

Workshop Manual OCTAVIA

**1.9 ltr. / 50 kW (SDI) Engine,
Fuel Injection and Glow Plug System**

List of Supplements to reparationshåndbog for **OCTAVIA**

Edition: 12.00

1.9 I/50 kW (SDI) Engine - Fuel Injection and Glow Plug System

Replaces List of Supplements - Edition: 07.99

Supplement	Edition	Subject	Article Number
	08.96	Basic Edition of Workshop Manual	S00.5113.50.20
1	09.97	Supplement to Basic Edition	S00.5113.51.20
2	07.99	Modification of Fault Codes	S00.5113.52.20
3	12.00	Modifications for vehicles 08.00 ➤	S00.5113.53.20
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

Contents ⇒ next page.

Contents

01	Self-diagnosis	Page
	Self-diagnosis	01-1
	- Features of self-diagnosis	01-1
	- Technical data of self-diagnosis	01-1
	- Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit ..	01-2
	- Interrogating and erasing fault memory	01-5
	- Fault table	01-8
	Final control diagnosis	01-17
	- Performing final control diagnosis	01-17
	- Basic setting	01-20
	- Coding control unit	01-22
	Measured value blocks	01-23
	- Reading measured value block	01-23
	- List of display groups	01-24
	- Specified readouts for general vehicle check	01-28
	- Specified readouts for injection pump	01-31
	- Specified readouts for engine idling	01-40
	- Specified readouts for exhaust gas recirculation	01-43
	- Specified readouts for temperature sensors	01-43
	- Specified readouts for vehicle power output	01-44
	- Specified readouts for charge pressure control	01-47
23	Fuel Formation/Fuel Injection	Page
	Servicing diesel direct injection system	23-1
	- Safety precautions	23-1
	- Rules for cleanliness	23-1
	- List of fitting locations	23-2
	- Removing and installing air filter and throttle valve positioner	23-4
	- Removing and installing intake manifold	23-5
	- Removing and installing injection pump	23-6
	- Dynamically testing and setting commencement of injection	23-12
	- Testing intake manifold temperature sender	23-15
	- Testing throttle valve positioner -V60-	23-17
	- Servicing injection pump	*
	- Servicing fuel filter	*
	- Servicing throttle mechanism	*
	- Setting accelerator pedal position sender	*
	- Removing and installing and testing injectors	✗
	- Replacing O-ring at injection timing cover	*
	- Testing cables and components with test box	*
	- Replacing engine electronics control unit	*
	Testing fuel injection control	*
	- Testing injection timing control range	*
	- Testing commencement of injection valve	*
	- Testing fuel temperature sender	*
	Testing exhaust gas recirculation system	23-19
	- Testing exhaust gas recirculation	23-19
	- Testing electromagnetic exhaust gas recirculation valve -N18-	*

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

✗ refer to 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System (The specifications for the 1.9 l/50 kW - SDI engine differ and are listed in Repair Group 01 „Measured value blocks“ of the SDI engine)

Testing control unit input parameters	*
- Testing voltage supply for diesel direct injection system	*
- Testing engine speed sender	*
- Testing needle lift sender	*
- Testing coolant temperature sender	*
- Testing brake light switch and brake pedal switch	*
- Testing modulating piston movement sender and quantity adjuster	✕
- Testing accelerator pedal position sender	*
Testing additional signals	*
- Testing signals from/to air conditioning	*
- Testing clutch pedal switch	*
- Testing vehicle speed signal	*
- Testing engine speed signal	*
- Testing CAN databus	*

28	Glow Plug System	Page
	Testing glow plug system	*
	- Testing operation	*
	- Testing glow plugs	*
	- Testing glow period warning light.....	*

* refer to 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System
✕ refer to 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System (The specifications for the 1.9 l/50 kW - SDI engine differ and are listed in Repair Group 01 „Measured value blocks“ of the SDI engine)

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	yes
08 Read measured value block	yes	yes

¹⁾ Only if engine does not start (starter must be operated for at least 6 s).

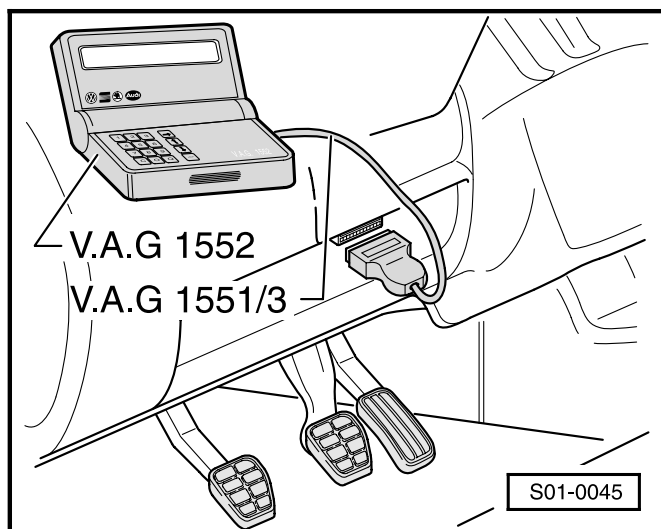
Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit

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 diagnostic cable.

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.

- ◀ ♦ 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

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
---	------

Test of vehicle systems Enter address word XX	HELP
--	------

Note:

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

- ◀ Readout in display:

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

038906013A	1.9l	R4	EDC	G00SG	1504	→
Coding 00002					WSC 01234	

◀ The control unit identification appears in the display (example):

- ◆ 038906013A Part No. of control unit¹⁾
- ◆ 1.9l Displacement of engine
- ◆ R4 Type of engine (4-cyl. inline engine)
- ◆ EDC Injection system (Electronic Diesel Control)
- ◆ G or no readout Vehicle with or without cruise control system
- ◆ 00 Control unit maps
- ◆ SG Manual gearbox
AG Automatic gearbox²⁾
- ◆ 1504 Data status (software version) of control unit
- ◆ Coding 00002 Coding version of control unit
- ◆ WSC 01234 Workshop code from V.A.G 1552, with which the last coding was performed

List of control units

Part No. of ECU ¹⁾	Software version	Date of introduction
038906013A	1508	► 08.97
038906013P	1827	► 08.97
038906013AL	1836	08.97 ► 04.99
038906013AS	1837	05.99 ► 07.00
038906012E	3312	08.00 ►

¹⁾ Current control unit version ⇒ Parts List

²⁾ Not available at present

Notes:

If the control unit version displayed does not match the vehicle, replace control unit. ⇒ 1.9 l/ 66 kW Engine, Fuel Injection and Glow Plug System; Repair Group 23

Incorrect coding of the engine control unit results in:

- ◆ *Poor handling properties (jerky gearshifts, load change jolts, etc.)*
- ◆ *Increased fuel consumption*
- ◆ *Increased emission levels*
- ◆ *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 01-22.
- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ 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
Select function XX

HELP

◀ 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
Select function XX

HELP

◀ Readout in display:

- End output (function 06).

If one or several faults are stored:

- Press the → key.

◀ Fault number appears in the display (example):

- Press the → key.

◀ Fault source with fault type appear in the display (example):

- Press the → key.

The faults stored are displayed one after the other.

- Press the → key.

◀ Readout in display:

- Press the keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Rectify the faults displayed by referring to the fault table ⇒ page 01-8.

Note:

When carrying out test and removal and installation work, other control units may also detect faults, such as connectors unplugged. For this reason, you must always interrogate the fault memories of all the control units and erase them after completing the work. Adopt the following procedure for this:

- Press the key 0 twice for the address word „Automatic test sequence“ and confirm the entry with the key Q. V.A.G 1552 sends all the known address words one after the other.

Erasing fault memory**Test condition**

- Faults rectified

Note:

After rectifying faults, the fault memory must once again be interrogated as described below, and then erased.

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

Fault number: 00542

→

Needle lift sender -G80
Short circuit to earth

→

Test of vehicle systems
Select function XX

HELP

Test of vehicle systems
Select function XX

HELP

◀ 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 faults stored are displayed one after the other.

Test of vehicle systems
Select function XX

HELP

◀ 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 then not erased.

- Press the → key.
- Press the keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.
- Carry out a road test. After this, once again interrogate the fault memory. There must not be any more faults displayed.

Fault table

Notes:

- ♦ On vehicles 08.98 ➤ different fault codes are displayed with the same or a similar text. In the fault table, select the text required on the basis of the fault code.
- ♦ If „see info in literature“ appears in the display of the vehicle system tester, look for the text required in the fault table on the basis of the fault code.
- ♦ The fault table is arranged according to the 5-digit fault code shown on the left.
- ♦ Explanations regarding fault types (e.g. „open/short circuit to earth“):
 - ⇒ Operating instructions of vehicle system tester
 - ♦ If components are shown as faulty:
First of all test the wiring and plug connections to these components and also the earth cables of the system on the basis of the current flow diagram. Only if no fault is found in this case, replace the component. This applies in particular if faults are shown as „sporadically occurring“ (SP).

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
old	new			
00282 Throttle valve positioner -V60 Open/short circuit to earth Short circuit to positive	-	♦ Open circuit in wiring ♦ -V60 faulty ♦ Short circuit to earth ♦ Short circuit to positive	♦ No exhaust gas recirculation, throttle valve fully opened ♦ No exhaust gas recirculation, throttle valve fully opened ♦ No exhaust gas recirculation, throttle valve fully opened	- Test V60 ⇒ page 23-16
00513 Engine speed sender -G28 Implausible signal	16705	♦ Sender rotor bent or loose ♦ Distance of speed sensor/sender rotor too large ♦ Metal swarf on G28 or base loose ♦ Open circuit in screening ♦ -G28 faulty	♦ Irregular engine running, misfiring ♦ Poor starting ♦ Increased idling speed ♦ Glow warning lamp flashes ♦ Reduced output	
No signal	16706	♦ -G28 faulty ♦ Open circuit in wiring or short circuit ♦ Open circuit in screening	♦ No indication of rev counter ♦ Engine does not start	

