Audi A8 1994 ➢

MPI Fuel Injection and Ignition system									
Engine ID	AAH								

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List of Workshop Manual Repair GroupsList of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

Audi A8 1994 ➤

MPI Fuel Injection and Ignition system

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system

Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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01 - Self-diagnosis

1 - Self-diagnosis of Multi Point Injection

1.1 - Self-diagnosis of Multi Point Injection

1.2 - Technical data of self-diagnosis

Features

- The data transfer between the control unit and the fault reader V.A.G 1551 or the vehicle system tester V.A.G 1552 is carried out in the operating mode "Rapid data transfer".
- The fault memory is designed as a non-volatile memory. It is however dependent on the power supply. Disconnecting the permanent positive supply erases the fault memory of the engine control unit.

1.3 - Safety precautions

Note the following points if testers and measuring instruments have to be used during a road test:

Warning:

- **Always secure the testers and measuring instruments to the rear seat and have a second person operate them from there.**
- **If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.**

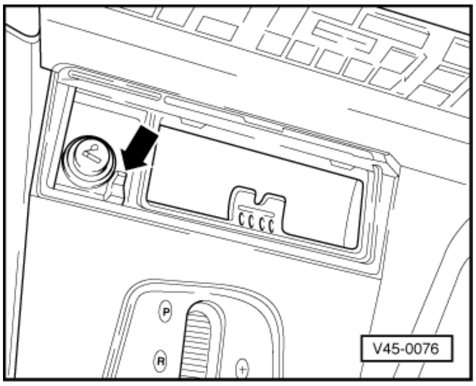
1.4 - Connecting fault reader V.A.G 1551 and selecting engine electronics control unit

Test requirements:

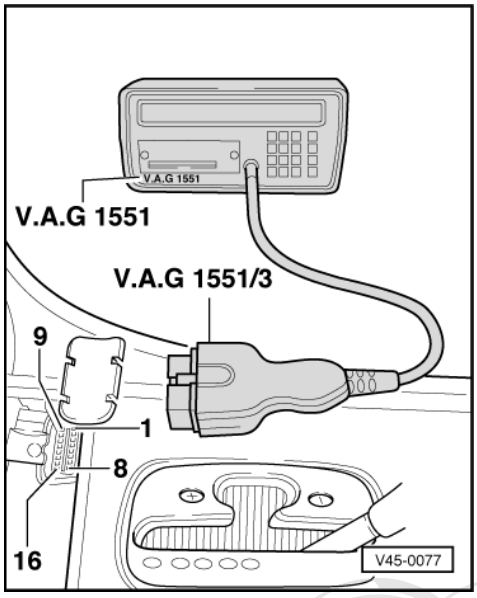
- Supply voltage of vehicle electrical system OK.
- Earth connections at engine, intake manifold and bodywork OK.
- Fuses for engine OK

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- Fuel-pump relay -J17 OK; checking => Page 93 .



- -> Release ashtray in centre console by pressing small lever -arrow-.
- Remove ashtray from centre console and remove cover for diagnostic connector.



- -> Make sure the ignition is switched off, then connect fault reader V.A.G 1551 using test lead V.A.G 1551/3.

-> Display readout:

```
V.A.G SELF-DIAGNOSIS      HELP
1 - Rapid data transfer 1)
2 - Flash code output 1)
```

1) appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on required function => "Available functions" table => Page 4 .

- Switch the ignition on.

or

- Start the engine.
- Switch on the fault reader printer with the print key. The indicator lamp in the key must light up.
- Press key 1 for "Rapid data transfer".

-> If adjacent display appears:

```
Rapid data transfer       HELP
Enter address word XX
```

Note:

Address word 00 implements the automatic test sequence, i.e. the interrogation of the fault memory via rapid data transfer for all vehicle systems with a self-diagnosis capability.

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

-> The fault reader V.A.G 1551 display will show the control unit identification. For example:

```
8A0906266C     2.8l     V6/2V     MPI
D03     □
Code 04503     WSC 12345
```

Note:

The control unit identification can be printed out by pressing the PRINT key on fault reader V.A.G 1551.

Control unit identification (example)

- 8A0 906 266 C	Part-No.; assignment => Parts List
- V6/2V	Design of engine (V-engine, 6-cylinder, 2-valve)
- MPI	Multi point injection and ignition system
- D03	Data status (software status) of control unit
- Code 04503	Control unit code
- WSC 12345	Workshop Code of V.A.G 1551 with which encoding was last performed

- Press the ⇒key.

-> Display readout (function selection):

```
Rapid data transfer      HELP
Select function XX
```

Notes:

- The control unit identification can be displayed again by entering function "01" for "Interrogating control unit version" and confirming with the Q key.

```
Rapid data transfer      HELP
No control unit response
```

-> If adjacent display appears:

- Press HELP key to print out a list of possible fault causes.

```
Rapid data transfer      HELP
L-line not switching to earth
```

Use current flow diagram to check wiring of diagnostic connector => Page 59 .

```
Rapid data transfer      HELP
L-line not switching to positive
```

```
Rapid data transfer      HELP
K-line not switching to earth
```

```
Rapid data transfer      HELP
K-line not switching to positive
```

```
Rapid data transfer
Fault in communications link
```

-> If this display appears when starting or during the program, faults have occurred and data exchange between fault reader V.A.G 1551 and the engine control unit is no longer possible.

- After rectifying the faults, enter "01" again for address word "Engine electronics" => Page 1 .

Available functions

Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552		Ignition on, engine stopped	Engine idling	Vehicle running	Page
Address words					
01	Engine electronics	yes	yes	yes	1
00	Automatic test sequence	yes	yes	yes	2
Functions					
01	Interrogating control unit version	yes	yes	yes	3
02	Interrogating fault memory	no	yes	yes	4
03	Final control diagnosis	yes	no	no	25
04	Basic setting	no	yes	yes	27
05	Erasing fault memory	yes	yes	yes	4
06	End output	yes	yes	yes	5
07	Encode control unit	yes	no	no	29
08	Read measured value block	yes	yes	yes	31
10	Adaptation	yes	yes	no	54

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine electronics control unit => Page 1 .)

Note:

If the engine will not start, crank it for at least 5 seconds with the starter and then leave the ignition on.

-> Display readout:

```
Rapid data transfer      HELP
Select function XX
```


- Enter "02" for the function "Interrogating fault memory" and confirm entry with Q key.

-> If adjacent display appears:

```
No fault detected!
```

- Press the ⇒key.

or

-> If adjacent display appears:

```
X fault(s) recognised!
```

The stored faults are displayed and printed in sequence when the printer is switched on.

- Locate and eliminate faults listed on printout as per fault table => Page 6 .

- Press the ⇒key.

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "05" for the function "Erasing fault memory" and confirm entry with Q key.

Note:

-> If adjacent display appears:

```
Warning:
Fault memory was not interrogated
```

Sequence of operations was not carried out properly.

- Interrogate fault memory:

The fault memory will also not be erased if:

- The ignition has been switched off after interrogating the fault memory
- A static fault has not been rectified

-> If adjacent display appears

```
Rapid data transfer
Fault memory is erased!
```

- Press the ⇒key.
- Interrogate fault memory again after carrying out the repairs.

Note:

This erases faults that have been stored whilst the fault was being rectified, for example, faults that have arisen as a result of connectors being detached.

- Carry out a test drive (lasting at least 10 minutes).
- Enter "00" for address word "Automatic test sequence" and confirm entry with Q key.

Note:

If, when rectifying faults on vehicles with automatic gearbox, the connector is pulled off the engine control unit, the fault memory of the gearbox control unit must also be interrogated and erased. This is because the "Engine/ gearbox electrical connection: Open circuit" fault will have been stored in the gearbox control unit.

End output

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "06" for "End output" function and confirm entry with Q key.

-> If adjacent display appears:

```
Rapid data transfer      HELP
Enter address word XX
```

- Switch off ignition and detach diagnostic connector.

2.2 - Fault table

Notes:

- The fault table is listed according to the 5 digit fault code on the left.
- Before renewing components indicated as being faulty, check the wiring and connectors to these components as well as the earth connections using the current flow diagram. This is particularly relevant for faults recorded as "occurring sporadically" (SP).
- Sporadic faults are faults which only occur occasionally (sporadic = at irregular intervals, intermittently).

2.3 - Fault code from 01119 to 17509

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01119 Gear recognition signal Implausible signal	▪ Stored if the following conditions apply 1 second after starting engine: Engine control unit encoded for automatic gearbox, vehicle speed less than 1 km/h, gear signal "high" during entire period ▪ Fault 18020 is stored at the same time and to be dealt with first		
	- Open circuit or short to positive in signal wire between engine control unit and gearbox control unit	- Engine running problems (juddering gear changes, load change jolts)	- Reading measured value block, display group 004 =>Page 39
	- Signal output in engine control unit defective (control unit defective)		- Check gear signal => Page 153
	- Gearbox control unit defective		- Interrogate fault memory => Automatic gearbox 01F and 01K Self-diagnosis; Repair Group 01; Self-diagnosis; Interrogating fault memory Self-diagnosis; Interrogating fault memory

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01119 Gear recognition signal Signal to earth	Stored if the following conditions apply for more than 5 seconds: Engine control unit encoded for automatic gearbox, idling speed switch is open, engine speed greater than 2000 rpm, engine load greater than 64%, gear signal "low"		
	- Short to earth in signal wire between engine control unit and gearbox control unit	- Engine running problems (juddering gear changes, load change jolts)	- Read measured value block, display group 004 =>Page 53
	- Gearbox control unit defective (short to earth is not eliminated on engaging gear)		- Interrogate fault memory => Automatic gearbox 01F and 01K Self-diagnosis; Repair Group 01; Self-diagnosis; Interrogating fault memory Self-diagnosis; Interrogating fault memory

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16486			

Air mass meter -G70 Signal too low	Stored if signal voltage is less than 0.3 V for more than 0.3 seconds (engine speed less than 2000 rpm)		
	- Unmetered air between air mass meter -G70 and engine - Air cleaner blocked	- Emergency running mode - Poor throttle response - Poor performance	- Locate and eliminate leak Replace filter element
	- Power supply for -G70 defective - Open circuit or short to earth in signal wire between -G70 and engine control unit - -G70 defective	- Engine may cut out after starting or in overrun phase	- Reading measured value block, display group 001 => Page 102
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16487 Air mass meter -G70 Signal too high	Stored if signal voltage is more than 5 V for more than 0.3 seconds (engine speed less than 2000 rpm)		
	- Short to positive in signal wire between -G70 and engine control unit - Fault in earth supply for -G70 - -G70 defective	- Emergency running mode - Poor throttle response - Poor performance - Engine may cut out after starting or in overrun phase	- Read measured value block, display group 001 => Page 102
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16500 Coolant temperature sensor -G62 Implausible signal	Stored if coolant temperature is less than 55 oC on starting engine and is still less than 70 oC 18 minutes later		
	- -G62 supplies implausible signal due to loose contact/corrosion caused by moisture in connector	- Cold start problems at very low temperatures - Engine running problems when warm	- Read measured value block, display group 001 => Page 177
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16501 Coolant temperature sensor -G62 Signal too low	Stored if signal voltage is less than 0.10 V for more than 1 second when ignition is switched on (corresponds to coolant temperature of more than 200 oC)		
	- Short to earth in wiring between -G62 and engine control unit	- Cold start problems at very low temperatures - Engine running problems when warm	- Read measured value block, Display Group 001 => Page 35

	- -G62 defective		- Check -G62 => Page 177
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16502 Coolant temperature sensor - G62			
Signal too high	Stored if signal voltage is less than 4.94 V for more than 1 second when ignition is switched on (corresponds to coolant temperature of less than 50 oC)		
	- Open circuit or short to positive in wiring between -G62 and engine control unit	- Cold start problems at very low temperatures - Engine running problems when warm	- Read measured value block, Display Group 001 => Page 35
	- -G62 defective - Earth supply to - -G62 defective		- Check -G62 => Page 177
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16504 Throttle valve potentiometer - G69			
Electrical fault in circuit	▪ Stored if signal voltage is greater than 0.72 V for more than 1 second with idling switch closed (corresponds to throttle valve being open more than 7o) ▪ Fault 17914 is stored at the same time		
	- Idling speed switch sticking or defective	- Poor performance - Engine running problems	- Read measured value blockdisplay group 002 => Page 128

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16505 Throttle valve potentiometer - G69			
Implausible signal	Stored if signal voltage is less than 0.96 V for more than 1 second (corresponds to throttle valve being open less than 12o) under the following conditions: Coolant temperature greater than 70 oC, engine speed 1500 ... 3500 rpm, engine load greater than 66% (air mass meter signal)		
	- Unmetered air between throttle valve and engine (possible leakage in hose connections at air cleaner) - -G69 incorrectly adjusted - -G69 loose or shaft connection worn - Moisture or corrosion in connector at -G69	- Poor performance - Engine running problems	- Read measured value blockdisplay group 002 => Page 128

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination

16506 Throttle valve potentiometer - G69			
Signal too low	Stored if signal voltage is less than 0.1 V for more than 1 second at an engine speed greater than 600 rpm		
	- Open circuit or short to earth in signal wire between -G69 and engine control unit - Power supply for -G69 defective - -G69 defective	- Poor performance - Engine running problems	- Read measured value blockdisplay group 002 => Page 128 Rectify short circuit or open circuit => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16507 Throttle valve potentiometer - G69			
Signal too high	Stored if signal voltage is greater than 4.9 V for more than 1 second		
	- Short to positive in signal wire between -G69 and engine control unit - Fault in earth supply for -G69 - -G69 defective	- Poor performance - Engine running problems	- Read measured value blockdisplay group 002 => Page 128
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16514 Bank 1, probe 1			
Electrical fault in circuit	▪ Stored if, 60 seconds after start of control, the difference between min and max. signal voltage is less than 500 mV at an engine temperature greater than 80 oC ▪ Fault 17511 is stored at the same time		
	- Corrosion due to moisture in connector for lambda probe heating or lambda probe - Lambda probe contaminated/probe slits clogged or dirty	- Emissions not OK - Lambda control switches to open loop control	- Read measured value block, Display Group 010 => Page 113

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16516 Bank 1, probe 1			
Voltage too high	Stored if signal voltage is greater than 1.2 V for more than 1 second after starting engine		
	- Short to positive between lambda probe and engine control unit - Failure of spark plugs, spark plug connectors or ignition cables	- Lambda control switches to open loop control - Emissions not OK - Soot deposits on spark plugs - Black smoke	- Read measured value block, Display Group 010 => Page 47

	- Lambda probe defective		- Check lambda control =>Page 113
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16518 Bank 1, probe 1 No activity	Stored if, 90 seconds after starting engine, signal voltage is 370... 430 mV for more than 4 seconds at an engine temperature greater than 30 oC		
	- Open circuit between lambda probe and engine control unit	- Emissions not OK - Lambda control switches to open loop control	- Read measured value block, Display Group 010 => Page 47
	- Lambda probe defective		- Check lambda control =>Page 113
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16534 Bank 2, probe 1 Electrical fault in circuit	Fault 17516 is stored at the same time		
	=>Bank 1, probe 1 Fault code 16514	=>Bank 1, probe 1 Fault code 16514	=>Bank 1, probe 1 Fault code 16514
16536 Bank 2, probe 1 Voltage too high	=>Bank 1, probe 1 Fault code 16516	=>Bank 1, probe 1 Fault code 16516	=>Bank 1, probe 1 Fault code 16516
16538 Bank 2, probe 1 No activity	=>Bank 1, probe 1 Fault code 16518	=>Bank 1, probe 1 Fault code 16518	=>Bank 1, probe 1 Fault code 16518

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16554 Bank 1, fuel metering system Malfunction	Stored if, during learning process, the difference between newly learned and stored lambda learned value is greater than 8%		
	- Oil dilution (fuel in engine oil) - Leakage air in area of intake manifold	- Emissions not OK	- Read measured value block, display group 005 or 006. => Page 41
	- Biased signal supplied by air-mass meter -G70		- Read measured value block, Display Group 001 => Page 35

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	- Oil combustion caused by defective pistons		- Check compression pressure => 6-cylinder engine, Mechanical Components; Repair Group 15; Servicing Valve Gear; Checking compression pressure Servicing Valve Gear; Checking compression pressure

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16555 Bank 1, fuel metering system System too lean	Stored if lambda control has exceeded learned value limit in "Enrichment" direction but lambda probe still detects "Mixture too lean"		
	- Fuel pressure regulator defective	- CO upstream of catalytic converter less than 0.3%	- Check system pressure => Page 82
	- Fuel filter clogged - Insufficient fuel pump delivery		- Check fuel pump delivery rate => 6-cylinder engine, Mechanical components; Repair Group 20; Fuel supply; Checking fuel pump delivery rate Fuel supply; Checking fuel pump delivery rate
	Continued ▼		

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16555 Bank 1, fuel metering system System too lean	(Fault 16555 continued)		
	- Unmetered air downstream of air mass meter -G70	- CO upstream of catalytic converter less than 0.3%	- Read measured value block, Display Group 001 => Page 35
	- Leakage air from exhaust system as far as lambda probe		- Locate and eliminate cause
	- Activated charcoal filter system solenoid 1 -N80 sticking		- Check activated charcoal filter system solenoid 1 -N80 for leaks => Page 123

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16556 Bank 1, fuel metering system System too rich	Stored if lambda control has dropped below learned value limit in "Leaning" direction but lambda probe still detects "Mixture too rich"		
	- Fuel pressure regulator defective	- Increased fuel consumption	- Check system pressure => Page 82
	- Injector not closing	- Black smoke - Soot on spark plugs - CO upstream of catalytic converter greater than 1%	- Check injectors => Page 85
16557 Bank 2, fuel metering system			

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
Malfunction	=>Bank 1, fuel metering system Fault code 16554	=>Bank 1, fuel metering system Fault code 16554	=>Bank 1, fuel metering system Fault code 16554

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16558 Bank 2, fuel metering system Too lean	=>Bank 1, fuel metering system Fault code 16555	=>Bank 1, fuel metering system Fault code 16555	=>Bank 1, fuel metering system Fault code 16555
16559 Bank 2, fuel metering system System too rich	=>Bank 1, fuel metering system Fault code 16556	=>Bank 1, fuel metering system Fault code 16556	=>Bank 1, fuel metering system Fault code 16556

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16706 Engine speed sender -G28 No signal	No ignition or injection if this fault is detected on starting engine		
	- Open circuit or short to earth or short to positive in signal wire	- Engine will not start/ cuts out	- Rectify open circuit or short circuit => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"
	- -G28 loose or defective - Gap between -G28 and ring gear of flywheel greater than 1.2 mm		- Check -G28 => Page 172
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16711 Knock sensor 1 -G61 Signal too low	Stored if output voltage of knock sensor is too low (coolant temperature greater than 20 oC, engine speed greater than 3500 rpm, engine load greater than 16%). The ignition timing is then retarded by 12o crankshaft in map knock areas (engine load greater than 40%).		
	- Knock sensor loose	- High fuel consumption - Poor performance	- Tightening torque for knock sensor: 20 Nm
	- Corrosion at connector of -G61 - Open circuit or short to earth in signal wire between -G61 and engine control unit - Open circuit in sender earth wire between -G61 and engine control unit	- Abrupt loss of power (similar to misfiring)	- Read measured value block, display group 015 or 016 =>Page 50 Rectify open circuit or short circuit => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Continued ▾

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination

16711 Knock sensor 1 -G61 Signal too low	(Fault 16711 continued) - Knock sensor defective		- Check -G61 => Page 182
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78
16716 Knock sensor 2 -G66 Signal too low	=>Knock sensor 1 -G61 Fault code 16711	=>Knock sensor 1 -G61 Fault code 16711	=>Knock sensor 1 -G61 Fault code 16711

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16721 Crankshaft position sensor Signal too low	Stored if signal from crankshaft position sensor is not detected for more than 3 seconds at an engine speed of 25... 2000 rpm		
	- Ignition timing sender - -G4 loose - Gap between -G4 and groove at crankshaft balancing weight greater than 1.3 mm	- If fault occurs before starting engine: - Engine will not start (no ignition or injection) - If fault occurs after starting engine: - Fault is stored	- Check tightness of -G4 (bottom left in cylinder block)
	- -G4 defective		- Check -G4 => Page 170
	- Open circuit or short to earth in signal wire between -G4 and engine control unit		- Rectify open circuit or short circuit => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16785 EGR system Throughput too low	Stored if EGR temperature signal is less than 65 oC for more than 45 seconds under the following conditions: Coolant temperature greater than 60 oC, idling speed switch open, throttle valve angle less than 42.5o, vehicle speed 70... 105 km/h, EGR duty cycle greater than 50%, engine speed 1500... 3000 rpm, engine load 16... 60%		
	- Vacuum pipe kinked/dropped off - Mechanical EGR valve permanently closed		- Check exhaust gas recirculation system

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16786 EGR system Throughput too high	Stored if EGR temperature signal in warm-up phase is greater than 60 oC measured on cold start (-15... +30 oC coolant temperature) and at 35 oC coolant temperature		

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	- Mechanical EGR valve permanently open/leaking	- Rough idling - Poor starting - Jolting - Sudden loss of power	- Check exhaust gas recirculation system

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16885 Vehicle speed signal Implausible signal	Stored if, during an overrun cut-off phase lasting more than 4 seconds, the vehicle speed signal is less than 3 km/h under the following conditions: Coolant temperature greater than 80 oC, engine speed 1300 ... 6000 rpm		
	- Speedometer sender/road speed sender -G22/-G68 defective - Speedometer -G21 defective - Open circuit or short circuit between speedometer sender and speedometer - Open circuit or short in wiring between dash panel insert and engine control unit Continued ▾	- No air-conditioner compressor shut-off in first gear at full throttle - Brief deviation between idling speed and specified speed - Load change jolt	- Check speed signal=> Page 37 Rectify open circuit or short circuit => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16885 Vehicle speed signal Implausible signal	(Fault 16885 continued) - Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78
16989 Control unit faulty	Stored in the event of errors in ROM/RAM or EPROM		
	- Engine control unit defective	- Engine will not start	- Renew engine control unit => Page 78

