

Audi A4 1995 ➤

**TDI Injection and Glow Plug System (4-cyl.) 07.97 >
07.99**

Engine ID	AFF	AFN	AHH	AHU					
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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

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TDI Injection and Glow Plug System (4-cyl.) 07.97 > 07.99

Repair Group

01 - Self-diagnosis

23 - Mixture preparation, Injection

28 - Glow plug 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

1.2 - Technical data of self-diagnosis

Features

- ♦ Fault memory: Non-volatile and volatile memories 1) Non-volatile memory and volatile memory1).
- ♦ Rapid data transfer

1) Will be erased after the 50th engine start, if the fault has not reappeared.

Control unit identification

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Control unit version is displayed when fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 is connected and engine control unit is selected => Page 1 .

Functions which can be selected when using the V.A.G 1551 fault reader or V.A.G 1552 vehicle system tester

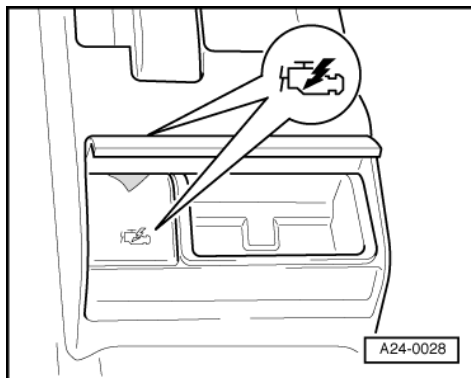
The conditions to be met when selecting the desired functions are given in the following table.

Functions on fault reader V.A.G 1551 or V.A.G 1552		Ignition on, engine stopped	Engine running at idle	Vehicle running
Address words				
01	Engine electronics	yes	yes	yes
00	Automatic test sequence	yes	yes	yes
Functions				
01	Interrogating control unit version	yes	yes	yes
02	Interrogating fault memory	yes	yes	yes
03	Final control diagnosis	no	yes	no
04	Basic setting	no	yes	yes
05	Erase fault memory	yes	yes	yes
06	End of output	yes	yes	yes
07	Encoding control unit	yes	no	no
08	Reading measured value block	yes	yes	yes

1.3 - Connecting fault reader V.A.G 1551 and selecting engine electronic control unit

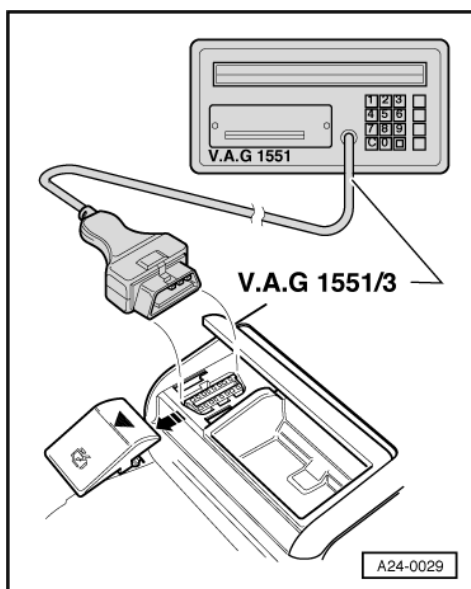
Note:

The vehicle system tester V.A.G 1552 can be used instead of the fault reader V.A.G 1551, however a print out is not possible.



Test conditions

- Battery voltage at least 11 V
 - Fuse OK
- -> Open the rear ashtray (in the centre console) and remove the cover for the diagnostic connector.



- -> Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.

-> Indicated on display:

V.A.G self diagnosis HELP
 1 - Rapid data transfer*
 2 - Flash code output*

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* Displays appear alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required:

- Switch on ignition

or

start engine => Page 1, "Selectable functions" table.

- Switch on printer using the Print button (Warning lamp in switch lights up).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

Rapid data transfer HELP
Enter address word XX

Rapid data transfer Q
01 - Engine electronics

-> Press keys 0 and 1 for address word "Engine electronics" and press the Q key to confirm entry.

-> If the display shows one of the messages, run through the fault finding procedure as described in the diagnosis management fault finding program.

Rapid data transfer HELP
No reply from control unit

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

Rapid data transfer HELP
Communication problem

Rapid data transfer HELP
K wire not switching to earth

Rapid data transfer HELP
K wire not switched to positive

-> The display on fault reader V.A.G 1551 shows the control unit identification code e.g.:

038906018.. 1.9l R4 EDC
G00SG 0203
Code 00002 WSC 12345

- 038906018.. Control unit number (see also spare parts list)
- 1.9l Engine capacity
- R4 In-line engine, 4-cylinder
- EDC Electronic Diesel Control
- G or no display Vehicle with or without cruise control
- 00 Control unit maps
- AG Automatic gearbox
- MG Manual gearbox
- 0203 Control unit software version
- Code 00002 Coding of control unit
- WSC 12345 Workshop Code from V.A.G 1551 which was used to perform the last coding

- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

1.4 - Interrogating and erasing fault memory

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.



(Connecting fault reader and selecting engine electronics control unit => Page **1** .)

Only if engine does not start:

- Interrogate fault memory with ignition switched on.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 2 for "Interrogate fault memory" function and press Q key to confirm entry.

-> The display shows the number of stored faults or "No fault detected!".

X fault(s) detected

If no fault is stored:

- Press =>key.

If one or more faults are stored:

The stored faults are displayed and printed out one after the other.

-> The display then shows the following:

Rapid data transfer	HELP
Select function XX	

- Locate and eliminate faults listed on printout as per fault table => Page **5** .
- Press keys 0 and 5 for the "Erase fault memory" function and press the Q key to confirm entry.

-> Indicated on display:

Rapid data transfer
Fault memory is erased

Note:

If the ignition is switched off between interrogating the fault memory and erasing the fault memory, then the fault memory will not be erased.

- Press =>key.

Automatic test sequence

During test- and assembly work, faults such as detached connectors may also be recognised by other control units. Therefore on completion, the fault memories of all the control units must be interrogated and erased. For this purpose:

- Press key 0 twice for the address word "Automatic test sequence" and confirm entry with the Q key. The V.A.G 1551 transmits all known address words in sequence.

If a control unit answers with its identification, the number of faults stored or "No fault detected" appears on the display.

Any system faults stored will be displayed in sequence and printed out. The V.A.G 1551 will then transmit the next address word.

-> The automatic test sequence has ended when the following appears on the display:

V.A.G - SELF-DIAGNOSIS	HELP
1 - Rapid data transfer*	
2 - Flash code output*	

- Erase all fault memories and then carry out a test run.

- Interrogate the fault memories of all control units again using the "automatic test sequence". No faults must be stored in the fault memory.

If no fault is stored:

- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
 Select function XX

- Press keys 0 and 6 for the function "End data transfer" and confirm entry with the Q key.

1.5 - Fault table

Notes:

- ◆ If faults occur in the monitored sensors and components, these are stored in the fault memory together with an indication of type of fault.
- ◆ The fault table is sorted according to the 5-digit fault code on the left.
- ◆ Sporadic faults are marked "SP" (sporadic fault) on the V.A.G 1551 display.
- ◆ If a stored fault does not appear within the next 50 engine starts, the fault code will be automatically erased.
- ◆ Before renewing components shown as being faulty, check the wiring and connectors to these components and the earth connections using the current flow diagram.

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00513 Engine speed sender -G28 Implausible signal	- Sensor disc bent or loose - -G28 defective - Open circuit in screening	- Engine will not start - Engine cuts out - Glow plug warning lamp flashes	- Remove oil sump and check sensor disc - Check engine speed sensor =>Page 72
No signal	- -G28 defective - Open circuit or short circuit		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00519 Intake manifold pressure sender -G71 Short to positive	- Open circuit or short circuit - -G71 defective	- Loss of power	- Check intake manifold pressure sender => 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 21; Check boost pressure system; Check intake manifold pressure sender
Open circuit/short circuit to earth	- Open circuit - -G71 defective		
Voltage supply	- Open circuit or short circuit		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00522 Coolant temperature sender -G62			



Short to earth	- G62 defective - Short circuit to earth in wiring	- Black exhaust smoke when starting - Engine preheating not working - Glow plugs always operate for about 20 seconds.	- Test coolant temperature sensor =>Page 74 .
Open circuit / short to positive	- G62 defective - Open circuit or wiring has short circuit to positive		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00527 Intake manifold temperature sender -G72 Short to earth	- G72 defective - Short circuit to earth in wiring	- Engine preheating not working	- Check intake manifold temperature sender =>Page 75
Open circuit / short to positive	- G72 defective - Open circuit or short to positive		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00532 Power supply Implausible signal	- Control unit was connected while ignition was switched on		- Erase fault memory and continue observing vehicle
	- Open circuit or short	- Engine will not start - Engine cuts out	- Checking power supply to diesel direct- injection system =>Page 63
	- Diesel direct injection control unit -J248 defective		- Replace control unit =>Page 62

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00539 Fuel temperature sender - G81 Short to earth	- G81 defective - Short circuit to earth in wiring	- Reduced power	- Check fuel temperature sensor =>Page 70
Open circuit / short to positive	- G81 defective - Open circuit or short to positive		
	- Plug for injection pump disconnected	- Several faults stored - Engine cuts out	- Check connector for injection pump

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00542 Needle lift sensor -G80 Short to earth	- G80 defective	- Fault lamp lights up	- Checking needle lift sensor =>Page 73
Open circuit / short to positive	- Open circuit or short circuit	- Engine running rough - Reduced power	
	- Sporadic open circuit (break in wiring)	- Misfiring, bucking	

Implausible signal	- Fuel supply is/was interrupted tank empty, supply pipe or filter blocked, air entering fuel system	- Fault 00550 control of commencement of injection/control difference may be recorded - Misfiring, bucking	- Check fuel system
	- (Sporadic) open circuit in wiring to fuel cut off valve	- Engine cuts out - Misfiring	- Check wiring and plug connections to injection pump

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00542 Needle lift sensor -G80 Implausible signal	- Sensor disc in engine speed sensor is bent or loose	- Misfiring at exactly 3000 rpm	- Remove oil sump and check sensor disc
	- -G80 defective	- Misfiring, jolting (especially at high engine speeds)	- Replace the needle lift sensor
	- Injection pump defective	- Fault 01268 recorded (regulating difference in metering control) - Engine running rough, misfiring - No throttle response after overrun	- Replace the injection pump

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00545 Engine/gearbox electrical connection	- Open circuit or short circuit	- Gearshift stiffer than normal	- Check gear shift signal => Page 85
00550 Injection start control Control difference	- Start of delivery not OK	- Loss of power at high engine speeds - Engine difficult to start	- Check and adjust injection start =>Page 50
	- Injection pump control range blocked (dirt, metal particles)	- Loss of power at high engine speeds	- Check and adjust injection timing range =>Page 67
	- Engine has stalled (within the last 50 starts)		- Erase fault memory and continue to monitor vehicle

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00550 Injection start control Control difference	- Fuel supply is/was interrupted tank empty, supply pipe or filter blocked, air entering fuel system	- Fault 00542 (implausible signal for needle lift sensor) may be recorded	- Check fuel system
	- Open circuit in wiring to injection start valve -N108	- Engine knocks when idling because injection start is always advanced	- Check valve for commencement of injection => Page 68
		- Several faults may be recorded	- Check fuse



	- -N108 valve for commencement of injection is worn	- No constant injection start in "Default setting" (value in display zone 2 fluctuates but stays above 10) - Irregular engine operation, loss of power	- Fit new injection start valve
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V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00553 Air mass meter -G70 Implausible signal	- Engine has stalled (within the last 50 starts)		- Erase fault memory and continue to monitor vehicle
	- Sporadic open circuit in wiring (cable break) to -G80 needle lift sensor	- Misfiring, bucking - Possibility of fault 00542 (needle lift sensor - open circuit/short to positive)	- Checking needle lift sensor =>Page 73
	- Air cleaner blocked - Vacuum hose system for exhaust gas recirculation incorrectly connected, or mechanical exhaust gas recirculation valve is constantly open	- Rough idling, loss of power	- Check intake system Check vacuum hoses => 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 26; Check exhaust gas recirculation system; Check exhaust gas recirculation system; Check exhaust gas recirculation
	- Air mass meter defective	- Loss of power, bucking	- Test air mass meter =>Page 82

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00553 Air mass meter -G70			- Test air mass meter =>Page 82
Open circuit/short circuit to earth	- -G70 defective - Open circuit or short circuit to earth	- Reduced power - Possibility of black smoke when accelerating from low engine speeds	
Short to positive	- -G70 defective - Open circuit or short to positive - Hose between turbocharger and intake manifold is leaking or has burst		
Voltage supply	- Open circuit or short circuit		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00575 Intake manifold pressure			

Control difference	- Hoses wrongly connected, not connected, blocked or leaking - Vacuum unit for turbocharger defective - Boost pressure limitation solenoid valve -N75 defective	- Sudden loss of power - Reduced power	- Test boost pressure => 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 21; Check boost pressure system; Check boost pressure Check boost pressure system; Check boost pressure
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V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00625 Vehicle speed signal Implausible signal	- Open circuit between speedometer sensor -G22 and dash panel insert - -G22 defective - Speedometer -G21 defective - Open circuit between dash panel insert and engine control unit	- Cruise control system not working - Air conditioner not working - Possibility of load change jolts	- Check speed signal => Page 89 - Test speedometer sensor => Electrical System; Repair group 90; Fittings, instruments Fittings, instruments
00626 Glow period warning lamp -K29 Open circuit/short circuit to earth	- Open circuit - Bulb defective - Short to earth	- Pre-glow warning system not working - Glow period warning lamp permanently lit	- Check glow plug warning lamp => Page 93
Short to positive	- Short to positive	- Pre-glow warning system not working	

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00668 Electrical system voltage terminal 30 Implausible signal	- Relay for diesel direct injection system -J322 sticking	- Engine will not start (safety cut out)	- Check power supply for diesel direct injection system =>Page 63
00671 CCS switch -E45 Undefined switch position	- -E45 switch for CCS defective - Open circuit or short circuit	- Cruise control system switched off	- Test cruise control system => Electrical System; Repair group 01; Self-diagnosis; Self-diagnosis for the cruise control system (CCS) - diesel engine- Self-diagnosis; Self-diagnosis for the cruise control system (CCS) - diesel engine-

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00741 Brake pedal monitoring			



Implausible signal	- Switch incorrectly set - Open circuit - Brake light switch -F defective - Fuse defective - Both brake lights defective	- No throttle response at times, complete loss of power - Glow plug warning lamp flashes	- Test and adjust brake light switch =>Page 76 - Check brake light
00765 Modulating piston movement sender -G149	- Plug for injection pump disconnected - Injection pump defective - Open circuit or short circuit	- Several faults stored - Engine cuts out - Engine running problems - Engine cuts out	- Check connector for injection pump - Test modulating piston movement sender =>Page 79

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
00777 Accelerator position sender -G79			
Implausible signal	- Open circuit - -G79 defective (idling speed switch)	- Safety speed regulation at approx. 1100 rpm - No throttle response	- Checking accelerator position sender
Short to positive	- Open circuit or short circuit to positive - -G79 defective		=> 4-cyl. Diesel Direct Injection System (TDI) Mechanical Components; Repair group 20; Check accelerator position sender -G79; Vehicles with 4-cyl. engine
Voltage supply	- Open circuit or short circuit		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01028 Blower relay -J323			
Open circuit/short circuit to earth	- Open circuit - Relay defective	- Radiator fan run-on not working	- Checking wiring
	- Short to earth	- Radiator fan permanently on	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
Short to positive	- Short to positive	- Radiator fan run-on not working	

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01044 Control unit incorrectly encoded	- Invalid control unit coding	- Glow plug warning lamp flashes	- Encoding control unit =>Page 19
01117 Load signal for DF alternator terminal			

Implausible signal	- Open circuit or short	- Engine preheating not working	- Checking wiring => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
01180 Electrical connection for engine / air conditioner compressor shutoff Short to positive	- Short in the line connection	- Reduced acceleration when air conditioner is on	- Check air conditioner compressor shutoff =>Page 87

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01193 Low heating output relay 01194 High heating output relay Open circuit/short circuit to earth	- Open circuit - -J359 low heating output relay or -J360 high heating output relay defective - Short to earth	- Engine preheating not working - Engine pre heating stays on constantly	- Checking wiring => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
Short to positive	- Short to positive	- Engine preheating not working	

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01237 -N109 fuel cut-off valve Mechanical fault	- -N109 defective, leaking or sticking	- Reduced power - Engine cuts out	- Check fuel cut-off valve =>Page 13 final control diagnosis
Open circuit/short circuit to earth	- -N109 defective - Open circuit or short circuit to earth	- Engine cuts out	- Checking wiring => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

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V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01262 Boost pressure limitation solenoid valve -N75 Open circuit/short circuit to earth	- Open circuit - Solenoid valve defective - Short to earth	- Reduced power - Boost pressure too low - Reduced power - Boost pressure too high	- Test boost pressure control solenoid valve => 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 21; Check boost pressure system; Check solenoid valve for boost pressure control
Short to positive	- Short to positive	- Reduced power - Boost pressure too low	

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
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01265 EGR valve -N18 Open circuit/short circuit to earth	- Open circuit - Solenoid valve defective	- No exhaust gas recirculation	- Testing exhaust gas recirculation valve => 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 26; Check exhaust gas recirculation system; Check exhaust gas recirculation valve
	- Short to earth	- Too much exhaust gas recirculation - Reduced power, black exhaust smoke	
Short to positive	- Short to positive	- No exhaust gas recirculation	

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01266 Glow plug relay -J52 Open circuit/short circuit to earth	- Open circuit - Relay defective	- Glow plug system not working	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
	- Short to earth	- Glow plug system stays on constantly	
Short to positive	- Short to positive	- Glow plug system not working	
01268 Metering control -N146 Control difference	- Injection pump defective - Open circuit or short circuit	- Engine running problems - Engine cuts out	- Test quantity adjuster =>Page 79 Replace the injection pump
Lower stop value	- Quantity adjuster incorrectly set	- Engine stops (safety cut out)	
Upper stop value	- Quantity adjuster incorrectly set		

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
01269 Injection start valve -N108 Open circuit/short circuit to earth	- Open circuit (fuse) - Valve defective	- Engine knocks when idling because injection start is always advanced	- Check valve for commencement of injection => Page 68
		- Several faults may be recorded	- Check fuse
	- Short to earth	- Loss of power because commencement of injection is constantly retarded	- Check valve for commencement of injection => Page 68
Short to positive	- Short to positive	- Engine knocks when idling because injection start is always advanced	

V.A.G 1551 printout	Possible causes of fault	Possible effects	Fault remedy
17978 Engine control unit disabled			

	- Attempted tampering - Immobiliser not adapted - Immobiliser defective	- Engine starts but cuts out again immediately	- Adapt electronic immobiliser to engine control unit => Electrical system; Repair group 01; Self-diagnosis; Self-diagnosis for the immobiliser; Adaption after changing the engine control unit
65535 Control unit defective	- Internal fault in control unit	- Engine running problems - Engine cuts out	- Replace control unit =>Page 62

2 - Final control diagnosis

2.1 - Final control diagnosis

Test requirements for vehicles with air -conditioners

- Vehicle at room temperature (warmer than + 15 °C)
- Air conditioner switched on
- Lowest temperature and fastest fan speed selected

The final control diagnosis activates the following components in the stated order:

1. Injection start valve (N108)
2. Valve for exhaust gas recirculation (N18)

3. Air conditioner compressor cut-in

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4. Fuel cut-off valve (N109)

5. Solenoid valve for boost pressure limitation (N75)
 6. Glow plug relay (J52)
 7. Pre-glow time warning lamp (K29)
 8. Low heating output relay (J359)
(vehicles with manual gearboxes only)
 9. High heating output relay (J360)
(vehicles with manual gearboxes only)
 10. Blower relay (J323)
(only vehicles with engine code AFN)
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page **1** .)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 3 for "Final control diagnosis" function

-> Indicated on display:



Rapid data transfer Q
03 - Final control diagnosis

- Confirm input with Q key.

-> Indicated on display:

Final control diagnosis
Injection start valve N108

Valve actuation has a considerable effect on combustion noise (pre ignition).

If no change in the combustion noise is heard:

- Check the injection timing control range
=>Page 67 .
- Press =>key.

-> Indicated on display:

Final control diagnosis
EGR valve -N18

The injector valve should click.

Notes:

- ♦ Due to the engine noise, the clicking of the valve is not audible and therefore may only be detected by feeling.
- ♦ The piston movement of the mechanical exhaust gas recirculation valve is clearly visible in the side slot.

If the injector does not click:

- Testing exhaust gas recirculation valve

=> 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 26; Check exhaust gas recirculation system; Check exhaust gas recirculation valve Check exhaust gas recirculation system Check exhaust gas recirculation valve

- Press =>key.

-> Indicated on display:

Final control diagnosis
Air conditioner compressor cut-in

Check the air conditioner compressor shutoff.

This test step is also invoked for vehicles without air conditioners.

The conditioner compressor must stop within 5 secs. (visual check) then start approx. every 5 secs. and then stop again.

If the conditioner compressor is not switched off:

- Checking the air conditioner compressor shutoff
=>Page 87 .
- Press =>key.

-> Indicated on display:

Final control diagnosis
-N109 fuel cut-off valve

The engine must stop.

If the engine does not stop:

- Switch ignition off.

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- Unscrew the fuel cut-off valve and remove any metallic parts or dirt
- Repeat final control diagnosis and if the engine will still not stop, replace the fuel cut off valve.
- Press ⇒key.

-> Indicated on display:

Final control diagnosis
Boost pressure limit. solenoid valve -
N75

The solenoid valve must click.

Note:

The clicking of the valve is difficult to hear and is therefore best checked by touch.

If the solenoid valve does not click:

- Test boost pressure control solenoid valve

=> 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 21; Check boost pressure system; Check solenoid valve for boost pressure control Check boost pressure system Check solenoid valve for boost pressure control

- Press ⇒key.

-> Indicated on display:

Final control diagnosis
Glow plug relay -J52

The relay must click.

Fitting location: Central electrics, relay position 4

Due to the high current consumption, the switching on and off of the relay may also be observed from the interior light becoming brighter and darker.

If the relay does not click:

- Check the glow plug relay:

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

- Press ⇒key.

-> Indicated on display:

Final control diagnosis
Glow period warning lamp -K29

The warning lamp must blink.

Warning lamp does not blink:

- Check glow plug warning lamp => Page 93
- Press ⇒key.

-> Indicated on display:

Final control diagnosis
Low heating output relay (J359)

(vehicles with manual gearboxes only)

The relay must click.

Fitting location: Electronics box in the plenum chamber



If the relay does not click:

- Test low heating output relay:

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

- Press =>key.

