

Audi 100 1991 ➤

Diesel Direct Injection and Glow Plug System (2.4 l Engine)

Engine ID

AAS

Edition 02.1991



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List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups
Audi 100 1991 ➤

**Diesel Direct Injection and Glow Plug System (2.4 l
Engine)**

Repair Group

01 - Self-diagnosis

23 - Mixture preparation, Injection

28 - Ignition system

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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.

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01 - Self-diagnosis

1 - Self-diagnosis

1.1 - Self-diagnosis

The injection system identified by engine code AAS is a purely mechanical injection system.

No provision is made for self-diagnosis.

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23 - Mixture preparation, Injection

1 - Servicing diesel injection system

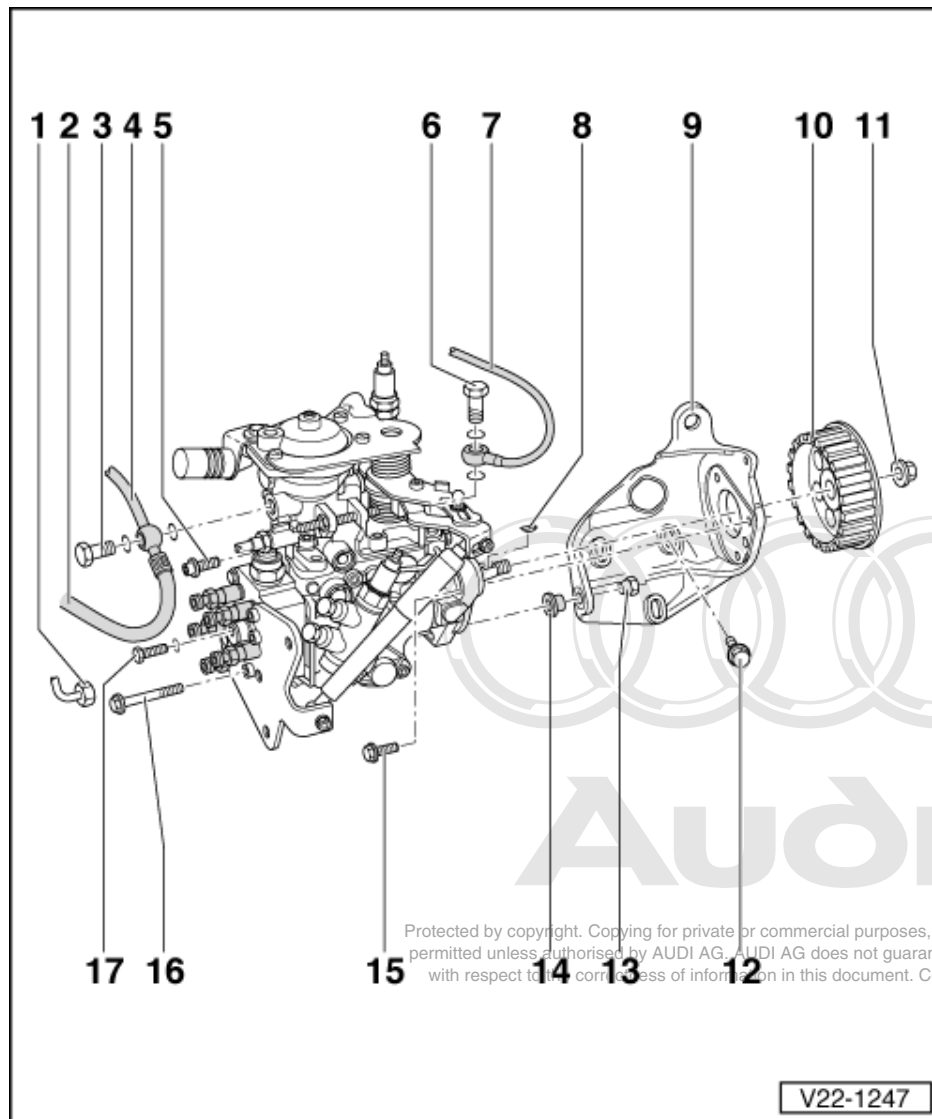
1.1 - Servicing diesel injection system

1.2 - Rules for cleanliness

When working on the fuel supply/injection system, observe the following basic rules:

- ♦ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ♦ Place removed parts on a clean surface and cover. Use foil or paper. Use lint-free cloths.
- ♦ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ♦ Only install clean components:
 - Only remove replacement parts from packaging immediately prior to installation.
 - Do not use parts that have been stored loose (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.
- ♦ Also ensure that no diesel fuel runs onto the coolant hoses. If necessary, the hoses must be cleaned again immediately. Affected hoses must be replaced.

1.3 - Repairing fuel injection system



Notes:

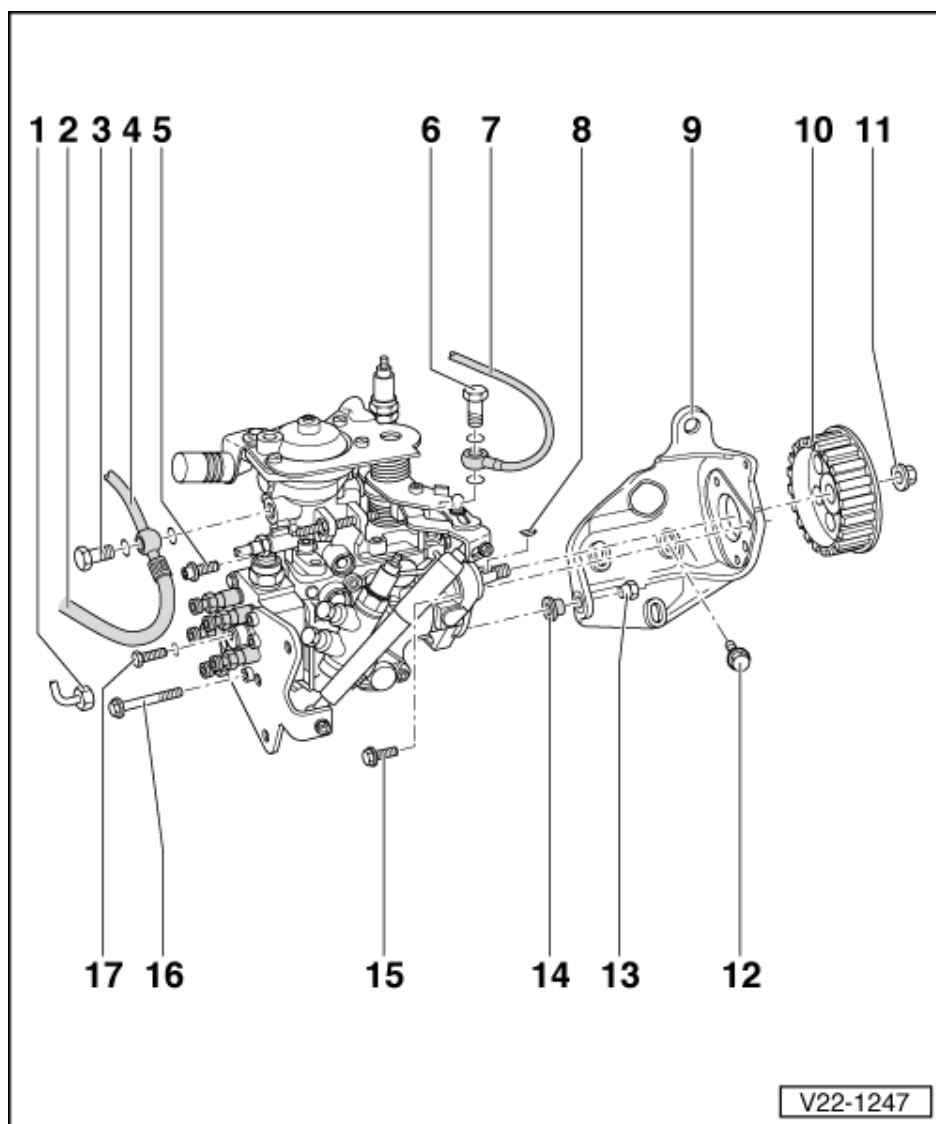
- ◆ Observe rules for cleanliness=> page 2 .
- ◆ Always renew seals.
- ◆ Secure all hose connections with the correct hose clamps (same as original equipment):

=> Parts List

- ◆ Tensioning toothed belt:

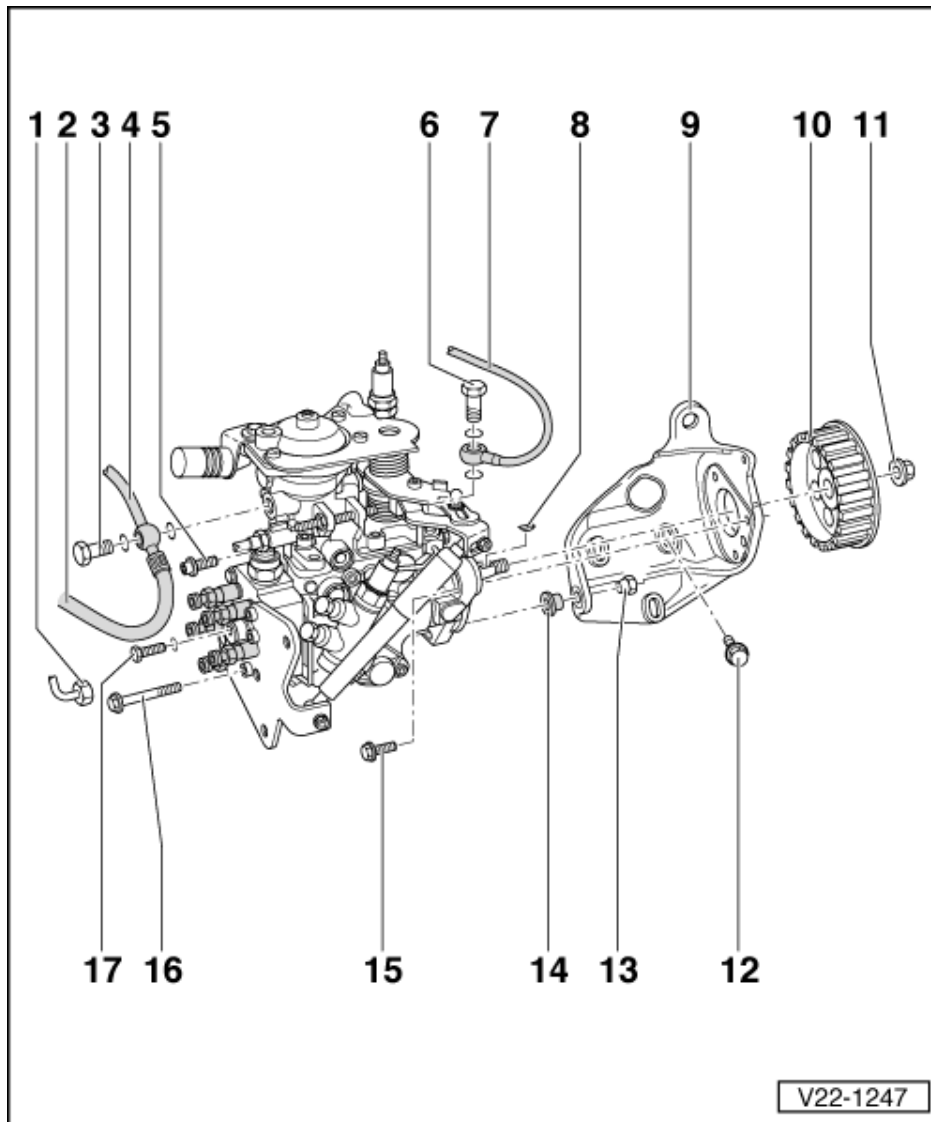
1 Injector pipes

- ◆ Remove using open ring spanner 3035
- ◆ Always remove pipework as a complete unit
- ◆ Do not alter shape
- ◆ Tighten to 25 Nm



- 2 Fuel return line**
 - ◆ To fuel filter
- 3 Banjo bolt - 25 Nm**
 - ◆ For fuel return line
 - ◆ with identification "OUT"
- 4 Fuel return line**
 - ◆ From injector, cyl. 5
- 5 25 Nm**
 - ◆ Loosen using V.A.G 1669
- 6 Banjo bolt - 25 Nm**
- 7 Fuel feed pipe**
 - ◆ From fuel filter
- 8 Woodruff key**
 - ◆ Check installation position before installing injection pump sprocket

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9 Console

10 Injection pump sprocket

- ♦ Removing and installing => Removing and installing injection pump, Page 6

11 50 Nm

12 50 Nm

13 Nut - 25 Nm

- ♦ With cone

14 Socket

- ♦ With taper

15 25 Nm

16 25 Nm

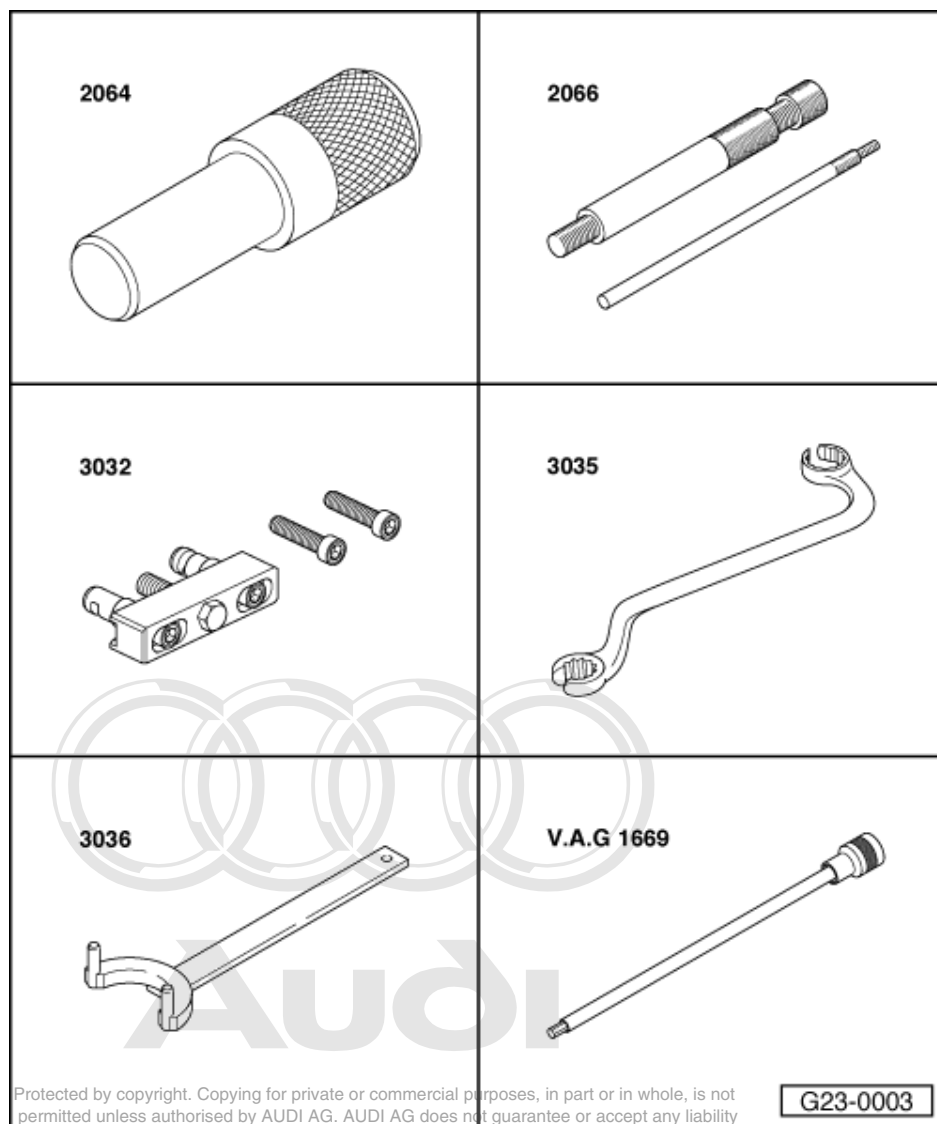
17 Screw plug - 20 Nm

- ♦ Replace sealing ring

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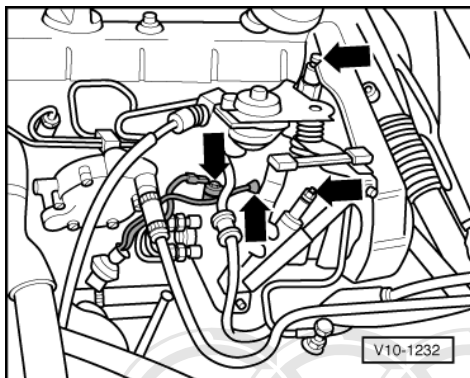


1.4 - Removing and installing injection pump



Special tools and workshop equipment required

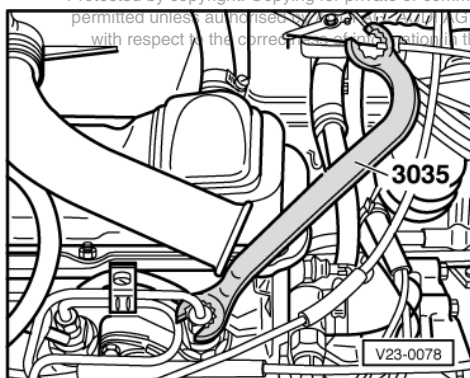
- ♦ V-belt and toothed belt test unit VW 210
- ♦ Mandrel 2064
- ♦ Adapter for dial gauge 2066
- ♦ Puller 3032
- ♦ Ring spanner 3035
- ♦ Counterhold 3036
- ♦ Socket V.A.G 1669
- ♦ Dial gauge



Removing

- -> Detach the following connectors -arrows- at the injection pump.
 - Expansion element
 - Shut-off device
 - Earth wire
- Disengage throttle linkage from the adjustment lever and unscrew the throttle linkage support.
- Remove the idle cable.
- Unscrew fuel pipes from injection pump.