Note on Fault code 16885:

Start by checking whether speedometer reading is OK. If reading is not OK, fault can be ignored.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17509 Bank 1, probe 1 Voltage too low/leakage air	Stored if, 90 seconds after starting engine, lambda control has reached rich stop more than 20 times for 2 seconds at a coolant temperature greater than 30 oC		
	- Short to earth between lambda probe and engine control unit	- CO upstream of catalytic converter less than 0.3% - Lambda control switches to open loop control	- Read measured value block, Display Group 010 => Page 47
	- Lambda probe defective		- Check lambda control =>Page 113
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

	- Fuel pressure regulator defective Continued ▾		- Check system pressure => Page 82

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17509 Bank 1, probe 1 Voltage too low/leakage air	(Fault 17509 continued) - Fuel filter clogged - Insufficient fuel pump delivery	- CO upstream of catalytic converter less than 0.3% - Lambda control switches to open loop control	- Check fuel pump delivery rate => 6-cylinder engine, Mechanical components; Repair Group 20; Fuel supply; Checking fuel pump delivery rate Fuel supply; Checking fuel pump delivery rate
	- Activated charcoal filter system solenoid 1 -N80 sticking		- Check activated charcoal filter system solenoid 1 -N80 for leaks => Page 123
	- Leakage air from exhaust system as far as lambda probe		- Locate and eliminate cause
	- Unmetered air downstream of air mass meter -G70		- Read measured value block, Display Group 001 => Page 35

2.4 - Fault code from 17514 to 18020

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17514 Bank 2, probe 1 Voltage too low/leakage air	=>Bank 1, probe 1 Fault code 17509	=>Bank 1, probe 1 Fault code 17509	=>Bank 1, probe 1 Fault code 17509
17609 Injector, cylinder 1 -N30 Electrical fault in circuit	▪ Lambda control is deactivated at the same time ▪ If this fault is stored for all 6 injectors, fault 17908 is stored as well		
	- Open circuit or short to earth between -N30 and engine control unit - Fault in power supply to -N30 - -N30 defective	- Rough engine running	- Check injectors =>Page 85 .
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17610 Injector, cylinder 2 -N31 Electrical fault in circuit	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17611 Injector, cylinder 3 -N32 Electrical fault in circuit	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609
17612 Injector, cylinder 4 -N33 Electrical fault in circuit	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17613 Injector, cylinder 5 -N83 Electrical fault in circuit	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609
17614 Injector, cylinder 6-N84 Electrical fault in circuit	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609	=>Injector, cylinder 1 -N30 Fault code 17609
17621 Injector, cylinder 1 -N30 Short-circuit to positive	At the same time, the affected injector is no longer actuated until ignition is switched off and the lambda control is deactivated.		
	- Short to positive between -N30 and engine control unit - -N30 defective	- Rough engine running - No full throttle enrichment	- Check injectors =>Page 85 .
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17622 Injector, cylinder 2 -N31 Short-circuit to positive	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621
17623 Injector, cylinder 3 -N32 Short-circuit to positive	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621
17624 Injector, cylinder 4 -N33 Short-circuit to positive	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17625 Injector, cylinder 5 -N83 Short-circuit to positive	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621
17626 Injector, cylinder 6-N84			

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
Short-circuit to positive	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621	=>Injector, cylinder 1 -N30 Fault code 17621

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17733 Knock control, cylinder 1 Control limit reached	Stored if ignition timing is fully retarded for more than 180 seconds whilst driving		
	- Poor quality fuel (less than RON 91)	- High fuel consumption - Poor performance	- Fill up with petrol of at least RON 91
	- Knock control module in engine control unit defective (control unit defective)	- Rough engine running - Maximum speed is not reached	- Renew engine control unit => Page 78
	- Abnormal engine noise (ancillaries loose) - Open circuit in knock sensor screen wiring - Loose contact in the connector		- Reading measured value block, display group 013 or 014 =>Page 182
	- Knock sensor loose		- Tightening torque for knock sensor: 20 Nm

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17734 Knock control, cylinder 2 Control limit reached	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733
17735 Knock control, cylinder 3 Control limit reached	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733
17736 Knock control, cylinder 4 Control limit reached	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733
17737 Knock control, cylinder 5 Control limit reached	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17738 Knock control, cylinder 6 Control limit reached	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733	=> Knock control, cylinder 1 Fault code 17733
17747 Crankshaft position sensor/engine speed sensor			

Interchanged	▪ Stored if ignition timing sender -G4 and engine speed sender -G28 have been interchanged ▪ If -G4 and -G28 have been interchanged, fault 16706 is stored as well		
	- 3-way connectors of the ignition timing sender -G4 (crankshaft sensor) and engine speed sender -G28 interchanged	- Engine will not start (no ignition or injection)	- Attach 3-way connector properly

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17748 Camshaft/crankshaft position sensor			
Incorrect assignment	▪ Stored if, at an engine speed of 50... 2000 rpm, Hall sender signal is always "high" for more than 15 detected crankshaft sensor signals ▪ Fault 17800 is stored at the same time		
	- Incorrect valve timing (toothed belt skipped)	- If fault occurs before starting engine: - Engine will not start (no ignition or injection) - If fault occurs after starting engine: - Fault is stored - No engine power at full throttle	- Check valve timing => 6-cylinder engine, Mechanical Components; Repair Group 13; Dismantling and assembling engine; Removing and installing toothed belt Dismantling and assembling engine; Removing and installing toothed belt
	- Hall sender rotor ring incorrectly fitted or loose		- Perform visual inspection

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17749 Ignition output 1 Short to earth	- Short to earth between output stage - N122 and engine control unit - -N122 defective	- Corresponding injectors are deactivated (no injection) - Lambda control switches to open loop control - Loss of power (no full throttle enrichment)	- Check -N122 => Page 167
	- Signal output in engine control unit defective (control unit defective)		- Renew engine control unit => Page 78
17751 Ignition output 2 Short to earth	=>Ignition output 1 Fault code 17749	=>Ignition output 1 Fault code 17749	=>Ignition output 1 Fault code 17749

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17753 Ignition output 3 Short to earth	=>Ignition output 1 Fault code 17749	=>Ignition output 1 Fault code 17749	=>Ignition output 1 Fault code 17749
17799 Bank 2, camshaft position sensor			

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
Short to earth	Stored if, at an engine speed of 25... 2000 rpm, Hall sender signal is always "low" for more than 3 detected crankshaft sensor signals		
	- Short to earth between Hall sender - G40 and engine control unit - -G40 defective	- Engine will not start/ cuts out (no ignition or injection)	- Check -G40 => Page 185
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17800 Bank 2, camshaft position sensor			
Short-circuit to positive	▪ Stored if, at an engine speed of 50... 2000 rpm, Hall sender signal is always "high" for more than 15 detected crankshaft sensor signals ▪ Fault 17748 is stored at the same time		
	- Open circuit or short to positive between Hall sender -G40 and engine control unit - Fault in power supply or earth supply for -G40 - -G40 defective	- If fault occurs before starting engine: - Engine will not start (no ignition or injection) - If fault occurs after starting engine: - Fault is stored	- Check -G40 => Page 185
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17801 Ignition output 1 Electrical fault in circuit	- Open circuit or short to positive between output stage -N122 and engine control unit - -N122 defective	- Corresponding injectors are deactivated (no injection) - Lambda control switches to open loop control - Loss of power (no full throttle enrichment)	- Check -N122 => Page 167
	- Signal output in engine control unit defective (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17802 Ignition output 2 Electrical fault in circuit	=>Ignition output 1 Fault code 17801	=>Ignition output 1 Fault code 17801	=>Ignition output 1 Fault code 17801
17803 Ignition output 3 Electrical fault in circuit	=>Ignition output 1 Fault code 17801	=>Ignition output 1 Fault code 17801	=>Ignition output 1 Fault code 17801

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17808			

EGR valve -N18 Electrical fault in circuit	Stored if, after starting engine, control unit output of EGR valve -N18 is "low" for more than 1 second under the following conditions: Engine speed less than 900 rpm, engine load less than 25%, EGR duty cycle less than 20%		
	- Power supply for - -N18 defective - Open circuit or short to earth between -N18 and engine control unit - -N18 defective		- Read measured value block, display group 017 => Page 135
	- Signal output in engine control unit defective (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17810 EGR valve -N18 Short-circuit to positive	Stored if, after starting engine, control unit output of EGR valve -N18 is "high" for more than 1 second under the following conditions: Engine speed 1000 ... 3500 rpm, engine load 33... 66%, EGR duty cycle greater than 30%		
	- Short to positive between -N18 and engine control unit - -N18 defective		- Read measured value block, display group 017 => Page 135
	- Signal output in engine control unit defective (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17815 EGR temperature sensor -G98 Signal too low	Stored if EGR temperature signal greater than 200 oC is received under the following conditions: More than 3 seconds after starting engine, coolant temperature less than 30 oC		
	- Short to earth between -G98 and engine control unit - -G98 defective		- Read measured value block, display group 017 => Page 141
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17816 EGR temperature sensor -G98 Signal too high	Stored if EGR temperature signal is less than 5 oC for more than 45 seconds under the following conditions: Coolant temperature greater than 60 oC, idling speed switch open, throttle valve angle less than 42.5o, vehicle speed 70... 105 km/h, EGR duty cycle greater than 50%, engine speed 1500... 3000 rpm, engine load 16... 60%		
	- Open circuit or short to positive between -G98 and engine control unit - Fault in earth supply for -G98 - -G98 defective		- Read measured value block, display group 017 => Page 141

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17817 Fuel tank breather valve -N80 Electrical fault in circuit	Stored if, after starting engine, control unit output of activated charcoal filter solenoid 1 -N80 is "low" for more than 1 second under the following conditions: Engine speed less than 1100 rpm, engine load less than 32%, duty cycle of activated charcoal filter solenoid 1 greater than 30%		
	- Power supply for - -N80 defective - Open circuit or short to earth between - N80 and engine control unit - -N80 defective	- Poor progression in part throttle range - Smell of petrol in vehicle	- Read measured value block, display group 009 => Page 135
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17818 Fuel tank breather valve -N80 Short-circuit to positive	Stored if, after starting engine, control unit output of activated charcoal filter solenoid 1 -N80 is "high" for more than 1 second under the following conditions: Engine speed greater than 1250 rpm, engine load greater than 40%, duty cycle of activated charcoal filter solenoid 1 less than 19%		
	- Short to positive between - N80 and engine control unit - -N80 defective	- Poor progression in part throttle range	- Read measured value block, display group 009 => Page 135
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17908 Fuel pump relay -J17 Electrical fault in circuit	Only stored if faults 17609/17610/17611/17612/17613/17614 have been stored at the same time		
	- Open circuit or short to earth between -J17 and engine control unit - -J17 defective	- In the event of a short circuit to earth: - Engine runs normally but battery is slowly discharged as -J17 is permanently energised	- Check -J17 => Page 93
	- Signal output in engine control unit defective (control unit defective)	- In the event of an open circuit: - Engine cuts out/will not start	- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17912 Air intake system Leakage detected	If this fault is stored, both output stages ("+" and "-" output) are deactivated. The idling stabilisation valve -N71 is de-energised and opens emergency running cross section		
	- Large quantity of unmetered air - Mechanical fault in the idling stabilisation valve -N71	- Engine speed deviates from specified speed when the engine is at operating temperature - Possibly no idling if engine is cold	- Read measured value block, Display Group 004 => Page 98
	- 2nd stage of throttle valve unit sticking	- Air-conditioner compressor deactivated - Jolting in part throttle range - Flat spots or engine hunts	- Perform visual inspection

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17913 Idling switch - F60 Does not close / open circuit	Stored if idling switch is not detected as being closed at least once after starting engine and after driving for 10 minutes at less than 100 km/h		
	- Throttle valve sticking - -F60 defective		- Check idling switch => Page 132
	- Throttle cable setting - Floor mat pressing down on accelerator pedal		- Adjust throttle cable => 6-cylinder engine, Mechanical components; Repair Group 20; Servicing throttle control; Adjusting throttle cable Servicing throttle control; Adjusting throttle cable
	- Open circuit or short to positive between -F60 and engine control unit		- Read measured value block, display group 002 => Page 36
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17914 Idling switch - F60 Does not open/short to earth	▪ Stored if throttle valve open more than 7o and idling switch is closed for more than 1 second ▪ Fault 16504 is stored at the same time		
	- Short to earth between -F60 and engine control unit - Moisture in connector of -F60 - -F60 defective		- Read measured value block, display group 002 => Page 132
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17917 Idling stabilisation valve -N71			

Electrical fault in circuit	If this fault is stored, both output stages ("+" and "-" output) are deactivated. The idling stabilisation valve -N71 is de-energised and opens the emergency running cross section		
	- Open circuit or short to earth between - N71 and engine control unit - -N71 defective	- Engine speed deviates from specified speed when the engine is at operating temperature - Possibly no idling if engine is cold	- Read measured value block, Display Group 004 => Page 98
	- Signal output in engine control unit defective (control unit defective)	- Air-conditioner compressor deactivated	- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17918 Idling stabilisation valve -N71 Short-circuit to positive	If this fault is stored, both output stages ("+" and "-" output) are deactivated. The idling stabilisation valve -N71 is de-energised and opens the emergency running cross section		
	- Short to positive between -N71 and engine control unit - -N71 defective	- Engine speed deviates from specified speed when the engine is at operating temperature - Possibly no idling if engine is cold	- Read measured value block, Display Group 004 => Page 98
	- Signal output in engine control unit defective (control unit defective)	- Air-conditioner compressor deactivated	- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17919 Intake manifold changeover valve -N156 Electrical fault in circuit	- Open circuit or short to earth between -N156 and engine control unit - Fault in power supply to -N156 - -N156 defective	- In the event of an open circuit: - -N156 does not open, loss of power above 4000 rpm - In the event of a short circuit to earth: - -N156 always open, loss of torque up to 4000 rpm	- Test -N156 => Page 106
	- Signal output in engine control unit defective (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17920 Intake manifold changeover valve -N156 Short-circuit to positive	- Short to positive in wiring between -N156 and engine control unit - -N156 defective	- -N156 does not open, loss of power above 4000 rpm	- Test -N156 => Page 106

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	- Signal output in engine control unit defective (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17978 Engine control unit blocked	**Vehicles ä 1994:** - Engine control unit not adapted.	- Engine starts but cuts out again immediately	- Perform adaptation =>Page 54 .
	- Anti-theft alarm system activated:	- Engine does not crank	- Deactivate anti-theft alarm Check anti-theft alarm => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17978 Engine control unit blocked	**Vehicles 1995 ä:** - Fault in immobilizer system	- Engine starts but cuts out again immediately	- Interrogate fault memory => Electrical System; Repair Group 01; Immobilizer Self-diagnosis; Interrogating fault memory Immobilizer Self-diagnosis; Interrogating fault memory
	- Immobilizer control unit not adapted to engine control unit		- Adapt control units => Electrical System; Repair Group 01; Immobilizer Self-diagnosis; Adaptation Immobilizer Self-diagnosis; Adaptation
	- Open circuit between immobilizer control unit and engine control unit		- Rectify open circuit . => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
18008 Power supply, term. 15 Voltage too low	Stored if supply voltage is less than 10.0V for more than 1 second (engine control unit does not function below 6.5V)		
	- Poor earth connection to engine control unit	- Voltage less than 6 V - Engine will not run	- Read measured value block, Display Group 001 => Page 180 .
	- Battery flat - Current draw with "ignition off" (discharge)		- Check voltage Check charge

Note:

If fault 18008 is shown as a sporadic fault, ignore the fault message on the display. This fault is often stored when the engine is left idling for a long period with a large number of electrical consumers switched on, causing the battery charge to become very low.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
18020 Engine control unit incorrectly encoded	**Vehicles with control unit no. 8A0 906 266 lower than index "E":** - Engine control unit not encoded for ASR on vehicles with traction control system (ASR).		- Encode control unit => Page 29

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
18020 Engine control unit incorrectly encoded	**Vehicles as of control unit no. 8A0 906 266 E:**		
	Fault is stored if ▪ The following conditions apply 1 second after starting engine on vehicles with manual gearbox: Engine control unit encoded for automatic gearbox, vehicle speed less that 1 km/h, gear signal "high" during entire period; fault 01119 is stored at the same time ▪ 1 second after starting the engine, the following conditions apply for more than 1 second on vehicles with automatic gearbox: Engine control unit encoded for manual gearbox, gear signal "low" ▪ Vehicle fitted with traction control system (ASR) is not encoded for ASR and engine control unit receives signal from ABS/ASR control unit		
	- Engine control unit incorrectly encoded		- Encode control unit => Page 29

3 - Final control diagnosis

3.1 - Final control diagnosis

Notes:

- The final control diagnosis can only be performed with the engine stopped and the ignition switched on.
- The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.
- During the final control diagnosis, individual control elements are actuated until the test programme is advanced to the next control element by pressing the ⇒ key.
- The control elements can be checked acoustically or by way of touch.
- If the final control diagnosis is to be repeated without first starting the engine briefly, switch off the ignition for approx. 20 seconds.

The final control diagnosis activates the following components in the stated sequence:

Actuation sequence
1 Fuel pump relay -J17
2 Idling stabilisation valve -N71
3 Intake manifold changeover valve -N156
4 Activated charcoal filter system solenoid valve 1-N801)

5 EGR valve -N182)

1) Vehicles with lambda probes only

2) Vehicles with EGR only

Test requirements:

- Engine fuses OK.
- Idling switch-F60 OK.
- Fuel pump relay -J17 OK.

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. Engine must not be running.
  (Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "03" for the "Final control diagnosis" function and confirm entry with Q key.

-> If adjacent display appears:

```
Final control diagnosis
Fuel pump relay -J17
```

The relay must be energised and the fuel pump must run. Flow noise at fuel pressure regulator is clearly audible.

If the relay does not pull:

- Check actuation of the fuel pump relay -J17 => Page 94 .

Actuating idling stabilisation valve

- Press the ⇒key.

-> If adjacent display appears:

```
Final control diagnosis
Idling stabilisation valve -N71
```

The idling stabilisation valve must hum and vibrate.

Note:

The humming of the valve is difficult to hear and is therefore best checked by touching the valve.

If the valve does not hum and vibrate:

- Check idling stabilisation valve -N71 => Page 98 .

Actuating the intake manifold changeover valve

- Press the ⇒key.

-> If adjacent display appears:

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

The valve must click.

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

- Check intake manifold changeover valve -N156 => Page 106 .

Actuating the activated charcoal filter system solenoid valve

- Press the ⇒key.

-> If adjacent display appears:

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

The valve must click.

If the valve does not click:

- Check the activated charcoal filter system solenoid valve 1 -N80 =>Page 123 .

Actuating the EGR valve (vehicles with EGR only)

- Press the ⇒key.

-> If adjacent display appears:

```
Final control diagnosis
EGR valve -N18
```

The valve must click.

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

- Check EGR valve => Page 135
- Press the ⇒key.

-> Display readout (function selection):

```
Rapid data transfer      HELP
Select function XX
```

Note:

Before selecting function 03 "Final control diagnosis" again, switch off the ignition for approx. 20 seconds.

4 - Basic setting

4.1 - Basic setting

With the engine running, the following operations can be performed with the basic setting function:

- Learning process for lambda control
  => Respective display group
- Fault finding by means of pin-pointed activation and deactivation of the lambda control => Page 54 , display group 099

Notes:

- All learned values in the control unit are erased when the connector on the engine control unit is disconnected or when the battery is disconnected. This may be followed by rough idling for a brief period. In this case, leave the engine idling for several minutes until learning process has been completed.
- On initiating the basis setting (function 04), all learning demand displays (display group 007 or 008) are set to 0 so that the lambda learned values have to be learned again after the vehicle has been serviced.
- Learning is prohibited as soon as a fault affecting the lambda control has been stored in the fault memory (does not apply to sporadic faults).

- The basic setting is performed with the engine running.
- After initiating the basic setting, the MPI control unit performs the following operations:
  - Constant ignition timing of 12o BTDC is output at idling speed.
  - Digital idling stabilisation is blocked.
  - ACF valve is closed.
  - Air-conditioner compressor is deactivated
  - EGR valve is closed (vehicles with EGR only)
  - No coolant temperature correction is implemented (fixed value of 80 oC)
  - Renewed learning of lambda learned values is prompted.

Test requirements:

- Coolant temperature at least 85 oC.
- Accelerator pedal not depressed.
- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off; repeatedly keep pressing the "-" for the fresh-air blower on the air-conditioner operating and display unit until all displays disappear.

- Selector lever in position P or N
- No faults stored in fault memory

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "04" to select "Start basic setting" and confirm with Q key.

-> If adjacent display appears:

```
Basic setting      Q
Enter display group number XXX
```

- Enter the required display group number =>Reading measured value block display groups, Page 32 .

Example:

- Enter "000" for "Display group number 000" and confirm entry with Q key.

-> Display readout:

```
Basic setting 0     Q
1     2     3     4     5     6     7
8     9     10
```

Notes:

- In display group 000 the measured values are shown in decimal form.
- If the printer is switched on, the current display can be printed out on the record slip.
- Proceed as follows to switch to a different display group:

Display group	V.A.G 1551	V.A.G 1552
Higher	Press key 3	Press ↑ key.
Lower	Press key 1	Press ↓ key
Skip	Press the C key	Press the C key

- If all the display zones show the specified values, press the ⇒ key.

