

Workshop Manual OCTAVIA

**1.6 ltr. / 74 kW Engine, Simos 2
Fuel Injection and Ignition System**

List of Supplements for OCTAVIA Workshop Manual

Edition: 08.00

1.6-ltr./74 kW Engine, Simos 2 Fuel Injection and Ignition System

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Supplement	Edition	Subject	Article Number
	08.96	Basic Edition of Workshop Manual	S00.5108.50.20
1	05.97	Supplement to Basic Edition	S00.5108.51.20
2	12.99	Modifications to Repair Groups 01, 24 and 28	S00.5108.52.20
3	08.00	Modifications to Repair Groups 01 and 24	S00.5108.53.20
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Self-diagnosis

Function

The engine control unit for the fuel injection and ignition system is equipped with a fault memory.

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

The stored faults can be read after initiating the fault display ⇒ page 01-4.

This fault memory has to be erased after rectifying the faults ⇒ page 01-4.

A fault which affects the operation of the lambda control, can only be interrogated after conducting a road test lasting at least 10 minutes.

Faults which are attributable to temporary open circuits in the wiring or loose contacts, are also stored. Such faults are displayed as sporadic faults „/SP“ and if they are not repeated after 40 engine starts, are automatically erased.

Notes:

- ◆ *The descriptions which follow refer to the vehicle system tester V.A.G 1552 using programme card version 5.0.*
- ◆ *If „see literature“ appears in the display, determine the text relating to the fault code by referring to the fault table.*
- ◆ *Use of the fault reader V.A.G 1551 with programme card 8.0 and integrated printer is similar. Slight differences in the readouts in the display are possible.*

Technical data of self-diagnosis

Equipment

- ◆ Fault memory: permanent memory and volatile memory¹⁾

¹⁾ If a fault has no longer occurred after the 40th engine start, it is erased.

Control unit identification

⇒ page 01-2; Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit

Available functions

Function	Requirement	
	Engine not running, ignition on	Engine idling
01 Interrogating control unit version	yes	yes
02 Interrogating fault memory	yes ¹⁾	yes
03 Final control diagnosis	yes	no
04 Initiating basic setting	yes ²⁾	no
05 Erasing fault memory	yes	yes
06 Ending output	yes	yes
07 Coding control unit	yes	no
08 Reading measured value block	yes	yes

¹⁾ Only if engine does not start (starter is operated for at least 6 seconds).

²⁾ Must be carried out after the following operations:

Replacing engine control unit (J220), throttle valve control unit (J338) or engine.

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

Special tools, testers and aids required

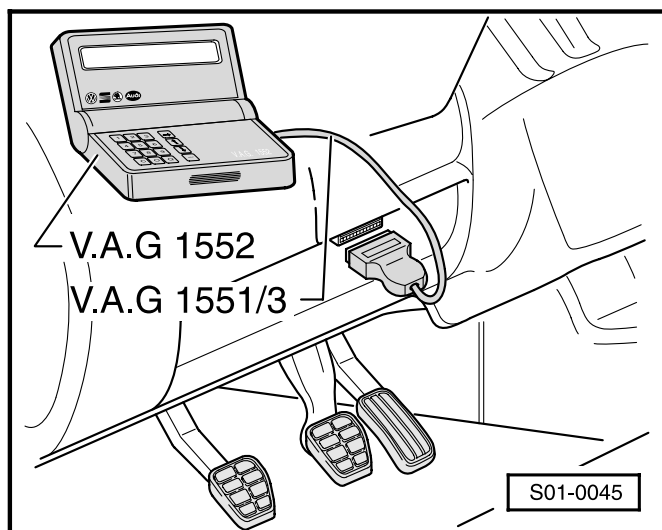
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test conditions

- Battery voltage at least 11 V
- Earth connections at engine and gearbox o.k.
- Fuses according to current flow diagram o.k.

Procedure

- ◀ - Connect the vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.



Test of vehicle systems
Enter address word XX

HELP

◀ Readout in display:

Note:

If no readout appears in the display:

⇒ Operating instructions of the vehicle system tester

Depending on the function desired:

- Switch on the ignition or start the engine
⇒ page 01-2, table of „Available Functions“.
- Select the function 01 „Engine electronics“ and confirm the engine with the key Q.

06A906019B 1.6l 2V/R4 SIMOS HSXXXX →
Coding 00000 WSC XXXXX

◀ The control unit identification appears in the display of the vehicle system tester V.A.G 1552, e.g.:

- ◆ 06A 906 019 B = Part No. of control unit (current control unit version - Parts List)
- ◆ 1.6l = Displacement of engine
- ◆ 2V/R4 = Type of engine (in-line 2-valve, 4-cylinder)
- ◆ SIMOS = Designation of fuel injection and ignition system
- ◆ HS = Manual gearbox
AT = Automatic gearbox
- ◆ XXXX = Data status (hardware and software version) of control unit
- ◆ Coding = Coding version of control unit
- ◆ WSC = Workshop code

If the coding does not match the appropriate version in the vehicle:

- Check control unit coding ⇒ page 01-27.
- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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
- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The engine should be idling during this step.

Only if engine does not start:

- Interrogate fault memory with the ignition switched on.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

X faults recognised!

◀ The number of stored faults or „No fault recognised!“ appears in the display.

- If no fault is stored:
- Press the → key.

If one or more faults are stored:

The stored faults are displayed one after the other.

Test of vehicle systems
Select function XX

HELP

◀ The following readout then appears in the display:

- Select the function 05 „Erase fault memory“ and confirm the entry with the key Q.

Test of vehicle systems
Fault memory is erased!

→

◀ Readout in display:

Note:

If the ignition was switched off between interrogating the fault memory and erasing the fault memory, the fault memory is then not erased. Follow the procedure exactly, in other words interrogate fault memory and then erase the memory.

- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Select the function 06 „End output“ and confirm the entry with the key Q.
- Locate and rectify the faults displayed by referring to the fault table ⇒ page 01-5.

Fault table

Notes:

- ♦ All the possible faults which can be recognised by the engine control unit and appear in the display of V.A.G 1552, are listed below according to the fault code.
- ♦ If „see literature“ appears in the display, refer to the text of the fault code in the fault table.
- ♦ The fault table is arranged according to the 5-digit fault code on the left.
- ♦ If faults occur only occasionally or if the fault memory was not erased after rectifying faults, these faults appear in the display as „sporadic faults“ with „SP“.
- ♦ Explanations of types of faults (e.g. „open/short circuit to earth“):
⇒ Operating instructions of vehicle system tester
- ♦ Before replacing components which are displayed as faulty, first of all test the wiring and plug connections to these components and also the earth connections on the basis of the current flow diagram. This applies in particular if faults are displayed as „sporadic“ (SP).

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
00282 Throttle valve positioner -V60-¹⁾ Short circuit	♦ Open circuit in wiring or short circuit to earth or positive or short circuit of wiring to each other	♦ Cold starting problems ♦ Cold idling problems	- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
Blocks or no voltage	♦ V60 faulty/jamming	♦ Hard load change jolts	- Test throttle valve control unit ⇒ page 24-53.
Plug connection	♦ Cable wrongly connected	♦ Mechanical emergency running -J338- detected	- Replace engine control unit ⇒ page 24-15.
Upper stop value	♦ Engine control unit faulty		
Signal out of tolerance			
Control difference			
00305 Vehicle consumption signal Short circuit to positive	♦ Short circuit to positive in cable connection between engine control unit and dash panel insert		- Test fuel consumption signal ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

¹⁾ The throttle valve positioner V60 is an integral part of the throttle valve control unit J338.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
00513 Engine speed sender -G28- No signal	◆ Signal wire has open circuit or short circuit to earth or short circuit to positive ◆ Earth wire has open circuit or short circuit to positive ◆ Open circuit in screening of -G28- ◆ -G28- faulty ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Engine cuts out ◆ Engine does not start	- Test -G28- ⇒ page 28-5. - Replace engine control unit ⇒ page 24-15.
Implausible signal	◆ Metal swarf on engine speed sender -G28- ◆ Excessive clearance -G28-/sender rotor	◆ Engine cuts out ◆ Engine does not start	- Test -G28- ⇒ page 28-5.

Notes re fault code 00513:

- ◆ *Metal swarf can result in additional signals being generated.*
- ◆ *Signals may not be transmitted or may be too small and therefore not recognised because of excessive clearance of sender to sender rotor or if sender rotor is damaged.*
- ◆ *The signal pattern may be irregular as a result of a loose sender rotor (or loose sender).*

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
00515 Hall sender -G40- No signal Implausible signal Defective	◆ Voltage supply or earth connection for -G40- faulty ◆ Signal input in engine control unit faulty (control unit faulty) ◆ Open circuit in wiring or short circuit to positive or earth in signal wire between -G40- and engine control unit ◆ -G40- faulty ◆ Toothed belt jumps across (signal not received at moment expected) ◆ Loose contact	◆ Engine does not rev up to governed speed (engine speed governed at about 5100 rpm) ◆ Engine does not start or difficult to start when cold (cold starting problems) ◆ Engine does not start or difficult to start when warm (hot starting problems) ◆ Poor performance	- Test G40 ⇒ page 28-8. - Replace engine control unit ⇒ page 24-15. - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Check engine timing ⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 13; Removing and installing, tensioning toothed belt

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00516 Idling switch -F60-¹⁾ Open/short circuit to positive	♦ Open circuit or short circuit to positive or short circuit to earth in signal wire from -F60- to engine control unit	♦ Poor performance when starting off	- Test throttle valve control unit ⇒ page 24-53. - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
Short circuit to earth	♦ -F60- faulty ♦ Throttle valve sticking ♦ Footmat pressing on accelerator pedal ♦ Setting of throttle cable ♦ Moisture in plug connection for throttle valve control unit ♦ Signal input in engine control unit faulty (control unit faulty)	♦ Poor performance in transition from idling speed/ deceleration at part load ♦ Idling speed not within specified range ♦ Jerky acceleration ♦ Irregular idling ♦ Load change jolts when accelerator released	- Check setting of throttle cable ⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Adjusting throttle cable - Test plug connection - Replace engine control unit ⇒ page 24-15.

¹⁾ The idling switch F60 is an integral part of the throttle valve control unit -J338-.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00518 Throttle valve potentiometer -G69-¹⁾ Short circuit to positive	◆ Open circuit in earth wire ◆ Wiring has short circuit to positive ◆ -G69- faulty	◆ Load change jolts	- Test -G69- ⇒ page 24-53, Testing throttle valve control unit
Short circuit to earth	◆ -G69- faulty ◆ Open circuit in wiring ◆ Short circuit to earth in signal wire between -G69- and engine control unit	◆ Poor throttle response of engine	- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
Implausible signal	◆ Loose contact ◆ -G69- faulty ◆ Moisture or corrosion in plug connection at potentiometer ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Jerky acceleration ◆ Irregular idling ◆ Load change jolts when accelerator released	- Test plug connection - Replace engine control unit ⇒ page 24-15.

¹⁾ The throttle valve potentiometer -G69- is an integral part of the throttle valve control unit -J338-.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00520 Air mass/quantity meter -G70/G19- Short circuit to positive Open/short circuit to earth	◆ Open circuit or short circuit to positive or short circuit to earth in signal wire between -G70- and engine control unit ◆ Voltage supply for -G70- faulty ◆ -G70- faulty ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Poor performance ◆ Engine does not start or difficult to start when cold (cold starting problems) ◆ Engine does not start or difficult to start when warm (hot starting problems) ◆ Irregular idling or no idling in cold or warming-up phase ◆ Idling speed not to tolerance	- Test -G70- ⇒ page 24-28. - Read measured value block, display group 000 ⇒ page 01-30. - Replace -G70-. - Replace engine control unit ⇒ page 24-15.
00522 Coolant temperature sender -G62- Open/short circuit to positive Short circuit to earth Implausible signal	◆ Open circuit in wiring or short circuit to positive or short circuit to earth in cable connection between -G62- and engine control unit ◆ -G62- faulty ◆ Earth connection for -G62- faulty ◆ Signal input in engine control unit faulty (control unit faulty) ◆ Loose contact or corrosion because of moisture in connector	◆ Cold starting problems at very low temperatures ◆ Poor performance in warming-up phase ◆ Increased fuel consumption ◆ Increased emission levels ◆ Unsatisfactory performance	- Read measured value block, display group 000 ⇒ page 01-30. - Test -G62- ⇒ page 24-38. - Replace engine control unit ⇒ page 24-15.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00523 Intake air temperature sender -G42- Short circuit to earth Open/short circuit to positive	◆ Open circuit in wiring or short circuit to positive or short circuit to earth in cable connection between -G42- and engine control unit ◆ -G42- faulty ◆ Earth connection for -G42- faulty ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Poor hot starting characteristics ◆ Poor throttle response of engine when cold or in warming-up phase, transition problems ◆ Irregular idling or no idling in cold or warming-up phase	- Read measured value block, display group 000 ⇒ page 01-30. - Test -G42- ⇒ page 24-34. - Replace engine control unit ⇒ page 24-15.
00524 Knock sensor 1 -G61- Defective Implausible signal	◆ -G61- faulty ◆ Knock sensor loose or corrosion at connector ◆ Open circuit or short circuit to positive or short circuit to earth or to screening of signal wire between knock sensor and engine control unit ◆ Signal input in engine control unit faulty (control unit faulty) ◆ Loose ancillaries as a result of which knock sensor detects additional signals (vibrations)	◆ Reduced output ◆ High fuel consumption	- Test -G61- ⇒ page 28-6. - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-15.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00525 Lambda probe -G39- Output open	◆ Open circuit or short circuit to earth or short circuit to positive in signal wire from -G39- to engine control unit	◆ No lambda control	- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test lambda control ⇒ page 24-41. - Read measured value block, display group 001 ⇒ page 01-29 and 099 ⇒ page 01-39. - Replace engine control unit ⇒ page 24-15.
Short circuit to earth	◆ Earth connection for -G39- faulty	◆ Poor idling	
Implausible signal	◆ Corrosion on moisture in plug connection for probe heater -Z19- or lambda probe -G39-	◆ Increased fuel consumption	
Signal out of tolerance	◆ Lambda probe heater not operating ◆ -G39- faulty ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Spark plugs coked ◆ Emission levels not o.k.	

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00530 Throttle valve positioner/ potentiometer -G88-¹⁾ Open/short circuit to positive Open/short circuit to earth Implausible signal	◆ Open circuit in wiring between -G88- and engine control unit or short circuit to positive ◆ Open circuit in wiring between -G88- and engine control unit or short circuit to earth ◆ -G88- faulty/loose contact in plug connection for throttle valve control unit -J338- ◆ Signal input in engine control unit faulty (control unit faulty) ◆ Contact resistance as a result of moisture in connector for throttle valve control unit -J338- ◆ Incorrect connector assignment	◆ Idling positioner is switched off; engine idles with mechanically defined air quantity as a result of emergency running gap ◆ Altered idling speed ◆ Cold starting problems ◆ Cold idling problems ◆ Load change jolts ◆ Reduced output ◆ Irregular idling	- Carry out adaptation of throttle valve control unit ⇒ page 24-64. - Test throttle valve control unit ⇒ page 24-53. - Replace engine control unit ⇒ page 24-15.
00533 Idling control Upper stop value Lower stop value	◆ Throttle valve positioner -V60- jamming ◆ Air filter blocked ◆ Unmetered air downstream of throttle valve ◆ Injector faulty ◆ Fuel pressure regulator faulty	◆ Poor performance ◆ High fuel consumption ◆ Smell of fuel	- Test throttle valve control unit ⇒ page 24-53. - Test intake system for leaks (unmetered air) ⇒ page 24-32. - Test injectors ⇒ page 24-21. - Replace fuel pressure regulator.

¹⁾ The throttle valve positioner/potentiometer -G88- is an integral part of the throttle valve control unit -J338-. The throttle valve positioner potentiometer (variable resistance, operated by throttle valve positioner) signals the position of the throttle valve to the engine control unit.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00537 Lambda control Upper stop value	◆ Short circuit to earth in signal wire from lambda probe to engine control unit ◆ Injector(s) faulty (blocked) ◆ Fuel pressure regulator faulty ◆ Fuel pump faulty ◆ Unmetered air ◆ Fuel tank empty	◆ No lambda control ◆ Poor performance	- Test lambda probe and lambda control ⇒ page 24-41. - Test injectors ⇒ page 24-21. - Test fuel pressure regulator and holding pressure ⇒ page 24-18. - Test fuel pump ⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Testing fuel pump - Inspect intake system for leaks. - Refuel vehicle.
Lower stop value	◆ Solenoid valve 1 for activated charcoal filter -N80- leaking, jamming ◆ Injector(s) faulty (not closing completely) ◆ Fuel pressure regulator faulty	◆ No lambda control ◆ Poor performance	- Test -N80- ⇒ page 24-50, Final control diagnosis ⇒ page 01-25. - Test injectors ⇒ page 24-21. - Test fuel pressure regulator and holding pressure ⇒ page 24-18.

Notes re fault code 00537:

- ◆ If the fault „Lambda control upper stop“ is detected, the lambda control has moved against the control limit in the „richer mixture“ direction. The lambda probe, however, still measures „lean“ mixture.
- ◆ If the fault „Lambda control lower stop“ is detected, the lambda control has moved against the control limit in the „leaner mixture“ direction. The lambda probe, however, still measures „rich“ mixture.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00545 Engine/gearbox electrical connection Short to positive Short circuit to earth Undefined switch state	◆ Short circuit to positive in cable connection from engine control unit to automatic gearbox control unit ◆ Short circuit to earth in cable connection from engine control unit to automatic gearbox control unit ◆ Fault in automatic gearbox or at automatic gearbox control unit	◆ Workshop Manual automatic Gearbox ⇒ Workshop Manual Automatic Gearbox; Repair Group 01; Fault Table ◆ Signal output of engine control unit faulty (engine control unit faulty)	- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-15. - Interrogate fault memory of automatic gearbox control unit ⇒ Automatic Gearbox; Repair Group 01; Function of Self-Diagnosis
Models 08.97 ➤ 00557 Power steering pressure switch -F88¹⁾ Short circuit to earth Short circuit to positive	◆ Short circuit to earth ◆ -F88 faulty ◆ Short circuit to positive ◆ -F88 faulty	◆ Engine cuts out at full steering lock	- Test signal from power steering pressure switch ⇒ page 24-81
00609 Ignition output 1 Short circuit to positive	◆ Open circuit or short circuit to positive in cable connection from engine control unit to output stage at the ignition coil ◆ Earth connection of output stage at ignition coil faulty ◆ Output stage at ignition coil faulty ◆ Engine control unit faulty	◆ Starting problems ◆ Extremely irregular engine running in all load ranges ◆ Extremely poor performance	- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test twin spark ignition system with two ignition coils ⇒ page 28-2. - Replace engine control unit ⇒ page 24-15.

¹⁾ If fault 00557 is stored, fault 00533 may also be stored as a consequential fault.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00610 Ignition output 2 Short circuit to positive	- ⇒ Fault code „00609“	- ⇒ Fault code „00609“	- ⇒ Fault code „00609“

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00625 Road speed signal Implausible signal	◆ Open circuit or short circuit in signal wire between dash panel insert and engine control unit ◆ Short circuit in signal wire between speedometer and another control unit which uses the road speed signal ◆ Signal input in engine control unit faulty (control unit faulty)		- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-15.

Notes re fault code 00609 and 00610:

„Ignition output 1“ or „Ignition output 2“ refers to the outputs at the engine control unit through which the engine control unit actuates the power output stage at the ignition coil.

Note re fault code 00625:

If fault „00625“ is stored, the engine control unit adopts a fixed substitute value of 5 km/h.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00635 Lambda probe heater before Cat Faulty	◆ Open circuit or short circuit to positive or short circuit to earth in cable from engine control unit to lambda probe ◆ Power output stage in engine control unit faulty (engine control unit faulty) ◆ Lambda probe faulty ◆ Fuel pump relay/actuation of fuel pump relay faulty	◆ Irregular idling ◆ Possible exhaust problems	- Test lambda control ⇒ page 24-41. - Rectify open circuit or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-15. - Replace lambda probe - Test fuel pump relay and actuation ⇒ page 24-26.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
Models 08.97 ➤ 00650 Clutch pedal switch -F36 Defective	◆ Open circuit in wiring or short circuit		- Test signal from clutch pedal switch ⇒ page 24-83

Notes re fault code 00635:

- ◆ The positive voltage for the lambda probe heater is supplied through the fuel pump relay.
- ◆ The earth for the lambda probe heater is supplied by the engine control unit, i.e. the entire heating current for the lambda probe heater flows through the engine control unit.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
Models 08.97 ► 00668 System voltage tml. 30 open circuit Open circuit	♦ Open circuit/loose contact in cable to engine control unit		- Test voltage supply of engine control unit ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Adapt engine control unit to throttle valve control unit ⇒ page 24-64
Models 08.98 ► 01013 AC compressor load signal Open/short circuit to earth Short circuit to positive	♦ Open circuit in wiring or short circuit to earth ♦ Short circuit to positive		- Check measured value block 57 ⇒ page 01-45 - Rectify short circuit or open circuit as specified in CFD ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Check measured value block 57 ⇒ page 01-45 - Rectify short circuit or open circuit as specified in CFD ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
01087 Basic setting not carried out Implausible signal	Conditions for basic setting (adaptation of throttle valve control unit) not met: ♦ Ignition not switched on ♦ Engine not switched off ♦ Idling switch not closed ♦ Voltage of throttle valve potentiometer and of throttle valve positioner potentiometer implausible (not clearly recognisable by control unit; throttle valve not fully closed) ♦ Throttle valve positioner jamming/mechanical damage ♦ Battery voltage too low (less than 8V) ♦ Fault in fault memory ♦ Throttle valve control unit faulty ♦ Engine control unit faulty	♦ Engine control unit cannot learn the stop position of the throttle valve because of conditions for this are not met (Possible cause of fault)	- Read measured value block, display group 001 and 098 ⇒ page 01-34 and page 01-46, respectively - Test throttle valve control unit ⇒ page 24-53 - Interrogate fault memory - Carry out adaptation of throttle valve control unit ⇒ page 24-64 - Read measured value block, display group 005 ⇒ page 01-29 - Interrogate fault memory - Replace throttle valve control unit - Replace engine control unit ⇒ page 24-15

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
01126 Engine speed signal Defective	◆ Open circuit in wiring or short circuit to positive or to ground between engine control unit and dash panel insert ◆ Signal input at dash panel insert faulty ◆ Signal output in engine control unit faulty (engine control unit faulty)	◆ Rev counter does not operate	- Rectify open circuit in wiring or short circuit according to CFD. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Replace dash panel insert. - Replace engine control unit ⇒ page 24-15.
01163 Ignition flashover	◆ Open circuit in ignition circuit ◆ Fault in cable to spark plug	◆ Irregular engine running	- Test twin spark ignition system with two ignition coils ⇒ page 28-2.
01177 Engine control unit Defective	◆ Earth cable in control unit has open circuit ◆ Engine control unit faulty	◆ Engine does not start	- Test voltage supply to engine control unit ⇒ page 24-33. - Replace engine control unit ⇒ page 24-15.
01242 Output stages in control unit Defective	◆ Engine control unit faulty	◆ Engine does not start	- Replace engine control unit ⇒ page 24-15.

Notes on fault code 01126:

What is meant in this case by „Engine speed signal“ is not the signal from the speed sensor at the crankshaft to the engine control unit, but the signal from the engine control unit to the dash panel insert which is then used for various other systems (e.g. rev counter, air conditioning, etc.).

Notes on fault code 01163:

Engine can be started again after erasing fault from fault memory ⇒ page 01-4, Interrogating and erasing fault memory.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
01243 Intake manifold changeover valve -N156- Output open Short circuit to positive Short circuit to earth	 ♦ Open circuit or short circuit to positive or short circuit to earth in cable connection between intake manifold changeover valve -N156- and engine control unit ♦ Voltage supply for -N156- faulty ♦ -N156- faulty ♦ Signal output in engine control unit faulty (engine control unit faulty)	 ♦ Poor performance 	 - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test -N156- ⇒ page 24-69. - Replace engine control unit ⇒ page 24-15.
01247 Solenoid valve 1 for activated charcoal filter -N80- Short circuit to positive Short circuit to earth Output open	 ♦ Open circuit or short circuit to positive or short circuit to earth in cable connection from -N80- to engine control unit ♦ Voltage supply for -N80- faulty ♦ -N80- faulty ♦ Signal output of engine control unit faulty (engine control unit faulty)	 ♦ Possible irregular idling ♦ Possible jerking in part load range ♦ Vehicle may smell of fuel	 - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test -N80- ⇒ page 24-50. - Replace engine control unit ⇒ page 24-15.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
01249 Injector cylinder 1 -N30- Short circuit to positive Short circuit to earth Output open	 ♦ Open circuit or short circuit to positive or short circuit to earth in cable connection from engine control unit to injector ♦ Injector faulty ♦ Voltage supply for injector faulty ♦ Signal output of engine control unit faulty (engine control unit faulty)	 ♦ Irregular engine idling or engine cuts out	 - Test injectors ⇒ page 24-21. - Replace engine control unit ⇒ page 24-15.
01250 Injector cylinder 2 -N31- Short circuit to positive Short circuit to earth Output open	⇒ Cyl. 1 fault code „01249“	⇒ Cyl. 1 fault code „01249“	⇒ Cyl. 1 fault code „01249“
01251 Injector cylinder 3 -N32- Short circuit to positive Short circuit to earth Output open	⇒ Cyl. 1 fault code „01249“	⇒ Cyl. 1 fault code „01249“	⇒ Cyl. 1 fault code „01249“
01252 Injector cylinder 4 -N33- Short circuit to positive Short circuit to earth Output open	⇒ Cyl. 1 fault code „01249“	⇒ Cyl. 1 fault code „01249“	⇒ Cyl. 1 fault code „01249“

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
01259 Fuel pump relay -J17- Defective	◆ Open circuit or short circuit to positive in cable connection from engine control unit to fuel pump relay ◆ Fuel pump relay faulty ◆ Signal output of engine control unit faulty (engine control unit faulty)	◆ Engine does not run if open circuit or short circuit to positive	- Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder - Test fuel pump relay ⇒ page 24-26. - Replace engine control unit ⇒ page 24-15.

Output on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
Models 08.97 ➤ 01312 Drive databus defective	◆ Fault in datalines	◆ Driving characteristic faults (jerky gearshifts, load change jolts) ◆ No driving dynamics control	- Test databus lines ⇒ page 24-84.

Notes re fault code 01259:

If fault „01259“ is stored, components which are supplied with voltage through the fuel pump relay may also be displayed as faulty.

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

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
Models 08.97 ➤ 01315 Gearbox control unit no communication	♦ Fault in datalines to gearbox control unit	♦ Poor driving characteristic (jerky gearshifts, load change jolts)	- Test drive databus ⇒ page 24-84.
Models 08.97 ➤ 01316 Brake control unit no communication	♦ Fault in datalines to ABS control unit	♦ No driving dynamic control	- Test drive databus ⇒ page 24-84.
01321 Airbag control unit -J234 no communication	♦ Fault in datalines to airbag control unit	♦ Fuel pump is not separated in accident in which airbag deployed	- Test databus ⇒ page 24-84.
17978 Engine control unit inhibited	♦ Attempt at manipulation ♦ Open circuit in wiring or short circuit to positive or to earth between engine control unit and immobiliser control unit ♦ Immobiliser control unit faulty ♦ Signal input in engine control unit faulty (control unit faulty) ♦ Attempt at starting with unauthorised ignition key ♦ Engine control unit not adapted to immobiliser control unit	♦ Engine starts but immediately cuts out again	- Rectify open circuit in wiring or short circuit according to CFD. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Replace dash panel insert. - Replace engine control unit ⇒ page 24-15. - Adapt ignition keys. ⇒ Electrical System; Repair Group 96; Adaptation - Adapt engine control unit to immobiliser control unit ⇒ page 24-16.
65535 Control unit defective	♦ Fault within engine control unit	♦ Poor driving characteristics ♦ Engine stops	- Replace engine control unit ⇒ page 24-15.

Note on fault code 17978:

The immobiliser control unit is located in the dash panel insert and cannot be replaced separately.

Final control diagnosis

Notes:

- ◆ *Final control diagnosis can only be carried out when the engine is not running and the ignition is switched on.*
- ◆ *Final control diagnosis is aborted if the engine is started or if a engine speed pulse is detected.*
- ◆ *During final control diagnosis the individual control elements are actuated for about 50 seconds unless the programme is switched on before the end of this period to the next control element by pressing the → key.*
- ◆ *The control elements can be checked audibly or by touching.*
- ◆ *Before repeating final control diagnosis without briefly running the engine, switch off the ignition for about 2 seconds.*
- ◆ *After completing final control diagnosis, you cannot start the engine again until first of all switching the ignition off and on again.*
- ◆ *Ignition and fuel injection are blocked during final control diagnosis.*

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

1. Fuel pump relay -J17-
2. Solenoid valve 1 for activated charcoal filter -N80-
3. EGR valve -N18-, (two-way valve)¹⁾
4. Intake manifold changeover valve -N156-

¹⁾ Not used at present

Special tools, testers and aids required

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

Procedure

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The ignition should be switched on for this step.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Operate the vehicle system tester according to the readout in the display:
- Select the function 03 „Final control diagnosis“.

Test of vehicle systems
03 - Final control diagnosis

Q

◀ Readout in display:

Actuating fuel pump relay -J17-:

- Confirm the entry with the key Q.

Final control diagnosis
Fuel pump relay -J17

→

◀ Readout in display:

The fuel pump relay is constantly switched off and on (clicks) for about 50 seconds unless the programme is moved forward before the end of this period to the next control element by pressing the → key.

Note:

The fuel pump should also be heard to run at intervals during actuation of the fuel pump relay.

If the relay does not click:

- Test fuel pump relay and actuation ⇒ page 24-26, Testing fuel pump relay and actuation.
- Press the → key.

Final control diagnosis
Solenoid valve 1 for activated charcoal filter -N80

→

◀ Readout in display:

The solenoid valve 1 for activated charcoal filter -N80- is constantly switched off and on (clicks) for about 50 seconds unless the programme is moved forward before the end of this period to the next control element by pressing the → key.

- If the valve is not actuated (does not click), test activated charcoal filter solenoid valve -N80- ⇒ page 24-50.
- Press the → key.

Final control diagnosis
EGR valve -N18

→

◀ Readout in display:

Note:

You can ignore this readout.

- Press the → key.

Final control diagnosis Intake manifold changeover valve -N156	→
---	---

◀ Readout in display:

This valve is constantly switched off and on (clicks) for about 50 seconds unless the programme is moved forward before the end of this period to the next control element by pressing the → key.

- If the valve is not actuated (does not click), test intake manifold changeover valve -N156- ⇒ page 24-69, Testing intake manifold changeover.
- Press the → key.

Function is unknown or cannot be carried out at the moment	→
--	---

◀ Readout in display:

Final control diagnosis is completed.

- Press the → key.

Note:

Before again selecting function 03 „Final control diagnosis“, switch off ignition for about 2 seconds.

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.

- Connect vehicle system tester V.A.G 1552 and select the address word 01 „Engine electronics“. The ignition should be switched on for this step.

Test of vehicle systems Select function XX	HELP
---	------

◀ Readout in display:

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

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

◀ Readout in display:

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

List of possible code versions which can be selected:

Models ► 04.99

Code number	Gearbox	Equipment
04000	Manual gearbox	ABS
04030	Automatic gearbox	-
04900	Manual gearbox	without ABS

Models 05.99 ►

Code number	Gearbox	Equipment
00001	Manual gearbox	-
00003	Automatic gearbox	-
00011	Manual gearbox	ABS
00013	Automatic gearbox	ABS
00021	Manual gearbox	Airbag
00023	Automatic gearbox	Airbag
00031	Manual gearbox	Airbag + ABS
00033	Automatic gearbox	Airbag + ABS

Continued for all models

Coding 04000

WSC 12345

◀ The control unit code appears in the display of the vehicle system tester V.A.G 1552 (example):

Note:

If a code number which is not authorised is entered:

Function is not known or cannot be carried out at the moment

→

◀ Readout in display:

- Repeat procedure, enter correct code.
- Press → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Note:

An incorrect code results in:

- ◆ poor driving characteristics
- ◆ increased fuel consumption
- ◆ increased emission levels
- ◆ storage of non-existent faults in fault memory
- ◆ reduction in gearbox life

Reading measured value block

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The engine should be idling for this step.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Enter 08 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 three-digit display group and confirm the entry with the key Q.

Example: To select display group 005, press keys 0, 0 and 5.

Note:

Proceed as follows to switch to another display group:

Display group	V.A.G 1552
higher	Press ↑ key
lower	Press ↓ key
skip	Press key C

Test requirements

- No fault stored in fault memory
⇒ page 01-4; Interrogating and erasing fault memory
- Vehicle stationary; engine idling; throttle valve closed
- Coolant temperature at least 80 °C
- All electrical consumers switched off (radiator fan must not cut in during the test)
- Air conditioning switched off
- On models fitted with automatic gearbox, selector lever must be in position „P“ or „N“

Reading measured value block: display groups 000 to 010

Display group 000 (decimal readouts)										
• Engine idling										
Display blocks										
1	2	3	4	5	6	7	8	9	10	
										Engine speed (idling speed)
										23 to 27
										760 to 880 rpm ¹⁾
										Injection time
										2 to 4
										2 to 4.1 ms
										Throttle valve angle
										4 to 12
										1.9 to 5.7 ∠°
										Operating state of lambda control
										⇒ Reading measured value block 099 ¹⁾
										Injection time (additive learned value) determined by lambda control
										0 to 100
										0 to +0.8 ms
										Lambda probe voltage
										0 to 50
										0.0 to 1.0 V
										Inducted air mass
										14 to 30
										76 to 164 mg/H
										Coolant temperature
										170 to 211
										80 to 110 °C
										Voltage supply of engine control unit
										98 to 147
										10 to 15 V
										Intake air temperature
										84 to 158
										15 to 71 °C

- ¹⁾ The „Operating state of the lambda control“ is shown in display block 7 by means of a decimal figure. The „Operating state of the lambda control“ is shown as a coded bit pattern (8-digit readout) in display block 4 in Measured value block 099 ⇒ page 01-52.

