

Workshop Manual OCTAVIA

**1.6-ltr./55 kW Engine, 1 AVM
Fuel Injection and Ignition System**

List of Supplements to **OCTAVIA** Workshop Manual

Edition: 11.98

1.6-ltr./55 kW Engine, 1 AVM Fuel Injection and Ignition System

Replaces List of Supplements - Edition: 08.96

Supplement	Edition	Subject	Article Number
	08.96	Basic Edition of Workshop Manual	S00.5109.50.20
1	11.98	Supplement to Self-Diagnosis	S00.5109.51.20
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Self-diagnosis

Note:

The self-diagnosis monitors only a part of the fuel injection and ignition system. Always use Binder 2 for fault finding.

Features of self-diagnosis

The engine control unit -J382- is equipped with a fault memory. The fault memory is designed as a permanent memory.

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

Faults which occur only temporarily (sporadically), are also printed out with the addition „sporadically occurring fault“. Such faults are identified in the display by the addition „SP“. The cause of a sporadic fault may be, for example, a loose contact or a short-time open circuit in the wiring. If a sporadic fault no longer occurs within 40 engine starts, it is erased from the fault memory.

The faults stored 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, it is necessary to erase the fault memory ⇒ page 01-4.

Notes:

- ◆ *The description which follows relates only to vehicle system tester V.A.G 1552 using programme card version 3.0 or higher.*
- ◆ *The procedure for using the fault reader V.A.G 1551 with integrated printer is similar although slight differences in the readouts in the display are possible.*

Technical data of self-diagnosis

Interrogating control unit version

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

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

Please refer to the table which follows for the requirements which have to exist if you wish to select the desired functions.

Function	Requirement	
	Engine not running, ignition on	Engine idling
02 Interrogate fault memory ¹⁾	yes ¹⁾	yes
03 Final control diagnosis	yes	no
04 Basic setting	yes ²⁾	yes ³⁾⁴⁾
05 Erase fault memory	yes	yes
06 End output	yes	yes
08 Read measured value block	yes	yes

- 1) Only if engine does not start (starter must operate for at least 6 seconds).
- 2) Must be performed after completing the following work:
Replacing engine control unit, throttle valve control unit or engine, or disconnecting battery.
- 3) Only possible once coolant temperature is higher than 80 °C. This function is inhibited up until this moment.
- 4) Must be performed for testing and setting ignition timing.

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

Special tools, testers and aids required

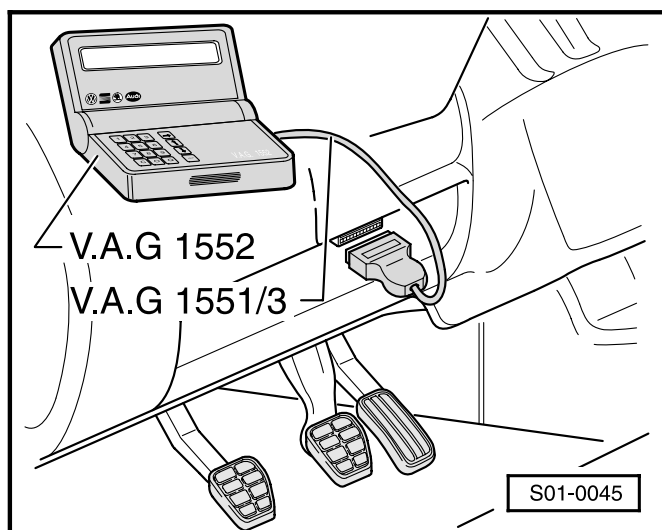
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test conditions

- Battery voltage at least 11 V
- Fuse 12 o.k.
- Earth connections at front of connector housing and in cylinder head o.k.

Procedure

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



After the vehicle system tester has been connected:

- Depending on the desired function, you must: switch on ignition or start the engine ⇒ page 01-1, table of „Available Functions“.

Notes:

- ◆ *If the readouts which appear in the display are not the same as shown in the procedure:*
⇒ Operating Instructions of vehicle system tester
- ◆ *If "Fault in data transfer!" is displayed because of an incorrect entry, disconnect cable at fault reader, plug in again and repeat the steps.*

Test of vehicle systems
Enter address word XX

HELP

◀ Readout in display:

Note:

Operate the vehicle system tester by referring to the readouts which appear in the display.

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

032906014A Marelli 1AVM

2162 →

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

- ◆ 032 906 014A = Part No. of control unit
- ◆ Marelli 1AVM = System designation and version
- ◆ 2162 = Programme status number
- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- Refer to repair operations for further procedure.

List of engine control units

Production	Control unit designation	Programme No.
08.96 ► 03.97	032906014 A	2162
04.97 ► 01.98	032906014 E	2170
02.98	032906014 E	2177
03.98 ►	032906014 F	2231

The old type of control units can be replaced by control units with the designation 032906014 F when they are replaced.

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

Only if engine does not start:

- Switch the ignition on.

Test of vehicle systems
Select function XX

HELP

◀ Readout on display:

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

X faults recognised!

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

If one or several faults are stored:

The stored faults are displayed one after the other.

Test of vehicle systems
Select function XX

HELP

◀ Readout on display:

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

Note:

If you switched off the ignition between „interrogating fault memory“ and „erasing fault memory“, the fault memory is then not erased.

Test of vehicle systems
Fault memory is erased!

→

◀ Readout on display:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Rectify the faults displayed by referring to the fault table ⇒ page 01-6.
- After you have rectified the faults, you then have to carry out a road test.

During this road test, the following operating conditions should be met:

- ♦ The coolant temperature should rise to more than 80 °C.
- ♦ Once this temperature is reached, the operating states of
 - idling
 - part throttle
 - full throttle
 - overrun
 have to be achieved several times.
- ♦ Engine speed should be increased to more than 3500 rpm at full throttle.
- Once again interrogate fault memory of the control unit.

If no fault is stored:

- Press the → key.

Test of vehicle systems
Select function XX

HELP

◀ Readout on display:

- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.

Note:

If not fault has been recognised by the self-diagnosis, use the relevant fault table in binder 2 „Fault Finding Engine - Mechanical Components“ for continuing fault finding.

Fault table

Notes:

- ♦ The fault table is arranged in accordance with the 5-digit fault code indicated on the left.
 - ♦ Explanations regarding the types of faults (e.g. „open circuit/short circuit to earth“):
- ⇒ Operating instructions of fault reader

- ♦ If components are displayed as faulty:
First of all test the wiring and plug connections to these components and also the earth cables of the system on the basis of the current flow diagram. Only replace component if no fault is found here. This applies particularly if faults are indicated as „sporadic faults“ (SP).

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
No fault recognised!	If a complaint exists: Fault not recognised by self-diagnosis	—	Continue fault finding according to fault table in binder 2.
00282 Throttle valve positioner -V60 ¹⁾			
Short circuit to earth	♦ Short circuit to earth ♦ V60 faulty/jamming in closing direction	♦ Cold starting problems ♦ Cold idling problems ♦ Jolts during load changes ♦ Idling problems	- Test V60 ⇒ page 24-18, Testing throttle valve control unit
Short circuit to positive	♦ Short circuit to Positive ♦ V60 faulty/jamming in opening direction		
Open circuit	♦ Open circuit in wiring		
Signal not within tolerance	♦ Short circuit to earth and/or battery positive		
00516 Idling switch -F60 ²⁾			
implausible signal	♦ F60 faulty	♦ Idling problems ♦ Handling problems when starting off	- Carry out basic setting ⇒ page 24-10 - Test F60 ⇒ page 24-18, Testing throttle valve control unit

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

²⁾ The idling switch (F60) is part of the throttle valve control unit (J338).

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
00518 Throttle valve potentiometer -G69 ¹⁾ Short circuit to earth Open circuit/short circuit to positive	♦ G69 faulty ♦ Cable has short circuit to earth ♦ Open circuit in earth wire ♦ Cable has short circuit to positive ♦ G69 faulty	♦ poor throttle response ♦ jolts during load changes ♦ increased emission levels ♦ no full throttle recognition	- Carry out basic setting ⇒ page 24-10 - Test G69 ⇒ page 24-18, Testing throttle valve control unit
00519 Intake manifold sender -G71 Short circuit to positive Open circuit/short circuit to earth implausible signal	♦ Cable has short circuit to positive ♦ Open circuit in earth wire ♦ Cable has short circuit to earth ♦ G71 faulty ♦ Loose contact ♦ G71 faulty	♦ increased emission levels ♦ poor throttle response ♦ jolts during load changes	- Test G71 ⇒ page 24-26
00522 Coolant temperature sender -G62 Short circuit to earth Open circuit/short circuit to positive	♦ Cable has short circuit to earth ♦ G62 faulty ♦ Open circuit in wiring or short circuit to positive ♦ G62 faulty	♦ poor cold starting ♦ poor hot starting ♦ no idling speed adaptation ♦ increased emission levels	- Test G62 ⇒ page 24-31

¹⁾ The throttle valve potentiometer (G69) is part of the throttle valve control unit (J338).

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
00523 Intake air temperature sender -G42 Short circuit to earth Open circuit / short circuit to positive	 ♦ Cable has short circuit to earth ♦ G42 faulty ♦ Open circuit in wiring or short circuit to positive ♦ G42 faulty	 ♦ poor hot starting ♦ increased emission levels	 - Test G42 ⇒ page 24-34
00524 Knock sensor 1 -G61 Signal too small	 ♦ Open circuit in the wiring or short circuit to earth ♦ G61 faulty	 ♦ Ignition timing is retarded by 15 ∠ ° ♦ reduced output ♦ high fuel consumption	 - Test G61 ⇒ page 28-9
00525 Lambda probe -G39 Short circuit to positive Signal too large Signal too small	 ♦ Cable has short circuit to positive ♦ G39 faulty ♦ G39 faulty ♦ G39 faulty ♦ Cable has short circuit to earth	 ♦ no lambda control	 - Test lambda probe and lambda control ⇒ page 24-12
00529 Engine speed information missing no signal	 ♦ Hall sender (G40) in distributor faulty ♦ Open circuit in wiring ♦ Cable has short circuit to positive ♦ Cable has short circuit earth	 ♦ Engine does not start	 - Test G40 ⇒ page 28-5

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00530 Throttle valve positioner/ potentiometer -G88 ¹⁾ Open/short circuit to positive Short circuit to earth	♦ Open circuit in wiring or short circuit to positive ♦ G88 faulty ♦ Cable has short circuit to earth ♦ G88 faulty	♦ Cold start problems ♦ Idling speed not within tolerance ♦ Cold idling problems ♦ Irregular idling	- Test G88 ⇒ page 24-17, Testing throttle valve control unit
00532 Supply voltage Signal too large	♦ Battery voltage greater than 16.3 V	♦ No idling speed adaptation	- Test generator ⇒ Current Flow Diagrams, Fault Finding Programmes and Fitting Locations
00537 Lambda control Control limit exceeded	♦ Lambda probe heater faulty ♦ Leak in exhaust system between cylinder head and catalytic converter ♦ Ignition misfiring	♦ No lambda control ♦ Poor drivability ♦ Poor idling ♦ Emission levels not o.k.	- Test lambda probe heater for open circuit in wiring ⇒ page 24-13 - Inspect exhaust system for leaks - Testing ignition system ⇒ page 28-1

¹⁾ The throttle valve positioner/potentiometer (G88) is part of the throttle valve control unit (J338).

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00537 Lambda control Control limit exceeded	♦ Fuel pump faulty	♦ No lambda control ♦ Poor drivability	- Test fuel pump ⇒ Engine, Mechanical Components; Repair Group 20
	♦ Fuel pressure regulator faulty	♦ Poor idling	- Test fuel pressure regulator ⇒ page 24-44
	♦ Lambda probe faulty - change in characteristic as a result of effect of chemicals	♦ Emission levels not o.k.	- Replace lambda probe
	♦ Fuel tank empty		- Refuel vehicle
	♦ Injector(s) faulty (blocked)		- Test injectors ⇒ page 24-41
	♦ Short circuit to earth or positive, or open circuit in wiring between lambda probe and engine control unit		- Test lambda control ⇒ page 24-12
Control limit not reached	♦ Short circuit to earth or positive, or open circuit in wiring between lambda probe and engine control unit		- Test lambda control ⇒ page 24-12
	♦ Fuel pressure too high	♦ No lambda control	- Test fuel pressure regulator ⇒ page 24-44
	♦ Activated charcoal filter solenoid valve N80 leaking or jamming	♦ Poor drivability ♦ Poor idling	- Test N80 ⇒ page 01-12, Final control diagnosis
	♦ Lambda probe faulty - change in characteristic as a result of effect of chemicals	♦ Emission levels not o.k.	- Replace lambda control
	♦ Injector(s) faulty (always open)	♦ Increased fuel consumption	- Test injectors ⇒ page 24-41

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
00609 Ignition output 1 Short circuit to positive Open/short circuit to earth	♦ Cable to ignition transformer has short circuit to positive ♦ Open circuit in earth cable ♦ Cable has short circuit to earth	♦ Engine does not start	- Test output stage of ignition transformer ⇒ page 28-7
01087 Basic setting not performed	♦ Engine control unit not matched to engine	—	- Perform basic setting ⇒ page 24-10
01126 Engine speed signal Short circuit to positive Short circuit to earth	♦ Open circuit in wiring or short circuit to positive ♦ Cable has short circuit to earth	♦ Rev counter does not operate	- Test engine speed signal ⇒ page 01-12, Final control diagnosis
01247 Solenoid valve 1 for activated charcoal filter -N80 Open/short circuit to earth Short circuit to positive	♦ Open circuit in wiring or short circuit to earth ♦ N80 faulty ♦ Cable has short circuit to positive ♦ N80 faulty	♦ Irregular idling ♦ Smell of fuel	- Test N80 ⇒ page 01-12, Final control diagnosis

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying faults
01249 Injector cylinder 1 -N30 Short circuit to positive Open/short circuit to earth	♦ N30 faulty ♦ Cable has short circuit to positive ♦ N30 faulty ♦ Open circuit in earth ♦ Cable short circuit to earth	♦ Increased emission levels ♦ Poor starting characteristics ♦ Drivability problems ♦ Poor throttle response ♦ Irregular idling	- Test N30...N33 ⇒ page 24-41, Testing injectors
01250 Injector cylinder 2 -N31 Short circuit to positive Open/short circuit to earth	Fault code 01249, cyl. 1		
01251 Injector cylinder 3 -N32 Short circuit to positive Open/short circuit to earth	Fault code 01249, cyl. 1		

Readout on V.A.G 1552	Possible cause of fault	Possible effects	Rectifying fault
01252 Injector cylinder 4 -N33 Short circuit to positive Open circuit/short circuit to earth	⇒ fault code 01249, cyl. 1		
01259 Fuel pump relay -J17 Short circuit to positive Open circuit/short circuit to earth	♦ J17 faulty ♦ Cable has short circuit to positive ♦ J17 faulty ♦ Open circuit in earth wire ♦ Short circuit to earth	♦ Engine does not start	- Test J17 ⇒ page 01-12, Final control diagnosis
17978 Engine control unit inhibited	♦ Attempt at manipulation ♦ Short circuit in communication wire ♦ Incorrect code ♦ Immobiliser unit faulty/missing	♦ Engine starts briefly and then cuts out again	- Adapt engine electronics control unit to electronic immobiliser ⇒ page 24-40 - Test electronic immobiliser ⇒ Electrical System; repair group 96; Servicing electronic immobiliser
65535 Control unit faulty	♦ Internal fault in control unit	♦ Handling problems ♦ Engine not running	- Replace J382 as necessary ⇒ page 24-5, item 28

Final control diagnosis

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

1. Throttle valve positioner (V60)
2. Solenoid valve 1 for activated charcoal filter (N80)
3. Engine speed signal
4. Fuel pump relay (J17)
5. Engine/AC compressor electrical connection (ignore)

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Throttle valve potentiometer (G69) o.k.
- Main fuses o.k.
- Fuses S10, S228, S229a and S243 o.k.

Notes:

To repeat final control diagnosis without starting the engine in between, switch off ignition for about 20 seconds.

Procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Test of vehicle systems
03 - Final control diagnosis

Q

◀ Readout in display:

Operate throttle valve positioner (V60):

- Confirm the entry with the key Q.

Final control diagnosis
Throttle valve positioner -V60

→

◀ Readout in display:

The throttle valve positioner must continue opening and closing the throttle flap until the next actuator is operated by pressing the → key.

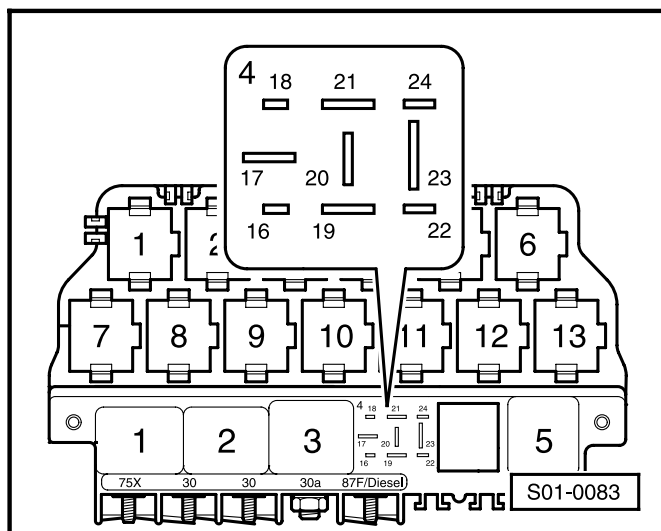
If the throttle valve positioner does not move:

- Test throttle valve positioner
⇒ page 24-17, Testing throttle valve control unit.

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

- ◀ Remove fuel pump relay and connect contacts 17 and 23 using auxiliary cables from adapter cable set V.A.G 1594 A.

- Press the → key.



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

→

◀ Readout in display:

This solenoid valve (on right in front of coolant reservoir) must click until the next actuator is operated by pressing the → key.

If the valve does not click:

- Continue test ⇒ page 24-49.

Display engine speed signal:

Disconnect auxiliary cables from adapter cable set V.A.G 1594 A and install fuel pump relay -1-.

- Press the → key.

Final control diagnosis
Signal for engine speed

→

◀ Readout in display:

The rev counter must indicate approx. 3000 rpm until the next actuator is operated by pressing the → key.

If no readout appears:

- Test the rev counter.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations, Engine - Mechanical Components

Operate fuel pump relay (J17):

- Press the → key.

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 actuator is operated by pressing the → key.

Note:

During the time the fuel pump relay is activated, the fuel pump must also be heard to run at intervals.

If the relay does not click:

- Test fuel pump relay
⇒ page 24-52, Testing fuel pump relay and actuation.
- Press the → key.

Final control diagnosis
Engine/AC compr. electr. connection

→

◀ Readout in display:

This test step is also displayed on models without air conditioning.
Ignore readout.

Test of vehicle systems
Select function XX

HELP

- Press the → key.

◀ Readout in display:

- Press keys 0 and 6 for the function "End data transfer" and confirm the entry with the key Q.
- Switch off the ignition.

Note:

After completing final control diagnosis, you must switch off the ignition. If you do not switch off the ignition before again starting the engine, the engine may not start as the injectors and the ignition transformer are not operated.

- In addition, test the cable for short circuit to battery positive and to earth.
Specification: $\infty \Omega$
- Test the cable between contact 1 of the 2-pin connector and fuse 43 for open circuit according to the current flow diagram.
Cable resistance: max. 1.5Ω

If no fault is found in the wiring:

- Replace the engine control unit (J382)
⇒ page 24-5.

Read measured value block and basic setting

The measured values in the functions Read measured value block and Basic setting are described in the individual component tests. The list below is intended only as an overview.

Note:

Proceed as follows in order 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
skip	Press key C	Press key C

List of display groups

Display group 000 (decimal readout)									
Test conditions ♦ Engine idling ♦ Coolant temperature at least 80 °C ♦ Electrical components are switched off									
Display blocks									
1	2	3	4	5	6	7	8	9	10
									Engine speed
									Injection time
									Throttle valve potentiometer voltage
									Ignore
									Lambda correction
									Lambda probe signal
									Intake manifold pressure
									Coolant temperature
									Battery voltage
									Intake air temperature
Specification									
									77 - 68
									5 - 12
									24 - 50
									—
									75 - 165
									0 - 205
									45 - 88
									37 - 18
									186 - 226
									156 - 35
Equals									
									760 - 860 rpm
									2.46 - 6.14 msec
									4.53 - 4.02 V
									0
									Standard value 128
									0 - 1 V
									300 - 500 mbar
									80 - 110 °C
									12 - 14.5 V
									15 - 80 °C

Test table display group 000

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
1	less than 35 ¹⁾	♦ Open circuit in wiring or short circuit to intake air temperature sender	- Test cable to sender for open circuit and short circuit
	greater than 156 ¹⁾	♦ Intake air temperature sender faulty	- Test intake air temperature sender ⇒ page 24-34
2	less than 186	♦ Alternator faulty, battery severely discharged ♦ Heavy load on electrical circuit shortly after starting as a result of high charge current and ancillaries ♦ Contact resistance in voltage supply or earth connection for engine control unit ♦ Power drain when ignition off	- Test voltage, charge battery - Increase engine speed slightly for a few minutes and switch off ancillaries - Test voltage supply for engine control unit ⇒ page 24-38 - Eliminate power drain
	greater than 226	♦ Voltage regulator at alternator faulty ♦ Overvoltage caused by jump-starting or quick-charger	- Test voltage, replace regulator if necessary - Interrogate fault memory ⇒ page 01-4
3	less than 18	♦ Coolant temperature sender or cable connection to engine control unit faulty ♦ Radiator dirty ♦ Radiator fan not operating ♦ Coolant thermostat faulty	- Test coolant temperature sender -G62 ⇒ page 24-31 - Clean radiator - Test operation of radiator fan - Test thermostat
	greater than 37	♦ Engine too cold ♦ Coolant temperature sender or cable connection to engine control unit faulty ♦ Coolant thermostat always open	- Warm up engine - Test coolant temperature sender -G62 ⇒ page 24-31 - Test thermostat
4	not within tolerance	♦ Air filter soiled or air supply blocked ♦ Unmetered air	- Replace air cleaner or clear air supply - Rectify cause of unmetered air

¹⁾ Depending on outside temperature

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
5	readout does not vary constant 255 constant 80 constant 0	◆ Large quantity of unmetered air ◆ Spark plug faulty ◆ Fuel system pressure too low or too high ◆ Injector faulty ◆ Coolant temperature sender -G62 faulty ◆ Activated charcoal filter solenoid valve -N80 faulty, blocked or sticking ◆ Lambda probe heater not operating ◆ Lambda probe faulty or dirty ◆ Short circuit to positive caused by: Lambda probe or Signal line or Engine control unit ◆ Open circuit in wiring caused by: Lambda probe or Signal line or Engine control unit ◆ Short circuit to earth caused by: Lambda probe or Signal line or Engine control unit	- Eliminate cause of unmetered air - Inspect spark plugs - Test fuel pressure regulator and holding pressure ⇒ page 24-44 - Test injectors ⇒ page 24-41 - Test coolant temperature sender -G62 ⇒ page 24-31 - Test activated charcoal filter solenoid valve ⇒ page 01-12, Final control diagnosis - Test lambda probe heater ⇒ page 24-13 - Interrogate fault memory ⇒ page 01-4, test lambda probe if necessary ⇒ page 24-12 - Test lambda probe ⇒ page 24-12 - Test lambda probe ⇒ page 24-12 - Test lambda probe ⇒ page 24-12
6	do not analyse		
8	less than 24 greater than 50	◆ Basic setting of throttle valve control unit not performed ◆ Throttle valve potentiometer in throttle valve control unit -J338 faulty or incorrectly set ◆ Throttle cable incorrectly set ◆ Throttle flap sticking ◆ Throttle valve potentiometer in throttle valve control unit -J338 faulty or incorrectly set ◆ Unmetered air between intake manifold and air mass meter (results in fast idling)	- Carry out basic setting of throttle valve control unit ⇒ page 24-10 - Test throttle valve control unit -J338 ⇒ page 24-17 - Adjust throttle cable ⇒ Engine, Mechanical Components; Repair Group 20 - Adjust throttle cable ⇒ Engine, Mechanical Components; Repair Group 20 - Test throttle valve control unit -J338 ⇒ page 24-17 - Rectify cause of unmetered air