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
old	new			
00522 Coolant temperature sender -G62 Short circuit to earth	17663	♦ -G62 faulty ♦ Cable has short circuit to earth	♦ Black exhaust when starting ♦ Engine preheating not operating ♦ Preglowing always for about 20 seconds	- Test coolant temperature sender ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
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 Short circuit to earth	17568	♦ -G72 faulty ♦ Cable has short circuit to earth	♦ Engine preheating not operating	- Test intake manifold temperature sender ⇒ page 23-15
Open/short circuit to positive	17569	♦ -G72 faulty ♦ Open circuit in wiring or short circuit to positive		
00532 Supply voltage Implausible signal or Voltage supply tml. 15 Voltage too low	18008	♦ Control unit was connected when ignition switched on ♦ Open circuit in wiring or short circuit ♦ Voltage not present when ignition on (terminal 15)	♦ Engine does not start ♦ Engine stops	- Erase fault memory and continue checking vehicle - Test voltage supply for engine control unit ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System - Test voltage supply 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 ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System - Test voltage supply for engine control unit ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00539 Fuel temperature sender -G81 Short circuit to earth	17570	♦ -G81 faulty ♦ Cable has short circuit to earth	♦ Reduced output	- Test fuel temperature sender ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
Open/short circuit to positive	17571	♦ -G81 faulty ♦ Open circuit in wiring or short circuit to positive ♦ Connector for injection pump separated		
00542 Needle lift sender -G80 Short circuit to earth	17653	♦ -G80 faulty ♦ Open circuit in wiring or short circuit	♦ Glow warning light flashes ♦ Rough engine running ♦ Reduced output	- Test needle lift sender ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
Implausible signal	17654	♦ Fuel feed (was) interrupted: tank run empty, feed line or filter blocked, system drawing air ♦ (Sporadic) open circuit in wiring to fuel shut-off valve ♦ Sender rotor of engine speed sender bent or loose ♦ -G80 faulty ♦ Injection pump faulty	♦ Fault 00550 Commencement of injection control may be stored ♦ Misfiring, jerking ♦ Engine stops ♦ Misfiring ♦ Misfiring at exactly 3000 rpm ♦ Misfiring, jerking (particularly at high revs) ♦ Fault 01268 Quantity adjuster -N146 ♦ Irregular engine running, misfiring ♦ No throttle response after overrun	- Inspect fuel system - Inspect cable connection and plug connection at injection pump - Detach oil pan and inspect sender rotor - Replace needle lift sender - Replace injection pump
Open/short circuit to positive	17655	♦ -G80 faulty ♦ Sporadic open circuit in wiring (cable break)	♦ Glow warning light flashes ♦ Misfiring, jerking ♦ Reduced output	- Test needle lift sender ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
00545	-	♦ Open circuit in wiring or short circuit	♦ Hard gearshifts	- Test signals from/to automatic gearbox
00550	17656	♦ Commencement of injection not o.k.	♦ Poor performance at high revs ♦ Engine difficult to start	- Test commencement of injection and set ⇒ page 23-12
Commencement of injection control Control difference		♦ Adjustment of injection pump blocked (dirt, swarf)	♦ Poor performance at high revs	- Test injection timing range control ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
		♦ Engine was stalled (within the last 50 starts)		- Erase fault memory, continue checking vehicle
		♦ Fuel feed (was) interrupted: tank run empty, feed line or filter blocked, system drawing air	♦ Fault 00542 Needle lift sender implausible signal may be stored	- Inspect 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 ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
			♦ 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 by 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			
00741	-			
Brake pedal monitoring				
Implausible signal		♦ Switch incorrectly set ♦ Open circuit in wiring ♦ -F or -F47 faulty ♦ Fuse faulty ♦ Both brake lights faulty	♦ Preglow warning light flashes ♦ Fuse or brake light faulty	- Test and set -F and -F47 ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System - Test fuse and brake light
00765	17762			
Modulating piston movement sender -G149				
Fault in electrical circuit		♦ 10-pin connector for injection pump separated ♦ Injection pump faulty ♦ Open circuit in wiring or short circuit	♦ Several faults stored ♦ Engine stops ♦ Drivability problems	- Inspect plug connection for injection pump - Test modulating piston movement sender ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
00777	18039			
Accelerator pedal position sender -G79				
Signal too large		♦ Open circuit in wiring ♦ -G79 faulty (idling switch)	♦ Safety governing to approx. 1100 rpm ♦ No throttle response ♦ Preglow warning light flashes ♦ Increased idling speed	- Test accelerator pedal position sender ⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
Voltage supply	18040	♦ Open circuit in wiring or short circuit		
Implausible signal or	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		

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

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
01044 Engine control unit in- correctly coded	18020	Invalid control unit coding	Preglow indicator light flashes	Code control unit ⇒ page 01-22
01117 Load signal for alter- nator terminal DF Implausible signal	-	- Open circuit in wiring or short circuit - Alternator faulty - Voltage regulator faulty	Engine preheater not operating	- Test cable connections - Test alternator ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
01180 Engine/AC compr. electr. connection Short circuit to positive	-	Short circuit in cable connection	Reduced vehicle acceleration if AC on	Test signals from/to air conditioning ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23
01193 Low heating capacity relay -J359 Open/short to earth	-	- Open circuit in wiring - Low heating capacity relay -J359 faulty - Short circuit to earth	- Engine preheater not operating - Engine preheater constantly on	- Test cable connections ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test low heating capacity relay ⇒ page 01-17, Final control diagnosis
Short to positive	19459	Short circuit to positive	Engine preheater not operating	

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
01194 High heating capacity relay -J360 Open/short to earth	-	♦ Open circuit in wiring ♦ High heating capacity relay -J360 faulty ♦ Short circuit to earth	♦ Engine preheater not operating ♦ Engine preheater constantly on	- Test cable connections ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test high heating capacity relay ⇒ page 01-17, Final control diagnosis
Short to positive	19461	♦ Short circuit to positive	♦ Engine preheater not operating	
01237 Fuel shut-off valve -N109 Malfunction (mechanical fault)	17945	♦ -N109 faulty, leaking or jamming	♦ Reduced output ♦ Engine stops	- Test -N109 ⇒ page 01-17, Final control diagnosis - Test cable connections ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
Open/short to earth	17946	♦ -N109 faulty ♦ Open circuit in wiring or short to earth	♦ Engine stops	
01265 EGR valve -N18 Short to positive	17810	♦ Short circuit to positive	♦ Engine runs without exhaust gas recirculation	- Test EGR valve ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23
Open/short to earth	17849	♦ Open circuit in wiring ♦ Solenoid valve faulty	♦ Engine runs without exhaust gas recirculation	
		♦ Short to earth	♦ Excessive exhaust gas recirculation ♦ Reduced output, black exhaust	

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
01266 Glow plug relay -J52 Short to positive	18026	♦ Short circuit to positive	♦ Glow plug system not operating	- Test glow plug relay -J52 ⇒ page 01-17, Final control diagnosis
Open/short to earth	18027	♦ Open circuit in wiring ♦ Relay faulty	♦ Glow system not operating	
		♦ Short circuit to earth	♦ Glow plug system constantly on	
01268 Quantity adjuster -N146 Control difference (variation)	17969	♦ Injection pump faulty ♦ Open circuit in wiring or short circuit	♦ Poor drivability ♦ Engine stops ♦ Preglow indicator light flashes	- Test quantity adjuster ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23 - Replace injection pump
Upper stop value	17970	♦ Quantity adjuster incorrectly set	♦ Jerking, poor output	
Lower stop value	17971	♦ Quantity adjuster incorrectly set	♦ Black exhaust ♦ Irregular idling	
01269 Commencement of injection valve -N108 Short to positive	17659	♦ Short circuit to positive	♦ Engine clatters when idling as commencement of injection constantly „advanced“	- Test commencement of injection valve ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23 - Test fuse ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test commencement of injection valve ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23
Open circuit/short to earth	17660	♦ Open circuit in wiring (fuse) ♦ Valve faulty	♦ Engine clatters when idling as commencement of injection constantly „advanced“	
			♦ Several faults may be stored	
		♦ Short circuit to earth	♦ Poor performance as commencement of injection constantly „retarded“	

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
01283	-			
Intake manifold flap motor -V157				
Open/short circuit to earth		♦ Open circuit in wiring ♦ -V157 faulty ♦ Short circuit to earth	♦ Engine runs without exhaust gas recirculation, throttle valve fully opened	- Test throttle valve positioner -V60 ⇒ page 23-17
Short circuit to positive		♦ Short circuit to positive	♦ Engine runs without exhaust gas recirculation, throttle valve fully opened	
16500	-			
Coolant temperature sender -G62				
Implausible signal		♦ Loose contact ♦ -G62 faulty 		

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
17978	-	◆ Attempt at manipulation ◆ Attempt at starting with non-authorized key ◆ Engine control unit not adapted to immobiliser ◆ Short circuit in communication line ◆ Fault in immobiliser system ◆ Immobiliser control unit faulty/missing ◆ Engine control unit incorrectly coded	◆ Engine starts and cuts out again immediately	- Adapt engine control unit to electronic immobiliser ⇒ Electrical System; Repair Group 96 - Test electronic immobiliser: ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Code engine control unit ⇒ page 01-22
18044	-	◆ Datalines faulty ◆ Fault in ABS system	◆ Poor drivability	- Test databus ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23 - Test airbag control unit ⇒ Body Fitting Work; Repair Group 01

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
18058	-			
Drive databus				
No message from instrument cluster		◆ Datalines faulty ◆ Incorrect or faulty dash panel insert ◆ Incorrect or faulty engine control unit	◆ Poor drivability	- Test databus ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23
18061	-			
Read out fault memory contents for ABS control unit		◆ Fault in ABS control unit	◆ No vehicle dynamic control ◆ TCS not operating ◆ EBC not operating	- Test ABS control unit ⇒ Running Gear; Antilock Brake System
18062	-			
Read out fault memory contents for instrument cluster		◆ Oil level/oil temperature sender -G266 faulty	◆ Oil level warning light comes on	- Test oil level/oil temperature sender -G266 ⇒ Electrical System; Repair Group 90
18065	-			
AC input/output				
Short to positive		◆ Short circuit in cable connection	◆ Reduced output	- Test air conditioning ⇒ page 01-17, Final control diagnosis
18090	-			
Drive databus				
Implausible signal from ABS control unit		◆ Open circuit in datalines to ABS control unit	◆ No vehicle dynamic control ◆ TCS not operating ◆ EBC not operating	- Test databus ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

Readout on V.A.G 1552		Possible cause of fault	Possible effects	Rectifying fault
Fault number				
old	new			
18259 Drive databus No message from ABS control unit	18057	♦ Fault in datalines to ABS control unit	♦ No vehicle dynamic control	- Test databus ⇒ 1.9 I/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23
		♦ Fault in ABS system		- Test ABS control unit ⇒ Running Gear; Antilock Brake System
18262 Drive databus Hardware faulty or defective	18056	♦ Fault in datalines to ABS control unit	♦ No vehicle dynamic control	- Test databus ⇒ 1.9 I/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23
		♦ Fault in ABS system		- Test ABS control unit ⇒ Running Gear; Antilock Brake System
65535 Control unit defective	16989 17795 18048	♦ Internal fault in control unit	♦ Poor drivability ♦ Engine stops ♦ Glow indicator light flashes	- Replace control unit ⇒ 1.9 I/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

Final control diagnosis

Performing final control diagnosis

With final control diagnosis the following components are actuated in the order stated:

1. Commencement of injection valve (N108)
 2. Exhaust gas recirculation valve (N18)
 3. AC compressor control
 4. Throttle valve positioner (V60)¹⁾
 5. Fuel shut-off valve (N109)
 6. Glow plug relay (J52)
 7. Glow period warning light (K29)
 8. Low heating capacity relay (J359)²⁾
 9. High heating capacity relay (J360)²⁾
- ¹⁾ Models 09.98 ► Intake manifold flap motor (V157)
- ²⁾ Only models with optional equipment.

Note:

To repeat final control diagnosis without switching on the engine in-between, switch ignition off for about 10 seconds.

Test requirements for models fitted with air conditioning

- Vehicle is at room temperature (warmer than +15 °C)
- Air conditioning switched on
- Lowest temperature and highest blower speed selected

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). Engine must be idling for this step. (Connecting vehicle system tester and selecting engine electronics control unit ⇒ page 01-2)

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Test of vehicle systems
03 - Final control diagnosis

Q

◀ Readout in display:

- Confirm the entry with the key Q.

Final control diagnosis
Commencement of injection valve -N108

→

◀ Readout in display:

When the valve is actuated, a clearly audible change in the combustion noise can be heard (clattering noise).

If no change in the combustion noise can be heard:

- Test injection timing control range
⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
- 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 sensed by touching.

If the valve does not click:

- Test EGR valve
⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System
- 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 on vehicles without air conditioning.

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

If the AC compressor is not cut off:

- Test AC compressor cut-off
⇒ 1.9-ltr./66 kW (TDI) Engine, Fuel Injection and Glow Plug System

Final control diagnosis
Throttle valve positioner -V60

→

- Press the → key.

◀ Readout in display:

Activation of the positioner results in alternating changes to the combustion noise (the positioner switches over the throttle valve).

Activation of the positioner cannot be heard:

- Carry out diagnosis of the positioner with the engine off and the ignition switched on.

Activation of the positioner cannot be heard:

- Test throttle valve positioner ⇒ page 23-10.
- 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 swarf and dirt.
- Repeat final control diagnosis; if the engine again does not stop, replace fuel cut-off valve.
- Continue final control diagnosis with engine off and ignition switched on.
- Press the → key.

Final control diagnosis
Glow plugs relay -J52

→

◀ Readout in display:

The relay should click.