Note on display group 000:

Analysing ⇒ page 01-31.

Analysing display group 000

Display block	Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
1	less than 84 ¹⁾	♦ Fault in intake air temperature sender ♦ Fault in cables to intake air temperature sender	- Test intake air temperature sender ⇒ page 24-34.
	greater than 158 ¹⁾		
2	less than 98	♦ Fault in alternator, battery severely discharged ♦ Severe load on electrical system shortly after start because of high charge current and ancillaries ♦ Contact resistance in voltage supply, or earth connection for engine control unit ♦ Current drain when ignition off	- Test voltage, charge battery. - Increase engine speed slightly for a few minutes and switch off ancillaries. - Test voltage supply to engine control unit ⇒ page 24-33. - Eliminate current drain.
	greater than 147	♦ Fault in voltage regulator at alternator ♦ Excess voltage caused by jump-starting or quick-charger	- Test voltage, replace regulator if necessary. - Interrogate fault memory ⇒ page 01-4.
3	less than 170	♦ Engine too cold ♦ Fault in coolant temperature sender or in cable connection to engine control unit ♦ Fault in coolant thermostat	- Conduct road test, if necessary. - Test coolant temperature sender -G62- ⇒ page 24-38. - Test coolant thermostat, replace if necessary. ⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 19; Removing and installing, testing coolant thermostat
	greater than 211	♦ Radiator dirty ♦ Radiator fan not operating ♦ Fault in coolant thermostat ♦ Fault in coolant temperature sender or in cable connection to engine control unit	- Clean radiator. - Test operation of radiator fan. - Test coolant thermostat, replace if necessary. ⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 19; Removing and installing, testing coolant thermostat - Test coolant temperature sender -G62- ⇒ page 24-38.

Display block	Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
4	less than 14	◆ Large quantity of unmetered air between intake manifold and air mass meter ◆ Fault in air mass meter or in cable connection to engine control unit	- Eliminate unmetered air. - Test air mass meter ⇒ page 24-28.
	greater than 30	◆ Gear engaged (automatic gearbox) ◆ Engine load caused by ancillaries ◆ Fault in air mass meter or in cable connection to engine control unit	- Move selector lever into P or N. - Eliminate load (PAS) or switch off ancillaries (e.g. AC). - Test air mass meter ⇒ page 24-28.

¹⁾ Depends on ambient temperature and time vehicle is parked.

Display block	Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
5	Readout does not vary (lambda controller at too rich or too lean stop; ⇒ display group 099)	◆ Large quantity of unmetered air ◆ Fault in spark plug ◆ Fault in ignition cable termination ◆ Fuel system pressure too low or too high ◆ Fault in injector ◆ Fault in coolant temperature sender -G62- ◆ Fault in activated charcoal filter solenoid valve -N80- ◆ Lambda probe heater not operating ◆ Lambda probe faulty or dirty	- Eliminate causes of unmetered air. - Test spark plugs and terminations. - Test fuel pressure regulator and pressure in system ⇒ page 24-18. - Test injectors ⇒ page 24-21. - Interrogate fault memory ⇒ page 01-4, test -G62- if necessary ⇒ page 24-38. - Perform final control diagnosis ⇒ page 01-25, test -N80- if necessary ⇒ page 24-50. - Test lambda probe heater ⇒ page 24-47. - Interrogate fault memory ⇒ page 01-4, test lambda probe if necessary ⇒ page 24-41 - Read measured value block, display group 099.
	constant 255	◆ Short circuit to positive caused by: Lambda probe -G39- or Signal cable or Engine control unit	- Test lambda probe ⇒ page 24-41.
	constant 80	◆ Open circuit in wiring caused by: Fuse, lambda probe -G39- or Signal cable or Engine control unit	- Test lambda probe ⇒ page 24-41.
	constant 0	◆ Short circuit to positive caused by: Lambda probe -G39- or Signal cable or Engine control unit	- Test lambda probe ⇒ page 24-41.

Display block	Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
6	low lambda learned values	♦ Low lambda idling speed learned values with normal lambda part load learned values: slight oil dilution (high concentration of fuel in oil) ♦ Leak in injector(s) ♦ Fuel pressure too high ♦ Activated charcoal filter solenoid valve -N80- constantly open ♦ Fault in air mass meter -G70- ♦ Fault in lambda probe heater or lambda probe dirty	- Disappears after driving on motorway, or changing oil. - ⇒ display group 011, display blocks 2 and 3. - Test injectors ⇒ page 24-21. - Test fuel pressure ⇒ page 24-18. - Test -N80- ⇒ page 24-50. - Test -G70- ⇒ page 24-28. - Test lambda probe heater ⇒ page 24-47.
	high lambda learned values	♦ High lambda idling speed learned values with slightly higher lambda part load learned values: unmetered air in intake manifold ♦ Injector clogged ♦ Fuel pressure too low ♦ Unmetered air between -G70- and throttle valve ♦ Unmetered air at exhaust manifold gasket ♦ Fault in lambda probe heater or lambda probe dirty	- Rectify cause. - ⇒ display group 011, display blocks 2 and 3. - Test injected quantity ⇒ page 24-23. - Test fuel pressure ⇒ page 24-18. - Test -G70- ⇒ page 24-28. - Rectify causes of unmetered air. - Test lambda probe heater ⇒ page 24-47.
7	♦ The „Operating state of lambda control“ is shown encoded as a bit pattern (8-digit readout) in display block 4 in Measured value block 099.		
8	less than 4	♦ Fault in throttle valve potentiometer in throttle valve control unit -J338- or incorrectly set ♦ Unmetered air between intake manifold and air mass meter (causes fast idling speed; throttle valve control unit attempts to control fast idling speed to set idling speed)	- Test throttle valve control unit -J338- ⇒ page 24-53. - Rectify causes of unmetered air.
	greater than 12	♦ Adaptation of throttle valve control unit -J338- was not performed ♦ Fault in throttle valve potentiometer in throttle valve control unit -J338- or incorrectly set ♦ Throttle cable incorrectly set ♦ Throttle valve sticks	- Perform adaptation of throttle valve control unit -J338- ⇒ page 24-64. - Test throttle valve control unit -J338- ⇒ page 24-53. - Adjust throttle cable. ⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Adjusting throttle cable - Eliminate cause.

Display block	Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
9	less than 2	♦ High quantity of fuel out of activated charcoal filter system ♦ Incorrect injectors with excessive fuel flow installed ♦ Fault in fuel pressure regulator	- Test activated charcoal filter solenoid valve ⇒ page 24-50. - Test quantity of fuel injected ⇒ page 24-23. - Test fuel pressure regulator ⇒ page 24-18.
	greater than 4	♦ Increased engine load because of electrical consumers, AC on, gear engaged, PAS at full lock ♦ Gear engaged (automatic gearbox)	- Eliminate load. - Move selector lever into P or N.
10	less than 23	♦ Throttle valve control unit -J338- continues to jam or is faulty ♦ Large quantity of unmetered air (can no longer be compensated by idling speed stabilisation)	- Test throttle valve control unit ⇒ page 24-53. - Eliminate unmetered air. - Test idling speed ⇒ page 24-17.
	greater than 27	♦ Throttle valve control unit -J338- continues to jam or is faulty ♦ Large quantity of unmetered air (can no longer be compensated by idling speed stabilisation)	- Test throttle valve control unit ⇒ page 24-53. - Eliminate unmetered air. - Test idling speed ⇒ page 24-17.

Display group 001 (base values):

If display group 001 is selected in function 04 „Basic setting“, the engine control unit is adapted to the throttle valve control unit -J338- (⇒ display group 098). Performing adaptation ⇒ page 24-64.

• Engine idling						
Read measured value block 1 xxx rpm xxx °C xx.x V xxxxxxxx →				◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Setting condition for throttle valve adaptation (⇒ next page)	00000010	⇒ page 01-36
				Lambda probe voltage	0.00...1.00 V	⇒ page 01-30
				Coolant temperature	80...110 °C	⇒ page 01-30
				Engine speed (idling speed)	-	⇒ page 01-30

Note on display block 4:

Meaning of the digits in the 8-digit numerical block for the setting condition for throttle valve adaptation:

x	x	x	x	x	x	x	x	Meaning if display positions = 1
1								Fault detected by self-diagnosis ²⁾
	1							Signal from automatic gearbox
		1						AC compressor switched on
			1					Idling speed switch open ¹⁾
				1				Fault in lambda control
					1			Throttle valve open (scanning angle) ¹⁾
						1		Engine running ¹⁾
							1	Coolant temperature below 80 °C

- ¹⁾ If a „1“ is shown at the appropriate point, it is not possible to adapt the throttle valve control unit.
- ²⁾ A fault has been detected by the self-diagnosis, but the fault not yet stored in the fault memory. In the case of faults relating to the throttle valve unit, adaptation of the throttle valve unit is not performed in the function „Basic setting“.

Display group 002 (base values):

• Engine idling						
Read measured value block 2				→ Readout in display		
xxx rpm	xxx mg/H	x km/h	xxxx			
1	2	3	4	Display blocks	Specification	Analysis
				Engine operating state	0100	⇒ page 01-36
				Vehicle speed	0 km/h	-
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Note on display block 4:

Meaning of the digits in the 4-digit numerical block for engine operating state:

Meaning if display position = 1				
x	x	x	x	Engine operating state
1				Deceleration
	1			Idling speed
		1		Part throttle
			1	Full throttle

Display group 003 (base values):

• Engine idling						
Read measured value block 3				→		
xxx rpm	xxx mg/H	xx.x ∠°	xxx %	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				On/off ratio of throttle valve positioner	-100...+100 %	-
				Throttle valve angle	1.9...5.7 ∠°	⇒ page 01-30
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Display group 004 (base values):

• Engine idling						
Read measured value block 4				→		
xxx rpm	xxx mg/H	x.x ms	x.x g/s	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Inducted air mass	1.0...3.2 g/s	-
				Injection time	2...4.1 ms	⇒ page 01-30
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Display group 005 (base values):

• Engine idling						
Read measured value block 5				→		
xxx rpm	xxx mg/H	x.x ms	x.x g/s	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Intake air temperature	15...71 °C	⇒ page 01-30
				Coolant temperature	80...110 °C	⇒ page 01-30
				Supply voltage of engine control unit	10...15 V	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Display group 006 (altitude adaptation):

• Engine idling						
Read measured value block 6 xxx rpm xxx mg/H xx.x ∠° x.xx				→ Readout in display		
1	2	3	4	Display blocks	Specification	Analysis
				Altitude correction factor	0.70...1.30	-
				Throttle valve angle	1.9...5.7 ∠°	⇒ page 01-30
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Display group 007 (idling speed setting):

• Engine idling						
Read measured value block 7 x.x ∠° x.xx x.xx xxxx				→ Readout in display		
1	2	3	4	Display blocks	Specification	Analysis
				Engine operating state	0100	⇒ page 01-38
				Idling speed learned value (gear engaged)	0.95...1.05	-
				Idling speed learned value (gear not engaged)	0.95...1.05	-
				Throttle valve angle	1.9...5.7 ∠°	⇒ page 01-30

Note on display block 4:

Meaning of the digits in the 4-digit numerical block for engine operating state:

Meaning if display position = 1				
x	x	x	x	Engine operating state
1				Deceleration
	1			Idling speed
		1		Part throttle
			1	Full throttle

Note:

Measured value block 007 is for information only. Not relevant for fault finding in the Service sector.

Display group 008 (idling stabilisation):

• Engine idling						
Read measured value block 8				→		
xxx rpm	xxx rpm	xx %	x.x g/s	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
Inducted air mass					1.0...3.2 g/s	-
Idling speed controller					-10...+15 %	-
Specified idling speed when vehicle stationary					800...840 rpm	-
Idling speed					-	⇒ page 01-30

Display group 009 (idling speed air demand):

• Engine idling						
Read measured value block 9				→		
xx %	xxxxxxx	xxx °C	xxx rpm	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
Engine speed					-	⇒ page 01-30
Coolant temperature					80...110 °C	⇒ page 01-30
Adaptation state of throttle valve control unit					00000000	⇒ page 01-39
Idling speed controller					-10...+15 %	-

Note on display block 2:

Meaning of the digits in the 8-digit numerical block for adaptation state of the throttle valve control unit:

	Meaning if display positions = 1				
0000	x	x	x	x	Adaptation state
0000					not assigned
	1				A fault has occurred during adaptation of throttle valve control unit (interrogate fault memory ⇒ page 01-4)
		1			Throttle valve control unit de-energised (on/off ratio = 0)
			1		Adaptation aborted because battery voltage too low (below 8 V)
				1	Idling speed switch separated (interrogate switch)

Display group 010 (lambda control and activated charcoal filter system):

• Engine idling						
Read measured value block 10 xx % x.xx V xx % → xx %				◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Lambda correction factor with fuel tank vent active	-20...2 %	-
				Actuate activated charcoal filter solenoid valve -N80-:	0...20 %	-
				Lambda probe voltage	0.00...1.00 V	⇒ page 01-30
Lambda controller					-25...25 %	-

Note:

Measured value block 010 is for information only. Not relevant for fault finding in the Service sector.

Reading measured value block: display groups 011 to 099**Display group 011 (lambda learned values):**

• Engine idling						
Read measured value block 11 x.x ms x.xx ms x.xx → xxxxxxxx				◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Status of tank vent valve	00000010	⇒ page 01-41
				Lambda learned value at part throttle	0.90...1.15	⇒ page 01-41
				Lambda learned value at idling speed	-1.00...+1.00 ms	⇒ page 01-41
Injection time					2...4.1 ms	⇒ page 01-30

Note on display block 4:

Meaning of the digits in the 8-digit numerical block for status of tank vent valve:

x	x	x	x	x	x	x	x	Meaning if display positions = 1
0								not assigned
	1							Transition to determining charge of tank vent valve
		1						Transition to minimum operation of tank vent valve
			1					Transition to closing of tank vent valve
				1				Determining charge of tank vent valve
					1			Normal operation of tank vent valve
						1		Minimum operation of tank vent valve
							1	Tank vent valve closed

Analysis of display group 011, display blocks 2 and 3 - lambda learned value

Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
not within tolerance range	◆ Negative readout: mixture too rich, lambda control produces leaner mixture ◆ Positive readout: mixture too lean, lambda control produces richer mixture ◆ Injector faulty ◆ Large quantity of unmetered air	- Wait about 30 seconds until readout stabilises. - Test injectors ⇒ page 24-21. - Eliminate cause of unmetered air.

Display group 012 (lambda learned values):

• Engine idling						
Read measured value block 12 →				◀ Readout in display		
xxx rpm	xxx mg/H	xx %	x.xx V			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Lambda probe voltage	0.00...1.00 V	⇒ page 01-30
				Lambda controller	-25...25 %	-
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Display group 013 (fuel consumption):

• Engine idling						
Read measured value block 13 →				◀ Readout in display		
xxx rpm	xxx mg/H	xxx km/h	x.xx l/h			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Fuel consumption	0.50...2.00 l/h	-
				Vehicle speed	0 km/h	-
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Note:

Measured value block 013 is for information only. Not relevant for fault finding in the Service sector.

Display group 014 (knock control):

• Vehicle driven						
Read measured value block 14 →				◀ Readout in display		
x.x °CA	x.x °CA	x.x °CA	x.x °CA			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Ignition angle retardation cylinder 4 by knock control	0.0...12.0 °CA	⇒ page 01-43
				Ignition angle retardation cylinder 3 by knock control	0.0...12.0 °CA	⇒ page 01-43
				Ignition angle retardation cylinder 2 by knock control	0.0...12.0 °CA	⇒ page 01-43
				Ignition angle retardation cylinder 1 by knock control	0.0...12.0 °CA	⇒ page 01-43

Note on display blocks 1 to 4:

0.0 °CA is displayed when engine idling.

Analysis of display group 014, display blocks 1 to 4 - ignition angle retardation

Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
all cylinders between 8.0...12.0 °CA and at same readout	♦ Knock sensor faulty	- Test knock sensor ⇒ page 28-6
	♦ Plug connection corroded	
	♦ Knock sensor not correctly tightened	- Slacken knock sensor and tighten again to 20 Nm
	♦ Engine components loose	- Tighten loose components
	♦ Poor quality fuel	- Select correct grade of fuel
one cylinder differs significantly from the others	♦ Plug connection corroded	- Test knock sensor ⇒ page 28-6
	♦ Engine damage	- Test compression: ⇒ 1.6-ltr./74 kW Engine - Mechanical Components; Repair Group 15; Testing compression
	♦ Engine components loose	- Tighten loose components

Display group 015 (knock control cylinders 1 and 2):

• Vehicle driven						
Read measured value block 15				→		
xxx rpm	xxx mg/H	x.x °CA	x.x °CA	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Ignition angle retardation cylinder 2 by knock control	0.0...12.0 °CA	⇒ page 01-45
				Ignition angle retardation cylinder 1 by knock control	0.0...12.0 °CA	⇒ page 01-45
Inducted air mass					-	-
Engine speed					760...6350 rpm	-

Display group 016 (knock control cylinders 3 and 4):

• Vehicle driven						
Read measured value block 16				→		
xxx rpm	xxx mg/H	x.x °CA	x.x °CA	◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				Ignition angle retardation cylinder 4 by knock control	0.0...12.0 °CA	⇒ page 01-45
				Ignition angle retardation cylinder 3 by knock control	0.0...12.0 °CA	⇒ page 01-45
Inducted air mass					-	-
Engine speed					760...6350 rpm	-

Note:

As soon as knocking is detected, the ignition angle must be retarded by the knock control in order to avoid engine damage.

Note on display blocks 3 and 4:

0.0 °CA is displayed when engine idling.

Analysis of display groups 015 and 016, display blocks 3 and 4 - ignition angle retardation

Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
all cylinders between 8.0...12.0 °CA and at same readout	♦ Knock sensor faulty	- Test knock sensor ⇒ page 28-6
	♦ Plug connection corroded	- Slacken knock sensor and tighten again to 20 Nm
	♦ Knock sensor not correctly tightened	
	♦ Engine components loose	- Tighten loose components
	♦ Poor quality fuel	- Select correct grade of fuel
one cylinder differs significantly from the others	♦ Plug connection corroded	- Test knock sensor ⇒ page 28-6
	♦ Engine damage	- Test compression: ⇒ 1.6-ltr./74 kW Engine - Mechanical Components; Repair Group 15; Testing compression
	♦ Engine components loose	- Tighten loose components

Display group 017 (knock control):

• Engine idling						
Read measured value block 17 →				◀ Readout in display		
x.xxx Vpp	x.xxx Vpp	x.xxx Vpp	x.xxx Vpp			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Knock sensor voltage signal cylinder 4	0.400...1.300 Vpp	-
				Knock sensor voltage signal cylinder 3	0.400...1.300 Vpp	-
				Knock sensor voltage signal cylinder 2	0.400...1.300 Vpp	-
				Knock sensor voltage signal cylinder 1	0.400...1.300 Vpp	-

Notes on display blocks 3...4:

- ♦ If a difference of more than 50 % exists between the smallest and largest knock sensor signal, the cause may be corrosion at the plug connection.
- ♦ Testing knock sensor ⇒ page 28-6.
- ♦ If no fault is found when testing the wiring and connector, inspect whether ancillaries are loose or engine damage present.
- ♦ The readout of the knock sensor voltage signal may be as much as 5.1 V at high engine speeds.

Display group 018 (torque reduction with automatic gearbox):

• Engine idling						
Read measured value block 18 xxx rpm xxx mg/H x.x °CA xx °BTDC				→ Readout in display		
1	2	3	4	Display blocks	Specification	Analysis
				Ignition angle	-6...14 °BTDC	-
				Ignition angle retardation when signal from automatic gearbox control unit	0.0 °CA	-
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Note on display blocks 3 and 4:

The ignition angle is retarded so rapidly when a signal is received from the automatic gearbox control unit that it is not always detected by the vehicle system tester V.A.G 1552. The ignition angle readout in display block 4 is therefore for information only, and not relevant for the Service sector.

Display group 019 (operating states) models ► 07.97:

• Engine idling						
Read measured value block 19 xxx rpm x x x				→ Readout in display		
1	2	3	4	Display blocks	Specification	Analysis
				AC compressor (0 = compressor off; 1 = compressor on)	0	-
				Air conditioning (0 = AC off; 1 = AC on)	0	-
				Selector lever position (0 = Neutral; 1 = gear engaged)	0	-
				Idling speed	-	⇒ page 01-30

Display group 019 (operating states) models 08.97 ►

• Engine idling						
Read measured value block 19 xxx rpm x x xxxxxxxx				→ ◀ Readout in display		
1	2	3	4	◀ Display blocks	Specification	Analysis
				AC compressor operating states	00000000	⇒ page 01-47
				Air conditioning (0 = AC off; 1 = AC on)	0	-
				Selector lever position (0 = Neutral; 1 = gear engaged)	0	-
				Idling speed	-	⇒ page 01-30

Note on display block 4:

Meaning of the digits in the 8-digit numerical block of operating state:

x	x	x	x	x	x	x	x	Meaning if display positions = 1
0								not assigned
	0							not assigned
		0						not assigned
			0					not assigned
				0				not assigned
					1			Clutch pedal switch F36 opened (pedal depressed)
						1		Power steering pressure switch active
							1	AC compressor switched on

Display group 020 (operating state of lambda control ⇒ also display group 099):

• Engine idling						
Read measured value block 20 xxx rpm xxx mg/H xxx °C xxxxxxxx				→ Readout in display		
1	2	3	4	Display blocks	Specification	Analysis
				Operating state of lambda controller ¹⁾	0001011X	⇒ page 01-48
				Coolant temperature	80...110 °C	⇒ page 01-30
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

¹⁾ A „0“ or a „1“ may be displayed alternately at the places marked with „X“.

Note on display block 4:

Meaning of the digits in the 8-digit numerical block for the operating state of the lambda controller:

x	x	x	x	x	x	x	x	Meaning if display positions = 1
1								Diagnosis fault entered in fault memory; interrogate fault memory ⇒ page 01-4
	0							not assigned
		0						not assigned
			1					Limited dynamics active
				1				Lambda controller at stop
					1			Lambda controller switched on
						1		Lambda probe operational
							1	Status of mixture; readout = 1: mixture too rich readout = 0: mixture too lean

Note:

For further explanations of the 8-digit numerical block ⇒ page 01-52, display group 099.

Display group 021 (adaptation status of throttle valve control unit; ⇒ display group 098):

• Engine idling						
Read measured value block 21 →				◀ Readout in display		
xxxxxxx	xxx %	xxx %	xx %			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Max. position of throttle valve	0...20 %	-
				Emergency mode position of throttle valve	67...100 %	-
				Min. position of throttle valve	70...100 %	-
Adaptation status of throttle valve control unit					00000000	⇒ page 01-49

Note:

Measured value block 021 is for information only. Not relevant for fault finding in the Service sector.

Note on display block 1:

Meaning of the digits in the 8-digit numerical block for adaptation status of the throttle valve control unit.

	Meaning if display positions = 1				
0000	x	x	x	x	Adaptation status of throttle valve control unit
0000					not assigned
	1				A fault occurred during adaptation of throttle valve control unit (interrogating fault memory ⇒ page 01-4)
		1			Throttle valve control unit de-energised (on/off ratio = 0)
			1		Adaptation aborted because of insufficient battery voltage (below 8 V)
				1	Idling switch separated (interrogate switch)

Display group 022 (position of camshaft relative to crankshaft):

• Engine idling						
Read measured value block 22 →				◀ Readout in display		
xxx rpm	xxx mg/H	xx	xx			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Number of teeth of sensor rotor at crankshaft when Hall sender signal switches from + to -	86...90	⇒ page 01-50
				Number of teeth of sensor rotor at crankshaft when Hall sender signal switches from - to +	26...30	⇒ page 01-50
				Inducted air mass	76...164 mg/H	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

Notes on display block 3 and 4:

- ◆ The rpm sensor at the crankshaft is a speed and reference mark sensor (gaps). Signal generated by two gaps at sensor rotor.
- ◆ The orifice plate of the Hall sender on the camshaft is split by 180°, in other words when the orifice plate is within the gap of the Hall sender after half a revolution, the orifice plate again leaves the gap after the next half revolution of the camshaft.
- ◆ The moment at which the orifice plate moves into the gap (signal switches from - to +), or leaves the gap (signal switches from + to -) is detected as the start of synchronisation.
- ◆ As soon as the sensor detects the gap at the sensor rotor, the engine control unit begins counting the teeth of the sensor rotor. The Hall sender signal at the camshaft must switch from - to + after 26 to 30 teeth (this is the moment at which the orifice plate moves into the gap). After 86 to 90 teeth (the crankshaft is just making its second revolution), the Hall sender signal must switch from + to - (this is the moment at which the orifice plate leaves the gap).
- ◆ If no signal change takes place within the specified tooth range, as described above, this is an indication that the toothed belt has jumped across.

Display group 057 (vehicles fitted with AC and high-pressure switch (G65) from 08.98):

• Engine idling						
Read measured value block 57 →				◀ Readout in display		
xxx rpm	xxx rpm	Text	xx	◀ Display blocks	Specification	Analysis
1	2	3	4			
				Signal output from pressure sensor when:		⇒ page 01-51
				♦ Compr. OFF	1...5 %	
				♦ Compr. ON	10...70 %	
		AC compressor operating state (ON, OFF)			Compr. ON Compr. OFF	-
		Specified idling speed when AC compressor switched off			760...880 rpm	-
		Specified idling speed when AC compressor switched on			800...880 rpm	
	Idling speed				-	⇒ page 01-30

Notes on display block 4:

- ♦ Signal output from pressure switch (block 4) when „Compr. OFF“ does not provide any information regarding the status of the cooling medium in the air conditioning system.
- ♦ If fault 01013 is entered in the fault memory, a constant 25 % is shown in display block 4.

Display group 098 (adaptation of throttle valve control unit):

When display group 098 is selected in function 04 „Basic setting“, the throttle valve control unit -J338- is adapted to the engine control unit.

Adaptation should always be carried out after replacing or removing engine control unit, throttle valve control unit or both of these components.

• Engine idling						
Read measured value block 98 →				◀ Readout in display		
x.xx V	x.xx V	xxxxxxx	xx	◀ Display blocks	Specification	Analysis
1	2	3	4			
				Operating state of adaptation	00	⇒ page 01-52
		Adaptation status of throttle valve control unit			0000xxxx	⇒ page 01-52
		Voltage of throttle valve potentiometer for idling speed positioner -G88-			2.28...4.75 V	-
	Voltage of throttle valve potentiometer -G69-				3.70...4.75 V	-

Note on display block 3:

Meaning of the digits in the 8-digit numerical block for the adaptation status of the throttle valve control unit:

Meaning if display positions = 1							
0000	x	x	x	x	Adaptation status of throttle valve control unit		
0000					not assigned		
	1				A fault occurred during adaptation of throttle valve control unit (interrogating fault memory ⇒ page 01-4)		
		1			Throttle valve control unit de-energised (on/off ratio = 0)		
			1		Adaptation aborted because of insufficient battery voltage (below 8 V)		
				1	Idling speed switch separated (interrogate switch)		

Note on display block 4:

Meaning of the digits in the 2-digit numerical block for operating state of adaptation:

Meaning if display positions = 1		
x	x	Operating state of adaptation
1		A fault occurred during adaptation of throttle valve control unit (interrogating fault memory ⇒ page 01-4)
	1	Adaptation of throttle valve control unit in progress

Display group 099 (operating state of lambda control):

• Engine idling						
Read measured value block 99				→ Readout in display		
xxx rpm	xxx °C	xx %	xxxxxxx			
1	2	3	4	◀ Display blocks	Specification	Analysis
				Operating state of lambda controller ¹⁾	0001011X	⇒ page 01-53
				Lambda controller	-25...+25 %	-
				Coolant temperature	80...110 °C	⇒ page 01-30
				Idling speed	-	⇒ page 01-30

¹⁾ A „0“ or a „1“ may be displayed alternately at the places marked with „X“.

Note on display block 4:

Meaning of the digits in the 8-digit numerical block for the status of the lambda controller:

x	x	x	x	x	x	x	x	Meaning if display positions = 1
1								Fault entered in fault memory; interrogating fault memory ⇒ page 01-4
	0							not assigned
		0						not assigned
			1					Limited dynamics active
				1				Lambda controller at stop
					1			Lambda controller switched on
						1		Lambda probe operational
							1	Status of mixture; readout = 1: = rich mixture readout = 0: = lean mixture

Notes on the 8-digit numerical block:

- ◆ Each individual number of the 8-digit numerical block is considered as a „bit“.
- ◆ Bit string (representing the 8-digit numerical block) is read from right to left. The first bit indicates, for example, the mixture status, the eighth bit indicates whether a fault is stored in the fault memory or not.
- ◆ If the fifth bit is set to „1“ (limited dynamics active), the lambda closed-loop control is being controlling at that moment within a constant load range (e.g. idling speed or driving at a constant engine speed).
- ◆ In the normal situation, the first bit (mixture status) should jump back and forward constantly between „0“ and „1“.
- ◆ If the fourth bit is set to „1“ (lambda controller at stop), it is possible to determine from the first bit (mixture status) in which direction the lambda controller is positioned against the stop.
- ◆ If the first bit is constantly at „1“, the lambda controller has moved up to the leaner mixture stop, but the lambda probe is still measuring „rich“ mixture.
- ◆ If the first bit is constantly at „0“, the lambda controller has moved up against the richer mixture stop, but the lambda probe is still measuring „lean“ mixture.
- ◆ The operations of the lambda probe and of the lambda controller are compensatory, in other words if the lambda probe measures a „rich“ mixture, the lambda controller must produce a leaner mixture. If, on the other hand, the lambda probe measures a „lean“ mixture, the lambda controller must produce a richer mixture.
- ◆ The lambda control cannot be switched on or off manually.

Servicing Simos 2 fuel injection system

Safety precautions

Warning!

The fuel system is pressurised! Place cleaning rags around the connection point before detaching hose connections or opening the test connection (for measuring fuel pressure). Then, release pressure by carefully detaching the hose or opening the cap.

Pay attention to the following points to avoid injuries to persons and/or damage to the fuel injection and ignition system:

- ◆ Do not touch or disconnect ignition cables when engine is running or operating at starter speed.
- ◆ Do not disconnect or connect cables of the fuel injection and ignition system, also not cables of test equipment, unless the ignition is switched off.
- ◆ To operate the engine at starting speed without it actually starting (e.g. testing compression pressure), unplug the connector from the power output stage for ignition coils and the connectors from the injectors. After completing the work, interrogate fault memory and erase ⇒ page 01-4.
- ◆ Do not carry out an engine wash unless the ignition is switched off.
- ◆ Do not disconnect and connect the battery unless the ignition is switched off otherwise the engine control unit may be damaged.

Rules for cleanliness

Pay careful attention to the following „5 rules“ for cleanliness when carrying out work on the fuel supply and 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 the repairs are not carried out immediately.
- ◆ Install only clean parts:
Do not remove replacement parts from their wrapping until just before installing.
Do not use parts which have been stored unwrapped (e.g. in tool boxes etc.).
- ◆ If the system is opened:
Avoid working with compressed air, if possible.
Avoid moving the vehicle, if possible.

