Workshop Manual

Jetta 2005 ➤
Bora 2006 ➤

4-cylinder Injection engine (1.6 l engine, direct injection)									
Engine ID	BLF								

Edition 08.2005

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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

1.1 Engine number

Engine code and engine number can be found on the sticker -arrow- on the control housing.

The engine code is also on the vehicle data plate and on the crankcase above the gearbox.

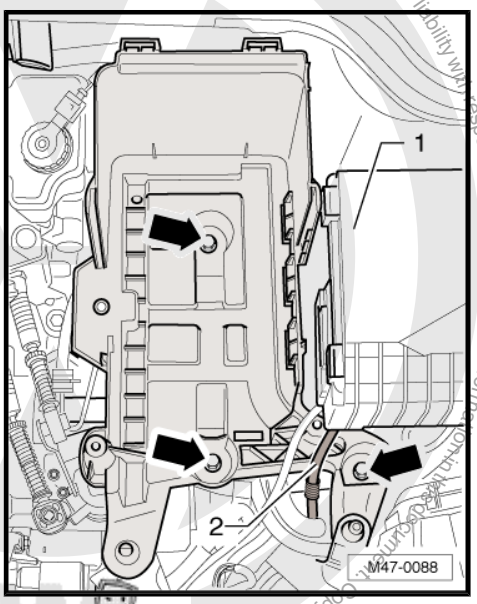
The engine number consists of up to nine characters (alphanumeric). The first part (maximum 3 characters) makes up the “engine code”, and the second part (6 characters), the “serial number”. If more than 999,999 engines with the same engine code are produced, the first of the six characters is replaced with a letter.

If there is no sticker and you need the “engine codes” and the “serial number”, proceed as follows:

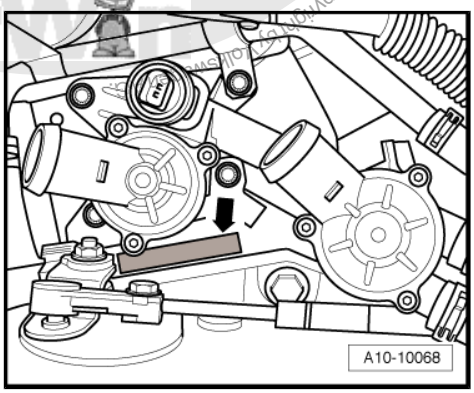
– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with petrol engine .

– Open the cover -1- of the electronics box and remove the cable -2-.

– Remove bolts -arrows- and battery carrier.



– Read the engine code and the serial number on the left of the cylinder block -arrow-.



Install in reverse order of removal. During this step, observe the following:

– Install the battery and observe the respective measures after connecting the battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Models with petrol engine .

1.2 Engine data

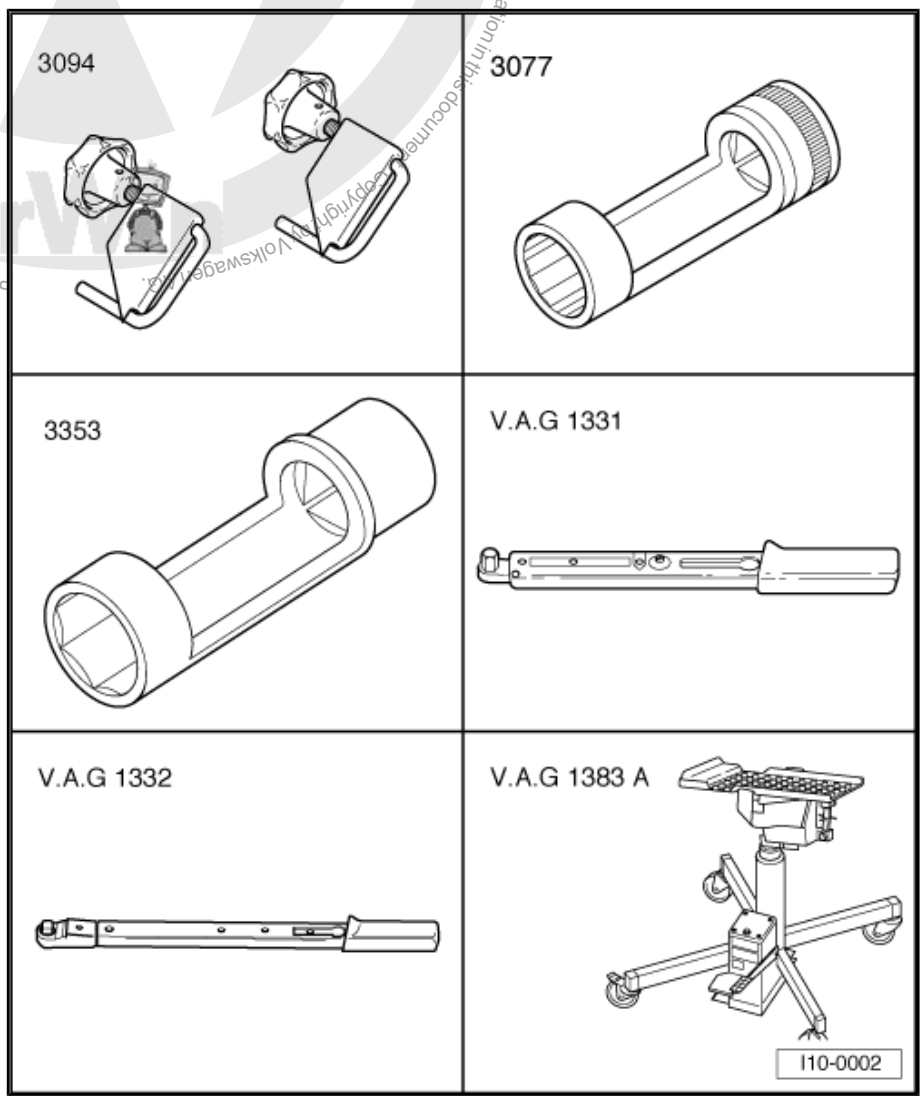
Engine code		BLF		
Manufactured		08.05 ▸		
Emissions fulfil		EU 4 Standard		
Displacement	cm^3	1598		
Output	kW at rpm	85/6000		
Torque	Nm at rpm	155/4000		
Bore	∅ mm	76,5		
Stroke	mm	86,9		
Compression ratio		12,0		
Valves per cylinder		4		
RON	min.	95 Unleaded		
Injection, ignition		Motronic MED 9.5.10		
Mixture formation		homogeneous		
Variable valve timing		yes		
Knock control		1 sensor		
Lambda regulation		2 probes		
Three-way catalytic converter		yes		
Exhaust gas recirculation		yes		
Secondary air system		no		
Electronic power control		yes		

10 – Removing and installing engine

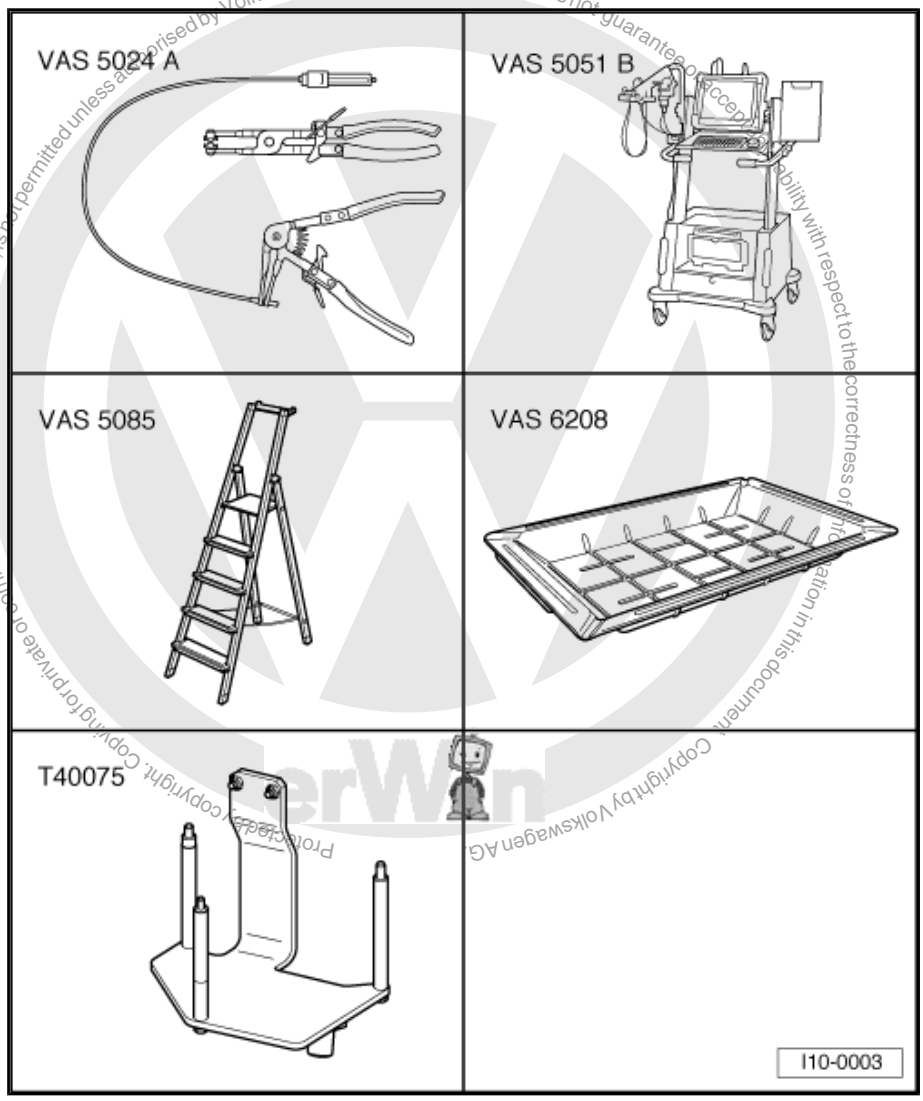
1 Removing and installing engine

Special tools and workshop equipment required

- Hose clamp to Ø 25 mm -3094-
- Multi-point bit 19 mm -3077-
- Multi-point bit 18 mm -3353-
- Torque wrench -V.A.G 1331-
- Torque wrench -V.A.G 1332-
- Engine and gearbox jack -V.A.G 1383 A-



- Spring-type clip pliers -VAS 5024 A-
- Vehicle diagnosis, testing and information system -VAS 5051-
- or vehicle diagnosis and service information system -VAS 5052-
- Double ladder -VAS 5085-
- Drip tray -VAS 6208-
- Engine bracket -T40075-
- Engine bung set -VAS 6122-
- Grease -G 000 100-



1.1 Removing engine

Note

- *In subsequent work sequences the battery earth strap must be disconnected. Therefore first check whether a coded radio is fitted. Obtain radio code first if necessary.*
- *The engine is removed downwards together with the gearbox.*
- *Observe rules for cleanliness* ⇒ page 115 .
- *All cable ties which are opened or cut through when engine is removed must be replaced in the same position when engine is installed.*
- *Pull engine coolant hoses off with spring-type clip pliers -VAS 5024 A- .*

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- ***All wirings (e.g. for fuel, hydraulic system, activated charcoal canister system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings are to be installed in the original way.***
- ***Ensure that there is sufficient clearance to all moving or hot components.***

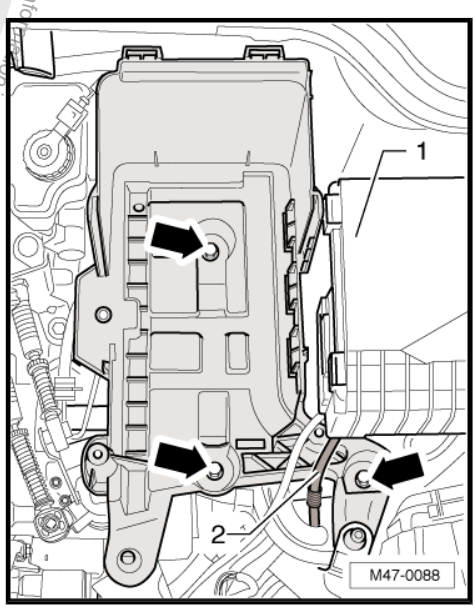
– With ignition switched off disconnect battery earth strap ⇒ Electrical system; Rep. Gr. 27 ; Disconnecting and connecting the battery .

– Remove engine cover with air cleaner ⇒ page 161 .

– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with petrol engine .

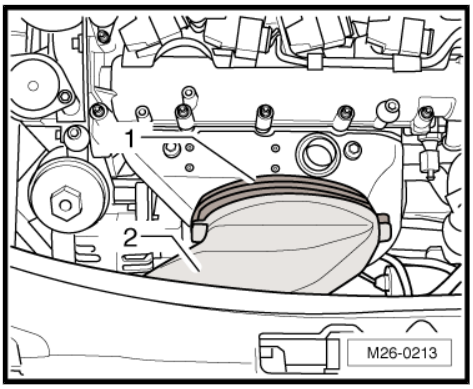
– Open the cover -1- of the electronics box and remove the cable -2-.

– Remove bolts -arrows- and battery carrier.

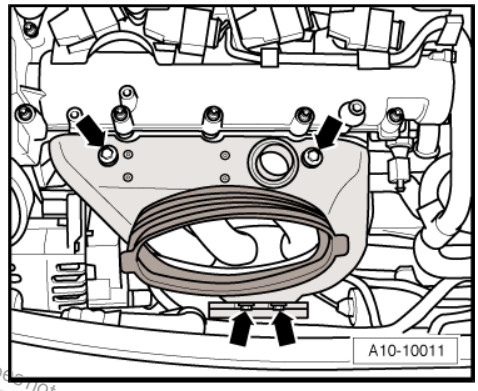


– Disconnect rubber bellows -1- from air duct -2-.

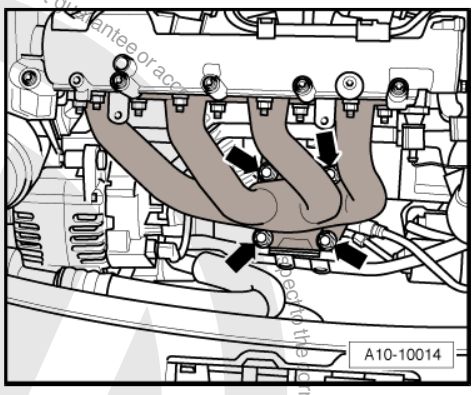
– Release both locking devices and take air duct -2- off.



– Remove warm air collector plate -arrows-.

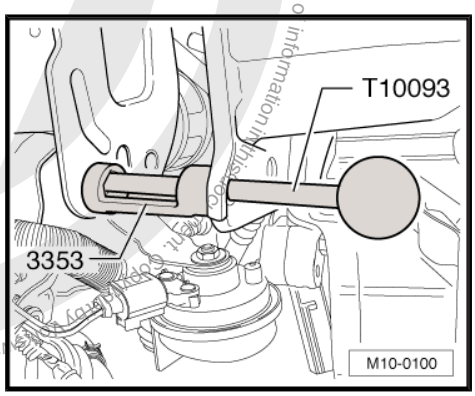


– Remove pre-catalytic converter with exhaust pipe from exhaust manifold -arrows-.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Remove right and left front part of wheel housing liner ⇒ General body repairs, exterior; Rep. Gr. 66 ; Wheel housing liner; Removing and installing front wheel housing liner .
– Drain coolant ⇒ page 102 .
– Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. Gr. 50 ; Body front; Lock carrier service position .

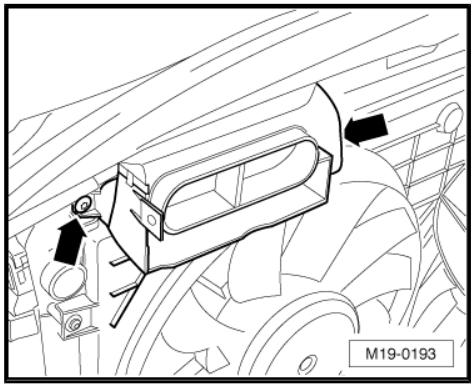


For subsequent work sequences the lock carrier must be supported on the longitudinal member.

– Support the lock carrier on one side using the multi-point bit 18 mm -3353- .
– Support the lock carrier on the other side using the multi-point bit 19 mm -3077- .

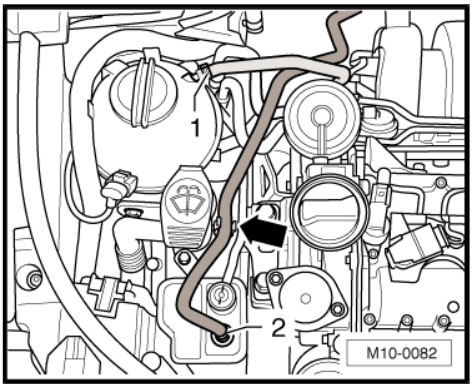


– Unscrew intake connecting piece on lock carrier -arrows-.



– Pull coolant hose -1- off expansion tank.

– Pull vacuum hose -2- off activated charcoal canister and windscreen washer system reservoir -arrow- and lay free.



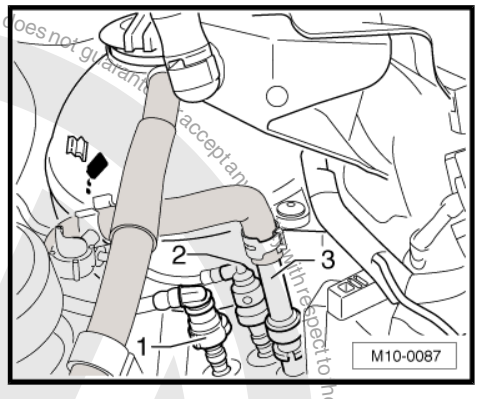
WARNING

The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

– Disconnect fuel supply line -3- (press locking ring inwards) and collect escaping fuel with a cloth.

– Disconnect breather line -1- (press locking ring inwards).

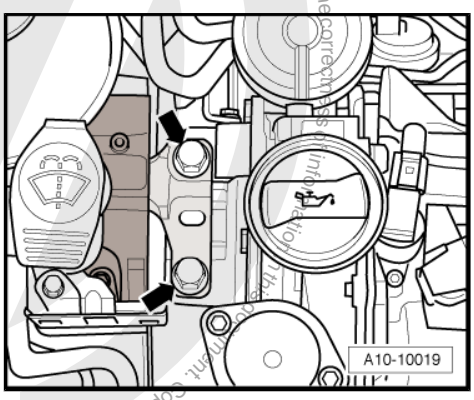
– Seal the lines so that the fuel system is not contaminated by dirt etc.



– Loosen bolts -arrows- of assembly mounting on engine just a bit (less than 1 turn).

– Remove upper coolant hose from radiator.

Models without auxiliary heating

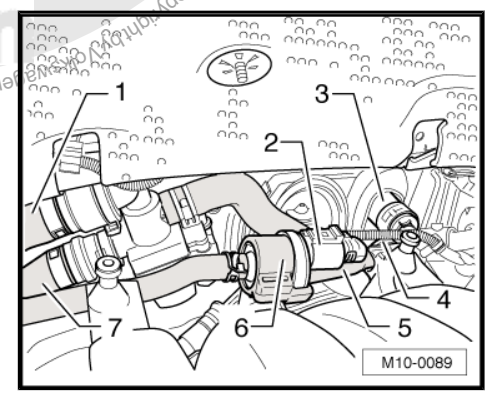


– Remove coolant hoses -3- and -4- to heat exchanger on bulkhead.

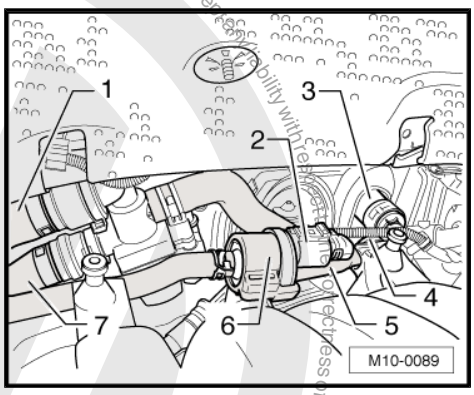
– Remove connector -2- and hose -5- from active charcoal filter system solenoid valve 1 -N80- -6-.

– Remove retainer along with active charcoal filter system solenoid valve 1 -N80- -6- from intake manifold.

Models with auxiliary heater

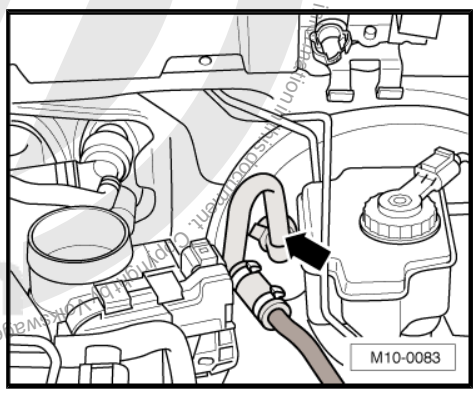


– Remove coolant hose -3- to heat exchanger on bulkhead.
– Remove connector -2- and hose -5- from active charcoal filter system solenoid valve 1 -N80- -6-.
– Remove retainer along with active charcoal filter system solenoid valve 1 -N80- -6- from intake manifold.
– Remove coolant hoses -1- and -7- on heater coolant shut-off valve -N279- .

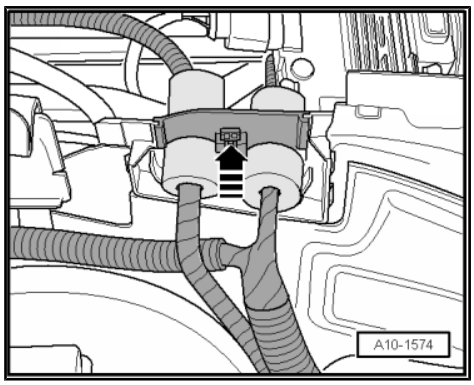


Continuation for all vehicles

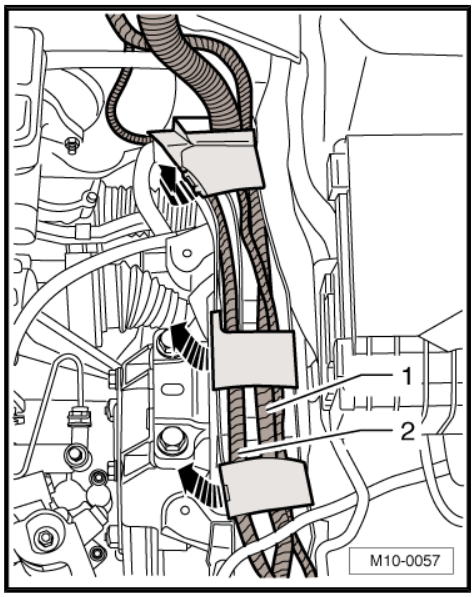
– Pull the vacuum hose -arrow- off brake servo.
– Release the front connector on the engine control unit and pull it off ⇒ page 179 .



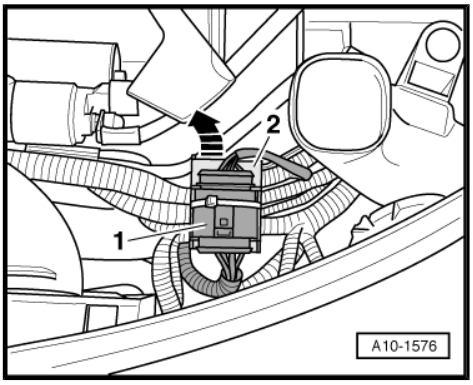
– Unlock duct for engine wiring harness -arrow- and pull off upwards.



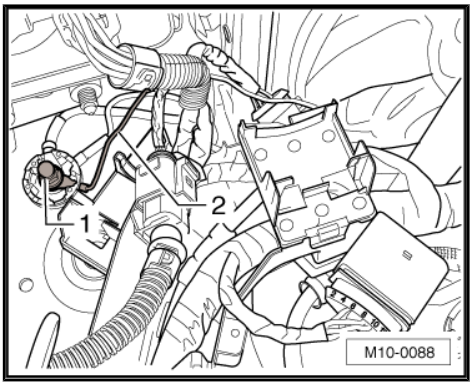
– Open wiring bracket -arrows-.
– Take engine wiring harness -1- to control unit out of the wiring guide.



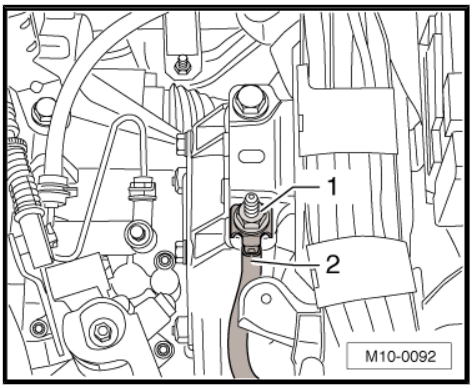
– Move electrical connector -1- free and disconnect.
– Release underneath bracket -2- of the wiring -arrow-.



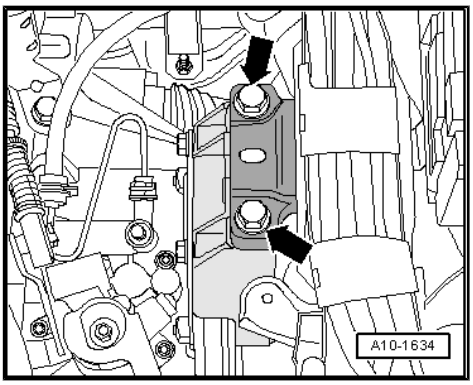
– Remove nut -1- and pull earth strap -2- off earth point.
– Take engine wiring harness to control unit off the wiring guide.
– Fit the cable with a cable tie to the engine.



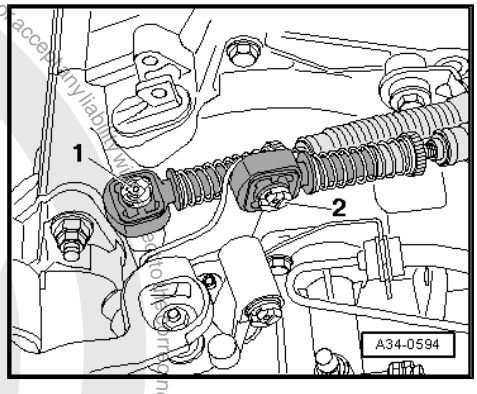
– Remove nut -1- and the earth strap -2- from the assembly mounting.



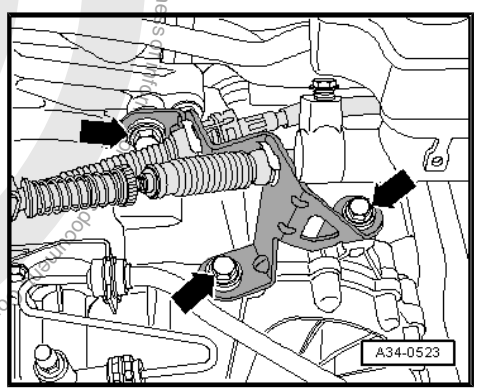
– Loosen bolts -arrows- of assembly mounting on gearbox just a bit (less than 1 turn).



– Unclip securing clips -1- and -2- on both cables.
– Pull cable end-pieces off gearbox selector lever and relay lever.



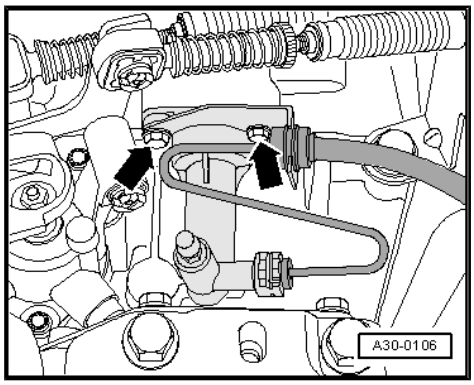
– Remove cable support bracket from gearbox -arrows- and lay to side.



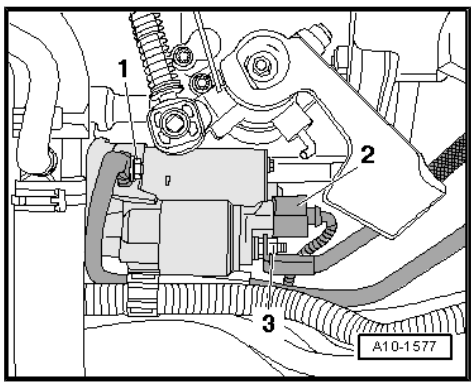
– Remove clutch slave cylinder -arrows- and lay to side, do not open pipes.

Caution

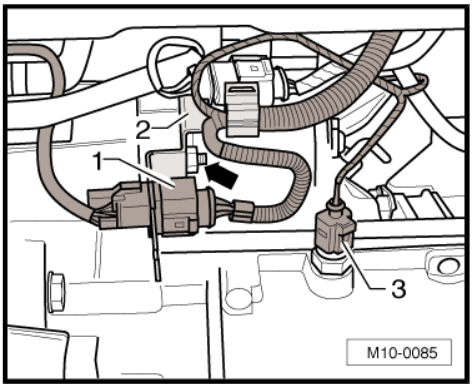
Do not operate the clutch pedal anymore after removing the clutch slave cylinder.



– Unscrew earth wire -1-.
– Remove electrical wirings -2- and -3- on starter and lay to side.

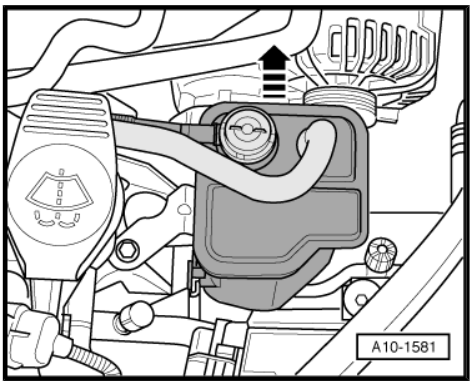


– Separate electrical connector -1- for Lambda probe -G39- .
– Disconnect electrical connector -3- for reversing light switch -F4- .
– Lay engine wiring harness on bracket -2- to side.
– Unscrew nut -arrow- and take retainer for electrical wiring off threaded stud.



Models with an air conditioning system

– Pull activated charcoal canister off the bracket upwards -arrow-.

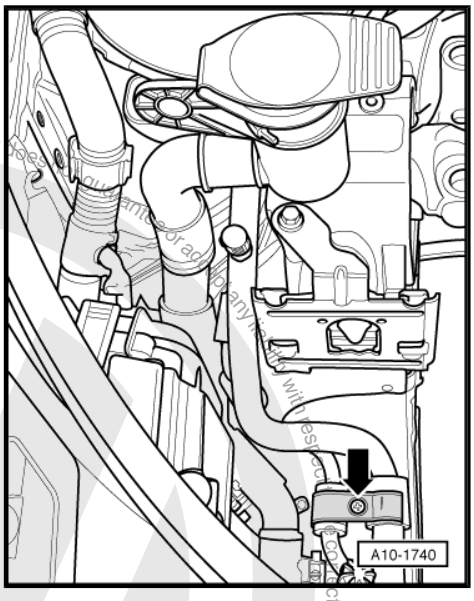


Note

To prevent damage to condenser also to the refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.

To facilitate removing and installing the engine without opening the refrigerant circuit:

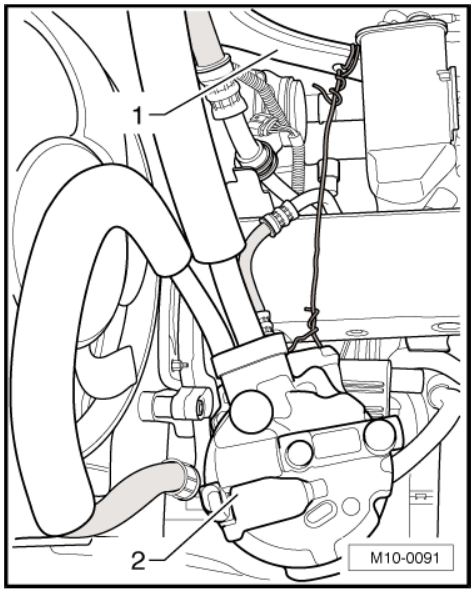
– Remove bracket -arrow- for refrigerant lines on right longitudinal member.
– Remove ribbed belt ⇒ page 29 .
– Remove air conditioner compressor from bracket for ancillaries ⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor .



Note

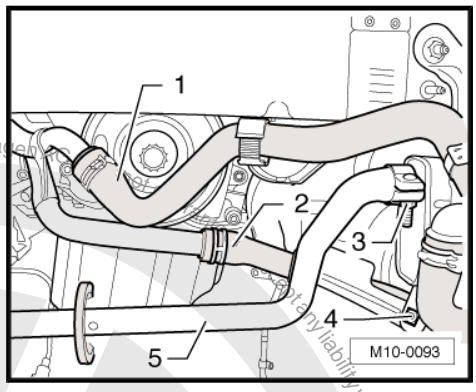
The air conditioning system wiring must not be opened.

– Fit air conditioner compressor -2- to lock carrier -1-. To do this pull e.g. a wire through the right air conditioner compressor mounting.
– Observe that the wiring is not kinked.



Models with auxiliary heater

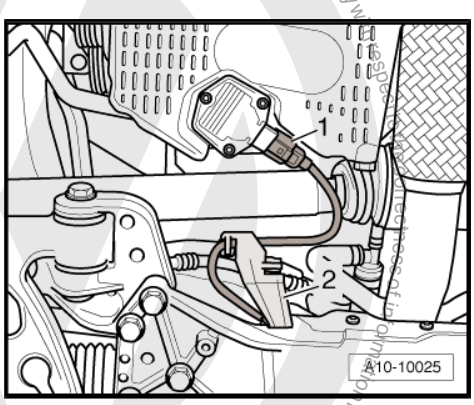
– Loosen nut -3-, remove bolt -4- and take exhaust pipe -5- off auxiliary heater.
– Place drip tray underneath.
– Release spring-type clips of coolant hoses -1- and -2- and pull coolant hoses off auxiliary heater.



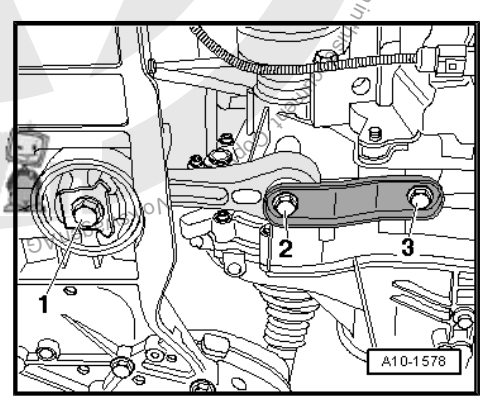
Continuation for all vehicles

– Remove alternator ⇒ Electrical system; Rep. Gr. 27 ; Alternator; Alternator 1.6 l FSI engine

– Separate connector -1- at oil level and oil temperature sender -G266- .
– Unclip retainer -2- for the line to the oil level and oil temperature sender -G266- on subframe.

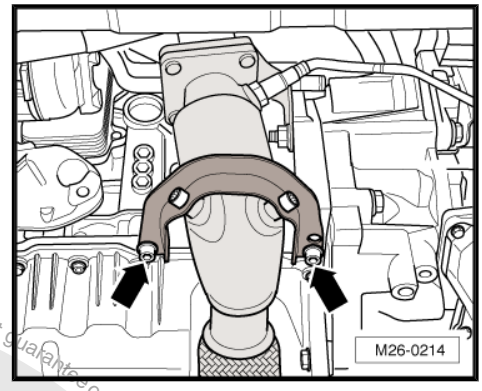


– Unscrew bolt -1- first.
– Unscrew bolts -2- and -3- and take pendulum support off.



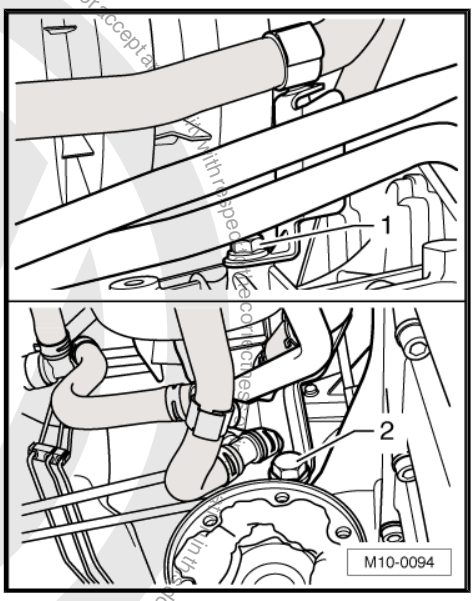
– Remove bolts -arrows-.

– Remove right-hand drive shaft and left-hand drive shaft ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shafts; Removing and installing drive shafts .



Models with auxiliary heater

– Remove bolts -1- and -2- and pull coolant hoses off engine and gearbox. The coolant hoses remain connected.



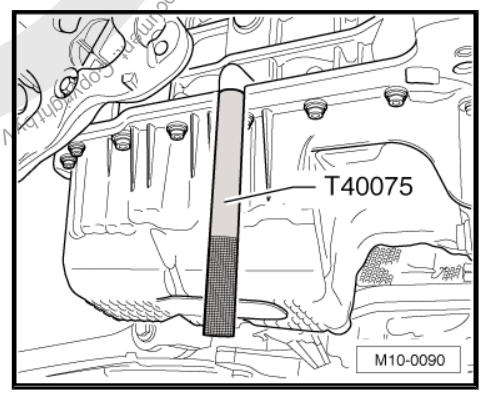
Continuation for all vehicles

– Remove pre-catalytic converter along with exhaust pipe ⇒ page 183 .

– Pull off/disconnect all other electrical connections and hoses as necessary from engine and lay to one side.

– Fit all electrical wirings and hoses on engine.

– Fit pin of engine bracket -T40075- to engine front first.

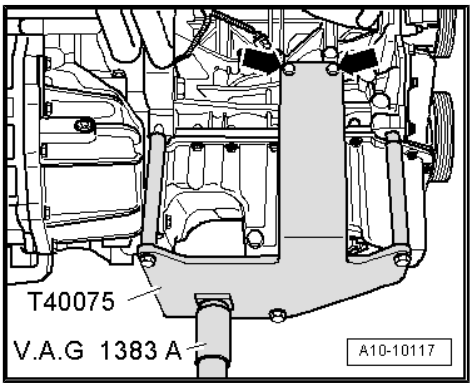


– Fit engine bracket -T40075- to the engine and gearbox jack -V.A.G 1383 A- .

– Fit engine bracket -T40075- to pin.

– Fit the engine bracket -T40075- to the rear side of the cylinder head -arrows- and tighten to 20 Nm.

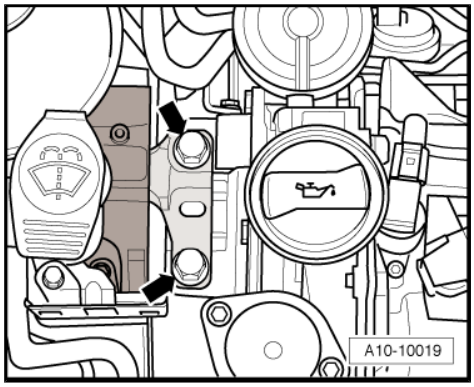
– Lift engine/gearbox assembly lightly.



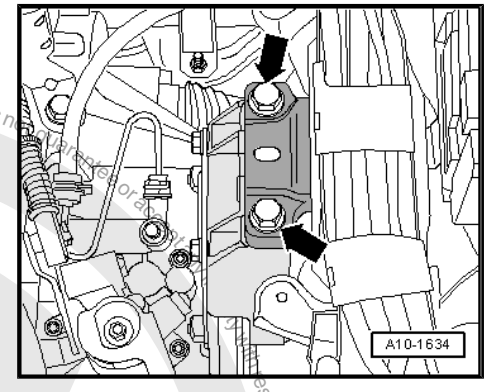
Note

To remove securing bolts for assembly mounting use double ladder -VAS 5085- .

– Remove bolts -arrows- of assembly mounting from engine bracket.



– Remove bolts -arrows- of assembly mounting from gearbox bracket.



Note

- *Check whether all hoses and wiring connections between engine, gearbox and body are disconnected.*
- *Engine with gearbox must be guided carefully when lowered to prevent damage.*

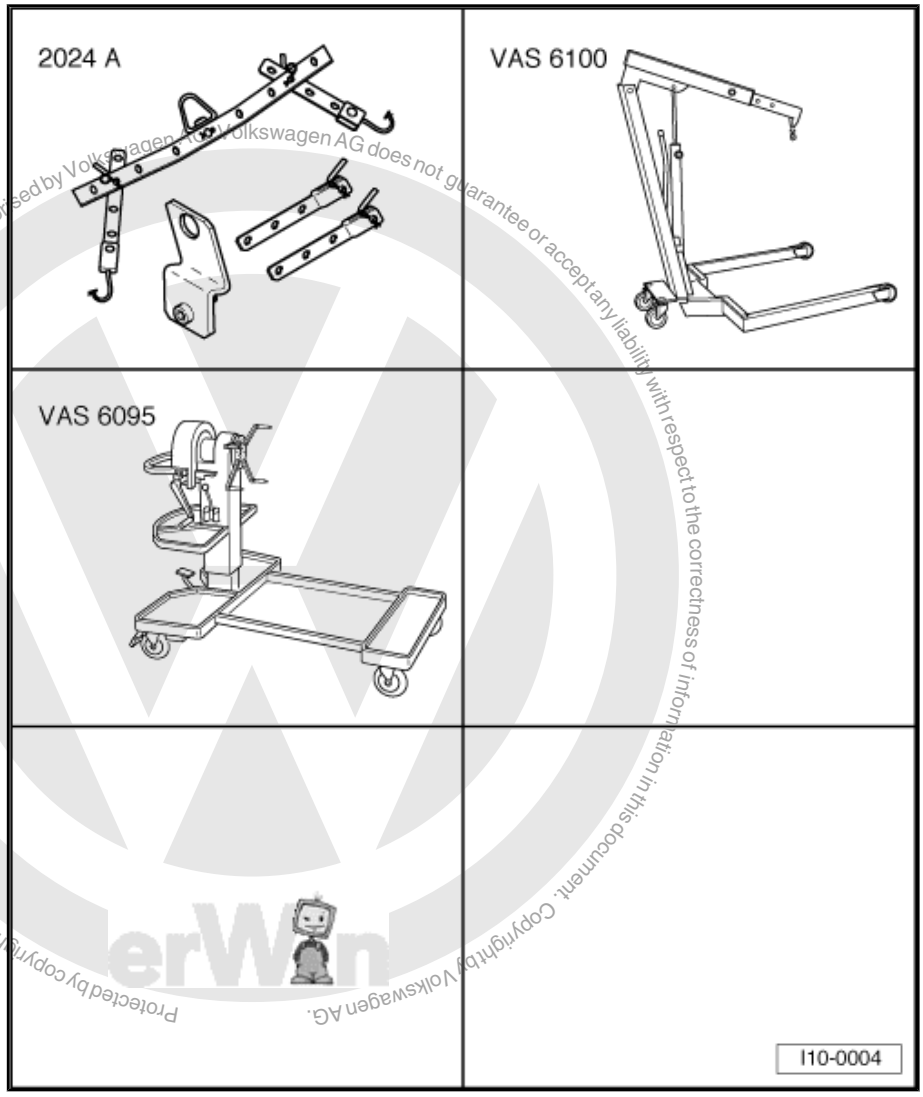
– Pull engine/gearbox assembly forwards as far as possible and carefully lower.

1.2 Securing engine to engine and gearbox support -VAS 6095-

When working on the engine, the engine should be secured on the engine and gearbox support -VAS 6095- .

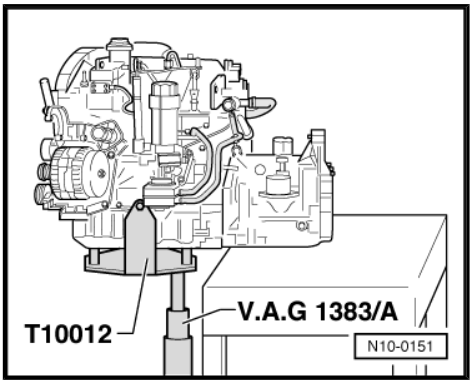
Special tools and workshop equipment required

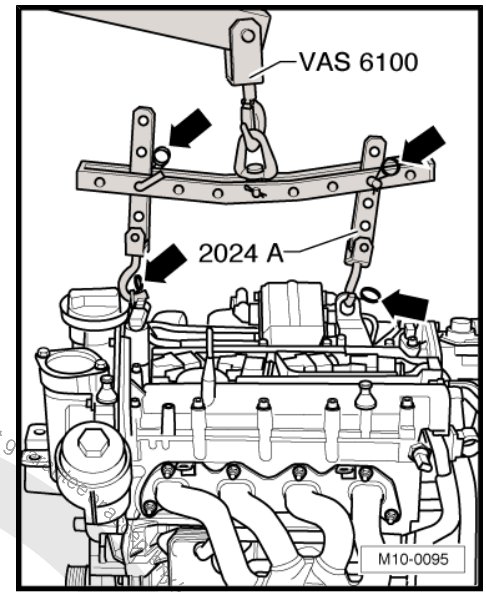
- Lifting tackle -2024 A-
- Workshop crane - VAS 6100-
- Engine and gearbox stand - VAS 6095-



Procedure

– Move Engine/gearbox jack -V.A.G 1383 A- to a workbench.
– Lower engine/gearbox assembly so that the gearbox is on the workbench.
– Remove engine/gearbox connecting bolts.
– Press gearbox off engine.





– Remove lifting tackle -2024 A- as follows and lift off engine/ gearbox jack -V.A.G 1383 A- with workshop crane -VAS 6100- .

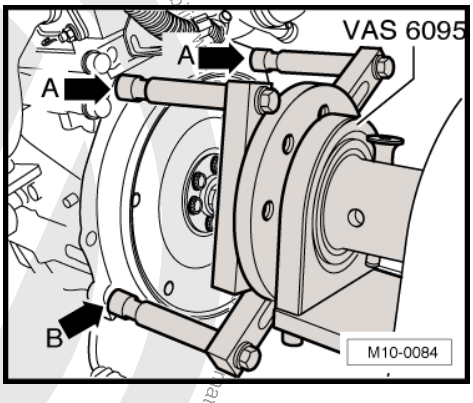
Belt pulley end: 2nd hole in hook rail at position 2

Flywheel end: 3rd hole on support bar in position 7

> ⚠ **WARNING**
>
> *The hooks and locating pins must be secured with locking pins -arrows- to prevent injuries and damages to the engine.*

♦ The positions marked 1...4 on the bar must be towards the belt pulley end.

♦ The holes in the hook rails are counted up from the hook.



– Pull dowel sleeve -arrow B- out of the cylinder block.

– Secure engine to engine and gearbox support -VAS 6095- -arrows A- and -arrow B-.

1.3 Installing engine

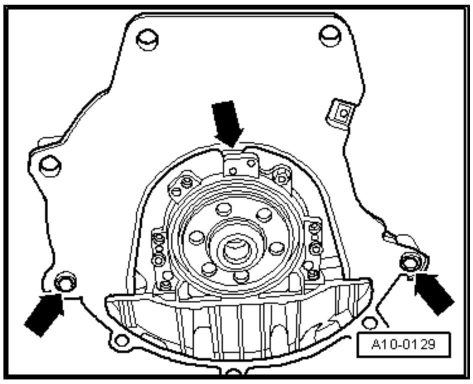
Install in reverse order of removal. During this step, observe the following:

> ⚠ **Caution**
>
> *When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:*
>
> ♦ *All wirings (e.g. for fuel, hydraulic system, activated charcoal canister system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings are to be installed in the original way.*
>
> ♦ *Ensure that there is sufficient clearance to all moving or hot components.*

Note

- *Install all cable ties at the same place when removing.*
- *Hoses must be locked with clamps ⇒ Electronic parts catalogue "ETKA".*
- *When performing repair work, renew self-locking nuts and bolts.*
- *Renew bolts which are tightened with a swing angle as well as seals and gaskets.*
- *When swinging the assembly in, ensure that clearance exists between the drive shafts.*

– Fit new dowel sleeves to centralize gearbox on engine block.



– Ensure that the intermediate plate is attached to the sealing flange and is slided onto the dowel sleeves -arrows-.

– Check clutch release bearing for wear, renew if necessary.

– Lightly grease clutch release bearing, release bearing guide sleeve and splines on input shaft with grease -G 000 100- . If necessary clean and remove corrosion.

– Installing and checking clutch and clutch mechanism ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 30 ; Repairing clutch control .

– Rock engine to align engine mounting stress-free, loosen engine mounting to body if necessary.

Note

♦ *Checking and adjusting assembly mounting ⇒ page 20 .*

♦ *Torque settings for assembly mounting ⇒ page 22 .*

♦ *Connecting bolts for engine/gearbox ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 34 ; Removing and installing gearbox .*

♦ *Electrical connections and routing ⇒ Electrical system; Rep. Gr. 97 .*

– When installing the engine/gearbox assembly, ensure sufficient clearance to assembly mountings and radiator.

– Install pendulum support ⇒ page 22 .

– Install drive shafts ⇒ Running gear, axles, steering; Rep. Gr. 40 ; Servicing drive shafts; Removing and installing drive shafts .

– Installing pre-catalytic converter with exhaust pipe ⇒ page 188 .

– Install selector mechanism, adjust if necessary ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 34 ; Servicing selector mechanism .

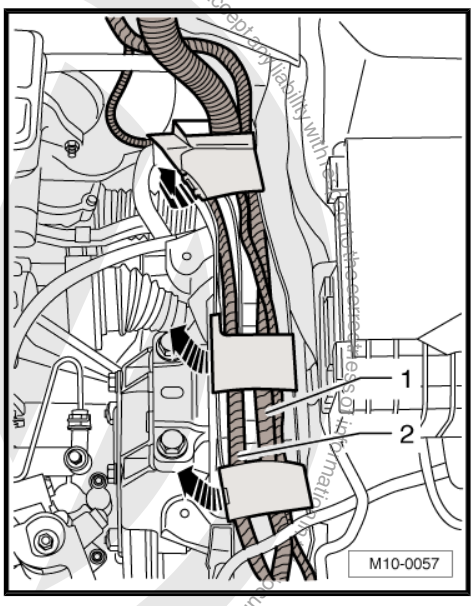
– Install hydraulic clutch slave cylinder ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 30 ; Repairing clutch control; Assembly overview - hydraulic system .

– Install air conditioner compressor ⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor .

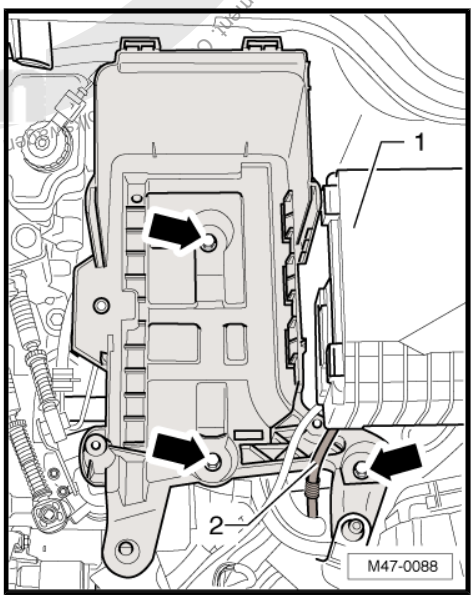
– Install ribbed belt ⇒ page 29 .

– Install bulkhead in plenum chamber ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Plenum chamber bulkhead .

– Route engine wiring harness -1- to control unit below and on the left (in direction of road) of the wiring harness -2-.



– Install battery carrier first and tighten bolts -arrows-.



– Route wiring -2- as shown in the figure and fit to electronics box -1-.
– Install the battery and observe the respective measures after connecting the battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Models with petrol engine .
– Install engine cover with air cleaner ⇒ page 161 .
– Top-up coolant ⇒ page 102 .
– Install noise insulation ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Noise insulation .
– Connect vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052- .
– Interrogate all fault memories and then erase all fault entries which have been caused when the engine has been removed and installed.

  After erasing the fault memory of the engine control unit generate readiness code.

Observe applicable safety precautions during road test.

– Carry out a road test.
– After this, perform a vehicle system test and if necessary, rectify faults.

Torque settings

Threaded connection		Torque setting
Nuts and bolts	M 6	10 Nm
	M7	15 Nm
	M 8	25 Nm
	M10	40 Nm
	M12	60 Nm
Connecting bolts for engine/gearbox ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 34 ; Removing and installing gearbox .		
Bolts for assembly mounting ⇒ page 22		

1.4 Checking and adjusting assembly mounting

Checking settings ⇒ page 20

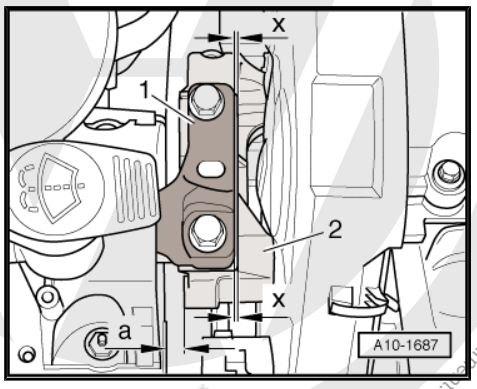
Adjusting assembly mounting ⇒ page 20

1.4.1 Check settings

– Remove engine cover with air cleaner ⇒ page 161 .

The following dimensions must be obtained:

- Between the engine support and the right longitudinal member must be a distance of -a- = 10 mm at least.
- The edge on the engine support -2- must be parallel to the arm -1-. Dimension -x- must be the same on top and bottom.



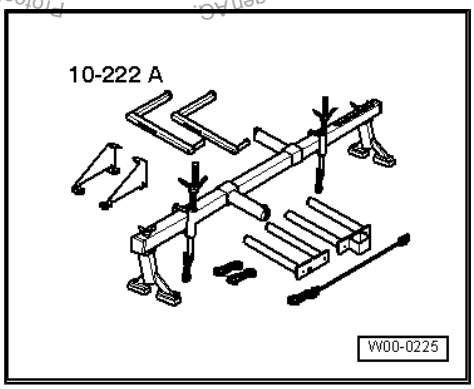
Note

Dimension -a- = 10 mm can be checked e.g. with suitable round bars.

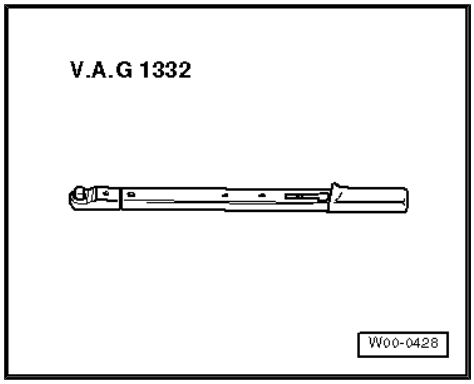
1.4.2 Adjusting assembly mounting

Special tools and workshop equipment required

♦ Support bracket -10-222 A-



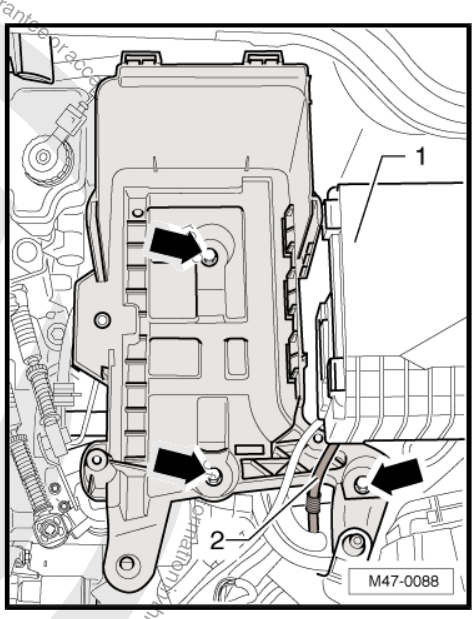
♦ Torque wrench -V.A.G 1332-



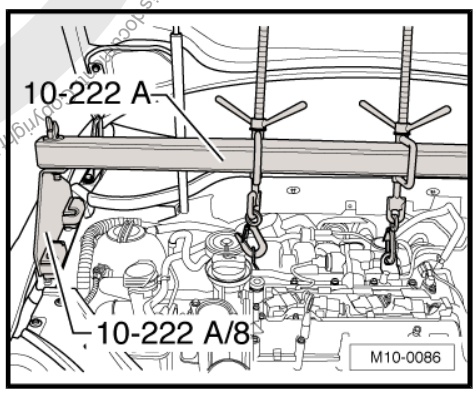
If dimension is too small or to large proceed as follows:

– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with petrol engines .

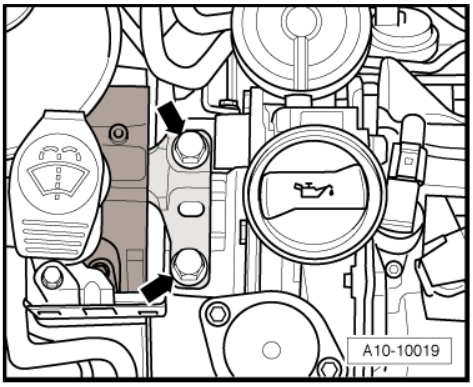
– Open the cover -1- of the electronics box and remove the cable -2-.
– Remove bolts -arrows- and battery carrier.



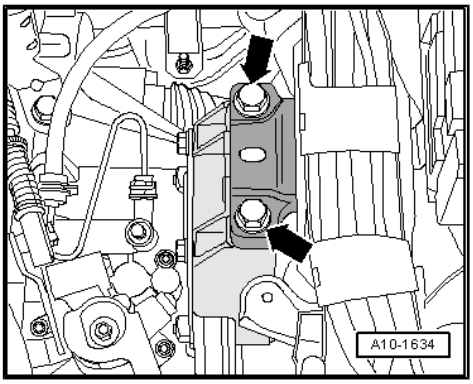
– Fit support bracket -10 - 222 A- before the gas pressure damper for the front flap using adapter -10 - 222 A/8- .
– Attach trigger snap of spindles to lifting eyes.
– Tension engine with both spindles evenly, do not lift.



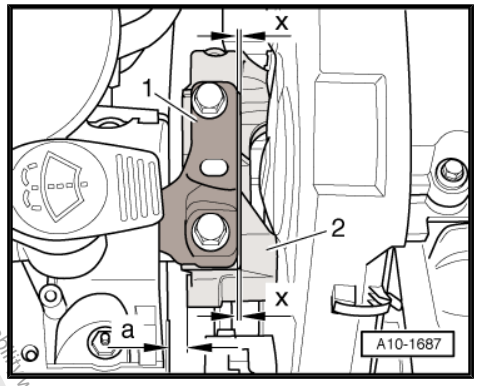
– Remove bolts -arrows- of engine assembly mounting.



– Remove bolts -arrows- of gearbox assembly mounting.
– Renew all bolts one after the other (if they had not been removed when the engine was removed) and screw in loosely.



– Slide the engine with a lever between engine console -1- and arm -2- until the bolts are centered in the elongated holes:



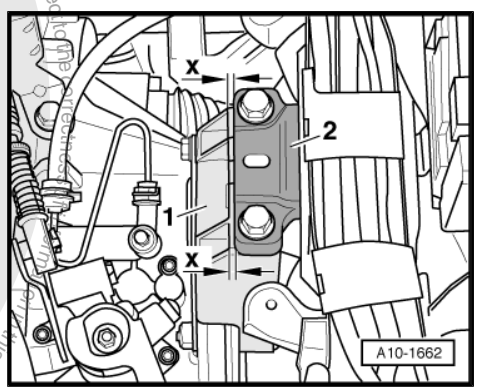
- Between the engine support and the right longitudinal member must be a distance of -a- = 10 mm at least.
- The edge on the engine support -2- must be parallel to the arm -1-. Dimension -x- must be the same on top and bottom.

Note

Dimension -a- can also be checked e.g. with suitable round bars.

– Tighten bolts for engine side assembly mounting ⇒ page 22 .

– Ensure that on gearbox side the edges of the arm -2- and the gearbox support -1- are parallel with one another. Dimension -x- must be the same on top and bottom.



– Tighten bolts for gearbox side assembly mounting ⇒ page 22 .

Assembly is carried out in the reverse sequence of removal.

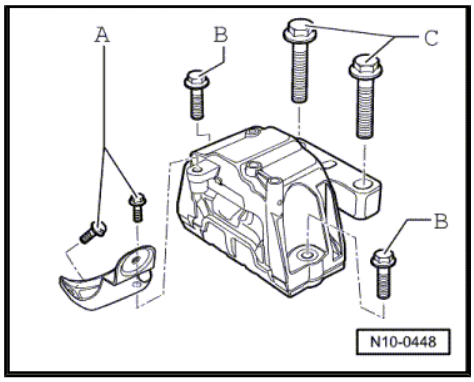
– Install the battery and observe the respective measures after connecting the battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Models with petrol engine .

1.5 Assembly mountings

Torque settings

Note

The assembly mounting securing bolts are stretch bolts and must be replaced.



Engine assembly mounting

A = 20 Nm + 90° ($^1/_4$ turn) further

Renew bolts.

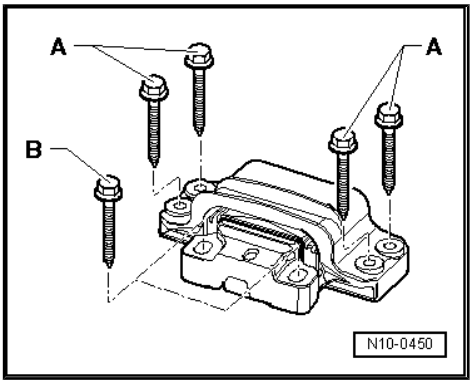
B = 40 Nm + 90° ($^1/_4$ turn) further

Renew bolts.

C = 60 Nm + 90° ($^1/_4$ turn) further

Renew bolts.

Gearbox assembly mounting



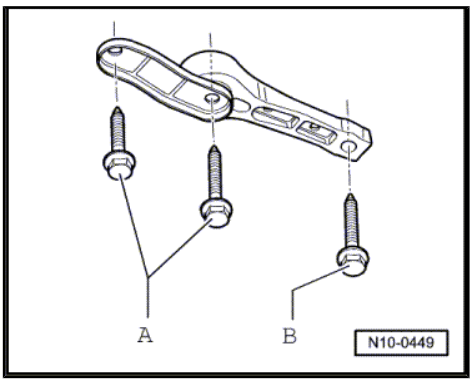
A = 40 Nm + 90° (1/4 turn) further

Renew bolts.

B = 60 Nm + 90° (1/4 turn) further

Renew bolts.

Pendulum support



A = 40 Nm + 90° (1/4 turn) further

Renew bolts.

B = 100 Nm + 90° (1/4 turn) further

Renew bolts.

Removing: First remove bolt -B- then bolts -A-.

Installing: First tighten bolts -A- then bolt -B-.

13 – Crankshaft group

1 Dismantling and assembling engine

Note

- *If large quantities of metal particles or other deposits (caused, for example, by partial seizure of the conrod bearings) are found in the engine oil when performing repairs, clean the oil passages thoroughly and renew the oil filter in order to prevent further damage from occurring later.*
- *Oil all contact surfaces before beginning with the assembly work.*

Overview ⇒ page 25

Belt drive - Assembly overview ⇒ page 26

Chain drive - Assembly overview ⇒ page 27 .

Removing and installing poly V-belt ⇒ page 29

Removing and installing control housing ⇒ page 31

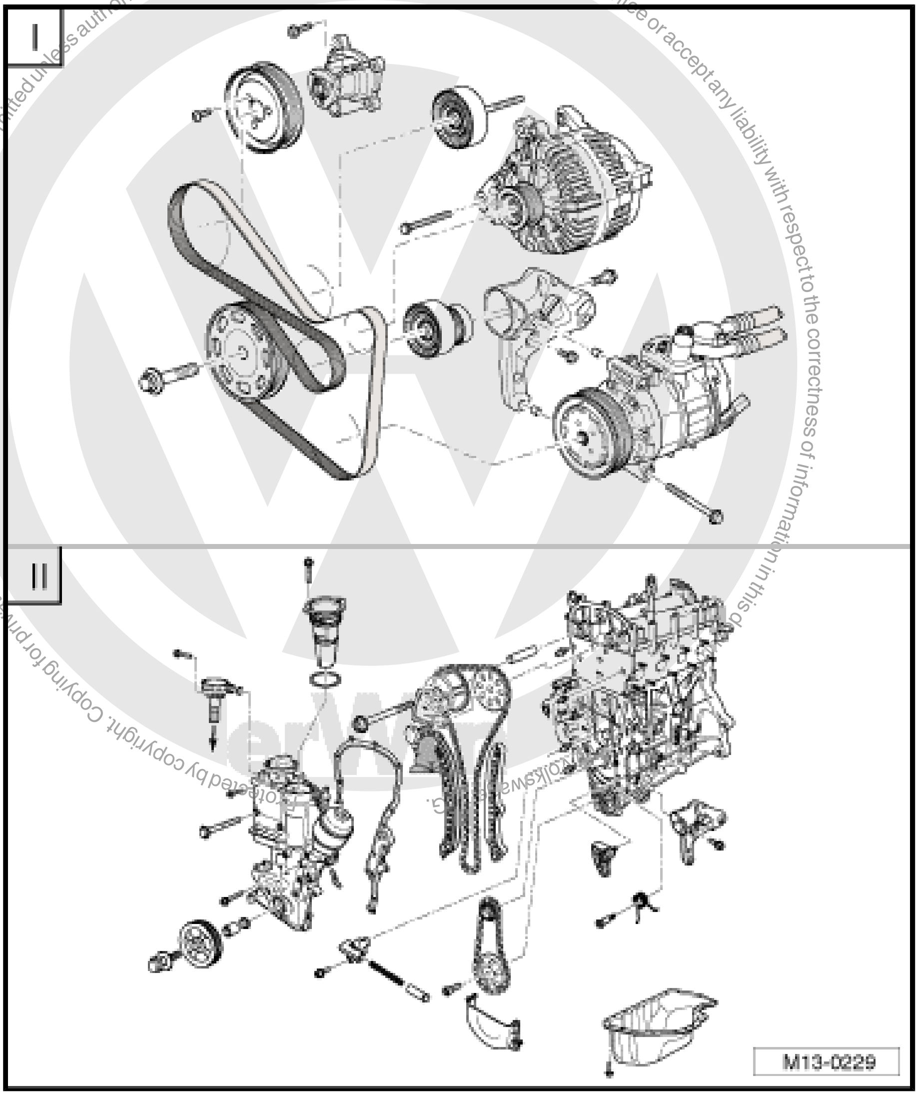
Note

When working on the engine, the engine should be secured on the engine and gearbox support -VAS 6095- .

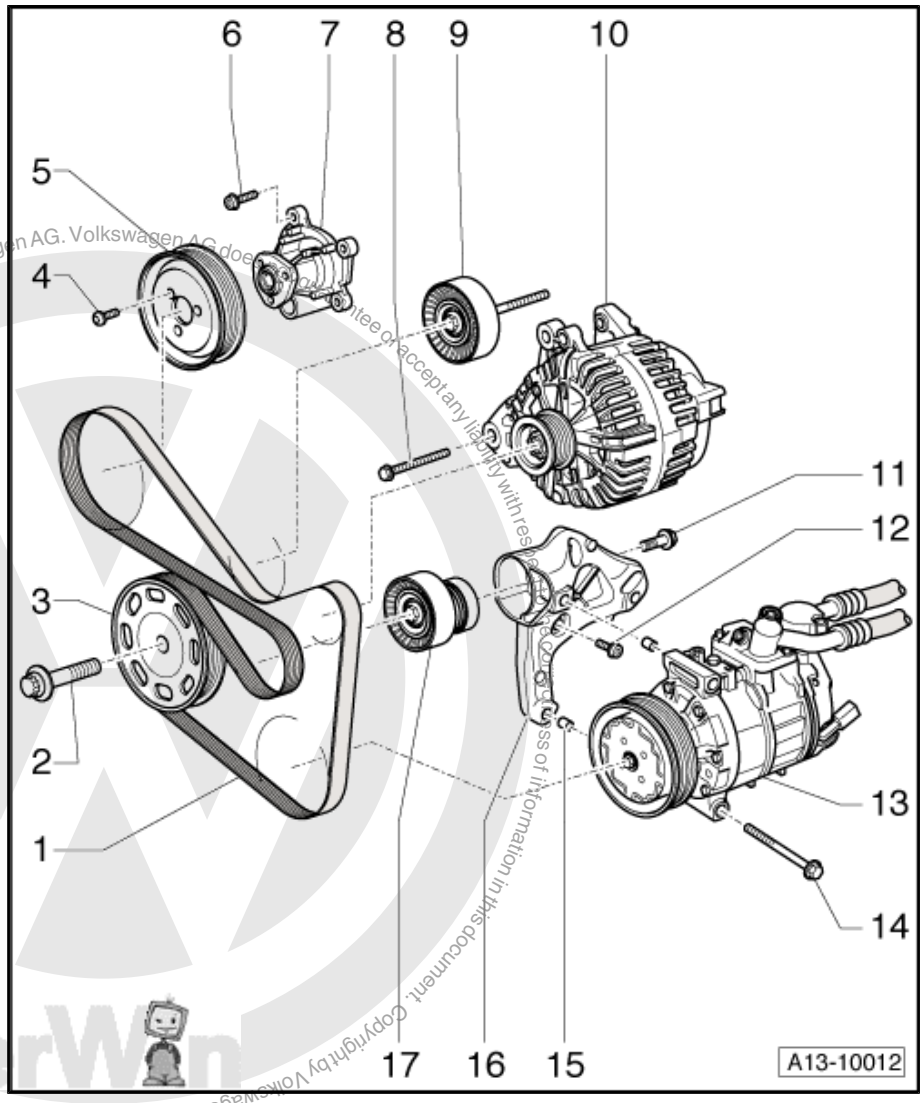
1.1 Overview

I - Belt drive - Assembly overview ⇒ page 26

II - Chain drive - Assembly overview ⇒ page 27 .