-> Indicated on display:

Final control diagnosis
-J360 high heating output relay

(vehicles with manual gearboxes only)

The relay must click.

Fitting location: Electronics box in the plenum chamber

If the relay does not click:

- Test high heating output relay

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

- Press =>key.

-> Indicated on display:

Final control diagnosis
Blower relay -J323

The radiator fan should come on and then switch off again.
(only vehicles with engine code AFN)

Note:

The radiator fan may also be activated by the thermostwitch, the automatic gearbox or the air conditioner. When performing the final control diagnosis, ensure that the fan has not been actuated for this reason.

- If necessary, allow engine to cool down.

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If the radiator fan is not activated:

- Test radiator fan actuation

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

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.

3 - Basic setting

3.1 - Basic setting

Test conditions

- Coolant temperature must be at least 80°C.
- All electrical consumers, such as the rear window heating, must be switched off.
- If the vehicle is equipped with an air conditioner, this must be switched off.
- On vehicles with an automatic gearbox, the selector lever must be in P or N.

- There must no faults stored in the fault memory => Page 3 , Interrogating fault memory.
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> Indicated on display:

Rapid data transfer
HELP

Select function XX

- Press keys 0 and 4 for function "Basic Setting" and confirm entry by pressing the Q key.

-> Indicated on display:

Basic setting
Q

Enter display group number XXX

- Press key 0 three times for "Display group number 00" and confirm entry with the Q key.

-> Indicated on display:

System in basic setting 0
Q

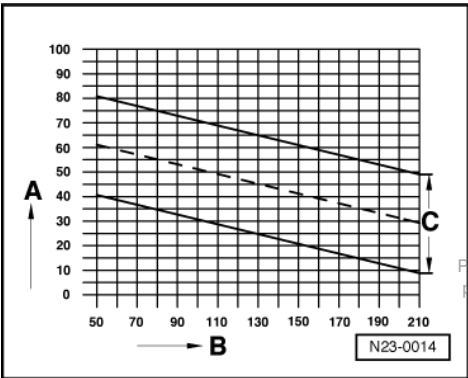
1234567

8910

Readout specification for display group 00

This display group is used for a dynamic check on the commencement of injection. The valve for the commencement of injection, -N108, is constantly actuated so that the injection timing device is "retarded"

System in basic setting 0										⇒	◀ Indicated on display
40	46	0	20	90	201	64	153	127		83	
											Ignore
											Fuel temperatureat approx. 40 °C (not reached at low outside temperatures, no specified value)
											Ignore
											Coolant temperature at approx. 90 °C
											Ignore
											Ignore
											Ignore
											Accelerator pedal position: 0
											The commencement of injection depends upon the fuel temperature (display zone 9). Specified values => 18
											Idling speed: 37 ... 42



- -> The commencement of injection in display zone 2 depends on the fuel temperature value in display zone 9.



Specified value: => Range C in illustration
A - Display zone 2 Commencement of injection
B - Display zone 9 Fuel temperature

Notes:

- ♦ If the commencement of injection is advanced, turn the injection pump in the engine's direction of rotation, if the commencement of injection is retarded, turn against the direction of rotation.
- ♦ If injection start is within specified range C when tested, no adjustment is required. After repairs, such as the removal and installation of the injection pump, the adjustment of the timing, the commencement of injection should be set to the mean valve (dashed line) in specified range -C-.

If the specified value in range -C- is not attained

- Adjust the commencement of injection => Page **50** .

Display group 03 at idling speed

This display group is used for testing the exhaust gas recirculation. The exhaust gas recirculation valve (N18) opens and closes alternately for periods of 10 seconds.

System in basic setting 3				⇒	◀ Indicated on display
860 rpm	EGR active	200 mg/stroke	99 %		
					Duty cycle (actuation) of exhaust gas recirculation valve
					Intake air mass
					Exhaust gas recirculation valve (N18) open
					Engine speed

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System in basic setting 3				⇒	◀ Indicated on display
860 rpm	EGR not active	420 mg/stroke	0 %		
					Duty cycle (actuation) of exhaust gas recirculation valve
					Intake air mass
					exhaust gas recirculation valve (N18) closed
					Engine speed

Display group 11 at idling speed

This display group is used for checking the boost pressure control. The boost pressure control solenoid valve (N75) opens and closes alternately for 10 seconds.

System in basic setting 11				⇒	◀ Indicated on display
860 rpm	on	969 mbar	0 %		
					Boost pressure control solenoid valve actuation
					Boost pressure
					Boost pressure control solenoid valve open
					Engine speed

--

System in basic setting 11				⇒	Indicated on display
860 rpm	off	948 mbar	99 %		
				Boost pressure control solenoid valve actuation	
				Boost pressure	
				Solenoid valve for boost pressure control closed	
				Engine speed	

4 - Encoding control unit

4.1 - Encoding control unit

If the appropriate code for the vehicle is not displayed or if the control unit has been replaced, the control unit must be encoded as follows.

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- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 7 for the function "Code control unit" and confirm entry with Q key.

-> Indicated on display:

Code control unit	Q
Enter code number xxxxx (0-32000)	

- Enter the appropriate code number for this vehicle and confirm with Q key.

Code number	For vehicles with
00001	Automatic Gearbox
00002	Manual gearbox (front-wheel drive)
00003	Manual gearbox (4-wheel drive)

-> The display on fault reader V.A.G 1551 will show the control unit coding, e.g.:

038906018.. 1.9l	R4	EDC
G00SG 0203		
Code 00002	WSC 12345	

- Switch the ignition off and then on again.

Note:

The next time the ignition is switched on the newly entered code will be activated.

If the ignition is not switched off and on after the correct code has been entered, it will not be possible to erase fault "01044 Control unit incorrectly coded".

- Press ⇒key.



-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.

5 - Reading measured value block

5.1 - Reading measured value block

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number XXX

- Enter the desired display group number and confirm entry with the Q key.

-> Display readout (for example):

Read measured value block 0
1 2 3 4 5 6 7
8 9 10

Display group overview

Display group no.	Indicated on display	Designation
00 General Vehicle inspection	Read measured value block 0 1 2 3 4 5 6 7 8 9 10	1 = Engine speed 2 = Injection start 3 = Accelerator pedal position 4 = Injection quantity 5 = Intake manifold pressure (boost pressure) 6 = Atmospheric pressure (ambient air pressure) 7 = Coolant temperature 8 = Intake manifold temperature 9 = Fuel temperature 10 = Intake air mass
01 Injection quantity	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Injection quantity 3 = Voltage from modulating piston movement sender -G149 4 = Coolant temperature

Display group no.	Indicated on display	Designation
02 Idling speed	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Accelerator pedal position

		3 = Operating status: X X 1 Air conditioner signal on X 1 X Idling speed switch closed 1 X X Increased idling speed: ▪ Due to request from air conditioner 1) ▪ Because acceleration and braking detected ▪ Because sheathed-element additional heater is on 4 = Coolant temperature
03 Exhaust gas recirculation system	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Intake air mass (specified) 3 = Intake air mass (actual) 4 = Duty cycle (actuation) of exhaust gas recirculation valve -N18

1) The idling speed is not increased in all control units. However, a "1" will appear in spite of this if the air conditioner request is received.

Display group no.	Indicated on display	Designation
04 Injection start	Read measured value block 4 1 2 3 4	1 = Engine speed 2 = Injection start (specified) 3 = Injection start (actual) 4 = Duty cycle (actuation) of injection start valve -N108
05 Starting conditions	Read measured value block 5 1 2 3 4	1 = Engine speed 2 = Injection quantity for starting (recorded from last start) 3 = Injection start 4 = Coolant temperature
06 Switch settings	Read measured value block 6 1 2 3 4	1 = Vehicle speed 2 = Brake pedal monitoring: Brake light switch and brake pedal switch are a joint unit X X 1 Brake light switch -F closed X 1 X Brake pedal switch open 1 X X Clutch pedal switch -F36 open

Display group no.	Indicated on display	Designation
06 Switch settings	Read measured value block 6 1 2 3 4	3 = Cruise control system (CCS) control unit: X X X X X 1 CCS on X X X X 1 X CCS switched off with memory X X X 1 X X Speed reduction X X 1 X X X Resume/accelerate X 1 X X X X Brake pedal depressed 1 X X X X X Clutch pedal depressed 4 = Operating status of the cruise control system: 0 Control unit with CCS function 1 CCS switched off 2 Accelerate 4 Decelerate 8 Resume 1 6 Brake depressed 3 2 Maintain speed 6 4 Ignore 1 2 8 Ignore



2 5 5 Control unit without CCS function

Display group no.	Indicated on display	Designation
07 Temperatures	Read measured value block 7 1 2 3 4	1 = Fuel temperature 2 = No display 3 = Intake manifold temperature 4 = Coolant temperature
08 Injection quantity limitation	Read measured value block 8 1 2 3 4	1 = Engine speed 2 = Desired injection quantity (driver's requirement via accelerator pedal) 3 = Injection quantity limitation via engine speed (torque limitation) 4 = Injection quantity limitation based on intake air mass (avoid exhaust smoke)
09 Injection quantity limitation	Read measured value block 9 1 2 3 4	1 = Engine speed 2 = Injection quantity (cruise control system activated) 3 = Injection quantity limitation by automatic gearbox during gear change 4 = Voltage from sensor for modulating piston movement

Display group no.	Indicated on display	Designation
10 Air quantities	Read measured value block 10 1 2 3 4	1 = Intake air mass 2 = Atmospheric pressure (ambient air pressure) 3 = Intake manifold pressure (boost pressure) 4 = Accelerator pedal position
11 Boost pressure control	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = Boost pressure (specified) 3 = Boost pressure (actual) 4 = Duty cycle (actuation) of boost pressure control solenoid valve -N75
12 Glow plug	Read measured value block 12 1 2 3 4	1 = Ignore display 2 = Glow time (in seconds) 3 = Supply voltage from control unit 4 = Coolant temperature

Display group no.	Indicated on display	Designation
13 Idling smooth operation	Read measured value block 13 1 2 3 4	1 = Idling difference between injection quantities for cyl. 4 and 3 2 = Idling difference between injection quantities for cyl. 2 and 3 3 = Idling difference between injection quantities for cyl. 1 and 3 4 = No display

14 Not used	Read measured value block 14	No display
15 Fuel consumption	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Injection quantity (actual) 3 = Fuel consumption 4 = Desired injection quantity (driver's requirement via accelerator pedal)

Display group no.	Indicated on display	Designation
16 Additional heater	Read measured value block 16 1 2 3 4	1 = Alternator load 2 = Additional heater switched off because: X X X X X X X 1 Coolant temperature above 70 °C ... 80 °C1) or intake air temperature above 5 °C X X X X X X 1 X Alternator defective X X X X X 1 X X Battery voltage less than 9 V X X X X 1 X X X Engine speed less than 800 rpm X X X 1 X X X X Engine started within the last 10 seconds X X 1 X X X X X Sensor for coolant temperature (G62) or Intake manifold temperature sender (G72) defective X 1 X X X X X X Ignore 1 X X X X X X X Ignore 3 = Actuation of heating elements X 1 Low heating output relay (J359) on 1 X High heating output relay (J360) on 4 = Supply voltage from control unit

1) If the intake temperature is 5 °C when the engine is started, the additional heater is switched off when a coolant temperature of 70 °C is reached. However, if the air temperature is -10°C, the heater is not switched off until the coolant temperature reaches 80 °C.

Display group no.	Indicated on display	Designation
17 Not used	Read measured value block 17	No display
18	Read measured value block 18 1 2 3 4	Ignore
19 Metering control	Read measured value block 19 1 2 3 4	1 = Lower stop value (voltage from sensor for modulating piston movement) 2 = Upper stop value (voltage from modulating piston movement sender) 3 = No display 4 = No display



5.2 - Readout specifications for general vehicle inspection

Display group 00 during idling (warm engine, coolant temperature not below +85 °C)

Engine codes: AFF, AHU, AHH, AFN

Read measured value block 0										⇒	Indicated on display
40	50	0	20	90	201	64	153	127	83		
											Intake air mass: 70...110: OK
											▪ If outside tolerance => display group 03, Page 29
											Fuel temperature: no specification
											Intake manifold temperature: no specification
											Coolant temperature: 80 ... 51: OK
											▪ Above 80 Run engine until warm
											Ambient air pressure: no specification
											Boost pressure: Ignore
											Injection quantity: 10 ... 30: OK
											▪ If outside tolerance => display group 01, Page 26
											Accelerator pedal position: 0
											Commencement of injection: 20 ... 60: OK
											▪ If outside tolerance=> display group 04, Page 27
											Idling speed: 3 7... 42: OK
											▪ If outside tolerance => display group 02, Page 28

Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine code AFF

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 0										⇒	Indicated on display
186	225	255	154	186	201	64	138	175	233		
											Intake air mass: above 210 OK
											▪ Less than 210 => display group 10, Page 32
											Fuel temperature: no specification
											Intake manifold temperature: no specification
											Coolant temperature: 80 ... 51: OK
											▪ Above 80 Run engine until warm
											Ambient air pressure: Ignore
											Boost pressure: 171 ... 191: OK
											▪ If outside tolerance => display group 11, Page 33
											Injection quantity: 145 or 158 (injection quantity at full throttle) OK
											▪ 125: Emergency injection quantity, syst. error detected => interrogate fault mem., Page 3
											Accelerator pedal: 255 (fully depressed)
											Commencement of injection: 170 ... 245 (depending on engine speed)
											▪ If outside tolerance=> display group 04, Page 27
											Engine speed: 160 ... 190 (do not exceed 4000 rpm; engine speed is controlled)

Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine codes: AHU, AHH

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 0										⇒	• Indicated on display
186	225	255	199	190	201	64	138	175	255		
											Intake air mass: above 210 OK
											▪ Less than 210 => Display group 10, Page 32
											Fuel temperature: no specification
											Intake manifold temperature: no specification
											Coolant temperature: 80 ... 51: OK
											▪ Above 80 Run engine until warm
											Ambient air pressure: Ignore
											Boost pressure: 171 ... 191: OK
											▪ If outside tolerance => display group 11, Page 33
											Injection quantity: 160-180 (injection quantity at full throttle) OK
											▪ 125: Emerg. injection quantity, syst. error detected=>interrogate fault mem., Page 3
											Accelerator pedal: 255 (fully depressed)
											Commencement of injection: 180...245 (depending on engine speed)
											▪ If outside tolerance=> display group 04, Page 27
											Engine speed: 160 ... 190 (do not exceed 4000 rpm; engine speed is controlled)

Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine code AFN

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 0										⇒	• Indicated on display
186	225	255	199	190	201	64	138	175	255		
											Intake air mass: above 240 OK
											▪ Less than 240 => Display group 10, Page 32
											Fuel temperature: no specification
											Intake manifold temperature: no specification
											Coolant temperature: 80 ... 51: OK
											▪ Above 80 Run engine until warm
											Ambient air pressure: Ignore
											Boost pressure: 180 ... 200: OK
											▪ If outside tolerance => display group 11, Page 33
											Injection quantity: 190-210 (injection quantity at full throttle) OK
											▪ 125: Emerg. injection quantity, syst. error detected=>interrogate fault mem., Page 3
											Accelerator pedal: 255 (fully depressed)
											Commencement of injection: 180 ... 245 (depending on engine speed)
											▪ If outside tolerance=> display group 04, Page 27
											Engine speed: 160 ... 190 (do not exceed 4000 rpm; engine speed is controlled)



5.3 - Readout specified values for injection pump

Display group 01 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 1			⇒	◀ Indicated on display
860 rpm	5.6 mg/stroke	1.680 V	87.3 °C	
			Coolant temperature	
			▪ 85 ... 100 °C OK	
			▪ Less than 85 °C: => Run engine until warm	
			Voltage from modulating piston movement sender -G149	
			▪ 1.250 ... 1.750 V: OK	
			▪ Less than 1.250 V Injection pump too rich => replace injection pump	
			▪ Greater than 1.750 V Engine loaded => switch off consumption units	
			Engine too cold => allow engine to warm up, see display zone 4	
			Injection pump too lean=> replace injection pump	
			Injection quantity	
			▪ 2.0 ... 9.0 mg/stroke: OK	
			▪ Less than 2.0 mg/stroke Injection pump too rich => replace injection pump	
			▪ Greater than 9.0 mg/stroke: Engine loaded => Switch off consumption units	
			Engine too cold => allow engine to warm up, see display zone 4	
			Injection pump too lean=> replace injection pump	
Engine speed			▪ 780 ... 900 rpm OK	

Display group 01 with attempted start (if engine does not start)¹⁾

Read measured value block 1			⇒	◀ Indicated on display
230 rpm	37.4 mg/stroke	2.780 V	14.3 °C	
			Coolant temperature	
			Voltage from modulating piston movement sender G149	
			(quantity adjuster returns modulating piston position to control unit)	
			▪ Periodic voltage increases: okay (pump is injecting)	
			▪ Less than 1.000 V Metering control closed => observe display zone 2, only if specified injection quantity okay => replace injection pump	
			Specified injection quantity (control unit actuating metering control in injection pump)	
			▪ Periodic injection quantity increases: okay (pump is being activated)	
			▪ 0.0 mg/stroke System fault => interrogate fault memory, Page 3	
Engine speed				

1) If the electrical system voltage falls below 10.8 V during the attempted start, the V.A.G 1551 fault reader will abort the diagnosis.

Display group 19 with ignition on

Read measured value block 19			⇒	◀ Indicated on display
0.780 V	4.350 V			

			No display
			No display
		Voltage at sensor for modulating piston movement with metering control at maximum stop	
		▪ 4.150 ... 4.720 V: OK	
		▪ If outside tolerance: Check contact resistance in wiring => Page 80	
		Metering control in injection pump incorrectly set=> replace injection pump	
		Voltage at sensor for modulating piston movement with metering control at minimum stop	
		▪ 0.500 ... 0.970 V: OK	
		▪ If outside tolerance: Check contact resistance in wiring => Page 80	
		Metering control in injection pump incorrectly set=> replace injection pump	

Display group 04 during idling (warm engine, coolant temperature not below +85 °C)

Read measured value block 4				⇒	▪ Indicated on display
860 rpm	0.9 °BTDC	0.9 °BTDC	23 %		
					Duty cycle (actuation) of injection start valve
					▪ no specification
					Current actual commencement of injection
					▪ 2°ATDC -4°BDTC: OK
					▪ later 2°ATDC: Injection timing control stuck
					Injection start valve defective
					Injection pump set at extremely retarded position
					=> Check injection timing range, Page 67
					Injection start specified by control unit
					▪ 2°ATDC -4°BDTC: OK
					Engine speed
					▪ 780 ... 900 rpm OK

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Display group 04 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 4				⇒	▪ Indicated on display
4060 rpm	16.3 °BTDC	16.1 °BTDC	84 %		
					Duty cycle (actuation) of injection start valve
					▪ No specification
					Current injection start
					▪ As specified commencement of injection in display zone 2
					▪ (tolerance ±2°): OK
					▪ If outside tolerance: Injection pump delivery start incorrect
					=> check injection start, Page 67
					Injection start specified by control unit
					▪ 14 ... 18 °BTDC: OK
					Engine speed
					▪ 3800 ... 4200 rpm: OK



5.4 - Readout specifications for engine idling speed

Display group 02 during idling (warm engine, coolant temperature not below +85°C)

Read measured value block 2			⇒	◀ Indicated on display
860 rpm	0.0 %	0 1 0	88.4 °C	
				Coolant temperature ▪ 85 ... 100 °C OK ▪ Less than 85 °C: => Run engine until warm
				Operating status ▪ XX1: Air conditioner signal=> switch off air conditioner ▪ X1X: Okay (idling speed switch closed) ▪ 1XX: Idling speed high because air conditioner switched on => switch off air conditioner
				Acceleration and braking detected => Check brake pedal switch
				Accelerator pedal position ▪ 0.0 %: OK ▪ Greater than 0.0% Sensor for accelerator pedal position incorrectly set or defective => adjust
				Engine speed ▪ 780 ... 900 rpm: OK

Display group 13 during idling (warm engine, coolant temperature not below +85°C)

Read measured value block 13			⇒	◀ Indicated on display
0.82 mg/stroke	-0.12 mg/stroke	0.49 mg/stroke		
				No display
				Difference between injection quantities for cylinders 4/2/1 and cyl. 3 ▪ -1.5 mg/stroke...+1.5 mg/stroke: OK ▪ All display zones too high: cylinder 3 strong ▪ All display zones too low: cylinder 3 weak
				Difference between injection quantities for cylinder 1 and cylinder 3 ▪ -1.5 mg/stroke...+1.5 mg/stroke: OK ▪ Greater than +1.5 mg/stroke: cylinder 1 weak ▪ Less than -1.5 mg/stroke; cylinder 1 strong
				Difference between injection quantities for cylinder 2 and cylinder 3 ▪ -1.5 mg/stroke...+1.5 mg/stroke: OK ▪ Greater than +1.5 mg/stroke: cylinder 2 weak ▪ Less than -1.5 mg/stroke; cylinder 2 strong
				Difference between injection quantities for cylinder 4 and cylinder 3 ▪ -1.5 mg/stroke...+1.5 mg/stroke: OK ▪ Greater than +1.5 mg/stroke: cylinder 4 weak ▪ Less than -1.5 mg/stroke; cylinder 4 strong

Notes on display group 13:

- ♦ The injection system is equipped with an idling speed smooth running control function. There may be power differences between the individual cylinders (component tolerances, injector delivery rate, compression etc.) which are recognised and equalised by means of selective injected quantities during idling.
- ♦ The recognition at idling speed is performed using the signal from the engine-speed sensor which delivers four signals per crankshaft revolution to the control unit. If the signals are delivered at the same rate then all the cylinders are performing equally. If one cylinder is weaker, then the crankshaft will require longer for the next half crankshaft revolution. Conversely, a more powerful cylinder accelerates the crankshaft, ensuring that less time is taken. Conversely, a more powerful cylinder accelerates the crankshaft, meaning that less time is taken.
- ♦ If the control unit detects a difference, the relevant cylinder is injected with more or less fuel until the engine is running evenly again.
- ♦ Using No. 3 cylinder as a reference, the measured value block displays the injected quantity adjustments that are required for the individual cylinders in order to attain an even engine idling speed.
- ♦ +... mg/stroke: The cylinder in question is less powerful than cylinder No. 3 and is therefore supplied with more fuel.
- ♦ -... mg/stroke: The respective cylinder is more powerful than No. 3 cylinder and is therefore supplied with less fuel.

