Workshop Manual
OCTAVIA

1.9-ltr. / 66 kW (TDI) Engine
Fuel Injection and Glow Plug System

Service Department. Technical Information

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List of Supplements to Workshop Manual OCTAVIA

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1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System

Replaces List of Supplements - Edition: 09.03

Supplement	Edition	Subject	Article Number
	08.96	Basic Edition of Workshop Manual	S00.5111.50.20
1	05.97	Supplement to Basic Edition	S00.5111.51.20
2	03.98	Modifications for Vehicles ➤ 08.97	S00.5111.52.20
3	02.99	Modification of Fault Code	S00.5111.53.20
4	12.00	Modifications for Vehicles 08.00 ➤	S00.5111.54.20
5	09.03	Supplement to Repair Group 01 and 23	S00.5111.55.20
6	01.04	Supplement to Repair Group 01 and 23	S00.5111.56.20
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Contents

Self-diagnosis

Features of self-diagnosis

The diesel direct injection system control unit is equipped with a fault memory. The fault memory is designed as a permanent memory and as a volatile memory.

If faults occur in the monitored sensors or components, these are stored in the fault memory together with an indication of the fault type.

The engine control unit analyses this fault information and distinguishes the fault types ⇒ page 01-8, Fault Table, and stores these faults until the contents of the fault memory are erased.

Faults which occur only temporarily (sporadically), are displayed as „sporadic“ by the addition „/SP“. The cause of a sporadic fault may be, for example, a loose contact or a temporary open circuit in the wiring. If a sporadic fault no longer occurs within 50 engine starts, it is automatically erased from the fault memory.

The stored faults can be read out with the vehicle system tester V.A.G 1552 or V.A.G 1551, or also with VAS 5051 ⇒ page 01-5.

After any faults have been rectified, it is then necessary to erase the fault memory ⇒ page 01-6.

Notes:

- *The description which follows relates only to the vehicle system tester V.A.G 1552 using the programme card version 5.0.*
- *If “see info in literature” appears in the display of the vehicle system tester, look for the appropriate text in the fault table on the basis of the fault code.*
- *Use of the fault reader V.A.G 1551 (with programme card version 8.0) with integrated printer, or VAS 5051, is similar. Slight variations are possible in the readouts in the display.*

Technical data of self-diagnosis

Interrogating control unit version

The control unit version is displayed when the vehicle system tester V.A.G 1552 is connected and the engine electronics control unit is selected ⇒ page 01-2.

Functions available when using vehicle system tester V.A.G 1552

Please refer to the table below for the requirements necessary to enable you to select the desired functions.

Function	Condition	
	Engine not running, ignition on	Engine idling
01 Interrogate control unit version	yes	yes
02 Interrogate fault memory	yes[1)]	yes
03 Final control diagnosis	yes	yes
04 Basic setting	no	yes
05 Erase fault memory	yes	yes
06 End output	yes	yes
07 Code control unit	yes	no
08 Read measured value block	yes	yes

1) Only perform when ignition switched on if engine does not start (operate starter first of all for at least 6 seconds).

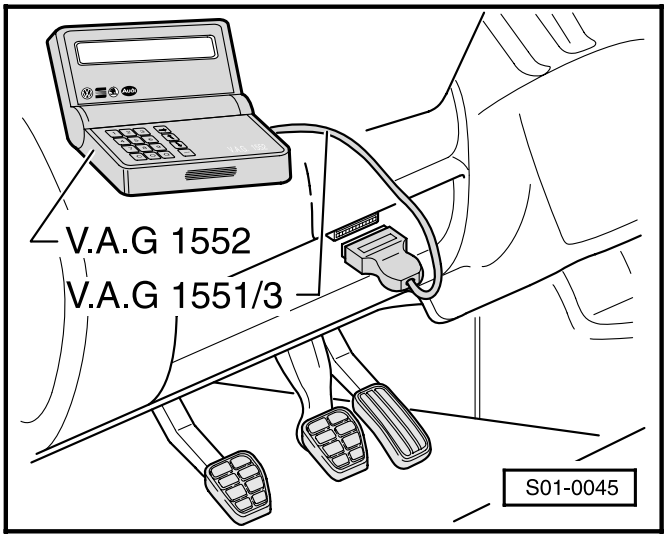
Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit

Special tools, testers and aids required

♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test conditions

- Battery voltage at least 11.5 V
- Fuse 12 o.k.
- Earth connections at gearbox and on left below battery o.k.



Test procedure

◄ - Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C.

After the vehicle system tester has been connected:

- Depending on the desired function, switch the ignition on or start the engine ⇒ page 01-2, table of „Available functions“.

If the readouts which appear in the display do not correspond to the description in the procedure, refer to the following notes:

Notes:

♦ *If „Error in data transmission“ is displayed because of an input error, disconnect cable at vehicle system tester, plug it in again and repeat the steps.*

Test of vehicle systems Control unit does not answer	HELP

Test of vehicle systems Error in establishing communication	HELP

Test of vehicle systems K wire not switching to earth	HELP

Test of vehicle systems K wire not switching to positive	HELP

◄ ♦ *If one of the following messages appears in the display, perform fault finding according to diagnostic cable fault finding programme:*

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder, or

⇒ Operating Instructions of vehicle system tester

Note:

Operate the vehicle system tester on the basis of the readout in the display.

Test of vehicle systems Enter address word XX	HELP

◄ Readout in display:

- Enter address word 01 for „Engine electronics“ and confirm the entry with the key Q.

038906018BQ 1.9 l R4 EDC G00SG 2112 →
Coding 00002 WSC 01234

◄ The control unit identification appears in the display, e.g.:

- 038906018BQ — Part no. of control unit part[1)]
- 1.9 l — Engine displacement
- R4 — Engine displacement version (4 cyl. in-line engine)
- EDC — Injection system (Electronic Diesel Control)
- G or no display — Vehicle with or without cruise control system
- 00 — Control unit mapping
- MG / AG — Manual gearbox / Automatic gearbox
- 2112 — Data status (software version) of control unit
- Coding 00002 — Coding variant of control unit
- WSC 01234 — Workshop code from the vehicle system tester V.A.G 1552 with which the last coding was performed

List of all control units

Part no. of CU[1)]	Software version	Starting date
038906018B	1002	➤ 08.97
038906018BC	1822	➤ 08.98
038906018BQ	2112	08.98 ➤ 04.99
038906018GM	2162	05.99 ➤ 07.00
038906012F	3313	08.00 ➤
038906012H	3315	08.00 ➤
038906012HA	4922	08.03 ➤

1) For current control unit version - spare parts catalogue

Notes:

If the control unit version displayed does not correspond to the vehicle, replace the control unit ⇒ page 23-20.

Incorrect coding of the engine control unit results in:

- *poor driveability (jerking when changing gears, load alteration shock etc.)*
- *Increase in fuel consumption*
- *Increase in pollution*

- *Storage of non-existent faults in fault memory*
- *Functions not being performed*
- *Reduction in life of automatic gearbox*

If the code does not match the corresponding version in the vehicle:

- Check coding of engine control unit ⇒ page 01-23, Coding engine control unit.

- Press → key.

Test of vehicle systems HELP Select function XX	◄ Readout in display:

- For further procedure ⇒ Repair descriptions.

Interrogating and erasing fault memory

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Interrogating fault memory

- Connect vehicle system tester V.A.G 1552 with cable and select engine electronics control unit (address word 01). Engine should be idling for this step.
  (Connecting vehicle system tester and selecting engine electronics control unit ⇒ page 01-2).

Only if the engine does not start:

- Switch ignition on.

Test of vehicle systems HELP Select function XX	◄ Readout in display:

- Enter 02 for the function „Interrogate fault memory“ and confirm the entry with the key Q.

X faults recognized!	◄ The number of stored faults or „No fault recognized!“ appears in the display.

If no fault is stored:

- Press → key.

Test of vehicle systems HELP Select function XX	◄ Readout in display:

- Enter 06 for the function „End output“ and confirm entry with the key Q.

If one or several faults are stored:

- → Press key.

Fault number: 00542 →	◄ Read-out of fault number on display, e.g.:

- → Press key.

Needle lift sender -G80 → Short-circuit to earth	◄ Fault source and fault type appear in the display, e.g.:

- → Press key.

The stored faults are displayed in sequence.

- → Press key.

Vehicle system test HELP Select function XX	◄ Read-out on display:

- Enter 06 for the function “end output” and confim entry with key Q.

- Rectify fault by referring to the fault table ⇒ page 01-8.

Note:

When carrying out test and removal and installation operations, faults, such as connectors unplugged, may also be detected by other control units. This is why, when the work is concluded, that it is necessary to interrogate and erase the fault memory on all control units. For this you must proceed as follows:

- Enter 00 twice for the address word “Automatic check sequence” and confirm entry with Q key. The -V.A.G 1552- sends all known address words in sequence.

Erasing fault memory

Test condition

- Rectifying fault

Note:

After fault elimination the fault memory must again as described be interrogated and subsequently erased.

For vehicles 08.03 ➤

Whenever the fault memory is erased, it is necessary to generate a readiness code ⇒ page 01-26.

- Connect vehicle system tester -V.A.G 1552- and select the engine electronics control unit (address word 01). The engine must be running in idle.
  (Connect vehicle system and select engine electronics control unit ⇒ page 01-2).

Test of vehicle systems HELP Select function XX	◄ Readout in display:

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

X faults recognized	◄ The number of stored faults appears in the display.

If one or several faults are stored:

The stored faults are displayed one after the other.

Test of vehicle systems HELP Select function XX	◄ After the stored faults have been displayed, the following readout appears:

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

Test of vehicle systems → Fault memory is erased	◄ Readout in display:

Note:

If you have switched off the ignition between „Interrogating fault memory“ and „Erasing fault memory“, the fault memory is not erased.

- Press the → key.
- Press the keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Carry out a road test. During the road test, once again interrogate the fault memory. No further faults should be displayed.

Fault table

Notes:

- *For vehicles 08.98 ➤, different fault codes with the same or similar texts are displayed. The required text is to be selected in the fault table according to the fault code.*
- *If the display of the vehicle system tester reads „Information in the literature“ the required text is to be found in the fault table according to the fault code.*
- *The fault table is ordered according to the fault code on the left.*
- *Explanations concerning the types of faults (e.g. Interruption or short-circuit to earth):*

  ⇒ Operating instructions for vehicle system tester

- *If components are output as faulty: First check all cables and connectors to these components as well as the earth connections according to the Current Flow Diagram. Replace the component only if this test does not reveal any fault. This applies in particular for faults that are output as „sporadically occurred“ (SP) faults.*

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
00513 **Engine speed sender -G28**	**16705**			
Implausible signal		♦ Bent or loose sensor washer ♦ Distance to speed sender/ sensor rotor too great ♦ Metallic swarf on engine speed sender -G28 ♦ Line interruption of screening ♦ -G28 defective	♦ Poor starting ♦ Irregular engine running, misfiring ♦ Increased idling speed ♦ Glow period indicator light flashes ♦ Reduced performance ♦ No display on rev counter ♦ Engine does not start	- Remove noise insulation and check sensor washer - Check engine speed sensor ⇒ page 23-41
No signal	**16706**	♦ -G28 defective ♦ Line interruption or short-circuit ♦ Line interruption of screening.		
00519 **Intake manifold sender -G71**	**17563**			
Short-circuit to positive		♦ Short-circuit to positive ♦ -G71 defective	♦ Poor performance	- Check intake manifold pressure ⇒ page 23-26
Line interruption/short-circuit to earth	**17564**	♦ Line interruption or short-circuit to earth ♦ -G71 defective		
Supply voltage	**17565**	♦ Line interruption or short-circuit		
	17566	♦ Line interruption or short-circuit		- Check sender -G71 - Check intake system for leaks ⇒ page 23-27

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00522 **Coolant temperature sender -G62**	**17663**			
Short circuit to earth		♦ -G62 faulty ♦ Cable has short circuit to earth	♦ Black exhaust when starting ♦ Engine preheater does not operate ♦ Preglowing always operates for about 20 seconds	- Test coolant temperature sender ⇒ page 23-43
Open/short circuit to positive	**17664**	♦ -G62 faulty ♦ Open circuit in wiring or cable has short circuit to positive		
00527 **Intake manifold temperature sender -G72**	**17568**			
Short circuit to earth		♦ -G72 faulty ♦ Cable has short circuit to earth	♦ Engine preheater does not operate	- Test intake manifold temperature sender ⇒ page 23-25
Open/short circuit to positive	**17569**	♦ -G72 faulty ♦ Open circuit in wiring or short circuit to positive		
00532 **Supply voltage**	**18008**			
Implausible signal as appropriate		♦ Control unit was connected when ignition on		- Erase fault memory and continue checking vehicle
Voltage supply tml. 15 Voltage too low		♦ Open circuit in wiring or short circuit ♦ Voltage not present when ignition on (terminal 15)	♦ Engine does not start ♦ Engine stops	- Test voltage supply of diesel direct injection system control unit ⇒ page 23-38 - Test voltage supply of terminal 15 ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
		♦ Diesel direct injection system control unit -J248 faulty ♦ Voltage supply relay terminal 30 (J322) faulty		- Replace control unit ⇒ page 23-20 - Test voltage supply of diesel direct injection system control unit ⇒ page 23-38

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00539 **Fuel temperature sender -G81**	**17570**			
Short circuit to earth		♦ -G81 faulty ♦ Cable has short circuit to earth	♦ Reduced output	- Test fuel temperature sender ⇒ page 23-30
Open/short circuit to positive	**17571**	♦ -G81 faulty ♦ Open circuit in wiring or short circuit to positive		
		♦ Connector for injection pump separated	♦ Several faults stored ♦ Engine stops	- Check plug connection for injection pump
00542 **Needle lift sender -G80**	**17653**			
Short circuit to earth		♦ -G80 faulty ♦ Open circuit in wiring or short circuit	♦ Glow indicator lamp flashes ♦ Rough engine running ♦ Reduced output	- Test needle lift sender ⇒ page 23-42
Implausible signal	**17654**	♦ Fuel supply (was) interrupted: tank has run empty, feed line or filter blocked, system drawing in air	♦ Fault 00550 Commencement of injection control possible ♦ Misfiring, jerking	- Check fuel system
		♦ (Sporadic) open circuit in wiring to fuel cut-off valve	♦ Engine stops ♦ Misfiring	- Check cable connection and plug connection at injection pump
		♦ Sender plate of engine speed sender bent or loose	♦ Misfiring at exactly 3000 rpm	- Take off oil pan and inspect sender plate
		♦ -G80 faulty	♦ Misfiring, jerking (particularly at high revs)	- Replace needle lift sender
		♦ Injection pump faulty	♦ Fault 01268 quantity adjuster control difference stored ♦ Irregular engine running, misfiring ♦ No throttle response after overrun	- Replace injection pump
Open/short circuit to positive	**17655**	♦ -G80 faulty ♦ Sporadic open circuit in wiring (cable break)	♦ Glow indicator lamp flashes ♦ Misfiring, jerking ♦ Reduced output	- Test needle lift sender ⇒ page 23-42

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00545 **Engine/gearbox electrical connection** [1]	-	♦ Open circuit in wiring or short circuit	♦ Hard gearshifts	- Test signals from/to automatic gearbox A - Signal for gearshift
00550 **Commencement of injection control** Control difference	**17656**	♦ Commencement of delivery not o.k.	♦ Poor performance at higher revs ♦ Engine difficult to start	- Test and set commencement of injection ⇒ page 23-13
		♦ Adjustment travel of injection pump blocked (dirt, swarf)	♦ Poor performance at higher revs	- Test injection timing control range ⇒ page 23-28
		♦ Engine was stalled (within the last 50 starts)		- Erase fault memory, continue checking vehicle
		♦ Fuel feed (was) interrupted: tank has run empty, feed line or filter blocked, system drawing in air	♦ Fault 00542 Needle lift sender implausible signal may be stored	- Check fuel system
		♦ Open circuit in wiring to commencement of injection valve -N108	♦ Engine clatters when idling as commencement of injection constantly ”advanced”	- Test commencement of injection valve ⇒ page 23-29
			♦ Several faults may be stored	- Test fuse
		♦ Commencement of injection valve -N108 worn	♦ No constant commencement of injection possible at ”Basic setting” (display block 2 varies over more than 10 readouts) ♦ Irregular engine running, poor performance	- Replace commencement of injection valve

[1] Not available at present.

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00553 **Air mass meter -G70** Implausible signal	**16485**	♦ Engine was stalled (within the last 50 starts)		- Erase fault memory, continue checking vehicle
		♦ Battery weak	♦ Poor performance ♦ Air mass constantly indicated in measured value block	- Test battery
		♦ Sporadic open circuit in wiring (cable break) to needle lift sender -G80	♦ Misfiring, jerking ♦ Fault 00542 Needle lift sender implausible signal possible or open/short circuit to positive	- Test needle lift sender ⇒ page 23-42
		♦ Air filter blocked ♦ Vacuum hoses of exhaust gas recirculation incorrectly connected or mechanical EGR valve constantly open	♦ Irregular idling, poor performance	- Inspect intake system - Inspect vacuum hoses ⇒ page 23-37
		♦ Air mass meter faulty	♦ Poor performance, jerking	- Test air mass meter ⇒ page 23-35
Open/short circuit to earth	**17552**	♦ -G70 faulty ♦ Open circuit in wiring or short circuit to earth	♦ Reduced output ♦ Black exhaust possible when accelerating from low revs	
Short circuit to positive	**17553**	♦ -G70 faulty ♦ Open circuit in wiring or short circuit to positive		
Supply voltage	**17554**	♦ Open circuit in wiring or short circuit		
00575 **Intake manifold pressure** Control difference if appropriate **Charge pressure** Control difference	**17958**	♦ Hoses wrongly connected, not fitted on, blocked, leaking ♦ Turbocharger vacuum unit faulty ♦ Charge pressure control solenoid valve -N75 faulty	♦ Sudden drop in power ♦ Reduced output	- Test charge pressure ⇒ page 23-22 - Inspect charge pressure hoses ⇒ page 23-27

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
00625 **Speed signal** Implausible signal If necessary **Vehicle speed signal** Implausible signal	**16885**	♦ Line interruption between speedometer sender -G22 and dash panel insert ♦ -G22 defective ♦ Speedometer -G21 defective ♦ Line interruption between dash panel insert and engine control unit	♦ CCS not operational ♦ Air conditioning not operational ♦ Possible load alteration shock	- Check speed signal ⇒ page 23-52 - Check speedometer sender ⇒ Electrical System; Repair Group 90
Vehicle speed signal Signal too great	**17948**			
00626 **Glow period warning lamp -K29** Short-circuit to positive	**18024**	♦ Short-circuit to positive	♦ Glow period warning lamp not operational	
Line interruption/short-circuit to earth	**18025**	♦ Line interruption ♦ Bulb defective ♦ Short-circuit to earth	♦ Glow period warning lamp not operational ♦ Glow period warning lamp lights up constantly	- Check glow period warning lamp ⇒ page 28-2
00668 **Onboard voltage, terminal 30** Implausible signal	**18009**	♦ Diesel direct injection system relay -J322 jams	♦ Engine does not start (safety deactivation)	- Test voltage supply for diesel direct injection system ⇒ page 23-38
00671 **Cruise control system switch -E45** Undefined switch status	**-**	♦ E45 defective ♦ Line interruption or short-circuit	♦ Cruise control system not operational	- Check cruise control system ⇒ page 23-55 - Reading measured value block 6 ⇒ page 01-35

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00741 **Brake pedal monitoring**	-			
Implausible signal		♦ Switch incorrectly set ♦ Open circuit in wiring ♦ -F or -F47 faulty ♦ Fuse faulty ♦ Both brake lights faulty	♦ Preglow indicator lamp flashes ♦ Fuse or brake light faulty	- Test -F and -F47 and set ⇒ page 23-44 - Test fuse and brake light
00765 **Modulating piston movement sender -G149**	**17762**	♦ 10-pin connector for injection pump separated ♦ Injection pump faulty ♦ Open circuit in wiring or short circuit	♦ Several faults stored ♦ Engine stops ♦ Drivability problems ♦ Engine stops	- Inspect plug connection of injection pump - Test modulating piston movement sender ⇒ page 23-45
00777 **Accelerator pedal position sender -G79**	**18039**		♦ Speed governed to approx. 1100 rpm as safety measure ♦ No throttle response ♦ Preglow indicator light flashes ♦ Fast idling speed	- Test accelerator pedal position sender ⇒ page 23-47
Signal too large		♦ Open circuit in wiring ♦ -G79 faulty (idling switch)		
Voltage supply	**18040**	♦ Open circuit in wiring or short circuit		
Implausible signal as appropriate	**18047**	♦ Open circuit in wiring ♦ -G79 faulty (idling switch)		
Accelerator pedal position sender 1/2 -G79+-G185 [1] Implausible signal				
Short circuit to positive	-	♦ Short circuit to positive ♦ -G79 faulty		
01044 **Engine control unit incorrectly coded**	**18020**	♦ Invalid control unit coding	♦ Preglow indicator light flashes	- Code control unit ⇒ page 01-23

[1] Incorrect fault text readout. The correct readout is: Accelerator pedal position sender -G79

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
01117 **Load signal for generator tml. DF**	**17911**			
Implausible signal		♦ Line interruption between AC generator and diesel direct injection system control unit -J248- ♦ AC generator defective ♦ Voltage regulator on AC generator defective	♦ Auxiliary heater not operational	- Check wiring ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting locations - Check AC generator Repair Group 27; AC generator - Reading measured value block, display group 016 ⇒ page 01-37
01180 **Engine/air conditioning compressor electrical connection**	**-**			
Short-circuit to positive		♦ Short-circuit in the wiring	♦ Reduced vehicle acceleration, when the air conditioning system is switched on	- Testing signals from/to the air conditioning system ⇒ page 23-49.
01193 **Low heat output relay -J359**	**19460**			
Line interruption or short-circuit to earth		♦ Line interruption	♦ Engine preheating not operational	- Check wiring ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting locations
		♦ Low heat output relay -J359 defective	♦ Engine preheating is on	- Check low heat output relay ⇒ page 01-18, Actuator diagnosis
		♦ Short-circuit to earth		
Short-circuit to positive	**19459**	♦ Short-circuit to positive	♦ Engine preheating not operational	

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
01194 **High heat output relay -J360**	**19462**			
Line interruption or short-circuit to earth		♦ Line interruption	♦ Engine preheating not operational	- Check wiring ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
		♦ High heat output relay -J360 defective ♦ Short-circuit to earth	♦ Engine preheating is on	- Check high heat output relay ⇒ page 01-18, Actuator diagnosis
Short-circuit to positive	**19461**	♦ Short-circuit to positive	♦ Engine preheating not operational	
01237 **Fuel shut-off valve -N109**	**17945**			
Mechanical fault or Malfunction		♦ -N109 defective, leaking or jammed	♦ Reduced performance ♦ Engine stoppage	- Check -N109 ⇒ page 01-18, Actuator diagnosis - Check wiring ⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
Line interruption/short-circuit to earth	**17946**	♦ -N109 defective ♦ Line interruption or short-circuit to earth	♦ Engine stoppage	
01262 **Charge pressure solenoid valve -N75**	**17954**			
Short-circuit to positive		♦ Short-circuit to positive	♦ Reduced performance ♦ Charge pressure too low	- Check charge pressure solenoid valve ⇒ page 23-24
Short-circuit to earth	**17955**	♦ Short-circuit to earth	♦ Reduced performance ♦ Charge pressure too high	
Line interruption/short-circuit to earth	**17957**	♦ Line interruption ♦ Solenoid valve defective	♦ Reduced performance ♦ Charge pressure too low	

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
01265 **Exhaust gas recirculation valve -N18**	**17810**			
Short-circuit to positive		♦ Short-circuit to positive	♦ No exhaust gas recirculation	
Line interruption/short-circuit to earth	**17849**	♦ Line interruption ♦ Solenoid valve defective	♦ No exhaust gas recirculation	- Check exhaust gas recirculation valve -N18 ⇒ page 23-24
		♦ Short-circuit to earth	♦ Too much exhaust gas recirculation ♦ Reduced performance, black smoke	
01266 **Glow plug relay -J52**	**18026**			
Short-circuit to positive		♦ Short-circuit to positive	♦ Glow plug system not operational	- Check glow plug relay -J52
Line interruption/short-circuit to earth	**18027**	♦ Line interruption ♦ Relay defective	♦ Glow plug system not operational	⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting Locations
		♦ Short-circuit to earth	♦ Glow plug system not operational	
01268 **Metering adjuster -N146**	**17969**			
Control difference (deviation)		♦ Injection pump defective, leaking ♦ Line interruption or short-circuit	♦ Incorrect driving behaviour ♦ Engine stoppage	- Check metering adjuster -N146 ⇒ page 23-45 - Replace injection pump ⇒ page 23-8
upper limit value	**17970**	♦ Metering mechanism adjusted	♦ Jerking, poor performance	
lower limit value	**17971**	♦ Metering mechanism adjusted	♦ Black smoke ♦ Irregular engine running	

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
01269 **Commencement of injection valve -N108**	**17659**			
Short-circuit to positive		♦ Short-circuit to positive	♦ Engine jerks when idling because commencement of injection is constantly adjusted to “advance”.	
Line interruption/short-circuit to earth	**17660**	♦ Valve defective	♦ Engine jerks when idling because commencement of injection is constantly adjusted to “advance”.	- Check commencement of injection valve ⇒ page 23-29
		♦ Line interruption (fuse)	♦ Possible that several faults are stored	- Check fuse
		♦ Short-circuit to earth	♦ Poor performance because commencement of injection is constantly adjusted to “late”	- Check commencement of injection valve ⇒ page 23-29
For vehicles 08.97 ➤ **01282** **Variable intake manifold flap change-over valve -N239**	**19561**			
Line interruption/short-circuit to earth		♦ Line interruption ♦ Variable intake manifold flap change-over valve defective	♦ Hard engine knock	- Check Variable intake manifold flap change-over valve -N239 ⇒ page 23-57
Short-circuit to positive	**19560**	♦ Short-circuit to positive		

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
16500 **Coolant temperature sender -G62** Implausible signal	-	♦ Sender for coolant temperature -G62 supplies implausible signal caused by loose contact or corrosion due to humidity in the connector	♦ Cold-start difficulties at very low temperatures ♦ Poor driveability during warm-up ♦ Increase in fuel consumption ♦ Increased emission levels	- Reading measured value block, display group 007 ⇒ page 01-51 - Check -G62 ⇒ page 23-43
		♦ Signal input in engine control unit defective (control unit defective		- Replacing engine control unit ⇒ page 23-20
		♦ Coolant regulator defective (thermostat)		- Check coolant regulator ⇒ 1.9 l/66 kW (TDI) Engine, Mechanical Components; Repair Group 19
16955 **Brake light switch -F** Implausible signal	-	♦ Brake light defective ♦ Line interruption or short-circuit to positive or earth between brake light switch and engine control unit	♦ Brake light does not light up ♦ Engine speed fluctuations during braking	- Check brake light switch and brake pedal switch ⇒ page 23-44
17811 **Exhaust gas recirculation system**	-	♦ Exhaust gas recirculation valve -N18- defective	♦ Exhaust gas recirculation system not operational	- Check exhaust gas recirculation solenoid valve ⇒ page 01-18, Actuator diagnosis
Control deviation		♦ Exhaust gas recirculation potentiometer -G212- defective	♦ Mixture adaptation not operational	- Check exhaust gas recirculation valve ⇒1.9 l/66 kW (TDI) Engine, Mechanical Components; Repair Group 26

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
17931 **Crash signal of airbag CU** Implausible signal	-	♦ Fault in airbag system	♦ Airbag warning light comes on	- Check airbag ⇒ Body Work; Repair Group 01
17964 **Charge pressure control** Regulating limit not reached	-	♦ Fault in charge pressure control ♦ -N75 defective	♦ Incorrect driving behaviour ♦ Reduced performance	- Check charge pressure control solenoid valve -N75 ⇒ page 01-18, Actuator diagnosis - Check charge pressure control ⇒ 1.9 l/66 kW (TDI) Engine, Mechanical Components; Repair Group 21
17965 **Charge pressure control** Regulating limit exceeded	-	♦ Fault in charge pressure control ♦ -N75 defective	♦ Incorrect driving behaviour ♦ Reduced performance	- Check charge pressure control solenoid valve -N75 ⇒ page 01-18, Actuator diagnosis - Check charge pressure control ⇒ 1.9 l/66 kW (TDI) Engine, Mechanical Components; Repair Group 21
17977 **Cruise control system switch (CCS) -E45** Implausible signal	-	♦ Cruise control system switch defective ♦ Line interruption	♦ Cruise control system not operational	- Check cruise control system ⇒ page 23-54 - Reading measured value block 6 ⇒ page 01-35

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
17978 **Engine control unit blocked**	-	♦ Manipulation attempt ♦ Start attempt with an adapted ignition key ♦ Engine control unit not adapted to immobiliser control unit	♦ Engine starts and stops immediately	- Adapt engine control unit to immobiliser ⇒ Binder: Electrical system; Repair Group 90
		♦ Short-circuit in communication cable ♦ Fault in the immobiliser system		- Check immobiliser ⇒ Binder: Electrical system; Repair Group 90
		♦ Immobiliser control unit defective/missing ♦ Engine control unit wrongly coded		- Code engine control unit ⇒ page 01-23
For vehicles 08.97 ➤ **18034** **Data bus drive** Missing message from transmission CU	-	♦ Databus lines to automatic transmission control unit interrupted	♦ Poor driveability (jerking when changing gears, load alteration shock etc.)	- Check data bus ⇒ page 23-55.3
		♦ Fault in the system of the automatic transmission		- Check automatic transmission control unit ⇒ Binder: Automatic transmission
18044 **Data bus drive** Missing message from Airbag CU	-	♦ Databus lines defective ♦ Fault in ABS system	♦ Incorrect driving behaviour	- Check data bus ⇒ page 23-55.3
18050 **Read out fault memory of airbag control unit**	-	♦ Fault in airbag system	♦ Warning light for airbag comes on	♦ Check airbag ⇒ Body Work; Repair Group 01

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
18058 **Data bus drive** Missing message from instrument cluster	-	♦ Databus lines defective ♦ Incorrect or defective dash panel insert ♦ Incorrect or defective engine control unit	♦ Poor driveability	- Check data bus ⇒ page 23-55.3
18061 **Read out fault memory of ABS control unit**	-	♦ Fault in ABS control unit	♦ No vehicle dynamics control ♦ TCS not operational ♦ MSR not operational	- Check ABS control unit ⇒ Binder: Chassis; Antilock Brake System
18062 **Read out fault memory of instrument cluster**	-	♦ Oil level/oil temperature sender -G266 defective	♦ Warning light for oil level comes on	- Check oil level/oil temperature sender -G266 ⇒ Binder: Electrical System; Repair Group 90
18065 **Air conditioning input/output** Short-circuit to positive	-	♦ Short circuit in wiring	♦ Reduced performance	- Check air conditioning compressor engagement ⇒ page 01-18, Actuator diagnosis
18090 **Data bus drive** Implausible signal from ABS control unit	-	♦ Databus lines to ABS control unit interrupted	♦ No vehicle dynamics control ♦ TCS not operational ♦ MSR not operational	- Check data bus ⇒ page 23-55.3
		♦ Fault in ABS system		- Check ABS control unit ⇒ Binder: Chassis; Antilock Brake System

Readout on V.A.G 1552 Fault number old	new	Possible cause of fault	Possible effects	Rectifying fault
For vehicles 08.97 ➤				
18259	**18057**			
Data bus drive				
Missing message from ABS CU		♦ Databus lines to ABS control unit interrupted	♦ No vehicle dynamics control	- Check data bus ⇒ page 23-55.3
		♦ Fault in ABS system		- Check ABS control unit ⇒ Binder: Chassis; Antilock Brake System
For vehicles 08.97 ➤				
18262	**18056**			
Data bus drive		♦ Databus lines to automatic transmission or ABS control unit interrupted	♦ Poor driveability (jerking when changing gears, load alteration shock etc.)	- Check data bus ⇒ page 23-55.3
Hardware defective or defective		♦ Fault in automatic transmission or ABS system	♦ Mixture adaptation not operational	- Check ABS control unit ⇒ Binder: Chassis; Antilock Brake System - Check automatic transmission control unit ⇒ Binder: Automatic transmission
19458	-			
Kick-down switch F8				
Implausible signal		♦ Accelerator pedal position sender -G79 defective	♦ Shifting points for automatic gearbox N.O.K.	- Check accelerator pedal position sender -G79 ⇒ page 23-47
65535	**16989 17795 18048**			
Control unit defective		♦ Engine control unit internally defective	♦ Poor driveability ♦ Engine stoppage ♦ Glow period indicator light flashes	- Replace engine control unit ⇒ page 23-20

Actuator diagnosis

Performing actuator diagnosis

With the actuator diagnosis the following parts are activated in the sequence indicated:

1. Commencement of injection valve (N108)
2. Exhaust gas recirculation valve (N18)
3. AC compressor engagement
4. Fuel shut-off valve (N109)
5. Charge pressure control solenoid valve (N75)
6. Glow plug relay (J52)
7. Glow period warning lamp (K29)
8. Low heat output relay (J359) [1)]
9. High heat output relay (J360) [1)]
10. Fault lamp [2)]

[1)] Only for vehicles with special equipment

[2)] For vehicles as of 08.03.

Test preconditions for vehicles with air conditioning

- Vehicle at room temperature (at least + 15 °C)
- Air conditioning switched on
- Lowest temperature and highest blower speed preselected

Special tools, aids and testers required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit (address word 01). The engine must be running in idle ⇒ page 01-2).

Vehicle system test Select function XX	HELP

◄ Read-out on display:

- Press keys 0 and 3 for the function „Final control diagnosis“.

Test of vehicle systems Q 03 - Final control diagnosis	◄ Readout in display:

- Confirm the entry with the key Q.

Final control diagnosis → Start of injection valve -N108	◄ Readout in display:

When the valve is actuated, this results in a clearly audible change in the combustion noise (diesel noise).

If no change in the combustion noise can be heard:

- Test injection timing device control range ⇒ page 23-28.

- Press the → key.

Final control diagnosis → EGR valve -N18	◄ Readout in display:

The valve should click.

Note:

The clicking of the valve cannot be heard because of the engine noise and should therefore be felt by touching.

If the valve does not click:

- Test EGR valve ⇒ page 23-34.

- Press the → key.

Final control diagnosis → AC compressor cut-off	◄ Readout in display:

What is tested is the AC compressor cut-off.

The test step is also displayed in the case of vehicles without air conditioning.

The AC compressor should stop within 5 seconds (visual inspection with electric torch), and then start and stop again approximately every 5 seconds.

If the AC compressor is not switched off:

- Test AC compressor cut-off ⇒ page 23-49.

- Press the → key.

Final control diagnosis → Fuel cut-off valve -N109	◄ Readout in display:

The engine should stop.

If the engine does not stop:

- Switch off the ignition.
- Unscrew fuel cut-off valve and clean any metal swarf and dirt.
- Repeat final control diagnosis; if the engine again does not stop, replace fuel cut-off valve.
- Press the → key.

Final control diagnosis → Charge pressure control solenoid valve -N75	◄ Readout in display:

The solenoid valve should click.

Note:

It is very difficult to hear the clicking of the valve and it should therefore be checked by touching.

If the solenoid valve does not click:

- Test charge pressure control solenoid valve ⇒ page 23-24.
- Press the → key.

Final control diagnosis → Glow plugs relay -J52	◄ Readout in display:

The relay should click.

Because of the high power consumption of the glow plugs, it is also possible to check that the relay switches on and off by observing how the interior light becomes dimmer and then brighter.

If the relay does not click:

- Test glow plugs relay

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

- Press the → key.

Final control diagnosis → Glow period warning light -K29	◄ Readout in display:

The warning light should flash.

If the warning lamp does not flash:

- Check glow period warning lamp
  ⇒ page 28-2.

- → Press key.

Actuator diagnosis → Low heat output relay -J359	◄ Read-out on display:

The relay valve must click.

If the relay does not click:

- Check low heat output relay:

⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting locations.

- → Press key.

Actuator diagnosis → High heat output relay -J360	◄ Read-out on display:

The relay valve must click.

If the relay does not click:

- Check low high heat output relay:

⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting locations.

- → Press key.

Actuator diagnosis → Fault lamp	◄ Read-out on display:

The fault lamp must flash.

If the fault lamp does not flash:

- Check fault lamp

⇒ Binder: Current Flow Diagrams, Electrical Fault Finding and Fitting locations

- → Press key.

Vehicle system test HELP Select function XX	◄ Read-out on display:

- Enter 06 for the function „end output“ and confim entry with key Q.

Basic setting

Test conditions

- Coolant temperature at least 80 °C
- Electrical consumers must be disconnected (the radiator cooling fan must be off during this test)
- Air conditioning switched off

Special tools, aids and testers required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3A, 3B or 3C.

Procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit (address word 01). The engine must be running in idle.
  (Connect vehicle system tester and select engine electronics control unit ⇒ page 01-2).

Vehicle system test HELP Select function XX

◄ Read-out on display:

- Enter 04 for the function „Basic setting“ and confirm entry with the key Q.

Basic setting HELP Enter display group number XXX

◄ Read-out on display:

- Enter 000 and confirm entry with the key Q.

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

◄ Read-out on display:
(1... 10 = Display fields)

Display group 000 in idle (warm engine, coolant temperature not below +85 °C)

This display group serves as a dynamic test of the commencement of injection. The commencement of injection valve (N108) is constantly actuated, so that the injection timing device is retarded.

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

◄ Read-out on display:

Ignore

Fuel temperature: at approx. 40 °C (if the temperature is not reached at a low outside temperature, ignore specified value)

Ignore

Coolant temperature: approx. 90 °C

Ignore

Ignore

Ignore

Accelerator pedal position: 0

The commencement of injection is dependent on the fuel temperature,
specified values ⇒ page 23-13, Dynamically test and set commencement of injection

Idling speed: 41...44[1)]

[1)] For vehicles ➤ 07.97 = 41...44
For vehicles 08.97 ➤ = 42...45
For vehicles 05.99 ➤ = 43...46

Coding control unit

If the code which is displayed does not match the vehicle, or if the control unit has been replaced, it is then necessary to code the control unit as follows.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit (address word 01). The ignition must be switched on for this step ⇒ page 01-2.

Test of vehicle systems Select function XX	HELP

◄ Readout in display:

- Enter 07 for the function „Code control unit“ and confirm the entry with the key Q.

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

◄ Readout in display:

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

Coding control units

Models ➤ 07.97		Models 08.97 ➤	
Code number	**Models fitted with**	**Code number**	**Models fitted with**
00001	Automatic gearbox	00001	Automatic gearbox
00002	Manual gearbox	00002	Manual gearbox with activated CAN databus (models with ABS)
		00003	Manual gearbox for 4x4 models
		00005	Manual gearbox without CAN databus (models without ABS)

038906018.. 1.9l R4 EDC G00SG 1822 → Coding 00002	WSC 01234

◄ The control unit identification is shown in the display (example):

- Switch ignition off and on again.

Notes:

- *The code entered is activated when the ignition is switched on again*
- *If the ignition is not switched off and on again after entering the valid code, it is then not possible to erase the fault „01044 Control unit incorrectly coded“.*

- Press → key.

Vehicle system test Select function XX	HELP

◄ Read-out on display

- Enter 06 for the function “end output” and confirm entry with the key Q.

Readiness code

Valid for vehicles 08.03 ➤

Reading readiness code

Function

The readiness codes are two 8-digit numerical codes which indicate the status of the emission-relevant diagnoses.

If the diagnosis for a system was successfully performed (e.g. exhaust gas recirculation system), the relevant position of the numerical code is set from 1 to 0.

This diagnosis is performed at regular intervals during normal driving. After repairs have been carried out to an emission-relevant system, it is recommended to generate the readiness code in order to thus ensure that the systems operate properly. If a fault is detected during diagnosis, it is then stored in the fault memory.

The readiness code is erased through deletion of the fault memory, that is all relevant points will be set to 1.

Generation of the readiness code means to activate the diagnostic functions such as diagnosis of fuel supply, diagnosis of other systems etc.

Procedure

♦ Vehicle system tester -V.A.G 1552- with cable -V.A.G 1551/3, 3A, 3B or 3C-

- Connect vehicle system tester -V.A.G 1552- and enter address word 01 “Engine electronics”, ignition switched on ⇒ page 01-24.

- Read function 08 “Reading measured value block” and select display group 017.

Reading measured value block 17 →
00000000 00000110 10000000 00000000

◄ Read-out on display

Meaning of 8-digit numerical block for readiness code in display field 2								
1	2	3	4	5	6	7	8	Meaning
							0	Ignore
						1		Ignore
					1			Ignore
				0				Ignore
			0					Ignore
		0						Diagnosis of other systems
	0							Diagnosis of fuel supply
0								Ignore

Meaning of 8-digit numerical block for readiness code in display field 4								
1	2	3	4	5	6	7	8	Meaning
							0	Ignore
						0		Ignore
					0			Ignore
				0				Ignore
			0					Ignore
		0						Ignore
	0							Ignore
0								Diagnosis of exhaust gas recirculation system

- If the specified values are not reached, generate readiness code ⇒ page 01-26.

