

Workshop Manual OCTAVIA

**1.4-ltr./44 kW Engine, Simos 3PB Fuel
Injection and Ignition System**

List of Supplements for **OCTAVIA** Workshop Manual

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1.4-ltr./44 kW Engine, Simos 3PB Fuel Injection and Ignition System

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Self-diagnosis

Note:

Self-diagnosis monitors only a part of the fuel injection and ignition system.

Features of self-diagnosis

The Simos 3PB control unit is equipped with a fault memory. The fault memory is designed as a permanent memory.

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

Faults which occur only occasionally (sporadically), appear in the display with the addition „/SP“. The cause of a sporadic fault may be, for example, a loose contact or a temporary open circuit in the wiring. If a sporadic fault no longer occurs within 40 engine starts, it is erased from the fault memory.

These stored faults can be read with the vehicle system tester V.A.G 1552 or with the fault reader V.A.G 1551 ⇒ page 01-4.

After rectifying the fault or faults, the fault memory must be erased ⇒ page 01-4.

Note:

The description which follows relates only to the vehicle system tester V.A.G 1552 using the programme card 5.0 or higher.

Technical data of self-diagnosis

Interrogating control unit version

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

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

Please refer to the table which follows for the conditions which must exist to allow you to select the desired functions.

Function		Requirement	
		Ignition on	Engine idling
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
08	Reading measured value block	yes	yes

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

²⁾ Must be carried out after completing the following operations:
Replacing engine control unit, throttle valve control unit or engine, or disconnecting battery.

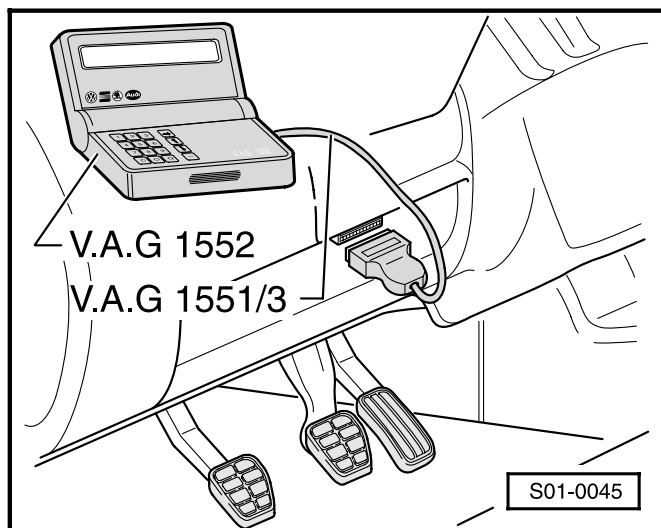
Connecting vehicle system tester V.A.G 1552 and selecting engine electronics control unit

Special tools, testers and aids required

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

Test requirements

- Battery voltage at least 11 V
- Fuses according to up-to-date current flow diagram o.k.
- Earth connections at front of clutch housing and at cylinder head o.k.



Procedure

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

After connecting the vehicle system tester:

- Either, depending on the function desired, switch on the ignition
or
start the engine ⇒ page 01-1, table of „Available Functions“.

Notes:

- ◆ If the readout which appears in the display does not correspond to the procedure:
⇒ Operating instructions of vehicle system tester
- ◆ If „Error in data transmission!“ is displayed because of an incorrect entry, unplug cable at fault reader, plug in again and repeat these steps.

Test of vehicle systems
Enter address word XX

HELP

- ◀ Readout in display:

Note:

Operate the vehicle system by referring to the readout in the display.

- Press keys 0 and 1 for the address word „Engine electronics“ and confirm the engine with the key Q.

047906033B 1.4 I SIMOS 3PB 00HSSC01 →
Coding 00001 WSC 00000

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

- ◆ 047906033B = Part No. of control unit
- ◆ 1.4 I = Displacement of engine
- ◆ SIMOS 3PB = System designation
- ◆ HS = Manual gearbox
- ◆ SC01 = Software number

- Press the → key.

Test of vehicle systems
Select function XX

HELP

- ◀ Readout in display:

- For the further procedure ⇒ Repair Descriptions.

Interrogating and erasing fault memory

Special tools, testers and aids required

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

Procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

Only if engine does not start:

- Switch on ignition.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

X faults recognized!

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

If one or several faults are stored:

The stored faults are displayed one after the other.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Note:

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

Test of vehicle systems
Fault memory is erased!

→

◀ Readout in display:

- Press the → key.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Rectify the faults displayed by referring to the fault table ⇒ page 01-6.
- After rectifying the faults, it is then necessary to carry out a road test.

The following operating conditions must be met during this road test:

- ♦ The coolant temperature must rise to more than 80 °C.
- ♦ Once this temperature is reached, the following operating states must be achieved several times:
 - Idling speed
 - Part load
 - Full load
 - Fuel shut-off on overrun.
- ♦ At full throttle, the engine speed must rise to more than 3500 rpm ⇒ page 24-17.
- Once again, interrogate the fault memory of the control unit.

If no fault is stored:

- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Fault table

Notes:

- ◆ The fault table is arranged according to the 5-digit fault code shown on the left.
- ◆ The SAE code (e.g. P0107) which is positioned on the right next to the fault code, should be ignored (applies at present only to USA).
- ◆ Explanations regarding fault types (e.g. „open or short circuit to earth“):
⇒ Operating instructions of vehicle system tester
- ◆ If components are shown as faulty:
Test cables and plug connections to these components, and also earth cables of the system according to the current flow diagram. Replace component only if no fault is also found in this case. This applies in particular to faults which are shown as „sporadic“ (SP).

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16496 Intake air temperature sender -G72 Signal too small	◆ Short circuit to earth ◆ Sender -G72 faulty	◆ Emergency mode, control unit operating with substitute temperature	- Read measured value block, display group 004, display block 4 ⇒ page 01-36. - Test intake air temperature sender ⇒ page 24-31.
16497 Intake air temperature sender -G72 Signal too large	◆ Short circuit to positive ◆ Sender -G72 faulty	◆ Emergency mode, control unit operating with substitute temperature	- Read measured value block, display group 004, display block 4 ⇒ page 01-36. - Test intake air temperature sender ⇒ page 24-31.
16500 Coolant temperature sender -G62 Implausible signal	◆ Coolant temperature sender -G62 supplying implausible signal because of loose contact, or corrosion caused by moisture in connector ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Cold start problems at very low temperatures ◆ Poor driving characteristics in warming-up phase ◆ Increased fuel consumption ◆ Increased emission levels	- Read measured value block, display group 004, display block 3 ⇒ page 01-36. - Test coolant temperature sender ⇒ page 24-35. - Replace engine control unit ⇒ page 24-14.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16501 Coolant temperature sender -G62 Signal too small	◆ Short circuit to earth ◆ Sender -G62 faulty	◆ Cold start problems at very low temperatures ◆ Poor driving characteristics in warming-up phase ◆ Increased fuel consumption ◆ Increased emission levels	- Read measured value block, display group 004, display block 3 ⇒ page 01-36. - Test coolant temperature sender ⇒ page 24-35.
16502 Coolant temperature sender -G62 Signal too large	◆ Short circuit to positive ◆ Sender -G62 faulty	◆ Cold start problems at very low temperatures ◆ Poor driving characteristics in warming-up phase ◆ Increased fuel consumption ◆ Increased emission levels	- Read measured value block, display group 004, display block 3 ⇒ page 01-36. - Test coolant temperature sender ⇒ page 24-35.
16514 Bank 1, probe 1 Electrical fault in circuit	◆ Open circuit in wiring or short circuit to earth ◆ Lambda probe faulty	◆ Lambda closed-loop control switches to open-loop ◆ Poor idling ◆ Increased emission levels ◆ Increased fuel consumption	- Rectify short circuit or open circuit in wiring ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test lambda control ⇒ page 24-41.
16515 Bank 1, probe 1 Voltage too small	◆ Short circuit of lambda probe signal cable to earth or to screening ◆ Short circuit of lambda probe signal cable to earth or to screening ◆ Lambda probe faulty	◆ Lambda closed-loop control switches to open-loop ◆ Poor idling ◆ Emission levels not o.k. ◆ Increased fuel consumption	- Rectify short circuit or open circuit in wiring ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test lambda control ⇒ page 24-41. - Read measured value block, display group 030 ⇒ page 01-38. - Read measured value block, display group 031 ⇒ page 01-39.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16516 Bank 1, probe 1 Voltage too large	♦ Short circuit of signal cable to positive ♦ Lambda probe faulty	♦ Lambda closed-loop control switches to open-loop ♦ Poor idling	- Rectify short circuit or open circuit in wiring ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test lambda control ⇒ page 24-41.
16517 Bank 1, probe 1 Signal too slow	♦ Lambda probe faulty	♦ Lambda closed-loop control switches to open-loop ♦ Poor idling ♦ Emission levels not o.k. ♦ Increased fuel consumption	- Test lambda control ⇒ page 24-41.
16518 Bank 1, probe 1 No activity	♦ Lambda probe faulty (dirty) ♦ Open circuit in wiring between probe heater and engine control unit ♦ Lambda probe heater not operating	♦ Increased fuel consumption ♦ Emission levels not o.k. ♦ Carbon deposits on spark plugs	- Read measured value block, display group 030 ⇒ page 01-38. - Read measured value block, display group 031 ⇒ page 01-39. - Test lambda probe heater ⇒ page 24-47.

Note on fault codes 16500 - 16502:

As soon as one of the faults is recognised, the control unit uses a substitute value from the model map stored in the control unit.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16554 Bank 1, fuel metering system Malfunction	◆ Fuel pressure regulator faulty ◆ Injectors faulty	◆ Engine does not start ◆ Increased emission levels ◆ Poor starting characteristics	- Test fuel pressure regulator and holding pressure ⇒ page 24-19. - Test injectors ⇒ page 24-23. - Test injected quantity and leaktightness ⇒ page 24-25. - Test fuel pump: ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 20; Testing fuel pump - Inspect intake system for leaks ⇒ page 24-22. - Test exhaust system for leaks: ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 26; Removing and installing parts of exhaust system - Inspect vacuum lines for leaks.
16555 Bank 1, fuel metering system System too lean	◆ Fuel system faulty ◆ Lambda probe faulty	◆ Lambda closed-loop control switches to open-loop ◆ Poor idling ◆ Emission levels not o.k. ◆ Increased fuel consumption	- Test fuel pressure regulator and holding pressure ⇒ page 24-19. - Test lambda control ⇒ page 24-41. - Read measured value block, display group 030 ⇒ page 01-38. - Read measured value block, display group 031 ⇒ page 01-39.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16556 Bank 1, fuel metering system System too rich	◆ Fuel system faulty ◆ Lambda probe faulty	◆ Lambda closed-loop control switches to open-loop ◆ Poor idling	- Test fuel pressure regulator and holding pressure ⇒ page 24-19. - Test lambda control ⇒ page 24-41. - Read measured value block, display group 030 ⇒ page 01-38. - Test lambda control ⇒ page 24-41.
16705 Engine speed sender -G28 Implausible signal	◆ Engine speed sender -G28 loose	◆ Engine misfires	- Test engine speed sender -G28 ⇒ page 28-10.
16706 Engine speed sender -G28 No signal	◆ Signal cable has open circuit or short circuit to earth or to positive ◆ Earth cable has open circuit or short circuit to positive ◆ -G28 loose, or faulty ◆ Open circuit to screening of -G28 ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Engine does not start ◆ Engine cuts out	- Rectify open circuit in wiring or short circuit. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test engine speed sender -G28 ⇒ page 28-10. - Replace engine control unit ⇒ page 24-14.
16711 Knock sensor 1 -G61 Signal too small	◆ Knock sensor faulty ◆ Short circuit to earth	◆ High fuel consumption ◆ Reduced power	- Test knock sensor -G61 ⇒ page 28-8.
16712 Knock sensor 1 -G61 Signal too large	◆ Knock sensor faulty ◆ Short circuit to earth	◆ High fuel consumption ◆ Reduced power	- Test knock sensor -G68 ⇒ page 28-8.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16719 Engine speed sender -G28 Malfunction	◆ Short circuit of lambda probe signal wire to earth or to screening ◆ Earth cable has open circuit or short circuit to positive ◆ -G28 loose, or faulty ◆ Open circuit to screening of -G28 ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Engine does not start ◆ Engine cuts out	- Rectify open circuit in wiring or short circuit. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test engine speed sender -G28 ⇒ page 28-10. - Replace engine control unit ⇒ page 24-14.
16725 Camshaft position sensor => sender -G40 Implausible signal	◆ Voltage supply or earth supply for camshaft position sensor -G163¹⁾ faulty ◆ -G163 faulty ◆ Signal input in engine control unit faulty (control unit faulty) ◆ Open circuit or short circuit to earth or to positive in signal cable between -G163 and engine control unit ◆ Timing chain stretched (engines with high mileage)	◆ Engine does not rev up to maximum speed ◆ Poor performance ◆ Start problems ◆ Valve timing loud, reduced engine output	- Test camshaft position sensor -G163 ⇒ page 28-6 - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Read measured value block, display group 012; check readouts in display blocks 3 and 4 ⇒ page 01-37.
16726 Camshaft position sensor => sender -G40 Signal too small	◆ -G163¹⁾ faulty ◆ Large contact resistances in connectors (corrosion)	◆ Engine does not rev up to maximum speed ◆ Poor performance ◆ Start problems	- Test camshaft position sensor -G163 ⇒ page 28-6. - Test cable connection or wiring to -G163 ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder

¹⁾ The camshaft position sensor -G163 is identical with the Hall sender -G40.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16825 Tank vent system Flow faulty	◆ -N80 faulty ◆ Open circuit in wiring or short circuit	◆ Irregular idling ◆ Smell of fuel	- Test activated charcoal filter solenoid valve ⇒ page 01-30, Final control diagnosis ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 20; Removing and installing activated charcoal filter - Inspect hoses and connection pipes from fuel tank up to throttle valve control unit. ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 20; Removing and installing fuel tank with attached parts and fuel filter - Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
16885 Vehicle speed signal Implausible signal	◆ Vehicle speed sender faulty ◆ Open circuit in wiring or short circuit between vehicle speed sender and speedometer ◆ Open circuit in wiring or short circuit between dash panel insert and engine control unit	◆ Brief variation between idling speed and specified speed ◆ Poor load change characteristics ◆ Malfunction in systems which use vehicle speed signal	- Read measured value block, display group 005, display block 3 ⇒ page 01-36. - Rectify open circuit in wiring or short circuit. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test vehicle speed signal ⇒ page 24-65.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16890 Idling speed control Speed below set value	◆ Throttle valve positioner jamming ◆ Air filter blocked	◆ Poor driving characteristics ◆ Increased fuel consumption	- Test throttle valve control unit ⇒ page 24-56. - Inspect intake system for leaks (unmetered air) ⇒ page 24-22.
16891 Idling speed control Speed above set value	◆ Unmetered air downstream of throttle valve ◆ Injector faulty ◆ Fuel pressure regulator faulty	◆ Smell of fuel	- Test throttle valve control unit ⇒ page 24-56. - Test injectors ⇒ page 24-23. - Replace fuel pressure regulator.
16955 Brake light switch -F Implausible signal	◆ Brake light switch faulty ◆ Open circuit in wiring or short circuit to positive or to earth between brake light switch and engine control unit	◆ Brake light does not come on ◆ Variations in engine speed during brake application	- Test brake light switch -F ⇒ page 24-67. - Rectify open circuit in wiring or short circuit according to current flow diagram ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
16984 Drive databus No message	◆ Open circuit in datalines to ABS control unit	◆ Poor driving characteristics ◆ Variations in engine speed when ABS activated	- Test databus ⇒ page 24-75.
16985 Control unit defective	◆ Engine control unit faulty	◆ Engine does not start	- Replace engine control unit ⇒ page 24-14.
16988 Control unit defective	◆ Engine control unit faulty	◆ Engine does not start	- Replace engine control unit ⇒ page 24-14.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
16990 Control unit defective	♦ Engine control unit faulty	♦ Engine does not start	- Replace engine control unit ⇒ page 24-14.
17510 Bank 1, probe 1, heating circuit Short to positive	♦ Short circuit to positive in cable from engine control unit to lambda probe ♦ Output stage in engine control unit faulty (engine control unit faulty) ♦ Lambda probe faulty ♦ Fuel pump relay or actuation of fuel pump relay faulty	♦ Irregular idling ♦ Emission levels not o.k.	- Test lambda probe heater ⇒ page 24-47. - Rectify short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-14. - Replace lambda probe. - Test fuel pump relay and actuation ⇒ page 24-27.
17511 Bank 1, probe 1, heating circuit Insufficient capacity	♦ Open circuit in cable from engine control unit to lambda probe ♦ Output stage in engine control unit faulty (engine control unit faulty) ♦ Lambda probe faulty ♦ Fuel pump relay or actuation of fuel pump relay faulty	♦ Irregular idling ♦ Emission levels not o.k.	- Test lambda probe heater ⇒ page 24-47. - Rectify open circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-14. - Replace lambda probe. - Test fuel pump relay and actuation ⇒ page 24-27.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17523 Bank 1, probe 1, heating circuit Short circuit to earth	◆ Short circuit to earth in cable from engine control unit to lambda probe ◆ Output stage in engine control unit faulty (engine control unit faulty) ◆ Lambda probe faulty	◆ Irregular idling ◆ Emission levels not o.k.	- Test lambda probe heater ⇒ page 24-47. - Replace engine control unit ⇒ page 24-14. - Replace lambda probe. ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 26; Removing and installing parts of exhaust system
17524 Bank 1, probe 1, heating circuit Open circuit	◆ Open circuit in wiring from engine control unit to lambda probe ◆ Output stage in engine control unit faulty (engine control unit faulty) ◆ Lambda probe faulty	◆ Irregular idling ◆ Emission levels not o.k.	- Test lambda probe heater ⇒ page 24-47. - Rectify open circuit in wiring. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Replace engine control unit ⇒ page 24-14. - Replace lambda probe. ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 26; Removing and installing parts of exhaust system
17549 Load detection Implausible value	◆ Leak in intake system	◆ Reduced output	- Test intake system for leaks (unmetered air) ⇒ page 24-22. - Erase fault memory ⇒ page 01-4 and conduct road test.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17563 Intake manifold pressure sender -G71 Short to positive	◆ Cable has short circuit to positive ◆ -G71 faulty	◆ Increased emission levels ◆ Poor throttle response ◆ Hard load change jolts	- Test intake manifold pressure sender -G71 ⇒ page 24-30. - Test intake system for leaks (unmetered air) ⇒ page 24-22.
17564 Intake manifold pressure sender -G71 Open/short to earth	◆ Open circuit in wiring ◆ Cable has short circuit to earth ◆ -G71 faulty	◆ Increased emission levels ◆ Poor throttle response ◆ Hard load change jolts	- Test intake manifold pressure sender -G71 ⇒ page 24-30. - Test intake system for leaks (unmetered air) ⇒ page 24-22.
17568 Intake manifold temperature sender -G72 Short to earth	◆ Short circuit to earth in cable connection between intake manifold temperature sender -G72 and engine control unit ◆ -G72 faulty ◆ Signal input in engine control unit faulty (control unit faulty) ◆ -G72 faulty ◆ Fault in earth supply to -G72 ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Emergency mode, engine control unit operates with substitute temperature in line with coolant temperature	- Read measured value block, display group 004, display block 4 ⇒ page 01-36. - Test intake manifold temperature sender -G72 ⇒ page 24-31. - Replace engine control unit ⇒ page 24-14. - Test intake manifold temperature sender -G72 ⇒ page 24-31. - Replace engine control unit ⇒ page 24-14.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17569 Intake manifold temperature sender -G72 Open/short to positive	◆ Open circuit or short circuit to positive in cable connection between intake manifold temperature sender -G72 and engine control unit ◆ -G72 faulty ◆ Fault in earth supply to -G72 ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Emergency mode, engine control unit operates with substitute temperature in line with coolant temperature	- Read measured value block, display group 004, display block 4 ⇒ page 01-36. - Test intake manifold temperature sender -G72 ⇒ page 24-31. - Replace engine control unit ⇒ page 01-36.
17579 Angle sender 2 for TV drive -G188 Implausible signal	◆ -G188 faulty or loose contact in plug connection for throttle valve control unit -J338 ◆ Signal input in engine control unit faulty (engine control unit faulty) ◆ Incorrect connector assignment	◆ Engine runs in emergency mode ◆ Reduced output ◆ Irregular idling	- Test throttle valve control unit ⇒ page 24-56. - Replace engine control unit ⇒ page 24-14.
17580 Angle sender 2 for throttle valve drive -G188 Signal too small	◆ Open circuit or short circuit to earth in signal cable from -G188 to engine control unit	◆ Engine runs in emergency mode ◆ Altered idling speed	- Test throttle valve control unit ⇒ page 24-56.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17581 Angle sender 2 for throttle valve drive -G188 Signal too large	◆ Open circuit in earth cable from -G188 to engine control unit	◆ Engine runs in emergency mode ◆ Cold start problems ◆ Cold idling problems	- Test throttle valve control unit ⇒ page 24-56.
17621 Injector cyl. 1 -N30 Short to positive	◆ -N30 faulty ◆ Cable has short circuit to positive	◆ Increased emission levels ◆ Poor start characteristics ◆ Poor driving characteristics ◆ Poor throttle response ◆ Irregular idling	- Test injectors N30...N33 ⇒ page 24-23.
17622 Injector cyl. 2 -N31 Short to positive	⇒ Fault code 17621, cyl. 1		
17623 Injector cyl. 3 -N32 Short to positive	⇒ Fault code 17621, cyl. 1		
17624 Injector cyl. 4 -N33 Short to positive	⇒ Fault code 17621, cyl. 1		
17633 Injector cyl. 1 -N30 Short to earth	◆ -N30 faulty ◆ Cable has short circuit to earth	◆ Increased emission levels ◆ Poor start characteristics ◆ Poor driving characteristics ◆ Poor throttle response ◆ Irregular idling	- Test injectors N30...N33 ⇒ page 24-23.
17634 Injector cyl. 2 -N31 Short to earth	⇒ Fault code 17633, cyl. 1		

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17635 Injector cyl. 3 -N32 Short to earth	⇒ Fault code 17633, cyl. 1		
17636 Injector cyl. 4 -N33 Short to earth	⇒ Fault code 17633, cyl. 1		
17645 Injector cyl. 1 -N30 Open circuit	♦ -N30 faulty ♦ Open circuit in wiring ♦ Short circuit to earth	♦ Increased emission levels ♦ Poor start characteristics ♦ Poor driving characteristics ♦ Poor throttle response ♦ Irregular idling	- Test injectors N30...N33 ⇒ page 24-23.
17646 Injector cyl. 2 -N31 Open circuit	⇒ Fault code 17645, cyl. 1		
17647 Injector cyl. 3 -N32 Open circuit	⇒ Fault code 17645, cyl. 1		
17648 Injector cyl. 4 -N33 Open circuit	⇒ Fault code 17645, cyl. 1		
17743 Engine torque monitor 2 Control limit exceeded	♦ Leak in intake system ♦ Throttle valve control unit -J338 faulty or accelerator pedal position sender -G79 and -G185 faulty; possible cable fault	♦ Engine runs in emergency mode ♦ Altered idling speed	- Test intake system for leaks ⇒ page 24-22. - Test throttle valve control unit ⇒ page 24-56. - Test accelerator pedal position sender ⇒ page 24-62.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17744 Engine torque monitor Control limit exceeded	◆ Leak in intake system ◆ Throttle valve control unit -J338 faulty or accelerator pedal position sender -G79 and -G185 faulty; possible cable fault	◆ Engine runs in emergency mode ◆ Altered idling speed	- Test intake system for leaks ⇒ page 24-22. - Test throttle valve control unit ⇒ page 24-56. - Test accelerator pedal position sender ⇒ page 24-62.
17746 Bank 1, camshaft position sensor => sender -G163¹⁾ Open/short to positive	◆ Signal input in engine control unit faulty (engine control unit faulty) ◆ -G163 faulty ◆ Loose contact ◆ Open circuit or short circuit to positive or to earth between camshaft position sensor -G163 and engine control unit	◆ Engine does not rev up to maximum speed ◆ Poor performance ◆ Start problems	- Test camshaft position sensor -G163- ⇒ page 28-6. - Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
17748 Camshaft position/crankshaft position sensor Incorrect assignment	◆ Signal from camshaft sensor not within tolerance		- Test camshaft position sensor -G163- ⇒ page 28-6. - Read measured value block, display group 012, display block 3 ⇒ page 01-37.