5.5 - Readout specifications for exhaust gas recirculation

Display group 03 during idling (warm engine, coolant temperature not below +85°C)

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Read measured value block 3		⇒	◀ Indicated on display
860 rpm	290 mg/stroke	308 mg/stroke	54 %
		Duty cycle (actuation) of exhaust gas recirculation valve	
		▪ No specification	
		Actual intake air mass	
		▪ As specified air mass in display zone 2 (tolerance ±20 mg/stroke: OK	
		▪ Air mass too small: Unmetered air in intake area	
		Excessive exhaust gas recirculation => check	
		▪ Air mass too great: insufficient exhaust gas recirculation => check	
		Engine idling for 10 minutes=> give brief burst of throttle	
		▪ Constant 425 mg/stroke: substitute value for 66 kW vehicles	
		▪ Constant 550 mg/stroke: substitute value for 81 kW vehicles	
		=> interrogate fault memory	
		Air mass specified by control unit	
		▪ 230 - 370 mg/stroke: OK	
		▪ Greater than 370 mg/stroke: Engine too cold => run until warm	
		Injection quantity too high=> readout specifications for injection pump	
		Intake manifold temperature very high=> no correction possible	
Engine speed			
▪ 780 ... 900 rpm OK			

5.6 - Readout specifications for temperature senders

Display group 07 with ignition switched on (engine cold and not running)

--



Read measured value block 7 ➔			Indicated on display
15.4 °C	15.9 °C	16.7 °C	
			Coolant temperature (at G62 coolant temperature sensor) ▪ In the event of an open circuit, the approximate fuel temperature (display zone 1) will be displayed as a substitute value, check sensor => Page 74
			Intake manifold temperature (at intake manifold temperature sender -G72) ▪ In the event of an open circuit, a constant 136.8 °C is displayed as a substitute value, check sensor => Page 75
		No display	
			Fuel temperature (at fuel temperature sender -G81) ▪ In the event of an open circuit, a constant 5.4 °C is displayed as a substitute value, check sensor =>Page 70 .

Notes:

- ♦ No specifications can be given for temperature values.
- ♦ When the engine is cold, the fuel, intake manifold and coolant temperatures should be approximately the same as the ambient temperature. If one of the temperature readings differs noticeably, the sender in question should be checked.

5.7 - Readout specifications for vehicle performance

Display group 08 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine code AFF

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 8			➔	Indicated on display
3990 rpm	38.4 mg/stroke	31.0 mg/stroke	35.7 mg/stroke	
				Injection quantity limitation according to recognised air mass greater than 35 mg/stroke: OK ▪ Less than 35 mg/stroke detected air mass insufficient => Test air mass meter, Page 82 Check exhaust gas recirculation at full throttle=>
				Injection quantity limitation according to engine speed (torque limitation) 29.0 - 31.5 mg/stroke OK ▪ Less than 29.0 mg/stroke engine speed too high or too low ▪ Greater than 31.5 mg/stroke: increase in injection quantity as a result of tuning

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	Desired injection quantity (accelerator pedal position) greater than 36 mg/stroke OK ▪ Less than 36 mg/stroke accelerator pedal not fully depressed, incorrectly adjusted or defective, check => 4-cyl. Diesel Direct Injection System (TDI) Mechanical Components; Repair group 20; Check accelerator position sender G79; Vehicles with 4-cylinder engine Check accelerator position sender G79; Vehicles with 4-cylinder engine
Engine speed, 2800 ... 4000 rpm OK	

Display group 08 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine codes: AHU, AHH

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 8			⇒	◀ Indicated on display
3990 rpm	38.4 mg/stroke	35.0 mg/stroke	35.7 mg/stroke	
			Injection quantity limitation according to recognised air mass greater than 35 mg/stroke: OK	
			▪ Less than 35 mg/stroke detected air mass insufficient => Test air mass meter, Page 82	
			Check exhaust gas recirculation at full throttle =>	
			Injection quantity limitation according to engine speed (torque limitation) 34.2 - 36.5 mg/stroke: OK	
			▪ Less than 34.2 mg/stroke engine speed too high or too low ▪ Greater than 36.5 mg/stroke: increase in injection quantity as a result of tuning	
Desired injection quantity (accelerator pedal position) greater than 36 mg/stroke OK				
▪ Less than 36 mg/stroke accelerator pedal not fully depressed, incorrectly adjusted or defective, check => 4-cyl. Diesel Direct Injection System (TDI) Mechanical Components; Repair group 20; Check accelerator position sender G79; Vehicles with 4-cylinder engine Check accelerator position sender G79; Vehicles with 4-cylinder engine				
Engine speed, 2800...4000 rpm OK				

Display group 08 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine code AFN

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 8		⇒	◀ Indicated on display
3990 rpm	43.4 mg/stroke	40.4 mg/stroke	42.0 mg/stroke



			Injection quantity limitation according to recognised air mass greater than 40 mg/stroke: OK ▪ Less than 40 mg/stroke detected air mass insufficient => Test air mass meter, Page 82 Check exhaust gas recirculation at full throttle=> Injection quantity limitation according to engine speed (torque limitation) 38.0 - 43.5 mg/stroke: OK ▪ Less than 38.0 mg/stroke engine speed too high or too low ▪ Greater than 43.5 mg/stroke: increase in injection quantity as a result of tuning Desired injection quantity (accelerator pedal position) greater than 42 mg/stroke OK ▪ Less than 42 mg/stroke accelerator pedal not fully depressed, incorrectly adjusted or defective, check => 4-cyl. Diesel Direct Injection System (TDI) Mechanical Components; Repair group 20; Check accelerator position sender G79; vehicles with 4-cylinder engine Check accelerator position sender G79; vehicles with 4-cylinder engine
Engine speed, 2800 ... 4000 rpm OK			

Display group 10 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine codes: AFF, AHU, AHH

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 10 830 mg/stroke 1030 mbar 1968 mbar 100 %		=>	▪ Indicated on display
			Accelerator pedal position: 100 %: OK ▪ Less than 100%: accelerator pedal not fully depressed -G79 sensor for accelerator position incorrectly adjusted or defective => check => 4-cyl. Diesel Direct Injection System (TDI) Mechanical Components; Repair group 20; Check accelerator position sender G79; vehicles with 4-cylinder engine Check accelerator position sender G79; vehicles with 4-cylinder engine Current boost pressure: 1800 ... 2050 mbar OK If outside tolerance: boost pressure control defective => display group 11, Page 33 Current air pressure: no specification Intake air mass: 750 ... 850 mg/stroke: OK ▪ Less than 750 mg/stroke Engine speed below 2000 rpm or above 4000 rpm Boost pressure too low, observe display zone 3 =>Page 29 Unmetered air between air mass meter and turbocharger Air mass meter defective

Display group 10 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine code AFN

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives=> Page 35 .

Read measured value block 10				⇒	◀ Indicated on display
963 mg/stroke	1030 mbar	1968 mbar	100 %		
					Accelerator pedal position: 100 %: OK ▪ Less than 100%: accelerator pedal not fully depressed -G79 sensor for accelerator position incorrectly adjusted or defective => check => 4-cyl. Diesel Direct Injection System (TDI) Mechanical Components; Repair group 20; Check accelerator position sender -G79; Vehicles with 4-cylinder engine Check accelerator position sender -G79; Vehicles with 4-cylinder engine
					Current boost pressure: 1800...2250 mbar okay If outside tolerance: boost pressure control defective => display group 11, Page 33
					Current air pressure: no specification
					Intake air mass: 800...1100 mg/stroke: OK ▪ Less than 800 mg/stroke Engine speed below 2000 rpm or above 4000 rpm Boost pressure too low => observe display zone 3 Unmetered air between air mass meter and turbocharger Air mass meter defective

5.8 - Readout specifications for boost pressure control

Display group 11 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine codes: AFF, AHU, AHH

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 11				⇒	◀ Indicated on display
3340 rpm	1830 mbar	1850 mbar		57 %	
					Duty cycle (actuation) of boost pressure control solenoid valve -N75 Current boost pressure ▪ As specified boost pressure in display zone 2 (tolerance ±100 mbar): OK ▪ Boost pressure too low: no boost pressure control => check boost pressure ▪ Boost pressure too high: solenoid valve -N75 jamming Pressure hose for boost pressure control detached or blocked Vacuum unit defective => check boost pressure => 4-cyl. Diesel Direct Injection System (TDI), Mechanical Components; Repair group 21; Check boost pressure system; Check solenoid valve for boost pressure control Check boost pressure system; Check solenoid valve for boost pressure control



	Boost pressure specified by control unit ▪ 1800 - 2050 mbar OK ▪ Over 2050 mbar: boost pressure increased as a result of tuning
Engine speed, 2900 ... 4000 rpm OK	

Display group 11 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- Engine code AFN

Important: The fault reader must be secured on the rear seat and operated from this position. Observe the safety precautions applicable to test drives => Page 35 .

Read measured value block 11		⇒	◀ Indicated on display
3340 rpm 1948 mbar 1917 mbar		57 %	
			Duty cycle (actuation) of boost pressure control solenoid valve -N75
			Current boost pressure ▪ As specified boost pressure in display zone 2 (tolerance ± 100 mbar): OK ▪ Boost pressure too low: no boost pressure control => check ▪ Boost pressure too high: solenoid valve -N75 jamming Pressure hose for boost pressure control detached or blocked Vacuum unit defective => check boost pressure => 4-cyl. Diesel Direct Injection System (TDI); Mechanical Components; Repair group 21; Check boost pressure system; Check solenoid valve for boost pressure control Check boost pressure system; Check solenoid valve for boost pressure control
			Boost pressure specified by control unit ▪ 1800 ... 2250 mbar OK ▪ Greater than 250 mbar boost pressure increased as a result of tuning
Engine speed, 2900 ... 4000 rpm OK			

23 - Mixture preparation, Injection

1 - Servicing diesel direct injection system

1.1 - Servicing diesel direct injection system

1.2 - Safety precautions

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

- ◆ Switch off the ignition before connecting or disconnecting injection or glow plug system wiring or tester cables.
- ◆ If the engine is to be operated at starting speed without starting, e.g. for checking compression, pull the connector off the injection pump.
- ◆ For radios with anti-theft coding, ask for code before disconnecting battery.
- ◆ Only disconnect and connect the battery with the ignition switched off, otherwise the diesel direct injection system control unit may be damaged.

Note the following points if testers and measuring instruments have to be used during a road test:

- ◆ Testers and measuring instruments must always be secured to the rear seat and operated by a 2nd person from this location.

If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.

Important:
Secure fault reader to the rear seat and operate from this location.

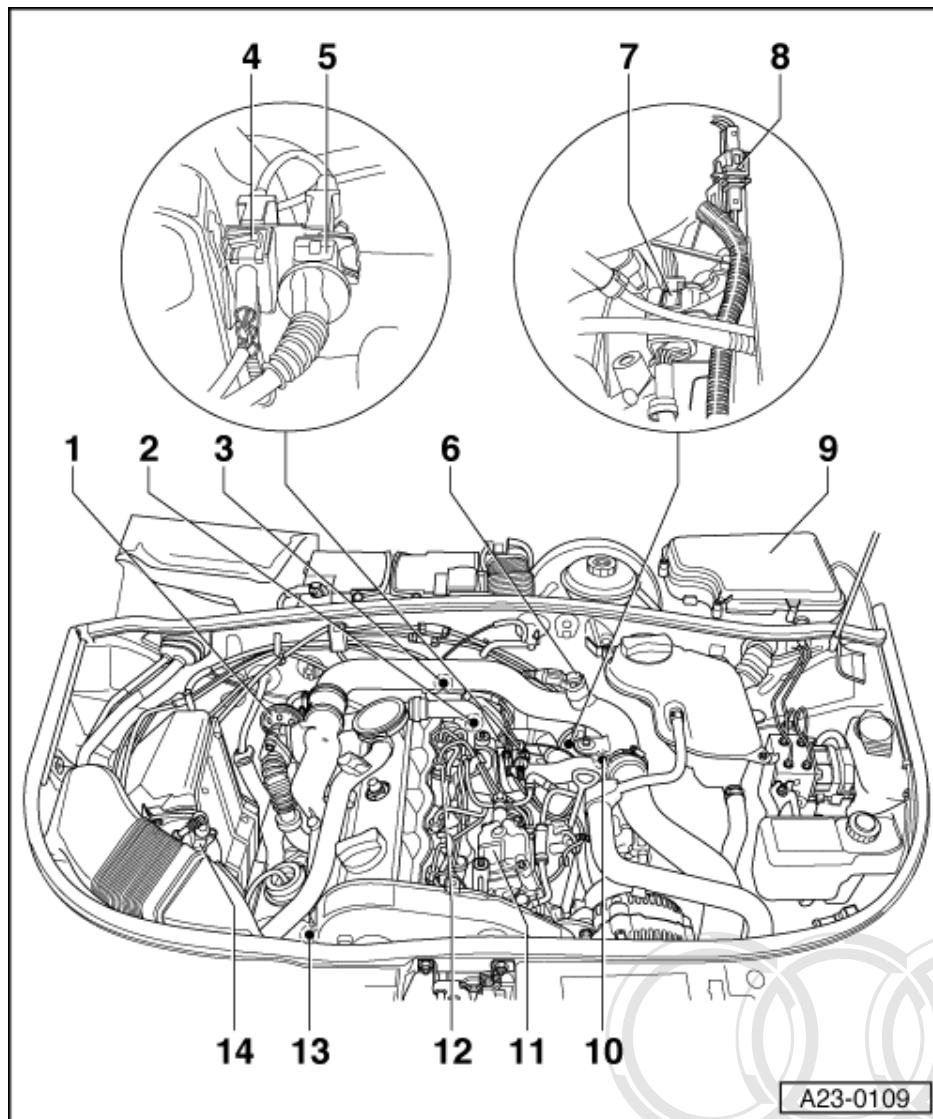
1.3 - Rules for cleanliness

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

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. 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 toolboxes 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.



1.4 - Fitting locations overview



Components A to E are not shown in the illustration.

A - Glow plug relay (J52)

- ◆ Central electrics, relay position 4

B - Accelerator position sensor (G79)

- ◆ In footwell on accelerator

C - Brake light switch (F) and brake pedal switch

- ◆ In footwell at brake pedal
- ◆ Common component

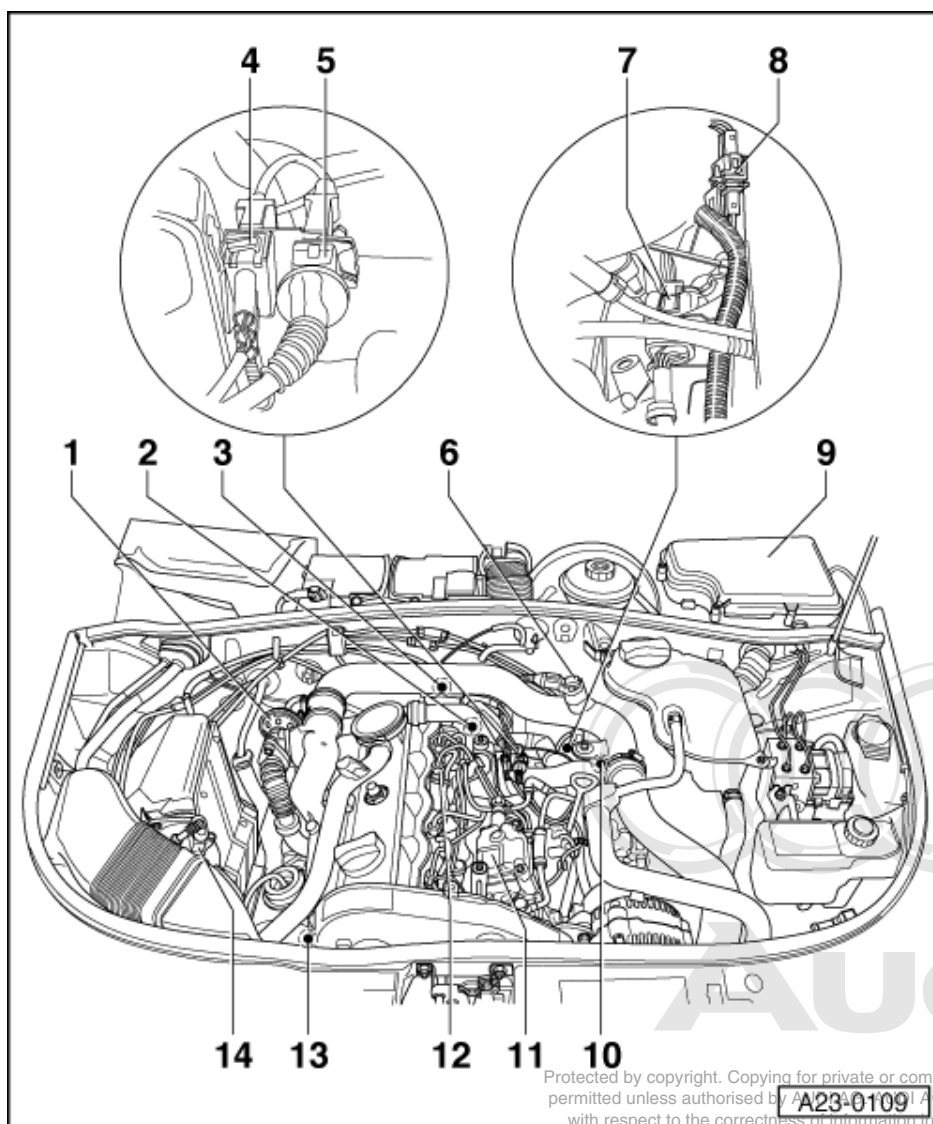
D - Clutch pedal switch (F36)

- ◆ In footwell at clutch pedal

E - Low/high heating output relay (sheathed-element heater)

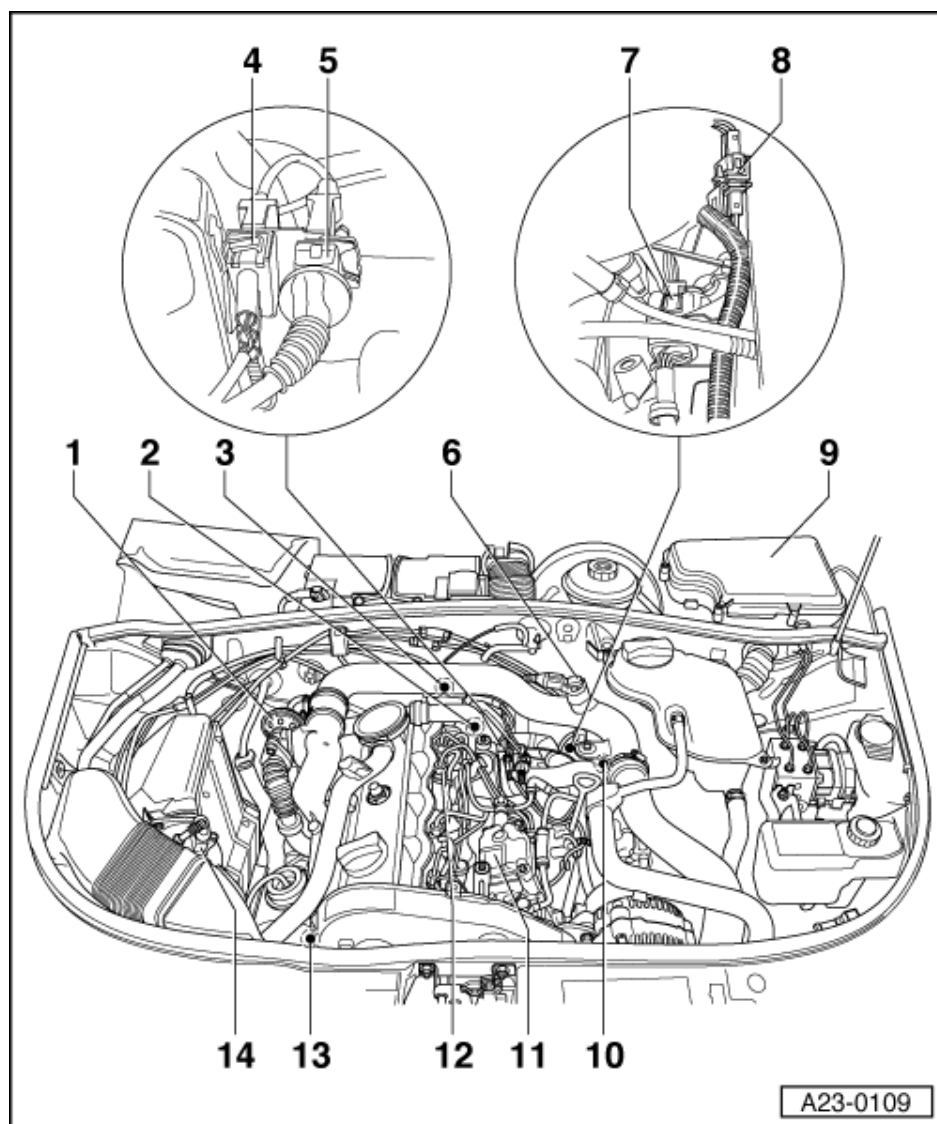
- ◆ Electronics box in the plenum chamber
- ◆ only in vehicles with manual gearboxes

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- 1 Mechanical exhaust gas recirculation valve
- 2 Coolant temperature sender (G62)
- 3 Valve for exhaust gas recirculation (N18)
- 4 Connector
 - ◆ 3-pin
 - ◆ For engine speed sender (G28)
- 5 Connector
 - ◆ 2-pin
 - ◆ For needle lift sensor (G80)
- 6 Intake manifold pressure sender (G71) and intake manifold temperature sender (G72)



Note:

Some vehicles are fitted with a 10-pin connector instead of an 8-pin and a 3-pin connector (items 7 and 8)

