

Audi 80 1992 ➤

Diesel Direct Injection and Glow Plug System ➤ 02.94

Engine ID

1Z

Edition 05.1997



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Audi 80 1992 ➤

Diesel Direct Injection and Glow Plug System ➤ 02.94

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

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Equipped with

- ◆ Fault memory: Non-volatile memory and volatile memory¹⁾
 - ◆ Rapid data transfer
- 1) Will be cancelled after 50th engine start if fault has not occurred again.

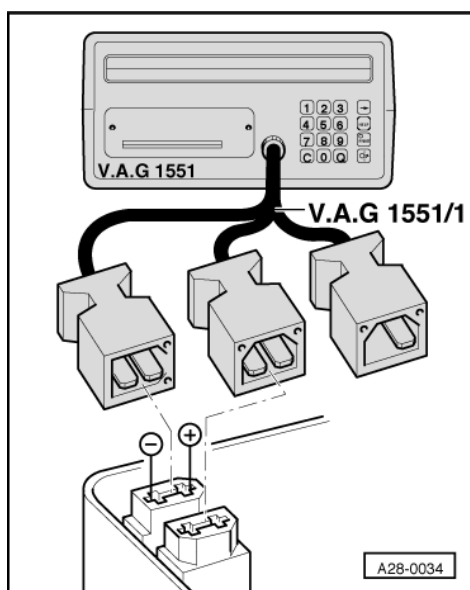
1.3 - Safety notes

Note the following points if test equipment has to be used during a road test:

Warning

- ◆ Test equipment must always be secured on the rear seat and operated by a second person.
- ◆ If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.

1.4 - Connecting fault reader V.A.G 1551 and selecting engine electronics control unit



**Requirements for test:**

- Supply voltage of electrical system OK
- Fuses OK

=> Current flow diagrams, Electrical fault-finding and Fitting locations

- Remove cover from relay panel with fuse holder in plenum chamber.
- -> Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 to diagnostic connectors on relay panel as follows using cable V.A.G 1551/1:
- Fit black cable connector to black diagnostic connector.

-> Indicated in display

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

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1) appears alternately

Note:

If the display remains blank, test voltage supply to black diagnostic connector=>Page 20.

- Fit white cable connector to white diagnostic connector. (The blue connector is not used.)

Depending on the function required, see table of selectable functions=>Page 3.

- Switch on ignition.

or

- Start the engine.
- Switch on printer with the Print key (indicator lamp in key lights up).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

Rapid data transfer HELP
Enter address word XX

- Press keys 0 and 1 for address word "Engine electronics" and confirm entry with Q key.

-> The display on fault reader V.A.G 1551 will show the control unit identification, as in the example shown.

8A0907401A 1.9l R4 EDC A23
D06 □
Coding 00000 WSC 00000

Control unit identification (example)

- 8A0907401A	Part No. => Parts List
- 1.9 ltr.	Engine capacity
- R4	In-line engine, 4 cylinders
- EDC	Electronic Diesel Control
- A23	Emission limit values as per Appendix 23 of §47 StVZO
- D06	Data level (software version) of control unit
- Coding 00000	Control unit coding
- WSC 00000	Workshop Code of V.A.G 1551 which was used to perform the last coding

Note:

If no data link can be established with the control unit

=>Page **21** .

- Press =>key.

-> Indicated on display:

Rapid data transfer **HELP**
 Select function XX

Selectable functions

Function	Ignition on	Engine idling	Page
01 Interrogate control unit version	X	X	2
02 Interrogate fault memory	-	X	3
03 Final control diagnosis	-	X	11
04 Basic setting	-	X	14
05 Erase fault memory	-	X	3
06 End output	X	X	3
08 Read measured value block	X	X	16
09 Read individual measured value	X	X	19

Further functions, which can be printed out by pressing the HELP key, need not be considered.

After a function has been interrogated, the V.A.G 1551 returns to the following start position:

-> Indicated on display:

Rapid data transfer **HELP**
 Select function XX

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
 (Connecting fault reader and selecting engine electronics control unit => Page **2** .)

Note:

If the engine does not start, turn the engine over for at least 5 seconds using the starter. After doing this, do not switch off the ignition.

-> Indicated on display:

Rapid data transfer **HELP**
 Select function XX

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

-> Indicated on display:

No fault recognised

- Press =>key.

**Note:**

If problems have been reported but no faults are detected by the self-diagnosis:

- Perform self-diagnosis=>Page 44

or

-> Indicated on display:

X faults recognised

If the printer on the fault reader is switched on the stored faults will be displayed and printed out in sequence.

Note:

If the printer is switched off, press the=>key to display the next fault.

- After the last fault has been displayed and printed out, rectify the faults as described in the fault table=>from Page 5.
- Press =>key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 5 for the function "Erase fault memory" and confirm entry with Q key.

Notes:

-> Indicated on display:

Attention!
Fault memory is not interrogated

This means that the proper sequence of steps was not followed.

- Interrogate fault memory.

In the following cases the fault memory is not erased:

- ♦ If the ignition was switched off after interrogating the fault memory
- ♦ If the engine speed exceeded 2000 rpm
- ♦ If an existing static fault was not rectified

-> Indicated on display:

Rapid data transfer
Fault memory is erased!

- Press =>key.

-> Indicated on display:

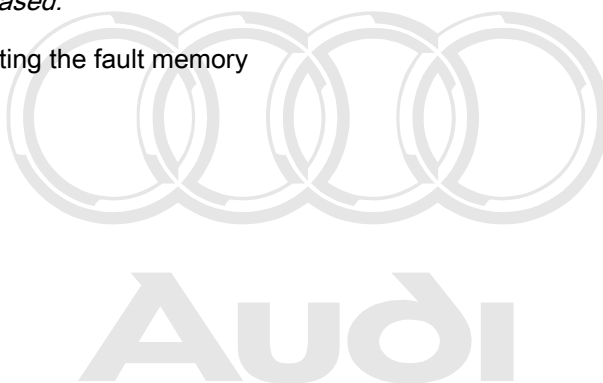
Rapid data transfer HELP
Select function XX

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

-> Indicated on display:

Rapid data transfer HELP
Insert address word XX

- Switch off ignition and unplug the diagnostic connector.



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2.2 - Fault table

Notes:

- ♦ The table below lists all the possible faults that can be detected by diesel direct injection system control unit -J248, and which may appear on fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 when the fault memory is interrogated. The fault table lists the faults in order according to fault code.
- ♦ Before renewing a component indicated as being faulty, test the wiring and connectors for the component and also the earth connections using the current flow diagram. This is particularly important in the case of sporadic faults (indicated by the letters "/SP").
- ♦ If the engine is switched off after the test drive and before interrogating the fault memory, all existing faults will be displayed as sporadic faults. If there are faults which only occur sporadically, or if the fault memory is not erased once the faults have been rectified, these faults will also be displayed as sporadic faults, i.e. with the letters "/SP" on the right of the V.A.G 1551 display.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00281 Road speed sender -G68 Implausible signal	- Speedometer -G21 defective - Speedometer sender -G22 defective - Open circuit	- Load change jolts - Air conditioner does not work	- Trace fault using current flow diagram - Test speedometer sender -G22 => Electrical system; Repair group 90; Testing dash panel insert components; Testing speedometer sender signal at dash panel insert wiring harness Testing dash panel insert components; Testing speedometer sender signal at dash panel insert wiring harness - Test road speed signal => Page 91

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00513 Engine speed sender -G28 Implausible signal 1)	- Sender disc bent or loose - G28 defective - Open circuit in screening	- Poor starting - Engine runs rough, misfiring - Poor starting - Increased idling speed - Fault lamp lights up - Reduced power - No display on rev counter - Oil pressure indicator lamp lights up	- Remove sump and check sender disc - Test engine speed sender -G28 => Page 77 - Test wiring to engine speed sender =>Page 78
Input open 1)	- G28 defective - Open circuit or short circuit		

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00519			



Intake manifold pressure sender - G71	Signal too small 1)	- Open circuit or - short circuit - -G71 defective	- Loss of power	- Test intake manifold pressure sender -G71 =>Page 58
	Signal too great 1)	- Open circuit - -G71 defective		
	Implausible signal 1)	- Hoses wrongly connected or disconnected		- Check hose connections
		- Diesel direct injection control unit -J248 defective		- Renew control unit => Page 50
	Regulating difference 1)	=> Fault code 00575		

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00522 Coolant temperature sender - G62	Signal too small 1)	- Black exhaust smoke when starting - Glow period always approx. 20 seconds	- Test coolant temperature sender -G62 =>Page 80
	Signal too great 1)		

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00523 Intake air temperature sender -G42	Signal too small 1)	- Loss of power	- Test intake air temperature sender -G42 =>Page 82
	Signal too great 1)		

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00526 Brake light switch -F Implausible signal	- Switching points of brake light switch -F and brake pedal switch -F47 are too far apart	- Sudden loss of power (sporadic) - Warning lamp lights up	- Test brake light switch -F and brake pedal switch -F47 =>Page 83
	- Open circuit - -F defective - -F47 defective	- Brake light defective	
	- Wire to brake pedal switch has been connected to clutch pedal switch and vice versa		- Check wiring

	- Fuse defective	- Fault code 00550 is stored ("Injection commencement regulation; Regulating difference")	- Check fuse
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V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00527 Intake manifold temperature sender -G72 Signal too small 1)	- -G72 defective - Short to earth in wiring	- Reduced power	- Test intake manifold temperature sender -G72 =>Page 60
Signal too great 1)	- -G72 defective - Open circuit or short to positive		
00532 Supply voltage Signal too small	- Excess voltage protection relay - J249 defective - Open circuit or short circuit	- Engine will not start - Engine cuts out	- Test voltage supply to Diesel direct injection system =>Page 75

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00539 Fuel temperature sender -G81 Signal too small 1)	- Fuel overheating - -G81 defective - Short to earth in wiring - Fuel pre-heater defective or non-return valve in return pipe between filter and fuel tank is fitted the wrong way round	- Reduced power - Uneven idling	- Test fuel temperature sender -G81 => Page 65
Signal too great 1)	- -G81 defective - Open circuit or short to positive		
	- Plug for injection pump disconnected	- Several faults stored - Engine cuts out	- Check injection pump connector

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00541 Slide travel potentiometer -G99 Signal too small 1)	- -G99 defective - Open circuit or short to earth in wiring to control unit	- Misfiring, jolting - Engine cuts out	- Test slide travel potentiometer -G99 => Page 85
Signal too great 1)	- -G99 defective - Open circuit or short to positive in wiring to control unit		



Implausible signal 1)	- G99 defective	- Engine cuts out but can be started again - Loss of power, black exhaust smoke	- Erase fault memory, take car for test drive and interrogate fault memory again. If fault still occurs, renew injection pump => Page 38
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1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00542 Needle lift sender -G80 Input open 1)	- G80 defective - Open circuit or short circuit	- Warning lamp lights up - Engine running rough - Reduced power	- Test needle lift sender -G80 => Page 79
	- Sporadic open circuit (break in wiring)	- Misfiring, jolting	
Implausible signal 1)	- Interruption in fuel feed: fuel tank run dry, supply pipe or filter blocked, air entering fuel system	- Fault 00550 may be stored ("Injection commencement regulation; Regulating difference") - Misfiring, jolting	- Check fuel system
	- (Sporadic) open circuit in wiring to fuel cut-off valve	- Engine cuts out - Misfiring	- Check wiring and plug connection to injection pump
	Continued ▼		

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00542 Needle lift sender -G80 Implausible signal 1)	(Fault code 00542 continued) - Sender disc of engine speed sender -G28 is bent or loose	- Misfiring at exactly 3000 rpm	- Remove sump and check sender disc
	- G80 defective	- Misfiring, jolting (especially at high engine speeds)	- Renew needle lift sender -G80
	- Injection pump defective	- Fault 01268 is stored ("Metering control; Regulating difference") - Engine running rough, misfiring - No throttle response after overrun	- Renew injection pump =>Page 38

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1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00550 Injection commencement regulation Regulating difference	- Commencement of injection (injection timing) not OK	- Loss of power at high engine speeds - Engine difficult to start	- Check and adjust commencement of injection =>Page 44

	- Control range of injection pump blocked (dirt, metal particles)	- Loss of power at high engine speeds	- Check control range of injection timing control => Page 62
	- Engine has been stalled (within the last 50 starts)		- Erase fault memory and continue to monitor vehicle
	- Interruption in fuel feed: fuel tank run dry, supply pipe or filter blocked, air entering fuel system	- Fault 00542 may be stored ("Needle lift sender; - Implausible signal")	- Check fuel system
	Continued ▼		

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00550 Injection commencement regulation Regulating difference	(Fault code 00550 continued) - Open circuit in wiring to commencement of injection valve -N108 - Commencement of injection valve -N108 is worn - Fuse defective	- Engine knocks when idling because commencement of injection is constantly advanced - Commencement of injection cannot be made constant during "Basic setting" (value in display zone 2 fluctuates by more than 10 units) - Engine running rough, loss of power - Fault code 00526 is stored ("Brake light switch -F; - Implausible signal")	- Test commencement of injection valve -N108 => Page 63 - Renew commencement of injection valve -N108 - Check fuse

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00552 Air flow meter potentiometer -G19 Signal too small 1)	- -G19 defective - Open circuit or short in wiring to control unit	- Jolting - Reduced power	- Test air flow meter potentiometer -G19 => Page 72
Signal too great 1)	- -G19 defective - Open circuit		
Implausible signal 1)	- -G19 defective - Unmetered air - Vacuum hoses on exhaust gas recirculation valve -N18 wrongly connected		- Test air flow meter potentiometer -G19 => Page 72 - Check intake system Check vacuum hoses => Page 75

1) One of these displays will appear in addition to the name of the component.

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



Regulating difference	- Hoses wrongly connected, disconnected, blocked or leaking - Fault in hose connection to intake manifold pressure sender -G71	- Sudden loss of power - Reduced power	- Check charge pressure hose connections => Page 62
	- Pressure unit for - turbocharger defective - Solenoid valve for charge pressure control -N75 - defective		- Test charge pressure => Page 56
00627 Water level sender -G120 Implausible signal	- Water level in fuel filter - Short circuit	- Glow period warning lamp flashes 1)	- Drain fuel filter Test water level sender -G120 => Page 93

1) From software version D06 onwards=>Interrogate control unit version=>Page 2.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00777 Accelerator position sender - G79 Signal too small 1)	- G79 defective - Open circuit	- Speed is governed to around 1100 rpm - (safety function)	- Test accelerator position sender -G79 => Page 87
Signal too great 1)	- G79 defective - Open circuit or short in wiring to control unit	- No throttle response	
Implausible signal 1)	- G79 defective - Open circuit or short in wiring to control unit		

1) One of these displays will appear in addition to the name of the component.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01237 Fuel cut-off valve -N109 Implausible signal	- N109 defective, leaking or jamming - Open circuit or short to earth	- Reduced power - Engine cuts out	- Perform final control diagnosis => Page 11 - Check wiring connections => Current flow diagrams, Electrical fault-finding and Fitting locations binder

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01242 Output stage in control unit Implausible signal	- Commencement of injection valve -N108 - defective - Solenoid valve for charge pressure control -N75 - defective	- Fault code 00550 is stored ("Injection commencement regulation; Regulating difference") - Fault code 00575 is stored ("Intake manifold pressure; Regulating difference")	- Perform final control diagnosis => Page 11

	- Short to positive in wiring to glow period warning lamp -K29	- Glow period warning lamp does not work	- Perform final control diagnosis => Page 98
	- Glow plug relay -J52 defective	- Poor starting at low ambient temperatures	- Perform final control diagnosis => Page 97
	- Exhaust gas recirculation valve -N18 defective		- Perform final control diagnosis => Page 11

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01268 Metering control -N146 Regulating difference 1)	- Injection pump defective - Open circuit or short circuit	- Engine running problems - Engine cuts out	- Test quantity adjuster -N146 =>Page 38
Implausible signal 1)	- Open circuit (sporadic) - Injection pump defective	- Loss of power, black exhaust smoke	
65535 Control unit defective	- Internal fault in control unit	- Engine running problems - Engine cuts out	- Renew control unit => Page 50

1) One of these displays will appear in addition to the name of the component.

3 - Final control diagnosis

3.1 - Final control diagnosis

Requirements for test on vehicles with air conditioner:

- Vehicle at room temperature (above +15°C)
- Air conditioner switched on
- Lowest temperature setting and maximum blower speed selected

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

Activation sequence
1 Commencement of injection valve -N108
2 Exhaust gas recirculation valve -N18
3 Air conditioner compressor cut-in (shut-off)
4 Fuel cut-off valve -N109
5 Charge pressure control valve -N75
6 Glow plug relay -J52
7 Glow period warning lamp -K29

Notes:

- ♦ When performing final control diagnosis, the procedure must be carried out in full once the ignition has been switched on.
- ♦ During the final control diagnosis the individual control elements are activated for 30 seconds each. If the →key is not pressed within this 30-second period, the following display will appear:

-> Indicated on display:

Function is unknown or cannot be carried out at the moment



- ♦ To continue the final control diagnosis, press the ➔key and start the programme sequence again.
- ♦ To repeat the final control diagnosis, switch off the ignition, wait for about 20 seconds, then switch on again.
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 2.)

-> Indicated on display:

Rapid data transfer HELP
Select function XX

- Press keys 0 and 3 for the function "Final control diagnosis" and confirm entry with Q key.

-> Indicated on display:

Final control diagnosis
Commencement of injection valve -N108

Activating the valve influences the noise of combustion considerably (pre-ignition).

If no changes in the combustion noises are heard:

- Check injection adjuster control range
=> Page 62
- Press ➔key.

-> Indicated on display:

Final control diagnosis
Exhaust gas recirculation valve -N18

The valve must click.

Notes:

- ♦ Because of engine noises the clicking of the valve cannot be heard and therefore must be felt to detect its operation.
- ♦ The piston movement of the mechanical exhaust gas recirculation valve is visible in the side slot.

If the valve does not click:

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- Test exhaust gas recirculation valve -N18=>Page 69
- Press ➔key.

-> Indicated on display:

Final control diagnosis
Air conditioner compressor cut-in

The air conditioner compressor shut-off is checked.

The test step is also carried out on vehicles without air conditioner.

The "cut-in" or "shut-off" function should cause the air conditioner compressor to switch itself off within 5 seconds (check visually), then start and stop again at 5-second intervals.

If the conditioner compressor is not switched off:

- Test air conditioner compressor shut-off
=>Page 90.
- Press ➔key.

-> Indicated on display:

Final control diagnosis
Fuel cut-off valve -N109

The engine must stop.

If the engine does not stop:

- Switch off ignition.
- Unscrew fuel cut-off valve and remove any metal particles or dirt.
- Repeat final control diagnosis and if the engine will not stop replace fuel cut-off valve.

Continue the final control diagnosis with the ignition switched on and the engine not running.

- Press ➡key.

-> Indicated on display:

Final control diagnosis
Boost pressure control 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 solenoid valve for charge (boost) pressure control -N75
=>Page 56 .
- Press ➡key.

-> Indicated on display:

Final control diagnosis
Glow plug relay -J52

The relay must click.

Switching on and off the relay can also be observed as the interior light becomes brighter and darker as a result of the glow plug high power consumption.

If the relay does not click:

- Test glow plug system=>Page 97 .
- Press ➡key.

-> Indicated on display:

Final control diagnosis
Glow period warning lamp -K29

The control lamp must blink.

Control lamp does not blink:

- Test glow period warning lamp -K29=>Page 98 .
- Press ➡key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

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

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4 - Basic setting

4.1 - Basic setting

Note:

The basic setting procedure is used as a dynamic check of the injection timing (commencement of injection). Commencement of injection valve -N108 is activated continuously, causing the injection adjuster to move to the "retarded" setting.

Requirements for test:

- Coolant temperature at least 80°C
- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Gear selector lever in position P or N
- Connect fault reader V.A.G 1551 (or V.A.G 1552) and interrogate fault memory=>Page 3. After interrogating the fault memory, run the engine at idling speed.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

Basic setting	HELP
Enter display group number XX	

- Press key 0 twice for Display Group 00 and confirm entry with Q key.

Display group overview

System in basic setting 0										⇒ • Indicated on display
1	2	3	4	5	6	7	8	9	10	
										Up to software version D05: voltage at slide travel potentiometer -G99
										From software version D06 onwards: intake air quantity
										Fuel temperature
										Intake air temperature
										Coolant temperature
										Atmospheric pressure (ambient air pressure)
										Intake manifold pressure (charge pressure)
										Injection quantity
										Accelerator pedal position
										Commencement of injection
										Engine speed

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

System in basic setting 0	⇒ • Indicated on display
---------------------------	--------------------------

40	55	0	20	116	117	62	97	127	X	
										Up to software version D05: 55 ... 80 From software version D06 onwards: 80 ... 99. If readout does not match specification, test exhaust gas recirculation => Page 67 . The exhaust gas recirculation is switched off after 10 minutes at idling speed. Readout: 125 ... 160.
										Fuel temperature (at outside temperature of approx. 40 °C) - not reached if outside temperature is low; no specified value
										Intake air temperature (at outside temperature of approx. 30 °C) - dependent on outside temperature; no specified value
										Coolant temperature (at outside temperature of approx. 90 °C)
										Atmospheric pressure (ambient air pressure): no specified value - ignore
										Intake manifold pressure (charge pressure): no specified value - ignore
										Injection quantity: 15 ... 30 (idling)
										Accelerator pedal position: 0 (pedal not depressed)
										Commencement of injection depends on fuel temperature => Page 15
										Engine speed: 39 ... 42 (idling speed)

- Press =>key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

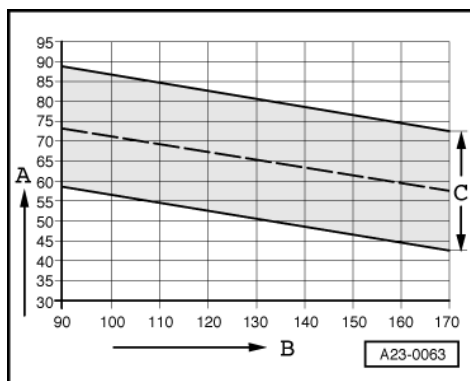
Rapid data transfer	HELP
Insert address word XX	

- Switch off ignition and unplug diagnostic connector.

Commencement of injection (injection timing)

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The commencement of injection value in display zone 2 is dependent on the fuel temperature value in display zone 9.



-> Vehicles with software versions up to D081):

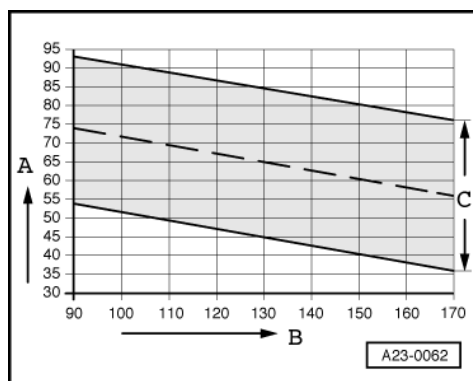
- 1) Interrogating control unit version=>Page 2 .

A - Display zone 2 - commencement of injection



B - Display zone 9 - fuel temperature

- ◆ Specification:⇒area C on graph



→ Vehicles with software versions from D09 onwards1):

- 1) Interrogating control unit version⇒Page 2.

A - Display zone 2 - commencement of injection
B - Display zone 9 - fuel temperature

- ◆ Specification:⇒area C on graph

5 - Reading measured value block

5.1 - Reading measured value block

Requirements for test:

- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Connect fault reader V.A.G 1551 (or V.A.G 1552) and select engine electronics control unit with the "Address word" 01. If necessary, start the engine.
(Connecting fault reader and selecting engine electronics control unit⇒Page 2.)

→ 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 Q
Enter display group number XX

- Press key 0 twice for Display Group 00 and confirm entry with Q key.

→ Indicated on display:

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

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Display group overview

Basic setting 0										⇒	• Indicated on display
1	2	3	4	5	6	7	8	9	10		
											Up to software version D05: voltage at slide travel potentiometer -G99 From software version D06 onwards: intake air quantity
											Fuel temperature
											Intake air temperature
											Coolant temperature
											Atmospheric pressure (ambient air pressure)
											Intake manifold pressure (charge pressure)
											Injection quantity
											Accelerator pedal position
											Commencement of injection
											Engine speed

5.2 - Readout specifications for general vehicle inspection

Display group 00 with ignition on and engine not running

Read measured value block 0															⇒	• Indicated on display
0	X	0	0	117	117	196	82	91	X							
															Up to software version D05: > 120 (30 seconds after ignition is switchedd on, value returns to between 20 and 40) From software version D06 onwards: readout undefined - ignore	
															Fuel temperature (outside temp. approx. 20 °C) - no specified value	
															Intake air temperature (outside temp. approx. 20 °C) - no specified value	
															Coolant temperature (outside temp. approx. 20 °C) - no specified value	
															Atmospheric pressure (ambient air pressure) at 1000 mbar	

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					Intake manifold pressure (charge pressure): Compare display zones 5 and 6. The pressure readouts should be approximately the same. If not, test intake manifold pressure sender -G71 => Page 58 .
					Injection quantity: 0
					Accelerator pedal position: Depress pedal slowly. The readout should rise steadily to 255. If not, test accelerator position sender -G79 => Page 87 .
					Commencement of injection: readout undefined - ignore
					Engine speed: 0

Display group 00 at idling speed (engine warm, coolant temperature not below 80°C)

Read measured value block 0										⇒	• Indicated on display
42	55	0	20	116	117	62	97	127	X		
											Up to software version D05: 55 ... 80 From software version D06 onwards: 80 ... 99. If readout does not match specification, test exhaust gas recirculation => Page 67 . The exhaust gas recirculation is switched off after 10 minutes at idling speed. Readout: 125 ... 160.
											Fuel temperature (at outside temperature of approx. 40 °C) not reached if outside temperature is low; no specified value
											Intake air temperature (at outside temperature of approx. 30 °C) - dependent on outside temperature; no specified value
											Coolant temperature (at outside temperature of approx. 90 °C)
											Atmospheric pressure (ambient air pressure) at 1000 mbar
											Intake manifold pressure (charge pressure) at 1000 mbar
											Injection quantity: 15 ... 30 (idling)
											Accelerator pedal position: 0 (pedal not depressed)
											Commencement of injection: 50 ... 65. If readout is outside tolerance, check and adjust commencement of injection (dynamic check) => Page 44 .
											Engine speed: 39...42 (idling speed)

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

Important: Always observe safety precautions=>Page 1.