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
9	less than 5	♦ High quantity of fuel out of ACF system	- Test activated charcoal filter solenoid valve ⇒ page 24-49
		♦ Incorrect injectors with excessively large flow installed	- Test quantity injected ⇒ page 24-41
		♦ Fuel pressure regulator faulty	- Test fuel pressure regulator and fuel pressure ⇒ page 24-44
	greater than 12	♦ Increased engine load because of additional electrical components, AC on, steering wheel at full lock	- Switch off additional consumers, move steering wheel into middle position
10	less than 68	♦ Throttle valve jamming or faulty ♦ Large quantity of unmetered air (can no longer be compensated by idling stabilisation) ♦ Idling limit switch -F60 not closed or faulty ♦ Throttle valve jamming or faulty	- Adjust throttle cable ⇒ Engine, Mechanical Components; Repair Group 20 - Rectify cause of unmetered air - Interrogate fault memory and test idling switch ⇒ page 24-17 - Adjust throttle cable ⇒ Engine, Mechanical Components; Repair Group 20
	greater than 77	♦ Throttle valve jamming or faulty ♦ Air conditioning not switched off	- Adjust throttle cable ⇒ Engine, Mechanical Components; Repair Group 20 - Test throttle valve control unit -J338 ⇒ page 24-17 - Switch off air conditioning

Display group 001

Read measured value block				1	→	◀ Readout in display
760...860 rpm	80...110 °C	0...1.0 V	00000000			
1	2	3	4	Display blocks		
				Engine operating state		
				Lambda voltage		
				Coolant temperature		
				Idling speed		

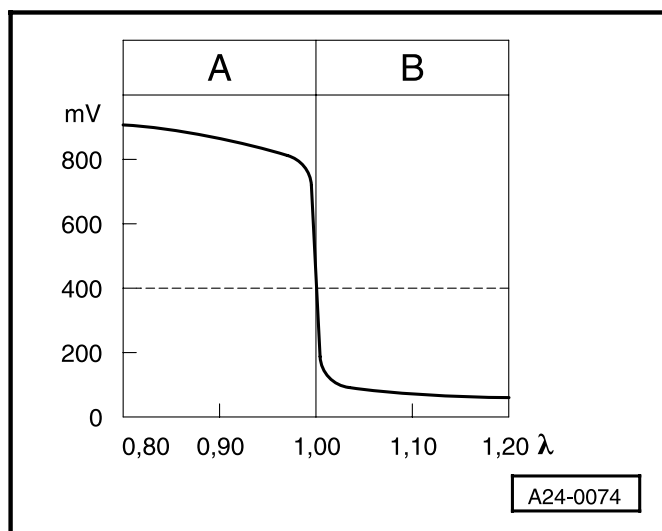
Test table - display group 001

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
1		♦ Test table - display group 000, display block 10 ⇒ page 01-19	
2		♦ Test table - display group 000, display block 3 ⇒ page 01-17	
3	Readout does not vary (constant 0.00 and 0.30 V or constant 0.7 and 1.00 V)	♦ Large quantity of unmetered air ♦ Spark plug faulty ♦ Holding pressure too low or too high ♦ Injector faulty ♦ Coolant temperature sender -G62 faulty ♦ Activated charcoal filter solenoid valve -N80 faulty, blocked or jamming ♦ Lambda probe heater not operating ♦ Lambda probe faulty or dirty	- Eliminate cause of unmetered air - Test spark plugs - Test fuel pressure regulator and holding pressure ⇒ page 24-44 - Test injectors ⇒ page 24-41 - Test coolant temperature sender -G62 ⇒ page 24-31 - Test activated charcoal filter solenoid valve ⇒ page 01-12, Final control diagnosis - Test lambda probe heater ⇒ page 24-13 - Interrogate fault memory ⇒ page 01-4, test lambda probe if necessary ⇒ page 24-12
	constant 1.00 V	♦ Short circuit to positive caused by: Lambda probe or Signal wire or Engine control unit	- Test lambda probe ⇒ page 24-12

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
3	constant between 0.40 and 0.50 V	♦ Open circuit in wiring caused by: Lambda probe or Signal wire or Engine control unit	- Test lambda probe ⇒ page 24-12
	constant 0.00 V	♦ Short circuit to earth caused by: Lambda probe or Signal wire or Engine control unit	- Test lambda probe ⇒ page 24-12

Notes on display block 3:

- ♦ The voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.7...1.0 V (related to the reference value).
- ♦ The voltage signal „lean mixture (high level of residual oxygen)“ is at approx. 0.0...0.3 V (related to the reference value).
- ♦ A voltage jump from 0.7...1.0 V to 0.0...0.3 V and vice versa occurs at the transition from „rich“ to „lean“ and vice versa ($\lambda = 1.0$).
- ♦ In view of the steep voltage jump, the lambda control is not able to hold constant the ideal mixture composition, which corresponds to $\lambda = 1.0$. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.
- ♦ The readout must occasionally be below 0.3 V and occasionally above 0.6 V. Readouts below 0.45 V indicate a lean mixture, above 0.45 V a rich mixture.

◀ **Lambda probe voltage U_λ in mV**

A: Lambda probe voltage high

- ♦ rich mixture (fuel excess or air deficiency)
- ♦ high CO concentration

B: Lambda probe voltage low

- ♦ lean mixture (fuel deficiency or air excess)
- ♦ low CO concentration

Continuation of test table - Display group 001									
Display block	Readout on V.A.G 1552								Meaning of digits in 8-digit numerical block Meaning if display positions = 1
4	x	x	x	x	x	x	x	x	
	1								Fault stored in fault memory
		1							Ignore
			1						AC compressor switched on
				1					Idling switch open ¹⁾
					1				Fault in lambda control ²⁾
						1			Throttle valve open
							1		Engine running (engine speed > 1200 rpm)
								1	Coolant temperature below 80 °C

1) The cause may be that the throttle cable is excessively tensioned.

2) Not all faults are detected by the self-diagnosis. If display readout is 1, it is necessary to test the lambda probe and the lambda control even if no faults are stored in the fault memory ⇒ page 24-12.

Display group 002

Read measured value block				2	→	◀ Readout in display
760...860 rpm	2.56...6.14 ms	12...14.5 V	15...80 °C			
1	2	3	4	Display blocks		
				Intake air temperature		
				Battery voltage		
				Injection time		
Idling speed						

Test table - display group 002

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
1		♦ Test table - display group 000, display block 10 ⇒ page 01-19	
2		♦ Test table - display group 000, display block 9 ⇒ page 01-19	
3		♦ Test table - display group 000, display block 2 ⇒ page 01-17	
4		♦ Test table - display group 000, display block 1 ⇒ page 01-17	

Display group 003

Read measured value block 3 →				◀ Readout in display
760...860 rpm	17...34 %	4...10 °	22...41 %	
1	2	3	4	Display blocks
				Throttle valve positioner analysis
				Throttle valve angle
				Engine load
				Idling speed

Test table - display group 003

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
1		♦ Test table - display group 000, display block 10 ⇒ page 01-19	
2	Signal not to tolerance	♦ Air conditioning on	- Switch off air conditioning
		♦ Electrical components on	- Switch off consumers
		♦ Lambda control at limit of rich or lean mixture	- Test lambda control ⇒ page 24-12
		♦ AC compressor runs even though AC off	- Test AC compressor switch ⇒ page 01-12, Final control diagnosis
		♦ Unmetered air downstream of air mass meter	- Rectify cause of unmetered air
		♦ Unmetered air downstream of throttle valve	
		♦ Vacuum hoses detached	- Inspect attachment of vacuum hoses
		♦ Fuel pressure regulator faulty	- Test fuel pressure regulator and holding pressure ⇒ page 24-44

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
3	less than 4 $\angle^\circ$	♦ Throttle valve potentiometer in throttle valve control unit faulty or incorrectly set	- Test throttle valve control unit ⇒ page 24-17
		♦ Unmetered air between intake manifold and air mass meter	- Rectify cause of unmetered air
	greater than 10 $\angle^\circ$	♦ Basic setting not performed	- Carry out basic setting ⇒ page 24-10
		♦ Throttle valve potentiometer in throttle valve control unit faulty or incorrectly set	- Test throttle valve control unit ⇒ page 24-17
		♦ Throttle cable incorrectly set	- Adjust throttle cable and check ⇒ Engine, Mechanical Components; Repair Group 20
		♦ Throttle valve sticking	
4	less than 22 % or greater than 41 %	♦ Air conditioning on	- Switch off air conditioning
		♦ Electrical components on	- Switch off consumers
		♦ Lambda control at limit of lean or rich mixture	- Test lambda control ⇒ page 24-12
		♦ AC compressor running although AC off	- Test AC compressor switch ⇒ page 01-12, Final control diagnosis
		♦ Unmetered air downstream of throttle valve	- Rectify cause of unmetered air
		♦ Vacuum hoses detached	- Inspect attachment of vacuum hoses
		♦ Fuel pressure regulator	- Test fuel pressure regulator and holding pressure ⇒ page 24-44

Display group 004

Read measured value block				4	→	◀ Readout in display
760...860 rpm	17...34 %	255	01000000			
1	2	3	4	Display blocks		
				Engine operating state		
				Ignore		
				Engine load		
				Idling speed		

Test table - display group 004

Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
1		♦ Test table - display group 000, display block 10 ⇒ page 01-19	
2		♦ Test table - display group 000, display block 2 ⇒ page 01-23	

Display block	Readout on V.A.G 1552								Meaning of digits in 8-digit numerical block Meaning if display positions = 1
4	x	x	x	x	x	x	x	x	
	1								Deceleration
		1							Idling
			1						Part load
				1					Full load
					1				Ignore
						1			Ignore
							1		Ignore
								1	Ignore

Display group 005

Read measured value block 5 →				◀ Readout in display
760...860 rpm	6...19 %	0 %		
1	2	3	4	Display blocks
				Not assigned
				Ignore
				On/off ratio (actuation) of activated charcoal filter solenoid valve
				Idling speed

Test table - display group 005

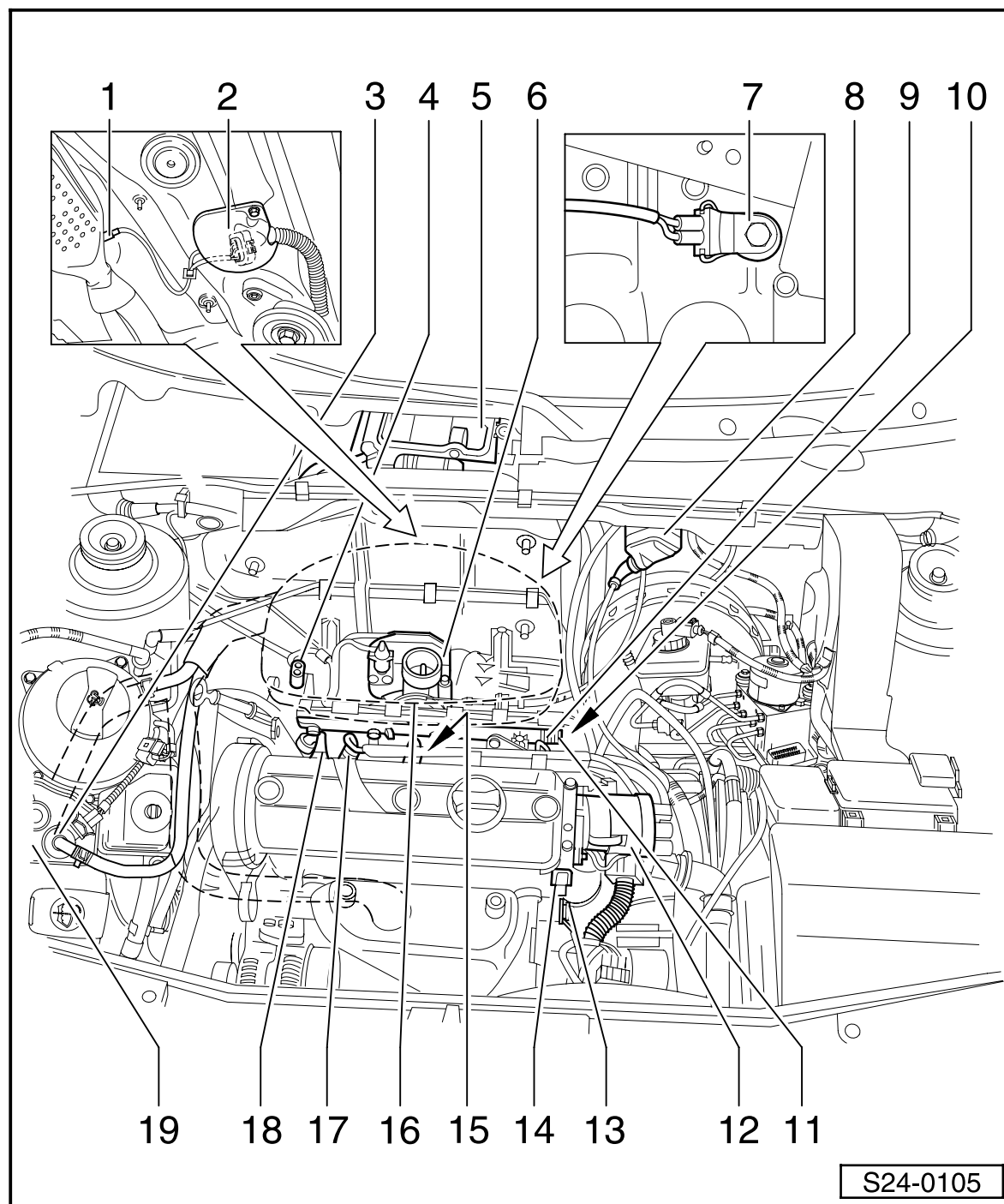
Display block	Readout on V.A.G 1552	Possible cause of fault	Rectifying fault
1		♦ Test table - display group 000, display block 10 ⇒ page 01-19	
2	less than 6 % or greater than 19 %	♦ Activated charcoal filter valve blocked or sticking	- Test activated charcoal filter valve ⇒ page 01-12, Final control diagnosis
		♦ Leak in ventilation of fuel system	- Inspect vacuum lines for leaks
		♦ Leak in intake system	- Inspect intake system for leaks
		♦ Fuel pressure too low or too high	- Test fuel pressure regulator and holding pressure ⇒ page 24-44

Display group 006

Read measured value block 6 →				◀ Readout in display
75...165	75...165	xxx	20...30	
1	2	3	4	Display blocks
				Ignore
				Ignore
				Ignore
				Ignore

Servicing fuel injection system

Summary of fitting locations



1 - Lambda probe (G39), 55 Nm

- ◆ Installation point: in front exhaust pipe

2 - 4-pin connector

- ◆ For lambda probe (G39)

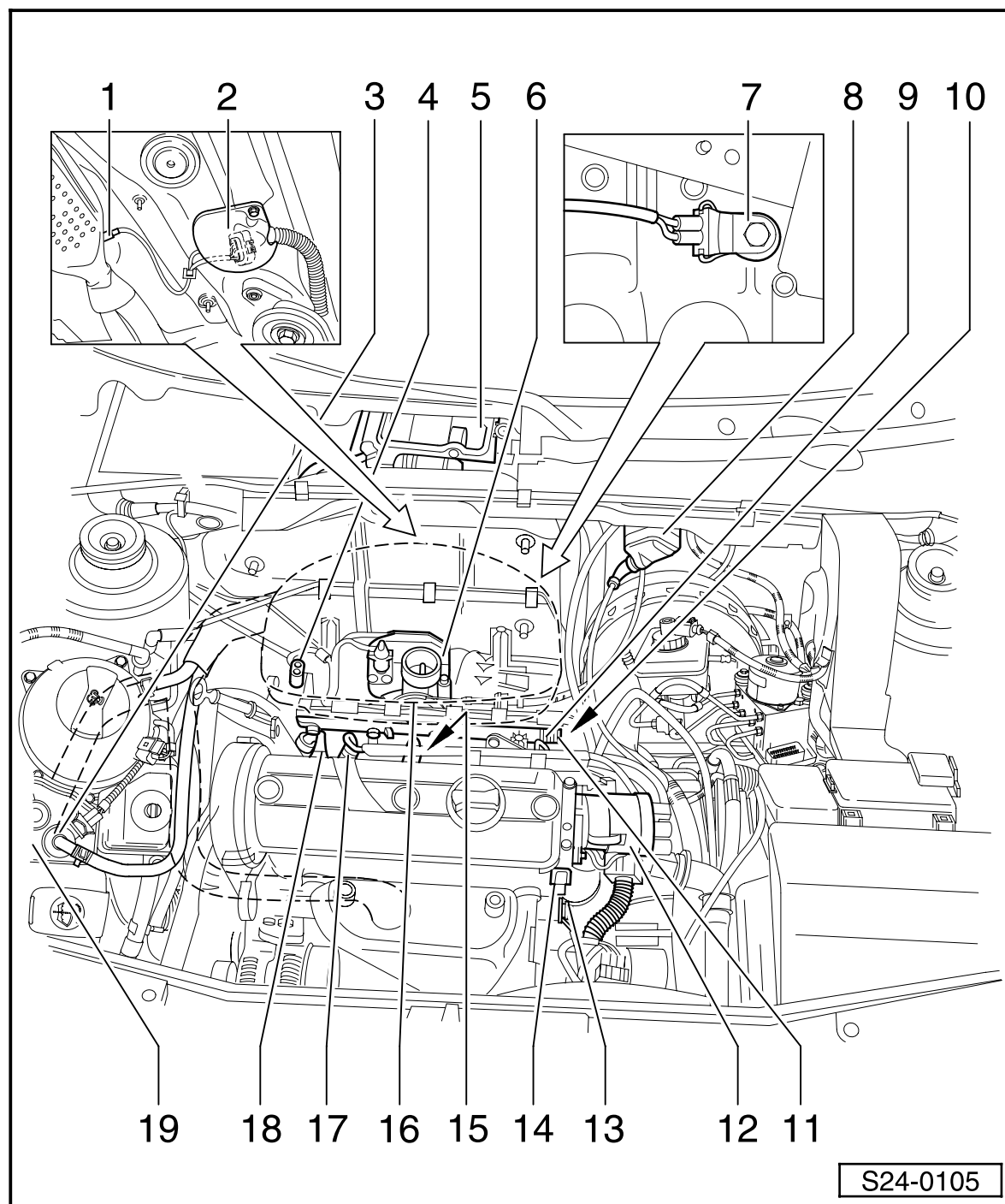
Note:

The 4-pin connector for the lambda probe is located on the right of the vehicle floor next to the lambda probe below a plastic covering.

3 - 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

4 - Intake manifold pressure sender (G71) with intake air temperature sender (G42)



S24-0105

5 - Engine control unit (J382)

6 - Throttle valve control unit (J338)

7 - Knock sensor 1 (G61)

♦ ⇒ page 28-1

8 - Ignition transformer (N152)

♦ ⇒ page 28-1

9 - Fuel rail

10 - Earth connection

11 - Fuel pressure regulator

12 - Distributor

♦ ⇒ page 28-1

13 - Earth connection

14 - Coolant temperature sender (G62)

15 - Injector (N30...N33)**16 - Air filter**

- ♦ Removing ⇒ page 24-8, Fig. 3

17 - Spark plug, 25 Nm

- ♦ ⇒ page 28-3

18 - Oil pressure switch**19 - Activated charcoal filter**

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

Servicing fuel injection system

Servicing ignition system

⇒ Repair Group 28

Notes:

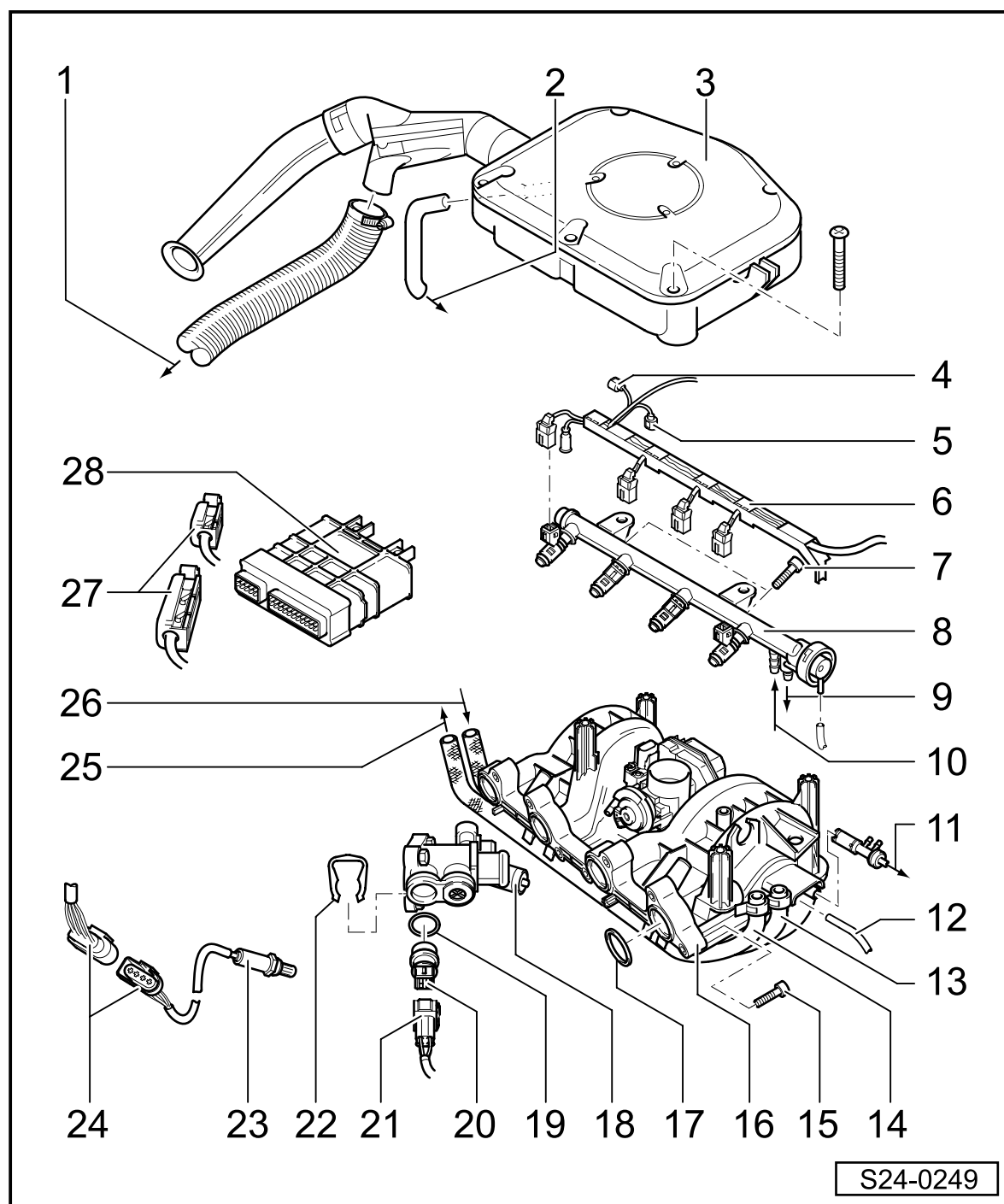
- ♦ *Before carrying out repairs or fault finding, first of all interrogate the fault memory and also inspect the vacuum hoses and connections (unmetered air).*
- ♦ *Components marked with * are tested by self-diagnosis.
⇒ page 01-4, Interrogating fault memory*
- ♦ *Components marked with ** can be tested with the final control diagnosis ⇒ page 01-12.*
- ♦ *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 carrying out troubleshooting, repairs or tests of components, the cause of this may be that the immobiliser has blocked the engine control unit. In this case, interrogate the fault memory and adapt the control unit, if necessary ⇒ page 24-40.*
- ♦ *When conducting certain tests it is possible that the control unit detects a fault and stores it. For this reason, after completing all the tests and repair work, interrogate the fault memory and erase it, if necessary ⇒ page 01-4, Interrogating fault memory.*
- ♦ *Always replace clamp-type clips with screw-type clips.*

Safety precautions ⇒ page 24-9.