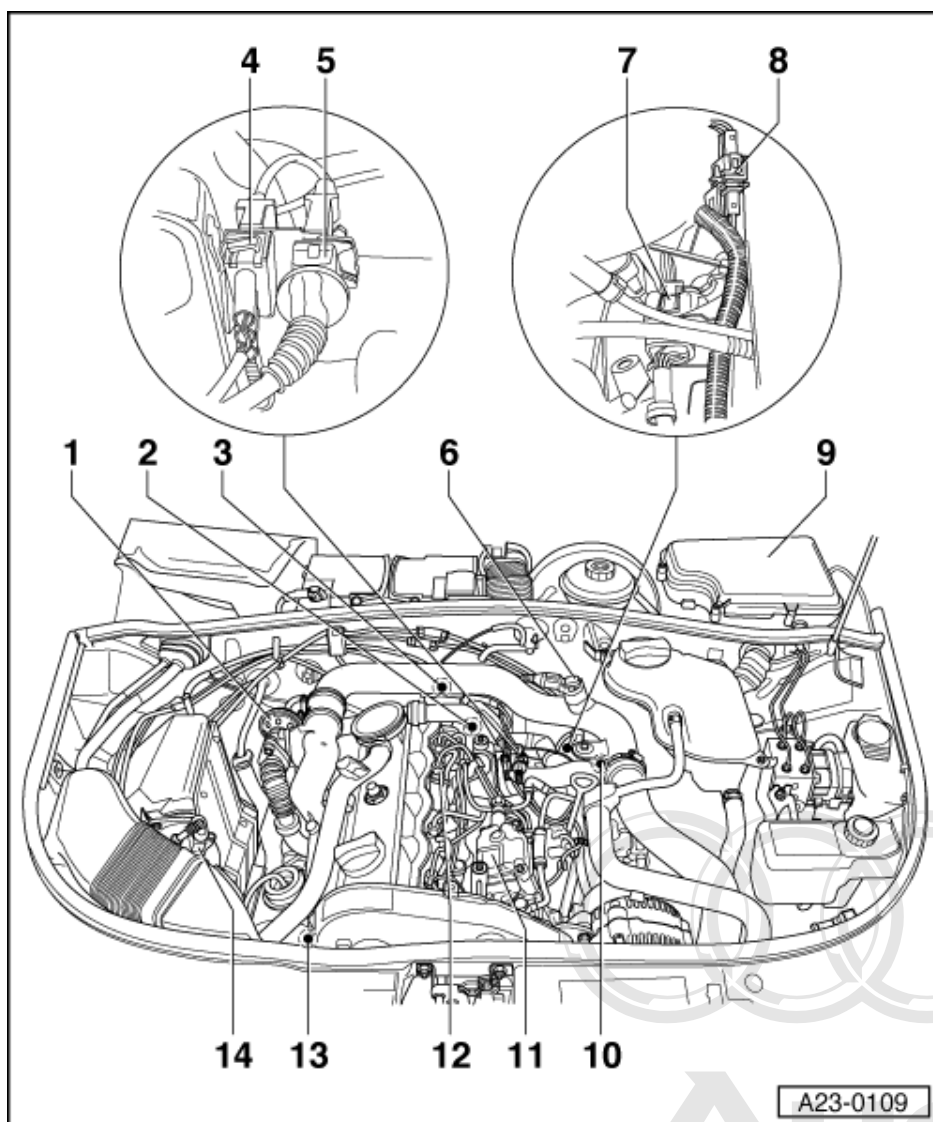
7 Connector

- ◆ 8-pin
- ◆ For fuel temperature sender (G81)
- ◆ For metering control (N146)
- ◆ For modulating piston movement sensor (G149)

8 Connector

- ◆ 3-pin
- ◆ For injection start valve (N108)
- ◆ For fuel shut off valve (N109)

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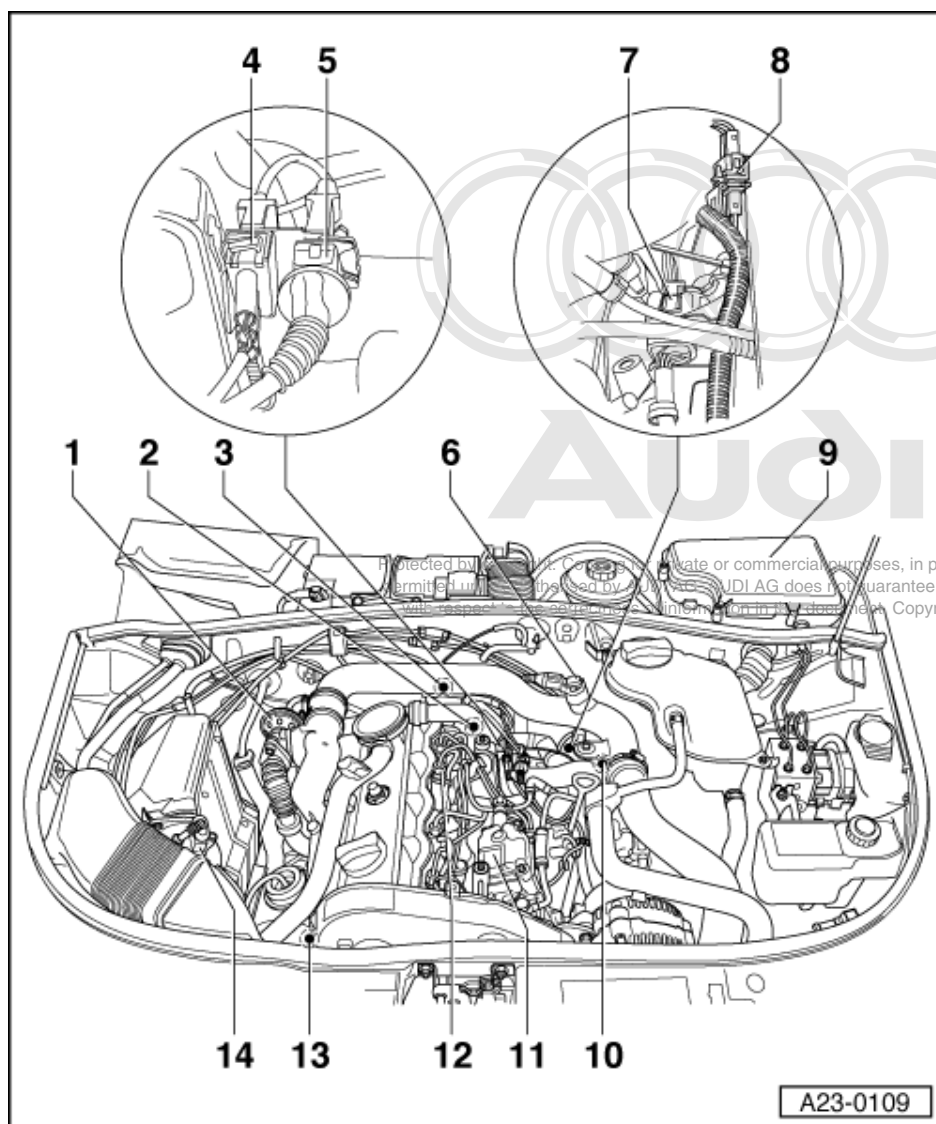
9 Electronics box

- ◆ Diesel direct-injection system control unit (J248) with altitude sensor (F96)
- ◆ Diesel direct-injection system relay (J322)
- ◆ Glow plug fuse
- ◆ Low/high heating output relay (only vehicles with manual gearboxes)

10 Engine speed sender (G28)

11 Injection pump

- ◆ With valve for commencement of injection (N108)
- ◆ With fuel cut-off valve (N109)
- ◆ With fuel temperature sensor
- ◆ With quantity adjuster (N146)
- ◆ With sensor for modulating piston movement (G149)

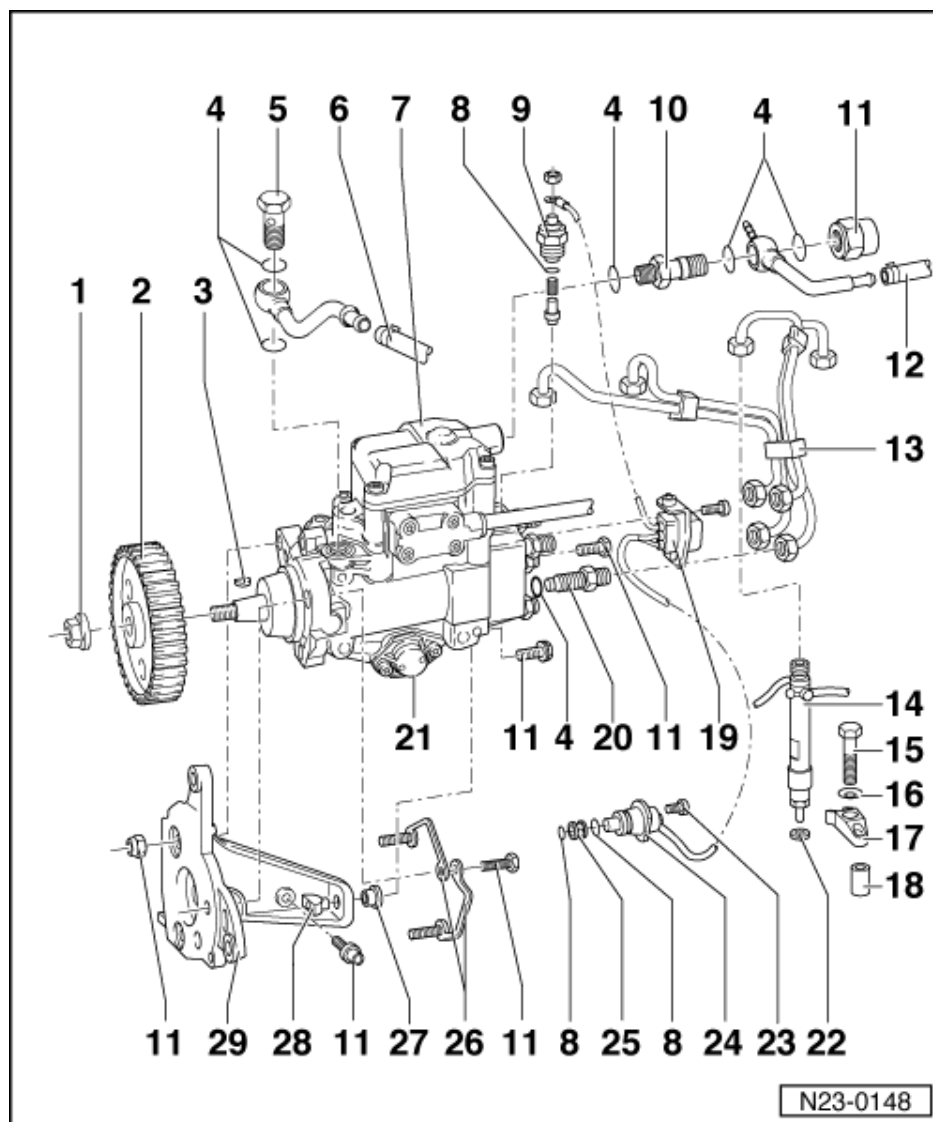


12 Injector with needle lift sensor (G80)

13 Solenoid valve for boost pressure limitation (N75)

14 Air mass meter (G70)

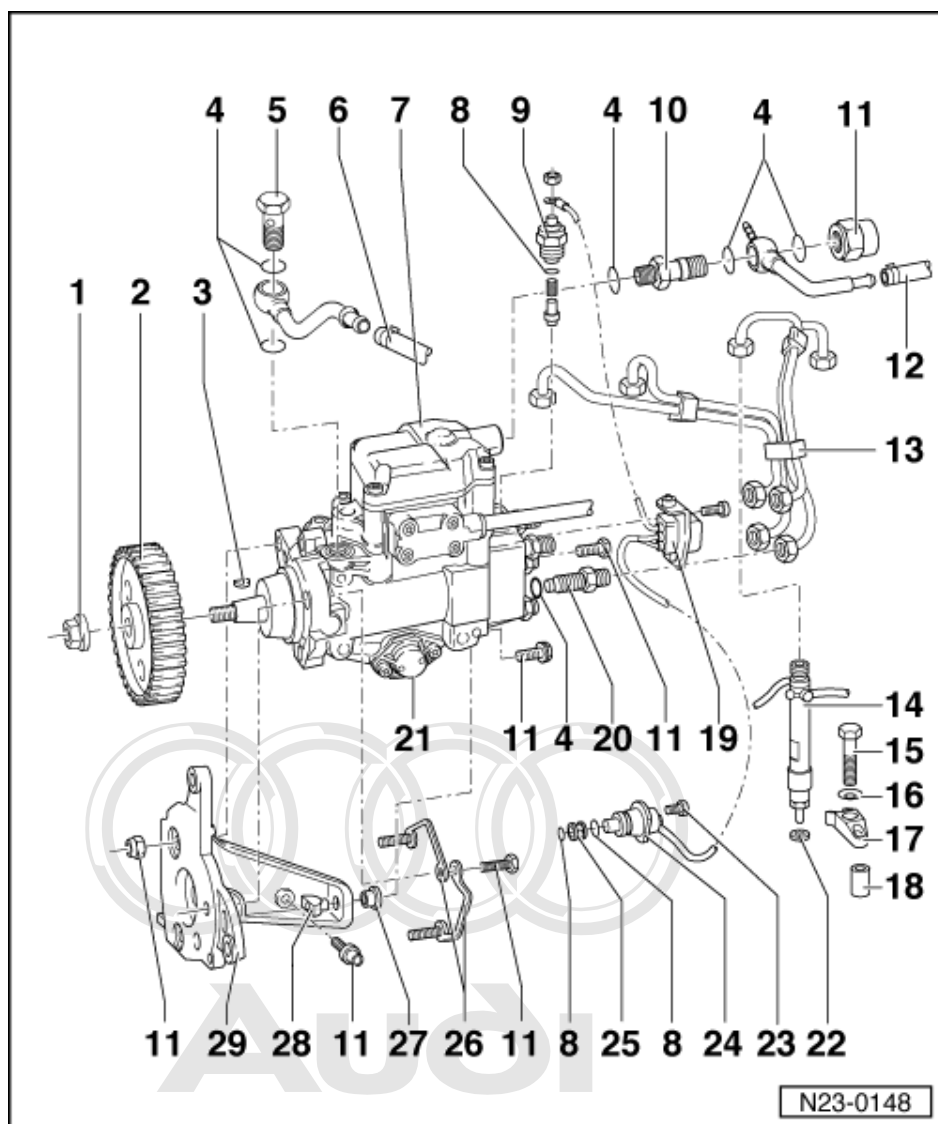
1.5 - Repairing injection pump



- ♦ Observe safety precautions
=> Page 35
- ♦ Observe rules for cleanliness
=>Page 35
- ♦ Removing and installing injection pump =>Page 45
- ♦ Check and adjust commencement of injection => Page 50

- 1 45 Nm
- 2 Injection pump sprocket
- 3 Woodruff key
- 4 Sealing ring
 - ♦ Replace
- 5 Banjo bolt, 25 Nm

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6 **Supply hose**
 ♦ From fuel filter

7 **Injection pump**
 ♦ With quantity adjuster (N146)
 ♦ With sensor for modulating piston movement (G149)
 ♦ With fuel temperature sensor

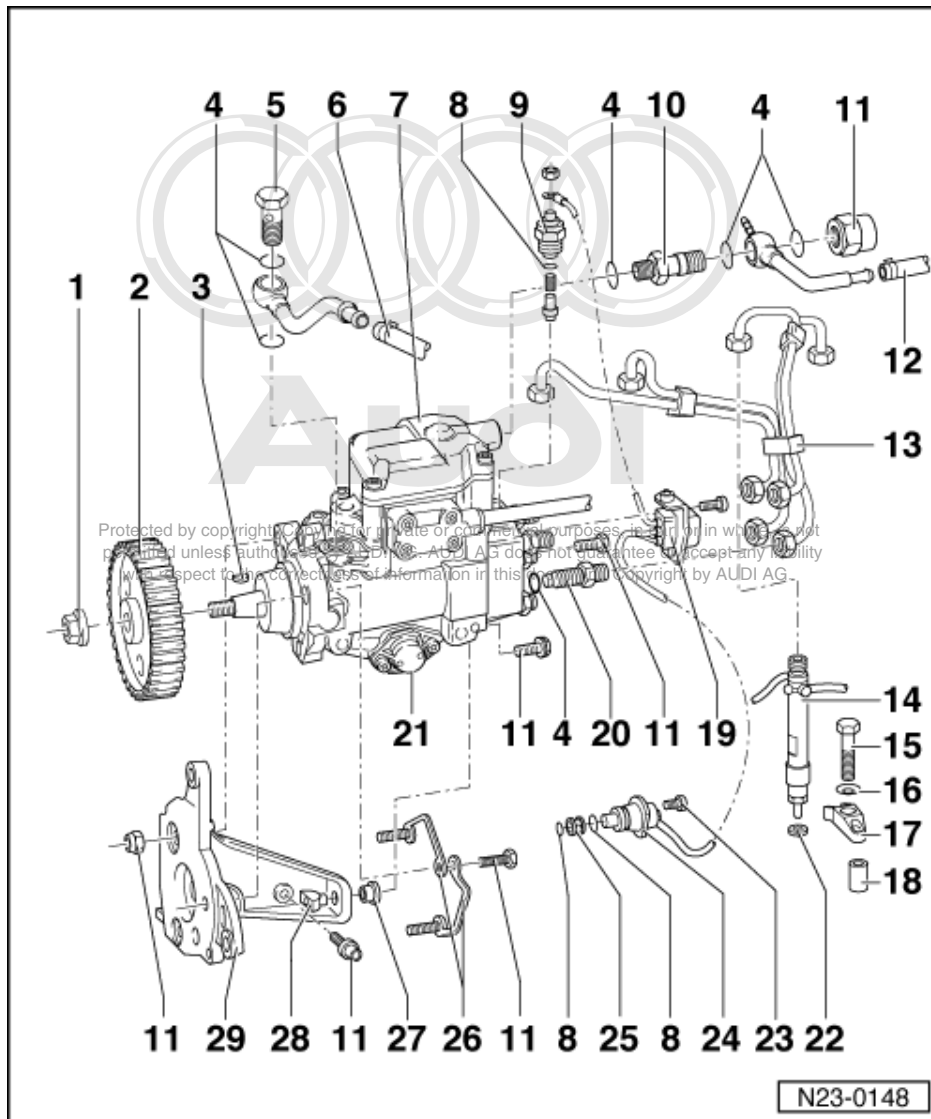
8 **O-ring**
 ♦ Replace, if damaged

9 **Fuel cut-off valve**
 ♦ 20 Nm

10 **Pipe union**
 ♦ For return pipe
 ♦ 28 Nm

11 25 Nm

12 **Return hose**
 ♦ To control valve/fuel filter



13 Injector pipes

- ◆ Tighten to 25 Nm
- ◆ Remove with 3035
- ◆ Always remove pipework complete
- ◆ Do not alter shape

14 Injector

- ◆ For 3rd cylinder with needle lift sensor
- ◆ Remove, install and test => Page 59

15 20 Nm

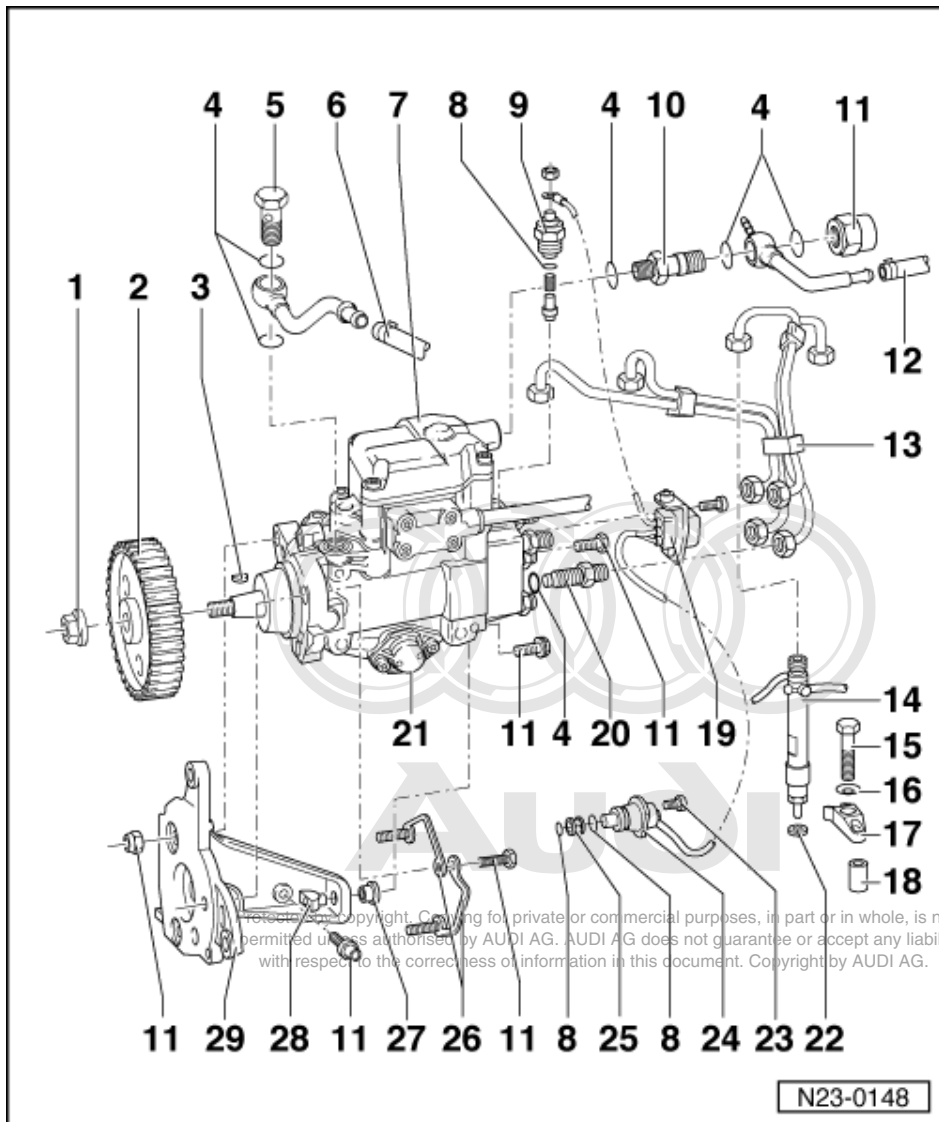
16 Spherical washer

17 Retainer

18 Mounting bracket

19 Connector

- ◆ 3-pin
- ◆ For injection start valve (N108)
- ◆ For fuel shut off valve (N109)

**20 Constant pressure valve**

- ♦ 45 Nm

21 Timing control cover

- ♦ If any leaks are found, replace O-ring =>Page 61

22 Copper seal

- ♦ Replace

23 12 Nm**24 Injection start valve (N108)****25 Strainer****26 Fastener****27 Socket**

- ♦ Tapered

28 25 Nm

- ♦ Nut with taper

29 Bracket

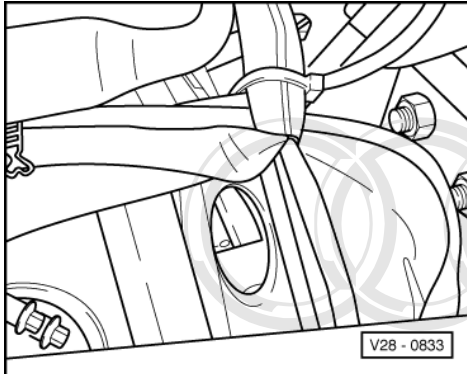
1.6 - Removing and installing the injection pump Engine codes: AFF, AHU, AFN

Remove the injection pump

- Move lock carrier to service position.