- → Press key.

- Enter function 06 “End output” and switch off ignition.

Generating readiness code

Special tools, aids and testers required

♦ Vehicle system tester -V.A.G 1552- with cable -V.A.G 1551/3, 3A, 3B or 3C-

Test conditions

- All electrical consumers such as e.g. light and rear window heater must be switched off.

- Intake air temperature below 60 °C ⇒ display group 007, display field 3

- Coolant temperature at least 83 °C ⇒ display group 007, display field 4

Procedure

- Connect vehicle system tester -V.A.G 1552- and enter address word 01 “Engine electronics”, ignition switched on ⇒ page 01-2.

Note:

Certain steps must be carried out twice, in order to achieve the readiness code.

Work step 1: Interrogating fault memory

- Enter function 02 “Interrogating fault memory” and confirm entry with key Q.

X fault detected	→	◄ The number of stored faults or “No fault detected” appears in the display.

If a fault is stored:

- Rectify fault by referring to the fault table ⇒ page 01-8.

If no fault is stored:

- → Press.

Work step 2: Erasing fault memory

Vehicle system test →
Fault memory is erased

◄- Enter function 05 “Erasing fault memory” and confirm entry with key Q.

Note:

Readiness code is erased each time the fault memory is erased.

If the ignition is switched off during “Interrogating fault memory” and “Erasing Fault memory”, the fault memory is not erased.

- → Press.

Work step 3: Switching off ignition

- Wait at least 5 seconds with ignition OFF.

Note:

This point is important, because with certain diagnoses the slowing down of the control unit must be ended. Otherwise readiness code cannot be generated.

Work step 4: Switching on ignition

- Wait at least 10 seconds with ignition OFF.

Charge pressure sender is adapted with atmospheric charge pressure sender.

Work step 5: 1st test of fuel supply and other systems

- Start engine.

- Select function “Reading measured value block” and display group 001.

Reading measured value block 1 →			
2500/rpm	4.6 mg/h	2.0 °CA	94.2 °C

◄- For 5 seconds increase the engine speed to 2500 rpm and then run engine at idling speed.

Work step 6: 1st test of exhaust gas recirculation

Reading measured value block 1 →			
1650/rpm	4.1 mg/h	4.0 °CA	93.2 °C

◄- Increase engine speed to 1600 rpm up to 1700 rpm and maintain it for at least 10 seconds in this range.

In this speed range, the exhaust gas recirculation is active and the control difference is checked. (Condition for readiness code to generate exhaust gas recirculation).

Work step 7: Switching off ignition

- Wait at least 5 seconds with ignition OFF.

Work step 8: Switching on ignition

- Wait at least 10 seconds with ignition ON.

Work step 9: 2nd test of fuel supply and other systems

- Start engine.
- Select function “Reading measured value block” and display group 001.

Reading measured value block 1 →			
2500/rpm	4.6 mg/h	2.0 °CA	94.2 °C

◄ - For 5 seconds increase the engine speed to 2500 rpm and then run engine at idling speed.

Work step 10: 2nd test of exhaust gas recirculation

Reading measured value block 1 →			
1650/rpm	4.1 mg/h	2.0 °CA	93.2 °C

◄ - Increase engine speed to 1600 rpm up to 1700 rpm and maintain it for at least 10 seconds in this range.
- Press C.
- Enter 017 for display group 017 and read readiness code.

Reading measured value block 17 →			
00000000	0**00**00110	10000000	**0**0000000

◄ Specified value in display field 2:
0**00**00110

Specified value in display field 4:
000000000

- → Press.
- If the specified values are not reached, repeat procedure for generating readiness code ⇒ page 01-26.

Work step 11: Interrogating fault memory

- Enter function 02 “Interrogating fault memory” and confirm entry with key Q.

X fault detected! →

◄ The number of stored faults or “No fault detected” appears in the display.

If a fault is stored:

- Rectify fault by referring to the fault table ⇒ page 01-8 and re-generate the readiness code ⇒ page 01-26.

If no fault is stored:

- → Press.

Reading measured value block		17	→
00000000	**00000110**	10000000	**00000000**

◄ Readiness code was successfully generated, if no fault is stored after two work sequences of the test procedure in the fault memory for the engine control unit and if the following display appears in the channel 017.

Measured value blocks

Reading measured value block

Test conditions

- Coolant temperature at least 80 °C
- Electrical consumers must be disconnected (the radiator cooling fan must be off during this test)
- Air conditioning switched off
- No fault in fault memory

Special tools, aids and testers required

♦ Vehicle system tester -V.A.G 1552- with cable -V.A.G 1551/3, 3A, 3B or 3C-.

Procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01). The engine must be running in idle.

Vehicle system test HELP Select function XX

◄ Read-out on display:

- Enter 08 for the function „Read measured value block“ and confirm entry with the key Q.

Reading measured value block HELP Enter display group number XXX

◄ Read-out on display:

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

Note:

Display group number 000 is an example to represent the sequence.

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

◄ Read-out on display, e.g.:

- → Press key.

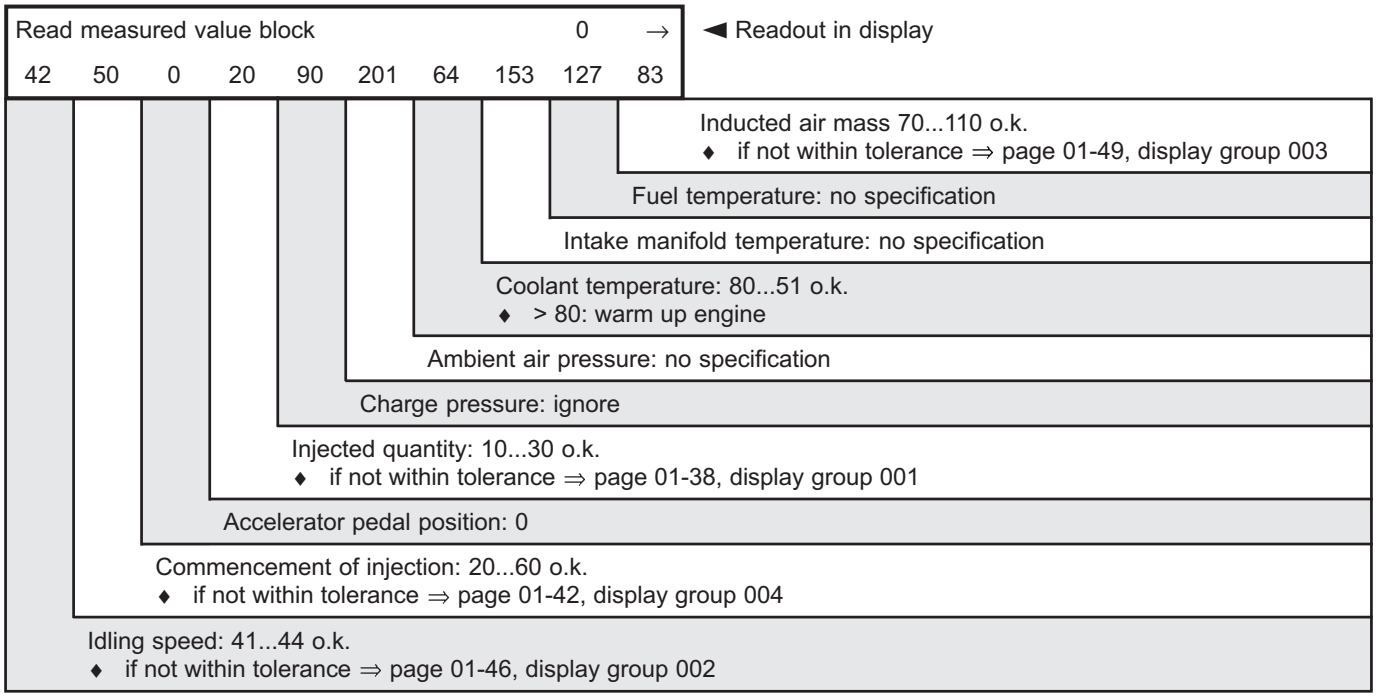
Vehicle system test HELP Select function XX

◄ Read-out on display:

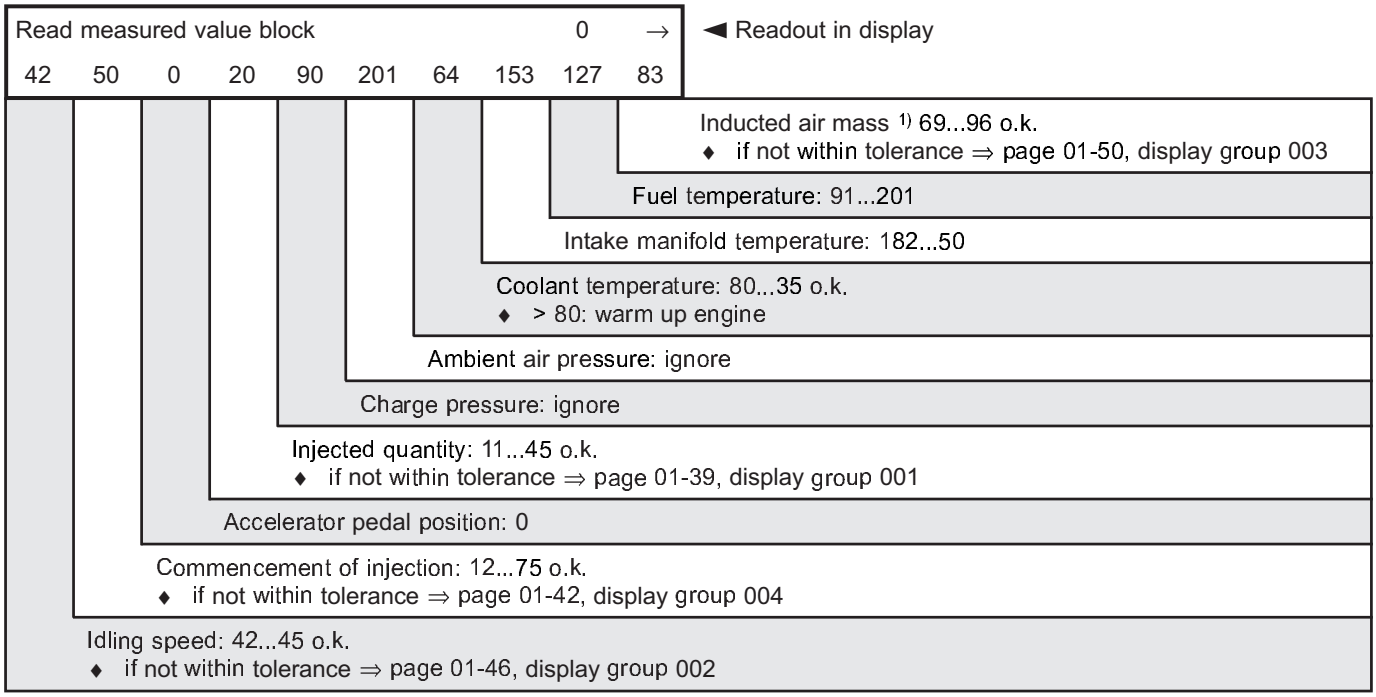
- Enter 06 for the function „End output“ and confirm entry with the key Q.

Specified readouts for general vehicle check

Display group 000, engine idling (engine warm, coolant temperature not less than +85 °C) for models ➤ 07.97

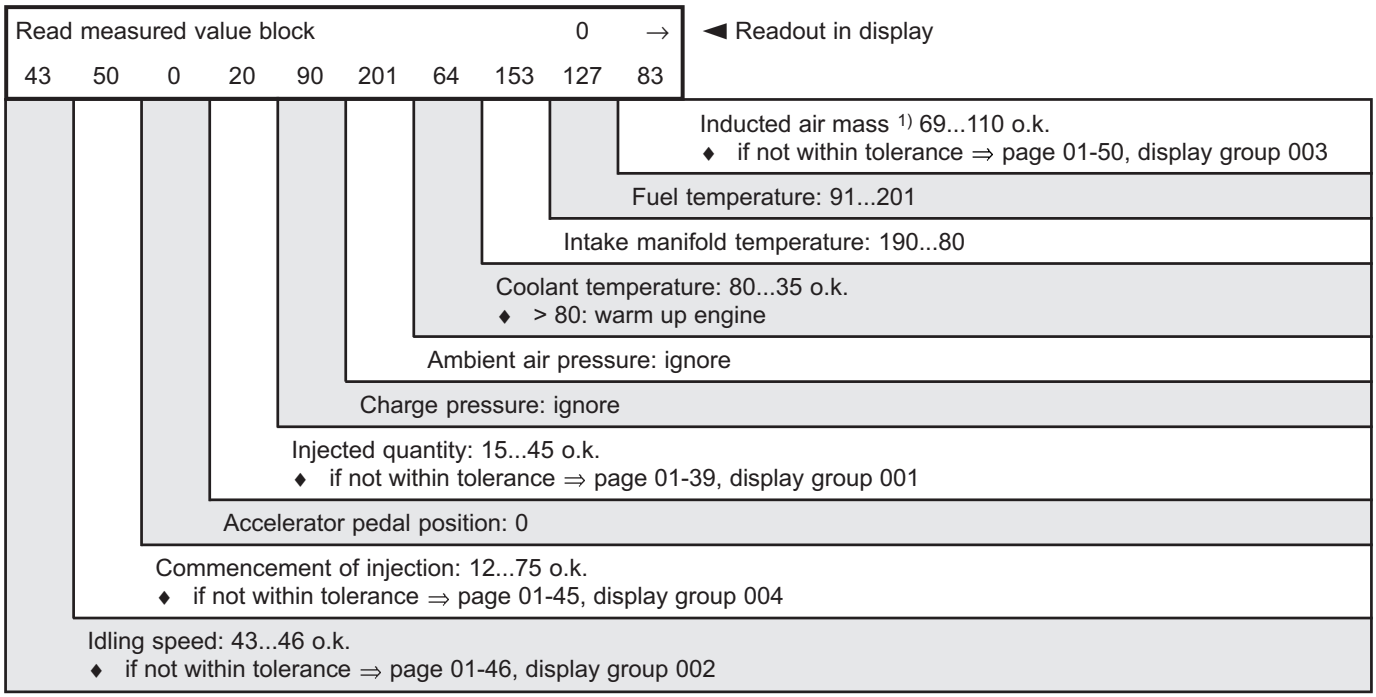


Display group 000, engine idling (engine warm, coolant temperature not less than +80 °C) for models 08.97 ➤ 04.99



1) The measured values apply when the exhaust gas recirculation system is switched on. The exhaust gas recirculation is switched off in the idling speed range after about 2 minutes; if necessary briefly blip throttle or re-start engine.

Display group 000, engine idling (engine warm, coolant temperature not less than +80 °C) for models 05.99 ➤

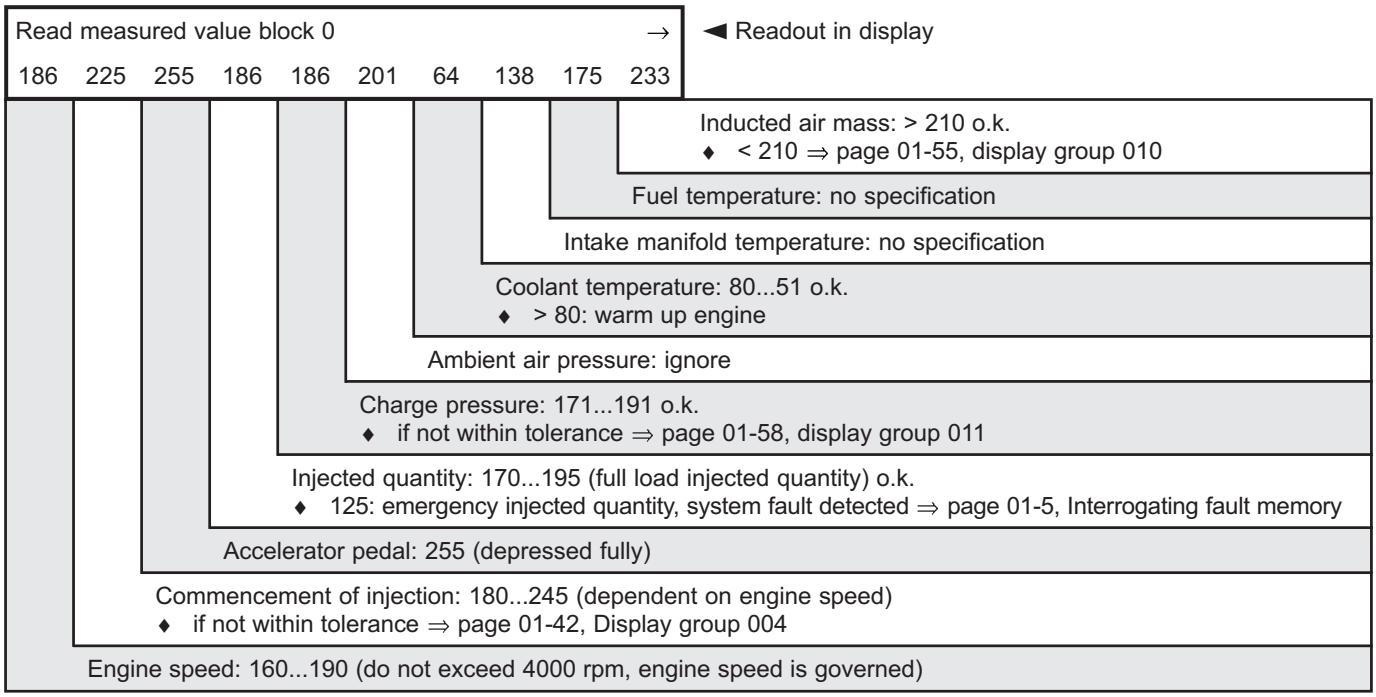


1) The measured values apply when the exhaust gas recirculation system is switched on. The exhaust gas recirculation is switched off in the idling speed range after about 2 minutes; if necessary briefly blip throttle or re-start engine.

Display group 000 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +85 °C) for models ➤ 07.97

Notes:

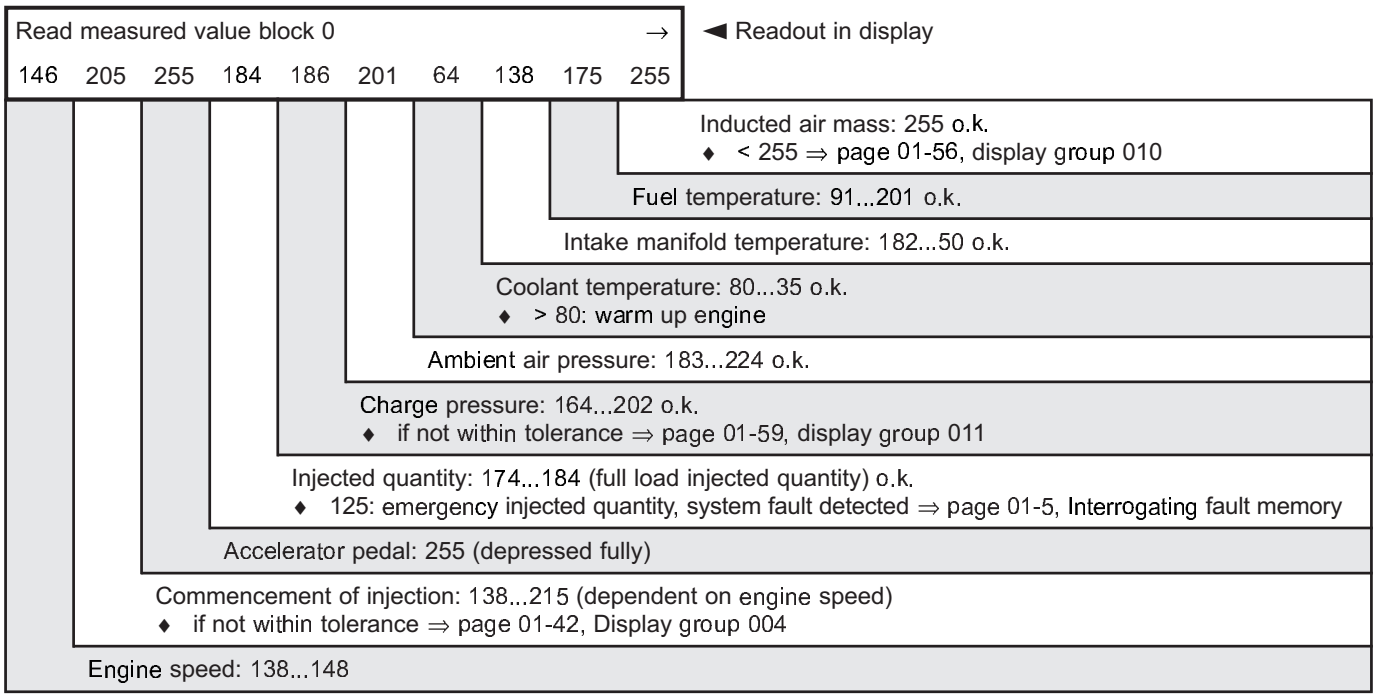
- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*



Display group 000 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 08.97 ➤ 04.99

Notes:

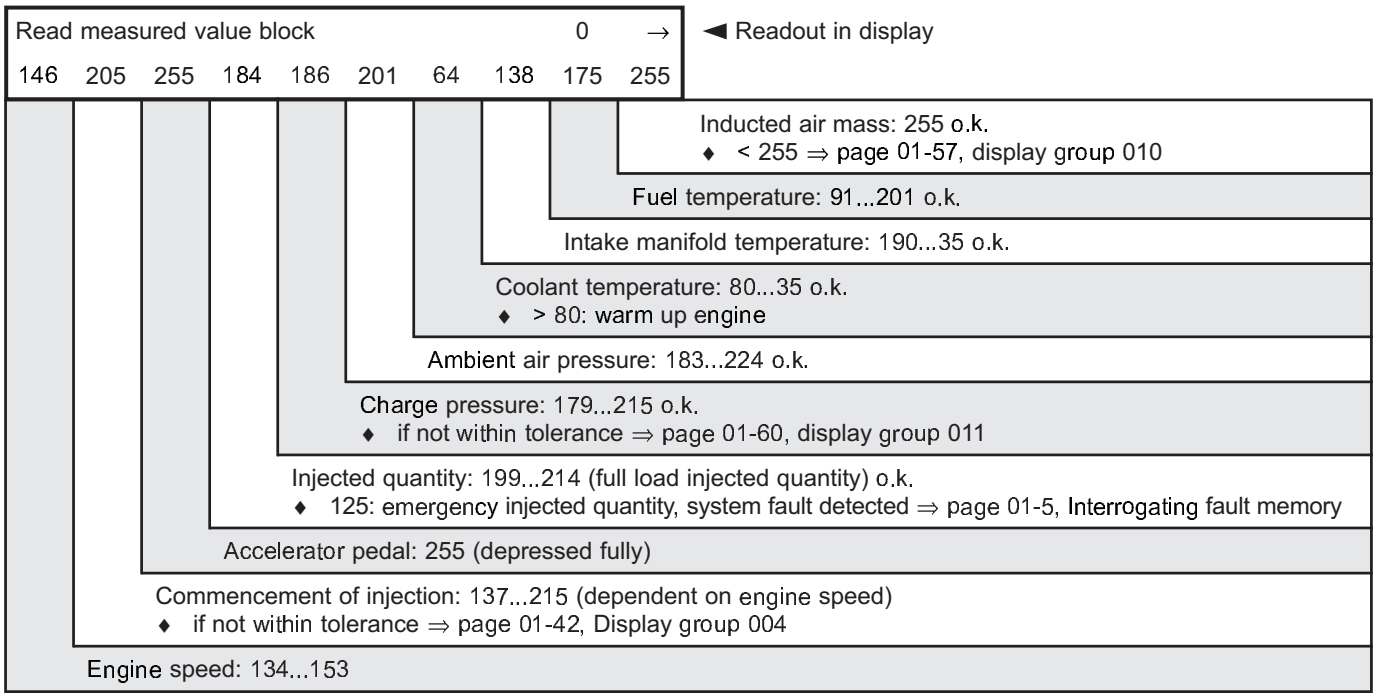
- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*



Display group 000 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 05.99 ➤

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*



Display group 006, ignition switched on

Read measured value block			6 →	◄ Readout in display
0 km/h	0 0 0	0 0 0 0 0 0	0	

CCS operating state ⇒ Table 3, page 01-36

Operating state of CCS ⇒ Table 2, page 01-35

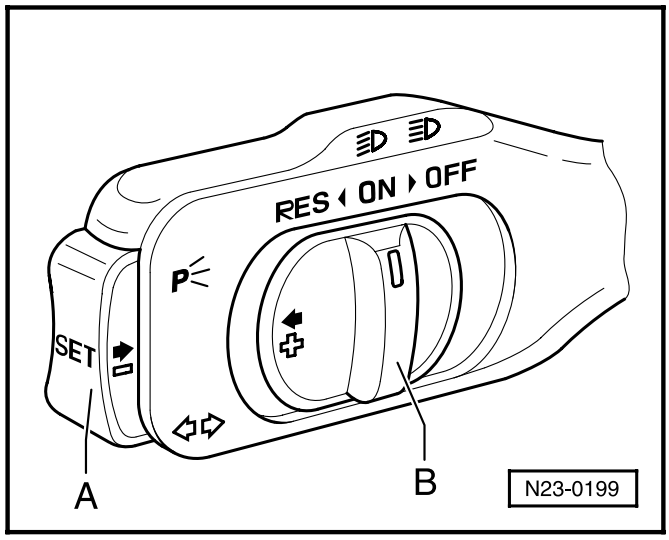
Brake pedal monitor ⇒ Table 1, page 01-35

Vehicle speed: ignore

Analysis: Table 1; brake pedal monitor

Display block 2	Operating state of clutch pedal and brake pedal	x	x	x	Operating state of pedal switches when display positions = 1
000	Clutch pedal and brake pedal not depressed				
011	Brake pedal depressed (brake light switch)			1	Brake light switch -F closed
011	Brake pedal depressed (brake pedal switch)		1		Brake pedal switch -F47 opened
100	Clutch pedal depressed	1			Clutch pedal switch -F36 opened
111	Clutch pedal and brake pedal depressed				

Analysis: Table 2; operating state of cruise control system (CCS)

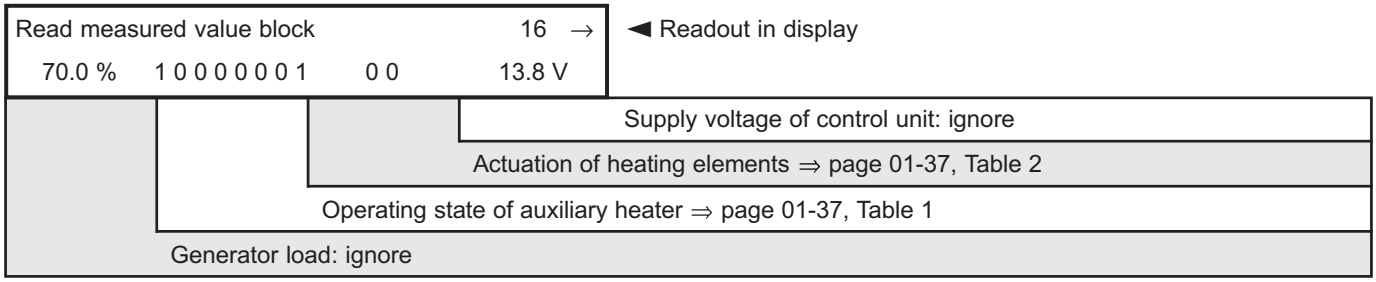


Cruise control system	Display block 3
Switch B to „ON“	000011
Switch B to „RES“	001011
Switch A operated	000111
Switch B to „OFF“ before operating point	000001
Switch B locked in „OFF“	000000
Brake pedal depressed	010011
Clutch pedal depressed	100011

Analysis: Table 3, CCS operating state

CCS operating state	
0	Model fitted with CCS - CCS switched off
1	Model fitted with CCS - CCS switched on
2 5 5	Model without CCS, CCS function is not activated in engine control unit

Display group 016, engine idling



Analysis: Table 1, operating state of auxiliary heater

Meaning if readout places = 1								
x	x	x	x	x	x	x	x	**Auxiliary heater switched off because:**
							1	Coolant temperature greater than 70...80 °C[1)] or intake air temperature greater than 5 °C
						1		Alternator faulty
					1			Battery voltage less than 9 V
				1				**Models ➤ 07.97** - engine speed less than 800 rpm **Models 08.97 ➤ 04.99** - engine speed less than 875 rpm **Models 05.99 ➤** - engine speed less than 861 rpm
			1					Engine start within the last 10 seconds
		1						Coolant temperature sender (G62) or intake manifold temperature sender (G72) faulty
	1							Ignore
1								Ignore

1) If the intake air temperature at engine start is 5 °C, the auxiliary heater is then switched off once the coolant temperature reaches 70 °C. If the air temperature is -10 °C, however, the auxiliary heater is not switched off until the coolant temperature is 80 °C.

Analysis: Table 2, actuation of heating elements

Meaning if display places = 1		
x	x	Actuation of heating elements
	1	Low heating capacity relay (J359), switched on
1		High heating capacity relay (J360), switched on

Specified readouts for injection pump

Display group 001, engine idling (engine warm, coolant temperature not less than +85 °C) for models ➤ 07.97

Read measured value block			1 →	◄ Readout in display
900 rpm	5.6 mg/H	1.480 V	87.3 °C	

Coolant temperature
- ♦ 80...100 °C o.k.
- ♦ < 80 °C ⇒ warm up engine

Voltage of modulating piston movement sender -G149
- ♦ 1.250...1.700 V: o.k.
- ♦ < 1.250 V:
- - Injection pump damaged ⇒ replace injection pump, page 23-8
- ♦ > 1.700 V:
- - Engine load ⇒ switch off consumers
- - Engine too cold ⇒ warm up engine
- - Injection pump damaged ⇒ replace injection pump, page 23-8

Injected quantity
- ♦ 2.0...6.0 mg/H: o.k.
- ♦ < 2.0 mg/H:
- - Injection pump damaged ⇒ replace injection pump, page 23-8
- ♦ > 6.0 mg/H:
- - Engine load ⇒ switch off consumers
- - Injection too cold ⇒ replace injection pump
- - Injection pump damaged ⇒ replace injection pump, page 23-8

Engine speed
- ♦ Models ➤ 07.97 = 860...940 rpm o.k.
- ♦ Models 08.97 ➤ 04.99 = 875...950 rpm o.k.
- ♦ Models 05.99 ➤ = 861...945 rpm o.k.

Display group 001, engine idling (engine warm, coolant temperature not less than +80 °C) for models 08.97 ➤ 04.99

Read measured value block 1 →

900 rpm 5.6 mg/H 1.480 V 87.3 °C

◄ Readout in display

Coolant temperature
- ♦ 80...110 °C o.k., < 80 °C ⇒ warm up engine

Voltage of modulating piston movement sender -G149
- ♦ 1.450...1.850 V: o.k.
- ♦ < 1.450 V:
- - Injection pump damaged ⇒ replace injection pump, page 23-8
- ♦ > 1.850 V:
- - Engine load ⇒ switch off consumers
- - Engine too cold ⇒ warm up engine
- - Injection pump damaged ⇒ replace injection pump, page 23-8

Injected quantity
- ♦ 2.2...9.0 mg/H: o.k.
- ♦ < 2.2 mg/H:
- - Injection pump damaged ⇒ replace injection pump, page 23-8
- ♦ > 9.0 mg/H:
- - Engine load ⇒ switch off consumers
- - Injection too cold ⇒ replace injection pump
- - Injection pump damaged ⇒ replace injection pump, page 23-8

Engine speed ⇒ page 01-38; display group 001

Display group 001, engine idling (engine warm, coolant temperature not less than +80 °C) for models 05.99 ➤

Read measured value block 1 →

900 rpm 5.6 mg/H 1.480 V 87.3 °C

◄ Readout in display

Coolant temperature
- ♦ 80...110 °C o.k., < 80 °C ⇒ warm up engine

Voltage of modulating piston movement sender -G149
- ♦ 1.30...2.10 V: o.k.
- ♦ < 1.30 V:
- - Injection pump damaged ⇒ replace injection pump
- ♦ > 2.10 V:
- - Engine load ⇒ switch off consumers
- - Engine too cold ⇒ warm up engine
- - Injection pump damaged ⇒ replace injection pump

Injected quantity
- ♦ 3...9.0 mg/H: o.k.
- ♦ < 3 mg/H:
- - Injection pump damaged ⇒ replace injection pump, page 23-8
- ♦ > 9.0 mg/H:
- - Engine load ⇒ switch off consumers
- - Injection too cold ⇒ replace injection pump
- - Injection pump damaged ⇒ replace injection pump, page 23-8

Engine speed ⇒ page 01-38; display group 001

Display group 001, during attempt at starting (if engine does not start) - all models [1)]

Read measured value block			1 →	◄ Readout in display
230 rpm	37.4 mg/H	2.780 V	14.3 °C	

Coolant temperature

Voltage of modulating piston movement sender -G149 (feedback of fuel metering control to control unit regarding position of modulating piston)
- ♦ Voltage rises in time jumps: o.k. (pump injecting)
- ♦ < 1.000 V: fuel metering control closed
- \- Observe display block 2; only if specified injected quantity o.k. ⇒ replace injection pump, page 23-8

Specified injected quantity (actuation of fuel metering control in injection pump by control unit)
- ♦ Injected quantity rises in time jumps: o.k. (pump is operated)
- ♦ 0.0 mg/H or constant quantity: system fault
- \- Interrogate fault memory ⇒ page 01-5
- \- Test fuel supply system ⇒ page 01-18, Final control diagnosis; Testing fuel shut-off valve

Engine speed

1) If electrical system voltage of vehicle drops below 10.8 V during attempt at starting, vehicle system tester V.A.G 1552 then interrupts the diagnosis.

Display group 019, ignition switched on, models ➤ 07.97

Read measured value block 19 →

0.780 V 4.250 V

◄ Readout in display

No readout

No readout

Voltage of modulating piston movement sender at maximum stop of quantity adjuster
- ♦ 3.800...4.400 V o.k.
- ♦ Not within tolerance:
- \- Contact resistance in cable connection ⇒ test, page 23-46
- \- Fuel metering control of injection pump incorrectly set ⇒ replace injection pump, page 23-8

Voltage of modulating piston movement sender at minimum stop of quantity adjuster
- ♦ 0.600...0.900 V o.k.
- ♦ Not within tolerance:
- \- Contact resistance in cable connection ⇒ test, page 23-46
- \- Fuel metering control of injection pump incorrectly set ⇒ replace injection pump, page 23-8

Display group 019, ignition switched on, models 08.97 ➤

Read measured value block 19 →

0.780 V 4.250 V

◄ Readout in display

No readout

No readout

Voltage of modulating piston movement sender at maximum stop of quantity adjuster
- ♦ 4.150...4.740 V o.k.
- ♦ Not within tolerance:
- \- Contact resistance in cable connection ⇒ test, page 23-46
- \- Fuel metering control of injection pump incorrectly set ⇒ replace injection pump, page 23-8

Voltage of modulating piston movement sender at minimum stop of quantity adjuster
- ♦ 0.500...0.970 V o.k.
- ♦ Not within tolerance:
- \- Contact resistance in cable connection ⇒ test, page 23-46
- \- Fuel metering control of injection pump incorrectly set ⇒ replace injection pump, page 23-8

Display group 004, engine idling (engine warm, coolant temperature not less than +85 °C) for models ➤ 07.97

Read measured value block 4 →	◄ Readout in display
900 rpm 0.9° BTDC 0.9° BTDC 3 %	
On/off ratio (actuation) of commencement of injection valve ♦ No specification	
Momentary commencement of injection ♦ 2° ATDC...4° BTDC o.k. ♦ Later than 2° ATDC: commencement of injection blocked - Commencement of injection valve faulty ⇒ page 01-18, Final control diagnosis - Injection pump stops extremely too late ⇒ Dynamically test and set commencement of injection ⇒ page 23-13 ♦ Earlier than 4° BTDC: - Engine too cold ⇒ warm up engine - Injection pump stops too soon ⇒ Dynamically test and set commencement of injection ⇒ page 23-13 - Commencement of injection valve faulty ⇒ page 23-13, Final control diagnosis	
Specified commencement of injection requested by control unit ♦ 2° ATDC...4° BTDC o.k.	
Engine speed ⇒ page 01-38; display group 001	

Display group 004, engine idling (engine warm, coolant temperature not less than +80 °C) for models 08.97 ➤

Read measured value block 4 →	◄ Readout in display
900 rpm 0.9° BTDC 0.9° BTDC 3 %	
On/off ratio (actuation) of commencement of injection valve ♦ 3...80%	
Momentary commencement of injection ♦ 2° ATDC...3° BTDC o.k. ♦ Later than 2° ATDC: commencement of injection blocked - Commencement of injection valve faulty ⇒ page 01-18, Final control diagnosis - Injection pump stops extremely too late ⇒ Dynamically test and set commencement of injection ⇒ page 23-13 ♦ Earlier than 3° BTDC: - Engine too cold ⇒ warm up engine - Injection pump stops too soon ⇒ Dynamically test and set commencement of injection ⇒ page 23-13 - Commencement of injection valve faulty ⇒ page 01-18, Final control diagnosis	
Specified commencement of injection requested by control unit ♦ 2° ATDC...3° BTDC o.k. ♦ Earlier than 3° BTDC: - Engine too cold ⇒ warm up engine	
Engine speed ⇒ page 01-38; display group 001	

Display group 004 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +85 °C) for models ➤ 07.97

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block 4 →

4060 rpm 16.3° BTDC 16.1° BTDC 84 %

◄ Readout in display

On/off ratio (actuation) of commencement of injection valve
- No specification

Momentary commencement of injection
- As specified commencement of injection in display block 2 (tolerance ± 2°) then o.k.
- Not within tolerance:

- Commencement of injection of injection pump incorrect ⇒ test commencement of injection, page 23-13
- Injection timing device blocked: commencement of injection valve faulty ⇒ Final control diagnosis, page 01-18

Specified commencement of injection requested by control unit
- 14...18° BTDC o.k.

Engine speed
- 2800...3200 rpm o.k.

Display group 004 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 08.97 ➤ 04.99

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			4 →	◄ Readout in display
3060 rpm	9.3° BTDC	9.1° BTDC	84 %	

On/off ratio (actuation) of commencement of injection valve
- ♦ 70...95 % o.k.
- ♦ Not within tolerance:
- Commencement of injection valve faulty ⇒ page 01-18, Final control diagnosis
- Dynamically test and set commencement of injection ⇒ page 23-13

Momentary commencement of injection
- ♦ As specified commencement of injection in display block 2 (tolerance ± 5°) then o.k.
- ♦ Not within tolerance:
- Commencement of injection of injection pump incorrect ⇒ Dynamically test and set commencement of injection, page 23-13
- Commencement of injection valve faulty ⇒ Final control diagnosis, page 01-18
- Injection timing device blocked ⇒ test injection timing device control range, page 23-28
- Air in fuel supply ⇒ inspect fuel supply for leaks

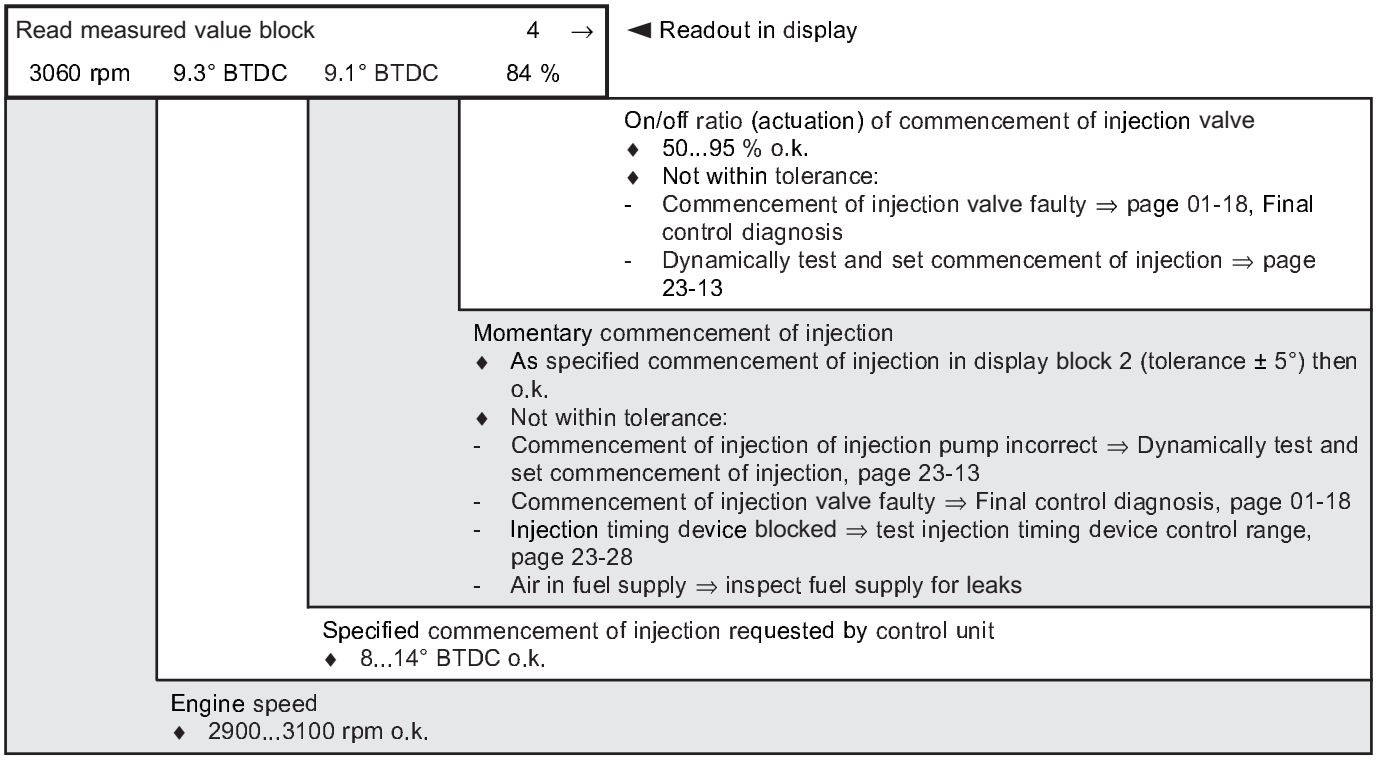
Specified commencement of injection requested by control unit
- ♦ 8...14° BTDC o.k.