The switching on and off of the relay can also be observed by the interior light becoming brighter and then dimmer, caused by high power consumption of the glow plugs.

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 must flash.

If the warning light does not flash:

- Test glow period warning light
⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 28
- Press → key.

Final control diagnosis
Low heating capacity relay -J359 →

◀ Readout in display:

The relay must click.

If the relay does not click:

- Test low heating capacity relay:
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- Press → key.

Final control diagnosis
High heating capacity relay -J360 →

◀ Readout in display:

The relay must click.

If the relay does not click:

- Test high heating capacity relay:
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- Press → key.

Køretøjssystem-test
Vælg funktion XX

HELP

◀ Readout in display:

- End output (function 06).

Basic setting

Test conditions

- Coolant temperature at least 80 °C
- Electrical components switched off (radiator fan must not run during the test)
- Air conditioning switched off

Special tools, testers and aids 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 the engine electronics control unit with the address word „01“. The engine should be idling for this step.
(Connecting vehicle system tester and selecting engine electronics control unit ⇒ page 01-2)

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Basic setting
Enter display group number XXX

HELP

◀ Readout in display:

- Press the key 0 three times for display group „000“ and confirm the entry with the key Q.

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

◀ Readout in display:

(1...10 = display zones)

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

This display group is used for the dynamic test of the commencement of injection. The commencement of injection valve (N108) is constantly actuated; as a result the injection timing control is „retarded“.

System in basic setting										0	→
42	63	0	24	19	201	64	153	127	255		

◀ Readout in display

										Ignore
										Fuel temperature: approx. 40 °C (is not achieved at a low outside temperature; no specification)
										Ignore
										Coolant temperature: approx. 90 °C
										Ignore
										Ignore
										Ignore
										Accelerator pedal position: 0
										Commencement of injection depends on fuel temperature, specifications ⇒ page 23-6, Dynamic test and setting of commencement of injection
										Idling speed: 41...44

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.
(Connecting vehicle system tester and selecting engine electronics control unit ⇒ 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 ► 07.00		Models 08.00 ►	
Code number	Models fitted with	Code number	Models fitted with
00002	Manual gearbox	00002	Manual gearbox with activated CAN databus (models with ABS)
		00005	Manual gearbox without CAN databus (models without ABS)

038906013A 1.9l R4 EDC G00SG 1504 →
Coding 00002 WSC 01234

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

- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- End output (function 06).
- Switch the ignition off and on again.

Note:

- ♦ The code entered is activated when the ignition is switched on again for the next time.

Measured value blocks

Reading measured value block

Test conditions

- Coolant temperature at least 80 °C
- Electrical components switched off (radiator fan must not cut in during the test)
- Air conditioning switched off
- No fault stored in the fault memory

Special tools, testers and aids required

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

Procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

HELP

◀ Readout in display:

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

Note:

The display group number 000 is an example in order to present the sequence.

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

◀ Readout in display, e.g.:

- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Note:

Proceed as follows in order to switch into another display group:

Display group	V.A.G 1552	V.A.G 1551
higher	Press ↑ key	Press key 3
lower	Press ↓ key	Press key 1
skipping	Press key C	Press key C

List of display groups

Display group number	Readout in display	Designation
000 General vehicle check	Read measured value block 0 1 2 3 4 5 6 7 8 9 10	1 = Engine speed 2 = Commencement of injection 3 = Accelerator pedal position 4 = Injected quantity 5 = Intake manifold pressure (charge pressure) 6 = Atmospheric pressure (ambient air pressure) 7 = Coolant temperature 8 = Intake manifold temperature 9 = Fuel temperature 10 = Ignore
001 Injected quantity	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Injected quantity 3 = Voltage of modulating piston movement sender -G149 4 = Coolant temperature
002 Idling speed	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Accelerator pedal position 3 = Operating state 4 = Coolant temperature

Display group number	Readout in display	Designation
003 Exhaust gas recirculation	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = No readout 3 = No readout 4 = On/off ratio (actuation) of exhaust gas recirculation valve -N18
004 Commencement of injection	Read measured value block 4 1 2 3 4	1 = Engine speed 2 = Commencement of injection (set value) 3 = Commencement of injection (actual value) 4 = On/off ratio (actuation) of commencement of injection valve -N108
005 Start conditions	Read measured value block 5 1 2 3 4	1 = Engine speed 2 = Start injected quantity (stored from last start) 3 = Commencement of injection 4 = Coolant temperature
006 Switch positions	Read measured value block 6 1 2 3 4	1 = Vehicle speed 2 = Brake pedal monitor 3 = CCS operating unit ¹⁾ 4 = CCS operating state ¹⁾

¹⁾ Not available at present

Display group number	Readout in display	Designation
007 Temperatures	Read measured value block 7 1 2 3 4	1 = Fuel temperature 2 = No readout 3 = Intake manifold temperature 4 = Coolant temperature
008 Injected quantity limit	Read measured value block 8 1 2 3 4	1 = Engine speed 2 = Injected quantity request (driver request through accelerator) 3 = Injected quantity limit through engine speed (torque limit) 4 = Injected quantity limit based on inducted air mass (avoiding smoky exhaust)
009 Injected quantity limit	Read measured value block 9 1 2 3 4	1 = Engine speed 2 = Injected quantity (CCS active) ¹⁾ 3 = Injected quantity limit from automatic gearbox during gearshift ¹⁾ 4 = Emergency quantity (voltage from modulating piston movement sender -G149)
010 Air quantities	Read measured value block 10 1 2 3 4	1 = No readout 2 = Atmospheric pressure (ambient air pressure) 3 = No readout 4 = Accelerator pedal position
011 Charge pressure control	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = No readout 3 = No readout 4 = On/off ratio (actuation) of charge pressure control solenoid valve -N75

¹⁾ Not available at present

Display group number	Readout in display	Designation
012 Glow plug system	Read measured value block 12 1 2 3 4	1 = Ignore readout 2 = Glow period (seconds) 3 = Supply voltage from control unit 4 = Coolant temperature
013 Smooth idling control	Read measured value block 13 1 2 3 4	1 = Injected quantity variation of cylinder 4 to cylinder 3 2 = Injected quantity variation of cylinder 2 to cylinder 3 3 = Injected quantity variation of cylinder 1 to cylinder 3 4 = No readout
014 not assigned	Read measured value block 14	No readout
015 Fuel consumption	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Injected quantity (actual value) 3 = Fuel consumption 4 = Injected quantity request (driver request through accelerator)
016 Auxiliary heater	Read measured value block 16 1 2 3 4	1 = Alternator load 2 = Auxiliary heater switched off 3 = Actuation of heating elements 4 = Supply voltage from control unit
017 Not assigned	Read measured value block 17	No readout
018	Read measured value block 18 1 2 3 4	Ignore
019 Fuel metering control	Read measured value block 19 1 2 3 4	1 = Lower stop value (voltage from modulating piston movement sender) 2 = Upper stop value (voltage from modulating piston movement sender) 3 = No readout 4 = No readout

Specified readouts for general vehicle check

Display group 000, engine idling (engine warm, coolant temperature not less than +80 °C)
for models ► 07.00

Read measured value block										0	→	◀ Readout in display
42	61	0	24	19	201	70	161	127	255			
										Inducted air mass: ignore		
										Fuel temperature: no specification		
										Intake manifold temperature: no specification		
										Coolant temperature: 80...51 o.k.		
										• > 80: warm up engine		
										Ambient air pressure: ignore		
										Charge pressure: ignore		
										Injected quantity: 15...45 o.k.		
										• If not within tolerance ⇒ page 01-31, Display group 001		
										Accelerator pedal position: 0		
										Commencement of injection: 0...88 o.k.		
										• If not within tolerance ⇒ page 01-33, Display group 004		
										Idling speed: 41...44 o.k.		
										• If not within tolerance ⇒ page 01-40, Display group 002		

Display group 000, engine idling (engine warm, coolant temperature not less than +80 °C)
for models 08.00 ►

Read measured value block										0	→	◀ Readout in display
42	61	0	24	19	201	70	161	127	255			
										Inducted air mass: ignore		
										Fuel temperature: no specification		
										Intake manifold temperature: no specification		
										Coolant temperature: 80...51 o.k.		
										• > 80: warm up engine		
										Ambient air pressure: ignore		
										Charge pressure: ignore		
										Injected quantity: 15...45 o.k.		
										• If not within tolerance ⇒ page 01-32, Display group 001		
										Accelerator pedal position: 0		
										Commencement of injection: 25...125 o.k.		
										• If not within tolerance ⇒ page 01-34, Display group 004		
										Idling speed: 41...45 o.k.		
										• If not within tolerance ⇒ page 01-40, Display group 002		

Display group 000 at full throttle (road test in 2nd or 3rd gear, coolant temperature not less than +80 °C) for models ► 07.00

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										0	→	◀ Readout in display
146	125	255	120	19	201	64	165	105	118			
										Inducted air mass: ignore		
										Fuel temperature: no specification		
										Intake manifold temperature: no specification		
										Coolant temperature: 80...51 o.k.		
										• > 80: warm up engine		
										Ambient air pressure: ignore		
										Charge pressure: ignore		
										Injected quantity: 116...135 (full load injected quantity) o.k.		
										• 125: emergency injected quantity, system fault detected ⇒ page 01-5, Interrogating fault memory		
										Accelerator pedal: 255 (depressed fully)		
										Commencement of injection: 112...188 (dependent on engine speed)		
										• If not within tolerance ⇒ page 01-35, Display group 004		
										Engine speed: 138...148 o.k.		

Display group 000 at full throttle (road test in 2nd or 3rd gear, coolant temperature not less than +80 °C) for models **08.00** ►

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										0	→	◀ Readout in display
146	125	255	129	19	201	64	165	105	118			
										Inducted air mass: ignore		
										Fuel temperature: no specification		
										Intake manifold temperature: no specification		
										Coolant temperature: 80...51 o.k.		
										• > 80: warm up engine		
										Ambient air pressure: ignore		
										Charge pressure: ignore		
										Injected quantity: 125...140 (full load injected quantity) o.k.		
										• 125: emergency injected quantity, system fault detected ⇒ page 01-5, interrogate fault memory		
										Accelerator pedal: 255 (depressed fully)		
										Commencement of injection: 113...163 (dependent on engine speed)		
										• If not within tolerance ⇒ page 01-36, Display group 004		
										Engine speed: 133...153		

Specified readouts for injection pump

Display group 001, engine idling (engine warm, coolant temperature not less than +80 °C)
for models ► 07.00

Read measured value block				1 →	◀ Readout in display
900 rpm	4.6 mg/H	1.680 V	87.3 °C		
Coolant temperature					
• 80...110 °C o.k., < 80 °C: ⇒ warm up engine					
Voltage of modulating piston movement sender -G149					
• 1.400...1.800 V: o.k.					
• < 1.400 V:					
- Injection pump damaged ⇒ replace injection pump					
• > 1.800 V:					
- Engine load ⇒ switch off consumers					
- Engine too cold ⇒ warm up engine					
- Injection pump damaged ⇒ replace injection pump					
Injected quantity					
• 3.0...9.0 mg/H: o.k.					
• < 3.0 mg/H:					
- Injection pump damaged ⇒ replace injection pump					
• > 9.0 mg/H:					
- Engine load ⇒ switch off consumers					
- Injection too cold ⇒ replace injection pump					
- Injection pump damaged ⇒ replace injection pump					
Engine speed					
• 860...940 rpm o.k.					