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "06" for "End output" function and confirm entry with Q key.

Display group 000 (decimal values)1)												
Basic setting 0									⇒	◂ Display		
1	2	3	4	5	6	7	8	9	10	◂ Display zones	Specification	Corresponds to
										Learned value for throttle valve potenti-ometer	50...100	250...500 mV
										Lambda learning de-mand 0 = Learning demand at idling speed and part throttle range 3 = Learning process completed at idling speed	3	
										Lambda control value (mean value 128/cylinder 1...3) 0 is displayed for vehicles with no lambda probes	120...136	
										Switching inputs	20	
										Idling stabilisation feedback (mean value 128)	126...130	
										Learned value for idling stabilisation, automatic gearbox with gear engaged (0 is displayed for manual gearbox)	0...10 or 236...255	
										Learned value for idling stabilisation, manual gearbox in idling position, automatic gearbox in selector lever position P or N	0...14 or 240...255	
										Engine speed	26...30	650...750 rpm
										Air mass meter output voltage	145...158	1.45...1.58 V
										Coolant temperature	135...160	85...110 oC

1) This table is only intended to give an outline. Where appropriate, the individual measured values are evaluated in display groups 001...099 in the "Reading measured value block" function => Page 31 onwards.

5 - Encoding control unit

5.1 - Encoding control unit

If the appropriate code for the vehicle is not displayed or if the control unit has been renewed, the control unit must be encoded as follows:

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The ignition must be switched on
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "07" for the function "Encode control unit" and confirm entry with Q key.

-> If adjacent display appears:

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

- Enter control unit code in line with control unit number as per encoding table => Page 31 .

Key to code

XX			Country/emissions
	X		Drive / auxiliary functions
		X	Gearbox
		X	Vehicle type

Example of encoding	
04403	European Union member state, FWD with no traction control system, 5-speed manual gearbox, Audi A8

-> If adjacent display appears (example):

```
Encode control unit      Q
Enter code number 04403      (0-32000)
```


- Confirm entry with Q key.

-> The fault reader V.A.G 1551 display will show the control unit identification. For example:

```
8A0906266C     2.8l V6/2V     MPI D03

Code 04403     WSC 12345
```

Note:

-> If adjacent display appears:

```
Function is unknown or cannot
be carried out at present.
```

The code number that was entered was not authorised.

- Press the ⇒key.

-> Display readout (function selection):

```
Rapid data transfer      HELP
Select function XX
```

- Switch off ignition and detach diagnostic connector.

Note:

The next time the ignition is switched on the newly entered code will be activated.

5.2 - Encoding table for control unit no. 8A0 906 266 with index lower than "E"

Country/emissions	02			Non-member states of the European Union (MVEG I)
	03			Vehicles without lambda probes and ACF system (ECE)
	04			Member states of the European Union (MVEG II)
Drive / auxiliary functions		4		FWD without traction control system
		5		FWD with traction control system1)
		6		4WD without traction control system
Gearbox			0	5-speed manual gearbox
			4	Automatic gearbox 01K / 01F

Vehicle type	3	Audi A8

1) Vehicles with traction control system (ASR) can be recognised from ASR warning lamp in dash panel insert / or on the basis of ABS/ASR self-diagnosis.

5.3 - Encoding table as of control unit no. 8A0 906 266 E

Country/emissions	01			USA vehicles with EGR
	02			Sweden and non-member states of European Union
	03			South Africa - vehicles with no lambda probes
	04			European member states and Norway
Drive / auxiliary functions		0		FWD without traction control system
		1		FWD with traction control system1)
		2		4WD without traction control system
Gearbox			0	5-speed manual gearbox
			4	Automatic gearbox 01K / 01F
Vehicle type			3	Audi A8

1) Vehicles with traction control system (ASR) can be recognised from ASR warning lamp in dash panel insert / or on the basis of ABS/ASR self-diagnosis.

6 - Reading measured value block

6.1 - Reading measured value block

Test requirements:

- Coolant temperature at least 85 oC.
- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Selector lever in position P or N
- No faults stored in fault memory

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Switch on the fault reader printer with the print key. The indicator lamp in the key must light up.
- Enter "08" to select the function "Reading measured value block" and confirm entry with Q key.

-> If adjacent display appears:

```
Reading measured value block     Q
Enter display group number XXX
```

- Enter the required display group number =>Display groups, Page 32 .
- Confirm entry with Q key.

-> Display for display group 000:

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

-> Display for display group 001 (example):

```
Reading measured value block     1
1     2     3     4
```

Notes:

- If the printer is switched on, the current display can be printed out on the record slip.
- Proceed as follows to switch to a different display group:

Display group	V.A.G 1551	V.A.G 1552
Higher	Press key 3	Press ↑ key.
Lower	Press key 1	Press ↓ key
Skip	Press the C key	Press the C key

- If all the display zones show the specified values, press the ⇒ key.

6.2 - Display groups

Display Group No.	Display	Designation
000 Basic function	Reading measured value block 1 2 3 4 5 6 7 8 9 10	1 = Coolant temperature 2 = Air mass meter output voltage 3 = Engine speed 4 = Learned value for idling stabilisation 5 = Learned value for idling stabilisation 6 = Idling stabilisation feedback 7 = Switching inputs 8 = Lambda control value 9 = Lambda learning demand 10 = Learned value for throttle valve potentiometer

Display Group No.	Display	Designation
001 Basic function	Read measured value block 1 1 2 3 4	1 = Coolant temperature 2 = Air mass meter output voltage 3 = Not allocated 4 = Engine control unit power supply
002 Throttle valve potentiometer	Read measured value block 2 1 2 3 4	1 = Throttle valve potentiometer voltage - idling speed to full throttle 2 = Throttle valve positioner potentiometer voltage - idling speed, lower part throttle 3 = Learned value for throttle valve potentiometer 4 = Idling switch
003	Read measured value block 3	1 = Engine speed

Display Group No.	Display	Designation
Basic function	1 2 3 4	2 = Engine load - idling speed 3 = Throttle valve angle 4 = Vehicle speed

Display Group No.	Display	Designation
004 Idling speed stabilisation	Read measured value block 4 1 2 3 4	1 = Idling speed control 2 = Learned value for idling stabilisation 3 = Idling stabilisation learned value for automatic gearbox 4 = Switching input at idling speed
005 Lambda learned values	Read measured value block 5 1 2 3 4	1 = Lambda learned value - idling speed (bank 1) 2 = Lambda learned value - part throttle 1 (bank 1) 3 = Lambda learned value - part throttle 2 (bank 1) 4 = Lambda learned value - part throttle 3 (bank 1)
006 Lambda learned values	Read measured value block 6 1 2 3 4	1 = Lambda learned value - idling speed (bank 2) 2 = Lambda learned value - part throttle 1 (bank 2) 3 = Lambda learned value - part throttle 2 (bank 2) 4 = Lambda learned value - part throttle 3 (bank 2)

Display Group No.	Display	Designation
007 Lambda control	Read measured value block 7 1 2 3 4	1 = Lambda control (bank 1) 2 = Lambda learning range - display 3 = Lambda learning demand - diagnosis 4 = Lambda learning demand - display
008 Lambda control	Read measured value block 8 1 2 3 4	1 = Lambda control (bank 2) 2 = Lambda learning range - display 3 = Lambda learning demand - diagnosis 4 = Lambda learning demand - display
009 Lambda control	Read measured value block 9 1 2 3 4	1 = Lambda control (bank 1) 2 = Lambda control (bank 2) 3 = Duty cycle of ACF solenoid 1 -N80 4 = Throttle valve angle

Display Group No.	Display	Designation
010 Lambda control/ voltage signal	Read measured value block 10 1 2 3 4	1 = Sum total of lambda control and instantaneous lambda learned value (bank 1) 2 = Sum total of lambda control and instantaneous lambda learned value (bank 2) 3 = Lambda probe 1 voltage signal (bank 1) 4 = Lambda probe 1 voltage signal (bank 2)
011 Ignition timing	Read measured value block 11 1 2 3 4	1 = Ignition timing without knock control and digital idling speed stabilisation 2 = Ignition timing with knock control and digital idling speed stabilisation (mean value of all cylinders) 3 = Ignition timing intervention for digital idling speed stabilisation

		4 = Idling switch
012 Ignition timing	Read measured value block 12 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing map switching 4 = Ignition timing retardation by knock control (mean value of all cylinders)

Display Group No.	Display	Designation
013 Knock control	Read measured value block 13 1 2 3 4	1 = Ignition timing map switching 2 = Ignition timing retardation by knock control, cylinder 1 3 = Ignition timing retardation by knock control, cylinder 2 4 = Ignition timing retardation by knock control, cylinder 3
014 Knock control	Read measured value block 14 1 2 3 4	1 = Ignition timing map switching 2 = Ignition timing retardation by knock control, cylinder 4 3 = Ignition timing retardation by knock control, cylinder 5 4 = Ignition timing retardation by knock control, cylinder 6
015 Knock sensor	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Knock sensor signal, cylinder 1 3 = Knock sensor signal, cylinder 2 4 = Knock sensor signal, cylinder 3

Display Group No.	Display	Designation
016 Knock sensor	Read measured value block 16 1 2 3 4	1 = Engine speed 2 = Knock sensor signal, cylinder 4 3 = Knock sensor signal, cylinder 5 4 = Knock sensor signal, cylinder 6
017 EGR .	Read measured value block 17 1 2 3 4	1 = Time counter 1 2 = Time counter 2 3 = Engine load 4 = EGR temperature
018 Idling speed stabilisation	Read measured value block 18 1 2 3 4	1 = Internal specified duty cycle of idling stabilisation valve 2 = Current input of idling stabilisation valve 3 = Current regulation of idling stabilisation valve 4 = Engine control unit power supply

Display Group No.	Display	Designation
019 Mixture preparation	Read measured value block 19 1 2 3 4	1 = Engine power (internal calculated value) 2 = Intake air mass 3 = Vehicle speed 4 = Injection period (mean value of all cylinders)
020, 021		Unallocated
022 Traction control	Read measured value block 22 1 2 3 4	1 = Reduction stages 2 = Ignition timing retardation by ASR 3 = Reduced engine torque (actual torque)

Display Group No.	Display	Designation
control		4 = Non-reduced engine torque
023 Operating status	Read measured value block 23 1 2 3 4	1 = Change-up/change-down signal 2 = Signal for gear recognition and gear shift 3 = Air conditioner operating status 4 = Air-conditioner compressor shut-off

Display Group No.	Display	Designation
024...098		Unallocated
099 Operating status Lambda control	Read measured value block 99 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Coolant temperature 4 = Lambda control OFF/ON

6.3 - Reading measured value block: Display Groups 001 to 010

Display group 001; basic function:

Reading measured value block 1 ⇒ ◂ Display

... oC ... V - ... V

Engine control unit power supply
▪ 12.0 ... 14.0 V OK

Not allocated

Air mass meter output voltage
▪ 1.450 ... 1.580 V OK (for new engines, max. 1.680 V)
▪ In the event of engine speed increase, display value rises to 2.500 V, drops to 0.000 V and starts rising again.

Coolant temperature
▪ 85 ... 110 oC OK.

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1	Less than 85 oC 1)	- Engine too cold	- Perform test drive if necessary
		- Coolant temperature sender or wiring to engine control unit	- Check coolant temperature sensor -G62 =>Page 177
	Greater than 110 oC 1)	- Radiator dirty	- Clean radiator
		- Radiator fan not working	- Check operation
		- Thermostat defective	- Check coolant thermostat
		- Coolant temperature sender or wiring to engine control unit	- Check coolant temperature sensor -G62 =>Page 177

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
2	Less than 1.450 V	- Large quantity of unmetered air between intake manifold and air mass meter	- Eliminate air leak
	Greater than 1.580 V	- Loads switched on, e.g. air conditioner is on; steering wheel is at end stop; selector lever of automatic gearbox not set to position "P" or "N"	- Switch off all electrical loads Centre steering wheel Move selector lever to "P" or "N"

1) Vehicle at operating temperature.

Notes on display zone 2:

- Only assess the tolerance range of the air mass meter output voltage in function 04 "Basic setting" at idling speed.
- The air-mass meter output voltage decreases by 0.05 V for every 500 m above sea level.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
4	Less than 12 V	- Alternator defective, battery heavily discharged	- Check voltage, charge battery
		- High load on electrical system shortly after starting engine due to high charge current and load from ancillaries	- Increase engine speed for several minutes and switch off ancillaries
		- Contact resistance in power supply or earth connection for engine control unit	- Check power supply to engine control unit => Page 180
		- Current drain with ignition off	- Eliminate current drain
	Greater than 14.0 V	- Voltage control on alternator defective	- Test voltage; if necessary, fit a new voltage regulator.
		- Excess voltage from assisted start or high speed charging	- Interrogate fault memory => Page 4

Display group 002, throttle valve potentiometer:

Reading measured value block 2			⇒	◂ Display
... V	... V	... V	0	Idling switch ▪ 0 = open ▪ 1 = closed
				Learned value for throttle valve potentiometer ▪ 0.250 ... 0.500 V OK
				Throttle valve potentiometer voltage (idling speed to part throttle range) ▪ 0.250 ... 1.275 V OK
				Throttle valve potentiometer voltage (idling speed to full throttle range) ▪ 0.250 ... 4.750 V OK

Test table, Display Group 002

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1	Deviation from tolerance range	- Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory =>Page 128
2	Outside the tolerance range	- Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory =>Page 128
3	Outside the tolerance range	- Idling switch actuated or defective - Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory =>Page 128
		- Loads switched on, e.g. air conditioner is on; steering wheel is at end stop; selector lever of automatic gearbox not set to position "P" or "N"	- Switch off all electrical loads Centre steering wheel Move selector lever to "P" or "N"
		- Moisture in connector of throttle valve potentiometer -G69	- Check connector
		- Earth point at intake manifold	- Check earth connection => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Notes on display zone 3:

- Idling switch must be closed for checking throttle valve potentiometer learned value => Display zone 4.
- If the displays in zones 2 and 3 agree at idling speed, the learning process is OK. The last value learned is constantly displayed if no learning process takes place.
- The throttle valve potentiometer learned value is set to 0.550 V if the control unit is de-energised.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
4	0 or 1	- Idling switch -F60 defective - Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory =>Page 132
		- Throttle valve sticking - Floor mat pressing down on accelerator pedal	- => Display group 011, Display zone 4 Rectify fault
		- Throttle cable setting	- Adjust throttle cable => 6-cylinder engine (2-valve), Mechanical components; Repair Group 20; Servicing throttle control; Adjusting throttle cable Servicing throttle control; Adjusting throttle cable

Display group 003; basic function:

Reading measured value block 3			⇒	◂ Display
...rpm	...%	...%	... km/h	
				Vehicle speed
			Throttle valve angle: ▪ Idle speed: 0% OK ▪ Full throttle: Greater than 95% OK	
		Engine load (idling speed) ▪ 15.0 ... 35.0% OK		

Engine speed (idling speed) ▪ 650 ... 750 rpm OK

Test table, Display Group 003

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1	Greater than 750 rpm	- Idling switch -F60 defective or incorrectly set	- Check and adjust idling speed switch -F60 => Page 132 or => Display group 004, Display zone 4
		- Air intake system drawing in large quantities of unmetered air	- Check air intake system for leaks
		- Idling stabilisation valve -N71 is sticking or stiff	- Perform final control diagnosis => Page 98 .
	Less than 650 rpm	- Idling stabilisation valve -N71 is sticking or stiff	- Perform final control diagnosis =>Page 98 .
		- Idling switch -F60 defective or incorrectly set	- Check and adjust idling speed switch -F60 => Page 132 or => Display group 004, Display zone 4
		- Loads switched on, e.g. air conditioner is on; steering wheel is at end stop; selector lever of automatic gearbox not set to position "P" or "N"	- Switch off all electrical loads Centre steering wheel Move selector lever to "P" or "N"

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
2	Outside the tolerance range	- Poor idle (not running on all cylinders)	- Injector or spark plugs defective
		- Air mass meter -G70 defective	- Interrogate fault memory => Page 4 or => Display group 001, Display zones 2 and 3
		- Idling stabilisation valve -N71 defective	- Interrogate fault memory =>Page 4 or =>Display group 018
		- Loads switched on, e.g. air conditioner is on; steering wheel is at end stop; selector lever of automatic gearbox not set to position "P" or "N"	- Switch off all electrical loads Centre steering wheel Move selector lever to "P" or "N"

Note on display zone 2:

Only assess engine load tolerance band at idling speed in function 04 "Basic setting"

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3	Greater than 0% at idling speed	- Throttle valve potentiometer -G69 defective	- Interrogate fault memory =>Page 4 or =>Display group 002
		- Throttle cable setting	- Adjust throttle cable => 6-cylinder engine (2-valve), Mechanical components; Repair Group 20; Servicing throttle control; Adjusting throttle cable Servicing throttle control; Adjusting throttle cable
		- Throttle valve sticking	- Rectify fault
	Less than 95% at full throttle	- Throttle valve potentiometer -G69 defective	- Interrogate fault memory =>Page 4 or =>Display group 002

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
		- Throttle cable setting	- Adjust throttle cable => 6-cylinder engine (2-valve), Mechanical components; Repair Group 20; Servicing throttle control; Adjusting throttle cable Servicing throttle control; Adjusting throttle cable
		- Throttle valve potentiometer -G69 incorrectly set	- Check throttle valve potentiometer -G69 => Page 128

Notes on display zone 3:

- For checking at full throttle, switch engine off and ignition on.
- Vehicles with manual and automatic gearbox have different throttle valve units. As of control unit no. 8A0 906 266 E, the start of the opening of the 2nd stage of the throttle valve unit can be measured with ignition switched on; this also checks that it has been fitted correctly. Manual gearbox 45 ...53%; automatic gearbox 27 ... 35%

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
4	No Display	- Fault in wiring between dash panel insert and engine control unit	- Check wiring => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"
		- Open circuit or short circuit between speedometer sender/road speed sender -G22/-G68 and engine control unit	- Check wiring => Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"
		- Speedometer sender/road speed sender -G22/-G68	- Check speedometer sender/road speed sender -G22/-G68 => Page 147

Note on display zone 4:

If vehicle speed is not displayed on V.A.G 1551, start by checking whether speedometer reading is OK. If not, check speedometer:

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Display group 004, Idling stabilisation:

Reading measured value block 4									◂ Display
1	4	0		0	0	1		1	0	

X X X X X
- Display always 0
- Air conditioner compressor: 0 = off, 1 = on
- Idling switch: 0 = open, 1 = closed
- Gear recognition signal: 1 = manual gearbox or automatic gearbox in selector lever position "P" or "N"
- 0 = automatic gearbox in selector lever position R, 2, 3, 4
- Gearshift signal (as of control unit no. 8A0 906 266 E):
- 0 = not active, 1 = active

Idling stabilisation learned value for automatic gearbox (AT)
- In selector lever position D, 2, 3, 4 or R +10... -20 OK
- Display always 0 for manual gearbox (MT)

Learned value for idling stabilisation
- For manual gearbox (MT) in idling position +14... -16 OK
- (new engines +20... -16)
- For automatic gearbox (AT) in selector lever position "P" or "N" +10... -20 OK
- (new engines +16... -20)

Idling control at idle
- 0 ± 2 OK

Notes on display zones 2 and 3:

- Only assess values in display zone 2 or 3 if idling control is within tolerance at idle (display zone 1). If idling control is not within the tolerance after 1 minute waiting time, learning does not take place in display zone 2 or 3.
- Positive learned values indicate higher learned value than in basic setting: -N71 still open.
  Negative learned values indicate lower learned value than in basic setting: -N71 is still closed.

Test table, Display Group 004

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1	Outside the tolerance range	- Fault in fault memory	- Interrogate fault memory =>Page 4
		- Idling switch -F60 actuated or defective	- Check idling switch -F60 => Page 132 and => Display group 002, display zone 4
		- Idling stabilisation valve -N71 defective	- Check idling stabilisation valve -N71 => Page 98 .
		- Loads switched on, e.g. air conditioner is on; steering wheel is at end stop; selector lever of automatic gearbox not set to position "P" or "N"	- Switch off all electrical loads Centre steering wheel Move selector lever to "P" or "N"
		- Throttle valve sticking - Floor mat pressing down on accelerator pedal - Unmetered air	- Eliminate cause

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
2	Greater than +14 (MT)	- Idling stabilisation valve -N71 defective	- Check idling stabilisation valve -N71 => Page 98 .