¹⁾ The camshaft position sensor -G163- is identical with the Hall sender -G40-.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17764 Ignition actuation cyl. 1 Short to positive	◆ Ignition unit (ignition trafo with power output stage) -N152 faulty ◆ Cable has short circuit to positive	◆ Engine cuts out ◆ Engine vibrates	- Test ignition unit ⇒ page 28-4. - Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
17765 Ignition actuation cyl. 1 Short to earth	◆ Ignition unit (ignition transformer with power output stage) -N152 faulty ◆ Cable has short circuit to earth	◆ Engine cuts out ◆ Engine vibrates	- Test ignition unit ⇒ page 28-4. - Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
17767 Ignition actuation cyl. 2 Short to positive	◆ Ignition unit (ignition transformer with power output stage) -N152 faulty ◆ Cable has short circuit to positive	◆ Engine cuts out ◆ Engine vibrates	- Test ignition unit ⇒ page 28-4. - Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
17768 Ignition actuation cyl. 2 Short to earth	◆ Ignition unit (ignition transformer with power output stage) -N152 faulty ◆ Cable has short circuit to earth	◆ Engine cuts out ◆ Engine vibrates	- Test ignition unit ⇒ page 28-4. - Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17794 Control unit defective	♦ Engine control unit faulty	♦ Engine does not start	- Replace engine control unit ⇒ page 24-14.
17796 Control unit defective	♦ Engine control unit faulty	♦ Engine does not start	- Replace engine control unit ⇒ page 24-14.
17805 Engine speed sender rotor Adaptation limit reached	♦ Sender rotor faulty	♦ Engine misfires	- Test engine speed sender -G28 ⇒ page 28-10. - Test sender rotor. ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 13; Disassembling and assembling cylinder block, crankshaft and flywheel
17818 Tank vent valve -N80 Short to positive	♦ Short circuit to positive between -N80 and engine control unit ♦ -N80 faulty	♦ Smell of fuel in vehicle	- Test activated charcoal filter solenoid valve -N80 ⇒ page 01-30, Final control diagnosis.
17833 Tank vent valve -N80 Short to earth	♦ Short circuit to earth between -N80 and engine control unit ♦ -N80 faulty	♦ Possible jerking in part load range	- Test activated charcoal filter solenoid valve -N80 ⇒ page 01-30, Final control diagnosis.
17834 Tank vent valve -N80 Open circuit	♦ Open circuit in wiring between -N80 and fuse ♦ Open circuit in wiring between -N80 and engine control unit ♦ Fuse faulty ♦ -N80 faulty	♦ Possible jerking in part load range	- Rectify open circuit in wiring or short circuit according to CFD ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test fuse. - Test activated charcoal filter solenoid valve -N80 ⇒ page 01-30.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17909 Fuel pump relay -J17 Short to earth	♦ -J17 faulty ♦ Short circuit to earth	♦ Engine does not start	- Test fuel pump relay -J17 ⇒ page 24-27.
17910 Fuel pump relay -J17 Short to positive	♦ -J17 faulty ♦ Short circuit to positive	♦ Engine does not start	- Test fuel pump relay -J17 ⇒ page 24-27.
17915 Idling system learned value Lower limit reached	♦ Leak in intake system ♦ Throttle valve control unit -J338 faulty or accelerator pedal position sender -G79 and -G185 faulty; possible cable fault	♦ Irregular idling ♦ Altered idling speed	- Test idling speed ⇒ page 24-15. - Test intake system for leaks (unmetered air) ⇒ page 24-22. - Test accelerator pedal po- sition sender ⇒ page 24-62. - Test throttle valve control unit ⇒ page 24-56.
17916 Idling system learned value Upper limit reached	♦ Open circuit in wiring ♦ Throttle valve control unit -J338 faulty or accelerator pedal position sender -G79 and -G185 faulty; possible cable fault	♦ Irregular idling ♦ Altered idling speed	- Test idling speed ⇒ page 24-15. - Test intake system for leaks (unmetered air) ⇒ page 24-22. - Test accelerator pedal po- sition sender ⇒ page 24-62. - Test throttle valve control unit ⇒ page 24-56.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17950 Angle sender for TV drive -G187 Implausible signal	◆ -G187 faulty or loose contact in plug connection for throttle valve control unit -J338 ◆ Signal input in engine control unit faulty (engine control unit faulty) ◆ Incorrect connector assignment	◆ Engine runs in emergency mode ◆ Reduced output ◆ Irregular idling	- Test throttle valve control unit ⇒ page 24-56. - Replace engine control unit ⇒ page 24-14.
17951 Angle sender for TV drive -G187 Signal too small	◆ Open circuit or short circuit to earth in signal cable from -G187 to engine control unit	◆ Engine runs in emergency mode ◆ Altered idling speed	- Test throttle valve control unit ⇒ page 24-56.
17952 Angle sender for TV drive -G187 Signal too large	◆ Open circuit in earth cable from -G187 to engine control unit	◆ Engine runs in emergency mode ◆ Cold start problems ◆ Cold idling problems	- Test throttle valve control unit ⇒ page 24-56.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17953 Throttle valve control Malfunction	◆ Fault in voltage or earth supply for throttle valve potentiometer -G69 and throttle valve positioner sender -G127 ◆ Open circuit in signal wire for -G69 and -G127 ◆ -G69 and -G127 faulty ◆ Throttle valve stiff, or dirty	◆ Increased idling speed ◆ Load change jolt when accelerator released ◆ Engine runs in emergency mode	- Test throttle valve control unit ⇒ page 24-56.
17966 Throttle valve drive -G186 Electrical fault in circuit	◆ Open circuit in wiring or short circuit to positive ◆ Cable has short circuit to earth ◆ -G88 faulty	◆ Engine runs in emergency mode	- Test throttle valve control unit ⇒ page 24-56.
17967 Throttle valve control unit -J338 Fault in basic setting	◆ Adaptation of throttle valve control unit not performed	◆ Engine runs in emergency mode	- Carry out adaptation of throttle valve control unit ⇒ page 24-56.
17972 Throttle valve control unit -J338 Undervoltage in basic setting	◆ Voltage below 10 V during basic setting	◆ Engine runs in emergency mode	- Test throttle valve control unit -J338 ⇒ page 24-56.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17973 Throttle valve control unit -J338 Lower stop is not reached	◆ Throttle valve jamming ◆ Throttle valve positioner jamming or has mechanical damage	◆ Start problems ◆ Poor throttle response ◆ Starting-off problems	- Inspect throttle valve for damage or dirt. - Test throttle valve control unit ⇒ page 24-56.
17976 Throttle valve control unit -J338 Mechanical fault	◆ Throttle valve jamming ◆ Throttle valve positioner jamming or has mechanical damage	◆ Start problems ◆ Poor throttle response ◆ Starting-off problems	- Inspect throttle valve for damage or dirt. - Test throttle valve control unit ⇒ page 24-56.
17978 Engine control unit inhibited	◆ Attempt at starting with unauthorised key ◆ Attempt at manipulation ◆ Short circuit in communication line ◆ Incorrect coding ◆ Fault in immobiliser system ◆ Dash panel insert faulty ◆ Engine control unit replaced and not adapted to immobiliser	◆ Engine starts and immediately cuts out again	- Adapt engine control unit to electronic immobiliser ⇒ page 24-39. - Test electronic immobiliser: ⇒ Electrical System; Repair Group 96; Servicing electronic immobiliser

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
17987 Throttle valve control unit -J338 Adaptation not started	◆ Incorrect connector assignment at throttle valve control unit ◆ Throttle valve control unit faulty ◆ Signal input in engine control unit faulty (control unit faulty)	◆ Engine runs in emergency mode ◆ Irregular idling	- Inspect connector assignment at throttle valve control unit ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder - Test throttle valve control unit ⇒ page 24-56. - Replace engine control unit ⇒ page 24-14.

Notes on fault code 17978:

- ◆ *The electronics for controlling the immobiliser is located in the dash panel insert and cannot be replaced separately.*
- ◆ *If an attempt is made to start the engine with a key which is not adapted, a static fault is stored. If the engine is subsequently started with an adapted key, the fault is converted to a sporadic fault.*

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
18010 Voltage supply tml. 30 Voltage too small	◆ Battery voltage below 10 V ◆ Alternator faulty ◆ Open circuit in wiring	◆ Engine cuts out	- Test charge state of battery. ⇒ Electrical System; Repair Group 27; Measuring voltage under load - Test alternator. - Rectify open circuit in wiring according to CFD. ⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder
18011 Control unit defective	◆ Engine control unit faulty	◆ Engine does not start	- Replace engine control unit ⇒ page 24-14.
18020 Control unit incorrectly coded	◆ Incorrect coding	◆ Engine does not start	- Adapt engine control unit to electronic immobiliser ⇒ page 24-39.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
18038 Accelerator pedal position sender -G79 Signal too small	♦ Open circuit in wiring or short circuit to positive ♦ -G79 faulty	♦ Engine runs in emergency mode at fast idling speed	- Test accelerator pedal position sender ⇒ page 24-62.
18039 Accelerator pedal position sender -G79 Signal too large	♦ Short circuit to positive ♦ -G79 faulty	♦ Engine runs in emergency mode at fast idling speed	- Test accelerator pedal position sender ⇒ page 24-62.
18041 Accelerator pedal position sender 2 -G185 Signal too small	♦ Open circuit in wiring or short circuit to earth ♦ -G185 faulty	♦ Engine runs in emergency mode at fast idling speed	- Test accelerator pedal position sender ⇒ page 24-62.
18042 Accelerator pedal position sender 2 -G185 Signal too large	♦ Short circuit to positive ♦ -G185 faulty	♦ Engine runs in emergency mode at fast idling speed	- Test accelerator pedal position sender ⇒ page 24-62.
18047 Accelerator pedal position sender 1/2 -G79+G185 Implausible signal	♦ Open circuit in wiring ♦ -G79 and -G185 faulty	♦ Engine runs in emergency mode at fast idling speed	- Test accelerator pedal position sender ⇒ page 24-62.
18048 Control unit defective	♦ Engine control unit faulty	♦ Engine does not start	- Replace engine control unit ⇒ page 24-14.

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
18056 Drive databus Faulty	♦ Fault in datalines to ABS control unit ♦ Fault in ABS	♦ Poor driving characteristics (jerky gearshifts, load change jolts)	- Test datalines to engine control unit contacts 20, 21 and 41 for open circuit and short circuit ⇒ page 24-75. - Test ABS control unit. ⇒ Running Gear; Repair Group 45
18057 Drive databus No message from ABS ECU	♦ Fault in datalines to ABS control unit	♦ Poor driving characteristics ♦ Engine speed varies when ABS activated	- Test databus line ⇒ page 24-75.
18085 Electric throttle control fault lamp -K132 Short to positive	♦ Cable has short circuit to positive	♦ Fault lamp does not come on even if fault exists	- Test dash panel insert. ⇒ Electrical System; Repair Group 90; Dash Panel Insert
18086 Electric throttle control fault lamp -K132 Short to earth	♦ Cable has short circuit to earth	♦ Fault lamp comes on and remains on or ♦ Fault lamp also does not come on when fault exists	- Test dash panel insert. ⇒ Electrical System; Repair Group 90; Dash Panel Insert
18088 Reset-fixed emergency mode active	♦ Fault stored in fault memory	♦ Engine operates in emergency mode	- Interrogate and erase fault memory ⇒ page 01-4. - Rectify cause of fault and conduct road test.

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)

Special tools, testers and aids required

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

Test condition

- Fuses o.k.

Note:

To repeat final control diagnosis without having switched on the engine in-between, switch off ignition for about 20 seconds.

Procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Test of vehicle systems
03 - Final control diagnosis

Q

◀ Readout in display:

- Confirm the entry with the key Q.

Operate fuel pump relay (J17).

Final control diagnosis
Fuel pump relay -J17

→

◀ Readout in display:

The fuel pump relay (on relay plate, relay position 4) must continue clicking until the next control element is actuated by pressing the → key.

Note:

During actuation of the fuel pump relay, it must also be possible to hear the fuel pump operating at intervals.

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

If the relay does not click:

- Test the fuel pump relay ⇒ page 24-27.
- Press the → key.

Actuate solenoid valve 1 for activated charcoal filter (N80).

- Press the → key.

◀ Readout in display:

The solenoid valve (in front of coolant reservoir on right) must click until the next control element is actuated by pressing the → key.

If the solenoid valve does not click:

- Test solenoid valve 1 for activated charcoal filter ⇒ page 24-49.

Final control diagnosis →
END

◀ Readout in display:

- Press the → key.

Test of vehicle systems HELP
Select function XX

◀ Readout in display:

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

Note:

After ending final control diagnosis, it is necessary to switch off the ignition. If the ignition is not switched off before again starting the engine, the engine is not able to start as the injectors and the ignition transformer are not actuated.

Reading measured value block

Test conditions

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

Test sequence:

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Display group number XXX

◀ Readout in display:

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

Read measured value block 0 →

1 2 3 4 5 6 7 8 9 10

◀ Readout in display:

Read measured value block 1 →

1 2 3 4

◀ Readout in display (example) for display group 001:

Note:

Proceed as follows to switch to another display group:

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

Reading measured value block: display groups 000 to 010

Display group 000 (decimal readouts)												
• Engine idling (coolant temperature not below 80 °C) • All electrical components switched off												
1	2	3	4	5	6	7	8	9	10	◀ Display blocks	Specification	Equals
										Learned value of mixture formation part load	110...145	−7...+7 %
										Learned value of mixture formation idling	125...131	−2.25...+3 ms
										Control value of mixture formation	100...155	−11...+11 %
										Learned value of idling speed stabilisation	101...154	−10...+10 %
										Idling speed controller	100...155	−11...11 %
										Throttle valve angle	4...12	2...6°
										Vehicle electrical system voltage	110...150	11...15 V
										Engine speed (idling speed)	23...27	730...870 rpm
										Ignore readout	255	
Coolant temperature										164...201	75...103 °C	

Display block: 3 Engine speed (idling speed)		
Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
less than 23	♦ Throttle valve control unit -J338 jamming or faulty	- Test throttle valve control unit ⇒ page 24-56.
greater than 27	♦ Throttle valve control unit -J338 jamming or faulty ♦ Large quantity of unmetered air (cannot be compensated for (balanced) by idling speed stabilisation)	- Test throttle valve control unit ⇒ page 24-56. - Rectify unmetered air.
Display block: 4 Vehicle electrical system voltage		
Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
less than 110	♦ Alternator faulty, battery severely discharged ♦ Battery severely discharged shortly after start by high charge current and by ancillaries ♦ Contact resistance in power supply or in earth connection for engine control unit ♦ Power drain when ignition off	- Test voltage, charge battery. - Increase revs slightly for a few minutes and switch off ancillaries. - Test voltage supply of engine control unit ⇒ page 24-38. - Eliminate power drain.
greater than 150	♦ Voltage regulator at alternator faulty ♦ Overvoltage caused by jump-starting aid or quick-charger	- Test voltage, replace regulator, if necessary. - Interrogate fault memory ⇒ page 01-4.
Display block: 5 Throttle valve angle		
Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
less than 4	♦ Throttle valve potentiometer in throttle valve control unit -J338 faulty or incorrectly set ♦ Unmetered air between intake manifold and air mass meter (causes fast idling speed; the throttle valve control unit attempts to control fast idling speed to specified idling speed)	- Test throttle valve control unit -J338 ⇒ page 24-56. - Rectify causes of unmetered air.
greater than 12	♦ Adaptation of throttle valve control unit -J338 not performed ♦ Throttle valve potentiometer in throttle valve control unit -J338 faulty or incorrectly set ♦ Throttle valve jamming	- Perform adaptation of throttle valve control unit -J338 ⇒ page 24-56. - Test throttle valve control unit -J338 ⇒ page 24-56.
Display block: 6 Idling speed controller		
Readout in V.A.G 1552	Possible cause of fault	Rectifying fault
less than 100 greater than 155	♦ Throttle valve potentiometer in throttle valve control unit -J338 faulty or incorrectly set	- Test throttle valve control unit -J338 ⇒ page 24-56. - Perform adaptation of throttle valve control unit -J338 ⇒ page 24-56.

Display group 001 - base functions:

Read measured value block 1 →				◀ Readout in display
730...870 rpm	75...105 °C	-10.0...10.0 %	xxxxxxx	
				Setting condition for basic setting ⇒ Table below
				Lambda control value
				Coolant temperature
				Engine speed (idling speed)

Note on display block 4:

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

1 = condition met

0 = condition not met

x	x	x	x	x	x	x	x	Condition if display position = 1
1								No fault detected by self-diagnosis
	1							Ignore readout
		1						AC compressor off (always „1“)
			1					Idling speed switch closed
				1				Lambda control o.k.
					1			Throttle valve closed
						1		Engine speed less than 2000 rpm
							1	Coolant temperature at least 80 °C

Display group 002 - base functions:

Read measured value block 2 →				◀ Readout in display:
XXX rpm	XXX %	2...5.5 ms	XXX mbar (g/s)	
				Ignore readout
				Mean injection time
				Ignore readout
				Idling speed ⇒ page 01-35, display group number 001

Display group 003 - base functions:

Read measured value block 3				→	◀ Readout in display:
XXX rpm	XXX mbar (g/s)	X.X % (∠°)	0...12 BTDC		
			Ignition angle (actual value)		
			Ignore readout		
			Ignore readout		
Idling speed ⇒ page 01-35, display group number 001					

Display group 004 - base functions:

Read measured value block 4				→	◀ Readout in display:
XXX rpm	11...15 V	75...105 °C	-45...105 °C		
			Intake air temperature		
			Coolant temperature		
			Supply voltage of engine control unit		
Idling speed ⇒ page 01-35, display group number 001					

Display group 005 - base functions:

Read measured value block 5			→	◀ Readout in display:
XXX rpm	XXX %	0 km/h	Text	
			Operating state (idling speed, enrichment, part load, full load, fuel shut-off on over-run)	
			Vehicle speed	
	Ignore readout			
Idling speed ⇒ page 01-35, display group number 001				

Reading measured value block: display groups 011 to 055

Display group 011 - ignition:

Read measured value block 11				→	◀ Readout in display:
XXX	75...105	-45...105	0...12		
rpm	°C	°C	BTDC		
					Ignition angle (actual value)
					Intake air temperature
					Coolant temperature
Idling speed ⇒ page 01-35; display group 001					

Display group 012 - distributor setting:

Read measured value block 12				→	◀ Readout in display:
XXX	XXX	25 - 31	85 - 91		
rpm	%				
					No. of crankshaft tooth at camshaft slope change high - low ¹⁾
					No. of crankshaft tooth at camshaft slope change low - high ¹⁾
					Ignore
Idling speed ⇒ page 01-35; display group 001					

- ¹⁾ If the readout is not within the tolerance and fault 16725 is stored in the fault memory, it is then necessary to check the tension of the timing chain (on engines with high mileage).

Display group 020 - knock control:

Read measured value block 20				→	◀ Readout in display:
0...15	0...15	0...15	0...15		
BTDC	BTDC	BTDC	BTDC		
					Ignition angle retardation in cylinder 4
					Ignition angle retardation in cylinder 3
					Ignition angle retardation in cylinder 2
					Ignition angle retardation in cylinder 1

Display group 026 - knock control, knock sensor voltages:

Read measured value block 26 →				◀ Readout in display:
0.2...2.0 V	0.2...2.0 V	0.2...2.0 V	0.2...2.0 V	
			Knock sensor voltage signal cyl. 4	
			Knock sensor voltage signal cyl. 3	
			Knock sensor voltage signal cyl. 2	
			Knock sensor voltage signal cyl. 1	

Display group 028 - test of knock sensor:

Read measured value block 28 →				◀ Readout in display:
XXX rpm	XXX %	75...105 °C	Text	
			Result (test on, test off, sys. o.k., sys. n.o.k.)	
			Coolant temperature	
			Ignore readout	
			Idling speed ⇒ page 01-35, display group number 001	

Display group 030 - lambda probes, status:

Read measured value block 30 →				◀ Readout in display:
XXX	XXX			
			Vacant	
			Vacant	
			Ignore readout	
			Operating state ⇒ Table below	

Note on display block 1:

Meaning of digits in 3-digit numerical block for lambda probe status bank 1, probe 1:

1	1	1	Meaning if display places = 1
1			Status of lambda probe heater
	1		Operational readiness of lambda probe
		X	Ignore readout

Display group 031 - lambda probe voltages:

Read measured value block 31 →				◀ Readout in display:
0.0...1.0	X.XX			
V				
			Vacant	
		Vacant		
		Ignore readout		
		Lambda probe voltage		

Display group 033 - lambda control value:

Read measured value block 33 →				◀ Readout in display:
-10...10	X.X			
%	V			
			Vacant	
		Vacant		
		Ignore readout		
		Lambda controller		

Display group 050 - engine speed increase:

Read measured value block 50 →				◀ Readout in display:
XXX	800	Text	Text	
rpm	rpm			
			AC compressor (on, off) ¹⁾	
		Ignore readout		
		Specified engine speed		
		Idling speed ⇒ page 01-35, display group number 001		

¹⁾ Readout is always at „Comp. OFF“.

Display group 054 - idling speed positioner/switch of electronic throttle systems:

Read measured value block 54 →				◀ Readout in display:
XXX rpm	Text	0 %	X.X % (∠°)	
				Ignore readout
				Sender 1 for accelerator pedal position
				Operating state (idling, enrichment, part load, full load, fuel shut-off on overrun)
				Idling speed ⇒ page 01-35, display group number 001

Display group 055 - idling speed stabilisation:

Read measured value block 55 →				◀ Readout in display:
XXX rpm	XX %	-10...10 %	00000	
				Operating states ⇒ Table below
				Learned value of idling speed stabilisation
				Ignore readout
				Idling speed ⇒ page 01-35, display group number 001

Note on display block 4:

Meaning of the digits in the 5-digit numerical block for idling speed stabilisation:

x	x	x	x	x	Meaning
0					Steering position (middle position = 0; right or left lock = 1)
	0				Always 0
		0			Ignore readout
			0		Always 0
				0	Always 0

Servicing fuel injection system

Safety precautions

Warning!

The fuel system is pressurized! 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 the cap.

Pay attention to the following points in order 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 starting speed.
- ◆ Do not disconnect or re-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), unplug connector from the ignition unit and 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 re-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 „6 rules“ for cleanliness when carrying out work on the fuel supply and fuel injection system:

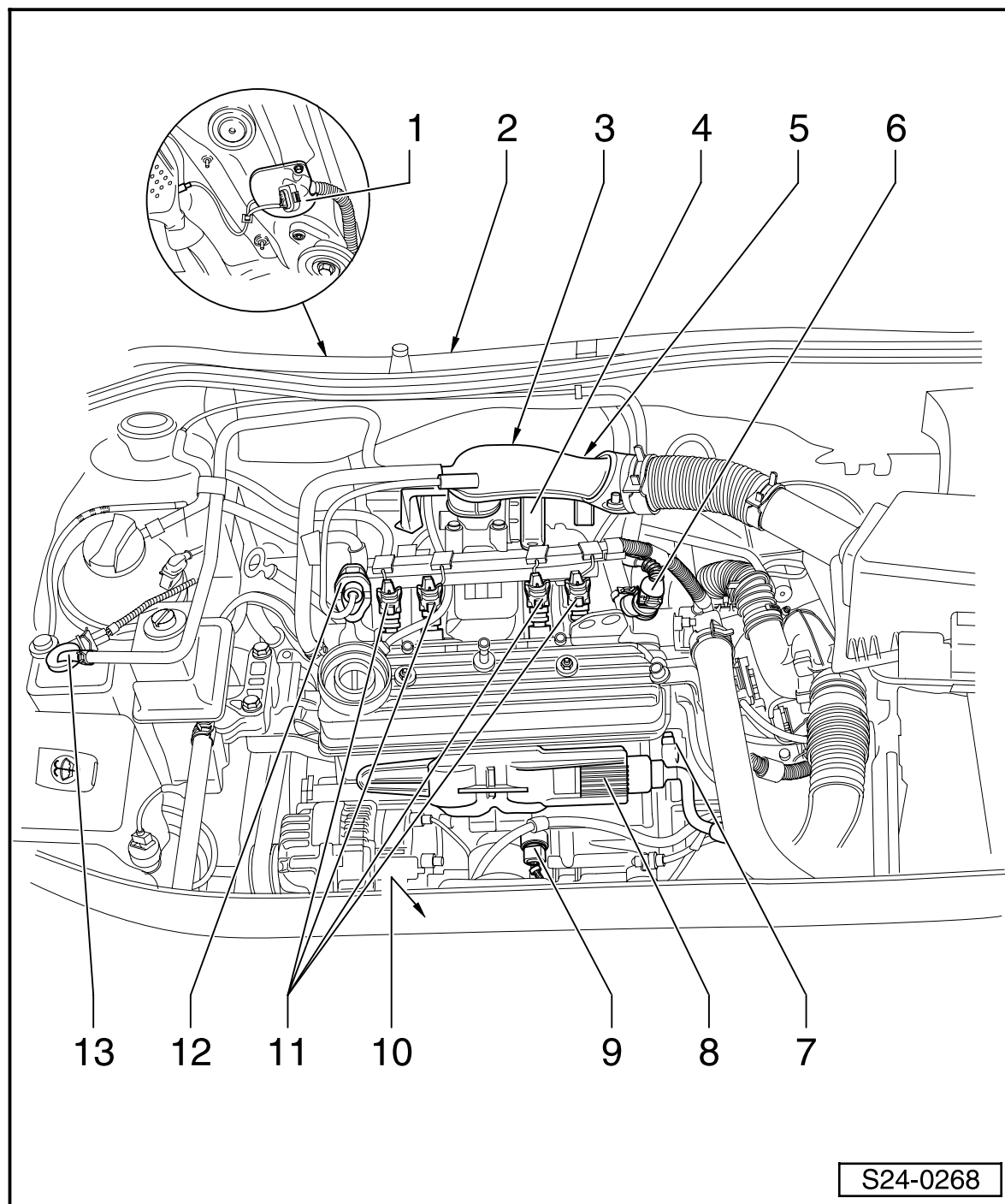
- ◆ Thoroughly clean connection points and the surrounding area before disconnecting.
- ◆ Place removed parts down on a clean surface and cover over. Do not use fluffing cloths!
- ◆ Carefully cover over or seal opened components if repairs are not carried out immediately.
- ◆ Install only clean parts:
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.
Avoid moving the vehicle.
- ◆ Protect separated electrical plug connections from dirt and moisture.
Plug together only when dry.

