

Audi 80 1992 ➤

Diesel Direct Injection and Glow Plug System 03.94 ➤

Engine ID	1Z								
-----------	----	--	--	--	--	--	--	--	--

Edition 06.1997



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

List of Workshop Manual Repair GroupsList of Workshop Manual
Repair GroupsList of Workshop Manual Repair Groups

Audi 80 1992 ➤

Diesel Direct Injection and Glow Plug System 03.94 ➤

Repair Group

01 - Self diagnosis

23 - Mixture preparation, Injection

28 - Glow plug system

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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.

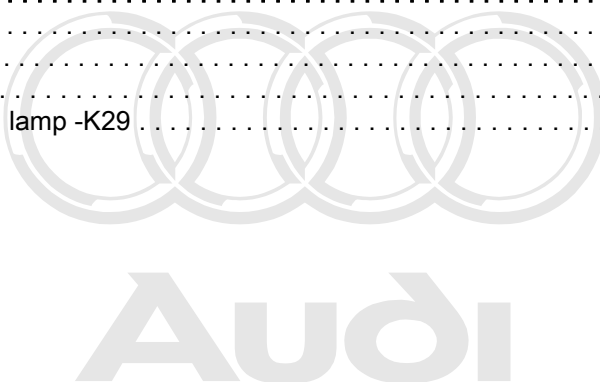
All rights reserved.
No reproduction without prior agreement from publisher.

Contents

01 - Self diagnosis	1
1 Self diagnosis	1
1.1 Self diagnosis	1
1.2 Differences between injection systems	1
1.3 Technical data of self diagnosis	1
1.4 Safety notes	1
1.5 Connecting fault reader V.A.G 1551 and selecting engine electronics control unit	2
2 Interrogating and erasing fault memory	4
2.1 Interrogating and erasing fault memory	4
2.2 Fault table	5
3 Final control diagnosis	16
3.1 Final control diagnosis	16
4 Basic setting	19
4.1 Basic setting	19
5 Coding control unit	21
5.1 Coding control unit	21
6 Reading measured value block	23
6.1 Reading measured value block	23
6.2 Readout specifications for general vehicle inspection	27
6.3 Readout specifications for injection pump	28
6.4 Readout specifications for engine idling speed	30
6.5 Readout specifications for exhaust gas recirculation	31
6.6 Readout specifications for temperature senders	32
6.7 Readout specifications for engine power output	32
6.8 Readout specifications for charge pressure control	33
23 - Mixture preparation, Injection	34
1 Servicing Diesel direct injection system	34
1.1 Servicing Diesel direct injection system	34
1.2 Safety precautions	34
1.3 Rules for cleanliness	34
1.4 Fitting locations overview	35
1.5 Servicing fuel injection system	37
1.6 Servicing fuel filter	42
1.7 Servicing accelerator linkage	44
1.8 Installing and adjusting accelerator position sender -G79	45
1.9 Removing, installing and adjusting injection pump	47
1.10 Bleeding fuel system	52
1.11 Dynamically checking and adjusting commencement of injection	52
1.12 Checking fuel system for leaks	54
1.13 Removing, installing and testing injectors and constant pressure valves	55
1.14 Renewing injection timing device cover O-ring	57
1.15 Renewing engine electronics control unit	58
1.16 Wiring and component check with test box V.A.G 1598/18	60
2 Testing charge pressure system	61
2.1 Testing charge pressure system	61
2.2 Checking charge pressure	61
2.3 Testing charge pressure control solenoid valve -N75	64
2.4 Testing intake manifold temperature sender -G72	66
2.5 Testing intake manifold pressure sender -G71 and altitude sender -F96	67
2.6 Hose routing diagram for charge pressure control system	70
3 Testing injection control	71
3.1 Testing injection control	71



3.2	Checking injection timing control range	71
3.3	Testing commencement of injection valve -N108	72
3.4	Testing fuel temperature sender -G81	73
4	Testing exhaust gas recirculation (EGR)	74
4.1	Testing exhaust gas recirculation (EGR)	74
4.2	Testing operation	74
4.3	Testing exhaust gas recirculation valve -N18	76
4.4	Testing air mass meter -G70	78
4.5	Hose routing diagram for exhaust gas recirculation	81
5	Checking control unit input values	82
5.1	Checking control unit input values	82
5.2	Checking Diesel direct injection system voltage supply	82
5.3	Testing engine speed sender -G28	86
5.4	Testing needle lift sender -G80	87
5.5	Testing coolant temperature sender -G62	88
5.6	Testing brake light switch -F and brake pedal switch -F47	89
5.7	Testing modulating piston movement sender -G149 and quantity adjuster -N146	91
5.8	Testing accelerator position sender -G79	93
6	Testing auxiliary signals	95
6.1	Testing auxiliary signals	95
6.2	Testing signals from and to automatic gearbox	95
6.3	Testing air conditioner compressor shut-off	97
6.4	Testing speed signal	98
6.5	Testing clutch pedal switch -F36	99
6.6	Testing cruise control system (CCS)	100
6.7	Testing engine speed signal	102
6.8	Testing fuel consumption signal	103
6.9	Testing self-diagnosis fault warning lamp -K83	104
28	Glow plug system	105
1	Testing glow plug system	105
1.1	Testing glow plug system	105
1.2	Testing operation	105
1.3	Checking glow plugs	106
1.4	Testing glow period warning lamp -K29	106



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

01 - Self diagnosis

1 - Self diagnosis

1.1 - Self diagnosis

1.2 - Differences between injection systems

Version 1:

- ◆ Vehicle Identification Nos. up to 8C RA 300 000
- ◆ No immobilizer
- ◆ With separate altitude sender -F96.
Intake manifold pressure sender -G71 is integrated in control unit.

Version 2:

- ◆ Vehicle Identification Nos. from 8C SA 000 001 onwards
- ◆ Control unit with immobilizer
- ◆ Altitude sender -F96 and intake manifold pressure sender -G71 integrated in control unit

1.3 - Technical data of self diagnosis

Equipped with

- ◆ Fault memory: Non-volatile memory
(maximum of 5 different faults)¹⁾
1) Will be cancelled after 50th engine start if fault has not occurred again.
- ◆ Rapid data transfer

1.4 - Safety notes

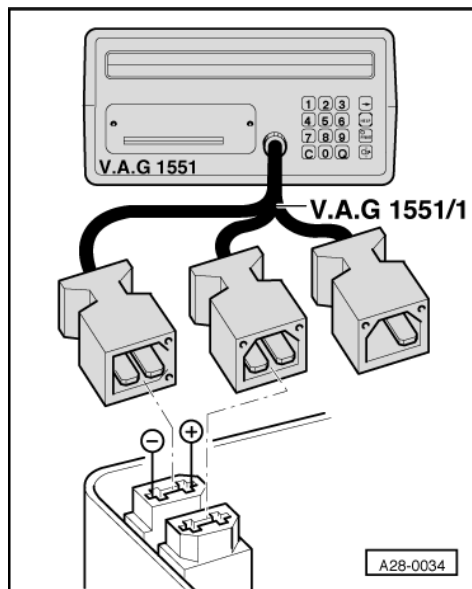
Note the following points if test equipment has to be used during a road test:

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.



1.5 - 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)

1) appears alternately

Note:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions. Copyright by AUDI AG.

If the display remains blank, test the voltage supply and wiring using the current flow diagram.

- 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 4 .

- 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 by pressing the Q key.

-> The display on fault reader V.A.G 1551 will show the control unit identification. For example:

028906021A	1.9l	R4	EDC
SG	D ..		
Coding 00000	WSC 00000		

Note:

The control unit identification can be printed out by pressing the PRINT key on fault reader V.A.G 1551.

Control unit identification (example)

- 028 906 021 A	Part No. (see also Parts List)
- 1.9 ltr.	Engine capacity
- R4	In-line engine, 4 cylinders
- EDC	Electronic Diesel Control
- AG	Automatic gearbox
- SG	Manual gearbox
- D ..	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

- Press ➡key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

Notes:

-> If the following message appears on the display:

Rapid data transfer	HELP
Control unit does not answer!	

- ◆ K-wire disconnected by immobilizer control unit (only on injection system version 2=>Differences between injection systems, Page 1).
- ◆ Open circuit in diagnostic wiring
- ◆ Fault in voltage supply to control unit
- ◆ Diesel direct injection system control unit defective

-> If the following message appears on the 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	

- ◆ Fault in diagnostic wiring (including wiring to other control units)
- ◆ Fault in voltage supply to control unit

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- ♦ Diesel direct injection system control unit or other control unit defective

Selectable functions

Function	Ignition on	Engine idling	Page
01 Interrogate control unit version	x	x	2
02 Interrogate fault memory	-	x	4
03 Final control diagnosis	-	x	16
04 Basic setting	-	x	19
05 Erase fault memory	-	x	4
06 End output	x	x	4
07 Code control unit	x	-	21
08 Read measured value block	x	x	23

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 Select function XX	HELP
---	------

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.)

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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 Select function XX	HELP
---	------

- 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 52

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.

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
00513 Engine speed sender -G28 Implausible signal 1)	- Sender disc bent or loose	- Poor starting - Engine runs rough, - misfiring	- Remove sump and check sender disc
	- -G28 defective	- Poor starting - Increased idling speed	- Test engine speed sender -G28 => Page 86
	- Open circuit in screening	- Reduced power - No display on rev counter	- Test wiring to engine speed sender =>Page 86
No signal 1)	- Open circuit or short circuit		
	- -G28 defective		- Test engine speed sender =>Page 86

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 Short circuit to positive 1)	- Charge pressure (boost pressure) too high	- Sudden loss of power - during acceleration and - reduced power	- Test charge pressure system =>Page 61
	- -G71 defective	- Loss of power	- Test intake manifold pressure sender -G71 =>Page 67
Open/short circuit to earth 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
00522 Coolant temperature sender -G62 Short circuit to earth 1)	- Short to earth in wiring - -G62 defective	- Poor starting below -20 °C - Black exhaust smoke when starting above +10 °C	- Test coolant temperature sender -G62 =>Page 88

Open/short circuit to positive 1)	- Open circuit or short to positive in wiring - G62 defective	- Additional heater not working	
-----------------------------------	--	---------------------------------	--

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
00527 Intake manifold temperature sender -G72 Short circuit to earth 1)	- Short to earth in wiring - G72 defective	- Additional heater not working	- Test intake manifold temperature sender -G72 =>Page 66
Open/short circuit to positive 1)	- Open circuit or short to positive - G72 defective		
00528 Altitude sender -F96 Open/short circuit to earth	- Open circuit or short to earth - F96 defective	- Black exhaust smoke when engine is subject to load at low air pressure	- Test altitude sender -F96 =>Page 67

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
00532 Supply voltage Signal too small	- Control unit was connected while ignition was on - Open circuit or short circuit - Excess voltage protection relay -J249 defective (sticking) - Diesel direct injection system control unit -J248 defective	- Engine cuts out (safety cut-out)	- Erase fault memory and continue to monitor vehicle - Test wiring and relay => Current flow diagrams, Electrical fault-finding and Fitting locations binder - Fit a new control unit => Page 58

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00539 Fuel temperature sender -G81 Short circuit to earth 1)	- Fuel overheating - G81 defective - Short circuit to earth in wiring - Fuel pre-heating not working, or non-return valve in return hose - between filter and fuel tank is installed the wrong way round	- Reduced power - Uneven idling	- Test fuel temperature sender -G81 => Page 73
Open/short circuit to positive 1)	- Open circuit or short to positive in wiring - G81 defective		



	- 8-pin connector for - injection pump detached	- Several faults stored - Engine cuts out	- Check connector for injection pump
--	--	--	---

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)	- Open circuit or short circuit in wiring - -G80 defective	- Reduced power - Engine running rough - Warning lamp lights up	- Test needle lift sender -G80 => Page 87
Implausible signal 1)	- Fuel feed was interrupted; tank run dry, supply hose or filter blocked, air entering fuel system	- Misfiring, jolting - Fault 00550 ("Injection commencement regulation; Regulating difference") may be stored	- Check fuel system
	- (Sporadic) open circuit in wiring to fuel cut-off valve	- Engine cuts out - Misfiring	- Check wiring and 3-pin connector on injection pump
	Continued ▼		

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions in this document. Copyright by AUDI AG.

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 - Injection pump defective - Control unit defective - -G80 defective	- Misfiring at exactly 3000 rpm - Fault 01268 ("Metering control; Regulating - difference") is stored - No throttle response after overrun - Fault 00513 ("Engine speed sender -G28") - is stored - Engine running unevenly, misfiring - Misfiring, jolting	- Remove sump and check sender disc - Fit a new injection pump (=> Page 47); do not fit a new needle lift sender -G80 - Fit a new control unit => Page 58 - Fit a new needle lift send- er -G80

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
00545 Engine/gearbox electrical connection	- Open circuit or short cir- cuit	- Gearshift harsher than normal	- Check signals to and from automatic gearbox; A - gearshift signal => Page 96
00550 Injection commencement reg- ulation			

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 52
	- Control range of injection pump blocked (dirt, metal particles)	- Loss of power at high engine speeds	- Check control range of injection timing control => Page 71
	- Engine has been stalled (within the last 50 starts) Continued ▼		- Erase fault memory and continue to monitor vehicle

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00550 Injection commencement regulation Regulating difference	(Fault code 00550 continued) - Fuel feed was interrupted; tank run dry, supply hose or filter blocked, air entering fuel system - Open circuit in wiring to commencement of injection valve -N108	 - Fault 00542 ("Needle lift sender; Implausible signal") may be stored - Engine knocks when idling because commencement of injection is constantly advanced - Fault 00741 ("Brake pedal monitoring; Implausible signal") may be stored	 - Check fuel system - Test commencement of injection valve -N108 => Page 72 - Test fuse
	- Commencement of injection valve -N108 is worn	- Commencement of injection cannot be made constant during "Basic setting" (value in display zone 2 fluctuates by more than 10 units) - Engine running unevenly, loss of power	- Fit a new commencement of injection valve -N108 =>Page 72

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00553 Air mass meter -G70 Implausible signal 1)	- Engine has been stalled (within the last 50 starts) - Battery low - Sporadic open circuit in wiring to needle lift sender -G80 (break in wiring) Continued ▼	 - Loss of power - Constant air mass readout in measured value block - Misfiring, jolting - Fault 00542 ("Needle lift sender; Input open" or "Implausible signal") may be stored	 - Erase fault memory and continue to monitor vehicle - Test battery - Test needle lift sender => Page 87

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
00553 Air mass meter -G70	(Fault code 00553 continued)		



Implausible signal 1)	- Air cleaner blocked - Vacuum hose system for exhaust gas recirculation wrongly connected, or mechanical exhaust gas recirculation valve constantly open	- Uneven idling, loss of power	- Check intake system Check vacuum hoses => Page 81
	- Implausible signal from brake pedal monitoring	- Fault 00741 ("Brake pedal monitoring; Implausible signal") is also stored - No throttle response at times, complete loss of power - Warning lamp lights up	- Do not fit a new air mass meter -G70 Test and adjust brake light switch -F and brake pedal switch -F47 => Page 89
	- -G70 defective Continued ▼	- Loss of power, jolting	- Test air mass meter -G70 => Page 78

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
00553 Air mass meter -G70 Open/short circuit to earth 1)	(Fault code 00553 continued) - -G70 defective - Open circuit or short to earth in wiring	- Reduced power - Black exhaust smoke - possible when accelerating from low engine speeds	- Test air mass meter -G70 =>Page 78
Short circuit to positive 1)	- Open circuit or short to positive in wiring - -G70 defective		
Power supply 1)	- Open circuit or short circuit in wiring		

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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 70
	- Pressure unit for turbocharger defective - Solenoid valve for charge pressure control -N75 defective		- Test charge pressure => Page 64

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00625 Speed signal			

Implausible signal	- Open circuit between speedometer sender -G22 and dash panel insert - -G22 defective - Speedometer -G21 defective - Open circuit between dash panel insert and engine control unit	- Cruise control not working - Air conditioner not working - Load change jolts	- Test speed signal => Page 98 - Test speedometer sender -G22 - => Electrical system; Repair group 90; Dash panel insert; Testing speedometer sender Dash panel insert; Testing speedometer sender
--------------------	--	--	--

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00626 Glow period warning lamp - K29 Open/short circuit to earth 1)	- Open circuit in wiring - Bulb defective - Short circuit to earth	- Glow period warning system not working - Glow period warning lamp permanently lit	- Test glow period warning lamp => Page 106
Short circuit to positive 1)	- Short circuit to positive	- Glow period warning system not working	
00668 Vehicle voltage terminal 30 Signal too small	- Excess voltage protection relay -J249 sticking - Open circuit in wiring	- Engine will not start (safety cut-out)	- Test voltage supply to diesel direct injection system =>Page 82

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
00671 CCS Switch -E45 Undefined switch position	- Open circuit or short circuit - Cruise control system switch -E45 defective	- Cruise control not working	- Test cruise control system =>Page 100
00741 Brake pedal monitoring Implausible signal	- Switch incorrectly set - Connectors for -F and -F47 interchanged - Open circuit - -F or -F47 defective - Fuse defective - Both brake lights defective	- No throttle response at times, complete loss of power - Warning lamp lights up or glow period warning lamp flashes - Cruise control not working	- Test and adjust -F and -F47 => Page 89 Test brake lights

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00765 Modulating piston movement sender -G149	- Open circuit or short circuit - -G149 defective	- Engine running problems - Engine cuts out	- Test modulating piston movement sender -G149 => Page 91



	- 8-pin connector for - injection pump detached	- Several faults stored - Engine cuts out	- Check connector for injection pump
Implausible signal	- Metering control - mechanism out of position	- Engine jolting on over-run	- Fit a new injection pump => Page 47
	- Needle lift sender -G80 - defective. Fault 00542 ("Needle lift sender; - Implausible signal") is usually stored as well.	- Brief misfiring while driving	- Fit a new needle lift sender -G80

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00777 Accelerator position sender - G79			
Short circuit to positive 1)	- Open circuit - -G79 defective	- Engine speed governed to approx. 1100 rpm (safety function)	- Test accelerator posi- tion sender -G79 => Page 93
Implausible signal 1)	- Open circuit or short cir- cuit - -G79 defective		
Power supply 1)	- Open circuit or short cir- cuit		

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
01044 Control unit incorrectly coded			
	- Invalid control unit coding	- Glow period warning lamp flashes	- Code control unit => Page 21
01117 Load signal for alternator terminal DF			
Implausible signal	- Open circuit or short circuit	- Additional heater not working	- Check wiring => Current flow diagrams, Electrical fault-finding and Fitting locations binder
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.			
01180 Engine / ACC electrical connec- tion			
Short circuit to positive	- Short circuit in wiring	- Slower acceleration when air conditioner is on	- Test air conditioner shut- off => Page 97

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01193 Low heating output relay			
01194 High heating output relay			

Open/short circuit to earth 1)	- Open circuit - Low heating output relay -J359, high heating output relay -J360 or coolant heater element relay -J325 defective	- Additional heater not working	- Check wiring => Current flow diagrams, Electrical fault-finding and Fitting locations binder
	- Short circuit to earth	- Additional heater remains on constantly	
Short circuit to positive 1)	- Short circuit to positive	- Additional heater not working	

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 Mechanical fault 1)	- -N109 defective, leaking or sticking	- Reduced power - Engine cuts out	- Perform final control diagnosis => Page 16
Open/short circuit to earth 1)	- Open circuit or short circuit to earth - -N109 defective	- Engine cuts out	- Check wiring => Current flow diagrams, Electrical fault-finding and Fitting locations binder

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
01242 Output stage in control unit Open/short circuit to positive	- Commencement of injection valve -N108 defective	- Fault 00550 ("Injection commencement regulation; Regulating difference") is stored	- Perform final control diagnosis => Page 16
	- Charge pressure control valve -N75 defective	- Reduced charge pressure (boost pressure)	
	- Short to positive in wiring to glow period warning lamp -K29	- Glow period warning lamp does not work	- Perform final control diagnosis => Page 106
	- Glow plug relay -J52 defective Continued ▼	- Poor cold starting at low ambient temperatures	- Perform final control diagnosis => Page 105

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01242 Output stage in control unit Open/short circuit to positive	(Fault code 01242 continued) - Exhaust gas recirculation valve -N18 defective - Coolant heater element relay -J325 or low heating output relay -J359 defective 1) 2)	- Poor cold starting at low ambient temperatures - Additional heater not working	- Perform final control diagnosis => Page 16



	- Low heating output relay - J359 or high heating - output relay - J360 - defective 1) 3)		
--	---	--	--

- 1) Only applies to vehicles with manual gearbox.
- 2) Only applies to vehicles with injection system version 1=>Differences between ignition systems, Page 1.
- 3) Only applies to vehicles with injection system version 2=>Differences between ignition systems, Page 1.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01262 Boost pressure control solenoid -N75 Open/short circuit to earth 1)	- Open circuit - Boost pressure (charge pressure) control solenoid valve -N75 defective - Short circuit to earth	- Reduced power - Boost pressure too low - Reduced power - Boost pressure too high	- Test boost pressure (charge pressure) control solenoid valve => Page 64
Short circuit to positive 1)	- Short circuit to positive	- Reduced power - Boost pressure too low	

- 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
01265 Exhaust gas recirculation valve -N18 Open/short circuit to earth 1)	- Open circuit - Exhaust gas recirculation valve -N18 defective - Short circuit to earth	- No exhaust gas recirculation - Too much exhaust gas recirculation - Reduced power, black exhaust smoke	- Test exhaust gas recirculation valve => Page 76
Short circuit to positive 1)	- Short circuit to positive	- No exhaust gas recirculation	

- 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
01266 Glow plug relay -J52 Open/short circuit to earth 1)	- Open circuit - Relay -J52 defective - Short circuit to earth	- Glow plug system not working - Glow plug system remains on constantly	- Check wiring => Current flow diagrams, Electrical fault-finding and Fitting locations binder

Short circuit to positive 1)	- Short circuit to positive	- Glow plug system not working	
------------------------------	-----------------------------	--------------------------------	--

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
01268 Metering control -N146 Regulating difference 1)	- Open circuit or short circuit	- Engine jolting, misfiring	- Test quantity adjuster - N146 (metering control) =>Page 91 - Fit a new injection pump => Page 47
	- Implausible signal from modulating piston - movement sender -G149	- No throttle response after overrun	
	- Quantity adjuster (metering control) stiff or jamming	- Engine jolting, misfiring	
Lower stop value 1)	- Quantity adjuster out of position - Open circuit	- Engine will not start - (safety cut-out)	
Upper stop value 1)	- Quantity adjuster out of position		

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
01269 Commencement of injection valve -N108 Open/short circuit to earth 1)	- Open circuit (fuse) - Commencement of injection valve -N108 - defective	- Engine knocks when idling because commencement of injection is constantly advanced - Several faults may be recorded	- Test commencement of injection valve => Page 72 - Test fuse
	- Short circuit to earth	- Loss of power because commencement of injection is constantly retarded	- Test commencement of injection valve => Page 72
Short circuit to positive 1)	- Short circuit to positive	- Engine knocks when idling because commencement of injection is constantly advanced	

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17978 Engine control unit blocked 1)	- Attempted tampering	- Engine starts but cuts out again immediately	- Adapt engine electronics control unit to immobilizer control unit => Electrical system; Repair group 01; Self-diagnosis; Adaption procedure after renewing engine control unit Self-diagnosis; Adaption procedure after renewing engine control unit



	- Short circuit in signal wire - Immobilizer control unit - defective/missing		- Check electronic immobilizer: => Repair group 96; Servicing electronic immobilizer
--	---	--	---

1) Only applies to vehicles with injection system version 2=>Differences between ignition systems, Page 1.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
65535 Control unit defective	- Internal fault in control unit - Signal communication problems between fault reader and engine control unit	- Engine running problems - Engine cuts out - None	- Renew control unit => Page 58 - Erase fault memory and continue to monitor the vehicle

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
8 Low heating output relay -J359
9 High heating output relay -J360

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 only activated for 30 seconds each.
- 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 71
- Press =>key.

