - 20 Nm

8 - 3 Nm

9 - Intake manifold pressure sensor -G71- with Air temperature sensor -G42-

- ❑ 4-pole coupling connector.
- ❑ Golden contacts.

10 - Sealing ring

- ❑ Replace if damaged

11 - 20 Nm

12 - Sealing ring

- ❑ Replace if damaged

13 - Intake manifold

14 - Intake nozzle

1.4 Fuel distributor with injection valves - remove and install

1 - Fuel distributor with injection valves

- ❑ Check injection valves for tightness and flow ⇒ page 95 .

2 - Sealing ring

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

3 - For cylinder 1 injection valve -N30 -

- ❑ For cylinder 2 injection valve -N31- .
- ❑ For cylinder 3 injection valve -N32- .
- ❑ Check injection valves for tightness and flow ⇒ page 95 .

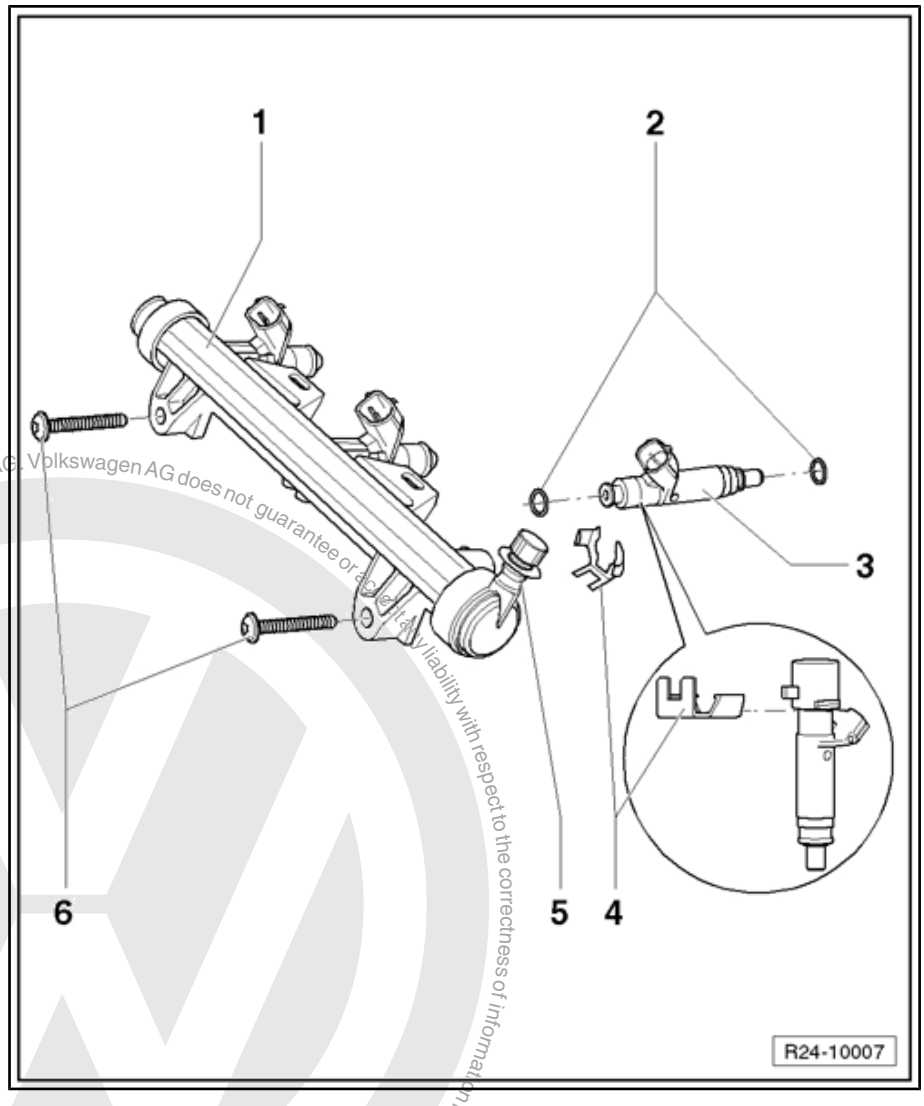
4 - Retaining clip

- ❑ Ensure proper seating on injection valve and fuel distributor.

5 - Drainage valve

- ❑ Drain the air ⇒ page 78 .

6 - 10 Nm



1.5 Air filter set - disassemble and assemble

Note

- *For fastening the upper part of the air filter to the lower part, a number of self-tightening bolts are used. If these bolts are tightened or loosened with a power screwdriver, the thread on the lower part of the filter can be damaged.*
- *For that reason, a power screwdriver is allowed only if:*
- *the power screwdriver speed does not exceed 200 rpm*
- *a torque of 1.6 Nm at most is adjusted.*

1 - Upper part of filter air

2 - 1.6 Nm

3 - Filtering element

4 - Lower part of filter air

5 - 8 Nm

6 - Metal bonded rubber support

7 - 5 Nm

8 - Rubber bearing

9 - Duct for air aspiration

10 - Rubber bearing

11 - Hose

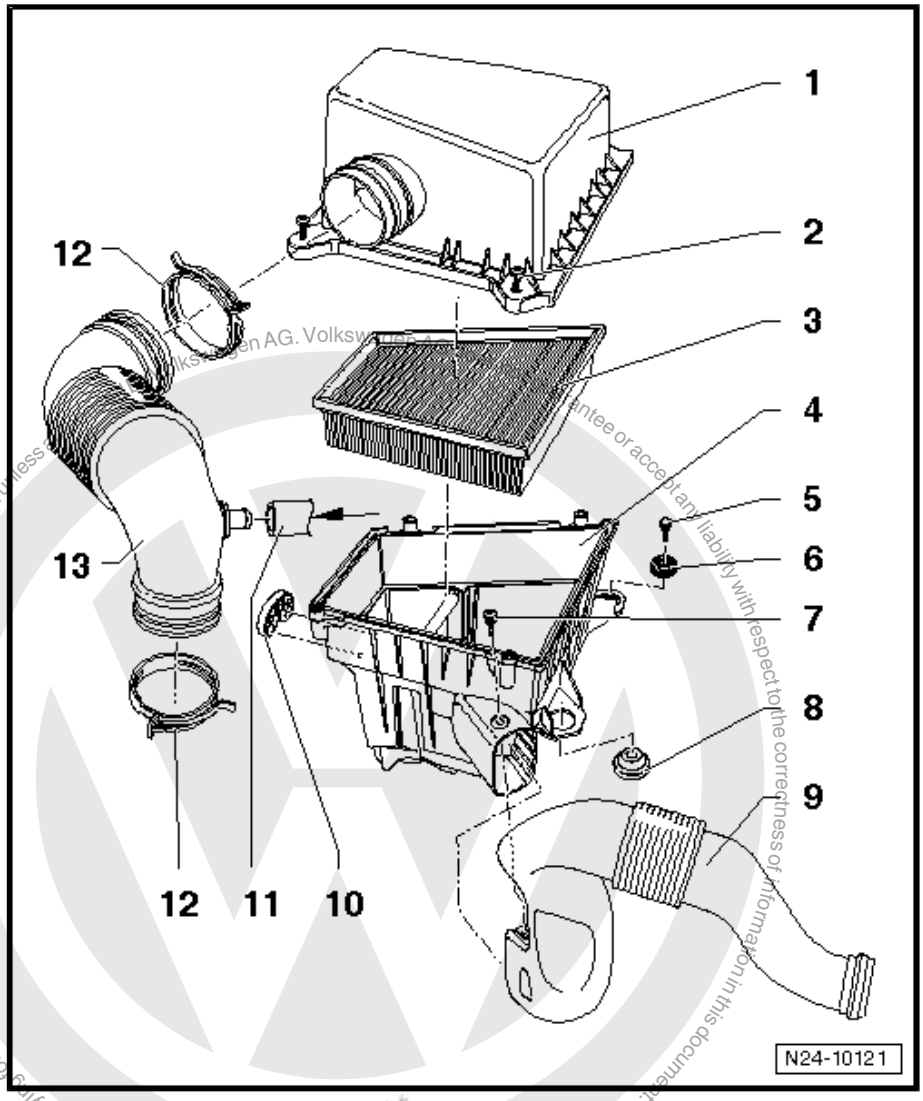
- ❑ For engine cylinder head cover.