Technical data

Engine code	AMD	
Idling speed Speed cannot be adjusted, is regulated by idling speed stabilisation	730...870 rpm	
Speed governed by shutting off injectors	approx. 5800 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	Ejection spray	identical for all injectors
	Resistance (room temperature) ¹⁾	approx. 14.5 Ω

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

Survey of fitting locations

**1 - 4-pin plug connection**

- ◆ For lambda probe 1 -G39- and lambda probe heater -Z19-
- ◆ Fitting location ⇒ Fig. 1

2 - Engine control unit -J361-

- ◆ In plenum chamber

3 - Intake manifold pressure sender -G71- with intake manifold temperature sender -G72-

- ◆ Below throttle valve

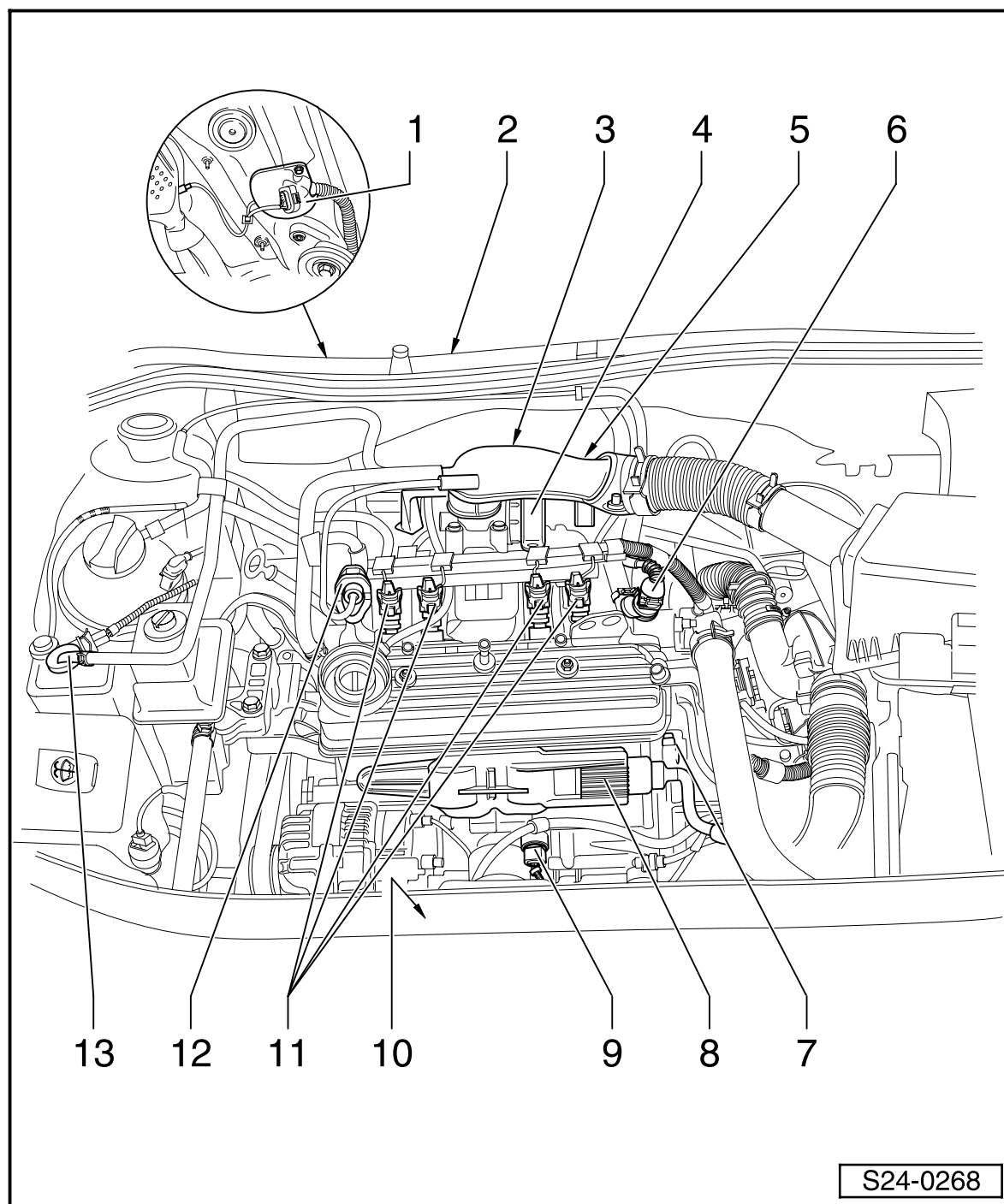
4 - Throttle valve control unit -J338-

- ◆ With throttle valve drive -G186-, angle sender 1 for throttle valve drive -G187- and angle sender 2 for throttle valve drive -G188-

5 - Knock sensor 1 -G61-

- ◆ In cylinder block below exhaust manifold on left

6 - Coolant temperature sender -G62-



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7 - Engine speed sender -G28-

8 - Ignition unit (ignition transformer with power output stage) -N152-

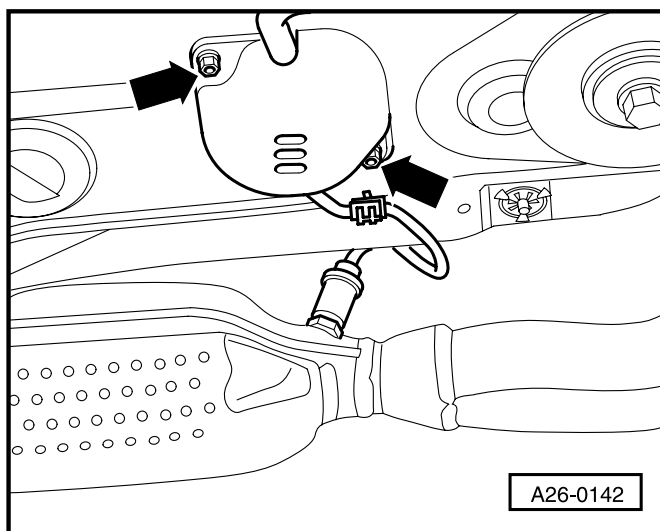
9 - Camshaft position sensor -G163-

10 - PAS pressure switch -F88-
♦ Fitting location ⇒ Fig. 4

11 - Injectors -N30- to -N33-

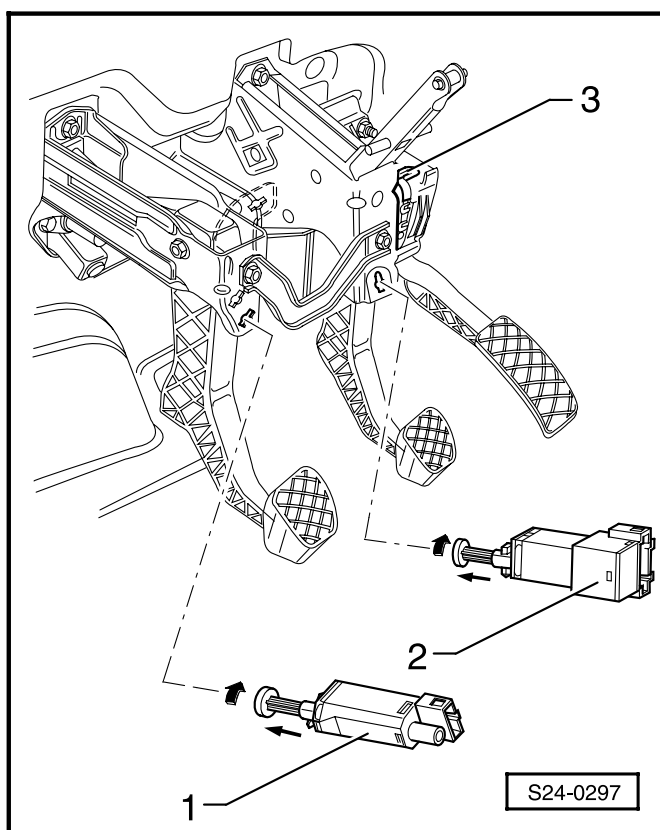
12 - Fuel pressure regulator

13 - Activated charcoal filter solenoid valve -N80-



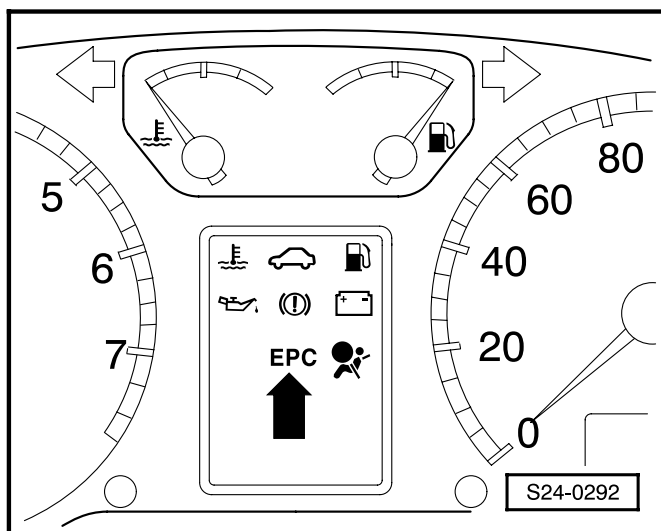
◀ Fig. 1 Fitting location of 4-pin plug connection for lambda probe and lambda probe heater

The 4-pin plug connection for lambda probe 1 -G39- and lambda probe heater -Z19- is accessible after unscrewing the protective cover -arrows- at the vehicle floor.

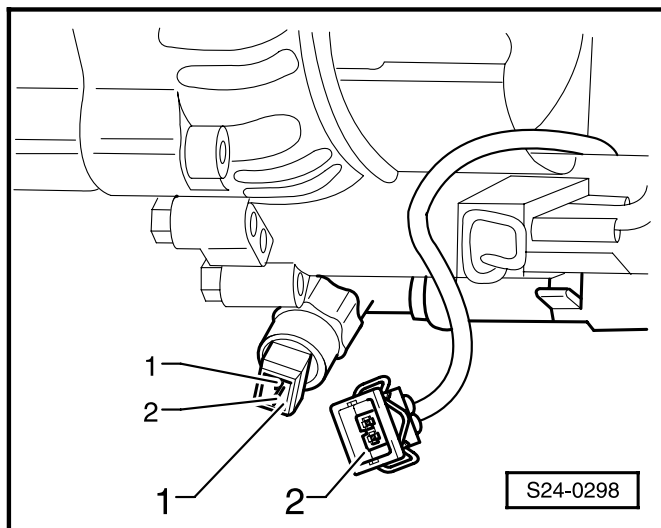


◀ Fig. 2 Survey of fitting location of pedal assembly

- 1 - Clutch pedal switch -F36-
- 2 - Brake light switch -F- and brake pedal switch -F47-
- 3 - Sender for accelerator pedal position -G79- and sender 2 for accelerator pedal position -G185-



◀ Fig. 3 Fitting location of electronic throttle control fault lamp -K132-



◀ Fig. 4 Fitting location of power steering pressure switch -F88-

General information on fuel injection system

Servicing ignition system
⇒ Repair Group 28

Notes:

- ◆ *The engine control unit is equipped with self-diagnosis. First of all, interrogate the fault memory before commencing repairs or fault finding. In addition, also check the vacuum hoses and connections (unmetered air).*
- ◆ *Components marked with * are tested by self-diagnosis ⇒ page 01-4, Interrogating fault memory.*
- ◆ *Components marked with ** can be tested with the final control diagnosis ⇒ page 01-30.*
- ◆ *A voltage of at least 11.5 V is required for proper operation of the electrical components.*
- ◆ *If the engine starts only for a short time and then cuts out again after completing fault finding, repairs or testing of components, this may be caused by the immobiliser inhibiting the engine control unit. In this case, it is necessary to interrogate the fault memory and to adapt the control unit, if necessary ⇒ page 24-39.*
- ◆ *When conducting certain tests, it is possible that a fault is detected and stored by the control unit. For this reason, always interrogate the fault memory and erase it, if necessary, after completing all tests and repair work ⇒ page 01-4, Interrogating fault memory.*
- ◆ *Always replace collar clamps by screw-type clamps.*

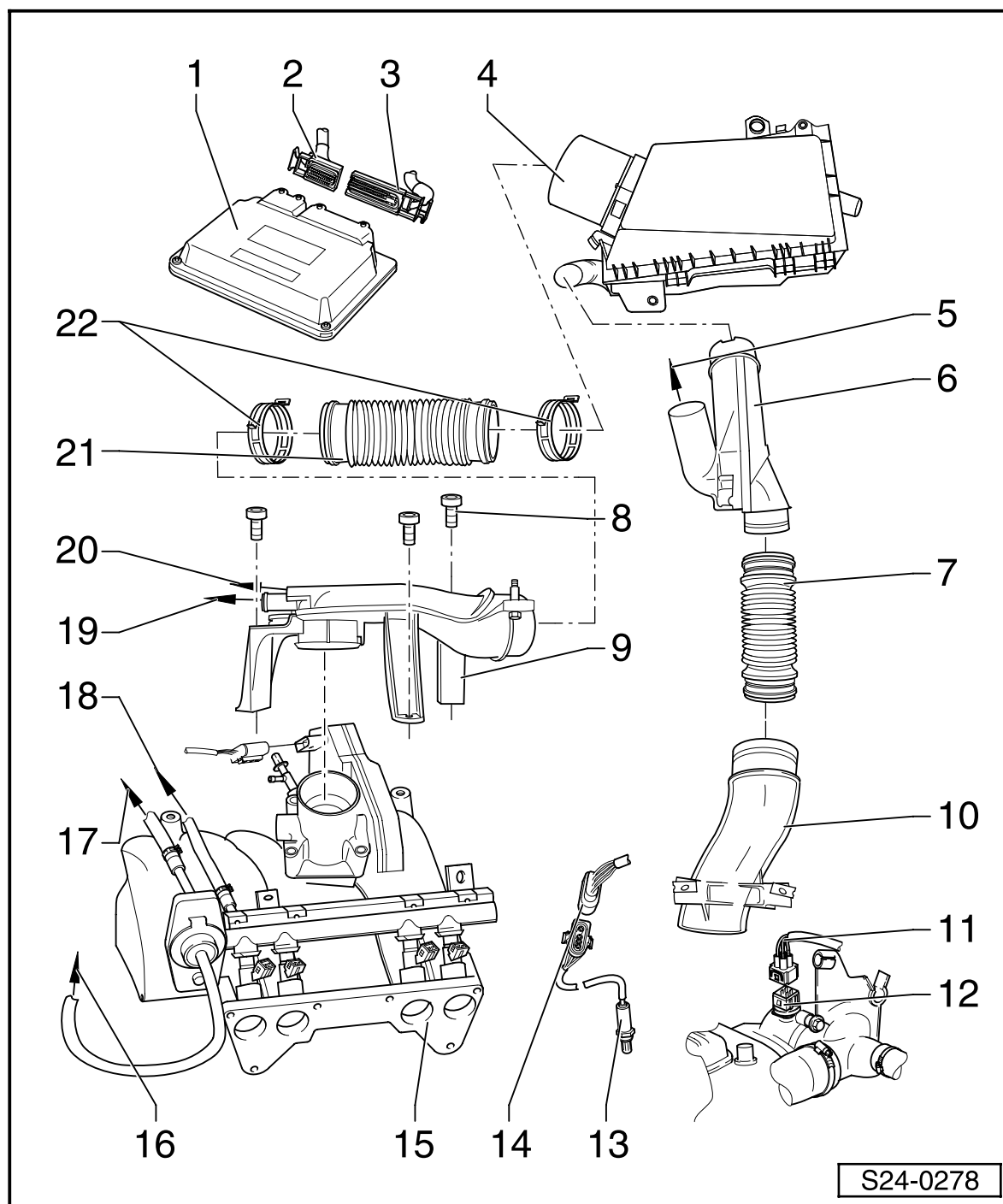
Safety precautions ⇒ page 24-1.

Rules for cleanliness ⇒ page 24-2.

Technical data ⇒ page 24-2.

Testing intake system for leaks (unmetered air)
⇒ page 24-22.

Removing and installing parts of fuel injection system



S24-0278

1 - Engine control unit -J361-*

- ◆ Fitting location: in plenum chamber
- ◆ Attached to mount with clips
- ◆ Testing voltage supply ⇒ page 24-38

2 - Connector, 40-pin

- ◆ Switch off ignition to unplug or plug in connector
- ◆ Release for unplugging

3 - Connector, 81-pin

- ◆ Switch off ignition to unplug or plug in connector
- ◆ Release for unplugging

4 - Air filter

- ◆ Disassembling and assembling ⇒ page 24-11

5 - Warm air intake

- ◆ To warm air baffle at exhaust manifold

6 - Inlet connection with control flap**7 - Inlet hose****8 - 8 Nm****9 - Inlet connection**

- ◆ At throttle valve control unit

10 - Inlet connection**11 - Connector**

- ◆ For coolant temperature sender -G62-

12 - Coolant temperature sender -G62-*

- ◆ With coolant temperature gauge sender -G2-
- ◆ Identification: yellow ring
- ◆ Before removing, equalise pressure in cooling system if necessary
- ◆ Testing ⇒ page 24-35
- ◆ Resistances ⇒ page 24-12, Fig. 1

13 - Lambda probe -G39-*, 55 Nm

- ◆ Fitting location: in front exhaust pipe
- ◆ Coat thread with „G 052 112 A3“ paste; paste must not get into the slot of the probe body
- ◆ Testing lambda probe and lambda control ⇒ page 24-41

14 - 4-pin plug connection

- ◆ For lambda probe and lambda probe heater
- ◆ On right of vehicle floor next to lambda probe below a cover

15 - Intake manifold

- ◆ Disassembling and assembling
⇒ page 24-10

16 - Connection hose

- ◆ From pressure regulator to inlet connection -item 20-

17 - Fuel return-flow hose

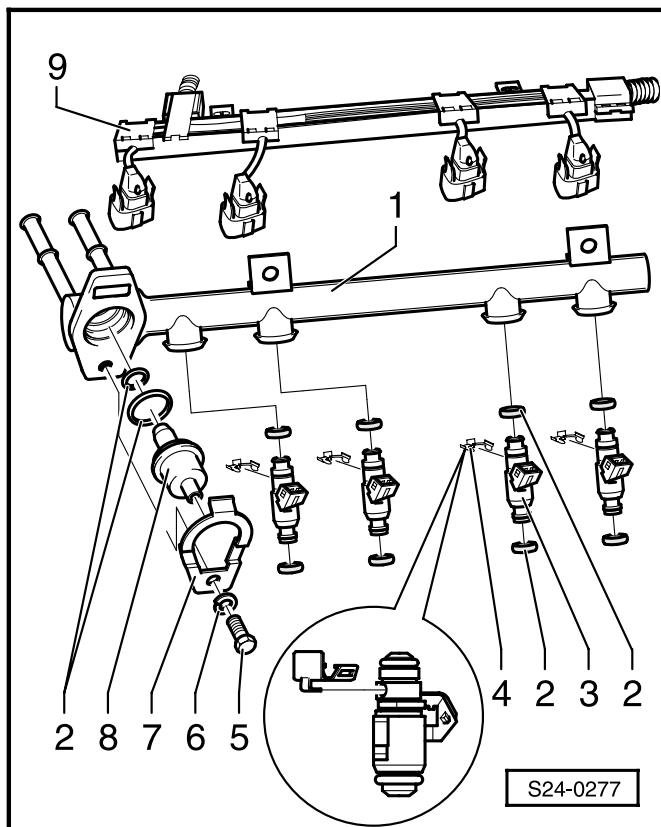
- ◆ Secure at fuel rail with spring strap clamp
- ◆ Blue, or blue marking

18 - Fuel feed hose

- ◆ Secure at fuel rail with spring strap clamp
- ◆ Black, or white marking

19 - To crankcase ventilation**20 - To fuel pressure regulator -item 16-****21 - Intake hose****22 - Collar clamp**

Disassembling and assembling fuel rail and injectors



1 - Fuel rail

2 - O-ring

♦ Replace if damaged

3 - Injectors -N30...N33-*

♦ Testing ⇒ page 24-23

♦ Resistance 14...17 Ω

4 - Retaining clamp

5 - 8 Nm

6 - Spring lock washer

7 - Retaining claw

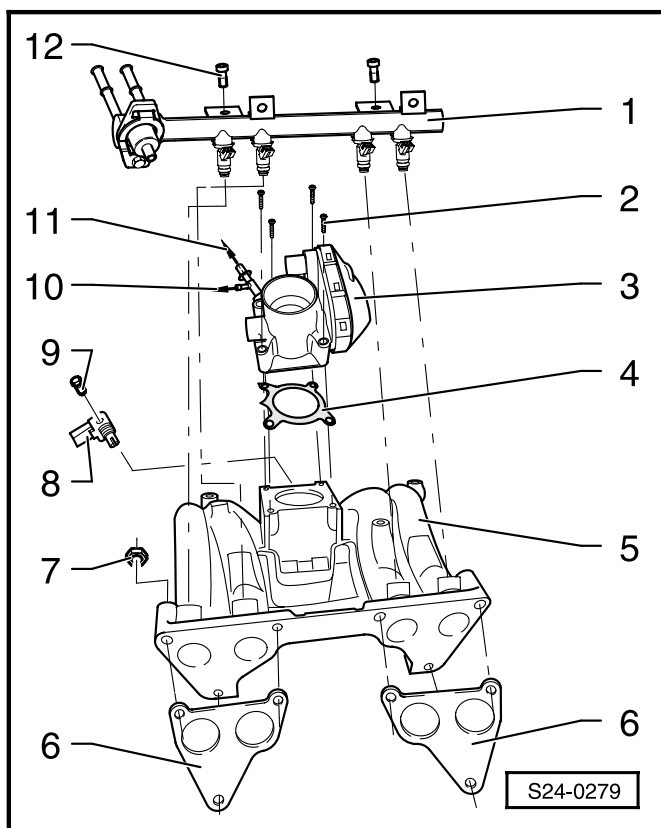
♦ Ensure tight and correctly installed

8 - Fuel pressure regulator

♦ Testing pressure regulator and holding pressure ⇒ page 24-19

9 - Collector strip

♦ For injectors, throttle valve control unit and intake manifold pressure/temperature sender



Disassembling and assembling intake manifold

1 - Fuel rail

♦ Disassembling and assembling
⇒ page 24-10

2 - 10 Nm

3 - Throttle valve control unit -J338-*

♦ Testing ⇒ page 24-56

♦ With throttle valve drive -G186-, angle sender 1 for throttle valve drive -G187- and angle sender 2 for throttle valve drive -G188-

4 - Gasket

♦ Replace

5 - Intake manifold

6 - Gasket

♦ Replace

7 - 25 Nm

8 - Intake manifold pressure sender (G71)* with intake manifold temperature sender (G72)*

- ♦ Resistances for intake manifold temperature sender ⇒ page 24-12, Fig. 2

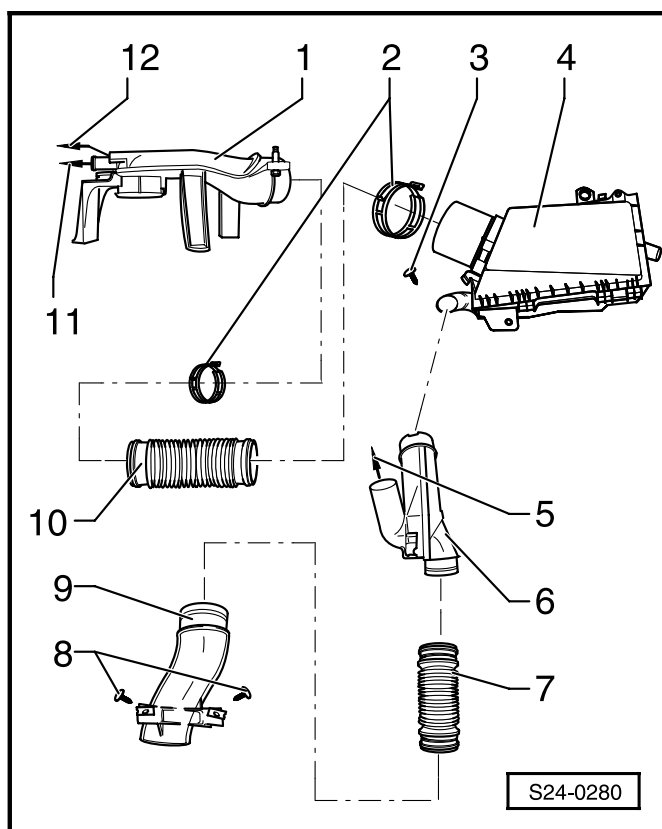
9 - 10 Nm

10 - To crankcase ventilation

11 - To solenoid valve 1 for activated charcoal filter (N80)

- ♦ Activated charcoal filter system
- ⇒ Engine Mechanical Components; Repair Group 20; Removing and installing parts of activated charcoal filter system

12 - 20 Nm



Disassembling and assembling air filter

1 - Inlet connection

2 - Tensioning clamps

3 - 3 Nm

4 - Air filter housing

- ♦ With air filter

5 - Warm air intake

6 - Intake air connection with regulating flap

7 - Intake hose

8 - 8 Nm

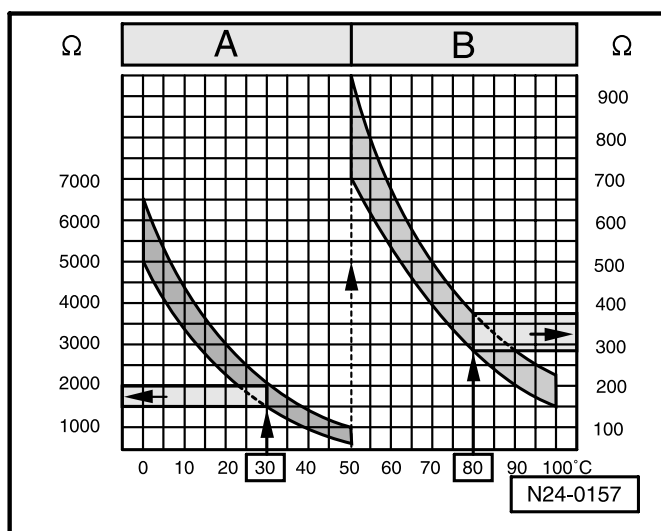
9 - Intake connection

10 - Intake hose

11 - Crankcase ventilation

12 - To fuel pressure regulator

- ♦ ⇒ page 24-9, item 20

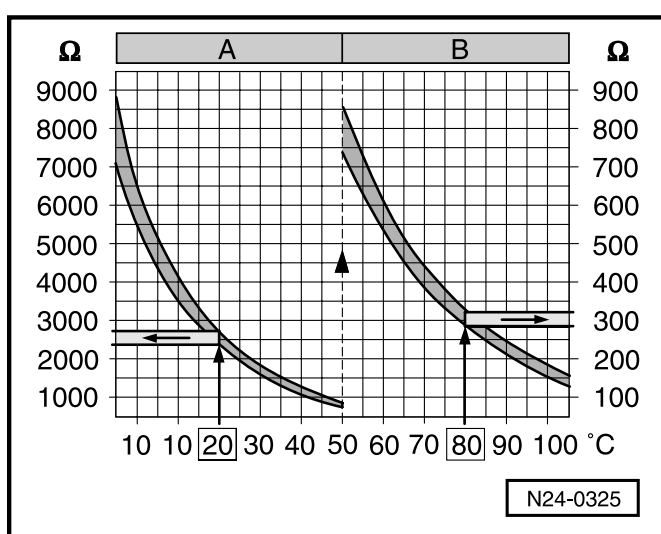


◀ **Fig. 1 Resistances for coolant temperature sender -G62-**

The range A indicates the resistances for the temperature range 0...50 °C, range B the resistances for the temperature range 50...100 °C.

Examples of how to read chart:

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



◀ **Fig. 2 Resistances for intake manifold temperature sender -G72-**

The range A indicates the resistances for the temperature range 0...50 °C, range B the resistances for the temperature range 50...100 °C.

Examples of how to read chart:

- ◆ 20 °C equals a resistance of 2340...2680 Ω
- ◆ 80 °C equals a resistance of 290...330 Ω

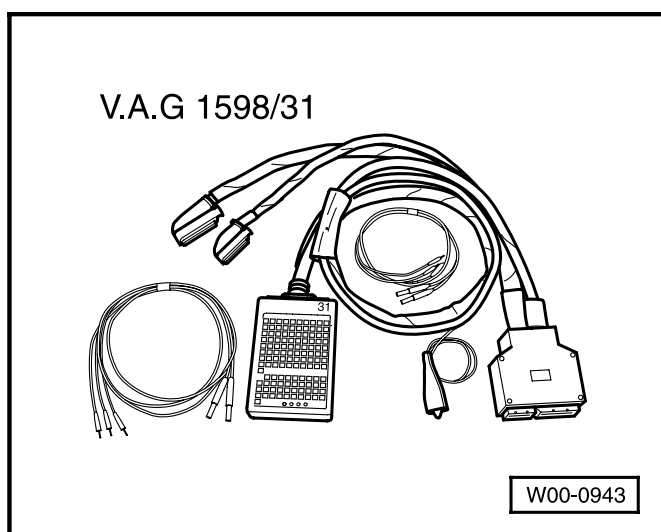
Testing wiring and components with test box V.A.G 1598/31

Special tools, testers and aids required

- ◀ ◆ Test box V.A.G 1598/31

Notes:

- ◆ Test box V.A.G 1598/31 is designed in such a way that it can be connected at the same time to the wiring loom to the engine control unit and to the engine control unit itself.
- ◆ This offers the advantage that the electronic engine control remains fully operational even when the test box is connected (e.g. for measuring signals when engine running).

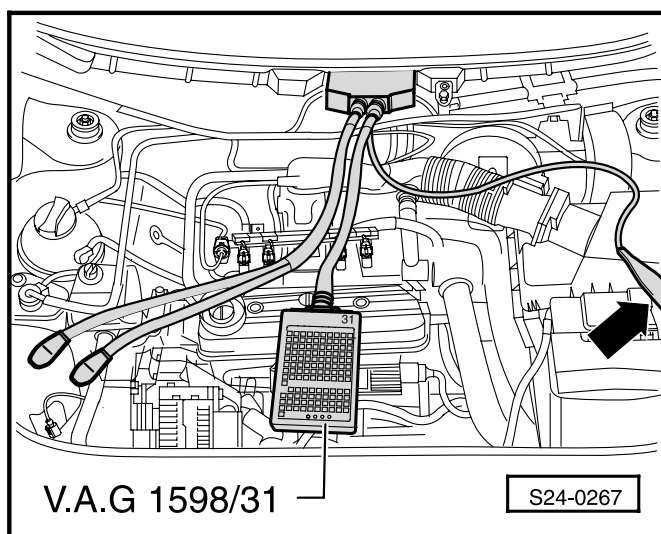


- ◆ Refer to the particular test procedure to determine whether the control unit is connected to the test box or not.
- ◆ Always use adapter cable set V.A.G 1594 A for connecting test equipment (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.).
- ◆ The contact numbers of the control unit connector and the socket numbers of the test box are identical.

Warning!

Switch on the relevant measuring range and pay attention to the test conditions before connecting the test cables in order to avoid damaging the electronic components.