-> Indicated on display:

Final control diagnosis
Exhaust gas recirculation valve -N18

The valve should 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:

- Test exhaust gas recirculation valve -N18 => Page 76 .
- Press =>key.

-> Indicated on display:

Final control diagnosis
Air conditioner compressor cut-in

Conditioner compressor shut-off is checked.

The test step is also recalled on vehicles without air conditioner system.

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 97 .
- 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 should 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 64 .
- Press ➔key.

-> Indicated on display:

Final control diagnosis
Glow plug relay -J52

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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 105 .
- Press ➔key.

-> Indicated on display:

Final control diagnosis
Glow period warning lamp -K29

The indicator lamp should flash.

If the indicator lamp does not flash:

- Test glow period warning lamp -K29 => Page 106 .
- Press ➔key.

-> Indicated on display:

Final control diagnosis
Low heating output relay -J359

The test step is only carried out on vehicles with manual gearbox.
The relay should click.

If the relay does not click:

- Test low heating output relay

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

- Press ➔key.

-> Indicated on display:

Final control diagnosis
High heating output relay -J360

The test step is only carried out on vehicles with manual gearbox, although not with all control unit versions.

Note:

On vehicles with injection system version 11), coolant heater element relay -J325 is activated at this point.

- 1) Differences between injection systems=>Page 1 .

The relay should click.

If the relay does not click:

- Test high heating output relay or coolant heater element relay.

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

- 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.

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 4 . 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 Q
Enter display group number XXX

- Press key 0 three times to select Display Group 000 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	
										Intake air mass
										Fuel temperature
										Intake manifold temperature
										Coolant temperature
										Atmospheric pressure (ambient air pressure)
										Intake manifold pressure (charge pressure)
										Injection quantity
										Accelerator pedal position
										Commencement of injection
										Engine speed

Display Group 000 at idling speed (engine warm, coolant temperature not below +80°C)

System in basic setting 0 ➡										◀ Indicated on display
40	46	0	20	90	201	62	97	127	83	
										Intake air mass: 70 ... 110. If the specification is not obtained, test exhaust gas recirculation => Page 74 . After 10 minutes at idling speed the exhaust gas recirculation is switched off. The display will show 125 ... 145.
										Fuel temperature: approx. 40 °C (not reached if outside temperature is low; no specified value)
										Intake manifold temperature: approx. 30 °C (dependent on ambient temperature - no specified value)
										Coolant temperature: approx. 90 °C
										Atmospheric pressure (ambient air pressure): no specified value - ignore
										Intake manifold pressure (charge pressure): no specified value - ignore
										Injection quantity: 10 ... 45 (idling)
										Accelerator pedal position: 0 (pedal not depressed)
										Commencement of injection depends on fuel temperature => Page 21
										Engine speed: 37 ... 42 (idling speed)

- Press ➡key.

-> Indicated on display:

Rapid data transfer HELP
Select function XX

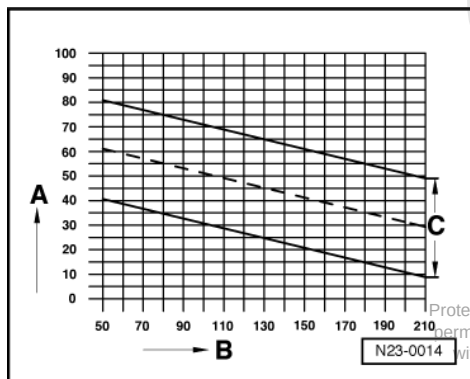
- Press keys 0 and 6 for the function "End output" and confirm entry with Q key.

-> Indicated on display:

Rapid data transfer HELP
Insert address word XX

- Switch off ignition and unplug diagnostic connector.

Commencement of injection (injection timing)



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

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

♦ Specification: => area C on graph

5 - Coding control unit

5.1 - Coding control unit

- ♦ There are some control units that must not be coded (engine control unit MSA 12) and some that must be coded (engine control unit MSA 15).
- ♦ A codable control unit needs to be coded if the coding which appears on the fault reader display does not correspond to the vehicle, or if the control unit has been newly fitted.

- ♦ Always start by calling up (and if necessary printing out) the control unit identification code on the fault reader display => Page 3 .
- ♦ An incorrect coding can affect the performance of the engine, gearbox and exhaust system.

Work sequence

- 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 ignition must be switched on.
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)
- Control units that must not be coded (MSA 12)

-> Indicated on display (control unit identification):

```
028906021XX 1.9L      R4      EDC      SG
DXX
Coding 00000      WSC 00000
```

Distinguishing points:

- ♦ No zeros before the gearbox type (SG or AG).
- ♦ Software version starts with a letter.



- ♦ Control unit has a plastic housing.
- **Control units that must be coded (MSA 15)**

-> Indicated on display (control unit identification):

```
028906021XX 1.9l R4 EDC G00SG XXXX
Coding XXXXX WSC XXXXX
```

Distinguishing points:

- ♦ Two zeros before the gearbox type (SG or AG), and an extra letter "G" for vehicles with cruise control.
 - ♦ Software version is indicated by an alphanumeric code (i.e. a combination of letters and numbers, e.g. KD09).
 - ♦ The code sequence "KDxx" indicates that the control unit is a replacement part.
To find out what coding needs to be entered, check the printout obtained previously for the original control unit.
 - ♦ Control unit has an aluminium housing.
- Press =>key.

-> Indicated on display:

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

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

-> If the following readout appears on the display:

```
Code control unit
Feed in code number 00000 (0 - 00127)
```

- Enter the correct coding for the vehicle and confirm entry with Q key.

Codings to be entered when replacing an MSA 12 control unit with an MSA 15 control unit

Control unit MSA 12	Replacement control unit MSA 15	Coding for replacement con- trol unit MSA 15
028 906 021 D	028 906 021 ET	00013
028 906 021 E	028 906 021 ET	00011
028 906 021 H	028 906 021 ET	00012
028 906 021 AQ	028 906 021 FD	00011
028 906 021 AR	028 906 021 FD	00012
028 906 021 G	028 906 021 FE	00011
028 906 021 AP	028 906 021 FE	00013

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

```
028906021XX 1.9l R4 EDC G00SG
KD09 □
Coding 00012 WSC 12345
```

- Switch ignition off and then on again.

Notes:

- ♦ The newly entered code will be activated the next time the ignition is switched on.
 - ♦ If the ignition is not switched off and then on again after entering the correct coding, it will not be possible to erase fault code 01044 ("Control unit incorrectly coded") from the fault memory.
- Erase fault memory=>Page 4 .
- Activate the cruise control system

=>Page 102 .

6 - Reading measured value block

6.1 - 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 XXX	

Protected by Copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without express authorisation by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Enter the Display Group number.
=>Overview of Display Group numbers to be selected, Page 23 .

-> Indicated on display for Display Group 000:

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

-> Indicated on display (example) for Display Group 001:

Read measured value block				1
1	2	3	4	

Overview of Display Group numbers to be selected

Display Gr. number	Indicated on display	Meaning
000 General vehicle inspection	Read measured value block 0 1 2 3 4 5 6 7 8 9 10	1 = Engine speed 2 = Commencement of injection 3 = Accelerator pedal position 4 = Injection quantity 5 = Intake manifold pressure (charge/boost pressure) 6 = Atmospheric pressure (ambient air pressure) 7 = Coolant temperature 8 = Intake manifold temperature 9 = Fuel temperature 10 = Intake air mass

Display Gr. number	Indicated on display	Meaning
001	Read measured value block 1	1 = Engine speed



Display Gr. number	Indicated on display	Meaning
Injection quantity	1 2 3 4	2 = Injection quantity 3 = Voltage from modulating piston movement sender - G149 4 = Coolant temperature
002 Idling speed	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Accelerator pedal position 3 = Operating status: X X 1 Air conditioner "ON" signal X 1 X Idling speed switch closed 1 X X Increased idling speed: ▪ because required by air conditioner 1) ▪ because acceleration and braking detected ▪ because glow plug additional heater is on 4 = Coolant temperature

1) The idling speed is not increased with all control units. However, a "1" will appear if this condition is required by the air conditioner.

Display Gr. number	Indicated on display	Meaning
003 Exhaust gas recirculation	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Intake air mass (specified) 3 = Intake air mass (actual) 4 = Duty cycle (activation) of exhaust gas recirculation valve -N18
004 Start of injection	Read measured value block 4 1 2 3 4	1 = Engine speed 2 = Commencement of injection (specified) 3 = Commencement of injection (actual) 4 = Duty cycle (activation) of commencement of injection valve -N108
005 Start conditions	Read measured value block 5 1 2 3 4	1 = Engine speed 2 = Injection quantity for starting (recorded from last start) 3 = Commencement of injection 4 = Coolant temperature

Display Gr. number	Indicated on display	Meaning
006 Switch positions	Read measured value block 6 1 2 3 4	1 = Road speed 2 = Brake pedal monitoring: X X 1 Brake light switch -F closed X 1 X Brake pedal switch -F47 open 1 X X Clutch pedal switch -F36 open 3 = Cruise control system (CCS) controls: X X X X X CCS on X X X X 1 X CCS off with memory or "Set speed" 1) X X X 1 X X "Set speed" or no display 1) X X 1 X X X Resume speed X 1 X X X X Brake pedal depressed 1 X X X X X Clutch pedal depressed

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of the information and data. Copyright © AUDI AG.

Display Gr. number	Indicated on display	Meaning
	Continued ▼	

1) Version 1 only=>Differences between injection systems, Page 1 .

Display Gr. number	Indicated on display	Meaning
006 Switch positions	Read measured value block 6 1 2 3 4	4 = Operating status of cruise control system (CCS): 0 Control unit with CCS function 1 CCS switched off 2 Accelerate 4 Decelerate 8 Resume 1 6 Brake depressed 3 2 Maintain speed 6 4 (Ignore) 1 2 8 (Ignore) 2 5 5 Control unit without CCS function

Display Gr. number	Indicated on display	Meaning
007 Temperatures	Read measured value block 7 1 2 3 4	1 = Fuel temperature 2 = No display 3 = Intake manifold temperature 4 = Coolant temperature
008 Injection quantity limitation	Read measured value block 8 1 2 3 4	1 = Engine speed 2 = Desired injection quantity (driver's requirement via accelerator pedal) 3 = Injection quantity limitation via engine speed (torque limitation) 4 = Injection quantity limitation based on intake air mass (avoidance of exhaust smoke)
009 Injection quantity limitation	Read measured value block 9 1 2 3 4	1 = Engine speed 2 = Injection quantity (cruise control system activated) 3 = Injection quantity limitation by automatic gearbox during gear change 4 = Emergency quantity (voltage from modulating piston movement sender - G149)

Display Gr. number	Indicated on display	Meaning
010 Air quantities	Read measured value block 10 1 2 3 4	1 = Intake air mass 2 = Atmospheric pressure (ambient pressure) 3 = Intake manifold pressure (charge pressure) 4 = Accelerator pedal position
011	Read measured value block 11	1 = Engine speed



Display Gr. number	Indicated on display	Meaning
Charge pressure control	1 2 3 4	2 = Charge pressure (specified) 3 = Charge pressure (actual) 4 = Duty cycle (activation) of charge pressure control solenoid -N75
012 Glow plug system	Read measured value block 12 1 2 3 4	1 = (Ignore) 2 = Glow period (in seconds) 3 = Supply voltage from control unit 4 = Coolant temperature

Display Gr. number	Indicated on display	Meaning
013 Smooth idling control	Read measured value block 13 1 2 3 4	1 = Difference between injection quantities for cylinders 4 and 3 2 = Difference between injection quantities for cylinders 2 and 3 3 = Difference between injection quantities for cylinders 1 and 3 4 = No display
014 (Unallocated)	Read measured value block 14	No display
015 Fuel consumption	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Injection quantity (actual) 3 = Fuel consumption 1) 4 = Desired injection quantity (driver's requirement via accelerator pedal)

1) Does not appear with all control units.

Display Gr. number	Indicated on display	Meaning
016 1) Additional heater	Read measured value block 16 1 2 3 4	1 = Alternator load 2 = Additional heater switched off because: X X X X X X X 1 Coolant temperature above 70 °C... 80 °C 2) or intake air temperature above 5 °C X X X X X X 1 X Alternator defective X X X X X 1 X X Battery voltage less than 9 V X X X X 1 X X X Engine speed less than 800 rpm X X X 1 X X X X Engine started within the last 10 seconds X X 1 X X X X X Coolant temperature sender -G62 or intake manifold temperature sender -G72 defective X 1 X X X X X X (Ignore) 1 X X X X X X X (Ignore)

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Display Gr. number	Indicated on display	Meaning
	Continued ▼	

1) Does not appear with all control units.

1) If the intake air temperature is 5°C when the engine is started, the additional heater will switch off when the coolant temperature reaches 70°C. If the air temperature is -10°C, the additional heater will not switch off until the coolant temperature reaches 80°C.

Display Gr. number	Indicated on display	Meaning
016 1) Additional heater		3 = Heater element activation X 1 Low heating output relay -J359 activated 1 X High heating output relay -J360 2) activated or coolant heater relay -J325 3) activated 4 = Supply voltage from control unit

1) Does not appear with all control units.

2) Version 2 only=>Differences between injection systems, Page 1.

3) Version 1 only=>Differences between injection systems, Page 1.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Display Gr. number	Indicated on display	Meaning
017 1) (Unallocated)	Read measured value block 17	No display
018 1)	Read measured value block 18 1 2 3 4	(Ignore)
019 1) Quantity adjuster	Read measured value block 19 1 2 3 4	1 = Lower stop value (voltage from modulating piston movement sender) 2 = Upper stop value (voltage from modulating piston movement sender) 3 = No display 4 = No display

1) Does not appear with all control units.

6.2 - Readout specifications for general vehicle inspection

Display Group 000 at idling speed (engine warm, coolant temperature not below 80°C)

Read measured value block 0										⇒	Indicated on display
40	50	0	20	90	201	62	97	127	83		
											Intake air mass: 70...110 okay
											▪ If outside tolerance => Display Group 03, Page 31
											Fuel temperature: no specification
											Intake manifold temperature: no specification
											Coolant temperature: approx. 90 °C
											Ambient air pressure: no specification



Charge pressure: ignore
Injection quantity: 10...45 okay
▪ If outside tolerance => Display Group 01, Page 28
Accelerator pedal position: 0 (pedal not depressed)
Commencement of injection: 20...60 okay
▪ If outside tolerance => Display Group 04, Page 29
Idling speed: 37...42 okay
▪ If outside tolerance => Display Group 02, Page 30

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for errors or omissions.

Display Group 000 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
186	225	255	171	186	201	62	177	175	233		
											Intake air mass: > 210 okay
											▪ < 210: => Display Group 10, Page 33
											Fuel temperature: ignore
											Intake air temperature: ignore
											Coolant temperature: ignore
											Ambient air pressure: ignore
											Charge pressure: 213...238 (Version 1 1)) or 171...191 (Version 2 1)) okay
											▪ If outside tolerance => Display Group 11, Page 33
											Injection quantity: 160...176 (at full throttle)
											▪ 125 (emergency quantity - system fault detected)
											Accelerator pedal position: 255 (fully depressed)
											Commencement of injection: 180...245 (depending on engine speed)
											▪ If outside tolerance => Display Group 04, Page 29
											Engine speed: 160...190 (display value of 190 = 4000 rpm; do not exceed - engine speed is governed)

1) Differences between injection systems=>Page 1.

6.3 - Readout specifications for injection pump

Display Group 001 at idling speed (engine warm, coolant temperature not below 85°C)

Read measured value block 1				=>	• Indicated on display
840 rpm	6.5 mg/H	1.480 V		87.3 °C	
					Coolant temperature
					▪ 85...100 °C okay
					▪ < 85 °C: => run engine till warm
					Voltage from modulating piston movement sender -G149
					▪ 1.250...1.700 V okay
					▪ < 1.250 V: injection pump too rich => fit a new injection pump
					▪ > 1.700 V: engine load => switch off consumers
					▪ Injection pump too lean => fit a new injection pump

	Injection quantity ▪ 2.0...9.0 mg/H (mg/stroke) okay ▪ < 2.0 mg/H: injection pump too rich => fit a new injection pump ▪ > 9.0 mg/H: engine load => switch off consumers ▪ Injection pump too lean => fit a new injection pump
	Engine speed ▪ 780...860 rpm okay for vehicles with manual gearbox ▪ 820...900 rpm okay for vehicles with automatic gearbox

Display Group 001 with attempted start (if engine does not start)¹⁾

Read measured value block 1	⇒	• Indicated on display
230 rpm 37.4 mg/H 2.780 V	14.3 °C	
		Coolant temperature
		Voltage from modulating piston movement sender -G149 (quantity adjuster informs control unit of position of modulating piston) ▪ Voltage increases periodically: okay (pump is injecting) ▪ < 1.000 V: quantity adjuster closed => monitor display zone 2. ▪ Only fit a new injection pump if injection quantity is as specified.
		Specified injection quantity (control unit activating quantity adjuster in injection pump) ▪ Injection quantity increases periodically: okay (pump is being activated) ▪ 0.0 mg/H (mg/stroke): system fault => interrogate fault memory, Page 4
Engine speed		

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

Display Group 019 with ignition on

Read measured value block 19	⇒	• Indicated on display
0.780 V 4.150 V		
		No display
		Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not undertake any liability with respect to the content of this document. No display Voltage from modulating piston movement sender at maximum stop of quantity adjuster ▪ 3.800...4.400 V okay ▪ If outside tolerance: contact resistance in wiring => test, Page 92 ▪ Quantity adjuster in injection pump out of position => fit a new injection pump
		Voltage from modulating piston movement sender at minimum stop of quantity adjuster ▪ 0.600...0.900 V okay ▪ If outside tolerance: contact resistance in wiring => test, Page 92 ▪ Quantity adjuster in injection pump out of position => fit a new injection pump

Display Group 004 at idling speed (engine warm, coolant temperature not below 85°C)

--



Read measured value block 4				⇒	◀ Indicated on display
840 rpm	0.9 °BTDC	0.9 °BTDC	23 %		
					Duty cycle (activation) of commencement of injection valve
					▪ No specification
					Current commencement of injection
					▪ 2° ATDC...4° BTDC okay
					▪ Later than 2° ATDC: injection timing control jammed
					▪ Commencement of injection valve defective
					▪ Injection pump set at extreme retard position
					▪ => check injection timing control range, Page 71
					Commencement of injection specified by control unit
					▪ 2° ATDC...4° BTDC okay
					Engine speed
					▪ 780...860 rpm okay for vehicles with manual gearbox
					▪ 820...900 rpm okay for vehicles with automatic gearbox

6.4 - Readout specifications for engine idling speed

whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Display Group 002 at idling speed (engine warm, coolant temperature not below 85°C)

Read measured value block 2				⇒	◀ Indicated on display
840 rpm	0.0 %	0 1 0		88.4 °C	
					Coolant temperature
					▪ 85...100 °C okay
					▪ < 85 °C: => run engine till warm
					Operating status:
					▪ 0 1 0: Okay (idling speed switch closed)
					▪ 1 1 0: Idling speed increased because:
					▪ - Signal from air conditioner1)
					▪ - Acceleration and braking detected
					▪ - Additional heater on
					▪ 1 1 1: Air conditioner ON signal
					Accelerator pedal position
					▪ 0.0 % okay
					▪ > 0.0 %: accelerator pedal position sender incorrectly set or defective => adjust
					Engine speed
					▪ 780...860 rpm okay for vehicles with manual gearbox
					▪ 820...900 rpm okay for vehicles with automatic gearbox

1) The increase in idling speed does not occur with all control unit versions. However, a "1" will still appear if a signal is received from the air conditioner.

Display Group 013 at idling speed (engine warm, coolant temperature not below 85°C)

The injection system is equipped with an idling speed smooth running control. There may be power differences between the individual cylinders (component tolerances, jet drillings, compressions etc.) which are recognised and equalized via selective injected quantities.

Recognition at idling speed is via the signal from the engine speed sender which delivers four signals per crankshaft revolution to the control unit. If the signals are delivered at the same rhythm then all cylinders work the same. If one cylinder is weaker then the crankshaft takes longer for the next half revolution. Conversely a more powerful cylinder accelerates the crankshaft so less time is taken.

If the control unit recognises a difference, then the relevant cylinder is given more or less fuel, until the engine runs evenly again.