=> General Body Assembly, Exterior; Repair group 50; Body front; Lock carrier-service position Body front Lock carrier-service position

- Remove the upper toothed belt guard and the cylinder head cover.
- Set the crankshaft to TDC for cylinder No. 1.

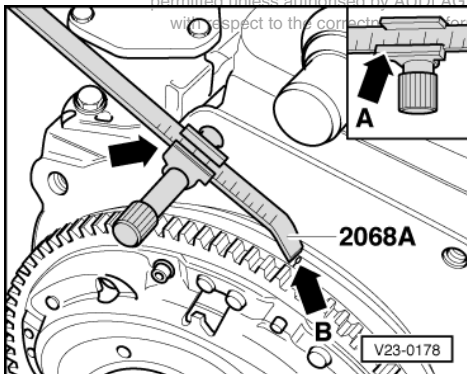


TDC-position of the crankshaft in vehicles with automatic gearboxes =>Page 58 .

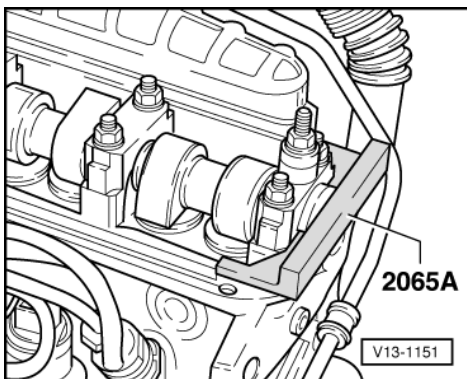
TDC-position of the crankshaft in vehicles with manual gearboxes

- > The -0- mark should be below the edge visible through the inspection hole.

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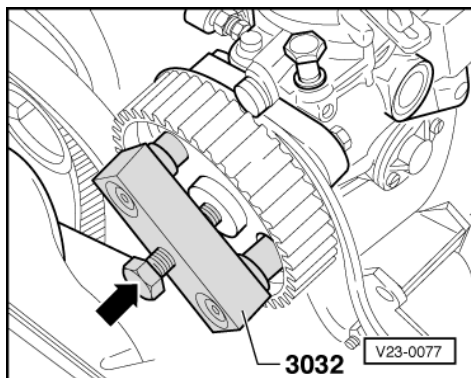


- -> Screw in the adjustment device 2068 A as shown.
- Set the adjusting device to 107 mm. The left notch on the vernier scale is the reference point.
- Turn the crankshaft until the TDC marking on the fly wheel is in alignment with the end of the setting device -arrow-.

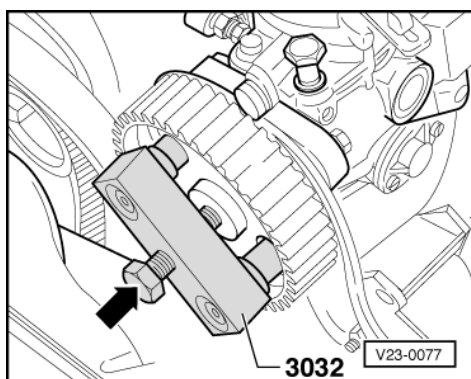




- ➔ Lock the camshaft with the setting bar.
- Centre the setting bar as follows:
Turn locked camshaft so that one end of setting bar contacts the cylinder head. Measure the gap at the other end of the setting bar using a feeler gauge. Place a feeler gauge corresponding to half the gap between the setting bar and the cylinder head. Turn camshaft until the setting bar contacts the feeler gauge. Insert a 2nd feeler gauge of the same thickness at the other end, between the setting bar and cylinder head.
- Remove the idler pulley.
- Remove the nuts from the tensioning roller.



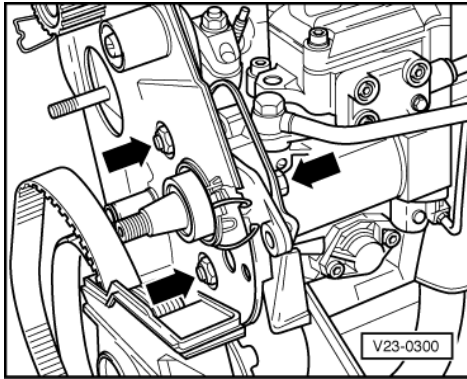
- Relieve the toothed belt tension and detach it from the toothed belt sprockets on the camshaft and injection pump.
- Lock the injection pump sprocket with pin 2064.
- Unscrew the securing nut for the injection pump sprocket.
- ➔ Loosen the puller arms and apply the puller.
- Align the arms with the holes in the injection pump sprocket and tighten them firmly.
- Use the puller to tension the injection pump sprocket.



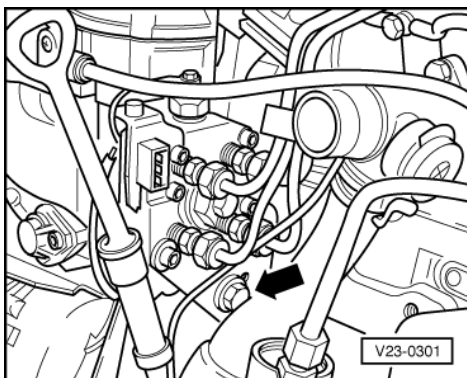
- ➔ Release the injection pump sprocket from the taper of the injection pump by gently tapping on the puller stem-arrow- (while doing so, hold the sprocket firmly to prevent it from falling out).
- Unscrew all the fuel lines on the fuel pump.
- Cover openings with a clean cloth.

Note:

Use the slotted ring spanner 3035 to remove the injection pipes.



- Disconnect the connector for the fuel cut off valve/commencement of injection valve.
- Disconnect the connector for the metering control and unclip the connector from the bracket.
- -> Unscrew the securing bolts from the console - arrows- .

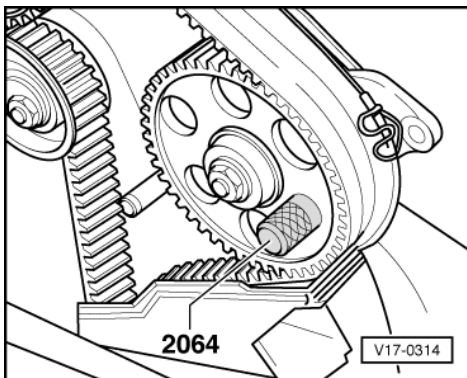


- -> Then remove securing bolt from rear support (arrow).
- Remove injection pump.

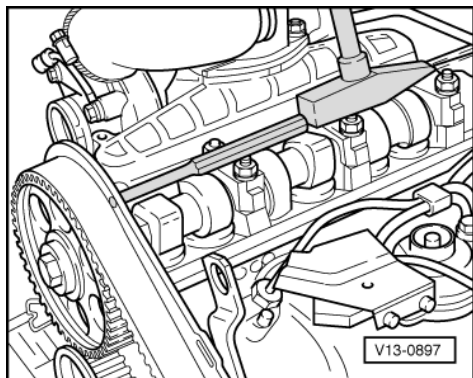
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Installing the injection pump

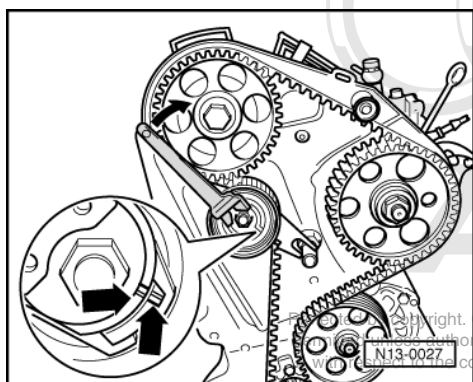
- Insert the injection pump into the console and then first tighten the securing bolt on the rear support with the conical nut.
- Centre the injection pump in the slots in the console and then tighten the pump by hand.



- -> Install the injection pump sprocket and lock in position with pin 2064. When installing, ensure correct seating of the Woodruff key.
- Tighten securing nut to 45 Nm.
- Loosen the securing bolt in the camshaft gear wheel by 1/2 a turn.



- -> Insert a drift through the hole in the rear of the toothed belt guard and release the camshaft gear wheel from the camshaft taper by tapping with a hammer.
- Remove the camshaft gear wheel.
- Check whether TDC mark on flywheel and the reference mark line up.
- Place the toothed belt on the injection pump sprocket and the tensioning roller.
- Fit the camshaft gear wheel into toothed belt and secure the wheel on the camshaft so that it is still able to turn.
- Install the idler wheel.

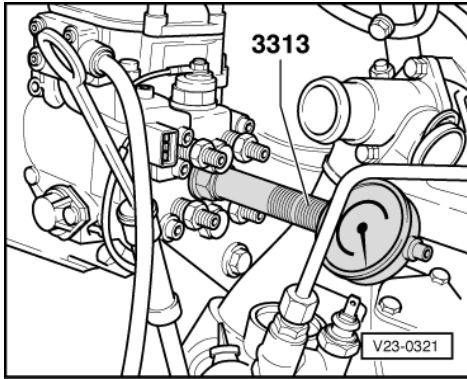


- Remove the locking pin from the injection pump sprocket.
- -> Tension the toothed belt. For this purpose, rotate spanner (e.g. Matra V159) on eccentric clockwise until the notch and the raised arrows line up.
- Tighten securing nut to 20 Nm.
- Check TDC mark on flywheel again.
- Tighten camshaft sprocket securing bolt to 45 Nm.
- Remove the setting bar 2065 A from the camshaft.
- Turn the crankshaft two rotations in the engine direction of rotation until the crankshaft is set to the TDC for cylinder No. 1 again.

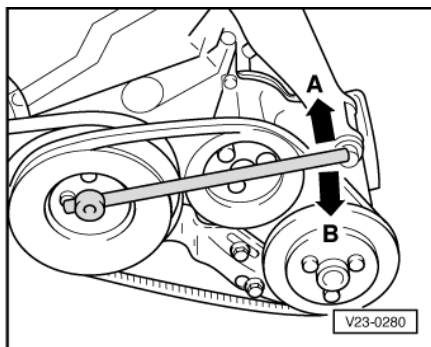
Adjusting the injection pump

Checking and adjustment conditions

- Engine's basic mechanical settings OK.
- Toothed belt tension OK.
- Engine at TDC.



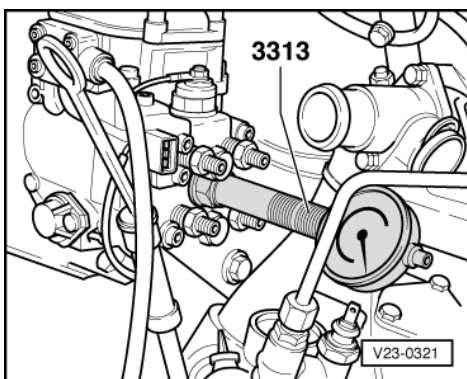
- -> Remove the screw plug on the injection pump and replace it with the adapter 3313 for the dial gauge.
- Insert the dial gauge and plunger into adapter.
- Pre load the dial gauge to about 2 mm and tighten the adjusting nut on the adapter.



- -> Rotate the crankshaft slowly in the direction opposite to the direction of engine rotation -A- until the needle on the dial gauge no longer moves.
- Loosen the dial gauge, then re tighten with a pre load of about 1 mm.
- Set the measuring scale to "0".
- -> Rotate the crankshaft slowly in the direction of engine rotation -B- until the marking -0- on the flywheel is aligned with the reference mark or the edge of the setting bar.

Note:

The TDC mark is approached by rotating the crankshaft in the direction of engine rotation. If the crankshaft is inadvertently rotated too far (i.e. beyond the TDC mark):



- Turn the crankshaft in the opposite direction until the dial gauge reads "0" and approach the TDC again.
- -> Read the commencement of delivery from the dial gauge.

Specified value: 0.7 ± 0.02 mm stroke

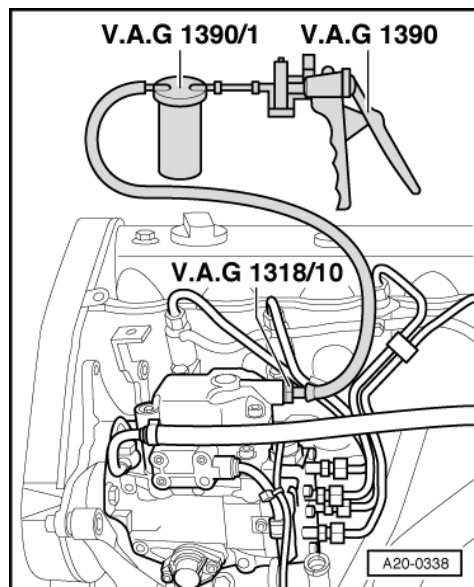
- Adjust the commencement of delivery by turning the injection pump.



Tightening torque:

Securing bolts for injection pump: 25 Nm
Screw plug: 20 Nm

- Reconnect injection pipes, fuel supply pipe and electrical wiring.



-> Fill injection pump with clean diesel fuel as follows:

- Screw the adapter 1318/10 into the return pipe connection on the injection pump.
 - Connect the vacuum hand pump 1390 with the bleeder vessel V.A.G 1390/1 to the return pipe connection.
 - Actuate the vacuum hand pump until there are no bubbles in the fuel coming out of the return pipe connection. Do not draw fuel into the vacuum pump.
- Reconnect the return pipe to the injection pump (25 Nm).
Install the toothed belt guard and the cylinder head cover.
Dynamically checking and adjusting commencement of injection =>Page 50 .

1.7 - Dynamically checking and adjusting commencement of injection: Engine codes: AFF, AHU, AFN

Notes:

- ♦ The injection start must always be checked after renewing the toothed belt or loosening the injection pump bolts or toothed belt sprockets and adjusted if necessary.
- ♦ The dynamic checking and correction of the commencement of injection is only possible in function 04 "Basic Engine Setting". This is because in function 04 the commencement of injection valve is activated continuously and therefore the injection timing control is set to "retarded".
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

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-> Indicated on display:

Rapid data transfer	HELP
Select function xx	

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with Q key.

-> Indicated on display:

Default setting HELP
Enter display group number XXX

- Press key 0 three times for "Display group number 0" and confirm entry with the Q key.

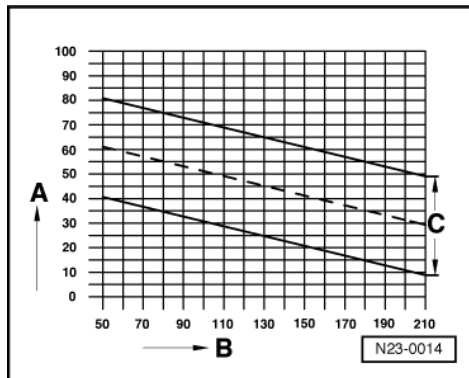
-> Indicated on display:

System in basic setting 0
1 2 3 4 5 6 7
8 9 10

- Observe the display in display zone 7 (coolant temperature).

Specified value: less than 73 (corresponding to 85 °C)

Do not continue with the test until the coolant has reached the specified temperature.



- -> The commencement of injection in display zone 2 depends on the fuel temperature value in display zone 9.

Specified value: => Range C in illustration

A - Display zone 2 Commencement of injection

B - Display zone 9 Fuel temperature

Notes:

- ♦ If the commencement of injection is advanced, turn the injection pump in the engine's direction of rotation, if the commencement of injection is retarded, turn against the direction of rotation.
- ♦ If injection start is within specified range C when tested, no adjustment is required. After repairs, such as the removal and installation of the injection pump, the adjustment of the timing, the commencement of injection should be set to the mean valve (dashed line) in specified range -C-.

If the commencement of injection (timing) is outside the specification tolerances, adjust the commencement of injection as follows:

Adjust the commencement of injection

- Remove the upper toothed belt guard, if this has not already been done.
- Loosen the injection pump securing bolts by approx. one turn, leaving the easiest bolt to reach till last.
- **By hand, hold the injection pump under tension in the direction to be adjusted.**
- Carefully loosen the last securing bolt until the pump can be turned slightly and then retighten the securing bolt.
- Check the setting in the function "Basic Setting 04".

-> Indicated on display:

System in basic setting 0
1 2 3 4 5 6 7
8 9 10

- Observe the value in display zone 2 and, if necessary, repeat adjustment until the value displayed remains at the mean value for the specified range -C- => Page 51 .
- Tighten the injection pump securing bolts to 25 Nm.



- Check the commencement of injection again.

Note:

After a dynamic adjustment of the injection pump, the injection lines on the injection pump must always be loosened and then tightened again (25 Nm). This relieves the strain on the pipes and prevents vibration fractures.

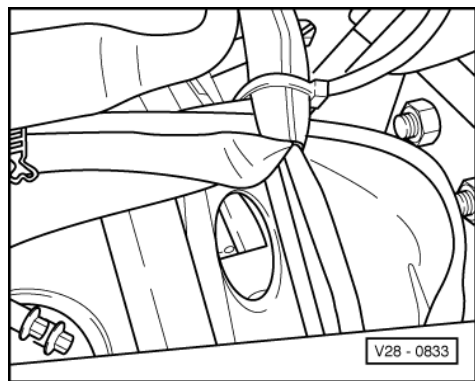
1.8 - Removing and installing the injection pump Engine code: AHH

Remove the injection pump

- Move lock carrier to service position.

=> General Body Assembly, Exterior; Repair group 50; Body front; Lock carrier-service position Body front Lock carrier-service position

- Remove the upper toothed belt guard and the cylinder head cover.
- Set the crankshaft to TDC for cylinder No. 1.

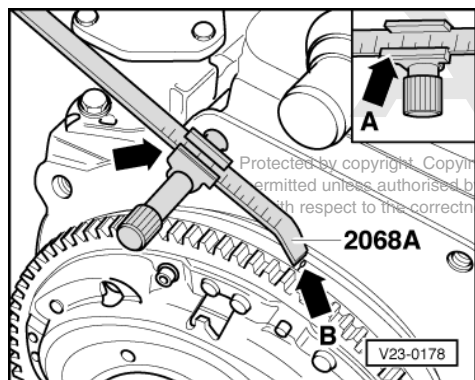


TDC-position of the crankshaft in vehicles with automatic gearboxes =>Page 58 .

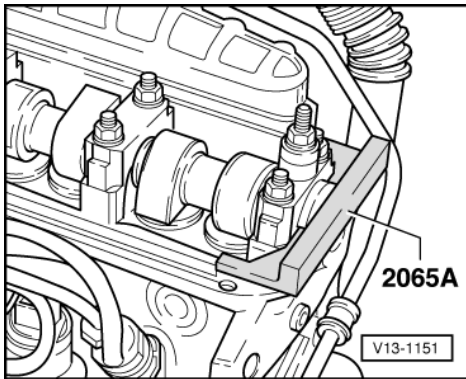
TDC-position of the crankshaft in vehicles with manual gearboxes

-> The -0- mark should be below the edge visible through the inspection hole.

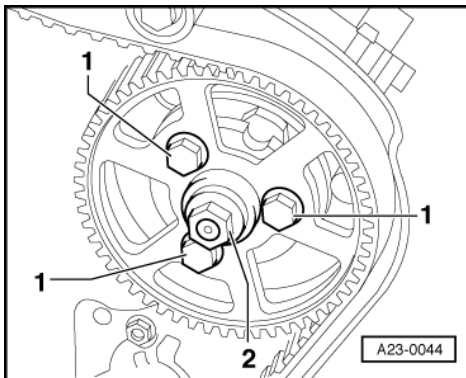
With engine removed



- -> Screw in the adjustment device 2068 A as shown.
- Set the adjusting device to 107 mm. The left notch on the vernier scale is the reference point.
- Turn the crankshaft until the TDC marking on the fly wheel is in alignment with the end of the setting device -arrow-.



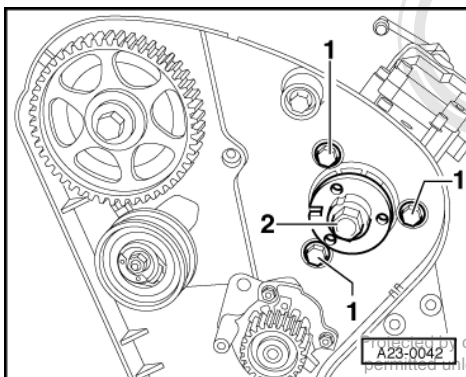
- -> Lock the camshaft with the setting bar.
- Centre the setting bar as follows:
Turn locked camshaft so that one end of setting bar contacts the cylinder head. Measure the gap at the other end of the setting bar using a feeler gauge. Place a feeler gauge corresponding to half the gap between the setting bar and the cylinder head. Turn camshaft until the setting bar contacts the feeler gauge. Insert a 2nd feeler gauge of the same thickness at the other end, between the setting bar and the cylinder head.



- -> Loosen injection pump sprocket attachment screws -1-.
- Remove the nuts from the tensioning roller.
- Remove toothed belt from camshaft and injection pump sprockets.

=> Repair group 13; Dismantling and assembling engine; Removing and installing toothed belt and adjusting tension Dismantling and assembling engine Removing and installing toothed belt and adjusting tension

- Unscrew the injection pipes from pump using the slotted ring spanner 3035.
- Cover openings with a clean cloth.

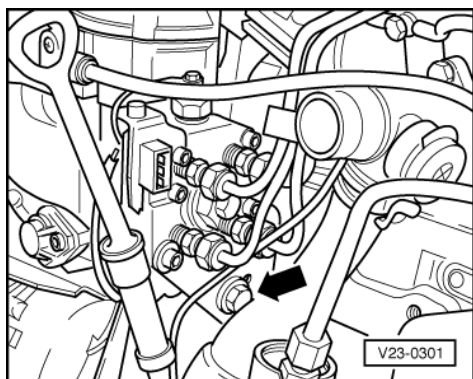


- -> Unscrew the securing bolts from the console -1-.



Note:

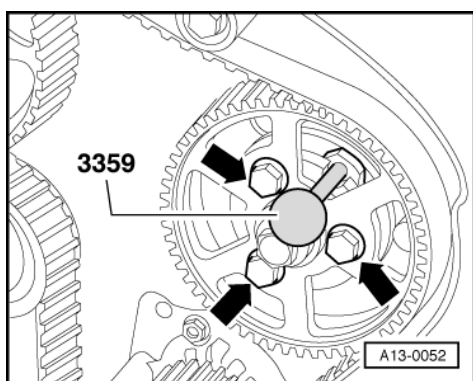
Do not loosen hub nut -2-. Otherwise the injection pump basic setting is maladjusted and cannot be corrected using workshop tools.



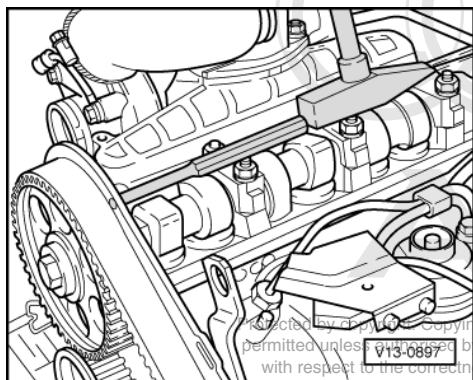
- -> Then remove securing bolt from rear support (arrow).
- Remove injection pump.