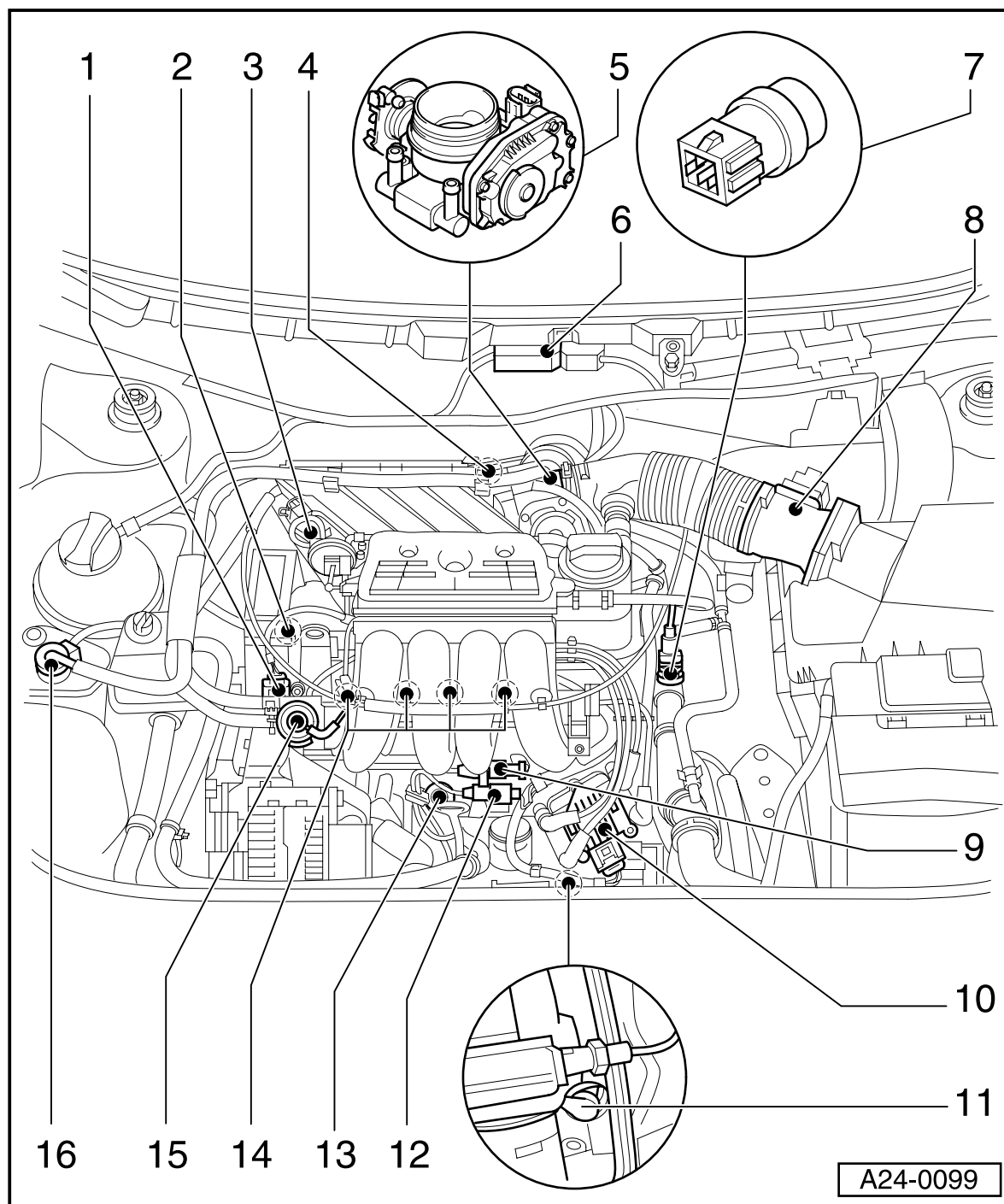
Technical data

Engine code	AEH, AKL	
Idling speed Idling speed cannot be altered, if controlled by idling stabilisation	760...880 rpm	
Engine speed governed by switching off injectors	at approx. 6350 rpm	
Fuel pressure at idling speed	Vacuum hose fitted on	approx. 0.25 MPa (2.5 bar)
	Vacuum hose disconnected	approx. 0.3 MPa (3 bar)
Holding pressure after 10 minutes	at least 0.15 MPa (1.5 bar)	
Injectors	Ejected spray	identical at all injectors
	Resistance (room temperature) ¹⁾	approx. 14.5 Ω

¹⁾ The resistance of the injectors increases by approx. 4...6 Ω when engine is at operating temperature.

Survey of fitting locations

Models ► 07.97



Parts A and B are not shown in the survey of fitting locations

A - Lambda probe -G39- with lambda probe heater -Z19-

- ◆ Immediately upstream of catalytic converter

B - 4-pin connector

- ◆ For lambda probe and lambda probe heater
- ◆ On right on underside of vehicle looking in direction of travel, below a plastic cap

1 - 3-pin connector

- ◆ For Hall sender -G40-
- ◆ black

2 - Hall sender -G40-

- ◆ Below camshaft sprocket

11 - Engine speed sender -G28-

14 - Injectors -N30- to -N33-

12 - 3-pin connector

15 - Fuel pressure regulator

- ◆ For engine speed sender

- ◆ grey

16 - Solenoid valve 1 for activated charcoal filter -N80-

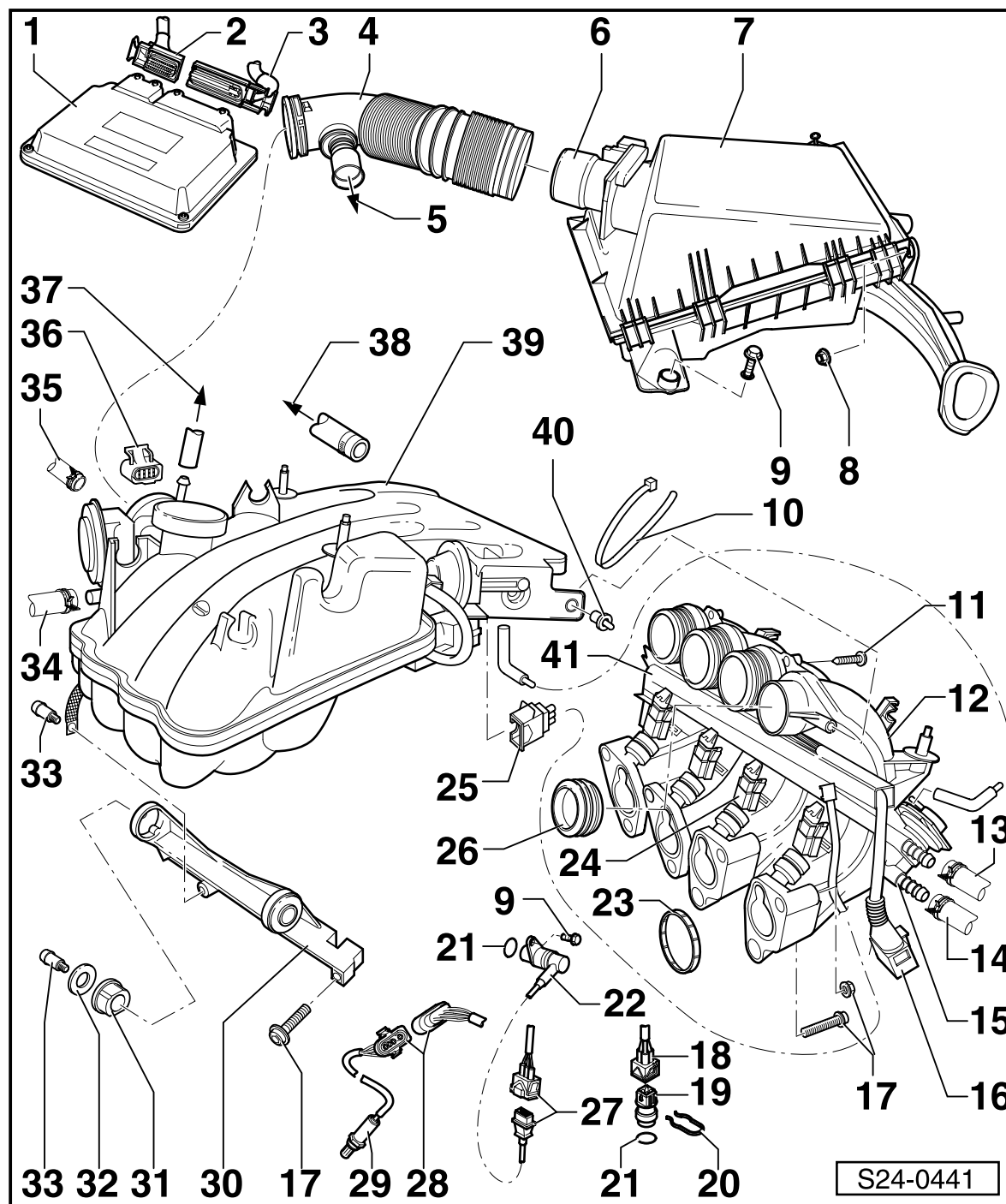
13 - Knock sensor 1 -G61-

-
- | | |
|--|--|
| 4 - 4-pin connector <ul style="list-style-type: none">◆ For lambda probe and lambda probe heater◆ On underside of vehicle on right low cover | 12 - Ignition coils (N and N128) with power output stage (N122) |
| 5 - Variable intake manifold changeover valve (N156) | 13 - Engine speed sender (G28) |
| 6 - Simos 2 fuel injection and ignition system control unit (J361) | 14 - 3-pin connector <ul style="list-style-type: none">◆ For engine speed sender (G28)◆ grey |
| 7 - Throttle valve control unit (J338) | 15 - Knock sensor 1 (G61) |
| 8 - Air mass meter (G70) with intake air temperature sender (G42) | 16 - Injector (N30...N33) |
| 9 - Coolant temperature sender (G62) | 17 - Fuel pressure regulator |
| 10 - Earth connection <ul style="list-style-type: none">◆ At gearbox | 18 - Power-assisted steering pressure switch (F88) |
| 11 - 3-pin connector <ul style="list-style-type: none">◆ For knock sensor 1 (G61) | 19 - Activated charcoal filter |
| | 20 - Solenoid valve 1 for activated charcoal filter (N80) |

Removing and installing parts of fuel injection system

Notes:

- ♦ Removing and installing engine trim panels ⇒ page 24-14.
- ♦ Components marked with * are tested by self-diagnosis ⇒ page 01-4, Interrogating and erasing fault memory.
- ♦ Components marked with ** can be tested by final control diagnosis ⇒ page 01-25.



1 - Simos 2 fuel injection and ignition system control unit (J361)*

- ♦ Fitting location: in plenum chamber
- ♦ Testing voltage supply ⇒ page 24-33
- ♦ Replacing ⇒ page 24-15

2 - Connector, 28-pin

- ♦ Do not unplug or plug in connector unless the ignition switched off
- ♦ Unlock for unplugging

3 - Connector, 52-pin

- ◆ Do not unplug or plug in connector unless the ignition switched off
- ◆ Unlock for unplugging

4 - Intake hose**5 - To oil filler neck****6 - Air mass meter (G70)* and intake air temperature sender (G42)***

- ◆ Up to model year 1997, intake air temperature sender (G42) is a separate component
- ◆ Testing air mass meter ⇒ page 24-28
- ◆ Testing intake air temperature sender ⇒ page 24-34

7 - Air filter

- ◆ Disassembling and assembling ⇒ page 24-13

8 - 6 Nm**9 - 10 Nm****10 - Cable strap**

- ◆ For cable rail item 41

11 - 3 Nm**12 - Bottom part of intake manifold****13 - Feed line**

- ◆ Secure with spring strap clamps
- ◆ From fuel filter:

⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Removing and installing parts of fuel supply system

14 - Return-flow line

- ◆ Secure with spring strap clamps
- ◆ To fuel delivery unit in fuel tank

15 - Fuel rail

- ◆ Disassembling and assembling ⇒ page 24-13

16 - Connector

- ◆ 3-pin
- ◆ Hall sender (G40)

17 - 15 Nm**18 - Connector**

- ◆ 4-pin
- ◆ For coolant temperature sender (G62)
- ◆ Contacts 1 and 3 gold-plated

19 - Coolant temperature sender (G62)*

- ◆ blue
- ◆ For engine control unit
- ◆ With coolant temperature gauge sender (G2)
- ◆ Testing ⇒ page 24-38
- ◆ Release pressure if necessary in cooling system before removing

20 - Split pin

- ◆ Ensure tightly installed

21 - O-ring

- ◆ Replace if damaged

22 - Engine speed sender (G28)*

- ◆ Testing ⇒ page 28-5

23 - Seal

- ◆ Replace

24 - Connector

- ◆ black, 2-pin
- ◆ For injector (N30...N33)

25 - Connector

- ◆ black, 2-pin
- ◆ For variable intake manifold change-over valve (N156)

26 - Seal

If no stops exist on bottom part of intake manifold for correctly positioning seal:

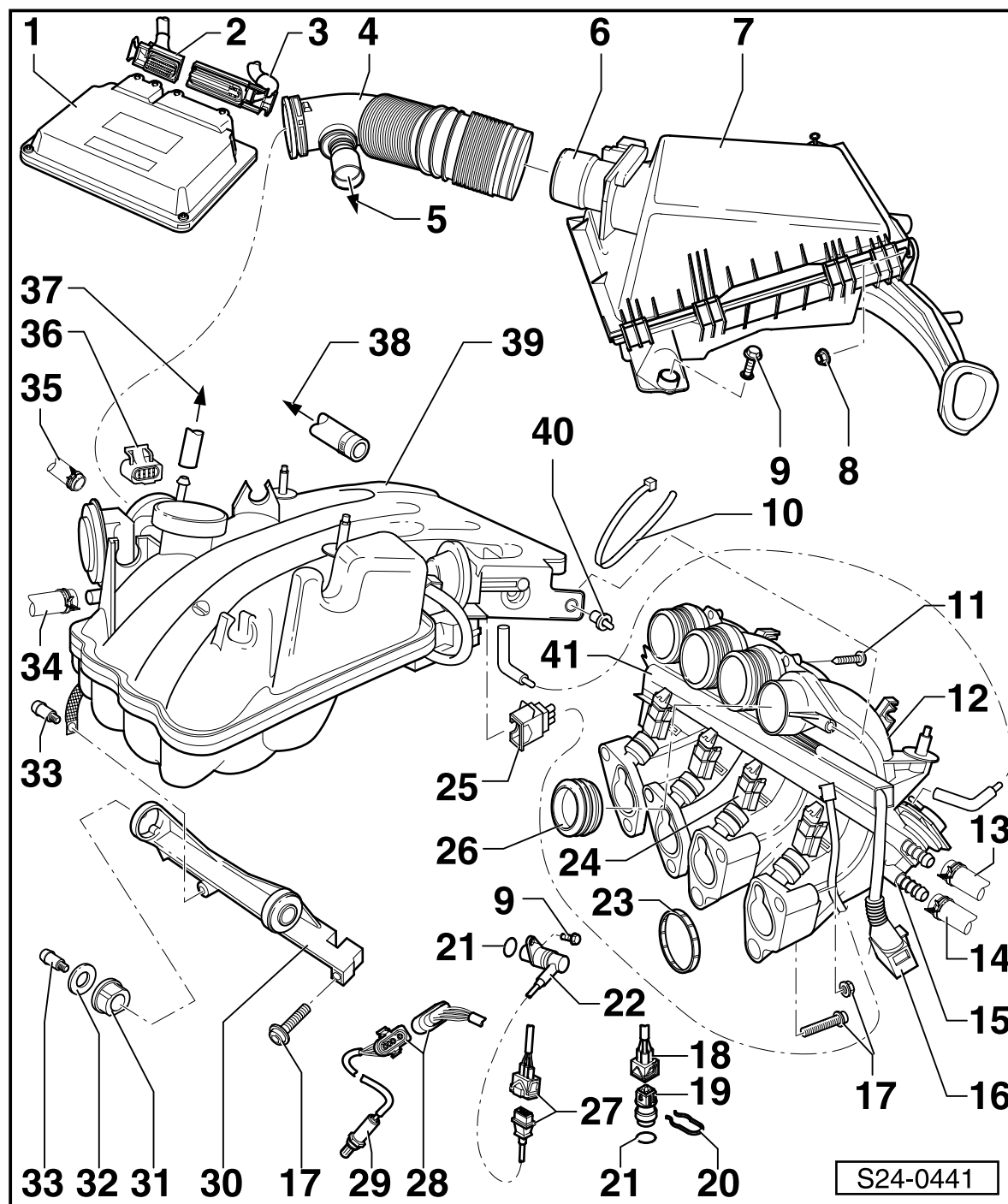
- ◆ Stick seal to bottom part of intake manifold with adhesive D000 801 and hardener D000 802
- ◆ Fitting location: ⇒ page 24-11, Fig. 1

27 - Connector, 3-pin

- ◆ grey
- ◆ For engine speed sender
- ◆ Fitting location ⇒ page 24-3, List of fitting locations

28 - Connector, 4-pin

- ◆ black
- ◆ For lambda probe and lambda probe heater
- ◆ Contacts 3 a and 4 gold-plated
- ◆ Fitting location ⇒ page 24-3, List of fitting locations



29 - Lambda probe (G39)*, 50 Nm

- ◆ Grease thread with „G 052 112 A3“; „G 052 112 A3“ must not get onto slots of probe body
- ◆ Testing lambda control ⇒ page 24-41
- ◆ Voltage of probe heater supplied through fuel pump relay (J17)
- ◆ Testing lambda probe heater ⇒ page 24-47
- ◆ Fitting location ⇒ page 24-3, List of fitting locations

30 - Support

- ◆ Between intake manifold and cylinder head

31 - Rubber bush

32 - Washer

33 - 8 Nm

34 - To heat exchanger

35 - From expansion reservoir

36 - Connector

- ♦ 8-pin
- ♦ Contacts gold-plated
- ♦ For throttle valve control unit (J338)

37 - To activated charcoal filter solenoid valve (N80)*/**

- ♦ Activated charcoal filter system:

⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Removing and installing activated charcoal filter

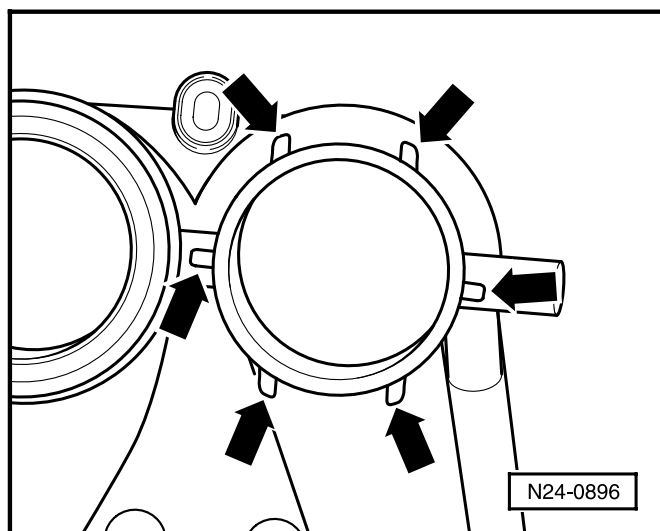
38 - To brake servo unit

39 - Top part of intake manifold

- ♦ With variable intake manifold change-over
- ♦ Disassembling and assembling
⇒ page 24-12

40 - Expanding rivet

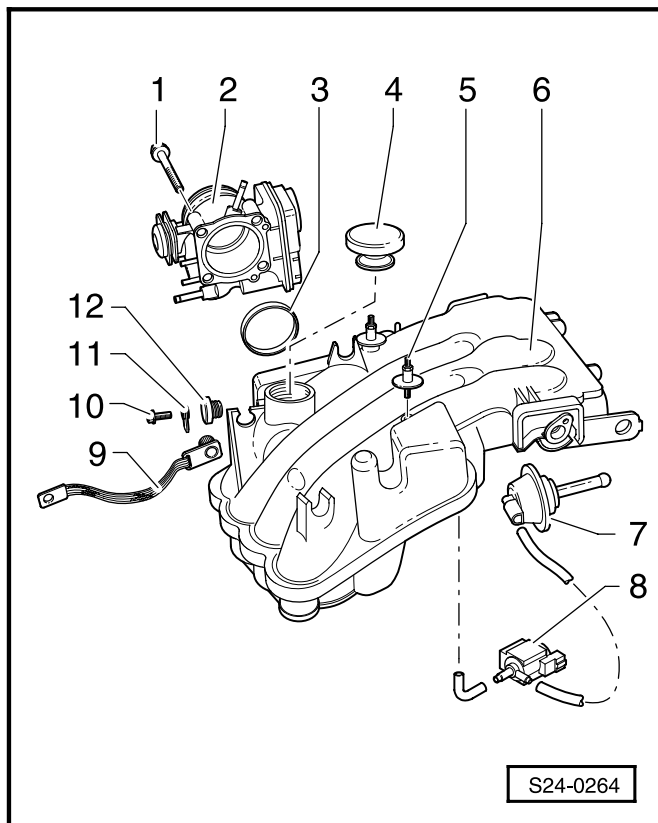
41 - Cable rail



◀ Fig. 1 Fitting location: stops for seal on bottom part of intake manifold -arrows-

If no stops -arrows- are present, the seals must be fixed in place with adhesive D 000 801 and hardener D 000 802 to bottom part of intake manifold.

Disassembling and assembling top part of intake manifold



1 - 8 Nm

2 - Throttle valve control unit (J338)*

- ♦ Testing ⇒ page 24-53
- ♦ If replaced, adapt engine control unit ⇒ page 24-64

3 - Seal

- ♦ Replace if damaged

4 - Gas pressure valve

5 - Threaded insert, 8 Nm

6 - Top part of intake manifold

7 - Vacuum positioning element

- ♦ Testing intake manifold changeover ⇒ page 24-67

8 - Variable intake manifold changeover valve (N156)*/**

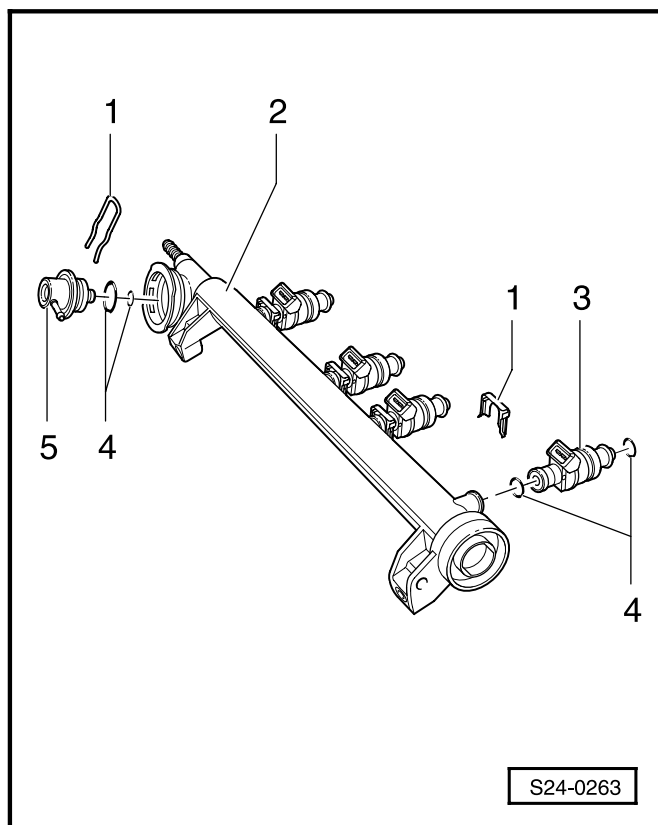
- ♦ Testing intake manifold changeover ⇒ page 24-67

9 - Earth strap

10 - 10 Nm

11 - Cover

12 - Sealing plug



Disassembling and assembling fuel rail

1 - Retaining clamp

- ◆ Ensure correctly located at injector and fuel rail

2 - Fuel rail

3 - Injector (N30...N33)*

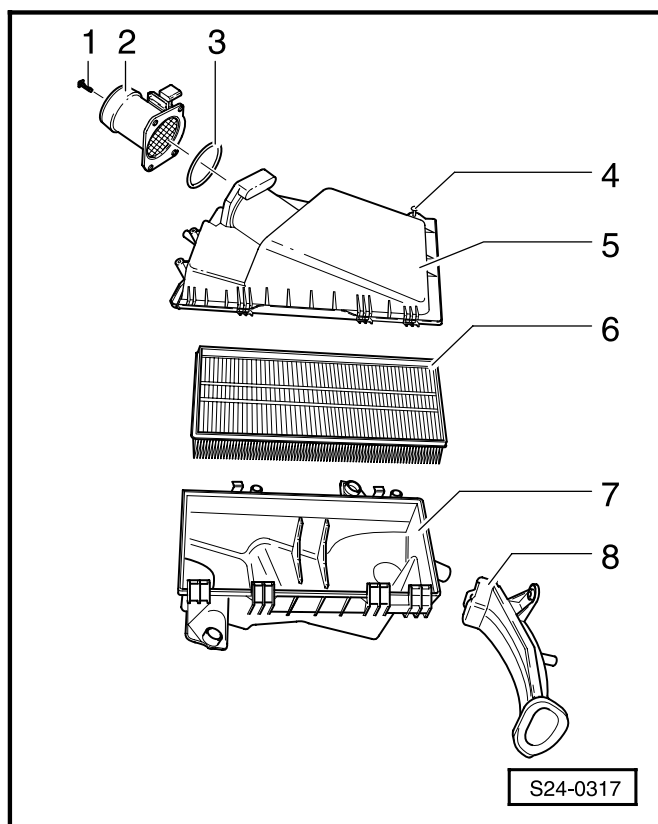
- ◆ Testing ⇒ page 24-21

4 - O-ring

- ◆ Replace if damaged

5 - Fuel pressure regulator

- ◆ Testing ⇒ page 24-18



Disassembling and assembling air filter

1 - 6 Nm

2 - Air mass meter (G70)* with intake air temperature sender (G42)*

- ◆ Up to model year 1997, intake air temperature sender (G42) separate component
- ◆ Contacts of sender and connector gold-plated
- ◆ Testing air mass meter ⇒ page 24-28
- ◆ Testing intake air temperature sender ⇒ page 24-34

3 - Seal

- ◆ Replace if damaged

4 - 6 Nm

5 - Top part of air filter

6 - Filter element

7 - Bottom part of air filter

8 - Air guide

Removing and installing engine trim panels

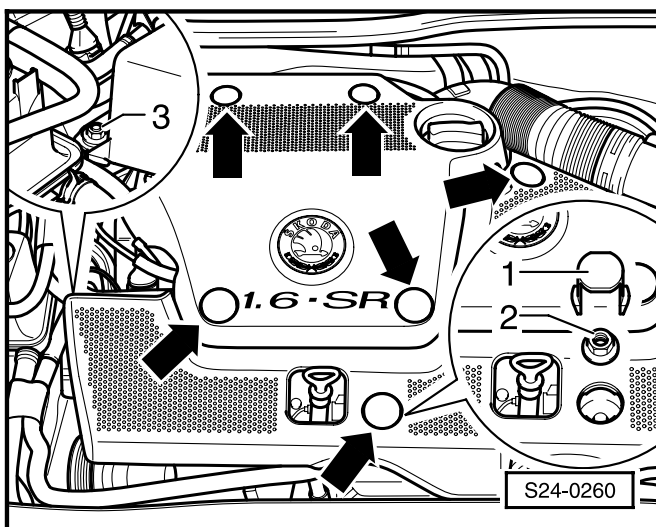
Removing

- ◀ - Lever out the plugs -1- at the points marked with arrows and slacken the nuts -2- attaching the two engine trim panels.
- Slacken the nut -3- and pull engine trim panels up and off.

Installing

Installation is carried out in the reverse order. Pay attention to the following point:

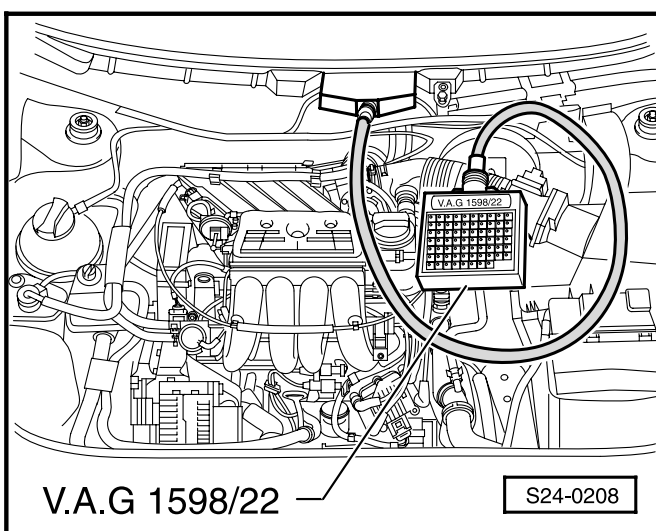
- Tighten nuts attaching engine trim panels to 8 Nm and press in plugs.



Testing wiring and components with test box V.A.G 1598/22

Notes:

- ♦ For the test use e.g. hand-held multimeter V.A.G 1526A or multimeter as well as the diode test lamp, e.g. V.A.G 1527.
- ♦ Use adapter cables from adapter cable set V.A.G 1594A for connecting the testers to the test box.
- ♦ The contact numbers of the connector and the socket numbers of the test box are identical.
- Switch off ignition (if not already off) and unplug connector from the control unit.
- ◀ - Connect test box to the connector of the wiring loom.
- Carry out test as described in the relevant repair procedures.



Warning!

Switch on the relevant measurement range and observe the test conditions before connecting the test cables in order to avoid damaging the electronic components.

Note:

After re-connecting the engine control unit, it is necessary to carry out adaptation of the engine control unit to the throttle valve control unit ⇒ page 24-64.

Replacing engine control unit

Removing

- Switch off the ignition.
- Unscrew the windscreen wiper arms and remove the cover of the plenum chamber.
⇒ General Body Repairs; Repair Group 66; Trim Panels

Note:

Detach the hose for the spray nozzles when taking off the cover.

- ◀ - Use a screwdriver to press the catch of the fixture to the side and pull the engine control unit forward.
- Detach the connector catches and unplug the control unit connectors.

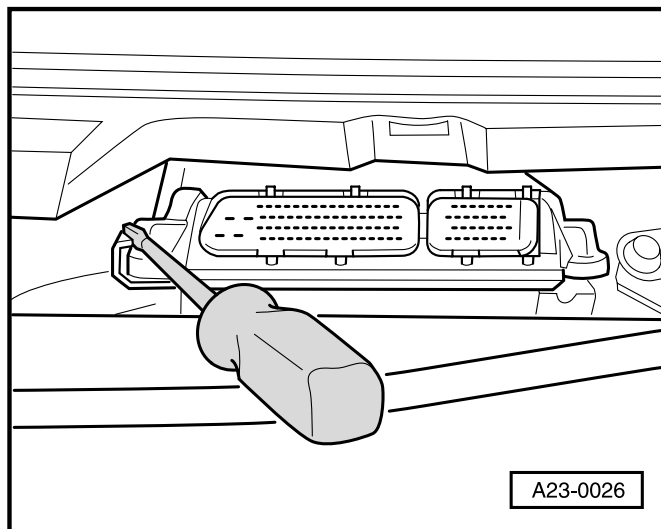
Installing

Installation is carried out in the reverse order.

Important note:

After installing the engine control unit, it is necessary to carry out the following steps:

- Carry out coding of the new engine control unit ⇒ page 01-27.
- Carry out adaptation of throttle valve control unit (J338) ⇒ page 24-64.
- Adapt engine control unit to the immobiliser control unit ⇒ page 24-16.



Adapting engine control unit to immobiliser control unit

Special tools, testers and aids required

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

Test condition

- Authorised vehicle key available
- Connect the vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.
- Switch on the ignition.
- Select address word 17 „Dash panel insert“ and confirm the entry with the key Q.

1U1919034J A+-KOMBIINSTR. VDO X27 →
Coding 02142 WSC xxxxx

◀ Readout in display (example):

- Press the → key.

IMMO-IDENTNR: SK27Z0W0095705 →

◀ Readout in display (example):

- Press the → key.

Test of vehicle systems HELP
Select function XX

◀ Readout in display:

- Select function 10 for „Adaptation“ and confirm the entry with the key Q.

Adaptation
Enter channel number XX

◀ Readout in display:

- Select 00 and confirm the entry with the key Q.

Adaptation Q
Erase learned values?

◀ Readout in display:

- Confirm the entry with the key Q.

Adaptation →
Learned values are erased

◀ Readout in display:

- Complete adaptation by pressing the → key.

Note:

When the ignition is next switched on, the identifier of the engine control unit is entered in the immobiliser control unit.

Testing components and functions

Testing idling speed

Special tools, testers and aids required

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

Test conditions

- No leak in exhaust system.
- Coolant temperature at least 80 °C.
- Throttle valve in idling position.
⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Fuel Supply System; Servicing throttle mechanism.
- Electrical components switched off (radiator fan must not cut in during the test)
- Air conditioning switched off
- Selector lever in P or N (only for automatic gearbox).

Testing idling speed

Notes:

- ◆ *Idling speed cannot be adjusted.*
- ◆ *Idling speed is controlled through the throttle valve control unit by the engine control unit.*
- Interrogate fault memory ⇒ page 01-4. No fault must be stored in the fault memory; rectify any faults and erase fault memory, switch off engine and start again, carry out a road test and once again interrogate fault memory as a check.
- Continue running engine at idling speed.
- Switch off air conditioning.
- Switch off rear window heater.
- Move selector lever into P or N (models with automatic gearbox).

- Select function 08 „Read measured value block“ ⇒ page 01-34.

Read measured value block 1 →			
850g/rpm	90 °C	0.80 V	00000010

◀ Readout in display:

- Read off idling speed in display zone 1.

Specification: ⇒ page 01-30; display group 000

- Press the → key.
- Select function 06 „End output“ and confirm the entry with the key Q.
- If the specification is not achieved, once again interrogate fault memory ⇒ page 01-4.

If the idling speed is too high or too low and no fault is stored in the fault memory, carry out the tests marked below with a dot:

- Test idling switch ⇒ page 24-54.
- Large quantity of unmetered air ⇒ Reading measured value block, display group 003, 008 and 099, respectively.
- Test throttle valve control unit ⇒ page 24-53.

Testing fuel pressure regulator and holding pressure

Special tools, testers and aids required

- ◆ Pressure measuring device, e.g. V.A.G 1318
- ◆ Adapter, e.g. V.A.G 1318/8
- ◆ Adapter, e.g. V.A.G 1318/9
- ◆ Adapter, e.g. V.A.G 1318/17

Test conditions

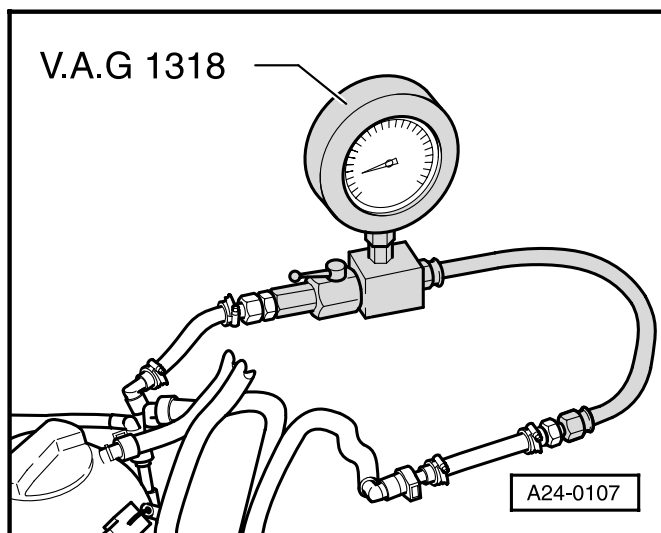
- Fuel pump relay o.k., testing ⇒ page 24-26.
- Fuel pump o.k.
- Fuel filter o.k.
- Battery voltage o.k.