Read measured value block 0										⇒	◀ Indicated on display
167	230	255	168	215	117	62	82	127	X		
											Up to software version D05: readout rises together with engine speed up to about 190 From software version D06 onwards: 190 ... 255 (depending on charge pressure)
											Fuel temperature: ignore
											Intake air temperature: ignore
											Coolant temperature: ignore
											Atmospheric pressure (ambient air pressure): ignore
											Intake manifold pressure (charge pressure): 200 ... 235 (215 = 1.76 bar charge pressure)
											Injection quantity: 160...172 (full throttle)
											Accelerator pedal position: 255 (fully depressed)
											Commencement of injection: 190...245 (depending on engine speed)
											Engine speed: 130...190 (readout of 190 = 4000 rpm; do not exceed engine speed is governed)

6 - Reading individual measured values

6.1 - Reading individual measured values

Notes:

- ◆ There are 100 different channels available for selection but only 12 measured values that can be checked.
- ◆ All readouts are displayed as decimal values between 0 and 255.

Requirements for test:

- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Connect fault reader V.A.G 1551 (or V.A.G 1552) and select engine electronics control unit with the "Address word" 01. If necessary, start the engine.
(Connecting fault reader and selecting engine electronics control unit=>Page 2.)

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 9 for the function "Read individual measured value" and confirm entry with Q key.

-> Indicated on display:

Read individual measured value	Q
Feed in channel number XX	

- Enter a channel number (=>List of Channel Nos. for individual measured values, Page 20) and confirm entry with the Q key.



-> Indicated on display (example):

Read individual measured value
Channel 01 Measured value 128

Notes:

- ♦ Channel 01 is given as an example to illustrate the procedure.
- ♦ The measured value on the display is continuously updated until the "Print" key is pressed.
- Press the "Print" key to print out the display.
- To repeat the printout, press the "Print" key again.
- To enter a new channel number, press the C key.

List of Channel Nos. for individual measured values

Channel No.	Voltage at
00	Accelerator position sender -G79
01	Altitude sender -F96 (integrated in control unit)
06	Slide travel potentiometer -G99
07	Air flow meter potentiometer -G19
08	Supply voltage for control unit
09	Needle lift sender -G80
65	Intake air temperature sender -G42
66	Water level sender -G120
67	Fuel temperature sender -G81
68	Coolant temperature sender -G62
69	Intake manifold temperature sender -G72
72	Intake manifold pressure sender -G71

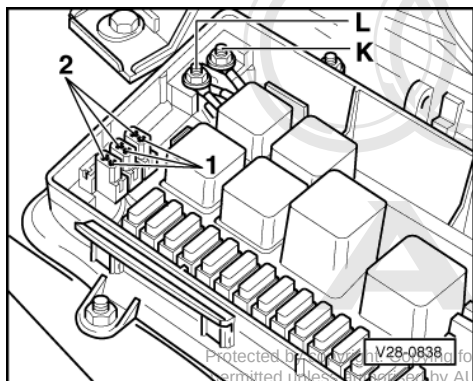
7 - Testing wiring for diagnostic connector

7.1 - Testing wiring for diagnostic connector

Notes:

- ♦ To perform the test, use hand-held multimeter V.A.G 1526, adapter set V.A.G 1594 A and test box V.A.G 1598 A.
- ♦ Before testing the wiring, switch off the ignition.

Testing voltage supply to black diagnostic connector



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-> Location of diagnostic connector:
In relay panel with fuse holder in plenum chamber

=> Current flow diagrams, Electrical fault-finding and Fitting locations

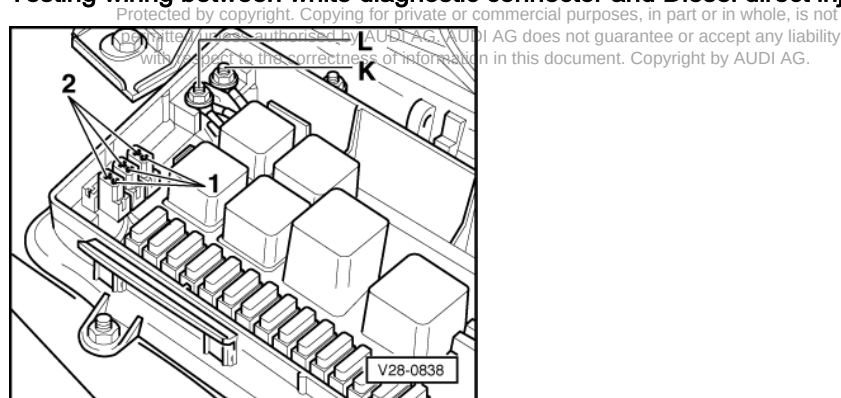
Contact assignment for black diagnostic connector:

- 1 - Earth
- 2 - Terminal 30

Select test range on hand-held multimeter V.A.G 1526: voltage measurement range (20 V =)				
Contact on diag. connector	Measure against	To be tested	Specification	Measures if readout does not match specification
1 1)	Battery positive	Wiring to vehicle body (earth connection)	approx. battery voltage	- Check wiring using current flow diagram
2 1)	Earth (vehicle body)	Wiring to permanent positive (terminal 30)	approx. battery voltage	- Check wiring using current flow diagram

1) Earth connection and voltage supply for black diagnostic connector=>illustration on Page 21 .

Testing wiring between white diagnostic connector and Diesel direct injection system control unit -J248



-> Location of diagnostic connector and of wiring junctions K and L:
In relay panel with fuse holder in plenum chamber

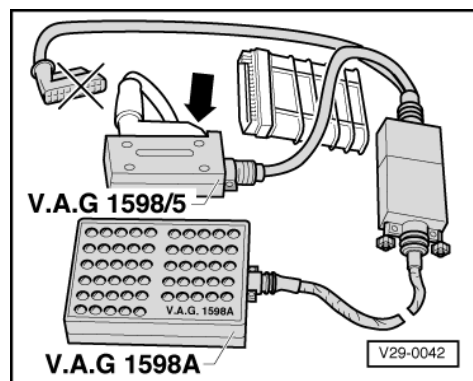
=> Current flow diagrams, Electrical fault-finding and Fitting locations

Contact assignment of white diagnostic connector:

- 1 - L wire
- 2 - K wire

Note:

The wiring between the white diagnostic connector and Diesel direct injection system control unit -J248 is routed via wiring junctions K and L in the relay panel with fuse holder.





=> Current flow diagrams, Electrical fault-finding and Fitting locations

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .

Select test range on hand-held multimeter V.A.G 1526: resistance measurement range (20 k ω) ▪ Adapter lead V.A.G 1598/5 connected				
V.A.G 1598 A socket	To be tested	▪ Test requirements - Additional steps	Specification	Measures if readout does not match specification
42 + K 1) 42 + 2 2)	Wiring	▪ Ignition switched off	< 1.5 ω	- Check wiring using current flow diagram
41 + earth (vehicle body)			infinity ω	- If short circuit is detected => Page 22
27 + L 1) 27 + 2 2)	Wiring	▪ Ignition switched off	< 1.5 ω	- Check wiring using current flow diagram
27 + earth (vehicle body)			infinity ω	- If short circuit is detected => Page 22

1) Corresponding contact on relay panel with fuse holder=>illustration, Page 21 .

2) Corresponding contact on white diagnostic connector=>illustration, Page 21 .

Testing for short to positive or earth in wiring to white diagnostic connector

Note:

This test must be carried out if any of the following displays appears on fault reader V.A. G 1551 when connected:

-> Indicated on display:

Rapid data transfer
Fault in communication build up

or

Rapid data transfer HELP
K wire not switching to earth

or

Rapid data transfer HELP
K wire not switching to positive

or

Rapid data transfer HELP
L wire not switching to earth

or

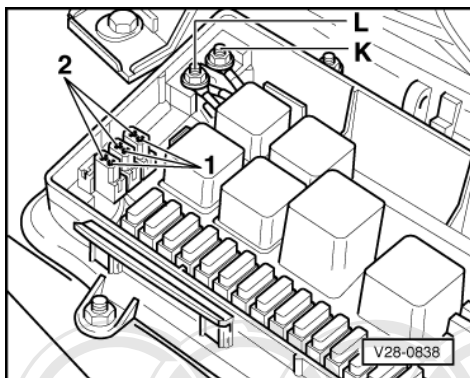
Rapid data transfer HELP
L wire not switching to positive

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If the wiring junctions carry wires of different colours:

- Switch off ignition.

- Identify colour of wire between white diagnostic connector and Diesel direct injection system control unit.



- -> One by one, disconnect from wiring junctions K and L all other wires for vehicle systems with diagnostic capability ("Rapid data transfer").

=> Current flow diagrams, Electrical fault-finding and Fitting locations

- Each time a wire for a particular vehicle system has been disconnected, start the engine, allow it to run at idling speed and enter address word 01 for "Engine electronics" again=>Page 2 .
- If the control unit identification appears on the display, use the current flow diagram to check the wire to the last control unit that was disconnected.
- If no wiring faults are found, renew the last control unit that was disconnected and re-connect all wires to wiring junctions K and L.

-> Indicated on display:

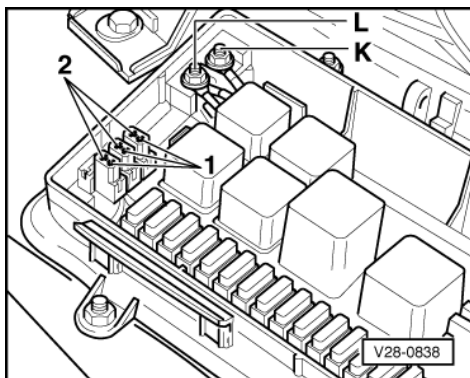
Control unit does not answer HELP

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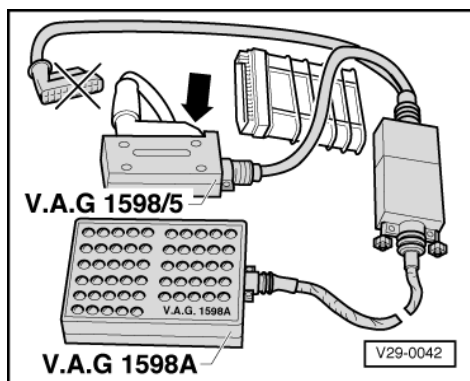
Open circuit in wiring to control unit

If the wiring junctions carry wires of the same colour:

- Switch off ignition.



- -> Disconnect all wires from wiring junctions K and L.

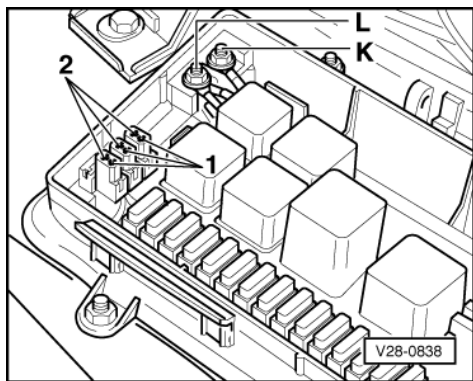




- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page **51**.
- Identify wires leading to Diesel direct injection system control unit and re-connect these wires to wiring junctions K and L.

White diag. connector Contact No.	Wiring junction	V.A.G 1598 A Socket No.
1	L	27
2	K	42

- Disconnect test box and fit connector to Diesel direct injection system control unit.
- Start the engine, allow to run at idling speed and enter address word 01 for "Engine electronics" again=>Page **2**.
- If the control unit identification is still not displayed, renew Diesel direct injection system control unit.
- Re-connect all wires to wiring junctions K and L.
- Interrogate fault memory. If the control unit identification appears on the display, this means that the Diesel direct injection system control unit is okay.
- Switch off ignition.



- -> Identify all wires between the individual control units and wiring junctions K and L as described above for the Diesel direct injection system control unit.
- Connect each wire in turn to wiring junctions K and L.

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=> Current flow diagrams, Electrical fault-finding and Fitting locations

- Each time a wire for a particular vehicle system has been re-connected, start the engine, allow it to run at idling speed and enter address word 01 for "Engine electronics" again=>Page **2**.
- If the control unit identification appears on the display, switch off the ignition.
- Identify the wire for the next control unit and re-connect to wiring junctions K and L.
- If the control unit identification appears on the display, renew the last control unit that was disconnected and then re-connect all wires to wiring junctions K and L.

23 - Mixture preparation, Injection

1 - Servicing Diesel direct injection system

1.1 - Servicing Diesel direct injection system

1.2 - Safety precautions

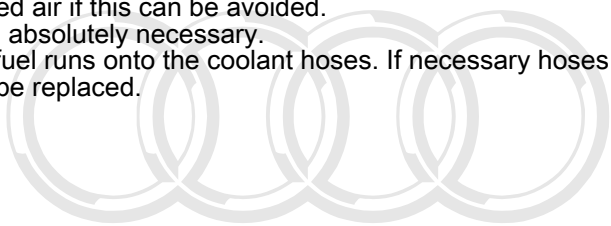
To prevent injuries to persons and/or damage to the injection and glow plug system, the following must be noted:

- ◆ The ignition must be switched off before connecting or disconnecting injection or glow plug system wiring or tester cables.
- ◆ If the engine is to be turned at starter speed without starting, e.g. when checking compressions, pull connector off injection pump.
- ◆ Before disconnecting battery, obtain radio code for radios fitted with anti-theft coding.
- ◆ Disconnecting and connecting the battery must only be undertaken when the ignition switched off otherwise the Diesel direct injection system control unit may be damaged.
- ◆ When connecting test equipment (voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 etc.), always use adapter set V.A.G 1594 A.

1.3 - Rules for cleanliness

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

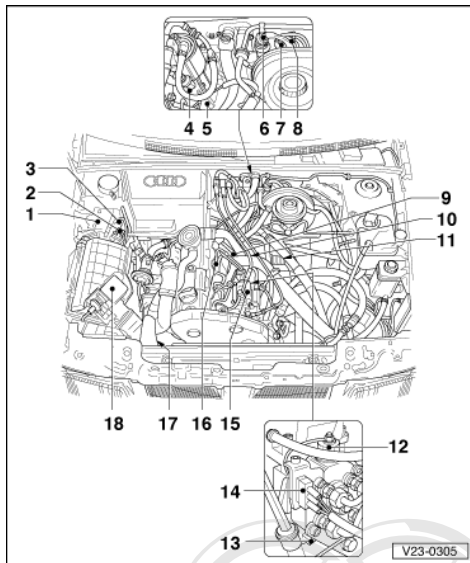
- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover with plastic sheeting or paper. Do not use fluffy cloths.
- ◆ Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- ◆ Only install clean components:
Only unpack replacement parts immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.
- ◆ Also ensure that no Diesel fuel runs onto the coolant hoses. If necessary hoses must be cleaned immediately. Affected hoses must be replaced.


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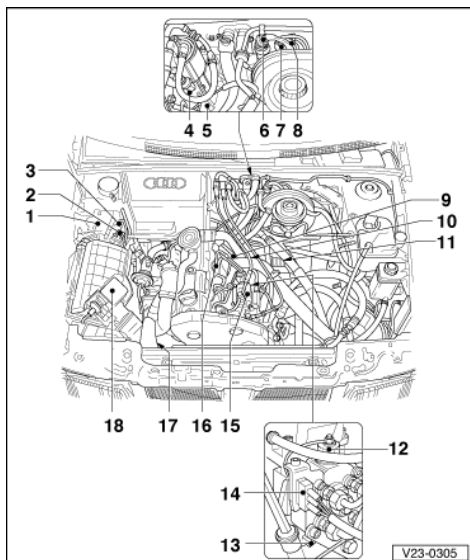


1.4 - Fitting locations overview



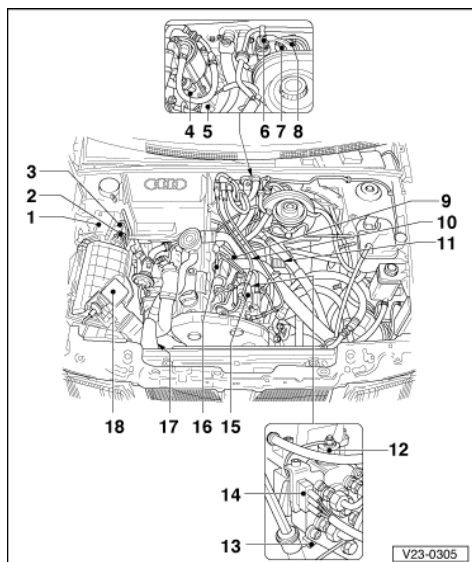
- 1 Intake manifold pressure sender -G71
- 2 Exhaust gas recirculation valve -N18
- 3 Solenoid valve for charge pressure control -N75
- 4 Connector
 - ◆ 2 pin
 - ◆ For water level sender -G120
- 5 Water level sender -G120
- 6 Connector
 - ◆ 8 pin
 - ◆ For quantity adjuster -N146
 - ◆ For slide travel potentiometer -G99
 - ◆ For fuel temperature sender -G81

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- 7 Connector
 - ◆ 3 pin
 - ◆ For engine speed sender -G28
- 8 Connector
 - ◆ 2 pin
 - ◆ For needle lift sender -G80
- 9 Coolant temperature sender -G62

- 10 Engine speed sender -G28**
- 11 Speedometer sender -G22**
- 12 Fuel cut-off valve -N109**
- 13 Commencement of injection valve -N108**



14 Connector

- ◆ 3 pin
- ◆ For fuel cut-off valve -N109
- ◆ For commencement of injection valve -N108

15 Metering control for injection pump

- ◆ With quantity adjuster -N146
- ◆ With slide travel potentiometer -G99
- ◆ With fuel temperature sender -G81

16 Injector

- ◆ For cylinder 3 with needle lift sender -G80

17 Intake manifold temperature sender -G72

18 Air flow meter -G19

- ◆ With intake air temperature sender -G42

Fitting locations not shown in illustration

Diesel direct injection system control unit -J248

- ◆ Between cross panel and air duct in front passenger's footwell

Excess voltage protection relay -J249

- ◆ In front relay carrier (position 14) under dash panel

Glow plug strip fuse -S22

- ◆ On relay panel with fuse holder

Glow plug relay -J52

- ◆ On relay panel with fuse holder

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Clutch pedal switch -F36

- ♦ On clutch pedal in footwell

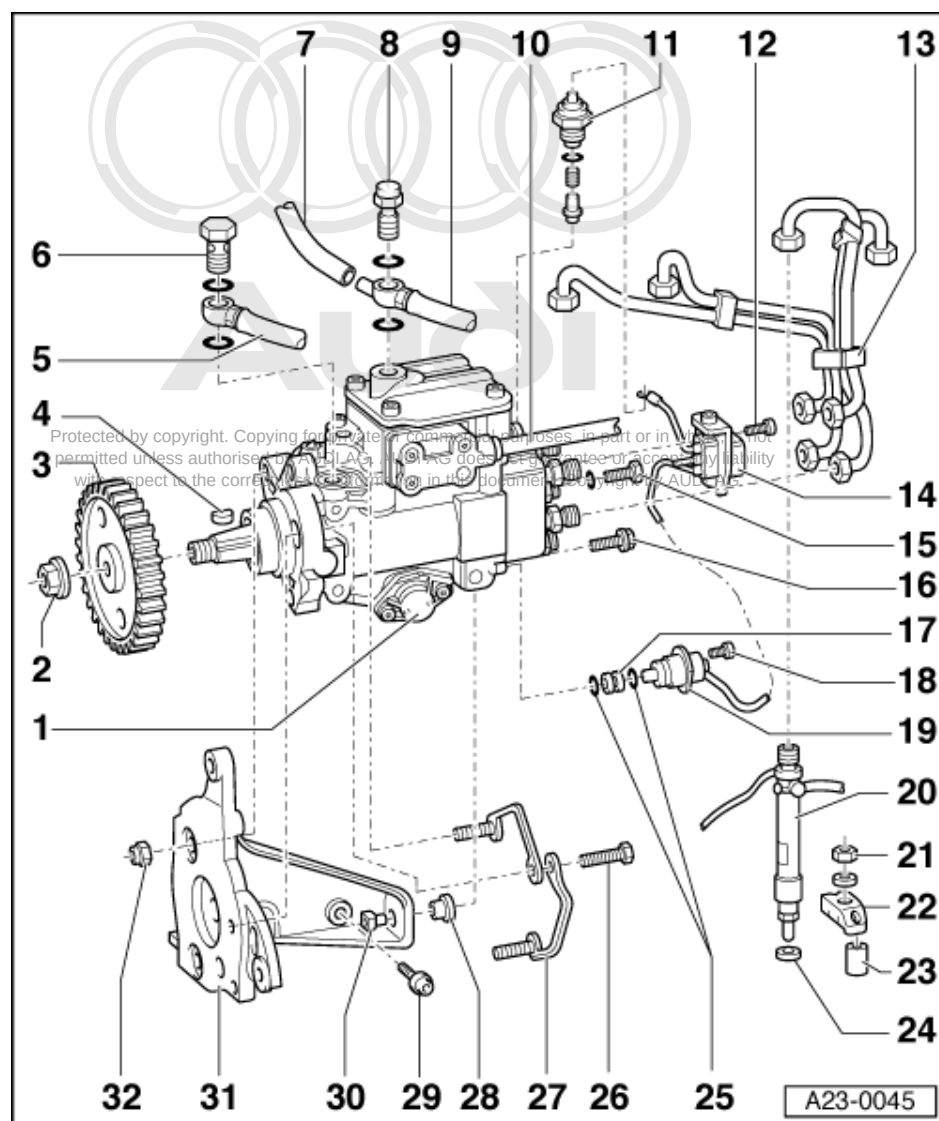
Brake light switch -F and brake pedal switch -F47

- ♦ On brake pedal in footwell

Accelerator position sender -G79

- ♦ On accelerator pedal in footwell

1.5 - Servicing fuel injection system



Notes:

- ♦ Observe safety precautions
=>Page 25.
- ♦ Observe rules for cleanliness
=>Page 25.
- ♦ Always renew seals and gaskets.