1.2 Belt drive - Assembly overview



1 - Poly V-belt

- ❑ Check for wear
- ❑ Do not kink
- ❑ Mark D.O.R. with chalk or a felt tipped pen before removing. Reverse direction of rotation may lead to destruction with used belts
- ❑ Removing and installing ⇒ page 29
- ❑ Ribbed belt routing in vehicles with air conditioner ⇒ page 30
- ❑ Ribbed belt routing in vehicles without air conditioner ⇒ page 30

2 - Bolt

- ❑ Observe tightening procedure ⇒ page 40
- ❑ Renew
- ❑ Contact surface of the securing bolt must be free of oil and grease
- ❑ Insert oiled (thread)
- ❑ Secure poly V-belt sprocket with counterhold -3415- against turning
- ❑ The turning further angle can be measured with a commercially available angle measuring instrument e.g. Hazet 6690

3 - Poly V-belt sprocket for crankshaft

4 - 20 Nm

- ❑ To loosen and tighten counterhold with coolant pump wrench -V.A.G 1590- . To do this rework water pump wrench -V.A.G 1590- ⇒ page 108

5 - Belt pulley for coolant pump

- ❑ Removing and installing ⇒ page 108

6 - 9 Nm

7 - Coolant pump

- ❑ Removing and installing ⇒ page 108

8 - 25 Nm

9 - Idler roller

- ❑ Tightening torque: 40 Nm

10 - Alternator

- ❑ Removing and installing ⇒ Electrical system; Rep. Gr. 27 ; Alternator; Alternator 1.6 l FSI engine

11 - 20 Nm + 90° (1/4 turn) further

- ❑ Renew

12 - 25 Nm

13 - Air conditioner compressor

- ❑ Removing and installing ⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor

14 - 25 Nm

15 - Bush

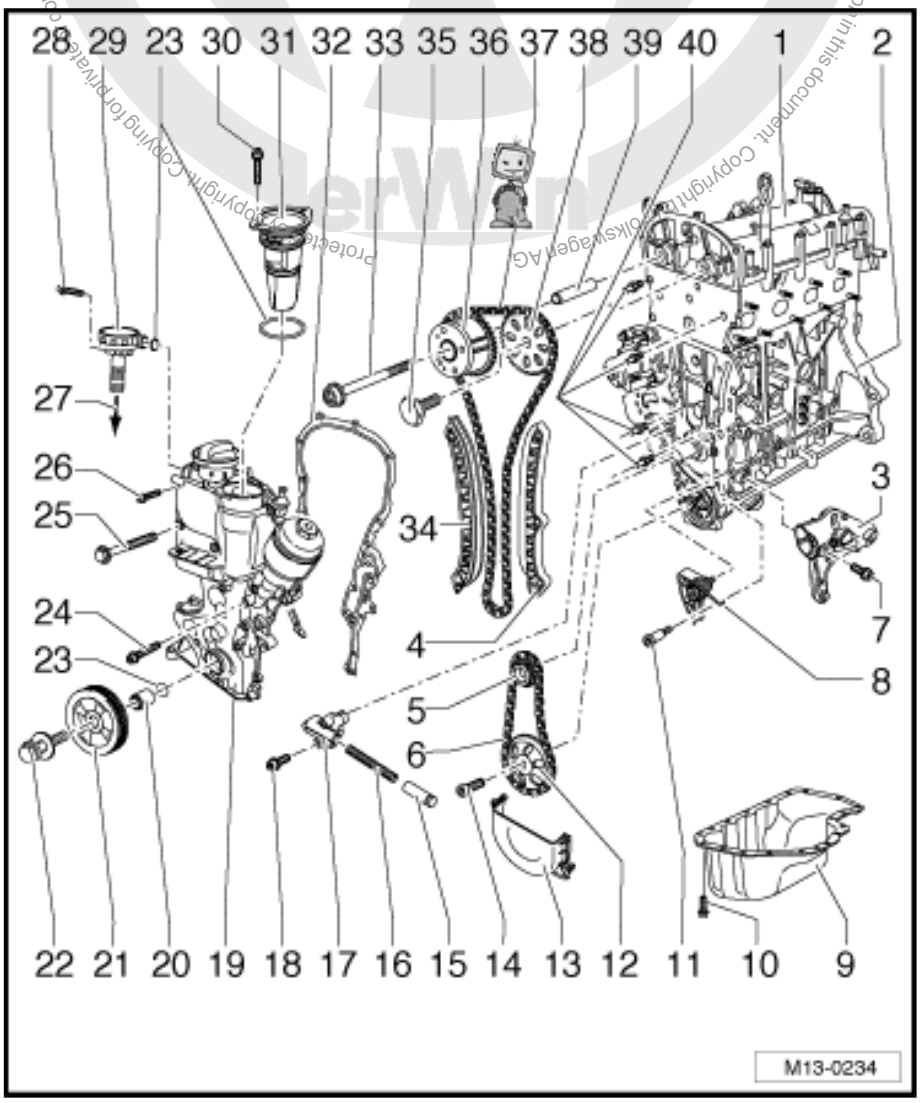
- ❑ Qty. 2

16 - Bracket for ancillaries

17 - Tensioning element for ribbed belt

- ❑ Turn with open jaw spanner to relieve tension on poly V-belt
- ❑ Secure tensioning device with a 4 mm hexagon key
- ❑ To remove, unscrew bolt ⇒ Item 11 (page 26)

1.3 Chain drive - Assembly overview



1 - Cylinder head with camshaft housing

- ❑ Sealing surface must not be reworked
- ❑ With integrated camshaft bearings
- ❑ Remove sealant remnants
- ❑ Apply sealing compound -AMV 188 100 02- before fitting
- ❑ When installing fit vertically from above with the dowel pins into the holes in the cylinder head
- ❑ Removing and installing ⇒ page 63

2 - Cylinder block

- ❑ Dismantling and assembling cylinder block ⇒ page 36
- ❑ Dismantling and assembling pistons and conrods ⇒ page 53

3 - Retainer

- ❑ For tensioning element and air conditioner compressor

4 - Sliding rail

- ❑ For control chain

5 - Chain sprocket

- ❑ Note installation position: The journal must engage into the groove of the crankshaft!
- ❑ For oil pump and control chain drive
- ❑ Contact surfaces must be free of oil and grease

6 - Drive chain

- ❑ Mark D.O.R. before removing (installation position)

7 - 25 Nm

8 - Chain tensioner with tensioning plate and tension spring

- ❑ For oil pump drive
- ❑ Tightening torque: 15 Nm
- ❑ Is replaced complete only

9 - Oil pan

- ❑ Removing and installing ⇒ page 87
- ❑ Clean sealing surface before fitting.
- ❑ Install with silicone sealing compound -D 176 404 A2-

10 - 13 Nm

11 - 15 Nm

12 - Chain sprocket

- ❑ Counterhold chain sprocket with counter-hold -T10172-

13 - Cover

14 - 20 Nm + 90° (1/4 turn) further

15 - Piston

- ❑ For chain tensioner drive chain

16 - Compression spring

17 - Chain tensioner

18 - 9 Nm

19 - Valve gear casing

- ❑ For a better guide purpose when installing, insert two M6x80 studs into the camshaft housing and the cylinder block
- ❑ Removing and installing ⇒ page 31

20 - Bearing bush

- ❑ Renew if scored
- ❑ Observe tightening procedure ⇒ page 40
- ❑ Contact surfaces must be free of oil and grease

21 - Poly V-belt sprocket

- ❑ Observe tightening procedure ⇒ page 40
- ❑ Contact surfaces must be free of oil and grease
- ❑ Secure poly V-belt sprocket with counter-hold -3415- against turning
- ❑ Removing and installing poly V-belt ⇒ page 29

22 - Bolt

- ❑ Observe tightening procedure ⇒ page 40
- ❑ Renew
- ❑ Contact surface of the securing bolt must be free of oil and grease
- ❑ Insert oiled (thread)
- ❑ Secure poly V-belt sprocket with counter-hold -3415- against turning
- ❑ The turning further angle can be measured with a commercially available angle measuring instrument e.g. Hazet 6690

23 - O-ring

- ❑ Renew

24 - Bolt, 10 Nm

- ❑ M6x45 mm

25 - 50 Nm

26 - Bolt, 10 Nm

- ❑ M6x22 mm
- ❑ Insert with locking fluid

27 - To intake manifold

28 - 10 Nm

29 - Suction relief valve

30 - 10 Nm

31 - Oil separator

32 - Seal

- ❑ Renew

33 - 40 Nm + 90° (1/4 turn) further

- ❑ Counterhold chain sprockets with counter-hold -T10172-
- ❑ Bolt with left-hand thread
- ❑ Renew

34 - Tensioning plate

35 - 50 Nm + 90° (1/4 turn) further

36 - Camshaft adjuster

- ❑ Must not be dismantled
- ❑ Removing and installing ⇒ page 69

37 - Control chain

- ❑ Mark D.O.R. before removing (installation position)

38 - Chain sprocket

- ❑ For exhaust camshaft
- ❑ Lock chain sprockets with counter-hold -T10172-

39 - Guide pins

- ❑ Tightening torque: 20 Nm

40 - Bearing bush

1.4 Removing and installing poly V-belt

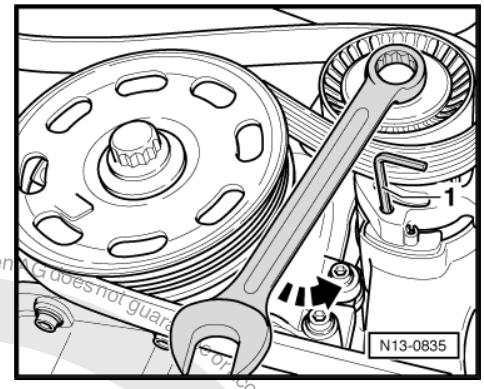
Removing

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Remove front right wheel housing liner ⇒ General Body Repairs, Exterior; Rep. Gr. 66 ; Wheel housing liner; Removing and installing front wheel housing liner .

– Mark direction of rotation of poly V-belt.

– To relieve tension on ribbed belt, swing tensioning element in -direction of arrow- using a 16 mm spanner.
– Lock tensioning element using a 4 mm hexagon key -1-.
– Remove ribbed belt.



Installing

Note

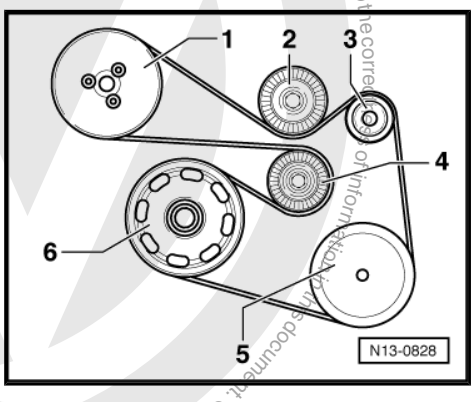
- *Ensure, before installing ribbed belt, that all ancillaries (alternator, air conditioner compressor) are secured tightly.*
- *When fitting poly V-belt, check direction of belt rotation and proper seating of belt in belt pulleys.*

– Place ribbed V-belt onto crankshaft pulley first. Slide belt onto tensioning roller last.

Further assembly is basically the reverse of the dismantling procedure.

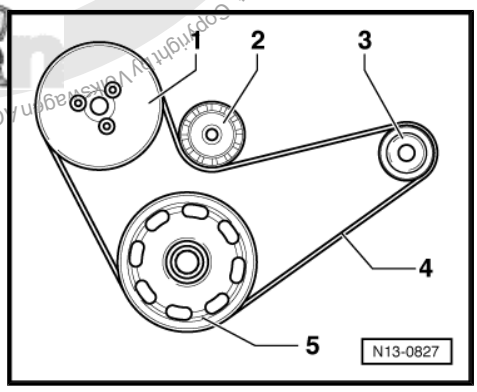
Belt drive with air conditioner compressor

1 - Belt pulley - Coolant pump
2 - Idler roller
3 - Belt pulley - Alternator
4 - Tensioning roller
5 - Belt pulley - Air conditioner compressor
6 - Belt pulley - Crankshaft



Belt drive with no air conditioner compressor

1 - Belt pulley - Coolant pump
2 - Tensioning roller
3 - Belt pulley - Alternator
4 - Poly V-belt
5 - Belt pulley - Crankshaft



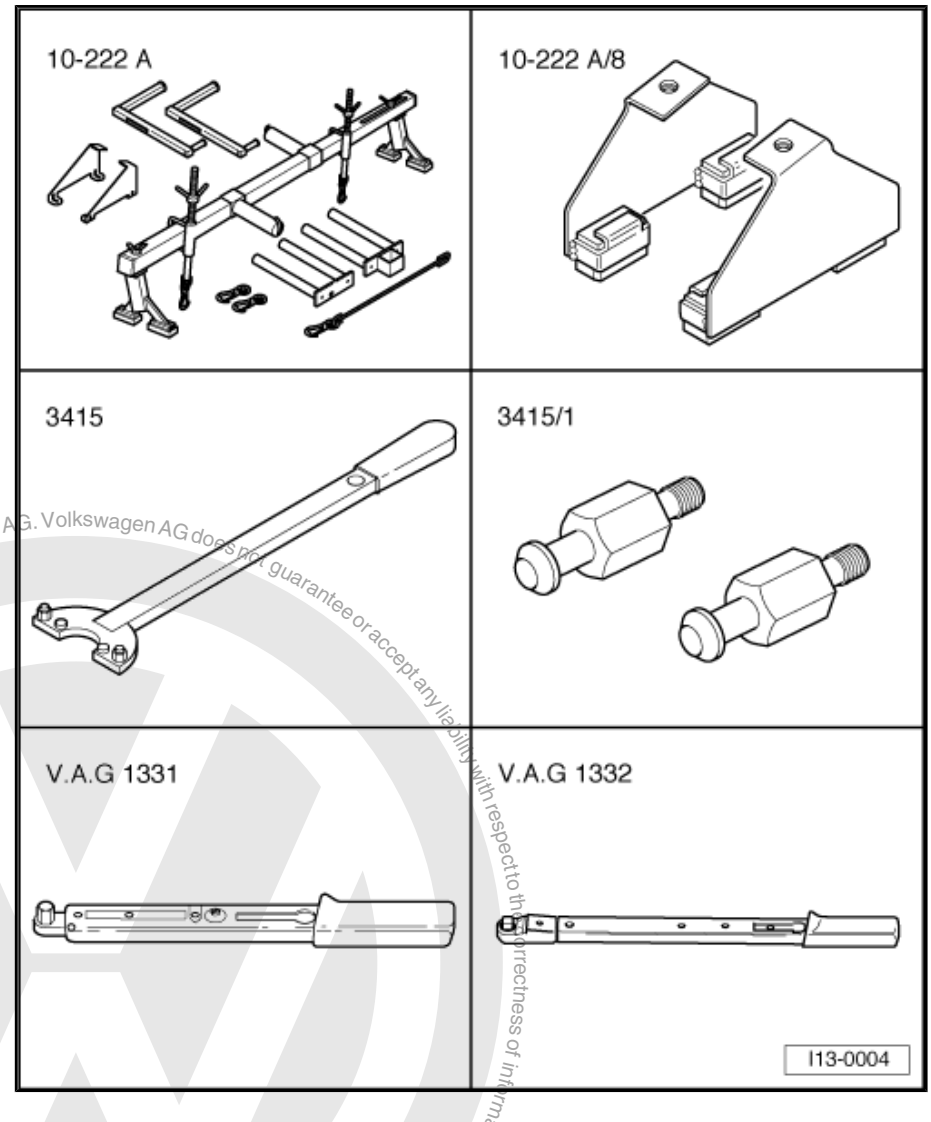
After completing repairs always:

– Start engine and check belt running.

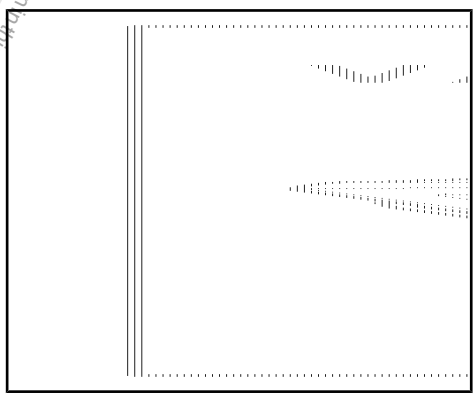
1.5 Removing and installing control housing

Special tools and workshop equipment required

- Support bracket -10-222 A-
- Adapter -10 - 222 A/8-
- Counter-hold tool -3415-
- Pin -3415/1-
- Torque wrench -V.A.G. 1331-
- Torque wrench -V.A.G. 1332-



- Drip tray for workshop hoist -VAS 6208-

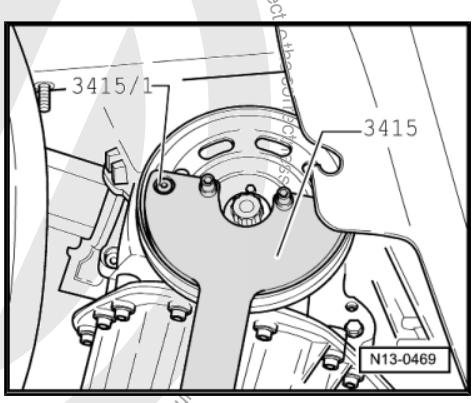


Removing

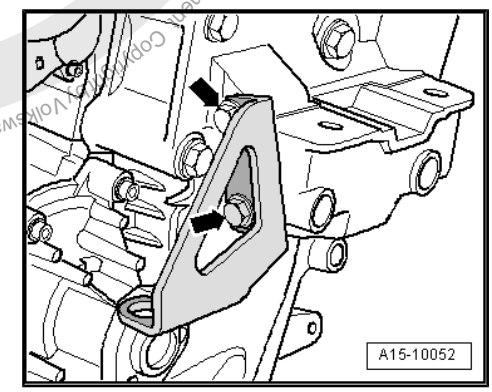
– Remove engine cover with air cleaner ⇒ page 161 .

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

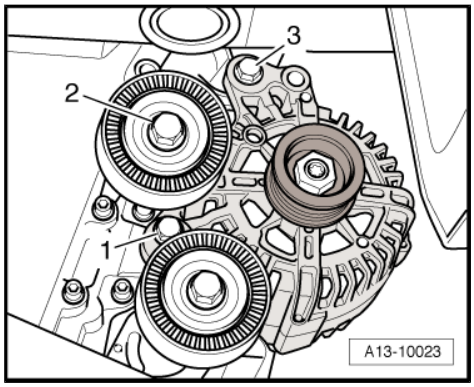
– Remove front right wheel housing liner ⇒ General Body Repairs, Exterior; Rep. Gr. 66 ; Removing and installing wheel housing liner .
– Remove pre-catalytic converter along with exhaust pipe ⇒ page 188 .
– Mark ribbed belt direction of rotation and remove ⇒ page 29 .
– Remove poly V-belt sprocket securing bolt. Lock poly V-belt sprocket using counter-hold -3415- and -3415/1- .



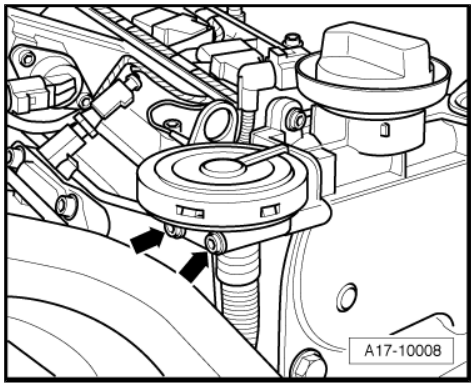
– Remove bolts -arrows- and take engine lifting eye off.
– Remove coolant pump belt pulley ⇒ page 108 .
– Remove air conditioner compressor with connected coolant hoses from bracket ⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor .
– Remove tensioning element bracket and air conditioner compressor.



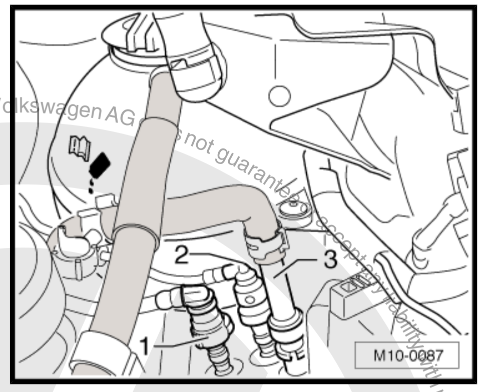
– Remove alternator and idler roller -2- ⇒ Electrical system; Rep. Gr. 27 ; Alternator; Alternator, 1.6 l FSI engine .



– Unscrew pressure control valve for crankcase heater element -arrows-.

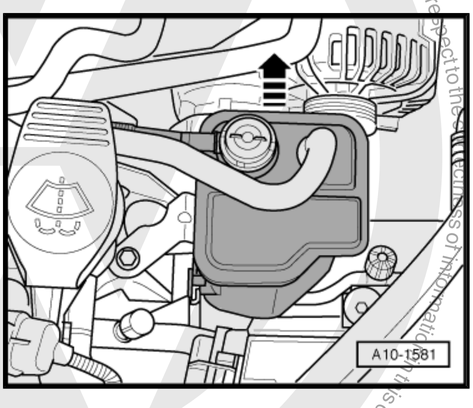


– Remove breather line -1- (press locking ring in).



– Pull activated charcoal canister off the bracket upwards -arrow-.

– Seal the lines so that the fuel system is not contaminated by dirt etc.

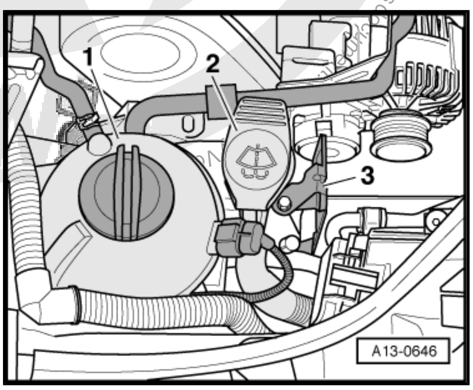


– Remove bracket -3- for activated charcoal canister.

– Remove bolt on filler neck for fluid reservoir -2-.

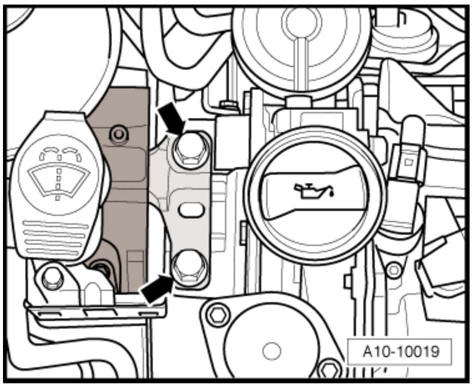
– On expansion tank, disconnect electrical connection on coolant shortage indicator sender -G32- and free wiring harness.

– Remove expansion tank -1- and lay on the engine with connected hoses, tie if necessary.

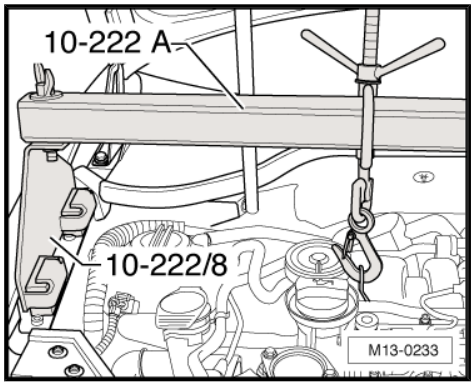


– Loosen bolts -arrows- of assembly mounting on engine just a bit (less than 1 turn).

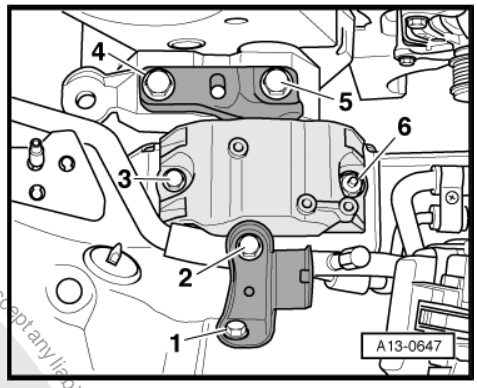
– Remove oil sump ⇒ page 87 .



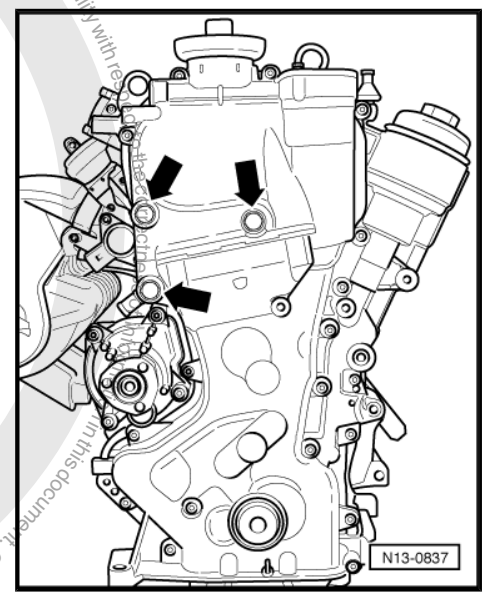
– Fit support device -10 - 222 A- using adapter -10 - 222 A/8- as shown and hook into lifting eye.
– Put engine under slight tension.



– Remove bolts -1- and -2- and remove support.
– Remove bolts from -3- to -6- and remove engine mounting.



– Remove hexagon socket head bolts of the control housing and the hexagon bolts marked with -arrows-.
– Place drip tray under the engine.
– Remove control housing. To do this raise the engine with the support device -10 - 222 A- lightly.



Note

Observe that the bearing bush for the crankshaft remains in the control housing.

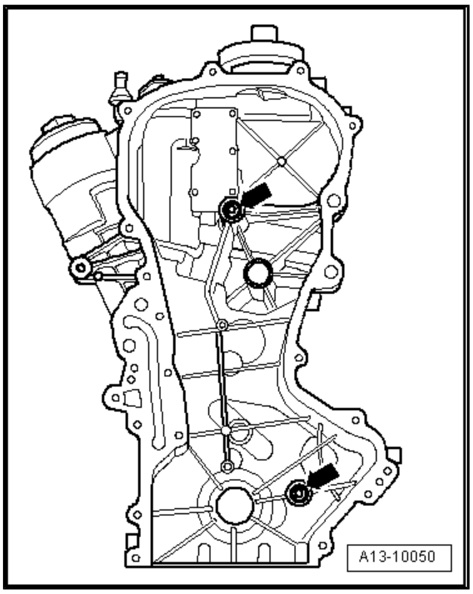
– Drive crankshaft seal for poly V-belt sprocket out of the control housing.

Installing

– Clean sealing surfaces carefully. They must be free of oil and grease.

Note

Observe that the contact surfaces of the poly V-belt sprocket, the securing bolt, the bearing bush and the crankshaft pulley sprocket must be free of oil and grease.



– Fit new seals -arrows- on the back of the control housing.

– Fit new seal onto dowel pins.

– For a better guide purpose when installing, insert two M6x80 studs into the cylinder head and the cylinder block.

– Fit the control housing at the same time onto the studs and the dowel pins.

Ensure the camshaft housing does not cant when doing this.

– Tighten control housing securing bolts uniformly using alternate sequence.

Torque settings:

◆ Bolts M6, 10 Nm

◆ Bolts M10, 50 Nm

– Renew seal for crankshaft poly V-belt sprocket ⇒ page 38 .

– Observe tightening procedure for the crankshaft poly V-belt sprocket securing bolt ⇒ page 40 .

Further installation is performed in the reverse order of removal. During this step, observe the following:

– Installing engine bracket ⇒ page 22 .

– Install oil sump ⇒ page 87 .

– Installing pre-catalytic converter along with exhaust pipe ⇒ page 188 .

– Install pendulum support ⇒ page 22 .

– Installing coolant pump belt pulley ⇒ page 108 .

– Fit air conditioner compressor with connected coolant hoses to bracket⇒ Heating, Air conditioning system; Rep. Gr. 87 ; Repair work on refrigerant circuit; Removing and installing air conditioner compressor .

– Install alternator with idler roller ⇒ Electrical system; Rep. Gr. 27 ; Alternator; Alternator, 1.6 l FSI engine .

– Install front right wheel housing liner ⇒ General body repairs, exterior; Rep. Gr. 66 ; Removing and installing wheel housing liner .

– Install noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

2 Removing and installing sealing flange and flywheel

Caution

The crankshaft must not be removed. Just loosening the main bearing caps will cause deformation of the cylinder block bearing pedestals. This deformation will cause a reduction of the bearing clearance. Even if the bearing shells are not renewed bearing damage could occur due to a different bearing clearance.

If the bearing cap bolts are loosened, the cylinder block must be replaced complete with the crankshaft.

Measuring the main bearing clearance is not possible with normal workshop equipment.

2.1 Flywheel end - Assembly overview

Caution

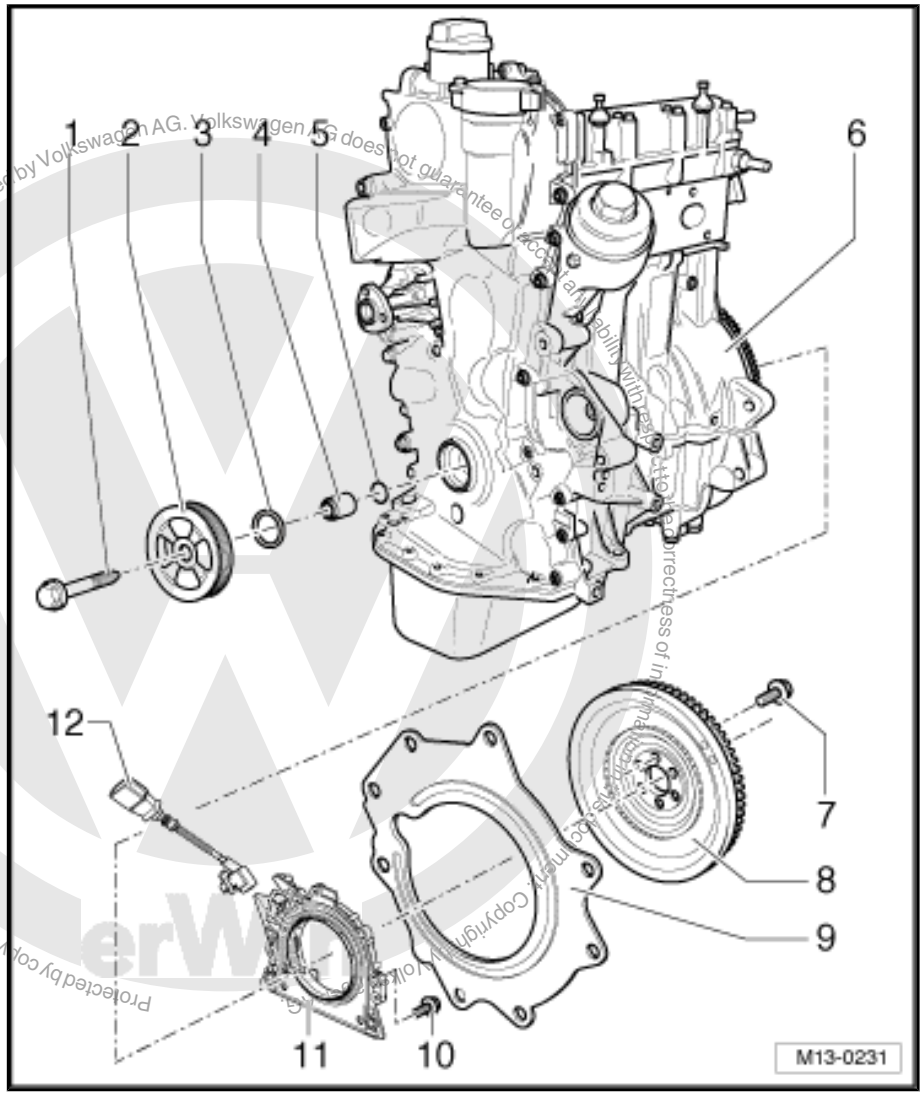
The crankshaft must not be removed. Just loosening the main bearing caps will cause deformation of the cylinder block bearing pedestals. This deformation will cause a reduction of the bearing clearance. Even if the bearing shells are not renewed bearing damage could occur due to a different bearing clearance.

If the bearing cap bolts are loosened, the cylinder block must be replaced complete with the crankshaft.

Measuring the main bearing clearance is not possible with normal workshop equipment.

Note

Servicing clutch ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 30 ; Removing and installing clutch



1 - Bolt

- ❑ Observe tightening sequence ⇒ page 40
- ❑ Renew
- ❑ Contact surface of the bolt must be free of oil and grease
- ❑ Insert oiled (thread)
- ❑ Secure poly V-belt sprocket with counter-hold -3415- against turning
- ❑ The turning further angle can be measured with a commercially available angle measuring instrument e.g. Hazet 6690

2 - Poly V-belt sprocket

- ❑ Contact surfaces must be free of oil and grease
- ❑ When removing and installing secure with counter-hold -3415- against turning
- ❑ Removing and installing poly V-belt ⇒ page 29

3 - Seal

- ❑ Renew

4 - Bearing bush

- ❑ Renew if scored
- ❑ Observe tightening procedure ⇒ page 40
- ❑ Contact surfaces must be free of oil and grease

5 - O-ring

- ❑ Renew

6 - Aluminium cylinder block

7 - 60 Nm + 90° (1/4 turn) further

- ❑ Renew

8 - Flywheel

- ❑ To remove and install counterhold flywheel with counter-hold -T10044-

9 - Intermediate plate

- ❑ Must fit on dowel sleeves
- ❑ Do not damage/bend when assembling

10 - 12 Nm

- ❑ Renew

11 - Sealing flange with sender wheel and seal

- ❑ Only renew sealing flange complete with seal and sender wheel
- ❑ Renewing crankshaft sealing flange -flywheel end- ⇒ page 43

12 - Engine speed sender -G28-

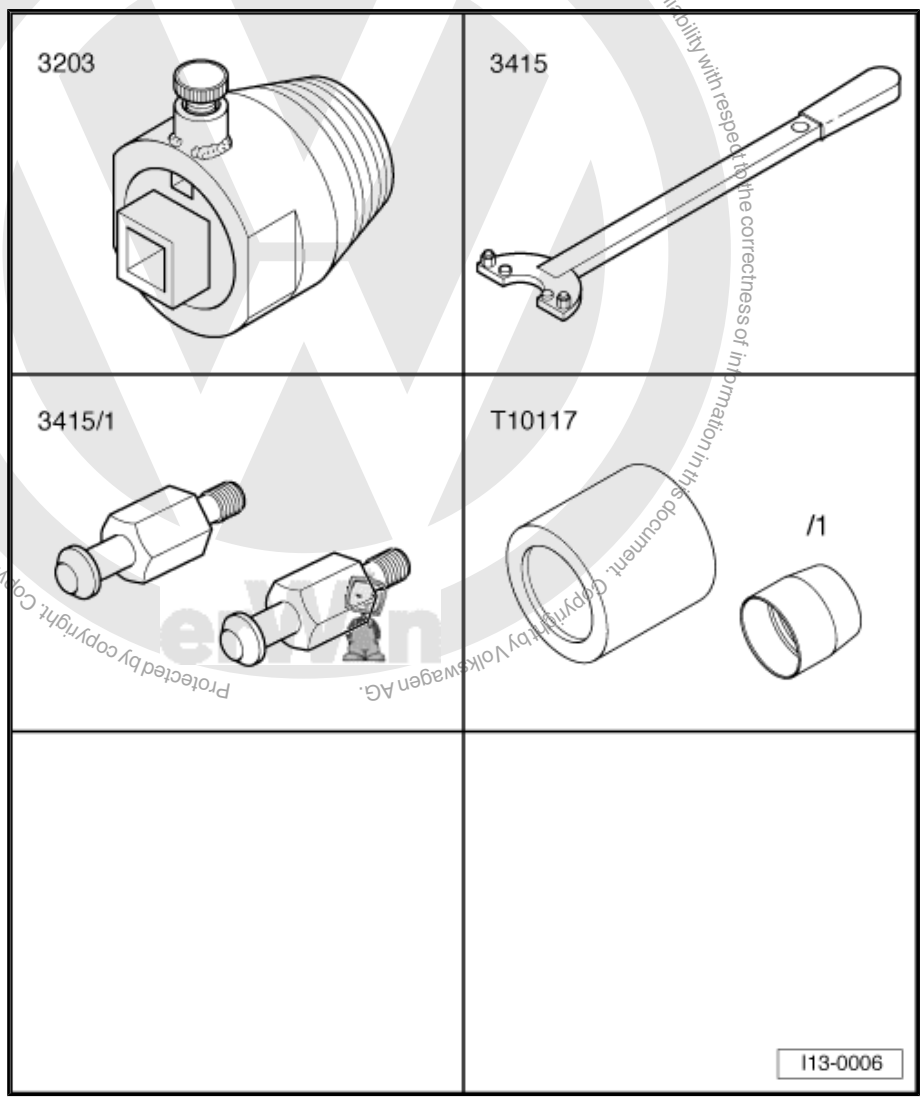
- ❑ With attached bolt

❑ Tightening torque: 5 Nm

2.2 Renewing crankshaft oil seal - belt pulley end

Special tools and workshop equipment required

- Oil seal extractor -3203-
- Counter-hold tool -3415-
- Pin -3415/1-
- Fitting appliance -T10117-

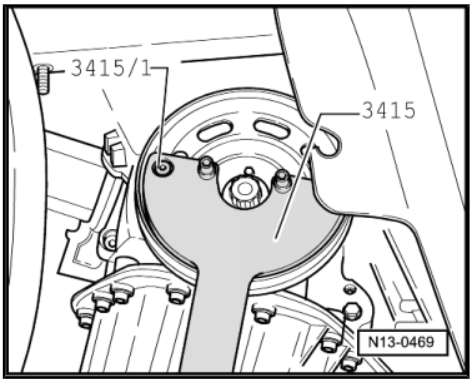


Removing

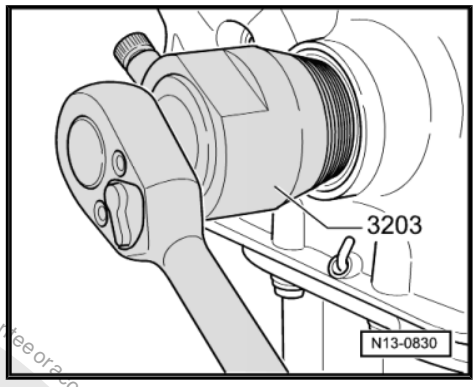
– Remove front right wheel housing liner ⇒ General Body Repairs; Rep. Gr. 66 ; Removing and installing wheel housing liner; Front wheel housing liner .

– Remove ribbed belt ⇒ page 29 .

– Loosen bolt for poly V-belt sprocket - crankshaft. To do this counterhold poly V-belt sprocket using counter-hold -3415- and pin -3415/1- .
– Unscrew bolt and take poly V-belt sprocket off.
– Unscrew inner part of oil seal extractor -3203- three turns (approx. 5 mm) out of outer part and lock with knurled screw.



– Lubricate threaded head of oil seal extractor, place it in position and exerting firm pressure screw it into oil seal as far as possible.
– Loosen knurled screw and turn inner part against mounting bush until the seal is pulled out.
– Take the mounting bush off crankshaft journal and clean the contact surfaces of the crankshaft pulley sprocket and the mounting bush.

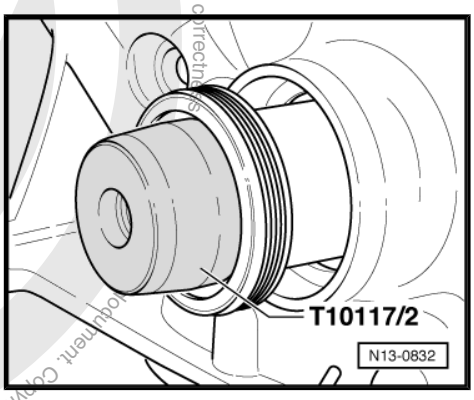


Installing

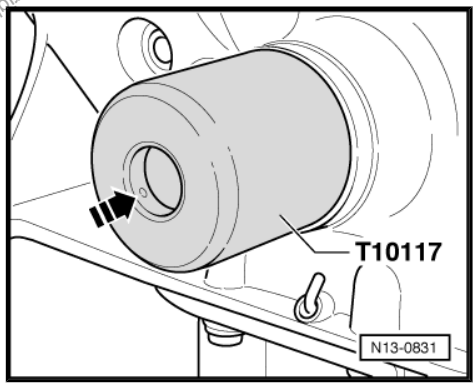
Note

Observe that the contact surfaces of the poly V-belt sprocket, the bolt, the bearing bush and the crankshaft pulley sprocket must be free of oil and grease.

– Renew O-ring ⇒ Item 5 (page 37) .
– Slide the bearing bush with the new O-ring onto the crankshaft journal.
– Place the sleeve -T10117/2- onto the bush and the seal onto the bearing bush.
– Take sleeve -T10117/2- off bearing bush.



– Using even blows, press the seal into control housing up to limit stop using assembly device -T10117- .
– Tighten bolt for poly V-belt sprocket - crankshaft ⇒ page 40 .

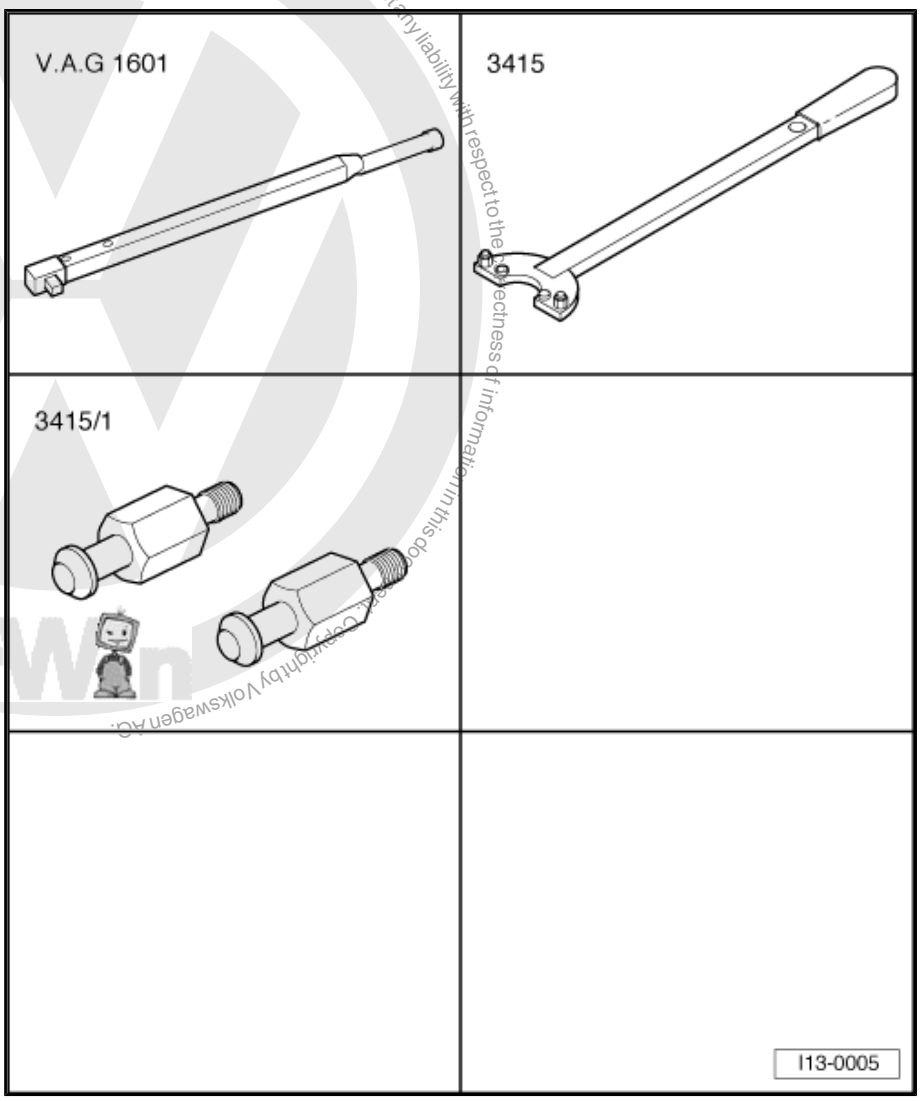


Further assembly is basically the reverse of the dismantling procedure.

2.3 Tighten bolt for poly V-belt sprocket - crankshaft

Special tools and workshop equipment required

- Torque wrench -V.A.G 1601-
- Counter-hold tool -3415-
- Pin -3415/1-



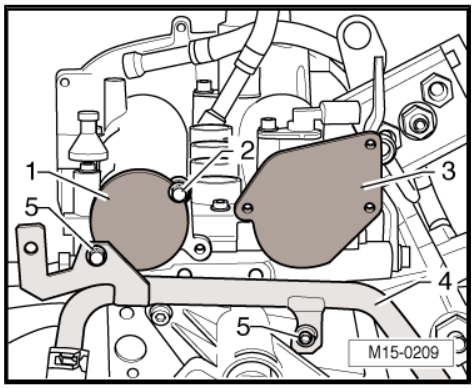
– Remove exhaust gas recirculation valve -N18- ⇒ page 195 .

– Unhook wiring harness (not shown in the figure) on the coolant pipe -4-.

– Remove bolts -5- from coolant pipe -4-.

– Remove bolt -2- from cap -1-.

– Take caps -1- and -3- off. Collect leaking engine oil with a cloth.



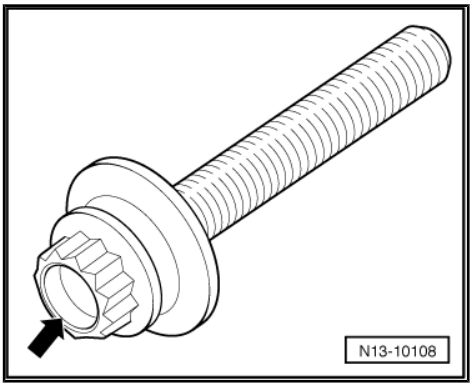
Note

Observe that all contact surfaces from the bolt for the poly V-belt sprocket - crankshaft up to the crankshaft pulley sprocket must be free of oil and grease.

– Place poly V-belt sprocket to the bearing bush and screw new bolt into for the poly V-belt sprocket.

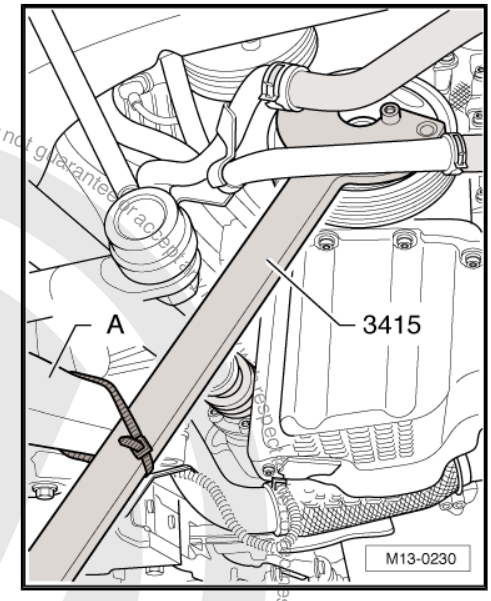
The bolt for the poly V-belt sprocket is spotted on the bolt head -arrow-.

Always use a new bolt.

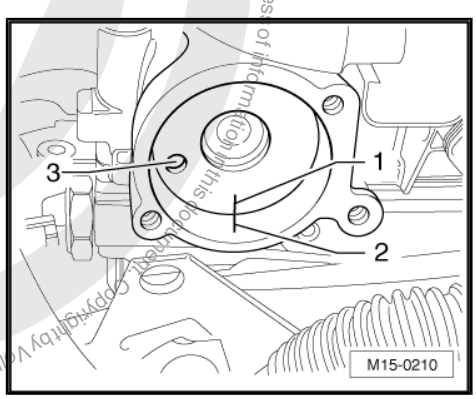


– Set the counter-hold -3415- into the openings of the poly V-belt sprocket using pin -3415/1- , support counter-hold on wishbone -A- and secure in this position using a cable tie. Tighten cable tie tightly.
– Tighten bolt for poly V-belt sprocket in the 1st stage as follows:

Tightening torque: 150 Nm



– Now mark position of exhaust camshaft -1- to camshaft housing -2- with a coloured pen. The position of the hole -3- is not relevant for the later check.

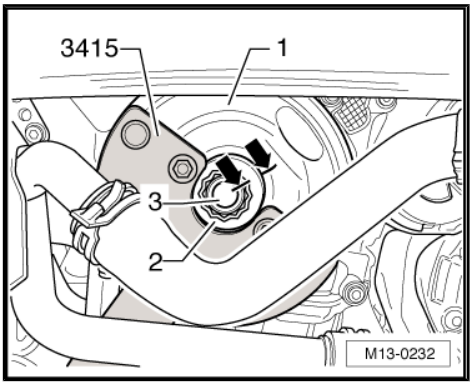


– In this position mark the position of the bolt -3- to the poly V-belt sprocket -1- -arrows-. The marking must not be made on the washer -2- otherwise it will not turn when turning further.
– Now tighten bolt for poly V-belt sprocket in the 2nd stage as follows:

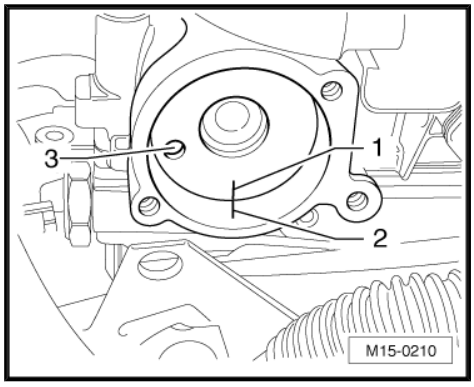
Turn bolt 180° (1/2 turn) further.

Turning further can be done in several stages.

– Check exhaust camshaft position.



- Both markings -1- and -2- must align.



If both markings -1- and -2- align.

– Check timing ⇒ page 67 .

  In this way it is checked whether the chain sprocket has turned on the crankshaft when the bolt for the poly V-belt sprocket was tightened.

If the markings -1- and -2- do not align.

– Check timing ⇒ page 67 .

If the timing is not OK:

– Adjust timing ⇒ page 69 .

Note

First check whether the journal of the chain sprocket is still in the crankshaft groove.

– If the journal of the chain sprocket is not in the crankshaft groove anymore, remove and check it for damage.

  Replace a damaged chain sprocket.

If the timing is OK:

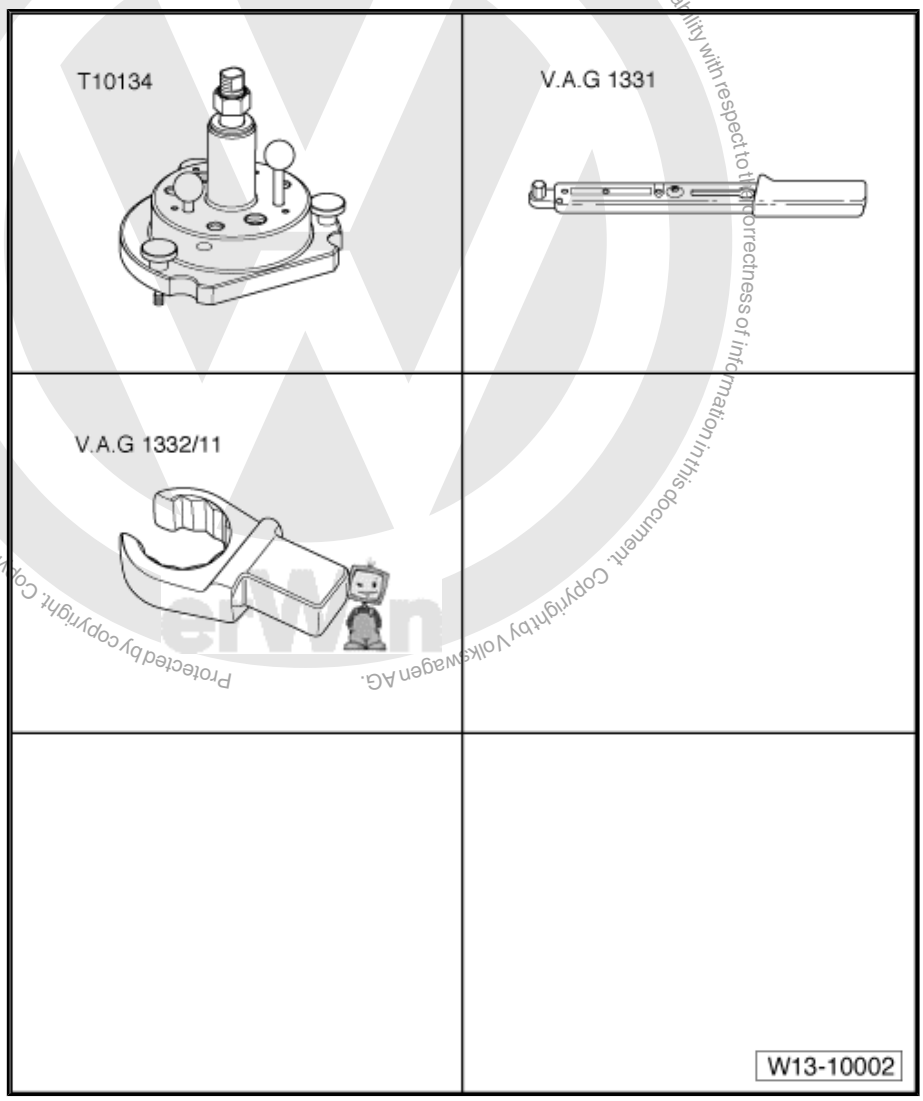
  The crankshaft has been turned to the poly V-belt sprocket.

– Remove poly V-belt sprocket, seal and bearing bush and clean thoroughly. They must be free of oil and grease.
– Replace damaged parts.
– Thoroughly clean also the contact surface of the chain sprocket.
– Reinstall parts with a new bolt for the poly V-belt sprocket.

2.4 Renewing crankshaft sealing flange -flywheel end-

Special tools and workshop equipment required

- Fitting appliance -T10134-
- Torque wrench -V.A.G. 1331-
- Socket insert AF 24 -V.A.G. 1332/11-
- Three M6×35 mm hexagon bolts
- Feeler gauges
- Vernier gauge



Procedure

Note

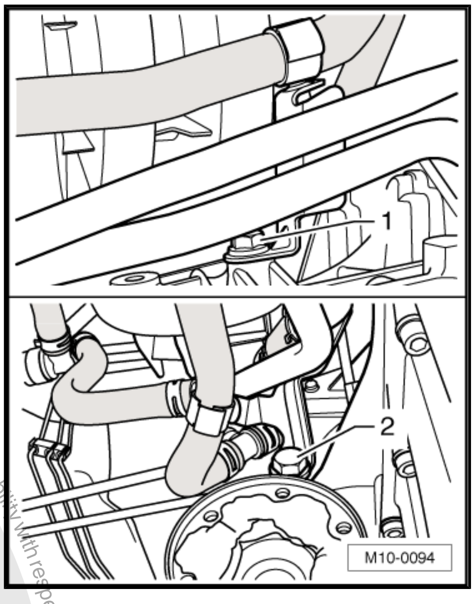
- *To show the work sequence more clearly, the sequence is described for a removed engine.*
- *The work sequence is the same when the engine is in the vehicle and the gearbox removed.*

Pressing sealing flange with sender wheel off crankshaft

– Remove the flywheel ⇒ page 50 .
– Remove intermediate plate.
– Position engine at TDC for cylinder No. 1. ⇒ page 67 .
– Remove oil sump ⇒ page 87 .

Models with auxiliary heater

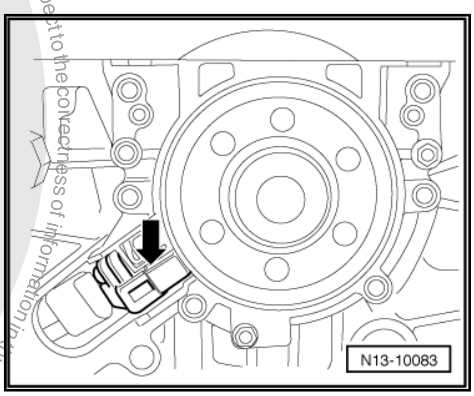
– Remove bolts -1- and -2- and pull coolant hoses off engine and gearbox. The coolant hoses remain connected.



Continuation for all vehicles

– Remove engine speed sender -G28- -arrow-.

– Undo sealing flange securing bolts.

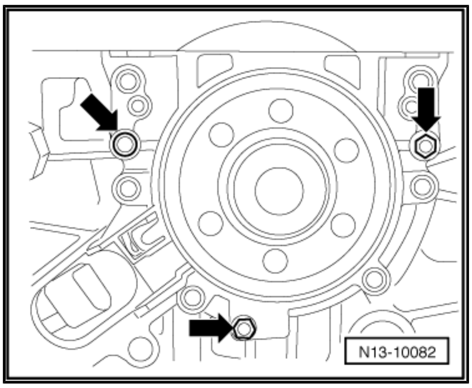


Note

Sealing flange and sender wheel are pressed off the crankshaft with M6×35 mm bolts.

– Screw three M6×35 mm bolts into the threaded holes of the sealing flange -arrow-.

– Screw bolts alternately (maximum $^1/_2$ turn (180 °) for each bolt) into sealing flange and press sealing flange together with sender wheel off crankshaft.



Pressing sealing flange with sender wheel onto crankshaft

Note

- *The sealing flange with a PTFE seal is equipped with a sealing lip support ring. This support ring serves the function of a fitting sleeve and may not be removed prior to installation.*
- *Sealing flange and sender wheel must not be separated or twisted after removal from packaging.*
- *The sender wheel is held in its installation position on the assembly device -T10134- by a locating pin.*
- *Sealing flange and seal are one unit and must be replaced together with the sender wheel only.*
- *The assembly device -T10134- is held in its position relative to the crankshaft by a guide pin inserted into a hole in the crankshaft.*

Fitting appliance -T10134-

A - Clamping surface

B - Hexagon nut

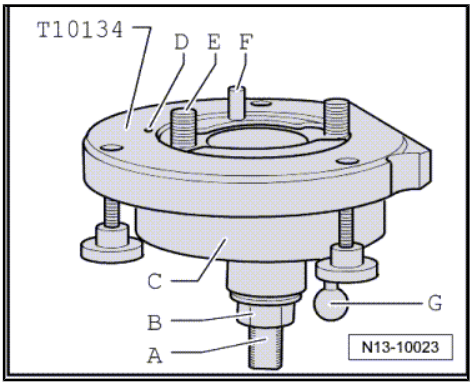
C - Assembly bell housing

D - Locating pin

E - Hexagon socket head bolt

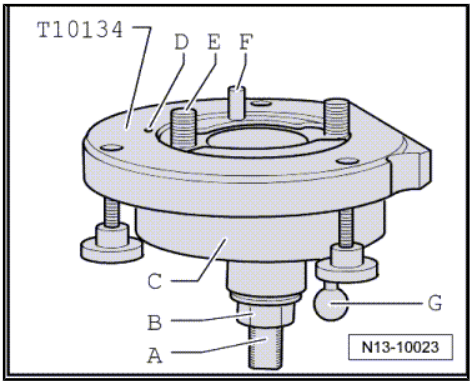
F - Guide pin for diesel engines (black knob)

G - Guide pin for petrol engines (red knob)



A - Fit assembling seal with sender wheel on assembly appliance -T10134-

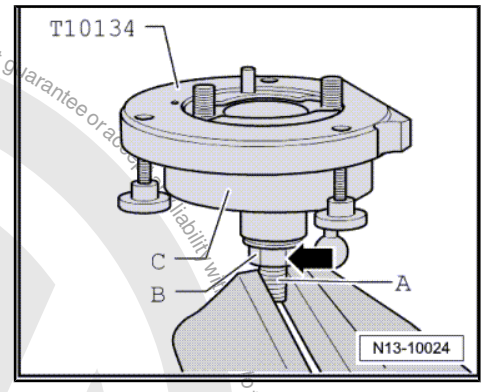
– Screw hexagon nut -B- to just before clamping surface -A- of threaded spindle.



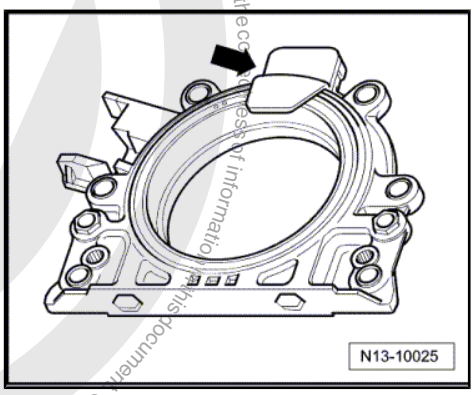
– Clamp assembly device -T10134- in a vice on clamping surface -A- of threaded spindle.

– Press assembly bell housing -C- downwards so that it lies on hexagon nut -B- -arrow-.

– Screw hexagon nut onto the threaded spindle until the inner part of assembly appliance and the assembly bell housing are at same height.



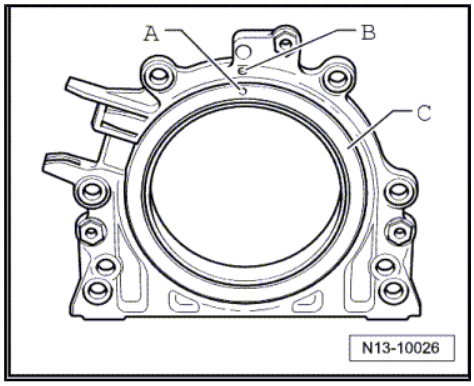
– Remove securing clip -arrow- from new sealing flange.



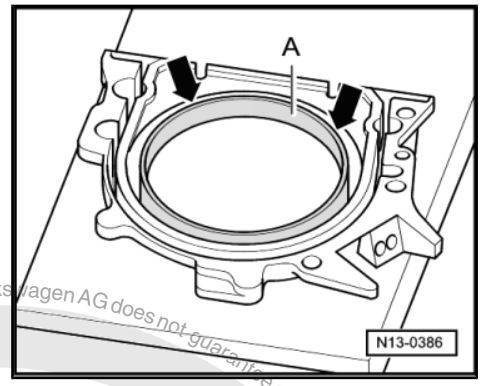
Note

The sender wheel must not be taken out of the sealing flange or twisted.

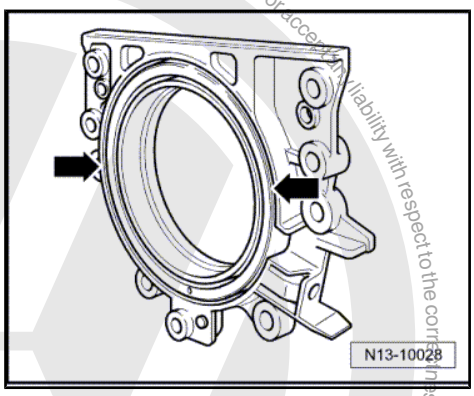
– Locating hole -A- on sender wheel -C- must align with marking -B- on sealing flange.
– Place sealing flange with front side downwards on a clean flat surface.



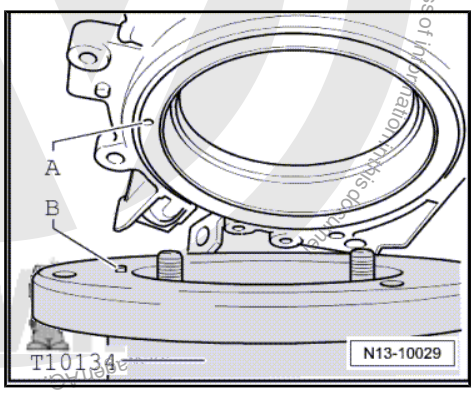
– Push sealing lip support ring -A- downwards in -direction of arrow- until it lies on flat surface.



– Upper edge of sender wheel and front edge of sealing flange must align -arrows-.



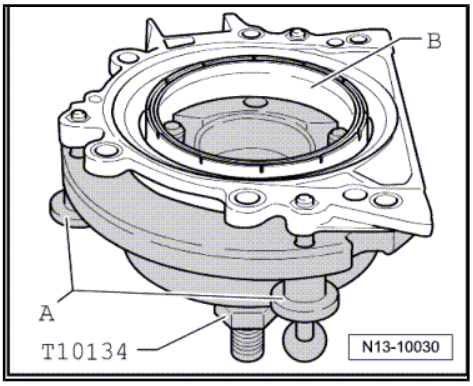
– Place sealing flange with front side on assembly device -T10134- that locating pin -B- can be inserted in sender wheel hole -A-.



Note

Ensure sealing flange lies flat on assembly device.

– Push sealing flange and support ring for sealing lip -B- against surface of assembly device -T10134- whilst tightening the three knurled screws -A-, so that locating pin cannot slide out of sender wheel hole.



Note

When installing sealing flange, ensure that sender wheel remains fixed in assembly device.

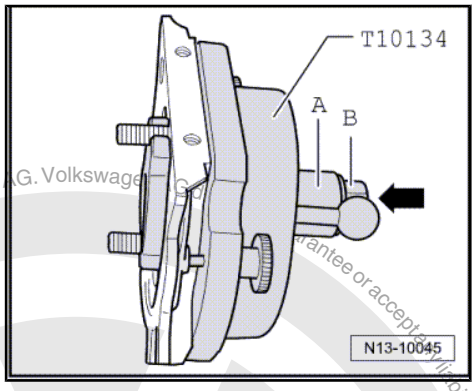
B - Attaching assembling tool -T10134- with sealing flange to crankshaft flange

- Crankshaft flange must be free of oil and grease.
- Engine positioned at TDC No. 1 cylinder.

– Screw hexagon nut -B- to end of threaded spindle.

– Press threaded spindle of assembly tool -T10134- in -direction of arrow-, until hexagon nut -B- lies against assembly bell housing -A-.

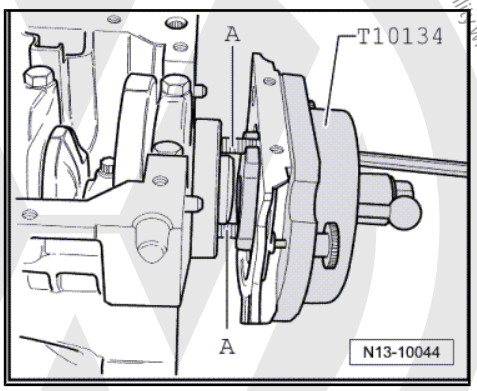
– Align flat side of assembly bell housing towards oil sump side of crankcase sealing surface.



– Secure assembly tool -T10134- to crankshaft flange using hexagon socket head bolts -A-.

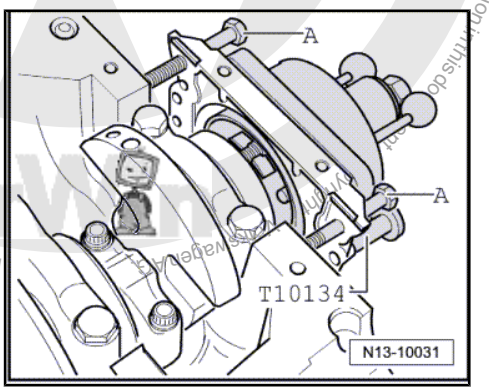
Note

Screw hexagon socket head bolts -A- into crankshaft flange (approx. 5 threads).

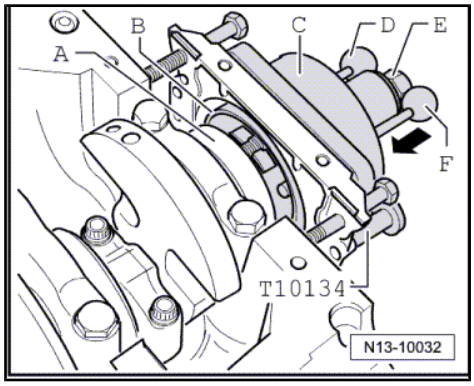


– Screw two M6x35 mm bolts -A- into the cylinder block to guide the sealing flange.

C - Bolting assembly tool -T10134- onto crankshaft flange



– Push assembly bell housing -C- by hand in -direction of arrow- until sealing lip support ring -B- contacts crankshaft -A-.
– Push guide pin for petrol engines (red knob) -F- into threaded hole in crankshaft. This ensures that the sender wheel reaches its final installation position.



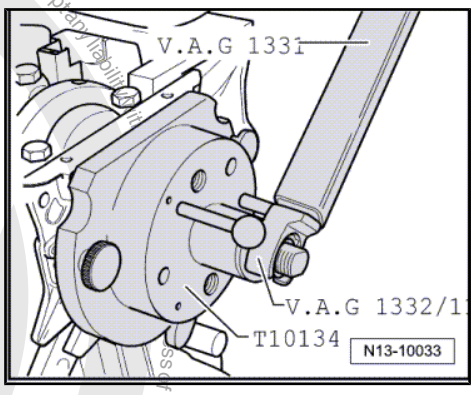
Note

The guide pin for diesel engines (black knob) -F- must not be inserted in threaded hole of crankshaft.

– Hand tighten both hexagon socket head bolts of assembly tool.
– Screw hexagon nut -E- onto threaded spindle by hand until it lies against assembly bell housing -C-.

D - Pressing sender wheel onto crankshaft flange using assembly tool -T10134-

– Tighten hexagon nut of assembly tool -T10134- to 35 Nm using torque wrench -V.A.G 1331- and 24 mm insert -V.A.G 1332/11-

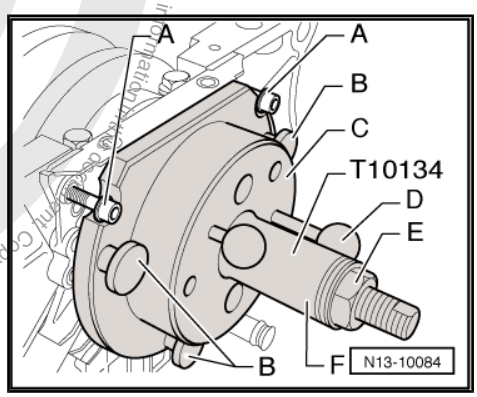


Note

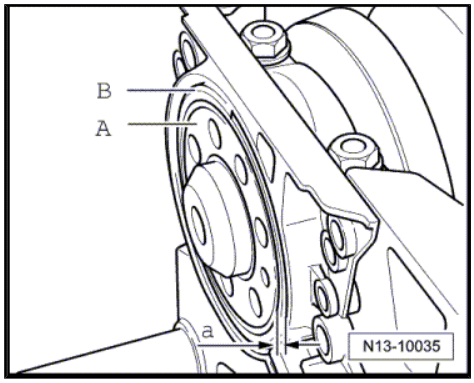
After hexagon nut is tightened to 35 Nm torque, a small air gap must be present between cylinder block and sealing flange.

E - Checking sender wheel installation position on crankshaft

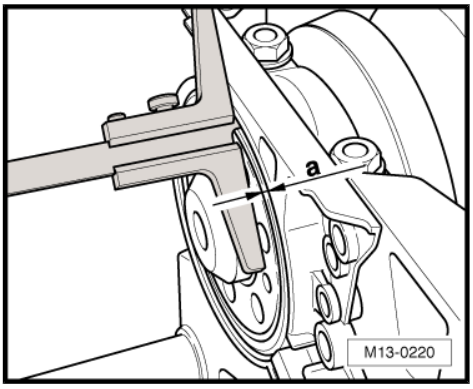
– Screw hexagon nut -E- to end of threaded spindle.
– Remove the two bolts -A- from cylinder block.
– Screw the three knurled screws -B- out of sealing flange.
– Remove assembly tool -T10134- .
– Remove sealing lip support ring.



– The sender wheel is in the correct installation position on the crankshaft if a gap -a- = 0.5 mm exists between crankshaft flange -A- and sender wheel -B-.
– Set vernier gauge on crankshaft flange.



– Measure distance -a- between crankshaft flange and sender wheel.



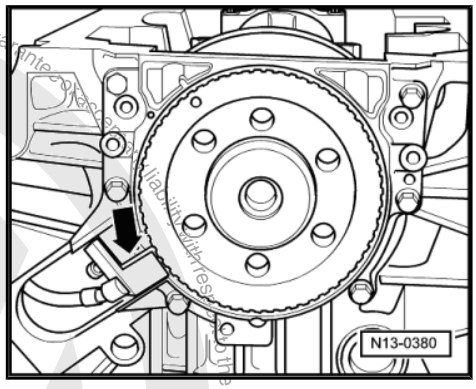
Is measurement -a- too small:

– Press sender wheel further ⇒ page 49

When dimension -a- is achieved:

– Tighten new securing bolts for sealing flange to 15 Nm using alternate and diagonal sequence.

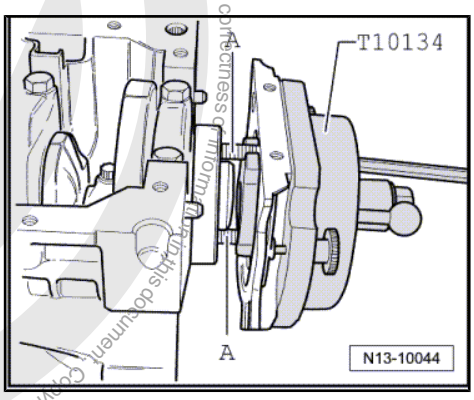
– Install engine speed sender -G28- -arrow- and tighten securing bolt to 5 Nm.



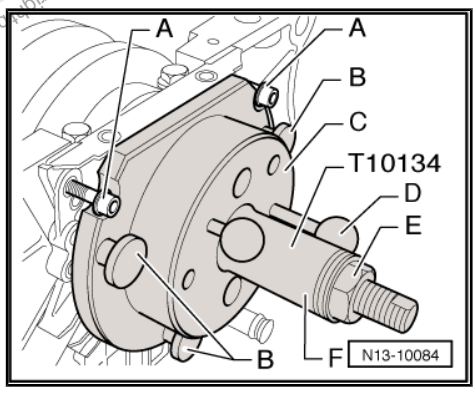
– Install oil sump ⇒ page 87 .
– Install intermediate plate.
– Install flywheel ⇒ page 50 .

F - Re-pressing sender wheel

– Secure assembly tool -T10134- to crankshaft flange using hexagon socket head bolts -A-.
– Hand tighten both hexagon socket head bolts.
– Push assembly tool -T10134- by hand to sealing flange.

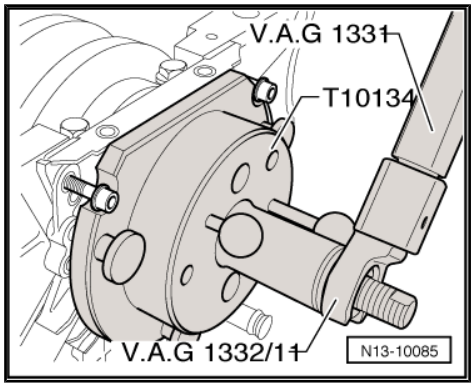


– Screw hexagon nut -E- onto threaded spindle by hand until it lies against assembly bell housing -C-.



– Tighten hexagon nut of assembly tool -T10134- to 40 Nm using torque wrench -V.A.G 1331- and 24 mm insert -V.A.G 1332/11- .

– Check installation position of sender wheel on crankshaft again ⇒ page 48 .