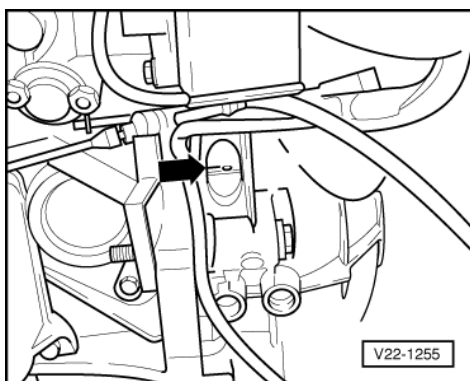
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- -> Disconnect the injector pipes using open ring spanner 3035.

Note:

Always remove complete pipe set. Do not alter pipe shape.



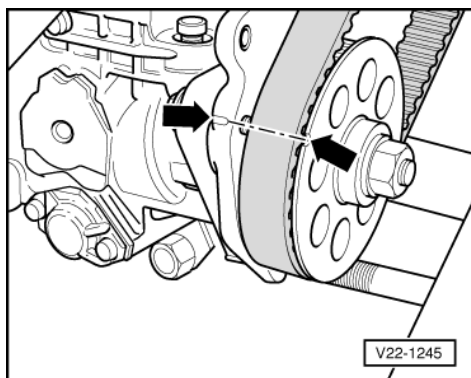
- Remove the toothed belt guard for injection pump drive.



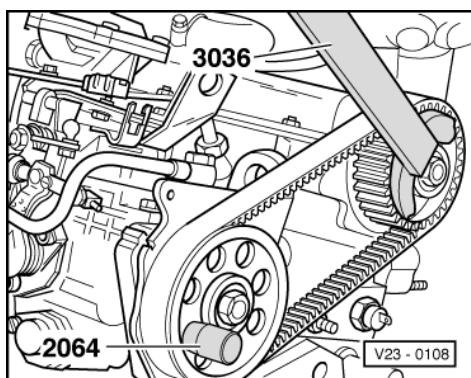
Note:

The engine can be turned using the hexagon attachment (32 mm A/F) located at the hydraulic pump.

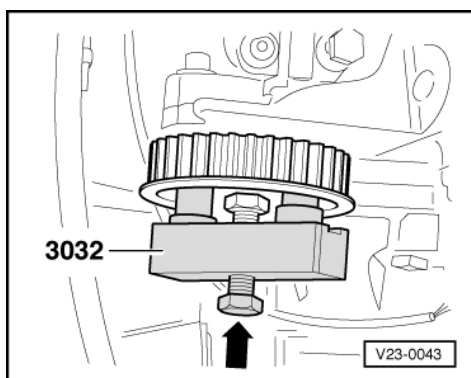
- -> Turn crankshaft to TDC of No. 1 cylinder -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...



- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.



- -> Lock injection pump sprocket using mandrel 2064.
- Unscrew securing bolt of injection pump drive wheel at camshaft, using counterhold 3036 and ring spanner attachment V.A.G 1332/7.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove the drive wheel and toothed belt from the camshaft.



- -> Loosen the injection pump sprocket securing nut by approx. 1 turn and remove the mandrel -2064-.
- Use the puller 3032 to apply preload to the injection pump sprocket.
- Release the injection pump sprocket from the injection pump taper by gently tapping on the spindle -arrow-.

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- Unscrew the nut.
- Remove the injection pump sprocket.

Note:

Note Woodruff key when removing the injection pump sprocket.

- Unscrew the injection pump securing bolts at the front of the console.
- Unscrew the rear support securing bolt using V.A.G 1669.
- Remove injection pump.

Installing

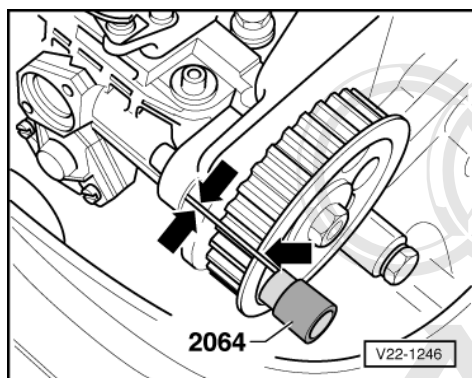
Installation is carried out in the reverse order; note the following:

Notes:

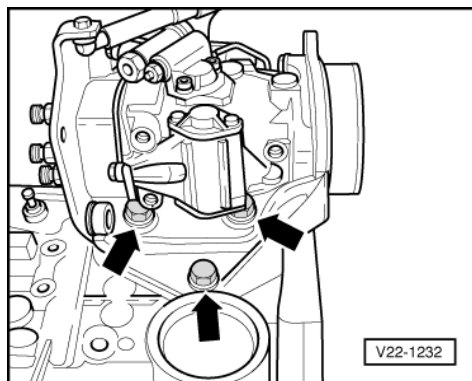
- ◆ Do not interchange banjo bolts for supply and return lines.
- ◆ The banjo bolt with identification "OUT" corresponds to the return line.
- Insert the injection pump into the console and then first install the securing bolt on the rear support.
- Align the injection pump to centre position in the slots of the console.
- Hand-tighten the injection pump securing bolts at the front of the console.
- Install the injection pump sprocket.

Note:

Ensure correct seating of Woodruff key



- -> Rotate the injection pump sprocket until the marks on the injection pump sprocket and the injection pump align -arrows-.
- Lock injection pump sprocket in place using mandrel 2064.
- Fit toothed belt with drive sprocket onto camshaft. Ensure that it runs in the correct direction as marked.
- Bolt the camshaft sprocket in place until the sprocket can still just be turned.
- Check toothed belt tension with VW 210.
 - Scale reading: 12...13





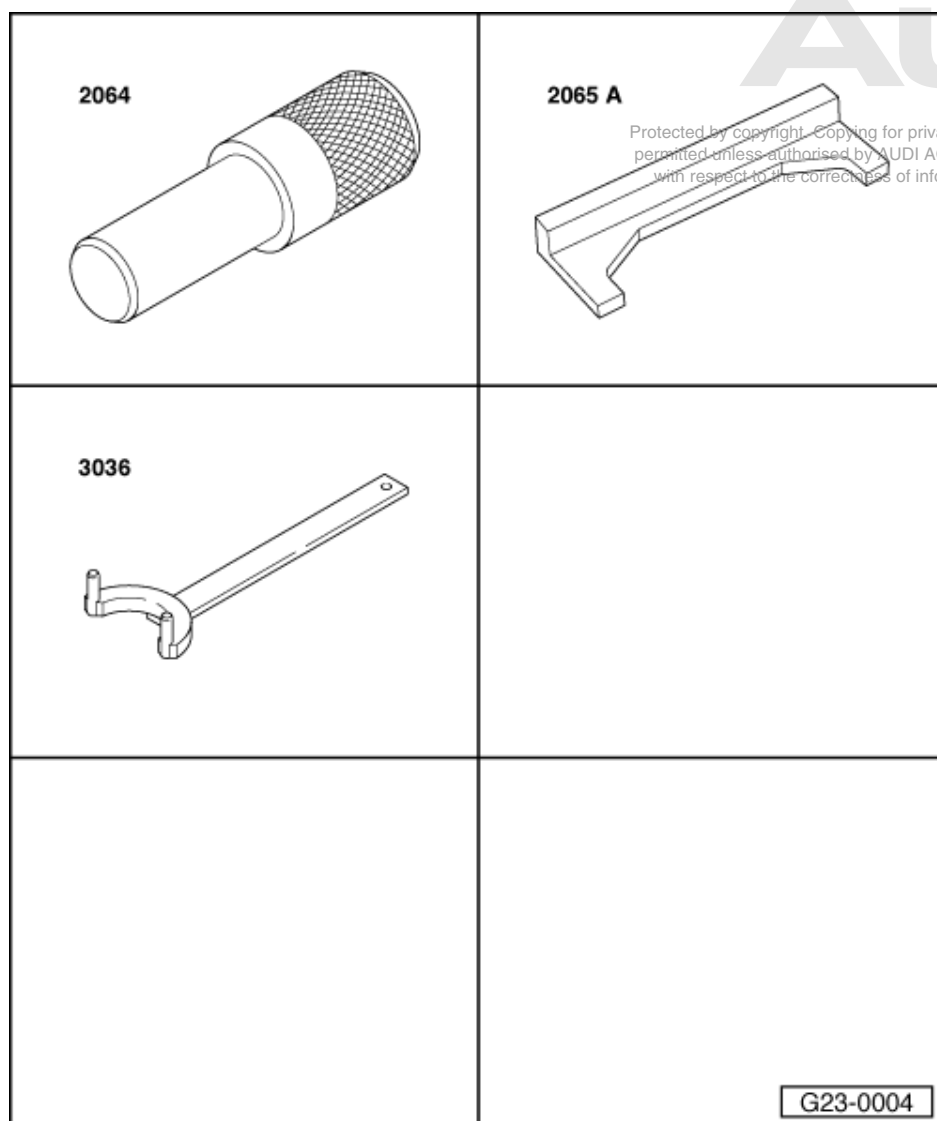
- -> To adjust tension of toothed belt, loosen the bolts -arrows-.
- Set the tension of the toothed belt to the specification by pushing the console and injection pump up or down.
- Tighten the console securing bolts to 50 Nm.
- Remove mandrel 2064.
- Check start of delivery of injection pump and adjust as necessary => Page 14
- Check idling speed and cutoff speed and adjust as necessary => Page 18

Tightening torques

Component	Nm
Toothed belt sprocket to injection pump	50
Injector pipes	25



1.5 - Checking and adjusting basic mechanical setting



Special tools and workshop equipment required

- ♦ Mandrel 2064
- ♦ Setting bar 2065 A

- ♦ Counterhold 3036

Test requirements:

- Toothed belt tension for camshaft OK

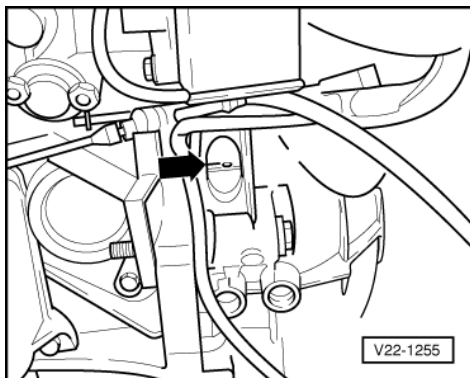
=> 5 cyl. Diesel Engine, Mechanical Components (2.4 l Engine); Repair group 13; Dismantling and assembling engine

- Remove the cylinder head cover.

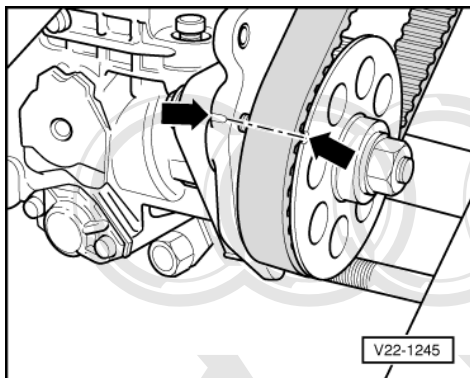
=> 5 cyl. Diesel Engine, Mechanical Components (2.4 l Engine); Repair group 15; Dismantling and assembling cylinder head

Test sequence

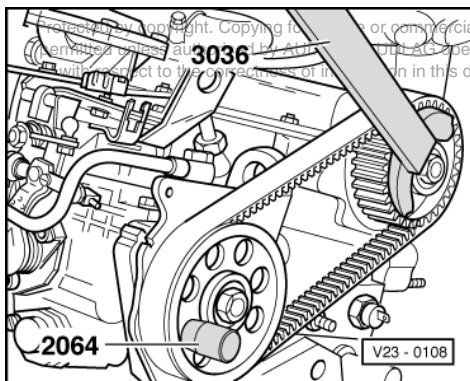
- Remove the toothed belt guard for injection pump drive.



- -> Turn crankshaft to TDC of No. 1 cylinder -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...

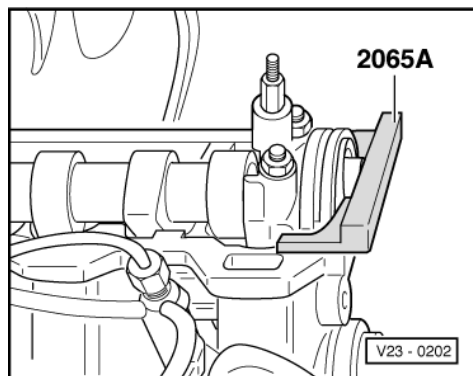


- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.





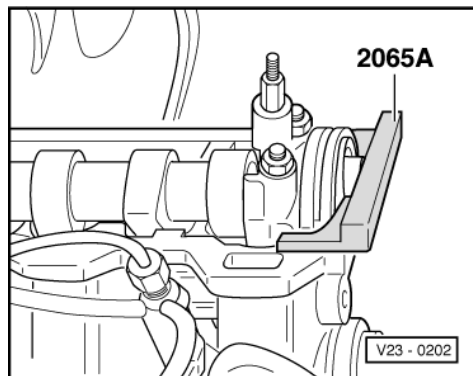
- -> Lock injection pump sprocket using mandrel 2064.
- Unscrew securing bolt of injection pump drive wheel at camshaft, using counterhold 3036 and ring spanner attachment V.A.G 1332/7.
- Mark direction of rotation of toothed belt with chalk or felt pen.
- Remove the drive wheel and toothed belt from the camshaft.



- -> If engine timing is OK, it must be possible to insert the setting bar 2065 A into the groove on the rear of the camshaft.

Notes:

- ♦ If the groove on the camshaft is concealed by the top edge of the cylinder head, rotate the crankshaft a further revolution.
- ♦ Loosening of the injection pump drive sprocket always requires adjustment of the start of delivery of the injection pump => Page 14 . This also applies if engine timing does not require re-adjustment.

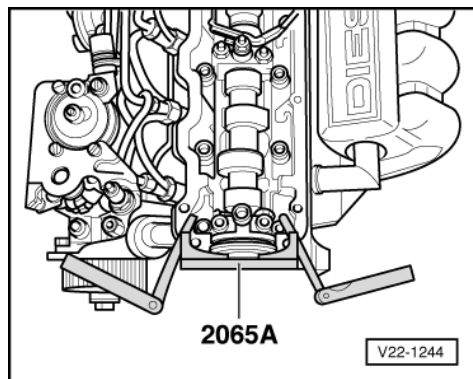


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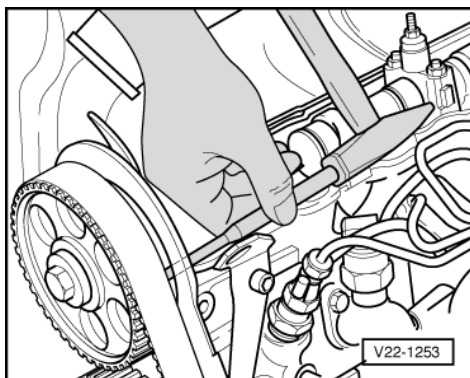
Adjusting

If the setting bar cannot be inserted, engine timing must be adjusted as follows:

- -> Rotate the crankshaft until the setting bar 2065 A can be inserted.



- -> Turn camshaft until one end of setting bar 2065 A contacts the cylinder head.
- Measure the clearance created at the opposite end using a feeler gauge.
- Insert a feeler gauge corresponding to half the clearance between the setting bar and the cylinder head.
- Turn camshaft until the setting bar lightly contacts the feeler gauge.
- Insert a second feeler gauge corresponding to half the clearance between the setting bar and the cylinder head at the other end.
- Remove the upper toothed belt guard for camshaft drive.

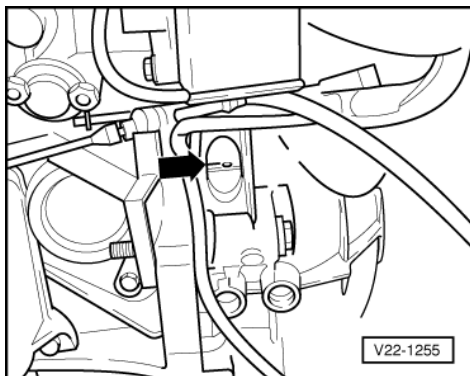


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Note:

When loosening and tightening the camshaft sprocket, never use the setting bar to counterhold. Counterhold using 3036.

- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn. Release camshaft sprocket from camshaft taper by tapping (pin through hole on rear toothed belt guard) using hammer.



- -> Turn crankshaft to TDC of No. 1 cylinder -arrow-.
- Tighten the bolt of the camshaft sprocket as follows.
 - Bolt with strength rating 8.8: tighten to 85 Nm.
 - Replace bolt with bolt tightness 10.9 and tighten to 30 Nm + 90°

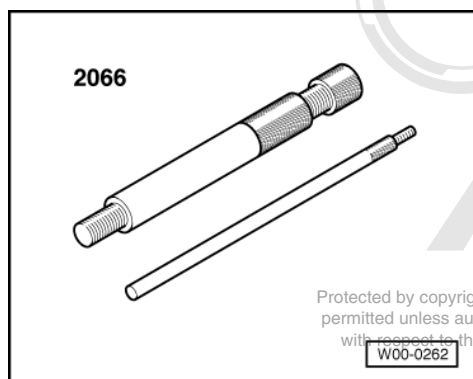
Note:

When loosening and tightening the camshaft sprocket, never use the setting bar to counterhold. Counterhold using 3036.

- Remove setting bar.
- Install the injection pump drive sprocket and toothed belt and check toothed belt tension =>Page 9 .
- Check start of delivery of injection pump and adjust as necessary => Page 14

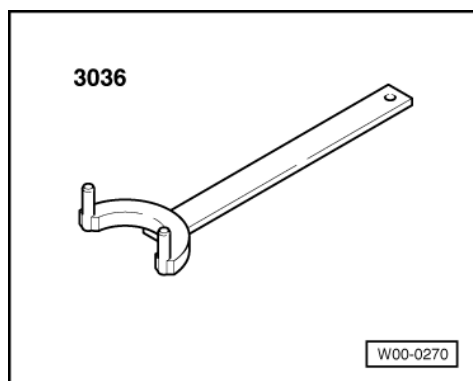


1.6 - Checking and adjusting start of delivery of injection pump.



Special tools and workshop equipment required

- ♦ Adapter 2066



- ♦ Counterhold 3036
- ♦ Dial gauge

Note:

The start of delivery of the injection pump must always be re-adjusted:

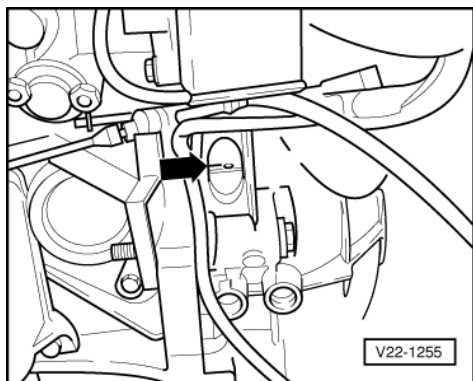
- ♦ After tensioning or removing and installing of the toothed belt;
- ♦ After loosening the bolted connections on the injection pump or the camshaft sprockets.

Preconditions:

- Toothed belt tension for camshaft OK

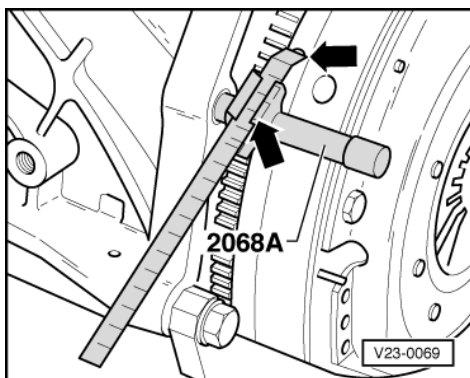
=> 5 cyl. Diesel Engine, Mechanical Components (2.4 l Engine); Repair group 13; Dismantling and assembling engine Dismantling and assembling engine

- Toothed belt tension for injection pump OK => page 9 .
- Basic mechanical setting for engine OK => Page 10 .



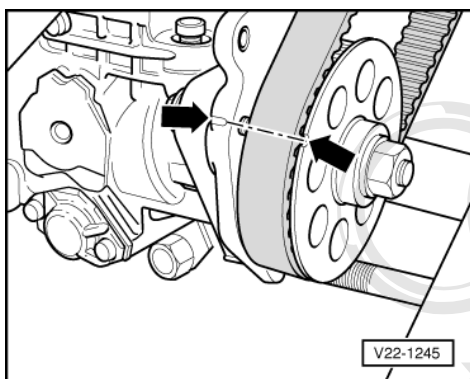
Test sequence

- -> Turn crankshaft to TDC of No. 1 cylinder -arrow-.
- The -O- mark on the flywheel must be located under the edge of the inspection hole...



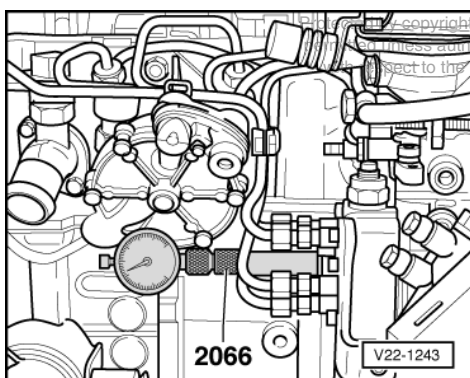
With the engine removed, rotate the crankshaft to TDC for cylinder 1 as follows:

- -> Screw in TDC adjustment device 2068 A, as shown in the illustration.
- Set adjustment device to 111.5 mm (the left notch on the vernier scale -arrow- is the reference point).
- Rotate crankshaft until TDC mark "0" on flywheel aligns with edge of adjustment device...



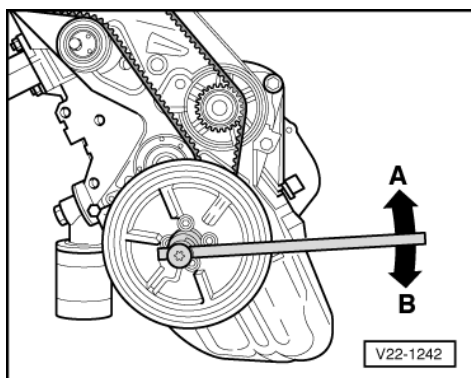
- -> ...at the same time, the marks on the injection pump sprocket and the injection pump must align - arrows-.

Remove the toothed belt guard for injection pump drive.



- Remove screw plug on the injection pump.
- -> Screw in the dial gauge adapter 2066 in place of the screw plug (screw plug with sealing ring).
- Screw the threaded side of the adapter plunger tightly into the dial gauge (small version, measuring range 0...3 mm).
- Insert the dial gauge and plunger into adapter.

- Preload the dial gauge to about 2 mm and tighten the adjusting nut on the adapter.



- -> Rotate the crankshaft slowly against the direction of engine rotation -direction of arrow A-, until the pointer on the dial gauge no longer moves.
- Set the measuring scale to "0".
- Rotate the crankshaft slowly in direction of engine rotation -direction of arrow B-, until the mark -O- on the flywheel is aligned with the reference mark or the edge of the adjustment device.

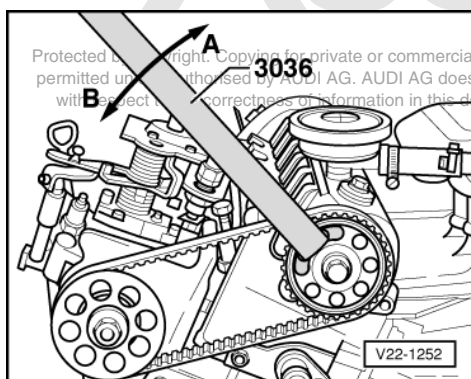
Note:

TDC mark is to be approached by rotating crankshaft in direction of engine rotation. If you have accidentally passed the TDC mark:

- Rotate the crankshaft in reverse direction until dial gauge reading is "0" again and re-approach TDC mark.
- Read the start of delivery on the dial gauge:
 - Test value 0.93...1.07 mm/stroke

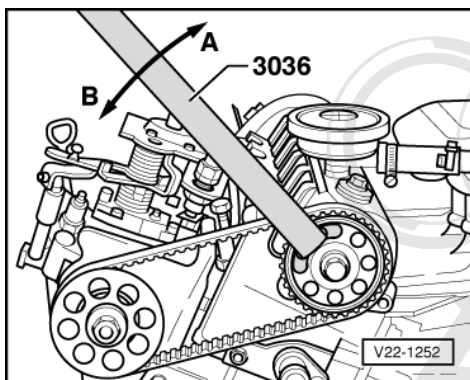
Notes:

- ♦ If the test value is within the specified tolerance range, no re-adjustment is required.
- ♦ If the test value is outside the tolerance range, the adjustment must be repeated. The adjustment value applies.



Adjusting

- Loosen securing bolt of injection pump drive sprocket at camshaft by 1/2 turn using counterhold 3036 and ring socket tool V.A.G 1332/7.
- Check again whether the crankshaft is positioned at TDC.
- Using the counterhold 3036, rotate the drive sprocket slowly in -direction of arrow A-, until the pointer on the dial gauge no longer moves.
- Set the measuring scale to "0".



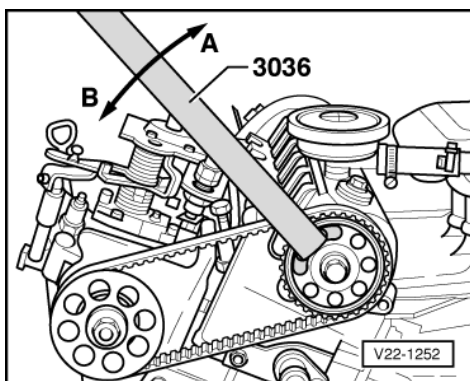
- -> Using the counterhold 3036, rotate the drive sprocket slowly in -direction of arrow B-, until the pointer on the dial gauge displays the following value:
 - Specified value: 1.00 ± 0.02 mm stroke (start of delivery)
- Hold the drive sprocket in this position using counterhold 3036 and tighten the securing bolt to approx. 50 Nm.
- Re-check the start of delivery by rotating the crankshaft back and forth.

Notes:

- ♦ Due to the slackness of the toothed belt, the indicated test value deviates from the specified value.
- ♦ Example:

Specified value		1.00 mm
Test value	-	0.93 mm
Deviation	=	0.07 mm

- ♦ Adding the deviation to the specified value yields the hold value for the second adjustment: 1.07 mm stroke.



Carry out the second adjustment as follows:

- -> Loosen the securing bolt of the camshaft sprocket 1/2 turn.
- Check again whether the crankshaft is positioned at TDC.
- Using the counterhold 3036, rotate the drive sprocket slowly in the direction of arrow A - until the pointer on the dial gauge no longer moves.
- Set the measuring scale to "0".
- Using the counterhold 3036, rotate the drive sprocket slowly in the -direction of arrow B-, until the pointer on the dial gauge displays the hold value.
 - Example for hold value: 1.07 mm stroke
- Hold the drive sprocket in this position using counterhold 3036 and tighten the securing bolt to approx. 50 Nm.
- Re-check the start of delivery adjustment by rotating the crankshaft back and forth.
- Specified value: 1.00 ± 0.02 mm stroke

Note:

The adjustment must be repeated as often as necessary to obtain the specified value.

- Tighten the drive sprocket securing bolt to final torque using counterhold 3036.

Note:

After a static adjustment of the injection pump, the injection lines on the injection pump must always be loosened and then re-tightened to 25 Nm. This relieves the strain on the pipes and prevents vibration fractures.

- Remove the dial gauge and adapter.
- Install the screw plug with a new sealing ring.
- Install toothed belt guard.

Tightening torques

Component	Nm
Injection pump console to cylinder head	50
Screw plug to injection pump 1)	20
Drive sprocket for injection pump to camshaft	100

- 1) Replace sealing ring

1.7 - Adjusting idling speed, idling speed increase and cutoff speed

Special tools and workshop equipment required

- ♦ Ignition tester V.A.G 1367

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Test requirements:

- Engine oil temperature at least 60 °C
- Hand throttle turned all the way back.
- Electrical consumers switched off (radiator fan must not run during the test).

Test sequence

- Connect ignition tester V.A.G 1367:

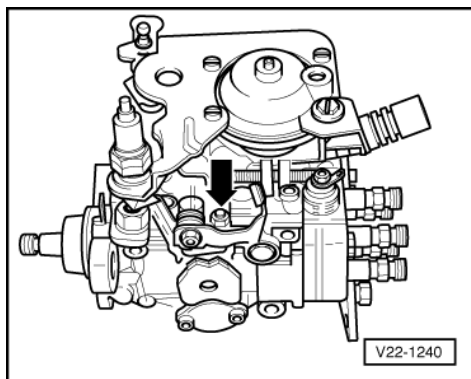
=> Operating Instructions

Note:

The TDC sender of ignition tester V.A.G 1367 must be inserted into the gearbox housing as far as the stop.

Checking and adjusting idling speed

- Start engine and run at idling speed.
- Read the idling speed on V.A.G 1367.
 - Specified value: 850 ± 50 rpm



If specification not attained or exceeded:

- -> Loosen lock nut on idling speed adjuster screw -arrow-.
- Adjust idling speed and secure idling speed adjuster screw again with lock nut.

Checking and adjusting idling speed increase

Note:

Adjust the idling speed increase only in case of customer complaints.

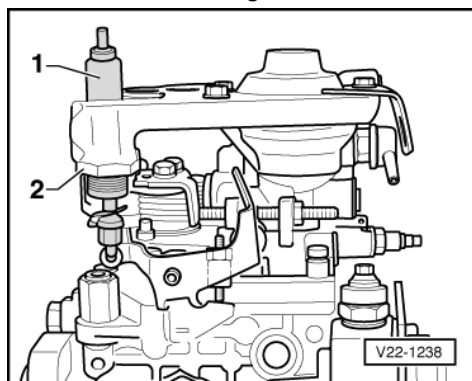
The idling speed increase raises the idling speed to 900 ± 50 rpm after a cold start by means of the electrically-heated idling speed increase actuator -N123.

After 2 minutes of engine run time, at the latest, the idling speed must drop by 50 rpm.

Test requirements:

- Idling speed OK =>Page 18 .
- Engine oil temperature at least 60°C
- Hand throttle turned all the way back.
- Electrical consumers switched off (radiator fan must not run during the test).
- Idling speed increase actuator voltage supply -N123 OK.

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder



Adjusting

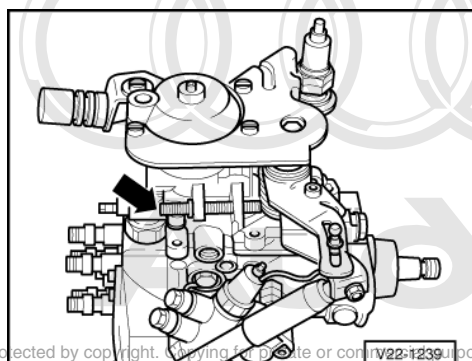
- Start engine and run at idling speed.
- -> Detach the connector for the idling speed increase actuator -1-.
- Spray cold spray on the idling speed increase actuator.
 - The idling speed must increase.
- Specified value: 900 ± 50 rpm

If the idling speed does not change:

- Release the lock nut -2- on the bracket.
- Turn the idling speed increase actuator until 900 rpm is reached and secure it again with the lock nut.
- Plug in the connector.
 - After 2 minutes of engine run time, at the latest, the idling speed must drop by 50 rpm.

If the idling speed does not change:

- Replace the idling speed increase actuator.



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Adjusting cutoff speed (no load applied).

- -> Loosen lock nut on cutoff speed adjuster screw -arrow-.
- Start the engine.
- Move the adjustment lever to the wide open throttle position.
- Adjust the cutoff speed and re-secure the speed adjuster screw using the lock nut.
 - Specified value: 4800 ± 100 rpm

1.8 - Basic setting of residual fuel quantity

Notes:

- ♦ The residual fuel quantity adjustment screw is secured with a cap and its adjustment must not be changed.
- ♦ This screw is used in the factory to adjust the so-called residual fuel quantity on an injection pump test stand.

Adjusting the residual fuel quantity adjuster screw may give rise to the following complaints:

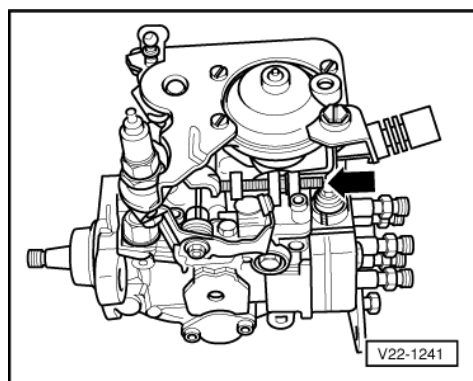
- ♦ Screw turned in = residual fuel quantity too large.
In this case the engine speed is too high and adjustment of the idling speed is not possible.
- ♦ Screw turned out (free play on the adjustment lever) = residual fuel quantity too small.
Causes driveability problems such as flat spots during startup and acceleration from low rpm, or juddering in all gears.