The measured value block displays the injected quantity differences of the individual cylinders compared with No. 3 cylinder that is required to ensure an even engine idling speed.
+... mg/H: The relevant cylinder is less powerful than No. 3 cylinder and is therefore supplied with more fuel.
-... mg/H: The relevant cylinder is more powerful than No. 3 cylinder and is therefore supplied with less fuel.

Read measured value block 13			⇒	◀ Indicated on display
0.82mg/H1)	-0.12mg/H1)	0.49mg/H1)		
			No display	
			Difference between injection quantities for cylinder 1 and cylinder 3 ▪ -1.5 mg/H...+1.5 mg/H (mg/stroke) okay ▪ > +1.5 mg/H: cylinder 1 weak ▪ < -1.5 mg/H: cylinder 1 strong	
			Difference between injection quantities for cylinder 2 and cylinder 3 ▪ -1.5 mg/H...+1.5 mg/H (mg/stroke) okay ▪ > +1.5 mg/H: cylinder 2 weak ▪ < -1.5 mg/H: cylinder 2 strong	
			Difference between injection quantities for cylinder 4 and cylinder 3 ▪ -1.5 mg/H...+1.5 mg/H (mg/stroke) okay ▪ > +1.5 mg/H: cylinder 4 weak ▪ < -1.5 mg/H: cylinder 4 strong	

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1) Difference between injection quantities for cylinders 4/2/1 and cylinder 3:

- -1.5 mg/H ... +1.5 mg/H: okay
- Values in all display zones too high: cylinder 3 strong
- Values in all display zones too low: cylinder 3 weak

6.5 - Readout specifications for exhaust gas recirculation

Display Group 003 at idling speed (engine warm, coolant temperature not below 85°C)

Read measured value block 3			⇒	◀ Indicated on display
840 rpm	290 mg/H	308 mg/H	54 %	
			Duty cycle (activation) of exhaust gas recirculation valve	
			Intake air mass ▪ If as specified in display zone 2 (tolerance ± 20 mg/H (mg/stroke)): okay ▪ Air mass too small: unmetered air in intake tract ▪ Excessive exhaust gas recirculation => test, Page 74 ▪ Press accelerator briefly if engine has been idling for 10 minutes or more. ▪ Constant 425 mg/H: substitute value => interrogate fault memory	
			Air mass specified by control unit ▪ 230...370 mg/H (mg/stroke) okay ▪ > 370 mg/H: engine too cold => run engine till warm ▪ Injection quantity too great => readout specifications for injection pump ▪ Intake manifold temperature very high => correction not possible	
			Engine speed ▪ 780...860 rpm okay for vehicles with manual gearbox ▪ 820...900 rpm okay for vehicles with automatic gearbox	



6.6 - Readout specifications for temperature senders

Display Group 007 with ignition on (engine cold and not running)

Read measured value block 7 ➡			◀ Indicated on display
15.4 °C	15.9 °C	16.7 °C	
			Coolant temperature (at coolant temperature sender -G62) ▪ If the wiring has an open circuit the approximate fuel temperature will be displayed as a substitute value.
			Intake manifold temperature (at intake manifold temperature sender -G72) ▪ If the wiring has an open circuit, a constant temperature of 18.9 °C will be displayed as a substitute value.
		No display	
			Fuel temperature (at fuel temperature sender -G81) ▪ If the wiring has an open circuit, a constant temperature of -5.4 °C will be displayed as a substitute value.

Notes:

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

6.7 - Readout specifications for engine power output

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Display Group 008 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 8 ➡				◀ Indicated on display
3290 rpm	38.4 mg/H	35.2 mg/H	35.7 mg/H	
				Injection quantity limitation according to detected air mass 35...38 mg/H (mg/stroke) okay ▪ < 35 mg/H: detected air mass too small ▪ => test air mass meter, Page 74
				Injection quantity according to engine speed (torque limitation) 34.2...35.2 mg/H (mg/stroke) okay ▪ < 34.2 mg/H: engine speed too high or too low ▪ > 35.2 mg/H: injection quantity increased as a result of tuning
				Desired injection quantity (accelerator pedal position) 36...42 mg/H (mg/stroke) okay ▪ < 36 mg/H: accelerator pedal not fully depressed, incorrectly adjusted or defective ▪ => test, Page 93
				Engine speed 2800...4000 rpm okay

Display Group 010 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 10				⇒	◀ Indicated on display
830 mg/H	1030 mbar	1850 mbar	100 %		
					Accelerator pedal position: 100 % okay ▪ < 100 %: accelerator pedal not fully depressed ▪ Accelerator pedal position sender -G79 incorrectly ▪ adjusted or defective => test, Page 93
					Current charge pressure: 1800...2050 mbar okay If outside tolerance: charge pressure control defective => Display Group 11, Page 33
					Current air pressure: no specification
					Intake air mass: 750...850 mg/H (mg/stroke) okay ▪ < 750 mg/H: Engine speed below 2000 rpm or above 4000 rpm ▪ Charge pressure too low => monitor display zone 3 ▪ Unmetered air between air mass meter and turbocharger ▪ Air mass meter defective

6.8 - Readout specifications for charge pressure control

Display Group 011 at full throttle (test drive in 3rd and 4th gear, coolant temperature not below 85°C)

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Important: Always observe safety precautions => Page 1.

Read measured value block 11				⇒	◀ Indicated on display
3340 rpm	1830 mbar	1850 mbar	68 %		
					Duty cycle (activation) of charge pressure control solenoid valve - N75
					Current charge pressure ▪ If as specified in display zone 2 (tolerance ±100mbar): okay ▪ Charge pressure too low: no charge pressure control => test, Page 61
					Charge pressure specified by control unit ▪ 1800...2050 mbar okay ▪ > 2050 mbar: charge pressure increased as a result of tuning
					Engine speed 2900...4000 rpm okay



23 - Mixture preparation, Injection

1 - Servicing Diesel direct injection system

1.1 - Servicing Diesel direct injection system

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

1.2 - Safety precautions

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

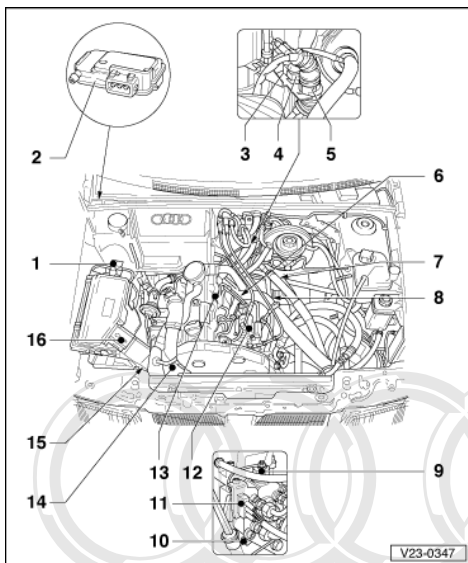
- ♦ The ignition must be switched off before connecting or disconnecting injection or glow plug system wiring or tester cables.
- ♦ If the engine is to be turned at starter speed without starting (e.g. when checking compression), detach the 3-pin connector from the injection pump.
- ♦ Before disconnecting 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.

1.4 - Fitting locations overview



1 Exhaust gas recirculation valve -N18

2 Altitude sender -F96

- ◆ Only in Version 1 of injection system=>Differences between injection systems, Page 1
- ◆ Located behind cover on right-hand A-pillar

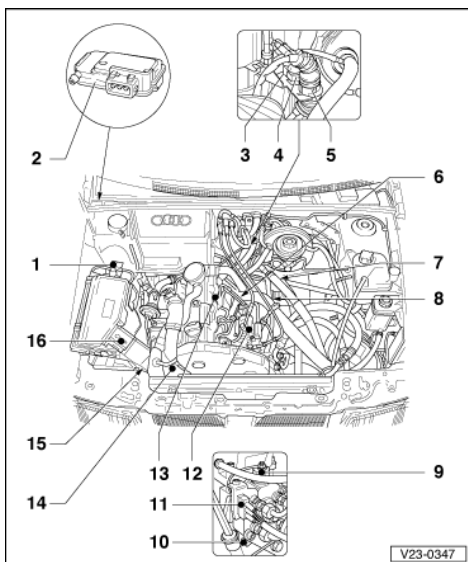
3 Connector

- ◆ 2 pin

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written permission of Audi AG. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

4 Connector

- ◆ 3 pin
- ◆ For engine speed sender -G28



5 Connector

- ◆ 8 pin
- ◆ For injection pump

6 Coolant temperature sender -G62

7 Speedometer sender -G22

8 Engine speed sender -G28

9 Fuel cut-off valve -N109

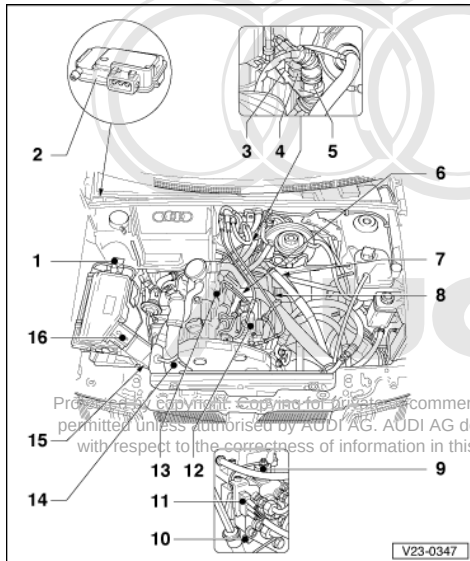
10 Commencement of injection valve



-N108

11 Connector

- ◆ 3 pin
- ◆ For injection pump



12 Metering control for injection pump

- ◆ With quantity adjuster -N146
- ◆ With fuel temperature sender -G81
- ◆ With modulating piston movement sender -G149

13 Injector

- ◆ For cylinder 3 with needle lift sender -G80

14 Charge pressure control valve -N75 (solenoid valve)

15 Intake manifold temperature sender -G72

16 Air mass meter -G70

Fitting locations not shown in illustration

Diesel direct injection system control unit -J248

(Differences=>Page 1)

- ◆ 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

Clutch pedal switch -F36

- ◆ On clutch pedal in footwell

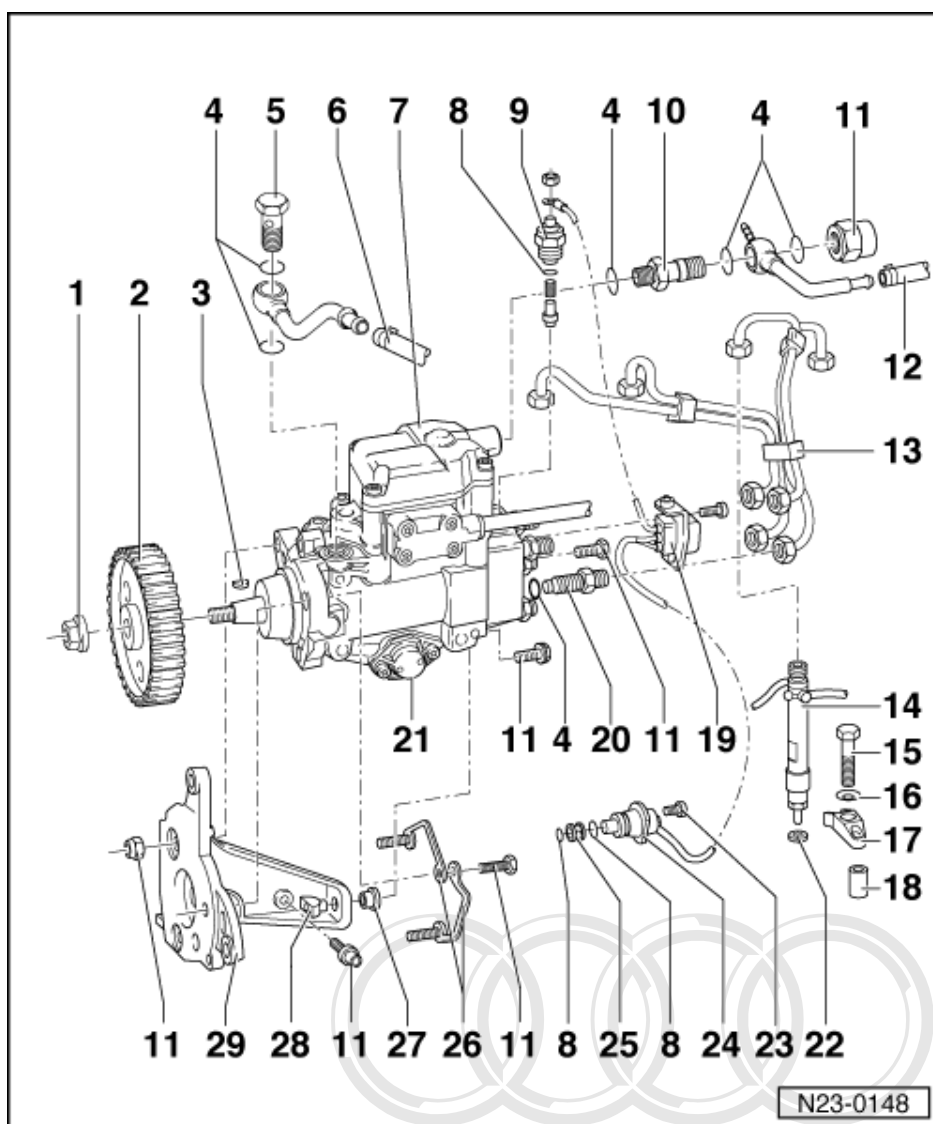
Brake light switch -F and brake pedal switch -F47

- ◆ 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 34 .
- ◆ Observe rules for cleanliness
=>Page 34 .
- ◆ Always renew seals and gaskets
- ◆ Tensioning toothed belt:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

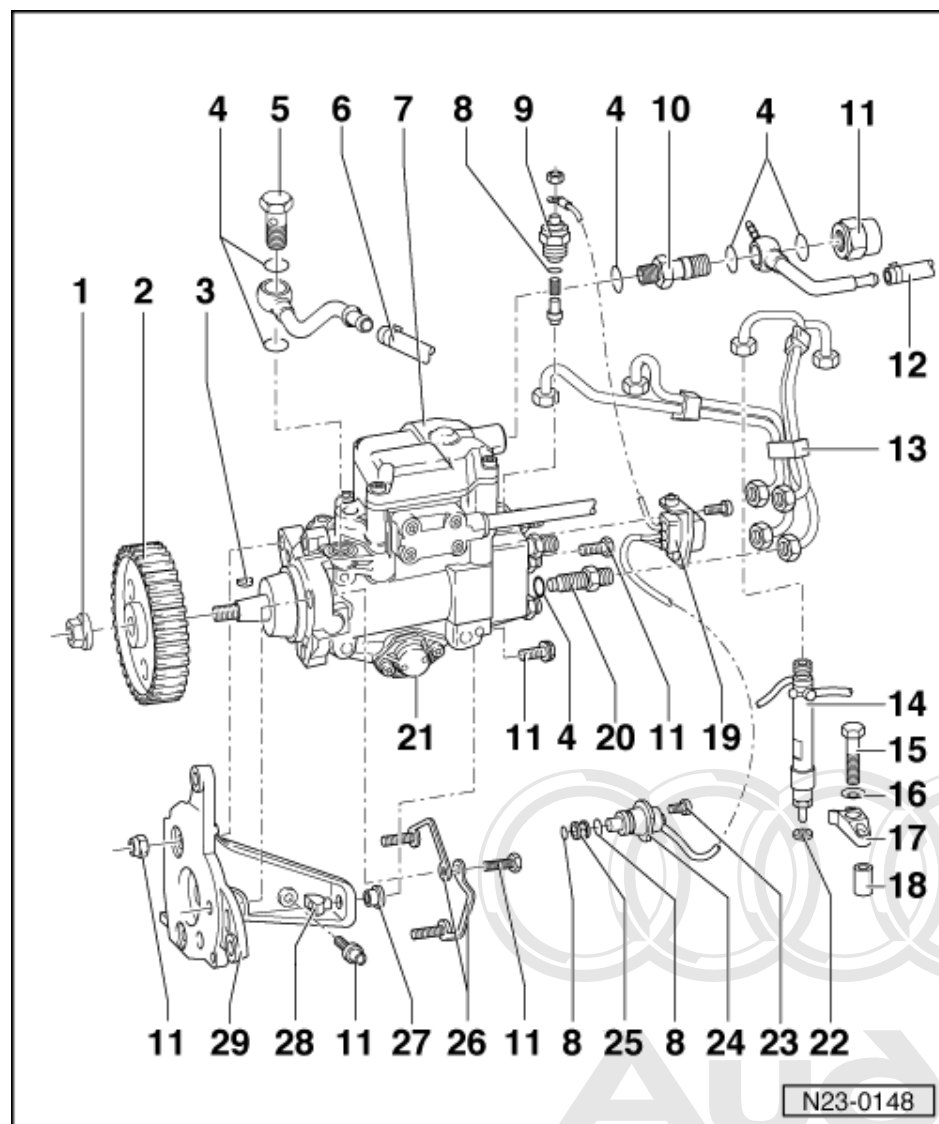


=> 4-cyl. Diesel engine (turbo), Mechanics; Repair group 13; Crankshaft group; Removing and installing toothed belt Crankshaft group Removing and installing toothed belt

1 45 Nm

2 Injection pump sprocket

- ♦ Removing and installing
=>Removing, installing and adjusting injection pump, Page 47



3 Woodruff key

- ♦ Check position before fitting injection pump sprocket

4 Seal

- ♦ Renew

5 Banjo bolt - 25 Nm

- ♦ For supply pipe

6 Supply hose

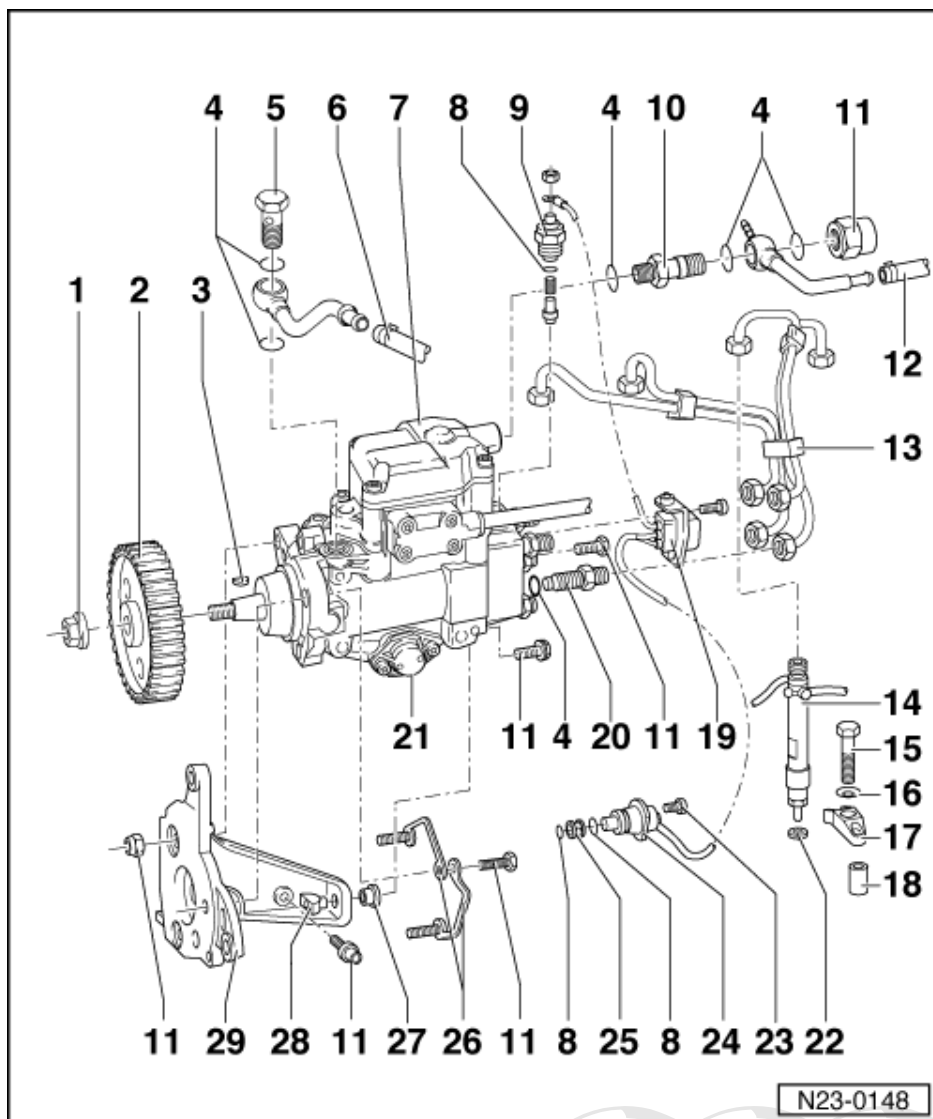
- ♦ From fuel filter

7 Injection pump

- ♦ With quantity adjuster -N146
- ♦ With fuel temperature sender -G81
- ♦ With modulating piston movement sender -G149

8 O-Ring

- ♦ Renew if damaged



9 Fuel cut-off valve -N109

- ♦ Tighten to 20 Nm
- ♦ Testing =>Final control diagnosis, Page 16

10 Connection

- ♦ For return pipe
- ♦ Tighten to 28 Nm

11 25 Nm

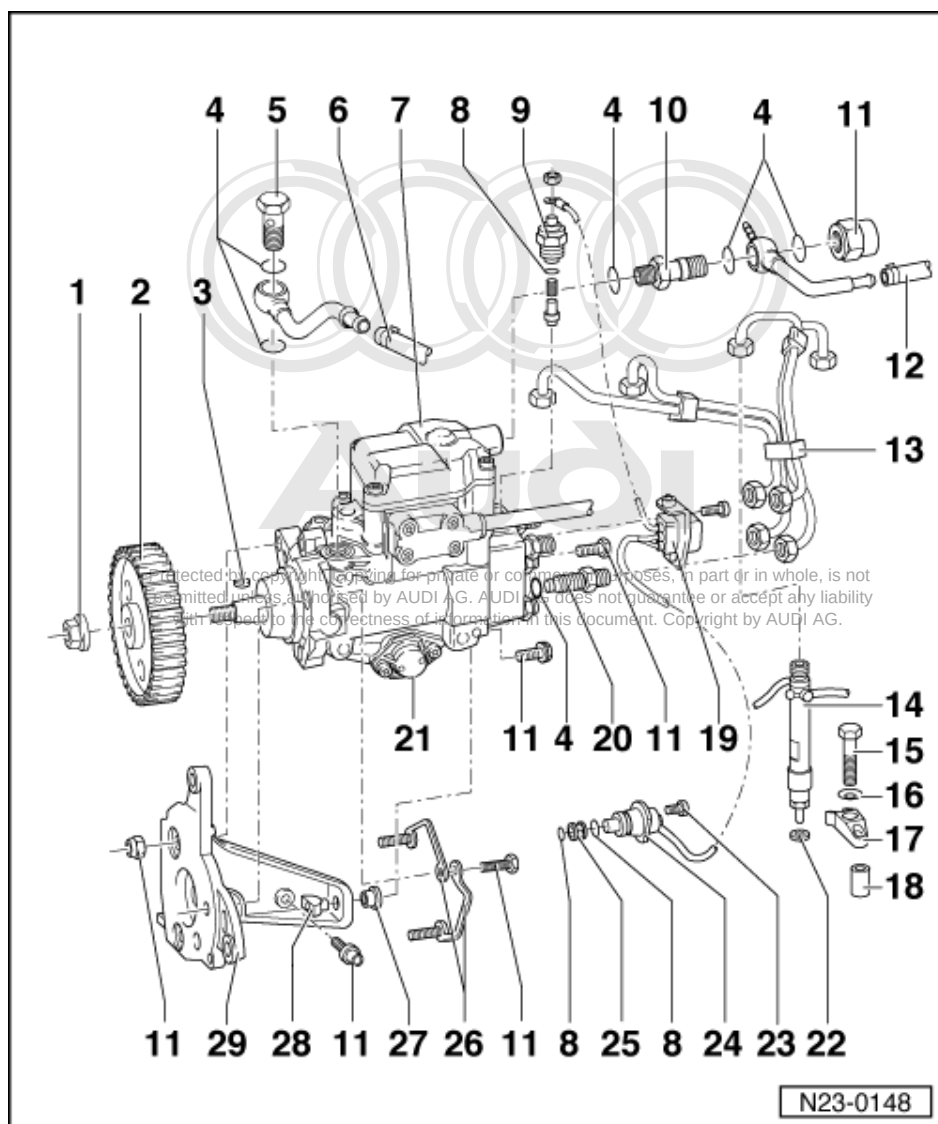
12 Return hose

- ♦ To fuel filter

13 Injector pipes

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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



14 Injector

- ♦ Removing and installing
=> Page 55
- ♦ Testing => Page 56
- ♦ For cylinder 3 with needle lift sender -G80. Testing => Page 87 .