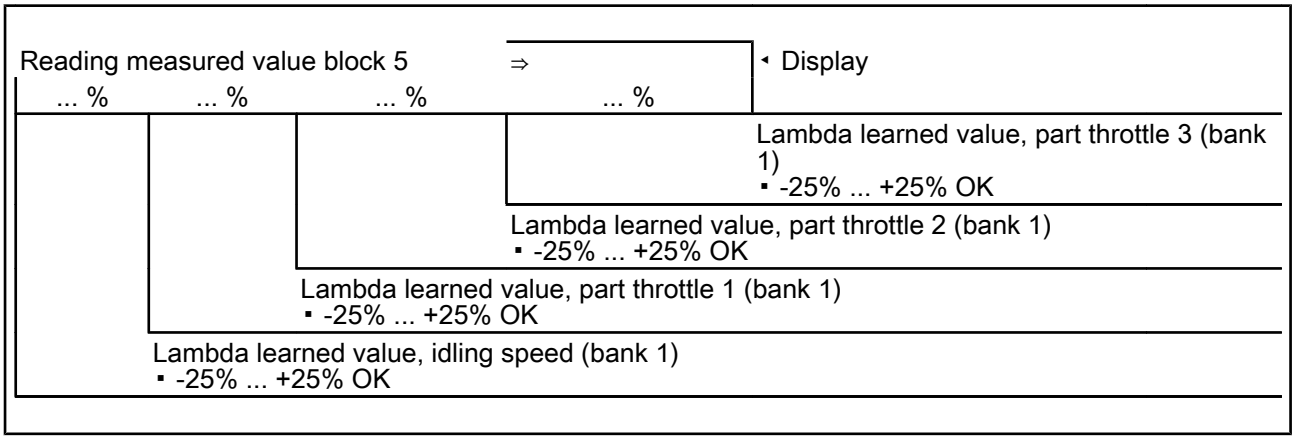
Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
	or Greater than +10 (AT)	- Loads switched on, e.g. air conditioner is on; steering wheel is at end stop; selector lever of automatic gearbox not set to position "P" or "N"	- Switch off all electrical loads Centre steering wheel Move selector lever to "P" or "N"
		- Suction jet pump clogged (automatic gearbox)	- Eliminate cause
	Less than -16 (MT)	- Idling stabilisation valve -N71 defective	- Interrogate fault memory =>Page 4 or =>Display group 018
	or Less than -20 (AT)	- Large volume of unmetered air, intake manifold area, throttle valve stop not OK, leakage air at throttle valve 2nd stage	- Eliminate cause

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3	Outside the tolerance range	Vehicles with automatic gearbox only: - Display zone 2 outside tolerance range	- => Display zone 2
		- Display zone 2 within tolerance range: - Set selector lever to D and observe idling speed for approx. 1 min; if display zone 3 remains outside tolerance range, then the gearbox will not operate smoothly	- Check gearbox
4	Not 001 1 1) or Not 001 10 2)	- Idling switch -F60 actuated or defective	- Check and adjust idling speed switch -F60 => Page 132
		- A/C compressor switched on	- Switch off the air conditioner
		- Air conditioner requires higher cooling or heat output ("high")	- Check air conditioner compressor shut-off => Page 144
		- Gear engaged (automatic gearbox)	- Move selector lever to P or N

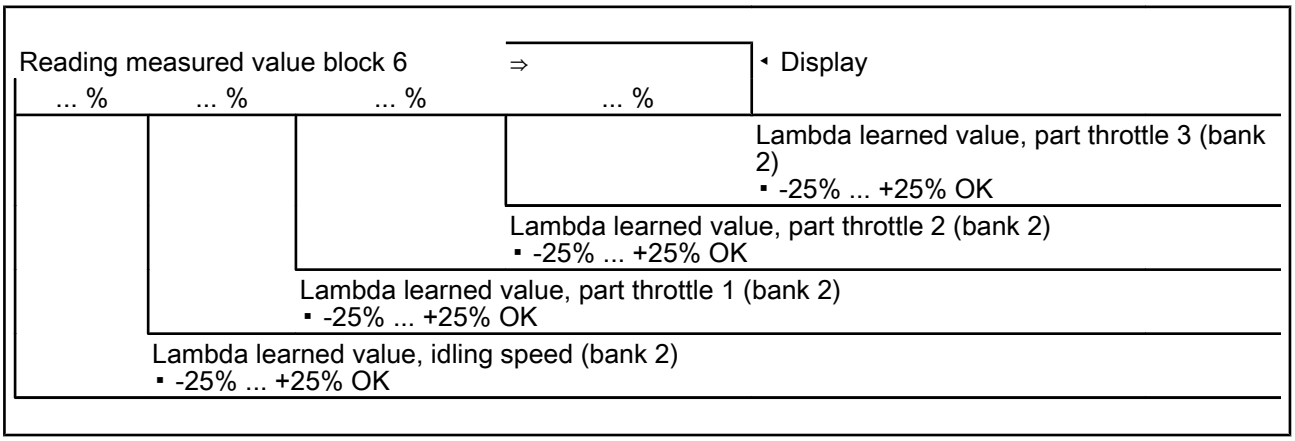
1) Control unit no. 8A0 906 266 C

2) As of control unit no. 8A0 906 266 E

Display group 005, lambda learned values, cylinder bank 1:



Display group 006, lambda learned values, cylinder bank 2:



Test table: Display groups 005 and 006

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2/3/4	Low lambda learned values	Lambda learned values low for idling and normal for part throttle 2 and 3: - Oil dilution (high petrol content in oil)	- Disconnect and seal off crankcase breather Problem eliminated after motorway drive or oil change
		- Injector leaking	- Check injectors =>Page 85 .
		If all 4 lambda learned values are very low: - Fuel pressure too high	- Check fuel pressure =>Page 82 .
		- Solenoid valve 1 for activated charcoal filter -N80 is constantly open	- Check -N80 => Page 123 or => Display group 009, display zone 3 and display group 001, display zone 2
		- Air mass meter -G70 defective	- Check -G70 => Page 102
(cont.) t		- Lambda probe heating defective or lambda probe dirty	- Check lambda probe => Page 117 or =>Display group 010, display zones 1 and 2

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2/3/4	High lambda learned values	Lambda learned values high for idling and less high for part throttle: - Unmetered air in intake manifold area	- Eliminate fault
		- Injector blocked	- Test injection quantity =>Page 90 .
		If all 4 lambda learned values are very high: - Air mass meter -G70 defective	- Check -G70 => Page 102
		- Fuel pressure too low	- Check fuel pressure =>Page 82 .

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
		- Unmetered air between -G70 and throttle valve - Unmetered air at manifold gasket	- Eliminate cause
		- Lambda probe heating defective or lambda probe dirty	- Check lambda probe => Page 117 or =>Display group 010, display zones 1 and 2

Notes on display groups 005 and 006:

- Differences in lambda learned values (=> Display group 010, display zones 1 and 2) of more than 8% between display group 005 (bank 1) and display group 006 (bank 2) may be due to the following:
  - Defective spark plugs
  - Defective injectors (leaking, clogged)
  - Unmetered air at one end
  - Lambda probe defective or dirty
  - Mechanical base setting (valve timing) of engine not OK
- If the difference between the richest and leanest lambda learned value of a display group is 9%, any further learning of the two learning ranges in question is stopped (=> Display group 007 or 008). The learning demand display (=> Display group 007 or 008) for these learning ranges cannot be "1".
- All values are reset to 0.0% if control unit is deenergised.

Display group 007, lambda control, cylinder bank 1:

Reading measured value block 7		⇒	◂ Display
... %	X X X X	XXXXXXXX	XXXXXXXX
			Lambda learning demand diagnosis (bank 1); significance =>Page 44
		Lambda learning demand diagnosis (bank 1); significance =>Page 44	
	X X X X	Lambda learning range display (bank 1) ▪ Part throttle 3:0 = engine speed and load for this learning range not attained ▪ 1 = engine speed and load for this learning range attained ▪ Part throttle 2:0 = engine speed and load for this learning range not attained ▪ 1 = engine speed and load for this learning range attained ▪ Part throttle 1:0 = engine speed and load for this learning range not attained ▪ 1 = engine speed and load for this learning range attained ▪ Idling speed:0 = engine speed for this learning range not attained ▪ 1 = engine speed for this learning range attained	
		Lambda control (bank 1) ▪ 0.0 ± 6.0% OK 1)	

1) Only assess the lambda control tolerance range at idling speed in function 04 "Basic setting", as function 08 "Reading measured value block" also includes control of ACF influence.

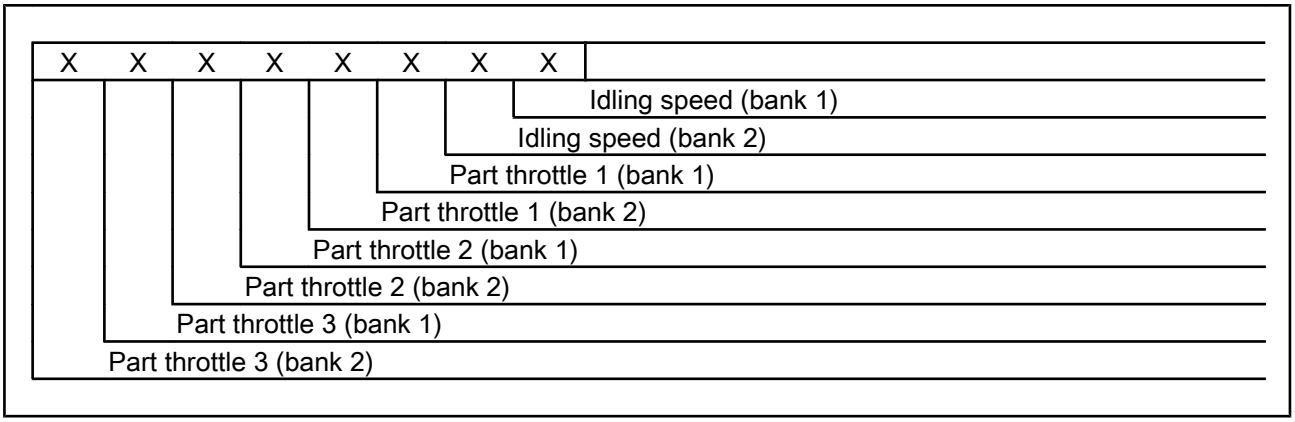
Display group 008, lambda control, cylinder bank 2:

Reading measured value block 8		⇒	◂ Display
... %	X X X X	XXXXXXXX	XXXXXXXX
			Lambda learning demand diagnosis (bank 2); significance =>Page 44
		Lambda learning demand diagnosis (bank 2); significance =>Page 44	

X X X X	Lambda learning range display (bank 2) ▪ Part throttle 3:0 = engine speed and load for this learning range not attained ▪ 1 = engine speed and load for this learning range attained ▪ Part throttle 2:0 = engine speed and load for this learning range not attained ▪ 1 = engine speed and load for this learning range attained ▪ Part throttle 1:0 = engine speed and load for this learning range not attained ▪ 1 = engine speed and load for this learning range attained ▪ Idling speed:0 = engine speed for this learning range not attained ▪ 1 = engine speed for this learning range attained
	Lambda control (bank 2) ▪ 0.0 ± 6.0% OK 1)

1) Only assess the lambda control tolerance range at idling speed in function 04 "Basic setting", as function 08 "Reading measured value block" also includes control of ACF influence.

Significance of 8-digit display "Lambda learning demand diagnosis/Lambda learning demand display"



Test table: Display groups 007 and 008

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1	Outside tolerance range	Negative display - engine too rich Effect: Lambda control leans the mixture	- Wait 30 seconds for the display to stabilise
		Positive display ("+" is not displayed) - engine too lean Effect: Lambda control enriches the mixture	
		- Unmetered air	- Eliminate air leak
		- Injector defective	- Check injection quantity =>Page 90 .
		- Not successfully learned	- => Display zone 4
		- Lambda learned values at stop	- Check lambda learned values => Display group 005 or 006
2	-		- => Notes
3	-		- => Notes
4	-		- => Notes

Notes on display zone 1:

- Do not assess lambda control in either function 04 "Basic setting" or function 08 "Reading measured value block" until after the learning process has been completed successfully (=> Learning demand display).
- The lambda control indicates the instantaneous control status. After the learning process has been successfully completed (=> Learning demand display), the values fluctuate around 0.0 ± 6.0%. If the learning process (display zone 4) has been completed and a value around 0.0 ±6.0% is not attained, observe display group 010, display zone 3 or 4 and check control action of both lambda probes. The display values must intermittently drop below 0.3 V and exceed 0.6 V; if not, check lambda probe heating and lambda probe.
- The lambda control stop must also be assessed only after the learning process has been completed successfully (=> Learning demand display):
  For control unit no. 8A0 906 266 C: Control stop max. + 29 %
  Control stop min. - 60%
  From control unit no. 8A0 906 266 E: Control stop max. +32 %
  Control stop min. - 87.5%
- Values of more than ±20 % in function 04 "Basic setting" may be due to the following faults:
  - Unmetered air
  - Engine damage (oil combustion due to defective piston)

Notes on display zone 2:

- The instantaneous learning range (load status) is displayed in zone 2 (learning range display). Only idling speed and part throttle learning ranges are displayed, as learning does not take place at full throttle.
- The following procedure must be implemented to reach the corresponding learning range (load status):
  - Idling speed learning range: Allow vehicle to idle (650... 900 rpm).
  Part throttle 1, 2, 3 learning range: Perform test drive (second person); in doing so, increase engine speed to 1500... 3000 rpm and generate load by pressing the brake gently.

Notes on display zone 3:

- The lambda learning diagnosis shows which lambda learned value was checked in the learning process.
- On completion of diagnosis, the corresponding value is set to "1", regardless of whether the diagnosis was found to be OK or not.
- If the lambda learning demand diagnosis value in display zone 3 is set to "1", but the corresponding lambda learning demand display (display zone 4) is not set to "1", diagnosis has been performed but found not to be OK.
- The lambda learning demand diagnosis is always reset to "0" on starting with a coolant temperature of less than 40 oC .

Notes on display zone 4:

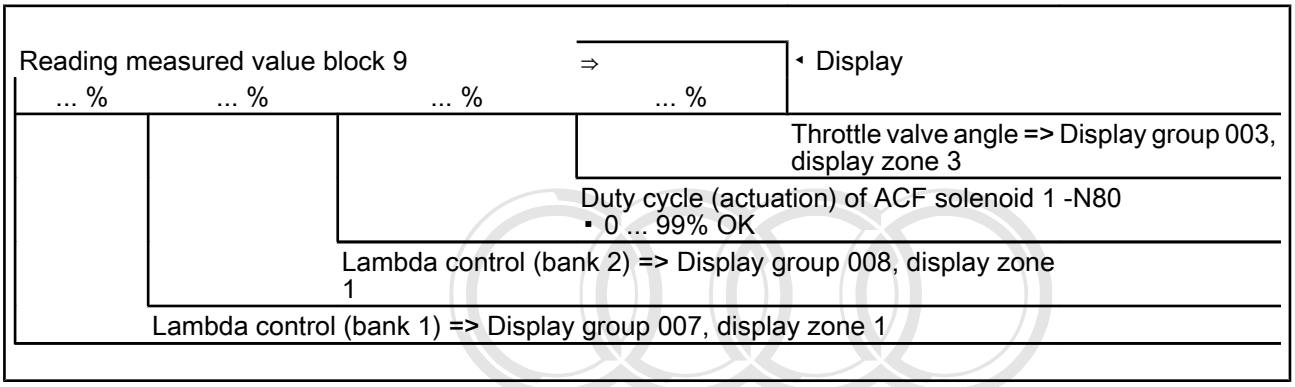
- Display zone 4 (learning demand display) shows the learning range (display zone 2) in which there is a demand for learning.
- Learning requirements:
  - No fault stored in fault memory
  - Engine speed at idle (650 ... 900 rpm or 1500 ... 3000 rpm
  - Coolant temperature 80 ... 110 oC
  If these requirements are met, but learning still does not start immediately, give a burst of throttle.
- Learning is prohibited:
  - With rough idling (hunting), during acceleration and at full throttle
  - If faults have been stored in the fault memory (does not apply to sporadic faults)
  - If the difference between the richest and the leanest lambda learned value of a display group is 9%.
  Learning in both learning ranges is discontinued in the event of a 9% difference. The learning demand display for these learning ranges cannot be "1"=> Display group 005 or 006 .
- Learning commences 20 seconds after start of function 04 "Basic setting", or 2 ... 4 minutes after every start with a coolant temperature of less than 40 oC.

Notes continued:

- The following list indicates the conditions under which the re-learn prompt (learning demand) is enforced:
  On starting function 04 "Basic setting" with V.A.G 1551 or whenever fault memory has been erased, all learning demand displays are set to "0" in order to force a re-learn prompt for the lambda learned values after vehicle servicing.
  - A learning demand is always enforced in all learning ranges whenever the engine is started with the coolant temperature lower than 40 oC.
  - All learning demand displays are set to "0" again if a major learned value deviation (between a stored learned value and a newly learned value) occurs in a learning range during the learning process.

- If learning is successful, the learning demand values of the respective learning range (display zone 2) are set to "1".
- Significance of 8-digit learning demand display: 0 = renewed learning prompt
  1 = learning process completed

Display group 009, lambda control:



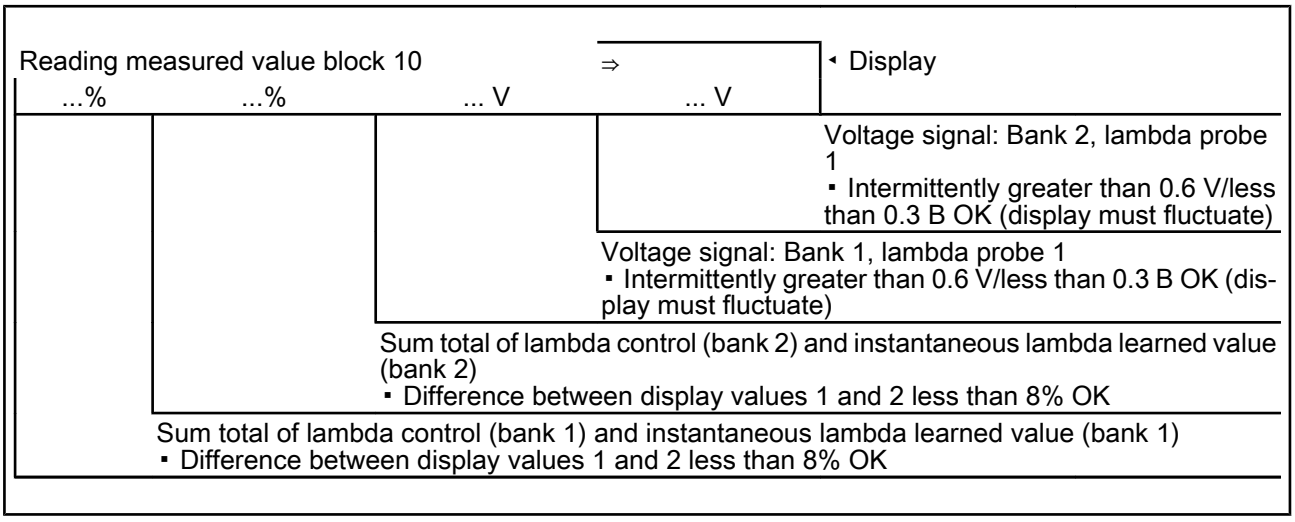
Note on display zones 1 and 2:

Do not assess lambda control in either function 04 "Basic setting" or function 08 "Reading measured value block" until after the learning process has been completed successfully (=> Display group 007 or 008, display zone 4).

Notes on display zone 3:

- ACF solenoid 1 -N80 is closed during learning process.
- The influence of ACF can be assessed by comparing the display value in function 04 "Basic setting" (ACF valve closed: 99%) and function 08 "Reading measured value block" (ACF valve open: 0%).

Display group 010, Lambda control, lambda probe voltage signal:



Test table, Display Group 010

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2	Difference	- Defective spark plug	- Test spark plugs
	between	- Unmetered air at one end	- Eliminate cause
	Display zone 1 and	- Injector leaking	- Interrogate fault memory =>Page 85
	Display zone 2 greater than 8%	- Lambda probe defective or dirty	- Interrogate fault memory => Page 4 or => Display zones 3 and 4
		- Mechanical base setting (valve timing) of engine not OK	- Check valve timing => 6-cylinder engine, Mechanical Components, Dismantling and assembling engine; Removing and installing toothed belt

Note on display zones 1 and 2:

The sum total of lambda control and lambda learned value indicates the overall influence of the lambda control. Comparison of display zones 1 and 2 permits direct assessment of differences between banks.

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3/4	Display	- Injector defective	- Check injectors =>Page 85
	not fluctuating	- Defective spark plug	- Test spark plugs
	(less than 0.3 V	- Large quantity of unmetered air	- Eliminate cause
	or greater than 0.6 V)	- Solenoid valve 1 for activated charcoal filter -N80	- Perform final control diagnosis => Page 123
		- Lambda probe defective or dirty	- Interrogate fault memory =>Page 115
		- Lambda probe heating defective	- Check lambda probe heating => Page 117
		- Fuel system pressure too high or too low	- Check fuel pressure =>Page 82 .

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3/4	constant 2.550 V	- Short to positive through: - Lambda probe - Signal wire - Engine control unit	- Check lambda probe =>Page 115 .
	constant 0.350... 0.450 V	- Open circuit through: - Lambda probe - Signal wire - Engine control unit	- Check lambda probe =>Page 115 .
	constant 0.000 V	- Short to earth through: - Lambda probe - Signal wire - Engine control unit	- Check lambda probe =>Page 115 .

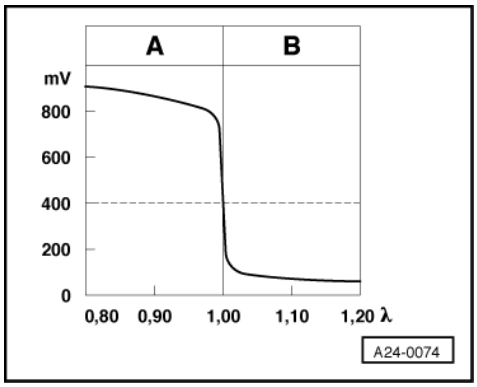
Notes on display zones 3 and 4:

- The voltage signal for "Rich mixture (low level of residual oxygen)" is between about 0.6 and 1.0 V.
- The voltage signal for "Lean mixture (high level of residual oxygen)" is between about 0.0 and 0.3 V.

- During the transition from "rich" to "lean" and vice versa (λ = 1.0), there is a voltage jump from 0.6...1.0 V to 0.0...0.3 V or vice versa.