**Display group 001, engine idling (engine warm, coolant temperature not less than +80 °C)
for models 08.00 ➤**

Read measured value block				1 →	◀ Readout in display
900 rpm	4.6 mg/H	1.680 V	87.3 °C		
Coolant temperature					
• 80...110 °C o.k., < 80 °C: ⇒ warm up engine					
Voltage of modulating piston movement sender -G149					
• 1.600...2.100 V o.k.					
• < 1.600 V:					
- Injection pump damaged ⇒ replace injection pump					
• > 2.100 V:					
- Engine load ⇒ switch off consumers					
- Engine too cold ⇒ warm up engine					
- Injection pump damaged ⇒ replace injection pump					
Injected quantity					
• 3.0...9.0 mg/H o.k.					
• < 3.0 mg/H:					
- Injection pump mixture too rich ⇒ replace injection pump					
• > 9.0 mg/H:					
- Engine load ⇒ switch off consumers					
- Injection too cold ⇒ replace injection pump					
- Injection pump damaged ⇒ replace injection pump					
Engine speed					
• 860...940 rpm o.k.					

Display group 001, during attempt at starting (if engine does not start)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					
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 01-17, 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 004, engine idling (engine warm, coolant temperature not less than +80 °C)
for models ► 07.00**

Read measured value block				4 →	◀ Readout in display
900 rpm	0.9° BTDC	0.9° BTDC	5 %		
On/off ratio (actuation) of commencement of injection valve					
• 3...80 %					
Momentary commencement of injection					
• 0° ATDC...4° BTDC o.k.					
• Later than 0° ATDC: commencement of injection blocked					
- Commencement of injection valve faulty ⇒ page 01-17, Final control diagnosis					
- Injection pump stops extremely too late ⇒ Dynamically test and set commencement of injection ⇒ page 23-12					
• Earlier than 4° BTDC:					
- Engine too cold ⇒ warm up engine					
- Commencement of injection valve faulty ⇒ page 01-17, Final control diagnosis					
- Injection pump stops too soon ⇒ Dynamically test and set commencement of injection ⇒ page 23-12					
Specified commencement of injection requested by control unit					
• 0° ATDC...4° BTDC o.k.					
• Earlier than 4° BTDC:					
- Engine too cold ⇒ warm up engine					
Engine speed					
• 860...940 rpm o.k.					

Display group 004, engine idling (engine warm, coolant temperature not less than +80 °C)
for models 08.00 ►

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					
• 2...80 %					
Momentary commencement of injection					
• 1° ATDC...7° BTDC o.k. • Later than 1° ATDC: commencement of injection blocked - Commencement of injection valve faulty ⇒ page 01-17, Final control diagnosis - Injection pump stops extremely too late ⇒ Dynamically test and set commencement of injection ⇒ page 23-12 • Earlier than 7° BTDC: - Engine too cold ⇒ warm up engine - Commencement of injection valve faulty ⇒ page 01-17, Final control diagnosis - Injection pump stops too soon ⇒ Dynamically test and set commencement of injection ⇒ page 23-12					
Specified commencement of injection requested by control unit					
• 1° ATDC...7° BTDC o.k. • Earlier than 7° BTDC: - Engine too cold ⇒ warm up engine					
Engine speed					
• 860...940 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 ► 07.00

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	6.3° BTDC	6.3° BTDC	52 %			
				</		

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 08.00 ►

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	6.3° BTDC	6.3° BTDC	79 %
On/off ratio (actuation) of commencement of injection valve • 70...95 % o.k. • Not within tolerance: - Commencement of injection valve faulty ⇒ page 01-17, Final control diagnosis - Dynamically test and set commencement of injection ⇒ page 23-12			
Momentary commencement of injection • As specified commencement of injection in display block 2 (tolerance ± 5°) then o.k. • Not within tolerance: - Engine too cold ⇒ warm up engine - Commencement of injection valve faulty ⇒ page 01-17, Final control diagnosis - Air in fuel supply system ⇒ Test fuel supply system for leaks - Injection pump stops too soon ⇒ Dynamically test and set commencement of injection ⇒ page 23-12			
Specified commencement of injection requested by control unit • 6...12° BTDC o.k.			
Engine speed • 2800...3200 rpm o.k.			

Display group 019, ignition switched on, models ► 07.00

Read measured value block		19 →	◀ Readout in display
0.780 V	4.150 V		
		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, 1.9 l/66 kW Engine, Fuel Injection and Glow Plug System - Fuel metering control of injection pump incorrectly set ⇒ replace injection pump	
		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, 1.9 l/66 kW Engine, Fuel Injection and Glow Plug System - Fuel metering control of injection pump incorrectly set ⇒ replace injection pump	

Display group 019, ignition switched on, models 08.00 ►

Read measured value block		19 →	◀ Readout in display
0.780 V	4.150 V		
		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, 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System - Fuel metering control of injection pump incorrectly set ⇒ replace injection pump	
		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, 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System - Fuel metering control of injection pump incorrectly set ⇒ replace injection pump	

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	255
CCS operating state ¹⁾			
Operating state of cruise control ¹⁾			
Brake pedal monitor ⇒ Table 1: brake pedal monitor, page 01-38			
Vehicle speed: ignore			

¹⁾ Not available at present

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				

Display group 016, engine idling

Read measured value block	16	→	◀ Readout in display
70.0 % 1 0 0 0 0 0 1 0 0	13.8 V		
Supply voltage of control unit: ignore			
Actuation of heating elements ⇒ page 01-39, Table 2			
Operating state of auxiliary heater ⇒ page 01-39, Table 1			
Generator load: ignore			

Analysis: Table 1, operating state of auxiliary heater

Meaning if readout places = 1									Auxiliary heater switched off because:
x	x	x	x	x	x	x	x	x	
								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					Engine speed less than 800 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 engine idling

Display group 002, engine idling (engine warm, coolant temperature not less than +80 °C)

Read measured value block		2 →	◀ Readout in display
900 rpm	0.0 %	0 1 0	88.4 °C
Coolant temperature			
• 80...100 °C o.k. • < 80 °C: ⇒ warm up engine			
Engine operating state ⇒ Table of engine operating state			
Accelerator pedal position			
• 0.0 % o.k. • > 0.0 % Accelerator pedal position sender incorrectly set or faulty ⇒ set			
⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23			
Engine speed			
• 860...940 rpm o.k.			

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 +80 °C)
for models ► 07.00**

- ◆ 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 →	◀ Readout in display
0.82 mg/H -0.12 mg/H 0.49 mg/H				
No readout				
Variation of injected quantity of cylinders 4, 2, 1 to cylinder 3				
• -2 mg/H...+2 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				
• -2 mg/H...+2 mg/H o.k. • > +2 mg/H: cylinder 1 weak • < -2 mg/H: cylinder 1 strong				
Variation of injected quantity of cylinder 2 to cylinder 3				
• -2 mg/H...+2 mg/H o.k. • > +2 mg/H: cylinder 2 weak • < -2 mg/H: cylinder 2 strong				
Variation of injected quantity of cylinder 4 to cylinder 3				
• -2 mg/H...+2 mg/H o.k. • > +2 mg/H: cylinder 4 weak • < -2 mg/H: cylinder 4 strong				

**Display group 013, engine idling (engine warm, coolant temperature not less than +80 °C)
for models 08.00 ➤**

- ◆ 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 →	◀ Readout in display
0.82 mg/H	-0.12 mg/H	0.49 mg/H	-0.12 mg/H		
				Idling controller - injected quantity cylinder 4	
				• -1.9 mg/H...+1.9 mg/H o.k. • > +1.9 mg/H: cylinder 4 weak • < -1.9 mg/H: cylinder 4 strong	
				Idling controller - injected quantity cylinder 3	
				• -1.9 mg/H...+1.9 mg/H o.k. • > +1.9 mg/H: cylinder 3 weak • < -1.9 mg/H: cylinder 3 strong	
				Idling controller - injected quantity cylinder 2	
				• -1.9 mg/H...+1.9 mg/H o.k. • > +1.9 mg/H: cylinder 2 weak • < -1.9 mg/H: cylinder 2 strong	
				Idling controller - injected quantity cylinder 1	
				• -1.9 mg/H...+1.9 mg/H o.k. • > +1.9 mg/H: cylinder 1 weak • < -1.9 mg/H: cylinder 1 strong	

Specified readouts for exhaust gas recirculation

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

Read measured value block	3 →	◀ Readout in display
900 rpm	94 %	
		On/off ratio (actuation) of exhaust gas recirculation valve
		• 94...96 % o.k.
		No readout
	No readout	
Engine speed		
• 860...940 rpm o.k.		

Specified readouts for temperature sensors

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

Read measured value block	7 →	◀ Readout in display
15.4 °C	15.9 °C	16.7 °C
		Coolant temperature (at coolant temperature sender -G62)
		• If open circuit in wiring, approx. fuel temperature is shown as a substitute value
		Intake manifold temperature (at intake manifold temperature sender -G72)
		• If open circuit in wiring, a constant 136.8 °C is shown as a substitute value
	No readout	
Fuel temperature (at fuel temperature sender -G81)		
• If open circuit in wiring, a constant -5.4 °C is shown as a substitute value		

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 2nd or 3rd gear, coolant temperature not less than +80 °C) for models ► 07.00

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	27 mg/H	25.8 mg/H		
				Injected quantity limit on the basis of detected air mass 25...35 mg/H: o.k. • < 25 mg/H: - detected air mass insufficient ⇒ Test air mass meter ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23 - Excessive exhaust gas recirculation ⇒ test ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23	
				Injected quantity control on the basis of engine speed (torque limit) 26...27 mg/H o.k. • < 26 mg/H: engine speed too high or too low • > 27 mg/H: injected quantity increased as a result of „tuning“	
				Injected quantity request (accelerator pedal position) > 32 mg/H o.k. • < 32 mg/H: - Accelerator pedal not depressed, accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23	
Engine speed 2800...3200 rpm o.k.					

Display group 008 at full throttle (road test in 2nd or 3rd gear, coolant temperature not less than +80 °C) for models 08.00 ►

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	41.4 mg/H	27 mg/H	25.8 mg/H		
			Injected quantity limit on the basis of detected air mass 25...38 mg/H: o.k. • < 25 mg/H: - detected air mass insufficient ⇒ Test air mass meter ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23 - Excessive exhaust gas recirculation ⇒ test ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23		
			Injected quantity control on the basis of engine speed (torque limit) 26...28 mg/H o.k. • < 26 mg/H: engine speed too high or too low • > 28 mg/H: injected quantity increased as a result of „tuning“		
			Injected quantity request (accelerator pedal position) 41...45 mg/H o.k. • < 41 mg/H: - Accelerator pedal not depressed, accelerator pedal position sender -G79 incorrectly set or faulty ⇒ test ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23		
Engine speed 2800...3200 rpm o.k.					

Display group 010 at full throttle (road test in 2nd or 3rd gear, coolant temperature not less than +80 °C) for models ► 07.00

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
990 mbar	100 %	
Accelerator pedal position: 100 % o.k.		
• < 100 %:		
- Accelerator pedal not depressed		
- Accelerator pedal position sender -G79 incorrectly set or faulty		
⇒ test		
⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System;		
Repair Group 23		
No readout		
Momentary charge pressure: 900...1200 mbar		
No readout		

Display group 010 at full throttle (road test in 2nd or 3rd gear, coolant temperature not less than +80 °C) for models 08.00 ►

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
990 mbar	100 %	
Accelerator pedal position: 100 % o.k.		
• < 100 %:		
- Accelerator pedal not depressed		
- Accelerator pedal position sender -G79 incorrectly set or faulty		
⇒ test		
⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System;		
Repair Group 23		
No readout		
Momentary atmospheric pressure: 900...1100 mbar		
No readout		

Specified readouts for charge pressure control

Display group 011 at full throttle (road test in 2nd or 3rd gear, coolant temperature not less than +80 °C)

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
3110 rpm		5 %	
		On/off ratio (actuation) for throttle valve positioner -V60	
		• 4...6 % o.k.	
		No readout	
		No readout	
		Engine speed 2900...3200 rpm o.k.	