Note:

The fuel pressure regulator regulates the fuel pressure in line with the intake manifold pressure at the throttle valve housing.

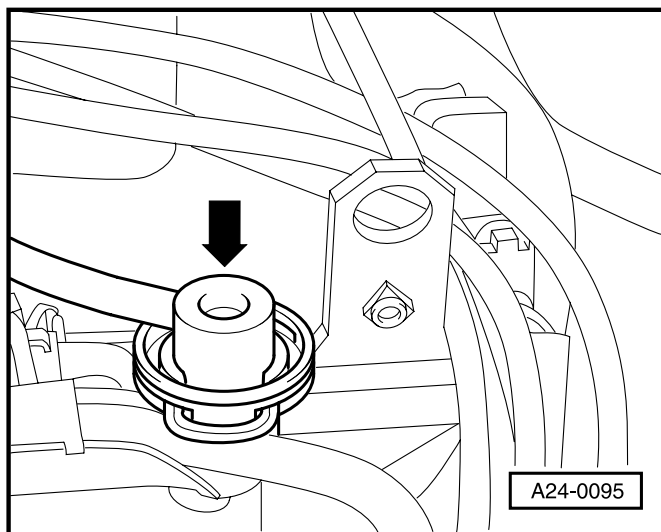
Warning!

The fuel system is pressurised! Place cleaning rags around the connection point before opening the system. Then, release pressure by carefully detaching the connection point.

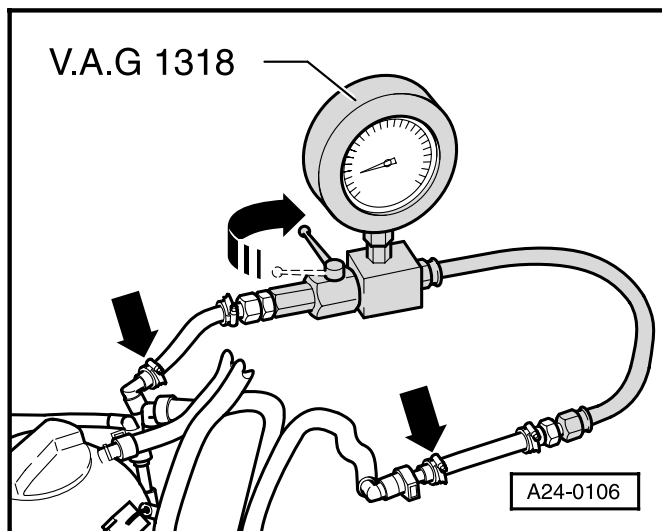


- Detach the fuel feed hose (with white marking) from the feed pipe.
- Connect the pressure measuring device V.A.G 1318 to the feed pipe with the adapters 1318/8, 1318/9 and 1318/17.
- ◀ - Open the shut-off cock of the pressure measuring device. The lever points in direction of flow.
- Leave the engine on and running at idling speed.
- Measure the fuel pressure.

Specification: approx. 2.5 bar (0.25 MPa)



- ◀ - Detach the vacuum hose from the fuel pressure regulator. The fuel pressure should rise to approx. 3.0 bar (0.30 MPa).
- Switch the ignition off.
- Check for leaks and check holding pressure by observing the pressure drop at the gauge. A pressure of at least 1.5 bar (0.15 MPa) should still exist after 10 minutes.

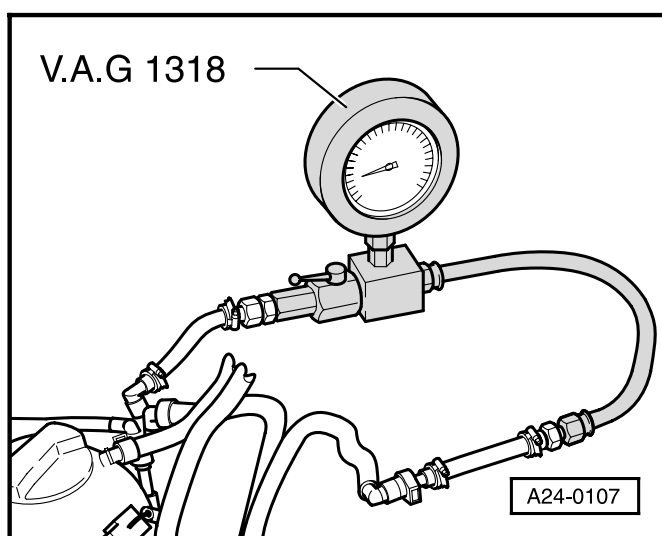


If the pressure drops below 1.5 bar (0.15 MPa):

- Start engine and run at idling speed.
- ◀ - After pressure has been built up, switch the ignition off. At the same time, close the shut-off cock at the pressure measuring device V.A.G 1318 (lever at right angles to direction of flow).
- Observe pressure drop on gauge.

If the pressure again drops:

- Inspect check valve of fuel pump.



If the pressure does not drop:

- ◀ - Open shut-off cock of pressure measuring device V.A.G 1318 (lever in direction of flow).
- Start engine and run at idling speed.
- After the pressure has built up, switch the ignition off. At the same time, compress the return-flow hose (blue marking).

If the pressure does not drop:

- Replace fuel pressure regulator.

If the pressure again drops:

- Inspect line connections, O-rings at fuel rail and injectors for leaks.
- Inspect pressure measuring device for leaks.

Note:

Before detaching the pressure measuring device, release fuel pressure by opening shut-off cock; place cleaning cloth around connection point for this step.

Testing injectors

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/18
- ◆ Current flow diagram

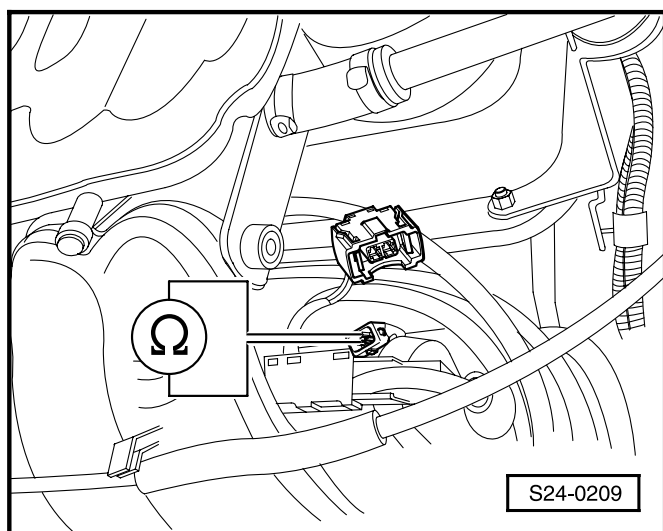
A - Electrical test of injectors

- Remove the fuel rail ⇒ page 24-23.
- Unplug the connector at the injector to be tested.
- ◀ - Use multimeter to carry out a resistance measurement between the contacts of the injector.

Specification: approx. 14.5 Ω .

When engine is at operating temperature, the resistance is increased by about 4...6 Ω .

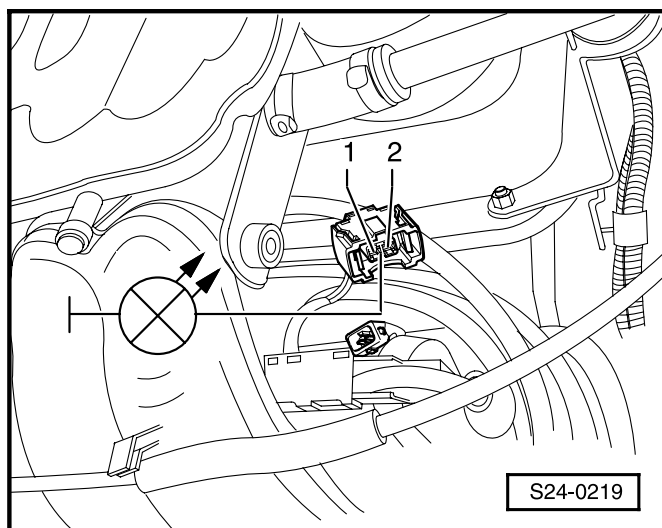
- If the specification is not achieved, replace injector.



B - Testing voltage supply

Test condition

- Fuel pump relay o.k., testing ⇒ page 24-26.
- Fuse for injectors o.k.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



- Unplug connector at the injector to be tested.
- ◀ - Connect diode test lamp between contact 1 of the connector and engine earth.

Note:

Unplug the connector at the ignition module to prevent the engine starting.

- Operate starter for a few seconds; the diode test lamp should come on.
- If the diode test lamp does not come on, test cable connection from contact 1 to fuse for injectors for continuity and rectify any open circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

- If the diode test lamp comes on, test the actuation of the injectors.

C - Testing actuation of the injectors

- Unplug the connector at the injector to be tested.
- ◀ - Connect diode test lamp between contact 2 of the connector and battery positive (+).
- Operate starter for a few seconds.

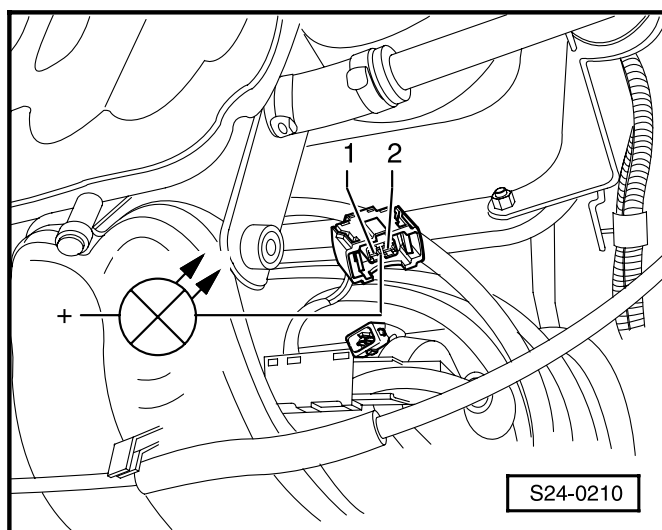
Specification: diode test lamp should flash.

Note:

Diode test lamps with a low current consumption do not go out completely between the actuations of the engine control unit but continue to glow a little and become significantly brighter during actuation of the injector.

If the diode test lamp does not flash

- Connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Test cable connection between contact 2 of the connector of the relevant injector and the engine control unit for continuity and short circuit to positive.



Contact 2 at connector of injectors	Test box V.A.G 1598/22
1	73
2	80
3	58
4	65

- Rectify any open circuit in the wiring or short circuit.
- If there is no fault in the cable connection, replace engine control unit ⇒ page 24-15.

Testing injected quantity, leaktightness and spray pattern of the injectors

Special tools, testers and aids required

- ◆ Remote control V.A.G 1348/3 A
- ◆ Adapter cable V.A.G 1348/3-2
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Measuring glasses, e.g. V.A.G 1602

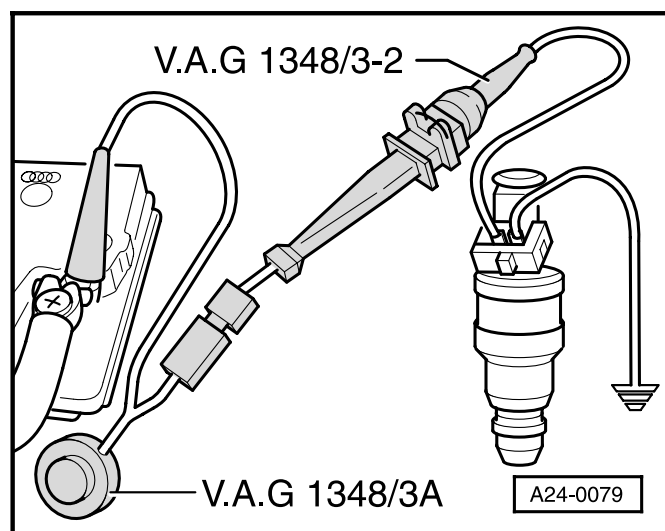
Test requirement

- Fuel pressure o.k., testing ⇒ page 24-18.
- Detach vacuum hose from the fuel pressure regulator.
- Slacken fuel feed line and return-flow line at the quick-locks.

Warning!

The fuel system is pressurised.

- Detach the hose connecting the activated charcoal solenoid valve to the throttle valve control unit at the valve and also at the control unit, and hang it out at intake manifold.



- Unplug connector from intake manifold changeover valve and from Hall sender.
- Unplug spark plug connectors for cylinders two and three.
- Unbolt fuel rail from intake manifold and carefully detach it from the intake manifold together with the injectors.
- Unclip wiring loom from cable guide and remove.
- Carefully pull out fuel rail together with the injectors, fuel feed line and return-flow line as well as activated charcoal filter hose to the right below the intake manifold (away toward activated charcoal filter) and fit the fuel feed line and return-flow line on again (blue marking).
- Insert injector to be tested into a measuring glass, e.g. V.A.G 1602.
- ◀ - Connect one contact of the injector to engine earth using test cable and crocodile clamp from the adapter cable set V.A.G 1594.
- Connect second contact of the injector to battery positive using remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable.
- Initiate final control diagnosis and select activated charcoal filter solenoid valve -N80- ⇒ page 01-25. The fuel pump runs for about 50 s.
- Inspect injectors for leaks (visual inspection). When the fuel pump is running, only 1 to 2 drops may flow out at each injector (during 50 s).
- If the fuel loss is greater, switch off fuel pump (end final control diagnosis) and replace faulty injector.
- Once again initiate final control diagnosis and select activated charcoal filter solenoid valve -N80-.

Note:

Final control diagnosis cannot be initiated again until after the ignition has been switched off for a short time.

- Immediately after selecting the ACF valve (the fuel pump is switched on for about 50 s), operate remote control V.A.G 1348/3 A for 30 seconds.
- Carry out measurement with all the injectors (once again initiate final control diagnosis).
- After all four injectors have been actuated, place the measuring glasses on a flat surface.

Specification: 85...105 ml.

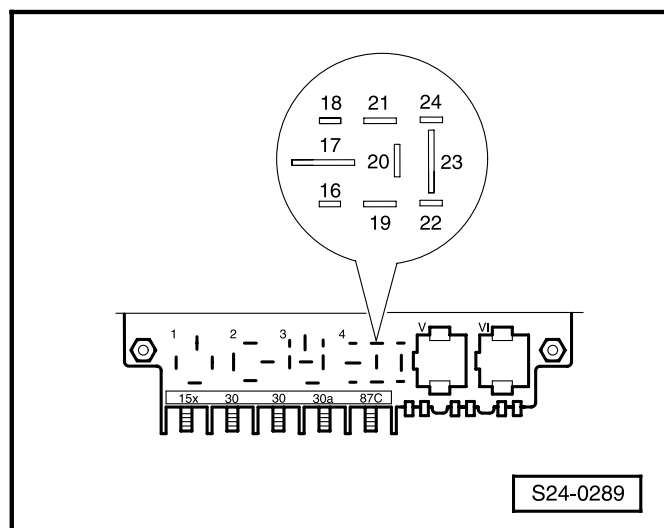
- If the measurement obtained for one or several injectors is not within the tolerance, switch off fuel pump (end final control diagnosis) and replace the faulty injector.
- If the measurements obtained for all the injectors are not within the tolerance, test fuel pressure ⇒ page 24-18.

Note:

When testing the quantity of fuel injected, the spray pattern should also be checked. The spray ejected should be identical at all the injectors.

Installation of the fuel rail with the injectors is carried out in the reverse order of removal. Pay attention to the following points:

- Replace O-rings at all the opened connection points (the plastic cap must on no account be removed from the injector head for replacing the front O-ring - lift the O-ring over the plastic cap).
- Moisten O-rings with clean engine oil.
- Ensure the injectors are correctly installed.
- Ensure the retaining clips are properly located.



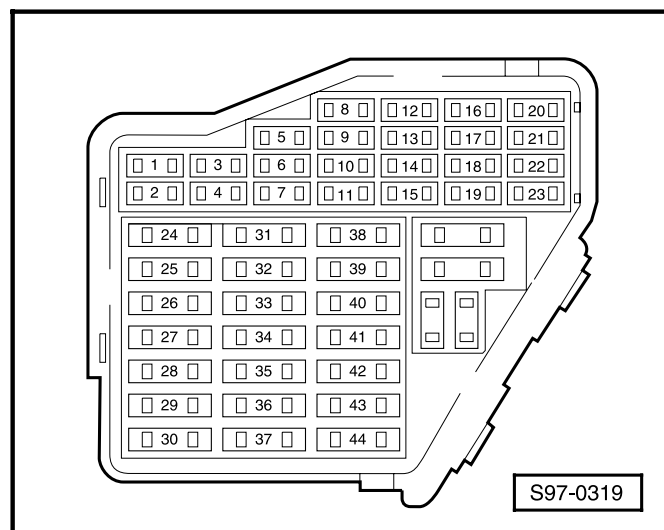
Testing fuel pump relay and actuation

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Note:

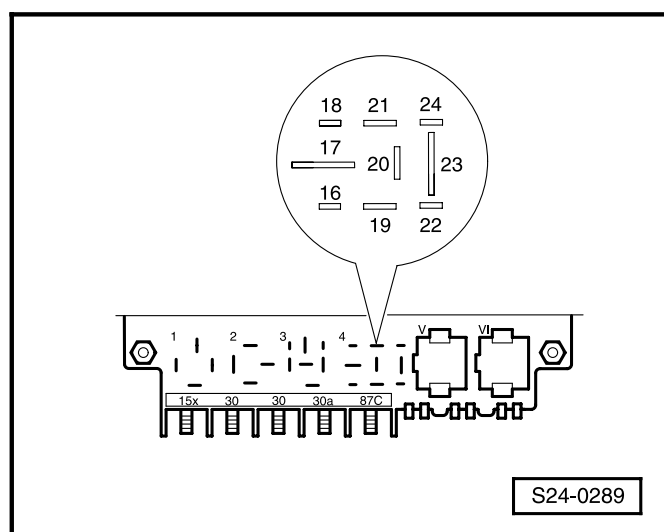
- ◀ The fuel pump relay is located in the electrical centre in the left footwell, relay position 4.



A - Testing fuel pump relay -J17-

- Remove the stowage compartment in the front left footwell.
- ◀ - Pull out fuse for the fuel pump (fuse 28) at the fuse holder and connect diode test lamp V.A.G 1527 between earth and one of the two contacts of the fuse for the fuel pump.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- Briefly operate the starter.

The fuel pump relay should operate (can be heard and felt), diode test lamp should come on.



- If the fuel pump relay does not operate, test actuation ⇒ page 24-27.
- If the diode test lamp does not come on although the fuel pump relay operates, repeat test at the other contact.
- ◀ - If the diode test lamp again does not come on, test cable connection between contact 23 at relay position 4 and the fuse for the fuel pump for continuity and rectify any open circuit.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If the voltage supply, the actuation and the cable connections of the fuel pump relay are o.k., replace fuel pump relay.

B - Testing voltage supply and actuation of the fuel pump relay

Note:

Actuation of the fuel pump relay can also be tested with the final control diagnosis ⇒ page 01-25.

- Remove the fuel pump relay -J17- from the central electrics, relay position 4.

Testing voltage supply

- Switch on the ignition.
- Connect the hand-held multimeter V.A.G 1526 A in turn to contacts 19 (positive, terminal 15 of ignition lock) of the relay base and earth, as well as 17 (continuous positive, terminal 30 of battery) of the relay base and earth.

Specification: approx. battery voltage in each case

- If the specifications are not achieved, rectify open circuit in wiring.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

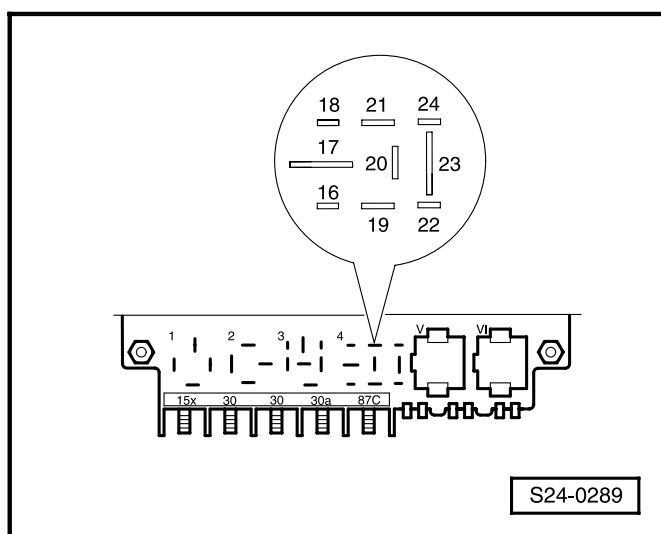
Testing actuation

- ◀ - Connect the diode test lamp V.A.G 1527 to contact 16 of the relay base (earth actuation from engine control unit) and to positive.
- Briefly operate the starter.
- The diode test lamp should come on and remain on when the starter is operated.

Note:

Diode test lamps with a low current consumption do not go out completely but continue to glow a little until the starter is operated.

- If the actuation of the fuel pump relay as well as the cable connection and the voltage supply are o.k., but the fuel pump relay still does not operate, replace fuel pump relay.



If the diode test lamp does not come on, test the wiring as follows:

- Connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Connect the hand-held multimeter between contact 16 of the relay base and circuit 4 of the test box and test the cable connection for continuity.
- Rectify any open circuit in the wiring.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If no open circuit is present and if the diode test lamp does not come on, replace engine control unit ⇒ page 24-15.
- Re-insert the fuse for the fuel pump.

Testing air mass meter (G70)

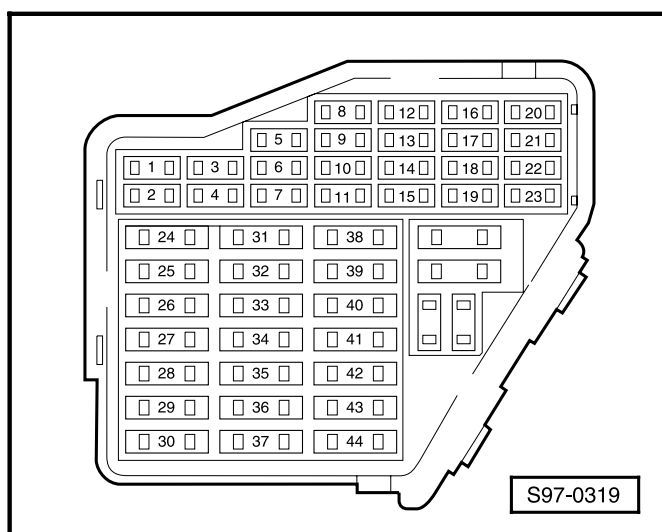
Special tools, testers and aids required

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

Testing operation

Test conditions

- Fuse 43 o.k.
- Coolant temperature at least 80 °C
- All electrical components, such as lights and rear window heater, switched off
- If vehicle is equipped with air conditioning, AC must be switched off



Read measured value block 1 →			
860 g/rpm	90 °C	0.80 V	0000010

- On models fitted with automatic gearbox, selector lever must be in position „P“ or „N“
- Vehicle stationary, engine idling
- Select function 08 „Read measured value block“ and display group 001 ⇒ page 01-35.

◀ Readout in display:

- Check whether the coolant temperature shown in display zone 2 is more than 80 °C.
- Switch to display group 2 by pressing the ↑ key:

Read measured value block 2 →			
850 g/rpm	120 mg/H	0 km/h	0100

◀ Readout in display:

The inducted air mass is indicated in display zone 2 (mg/H).

Specification: 76...164 mg/H

- If the specifications are not achieved or if a fault relating to the air mass meter is stored in the fault memory, test the voltage supply of the air mass meter ⇒ page 24-29.

Testing voltage supply of air mass meter - models ► 07.97

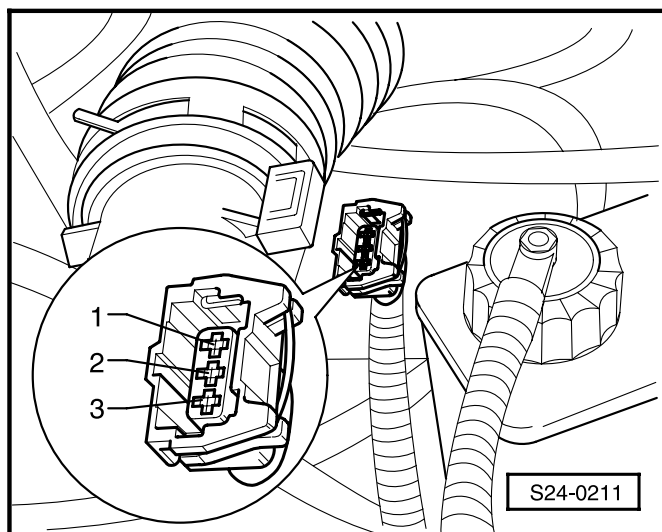
- ◀ - Unplug the connector from -G70- and connect hand-held multimeter between contact 3 of the connector and engine earth.
- Start the engine and run at idling speed.

Specification: 11...15 V

- Switch the ignition off.
- If the voltage supply is o.k., test the signal wire and earth cable ⇒ page 24-30.

If no voltage is present:

- Test the cable connection from contact 3 of connector to fuse 43 for open circuit or short circuit to earth; repair cable connection if necessary.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



- If the fuse and cable are o.k. but no voltage is present, test the fuel pump relay ⇒ page 24-26.

Testing signal wire and earth cable for sender - models ► 07.97

- Connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.
- Test the cable connection from the connector at air mass meter to the engine control unit for open circuit and for short circuit to positive and earth.

Connector for air mass meter G70	Test box V.A.G 1598/22
1	13
2	12

- If the cable connection is o.k., replace the air mass meter (G70).

Testing voltage supply for sender - models 08.97 ►

- ◀ - Unplug the connector -1- from the air mass meter -2- and connect hand-held multimeter between contact 3 of the connector and engine earth.

- Start the engine and run at idling speed.

Specification: 11...15 V

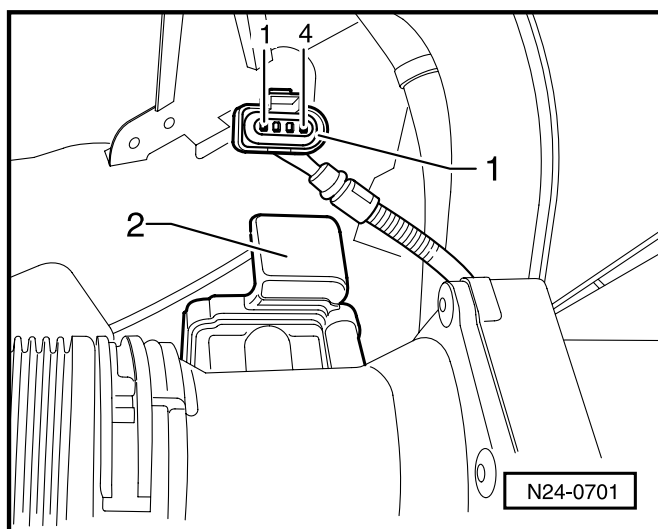
- Switch the ignition off.
- If the voltage supply is o.k., test the signal wire and earth cable ⇒ page 24-31.

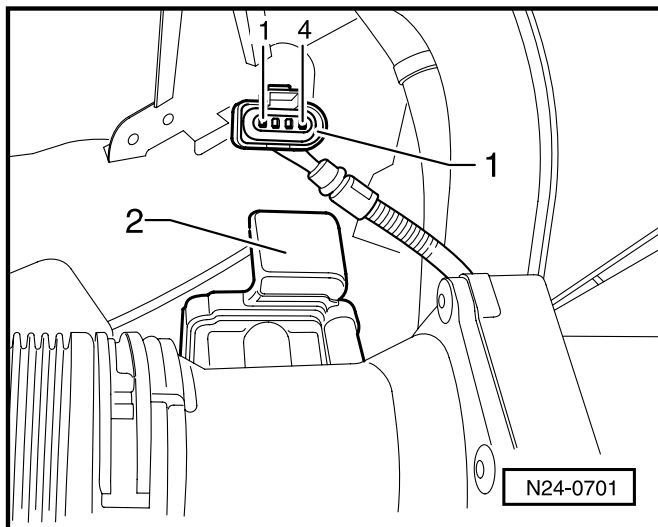
If no voltage is present:

- Test the cable connection from contact 3 of the connector to the fuse 43 for open circuit and for short circuit to earth; repair cable connection if necessary.

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

- If the fuse and cable are o.k. but no voltage is present, test the fuel pump relay ⇒ page 24-26.



Testing signal wire and earth cable - models 08.97 ➤

- Connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.
- ◀ - Test the wiring between test box and 4-pin connector for open circuit as specified in the current flow diagram.
Cable resistance: max. 1.5 Ω

Connector for air mass meter G70	Test box V.A.G 1598/22
1	13
2	12

- In addition, test all the wiring for short circuit to each other.

Specification: $\infty \Omega$

If no fault is found in the wiring:

- Replace air mass meter (G70) with intake air temperature sender (G42) ⇒ page 24-9, item 6.

Testing intake system for leaks (unmetered air)

Special tools, testers and aids required

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

Test with engine leak detection spray G 001 800 A1

Notes:

- ◆ *As a result of the vacuum in the intake system, the leak detection spray is drawn in with the unmetered air. The leak detection spray reduces the ignition properties of the mixture. This results in a drop in engine speed and a steep rise in the CO concentration.*
- ◆ *It is essential to observe the safety precautions stated on the can.*
- Select function 08 „Read measured value block“ and display group number 001.

Read measured value block 1 →			
850 g/rpm	90 °C	0.05 V	0000010

◀ Readout in display:

- Note the engine speed in display zone 1.
- Note the lambda probe voltage shown in display zone 3 and the range within which it varies.
- Spray the parts of the intake system systematically with engine leak detection spray.

If there is no change in engine speed or in the lambda probe voltage:

- Press the → key.
- Select function 06 „End output“ and confirm the entry with the key Q.

If engine speed drops or if there is a change in the lambda probe voltage:

- Press the → key.
- Select function 06 „End output“ and confirm the entry with the key Q.
- Inspect the sprayed point of the intake system for leaks and rectify any fault.

Testing voltage supply for control unit

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Test box V.A.G 1598/22

Note:

For testing the voltage supply of the engine control unit ⇒ also Reading measured value block, display group 005, display zone 2.

Test requirements:

- Fuse for engine control unit o.k.
- Battery voltage at least 11 V
- Alternator o.k.
- Connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.
- Switch the ignition on.
- Connect the multimeter to socket 1 (positive through ignition) and to earth.

Specification: approx. battery voltage

- If the specification is not achieved, test the cable connection from contact 1 at the control unit connector to the fuse for open circuit as specified in current flow diagram, and repair if necessary.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If the specification is not achieved, connect multimeter to socket 1 of the control unit connector (positive through ignition) and socket 2 of the control unit connector (earth supply for engine control unit).

Specification: approx. battery voltage

- If the specification is not achieved, test the cable connection from contact 2 at the control unit connector to earth for open circuit, and rectify any open circuit.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

- Connect multimeter to socket 3 (continuous positive) and to earth.

Specification: approx. battery voltage

- If the specification is not achieved, test the cable connection from contact 3 at the control unit connector and the electrical centre for continuity as specified in current flow diagram, and rectify any open circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing intake air temperature sender

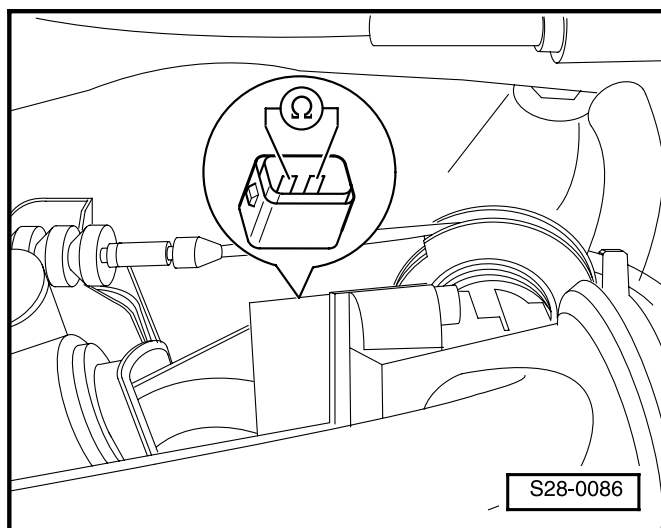
Models ► 07.97

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Notes:

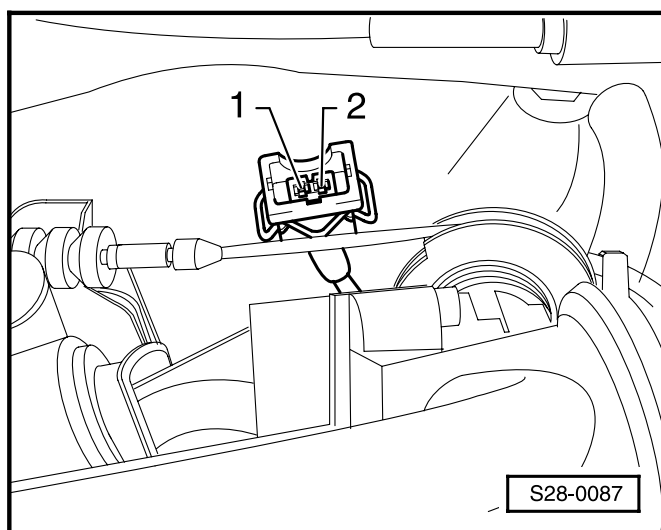
- ◆ *For the operational test of the intake air temperature sender ⇒ also Reading measured value block, display group 005, display zone 4.*
- ◆ *Fitting location of intake air temperature sender ⇒ page 24-4.*
- ◆ *Engine cooled down to room temperature (approx. 20 °C).*



- Unplug the connector from the intake air temperature sender.
- ◀ - Connect the ohmmeter to the intake air temperature sender.