Notes continued:

- Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of λ = 1.0. The system fluctuates continuously between "slightly too lean" and "slightly too rich".
- The display value must intermittently drop below 0.3 V and increase beyond 0.6 V. Display values less than 0.45 V indicate "lean", whilst values over 0.45 V indicate "rich".



-> Lambda probe voltage Uλ in mV

A: High lambda probe voltage

- Rich mixture (excess fuel or lack of air)
- High CO value

B: Low lambda probe voltage

- Lean mixture (lack of fuel or excess air)
- Low CO value

6.4 - Reading measured value block: Display Groups 011 to 099

Display group 011, ignition timing:

Reading measured value block 11	⇒	◂ Display
... oBTDC ... oBTDC	± ... ocrankshaft	0
		Idling switch ▪ 0 = open ▪ 1 = closed
		Ignition timing intervention for digital idling speed stabilisation
		Ignition timing with knock control and digital idling-speed stabilisation (mean value of all cylinders)
		Ignition timing without knock control and digital idling-speed stabilisation

Notes on display zone 1:

- Ignition timing of 12o BTDC is displayed at idling speed (idling switch closed) in functions 04 "Basic setting" and 08 "Reading measured value block" .
- In the event of an increase in engine speed (idle switch open) the current ignition timing without knock control and digital idling stabilisation is displayed.

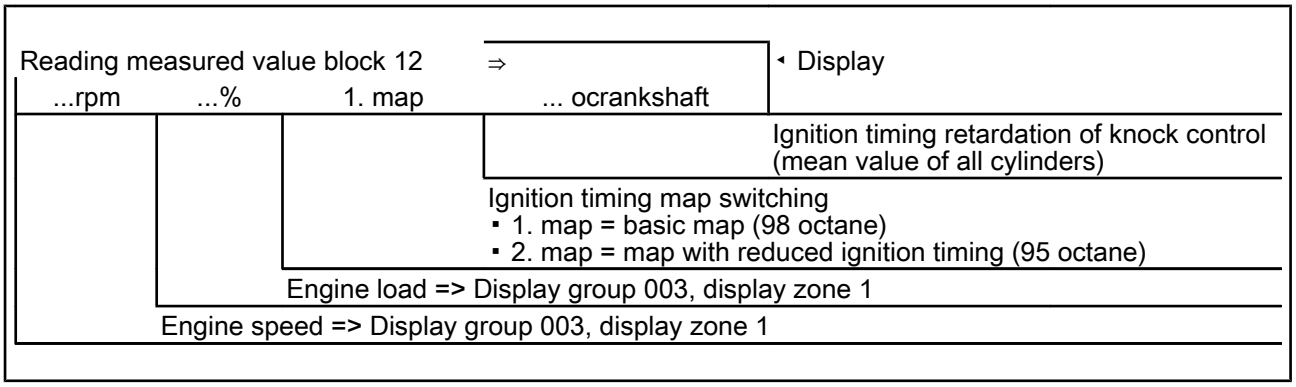
Notes on display zone 2:

- Digital idling stabilisation is only active when the idling switch is closed.
- Knock control is active as of an engine load greater than 40% => Display group 013 or 014.

Notes on display zone 3:

- Digital idling stabilisation (DIS) is only active when the idling switch is closed.
- Ignition timing for DIS with idling switch open 0.0ocrankshaft.
- DIS is blocked in function 04 "Basic setting", display 0.0ocrankshaft
- Ignition timing intervention for DIS in function 08 "Reading measured value block" at idling speed without electrical loads 0.0 ±3.0ocrankshaft

Display group 012, ignition timing:



Notes on display zone 3:

- Ignition timing map switching is selected by the knock control
- The ignition timing difference between the 1st and 2nd map is approx. 3ocrankshaft. The 2nd map is selected if ignition timing retardation (display zone 4) of approx. 4 ocrankshaft is detected.

Notes continued:

- 2nd map is selected in the event of:
  - Poor fuel grade (less than 95 RON)
  - Abnormal engine running noise (ancillaries loose)
  - Engine damage (oil combustion caused by defective piston)
- Ignition timing map switching is disabled if there is a knock sensor fault stored in the fault memory.
- For more precise assessment with 2nd map selected => Display groups 013 and 014

Notes on display zone 4:

Notes on display zone 4:

- Knock control is active as of an engine load greater than 40% => Display group 013 or 014.
- The ignition timing retardation values are only used when the knock control is "active".

Display Group 013, Knock control:

Reading measured value block 13	⇒	◂ Display
1. map ...ocrankshaft	...ocrankshaft	...ocrankshaft
		Ignition timing retardation by knock control, cylinder 3
		Ignition timing retardation by knock control, cylinder 2
		Ignition timing retardation by knock control, cylinder 1
		Ignition timing map switching => Display group 012, display zone 3

Display Group 014, Knock control:

Reading measured value block 14	⇒	◂ Display
1. map ...ocrankshaft	...ocrankshaft	...ocrankshaft
		Ignition timing retardation by knock control, cylinder 6
		Ignition timing retardation by knock control, cylinder 5
		Ignition timing retardation by knock control, cylinder 4
		Ignition timing map switching => Display group 012, display zone 3

Notes on display groups 013 and 014:

- The knock control is active from an engine load of greater than 40%.
- At engine loads of more than 40%, the display will show the current ignition timing retardation values. At engine loads of less than 40% the display will constantly show the last values used.
- If there is audible knocking and no perceptible ignition timing retardation, increase the engine speed to above 3500 rpm for 5 seconds in order to activate the knock sensor fault detection (diagnosis) function.
- If there is a significant difference between the ignition timing retardation value for one of the cylinders and the values for the other cylinders, the following faults are possible:
  - Loose ancillaries
  - Corrosion at connector
  - Engine damage (e.g. oil combustion because of defective piston)
- If the ignition timing retardation values for all the cylinders are high, the following faults are possible:
  - Corrosion at connector => Display group 015
  - Corrosion at connector
  - Tightening torque (20 Nm) not OK
  - Open circuit
  - Knock sensor defective
  - Loose ancillaries
- High ignition timing retardation values for all cylinders (banks 1 and 2) are caused by the use of fuel with a low octane number (less than 95 RON).

Display group 015, knock sensor signal:

Reading measured value block 15		⇒	◂ Display
... rpm	... V	... V	... V
			Knock sensor signal, cylinder 3
			Knock sensor signal, cylinder 2
			Knock sensor signal, cylinder 1
			Engine speed =>Display group 003, display zone 1

Display group 016, knock sensor signal:

Reading measured value block 16 ⇒ ◂ Display

... rpm ... V ... V ... V

Knock sensor signal, cylinder 6

Knock sensor signal, cylinder 5

Knock sensor signal, cylinder 4

Engine speed =>Display group 003, display zone 1

Notes on display groups 015 and 016, display zones 2, 3, and 4:

- Differences of more than a factor of three between the min. and max. knock sensor signal in a display group may be caused by the following fault:
  - Corrosion at connector
- Signal differences of more than a factor of three between display group 015 (cylinder 1 to 3) and display group 016 (cylinder 4 to 6) may result from the following faults:
  - Corrosion at connector
  - Open circuit
  - Knock sensor defective
- If no faults are found when checking the knock sensor, wiring and connector, check the engine for loose ancillaries or engine damage => Display group 013 and 014.

Display group 017, EGR (if fitted):

Notes:

- Display 017 only needs to be observed for vehicles fitted with exhaust gas recirculation system (EGR).
- "0"is always displayed in zones 1, 2, and 4 if the vehicle is not fitted with EGR.
- There is no EGR on cold starting (-10 oC ... 30 oC), at idling speed and in function 04 "Basic setting".
- Display group 017 is only to be assessed in function 08 "Reading measured value block" because exhaust gas recirculation is automatically deactivated in function 04 "Basic setting".
- If diagnosis conditions are satisfied, the engine control unit always checks flow through EGR system after starting.
- Diagnosis conditions are only attained whilst driving at 80... 100 km/h in 4th or 5th gear. Diagnosis is active if diagnosis conditions are satisfied. The vehicle must then be driven within the constraints of the diagnostic conditions for 1 1/2 ... 5 minutes to obtain a diagnostic result.
  EGR flow check diagnosis (EGR volume) is active as soon as the following conditions are satisfied:
  - Speed: Constant
  - Engine speed: 2000 ... 3000 rpm (=> Display group 003)
  - Engine load: 33 ... 60 %

Reading measured value block 17 ⇒ ◂ Display

2 0 ...% ... oC

EGR temperature
▪ Determined by EGR temperature sensor -G98

Engine load

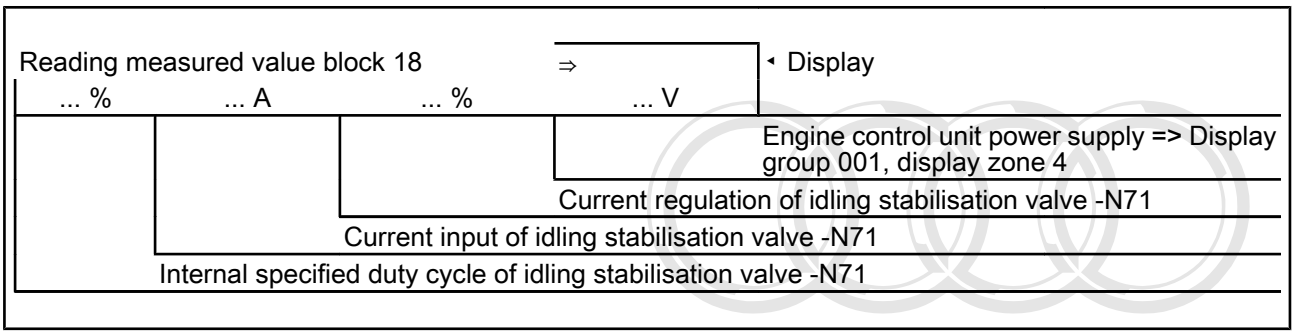
Time counter 2
▪ Final value = 0

Time counter 1
▪ Final value = 2

Notes on display zones 1 and 2:

- Time counters are displayed in zones 1 and 2. Final value of counter 1 is "2", final value of counter 2 is "0".
- Counters are incremented if diagnosis conditions are satisfied and decremented if not.
- Counter 1 switches from "0" to "1" as soon as counter 2 reaches "255". Counter 2 then switches to "0" and starts counting up again. Counter 1 switches from "1" to "2" as soon as counter 2 reaches "255" again.
- Diagnosis is completed as soon as both counters have reached their final value.
  Diagnosis is however only found to be OK if EGR temperature in display zone 4 is greater than 65 oC at the end of diagnosis.
- Diagnosis is terminated if EGR temperature at end of diagnosis is greater than 65 oC.
- Fault "16785" is stored if EGR temperature at end of diagnosis is less than 65 oC.
- If EGR flow check diagnosis is to be specifically repeated or repeated following successful diagnosis, switch off engine and restart.

Display group 018, Idling stabilisation:



Note on display zone 1:

The display shows the internal control unit computed value for the specified duty cycle without current and voltage correction.

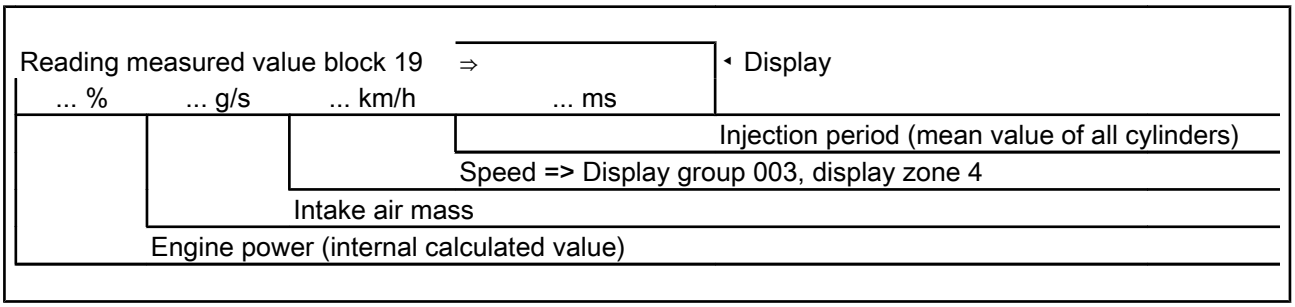
Note on display zone 2:

The display shows the actual current input of the idling stabilisation valve -N71.

Notes on display zone 3:

- Positive/negative values signify increase/decrease in duty cycle to obtain specified current.
- If + 60% is displayed for a lengthy period of time, this is an indication of contact resistance -N71 overheating; a display of - 40% for a lengthy period indicates an interturn short circuit in -N71.

Display group 019, mixture preparation:

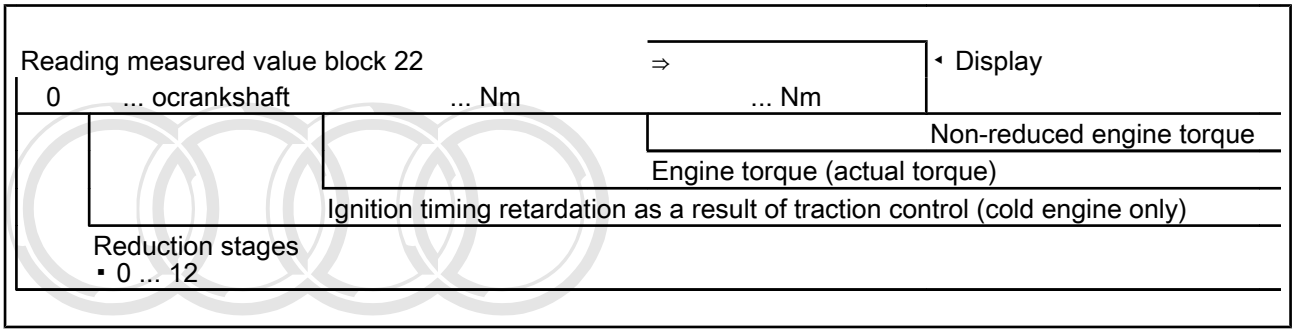


Note on display zone 1:

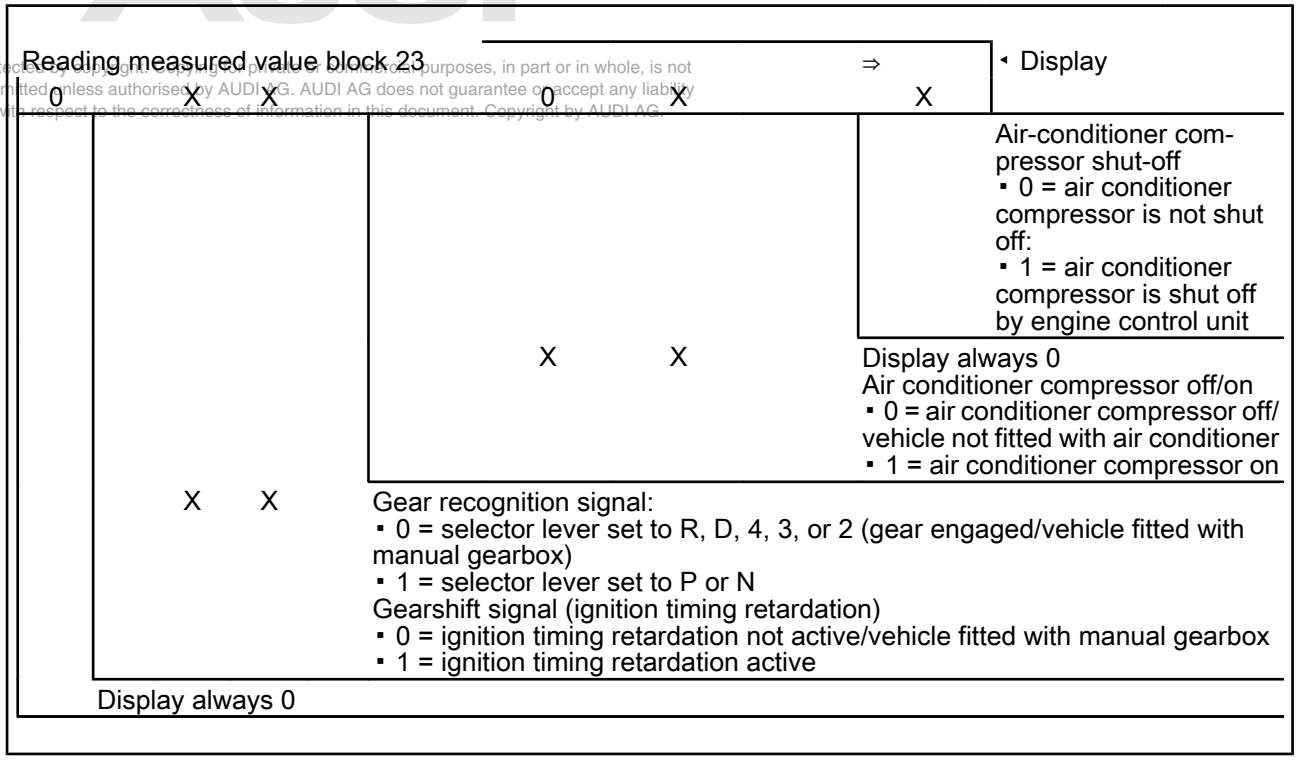
The engine power is an internal control unit computed value calculated from the air intake under standard conditions (atmospheric pressure 1013 mbar, air temperature 20 oC).

Display group 022, traction control system:

- The wheel slip information for traction control (ASR) is calculated in the ABS/ASR control unit. If slip is detected, the ABS control unit requests the engine control unit to reduce torque. This torque reduction is subdivided into 12 reduction stages.
- If the engine is cold (coolant temperature less than 20 oC), the reduction in engine torque is attained
  - In low reduction stages (1... 5) by ignition timing retardation;
  - In high reduction stages (6... 12) by briefly deactivating individual injectors.
- If the engine is warm (coolant temperature greater than 40 oC), the engine torque is reduced solely by way of brief deactivation of individual injectors.



Display group 023 - Operating status:



Notes on display zone 2:

- Gear shift is not always displayed on account of brief signal.
- Checking ignition timing retardation on changing gear => Page 156

- Checking gear signal => Page 153 .

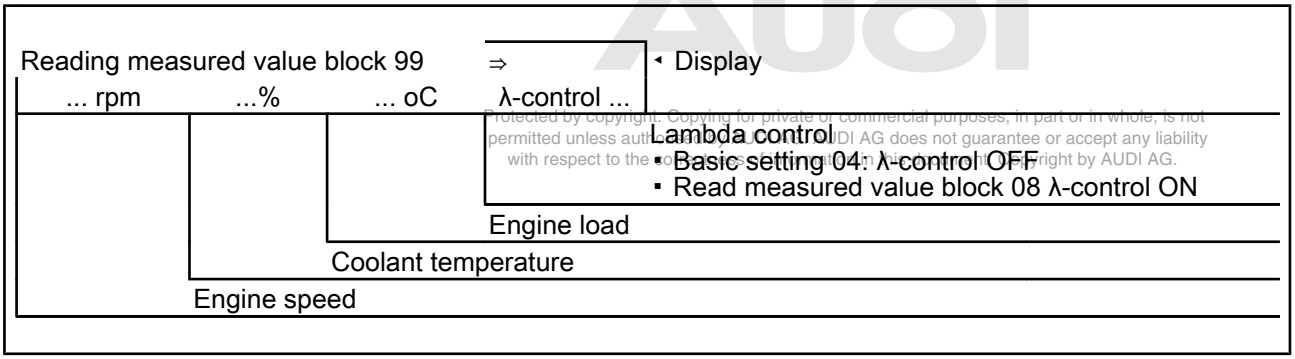
Notes on display zone 3:

- Checking air conditioner compressor shut-off =>Page 144
- The air conditioner compressor is shut off by the engine control unit on accelerating from standstill and from low vehicle speed for approx. 12 seconds. If the accelerator pedal is released sooner, the time is reduced to min. 3 seconds. At full throttle, the air conditioner compressor is shut off by the automatic gearbox (kick-down switch)

Note on display zone 4:

If the air conditioner compressor is off => Display zone 3, display zone 4 shows whether the compressor was shut off by the engine control unit.

Display group 099, Lambda control:



Notes on display zone 4:

- For defined fault finding, the lambda control is switched off when display group 099 in function 04 "Basic setting" is selected and is switched on when this group is selected in function 08 "Reading measured value block".
- Lambda control is automatically re-activated on exit from function 04 "Basic setting".

7 - Adaptation

7.1 - Adaptation

7.2 - Adapting engine control unit to immobilizer - vehicles > 1994

Note:

The "adaptation" function adapts the engine control unit to the immobilizer on Model Year 1994 vehicles.

Work sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The ignition must be switched on
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```

- Enter "10" to select the function "Adaptation" and confirm entry with Q key.

-> If adjacent display appears:

```
Adaptation
Enter channel number XX
```

- Enter "91" to select "adaptation channel 91" and confirm entry with Q key.

-> If adjacent display appears:

```
Channel 91     Adaptation 1010
```

- Press the ⇒key.

Note:

-> If adjacent display appears:

```
Channel 91     Adaptation 2020
```

Adaptation already performed, press ⇒key.

-> If adjacent display appears:

```
Channel 91     Adaptation 1010     Q
Enter adaptation value     XXXXX
```

- Enter 5-digit adaptation value: "30701"

-> If adjacent display appears:

```
Channel 91     Adaptation 1010     Q
Enter adaptation value     30701
```

- Confirm entry with Q key.

-> If adjacent display appears:

```
Channel 91     Adaptation 30701     Q
Store changed value?
```


- Confirm entry with Q key.

-> If adjacent display appears:

```
Channel 91     Adaptation 30701
Changed value is stored
```

- Terminate adaptation by pressing the ⇒ key.
- Interrogate and erase fault memory => Page 4 .