Servicing diesel direct injection system

Safety precautions

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

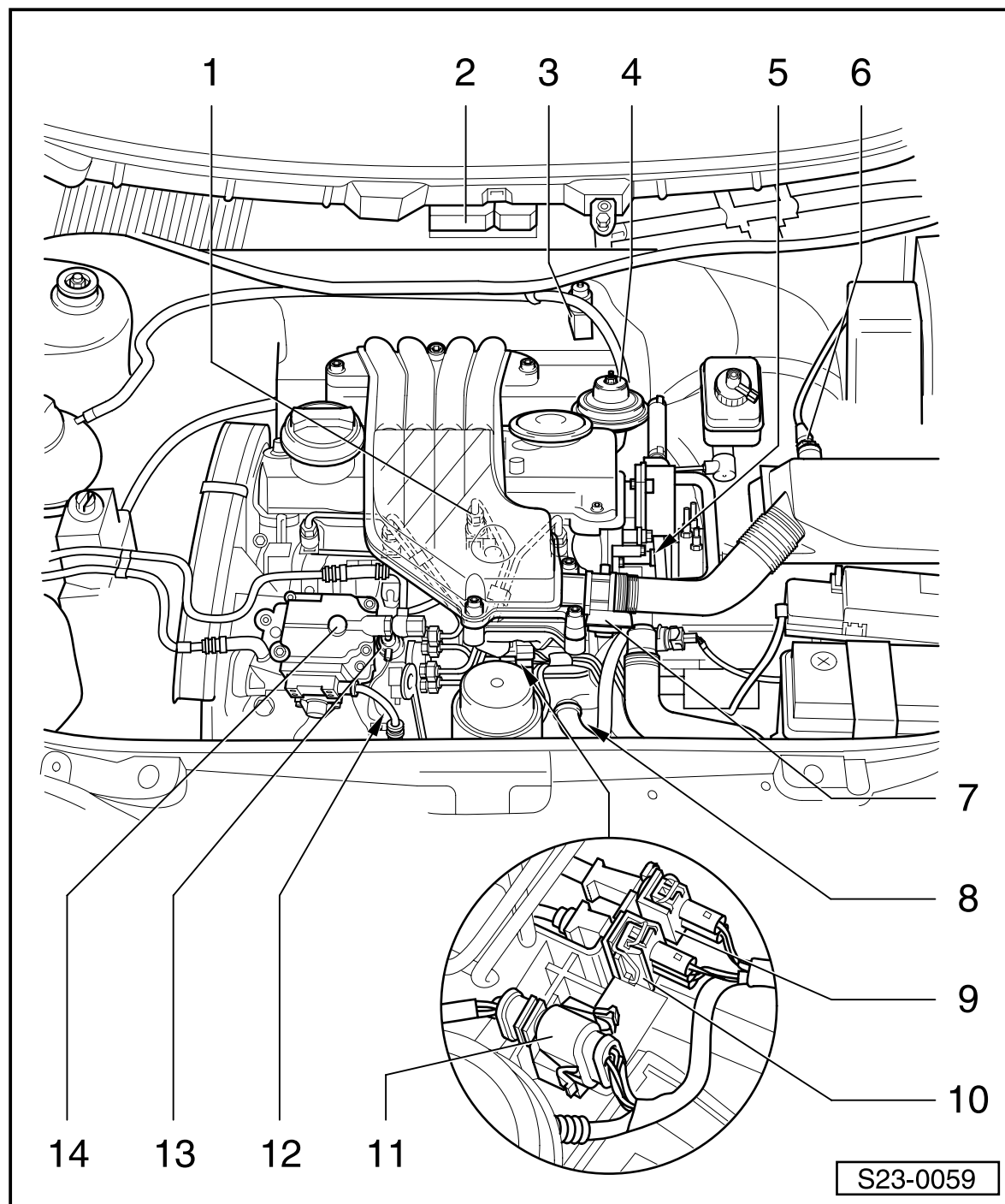
- ◆ Do not disconnect and connect the cables of the glow plug and fuel injection system - also not of test equipment - unless the ignition is switched off.
- ◆ To operate the engine at starting speed without it actually starting, e.g. for testing compression pressure, unplug the connector of the injection pump.
- ◆ Before disconnecting the battery, determine the code number of radio sets fitted with anti-theft coding.
- ◆ Do not disconnect and connect the battery unless the ignition is switched off otherwise the control unit for the diesel direct injection system 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 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 gets onto the coolant hoses. If this happens, it is then necessary to clean the hoses again immediately. Replace any hoses which have suffered damage.

Survey of fitting locations



Components A to E are not shown in the exploded view.

A - Relay for diesel direct injection system (J322)

- ◆ On relay plate ⇒ page 23-3, Fig. 1

B - Relay for glow plugs (J52)

- ◆ On relay plate ⇒ page 23-3, Fig. 1

C - Accelerator pedal position sender (G79)

- ◆ In footwell at accelerator pedal

D - Brake light switch (F) and brake pedal switch for CCS/diesel direct injection system (F47)

- ◆ Mounted together on a bracket
- ◆ In footwell at brake pedal ⇒ page 23-3, Fig. 1

E - Clutch pedal switch (F36)

- ◆ In footwell at clutch pedal ⇒ page 23-3, Fig. 1

1 - Injector with needle lift sender (G80)

2 - Diesel direct injection system control unit (J248)

- ◆ With altitude sender (F96)

3 - EGR valve (N18)**4 - Mechanical exhaust gas recirculation valve****5 - Coolant temperature sender (G62)****6 - Intake manifold temperature sender (G72)****7 - Throttle valve positioner (V60) for models ► 09.98
Intake manifold flap motor (V157) for models 09.98 ►****8 - Engine speed sender (G28)****9 - Plug connection**

- ◆ 2-pin
- ◆ For needle lift sender (G80)

10 - Plug connection

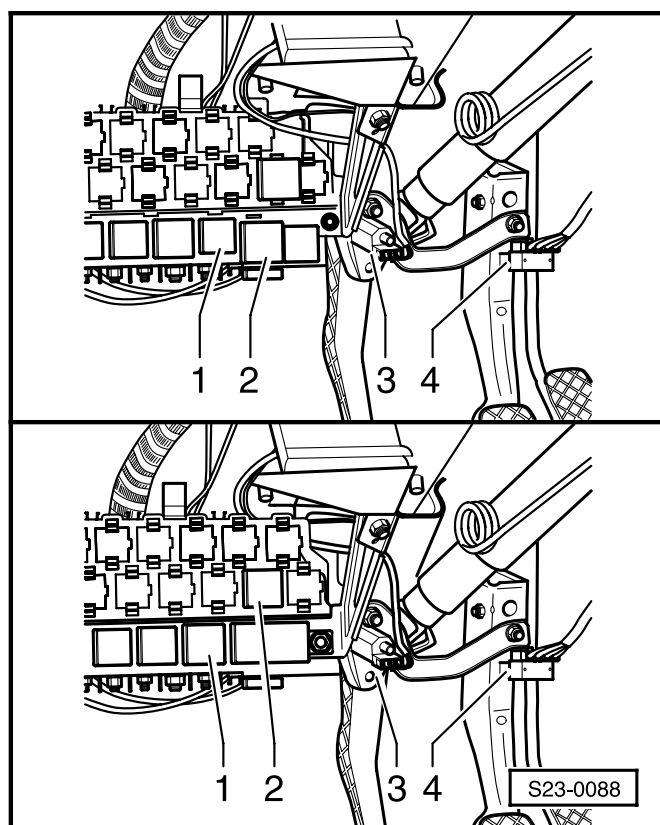
- ◆ 3-pin
- ◆ For engine speed sender (G28)

11 - 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)

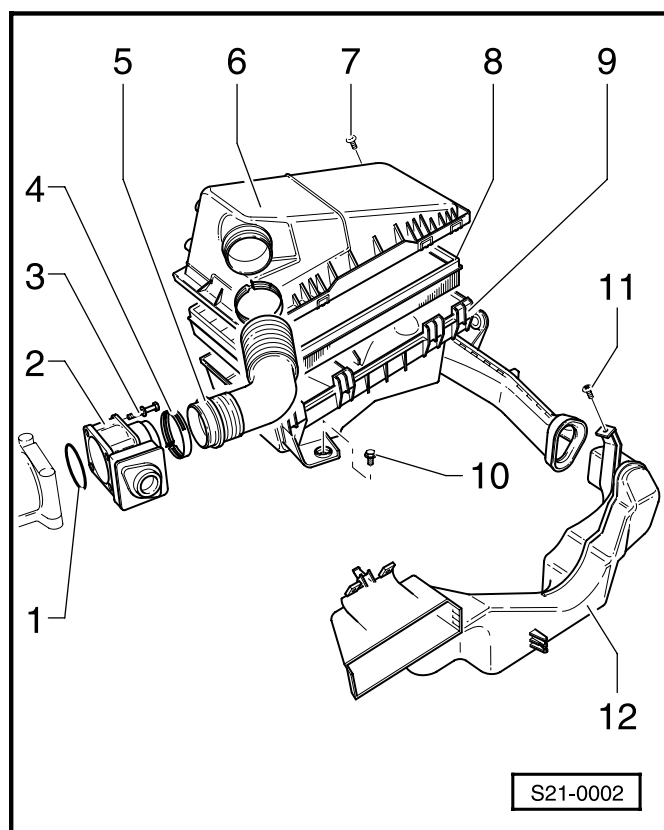
12 - Commencement of injection valve (N108)**13 - Fuel cut-off valve (N109)****14 - Fuel quantity actuator of injection pump**

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

**◀ 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 for CCS/diesel direct injection system (F47)

Removing and installing air filter and throttle valve positioner



1 - O-ring

2 - Throttle valve positioner (V60) for models ► 09.98
Intake manifold flap motor (V157) for models 09.98 ►

3 - 10 Nm

4 - Spring strap clip

5 - Intake hose

6 - Top part of air filter

7 - 10 Nm

8 - Air filter element

9 - Bottom part of air filter

10 - 15 Nm

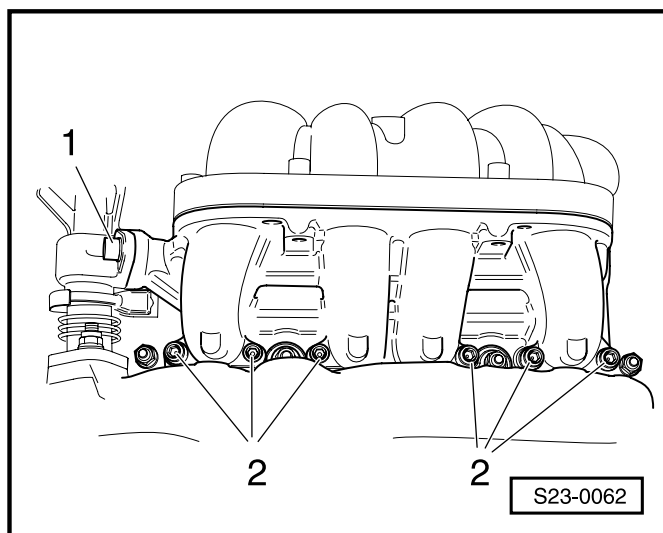
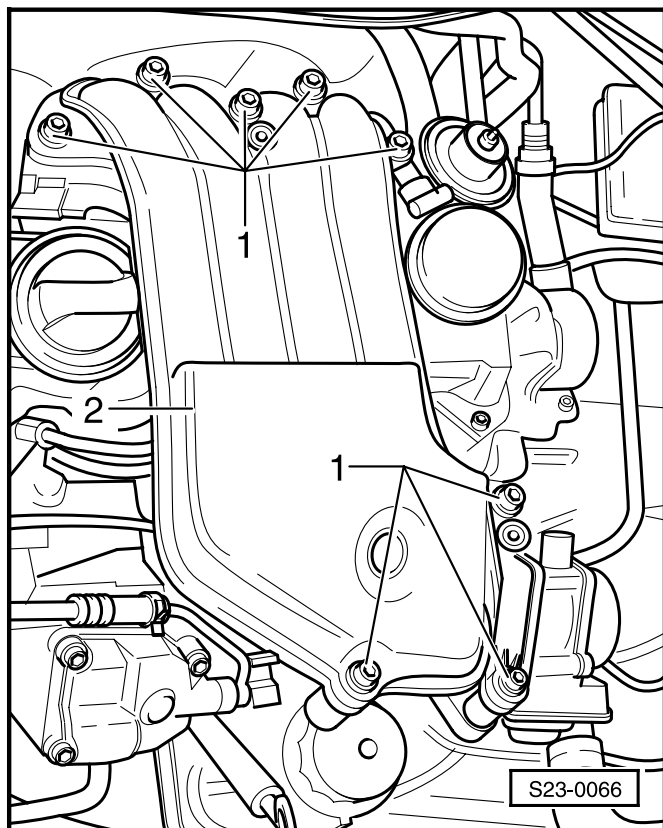
11 - 10 Nm

12 - Inlet connection

Removing and installing intake manifold

Removing

- Detach the hose pipe from the throttle valve positioner.
- ◀ - Slacken the bolt -1- and take off the intake manifold -2-.
- Take off the shaped rubber element of the cylinder head breather.