If these problems are present, perform basic setting of the residual fuel quantity adjustment screw as follows.

Adjusting

Test requirements:

- Engine oil temperature at least 60°C
- Electrical consumers switched off (radiator fan must not run during the test).



- -> Loosen the lock nut on the residual fuel quantity adjustment screw -arrow-.

Residual fuel quantity too low: (Driveability problems)

- Turn adjustment screw in until idling speed just begins to increase.
- Starting from this point turn the adjustment screw 1/2 turn back.

Residual fuel quantity too large: (Engine speed too high)

- Turn adjustment screw out until idling speed no longer decreases.
- Turn adjustment screw back in until idling speed increases.
- Turn adjustment screw back by one half of a turn from the starting point of idling speed increase.
- Lock adjustment screw and secure using a new securing cap.

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1.9 - Checking injectors and constant pressure valves

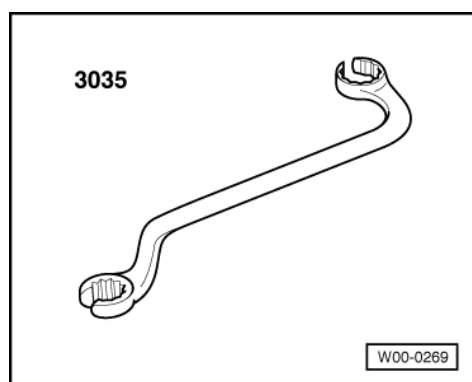
Note:

Defective injectors cause the following faults:

- ◆ Loss of power
- ◆ Excessive black exhaust smoke
- ◆ Excessive blue smoke when starting from cold
- ◆ High fuel consumption
- ◆ Engine overheating
- ◆ Knocking in one or more cylinders
- ◆ Misfiring

Defective constant pressure valves cause the following fault:

- ◆ Rough idling, possibly intermittent



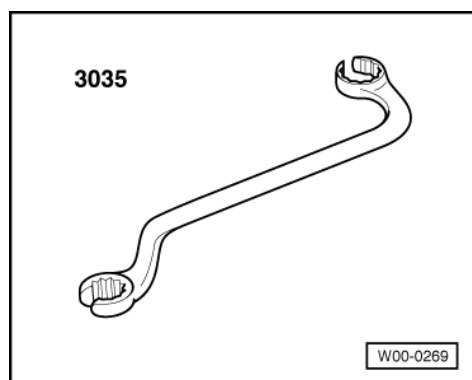
Special tools and workshop equipment required

- ◆ Ring spanner 3035

Test sequence

- To locate defective injectors or constant pressure valves, loosen the injector pipe union nuts in turn while the engine is running at idling speed.
- If the engine speed remains constant after loosening a union nut, this indicates a defective injector or a defective constant pressure valve.
- If the engine speed remains constant after loosening one or more union nuts on the injectors, interchange the injectors.
- If the fault moves along with the injector, fit a new injector.
- If the fault remains on the cylinder, check the compression.
- If the compression is OK, replace the relevant constant pressure valve and sealing ring => Page 23 .

1.10 - Removing and installing injectors

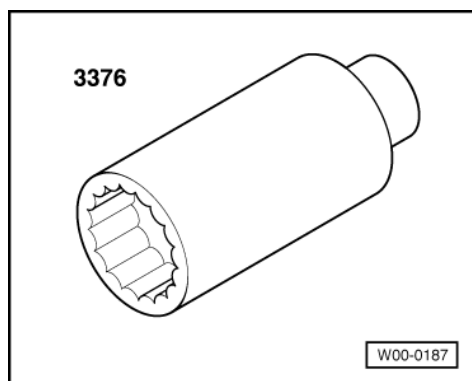


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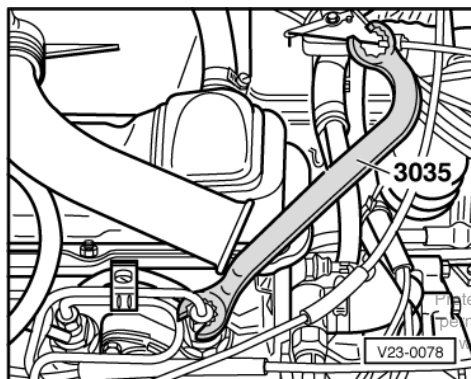


Special tools and workshop equipment required

- ♦ Ring spanner 3035



- ♦ Socket 3376



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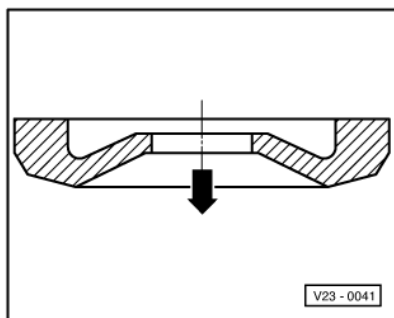
Removing

- -> Disconnect the injector pipes using open ring spanner 3035.

Note:

Always remove complete pipe set. Do not alter pipe shape.

- Remove injectors using socket insert 3376.
- To remove injectors at cylinder 4 and 5, detach the idling speed increase actuator and the idle cable angle bracket.
- Remove heat insulation seals from injector holes in cylinder head.



Installing

Installation is carried out in the reverse order; note the following:

Note:

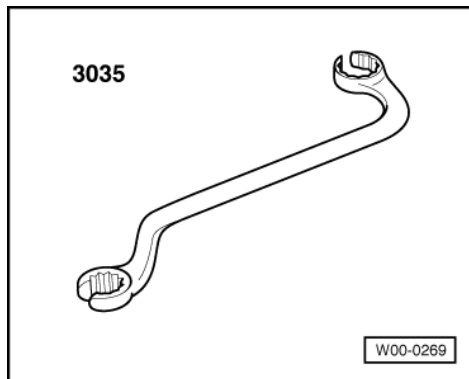
Replace heat insulation seal between cylinder head and injectors after removing injectors.

- -> Note the installation position of the heat insulation seal.
- Installation position: Arrow points in direction of cylinder head
- Insert the injectors.

Tightening torques

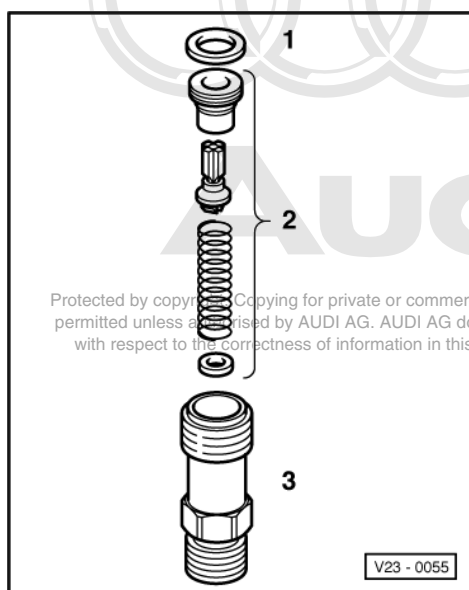
Component	Nm
Injectors	70
Injector pipes	25

1.11 - Removing and installing constant pressure valves



Special tools and workshop equipment required

- ◆ Ring spanner 3035





Procedure

- Disconnect the injector pipes using open ring spanner 3035.

- 1 - -> Sealing ring
- 2 - Constant pressure valve
- 3 - Connection

Notes:

- ♦ When removing the sealing ring from the pump, always use a soft object (plastic or wood) in order not to scratch the sealing surface.
- ♦ After mileage of over 15,000 km, constant pressure valves must always be replaced as a complete set.
- ♦ In case of leakage at the connections tighten these to 45 Nm. If leakage is not remedied using this procedure install new connection with new sealing ring.
- ♦ When replacing connections do not interchange pressure valves.

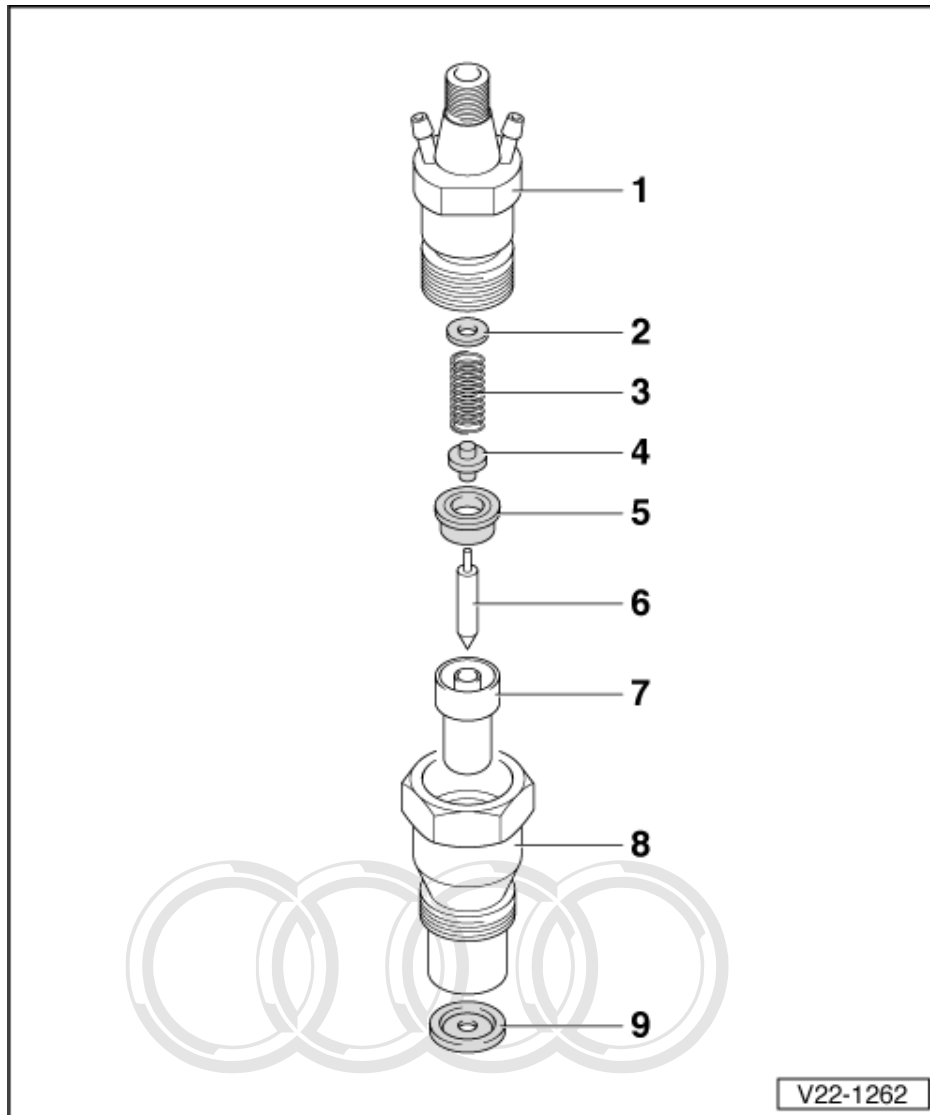
Tightening torques

Component	Nm
Injectors	70
Injector pipes	25



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1.12 - Repairing injectors



1 Injectors-upper part - 70 Nm

- ♦ Hoses attached to the return connection
- ♦ A rubber cap must be placed on the vacant return connection located on the cylinder 1 injector

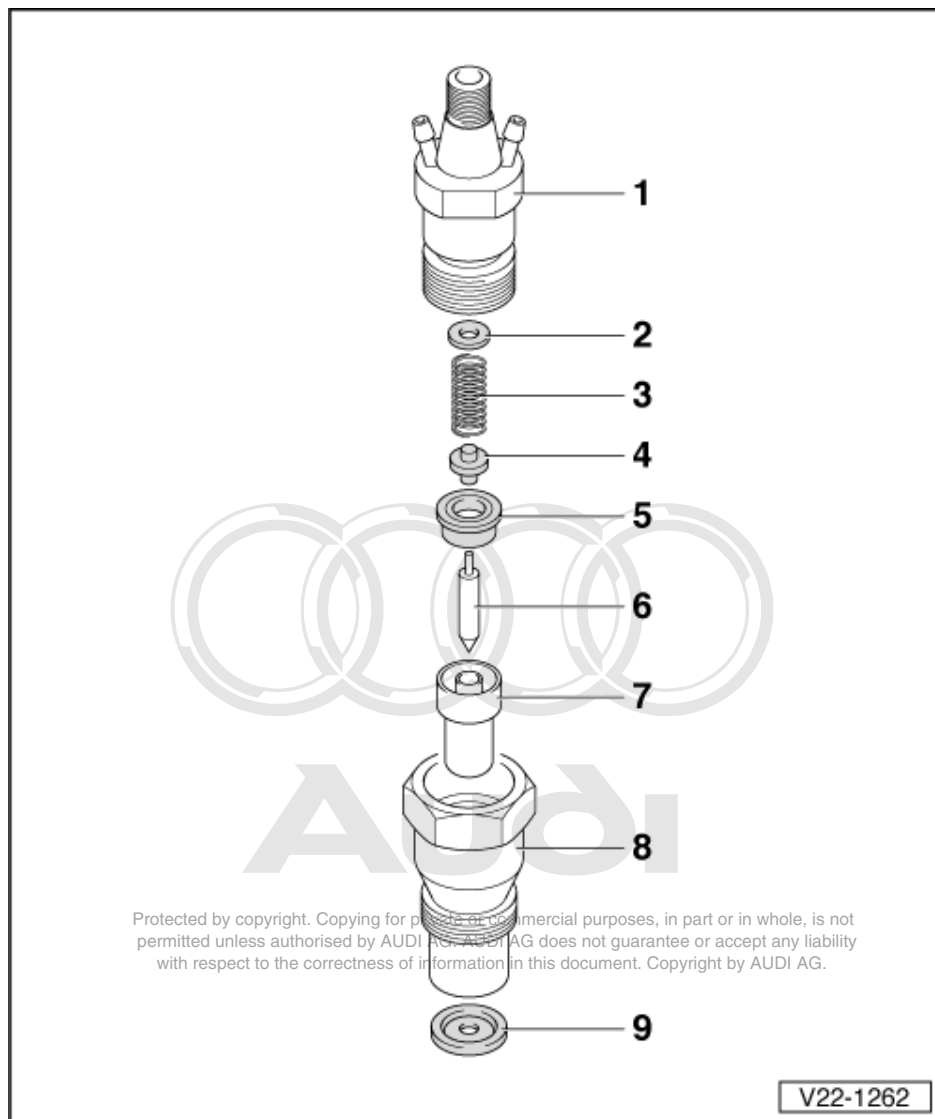
2 Shim

- ♦ For adjusting the spray pressure. Part numbers
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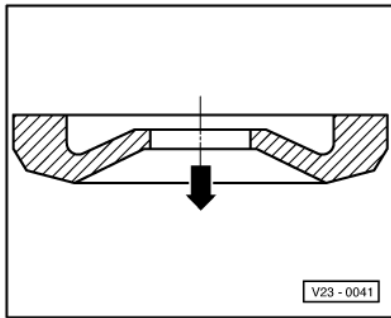
=> Parts List

- ♦ Checking spray pressure
=>Page 28 .
- ♦ Adjusting spray pressure =>Page 31

3 Injector spring



- 4 Pressure pin**
- 5 Injector holder insert**
- 6 Injector needle**
 - ♦ Checking spray pintle for damage => Page **27**
 - ♦ Check for freedom of movement in injector body
 - ♦ Can only be replaced in conjunction with injector body
- 7 Injector body**
 - ♦ Can only be replaced in conjunction with injector needle
- 8 Injector, lower part**
- 70 Nm
- 9 Heat insulation seal**
 - ♦ Replace
 - ♦ Installation position
=> Fig. **27**

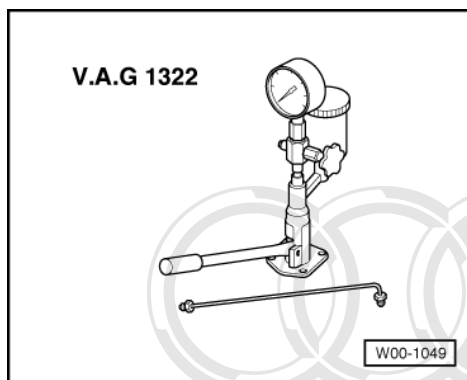


-> Fig.1 Installation position of heat insulation seal

- Installation position: Arrow points in direction of cylinder head

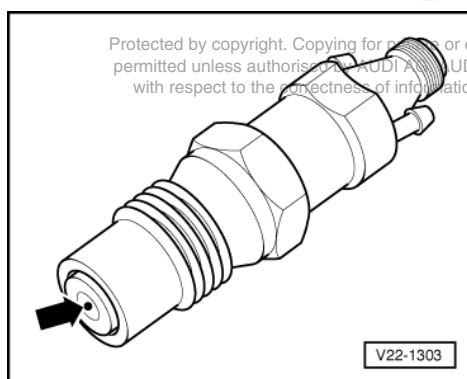
1.13 - Checking and adjusting injectors

- Injector removed =>Page 21 .