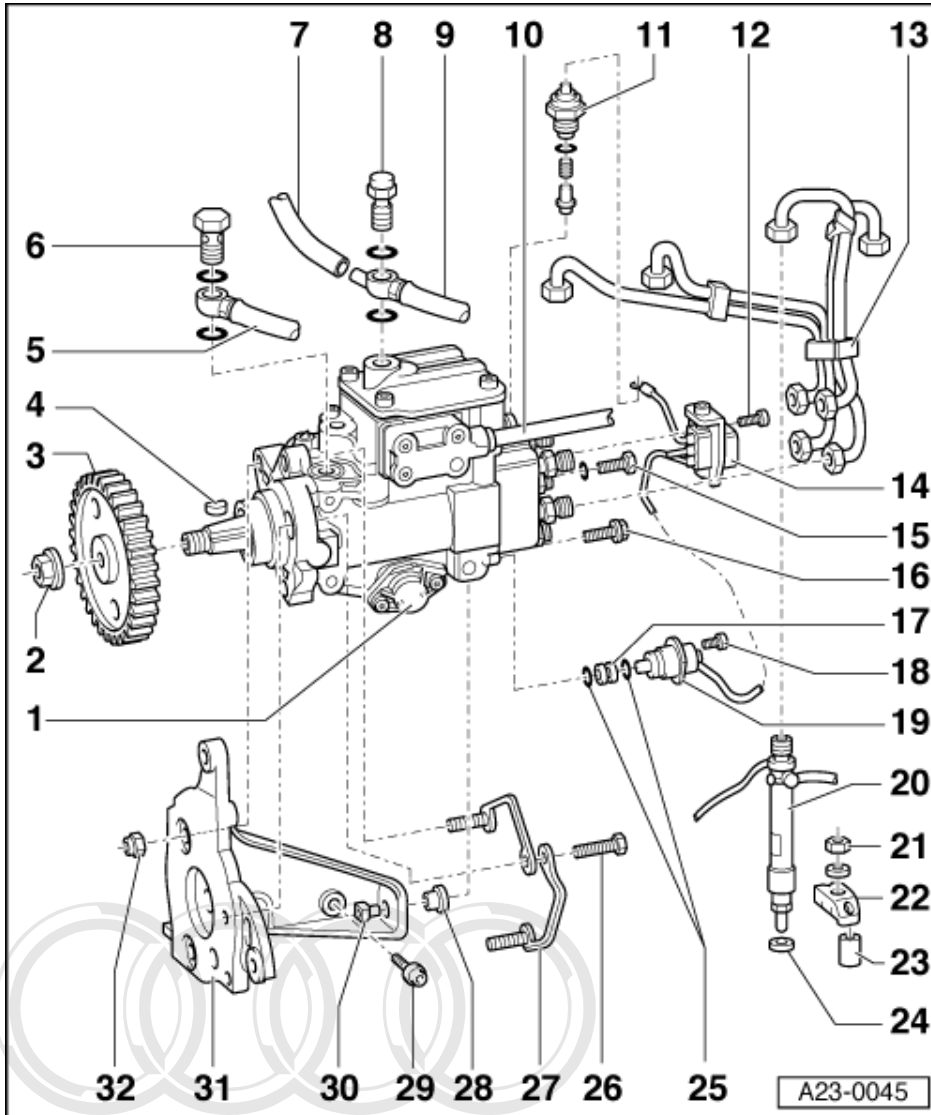
- ♦ Tensioning toothed belt:

=> 4-cyl. Diesel engine (turbo), Mechanics; Repair group 13; Crankshaft group; Removing and installing toothed belt Crankshaft group Removing and installing toothed belt

1 Cover for injection timing control

- ♦ If leaking, replace O-ring
=>Page 49

2 45 Nm



3 Injection pump sprocket

- ♦ Removing and installing
=>Removing, installing and adjusting injection pump, Page 38

4 Woodruff key

- ♦ Check position before fitting injection pump sprocket

5 Supply pipe

- ♦ From fuel filter

6 Banjo bolt - 25 Nm

- ♦ For supply pipe

7 Return pipe

- ♦ From injector for cylinder 1

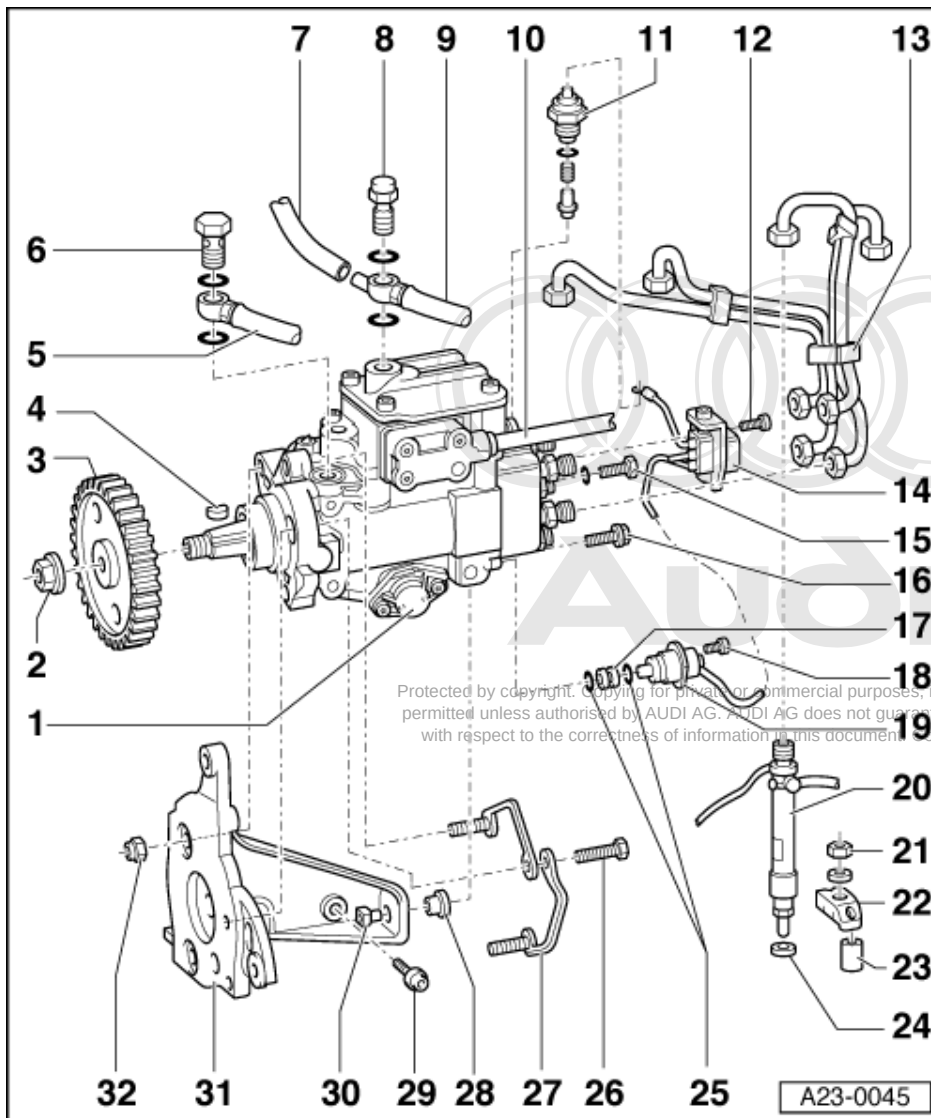
8 Banjo bolt - 25 Nm

- ♦ For return pipe

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**9 Return pipe**

- ♦ To fuel filter

**10 Wiring for metering control**

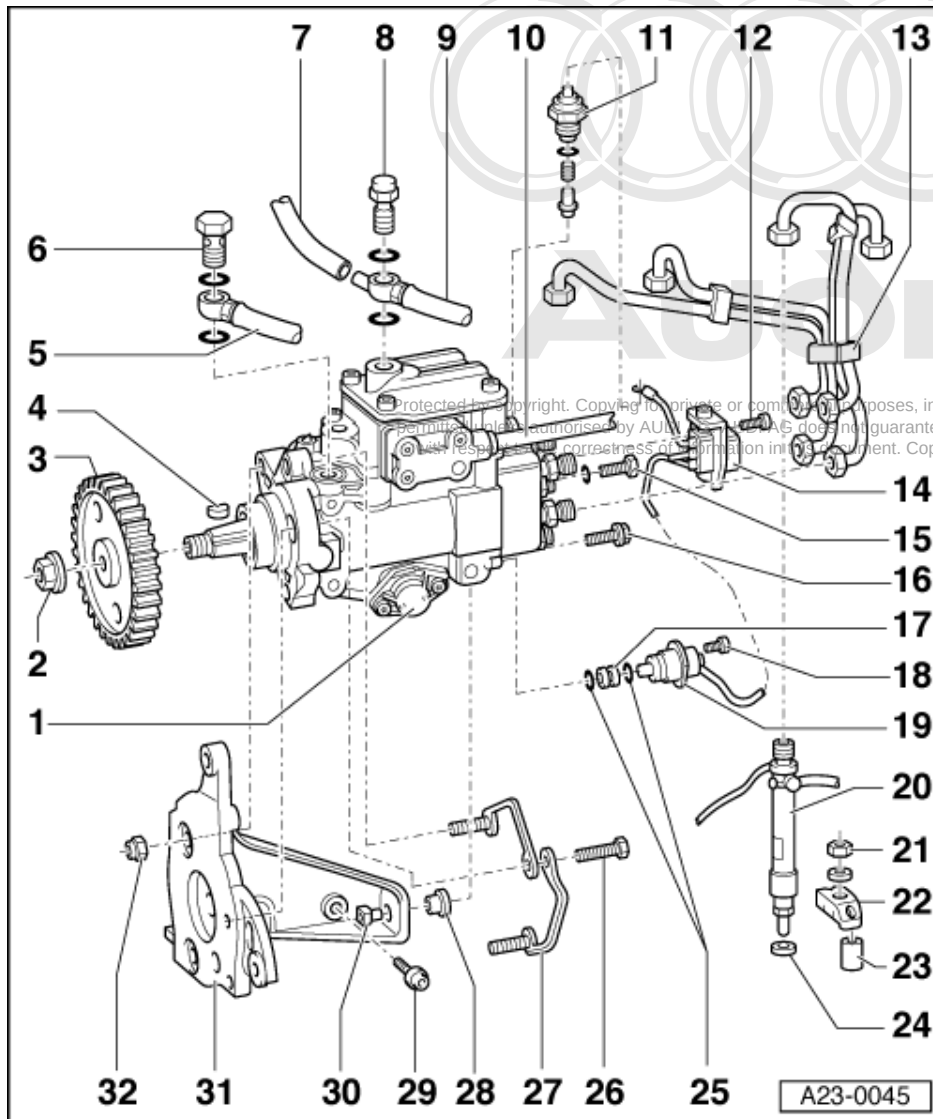
- ♦ Fuel temperature sender -G81, slide travel potentiometer -G99 and quantity adjuster -N146 can be tested via this wiring

11 Fuel cut-off valve -N109

- ♦ Tighten to 20 Nm
- ♦ Testing=>Final control diagnosis, Page 11

12 10 Nm**13 Injector pipes**

- ♦ Remove with open ring spanner 3035
- ♦ Always remove pipework complete
- ♦ Do not alter shape
- ♦ Tighten to 25 Nm



14 Connector

- ♦ For fuel cut-off valve -N109 and commencement of injection valve -N108

15 Screw plug - 20 Nm

- ♦ Seal under screw plug must always be renewed (if fitted)

16 25 Nm

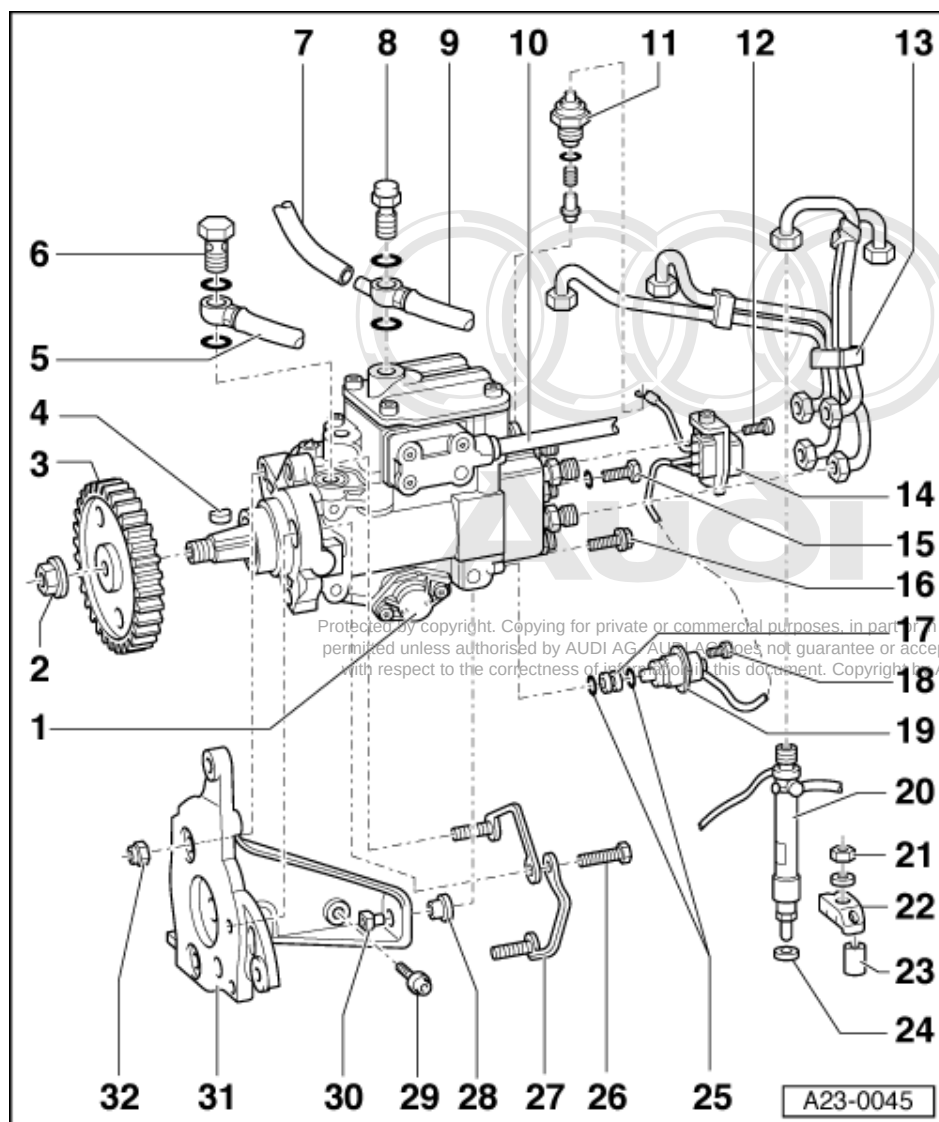
17 Strainer

18 10 Nm

19 Commencement of injection valve -N108

20 Injector

- ♦ Removing and installing
=>Page [47](#)
- ♦ Testing=>Page [48](#)
- ♦ For cylinder 3 with needle lift sender -G80. Testing=>Page [79](#).



21 20 Nm

22 Retainer

23 Mounting

24 Copper seal

25 O-Ring

26 25 Nm

27 Bar with headless bolt

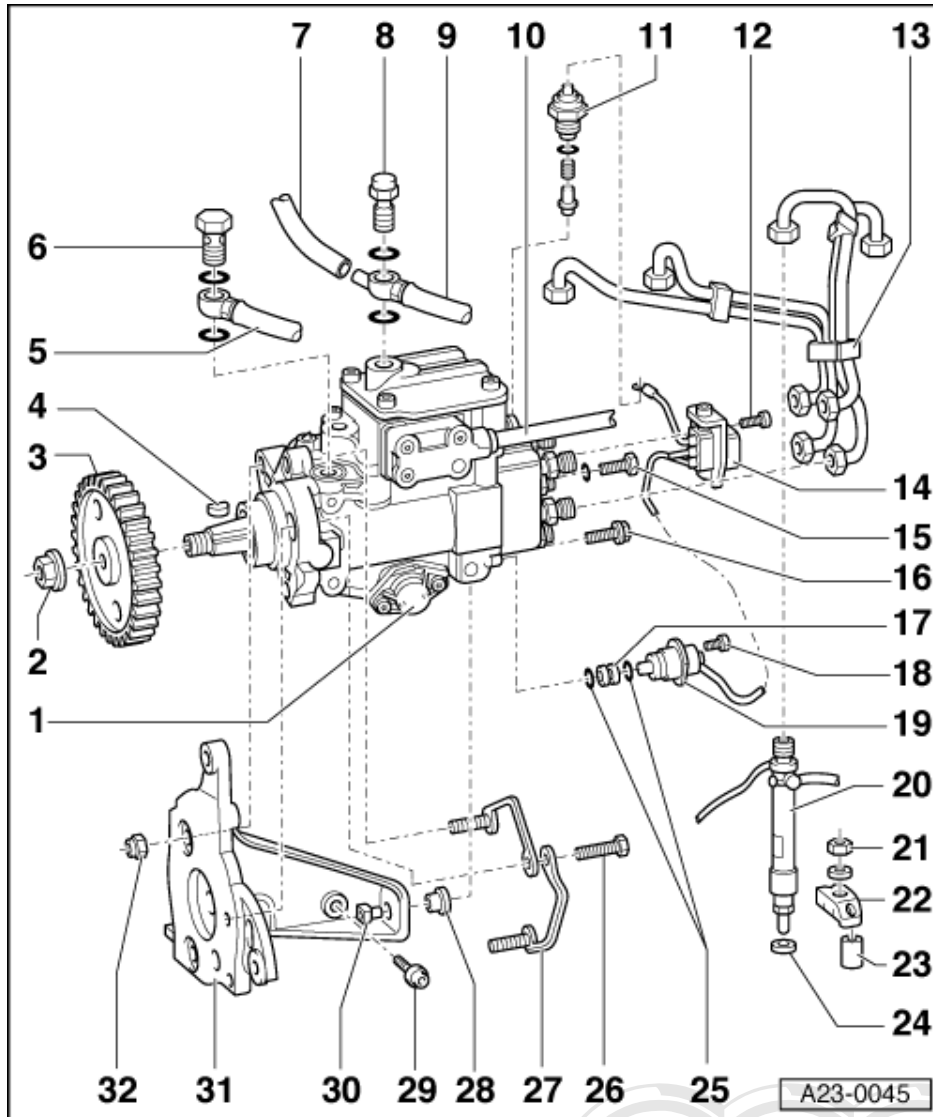
28 Bush

- ♦ Tapered

29 25 Nm

30 Nut - 25 Nm

- ♦ Conical



31 Console

- ♦ Removing and installing

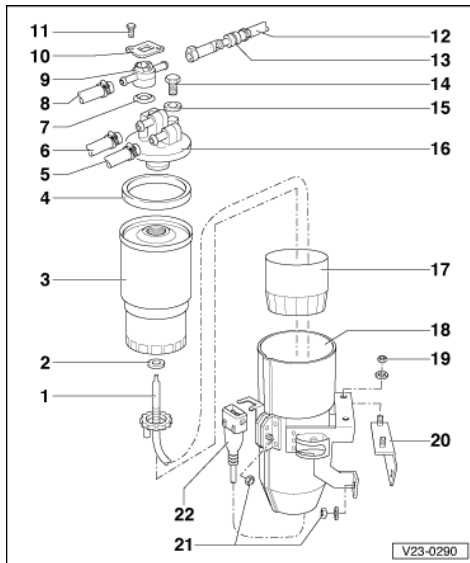
=> 4-cyl. Diesel engine (turbo), Mechanics; Repair group 13; Crankshaft group; Removing and installing toothed belt Crankshaft group Removing and installing toothed belt

32 25 Nm

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1.6 - Servicing fuel filter



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Notes:

- ♦ All hose connections must be secured with hose clips (same as original parts).

=> Parts List

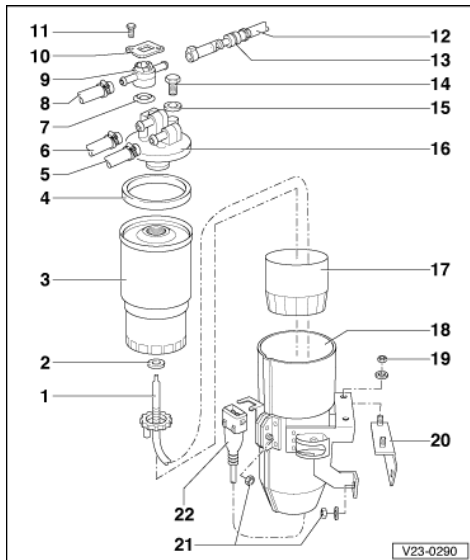
- ♦ Always renew seals and gaskets.

1 Water drain plug

- ♦ With water level sender -G120
- ♦ Loosen and allow approx. 100 cm³ fluid to drain
- ♦ Loosen vent screw in order to drain water

2 Seal

- ♦ Renew if damaged

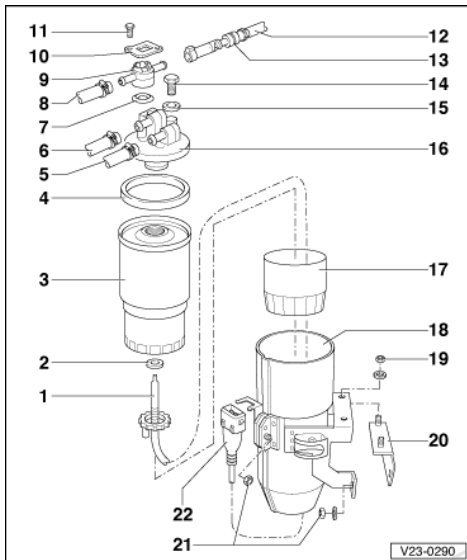


3 Fuel filter

- ♦ Loosen with strap wrench
- ♦ Lightly lubricate seals with diesel before installing
- ♦ Fill with clean fuel before installing
- ♦ Tighten by hand

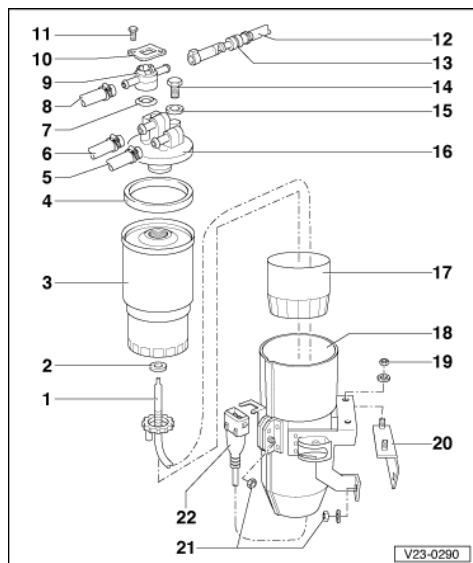
4 Seal

- ♦ Renew if damaged
- 5 Supply pipe**
 - ♦ From fuel tank
- 6 Supply pipe**
 - ♦ To injection pump
- 7 O-Ring**
 - ♦ Renew
- 8 Return pipe**
 - ♦ From injection pump



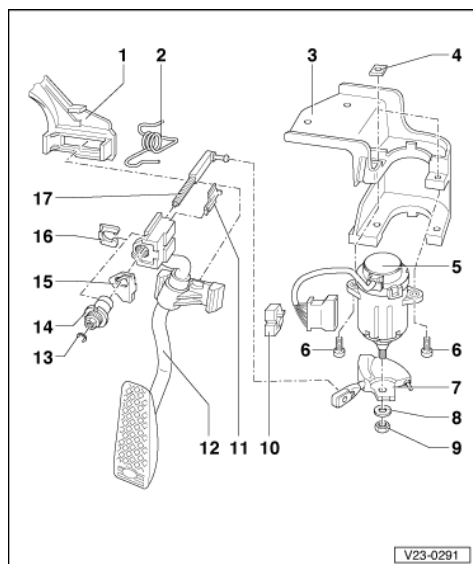
- 9 Control valve**
 - ♦ Installation position: arrow points towards fuel tank
- 10 Retainer plate**
- 11 5 Nm**
- 12 Return pipe**
 - ♦ To fuel tank
- 13 Non-return valve**
 - ♦ Installation position: arrow points towards fuel tank
- 14 Vent screw - 10 Nm**
 - ♦ Loosen in order to drain water
- 15 Seal**
- 16 Fuel filter flange**

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- 17 Insert
18 Heat shield
19 10 Nm
20 Bracket
21 10 Nm
22 Connector
 ♦ For water level sender -G120

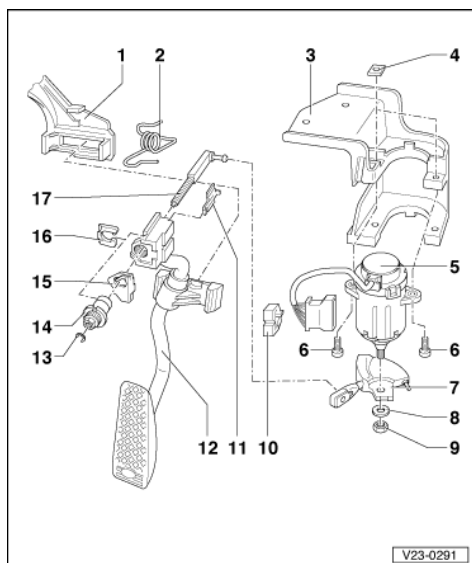
1.7 - Servicing accelerator linkage



- 1 Pedal bracket
- 2 Torsion spring
- 3 Console
- 4 Square nut
- 5 Accelerator position sender -G79
 - ♦ Installing and adjusting
=>Page 37
- 6 Hexagon socket head bolt,
-10Nm
- 7 Cable cam

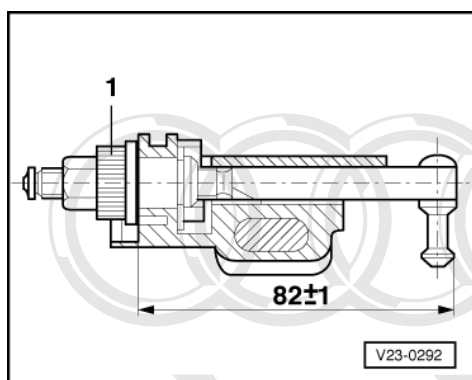
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- 8 Washer
- 9 10 Nm



- 10 Retaining clamp
- 11 Retaining spring
- 12 Accelerator pedal
- 13 Circlip
- 14 Screw adjuster
- 15 Detent spring
- 16 Circlip
- 17 Stud

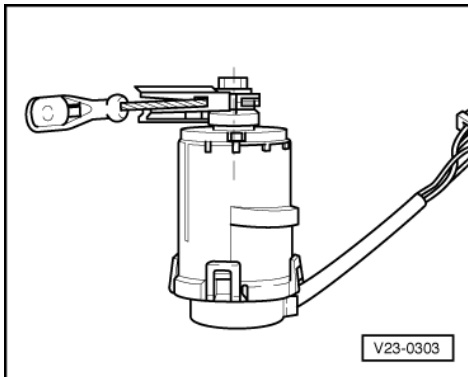
1.8 - Installing and adjusting accelerator position sender -G79



Note:

To renew accelerator position sender -G79, first remove the accelerator pedal.

- ► Check the accelerator pedal setting.
- If necessary, adjust the setting using screw adjuster -1-.



- ➔ Fit cable cam to accelerator position sender -G79, making sure that it is correctly positioned.
- The edge of the cable cam must be aligned with the edge on the housing.
- Bolt sender onto console and fit connector with retaining clamp.
- Press torsion spring into pedal bracket as far as it will go.
- Insert accelerator pedal into pedal bracket so that lugs engage, then tension the torsion spring.
- Fit eye from cable cam over stud on accelerator pedal. Make sure that the cable attached to the eye is properly seated in the slot in the cable cam.
- Carry out fine adjustment.