Installing the injection pump

- Insert the injection pump into the console and then first tighten the securing bolt on the rear support with the conical nut.
- Insert front securing bolts and tighten to 25 Nm.
- Fit the injection pump sprocket loosely to the hub using new securing bolts.
- Centre the injection pump sprocket in the slots.

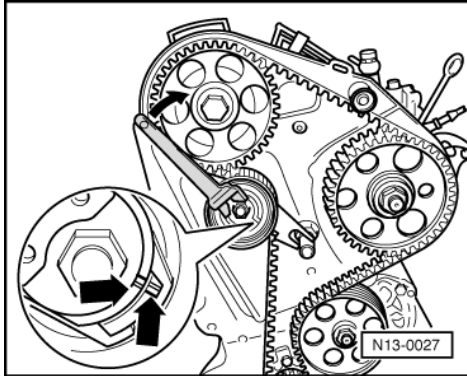


- -> Lock the injection pump sprocket with pin 3359.
- Loosen the securing bolt in the camshaft gear wheel by 1/2 a turn.

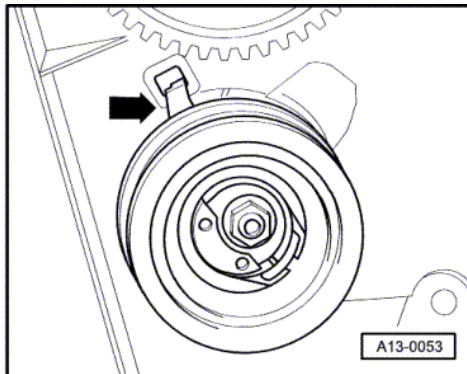


- -> Insert a drift through the hole in the rear of the toothed belt guard and release the camshaft gear wheel from the camshaft taper by tapping with a hammer.
- Check whether TDC mark on flywheel and the reference mark line up.

- Place the toothed belt on the injection pump sprocket and the tensioning roller.



- -> Tension the toothed belt. For this purpose, rotate spanner (e.g. Matra V159) on eccentric clockwise until the notch and the raised arrows line up.



Note:

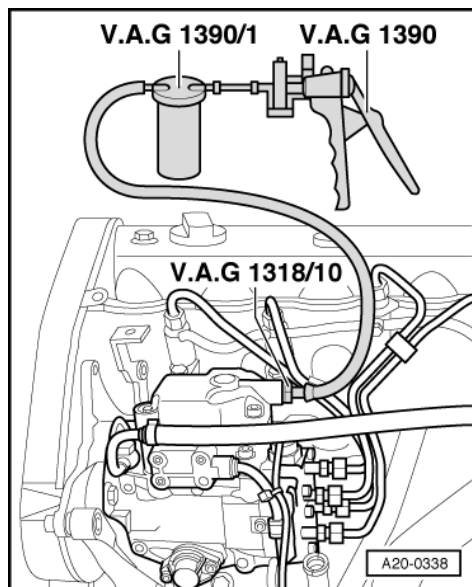
-> Make sure that the holding claw is correctly positioned.

- Tighten securing nut to 20 Nm.
- Check TDC mark on flywheel again.
- Tighten the new securing bolts for the injection pump sprocket to 20 Nm.

Notes:

- ◆ After the injection start dynamic test, screws 1/4 must be tightened by a (90°) turn.
- ◆ The securing bolts are stretch bolts and can therefore only be used once.
- Tighten camshaft sprocket securing bolt to 45 Nm.
- Remove the locking pin 3359.
- Remove the setting bar 2065 A from the camshaft.

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- Turn the crankshaft two rotations in the engine direction of rotation until the crankshaft is set to the TDC for cylinder No. 1 again.
 - Reconnect injection pipes, fuel supply pipe and electrical wiring.
- > Fill injection pump with clean diesel fuel as follows:
- Screw pipe union 1318/10 into the return pipe connection on the injection pump.
 - Connect the vacuum hand pump 1390 with the bleeder vessel V.A.G 1390/1 to the return pipe connection.
 - Operate vacuum hand pump until fuel comes out of return pipe connection. Do not draw fuel into the vacuum pump.
- Connect return pipe.
 - Install the cylinder head cover and intake hose.
 - Dynamically checking and adjusting commencement of injection =>Page 56 .

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1.9 - Dynamically checking and adjusting commencement of injection: Engine code AHH

Notes:

- ♦ The injection start must always be checked after renewing the toothed belt or loosening the injection pump bolts or toothed belt sprockets and adjusted if necessary.
 - ♦ The dynamic checking and correction of the commencement of injection is only possible in function 04 "Basic Engine Setting". This is because in function 04 the commencement of injection valve is activated continuously and therefore the injection timing control is set to "retarded".
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with Q key.

-> Indicated on display:

Default setting	HELP
Enter display group number XXX	

- Press key 0 three times for "Display group number 0" and confirm entry with the Q key.

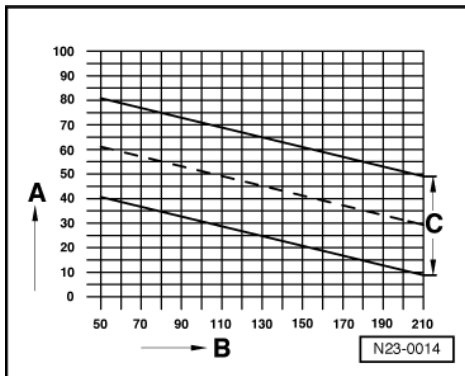
-> Indicated on display:
(1...10 = display zones)

Basic setting 0						
1	2	3	4	5	6	7
8	9	10				

- Observe the display in display zone 7 (coolant temperature).

Specified value: less than 73 (corresponding to 85 °C)

Do not continue with the test until the coolant has reached the specified temperature.



- -> The commencement of injection in display zone 2 depends on the fuel temperature value in display zone 9.

Specified value: => Range C in illustration

A - Display zone 2 Commencement of injection

B - Display zone 9 Fuel temperature

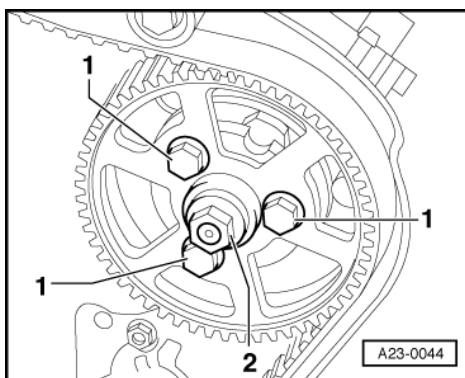
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Note:

If injection start is within specified range C when tested, no adjustment is required.

If the commencement of injection is outside the specified range, adjust the injection pump as follows:

- Switch ignition off.
- Remove upper toothed belt guard.
- Check toothed belt tension.



The marks must be opposite each other.

If the markings are not aligned:

- Adjust the toothed belt tension:



=> Repair group 13; Dismantling and assembling engine; Removing and installing toothed belt and adjusting tension Dismantling and assembling engine Removing and installing toothed belt and adjusting tension

- -> Undo two injection pump sprocket attachment screws -1-.
- Apply a ring spanner (22 mm A/F) to hub nut 2 to hold the pump shaft in position.
- Loosen the third securing bolt on the injection pump sprocket and turn the pump shaft slightly.

to the left => commencement of injection retarded
(value displayed in display zone 2 becomes smaller)
to the right => commencement of injection is advanced
(value displayed in display zone 2 becomes higher)

Note:

Do not loosen hub nut -2-. Otherwise the injection pump basic setting is maladjusted and cannot be corrected using workshop tools.

- Tighten the new securing bolts for the injection pump sprocket to 20 Nm.

Note:

The securing bolts are stretch bolts and can therefore only be used once.

- Check again that the commencement of injection is as specified (Basic setting 04, display group 00 display zone 2).

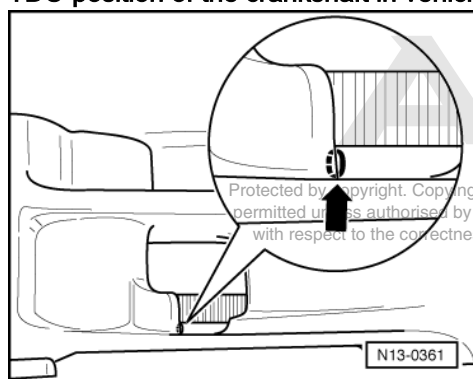
If the commencement of injection is outside the tolerance range:

- Correct the setting at the injection pump sprocket again.

If the commencement of injection is in the specified range.

- Replace the 3 securing bolts (stretch bolts) in sequence and tighten to 20 Nm.
- Then tighten the 3 securing bolts (stretch bolts) for the injection pump sprocket by 1/4 turn (90°).
- Install the toothed belt guard and intake hose.

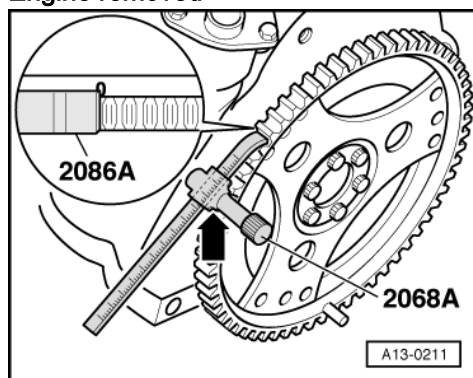
TDC-position of the crankshaft in vehicles with automatic gearboxes



Engine installed

- -> Set the crankshaft to the TDC for cylinder 1 -arrow-.

Engine removed



- -> Screw in the adjustment device 2068 A as shown.
- Set the adjusting device to 99 mm -arrow-. The left notch on the vernier scale is the reference point.
- Turn the crankshaft until the flywheel TDC marking is aligned with the point of setting device.

1.10 - Removing, installing and testing injectors

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

Removing the injectors

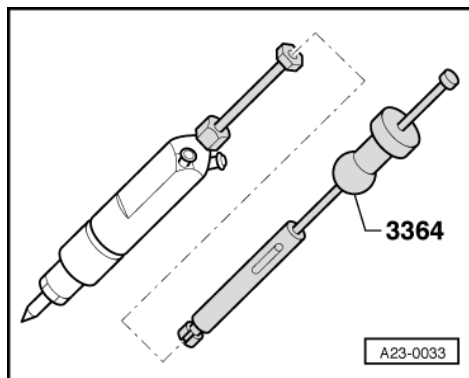
- Remove injection pipes using open ring spanner 3035.

Note:

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

- Remove securing nut, take off retainer and take out injector.

If the injectors are seized, construct the following auxiliary tool:



- Saw off an injection pipe about 5 cm away from the injector union nut.
- Braze an M6 nut onto the sawn off end of the pipe section.
- Clean the auxiliary tool thoroughly. Any dirt will render the injector unusable.
- -> Screw the union nut end of the auxiliary tool to the seized injector, then apply special tool 3364 to the end with the soldered-on nut.

Installing the injectors

Note:

Always renew copper seals between cylinder head and injectors.

- Insert the injectors.
- Check mounting bracket is seated correctly in the cylinder head.
- Fit the retainer.

Tightening torque:

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Injection pipes: 25 Nm
Retainer clip nut: 20 Nm

Checking the injectors

- ->

Read measured value block 13
0.82 mg/stroke 0.12 mg/stroke 0.49 mg/stroke

Read measured value block, display group 13, engine at idling speed => Page 28

Specified value: -1.50 mg/stroke +1.50 mg/stroke (milligrams per stroke)

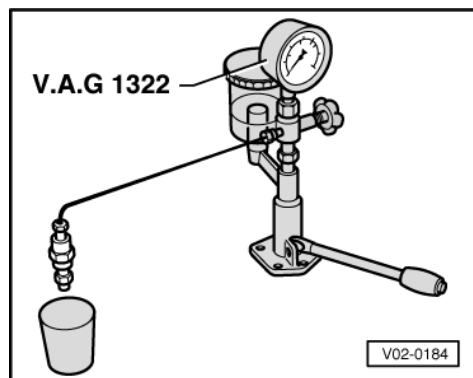
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- If one or more of the specified values is out of range, swap round the injectors (except the injector for No. 3 cylinder).
- If the fault moves along with the injector, fit a new injector.
- If the fault remains on the same cylinder, swap round the constant pressure valves.
- If the fault moves with the constant pressure valve, replace the pressure valve and oil seal=>Repair injection pump - Page 41 .

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 15,000 km, the complete set of pressure valves must always be replaced.
- If the fault remains on the cylinder, check the compression.

This engine is equipped with dual spring injectors. The fuel injection therefore takes place in 2 stages. If faults occur in these injectors they must be replaced, since neither repair nor pressure setting is possible.



-> Testing injectors using V.A.G 1322 and pressure pipe V.A.G 1322/2.

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 and it could cause severe injuries.

- Pressure gauge on
- Slowly depress the pump lever. When injection begins, read off spray pressure. If the pressure does not match the specified value, fit a new injector.

Engine codes: AFF, AHU, AFN

New injectors	190 ... 200 bar
Wear limit	170 bar

Engine codes: AHH

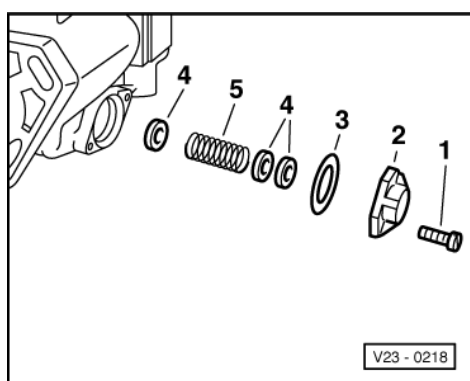
New injectors	220 ... 230 bar
Wear limit	200 bar

Testing for leaks

- Pressure gauge on
- Move pump lever down slowly and maintain a pressure of approx. 150 bar for 10 seconds. No fuel should leak from the nozzle opening.
- If injector leaks, replace.

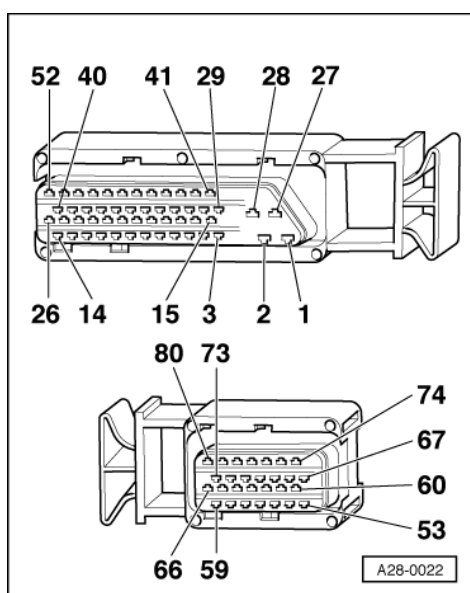
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1.11 - Replacing the O-ring on the injection timing device cover



- Place a clean cloth under the injection pump.
- -> Unscrew cover bolts -1- using commercially available offset screwdriver for Torx socket bolts, e.g. Hazet 2115-T30.
- Remove the cover -2- and clean it.
- Replace O-ring -3- and attach cover using existing shims -4-.

1.12 - Wiring and component test with test box V.A.G 1598/22





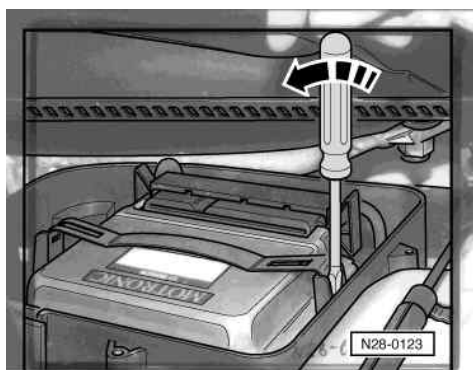
Notes:

- ♦ Use the hand multimeter V.A.G 1526 or the multimeter V.A.G 1715 and the diode test lamp V.A.G 1527 for the checks.
- ♦ To connect the testers to the test box use the auxiliary cables from adapter set V.A.G 1594.
- ♦ -> The contact numbers on the connector correspond to the socket numbers on the test box.

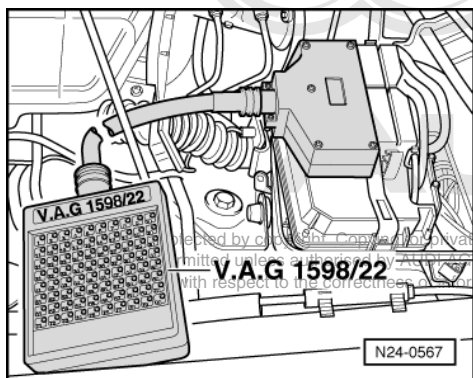
Important:

To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

- Switch ignition off.
- Remove cover of protective housing for control units.



- -> Carefully lever off the retainer bar with a screwdriver arrow-.
- Then release connectors on control unit and pull off.



- -> Connect V.A.G 1598/22 test box to connector on wiring harness.
- Carry out test as described in the appropriate repair procedures.

1.13 - Renewing engine control unit

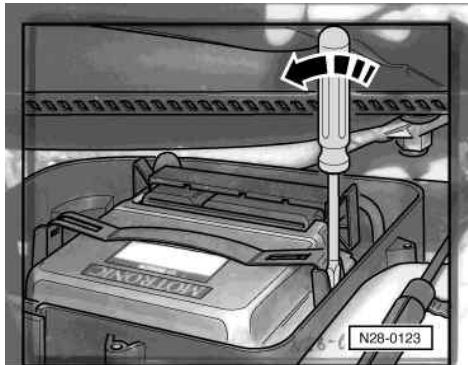
Note:

When the engine control unit is disconnected, the learned values are erased but the contents of the fault memory remain intact.

Removing engine control unit

- Switch ignition off.

- Remove cover of protective housing for control units.



- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Then release connectors on control unit and pull off.
- Take out old engine control unit and install new engine control unit.

Installing engine control unit

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Installation is performed in the reverse sequence.

The following operations must be carried out after installing the engine control unit:

- Code control unit =>Page 19
- Adapt immobiliser to engine control unit
- In vehicles with a cruise control system the CCS must be activated

=> Electrical System, Cruise control system (CCS) self-diagnosis, diesel engine; Check cruise control system (CCS)

1.14 - Checking power supply to diesel direct-injection system

The injection system receives its current supply via the diesel direct injection system relay (J322).

Precondition for the closing of the relay (J322) is the application of voltage via terminal 15 at the control device for the diesel direct-injection system. This means that the relay (J322) is only earthed (via the control device for the diesel direct-injection system), if the control unit receives voltage via terminal 15.

Test conditions

- Battery voltage OK.

Testing voltage supply at terminal 15

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .
- Connect multimeter between earth and socket 47 of the test box to measure the voltage.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

- Check the wiring connections.

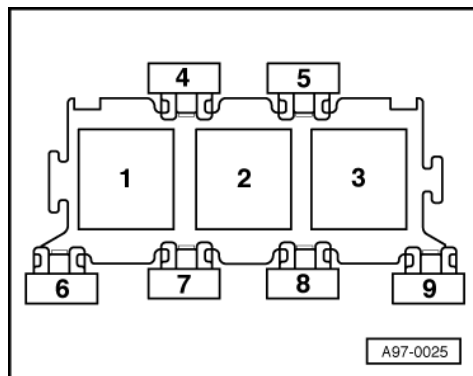
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder



Testing earth actuation for Diesel direct injection system relay -J322

Test conditions

- Battery voltage OK.
- Terminal 15 power supply OK

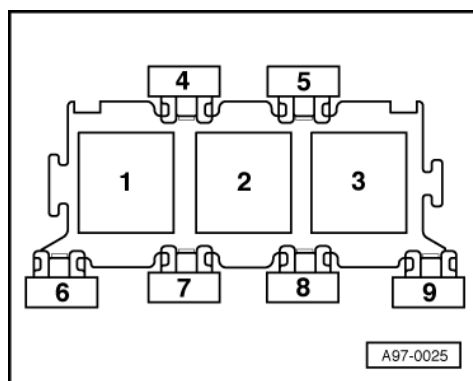


- Open electronics box in plenum chamber.
- Switch the ignition on.

-> Specified value: Diesel direct-injection system relay (electronics box, relay position 3) must be energised.

Note:

The clicking of the valve is difficult to hear and is therefore best checked by touching the relay.



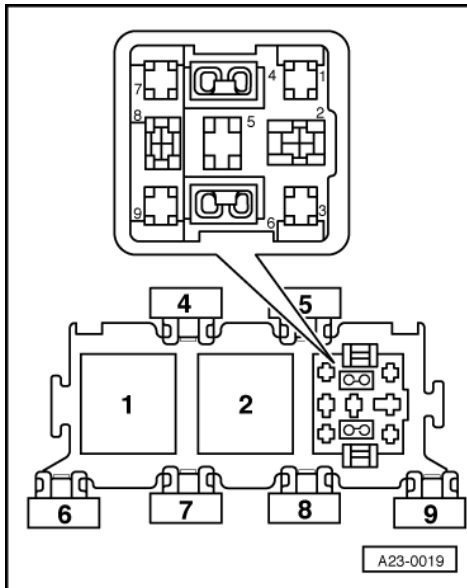
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If the relay does not respond:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **61**.
- Connect together sockets 33 and 1 on the test box using an auxiliary cable from V.A.G 1594.

-> Specified value: Diesel direct-injection system relay (electronics box, relay position 3) must be energised.

If the relay picks up now, but not when the control unit is connected:



- Renew Diesel direct-injection system control unit.

If the relay does not respond:

- Switch ignition off.
- -> Unplug J322 diesel direct-injection system relay from relay panel (electronics box, relay position 3).

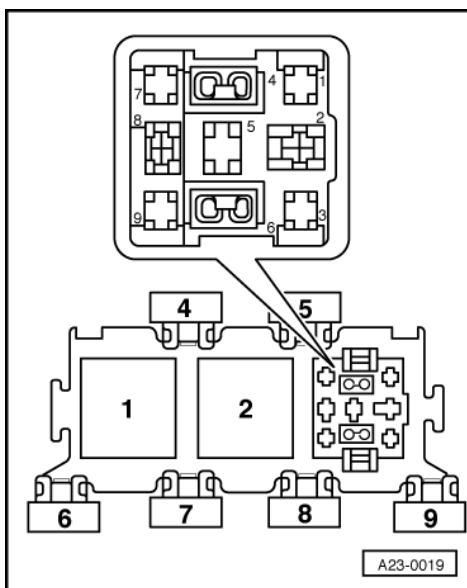
The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Electronics box, relay panel 3, contact	Test box V.A.G 1598/22, socket
9	33

- Rectify any open/short circuit as necessary.