- Switch ignition off.
- Unscrew windscreen wiper arms and remove the cover of the plenum chamber.
- ⇒ Body Fitting Work; Repair Group 66; Trim Panels
- Release the connector catches and unplug the control unit connector.
- ◀ - Connect test box V.A.G 1598/31 to the connector of the wiring loom. The earth clip -arrow- should be connected to the test box and to the battery. Refer to the particular test procedure to determine whether the control unit is connected to the test box or not.
- Carry out the test as described in the particular repair procedure.



Note:

After re-connecting the engine control unit, it is then necessary to adapt the engine control unit to the throttle valve control unit ⇒ page 24-56.

Replacing engine control unit

Note:

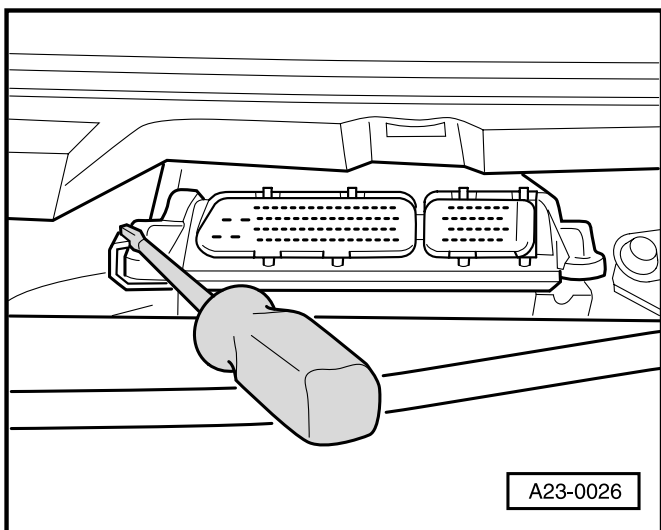
When the connectors are unplugged from the engine control unit, the learned values are erased although the contents of the fault memory are retained.

Removing

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

Note:

When removing the cover, detach the hose for the spray nozzles.



- ◀ - Use a screwdriver to press the catch of the fixture to the side and pull the engine control unit forward.
- Release 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:

- Adaptation of throttle valve control unit (J338)
⇒ page 24-56.
- Adaptation of engine control unit to immobiliser control unit ⇒ page 24-39.

Testing idling speed

Special tools, testers and aids required

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

Test requirements:

- No leak in exhaust system.
- Coolant temperature at least 80 °C.
- Electrical components switched off (radiator fan must not cut in during the test).

Notes:

- ◆ *Idling speed cannot be adjusted.*
- ◆ *Idling speed is tested during basic setting of the engine.*
- ◆ *During the basic setting, the activated charcoal filter solenoid valve (ACF valve -N80) is closed and the AC compressor is switched off.*

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.
- Interrogate fault memory ⇒ page 01-4. There must not be any fault stored; if necessary, rectify faults, erase fault memory, switch off engine and start again, conduct a road test and once again interrogate fault memory as a check.
- Continue running engine at idling speed.

Warning!

The radiator fan must not cut Installation is carried out in the reverse order; pay attention to the following points:

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

- Enter „056“ for „Display group number 056“ and confirm the entry with the key Q.

System in basic setting 56 →			
780 rpm	800 rpm	2.5 %	00000

◀ Readout in display:

- Check whether the engine speed in display block 1 (actual engine speed) is within the permissible tolerance range of display block 2 (specified engine speed).

Notes:

- ♦ *The engine speed in display block 1 (actual engine speed) is the speed at which the engine is running at that moment.*
- ♦ *The speed in display block 2 (specified engine speed) is a theoretical speed computed by the engine control unit.*
- ♦ *In the idling speed range, the engine control unit always attempts to adapt the actual engine speed to the specified engine speed.*
- ♦ *What this means is that in the idling speed range the actual engine speed must always approximately equal the specified engine speed.*
- ♦ *Display blocks 3 and 4 are for information purposes only but are not relevant for checking the idling speed.*

If the specification is achieved:

- Press the → key.

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

◀ Readout in display (function selection):

If the specification is not achieved:

- Once again interrogate fault memory ⇒ page 01-4.

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

- Unmetered air in intake system, testing ⇒ page 24-22.
- Throttle valve control unit, testing ⇒ page 24-56.
- Activated charcoal filter solenoid valve constantly open, testing ⇒ page 24-49.
- Adaptation of throttle valve control unit, performing ⇒ page 24-56.

Testing operating states of engine

Note:

What is tested is whether the engine control unit (J361) detects the operating states of the engine.

Special tools, testers and aids required

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

Test condition

- Coolant temperature must be at least 80 °C.

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display (function selection):

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Press keys 0, 0 and 1 for „Display group number 001“ and confirm the entry with the key Q.

Read measured value block 1 →
780 rpm **85.0 °C** 5 % 1011111

◀ Readout in display:
(1...4 = display blocks)

- Check in display block 2 whether the coolant temperature is more than 80 °C.
- Switch to display group 005 as follows:
- Press the key C.
- Press keys 0, 0 and 5 for „Display group number 005“ and confirm the entry with the key Q.

Read measured value block 5
780 rpm 99 % 0 km/h

→

Idling

◀ Readout in display:
(1...4 = display blocks)

Operating state of engine (display block 4):

◆ Idling:

„Idling“ must appear in display block 4 in the idling speed mode.

◆ Part load:

- Depress throttle evenly.

„Part load“ must appear in display block 4.

◆ Deceleration mode:

- Increase engine speed to more than 3000 rpm.
- Close throttle valve suddenly.

„Decel“ must appear in display block 4.

◆ Full load:

- Briefly depress to full throttle.

„Full load“ must appear in display block 4.

Note:

It may be necessary to carry out a road test in order to obtain the full load readout.

A 2nd person is required when conducting a road test.

Warning!

Attach fault reader on the rear seat and operate it from this point.

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

If the specifications are not achieved:

- Interrogate the fault memory, rectify any faults present and then erase the fault memory
⇒ page 01-4, Interrogating and erasing fault memory.
- Test the accelerator pedal position sender
⇒ page 24-62.
- Test the throttle valve control unit ⇒ page 24-56.

Testing fuel pressure regulator and holding pressure

The fuel pressure regulator regulates the fuel pressure in line with the intake manifold pressure.

Special tools, testers and aids required

- ◆ Pressure measuring device V.A.G 1318
- ◆ Adapter 1318/10
- ◆ Adapter 1318/11
- ◆ Adapter 1318/16

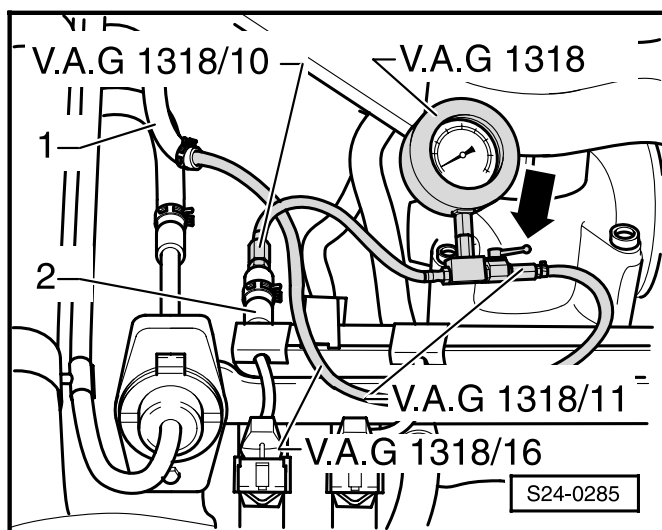
Test condition

- Delivery of fuel pump o.k.; testing:
⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 20; Removing and installing parts of fuel supply system; Testing fuel pump

Test procedure

Warning!

The fuel system is pressurized! Place cleaning cloths around the connection point before detaching hose connections or opening the test connections. Then, release pressure in stages by carefully detaching the hose, or removing the cap.



- ◀ - Detach fuel feed line -1- from connection at fuel rail -2- and connect with adapter V.A.G 1318/10 to pressure measuring device V.A.G 1318.
- Link pressure measuring device V.A.G 1318 to adapter 1318/11 and 1318/16 and connect to fuel rail -2-. Open shut-off cock of pressure measuring device (turn lever into direction of flow -arrow-).
- Start engine and run at idling speed.
- Measure fuel pressure.

Specification: 2.7...3.3 bar (0.27...0.33 MPa).

If the specification is not achieved:

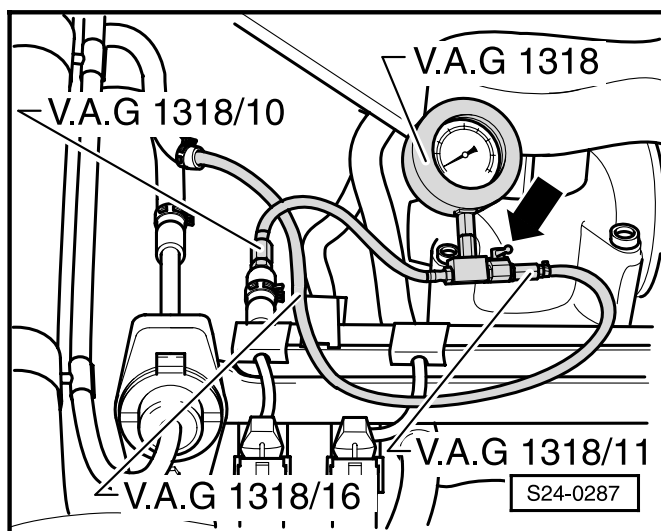
- Switch ignition off.
- Check non-return valve of fuel pump and fuel line.
- ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 20; Removing and installing parts of fuel supply system; Testing fuel pump.

If the specification is achieved:

- Use V.A.G 1318 to test system for correct pressure and leaks. The pressure gauge must indicate at least 2 bar (0.2 MPa) after 10 minutes.

If the pressure drops below 2 bar (0.2 MPa):

- Inspect line connections for leaks, O-rings at fuel rail and injectors for leaks.
- Start engine and run at idling speed.

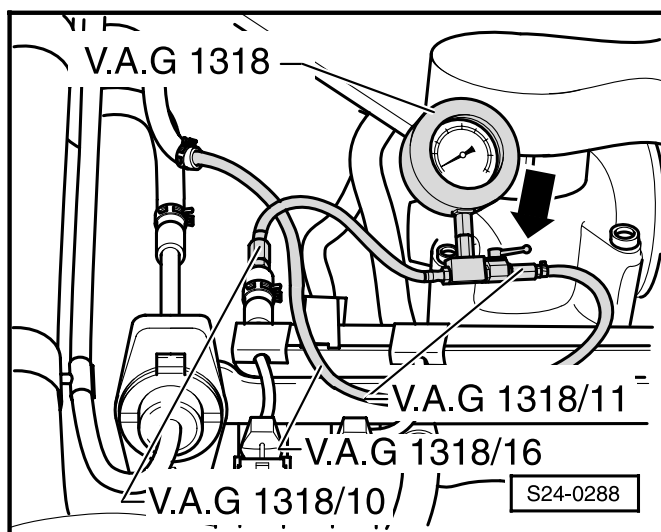


- After building up pressure, switch ignition off and at the same time close shut-off cock at pressure measuring device V.A.G 1318 (turn lever to right angles to direction of fuel flow -arrow-).

- Observe pressure drop at gauge.

If the pressure again drops:

- Replace fuel pressure regulator.



- Open shut-off cock of pressure measuring device V.A.G 1318 (turn lever in direction of flow -arrow-).

- Start engine and run at idling speed.
- After pressure has built up, pinch together hose of return-flow line at fuel rail and switch ignition off.
- Detach return-flow line and observe pressure drop.

If the pressure does not drop:

- Replace fuel pressure regulator.

Note:

Before disconnecting the pressure measuring device, release pressure by carefully detaching the hose from the feed line in stages. Hold a vessel and cloth below the connection for collecting the fuel which flows out.

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
- ◆ Engine leak detection spray G 001 800 A1

Test procedure

Notes:

- ◆ *As a result of the vacuum in the intake system, the leak detection spray is inducted together with the unmetered air. The leak detection spray reduces the ignition performance of the mixture. This results in a drop in engine speed and an enlargement of the throttle valve angle.*
- ◆ *It is essential to observe the safety precautions stated on the can.*
- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

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

◀ Readout in display:

- Enter 011 for „Display group number“ and confirm the entry with the key Q.

Read measured value block 11 →
780 rpm 85.0 °C 45.0 °C 9.0° BTDC

◀ Readout in display:
(1...4 = display blocks)

- Check the readout in display block 1 (engine speed) and note.
- Systematically spray parts of the intake system with engine leak detection spray.

If the engine speed drops or if the readout increases beyond the earlier limits:

- Inspect sprayed point of intake system for leaks and rectify any leak.
- Press → key.
- Press keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.

Testing injectors

Testing actuation

Special tools, testers and aids required

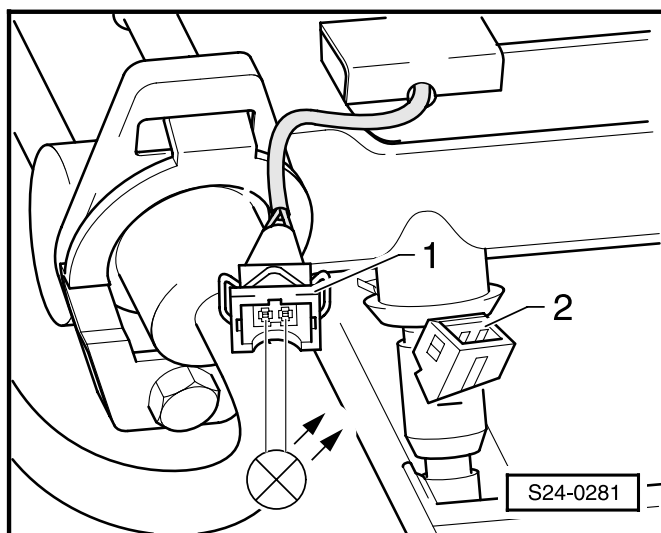
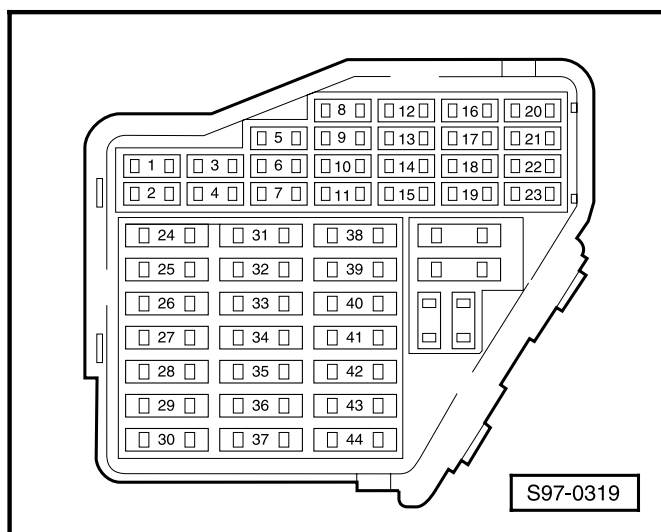
- ◆ Test box V.A.G 1598/31
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Diode test lamp (e.g. V.A.G 1527 B)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Current flow diagram

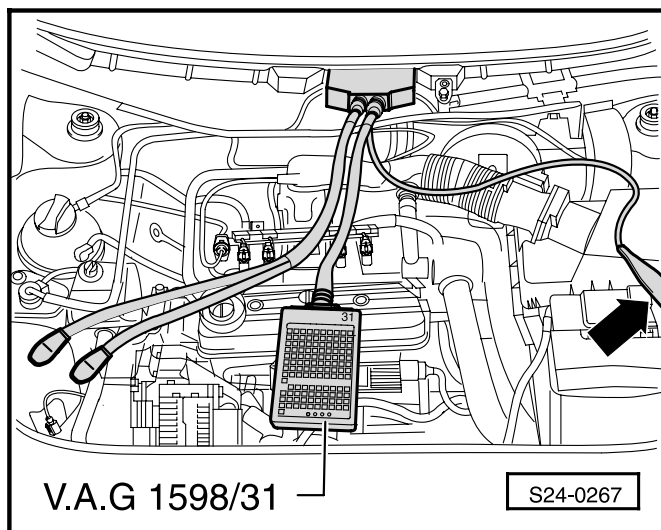
Test conditions

- Fuse 32 must be in proper order.
- Earth connections between engine (at clutch housing) and body (below battery) in proper order.
- Battery voltage at least 11 V.
- Engine speed sender must be in proper order; testing ⇒ page 28-10.
- Fuel pump relay must be in proper order.

Test procedure

- Remove the engine trim panel.
- ◀ - Unplug the connectors -1- from the injectors -2-.
- Use adapter cables from V.A.G 1594 A to connect the diode test lamp to the contacts of the connector of cylinder 1.

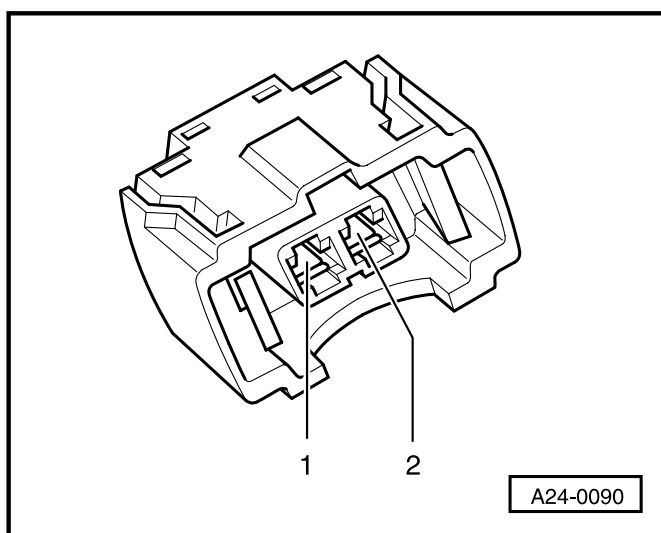




- Operate the starter.
The LED must flicker.
- Repeat the test at the connectors of the injectors of cylinders 2...4.

If the LED does not flicker:

- Switch off ignition.
- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.



- ◀ - Test the cables between test box and the connectors of the injectors for open circuit according to the current flow diagram.
Connector cyl. 1, contact 2+socket 88
Connector cyl. 2, contact 2+socket 87
Connector cyl. 3, contact 2+socket 85
Connector cyl. 4, contact 2+socket 86
Cable resistance: max. 1.5 Ω
- In addition, test the cables for short circuit to each other to positive.
Specification: $\infty \Omega$
- Connect voltage tester V.A.G 1527 B as follows:

Plug connection Contact	Measure to
1	Engine earth

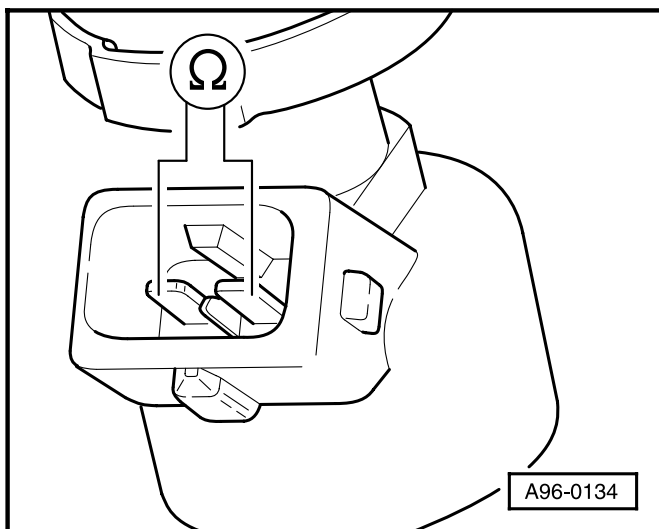
- Briefly operate the starter (the engine may also start when this is done).
♦ The LED must come on.

If the LED does not come on:

- Test cable connection between contact 1 and fuse for injectors for open circuit.
⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder
- Rectify any open circuit in the wiring.

If the LED comes on:

- Test actuation of the injectors.



Testing resistances of injectors

- ◀ - Test the resistance of the injectors between the contacts.
Specification: 14...20 Ω

If the specification is not achieved:

- Replace injector(s).

Testing injected quantity, leaktightness and spray pattern of injectors

Special tools, testers and aids required

- ◆ Remote control V.A.G 1348/3A
- ◆ Adapter cable V.A.G 1348/3-2
- ◆ Tester for injected quantity (e.g. V.A.G 1602)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)

Test requirement:

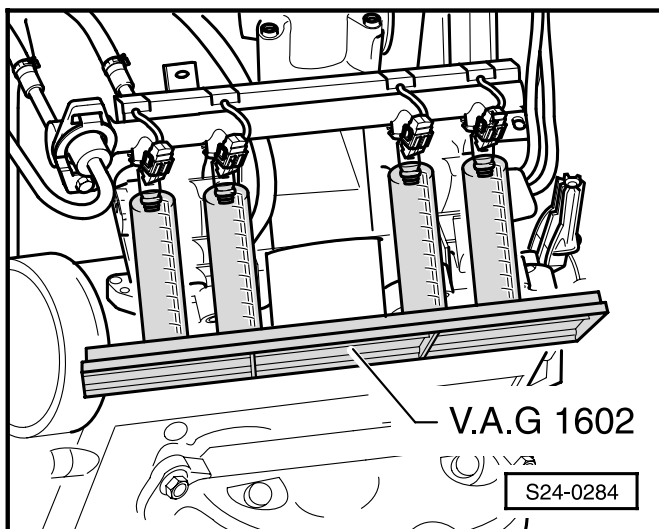
- Fuel pressure in order; testing
⇒ page 24-19.

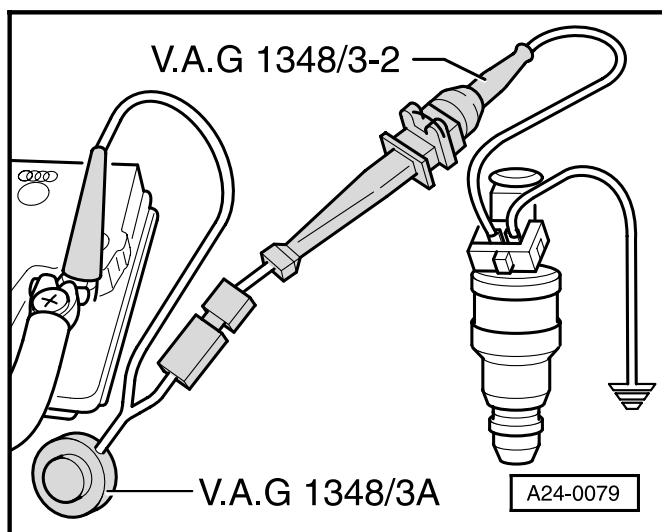
Test procedure

- Take the fuel rail and the injectors out of the intake manifold ⇒ page 24-10. The fuel hoses remain connected.
- ◀ - Hold the injectors in the measuring device V.A.G 1602.

Inspecting for leaks

- Initiate final control diagnosis ⇒ page 01-30 and actuate the fuel pump relay -J17-.
- Check the injectors for leaks (visual inspection). When the fuel pump is running, no more than 1...2 drips a minute must flow out of each injector.
- If the fuel loss is greater, switch off fuel pump (end final control diagnosis) and replace the faulty injector ⇒ page 24-10.





Testing injected quantity

- Hold the injector to be tested in a measuring glass of the injected quantity tester V.A.G 1602.
- ◀ - Connect one contact of the injector with the test cable and a crocodile clamp from V.A.G 1594 A to engine earth.
- Connect the second contact of the injector with the remote control V.A.G 1348/3A, adapter cable V.A.G 1348/3-2 and auxiliary cable to positive.
- Initiate final control diagnosis ⇒ page 01-30 and actuate the fuel pump relay -J17-.

The fuel pump must run.

- Operate remote control V.A.G. 1348/3A for 30 seconds.
- Repeat the measurement at all the injectors.
- After all four injectors have been actuated, place the measuring glasses on a flat surface.

Specification for each injector: 145 ± 12 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 ⇒ page 24-10.

Note:

When testing the injected quantity, also inspect the spray pattern. The ejected spray must be identical at all the injectors.

- Install the injectors and the fuel rail ⇒ page 24-10.

Testing fuel pump relay -J17 and actuation

The voltage for the fuel pump and several components of the fuel injection system is supplied through the fuel pump relay -J17.

The engine must be running if the fuel pump relay -J17 is to close. In other words, the engine is not supplied with earth (through the engine control unit) until the engine control unit has detected speed pulses.

Special tools, testers and aids required

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

Note:

◀ The fuel pump relay is located on the micro electrical centre in the driver footwell on left, plug position 4.

Test requirement:

- Battery voltage at least 11 V

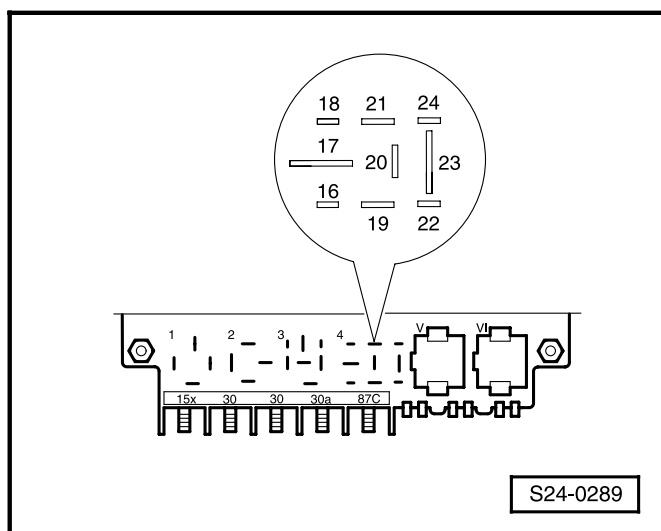
Operational test of fuel pump relay

- Remove the bottom part of the dash panel on the left:
⇒ Body Fitting Work; Repair Group 70; Dash Panel; Removing and installing dash panel
- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); ignition is switched on for this step ⇒ page 01-2.
- Initiate final control diagnosis ⇒ page 01-30 and actuate the fuel pump relay -J17-.

The fuel pump relay must operate and the fuel pump must run.

If the fuel pump relay does not operate:

- Test actuation of fuel pump relay.



If the fuel pump does not run:

- Test voltage supply for fuel pump and components (through fuel pump relay) ⇒ page 24-27.

Testing actuation of fuel pump relay

- Switch off the ignition.
- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Use an adapter cable from V.A.G 1594 A to connect socket 80 and socket 2 of the test box.
- Switch on the ignition.

The fuel pump relay must operate.

If the relay now operates, but not during final control diagnosis:

- Replace the engine control unit
⇒ page 24-14.

If the relay does not operate:

- Switch off the ignition.
- Remove the fuel pump relay.
- ◀ - Connect the multimeter for voltage measurement to contact 19 of relay base and to earth.

- Switch on the ignition.