Fine adjustment of accelerator position sender -G79

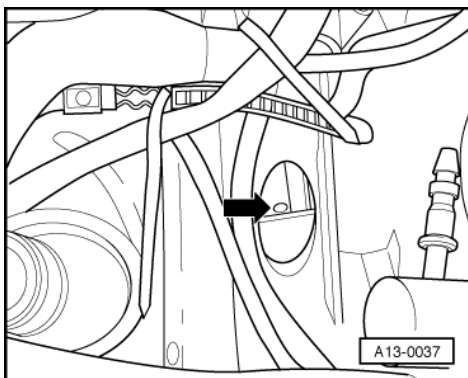
Note:

Accelerator position sender -G79 contains a kickdown switch which can be disregarded at this stage.

- Use screw adjuster to adjust accelerator pedal so that point of resistance of kickdown switch is reached just as accelerator pedal touches floor.
- To do this, press accelerator pedal down by hand until it touches the floor.
- If pedal touches floor before point of resistance is felt:
- Turn screw adjuster clockwise until point of resistance is reached just as accelerator pedal touches floor.
- If point of resistance is reached before pedal touches floor:
- Turn screw adjuster anticlockwise until point of resistance is reached just as accelerator pedal touches floor

1.9 - Removing, installing and adjusting injection pump

Removing



- Remove upper toothed belt guard.
- Unbolt cylinder head cover.

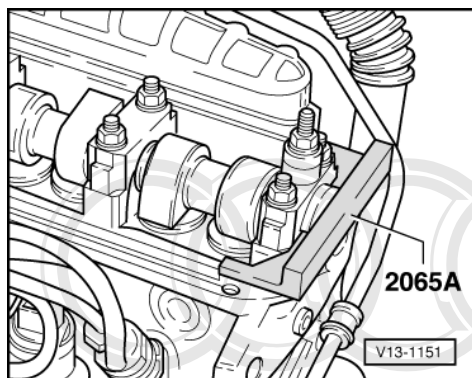


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- Rotate crankshaft to TDC for cylinder 1.

Engine installed:

- -> Marking -O- on the flywheel must be below the edge which is visible through the inspection hole.

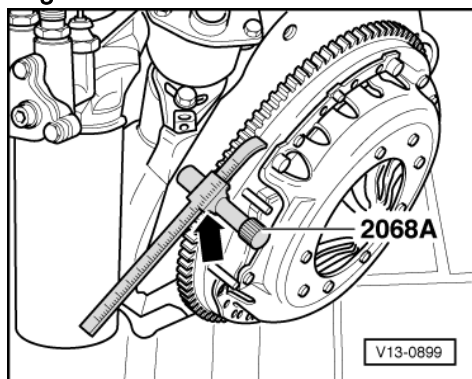


- -> It must also be possible to insert adjustment bar 2065 A in the slot on the back of the camshaft.

Notes:

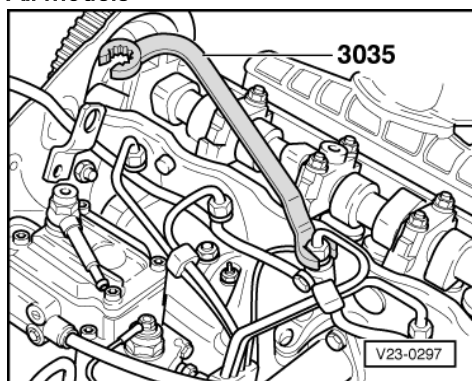
- ♦ If the camshaft slot is covered by the upper edge of the cylinder head, rotate the crankshaft through one more revolution.
 - ♦ If adjustment bar 2065 A cannot be inserted with the crankshaft in TDC position, adjust the basic mechanical setting when installing the injection pump.
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- Lock camshaft with adjustment bar 2065 A.

Engine removed:



- Unscrew oil filter.
- -> Screw in adjustment bar 2068 A as shown in the illustration.
- Set adjustment bar to 107 mm -arrow-. The reference point is the left-hand notch of the vernier scale.
- Rotate crankshaft until TDC marking ("O") on flywheel is aligned with edge of adjustment bar.

All models

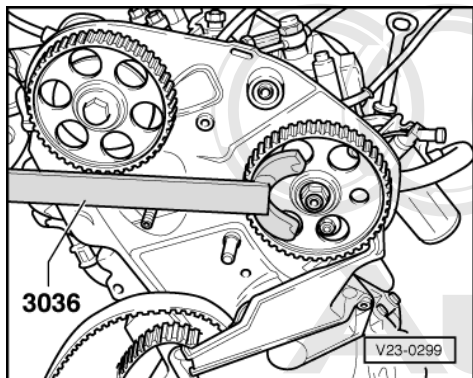




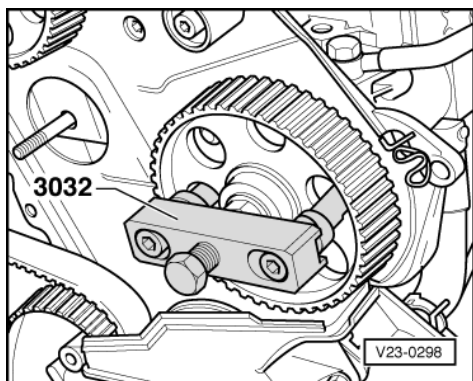
- Unscrew fuel hoses from injection pump.
- Unplug electrical connectors.
- -> Unscrew injection pipes using open ring spanner 3035.

Note:

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



- Remove tensioning roller nut.
- Slacken toothed belt and remove from toothed belt sprockets on camshaft and injection pump together with tensioning roller.
- -> Slacken securing nut for injection pump by about 1 turn, counterholding with retainer 3036.
- Unscrew arms of puller 3032 by about 2 turns.



- -> Fit the puller so that the slots in the arms engage in the holes on the injection pump sprocket.
- Use puller to detach injection pump sprocket.

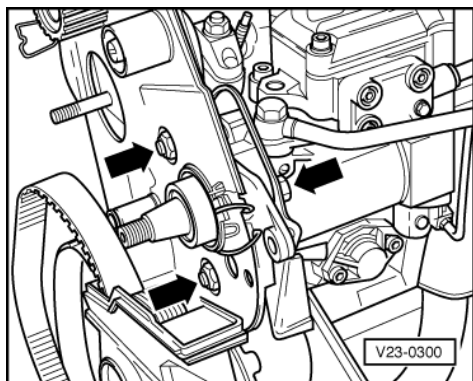
Note:

When removing the injection pump sprocket, do not strike the spindle.

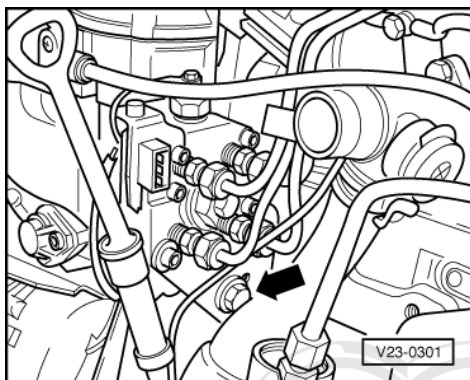
- Unscrew nut.

Note:

When removing the injection pump sprocket, make sure not to lose the Woodruff key.



- -> Remove securing bolts -arrows- for injection pump on front of console.



- -> Remove securing bolt -arrow- on rear support.
- Take off injection pump.

Installing

Notes:

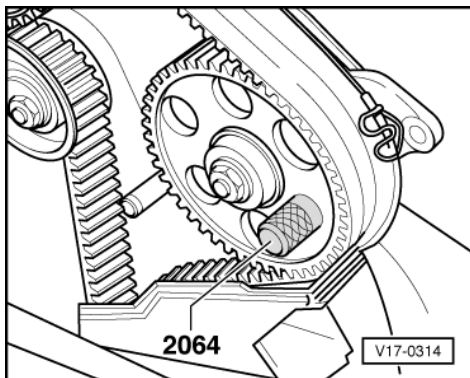
- ◆ Do not interchange banjo bolts for supply and return pipes.
- ◆ The banjo bolt with non-return valve is fitted to the return pipe.
- Insert injection pump into console and then tighten securing bolt on rear support with conical nut first.
- Centre the injection pump in the slots in the console.
- Tighten securing bolts for injection pump on front of console by hand.
- Fit injection pump sprocket.

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Note:

Make sure that the Woodruff key is properly seated.

- Tighten securing nut to 45 Nm, counterholding with retainer 3036.



- -> Rotate the injection pump sprocket until it is possible to insert mandrel 2064 into the hole in the console via the small hole in the sprocket.
- Fit the toothed belt.

=> 4-cyl. Diesel engine (turbo), Mechanics; Repair group 13; Crankshaft group; Removing and installing toothed belt Crankshaft group Removing and installing toothed belt

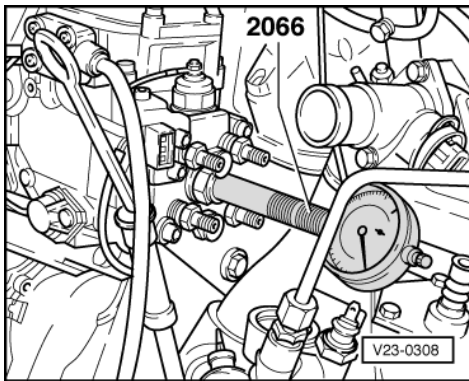
Adjusting

Requirements:

- Correct basic mechanical setting of engine



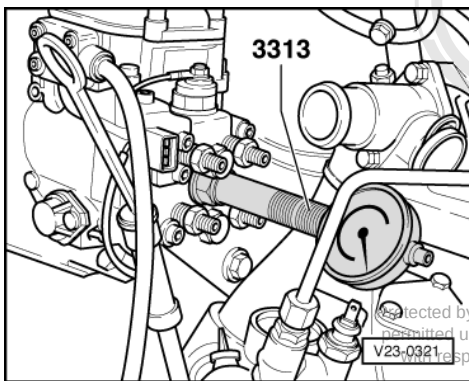
- Toothed belt correctly tensioned



- Remove screw plug from injection pump.

Models ➤08.92 (screw plug with sealing ring):

- -> Screw in dial gauge adapter 2066 in place of screw plug.

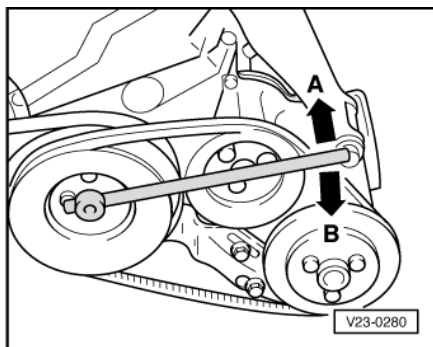


Models 09.92 ➤(screw plug with tapered seal):

- -> Screw in dial gauge adapter 3313 in place of screw plug.

All models

- Screw threaded end of adapter plunger rod firmly into dial gauge (small version with measuring range from 0 to 3 mm).
- Insert plunger rod with dial gauge into adapter.
- Set dial gauge to pre-load of 2 mm and tighten tensioning nut on adapter.

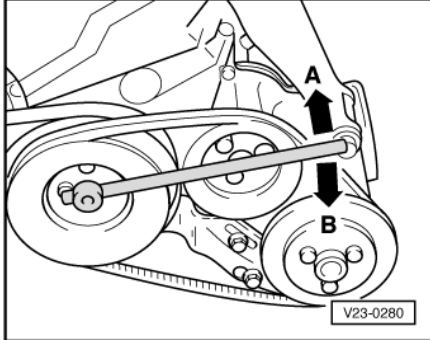


- -> Rotate crankshaft slowly in direction of arrow -A- (against engine running direction) until needle on dial gauge stops moving.

Note:

Use a 12-point socket (AF 19) to rotate the crankshaft.

- Slacken dial gauge and tighten again with pre-load of about 1 mm.
- Set measuring scale to 0.



- -> Rotate crankshaft slowly in direction of arrow -B- (engine running direction) until marking -O- on flywheel aligns with reference marking or with edge of adjuster.

Note:

When aligning the TDC marking, the crankshaft must be rotated in the engine running direction. If the crankshaft is rotated too far by mistake:

- Rotate crankshaft back until dial gauge returns to zero, then rotate forwards again to align TDC marking.
- Read off commencement of injection value on dial gauge:
 - Test value: 0.65 ... 0.75 mm travel
 - Setting value: 0.7 ± 0.02 mm travel

Notes:

- ♦ If the test value is within the specified tolerance, no new setting is required.
- ♦ If the test value is outside the tolerance, adjust to the setting value.
- Slacken securing bolts for injection pump on front of console and on rear support by about 1 turn each.
- Adjust commencement of injection by turning the injection pump.
- Tighten securing bolts to 25 Nm.
- Reconnect injection pipes, fuel supply pipe and electrical wiring.
- Bleed the fuel system=>Page 44 .

Note:

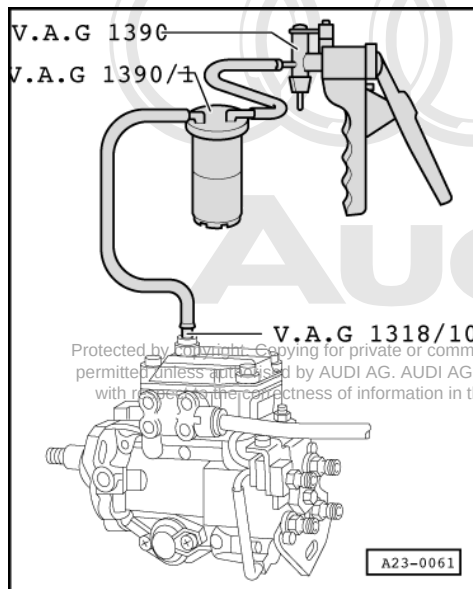
If the screw plug has a sealing ring, the sealing ring must always be renewed. Tightening torque for screw plug: 20 Nm.

- Fit toothed belt guard.
- Dynamically check and adjust commencement of injection
=>Page 44 .

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1.10 - Bleeding fuel system



- -> Fill the injection pump with clean diesel fuel as follows:
- Screw adapter V.A.G 1318/10 into return connection on injection pump.
- Connect hand vacuum pump V.A.G 1390 and bleeder container V.A.G 1390/1 to adapter.
- Operate hand vacuum pump until fuel flows free of bubbles.

Do not allow fuel to be drawn into the hand vacuum pump.

- Connect return pipe.
- Start the engine and check fuel system for leaks (visual check).

1.11 - Dynamically checking and adjusting commencement of injection

Notes:

- ♦ The commencement of injection must always be checked (and if necessary adjusted) after renewing the toothed belt or loosening the injection pump bolts or toothed belt sprockets.
- ♦ The dynamic check of the commencement of injection is only possible with function 04 "Basic setting". This is because in the basic setting mode the commencement of injection valve is activated continuously and therefore the injection timing control is set to "late" (retarded).

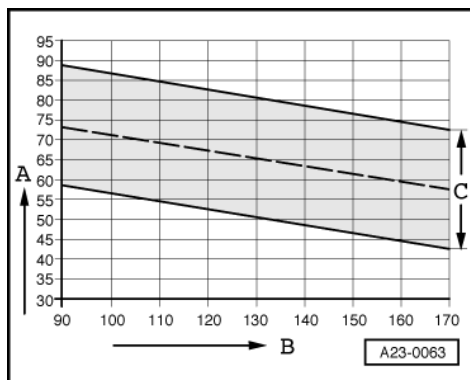
Requirements for test:

- Correct basic mechanical setting of engine
- Toothed belt correctly tensioned
- Start basic setting and select Display Group 00=>Page 14 .

-> Indicated on display:

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

- Monitor the display in display zone 7 (coolant temperature).
 - Specification: less than 70 (corresponds to 85°C)
- Do not proceed with the test until the coolant temperature has reached the specified level.



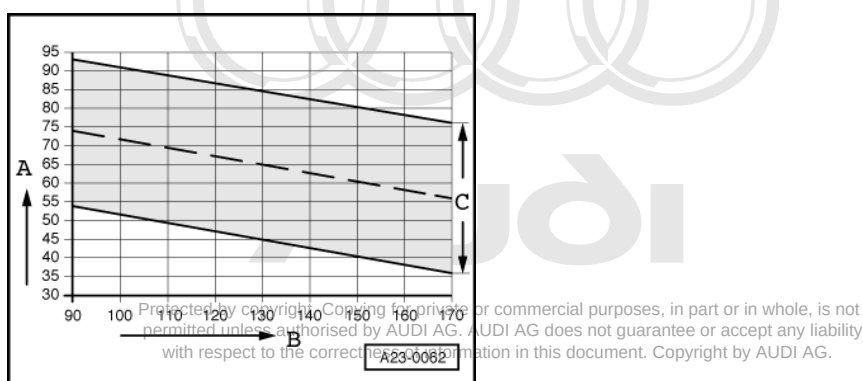
The commencement of injection value in display zone 2 is dependent on the fuel temperature value in display zone 9.

-> Vehicles with software versions up to D081):

1) Interrogating control unit version=>Page 2.

A - Display zone 2 - commencement of injection
B - Display zone 9 - fuel temperature

◆ Specification:=>area C on graph



-> Vehicles with software versions from D09 onwards1):

1) Interrogating control unit version=>Page 2.

A - Display zone 2 - commencement of injection
B - Display zone 9 - fuel temperature

◆ Specification:=>area C on graph

Note:

If the commencement of injection is within the specified range -C- when tested, no adjustment is required.

- If the commencement of injection is outside the tolerance range, adjust the injection pump as follows:
- Slacken securing bolts for injection pump by about 1 turn each. The most easily accessible bolt should be slackened last.
- Take hold of injection pump and apply manual turning force in direction of adjustment.
- Carefully slacken the last securing bolt far enough to allow the pump to turn slightly.
- If commencement of injection is too early, turn injection pump in engine running direction. If commencement of injection is too late, turn pump against engine running direction.
- Re-tighten securing bolt.



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

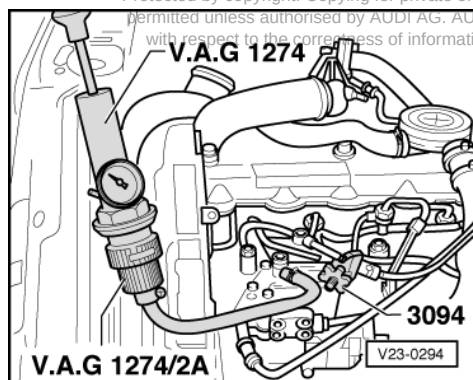
- > Observe readout in display zone 2 and if necessary repeat the adjustment procedure until the readout is within the specified range.
- Re-tighten securing bolts for injection pump to 25 Nm.

Note:

After performing the dynamic adjustment of the injection pump, always slacken the injection pipes on the injection pump and then re-tighten them to 25 Nm. This relieves the tension on the pipes and prevents fracturing caused by constant vibrational stress.

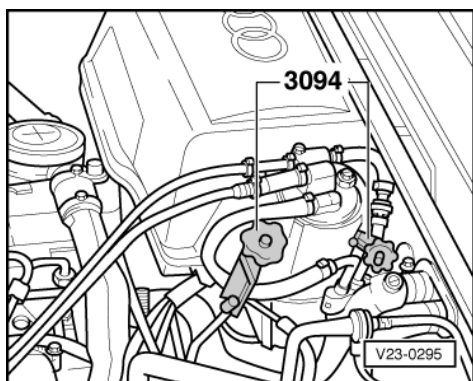
1.12 - Checking fuel system for leaks

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Leaks in the fuel system may result in the following:

- ♦ Foam build-up or air bubbles in the supply pipe
 - ♦ Loss of power, misfiring
 - ♦ Starting problems
- -> Attach adapter 1274/2 A to cooling system tester V.A.G 1274.
 - Unscrew return pipe from injection pump and connect adapter hose in its place.



- -> Fit hose clamps 3093 or 3094 at the following points:
 - On supply hose downstream of fuel filter
 - On return hose downstream of fuel filter
 - On return hose from injection pump
- Use hand pump on tester to create a pressure of between 1.0 and 1.5 bar.
- If the pressure constantly drops, locate leak and eliminate fault.

Note:

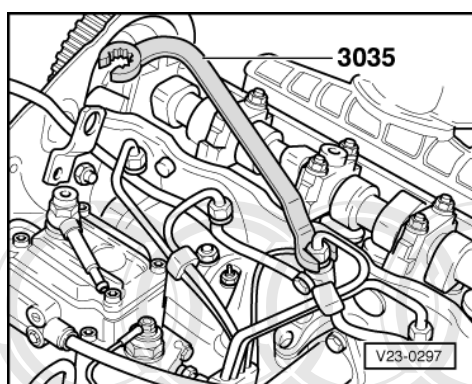
By moving the hose clamps from the filter to the fuel tank connections it is also possible to test the fuel hoses.

1.13 - Removing, installing and testing injectors and constant pressure valves

Note:

Defective injectors cause the following faults:

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



Defective constant pressure valves cause the following fault:

- ◆ Uneven idling, possibly at irregular intervals (sporadically)

Removing

- -> Unscrew injection pipes using open ring spanner 3035.

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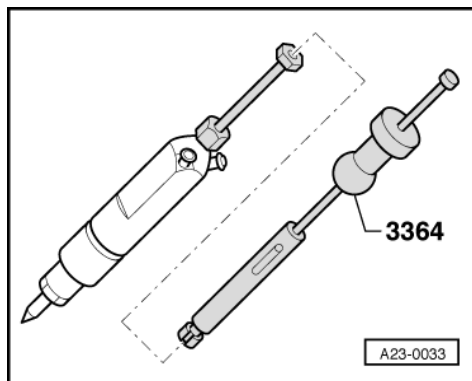
Note:

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

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

Note:

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 make the injector unusable.
- -> Screw the union nut end of the auxiliary tool onto the seized injector, then apply special tool 3364 to the end with the brazed-on nut.

Installing

Note:

Always renew copper seals between cylinder head and injectors.

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

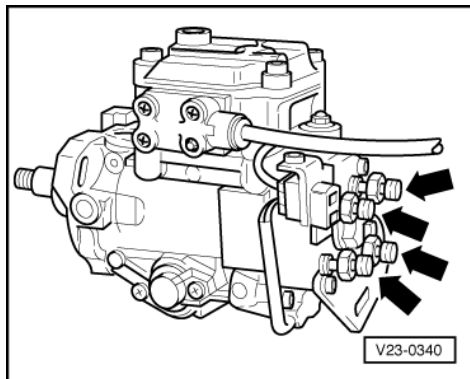
Tightening torques

Component	Nm
Injection pipes	25
Nut for retainer	20

Testing

- To identify defective injectors and constant pressure valves, slacken union nuts for injection pipes one after another while engine is idling.
- If the engine speed remains constant when one of the union nuts is slackened, this means that one of the injectors or constant pressure valves is defective.
- If the engine speed remains constant when one or more of the union nuts on the injectors is slackened, swap the injectors round (all except injector for cylinder 3).
- If the fault moves along with the injector, fit a new injector.
- If the fault remains on the same cylinder, check the compression.

=> 4-cyl. Diesel engine (turbo), Mechanics; Repair group 15; Cylinder head, valve gear; Testing compression
Cylinder head, valve gear Testing compression



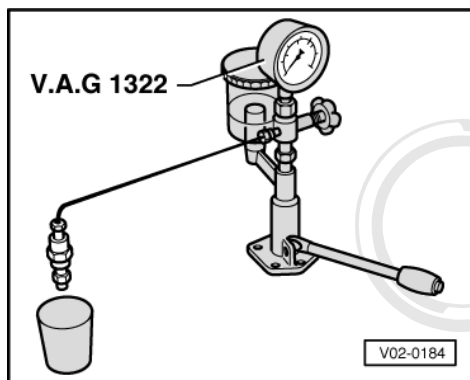
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- -> If the compression is OK, renew the relevant constant pressure valve -arrow- together with sealing ring.
- Tightening torque: 50 Nm

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 pressure valves must always be renewed as a complete set if one or more of them is defective.

This engine is equipped with dual spring injectors. The fuel injected therefore occurs in 2 stages.
If faults occur with these injectors then they are to be exchanged as neither servicing nor pressure setting is possible.



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

Warning:

When testing injectors ensure that the jet of fuel does not contact the hands as the high pressure will cause the fuel to penetrate the skin and may cause severe injuries.

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Testing spray pressure

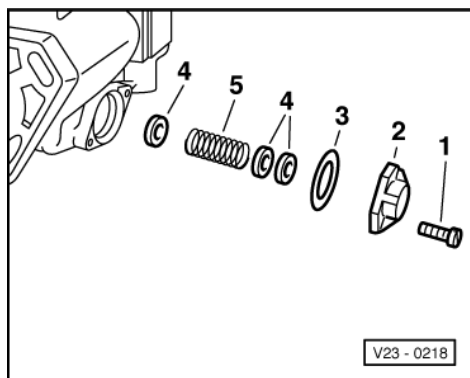
- Pressure gauge on
- Move pump lever down slowly. When injection begins, read off spray pressure. If the pressure does not match the specification, fit a new injector.