Note:

-> If adjacent display appears:

```
Function is unknown or cannot
be carried out at present.
```

- Adaptation already performed
- Incorrect adaptation value entered
- Engine idling

7.3 - CO adjustment on vehicles not fitted with lambda probes

Notes:

- In the "Adaptation" function, the engine control unit executes the same operations as in function 04 "Basic setting" => Page 27 .
- The "Adaptation" function sets the CO content on vehicles with no lambda probes.
- Channels 01 and 02 can be selected; channel 01 is used to set the CO content on vehicles with no lambda probe, whilst channel 02 has no function.
- If the stored adaptation values are altered on vehicles with lambda probes by entering different adaptation values, this has no effect on the fuel injection and ignition system.

Work sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> If adjacent display appears:

```
Rapid data transfer      HELP
Select function XX
```


- Enter "10" to select the function "Adaptation" and confirm entry with Q key.

-> If adjacent display appears:

```
Adaptation
Enter channel number XX
```

- Enter "01" to select "adaptation channel 01" and confirm entry with Q key.

-> The last stored adaptation value is displayed

```
Channel 1     Adaptation 128
```

Notes:

- Adaptation value 128 is the mean value stored at the factory.
- Reducing the value of 128 signifies leaning (CO content decreases), whilst increasing the value signifies enrichment (CO content increases).
- Any change in adaptation value must remain within the tolerance range of 110 ...150.
- Adaptation can be performed in stages => Page 57 .

A- Step-by-step adaptation

Notes:

-

```
Channel 1     Adaptation 128
```

  -> <- 1: Adaptation value is reduced in steps by pressing key 1.
- 3 ->: Adaptation value is increased in steps by pressing key 3.

- Press the ⇒key.

-> If adjacent display appears:

```
Channel 1     Adaptation 128
```

- Press key 1.

-> Display readout:

```
Channel 1     Adaptation 127     Q
1     2     3     4     5     6     7
8     9     10
```

Adaptation value decreases

or

-> Display readout:

```
Channel 1     Adaptation 129     Q
1     2     3     4     5     6     7
8     9     10
```

Adaptation value increases

Notes:

- The display shows the corresponding adaptation value, as well as the 10 measured values from function 04 "Basic setting" / 08 "Reading measured value block", display group 000.
- If modified adaptation is not to be stored, press the C key to return to previous display.

- Confirm entry with Q key.

-> If adjacent display appears:

```
Channel 1     Adaptation 129     Q
Store changed value?
```

- Confirm entry with Q key.

-> If adjacent display appears:

```
Channel 1     Adaptation 129
Changed value is stored
```

- Terminate adaptation by pressing the ⇒ key.

-> Display readout (function selection):

```
Rapid data transfer      HELP
Select function XX
```

B- Direct adaptation

-> If adjacent display appears:

```
Channel 1     Adaptation 128
```

- Press the ⇒key.

-> If adjacent display appears:

```
Channel 1     Adaptation 128     Q
Enter adaptation value     XXXXX
```

- Enter desired 5-digit adaptation value
  e.g. 120 = 00120

-> If adjacent display appears:

```
Channel 1     Adaptation 128     Q
Enter adaptation value     00120
```

- Confirm entry with Q key.

-> Display readout:

```
Channel 1     Adaptation 120     Q
1     2     3     4     5     6     7
8     9     10
```

Notes:

- The display shows the corresponding adaptation value, as well as the 10 measured values from function 04 "Basic setting" / 08 "Reading measured value block", display group 000.
- If modified adaptation is not to be stored, press the C key to return to previous display.

-> If adjacent display appears:

```
Channel 1     Adaptation 120     Q
Store changed value?
```

- Confirm entry with Q key.

-> If adjacent display appears:

```
Channel 1     Adaptation 120
Changed value is stored
```

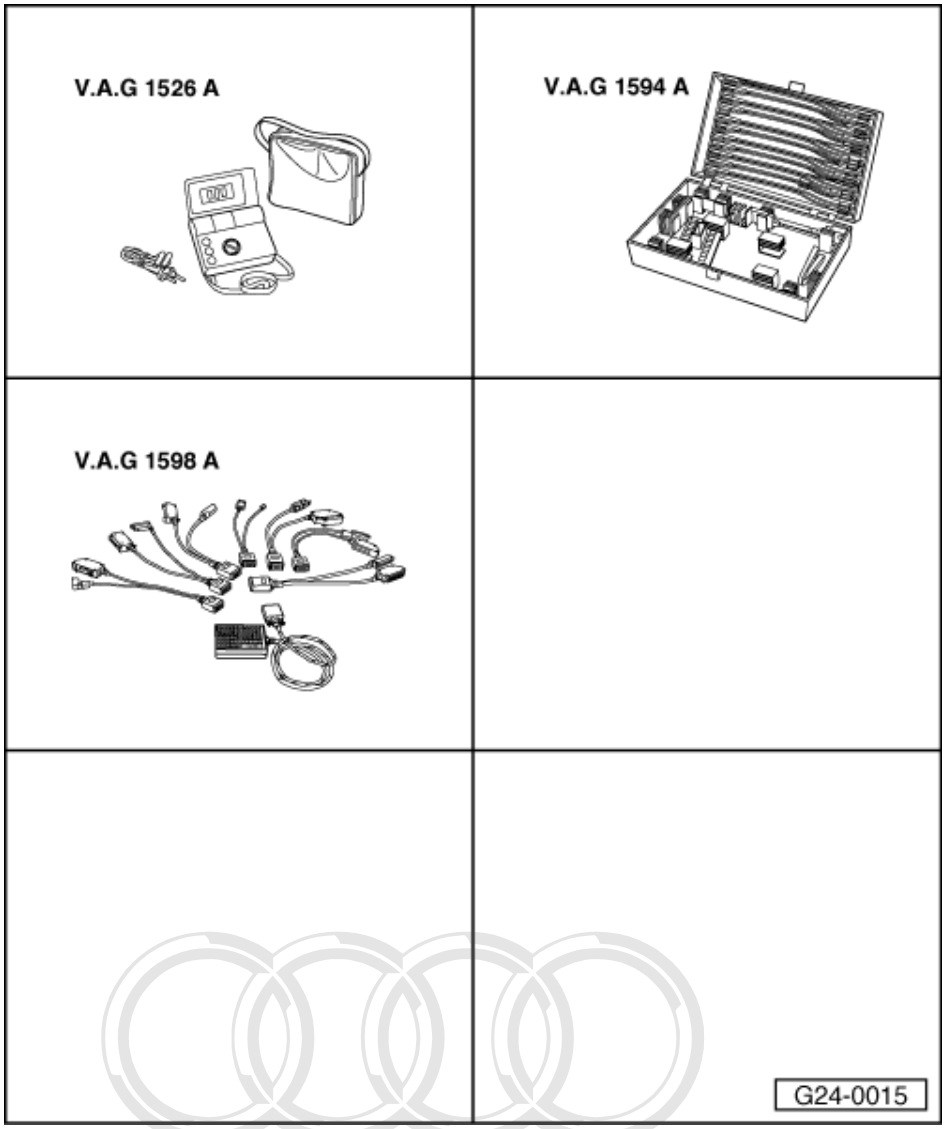
- Terminate adaptation by pressing the ⇒ key.

-> Display readout (function selection):

```
Rapid data transfer      HELP
Select function XX
```

8 - Checking wiring of diagnostic connector

8.1 - Checking wiring of diagnostic connector



**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

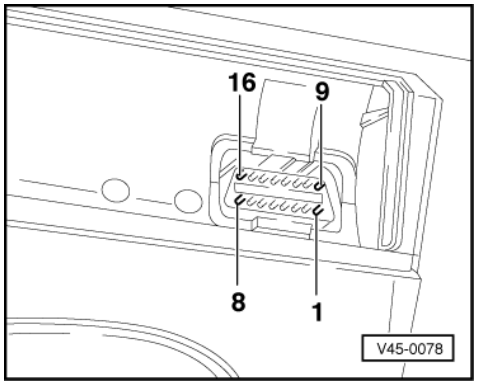
Warning:
Switch off ignition before checking wiring.

Note:

Diagnostic connector is installed beneath ashtray insert at front of centre console. Junction for diagnostic line (K-line) takes the form of a spot weld in the wiring loom:

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Receptacle assignment of diagnostic connector



4 - -> Earth connection for V.A.G 1551/1552
7 - K-line
15 - L-line
16 - Power supply for V.A.G 1551/1552

Vehicles with control unit no. 8A0 906 266 with index lower than "E"

Note:

This check has to be performed if one of the following displays appears on the connected fault reader V.A.G 1551.

-> If adjacent display appears:

```
Rapid data transfer      HELP
No control unit response
```

or

```
Rapid data transfer      HELP
K-line not switching to earth
```

or

```
Rapid data transfer      HELP
K-line not switching to positive
```

- With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector of engine control unit => Page 77 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

Diagnostic line	Diagnostic connector Contact	Engine control unit Contact	Test box 1598 A Contact
K	7	C12	12
L	15	C13	13

Notes:

- The diagnostic line K is routed by way of a spot weld in the wiring loom to the various control units

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

```
Rapid data transfer
Fault in communications link
```

-> If the adjacent display appears at start of or during self-diagnosis:

- Switch off ignition.
- Consecutively detach connectors to control units of other vehicle systems with self-diagnosis.
- After connector to specific vehicle system has been detached, enter address word "01" again for engine electronics after switching on ignition.
- If control unit identification is then displayed, replace the last control unit to be disconnected from the diagnostic line.

Vehicles with control unit as of no. 8A0 906 266 E

Wiring between diagnostic connector and engine control unit is routed via junction K and immobilizer control unit.

Diagnostic line	Diagnostic connector Contact	Immobilizer control unit IN	Immobilizer control unit OUT	Engine control unit Contact	Test box 1598 A Contact
K	7	10	9	C12	12
L	15	-	-	C13	13

Note:

This check has to be performed if one of the following displays appears on the connected fault reader V.A.G 1551.

-> If adjacent display appears:

```
Rapid data transfer      HELP
No control unit response
```

or

```
Rapid data transfer
Fault in communications link
```

or

```
Rapid data transfer      HELP
K-line not switching to earth
```

or

```
Rapid data transfer      HELP
K-line not switching to positive
```

- Press the ⇒key.

-> If adjacent display appears:

```
Rapid data transfer      HELP
Enter address word XX
```

- Press keys 2 and 5 for address word "Immobilizer" and confirm entry by pressing Q.

-> If immobilizer control unit identification is displayed on connected fault reader V.A.G 1551:

```
4A0953234 IMMO AUZ9Z0R4010830 D66
Code 00000      WSC 12345
```


- Continue with check A => Page 62 .

If immobilizer control unit identification is not displayed:

- Continue with check B => Page 62 .

Check A

- Switch off ignition.
- Pull connector off immobilizer control unit -J362.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- Use cable link to jumper contacts 9 and 10 in connector.
- Switch on ignition, press keys 0 and 1 for address word "Engine electronics" and confirm entry with Q key.

If engine control unit identification is displayed:

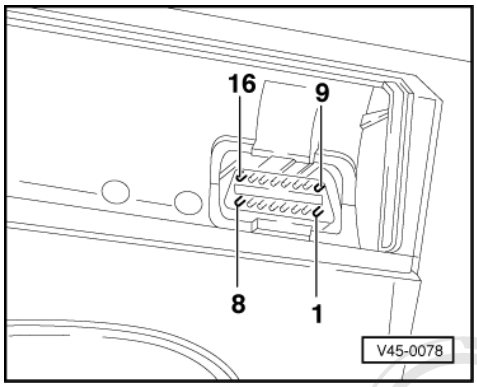
- Renew immobilizer control unit.

If engine control unit identification is not displayed:

- Use current flow diagram to check wiring between immobilizer control unit -J362 and engine control unit for open circuit or short to earth/positive.

Check B

Note:



-> All the diagnostic lines of the various systems merge in the diagnostic connector. A defective line (short to earth or positive) or a defective control unit may also lead to one of the fault messages listed.

- Switch off ignition.
- Consecutively detach connectors to control units of other vehicle systems with self-diagnosis.
- After detaching connector to specific vehicle system, enter address word "25" again for immobilizer after switching on ignition.

-> If immobilizer control unit identification is then displayed:

```
4A0953234 IMMO AUZ9Z0R4010830 D66
Code 00000     WSC 00000
```

Fault is to be found in last control unit to be disconnected.

If immobilizer control unit identification is never displayed:

- Pull connector off immobilizer control unit -J362.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- Check for open circuit and short to positive or earth in the following wiring connections:

Connector of immobilizer control unit -J362 Contact	Diagnostic connector K diagnostic line Contact
10	7

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- Replace immobilizer control unit if neither an open circuit nor a short circuit is found.

24 - Mixture preparation, Injection

1 - Servicing Multi Point Injection System

1.1 - Servicing Multi Point Injection System

1.2 - Safety precautions

Warning:
Fuel system is pressurised. Before loosening hose connections or opening the test connection, place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- To operate the engine at starting speed without actually starting it (for example, to check the compression), unplug the connector from the power output stage for the ignition coils and the connector from the injectors. After completing the work, interrogate the fault memory.
- For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A)

Note the following points if testers and measuring instruments have to be used during a road test:

Warning:
- **Always secure the testers and measuring instruments to the rear seat and have a second person operate them from there.**
- **If test equipment were operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.**

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following 6 rules for cleanliness:

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place removed parts on a clean surface and cover. Never use fluffy cloths.
- Carefully cover or seal open components if repairs cannot be carried out immediately.
- Only install clean components:
  Only remove replacement parts from packaging immediately prior to installation.
  Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open:
  Do not work with compressed air if this can be avoided.
  Do not move vehicle unless absolutely necessary.

- Separated electrical connections:
  Protect from dirt and moisture.
  Make sure connections are dry when attaching.

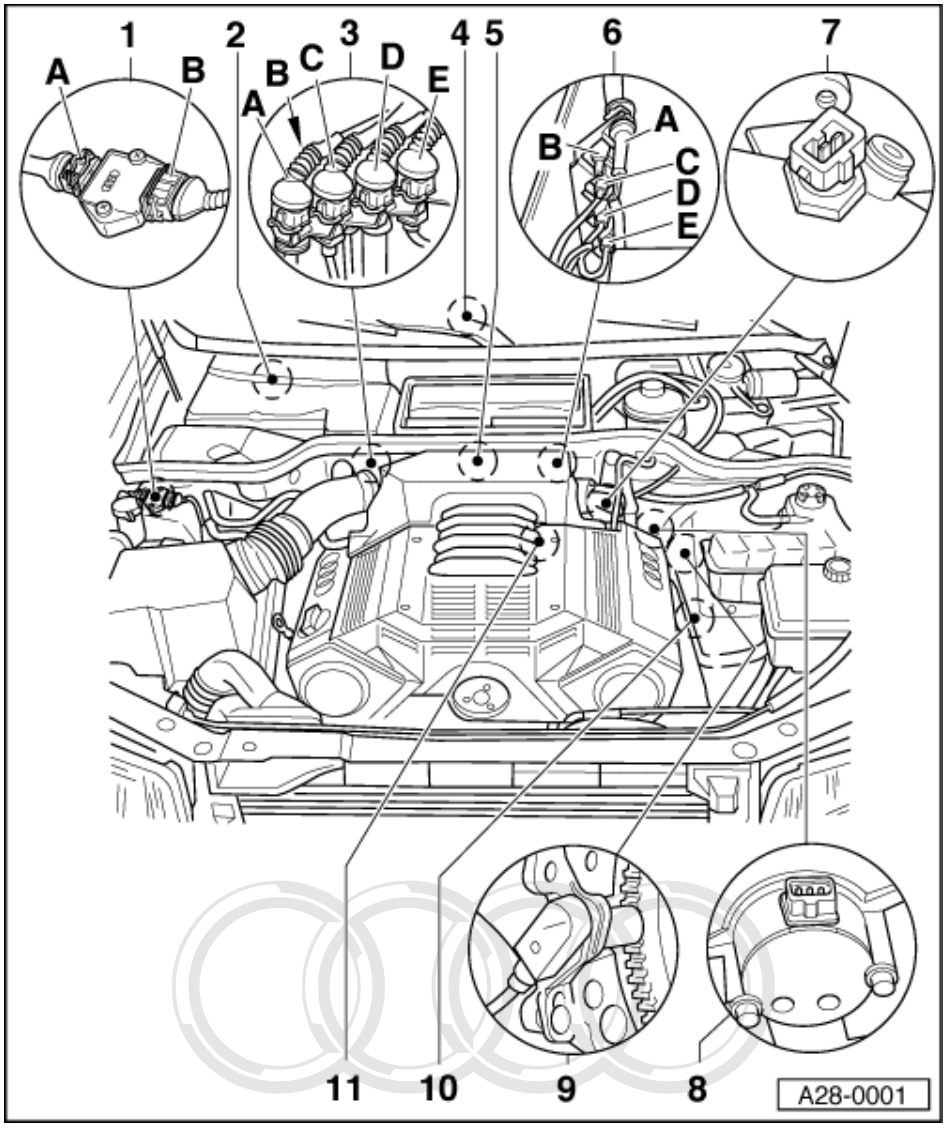
1.4 - Technical data

Engine code letters			AAH (2.8 l / 2V / 128 kW-engine)
MPI control unit	Part no.		=>Parts list
	Speed governing by deactivation of injectors		6200 rpm
Idling speed adjustment	Not adjustable - controlled by the idling speed stabilisation		650 ... 750 rpm
	CO content1)	Test value	0.2 ... 1.2 % by vol.
		Setting	0.70 ± 0.45 % by vol.
Fuel pressure at idling speed		Vacuum hose connected	3.2 ... 3.8 bar
		Vacuum hose detached	3.8 ... 4.2 bar

1) Vehicles without lambda probes.

Engine code letters			AAH (2.8 l / 2V / 128 kW-engine)
Holding pressure after 10 minutes		Engine cold	approx. 2.2 bar
		Engine warm	approx. 3.0 bar
Injectors	Spray pattern		Same for all injectors
		Injection quantity (30 s)	85 ... 110 ml
	Resistance Manufacturer	Bosch	15 ... 17 ω
		Siemens	13.5 ... 15.5 ω

1.5 - Fitting locations overview



1 Output stage -N122

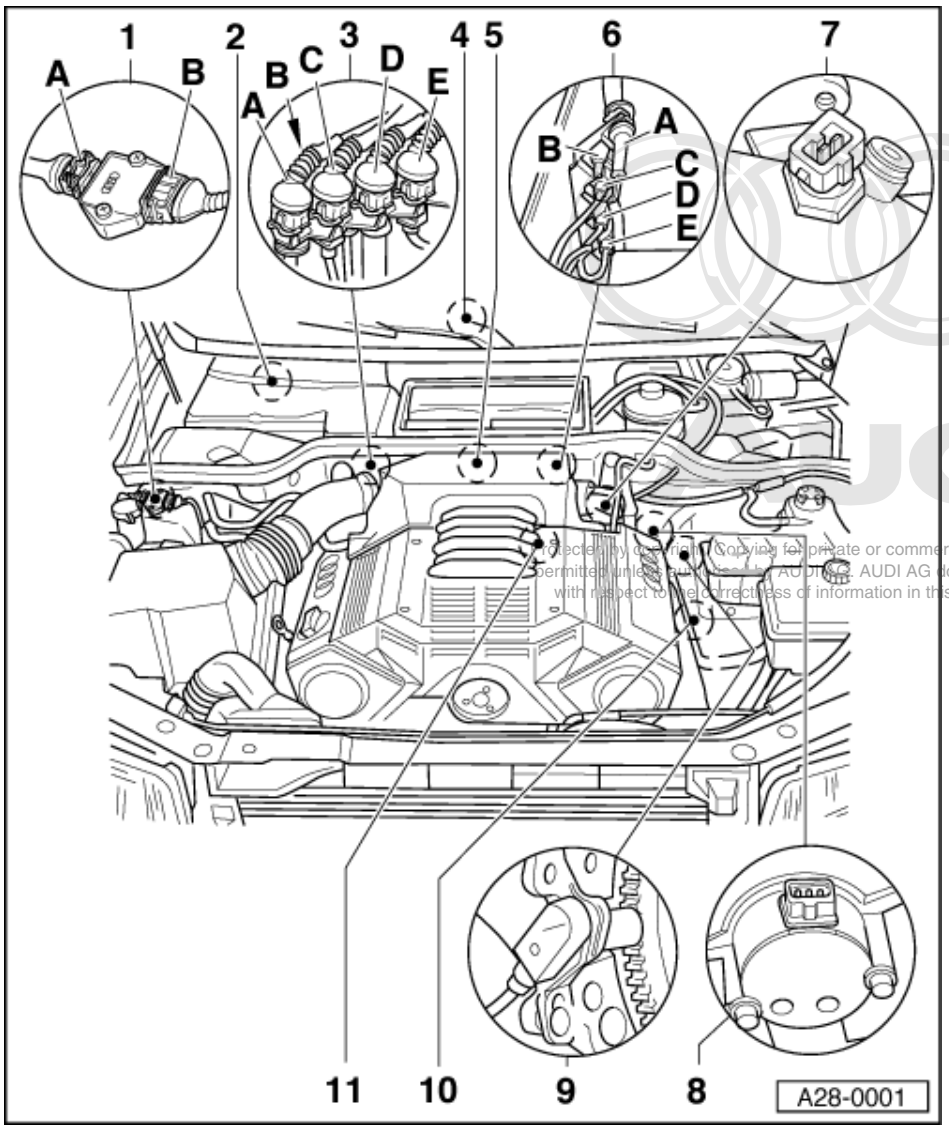
- A - dark brown 3-way connector, primary connections for ignition coils
- B - light brown 4-way connector, signal wires from engine control unit