Special tools and workshop equipment required

- ♦ Injector tester V.A.G 1322 with pressure line V.A.G 1322/2

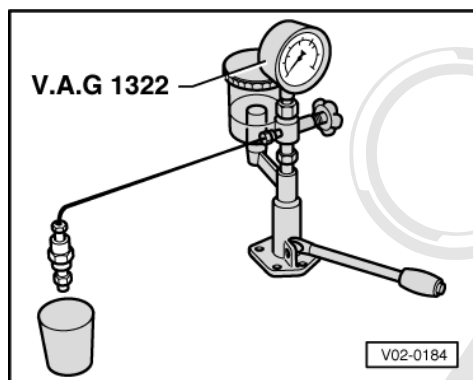


Checking injector needle spray pintles (visual check)

- -> Check the spray pintle for damage (broken or bent).



- Replace the injector as necessary.



Checking spray pressure

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Test requirements:

- Injector fastened to injector tester.

Important

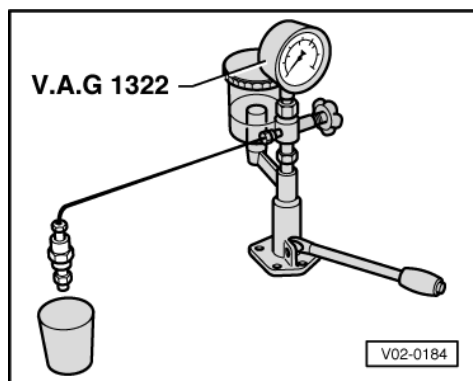
When testing injectors, care should be taken to ensure that the jet of fuel does not come into contact with the hands, as the high pressure will cause the fuel to penetrate the skin which could cause severe injuries.

- -> Open the valve to pressure gauge on V.A.G 1322.
- Slowly press hand lever downwards. Read spray pressure upon commencement of spray:

Specified value	Wear limit
130...138 bar	120 bar

If specified value is not attained:

- Adjust the spray pressure => Page **31** .

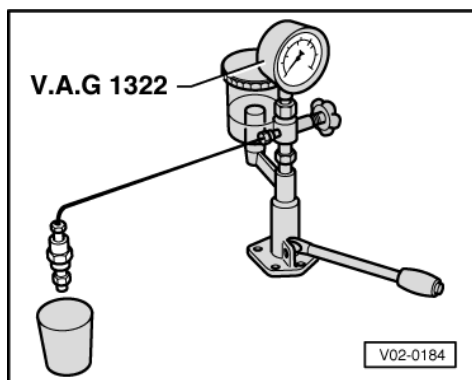


Checking for leaks

Test requirements:

- Injector fastened to injector tester.
- -> Open the valve to pressure gauge on V.A.G 1322.
- Press pump lever slowly downwards and maintain approx. 110 bar for 10 seconds.
 - No fuel must leak from the nozzle opening

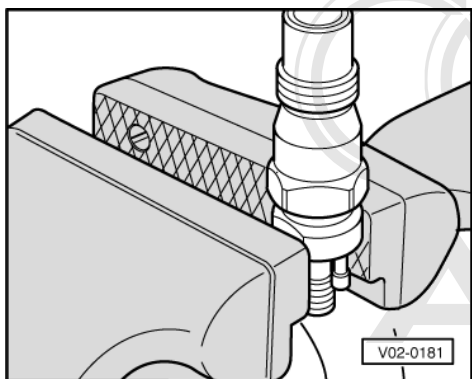
- Replace the injector as necessary.



Checking spray pattern

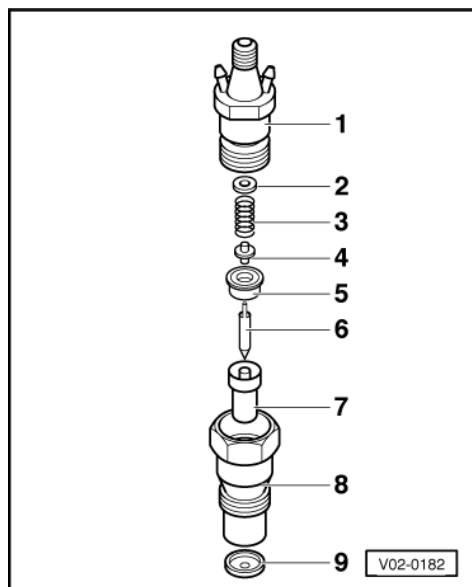
Test requirements:

- Injector fastened to injector tester.
- -> Close the valve to pressure gauge on V.A.G 1322.
- Slowly depress the pump lever using brief, rapid downward strokes (4...6 strokes/second).
 - The injector spray pattern must resemble a closed cone as closely as possible
 - The injector must not drip after spraying - the spray must cease at once.
 - The injector must issue a brief chattering sound when the fuel escapes.
- Replace the injector as necessary.



Dismantling and assembling injector

- -> Clamp upper part of injector in vice and loosen threaded connection.
- Clamp lower part of injector in vice to prevent individual components from falling apart, and dismantle injector.



- -> When dismantling the injector make sure that the individual parts are not interchanged.

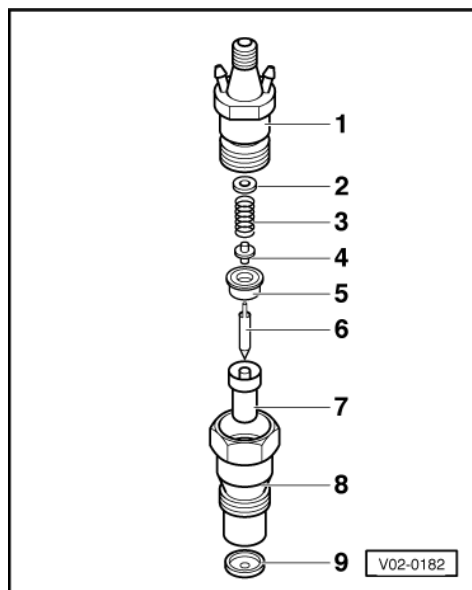
- 1 - Injector, upper part
- 2 - Shim
- 3 - Injector spring
- 4 - Pressure pin
- 5 - Injector holder insert
- 6 - Injector needle
- 7 - Injector body
- 8 - Injector, lower part
- 9 - Heat insulation seal

Note:

To avoid corrosion caused by sweat from technician's hands the injector must be installed in the engine and operated immediately following assembly. If this is not possible the injector must be flushed once with pressurised fuel on the V.A.G 1322 tool.

Tightening torque

Component	Nm
Upper part of injector to lower part of injector	70



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Adjusting spray pressure

- Injector dismantled =>Page 29 .

For adjustment purposes, shims of thicknesses from 1.00...1.95 mm are available. Part numbers

=> Parts List

Note:

-> Shim sizes are staggered in thickness intervals of 0.05 mm. Use the storage box 3065 for purposes of storing the shims.

- ♦ A thicker shim increases the spray pressure.
- ♦ A thinner shim lowers the spray pressure.
- ♦ Increasing the preload by 0.05 mm increases the spray pressure by approx. 5.0 bar.

Note:

When repairing used injectors, the spray pressure must be adjusted to the specified value for new injectors.

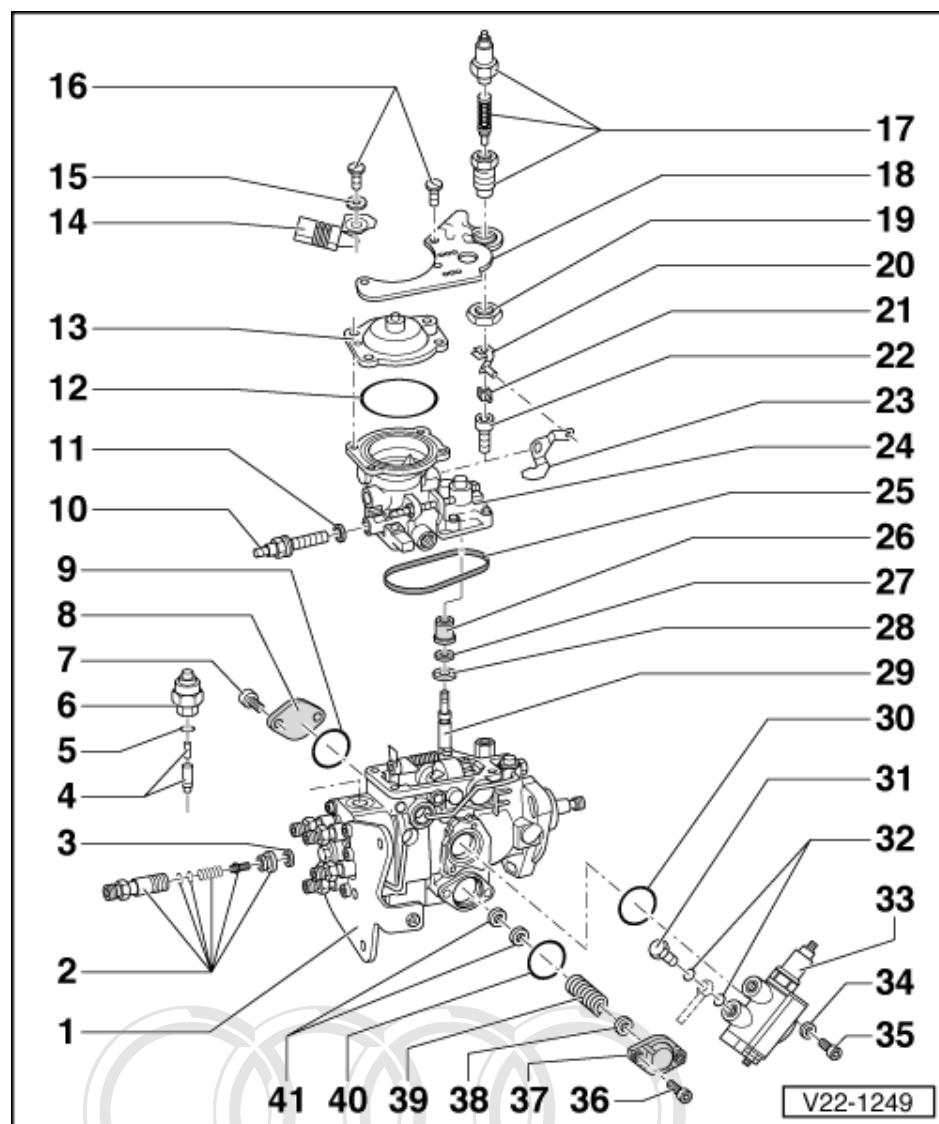
- Following assembly:
Checking spray pressure =>Page 28 .
- Checking injector spray pattern => Page 29 .



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2 - Repairing injection pump

2.1 - Repairing injection pump



Notes:

- ♦ Observe rules for cleanliness=> page 2 .
- ♦ Always renew seals.

1 Injection pump

- ♦ Removing and installing
=>Page 6 .

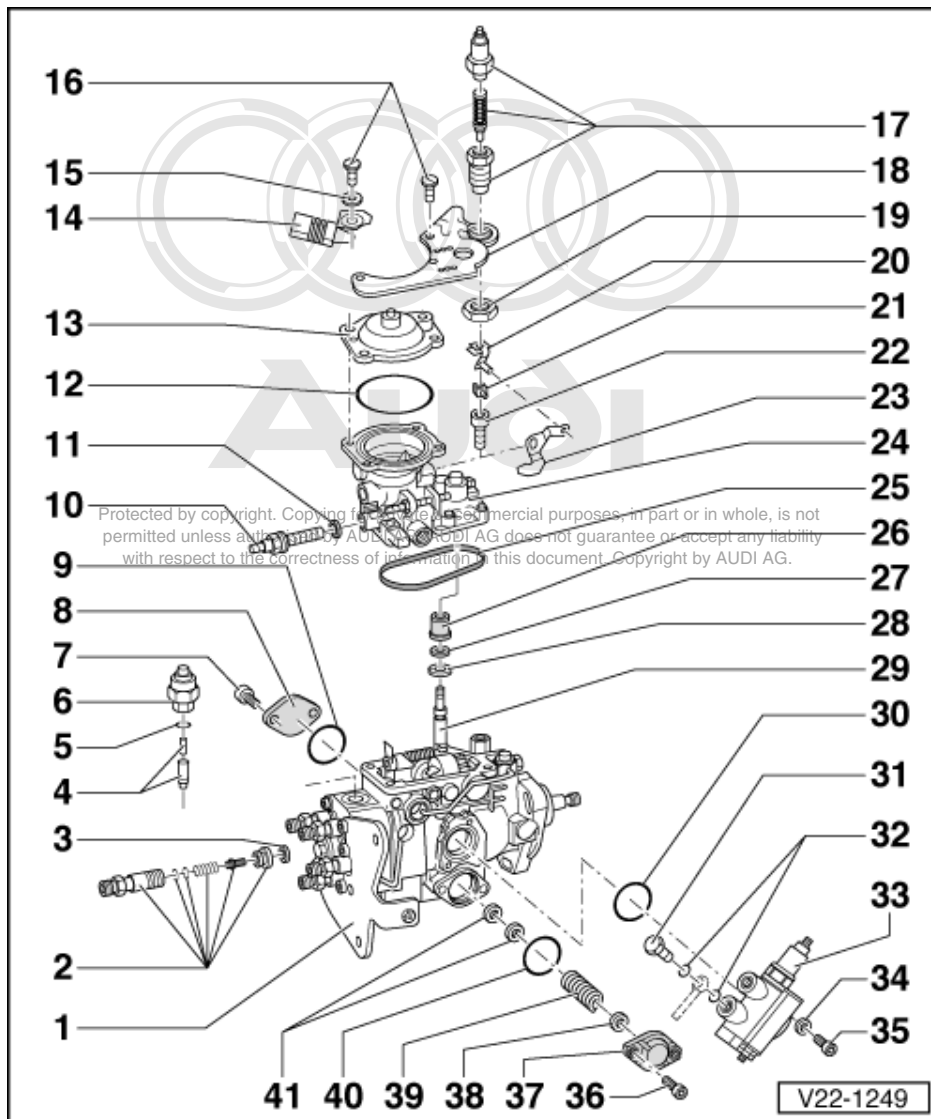
2 Constant pressure valve

- ♦ With connection
- ♦ Removing and installing
=>Page 23 .
- ♦ Tighten to 45 Nm

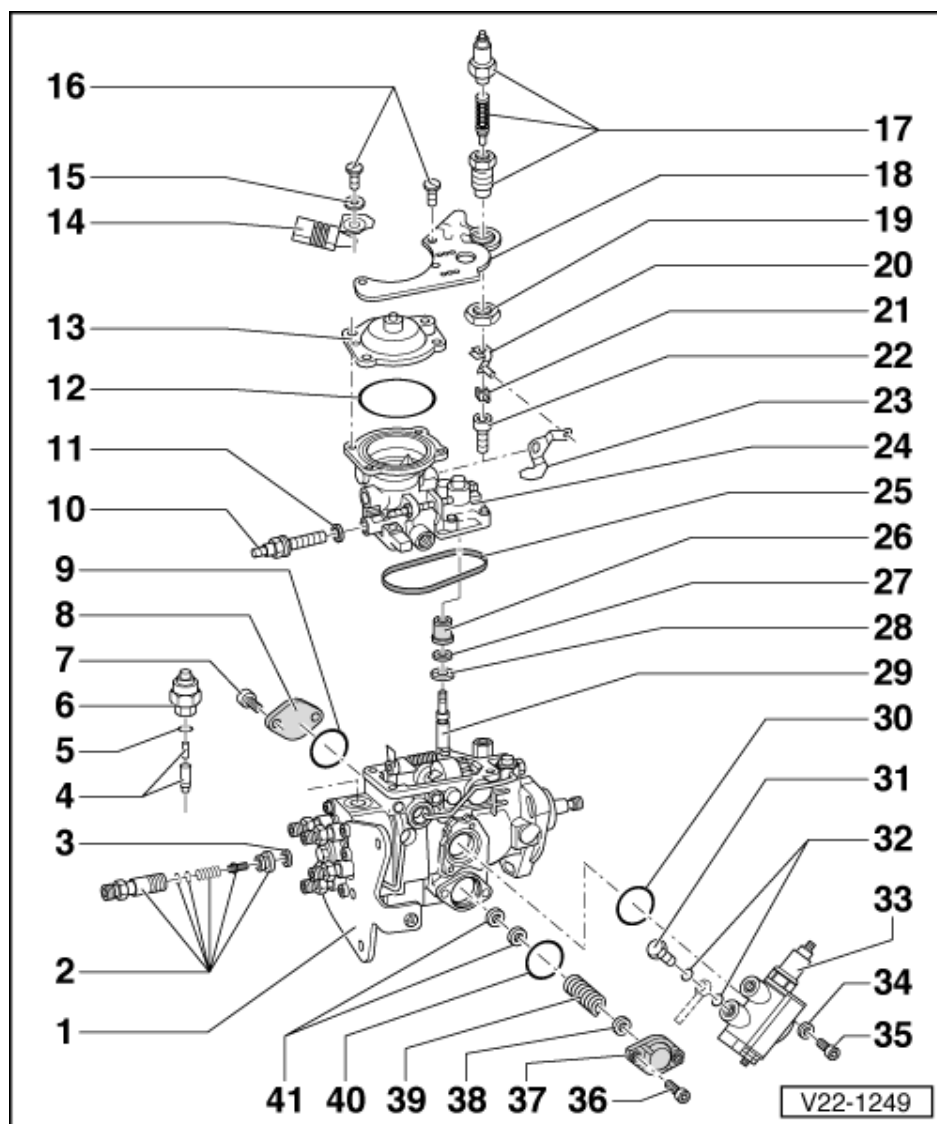
3 Sealing ring

4 Valve with spring

- ♦ Replace together with fuel cut-off valve



- 5 O-ring
 - ♦ Replace
- 6 Fuel cut-off valve -N109
 - ♦ Tighten to 40 Nm
 - ♦ Must click upon switching ignition on and off
- 7 10 Nm
- 8 Rear cover
 - ♦ For injection timing device
 - ♦ If any leaks are found, replace O-ring =>page 50
- 9 O-ring
 - ♦ Replacing => Page 50 .
- 10 Fuel quantity adjuster screw
 - ♦ Secured with plastic sleeve
 - ♦ Mark installation position
=>Page 41 .
- 11 O-ring
 - ♦ Replacing => Page 48 .