Specification	ä 08.92	09.92 ä
New injectors	246 ... 254 bar	190 ... 200 bar
Wear limit	210 bar	170 bar

Checking for leaks

- Pressure gauge on
- Move pump lever down slowly and maintain a pressure of about 200 bar(ä 08.92)or150 bar(09.92 ä)for 10 seconds. There should be no fuel leakage from the injector nozzle.
- If injector leaks, replace.

1.14 - Renewing injection timing device cover O-ring



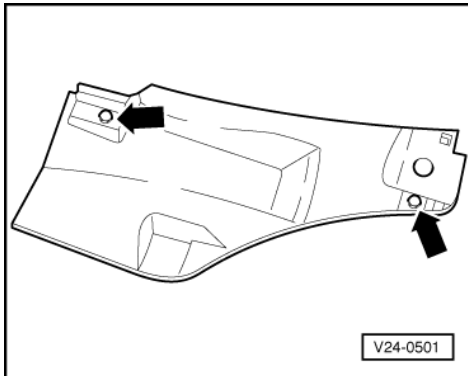
- Place a clean cloth beneath the injection pump.
- -> Remove cover screws -1- with commercially available key for Torx socket head screws, e.g. Hazet 2115-T30.
- Remove cover -2- and clean.



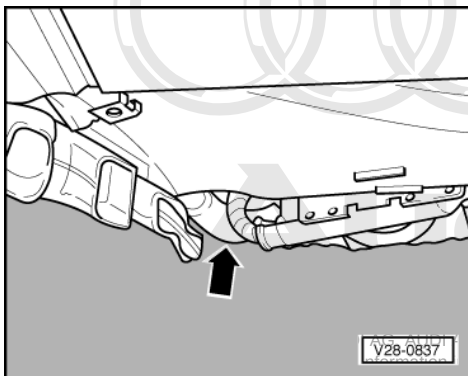
- Renew O-ring -3- and install cover with existing shim -4-.

1.15 - Renewing engine electronics control unit

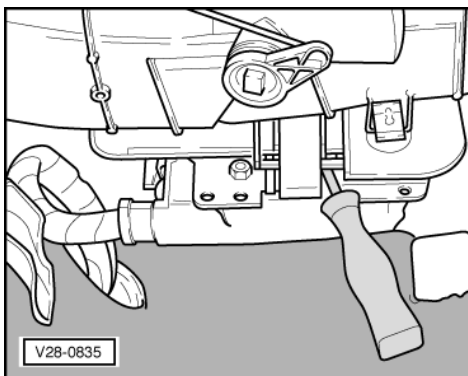
Removing



- Switch off ignition.
- -> Remove glove compartment cover -arrows-.
- Unscrew bolt and remove plastic clip for cover.



- -> On vehicles with air conditioner, disconnect condensation hose -arrow-.



- -> Insert a screwdriver next to retainer clip between control unit support bracket and plastic holder.
- Twist screwdriver as far as necessary to disengage lugs on support bracket (above retainer clip) from locating hole in plastic holder.
- Pull control unit down slightly and remove screwdriver.
- Pull control unit about 3 or 4 cm down. The control unit will engage in a second locating hole (service position).

- Disengage retainer clip and unplug control unit connector.

Notes:

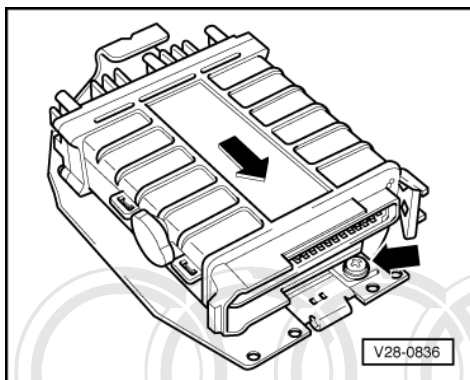
- ◆ Before connecting or disconnecting the Diesel direct injection system control unit connector, always switch off the ignition and wait 30 seconds.
- ◆ With the Diesel direct injection system control unit in the service position, test box V.A.G 1598 A can be connected either to the control unit or to the engine wiring harness using adapter V.A.G 1598/5 in order to carry out tests.

- To release the control unit, pull open the retainer clip and unplug the control unit connector.

Note:

The following steps are only necessary if the control unit has to be removed completely.

- Disengage control unit as described and pull carefully down and out of the plastic holder.
- When removing the control unit on vehicles with air conditioner, carefully press the disconnected condensation hose to one side to prevent it from being damaged by the side flange of the control unit.



- -> Unbolt control unit from support bracket.

Installing

Notes:

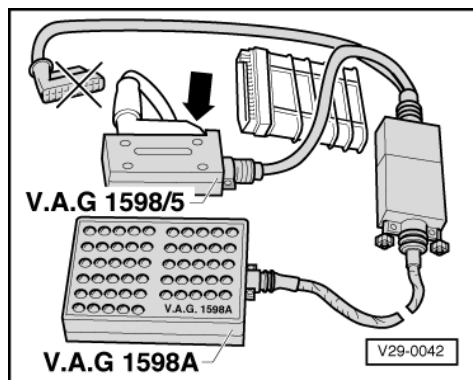
- ◆ Before connecting the Diesel direct injection system control unit connector, always switch off the ignition and wait 30 seconds.
- ◆ On vehicles with air conditioner, check under the glove box to make sure that the condensation hose has been re-connected before installing the glove box cover.

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1.16 - Wiring and component check with test box V.A.G 1598 A and adapter V.A.G 1598/5

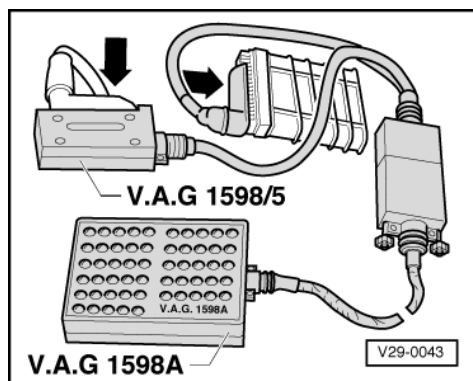
Notes:

- ◆ Before connecting or disconnecting the Diesel direct injection system control unit connector, always switch off the ignition and wait 30 seconds.
 - ◆ Test box V.A.G 1598 A must be disconnected when performing the diagnosis with fault reader V.A.G 1551.
 - ◆ Use hand-held multimeter V.A.G 1526 or multimeter V.A.G 1715 and voltage tester V.A.G 1527 B for the tests.
 - ◆ To connect the test equipment to the test box, use auxiliary cables from adapter set V.A.G 1594 A.
 - ◆ The layout of the sockets on test box V.A.G 1598 A is identical to the layout of the contacts on the connectors for Diesel direct injection system control unit -J248.
- Switch off ignition.
 - Move Diesel direct injection system control unit to service position and engage lugs=>Page 50 .



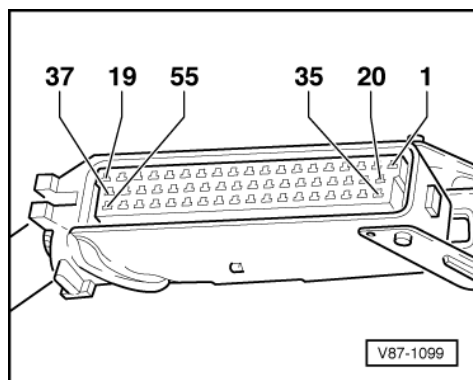
-> Testing connector for Diesel direct injection system control unit -J248

- With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5.



-> Performing tests with Diesel direct injection system control unit -J248 still connected

- Connect test box V.A.G 1598 A to the connector and also to the control unit itself using adapter V.A.G 1598/5.



Note:

- ♦ -> Layout of contacts for repair work on connector for Diesel direct injection system control unit -J248.
- ♦ The contact layout is identical to the socket layout on test box V.A.G 1598 A.

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2 - Testing charge pressure system

2.1 - Testing charge pressure system

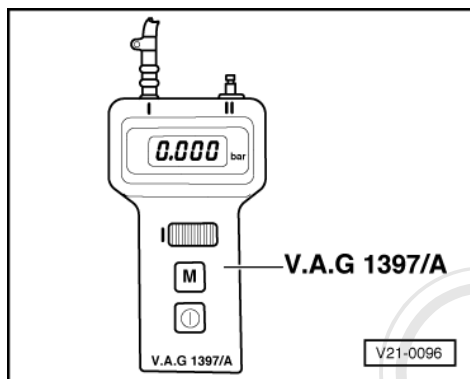
2.2 - Checking charge pressure

Safety notes

Note the following points if test equipment has to be used during a road test:

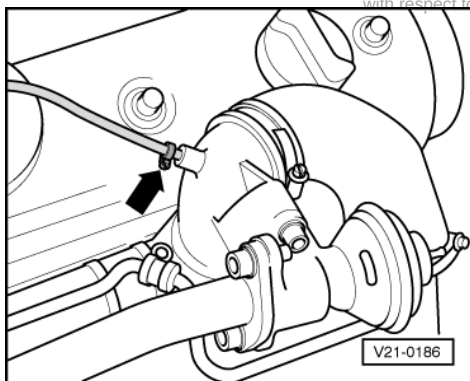
Warning

- ◆ Test equipment must always be secured on the rear seat and operated by a second person.
- ◆ If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.



Requirements for test:

- No leaks in intake or exhaust systems
- Compression, hydraulic tappets and injectors must be OK
- -> The charge pressure is measured with turbocharger tester V.A.G 1397/A and fault reader V.A.G 1551 during a test drive.
- Pull cap off connecting pipe for intake manifold.
- Check for obstructions in connecting pipe, if necessary piercing soot layer with a piece of wire.

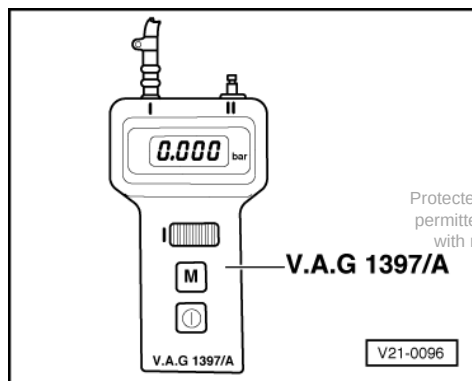




- -> Connect measuring hose from turbocharger tester V.A.G 1397/A to connecting pipe and secure with a hose clamp -arrow-.
- Route measuring hose under rear edge of bonnet and into passenger compartment via right-hand window.

Notes:

- ♦ Hose connections must be completely airtight, otherwise measurements will not be correct.
- ♦ Ensure that measuring hose is not pinched at bonnet or side window.
- ♦ A second mechanic is required to note the readings on the tester when the vehicle is moving.
- ♦ Observe safety notes => Page 53 .



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- -> Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.
- Connect fault reader V.A.G 1551 (or V.A.G 1552) and select engine electronics control unit with the "Address word" 01. Then start the engine.
(Connecting fault reader and selecting engine electronics control unit=>Page 2.)
- Select the function "Read measured value block" and Display Group 00=>Page 16 .

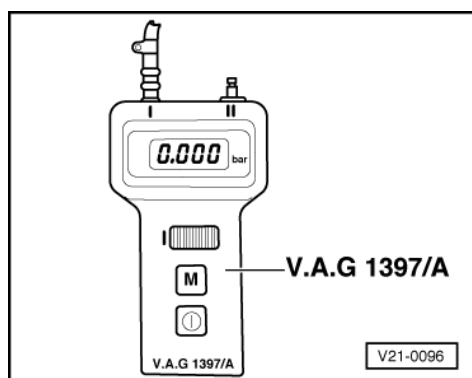
-> Indicated on display:

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

To determine the exact cause of the fault, first test the turbocharger without charge pressure control, and then test the charge pressure with charge pressure control.

Testing charge pressure without charge pressure control:

- Unplug connector from charge pressure control solenoid valve -N75=>Fitting locations overview, Page 26 .



- Accelerate vehicle at full throttle in 3rd gear from about 40 km/h.
- At a speed of about 80 km/h (approx. 2800 rpm), press memory key M on V.A.G 1397/A and at the same time press the PRINT key on V.A.G 1551.

-> Specification for V.A.G 1397/A:

- ◆ 1.500 ... 1.650 bar

-> Specification for display zone 5 on V.A.G 1551:

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

- ◆ 180 ... 200

Note:

The charge pressure level is measured with turbocharger tester V.A.G 1397/A. Fault reader V.A.G 1551 is used to check whether the charge pressure is being registered by the control unit.

Charge pressure too low - causes:

- ◆ Leak between turbocharger and intake manifold
- ◆ Turbocharger defective (turbine jammed by foreign body)
- ◆ Actuation (linkage, shaft) for by-pass valve stiff or jammed (by-pass valve permanently open)

Charge pressure too high - causes:

- ◆ Charge pressure control hose disconnected, leaking or blocked
- ◆ Charge pressure control solenoid valve -N75 blocked
- ◆ Actuation (linkage, shaft) for by-pass valve stiff or jammed (by-pass valve permanently closed)
- ◆ Leak in pressure unit

Testing charge pressure with charge pressure control:

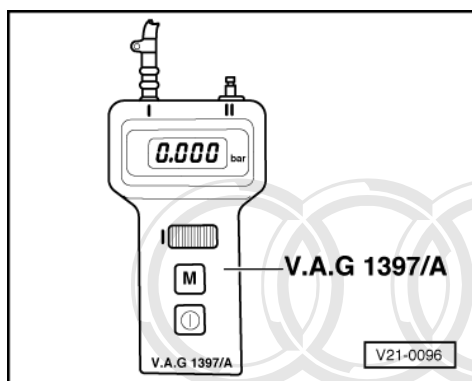
If the charge pressure level without charge pressure control is okay, repeat the test, this time with charge pressure control:

- Fit connector to charge pressure control solenoid valve -N75.

Note:

The charge pressure is determined by the control unit and is dependent on the intake manifold temperature and ambient air pressure.

- Accelerate vehicle at full throttle in 3rd gear from about 40 km/h.



- At a speed of about 80 km/h (approx. 2800 rpm), press memory key M on V.A.G 1397/A and at the same time press the PRINT key on V.A.G 1551.

-> Specification for V.A.G 1397/A:

- ◆ 1.650 ... 1.920 bar

-> Specification for display zone 5 on V.A.G 1551:

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

- ♦ 200 ... 235

Note:

The charge pressure level is measured with turbocharger tester V.A.G 1397/A. Fault reader V.A.G 1551 is used to check whether the charge pressure is being registered by the control unit.

- If the specification is not attained, check the hose and test intake manifold temperature sender -G72 and intake manifold pressure sender -G71.

Charge pressure too low - causes:

- ♦ Electrical fault in charge pressure control solenoid valve -N75
- ♦ Charge pressure control solenoid valve -N75 is jammed in the open position

Charge pressure too high - causes:

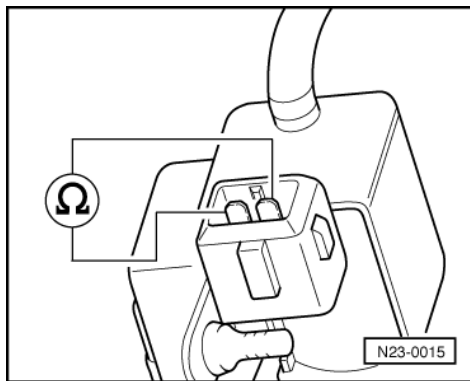
- ♦ Charge pressure control solenoid valve -N75 is jamming at times in the closed position
- ♦ Charge pressure has been increased as a result of tuning

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2.3 - Testing charge pressure control solenoid valve -N75

- Switch off ignition.
- Pull connector off charge pressure control solenoid valve -N75
=>Fitting locations overview, Page 26 .

Testing internal resistance

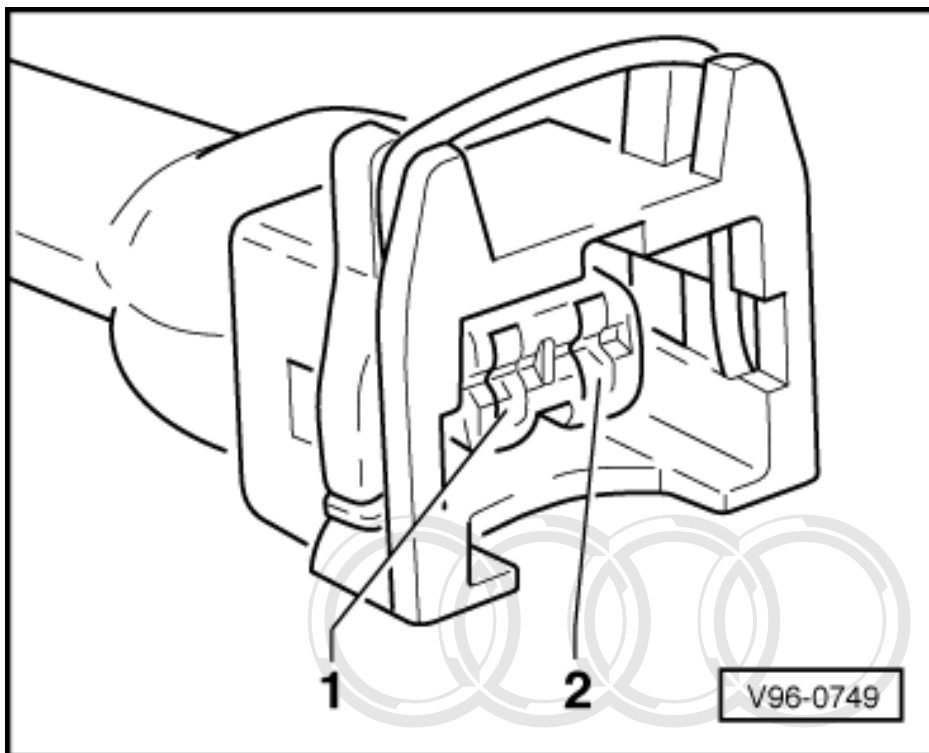


- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to valve contacts using test leads from V.A.G 1594 A.
- Specification: 25 ... 45Ω

If the specification is not attained:

- Renew charge pressure control solenoid valve -N75.

Testing voltage supply

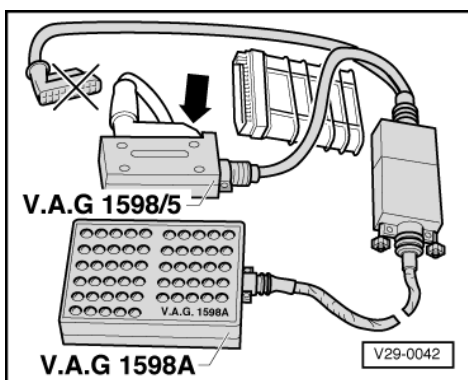


- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to earth and contact 2 of connector using test leads from V.A.G 1594 A.
- Switch on ignition.
 - Specification: approx. battery voltage

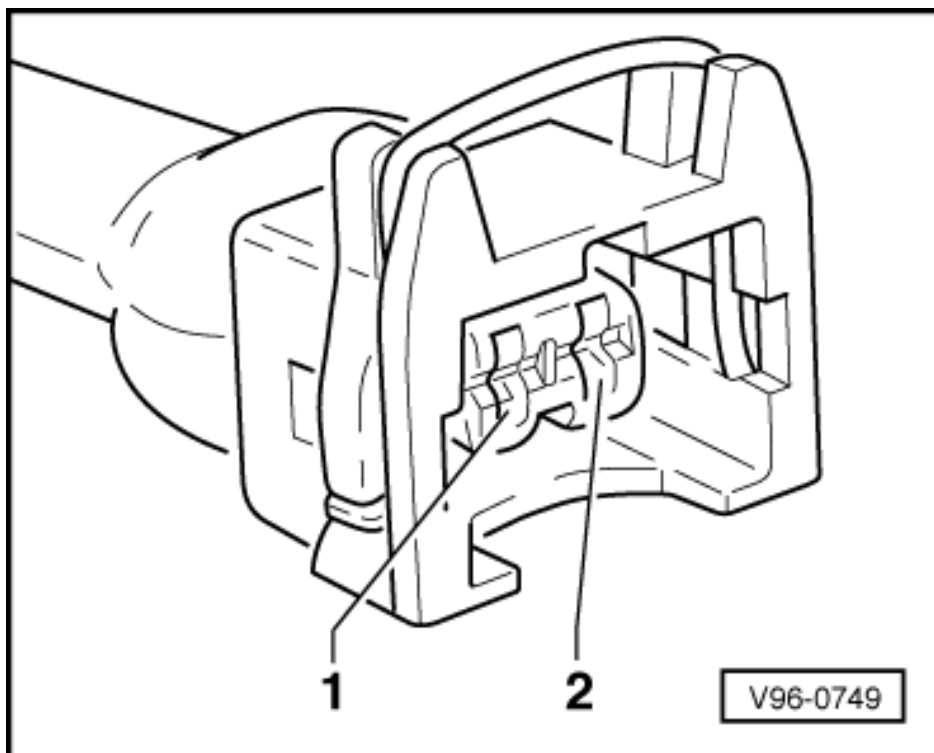
If the specification is not attained:

- Test fuse 27.
- Test wiring for open circuit and short to positive or earth.

Testing wiring



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- ➔ Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -N75 Contact No.	Test box V.A.G 1598 A Socket No.
1	7
2	15

- Rectify any open/short circuit as necessary.

2.4 - Testing intake manifold pressure sender -G71

Test requirement:

- Engine not running
- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2.
- Select the function "Read measured value block" and Display Group 00=>Page 16.

-> Indicated on display:

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

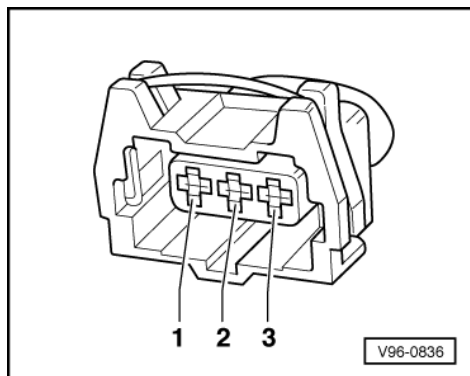
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- Observe readouts in display zones 5 and 6.
 - Specification: The difference between the readouts in display zones 5 and 6 should be less than 3.
- Start the engine.
- Observe the readouts again.

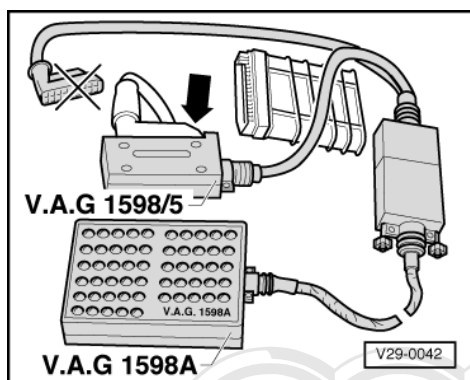
Notes:

- ♦ With the engine idling the readout in display zone 5 will decrease by between 1 and 3 units (low pressure in intake manifold).

- ♦ If the readout decreases by more than 4 units, this means either that the air cleaner is dirty or that the intake manifold is blocked.

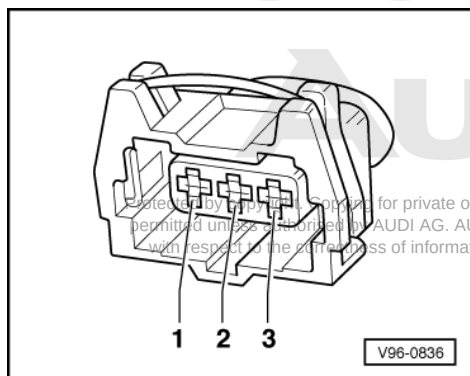


- If the specification is not attained, switch off the ignition.
- Unplug connector for intake manifold pressure sender -G71
 =>Fitting locations overview, Page 26 .
- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to contacts 1 and 3 of connector using test leads from V.A.G 1594 A.
- Switch on ignition.
 - Specification: approx. 5 V



If the specification is not attained:

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:



Connector for -G71 Contact No.	Test box V.A.G 1598 A Socket No.
1	51
2	54
3	13

- Test all wires for short circuits to each other.
- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew intake manifold pressure sender -G71.

2.5 - Testing intake manifold temperature sender -G72

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 .
- Select the function "Read individual measured value" and enter Channel No. 69=>Page 19 .