Rules for cleanliness ⇒ page 24-9.

Technical data ⇒ page 24-10.

Inspecting intake system for leaks (unmetered air) ⇒ page 24-46.

**1 - Warm air intake**

- ◆ To warm air baffle

2 - To oil separator**3 - Air filter**

- ◆ Disassembling and assembling
⇒ page 24-7

4 - Connector

- ◆ 4-pin
- ◆ For intake manifold pressure sender (G71) with intake air temperature sender (G42)

5 - Connector

- ◆ 8-pin
- ◆ For throttle valve control unit (J338)

6 - Cable guide

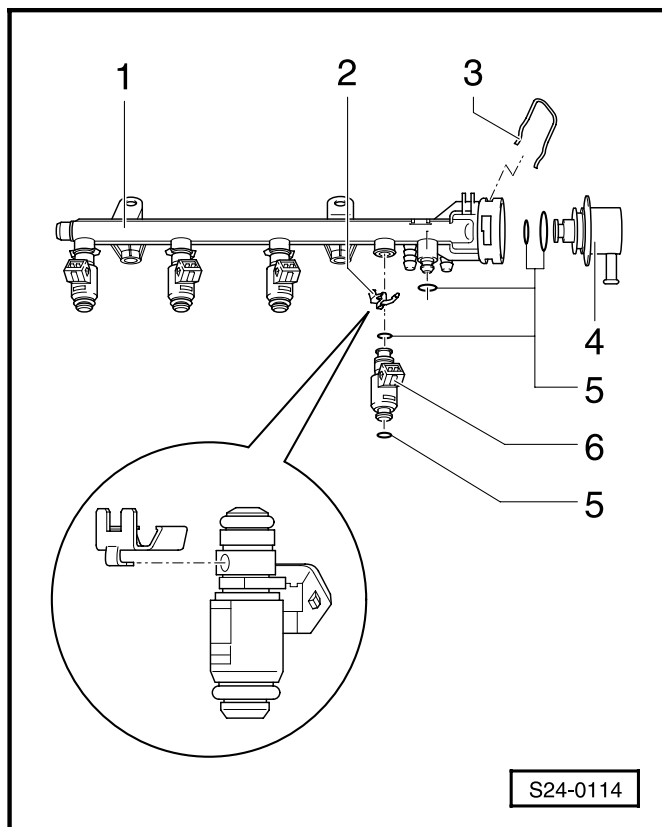
- ◆ Clipped onto fuel rail

7 - 10 Nm**8 - Fuel rail with injectors**

- ◆ Disassembling and assembling
⇒ page 24-6

- 9 - Connection for return-flow hose**
- 10 - Connection for feed hose**
- 11 - To brake servo unit**
- 12 - Vacuum hose**
- 13 - Feed hose**
 - ◆ Secure at fuel rail with spring strap clips
 - ◆ black, or white marking
- 14 - Return-flow hose**
 - ◆ Secure at fuel rail with spring strap clips
 - ◆ blue, or blue marking
- 15 - 20 Nm**
- 16 - Intake manifold**
 - ◆ Disassembling and assembling
⇒ page 24-6
- 17 - O-ring**
 - ◆ Replace
- 18 - Coolant thermostat housing**
- 19 - O-ring**
 - ◆ Replace if damaged
- 20 - Coolant temperature sender (G62)***
 - ◆ With coolant temperature gauge sender (G2)
 - ◆ Before removing, release pressure from cooling system if necessary
 - ◆ Testing ⇒ page 24-31
 - ◆ Resistances ⇒ page 24-8, Fig. 1
- 21 - Connector**
- 22 - Retaining clip**
- 23 - Lambda probe (G39)*, 55 Nm**
 - ◆ Installation point: in front exhaust pipe
 - ◆ Grease only thread with "G5"; "G5" must not get into the slot of the probe body
 - ◆ Testing lambda probe and lambda control ⇒ page 24-12
 - ◆ Testing voltage supply for probe heater ⇒ page 24-13
 - ◆ Testing probe heater for continuity
- 24 - 4-pin connector**
 - ◆ For lambda probe and lambda probe heater
 - ◆ On right of vehicle floor next to lambda probe below a cover
- 25 - To fuel tank**
- 26 - From fuel delivery unit in fuel tank**
- 27 - Connector**
 - ◆ Do not unplug or plug in connector unless the ignition is switched off
 - ◆ Release in order to unplug
- 28 - Engine control unit (J382)***
 - ◆ Installation position: in middle of plenum chamber
 - ◆ Testing voltage supply ⇒ page 24-38
 - ◆ Replacing control unit ⇒ page 24-55

Disassembling and assembling fuel rail together with injectors



1 - Fuel rail

2 - Retaining clip

- ◆ Ensure it is correctly fitted onto injector and fuel rail.

3 - Retaining clip

4 - Fuel pressure regulator

- ◆ Testing pressure regulator and holding pressure ⇒ page 24-44

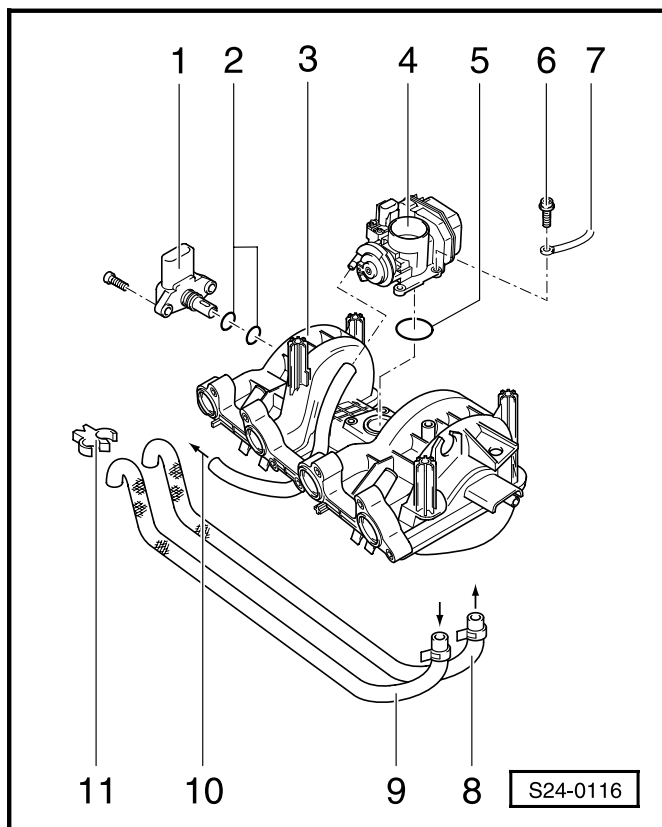
5 - O-ring

- ◆ Replace if damaged

6 - Injector (N30...N33)*

- ◆ Testing ⇒ page 24-41
- ◆ Resistance 14...17 Ω

Disassembling and assembling intake manifold



1 - Intake manifold pressure sender (G71)* together with intake air temperature sender (G42)*

- ◆ Resistances for intake air temperature sender ⇒ page 24-8, Fig. 2

2 - O-ring

- ◆ Replace if damaged

3 - Intake manifold

4 - Throttle valve control unit (J338)*

- ◆ Testing ⇒ page 24-18
- ◆ Components of throttle valve control unit (J338):
- ◆ Throttle valve positioner (V60), potentiometer for throttle valve positioner (G88), throttle valve potentiometer (G69) and idling switch (F60)

5 - O-ring

- ◆ Replace if damaged

6 - 10 Nm

7 - Earth cable

- ◆ for throttle valve control unit

8 - Feed hose

- ◆ clipped into intake manifold at bottom

9 - Return flow hose

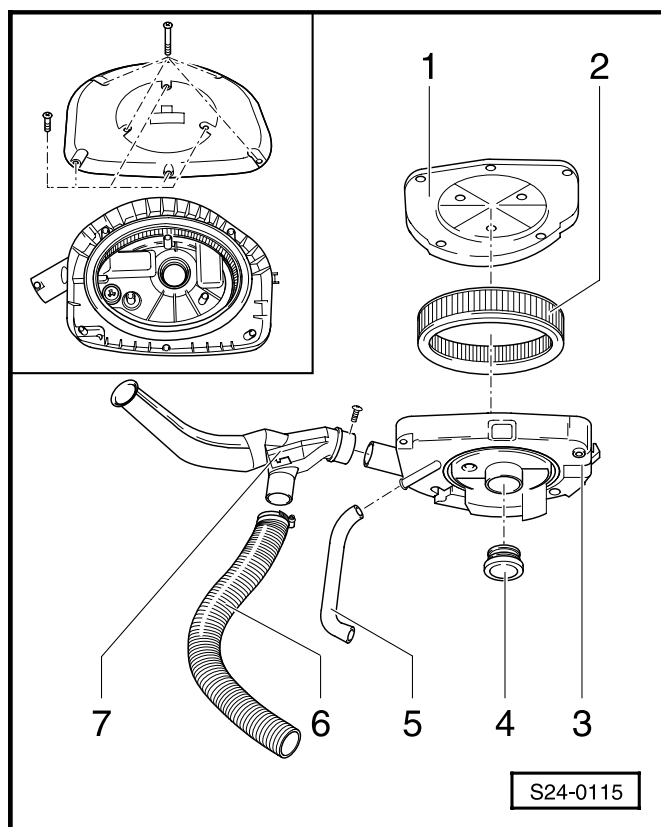
- ◆ clipped into intake manifold at bottom

10 - to solenoid valve 1 for activated charcoal filter (N80)

- ◆ Activated charcoal filter system

⇒ Engine, Mechanical Components; repair group 20; Removing and installing parts of the fuel supply system; Removing and installing parts of activated charcoal filter system

11 - Retaining clip



Disassembling and assembling air filter

Removing air filter ⇒ page 24-8, Fig. 3

1 - Air filter cover

2 - Filter element

3 - Bottom part of air filter

4 - Gasket

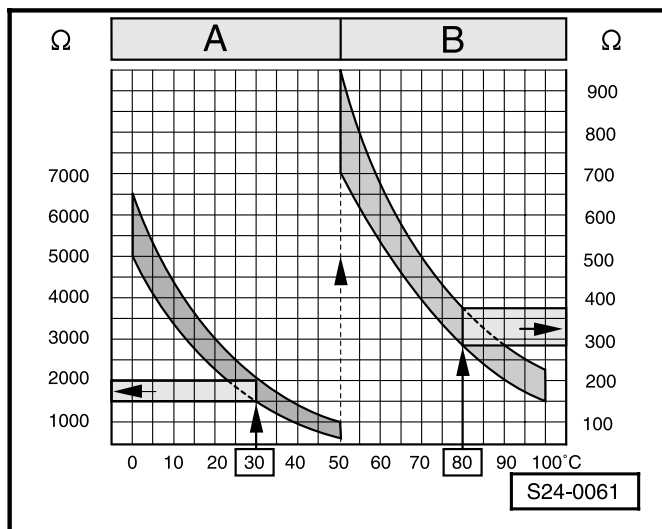
- ◆ Replace if damaged

5 - Hose for crankcase breather

6 - Warm air intake

7 - Intake air connection fitting with control flap

- ◆ Testing intake air preheater ⇒ page 24-48

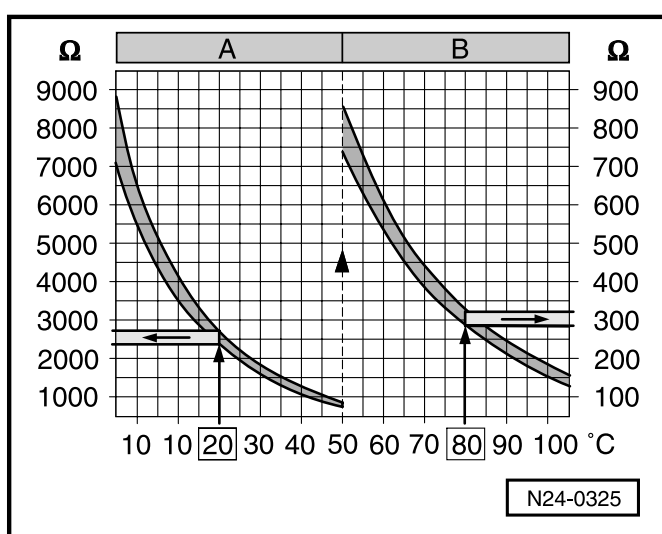


◀ Fig. 1 Resistances for coolant temperature sender (G62)

The range A tells you the resistances for the temperature range 0...50 °C; range B the resistances for the temperature range 50...100 °C.

How to read the chart:

- ◆ 30 °C equals a resistance of 1500...2000 Ω
- ◆ 80 °C equals a resistance of 275...372 Ω

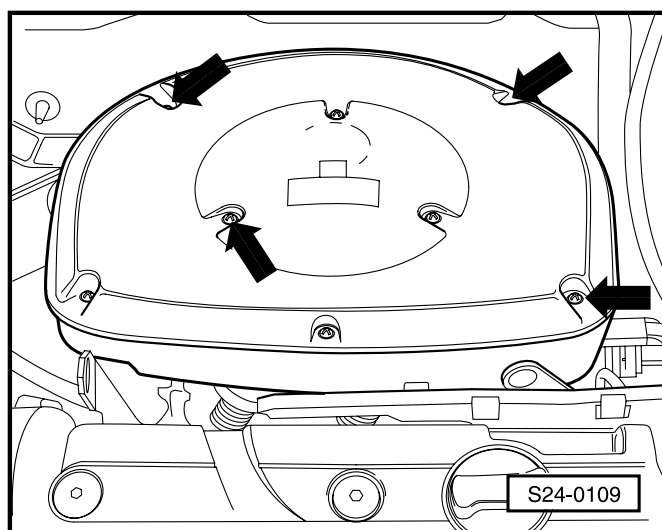


◀ Fig. 2 Resistance for intake air temperature sender (G42)

The range A tells you the resistances for the temperature range 0...50 °C; range B the resistances for the temperature range 50...100 °C.

How to read the chart:

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



◀ Fig. 3 Removing air filter

- Slacken the air filter at the securing screws marked with arrows.

Note:

Do not use an electric or compressed air screwdriver.

Safety precautions

Important!

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

Pay attention to the following precautions 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 connect cables of the fuel injection and ignition system - nor the cables of test equipment - unless the ignition is switched off.
- ◆ To operate the engine at starting speed without it actually starting, e.g. for testing compression pressure, unplug connector from the Hall sender (distributor).

Rules for cleanliness

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

- ◆ Thoroughly clean connection points and the surrounding area before disconnecting.
- ◆ Removed parts must be placed down on a clean surface and cover over. Do not use any fluffing cloth!
- ◆ Carefully cover over or seal opened components if repairs are not performed 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 open:
Avoid working with compressed air if possible.
Avoid moving the car if possible.

Technical data

Engine code letter			AEE
Idling speed			rpm
Engine control unit ²⁾			
Control unit version			1AVM
Part No.			⇒ Parts List
Fuel pressure at idling speed	Vacuum hose fitted on	MPa	approx. 0.25
Fuel pressure at idling speed	Vacuum hose detached	MPa	approx. 0.30
Holding pressure after 10 min.		MPa	min. 0.2
Engine speed limited by shutting off injectors			rpm
			approx. 5700...6100

¹⁾ At high engine loads, e.g. under the following conditions, the idling speed is increased by the engine control unit:

- ◆ Battery voltage too low: up to 850 rpm
- ◆ Air conditioning on: up to 900 rpm
- ◆ Cold start: at +20 °C up to 900 rpm, at -20 °C up to 1350 rpm
- ◆ Max. steering angle: up to 850 rpm

²⁾ If replaced, carry out basic setting ⇒ page 24-10.

Carrying out basic setting

Note:

When the basic setting is carried out, the 1AV control unit is matched to the throttle valve control unit with the ignition switched on.

Special tools, testers and aids required

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

Test condition

- No fault stored in fault memory
⇒ page 01-4, Interrogating fault memory

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

Basic setting Enter display group number XXX	HELP
---	------

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

◀ Readout in display:

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

System in basic setting 1	→
0 rpm 20 °C 0,0 V 00000000	

◀ Readout in display, for example:

After pressing the key Q, the throttle valve positioner moves into the Min., Max. and into three intermediate positions, and the control unit stores each throttle valve angle in the permanent memory. This procedure takes about 10 seconds. Following this, the throttle valve remains in the start position.

Note:

If the control unit aborts the basic setting, the cause of this may be that the throttle valve does not reach the mechanical idle speed stop because of dirt, e.g. oil carbon deposits. The fault "Basic setting not carried out" is then entered in the fault memory. The next time the ignition is switched on, the basic setting is performed once again automatically.

- End the basic setting of the engine by pressing the → key.
- Press keys 0 and 6 for the function "End data transfer" and confirm the entry with the key Q.

If the throttle valve positioner does not move:

- Check the 8-digit numerical block in display block 4. The 2nd, 3rd and 4th places from the right must be set to 0.
Readout: 00000000

Note:

If a "1" appears at one of the places mentioned in display block 4, the test conditions are not met: ⇒ page 01-22; Meaning of the digits in the 8-digit numerical block.

If all the places indicate 0:

- Test the throttle valve control unit
⇒ page 24-17.

Testing lambda probe and lambda control

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

The voltage signal „rich mixture (low level of residual oxygen)“ is at approx. 0.7...1.0 V (related to the reference value).

The voltage signal „lean mixture (high level of residual oxygen)“ is at approx. 0.0...0.3 V (related to the reference value).

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

In view of the steep voltage jump, the lambda control is not able to hold constant the ideal mixture composition, which corresponds to $\lambda = 1.0$.

In the control unit, the so-called reference voltage of approx. 0.4 to 0.5V is pre-programmed for analysing the signal supplied by the lambda probe. The control constantly fluctuates back and forward between the „slightly too lean“ and „slightly too rich“ states.

At idling speed and when engine is at normal operating temperature, the control must perform 30 cycles a minute.

Possible causes of fault if no control frequency supplied by probe, or control frequency too sluggish:

- ◆ *The slots or holes in the lambda probe head are blocked.*
- ◆ *The air admission hole at the probe -in area of connection cable- is sealed off.*
- ◆ *The probe has been subjected to excessive thermal stresses (glazed appearance).*
- ◆ *The probe has been damaged by leaded fuel.*
- ◆ *The contact resistance in signal line.*
- ◆ *The probe is too cold; probe heater not operating.*
- ◆ *Lambda closed-loop control off (engine control unit detects fault in fuel injection system $\Rightarrow$ Interrogating fault memory).*

- ◆ *The probe has been damaged by contact spray or a similar product (contact spray has got into the probe along the cables as a result of temperature changes and the capillary effect of the holes).*
- ◆ *The probe has been damaged by silicone vapours. (If sealing products containing silicone are used, traces of the silicone elements are inducted by the engine. Inducted silicone elements are not combusted and damage the lambda probe).*
- ◆ *The probe has been damaged by oil components of the oil (escapes through crankcase breather or the result of leaks in the engine).*

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Basic setting o.k.
- No leak in exhaust system between catalytic converter and cylinder head

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

HELP

◀ Readout in display:

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

Read measured value block 1 →			
780 rpm	85 °C	0,75 V	00000000

◀ Readout in display, e.g.:

Do not continue with the test until

- coolant temperature is more than 80 °C
-display block 2-
- engine has run for a further 2 minutes at idling speed
- Check the lambda probe voltage shown in display block 3. The voltage must vary at least 30 times a minute within the range 0...1.0 V.

If the specifications are not achieved:

- ◀
- Unplug connector -1- from the coolant temperature sender (G62) -2-. The probe voltage must rise and drop again to the former control range.
 - Plug in connector again. Lambda probe voltage must drop and rise again.

If the voltage change is slower, determine the cause ⇒ 24-12.

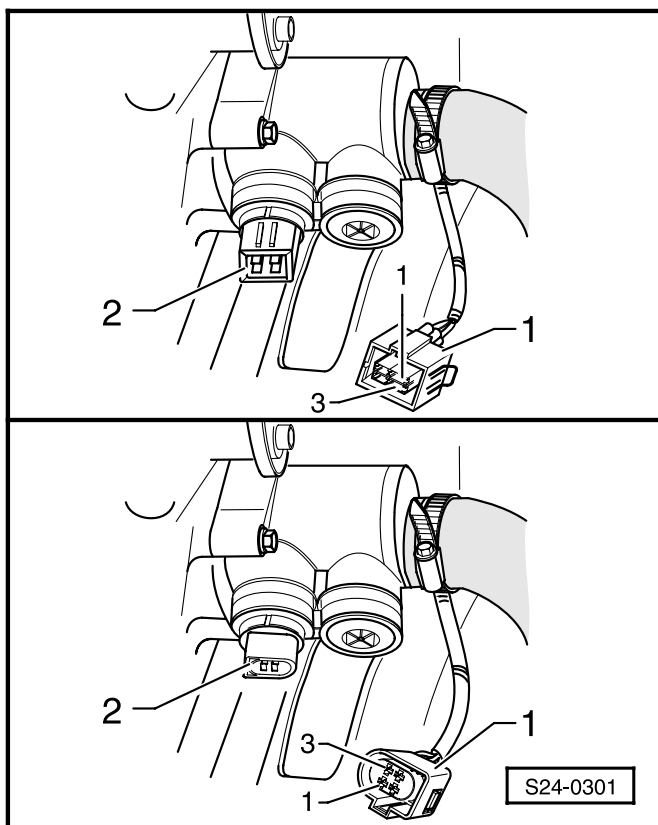
Note:

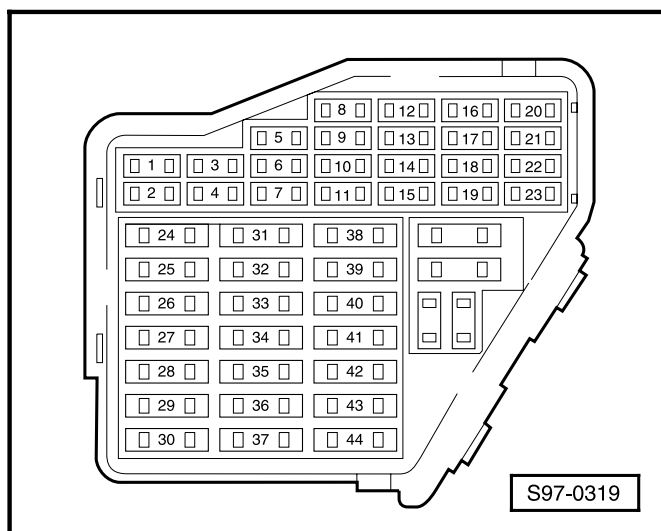
The throttle valve must not be operated during the test otherwise the control unit will detect the unplugged connector as a fault.