12 - Clamp

- ❑ Remove with VAS 5024A or Standart type clamp pliers -VW 5162- .

13 - Air duct

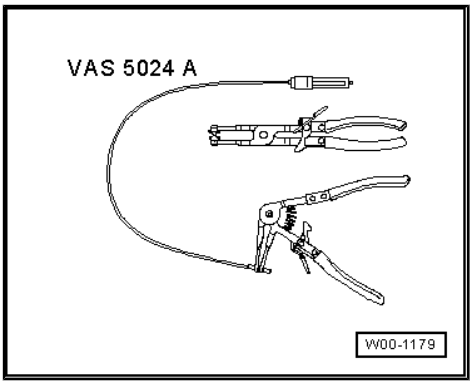
- ❑ To the Butterfly valve command unit -J338- .



1.6 Air filter set - remove and install

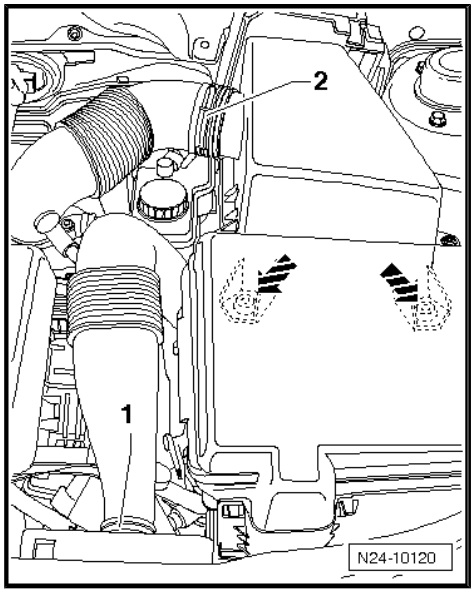
Special tools and workshop equipment required

♦ VAS 5024A or Standart-type clamp pliers -VW 5162-



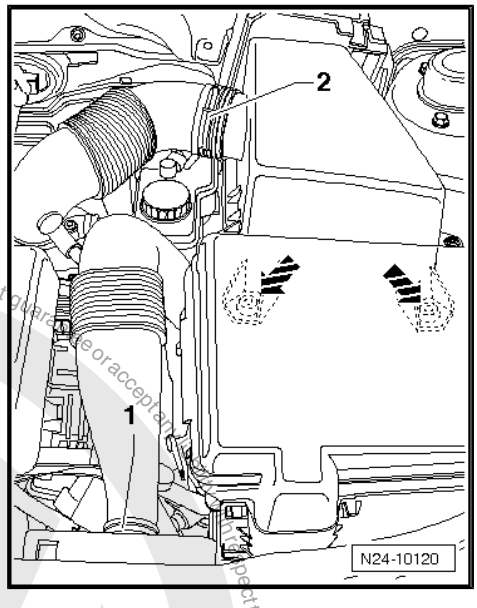
1.6.1 Removal

- Pull off intake air duct -1-.
- Loosen spring clamp -2- with the VAS 5024A or Standart type clamp pliers - VW 5162- and pull of air duct from the upper part of filter air set.
- Remove the left bolt fastening the air filter set -arrow-.
- Tilt the Battery -A- cover forwards.
- Move the air filter set upwards.
- Remove air filter set.



1.6.2 Installation

- Seat air filter set on the rubber supports -arrows-.
- Press air filter set downwards onto the pins.
- Tighten fastening bolts to 8 Nm.
- Fasten the air duct with the spring clamp on the upper part of the air filter set -2-.
- Install intake air duct on intake nozzle-1-.



1.7 Safety measures

WARNING

Fuel system is under pressure! Wear protective goggles and clothing, so as to avoid serious injuries and contact with the skin. Before loosening tube junctions, place a cloth around the union point. Then, eliminate pressure by pulling the flexible tube off carefully.

To prevent injuries in people and/or destruction of the injection and ignition system, take into consideration the following:

- For safety reasons, before opening the fuel system, remove fuse number 33 from fuse holder, as the Fuel pump (pre-supply pump) -G6- can be activated.
- Do not touch nor disconnect ignition cables with the engine in operation or upon start.
- Only connect or disconnect the injection and ignition system cables, including measurement device cables, with the ignition switched off.

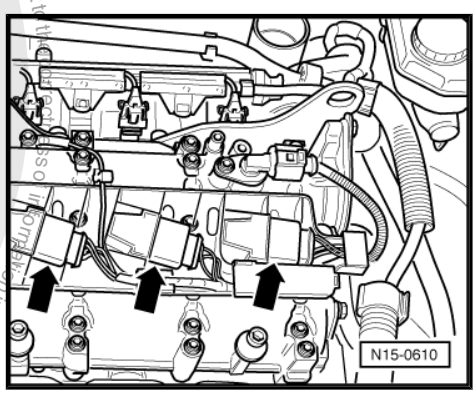
If, in drive tests, it is necessary to use measurement and test devices, consider the following:

- The measurement and test devices must be fastened to the back seat and operated by another mechanic from then on.

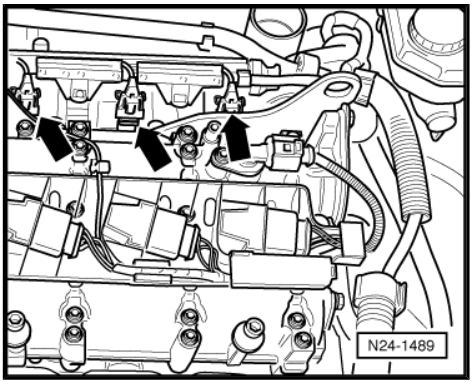
If the measurement and test devices are operated from the front passenger seat, the person seating there could be injured by the passenger airbag being triggered, in case of an accident.

- To make the engine rotate with the starter, without running it:

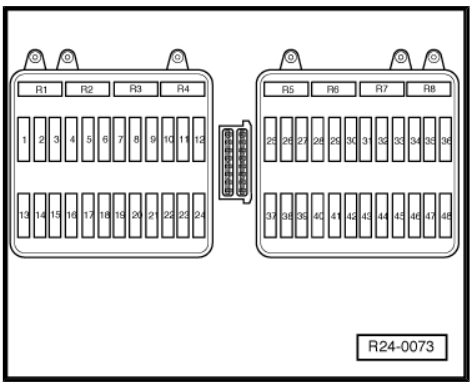
– Disengage 4-pole connectors from Ignition coil 1 with final power stage -N70- , Ignition coil 2 with final power stage -N127- and Ignition coil 3 with final power stage -N291- -arrows-.



– Disconnect coupling connectors -arrows- from cylinder 1 injector -N30-, cylinder 2 injector -N31- and cylinder 3 injector -N32- .



– Remove fuse 33 from fuse holder.



1.8 Cleaning rules

To carry out fuel supply/injection works, consider the following “5 cleaning” rules thoroughly:

- Carefully clean union points and respective surrounding areas before separating thm.
- Place parts on clean surface and cover them. Do not use cloths that fray!
- Carefully cover or close open parts, in case repair is not carried out immediately.
- Install clean parts only: Remove parts from the packaging immediately before installation. Do not use parts that have been kept out of the packaging (for example, in tool boxes).
- With system open: Do not work wit compressed air. Do not move the vehicle.

1.9 Technical data

Engine identification letters		BMD/CHFB
Idle speed check		
Idle speed operation [10]	rpm	650...870[9]
Engine control unit -J623- [11]		
System		Simos 3PG[8]
Part number		⇒ CPE (Electronic parts catalogue)
Engine speed regime limit	rpm	from about 5800

8) Simos 3 PG installed up to week 29, Simos 9.1 started in week 30.