2 Engine control unit -J192

- In electronics box on right of plenum chamber

3 Connectors

- A - black 2-way, for lambda probe heating -Z19
- B - 1-way, for signal of lambda probe -G39
- C - brown 3-way, for output stage -N122



- D - blue 2-way, for knock sensor 1 -G61
- E - white 3-way, for power supply of ignition coils

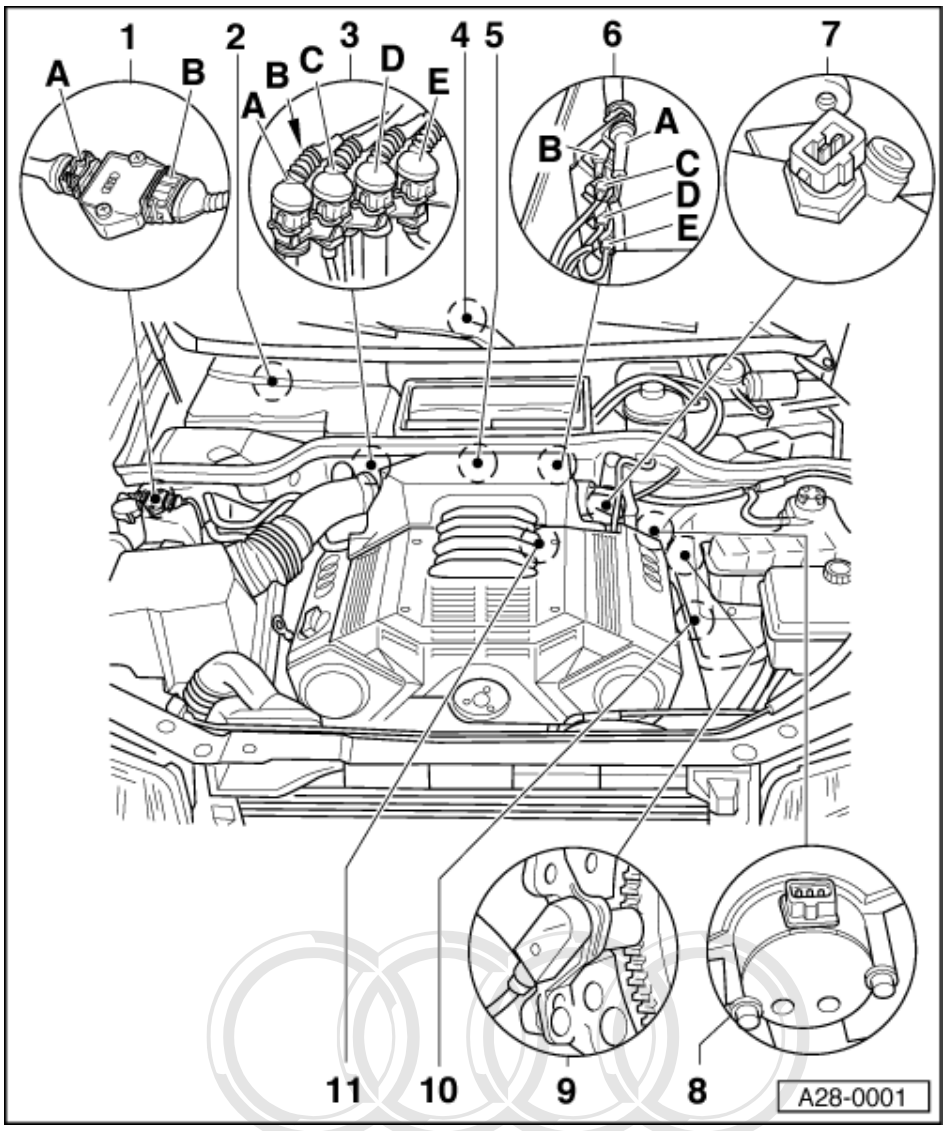
4 Diagnostic connector

5 Throttle valve potentiometer -G69

- With idling switch -F60

6 Connectors

- A - black 2-way, for lambda probe heating -Z28
- B - 1-way, for signal of lambda probe 2 -G108
- C - blue 2-way, for knock sensor 2 -G66
- D - grey 3-way, for engine speed sender -G28
- E - black 3way, for ignition timing point sender



7 Coolant temperature sender G62

- On coolant pipe behind cylinder head, bank 1

8 Hall sender -G40

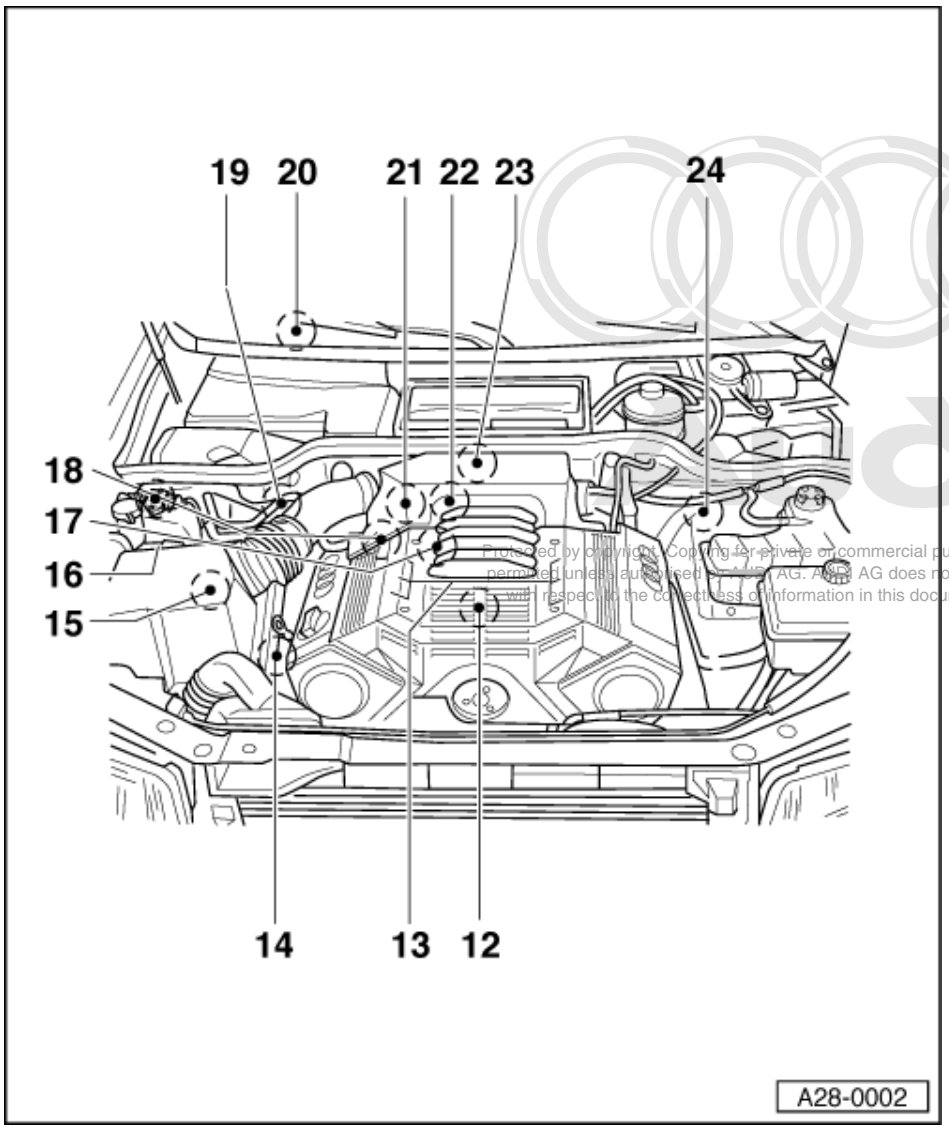
9 Engine speed sender -G28

- In gear case above ring gear

10 Ignition timing sender -G4

- Reference mark sender on left on cylinder block

11 Knock sensor 2 -G66



12 Ignition coils -N, -N128, -N158

13 Injectors -N30...-N33, -N83, -N84

14 Earth connection

- On right hand engine support

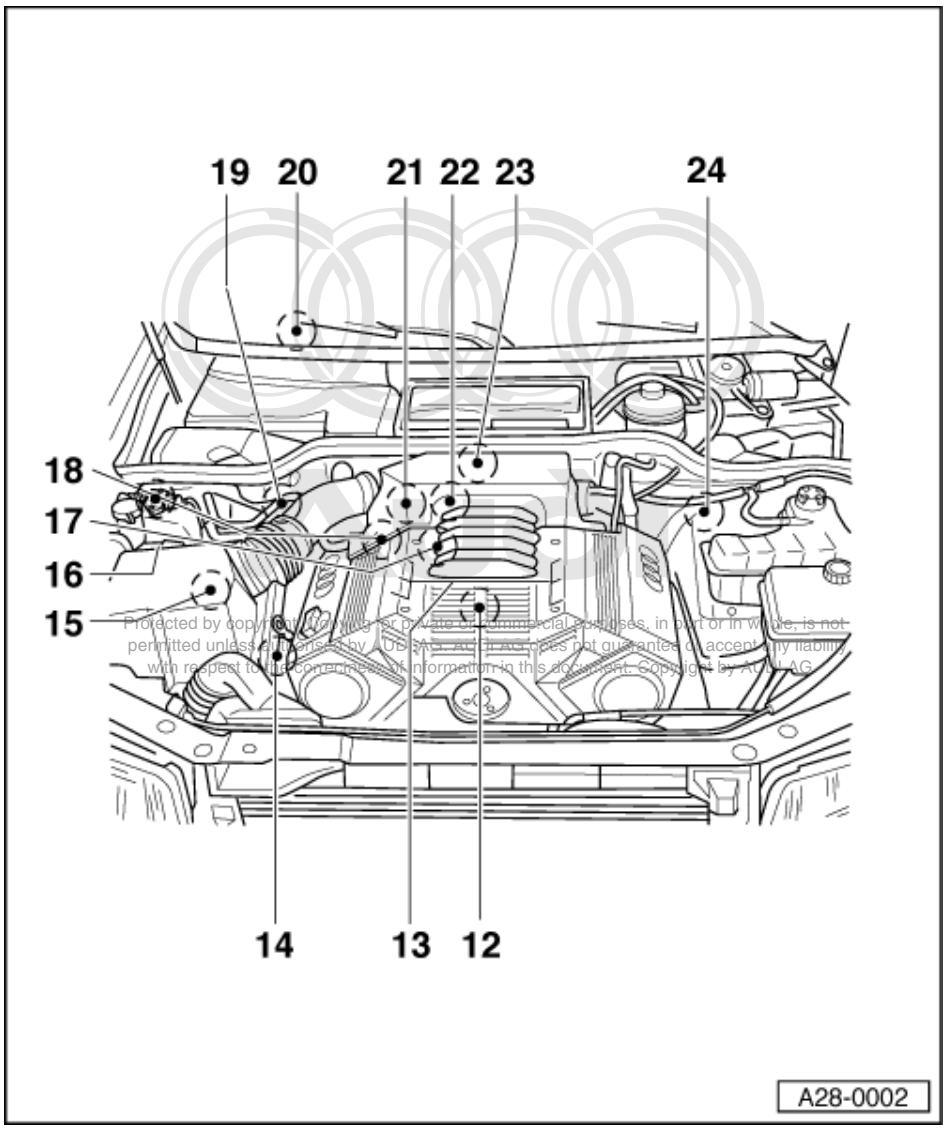
15 Air mass meter -G70

16 Solenoid valve 1 for activated charcoal filter -N80

17 Knock sensor 1 -G61

18 Fuel pressure regulator

19 Lambda probe 1 -G39



20 Fuel pump relay -J17

- Checking => Page 93

21 Idling stabilisation valve -N71

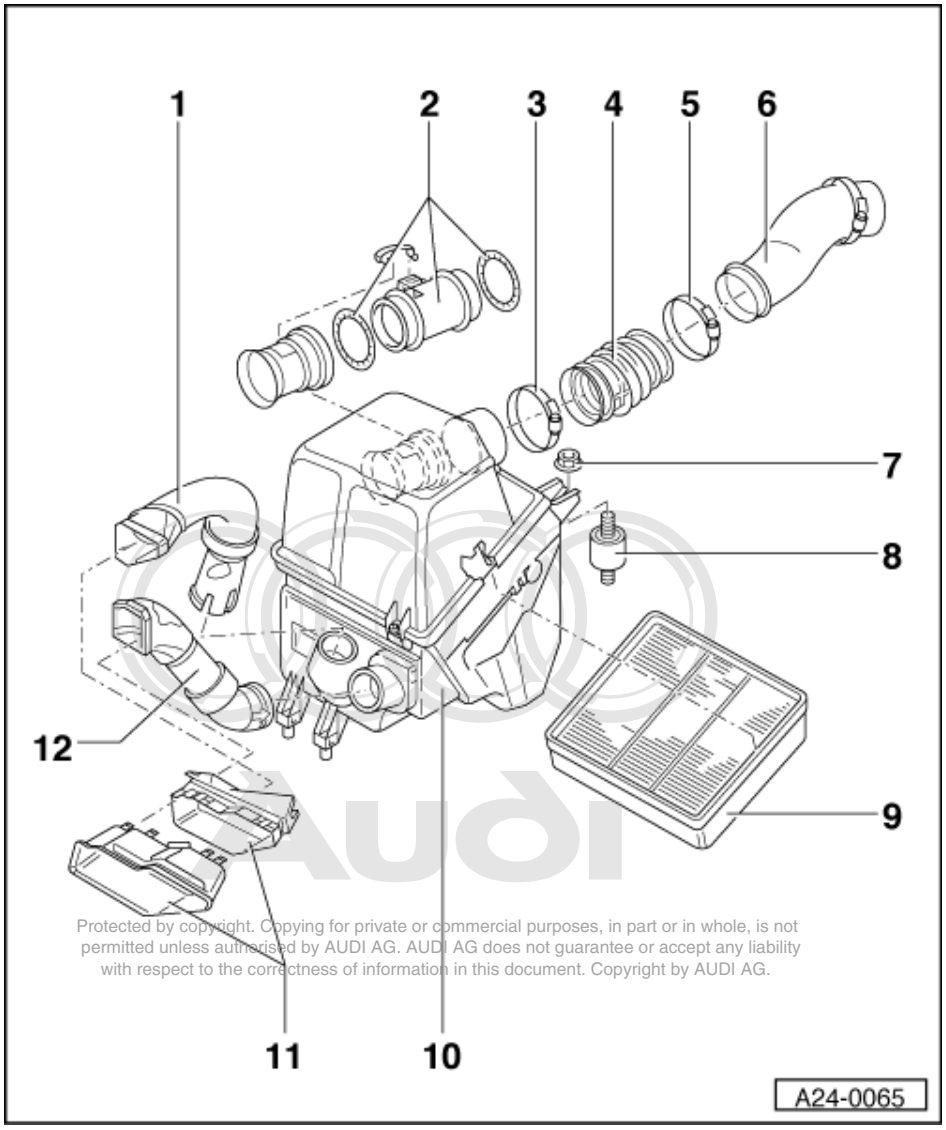
22 Earth connection

- On intake manifold

23 Intake manifold changeover valve -N156

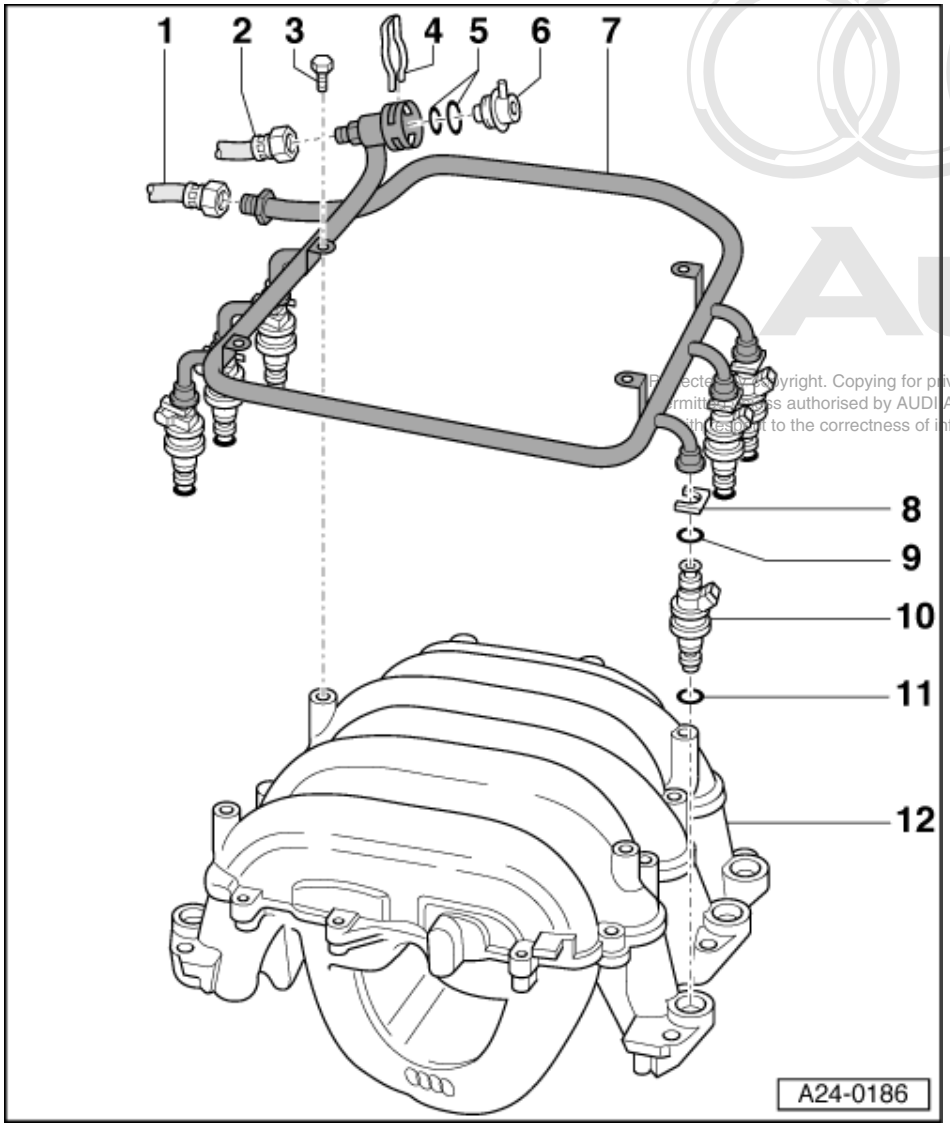
24 Lambda probe 2 -G108

1.6 - Dismantling and assembling air cleaner



1 Air duct
2 Air mass meter -G70
3 Hose clip
4 Intake hose
5 Hose clip
6 Intake pipe
7 Nut
8 Bonded rubber mounting
9 Filter element
10 Air cleaner housing
11 Air duct
12 Air duct