- ◀ - Slacken the bolts -1- at the EGR valve.
- Slacken the bolts -2- and take off the intake pipe.

Installing

- Install in the reverse order.
- Tighten the bolts attaching the intake pipe to the cylinder head to 20 Nm (replace seals).
- Tighten the bolts attaching the EGR valve to 20 Nm (replace seal).
- Tighten the bolts attaching the top and bottom parts of the intake manifold to 15 Nm.

Removing and installing injection pump

Special tools, testers and aids required

- ◆ Setting straightedge MP 1-312
- ◆ Setting device for TDC MP 1-313
- ◆ Locking pin 3359
- ◆ Counterholder MP 1-216
- ◆ Wrench for tensioning toothed belt (e.g. Matra V159, Hazet 2587 or Stahlwille 127-17)
- ◆ Connection fitting V.A.G 1318/10
- ◆ Vacuum pump, e.g. V.A.G 1390
- ◆ Torque wrench 5...50 Nm, e.g. V.A.G 1331
- ◆ Ring wrench for injection lines, e.g. 3035
- ◆ Puller T40001 with hook T40001/2 and T40001/3
- ◆ Feeler gauges
- ◆ Steel straightedge (marking tool), if required
- ◆ Transparent plastic line

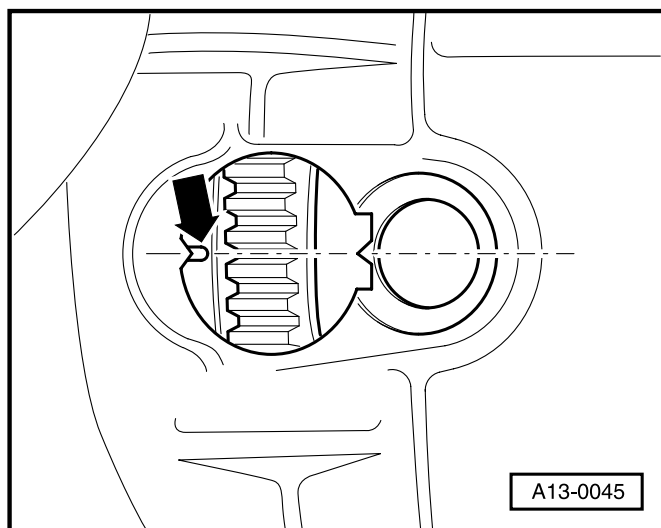
Removing

- Remove top engine trim panel.
- Remove all fuel lines of injection pump.

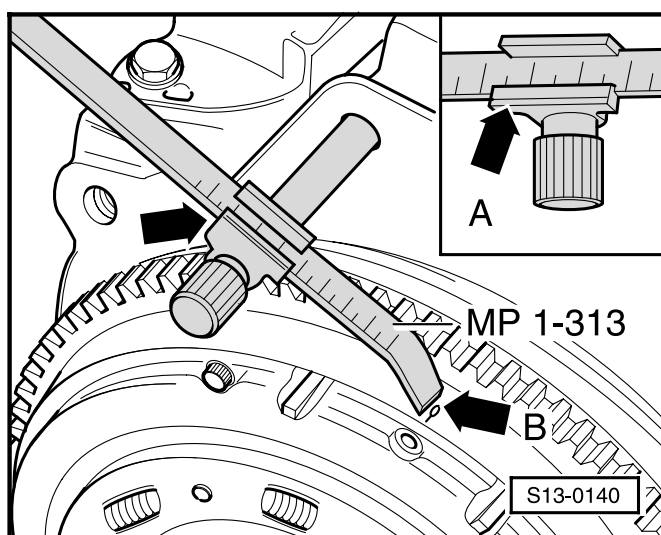
Note:

Use open ring wrench, e.g. 3035, for removing high-pressure line.

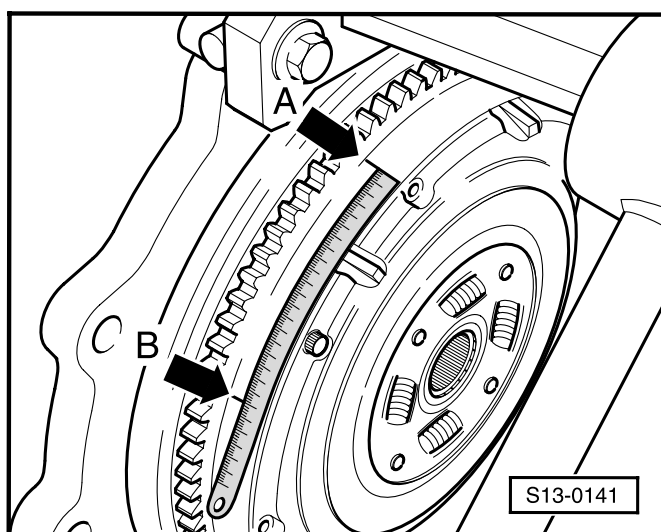
- Cover over the openings with a clean cloth.
 - Remove top toothed belt guard and cylinder head cover as well as vacuum pump.
- ⇒ 1.9 l/50 kW (SDI) Engine, Mechanical Components; Repair Group 13

**If engine installed**

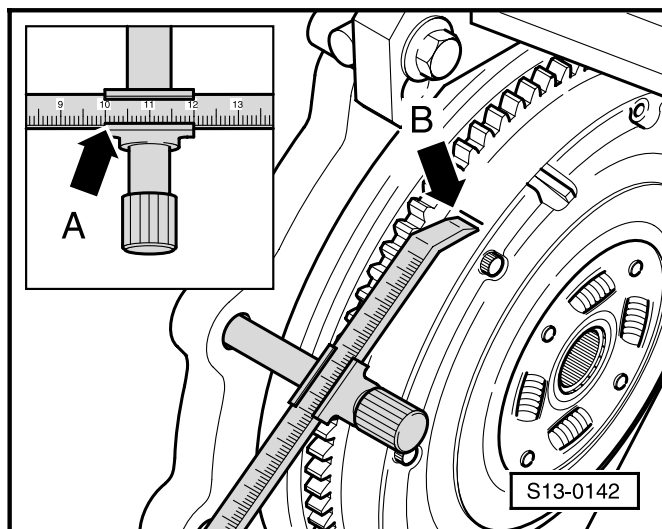
- Take off orifice plate at inspection opening.
- ◀ - Position the crankshaft to TDC of cylinder 1 -arrow-.

**Engine placed down on the ground:**

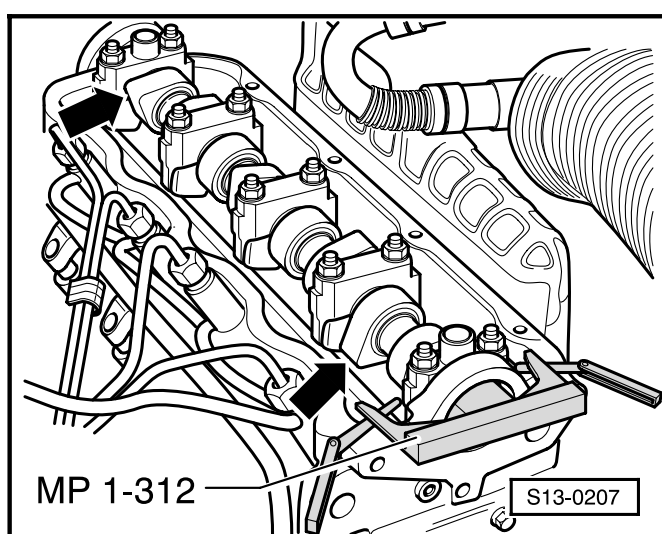
- ◀ - Screw in setting device for TDC MP 1-313, as shown in the illustration.
- Position setting device to 90 mm -arrow- (the left notch of the vernier -arrow A- is the reference point).
- Rotate crankshaft until TDC marking -arrow B- on the flywheel is aligned with the edge of the setting device.

**Engine attached to engine holder MP 1-202**

- ◀ - Position flexible steel ruler (marking tool) around the circumference of the flywheel.
- Measure exactly 100 mm from the TDC marking -arrow A- and make an aid marking -arrow B- with the marking tool.



- ◀ - Insert setting device for TDC MP 1-313, as shown in the illustration.
- Position setting device to 104 mm (the left-hand notch of the vernier -arrow A- is the reference point).
- Rotate crankshaft until the aid marking on the flywheel is aligned with the edge of the setting device -arrow B-.

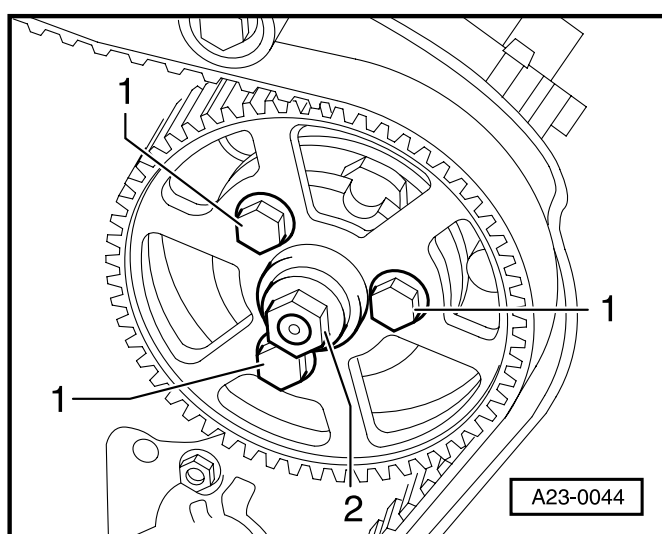


Continued for all models

- ◀ - Lock camshaft with the setting straightedge MP 1-312.

Note:

- ♦ *The valves of cylinder 1 must be closed and the valves of cylinder 4 positioned at overlap.*
- Centre the setting straightedge as follows: Rotate the locked camshaft until one end of the setting straightedge touches the cylinder head. Use a feeler gauge to measure the clearance produced at the other end of the straightedge. Insert a feeler gauge equal to half the clearance between straightedge and cylinder head. Now, rotate the camshaft until the straightedge touches the feeler gauge. Insert a second feeler gauge of the same thickness at the other end between straightedge and cylinder head.