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

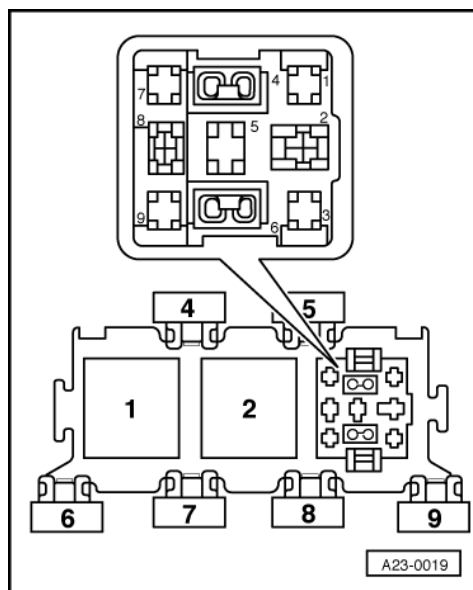




Testing voltage supply at terminal 30

Test conditions

- Battery voltage OK.
- Terminal 15 power supply OK
- Earth actuation for relay J322 OK
- Switch ignition off.
- ➔ Unplug -J322 diesel direct-injection system relay from relay panel (electronics box, relay position 3).
- Connect multimeter (voltage test range) between the following contacts on the relay panel:



Electronics box, relay panel 3, contact	Specified value
2 + earth	approx. battery voltage

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If specified value is not attained:

- Check the wiring connections.

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If specified value is attained:

- Plug the relay back into the relay panel (electronics box, relay position 3).
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .
- Connect together sockets 33 and 1 on the test box using an auxiliary cable from V.A.G 1594.
- Connect multimeter between the following contacts on the test box to test the voltage:

Test box V.A.G 1598/22, socket	Specified value
2 + 1	approx. battery voltage
28 + 1	approx. battery voltage
2 + 27	approx. battery voltage
28 + 27	approx. battery voltage

If specified value is not attained:

- Check the wiring connections.

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2 - Testing injection control

2.1 - Testing injection control

2.2 - Checking the injection timing control range

- Start the final control diagnosis and activate the valve for the commencement of injection. => Page 13 .

-> Indicated on display:

Final control diagnosis Injection start valve N108

Valve actuation has a considerable effect on combustion noise (pre ignition).

- Initiate the basic setting, display group 00 => Page 16 .

-> Display readout (for example):

System in basic setting 0						
42	46	0	20	90	201	
64	153	127	83			

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If necessary, correct injection start
=>Page 50
- Remove fuse for the engine electronics from the electronics box.
- Observe display in display zone 2.

Basic setting 0						
42	255	0	20	90	201	
64	153	127	83			

-> The display should run up to 255.

Note:

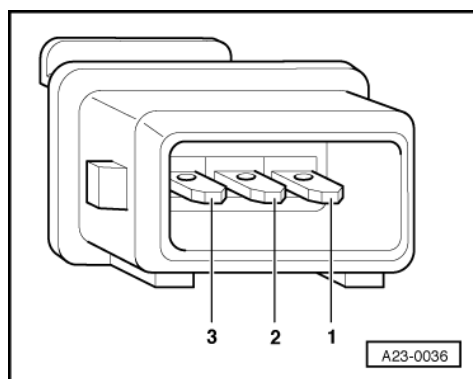
The interruption to the power supply will cause the valve for the commencement of injection to close. The interior pressure in the pump cannot be reduced further, and therefore the full pressure is applied to the injection timing control piston. This moves the injection timing control to the "advanced" stop.

If specified value is not attained:

- Replace the injection pump.
- Interrogate and delete fault memory => Page 3 .



2.3 - Checking valve for commencement of injection



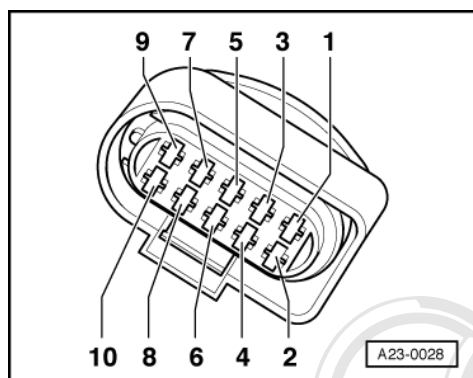
Check valve for commencement of injection electrically

- Detach connector the valve for commencement of injection => overview of fitting locations, Page 36 .

Resistance measurement on vehicles with 3-pin connector.

- -> Connect hand-held multimeter for resistance measurement between contacts 2 and 3.

Specified value: 12 ... 20 ω



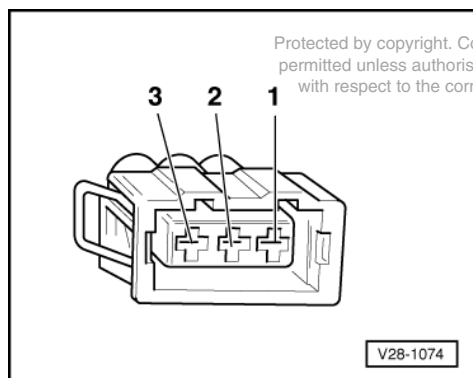
Resistance measurement on vehicles with 10-pin connector.

- -> Connect hand-held multimeter for resistance measurement between contacts 9 and 10.

Specified value: 12 ... 20 ω

If specified value is not attained:

- Replace valve for commencement of injection (N108).

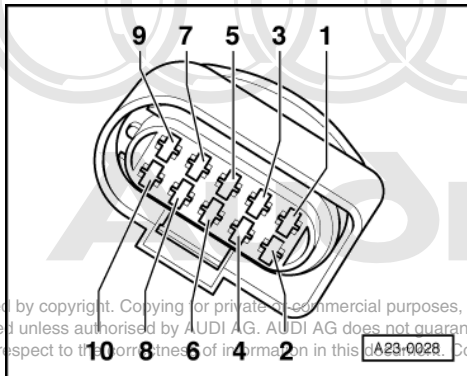


If specified value is attained:

Check power supply for valve for commencement of injection

Resistance measurement on vehicles with 3-pin connector.

- -> Connect hand-held multimeter for voltage measurement between engine earth and contact 3 on the connector.
- Switch the ignition on.



Specified value: approx. battery voltage

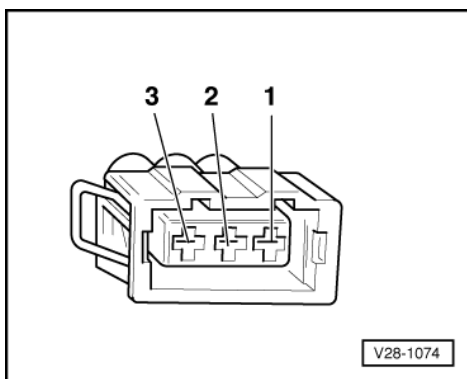
Voltage measurement on vehicles with 10-pin connector.

- -> Connect hand-held multimeter for voltage measurement between engine earth and contact 10 on the connector.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

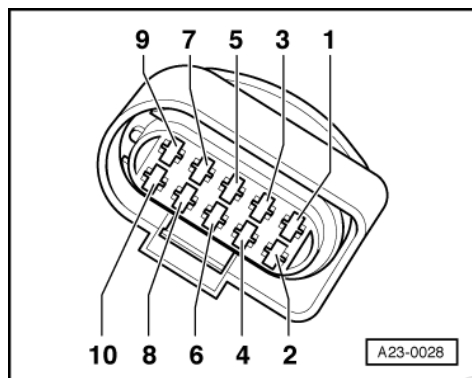
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61



The following wiring connections are to be checked for open circuits and/or short to positive or negative.

-> Wiring measurement on vehicles with 3-pin connector.

3-pin connector on wiring harness, contact	Test box V.A.G 1598/22, socket
2	79
3	2, 28



-> Wiring measurement on vehicles with 10-pin connector.

10-pin connector on wiring harness, contact	Test box V.A.G 1598/22, socket
9	79
10	2, 28

- Rectify any open/short circuit as necessary.

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2.4 - Checking fuel temperature sender -G81

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number XXX

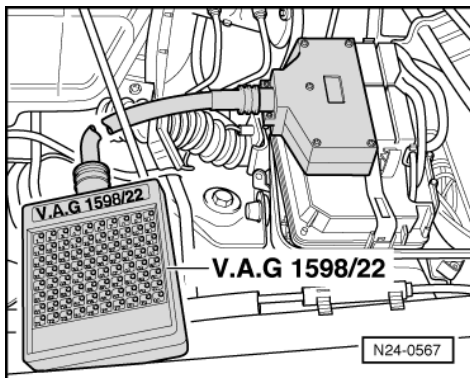
- Press keys 0, 0 and 7 for "display group number 7" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 7
15.4 5C 15.9 5C 16.7 5C

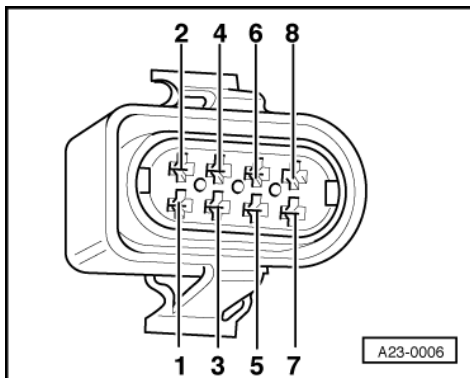
- Observe readout in display zone 1.

If the wiring to the sensor has an open circuit, a substitute value of -5.4 °C will be displayed.



If the display is implausible or if a substitute value of -5.4 °C is displayed:

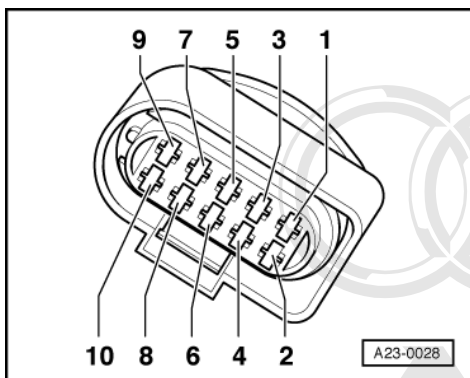
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .
- Detach the connector on the injection pump => overview of fitting locations, Page 36 .



The following wiring connections are to be checked for open circuits and/or short to positive or negative.

-> Wiring measurement on vehicles with 8-pin connector.

8-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
4	76
7	53



-> Wiring measurement on vehicles with 10-pin connector.

10-pin connector on wiring harness, contact	Test box V.A.G 1598/22, socket
4	76

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10-pin connector on wiring harness, contact	Test box V.A.G 1598/22, socket
7	53

- Rectify any open/short circuit as necessary.

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

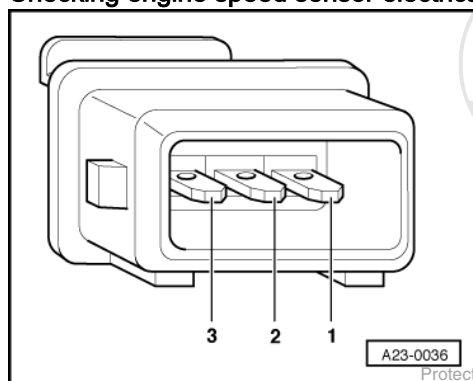
3 - Testing control unit input values

3.1 - Testing control unit input values

3.2 - Checking engine speed sender -G28

The engine speed sender is a combined speed sender and reference mark sender. If it fails, the engine will cut out.

Checking engine speed sensor electrically



- Switch ignition off.
- Detach the connector for the sensor => overview of fitting locations, Page 36 .
- -> Connect the multimeter for resistance measurement between contacts 1 and 2 on the sensor connector.

Specified value: approx. 1 kΩ

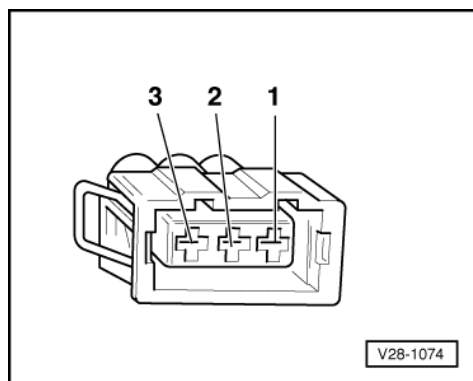
If specified value is not attained:

- Replace the engine speed sensor (G28).

If specified value is attained:

Checking wiring

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .



The following wiring connections are to be checked for open circuits and/or short to positive or negative.

3-pin connector on wiring harness, contact	Test box V.A.G 1598/22, socket
1	69
2	67
3	1, 27

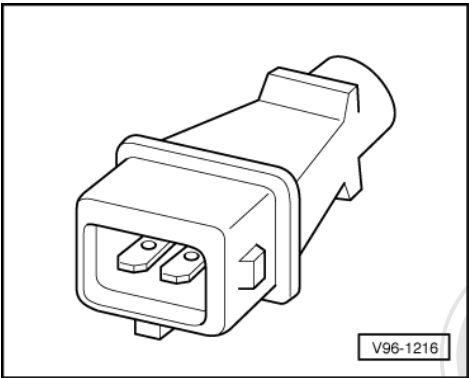
- Rectify any open/short circuit as necessary.
- => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

3.3 - Checking needle lift sensor

The needle lift sensor signal is used to determine the commencement of injection. If it fails, injection start switches to open loop control (according to engine speed and engine load). During normal operation, injection start is controlled by a closed loop function (according to engine speed, engine load and temperature).

Checking engine speed sensor electrically

- Switch ignition off.
- Detach the connector for the sensor=> overview of fitting locations, Page 36 .



- -> Connect the hand-held multimeter for resistance measurement between the contacts on the sensor connector.

Specified value: 90 ... 120 ω (with a hot engine the resistance may be up to 20 ω higher)

If specified value is not attained:

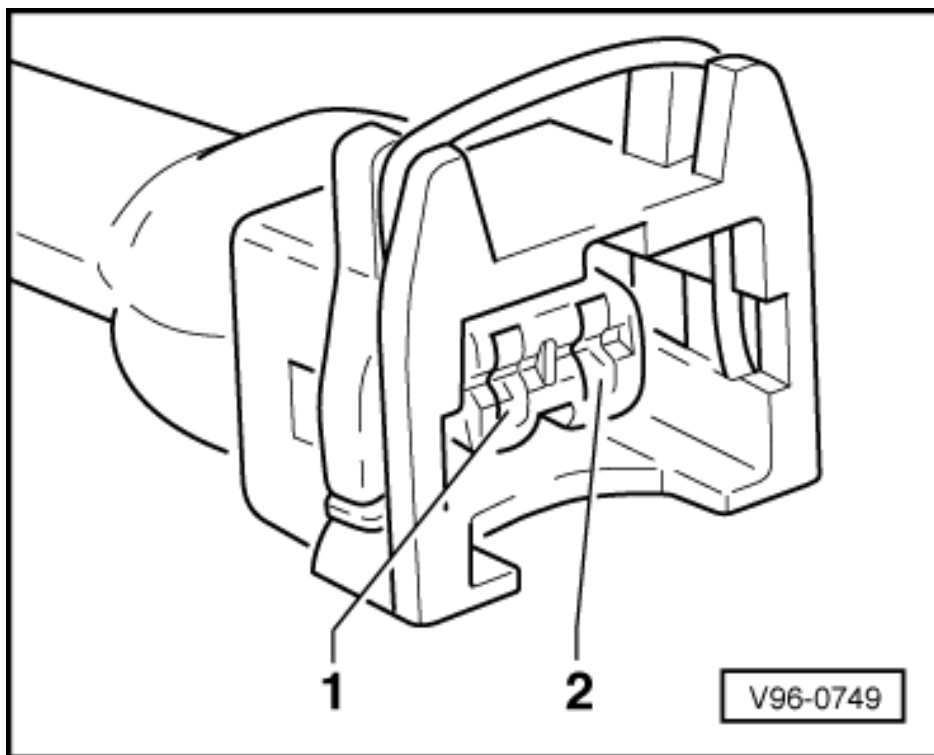
- Replace the injector cyl. 3 with needle lift sensor (G80)

If specified value is attained:

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Checking wiring

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .



The following wiring connections are to be checked for open circuits and/or short to positive or negative.

2-pin connector on wiring harness, contact.	Test box V.A.G 1598/22, socket
1	62
2	55

- Rectify any open/short circuit as necessary.

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

3.4 - Checking coolant temperature sender -G62

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> Indicated on display:

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Rapid data transfer HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number XXX

- Press keys 0, 0 and 7 for "display group number 7" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 7
□ 15.4 5C 15.9 5C 16.7 5C

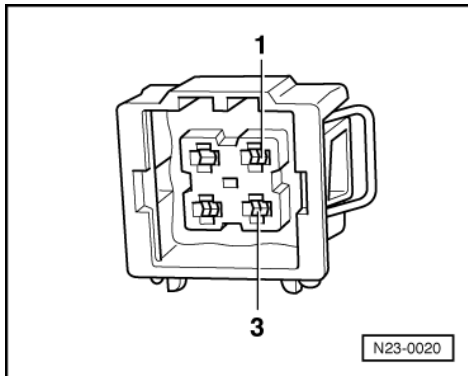
- Check display in display zone 4 (coolant temperature).

Specified value: The temperature reading should increase at a uniform rate.

If there is a fault, the fuel temperature will be displayed as a substitute value (display zone 1).

If an implausible value is displayed in display zone 4, or if the fuel temperature is displayed as a substitute value:

- Switch ignition off.



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- -> Pull off the connector on the sensor => Overview of fitting locations, Page 36 .
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

4-pin connector on the wiring harness, contact	Test box V.A.G 1598/22, socket
1	70
3	54

- Rectify any open/short circuit as necessary.

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

If no wiring fault is detected:

- Replace coolant temperature sender (G62).

3.5 - Checking intake manifold temperature sender

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. During this, the ignition must be switched on
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number XXX

- Press keys 0, 0 and 7 for "display group number 7" and confirm entry with Q key.

Read measured value block 7
15.4 5C 15.9 5C 16.7 5C

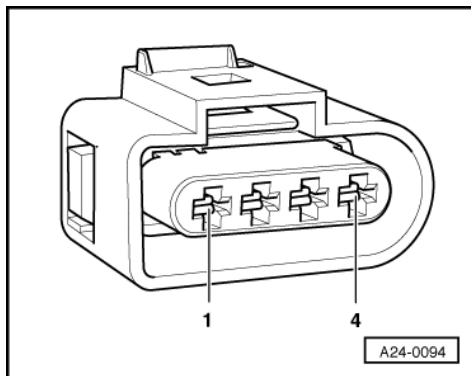


- > Indicated on display:
- Observe readout in display zone 3.

If the wiring to the sensor has an open circuit, a substitute value of 136.8 °C will be displayed.

An implausible value or a substitute value of 136.8°C is displayed:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **61** .



- -> Remove the connector from the sensor => overview of fitting locations Page **36** .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

4-pin connector on the wiring harness, contact	Test box V.A.G 1598/22, socket
1	1, 27
2	13

- Rectify any open/short circuit as necessary.

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

3.6 - Checking brake light switch -F

The brake pedal switch is an integral part of the brake light switch (joint component)

Because the injection system operates with an accelerator pedal sensor (potentiometer) which may be defective, the engine is regulated for reasons of safety when the brakes are operated. To do this the control unit requires signals from both the brake light switch and the brake pedal switch. This means that if the brakes are operated when the accelerator pedal is held at a constant position, the engine is immediately reduced to idling speed. Incorrectly adjusted switches may lead to undesired control action

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. During this, the ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit => Page **1** .)

-> Indicated on display:

Rapid data transfer **HELP**
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block **HELP**
Enter display group number XXX

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- Press keys 0, 0 and 6 for "display group number 6" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 6
0 km/h 0 0 0 000000
255
```

- Observe readout in display zone 2.

```
Read measured value block 6
0 km/h 0 0 0 000000
255
```

-> Specified value: 0 0 0

- Operate brake pedal slowly.

```
Read measured value block 6
0 km/h 1 1 0 000000
255
```

-> Specified value: 0 1 1

Both displays should change from 0 to 1.

- Centre display = Brake pedal switch
- Right display = Brake light switch

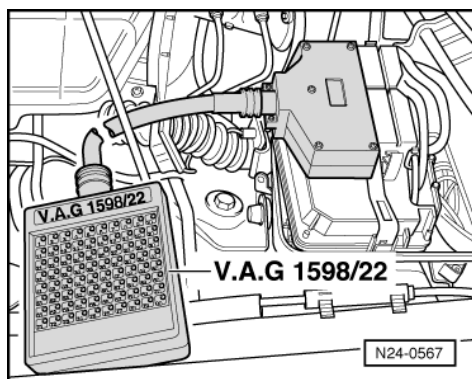
- Allow brake pedal to return slowly to its normal position.

```
Read measured value block 6
0 km/h 0 0 0 000000
255
```

-> Specified value: 0 0 0

Both displays should change from 1 back to 0.

If one or both of the displays does not change from 0 to 1:



- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Clutch pedal switch, contact
9	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder
20	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

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



3.7 - Checking clutch pedal switch F36

The clutch pedal switch (F36) informs the control unit whether the clutch is engaged or disengaged. This prevents the engine from bucking when disengaging and engaging and also prevents the engine from revving during disengaging operations when the cruise control system is switched on.

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. The ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit => Page **1**.)

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block HELP
Enter display group number XXX
```

- Press keys 0, 0 and 6 for "display group number 6" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 6
0 km/h    0    0    0    000000
255
```

- Observe display in display zone 2.

```
Read measured value block 6
0 km/h    0    0    0    000000
255
```

-> Specified value: 0 0 0

- Operate clutch pedal. The left position must change to 1.