9) Current values: ⇒ Inspection of exhaust gases

10) Not adjustable.

11) Remove and install Engine control unit -J623- ⇒ page 102 .

2 Check components

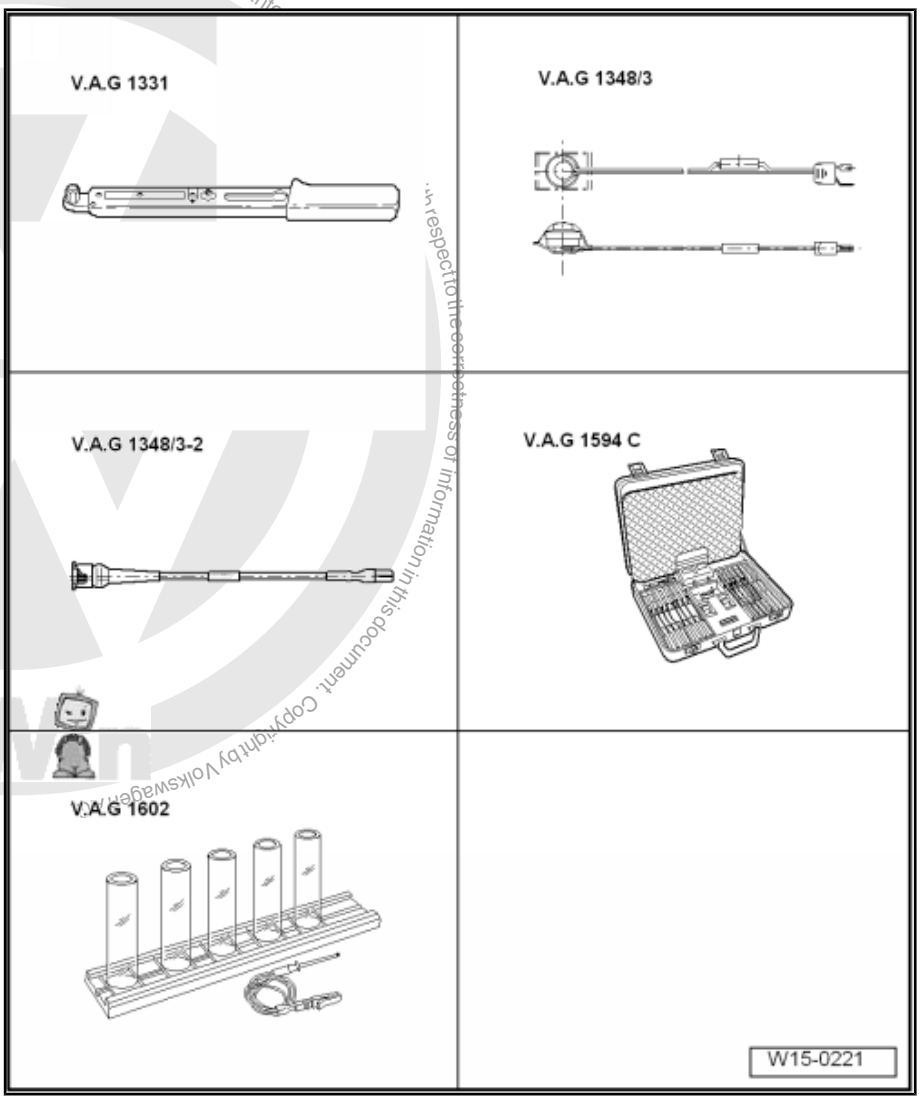
Check injection valves ⇒ page 95 .

Check fuel pressure regulator and residual pressure ⇒ page 98 .

2.1 Injection valves - check

Special tools and workshop equipment required

- Torque wrench - 5 to 50 Nm (enc. 1/2") -VAG 1331-
- Remote control -VAG 1348A-
- Auxiliary measuring cable set - VAG 1594C-
- Flow comparison meter - VAG 1602-



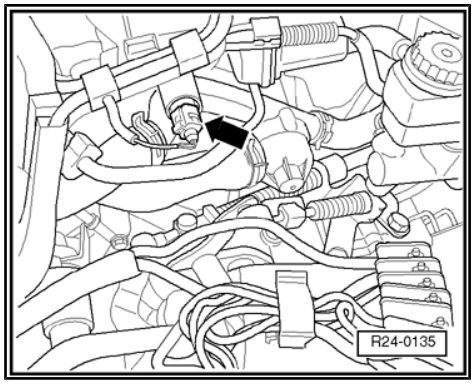
2.1.1 Injection valve flow and tightness - check

2.1.2 Check conditions

- Fuel pressure must be OK ⇒ page 98 .
- Residual pressure and fuel pressure regulator - check ⇒ page 98 .

2.1.3 Checking process

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

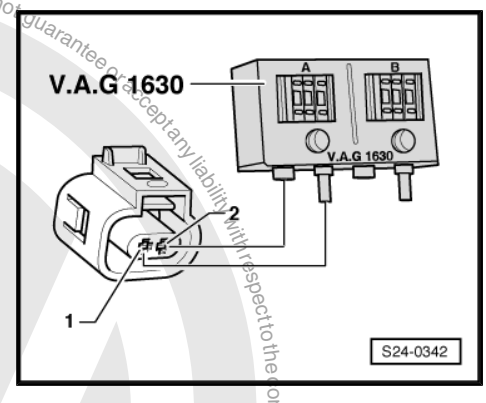


– Connect the Digital potentiometer (included at VAG 1594C) - VAG 1630- to 1+2 contacts of the connector for coolant temperature sensor -G62 - and adjust the connected side to 15 kO.

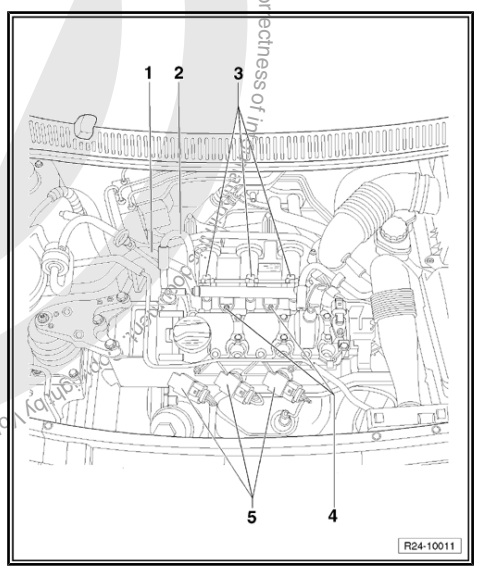
– Remove supply hose in the fuel distributor -1- and install it over the oil separator -2- hose.

– Remove injection valve harness -3- from fuel distributor bearings.

– Remove bolts fastening the fuel distributor-4-.



– Disengage ignition coil connectors -5-.



2.1.4 Tightness - check

2.1.5 Check conditions

• Fuel distributor removed from cylinder head.

– Keep a container below the injection valves with the connectors removed.

– Ask someone else to operate the starter motor.

Fuel loss cannot exceed 2 drops a minute.

If the fuel loss is greater:

– Turn the ignition off.

– Replace damaged injection valve ⇒ page 90 .

Injection valves are installed in the reversed order. Please note the following:

- All of the injection valve sealing rings must be replaced and slightly lubricated with clean engine oil.
- Install the fuel distributor, with injection valves locked, on the intake manifold and fasten it evenly.

2.1.6 Injection valve flow - check

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

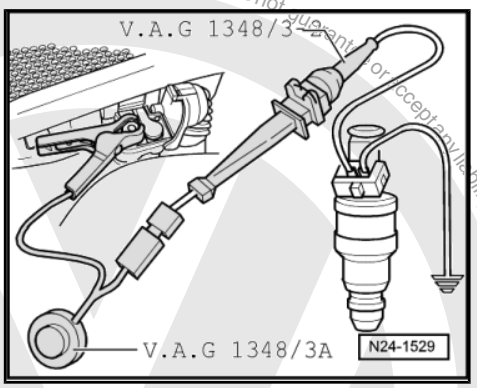
– Connect the other injection valve contact with Remote control -VAG 1348/3A- and Adapting cable -VAG 1348/3-2- to the Battery - A- positive terminal.