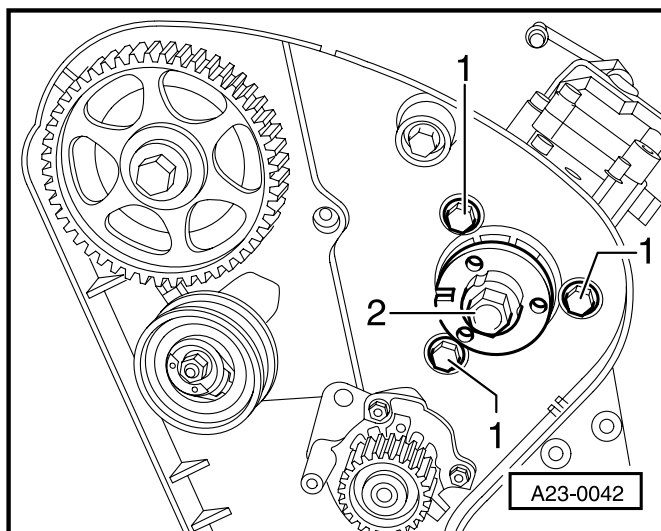
- ◀ - Slacken the bolts -1- attaching the injection pump gear.

Notes:

- ♦ *Use the locking pin 3359 for counterholding the injection pump gear ⇒ page 23-10, Fig. A13-0052.*
- ♦ *Always moisten the locking pin. Use a mirror to facilitate inserting pin.*
- ♦ *If it is not possible to lock the injection pump gear 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 gear and only now position the crankshaft at TDC.*

- ◆ *On no account slacken the central nut -2- of the injection pump gear otherwise the basic setting of the injection pump will be altered and can no longer be set with workshop equipment.*

- Unscrew the nut of the tensioning pulley.
- Take the toothed belt off the toothed belt sprockets of the camshaft and the injection pump.

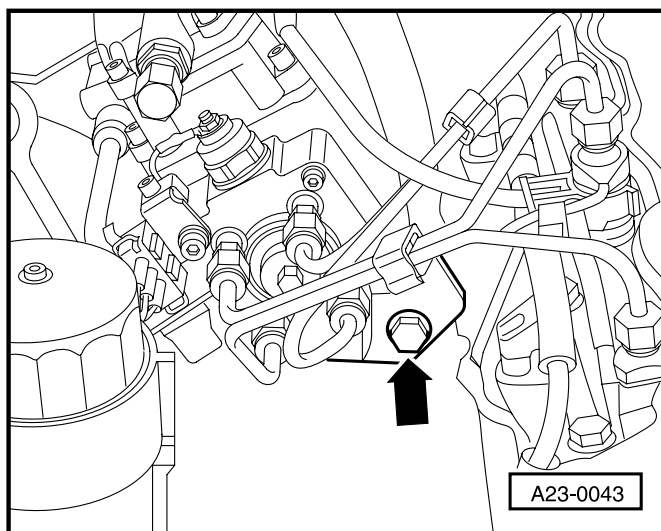


- Separate the plug connection for the electrical connections of the injection pump.

- ◀ Unscrew the bolts -1- attaching the mounting bracket.

Note:

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

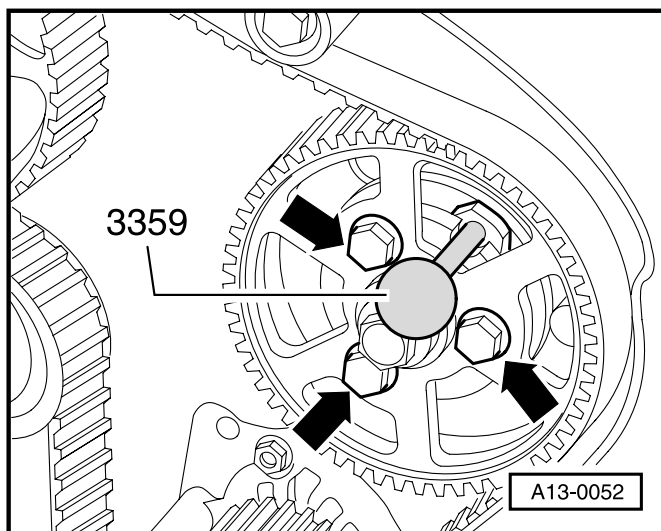


- ◀ Then, unscrew the bolt attaching the rear support -arrow-.

- Take off the injection pump.

Installing

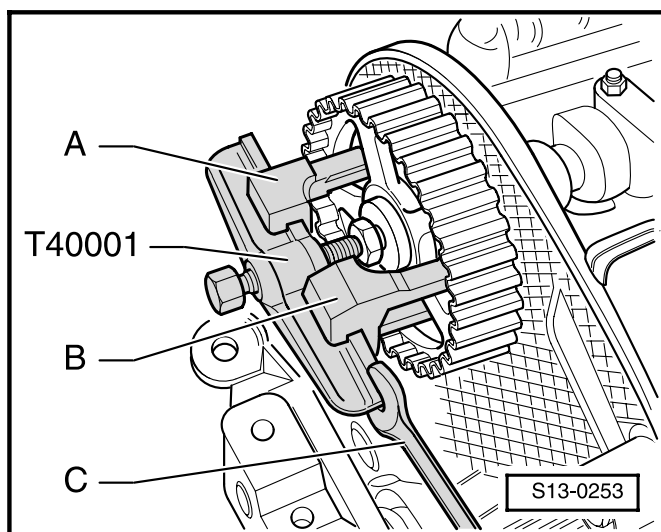
- Insert the injection pump into the mounting bracket and first of all attach it with the bolt at the rear support together with the tapered nut.
- Insert the securing bolts at front and tighten them fully to 25 Nm.
- Bolt the injection pump gear loosely to the hub with new bolts (injection pump gear can still be rotated).



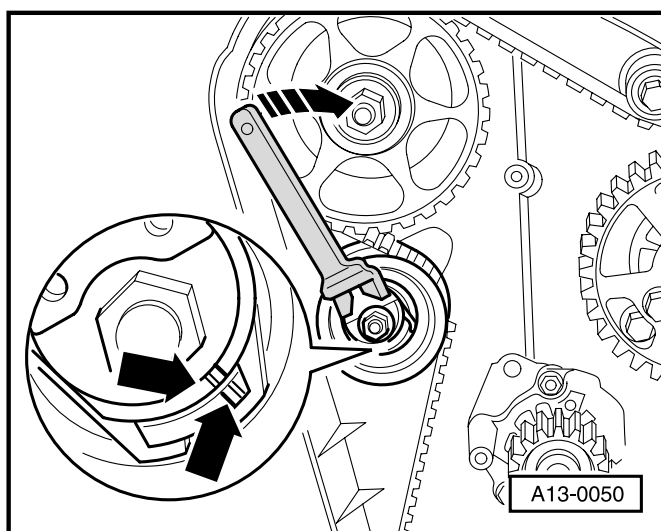
- ◀ - Align the injection pump gear in the middle of the slots -arrows-.
- Lock the injection pump gear with the locking pin 3359.
- Slacken the bolt attaching the camshaft sprocket about 1/2 turn.

Note:

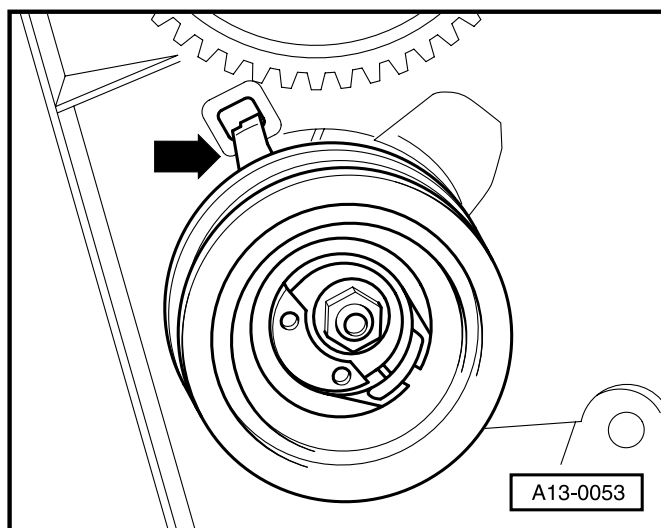
The adjusting straightedge must not be used as a counterholder when slackening and tightening the camshaft sprocket. Counterhold camshaft sprocket with special tool MP 1-216.



- ◀ - 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 located.

- Tighten the securing nut fully to 20 Nm.
- Once again check the TDC marking at the flywheel.
- Tighten the new bolts attaching the injection pump gear to a final torque of 20 Nm.

Note:

Use the bolts attaching the injection pump gear only once as these are stretch bolts.

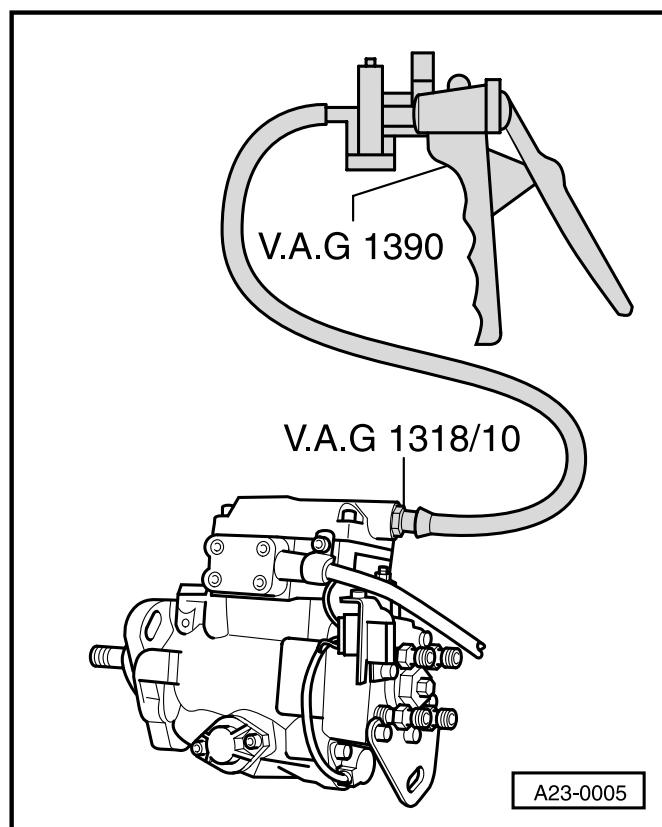
- Tighten the bolt attaching the camshaft sprocket to a final torque of 45 Nm (counterhold with MP 1-216).
- Remove the locking pin 3359.
- Remove the setting straightedge MP 1-312 from the camshaft.
- Rotate crankshaft a further two revolutions in direction of rotation of engine until the crankshaft is again positioned at TDC of cylinder 1.
- Check whether it is still possible to lock the injection pump gear with locking pin 3359.

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

- Continue rotating the crankshaft until the holes for the locking pin are aligned and insert locking pin 3359 to lock injection pump gear.
- Slacken the bolts attaching the injection pump gear.
- Rotate crankshaft until the aid marking on the flywheel is aligned with the edge of the setting device.

If it is possible to lock the injection pump gear:

- Tighten the bolts attaching the injection pump gear to 20 Nm + $\frac{1}{4}$ turn (90°).
- Remove locking pin 3359.



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

◀ - Fill the injection pump with clean diesel fuel as specified below:

- Insert 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 using a transparent plastic line about 1 m long.
- Operate the vacuum pump until fuel flows out of the return-flow opening. Do not draw the fuel as far as the vacuum hand pump.
- Close the return-flow line.
- Install top toothed belt guard, vacuum pump and cylinder head cover.
- Install top engine trim panel.
- Carry out dynamic test and setting of commencement of injection ⇒ page 23-12.

Dynamic test and setting of commencement of injection

Notes:

- ♦ *The commencement of injection must always be tested and set, if necessary, after replacing the toothed belt as well as after slackening the bolted connections at the injection pump or at the toothed belt sprockets.*
- ♦ *Dynamic testing of the commencement of injection is only possible in function 04 „Basic setting of engine“ as the commencement of injection valve is constantly actuated during this function 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
- ♦ Torque wrench 5...50 Nm (e.g. V.A.G 1331)
- ♦ Counterholder MP 1-216
- ♦ Locking pin 3359

Test procedure

- Connect vehicle system tester V.A.G 1552 and select the function „Initiate basic setting“
⇒ page 01-20.