If dimension -a- is too small again:

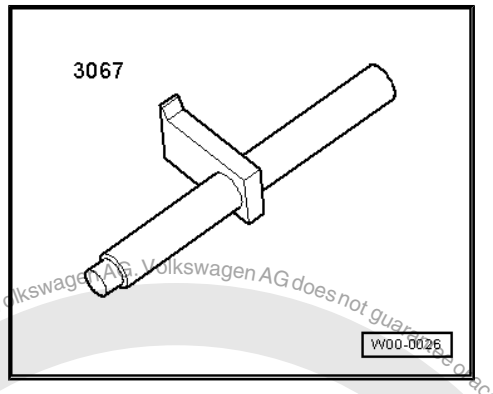
– Tighten hexagon nut for assembly tool assembly device -T10134- to 45 Nm.

– Check installation position of sender wheel on crankshaft again ⇒ page 48 .

2.5 Removing and installing flywheel

Special tools and workshop equipment required

♦ Counter-hold tool -3067-



Removing

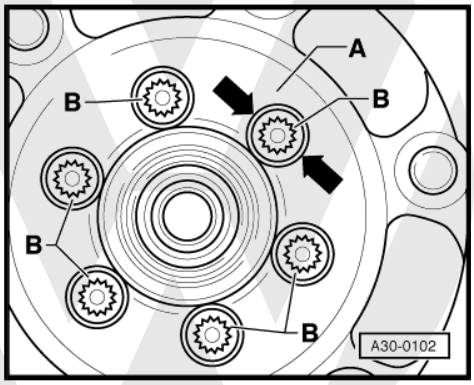
– Remove gearbox ⇒ 6-speed manual gearbox 0AG; Rep. Gr. 34 ; Removing and installing gearbox .

Note

To avoid damaging the dual-mass flywheel during removal, the bolts -B- must not be removed using a pneumatic or impact driver. The bolts -B- must be unscrewed by hand only.

– Rotate the dual-mass flywheel -A- so that the bolts -B- align centrally with the holes -arrows-.

– When removing bolts -B-, make sure that screw heads do not jam on flywheel.



– Insert counter-hold tool -3067- in hole on cylinder block.

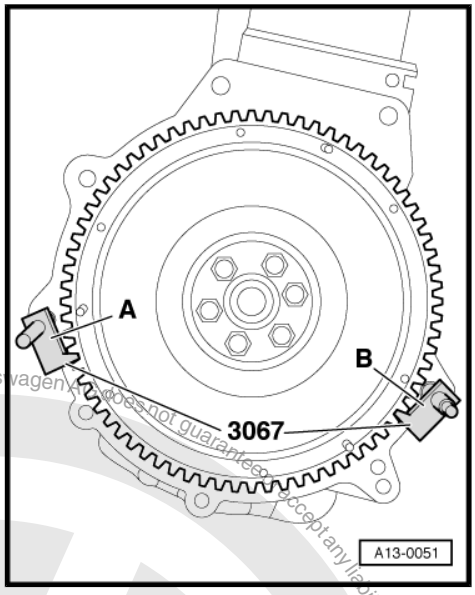
• Installation position of counter-hold:

A - To tighten

B - To loosen

– Mark position of flywheel in relation to engine.

– Unbolt flywheel.



Installing

Install in reverse order of removal. During this step, observe the following:

– Renew bolts and tighten to 60 Nm and 90° ($^1/_4$ turn) further.

3 Removing and installing crankshaft

Caution

The crankshaft must not be removed. Just loosening the main bearing caps will cause deformation of the cylinder block bearing pedestals. This deformation will cause a reduction of the bearing clearance. Even if the bearing shells are not renewed bearing damage could occur due to a different bearing clearance.

If the bearing cap bolts are loosened, the cylinder block must be replaced complete with the crankshaft.

Measuring the main bearing clearance is not possible with normal workshop equipment.

3.1 Crankshaft dimensions

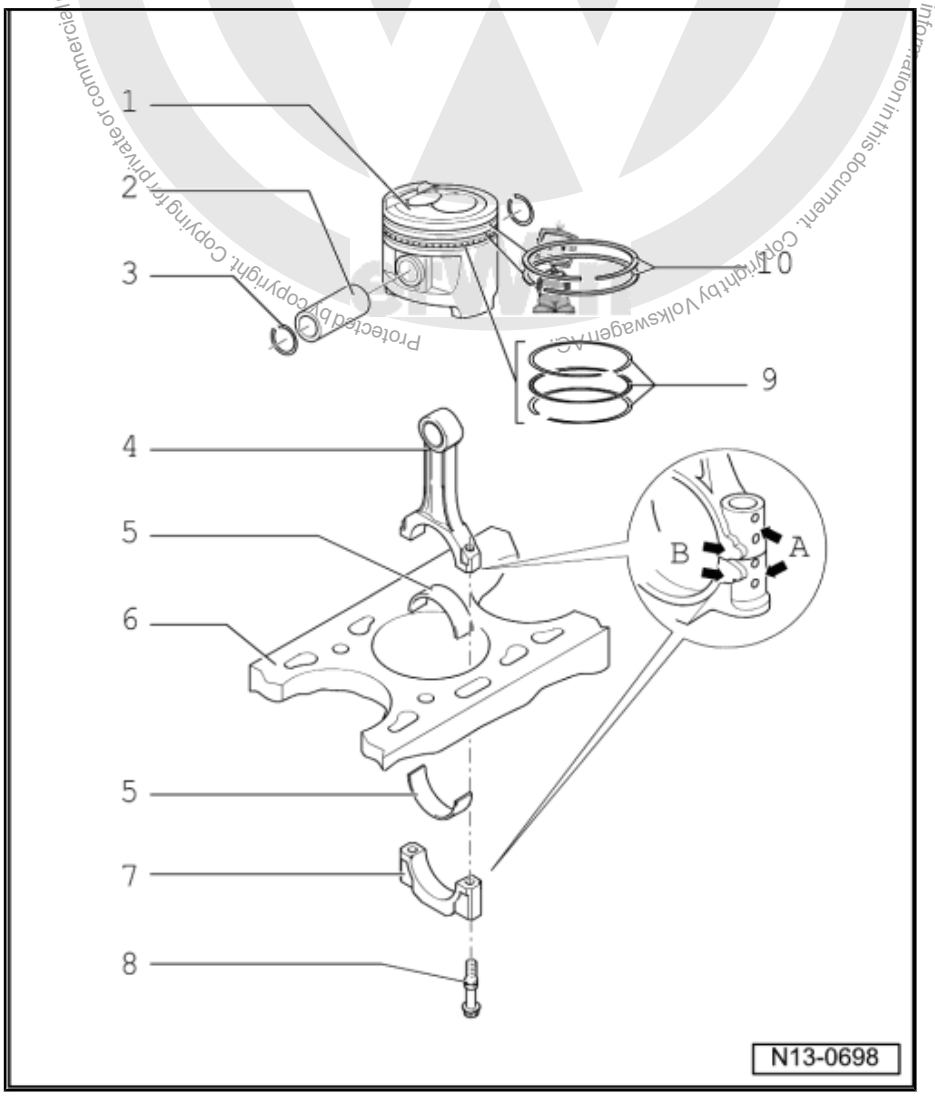
Honing dimension dimensions in mm	Conrod bearing journal-Ø
Basic dimension	-0,022 47,80 -0,037
1st undersize	-0,022 47,55 -0,037
2nd undersize	-0,022 47,30 -0,037
3rd undersize	-0,022 47,05 -0,037

4 Dismantling and assembling pistons and conrods

4.1 Pistons and conrods - Assembly overview

Note

Oil all contact surfaces before beginning with the assembly work.



1 - Piston

- ❑ Checking ⇒ page 54
- ❑ Mark installation position and cylinder number
- ❑ Arrow on piston crown points to belt pulley end
- ❑ Install using piston ring clamp

2 - Piston pin

- ❑ If difficult to remove, heat piston to 60 °C
- ❑ Remove and install drift -10 - 14-

3 - Retaining ring

4 - Conrod

- ❑ Renew as set only
- ❑ Mark cylinder number -arrows A-
- ❑ Installation position: Marking -arrows B- faces towards pulley end
- ❑ Guided axially via piston

5 - Ball socket

- ❑ Do not interchange used bearing shells.
- ❑ Insert bearing shells centrally

Check radial clearance with Plastigage:

- ❑ New: 0.020…0.060 mm
- ❑ Wear limit: 0.090 mm
- ❑ Do not rotate crankshaft when checking radial clearance

6 - Cylinder block

- ❑ Checking cylinder bores ⇒ page 55
- ❑ Piston and cylinder dimensions ⇒ page 55

7 - Conrod bearing cap

- ❑ The caps only fit in one position and only on the appropriate conrod, this is due to the breaking procedure (industrially cracking) separating the cap from the conrod

8 - Conrod bolt, 30 Nm + 90° (1/4 turn) further

- ❑ Renew
- ❑ Oil threads and contact surfaces
- ❑ To measure radial clearance, tighten to respective tightening torque, but do not turn further

9 - Oil scraper ring

- ❑ Remove and install 3-part oil scraper ring carefully by hand
- ❑ Offset end of upper steel band ring by 120° to adjacent compression ring
- ❑ Install part ends of the oil scraper ring offset to each other
- ❑ Checking ring gap ⇒ page 54
- ❑ Clearance can not be measured

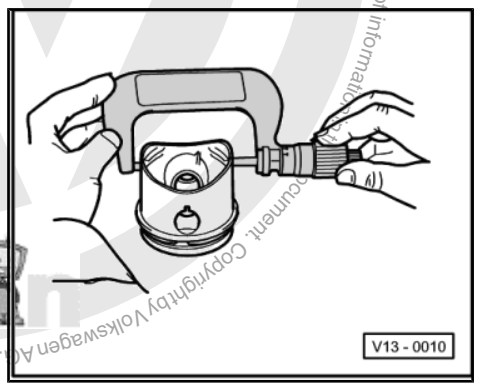
10 - Compression rings

- ❑ Offset gaps by 120°
- ❑ Remove and install compression rings using piston ring pliers.
- ❑ “TOP” faces towards piston crown.
- ❑ Checking ring gap ⇒ page 54
- ❑ Checking ring-to-groove clearance ⇒ page 54

4.2 Check piston

Special tools and workshop equipment required

- ♦ External micrometer 75...100 mm

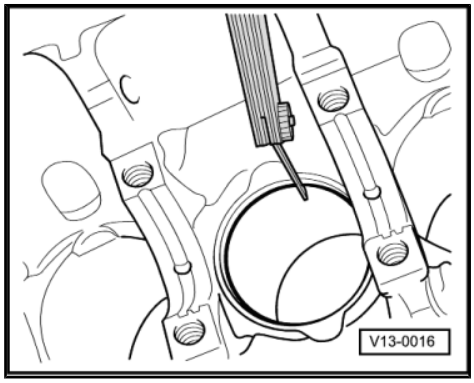


Check piston

– Measure pistons approx. 12 mm from the lower edge of skirt, at 90° to the piston pin axis. Deviation from nominal dimension max. 0.04 mm. Nominal dimension ⇒ page 55 .

Checking piston ring gap

– Push ring squarely from above down to approx. 15 mm from bottom end of cylinder.



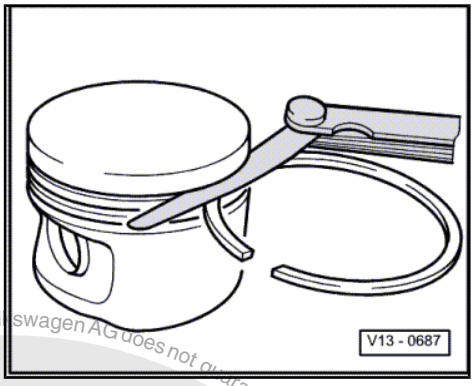
Piston ring dimensions in mm	new	Wear limit
1st compression ring	0,20…0,50	1,0
2nd compression ring	0,40…0,60	1,0
Oil scraper ring	0,20…1,10	---[1)]

1) No wear limit details

piston ring-checking ring-to-groove clearance

Clean groove before check.

Piston ring dimensions in mm	new	Wear limit
1st compression ring	0,04…0,08	0,15
2nd compression ring	0,02…0,06	0,15
Oil scraper ring	Can not be measured	



4.2.1 Checking cylinder bores

Special tools and workshop equipment required

- Internal dial gauge 50…100 mm

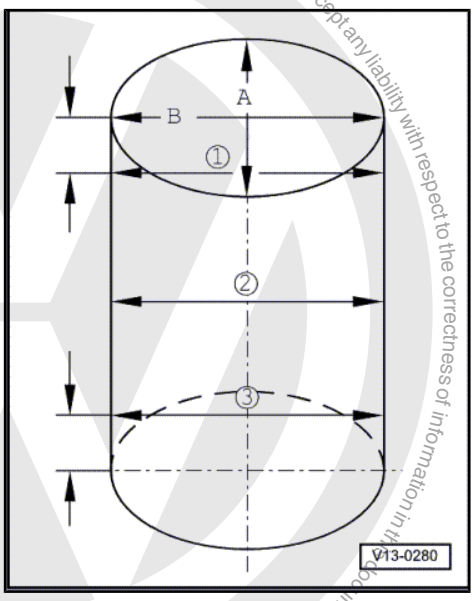
Checking cylinder bores

– Take measurements at 3 positions in both lateral -A- and longitudinal -B- planes, as illustrated. Deviation from nominal dimension max. 0.08 mm.

– Nominal dimension ⇒ page 55 .

Note

Measuring the cylinder bores must not be done when the cylinder block is fitted to the engine/gearbox bracket -VAS 6095- as incorrect measurements would then be possible.



4.3 Piston and cylinder dimensions

Honing dimension		Piston Ø[2)]	Cylinder bore Ø
Basic dimension	mm	76,455	76,51
1st oversize	mm	76,705	76,76
2nd oversize	mm	76,955	77,01

2) Measure approx. 12 mm from the piston lower edge

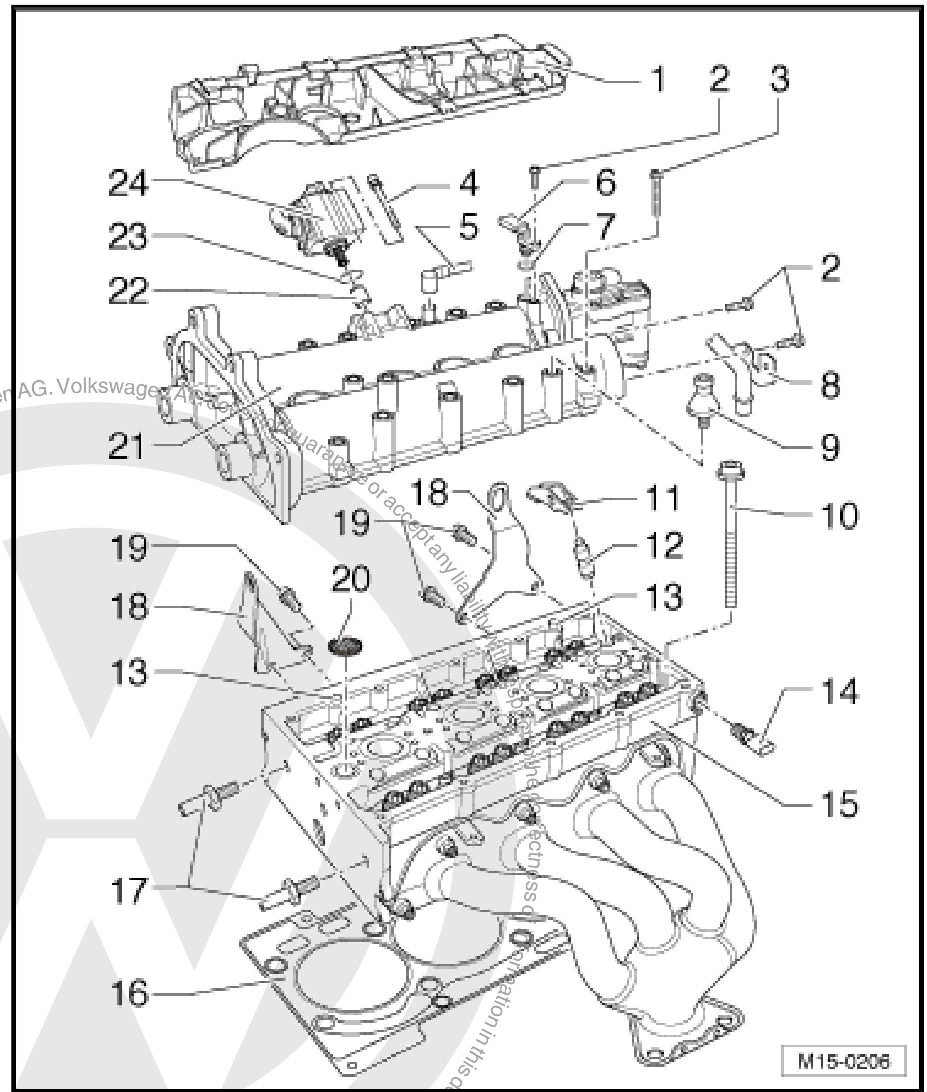
15 – Cylinder head, valve gear

1 Cylinder head

Note

- *When installing an exchange cylinder head, all the contact surfaces between the support elements, roller rocker fingers and the cams must be oiled before installing the camshaft housing.*
- *The plastic packing pieces for protecting the open valves must not be removed until immediately before fitting cylinder head.*
- *If the cylinder head is replaced, all the coolant in the system must also be renewed.*
- *Oil all contact surfaces before beginning with the assembly work.*
- *Dismantling and assembling intake manifold* ⇒ *page 162*

1.1 Cylinder head - Assembly overview



1 - Cable guide

- ❑ Fit on camshaft housing with 8 Nm

2 - 10 Nm

3 - 10 Nm + 90° ($^{1}/_{4}$ turn) further

- ❑ Renew
- ❑ Remove from outside inwards ⇒ page 61
- ❑ Tighten from centre outwards ⇒ page 63

4 - 10 Nm

5 - To air cleaner

6 - Hall sender -G40-

7 - O-ring

- ❑ Renew if damaged.

8 - Retainer

9 - Stud, 6 Nm

- ❑ For air cleaner

10 - Cylinder head bolt

- ❑ Renew
- ❑ Observe installation instructions and sequence when loosening and tightening ⇒ page 63

11 - Roller rocker finger

- ❑ Check roller bearing for easy movement
- ❑ Oil contact surfaces.
- ❑ Use securing clip to clip onto support element when installing

12 - Support element

- ❑ Do not interchange.
- ❑ With hydraulic valve clearance compensation.
- ❑ Oil contact surfaces.

13 - Dowel pins

14 - Oil pressure switch -F1- , 25 Nm

- ❑ Checking ⇒ page 94 .
- ❑ If sealing ring is leaking, nip open and replace.

15 - Cylinder head

- ❑ Removing and installing ⇒ page 63
- ❑ Check for distortion ⇒ page 58 .
- ❑ Sealing surfaces to the camshaft housing must be free of oil and grease
- ❑ After renewing, renew entire coolant.

16 - Cylinder head gasket

- ❑ Renew

- ❑ Metal gasket
- ❑ After renewing, renew entire coolant.

17 - Guide pins

- ❑ Tightening torque: 20 Nm

18 - Lifting eye

19 - 20 Nm

20 - Oil strainer

- ❑ Fitted in cylinder head
- ❑ Renew

21 - Camshaft housing

- ❑ With integrated camshaft bearings
- ❑ Removing and installing ⇒ page 59
- ❑ Remove sealant remnants
- ❑ Thoroughly clean sealing surfaces, they must be oil and grease free.
- ❑ Apply sealing compound -D 188 003 A1- before fitting
- ❑ When installing fit vertically from above onto studs and dowel pins

22 - Bucket tappet

- ❑ Renew
- ❑ Oil contact surfaces.

23 - O-ring

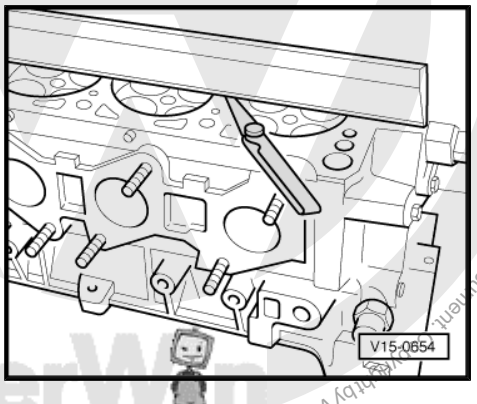
- ❑ Renew
- ❑ Coat with oil before inserting

24 - High-pressure pump

- ❑ For fuel supply system
- ❑ With fuel pressure regulating valve -N276-
- ❑ Removing and installing ⇒ page 139

Checking cylinder head for distortion

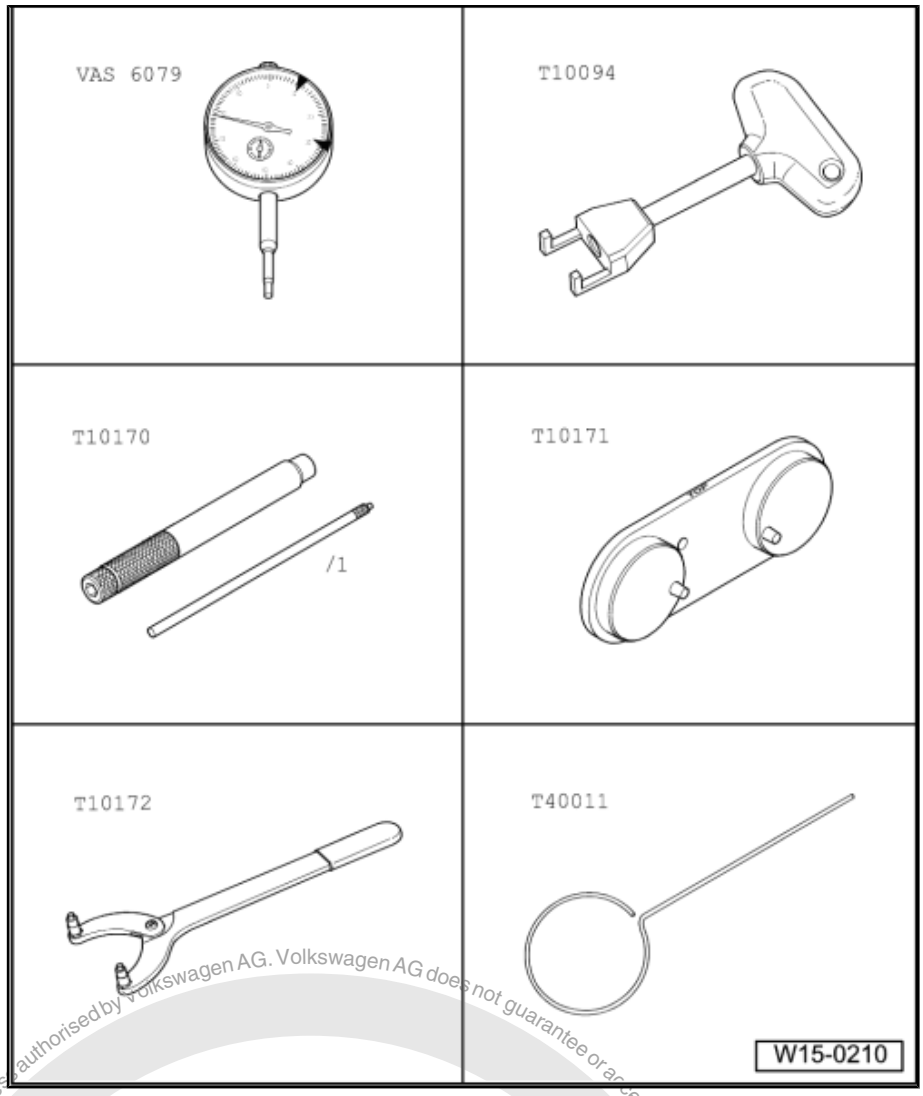
Max. permissible distortion: 0.05 mm



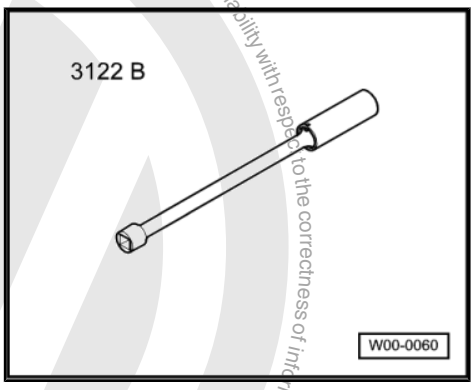
1.2 Removing and installing camshaft housing

Special tools and workshop equipment required

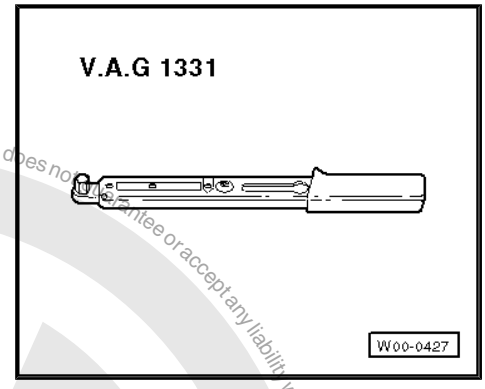
- Dial gauge -VAS 6079-
- Puller -T10094-
- Dial gauge adapter -T10170-
- Camshaft clamp -T10171-
- Counter-hold tool -T10172-
- Locking pin -T40011-



- Spark plug spanner -3122 B-



- Torque wrench -V.A.G 1331-



- Two M6x80 studs
- Sealants -D 188 003 A1-

Removing camshaft housing ⇒ page 60

Installing camshaft housing ⇒ page 61

1.2.1 Remove camshaft housing

Note

- *The camshafts are mounted in the camshaft housing on this engine. Therefore, the control housing must be removed before the camshaft housing can be removed ⇒ page 31 .*
- *The camshaft housing sealing surface must not be reworked.*

– Remove control housing ⇒ page 31 .

– Position crankshaft at TDC for cylinder No. 1. Then turn crankshaft against D.O.R. 45° of engine and remove camshaft sprockets with the control chain ⇒ page 69 .

– Remove exhaust gas recirculation valve -N18- ⇒ page 195 and remove camshaft sealing caps.

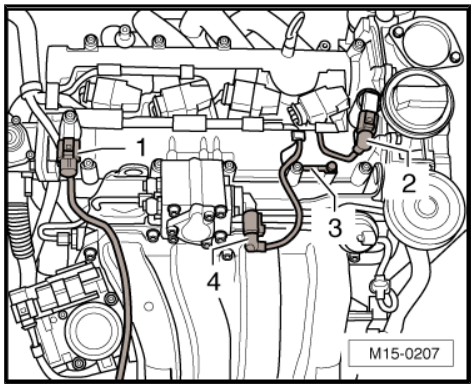
– Pull connector -1- off Hall sender -G40- and connector -2- off inlet camshaft control valve 1 -N205- .

– Unscrew earth cable -3- from camshaft housing.

– Disconnect connector -4- from high-pressure pump.

– Remove ignition coils. To do this use extractor -T10094- ⇒ page 198 .

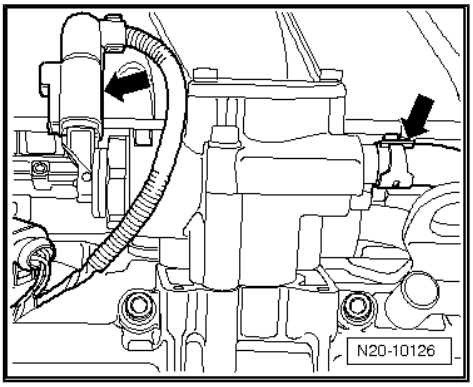
– Disassembling the wiring with wiring harness from the camshaft housing.



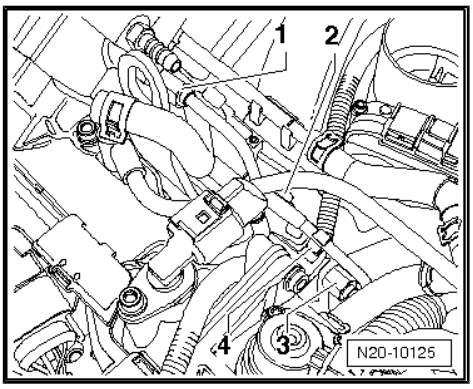
WARNING

The fuel line is under pressure! Wear protective glasses and protective gloves to avoid injuries and skin contact. Before loosening fuel pipes, wrap a cloth around the connection. Then release pressure by carefully removing the hose.

– Pull connector and fuel supply line -arrows- off the high-pressure pump.



– Remove cable guide -2- and remove clip -4- from the high-pressure line.

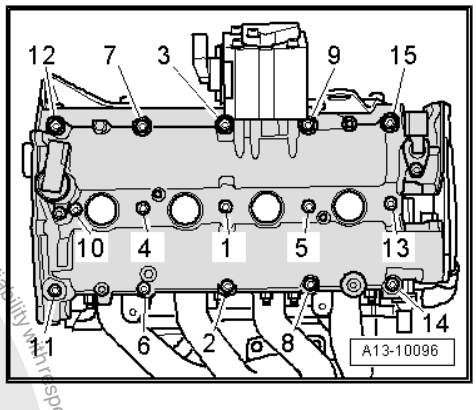


Note

Lock the screwed connections on the high-pressure pump and on fuel rail when unbolting the union nuts with a spanner.

– Unscrew union nuts -3- and -1- of the high-pressure line.
– Remove dipstick.
– Remove fuel rail ⇒ page 168 .
– Unscrew the left lifting eye.

– Unscrew camshaft housing bolts in the sequence -15 … 1- .



Note

The bolt -item 9- (below the high-pressure pump) remains in the camshaft housing.

– Carefully lift camshaft housing off.

1.2.2 Installing camshaft housing

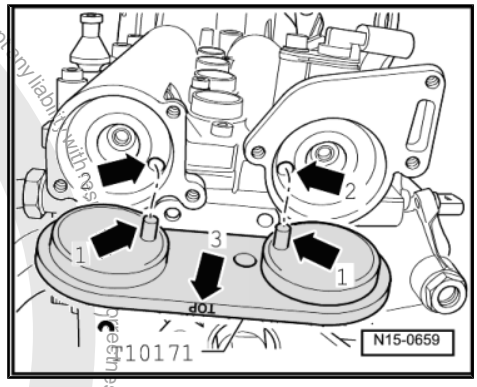
Prerequisites

- The pistons must not be positioned at TDC.

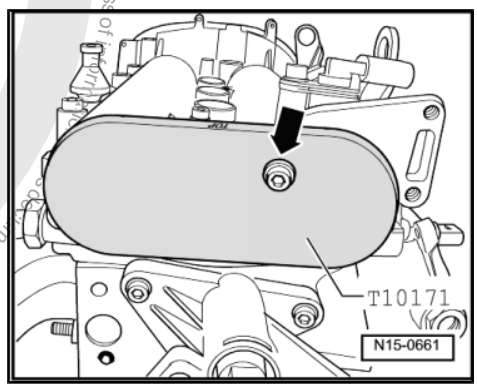
– Remove sealant remnants on cylinder head camshaft housing with a commercially available sealant remover.
– Prevent dirt and residual sealant from entering cylinder head.
– Clean sealing surfaces carefully. They must be free of oil and grease.

– Turn the inlet and outlet camshaft until the camshaft clamp - T10171- can be fitted into the camshaft openings to limit stop.

The retaining pins -arrows 1- must engage into the holes -arrows 2-. The inscription “TOP” -arrow 3- must be legible from above.

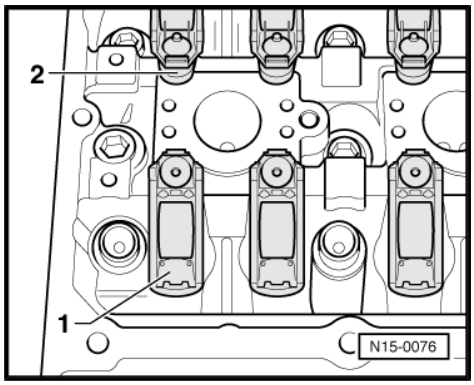


– To secure the camshaft -T10171- , hand-tight the M6 bolt -arrow-, do not tighten.

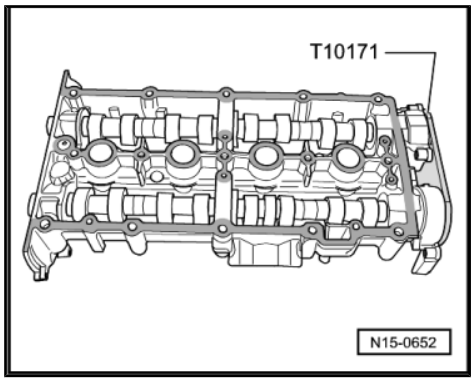


– Ensure all roller rocker fingers contact the valve ends -1- correctly and they are clipped into their respective support elements -2-.

– Screw two studs (M6 x 80) into cylinder head before installing camshaft housing.



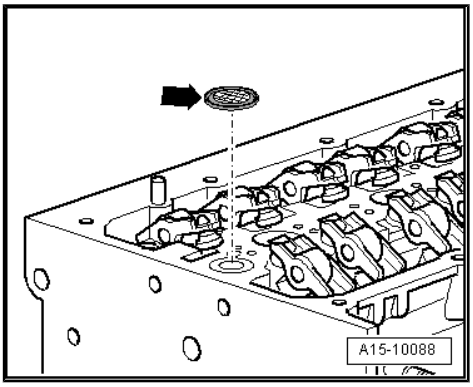
– Apply a thin even coat of sealant onto the clean camshaft housing sealing surface. See hatched area on illustration.



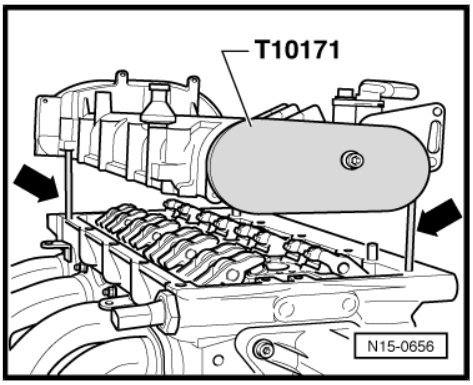
Note

The sealant must not be applied too thick otherwise excess sealant can enter the oil channels and cause damage to the engine.

– Renew oil strainer -arrow- and lay it into the cylinder head.



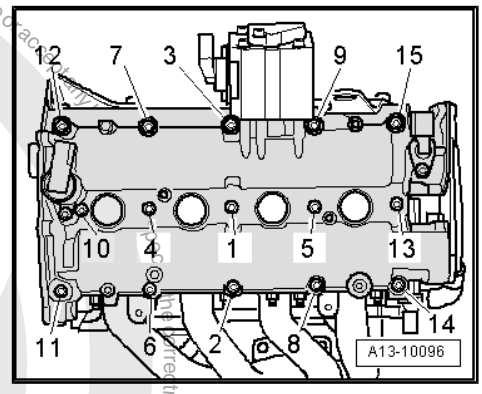
– Carefully fit the camshaft housing vertically onto the cylinder head studs -arrows- and the dowel pins of the cylinder head.



Note

Ensure no oil remnants drop on the sealing surfaces.

– Tighten new bolts for camshaft housing in 2 steps in the following tightening sequence as follows:



1. Tighten to 10 Nm using torque wrench.

2. Turn 90° (1/4 turn) further with a rigid wrench.

Ensure the camshaft housing does not cant when doing this.

Note

Sealant must be left dry for approx. 30 minutes after installing camshaft housing.

– Adjust timing ⇒ page 69 .

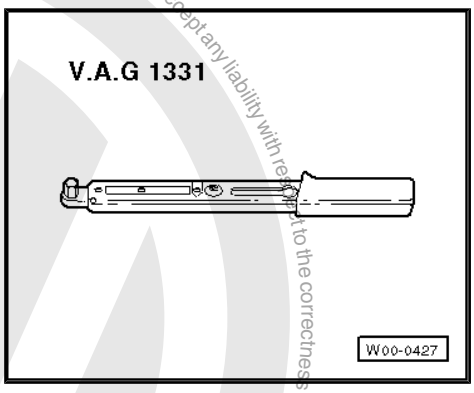
Further assembly is basically the reverse of the dismantling procedure. During this step, observe the following:

- Install control housing ⇒ page 31 .
- Installing fuel lines ⇒ page 139 .
- Installing exhaust gas recirculation valve -N18- ⇒ page 195 .

1.3 Removing and installing cylinder head

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



Note

To remove the cylinder head it is necessary to remove the engine with the gearbox. When working on the engine, the engine should be secured on the engine and gearbox support -VAS 6095- .

Remove cylinder head ⇒ page 64

Install cylinder head ⇒ page 65

1.3.1 Remove cylinder head

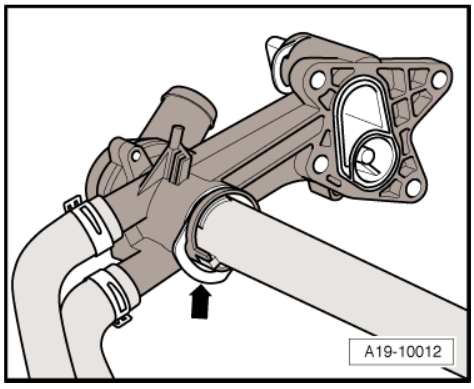
– Remove the engine ⇒ page 4 .

– Remove gearbox and fit engine to engine and gearbox bracket -VAS 6095- ⇒ page 14 .

If the cylinder head must be dismantled, remove the following components:

- Intake manifold ⇒ page 164
- Fuel rail ⇒ page 168
- Exhaust manifold ⇒ page 186

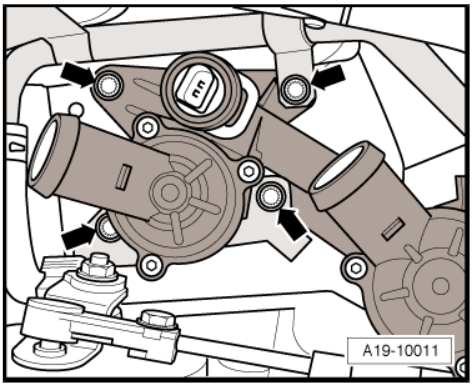
– Pull retaining clip for coolant pipe out -arrow-.



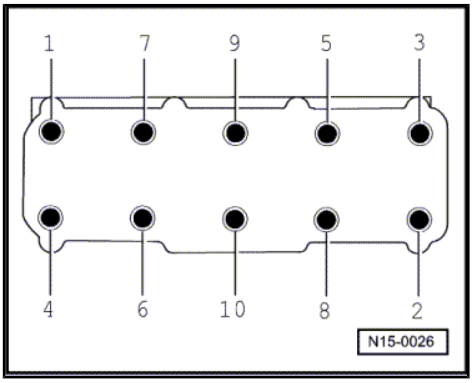
Note

The thermostat is removed for a clearer illustration.

– Remove thermostat housing from cylinder head -arrows-.
– Pull thermostat housing off coolant pipe.
– Remove exhaust gas recirculation valve -N18- ⇒ page 195 .
– Remove control housing ⇒ page 31 .
– Remove camshaft housing ⇒ page 59 .
– Remove roller rocker finger together with support elements and place on a clean surface.
– Ensure the roller rocker fingers and the support elements are not interchanged.



– Loosen socket head bolts in the sequence given and then remove.
– Carefully lift cylinder head off.



1.3.2 Install cylinder head

Prerequisites

- The pistons must not be positioned at TDC.

Note

♦ *Do not remove new cylinder head gasket from its packing until immediately before installing.*

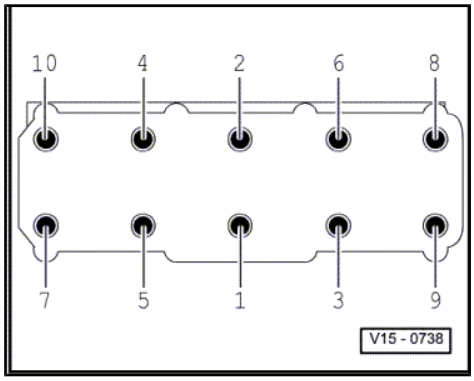
♦ *Handle new gasket with extreme care. Damage will cause leakage.*

– Place clean cloths in cylinders so that no dirt or emery cloth particles can get in between cylinder wall and piston.

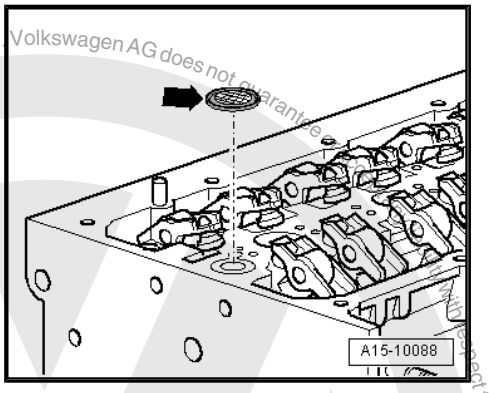
Now carefully clean sealing surfaces of cylinder head and cylinder block. Ensure thereby that surfaces are not scored or scratched (if abrasive paper is used, grade must not be less than 100).

– Carefully remove metal particles, emery residue and cloths.
– Set No. 1 cylinder piston to top dead centre and then turn crankshaft back slightly.
– Fit new cylinder head gasket. The inscription (Part No.) must be legible.
– Place cylinder head on. When doing this observe the centralizing pins in cylinder block.
– Fit new cylinder head bolts and tighten hand tight.

– Tighten cylinder head in tightening sequence as follows:
– Tighten all bolts to 30 Nm.
– Then tighten all bolts 90° ($^1/_4$ turn) using a rigid wrench.
– Then tighten all bolts again 90 ($^1/_4$ turn) further.
– Insert support element in cylinder head and fit roller rocker finger onto respective valve stem end or support element.



– Renew oil strainer -arrow- and lay it into the cylinder head.
– Install camshaft housing ⇒ page 59 .
– Adjust timing ⇒ page 69 .



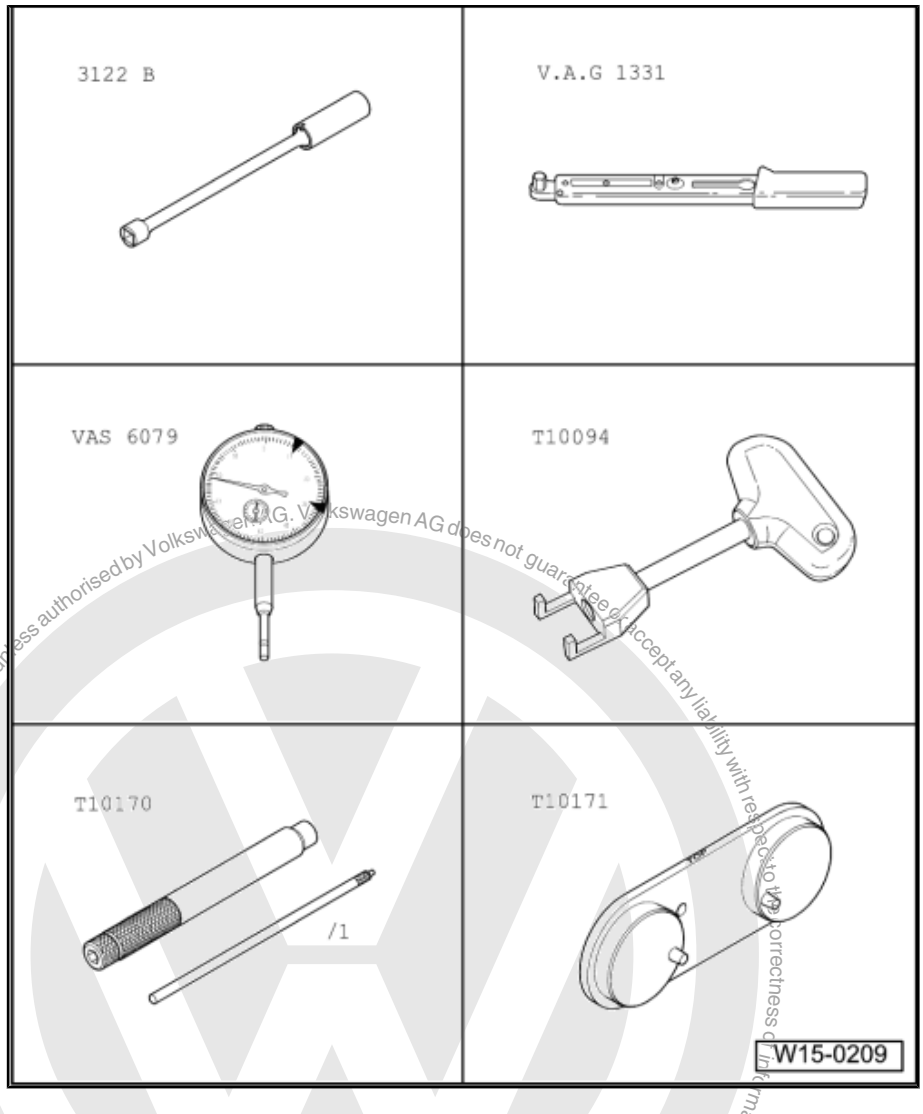
Further assembly is basically the reverse of the dismantling procedure. During this step, observe the following:

♦ Install control housing ⇒ page 31 .
♦ Installing fuel lines ⇒ page 139 .
♦ Installing exhaust gas recirculation valve -N18- ⇒ page 195 .

1.4 Checking valve timing

Special tools and workshop equipment required

- Spark plug spanner -3122 B-
- Torque wrench -V.A.G 1331-
- Dial gauge -VAS 6079-
- Puller -T10094-
- Dial gauge adapter -T10170-
- Camshaft clamp -T10171-



Test procedure

– Remove exhaust gas recirculation valve -N18- ⇒ page 195 .

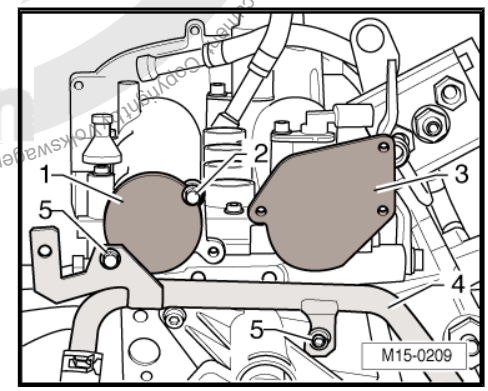
– Unhook wiring harness (not shown in the figure) on the coolant pipe -4-.

– Remove bolts -5- from coolant pipe -4-.

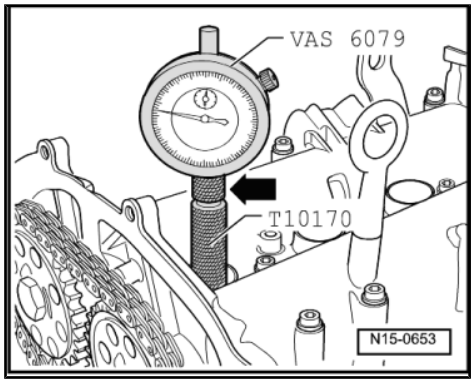
– Remove bolt -2- from cap -1-.

– Take caps -1- and -3- off. Collect leaking engine oil with a cloth.

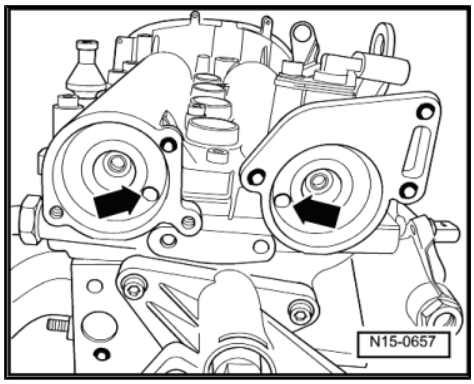
– Remove spark plug from cylinder No. 1. To do this use puller -T10094- and the spark plug spanner 3122 B ⇒ page 198 .



– Turn the dial gauge adapter -T10170- to limit stop into the spark plug thread.
– Set dial gauge -VAS 6079- with the extension -T10170/1- up to limit stop and clamp with the clamping nut -arrow-.
– Set crankshaft in engine D.O.R. to TDC cylinder No. 1. Note the position of the dial gauge indicator.



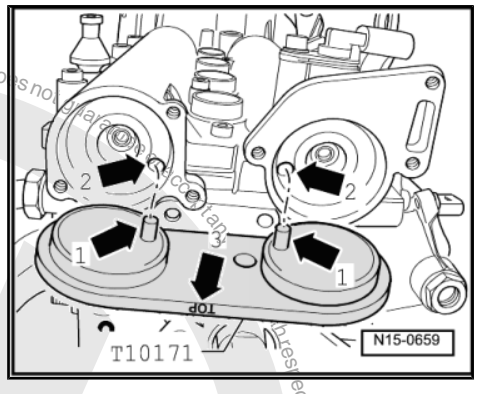
The holes -arrows- in the camshafts must stand as shown. If necessary turn crankshaft one turn further (360°).



Note

- *If the crankshaft was turned more than 0.01 mm past the TDC, the crankshaft must be turned again approx. 45° against engine direction of rotation. Then turn the crankshaft in engine D.O.R. to TDC cylinder No. 1.*
- *Max. permissible deviation of TDC cylinder No. 1: ±0.01 mm.*

– Fit camshaft clamp -T10171- to limit stop into the camshaft openings.



The retaining pins -arrows 1- must engage into the holes -arrows 2-. The inscription “TOP” -arrow 3- must be legible from above.

If the camshaft clamp -T10171- can not be inserted up to limit stop into the camshaft openings the timing is wrong and must be adapted again ⇒ page 69 .

The timing is OK when the camshaft clamp -T10171- can be inserted into the camshaft openings up to limit stop.

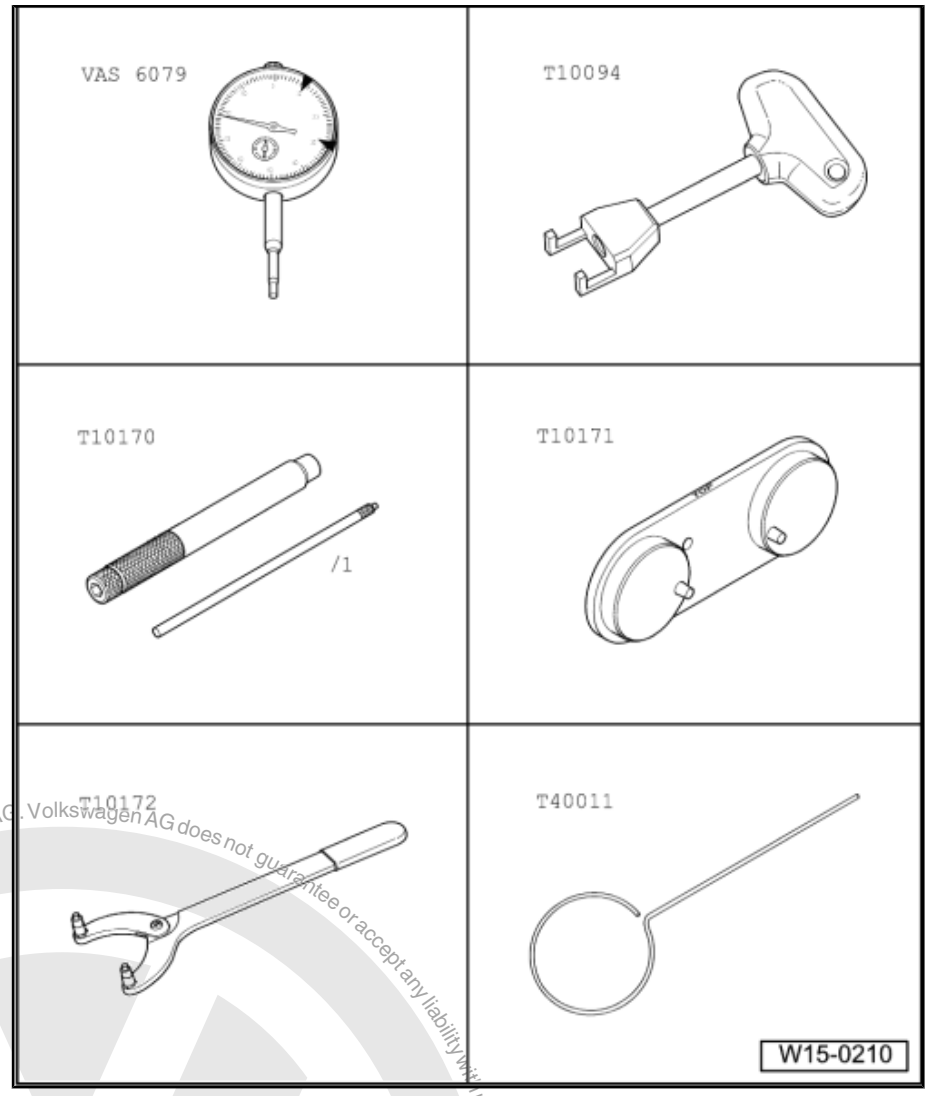
Further assembly is basically the reverse of the dismantling procedure. During this step, observe the following:

- Renew seals for the camshaft sealing caps and lubricate before installing.
- Installing exhaust gas recirculation valve -N18- ⇒ page 195 .

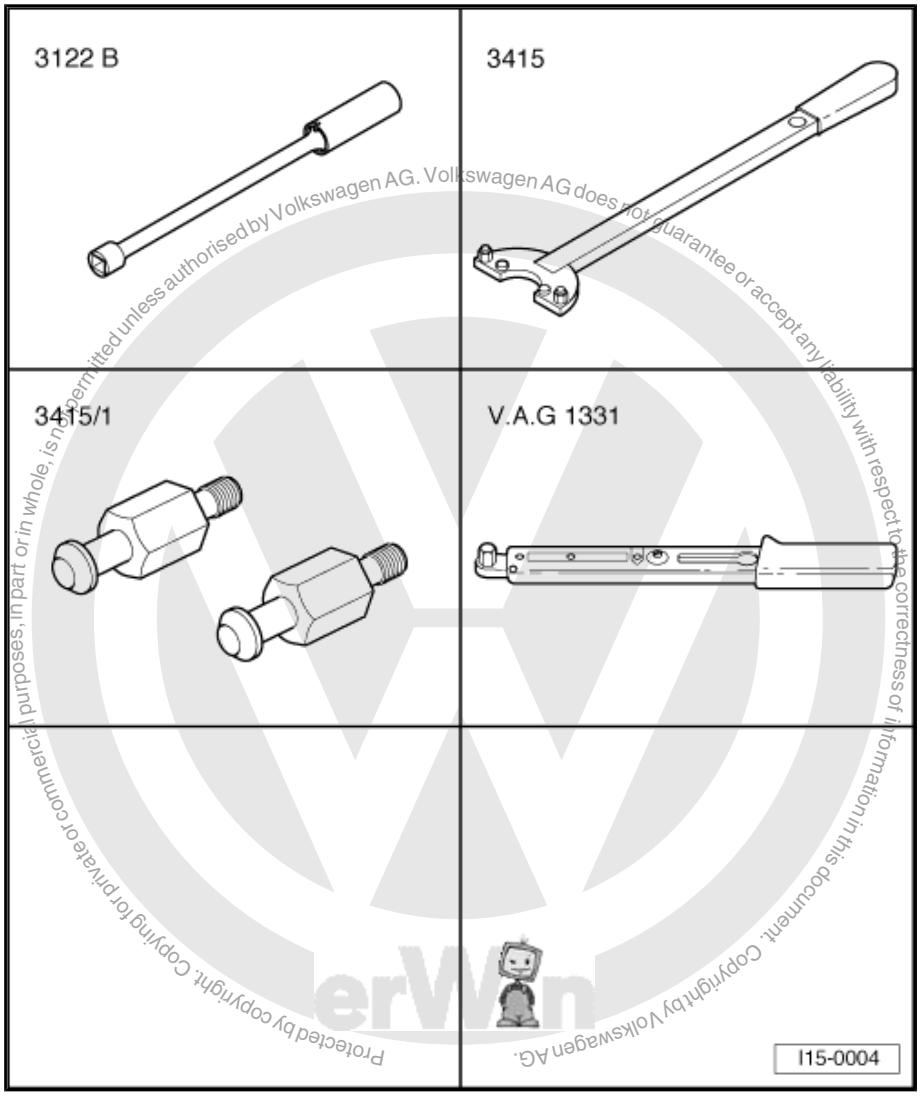
1.5 Adjusting valve timing

Special tools and workshop equipment required

- Dial gauge -VAS 6079-
- Puller -T10094-
- Dial gauge adapter -T10170-
- Camshaft clamp -T10171-
- Counter-hold tool -T10172-
- Locking pin -T40011-



- Spark plug spanner -3122 B-
- Counter-hold tool -3415-
- Pin -3415/1-
- Torque wrench - V.A.G 1331-

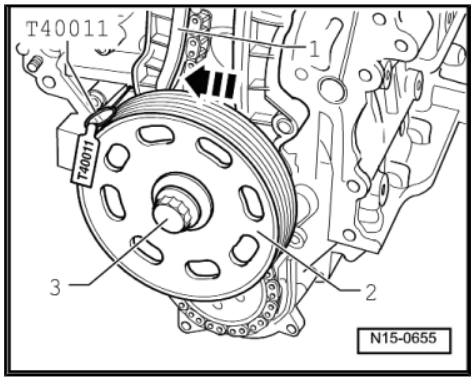


Procedure

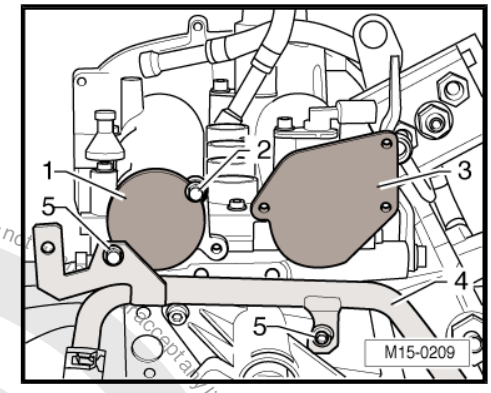
– Remove control housing ⇒ page 31 .

– To turn the crankshaft install bearing bush, crankshaft belt pulley -2- and crankshaft bolt -3- and tighten the crankshaft bolt. To do this use counter-hold -3415- .

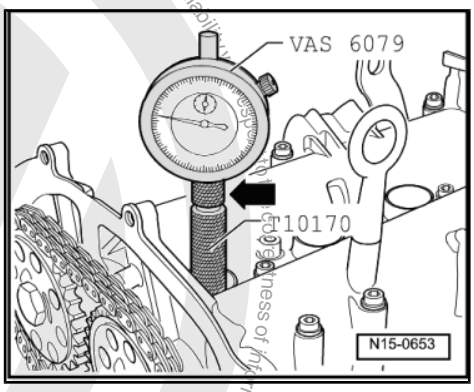
– Remove exhaust gas recirculation valve -N18- ⇒ page 195 .



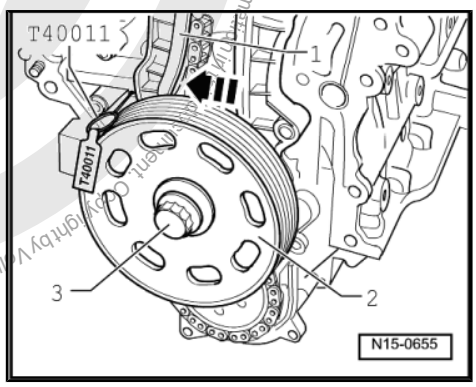
– Unhook wiring harness (not shown in the figure) on the coolant pipe -4-.
– Remove bolts -5- from coolant pipe -4-.
– Remove bolt -2- from cap -1-.
– Take caps -1- and -3- off. Collect leaking engine oil with a cloth.
– Remove spark plug from cylinder No. 1. To do this use puller -T10094- and spark plug spanner -3122 B- ⇒ page 198 .



– Turn the dial gauge adapter -T10170- to limit stop into the spark plug thread.
– Set dial gauge -VAS 6079- with the extension -T10170/1- up to limit stop and clamp with the clamping nut -arrow-.
– Set crankshaft in engine D.O.R. to TDC cylinder No. 1. Note the position of the dial gauge indicator.
– Then turn crankshaft against engine D.O.R. 45° back.



– Press tensioning plate -1- in direction of arrow and lock piston with the pin -T40011- .

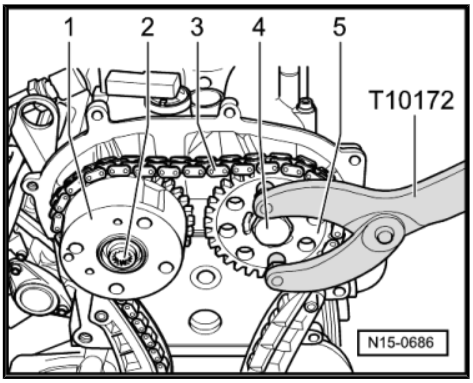


– Mark with a felt tipped pen the direction of road of the control chain -3-.

Note

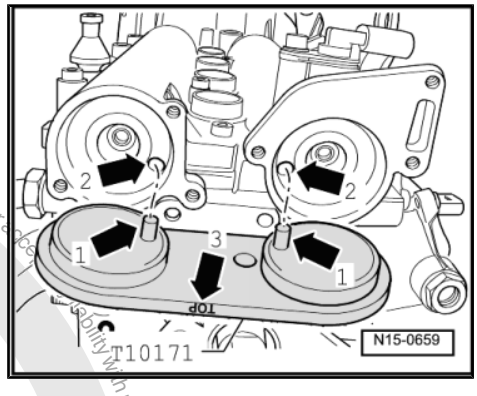
Centre bolt of the camshaft adjuster -2- has a left-hand thread.

– Remove bolts -2- (left-hand thread) and -4- and remove camshaft adjuster -1- with control chain -3-. To counterhold use counter-hold -T10172- .
– Fit camshaft adjuster -1- again.
– Renew bolts -2- (left-hand thread) and -4- and tighten bolt -2- to 40 Nm and bolt -4- to 50 Nm (use counter-hold -T10172-).



– Turn the inlet and outlet camshaft until the camshaft clamp -T10171- can be fitted into the camshaft openings to limit stop.

The retaining pins -arrows 1- must engage into the holes -arrows 2-. The inscription “TOP” -arrow 3- must be legible from above.

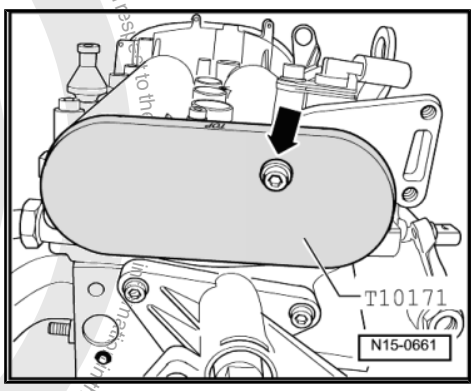


Note

The camshafts must not be moved axially when turning.

– To secure the camshaft -T10171- , hand-tight the M6 bolt -arrow-, do not tighten.

– Remove bolts of the camshaft sprockets. To do this is absolutely necessary to use counter-hold -T10172- .



Caution

The camshaft clamp -T10171- must not be used as counter-hold.

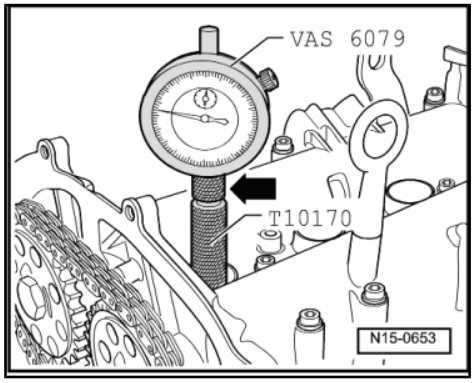
– Take a camshaft sprocket off.

– Considering direction of road, set the control chain on the camshaft sprockets and install removed camshaft sprocket again.

– Screw camshaft bolts into so that the camshaft sprockets can still be turned on the camshaft.

– Tension control chain by pulling out pin -T40011- .

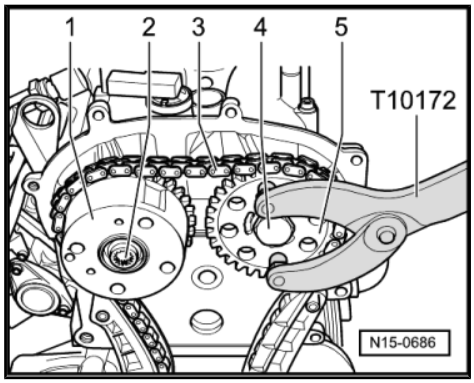
– Turn crankshaft in engine direction of road to TDC cylinder No. 1. Max. permissible deviation of TDC cylinder No. 1: ±0.01 mm.



Note

If the crankshaft was turned more than 0.01 mm past the TDC, the crankshaft must be turned again approx. 45° against engine direction of rotation. Then turn the crankshaft in engine D.O.R. to TDC cylinder No. 1.

– With the counter-hold -T10172- , hold the camshaft sprockets -1- and -5- in this position and tighten bolts -2- (left-hand thread) to 40 Nm and -4- to 50 Nm.



Note

When tightening the camshaft bolts the crankshaft must not turn and the control chain -3- must remain tensioned on both sides.

– Remove camshaft clamp -T10171- .

– Turn crankshaft two turns in engine direction of road to TDC cylinder No. 1. Max. permissible deviation of TDC cylinder No. 1: ±0.01 mm.

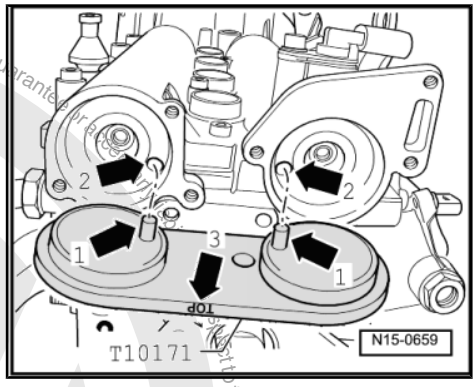
– Fit camshaft clamp -T10171- to limit stop into the camshaft openings.

If the camshaft clamp -T10171- can not be fitted:

– Repeat adjustment.

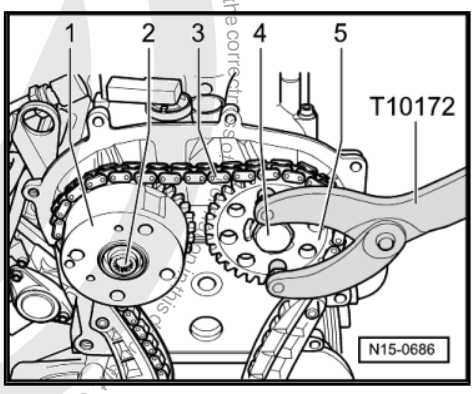
If the camshaft clamp -T10171- can be fitted:

– Remove the camshaft clamp -T10171- , hold the camshaft sprockets with the counter-hold -T10172- and turn bolt -2- (left-hand thread) and -4- 90° ($^1/_4$ turn) further using a rigid wrench.



Note

- *The centre bolt of the camshaft adjuster -2- has a left-hand thread.*
- *The camshaft sprockets must not turn on the camshaft when tightening.*

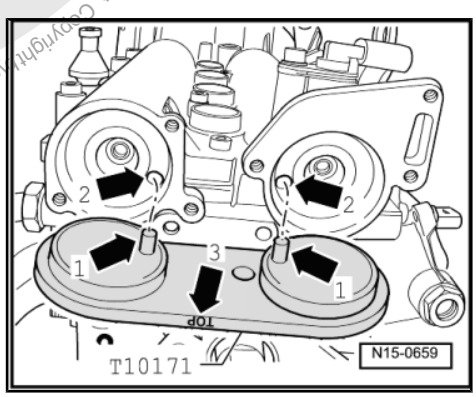


– Turn crankshaft two turns again in engine direction of road to TDC cylinder No. 1. Max. permissible deviation of TDC cylinder No. 1: ±0.01 mm.

– Fit camshaft clamp -T10171- to limit stop into the camshaft openings.

If the camshaft clamp -T10171- can not be fitted:

– Repeat adjustment.



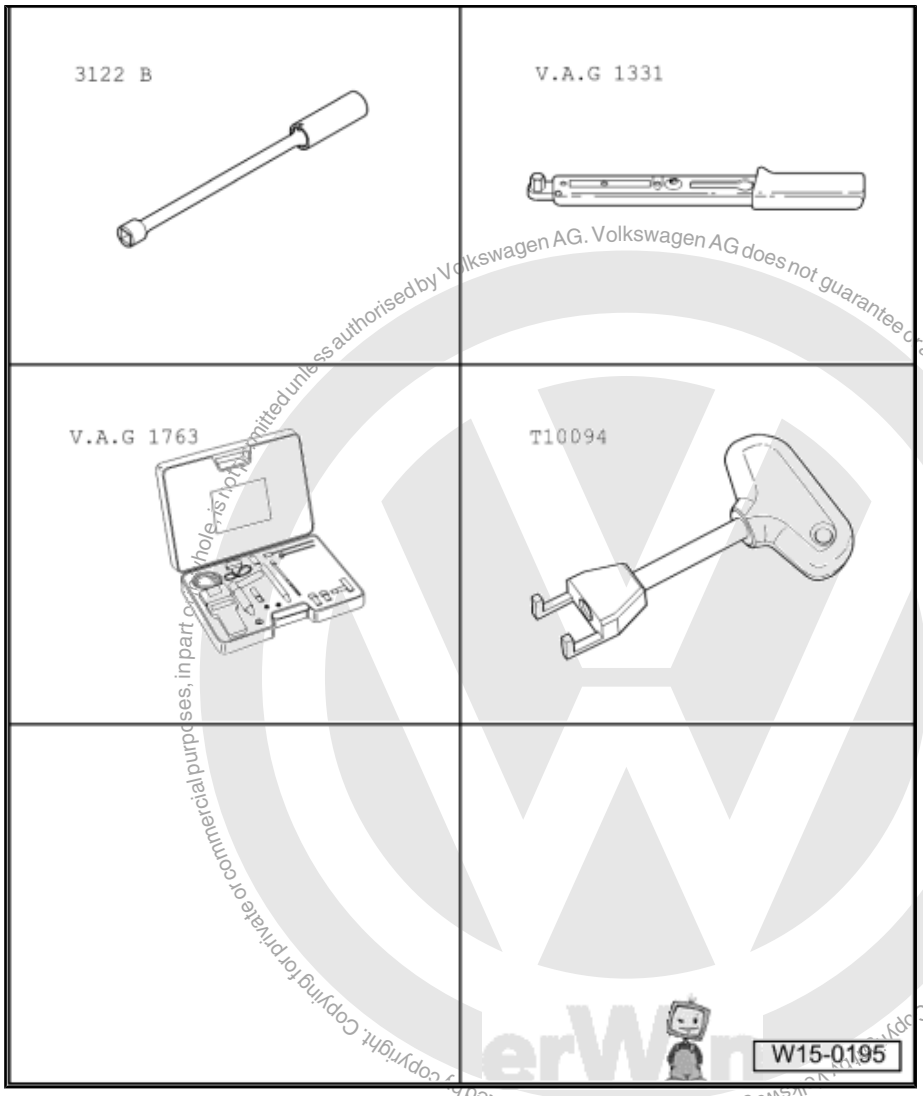
Further assembly is basically the reverse of the dismantling procedure. During this step, observe the following:

- Install control housing ⇒ page 31 .
- Install Poly V-belt ⇒ page 29 .
- Renew seals for the camshaft sealing caps and lubricate before installing.
- Installing exhaust gas recirculation valve -N18- ⇒ page 195 .

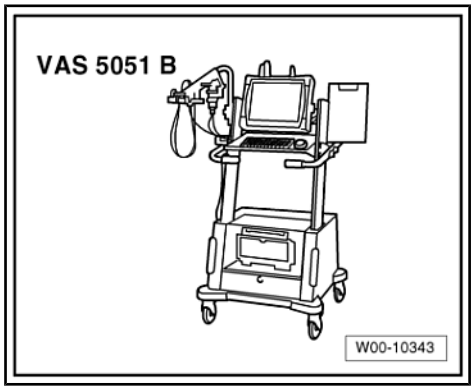
1.6 Check compression pressures

Special tools and workshop equipment required

- Spark plug spanner -3122 B-
- Torque wrench -V.A.G 1331-
- Compression tester -V.A.G 1763-
- Puller -T10094-



- Vehicle diagnosis, testing and information system -VAS 5051-



- or vehicle diagnosis and service information system -VAS 5052-

Test prerequisites

- Engine oil temperature must be at least 30 C.

Test procedure

– Remove engine cover with air cleaner ⇒ page 161 .