Temperature °C	Resistance kΩ
-20	approx. 13.8
0	approx. 5.5
20	approx. 2.4
40	approx. 1.1
60	approx. 0.6

- If the specification is not achieved, replace the intake air temperature sender.
- If the specification is achieved, test the wiring between sender socket and engine control unit as follows:
- Connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.



- ◀ - Test the cable connection from the 2-pin connector for the intake air temperature sender to the engine control unit for open circuit in wiring and also for short circuit to positive and to earth as specified in the current flow diagram.

Contact at 2-pin connector	Test box V.A.G 1598/22
1	54
2	67

Specification: max. 1.5 Ω

- If the tests so far have not revealed any fault, replace the engine control unit ⇒ page 24-15.

Models 08.97 ➤**Special tools, testers and aids required**

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Refrigerant spray (commercially available)

Test procedure

- Connect vehicle system tester V.A.G 1552 and select the address word 01 „Engine electronics“. The ignition must be switched on for this step.
- Select the function 08 „Read measured value block“ and display group number 005.

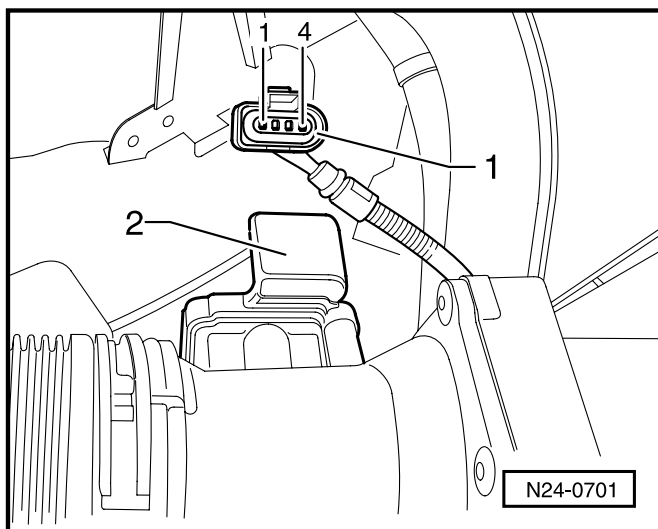
Operational test of sender:

Read measured value block	5	→
0 rpm 12 V 90 °C		53 °C

◀ Read off the intake air temperature in display zone 4:

Readout	Cause	Continue test
60 °C	Open circuit or short circuit to positive	⇒ page 24-37
	Short circuit to earth	
approx. ambient temperature ¹⁾	—	⇒ page 24-38

- ¹⁾ If a temperature which differs greatly from the ambient temperature of the sender is displayed, test the sender cables for contact resistance.

**Continuation of test:**

- Switch the ignition off.
- Connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.
- ◀ - Unplug the 4-pin connector -1- from the air mass meter -2-.
- Test the wiring between the test box and the 4-pin connector for open circuit as specified in current flow diagram.
Cable resistance: max. 1.5 Ω

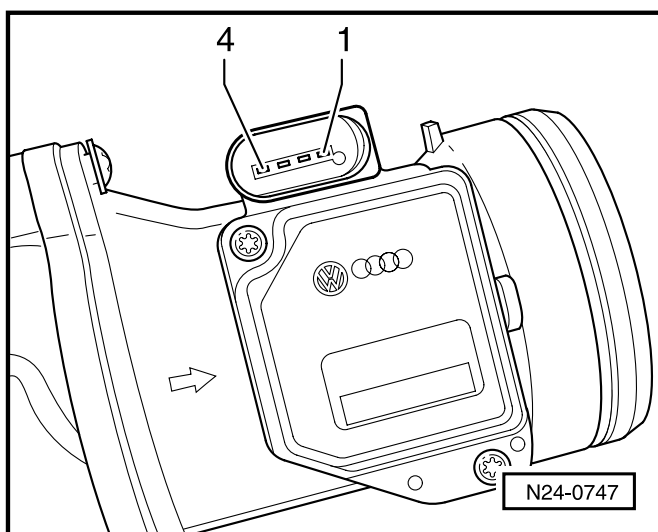
Connector at intake air temperature sender	Test box V.A.G 1598/22
2	12
4	9

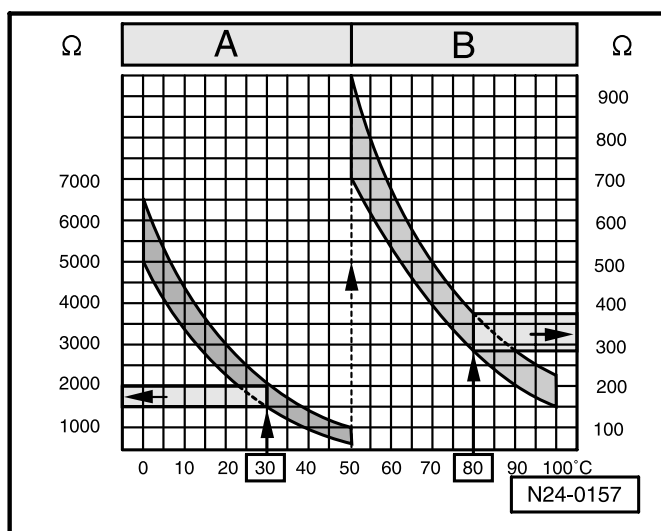
- In addition, test the wiring for short circuit to each other.

Specification: $\infty \Omega$

If no fault is found in the wiring:

- ◀ - Test the resistance between contacts 2 + 4 of the sender.





◀ The range A shows the resistances for the temperature range from 0...50 °C, range B the resistances for the temperature range from 50...100 °C.

How to read the chart:

- ◆ 30 °C equals a resistance of 1500...2000 Ω
- ◆ 80 °C equals a resistance of 275...375 Ω

If the specification is not achieved:

- Replace the air mass meter (G70) with intake air temperature sender (G42) ⇒ page 24-9, item 6.

Continuation of test if readout is ambient temperature:

- Remove the intake hose between air mass meter and throttle valve control unit.
- Note the intake air temperature shown in display zone 4.
- ◀ - Spray the sender -arrow- with commercially available refrigerant spray and observe the temperature readout. The temperature must drop.
- Press the → key.
- Select function 06 „End output“ and confirm the entry with the key Q.

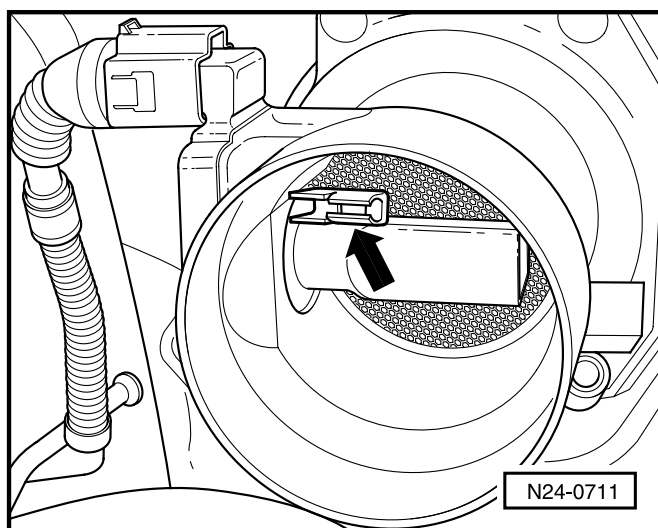
Testing coolant temperature sender (G62)

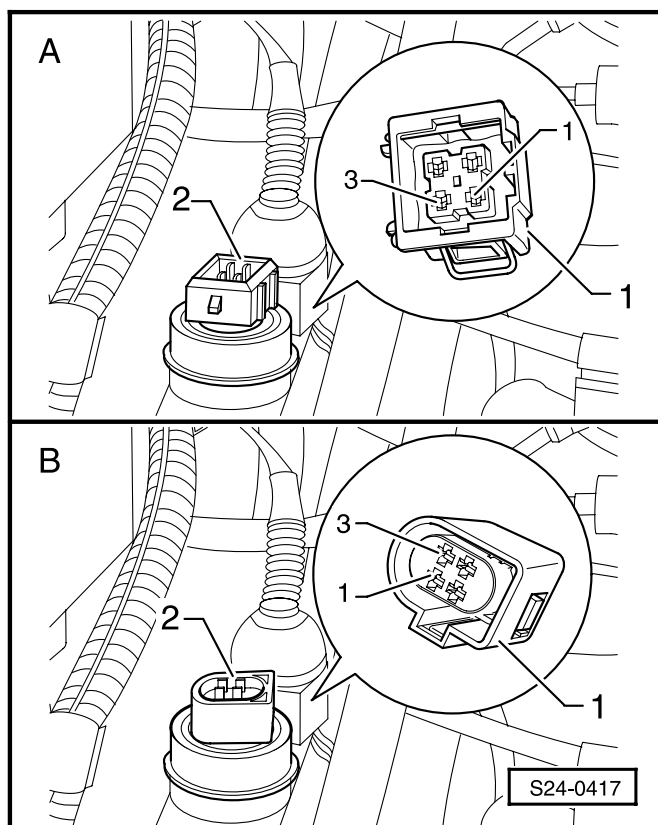
Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Notes:

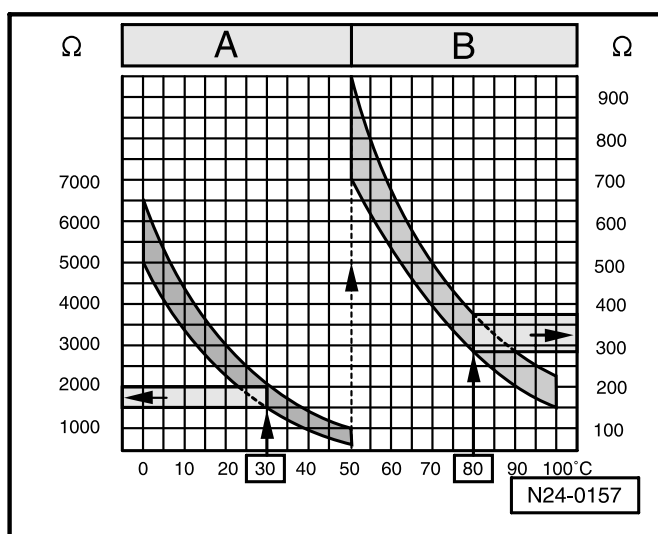
- ◆ For the operational test of the coolant temperature sender ⇒ also Reading measured value block, display group 001, display zone 2.
- ◆ Fitting location of coolant temperature sender ⇒ page 24-4.





- Unplug the connector at the coolant temperature sender.

◀ - Test the resistance between contact 1 (earth) and 3 (signal) of the sender.



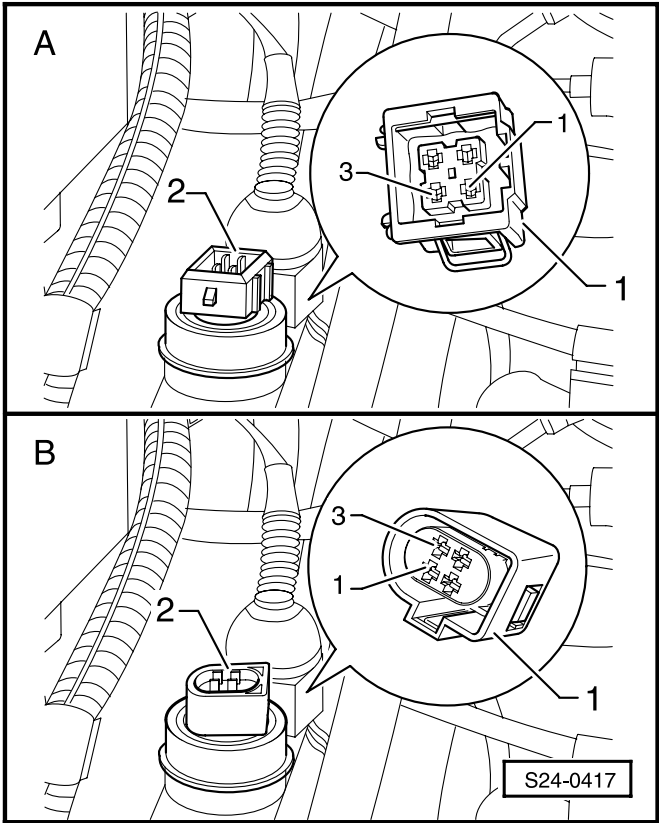
◀ Range A indicates the resistances for the temperature range 0...50 $^{\circ}\text{C}$, range B the resistances for the temperature range 50...100 $^{\circ}\text{C}$.

How to read the chart:

- ◆ 30 $^{\circ}\text{C}$ equals a resistance of 1500...2000 Ω
- ◆ 80 $^{\circ}\text{C}$ equals a resistance of 275...375 Ω
- If the specification is not achieved, replace the sender.

If the specification is achieved, test the wiring from the sender to the engine control unit as follows:

- Connect test box V.A.G 1598/22 to the engine control unit wiring loom $\Rightarrow$ page 24-14.



- ◀ - Test the wiring for short open circuit and also, if necessary, for short circuit.

Models ▶ 07.97 (Fig. A)

Contact at 4-pin connector	Test box V.A.G 1598/22
1	67
3	53

◀ Models 08.97 ▶ (Fig. B)

Contact at 4-pin connector	Test box V.A.G 1598/22
1	70
3	53

- If there is neither a short circuit nor an open circuit in the wiring and the coolant temperature sender is operating properly, replace the engine control unit ⇒ page 24-15.

Testing lambda control

The lambda probe compares the oxygen content of the air with the residual oxygen in the exhaust and supplies a voltage signal to the control unit.

The voltage signal „rich mixture (low level of residual oxygen)“ is at about 0.7...1.0 V.

The voltage signal „lean mixture (high level of residual oxygen)“ is at about 0.0...+0.3 V.

A voltage jump from 0.7...1.0 V to 0.0...+0.3 V and vice versa takes place at the transition from „rich“ to „lean“ and vice versa, respectively ($\lambda = 1.0$).

In view of this steep voltage jump, the lambda control is not able to hold the ideal mixture composition constant, which corresponds to $\lambda = 1.0$. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.

The lambda control (also known as lambda controller) consists of the actual lambda probe and special software which is stored in the engine control unit.

The engine control unit analyses the signal supplied by the lambda probe to determine values for other actuators, e.g. the throttle valve unit.

If there is no change to the voltage, or if this occurs only sluggishly, the following faults may exist:

- ◆ *Slots or holes in probe head blocked.*
- ◆ *Probe has been subjected to excessive thermal stresses.*
- ◆ *Contact resistance in signal wire or in earth wire.*
- ◆ *Probe too cold, probe heater not operating.*
- ◆ *Lambda control switched off (control unit has detected a fault at the fuel injection system $\Rightarrow$ Interrogating fault memory and also Reading measured value block, display group 099).*
- ◆ *Probe damaged by contact spray or similar products (because of the thermal fluctuations and the capillary effect, the contact spray is drawn through the fine cavities in the electric wires into the probe).*
- ◆ *Probe damaged by silicone vapours (sealing products containing silicone were used and, as a result, traces of silicone elements have been inducted by the engine. These silicone elements are not combusted and damage the lambda probe).*

Irregularities in engine running after cold start

Special tools, testers and aids required

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

Test condition

- No fault regarding lambda control stored; rectify any fault and erase fault memory.

The time which elapses until the control is activated (required probe temperature about 300 °C), is determined primarily by the following factors:

- ◆ Ambient temperature (summer/winter)
- ◆ Operating conditions after start
- ◆ Operation of the probe heater

If faults occur after a cold start, it is then necessary to check whether the problem occurs before or only after the lambda control is activated.

Test vehicle under cold start conditions:

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The engine should be idling for this step.
- Select function 08 „Read measured value block“ and display group number 099 ⇒ page 01-47.

Read measured value block 99			→
850 rpm	90 °C	+25%	00010111

◀ The status of the lambda closed-loop control is shown in display zone 4:

Meaning of the 8-digit numerical block in display zone 4 (⇒ also page 01-47):

Display zone 4	Meaning of readout
1XXXXXXX	Diagnosis fault entered in fault memory
X1XXXXXX	not assigned
XX1XXXXX	not assigned
XXX1XXXX	Limited dynamics active
XXXX1XXX	Lambda controller at stop
XXXXX1XX	Lambda controller switched on
XXXXXX1X	Lambda probe operational
XXXXXXX1	Status of mixture; if readout = 1: rich mixture if readout = 0: lean mixture

With cold start:

Read measured value block 99	→
850 rpm 30 °C +25%	00010001

◀ Readout in display:

Notes:

- ◆ The lambda probe is not yet operational immediately after a cold start (temperature of probe too low).
- ◆ The lambda controller is activated once the lambda probe is operational.
- Carry out a road test and observe display zone 4.

Warning!

V.A.G 1552 should be operated by a 2nd person.

Read measured value block 99	→
850 rpm 90 °C +25%	00010111

◀ Once the lambda control is activated, the lambda probe should be operational and the lambda controller switched on.

The readout for the status of the mixture (position on far right of 8-digit numerical block) should fluctuate constantly back and forward between „0“ and „1“.

A „1“ at the position for the status of the mixture indicates a rich mixture composition (low level of residual oxygen in exhaust).

A „0“ at the position for the status of the mixture indicates a lean mixture composition (high level of residual oxygen in exhaust).

- If the irregularities occur before the lambda control is activated, the lambda control can then not be the cause of the fault.
- If the irregularities do not occur until after the lambda control is activated, test operation ⇒ page 24-44.

Note:

If the irregularities become less after the lambda control is activated, the cause of the fault (e.g. unmetered air, faulty injector etc.) is compensated when the lambda control intervenes. This can be recognised by reading the lambda learned values.

- Select function 08 „Read measured value block“ and display group 011.
- Compare the actual values (indicated by tester) with the specified values.

Testing operation of the lambda control

- Select function 08 „Read measured value block“ and display group 001 ⇒ page 01-34.

Read measured value block 1 →			
850 rpm	90 °C	0.80V	0000010

◀ Readout in display:

Do not continue with the test until the coolant temperature shown in display zone 2 is at least 80 °C.

The signal voltage of the lambda probe is shown in display zone 3.

- If the probe voltage varies very slowly (less than 30 times a minute), test lambda probe heater ⇒ page 24-47.
- Press the → key.
- Select function 08 „Read measured value block“ and display group 099 ⇒ page 01-47.

Read measured value block 99 →			
850 rpm	90 °C	+25%	0001011X

◀ Readout in display:

The status of the lambda control is shown in display zone 4.

A „0“ or a „1“ may be displayed alternately at the points marked with „X“.

Meaning of the 8-digit numerical block in display zone 4 (⇒ also page 01-47):

Display zone 4	Meaning of readout
1XXXXXXX	Diagnosis fault entered in fault memory
X1XXXXXX	not assigned
XX1XXXXX	not assigned
XXX1XXXX	Limited dynamics active
XXXX1XXX	Lambda controller at stop
XXXXX1XX	Lambda controller switched on
XXXXXX1X	Lambda probe operational
XXXXXXX1	Status of mixture; if readout = 1: rich mixture if readout = 0: lean mixture

Read measured value block 99 →
850 rpm 90 °C +25% 00011111

◀ Readout in display:

If the lambda controller has moved against the stop (readout for lambda controller at stop to „1“), it is possible to recognise from the readout for the status of the mixture the direction in which the lambda controller has moved up against the stop.

Read measured value block 99 →
850 rpm 90 °C +25% 00011111

◀ Readout in display:

If the lambda controller has moved against the stop and the readout for the status of the mixture is constantly at „1“, the lambda control has moved to the control stop in the „leaner mixture“ direction, but the lambda probe still recognises „mixture too rich“.

Read measured value block 99 →
850 rpm 90 °C +25% 00011110

◀ Readout in display:

If the lambda controller has moved against the stop and the readout for the status of the mixture is constantly at „0“, the lambda control has moved to the control stop in the „richer mixture“ direction, but the lambda probe still recognises „mixture too lean“.

Note:

A fault is stored in the fault memory if the lambda controller moves up against the stop for a certain time - irrespective of whether this is in the „rich“ or „lean“ direction.

- If the lambda control is operating properly, check the lambda learned values.
- Press the key C.
- Select the function 0, 1 and 1 for „Display group number 011“ and confirm the entry with the key Q.

Mixture adaptation is adaptive, in other words differences between engines (injector flow, compression, fuel pressure, etc.) are recognised by means of the lambda control and compensated for by adapting the basic injection times programmed in the map. The injection times are extended or shortened until a mixture of $\lambda = 1$ is achieved.

Read measured value block 11 →			
3 ms	+1.0 ms	1.00	00000010

◀ Readout in display:

The lambda learned value when engine is idling appears in display zone 2.

- ◆ Positive learned value (+...ms): Programmed basic injection time too short, actual injection time extended by ...ms so that $\lambda = 1$ is achieved.
- ◆ Negative learned value (-...ms): Programmed basic injection time too long, actual injection time shortened by ...ms so that $\lambda = 1$ is achieved.

The lambda learned value in the part throttle range appears in display zone 3.

- ◆ Readouts greater than 1: Programmed basic injection time too short, actual injection time extended so that $\lambda = 1$ is achieved.
- ◆ Readouts less than 1: Programmed basic injection time too long, actual injection time shortened so that $\lambda = 1$ is achieved.

Specifications ⇒ page 01-39.

Testing lambda probe heater

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Test condition

- Fuse 43 o.k.

Procedure

The heating circuit of the lambda probe is monitored by the self-diagnosis.

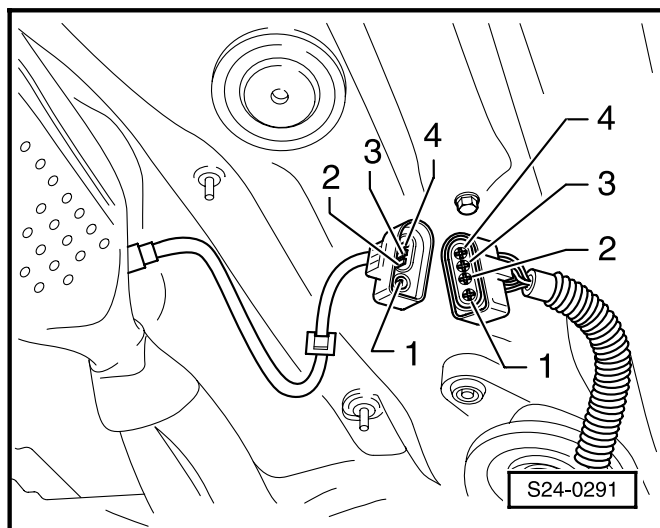
- Interrogating fault memory ⇒ page 01-4.
- Unplug the 4-pin connector to the lambda probe (on the underside of the vehicle on the right in direction of travel, below a cap).
- ◀ - Use V.A.G 1526 A to carry out a resistance measurement between contacts 1 and 2 of the probe connector.

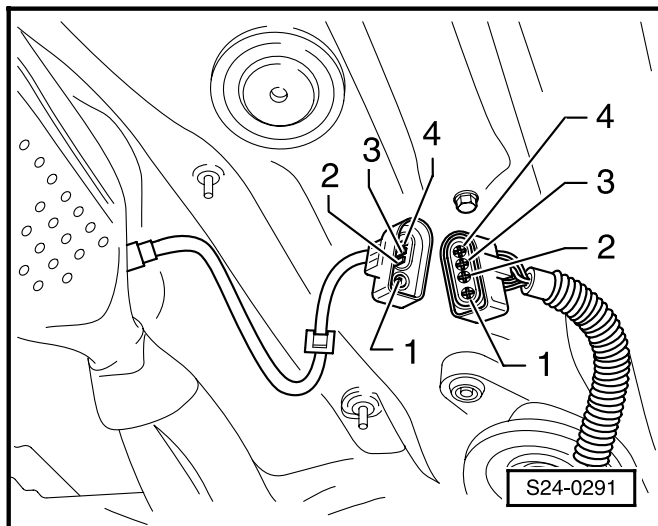
Note:

At room temperature the resistance of the heating element is about 1...5 Ω. The resistance rises sharply even if there is only a slight increase in temperature.

- If an open circuit is found, replace lambda probe.

If the heating element has continuity, test voltage supply for lambda probe heater as follows:





- ◀ - Connect multimeter between contact 1 of connector at the wiring loom and engine earth.
- Briefly operate the starter (engine may also briefly start).

Specification: approx. battery voltage

- If the specifications are not achieved, test the cable connection from contact 1 of the connector at the wiring loom to the fuse for open circuit and for short circuit to earth; repair if necessary.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- Connect the test box V.A.G 1598/22 to the control unit wiring loom ⇒ page 24-14.
- Test the cable connection from contact 2 of the connector at the wiring loom (earth actuation of engine control unit) to contact 27 at the engine control unit for continuity and rectify any open circuit in the wiring.
- If the fuses and the cable connection are o.k. but the diode test lamp still does not come on, test fuel pump relay ⇒ page 24-26.
- If all the preceding tests have not revealed any fault, replace engine control unit ⇒ page 24-15.

Testing lambda probe signal wire and lambda probe control unit

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

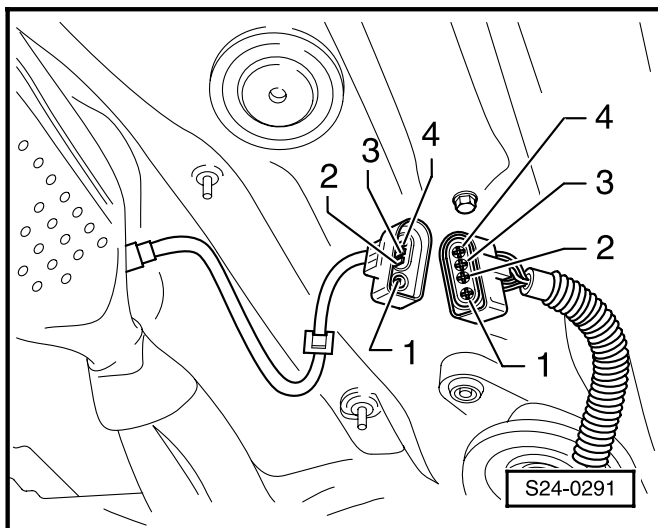
Note:

The lambda probe signal is monitored by the self-diagnosis.

- Interrogate fault memory ⇒ page 01-4.
- If a lambda probe fault is indicated and the probe heater is o.k., unplug connector for lambda probe.
- Switch on the ignition.
- ◀ - Use hand-held multimeter to carry out a voltage measurement between contacts 3 and 4 of the connector at the wiring loom.

Specification: approx. 1.50...1.60 V

- If the specification is not achieved, connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Test the following cable connections for open circuit, short circuit to positive and to earth, and repair if necessary:



Connector at wiring loom, contact	Test box V.A.G 1598/22
3	25
4	26

- If the cable connection is o.k., replace engine control unit ⇒ page 24-15.

Testing fuel tank ventilation

Testing solenoid valve 1 for activated charcoal filter

Special tools, testers and aids required

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

Testing for leaks

The solenoid valve is closed when de-energised.

- Detach the hose from the activated charcoal filter solenoid valve (N80).
- Connect a suitable pressure gauge and a compressed air system (air pump) to the solenoid valve.
- Use this equipment to produce an air pressure which can be indicated.
- Initiate final control diagnosis and select the activated charcoal filter solenoid valve (N80) ⇒ page 01-25.
- When the solenoid valve opens, the air pressure indicated should drop clearly and, when the valve closes, the pressure should rise again clearly; replace solenoid valve if necessary.

Electrical test of -N80- (ACF valve)

- Unplug the connector at the ACF valve.
- Use hand-held multimeter to carry out a resistance measurement between the contacts of the valve.

Specification: 22...30 Ω.

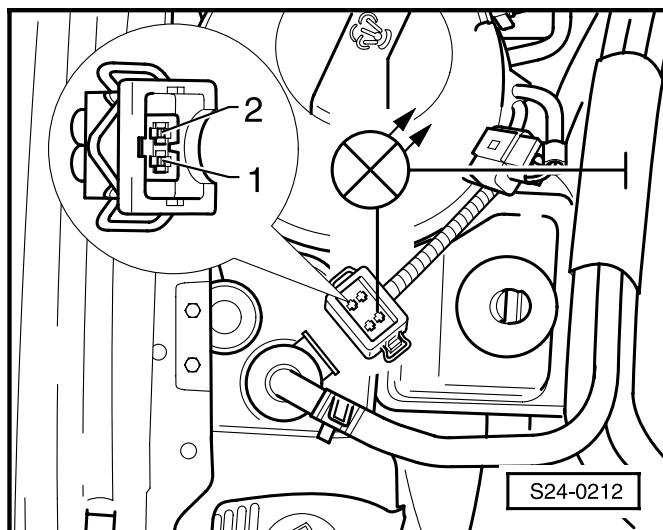
- If the specification is not achieved, replace ACF valve.

Testing voltage supply of ACF valve -N80**Note:**

The voltage for the ACF valve is supplied through the fuel pump relay.

Test condition

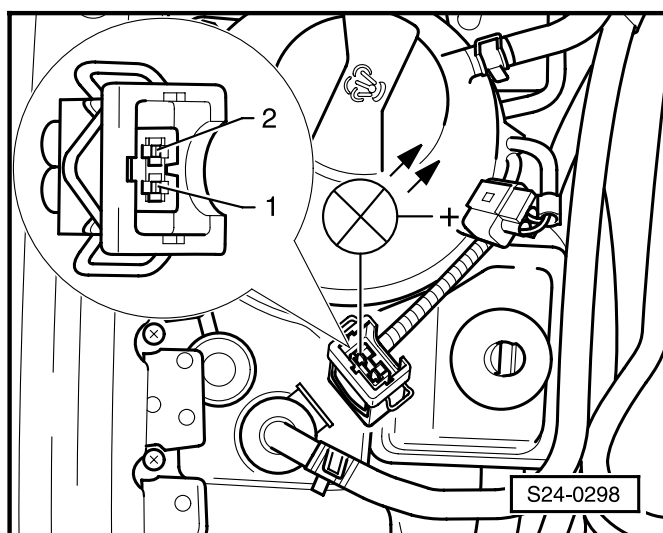
- Fuse for ACF valve (fuse 43) o.k.



- Unplug the connector at the ACF valve.
- ◀ - Connect diode test lamp V.A.G 1527 between contact 1 of the connector and engine earth.
- Operate the starter.

Specification: The diode test lamp should come on.

- If the diode test lamp does not come on, test the cable connection from contact 1 to the fuse for continuity, and repair if necessary.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If the cable connection is o.k., test fuel pump relay ⇒ page 24-26.

**Testing actuation of the ACF valve -N80**

- ◀ - Connect diode test lamp, e.g. V.A.G 1527 between contact 2 (earth actuation of engine control unit) and positive (+) of battery.
- Initiate final control diagnosis and select the activated charcoal filter solenoid valve (N80) ⇒ page 01-25.

Specification: The diode test lamp should flash.

If the diode test lamp does not flash or if it comes on and remains on:

- Switch off the ignition.

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- If the diode test lamp comes on and remains on, test the cable from contact 2 of the connector at the ACF valve to socket 15 of the test box for short to earth.
- If the diode test lamp does not flash, test the cable from contact 2 of the connector at the ACF valve to socket 15 of the test box for continuity and also for short circuit to positive.
- If there is neither an open circuit in the wiring nor a short circuit, replace engine control unit ⇒ page 24-15.

Testing throttle valve control unit

Function

The idling stabilisation is integrated in the throttle valve control unit.

The throttle valve potentiometer, idling switch, throttle valve positioner and potentiometer for throttle valve positioner are accommodated in the housing opposite the cable pulley.

The housing must not be opened. This means that it is not possible to mechanically adjust or to replace the two potentiometers, the idling switch and the throttle valve positioner.

All settings are carried out as part of basic setting with the V.A.G 1552.

When de-energised, the throttle valve moves into a particular, mechanically defined position, which results in fast idling when engine is at normal operating temperature.

The throttle valve positioner performs the closing damping function of the throttle valve.

The throttle valve positioner is able to open the throttle valve only up to a certain range, what this means is that the throttle valve positioner is not, for example, able to provide „full throttle“.

Note:

If the control unit is replaced, it is then necessary to:

- ◆ *adapt the engine control unit to the throttle valve control unit ⇒ page 24-64*
- ◆ *on models fitted with automatic gearbox: adapt the gearbox control unit*
⇒ Automatic Gearbox; Repair Group 01; Self-Diagnosis/Electrical Test

Test conditions

Models 08.97 ➤

- Earth connection between throttle valve control unit and cylinder head o.k. ⇒ page 24-12, item 9.

Continued for all models

- Throttle valve not damaged or dirty.

Special tools, testers and aids required

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

Testing throttle valve control unit on models ► 07.97**Testing idling switch**

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The engine should be idling for this step.
- Select the function 08 „Read measured value block“ and display group 002.

Read measured value block 2			→
850 rpm	120 mg/H	0 km/h	0100

◀ Observe readout in display zone 4.

Note:

Meaning of the digits in display zone 4:

Display zone 4	Meaning of readout
1XXX	Overrun
X1XX	Idling speed
XX1X	Part throttle
XXX1	Full throttle

The readout for idling speed must be „0100“.

- Slowly operate throttle.

Read measured value block 2			→
1000 rpm	120 mg/H	0 km/h	0010

◀ Readout in display:

Readout for part throttle „0010“ (when the throttle valve opens, the idling switch is also opened).

- If the specification is not achieved, switch ignition off and connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.

- Use hand-held multimeter to carry out a resistance measurement between sockets 67 and 69.

Specification: continuity, max. 1.5Ω (throttle valve closed)

- Open throttle valve slightly.