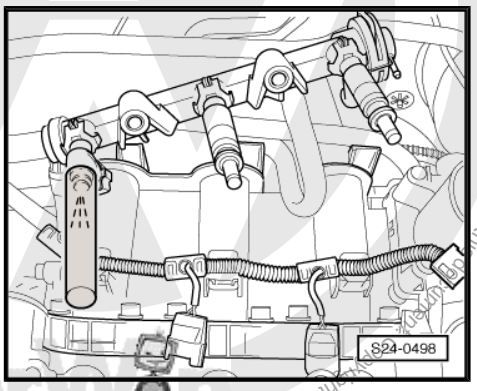
– Turn ignition on; Fuel pump (pre-supply pump) -G6- must work:

– Remove three graduated containers from the Flow comparison meter -VAG 1602- .

– Remove fuel distributor from intake manifold.

– Place the injection valve to be checked in a graduated container.





– Remove the connectors from the injection valves that are not being tested.

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

– Do the same for the remaining injection valves.

Note

Use one graduated container for each injection valve.

– After all injection valves have been tested, place graduated containers over a flat surface and compare the injection flow.

Nominal value: 85...91 ml per each valve.

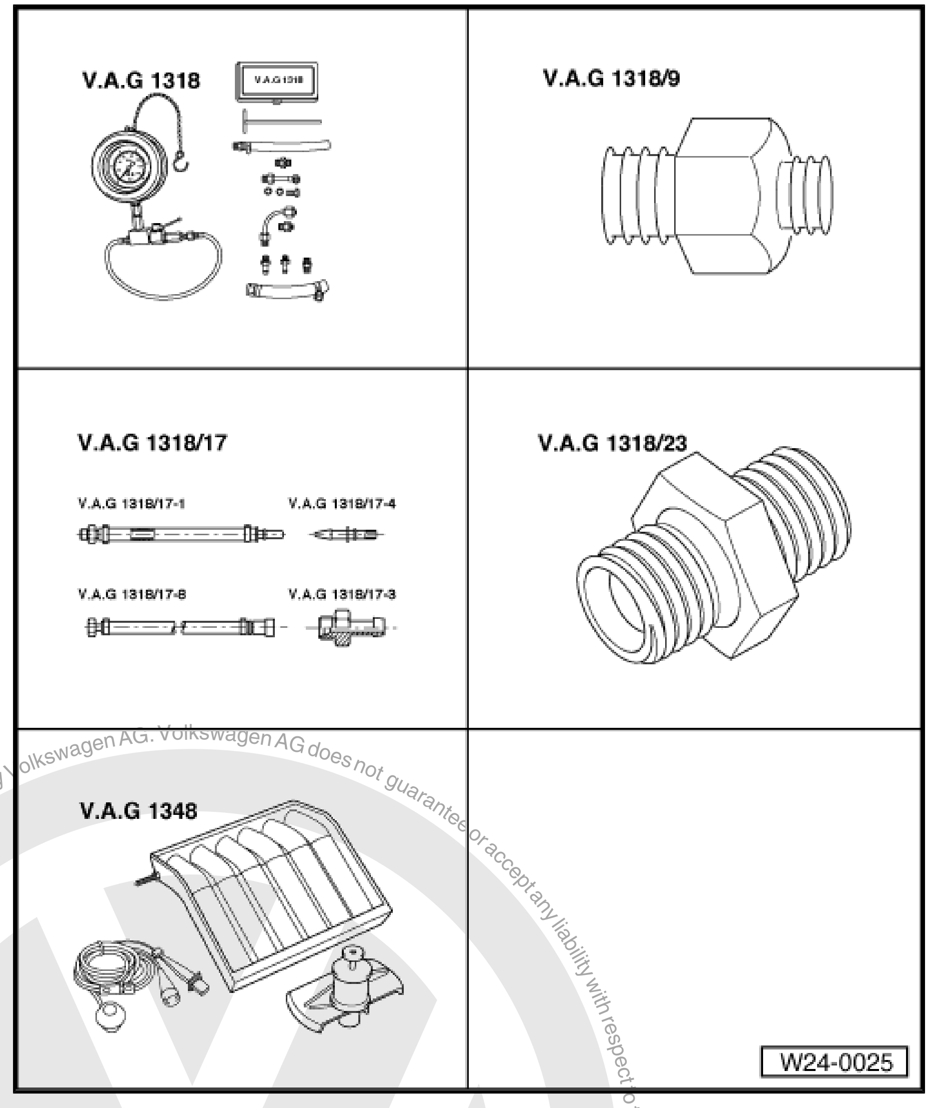
If the measured values of one or more injection valves are above or below the nominal value:

– Replace damaged injection valve.

2.2 Residual pressure and fuel pressure regulator - check

Special tools and workshop equipment required

- ♦ Pressure gauge -VAG 1318-
- ♦ Adapter -VAG 1318/9-
- ♦ Adapting set -VAG 1318/17-
- ♦ Connector -VAG 1318/23-
- ♦ Remote control -VAG 1348A-
- ♦ Adapting cable -VAG 1348/3-2-



2.2.1 Pressure - check

Note

- ♦ *The fuel pressure regulator establishes the approx. pressure of 3.0 bar for vehicles manufactured until May/2006 and 4.0 bar for the ones produced as of June/2006.*
- ♦ *The fuel pressure regulator is on the Fuel pump (pre-supply pump) -G6- .*

2.2.2 Checking process

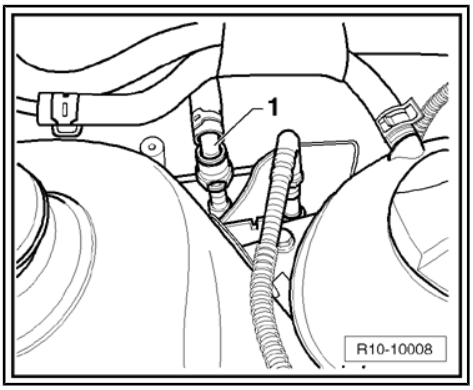
– Remove fuse holder cover.

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

WARNING

Fuel system is under pressure! Wear protective goggles and clothing, so as to avoid serious injuries and contact with the skin. Before loosening tube junctions, place a cloth around the union point. Then, eliminate pressure by pulling the flexible tube off carefully.

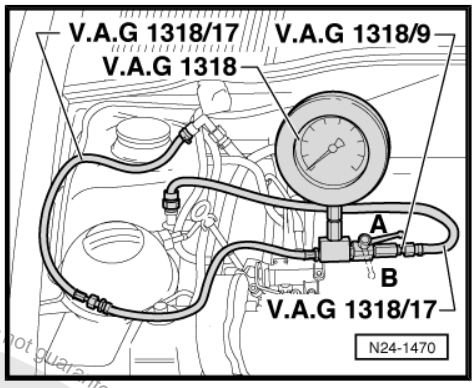
– Disconnect fuel hose coupling-1- and clean the spilled fuel with a cloth.



Note

To unblock the fuel hose coupling, press the safety key.

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



– Open the Pressure gauge -VAG 1318- valve. The valve indicates the flow direction.
– Put fuse 33 (Fuel pump (pre-supply pump) -G6-) in the fuse holder again.
– Start engine and let it run in idle speed.
– Measure fuel pressure. Nominal value: 3.0 bar for vehicles manufactured until May/2006 and 4.0 bar for the ones produced as of June/2006.