15 20 Nm

16 Spherical washer

17 Retainer

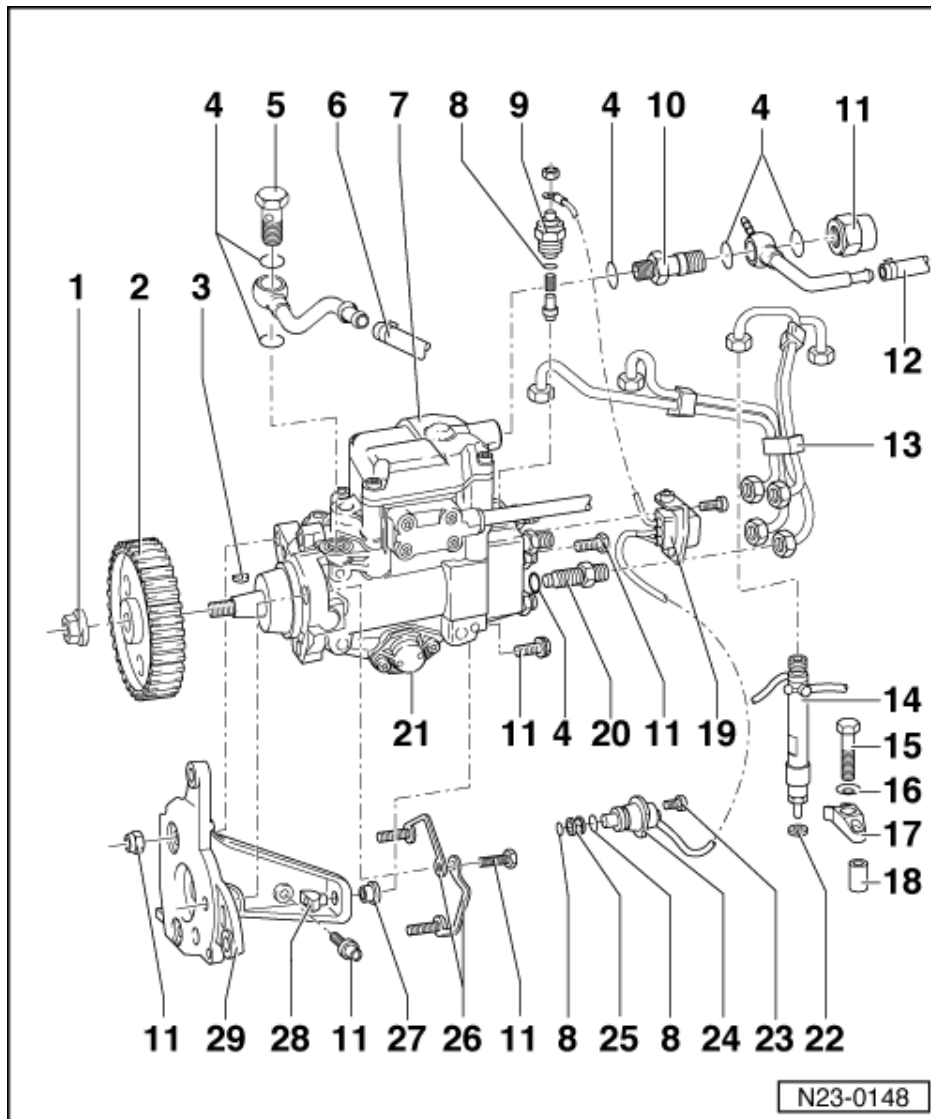
18 Mounting

19 Connector

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

20 Constant pressure valve

- ♦ Tighten to 45 Nm



21 Timing control cover

- ♦ If leaking, replace O-ring
=>Page 57

22 Copper seal

- ♦ Renew

23 12 Nm

24 Commencement of injection valve -N108

25 Strainer

26 Retainer bar

27 Bush

- ♦ Tapered

28 Nut - 25 Nm

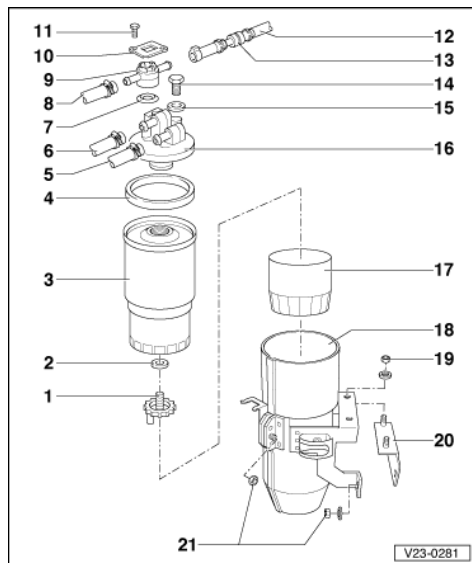
- ♦ Conical

29 Console

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



1.6 - Servicing fuel filter



Notes:

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

=> Parts List

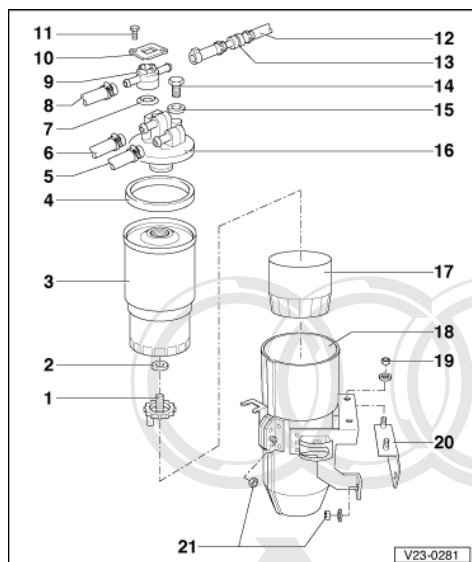
- ♦ Always renew seals and gaskets.

1 Water drain plug

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

2 Seal

- ♦ Renew if damaged



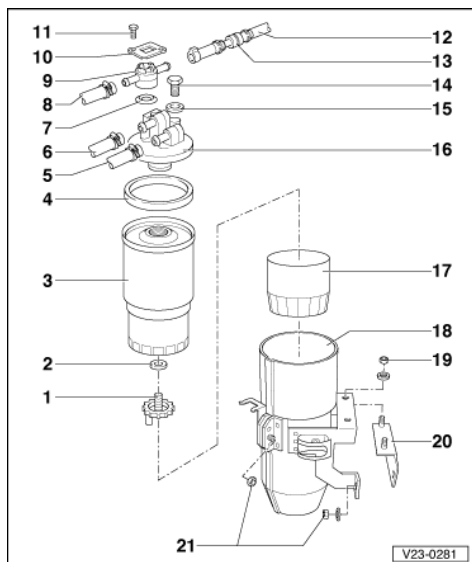
3 Fuel filter

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

4 Seal

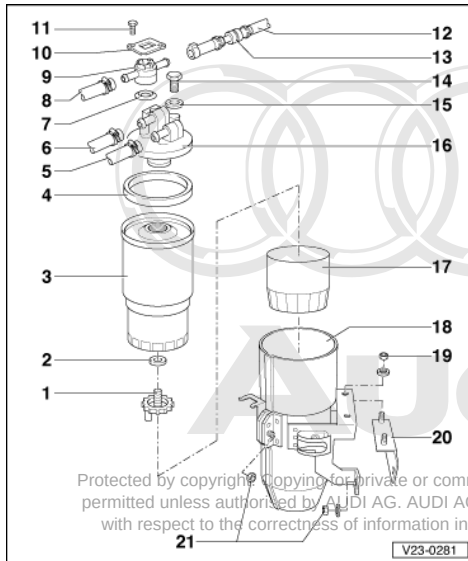
- ♦ Renew if damaged

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



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- 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**



17 Insert

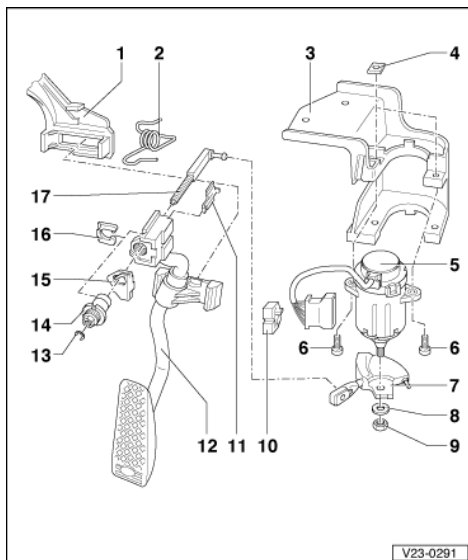
18 Heat shield

19 10 Nm

20 Bracket

21 10 Nm

1.7 - Servicing accelerator linkage



1 Pedal bracket

2 Torsion spring

3 Console

4 Square nut

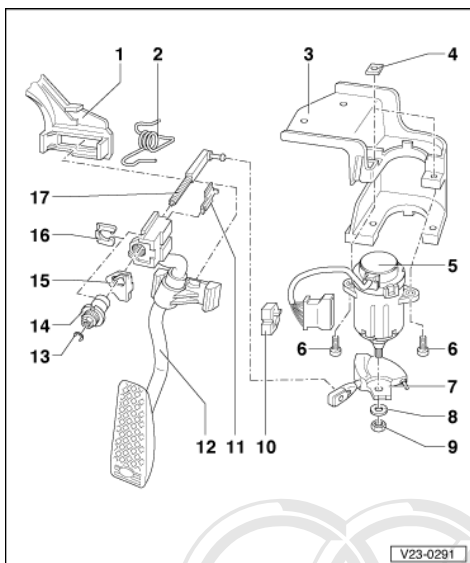
5 Accelerator position sender -G79

- ◆ Installing and adjusting
=> Page 45

6 Hexagon socket head bolt,
-10Nm

7 Cable cam

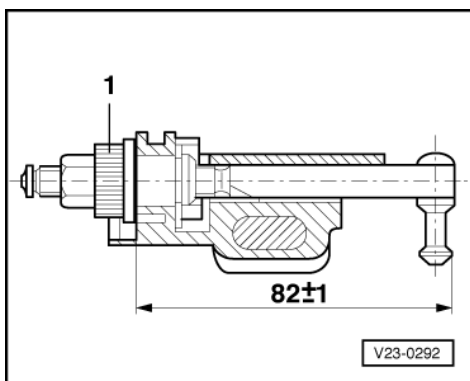
8 Washer



- 9 10 Nm
 10 Retaining clamp
 11 Retaining spring
 12 Accelerator pedal
 13 Circlip
 14 Screw adjuster
 15 Detent spring
 16 Circlip
 17 Stud

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

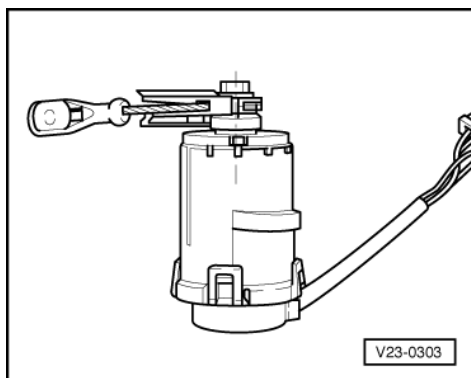
1.8 - Installing and adjusting accelerator position sender -G79



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 is only functional on vehicles with automatic gearbox.

Vehicles with manual gearbox

- 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

Vehicles with automatic gearbox

- Use screw adjuster to adjust accelerator pedal so that point of resistance of kickdown switch is definitely felt 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 definitely felt as accelerator pedal touches floor.
- If point of resistance is reached before pedal touches floor:
 - Turn screw adjuster anticlockwise until point of resistance is definitely felt as accelerator pedal touches floor.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability

1.9 - Removing, installing and adjusting injection pump

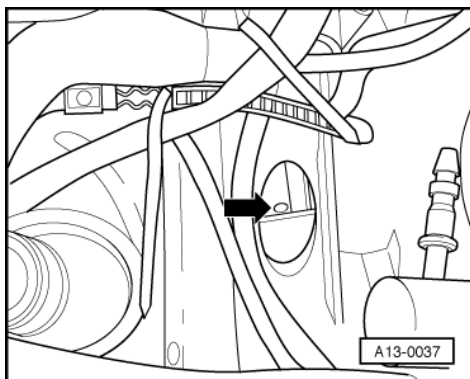
Special tools, testers and auxiliary items

- ◆ Mandrel 2064
- ◆ Setting bar 2065 A
- ◆ Adjustment bar 2068 A for top dead centre
- ◆ Puller 3032
- ◆ Ring spanner 3035
- ◆ Counter-hold tool 3036
- ◆ Adapter 3313
- ◆ Small dial gauge (measuring range from 0 to 3 mm)

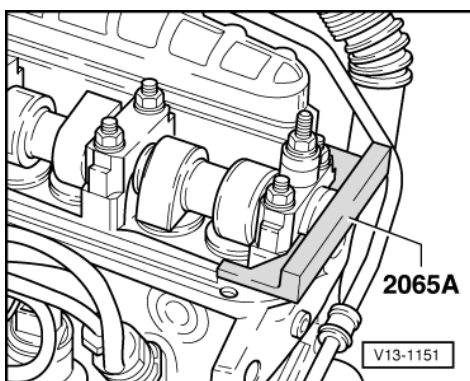
Removing

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

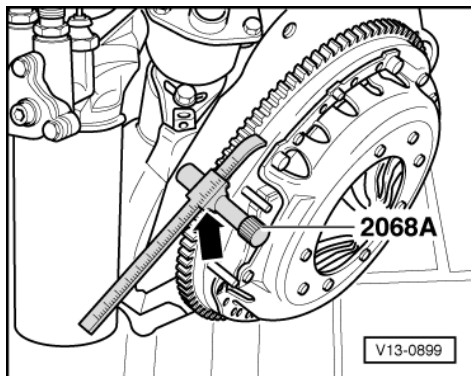
- ◆ If the camshaft slot is covered by the upper edge of the cylinder head, rotate the crankshaft through one more revolution.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



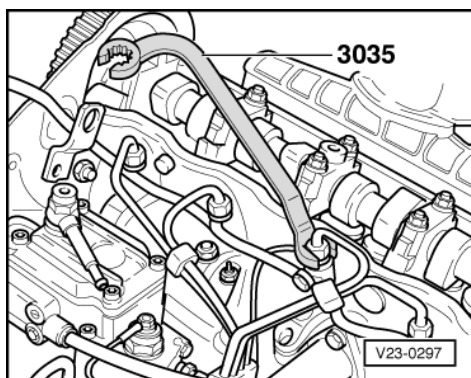
- ♦ If adjustment bar 2065 A cannot be inserted with the crankshaft in TDC position, adjust the basic mechanical setting when installing the injection pump.
- Lock camshaft with adjustment bar 2065 A.

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.

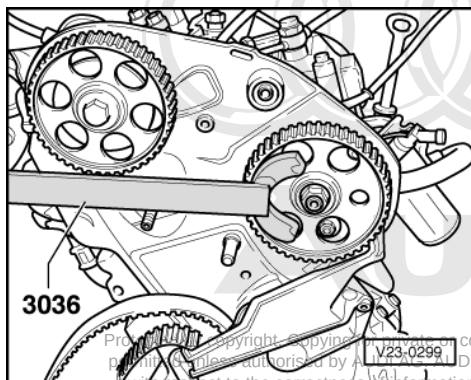
All models



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

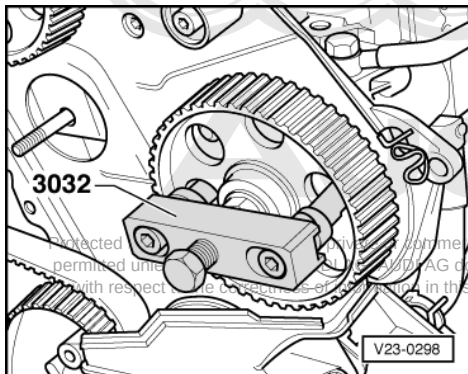
Note:

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.

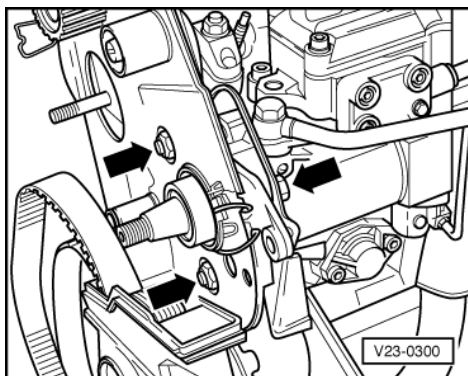
Note:

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

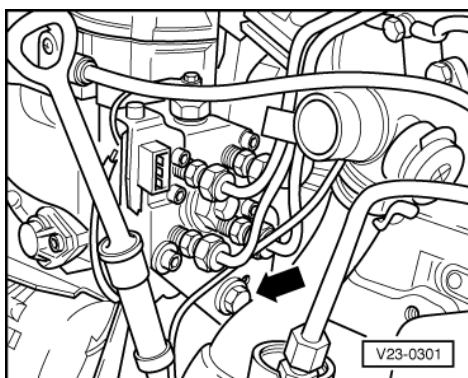
- Unscrew nut.

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.



Note:

Shown in illustration with coolant hose removed.

Installing

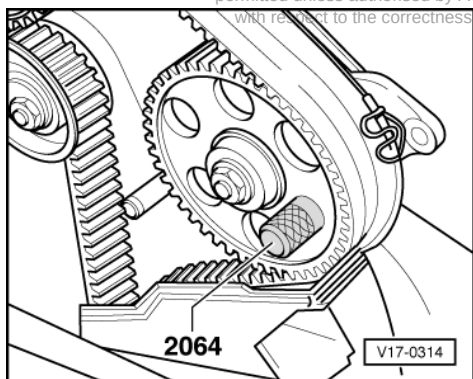
Notes:

- ♦ 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.

Note:

Make sure that the Woodruff key is properly seated.

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



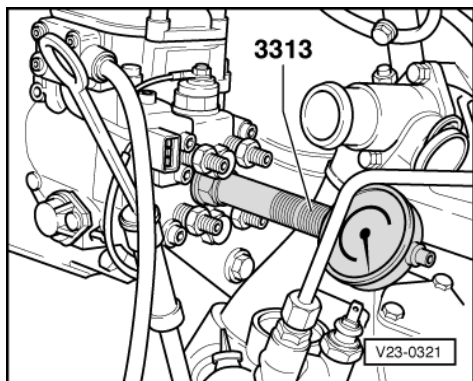
- -> Rotate the injection pump sprocket until it is possible to insert mandrel 2064 into the hole in the console via the small hole in the sprocket.
- Fit the toothed belt.