– Remove ignition coils. To do this use puller -T10094- ⇒ page 198 .

– Unscrew spark plugs with spark plug wrench -3122 B- .

– Check compressions with compression tester -V.A.G 1763- .

Note

See relevant test unit operating instructions for instructions on how to use test unit.

– With the accelerator pedal fully depressed, have a second mechanic to operate the starter until tester shows no further pressure increase.

Compression pressures:

New: 10...15 bar

Wear limit: 7 bar

Permissible difference between all cylinders: 3 bar

– Install spark plugs with spark plug socket -3122 B- and tighten to 30 Nm.

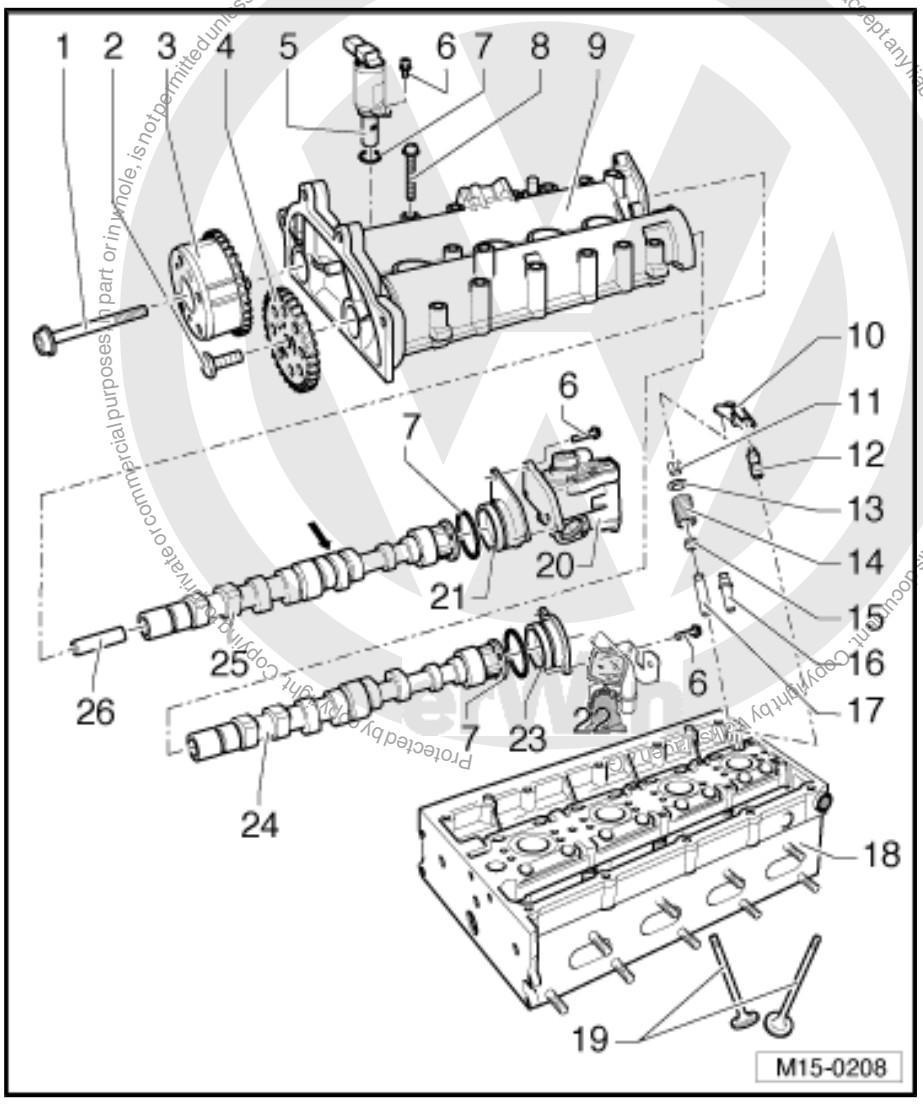
Further assembly is basically the reverse of the dismantling procedure.

– Interrogate engine control unit fault memory ⇒ page 178 .

If the fault memory was erased the readiness code must be generated.

2 Repairing valve gear

2.1 Valve gear - Assembly overview



1 - 40 Nm + 90° (1/4 turn) further
- ❑ Left-hand thread
- ❑ Renew

2 - 50 Nm + 90° (1/4 turn) further
- ❑ Renew

3 - Camshaft adjuster
- ❑ Must not be dismantled
- ❑ Removing and installing ⇒ page 69

4 - Camshaft pulley
- ❑ Note position when installing the control chain

5 - Camshaft variable timing adjustment valve 1 -N205-
- ❑ Checking ⇒ Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle Diagnosis and Service Information System -VAS 5052-

6 - 10 Nm

7 - O-ring
- ❑ Renew if damaged.

8 - 10 Nm + 90° (1/4 turn) further
- ❑ Renew
- ❑ Tighten from centre outwards

9 - Camshaft housing
- ❑ Removing and installing ⇒ page 59
- ❑ Remove sealant remnants
- ❑ Apply sealing compound -D 188 800 A1- before fitting
- ❑ When installing fit vertically from above onto studs and dowel pins

10 - Roller rocker finger
- ❑ Check roller bearing
- ❑ Oil contact surfaces
- ❑ Use securing clip to clip onto support element when installing

11 - Cotters

12 - Support element

- ❑ Check oil spray drillings
- ❑ With hydraulic valve clearance compensation
- ❑ Do not interchange
- ❑ Before installing check camshaft axial clearance ⇒ page 78
- ❑ Oil contact surfaces

13 - Valve spring plate

14 - Valve spring

- ❑ Removing and installing with removed cylinder head using hold down tool for valve springs -3362-
- ❑ With cylinder head installed ⇒ page 81

15 - Valve stem seal

- ❑ Renewing ⇒ page 81

16 - Repair valve guide

- ❑ With collar

17 - Valve guide

- ❑ Checking ⇒ page 80 .

18 - Cylinder head

- ❑ Reworking valve seat ⇒ page 79
- ❑ Reworking sealing surface ⇒ page 78

19 - Valves

- ❑ Do not rework. Only lapping-in is permitted
- ❑ Valve dimensions ⇒ page 79

20 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

- ❑ Removing and installing ⇒ page 195

21 - Sealing cover

- ❑ For inlet camshaft

22 - Coolant pipe/bracket

- ❑ Remove to remove sealing cap ⇒ Item 23 (page 77)

23 - Sealing cover

- ❑ For outlet camshaft
- ❑ Remove to remove coolant pipe/bracket ⇒ Item 22 (page 77)

24 - Outlet camshaft

- ❑ Do not interchange with inlet camshaft
- ❑ Checking axial clearance ⇒ page 78
- ❑ Coat with oil before inserting (also axle bearing shoulder)

25 - Inlet camshaft

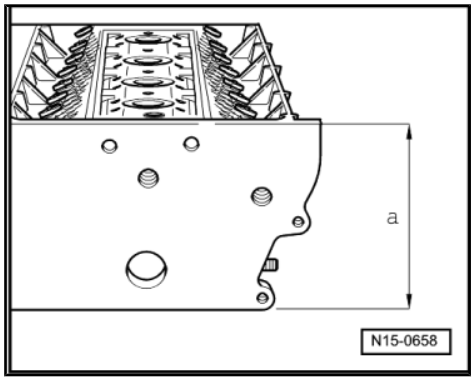
- ❑ With cams for high pressure pump -arrow-
- ❑ Remove to remove bucket tappets of the high pressure pump and renew
- ❑ Do not interchange with outlet camshaft
- ❑ Checking axial clearance ⇒ page 78
- ❑ Coat with oil before inserting (also axle bearing shoulder)

26 - Guide sleeve

Reworking cylinder head sealing surface

Cylinder head reworking limit:

Dimension -a- = 108.25 mm min.



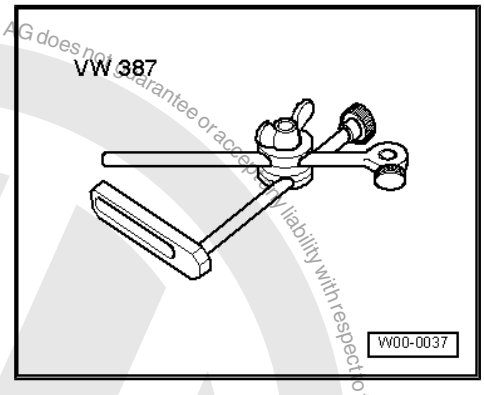
Note

When the sealing surface has been reworked, the valves must be set deeper by the same amount (rework valve seats) otherwise the valves will strike the pistons. When performing this work ensure that the minimum dimension ⇒ page 79 does not remain under.

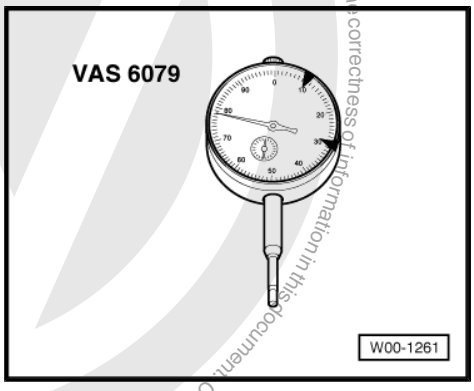
2.2 Checking camshaft axial clearance

Special tools and workshop equipment required

- Universal dial gauge bracket -VW 387-



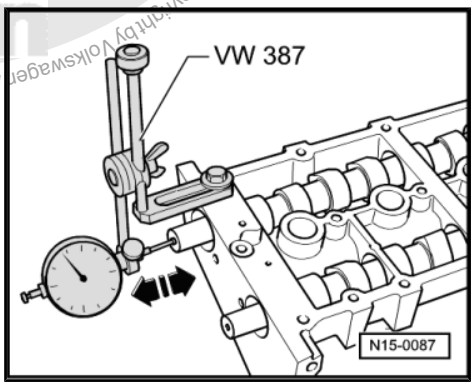
- Dial gauge -VAS 6097-



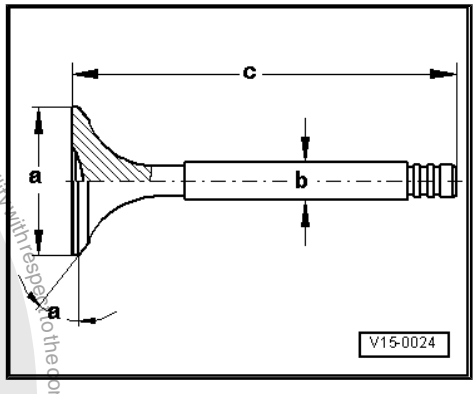
Perform measurements with camshaft housing removed and sealing cover fitted.

Checking camshaft axial clearance

Wear limit: max. 0.40 mm



Valve dimensions



Note

Valves must not be reworked. Only lapping-in is permitted.

Dimension		Inlet valve	Outlet valve
∅ a	mm	29,5	26,0
∅ b	mm	5,973	5,953
c	mm	100,9	100,5
α	∠°	45	45

2.3 Reworking valve seats

Special tools and workshop equipment required

- Depth gauge
- Valve seat refacing tool

Note

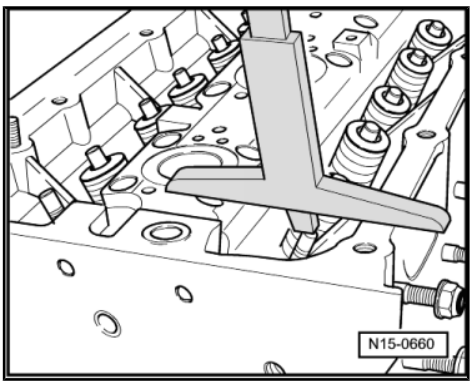
- *When repairing engines with leaking valves, it is not sufficient to reface or renew valve seats and valves. It is also necessary to check the valve guides for wear. This is particularly important on high mileage engines* ⇒ page 80.
- *Valve seats should be reworked only enough to produce a perfect seating pattern. Before beginning to rework valve seats, calculate the maximum permissible reworking dimensions. If the reworking dimension is exceeded, hydraulic valve compensation can no longer be guaranteed and the cylinder head should be renewed.*

The max. permissible reworking dimension is calculated as follows:

– Insert valve and press firmly against seat.

Note

If the valve is to be renewed as part of a repair, use a new valve for the calculation.



– Measure distance between end of valve stem and upper edge of cylinder head.
– Calculate max. permissible reworking dimension from measured distance and minimum dimension.

Minimum dimension: Inlet valve 7.6 mm; Outlet valve 7.6 mm

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

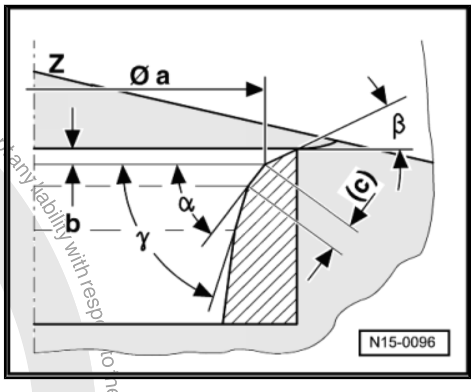
Example:

-	Measured distance	8,0 mm
	Minimum dimension	7,6 mm
=	max. perm. rework dimension[3)]	0,4 mm

3) The maximum permissible reworking dimension is shown on illustrations for reworking valve seats as dimension “b”.

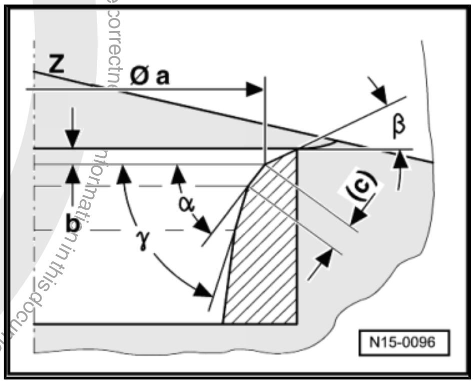
Rework inlet valve seat

a = ∅ 28.7 mm
b = max. permissible reworking dimension
c = 1.5…1.8 mm
Z = lower edge of cylinder head
α = 45° Valve seat angle
β = 30° upper correction angle
γ = 60° lower correction angle



Rework exhaust valve seat

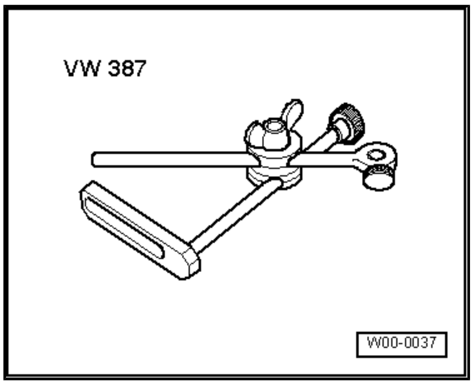
a = ∅ 25.0 mm
b = max. permissible reworking dimension
c = approx. 1.8 mm
Z = lower edge of cylinder head
α = 45° Valve seat angle
β = 30° upper correction angle
γ = 60° lower correction angle



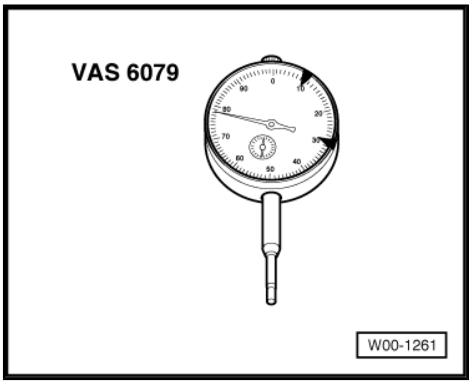
2.4 Checking valve guides

Special tools and workshop equipment required

- ♦ Universal dial gauge bracket -VW 387-



- ♦ Dial gauge -VAS 6097-



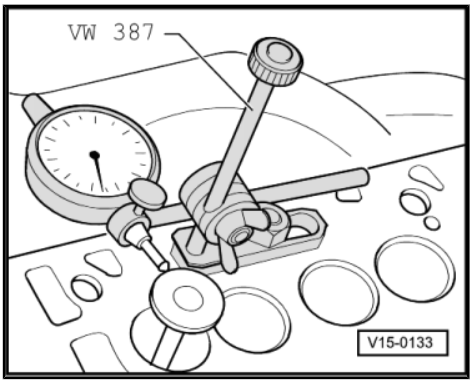
Test procedure

– Insert a new valve into the guide. The end of the valve stem must be flush with the guide. Due to slight differences in stem diameters, use only an inlet valve in inlet guide and an exhaust valve in exhaust guide.

– Determine rock. Wear limit: 0.8 mm

If rock tolerance is exceeded:

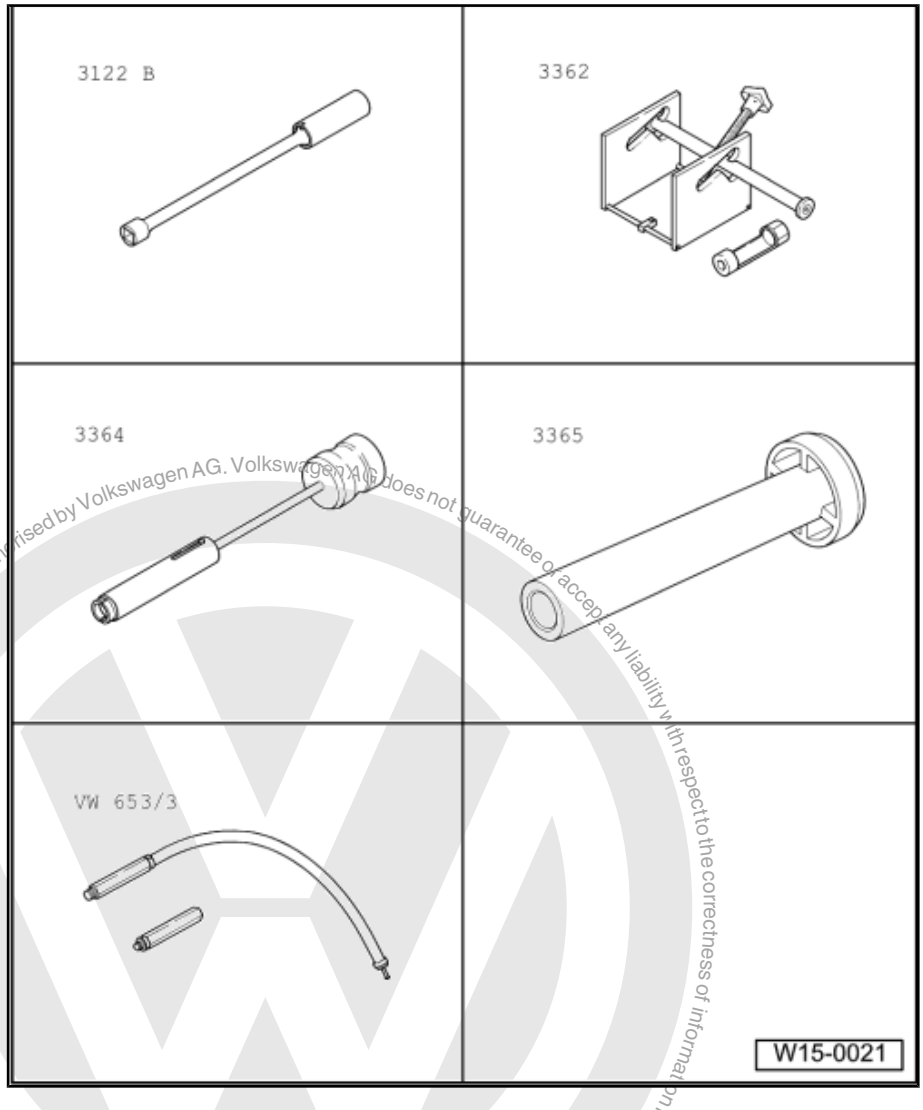
– Replace cylinder head.



2.5 Renewing valve stem seals

Special tools and workshop equipment required

- Spark plug spanner -3122 B-
- Hold down tool for valve springs -3362- with press piece -3362/1-
- Extractor for valve stem seal -3364-
- Valve stem seal fitting tool -3365-
- Pressure hose -VW 653/3-

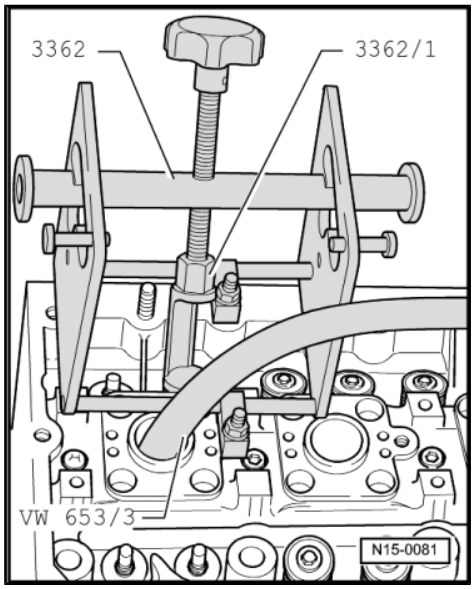


Removing

(with cylinder head installed)

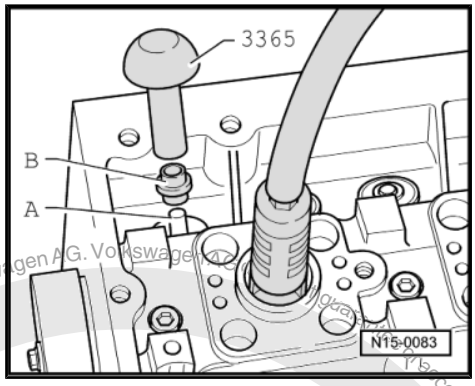
– Remove camshaft housing ⇒ page 59 .

– Remove roller rocker arms and place onto a clean surface. When doing this, ensure that the roller rocker fingers are not interchanged.
– Remove spark plugs with spark plug wrench -3122 B- .
– Set cylinder to “bottom dead centre”.
– Screw hold down tool for valve springs -3362- on with press piece -3362/1- .
– Now screw pressure hose -VW 653/3- into the spark plug thread.
– Connect pressure hose to a compressed air system of at least 6 bar and remove valve springs.
– Pull out valve stem seals using valve stem seal puller -3364- .



Installing

– Place the plastic sleeve supplied on the appropriate valve stem. This will prevent the new valve stem seal being damaged.
– Place new valve stem seal in valve stem seal fitting tool -3365- .
– Oil valve stem seal sealing lip and press carefully onto the valve guide.
– Install camshaft housing ⇒ page 61 .
– Adjust timing ⇒ page 69 .



Further assembly is basically the reverse of the dismantling procedure. During this step, observe the following:

♦ Install control housing ⇒ page 31 .
♦ Installing fuel lines ⇒ page 139 .
♦ Installing exhaust gas recirculation valve -N18- ⇒ page 195 .

17 – Lubrication

1 Removing and installing parts of lubrication system

Note

- *Finding metal shavings or a large quantity of small metal particles during engine repair could indicate that the conrod bearings are damaged. To prevent this from causing further damage, perform the following repairs:*
- *Thoroughly clean oil passages*
- *Renew oil filter*
- *The oil level must not be above the max. mark, danger of damage to catalytic converter! Markings ⇒ page 83 .*

Engine oil (oil capacities, engine oil specification) ⇒ page 83

Parts of the lubrication system - Assembly overview ⇒ page 84

Oil cooler - Assembly overview ⇒ page 86

Removing and installing oil sump ⇒ page 87

Removing and installing oil pump ⇒ page 89

Removing and installing oil cooler ⇒ page 92

Checking oil pressure and oil pressure switch ⇒ page 94

1.1 Engine oil

Oil capacities

With oil filter 3.5 l.

Top up to max. marking if necessary ⇒ page 83 .

Viscosity class and oil specification

⇒ Maintenance ; Booklet 20.1

Markings on dipstick

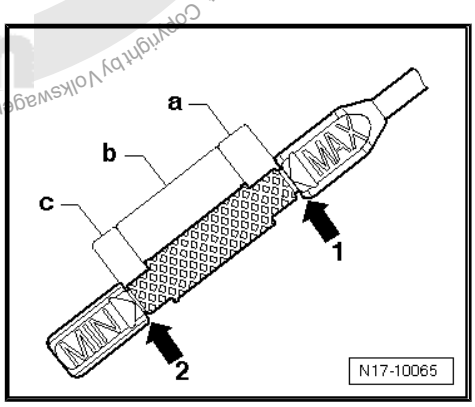
1 - Max. mark

2 - Min. mark

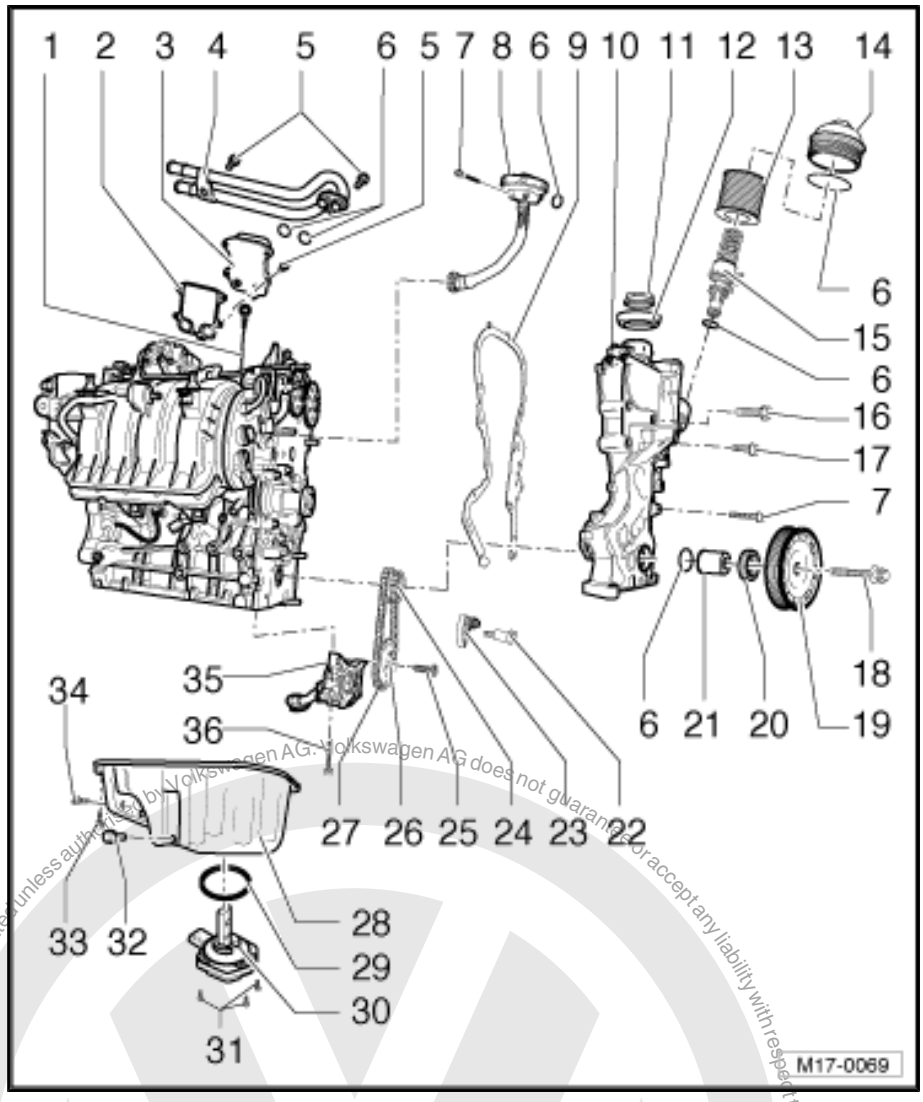
a - Area above hatched field up to max. mark: Do not replenish with engine oil!

b - Oil level within hatched field: Can be replenished with engine oil.

c - Area from min. mark up to hatched field: Replenish with max. 0.5 l of engine oil!



1.2 Parts of the lubrication system - Assembly overview



1 - Dipstick
- ❑ The oil level must not be above the max. mark!
- ❑ Markings ⇒ page 83

2 - Seal
- ❑ Renew

3 - Oil cooler

4 - Coolant pipes
- ❑ For oil cooler

5 - 8 Nm

6 - O-ring
- ❑ Renew

7 - 10 Nm

8 - Pressure regulating valve
- ❑ With breather hose

9 - Seal
- ❑ Renew

10 - Valve gear casing
- ❑ Removing and installing control housing ⇒ page 31
- ❑ For a better guide purpose when installing, insert two M6x80 studs into the camshaft housing and the cylinder block
- ❑ For a better guide purpose of the control housing set the oil sump with two bolts

11 - Sealing cover
- ❑ Renew seal if damaged

12 - Seal
- ❑ Renew if damaged

13 - Oil filter

14 - Oil filter cover, 25 Nm

15 - Valve
- ❑ With by-pass valve opening pressure: 2.5 bar
- ❑ With non-return valve

16 - 50 Nm

17 - Bolt, 10 Nm
- ❑ M6x22 mm
- ❑ Insert with locking fluid

18 - Bolt
- ❑ Observe tightening procedure ⇒ page 40
- ❑ Renew

- ❑ Contact surface of the securing bolt must be free of oil and grease
- ❑ Insert oiled (thread)
- ❑ Secure belt pulley with counter-hold -3415- against turning
- ❑ The turning further angle can be measured with a commercially available angle measuring instrument e.g. Hazet 6690

19 - Poly V-belt sprocket

- ❑ Contact surfaces of the belt pulley must be free of oil and grease
- ❑ Removing and installing poly V-belt ⇒ page 29
- ❑ Secure belt pulley with counter-hold -3415- against turning

20 - Seal

- ❑ Renew

21 - Bearing bush

- ❑ Renew if scored
- ❑ Observe tightening procedure ⇒ page 40
- ❑ Contact surfaces must be free of oil and grease

22 - 15 Nm

23 - Chain tensioner with tensioning plate and tension spring

- ❑ For oil pump drive
- ❑ Tightening torque: 15 Nm
- ❑ Is replaced complete only

24 - Chain sprocket

- ❑ Note installation position: The journal must engage into the groove of the crankshaft!
- ❑ For oil pump and control chain drive
- ❑ Contact surfaces must be free of oil and grease

25 - 20 Nm + 90° (1/4 turn) further

26 - Chain sprocket

- ❑ For oil pump
- ❑ Lock with counter-hold -T10172-

27 - Drive chain

- ❑ For oil pump
- ❑ Mark D.O.R. before removing (installation position)

28 - Oil pan

- ❑ Removing and installing ⇒ page 87
- ❑ Clean sealing surface before fitting
- ❑ Install with silicone sealing compound -D 176 404 A2-

29 - Seal

- ❑ Renew
- ❑ Lubricate before installing

30 - Oil level/ oil temperature sender -G266-

- ❑ Renew if damaged
- ❑ Checking: ⇒ Current flow diagrams, Electrical fault finding and Fitting locations

31 - 10 Nm

32 - Oil drain plug, 30 Nm

- ❑ With attached seal
- ❑ Renew

33 - 13 Nm

- ❑ Loosen and tighten the bolts on the flywheel end only using socket insert -T10058-

34 - 45 Nm

35 - Oil pump

- ❑ Renew complete only

36 - 25 Nm

1.3 Oil cooler - Assembly overview

1 - Oil cooler

- ❑ Removing and installing ⇒ page 92

2 - Seal

- ❑ Renew

3 - O-ring

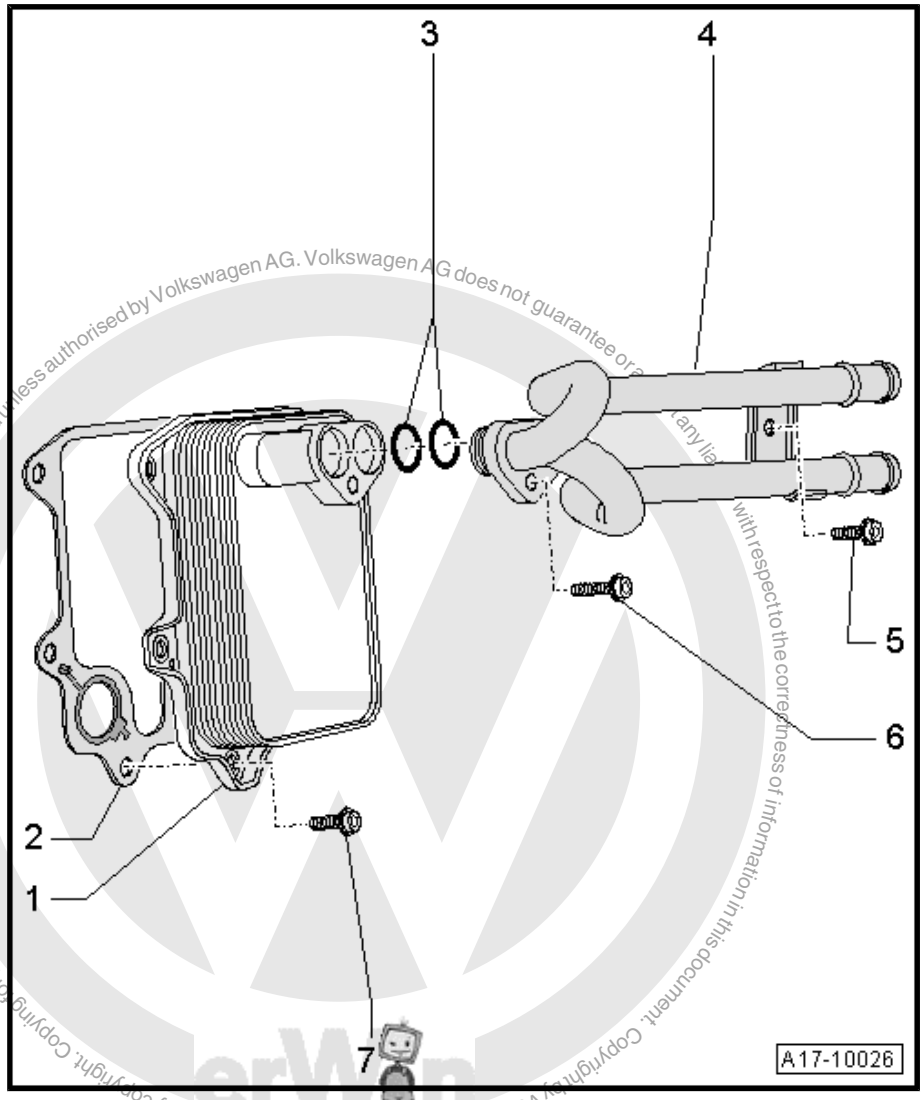
- ❑ Renew

4 - Coolant pipes

5 - 8 Nm

6 - 8 Nm

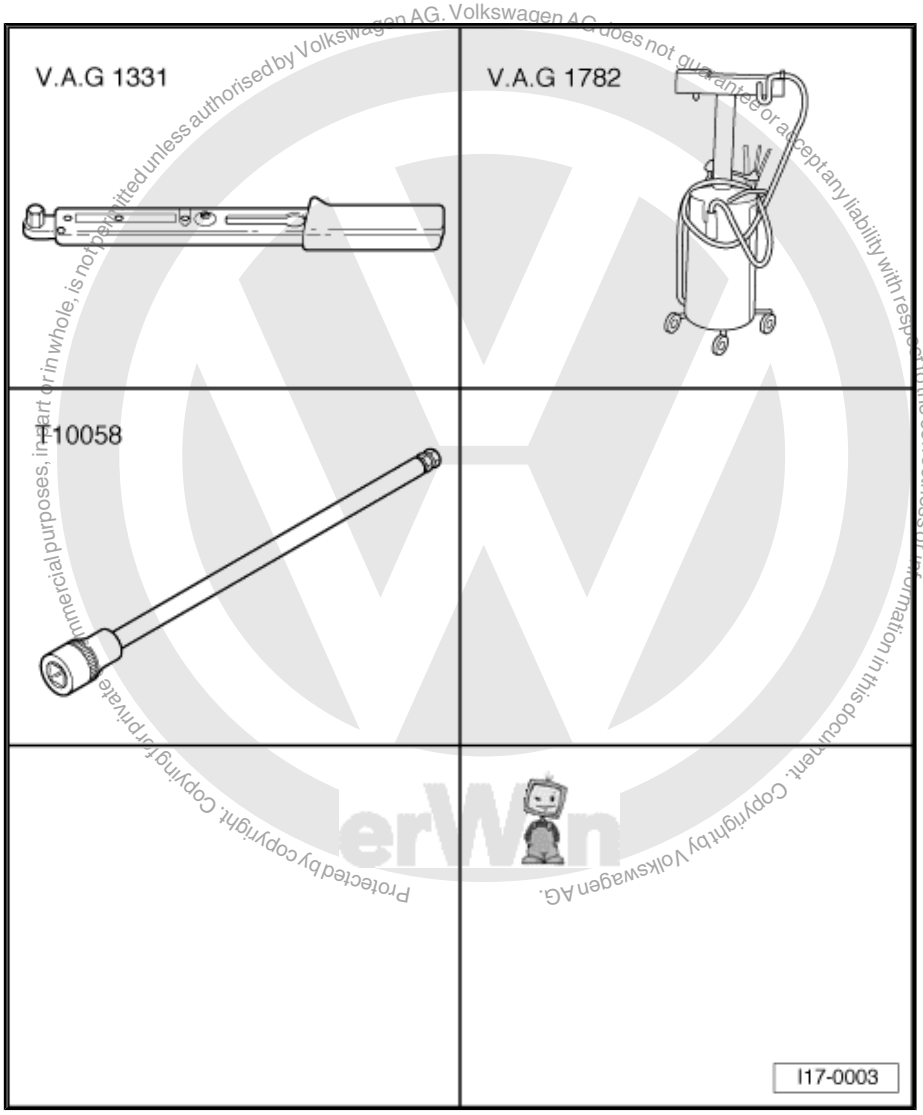
7 - 8 Nm



1.4 Removing and installing oil sump

Special tools and workshop equipment required

- Socket -T10058-
- Torque wrench -V.A.G. 1331-
- Used oil collection and extraction unit -V.A.G. 1782-
- Silicone sealing compound -D 176 404 A2-
- Hand drill with plastic brush
- Flat scraper
- Safety goggles
- 2 threaded studs M6



Removing

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Removing pre-catalytic converter with exhaust pipe ⇒ page 188 .

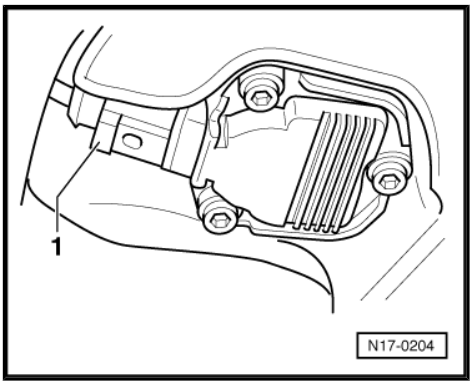
– Pull 3-pin connector -1- off oil level and oil temperature sender -G266- .

– Drain engine oil.

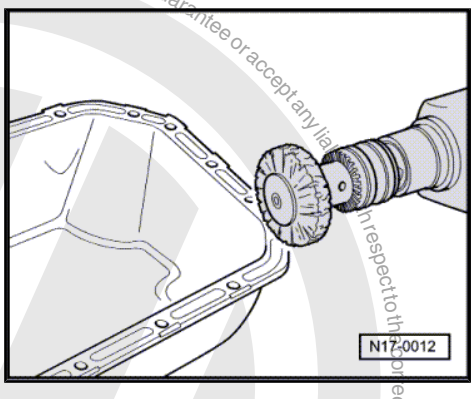
– Unbolt sump sealed with liquid gasket.

– Remove oil sump. Loosen oil sump with light blows of a rubber headed hammer if necessary.

– Remove sealant residue on cylinder block with a flat scraper.



– Remove sealant residue from oil sump with a rotating brush, e.g. a hand drill with a plastic brush attachment (wear protective goggles).
– Clean sealing surfaces. They must be free of oil and grease.



Installing

Note

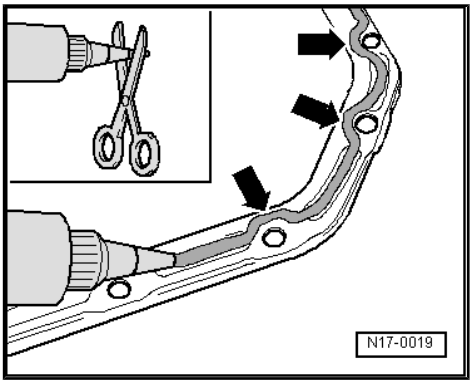
- *Observe the use by date of the sealing compound.*
- *The oil sump must be installed within 5 minutes of applying the silicone sealant.*
- *Sump can be offered up easier and with greater security if, for guide purposes, M6 studs are inserted into the cylinder block flange at two positions.*

– Cut off tube nozzle at forward marking (approx. 3 mm ∅ of nozzle).

– Apply silicone sealing compound, as shown, to clean oil sump sealing surface. Sealant bead must be:

♦ 2...3 mm thick.

♦ Run bead along inner side of bolt holes -arrows-.



Note

The sealing compound bead must not be thicker, otherwise excessive sealing compound will enter the oil sump and may block the oil suction pipe strainer.

– Install oil sump immediately and tighten the two on the opposite side oil sump bolts lightly.

Note

♦ *When placing the oil sump bolts to the flywheel end, observe that the oil sump bolts fit into the holes and not between the cylinder block and flyweel.*

♦ *If the oil sump bolts have been fitted between the cylinder block and the flywheel, and can not be removed anymore, the oil sump must be removed, the sealing surfaces cleaned and the silicone sealing compound renewed.*

– Then tighten both M6 oil sump bolts on flywheel end lightly.

Tighten both M10 bolts for oil sump/gearbox lightly.

– Tighten remaining oil sump bolts lightly.

– Tighten the oil sump bolts.

Bolts M6: 13 Nm

Bolts M10: 40 Nm

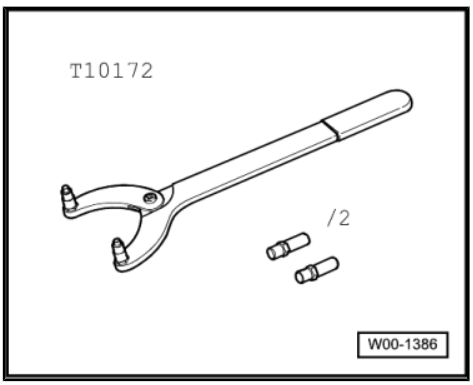
Note

Let sealing compound dry for approx. 30 minutes after installing oil sump. Only then fill engine oil.

1.5 Removing and installing oil pump

Special tools and workshop equipment required

♦ Counter-hold tool -T10172-

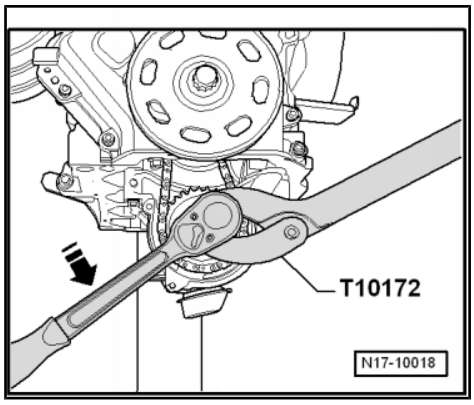


Removing

– Remove oil sump ⇒ page 87 .

– Lock the chain sprocket of the oil pump using counter-hold - T10172- .

– Remove chain sprocket securing bolt.



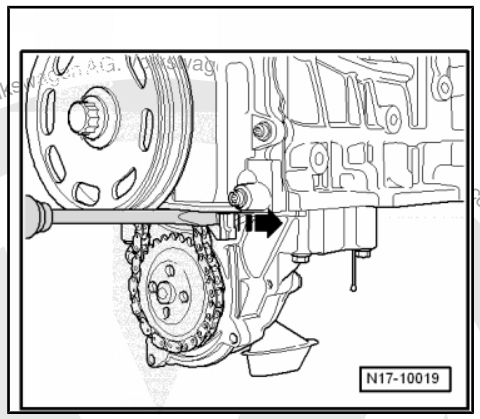
Note

Do not remove bolt yet.

– Press chain tensioner in -direction of arrow- using a screwdriver.

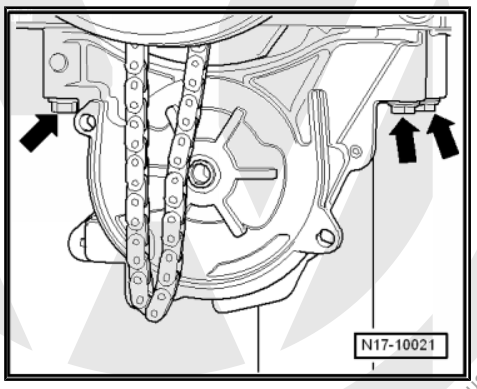
– Remove chain sprocket securing bolt.

– Take chain sprocket off oil pump and out of chain.



– Loosen securing bolts -arrows- of the oil pump and remove.

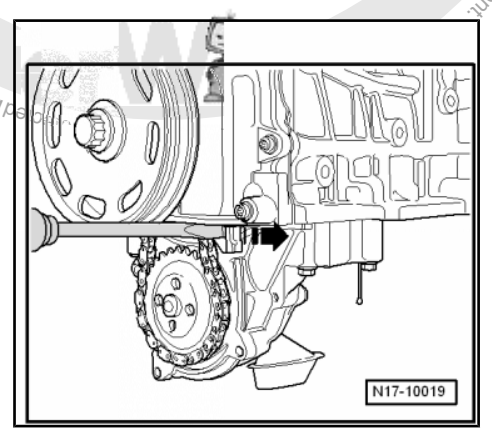
– Take oil pump out of the cylinder block.



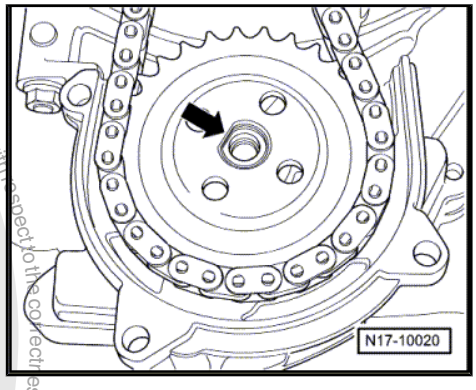
Installing

– Press chain tensioner in -direction of arrow- using a screwdriver.

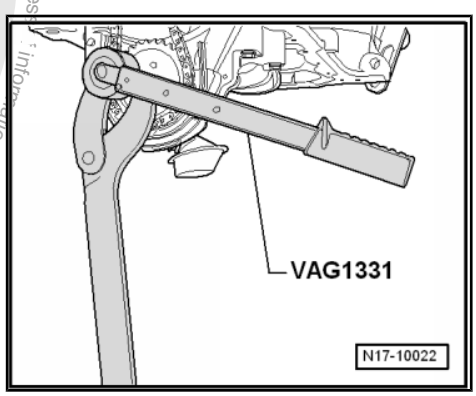
– Set the chain sprocket into the chain and on the oil pump shaft.



– Observe correct seat of chain sprocket on oil pump shaft -arrow-.
– Install chain sprocket securing bolt.
– Lock the chain sprocket using counter-hold -T10172- .



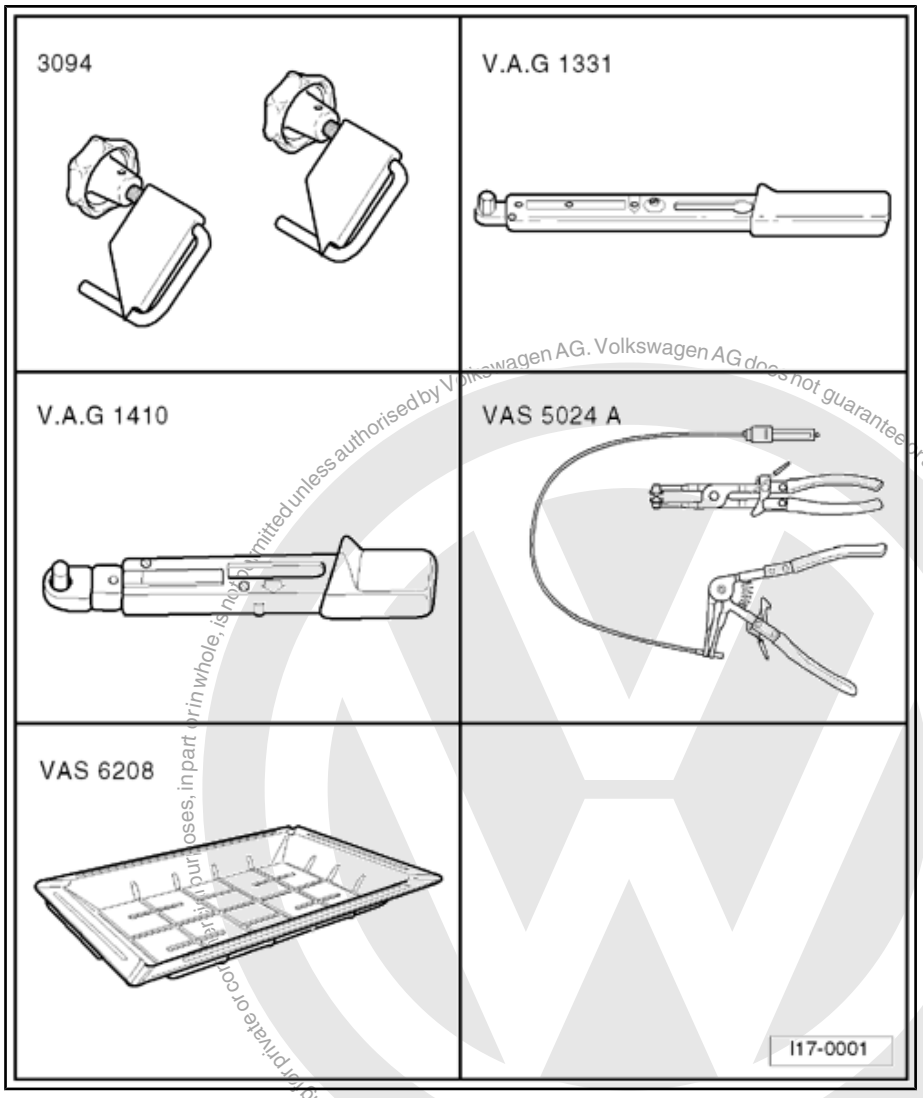
– Place torque wrench -V.A.G. 1331- as shown.
– Tighten securing bolt to 20 Nm + 90° ($^1/_4$ turn) further.
– Install oil sump ⇒ page 87 .



1.6 Removing and installing oil cooler

Special tools and workshop equipment required

- Hose clamp to Ø 25 mm -3094-
- Torque wrench - V.A.G. 1331-
- Torque wrench - V.A.G. 1410-
- Spring-type clip pliers - VAS 5024 A-
- Drip tray for workshop hoist -VAS 6208-



Removing

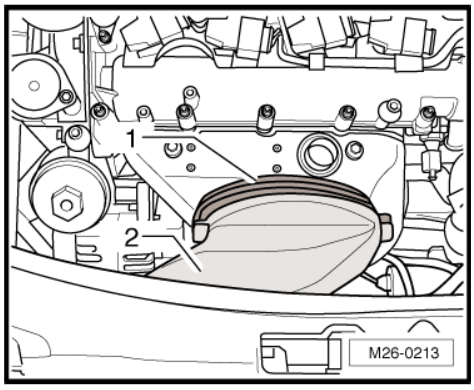
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Drain coolant ⇒ page 102 .

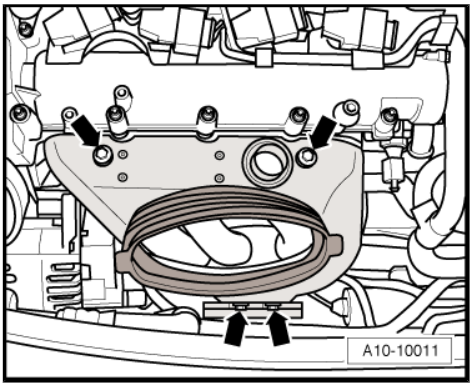
– Remove engine cover with air cleaner ⇒ page 161 .

– Disconnect rubber bellows -1- from air duct -2-.

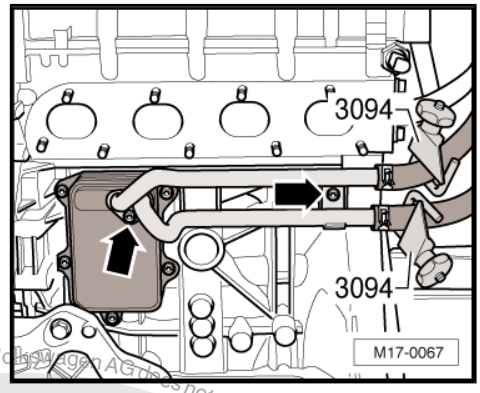
– Release both locking devices and take air duct -2- off.



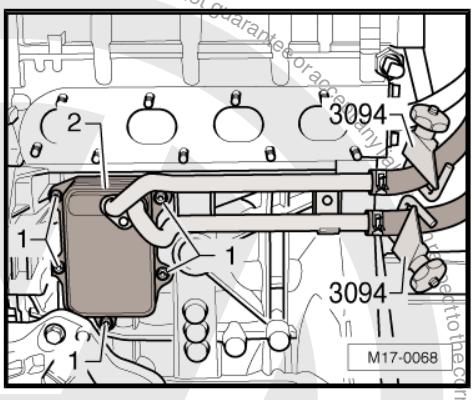
– Remove warm air collector plate -arrows-.



– Disconnect coolant hoses on oil cooler using hose clamps -3094- .
– Remove securing bolts -arrows- for coolant pipes on cylinder block and on oil cooler.
– Remove alternator ⇒ Electrical system; Rep. Gr. 27 ; Alternator; Alternator 1.6 l FSI engine .
– Place drip tray underneath.
– Pull coolant pipes out of oil cooler forwards.



– Remove bolts -1- and pull oil cooler -2- off cylinder block.



Installing

Install in reverse order of removal. During this step, observe the following:

Note

Renew O-ring.

– Add coolant or renew if the oil cooler has been removed ⇒ page 102 .
– Install alternator ⇒ Electrical system; Rep. Gr. 27 ; Alternator; Alternator 1.6 l FSI engine .

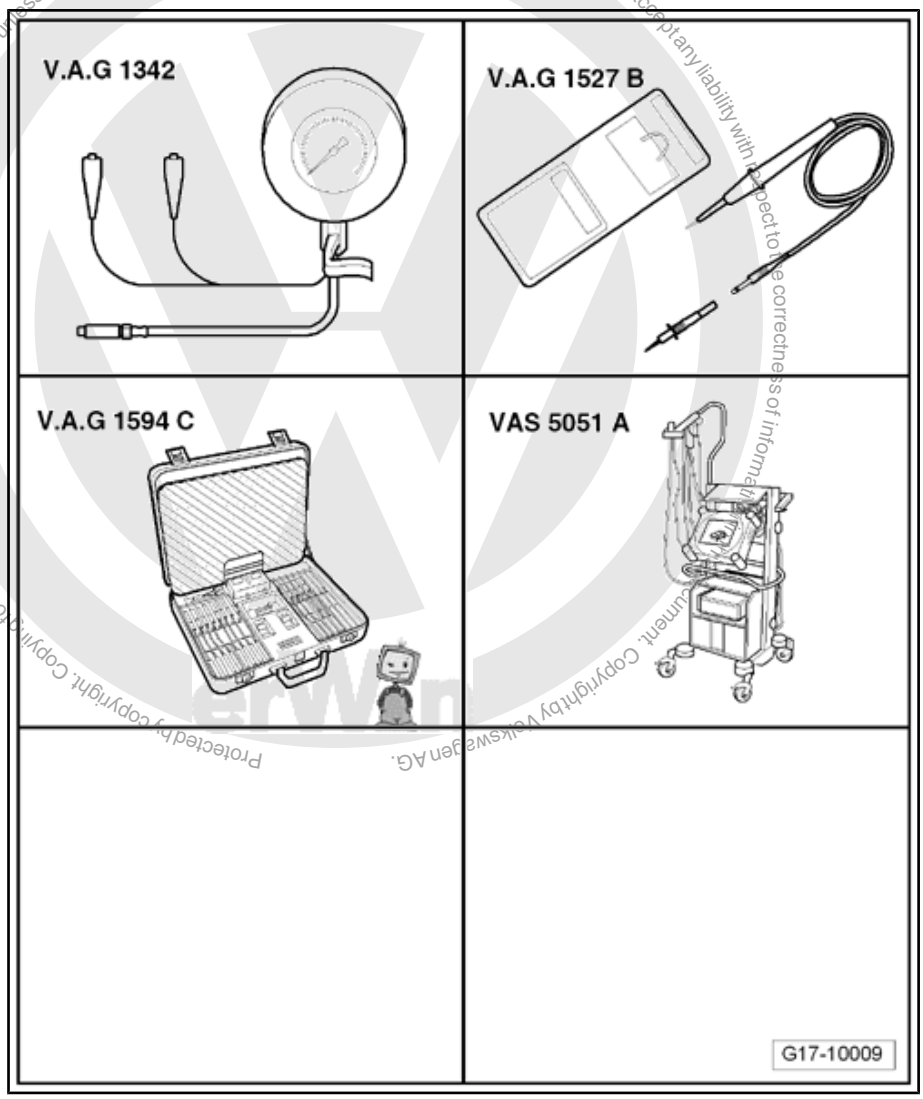
Torque settings

Component	Nm
Coolant pipes for oil cooler	8
Oil cooler to cylinder block	8
Warm air collector plate to exhaust manifold	10

1.7 Checking oil pressure and oil pressure switch

Special tools and workshop equipment required

- Oil pressure gauge -V.A.G. 1342-
- Voltage tester -V.A.G. 1527 B-
- Adapter set -V.A.G. 1594 C-
- Vehicle diagnosis, testing and information system -VAS 5051-
- or vehicle diagnosis and service information system -VAS 5052-



Prerequisites

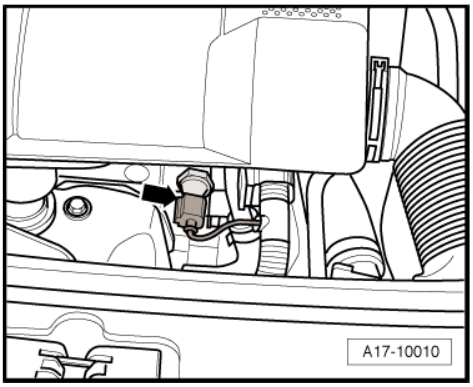
- Engine oil level OK.
- Engine oil temperature at least 80 °C (radiator fan must have run once).

Note

Functional check and repair of the visual and acoustic oil pressure display ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052- .

Test procedure

– Disconnect electrical wiring on oil pressure switch -F1- -arrow-.

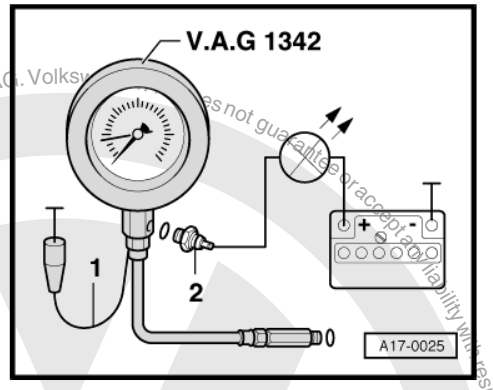


– Remove oil pressure switch -F1- -2- and screw into the oil pressure gauge -V.A.G. 1342- .

– Screw tester into the cylinder head in place of the oil pressure switch.

– Connect brown wire -1- of tester to earth (-).

– Connect voltage tester -V.A.G. 1527 B- using adapter cables from adapter set -V.A.G. 1594 C- to battery positive (+) and oil pressure switch.



LED must not light up.

– If the LED lights up, renew oil pressure switch -F1- .

If LED does not light up:

– Start engine and increase speed slowly. At 0.3...0.7 bar the LED must light up; otherwise renew oil pressure switch.

– Increase engine speed further. At 2000 rpm and an oil temperature of 80 °C the oil pressure should be min. 2.0 bar.

At higher engine speeds the oil pressure must not exceed 7.0 bar.

19 – Cooling system

1 Removing and installing parts of cooling system

Caution

- *When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:*
- *All wirings (e.g. for fuel, hydraulic system, activated charcoal canister system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings are to be installed in the original way.*
- *To avoid damages to the wiring ensure sufficient clearance to all moving or hot components.*

Note

- *When the engine is warm, the cooling system is under pressure. If necessary, release pressure before beginning repair work.*
- *Hoses are secured with spring-type clips. In case of repair, only use spring-type clips.*
- *Hose clip pliers -VAS 5024 A- are recommended for fitting spring-type clips.*
- *When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).*
- *Carry out leak test of cooling system with cooling system tester -V.A.G. 1274- and adapters -V.A.G. 1274/8- and -V.A.G. 1274/9- .*

Parts of cooling system - body side - Assembly overview ⇒ page 97

Parts of cooling system engine side (thermostat side) - Assembly overview ⇒ page 98

Parts of cooling system engine side (coolant pump side) - Assembly overview ⇒ page 99

Coolant hose schematic diagram ⇒ page 99

Draining and filling with coolant ⇒ page 102

Removing and installing radiator fan -V7- and radiator fan 2 -V177- ⇒ page 105

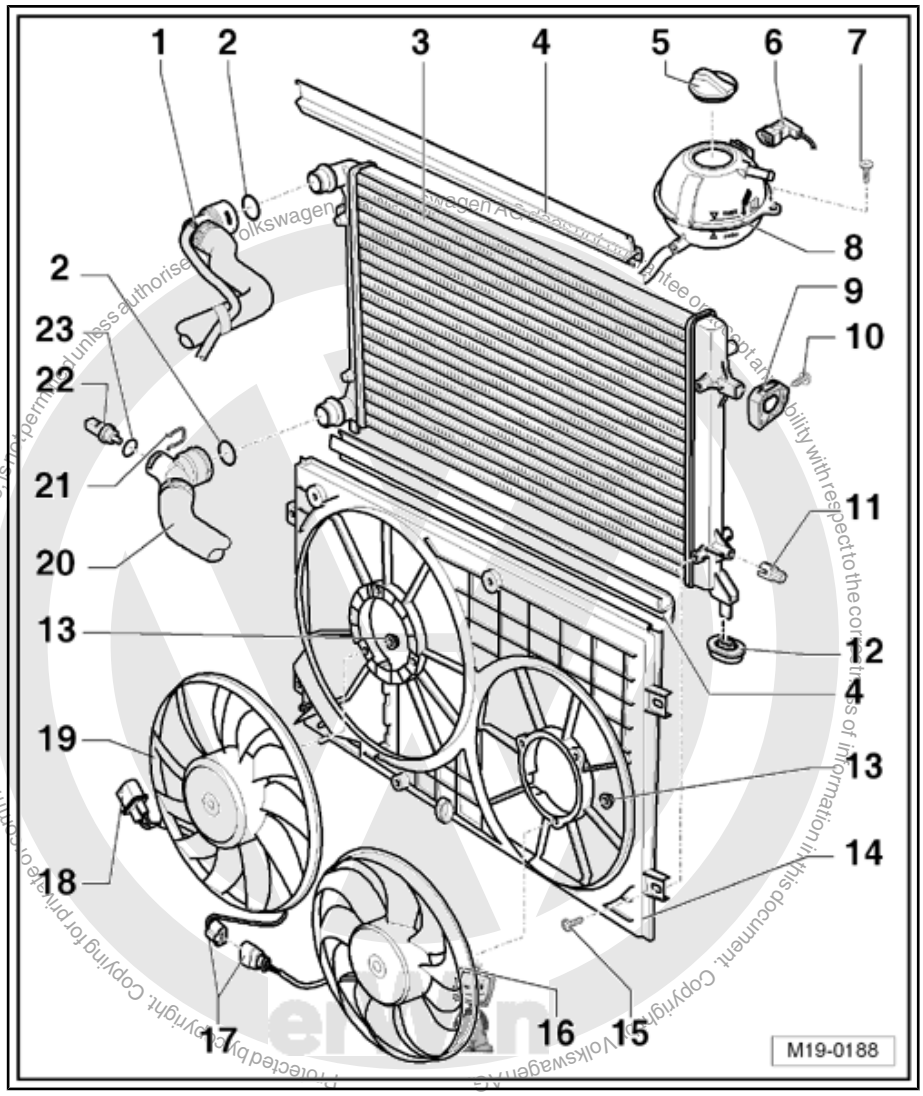
Removing and installing radiator ⇒ page 106

Removing and installing coolant pump ⇒ page 108

Removing and installing thermostat ⇒ page 110

Checking cooling system for leaks ⇒ page 113

1.1 Parts of cooling system - body side - Assembly overview



1 - Upper coolant hose
- ❑ From thermostat housing on cylinder head

2 - O-ring
- ❑ Renew if damaged

3 - Radiator
- ❑ Removing and installing ⇒ page 106
- ❑ After renewing, renew entire coolant

4 - Seal

5 - Sealing cover
- ❑ Check with cooling system tester -V.A.G 1274- and adapter for cooling system tester -V.A.G 1274/9- ⇒ page 113
- ❑ The pressure relief valve must open at a pressure of 1.4…1.6 bar

6 - Connector

7 - 3 Nm

8 - Expansion tank
- ❑ Carry out leak test of cooling system with cooling system tester -V.A.G 1274- and adapter for cooling system -V.A.G 1274/8- ⇒ page 113

9 - Retainer
- ❑ For radiator

10 - 5 Nm

11 - Spacer
- ❑ For refrigerant pipe tester

12 - Base plate
- ❑ Fit in lock carrier

13 - 5 Nm

14 - Air ducting
- ❑ Removing and installing ⇒ page 105

15 - 5 Nm

16 - Radiator fan 2 -V177-
- ❑ Removing and installing ⇒ page 105

17 - Connector

18 - Connector

19 - Radiator fan -V7-
- ❑ Removing and installing ⇒ page 105
- ❑ With radiator fan control unit -J293-

20 - Lower coolant hose

- ❑ From connection for thermostat

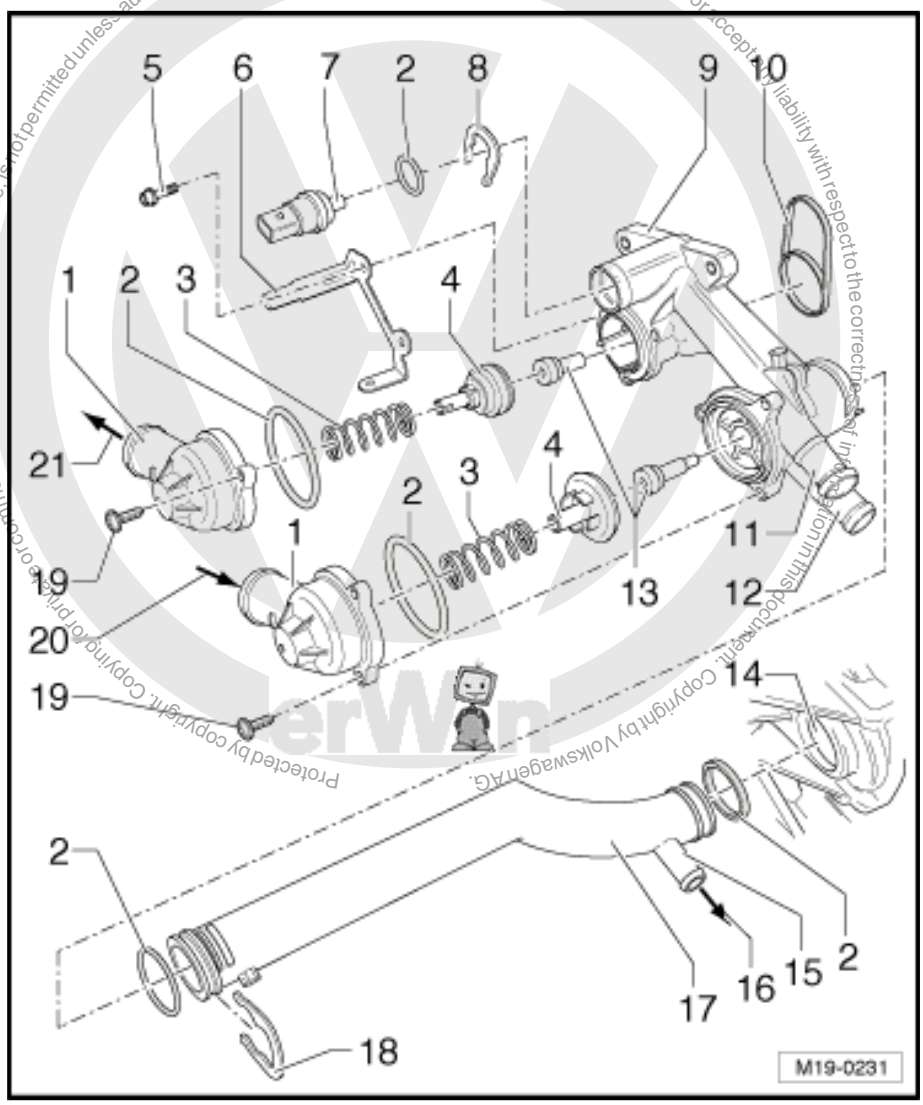
21 - Retaining clip

22 - Radiator outlet coolant temperature sender -G83-

23 - O-ring

- ❑ Renew

1.2 Parts of cooling system engine side (thermostat side) - Assembly overview



1 - Pipe union

2 - O-ring

- ❑ Renew

3 - Compression spring

4 - Rod

5 - 10 Nm

- ❑ Insert with locking fluid

6 - Retainer

- ❑ For wiring harness

7 - Coolant temperature sender -G62-

- ❑ If necessary, release pressure in cooling system before removing

8 - Retaining clip

- ❑ Check for secure seating

9 - Thermostat housing

10 - Seal

- ❑ Renew

11 - To heat exchanger

- ❑ Coolant hose schematic diagram ⇒ page 99

12 - From heat exchanger

- ❑ Coolant hose schematic diagram ⇒ page 99

13 - Thermostat

Control range:

- ❑ Long thermoelement 87 °C…102 °C
- ❑ Short thermoelement 103 °C…120 °C

14 - Coolant pump housing on cylinder block

15 - Pipe union

16 - To expansion tank

- ❑ Coolant hose schematic diagram ⇒ page 99

17 - Coolant pipe

- ❑ Coolant hose schematic diagram ⇒ page 99

18 - Retaining clip

- ❑ Check for secure seating

19 - 5 Nm

20 - From bottom of radiator.