Engine speed
- ♦ 2900...3100 rpm o.k.

Display group 004 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 05.99 ➤

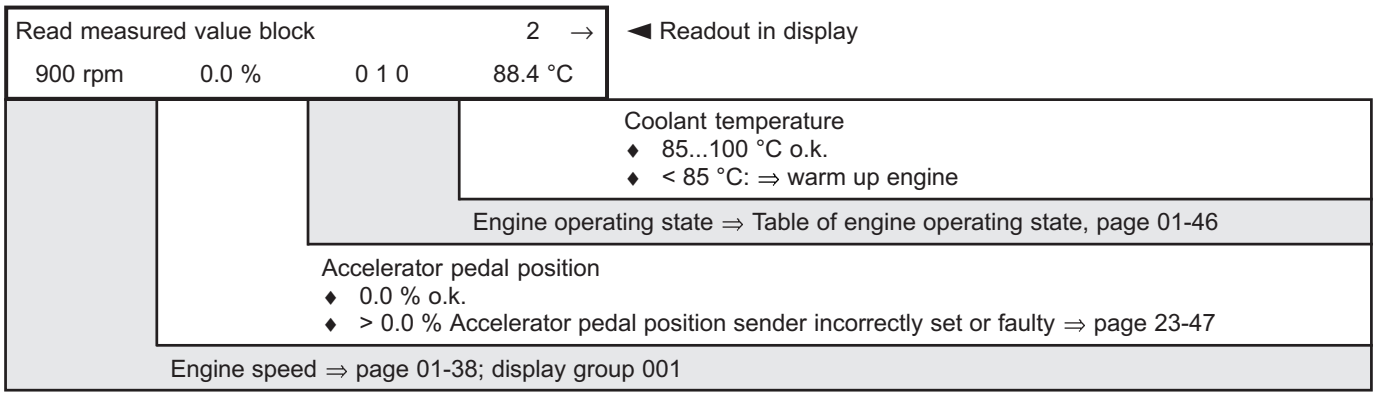
Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*



Specified readouts for engine idling

Display group 002, engine idling (engine warm, coolant temperature not less than +85 °C)



Analysis: display of engine operating state

Meaning if display places = 1			
x	x	x	Engine operating state
		1	AC signal ⇒ switch off air conditioning
	1		v o.k.: (idling speed switch closed)
1			Idling speed increased: ♦ if AC switched on ⇒ switch off air conditioning ♦ if accelerator and brake detected ⇒ test brake pedal switch ♦ if coolant auxiliary heater switched on ⇒ warm up engine

Display group 013, engine idling (engine warm, coolant temperature not less than +85 °C) for models ➤ 07.97

- The fuel injection system features a smooth idling control. It is able to detect differences in performance between the individual cylinders (parts tolerances, injector flow, compression, etc.) and to compensate for these by selective metering of the quantity of fuel injected in the idling speed range.
- Such differences are detected in the idling speed range on the basis of the signal supplied by the engine speed sender, which supplies four signals for each crankshaft revolution to the control unit. If the signals are received in the same rhythm, all the cylinders are performing the same work. If one cylinder has a weaker performance, the crankshaft requires a longer time for the next half crankshaft revolution. In contrast, a cylinder with a stronger performance accelerates the crankshaft to such an extent that it requires a shorter time.
- If the control unit has detected a variation, the cylinder in question is immediately supplied with a greater or lesser injected quantity until the engine is again running smoothly.
- What is shown in the measured value block is the variation of the injected quantity of the individual cylinders in comparison to cylinder 3, which is necessary to achieve smooth engine idling.
- +... mg/H: The relevant cylinder has a weaker performance than cylinder 3 and is therefore supplied with more fuel.
- - ... mg/H: The relevant cylinder is stronger in performance than cylinder 3 and is therefore supplied with less fuel.

Read measured value block 13 →

0.82 mg/H -0.12 mg/H 0.49 mg/H

◄ Readout in display

No readout

Variation of injected quantity of cylinders 4, 2, 1 to cylinder 3
- -1.5 mg/H...+1.5 mg/H o.k.
- All display blocks are too large: cylinder 3 strong
- All display blocks are too small: cylinder 3 weak

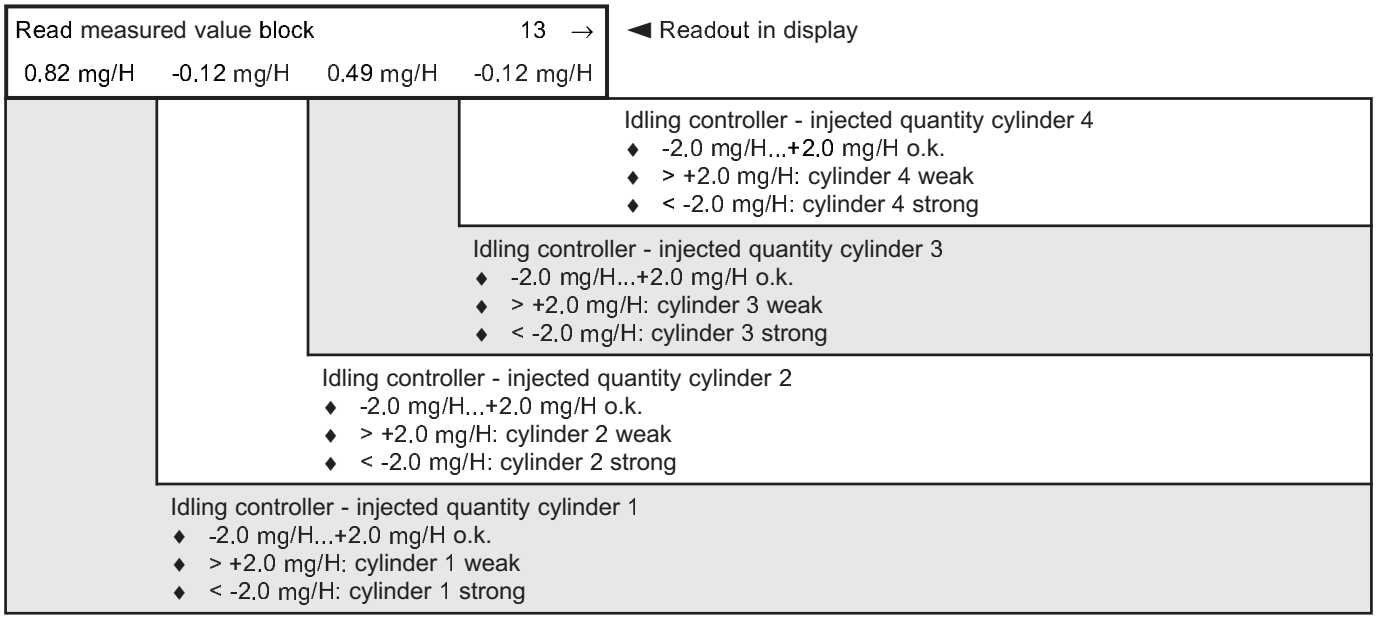
Variation of injected quantity of cylinder 1 to cylinder 3
- -1.5 mg/H...+1.5 mg/H o.k.
- > +1.5 mg/H: cylinder 1 weak
- < -1.5 mg/H: cylinder 1 strong

Variation of injected quantity of cylinder 2 to cylinder 3
- -1.5 mg/H...+1.5 mg/H o.k.
- > +1.5 mg/H: cylinder 2 weak
- < -1.5 mg/H: cylinder 2 strong

Variation of injected quantity of cylinder 4 to cylinder 3
- -1.5 mg/H...+1.5 mg/H o.k.
- > +1.5 mg/H: cylinder 4 weak
- < -1.5 mg/H: cylinder 4 strong

Display group 013, engine idling (engine warm, coolant temperature not less than +80 °C) for models 08.97 ➤

- The fuel injection system features a smooth idling control. It is able to detect differences in performance between the individual cylinders (parts tolerances, injector flow, compression, etc.) and to compensate for these by selective metering of the quantity of fuel injected in the idling speed range.
- Such differences are detected in the idling speed range on the basis of the signal supplied by the engine speed sender, which supplies four signals for each crankshaft revolution to the control unit. If the signals are received in the same rhythm, all the cylinders are performing the same work. If one cylinder has a weaker performance, the crankshaft requires a longer time for the next half crankshaft revolution. In contrast, a cylinder with a stronger performance accelerates the crankshaft to such an extent that it requires a shorter time.
- If the control unit has detected a variation, the cylinder in question is immediately supplied with a greater or lesser injected quantity until the engine is again running smoothly.
- +... mg/H: The relevant cylinder has a weaker performance than cylinder 3 and is therefore supplied with more fuel.
- - ... mg/H: The relevant cylinder is stronger in performance than cylinder 3 and is therefore supplied with less fuel.



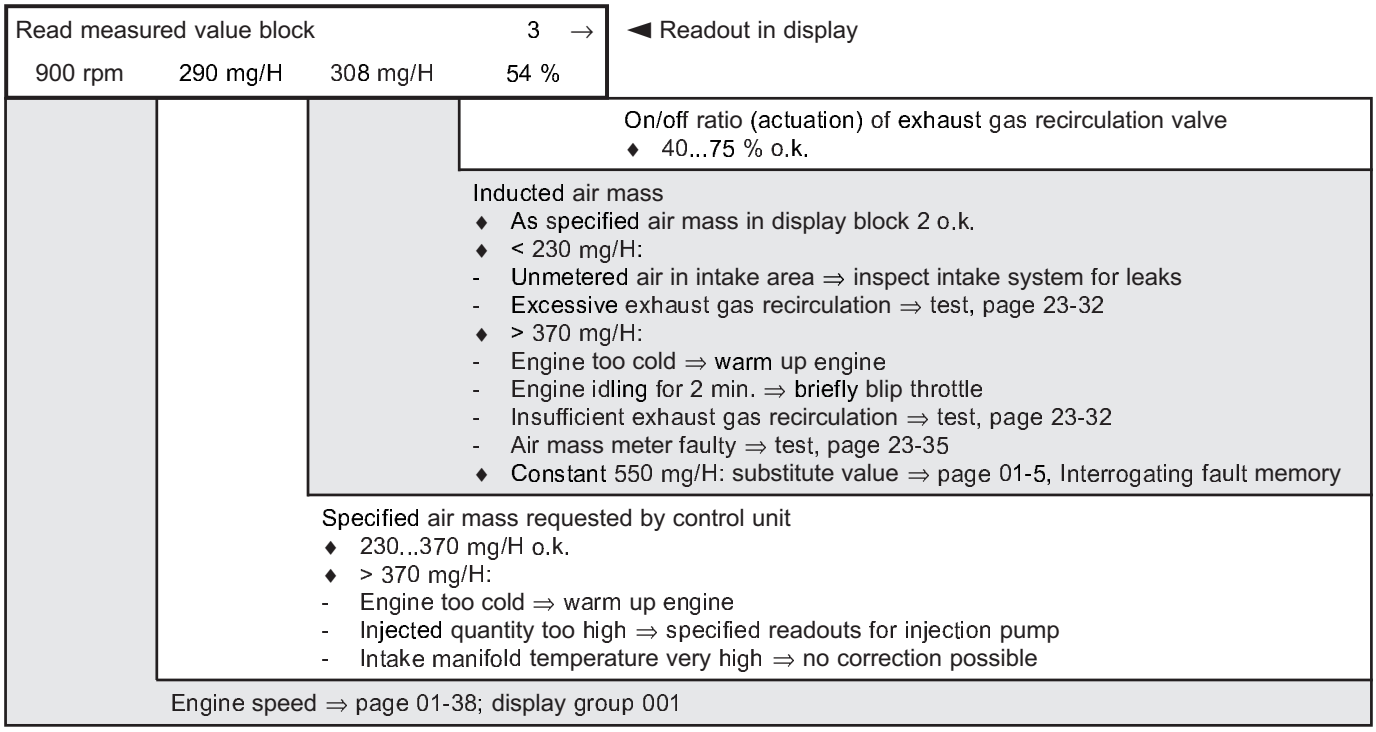
Specified readouts for exhaust gas recirculation

Display group 003, engine idling (engine warm, coolant temperature not less than +85 °C) for models ➤ 07.97

Read measured value block			3 →	◄ Readout in display
900 rpm	290 mg/H	308 mg/H	54 %	

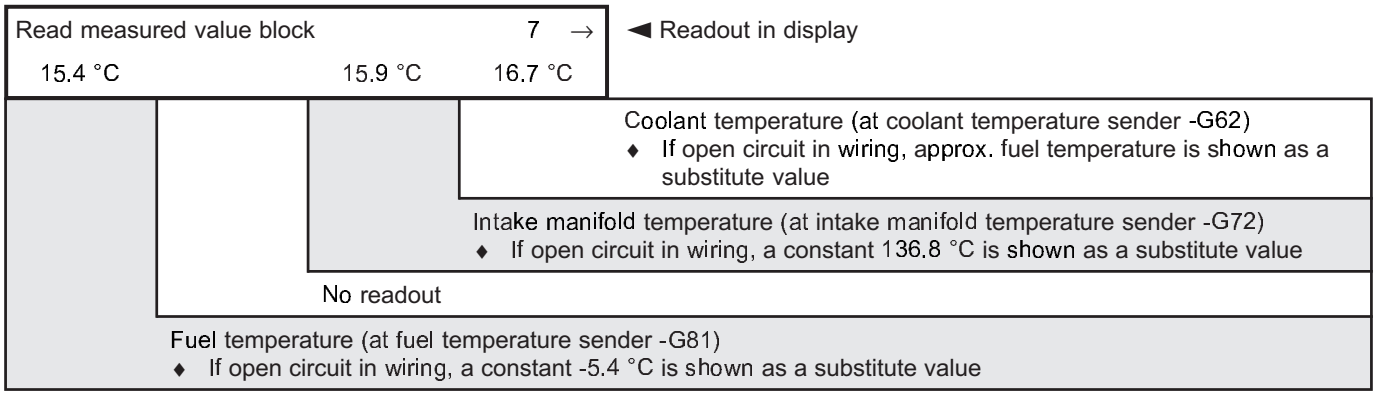
			On/off ratio (actuation) of exhaust gas recirculation valve ♦ 30...80 % o.k.
		Inducted air mass ♦ As specified air mass in display block 2 (tolerance ± 20 mg/H) o.k. ♦ < 230 mg/H: - Unmetered air in intake area ⇒ inspect intake system for leaks - Excessive exhaust gas recirculation ⇒ test, page 23-32 ♦ > 370 mg/H: - Insufficient exhaust gas recirculation ⇒ test, page 23-32 - Engine idling for 3 min. ⇒ briefly blip throttle ♦ Constant 425 mg/H: substitute value ⇒ page 01-5, Interrogating fault memory	
	Specified air mass requested by control unit ♦ 230...370 mg/H o.k. ♦ > 370 mg/H: - Engine too cold ⇒ warm up engine - Injected quantity too high ⇒ specified readouts for injection pump - Intake manifold temperature very high ⇒ no correction possible		
Engine speed ⇒ page 01-38; display group 001			

Display group 003, engine idling (engine warm, coolant temperature not less than +80 °C) for models 08.97 ➤



Specified readouts for temperature sensors

Display group 007, engine on (engine not running and cooled down) for all models



Notes:

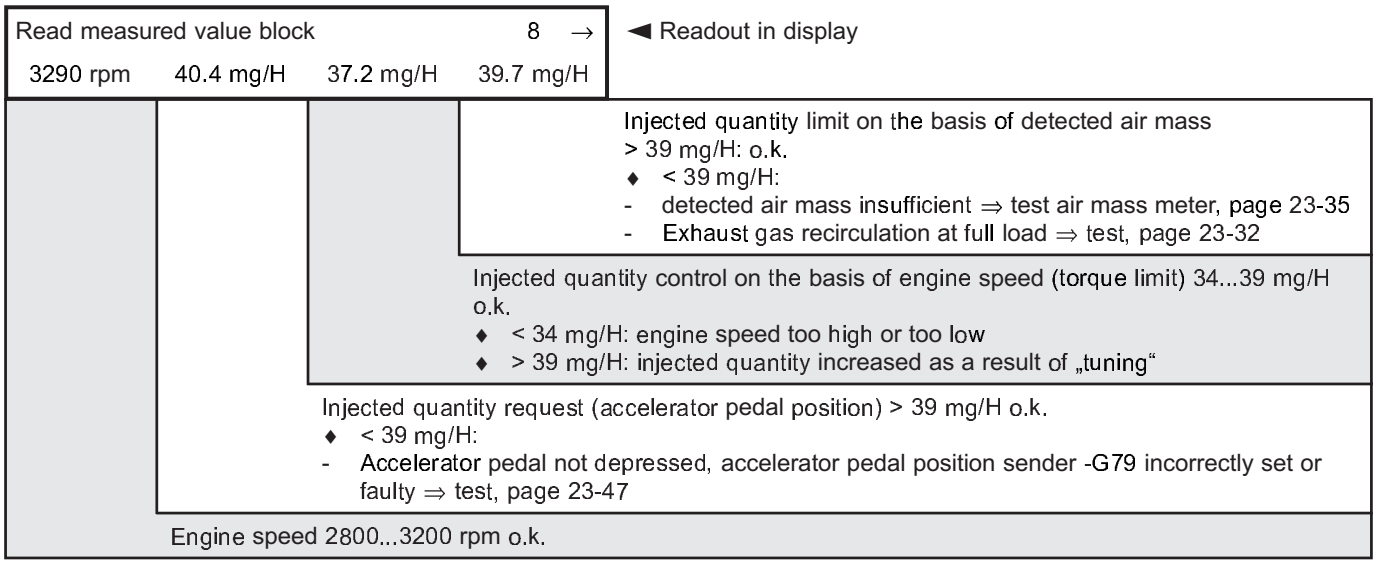
- *It is not possible to state specifications for the temperatures.*
- *If the engine is cooled down, the temperature readouts for fuel, intake manifold and coolant are by necessity approximately identical with the ambient temperature. If one of the readout differs significantly, it is then necessary to test the appropriate sensor.*

Specified readouts for vehicle performance

Display group 008 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +85 °C) for models ➤ 07.97

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*



Display group 008 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 08.97 ➤ 04.99

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			8 →	◄ Readout in display
3090 rpm	40.4 mg/H	36.2 mg/H	37.7 mg/H	

Injected quantity limit on the basis of detected air mass
36...39 mg/H: o.k.
- ♦ < 36 mg/H:
- - detected air mass insufficient ⇒ test air mass meter, page 23-35
- - excessive exhaust gas recirculation ⇒ test, page 23-32

Injected quantity control on the basis of engine speed (torque limit) 35.5...36.5 mg/H o.k.
- ♦ < 35.5 mg/H: engine speed too high or too low (specified engine speed 3000 rpm)
- ♦ > 36.5 mg/H: injected quantity increased as a result of „tuning“

Injected quantity request (accelerator pedal position) 40...42 mg/H o.k.
- ♦ < 40 mg/H:
- - Accelerator pedal not depressed, accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test, page 23-47

Engine speed 2900...3100 rpm o.k.

Display group 008 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 05.99 ➤

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			8 →	◄ Readout in display
3090 rpm	40.4 mg/H	36.2 mg/H	37.7 mg/H	

Injected quantity limit on the basis of detected air mass
37...40 mg/H: o.k.
- ♦ < 37 mg/H:
- detected air mass insufficient ⇒ test air mass meter, page 23-35
- excessive exhaust gas recirculation ⇒ test, page 23-32

Injected quantity control on the basis of engine speed (torque limit)
34.2...38.2 mg/H o.k.
- ♦ < 34.2 mg/H: engine speed too high or too low (specified engine speed 3000 rpm)
- ♦ > 38.2 mg/H: injected quantity increased as a result of „tuning“

Injected quantity request (accelerator pedal position) 38...42 mg/H o.k.
- ♦ < 38 mg/H:
- Accelerator pedal not depressed, accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test, page 23-47

Engine speed 2900...3100 rpm o.k.

Display group 010 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +85 °C) for models ➤ 07.97

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block 10 →

830 mg/H 1030 mbar 1850 mbar 100 %

◄ Readout in display

Accelerator pedal position: 100 % o.k.
- ♦ < 100 %:
- Accelerator pedal not depressed
- Accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test, page 23-47

Momentary charge pressure: 1800...2050 mbar o.k.
Not within tolerance:
- Charge pressure control faulty ⇒ display group 011, page 01-58

Atmospheric pressure: no specification

Inducted air mass: 750...850 mg/H o.k.
- ♦ < 750 mg/H:
- Engine speed less than 2000 rpm or more than 4000 rpm
- Charge pressure too low ⇒ check display block 3
- Unmetered air between air mass meter and turbocharger
- Air mass meter faulty ⇒ test, page 23-35

Display group 010 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 08.97 ➤ 04.99

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			10 →	◄ Readout in display
830 mg/H	1030 mbar	1850 mbar	100 %	

Accelerator pedal position: 100 % o.k.
- ♦ < 100 %:
- Accelerator pedal not depressed
- Accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test, page 23-47

Momentary charge pressure: 1700...2080 mbar o.k.
Not within tolerance:
- Charge pressure control faulty ⇒ display group 011, page 01-59
- Turbocharger faulty ⇒ test, page 23-22

Atmospheric pressure: no specification

Inducted air mass: 800...1000 mg/H o.k.
- ♦ < 800 mg/H:
- Engine speed too low or too high (specified engine speed 3000 rpm)
- Charge pressure too low ⇒ check display block 3
- Unmetered air between air mass meter and turbocharger
- Air mass meter faulty ⇒ test, page 23-35
- ♦ Constant 550 mg/H: substitute value ⇒ page 01-5, Interrogating fault memory

Display group 010 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 05.99 ➤

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block 10 →

830 mg/H 1030 mbar 1850 mbar 100 %

◄ Readout in display

Accelerator pedal position: 100 % o.k.
- ♦ < 100 %:
- Accelerator pedal not depressed
- Accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test, page 23-47

Momentary charge pressure: 1850...2250 mbar o.k.
Not within tolerance:
- Charge pressure control faulty ⇒ display group 011, page 01-60
- Turbocharger faulty ⇒ test, page 23-22

Atmospheric pressure: no specification

Inducted air mass: 800...1100 mg/H o.k.
- ♦ < 800 mg/H:
- Engine speed too low or too high (specified engine speed 3000 rpm)
- Charge pressure too low ⇒ check display block 3
- Unmetered air between air mass meter and turbocharger
- Air mass meter faulty ⇒ test, page 23-35
- ♦ constant 550 mg/H: substitute value ⇒ page 01-5, Interrogating fault memory

Specified readouts for charge pressure control

Display group 011 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +85 °C) for models ➤ 07 . 97

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			11 →	◄ Readout in display
3340 rpm	1830 mbar	1850 mbar	68 %	
				On/off ratio (actuation) of charge pressure control solenoid valve -N75
				Momentary charge pressure ♦ as specified charge pressure in display block 2 (tolerance ± 100 mbar) o.k. ♦ insufficient charge pressure: - No charge pressure control ⇒ test, page 23-22 ♦ excessive charge pressure: - Pressure hose of charge pressure control dropped off or blocked, solenoid valve -N75 jamming ⇒ test charge pressure, page 23-22 - Linkage at turbocharger rusted tight, pressure unit faulty ⇒ test charge pressure, page 23-22
				Specified charge pressure requested by control unit ♦ 1800...2050 mbar o.k. ♦ > 2050 mbar charge pressure increased by „tuning“
				Engine speed 2800...3200 rpm o.k.

Display group 011 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 08.97 ➤ 04.99

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			11 →	◄ Readout in display
3040 rpm	1870 mbar	1850 mbar	68 %	

On/off ratio (actuation) of charge pressure control solenoid valve -N75
45...95 % o.k.

Momentary charge pressure
- ♦ 1700...2080 mbar o.k., must agree with display block 2 within tol erance of ± 100 mbar
- ♦ insufficient charge pressure:
- No charge pressure control ⇒ test, page 23-22
- ♦ excessive charge pressure:
- Pressure hose of charge pressure control dropped off or blocked, solenoid valve -N75 jamming ⇒ test charge pressure, page 23-22
- Linkage at turbocharger rusted tight, pressure unit faulty ⇒ test charge pressure, page 23-22

Specified charge pressure requested by control unit
- ♦ 1850...1950 mbar o.k.
- ♦ > 1950 mbar charge pressure increased by „tuning“

Engine speed 2900...3100 rpm o.k.

Display group 011 at full throttle (road test in 3rd or 4th gear, coolant temperature not less than +80 °C, engine speed 2900...3100 rpm) for models 05.99 ➤

Notes:

- *Accelerate the vehicle at full throttle for the test.*
- *Read off or print out the measured values once an engine speed of 3000 rpm has been reached (second person required).*

Read measured value block			11 →	◄ Readout in display
3040 rpm	1870 mbar	1850 mbar	68 %	
			On/off ratio (actuation) of charge pressure control solenoid valve -N75 45...95 % o.k.	
		Momentary charge pressure ♦ 1850...2250 mbar o.k., must agree with display block 2 within tolerance of ± 100 mbar ♦ insufficient charge pressure: - No charge pressure control ⇒ test, page 23-22 ♦ excessive charge pressure: - Pressure hose of charge pressure control dropped off or blocked, solenoid valve -N75 jamming ⇒ test charge pressure, page 23-22 - Linkage at turbocharger rusted tight, pressure unit faulty ⇒ test charge pressure, page 23-22		
	Specified charge pressure requested by control unit ♦ 1850...1950 mbar o.k. ♦ > 1950 mbar charge pressure increased by „tuning“			
Engine speed 2900...3100 rpm o.k.				

Servicing diesel direct injection system

Safety precautions

Pay attention to the following precautions in order to avoid injuries to persons and/or damage to the fuel injection and glow plug system:

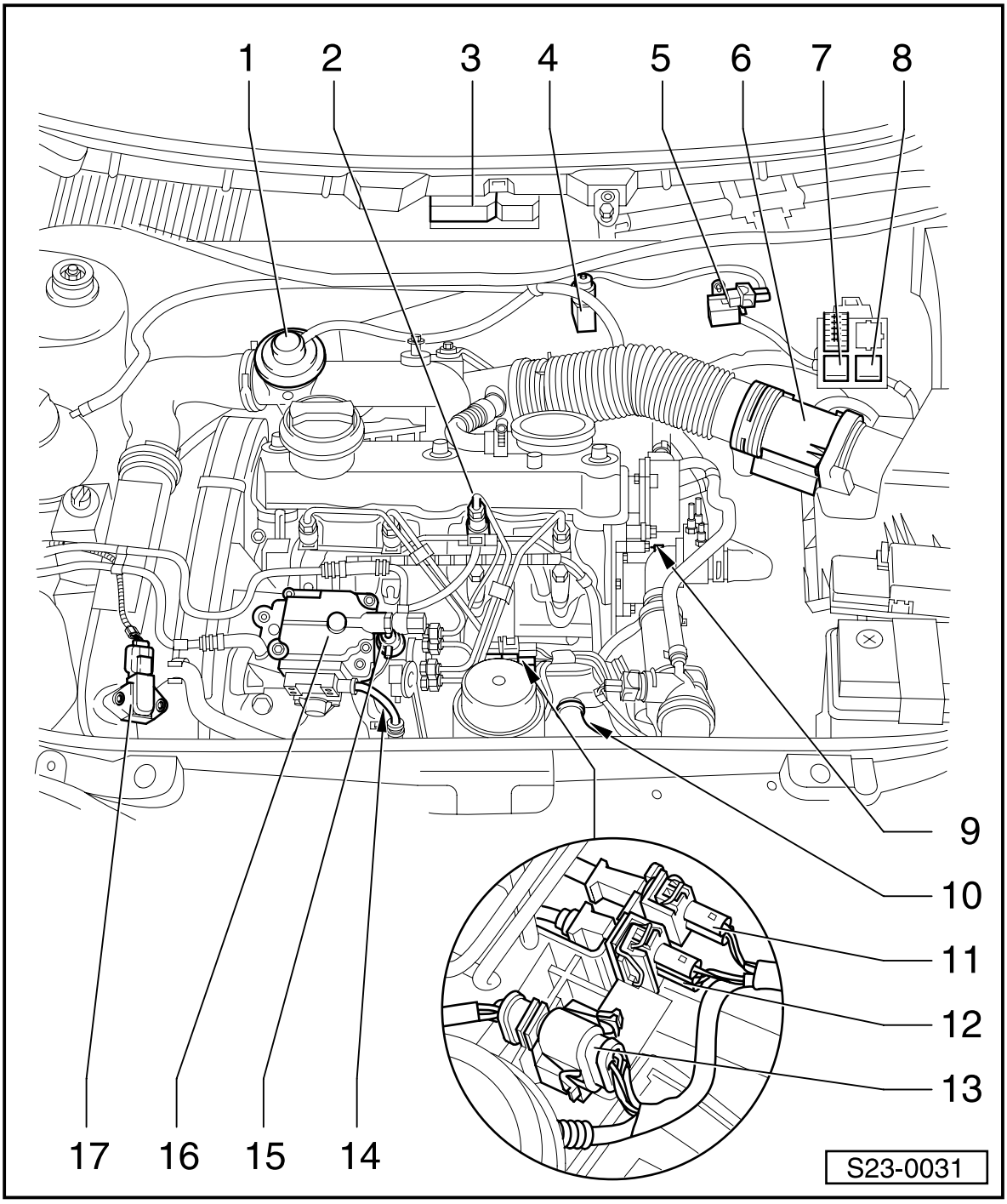
- Do not disconnect and connect the cables of the glow plug and fuel injection system - also not of test equipment - unless the ignition is switched off.
- To operate the engine at starting speed without it actually starting, e.g. for testing the compression pressure, unplug the connector at the injection pump.
- Before disconnecting the battery, determine the code of radio sets with anti-theft coding.
- The ignition should always be switched off before disconnecting and connecting the battery otherwise the diesel direct injection system control unit may be damaged.

Rules for cleanliness

Pay careful attention to the following „5 rules“ for cleanliness when carrying out work on the fuel supply/fuel injection system:

- Thoroughly clean connection points and the surrounding area before disconnecting.
- Place removed parts down on a clean surface and cover over. Do not use fluffing cloths!
- Carefully cover over or seal opened components if repairs are not carried out immediately.
- Install only clean parts:
  Do not remove replacement parts from their wrapping until just before installing.
  Do not use parts which have been stored unwrapped (e.g. in tool boxes etc.).
- If the system is opened:
  Avoid working with compressed air, if possible.
  Avoid moving the vehicle, if possible.
- In addition, ensure that no diesel fuel flows onto the coolant hoses. If this happens, it is then necessary to clean the hoses again without delay. Replace any hoses which have suffered damage.

Summary of fitting locations ➤ 07.97



Components A to E are not shown on the summary illustration.

A - Relay for diesel direct injection system (J322)
- Electrical centre ⇒ page 23-2.1, Fig. 1

B - Glow plug relay (J52)
- Electrical centre ⇒ page 23-2.1, Fig. 1

C - Accelerator pedal position sender (G79)
- In footwell at accelerator pedal ⇒ page 23-6

D - Brake light switch (F) and brake pedal switch (F47)
- Combined in a housing
- In footwell at brake pedal ⇒ page 23-2.1, Fig. 1

E - Clutch pedal switch (F36)
- In footwell at clutch pedal ⇒ page 23-2.1, Fig. 1

1 - Mechanical exhaust gas recirculation valve

2 - Injection nozzle with needle lift sender (G80)

3 - Diesel direct injection system control unit (J248)
- With altitude sender (F96)

4 - Electromagnetic EGR valve (N18)

5 - Charge pressure control solenoid valve (N75)

6 - Air mass meter (G70)

7 - High heating capacity relay (J360)
- Only for models with optional equipment

8 - Low heating capacity relay (J359)
- Only for models with optional equipment

9 - Coolant temperature sender (G62)

10 - Engine speed sender (G28)

11 - Plug connection
- 2-pin
- For needle lift sender (G80)

12 - Plug connection
- 3-pin
- For engine speed sender (G28)

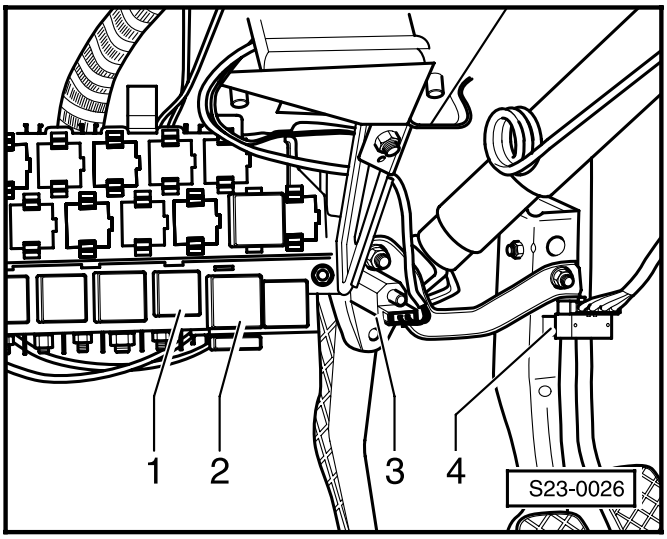
13 - Plug connection
- 10-pin
- For fuel temperature sender (G81)
- For quantity adjuster (N146)
- For modulating piston movement sender (G149)
- For commencement of injection valve (N108)
- For fuel cut-off valve (N109)

14 - Commencement of injection valve (N108)

15 - Fuel cut-off valve (N109)

16 - Fuel metering control of injection pump
- With fuel temperature sender
- With quantity adjuster (N146)
- With modulating piston movement sender (G149)

17 - Intake manifold pressure sender (G71) and intake manifold temperature sender (G72)



◄ **Fig. 1 Components in footwell**

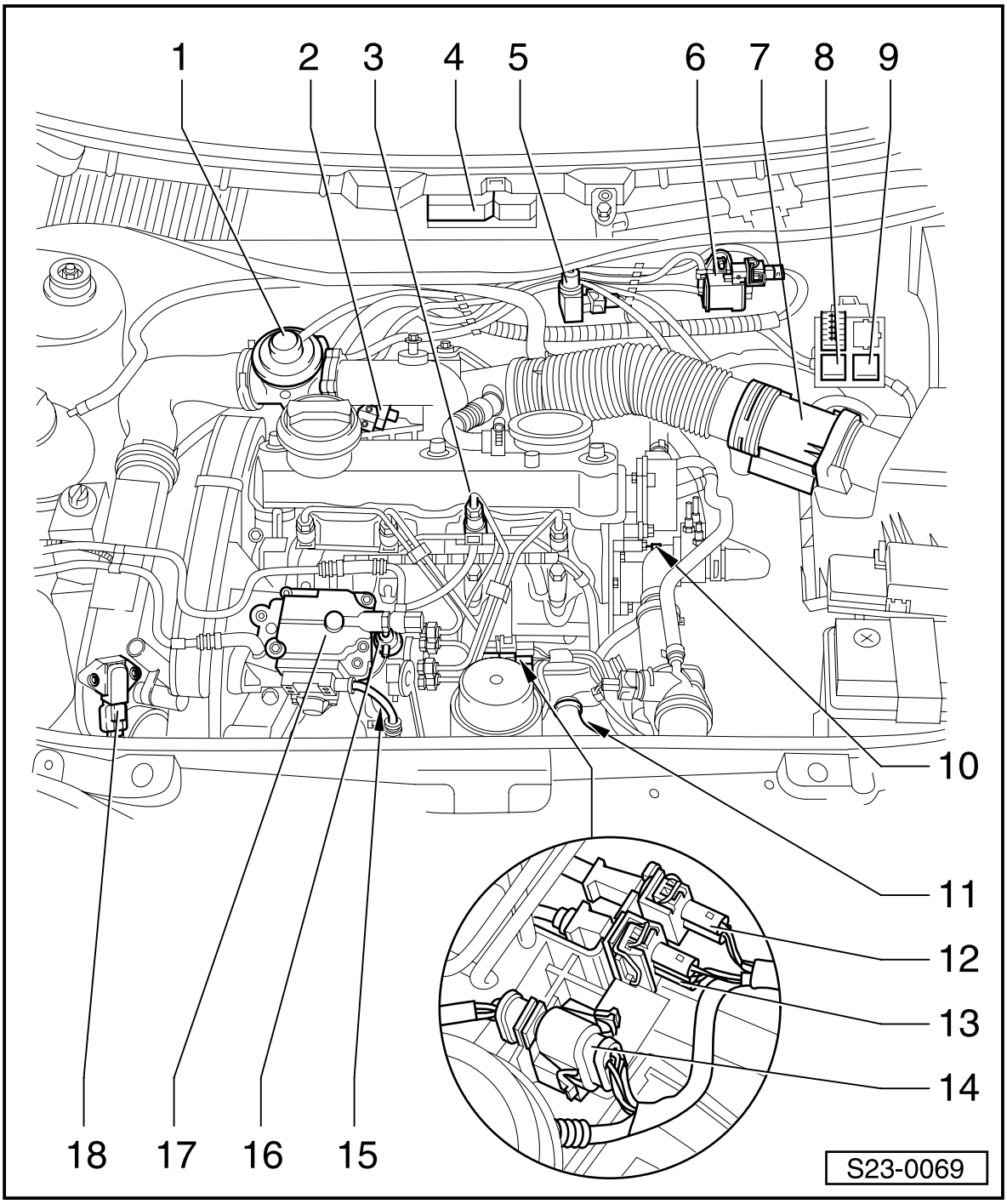
1 - Glow plug relay (J52)

2 - Diesel direct injection system relay (J322)

3 - Clutch pedal switch (F36)

4 - Brake light switch (F) and brake pedal switch (F47)

Overview of fitting locations 08.97 ➤ 07.00



Components A to E are not shown in the illustration.