- Press the → key.
- Press keys 0 and 6 for the function "End data transfer" and confirm the entry with the key Q.
- Switch off the ignition.

If no control is detected:

- Test the lambda probe heater ⇒ page 24-13.
- Test the signal line and actuation ⇒ page 24-14.





Testing lambda probe heater

Special tools, testers and aids required

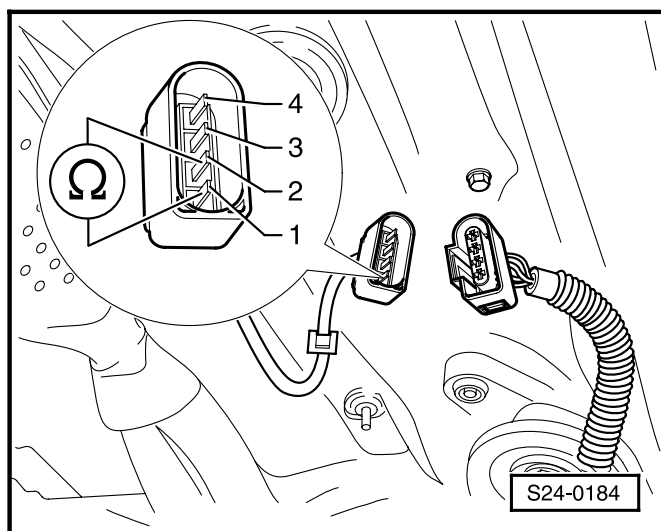
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Diode test lamp, e.g. V.A.G 1527
- ◆ Current flow diagram

Test condition

- ◀ ● Fuse 43 must be o.k.

Testing voltage supply

- Unplug the 4-pin connector to the lambda probe (G39).



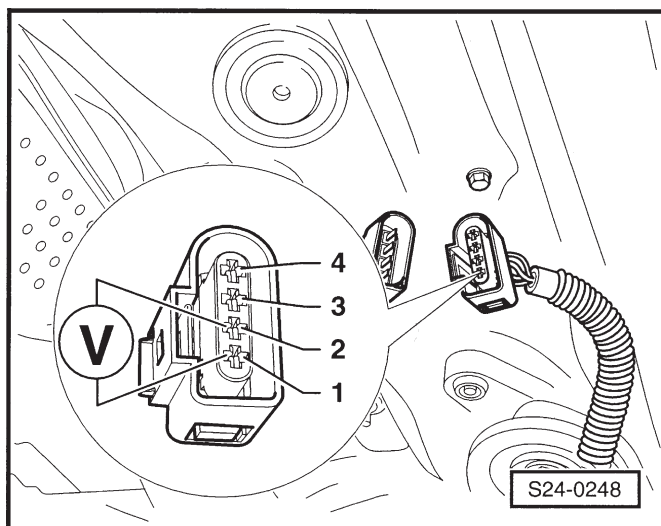
- ◀ - Use the auxiliary cables to connect the multimeter to contacts 1 + 2 of the connector for voltage measurement.
Požadovaná hodnota 2.7 až 3 Ω.

Note:

Carry out the measurement at room temperature. The resistance rises sharply even if there is only a slight increase in temperature.

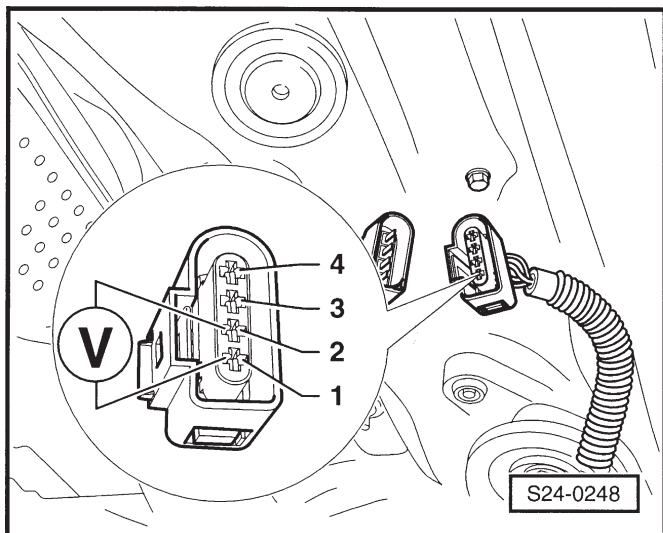
- If a fault is determined, replace the lambda probe.

If the heating element has continuity, test the voltage supply of the lambda probe heater:



- ◀ - Use the auxiliary cables to connect the multimeter to contacts 1 and 2 of the connector to the wiring loom.
- Start engine and run for a few minutes.

Specification: approx. battery voltage



- ◀ - If the specification is not achieved, connect the multimeter between contact 1 of the connector at the wiring loom and earth.

- Start engine.

Specification: approx. battery voltage

- If the specification is not achieved:
Test cable from contact 1 to fuse for open circuit or short circuit to earth.

If the cable to the fuse and the fuse are o.k., test fuel pump relay ⇒ page 01-12, Final control diagnosis.

- If no fault is found in the wiring, fuse or relay, measure resistance between contact 2 of the connector at the wiring loom and earth.

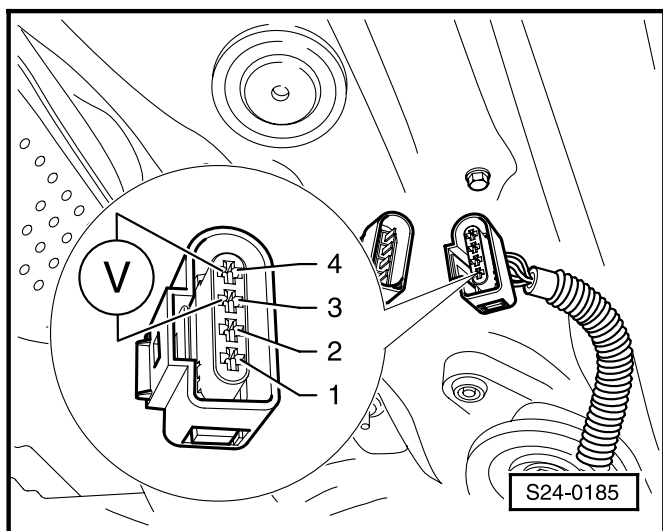
Specification: max. 1 Ω .

Testing lambda probe signal wire and actuation

Note:

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

- Interrogate fault memory ⇒ page 01-4.
- If a lambda probe fault is displayed and if the lambda probe heater is o.k., separate plug connection for lambda probe.



- ◀ - Use the multimeter (set to range 2 V) to carry out a voltage measurement between contacts 3 and 4 of the connector at the wiring loom.

- Switch on ignition.

Specification: 450 $\pm$ 50 mV.

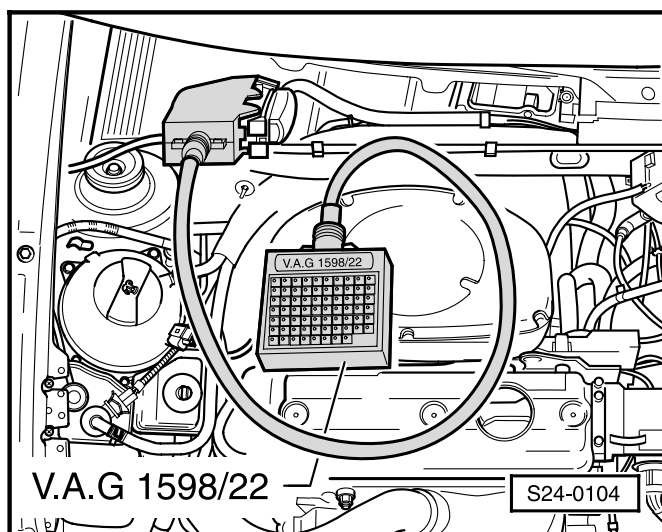
- Switch off ignition.

If the specification is achieved:

- Replace lambda probe.

If the specification is not achieved:

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit.
- Test the following cable connections for open circuit, short circuit to positive or to earth, and repair if necessary:



Connector at wiring loom, contact	Test box V.A.G 1598/22 or -J220
3	25
4	26

- If the cable connection is o.k., replace engine control unit.

Testing engine operating states

Note:

What is tested is whether the engine control unit (J382) detects the operating states of the engine (idling, part load, full load, overrun).

Special tools, testers and aids required

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

Test condition

- Coolant temperature at least 80 °C

Test procedure

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

Test of vehicle systems Select function XX

HELP

◀ Readout in display:

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

Read measured value block Enter display group number XXX

HELP

◀ Readout in display:

- Press the keys 004 for "Display group number 004" and confirm the entry with the key Q.

Read measured value block 4	→
850 rpm 32 % 255 01000000	

◀ Readout in display:

- Check the 8-digit numerical block in display block 4:
(Ignore the 4 right-hand places)

Readout in operating state

- ◆ Idling:

2nd place from left must indicate 1
Readout: 01000000

◆ Part throttle:

- Depress the throttle evenly.

3rd place from the left should indicate 1
Readout: 001000000

◆ Full throttle:

- Briefly depress to full throttle (blip throttle)

4th place from the left should briefly indicate
1
Readout: 00010000

◆ Overrun:

- Increase engine speed to more than 3000 rpm.
- After this, suddenly close the throttle valve.

1st place from the left should indicate 1 for as long as the engine speed is more than 1400 rpm
Readout: 11000000 (briefly)

Note:

Idling speed is again recognised below 1400 rpm.

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.

If the specifications are not achieved:

- Interrogate the fault memory, rectify any faults which exist and then erase the fault memory.
⇒ page 01-4; Interrogating and erasing fault memory
- Test the throttle valve potentiometer ⇒ page 24-18, Testing throttle valve control unit.

Testing throttle valve control unit

Note:

If the throttle valve control unit (J338) is removed and installed or replaced, it is then necessary to carry out a basic setting ⇒ page 24-10.

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 together with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Testing idling switch

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

Test of vehicle systems
Select function XX

HELP

◀ Readout on 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 XX

HELP

◀ Readout on display:

- Press the keys 0 and 1 for „display group number 01“ and confirm the entry with the key Q.

Read measured value block 1

1

2

3

4

→

◀ Readout on display:
(1...4 = display fields)

- Pay attention to the 8-digit numerical block in display field 4:
(Ignore the 4 places on the right)

The 4th place from the left should indicate 0 when throttle valve is closed.

Readout: 00000000

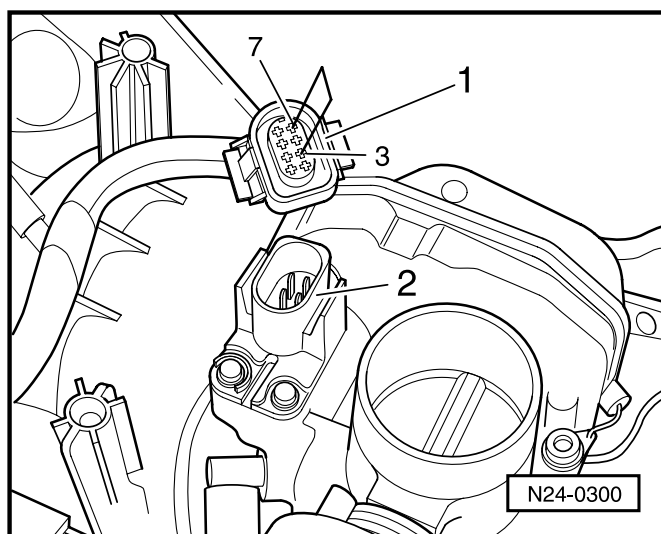
- Now, slowly open the throttle valve. After a certain idle travel, you reach a mechanical stop. If you continue opening the throttle valve, the 4th place from the left should jump to 1.

Readout: 00010000

If the specifications are not achieved:

- Remove the air filter ⇒ page 24-8, Fig. 3.

Readout	Cause	Continue test
always 1	Open circuit or short circuit to positive	⇒ page 24-19
always 0	Short circuit to earth	⇒ page 24-20



Continuation of test if readout always indicates 1

- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.
- Bridge contacts 3+7 of the connector using auxiliary cables from V.A.G 1594 and pay attention to the readout in the display.

Readout 0:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the throttle valve control unit ⇒ page 24-6, item 4.

Readout 1:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.

- Switch off the ignition.
- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-25.

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

- Replace the 1AV control unit (J382) ⇒ page 24-5, item 28.

Continuation of test if readout always indicates 0

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

Readout 1:

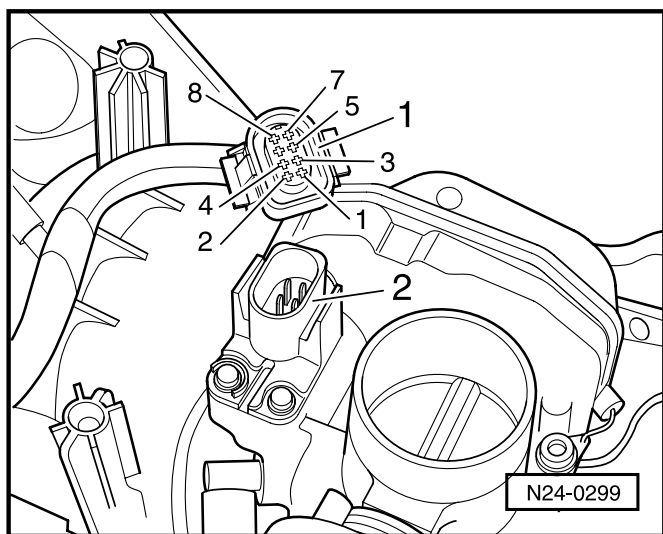
- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the throttle valve control unit ⇒ page 24-6, item 4.

Readout 0:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-25.

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

- Replace the 1AV control unit (J382) ⇒ page 24-5, item 28.



Testing throttle valve positioner and potentiometer for throttle valve positioner

Test condition

- Coolant temperature at least 80 °C

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout on 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 XX

HELP

◀ Readout on display:

- Press the keys 0 and 3 for „display group number 03“ and confirm the entry with the key Q.

Read measured value block 3
1 2 3 4

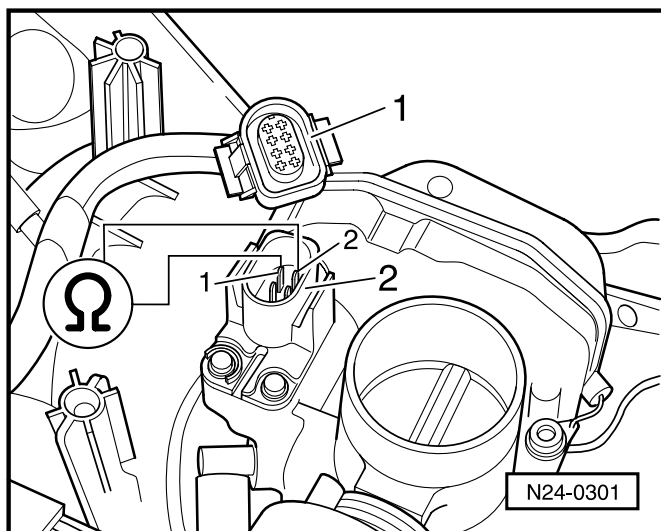
→

◀ Readout on display:
(1...4 = display fields)

- Check the on/off ratio for the throttle valve positioner in display field 4. The on/off ratio should vary within the range 42...54 %.

If the specification is not achieved:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Remove the air filter ⇒ page 24-8, Fig. 3



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

- Measure the resistance of the throttle valve positioner between contacts 1+2 at the connection.

Specification: 3...200 Ω

- Test the voltage supply of the throttle valve control unit and the wiring to the control unit
⇒ page 24-25.

If not fault is found:

- Replace the throttle valve control unit ⇒ page 24-6, item 4.

Testing throttle valve potentiometer

Test condition

- Coolant temperature at least 80 °C

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout on 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 XX

HELP

◀ Readout on display:

- Press the keys 0 and 3 for „display group number 03“ and confirm the entry with the key Q.

Read measured value block 3

1 2 3 4

→

◀ Readout on display:
(1...4 = display fields)

- Read off the throttle valve angle in display field 3. What is displayed is the opening angle of the throttle valve in the start position.

- Slowly open the throttle valve as far as the full throttle position and observe the angle readout in display field 3. The numerical value should rise evenly over the entire range.
- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.

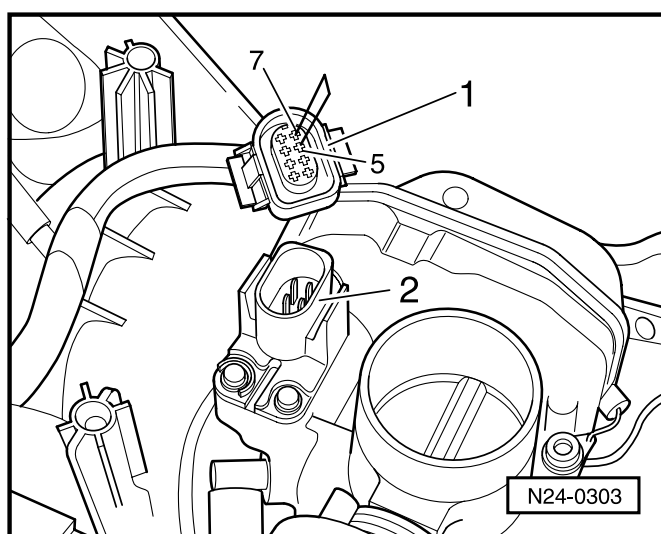
If the numerical value does not rise evenly:

- Replace the throttle valve control unit ⇒ page 24-6, item 4.

If the readout remains at a constant 0 ∠ ° or more than 100 ∠ °:

- Remove the air filter ⇒ page 24-8, Fig. 3.

Readout	Cause	Continue test
0 ∠ °	Open circuit or short circuit to positive	⇒ page 24-23
more than 100 ∠ °	Short circuit to earth	⇒ page 24-24



Continuation of test if readout 0 ∠ °:

- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.
- Bridge the contacts 5+7 of the connector using auxiliary cables from V.A.G 1594 and pay attention to the readout in the display.

Readout more than 100 ∠ °:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.

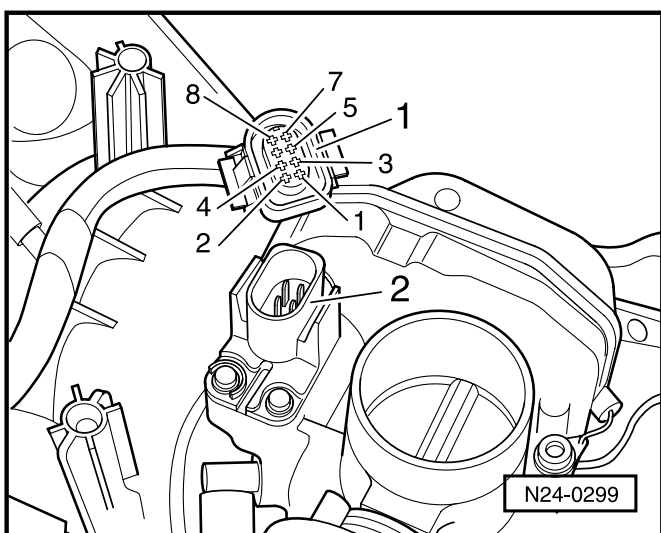
- Replace the throttle valve control unit ⇒ page 24-6, item 4.

Readout 0 ∠ °:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-25.

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

- Replace the 1AV control unit (J382) ⇒ page 24-5, item 28.



Continuation of test if readout more than 100 ∠ °:

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

Readout 0 ∠ °:

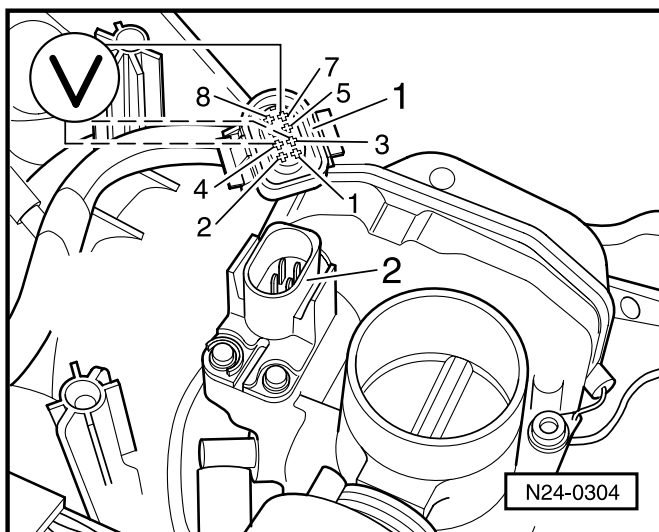
- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the throttle valve control unit ⇒ page 24-6, item 4.

Readout more than 100 ∠ °:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Test the voltage supply of the throttle valve control unit and the wiring to the control unit ⇒ page 24-25.

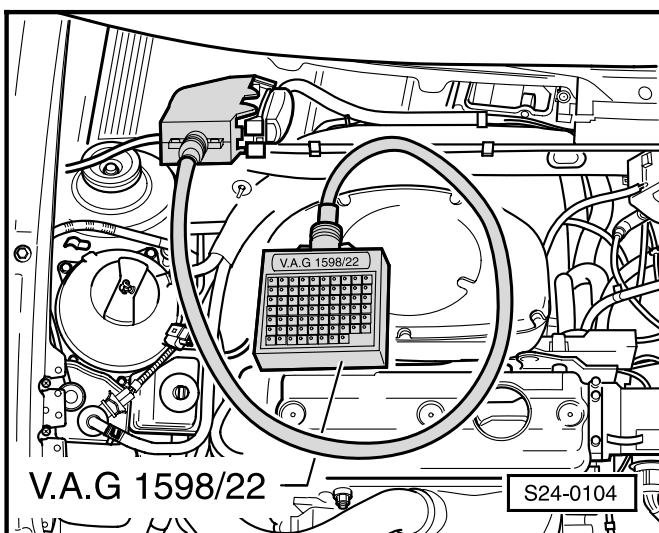
If the voltage supply and the wiring are o.k.:

- Replace the 1AV control unit (J382) ⇒ page 24-5, item 28.

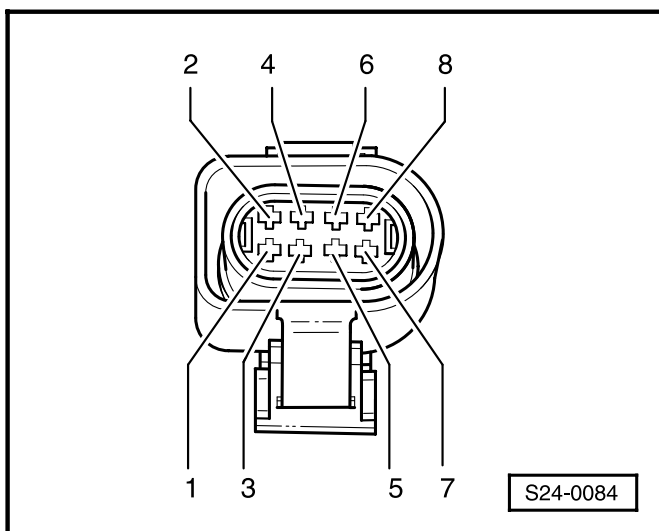


Testing voltage supply and wiring to the control unit

- Remove the air filter ⇒ page 24-8, Fig. 3.
- ◀ - Unplug the connector -1- from the throttle valve control unit -2-.
- Connect the multimeter for voltage measurement to contacts 4+7 of the connector.
- Switch on the ignition.
Specification: at least 4.5 V.
- Switch off the ignition.
- Connect the multimeter for voltage measurement to contacts 3+7 of the connector.