If the nominal value is not obtained:

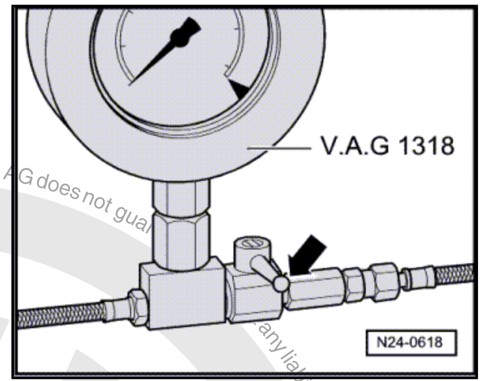
– Turn the ignition off.
– Verify Fuel pump (pre-supply pump) -G6- ⇒ page 77 check valve.

If nominal value is obtained:

– Turn the ignition off.
– Check tightness and residual pressure (of the whole system). To do so, check the pressure drop on the Pressure gauge -VAG 1318- . After 10 minutes, there must still be a positive pressure of at least 2.0 bar.

If retaining pressure drops below 2 bar:

– Start the engine and run it at idle speed.



– Switch ignition off, after pressure has been created. At the same time, it is necessary to close the Pressure gauge -VAG 1318- valve (valve transverse to the passage direction -arrow-)

– Check pressure drop on the Pressure gauge -VAG 1318- .

If pressure keeps dropping:

– Check Pressure gauge -VAG 1318- pipes to the Fuel pump (pre-supply pump) -G6- .

– Check the tightness of the Pressure gauge -VAG 1318- .

If the pressure does quit dropping:

– Check sealing rings between fuel distributor and injection valves and the hose between Pressure gauge -VAG 1318- and fuel distributor.

Note

Before removing the Pressure gauge -VAG 1318- , place again cloths around the hose connections.

2.2.3 Fuel pressure regulator - check

2.2.4 Check conditions

• Retention valve for Fuel pump (pre-supply pump) -G6- OK, check ⇒ page 77 .

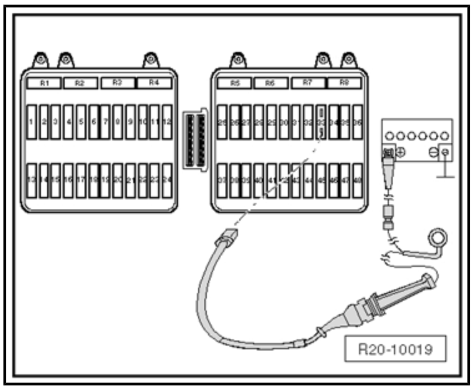
2.2.5 Checking process

– Turn the ignition off.

– Remove fuse holder cover.

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

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



WARNING

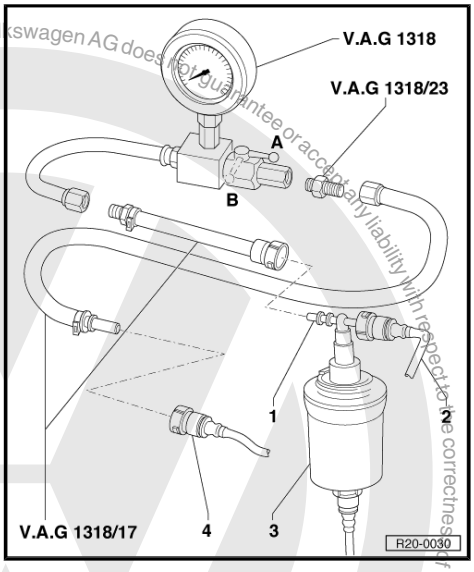
Fuel system is under pressure! Wear protective goggles and clothing, so as to avoid serious injuries and contact with the skin. Before loosening tube junctions, place a cloth around the union point. Then, eliminate pressure by pulling the flexible tube off carefully.

– 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

For that, press the keys on hose connectors.

– Connect Pressure gauge -VAG 1318 - with Adapting set -VAG 1318/17- and Connector -VAG 1318/23- as illustrated.
– Close the valve on the Pressure gauge -VAG 1318- (transverse valve in relation to the flow direction in position -B-).
– Activate the Remove control -VAG 1348/3A- for approximately 10 seconds to fill up the fuel filter and generate system pressure of around 3.0 bar for vehicles manufactured until May/2006, and 4.0 bar for those produced as of June/2006.
– Check pressure drop on the Pressure gauge -VAG 1318- . After 10 minutes, the pressure cannot drop below 2.0 bar.

If the pressure keeps dropping:

– Check tube connections for leaks.

If no faults are found in the pipes:

– Replace fuel pressure regulator.

3 Engine control unit -J623-

Check and erase the fault memory in the Engine control unit -J623- ⇒ page 102 again.

Adapt functions and components ⇒ page 104 .

3.1 Engine control unit -J623- - remove and install

– Before removing it, check identification and code ⇒ page 102 .

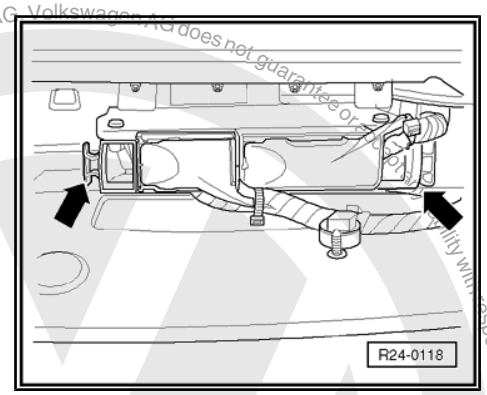
– Turn the ignition off.

3.1.1 Removal

– Remove windscreen wiper arms and lower windscreen covering ⇒ Electrical equipment; Rep. Gr. 92 ; Windscreen, rear window and headlight wiper and washer .

– Disengage fitting connectors -arrows - from the Engine control unit -J623- .

– Move the Engine control unit -J623- to the front part of the vehicle.



3.1.2 Installation

– Install the Engine control unit -J623 - until blocking it.

– Install fitting connectors for the Engine control unit -J623- .

– Install the windscreen wiper arms and lower windscreen covering ⇒ Electrical equipment; Rep. Gr. 92 ; Windscreen wiper and washer, rear window and headlights .

– Adjust the Engine control unit -J623- ⇒ page 104

– Finally, refer to the fault memory of the new Engine control unit -J623- and, if necessary, erase the fault memory ⇒ page 102 .

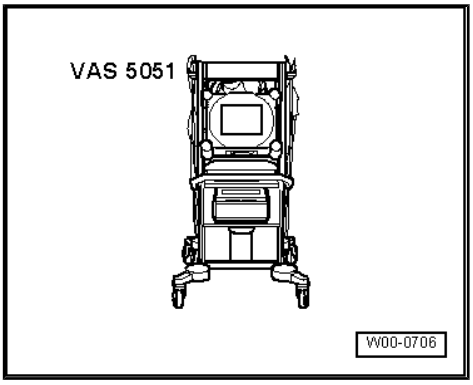
– Perform a test drive.

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

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

Special tools and workshop equipment required

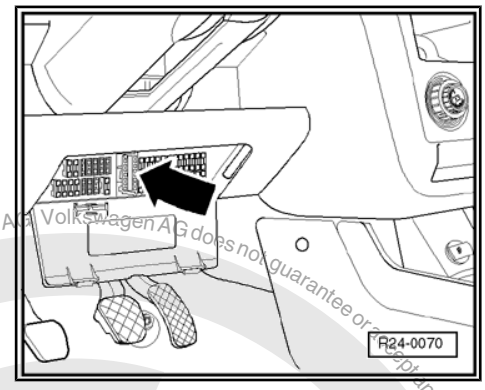
♦ Diagnosis, Measurement and Information System -VAS 5051A/52-



♦ Vehicle diagnosis, measurement and information system - VAS 5051A/52- with Cable -VAS 5051/1 - or Cable - VAS 5051/3- .

Operation sequence

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



– Connect with the Cable -VAS 5051/1- or Cable -VAS 5051/3- to the diagnosis plug.

– Start the engine and run it at idle speed.

Only when engine does not run:

– Turn the 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 the Engine control unit -J623- identification and code.

Select diagnosis function:

– Press “02 - Check fault memory” on the display.