A - Diesel direct injection system relay (J322)
- ♦ electrical centre ⇒ page 23-3, Fig. 2

B - Glow plug relay (J52)
- ♦ electrical centre ⇒ page 23-3, Fig. 2

C - Accelerator pedal position sender (G79)
- ♦ in footwell at accelerator pedal ⇒ page 23-6

D - Brake light switch (F) and brake pedal switch (F47)
- ♦ combined in a housing
- ♦ in footwell at brake pedal ⇒ page 23-3, Fig. 2

E - Clutch pedal switch (F36)
- ♦ in footwell at clutch pedal ⇒ page 23-3, Fig. 2

1 - Intake fitting
- With mechanical exhaust gas recirculation valve
- With intake manifold flap

2 - Intake manifold flap changeover valve (N239)

3 - Injection nozzle with needle lift sender (G80)

4 - Diesel direct injection system control unit (J248)
- With altitude sender (F96)

5 - Electromagnetic EGR valve (N18)

6 - Charge pressure control solenoid valve (N75)

7 - Air mass meter (G70)

8 - High heating capacity relay (J360)
- Only for models with optional equipment

9 - Low heating capacity relay (J359)
- Only for models with optional equipment

10 - Coolant temperature sender (G62)

11 - Engine speed sender (G28)

12 - Plug connection
- 2-pin
- For needle lift sender (G80)

13 - Plug connection
- 3-pin
- For engine speed sender (G28)

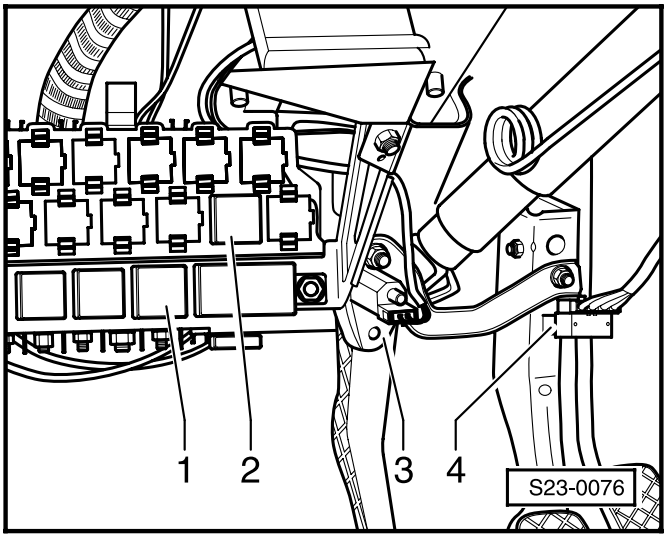
14 - Plug connection
- 10-pin
- For fuel temperature sender (G81)
- For quantity adjuster (N146)
- For modulating piston movement sender (G149)
- For commencement of injection valve (N108)
- For fuel cut-off valve (N109)

15 - Commencement of injection valve (N108)

16 - Fuel cut-off valve (N109)

17 - Fuel metering control of injection pump
- With fuel temperature sender
- With quantity adjuster (N146)
- With modulating piston movement sender (G149)

18 - Intake manifold pressure sender (G71) and intake manifold temperature sender (G72)



◄ **Fig. 2 Components in footwell**

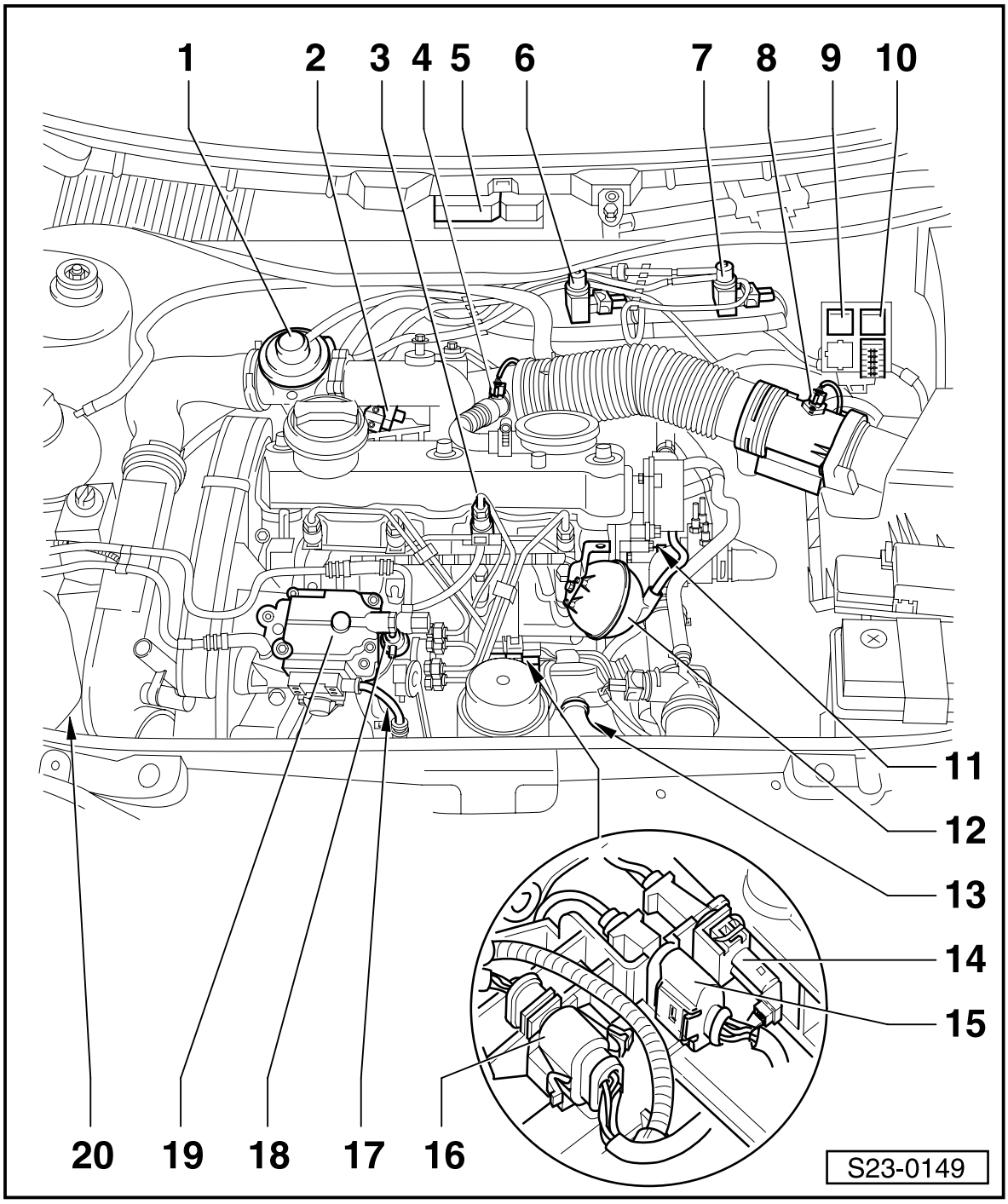
1 - Glow plug relay (J52)

2 - Diesel direct injection system relay (J322)

3 - Clutch pedal switch (F36)

4 - Brake light switch (F) and brake pedal switch (F47)

Overview of fitting locations 08.00 ➤



Components A to E are not shown in the illustration.

A - Diesel direct injection system relay (J322)
- ♦ electrical centre ⇒ page 23-3.2, Fig. 3

B - Glow plug relay (J52)
- ♦ electrical centre ⇒ page 23-3.2, Fig. 3

C - Accelerator pedal position sender (G79)
- ♦ in footwell at accelerator pedal ⇒ page 23-6

D - Brake light switch (F) and brake pedal switch (F47)
- ♦ combined in a housing
- ♦ in footwell at brake pedal ⇒ page 23-3.2, Fig. 3

E - Clutch pedal switch (F36)
- ♦ in footwell at clutch pedal ⇒ page 23-3.2, Fig. 3

1 - Mechanical exhaust gas recirculation valve
- with intake manifold flap

2 - Intake manifold flap changeover valve (N239)

3 - Injection nozzle with needle lift sender (G80)

4 - Heated crankcase ventilation (N79)
- only models with optional equipment

5 - Diesel direct injection system control unit (J248)
- with altitude sender (F96)

6 - Electromagnetic exhaust gas recirculation valve (N18)

7 - Charge pressure control solenoid valve (N75)

8 - Air mass meter (G70)

9 - Low heating capacity relay (J359)
- only models with optional equipment

10 - High heating capacity relay (J360)
- only models with optional equipment

11 - Coolant temperature sender (G62)

12 - Vacuum unit

13 - Engine speed sender (G28)

14 - Plug connection
- 2-pin
- for needle lift sender (G80)

15 - Plug connection
- 3-pin
- for engine speed sender (G28)

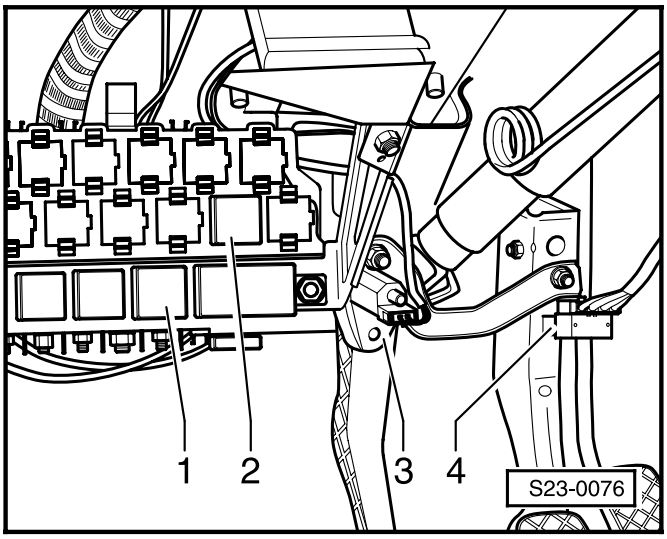
16 - Plug connection
- 10-pin
- for fuel temperature sender (G81)
- for quantity adjuster (N146)
- for modulating piston movement sender (G149)
- for commencement of injection valve (N108)
- for fuel shut-off valve (N109)

17 - Commencement of injection valve (N108)

18 - Fuel shut-off valve (N109)

19 - Fuel metering control of injection pump
- with fuel temperature sender (G81)
- with quantity adjuster (N146)
- with modulating piston movement sender (G149)

20 - Intake manifold pressure sender (G71) and intake manifold temperature sender (G72)



◄ **Fig. 3 Components in footwell**

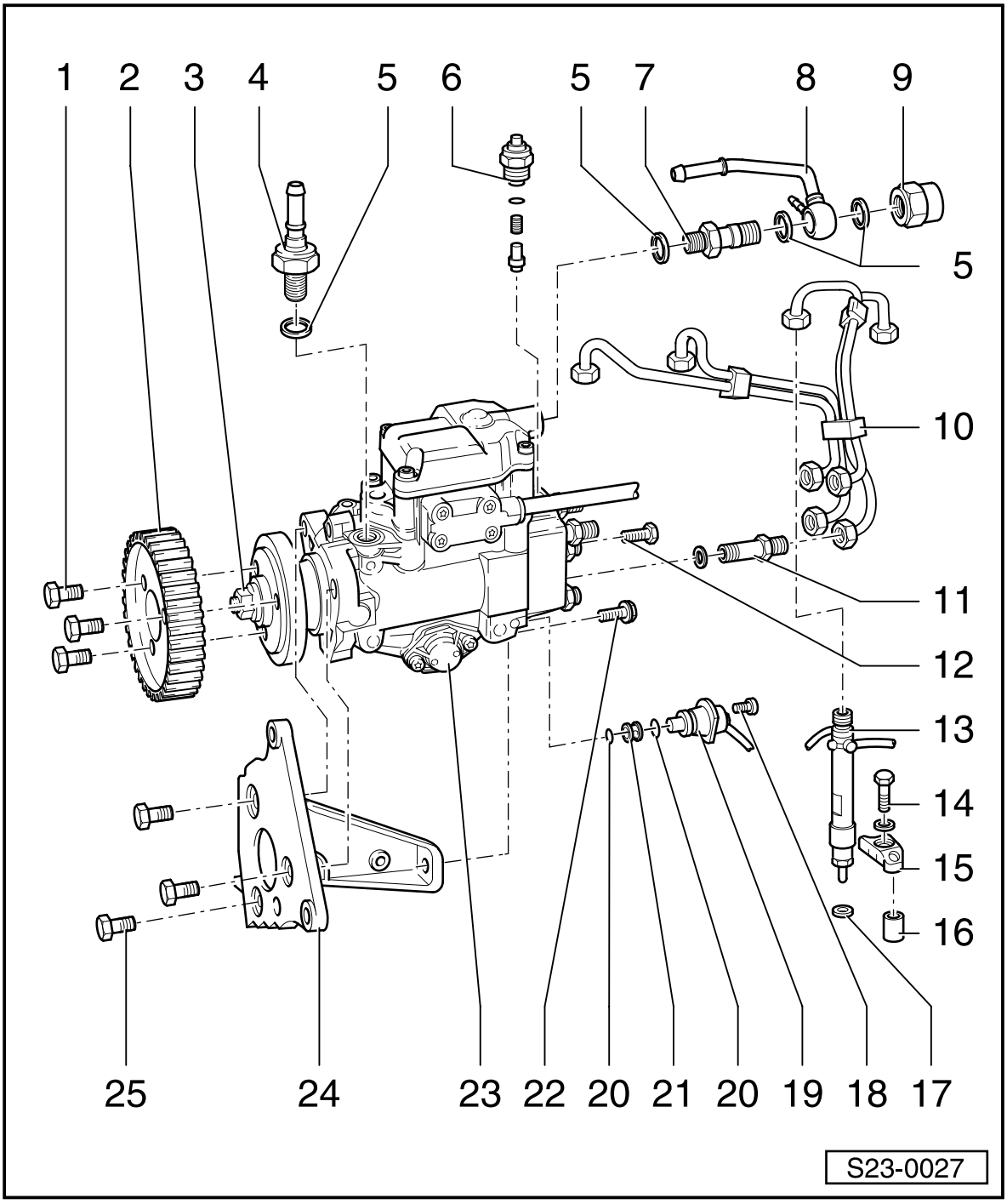
1 - Glow plug relay (J52)

2 - Diesel direct injection system relay (J322)

3 - Clutch pedal switch (F36)

4 - Brake light switch (F) and brake pedal switch (F47)

Servicing injection pump



- Pay attention to safety precautions ⇒ page 23-1
- Pay attention to rules for cleanliness ⇒ page 23-1
- Removing and installing injection pump ⇒ page 23-8
- Dynamic test and setting of start of injection ⇒ page 23-13

Note:

Fuel hoses at the engine must be secured only with spring-strap clips. It is not permitted to use clamp-type or screw-type clips.

1 - Stretch bolt
- Always replace
- 20 Nm + $^1/_4$ turn (90°)

2 - Injection pump gear

3 - Hub nut
- On no account slacken

4 - Connection fitting
- for feed line
- 28 Nm

5 - Seal
- replace

6 - Fuel shut-off valve
- 20 Nm

7 - Connection fitting
- for return-flow line
- 28 Nm

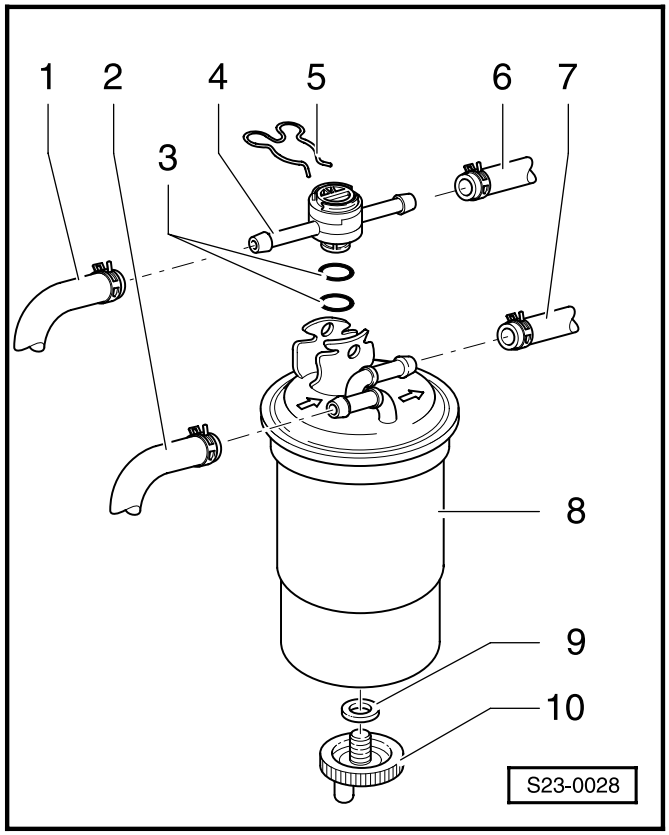
8 - Return-flow line
- to control valve/fuel filter

9 - 25 Nm

10 - Injection lines
- tighten to 25 Nm
- use ring wrench, e.g. 3035, for removing injection lines
- always remove complete set of lines

11 - Pressure valve
- 45 Nm

12 - 25 Nm



13 - Injection nozzle
- for cylinder 3 with needle lift sender
- removing and installing, testing ⇒ page 23-16
- tighten screw for return-flow line of cylinder 3 to 10 Nm

14 - 20 Nm

15 - Tensioning bar

16 - Bearing bracket

17 - Copper seal

18 - 12 Nm

19 - Commencement of injection valve (N108)

20 - O-ring

21 - Strainer

22 - 25 Nm

23 - Cover for injection timing device

24 - Mounting bracket

25 - 25 Nm

Servicing fuel filter

Note:

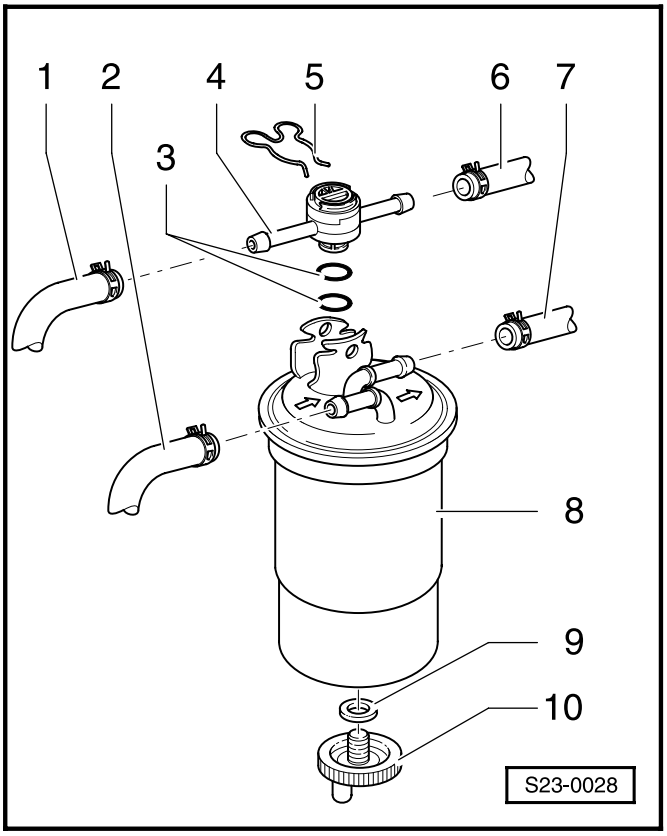
Fuel hoses at the engine must be secured only with spring strap clips. It is not permitted to use collar-type or screw-type clips.

1 - Return-flow line
- to fuel tank

2 - Feed line
- from fuel tank

3 - O-ring
- do not mix up, blue ring at top

4 - Control valve
- fitting location: arrow points toward fuel tank
- if filter replaced, remove retaining clamp and take off control valve with fuel lines connected
- passage to filter opened at temperature below +15 °C
- passage to filter closed at temperature above +31 °C



1 - Retaining clip

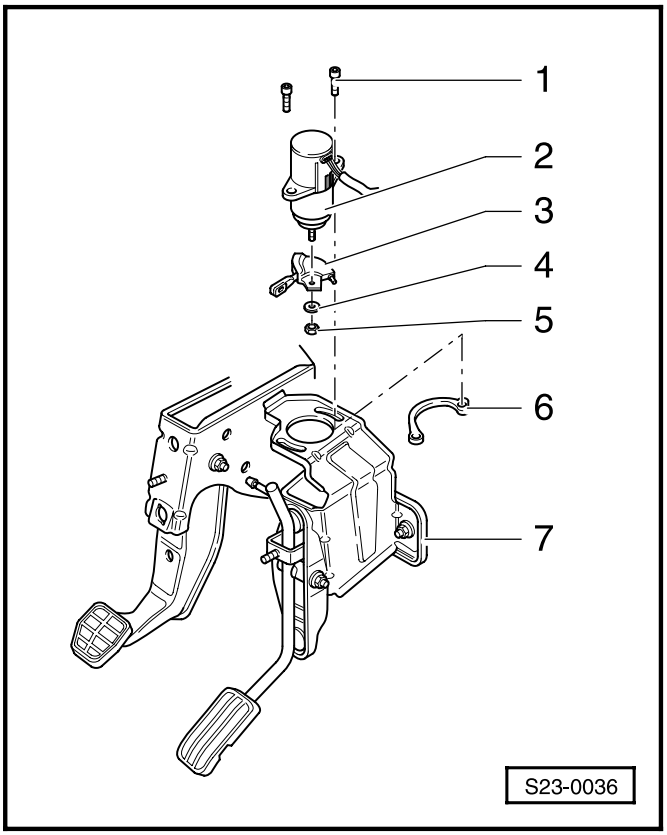
2 - Return line
- from injection pump

3 - Feed line
- to injection pump

4 - Fuel filter
- the direction of flow is marked by arrows
- for removing loosen clamping screw at bracket
- do not mix up connections
- replace if damaged
- fill up with diesel fuel before installing

5 - Gasket
- replace if damaged

6 - Drain plug
- to ventilate remove the retaining clip of the preheating valve and remove preheating valve with the fuel lines connected, loosen clamping screw and pull the filter upwards
- release and drain approx. 0.1 litre fluid



Assembly overview of throttle mechanism

For vehicles ➤ 07.98

1 - Allan screw
- 10 Nm

2 - Accelerator pedal position sender (G79)
- inspecting ⇒ page 23-47
- setting ⇒ page 23-7

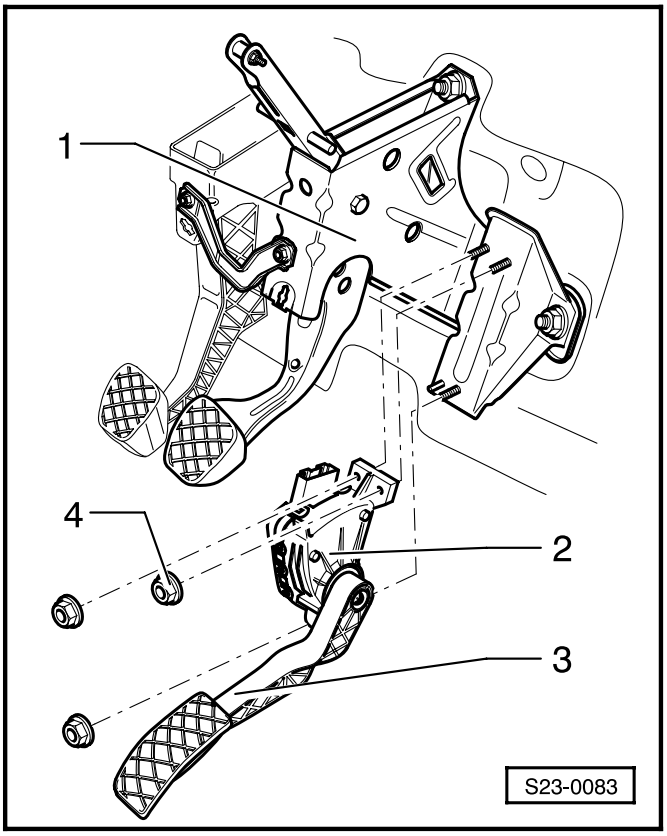
3 - Pulley

4 - Spring washer

5 - 10 Nm

6 - Thread cage

7 - Pedal bracket



Models 08.98 ➤

1 - Pedal bracket

2 - Accelerator pedal position sender (G79)
- testing ⇒ page 23-47

3 - Accelerator pedal

4 - 10 Nm

Setting accelerator pedal position sender

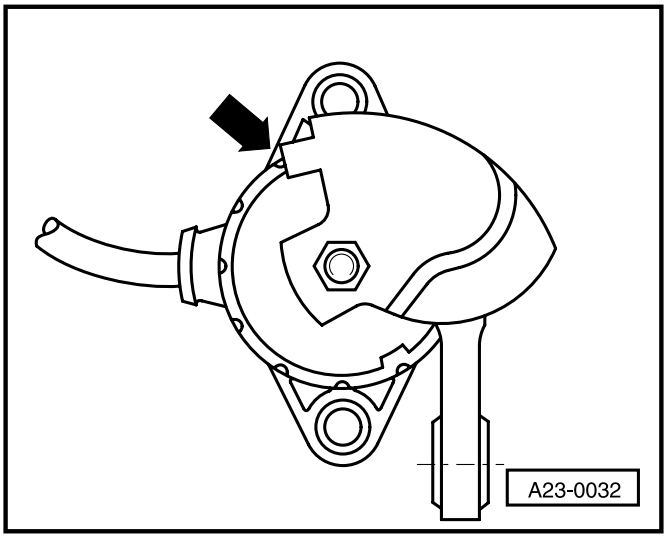
Models ➤ 07.98

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter, e.g. V.A.G 1526A
- Test box V.A.G 1598/22

Test procedure

If the sender has been removed:



◄ - Install cable pulley in position shown.

- Install sender with preassembled cable pulley.
- Connect vehicle system tester V.A.G 1552 ⇒ page 01-2.

- Select function 08 „Read measured value block“ and display group 002 ⇒ page 01-46, ignition switched on for this step.

Read measured value block	2	→
0 rpm **0.0 %** **0 1 0**	18.4 °C	

◄- Check readout in display block 2 (accelerator pedal position); accelerator not depressed.
Specification: 0.0 %

- Check readout in display block 3 (idling speed switch).
Specification: 0 **1** 0

- Slowly depress accelerator pedal.

Read measured value block	2	→
0 rpm **100.0 %** **0 0 0**	18.4 °C	

◄ Specification: readout in display block 2 must rise steadily up to 100 % (accelerator pedal fully depressed)

At 100 % the accelerator pedal must have reached full throttle stop.

- Check readout in display block 3 (idling speed switch).
Specification: 0 **0** 0

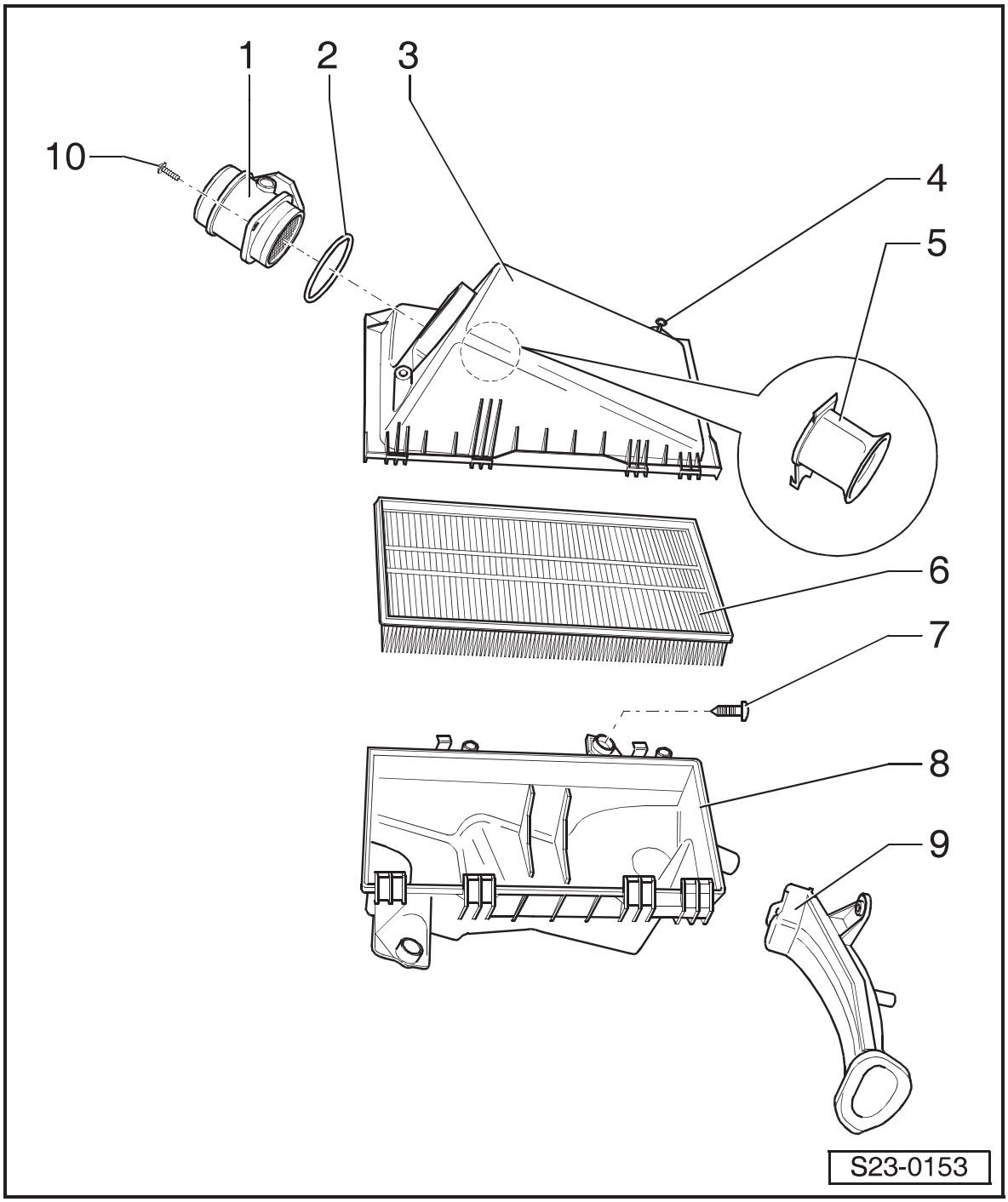
If the specification or full throttle stop is not reached:

- Turn the sender in the slots of the pedal bracket.

If the relevant readouts do not change or only in some cases:

- Test accelerator pedal position sender (G79) ⇒ page 23-47.

Disassembling and assembling air filter



1 - Air mass meter -G70
- ♦ inspecting ⇒ page 23-35.

2 - Gasket ring

3 - Air filter top part

4 - 6 Nm

5 - Air guide
- ♦ in air filter top part guide

6 - Filter element

7 - 10 Nm

8 - Air filter bottom part

9 - Air guide

10 - 6 Nm

Removing and installing injection pump

Special tools, aids and testers required

- Adjusting straightedge MP 1-312
- Adjusting device for TDC MP 1-313
- Rig pin 3359
- Counterholder MP 1-216
- Key for the timing belt tensioner (e.g. Matra V159, Hazet 2587, Stahlwille 127-17)
- Connection fitting e.g. V.A.G 1318/10
- Vacuum pump (e.g. V.A.G 1390)
- Torque
- Ring spanner for injection lines (e.g. 3035)
- Puller T40001 with hooks T40001/2 and T40001/3
- Feeler gauges
- If necessary steel straightedge (tear-off tool)
- Transparent plastic line

Removing

- Remove right headlight ⇒ Electrical System; Repair Group 94
- Remove engine cover.
- Remove all the fuel lines from the injection pump.

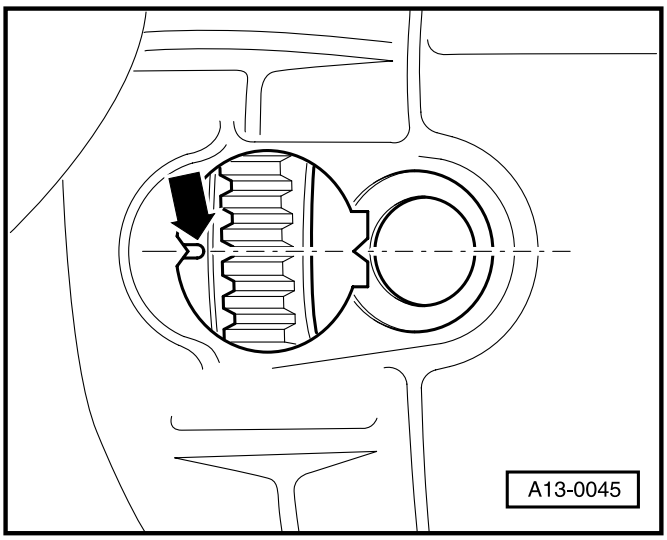
Note:

Use the open ring spanner e.g. 3035 for removing high pressure lines.

- Cover the openings with a clean cloth.
- Remove plug from the intake manifold pressure sender and the intake temperature sender.
- Remove air guide pipe between charge air cooler and intake pipe.

- Remove the top toothed belt guard, the vacuum pump and the cylinder head cover.

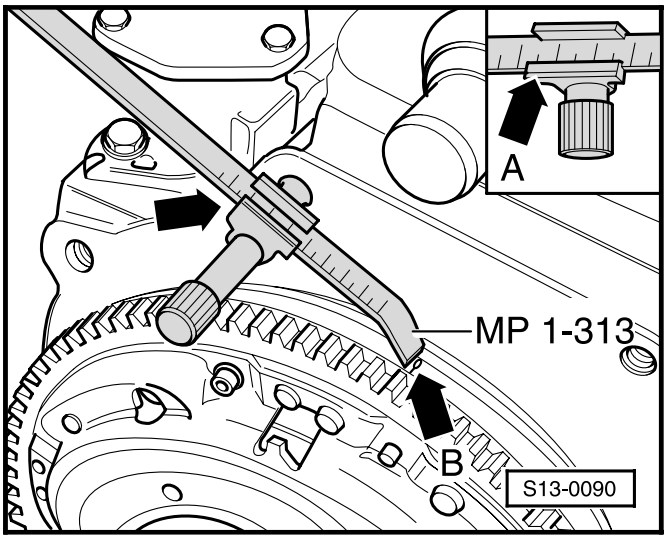
- Remove sound-absorbing pan and air guide pipe between intercooler and turbocharger.



Engine installed

- Take off cover at inspection opening.

◄- Position the crankshaft to TDC of cylinder 1 -arrow-.

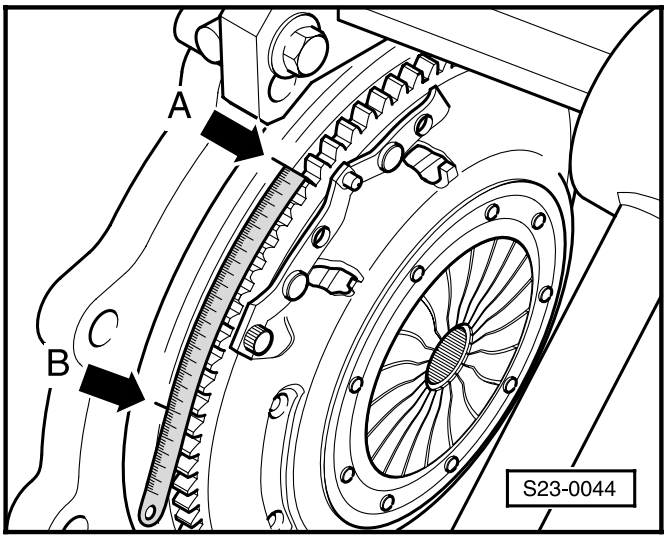


Engine placed down on floor

◄- Screw in setting device for TDC point (MP 1-313, as shown in the illustration.

- Set setting device to 96 mm -arrow- (the left notch of the vernier -arrow A- is the reference point).

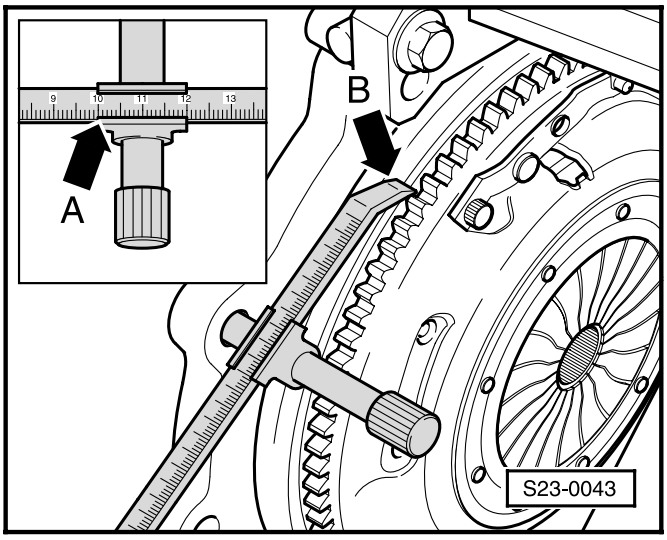
- Rotate crankshaft until TDC marking -arrow B- on the flywheel is aligned with the edge of the setting device.



Engine attached to engine holder MP 1-202

◄- Position flexible steel ruler (marking tool) against the circumference of the flywheel.

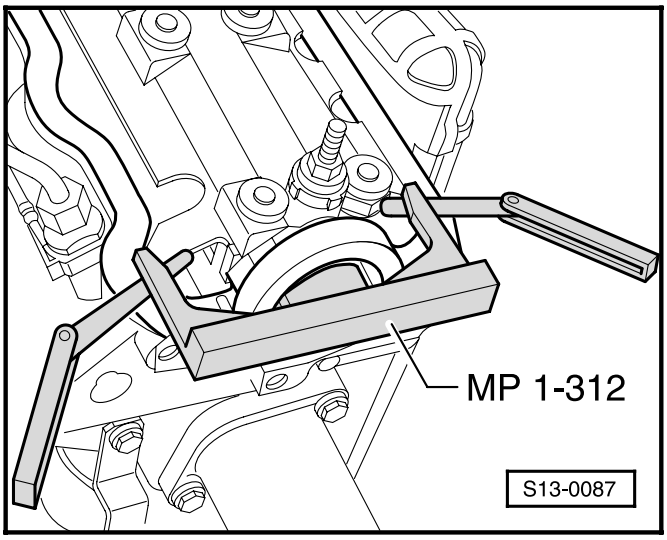
- Measure exactly 100 mm from the TDC marking -arrow A- and make a mark -arrow B- as an aid with marking tool.



◄- Screw in adjusting device for TDC MP 1-313 as shown in illustration.

- Set adjusting device to 91.4 mm (the left-hand notch of the vernier -arrow A- is the reference point).

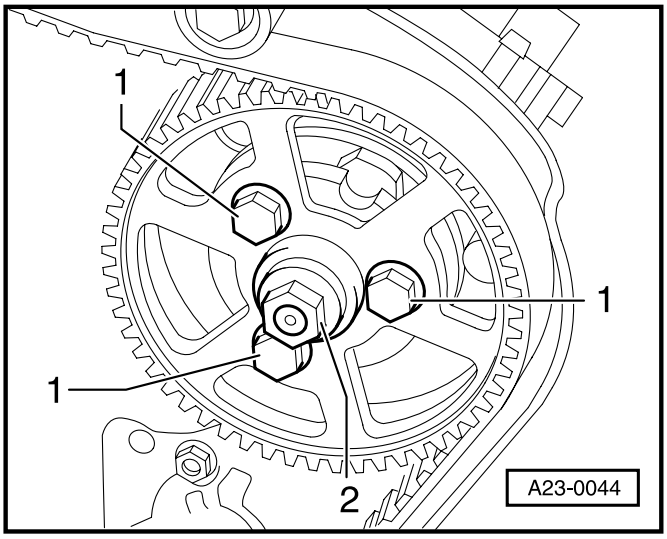
- Rotate crankshaft until the help marking on the flywheel is aligned with the edge of the adjusting device -arrow B-.



For all cases

◄- Lock the camshaft with the adjusting straightedge MP 1-312.

- The adjusting straightedge should be centred as follows: Rotate the locked camshaft until one end of the adjusting straightedge makes contact with the cylinder head. Use a feeler gauge to measure the clearance produced at the other end of the adjusting straightedge. Insert a feeler gauge equal to half the clearance measured, between adjusting straightedge and cylinder head. Now, rotate the camshaft until the adjusting straightedge touches the feeler gauge. Insert a second feeler gauge with the same thickness at the other end between adjusting straightedge and cylinder head.

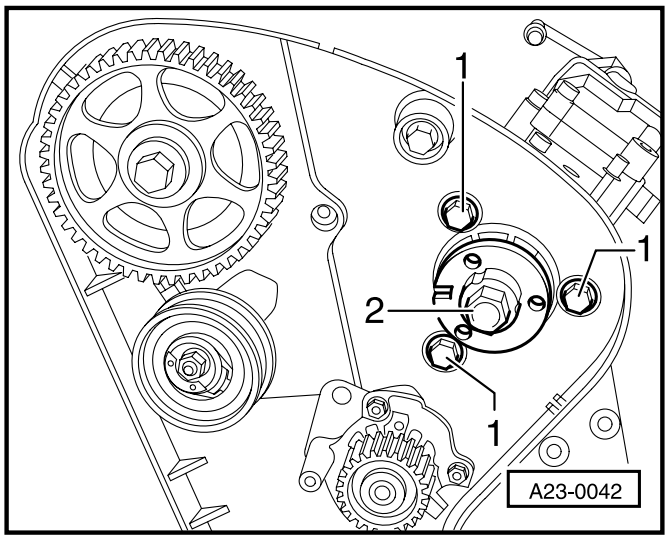


◄- Slacken the bolts -1- attaching the injection pump sprocket.

Notes:

- *Use the locking pin 3359 for counterholding the injection pump sprocket ⇒ page 23-12, Fig. A13-0052.*
- *Always moisten the locking pin with oil. Use a mirror to make it easier to insert the pin.*
- *If it is not possible to lock the injection pump sprocket with the locking pin, rotate the crankshaft so that the holes for the locking pin are aligned. Then, slacken the bolts of the injection pump sprocket and, only now, position the crankshaft to TDC.*
- *On no account, slacken the central nut -2- of the injection pump sprocket otherwise the basic setting of the injection pump will be altered and can no longer be set with workshop tools.*

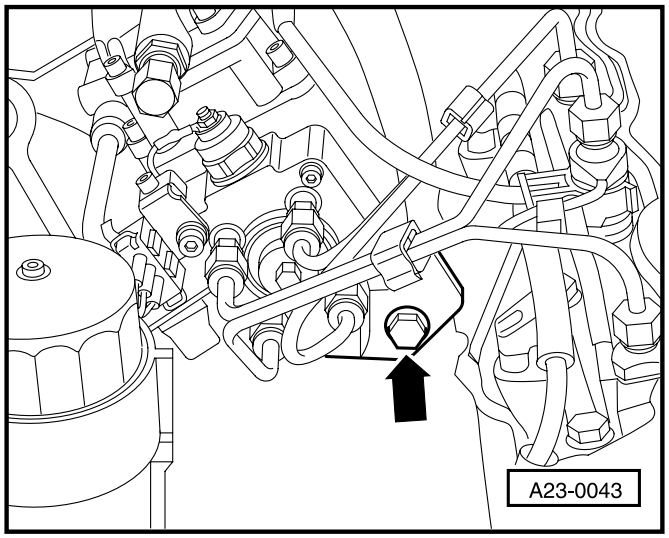
- Unscrew the nut of the tensioning pulley.
- Take the toothed belt off the toothed belt sprockets of the camshaft and injection pump.
- Unplug the connector for the electrical connections of the injection pump.