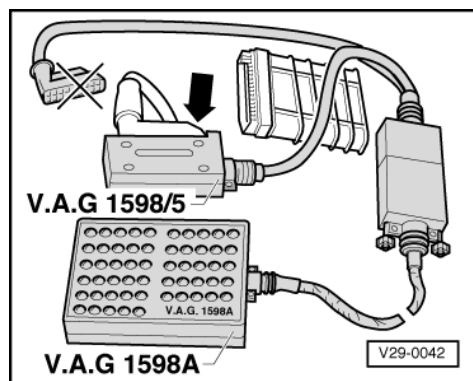
-> Indicated on display:

Read individual measured value	
Channel 69	Measured value XXX

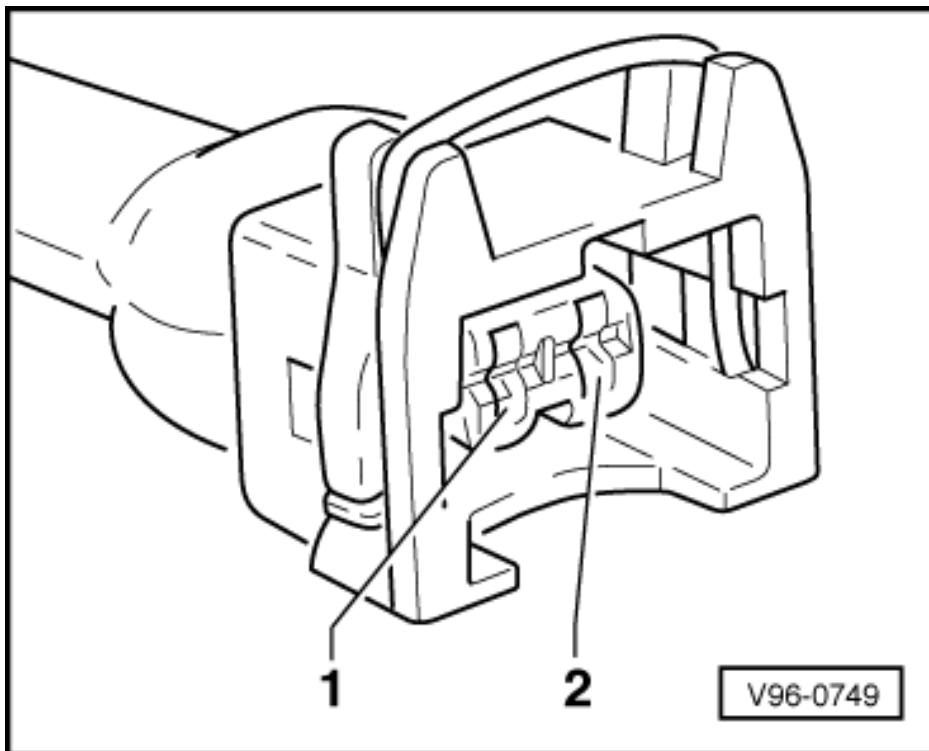
Specifications	at approx.
243	- 20 °C
226	0 °C
196	20 °C
155	40 °C

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- If the specifications are not attained, switch off the ignition.
- Unplug connector from intake manifold temperature sender -G72
=>Fitting locations overview, Page 26 .



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -G72 Contact No.	Test box V.A.G 1598 A Socket No.
1	20
2	13

- Test both wires for short circuit to each other.
- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew intake manifold pressure sender -G72.



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Diagram illustrating the V23-0335 engine assembly with numbered callouts:

- 1: Fuel filter
- 2: Fuel line
- 3: Fuel pump
- 4: Fuel pump drive shaft
- 5: Fuel pump housing
- 6: Fuel pump mounting bracket

- 1 Intake manifold pressure sender
-G71
- 2 Solenoid valve for charge pressure control -N75
- 3 Pressure unit for charge pressure control
- 4 Pressure connection on turbocharger
 - ♦ Pressure supply for charge pressure control system
- 5 Pressure connection on outlet for charge air cooler
 - ♦ Pressure tapping point for intake manifold pressure sender -G71
- 6 Air cleaner

3.1 - Testing injection control

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2.
- Select the function "Final control diagnosis" and activate commencement of injection valve -N108=>Page 11

11

Final control diagnosis
Commencement of injection valve -N108

- Start "Basic setting" and select Display Group 00=>Page 14.

System in basic setting 0					
42	55	0	20	116	117
62	97	127	83		

- If necessary, correct the commencement of injection
=> Page 44 .

- Pull out fuse 27.

Note:

Fault code 00526 will be stored in the fault memory.

- Observe readout in display zone 2.

System in basic setting 0					
42	255	0	20	116	117
62	97	127	83		

-> The readout should increase to 255.

Note:

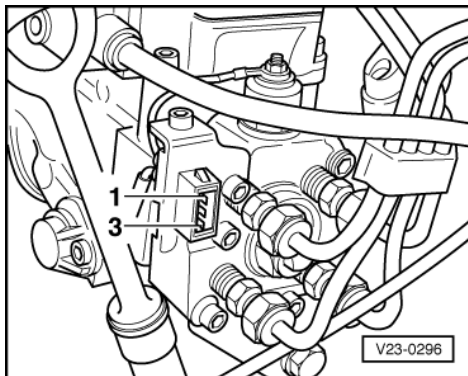
The break in the power supply will cause the commencement of injection valve to close. The interior pressure in the pump cannot be reduced further, and therefore the full pressure is applied to the injection timing control piston. This moves the injection timing control to the "early" (fully advanced)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

If the specification is not attained:

- Replace injection pump.
- Interrogate fault memory, then erase=>Page 3.

3.3 - Testing commencement of injection valve -N108

- Switch off ignition.

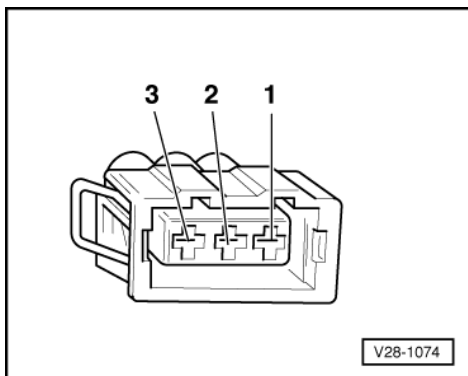


- Disconnect connector on injection pump
=>Fitting locations overview, Page 26.

Testing internal resistance

- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to valve contacts 2 and 3 using test leads from V.A.G 1594 A.
- Specification: 14 ... 18Ω

If the specification is not attained:



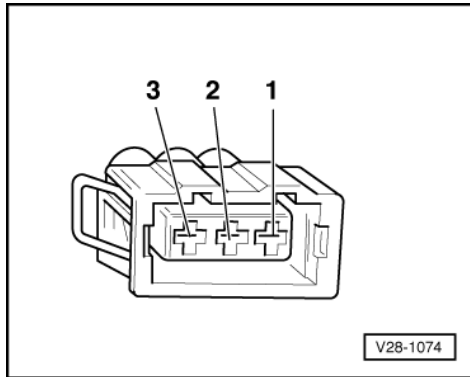


- Renew commencement of injection valve -N108
=>Item **27** .

Testing voltage supply

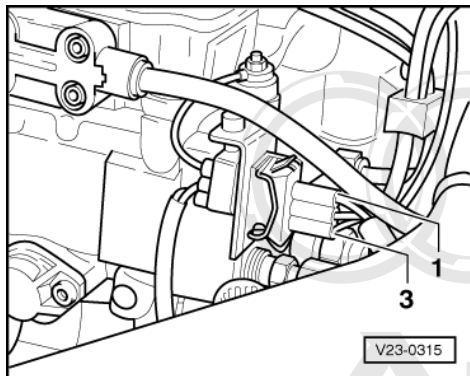
- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to engine earth and contact 3 on connector using test leads from V.A.G 1594 A.
- Switch on ignition.
 - Specification: approx. battery voltage

If the specification is not attained:



- Check fuse 27 in relay panel with fuse holder.
- -> Test for open circuit in wiring between fuse 27 and contact 3 on injection pump connector using current flow diagram.
- Test for open circuit in wiring between fuse 27 and excess voltage protection relay -J249 on front auxiliary relay carrier (relay position 14) under dash panel.

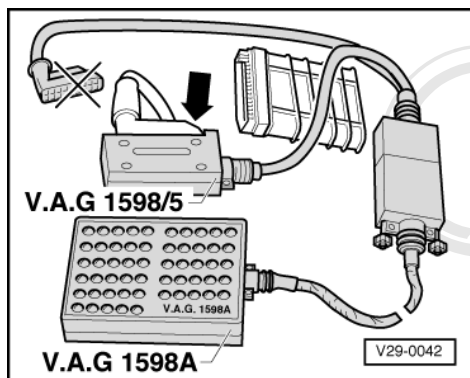
Testing activation



- -> Connect voltage tester V.A.G 1527 B to contacts 2 and 3 on injection pump connector using test leads from V.A.G 1594 A.
- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page **2** .

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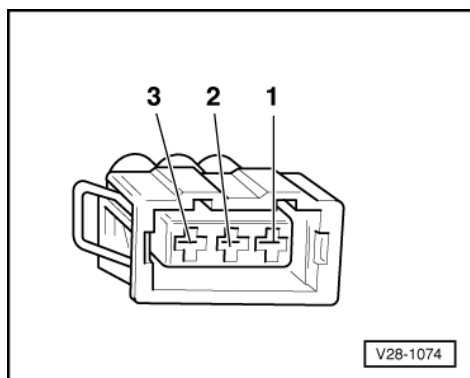
- Select the function **"Final control diagnosis"** and activate commencement of injection valve -N108=>Page **11** .



- The LED lamp on the voltage tester should flash.

If the LED lamp does not flash or lights up continuously:

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in wiring between contact 2 on injection pump connector and socket 10 on test box V.A.G 1598 A.
- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew Diesel direct injection system control unit -J248.

3.4 - Testing fuel temperature sender -G81

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 .
- Select the function "Read measured value block" and Display Group 00=>Page 16 .

-> Indicated on display:

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

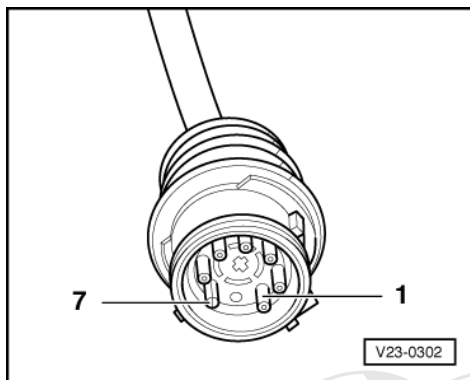
- Observe readout in display zone 9.

Specifications	at approx.
18	- 20 °C
55	0 °C
91	20 °C
127	40 °C
164	60 °C

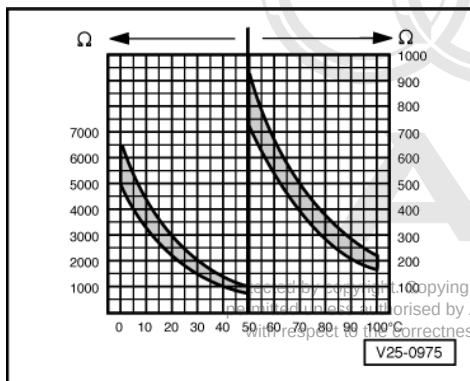
- If the specification is not attained, switch off the ignition.
- Disconnect injection pump connector



=>Fitting locations overview, Page 26 .



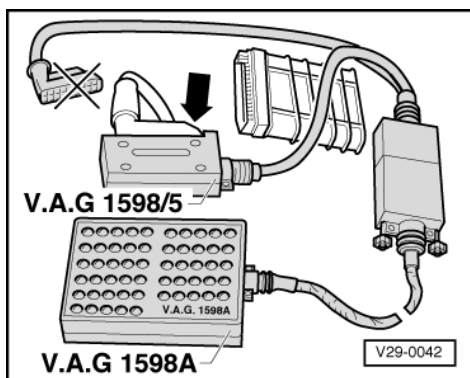
- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to contacts 5 and 6 of injection pump connector using test leads from V.A.G 1594 A.



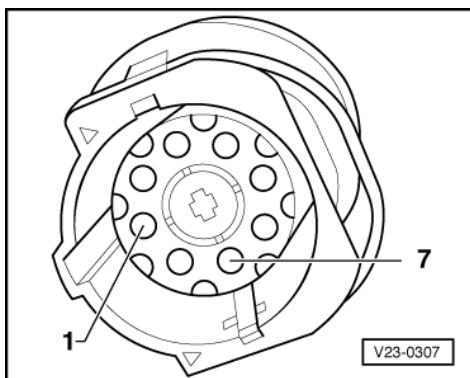
-> Specification

If the specification is not attained:

- Renew injection pump.



- -> If the specification is attained, make sure the ignition is switched off and then connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for injection pump Contact No.	Test box V.A.G 1598 A Socket No.
5	13
6	35

- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew Diesel direct injection system control unit -J248.

4 - Testing exhaust gas recirculation (EGR)

4.1 - Testing exhaust gas recirculation (EGR)

4.2 - Testing operation

Notes:

The exhaust gas recirculation (EGR) is affected by the following factors:

- ◆ Coolant temperature
- ◆ Engine idling for more than 10 minutes
- ◆ Injection quantity (if above tolerance)

The self-diagnosis of the control unit tests the operation of the exhaust gas recirculation system by checking the intake air quantity. The exhaust gas recirculation test must therefore always include a test of the air flow meter.

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 . Run the engine until warm, then allow to idle.

Vehicles with software versions up to D051):

- 1) Interrogating control unit version=>Page 2 .
- Select the function "Read individual measured value" and enter Channel No. 07=>Page 19 .

-> Indicated on display:

Read individual measured value			
Channel	07	Measured value	XXX



Readout	Possible cause of fault
55 ... 68	Okay
68 ... 90	Insufficient EGR Intake air temperature very high Injection quantity too high
90 ... 110	Engine idling for more than 10 minutes No EGR
< 55	Too much EGR Unmetered air
> 110	Engine too cold Air flow meter defective Control unit defective

Vehicles with software versions from D06 onwards1):

- 1) Interrogating control unit version=>Page 2 .
- Select the function "Read measured value block" and Display Group 00=>Page 16 .

-> Indicated on display:

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

- Observe readout in display zone 10.

Readout	Possible cause of fault
80 ... 99	Okay
100 ... 125	Insufficient EGR Intake air temperature very high Injection quantity too high
125 ... 160	Engine idling for more than 10 minutes No EGR
< 80	Too much EGR Unmetered air
> 160	Engine too cold Air flow meter defective Control unit defective

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All models

- Start final control diagnosis and activate EGR valve -N18
=>Page 11 .
- The valve should click.

If the valve does not click:

- Test exhaust gas recirculation valve=>Page 69

If the valve clicks:

- Check vacuum hoses=>Page 75 .

If vacuum hoses are OK:

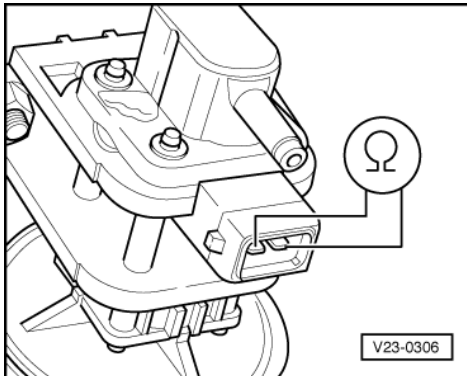
- Test mechanical exhaust gas recirculation valve

=> 4-cyl. Diesel engine (turbo), Mechanics; Repair group 26; Exhaust system; Testing exhaust gas recirculation
Exhaust system Testing exhaust gas recirculation

4.3 - Testing exhaust gas recirculation valve -N18

- Switch off ignition.
- Pull connector off EGR valve -N18
=>Fitting locations overview, Page 26 .

Testing internal resistance



- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to valve contacts using test leads from V.A.G 1594 A.
- Specification: 4 ... 8Ω
- If the specification is not attained, renew EGR valve -N18.

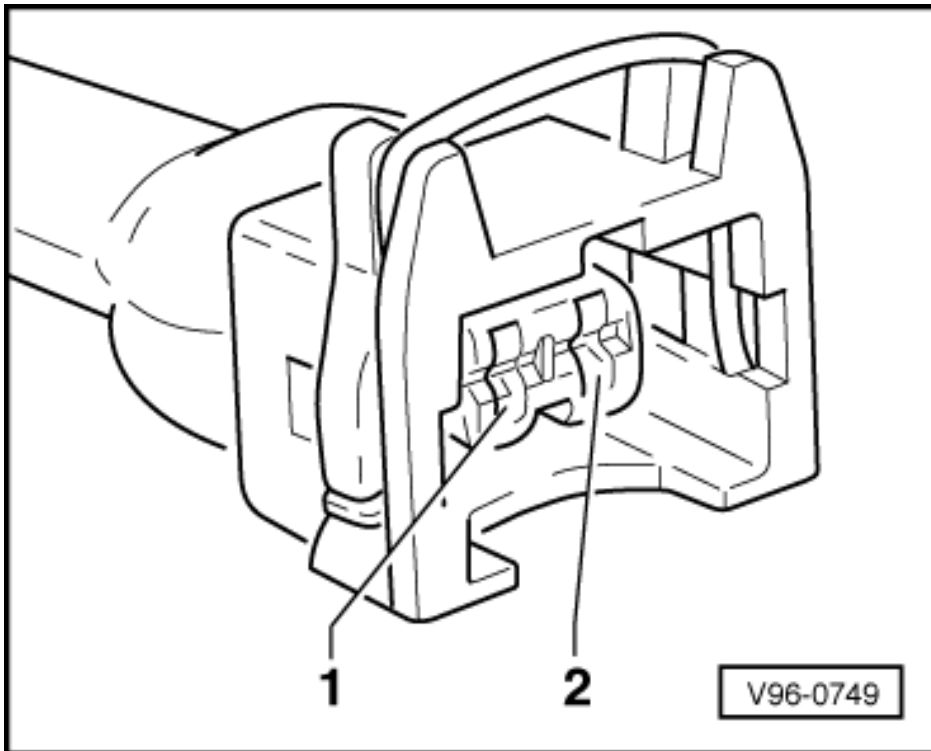
Note:

At room temperature the resistance value will be within the lower tolerance range. If the engine is warm, the resistance value will be within the upper tolerance range.

Testing voltage supply

- Pull connector off EGR valve -N18
=>Fitting locations overview, Page 26 .

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- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to engine earth and contact 2 of connector using test leads from V.A.G 1594 A.
- Switch on ignition.
 - Specification: approx. battery voltage

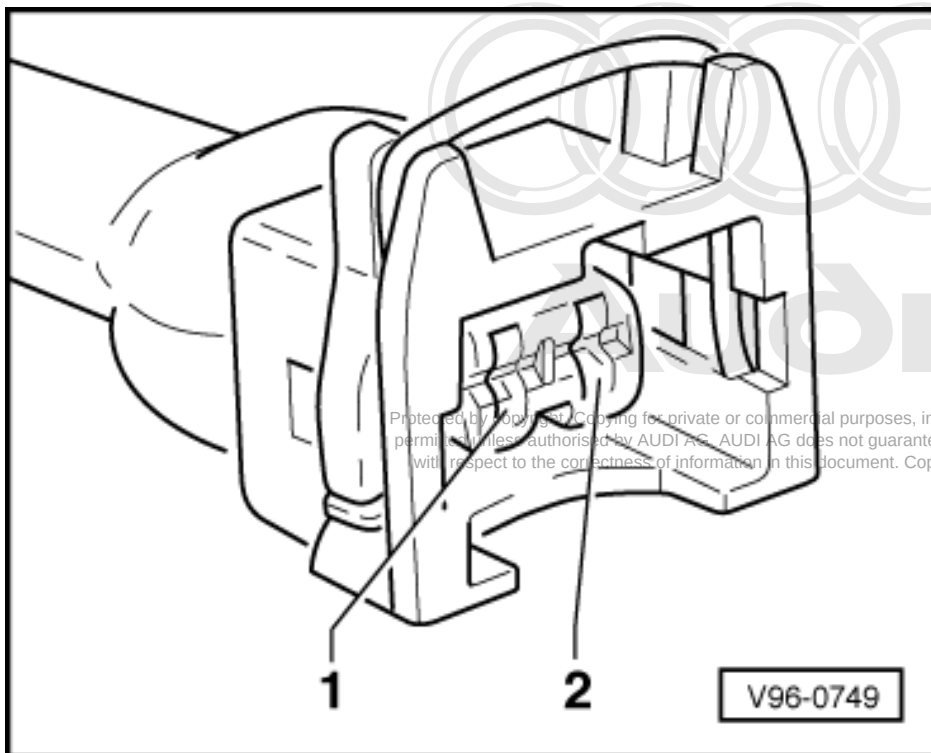
If the specification is not attained:

- Check fuse 27 in relay panel with fuse holder.
- Test for open circuit in wiring between fuse 27 and contact 2 on connector for EGR valve -N18 using current flow diagram.
- Test for open circuit in wiring between fuse 27 and excess voltage protection relay -J249 on front auxiliary relay carrier (relay position 14) under dash panel on left-hand side.

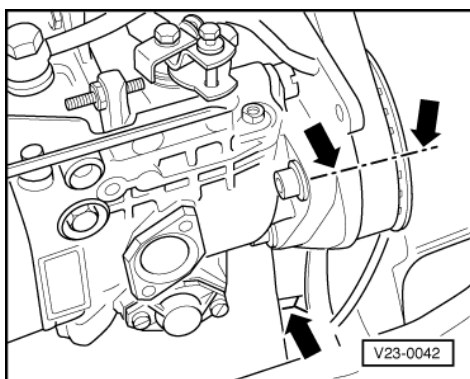


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Testing activation

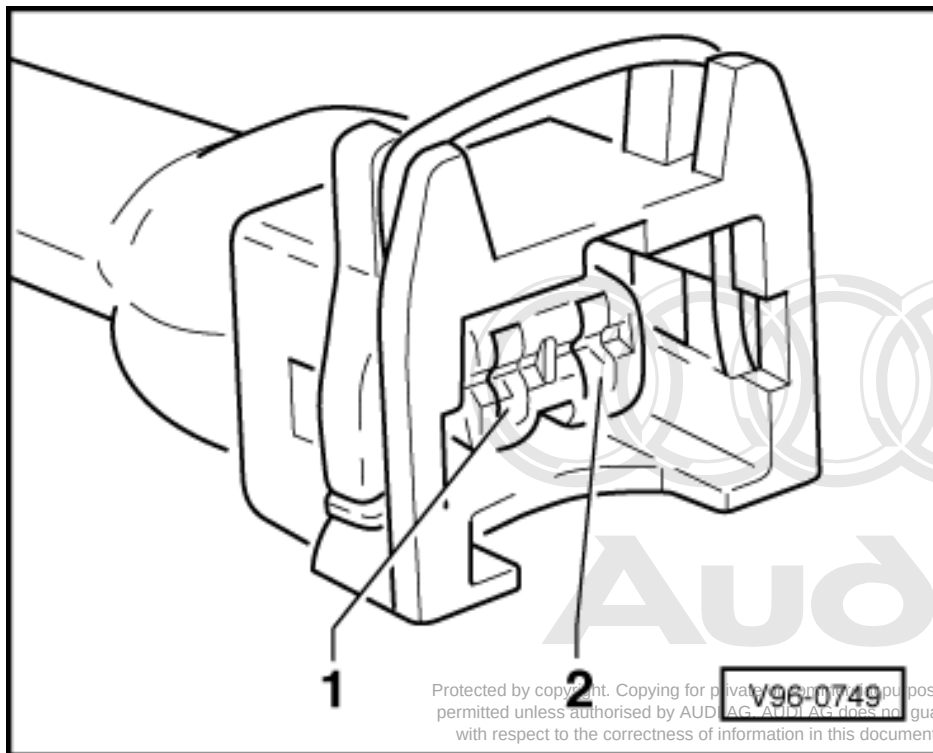


- -> Connect voltage tester V.A.G 1527 B to contacts on connector for EGR valve -N18 using test leads from V.A.G 1594 A.
- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page **2** .
- Select the function "Final control diagnosis" and activate EGR valve -N18=>Page **11** .
 - The LED lamp on the voltage tester should flash.



If the LED lamp does not flash or lights up continuously:

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page **51** .



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If the LED lamp does not flash:

- ➔ Test for open circuit and short to positive in wiring between contact 1 on connector for EGR valve -N18 and socket 6 on test box V.A.G 1598 A.

If the LED lamp lights up continuously:

- Test for short to earth in wiring between contact 1 on connector for EGR valve -N18 and socket 6 on test box V.A.G 1598 A.
- Rectify any open/short circuit as necessary.

4.4 - Testing air flow meter -G19

Testing operation

Vehicles with software versions up to D051):

- 1) Interrogating control unit version=>Page 2 .

Notes:

- ♦ A second mechanic is required to note the readings on the tester when the vehicle is moving.
- ♦ Observe safety notes => Page 53 .
- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 . Then start the engine.
- Select the function "Read individual measured value" and enter Channel No. 07=>Page 19 .

-> Indicated on display:

Read individual measured value
Channel 07 Measured value XXX

- Run the engine until it is warm, then allow to idle.
 - Specification: 55 ... 68
- If the specification is not attained, test exhaust gas recirculation

=>Page 67 .

- Take the vehicle for a test drive and accelerate at full throttle in 3rd gear from a speed of about 40 km/h.
 - Specification: The readout should increase steadily to about 200 at a speed of 100 km/h (3600 rpm).
- If the specification is not attained, test turbocharger (=>Testing charge pressure system, Page 53). If the turbocharger is okay, renew air flow meter -G19.
- Repeat the test several times. Under the same conditions (charge pressure, engine speed, gear, full throttle) the readout for the air quantity should be approximately the same.
- If readouts vary by more than 40 units, renew air flow meter -G19.

Vehicles with software versions from D06 onwards1):

1) Interrogating control unit version=>Page 2 .

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 . Then start the engine.
- Select the function "Read measured value block" and Display Group 00=>Page 16 .