Specification: $\infty\Omega$ (no continuity).

- If the specification is not achieved, test the cable connections and contacts on the basis of the current flow diagram for open circuit, damage or dirt; clean or replace any damaged parts.

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

- After this, carry out adaptation of the engine control unit to the throttle valve control unit ⇒ page 24-64.
- If the specification is again not achieved, inspect throttle valve for dirt or stiff operation and clean, if necessary.
- Repeat adaptation of throttle valve control unit ⇒ page 24-64.
- If it is not possible to start or successfully complete adaptation, replace the throttle valve control unit.
- Carry out adaptation of the throttle valve control unit ⇒ page 24-64.

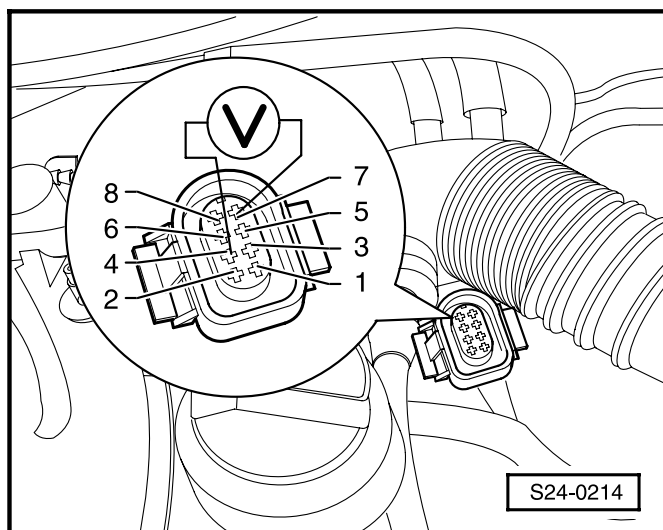
Testing voltages of senders for throttle valve positioner and throttle valve potentiometer

- Unplug the 8-pin connector at the throttle valve control unit.
- Switch on the ignition.
- Use hand-held multimeter to measure the voltage between contact 4 and contact 7 at the 8-pin connector.

Specification: min. 4.8 volts

If the specification is achieved, plug in the 8-pin connector.

- Start the engine.
- Select function 08 „Read measured value block“ and display group number 098 ⇒ page 01-46.



Read measured value block 98

4.20 V

3.48 V

00000000

→

00

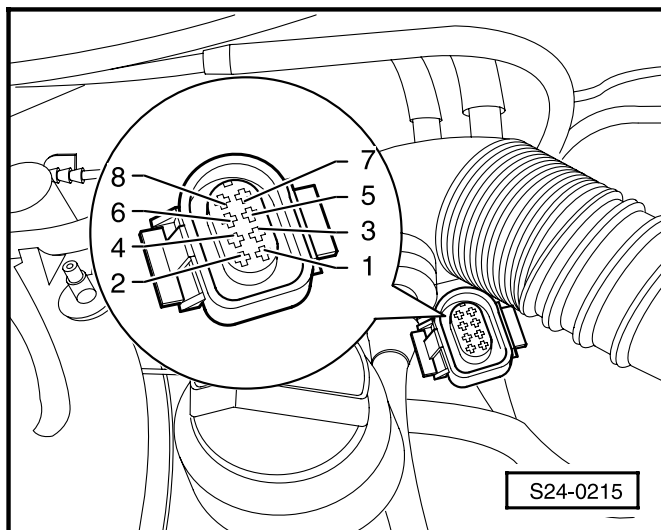
◀ Readout in display:

The readouts in display zone 1 (voltage of throttle valve potentiometer) should be between 3.70 V and 4.75 V.

The readouts in display zone 2 (voltage of throttle valve positioner potentiometer) should be between 2.28 V and 4.75 V.

If the specifications are not achieved:

- Switch the ignition off.
- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Unplug the 8-pin connector at throttle valve control unit.
- ◀ Use the multimeter V.A.G 1526 A to test the wiring between test box and 8-pin connector for continuity.
- Use the multimeter to test wiring for short circuit to each other.



Contact at 8-pin connector	Contact at test box
1	66
2	59
3	69
4	62
5	75
7	67
8	74

- Rectify any open circuit in the wiring and remove any dirt at the contacts, erase fault memory and carry out adaptation of the throttle valve control unit ⇒ page 24-64.
- If the specification is again not achieved, inspect throttle valve for dirt or stiff operation and clean, if necessary.
- Repeat adaptation of the throttle valve control unit ⇒ page 24-64.
- If it is not possible to start or successfully complete adaptation, replace throttle valve control unit.
- Carry out adaptation of throttle valve control unit ⇒ page 24-64.

- If it is not possible to start or successfully complete adaptation, replace engine control unit ⇒ page 24-15.
- If it was possible to successfully carry out adaptation with the new engine control unit, once again attempt to carry out adaptation with the old (removed) throttle valve control unit ⇒ page 24-64.

Testing throttle valve control unit - models 08.97 ➤

Testing idling switch

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The ignition should be switched on for this step.
- Select the function 08 „Read measured value block“ and display group number 098.

Read measured value block	98 →
4.20 V 3.48 V 00000000	00

◀ Test idling switch at idling speed stop in display zone 3.

1st place from the right must be 0
Readout: 00000000

- Slowly open throttle valve.

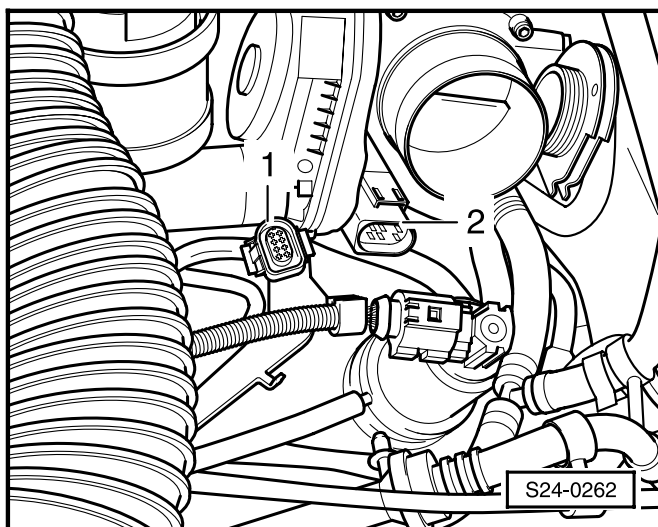
1st place from the right must be 1
Readout: 00000001

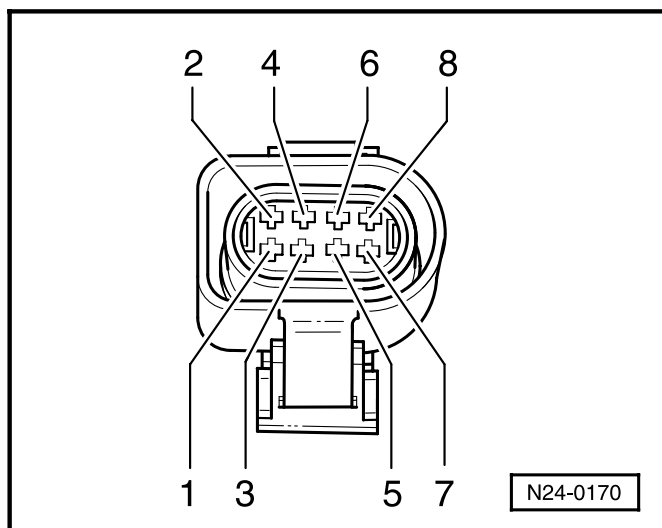
If the specifications are not achieved:

Readout	Cause	Continue test
always 1	Open circuit or short circuit to positive	⇒ page 24-57
always 0	Short circuit to earth	⇒ page 24-58

Continuation of test if readout is always 1

- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.





- ◀ - Bridge the contacts 3 and 7 of the connector and observe readout in the display.

Readout 0:

- End the test by selecting the function 06 „End output“.
- Replace the throttle valve control unit ⇒ page 24-12, item 2.

Readout 1:

- End the test by selecting the function 06 „End output“.
- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-62.

If the voltage supply and the wiring are o.k.:

- Replace the engine control unit ⇒ page 24-15.

Continuation of test if readout is always 0

- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.

Readout 1:

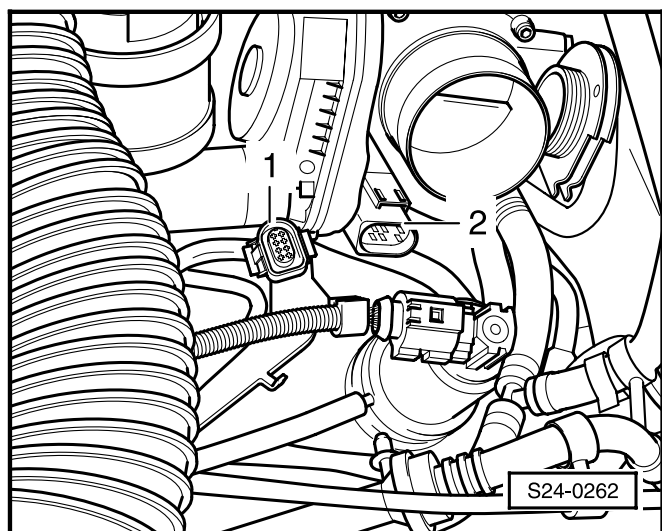
- End the test by selecting the function 06 „End output“.
- Replace the throttle valve control unit ⇒ page 24-12, item 2.

Readout 0:

- End the test by selecting the function 06 „End output“.
- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-62.

If the voltage supply and the wiring are o.k.:

- Replace the engine control unit ⇒ page 24-15.



Testing operating state

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The engine must be idling for this step.
- Select function 08 „Read measured value block“ and display group number 098.

Read measured value block			98 →
4.20 V	3.48 V	00000000	00

◀ Check the operating state of the throttle valve control unit in display zone 3.

Specification: 00000000

Meaning of the digits in the 8-digit numerical block for operating state of throttle valve control unit:

0000	x	x	x	x	Meaning if readouts = 1
0000					Not assigned
	1				Fault occurred during adaptation of throttle valve (interrogate fault memory ⇒ page 01-4)
		1			Throttle valve control unit de-energised (on/off ratio = 0)
			1		Adaptation aborted because of insufficient battery voltage (less than 8 V)
				1	Idling speed switch open (switch interrogation)

If the specifications are not achieved:

- Adapt engine control unit to throttle valve control unit ⇒ page 24-64.
- Repeat test.

If the specifications are again not achieved:

- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-62.

Testing throttle valve potentiometer

Test requirement

- Coolant temperature at least 80 °C

Test procedure

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The ignition is switched on for this step.
- Select 08 for function „Read measured value block“ and display group 001.

Read measured value block 1	→
0 rpm 90 °C 0.80 V 00000000	

◀ Check in display block 2 whether the coolant temperature is more than 80 °C.

- Switch over to display group 3 as follows:

Read measured value block 3	→
0 rpm 0 mg/H 3.2 ∠° 0 %	

◀ Read off the throttle valve angle in display block 3.

Specification: 1.9...5.7 ∠°

- Slowly open throttle valve fully and at the same time observe the angle displayed in block 3.
The numerical readout must rise evenly over the entire range.
- End the test by selecting function 06 „End output“.

Note:

The readout shown depends on the tolerances of the throttle valve potentiometer and does not equal the actual opening angle.

If the numerical readout does not rise evenly:

- Replace throttle valve control unit ⇒ page 24-12, item 2.

If the readout remains constant:

- Test the voltage supply and wiring to throttle valve control unit ⇒ page 24-62.

Testing throttle valve positioner and potentiometer for throttle valve positioner

Test condition

- Coolant temperature at least 80 °C

Test procedure

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The ignition must be switched on for this step.
- Select function 08 „Read measured value block“ and display group number 001.

Read measured value block 1 →			
850 rpm	90 °C	0.80 V	0000010

- ◀ Check in display zone 2 whether the coolant temperature is more than 80 °C.

- Switch into display group 098 as follows:

Read measured value block 98 →			
4.20 V	3.48 V	00000000	00

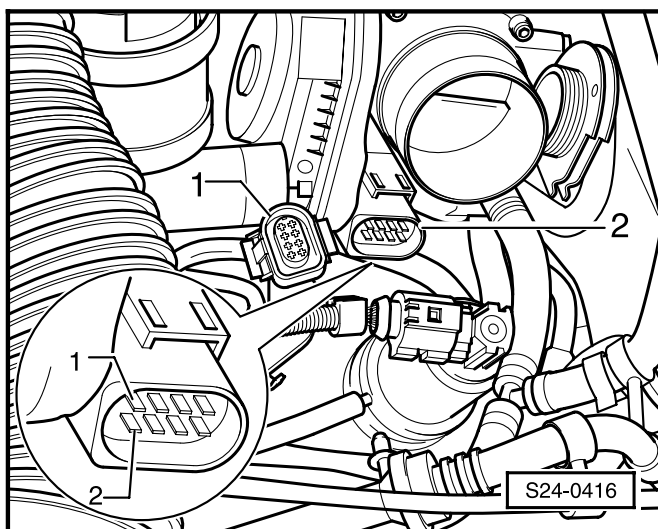
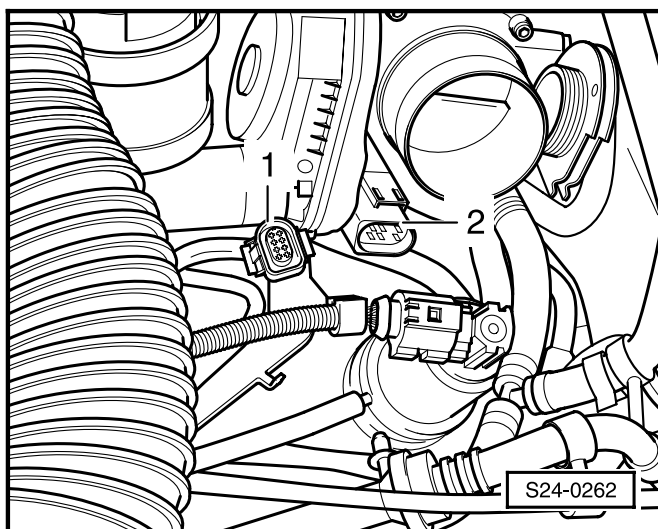
- ◀ Check the voltage readout for the throttle valve opening of the throttle valve positioner potentiometer in display zone 2.

Specification: 2.28...4.75 V

If the specification is not achieved:

- End the test by selecting the function 06 „End output“.
- Remove the intake hose.

- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.



- ◀ - Measure the resistance of the throttle valve positioner between contacts 1 and 2.

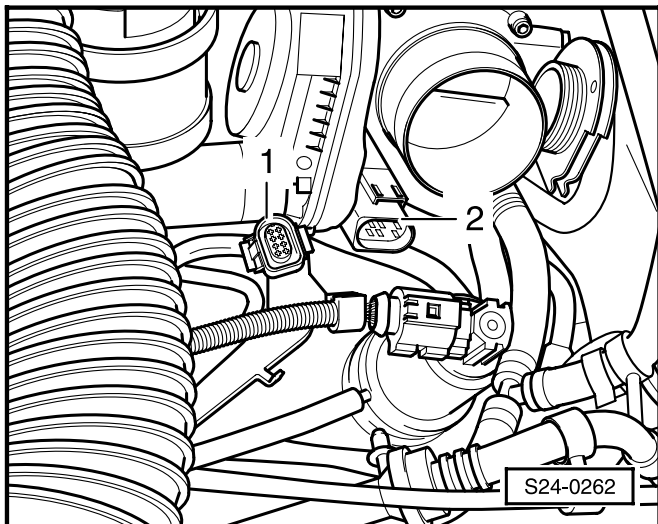
Specification: 3...200 Ω

If the specification is not achieved:

- Replace the throttle valve control unit ⇒ page 24-12, item 2.

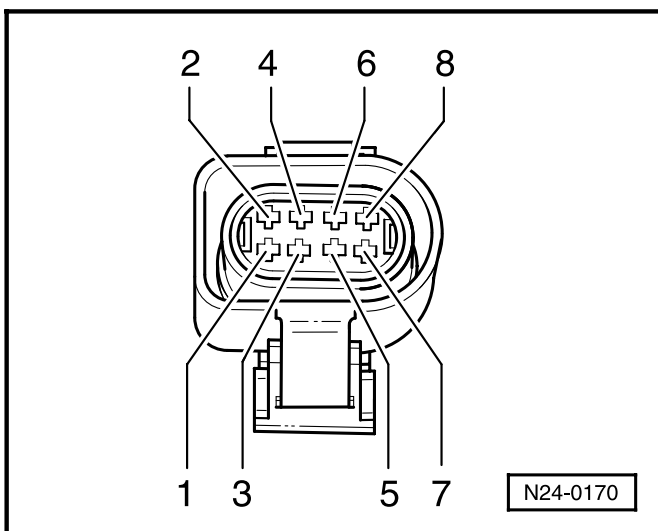
If the specification is achieved:

- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-62.



Testing voltage supply and wiring to control unit

- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.



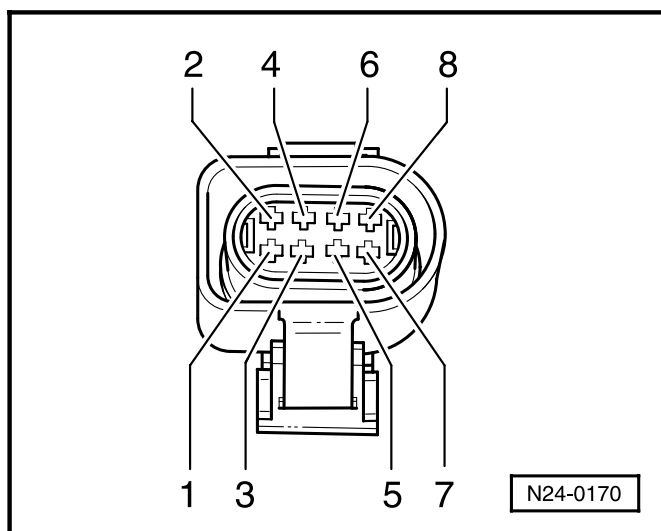
- Switch the ignition on.
- ◀ - Connect multimeter for voltage measurement to contacts 4 and 7 of the connector.

Specification: at least 4.5 V

- Connect multimeter for voltage measurement to contacts 3 and 7 of the connector.

Specification: at least 9 V

- Switch the ignition off.
- Connect test box V.A.G 1598/22 to the engine control unit wiring loom ⇒ page 24-14.



- ◀ - Test the wiring between test box and connector for open circuit as specified in the current flow diagram.

Contact at 8-pin connector	Contact at test box
1	66
2	59
3	69
4	62
5	75
7	70
8	74

Cable resistance: max. 1.5 Ω

- In addition, test the wiring for short circuit to each other.

Specification: $\infty \Omega$

If no fault is found in the wiring:

- Test the voltage supply of the engine control unit $\Rightarrow$ page 24-33.

Adapting engine control unit to throttle valve control unit

When the basic setting is performed, the engine control unit learns the stop positions of the throttle valve control unit with the ignition switched on and the engine not running.

Note:

If the throttle valve control unit (J338) is removed and installed, or replaced, or if the voltage supply of the engine control unit is interrupted, it is then always necessary to carry out a basic setting.

Test requirements

- No fault stored in fault memory ⇒ page 01-4, Interrogating and erasing fault memory
- Idling speed switch at stop, testing ⇒ page 24-54 and 24-57
- Throttle valve closed (opening angle of engine control unit), throttle cable correctly set; testing
⇒ 1.6-ltr./74 kW Engine, Mechanical Components; Repair Group 20; Adjusting throttle cable
- Engine not running
- Voltage supply for engine control unit greater than 8 V; testing ⇒ page 24-33.
- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. Ignition is switched on for this step.
- Select 04 for the function „Initiate basic setting“ and display group 098.

System in basic setting		98 →
4.20 V	3.48 V	00000000 01

◀ Readout in display:

After the key Q is pressed, the throttle valve positioner moves from the minimum stop (throttle valve is closed) to the maximum stop (throttle valve is opened).

The throttle valve control unit stores the particular voltage in the permanent memory.

This process takes not more than 10 seconds. After this, the throttle valve positioner is de-energised and stops.

System in basic setting	98 →
4.20 V 3.48 V 00000100 00	

◀ Readout in display:

Adaptation of the engine control unit to the throttle valve control unit has been successfully carried out.

Note:

If one of the following readouts appears in the display, it was not possible to carry out successful adaptation.

System in basic setting	98 →
4.20 V 3.48 V 00001100 10	

◀ Readout in display:

Note:

Meaning of the digits in display block 3:

Display block 3	Meaning of readout
XXXX1XXX	Fault entered in fault memory; interrogate fault memory ⇒ page 01-4
XXXXX1XX	Throttle valve control unit de-energised (on/off ratio = 0)
XXXXXXX1X	Adaptation aborted because of insufficient battery voltage (less than 8 V)
XXXXXXX1	Idling speed switch separated (interrogate switch), testing ⇒ page 24-54

Meaning of the digits in display block 4:

Display block 4	Meaning of readout
1X	Fault entered in fault memory; interrogate fault memory ⇒ page 01-4
X1	Adaptation of throttle valve control unit in progress

Notes:

- ◆ ⇒ *Fault Table, fault code 01087.*
- ◆ *The cause of unsuccessful adaptation of the throttle valve control unit can also be detected by reading display group 001 (reading measured value block; ignition switched on) ⇒ page 01-34.*
- ◆ *After unsuccessful adaptation, check the conditions for adaptation ⇒ page 24-64.*
- ◆ *After each condition which is recognised as being o.k., an attempt should be made to carry out adaptation of the engine control unit to the throttle valve control unit ⇒ page 24-64.*

If adaptation is aborted by the control unit, the reasons for this may be:

- ◆ *The conditions for adaptation of the engine control unit to the throttle valve control unit are not met; conditions for adaptation ⇒ Fault Table, fault code 01087.*
- ◆ *The throttle valve does not reach the mechanical idling speed stop because of dirt, e.g. oil carbon deposits, or incorrectly adjusted throttle cable.*
- ◆ *The throttle valve control unit or the cable connection is faulty.*

After the interruption, fault 01087 „Basic setting not carried out“ is entered in the fault memory. When the ignition is next switched on, the engine control unit once again attempts to carry out adaptation.

- End the basic setting of the engine by pressing the → key.
- Select function 06 „End output“ and confirm the entry with the key Q.

Testing intake manifold changeover

This test should only be performed if there is a problem of poor performance.

Test condition

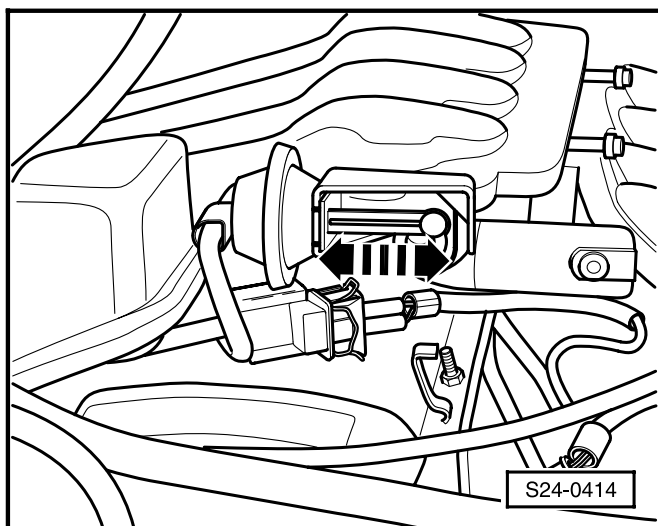
- Engine must be at normal operating temperature.

Testing operation

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“.
- Start engine and run at idling speed.
- Select function 08 „Read measured value block“ and display group number 001.
- Increase engine speed suddenly (at least to 2500 rpm) and release throttle again.
- ◀ - When this is done, the intake manifold changeover vacuum unit must operate, the shift linkage must move back again into its initial position -arrow-.

If no changeover occurs, carry out the following tests and inspections:

- Test intake manifold changeover valve -N156- (perform final control diagnosis ⇒ page 01-25, test valve and actuation if necessary ⇒ page 24-69).
- Inspect vacuum lines for leaks ⇒ page 24-68.
- Inspect vacuum lines for blockage and correct connection.
- Inspect ease of operation of changeover mechanism (operate changeover linkage by hand).



Testing vacuum system

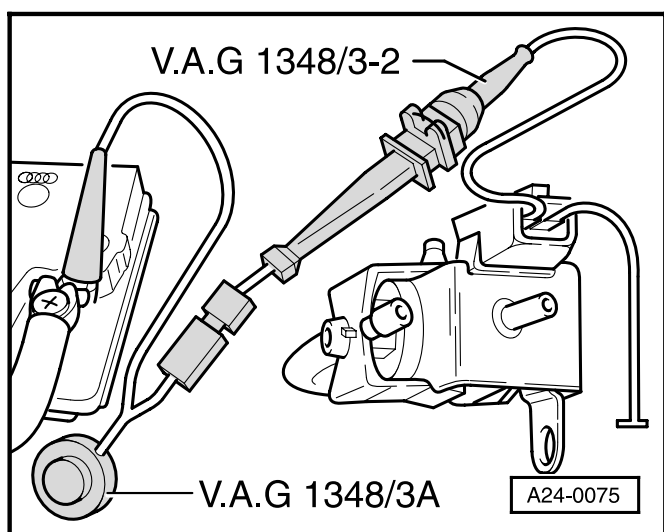
Special tools, testers and aids required

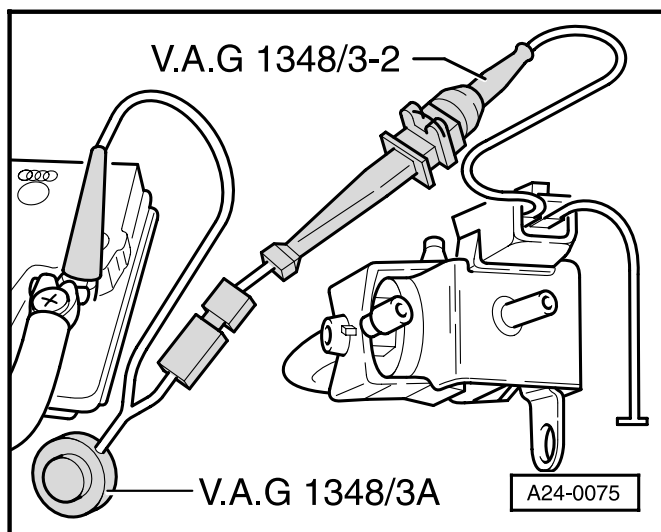
- ◆ Remote control, e.g. V.A.G 1348/3 A with adapter cable, e.g. V.A.G 1348/3-2
- ◆ Hand vacuum pump, e.g. V.A.G 1390
- ◆ Adapter cable set, e.g. V.A.G 1594 A
- Run vehicle at idling speed for 2 to 3 minutes (to build up vacuum).
- Switch ignition off.
- Unplug connector from the intake manifold changeover valve.
- Connect one contact of solenoid valve with test cables and crocodile clamp from V.A.G 1594 A to engine earth.
- ◀ - Connect second contact of the solenoid valve with remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable to positive.
- Operate remote control V.A.G 1348/3 A for about 2 to 3 minutes. The vacuum unit should remain operated during this time.

If the vacuum unit moves back, test vacuum unit as follows:

- Detach vacuum pipes from the vacuum unit for the intake manifold changeover.
- Connect hand vacuum pump to vacuum unit.
- Operate hand vacuum pump and observe the intake manifold changeover.
- Inspect vacuum unit for leaks. (The vacuum unit must not move back into its initial position so long as air is not admitted at the hand pump.)
- Replace vacuum unit, if necessary.

If the vacuum unit does not operate, inspect -N156 as follows for blockage.





- Connect one contact of -N156 with test cables and crocodile clamp from V.A.G 1594 A to engine earth.
- ◀ - Connect second contact of -N156 with remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable to positive.
- Operate remote control V.A.G 1348/3 A.
- Inspect valve for blockage (detach vacuum pipes and blow through).
- Replace intake manifold changeover valve, if necessary.
- If none of the tests or inspections carried out so far reveals any fault, test the vacuum system for leaks.

Testing intake manifold changeover valve (N156)

Fitting location ⇒ page 24-3.

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

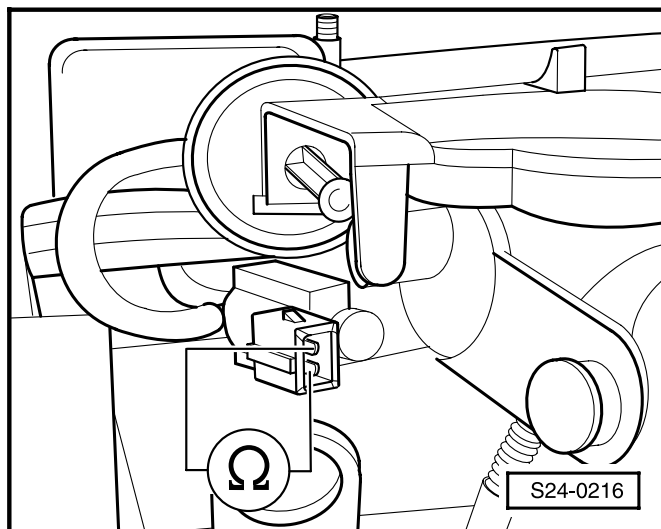
Test condition

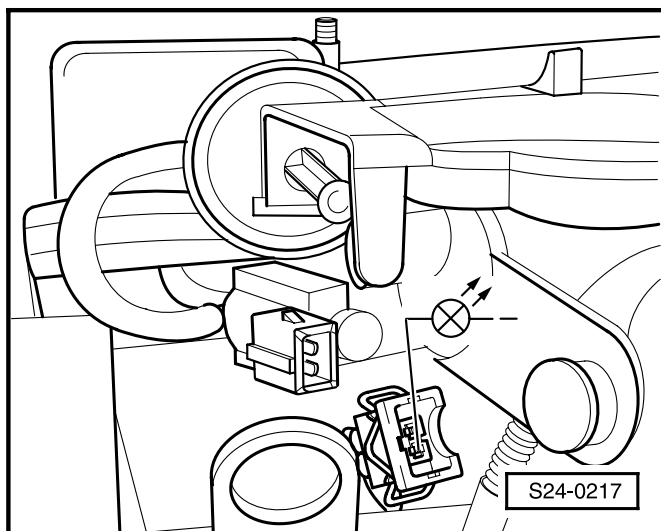
- Fuse 34 must be o.k.

Electrical test of intake manifold changeover valve -N156

- Unplug connector at the intake manifold changeover valve.
- ◀ - Measure resistance at the intake manifold changeover valve.
- Specification: 25 ... 35 ohms.

If the specification is not achieved, replace valve.





Testing voltage supply and actuation of intake manifold changeover valve -N156

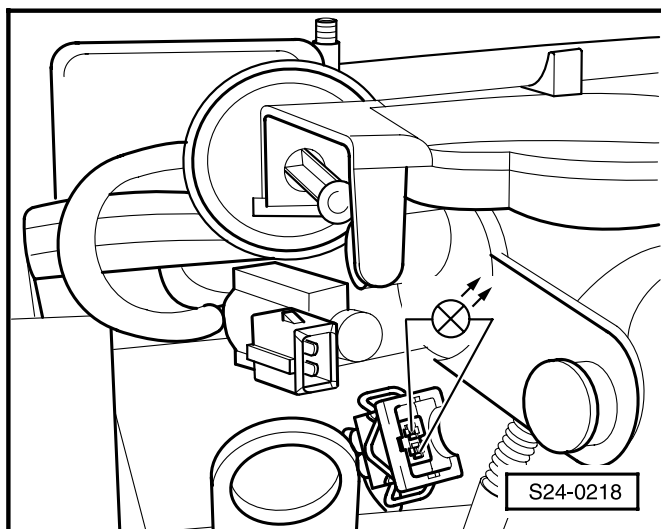
- ◀ - Unplug connector at the intake manifold changeover valve.
- Connect diode test lamp to contact 1 (positive) of the connector and to engine earth.
- Briefly operate starter, engine may also start.

Specification: Diode test lamp should come on

If the diode test lamp does not come on:

- Test the cable from contact 1 of the connector at the intake manifold changeover valve to the fuse for continuity as specified in the current flow diagram.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

- If the fuse and the cable are o.k., test the actuation of the fuel pump relay ⇒ page 24-26.



- ◀ - Connect diode test lamp to contact 1 (positive) and 2 (actuation of engine control unit) of connector at intake manifold changeover valve.
- Initiate final control diagnosis ⇒ page 01-25.

When the intake manifold changeover valve is actuated, the diode test lamp should flash.

- If the diode test lamp does not flash or if it comes on and remains on, connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- If the diode test lamp comes on and remains on, test cable from contact 2 of the connector and the intake manifold changeover box to socket 64 of the test box for short to earth.
- If the diode test lamp does not flash, test cable from contact 2 of the connector at the intake manifold changeover valve to socket 64 of the test box for continuity and also for short circuit to positive.
- Rectify any fault present.
- If there is neither an open circuit in the wiring nor a short circuit, replace engine control unit ⇒ page 24-15.

Testing additional signals

Testing air conditioner compressor cut-off

Notes:

- ◆ The engine control unit is able to switch off the air conditioner compressor.
- ◆ The air conditioner compressor is switched off during maximum acceleration (full throttle) in first gear (on models with manual gearbox).
- ◆ The air conditioner compressor is not switched off on models with automatic gearbox.

Special tools, testers and aids required

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

Test conditions

- Air conditioner operating properly.
- No fault stored in fault memory of engine control unit.

Note:

A second person must operate V.A.G 1552 during the road test.