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

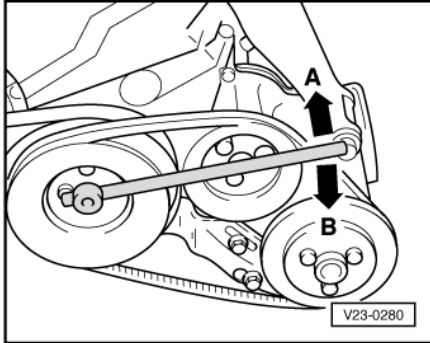
Adjusting

Requirements:

- Correct basic mechanical setting of engine
- Toothed belt correctly tensioned
- Engine at top dead centre



- Remove screw plug from injection pump.
- ➔ Screw in dial gauge adapter 3313 in place of screw plug.
- 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:
 - Setting value: 0.7 ± 0.02 mm travel

Notes:

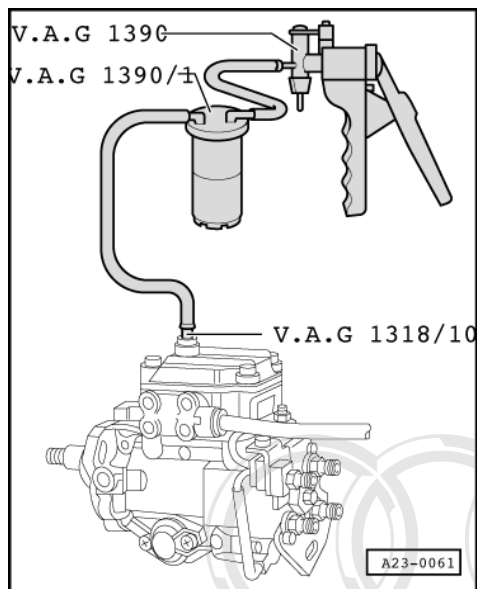
- ◆ If the test value is within the specified tolerance, no new setting is required.
- ◆ If the test value is outside the tolerance, adjust to the setting value.
- Slacken securing bolts for injection pump on front of console and on rear support by about 1 turn each.
- Adjust commencement of injection by turning the injection pump.
- Tighten securing bolts to 25 Nm.
- Tighten screw plug to 25 Nm.
- Reconnect injection pipes, fuel supply pipe and electrical wiring.
- Bleed the fuel system => Page 52 .
- Fit toothed belt guard.
- Dynamically check and adjust commencement of injection
=>Page 52 .



1.10 - Bleeding fuel system

Special tools, testers and auxiliary items

- ♦ Adapter 1318/10
- ♦ Hand-operated vacuum pump V.A.G 1390 with bleeder container V.A.G 1390/1.



- -> 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.

Important:

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

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1

Notes:

- ♦ The commencement of injection must always be checked after renewing the toothed belt or loosening the injection pump bolts or toothed belt sprockets and if necessary adjusted.
- ♦ 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
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .

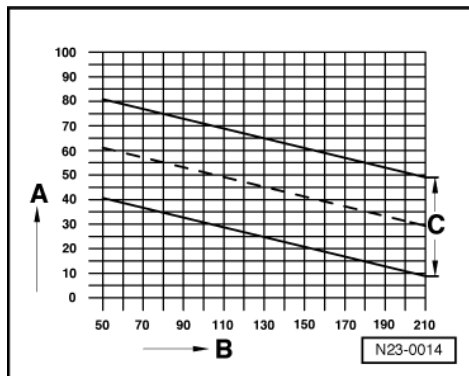
- Start the "Basic setting" function and select Display Group 000
=>Page 19.

-> 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.



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- > 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.

System in 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 remains 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.



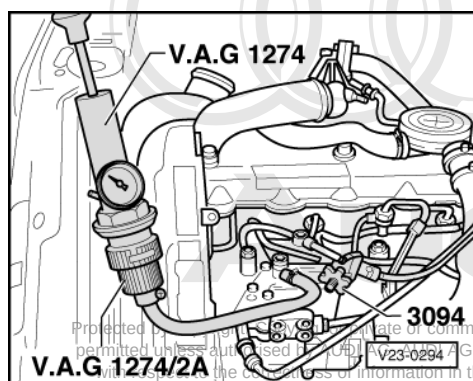
1.12 - Checking fuel system for leaks

Special tools, testers and auxiliary items

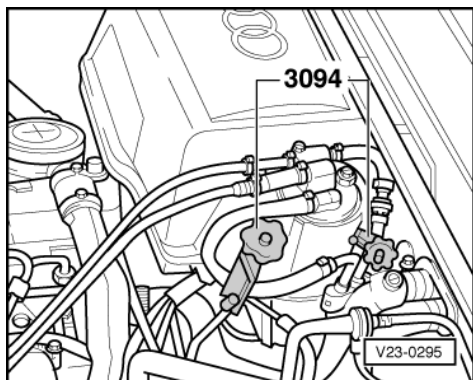
- ♦ Hose clamps 3093 or 3094
- ♦ Cooling system tester V.A.G 1274
- ♦ Adapter V.A.G 1274/2 A

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

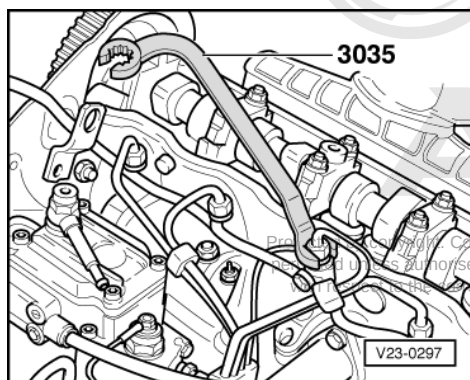
Defective constant pressure valves cause the following fault:

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

Special tools, testers and auxiliary items

- ◆ Ring spanner 3035
- ◆ Injector tester V.A.G 1322
- ◆ Pressure pipe V.A.G 1322/2
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1

Removing



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

Note:

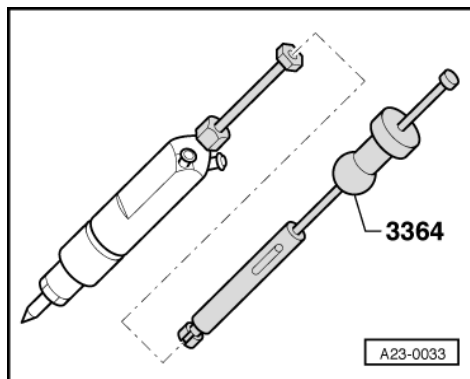
Always remove pipe set complete. Do not alter pipe shape.

- 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

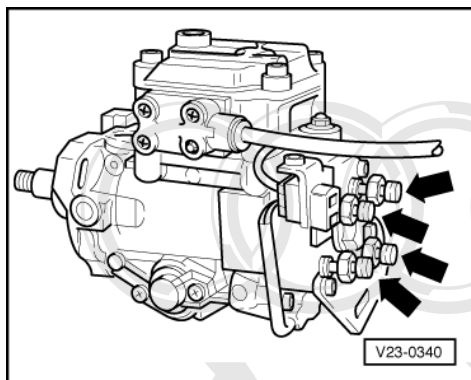
Testing

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- ->

Read measured value block 13
0.82mg/H -0.12mg/H 0.49mg/H

Read measured value block, Display Group 013, engine at idling speed=>Page 30 .

- Specification: -1,50 mg/H ... +1,50 mg/H (milligrams per stroke)
- If one or more of the values is outside the tolerance, swap round the injectors (except the 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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not accept any responsibility with respect to the correctness of information in this document. Copyright by AUDI AG.

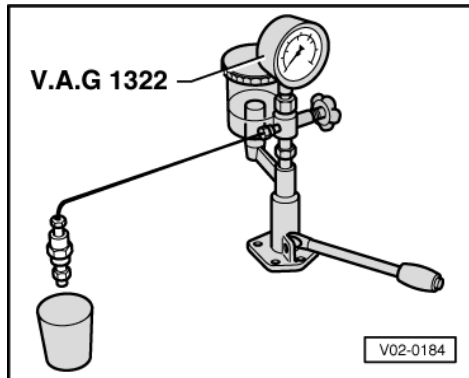
- -> If the compression is OK, renew the relevant constant pressure valve -arrow- together with sealing ring.
- Tightening torque: 45 Nm

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 constant 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.

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.

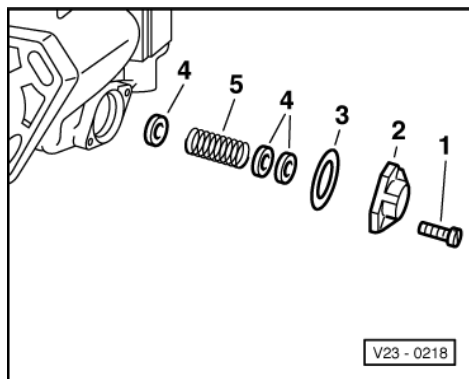
Specification	
New injectors	190...200 bar
Wear limit	170 bar

Checking for leaks

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

1.14 - Renewing injection timing device cover O-ring

Published by copyright. No part of this publication, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.





- 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-.

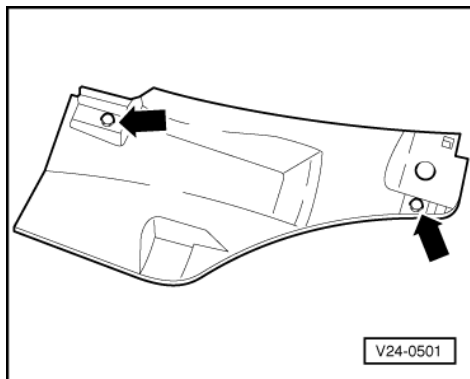
1.15 - Renewing engine electronics control unit

Special tools, testers and auxiliary items

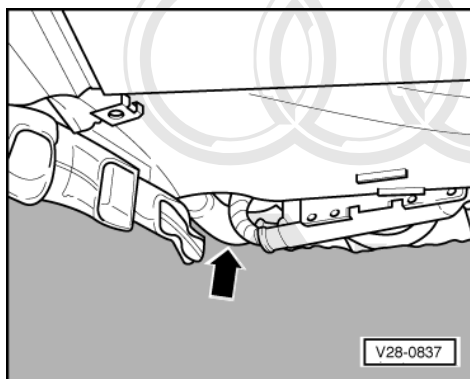
- ♦ Fault reader V.A.G 1551 with cable V.A.G 1551/1

Removing

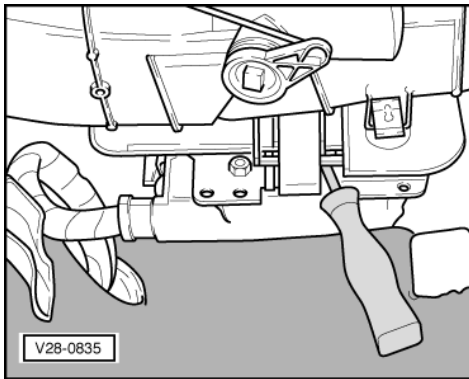
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2.
- Always start by calling up and printing out the control unit identification=>Page 3.
- Switch off ignition.



- -> 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:

- ◆ Always make sure that the ignition is switched off before detaching or fitting the connector for the Diesel direct injection system control unit.
- ◆ With the control unit in the service position, test box V.A.G 1598/18 can be connected to the engine wiring harness in order to carry out tests.
- To release the control unit, pull open the retainer clip and unplug the control unit connector.

Note:

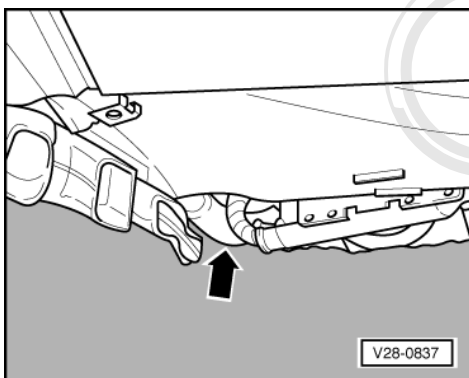
The following steps are only necessary if the control unit has to be removed completely.

- 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.

Installing

Notes:

- ◆ Always make sure that the ignition is switched off before detaching or fitting the connector for the Diesel direct injection system control unit.



- ◆ ➔ On vehicles with air conditioner, check under the glove box to make sure that the condensation drainage hose -arrow- has been re-connected before installing the glove box cover.



- If necessary, code the control unit=>Page 21 .

Vehicles with air conditioner1):

- 1) Injection system version 2 only
=>Differences between injection systems, Page 1 .
- Adapt engine electronics control unit to immobilizer control unit.

=> Electrical system; Repair group 01; Self-diagnosis; Adaption procedure after renewing engine control unit
Self-diagnosis Adaption procedure after renewing engine control unit

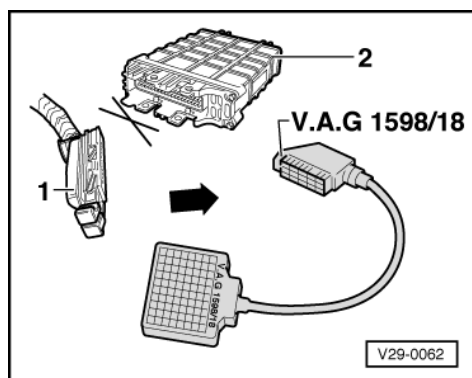
Vehicles with cruise control system:

- Activate cruise control system
=> Page 102 .

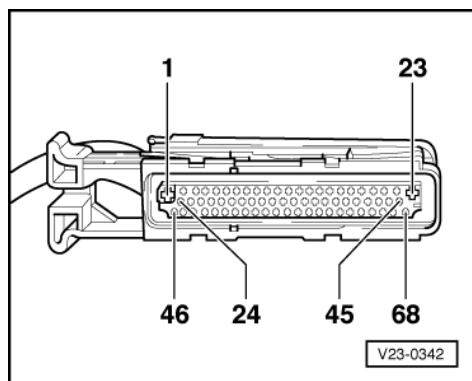
1.16 - Wiring and component check with test box V.A.G 1598/18

Notes:

- ♦ Always make sure that the ignition is switched off before detaching or fitting the connector for the Diesel direct injection system control unit.
 - ♦ Test box V.A.G 1598/18 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 contact numbers of the plugs and the socket numbers in the test box are identical.
- Switch off ignition.



- Move Diesel direct injection system control unit to service position and engage lugs => Page 58 .
- -> With the ignition switched off, connect test box V.A.G 1598/18 to connector -1- (the control unit -2- remains disconnected).



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Notes:

- ◆ -> 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 1598/18.

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:

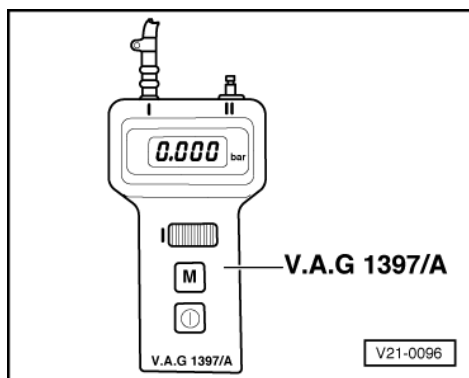
Warning

- ◆ 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.

Special tools, testers and auxiliary items

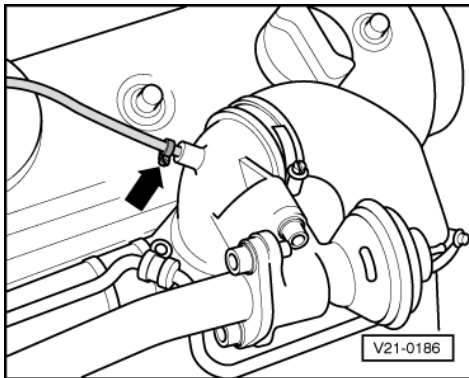
- ◆ Turbocharger tester V.A.G 1397 A
- ◆ Fault reader V.A.G 1551 with cable V.A.G 1551/1

Requirements for test:

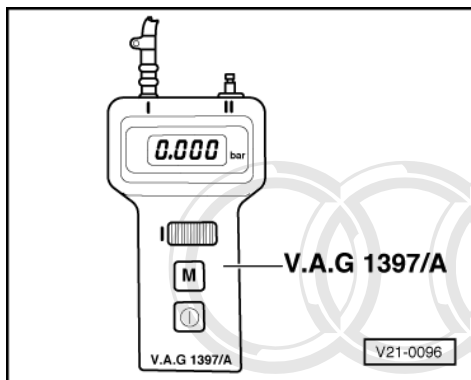


- No leaks in intake or exhaust systems
- Compression, hydraulic tappets and injectors must be OK
- -> The charge pressure is measured with turbocharger tester V.A.G 1397/A and fault reader V.A.G 1551 during a test drive.
- Pull cap off connecting pipe for intake manifold.
- Check for obstructions in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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



- -> 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 61 .
- -> 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 and select engine electronics control unit => Page 2 .
 - Read measured value block; Display Group 011; engine at idling speed=>Page 33 .

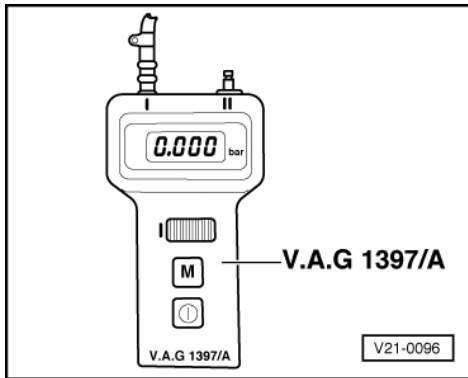
-> Indicated on display:

Read measured value block 11		
840 rpm	938 mbar	978 mbar
92 %		

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 35 .
- Accelerate vehicle in 3rd gear from about 1500 rpm using full throttle.
- At about 3000 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:

- ◆ 1.550 ... 1.750 bar

-> Specification for display zone 3 on V.A.G 1551:

Read measured value block 11			
3040 rpm	1846 mbar	1693	
mbar	39 %		

- ◆ 1550 ... 1750 mbar

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:

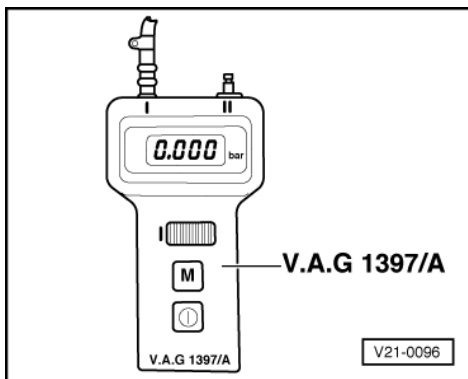
If the charge pressure level without charge pressure control is okay, repeat the test, this time with charge pressure control:

- 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 in 3rd gear from about 1500 rpm using full throttle.





- At about 3000 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:

- ♦ 1.800 ... 2.050 bar

-> Specification for display zone 3 on V.A.G 1551:

Read measured value block 11
3090 rpm 1866 mbar 1917
mbar 62 %

- ♦ 1800 ... 2050 mbar

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:

- ♦ 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

2.3 - Testing charge pressure control solenoid valve -N75

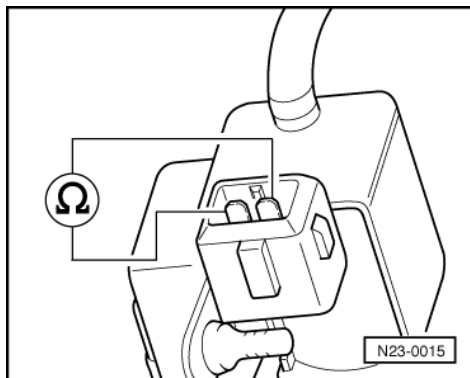
Special tools, testers and auxiliary items

- ♦ Hand-held multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594 A

- Switch off ignition.
- Pull connector off charge pressure valve -N75
=>Fitting locations overview, Page 36 , Item 14 .

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Testing internal resistance



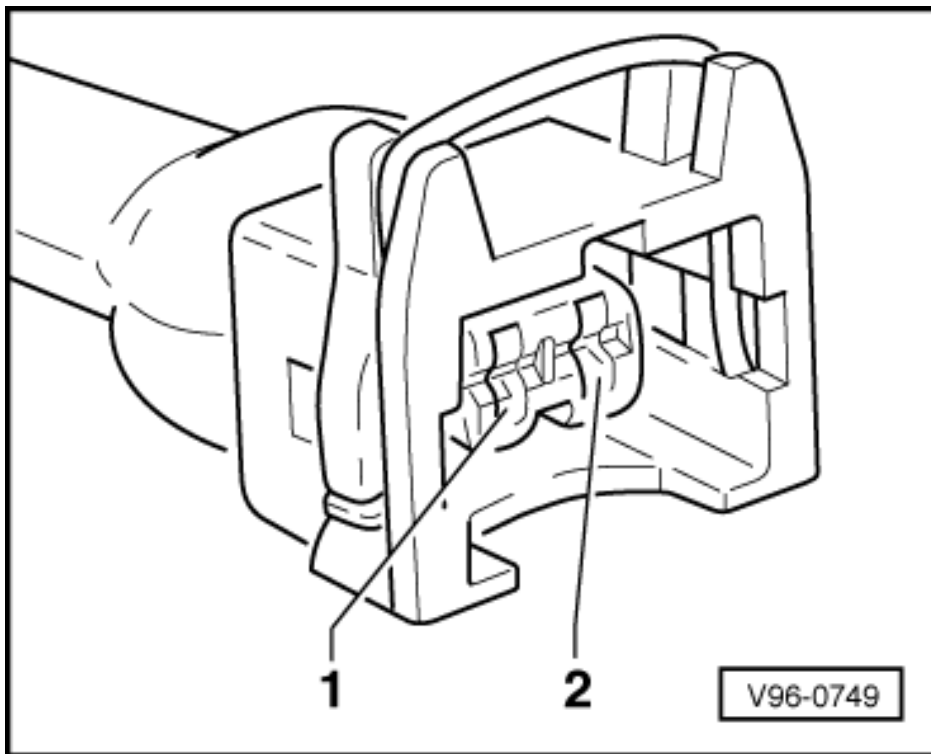
- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to valve contacts using test leads from V.A.G 1594 A.