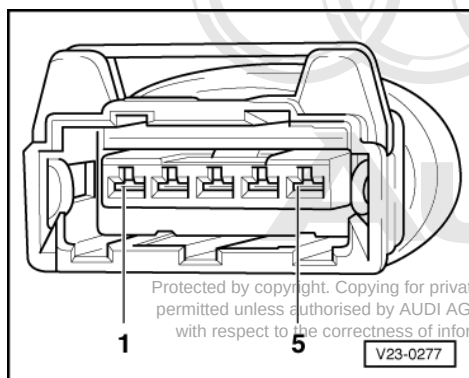
-> Indicated on display:

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

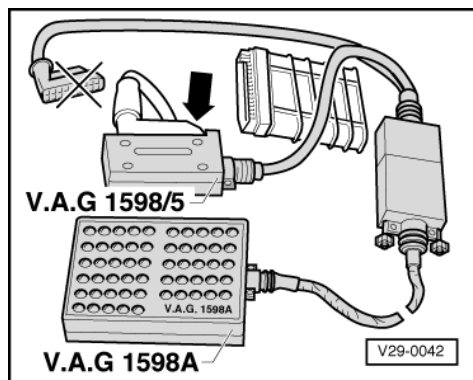
- Observe display in display zone 10.
- Run the engine until it is warm, then allow to idle.
 - Specification: 80 ... 99
- If the specification is not attained, test exhaust gas recirculation =>Page 67 .
- Take the vehicle for a test drive and accelerate at full throttle in 4th gear from a speed of about 60 km/h.
 - Specification: 210 ... 255 from approx. 80 km/h
- If the specification is not attained, test turbocharger (=>Testing charge pressure system, Page 53). If the turbocharger is okay, renew air flow meter -G19.
- Repeat the test several times. Under the same conditions (charge pressure, engine speed, gear, full throttle) the readout for the air quantity should be approximately the same.
- If readouts vary by more than 40 units, renew air flow meter -G19.

Testing voltage supply

- Switch off ignition.
- Pull connector off air flow meter -G19
=>Fitting locations overview, Page 26 .

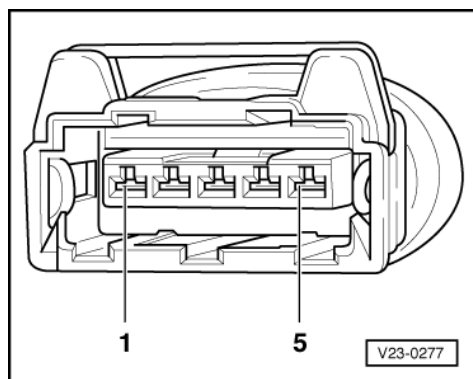


- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to contacts 3 and 4 of connector using test leads from V.A.G 1594 A.
- Switch on ignition.
 - Specification: approx. 5 V
- If the specification is not attained, test wiring.



Testing wiring

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

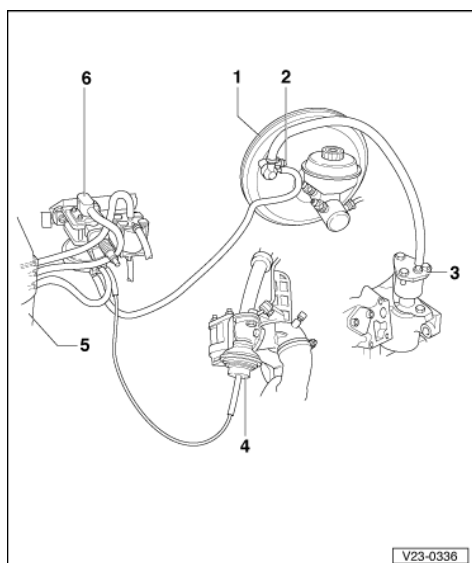
Connector for -G19 Contact No.	Test box V.A.G 1598 A Socket No.
2	38
3	34
4	13

- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew Diesel direct injection system control unit -J248.



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4.5 - Hose routing diagram for exhaust gas recirculation



- 1 Brake servo
- 2 Vacuum connection
 - ♦ For air conditioner
- 3 Vacuum pump
- 4 Mechanical exhaust gas recirculation valve
- 5 Air cleaner
- 6 Exhaust gas recirculation valve -N18



5 - Checking control unit input values

5.1 - Checking control unit input values

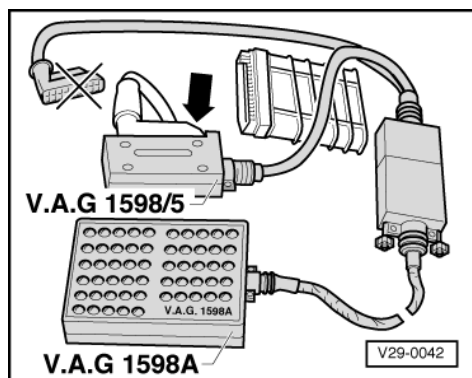
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5.2 - Testing Diesel direct injection system voltage supply

With the ignition switched on the injection system receives its voltage supply via excess voltage protection relay -J249.

Test requirement:

- Battery voltage not less than 12 V

**Testing voltage supply**

- ➔ With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .
- Switch on ignition.
- Connect voltage tester V.A.G 1527 B as follows using test leads from V.A.G 1594 A:

Test box V.A.G 1598 A Socket No.	Specification
15 + earth	approx. battery voltage
16 + earth	approx. battery voltage
17 + earth	approx. battery voltage

If the specifications are not obtained:

- Test excess voltage protection relay -J249 in front auxiliary relay carrier (relay position 14) under dash panel=>Page 76 , and also check the wiring.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

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Testing earth connection for control unit

- Connect voltage tester V.A.G 1527 B as follows using test leads from V.A.G 1594 A:

Test box V.A.G 1598 A Socket No.	Specification
18 + battery positive	approx. battery voltage
19 + battery positive	approx. battery voltage

If the specifications are not obtained:

- Check wiring.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

Testing excess voltage protection relay -J249**Note:**

Excess voltage protection relay -J249 is in the front auxiliary relay carrier (relay position 14) under the dash panel.

- Remove storage compartment (shelf) on driver's side.

=> General body repairs; Repair group 70; Dash panel; Removing driver's side shelf Dash panel Removing driver's side shelf

- Switch on ignition.
 - Excess voltage protection relay -J249 should "pull" (i.e. click).

Note:

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

If the relay clicks but there is no voltage at the control unit:

- Test wiring between excess voltage protection relay -J249 and control unit.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

If the relay does not click:

- Test voltage supply to excess voltage protection relay -J249.

Testing voltage supply to excess voltage protection relay -J249

- Switch off ignition.
- Remove relay from position 14 on front auxiliary relay carrier under dash panel.
- Switch on ignition.
- Connect voltage tester V.A.G 1527 B to the following contacts in relay position 14 on relay panel:

Position 14 in front auxiliary relay carrier Contact No.	Specification
6 + earth	approx. battery voltage
8 + earth	approx. battery voltage
2 + battery positive	approx. battery voltage

- If all the readouts match the specifications but there is still no voltage input at terminal 15 of the control unit (=>Testing voltage supply, Page 76), renew excess voltage protection relay -J249.

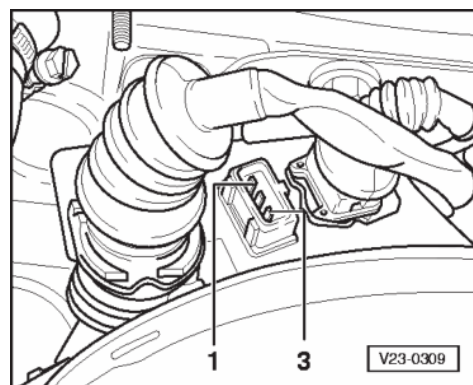
If the specifications are not obtained:

- Check the wiring.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

5.3 - Testing engine speed sender -G28

- Switch off ignition.

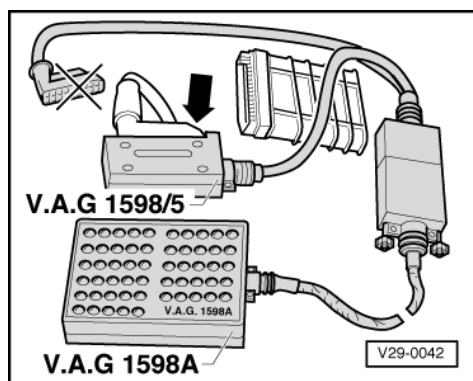




- Disconnect connector for engine speed sender -G28
=>Fitting locations overview, Page 26 .

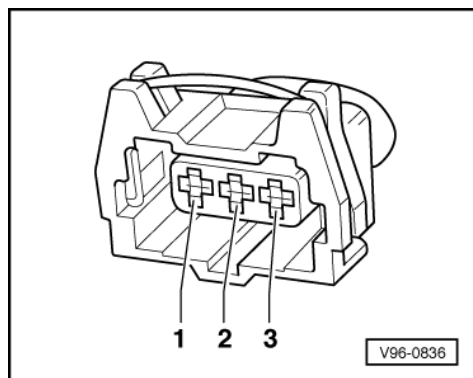
Testing internal resistance

- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to contacts 1 and 2 on the sender using test leads from V.A.G 1594 A.
 - Specification: approx. 1 kw
- If the specification is not obtained, renew engine speed sender -G28.



Testing wiring

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .

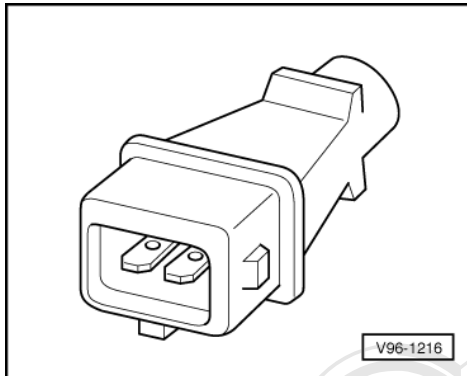


- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -G28 Contact No.	Test box V.A.G 1598 A Socket No.
1	13
2	47
3	18

- Test all wires for short circuit to each other.
- Rectify any open/short circuit as necessary.

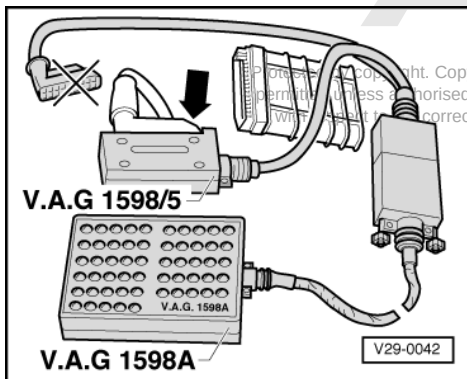
5.4 - Testing needle lift sender -G80



- Switch off ignition.
- Disconnect connector for needle lift sender -G80
=>Fitting locations overview, Page 23-4, Item 8.

Testing internal resistance

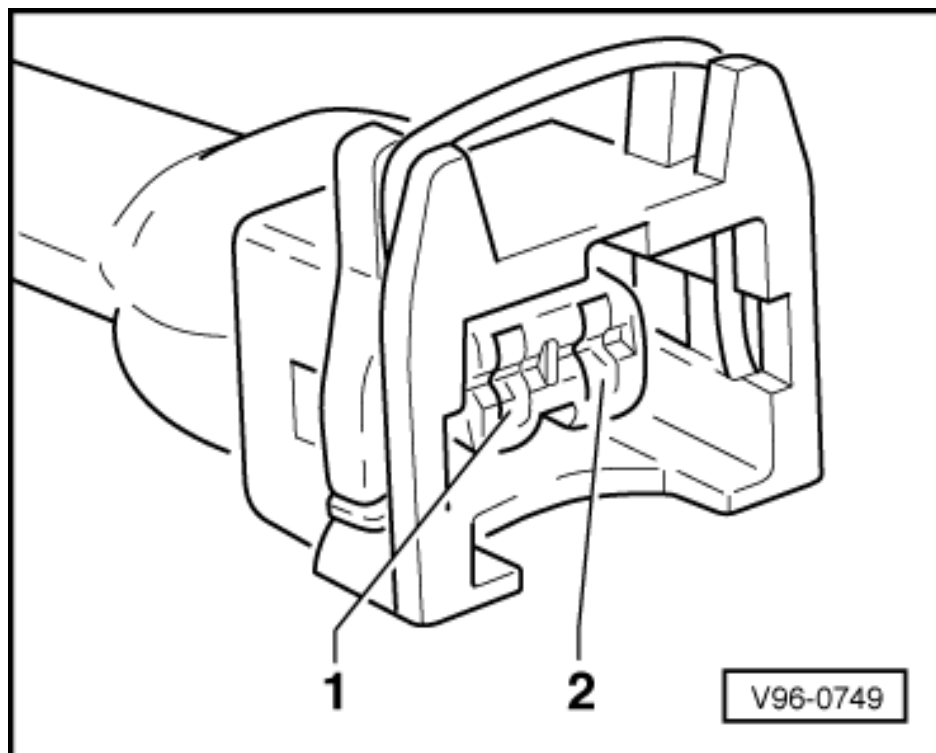
- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to sender contacts using test leads from V.A.G 1594 A.
- Specification: 90 ... 120Ω
(If the engine is warm, the resistance may be up to 20Ω higher.)



- If the specification is not obtained, renew injector for cylinder 3 together with needle lift sender -G80.

Testing wiring

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- ➔ Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -G80 Contact No.	Test box V.A.G 1598 A Socket No.
1	5
2	12

- Test both wires for short circuit to each other.
- Rectify any open/short circuit as necessary.

5.5 - Testing coolant temperature sender -G62

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- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2.
- Select the function "Read measured value block" and Display Group 00=>Page 16.

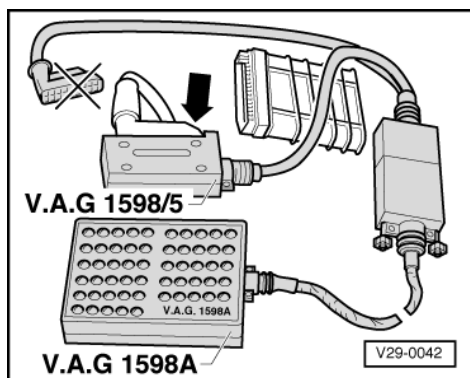
-> Indicated on display:

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

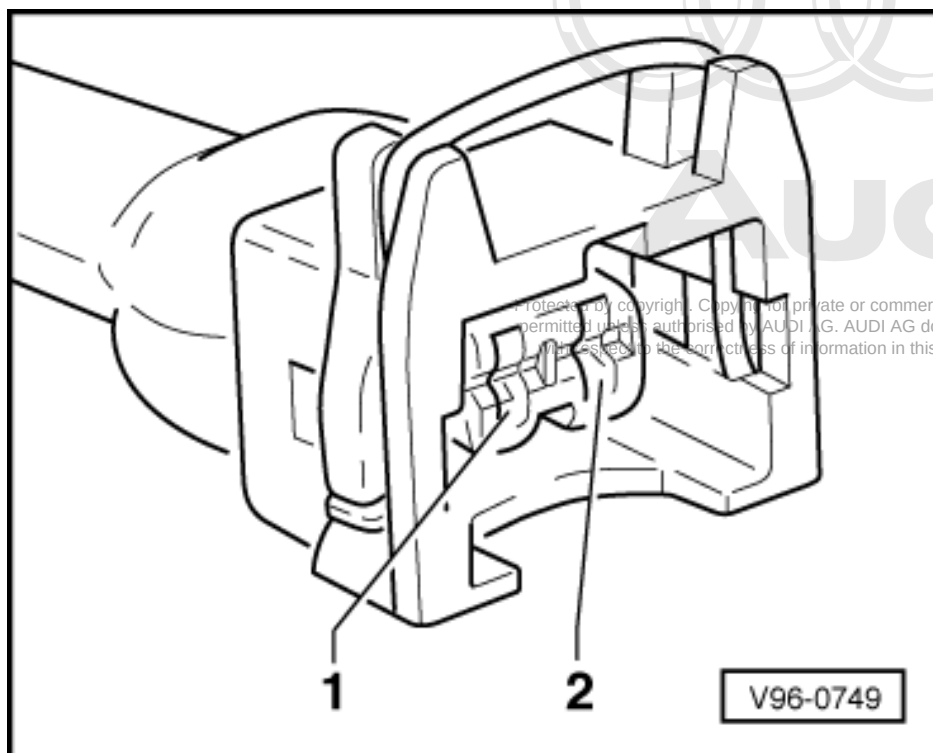
- Observe readout in display zone 7.

Specifications	at approx.
243	- 20 °C
226	0 °C
196	20 °C
134	50 °C
94	70 °C
62	90 °C

- If the specifications are not obtained, switch off the ignition.



- Unplug connector for coolant temperature sender -G62
=>Fitting locations overview, Page 26 , Item 9 .
- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -G62 Contact No.	Test box V.A.G 1598 A Socket No.
1	53
2	13

- Test both wires for short circuit to each other.
- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew coolant temperature sender -G62.



5.6 - Testing intake air temperature sender -G42

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 .
- Select the function "Read measured value block" and Display Group 00=>Page 16 .

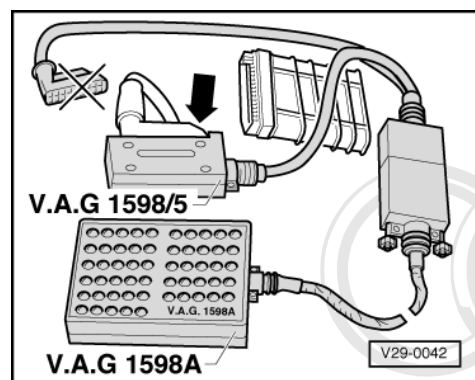
-> Indicated on display:

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

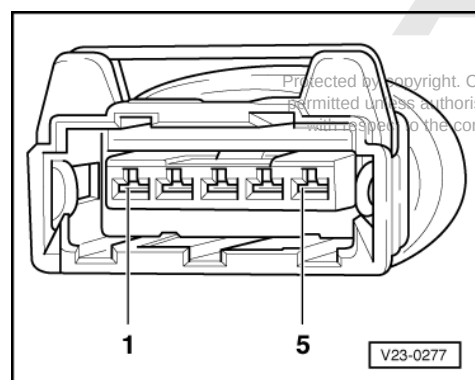
- Observe readout in display zone 8.

Specifications	at approx.
23	- 20 °C
53	0 °C
82	20 °C
112	40 °C

- If the specifications are not obtained, switch off the ignition.
- Unplug connector for air flow meter -G19
=>Fitting locations overview, Page 27 , Item 18 .



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for air flow meter -G19 Contact No.	Test box V.A.G 1598 A Socket No.
1	52

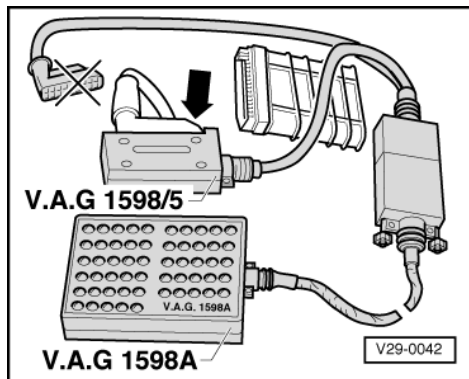
Connector for air flow meter -G19 Contact No.	Test box V.A.G 1598 A Socket No.
4	13

- Rectify any open/short circuit as necessary.
- If the wiring is OK, renew intake air temperature sender -G42.

5.7 - Testing brake light switch -F and brake pedal switch -F47

Because the injection system operates with an accelerator position sender (potentiometer) which may be defective, the engine is regulated for safety reasons when the brakes are operated. To do this the control unit requires signals from the brake light switch and brake pedal switch. If the brakes are applied while the accelerator is being held in a constant position the engine is immediately regulated down to idling speed. Incorrectly adjusted switches may lead to unrequired regulating action.

Brake light switch -F

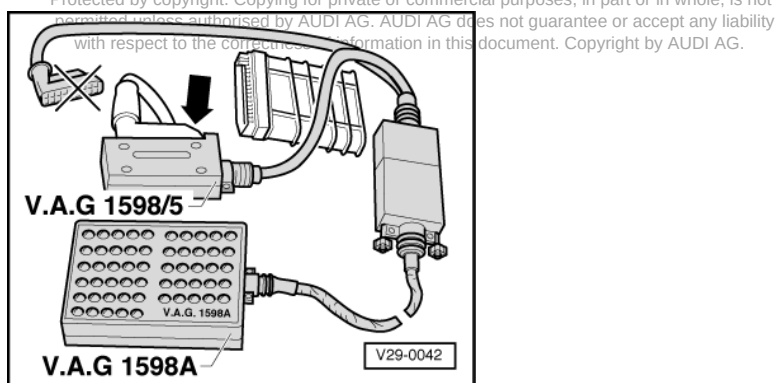


- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to sockets 31 and 18 of test box V.A.G 1598 A.
- Switch on ignition.
- Do not depress brake pedal.
 - Specification: 0 V
- Depress brake pedal.
 - Specification: approx. battery voltage

If the specification is not attained:

- Renew brake light switch -F (=>Fitting locations overview, from Page 26) and rectify any open circuits or short circuits in the wiring.

Testing brake pedal switch -F47





- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .
- Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to sockets 16 and 26 of test box V.A.G 1598 A.
- Do not depress brake pedal.
 - Specification: less than 10Ω
- Depress brake pedal.
 - Specification: ∞Ω(infinity)

If the specification is not attained:

- Renew brake pedal switch -F47 (=>Fitting locations overview, from Page 26) and rectify any open circuits or short circuits in the wiring.

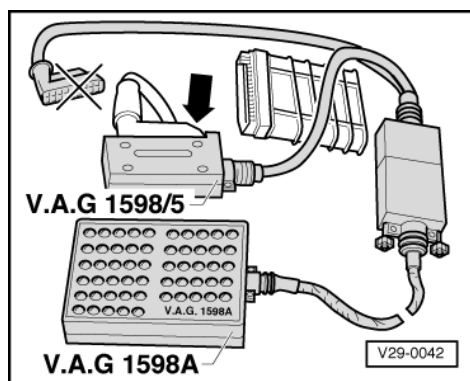
Adjusting brake light switch -F and brake pedal switch -F47

Requirement for test:

- Brake light switch -F and brake pedal switch -F47 must be okay

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Note:



If the switches are incorrectly adjusted, the following faults may occur:

- ♦ Fault code 00526 stored in fault memory
- ♦ Warning lamp in dash panel insert lights up
- ♦ Engine speed regulation occurs while driving
- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .
- Connect voltage tester V.A.G 1527 B to sockets 31 and 18 on test box V.A.G 1598 A using test leads from V.A.G 1594 A.
- Then set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to sockets 15 and 26 on test box V.A.G 1598 A.
- Slowly depress brake pedal.
 - The LED lamp on the voltage tester should light up and hand-held multimeter V.A.G 1526 should indicate infinityΩ.
- Bring switching points into alignment by turning. If necessary, hold retainer clip in place with long-nosed pliers.
- If the engine is misfiring at irregular intervals, this means that brake pedal switch -F47 is opening of its own accord while driving. If this happens, screw both switches further into the pedal bracket and repeat the adjustment procedure.

Note:

Because the brakes are servo-assisted, the return force of the brake pedal is much weaker when the engine is running than when the engine is switched off. Brake pedal switch -F47 must be properly closed when the engine is running and the brake is not depressed.

5.8 - Testing slide travel potentiometer -G99 and quantity adjuster -N146

Testing operation

Notes:

- ◆ A second mechanic is required to note the readings on the tester when the vehicle is moving.
- ◆ Observe safety notes => Page 53 .
- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 .
- Select the function "Read individual measured value" and enter Channel No. 06=>Page 19 .

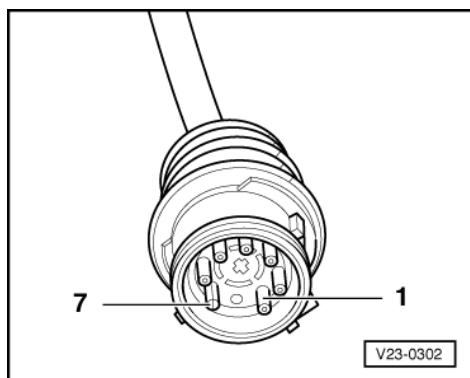
-> Indicated on display:

Read individual measured value			
Channel	06	Measured value	XXX

- Switch on ignition.
 - Specification: 39 ... 441)
- 1) When the ignition is switched on the display will show a value of more than 100 for a period of 30 seconds.
 - Start the engine.
 - Specification: more than 1002)
 - 2) If the engine does not start, the injection quantity will be increased in stages.
 - Allow engine to run at idling speed.
 - Specification: 68 ... 803)
 - 3) The displayed value will be higher when the engine is cold than when the engine is warm.
 - Take the vehicle for a test drive and accelerate at full throttle in 3rd gear from a speed of about 40 km/h.
 - Specification: The readout should increase steadily to between 170 and 190 at a speed of 100 km/h (3600 rpm).
 - Allow the vehicle to run on overrun.
 - Specification: 39 ... 44

Testing internal resistance

- Switch off ignition.
- Disconnect connector on injection pump
=>Fitting locations overview, Page 26 .





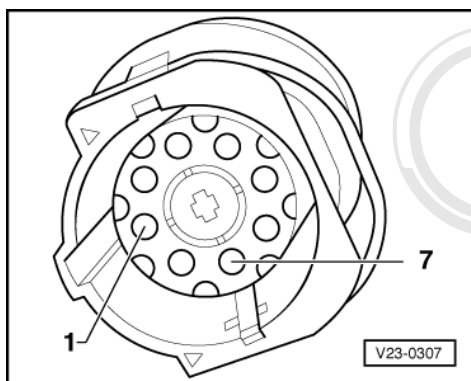
- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to the following contacts on the injection pump connector using test leads from V.A.G 1594 A:

Contact	To be tested	Specification
1 + 3	-G99	0.5 ... 2.0 kΩ
2 + 3	-G99	1.0 ... 3.0 kΩ
4 + 7	-N146	0.4 ... 1.1 Ω

- If the specifications are not obtained, renew the injection pump.