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. Engine must be idling for this step.
- Select function 08 „Read measured value block“ and display group number 019.
- Switch the air conditioning off.

Models ► 07.97

Read measured value block 19	→
850 rpm 0 0	0

◀ „0“ should appear in display zone 3 (AC standby).

„0“ should appear in display zone 4 (AC compressor).

- Switch on the air conditioning. The AC compressor should run.

Read measured value block 19	→
850 rpm 0 1 1	

◀ „1“ should appear in display zone 3 (AC standby on).

„1“ should appear in display zone 4 (AC compressor on).

- Carry out a road test in first gear (depress accelerator pedal suddenly at low revs).

Read measured value block 19	→
850 rpm 0 1 0	

◀ The readout in display zone 4 should be „0“ during acceleration (the AC compressor is switched off during this time).

Models 08.97 ►

Read measured value block 19	→
850 rpm 0 0 00000000	

◀ „0“ should appear in display zone 3 (AC off)

„0“ should appear in display zone 4 (AC compressor off)

- Switch air conditioning on. AC compressor must run.

Read measured value block 19	→
850 rpm 0 1 00000001	

◀ Readout in display:

„1“ should appear in display zone 3 (AC on)

„1“ should appear in display zone 4 (AC compressor on)

- Conduct a road test in first gear (depress the accelerator pedal suddenly at low revs).

Read measured value block 19	→
850 rpm 0 1 00000000	

◀ Readout in display:

The readout in display zone 4 should be „0“ during acceleration (the AC compressor is switched off during this time).

Continued for all models

- If the readouts do not appear as described, switch off the engine and connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Test the cable connection from contact 8 of the engine control unit to the air conditioner control unit for short circuit to earth and to positive and also for open circuit on the basis of the current flow diagram.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If there is no fault in the cable connection, test the operation of the air conditioner.
⇒ Binder; Heating and Air Conditioning

Testing engine speed adaptation by switching on air conditioner

Special tools, testers and aids required

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

Notes:

- ◆ *When the air conditioner is switched on, a positive signal is supplied to contact 8 at the engine control unit.*
- ◆ *The effect of this signal is that the engine control unit maintains idling speed at a constant level even if there is a varying high demand from the air conditioning system.*

Test conditions

- Air conditioner operating properly.
- Ancillary components (e.g. rear window heater) switched off.
- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. Engine must be idling for this step.
- Select function 08 „Read measured value block“ and display group number 019.

Models ► 07.97

Read measured value block 19				→
850 rpm	0	0	0	

◀ Readout in display:

Display zone 1: idling speed

Display zone 3: signal from air conditioner

Display zone 4: AC compressor status

- Switch the air conditioner on. The AC compressor should run.

Read measured value block 19				→
850 rpm	0	1	1	

◀ „1“ should appear in display zone 3.

„1“ should appear in display zone 4 (compressor on).

Models 08.97 ►

Read measured value block 19	→
850 rpm 0 0 00000000	

◀ Readout in display:

Display zone 1: idling speed

Display zone 3: signal from air conditioning

Display zone 4: status of AC compressor

- Switch the air conditioning on. The AC compressor must run.

Read measured value block 19	→
850 rpm 0 1 00000001	

◀ „1“ should appear in display zone 3.

„1“ should appear in display zone 4 (1st place from the right) (compressor on).

Continued for all models

Apart from a brief drop in engine speed idling speed should remain constant.

- If engine speed does not remain constant, switch off the engine and connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Test the cable connection from contact 8 at the engine control unit to the air conditioner control unit for open circuit and short circuit on the basis of the current flow diagram.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If there is no fault in the cable connection, test operation of the air conditioner.
⇒ Binder 1; Heating and Air Conditioning

Testing selector lever position of automatic gearbox**Special tools, testers and aids required**

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

Notes:

- ◆ *The engine control unit receives the information of whether a gear is engaged (selector lever in 1/2/3/R/D) or not (selector lever in P or N) from the starter inhibitor and reversing light relay -J226-.*
- ◆ *The starter inhibitor and reversing light relay -J226- switches earth to contact 22 at the engine control unit when selector lever is in position P or N.*

- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The ignition must be switched on for this step.
- Select function 08 „Read measured value block“ and display group number 019.

Read measured value block 19	→
850 rpm 0 1 xxxxxxxx	

◀ Readout in display:

„0“ should appear in display zone 2 (selector lever in P or N).

- Depress the footbrake and move selector lever into a gear.

„1“ should appear in display zone 2.

- If the readout does not appear as described, connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.

- Connect the diode test lamp between socket 3 (terminal 30) and socket 22.

- When a gear is engaged, the diode test lamp should go out.

- If the diode test lamp comes on and remains on or does not come on at all, test the cable connection from contact 22 at the engine control unit to the starter inhibitor and reversing light relay -J226- for short circuit to positive and to earth and also for open circuit.

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

- If there is not fault in the cable connection, test the multifunction switch.

⇒ Automatic Gearbox; Repair Group 01; Electrical Test

Testing starting signal

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Notes:

- ◆ *The starting signal (terminal 50, from ignition lock) is received at the same input of the engine control unit as the P/N signal.*
- ◆ *If the engine control unit detects the starting signal, the fuel pump relay is switched on immediately after this.*
- On models with automatic gearbox: remove the starter inhibitor and reversing light relay -J226-.
- Connect test box V.A.G 1598/22 to the control unit wiring loom ⇒ page 24-14.
- Connect hand-held multimeter for voltage measurement between sockets 2 (earth) and 22 (terminal 50).
- Operate starter. At least 8 V should be indicated on the hand-held multimeter.

If the specification is not achieved:

- Test cable connection to ignition lock (terminal 50) on the basis of the current flow diagram.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing engine speed signal

Note:

The engine speed signal is output at contact 6 of the engine control unit. The signal is required, for example, for the automatic gearbox control unit for calculating the shift points and for the rev counter in the dash panel insert.

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
 - Test cable connection from contact 6 of test box to the dash panel insert for open circuit on the basis of the current flow diagram.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing throttle valve position

Special tools, testers and aids required

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

Notes:

- ◆ *This system is used by the automatic gearbox control unit in conjunction with the engine speed as information for calculating the shift points.*
- ◆ *For models ► 07.97 the signal is a square-wave signal which is output by the engine control unit at contact 7.*
- ◆ *For models 08.97 ► the signal is a square-wave signal which is output by the engine control unit at contact 8.*
- Connect vehicle system tester V.A.G 1552
⇒ page 01-2.
- Initiate self-diagnosis of the gearbox control unit.
⇒ Binder Automatic Gearbox; Fuel Formation/
Fuel Injection
- If fault 00545 „Engine/Gearbox electrical connection“ is displayed by the gearbox control unit, interrogate the fault memory of the engine control unit ⇒ page 01-4.
- If a fault regarding the throttle valve potentiometer is stored in the engine control unit, then rectify this fault first of all (the fault in the gearbox control unit is then only a consequential fault).
- If no fault regarding the throttle valve potentiometer is displayed, connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.

Models ► 07.97

- Test the cable connection from contact 7 of the engine control unit connector to the gear-box control unit for open circuit and short circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Models 08.97 ►

- Test the cable connection from contact 8 of the engine control unit connector to the gear-box control unit for open circuit and short circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing road speed signal**Notes:**

- ◆ *The road speed signal is generated by the road speed sender -G68 (at gearbox) and processed in the instrument cluster (dash panel insert).*
- ◆ *The processed signal is passed to contact 20 of the engine control unit and is used for idling stabilisation and for minimising load change jolts during gearshifts.*

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22
- Connect vehicle system tester V.A.G 1552 and select address word 01 „Engine electronics“. The ignition must be switched on for this step.
- Select function 08 „Read measured value block“ and display group number 002.

Read measured value block 2			→
850 rpm	120 mg/H	0 km/h	0100

◀ Readout in display:

- Carry out a road test to determine whether the road speed is shown in display zone 3.

- If the road speed is not displayed, raise vehicle until the left front wheel is clear of the ground.
- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Connect the diode test lamp between socket 3 (positive) and socket 20 (road speed signal).
- Switch on the ignition and rotate the front left wheel by hand.
- Diode test lamp should flash (very short flash signal).

Note:

The front right wheel must not rotate during this test; hold tight if necessary.

- If the diode test lamp does not flash, test the cable connection from contact 20 at the connector of the engine control unit to the dash panel insert for open circuit and short circuit.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Testing gearbox control signal during gearshift**Notes:**

- ◆ *As a result of this signal from the gearbox control unit, the ignition angle is briefly retarded during a gearshift of the automatic gearbox, to a different extent which depends on road speed and engine speed (torque reduction) in order to minimise the gearshift jolt.*
- ◆ *For models ► 07.97 the signal in question is a square-wave signal which is received at contact 23 of the engine control unit.*
- ◆ *For models 08.97 ► the signal in question is a square-wave signal which is received at the databus of the engine control unit.*
- ◆ *In view of the very brief signal, the request for retarding the ignition angle is not always detected by V.A.G 1552.*

Special tools, testers and aids required

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

Procedure

- Connect vehicle system tester V.A.G 1552
⇒ page 01-2.
- Conduct a road test and select Reading measured value block (function 08) and display group 001 ⇒ page 01-34.

Warning!

V.A.G 1552 should be operated by a 2nd person.

Read measured value block 1 →			
850 rpm	90 °C	0.80 V	000000100

◀ Readout in display:

Specification: X 0 X X X X X X = no gearbox request

Specification: X 1 X X X X X X = gearbox request

Readout: X = ignore

Note:

If a request is received from the gearbox control unit to retard the ignition angle, the readout switches very briefly from „0“ to „1“.

- The cable connection to the gearbox control unit is monitored by the gearbox self-diagnosis (fault code 00545).

If no readout for torque reduction appears in the measured value block during a gearshift or if the fault code 00545 (in gearbox control unit) is displayed:

Models ► 07.97

- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Test the cable connection from contact 23 of the engine control unit to the gearbox control unit for open circuit and short circuit.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

Models 08.97 ►

- Test the databus ⇒ page 24-84.

Testing signal from power-assisted steering pressure switch**Models 08.97 ►****Special tools, testers and aids required**

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

Test procedure

- Connect vehicle system tester V.A.G 1552 and select with „address word 01“ engine electronics control unit; engine must be idling for this step.
- Select function 08 „Read measured value block“ and display group number 019.

Read measured value block 19				→
850 rpm	0	1	00000000	

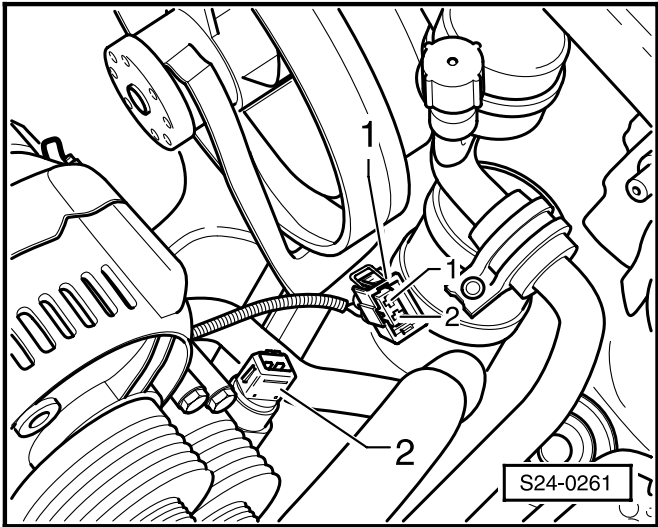
◀ Observe the readout in display zone 4.

Specification: x x x x x x **0** x

- Turn the steering wheel to full lock and observe the readout in display zone 4 (2nd place from the right).

Specification: x x x x x x **1** x

- End the test by selecting the function 06 „End output“.



If the specification is not achieved:

- Connect test box V.A.G 1598/22 to the control unit wiring loom.
- ◀ - Unplug the 2-pin connector -1- from the power-assisted steering pressure switch (F88) -2-.
- Test the wiring between test box and 2-pin connector for open circuit as specified in the current flow diagram.
Cable resistance: max. 1.5 Ω

Contact at 2-pin connector	Test box V.A.G 1598/22
1	24
2	14

- In addition, test all the cables for short circuit to each other.

Specification: ∞ Ω

If no fault is found in the wiring:

- Connect the multimeter to the contacts of the pressure switch.
- Start the engine and run at idling speed. Test pressure switch for continuity.

Specification: ∞ Ω

- Turn the steering wheel to full lock. The pressure switch must switch to continuity.

If the specifications are not achieved:

- Replace the power-assisted steering pressure switch:
⇒ Running Gear; Repair Group 48; Steering

If the specifications are not achieved:

- Replace the engine control unit
⇒ page 24-15.

Testing signal from clutch pedal switch

Models 08.97 ➤

Special tools, testers and aids required

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

Test procedure

- Connect vehicle system tester V.A.G 1552 and select with address word 01 „Engine electronics“. Engine must be idling for this step.
- Select function 08 „Read measured value block“ and display group number 019.

Read measured value block 19				→
850 rpm	0	1	00000100	

- ◀ Observe the readout in display zone 4 (3rd place from the right).

Specification: x x x x x **1** x x

- Depress the clutch pedal fully and observe the readout in display zone 4.

Specification: x x x x x **0** x x

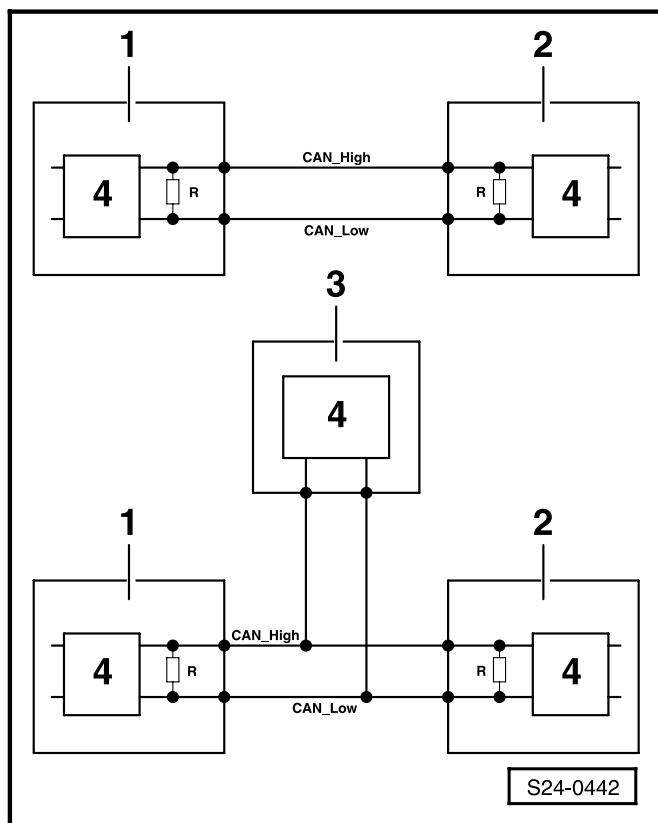
- End the test by selecting the function 06 „End output“.

If the specification is not achieved:

- Connect test box V.A.G 1598/22 to the control unit wiring loom ⇒ page 24-14.
- Test the cable between test box and 2-pin connector for open circuit as specified in the current flow diagram.
Contact 2+socket 21
Cable resistance: max. 1.5 Ω

If the specification is achieved:

- Test the cable between the 2-pin connector contact 1 and fuse 34 for open circuit as specified in the current flow diagram.
Cable resistance: max. 1.5 Ω
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



Testing databus

1 - Engine control unit

- ◆ Fitting location: in plenum chamber

2 - ABS control unit

- ◆ Fitting location: in left of engine compartment at hydraulic unit

3 - Gearbox control unit

- ◆ Fitting location: in plenum chamber

4 - Databus driver

- ◆ Part of control unit

Function

The engine control unit -1- communicates with the ABS control unit -2- and with the gearbox control unit -3- over the databus.

At least two databus-compatible control units are linked over two twisted databus lines (CAN_High and CAN_Low) and exchange information (messages). Missing information over the databus is recognised both by the engine control unit as well as by the other CAN databus control units as a fault.

To enable the databus to operate properly, it requires the terminating resistors R in two control units upstream of the databus driver -4-. These terminating resistors are installed in the engine control unit and in the ABS control unit.

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/21
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set, e.g. V.A.G 1594 A
- ◆ Current flow diagrams

Models fitted with automatic gearbox:

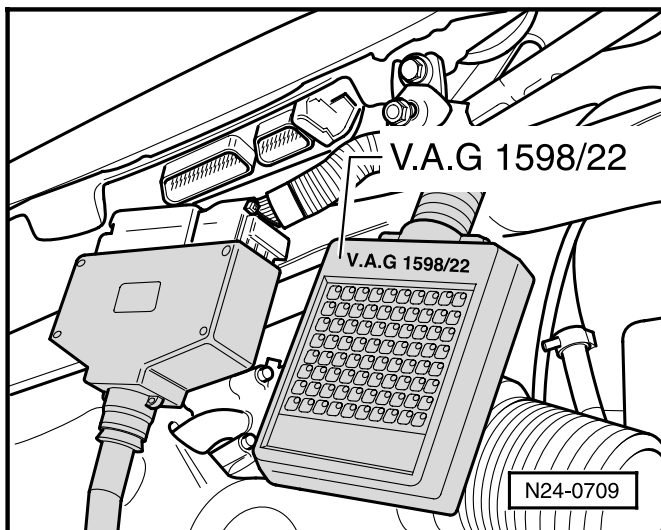
- ◆ Test box V.A.G 1598/18

Test requirements

- Before starting the test, it is necessary to interrogate the fault memories of the control units which are linked to the engine control unit over the databus (automatic test sequence, address word 00).

- A fault has been recognised by the self-diagnosis at the databus.
- ABS control unit is coded to databus operation.

Models fitted with automatic gearbox
⇒ page 24-87.



Models fitted with manual gearbox

- Remove plenum chamber cover:
⇒ Electrical System; Repair Group 92; Removing and installing windshield wipers
- Unlock the connector and unplug it from engine control unit.
- ◀ Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit.
- Test CAN databus lines with the terminating resistor in the ABS control unit:
- Measure resistance between test box sockets 29 and 31.

Models ► 04.99

Specification: 115...135 Ω

Models 05.99 ►

Specification: 2.3...2.8 k Ω

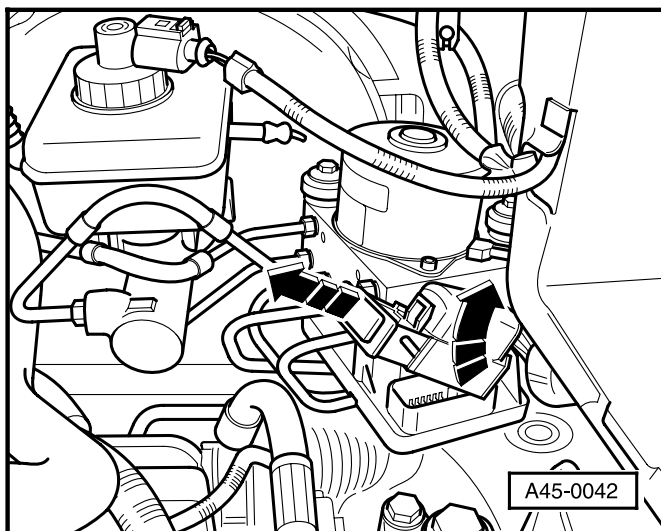
Continued for all models

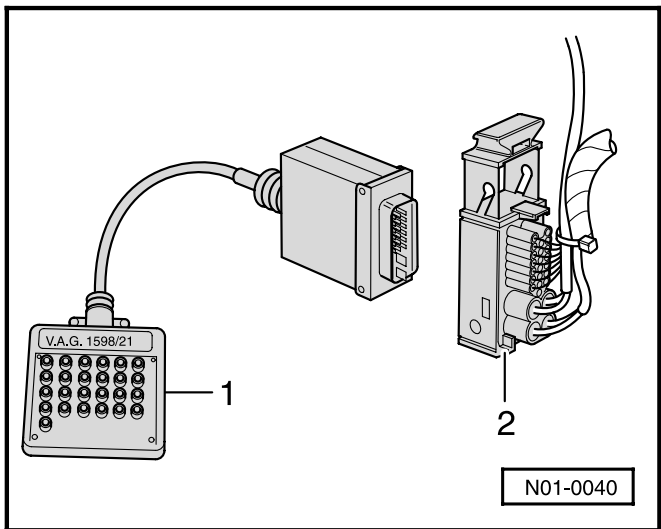
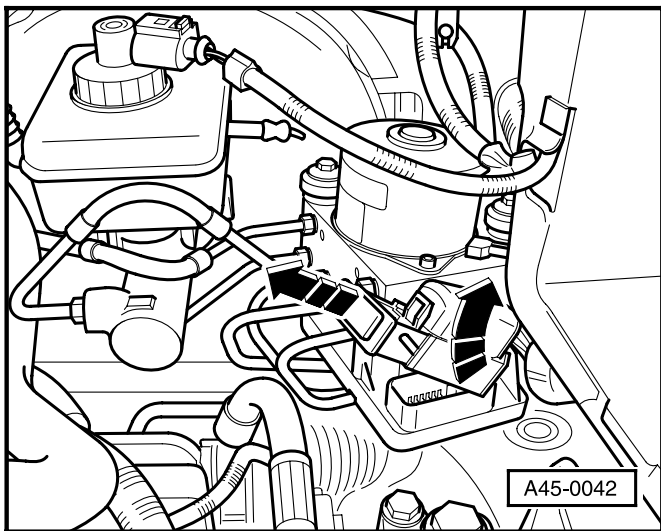
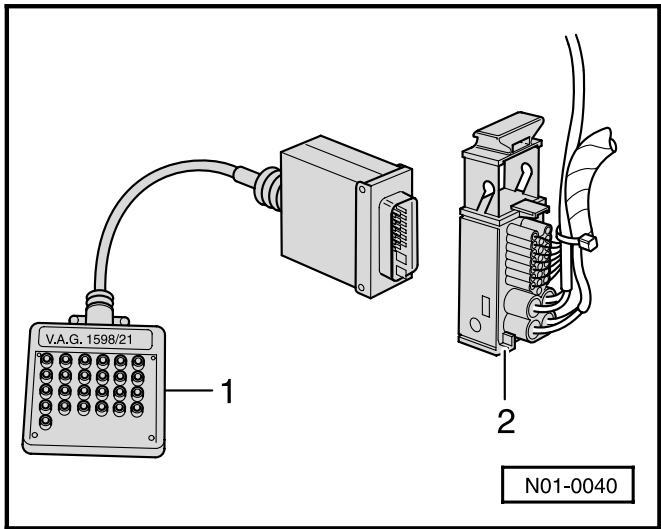
If the readout corresponds to the specification
⇒ page 24-86.

If the readout does not correspond to the specification:

- Remove air filter.
- ◀ Unlock connector and unplug it from the ABS control unit.
- Test CAN databus lines for short circuit to each other:
- Measure resistance between test box sockets 29 and 31.

Specification: $\infty \Omega$.





If the specification is not achieved (cables have short circuit to each other):

- Rectify fault in the wiring according to the CFD:
⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder

If the specification is achieved (cables do not have short circuit to each other):

- ◀ - Connect test box V.A.G. 1598/21 -1- to the wiring loom of ABS control unit -2-.
- Test CAN databus lines between sockets of test boxes 1598/22 and 1598/21 for open circuit according to current flow diagrams:
Cable resistance: max. 1.5 Ω

Socket at test box 1598/22	Socket at test box 1598/21
29	10
31	11

- In addition, test cable for short circuit to positive and to earth.

If no fault is found:

- Replace ABS control unit:
⇒ Running Gear; Repair Group 45; Removing and installing hydraulic control unit and bracket

If readout corresponds to specification:

- Remove air filter.
- ◀ - Unlock connector and unplug it from ABS control unit.
- Test wiring between engine control unit and ABS control unit for short circuit to positive and to earth.

If no fault is found in the wiring:

- Plug in connector again at engine control unit.
- ◀ - Connect test box V.A.G. 1598/21 -1- to wiring loom of control unit -2-.
- Test terminating resistor in the engine control unit:

- Measure resistance between test box sockets 10 and 11.

Models ► 04.99

Specification: 115...135 Ω

Models 05.99 ►

Specification: 60...72 Ω

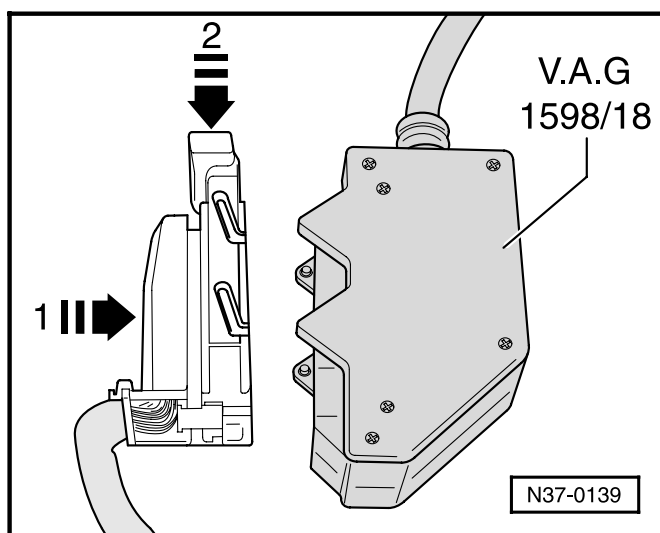
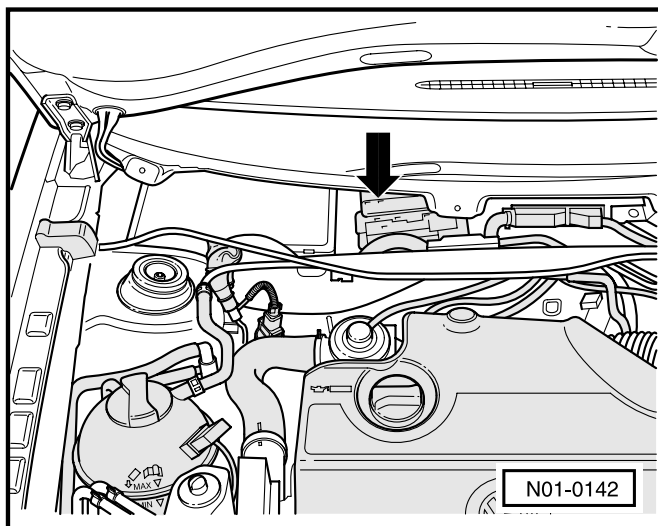
Continued for all models

If the readout does not correspond to the specification:

- Replace engine control unit $\Rightarrow$ page 24-15.

Models fitted with automatic gearbox

- Switch ignition off.
- Remove plenum chamber cover:
 $\Rightarrow$ Electrical System; Repair Group 92; Removing and installing windscreen wipers
- ◀ - Unlock connector and unplug it from gearbox control unit -arrow-.



- ◀ - Connect test box V.A.G 1598/18 -1- to wiring loom of gearbox control unit -1- and lock -2-.
- Test databus lines with terminating resistor in engine control unit and ABS control unit:
- Measure resistance between test box sockets 3 and 25.

Models ► 04.99

Specification: 115...135 Ω

Models 05.99 ►

Specification: 55...75 Ω

If readout does not correspond to specification:

- Conduct test as specified in the table which follows:

Readout	Cause	Remedy
0...5 Ω	♦ Short circuit between datalines	Test wiring ⇒ page 24-89
135... ∞ Ω or 72...8 Ω	♦ Open circuit in wiring ♦ Short circuit to positive ♦ Contact resistance	Test wiring ⇒ page 24-89

If readout corresponds to specification:

- Plug in connector again at gearbox control unit.
- Switch ignition on.
- Erase all faults in fault memory and conduct a road test.
- Once again, read out fault memories of all control units with „automatic test sequence“.

If a fault at the databus system is still displayed in the engine control unit after the road test:

- Test voltage supply of gearbox control unit
⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
- Test CAN databus lines for short circuit to positive and to earth ⇒ page 24-89.

If no fault is found in the wiring and the voltage supply is o.k.:

- Replace gearbox control unit:
⇒ Automatic Gearbox; Repair Group 01

Continuation of test if fault exists at databus system:

- Unlock connector and unplug it from engine control unit.
- Test CAN databus lines with terminating resistor in ABS control unit:
- Measure resistance between sockets 3 and 25 of test box 1598/18.

Models ► 04.99

Specification: 115...135 Ω

Models 05.99 ►

Specification: 2.3...2.8 k Ω

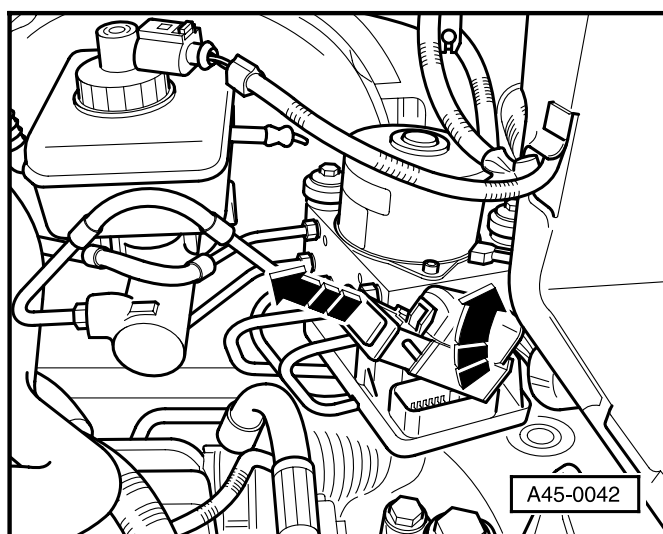
Continued for all models

If the readout does not correspond to specification:

- Test CAN databus lines $\Rightarrow$ page 24-89.

If the cables to the ABS control unit are o.k.:

- Replace ABS control unit:
 $\Rightarrow$ Running Gear; Repair Group 45; Removing and installing hydraulic control unit and bracket



If the readout corresponds to the specification:

- Plug in connector again at engine control unit.
- Remove air filter.
- ◀ - Unlock connector and unplug it from ABS control unit.
- Test CAN databus lines together with terminating resistor in engine control unit.
- Measure resistance between sockets 3 and 25 of test box 1598/18.

Models ► 04.99

Specification: 115...135 Ω

Models 05.99 ►

Specification: 60...72 Ω

Continued for all models

If the readout does not correspond to the specification:

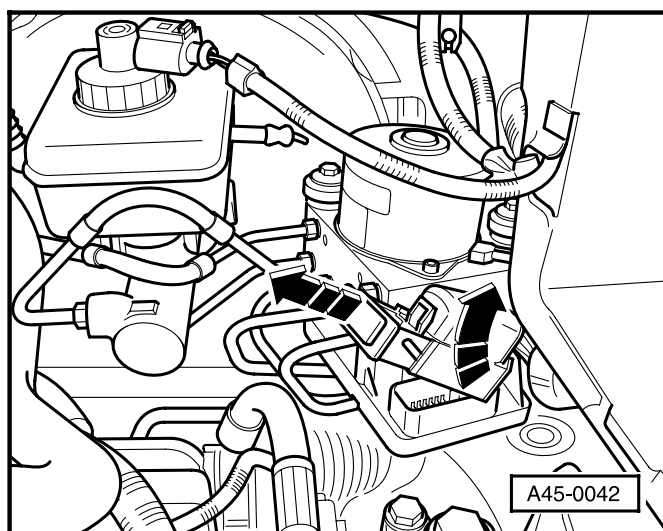
- Test CAN databus lines $\Rightarrow$ page 24-89.

If no fault is found in the wiring:

- Replace engine control unit $\Rightarrow$ page 24-15.

Testing CAN databus lines

- ◀ - Unlock connector and unplug it from the ABS control unit.



- Unlock connector and unplug it from the engine control unit.
- Test CAN databus lines for short circuit to each other.
- Measure resistance between sockets 3 and 25 of test box 1598/18.

Specification: $\infty \Omega$

If the readout does not correspond to the specification (cables have short circuit to each other):

- Rectify fault according to current flow diagrams:
⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder

If the readout corresponds to the specification (cables do not have short circuit to each other):

- Test CAN databus lines for short circuit to positive and to earth.