- Switch on the ignition.
Specification: at least 9 V
- Switch off the ignition.
- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.



- ◀ - Test the wiring between test box and connector for open circuit on the basis of the current flow diagram.
Contact 1+socket 66
Contact 2+socket 59
Contact 3+socket 69
Contact 4+socket 62
Contact 5+socket 75
Contact 7+socket 67
Contact 8+socket 74
Cable resistance: max. 1.5 Ω
- In addition, test the wiring for short circuit to each other.
Specification: $\infty \Omega$

If not fault is found in the wiring:

- Test the voltage supply of the 1AV control unit ⇒ page 24-38.

Testing intake manifold pressure sender

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 together with cable V.A.G 1551/3
- ♦ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ♦ Test box V.A.G 1598/22
- ♦ Adapter cable set V.A.G 1594 A
- ♦ Current flow diagram

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout on 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 XX

HELP

◀ Readout on display:

- Press the keys 0 and 3 for „display group number 03“ and confirm the entry with the key Q.

Read measured value block 3
1 2 3 4

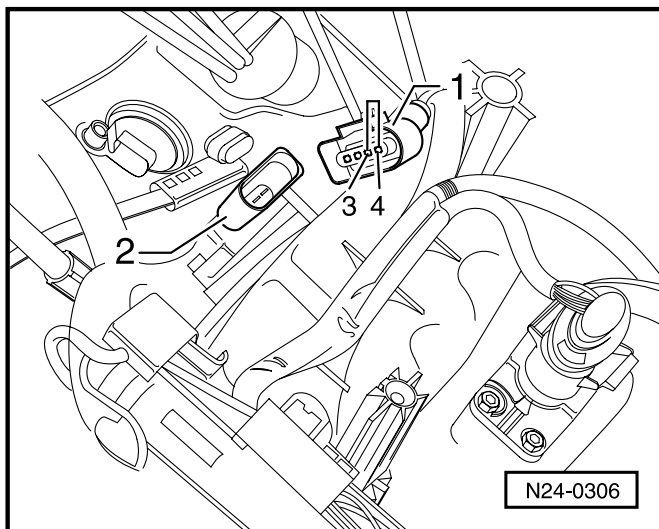
→

◀ Readout on display:
(1...4 = display fields)

- Check the readout for engine load in display field 2 and note this readout.
- Briefly open the throttle valve. The readout for engine load should increase briefly when this is done.

If the readout indicates a constant 0 % or 100 %:

Readout	Cause	Continue test
0 %	Open circuit or short circuit to earth	⇒ page 24-27
100 %	Short circuit to positive	⇒ page 24-28



Continuation of test if readout 0 %:

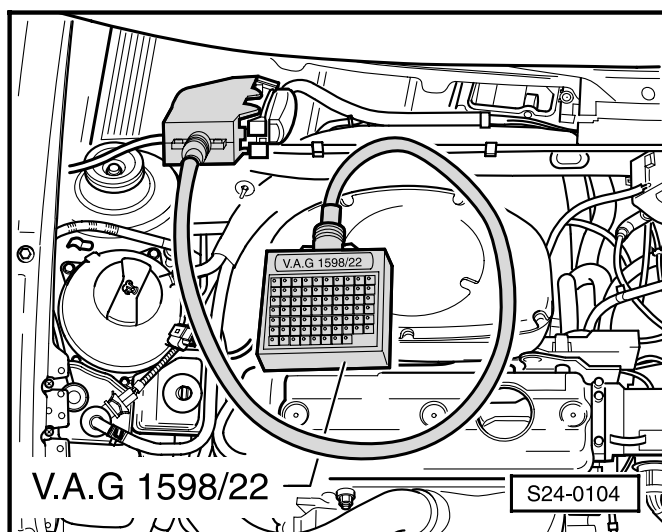
- ◀ - Unplug the connector -1- from the intake manifold pressure sender (G71) together with intake air temperature sender (G42) -2- (engine cuts out).
- Bridge the contacts 3+4 at the connector.

Readout 100 %:

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the intake manifold pressure sender (G71) together with intake air temperature sender (G42) -2- ⇒ page 24-6, item 1.

Readout 0 %:

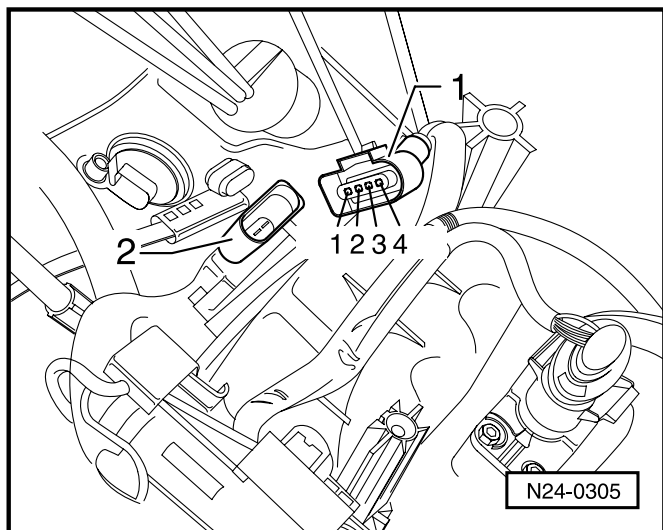
- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.
- Test the wiring between test box and connector for open circuit on the basis of the current flow diagram.
 - Contact 3+socket 62
 - Contact 4+socket 61
 - Cable resistance: max. 1.5 Ω



- In addition, test the cable of contact 4 for short circuit to earth and to contact 1.
Specification: $\infty \Omega$

If no fault is found in the wiring:

- Replace the 1AV control unit (J382) $\Rightarrow$ page 24-5, item 28.



Continuation of test if readout 100 %:

- ◀ - Unplug the connector -1- from the intake manifold pressure sender (G71) together with intake air temperature sender (G42) -2- (engine cuts out).

Readout 0 %:

- Press the $\rightarrow$ key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the intake manifold pressure sender (G71) together with intake air temperature sender (G42) -2- $\Rightarrow$ page 24-6, item 1.

Readout 100 %:

- Press the $\rightarrow$ key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Unplug the connector from the 1AV control unit.
- Test the wiring to the control unit connector at the 4-pin connector contact 4 for short circuit to cable contact 3 and also to battery positive.
Specification: $\infty \Omega$

If no fault is found in the wiring:

- Replace the 1AV control unit (J382) $\Rightarrow$ page 24-5, item 28.

Testing vehicle speed signal

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 together with cable V.A.G 1551/3
- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Test box V.A.G 1598/22
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test condition

- Speedometer o.k.; testing:
⇒ Repair group 90; Electrical System

Test procedure

Note:

The vehicle has to be driven in order to test the vehicle speed signal. A second person is required for this test.

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

Test of vehicle systems
Select function XX

HELP

◀ Readout on 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 XX

HELP

◀ Readout on display:

- Press the keys 0 and 4 for „display group number 04“ and confirm the entry with the key Q.

Read measured value block 4
1 2 3 4

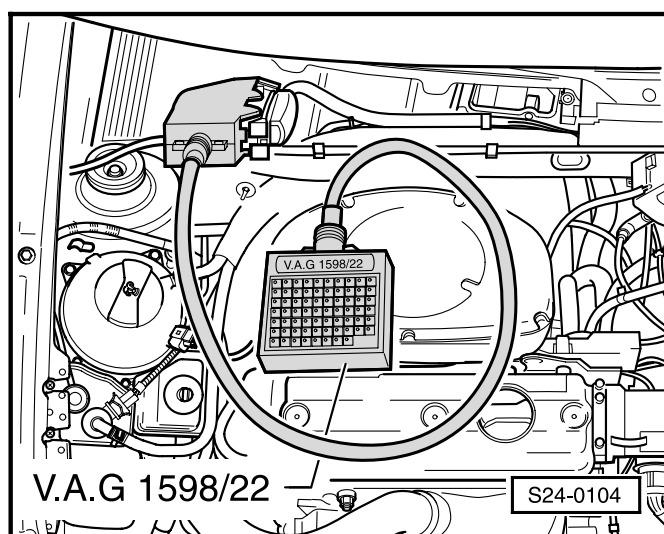
→

◀ Readout on display:
(1...4 = display fields)

- Carry out a road test and have a second person observe the readout in the display.
- Note the readout indicated when car stationary.
- Drive off slowly. The readout should drop.
- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.

If there is no change in the readout:

- Switch off the ignition.



- ◀ Connect test box V.A.G 1598/22 to the control unit wiring loom.
- Set the voltage measurement range on the multimeter and connect it between socket 2+20 of the test box.
- Switch on the ignition.
- Raise the left front wheel.
- Rotate the front wheel and observe the voltage readout.
Specification: fluctuating between 0 and at least 4 V.

If the readout does not change:

- Test the wiring to the speedometer or to the speedometer sender.
- ⇒ Binder 7, Current Flow Diagrams, Fault Finding Programmes and Fitting Locations

Testing coolant temperature sender

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Note:

Resistances for coolant temperature sender -G62- ⇒ page 24-8.

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

HELP

◀ Readout in display:

- Press keys 001 for "Display group number 001" and confirm the entry with the key Q.

Read measured value block 1 →
780 rpm **85 °C** 0,75 V 00000000

◀ Readout in display, e.g.:

- Read off the coolant temperature shown in display block 2.

Readout	Cause	Continue test
-40 °C	Open circuit or short circuit to positive	⇒ page 24-32
128 °C	Short circuit to earth	⇒ page 24-33
approx. coolant temperature ¹⁾	—	only a sporadic fault was detected: ²⁾ ⇒ page 24-34

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

²⁾ Test is only possible if engine is cold.

Continuation of test if readout -40 °C:

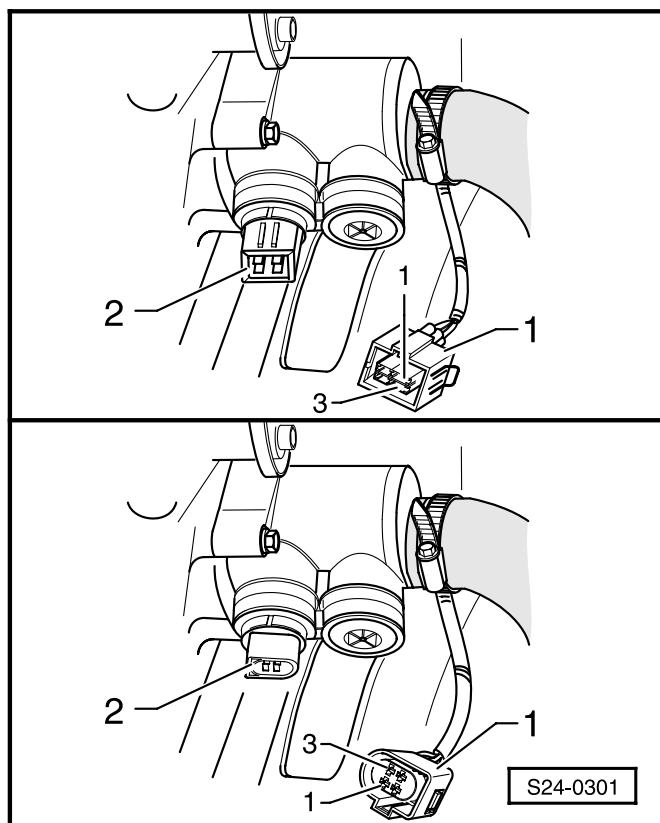
- ◀ Unplug the 4-pin connector -1- from the coolant temperature sender (G62) -2-.
- Bridge contacts 1 + 3 of the connector with the auxiliary cables from V.A.G 1594 A and check the readout in the display.

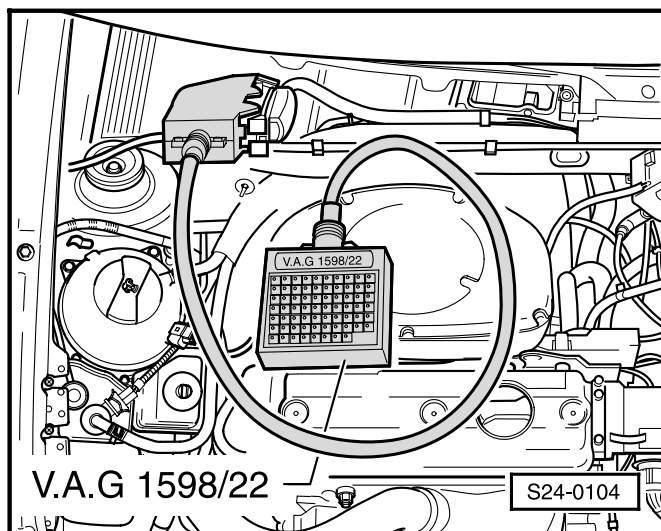
Readout 128 °C:

- Press → key.
- Press keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the coolant temperature sender -2- ⇒ page 24-5, item 20.

Readout -40 °C:

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





- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.
- Test the cable between test box socket 53 and 4-pin connector contact 3 for open circuit on the basis of current flow diagram.
Cable resistance: max. 1.5 Ω
- In addition, test the cable for short circuit to battery positive.
Specification: $\infty \Omega$
- Test the cable between test box socket 67 and 4-pin connector contact 1 for open circuit according to current flow diagram.
Cable resistance: max. 1.5 Ω

If no fault is found in the wiring:

- Replace the 1AV control unit (J382) $\Rightarrow$ page 24-5, item 28.

Continuation of the test if readout 128 °C:

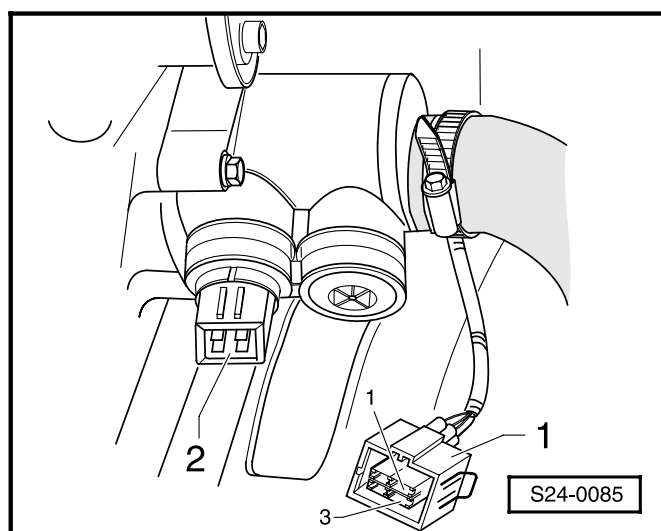
- ◀ - Unplug the 4-pin connector -1- from the coolant temperature sender (G62) -2-.

Readout -40 °C:

- Press the $\rightarrow$ key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the coolant temperature sender -2- $\Rightarrow$ page 24-5, item 20.

Readout 128 °C:

- Press the $\rightarrow$ key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Unplug the connector from the 1AV control unit.



- Test the wiring between control unit connector and 4-pin connector contact 3 for short circuit to cable contact 1 and also to vehicle earth on the basis of the current flow diagram.

Specification: $\infty \Omega$

If no fault is found in the wiring:

- Replace the 1AV control unit (J382) $\Rightarrow$ page 24-5, item 28.

Continuation of test if readout is coolant temperature:

Operational check of sender

- With the engine running, observe the coolant temperature readout in display field 2. The temperature readout should rise evenly without any interruption.

Notes:

- ♦ *If the readout on the vehicle system tester jumps by 2...5 °C, this is caused by the control unit and is not due to a faulty sender.*
 - ♦ *If engine running problems occur in certain temperature ranges and the temperature readout does not rise without an interruption, the temperature signal is occasionally interrupted and the sender should be replaced.*
- Press the $\rightarrow$ key.
 - Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.

Testing intake air temperature sender

Special tools, testers and aids required

- ♦ Vehicle system tester V.A.G 1552 together with cable V.A.G 1551/3
- ♦ Test box V.A.G 1598/22
- ♦ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715

- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram
- ◆ Refrigeration spray (commercially available)

Note:

Resistances for intake air temperature sender -G42- ⇒ page 24-8.

Test procedure

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

Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

- 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

HELP

◀ Readout in display:

- Press the keys 002 for "Display group number 02" and confirm the entry with the key Q.

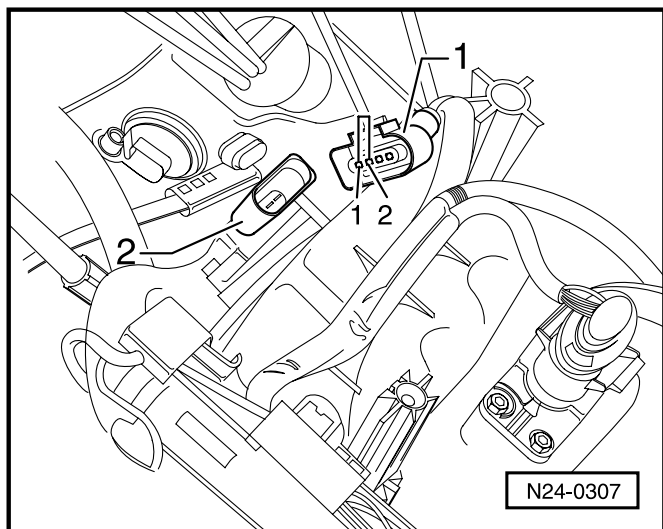
Read measured value block 1 →
0 rpm 0,0 ms 12,5 V **25 °C**

◀ Readout in display, e.g.:

- Read off the intake air temperature shown in display block 4.

Readout	Cause	Continue test
-40 °C	Open circuit or short circuit to positive	⇒ page 24-36
129 °C	Short circuit to earth	⇒ page 24-37
approx. ambient temperature ¹⁾	—	⇒ page 24-38

- ¹⁾ If the temperature displayed is below the ambient temperature of the sender, first of all test the sender cables for contact resistance. Note in this connection that the sender may be heated up when the vehicle is stationary by the radiated heat.



Continuation of test if readout -40 °C:

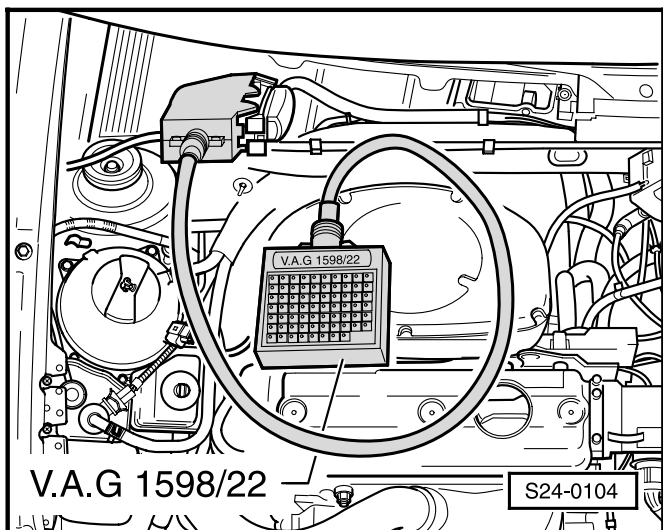
- ◀ - Unplug the connector -1- from the intake air temperature sender (G42) with the intake manifold pressure sender (G71) -2-.
- Bridge the contacts 1 + 2 of the connector using auxiliary cables from V.A.G 1594 A and at the same time check the readout in the display.

Readout 129 °C:

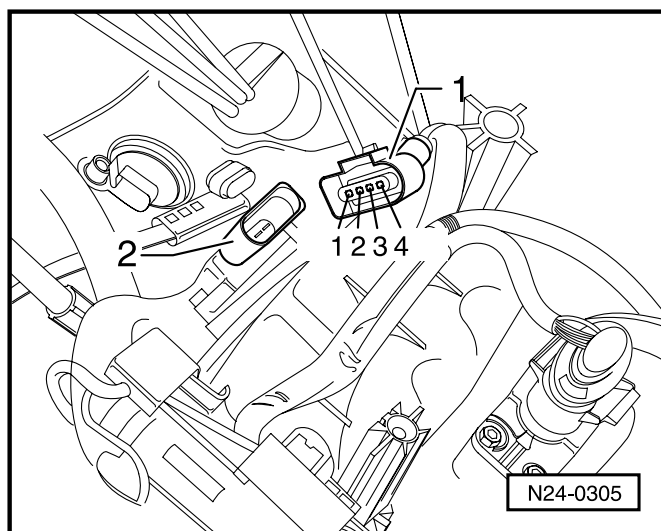
- Press → key.
- Press keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the intake air temperature sender with intake manifold pressure sender -2- ⇒ page 24-6, item 1.

Readout -40 °C:

- Press the → key.
- Press keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- ◀ - Connect test box V.A.G 1598/22 to the wiring loom of the control unit.
- Test the cable between test box socket 54 and 4-pin connector contact 2 for open circuit on the basis of the current flow diagram.
Cable resistance: max. 1.5 Ω
- Unplug the connector from the engine control unit.
- Test the cable in addition for short circuit to battery positive.
Specification: ∞ Ω
- Test the cable between test box socket 67 and 4-pin connector contact 1 for open circuit on the basis of the current flow diagram.
Cable resistance: max. 1.5 Ω



If no fault is found in the cable:



- Replace the engine control unit (J382)
⇒ page 24-5, item 28.

Continuation of test if readout 129 °C:

- ◀ - Unplug the connector -1- from the intake air temperature sender (G42) with intake manifold pressure sender (G71) -2-.

Readout -40 °C:

- Press the → key.
- Press keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Replace the intake air temperature sender with intake manifold pressure sender -2-
⇒ page 24-6, item 1.

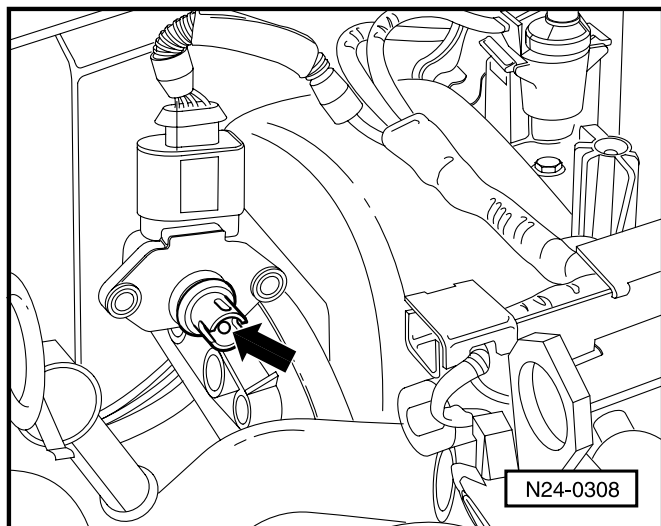
Readout 129 °C:

- Press the → key.
- Press keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.
- Unplug the connector from the engine control unit.
- Test the cables to the control unit connector at the 4-pin connector contact 2 for short circuit to cable of contact 1 and also to vehicle earth.

Specification: $\infty \Omega$

If no fault is found in the wiring:

- Replace the engine control unit (J382)
⇒ page 24-5, item 28.



Continuation of test if readout is ambient temperature:

- ◀ - Remove the intake air temperature sender with intake manifold pressure sender (the connector remains plugged in).
- Note the intake air temperature shown in display block 4.
- Spray the sender with a commercially available refrigeration spray and observe the temperature readout. The temperature readout should drop.
- Press the → key.
- Press keys 0 and 6 for the function „End data transfer“ and confirm the entry with the key Q.