**12 O-ring**

- ♦ Renew if damaged or leaking

13 Cover

- ♦ For diaphragm housing
- ♦ Diaphragm housing not working

14 Guide with angle bracket

- ♦ For idle cable

15 Shim**16 10 Nm****17 Idling speed increase actuator -N123**

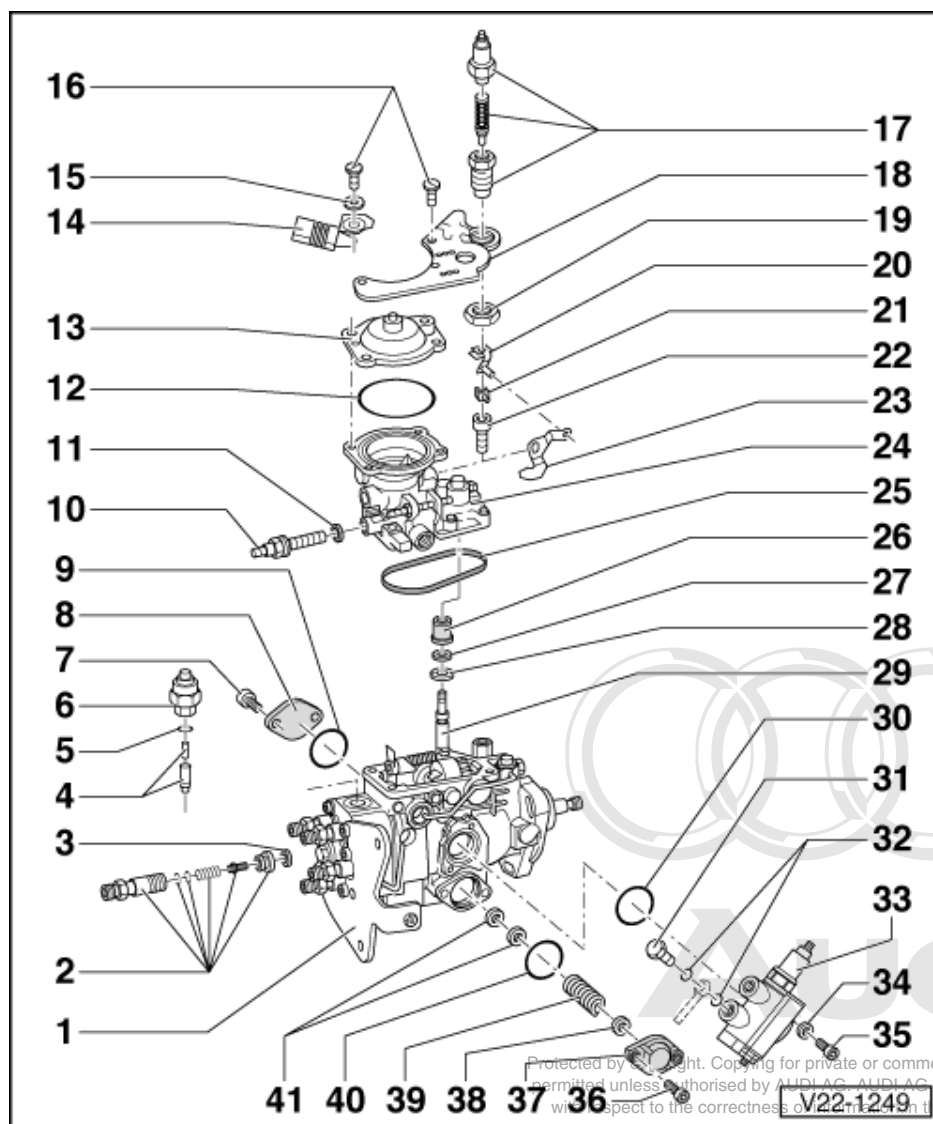
- ♦ Adjusting idling speed increase => Page 19

18 Bracket

- ♦ For actuator

19 Lock nut

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20 Angular lever

21 Clamp

22 10 Nm

23 Intermediate lever

- ♦ For idling speed
- ♦ If any leaks are found, replace O-ring =>page 47

24 Injection pump cover

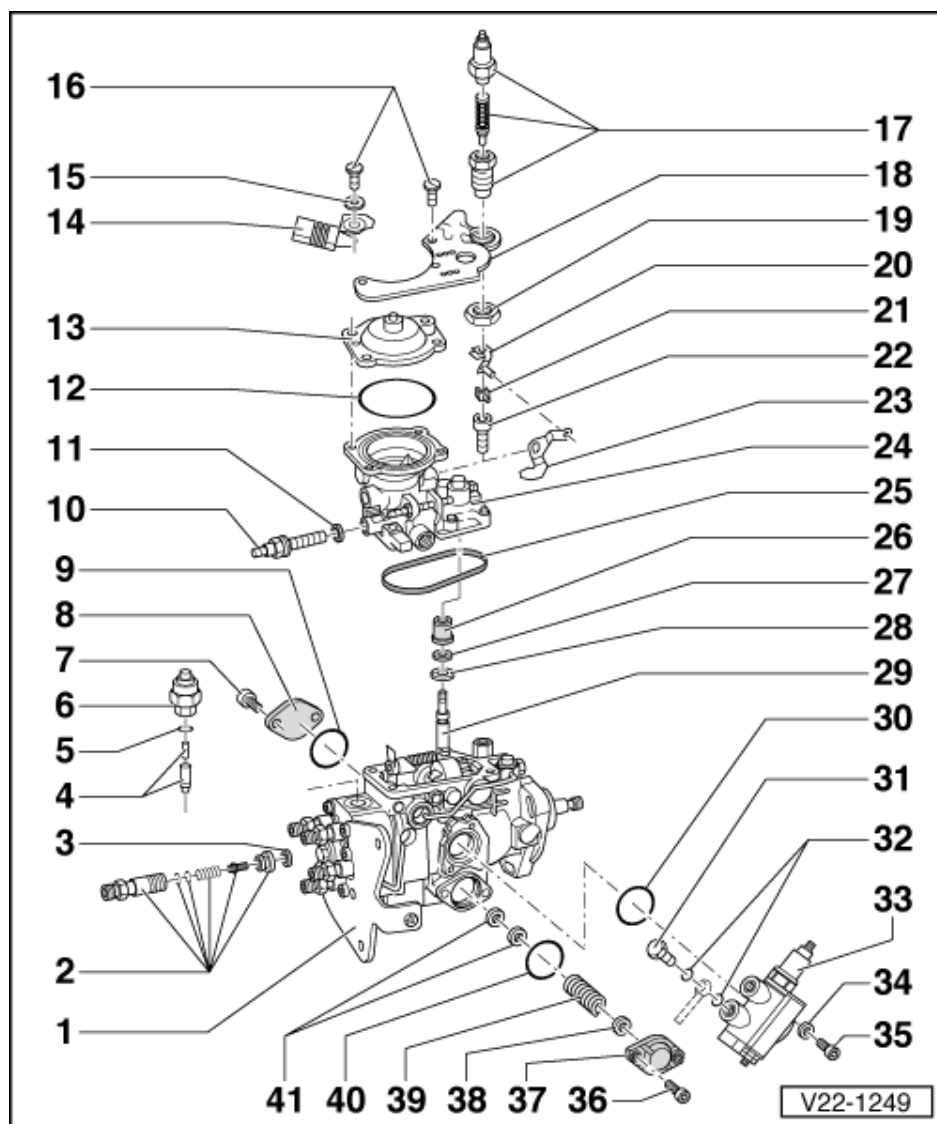
- ♦ Removing and installing =>Page 41

25 Seal

- ♦ For injection pump cover
- ♦ Replacing => Page 41 .

26 Bush

- ♦ For adjuster lever shaft
- ♦ Replacing => Page 45 .
- ♦ Select size according to the previously installed bearing bush
- ♦ Install with locking compound D 000 600 A2



27 O-ring

- ◆ Replacing => Page 46 .

28 Thrust washer

29 Adjuster lever shaft

- ◆ For adjuster lever shaft with load impact damping
- ◆ Removing-and installing adjuster lever shaft with load impact damping =>Page 38

30 O-ring

- ◆ Replacing => Page 50.

31 Banjo bolt - 15 Nm

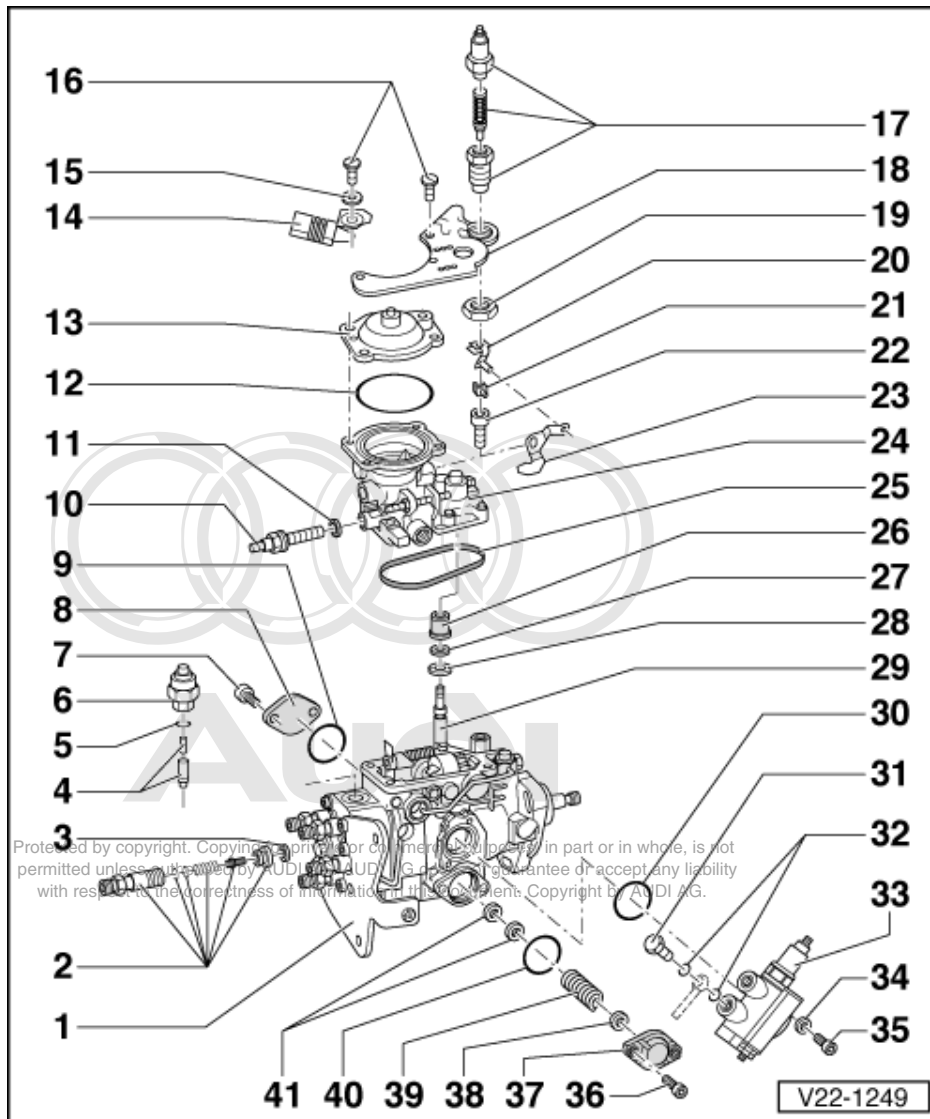
32 Sealing rings

- ◆ Replace

33 Cold start acceleration actuator -N124

- ◆ If any leaks are found, replace O-ring =>Page 50

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34 Spring lock washer

35 10 Nm

36 10 Nm

37 Front cover

- ♦ For injection timing device
- ♦ If any leaks are found, replace O-ring =>Page 49

38 Shim

- ♦ Do not change order

39 Spring

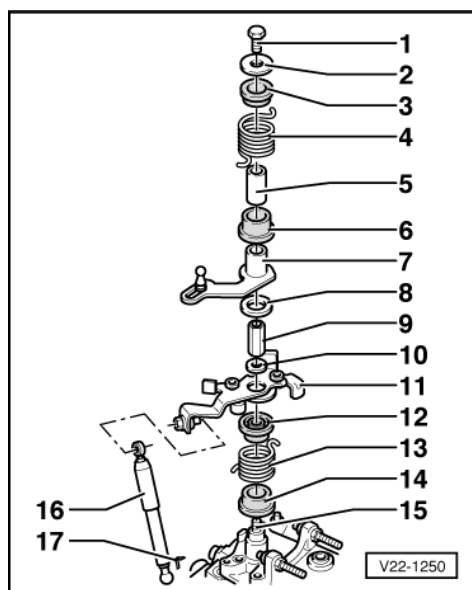
40 O-ring

- ♦ Replacing => Page 49 .

41 Shims

- ♦ Do not change order

2.2 - Removing and installing adjustment lever shaft with load impact damping



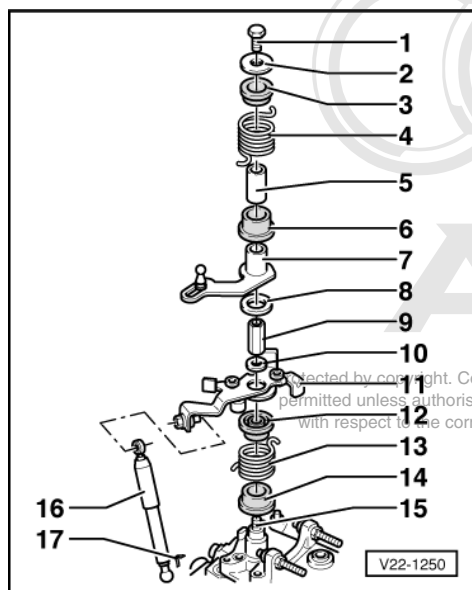
Removing

- Detach throttle mechanism coupling link on adjustment lever.
- Unscrew the idling speed increase actuator bracket and disengage the angular lever.
- -> Swing the securing clip -17- aside and press off the gas-filled strut -16-.
- Using water pump pliers, hold the washer -2- on the outer edge and loosen bolt -1- by briefly applying moderate force.

Note:

This will ensure loosening of the bolt and not the threaded piece -9-.

- Screw the bolt -1- out by a few turns and disengage the load damping spring -4- using a strong wire hook or a pair of pliers.

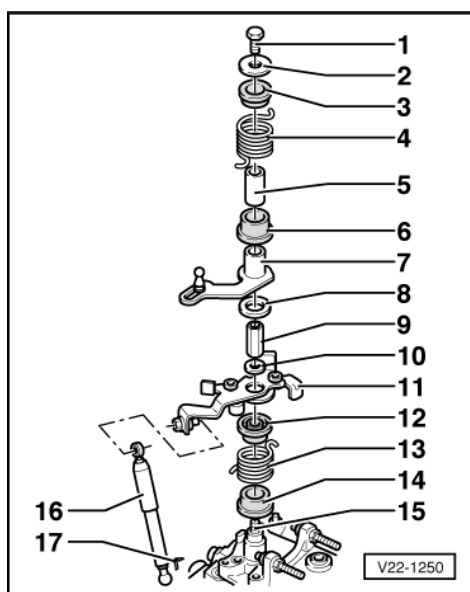


- -> Remove the upper adjustment lever -7- with load impact damping spring, spring retainers -3- and -6- as well as guide bush -5-.
- Remove the shim -8-.

- Disengage the return spring -13-.