If no short circuit is found:

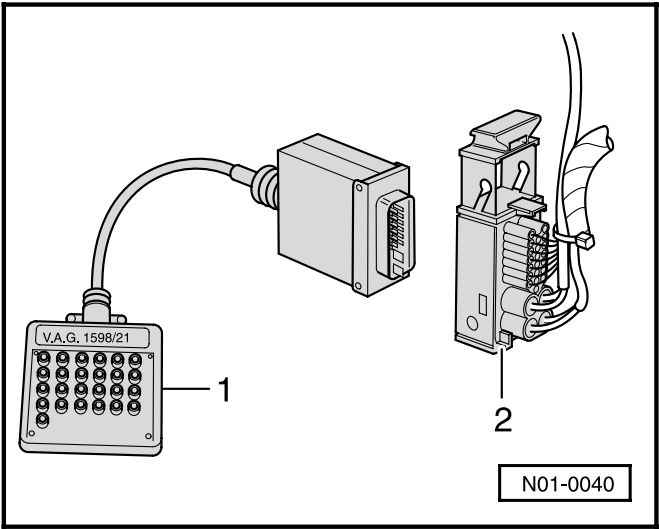
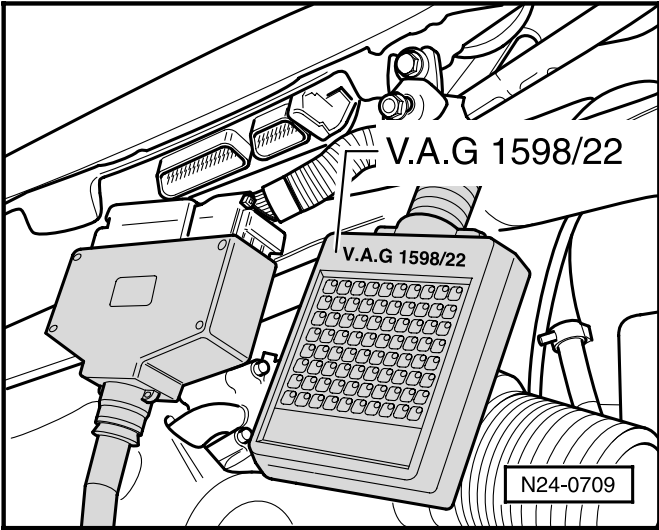
- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit.
- Test CAN databus lines between sockets of test boxes for open circuit according to current flow diagrams:
Cable resistance: max. 1.5 Ω

Socket at test box 1598/22	Socket at test box 1598/18
29	3
31	25

If no fault is found in the wiring:

- ◀ - Connect test box V.A.G 1598/21 -1- to the wiring loom of ABS control unit -2-.
- Test CAN databus lines between sockets of test boxes 1598/22 and 1598/21 for open circuit according to current flow diagrams:
Cable resistance: max. 1.5 Ω

Socket at test box 1598/22	Socket at test box 1598/21
31	11
29	10



Testing ignition system

Safety precautions

Pay attention to the following points to avoid injuries to persons and/or damage to the fuel injection and ignition system:

- ◆ Do not touch or disconnect ignition cables when engine is running or operating at starter speed.
- ◆ Do not disconnect or connect cables of the fuel injection and ignition system, also not cables of test equipment, unless the ignition is switched off.
- ◆ To operate the engine at starting speed without it actually starting (e.g. testing compression pressure), unplug the connector from the power output stage for ignition coils and the connectors from the injectors. After completing the work, interrogate fault memory and erase.
- ◆ Do not carry out an engine wash unless the ignition is switched off.
- ◆ Do not disconnect and connect the battery unless the ignition is switched off otherwise the engine control unit may be damaged.

Technical data of ignition system

Engine code	AEH, AKL
Idling speed Idling speed cannot be altered, is controlled by idling stabilisation	760...880 rpm
Engine speed governed by switching off injectors	at approx. 6350 rpm
Ignition timing is determined in the control unit. It is not possible to set the ignition timing.	
Ignition system	Twin spark ignition system with two ignition coils
Firing order	1-3-4-2
Spark plugs¹⁾	
Manufacturer's designation	NGK BK UR 6 ET-10
Electrode gap	1 mm
Tightening torque	30 Nm
Change interval	60 000 km

¹⁾ Current values

⇒ Binder 1; Repair and Maintenance

Testing twin spark ignition system with two ignition coils

Special tools, testers and aids required

- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Test box V.A.G 1598/22

Fitting location ⇒ page 24-3.

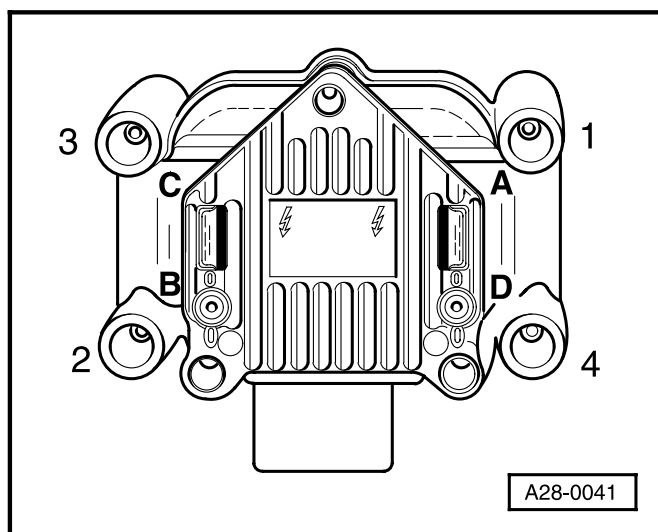
Identification of ignition connections at ignition coil

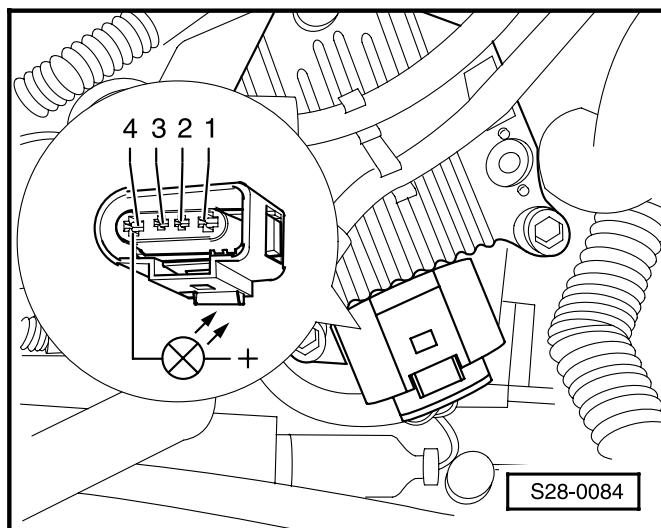
◀ The illustration shows the ignition coil with the high-voltage connections for the ignition cables.

Ignition output -A- at ignition coil ⇒ cylinder 1
 Ignition output -B- at ignition coil ⇒ cylinder 2
 Ignition output -C- at ignition coil ⇒ cylinder 3
 Ignition output -D- at ignition coil ⇒ cylinder 4

Note:

Ignition coils and power output stage are a single component and cannot be replaced separately.





Testing earth supply of power output stage

- Unplug the 4-pin connector at the ignition coils.
- ◀ - Connect diode test lamp V.A.G 1527 between battery positive and contact 4 of the connector (earth); diode test lamp should come on.
- If the diode test lamp does not come on, test cable connection for continuity on the basis of the current flow diagram and rectify any open circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

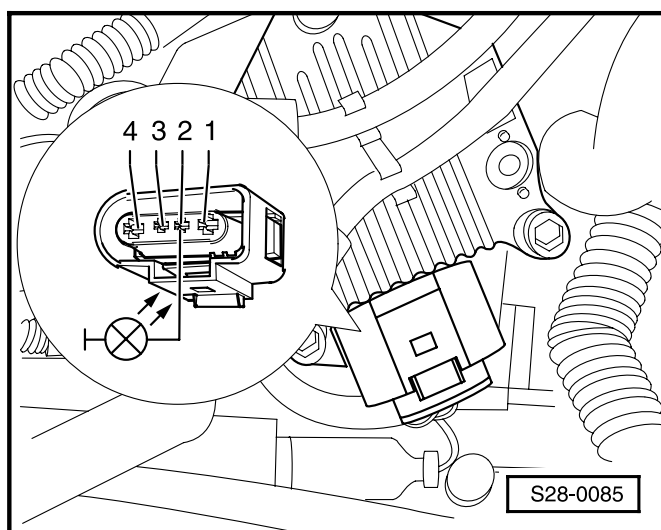
Testing voltage supply of ignition coils

Test requirement:

- Fuse for ignition coils (fuse 29) o.k.
- Unplug the 4-pin connector at the ignition coils.
- Switch on the ignition.
- ◀ - Connect the diode test lamp between engine earth and contact 2 of the connector (positive supply).

Specification: diode test lamp should come on.

- If the specifications are not achieved, test the cable connection on the basis of the current flow diagram, repair if necessary or test the fuse, respectively.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



Testing actuation

- Unplug the connector from all four injectors (to prevent fuel being injected without igniting).
- Switch on the ignition.
- Connect the diode test lamp between engine earth and contact 1 of the 4-pin connector at the ignition coil.
- Operate the starter for a few seconds. The diode test lamp should flash when this is done.

- Connect the diode test lamp between engine earth and contact 3 of the 4-pin connector at the ignition coil.
- Operate the starter for a few seconds. The diode test lamp should flash when this is done.
- If the diode test lamp does not flash, test the cable connection from the 4-pin connector at the ignition coil to the engine control unit for continuity and for short circuit to positive or earth on the basis of the current flow diagram (connect test box V.A.G 1598/22 to the wiring loom to the engine control unit).
- Rectify any open circuit in the wiring or short circuit.

Contact at 4-pin connector of power output stage	Contact at control unit connector
1	71
3	78

- If no open circuit in the wiring or short circuit is found, replace engine control unit ⇒ page 24-15.
- If the ignition cables, the voltage supply for the ignition coils as well as the actuation for the power output stage are o.k. and, despite this, no ignition spark is produced, replace ignition coils together with power output stages.

Testing engine speed sender

Special tools, testers and aids required

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

Notes:

- ◆ *The engine speed sender is a speed and reference mark sender.*
- ◆ *For the operational test of the engine speed sender $\Rightarrow$ also Reading measured value block, display group 003, display zone 1.*

Testing engine speed sender

Fitting location of sender and of plug connection $\Rightarrow$ page 24-3.

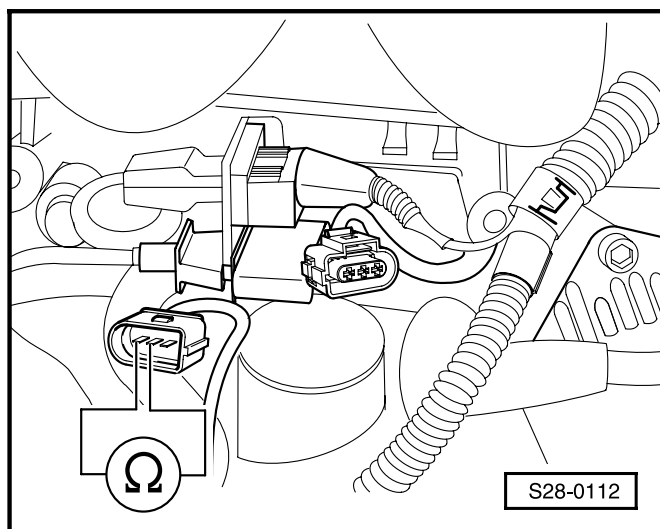
- Before carrying out the test, ensure that the sender is correctly installed and tight.
- Unplug the connector of the engine speed sender (identification: grey connector).
- ◀ - Connect hand-held multimeter (resistance measurement) to contacts 2 and 3 of the connector of the engine speed sender.

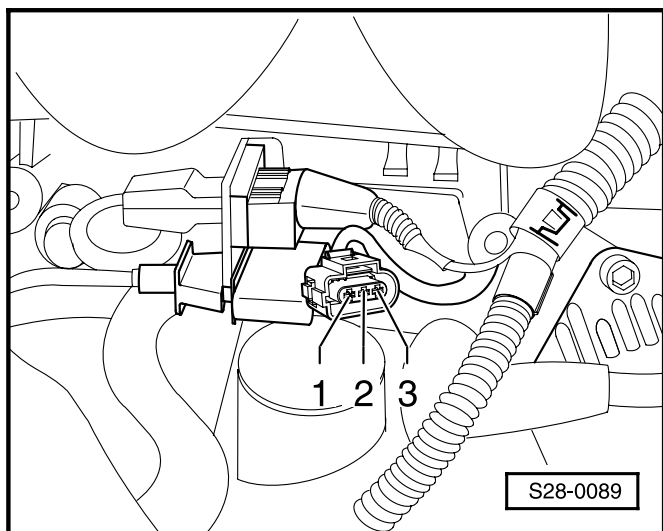
Specification: approx. 450...1000 Ω

- If the specification is not achieved, replace engine speed sender.
- If the specification is achieved, connect the hand-held multimeter to contacts 2 and 1 (earth) and also to contacts 3 and 1 (earth).

Specification: $\infty \Omega$

- If the specification is not achieved, replace the engine speed sender.
- If the specification is achieved, test the wiring between sender connector and engine control unit as follows:
- Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit $\Rightarrow$ page 24-14.





- ◀ - Test the cable connection between test box and 3-pin connector for continuity as specified in the current flow diagram.

Models ► 07.97

Contact at connector of sender Socket at test box	Contact at sender connector Contact at control unit connector
1	67
2	63
3	56

Models 08.97 ►

Contact at connector of sender Socket at test box	Contact at sender connector Contact at control unit connector
1	70
2	63
3	56

Continued for all models

Specification: max. 1.5 Ω

- If the specifications are not achieved, rectify the short circuit or open circuit in the wiring between the sender socket and the control unit connector.
- If there is neither an open circuit in the wiring nor a short circuit, replace the engine control unit ⇒ page 24-15.

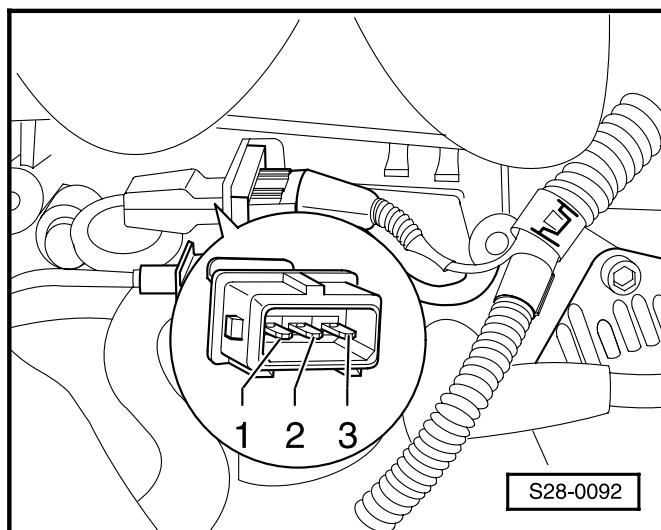
Testing knock sensor

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Notes:

- ◆ For the operational test of the knock sensors ⇒ Reading measured value block, display groups 014, 015, 016 and 017.
- ◆ Fitting location of the plug connections and of the knock sensor ⇒ page 24-3.



- ◆ The knock sensor itself cannot be tested electrically (interrogate fault memory ⇒ page 01-4).
- ◆ It is essential for the knock sensor to be tightened exactly to a torque of 20 Nm if it is to operate properly.
- ◆ Inspect plug connection for corrosion.
- ◆ Only gold-plated contacts may be used for repairing contacts in the plug connection of the knock sensor.

Testing knock sensor wiring

- Separate the plug connection of the knock sensor in the engine compartment.
- ◀ - Test all three contacts at the connector of the knock sensor for short circuit to each other. There must not be any connection between the wiring.
- If a connection exists, replace knock sensor.

Testing wiring from knock sensors to engine control unit

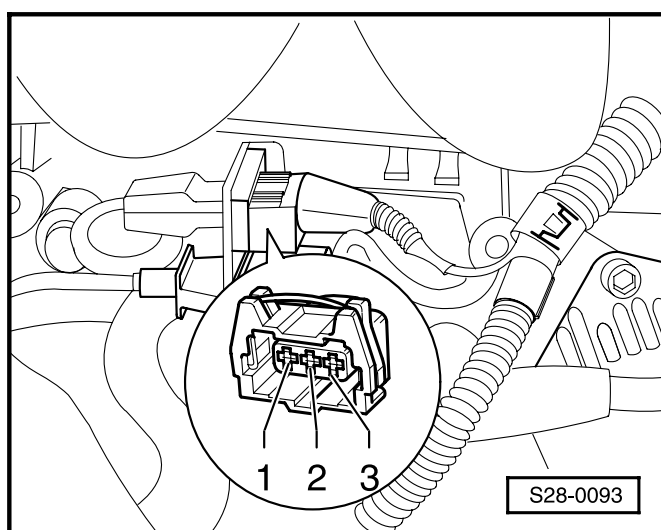
- Connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-14.
- Test the wiring between knock sensor and engine control unit for continuity and also for short circuit to each other and short circuit to positive and to earth on the basis of the current flow diagram.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

◀ Contact assignment of plug connection:

Contact at connector	Socket at test box
1 (signal)	68
2 (earth)	67
3 (screening)	67

Specification: max. 1 Ω

- If the specifications are not achieved, rectify the open circuit in the wiring or short circuit.



Testing Hall sender

Fitting location of Hall sender ⇒ page 24-3.

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526 A
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Test box V.A.G 1598/22

Notes:

- ◆ *The Hall sender is located below the cam-shaft gear.*
- ◆ *If the Hall sender signal is not supplied, it is no longer possible to assign the signals of the knock sensors to the cylinders; in this case, the knock control is switched off and the ignition angle is retarded slightly to reliably avoid any knocking.*
- ◆ *If the Hall sender signal is not supplied, the engine continues to run and can also be re-started for the following reasons:*
 - ◆ The offset by one engine revolution does not have any perceptible effects on fuel injection.
 - ◆ Fuel injection takes place „upstream“ of the closed inlet valve instead of with the inlet valve being opened. As a result, the quality of the mixture formation is only slightly affected.
 - ◆ In the case of the twin spark ignition system, an ignition spark is supplied to each cylinder during each revolution of the engine and not, as is normally the case, during each second revolution of the engine.

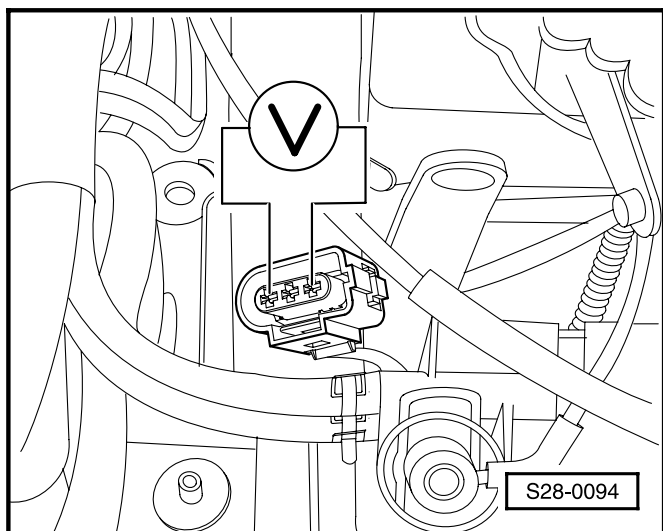
- Unplug the connector at the Hall sender.
- Switch on the ignition.

Note:

The connector contacts are appropriately numbered on the rear of the connector.

- ◀ - Connect hand-held multimeter for voltage measurement to contact 1 (positive) and 3 (earth) of the connector of the Hall sender.

Specification: 4.5...5.5 V



- Connect the hand-held multimeter to contacts 2 and 3 (earth) of the connector of the Hall sender.

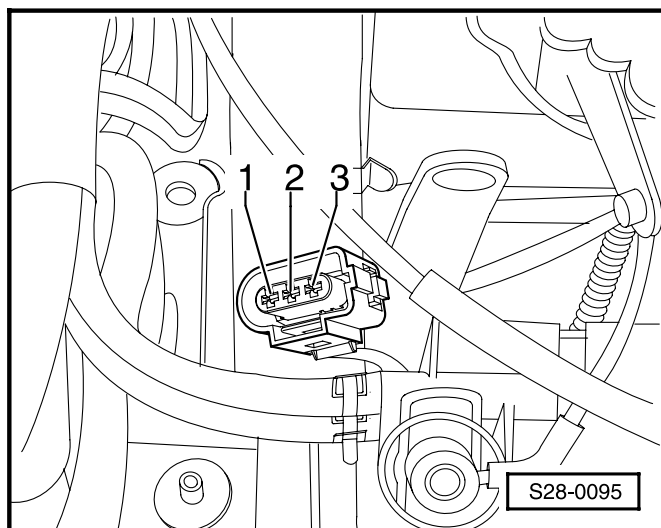
Specification: 4.5...5.5 V

- If the specifications are achieved, replace the Hall sender.

Note:

The voltage for the Hall sender is supplied by the engine control unit.

- If the specifications are not achieved, test the cable connections from the Hall sender to the engine control unit as follows:
- Switch off the ignition.
- Connect test box V.A.G 1598/22 at the wiring loom to the engine control unit ⇒ page 24-14.



- ◀ - Test the cable connection from the Hall sender to the engine control unit for open circuit in the wiring and also for short circuit to positive and to earth.

Models ► 07.97

Contact at 3-pin connector of Hall sender	Contact at control unit connector
1 (positive)	62
2 (signal)	76
3 (earth)	67

Models 08.97 ►

Contact at 3-pin connector of Hall sender	Contact at control unit connector
1 (positive)	62
2 (signal)	76
3 (earth)	70

Continued for all models

- If the cable connections are o.k. but the voltages do not exist as described, then replace the engine control unit ⇒ page 24-15.

Testing voltage supply for control unit

Special tools, testers and aids required

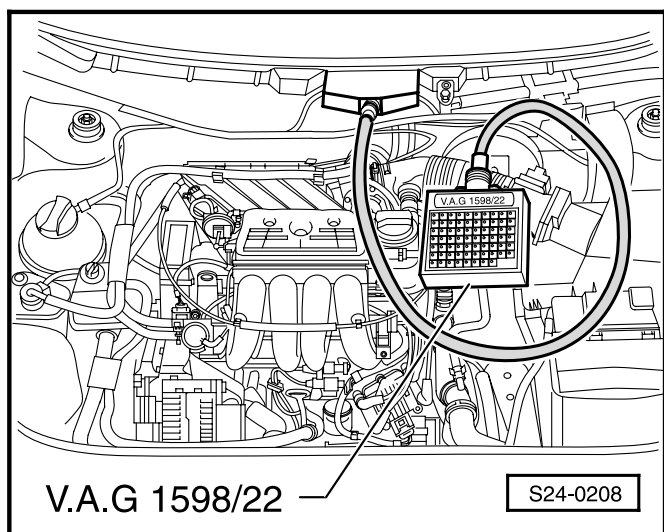
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Test box V.A.G 1598/22

Note:

For testing the voltage supply of the engine control unit ⇒ also Reading measured value block, display group 005, display zone 2.

Test requirements:

- Fuse for engine control unit o.k.
- Battery voltage at least 11 V
- Alternator o.k.

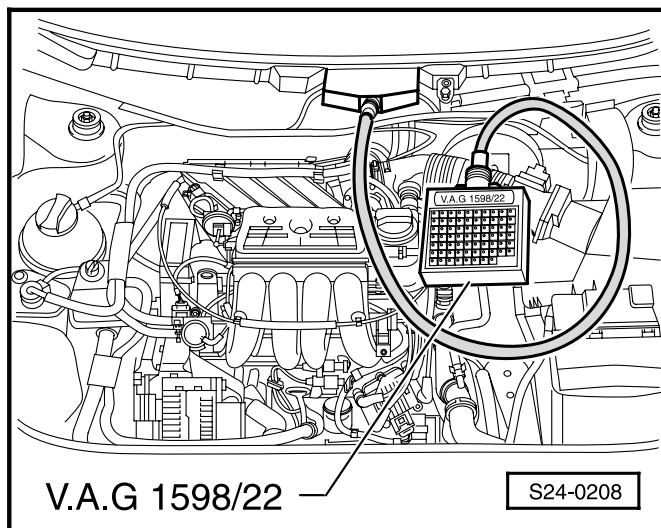


- ◀ - Connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit ⇒ page 24-5.
- Switch on the ignition.
- Connect the diode test lamp V.A.G 1527 to socket 1 (positive through ignition) and to earth.

The diode test lamp should come on.

- If the diode test lamp does not come on, test the cable connection from contact 1 at the control unit connector to the fuse for open circuit on the basis of the current flow diagram, and repair if necessary.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If the diode test lamp V.A.G 1527 comes on, connect the diode test lamp to socket 1 of the control unit connector (positive through ignition) and to socket 2 of the control unit connector (earth supply for engine control unit).

The diode test lamp should come on.



- If the diode test lamp does not come on, test the cable connection from contact 2 at the control unit connector to earth for open circuit, and rectify any open circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

- Connect the diode test lamp V.A.G 1527 to socket 3 (continuous positive) and to earth.

The diode test lamp should come on.

- ◀ - If the diode test lamp does not come on, test the cable connection between contact 3 of the control unit connector and central electrics for continuity on the basis of the current flow diagram, and rectify any open circuit.
- ⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder

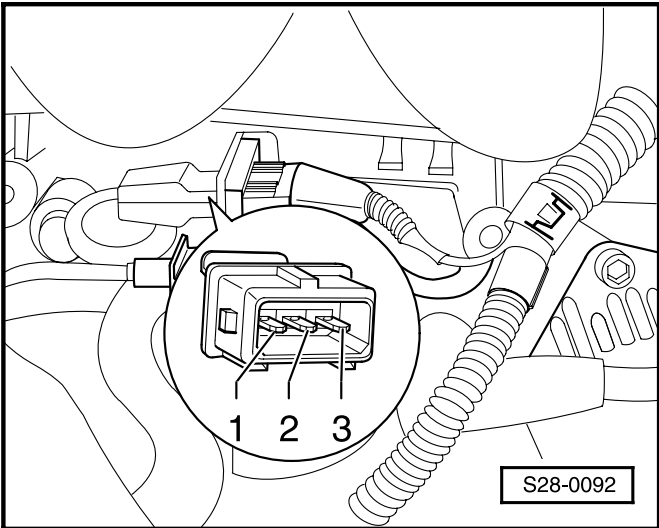
Testing knock sensor

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526
- ◆ Adapter cable set V.A.G 1594
- ◆ Test box V.A.G 1598/22

Notes:

- ◆ For the operational test of the knock sensors ⇒ Reading measured value block, display groups 14, 15, 16 and 17.
- ◆ Fitting location of the plug connections and of the knock sensor ⇒ page 24-3.
- ◆ The knock sensor itself cannot be tested electrically (interrogate fault memory ⇒ page 01-4).
- ◆ It is essential for the knock sensor to be tightened exactly to a torque of 20 Nm if it is to operate properly.
- ◆ Inspect plug connection for corrosion.
- ◆ Only gold-plated contacts may be used for repairing contacts in the plug connection of the knock sensor.

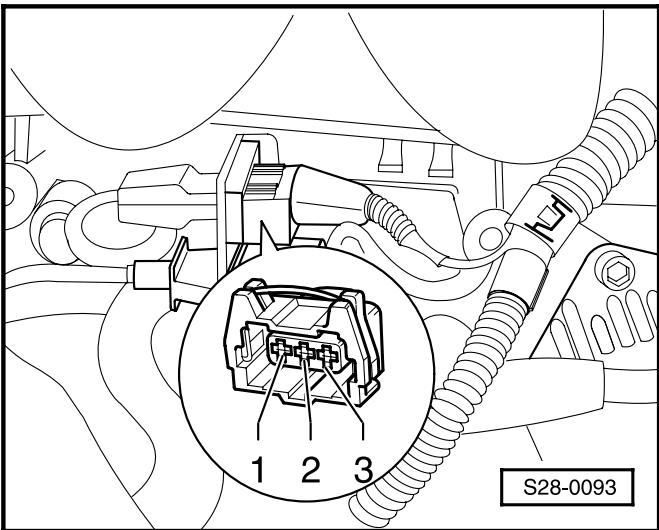
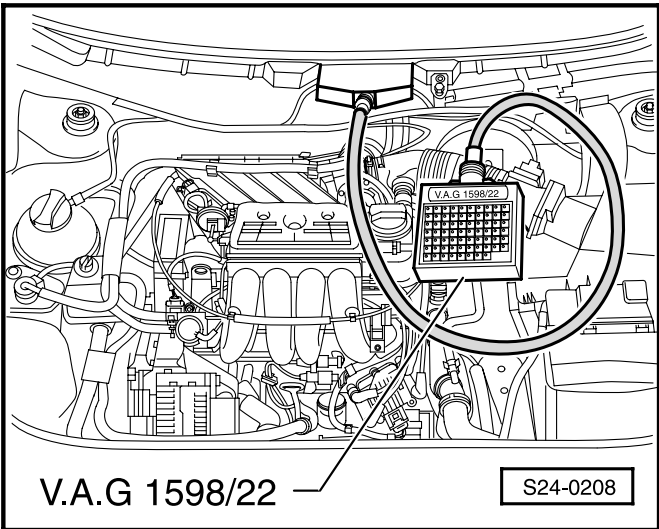


Testing knock sensor wiring

- Separate the plug connection of the knock sensor in the engine compartment.
- ◀ - Test all three contacts at the connector of the knock sensor for short circuit to each other. There must not be any connection between the wiring.
- If a connection exists, replace knock sensor.

Testing wiring from knock sensors to the engine control unit

- ◀ - Connect the test box V.A.G 1598/22 to the wiring loom to the engine control unit
⇒ page 24-5.
- Test the wiring between knock sensor and engine control unit for continuity and also for short circuit to each other and short circuit to positive and to earth on the basis of the current flow diagram.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder



◀ Contact assignment of plug connection:

Contact of sensor connector	Contact at control unit connector
1 (signal)	68
2 (earth)	67
3 (screening)	67

- Test signal wire of the knock sensor 1 -G61 from contact 1 of the connector in the engine compartment to socket 68 of the test box for continuity.

Specification: max. 1 Ω.

- Test earth wire of the knock sensor 1 -G61 from contact 2 of the connector in the engine compartment to socket 67 of the test box for continuity.

Specification: max. 1 Ω .

- Test screening of the wiring for knock sensor 1 -G61 from contact 3 of the connector in the engine compartment to socket 67 of the test box for continuity.

Specification: max. 1 Ω .

- If the specifications are not achieved, rectify open circuit in wiring or short circuit.

Testing Hall sender

Fitting location of Hall sender $\Rightarrow$ page 24-3.

Special tools, testers and aids required

- ◆ Hand-held multimeter, e.g. V.A.G 1526
- ◆ Adapter cable set V.A.G 1594
- ◆ Test box V.A.G 1598/22

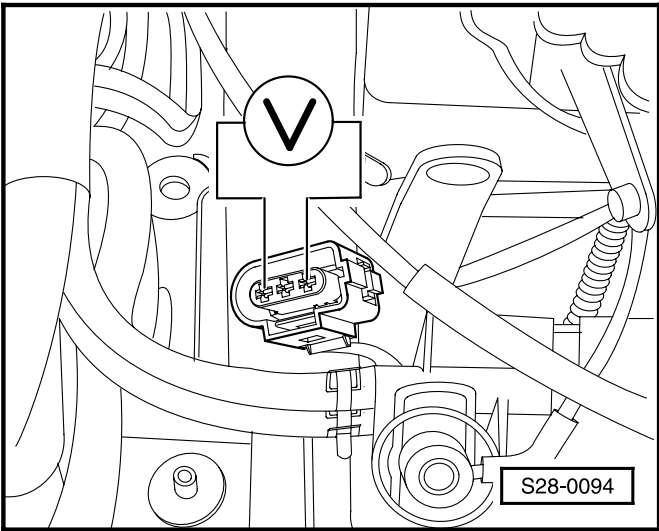
Notes:

- ◆ *The Hall sender is located below the camshaft gear.*
- ◆ *If the Hall sender signal is not supplied, it is no longer possible to assign the signals of the knock sensors to the cylinders; in this case, the knock control is switched off and the ignition angle is retarded slightly to reliably avoid any knocking.*
- ◆ *If the Hall sender signal is not supplied, the engine continues to run and can also be re-started for the following reasons:*
 - ◆ The offset by one engine revolution does not have any perceptible effects on fuel injection.
 - ◆ Fuel injection takes place „upstream“ of the closed inlet valve instead of with the inlet valve being opened. As a result, the quality of the mixture formation is only slightly affected.
 - ◆ In the case of the twin spark ignition system, an ignition spark is supplied to each cylinder during each revolution of the engine and not, as is normally the case, during each second revolution of the engine.

- Unplug the connector at the Hall sender.
- Switch on the ignition.

Note:

The connector contacts are appropriately numbered on the rear of the connector.



- ◀ - Connect hand-held multimeter V.A.G 1526 for voltage measurement to contact 1 (positive) and 3 (earth) of the connector of the Hall sender. Ensure that none of the contacts is bent.

Specification: 4.5...5.5 volts

- Connect the hand-held multimeter V.A.G 1526 to contacts 2 and 3 (earth) of the connector of the Hall sender. Ensure that none of the contacts is bent.

Specification: 4.5...5.5 volts

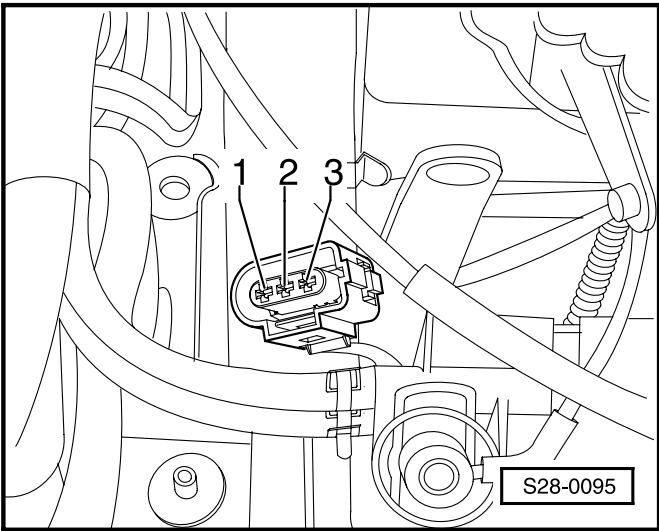
- If the specifications are achieved, replace the Hall sender.

Note:

The voltage for the Hall sender is supplied by the engine control unit.

- If the specifications are not achieved, test the cable connections from the Hall sender to the engine control unit as follows:

- Switch off the ignition.
- Connect test box V.A.G 1598/22 at the wiring loom to the engine control unit ⇒ page 24-5.



- ◀ - Test the cable connection from the Hall sender to the engine control unit for open circuit in the wiring and also for short circuit to positive and to earth.

Contact at 3-pin connector of Hall sender	Contact at control unit connector
1 (positive)	62
2 (signal)	76
3 (earth)	67

- If the cable connections are o.k. but the voltages do not exist as described, then replace the engine control unit ⇒ page 24-6.