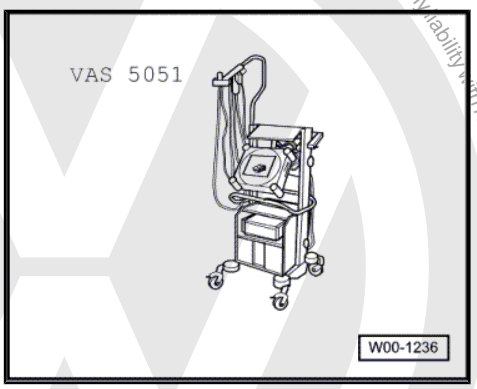
– If no faults are stored in the Engine control unit -J623- , the display shows “0 faults found”.

– If there are fault on the Engine control unit -J623- , they are indicated on the display one after the other.

– Press the key↵.

– Press “05 - Erase fault memory ” on the display.

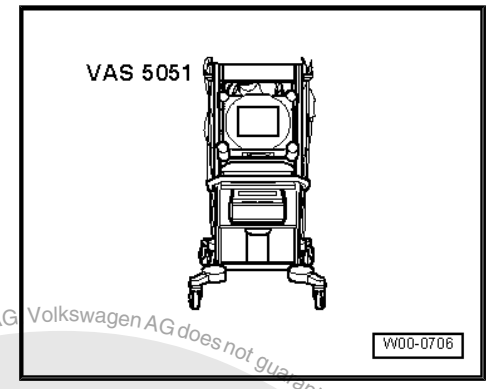
– Press “06 - End test” on the display.



3.3 Functions and components - adapt

Special tools and workshop equipment required

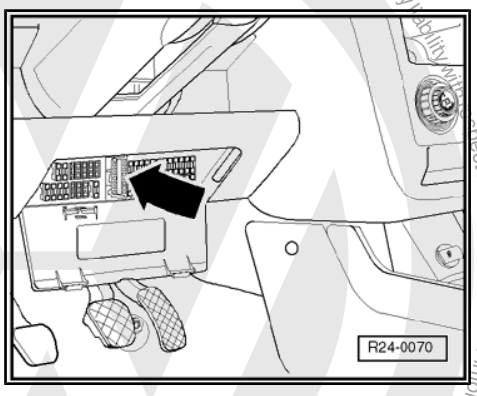
- Diagnosis, Measurement and Information System -VAS 5051A/52-



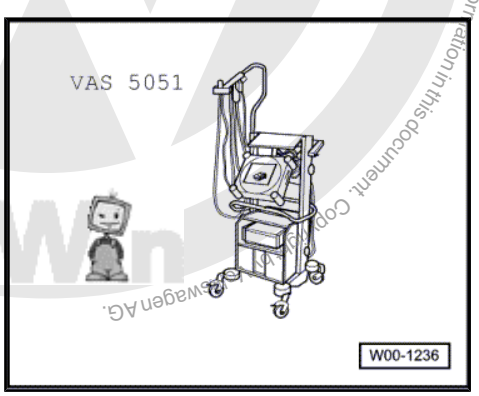
- Cable -VAS 5051/1- or Cable -VAS 5051/3-

Operation sequence

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



– Connect with the Cable -VAS 5051/1- or Cable -VAS 5051/3- to the diagnosis plug.



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

After having checked all command units:

– Press the “Skip” key
– Select “Function/component selection”
– “Select drive”
– Select “Engine identification letters”
– Select “ 01 - Systems with self-diagnosis”
– Select “Engine distribution”.
– Select “Functions”
– Select “Function or component”

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.*

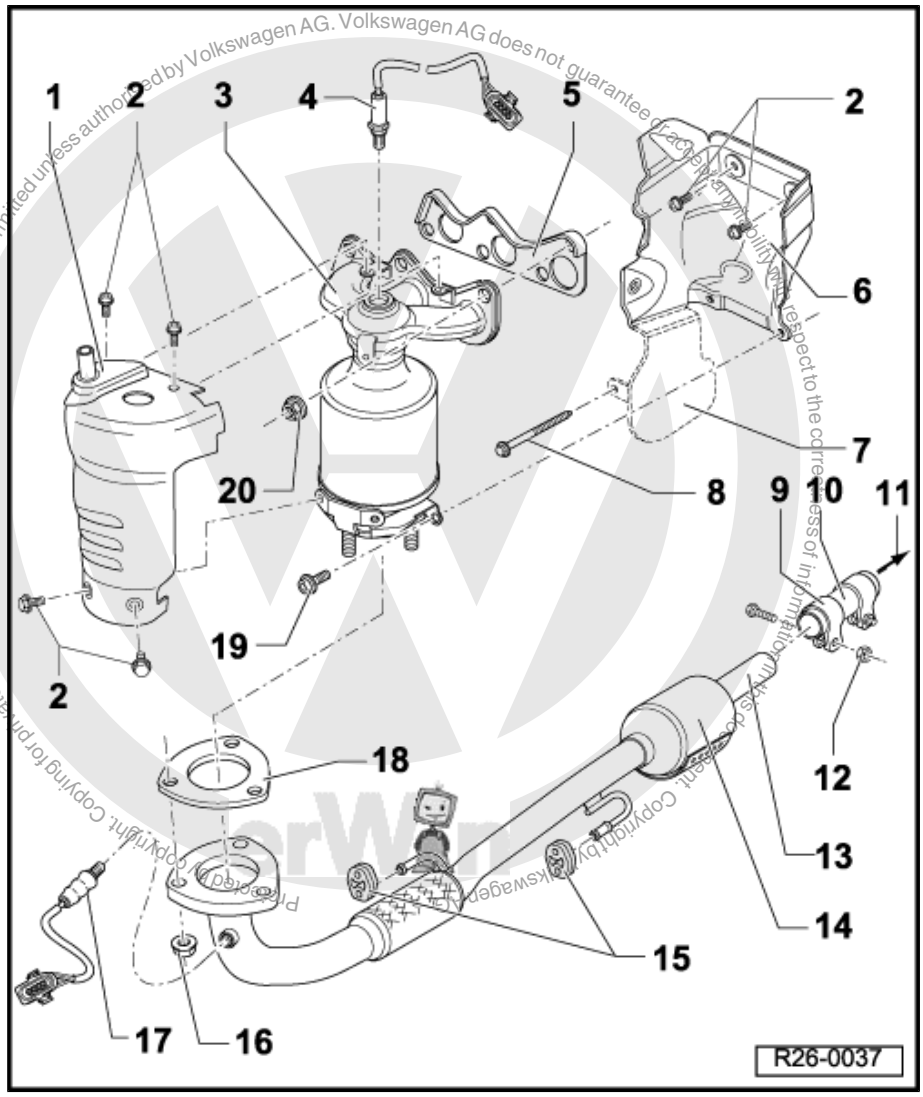
WARNING

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

Exhaust manifold, catalyst and front exhaust pipe with intermediate muffler and installation parts ⇒ page 106 .0

Rear muffler with supports ⇒ page 107 .

1.1 Exhaust manifold, catalyst and front exhaust pipe with intermediate muffler



1 - Heat deflector

- ❑ Install without tension.

2 - 10 Nm

3 - Exhaust manifold

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

4 - Lambda probe -G39- , 50 Nm

- ❑ Lubricate only the thread with High-temperature paste -G 052 112 A3- ; High-temperature paste -G 052 112 A3- should not enter in the grooves on the body of the Lambda probe -G39- .
- ❑ Remove and install with the Socket set for Lambda probe -3337- .
- ❑ In case of leakage, cut and replace the sealing ring.

5 - Gasket

- ❑ Replace.

6 - Heat deflector

7 - Heat deflector

- ❑ For Generator (Alternator) -C- .

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 - Sustaining handle

- ❑ Replace if damaged

16 - Self-locking nut

- ❑ 40 Nm
- ❑ Replace after each removal.