```
Read measured value block 6
0 km/h    1    0    0    000000
255
```

-> Specified value: 1 0 0

If specified value is not attained:

- Switch ignition off.
- Remove the connector from the clutch pedal switch => overview of fitting locations, Page **36**.
- Measure resistance at switch contacts.

Specified value: Clutch not depressed: max. 10 ω

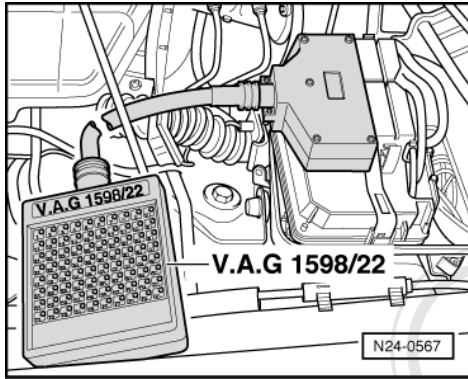
Specified value: Clutch depressed: ∞ ω

If the specified values are not obtained:

- Replace clutch pedal switch (F36).

If specifications are attained:

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- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Clutch pedal switch, contact
46	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

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

3.8 - Checking -G149 sensor for modulating piston movement and -N146 metering control

The quantity adjuster is an electromagnetic swivelling positioner that is controlled by the control unit by a specific duty cycle. The eccentric shaft on the quantity adjuster moves the modulating piston on the high pressure piston and thereby regulates the quantity of fuel injected.

The modulating piston movement sender informs the control unit of the modulating piston position, thereby indicating the quantity of fuel injected.

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. For this purpose, the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> Indicated on display:

```
Rapid data transfer      HELP
Select function XX
```

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block HELP
Enter display group number XXX
```

- Press keys 0, 0 and 1 for "display group number 1" and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 1
840 rpm      5.6 mg/stroke
1.480 V      87.3 5C
```

- Check display in display zone 4 (coolant temperature).

```
Read measured value block 1
840 rpm      5.6 mg/stroke      1.480
V      87.3 5C
```



-> Specified value: at least 85 °C

Do not continue with check until coolant temperature is reached.

- Switch off any electrical consumers that may be on (air conditioner, rear window heater, lights etc.).
- Check display in display zone 3 (voltage supplied from modulating piston movement).

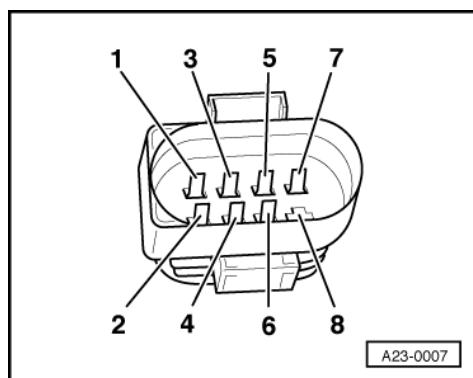
Read measured value block 1
840 rpm 5.6 mg/stroke 1.480
V 87.3 5C

-> Specified value: 1.250 ... 1.750 Volt

If specified value is not attained:

- Replace the injection pump.

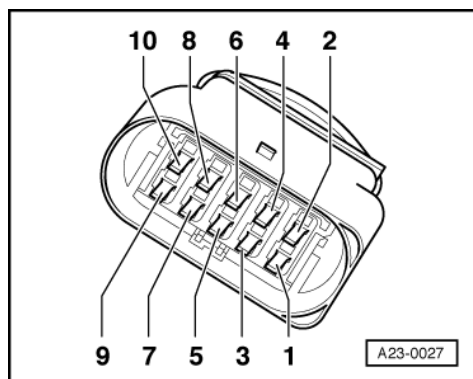
Electrical check of modulating piston movement sender (G149) and quantity adjuster (N146)



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- Switch ignition off.
- Detach the connector for the sensor => overview of fitting locations, Page 36 .
- Connect hand-held multimeter (resistance test range) between the following contacts on the injection pump connector:

-> Wiring measurement on vehicles with 8-pin connector.



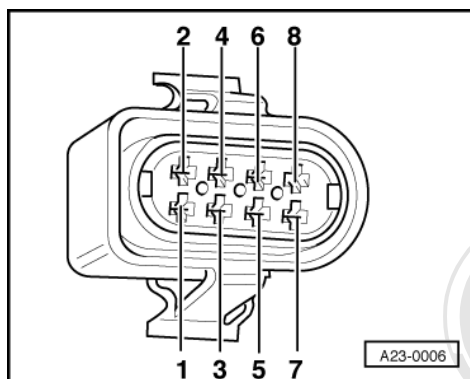
-> Wiring measurement on vehicles with 10-pin connector.

8-pin or 10-pin injection pump connector	Specified value
1 + 2	4.9 ... 7.5 ω
3 + 2	4.9 ... 7.5 ω
6 + 5	0.4 ... 1.1 ω

If the specified values are not obtained:

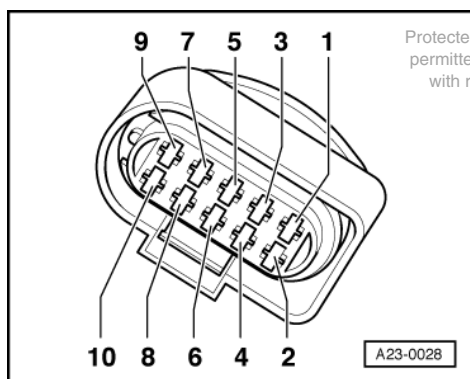
- Replace the injection pump.

Checking power supply and wiring connections



- Switch ignition off.
- Detach the connector for the sensor=> overview of fitting locations, Page 36 .
- Switch the ignition on.
- Connect hand-held multimeter (voltage test range) between the following contacts on the wiring harness connector:

-> Voltage measurement on vehicles with 8-pin connector.

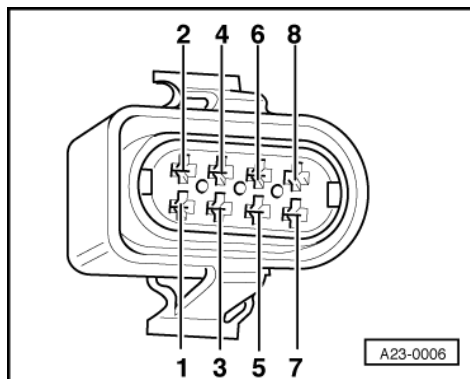


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-> Voltage measurement on vehicles with 10-pin connector.

8-pin or 10-pin connector on wiring harness, contact	Specified value
1 + earth	approx. 2.5 V
3 + earth	approx. 2.5 V
5 + earth	approx. battery voltage

If the specified values are not obtained: Check wiring connections =>Page 82



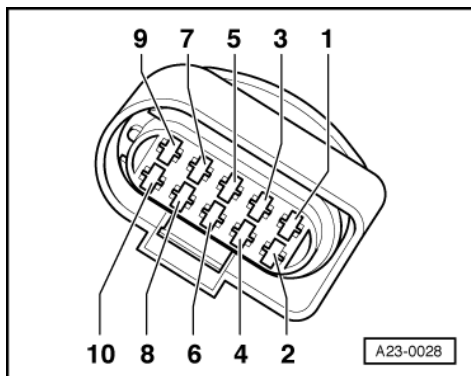


Checking wiring

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **61** .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

-> Wiring measurement on vehicles with 8-pin connector.



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-> Wiring measurement on vehicles with 10-pin connector.

8-pin or 10-pin connector on wiring harness, con- tact	Test box V.A.G 1598/22, socket
1	56
2	57
3	64
5	2, 28
6	59, 66, 80

- Rectify any open/short circuit as necessary.

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

3.9 - Checking air mass meter -G70

The signal from the air mass meter is required by the control unit to calculate the required injection quantity and to control the exhaust gas recirculation. The weaker the signal from the air mass meter, the less fuel can be injected.

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. For this purpose, the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page **1** .)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number XXX

- Press keys 0.1 and 0 for "display group number 10" and confirm entry by pressing Q key.

-> Indicated on display:

Read measured value block 10			
309 mg/stroke	1030 mbar	1011	
mbar 0.0 %			

- Observe readout in display zone 1.

Read measured value block 10			
309 mg/stroke	1030 mbar	1011	
mbar 0.0 %			

-> Specified value: 230 ... 370 mg/stroke

If specified value is not attained:

- Check exhaust gas recirculation:

=> 4-cyl. Diesel direct - injection system (TDI), Mechanical Components; Repair group 26; Checking exhaust gas recirculation system Checking exhaust gas recirculation system

If specified value is attained:

- Perform a road test.

Important:

Secure fault reader to the rear seat and operate from this location. When doing this, always observe the relevant safety precautions Page 35 .

- Accelerate the vehicle from approx. 1500 rpm at full throttle, manual gearbox should be in 2nd gear, automatic gearbox should be in position 2.
- At approx. 3000 rpm, press the PRINT key on the V.A.G 1551. The accelerator pedal must be fully depressed at this point.

Read measured value block 10			
830 mg/stroke	1030 mbar	1850	
mbar 100 %			

-> Specification for display zone 4: 100 % (accelerator pedal position)

If specified value is not attained:

- Repeat test and accelerate vehicle at full throttle.

Read measured value block 10			
830 mg/stroke	1030 mbar	1850	
mbar 100 %			

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-> Specification for display zone 3: Boost pressure

Engine codes: AFF, AHU, AHH 1800 ... 2050 mbar

Engine code: AFN 1800 ... 2250 mbar

If specified value is not attained:

- Test boost pressure

=> 4-cyl. Diesel direct injection system (TDI), Mechanical Components; Repair group 21; checking boost pressure system checking boost pressure system

Read measured value block 10			
830 mg/stroke	1030 mbar	1850	
mbar 100 %			

-> Specification for display zone 1: > 800 mg/stroke (intake air mass)

Engine codes: AFF, AHU, AHH

greater than 750 mg/stroke

Engine code: AFN



greater than 800 mg/stroke

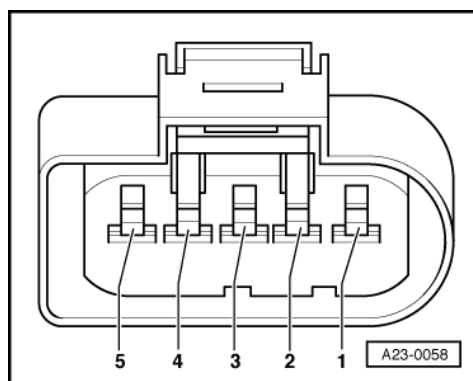
If specified value is not attained:

- Replace air mass meter (G70).

If display zone 1 shows a constant reading of 425 mg/stroke (fixed substitute value):

Substitute value for 66 kW vehicles 425 mg/stroke

Substitute value for 81 kW vehicles 550 mg/stroke

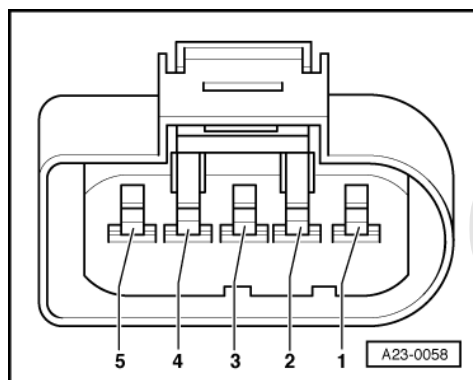


- Switch ignition off.
- Remove connector from air mass meter => Fitting location overview, Page 36
- Switch the ignition on.
- -> Connect hand-held multimeter (voltage range) between the following contacts on the connector:

5-pin connector on the wiring harness, contact.	Specified value
2 + earth	Battery voltage
2 + 3	Battery voltage
4 + earth	approx. 5 V
4 + 3	approx. 5 V

If the specified values are not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .



The following wiring connections are to be checked for open circuits and/or short to positive or negative.

5-pin connector on the wiring harness, contact	Test box V.A.G 1598/22, socket
1	2, 28
2	2, 28

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5-pin connector on the wiring harness, contact	Test box V.A.G 1598/22, socket
3	1, 27
4	50
5	52

- Rectify any open/short circuit as necessary.

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

4 - Testing signals from and to automatic gearbox

4.1 - Testing signals from and to automatic gearbox

4.2 - Testing gearshift signal

This signal causes the injection quantity to be briefly reduced (torque reduction) during gearshifts in order to smooth out the jolts experienced when changing gear.

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number XXX

- Press keys 0, 0 and 9 for "display group number 9" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 9
1 2 3 4

- Check display in display zone 3.

Specified value: 51 mg/stroke

- Perform a road test.

Important:

Secure fault reader to the rear seat and operate from this location. When doing this, always observe the relevant safety precautions Page 35.

- Accelerate the vehicle from a stationary position with full throttle, but without using kick down.

Read measured value block 9
1 2 3 4



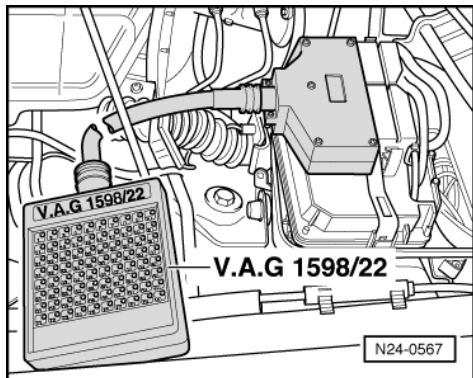
-> Observe display zone 3 when vehicle changes into 2nd gear.

Specified value: display should drop briefly below 51 mg/stroke

Note:

Because of the lag in data transfer, there might be a delay before the display reaches the specified value.

If specified value is not attained:



- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Automatic gearbox control unit, contact
36	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

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- Rectify any open/short circuit as necessary.

4.3 - Testing engine speed signal

This signal is required for calculating how to smooth out the gearshifts.

Signal testing

=> Check engine speed signal, Page 90

4.4 - Checking kickdown signal

The signal is monitored by the self-diagnosis function (fault memory, read measured value block) of the automatic gearbox control unit.

Signal testing

=> Automatic Gearbox 01N, self-diagnosis; Repair group 01; Self-diagnosis electrical test; Performing self-diagnosis Self-diagnosis electrical test Performing self-diagnosis

5 - Checking signals from/to air conditioner

5.1 - Checking signals from/to air conditioner

5.2 - Checking the air conditioner compressor shutoff

The engine control unit will shut off the air conditioning compressor in the following cases:

- ◆ Heavy acceleration from low speeds (control unit detects angle change at sensor for accelerator pedal position and receives road speed signal)
- ◆ In the emergency program (emergency running mode)
- ◆ If coolant temperature is above 120 °C
- ◆ After every start, for approx. 6 seconds.

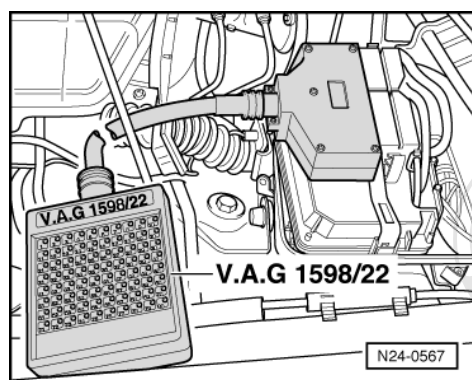
Test conditions

- Air conditioning system OK
- Air conditioner switched on
- No fault stored in fault memory

Final control diagnosis

-> Start final control diagnosis and activate exhaust gas recirculation start valve => Page 13 .

The air conditioner compressor should cut out within 5 seconds (visual check), then start and stop again every 5 seconds.



If the conditioner compressor is not switched off:

- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

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Test box V.A.G 1598/22, socket	Air conditioner operating and display unit, contact
16	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.



5.3 - Checking air conditioner signal

The increase in idling speed resulting from the air conditioner signal depends on the control unit version and is not activated in all vehicles.

The air conditioner signal informs the engine control unit that the air conditioner needs a higher idling speed in order to provide the desired interior temperature (both when cooling and heating).

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block	HELP
Enter display group number XXX	

- Press keys 0, 0 and 2 for "display group number 2" and confirm entry with Q key.

- Observe display in display zone 3, the air conditioner must not be switched on.

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-> Indicated on display:

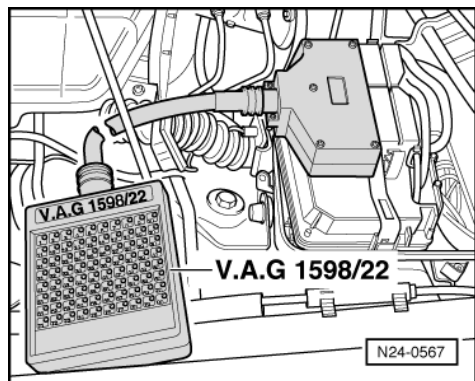
Read measured value block 2				
860 rpm	0.0 %	0	1	
0	18.4 5C			

- Switch on air conditioner, press the "Auto" key and select the lowest temperature.
- Select the lowest temperature and highest blower speed. The air conditioner compressor should run.
- Check display in display zone 3.

Read measured value block 2				
860 rpm	0.0 %	1	1	1
18.4 5C				

-> Specified value: 0 0 1 (air conditioner signal)
Specified value: 0 1 0 (idling switch closed)
Specified value: 1 0 0 (high idling speed)

If specified value is not attained:



- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61.

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Air conditioner operating and display unit, contact
48	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

6 - Testing signals from/to dash panel insert

6.1 - Testing signals from/to dash panel insert

6.2 - Checking vehicle speed signal

The speed signal is required for shutting off the air conditioner compressor when accelerating, for the cruise control system and to ensure smoother driving (jolt damping).

Test conditions

- Speedometer OK, checking:
- => Electrical System; Repair group 90
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> Indicated on display:

Rapid data transfer HELP
Select function **XX**

- Press keys 0 and 8 for the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

Read measured value block HELP
Enter display group number **XXX**

- Press keys 0, 0 and 6 for "display group number 6" and confirm entry with Q key.

-> Indicated on display:

Read measured value block 6
0 km/h 0 0 0 000000
255

- Carry out a test run and compare the display on display 2 (2nd person required) with the display on the tachometer.

Important:
Secure fault reader to the rear seat and operate from this location. When doing this, always observe the relevant safety precautions Page 35.

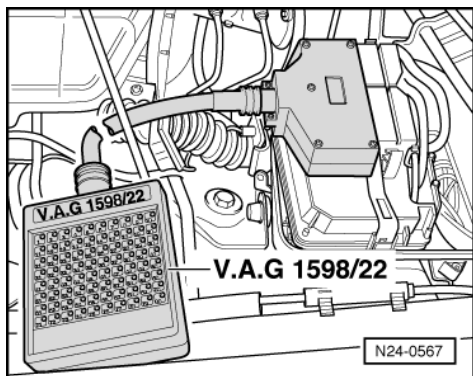
- Observe readout in display zone 1.

Read measured value block 6
45 kph 0 0 0 000000
255



-> Specified value: The current road speed should be displayed (compare with speedometer).

If specified value is not attained:



- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Dash panel insert, contact
51	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Find all the speed signal "consumers" (e.g. radio, automatic gearbox, air conditioner etc.), disconnect them one by one from the dash panel insert, then repeating the test until the cause of the problem has been identified.

6.3 - Checking engine speed signal

The engine speed signal is required for the rev counter, air conditioner and automatic gearbox.

However, since the signal cannot be read in the form in which it is generated by the engine speed sensor (G28), it has to be processed by the engine control unit.

Identify the engine speed signal as follows:

- Connecting V.A.G 1551 fault reader
=> Page 1 and perform "Automatic Test Sequence 00".

No faults relating to a "missing engine speed signal" should be stored in any of the control units.

If one of the control units indicates a fault:

- Locate open circuit or short circuit between engine control unit and the control unit concerned.

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

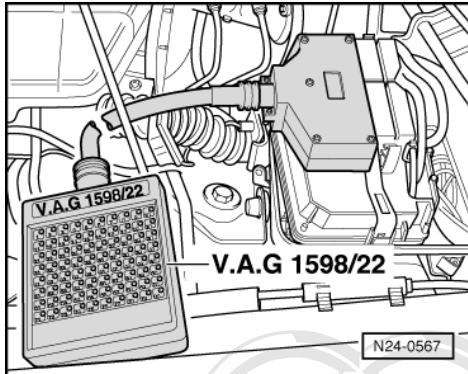
6.4 - Checking fuel consumption signal

This signal is required for the fuel consumption display on the dash panel insert.

If the dash panel insert display shows an incorrect fuel consumption rate:

- Adjust the fuel consumption display to match the actual rate of consumption

=> Electrical System; Repair group 01; Self diagnosis of dash panel insert; Adaption Self diagnosis of dash panel insert Adaption



If the fuel consumption is not indicated on the dash panel insert:

- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.

Test box V.A.G 1598/22, socket	Dash panel insert, contact
18	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations binder

- Rectify any open/short circuit as necessary.

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28 - Glow plug system

1 - Checking glow plug system

1.1 - Checking glow plug system

1.2 - Checking function

- Pull glow plug connector off glow plugs.
- Connect hand-held multimeter (voltage test range) between engine earth and one of the glow plug connectors.
- Start the final control diagnosis and activate the glow plug relay => Page 13.

-> Indicated on display:

Final control diagnosis
Glow plug relay -J52

Specified value: approx. battery voltage (every 5 seconds)

If specified value is not attained:

- Rectify any open/short circuit as necessary.

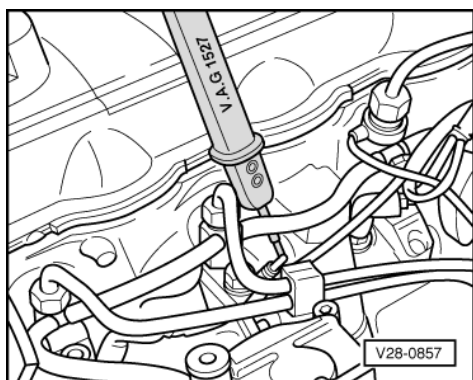
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1.3 - Checking glow plugs

Test conditions

- Battery voltage at least 11.5 V



- Switch ignition off.
- Pull glow plug connector off glow plug.
- -> Connect diode test lamp wire using auxiliary clips from auxiliary cable set to battery positive (+).
- Place diode test lamp probe on each glow plug one after the other.

Diode lights up: glow plug OK.

If diode does not light up: Renew glow plug.

- Remove and install glow plugs with jointed spanner 3220.

Tightening torque: 15 Nm

1.4 - Checking glow period warning lamp

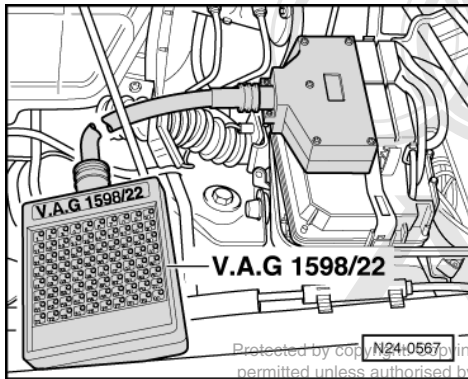
- Start final control diagnosis and activate glow period warning lamp => Page 13 .

-> Indicated on display:

Final control diagnosis
Glow period warning lamp -K29

The warning lamp must blink.

Warning lamp does not blink:



- -> Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 61 .
- Connect together sockets 1 and 41 on the test box using an auxiliary cable from V.A.G 1594.
- Switch the ignition on.

Specified value: The warning lamp should light up.

If the warning lamp does not light up:

- Rectify any open/short circuit as necessary.

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

If the warning lamp lights up now but did not light up during the final control diagnosis:

- Check control unit for diesel direct-injection system =>Page 62