Testing voltage supply for control unit

Special tools, testers and aids required

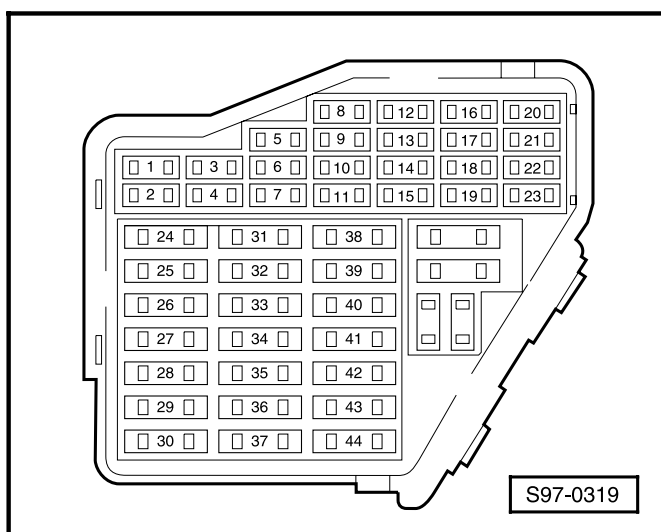
- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Battery voltage at least 11 V
- Alternator o.k.
- ◀ ● Fuses 10 and 29 o.k.

Test procedure

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



Test of vehicle systems
Select function XX

HELP

◀ Readout in display:

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

Read measured value block
Enter display group number XXX

HELP

◀ Readout in display:

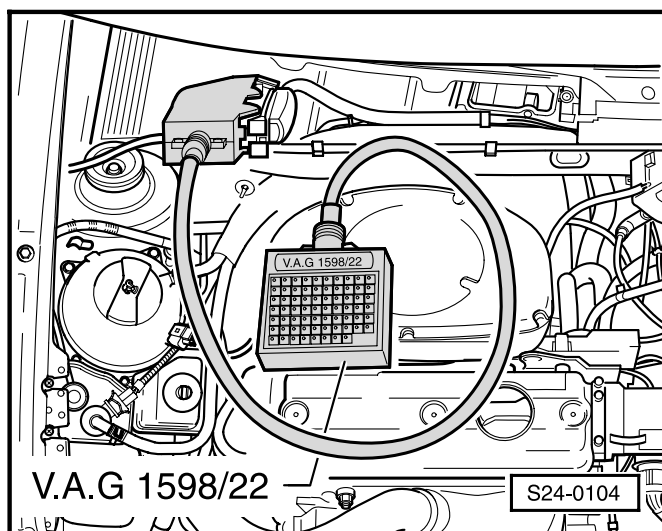
- Press keys 002 for "Display group number 02" and confirm the entry with the key Q.

Read measured value block 2
800 rpm 3,31 ms **14 V** 25 °C →

◀ Readout in display, e.g.:

- Read off the figures shown in display block 3.
Specification: approx. battery voltage
- Press the → key.
- Press keys 0 and 6 for the function "End data transfer" and confirm the entry with the key Q.
- Switch off the ignition.

If the specification is not achieved:



Test voltage supply of terminal 30

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom of the control unit.
- Use the multimeter and auxiliary cables from V.A.G 1594 A to measure the supply voltage between sockets 2+3 of the test box:
Specification: at least 11 V

Test voltage supply of terminal 15

- Switch the ignition on.
- Use the multimeter and auxiliary cables from V.A.G 1594 A to measure the supply voltage between sockets 2+1 of the test box:
Specification: at least 11 V

If the specifications are not achieved:

- Test the cable connections to the relay plate on the basis of the current flow diagram.

Adapting engine electronics control unit to the electronic immobiliser

Special tools, testers and aids required

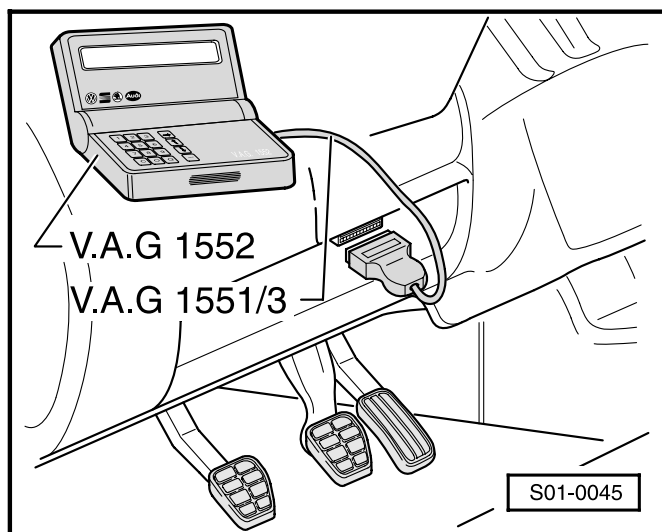
- ♦ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test condition

- Authorized car key available

Procedure

- ◀ - Connect vehicle system tester V.A.G 1552.
- Switch on the ignition.
- Press keys 1 and 2 for the address word "Immobiliser" and confirm the entry with the key Q.
- Press the → key.



1V1919033C A+-KOMBIINSTR: VDO V08 →
Coding 02142 WSC99132

◀ Readout in display, e.g.:

- Press the → key.

IMMO-IDENTNR: SKZ720V0040171 →

◀ Readout in display, e.g.:

- Press the → key.

Test of vehicle systems HELP
Select function XX

◀ Readout in display:

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

Adaptation
Enter channel number XXX

◀ Readout in display:

- Press key 0 three times for "Channel number 0" and confirm the entry with the key Q.

Adaptation Q
Erase learned values?

◀ Readout in display:

- Confirm the entry with the key Q.

Adaptation
Learned values are erased →

◀ Readout on display:

- Terminate adaptation by pressing the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Switch off the ignition.

Note:

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

Testing injectors

Testing actuation

Special tools, testers and aids required

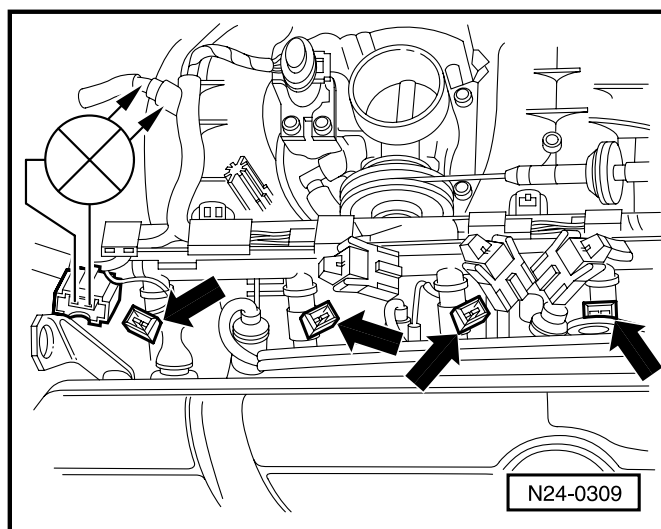
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Hall sender o.k.
- Fuel pump relay o.k.

Test procedure

- Remove the air filter ⇒ page 24-8, Fig. 3.
- ◀ - Unplug the connectors from the injectors -arrow-.
- Connect the diode test lamp V.A.G 1527 using auxiliary cables from V.A.G 1594 A to the contacts of the connector of cylinder 1.



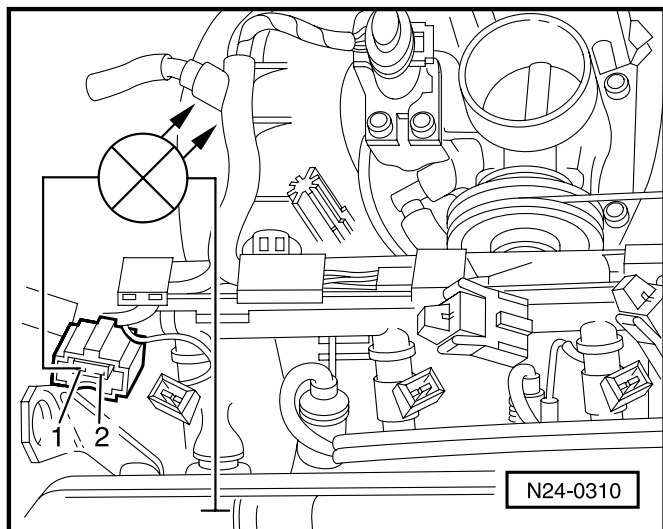
- Operate the starter.
The LED should flicker.
- Repeat the test at the connectors of the injectors of cylinders 2...4.

If the LED does not flicker at any of the cylinders:

- ◀ - Connect the diode test lamp to connector of cylinder 1, contact 1 and earth.
- Operate the starter.
The LED should come on.

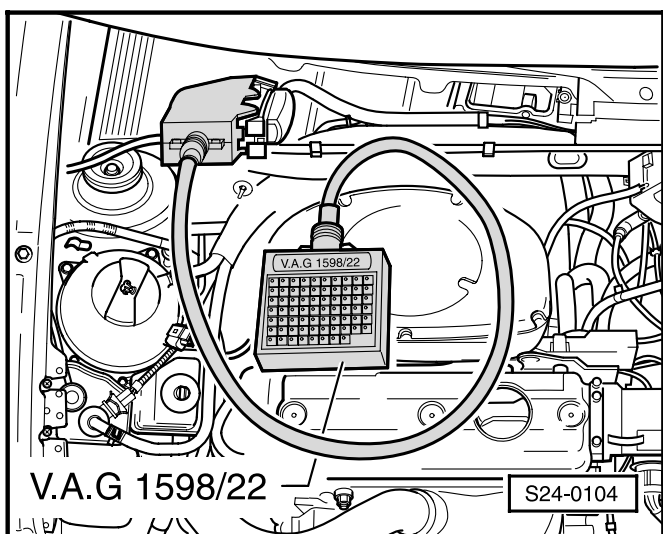
If the LED does not come on:

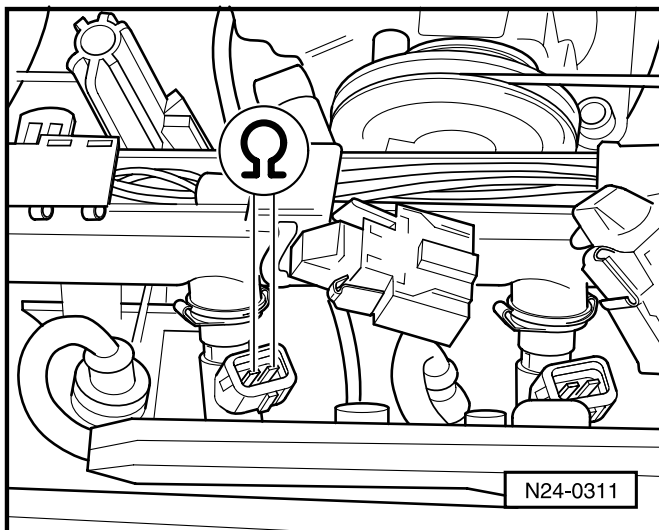
- Test the wiring between 2-pin connector contact 1 and fuel pump relay (J17) for open circuit on the basis of the current flow diagram.
Cable resistance: max. 1.5 Ω



If the LED does not flicker at one or several cylinders:

- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.
- Test the wiring between test box and the connectors of the injectors for open circuit on the basis of the current flow diagram.
Connector cyl. 1, contact 2+socket 3
Connector cyl. 2, contact 2+socket 80
Connector cyl. 3, contact 2+socket 58
Connector cyl. 4, contact 2+socket 65
Cable resistance: max. 1.5 Ω
- In addition, test the wiring for short circuit to each other.
Specification: $\infty \Omega$
- Test the wiring between contacts 1 of the connectors of the injectors for open circuit.
Cable resistance: max. 1.5 Ω
- In addition, test the wiring for short circuit to each other.
Specification: $\infty \Omega$





Testing the resistances of the injectors

- Test the resistance of the injectors between the contacts.
Specification: 14...17 Ω

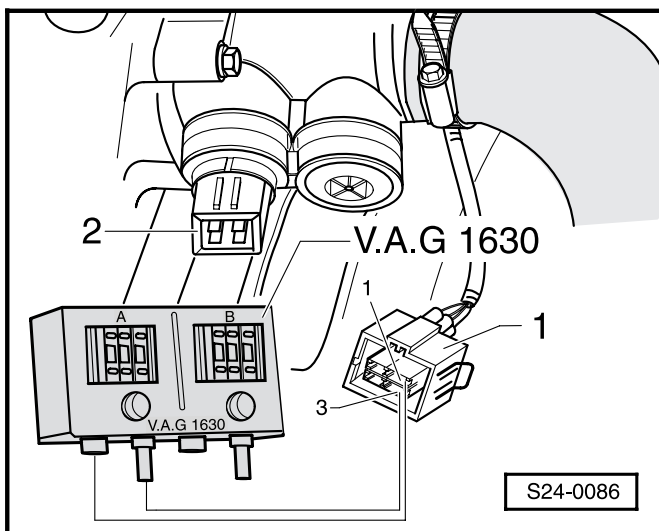
Testing spray pattern and leaks

Special tools, testers and aids required

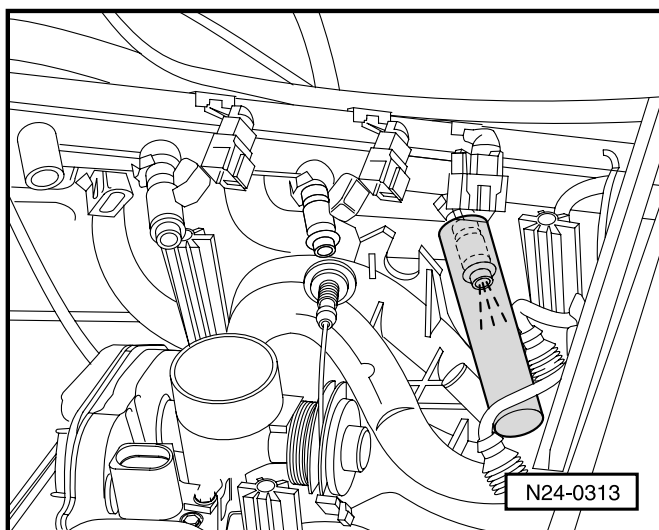
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Digital potentiometer V.A.G 1630
- ◆ Tester for injected quantity V.A.G 1602

Test procedure

- Unplug the 3-pin connector from the ignition transformer.



- Unplug the 4-pin connector -1- from the coolant temperature sender (G62) -2-.
- Connect the digital potentiometer V.A.G 1630 to contacts 1+3 of the connector using auxiliary cables from V.A.G 1594 A and set the connected side to 15 kΩ.
- Unplug the connectors from the throttle valve control unit, from the oil pressure switch and the intake manifold pressure sender and unclip the wiring loom at the intake manifold and at coolant thermostat housing.
- Remove the fuel rail complete with all injectors from the intake manifold (the fuel hoses remain connected).



- Hold a small vessel below the injector to be tested and unplug the connectors from the remaining injectors.
- Have a second person operate the starter. The injection valve should eject a pulsating spray.
- Repeat the test at the other injectors. Each time, ensure that only the injector to be tested is connected.

- Following this, test the injectors for leaks. No more than 2 drops/minute should flow out of each injector.

Note:

When installing the injectors, ensure that the O-rings are not damaged.

Testing fuel pressure regulator and holding pressure

The fuel pressure regulator regulates the fuel pressure as a function of 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

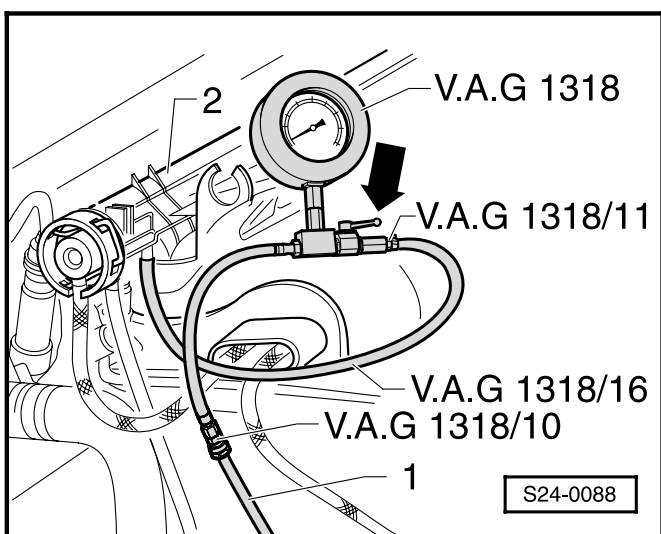
Test condition

- Delivery of fuel pump o.k.; testing:
⇒ Engine - Mechanical Components; repair group 20; Removing and installing parts of the fuel supply system; Testing fuel pump.

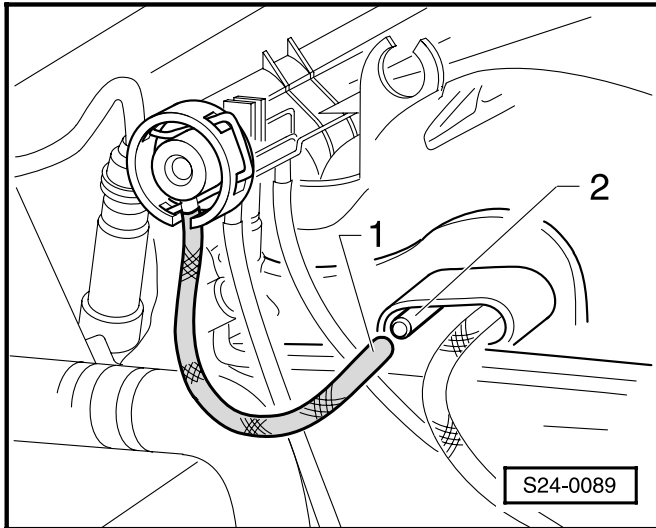
Test procedure

Important!

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

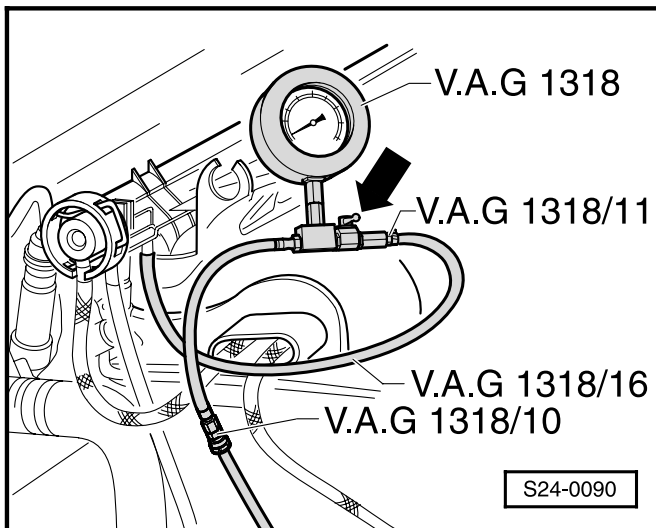


- ◀ - Detach the fuel feed hose (with white marking) -1- from the fuel rail -2-.
- Connect the pressure measuring device V.A.G 1318 to the hose using adapter 1318/10 and to the feed pipe using adapters 1318/11 and /16.
- Open the shutoff cock of the pressure measuring device. The lever points in the direction of flow -arrow-.



- Start the engine and run at idling speed.
- Measure the fuel pressure.
Specification: about 2.5 bar
- ◀ - Detach the vacuum hose from the fuel pressure regulator -1- at the intake manifold -2-. The fuel pressure should rise to about 3.0 bar.
- Switch off the ignition.
- Test for leaks and test holding pressure by observing the pressure drop on the gauge. After 10 minutes, the pressure indicated should be at least 2 bar.

If the holding pressure drops below 2 bar:

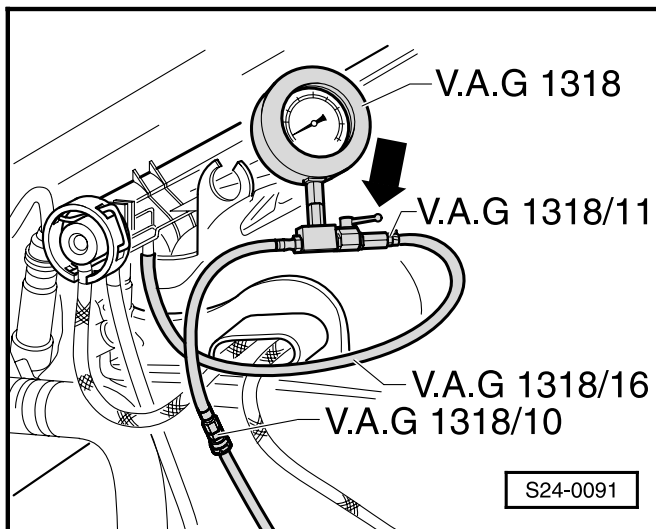


- Start the engine and run at idling speed.
- ◀ - After the pressure has built up, switch off the ignition. At the same time, you have to close the shutoff cock of the pressure measuring device V.A.G 1318 (lever at right angles to direction of flow -arrow-).
- Observe the pressure drop on the gauge.

If the pressure does not drop:

- Test the non-return valve of the fuel pump.
- ⇒ Engine - Mechanical Components; Removing and installing parts of the fuel supply system; Testing non-return valve of the fuel pump.

If the pressure again drops:



- ◀ - Open the shutoff cock of the pressure measuring device V.A.G 1318 (lever in direction of flow -arrow-).
- Start the engine and run at idling speed.
- After the pressure has built up, switch off the ignition. At the same time, you have to clamp the return flow hose (with blue marking) -3- tight.

If the pressure does not drop:

- Replace the fuel pressure regulator ⇒ page 24-6, item 4.

If the pressure again drops:

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

Note:

Before disconnecting the pressure measuring device, release the fuel pressure by opening the shutoff cock. Hold a vessel in front of the connection when carrying out this step.

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 drawn in 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 in a change in the lambda probe value.*
- ◆ *It is essential to adhere to the safety precautions stated on the can.*
- Connect the vehicle system tester V.A.G 1552 and select the control unit for engine electronics with the „address word“ 01. The engine should be idling during this step. (Connecting vehicle system tester and selecting control unit for engine electronics ⇒ page 01-2.)

Test of vehicle systems
Select function XX

HELP

◀ Readout on 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 XX

HELP

◀ Readout on display:

- Press the keys 0 and 1 for „display group number 01“ and confirm the entry with the key Q.

Read measured value block 1
1 2 3 4

→

◀ Readout on display:
(1...4 = display fields)

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

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

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.

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

- Press the → key.
- Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
- Inspect the sprayed point of the intake system for leaks and rectify the fault.

Testing intake air preheater

Testing control flap

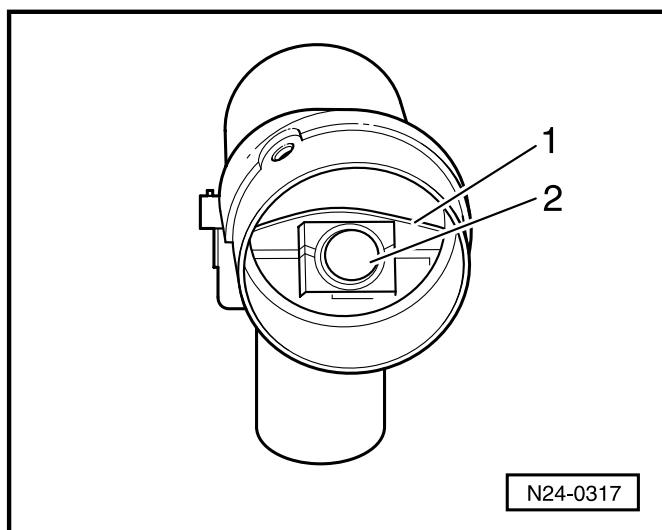
- Remove the intake connection fitting of the air filter.