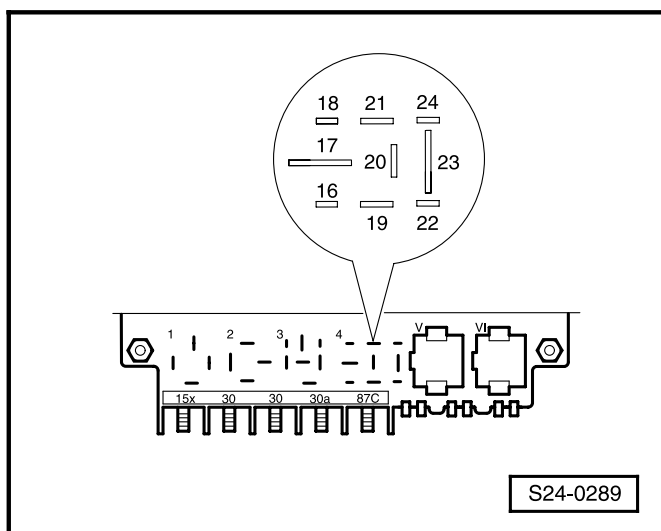
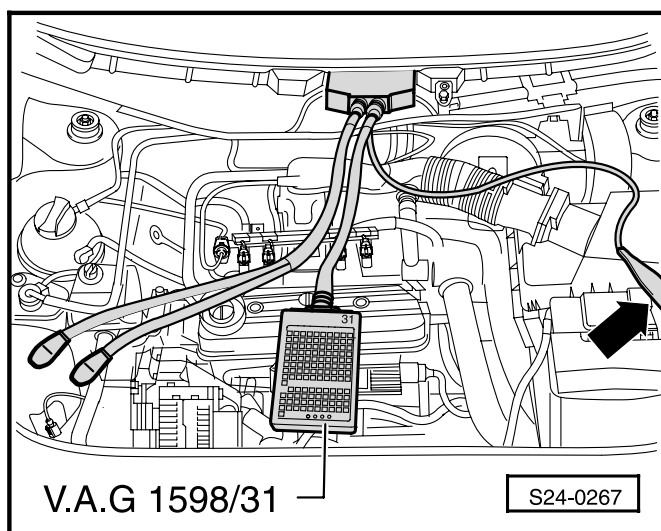
Specification: approx. battery voltage

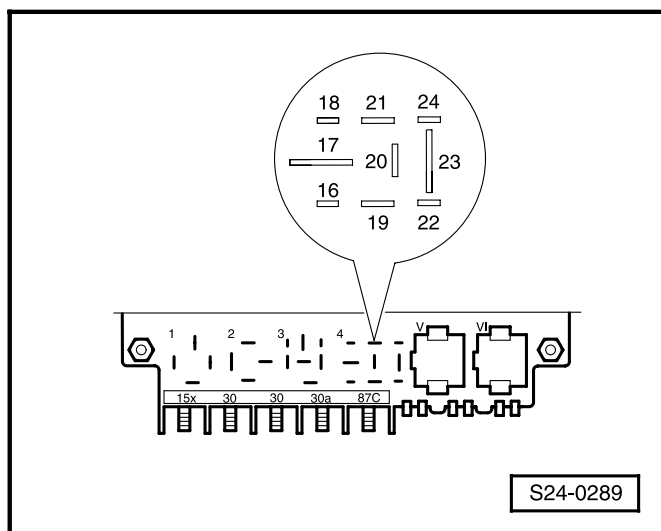
If the specification is not achieved:

- Test the cable connections.
⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder

If the specification is achieved:

- Switch off the ignition.





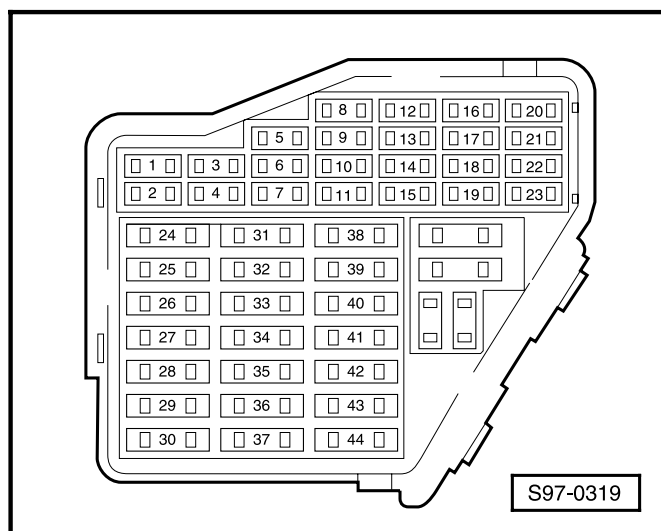
- Test the following cable connection for open circuit and for short circuit to earth and to positive:

Micro electrical centre in driver footwell on left, plug position 4 Contact	Test box V.A.G 1598/31 Socket
16	80

- Rectify any open circuit or short circuit in the wiring.
- If the cable connections are in proper order, replace the fuel pump relay -J17.

Testing voltage supply for fuel pump and components

- Remove fuses 28, 32, 34 and 43 in the fuse holder.
- Initiate final control diagnosis ⇒ page 01-30, and actuate the fuel pump relay -J17-.
- Connect the multimeter for voltage measurement to earth and to one of the contacts of the following fuses in the fuse holder.



Fuse	Specification at one of the contacts
S28	approx. battery voltage
S32	approx. battery voltage
S34	approx. battery voltage
S43	approx. battery voltage

If the specifications are not achieved:

- Repeat the test at the other contact of the fuse base.

If the specifications are again not achieved:

- Test the cable connections.
⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder
- If the cable connections are o.k., replace fuel pump relay -J17.

Testing intake manifold pressure sender (G71)

Special tools, testers and aids required

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

Test procedure

- ◀ - Unplug connector -1- from intake manifold pressure sender (G71) and intake manifold temperature sender (G72) -2-.
- Switch ignition on.
- Connect multimeter as follows for measuring voltage:

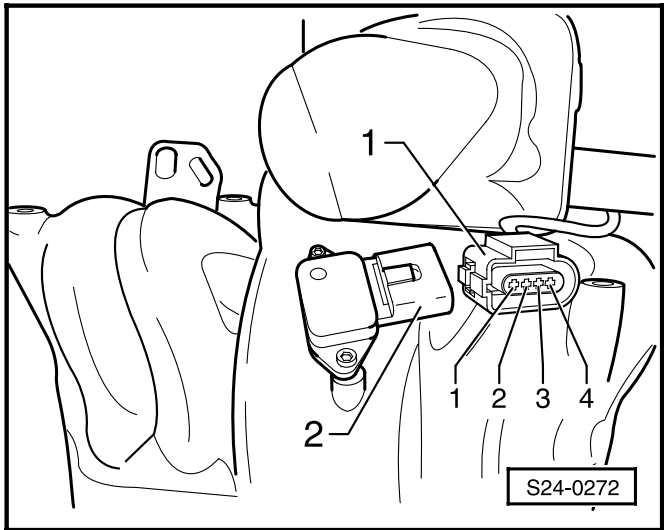
Contact at plug connection	Specification
3 + 4	approx. 5 V
3 + earth	approx. 5 V

If the specifications are achieved:

- Replace intake manifold pressure sender (G71) together with intake manifold temperature sender (G72) ⇒ page 24-11, item 8.

If the specifications are not achieved:

- Switch ignition off.
- Connect test box V.A.G 1598/31 to wiring loom to engine control unit ⇒ page 24-12. Engine control unit is not connected.



- Test cables between test box and connector for open circuit.

6-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
3	96
4	95

- Cable resistance: max. 1.5 Ω .
- Test cable to contact 4 for short circuit to earth, to contact 1 and 3 and to battery positive.

Specification: 8 Ω

If no fault is found in the wiring:

- Replace engine control unit $\Rightarrow$ page 24-14.

Testing intake manifold temperature sender (G72)

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/31
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Current flow diagram

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Enter 004 for display group number 4 and confirm the entry with the key Q.

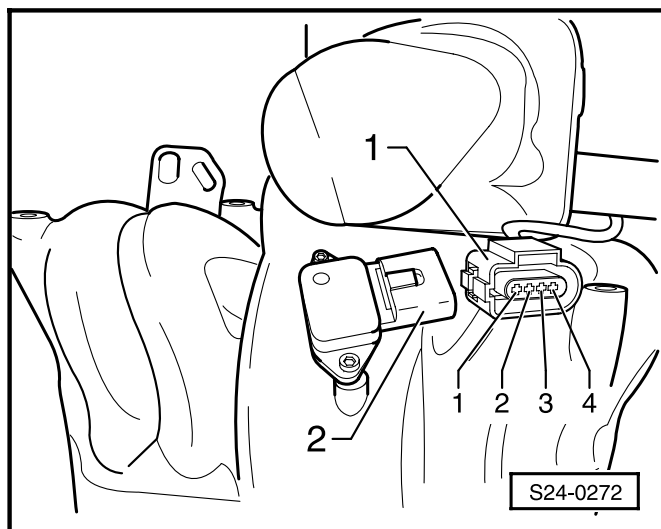
Read measured value block 4				→
0 rpm	12.8 V	85.0 °C	28.5 °C	

◀ Readout in display:
(1 to 4 = display blocks)

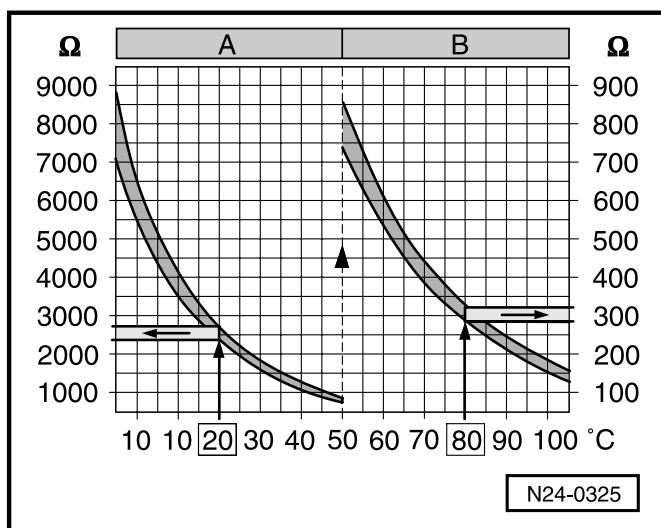
- Check specification for intake manifold temperature sender in display block 4.

If an implausible value appears in the display:

- Select function 06 „End output“ and confirm the entry with the key Q.
- Switch ignition off.



- ◀ - Unplug connector -1- from intake manifold temperature sender (G72) and intake manifold pressure sender (G71) -2-.
- Connect multimeter to contacts 1 and 2 of the intake manifold temperature sender -2- for resistance measurement.



◀ Specification:

Specification in range A applies to temperatures of 0...50 °C, in area B to temperatures of 50...105 °C.

Example:

- ♦ The specification for a temperature of 20 °C is 2340...2680 Ω.
- ♦ The specification for a temperature of 80 °C is 290...330 Ω.

If the specification is not achieved:

- Replace intake manifold temperature sender (G72) and intake manifold pressure sender (G71) ⇒ page 24-3.

If the specification is achieved:

- Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12. Engine control unit is not connected for this step.

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

6-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	107
2	93

- Cable resistance: max. 1.5 Ω .
- Rectify any open circuit in the wiring or short circuit.

If no fault is found in the wiring:

- Replace engine control unit ⇒ page 24-14.

Testing coolant temperature sender (G62)

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/31
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Current flow diagram

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Enter 004 for display group 4 and confirm the entry with the key Q.

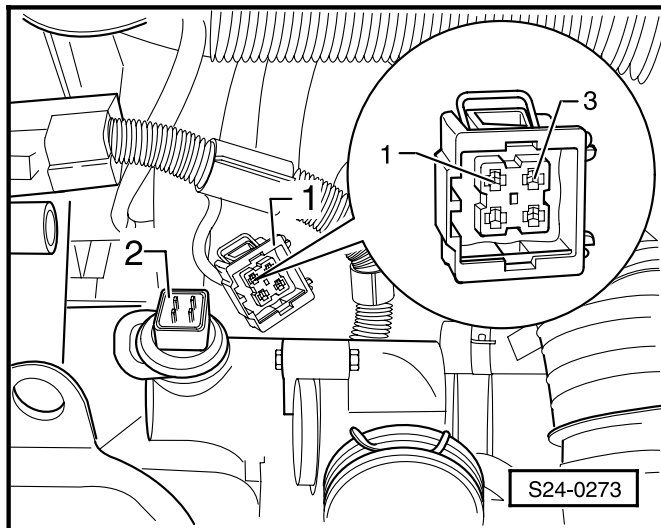
Read measured value block 4 →
780 rpm 13.8 V **85.0 °C** 28.5 °C

◀ Readout in display:
(1 to 4 = display blocks)

- Read off coolant temperature in display block 3.

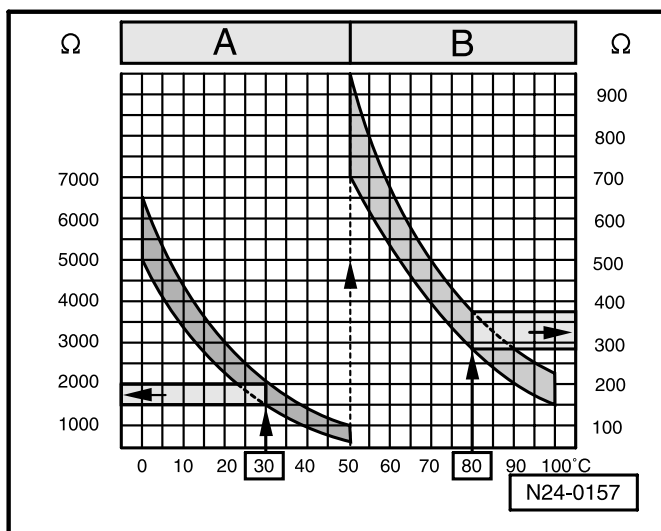
If an implausible readout appears in the display:

- Select function 06 „End output“ and confirm the entry with the key Q.
- Switch ignition off.



◀ - Unplug 4-pin connector -1- from the coolant temperature sender.

- Connect multimeter to contacts 1 and 3 of the coolant temperature sender (G62) -2- for resistance measurement.



◀ Specification:

Specification in range A applies to temperatures of 0...50 °C, in area B to temperatures of 50...100 °C.

Example:

- ♦ The specification for a temperature of 30 °C is 1500...2000 Ω.
- ♦ The specification for a temperature of 80 °C is 275...375 Ω.

If the specification is not achieved:

- Replace coolant temperature sender -G62.

If the specification is achieved:

- Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12. Engine control unit is not connected.
- Test the cables for short circuit to positive and to negative, and for open circuit.

4-pin connector at wiring loom, contact	Test box V.A.G 1598/31, socket
1	104
3	83

Cable resistance: max. 1.5 Ω .

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

If no fault is found in the wiring:

- Replace engine control unit $\Rightarrow$ page 24-14.

Testing voltage supply of engine control unit

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 1598/31
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Current flow diagram

Test requirements

- Battery voltage at least 11 V
- Generator o.k.

Test procedure

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Enter 004 for display group 4 and confirm the entry with the key Q.

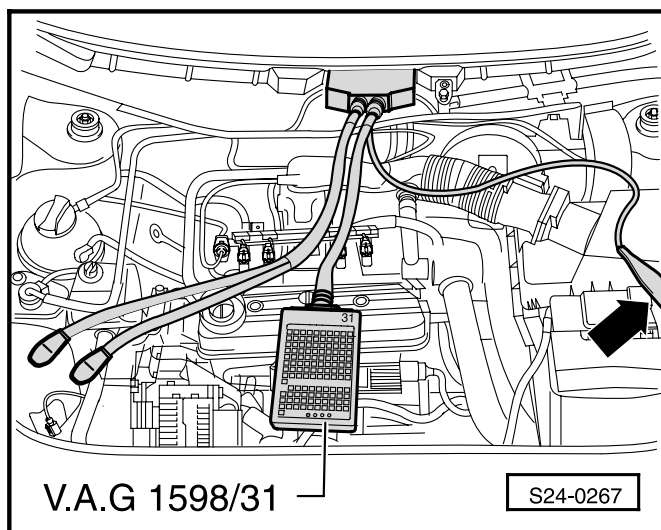
Read measured value block 4 →
780 rpm **13.8 V** **85.0 °C** 28.5 °C

◀ Readout in display:
(1 to 4 = display blocks)

- Read off figure in display block 2.

Specification: 12.0...14.5 V

- Press → key.



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

If the readout varies, or if the battery voltage is not achieved:

- Switch off the ignition.
- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Use the multimeter and adapter cables from V.A.G 1594 A to measure the supply voltage between sockets 2+62 of the test box:
Specification: approx. battery voltage
- Switch on the ignition.
- Use the multimeter and adapter cables from V.A.G 1594 A to measure the supply voltage between sockets 2+3 of the test box:
Specification: approx. battery voltage
- Repeat the tests at sockets 1+62 and sockets 1+3.

If the specifications are not achieved:

- Test the cable connections to the micro electrical centre according to the current flow diagram.

Adapting engine electronics control unit to electronic immobiliser

Special tools, testers and aids required

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

Test condition

- Authorized car key available

Procedure

- Connect vehicle system tester V.A.G 1552 with cable V.A.G 1551/3 ⇒ page 01-2.

- Switch on the ignition.
- Press keys 1 and 7 for the address word „Dash panel insert“ and confirm the entry with the key Q.
- Press the → key.

8L0919860 AB-COMBIINSTR Coding XXXXX	VDO WSC 00000	→
---	------------------	---

◀ Readout in display:

- Press the → key.

IMMO-IDENTNO: AUZXXXXXXXXXXXX	→
-------------------------------	---

◀ Readout in display:

- Press the → key.

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

◀ Readout in display:

- Press keys 1 and 0 for the function „Adaptation“ and confirm the entry with the key Q.

Adaptation Enter channel number XX

◀ Readout in display:

- Press the key 0 twice for „Channel number 0“ and confirm the entry with the key Q.

Adaptation Erase learned values?	Q
-------------------------------------	---

◀ Readout in display:

- Confirm the entry with the key Q.

Adaptation Learned values are erased	→
---	---

◀ Readout in display:

- Complete adaptation by pressing the → key.
- Press the keys 0 and 6 for the function „End output“ and confirm the entry with the key Q.
- Switch off the ignition.

Note:

When the ignition is switched on again, the code of the engine control unit is transferred to the immobiliser control unit.

Testing lambda control

Function of lambda control

Notes:

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

The „rich mixture (low level of residual oxygen)“ voltage signal is in the range 0.7...1.0 V (related to reference earth).

The „lean mixture (high level of residual oxygen)“ voltage signal is in the range 0.0...+0.3 V (related to reference earth).

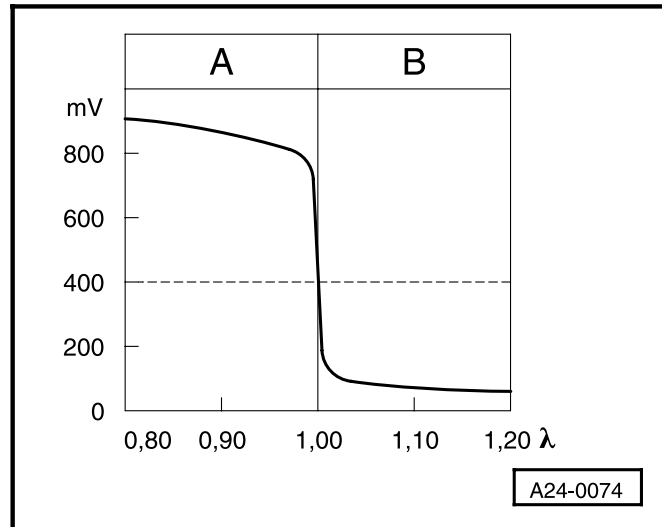
A voltage jump from 0.7...1.0 V to 0.0...+0.3 V, and vice versa, takes place at the transition from „rich“ to „lean“, and vice versa.

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

The control must take place at least 30 times a minute when the engine is idling and at normal operating temperature.

If no voltage change occurs, or occurs only sluggishly, the following faults may exist:

- ◆ *Slots or holes in probe head blocked.*
- ◆ *Probe has been subjected to excessive thermal stresses.*
- ◆ *The ventilation hole at the probe -in area of connection cable- is sealed off.*
- ◆ *Contact resistance in signal cable or in earth cable.*
- ◆ *Probe too cold; probe heater not operating.*
- ◆ *Probe damaged by leaded fuel.*
- ◆ *Probe damaged by contact spray or similar products (the contact spray is drawn into the probe through the fine cavities in the electric cables as a result of the thermal variations and the capillary effect).*
- ◆ *Probe damaged by silicone vapours (use of sealants containing silicone results in traces of silicone elements being inducted by the engine. These silicone elements are not combusted and damage the lambda probe).*



♦ *Lambda control switched off (engine control unit has detected a fault at the fuel injection system $\Rightarrow$ Interrogating fault memory and also Reading measured value block, display group 030).*

♦ *Probe has been damaged by oil elements escaping from the crankcase ventilation, or by leaks in the engine.*

◀ Lambda probe voltage U_{λ} in mV

A: Lambda probe voltage high

- ♦ Rich mixture (fuel excess or air deficiency)
- ♦ High CO_2 concentration

B: Lambda probe voltage low

- ♦ Lean mixture (fuel deficiency or air excess)
- ♦ Low CO_2 concentration

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 1598/31
- ♦ Hand-held multimeter (e.g. V.A.G 1526 A)
- ♦ Adapter cable set (e.g. V.A.G 1594 A)
- ♦ Current flow diagram

Test conditions

- Engine at operating temperature
- Basic setting o.k.
- No leaks in exhaust system between catalytic converter and cylinder head

Test procedure

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Connect vehicle system tester V.A.G 1552 and select engine electronics (address word 01); engine idling for this step ⇒ page 01-2.

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Press keys 0, 3 and 0 for „Display group number 030“ and confirm the entry with the key Q.

Read measured value block 30
110 010

→

◀ Readout in display:

(1...4 = display blocks)

- Check the lambda probe status in display block 1.

Specification: 1 1 X

If the specification is not achieved ⇒ page 24-46,
Testing lambda probe cables.

Note:

The „Lambda probe status“ indicates the status of the lambda control and of the lambda probe.

Meaning of the 3-digit readout of display group 030

1	1	1	Display block 1
1			Status of lambda probe heater
	1		Operational readiness of lambda probe
		X	Ignore readout

If the specification is achieved, but a fault is stored in the fault memory:

- Test lambda probe control ⇒ page 24-44.

Testing lambda probe control

- Press the key C.
- Enter „033“ for „Display group number 033“ and confirm the entry with the key Q.

Read measured value block 33 →

-3.5 % 0.2 V

◀ Readout in display:

- Check the lambda control in display block 1:

Specification for display block 1:

The readout must vary by at least 2 % within the range -10.0...10.0 %.

If the specification is not achieved ⇒ continuation on page 24-45.

- Switch into display group 031 as follows:
- Press the key C.
- Press keys 0, 3 and 1 for „Display group number 031“ and confirm the entry with the key Q.

Read measured value block 31 →

0.7 V 0.39 V

◀ Readout in display:

- Check the lambda probe voltage in display block 1:

Specification for display block 1:

The voltage must vary about 30 times a minute within the range 0.00...1.00 V.

If the specification is not achieved ⇒ analysis of display group 031, page 24-45.

Analysis of display group 031

Display block: 1	Possible cause of fault	Rectifying fault
constant 0.00...0.30 V poss. constant 0.70...1.00 V	◆ Large quantity of unmetered air ◆ Spark plug faulty ◆ Fuel pressure too high/too low ◆ Injector faulty ◆ -G62 faulty ◆ Activated charcoal filter solenoid valve ◆ Lambda probe heater not operating ◆ Lambda probe faulty/dirty	- Test intake system for leaks (unmetered air) ⇒ page 24-22. - Test spark plugs. - Test fuel pressure regulator and holding pressure ⇒ page 24-19. - Test injectors ⇒ page 24-23. - Test coolant temperature sender ⇒ page 24-34. - Test fuel tank breather ⇒ page 24-49. - Test lambda control ⇒ page 24-41.
constant 1.00 V	◆ Short circuit to positive in: Lambda probe Lambda probe cable Earth cable Engine control unit	- Test lambda control ⇒ page 24-41.
constant 0.40...0.50 V	◆ Open circuit in: Lambda probe Lambda probe cable Earth cable Engine control unit	
constant 0.00 V	◆ Short circuit to earth in: Lambda probe Lambda probe cable Earth cable Engine control unit	

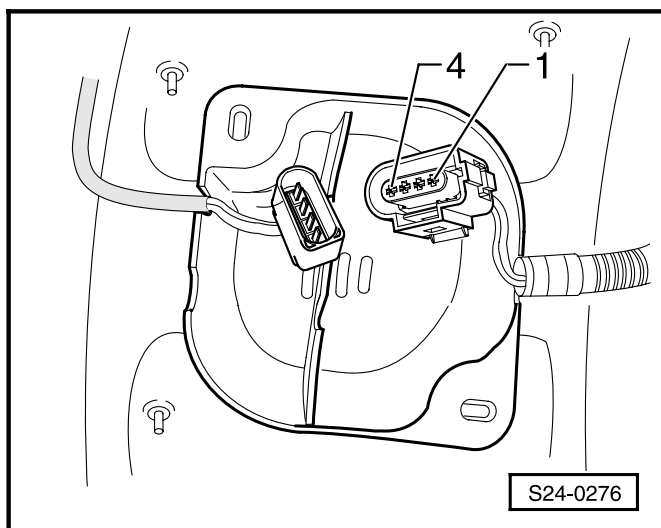
Continuation

If the specification is not achieved in display block 1, or if the readout does not vary by at least 2 %:

- Conduct a road test in order to eliminate any residues on the lambda probe, and repeat the test.

If the specification in display block 1 is also not reached after a road test, or if the readout does not vary by at least 2 %:

- Test the basic voltage ⇒ page 24-46.
- Test the lambda probe heater ⇒ page 24-47.



Testing basic voltage

- Separate the 4-pin plug connection to the lambda probe.
- ◀ - Connect the multimeter for voltage measurement between contacts 3 and 4.
- Switch on the ignition.
 - ◆ Specification: 0.400 ... 0.500 V
- Switch off the ignition.

If the specification is not achieved:

- Test the lambda probe cables ⇒ page 24-46.

If the specification is achieved:

- Replace the lambda probe.
- ⇒ 1.4-ltr./44 kW Engine, Mechanical Components; Repair Group 26; Removing and installing parts of the exhaust system

Testing lambda probe cables

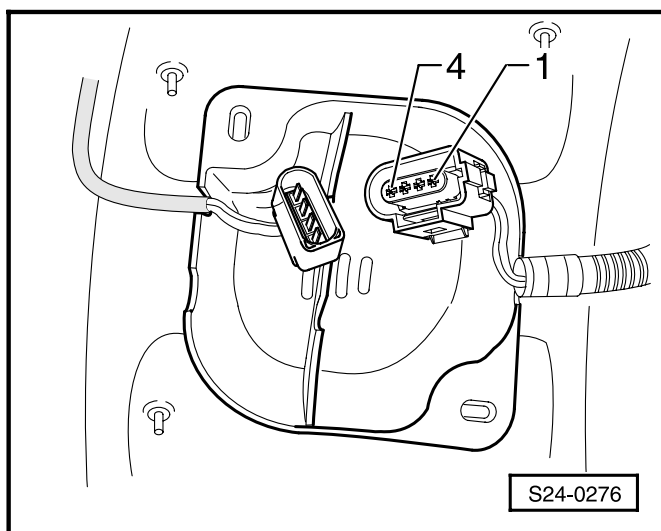
- Separate the 4-pin plug connection to the lambda probe.
- Connect the test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- ◀ - Test the following cable connections for open circuit:

Plug connection Contact	Test box V.A.G 1598/31 Socket
3	31
4	14

- Rectify any open circuit in the wiring.
- Test the cables to each other for short circuit.

If the cable connections are o.k.:

- Replace the engine control unit
⇒ page 24-14.