Notes:

- ◆ Under no circumstances must the lower adjustment lever -11- turn on the adjustment lever shaft -15- before the relative installation position of adjustment lever to adjustment lever shaft has been marked.
- ◆ After loosening the threaded piece, press the adjustment lever onto the adjustment lever shaft to prevent it from slipping on the splines.
- Unscrew the threaded piece -9-.
- Using a piece of wire, lift the washer -10- from the recess in the adjustment lever.
- Mark the installation position of the lower adjustment lever -11- relative to the adjustment lever shaft -15- using a metal scriber.
- Remove the lower adjustment lever with return spring -13- with spring retainers -12- and -14-.



Installing

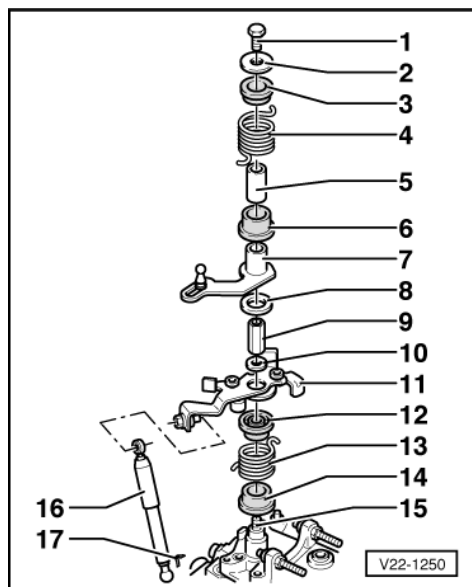
Installation is carried out in the reverse order; note the following:

Note:

Order of washers and shims must always be maintained upon assembly.

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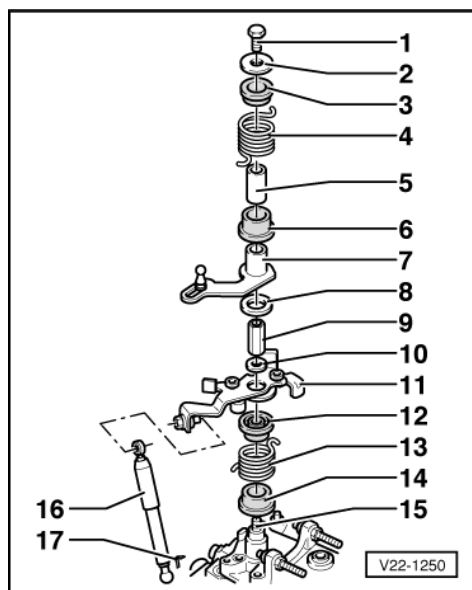
- -> Fit the return spring -13- with spring retainers -12- and -14-.
- Set the lower adjustment lever -11- in place according to the marking applied.
- Fit the washer -10- and tighten the threaded piece -9- to 10 Nm.
- Engage the return spring with a wire hook -13-.
- Before continuing with further assembly, check the idling speed and the cutoff speed => Page 18 .

**Notes:**

- ♦ If the idling and cutoff speed deviate only slightly from the specified value after assembly, the adjustment lever installation position is correct. Assembly may be continued.
- ♦ -> If the engine runs much too fast (approx. 4000 rpm), the lower adjustment lever -11- was inserted incorrectly by one tooth in anti-clockwise direction on the adjustment lever shaft -15-.
- ♦ If the engine runs much too slowly and the cutoff speed is not reached, the lower adjustment lever was inserted incorrectly by one tooth in clockwise direction on the adjustment lever shaft.
- Fit shim -8-.
- Fit the upper adjustment lever -7- with lower spring retainer -6-, guide bush -5-, load impact damping spring -4- and spring retainer -3-.

Note:

Ensure that the guide bush -5- engages in the shim -8-.

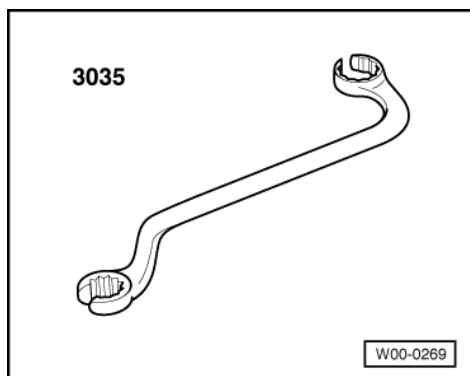


- -> Screw in the bolt -1- with washer -2- by several turns.
- Engage the load impact damping spring -4- and tighten the bolt to 10 Nm.
- Press the gas-filled strut -16- on the ball stud and secure it using the securing clip -17-.

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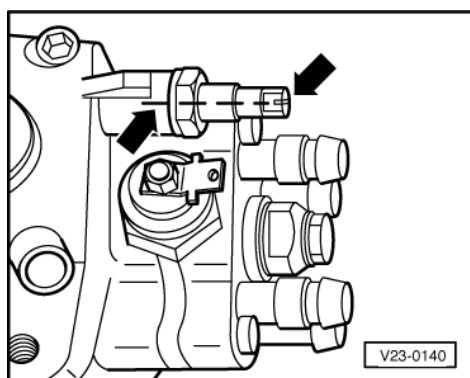
- Check idling speed and cutoff speed and adjust as necessary => Page 18

2.3 - Removing and installing injection pump cover



Special tools and workshop equipment required

- ◆ Ring spanner 3035

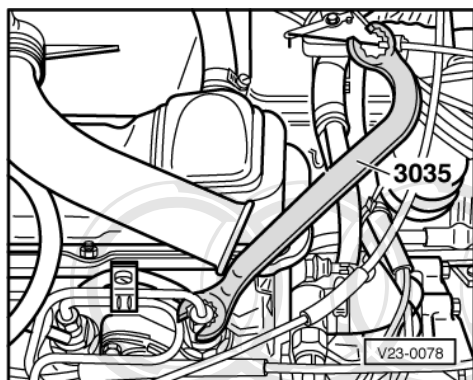


Removing

- Remove the adjustment lever with load impact damping => Page 38 .
- -> Mark the position of the fuel quantity adjustment screw relative to the pump cover, e.g. screw slot to pump cover -arrows-.

Notes:

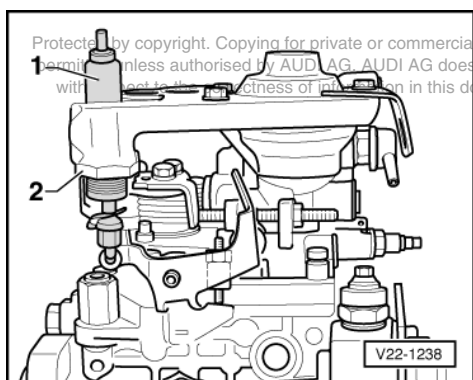
- ◆ Even minor changes of the fuel quantity adjustment screw position may lead to smoke development or performance loss of the engine. For this reason it is important to obtain the identical position upon re-installation. Under no circumstances must the fuel quantity adjustment screw be turned beyond the initial position.
- ◆ The fuel quantity adjustment screw is secured by a plastic sleeve. To turn the fuel quantity adjustment screw the plastic sleeve must be destroyed.
- Loosen lock nut, turn against the securing sleeve and unscrew the fuel quantity adjustment screw from the pump cover.



- -> Disconnect the injector pipes using open ring spanner 3035.

Note:

Always remove complete pipe set. Do not alter pipe shape.

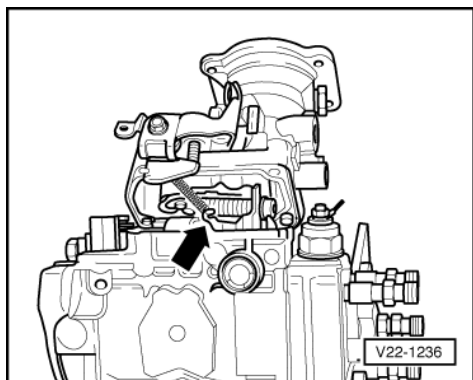


- -> Detach the connector for the idling speed increase actuator -1-.
- Unscrew the idling speed increase actuator retainer.
- Place a cloth around the injection pump housing to catch escaping fuel.
- Unscrew the fuel return line on the injection pump and lay it aside.

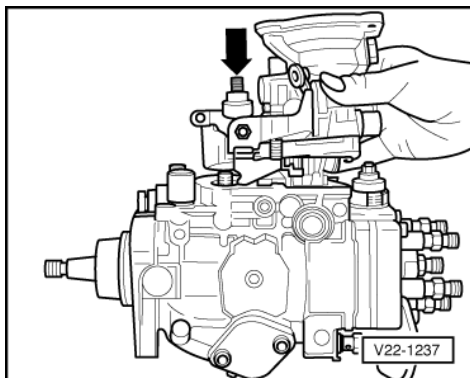
Note:

Close off the line with a clean closure plug.

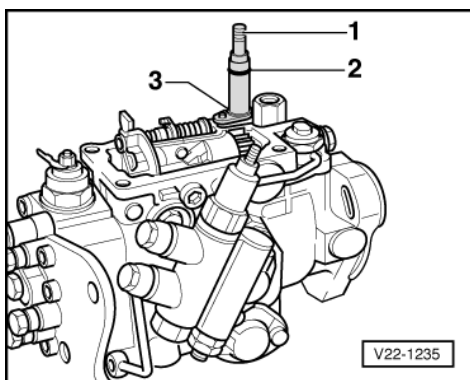
- Loosen the residual fuel quantity adjuster screw lock nut and turn the residual fuel quantity adjuster screw outwards.
- Unscrew the cover securing bolts.



- -> Tilt the injection pump cover slightly to the side, disengage the idling speed tension spring -arrow- (e.g. using a wire hook fashioned for this purpose). Do not over-stretch the spring in the process.



- -> Slightly lift up injection pump cover, push adjustment lever shaft -arrow- towards inside of cover while removing cover (e.g. using screwdriver handle).



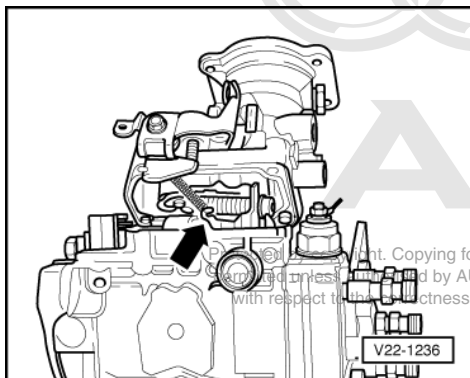
Installing

Installation is carried out in the reverse order; note the following:

Note:

If radial play of the adjustment lever within the injection pump cover bearing bush can clearly be felt, the adjustment lever bearing bush in the pump cover must be replaced => Page 45.

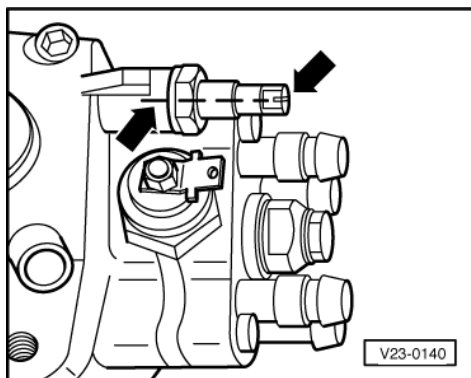
- -> Replace O-ring -2-, coat O-ring and adjustment lever -1- with diesel fuel.
- Before setting injection pump cover in place, check again whether the thrust washer -3- is fitted on the adjustment lever shaft.
- Set injection pump cover in place with new gasket, insert adjustment lever into bearing bush in the process.



- -> Engage the idling speed tension spring -arrow- (e.g. using a wire hook fashioned for this purpose). Do not over-stretch the spring in the process.



- Tighten pump cover.



- -> Insert fuel quantity adjustment screw using new O-ring=>Page 48 and turn in until the lock nut is in contact with the pump cover.
- Install return spring and adjuster lever shaft with load impact damping =>Page 39 .
- Let engine run warm.
- Adjust basic setting of residual fuel quantity =>Page 20 .
- Check idling speed and cutoff speed and adjust as necessary => Page 18
- Check exhaust gas opacity using V.A.G 1500 combustion tester:

=> Maintenance Manual

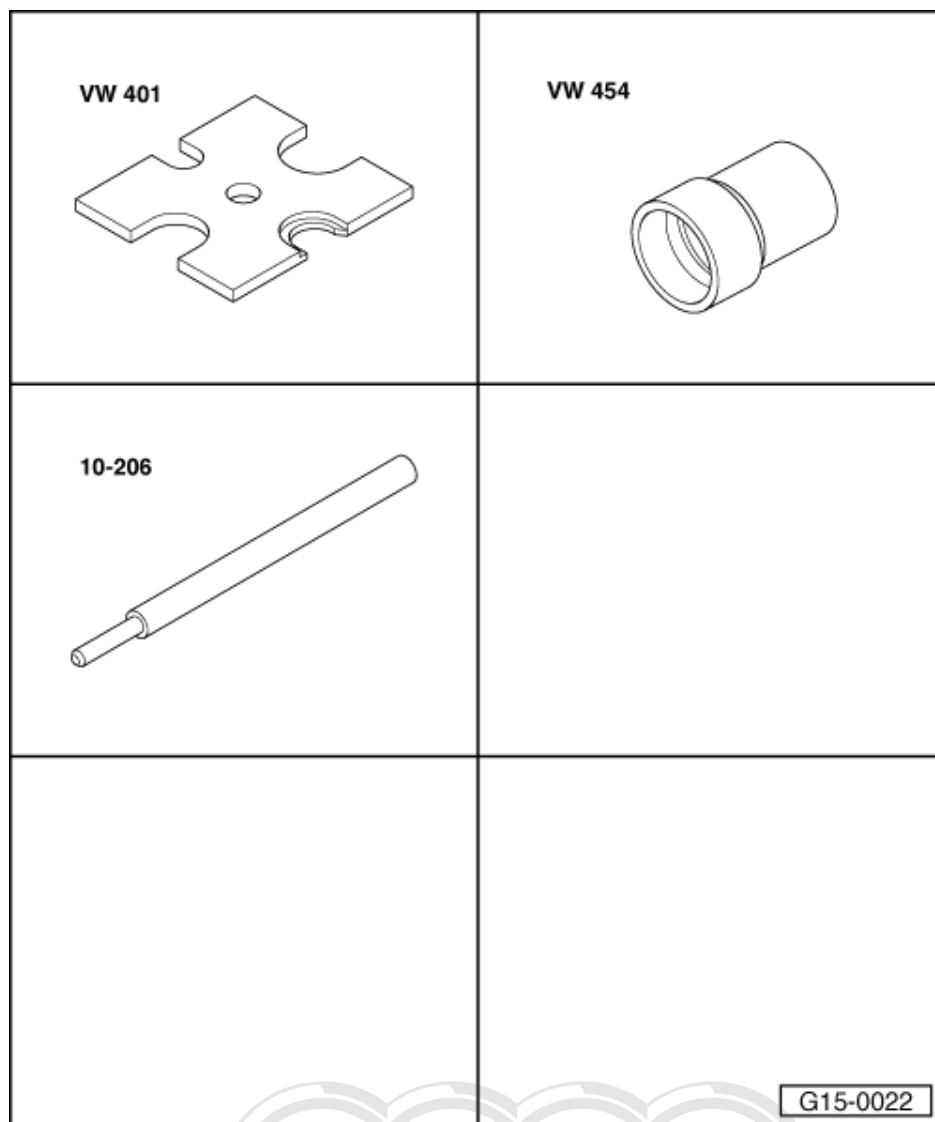
Tightening torque

Component	Nm
Pump cover to pump	10



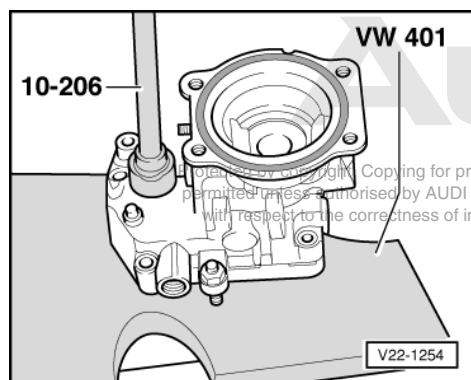
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2.4 - Replacing bearing bush for adjustment lever in injection pump cover



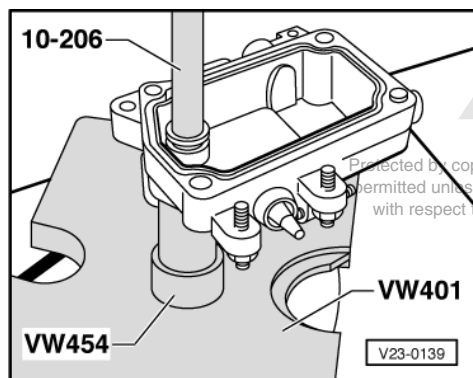
Special tools and workshop equipment required

- ◆ Thrust plate VW 401
- ◆ Thrust pad VW 454
- ◆ Driver 10-206



Removing

- Remove the injection pump cover
=>Page 41 .
- -> Press out the bearing bush.
- Clean the pump cover.



Installing

Note:

Different bearing bushes are available depending on pump version. Select correct bearing bush according to the bush that was removed.