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

- ❑ Lubricate only the thread with High-temperature paste -G 052 112 A3- ; High-temperature paste -G 052 112 A3- should not enter in the grooves on the Lambda probe -G130- body, after the catalytic converter.
- ❑ Remove and install with the Socket set for Lambda probe -3337- .
- ❑ In case of leakage, cut and replace the sealing ring.

18 - Gasket

- ❑ Replace.

19 - 10 Nm

20 - Self-locking nut

- ❑ 25 Nm
- ❑ Replace after each removal.

1.2 Rear muffler with supports

1 - Exhaust back tube with muffler

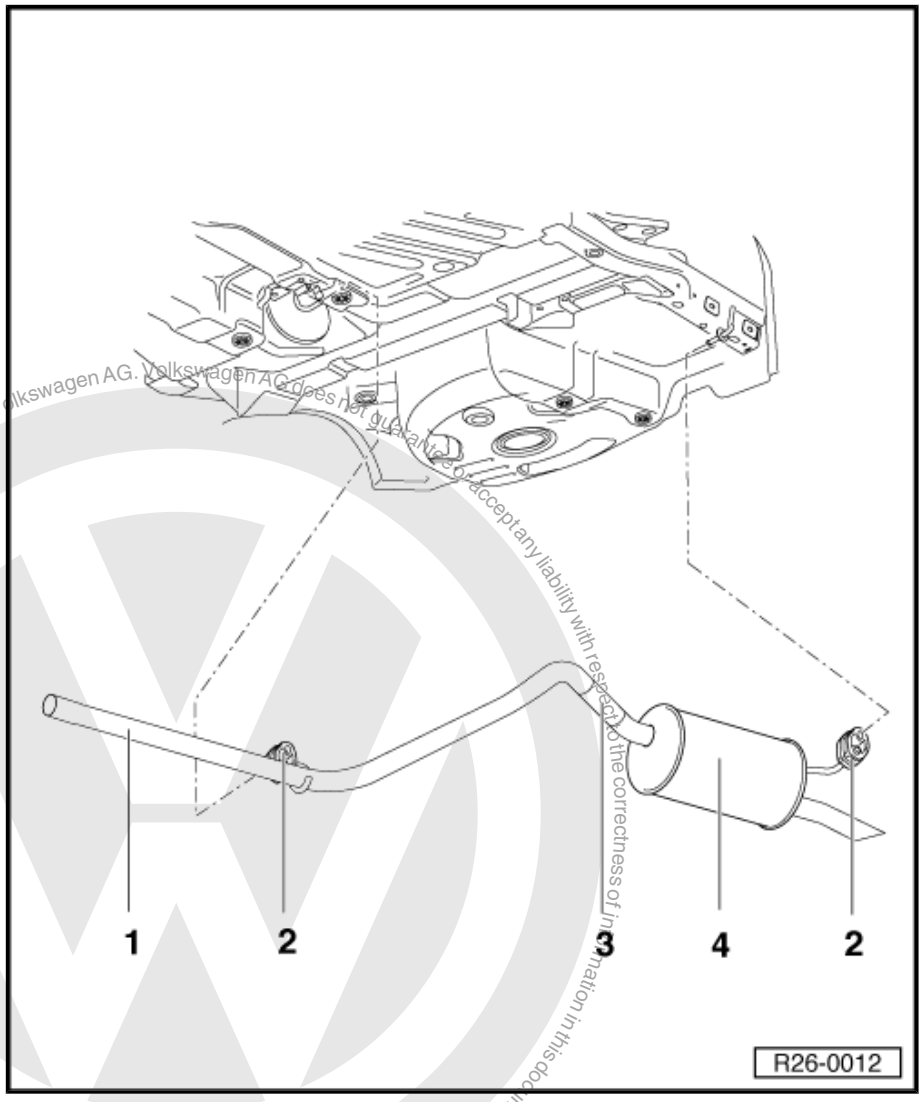
2 - Sustaining handle

- ❑ Replace when damaged.
- ❑ Remove with the Hook -VW 5812- .

3 - Separation point

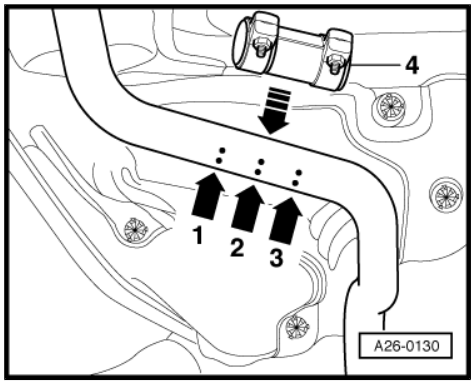
- ❑ Identified by a re-entry on the connecting pipe.
- ❑ As standard items, the rear muffler with exhaust tube as one part are mounted. For repair, the rear muffler is supplied individually with one double clamp.
- ❑ Separate perpendicularly the connecting pipe at the separation point with one Pneumatic Saw -EQ 7415- or Pneumatic Saw -VAG 1523A- or Tube cutter -VAS 6254- ⇒ page 108

4 - Rear muffler



Separation point on the exhaust tube

> **WARNING**
>
> ***Wear protection goggles and clothing to prevent from 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

General indications about the ignition system

- The Engine control unit -J623- is equipped with self-diagnosis.
- Minimum voltage of 11.5V is necessary for the perfect operation of electric components.
- In certain checks, the Engine control unit -J623- might identify a fault and record it on the memory. For that reason, at the end of all check and repair works, check the fault memory and erase it, if necessary.

Ignition system components - remove and install ⇒ page 109 .

Ignition coils with final power stages - remove and install ⇒ page 110 .

Safety measures ⇒ page 111 .

Test data, Spark plugs -Q- ⇒ page 112 .

1.1 Ignition system components - remove and install

1 - Ignition coil 1 with power final stage -N70-

- ❑ Ignition coil 2 with power final stage -N127-
- ❑ Ignition coil 3 with power final stage -N291-
- ❑ Remove and install with Puller -T 10094- ⇒ page 110 .

2 - Ignition coil connector

- ❑ Black, 4 poles.

3 - Knock sensor 1 -G61- connector

- ❑ Black, 2 poles.
- ❑ Golden connector contacts.

4 - 20 Nm

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

5 - Knock sensor 1 -G61-

- ❑ Golden connector contacts.