Testing voltage supply

- Switch off ignition.
- Disconnect connector on injection pump
=>Fitting locations overview, Page 26 .
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current).
- Switch on ignition.



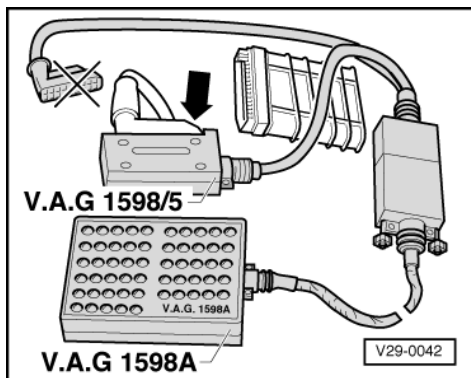
- -> Connect hand-held multimeter to the following contacts on the wiring harness connector using test leads from V.A.G 1594 A:

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Contact	To be tested	Specification
2 + earth	-G99	approx. 5 V 1)
7 + earth	-N146	approx. battery voltage 2)

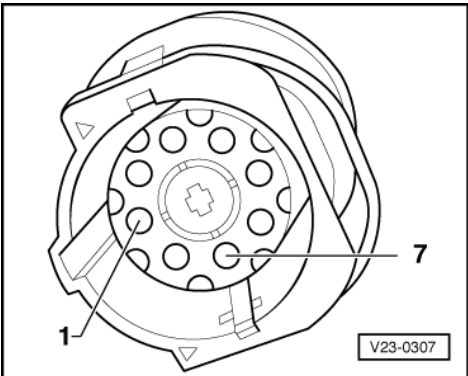
- 1) If the specification is not obtained, test wiring to Diesel direct injection system control unit -J248.
- 2) If the specification is not obtained, check wiring using current flow diagram.

Testing wiring



- Switch off ignition.
- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .

- Disconnect connector on injection pump
=>Fitting locations overview, Page 26 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

To be tested	Connector for wiring harness Contact No.	Test box V.A.G 1598 A Socket No.
-G99	1	21
	2	39
	3	14
-N146	4	2
	4	1
	7	15
	7	16
	7	17

- Test all wires for short circuit to each other.
- Rectify any open/short circuit as necessary.

5.9 - Testing accelerator position sender -G79

Accelerator position sender -G79 is located on the accelerator pedal. Its function is to tell the control unit what position the pedal is in.

- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 .
- Select the function "Read measured value block" and Display Group 00=>Page 16 .

-> Indicated on display:

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

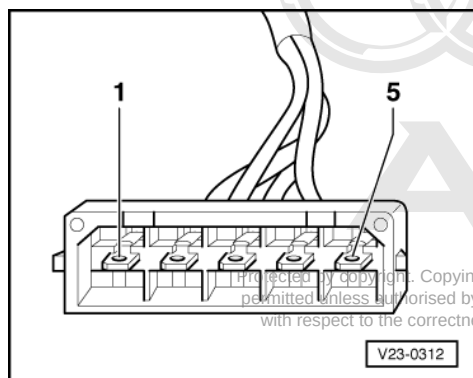
- Observe readout in display zone 3.
- Do not depress accelerator pedal.
 - Specification: 0
- Press accelerator pedal down slowly.
 - Specification: The readout should increase to 255 (accelerator fully depressed).
- If the specifications for the initial and/or final readouts are not obtained, adjust accelerator position sender -G79=>Page 37 .

If the display does not change or only changes irregularly:

- Switch off ignition.
- Disconnect connector for accelerator position sender -G79



=>Fitting locations overview, Page 27 .

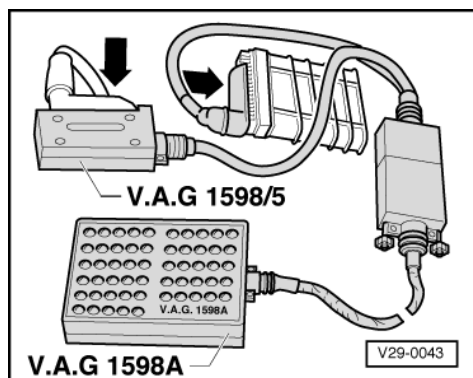


- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to the following contacts on connector for accelerator position sender -G79 using test leads from V.A.G 1594 A:

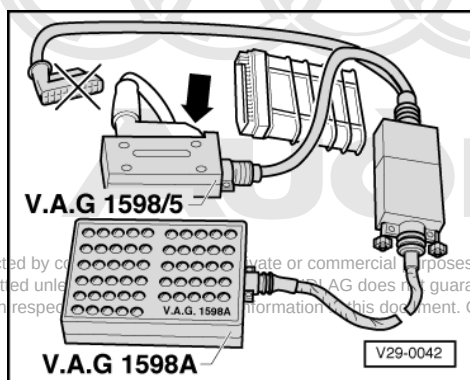
Contacts	Accelerator position	Specification
1 + 3	-	0.8 ... 1.4 kΩ
2 + 3	-	0.8 ... 1.4 kΩ
4 + 3	Accelerator not depressed	0.8 ... 1.2 kΩ
	Accelerator depressed	∞ Ω

- If the specifications are not obtained, renew accelerator position sender -G79.

Testing voltage supply

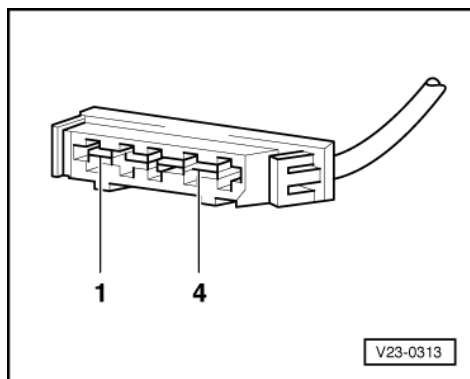


- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit and also to the control unit itself using adapter V.A.G 1598/5=>Page 51 .
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to sockets 33 and 14 of test box V.A.G 1598 A.
- Switch on ignition.
 - Specification: approx. 5 V
- If the specification is not obtained, test the wiring.



Testing wiring

- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .
- Disconnect connector for accelerator position sender -G79
=>Fitting locations overview, from Page 26 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -G79 Contact No.	Test box V.A.G 1598 A Socket No.
1	37
2	33
3	14
4	25

- Rectify any open/short circuit as necessary.

6 - Testing auxiliary signals

6.1 - Testing auxiliary signals

6.2 - Testing air conditioner compressor shut-off

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

- ♦ Heavy acceleration from low speeds (control unit detects angle change at accelerator position sender -G79 and receives road speed signal)
- ♦ In the emergency programme (emergency running mode)
- ♦ If the coolant temperature rises above 120 °C
- ♦ For about 6 seconds after every engine start

Requirements for test:

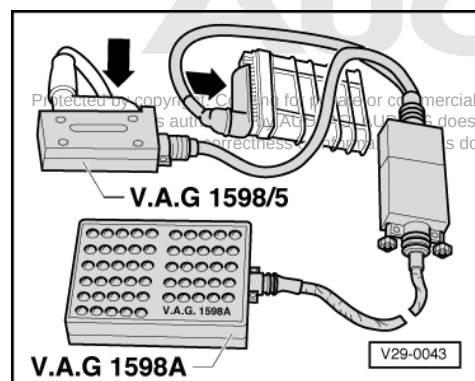
- Air conditioner okay
- Air conditioner switched on
- No faults stored in fault memory
- Connect fault reader V.A.G 1551 and select engine electronics control unit=>Page 2 .
- Select the function "Final control diagnosis" and activate air conditioner compressor cut-in (shut-off)=>Page 11 .

-> Indicated on display:

Final control diagnosis
Air conditioner compressor cut-in

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:



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit and also to the control unit itself using adapter V.A.G 1598/5=>Page 51 .
- Connect voltage tester V.A.G 1527 B to sockets 23 and 18 on test box V.A.G 1598 A using test leads from V.A.G 1594 A.
- Allow engine to run at idling speed.
 - The LED lamp on the voltage tester should light up about 6 seconds after the engine is started.
- From idling position, floor the accelerator sharply.
 - The LED lamp on the voltage tester should go out for up to 10 seconds.

If the LED lamp does not light up 10 seconds after the engine is started:

- Test for open circuit and short to earth in wiring between socket 23 of test box V.A.G 1598 A and contact 13 on connector (HLS - input for overheating warning lamp signal) using the current flow diagram.

If the LED lamp lights up as soon as the ignition is switched on, or if it does not go out when the accelerator is pressed down sharply from idling position:

- Test for short to positive in wiring between socket 23 of test box V.A.G 1598 A and contact 13 on connector (HLS - input for overheating warning lamp signal) using the current flow diagram.

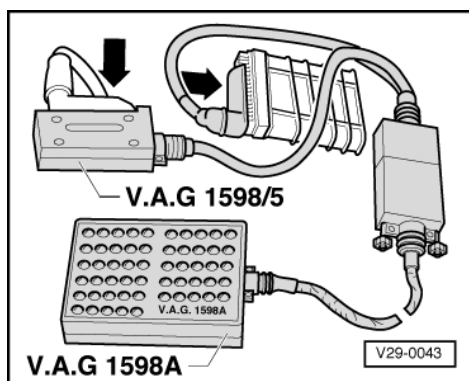
6.3 - Testing speed signal

The speed signal is required to ensure that the air conditioner compressor is switched off when accelerating. It is also required to help ensure smoother running (jolt damping).

Test requirement:

- Speedometer OK. Testing:

=> Electrical system; Repair group 90; Testing dash panel insert components; Testing speedometer sender signal at dash panel wiring harness Testing dash panel insert components Testing speedometer sender signal at dash panel wiring harness



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit and also to the control unit itself using adapter V.A.G 1598/5=>Page 51 .
- Connect voltage tester V.A.G 1527 B to sockets 29 and 18 on test box V.A.G 1598 A using test leads from V.A.G 1594 A.
- Turn the front left wheel or drive the vehicle a short distance.
 - The LED lamp on the voltage tester should flash.
- If the LED lamp does not flash, test wiring between dash panel insert and socket 29 on test box V.A.G 1598 A using the current flow diagram.

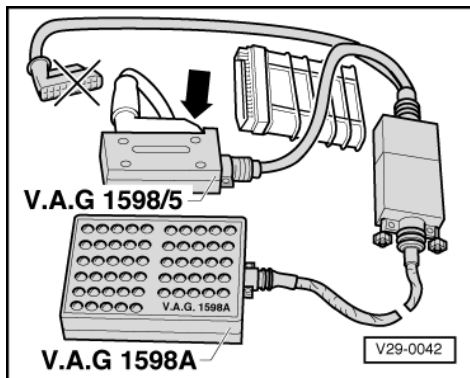
If no fault in wire is detected:

- Establish which systems (e.g. radio, automatic gearbox, air conditioner etc.) are using the speed signal, disconnect them one by one from the dash panel insert, then keep repeating the test until the cause of the problem has been identified.

6.4 - Testing clutch pedal switch -F36

This signal prevents engine speed fluctuations and load change jolts when the clutch is disengaged.

- Switch off ignition.



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .
- Connect voltage tester V.A.G 1527 B to sockets 28 and 18 on test box V.A.G 1598 A using test leads from V.A.G 1594 A.
- Switch on ignition.
- Do not depress clutch pedal.
- The LED lamp on the voltage tester should light up.
- Depress clutch pedal.
- The LED lamp on the voltage tester should go out.
- If the specification is not obtained, renew clutch pedal switch -F36=>Fitting locations overview, from Page 26 .
- Rectify any open/short circuit as necessary.

6.5 - Testing engine speed signal

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

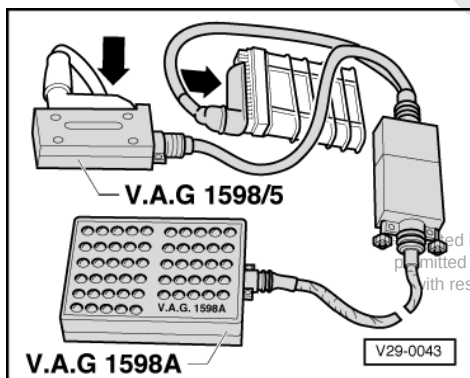
However, since the signal cannot be read in the form in which it is generated by engine speed sender -G28, it has to be processed by the engine control unit first.

Identify the engine speed signal as follows:

Dash panel insert

- Check reading on rev counter.
- The rev counter should show the current engine speed.

If no engine speed is shown:



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit and also to the control unit itself using adapter V.A.G 1598/5=>Page 51 .

- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to sockets 50 and 18 of test box V.A.G 1598 A.
- Remove dash panel insert.

=> Electrical system; Repair group 90; Dash panel insert; Removing and installing dash panel insert Dash panel insert Removing and installing dash panel insert

- Unplug the green 26-pin connector.
- Allow engine to run at idling speed.
 - Specification: approx. 4.5 ... 6 V

If the specification is attained:

- Rectify fault in dash panel insert.

=> Electrical system; Repair group 90; Testing dash panel insert components; Testing engine speed signal Testing dash panel insert components Testing engine speed signal

If the specification is not attained:

- Test for open circuit and short to earth in wiring between dash panel insert and socket 50 of test box V.A.G 1598 A using the current flow diagram.

If the specification is exceeded:

- Test for short to positive in wiring between dash panel insert and socket 50 of test box V.A.G 1598 A using the current flow diagram.

Air conditioner

The signal is monitored by the self-diagnosis function (fault memory, read measured value block) of the air conditioner.

Testing signal

- The current engine speed should be displayed in the measured value block.

6.6 - Testing water level sender -G120

Water level sender -G120 is located in the fuel filter.

On vehicles with control unit software versions from D06 onwards a warning is signalled via glow period warning lamp -K29.

Testing operation

- Drain the fuel filter and collect the fuel in a suitable container.
- Remove water level sender -G120.
- Place contact pins of sender in a container of water.

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Vehicles with software versions up to D051):

- 1) Interrogating control unit version=>Page **2**.
- Interrogate fault memory=>Page **3**.
 - Fault code 00627 should be stored in the fault memory.
 - If no faults are stored in the fault memory, test voltage supply to water level sender -G120.

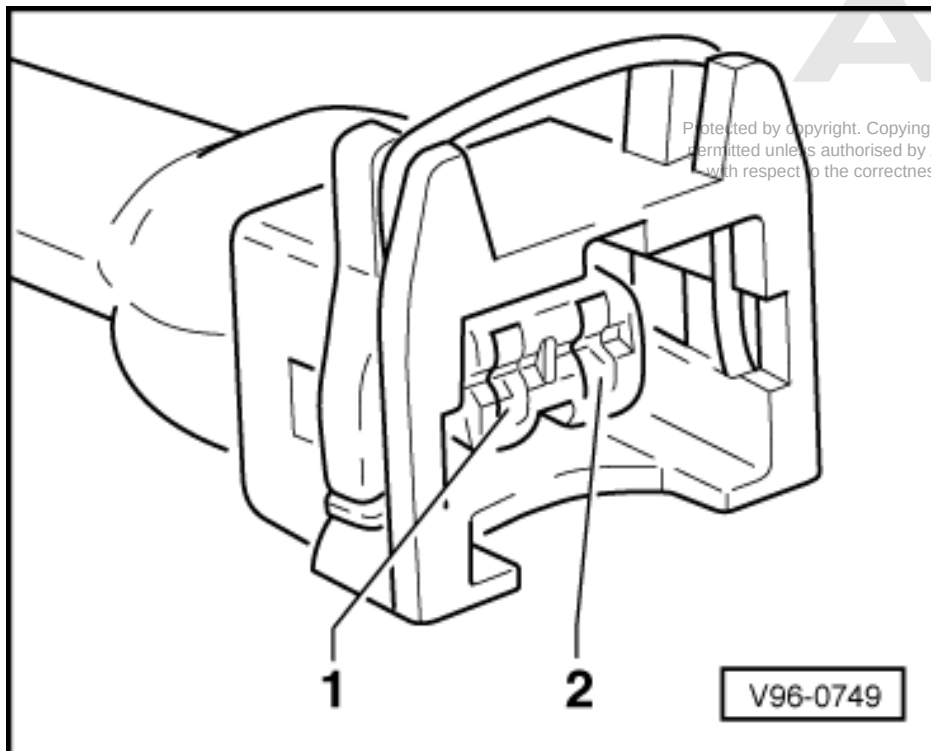


Vehicles with software versions from D06 onwards1):

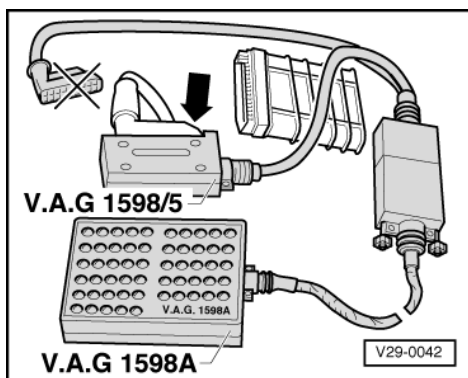
- 1) Interrogating control unit version=>Page **2**.
- Switch on ignition.
 - After about 15 seconds, glow period warning lamp -K29 should flash.
 - If glow period warning lamp -K29 does not flash, test warning lamp=>Page **98**.
 - If glow period warning lamp -K29 is okay, test voltage supply to water level sender -G120.

Testing voltage supply

- Switch off ignition.



- Disconnect connector for water level sender -G120
=>Fitting locations overview, Page **26**, Item **4**.
- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to engine earth and contact 1 of the connector.
- Switch on ignition.

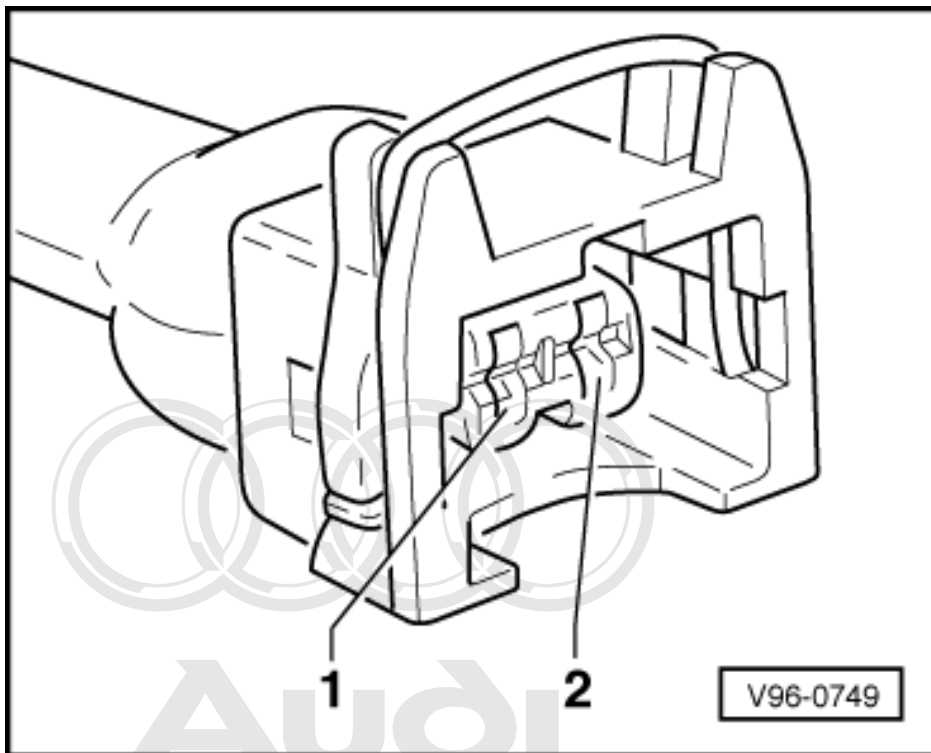


- Specification: ca. 5 V

If the specification is not attained, test wiring.

Testing wiring

- Disconnect connector for water level sender -G120
=>Fitting locations overview, Page 26 .
- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page 51 .



- -> Test for open circuit and short to positive or earth in the following wiring connections:

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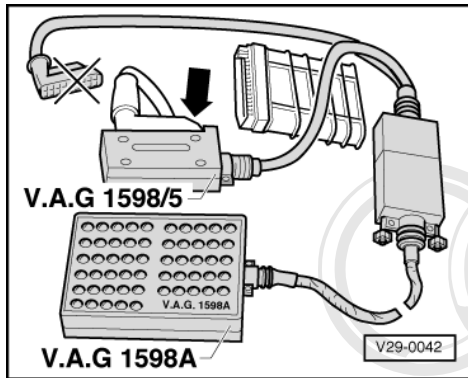
Connector for -G120 Contact No.	Test box V.A.G 1598 A Socket No.
1	36
4	13

- Rectify any open/short circuit as necessary.

6.7 - Testing self-diagnosis fault warning lamp -K83

The fault warning lamp indicates system faults in the following components:

- ◆ Brake pedal monitor
- ◆ Engine speed sender -G28
- ◆ Needle lift sender -G80
- ◆ Accelerator position sender -G79
- ◆ Slide travel potentiometer -G99
- ◆ Quantity adjuster -N146 (regulating fault)
- ◆ Control unit defective



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page **51** .
- Connect sockets 4 and 18 on test box V.A.G 1598 A using test leads from V.A.G 1594 A.
- Switch on ignition.
 - The fault warning lamp should light up.
- Rectify any open/short circuit as necessary.

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28 - Glow plug system

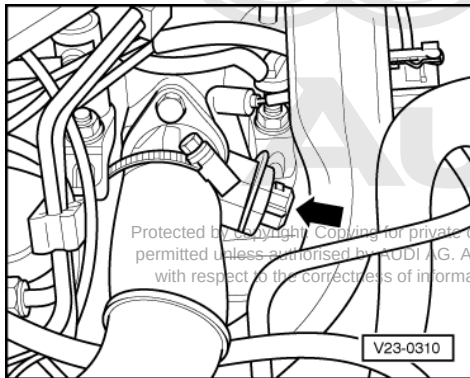
1 - Testing glow plug system

1.1 - Testing glow plug system

1.2 - Testing operation

Requirements for test:

- Battery voltage at least 11.5 V
- Diesel direct injection system control unit -J248 okay
- Switch off ignition.



- -> Unplug connector for coolant temperature sender -G62 -arrow-.

Note:

Unplugging the connector for coolant temperature sender -G62 simulates the condition of the engine when cold. Therefore when the ignition is switched on, the glow plug system is activated.

- Unplug glow plug connectors from glow plugs.
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect between engine earth and one of the glow plugs.
- Switch on ignition.
 - Specification: approx. battery voltage for about 20 seconds
- If the specification is not attained, check glow plug strip fuse -S22.
- If glow plug strip fuse -S22 is okay, test for open circuits and short circuits in the wiring and rectify as necessary.

=> Current flow diagrams, Electrical fault-finding and Fitting locations

Notes:

- ♦ Glow period warning lamp -K29 should light up during the simulated glow period.
- ♦ If the warning lamp does not light up, test glow period warning lamp -K29=>Page 98 .

1.3 - Checking glow plugs

- Switch off ignition.



- Remove glow plugs with jointed spanner 3220.
- Place the glow plug which is to be tested on a fireproof surface.
- Connect the connecting pin of the glow plug to the positive terminal of a fully charged 12 V battery.
- Connect the threaded section of the glow plug to the negative terminal of the battery.

Notes:

- ♦ Connect the glow plug using test leads which have a diameter of at least 2.5 mm².
- ♦ The connector clamps on the test leads must be robust and securely fitted.
- Check the glow plug as it is being activated.
- If the glow plug does not glow or if only part of the pin glows, renew the glow plug.

Tightening torque

Component	Nm
Glow plugs	15

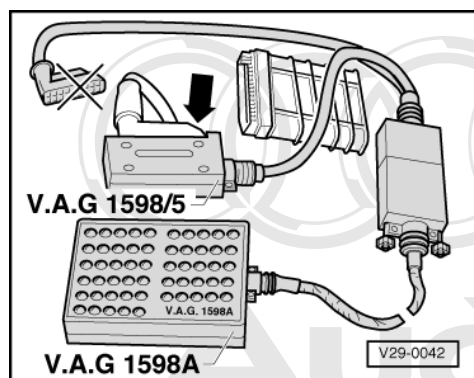
1.4 - Testing glow period warning lamp -K29

- Perform final control diagnosis=>Page **11** .

If the warning lamp does not light up during the final control diagnosis:

- Test bulb for glow period warning lamp -K29 in dash panel insert.

If bulb in dash panel insert is okay, test the wiring:



- -> With the ignition switched off, connect test box V.A.G 1598 A to connector for engine control unit but not to the control unit itself (control unit remains disconnected) using adapter V.A.G 1598/5=>Page **51** .
- Connect sockets 11 and 18 on test box V.A.G 1598 A using test leads from V.A.G 1594 A.
- Switch on ignition.
 - Glow period warning lamp -K29 should light up.

If the warning lamp does not light up:

- Test for open circuit and short to positive in wiring between socket 11 on test box V.A.G 1598 A and glow period warning lamp -K29 in dash panel insert using the current flow diagram.
- Rectify any open/short circuit as necessary.
- If the wiring is okay, the fault must be in the dash panel insert.

=> Electrical system; Repair group 90; Dash panel insert Dash panel insert