◄ - Unscrew the securing bolts -1- at the mounting bracket.

Note:

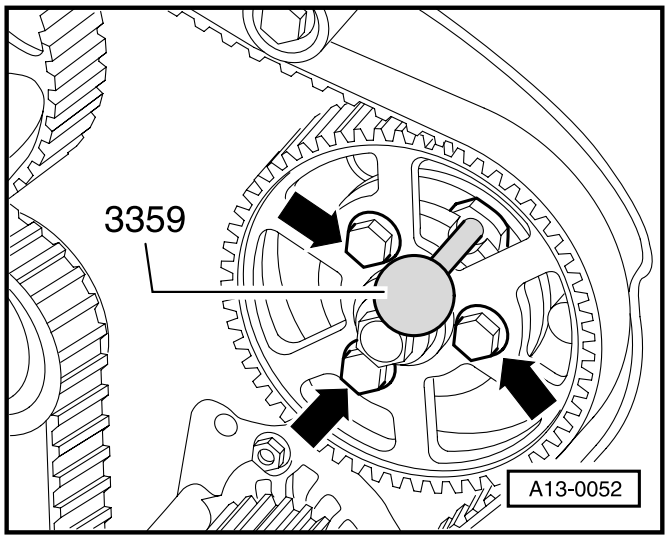
On no account, slacken the central nut -2- of the injection pump sprocket otherwise the basic setting of the injection pump will be altered and can no longer be set with workshop tools.



◄ - Then, unscrew the securing bolts from the rear support -arrow-.
- Take off the injection pump.

Installing

- Insert the injection pump into the mounting bracket and first of all attach the bolt at the rear support with the tapered nut.
- Insert the front securing bolts and tighten the bolts to 25 Nm.
- Loosely secure the injection pump sprocket at the hub with new securing bolts (do not rotate injection pump sprocket).



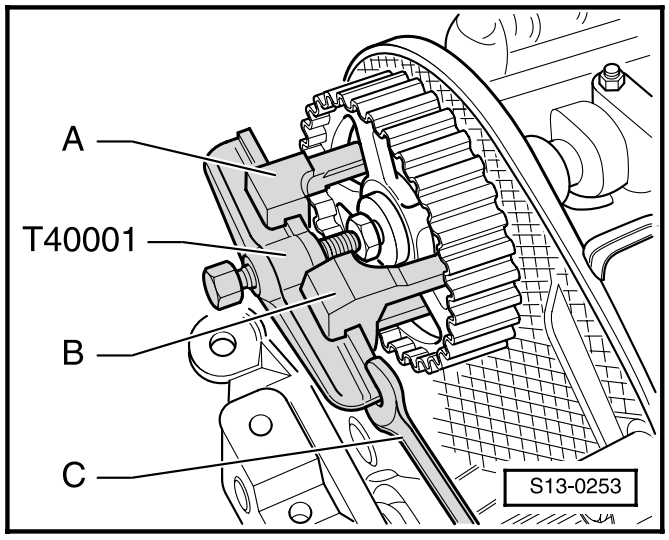
◄- Align the injection pump gear in the middle of the slots -arrows-.

- Lock the injection pump gear with the locking pin 3359.

- Slacken the bolt attaching the camshaft sprocket about 1/2 turn.

Note:

The adjusting straightedge must not be used as a counterholder when slackening and tightening the camshaft sprocket. Counterhold camshaft sprocket with special tool MP 1-216.

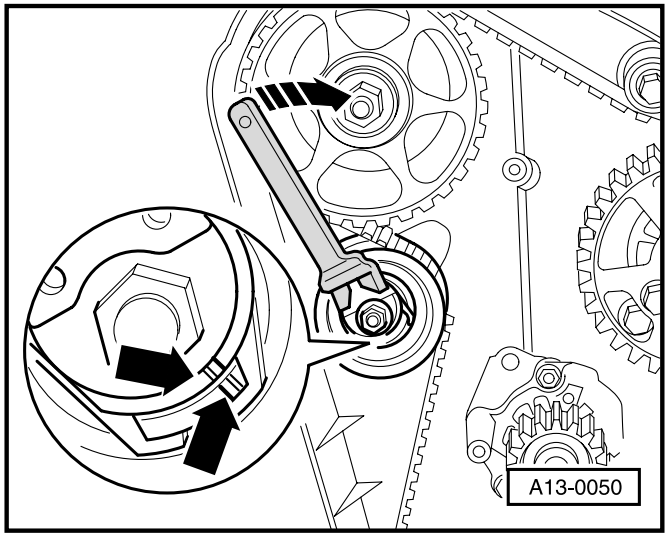


◄- Insert puller T40001 with hook T40001/2 -A- and T40001/3 -B- onto the belt pulley. Use the open-end wrench -C- as a counterholder and detach the belt pulley from the taper of the camshaft.

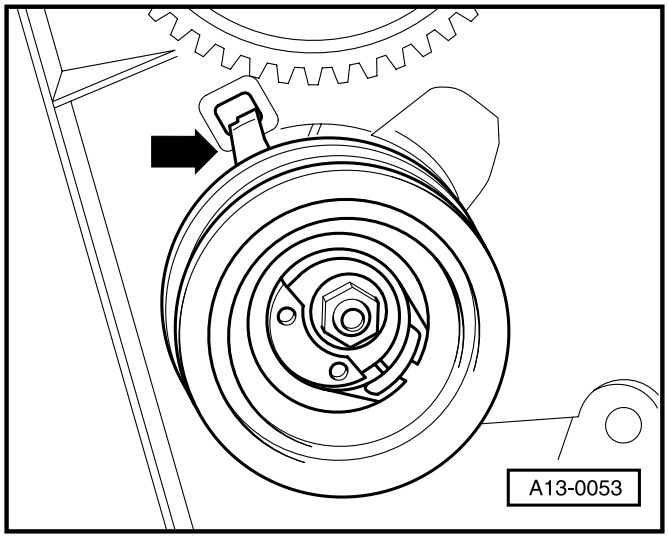
- Tighten the bolt attaching the camshaft sprocket so that it is still possible to turn the camshaft sprocket.

- Check whether the TDC marking on the flywheel is positioned opposite the reference mark.

- Fit toothed belt onto injection pump gear, camshaft sprocket and tensioning pulley.



◄- Tension toothed belt. Use the toothed belt tensioning wrench (e.g. Matra V159) with setting wedge to turn sufficiently to the right until notch and raised section -arrows- are positioned opposite.



Note:

◄ *Ensure the retaining claw is correctly positioned.*

- Tighten the securing nut to 20 Nm.
- Once again, check the TDC marking at the flywheel.
- Tighten the new bolts for attaching the injection pump sprocket to 20 Nm.

Note:

The bolts for attaching the sprocket must only be used once as these are stretch bolts.

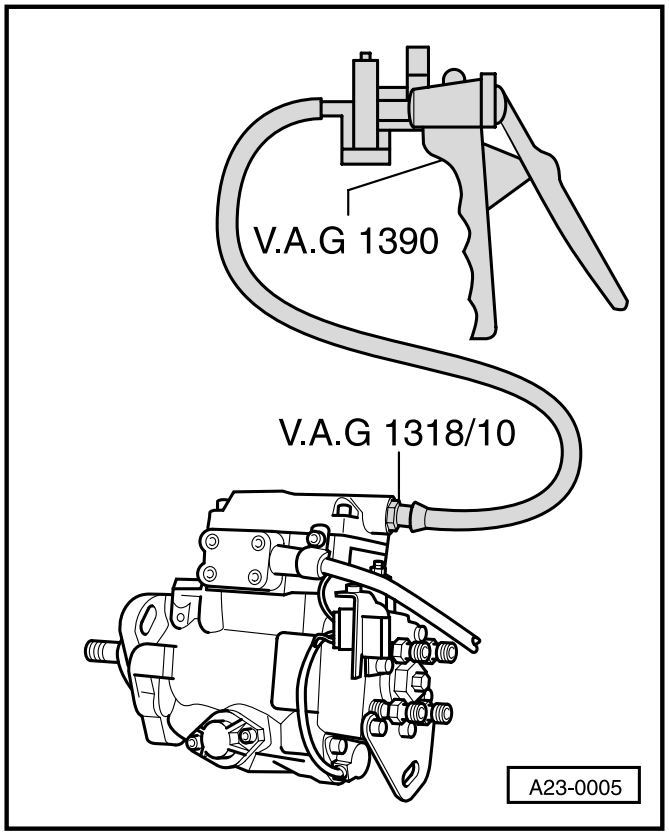
- Tighten the bolt for attaching the camshaft sprocket to 45 Nm (counterhold with MP 1-216).
- Remove the locking pin 3359.
- Remove the adjusting straightedge MP 1-312 from the camshaft.
- Rotate the crankshaft two revolutions in direction of rotation of engine until the crankshaft is again positioned at TDC of cylinder 1.
- Check whether the injection pump sprocket can be locked with locking pin 3359.

If it is not possible to lock the injection pump sprocket:

- Rotate the crankshaft sufficiently until the holes for the locking pin are aligned and lock the injection pump sprocket with locking pin 3359.
- Slacken the bolts attaching the injection pump sprocket.
- Rotate crankshaft until the help marking on the flywheel is aligned with the edge of the adjusting device.

If it is possible to lock the injection pump sprocket:

- Tighten the bolts attaching the injection pump sprocket to 20 Nm + ¼ turn (90°).
- Remove locking pin 3359.



- Connect the injection lines, fuel feed line and electric cables.

◄- Fill the injection pump with clean diesel fuel as follows:

  - Screw the connection fitting V.A.G 1318/ 10 into the return flow opening of the injection pump.
  - Connect the vacuum pump (e.g. V.A.G 1390) to the return-flow opening with a transparent fuel line about 1 m long.
  - Operate the vacuum pump until fuel flows out of the return-flow opening. Do not draw fuel into the vacuum pump.

- Close the return-flow pipe.
- Install top toothed belt guard, vacuum pump and cylinder head cover.
- Install air guide pipe from intercooler with hose to the intake manifold.
- Install connectors at intake manifold pressure sender and intake manifold temperature sender.
- Install right headlight ⇒ Electrical System; Repair Group 94; Exterior Lights/Bulbs/ Switches.
- Install top engine trim panel.
- Install sound-absorbing pan and air guide pipe between intercooler and turbocharger.
- Dynamically test and set commencement of injection ⇒ page 23-13.

Dynamically testing and setting commencement of injection

Notes:

- *Commencement of injection must always be checked and set, if necessary, after replacing the toothed belt or also after slackening the bolted connections at the injection pump or at the toothed belt sprockets.*
- *Dynamic testing of commencement of injection is only possible in function 04 „Basic setting of engine“ as, during this function, the commencement of injection valve is constantly actuated and the injection timing device is thus „retarded“.*

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Torque wrench 5...50 Nm (e.g. V.A.G 1331)
- Counterholder MP 1-216
- Locking pin 3359

Test procedure

- Select function „Basic setting“, display group 001 ⇒ page 01-21.

Initiate basic setting								0	→
1	2	3	4	5	6	**7**	8	9	10

◄ - Check readout in display block 7 (coolant temperature).

Specification: less than 73 (equals 85 °C)

Do not continue with the test until the coolant temperature is reached.

Models ➤ 07.00

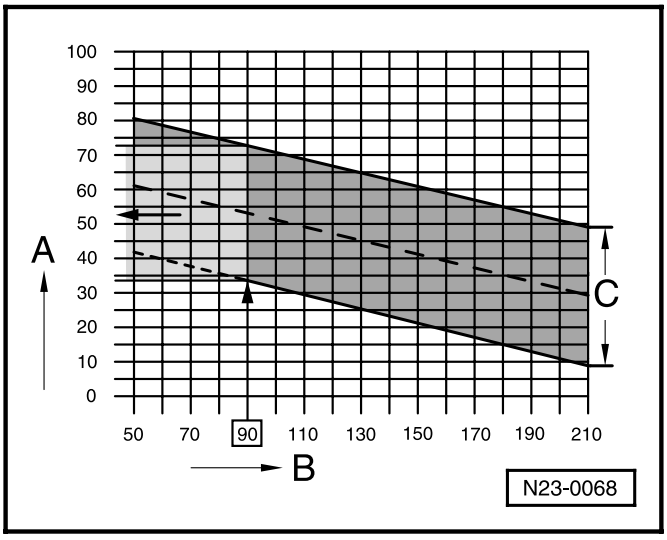
- Commencement of injection in display block 2 is dependent on the fuel temperature in display block 9.

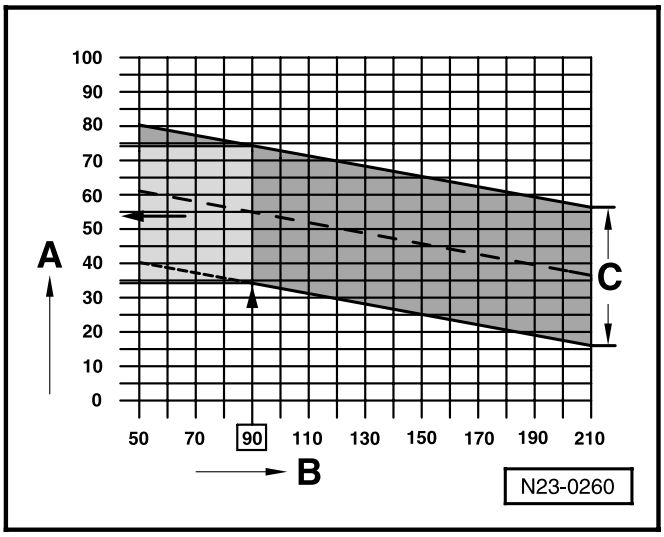
◄ Specification: ⇒ Figure - range C

A - Display block 2, commencement of injection

B - Display block 9, fuel temperature

C - Specified range for commencement of injection





Models 08.00 ➤

- Commencement of injection in display block 2 is dependent on the fuel temperature in display block 9.

◄ Specification: ⇒ Figure - range C

A - Display block 2, commencement of injection

B - Display block 9, fuel temperature

C - Specified range for commencement of injection

Continued for all models

Note:

Provided the check reveals that the commencement of injection is within the specified range -C-, it is not necessary to carry out any new setting. After replacing the injection pump and the engine control unit, the commencement of injection should be set to the mean value.

If the commencement of injection is not within the specified range, set the injection pump as shown in the illustration:

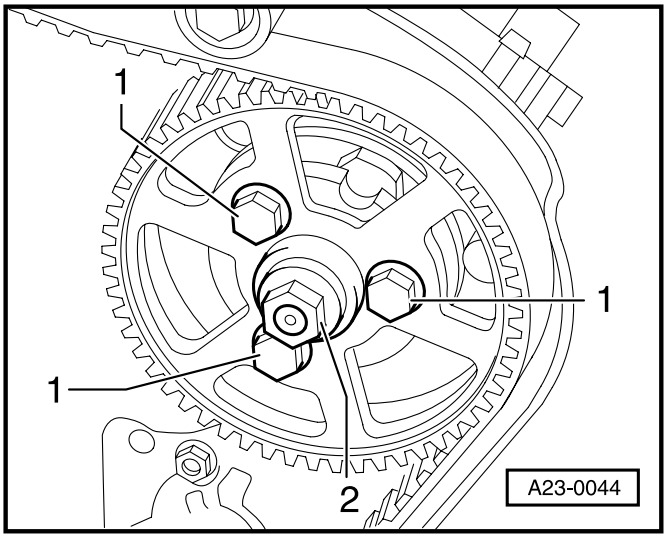
- Switch ignition off.
- Remove top engine trim panel.
- Remove right headlight ⇒ Electrical System; Repair Group 94; Exterior Lights, Bulbs, Switches.
- Unplug connector at intake manifold pressure and intake manifold temperature sender.
- Remove air guide pipe between charge air cooler and intake pipe.
- Remove top toothed belt guard.
- Inspect tension of toothed belt.

  The markings on the tensioning pulley must be positioned opposite.

If the markings are not positioned opposite:

- Adjust tension of toothed belt:

⇒ 1.9 l/66 kW (TDI) Engine, Mechanical Components; Repair Group 13



◄ - Slacken the two bolts -1- attaching the injection pump gear (counterhold with locking pin 3359).

- Position a ring wrench on the hub nut -2- in order to hold the pump shaft tight.

- Slacken the third bolt attaching the injection pump sprocket and turn the pump shaft slightly:

  Turning shaft to the left
  ⇒ commencement of injection retarded

  Turning shaft to the right
  ⇒ commencement of injection advanced

Note:

On no account should you slacken the nuts -2- for the hub otherwise the basic setting of the injection pump will be altered and cannot be set with workshop tools.

- Tighten the new bolts for attaching the injection pump sprocket to 20 Nm + 1/4 turn (90°) (counterhold with locking pin 3359).

Note:

The bolts for attaching the sprocket must only be used once as these are stretch bolts.

- Install top toothed belt guard.

- Install air guide pipe from intercooler with hose to intake manifold.

- Plug in connectors at intake manifold pressure sender and intake manifold temperature sender.

- Install top engine trim panel.

- Install right headlamp ⇒ Electrical System; Repair Group 94; Exterior Lights/Bulbs/ Switches.

- Once again check commencement of injection for specified value.

If the commencement of injection is not within the specified range:

- Correct the setting at the injection pump sprocket.

If the commencement of injection is not within the specified range:

- Check fuel injection control ⇒ page 23-28, replace injection pump if necessary.

Injection pump is o.k.:

- Replace engine electronics control unit ⇒ page 23-20.

Removing and installing and testing injectors

Note:

Faulty injectors cause the following problems:

- *Loss of power*
- *Excessive black smoke in exhaust*
- *Intensified blue exhaust when starting from cold*
- *High fuel consumption*
- *Engine overheats*
- *Knocking in one or several cylinders*
- *Misfiring*

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Injector tester (e.g. V.A.G 1322)
- Delivery pipe V.A.G 1322/2
- Torque wrench 5...50 Nm (e.g. V.A.G 1331)
- Ring wrench for injection pipes (e.g. 3035)
- As need be, puller for valve stem seals MP 1-230 and auxiliary tool

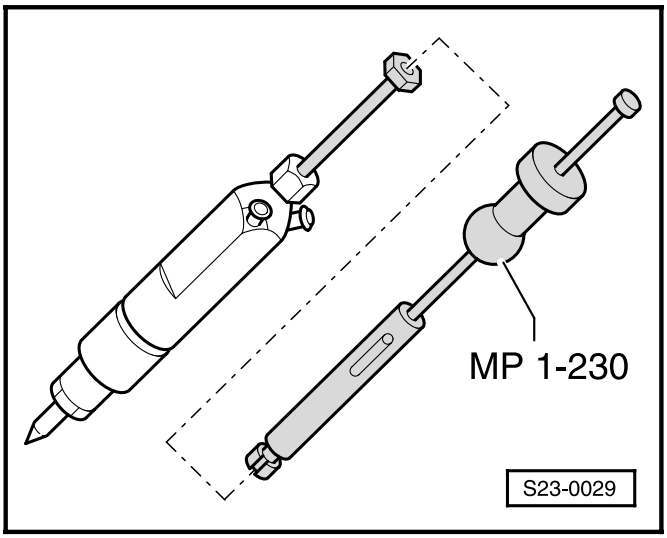
Removing

- Use the ring wrench (e.g. 3035) to detach the injection pipes.
- If necessary, unscrew banjo bolt for return-flow pipe (injector of cyl. 3).

Note:

Always remove all of the injection pipes. Do not alter the shape.

- Unscrew securing bolt, take off tensioning clamp and remove injector.
- Shop-make the following auxiliary tool for injectors which are tight:



Preparing an auxiliary tool

- Saw off an injection line (e.g. spare part line) approx. 5 cm behind the nozzle union nut.
- Hard solder an M6 bolt to the sawn off line.
- Thoroughly clean the auxiliary tool, the injection nozzle cannot be used if dirty!

◄- Tighten the union nut of the auxiliary tool on the jammed nozzle and insert the extractor MP 1-230 on the welded nut.

Note:

Store the auxiliary tool with dust protection for future use.

Installing

Note:

Always replace the copper seal and O-ring between the cylinder head and injection nozzles.

- Insert injection nozzles.
- Pay attention to correct fitting of the bracket in the cylinder head.
- Insert clamp and tighten fixing screw.

Tightening torques:
Injection lines: 25 Nm
Banjo bolt for return line (cyl. 3): 10 Nm
Screw for clamp: 20 Nm

Testing

- Connect vehicle system tester V.A.G 1552 and activate the function „Reading measured value block“ ⇒ page 01-28.2.

Reading measured value block	13	→
0.82 mg/H	-0.12 mg/H	0.49 mg/H

◄- Reading measured value block, display group 013, engine in idle ⇒ page 01-47.

Specified value: -1.50 mg/H...+1.50 mg/H (milligram per stroke)

- If one or several specified values are outside the tolerance, interchange the injection nozzles (except for the nozzle of cylinder 3).

- If the fault moves with the injector, replace the relevant injector.

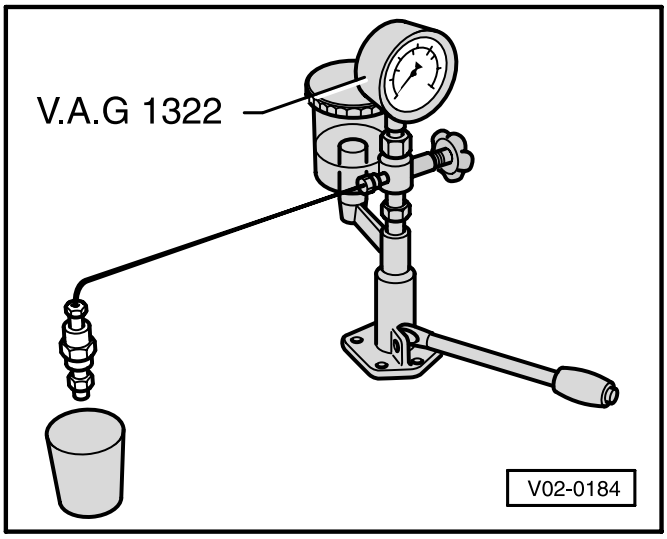
- If the fault remains at the cylinder, test the compression.

- If the compression is o.k., replace the relevant delivery valve together with seal
  ⇒ page 23-4, Servicing injection pump.

Notes:

- *Always use a soft object (plastic, wood) to remove the seal from the pump otherwise the sealing surface may be scratched.*
- *If the car has covered more than 15000 km, always replace the set of delivery valves.*

This engine is equipped with 2-spring injectors. The quantity of fuel is injected in this case in 2 stages.
If there is any problem with these injectors, it is only possible to replace them as it is neither possible to set the pressure nor to repair the injector.



◄ Test injectors with injector tester (e.g. V.A.G 1322) and pressure pipe V.A.G 1322/2.

Important!

When testing injectors, ensure that the fuel spray does not strike your hands otherwise the fuel will penetrate into the skin as a result of the high pressure and may cause severe injuries.

- Pressure gauge switched on

- Slowly press the pump lever down. When fuel ejection starts, read off the ejection pressure. If the ejection pressure differs from the specified pressure, replace the injector.

New injectors	19...20 MPa
Wear limit	17 MPa

Testing for leaks

- Pressure gauge switched on

- Slowly press the pump lever down and maintain the pressure at about 15 MPa for 10 seconds. During this time, no fuel should drip out of the injector opening.

- If a leak exists, replace injector.

Wiring and Component Test with Test Box

Note:

- *For testing use e.g. the handheld multimeter -V.A.G 1526 A or B-, also the voltage tester e.g. -V.A.G 1527 B-.*
- *For connecting measuring equipment (e.g. voltage tester, handheld multimeter etc.) always use the adapter cable set e.g. -V.A.G 1594 A, B or C-*
- *The contact numbers of the connector of the control unit and the socket numbers of the test box are identical.*

Attention!

To avoid damaging the electronic components, switch on the relevant measuring range before connecting the measuring cables and comply with the test conditions.

Special tools, aids and testers required

- Test box -V.A.G 1598/22- or -V.A.G 1598/31-

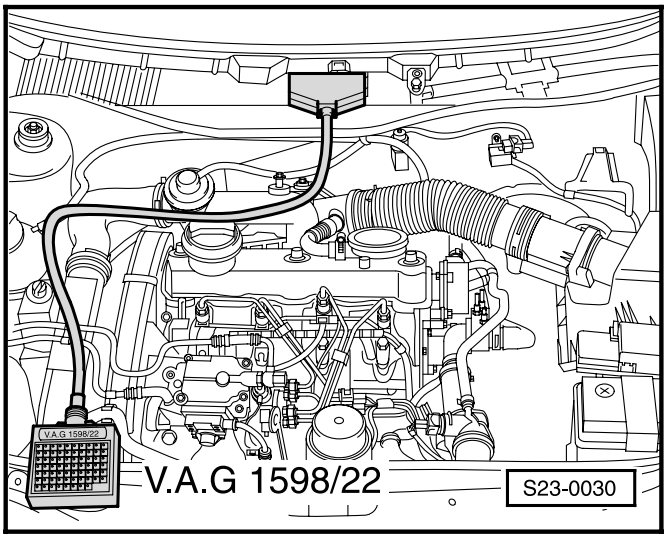
Test procedure

- Switch off ignition.
- Unscrew windscreen wiper arms and remove cover of plenum chamber

⇒ Body Work, Repair Group 66.

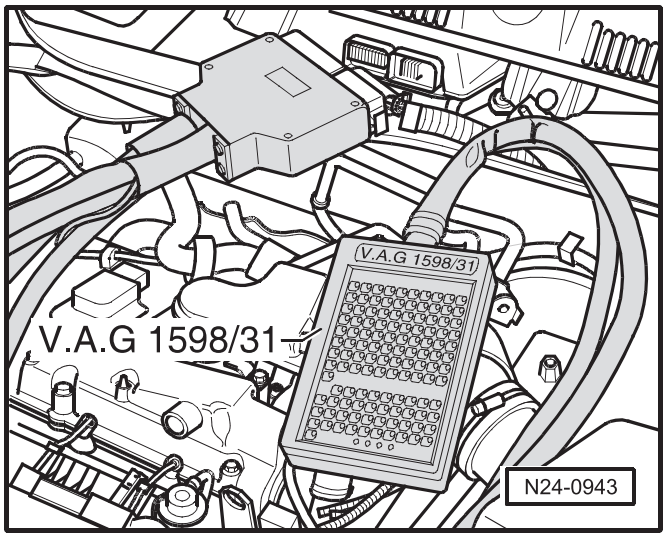
- Release the plug locks and unplug the plug connector of the engine control unit.

For the test box -V.A.G 1598/22-



◄- Connect test box -V.A.G 1598/22- to connector of wiring loom.

- Perform test as described in the relevant repair sequences.



Test box V.A.G 1598/31

◄ - Plug test box V.A.G 1598/31 into the connector of the wiring loom. The earth clip should be clamped to the test box and to the battery.

- Carry out the test as described in the relevant repair procedures.

Notes:

- *Test box V.A.G 1598/31 is designed in such a way that it can be connected simultaneously to the wiring loom to the engine control unit and to the engine control unit itself. The advantage of this is that the electronic engine management system remains fully operational even when the test box is connected (e.g. measuring signals when engine running).*
- *Whether the control unit is connected to the test box, is specified in the relevant test procedures.*

Replacing engine control unit

Special tools, aids and testers required

♦ Vehicle system tester -V.A.G 1552- with cable -V.A.G 1551/3, 3A, 3B or 3C-

- Connect vehicle system tester -V.A.G 1552- and select engine electronics control unit ⇒ page 01-2.

038906018.. 1.9 l R4 EDC G00SG 1002 →
Coding 00002 WSC 01234

◄ The control unit identification appears in the display, e.g.:

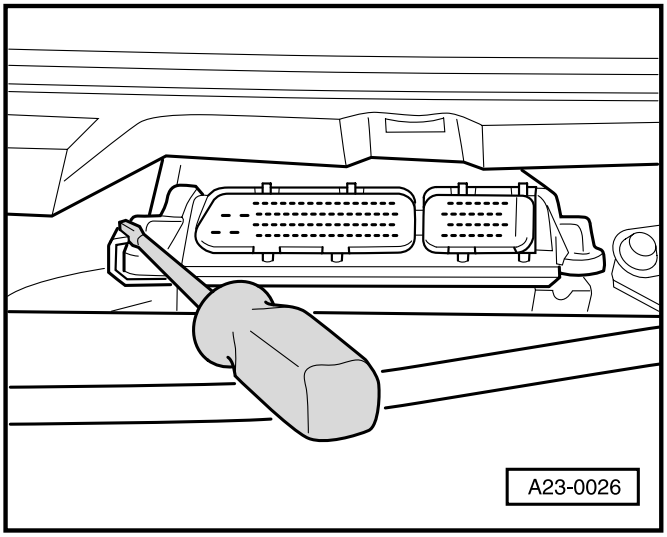
- Part no. of control unit part and write in coding.

- End output (function 06).

Removing

- Switch off ignition.

- Unscrew windscreen wiper arms and remove cover of plenum chamber
⇒ Body Work, Repair Group 66.



- Release the plug locks and remove the control unit plugs.

◄ - Use a screwdriver to push the catch of the fixture to the side and pull the engine control unit forward.

Installing

The installation occurs in reverse order.

- Check current coding and code new control unit ⇒ page 01-23.

- Adjust the engine control unit to the immobilizer control unit
⇒ Electrical System Repair Group 96.

- On vehicles fitted with CCS; activate CCS ⇒ page 23-54.

- Interrogate the fault memory, erase the fault memory, if necessary eliminate any faults which exist ⇒ page 01-5.

For vehicles 08.03 ➤

- Generate readiness code ⇒ page 01-26.

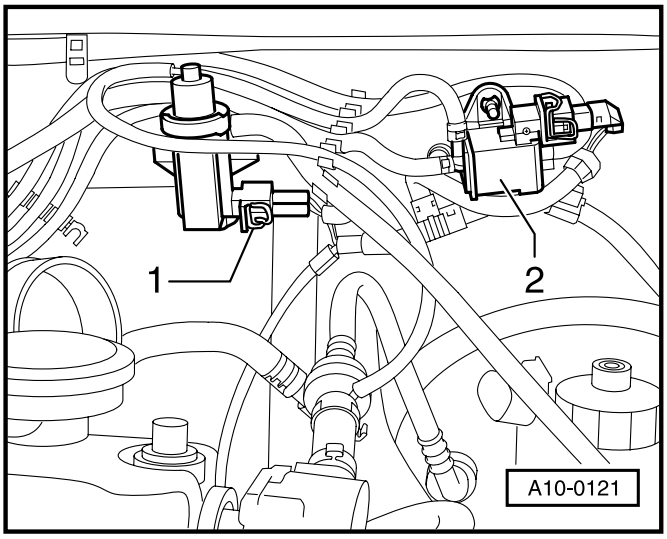
Testing charge pressure system

Testing charge pressure

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

In order to be able to test the function of the charge pressure control, it is necessary to first of all determine the charge pressure without charge pressure control.



Test procedure

◄ - Unplug connector of the charge pressure control solenoid valve (N75) -2-.

- The charge pressure is measured with the vehicle system tester V.A.G 1552 during a road test.

Warning!

Have a second person operate V.A.G 1552.

- Read measured value block, display group 011, engine idling ⇒ page 01-58.

- Accelerate vehicle in 3rd gear at full throttle from about 1500 rpm.

- At about 3000 rpm check readout in display block 3 and note.

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

◄ Specification in display block 3: 1550...1750 mbar

If the charge pressure measured is too low, the following faults are possible:

- Intake manifold pressure sender faulty.
- Leak between turbocharger and intake manifold.
- Turbocharger faulty (turbine blocked by foreign body).
- Mechanism (linkage, shaft) of bypass valve stiff or jammed (bypass valve constantly open).

If the charge pressure measured is too low, the following faults are possible:

- ♦ Hose of charge pressure control dropped off, leaking or blocked.
- ♦ Charge pressure control solenoid valve (N75) blocked.
- ♦ Mechanism (linkage, shaft) of bypass valve stiff or jammed (bypass valve constantly open).
- ♦ Pressure unit leaking.

If the charge pressure measured is o.k., repeat measurement of charge pressure with charge pressure control:

- Plug in connector at charge pressure control solenoid valve (N75).
- Read measured value block, display group 011, engine idling ⇒ page 01-58.
- Accelerate vehicle in 3rd gear at full throttle for about 1500 rpm.
- At about 3000 rpm check readout in display block 3 and note.

Models ➤ 07.97

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

◄ Specification in display block 3: 1800...2050 mbar

Models 08.97 ➤ 04.99

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

◄ Specification in display block 3: 1700...2080 mbar

Models 05.99 ➤

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

◄ Specification in display block 3: 1850...2250 mbar

Continued for all models

If the charge pressure measured is too low, the following faults are possible:

- ♦ Electrical fault in charge pressure control solenoid valve.
- ♦ Charge pressure control solenoid valve (N75) jamming in open position.

If the charge pressure measured is too high, the following faults are possible:

- ♦ Charge pressure control solenoid valve (N75) occasionally jamming in closed position.
- ♦ Charge pressure increase as a result of „tuning“.

Testing charge pressure control solenoid valve (N75)

Special tools, testers and aids required

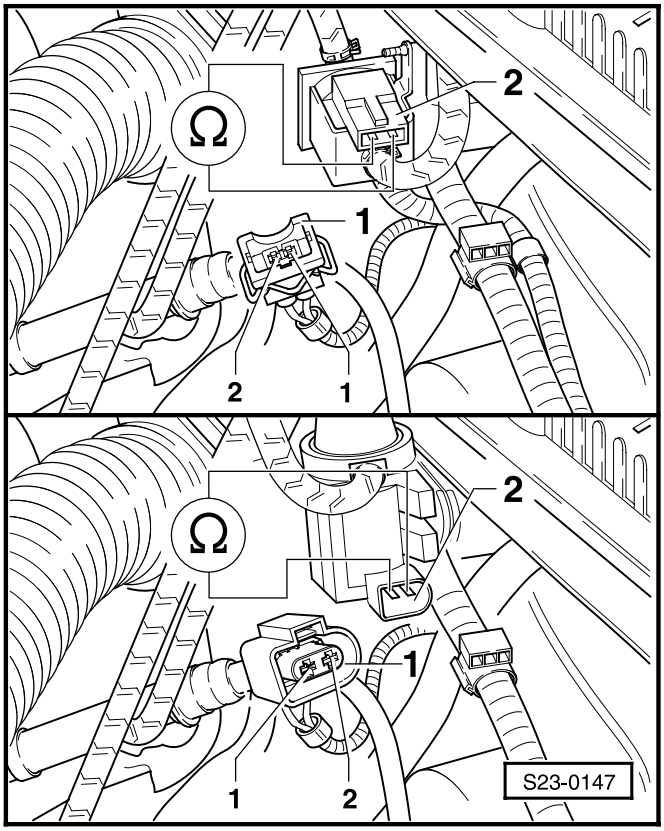
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31
- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Diode test lamp (e.g. V.A.G 1527 B)

Test condition

- Fuses 29 and 34 o.k.

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit ⇒ page 01-2.
- Select final control diagnosis and activate charge pressure control solenoid valve -N75 ⇒ page 01-18.



If the valve is not actuated (does not click):

◄ - Unplug connector -1- from charge pressure control solenoid valve (N75) and connect diode test lamp between contacts of connector.

Diode test lamp must flash.

Diode test lamp flashes.

- End final control diagnosis.
- Switch ignition off.
- Connect multimeter to valve -2- for resistance measurement.

Models ➤ 07.00

Specification: 25...45 Ω

Models 08.00 ➤

Specification: 14...20 Ω

Continued for all models

If the specification is not achieved:

- Replace charge pressure control solenoid valve (N75).

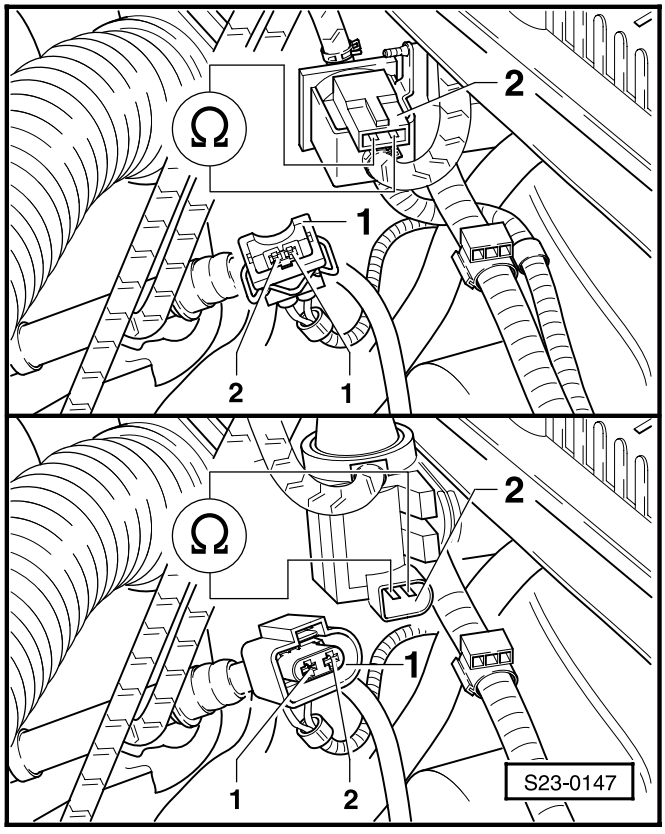
Diode test lamp does not flash:

- End final control diagnosis.
- Switch ignition off.
- Connect multimeter for voltage measurement to contact 1 of connector -1- and to earth.
- Switch ignition on.

  Specification: approx. battery voltage

If the specification is not achieved:

- Switch ignition off.
- Connect test box to wiring loom to engine control unit ⇒ page 23-19.



Test box V.A.G 1598/22

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

2-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	2, 28
2	15

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

◄ Test the following cable connections for short circuit to positive and to negative and for open circuit (connector -1-).

2-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	1, 2
2	62

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing intake manifold temperature sender (G72)

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure

- Read measured value block, display group 007; engine switched off and cooled down ⇒ page 01-51.

Read measured value block		7 →
15.4 °C	**15.9** °C	16.7 °C

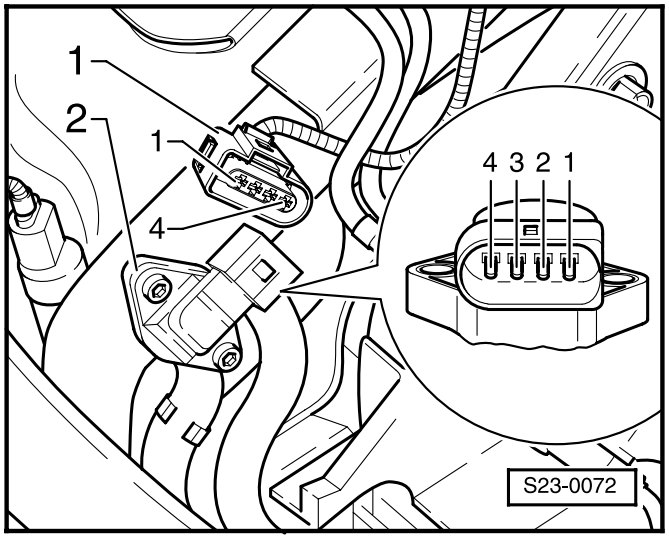
◄- Observe readout in display block 3.

Note:

If an open circuit exists in the wiring to the sender, a substitute value of 136.8 °C is displayed.

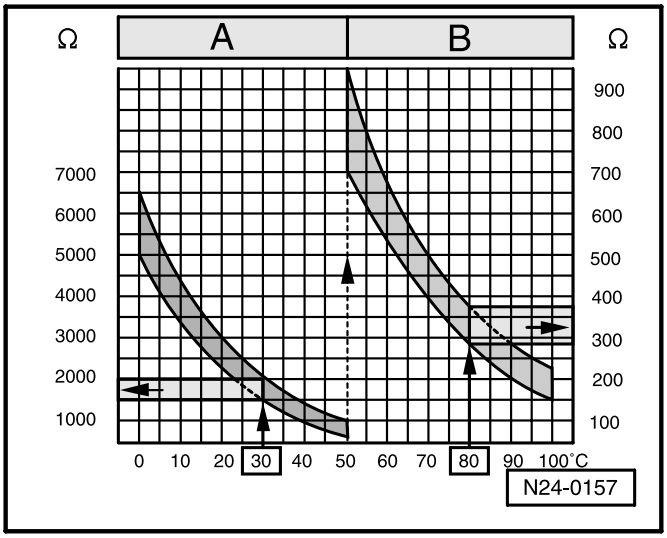
- End output (function 06) and switch ignition off.