6 - 10 Nm

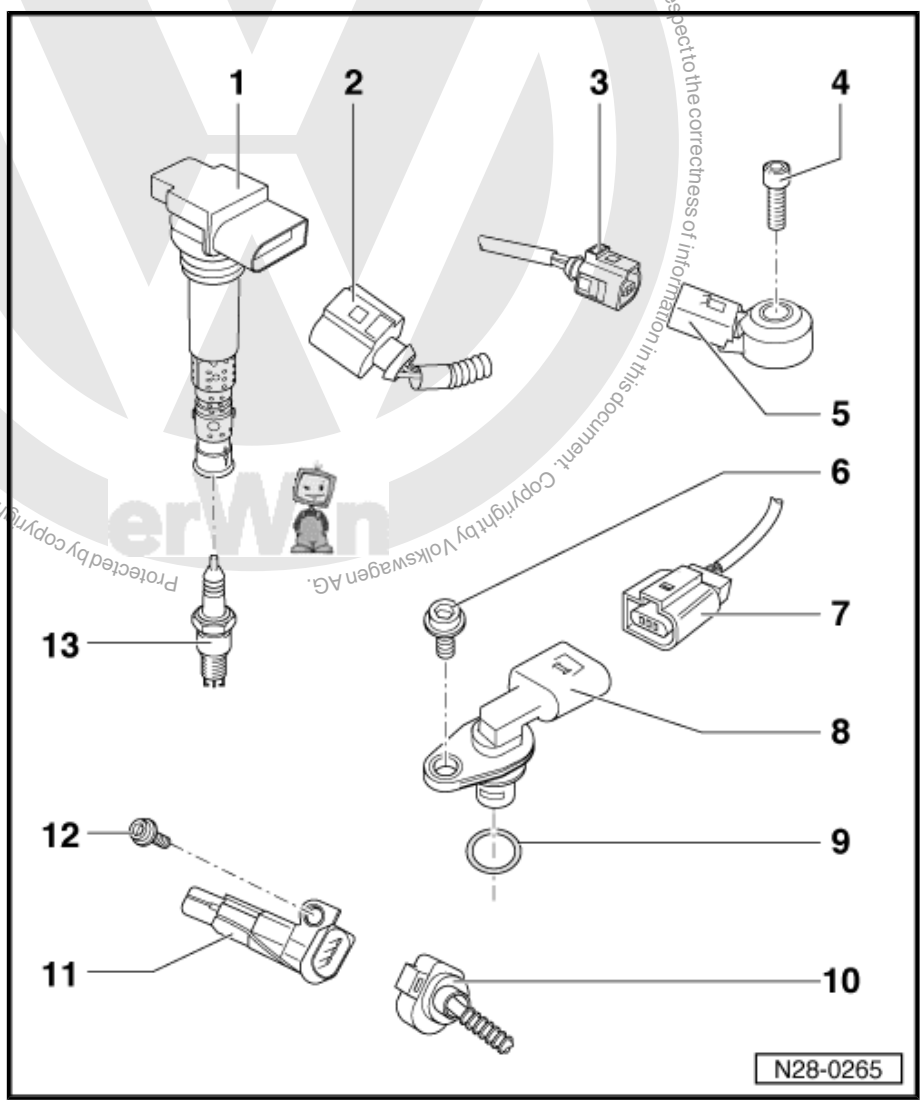
7 - Connector

- ❑ Black, 3 poles.
- ❑ For Hall Sensor -G40- .

8 - Hall Sensor -G40-

9 - Sealing ring

- ❑ Replace if damaged



10 - Connector

- ❑ Black, 3 poles.
- ❑ For Oil level and temperature sensor -G266- .
- ❑ Not applicable.

11 - Oil level and temperature sensor -G266-

- ❑ Not applicable.

12 - 8 Nm

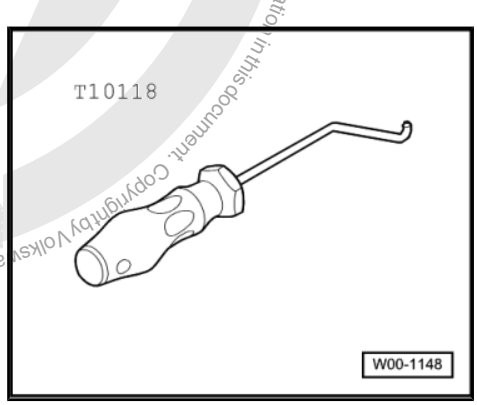
13 - Spark plug, 30 Nm

- ❑ Remove and install with Spark plug wrench -3122 B- .
- ❑ Type and inter-electrode gap ⇒ page 112

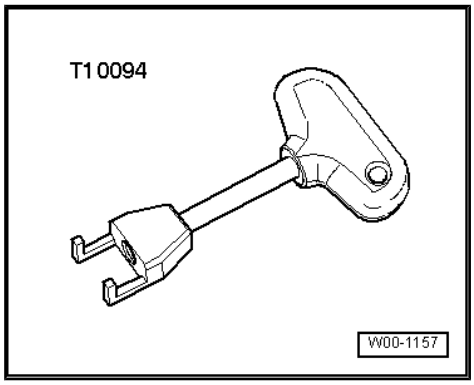
1.2 Ignition coils with final power stages - remove and install

Special tools and workshop equipment required

- ♦ Hook -T10118-



- ♦ Puller -T10094-



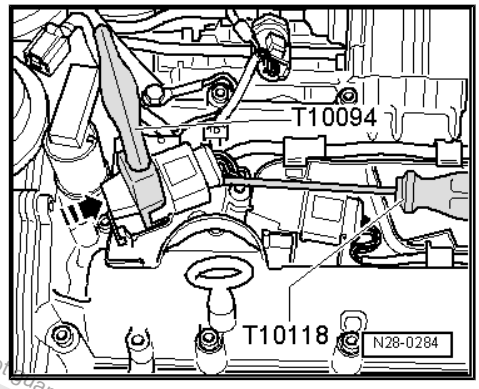
Removal

– Install the Extractor -T10094- over the ignition coil with final power stage.-arrow-

– Install the Hook -T10118- as illustrated.

– Unlock the connector block carefully and remove the connector.

– Remove ignition coil with final power stage.

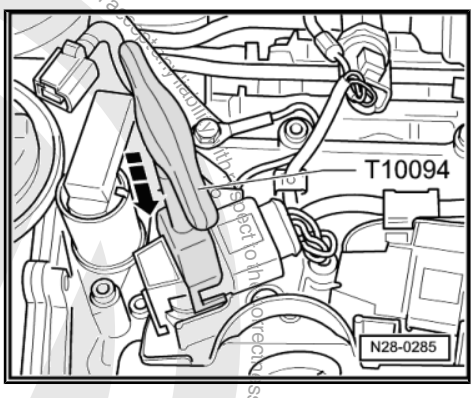


Installation

– Install the Extractor -T10094- over the ignition coil with final power stage.

– Install the ignition coil with final power stage in the -arrow- direction on the engine cylinder head.

– Connect the connector to the ignition coil with final power stage until fitting it audibly.



1.3 Safety measures

To prevent injuries in people and/or destruction of the injection and ignition system, take into consideration the following:

- Do not touch nor disconnect ignition cables with the engine in operation or upon start.
- Only connect or disconnect the injection and ignition system cables, including measurement device cables, with the ignition switched off.

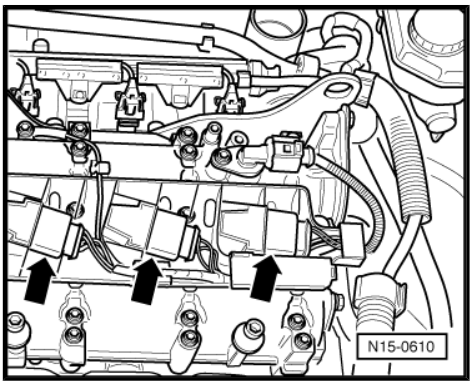
If during a test drive, it is necessary to use test and measuring equipment, observe the following:

- The measurement and test devices must be fastened to the back seat and operated by another mechanic from then on.

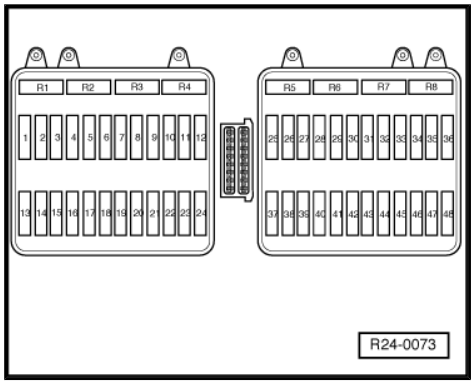
If the measurement and test devices are operated from the front passenger seat, the person seating there could be injured by the passenger airbag being triggered, in case of an accident.

- To make the engine rotate with the starter, without running it:

– Disconnect all 4-pole connectors -arrows- for the ignition coils.



– Remove fuse 33 from fuse holder.



Note

Removing fuse 44, the voltage supply to the injection valves is interrupted.

1.4 Test data, Spark plugs -Q-

Engine identification letters	BMD/CHFB	BMD/CHFB
Ignition order	1-2-3	1-2-3
Spark plugs 13) 12)	BOSCH	NGK
VW/Audi	101 905 601 B	101 905 617
Manufacturer reference	F 7 HER2	ZFR5P-G
Inter-electrode gap	0.8...0.9 mm	0.8...0.9 mm
Tightening torque	30 Nm	30 Nm

12) Current values and replacement intervals of the Spark plugs -Q- : ⇒ Exhaust gas Test Folder.

13) Remove and install Spark plugs -Q- with Spark plug wrench -3122B- .

12.09