Testing lambda probe heater

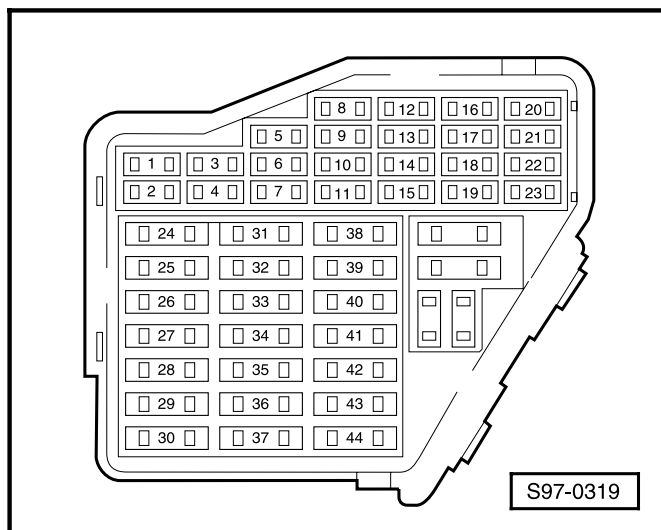
The heating circuit of the lambda probe is monitored by the self-diagnosis. Interrogating fault memory ⇒ page 01-4.

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/31
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Current flow diagram

Test conditions

- Fuel pump relay o.k.
- ◀ ● Fuse 43 o.k.



Continuity test

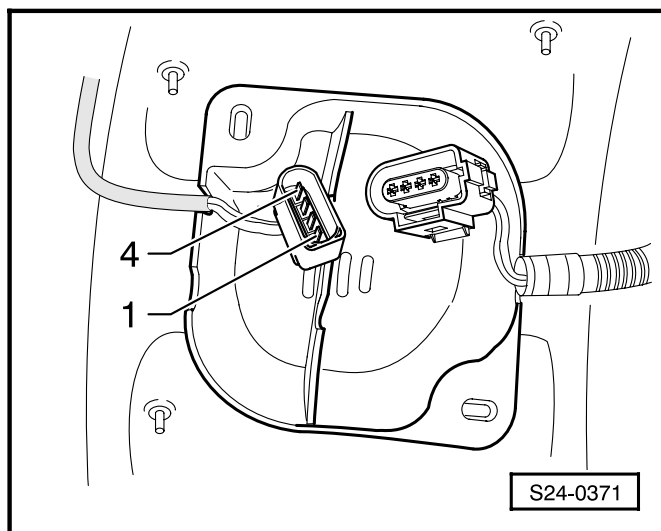
- Separate the 4-pin plug connection to the lambda probe (G39).
- ◀ - Use the hand-held multimeter to conduct a continuity test (resistance measurement) between contacts 1 and 2 of the probe connector.

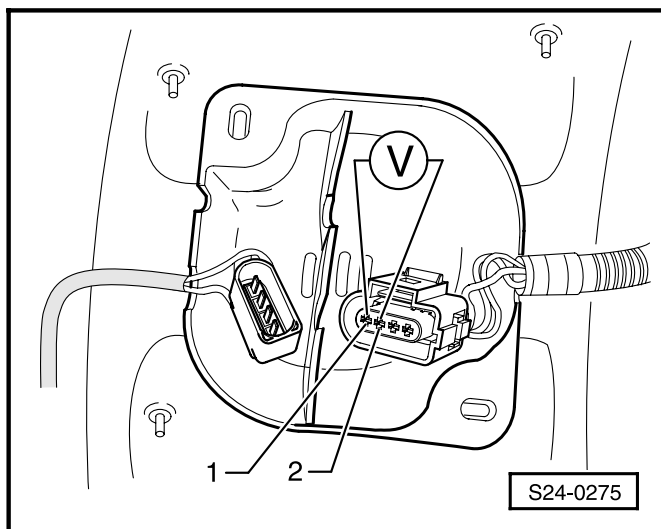
Note:

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

- If any open circuit is found, replace lambda probe (G39).

If the heating element has continuity, test voltage supply for lambda probe heater (Z19) as follows:





Testing voltage supply

- ◀ - Use the adapter cables from V.A.G 1594 A to connect the multimeter for voltage measurement to contacts 1+2 of the connector.
- Start the engine and measure the voltage.
Specification: approx. battery voltage
- Switch off the ignition.

If no voltage is present:

- Connect the multimeter to contact 1 of the 4-pin connector and to earth.
- Start the engine and measure the voltage.
Specification: approx. battery voltage
- Switch off the ignition.

If the specification is not achieved:

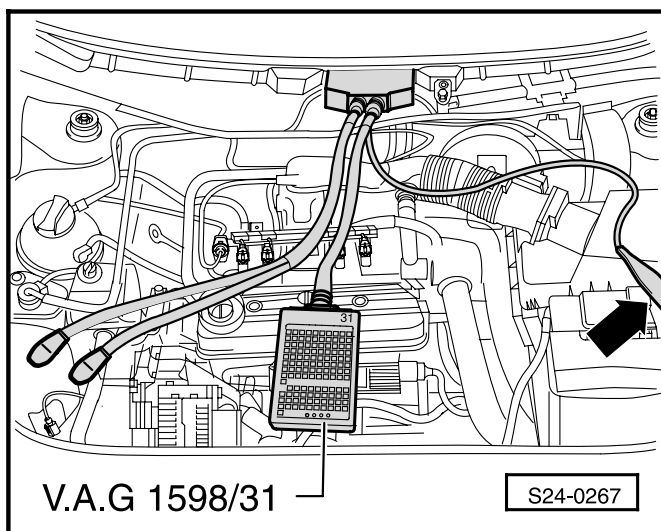
- Test the cable from contact 1 to fuse 43 for open circuit.

If the specification is achieved:

- ◀ - Connect the test box V.A.G 1598/31 to the wiring loom to the engine control unit → page 24-12.
- Test the cable from contact 2 of the 4-pin connector to socket 4 of the test box.

If the cable connection is o.k.:

- Replace the engine control unit.



Testing fuel tank breather

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 B)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31

Testing for leaks

The solenoid valve is closed in the de-energized state.

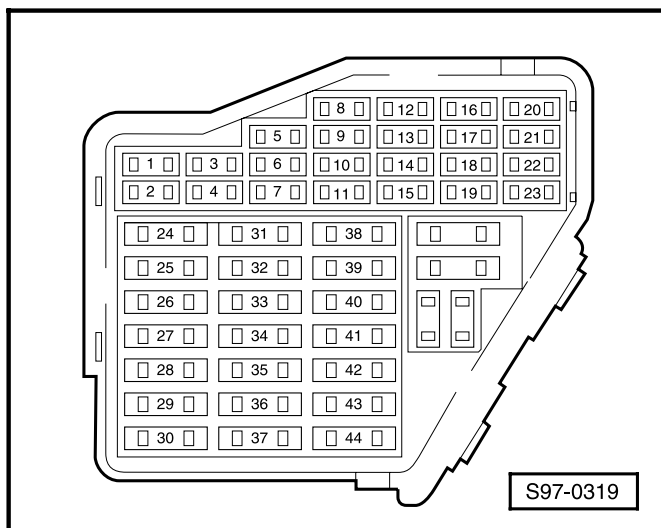
- Detach the hose from the activated charcoal filter solenoid valve (N80).
- Connect a suitable pressure gauge and a compressed air device (air pump) to the solenoid valve.
- Use these to produce an air pressure which can be indicated.
- Initiate final control diagnosis and select the activated charcoal filter solenoid valve (N80) ⇒ page 01-30.
- When the solenoid valve opens, the air pressure indicated must drop significantly and must increase again significantly when the valve closes; replace solenoid valve, if necessary.

Electrical test of ACF valve -N80-

- Unplug the connector at the ACF valve.
- Use the hand-held multimeter to conduct 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

Note:

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

Test condition

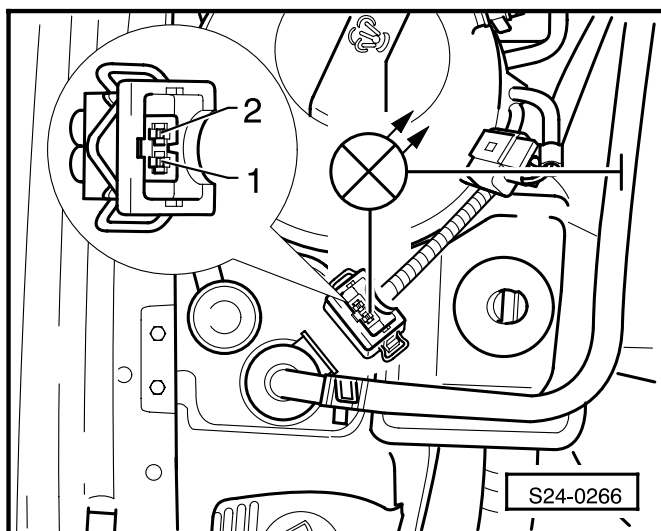
- ◀ ● Fuse 43 o.k.

Test procedure

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

Specification: The diode test lamp must come on.

- If the diode test lamp does not come on, test the cable connection from contact 1 to fuse 43 for continuity; 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 24-27.



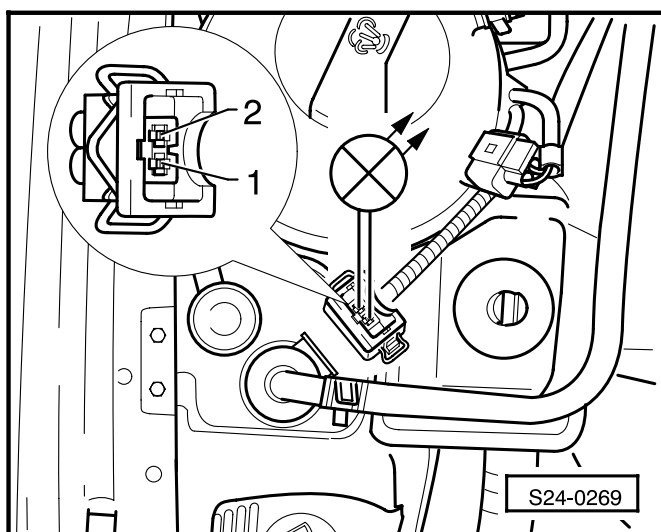
Testing actuation of the ACF valve

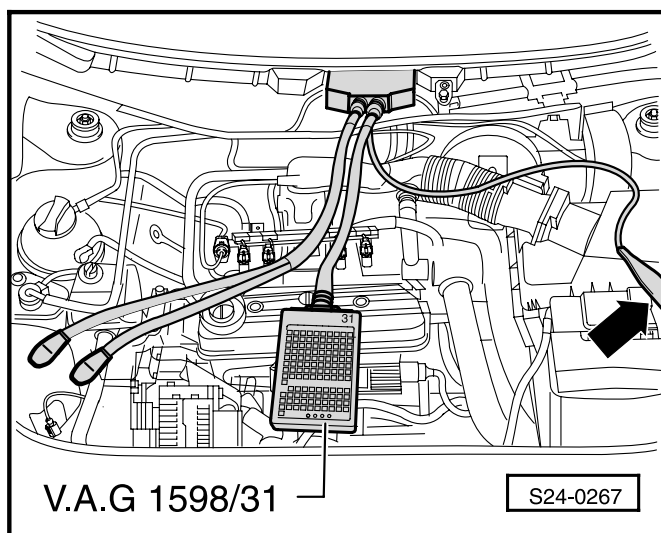
- ◀ - Connect the diode test lamp between contact 2 (earth actuation of the engine control unit) and positive terminal of battery.
- Initiate final control diagnosis and select the activated charcoal filter solenoid valve (N80)
⇒ page 01-30.

Specification: The diode test lamp must flash.

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

- Switch off the ignition.





- ◀ - Connect the test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- If the diode test lamp came on and remained on, test the cable from contact 2 of the connector at the ACF valve to socket 61 of the test box for short to earth.
- If the diode test lamp did not flash, test the cable from contact 2 of the connector at the ACF valve to socket 61 of the test box for continuity and also for short to positive.
- If there is neither an open circuit nor a short circuit in the wiring, replace engine control unit ⇒ page 24-14.

Testing electronic power control (electronic throttle)

Function of electronic throttle system

In the electronic throttle system, the throttle valve is not operated by a cable from the accelerator pedal. There is no mechanical link between the accelerator pedal and the throttle valve.

The position of the accelerator pedal is signalled to the engine control unit by two senders for accelerator pedal position (variable resistors, enclosed in a housing), which are linked to the accelerator pedal.

The position of the accelerator pedal (driver request) is a main input parameter for the engine control unit.

The throttle valve is operated by an electric motor (throttle valve positioner) in the throttle valve control unit, over the entire engine speed and engine load range.

The throttle valve is operated by the throttle valve positioner in line with the inputs of the engine control unit.

When the engine is not running and the ignition is switched on, the engine control unit controls the throttle valve positioner exactly in accordance with the inputs of the accelerator pedal position sender. In other words, if the accelerator pedal is depressed halfway, the throttle valve positioner opens the throttle valve to the same extent; the throttle valve is then approximately half-opened.

When the engine is running (under load), the engine control unit is able to open or close the throttle valve independently of the accelerator pedal position sender.

For example, the throttle valve may already be fully opened although the accelerator pedal is only depressed halfway. This offers the advantage of avoiding throttling losses at the throttle valve.

In addition, significantly improved values in respect of pollutant emissions and fuel consumption are achieved in this way in certain engine load states.

The engine control unit is able to produce the torque required by the engine by optimally combining the throttle valve cross-section and the charge pressure.

It would be incorrect to believe that the electronic throttle system consists of only one or two components. Rather, the electronic throttle is a system which embraces all the components which contribute to determining the position of the throttle valve, to controlling and monitoring it (e.g. the accelerator pedal position sender, the throttle valve control unit, the EPC warning lamp, the engine control unit ...).

Function of the EPC warning lamp (fault lamp for electronic throttle control) in dash panel insert

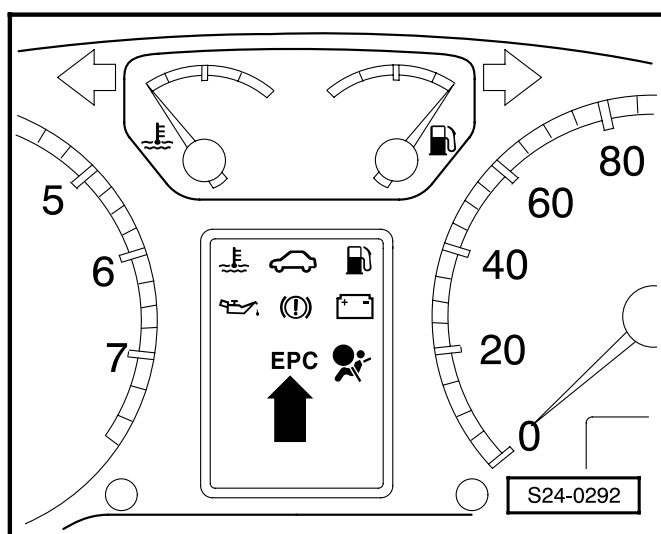
„EPC“ is an abbreviation which means **E**lectronic **P**ower **C**ontrol (electronic throttle).

◀ Fitting location of EPC warning lamp

The engine control unit checks all the principal components involved in the function of the electronic throttle system after the ignition is switched on.

During the check of these components, the engine control unit switches on the EPC lamp for about 3 seconds. If a fault is detected during this test, the lamp remains on.

If faults are detected in the electronic throttle system during operation of the engine, the engine control unit switches on the EPC lamp (these faults are stored in the fault memory). In the event of an open circuit in the wiring or a fault occurring in the electronic throttle system, the engine switches into the emergency mode. In the emergency mode, the engine runs at fast idling speed to allow the customer to drive the vehicle to the nearest workshop. The accelerator pedal position senders do not operate in this case.



Testing fault lamp for electronic throttle control -K132

Note:

The fault lamp for electronic throttle control -K132 is also known as the EPC warning lamp.

Special tools, testers and aids required

- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31

Operational check of warning lamp

- Switch on the ignition.

The EPC warning lamp must come on.

- Start the engine and run at idling speed.

The EPC warning lamp must go out if no fault relating to the electronic throttle is stored in the fault memory.

A - Fault lamp for electronic throttle control -K132- does not come on

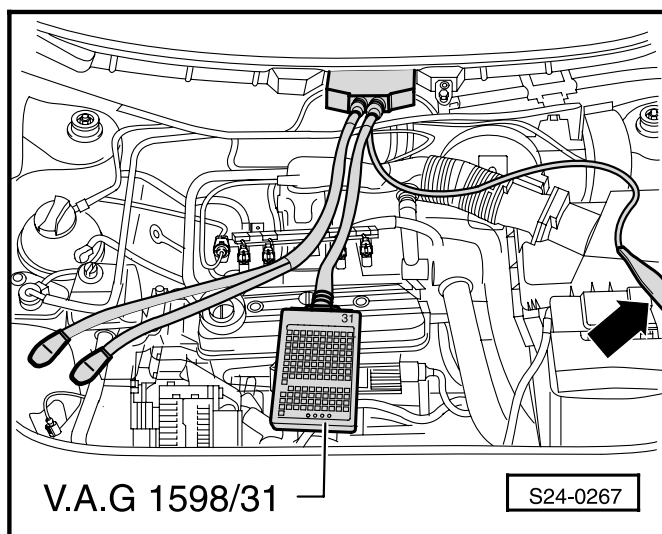
- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Bridge sockets 1 and 73 of the test box.
- Switch on the ignition.

The fault lamp must come on.

If the fault lamp does not come on:

- Switch off the ignition.
- Test the dash panel insert.
⇒ Electrical System; Repair Group 90; Dash Panel Insert; Removing and installing dash panel insert

If no fault is found:



- Test the following cable connection for open circuit and short circuit to positive:

Test box V.A.G 1598/31 Socket	Dash panel insert Contact
73	⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder

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

If the cable connection is o.k.:

- Replace the engine control unit
⇒ page 24-14.

B - Fault lamp for electronic throttle control -K132- comes on and remains on

- Interrogate the fault memory of the engine control unit ⇒ page 01-4.

If no fault is stored:

- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.

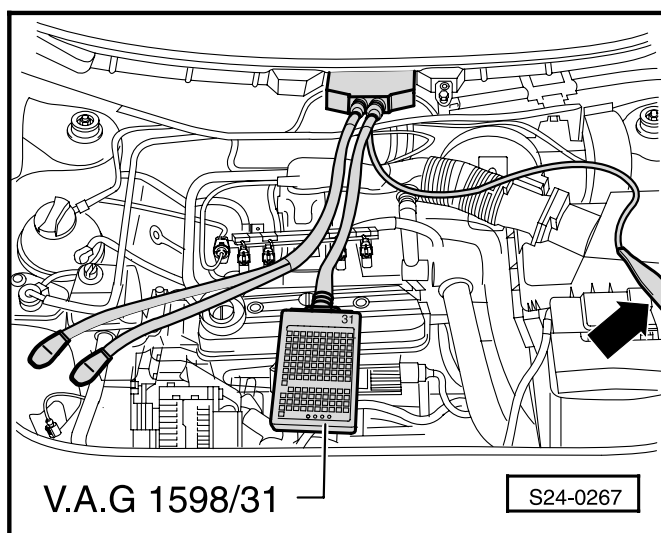
- Test the following cable connection for short circuit to earth:

Test box V.A.G 1598/31 Socket	Dash panel insert Contact
73	⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder

- Rectify any short circuit in the wiring.

If the cable connection is o.k.:

- Replace the engine control unit
⇒ page 24-14.



Testing throttle valve control unit -J338

The following components are integrated in the housing of the throttle valve control unit:

- ◆ Throttle valve drive -G186-. (This is an electric motor which is operated by the engine control unit. This electric motor opens the throttle valve by overcoming the force of a spring.)
- ◆ Angle sender -1- for throttle valve drive -G187-
- ◆ Angle sender -2- for throttle valve drive -G188-

Notes:

- ◆ *The housing of the throttle valve control unit must not be removed.*
- ◆ *The angle senders are designed as potentiometers (variable resistors). The senders supply the position of the throttle valve to the engine control unit; each sender does that independently of the other.*
- ◆ *The potentiometers cannot be set mechanically. Setting is performed with the vehicle system tester V.A.G 1552 in function 04 (initiating basic setting).*

Adapting engine control unit to throttle valve control unit

When adaptation is performed, the engine control unit learns various positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the engine control unit. The feedback regarding the position of the throttle valve is provided by the two angle senders for the throttle valve drive.

If the throttle valve control unit and re-installed, or replaced, or if the voltage supply of the engine control unit is interrupted, it is then necessary to carry out adaptation.

The learning process (adaptation) is performed:

- ◆ by initiating the basic setting (function 04) display group 60, ignition on.
- ◆ automatically, if the ignition is switched on for at least about 6 seconds, without operating the starter and accelerator pedal, and the engine control unit detects „learning demand“. (In this case, it is not clear whether adaptation was successful or not). Learning demand is detected in those cases where stored voltage values from the angle senders do not match with currently measured voltage values within a certain tolerance range.

Note:

The engine does not start during automatic adaptation.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/31

Requirements:

- No fault stored in fault memory; interrogating fault memory ⇒ page 01-4.
- Engine not running, ignition on.
- Accelerator pedal not depressed.
- Coolant temperature higher than 5 °C, but less than 100 °C.
- Intake air temperature less than 100 °C.
- Battery voltage at least 11 V.

Procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Basic setting
Enter display group number XXX

HELP

◀ Readout in display:

- Enter 060 for display group number 60 and confirm the entry with the key Q.

After pressing the key Q, the throttle valve positioner is first of all de-energized.

In this state, the throttle valve is pulled into an emergency running position by a mechanical spring integrated in the throttle valve control unit. The values which the two angle senders supply in this emergency running position, are stored by the engine control unit.

After this, the throttle valve is opened by a certain amount. Once this value is reached, the throttle valve positioner is again de-energized. Now, the mechanical spring must close the throttle valve within a certain time to the previously learned emergency running position (test of spring).

After this, the throttle valve is closed by the throttle valve positioner; the values which the angle senders in the throttle valve control unit supply, are stored in the engine control unit.

If the engine control unit de-energizes the throttle valve positioner when driving, this makes itself noticeable by a fast, surging idling of the engine. The engine then has only a very slow throttle response.

System in basic setting 60

5.4 %

5.4 %

0

→

ADP o.k

◀ Readout in display:

- Check the specification for the throttle valve control unit in display block 4.

Specification in display block 4: **ADP. runs**
ADP. o.k.

Note:

The abbreviation „ADP“ in display block 4 means „Adaptation“.

Note:

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

- ◆ *The throttle valve is not able to close fully (e.g. dirt).*
- ◆ *The battery voltage is too low.*
- ◆ *The throttle valve control unit or the cable connection is faulty.*
- ◆ *The engine is started during adaptation or the accelerator pedal is operated.*
- ◆ *Throttle valve housing twisted (check screw connection).*

If adaptation is aborted, „Function is unknown or cannot be carried out at the moment“ appears in the display of the tester. When the ignition is next switched on (for a few seconds), adaptation is automatically repeated.

- End the basic setting of the engine by pressing the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display (function selection):

Testing angle senders for throttle valve drive

The angle senders for throttle valve drive -G187 and -G188 inform the engine control unit of the position of the throttle valve. Both angle senders are integrated in the throttle valve control unit.

Special tools, testers and aids required

- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ 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 the engine electronics control unit (address word 01); ignition switched on for this step ⇒ page 01-2.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Press the keys 0, 6 and 2 for „Display group number 062“ and confirm the entry with the key Q.

Read measured value block 62 →
15.0 % 75.0 % 15.0 % 7.0 %

◀ Readout in display:

- Check the specifications for the potentiometer voltages of the electronic throttle.

Note:

The engine control unit converts the voltage values of the angle senders into a percentage based on 5 V and indicates these percentages (5 V supply voltage equals 100 %).

- Check display blocks 1 and 2.
- Slowly depress accelerator pedal fully.

The percentage readout in display block 1 must rise evenly. The tolerance range of 3...93 % is not fully utilized in this case.

The percentage readout in display block 2 must drop evenly. The tolerance range of 97...3 % is not fully utilized in this case.

Notes:

- ♦ *The reason why the readout in display block 1 rises, and the readout in display block 2 drops in contrast, is due to the contrarotation of the potentiometers (angle senders) in the throttle valve control unit.*
- ♦ *What this means is that the voltage tapped by the one angle sender moves in the direction of 5 V. (The more the throttle valve is opened, the greater is the voltage; the percentage readout rises).*
- ♦ *The voltage tapped by angle sender 2 moves away from 5 V in the direction of 0 V. (The further the throttle valve is opened, the lower is the voltage; the percentage readout drops).*

If the readouts do not appear as described:

- Test the voltage supply and the cable connections of the throttle valve control unit ⇒ page 24-61. Pay particular attention to the plug connections which may be loose or corroded.
- Test the accelerator pedal position senders ⇒ page 24-62.

Testing voltage supply of throttle valve control unit

- ◀ Unplug the connector of the throttle valve control unit.
- Switch on the ignition.
- Connect the multimeter for voltage measurement as follows:

Plug connection Contact	Specification
2 + earth	approx. 5 V
2 + 6	approx. 5 V

If the specifications are achieved:

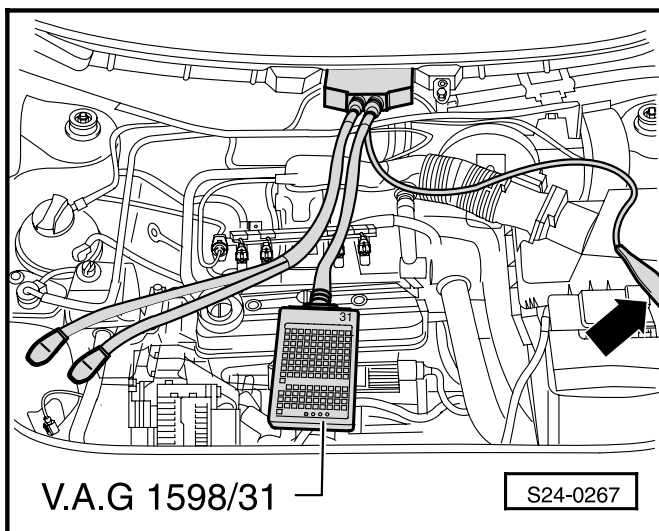
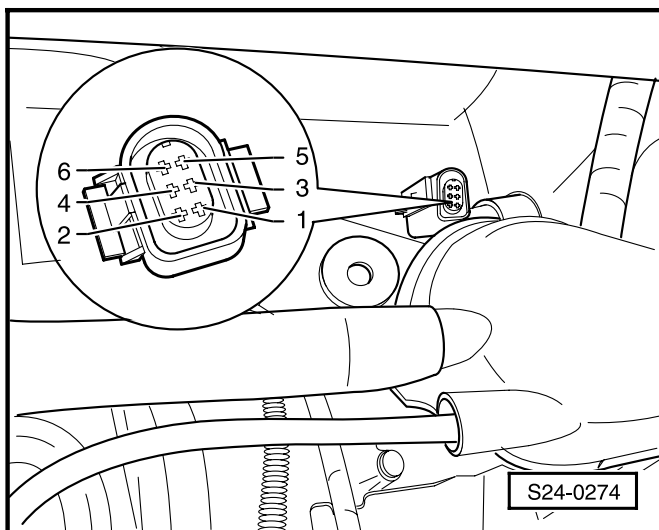
- In addition, test the signal cables and the actuating cables of the throttle valve positioner ⇒ page 24-61.