If an implausible temperature, or a substitute temperature of 136.8 °C is displayed:



◄- Unplug connector -1- from the intake manifold temperature sender -2-.

- Connect multimeter for resistance measurement to contacts 1 and 2 of the intake manifold temperature sender -2-.



◄ Specification:

Specification in field A applies to temperature 0...50 °C, in field B to a temperature of 50...100 °C.

Example:

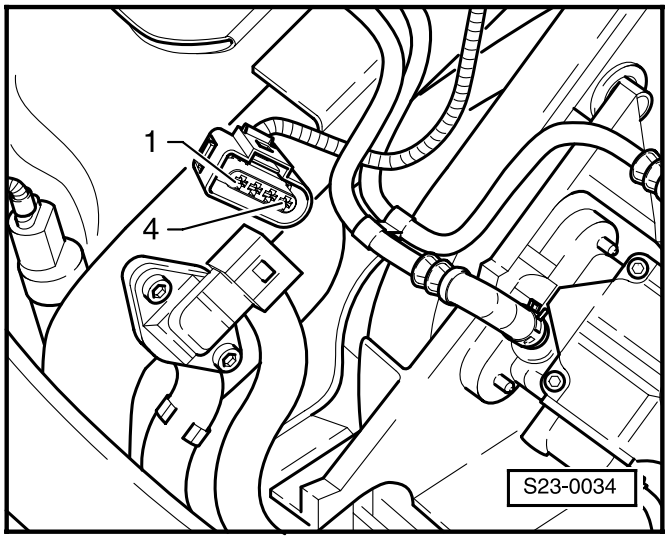
- A temperature of 30 °C equals a specification of 1500...2000 Ω
- A temperature of 80 °C equals a specification of 275...375 Ω

If the specification is not achieved:

Replace intake manifold temperature sender (G72).

If the specification is achieved:

- Connect test box to wiring loom to engine control unit ⇒ page 23-19.



Test box V.A.G 1598/22

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit.

4-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	25
2	13

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

4-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	52
2	73

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace diesel direct injection system control unit (J248) ⇒ page 23-20.

Testing intake manifold pressure sender (G71) and altitude sender

The altitude sender is located in the diesel direct injection system control unit. The intake manifold pressure sender is a separate component and is located at the intake line.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31
- Barometer (e.g. turbocharger tester V.A.G 1397/A)

Test procedure

- Read measured value block, display group 010; engine not running ⇒ page 01-55.

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

◄- Compare readout in display block 2 (altitude sender -F96) and display block 3 (intake manifold pressure sender -G71).

  Specification: pressures must agree (tolerance ± 30 mbar).

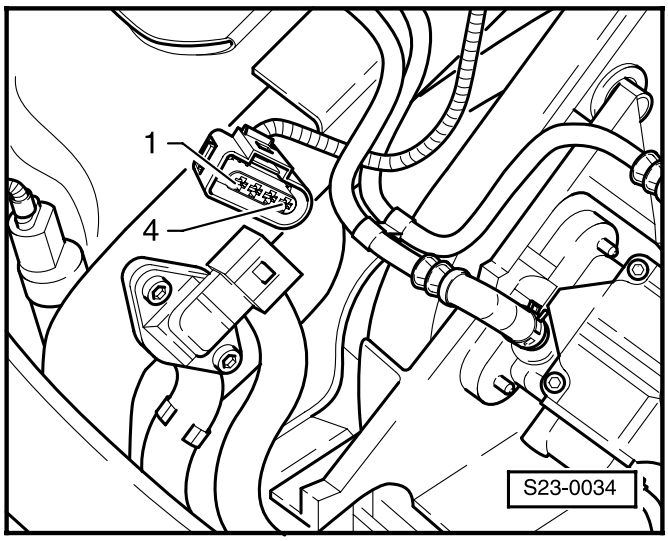
If the specification is not achieved:

- Compare pressure readouts with barometer (e.g. turbocharger tester V.A.G 1397/A), tolerance ± 30 mbar.

If the readout in display block 2 differs from the specification:

- Replace engine control unit (J248) ⇒ page 23-20.

If the readout in display block 3 differs from the specification:



- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

◄ - Unplug connector from the intake manifold pressure sender (G71).

Test box V.A.G 1598/22

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

4-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
3	39
4	40

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

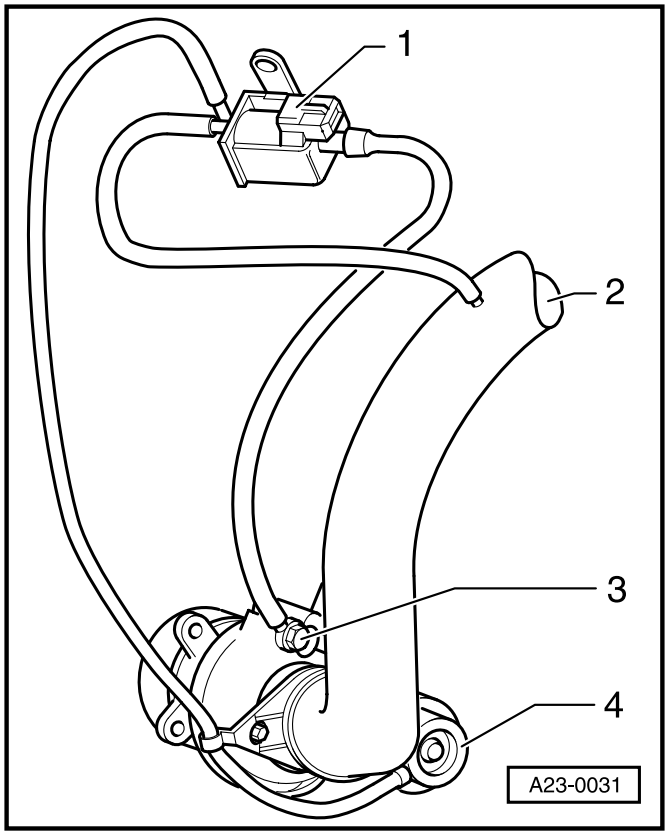
4-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
3	31
4	71

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace intake manifold pressure sender (G71) or diesel direct injection system control unit (J248), respectively.



Connection diagram for charge pressure control

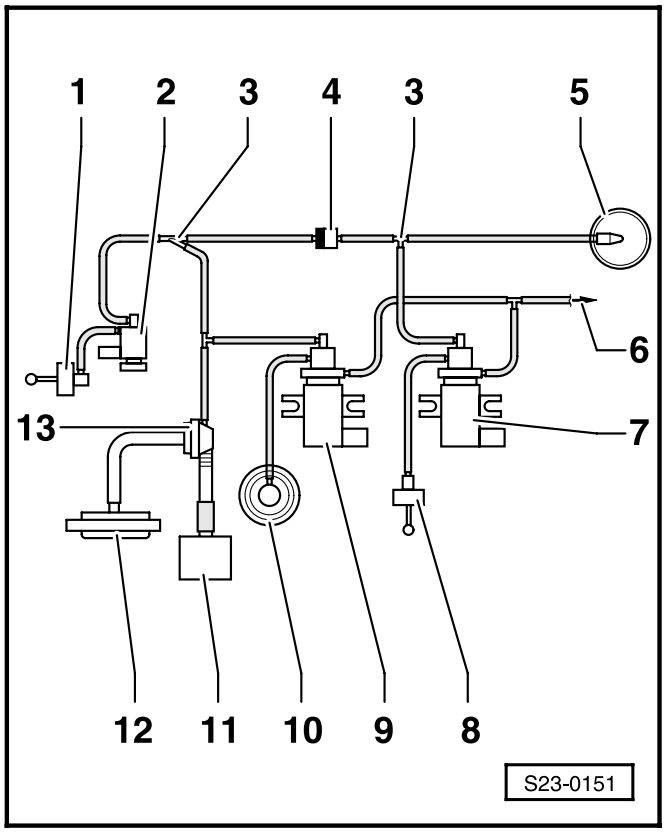
Models ➤ 07.00

1 - Charge pressure control solenoid valve (N75)

2 - Intake hose

3 - Pressure connection at turbocharger (pressure supply for charge pressure control)

4 - Charge pressure control pressure unit



Models 08.00 ➤

1 - Vacuum positioning element for intake manifold flap

2 - Intake manifold flap changeover valve (N239)

3 - Distributor

4 - Non-return valve
- white connection points toward charge pressure control solenoid valve -N75

5 - Vacuum unit

6 - To air filter

7 - Charge pressure control solenoid valve (N75)

8 - Pressure unit
- for charge pressure control valve
- part of turbocharger, cannot be replaced separately

9 - Electromagnetic exhaust gas recirculation valve (N18)

10 - Mechanical exhaust gas recirculation valve

11 - Vacuum pump

12 - Brake servo unit

13 - Non-return valve

Testing start of injection control

Testing injection timing control range

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Procedure

- Initiate final control diagnosis and actuate the start of injection valve ⇒ page 01-18.

Final control diagnosis →
Start of injection valve -N108

◄ Readout in display:

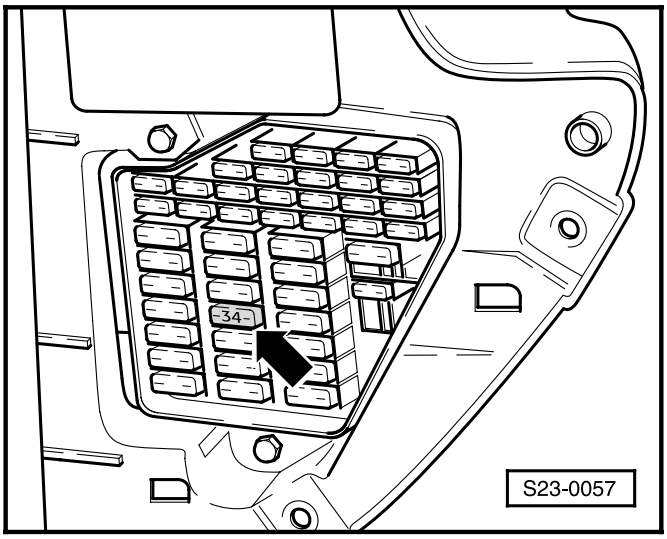
Actuation of the valve is indicated by a clearly audible change in the combustion noise (diesel combustion noise).

- Initiate the basic setting ⇒ page 01-21.

Basic setting 0 →									
42	46	0	20	90	201	64	153	127	83

◄ Readout in display, e.g.:

- Set start of injection, if necessary ⇒ page 23-13.



◄ - Remove the fuse 34 -arrow-.

- Observe the readout in display zone 2.

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

◄ The readout should increase to 255

Note:

As a result of the interruption to the voltage, the start of injection valve is closed. The pump internal chamber pressure can no longer be lowered and acts to its full extent on the piston of the injection control. The injection control is moved toward the „advanced“ stop.

If the specification is not achieved:

- Replace injection pump ⇒ page 23-8.
- Interrogate fault memory and erase ⇒ page 01-5.
- Re-insert fuse 34 in fuse holder.

Testing commencement of injection valve (N108)

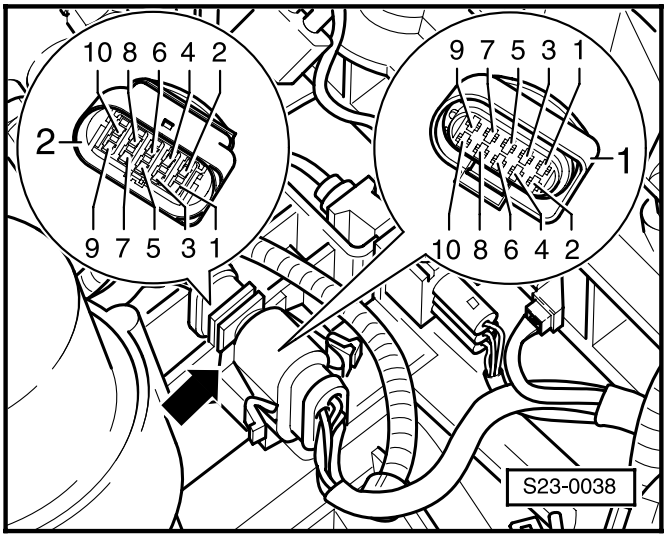
Special tools, testers and aids required

- ♦ Hand-held multimeter (e.g. V.A.G 1526 A)
- ♦ Adapter cable set (e.g. V.A.G 1594 A)
- ♦ Test box V.A.G 1598/22 or V.A.G 1598/31

Test condition

- ● Fuses 29 and 34 o.k.

Test procedure



◄ - Separate plug connection -arrow- at the injection pump.

- Connect multimeter for resistance measurement to contacts 9 and 10 of connector -2-.

  Specification: 12...20 Ω

If the specification is not achieved:

- Replace commencement of injection valve (N108) ⇒ page 23-4.

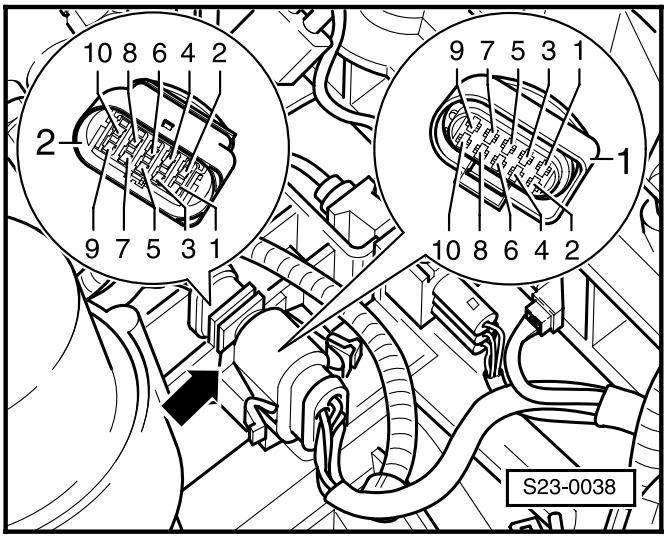
If the specification is achieved:

- Connect multimeter for voltage measurement to contact 10 of connector -1- and to earth.
- Switch ignition on.

  Specification: battery voltage

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

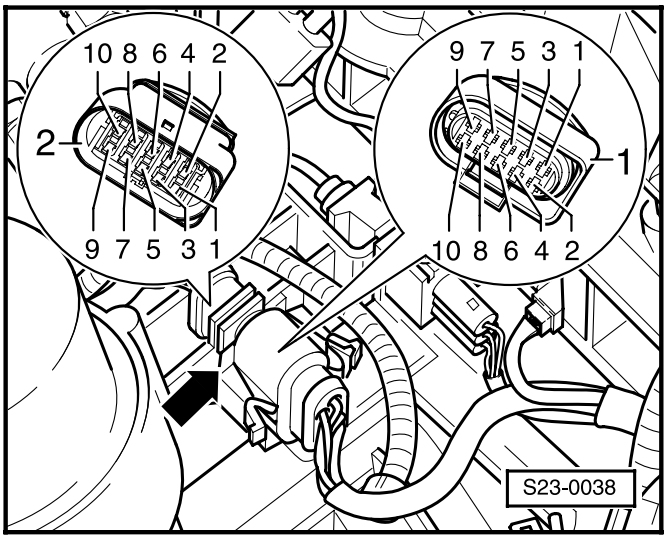


Test box V.A.G 1598/22

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

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

- Rectify any open circuit or short circuit in the wiring.



Test box V.A.G 1598/31

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

10-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
9	114
10	1, 2

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing fuel temperature sender (G81)

The fuel temperature sender (G81) is part of the injection pump.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure

- Read measured value block, display group 007; engine switched off and cooled down ⇒ page 01-51.

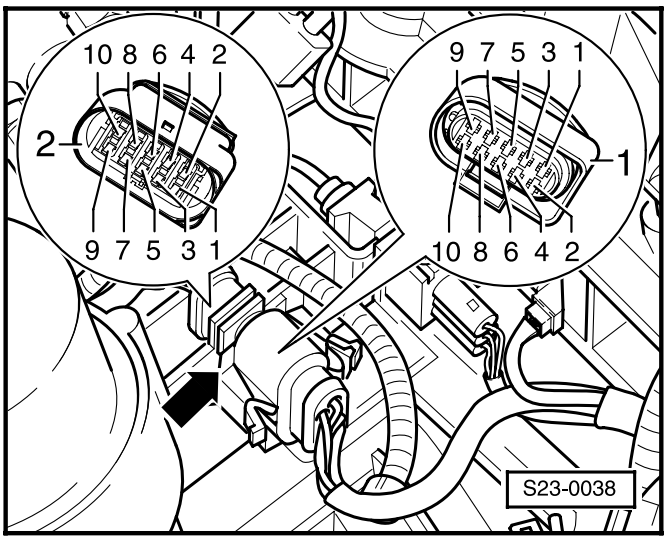
Read measured value block		7 →
15.4 °C	15.9 °C	16.7 °C

◄- Observe readout in display block 1.

If an open circuit exists in the wiring to the sender, a substitute value of -5.4 °C is displayed.

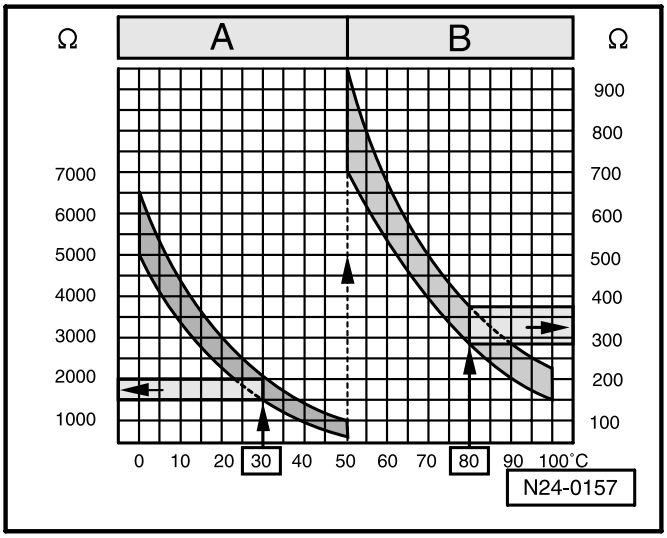
- End output (function 06) and switch ignition off.

If an implausible temperature, or a substitute temperature of -5.4 °C is displayed:



◄- Separate plug connection -arrow- at the injection pump.

- Connect multimeter for resistance measurement to contacts 4 and 7 of connector -2-.



◄ Specification:

Specification in field A applies to temperature 0...50 °C, in field B to a temperature of 50...100 °C.

Example:

- A temperature of 30 °C equals a specification of 1500...2000 Ω
- A temperature of 80 °C equals a specification of 275...375 Ω

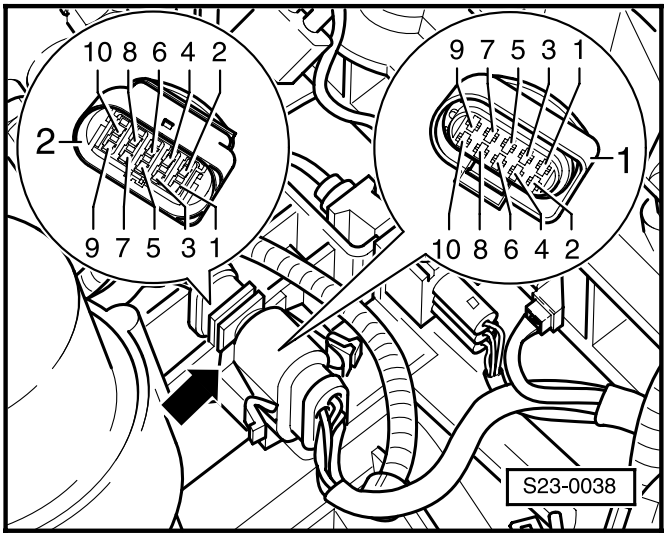
If the specification is not achieved:

Replace injection pump ⇒ page 23-8.

If the specification is achieved:

- Connect test box to wiring loom to engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

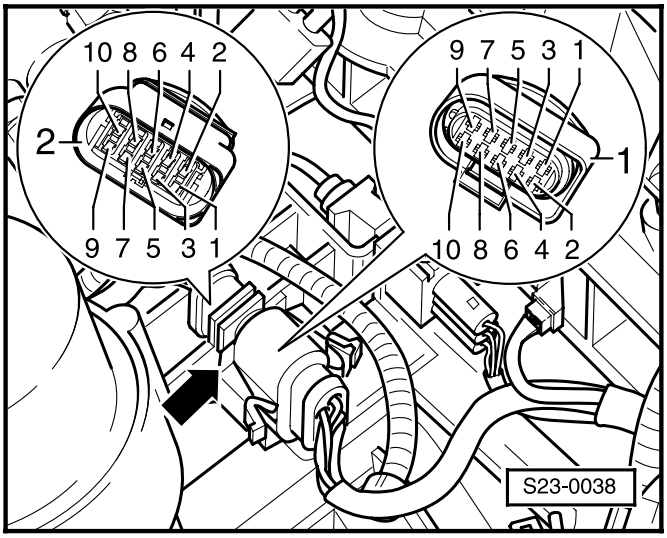


◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

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

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31



◄ Test the following cable connections for short circuit to positive and to negative and for open circuit (connector -1-).

10-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
4	103
7	111

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing exhaust gas recirculation system

Testing exhaust gas recirculation

Operation of the exhaust gas recirculation system is tested by measuring the inducted air mass. If exhaust gas is recirculated, the fresh air portion which is detected by the air mass meter is less. The greater the quantity of exhaust gas recirculated, the smaller the signal supplied by the air mass meter.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Procedure for models ➤ 07.97

- Read measured value block, display group 001, engine idling ⇒ page 01-36.

Read measured value block			1 →
900 rpm	6.5 mg/H	1.480 V	**87.3** °C

◄ Readout in display:

- Check readout in display block 4 (coolant temperature).

  Specification: at least 85 °C

Do not continue with the test until the coolant temperature is reached.

- Press the key C.
- Press the key 0 twice and key 3 for „Display group number 003“ and confirm the entry with the key Q.

Read measured value block			3 →
900 rpm	272 mg/H	268 mg/H	54 %

◄ Readout in display:

- Briefly blip the throttle and then allow the engine to continue idling.

Read measured value block			3 →
900 rpm	**272** mg/H	268 mg/H	54 %

◄ - Check the readout in display block 2 (specified air mass).

  Specification: 230...370 mg/H

If the air mass is higher than specified, the cause may be the following:

- Coolant temperature too low
- Intake manifold temperature very high
- Injected quantity too high

♦ Fault in fault memory

Read measured value block			3 →
900 rpm	272 mg/H	**268** mg/H	54 %

◄ - Check the readout in display block 3 (actual air mass).

Specification: should agree with specified air mass in display block 2
(tolerance ± 20 mg/H)

If the actual air mass is more than 20 mg/H lower than the specified air mass, the following faults are possible:

♦ Unmetered air in intake area

♦ Excessive exhaust gas recirculation

If the actual air mass is more than 20 mg/H higher than the specified air mass, the following faults are possible:

♦ Engine has been idling for 3 minutes

♦ Insufficient or no exhaust gas recirculation

If the actual air mass is a constant 425 mg/H, the following faults are possible:

♦ Open circuit in wiring to air mass meter

♦ Implausible air mass detected

If the specifications are not achieved:

- Start final control diagnosis and operate the EGR valve ⇒ page 01-18.

Final control diagnosis →
EGR valve -N18

◄ Readout in display:

The valve should click.

If the valve does not click:

- Test EGR valve (N18) ⇒ page 23-34.

If the valve clicks:

- Check the vacuum hoses ⇒ page 23-37.

If the vacuum hoses are o.k.:

- Test mechanical exhaust gas recirculation valve:

⇒ 1.9-ltr./66 kW Engine, Mechanical Components; Repair Group 26; Exhaust gas recirculation system

Test procedure for models 08.97 ➤

The exhaust gas recirculation function is tested in function 04 - Basic setting. The exhaust gas recirculation valve is pulsed every 10 seconds in order to produce the extreme values for exhaust gas recirculation. These values are displaced in measured value block, display group 003, display block 3.

- Connect vehicle system tester V.A.G 1552; engine idling ⇒ page 01-2.

- Enter function 04 „System in basic setting“ and display group number 003.

System in basic setting		3	→
900 rpm	**EGR not active**	**500** mg/H	**0** %

◄ The readout in display block 2 must change every 10 seconds between EGR not active and EGR active.

The readouts in display blocks 3 and 4 must vary within the following control range:

EGR not active

- Specification in display block 3:
  420...560 mg/H

- Specification in display block 4:
  0...5 %

EGR active

- Specification in display block 3:
  170...340 mg/H

- Specification in display block 4:
  95...100 %

Note:

If a constant value of 550 mg/H is shown in display block 3, test the air mass meter ⇒ page 23-35.

If the specification is not achieved:

- Test mechanical exhaust gas recirculation valve

⇒ 1.9l/66 kW Engine - Mechanical Components; Repair Group 26

- Inspect vacuum hoses ⇒ page 23-37.

- Test exhaust gas recirculation valve (N18) ⇒ page 23-34.

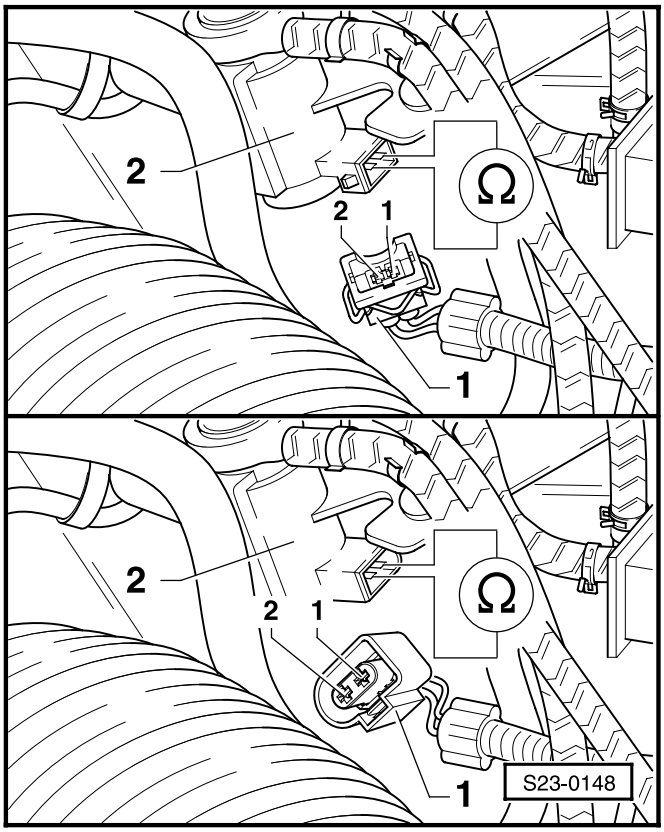
Testing electromagnetic exhaust gas recirculation valve (N18)

Special tools, testers and aids required

- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test condition

- Fuses 29 and 34 o.k.



Test procedure

- Connect vehicle system tester and select engine electronics control unit ⇒ page 01-2.
- Select final control diagnosis and activate exhaust gas recirculation solenoid valve (N18) ⇒ page 01-18.

If the valve is not actuated (does not click):

◄ - Unplug connector -1- to the exhaust gas recirculation solenoid valve (N18).

- Connect multimeter for resistance measurement to the valve -2-.

  Specification: 14...20 Ω

If the specification is not achieved:

- Replace exhaust gas recirculation solenoid valve.

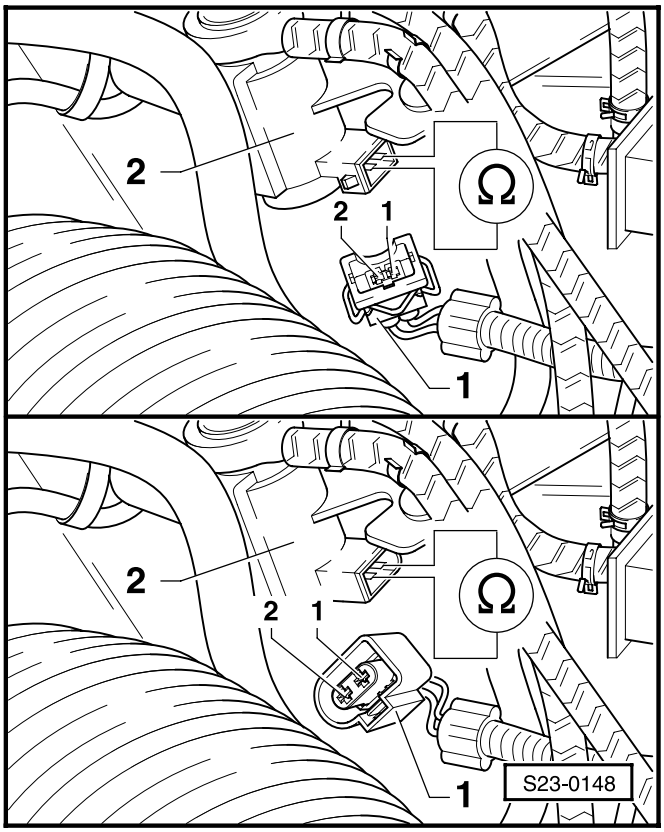
If the specification is achieved:

- Connect multimeter for voltage measurement to contact 1 of connector -1- and to earth.
- Switch ignition on.

  Specification: battery voltage

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.



Test box V.A.G 1598/22

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

2-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	2, 28
2	29

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

◄ Test the following cable connections for short circuit to positive and to negative and for open circuit (connector -1-).

2-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	1, 2
2	61

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing air mass meter (G70)

The signal from the air mass meter is required by the control unit for calculating the permissible injected quantity and for controlling the exhaust gas recirculation. The smaller the signal supplied by the air mass meter, the less fuel may be injected.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test condition

- Fuses 29 and 34 o.k.

Test procedure

- Read measured value block, display group 010, engine idling ⇒ page 01-55.

Warning!

Have a second person operate V.A.G 1552.

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

◄ - Observe readout in display block 1.

Specification: 230...370 mg/H

If the specification is not achieved:

- Test exhaust gas recirculation ⇒ page 23-32.

If the specification is achieved:

- Accelerate vehicle in 3rd gear at full throttle from about 1500 rpm.
- At about 3000 rpm, check readout in display block 4 and note.

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

◄ Specification in display block 4:
100 % (accelerator pedal position)

If the specification is not achieved:

- Repeat the test and accelerate the vehicle at full throttle.

Models ➤ 07.97

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

◄ Specification in display block 3:
1800...2050 mbar (charge pressure)

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

◄ Specification in display block 1:
>750 mg/H (inducted air mass)

Models 08.97 ➤

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

◄ Specification in display block 3:
1700...2080 mbar (charge pressure)

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

◄ Specification in display block 1:
>800 mg/H (inducted air mass)

Continued for all models

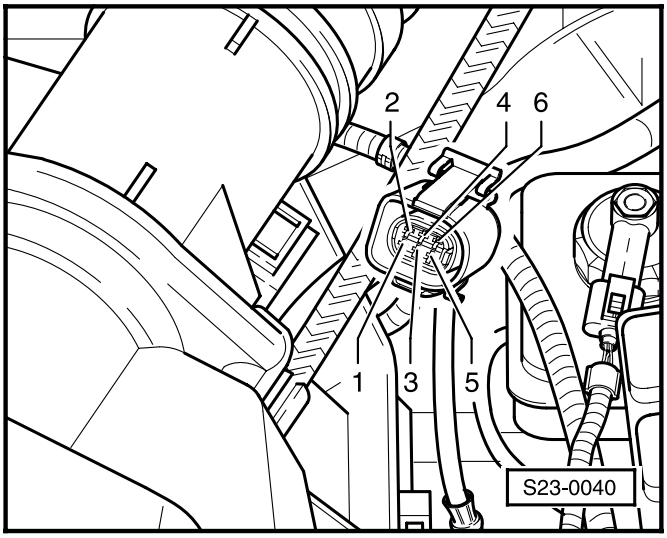
If the specification is not achieved:

- Test charge pressure ⇒ page 23-22.

- Replace the air mass meter (G70).

If a constant readout appears in display block 1 (fixed substitute value):
Models ➤ 07.97 = 425 mg/H
Models 08.97 ➤ = 550 mg/H

- Switch off the ignition.



Test box V.A.G 1598/22

Models ➤ 07.98

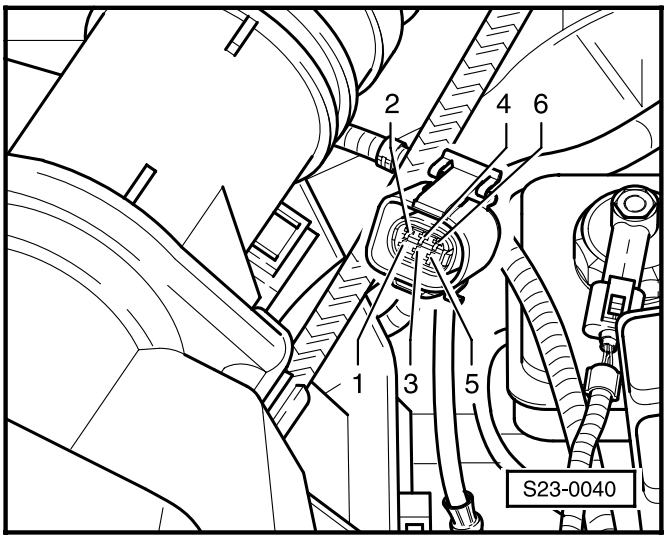
◄ - Unplug connector at air mass meter (G70).

- Switch ignition on.

- Connect multimeter for voltage measurement to the following contacts of the connector:

6-pin connector at wiring loom, contact	Specification
3 + earth	approx. battery voltage
3 + 5	approx. battery voltage
1 + earth	approx. 5 V
1 + 5	approx. 5 V

If the specifications are not achieved:

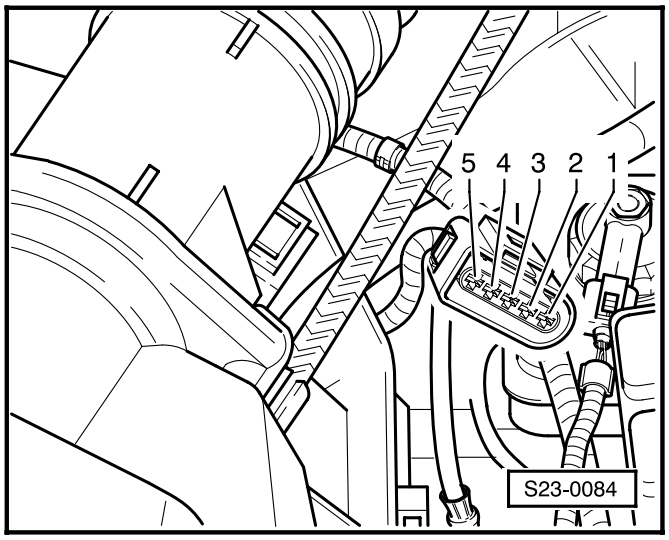


- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit.

6-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	50
2	25
3	2, 28
4	-
5	1, 27
6	52

- Rectify any open circuit or short circuit in the wiring.



Models 08.98 ➤

◄ - Unplug connector at air mass meter (G70).

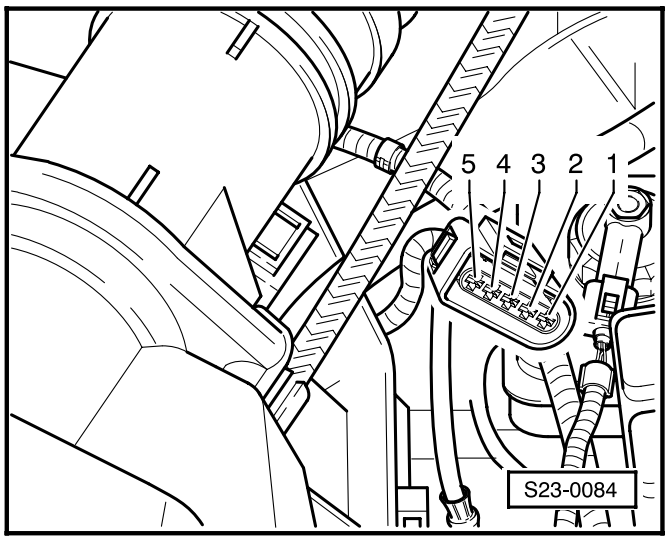
- Switch ignition on.

- Connect multimeter for voltage measurement to the following contacts of the connector:

5-pin connector at wiring loom, contact	Specification
2 + earth	approx. battery voltage
2 + 3	approx. battery voltage
4 + earth	approx. 5 V
4 + 3	approx. 5 V

If the specifications are not achieved:

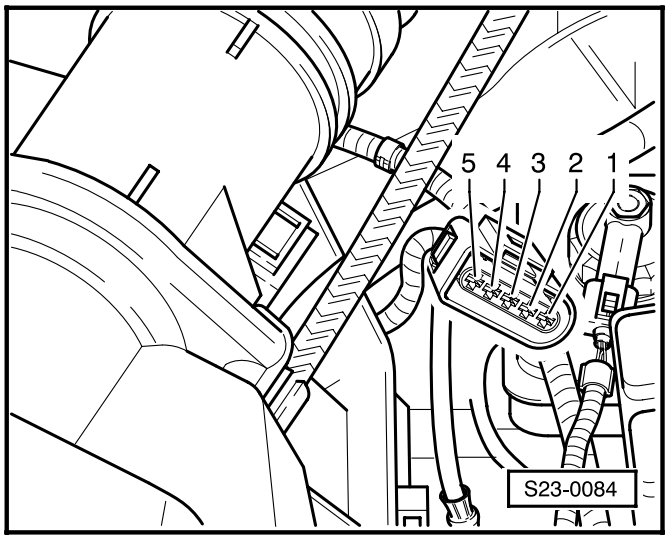
- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.



◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit.

5-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	-
2	2, 28
3	4
4	50
5	52

- Rectify any open circuit or short circuit in the wiring.



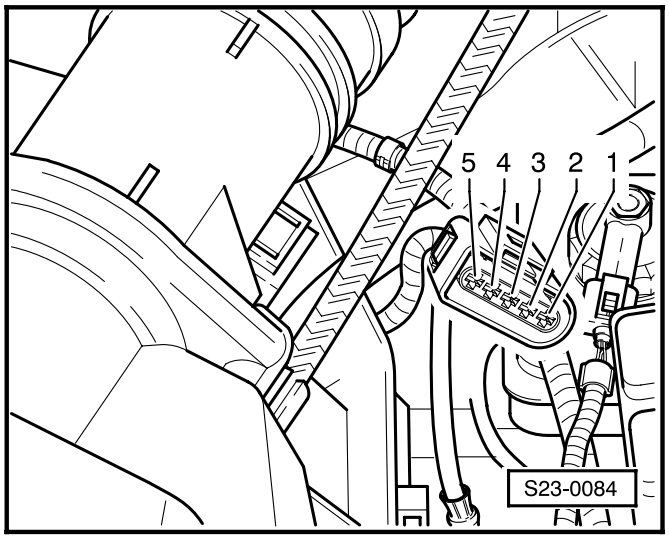
Test box V.A.G 1598/31

◄ - Unplug connector at air mass meter (G70).

- Switch ignition on.

- Connect multimeter for voltage measurement to the following contacts of the connector:

5-pin connector at wiring loom, contact	Specification
2 + earth	approx. battery voltage
2 + 3	approx. battery voltage
4 + earth	approx. 5 V
4 + 3	approx. 5 V



- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit.

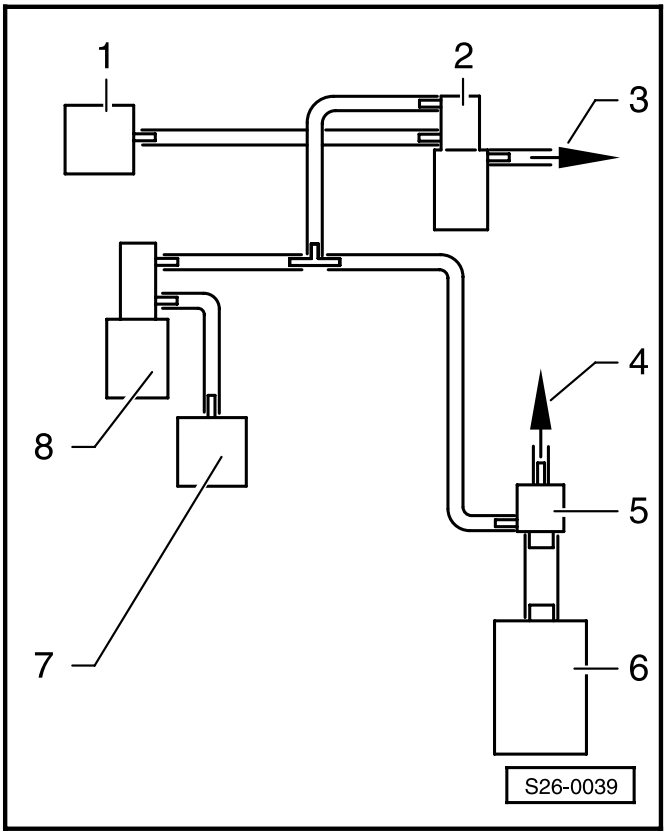
5-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	-
2	1, 2
3	49
4	30
5	68

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.