- ❑ Coolant hose schematic diagram ⇒ page 99

21 - To top of radiator

- ❑ Coolant hose schematic diagram ⇒ page 99

1.3 Parts of cooling system engine side (coolant pump side) - Assembly overview

1 - Coolant pump

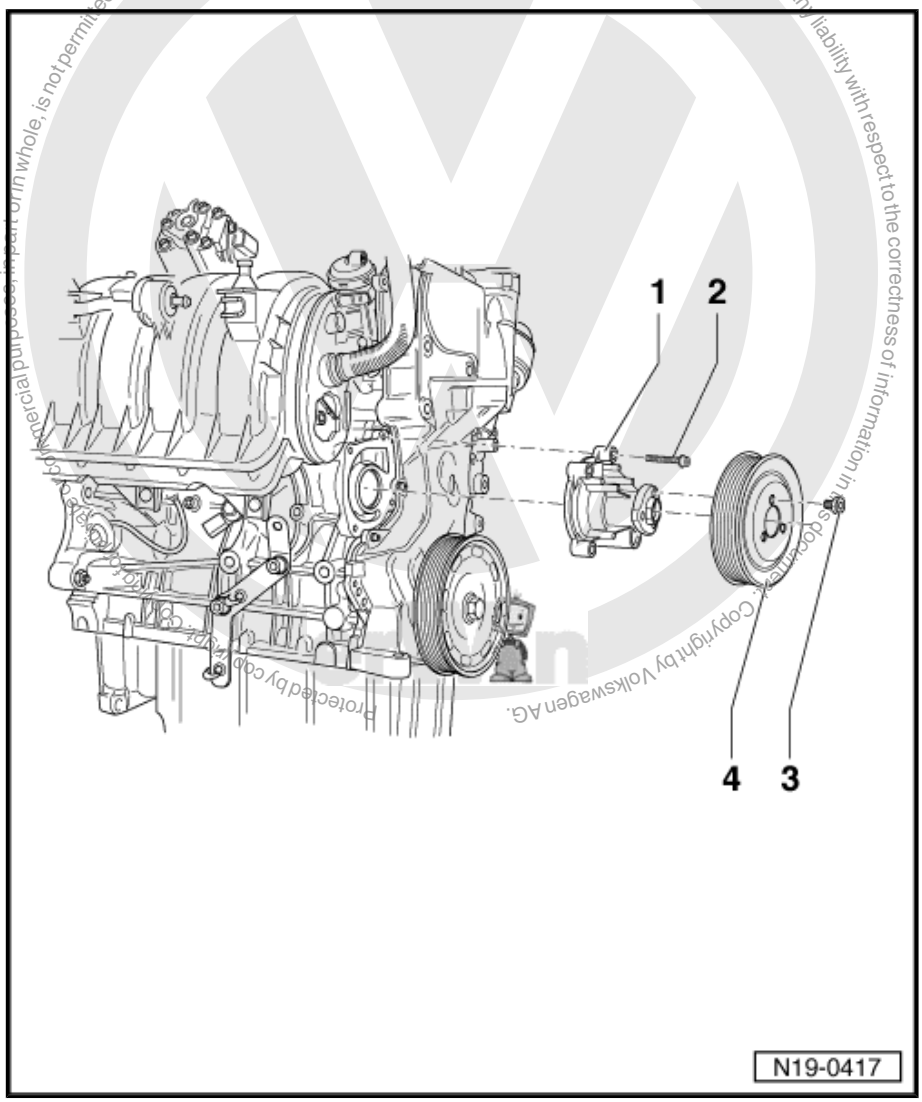
- ❑ Removing and installing ⇒ page 108
- ❑ Check for ease of movement
- ❑ With integrated seal
- ❑ If damaged or leaking renew complete

2 - 9 Nm

3 - 20 Nm

4 - Belt pulley

- ❑ To loosen and tighten use water pump wrench -V.A.G. 1590-
- ❑ Change water pump wrench -V.A.G. 1590- ⇒ page 108
- ❑ When installing note fixing arrangement
- ❑ Removing and installing poly V-belt ⇒ page 29

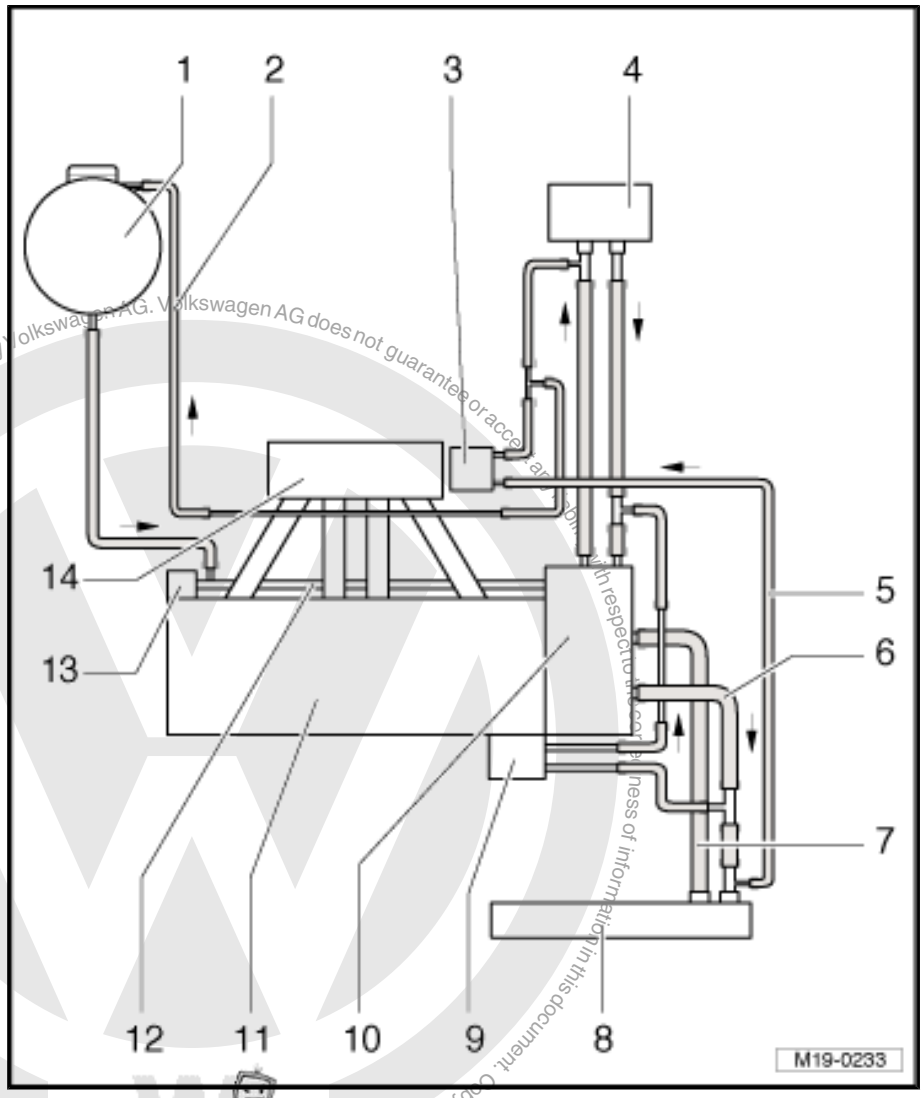


1.4 Coolant hose schematic diagram

Models without auxiliary heater ⇒ page 100

Models with auxiliary heater ⇒ page 101

1.4.1 Models without auxiliary heating



1 - Expansion tank

2 - Coolant hose

- ❑ From exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

3 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

4 - Heater unit heat exchanger

- ❑ After renewing, renew entire coolant

5 - Coolant hose

- ❑ To exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

6 - Upper coolant hose

7 - Lower coolant hose

8 - Radiator

- ❑ After renewing, renew entire coolant

9 - Engine oil cooler

- ❑ After renewing, renew entire coolant

10 - Thermostat housing

11 - Cylinder head/cylinder block

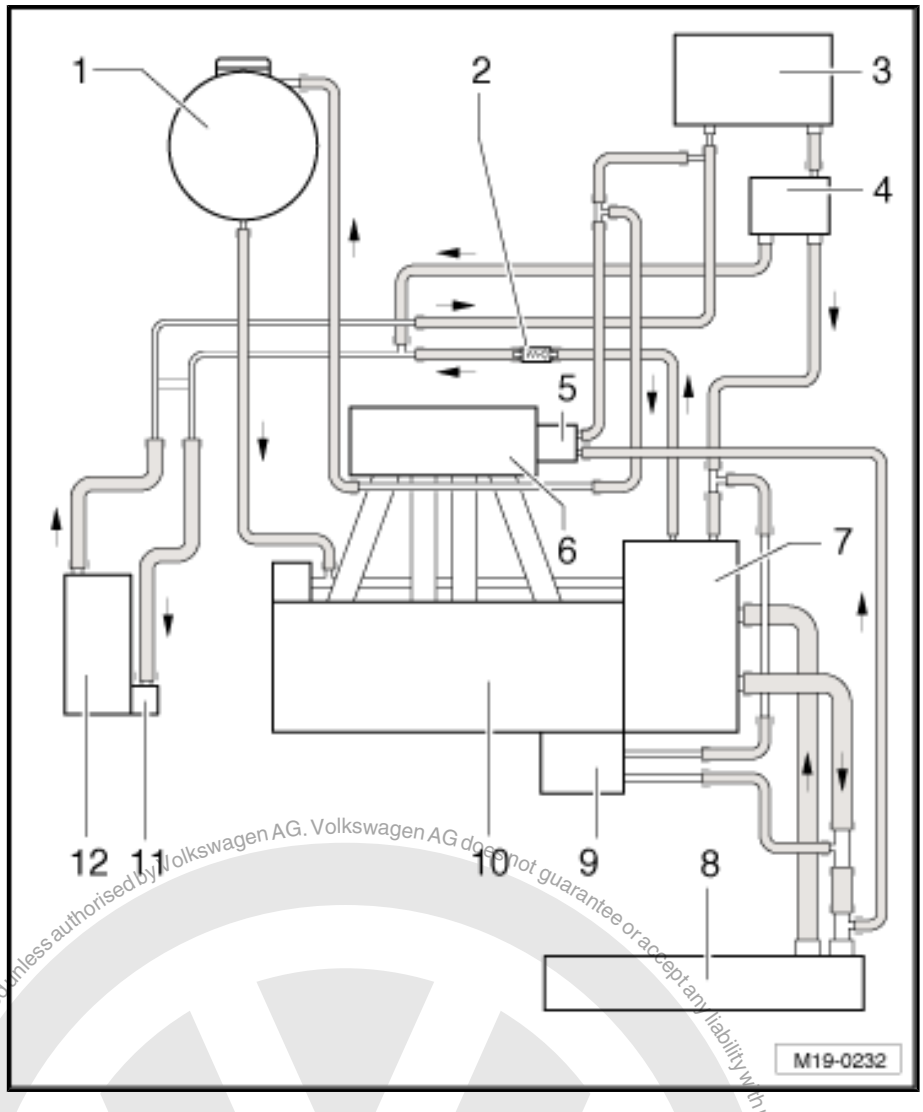
- ❑ After renewing, renew entire coolant

12 - Coolant pipe

13 - Coolant pump

14 - Intake manifold

1.4.2 Models with auxiliary heater



1 - Expansion tank

2 - Non-return valve

3 - Heater unit heat exchanger

- ❑ After renewing, renew entire coolant

4 - Heater coolant shut-off valve -N279-

- ❑ Location: Secured to engine compartment bulkhead

5 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

6 - Intake manifold

7 - Thermostat housing

8 - Radiator

- ❑ After renewing, renew entire coolant

9 - Engine oil cooler

- ❑ After renewing, renew entire coolant

10 - Cylinder head/cylinder block

- ❑ After renewing, renew entire coolant

11 - Circulation pump -V55-

- ❑ Removing and installing recirculating pump ⇒ auxiliary heater; Rep. Gr. 82 ; Removing and installing auxiliary heater Thermo Top V

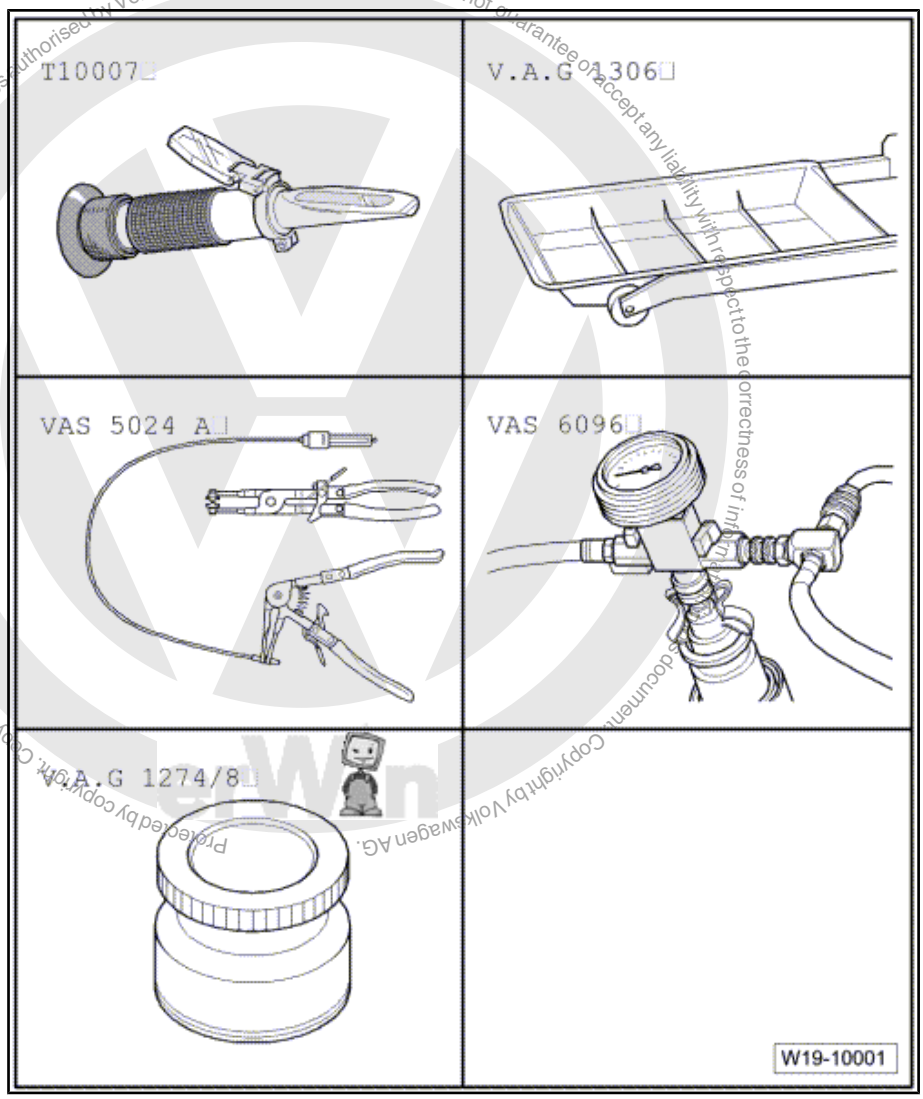
12 - Auxiliary heater Thermo Top V

- ❑ Removing and installing auxiliary heater ⇒ auxiliary heater; Rep. Gr. 82 ; Removing and installing auxiliary heater Thermo Top V

1.5 Draining and filling coolant

Special tools and workshop equipment required

- Refractometer -T10007-
- Drip tray -V.A.G. 1306- or -VAS 6208-
- Spring-type clip pliers -VAS 5024 A-
- Cooling system charging unit -VAS 6096-
- Adapter for cooling system tester -V.A.G. 1274/8-



Draining

WARNING

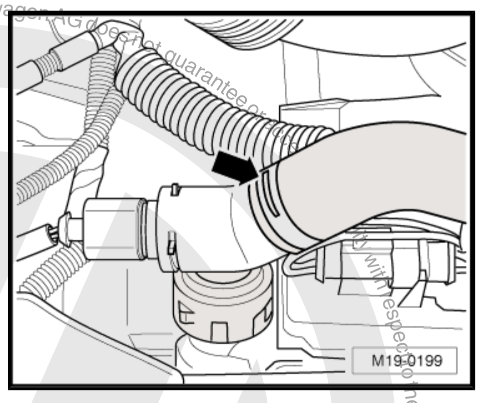
Hot steam can escape when opening expansion tank. Wear eye protection and protective clothing to prevent eye damage and scalding. Cover sealing cap with a cloth and open cap carefully.

– Open sealing cap of expansion tank.

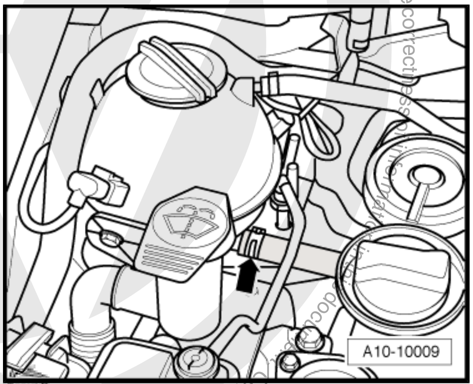
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

– Open spring-type clamp -arrow- and pull coolant hose off.

If quick release coupling is pulled off on the lower radiator union, much coolant will leak out on the bumper cover.



– Pull coolant hose -arrow- on expansion tank off and guide completely downwards to drain remaining coolant.



Note

Observe disposal regulations!

Filling

Note

- *Only use coolant additive G 12 in accordance with “TL VW 774 F”. Identification characteristics: Coloured lilac (purple)*
- *G 12 lilac according to “TL VW 774 F” can be mixed with coolant additive G 12 red.*
- *G 12 and coolant additives marked in accordance with “TL VW 774 F” prevent frost and corrosion damage, scaling and also raise boiling point of coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.*
- *Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.*
- *Frost protection (anti-freeze) must be guaranteed to approx. -25 °C (approx. -35 °C in countries with an arctic climate) in the washer system.*
- *The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze must be at least 40% of mixture.*
- *If for climatic reasons a higher frost protection is required, the amount of G 12 can be increased, but only up to 60 % (frost protection to about -40 °C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.*
- *If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.*

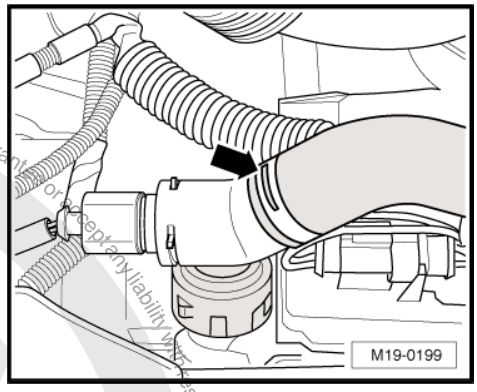
Recommended mixture proportions:

Frost protection to	Anti freeze proportion	G 12 [4]	Water [4]
-25 °C -35 °C	40 % 50%	2.25 l 2.8 l	3.35 l 2.8 l

4) The quantity of coolant can vary depending upon vehicle equipment.

– Fit the coolant hose on the union and secure with spring-type clamp.

– Install noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

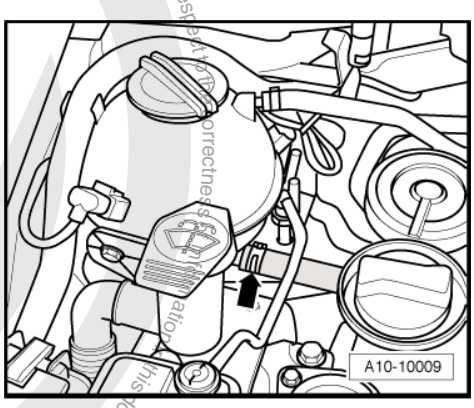


– Fit coolant hose -arrow- to expansion tank.

With cooling system charging unit -VAS 6096-

– Fill coolant circuit using cooling system charging unit - VAS 6096- . ⇒ Operating instructions for cooling system charging unit VAS 6096 .

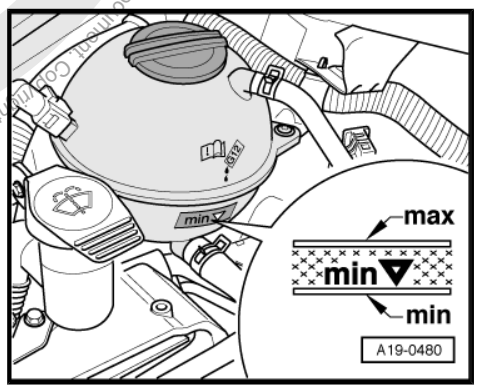
Without cooling system charging unit -VAS 6096-



– Fill with coolant up to max. mark on expansion tank.

– Fit expansion tank cap.

– Switch off heater blower.



Models without auxiliary heating

– Start engine and maintain an engine speed of about 2000 rpm for approx. 3 minutes.

– Run engine until radiator fans cuts-in.

Models with auxiliary heater

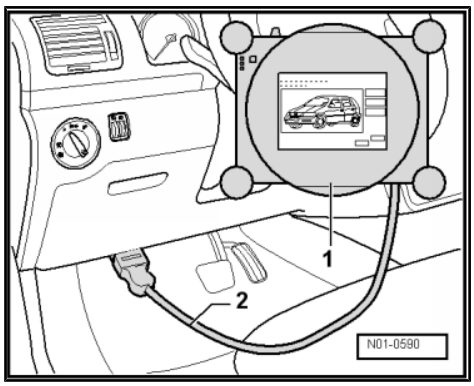
> **Caution**
>
> ***The auxiliary heater may only be switched on when the coolant circuit is filled as described in the following.***

– Connect the connector of the diagnostic cable -2- of the vehicle diagnosis, testing and information system -VAS 5051- or the vehicle diagnosis, testing and information system -VAS 5052- -1- to the diagnosis connection in the driver footwell.

– Start engine and maintain an engine speed of about 2000 rpm for approx. 3 minutes.

– Let the engine run with the same speed for one minute and initiate simultaneously in the same minute the selective final control diagnosis for the heater coolant shut-off valve -N279- (shut-off valve is supplied with current).

The coolant circuit of the auxiliary heater can be bled only this way correctly.

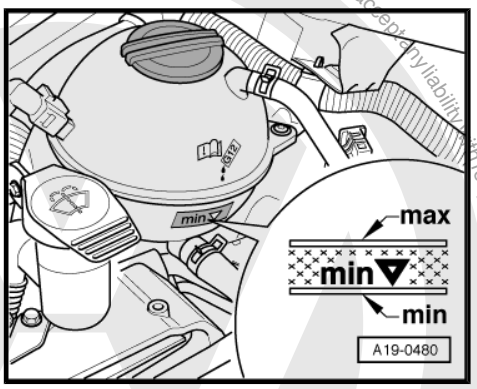


– Run engine until radiator fans cuts-in.

Continuation for vehicles with and without auxiliary heater

– Check coolant level when expansion tank is closed.

• When the engine is at operating temperature, the coolant level must be on the max. mark and between the min. and max. marks when the engine is cold.



WARNING

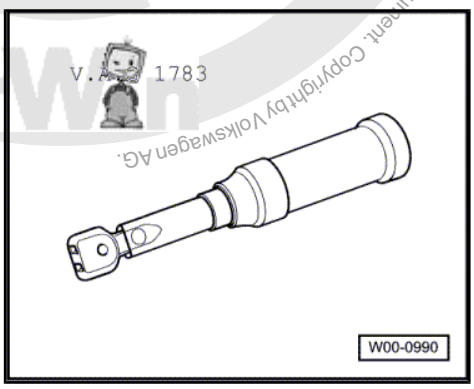
Hot steam can escape when opening expansion tank. Wear eye protection and protective clothing to prevent eye damage and scalding. Cover sealing cap with a cloth and open cap carefully.

– Replenish coolant, if necessary.

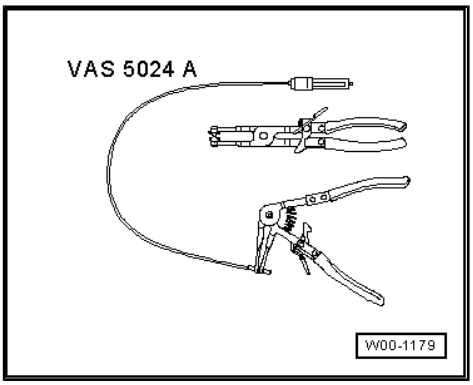
1.6 Removing and installing radiator fan - V7- and radiator fan 2 -V177-

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1783-



♦ Spring-type clip pliers -VAS 5024 A-



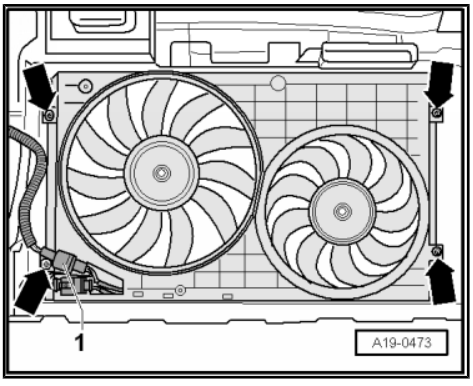
Removing

– Remove upper securing bolts -arrows- of the air ducting.

– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

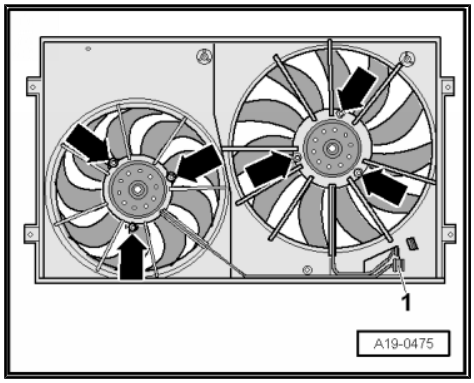
– Disconnect connector -1- and remove lower securing bolts -arrows- of the air ducting.

– Take air ducting out downwards.



– Disconnect connection -1- and place wiring to side.

– Remove nuts -arrows- and take radiator off.



Installing

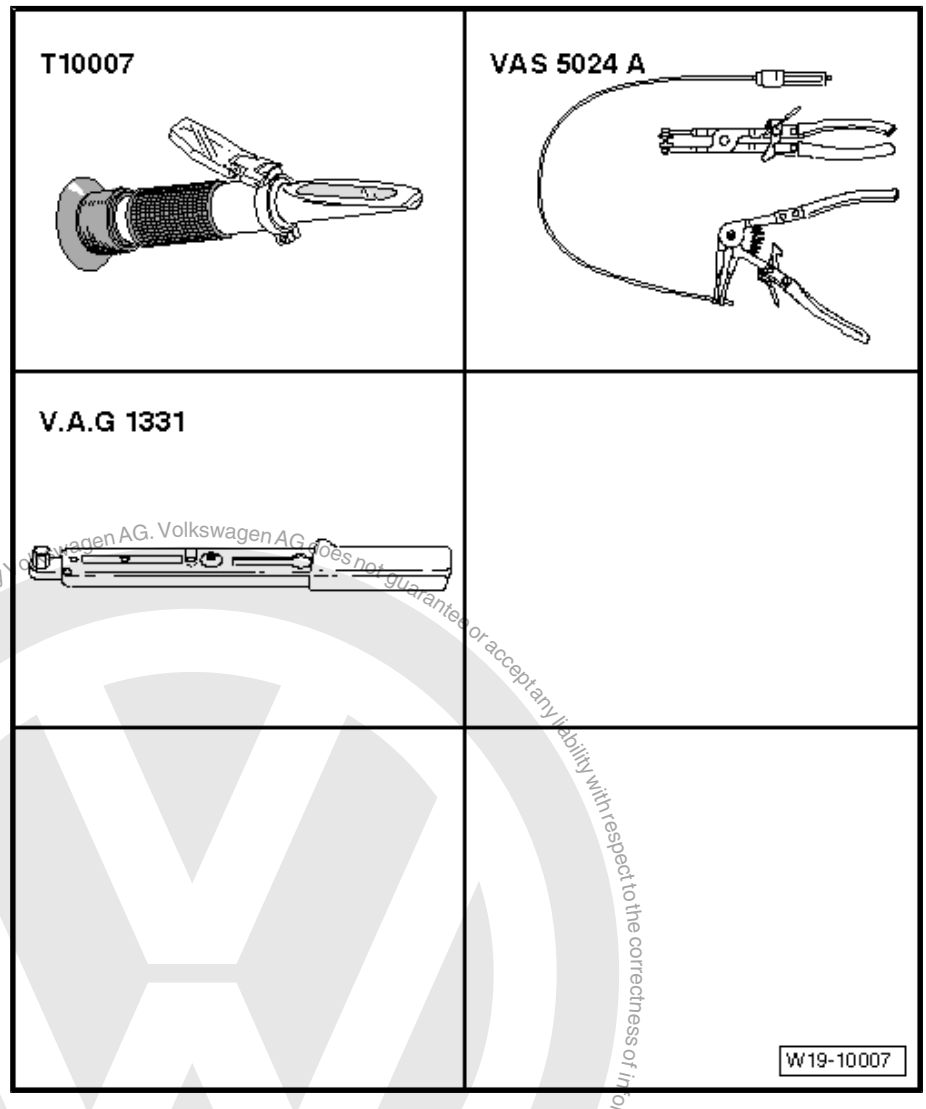
Install in reverse order of removal. During this step, observe the following:

– Install air ducting from below and tighten bolts to 5 Nm.

1.7 Removing and installing radiator

Special tools and workshop equipment required

- Refractometer -T10007-
- Spring-type clip pliers -VAS 5024 A-
- Torque wrench -V.A.G. 1331-



Removing

– Drain coolant ⇒ page 102 .

– Remove front bumper cover ⇒ General body repairs, exterior; Rep. Gr. 63 ; Front bumper; Removing and installing front bumper cover .

– Pull coolant hoses off radiator.

– Remove cowling with radiator fans ⇒ page 105 .

– Remove left and right bumper cover guide ⇒ General body repairs, exterior; Rep. Gr. 63 ; Front bumper; Front bumper cover substructure .

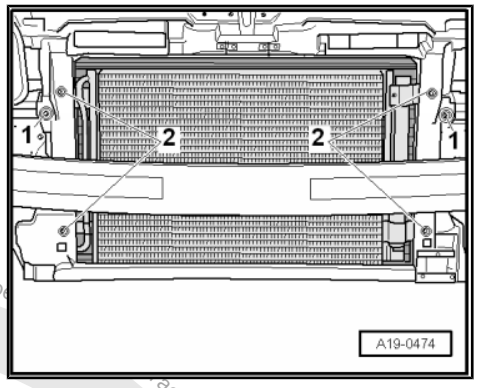
Models without air conditioning system

– Remove bolts -1- from radiator mounting.

– Take radiator out downwards.

Models with an air conditioning system

– Bring lock carrier into service position ⇒ General body repairs, exterior; Rep. Gr. 50 ; Lock carrier .



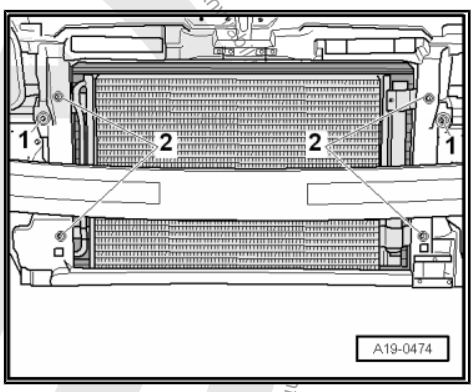
Note

To prevent damage to condenser also to the refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.

– Remove bolts -1- from radiator mounting.

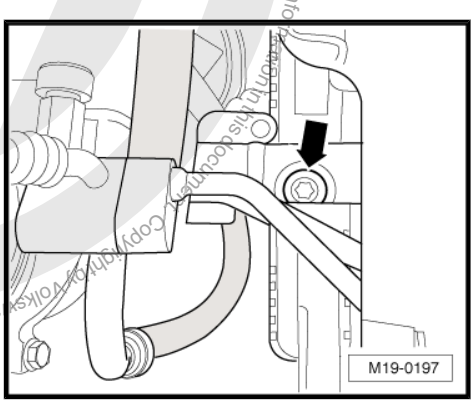
– Swing radiator slightly to back.

– Remove securing bolts -2- of condenser.



– Remove bolt -arrow- for fitting refrigerant pipe.

– Take radiator out downwards.



Installing

Install in reverse order of removal. During this step, observe the following:

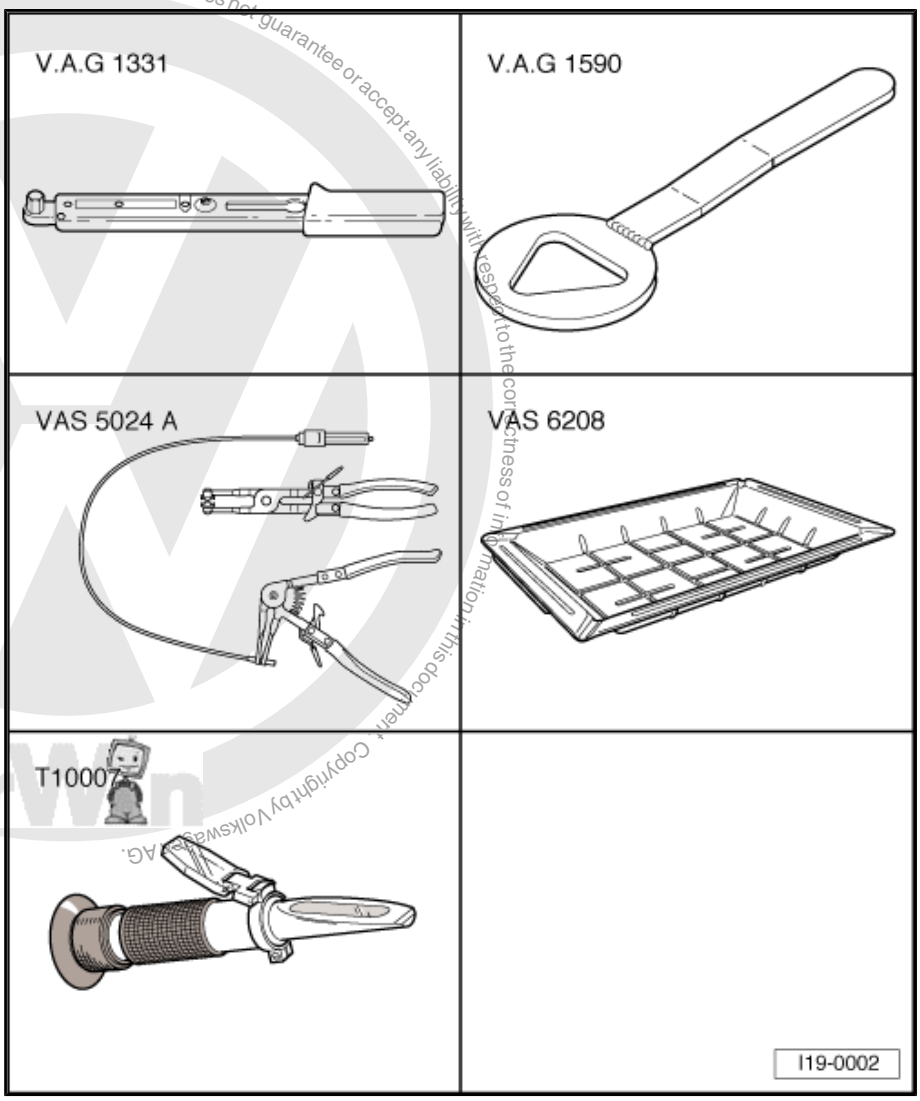
– Renew coolant if a new radiator has been installed.

– Fill with coolant ⇒ page 102 .

1.8 Removing and installing coolant pump

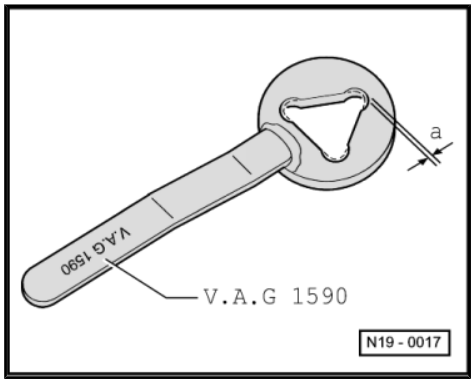
Special tools and workshop equipment required

- Torque wrench -V.A.G. 1331-
- Water pump wrench -V.A.G. 1590-
- Spring-type clip pliers -VAS 5024 A-
- Drip tray for workshop hoist -VAS 6208-
- Refractometer -T10007-



Change water pump wrench V.A.G. 1590

– Due to the modified securing bolts for the belt pulley coolant pump file the three curves for a = 1 mm minimum.



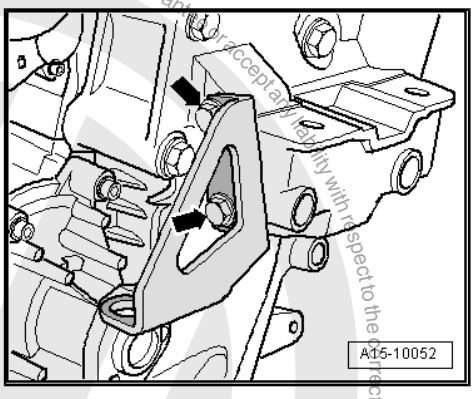
Removing

Note

- *The integrated coolant pump seal must not be separated from the coolant pump.*
- *Damaged or leaking coolant pumps must be replaced complete with seal.*

– Remove engine cover with air cleaner ⇒ page 161 .

– Remove bolts -arrows- and take engine lifting eye off.



– Drain coolant ⇒ page 102 .

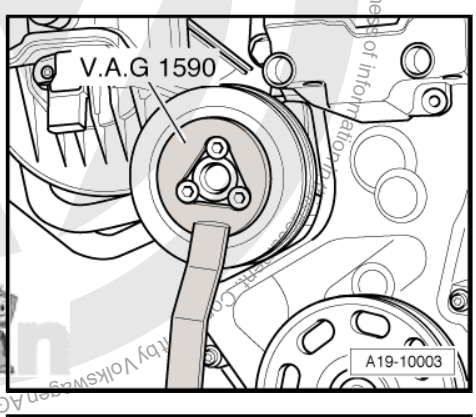
– Remove the front right wheel housing liner: ⇒ General body repairs; Rep. Gr. 66 ; Removing and installing wheel housing liner; Front wheel housing liner .

Note

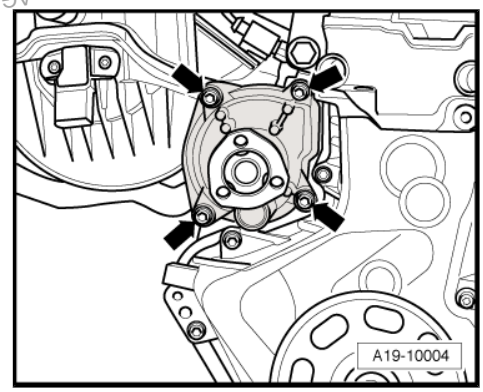
The belt pulley - Coolant pump is removed via the wheel case.

– Remove ribbed belt ⇒ page 29 .

– Unscrew belt pulley - Coolant pump. To do this counterhold with modified water pump wrench -V.A.G. 1590- .



– Remove bolts -arrows- and remove coolant pump from the cylinder block.



Installing

Install in reverse order of removal. During this step, observe the following:

– Fit coolant pump into the cylinder block.

– Tighten securing bolts to 25 Nm.

– Tighten belt pulley of coolant pump to 20 Nm.

– Install Poly V-belt ⇒ page 29 .

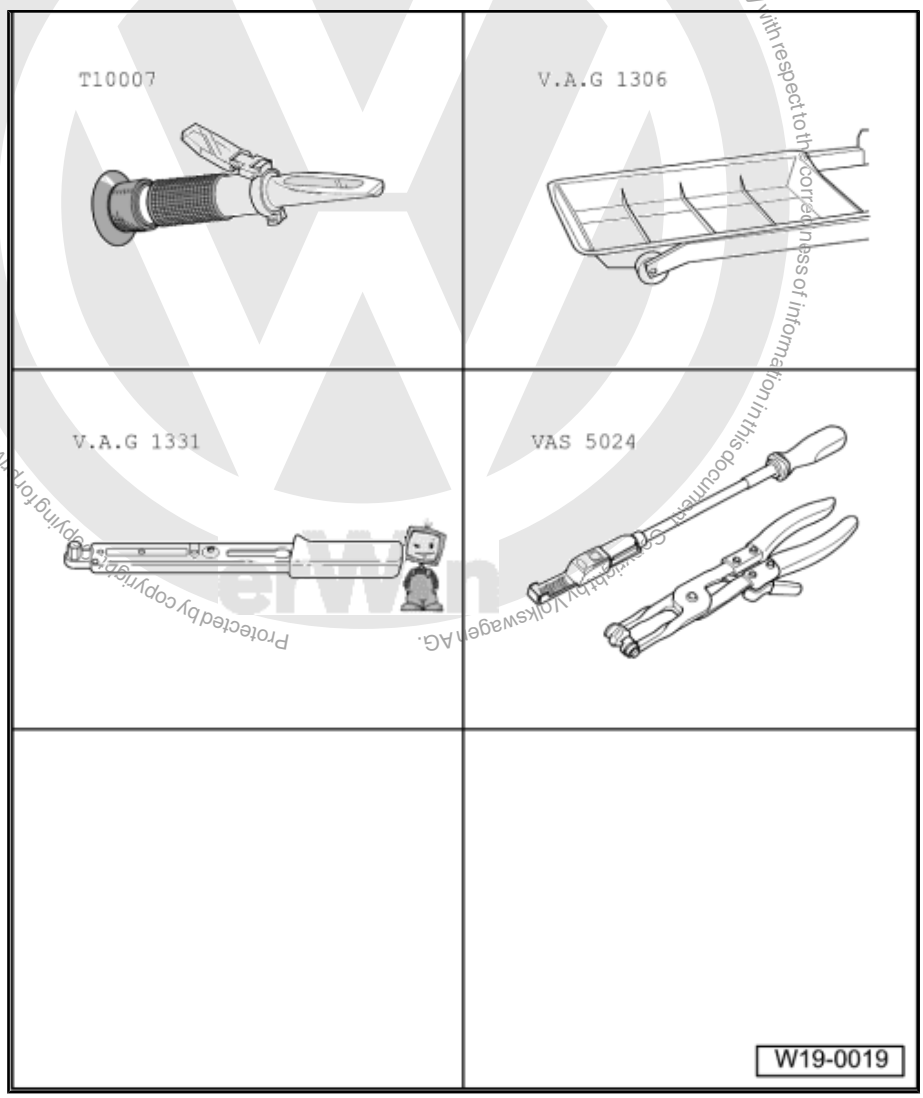
– Install front right wheel housing liner ⇒ General body repairs; Rep. Gr. 66 ; Removing and installing wheel housing liner; Front wheel housing liner .

– Fill with coolant ⇒ page 102 .

1.9 Removing and installing thermostat

Special tools and workshop equipment required

- Refractometer -T10007-
- Drip tray -V.A.G. 1306-
- Torque wrench -V.A.G. 1331-
- Spring-type clip pliers -VAS 5024 A-



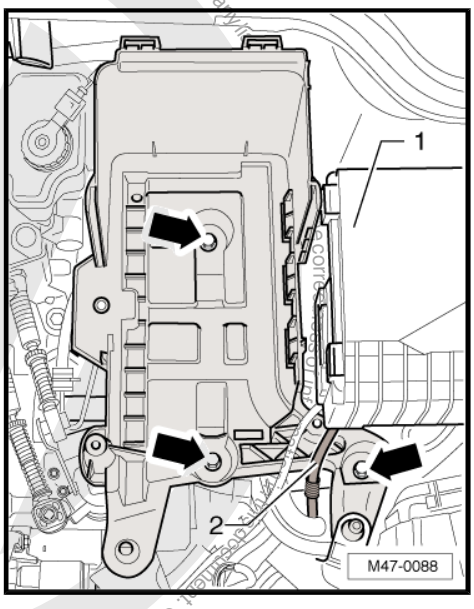
Removing

– With ignition switched off disconnect battery earth strap ⇒ Electrical system; Rep. Gr. 27 ; Disconnecting and connecting the battery .

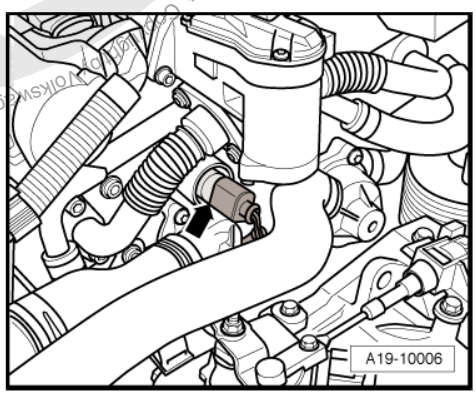
– Remove engine cover with air cleaner ⇒ page 161 .

– Removing battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Vehicles with petrol engine .

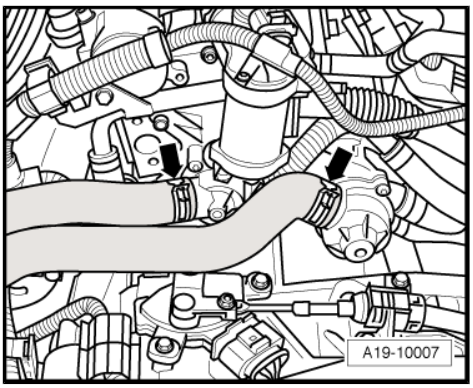
– Open the cover -1- of the electronics box and remove the cable -2-.
– Remove bolts -arrows- and battery carrier.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .
– Drain coolant ⇒ page 102 .



– Disconnect electrical connection -arrow- on coolant temperature sender -G62- .

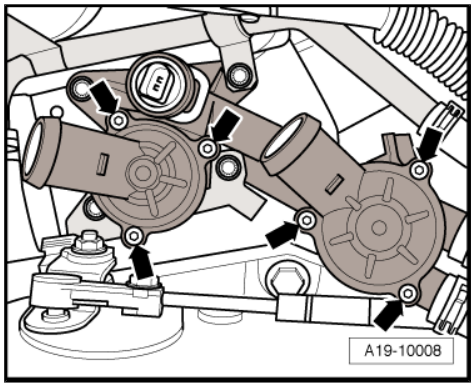


– Remove both coolant hoses from thermostat housing -arrows-.



– Remove bolts -arrows- and take respective pipe union off.

– Take spring, tappet and thermostat off.



Installing

Install in reverse order of removal. During this step, observe the following:

Note

O-rings; Renew.

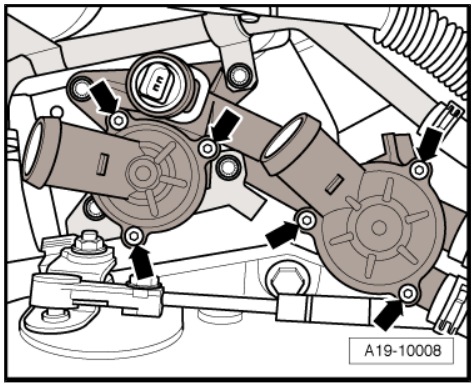
– Clean or smooth sealing surface for O-ring.

– Moisten new O-ring with coolant and fit into pipe union.

– Fit thermostat, spring and tappet.

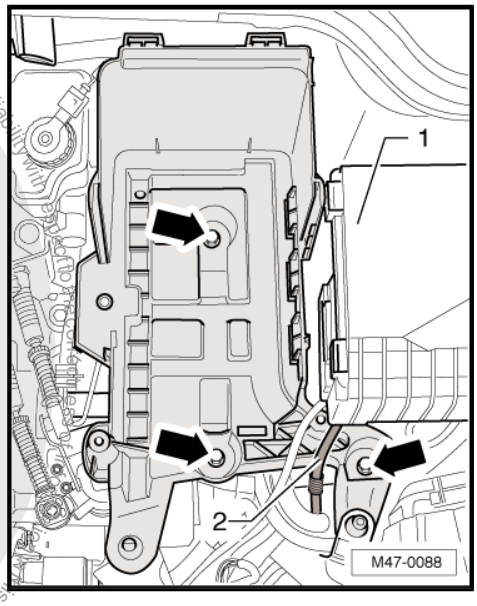
• Installation position: The hole in the tappet for thermostat must show upwards.

– Tighten bolts -arrows- of pipe union to 5 Nm.



– Install battery carrier first and tighten bolts -arrows-.

– Route wiring -2- as shown in the figure and fit to electronics box -1-.



– Top-up coolant ⇒ page 102 .

– Install noise insulation ⇒ General Body Repairs, Exterior; Rep. Gr. 50 ; Noise insulation .

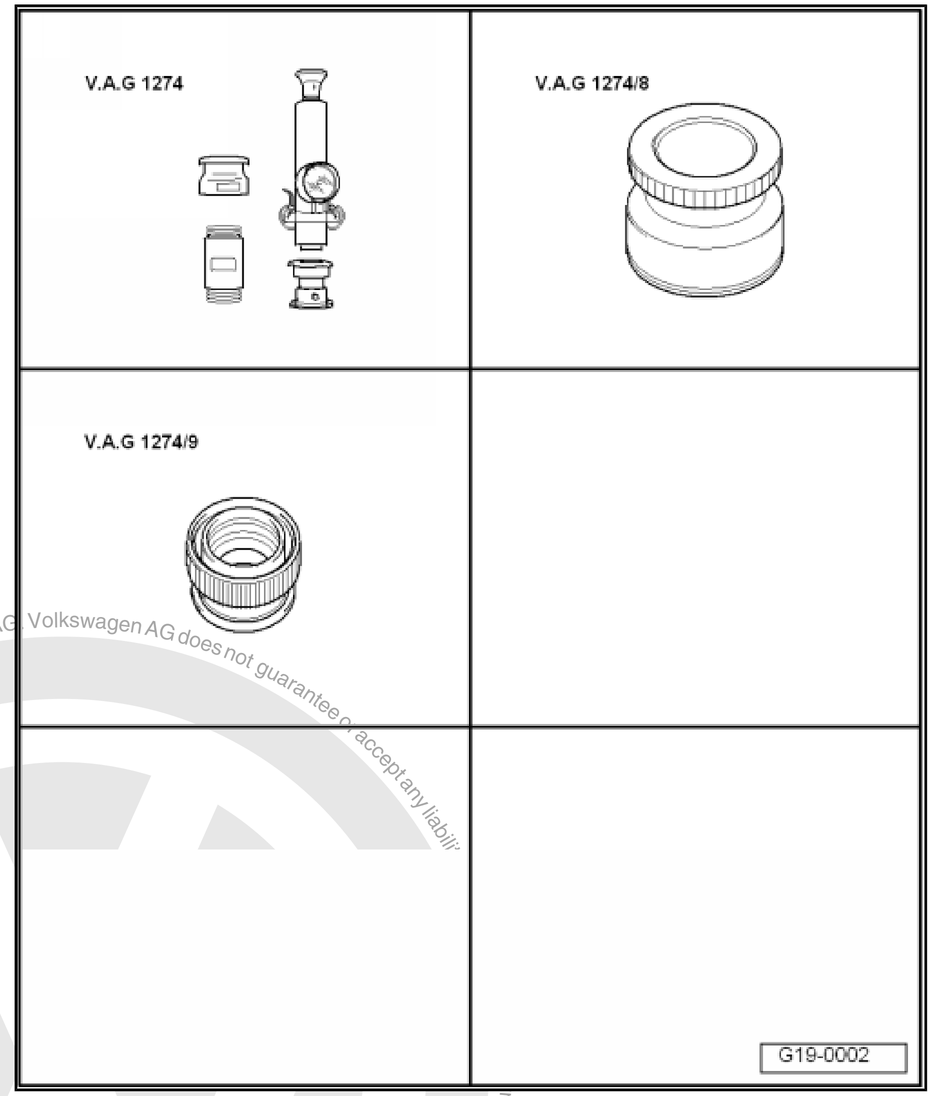
Install the battery and observe the respective measures after connecting the battery ⇒ Electrical system; Rep. Gr. 27 ; Removing and installing battery; Models with petrol engine .

– Install engine cover with air cleaner ⇒ page 161 .

1.10 Check cooling system for leaks:

Special tools and workshop equipment required

- ♦ Cooling system tester -V.A.G. 1274-
- ♦ Adapter for cooling system tester -V.A.G. 1274/8-
- ♦ Adapter for cooling system tester -V.A.G. 1274/9-



Test procedure

- Engine at operating temperature

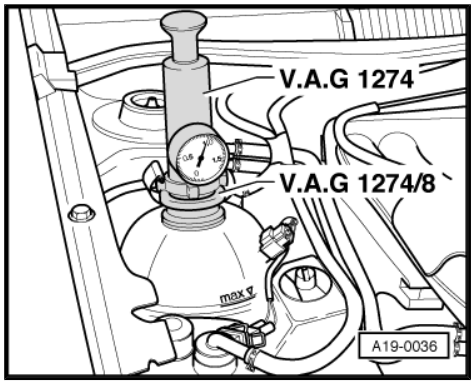
> ⚠ WARNING
>
> *Hot steam can escape when opening expansion tank. Wear eye protection and protective clothing to prevent eye damage and scalding. Cover sealing cap with a cloth and open cap carefully.*

– Open cap on coolant expansion tank.

– Set cooling system tester -V.A.G. 1274- with adapter -V.A.G. 1274/8- on coolant reservoir.
– Generate a pressure of approx. 1 bar using the tester hand pump.

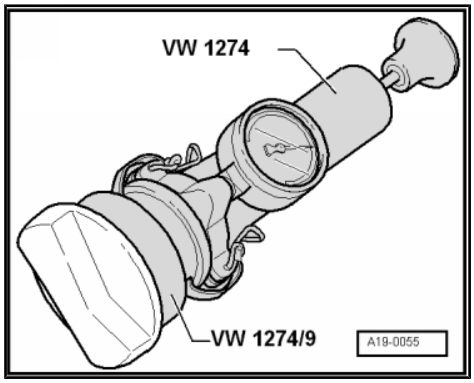
If the pressure drops:

– Search for the leak and eliminate fault.



Check pressure relief valve in sealing cap

– Set cooling system tester -V.A.G. 1274- with adapter -V.A.G. 1274/9- on coolant reservoir.
– Operate hand pump.
• The pressure relief valve must open at a pressure of 1.4…1.6 bar.



20 – Fuel supply system

1 Removing and installing parts of fuel supply system

Safety precautions when working on fuel supply system ⇒ page 115 .

Observe rules for cleanliness ⇒ page 115 .

Fuel tank with attachments - Assembly overview ⇒ page 116

Emptying fuel tank ⇒ page 118

Removing and installing fuel tank ⇒ page 120

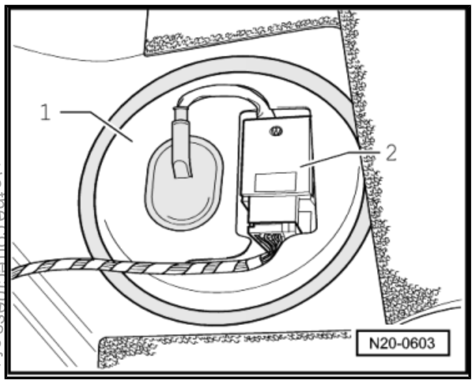
Fuel filter with attachments - Assembly overview ⇒ page 123

Removing and installing fuel filter ⇒ page 123

1.1 Safety precautions when working on fuel supply system

> ⚠ Caution
>
> *When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:*
>
> - *All wirings (e.g. for fuel, hydraulic system, activated charcoal filter system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings are to be installed in the original way.*
> - *To avoid damages to the wiring ensure sufficient clearance to all moving or hot components.*

The fuel pump is activated when switching on the ignition and by the driver's door contact switch. Therefore, for safety reasons, the fuel pump control unit -J538- -2- must be pulled out of the cover -1- and the electrical connection must be disconnected, before opening the fuel system, if the battery is not disconnected.



When removing and installing the fuel gauge sender or fuel pump (fuel delivery unit) from a full or partly full fuel tank the following must be observed:

- Before beginning work, place an extraction hose close to sender opening in fuel tank to extract escaping fuel fumes and switch on exhaust extraction system. If no exhaust extraction system is available, a radial fan with a displacement greater than 15 m^3/h can be used providing that motor is not in air flow.
- Prevent skin contact with fuel! Wear fuel-resistant gloves!

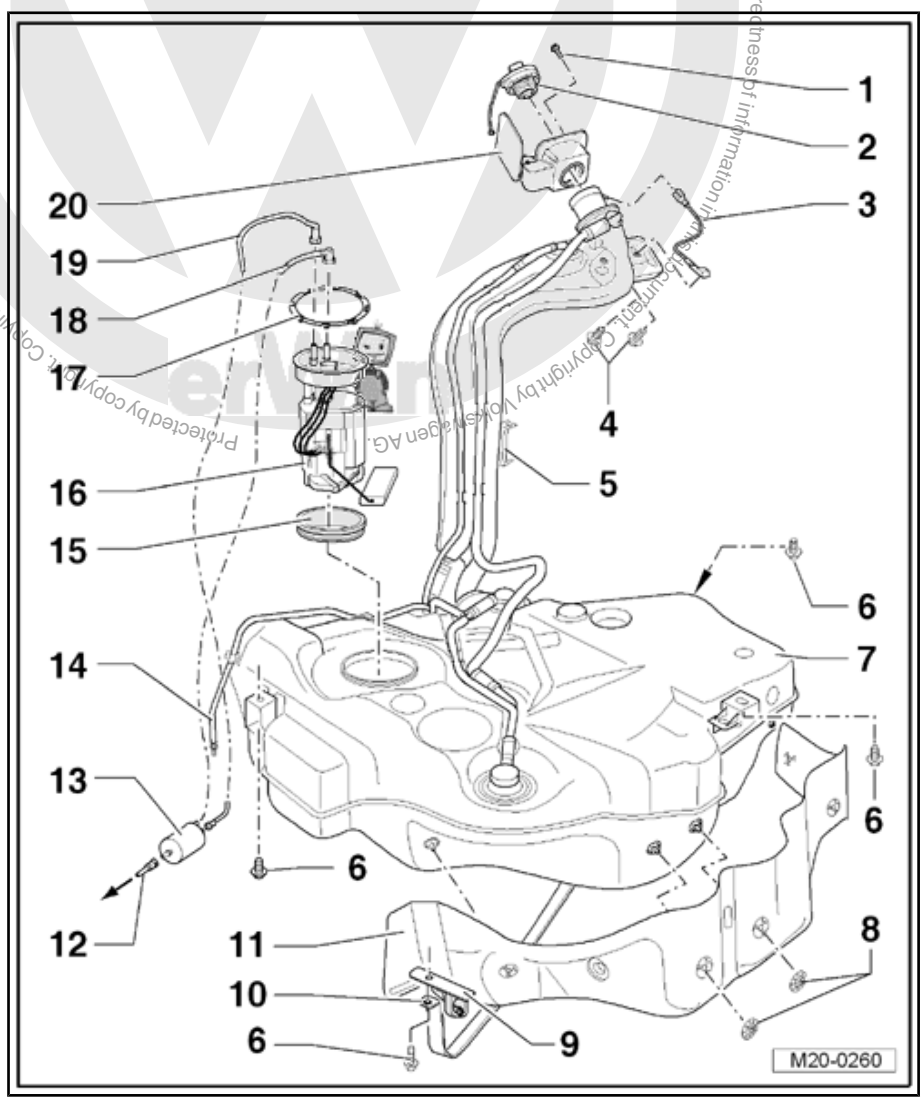
1.2 Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following “5 rules”:

- Thoroughly clean all joints and surrounding areas before dismantling.
- Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!

- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean parts only: Only unpack replacement parts immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

1.3 Fuel tank - Assembly overview



1 - Securing bolt

2 - Sealing cover

- ❑ Renew seal if damaged

3 - Earth connection

- ❑ Check for secure seating.

4 - 10 Nm

5 - Cable guide

- ❑ For ABS wiring

6 - 25 Nm

- ❑ Renew

7 - Fuel tank

- ❑ Removing and installing ⇒ page 120

8 - Lock washer

9 - Exhaust system bracket

10 - Securing strap

- ❑ Note installation position

11 - Heat shield

12 - Supply line

- ❑ To connecting pipe for high-pressure pump
- ❑ Check for secure seating

13 - Fuel filter

- ❑ Installation position: Arrow shows in direction of flow
- ❑ Fuel filter - Assembly overview ⇒ page 123
- ❑ Removing and installing ⇒ page 123

14 - Breather line

- ❑ To activated charcoal filter
- ❑ Clipped onto side of fuel tank
- ❑ Check for secure seating

15 - Seal

- ❑ Renew
- ❑ When installing, insert seal "dry" into fuel tank opening
- ❑ Moisten inner edges of seal with fuel when installing fuel delivery unit only

16 - Fuel delivery unit

- ❑ Removing and installing ⇒ page 127
- ❑ If fuel delivery unit was replaced, adapt the engine control unit to the fuel pump ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis, testing and information system -VAS 5052-
- ❑ Checking fuel pump ⇒ page 130
- ❑ Note installation position on fuel tank ⇒ page 117
- ❑ With fuel gauge sender -G-
- ❑ Removing and installing fuel gauge sender -G- ⇒ page 129
- ❑ Clean strainer if soiled

17 - Lock ring, 110 Nm

- ❑ Check for secure seating
- ❑ Remove and install using wrench -T10202-

18 - Supply line

- ❑ Black
- ❑ Clipped onto side of fuel tank
- ❑ Check for secure seating

19 - Return hose

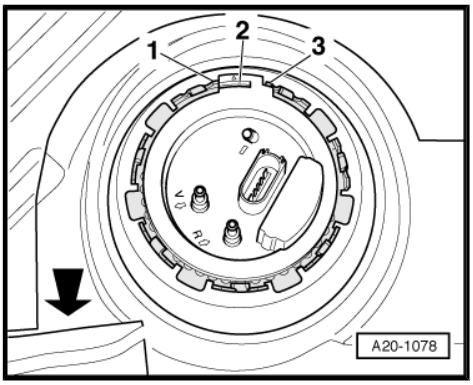
- ❑ Blue
- ❑ Clipped onto side of fuel tank
- ❑ Check for secure seating

20 - Tank flap unit

- ❑ With rubber cup
- ❑ Removing and installing ⇒ General body repairs, exterior; Rep. Gr. 55 ; Fuel tank filler flap unit; Removing and installing fuel tank filler flap unit

Installation position of fuel delivery unit:

The tab -2- on the fuel delivery unit must lie between the tongues -1- and -3-.



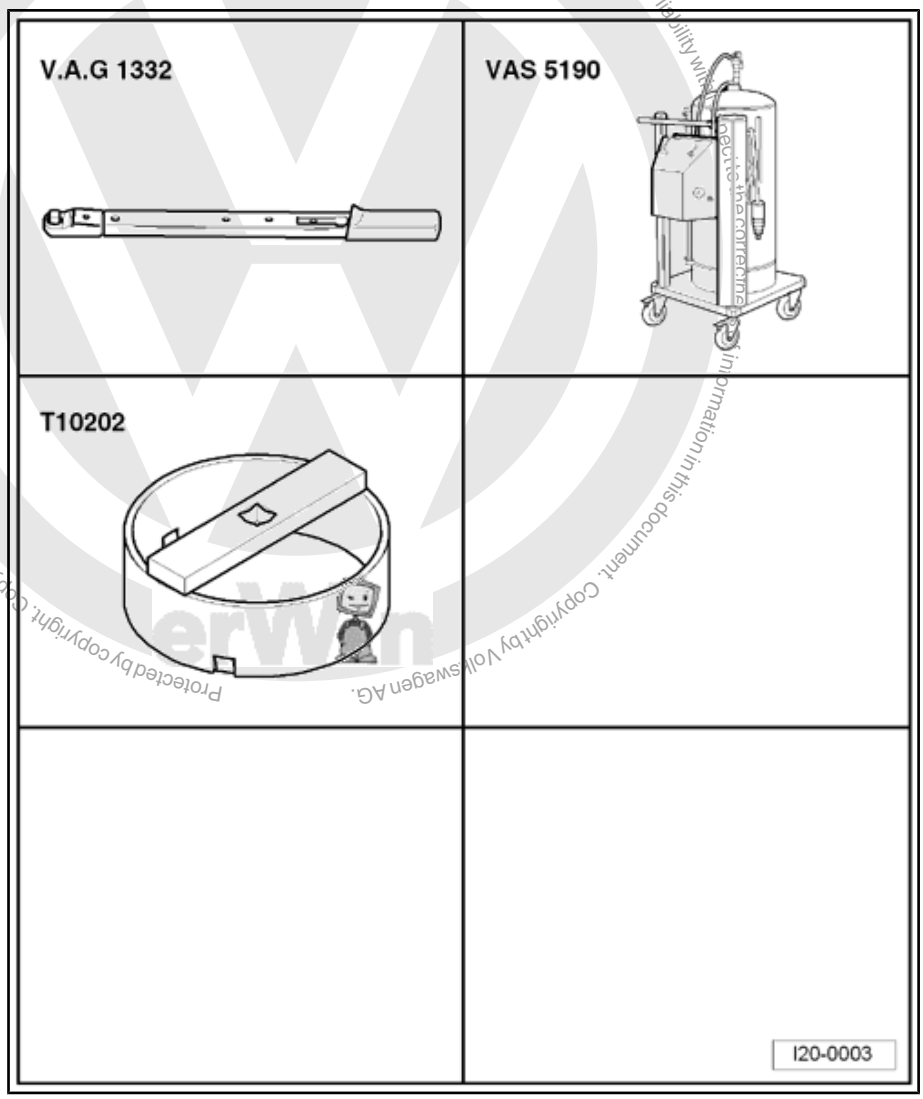
Note

- ♦ *The -arrow- shows in direction of travel.*
- ♦ *The fuel delivery unit can only be installed in this position.*

1.4 Emptying fuel tank

Special tools and workshop equipment required

- Torque wrench -V.A.G 1332-
- Fuel extractor -VAS 5190-
- Wrench -T10202-



– Note safety precautions before beginning work ⇒ page 115 .
– Observe rules for cleanliness ⇒ page 115 .

Empty fuel tank if fuel level is higher than $^{3}/_{4}$ ⇒ page 118

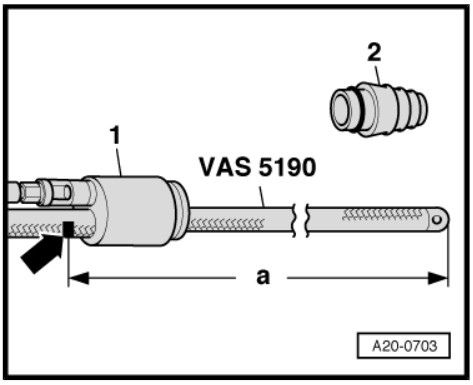
Empty fuel tank if fuel level is lower than $^{3}/_{4}$ ⇒ page 119

1.4.1 Emptying fuel tank if it is more than $^{3}/_{4}$ full

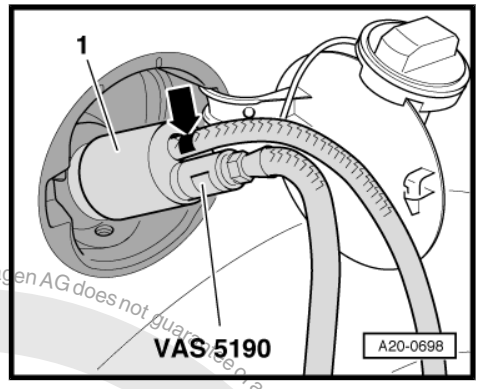
Caution

Fit earth wire of fuel extractor -VAS 5190- at a bare area of the body.

– Remove cotter -2- from shaft piece -1- of fuel extractor -VAS 5190- .
– Mark hose with insulation tape -arrow- at a distance of -a- = 1180 mm from the suction hose end.



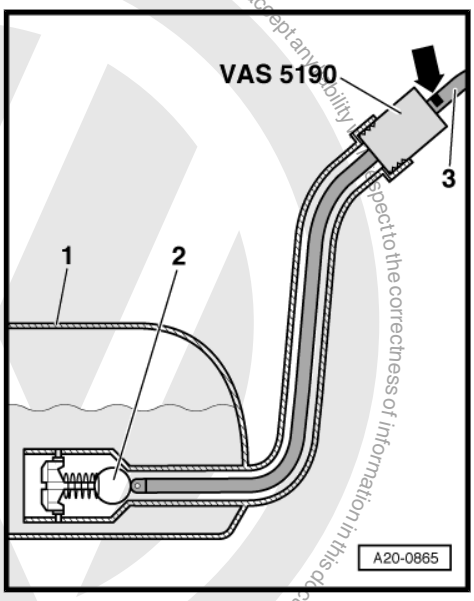
– Remove filler cap from fuel tank filler neck.
– Fit shaft piece -1- of fuel extractor -VAS 5190- to the filler neck.
– Slide suction hose into fuel reservoir until the applied mark -arrow- has reached the shaft piece.



Note

On the lower end of the filler neck there is a ball valve -2- in the fuel tank -1- which must not be damaged by the suction hose -3-. For this reason the hose must only be slid up to the applied mark -arrow-.

– Empty fuel tank as far as possible.
– Pull suction hose out very carefully.



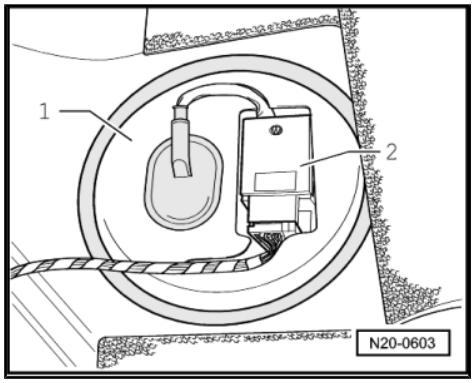
Note

- *If no fuel is be sucked anymore, the fuel tank is just sufficiently vacant to open the fuel delivery unit without danger.*
- *If you must empty the fuel tank completely* ⇒ page 119 .

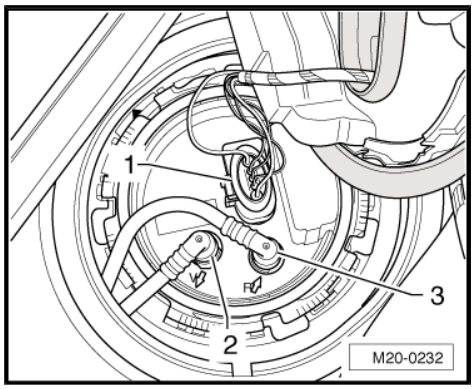
1.4.2 Emptying fuel tank if it is less than 3/4 full

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seats; Removing and installing seat bench .

– Unclip the cover -1- along with the fuel pump control unit -J538- -2-.



– Pull connector -1-, black supply line -2- and blue return line -3- off.



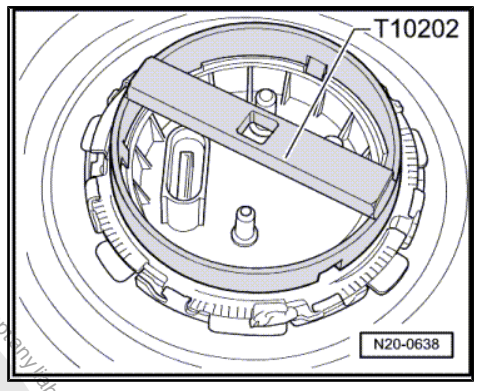
Note

Press locking ring inwards to release fuel lines.

– Open lock ring using wrench -T10202- .

– Pull out the fuel delivery unit a bit.

– Insert suction hose of fuel extraction unit -VAS 5190- as far as possible into the fuel tank and extract fuel.

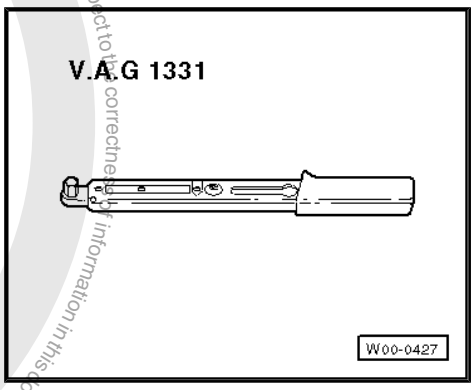


If the fuel tank must only be emptied, install fuel delivery unit again ⇒ page 127 .

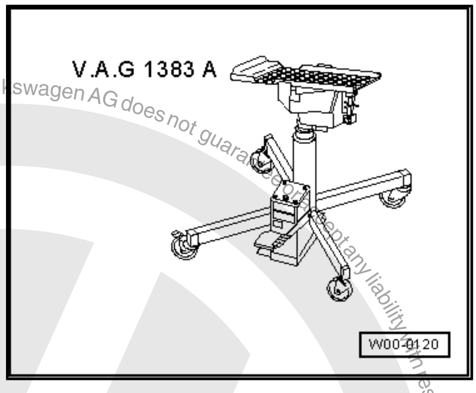
1.5 Removing and installing fuel tank

Special tools and workshop equipment required

- Torque wrench -V.A.G 1331-



- Engine and gearbox jack -V.A.G 1383 A-



Removing

- The fuel tank must not be filled more than 1/4.

Note

- *If necessary, empty fuel tank with fuel extractor -VAS 5190- ⇒ page 118 .*
- *Note safety precautions before beginning work ⇒ page 115 .*
- *Observe rules for cleanliness ⇒ page 115 .*

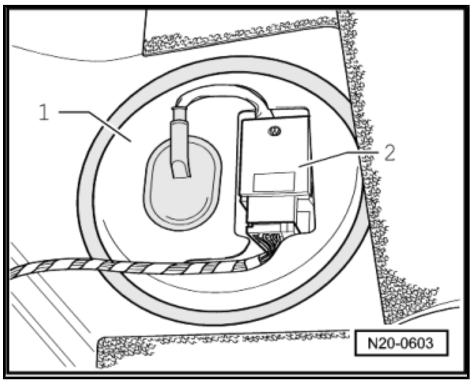
– Switch off ignition and all electrical consumers and pull out ignition key.

– Open the tank flap and remove filler cap.

– Unscrew tank flap unit securing bolt and remove tank flap unit ⇒ General Body Repairs, Exterior; Rep. Gr. 55 ; Tank flap unit .

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seats; Removing and installing seat bench .

– Unclip the cover -1- along with the fuel pump control unit -J538- -2-.