If the specifications are not achieved:

- Test the cable connections from the engine control unit to the throttle valve control unit ⇒ page 24-61.

Testing cable connections

- Unplug the connector of the throttle valve control unit.
- ◀ Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.



- Test the following cable connections for open circuit and for short circuit to earth and to positive:

Plug connection Contact	Test box V.A.G 1598/31 Socket
1	90
2	97
3	119
4	92
5	121
6	91

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

If no fault is found in the wiring:

- Replace the throttle valve control unit.

Testing accelerator pedal position senders

Special tools, testers and aids required

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

The two accelerator pedal position senders -G79- and -G185- are located at the accelerator pedal and pass on the driver request fully independently of each other to the engine control unit. Both senders are integrated in a housing.

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Press the keys 0, 6 and 2 for „Display group number 062“ and confirm the entry with the key Q.

Read measured value block 62
15.0 % 75.0 % 15.0 %

→

7.0 %

◀ Readout in display:

- Check the specifications for the potentiometer voltages of the electronic throttle.

Note:

The engine control unit converts the voltage values of the senders into a percentage, related to 5 V, and displays these percentages (5 V supply voltage equals 100 %).

- Check display blocks 3 and 4.
- Slowly depress accelerator pedal fully.

The percentage readout in display block 3 must rise evenly. The tolerance range of 12...97 % is not fully utilized in this case.

The percentage readout in display block 4 must likewise rise evenly. The tolerance range of 4...49 % is not fully utilized in this case.

Note:

The readout in display block 3 must always be approximately twice as great as the readout in display block 4.

If the readouts do not appear as described:

- Test the voltage supply and the cable connections of accelerator pedal position senders ⇒ page 24-64.

Testing voltage supply of accelerator pedal position senders

- Remove the bottom part of the dash panel on the left:
⇒ Body Fitting Work; Repair Group 70; Dash Panel; Removing and installing dash panel
- Separate the plug connection for the accelerator pedal position sender.
- Switch on the ignition.
- ◀ - Connect the multimeter for voltage measurement as follows:

Plug connection Contact	Specification
1 + earth	approx. 5 V
1 + 5	approx. 5 V
2 + earth	approx. 5 V
2 + 3	approx. 5 V

If the specifications are achieved:

- In addition, test the signal cables.

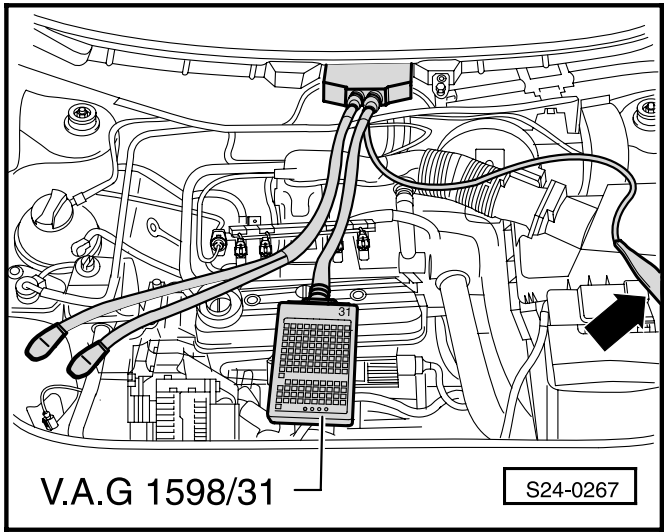
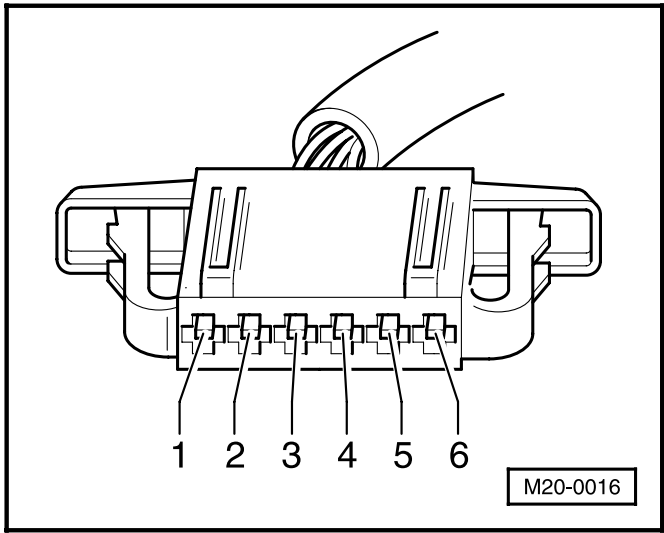
If the specifications are not achieved:

- Test the cable connections from the engine control unit to the accelerator pedal position senders ⇒ page 24-64.

Testing cable connections

- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Test the following cable connection for open circuit and for short circuit to earth and to positive:

Plug connection Contact	Test box V.A.G 1598/31 Socket
1	19
2	18
3	50
4	51
5	45
6	64



Testing additional signals

Testing engine speed signal

Notes:

- ◆ *The signal is generated by the engine speed sender -G28-, processed in the engine control unit and passed on by contact 22 of the engine control unit to the dash panel insert as a rev counter signal.*
- ◆ *Testing engine speed signal:*
⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder

Testing fuel consumption signal for multifunction display (MFD)

Note:

- ◆ *The fuel consumption signal is computed by the engine control unit from the injection time and passed on by contact 75 to the multifunction display.*

Testing vehicle speed signal

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 B)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Notes:

- ◆ The vehicle speed signal is generated by the vehicle speed sender -G68- (at the gearbox) and processed in the dash panel insert.
- ◆ The processed signal is received at contact 9 of the engine control unit and is used for the idling speed stabilisation and for minimizing load change jolts during gearshifts.

Test requirement

- Operation and indication of speedometer o.k.; fault finding:
- ⇒ Electrical System; Repair Group 90; Dash Panel Insert; Testing vehicle speed signal

Test procedure

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

Warning!

Please observe the safety precautions to avoid risks of accidents when conducting measurement and test runs ⇒ page 24-1.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

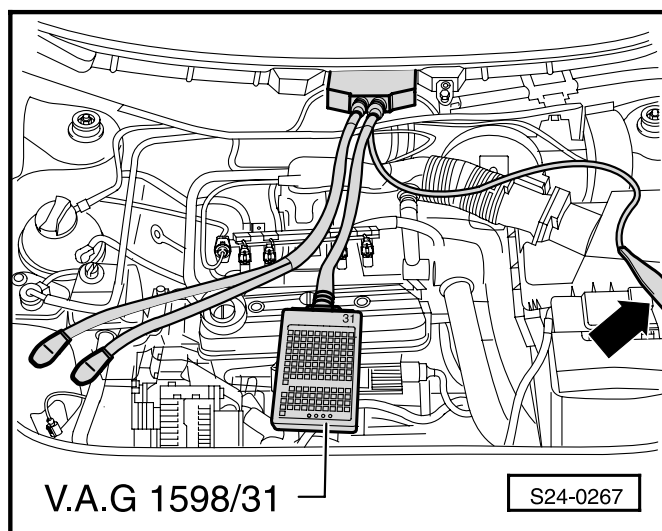
◀ Readout in display:

- Press keys 0, 0 and 5 for „Display group number 005“ and confirm the entry with the key Q.

Read measured value block 5 →
780 rpm 15 % 0 km/h Idling

◀ Readout in display:

- Conduct a road test to determine whether the vehicle speed is displayed in display block 3.
- If the vehicle speed is not displayed, raise vehicle -with a lift platform if possible- until the left front wheel is clear of the ground.



- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Connect the diode test lamp to socket 3 (positive) and socket 9 (vehicle speed signal) of test box V.A.G 1598/31.
- Switch on the ignition and rotate the left front wheel by hand.

The LED must flash (very brief flashing signal).

If the LED does not flash:

- Test the following cable connection for open circuit and for short circuit to earth and to positive:

Test box V.A.G 1598/31 Socket	Dash panel insert Contact
9	⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder

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

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

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 B)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Note:

The command from the accelerator pedal position sender (potentiometer) to the engine control unit to open the throttle valve is suppressed for safety reasons if the brakes are applied. The brake light switch signal and, in addition, the brake pedal switch signal are required in the control unit for this purpose.

If the brakes are applied when the accelerator pedal is constantly depressed, the engine is immediately governed to idling speed. A faulty brake pedal switch can result in unintentional governing of engine speed.

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Press keys 0, 6 and 6 for „Display group number 066“ and confirm the entry with the key Q.

Read measured value block 66
0 km/h **1000** 0 km/h

→

0000

◀ Readout in display:

- Check the readout for the brake light/brake pedal switch in display block 2.

Specification:

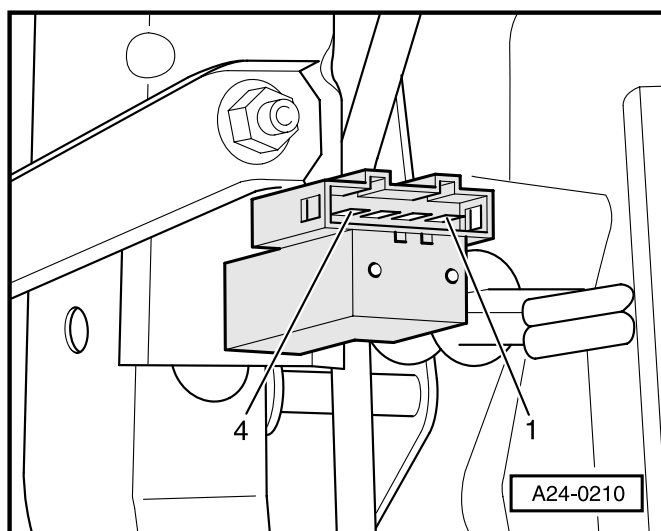
XX00 (brake pedal not depressed)

XX11 (brake pedal depressed)

If the readout does not appear as described:

Testing switch

- Remove the bottom part of the dash panel on the left:
⇒ Body Fitting Work; Repair Group 70; Dash Panel; Removing and installing dash panel
- Separate the plug connection at the brake light/brake pedal switch.

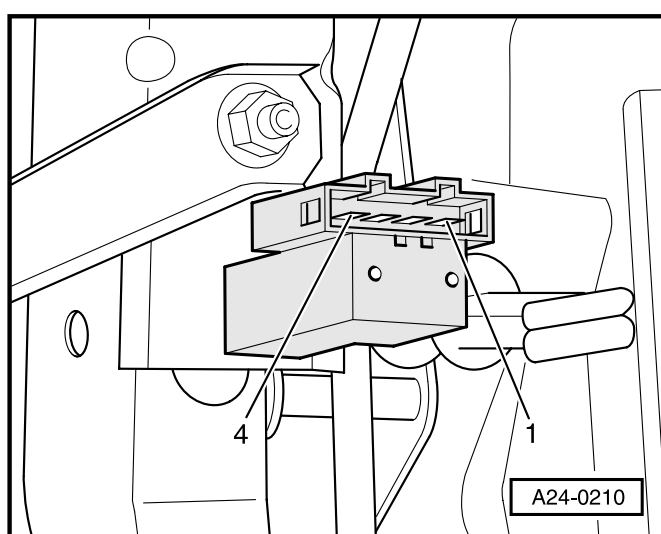


- ◀ - Connect the multimeter for resistance measurement between contacts 1 and 4.

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

- Depress the brake pedal.

Specification: max. 1.5Ω



- ◀ - Connect the multimeter for resistance measurement between contact 2 and 3.

Specification: max. 1.5Ω

- Depress the brake pedal.

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

If the specifications are not achieved:

- Replace the brake light/brake pedal switch.

If the specifications are achieved:

Testing voltage supply

- ◀ - Connect the diode test lamp as follows:

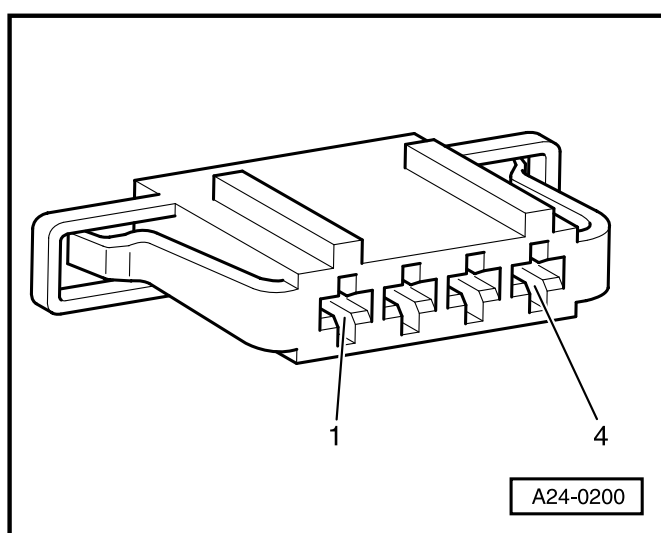
Plug connection Contact	Measure to
1	Body earth

- ♦ The LED must come on.

Plug connection Contact	Measure to
2	Body earth

- Switch on the ignition.

- ♦ The LED must come on.



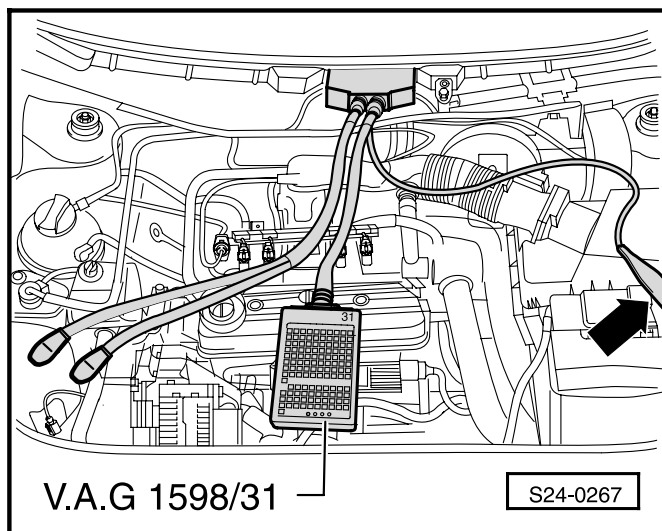
If the LED does not come on:

- Test the cable connection from contact 1 or 2, respectively, of the connector for open circuit and for short circuit to earth:
⇒ „Current Flow Diagrams, Electrical Fault Finding and Fitting Locations“ binder
- Rectify any open circuit or short circuit in the wiring.

If the LED comes on:

Testing actuation

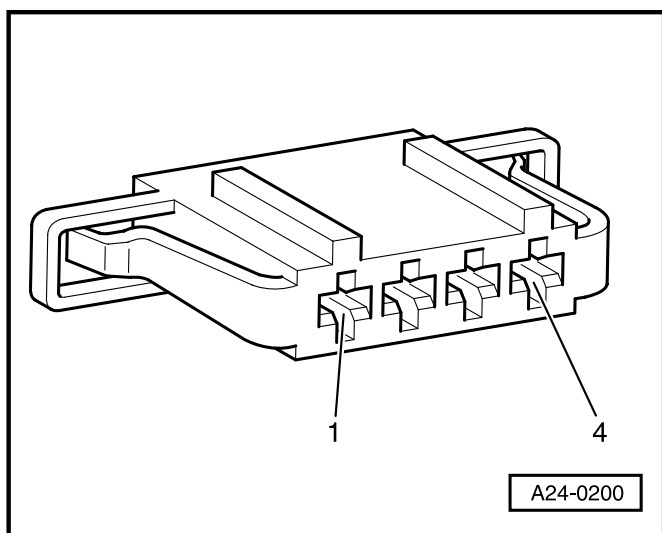
- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.



- ◀ - Test the following cable connections for open circuit and for short circuit to earth and positive:

Plug connection Contact	Test box V.A.G 1598/31 Socket
3	63
4	53

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



Testing clutch pedal switch -F36-

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 B)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Note:

This signal is used for avoiding the engine overrevving and load change jolts when the clutch is released.

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

◀ Readout in display:

- Press keys 0, 6 and 6 for „Display group number 066“ and confirm the entry with the key Q.

Read measured value block 66 →
0 km/h **1000** 0 km/h 0000

◀ Readout in display:

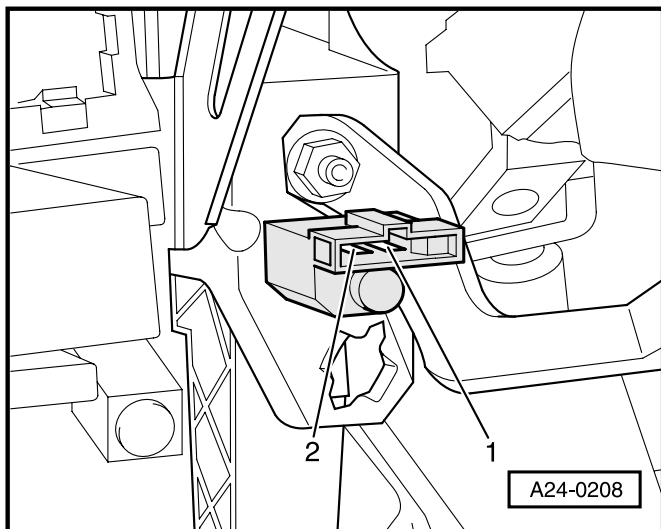
- Check the readout for the clutch pedal switch in display block 2.

Specification:

X0XX (clutch pedal not depressed)

X1XX (clutch pedal depressed)

If the readout does not appear as described:



Testing switch

- Remove the bottom part of the dash panel on the left:
⇒ Body Fitting Work; Repair Group 70; Dash Panel; Removing and installing dash panel

- Separate the plug connection at the clutch pedal switch.

- ◀ - Connect the multimeter for resistance measurement between contacts 1 and 2.

Specification: max. 1.5 Ω

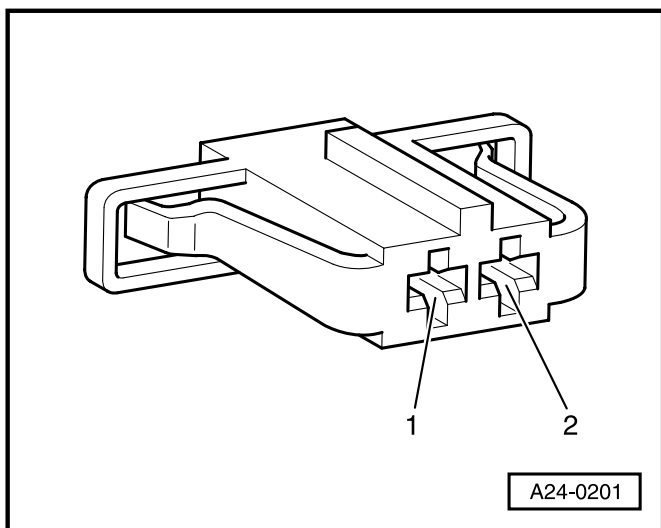
- Depress the clutch pedal.

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

If the specification is not achieved:

- Replace the clutch pedal switch.

If the specification is achieved:



Testing voltage supply

- ◀ - Connect the voltage tester V.A.G 1527 B as follows:

Plug connection Contact	Measure to
1	Body earth

- Switch on the ignition.

- ◆ The LED must come on.

If the LED does not come on:

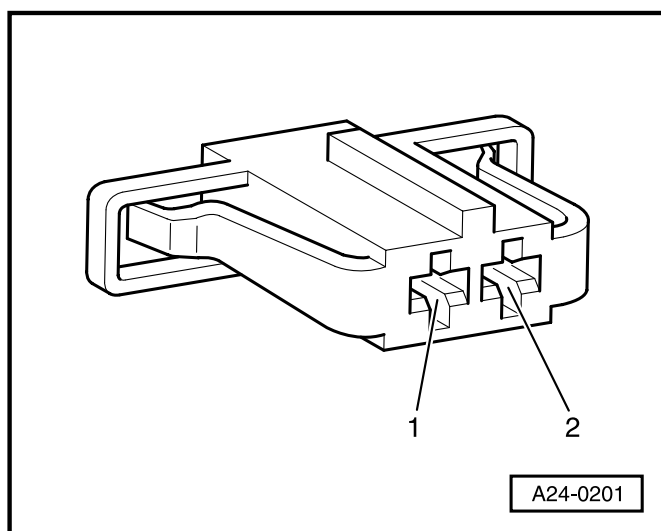
- Test the cable connection from contact 1 of the connector through the fuse to the fuel pump relay for open circuit and for short circuit to earth:

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

If the LED comes on:

Testing actuation

- Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.



- ◀ - Test the following cable connections for open circuit and for short circuit to earth and positive:

Plug connection Contact	Test box V.A.G 1598/31 Socket
2	65

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

Testing power steering pressure switch -F88-

The power steering pressure switch is used for the idling speed stabilisation when the steering is turned to full left or full right lock.

Special tools, testers and aids required

- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ 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 the engine electronics control unit (address word 01); engine idling for this step ⇒ page 01-2.

Test of vehicle systems
Select function XX

HELP

- ◀ Readout in display:

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

Read measured value block
Enter display group number XXX

- ◀ Readout in display:

- Press keys 0, 5 and 6 for „Display group number 056“ and confirm the entry with the key Q.

Read measured value block 56
 780 rpm 800 rpm 25 % →
00000

◀ Readout in display:

- Check the readout for the power steering pressure switch in display block 4.

Specification:

0XXXX (when steering straightahead or turned slightly)

1XXXX (when steering turned to full lock)

If the readout does not appear as described:

Testing switch

- ◀ - Separate the plug connection -2- at the power steering pressure switch (F88) -1- at the power steering pump.

- Connect the multimeter for resistance measurement to switch -1-.

- Start the engine.

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

- Turn the steering wheel to full right or full left lock.

Specification: max. 1.5Ω

If the readout does not change:

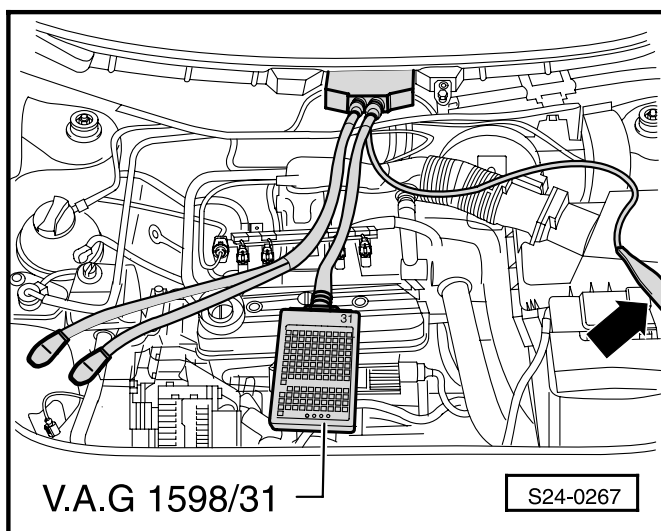
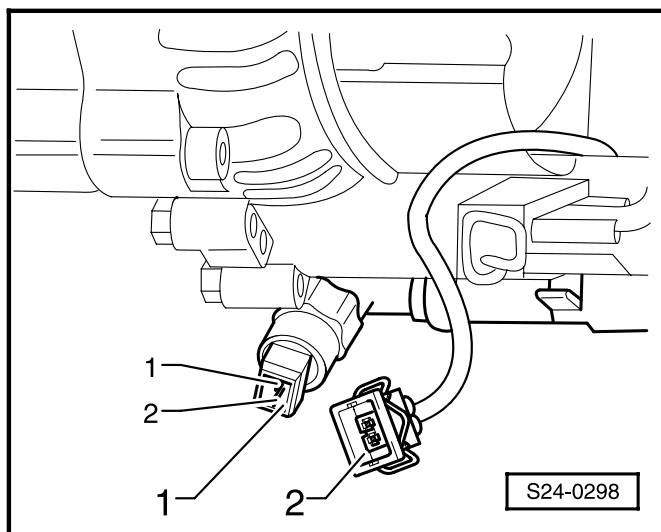
- Replace the power steering pressure switch -F88-.

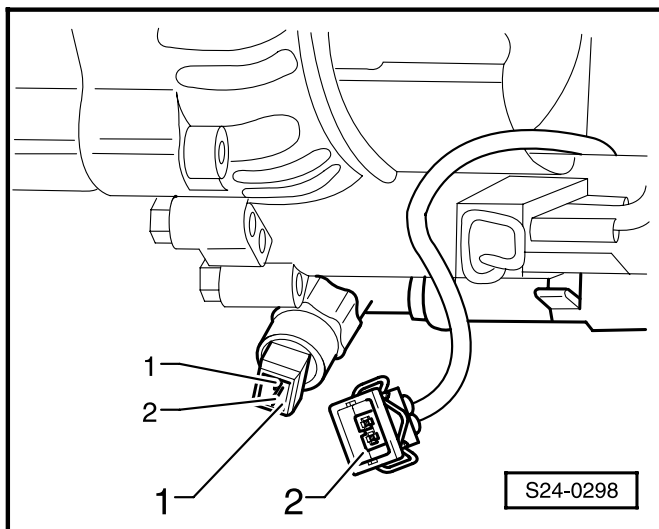
If the readout changes:

- Test the cable connections ⇒ page 24-74.

Testing cable connections

- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.





- ◀ - Test the following cable connections for open circuit and for short circuit to earth and to positive:

Contact at plug connection	Test box V.A.G 1598/31, socket
1	30
2	47

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

Testing databus (CAN databus)

1 - Engine control unit

- ♦ Located at plenum chamber

2 - ABS control unit

- ♦ Located at hydraulic unit in engine compartment

3 - Databus driver

- ♦ Part of control unit

Models ► 04.99

- ◀ Terminating resistor in engine control unit is 120 Ω .

- ◀ Terminating resistor in ABS control unit is 120 Ω .

Models 05.99 ►

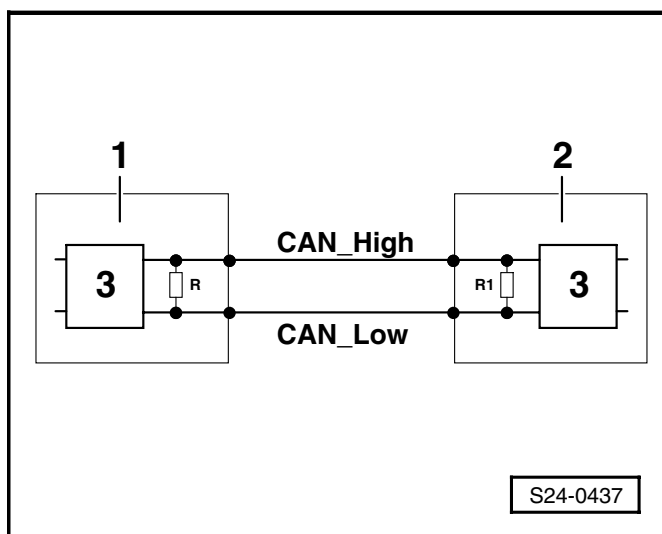
- ◀ Terminating resistor in engine control unit is 66 Ω .

- ◀ Terminating resistor in ABS control unit is 2.6 k Ω .

Function

The engine control unit -1- communicates with the ABS control unit -2- 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).



Information which is not supplied over the databus, is recognised both by the engine control unit -1- as well as by other CAN databus control units as a fault (e.g. ABS control unit -2-).

A terminating resistor R must be positioned upstream of the bus driver -3- in both control units to enable the CAN databus to operate properly.