- -> Coat new bearing bush outside diameter with liquid locking compound "D 000 600 A2".
- Press in the bearing bush into the cover up to stop.
- Carefully remove any excess locking compound.
- Install the injection pump cover using a new gasket => Page 43 .

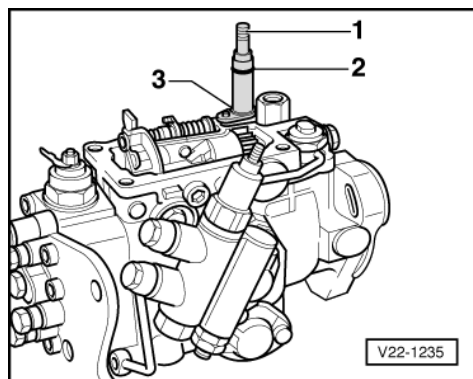
2.5 - Replace O-ring for adjustment lever shaft.

Removing

- Remove the injection pump cover
=>Page 41 .

Note:

If radial play of the adjustment lever within the injection pump cover bearing bush can clearly be felt, the adjustment lever bearing bush in the pump cover must be replaced => Page 45 .

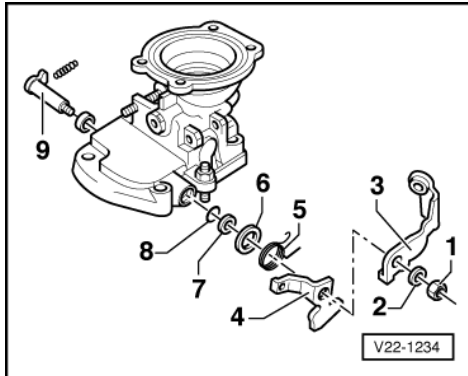


- -> Remove the adjustment lever shaft O-ring -2-.

Installing

- Fit the new O-ring on the adjustment lever shaft -1-.
- Install the injection pump cover using a new gasket => Page 43 .

2.6 - Replacing O-ring on the shaft for idling speed increase

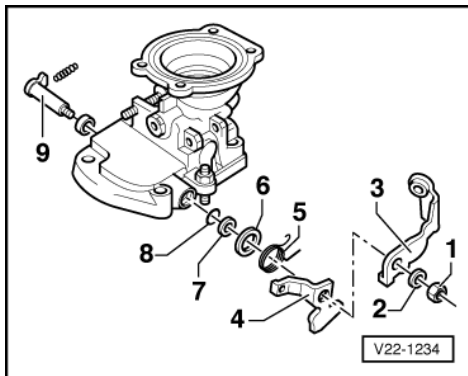


Removing

- Remove the injection pump cover
=>Page 41 .
- -> Screw out nut -1-.
- Remove the washer -2- and the idling speed intermediate lever -3-.
- Hold the idling speed adjustment lever -4- and disengage the return spring -5-.
- Remove the adjustment lever for idling speed with return spring.
- Push the shaft for idling speed -9- into the injection pump cover by a small amount and remove the spacer shim -7- and the O-ring -8- on the outside of the cover.

Note:

The contact ring -6- remains on the injection pump cover.



Installing

Installation is carried out in the reverse order; note the following:

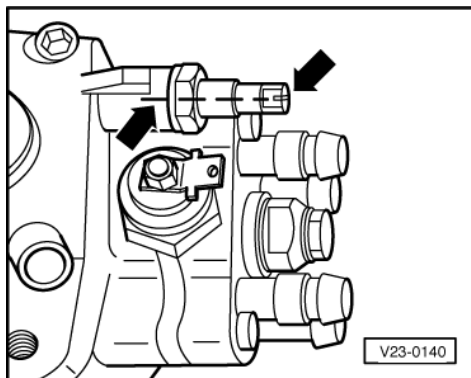
- -> Coat new O-ring -8- with diesel fuel prior to installation.
- Before installing the return spring check whether the contact ring -6- remains in place on the outside of the injection pump cover.
- Install the injection pump cover using a new gasket => Page 43 .



Tightening torque

Component	Nm
Nut to shaft for idling speed increase	5

2.7 - Replacing O-ring for fuel quantity adjustment screw.



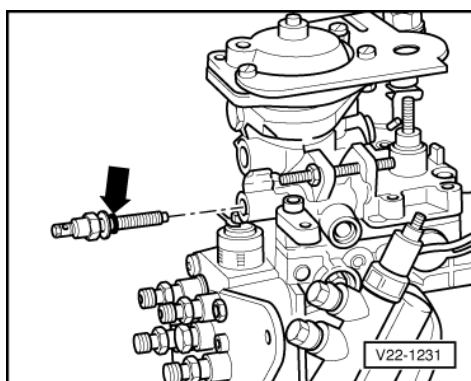
Removing

- -> Mark the position of the fuel quantity adjustment screw relative to the pump cover, e.g. screw slot to pump cover -arrows-.

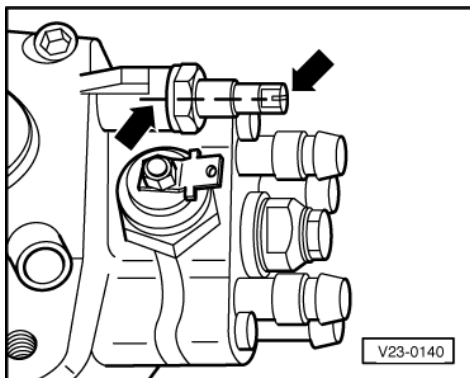
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Notes:

- ♦ Even minor changes in position of the fuel quantity adjustment screw may lead to smoke development or performance loss of the engine. For this reason it is important to obtain the identical position upon re-installation. Under no circumstances must the fuel quantity adjustment screw be turned beyond the initial position.
- ♦ The fuel quantity adjustment screw is secured by a plastic sleeve. To turn the fuel quantity adjustment screw, the plastic sleeve must be destroyed.
- Loosen lock nut, turn against the securing sleeve and unscrew the fuel quantity adjustment screw from the pump cover.



- -> Remove the old O-ring -arrow-.

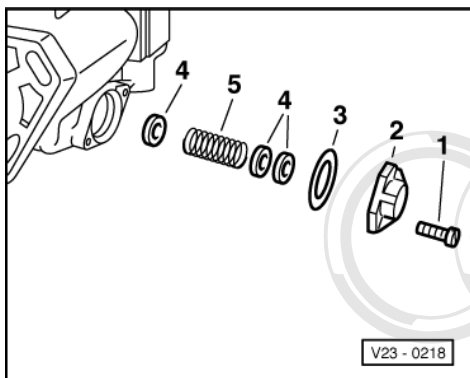


Installing

- Coat new O-ring with diesel fuel prior to installation.
- Turn the fuel quantity adjustment screw in until it makes contact with the pump cover.
- -> Then turn the fuel quantity adjustment screw back until the marks align -arrows-.
- Lock the fuel quantity adjustment screw.
- Check idling speed and cutoff speed and adjust as necessary => Page 18
- Check exhaust gas opacity using V.A.G 1500 combustion tester:

=> Maintenance Manual

2.8 - Replacing the O-ring on the front of the injection timing device cover



Removing

- Place a clean cloth beneath the injection pump.
- -> Unscrew bolts -1-.
- Remove and clean cover -2-.
- Remove the O-ring -3- from the cover.

Installing

- Install cover using the available shims -4- and spring -5-.

Note:

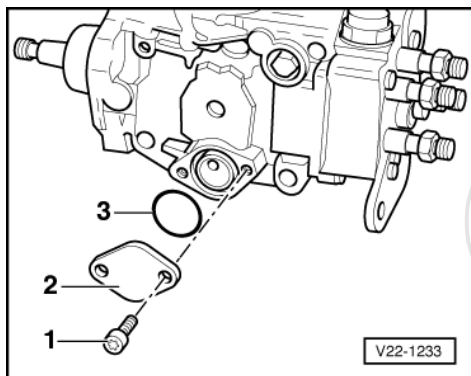
Ensure that order of shims is not changed upon installation.

Tightening torque

Component	Nm
Cover at front of injection pump	10



2.9 - Replacing the O-ring on the rear of the injection timing device cover



- Injection pump removed=>Page 6 .

Removing

- -> Unscrew bolts -1-.
- Remove and clean cover -2-.

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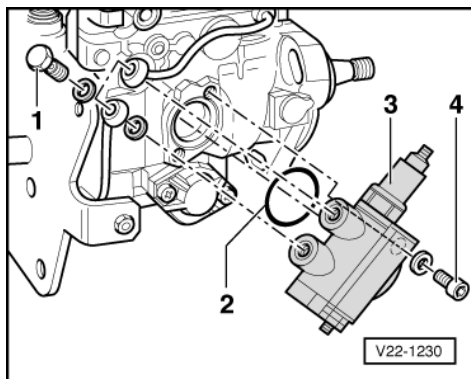
Installing

- Replace O-ring -3- and install cover.

Tightening torque

Component	Nm
Cover at rear of injection pump	10

2.10 - Replacing O-ring for cold start acceleration actuator



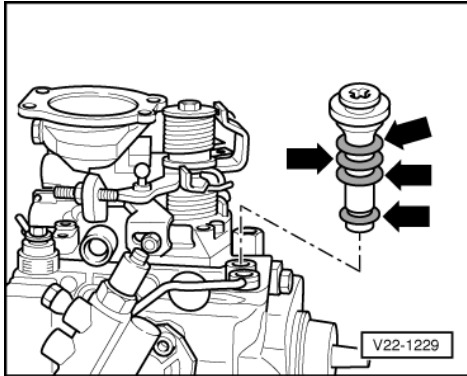
Removing

- Place a clean cloth beneath the injection pump.
- -> Loosen the banjo bolts -1- on the hydraulic lines.
- Remove bolts -4-.
- Remove the actuator -3- and clean.

Installing

- Replace O-ring -2- and install actuator.

2.11 - Replacing O-rings on the pressure control valve



- Loosen the pressure control valve using an open-ended spanner and unscrew it.
- -> Coat new O-rings -arrows- with diesel fuel prior to installation.
- Install the pressure control valve.



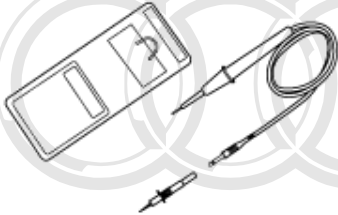
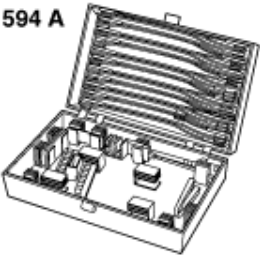
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28 - Ignition system

1 - Checking glow plug system

1.1 - Checking glow plug system

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
	G24-0006

1.2 - Checking function

Special tools and workshop equipment required

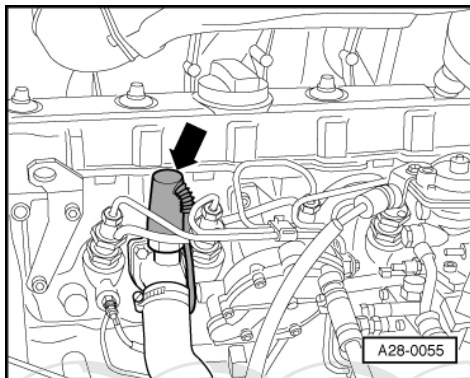
- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A

Note:

A defective glow plug system causes cold start problems, specifically if ambient temperatures are below approx +10 °C.

Test requirements:

- Battery voltage at least 12.7 V

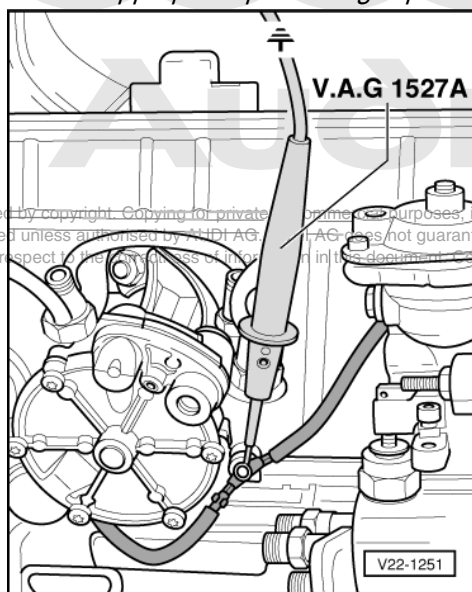


Test sequence

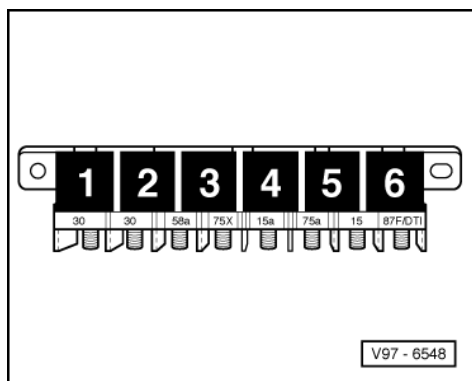
- -> Detach connector from coolant temperature sender.-G62 -arrow-

Note:

By unplugging the connector from the coolant temperature sender -G62, the "cold" engine status is simulated, and the appropriate preheating is performed when the ignition is switched on.



- -> Connect voltage tester V.A.G 1527 B on line connection of sheathed glow plug No. 5.



- Switch on the ignition (glow plug system glows).
 - -> The glow plug timer control module relay -J179 on driver's side central electrics socket position 6 must be heard and felt to respond and the LED must illuminate

Notes:

- ♦ Glow period warning lamp -K29 should illuminate during the simulated glow period.
- ♦ If the warning lamp does not illuminate, check the line connections and the glow period warning lamp -K29:

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Switch ignition off.

A - If the glow plug timer control module responds, but the LED does not illuminate:

- Check the glow plug strip fuse -S39 in the passenger side footwell electronics box.

If fuse for glow plugs OK:

- Check the wiring from relay socket terminal 30/87 via the glow plug fuse (in electronics box, plenum chamber) to the glow plugs.

A - If relay does not respond:

- Check the voltage supply and control of the glow plug timer control module for glow plugs:

=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

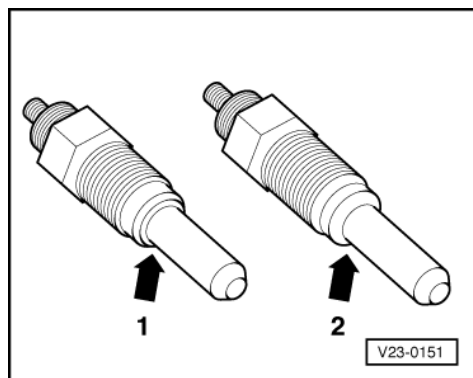
If no fault is found but the engine exhibits cold start difficulties or does not start on select cylinders at ambient temperatures below approx +10 °C:

- Check glow plugs => Page 55 .

1.3 - Removing and installing glow plugs

Removing

- To remove the cylinder 5 glow plug, unscrew the injection line on cylinder 5 => Page 21 .
- Remove the supply line and the power rail for glow plugs.
- Unscrew the glow plugs.



Installing

Installation is carried out in the reverse order; note the following:

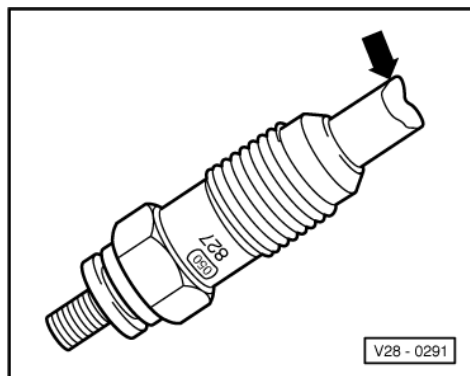
-> To ensure that the glow plugs function properly it is important to exactly maintain the specified tightening torque of 25 Nm, otherwise the ring gap between glow element and threaded piece is reduced.

- 1 - Ring gap (0.5 mm) OK.
- 2 - Ring gap reduced (glow plug not OK)

Note:

A reduced ring gap will lead to premature glow plug failure.

1.4 - Glow plugs with burnt heater elements



Burnt glow plug heater elements on glow plugs are often the result of problems with the injectors. Such types of damage are not caused by malfunctions within or on the glow plug.

-> If glow plugs damaged in this manner are found -arrow- it will not suffice to merely replace them in the case of a complaint. Testing of the injectors for pressure and leakage must also be performed => starting Page 27 .

1.5 - Checking glow plugs

- Removing glow plugs => Page 54 .
- Place the glow plug to be checked on a fireproof surface.
- Connect the terminal pin of the glow plug to the positive terminal of a charged 12 V battery.
- Connect the thread of the glow plug to the negative terminal of the battery.

Notes:

- ◆ To connect the glow plug, use wires with a minimum cross-section of 2.5 mm².
- ◆ The wires must be provided with robust connecting terminals.
- Observe the glow plug preheating process.
- Replace the glow plug if it does not glow, glows weakly or if only part of the heater element glows.
- Install the glow plugs =>Page 54 .

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