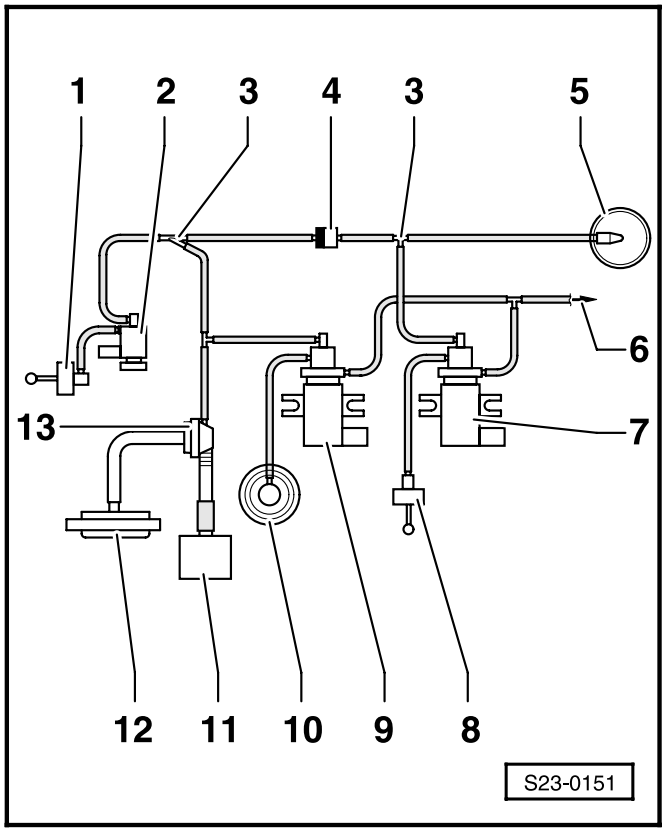


Diagram of hoses for exhaust gas recirculation

Models ➤ 07.00

1 - Mechanical exhaust gas recirculation valve

2 - Electromagnetic exhaust gas recirculation valve (N18)

3 - To air filter

4 - To brake servo unit

5 - Non-return valve

6 - Vacuum pump

7 - Vacuum positioning element for intake manifold flap
- ♦ models 08.97 ➤

8 - Intake manifold flap changeover valve (N239)
- ♦ models 08.97 ➤

Models 08.00 ➤

1 - Vacuum positioning element for intake manifold flap

2 - Intake manifold flap changeover valve (N239)

3 - Distributor

4 - Non-return valve
- ♦ white connection points toward charge pressure control solenoid valve -N75

5 - Vacuum unit

6 - To air filter

7 - Charge pressure control solenoid valve (N75)

8 - Pressure unit
- ♦ for charge pressure control valve
- ♦ part of turbocharger, cannot be replaced separately

9 - Electromagnetic exhaust gas recirculation valve (N18)

10 - Mechanical exhaust gas recirculation valve

11 - Vacuum pump

12 - Brake servo unit

13 - Non-return valve

Testing control unit input parameters

Testing voltage supply for diesel direct injection system

The voltage for the injection system is supplied through the diesel direct injection system relay (J322).

For the relay (J322) to close, necessitates voltage being applied through terminal 15 at the diesel direct injection system control unit.

Special tools, testers and aids required

- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Testing voltage supply of terminal 15

Test conditions

- Fuses 29 and 43 o.k.
- Battery voltage o.k.

Test procedure

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

- Connect multimeter for voltage measurement to socket 47 of test box and to earth.

Test box V.A.G 1598/31

- Connect multimeter for voltage measurement to socket 37 of test box and to earth.

Continued for all models

- Switch ignition on.

  Specification: battery voltage

If the specification is not achieved:

- Test wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

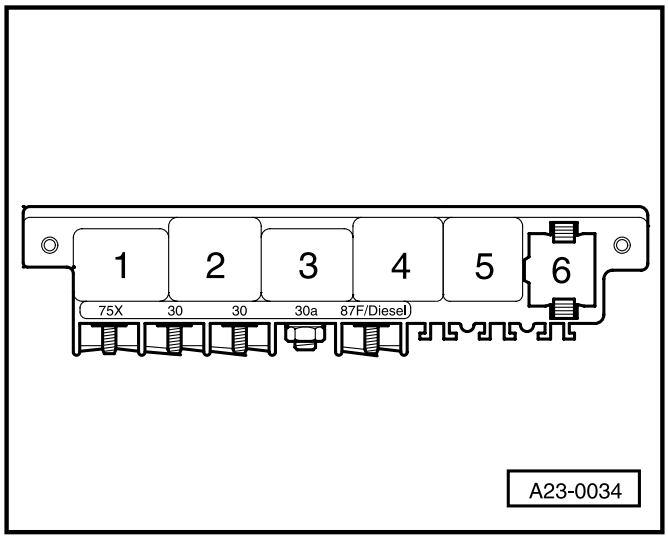
Testing earth actuation of diesel direct injection system relay (J322)

Test conditions

- Battery voltage o.k.
- Voltage supply of terminal 15 o.k.
- Fuses 29 and 43 o.k.

Test box V.A.G 1598/22

Models ➤ 07.97



- Switch ignition on.

◄ Specification: diesel direct injection system relay must click (electrical centre, relay position 5).

Note:

It is not easy to hear the clicking of the relay and this is therefore best detected by feeling.

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.
- Use an adapter cable to connect socket 33 and socket 1 of the test box.

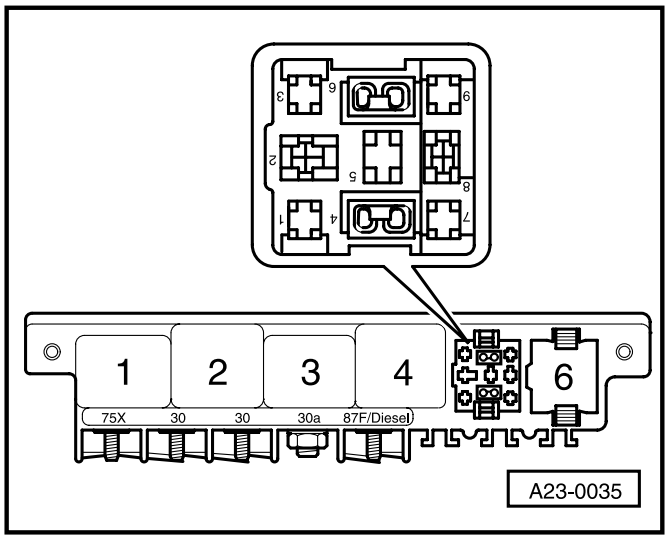
  Specification: diesel direct injection system relay (electrical centre, relay position 5) must operate.

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

- Replace engine control unit (J248) ⇒ page 23-20.

If the relay does not operate:

- Switch ignition off.



◄ - Remove diesel direct injection system relay (J322) from relay base (electrical centre, relay position 5).

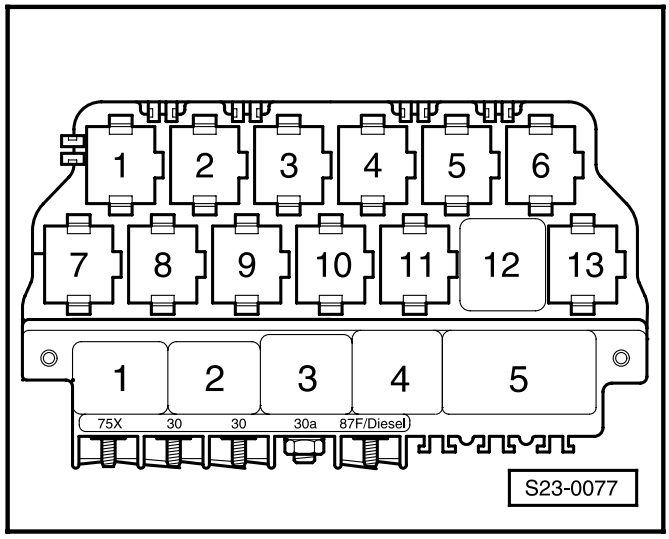
Test the following cable connections for short circuit to positive and to negative, and also for open circuit.

Electrical centre, relay base 5, contact	Test box V.A.G 1598/22, socket
9	33

- Rectify any open circuit or short circuit in the wiring.

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

Models 08.97 ➤



- Switch ignition on.

◄ Specification: diesel direct injection system relay must click (electrical centre, relay position 12).

Note:

It is not easy to hear the clicking of the relay and this is therefore best detected by feeling.

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

- Use an adapter cable to connect socket 33 and socket 1 of the test box.

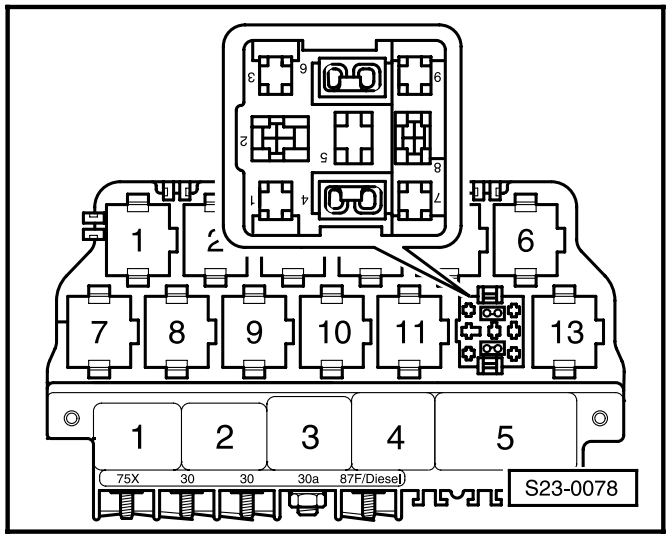
  Specification: diesel direct injection system relay (electrical centre, relay position 12) must operate.

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

- Replace engine control unit (J248) ⇒ page 23-20.

If the relay does not operate:

- Switch ignition off.



◄ - Remove diesel direct injection system relay (J322) from relay base (additional relay holder, relay position 12).

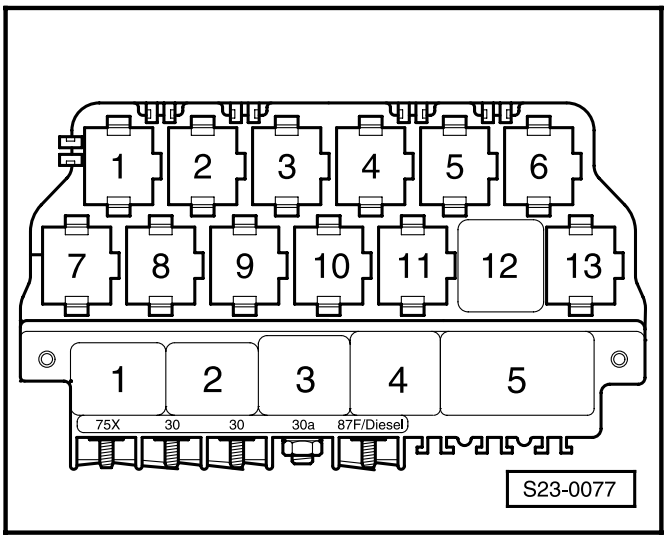
Test the following cable connections for short circuit to positive and to negative, and also for open circuit.

Electrical centre, relay base 12, contact	Test box V.A.G 1598/22, socket
9	33

- Rectify any open circuit or short circuit in the wiring.

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

Test box V.A.G 1598/31



- Switch ignition on.

◄ Specification: diesel direct injection system relay must click (additional relay holder, relay position 12).

Note:

It is not easy to hear the clicking of the relay and this is therefore best detected by feeling.

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit; engine control unit is not connected ⇒ page 23-19.

- Use an adapter cable to connect socket 18 and socket 4 of the test box.

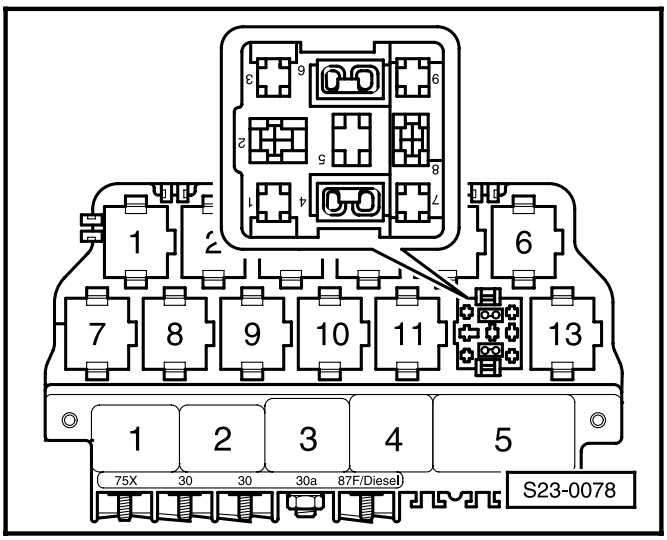
  Specification: diesel direct injection system relay (additional relay holder, relay position 12) must operate.

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

- Replace engine control unit (J248) ⇒ page 23-20.

If the relay does not operate:

- Switch ignition off.



◄ - Remove diesel direct injection system relay (J322) from relay base (additional relay holder, relay position 12).

Test the following cable connections for short circuit to positive and to negative, and also for open circuit.

Electrical centre, relay base 12, contact	Test box V.A.G 1598/31, socket
9	18

- Rectify any open circuit or short circuit in the wiring.

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

Testing voltage supply of terminal 30

Test conditions

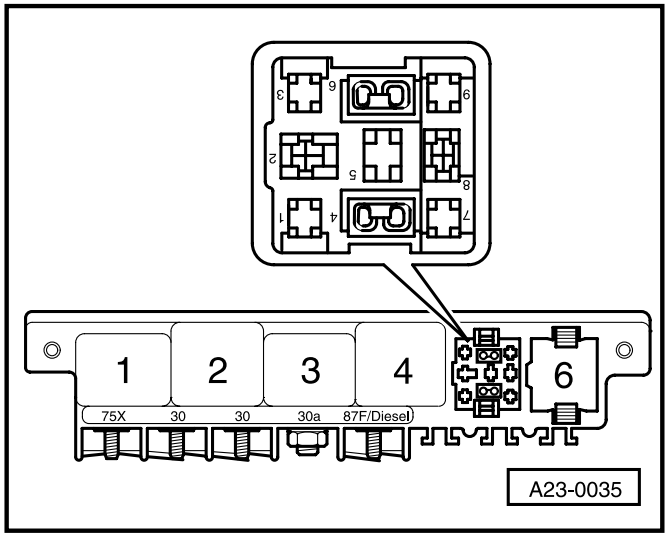
- Battery voltage o.k.
- Voltage supply of terminal 30 o.k.
- Earth actuation of diesel direct injection system relay (J322) o.k.
- Fuses 29 and 43 o.k.

Test procedure

- Switch ignition off.

Test box V.A.G 1598/22

Models ➤ 07.97



◄- Remove the diesel direct injection system relay (J322) from relay base (electrical centre, relay position 5).

- Connect multimeter for voltage measurement to the following contacts of the relay base:

Electrical centre, relay base 5, contact	Specification
2 + earth	approx. battery voltage

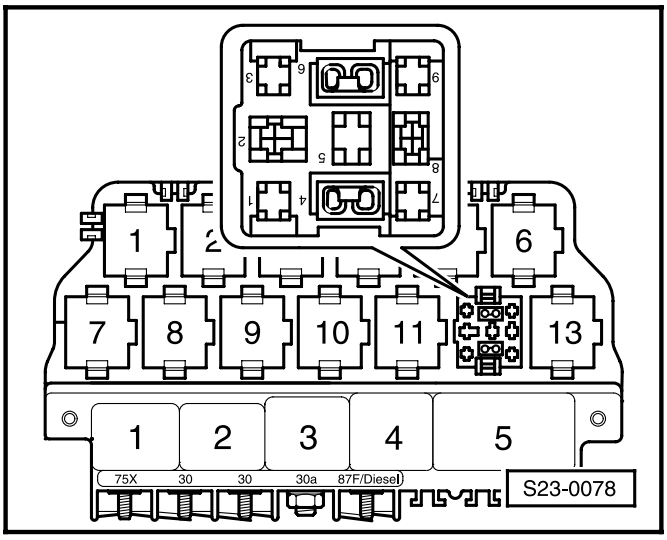
If the specification is not achieved:

- Test wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

If the specification is achieved:

- Insert relay into relay base again (electrical centre, relay position 5).



Models 08.97 ➤

◄- Remove the diesel direct injection system relay (J322) from relay base (additional relay holder, relay position 12).

- Connect multimeter for voltage measurement to the following contacts of the relay base:

Electrical centre, relay base 12, contact	Specification
2 + earth	approx. battery voltage

If the specification is not achieved:

- Test wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

If the specification is achieved:

- Insert relay into relay base again (electrical centre, relay position 12).

Continued for all models

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

- Use an adapter cable to connect socket 33 and socket 1 of the test box.

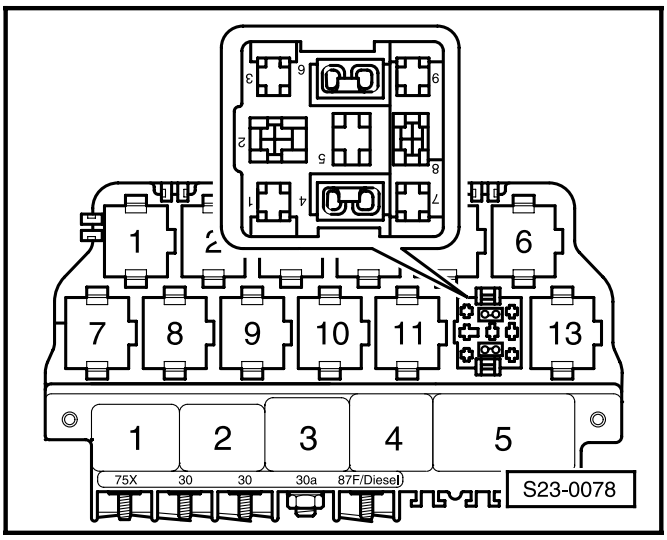
- Connect multimeter for voltage measurement to the following contacts of the test box:

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

If the specification is not achieved:

- Test wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder



Test box V.A.G 1598/31

◄ - Remove the diesel direct injection system relay (J322) from relay base (additional relay holder, relay position 12).

- Connect multimeter for voltage measurement to the following contacts of the relay base:

Electrical centre, relay base 12, contact	Specification
2 + earth	approx. battery voltage

If the specification is not achieved:

- Test wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

If the specification is achieved:

- Insert relay into relay base again (electrical centre, relay position 12).

- Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit; engine control unit is not connected ⇒ page 23-19.

- Use an adapter cable to connect socket 18 and socket 4 of the test box.

- Connect multimeter for voltage measurement to the following contacts of the test box:

Test box V.A.G 1598/31, socket	Specification
1 + 4	approx. battery voltage
2 + 4	approx. battery voltage
1 + 5	approx. battery voltage
2 + 5	approx. battery voltage

If the specification is not achieved:

- Test wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder

Testing engine speed sender (G28)

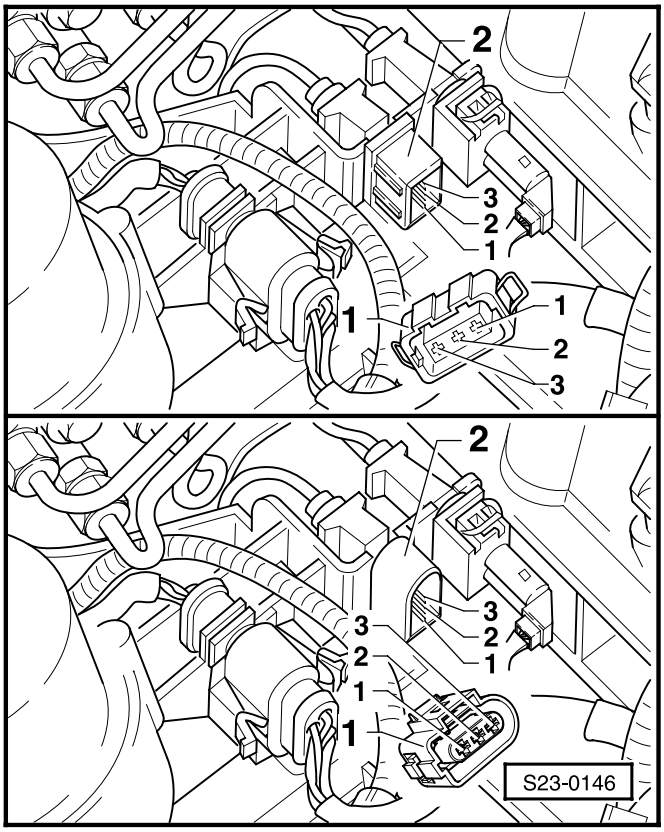
The engine speed sender is an rpm and reference mark sensor. If it fails, the engine stops.

Special tools, testers and aids required

- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure

- Switch ignition off.



◄ - Separate plug connection -1- at the injection pump.

- Connect multimeter for resistance measurement to contacts 1 and 2 of connector -2-.

Test box V.A.G 1598/22

Specification:
1...1.5 kΩ

If the specification is not achieved:

- Replace engine speed sender (G28).

If the specification is achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test the following cable connections for short circuit to positive and to negative, and also for open circuit (connector -1-).

3-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	69
2	67
3	71

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Specification:
1.1...1.6 kΩ

If the specification is not achieved:

- Replace engine speed sender (G28).

If the specification is achieved:

- Connect test box to the wiring loom to the engine control unit; engine control unit is not connected ⇒ page 23-19.

Test the following cable connections for short circuit to positive and to negative and for open circuit (connector -1-).

3-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	102
2	110
3	86

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

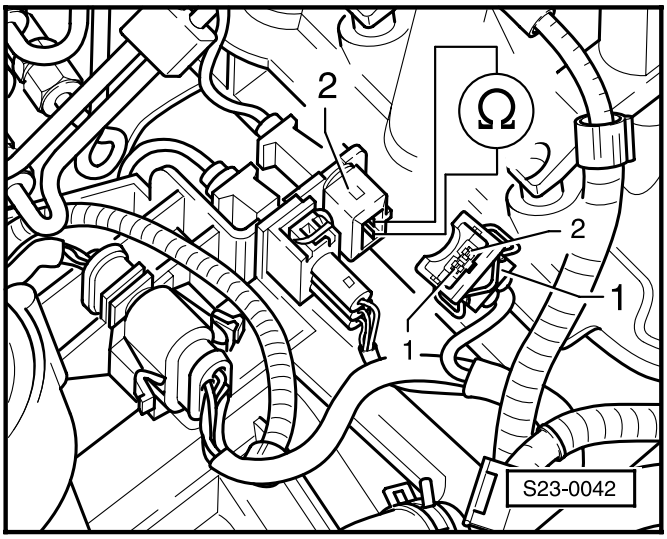
Testing needle lift sender (G80)

The signal from the needle lift sender is required for determining the commencement of injection. If no signal is received, the commencement of injection is determined by an open-loop control (in line with engine speed and load); in normal operation commencement of injection is determined in line with a closed-loop control (in line with engine speed, load and temperature).

Special tools, testers and aids required

- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure



- Switch ignition off.

◄ - Separate 2-pin plug connection -1- at the injection pump.

- Connect multimeter for resistance measurement to valve -2-.

  Specification: 80...120 Ω (when engine warm resistance may be up to 20 Ω higher)

If the specification is not achieved:

- Replace injection nozzle of cylinder 3 with needle lift sender (G80).

If the specification is achieved:

Test box V.A.G 1598/22

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test the following cable connections for short circuit to positive and to negative, and also for open circuit (connector -1-).

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

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

- Connect test box to the wiring loom to the engine control unit; engine control unit is not connected ⇒ page 23-19.

Test the following cable connections for short circuit to positive and to negative and for open circuit (connector -1-).

2-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	109
2	101

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing coolant temperature sender (G62)

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure

- Read measured value block, display group 007; cold engine idling ⇒ page 01-51.

Read measured value block		7 →
15.4 °C	15.9 °C	**16.7** °C

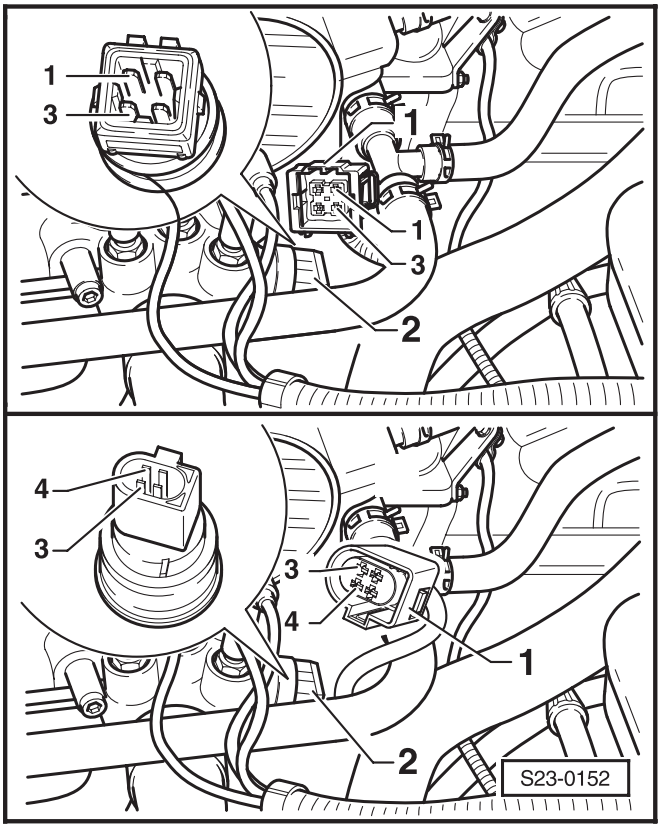
◄- Check readout in display block 4 (coolant temperature)

Specification:
The temperature readout must rise evenly.

If a fault exists, the fuel temperature is displayed as a substitute.

If an implausible temperature or if the fuel temperature is shown as a substitute in display block 4:

- Switch ignition off.



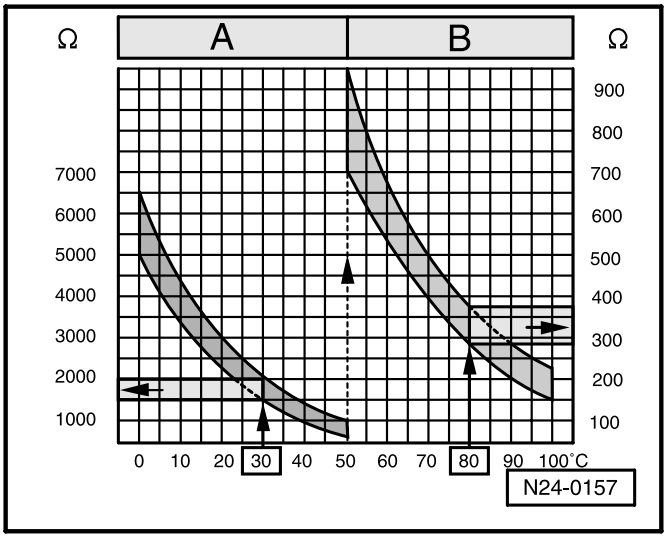
◄- Unplug connector -1- from coolant temperature sender -2- (G62).

Test box V.A.G 1598/22

- Connect multimeter for resistance measurement to contacts 1 and 3 of the coolant temperature sender (G62) -2-.

Test box V.A.G 1598/31

- Connect multimeter for resistance measurement to contacts 1 and 3 of the coolant temperature sender (G62) -2-.



Continued for all models

◄ Specification:

Specification in field A applies to temperature 0...50 °C, in field B to a temperature of 50...100 °C.

Example:

- A temperature of 30 °C equals a specification of 1500...2000 Ω
- A temperature of 80 °C equals a specification of 275...375 Ω

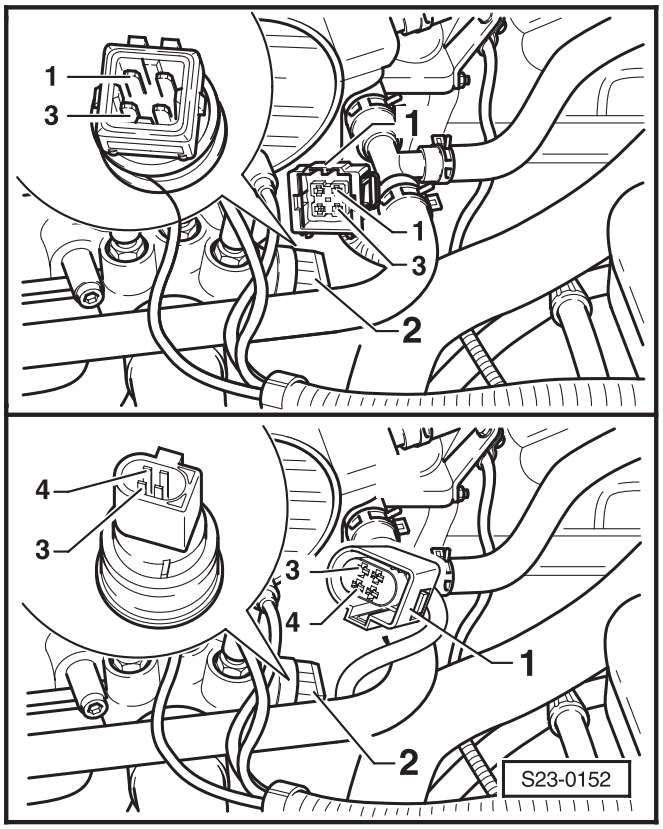
If the specification is not achieved:

- Replace coolant temperature sender (G62).

If the specification is achieved:

Test box V.A.G 1598/22

- Connect test box to wiring loom to engine control unit ⇒ page 23-19.



◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

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

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

- Connect test box to wiring loom to engine control unit; engine control unit is not connected ⇒ page 23-19.

◄ Test the following cable connections for short circuit to positive and to negative and for open circuit (connector -1-).

4-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
4	104
3	112

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing brake light switch and brake pedal switch

In view of the fact that the fuel injection system operates with an accelerator pedal sender (potentiometer), which could develop a fault, the engine is governed for safety reasons when the brakes are applied. The control unit requires the brake light switch signal and, in addition, the brake pedal switch signal for this purpose. What this means, therefore, is that, if the brake is operated when the accelerator pedal is constantly depressed, the engine is immediately governed down to idling speed. If the switch positions are not clearly detected, this can result in unintentional governing of the engine speed.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Procedure

- Read measured value block, display group 006, engine idling ⇒ page 01-33.

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

◄ Readout in display:

- Check readout in display block 2.

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

◄ Specification: 0 0 0

- Slowly depress brake.

Read measured value block			6	→
0 km/h	**0 1 1**	000000		0

◄ Specification: 0 1 1
Both readouts should jump from 0 to 1.

- Middle readout = brake pedal switch
- Right-hand readout = brake light switch

- Slowly release brake pedal into rest position.

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

◄ Specification: 0 0 0
Both readouts should switch back again from 1 to 0.

If one of the readouts or both does not switch from 0 to 1:

- Test the switches or the cable connections to the switches.

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing modulating piston movement sender (G149) and quantity adjuster (N146)

The quantity adjuster is an electromagnetic rotary positioner which is actuated by the control unit by means of a specific on/off ratio. The eccentric shaft of the quantity adjuster moves the control sleeve on the high-pressure piston and thus determines the quantity of fuel injected.

The modulating piston movement sender supplies the position of the control sleeve to the control unit, in other words defines the quantity of fuel to be injected.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test condition

- Fuses o.k.

Test procedure

- Read measured value block, display group 001, engine idling ⇒ page 01-38.

Read measured value block			1 →
900 rpm	5.6 mg/H	1.480 V	**87.3** °C

◄ - Specification in display block 4 (coolant temperature): at least 85 °C.

Do not continue the test until the coolant temperature is reached.

- Switch off any ancillary components which may be operated (air conditioning, rear window heater, lights, etc.).
- Check readout in display block 3 (voltage of modulating piston movement sender).

Models ➤ 07.97

Read measured value block			1 →
900 rpm	5.6 mg/H	**1.480 V**	87.3 °C

◄ Specification: 1.250...1.700 V

Models 08.97 ➤ 07.00

Specification: 1.450...1.850 V

Models 08.00 ➤

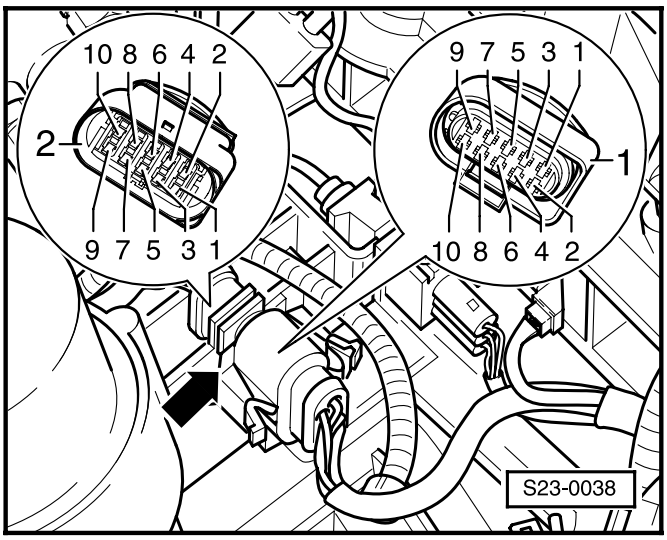
Specification: 1.300...2.100 V

Continued for all models

If the specification is not achieved:

- Test modulating piston movement sender (G149) ⇒ page 23-45.

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



- Switch ignition off.
- Separate plug connection -arrow- at the injection pump.
- Connect multimeter for resistance measurement to the following contacts of the connector -2-.

Injection pump connector	Specification
1 + 2	4.9...7.5 Ω
3 + 2	4.9...7.5 Ω
6 + 5	**Models ➤ 07.97** 0.4...1.1 Ω
	Models 08.97 ➤ 0.5...2.5 Ω

If the specifications are not achieved:

- Replace injection pump ⇒ page 23-8.

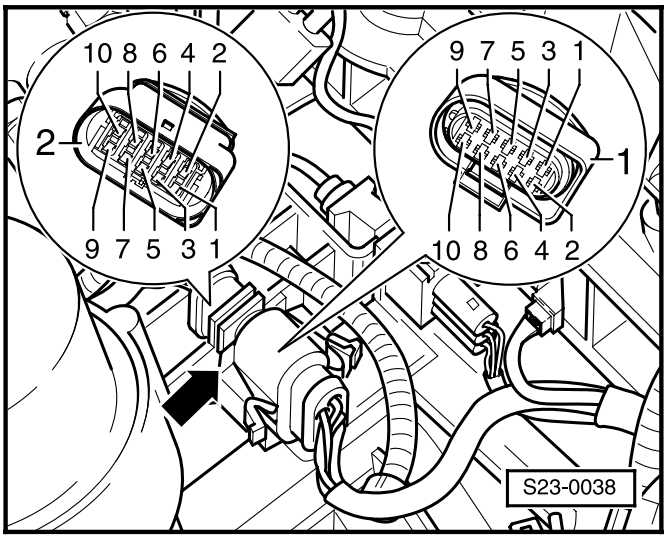
Testing voltage supply and cable connections

- Switch ignition off.
- Separate plug connection at injection pump.
- Switch ignition on.
- Connect multimeter for voltage measurement to the following contacts of connector -1- at the wiring loom.

10-pin connector at wiring loom, contact	Specification
1 + earth	approx. 2.5 V
3 + earth	approx. 2.5 V
5 + earth	approx. battery voltage

If the specifications are not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

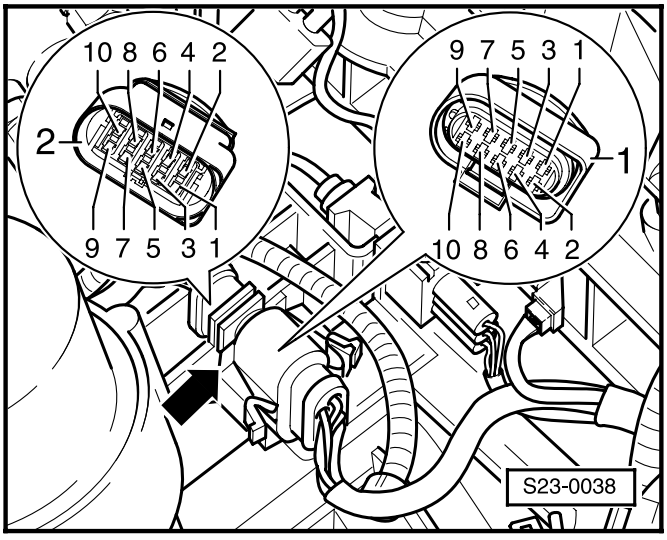


Test box V.A.G 1598/22

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

10-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	56
2	57
3	64
5	2, 28
6	59, 66, 80

- Rectify any open circuit or short circuit in the wiring.



Test box V.A.G 1598/31

◄ Test the following cable connections for short circuit to positive and to negative and also for open circuit (connector -1-).

10-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	108
2	106
3	99
5	1, 2
6	121, 116

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing accelerator pedal position sender (G79)

The accelerator pedal position sender is located at the accelerator pedal and supplies the driver input to the control unit.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure

- Read measured value block, display group 002; engine switched off ⇒ page 01-46.

Read measured value block			2 →
0 rpm	**0.0** %	0 1 0	18.4 °C

◄ Specification in display block 2: 0.0 % (accelerator pedal not depressed)

Read measured value block			2 →
0 rpm	0.0 %	**0 1 0**	18.4 °C

◄ Specification in display block 3: 0 1 0 (accelerator pedal not depressed)

- Slowly depress accelerator.

Read measured value block			2 →
0 rpm	**100.0** %	**0 0 0**	18.4 °C

◄ Specification in display block 2: readout must rise up to 100 % (when accelerator fully depressed).
Specification in display block 3: 0 0 0 (accelerator pedal depressed)

If the specification is not achieved:

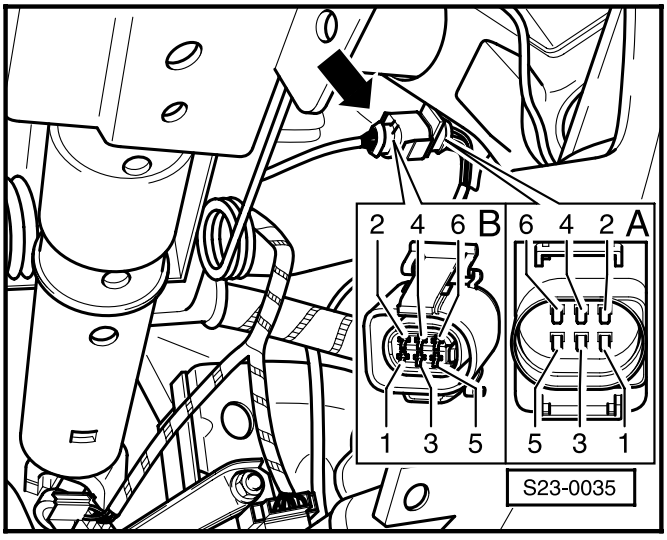
Test box V.A.G 1598/22

Models ➤ 07.98

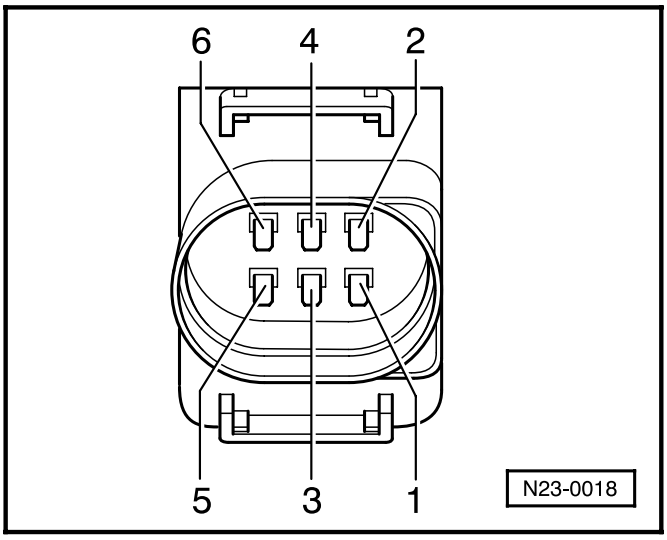
- Set accelerator pedal position sender ⇒ page 23-7.

If the readout does not change or only irregularly:

- Switch ignition off.



◄ - Separate plug connection -arrow- of accelerator pedal position sender (G79).