- Specification: 25 ... 45 ω

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

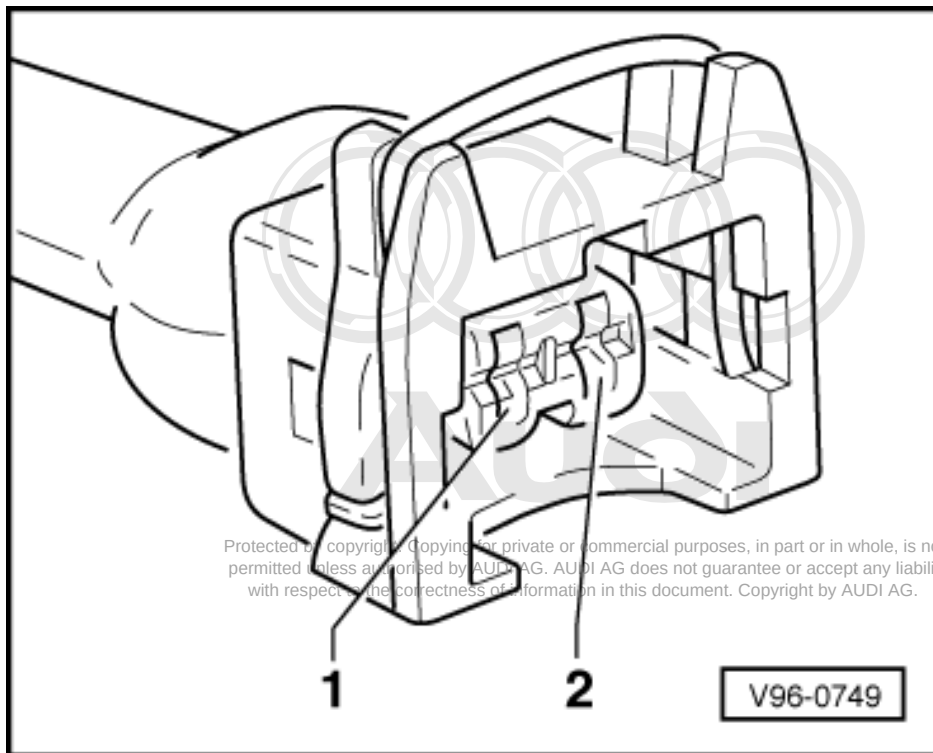
If the specification is not attained:

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

Testing wiring

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



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

Connector for -N75 Contact	Test box V.A.G 1598/18 Socket
1	47
2	68

- Rectify any open/short circuit as necessary.

2.4 - Testing intake manifold temperature sender -G72

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Fault reader V.A.G 1551 with cable V.A.G 1551/1
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 007, engine cold and not running=>Page 32 .

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

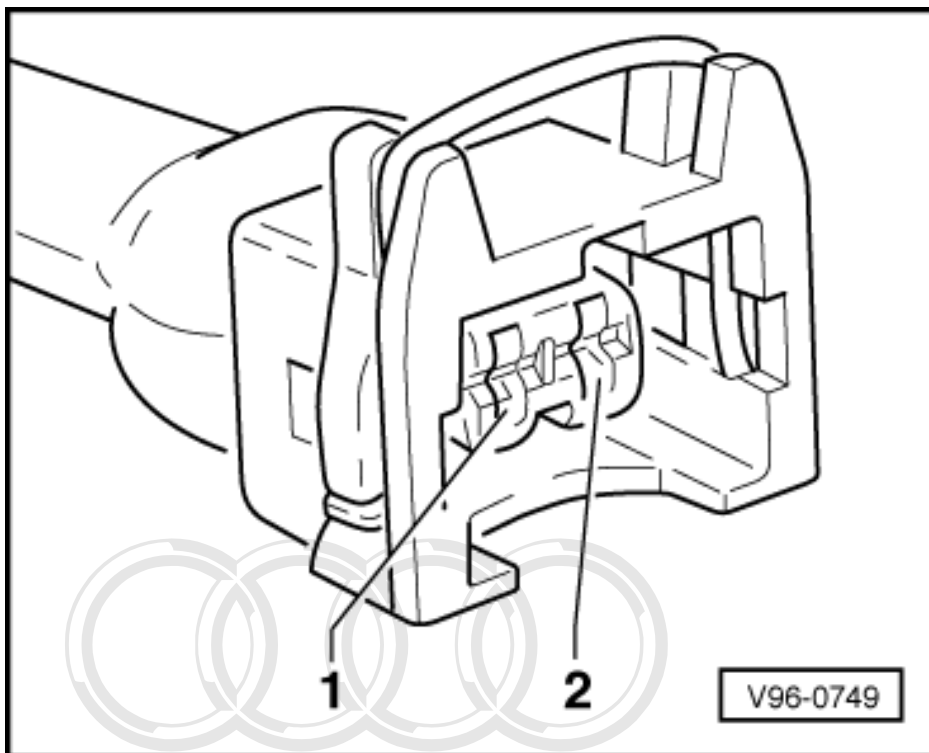
➔ Observe display in display zone 3.

If the wiring to the sender has an open circuit, a substitute value of 18.9°C will be displayed.

If an implausible value or a substitute value of 18.9°C is displayed:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Pull connector off intake manifold temperature sender -G72

=>Fitting locations overview, Page 36 , Item 15 .



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

Connector for -G72 Contact	Test box V.A.G 1598/18 Socket
1	64
2	33

Protected by Copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Rectify any open/short circuit as necessary.

2.5 - Testing intake manifold pressure sender -G71 and altitude sender -F96

- ◆ Intake manifold pressure sender -G71 is located in the Diesel direct injection system control unit.
- ◆ In Version 1 of the diesel direct injection system1), altitude sender -F96 is a separate component. Fitting location=>Page 35 .
- ◆ In Version 2 of the diesel direct injection system1), altitude sender -F96 is located in the Diesel direct injection system control unit.

1) Differences between injection systems=>Page 1 .

Special tools, testers and auxiliary items

- ◆ Turbocharger tester V.A.G 1397 A
- ◆ Hand-held multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

Test requirement:

- Engine not running



- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .

Read measured value block 10			
0 mg/H	1027 mbar	1013 mbar	0.0
%			

- > Read measured value block, Display Group 010, engine not running=>Page 33 .
- Observe the readouts in display zone 2 (altitude sender -F96) and display zone 3 (intake manifold pressure sender -G71).
 - Specification: The pressures should be the same.
 - Tolerance:±30 mbar

If the specification is not attained:

- Compare displayed pressures with pressure according to a barometer (e.g. turbocharger tester V.A.G 1397/A).
- Tolerance:±30 mbar.

If the value in display zone 3 does not agree:

- Detach pressure hose from control unit.

If the value in display zone 3 still does not agree:

- Fit a new Diesel direct injection system control unit -J248
- >Page 58 .

If the value in display zone 2 does not agree and a value of 1024 mbar is displayed constantly:

Injection system Version 11):

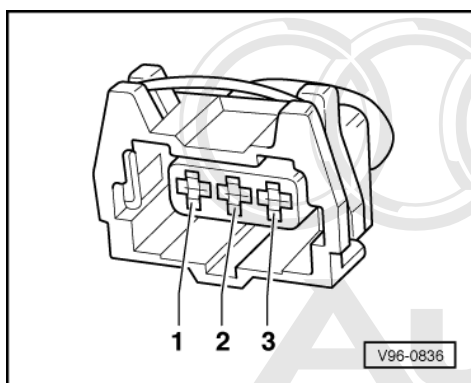
- Test wiring for open circuit and short to positive or earth.

Injection system Version 21):

- Fit a new Diesel direct injection system control unit -J248
- >Page 58 .

- 1) Differences between injection systems=>Page 1 .

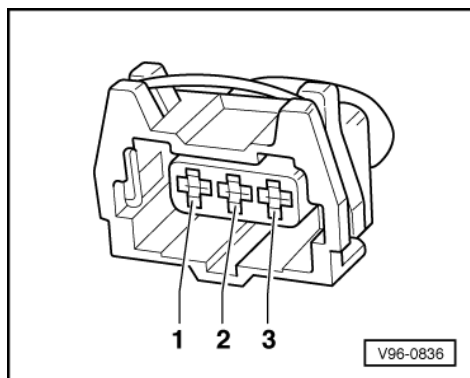
Testing wiring



- Switch off ignition.
- Unplug connector for altitude sender -F96
- >Fitting locations overview, Page 35 .
- > Select voltage measurement range (20 V direct current) on hand-held multimeter V.A.G 1526 and connect it to contacts 1 and 2 of the 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 1598/18 to connector for engine control unit=>Page 60 .



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

Connector for -F96 Contact	Test box V.A.G 1598/18 Socket
1	41
2	33
3	40

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

If the wiring is OK:

Injection system Version 11): Reproduction, distribution, sale or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

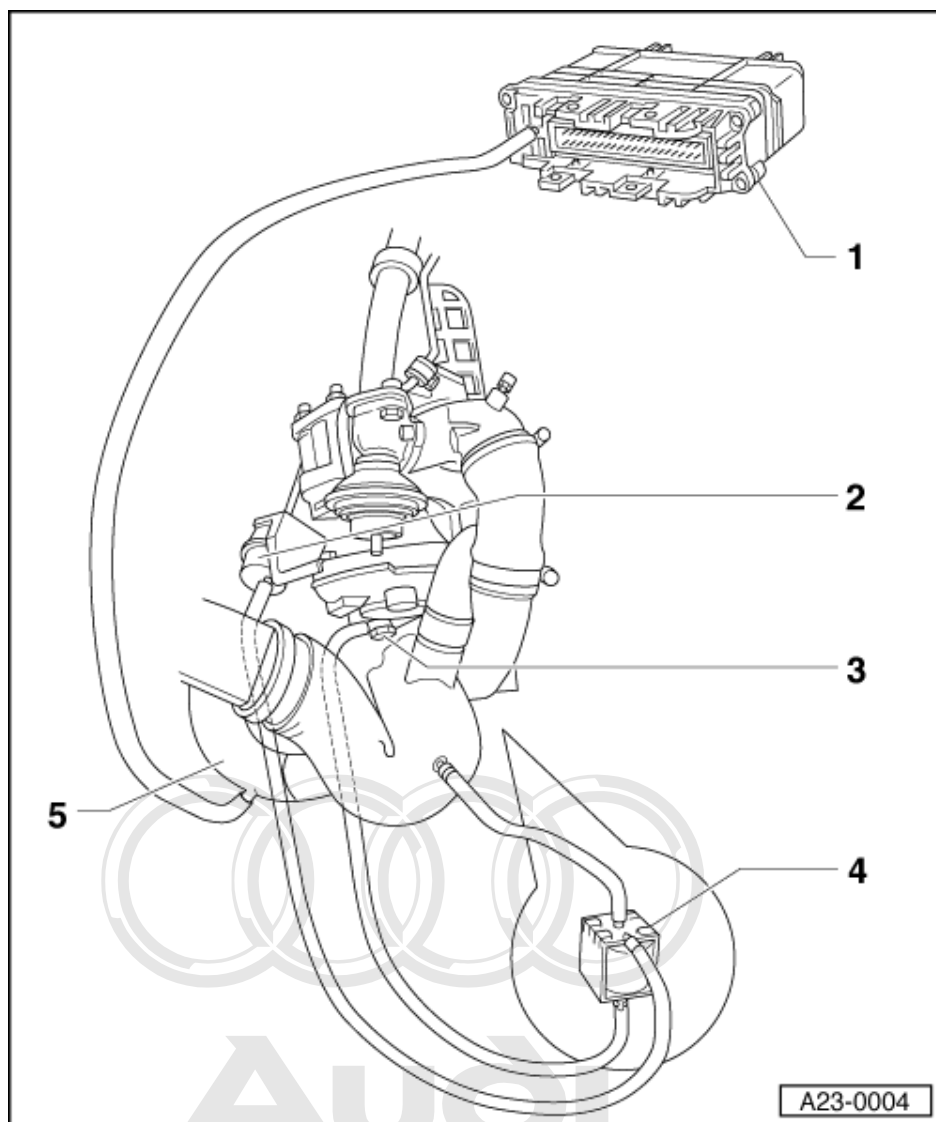
- Fit a new altitude sender -F96.

Injection system Version 21):

- Fit a new Diesel direct injection system control unit -J248
=>Page 58 .
- 1) Differences between injection systems=>Page 1 .



2.6 - Hose routing diagram for charge pressure control system



1 Control unit with intake manifold pressure sender -G71

2 Pressure unit for charge pressure control

3 Pressure connection on turbocharger

- ♦ Pressure supply for charge pressure control system

4 Solenoid valve for charge pressure control -N75

5 Pressure connection on outlet for charge air cooler

- ♦ Pressure tapping point for intake manifold pressure sender -G71

3 - Testing injection control

3.1 - Testing injection control

3.2 - Checking injection timing control range

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Start final control diagnosis and activate commencement of injection valve => Page 16 .

-> Indicated on display:

Final control diagnosis
Commencement of injection valve - N108

permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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

- Start the "Basic setting" function and select Display Group 000
=>Page 19 .

-> Indicated on display (example):

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

- If necessary, correct the commencement of injection
=> Page 52 .
- Pull out fuse 27.

Note:

Fault 00550 (and possibly also fault 00741) 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:

- Fit a new injection pump=>Page 47 .
- Interrogate fault memory, then erase => Page 4 .

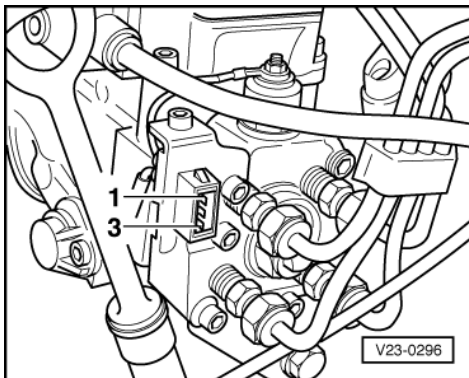


3.3 - Testing commencement of injection valve -N108

Special tools, testers and auxiliary items

- ♦ Hand-held multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Voltage tester V.A.G 1527 B
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18
- Switch off ignition.
- Unplug connector on injection pump
=>Fitting locations overview, Page 36 , Item 11 .

Testing internal resistance

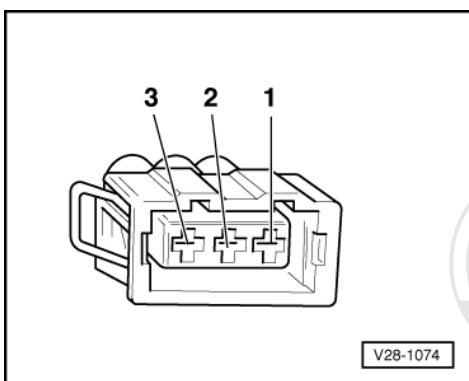


- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to valve contacts 2 and 3 using test leads from V.A.G 1594 A.
- Specification: 14 ... 18 ω

If the specification is not attained:

- Fit a new commencement of injection valve -N108
=>Fitting locations overview, Page 35 , Item 10 .

Testing voltage supply



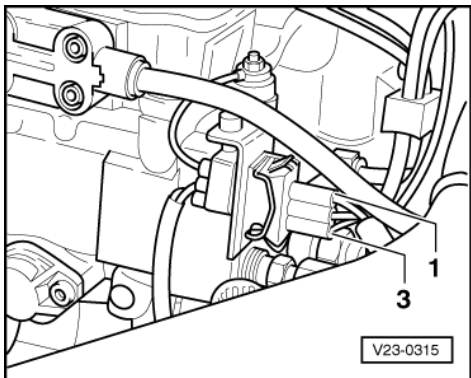
- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to engine earth and contact 3 on connector using test leads from V.A.G 1594 A.
- Switch on ignition.
- Specification: approx. battery voltage

If the specification is not attained:

- Eliminate open circuit or short circuit using the current flow diagram.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted, unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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.
- Start final control diagnosis and activate commencement of injection valve => Page 16 .

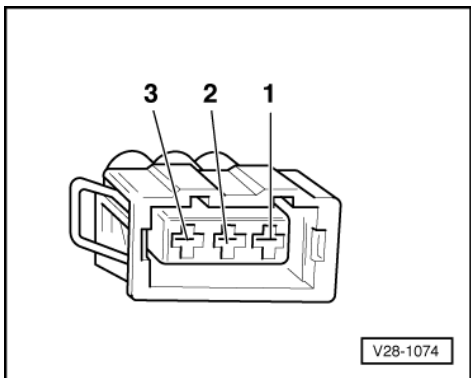
-> Indicated on display:

Final control diagnosis
Commencement of injection valve -N108

- 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 1598/18 to connector for engine control unit=>Page 60 .



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

Connector for -N108 Contact	Test box V.A.G 1598/18 Socket
2	51

- Rectify any open/short circuit as necessary.
- If the wiring is OK, fit a new Diesel direct injection system control unit -J248=>Page 58 .

3.4 - Testing fuel temperature sender -G81

Special tools, testers and auxiliary items for diagnostic purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1



♦ Test box V.A.G 1598/18

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page **2**.
- Read measured value block, Display Group 007, engine cold and not running=>Page **32**.

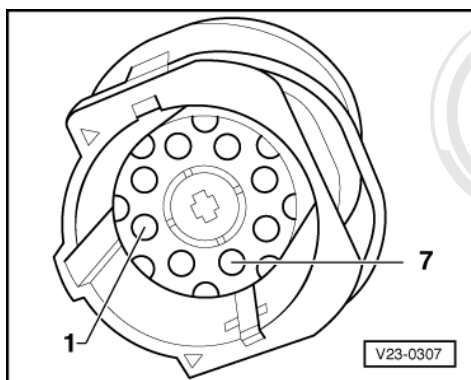
-> Indicated on display:

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

- Observe display in display zone 1.

If an implausible value is displayed:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page **60**.
- Unplug connector on injection pump
=>Fitting locations overview, Page **36**, Item **5**.



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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with regard to the correctness of information in this document. Copyright by AUDI AG.

Connector for injection pump Contact	Test box V.A.G 1598/18 Socket
5	33
6	63

- Rectify any open/short circuit as necessary.
- If the wiring is OK, fit a new injection pump
=>Page **47**.

4 - Testing exhaust gas recirculation (EGR)

4.1 - Testing exhaust gas recirculation (EGR)

4.2 - Testing operation

The operation of the exhaust gas recirculation system is tested by measuring the intake air mass. If the exhaust gas is being recirculated the proportion of fresh air detected by the air mass meter will be smaller. The larger the quantity of recirculated exhaust gas, the weaker the signal from the air mass meter.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 001, engine at idling speed=>Page 28 .

-> Indicated on display:

Read measured value block 1
 840 rpm 6.5 mg/H 1.480 V
 87.3 5C

- Check display in display zone 4 (coolant temperature).
 - Specification: at least 85°C
- Wait until the coolant has reached the specified temperature before continuing with the test.
- Press C key.
- Read measured value block, Display Group 003
 =>Page 31 .

-> Indicated on display

Read measured value block 3 "
 840 rpm 272 mg/H 268 mg/H
 54 %

- Briefly depress the accelerator pedal, then allow the engine to continue running at idling speed.
- Observe displays in display zones 2 and 3.

Display zone		Possible cause of fault
2 (spec.)	3 (actual)	
230...370 mg/H	230...370 mg/H	Okay
> 370 mg/H	> 370 mg/H	Engine too cold Injection pump too lean
230...370 mg/H	< 230 mg/H	Unmetered air Too much EGR
230...370 mg/H	> 370 mg/H	Too little EGR or none at all
	Constant 425 mg/H	Open circuit in wiring to air mass meter

- Start final control diagnosis and activate EGR valve -N18
 => Page 16 .

-> Indicated on display:

Final control diagnosis
 Exhaust gas recirculation valve -N18

The valve should click.

If the valve does not click:

- Test exhaust gas recirculation valve -N18 => Page 76 .

If the valve clicks:

- Check vacuum hoses => Page 81 .

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

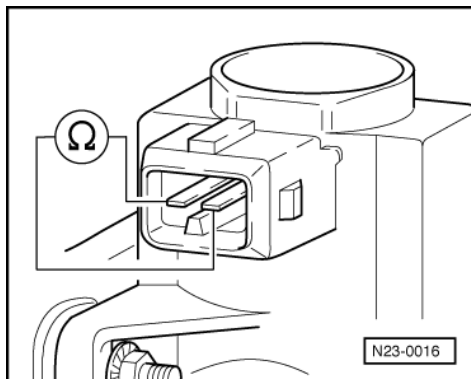
Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Switch off ignition.
- Pull connector off EGR valve -N18
=>Fitting locations overview, Page 35 .

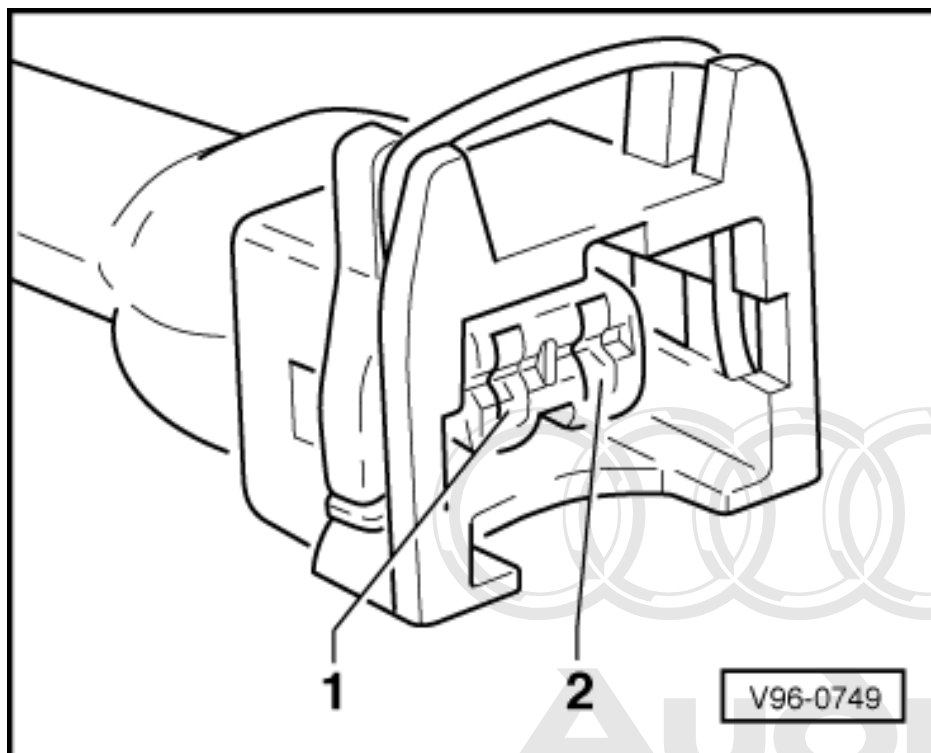
Testing internal resistance



- -> 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: 14 ... 20Ω
- If the specification is not attained, renew EGR valve -N18.

Testing voltage supply

- Pull connector off EGR valve -N18
=>Fitting locations overview, Page 35 .



- ➔ 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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

If the specification is not attained:

- Eliminate open circuit or short circuit using the current flow diagram.

Testing activation

- Fit connector for EGR valve -N18.
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Start final control diagnosis and activate EGR valve -N18
=> Page 16 .