◀ - Check the position of the control flap -1-.

- ◆ The flap should seal off the warm air connection at a temperature of more than +23 °C.
- ◆ The flap should open the warm air connection at a temperature of +10 °C.

Note:

The operation of the thermocouple -2- can be easily checked by spraying it with commercially available refrigerant spray.



Testing activated charcoal filter solenoid valve (N80)

Special tools, testers and aids required

- ◆ Vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Fuse 132 of the fuse holder on the battery must be o.k.
- ◀ ● Fuse 43 must be o.k.

Inspecting for leaks

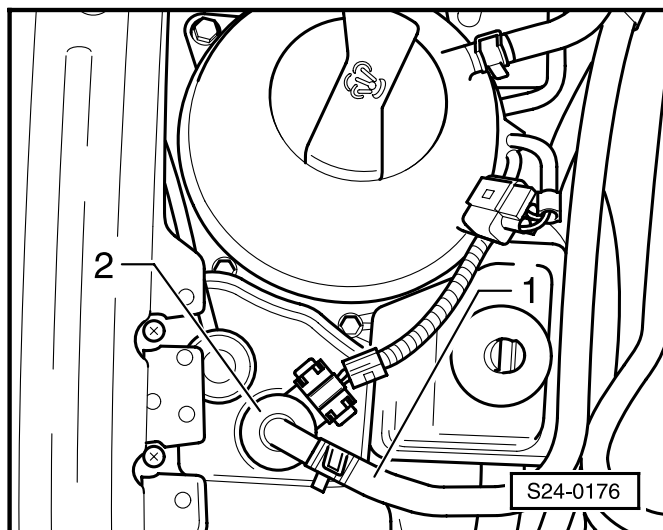
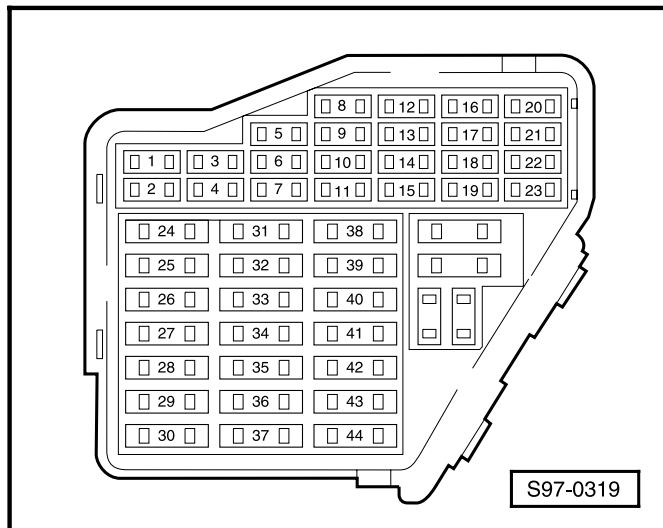
The solenoid valve is closed when de-energized.

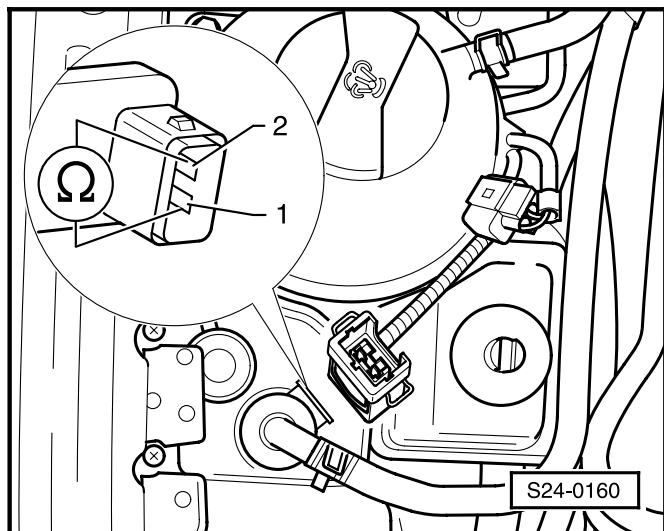
- ◀ - Detach the hose -1- from the solenoid valve -2- for the activated charcoal filter (N80).
- Push the auxiliary hose onto the free valve connection.
- Insert the connector for the solenoid valve.
- Initiate final control diagnosis (function 03) and select the activated charcoal filter solenoid valve ⇒ page 01-12.
- Check that the solenoid valve opens and closes correctly by blowing into the auxiliary hose during final control diagnosis; replace solenoid valve if necessary.

Testing -N80 (ACF valve)

Warning!

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





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

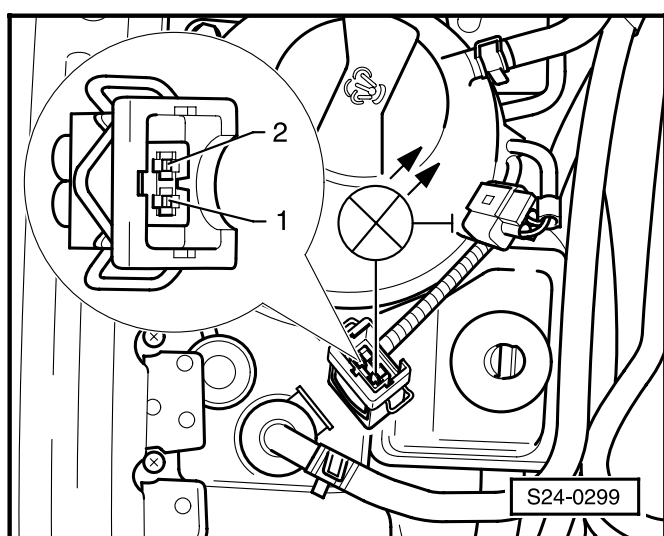
Specification: 22...30 Ω

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

Testing voltage supply of ACF valve

Note:

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

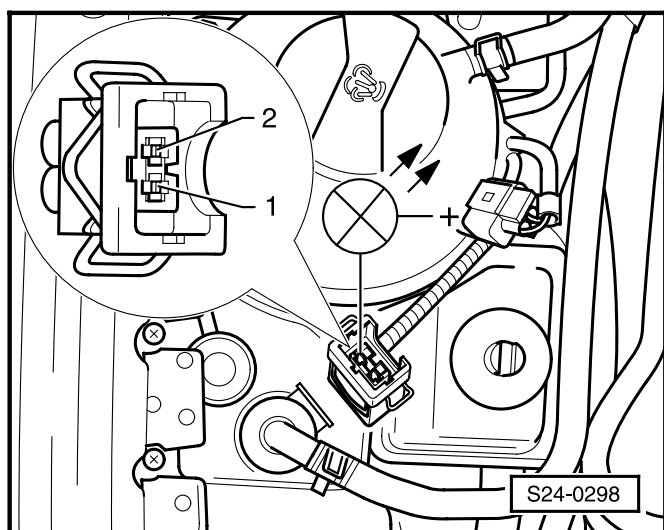


- Unplug the connector at the ACF valve.
- ◀ - Connect the diode test lamp between contact 1 of the connector and engine earth.

- Start the engine.

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 the fuse for continuity, and repair if necessary.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If the cable connection is o.k., test fuel pump relay ⇒ page 24-52.



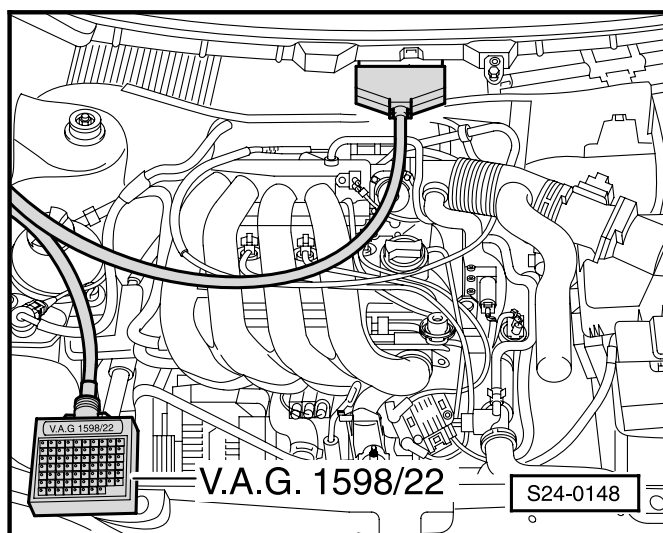
Testing actuation of the ACF valve

- ◀ - Connect the diode test lamp between contact 2 and positive (+) of battery.
- Initiate final control diagnosis (function 03) and select the activated charcoal filter solenoid valve (N80) ⇒ page 01-12 - Earth point, in left engine compartment

Note:

It is not necessary to take out the fuel pump relay and to bridge the contacts for this test.

Specification: The diode test lamp must flash.



- ◀ - If the diode test lamp does not flash or comes on and remains on:
Connect the test box V.A.G. 1598/22 to the wiring loom to the engine control unit.
- If the diode test lamp comes on and remains on, test the cable from contact 2 for short to earth.
- If the diode test lamp does not flash, test the cable from contact 2 of the connector to socket 15 of the test box for continuity and also for short circuit to positive.
- If there is neither an open circuit in the wiring nor a short circuit, replace engine control unit
⇒ page 24-55.

Testing fuel pump relay and actuation

Special tools, testers and aids required

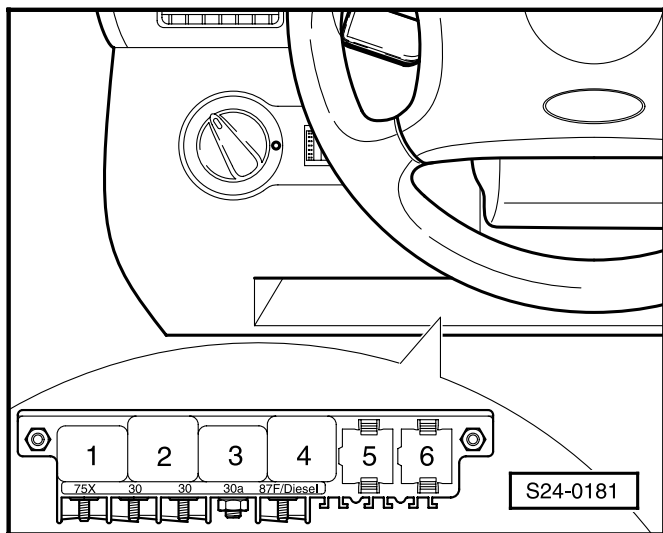
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter, e.g. V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Diode test lamp e.g. V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test condition

- Fuse 132 of the fuse holder on the battery must be o.k.

Note:

- ◀ The fuel pump relay is located in the electrical centre inside the vehicle on the driver's side behind the storage compartment in the footwell; relay position 4.

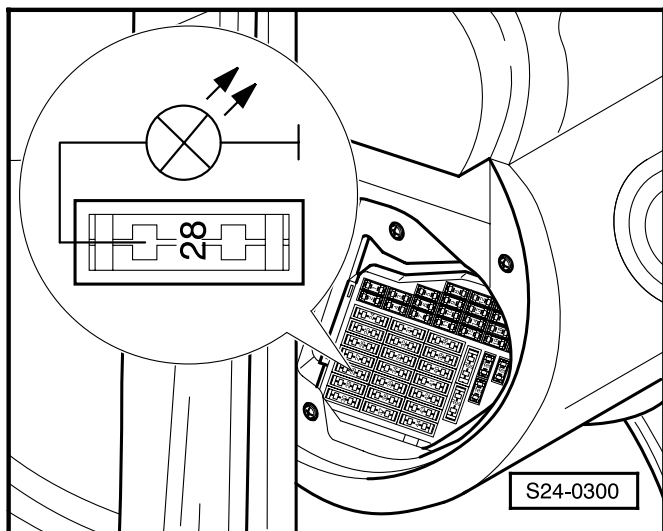


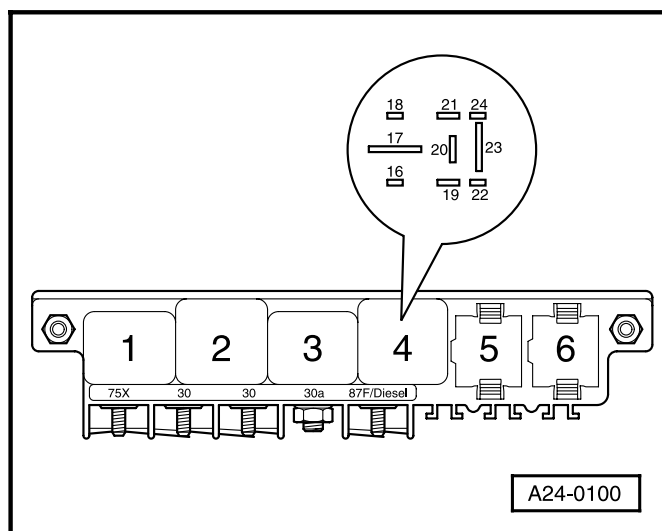
A - Operational test of fuel pump relay -J17

- ◀ - Remove fuse 28 from fuse holder and connect diode test lamp between earth and one of the two contacts of fuse 28 at the fuse holder.
- Briefly operate the starter.

The fuel pump relay must close (can be felt and heard); the diode test lamp must come on.

- If the diode test lamp does not come on although the fuel pump relay closes, repeat the test at the second contact.





- ◀ - If the diode test lamp again does not come on, test the cable between contact 23 (relay position 4) and fuse 28 for continuity, and rectify any open circuit.
⇒ Current Flow Diagrams, Electrical Fault Finding and Fitting Locations binder
- If an open circuit is detected, replace the fuel pump relay.
- If the relay does not operate, test actuation of fuel pump relay ⇒ page 24-53.
- If the power supply and actuation are o.k., replace fuel pump relay.

B - Testing voltage supply and actuation of fuel pump relay

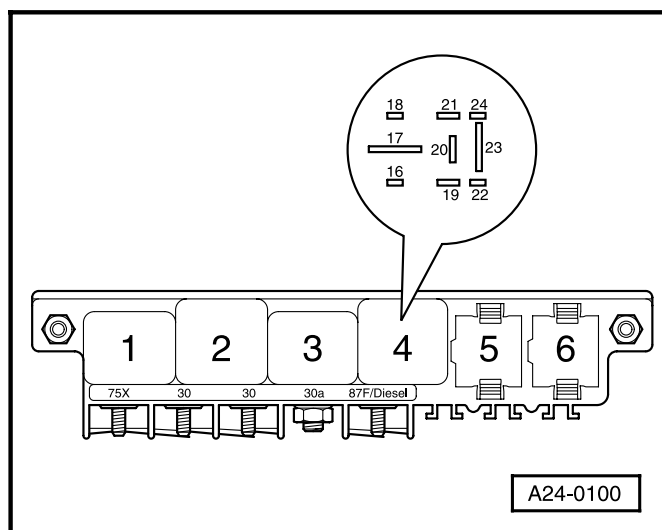
- Remove the fuel pump relay J17 from the relay base, relay position 4.

Testing voltage supply

- ◀ - Connect the hand-held multimeter for voltage measurement to contact 19 (positive) and earth and then to contact 17 (positive) and earth.
- Switch on the ignition. The relay closes for approx. 10 s, engine not started.

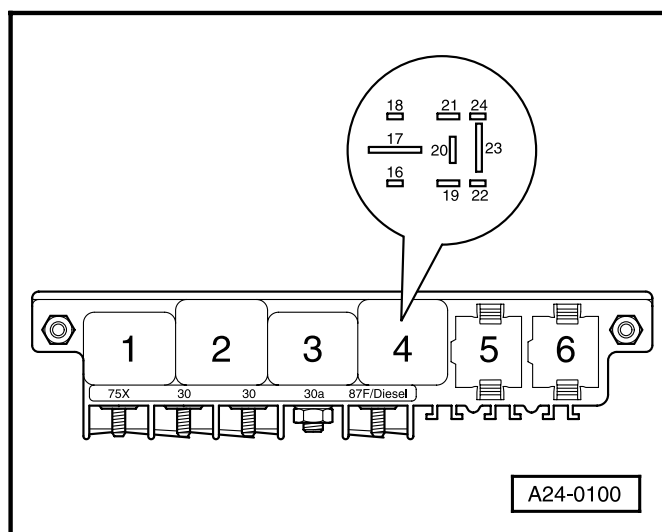
Specification: approx. battery voltage

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



Testing actuation

- ◀ - Connect diode test lamp to contact 16 (earth) and to positive.
- Diode test lamp must come on and remain on when engine is started.

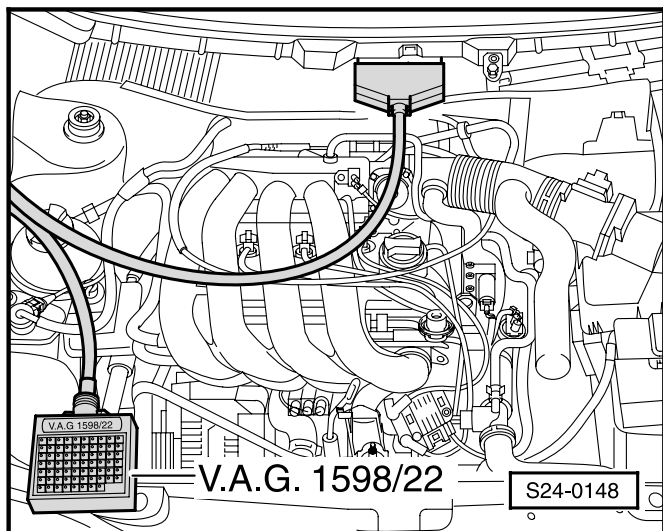


Note:

Diode test lamps with a low current consumption do not go out fully but continue displaying a weak light until the starter is operated.

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

- ◀ - Connect test box V.A.G 1598/22 to the wiring loom to the engine control unit.
- Connect hand-held multimeter between contact 16 of the relay base and socket 4 of the test box and test the cable connection for continuity.
- If there is no open circuit in the cable connection and the diode test lamp does not come on, replace engine control unit
⇒ page 24-55.
- If the actuation of the fuel pump relay is o.k., replace fuel pump relay.
- Insert fuse 28.



Replacing engine control unit

Note:

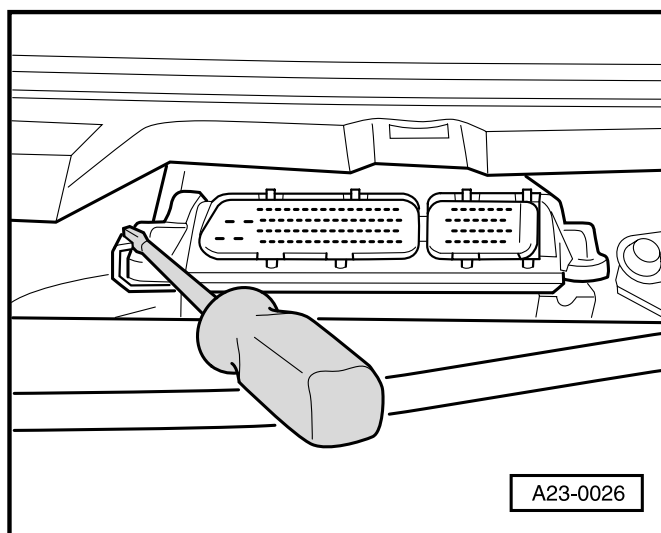
When the connector is unplugged from the engine control unit, the values are erased; the contents of the fault memory are retained.

Removing

- Switch off the ignition.
- Remove cover of plenum chamber ⇒ Body Removal and Fitting Work, Repair Group 66.

Note:

- ◆ *It is not necessary to remove the control unit in order to connect the test box V.A.G 1598/22 (for testing parts).*
- Unlock the connector to the engine control unit and separate connector.



- ◀ Use a screwdriver to push the catch on both sides to the side and pull out the engine control unit.

Installing

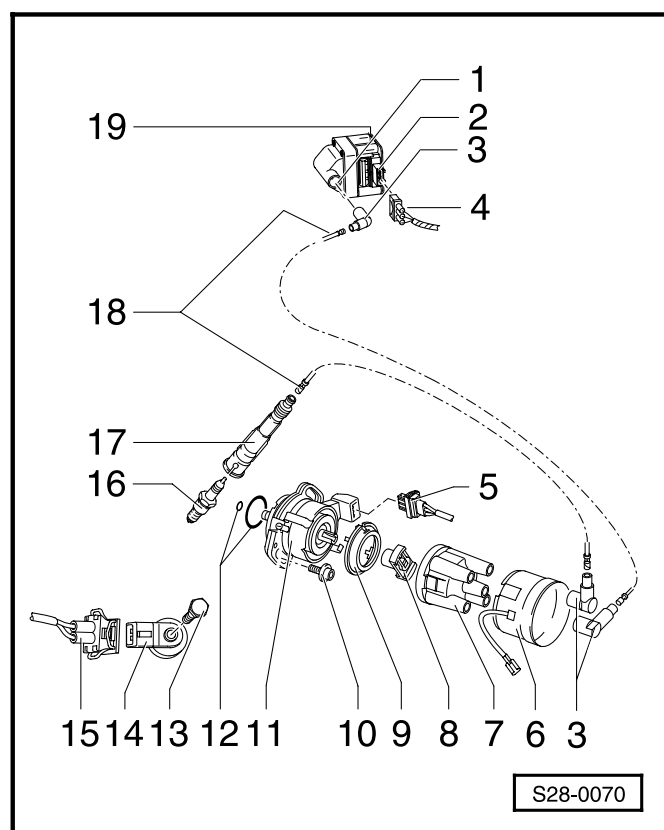
Installation is carried out in the reverse order.

Notes:

- ◆ *During the initial phase of reading the memory during basic setting of the engine, slightly irregular idling and slight jolts when driving are possible.*
- ◆ *Carry out the following steps after installing the engine control unit:*
 - Perform basic setting of the new engine control unit ⇒ page 24-10.
 - Adapt engine control unit to the electronic immobiliser ⇒ page 24-40.

Servicing ignition system

Survey of ignition components



Notes:

- ◆ Only the components specifically relating to the ignition system are dealt with here. For other components of the fuel injection and ignition system ⇒ *Repair Group 24*.
- ◆ The control unit for the fuel injection and ignition system is equipped with self-diagnosis.
- ◆ Components marked with * are tested by self-diagnosis ⇒ *page 01-4, Interrogating fault memory*.
- ◆ A voltage of at least 11.5 V is required for proper operation of the electrical components.
- ◆ When carrying out certain tests it is possible that the control unit detects a fault and stores it. For this reason, interrogate the fault memory and erase it if necessary after completing all the tests and repair work ⇒ *page 01-4, Interrogating fault memory*.