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

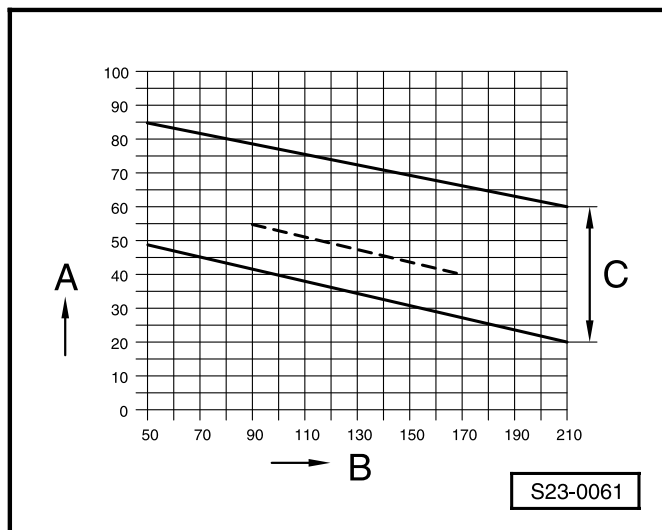
- ◀ - Commencement of injection in display block 2 is dependent on the fuel temperature in display block 9.

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 ►**

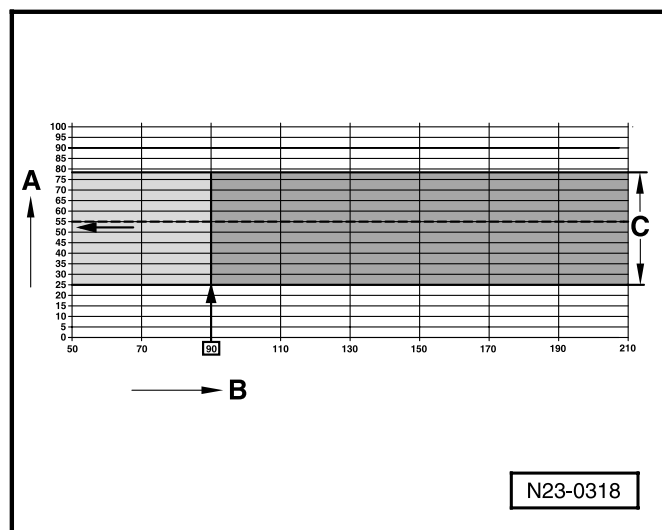
- ◀ - Commencement of injection in display block 2 is dependent on the fuel temperature in display block 9.

Specification: ⇒ Figure - range C

A - Display block 2, commencement of injection

B - Display block 9, fuel temperature

C - Specified range for commencement of injection

**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:

- Switch ignition off.
- Remove top engine trim panel.
- 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.

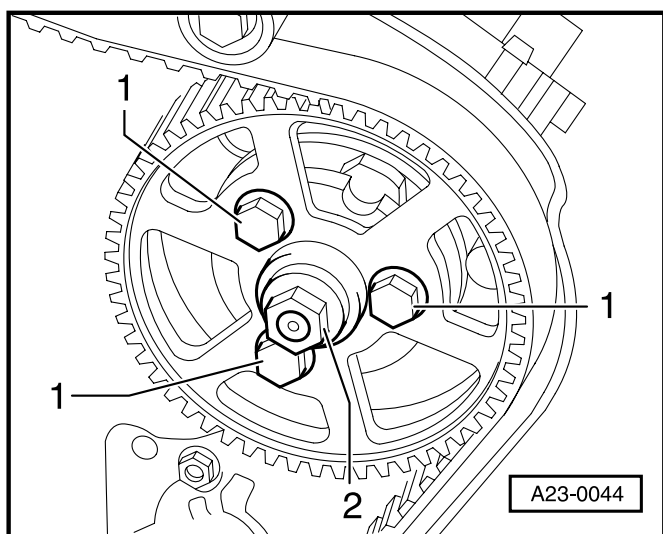
- Slacken the third bolt attaching the injection pump gear and turn the pump shaft slightly:

Turning shaft to the left

⇒ commencement of injection retarded

Turning shaft to the right

⇒ commencement of injection advanced



Note:

The nut -2- for the hub must on no account be slackened otherwise the basic setting of the injection pump will be altered and cannot be set with workshop tools.

- Tighten the new bolts attaching the injection pump gear to 20 Nm and then tighten a further 1/4 turn (90°) (counterhold with locking pin 3359).

Note:

The bolts must only be used once as these are stretch bolts.

- Install top toothed belt guard.
- Install top engine trim panel.
- Once again check that commencement of injection corresponds to the specification.

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

- Correct the setting at the injection pump gear.

If the commencement of injection cannot be set within the specified range:

- Test ejection pressure of pump.
- ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

If the injection pump is in proper order:

- Replace engine control unit.
- ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

Testing intake manifold temperature sender

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

Test procedure

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

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

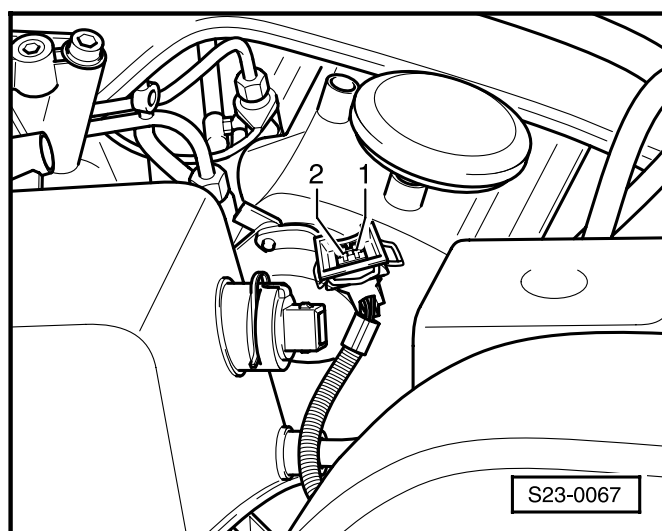
- ◀ Check readout in display block 3.

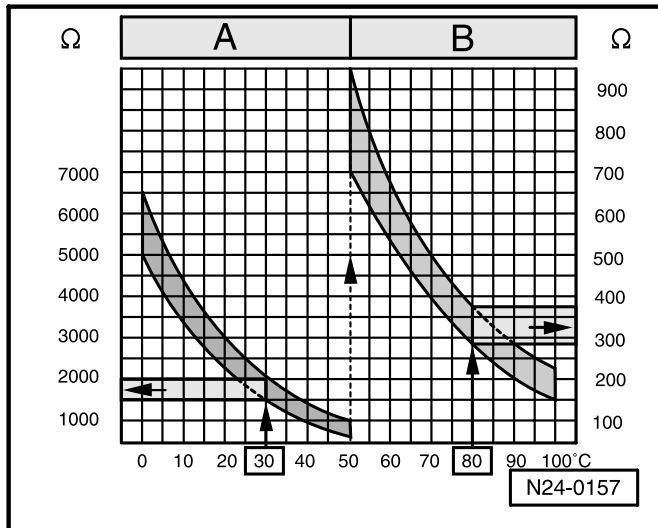
Note:

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

If the readout is implausible, or if a temperature of 136.8 °C is displayed as a substitute:

- ◀ Unplug connector from the intake manifold pressure sender (G72).
- Connect multimeter to contacts 1 and 2 of the intake manifold temperature sender for resistance measurement.





Specification:

Specification in field A applies to temperatures of 0...50 °C, in field B for temperatures of 50...100 °C.

Example:

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

If the specification is not achieved:

- Replace intake manifold temperature sender (G72).

If the specification is achieved:

- Connect test box to the wiring loom to the engine control unit.
⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

For test box V.A.G 1598/22

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

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

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

For test box V.A.G 1598/31

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

2-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	73
2	54

- 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.
- ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

Testing throttle valve positioner (V60)

Models 09.98 ► Motor in intake manifold flap (V157)

Special tools, testers and aids required

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

Test procedure

- ◀ - Separate the 4-pin plug connection to the throttle valve.
- Switch ignition on.
- Use hand-held multimeter to measure the voltage between contacts 1 and 4 at the 4-pin connector.

Specification: battery voltage

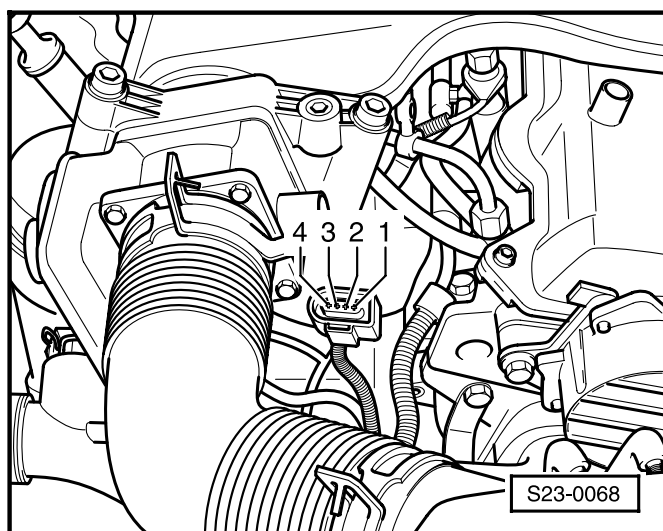
If the specification is not achieved:

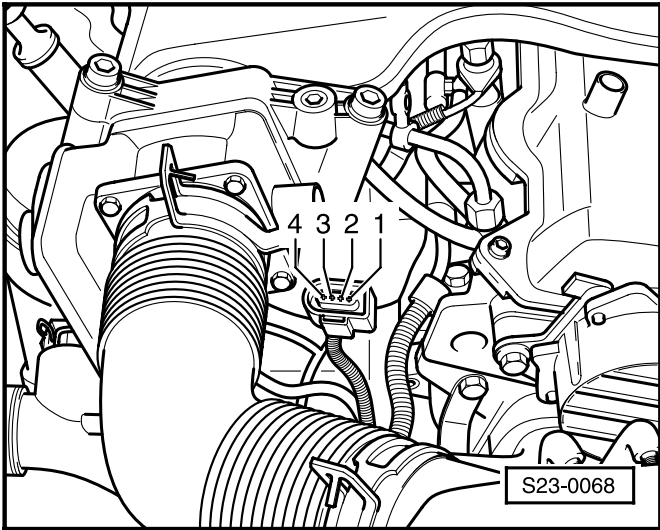
- Switch ignition off.
- Test the following cable connections from contacts 1 and 4 for short circuit to positive and to negative and for open circuit ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder.

If the specification is achieved:

- Connect test box to the wiring loom to the engine control unit.
- ⇒ 1.9 l/66 kW (TDI) Engine, Fuel Injection and Glow Plug System; Repair Group 23

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





For test box V.A.G 1598/22

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

4-pin connector at wiring loom, contact	Test box V.A.G 1598/22, socket
2	3
3	49

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

For test box V.A.G 1598/31

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

4-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
2	81
3	75

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

Continued for all models

If no fault is found in the wiring:

- Replace throttle valve positioner -V60.

Testing exhaust gas recirculation system

Testing exhaust gas recirculation

The test of the exhaust gas recirculation is performed in function 04 - Basic setting. The exhaust gas recirculation valve is pulsed every 10 seconds so as to produce extreme values for exhaust gas recirculation.

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
⇒ page 01-2.
- Select 04 for the function „Basic setting“ and enter display group number 003.

System in basic setting 900 rpm EGR not active	3	→ 0%
--	---	---------

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

The following readouts must vary in display block 4:

EGR not active

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

EGR active

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

If the specification is not achieved:

- Test mechanical exhaust gas recirculation valve
⇒ 1.9l/66 kW Engine - Mechanical Components; Repair Group 26
- Test EGR valve (N18)
⇒ 1.9l/66 kW (TDI) Engine - Fuel Injection and Glow Plug System; Repair Group 23