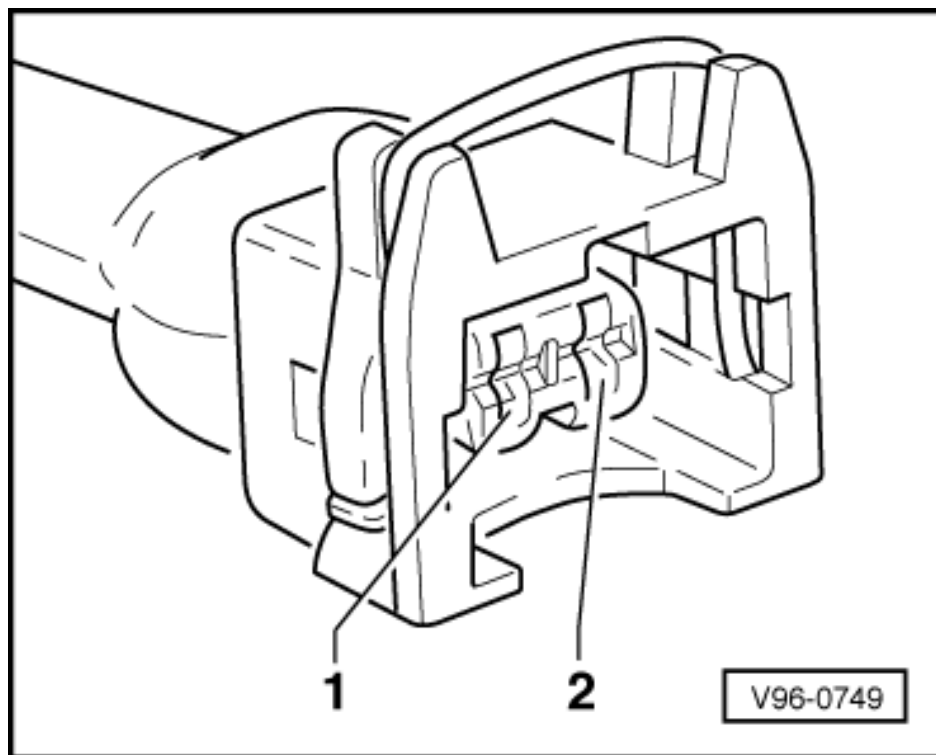
-> Indicated on display:

Final control diagnosis
Exhaust gas recirculation valve -N18

The valve should click.

If the valve does not click:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .



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

Connector for -N18 Contact	Test box V.A.G 1598/18 Socket
1	25

- Rectify any open/short circuit as necessary.

4.4 - Testing air mass meter -G70

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Testing operation

Notes:

- ♦ A second mechanic is required to note the readings on the tester when the vehicle is moving.
- ♦ Observe safety notes => Page 61 .
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 010, engine at idling speed=>Page 33 .

-> Indicated on display:

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

- Observe display in display zone 1.
 - Specification: 230 ... 370 mg/H (mg/stroke)
- If the specification is not attained, test exhaust gas recirculation
=> Page 74 .
- Accelerate vehicle in 3rd gear from about 1500 rpm using full throttle.
- Press PRINT key on V.A.G 1551 at about 3000 rpm.

-> Specification for display zone 4:

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

- 100 % (accelerator position)

If the specification is not attained:

- Repeat test and accelerate vehicle at full throttle.

-> Specification for display zone 3:

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

- 1800 ... 2050 mbar (charge pressure)

If the specification is not attained:

- Test charge pressure=>Page 61 .

-> Specification for display zone 1:

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

- > 750 mg/H (intake air mass)

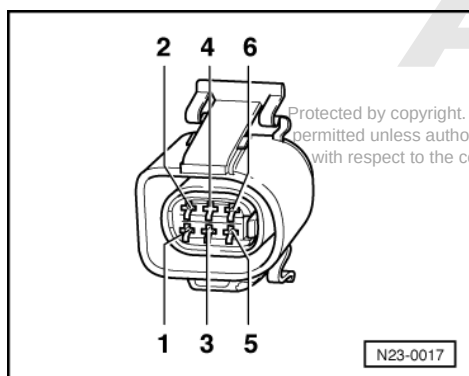
If the specification is not attained:

- Fit a new air mass meter -G70.

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

Testing voltage supply

- Switch off ignition.
- Unplug connector for air mass meter -G70
=>Fitting locations overview, Page 36 ,Item 16 .



- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect to contacts on connector using test leads from V.A.G 1594 A.



- Switch on ignition.

Connector for -G70 Contact	Test box V.A.G 1598/18 Socket
3 + earth	Battery voltage
3 + 5	Battery voltage
1 + earth	approx. 5 V
1 + 5	approx. 5 V

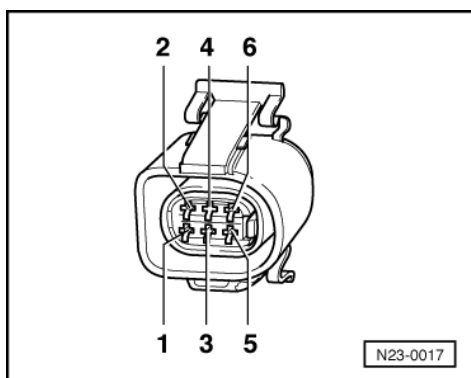
Protected by copyright. Copying or use for commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

If the specifications are not obtained:

- Check the wiring.

Testing wiring

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .

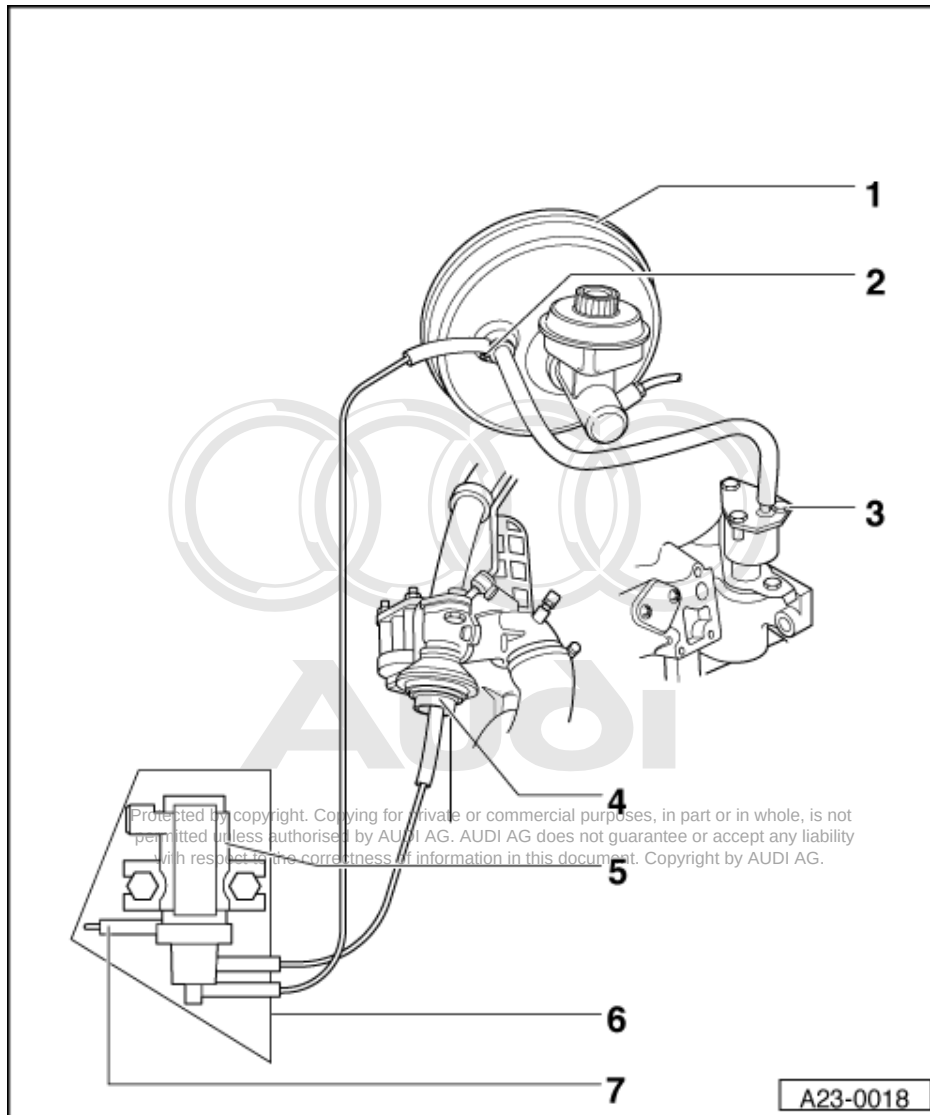


- -> Test for open circuit and short to positive or earth in the following wiring connections:

Connector for -G70 Contact	Test box V.A.G 1598/18 Socket
1	19
2	33
3	23, 45, 68
4	-
5	1, 24, 46
6	13

- Rectify any open/short circuit as necessary.

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 Exhaust gas recirculation valve -N18
- 6 Air cleaner
- 7 Vent connection
 - ♦ On air cleaner



5 - Checking control unit input values

5.1 - Checking control unit input values

5.2 - Checking Diesel direct injection system voltage supply

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

In order for relay -J249 to close, a voltage must be applied to the Diesel direct injection system control unit via terminal 15. This means that relay -J249 is only earthed (via the Diesel direct injection system control unit) if a voltage is applied to the control unit via terminal 15.

Note:

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

Special tools, testers and auxiliary items

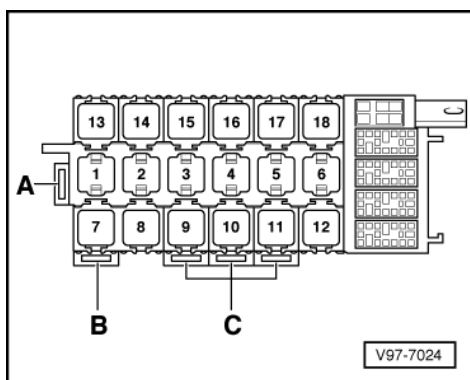
- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

Testing voltage supply via terminal 15 for Diesel direct injection system control unit -J248 and excess voltage protection relay -J249

Test requirement:

- Battery voltage not less than 12 V
- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- 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



- -> Unplug relay from relay position 14 on front additional relay carrier under dash panel.
- Switch on ignition.
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect it as follows:

Test box V.A.G 1598/18 Socket	Specification
38 + earth	approx. battery voltage

Position 14 on front additional relay carrier Contact	Specification
1 + earth	approx. battery voltage

If the specifications are not obtained:

- Check wiring.

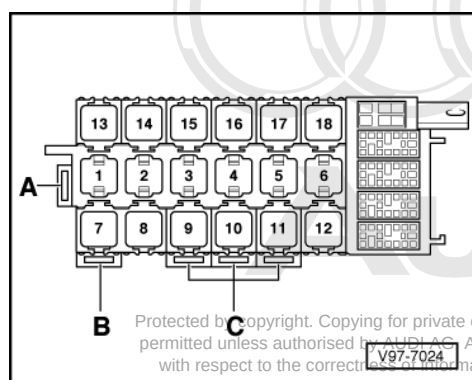
=> Current flow diagrams, Electrical fault-finding and Fitting locations

Testing earth activation for excess voltage protection relay

-J249

Requirements for test:

- Battery voltage not less than 12 V
- Voltage supply to terminal 15 okay
- Connector fitted to Diesel direct injection system control unit -J248
- Switch on ignition.



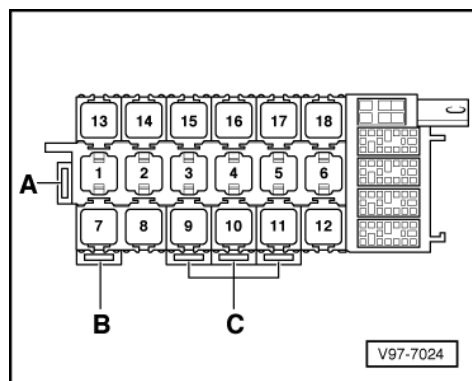
- -> Excess voltage protection relay -J249 at position 14 in the front additional relay carrier should pick up (i.e. click).

Note:

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

If the relay does not pick up:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60.
- Connect together sockets 1 and 42 on the test box using a test lead from V.A.G 1594 A.

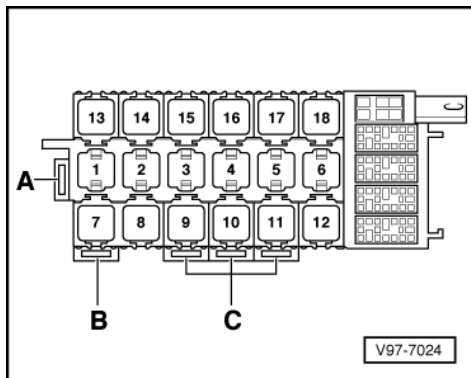




- Switch on ignition.
 - -> Excess voltage protection relay -J249 at position 14 in the front additional relay carrier should pick up (i.e. click).

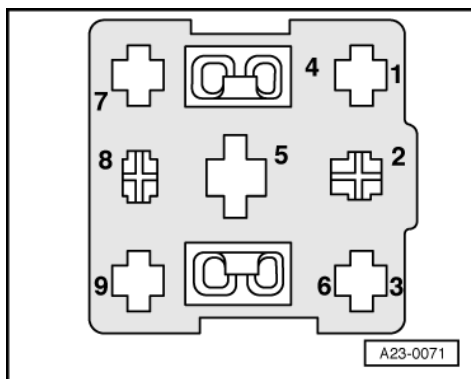
If the relay picks up now but not when the control unit is connected:

- Fit a new Diesel direct injection system control unit -J248
=>Page 58 .



If the relay does not pick up:

- Switch off ignition.
- -> Unplug relay from relay position 14 on front additional relay carrier under dash panel.



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

Position 14 on front additional relay carrier Contact	Test box V.A.G 1598/18 Socket
4	42

- Rectify any open/short circuit as necessary.

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

- If there is no open circuit and no short circuit, fit a new excess voltage protection relay -J249.

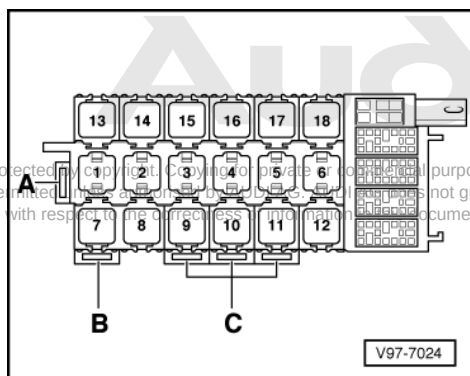
Testing voltage supply via terminal 30 for excess voltage protection relay -J249

Requirements for test:

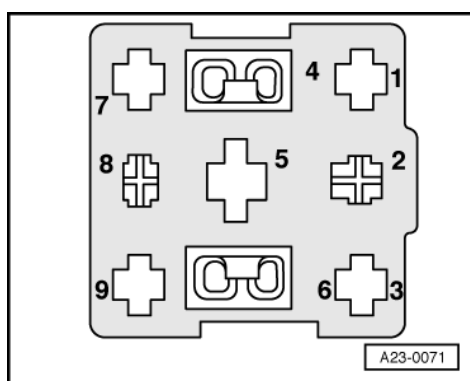
- Battery voltage not less than 12 V

- Switch off ignition.
- 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



- -> Unplug relay from relay position 14 on front additional relay carrier under dash panel.



- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect it as follows:

Position 14 on front additional relay carrier Contact	Specification
2 + earth	approx. battery voltage

If the specification is not attained:

- Check wiring.

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

If the specification is attained:

- Refit relay in relay position 14 on front additional relay carrier under dash panel.
- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60.
- Connect together sockets 1 and 42 on the test box using a test lead from V.A.G 1594 A.
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect it to the following sockets on the test box:

Test box V.A.G 1598/18 Socket	Specification
23 + earth	approx. battery voltage
45 + earth	approx. battery voltage



Test box V.A.G 1598/18 Socket	Specification
68 + earth	approx. battery voltage
1 + battery positive	approx. battery voltage
24 + battery positive	approx. battery voltage
46 + battery positive	approx. battery voltage

If the specifications are not obtained:

- Check wiring.

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

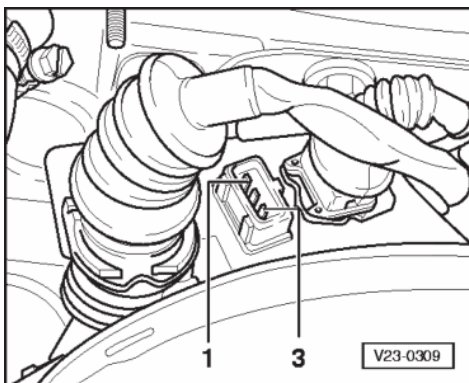
Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written permission of AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

5.3 - Testing engine speed sender -G28

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18
- Switch off ignition.
- Unplug connector for engine speed sender -G28
=>Fitting locations overview, Page 35 ,Item 8 .

Testing internal resistance



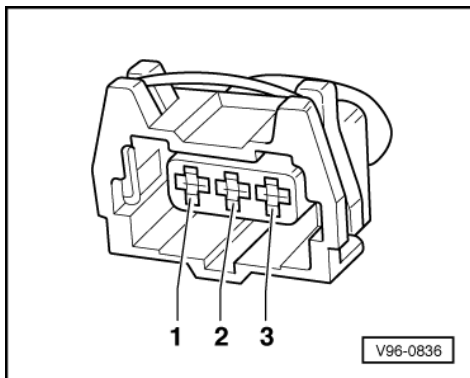
- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect to contacts 1 and 2 on the sender using test leads from V.A.G 1594 A.
 - Specification: approx. 1 kw
- If the specification is not obtained, renew engine speed sender -G28.

Testing wiring

Note:

A test is only necessary if fault 00513 ("Engine speed sender; No signal") is stored in the fault memory. The fault message "Implausible signal" is stored if the wiring is okay but the signal is incomplete or unclear.

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .



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

Connector for -G28 Contact	Test box V.A.G 1598/18 Socket
1	33
2	8
3	1, 24, 46

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

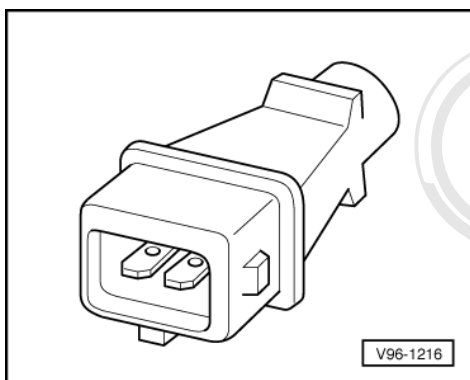
5.4 - Testing needle lift sender -G80

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

Special tools, testers and auxiliary item

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

- Switch off ignition.



- Unplug connector for needle lift sender -G80
=>Fitting locations overview, Page 35, Item 3.

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 ... 120 ω

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

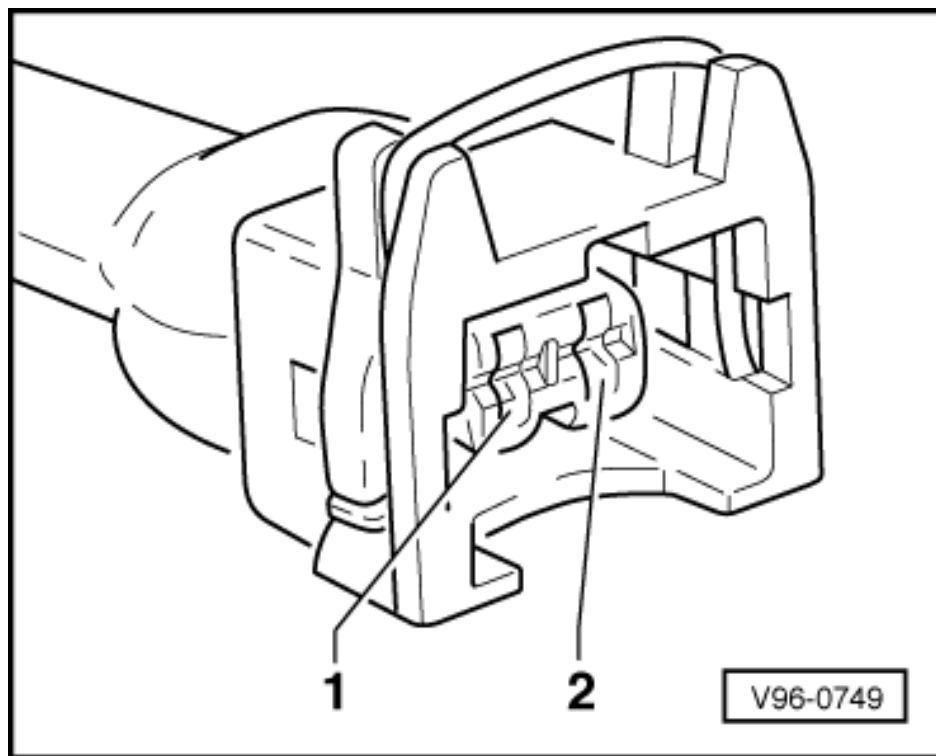


(If the engine is warm, the resistance may be up to 20Ω higher.)

- 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 1598/18 to connector for engine control unit => Page 60 .



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

Connector for -G80 Contact	Test box V.A.G 1598/18 Socket
1	12
2	11

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

5.5 - Testing coolant temperature sender -G62

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 007, engine cold and running at idling speed => Page 32 .