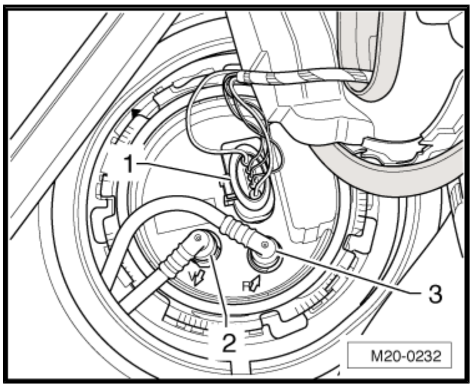


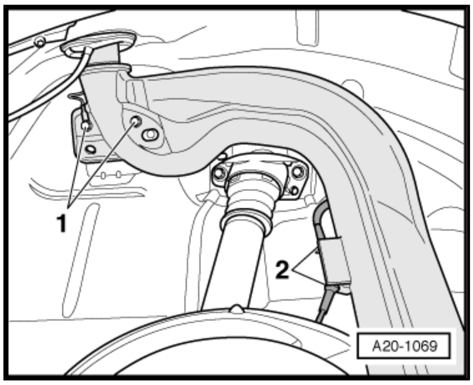
Note

In vehicles with auxiliary heater, the connector for the metering pump -V54- must be disconnected additionally.

– Disconnect connector -1- from fuel supply unit.

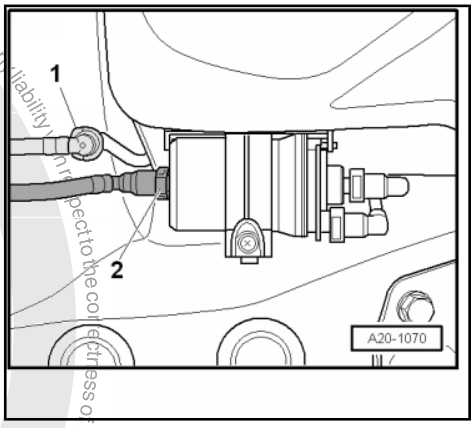
– Remove rear right wheel housing liner ⇒ General body repairs, exterior; Rep. Gr. 66 ; Wheel housing liner; Removing and installing rear wheel housing liner .





– Remove tank filler neck bolts -1-.
– Unhook electrical wiring -2- of ABS speed sensor on filler neck bracket.
– Remove front silencer, separate front and rear silencer first, if necessary ⇒ page 190 .

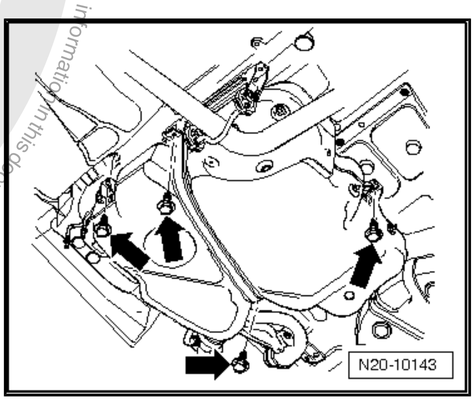
> **WARNING**
>
> *The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.*



– Disconnect white breather line -1- and black supply line -2- on the connection point.

Note

- *In vehicles with auxiliary heater, the line for the metering pump -V54- must be disconnected additionally.*
- *Press locking ring inwards to release fuel lines.*
- *A second mechanic is required to assist when supporting the fuel tank.*



– Remove tensioning strap and securing bolts -arrows-. When doing this support fuel tank with engine/gearbox jack -V.A.G 1383 A- .
– Remove fuel tank from side.

Installing

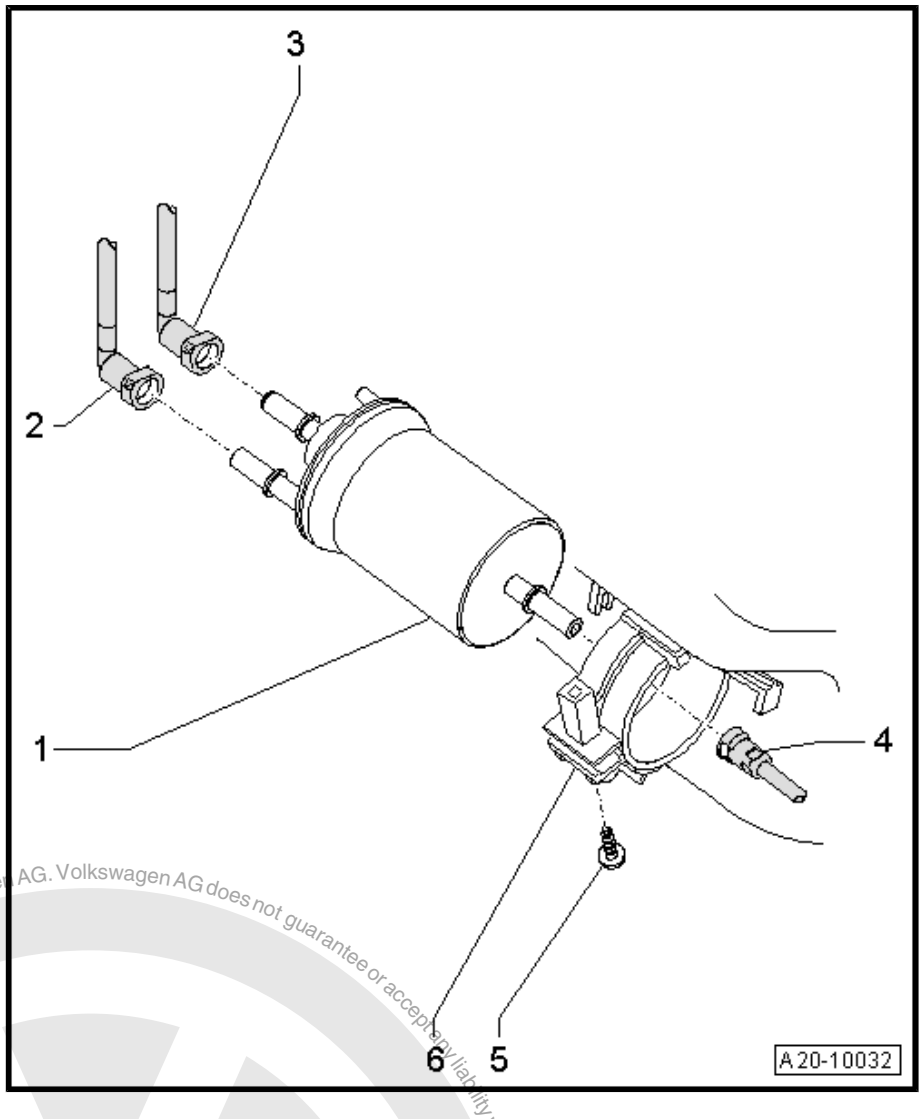
Installation is carried out in reverse order of removal. During this step, observe the following:

- Install breather and fuel hoses free of kinks.
- Do not interchange supply and return lines (return line blue, supply line black).
- Ensure line connections are tight.
- Check fuel tank/body earth connection on filler neck.
- After installing fuel tank, check that the supply and return lines are still clipped onto the fuel tank.
- If fuel delivery unit was replaced, adapt the engine control unit to the fuel pump ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis, testing and information system -VAS 5052- .

Torque settings

Component	Nm
Fuel tank to body - M6	10
Fuel tank to body - M8 ♦ Renew bolts.	25

1.6 Fuel fliter - Assembly overview



1 - Fuel filter

- ❑ With pressure limiting valve
- ❑ Flow direction is marked by arrows
- ❑ Do not interchange connections
- ❑ Removing and installing ⇒ page 123
- ❑ Installation position: The pin on the air filter housing must engage into the recess on the filter bracket guide ⇒ page 125

2 - Fuel supply line

- ❑ Black
- ❑ From fuel tank
- ❑ Press locking ring inwards to release fuel lines

3 - Fuel return line

- ❑ Blue
- ❑ To fuel tank
- ❑ Press locking ring inwards to release fuel lines

4 - Fuel supply line

- ❑ Black
- ❑ To engine
- ❑ Press locking ring inwards to release fuel lines

5 - 3 Nm

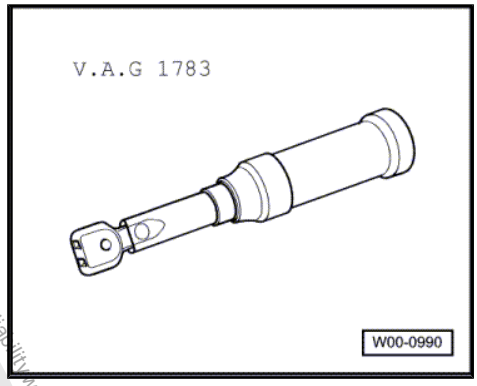
6 - Retainer

- ❑ For fuel filter
- ❑ Clipped onto fuel tank

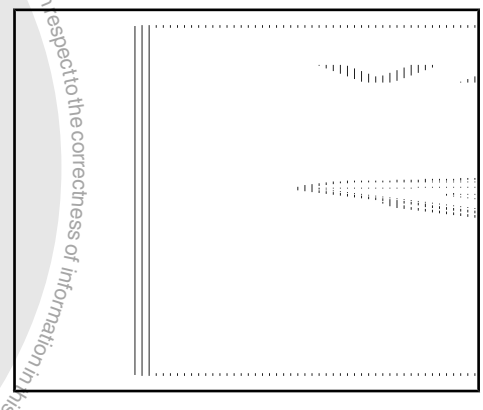
1.7 Removing and installing fuel filter

Special tools and workshop equipment required

- Torque wrench -V.A.G 1783-



- Drip tray for workshop hoist -VAS 6208-



Removing

– Note safety precautions before beginning work ⇒ page 115 .

– Observe rules for cleanliness ⇒ page 115 .

– Place container under fuel filter.

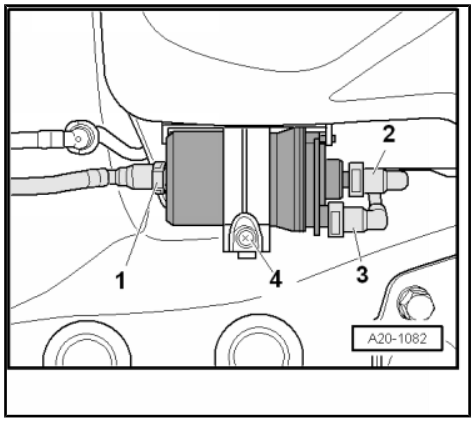
WARNING

The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

– Pull fuel lines -1-, -2- and -3- off. To do this press securing ring in.

– Remove bolt -4-.

– Remove fuel filter.



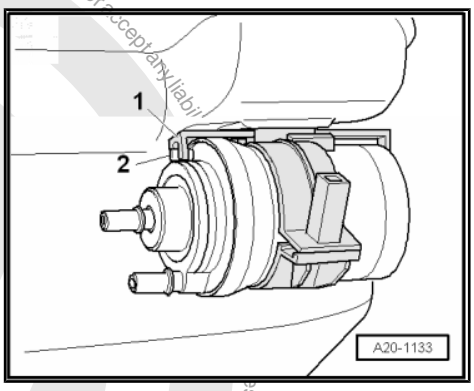
Installing

Install in reverse order of removal. During this step, observe the following:

The flow direction is marked on filter housing with arrows.

Installation position

The pin -2- on the air filter housing must engage into the recess on the filter bracket guide -1-.



– Tighten bolt of retaining clip for fuel filter to 3 Nm.

2 Repairing fuel supply

Note

- *Fuel hoses on the engine must be secured only with spring-type clips ⇒ Electronic parts catalogue “ETKA” .*
- *To install spring-type clips spring-type clip pliers -VAS 5024 A- or hose clamp pliers -V.A.G 1921- are recommended.*
- *If fuel delivery unit was replaced, adapt the engine control unit to the fuel pump ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis, testing and information system -VAS 5052- .*

Safety precautions when working on fuel supply system ⇒ page 126 .

Observe rules for cleanliness ⇒ page 127 .

Note crash fuel shut-off ⇒ page 127 .

Removing and installing fuel fuel delivery unit ⇒ page 127

Removing and installing fuel gauge sender -G- ⇒ page 129

Checking fuel pump ⇒ page 130

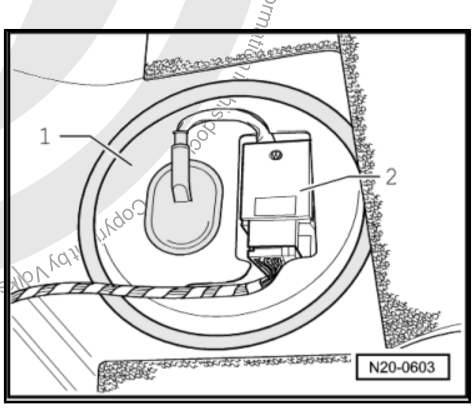
Removing and installing high-pressure pump ⇒ page 139

2.1 Safety precautions when working on fuel supply system

Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *All wirings (e.g. for fuel, hydraulic system, activated charcoal filter system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings are to be installed in the original way.*
- *To avoid damages to the wiring ensure sufficient clearance to all moving or hot components.*



The fuel pump is activated when switching on the ignition and by the driver's door contact switch. Therefore, for safety reasons, the fuel pump control unit -J538- -2- must be pulled out of the cover -1- and the electrical connection must be disconnected, before opening the fuel system, if the battery is not disconnected.

When removing and installing the fuel gauge sender or fuel pump (fuel delivery unit) from a full or partly full fuel tank the following must be observed:

- Before beginning work, place an extraction hose close to sender opening in fuel tank to extract escaping fuel fumes and switch on exhaust extraction system. If no exhaust extraction system is available, a radial fan with a displacement greater than 15 m^3/h can be used providing that motor is not in air flow.
- Prevent skin contact with fuel! Wear fuel-resistant gloves!

2.2 Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following “5 rules”:

- Thoroughly clean all joints and surrounding areas before dismantling.
- Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean parts only: Only unpack replacement parts immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

2.3 Crash fuel shut-off

Functional check

The crash fuel shut off reduces the danger of a fire in a crash as the fuel pump is switched off. At the same time the starting characteristics of the engine are also improved with this system. When the door is opened the fuel pump is activated for 2 seconds to build-up fuel pressure.

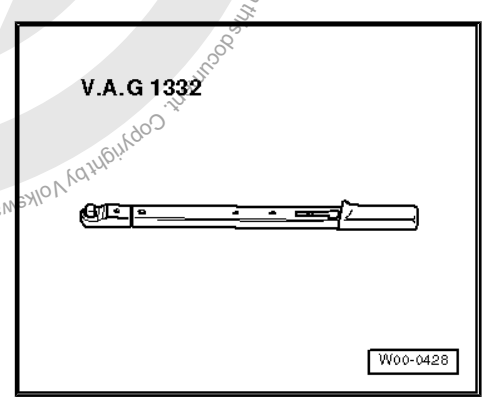
When opening the fuel system:

Observe safety precautions ⇒ page 126 .

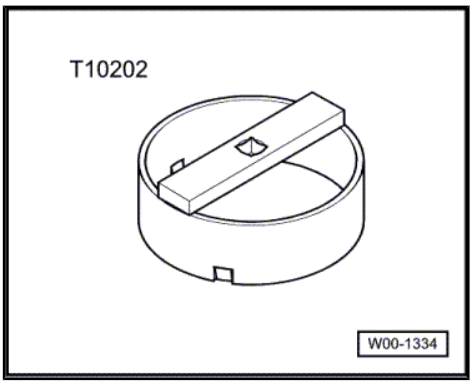
2.4 Removing and installing fuel delivery unit

Special tools and workshop equipment required

- Torque wrench -V.A.G 1332-



- Key -T10202-



Removing

- The fuel tank must not be filled more than $^3/_4$.

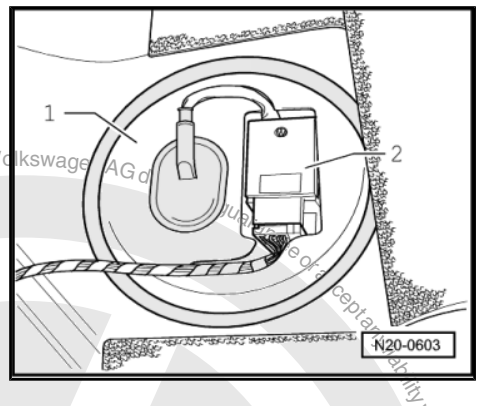
Note

- *If necessary, empty fuel tank with fuel extractor -VAS 5190- .*
- *Note safety precautions before beginning work ⇒ page 126 .*
- *Observe rules for cleanliness ⇒ page 127 .*

– Switch off ignition and all electrical consumers and pull out ignition key.

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seats; Removing and installing seat bench .

– Unclip the cover -1- along with the fuel pump control unit -J538- -2-.



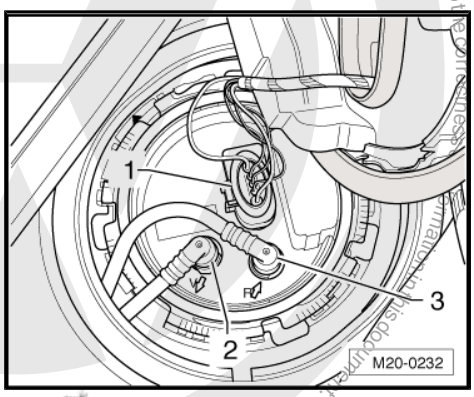
Note

In vehicles with auxiliary heater, the connector for the metering pump -V54- must be disconnected additionally.

WARNING

The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

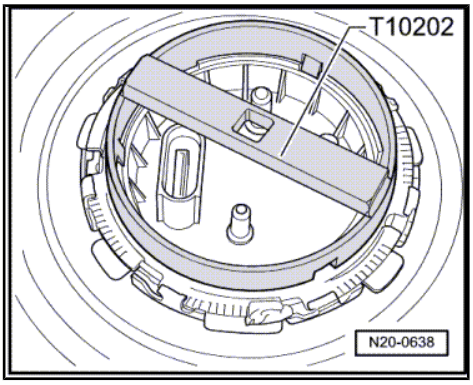
– Pull 5 pin connector -1-, black supply line -2- and blue return line -3- off.



Note

- *Press locking ring inwards to release fuel lines.*
- *In vehicles with auxiliary heater, the suction line for the metering pump -V54- must be pulled out additionally (open lower clamp).*

– Open lock ring using wrench -T10202- .



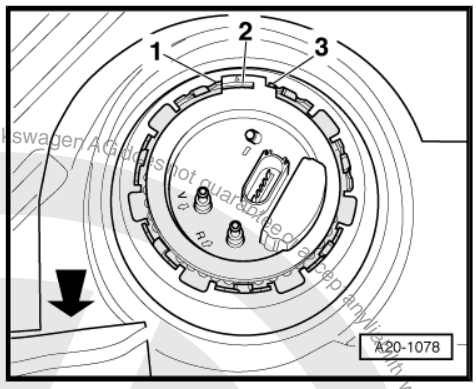
– Pull fuel delivery unit and seal out of the opening in fuel tank.

Note

- *Take care not to bend the fuel gauge sender when removing fuel delivery unit.*
- *If the fuel delivery unit is to be renewed then drain old fuel delivery unit before disposal.*

Installing

Installation of the fuel delivery unit is carried out in the reverse order. During this step, observe the following:



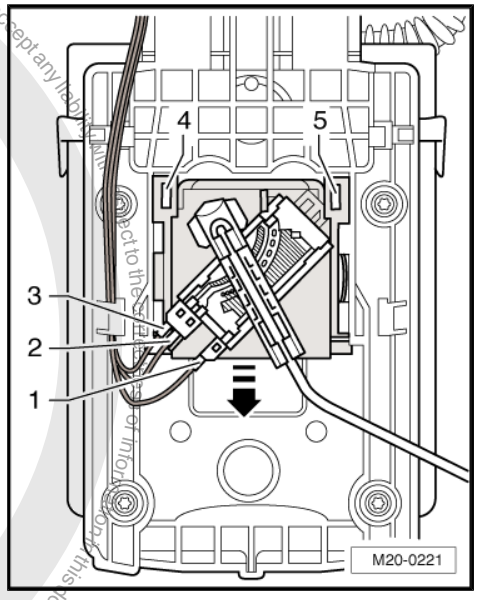
- Insert new fuel delivery unit seal dry into fuel tank opening.
- Moisten inner edges of seal with fuel only when installing fuel delivery unit.
- Take care not to bend the fuel gauge sender when installing fuel delivery unit.
- Note installation position of fuel delivery unit: The tab -2- on the fuel delivery unit must lie between the tongues -1- and -3-. The -arrow- shows in direction of travel.
- Tighten lock ring to 110 Nm.
- Do not interchange the black supply line and the blue return line (arrows on the flange of the fuel delivery unit).
- Ensure fuel pipes/hoses are fitted securely.
- After installing the fuel delivery unit, check that the supply and return lines are still clipped onto the fuel tank.
- If fuel delivery unit was replaced, adapt the engine control unit to the fuel pump ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis, testing and information system -VAS 5052- .

2.5 Removing and installing fuel gauge sender -G-

Removing

– Remove the fuel delivery unit ⇒ page 127 .

– Release line connectors -1- to -3- and pull off.
– Lift up retaining lugs -4- and -5- using a screwdriver and pull fuel delivery unit -G- off downwards -arrow-.



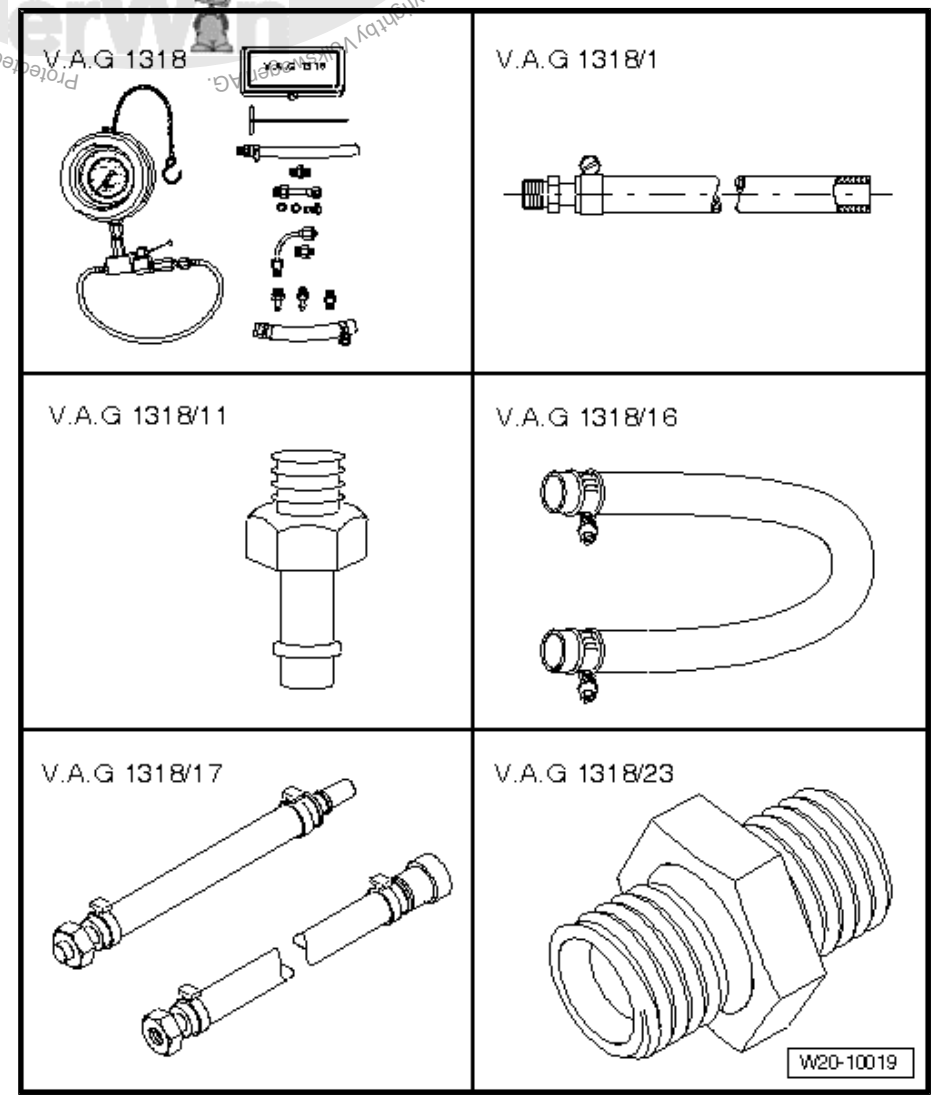
Installing

– Insert fuel gauge sender -G- in the guides on the fuel delivery unit and push up until it engages.
– Connect the connectors and check for secure fit.
– Install fuel delivery unit ⇒ page 127 .

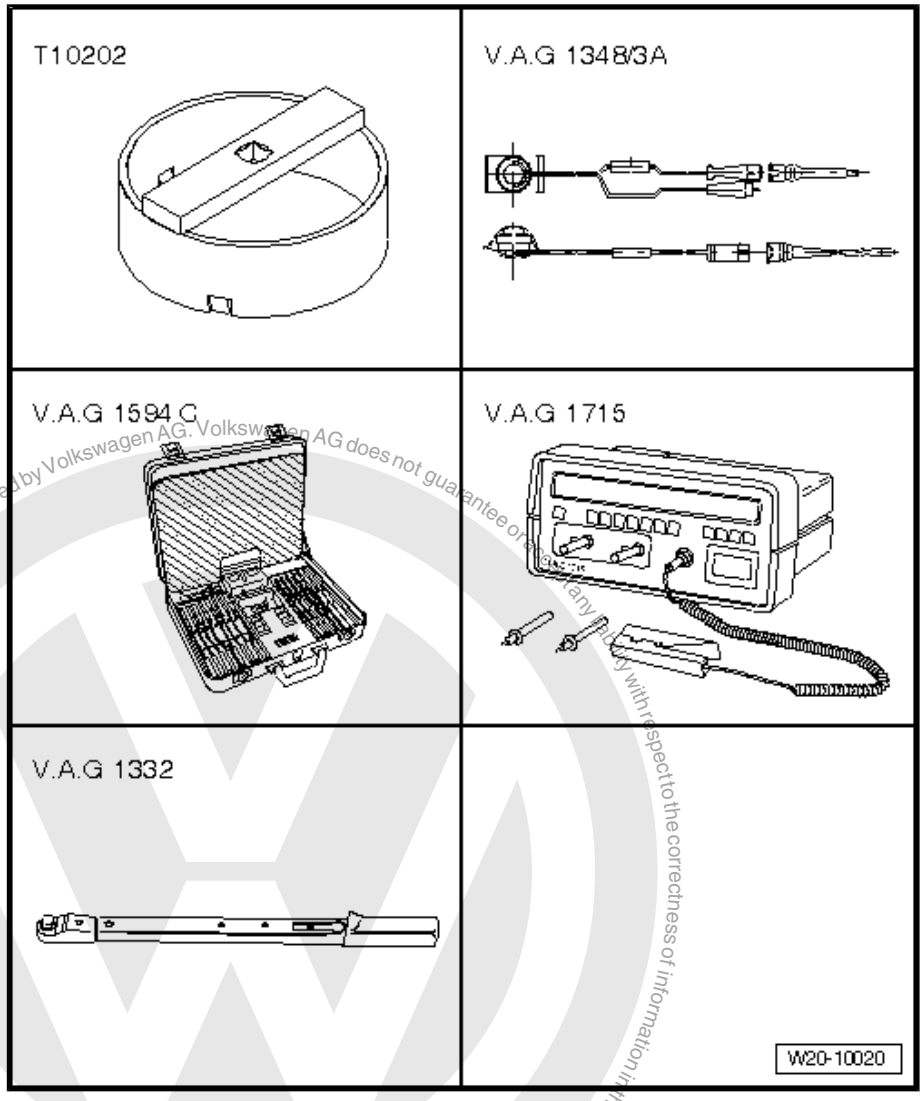
2.6 Checking fuel pump

Special tools and workshop equipment required

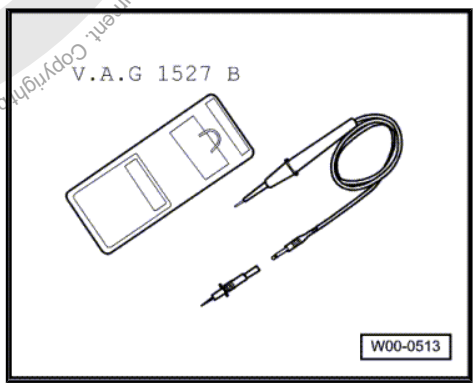
- Pressure tester -V.A.G 1318-
- Adapter -V.A.G 1318/1-
- Adapter -V.A.G 1318/11-
- Hose adapter -V.A.G 1318/16-
- Adapter -V.A.G 1318/17-
- Double socket -V.A.G 1318/23-



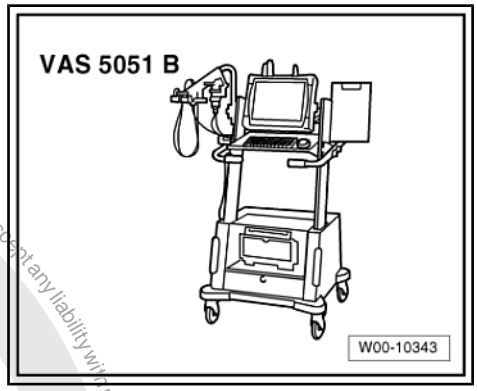
- Key -T10202-
- Remote control -V.A.G 1348/3A-
- Adapter set -V.A.G 1594C-
- Multimeter -V.A.G 1715-
- Torque wrench -V.A.G 1332-
- Measuring container



- Voltage tester -V.A.G 1527 B-



◆ Vehicle diagnosis, testing and information system -VAS 5051-



◆ Vehicle diagnosis and service information system -VAS 5052-

Checking function and voltage supply ⇒ page 132

Checking fuel pressure ⇒ page 133

Checking holding pressure ⇒ page 135

Checking delivery rate ⇒ page 136

Checking current consumption ⇒ page 138

2.6.1 Checking function and voltage supply

- Battery charge at least 11.5 V.
- Fuse for fuel pump OK ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

– Switch ignition on.

- Fuel pump must be heard to run briefly.

Note

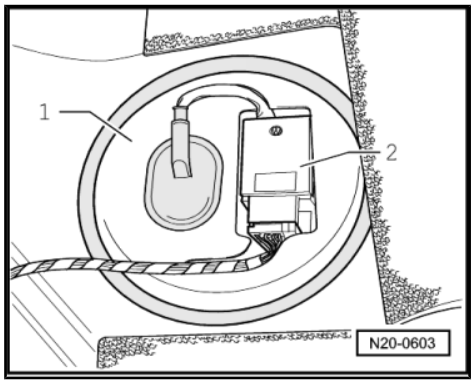
The fuel pump runs very quietly.

– Switch off ignition.

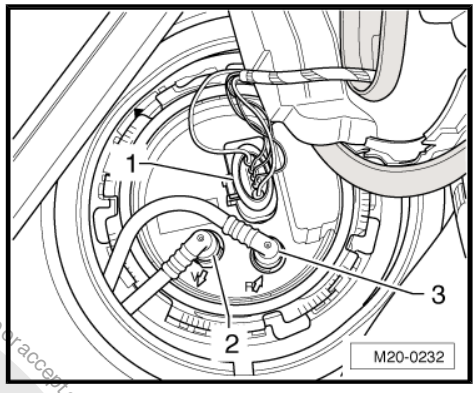
Fuel pump does not run

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seats; Removing and installing seat bench .

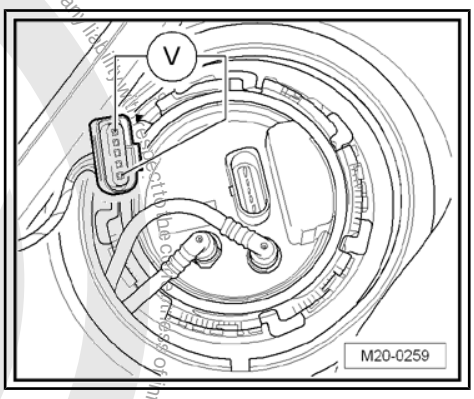
– Unclip the cover -1- along with the fuel pump control unit -J538- -2-.



– Pull connector off -1-.



– Connect voltage tester -V.A.G 1527 B- to the outer contacts of the connector with auxiliary cables from adapter set -V.A.G 1594 C-.
– Switch on ignition.
• The LED must light up briefly.



LED does not light up briefly:

– Locate and eliminate open circuit referring to current flow diagram ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

LED lights up briefly (voltage supply OK):

– Remove the fuel delivery unit ⇒ page 127 .
– Check that the electrical wires between flange and fuel pump are connected.

If no open circuit can be found:

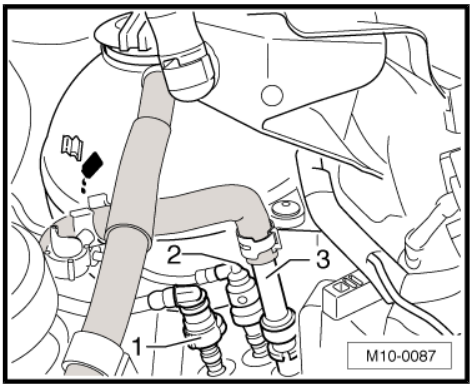
– Fuel pump is defective. Renew fuel delivery unit ⇒ page 127 .

2.6.2 Checking fuel pressure

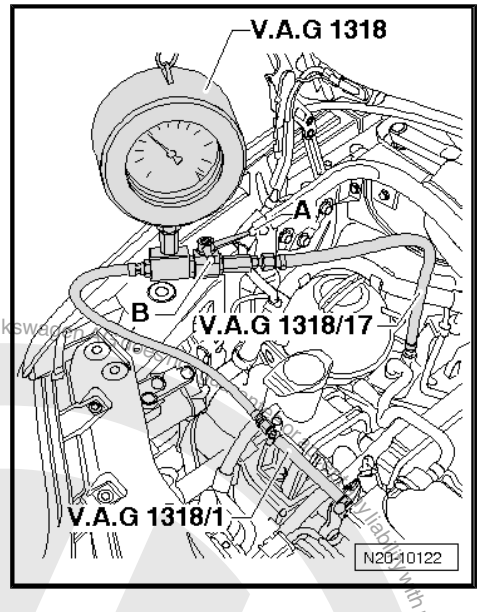
WARNING

The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

– Disconnect fuel supply line -3- (press locking ring inwards) and collect escaping fuel with a cloth.



– Install the pressure tester -V.A.G 1318- with the adapter -V.A.G 1318/1- and the adapter set -V.A.G 1318/17- instead of the fuel supply line.
– Open shut-off tap of pressure tester. The lever then points in position -A-.
– Switch on ignition repeatedly until fuel pressure does not rise any more on pressure gauge.
– Read fuel pressure on pressure gauge. Specification: 3.5 to 5.0 bar.



If fuel pressure is OK, check holding pressure ⇒ page 135 .

If the specification is exceeded:

– Check return line between fuel filter and fuel pump for kinking and blockages.

If no fault is detected:

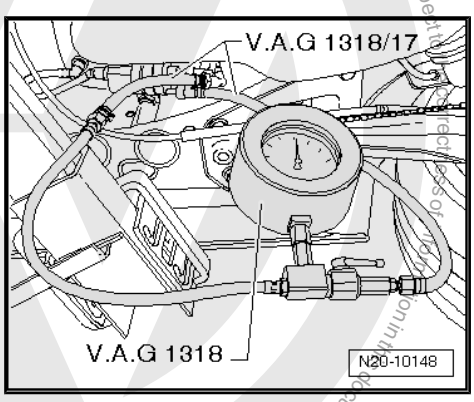
– Pressure limiting valve in fuel filter defective. Replace fuel filter.

If the specification is not obtained:

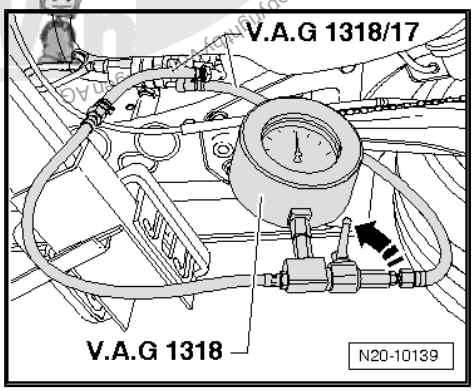
– Check fuel delivery rate upstream of fuel filter. Connect pressure tester -V.A.G 1318- with adapter set -V.A.G 1318/17- between fuel filter and supply pipe.
– Open shut-off tap on pressure gauge. The handle points in direction of flow.
– Start engine and run at idling speed.

Caution

Close the cut-off tap only slowly. At a fuel pressure of 8 bar, reopen the cut-off tap immediately to prevent damage to the pressure tester.



– Slowly close cut-off tap of pressure tester. The pressure must rise to 6.0 bar. When 6 bar have been reached, immediately reopen cut-off tap.



If pressure has risen:

– Fuel pump is OK. Pressure limiting valve in fuel filter is defective. Renew fuel filter.

If pressure does not rise:

– Fuel pump is defective. Renew fuel delivery unit ⇒ page 127 .

2.6.3 Checking holding pressure

- Fuel pressure is OK and pressure tester -V.A.G 1318- is connected. Checking fuel pressure ⇒ page 133 .

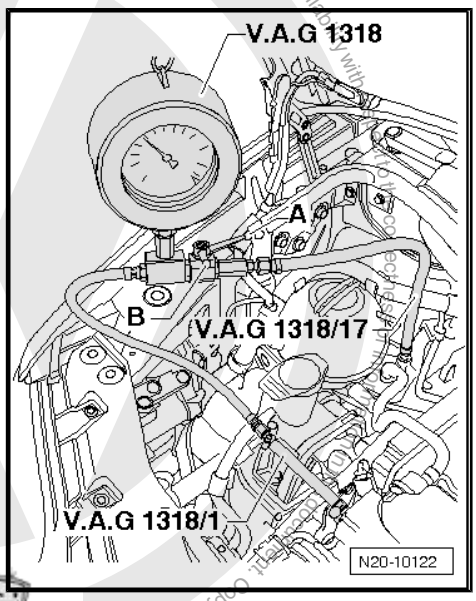
– Switch on ignition repeatedly until fuel pressure does not rise any more on pressure gauge.

– Read fuel pressure on pressure gauge. Specification: 3.5 to 5.0 bar.

– Observe pressure drop on gauge. After 10 minutes, pressure must not drop below 3.0 bar.

If the pressure drops further:

– Switch on ignition repeatedly until fuel pressure does not rise any more on pressure gauge.



– Immediately close pressure tester cut-off tap. The lever then points in direction -B-.

If the pressure drops again:

– Check fuel pipe to high-pressure pump for leaks.

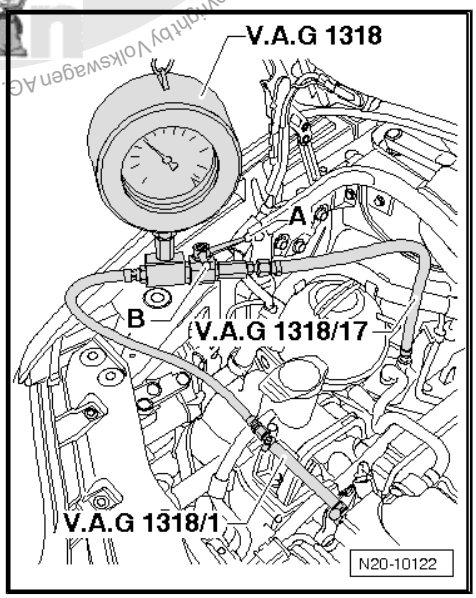
If no fault is detected:

– Renew high-pressure pump ⇒ page 139 .

If pressure does not drop any further:

– Check fuel line to fuel filter for leaks.

If no fault in the fuel line is detected:

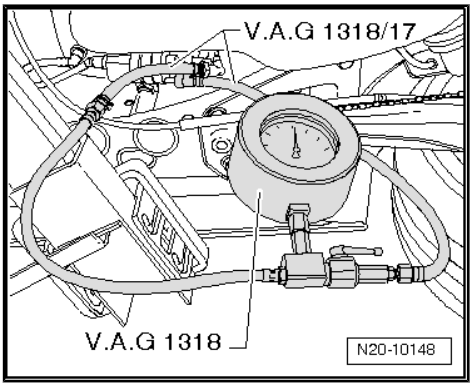


– Check the non-return valve in the fuel delivery unit. Connect pressure tester -V.A.G 1318- with adapter set -V.A.G 1318/17- between fuel filter and supply pipe.

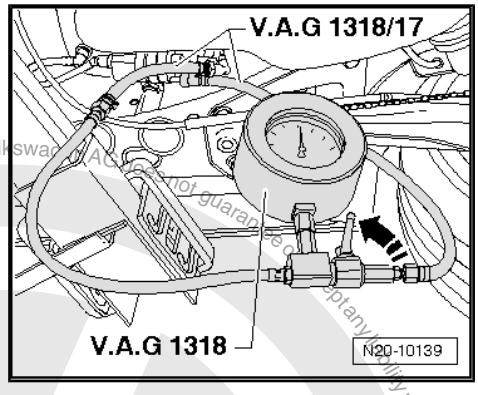
– Open shut-off tap on pressure gauge. The handle points in direction of flow.

– Switch on ignition repeatedly until fuel pressure does not rise any more on pressure gauge.

– Read fuel pressure on pressure gauge. Specification: 3.5 to 5.0 bar.



– After pressure has built up, immediately close pressure tester cut-off tap.
– Observe pressure drop on gauge. After 10 minutes, pressure must not drop below 3.0 bar.



If the pressure drops:

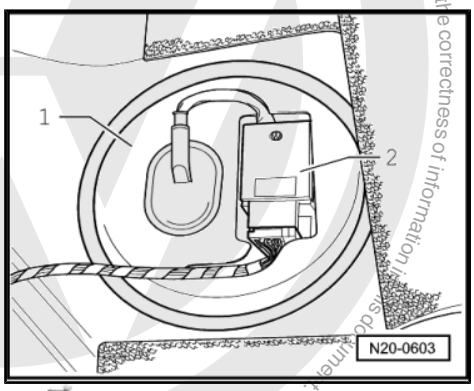
– Fuel pump non-return valve is defective, renew fuel delivery unit ⇒ page 127 .

If the pressure does not drop:

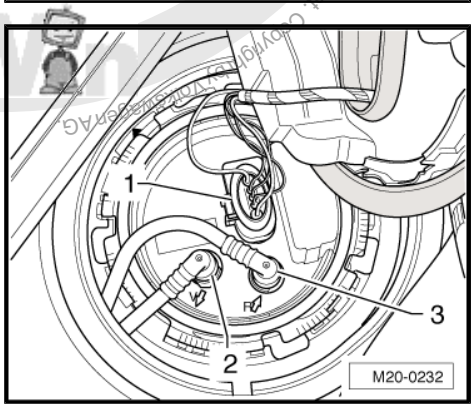
– Pressure limiting valve in fuel filter defective. Replace fuel filter.

2.6.4 Checking delivery rate

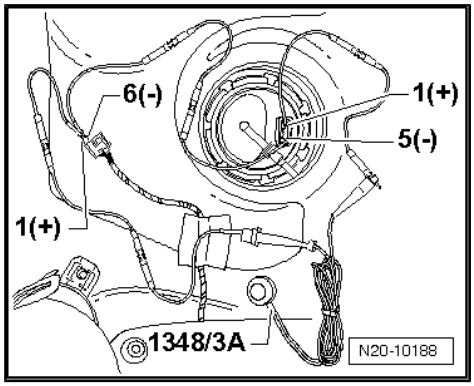
– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seats; Removing and installing seat bench .
– Unclip the cover -1- along with the fuel pump control unit -J538- -2-.



– Pull connector off -1-.



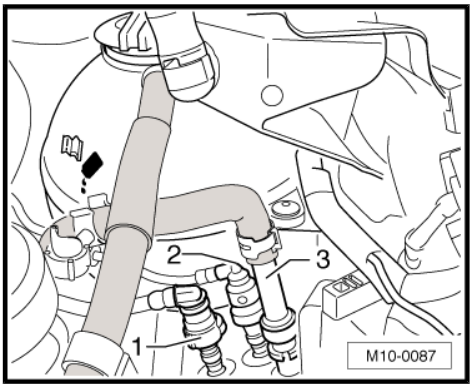
– Connect remote control -V.A.G 1348/3A- to contact -1(+)- of fuel pump and contact -1(+)- of connector using adapter cables.
– Connect contacts -6(-)- of connector and -5(-)- of fuel pump using an adapter cable from auxiliary measuring set -V.A.G 1594 C- .
– Remove filler cap from fuel tank filler neck.



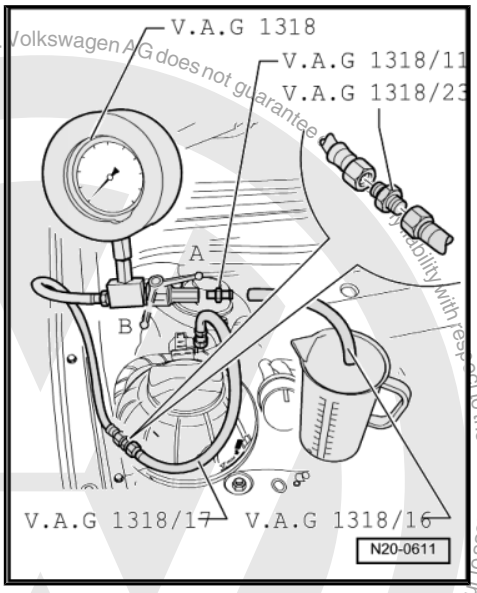
WARNING

The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

– Disconnect fuel supply line -3- (press locking ring inwards) and collect escaping fuel with a cloth.



– Connect pressure tester -V.A.G 1318- with connector -V.A.G 1318/23- and adapter set -V.A.G 1318/17- to the fuel supply line.
– Push hose adapter -V.A.G 1318/16- onto adapter -V.A.G 1318/11- of pressure tester and hold it in measuring container.
– Close shut-off tap of pressure tester. The lever then points in position -B-.

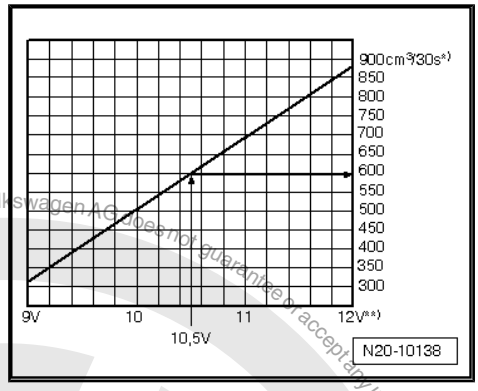


WARNING

Danger of spray when shut-off tap is opened. Wear protective glasses and clothing to avoid injuries and skin contact. Hold container over free connection of pressure tester.

– Open shut-off tap of pressure tester. The lever then points in the through flow direction -A-.
– Operate remote control -V.A.G 1348/3A- . At the same time slowly close shut-off tap until pressure gauge shows 4 bar. From this point on do not move position of shut-off tap.
– Drain measuring container.
– The fuel pump delivery rate is dependent upon battery voltage. Therefore connect multimeter -V.A.G 1715- with adapter cables from auxiliary measuring set -V.A.G 1594C- to vehicle battery.
– Operate remote control for 30 seconds and measure battery voltage.

– Compare the quantity of fuel delivered with specification.



*) Minimum delivery rate cm^3/30 seconds

**) Voltage at fuel pump with engine not running and pump running (approx. 2 volts less than battery voltage).

Example:

During the test a voltage of 12.5 volts is measured at the battery. As the voltage at the pump is approx. 2 volts less than the battery voltage, this will equate to a minimum delivery rate of approx. 580 cm^3/30 seconds.

If the minimum delivery rate is not attained:

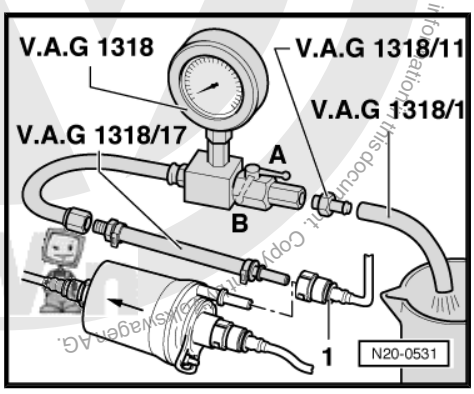
– Check fuel lines for possible restrictions (kinks) or blockages.

If no fault is detected:

WARNING

The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

– Pull fuel supply line -1- off fuel filter inlet (press locking ring inwards) and collect leaking fuel with a cloth.



– Connect pressure tester -V.A.G 1318- with adapter set -V.A.G 1318/17- to fuel supply line -1-.

– Repeat delivery rate check.

If the minimum delivery rate is now attained:

– Renew fuel filter ⇒ page 123 .

If the minimum delivery rate is again not attained:

– Remove the fuel delivery unit ⇒ page 127 and check the filter strainer for soiling.

Only when up to now no fault has been detected:

– Replace fuel delivery unit.

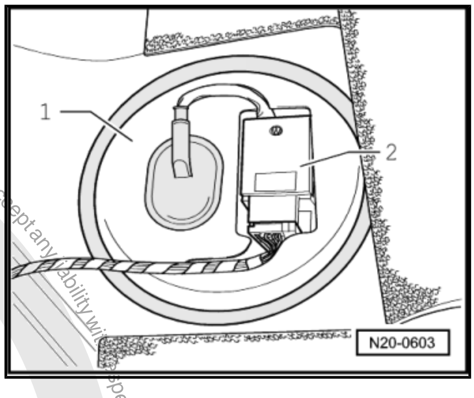
If delivery quantity has been attained, but nevertheless you suspect a fuel supply system fault (e.g. intermittent failure of fuel supply system):

– Measure current consumption of fuel pump ⇒ page 138 .

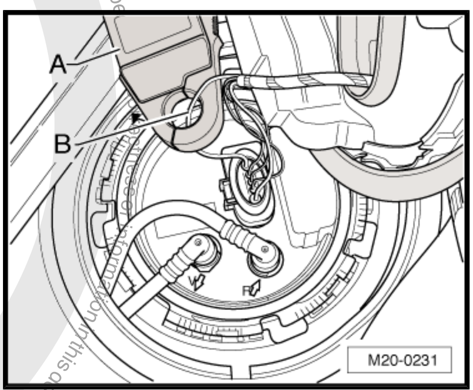
2.6.5 Checking current consumption

– Remove seat bench ⇒ General body repairs, interior; Rep. Gr. 72 ; Rear seats; Removing and installing seat bench .

– Unclip the cover -1- along with the fuel pump control unit -J538- -2-.



– Connect the current clamp -A- of the multimeter -V.A.G 1715- or the vehicle diagnosis, testing and information system -VAS 5051- to the cable -B- to contact 1 of the 5-pin connector.



– Start engine and run at idling speed.

– Check the current draw of the fuel pump.

Specification: max. 9 amps.

Note

If the fuel system malfunction is intermittent, the check can be performed during a road test, but a 2nd person is necessary.

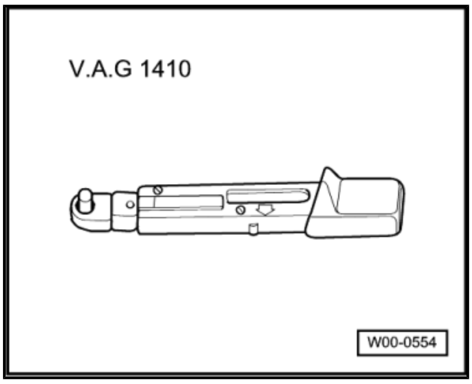
If the current draw is exceeded:

– Fuel pump is defective. Renew fuel delivery unit ⇒ page 127 .

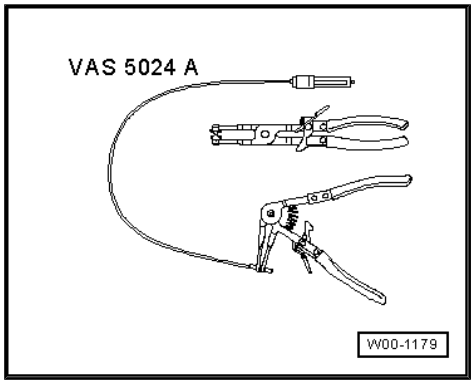
2.7 Removing and installing high-pressure pump

Special tools and workshop equipment required

♦ Torque wrench -V.A.G 1410-



◆ Spring-type clip pliers -VAS 5024 A-



Prerequisites

- Engine must be cold.

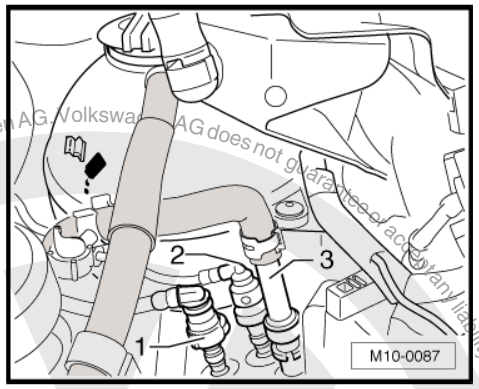
Removing

– Remove engine cover with air cleaner ⇒ page 161 .

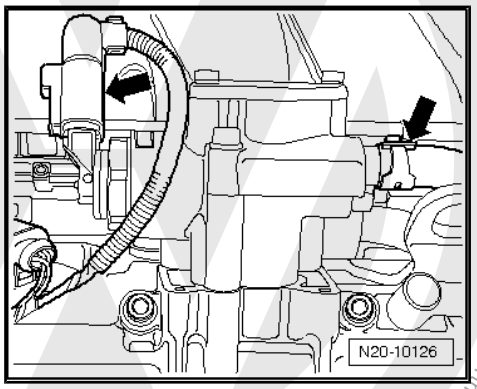
WARNING

The fuel line and the high pressure line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.

– Disconnect fuel supply line -3- (press locking ring inwards) and collect escaping fuel with a cloth.



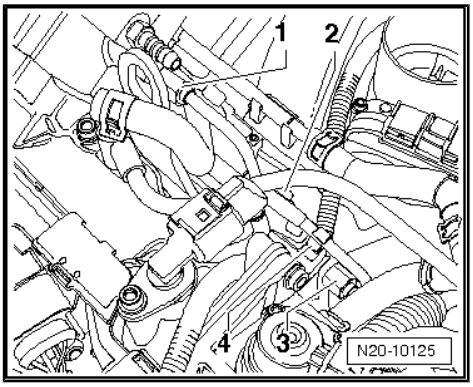
– Pull connector and fuel supply line -arrows- off the high-pressure pump.



Note

Collect leaking fuel with a cloth.

– Remove cable guide -2- and remove clip -4- from the high-pressure line.

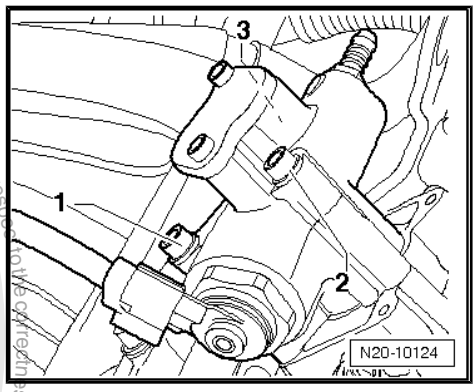


Note

Lock the screwed connections on the high-pressure pump and on fuel rail when unbolting the union nuts with a spanner.

– Unscrew union nuts -3- and -1- of the high-pressure line.

– Remove securing bolts -1-, -2- and -3- evenly.



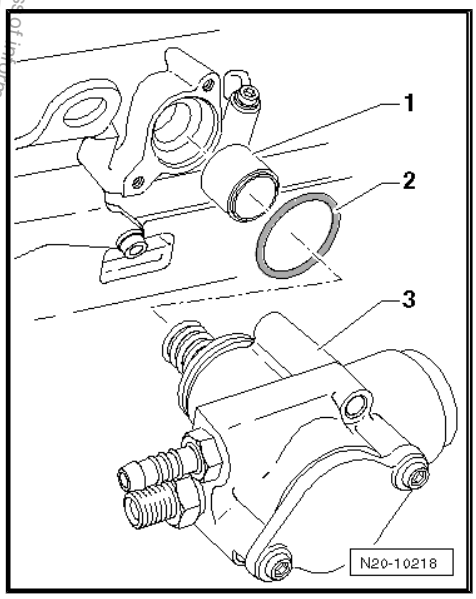
– Remove high pressure pump -3- and tappet -1- out of the camshaft housing.

Installing

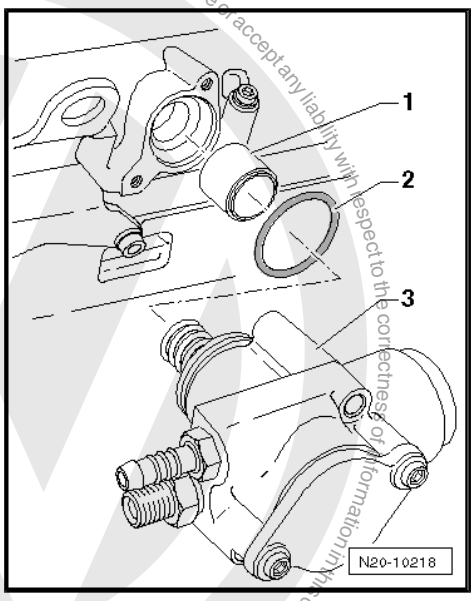
Install in reverse order of removal. During this step, observe the following:

Note

- *Moisten tappet of high pressure pump with clean engine oil.*
- *The O-ring of the high pressure pump must always be renew.*

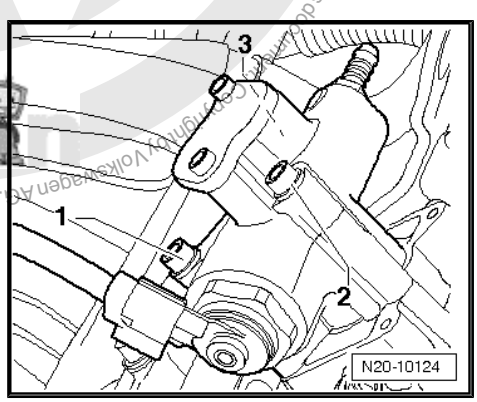


– Slide the tappet -1- into the camshaft housing.
– Fit a new oiled O-ring -2- into the groove of the high pressure pump -3-.
– Fit the high pressure pump -3- on the camshaft housing.



– Tighten securing bolts -1-, -2- and -3- evenly.

Tightening torque: 10 Nm

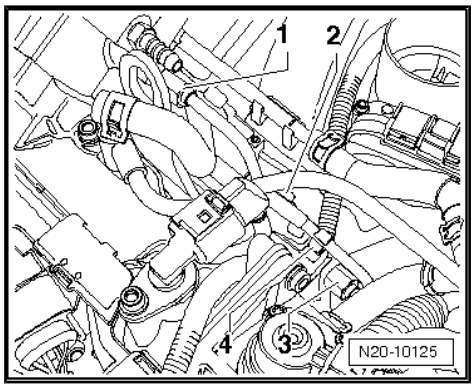


– Tighten union nuts of the high pressure line -1- and -3- hand-tight.
– Install cable guide -2- and press clip -4- onto the high-pressure line.

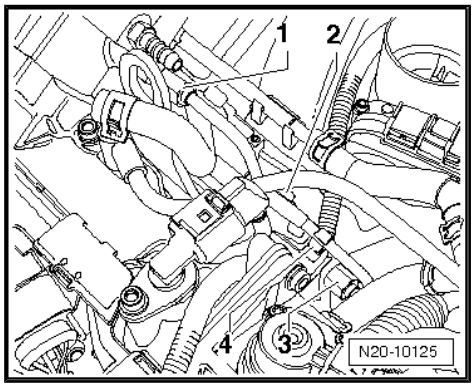
Tightening torque of the securing bolt of the cable guide: 10 Nm

Note

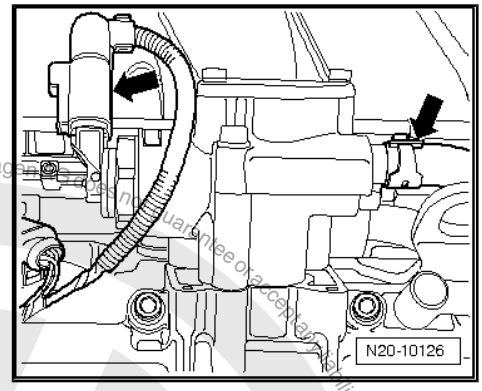
Lock the screwed connections on the high-pressure pump and on fuel rail when tightening the union nuts with a spanner.



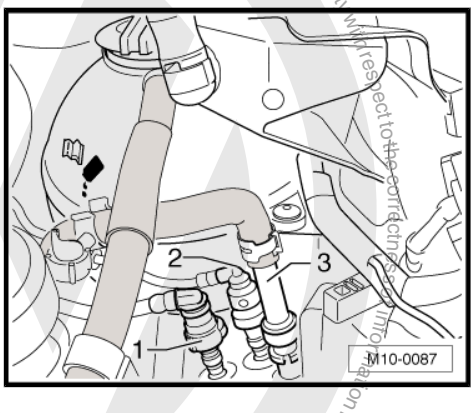
– Tighten union nut -1- of the high-pressure line to 30 Nm.
– Tighten union nut -3- of the high-pressure line to 25 Nm.



– Fit fuel supply line and the connector -arrows- to the high-pressure pump.



– Connect fuel supply line -3-.
– Install air cleaner ⇒ page 161 .



3 Servicing electronic power control (EPC)

Function of EPC system ⇒ page 144

Accelerator pedal module - Assembly overview ⇒ page 145

Removing and installing accelerator pedal module ⇒ page 145

3.1 Function of EPC system

With the electronic power control system (EPC) (also known as E-gas) the throttle valve is not operated by a cable. There is no mechanical connection between accelerator and throttle valve.

The position of the accelerator pedal is transmitted to the engine control unit by two accelerator pedal position senders (variable resistors together in one housing) connected to the accelerator pedal.

The position of the accelerator pedal (driver's requirement) is a main input value for the engine control unit.

The throttle valve is operated over the complete engine speed and load range by an electric motor (throttle valve positioner) in the throttle valve module.

The throttle valve is operated by the throttle valve positioner which is controlled by the engine control unit.

When the engine is not running and the ignition is switched on, the engine control unit moves the throttle valve exactly as prescribed by the accelerator pedal position sender. That is, when the accelerator is depressed halfway, the throttle valve positioner opens the throttle valve by the same amount. The throttle is then approximately half open.

When the engine is running (under load), the engine control unit can open or close the throttle valve independently of the accelerator pedal position sender.

This means that the throttle valve can already be completely open even though the accelerator pedal is depressed half way. This has the advantage of preventing throttling losses at the throttle valve.

After evaluating the torque requirements of various components (e.g. air conditioning system, automatic gearbox, ABS/ESP and so on), the engine control unit calculates the optimal throttle valve opening angle for the respective situation.

This also results in significantly improved consumption and exhaust emission values at certain load conditions.

“EPC” is a system comprising all components which contribute to determining, controlling or monitoring the position of the throttle valve, e.g. accelerator pedal position sender, the throttle valve control module, the EPC warning lamp, the engine control unit and so on.

3.2 Accelerator pedal module - Assembly overview

1 - Connector

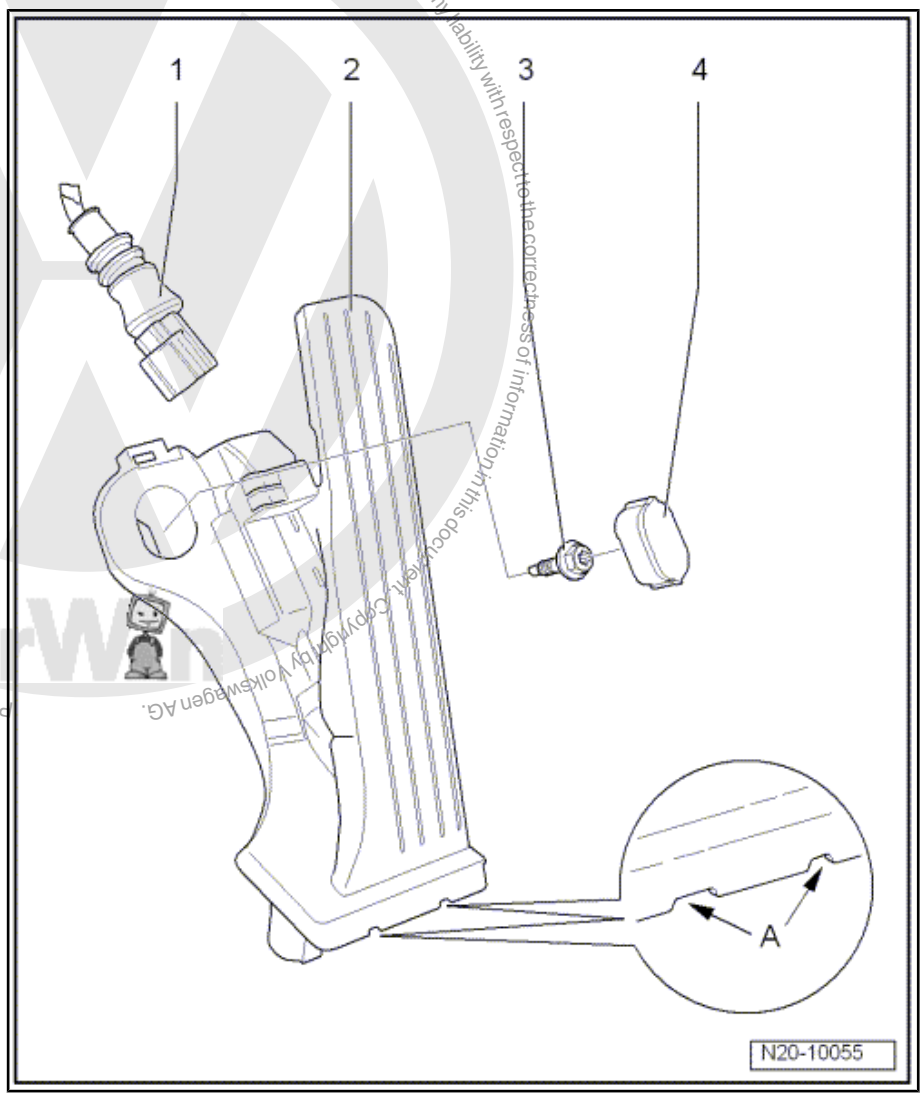
- ❑ Black, 6-pin.

2 - Accelerator position sender -G79- with accelerator position sender 2 -G185-

- ❑ Cannot be adjusted
- ❑ The accelerator pedal position passes the position of the pedal on to the engine control unit
- ❑ Openings -A- for release tool
- ❑ Removing and installing ⇒ page 145

3 - 10 Nm

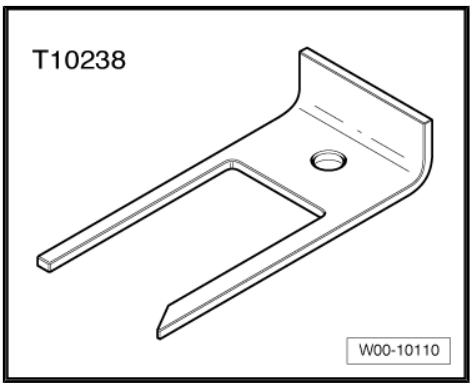
4 - Cover



3.3 Removing and installing accelerator pedal module

Special tools and workshop equipment required

- ♦ Release tool -T10238-

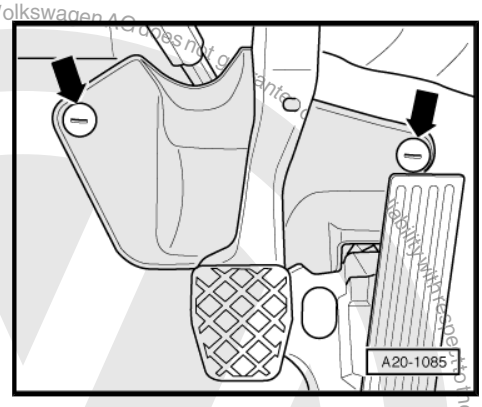


Removing

– Remove cover for steering column -arrows-.

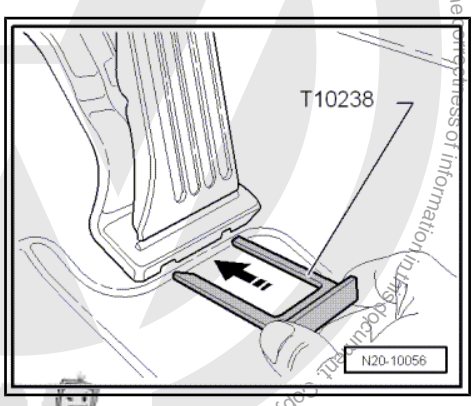
– Lever off the protective cap ⇒ Item 4 (page 145) using a screwdriver.

– Unbolt securing bolt ⇒ Item 3 (page 145) .



– Slide the release tool -T10238- as shown into the openings provided to the stop and take accelerator pedal module off.

– Disconnect connector and pull cable guide off accelerator pedal module.



Installing

– Fit connector -2- to the accelerator pedal module -5- and slide the rubber grommet -1- onto the connector again.

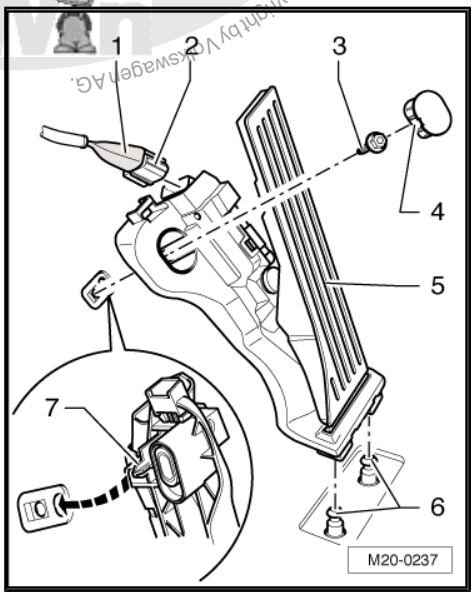
– Press the accelerator pedal module onto the securing pins -6-.

– Fit the centre pin -7- into the hole of the vehicle floor.

– Secure accelerator pedal module with the bolt -3- and fit cover cap -4-.

– Install steering column cover again.

– If the accelerator pedal module has been renewed, adapt the accelerator pedal module to the engine control unit⇒ Vehicle Diagnosis, Testing and Information System -VAS 5051- or Vehicle Diagnosis and Service Information System -VAS 5052- .



Torque setting

Component	Nm
Accelerator pedal module to body	10

4 Activated charcoal filter system

Function ⇒ page 147

Activated charcoal filter system - Assembly overview ⇒ page 148

Checking fuel tank breather ⇒ page 148

4.1 Functional check

Depending upon the air pressure and ambient temperature, fuel vapour will form above the level of fuel in the tank.

The active charcoal filter system prevents these HC emissions escaping to the atmosphere.

Fuel vapours from the highest point in the fuel tank pass through the gravity valve (which closes at an angle of 45°) and through a pressure retention valve (in limited quantities) to the activated charcoal filter.

The activated charcoal stores these vapours like a sponge.

When the Lambda control is active when driving (engine warm), the activated charcoal filter system solenoid valve 1 -N80- (also called regeneration valve), is activated (pulsed) from engine control unit depending upon load and engine speed. The opening period depends on the input signals.

Intake manifold vacuum draws fresh air through the vent opening on the underside of the activated charcoal filter during the purging procedure (regenerating the activated charcoal). The fuel vapours stored in the activated charcoal and fresh air are fed to combustion in metered quantities.

The pressure retention valve prevents fuel vapours from being drawn from the tank when the solenoid valve is open and intake manifold vacuum is present. It therefore ensures that the evacuation of the activated charcoal filter has priority.

When there is no electrical signal (i.e. open circuit) the solenoid valve remains closed. The activated charcoal filter will not be purged.

Note

- *Hose connections are secured with either spring-type or clamp-type clips.*
- *Always replace clamp-type clips with spring-type clips.*
- *Hose clip pliers -VAS 5024 A- are recommended for fitting spring-type clips.*

Observe safety precautions ⇒ page 115 .

Observe rules for cleanliness ⇒ page 115 .