Safety precautions ⇒ *page 28-3*

Setting data, spark plugs ⇒ *page 28-3*

1 - Ignition transformer (N152)

- ◆ Testing ⇒ *page 28-7*

2 - Output stage for ignition transformer (N157)

- ◆ Testing ⇒ *page 28-7*
- ◆ Only version attached with screws can be replaced separately

3 - Interference suppression connectors

- ◆ 0.6...1.4 kΩ

4 - Connector

5 - Connector, 3-pin

- ◆ For Hall sender

6 - Screening cap

7 - Distributor cap

- ◆ Pay attention to splits and traces of leakage currents
- ◆ Inspect wear of contacts
- ◆ Clean before fitting on
- ◆ Inspect carbons for wear and clearance

8 - Distributor rotor arm

- ◆ Marking: R1
- ◆ 0.6...1.4 kΩ

9 - Dust cap

10 - Internally serrated screw, 65 Nm

11 - Distributor with Hall sender (G40)*

- ◆ Disassembling and assembling ⇒ *page 28-2*
- ◆ Testing and setting ignition timing ⇒ *page 28-4*
- ◆ Testing Hall sender ⇒ *page 28-5*

12 - O-ring

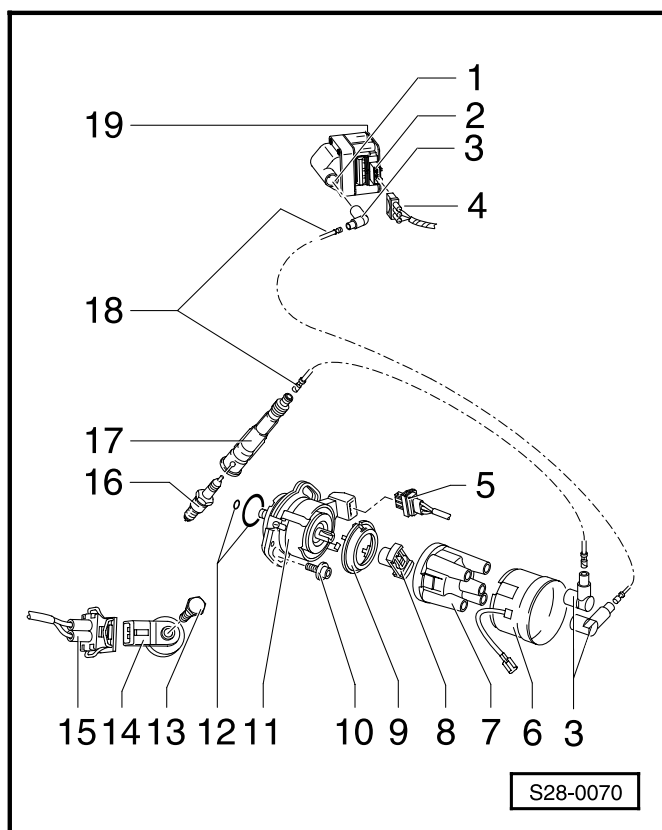
- ◆ Replace if damaged

13 - 20 Nm

- ◆ Tightening torque affects proper operation of knock sensor

14 - Knock sensor 1 (G61)*

- ◆ Contacts of sensor and of connector gold-plated

**15 - Connector, 2-pin**

- ◆ For knock sensor

16 - Spark plug, 25 Nm

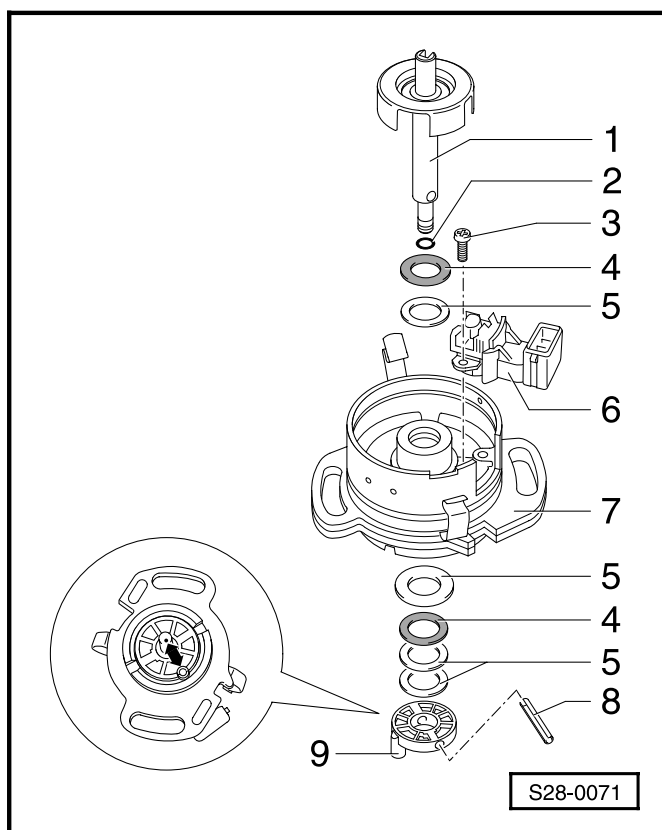
- ◆ Type and electrode gap ⇒ page 28-3

17 - Spark plug connector

- ◆ 4...6 kΩ

18 - Ignition cable

- ◆ Test for continuity

19 - Holder**Disassembling and assembling distributor****1 - Distributor shaft**

- ◆ With orifice plate for Hall sender
- ◆ Pull out after removing roll pin -8-

2 - O-ring

- ◆ Replace if damaged

3 - 3 Nm**4 - Plastic washer****5 - Shim(s)****6 - Hall sender (G40)**

- ◆ Testing ⇒ page 28-5

7 - Distributor housing**8 - Roll pin****9 - Socket**

- ◆ Before removing, mark position of driver stud to shaft -1- (arrow)

Safety precautions

Pay attention to the following precautions 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 connect cables of the fuel injection and ignition system - not even of test equipment - unless the ignition is switched off.
- ◆ To operate the engine at starting speed without it actually starting, e.g. when testing compression pressure, unplug the connector from the Hall sender (distributor).
- ◆ Do not connect a capacitor to terminal 1 (-).
- ◆ Do not replace the 1 k Ω distributor rotor arm (identification: R1) with a different rotor arm; not even for radio interference suppression.
- ◆ Use only 1 k Ω resistors and 5 k Ω spark plug connectors at the high voltage cables for interference suppression.

Setting data, spark plugs

Engine code letters	AEE
Ignition timing¹⁾	
Test value	
Setting	
Engine speed ²⁾	
Firing order	1 - 3 - 4 - 2
Spark plugs¹⁾	
Manufacturer's designation	
Electrode gap	
Tightening torque	25 Nm

1) For the current values and also spark plug change intervals
⇒ Binder 7, Inspection and Maintenance

2) Engine speed is increased by the 1AV control unit in the function „04 basic setting“.

Testing and setting ignition timing

Special tools, testers and aids required

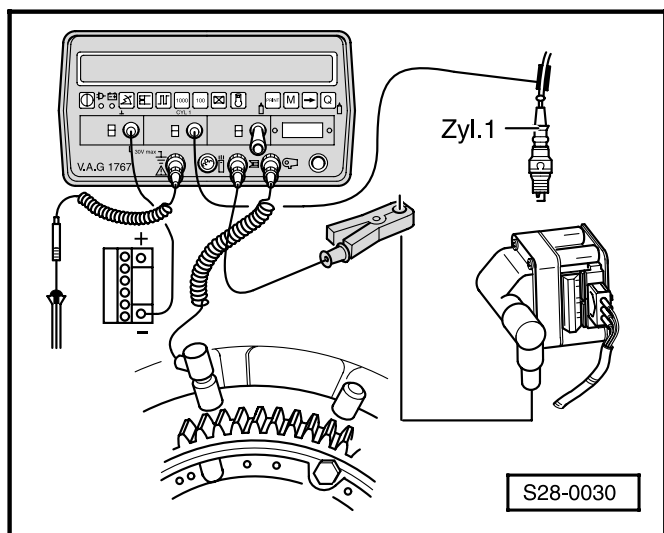
- ♦ Vehicle system tester V.A.G 1552 together with cable V.A.G 1551/3
- ♦ Ignition tester V.A.G 1767 or V.A.G 1367 together with trigger clamp V.A.G 1367/8

Test conditions

- Coolant temperature at least 80 °C
- No fault stored in fault memory
⇒ page 01-4, Interrogating fault memory

Test procedure

- ◀ - Connect the ignition tester V.A.G 1767 or the ignition tester V.A.G 1367 with the trigger clamp V.A.G 1367/8.
- Connect the vehicle system tester V.A.G 1552 and select the control unit for engine electronics with the „address word“ 01. The engine should be idling for this step. (Connecting vehicle system tester and selecting control unit for engine electronics ⇒ page 01-2.)



Test of vehicle systems
Select function XX

HELP

◀ Readout on display:

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

Basic setting
Enter display group number XX

HELP

◀ Readout on display:

- Press the keys 0 and 1 for „display group number 01“ and confirm the entry with the key Q.

System in basic setting 1

1 2 3 4

→

◀ Readout on display:
(1...4 = display fields)

Do not continue with the test until the 8-digit numerical block 00000000 appears in display field 4.

Note:

*If one or several places in display field 4 indicate a 1, the test conditions have not been met:
⇒ page 01-19; Meaning of the digits in the 8-digit numerical block.*

- The 1AV control unit increases idling speed to 1150...1400 rpm.
 - Test ignition timing.
Test value: 3...8 ° before TDC¹⁾
 - Set ignition timing, if necessary, by turning the distributor.
Setting: 6±1 ° before TDC¹⁾
- 1) Current values:
⇒ Binder 7, Inspection and Maintenance
- Press the → key.
 - Press the keys 0 and 6 for the function „end data transfer“ and confirm the entry with the key Q.
 - Test the basic setting, if necessary ⇒ page 24-10.

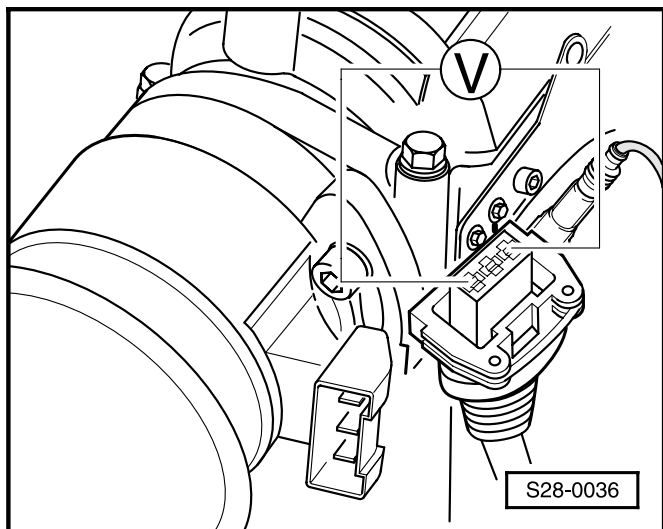
Testing Hall sender

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

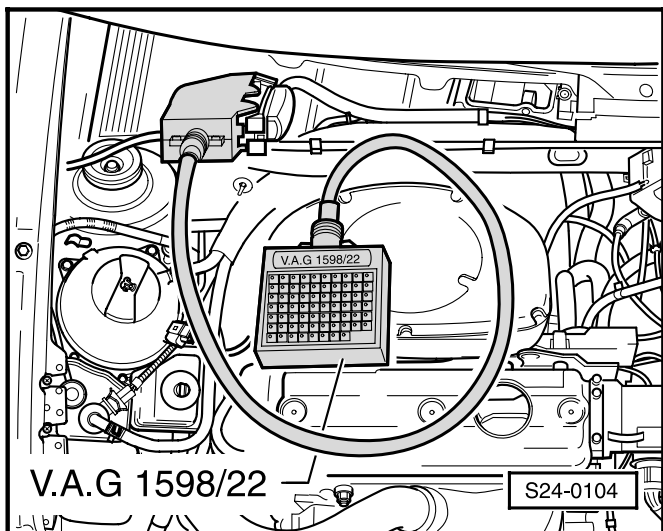
Test condition

- Fault at Hall sender recognised by the self-diagnosis.



Test procedure

- Unplug the connector at the Hall sender (distributor).
- ◀ - Connect the multimeter for voltage measurement to the outer contacts of the connector using auxiliary cables from V.A.G 1594.
- Switch on the ignition.
Specification: at least 9 V
- Switch off the ignition.



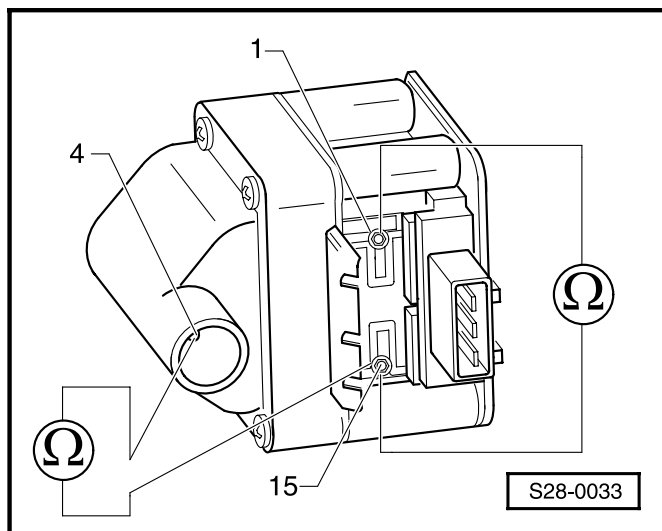
- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.
- Test the wiring between test box and connectors for open circuit on the basis of the current flow diagram.
Contact 1+socket 67
Contact 2+socket 63
Contact 3+socket 56
Cable resistance: max. 1.5 Ω
- In addition, test the wiring for short circuit to each other.
Specification: $\infty \Omega$

If no fault is found in the wiring, and voltage was present between contacts 1+3:

- Replace the Hall sender $\Rightarrow$ page 28-2, item 6.

If no fault is found in the wiring and no voltage was present between contacts 1+3:

- Replace the 1AV control unit (J382) $\Rightarrow$ page 24-5, item 28.



Testing ignition transformer

Special tools, testers and aids required

- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594 A

Test procedure

- Unplug the connector and ignition cable from the ignition transformer (N152).
- ◀ - Test the primary resistance between terminals 1 and 15.
Specification: 0.5...1.2 Ω
- Test the secondary resistance between terminals 4 and 15.
Specification: 3...4 kΩ

If the specifications are not achieved:

- Replace the ignition transformer ⇒ page 28-1, item 1.

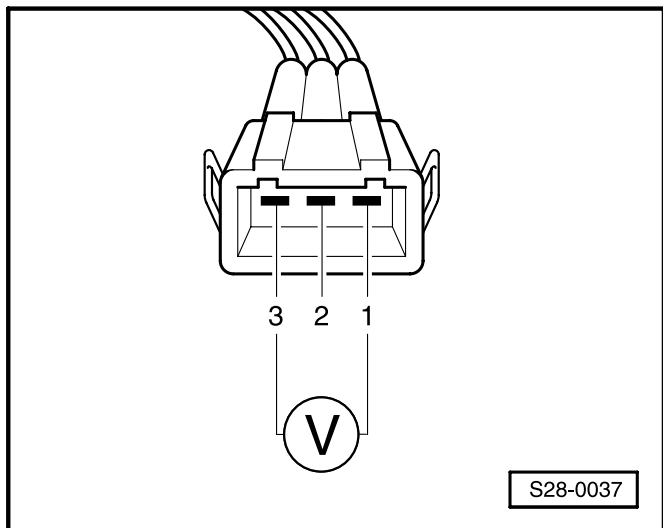
Testing ignition transformer output stage

Special tools, testers and aids required

- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 A or multimeter V.A.G 1715
- ◆ Diode test lamp V.A.G 1527
- ◆ Adapter cable set V.A.G 1594 A
- ◆ Current flow diagram

Test conditions

- Hall sender o.k.
- Ignition transformer o.k.

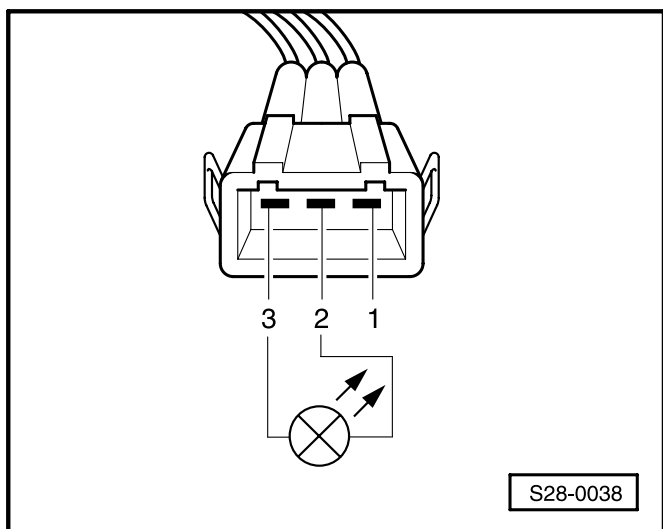


Testing voltage supply

- Unplug the 3-pin connector from the ignition transformer.
- ◀ - Connect the multimeter with auxiliary cables from V.A.G 1594 A for voltage measurement to contacts 1+3 of the unplugged connector.
- Switch on the ignition.
Specification: at least 11 V

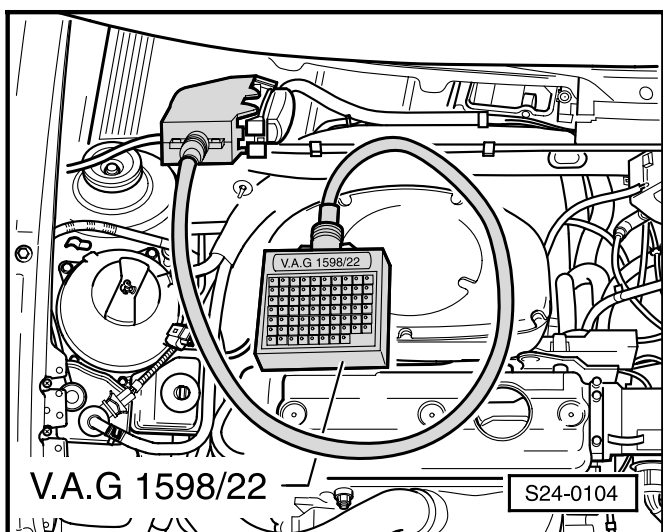
If no voltage is present:

- Switch off the ignition.
- Test the wiring between 3-pin connector contact 1 and earth for open circuit on the basis of the current flow diagram.
Cable resistance: max. 1.5 Ω
- Test the wiring between 3-pin connector contact 3 and the relay plate for open circuit on the basis of the current flow diagram.
Cable resistance: max. 1.5 Ω



Testing actuation

- Unplug the connectors from the injectors.
- ◀ - Connect the diode test lamp V.A.G 1527 with auxiliary cables from V.A.G 1594 A and the adapters V.A.G 1594/15 to contacts 2+3 of the connector.
- Operate the starter and check the ignition signal of the 1AV control unit.
The LED should flicker.



If the LED does not flicker:

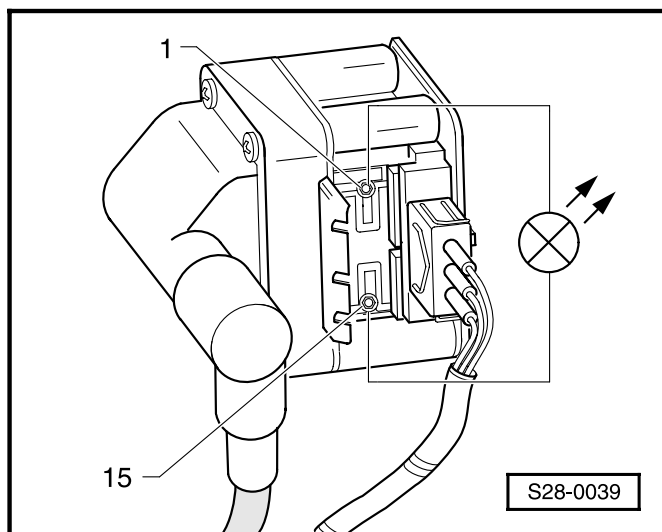
- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.
- Test the wiring between test box socket 16 and 3-pin connector contact 2 for open circuit on the basis of the current flow diagram.
Cable resistance: max. 1.5 Ω
- In addition, test the wiring for short circuit to each other.
Specification: $\infty \Omega$

If no fault is found in the wiring and voltage was present between contacts 1+3:

- Replace the 1AV control unit (J382) ⇒ page 24-5, item 28.

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

- Unplug the 3-pin connector and ignition cable at the ignition transformer.
- ◀ - Connect the diode test lamp with auxiliary cables and clamps to contacts 1 and 15 at the ignition transformer.



Important!

When carrying out the following tests, do not touch the connection parts of the ignition transformer or the test cables.

- Operate the starter - the LED should flicker.

Testing knock sensor

Special tools, testers and aids required

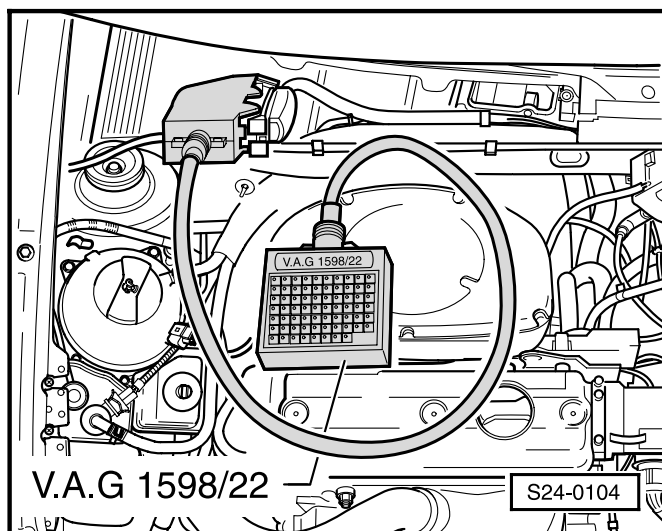
- ◆ Test box V.A.G 1598/22
- ◆ Hand-held multimeter V.A.G 1526 or multimeter V.A.G 1715
- ◆ Adapter cable set V.A.G 1594
- ◆ Current flow diagram

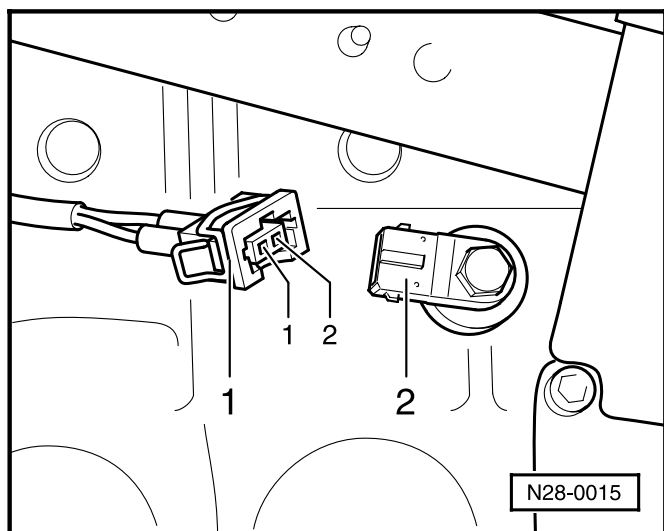
Test condition

- Fault at knock sensor recognised by the self-diagnosis.

Test procedure

- ◀ - Connect the test box V.A.G 1598/22 to the control unit wiring loom.
- Test the wiring and the knock sensor for short circuit.
Sockets: 67+68
Specification: $\infty \Omega$





If no short circuit is found:

- ◀ - Unplug the connector -1- from the knock sensor 1 (G61) -2-.
- Test the wiring between test box and knock sensor for open circuit on the basis of the current flow diagram.
 - Contact 1+socket 68
 - Contact 2+socket 67
 - Cable resistance: max. 1.5 Ω
- Measure the resistance between the contacts at the knock sensor.
 - Specification: $\infty \Omega$

If no fault is found in the wiring:

- Slacken the knock sensor and then tighten it again to 20 Nm.
- Carry out a road test.

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

- ◆ The coolant temperature should rise to more than 80 °C.
- ◆ Once the temperature is reached, the operating states of
 - idling
 - part throttle
 - full throttle
 - overrun
 should be achieved several times.
- ◆ Engine speed should be increased to more than 3500 rpm at full throttle.
- Once again interrogate the fault memory of the control unit.

If the problem still exists:

- Replace the knock sensor
⇒ page 28-2, item 14.