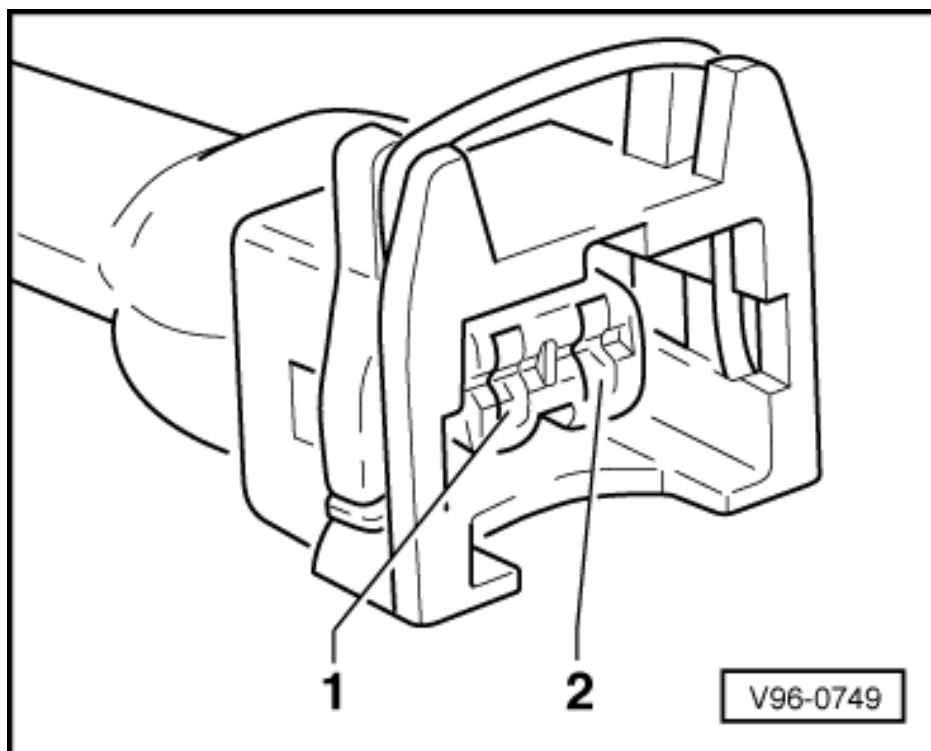
-> Indicated on display:

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

- Check display in display zone 4.
 - Specification: The temperature value should increase steadily.

If an implausible value is displayed in display zone 4:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Unplug connector for coolant temperature sender -G62
 =>Fitting locations overview, Page 35 , Item 6 .



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

Connector for -G62 Contact	Test box V.A.G 1598/18 Socket
1	14
2	33

- 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 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 accel-



erator 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.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1

Testing switches

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 006, engine at idling speed=>Page 23 .

-> Indicated on display:

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

- Check display in display zone 2.
 - Specification: 0 0 0
- Slowly depress brake pedal.

-> Indicated on display:

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

- Specification: 0 1 1
The two display values should change from 0 to 1.
Allow brake pedal to return slowly to its normal position.

-> Indicated on display:

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

- Specification: 0 0 0
The two display values should change back from 1 to 0.

If the display values do not change at the same time:

- Bring switching points into alignment by turning. If necessary, hold retainer clip in place with long-nosed pliers.

Notes:

- ♦ When the engine is running the return force of the brake pedal is much weaker than when the engine is switched off (because the brakes are servo-assisted). The push rods in the switches should be pressed fully into the switches even when the engine is running and the brake is not depressed.
- ♦ If the engine speed is regulated down sporadically (engine speed governing function), screw the switches further into the pedal bracket and repeat the test.

Reproduction, copying for non-commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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

- Check the wiring.

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

5.7 - Testing modulating piston movement sender -G149 and quantity adjuster -N146

The quantity adjuster is an electro-magnetic swivelling positioner which is controlled by the control unit via a directed duty cycle (on-off ratio). The eccentric shaft on the quantity adjuster moves the modulating piston on the high pressure piston and thereby regulates the quantity of fuel injected.

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

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

Testing operation

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 001, engine at idling speed=>Page 28 .

-> Indicated on display:

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

- Check display in display zone 4 (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.
- Switch off any electrical consumers that may be on (air conditioner, rear window heater, lights etc.).

-> Indicated on display:

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

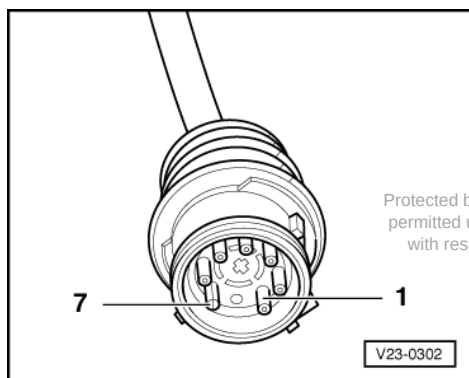
- Check display in display zone 3 (voltage supplied from modulating piston movement).
 - Specification: 1.250 ... 1.700 V

If the specification is not attained:

- Fit a new injection pump=>Page 47 .

Testing internal resistance

- Switch off ignition.
- Unplug connector for injection pump
=>Fitting locations overview, Page 35 , Item 5 .



Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



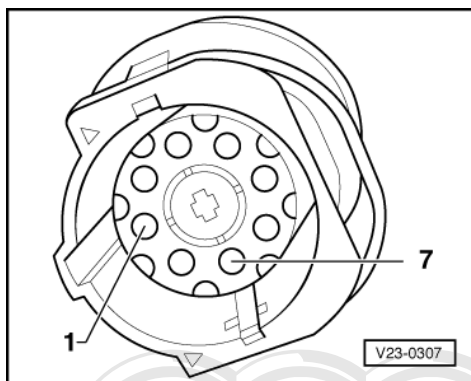
- -> Set hand-held multimeter V.A.G 1526 to resistance measuring range and connect it to the following contacts on the injection pump connector using test leads from V.A.G 1594 A:

Contact	To be tested	Specification
1 + 3	-G149	4.9 ... 7.5 ω
2 + 3	-G149	4.9 ... 7.5 ω
4 + 7	-N146	0.4 ... 1.1 ω

- If the specifications are not obtained, fit a new injection pump
=>Page **47** .

Testing voltage supply

- Switch off ignition.
- Disconnect connector on injection pump
=>Fitting locations overview, Page 23-3.
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current).
- Switch on ignition.



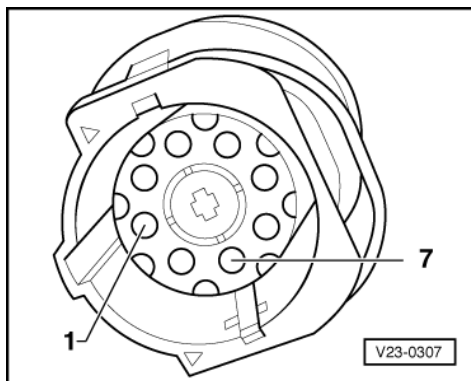
- -> Connect hand-held multimeter to the following contacts on the wiring harness connector using test leads from V.A.G 1594 A:

Contact	To be tested	Specification
1 + earth	-G149	approx. 2.5 V
2 + earth	-G149	approx. 2.5 V
7 + earth	-N146	approx. battery voltage

If the specifications are not obtained:

Testing wiring

- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized by AUDI AG. AUDI AG does not guarantee or accept any liability
With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page **60** respect to the correctness of information in this document. Copyright by AUDI AG.



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

Wiring harness connector Contact	Test box V.A.G 1598/18 Socket
1	29
2	52
3	7
4	4, 5, 49
7	23, 45, 68

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

5.8 - Testing accelerator position sender -G79

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

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

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 002, engine not running=>Page 30 .

-> Indicated on display:

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

- Check display in display zone 2 (accelerator pedal position).
 - Specification: 0.0 % (accelerator not depressed)
- Check display in display zone 3.
 - Specification:
 - 0 1 0 (accelerator not depressed)
 - 0 0 0 (accelerator depressed)
- Press accelerator pedal down slowly.

-> Indicated on display:

```
Read measured value block 2
0 rpm    100 %    0    0    0
18.4 5C
```

- Specification: The value in display zone 2 should increase steadily to 100 % (accelerator fully depressed).

On vehicles with an automatic gearbox the kickdown switch pressure point must be distinctly felt before the full throttle stop position is reached.

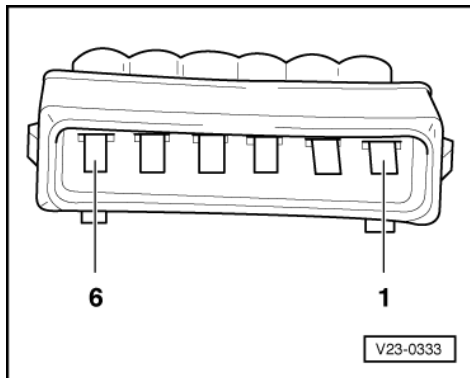
- If the specifications for the initial and/or final readouts are not obtained, adjust accelerator position sender -G79 => Page 45 .

If the display does not change or only changes irregularly:

- Switch off ignition.



- Disconnect connector for accelerator position sender -G79
=>Fitting locations overview, Page 36 .



- -> 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:

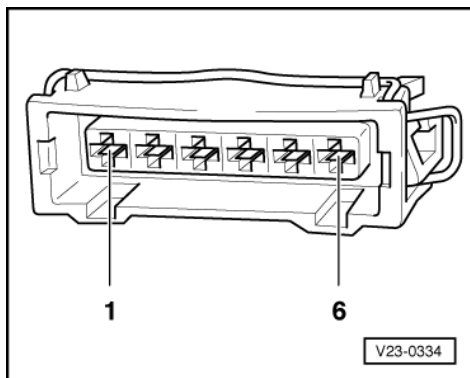
Contacts	Accelerator	Specification
1 + 3	Not depressed	0.8 ... 1.4 k Ω
2 + 3	Not depressed	0.8 ... 1.4 k Ω
4 + 6	Not depressed	0.8 ... 1.2 k Ω
	Depressed	$\infty \Omega$
5 + 6 1)	Not depressed	$\infty \Omega$
	Fully depressed	0.8 ... 1.2 k Ω

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the prior written authorisation by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- 1) Only on vehicles with automatic gearbox.

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

Testing voltage supply



- -> Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect it to contacts 2 and 3 on connector.
- Switch on ignition.
 - Specification: approx. 5 V

If the specification is attained:

- Check the wiring.

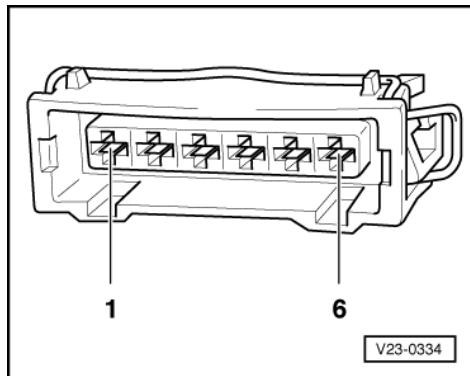
Testing wiring

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .

- 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

- Unplug connector for accelerator position sender -G79 (located in footwell on accelerator pedal).



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

Connector for -G79 Contact	Test box V.A.G 1598/18 Socket
1	15
2	57
3	55
4	65
6	1, 24, 46
5 1)	62

1) Only on vehicles with automatic gearbox.

- Rectify any open/short circuit as necessary.
- If the wiring is okay, fit a new Diesel direct injection system control unit -J248=>Page 58 .

6 - Testing auxiliary signals

6.1 - Testing auxiliary signals

6.2 - Testing signals from and to automatic gearbox

Special tools, testers and auxiliary items

- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.



A - Gearshift signal

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

Notes:

- ♦ A second mechanic is required to note the readings on the tester when the vehicle is moving.
- ♦ Observe safety notes => Page 61 .
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 009, engine at idling speed=>Page 23 .

-> Indicated on display:

Read measured value block 9			
1	2	3	4

- Check display in display zone 3.
 - Specification: 51 mg/H (mg/stroke)
- Accelerate the vehicle from a stationary position with full throttle, but without using kick-down.

Read measured value block 9			
1	2	3	4

- > Observe display zone 3 when vehicle changes into 2nd gear.
- Specification: The display value should briefly fall below 51 mg/H.

Note:

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

If the specification is not attained:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Test for open circuit and short to earth or positive in the following wiring connections:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Test box V.A.G 1598/18 Socket	Automatic gearbox control unit Contact
18	=> Current flow diagrams, Electrical fault-finding and Fitting locations binder

- Rectify any open/short circuit as necessary.

B - Accelerator pedal position signal

This signal is required for the calculation of gearshift points according to engine load.

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

Testing signal

=> Automatic Gearbox 097; Repair group 01; Self-diagnosis of automatic gearbox 097 Self-diagnosis of automatic gearbox 097

=> Automatic Gearbox 01N; Repair group 01; Performing self-diagnosis Performing self-diagnosis

C - Engine speed signal

This signal is required for smoothing out the gearshifts.

Testing signal

=> Testing engine speed signal, Page **102**.

=> Automatic Gearbox 097; Repair group 01; Self-diagnosis of automatic gearbox 097 Self-diagnosis of automatic gearbox 097

=> Automatic Gearbox 01N; Repair group 01; Performing self-diagnosis Performing self-diagnosis

D - Kick-down signal

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

Testing signal

=> Automatic Gearbox 097; Repair group 01; Self-diagnosis of automatic gearbox 097 Self-diagnosis of automatic gearbox 097

=> Automatic Gearbox 01N; Repair group 01; Performing self-diagnosis Performing self-diagnosis

6.3 - 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

Special tools, testers and auxiliary items

- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

Requirements for test:

- Air conditioner okay
- Air conditioner switched on
- No faults stored in fault memory

- Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability
- 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 **16**.

-> 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 1598/18 to connector for engine control unit => Page **60**.



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

Test box V.A.G 1598/18 Socket	Control unit for magnetic clutch Contact
28	=> Current flow diagrams, Electrical fault-finding and Fitting locations binder

- Rectify any open/short circuit as necessary.

6.4 - Testing speed signal

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

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

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

Notes:

- ♦ A second mechanic is required to note the readings on the tester when the vehicle is moving.
- ♦ Observe safety notes => Page 61 .
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 006, engine at idling speed=>Page 23 .

-> Indicated on display:

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

protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Take vehicle for a test drive.

Read measured value block 6	45 km/h	0	0	0	000000
255					

-> Indicated on display:

- Check display in display zone 1.
 - Specification: The current road speed should be displayed (compare with speedometer).

If the specification is not attained:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Test for open circuit and short to earth or positive in the following wiring connections:

Test box V.A.G 1598/18 Socket	Dash panel insert Contact
43	=> Current flow diagrams, Electrical fault-finding and Fitting locations binder

- Rectify any open/short circuit as necessary.

If no faults in the wiring are 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, and keep repeating the test until the cause of the problem has been identified.

6.5 - Testing clutch pedal switch -F36

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

Special tools, testers and auxiliary items

- ◆ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 006, engine not running=>Page 23 .

-> Indicated on display:

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

- Check display in display zone 2.
 - Specification: 0 0 0
- Depress clutch pedal.

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

- > Indicated on display:
- Specification: 1 0 0

If the specification is not attained:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Test for open circuit and short to earth or positive in the following wiring connections:

Test box V.A.G 1598/18 Socket	Clutch pedal switch Contact
17	=> Current flow diagrams, Electrical fault-finding and Fitting locations binder

- 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

- Rectify any open/short circuit as necessary.
- If the specification is not obtained, fit a new clutch pedal switch -F36 (located in footwell on clutch pedal).

6.6 - Testing cruise control system (CCS)

The CCS has no components of its own (except for the operating switch). All CCS functions are carried out by the Diesel direct injection system.

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .
- Read measured value block, Display Group 006, engine at idling speed=>Page 23 .

-> Indicated on display:

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

- Check display in display zone 4.
- Specification: 0

Note:

-> Indicated on display:

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

If a value of 255 appears in display zone 4:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express consent of AUDI AG. AUDI AG does not guarantee or accept any liability for the correctness of information in this document. Copyright by AUDI AG.

- Activate cruise control system=>Page 102 .

Vehicles with automatic gearbox

- Take the vehicle for a test drive and accelerate beyond 30 km/h once. Then leave the engine running and engage the gear selector lever in position 2, 3 or D.
- Apply the handbrake.

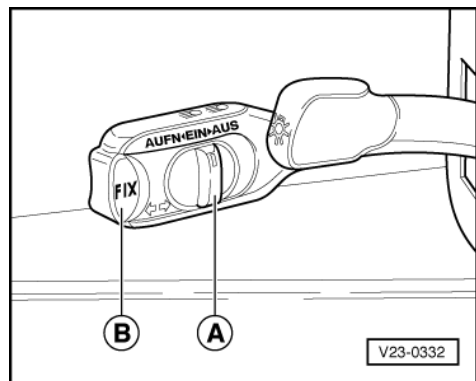
Note:

On vehicles with automatic gearbox the power supply for the CCS switch only cuts in when the road speed exceeds 30 km/h and when the selector lever is in position 2, 3 or D. The power supply is then maintained even during idling, as long as one of the drive positions (except 1 or R) is engaged.

All models

-> Indicated on display:

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



- -> Check display in display zone 3 for the various switch positions.

Test condition	Display zone 3	
	Injection system 1) Version 1	Version 2
Switch A engaged in "AUS" position	000 00	000000
Switch A just before "AUS" position	(Ignore)	000011
Switch A on "EIN"	000 01	000001
Switch A on "AUFN"	001 01	001001
Switch B pressed	000 11	000101
Brake depressed	010 01	010001
Clutch depressed	100 01	100001

- 1) Differences between injection systems=>Page 1 .

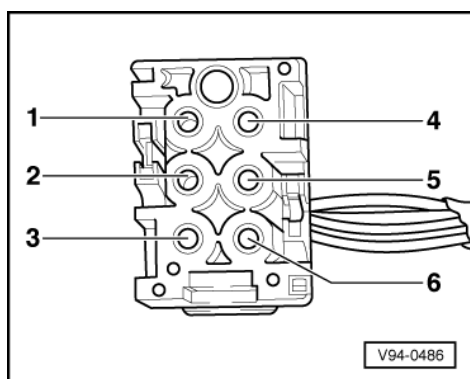
If the specifications are not obtained:

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the express written permission of Audi AG. Copyright by Audi AG.

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 66.

- Unplug connector from CCS switch

=> Electrical system; Repair group 96; Servicing cruise control system Servicing cruise control system



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

Connector on -E45 Contact	Test box V.A.G 1598/18 Socket
1	58
2	34
3	35
4	66
5 1)	To fuse 27
5 2)	To fuse 30
6	66

- 1) Vehicles with manual gearbox
 - 2) Vehicles with automatic gearbox
- Rectify any open/short circuit as necessary.



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

- If the wiring is okay, fit a new cruise control switch (CCS switch).

=> Electrical system; Repair group 96; Servicing cruise control system Servicing cruise control system

Activating cruise control system

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page **2**.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press key 1 twice for the function "Log-in procedure" and confirm entry with Q key.

-> Indicated on display:

Log-in procedure	HELP
Feed in code number XXXXX	

- Enter code number 11463 and confirm entry with Q 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.

6.7 - Testing engine speed signal

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

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

Special tools, testers and auxiliary items

- ♦ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

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:

- 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 yellow 26-pin connector.
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect between earth and contact 22 on yellow connector.
- Allow engine to run at idling speed.



Protected by copyright. Copying for private or commercial purposes in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

- 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 obtained:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Test for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/18 Socket	Yellow connector Contact
2	22

- If the wiring is OK, renew Diesel direct injection system control unit -J248.

Air conditioner

Protected by copyright. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or by any information storage or retrieval system, without prior permission in writing from Audi AG. Audi AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by Audi AG

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.

6.8 - Testing fuel consumption signal

This signal is required for the fuel consumption indicator in the dash panel insert.

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Adapter set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18

- 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 black 10-pin connector.
- Set hand-held multimeter V.A.G 1526 to voltage measuring range (20 V direct current) and connect between earth and contact 10 on black connector.
- Start the engine and vary the engine speed continuously between 1000 and 4000 rpm.
 - Specification: 0.3 ... 7.0 V (depending on engine speed)

If the specification is obtained:

- Test on-board computer using the Fault-Finding Programme.



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

If the specification is not attained:

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Test for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598/18 Socket	Black connector Contact
9	10

- Rectify any open/short circuit as necessary.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability for the correctness of information in this document. Copyright by AUDI AG.

6.9 - Testing self-diagnosis fault warning lamp -K83

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 2 .

Self-diagnosis fault warning lamp -K83 is only fitted on vehicles which have the following control unit identification codes:

-> Indicated on display:

028906021E	1.9l	R4	EDC
AG	D 52		
Coding 00000	WSC 00000		

or

-> Indicated on display:

028906021ET	1.9l	R4	EDC	00AG	XXXX
□					
Coding 00011	WSC 12345				

On all other vehicles the function is covered by glow period warning lamp -K29.

Testing

- With the ignition switched off, connect test box V.A.G 1598/18 to connector for engine control unit=>Page 60 .
- Connect sockets 46 and 48 on test box V.A.G 1598/18 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.

28 - Glow plug system

1 - Testing glow plug system

1.1 - Testing glow plug system

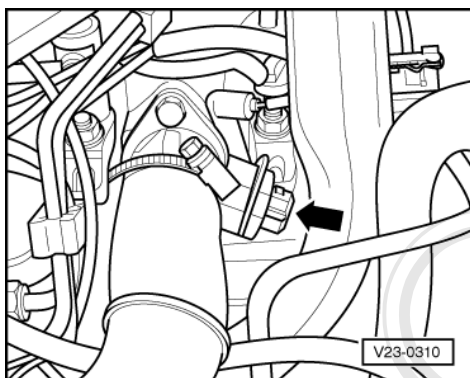
1.2 - Testing operation

Special tools, testers and auxiliary items

- ◆ Hand multimeter V.A.G 1526 or V.A.G 1526 A
- ◆ Adapter set V.A.G 1594 A

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.

- Pull glow plug connectors off 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 **106** .

1.3 - Checking glow plugs

Special tools, testers and auxiliary items

- ♦ Jointed spanner 3220
- ♦ 2 test leads with a diameter of at least 2.5 mm²
- 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**.

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Tightening torque

Component	Nm
Glow plugs	15

1.4 - Testing glow period warning lamp -K29

Special tools, testers and auxiliary items

- ♦ Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/1
- ♦ Adapter set V.A.G 1594 A
- ♦ Test box V.A.G 1598/18
- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page **2** .
- Perform final control diagnosis => Page **16** .

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 1598/18 to connector for engine control unit=>Page **60** .
- Connect the following sockets on test box V.A.G 1598/18 using test leads from V.A.G 1594 A:

Injection system1)	Test box V.A.G 1598/18	
	Socket	Socket
Version 1	26 or 27	46
Version 2	48	46

1) Differences between injection systems=>Page 1.

- 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.

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

- 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

Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.