4.2 Activated charcoal filter system - Assembly overview

1 - Activated charcoal filter

- ❑ Location: In engine compartment, right

2 - Pressure retention valve with connecting hose

3 - Connecting hose

- ❑ Check for secure seating
- ❑ From fuel tank

4 - 10 Nm

5 - Activated charcoal canister solenoid valve 1 -N80-

- ❑ Valve closed with ignition switched off
- ❑ When the engine is warm the valve will be activated from the engine control unit (pulsed)

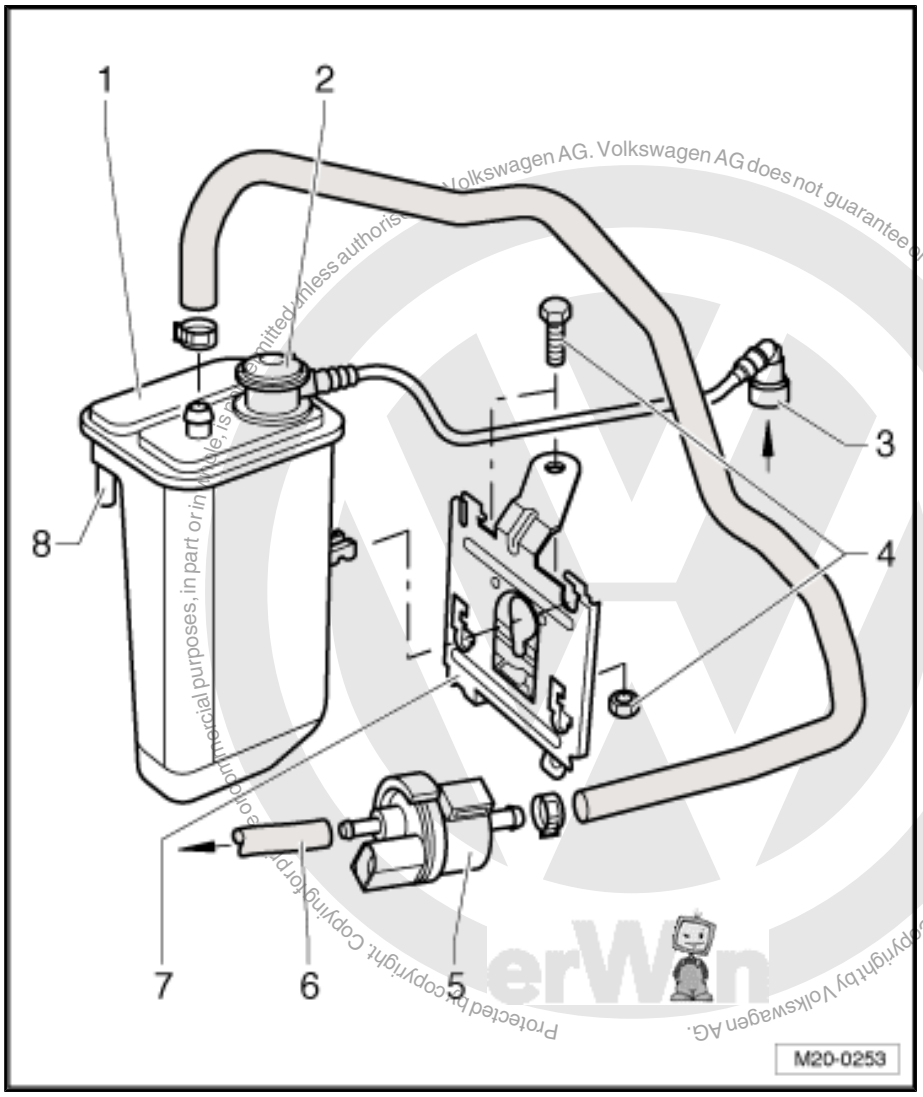
6 - Connecting hose

- ❑ To intake manifold
- ❑ Check for secure seating

7 - Retainer

- ❑ For activated charcoal filter

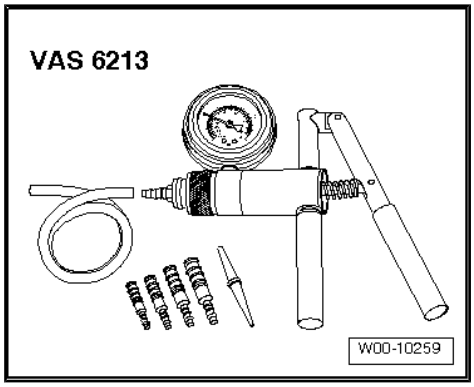
8 - Breather hose



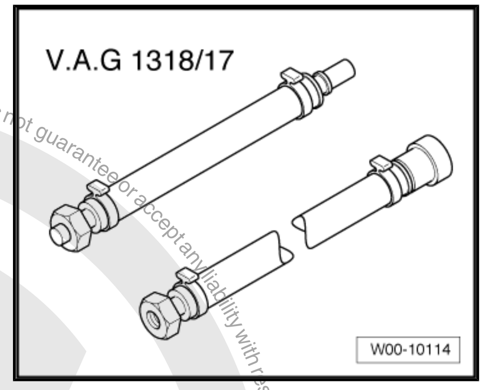
4.3 Checking fuel tank breather

Special tools and workshop equipment required

♦ Hand vacuum pump -VAS 6213-



♦ Adapter set -V.A.G 1318/17-



Test prerequisites

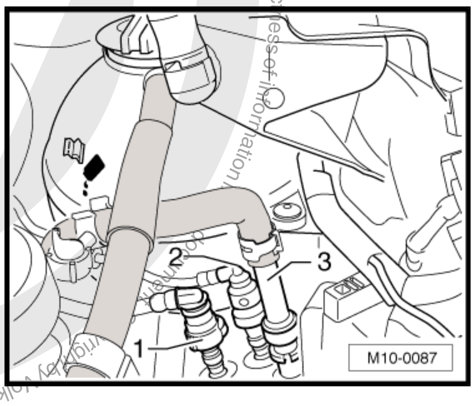
- Ignition must be switched off.

Test procedure

– Pull off breather line -1- (press locking ring in).

– Then connect the hand vacuum pump -VAS 6213- with the adapter set -V.A.G 1318/17- to the breather line -1- to the activated charcoal filter.

– Operate hand vacuum pump -VAS 6213- several times. Vacuum must not build-up.



If vacuum a builds-up:

– Check breather hose ⇒ Item 8 (page 148) on activated charcoal filter for soiling and clean if necessary.

If no vacuum builds up:

– Temporarily seal breather connection ⇒ Item 8 (page 148) and operate vacuum pump again several times. A vacuum must build up.

If no vacuum builds up:

– Renew activated charcoal filter.

24 – Mixture preparation, Injection

1 Repairing injection system

Observe general notes on injection ⇒ page 150 .

Safety precautions ⇒ page 151 .

Rules for cleanliness ⇒ page 152 .

1.1 General notes on injection

- The engine control unit is equipped with self-diagnosis. Before carrying out repairs and fault finding the fault memory must be interrogated. Also the vacuum hoses and connections must be checked (unmetered air).
- Fuel hoses in engine compartment must be secured only with spring-type clips ⇒ Electronic parts catalogue “ETKA” . The use of clamp or screw-type clips is not permissible.
- Disconnect the battery earth strap.only with ignition switched off. If a coded radio is installed, obtain radio code before disconnecting battery.
- Observe procedures after connecting battery ⇒ Electrical system; Rep. Gr. 27 ; Connecting and disconnecting battery .
- For trouble-free operation of electrical components, a voltage of at least 11.5 V is necessary.
- Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and damage the Lambda probe.
- During some checks, it is possible that the control unit will detect and store a fault. Therefore, after completing all tests and repairs, read the fault memory and erase if necessary ⇒ page 178 .
- Models with an airbag are fitted with a crash fuel shut-off system. It reduces the danger of a fire in a crash as the fuel pump is switched off by the fuel pump relay.
- When the driver's door is opened the fuel pump is activated for 2 seconds to build-up fuel pressure. The starting characteristics are thereby improved.

Safety precautions ⇒ page 151

Rules for cleanliness ⇒ page 152

Technical data ⇒ page 160

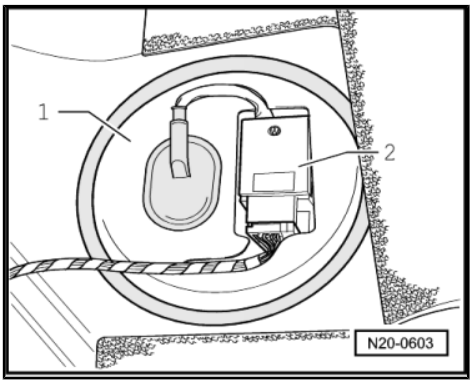
1.2 Safety precautions

WARNING

- *The fuel line is under pressure! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening lines, wrap a cloth around the connection. Then release pressure by carefully removing the line.*
- *The fuel pressure in the high-pressure pipe can reach 120 bar! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening fuel pipes, wrap a cloth around the connection. Then release pressure by carefully loosening the banjo bolts.*

To prevent injuries to persons and/or damage to the injection and ignition system, the following must be observed:

- The fuel pump is activated when switching on the ignition and by the driver's door contact switch. Therefore, for safety reasons, the fuel pump control unit -J538- -2- must be pulled out of the cover -1- and the electrical connection must be disconnected, before opening the fuel system, if the battery is not disconnected.
- Do not touch or pull off ignition wiring when engine is running or turning at starter speed.
- Switch off ignition before connecting or disconnecting injection and ignition system wiring as well as measuring instrument cables.



Caution

When doing any repair work, especially in the engine compartment, pay attention to the following due to the cramped conditions:

- *All wirings (e.g. for fuel, hydraulic system, activated charcoal canister system, coolant and refrigerant liquid, brake liquid, vacuum) and electrical wirings are to be installed in the original way.*
- *To avoid damages to the wiring ensure sufficient clearance to all moving or hot components.*

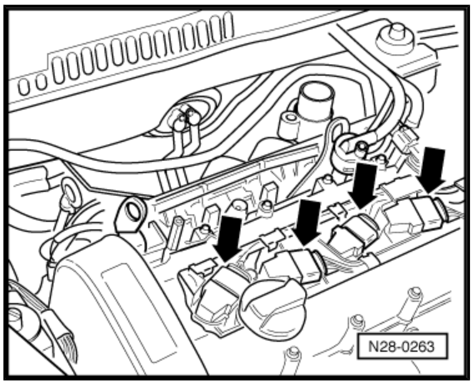
Observe following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to rear seat and operated by a second person from this location.

If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

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

– Pull all 4-pin connectors -arrows- off ignition coils.



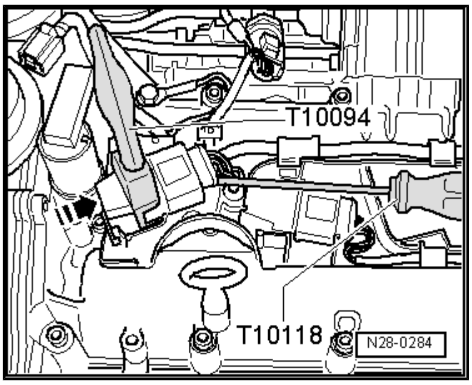
– To do this set the puller -T10094- on the ignition coil with final output stage -arrow-.

– Pull ignition coil with output stage out a bit.

– Place assembly tool -T10118- as shown.

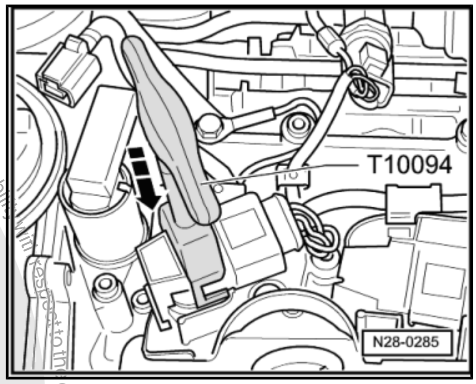
– Carefully loosen connector lock and pull connector off.

– To install the ignition coil for final output stage fit the connector until it engages audibly.



– Place puller -T10094- as shown.

– Press the ignition coil with output stage in direction of -arrow- into the cylinder head.



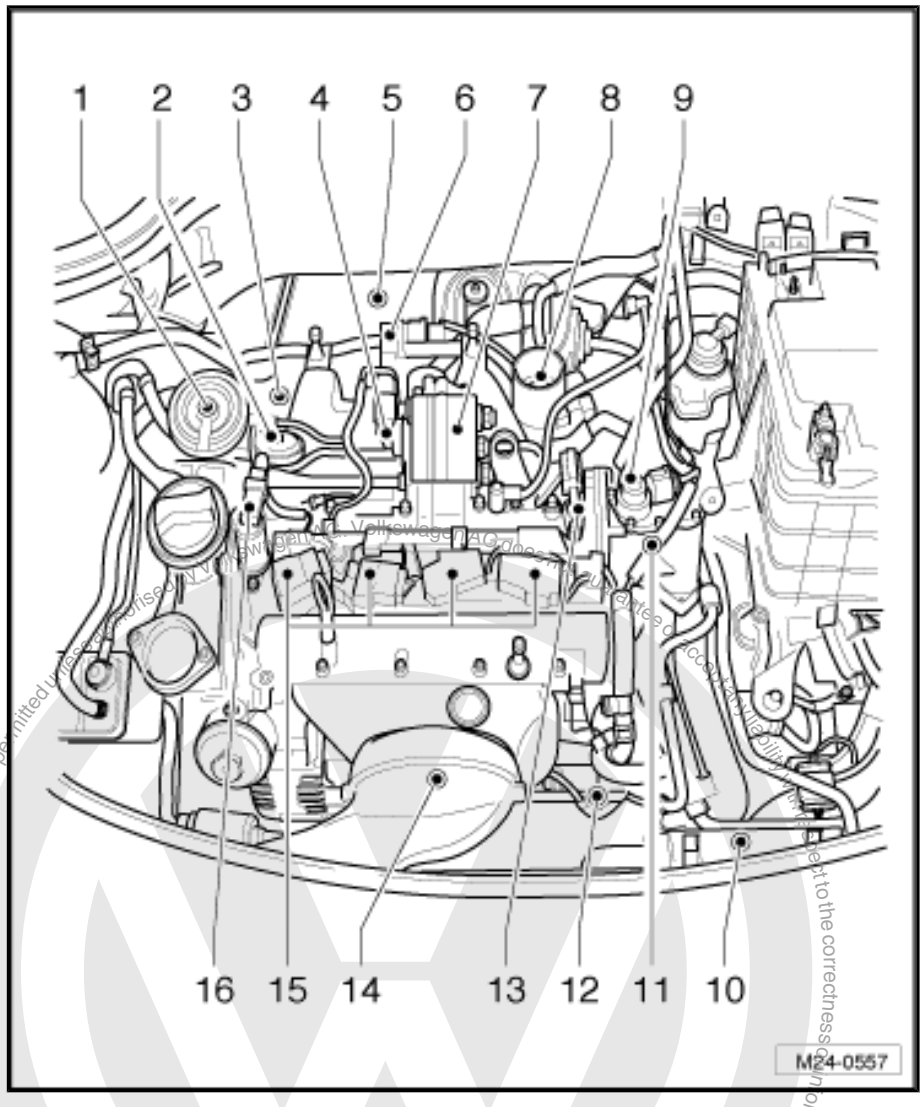
1.3 Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following “5 rules”:

- Thoroughly clean all joints and surrounding areas before dismantling.
- Place parts that have been removed on a clean surface and cover. Use lint-free cloths only!
- Carefully cover opened components or seal if repairs cannot be carried out immediately.
- Install clean parts only: Only unpack replacement parts immediately prior to installation. Do not use parts that have not been stored in their packing (e.g. in tool boxes etc.).
- When the system is open: Do not work with compressed air if this can be avoided. Do not move vehicle unless absolutely necessary.

1.4 Fitting locations overview

The components A to K are not shown on the illustration.



1 - Pressure regulating valve

- ❑ Fitted on control housing

2 - Vacuum actuator for intake manifold flap

3 - Intake manifold pressure sender -G71- and intake air temperature sender -G42-

- ❑ Fitting location ⇒ page 158

- ♦ Intake manifold flap potentiometer -G336- ⇒ page 158
- ♦ Intake manifold flap valve -N316- ⇒ page 157

4 - Fuel pressure regulating valve -N276-

- ❑ Fitting location ⇒ page 157

5 - Motronic control unit -J220- with ambient temperature sender

- ❑ Removing and installing ⇒ page 179

6 - Activated charcoal canister solenoid valve 1 -N80-

- ❑ Fitting location on rear intake manifold ⇒ page 157

7 - High-pressure pump

- ❑ Perform removal and installation of the high pressure pump only when engine is cold
- ❑ When installing the high-pressure pump, observe that the fuel system is not contaminated by dirt.
- ❑ Install lines free of stress

8 - Throttle valve module -J338- , throttle valve drive for electric throttle -G186-

- ❑ Throttle valve drive angle sender 1 for electric throttle -G187- and throttle valve drive angle sender 2 for electric throttle -G188-
- ❑ When renewing, erase learnt values and adapt engine control unit Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle diagnosis and service information system -VAS 5052- .
- ❑ Fitting location ⇒ page 156

9 - Exhaust gas recirculation valve -N18- and exhaust gas recirculation potentiometer -G212-

- ❑ Fitting location ⇒ page 156
- ❑ When renewing, erase learnt values and adapt engine control unit Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle diagnosis and service information system -VAS 5052-

10 - Radiator outlet coolant temperature sender -G83-

- ❑ Fitting location ⇒ page 159

11 - Coolant temperature sender -G62-

- ❑ Fitting location ⇒ page 156

12 - Connector for Lambda probe -G39-

- ❑ Fitting location ⇒ page 155

13 - Hall sender -G40-

- ❑ Fitting location ⇒ page 159

14 - Lambda probe -G39-

- ❑ Fitting location ⇒ page 155

15 - Ignition coils with output stages

- ❑ Ignition coil 1 with final output stage -N70-
- ❑ Ignition coil 2 with final output stage -N127-
- ❑ Ignition coil 3 with final output stage -N291-
- ❑ Ignition coil 4 with final output stage -N292-

16 - Camshaft variable timing adjustment valve 1 -N205-

- ❑ Checking ⇒ Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle Diagnosis and Service Information System -VAS 5052-

A - Fuel pump control unit -J538-

- ❑ Fitting location ⇒ page 155

B - “EPC” warning lamp

- ❑ In dash panel insert

C - “MIL” malfunction indicator lamp

- ❑ In dash panel insert

D - Accelerator position sender -G79- with accelerator position sender 2 -G185-

- ❑ In footwell on accelerator pedal (both senders are installed together in a housing)
- ❑ Fitting location ⇒ page 156

E - Motronic relay

- ❑ Motronic current supply relay -J271- ⇒ page 159

F - Injectors

- ❑ In fuel rail tube
- ❑ No. 1 cyl. injector -N30-
- ❑ No.2 cyl. injector -N31-
- ❑ No. 3 cyl. injector -N32-
- ❑ No. 4 cyl. injector -N33-

The injectors are high-pressure injectors which inject the fuel under high pressure (approx. 120 bar max.) directly into the cylinder.

G - Engine speed sender -G28-

- ❑ Fitting location ⇒ page 158

H - Knock sensor 1 -G61-

- ❑ Fitting location ⇒ page 159

I - Fuel pressure sender -G247-

- ❑ Fitting location ⇒ page 157

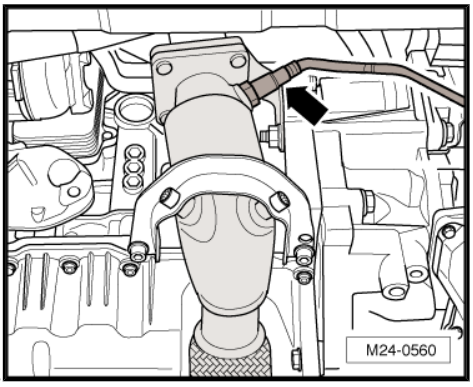
J - Intake air temperature sender 2 -G299-

- ❑ Intergrated in the engine cover
- ❑ Fitting location ⇒ page 158

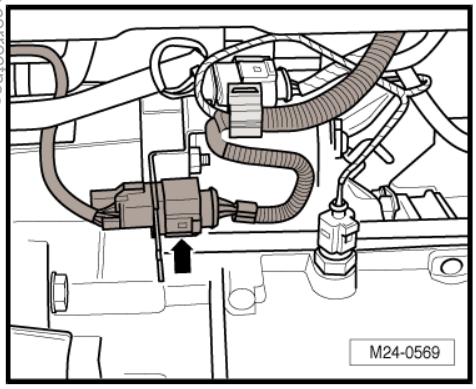
K - Lambda probe after catalytic converter -G130-

- ❑ Fitting location ⇒ page 155

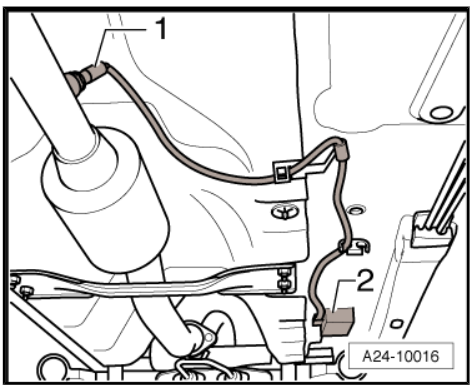
Lambda probe -G39- -arrow-



Connector -arrow- for Lambda probe -G39-



Lambda probe after catalytic converter -G130- -1- with connector -2-

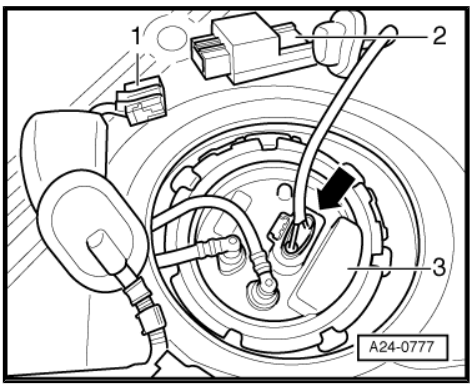


Fuel pump with fuel pump control unit -J538-

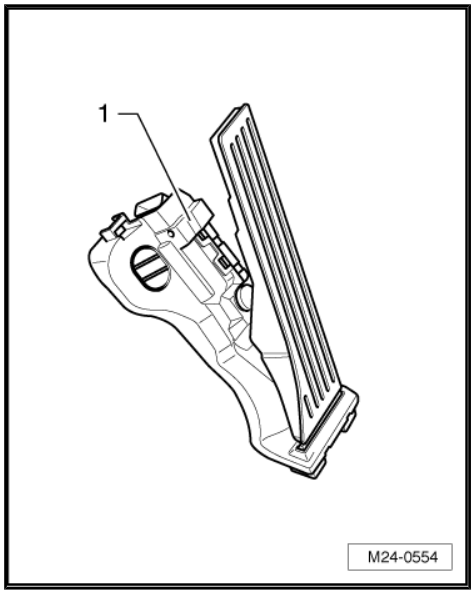
1 - Connector for fuel pump control unit -J538-

2 - Fuel pump control unit -J538-

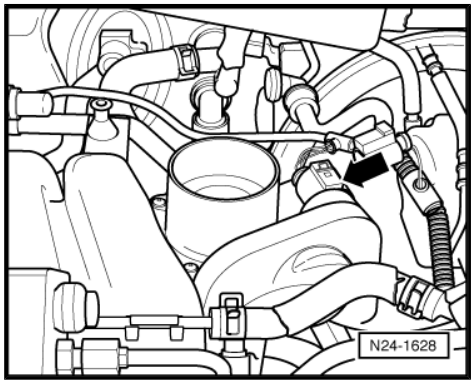
3 - Fuel delivery unit



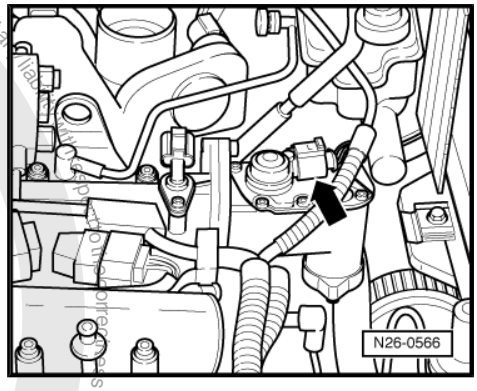
-1- Accelerator position sender -G79- with accelerator position sender 2 -G185- (in driver's footwell)



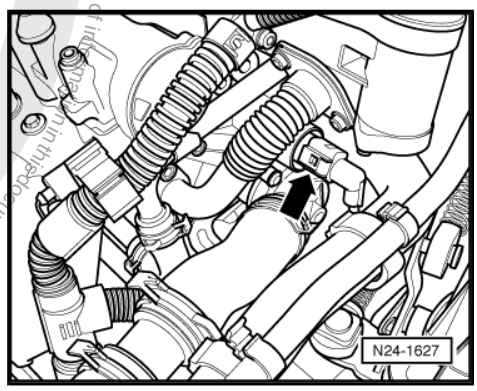
Throttle valve module -J338-



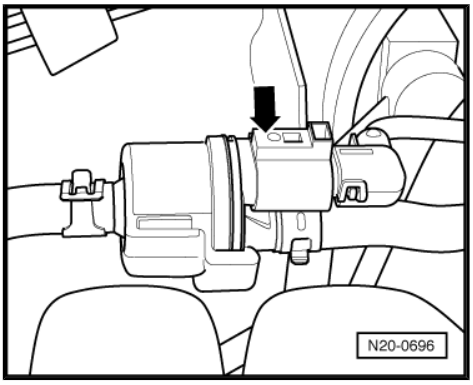
Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212- -arrow-



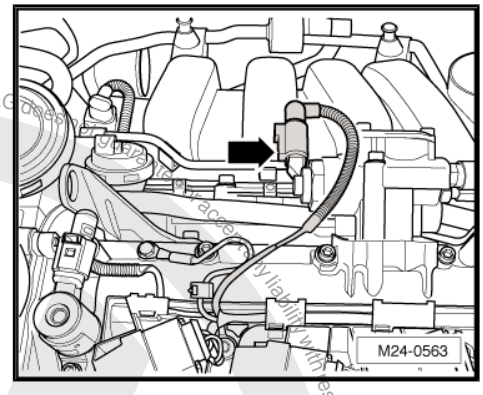
Coolant temperature sender -G62- -arrow-



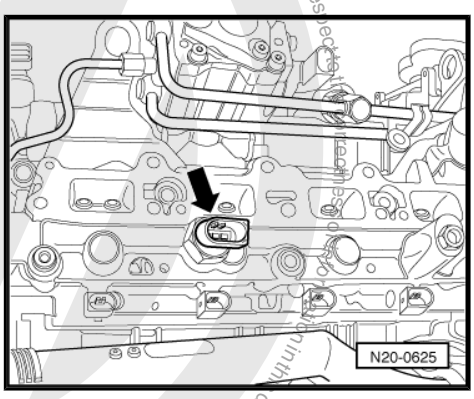
Active charcoal filter system solenoid valve 1 -N80- -arrow-



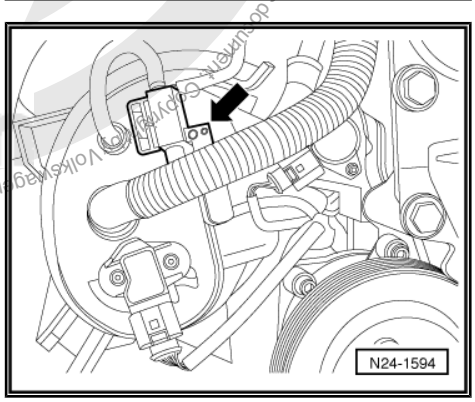
Fuel pressure regulating valve -N276- -arrow-



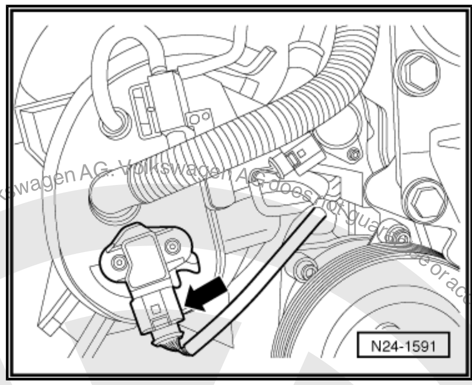
Fuel pressure sender -G247- -arrow-



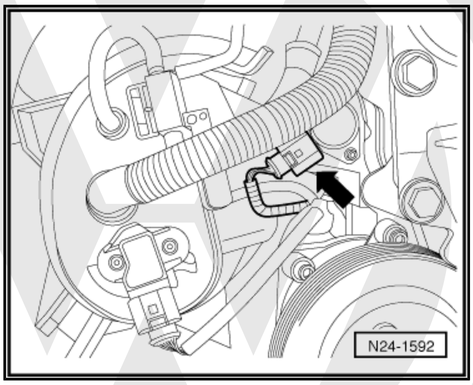
Intake manifold flap valve -N316- -arrow-



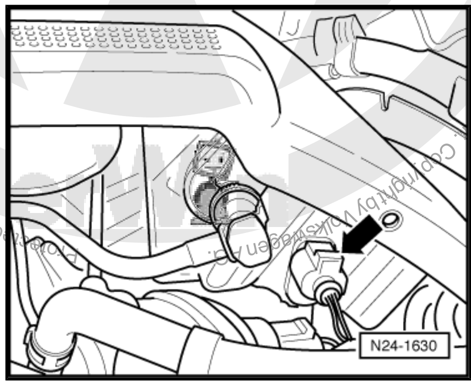
Intake manifold pressure sender -G71- and intake air temperature sender -G42- -arrow-



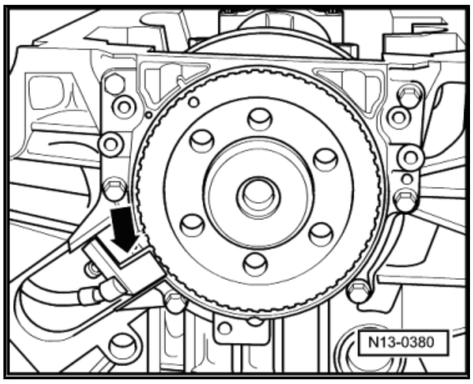
Intake manifold flap potentiometer -G336- -arrow-



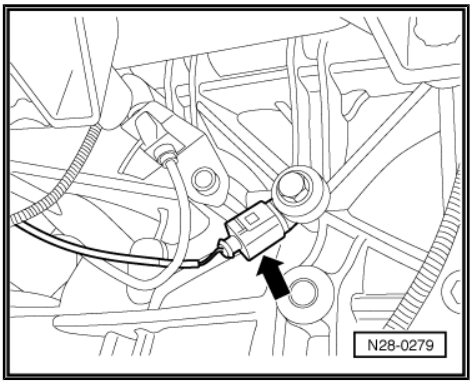
Intake air temperature sender 2 -G299- -arrow-



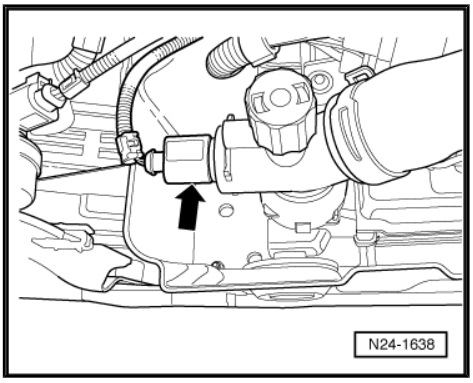
Engine speed sender -G28- -arrow-



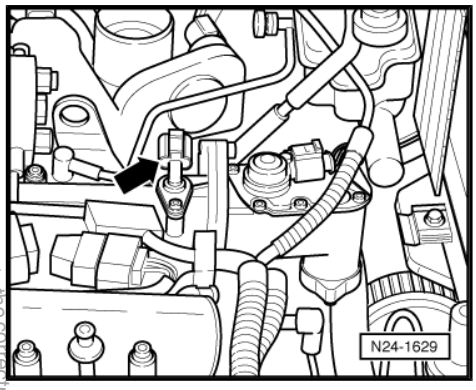
Knock sensor 1 -G61- -arrow-



Radiator outlet coolant temperature sender -G83- -arrow-



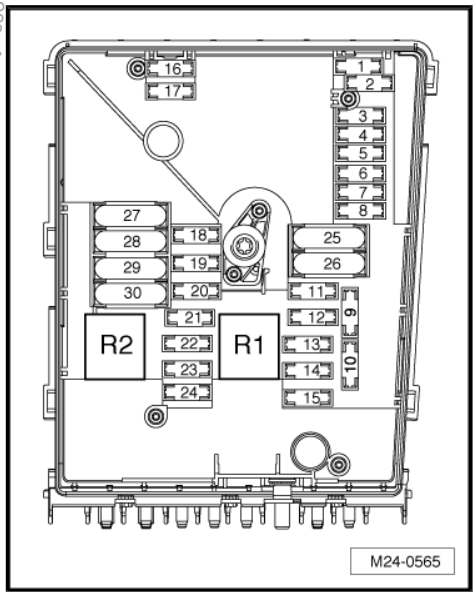
Hall sender -G40- -arrow-



Relay and fuse carrier in electronics box

R1 - Motronic current supply relay -J271-

R2 - not installed



1.5 Technical data

Engine code		BLF
Idling check		
Idling speed [5]	1 rpm	630…730
Engine control unit		
System		Motronic MED 9.5.10
Engine speed governor	1 rpm	from approx. 5700

5) Cannot be adjusted.

1.6 Air cleaner/engine cover - Assembly overview

Removing and installing air cleaner ⇒ page 161 .

1 - 3 Nm
- ❑ Observe tightening sequence (figures can be found on the air cleaner housing lower part)

2 - Air cleaner housing lower part

3 - Rubber bush

4 - Filter element

5 - Vacuum line
- ❑ From camshaft housing

6 - 3 Nm

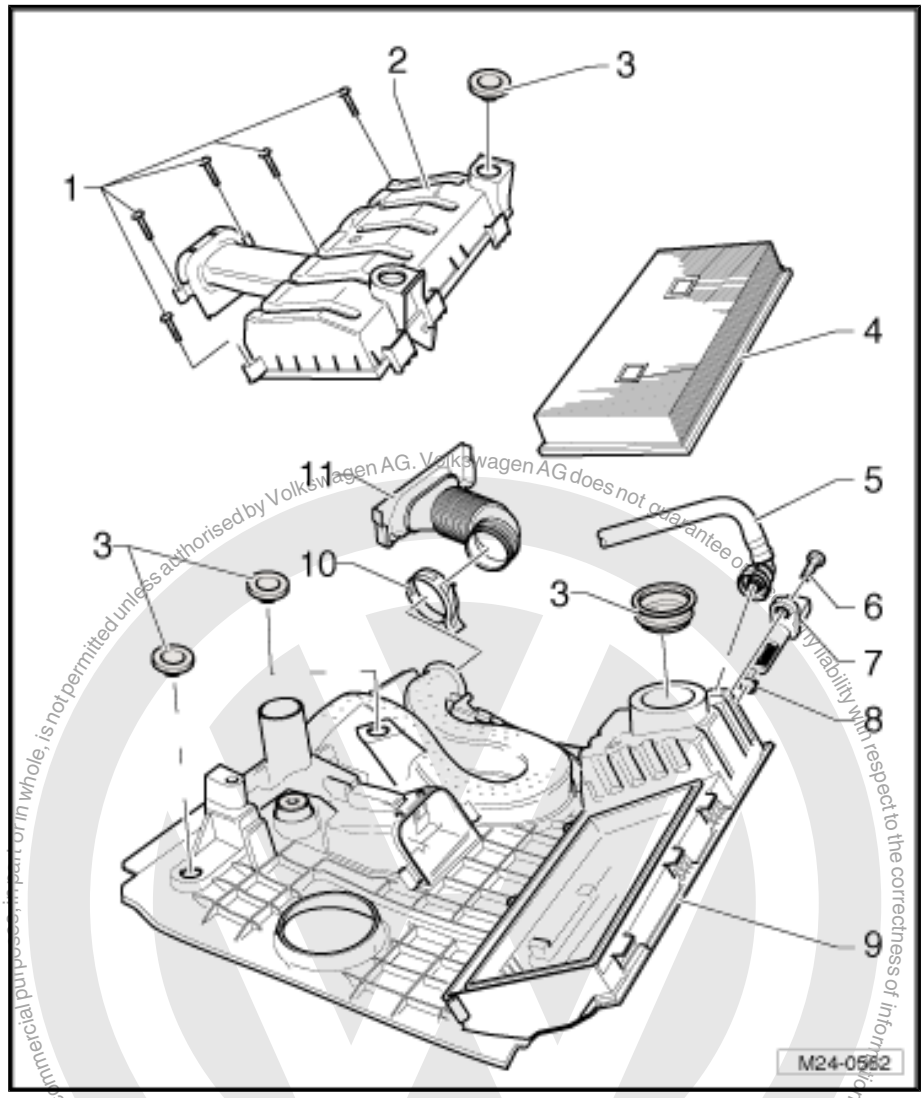
7 - Intake air temperature sender 2 -G299-

8 - O-ring
- ❑ Renew

9 - Air cleaner upper section

10 - Spring clip

11 - Air intake hose



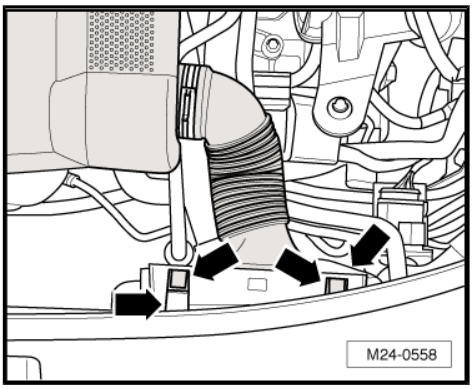
1.7 Removing and installing engine cover with air cleaner

Note

The air cleaner is integrated into the engine cover.

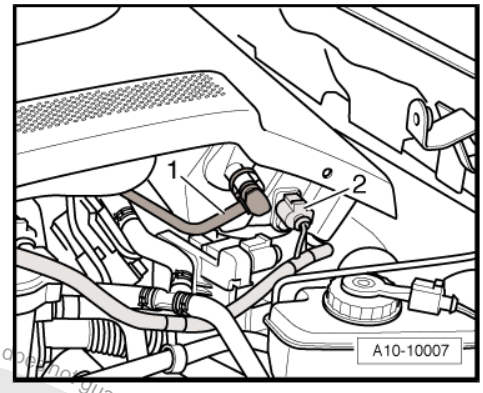
Removing

– Unclip air intake hose on the upper part and on the side of the air ducting -arrows-.



– Pull vacuum line -1- off the actuator for intake air preheating.

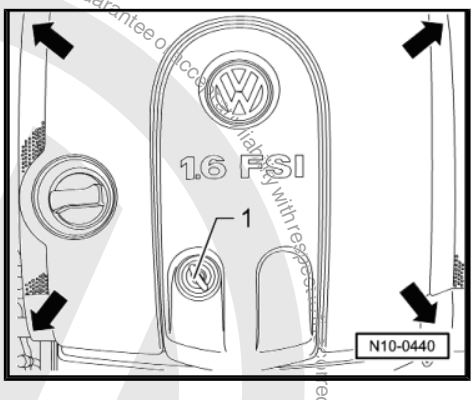
– Disconnect electrical connection -2- on intake air temperature sender 2 -G299- .



– Pull oil dipstick -1- out.

– Pull engine cover off on the marked points -arrows-.

– Fit the oil dipstick -1- again into guide tube to limit stop.



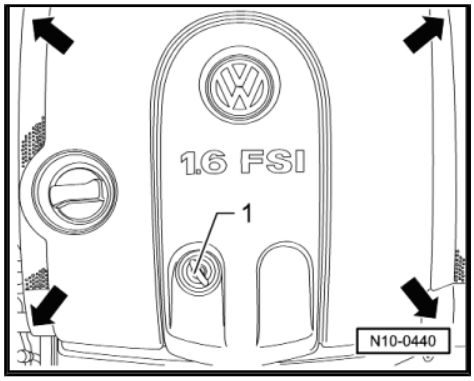
Installing

Install in reverse order of removal. During this step, observe the following:

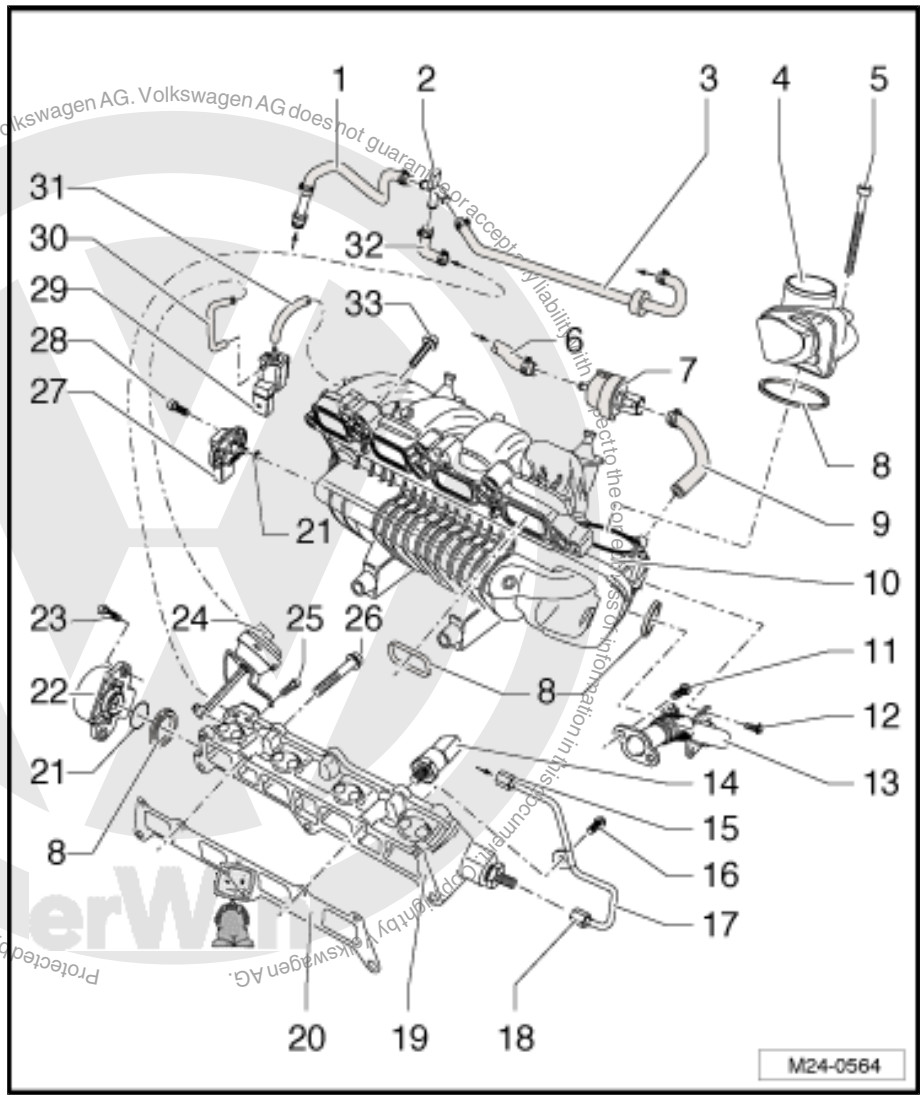
– Pull oil dipstick out of guide tube.

– Fit the rubber mountings of the cover on the pins fitted on the engine.

– Pull cover downwards on the marked points -arrows-.
– Fit the oil dipstick -1- again into guide tube to limit stop.



1.8 Intake manifold - Assembly overview



1 - Fuel supply line
- ❑ Secure with spring-type clips
- ❑ Check for secure seating
- ❑ From fuel filter

2 - Distributor
- ❑ Clipped on suction relief valve for crankcase breather

3 - Fuel supply hose
- ❑ To high-pressure pump

4 - Throttle valve module - J338-
- ❑ Clean ⇒ page 173
- ❑ When renewing, erase learnt values and adapt engine control unit Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle diagnosis and service information system - VAS 5052-

5 - 10 Nm

6 - Vacuum hose
- ❑ To active charcoal filter system solenoid valve 1 -N80-

7 - Activated charcoal canister solenoid valve 1 -N80-
- ❑ Repairing parts of the activated charcoal filter system ⇒ page 147

8 - Seal
- ❑ Renew
- ❑ Press in onto limit stop

9 - Vacuum hose
- ❑ From active charcoal filter system solenoid valve 1 -N80-

10 - Intake manifold

- ❑ Check vacuum reservoir in intake manifold ⇒ page 175
- ❑ Removing and installing ⇒ page 164

11 - 8 Nm

12 - 5 Nm

13 - Connecting pipe

- ❑ For exhaust gas recirculation system

14 - Fuel pressure sender -G247- , 20 Nm

- ❑ With attached seal

15 - Union nut, 30 Nm

16 - 8 Nm

17 - High-pressure line

18 - Union nut, 25 Nm

19 - Fuel rail

- ❑ When renewing, erase learnt values and adapt intake manifold flap potentiometer -G336- to engine control unit vehicle diagnosis, test and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052-
- ❑ Before removing and installing, lock the vacuum actuator with a 2.5 mm drill
- ❑ After installing a new fuel rail, remove the retaining clip of the vacuum actuator
- ❑ After the installation check the function of the manifold flap with the hand vacuum pump -VAS 6213- ⇒ page 176
- ❑ Removing and installing ⇒ page 168

20 - Seal

- ❑ Renew
- ❑ Note installation position

21 - O-ring

- ❑ Renew

22 - Intake manifold flap potentiometer -G336-

- ❑ When renewing, erase learnt values and adapt engine control unit Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle diagnosis and service information system -VAS 5052-

23 - 1.5 Nm

24 - Vacuum actuator

- ❑ For intake manifold flap
- ❑ Checking ⇒ page 176

25 - 10 Nm

26 - 20 Nm

27 - Intake manifold pressure sender -G71-

28 - 5 Nm

29 - Intake manifold flap valve -N316-

30 - Vacuum hose

- ❑ To vacuum actuator

31 - Vacuum hose

- ❑ From intake manifold

32 - Fuel return hose

- ❑ Fuel rail from fuel rail
- ❑ Blue or with blue marking

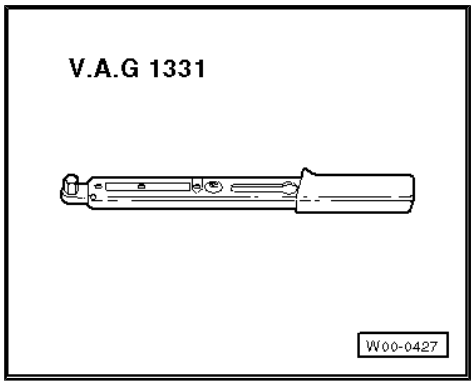
- ❑ Secure with spring-type clips
- ❑ Check for secure seating

33 - 20 Nm

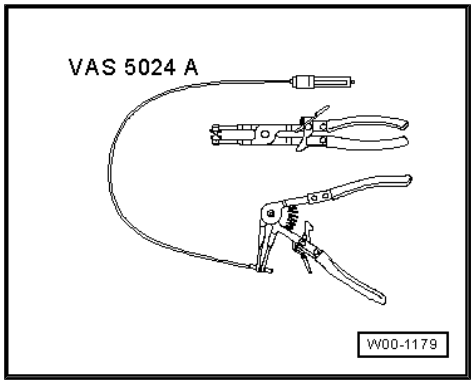
1.9 Removing and installing intake manifold

Special tools and workshop equipment required

- ♦ Torque wrench -V.A.G 1331-



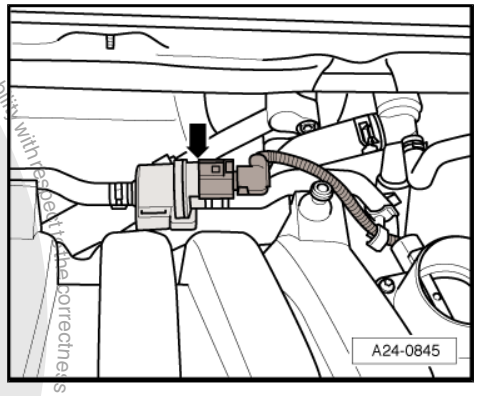
- ♦ Spring-type clip pliers -VAS 5024 A-



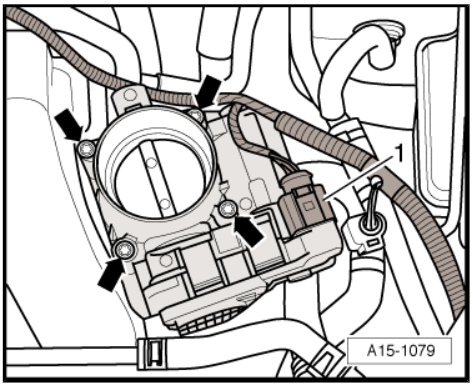
Removing

– Remove engine cover with air cleaner housing ⇒ page 161 .

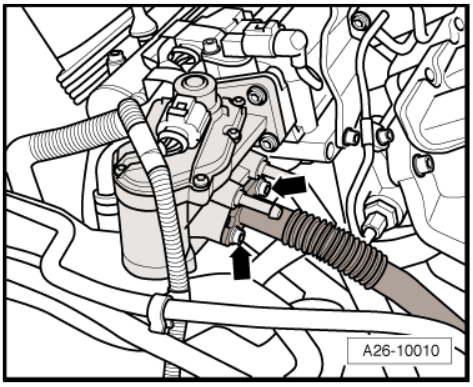
– Separate electrical connection of active charcoal filter system solenoid valve 1 -N80- .



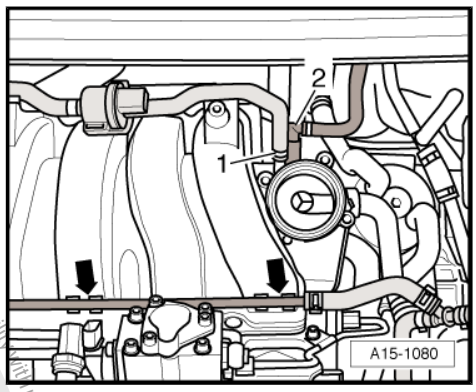
– Separate electrical connection -1- on throttle valve module -J338- .
– Remove bolts -arrows- and take throttle valve module -J338- off.



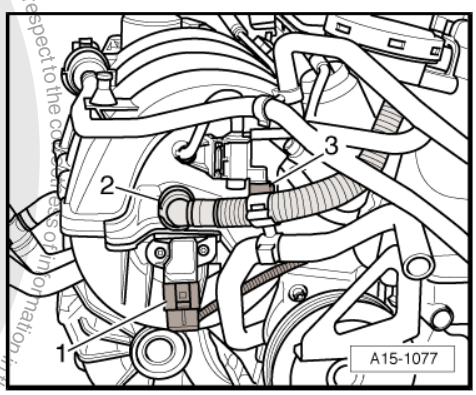
– Remove bolts -arrows- of connecting pipe on exhaust gas recirculation valve -N18- and remove seal.



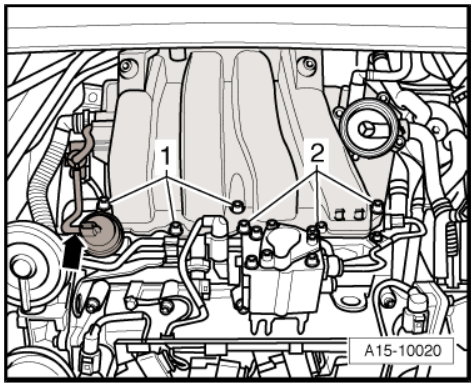
– Remove vacuum hose -1- to active charcoal filter system solenoid valve 1 -N80- on intake manifold.
– Unhook active charcoal filter system solenoid valve 1 -N80- from the brackets and lay to side with connected vacuum hoses.
– Pull vacuum line -2- off brake servo at intake manifold.
– Unclip coolant line on upper part of intake manifold -arrows- and lay to front.



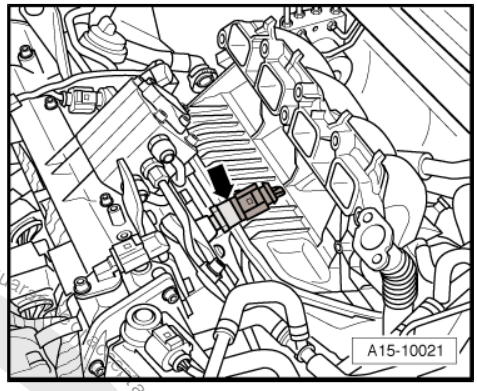
– Remove hose -2- for crankcase breather on intake manifold. To do this press release buttons.
– Disconnect electrical connection -1- on intake manifold pressure sender -G71- and -3- on intake manifold flap valve -N316- .



– Pull vacuum line -arrow- on actuator for variable intake manifold off.
– Remove securing bolts -1- and -2- for intake manifold and lay intake manifold to rear.



– Disconnect electrical connection -arrow- on fuel pressure sender -G247- .
– Remove fuel pressure sender -G247- -arrow-.
– Remove intake manifold upwards to the left.



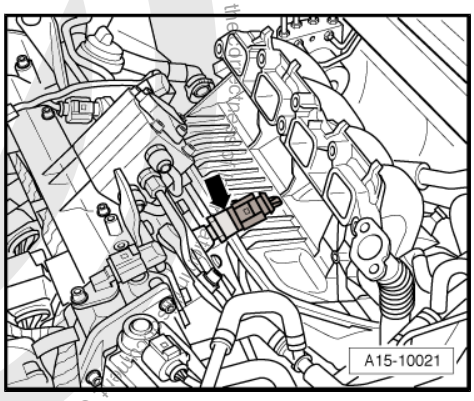
Installing

Install in reverse order of removal. During this step, observe the following:

Note

- *Observe that no dirt enters the opened intake manifold or the fuel rail/cylinder head.*
- *Renew seals and gaskets.*

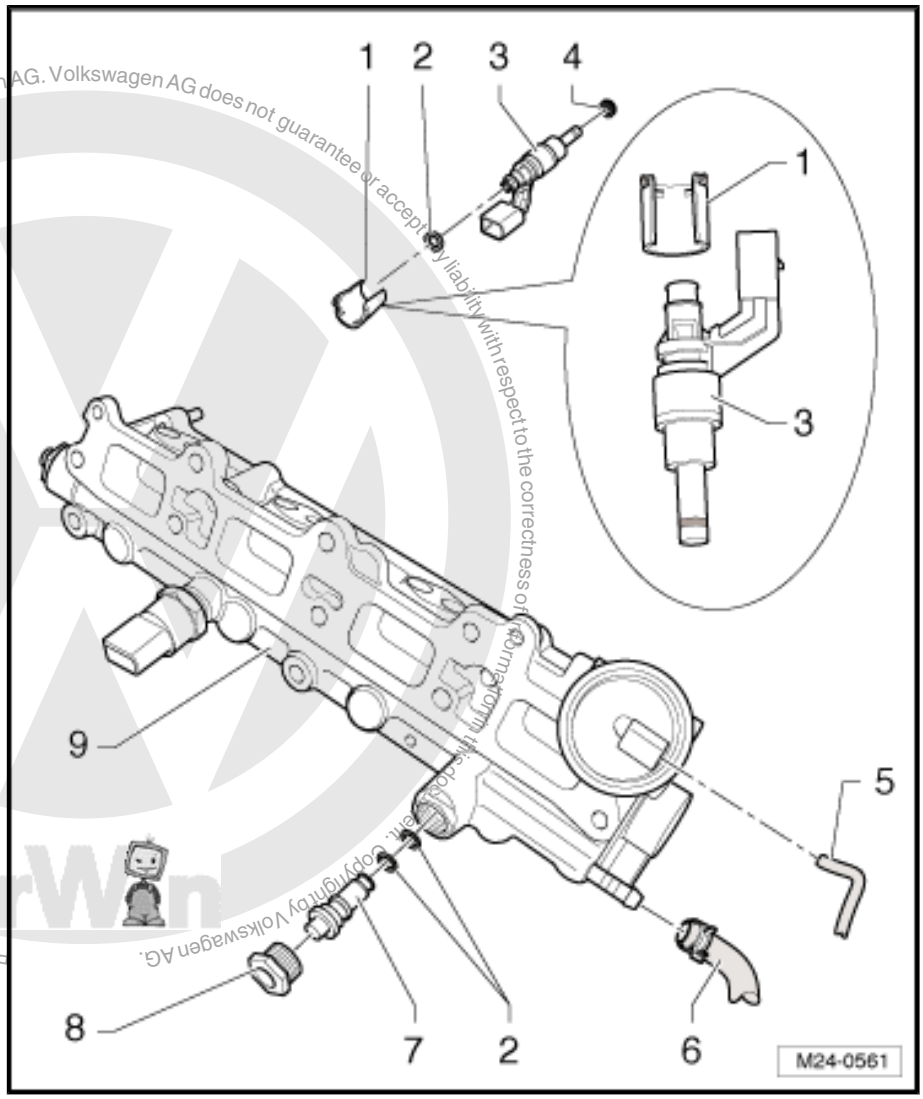
– At first, lay the intake manifold to rear in the engine compartment.
– Tighten fuel pressure sender -G247- -arrow-.
– Screw the intake manifold on the fuel rail.



Torque settings

Component	Nm
Fuel pressure sender -G247- to fuel rail	20
Intake manifold to fuel rail	20
Connecting pipe for exhaust gas recirculation to exhaust gas recirculation valve -N18-	8
Throttle valve module -J338- to intake manifold	10

1.10 Fuel rail with injectors - Assembly overview



1 - Retaining clip

- ❑ Ensure seated correctly at injector and retaining plate
- ❑ Fit with the opened side to the injector connector

2 - O-ring

- ❑ Renew
- ❑ Before installing moisten with clean engine oil

3 - Injector, cylinder 4 -N33-

- ❑ Injector, cylinder 1 - N30-
- ❑ Injector, cylinder 2 - N31-
- ❑ Injector, cylinder 3 - N32-
- ❑ Resistance 12.0…17.0 Ω~ (at room temperature)
- ❑ Removing and installing ⇒ page 170

4 - Seal

- ❑ Renew
- ❑ Do not oil or grease

5 - Vacuum hose

6 - Return hose

- ❑ From the high pressure pump
- ❑ Blue or with blue marking
- ❑ Secure with spring-type clips
- ❑ Check for secure seating

7 - Pressure limiting valve

- ❑ Renew removed valve
- ❑ Before installing moisten O-rings lightly with clean engine oil
- ❑ Press in by hand using a 8 mm hexagon socket

8 - 20 Nm

9 - Fuel rail

1.11 Removing and installing fuel rail

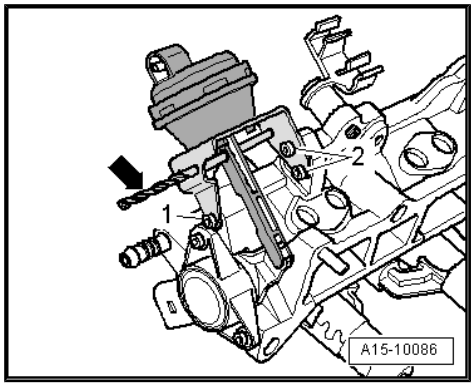
Removing

WARNING

The fuel pressure in the high-pressure pipe can reach 120 bar! Wear protective glasses and clothing to avoid injuries and skin contact. Before loosening fuel pipes, wrap a cloth around the connection. Then release pressure by carefully loosening the banjo bolts.

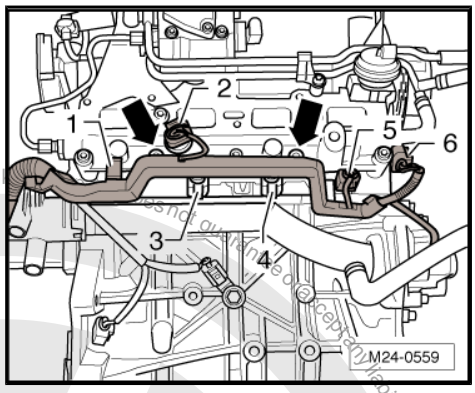
– Remove intake manifold ⇒ page 164 .

– Press operating bar of vacuum actuator in direction of actuator and lock with a ∅ 2.5 mm drill -arrow-.



– Separate electrical connectors -1- to -6-.

– Remove bolts -arrows- and take cable guide off.

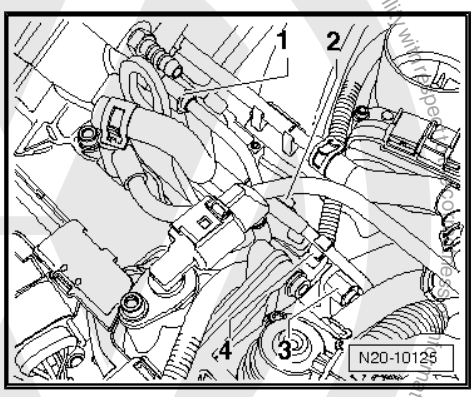


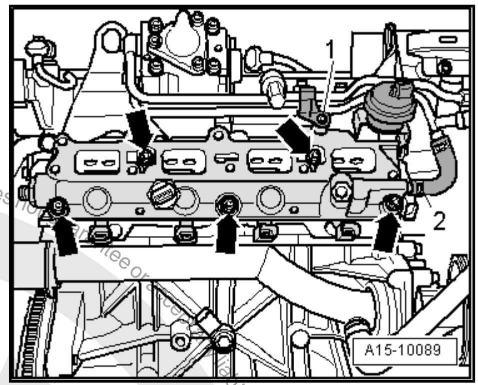
– Remove bolt -2- of the cable guide and remove clip -4- from the high-pressure line.

Note

Lock the screwed connections on the high-pressure pump and on fuel rail when unbolting the union nuts with a spanner.

– Unscrew union nuts -3- and -1- of the high-pressure line.





– Remove fuel return line -2- on fuel rail.

– Remove bolt -1- for fuel line bracket and unclip line bracket.

– Remove bolts -arrows- and remove fuel rail.

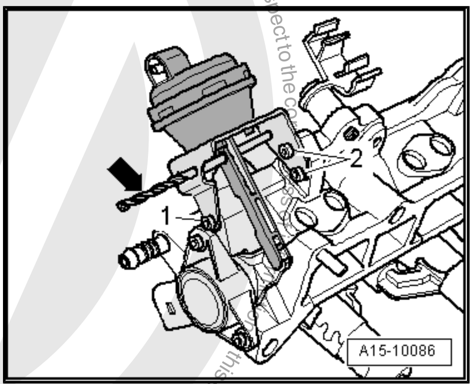
– Removing and installing injectors ⇒ page 170 .

Installing

Install in reverse order of removal. During this step, observe the following:

Note

Renew O-rings and seals.

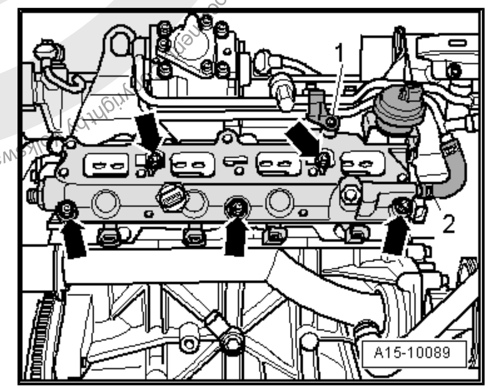


• The operating bar of the vacuum actuator must be locked with a ∅ 2.5 mm drill -arrow-.

– When placing the fuel rail on the cylinder head the charging flaps must be raised lightly.

Note

Otherwise the charging flaps between the fuel rail and the cylinder head may jam, so that it will not be possible anymore to operate them when installed.

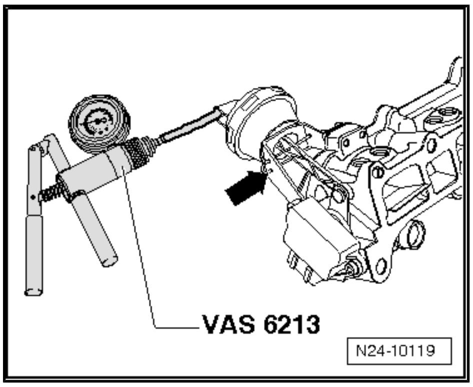


– Then fit the fuel rail -arrows-.

– Fit the line bracket -1-.

– Connect the fuel return line -2-.

– Check the function of the charging flaps using hand vacuum pump -VAS 6213- .



– Connect hand vacuum pump -VAS 6213- as shown.

– Pull drill or retaining clip -arrow- out.

– Produce vacuum and check function of vacuum actuator on operating rod.

Further installation is performed in the reverse order of removal.

– Install intake manifold ⇒ page 164 .

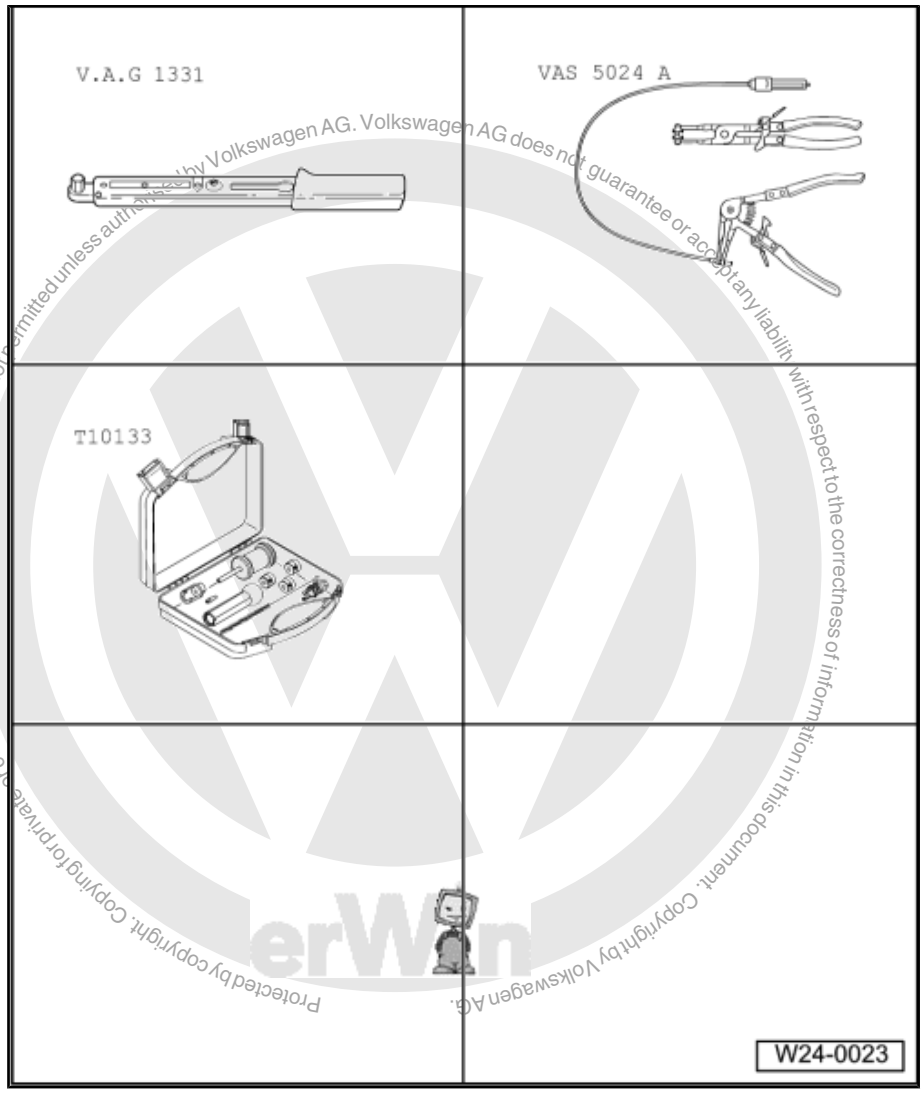
Torque settings

Component		Nm
Fuel rail on cylinder head		20
Line guide to fuel rail		7
High-pressure lines to	High-pressure pump	30
	Fuel rail	25
Line bracket to fuel rail		7

1.12 Removing and installing injectors

Special tools and workshop equipment required

- Torque wrench -V.A.G. 1331-
- Spring-type clip pliers -VAS 5024 A-
- Tool set for FSI engines -T10133-



Removing

– Remove fuse of fuel pump from fuse holder ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.

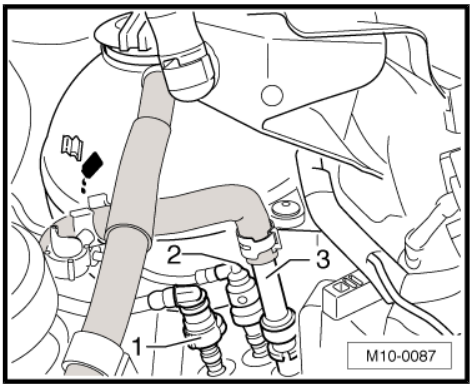
Note

Removing fuse interrupts the voltage supply to the fuel pump for reasons of safety, otherwise it is possible that the fuel pump will be activated when opening the driver's door.

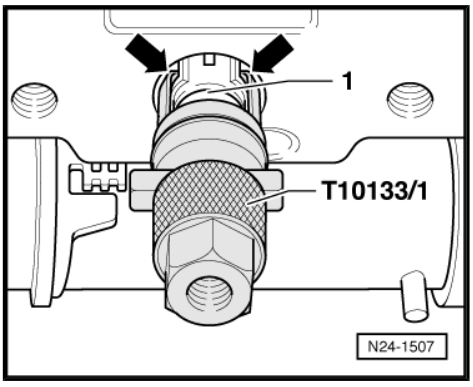
WARNING

Fuel system is under pressure! Wear eye protection and protective clothing to prevent injuries and skin contact. Before loosening hose connections, wrap a cloth around the connection. Then release pressure by carefully pulling hose off connection.

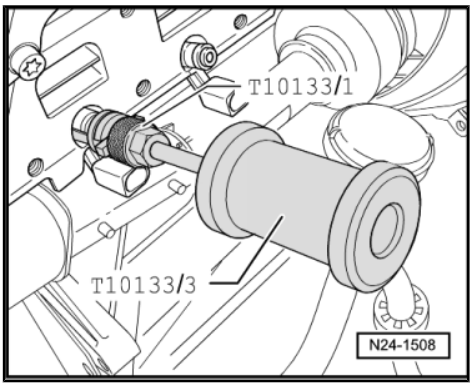
– Disconnect fuel supply line -3- (press locking ring inwards).
– Seal the lines so that the fuel system is not contaminated by dirt etc.
– Remove intake manifold ⇒ page 164 .
– Remove fuel rail ⇒ page 168 .
– Pull spacer sleeve off injector.



– Place the puller -T10133/1- on the injector -1-. Ensure that the hooks of the puller engage in the injector recesses -arrows-.
– Tighten knurled nut of the puller hand-tight.

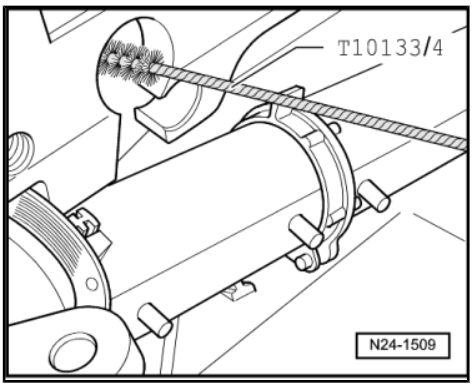


– Fit the slide hammer -T10133/3- on the puller -T10133/1- .
– Pull the injector out of the cylinder head by carefully knocking it.

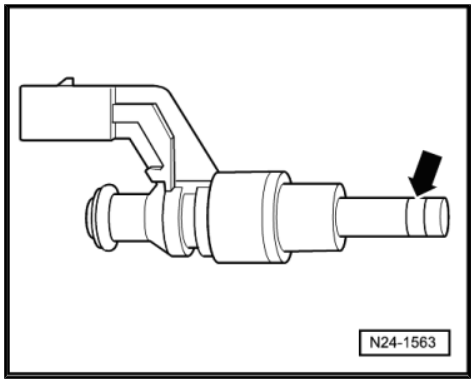


Installing

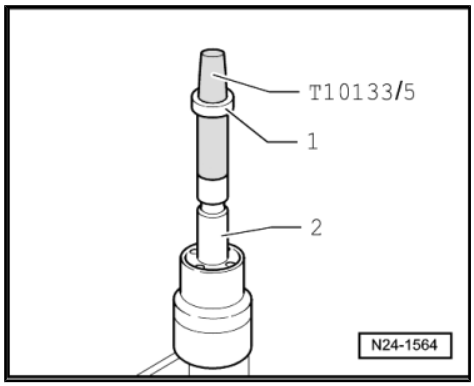
– Clean the hole in the cylinder head using the nylon cylinder brush -T10133/4- .