For further information:

⇒ Self-Study Programme 24 „The CAN Databus, Design and Function“.

Special tools, testers and aids required

- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/21
- ◆ Test box V.A.G 1598/31
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

- Read out fault memory of ABS control unit.

If a fault relating to the CAN databus is displayed:

- Switch ignition off.
- Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12. Engine control unit is not connected for this step.
- Test databus lines together with terminating resistor in ABS control unit.
- Measure resistance between test box sockets 20 and 21.

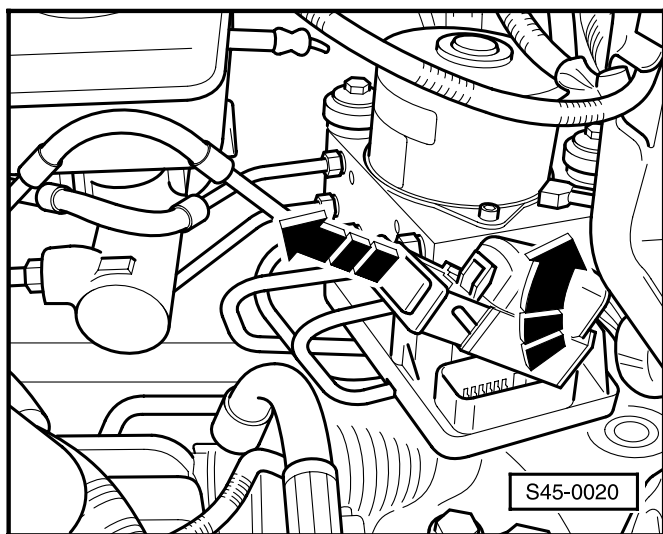
Models ► 04.99

Specification: 115...135 Ω.

Models 05.99 ►

Specification: 2.3...2.6 kΩ.

If the specifications are not achieved:



- Unlock and unplug connector of ABS control unit.
- Test databus cables for short circuit to each other.

Specification: $\infty \Omega$.

If the specification is not achieved:

- Rectify short circuit according to CFD.
⇒ Current Flow Diagrams, Fault Finding and Fitting Locations binder

If the specification is achieved:

- Connect test box V.A.G 1598/21 to the connector of the ABS control unit.
- Test databus cables between sockets of test box V.A.G 1598/21 and V.A.G 1598/31 for open circuit according to current flow diagram:

Test box V.A.G 1598/21, socket	Test box V.A.G 1598/31, socket
11	20
10	21

- Test cables for short circuit to earth and to positive.

If no fault is found in the wiring:

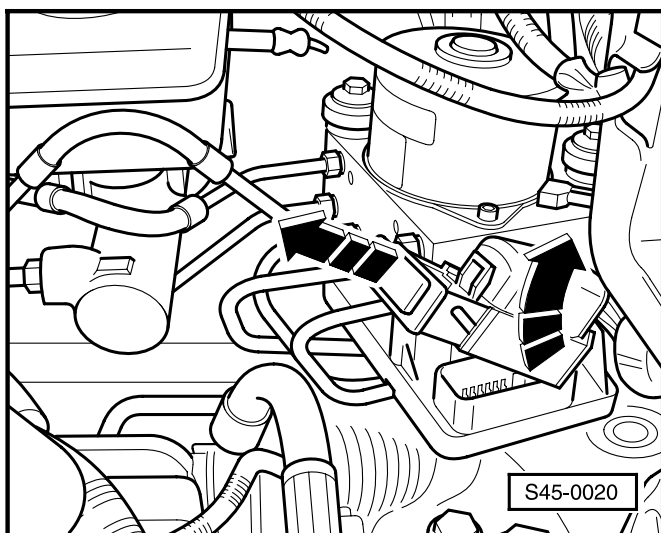
- Replace ABS control unit.
⇒ Running Gear; Repair Group 45; Electrical, Electronic Components and Fitting Locations

If the resistance in the ABS control unit is within the specified range:

- ◀ - Unlock and unplug connector of ABS control unit.
- Test cables between engine control unit and ABS control unit with test boxes V.A.G 1598/21 and V.A.G 1598/31 for short circuit to earth and to positive.

If no fault is found in the wiring:

- Plug in connector again at engine control unit.



- Test terminating resistor in engine control unit.
- Measure resistance between sockets 10 and 11 of test box.

Models ► 04.99

Specification: 115...135 Ω .

Models 05.99 ►

Specification: 60...72 Ω .

If the specification is not achieved:

- Replace engine control unit $\Rightarrow$ page 24-14.

Testing ignition system

General information on the ignition system

- ◆ *The engine control unit is equipped with self-diagnosis.*
- ◆ *A voltage of at least 11 V is required for proper operation of the electrical components.*
- ◆ *When conducting certain tests it is possible that a fault is detected and stored by the control unit. For this reason, always interrogate the fault memory and erase it, if necessary, after completing all the tests and repair work.*
- ◆ *If the engine starts only for a short time and then cuts out again after completing fault finding, repairs or tests of components, the reason for this may be that the immobiliser is inhibiting the engine control unit. In this case, it is then necessary to interrogate the fault memory and, if necessary, to adapt the control unit.*

Safety precautions

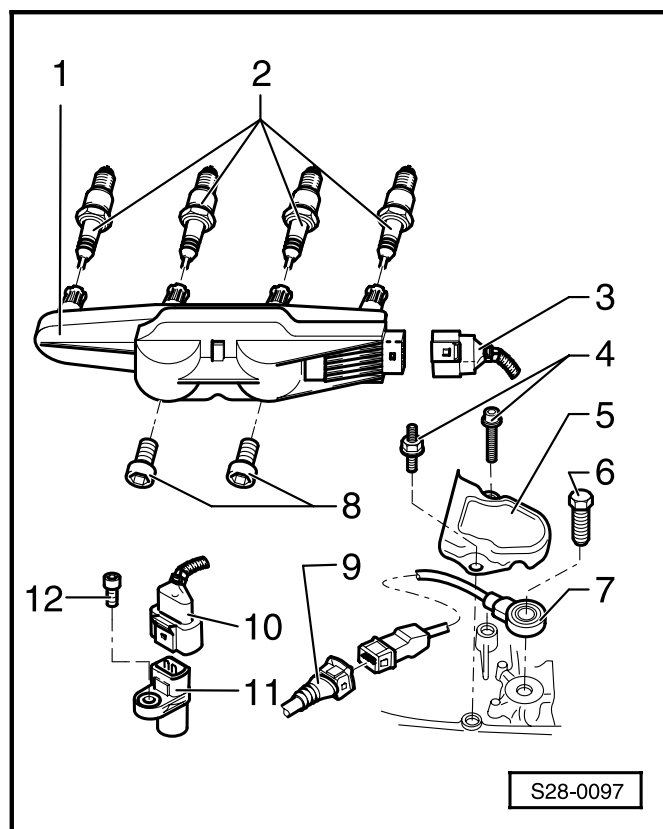
Pay attention to the following points in order to avoid injuries to persons and/or damage to the fuel injection and ignition system:

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

Setting data, spark plugs

Engine	AMD	
Idling speed Speed cannot be adjusted, is controlled by idling speed stabilisation	730 to 870 rpm	
Engine speed governed by shutting off injectors	approx. 5800 rpm	
Ignition timing cannot be adjusted, is determined by the engine control unit		
Firing order	1 - 3 - 4 - 2	
Spark plugs		
Manufacturer's designation	Champion RC 89 PYC	Brisk DR 15TC
Electrode gap	0.7 + 0.1 mm	0.8 ± 0.05 mm
Tightening torque	20-30 Nm	
Change interval	60 000 km	

Removing and installing ignition system



1 - Ignition unit

- ◆ Testing ignition unit ⇒ page 28-4
- ◆ Ignition transformer with power output stage -N152-

2 - Spark plug, 25 Nm

- ◆ Inspect for cracks, traces of creep current
- ◆ Inspect wear of contacts
- ◆ Clean before fitting on

3 - Connector

- ◆ 4-pin
- ◆ For ignition unit

4 - 10 Nm

5 - Shield

6 - 20 Nm

- ◆ It is essential to tighten to the correct torque as this affects proper operation of the knock sensor

7 - Knock sensor -G61-

- ◆ Testing ⇒ page 28-8

8 - 9 Nm

9 - Connector

- ◆ 3-pin
- ◆ For knock sensor -G61-

10 - Connector

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

11 - Engine speed sender -G28-

- ◆ Testing ⇒ page 28-10

12 - 10 Nm

Testing ignition coils with power output stage

Special tools, testers and aids required

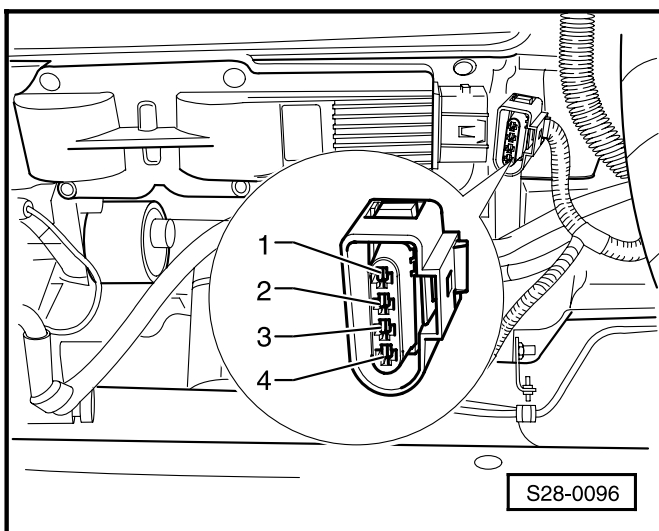
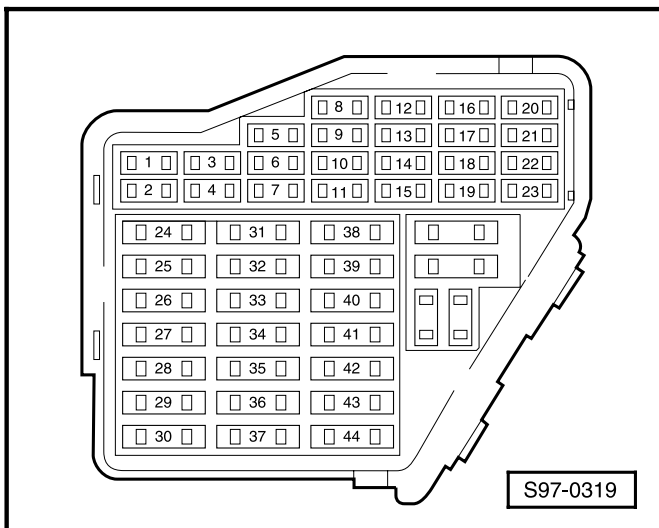
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Diode test lamp (e.g. V.A.G 1527 B)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ Current flow diagram

Test conditions

- Battery voltage must be at least 11 V.
- Engine speed sender o.k.; testing ⇒ page 28-10.
- Fuse 29 o.k.

Note:

Ignition coils and power output stage are a common component (ignition unit) and cannot be replaced separately.

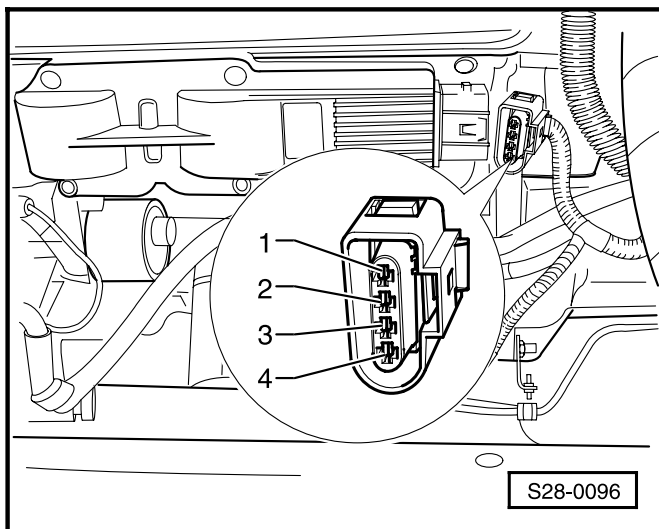


Testing voltage supply

- ◀ - Unplug the 4-pin plug connector from the power output stage for ignition coils.
- Use the multimeter and adapter cables from V.A.G 1594 A to measure the supply voltage between contacts 2 + 4 of the unplugged connector.
- Switch on the ignition.
Specification: approx. battery voltage
- Switch off the ignition.

If no voltage is present:

- Test the cable between 4-pin connector contact 4 and earth for open circuit according to current flow diagram.
Cable resistance: max. 1.5 Ω
- Test the cable between 4-pin connector contact 2 and microelectrical centre for open circuit according to current flow diagram.
Cable resistance: max. 1.5 Ω



Testing actuation

Warning!

When conducting the following test, do not touch the connection parts of the ignition coils or the test cables.

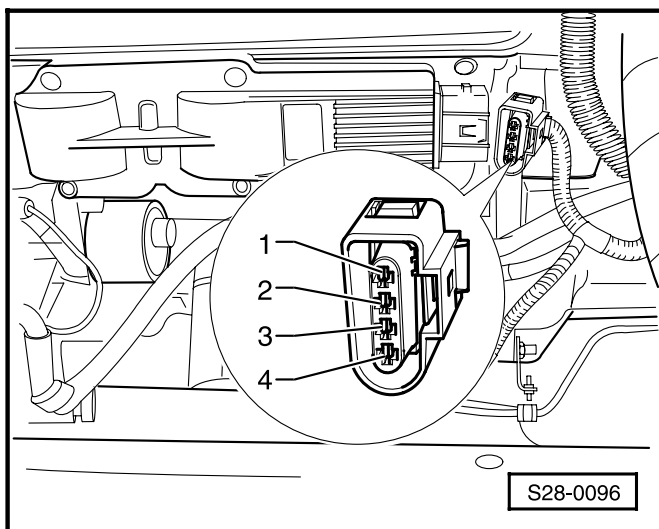
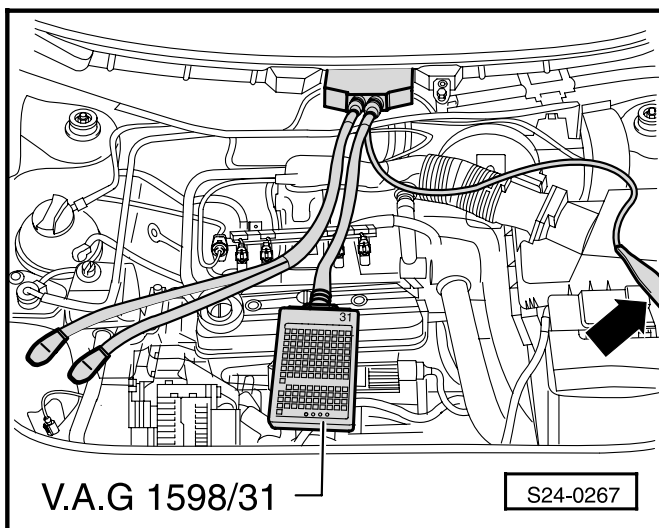
- Unplug the connectors from the injectors
- ◀ - Unplug the 4-pin connector from the power output stage for the ignition coils.
- Use adapter cables from V.A.G 1594 A to connect the diode test lamp to contacts 1 + 4 (ignition output 1), contacts 3 + 4 (ignition output 2) of the unplugged connector.
- Operate the starter and test the ignition signal of the engine control unit.
The LED must flicker.
- Switch off the ignition.

If the LED flickers and voltage is present between contacts 2 + 4:

- Replace the ignition unit ⇒ page 28-3, item 1.

If the LED does not flicker:

- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.



- ◀ - Test the cables between test box and 4-pin connector for open circuit according to the current flow diagram.
Contact 1+socket 112
Contact 3+socket 113
Cable resistance: max. 1.5 Ω
- In addition, test the cables for short circuit to each other.
Specification: $\infty \Omega$

If no fault is found in the wiring and voltage is present between contacts 2 + 4:

- Replace the engine control unit
⇒ page 24-14.

Testing camshaft position sensor -G163

Note:

The camshaft position sensor -G163- is identical with the Hall sender -G40-.

Special tools, testers and aids required

- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (e.g. V.A.G 1594 A)
- ◆ Test box V.A.G 1598/31
- ◆ Current flow diagram

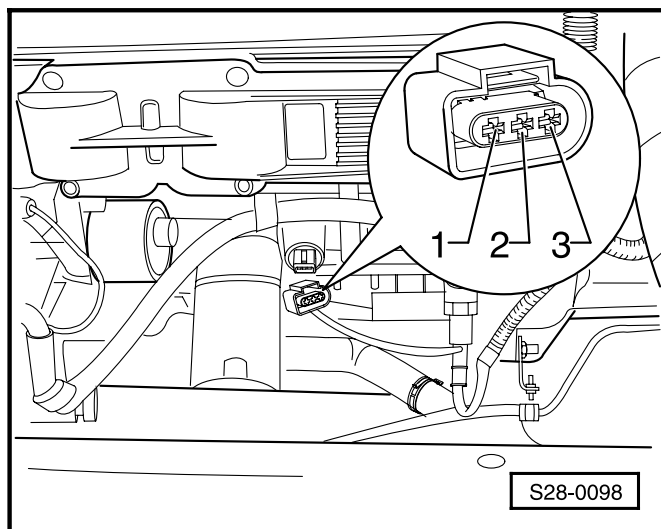
Fitting location ⇒ List of fitting locations, page 24-3.

The camshaft position sensor supplies the ignition position for cylinder 1.

If the sensor fails, the knock control is switched off and the ignition angle is retarded slightly because a cylinder assignment is no longer possible.

In the absence of a signal from the sensor, the engine continues running and can also be restarted:

- ◆ If a fault is detected, the engine control unit generates an ignition spark for each cylinder during each revolution of the crankshaft.
- ◆ The offset by one engine revolution does not have any perceptible effect on fuel injection. Instead of the fuel being injected when the injector is opened, it occurs „advanced“ (upstream of the closed injector). This ensures that there is only a slight effect on the quality of the mixture formation.

**Test procedure**

- ◀ - Unplug the connector at camshaft position sensor.
- Switch on the ignition.
- Connect the multimeter for voltage measurement as follows:

Plug connection Contact	Specification
1+earth	approx. 5 V
2+earth	approx. 5 V
3+battery positive terminal	approx. battery voltage

If all of the specifications are achieved:

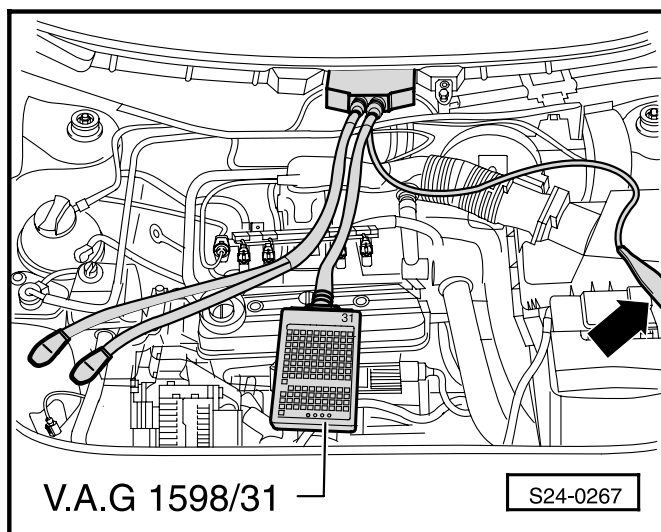
- Interrogate the fault memory of the engine control unit ⇒ page 01-4.

If no fault is stored:

- Replace the camshaft position sensor -G163-

If the specifications are not achieved:

- Switch off the ignition.
- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Test the following cable connections for open circuit and for short circuit to earth and to positive:



Plug connection Contact	Test box V.A.G 1598/31 Socket
1 (positive)	89
2 (signal)	105
3 (earth)	111

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

If no fault is found in the wiring:

- Replace the engine control unit
⇒ page 24-14.

Testing knock sensor -G61

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/31
- ◆ Hand-held multimeter (e.g. V.A.G 1526 A)
- ◆ Adapter cable set (V.A.G 1594 A)
- ◆ Current flow diagram

Notes:

- ◆ *The knock sensor -G61- itself cannot be tested electrically.*
- ◆ *Only gold-plated contacts may be used for repairing the cable connectors of the knock sensor.*
- ◆ *It is essential to exactly observe the tightening torque of 20 Nm if the knock sensor is to operate properly.*
- ◆ *Inspect plug connection of knock sensor to wiring loom for corrosion.*

Test condition

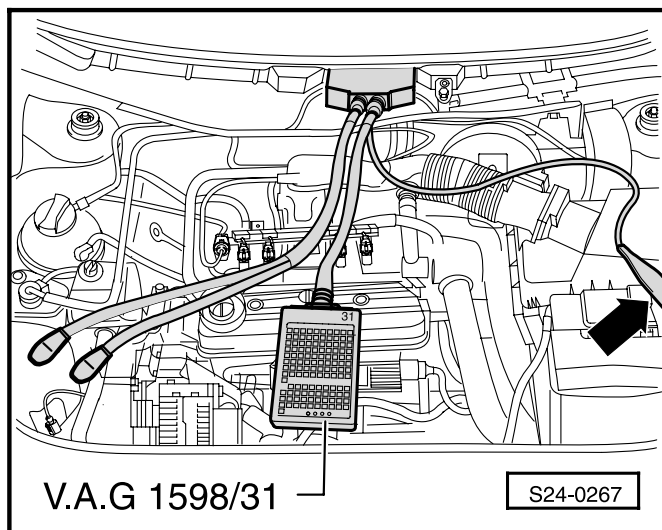
- Fault detected at knock sensor by the self-diagnosis

Test procedure

- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.
- Test the cables of the knock sensor for short circuit.
Sockets: 101+109
Specification: $\infty \Omega$

If no short circuit is found:

- Unplug the connector of knock sensor 1 -G61-.
- Test the cables between test box and knock sensor for open circuit according to the current flow diagram.
Contact 1+socket 109
Contact 2+socket 102
Contact 3+socket 100
Cable resistance: max. 1.5 Ω



- Measure the resistance between the contacts at knock sensor.
Specification: $\infty \Omega$

If no fault is found in the wiring:

- Slacken the knock sensor and then re-tighten it fully to 20 Nm.
- Conduct a road test.

The following operating conditions must be met during this road test:

- ◆ Coolant temperature must rise to more than 80 °C.
- ◆ Once this temperature is reached, the following operating states must be achieved several times:
 - Idling speed
 - Part load
 - Full load
 - Fuel shut-off on overrun
- ◆ Engine speed at full load must increase to more than 3500 rpm.
- Once again interrogate the fault memory of the control unit.

If the problem still exists:

- Replace the knock sensor ⇒ page 28-3, item 7.

Testing engine speed sender -G28

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 1598/31

Note:

If no signal is received from -G28- when the engine is running, this immediately results in the engine stopping. The engine control unit substitutes the signal from the engine speed sender -G28- with the signal from the camshaft position sensor -G163-. The engine can be re-started and runs at a fast idling speed in the emergency mode.

Test procedure

- Before conducting the test, ensure the sender is correctly installed and tight.
- ◀ - Unplug the 2-pin connector -2- from the engine speed sender -1-.
- Connect the multimeter for resistance measurement between contacts 1 and 2 at the sender -1-.

Specification: 400 ... 640 Ω

Note:

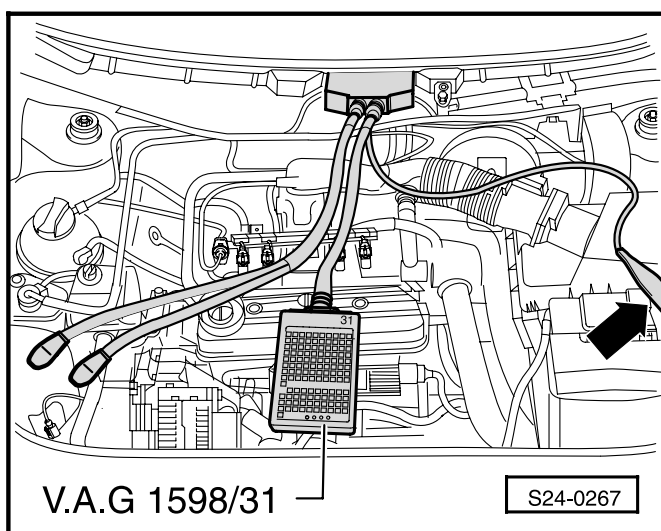
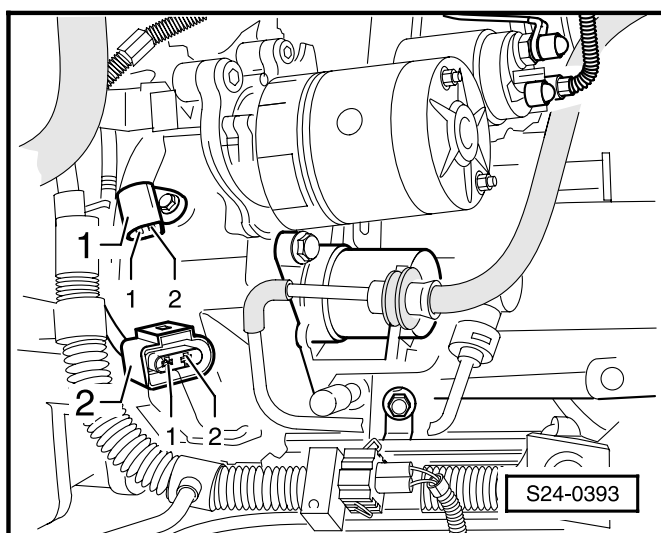
The resistance of the engine speed sender is based on a temperature of 20 °C. The resistance becomes greater as the temperature rises.

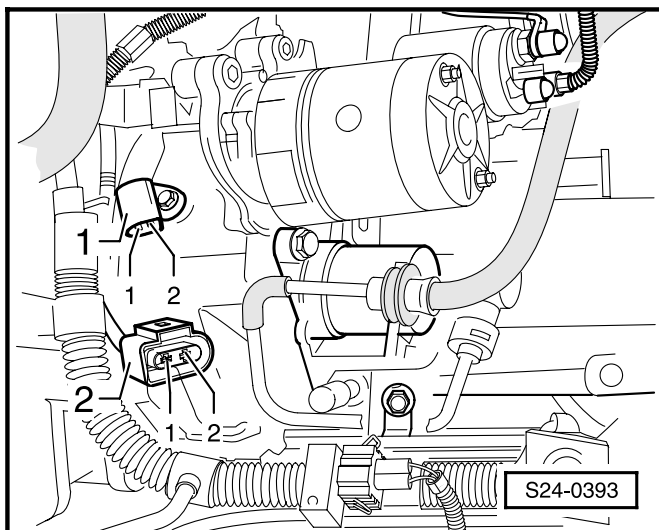
If the specification is not achieved:

- Replace the engine speed sender.

If the specification is achieved:

- ◀ - Connect test box V.A.G 1598/31 to the wiring loom to the engine control unit ⇒ page 24-12.





- ◀ - Test the following cable connections for open circuit and for short circuit to earth and to positive:

Plug connection Contact	Test box V.A.G 1598/31 Socket
1	98
2	106

- Rectify any open circuit or short circuit in the wiring.
- In addition, test contacts 1 and 2 to socket 99 (screening) for short circuit.

If no fault is found in the wiring:

- Replace engine control unit ⇒ page 24-14.