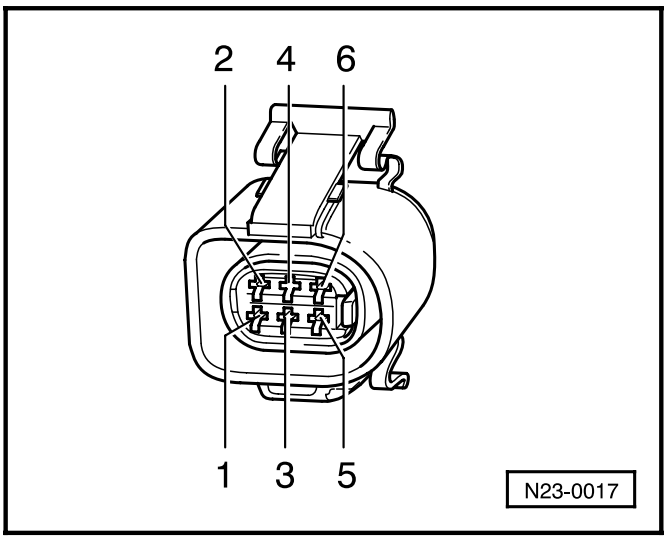
◄ - Test resistance of accelerator pedal position sender:

Accelerator	Contacts	Specification
not depressed	1 + 3	0.6...1.4 kΩ
not depressed	2 + 3	0.6...1.4 kΩ
not depressed	4 + 6	0.6...1.2 kΩ
depressed		∞ Ω
depressed	5 + 6	0.6...1.2 kΩ
not depressed		∞ Ω

If the specification is not achieved:

- Replace accelerator pedal position sender (G79).

If the specification is achieved:

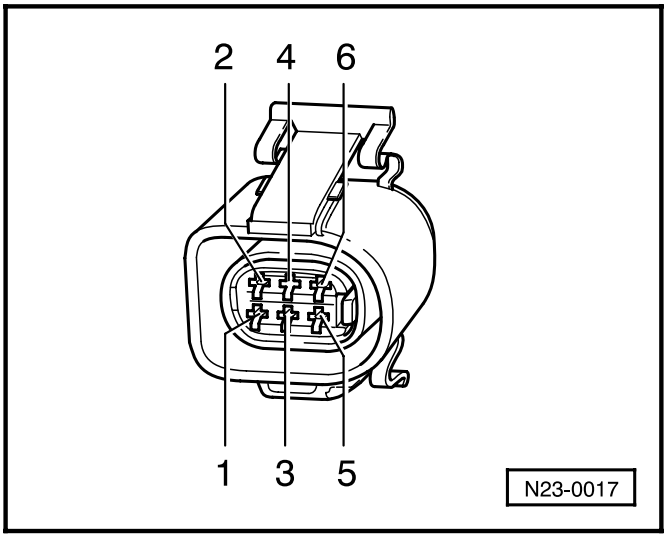


◄ - Test voltage supply of accelerator pedal position sender:

6-pin connector at wiring loom, contact	Specification
2 + earth	approx. 5 V
2 + 3	approx. 5 V
5 + earth	approx. 5 V
5 + 6	approx. 5 V

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.



Test the wiring between test box and connector of sender for open circuit according to the current flow diagram:

6-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	24
2	11
3	23
4	12
5	8
6	25

- Rectify any open circuit or short circuit in the wiring.

If no fault is found in the wiring:

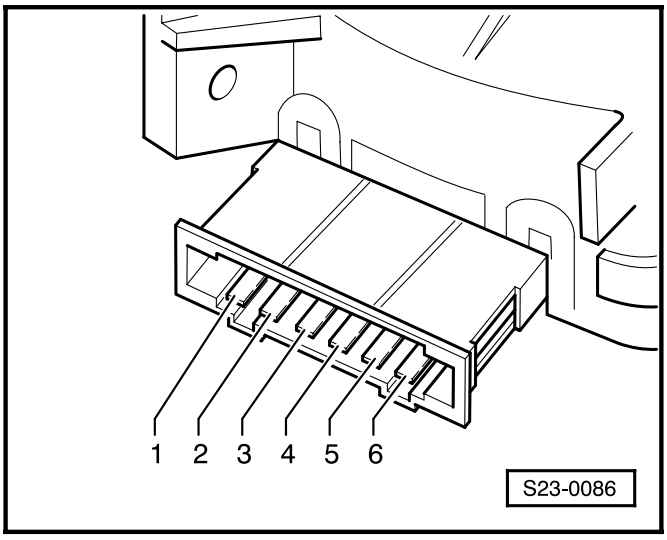
- Replace engine control unit (J248) ⇒ page 23-20.

Models 08.98 ➤

- Remove bottom part of dash panel

⇒ Body Fitting Work; Repair Group 68.

- Unplug 6-pin connector for accelerator pedal position sender (G79).

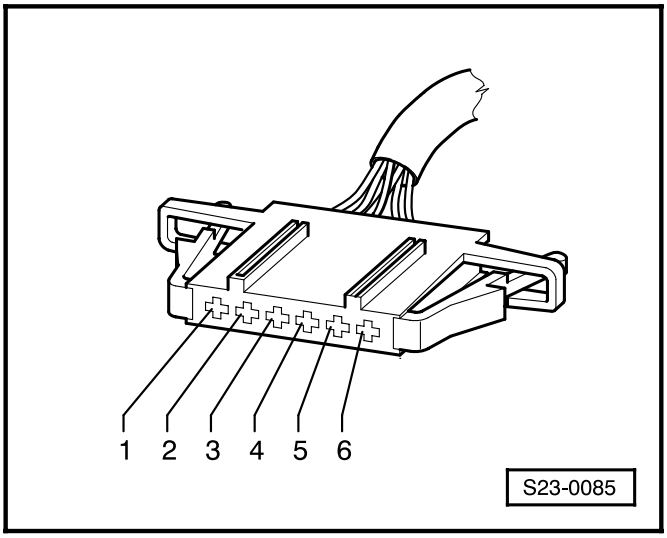


◄ - Test resistance of accelerator pedal position sender:

Accelerator	Contacts	Specification
not depressed	4 + 3	0.6...1.4 kΩ
not depressed	2 + 3	0.6...1.4 kΩ
not depressed	5 + 6	0.6...1.4 kΩ
depressed		∞ Ω
depressed	1 + 6	0.6...1.4 kΩ
not depressed		∞ Ω

If the specification is not achieved:

- Replace accelerator pedal position sender (G79).



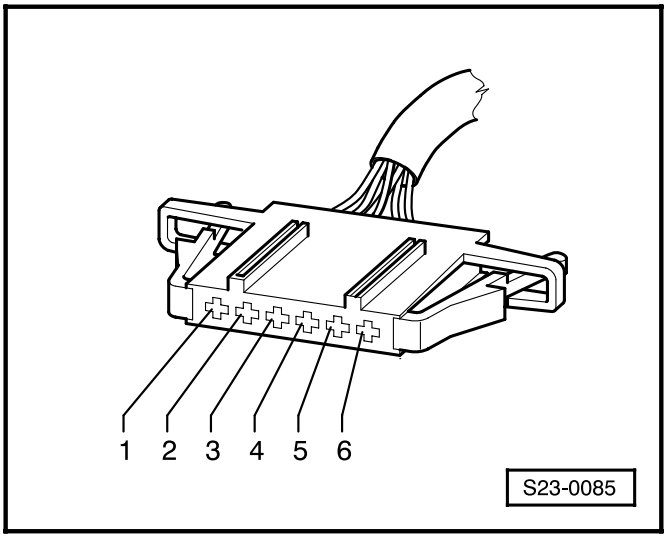
If the specification is achieved:

◄ - Test voltage supply of accelerator pedal position sender:

6-pin connector at wiring loom, contact	Specification
2 + earth	approx. 5 V
2 + 3	approx. 5 V
1 + earth	approx. 5 V
1 + 6	approx. 5 V

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

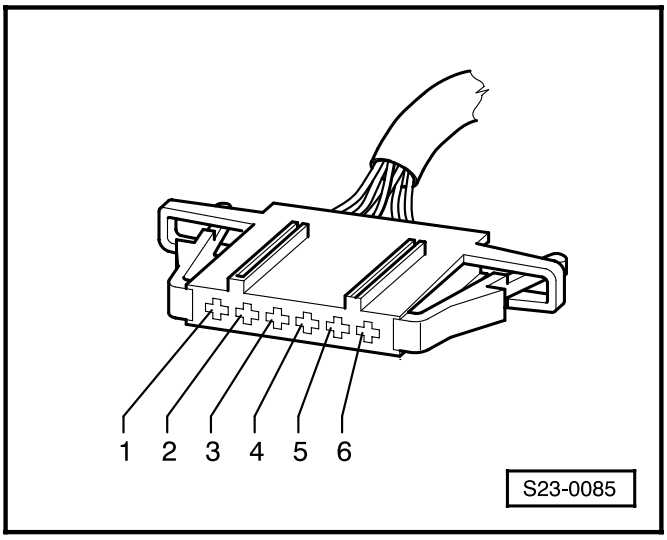


Test box V.A.G 1598/22

◄ Test the wiring between test box and connector of sender for open circuit according to the current flow diagram:

6-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
1	8
2	11
3	23
4	24
5	12
6	25

- Rectify any open circuit or short circuit in the wiring.



Test box V.A.G 1598/31

◄ Test the wiring between test box and connector of sender for open circuit according to the current flow diagram:

6-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	63
2	12
3	50
4	69
5	70
6	51

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing additional signals

Testing signals from and to air conditioning system

Testing AC compressor cutoff

The AC compressor is switched off by the engine control unit in the following situations:

- when accelerating from a low speed (recognised by change in angle and accelerator pedal position sender and from the vehicle speed signal)
- in the emergency programme (emergency mode)
- if the coolant is hotter than 120 °C
- for about 6 seconds each time the engine is started

Test conditions

- Air conditioning o.k.
- Air conditioning switched on
- No fault in fault memory

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31
- Hand lamp

Test procedure

Final control diagnosis AC compressor control →	◄- Initiate final control diagnosis and actuate AC compressor control ⇒ page 01-18.

AC compressor must stop within 5 seconds (visual check with hand lamp), and then run for 5 seconds and stop again.

If the AC compressor does not switch off:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

Test the wiring for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/22, socket	AC components, contact
16	⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Test the wiring for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/31, socket	AC components, contact
34	⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

Testing air conditioning system signal

The signal supplied by the air conditioning system informs the engine control unit that the air conditioning requires a higher idling speed for achieving the desired interior temperature (irrespective of whether cooling or heating is necessary).

The increase in idling speed when the AC signal is received, depends on the control unit and does not take place in all models.

- Switch on air conditioning and select the lowest temperature.

- Read measured value block, display group 002, engine idling ⇒ page 01-46.

Read measured value block			2 →
900 rpm	0.0 %	**1 1 1**	18.4 °C

◄ Specification in display block 3: X X 1 (AC signal)

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

Test the wiring for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/22, socket	AC components, contact
48	⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Test the wiring for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/31, socket	AC components, contact
49	⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder

- Rectify any open circuit or short circuit in the wiring.

Testing clutch pedal switch (F36)

This signal is used to avoid overrevving and load change jolts when the clutch is released, and is required for the cruise control system.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test condition

- Fuses o.k.

Test procedure

- Read measured value block, display group 006; engine switched off ⇒ page 01-35.

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

◄ Specification in display block 2: 0 X X

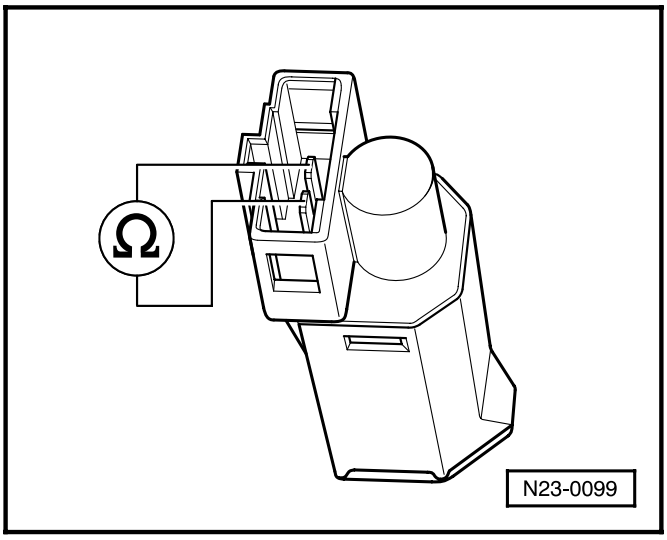
- Depress clutch.

Read measured value block			6	→
0 km/h	**1 0 0**	000000		0

◄ Specification: 1 X X

If the specification is not achieved:

- End output (function 06) and switch the ignition off.
- Unplug the connector of the clutch pedal switch ⇒ page 23-2, Overview of fitting locations.



◄ - Connect the multimeter for resistance measurement between the contacts of the switch.

Specification:
Clutch not depressed: max. 10 Ω
Clutch depressed: ∞ Ω

If the specification is not achieved:

- Replace clutch pedal switch (F36).

If the specification is achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/22, socket	Switch at clutch pedal, contact
2, 28	1
46	2

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/31, socket	Switch at clutch pedal, contact
1, 2	1
66	2

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing vehicle speed signal

The vehicle speed signal is required for switching off the AC compressor when accelerating, for the cruise control system and for enhancing ride comfort (absorbing jerks).

Test condition

- Speedometer o.k.

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Diode test lamp (e.g. V.A.G 1527 B)
- Test box V.A.G 1598/22 or V.A.G 1598/31

Test procedure

- Read measured value block, display group 006; engine idling ⇒ page 01-35.

Warning!

Have a second person operate V.A.G 1552.

- Conduct a road test.

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

◄ Specification in display block 1: the current speed of the vehicle must be displayed (compare with speedometer).

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

- Connect diode test lamp between socket 1 (earth) and socket 51 (vehicle speed signal).
- Switch ignition on and rotate front left wheel by hand.

- Diode test lamp must flash (about 4x for each revolution of wheel).

Note:

Ensure that the right front wheel does not rotate.

If the diode test lamp does not flash:

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/22, socket	Dash panel insert, contact
51	3

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

- Connect diode test lamp between socket 1 (earth) and socket 20 (vehicle speed signal).

- Switch ignition on and rotate front left wheel by hand.

- Diode test lamp must flash (about 4x for each revolution of wheel).

Note:

Ensure that the right front wheel does not rotate.

If the diode test lamp does not flash:

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/31, socket	Dash panel insert, contact
20	3

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Determine all the users of the vehicle speed signal (e.g. radio, air conditioning, etc.), separate the connection to the dash panel insert one after the other and repeat the test until the cause is determined.

Testing engine speed signal

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- Test box V.A.G 1598/22 or V.A.G 1598/31

The engine speed signal is required for the rev counter and for the air conditioning. If an automatic gearbox is fitted, it is also required for calculating the shift points.
The signal shape which is generated by the engine speed sender (G28), cannot be analysed however and it is therefore first of all processed in the engine control unit.

The engine speed is determined as follows:

Dash panel insert

- Read measured value block, display group 001; engine idling ⇒ page 01-38.
- Briefly operate full throttle.

Read measured value block			1 →
900 rpm	5.6 mg/H	1.480 V	87.3 °C

◄ Specification in display block 1:
The current engine speed must be displayed (evenly over entire range). This engine speed display must agree with the revs indicated on the right counter.

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

- Test cable connection from rev counter to contact 6 of test box for open circuit

⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

Test box V.A.G 1598/31

- Test cable connection from rev counter to contact 27 of test box for open circuit

⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

Continued for all models

Air conditioning

Signal is monitored by the self-diagnosis (fault memory, read measured value block) of the air conditioning system.

Testing signal
⇒ Heating and Air Conditioning; Repair Group 01
Specification:
The current engine speed must be displayed in the measured value block.

If the specification is not achieved at any of the users of the engine speed signal, the following faults are possible:

- Open circuit or short circuit between engine control unit and plug connection in the wiring loom
⇒ Current Flow Diagrams, Electrical Fault Finding, Fitting Locations binder.

- Short circuit between plug connection in wiring loom and user.

- Engine control unit (J248) faulty.

If the specification is achieved at at least one user of the engine speed signal, the following faults are possible:

- Open circuit between plug connection in the wiring loom and user.

- User faulty.

Activating and deactivating cruise control system

Special tools, testers and aids required

- Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C

Test condition

- There must not be any fault stored in the fault memory ⇒ page 01-5, Interrogating and erasing fault memory

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics control unit ⇒ page 01-2.

Readout in display (example):

038906012F 1.9l R4 EDC G000AG 2813 → Coding 00001 WSC 01234

◄ If G000AG is displayed, cruise control system is activated.

038906012F 1.9l R4 EDC 0000AG 2813 → Coding 00001 WSC 01234

◄ If 000AG is displayed, cruise control system is deactivated.

Test of vehicle systems HELP Select function XX

◄ Readout in display:

- Enter 11 for the function „Login procedure“ and confirm entry with the key Q.

Enter code number as specified in the table below and confirm entry with the key Q.

CCS	Code number
Activate CCS	11463
Deactivate CCS	16167

- End output (function 06).

Conduct a road test.

Testing cruise control system

With the exception of an operating switch, the CCS does not have any separate components. All the functions are performed by the engine control unit. The minimum vehicle speed for the cruise control function is 30 km/h.

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ♦ Hand-held multimeter (e.g. V.A.G 1526 A)
- ♦ Adapter cable set (e.g. V.A.G 1594 A)
- ♦ Test box V.A.G 1598/31

Test condition

- ● Fuses o.k.

Test procedure

- Read measured value block, display group 006; engine idling ⇒ page 01-35.

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

◄- Check readout in display block 4.

Specification:
0 = CCS switched off
1 = CCS switched on
255 = CCS not activated

Models fitted with automatic gearbox

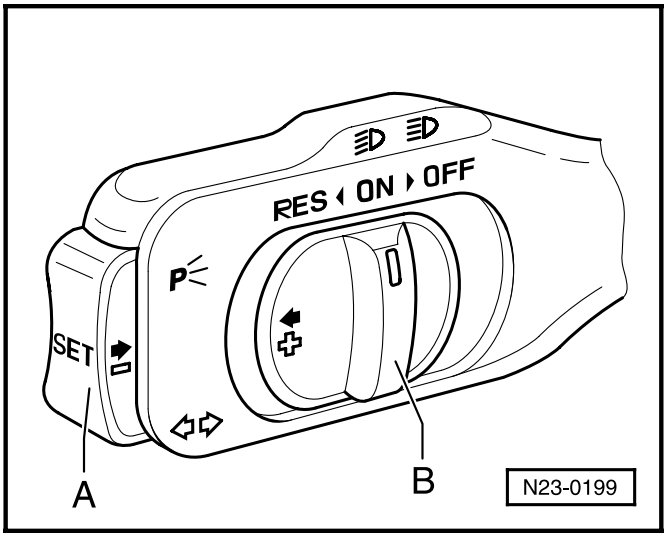
- Conduct a road test and drive at more than 30 km/h. Selector lever must be in position 2, 3 or D.

- Pull up handbrake lever.

Continued for all models

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

◄- Check readout in display block 3.

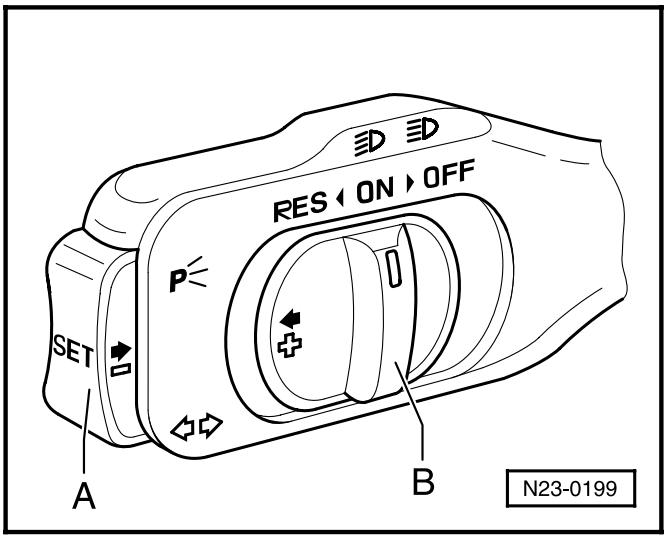


Test conditions	Display block 3
Switch B to „ON“	000011
Switch B to „RES“	001011
Switch A operated	000111
Switch B to „OFF“ before operation point	000001
Switch B locked in „OFF“	000000
Brake pedal depressed	010011
Clutch pedal depressed	100011

If the specifications are not achieved:

- End output (function 06).

- Switch ignition off.



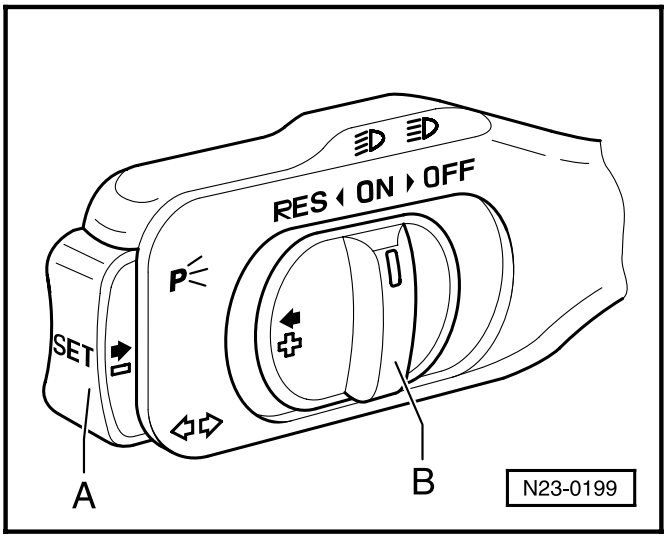
◄- Use the hand-held multimeter to test the resistance of the CCS switch as specified in the table below:

CCS switch	10-pin connector at CCS switch, contact	Specification
Switch B to „ON“	4 + 5 6 + 7	max. 1.5 Ω
Switch B to „RES“	4 + 5 2 + 7 6 + 7	max. 1.5 Ω
Switch A operated	3 + 7	max. 1.5 Ω
Switch B in „OFF“ position	6 + 7 4 + 5	max. 1.5 Ω ∞ Ω
Switch B locked in „OFF“ position	6 + 7 2 + 7 4 + 5	∞ Ω

If the specifications are not achieved:

- Replace CCS switch.

If the specifications are achieved:



- Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit; control unit is not connected ⇒ page 23-19.

- Test the following cable connections for short circuit to earth and to positive and also for open circuit:

10-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
2	45
3	44
4	14
5	46
7	14

- Connect hand-held multimeter for voltage measurement between contact 6 of connector and earth.

Specification: approx. battery voltage

- Rectify any open circuit or short circuit in the wiring.

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.

Testing CAN databus

Models 08.00 ➤

- Use the appropriate current flow diagrams to determine which control units are connected to the drive databus (CAN - Controller Area Network - bus).

- Inspect the plug connections at all the connected control units to ensure they are tight.

- Connect vehicle system tester V.A.G 1552 and enter function 00 „Automatic test sequence“.

Before testing the communication line determine whether any operational fault exists at the connected control units.

Special tools, testers and aids required

- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Test box V.A.G 1598/31

Test condition

- A fault was detected at the databus by the self-diagnosis

Test procedure

- Switch ignition off.

- Unlock the connector and unplug it from the engine control unit.

- Connect test box V.A.G 1598/31 to the engine control unit. Do not connect cables to the engine control unit ⇒ page 23-19.

- Test middle terminating resistor in the engine control unit and measure resistance between sockets 6 and 7 of the test box.

Specification: 60...72 Ω

If the readout is not within the specified range:

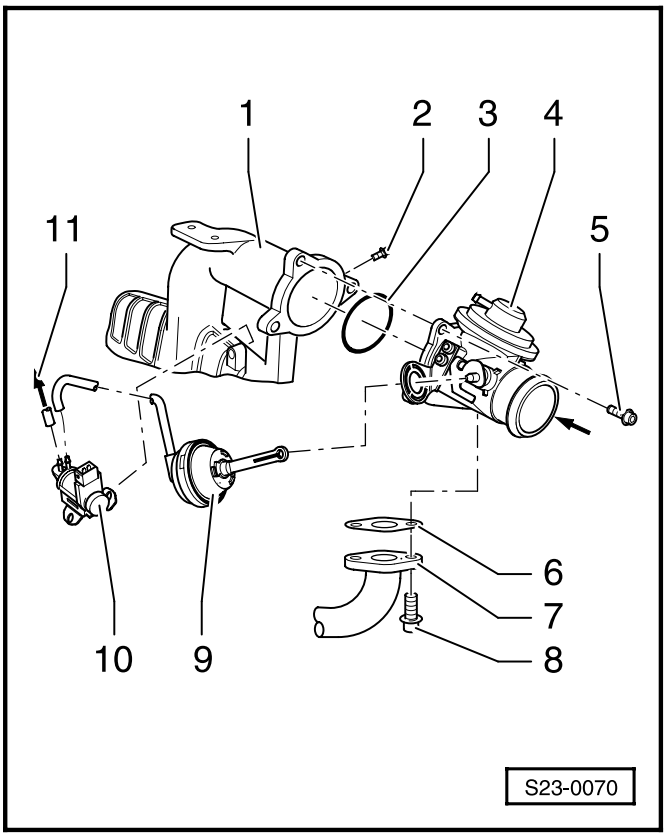
- Replace engine control unit ⇒ page 23-20.

If the readout is within the specified range:

- Test databus

⇒ Electrical System; Repair Group 90

Servicing intake manifold flap 08.97 ➤



The intake manifold flap is closed for about 3 seconds when the engine is switched off and then opens again. This reduces the engine stop jolt.

Testing intake manifold flap changeover ⇒ page 23-57.

1 - Intake manifold

2 - 10 Nm

3 - O-ring
- Replace

4 - Intake connection
- With exhaust gas recirculation valve and intake manifold flap

5 - 10 Nm

6 - Gasket
- Replace

7 - Connection pipe
- To exhaust manifold

8 - 25 Nm

9 - Vacuum positioning element for intake manifold flap

10 - Intake manifold flap changeover valve -N239
- Testing ⇒ page 23-57

11 - Vacuum supply
- From vacuum pump

Testing intake manifold flap changeover valve

Special tools, testers and aids required

- Hand vacuum pump (e.g. V.A.G 1390)
- Test box V.A.G 1598/22 or V.A.G 1598/31
- Hand-held multimeter (e.g. V.A.G 1526 A)
- Adapter cable set (e.g. V.A.G 1594 A)
- Current flow diagram

Test condition

- Fuses 29 and 34 o.k.

Testing operation

- Start engine and run at idling speed for about 5 seconds.
- Switch ignition off.
- Observe positioning lever at intake manifold flap (2nd person required).
- After the ignition is switched off, the intake manifold flap must close for about 3 seconds, then move back into its original position.

If the intake manifold flap does not switch over, perform the following inspections:

- Inspect switchover mechanism of intake manifold flap by operating the linkage by hand. It must be possible to easily move the intake manifold flap.
- Ensure the vacuum hoses are correctly attached and connected as specified in the hose diagram ⇒ page 23-59.
- Detach vacuum hose at vacuum positioning element for intake manifold flap.
- Connect hand vacuum pump to vacuum positioning element.
- Operate hand vacuum pump.
  - Intake manifold flap must close.

- Detach hand vacuum pump from vacuum positioning element.

  ♦ Intake manifold flap must open.

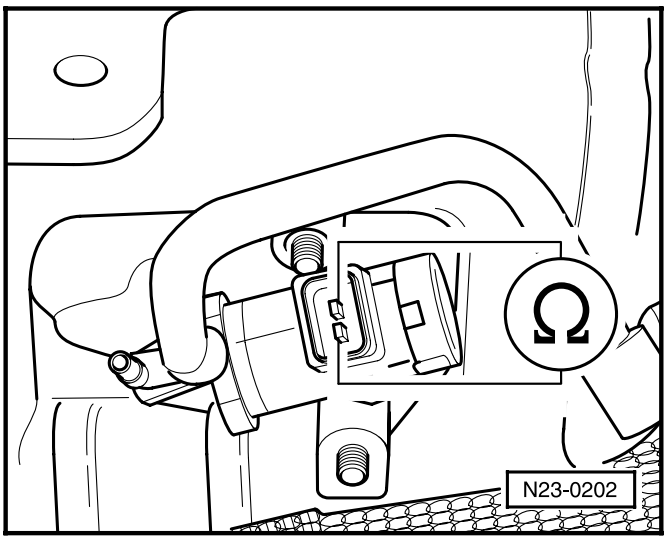
If the specifications are not achieved:

- Replace vacuum positioning element of intake manifold flap.

If no fault is found at the mechanical components of the intake manifold flap:

- Test the intake manifold flap changeover valve.

Test procedure



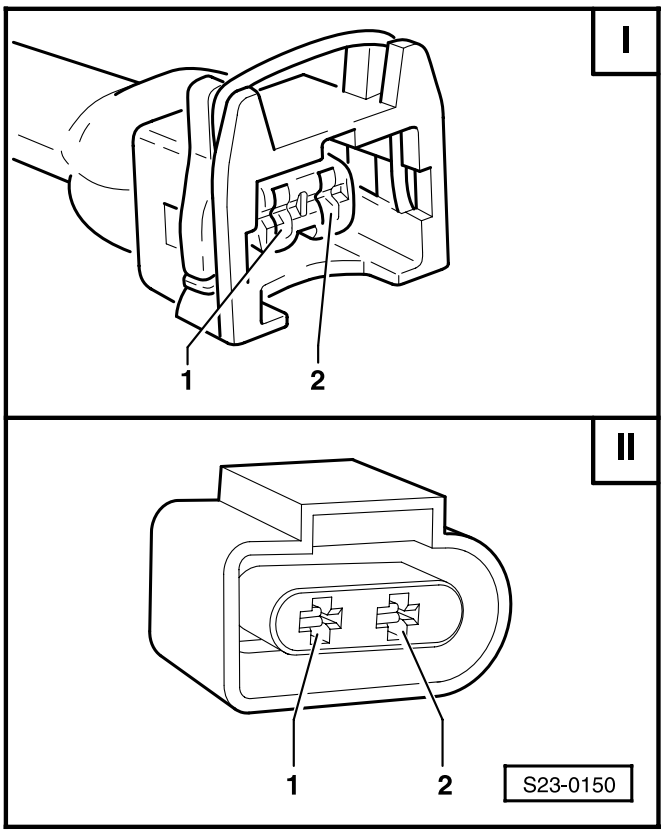
- Unplug connector from the intake manifold flap changeover valve -N239.

◄- Connect multimeter for resistance measurement to contacts of changeover valve.

Specification: 25...45 Ω

If the specification is not achieved:

- Replace the intake manifold flap changeover valve.



If the specification is achieved:

◄- Connect multimeter for voltage measurement between contacts -1- and -2- of the valve connector.

- Start engine and run at idling speed.

Specification: 5...6 V

- Switch ignition off.

- Voltage readout must rise to 11...14 V (battery voltage) and drop to 0 V after about 3 seconds.

If the specification is not achieved:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

Test box V.A.G 1598/22, socket	2-pin connector at wiring loom, contact
3	1
28	2

- Rectify any open circuit or short circuit in the wiring.

Test box V.A.G 1598/31

Test the following cable connections for short circuit to positive and to negative and also for open circuit.

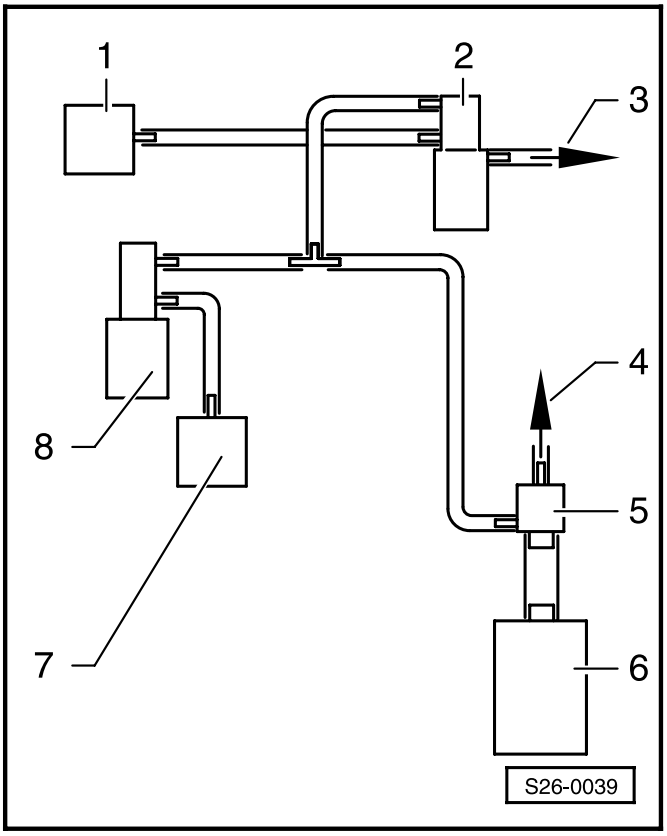
Test box V.A.G 1598/31, socket	2-pin connector at wiring loom, contact
1, 2	1
81	2

- Rectify any open circuit or short circuit in the wiring.

Continued for all models

If no fault is found in the wiring:

- Replace engine control unit (J248) ⇒ page 23-20.



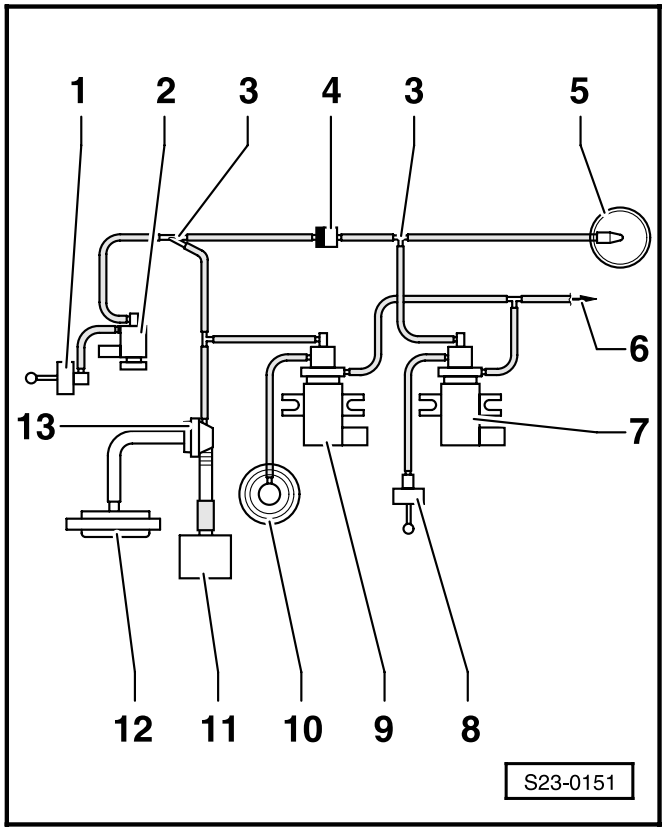


Diagram of hoses for operation of intake manifold flap

Models ➤ 07.00

1 - Mechanical exhaust gas recirculation valve

2 - Electromagnetic exhaust gas recirculation valve (N18)

3 - To air filter

4 - To brake servo unit

5 - Non-return valve

6 - Vacuum pump

7 - Vacuum positioning element for intake manifold flap
- ♦ models 08.97 ➤

8 - Intake manifold flap changeover valve (N239)
- ♦ models 08.97 ➤

Models 08.00 ➤

1 - Vacuum positioning element for intake manifold flap

2 - Intake manifold flap changeover valve (N239)

3 - Distributor

4 - Non-return valve
- ♦ white connection points toward charge pressure control solenoid valve -N75

5 - Vacuum unit

6 - To air filter

7 - Charge pressure control solenoid valve (N75)

8 - Pressure unit
- ♦ for charge pressure control valve
- ♦ part of turbocharger, cannot be replaced separately

9 - Electromagnetic exhaust gas recirculation valve (N18)

10 - Mechanical exhaust gas recirculation valve

11 - Vacuum pump

12 - Brake servo unit

13 - Non-return valve

Testing glow plug system

Testing operation

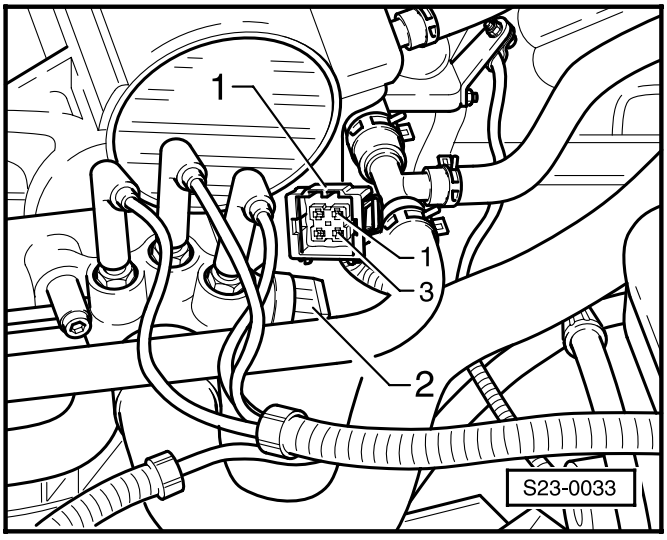
Special tools, testers and aids required

- Hand-held multimeter (e.g. V.A.G 1526)
- Current flow diagram

Test conditions

- Battery voltage at least 11.5 V
- Diesel direct injection system control unit (J248) o.k.
- Strip fuse for glow plugs (S 132) o.k.

Test procedure



- Switch off the ignition.

◄ - Unplug connector -1- at the coolant temperature sender (G62) -2-.

Note:

When the connector is unplugged from the sender, the „cold" engine state is simulated and appropriate glow plug heating operation is carried out when the ignition is switched on.

- Unplug the glow plug connectors from the glow plugs.
- Connect the multimeter for voltage measurement to a glow plug connector and to engine earth.
- Switch on the ignition.
  approx. battery voltage
  should be displayed for about 20 seconds.

If no voltage is present:

- Rectify any open circuit in the wiring or short circuit.

⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

During the simulated glow plug heating operation, the glow period warning lamp (K29) should come on.

If the warning light does not come on:

- Test glow period warning light ⇒ page 28-2.

Testing glow plugs

Special tools, testers and aids required

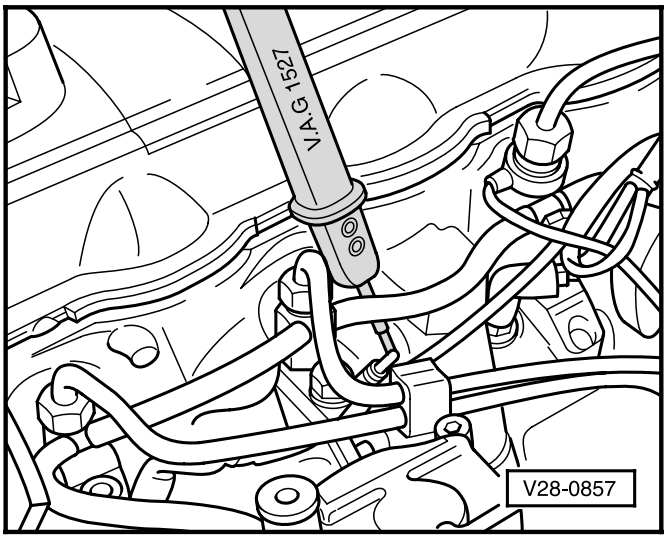
- ♦ Diode test lamp (e.g. V.A.G 1527 B)
- ♦ Hinged wrench for glow plugs (e.g. 3220)

Test condition

- ● Battery voltage at least 11.5 V

Test procedure

- Switch ignition off.
- Unplug glow plug connectors from the glow plugs.
- Connect cable of diode test lamp to battery positive (+).
- Switch ignition on.



◄ - Connect test prod of diode test lamp to each glow plug one after the other.

  LED comes on: glow plug o.k.

  LED does not come on: replace glow plug.

- Use hinged wrench, e.g. 3220, for removing and installing the glow plugs.
  Tightening torque: 15 Nm

Testing glow period warning light

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3, 3A, 3B or 3C
- ♦ Test box V.A.G 1598/22 or V.A.G 1598/31
- ♦ Adapter cable set (e.g. V.A.G 1594 A)

Test condition

- ● Fuse 29 o.k.

- Initiate final control diagnosis and operate glow period warning light ⇒ page 01-18.

Final control diagnosis Glow period warning light -K29	→

◄ Readout in display:

The warning light must flash.

If the warning light does not flash:

- Connect test box to the wiring loom to the engine control unit ⇒ page 23-19.

Test box V.A.G 1598/22

- Use an adapter cable to connect sockets 1 and 41 of the test box.

Test box V.A.G 1598/31

- Use an adapter cable to connect sockets 1 and 42 of the test box.

Continued for all models

- Switch ignition on.
  Warning light must come on.

If the warning light does not come on:

- Rectify any open circuit or short circuit in the wiring

⇒ Current Flow Diagrams, Fault Finding, Fitting Locations binder.

If the warning light now comes on, but not during final control diagnosis:

- Replace engine control unit (J248) ⇒ page 23-20.