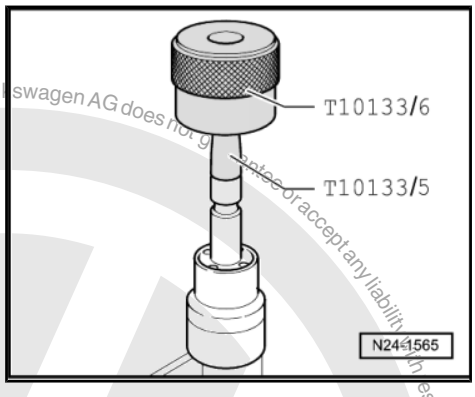
– Carefully clean injector in area of seal -arrow-. Remove residuals using a wire brush.
– Carefully cut open seal with a knife.
– Clean groove for seal.



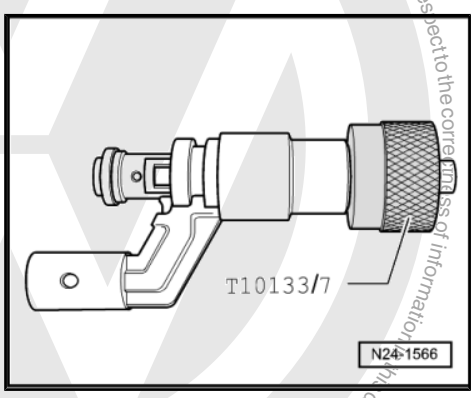
– Place the assembly cone -T10133/5- with a new seal -1- on the injector -2-.

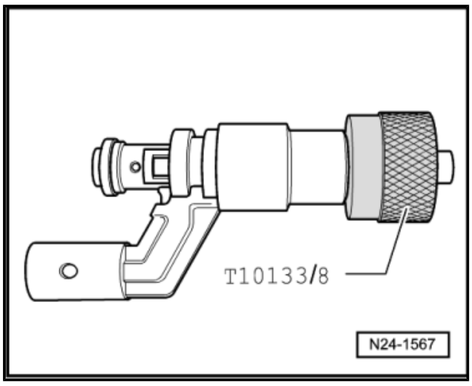


– Slide the seal with the fitting sleeve -T10133/6- on the assembly cone -T10133/5- .
– Turn the mounting sleeve -T10133/6- and slide the seal into the seal groove.



– Press calibration sleeve -T10133/7- onto injector to stop by turning gently (approx. 180°).
– Pull off calibrating sleeve -T10133/7- by turning in opposite direction.





– Press calibration sleeve -T10133/8- onto injector to stop by turning gently (approx. 180°).

– Pull off calibrating sleeve -T10133/8- by turning in opposite direction.

– Renew O-ring on injector.

– Moisten O-ring with clean engine oil before installing.

Note

The seal must not be oiled.

– Fit the injector into the cylinder head.

Note

The injector must easily be fitted, if necessary wait until the seal shrinks.

– Install spacer sleeve.

Further assembly is basically the reverse of the dismantling procedure.

– Install fuel rail ⇒ page 168 .

– Install intake manifold ⇒ page 164 .

– If injectors are renewed, erase learnt values and adapt engine control unit ⇒ Vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052- .

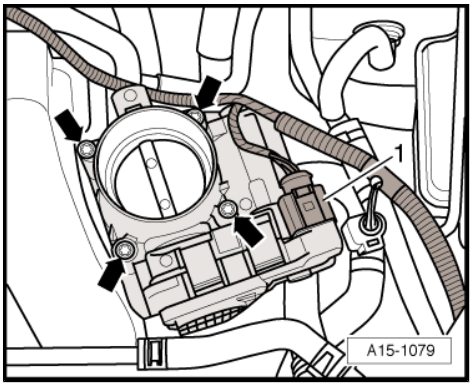
1.13 Cleaning throttle valve module -J338-

Note

♦ *If a new engine control unit is installed the throttle valve module must be adapted. Adaption must only be performed with a new or cleaned throttle valve module, because soiling/coking in closed throttle valve can lead to incorrect adaption values.*

♦ *When cleaning the throttle valve housing it must not be scratched.*

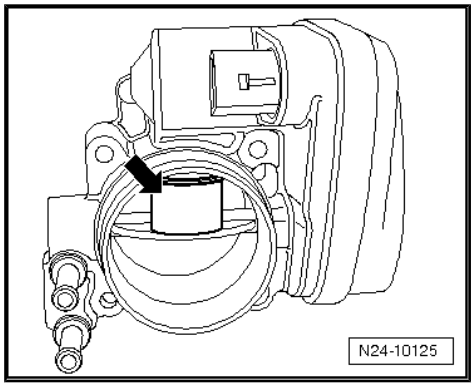
– Remove engine cover with air cleaner ⇒ page 161 .



– Separate electrical connection -1- on throttle valve module -J338- .

– Remove bolts -arrows- and take throttle valve module -J338- off.

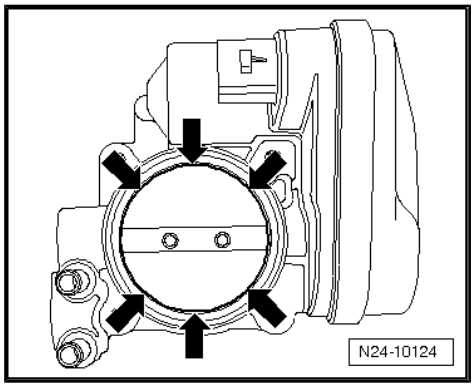
– Open the throttle valve by hand and, with a suitable object (e.g. a wedge made of plastic or wood) block the throttle valve in its open position -arrow-.



WARNING

Acetone is highly inflammable. Please observe the accidental regulations and safety notes when handling with highly inflammable fluids. Do not use compressed air when cleaning the throttle valve. Wear protective glasses and clothing to avoid injuries and skin contact.

– Clean throttle valve union thoroughly, especially in the area -arrows- of the closed throttle valve using commercially available acetone and a brush.



– Wipe off throttle valve housing using a lint-free cloth.

– Wait until the acetone is fully evaporated and reinstall the cleaned throttle valve module.

– Erase learnt values and adapt engine control unit to throttle valve control part ⇒ Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle diagnosis and service information system -VAS 5052- .

2 Checking components

Check vacuum reservoir in intake manifold for leaks
⇒ page 175

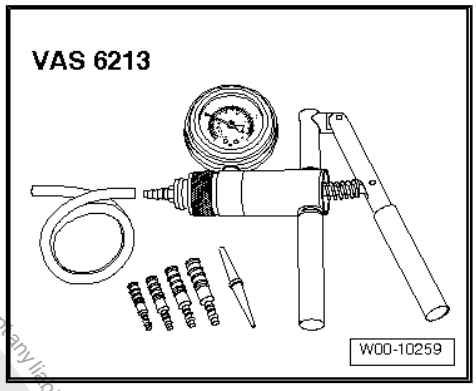
Check function of intake manifold flap ⇒ page 176

Checking intake air preheating ⇒ page 176

2.1 Check vacuum reservoir in intake manifold for leaks

Special tools and workshop equipment required

- Hand vacuum pump -VAS 6213-

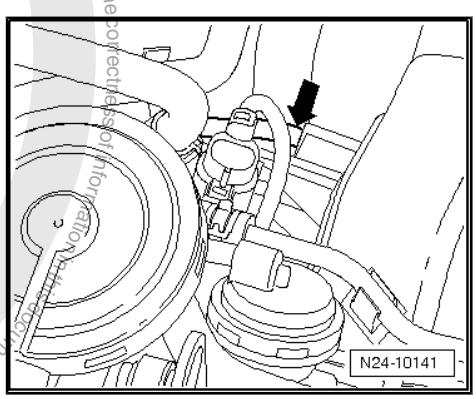


Test prerequisites

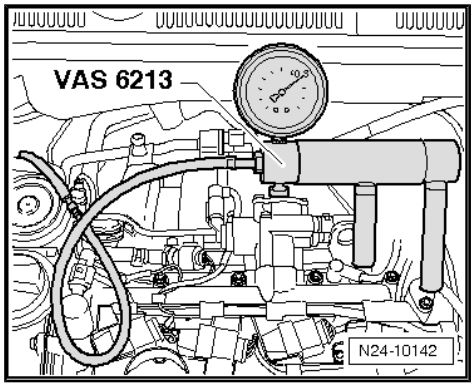
Perform visual check, whether all vacuum hoses on the intake manifold are damaged and seated correctly.

Test procedure

– Remove vacuum hose -arrow- from intake manifold flap valve -N316- to intake manifold on intake manifold.



– Connect hand vacuum pump -VAS 6213- to intake manifold.
– Close the knurled screw on the hand vacuum pump -VAS 6213- .
– Operate the hand vacuum pump until the pressure drop gauge indicates a pressure of 0.3 bar.



Note

The volume in the vacuum reservoir may require 20 lifts to produce a pressure of 0.3 bar.

– Observe pressure for approx. 3 up to 5 minutes.

If the pressure remains at 0.3 bar:

The vacuum reservoir in the intake manifold is OK.

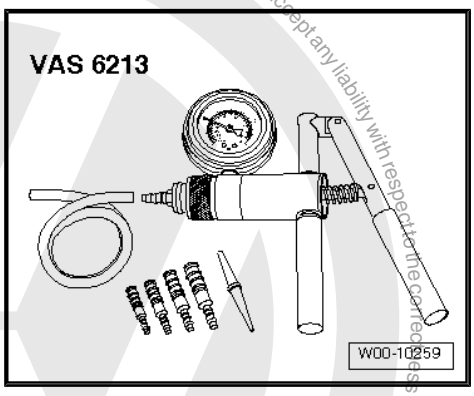
If the vacuum drops.

– Renew intake manifold ⇒ page 164 .

2.2 Check function of intake manifold flap

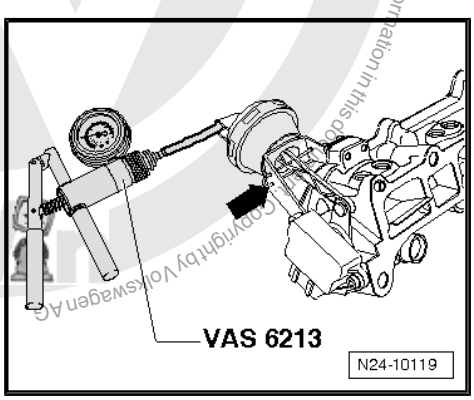
Special tools and workshop equipment required

♦ Hand vacuum pump -VAS 6213-



Test procedure

– After installing a new fuel rail, remove the retaining clip -arrow- of the vacuum actuator.
– Connect hand vacuum pump -VAS 6213- as shown.
– Produce vacuum and check function of vacuum actuator on lever arm.



Note

When the intake manifold is removed, the function of the intake manifold flap can be checked simultaneously.

2.3 Checking intake air preheating

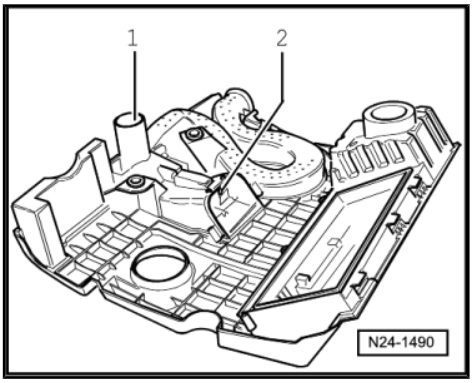
Special tools and workshop equipment required

♦ Chilling agent spray (commercially available)

Checking regulating flap

– Remove engine cover with air cleaner ⇒ page 161 .
– Remove intake connecting piece of the air cleaner.

– Check control flap position -1-.
– Spray thermoelement -2- with chilling agent.
• Over +23 °C the flap must close the warm air connection.
• Below +10 °C the flap opens the warm air connection.



Note

The function of the thermoelement can be checked easily by spraying with commercial chilling agent. To do this the air cleaner lower part must be removed ⇒ page 160 .

3 Engine control unit

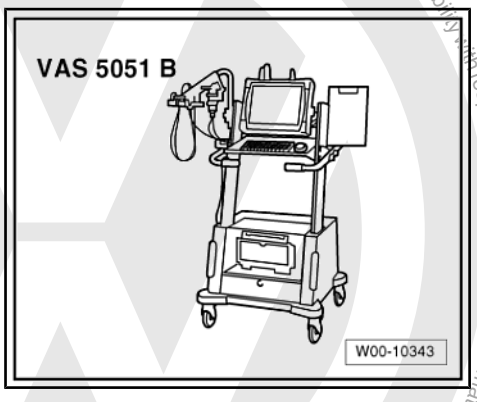
Reading and erasing engine control unit fault memory
⇒ page 178

Removing and installing engine control unit ⇒ page 179

3.1 Reading and erasing engine control unit fault memory

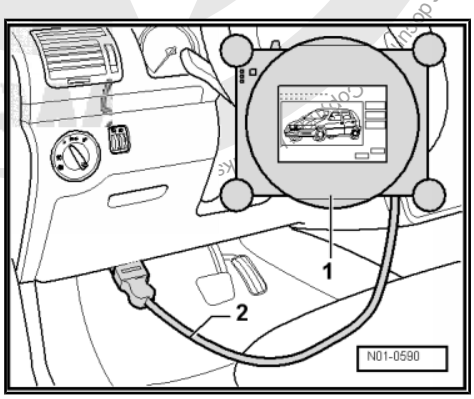
Special tools and workshop equipment required

- Vehicle diagnosis, testing and information system -VAS 5051-



- or vehicle diagnosis and service information system -VAS 5052-

Connect vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052- as follows:



– Fit the connector of the diagnosis cable -2- to the diagnosis connection in the driver footwell.
– Start engine and run at idling speed.

Only when engine does not start:

– Switch ignition on.

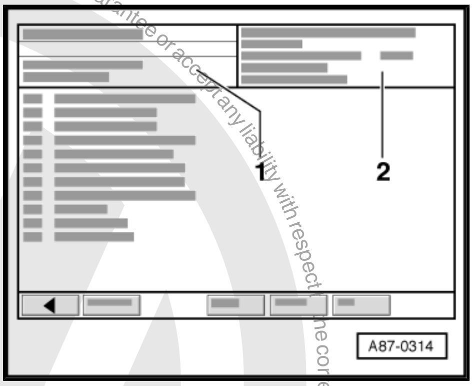
Select operating mode:

– Press button on display for “Vehicle self-diagnosis”.

Select vehicle system:

– Press button “01-Engine electronics” on display.

The display shows the control unit identification and coding -2- as well as the chassis number and the identification number of the immobilizer (centre part).



Note

A print-out can be made if needed. Then press key “Print”.

Select diagnostic function:

– Press button “02 - Read fault memory” on display.

– If no fault is stored in engine control unit “0 fault(s) detected” is displayed.

– If faults are stored in the engine control unit, these are shown one below the other on the display.

– Press the ⏎ key.

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

– Press function “06 - End output”.

Note

If the fault memory was erased the readiness code must be generated ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052- .

3.2 Removing and installing engine control unit

Removing and installing engine control unit without theft protection ⇒ page 179 .

Removing and installing engine control unit with theft protection ⇒ page 180 .

3.2.1 Removing and installing engine control unit without theft protection

Note

If the engine control unit must be renewed, connect vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis, testing and information system -VAS 5052- and perform “Renewing engine control unit”.

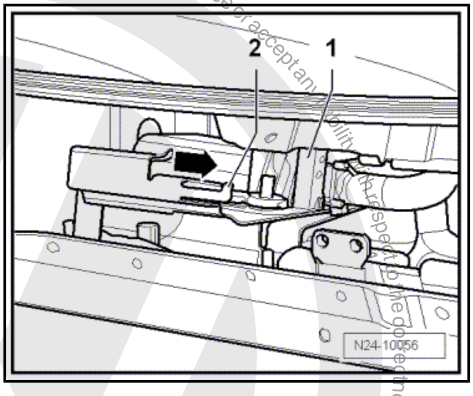
Removing

– Switch off ignition.

– Remove wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .

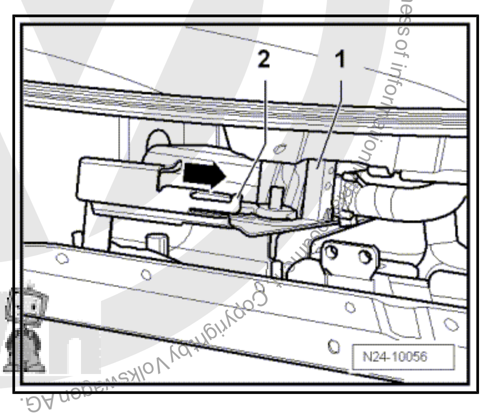
– Remove plenum chamber bulkhead ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .

– Release the front connectors -1- from the engine control unit and pull it off.
– Lever off latching device -2- a bit.
– Continuously slide the engine control unit out of the retainer -arrow-.
– Unlock the rear engine control unit connector and pull it off.



Installing

– Connect rear connector to engine control unit and lock it.
– Slide the engine control unit onto the retaining plate.

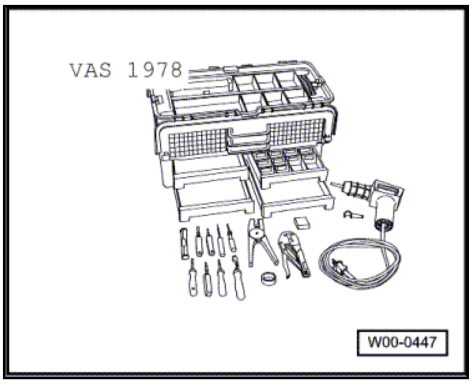


– Push lock -2- against the engine control unit.
– Now fit front connector -1- to engine control unit and lock it in position.
– Install bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .
– Install wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .

3.2.2 Removing and installing anti-theft engine control unit

Special tools and workshop equipment required

♦ Hot air blower from wiring harness repair set -VAS 1978-



♦ Insert injector from wiring harness repair set -VAS 1978-

Note

If the engine control unit must be renewed, connect vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis, testing and information system -VAS 5052- and perform “Renewing engine control unit”.

Removing

– Switch off ignition.
– Remove wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .

– Remove bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .

Note

Apply locking fluid to the shear bolts thread. By heating up the shear head bolts with the hot air blower the inhibitation of the locking fluid is reduced.

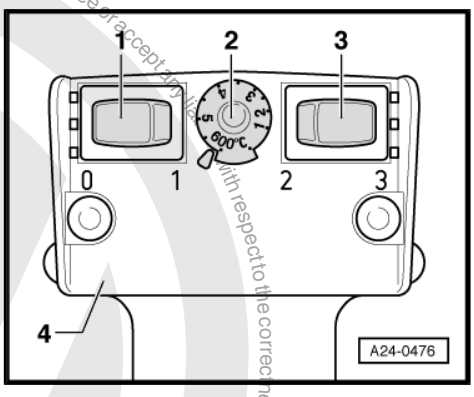
Caution

Cover lines, connectors and control units in the near area of the engine control unit to avoid damages by burns.

Perform hot air blower adjustments -4- as follows:

– Switch potentiometer for temperature adjustment -2- to maximum heating power (600 °C).

– Set the two-stage switch for air mass -3- to position 3.



WARNING

When heating up the shear head bolts, the protective housing parts will heat up considerably. Wear protective gloves to prevent injuries.

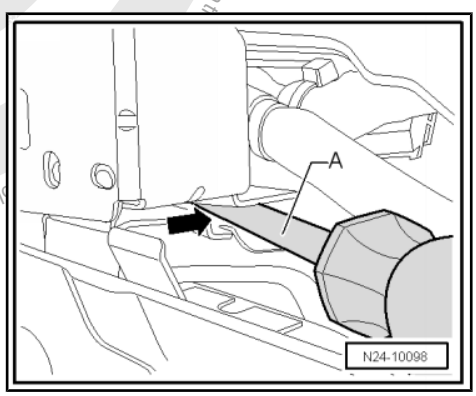
– Guide the injector of the hot air blower to a shear head bolt.

– Switch on the hot air blower and heat up the bolt for approx. 20 to 25 seconds.

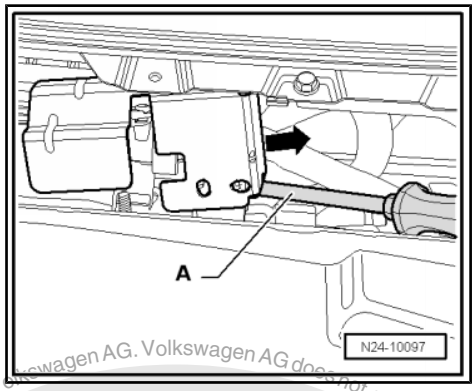
– Remove shear head bolt applying grip pliers at bolt head.

The procedure for the second shear head bolt is the same.

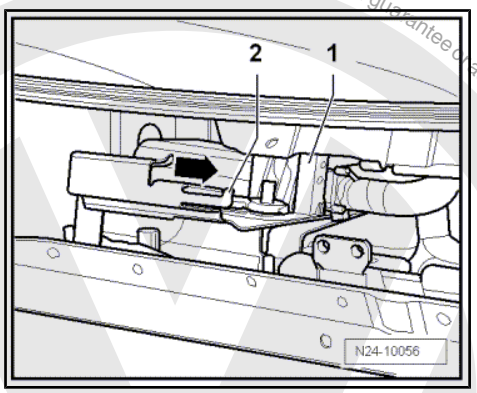
– Insert a screwdriver -A- between the protective housing and the retaining plate -arrow-.



– Lever the protective housing out upwards using the screwdriver -A- and pull it off sideways from the retaining plate -arrow-.

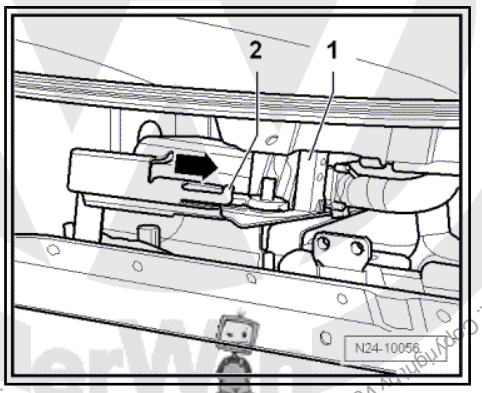


– Release the front connectors -1- from the engine control unit and pull it off.
– Lever off latching device -2- a bit.
– Continuously slide the engine control unit out of the retainer -arrow-.
– Unlock the rear engine control unit connector and pull it off.

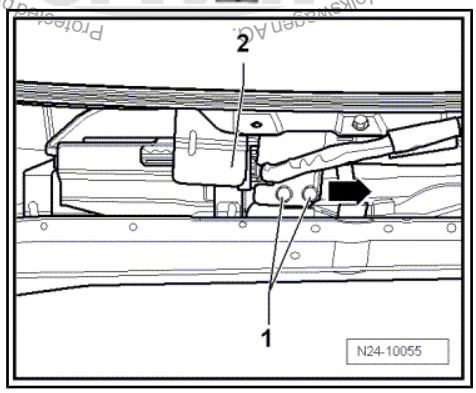


Installing

– Connect rear connector to engine control unit and lock it.
– Slide the engine control unit onto the retaining plate.
– Push lock -2- against the engine control unit.
– Now fit front connector -1- to engine control unit and lock it in position.
– Slide the protective housing onto the retaining plate.



– Tighten the new shear head bolts -1- evenly until bolt heads shear off.
– Install bulkhead in plenum chamber ⇒ General body repairs, exterior; Rep. Gr. 50 ; Plenum chamber bulkhead; Plenum chamber bulkhead - Assembly overview .
– Install wiper arms and the plenum chamber cover ⇒ Electrical system; Rep. Gr. 92 ; Windscreen wiper system; Removing and installing the windscreen wiper system .



26 – Exhaust system

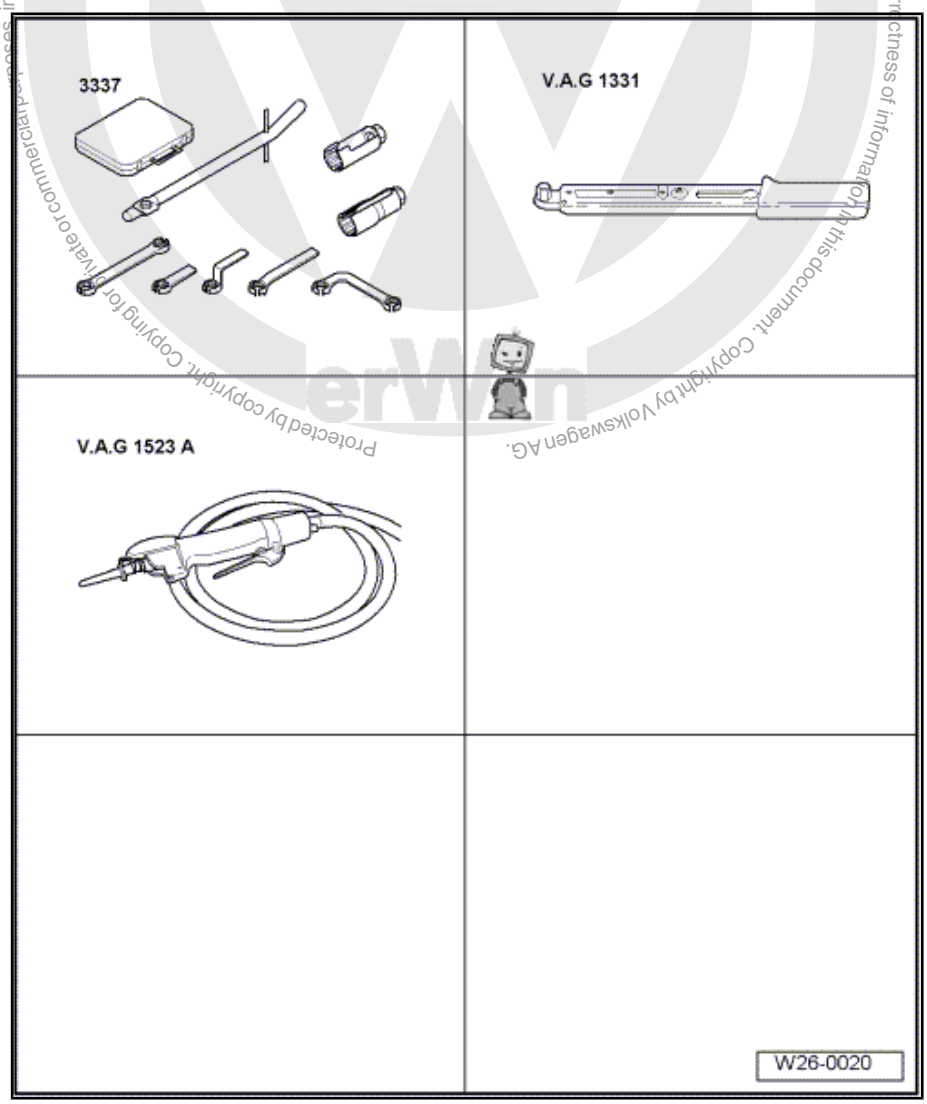
1 Removing and installing parts of exhaust system

Note

- *After working on the exhaust system ensure that the system is not under stress, and that there is sufficient clearance to the bodywork. If necessary, loosen double and single clamps and align silencer and pre-catalytic converter so that sufficient clearance is maintained to the bodywork and the support rings are evenly loaded.*
- *The flexible element of the front exhaust pipe must not be bent more than 30° - otherwise it will be damaged.*
- *Renew self-locking nuts.*

Special tools and workshop equipment required

- Lambda probe open ring spanner set -3337-
- Torque wrench -V.A.G. 1331-
- Body saw -V.A.G. 1523 A-
- Hot bolt paste -G 052 112 A3-



Catalytic converters and attachments - Assembly overview
⇒ page 184

Silencer with mountings - Assembly overview ⇒ page 186

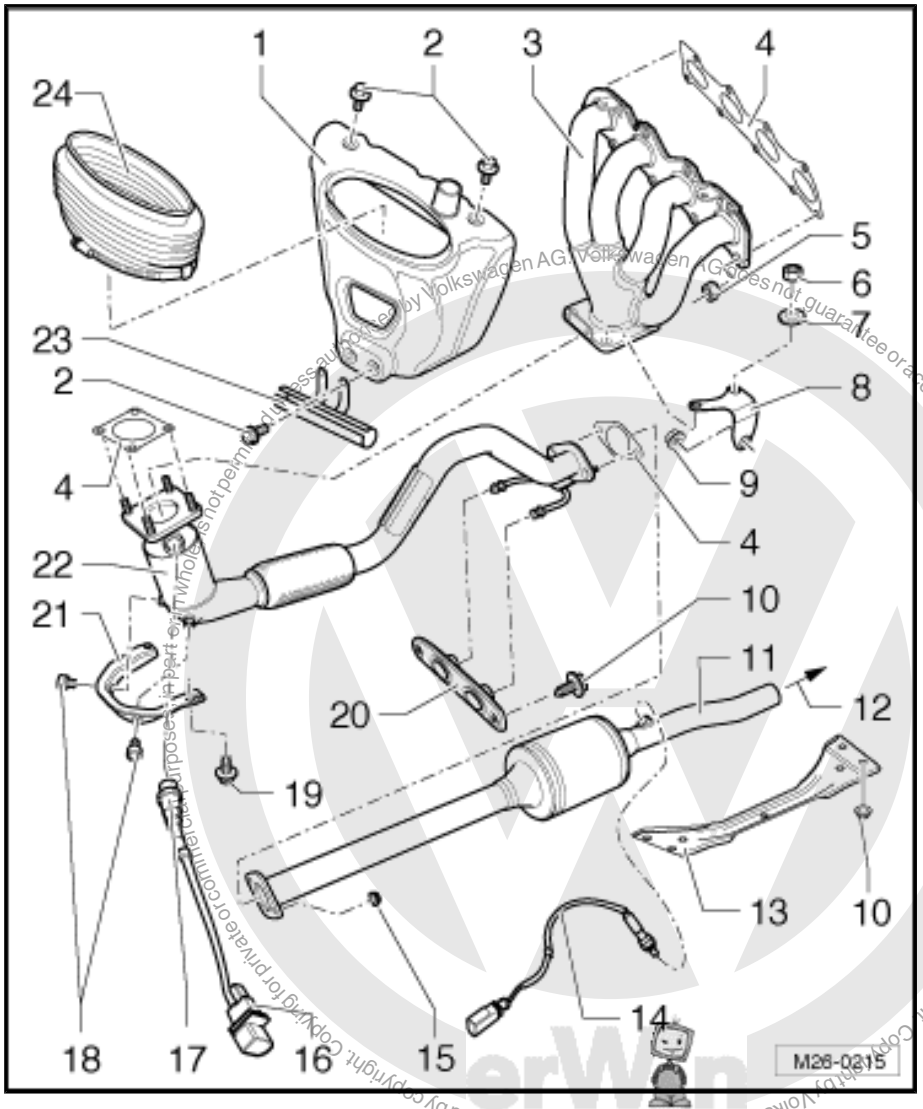
Removing and installing exhaust manifold ⇒ page 186

Removing and installing pre-catalytic converter with exhaust manifold ⇒ page 188

Connecting and disconnecting front and rear silencers ⇒ page 190

Aligning exhaust system free of stress ⇒ page 192

1.1 Catalytic converters and attachments - Assembly overview



1 - Warm air collector plate

2 - 10 Nm

3 - Exhaust manifold

- ❑ Removing and installing ⇒ page 186

4 - Seal

- ❑ Renew

5 - 25 Nm

- ❑ Renew

6 - 40 Nm

- ❑ Renew
- ❑ Note tightening sequence ⇒ page 185

7 - Washer

8 - Retainer

9 - 60 Nm

10 - 25 Nm

11 - Main catalytic converter with exhaust pipe

12 - To front silencer

13 - Front cross member

14 - Lambda probe after catalytic converter -G130- , 55 Nm

- ❑ Connector, black, 4-pin
- ❑ Fitting location of connector: On vehicle floor
- ❑ Lambda probe after catalytic converter -G130- with lambda probe open ring spanner set -3337-
- ❑ Grease only thread with hot bolt paste -G 052 112 A3- ; hot bolt paste -G 052 112 A3- must not get into slots in probe body
- ❑ If sealing ring is leaking, nip open and replace

15 - 25 Nm

- ❑ Renew

16 - Connector

- ❑ Black, 6-pin
- ❑ For Lambda probe -G39- and lambda probe heater -Z19-

17 - Lambda probe -G39- , 55 Nm

18 - 40 Nm

- ❑ Note tightening sequence ⇒ page 185

19 - 23 Nm

- ❑ Note tightening sequence ⇒ page 185

20 - Mounting

- ❑ Renew if damaged

21 - Retainer

22 - Pre-catalytic converter with exhaust pipe

- ❑ Observe tightening sequence when installing ⇒ page 185

23 - Cable guide

- ❑ For alternator feeder connection

24 - Bellows

Tightening sequence for pre-catalytic converter on exhaust manifold and engine

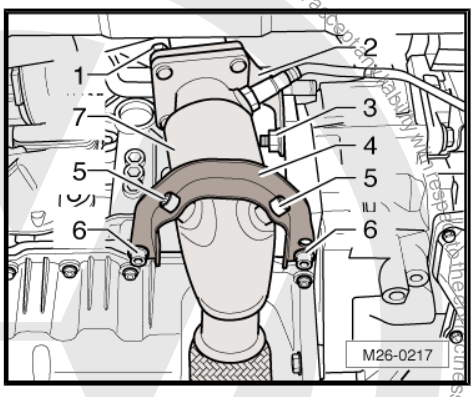
– Fit pre-catalytic converter -7- and bracket -2- and tighten nuts -1- on threaded studs by hand.

– Tighten nut -3-.

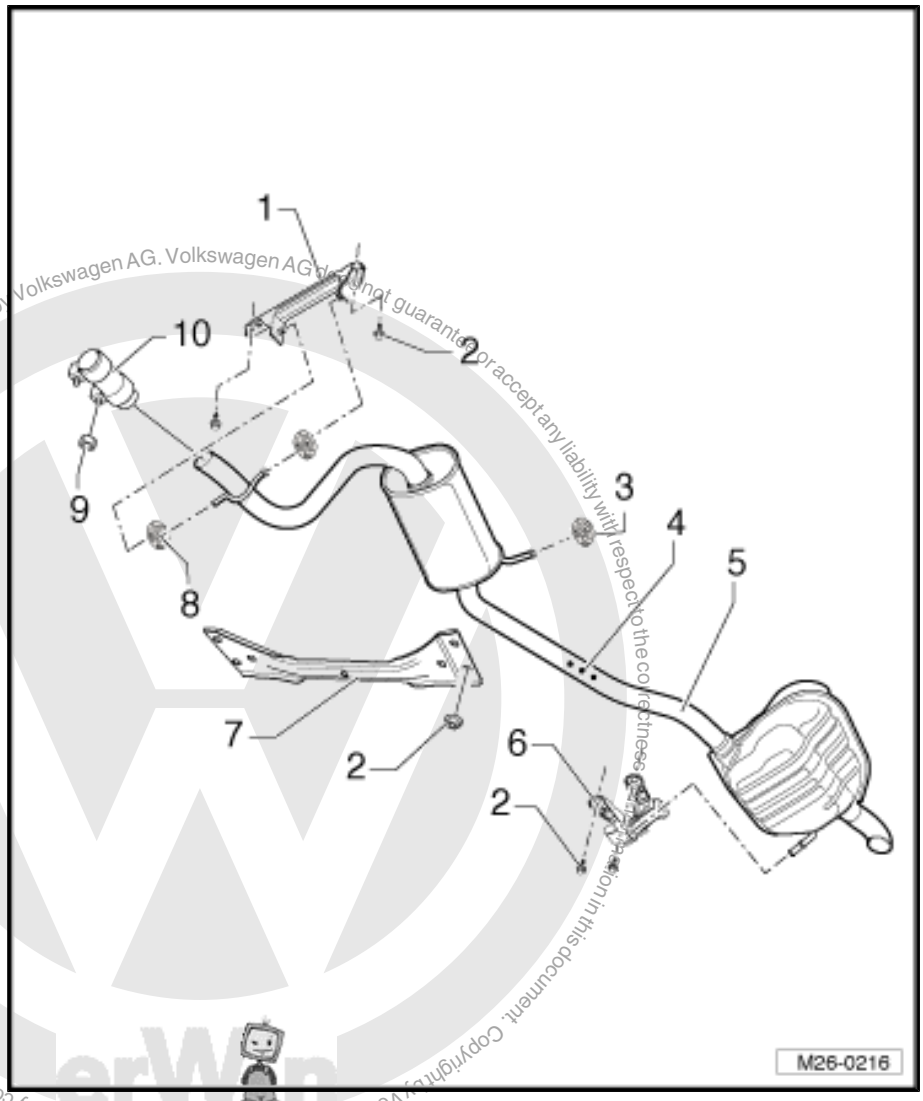
– Tighten nuts -1-.

– Slide bracket -4- to cylinder block to limit stop and tighten bolts -6-.

– Tighten bolts -5-.



1.2 Silencer with mountings - Assembly overview



1 - Mounting

2 - 25 Nm

3 - Retaining ring

- ❑ Renew if damaged

4 - Separating point

- ❑ For repair cases
- ❑ Marked by three impressions on circumference of exhaust pipe
- ❑ As standard, front and rear silencers are installed as a single component. In repair cases the front silencer and rear silencer are supplied individually with a repair clamp for connecting together
- ❑ Connecting and disconnecting front and rear silencers ⇒ page 190

5 - Front and rear silencers

- ❑ Front and rear silencers
- ❑ Connecting and disconnecting front and rear silencers ⇒ page 190
- ❑ Aligning exhaust system free of stress ⇒ page 192

6 - Mounting

- ❑ Renew if damaged

7 - Rear cross member

8 - Retaining ring

- ❑ Renew if damaged

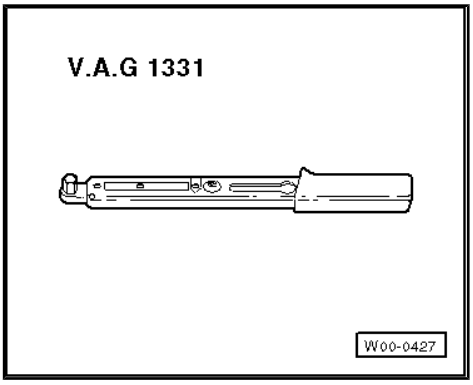
9 - 25 Nm

10 - Clamp

1.3 Removing and installing exhaust manifold

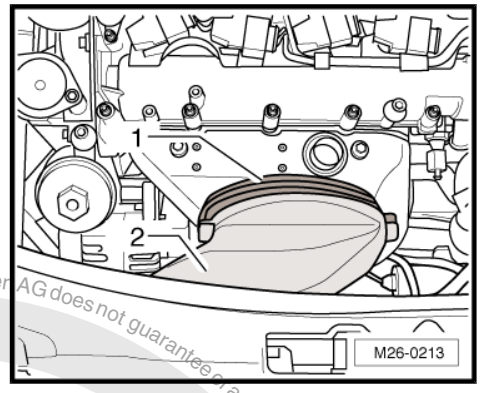
Special tools and workshop equipment required

♦ Torque wrench -V.A.G. 1331-

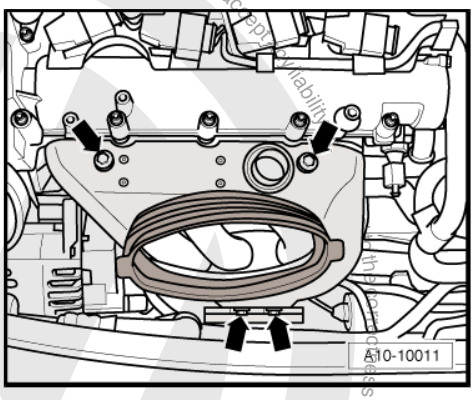


Removing

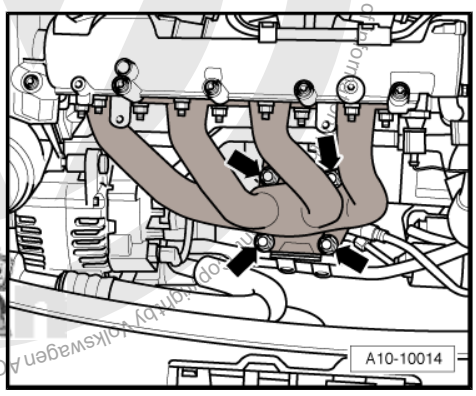
– Remove engine cover with air cleaner ⇒ page 161 .
– Disconnect rubber bellows -1- from air duct -2-.
– Release both locking devices and take air duct -2- off.



– Remove warm air collector plate -arrows-.



– Remove pre-catalytic converter with exhaust pipe from exhaust manifold -arrows-
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .

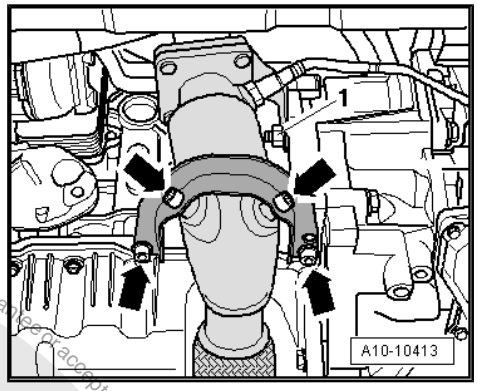


Note

The flexible element of the pre-catalytic converter must not be bent more than 30° - otherwise it will be damaged.

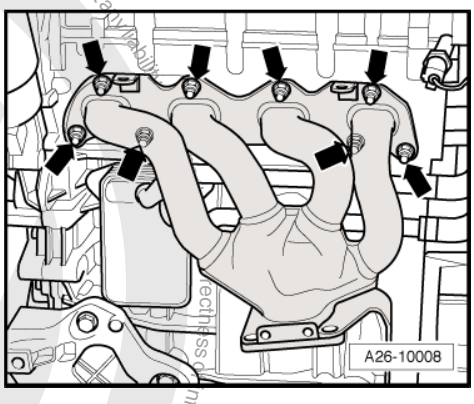
– Remove bolts -arrows-.

– Remove nut -1- from exhaust manifold/gearbox bracket. Take bracket off.



– Remove exhaust manifold from cylinder head -arrows-.

– Take exhaust manifold and seal for exhaust manifold off from above.



Installing

Install in reverse order of removal. During this step, observe the following:

Note

Renew seals and self-locking nuts.

– Grease threaded studs thread on cylinder head using hot bolt paste -G 052 112 A3- .

Torque settings

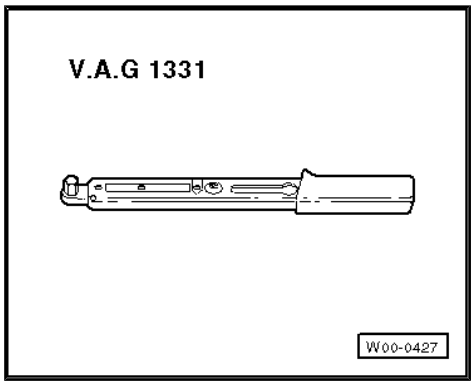
Component	Nm
Exhaust manifold to cylinder head	25[6)]
Warm air collector plate to exhaust manifold	10
Pre-catalytic converter to exhaust manifold	40[6)]
Pre-catalytic converter to cylinder block	23
Bracket for exhaust manifold to gearbox	60

6) Renew

1.4 Removing and installing pre-catalytic converter with exhaust manifold

Special tools and workshop equipment required

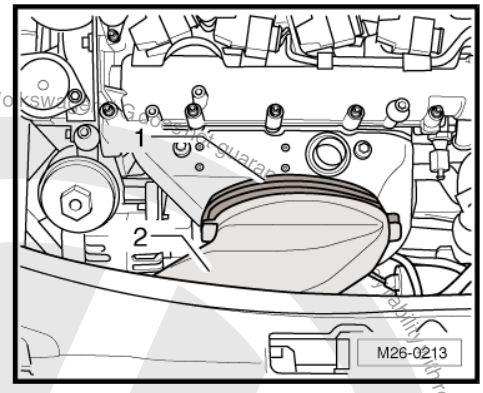
♦ Torque wrench -V.A.G. 1331-



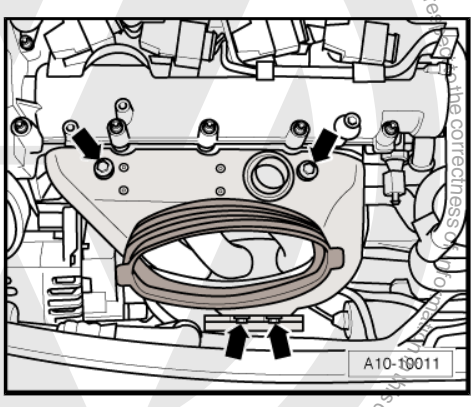
Removing

– Remove engine cover with air cleaner ⇒ page 161 .

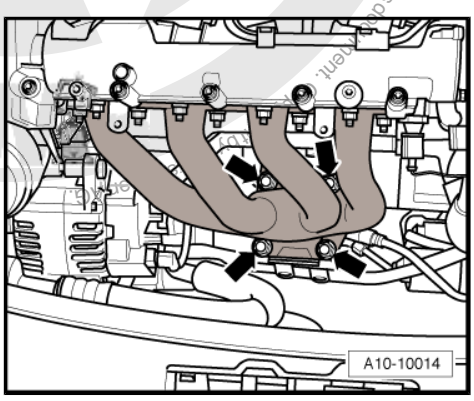
– Disconnect rubber bellows -1- from air duct -2-.
– Release both locking devices and take air duct -2- off.



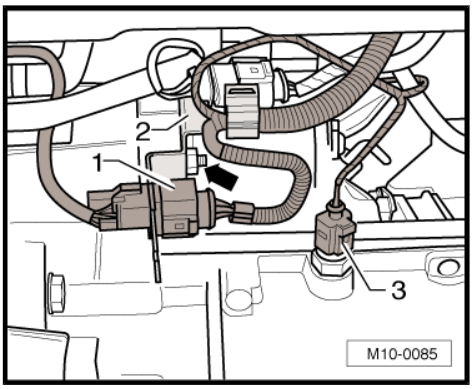
– Remove warm air collector plate -arrows-.



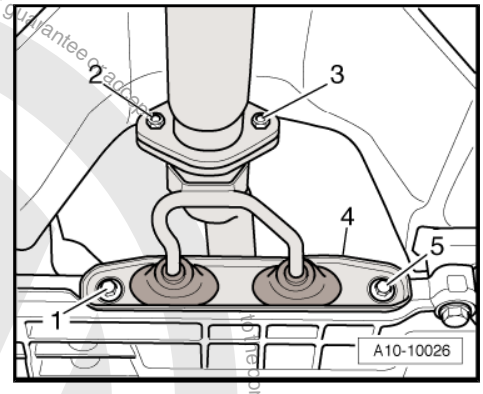
– Remove pre-catalytic converter with exhaust pipe from exhaust manifold -arrows-.
– Remove noise insulation ⇒ General body repairs, exterior; Rep. Gr. 50 ; Noise insulation .



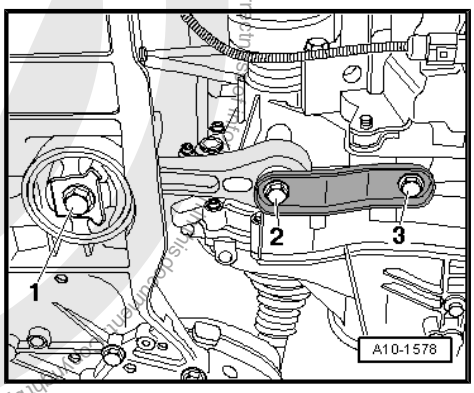
– Take electrical connection -1- for Lambda probe -G39- out of bracket -2- and disconnect.



– Remove bolts -1- and -5-.
– Remove mounting -4- for exhaust system from pins on pre-catalytic converter.
– Remove nuts -2- and -3- on exhaust system flange.
– Disconnect the exhaust system on flange.



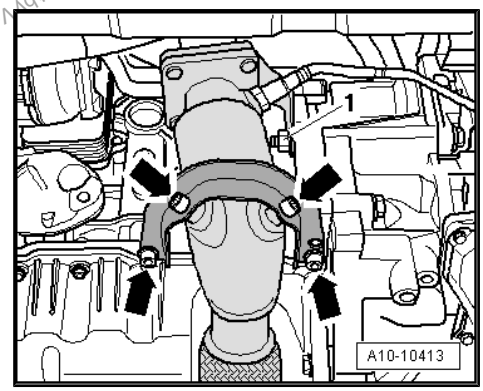
– Unscrew bolt -1- first.
– Unscrew bolts -2- and -3- and take pendulum support off.



Note

The flexible element of the pre-catalytic converter must not be bent more than 30° - otherwise it will be damaged.

– Remove nut -1- and take bracket off exhaust manifold/gear-box.
– Remove bolts -arrows- and take bracket off with pre-catalytic converter.
– Swing pre-catalytic converter out forwards.



Installing

Install in reverse order of removal. During this step, observe the following:

– Grease threaded studs thread on pre-catalytic converter with hot bolt paste -G 052 112 A3- .
– Observe tightening sequence ⇒ page 185 .
– Install pendulum support ⇒ page 22 .

Torque settings

Component	Nm
Pre-catalytic converter to cylinder block	23
Pre-catalytic converter to main catalytic converter	25[7)]
Pre-catalytic converter to exhaust manifold	40[7)]
Exhaust system bracket to subframe	25
Warm air collector plate to exhaust manifold	10

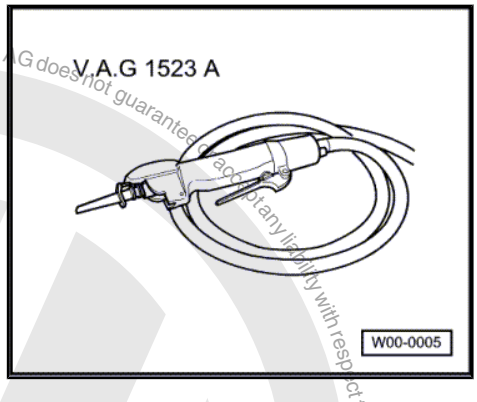
7) Renew

1.5 Connecting and disconnecting front and rear silencers

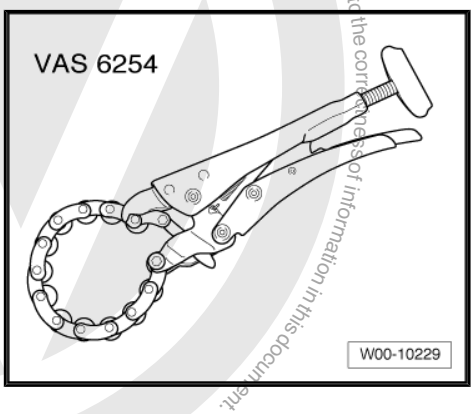
- To renew the front and rear silencers individually there is a separating point provided in the connecting pipe.
- The separating point is marked by an impression on the exhaust pipe circumference.

Special tools and workshop equipment required

- Body saw -V.A.G. 1523 A- or



- Chain pipe cutter -VAS 6254-



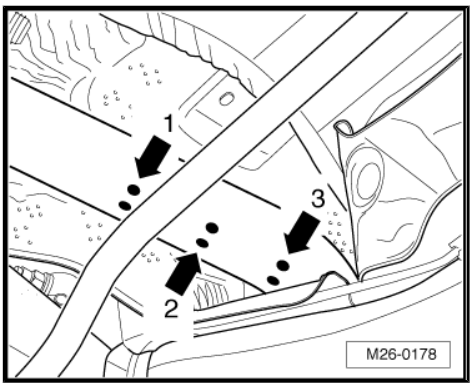
- Safety goggles

Separate

WARNING

To prevent damage by metal particles, wear protective goggles and protective clothes.

– Cut through exhaust pipe -arrow 2- at right angles, e. g. using body saw -V.A.G. 1523 A- or chain pipe cutter -VAS 6254- .



Connect

Note

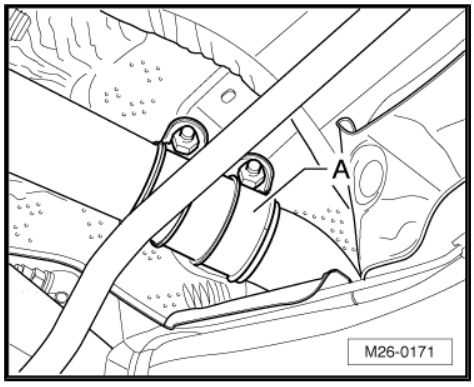
A second mechanic is required to tighten the repair clamp-type clip.

– Fit front silencer into retainers. Front socket remains fitted loosely on the pipes.

– Align rear silencer horizontally and hold in this position.

– Position the repair clamp-type clip at the side markings -arrow 1- and -arrow 3-.

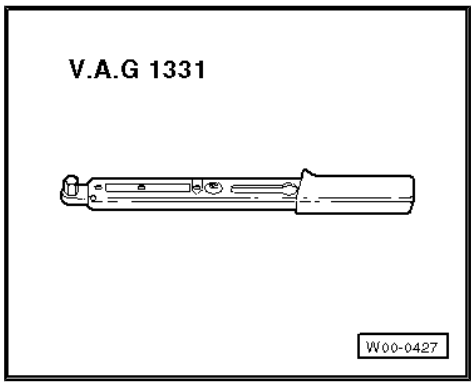
– Turn the repair clamp-type clip -A- as shown and tighten to 25 Nm.
– Then align exhaust system free of stress ⇒ page 192 .



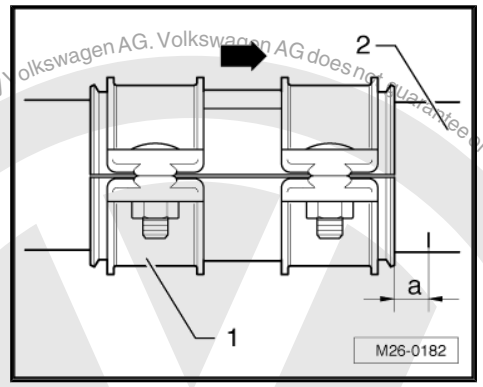
1.6 Aligning exhaust system free of stress

Special tools and workshop equipment required

♦ Torque wrench -V.A.G. 1331-

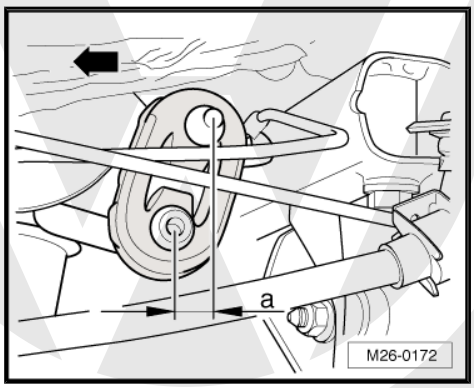


• The exhaust system must be aligned when it is cold.
– Loosen threaded connections on front clamp-type clip -1-.
– Position clamp-type clip -1- so that the distance -a- to the marking on the pipe (-2-) is 5 mm and tighten front bolt by hand. The -arrow- shows in direction of travel.

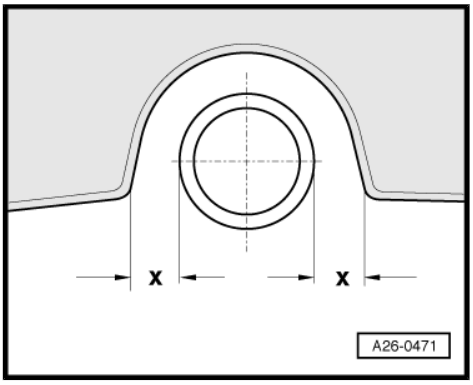


– Move the exhaust system forwards until the dimension -a- = 9…11 mm is reached on the outer hand hold straps of the front silencer. The -arrow- points forwards.
– In this position, tighten front clamp-type clip evenly to 25 Nm.

Align end pipe



– Align rear silencer so that dimension -x- between bumper cut-out and end pipe on the left and right-hand sides are the same.
– To align the end pipe, loosen rear silencer mounting if necessary.

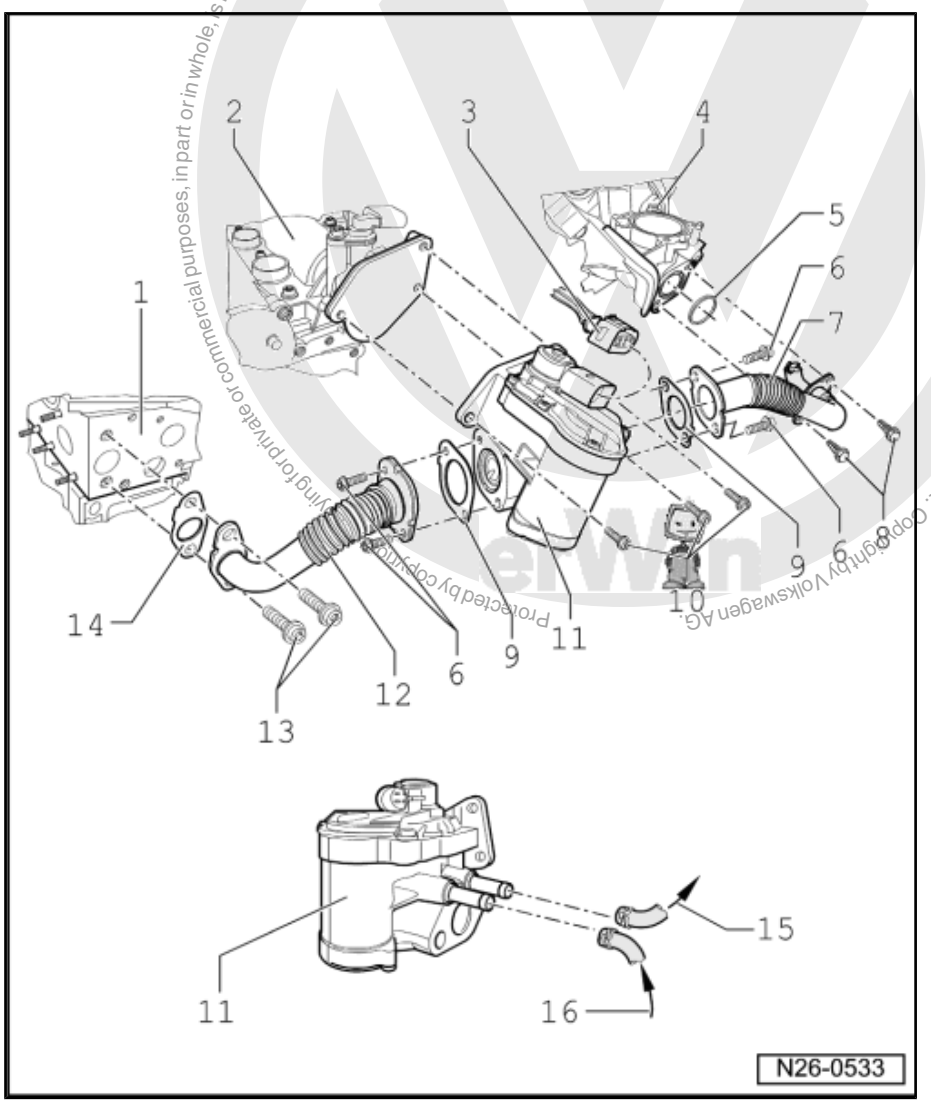


2 Exhaust gas recirculation system

Assembly overview - Exhaust gas recirculation system
⇒ page 194

Removing and installing left brake pad wear indicator shear element -N18- ⇒ page 195

2.1 Assembly overview - Exhaust gas recirculation system



1 - Cylinder head

2 - Camshaft housing

3 - Connector

- ❑ Gray, 6-pin

4 - Intake manifold

5 - Seal

- ❑ Renew

6 - 8 Nm

7 - Connecting pipe

- ❑ Bolt stress free

8 - 5 Nm

9 - Seal

- ❑ Renew
- ❑ The lug must show downwards

10 - 10 Nm

11 - Exhaust gas recirculation valve -N18- with exhaust gas recirculation potentiometer -G212-

- ❑ When renewing, erase learnt values and adapt engine control unit Vehicle diagnosis, testing and information system -VAS 5051- or Vehicle diagnosis and service information system - VAS 5052-
- ❑ Removing and installing ⇒ page 195

12 - Connecting pipe

- ❑ Install free of stress

13 - 18 Nm

14 - Seal

- ❑ Renew
- ❑ Note installation position ⇒ page 195

15 - To expansion tank

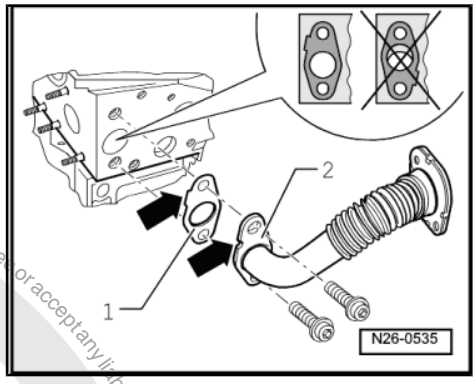
- ❑ Coolant hose schematic diagram ⇒ page 99

16 - From T-piece on cooler inlet

- ❑ Coolant hose schematic diagram ⇒ page 99

Installation position of seal on cylinder head

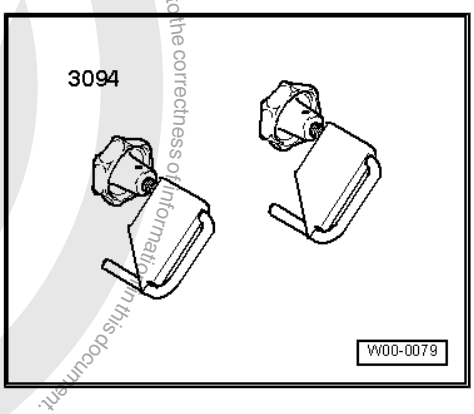
The lug on the seal -1- must align with the recess on the connecting pipe -2- -arrows-.



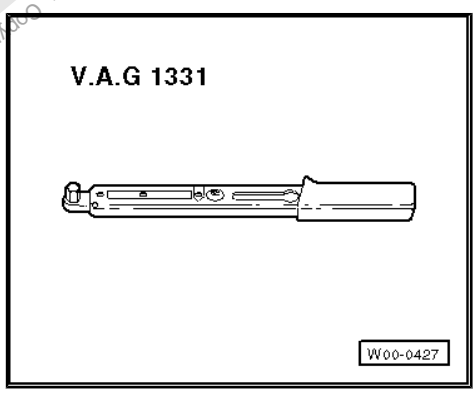
2.2 Removing and installing exhaust gas recirculation valve -N18-

Special tools and workshop equipment required

- Hose clamp to Ø 25 mm -3094-



- Torque wrench -V.A.G. 1331-



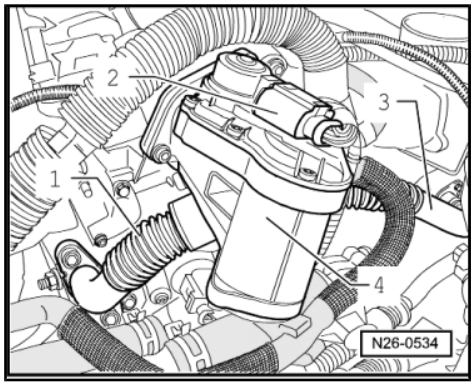
Removing

Note

To remove exhaust gas recirculation valve -N18- complete, coolant hoses must be clamped off and pulled off first.

– Remove engine cover with air cleaner ⇒ page 161 .

– Remove connecting pipe -1-.
– Remove connecting pipe -3-. When doing this swivel out of intake manifold upwards.
– Pull connector off -2-.
– Remove exhaust gas recirculation valve -N18- -4- from camshaft housing and lay to side with connected coolant hoses.



Installing

Install in reverse order of removal. During this step, observe the following:

- Renew seals and gasket in intake manifold.
- The lug of the seal connecting pipe/ exhaust gas recirculation valve must show downwards.
- Observe installation position of seal on cylinder head ⇒ page 195
- Connect connecting pipes free of stress. Before tightening all bolts screw in hand-tight.
- Torque settings ⇒ page 194 .

28 – Ignition system

1 Repairing ignition system

General notes on ignition system

- The engine control unit is equipped with self-diagnosis.
- For trouble-free operation of electrical components, a voltage of at least 11.5 V is necessary.
- During some checks, it is possible that the engine control unit will detect and store a fault. Therefore after completing all checks and repairs the fault memory must be interrogated and if necessary erased.
- If the engine starts only for a short period of time after performing fault finding, repairs or component tests and then stalls, it could be that the immobilizer blocks the engine control unit. In this case, the control unit must be adapted. ⇒ vehicle diagnosis, testing and information system -VAS 5051- or vehicle diagnosis and service information system -VAS 5052- .

Safety precautions ⇒ page 197 .

Assembly overview - ignition system ⇒ page 198 .

Removing and installing ignition coils with output stage ⇒ page 198 .

Test data, spark plugs ⇒ page 199 .

1.1 Safety precautions

To prevent injuries to persons and/or damage to the injection and ignition system, the following must be observed:

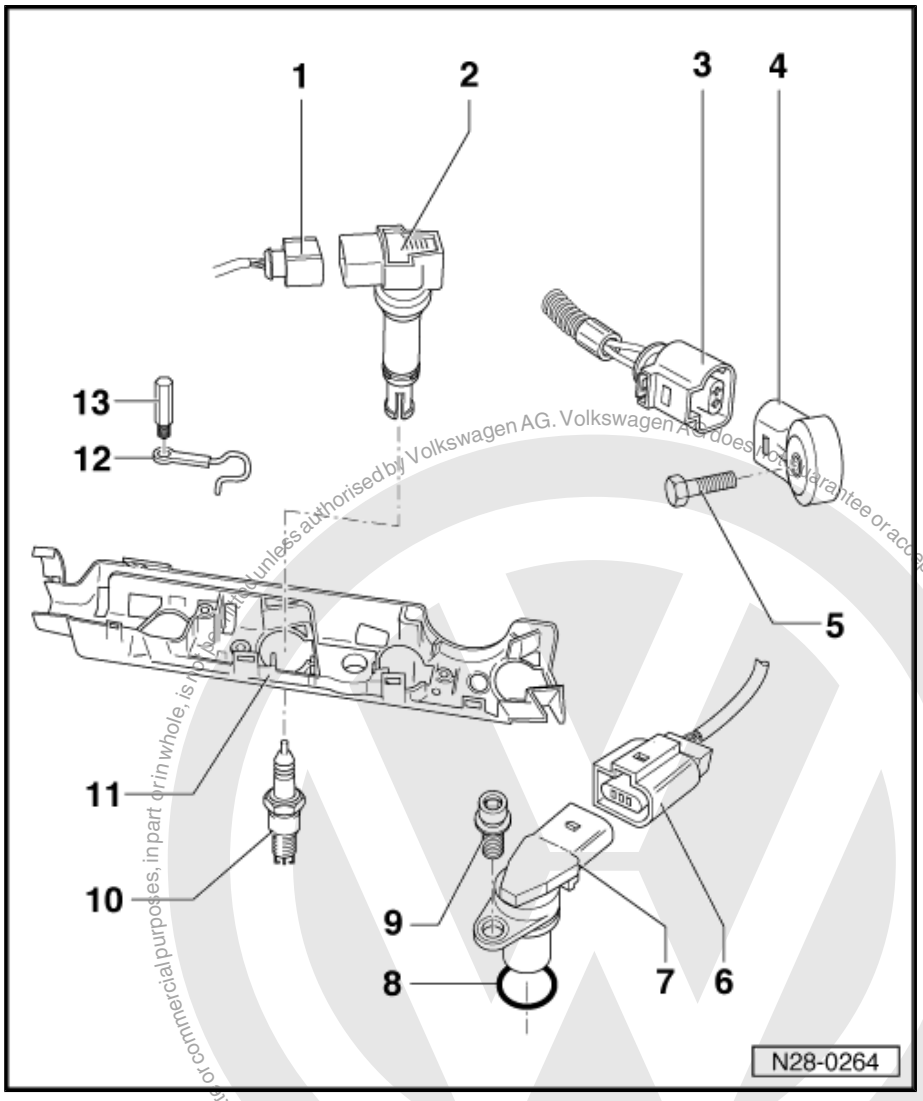
- Do not touch or pull off ignition wiring when engine is running or turning at starter speed.
- Switch off ignition before connecting or disconnecting injection and ignition system wiring as well as measuring instrument cables.

Observe following if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to rear seat and operated by a second person from this location.

If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

1.2 Assembly overview - ignition system



1 - Connector

- ❑ Black, 4-pin
- ❑ Unlock with assembly tool -T10118-

2 - Ignition coil 3 with final output stage -N291-

- ❑ Ignition coil 1 with final output stage -N70-
- ❑ Ignition coil 2 with final output stage -N127-
- ❑ Ignition coil 4 with final output stage -N292-
- ❑ Removing and installing ⇒ page 198

3 - Connector

- ❑ Black, 2-pin
- ❑ For knock sensor 1 -G61-
- ❑ Gold-plated connector contacts

4 - Knock sensor 1 -G61-

- ❑ Gold-plated connector contacts

5 - 20 Nm

- ❑ The torque setting influences the function of the knock sensor

6 - Connector

- ❑ Black, 3-pin
- ❑ For Hall sender -G40-

7 - Hall sender -G40-

8 - O-ring

- ❑ Renew if damaged

9 - 10 Nm

10 - Spark plug, 30 Nm

- ❑ Remove and install with spark plug spanner -3122 B-
- ❑ Type and electrode gap ⇒ page 199

11 - Cable guide

- ❑ Fit on camshaft housing with 8 Nm

12 - Earth wire

- ❑ Loosen or tighten when the ignition is switched off

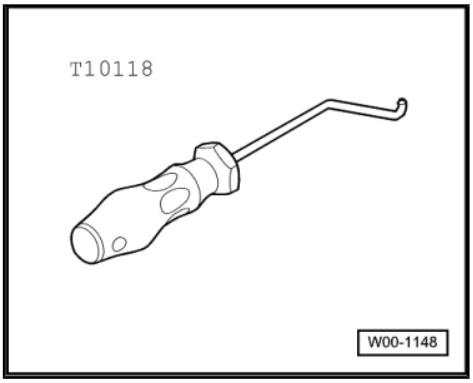
13 - 10 Nm

- ❑ Loosen or tighten when the ignition is switched off

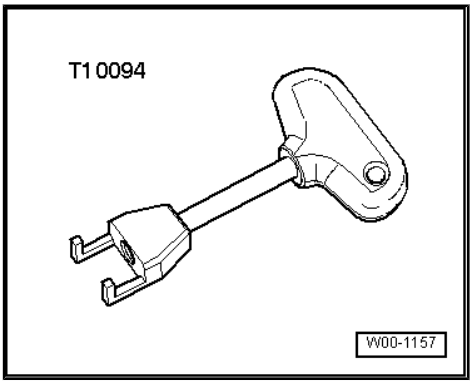
1.3 Removing and installing ignition coils with output stage

Special tools and workshop equipment required

- Assembly tool -T10118-



- Puller -T10094-



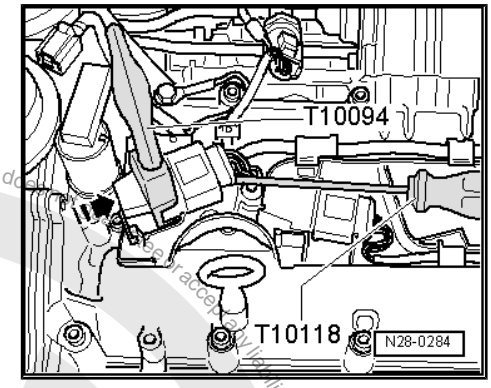
Removing

– Fit puller -T10094- on the ignition coil with final output stage -arrow-.

– Pull ignition coil with output stage out a bit.

– Place assembly tool -T10118- as shown.

– Carefully loosen connector lock and pull connector off.

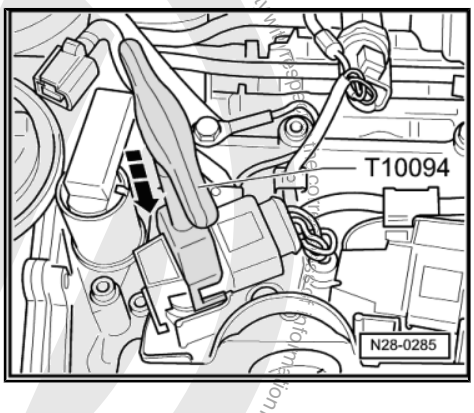


Installing

– Fit puller -T10094- on the ignition coil with final output stage.

– Slide the connector on the ignition coil with output stage until it audibly engages.

– Press the ignition coil with output stage in direction of -arrow- into the cylinder head.



1.4 Spark plug test data

Engine code	BLF
Firing order	1-3-4-2
Spark plugs	
VW/Audi	101,000,068 AA

Engine code	BLF
Manufacturer's designation	FGR 6HQ E0
Electrode gap	0.9…1.1 mm
Torque setting	30 Nm
Change interval	60,000 km