1.7 - Dismantling and assembling fuel manifold with injectors



1 **Supply pipe**
- From fuel filter
- Tighten to 25 Nm

2 **Return pipe**
- Tighten to 25 Nm

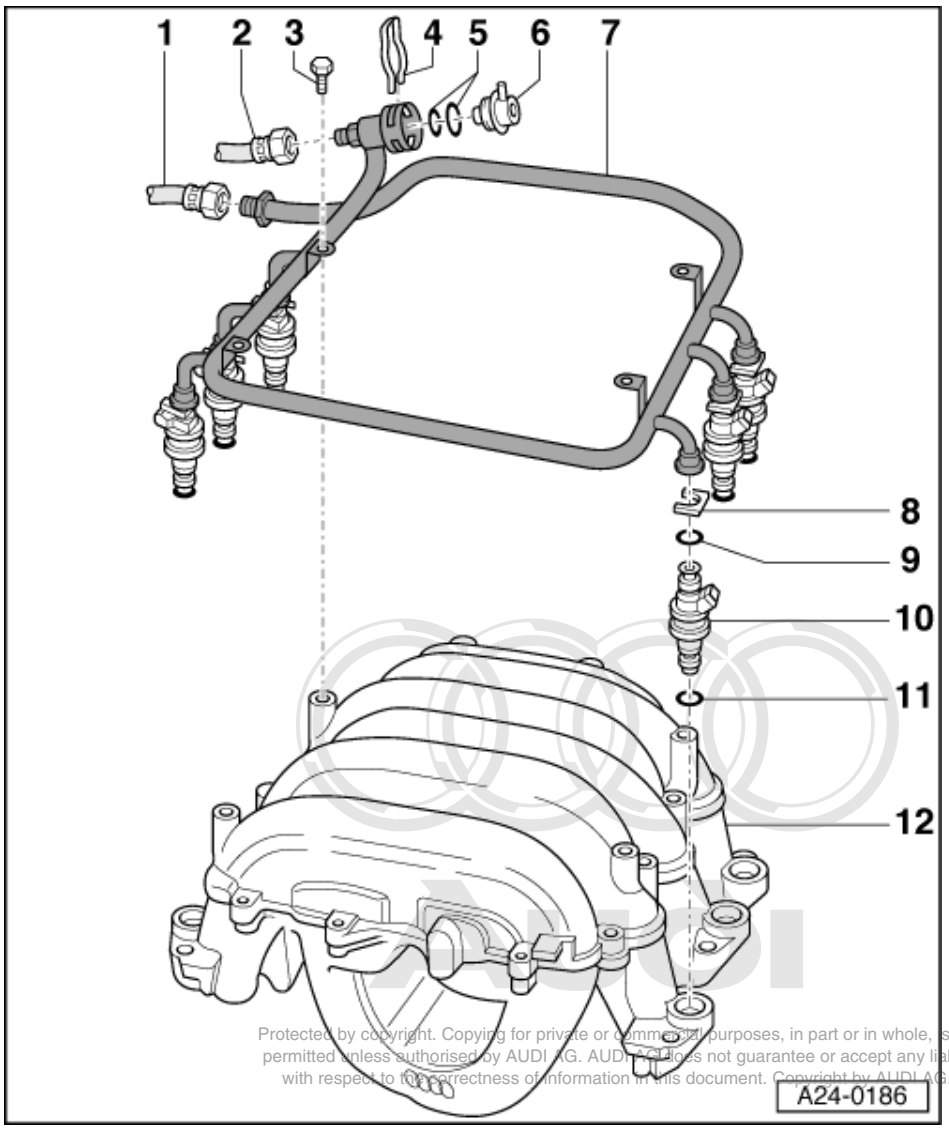
3 **10 Nm**

4 **Fastener**

5 **O-ring**
- Renew

6 **Fuel pressure regulator**

7 **Fuel manifold**



8 Fastener

- Ensure it is positioned correctly on injector and fuel manifold

9 O-ring

- Renew

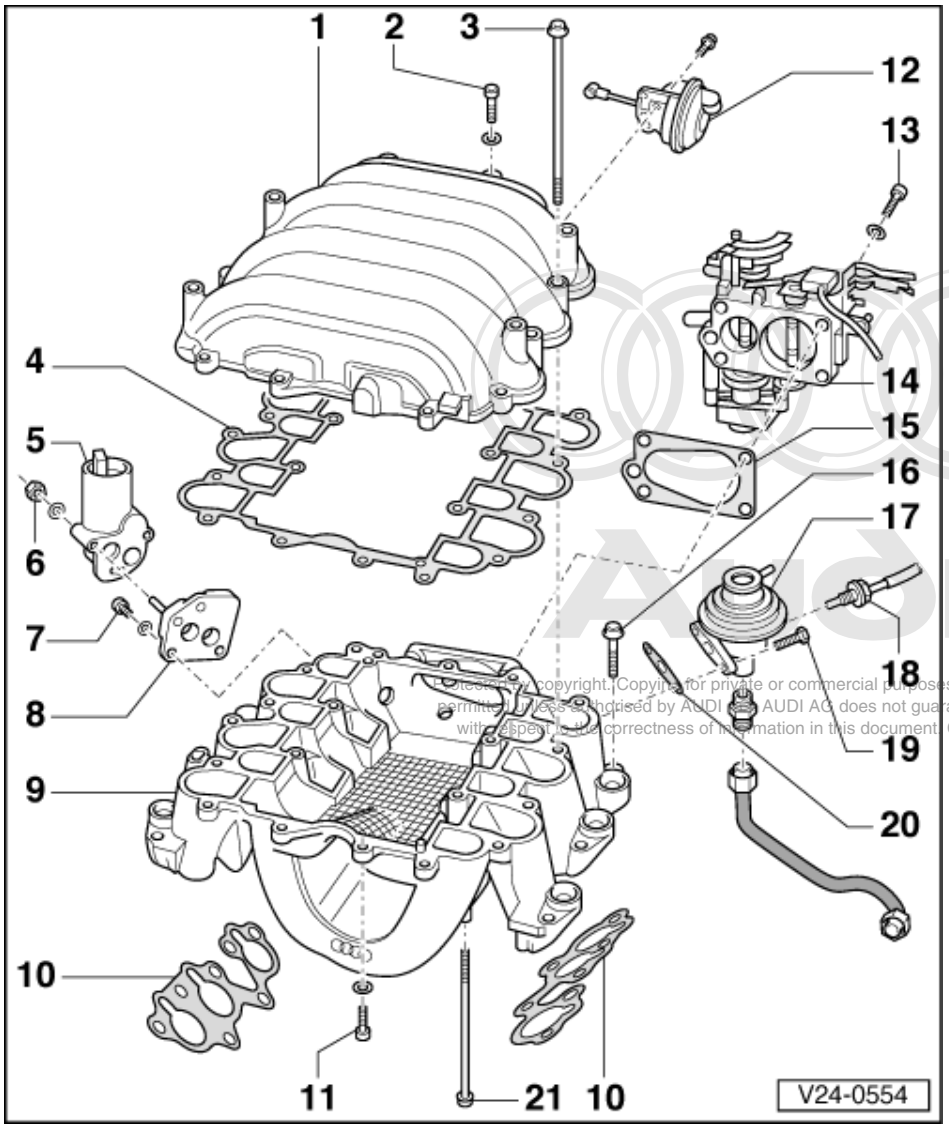
10 Injectors -N30...-N33, -N83, -N84

11 O-ring

- Renew

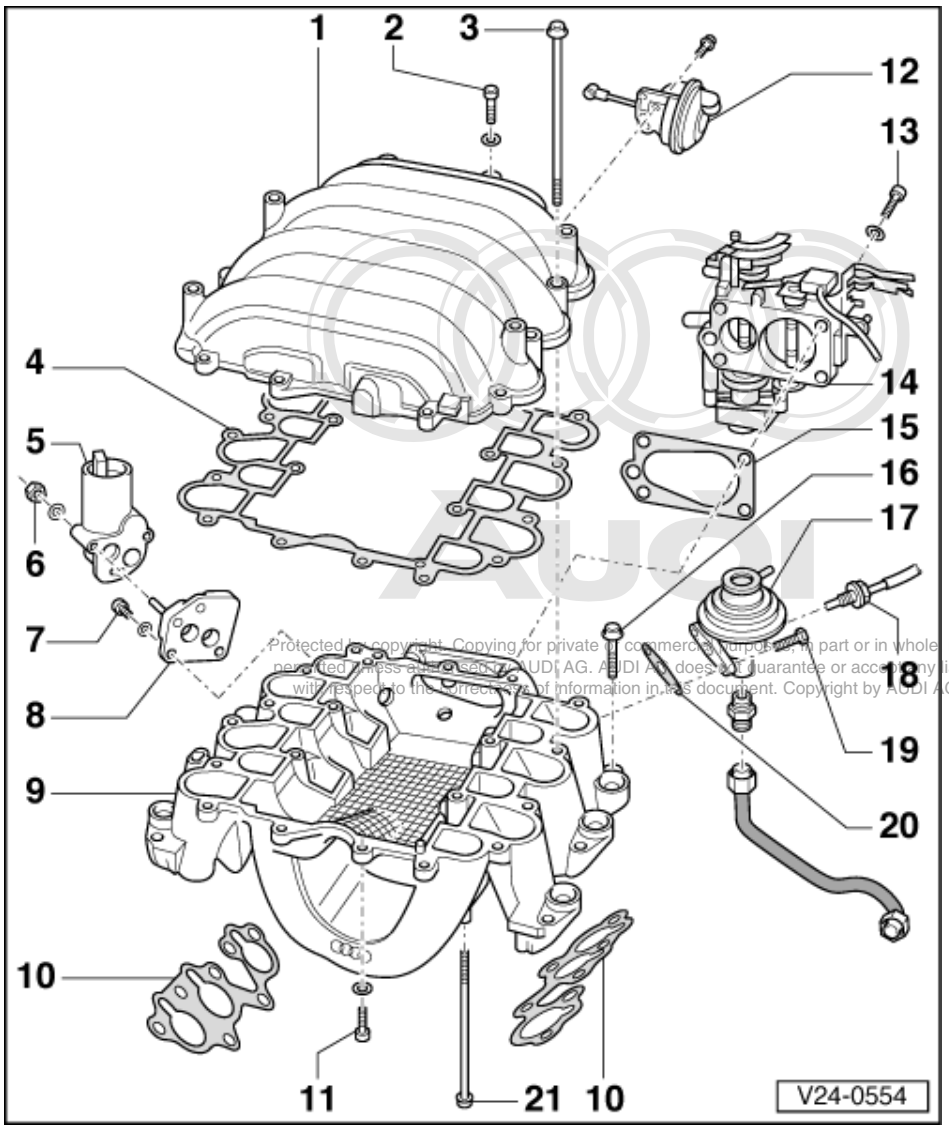
12 Intake manifold

1.8 - Removing and installing throttle valve unit and intake manifold changeover system components



1 Top part of intake manifold
2 10 Nm
3 20 Nm
4 Gasket
- Renew

5 Idling stabilisation valve -N71
6 10 Nm
7 6 Nm



8 Flange

9 Bottom part of intake manifold

10 Gasket

- Renew

11 10 Nm

12 Vacuum unit

- For intake manifold changeover valve

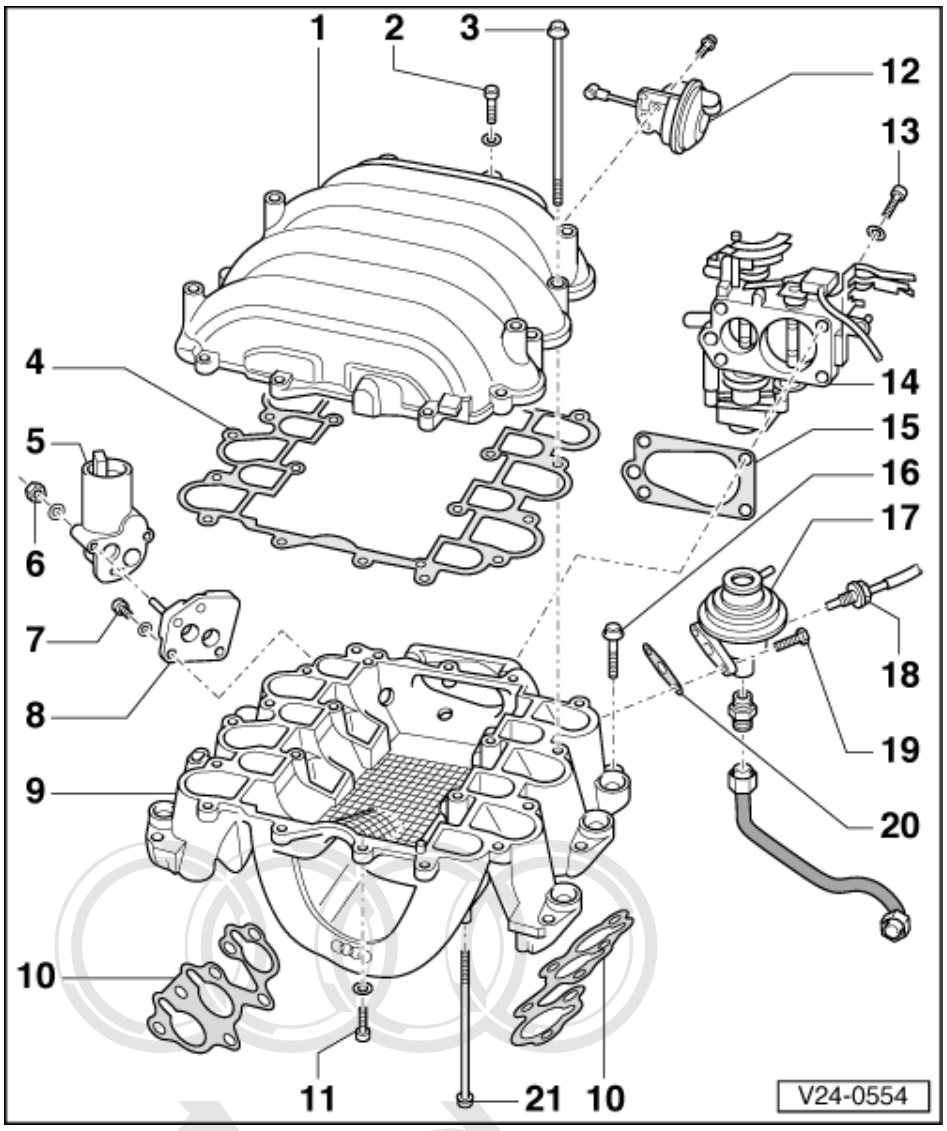
13 20 Nm

14 Throttle valve unit

15 Gasket

- Renew

16 20 Nm



17 Mechanical EGR valve

- For vehicles with EGR

18 EGR temperature sensor -G98

- For vehicles with EGR

19 10 Nm

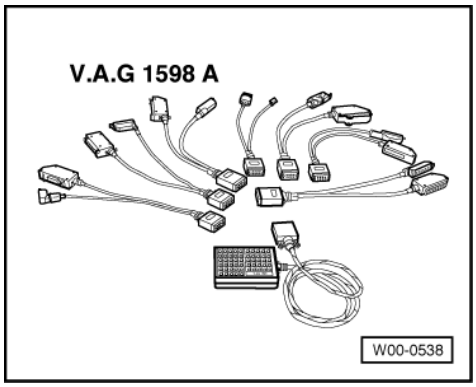
20 Gasket

- Renew

21 10 Nm

1.9 - Wiring and component check with test box V.A.G 1598 A

Special tools, testers and auxiliary items required



- V.A.G 1598 A
- V.A.G 1598/11
- V.A.G 1598/12

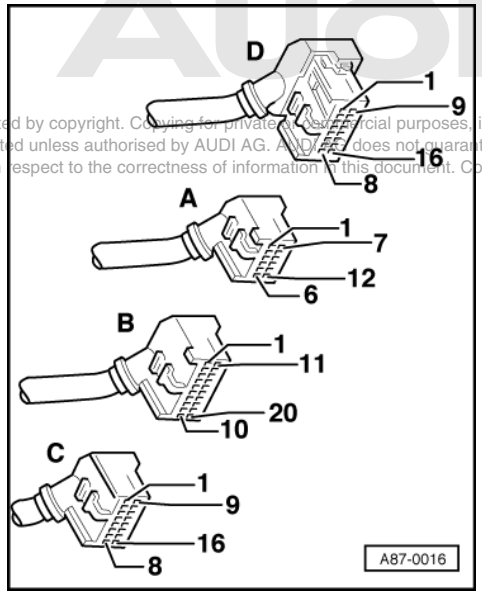
Notes:

- Test box V.A.G 1598 A must not be connected when performing diagnosis with fault reader V.A.G 1551.
- Allow 30 seconds after switching off ignition before detaching or attaching connector of engine control unit.

Warning:
To prevent damage to the electronic components, switch to the respective measuring range before connecting the measuring cable and observe the test requirements.

- Switch off ignition.
- Remove engine control unit => Page 79 .

- Release catches and detach connectors from control unit.



- -> Connect adapter cables V.A.G 1598/11 and V.A.G 1598/12 to detached connectors of engine control unit.

Notes:

- For measurement purposes, connect test box V.A.G 1598 A to the respective adapter cable.

- The contact assignment of connectors A and B with adapter cable V.A.G 1598/11 is not identical to the assignment of the sockets on the test box V.A.G 1598 A =>Pin assignment, Page 78 .
- With adapter cable V.A.G 1598/11, the contact assignment of connector C is identical to the socket assignment on the test box V.A.G 1598 A.
- The contact assignment of connector D with adapter cable V.A.G 1598/12 is identical to the assignment of the sockets on the test box V.A.G 1598 A.

- Carry out test as described in the repair instructions.

Pin assignment of the text box V.A.G 1598 A with adapter cable V.A.G 1598/11

Connector A Contact	V.A.G 1598 A Socket	Connector B Contact	V.A.G 1598 A Socket	Connector B Contact	V.A.G 1598 A Socket
1	41	1	21	13	33
2	42	2	22	14	34
3	43	3	23	15	35
4	44	4	24	16	36
5	45	5	25	17	37
6	46	6	26	18	38
7	47	7	27	19	39
8	48	8	28	20	40
9	49	9	29		
10	50	10	30		
11	51	11	31		
12	52	12	32		

Note:

The contact assignment of connectors C and D corresponds to the sockets on the test box V.A.G 1598 A.

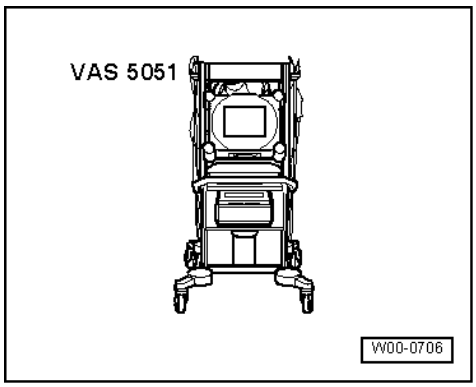
1.10 - Replacing engine control unit

Fitting location => Fitting locations overview, Page 66

Notes:

- Allow 30 seconds after switching off ignition before detaching or attaching connector of engine control unit.
- When the connectors are pulled off the engine control unit, the learned values and the contents of the fault memory are erased.

Special tools, testers and auxiliary items required



- VAS 5051

  or

- V.A.G 1551 with V.A.G 1551/3 A

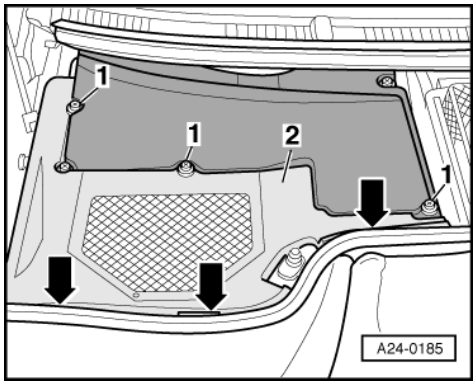
Removing

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page 1 .

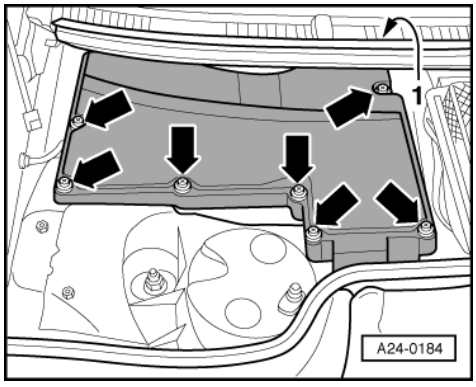
-> The fault reader V.A.G 1551 display will show the control unit identification. For example:

```
8A0906266C     2.8l V6/2V     MPI D03
□
Code 04403     WSC 12345
```

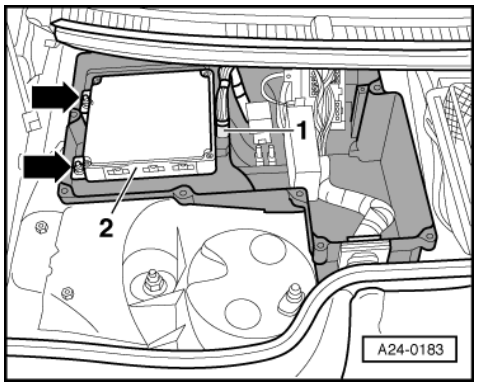
- Always start by displaying and printing out the control unit identification => Page 3 .
- Compare code to encoding versions => Page 29 .
- Switch off ignition.



- -> Slacken off cross-head bolts -1- at electronics box (plenum chamber).
- Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
- Take out plenum chamber cover.



- -> Prise out cover -1- in scuttle trim and slacken off rear cross-head bolt -rear right arrow-.
- Slacken off remaining cross-head bolts -arrows-.
- Detach cover for electronics box (plenum chamber).



- -> Unfasten catch and pull off control unit plugs -1-.

Note:

Always switch off ignition before detaching or attaching connectors of control unit.

- Unscrew engine control unit -2- from electronics box (plenum chamber) -arrows-.

Note:

There is a further bolt under the engine control unit connectors.

- Take out engine control unit.

Installing

Installation is carried out in the reverse order, when doing this note the following:

Note:

- Allow 30 seconds after switching off ignition before detaching or attaching connector of engine control unit.
- If rough idling is encountered after installing engine control unit, allow engine to run at idling speed for several minutes so that learning process can be implemented => Function 04 "Basic setting", Display group 007 or 008, Page 27 .

- Interrogate and erase fault memory => Page 4 .
- Encode control unit => Page 29 .

Vehicles ä 1994:

- Adapt engine electronics control unit to immobilizer => Page 54 .

Vehicles 1995 ä:

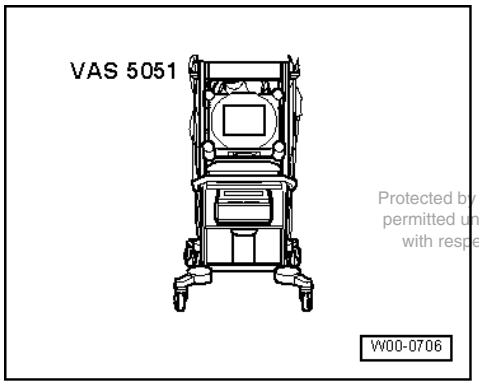
- Adapt engine electronics control unit to the immobilizer control unit.

=> Electrical system; Repair Group 01; Immobilizer self-diagnosis - fixed code; Adaptation after replacement of the engine control unit Immobilizer self-diagnosis - fixed code Adaptation after replacement of the engine control unit

=> Electrical system; Repair Group 01; Immobilizer self-diagnosis - alternating code; Adaptation after replacement of the engine control unit Immobilizer self-diagnosis - alternating code Adaptation after replacement of the engine control unit

1.11 - Checking idling speed and CO content

Special tools, testers and auxiliary items required



- VAS 5051

  or

- V.A.G 1551 with V.A.G 1551/3 A

Notes:

- The idling speed cannot be adjusted.
- The idling speed should be tested during the basic setting of the engine.
- On vehicles with no lambda probes (Encoding =>Page 56 .

Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 85 oC.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioner switched off.
- Pressure gauge not connected.
- Selector lever in position P or N.

Test sequence

- Connect fault reader V.A.G 1551 => Page 1 .
- Switch the ignition on.
- Interrogate fault memory =>Page 4 . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.
- Start basic setting, display group 003, engine idling =>Page 27 .

-> Display readout:

```
System in basic setting 3
     1     2     3     4
```

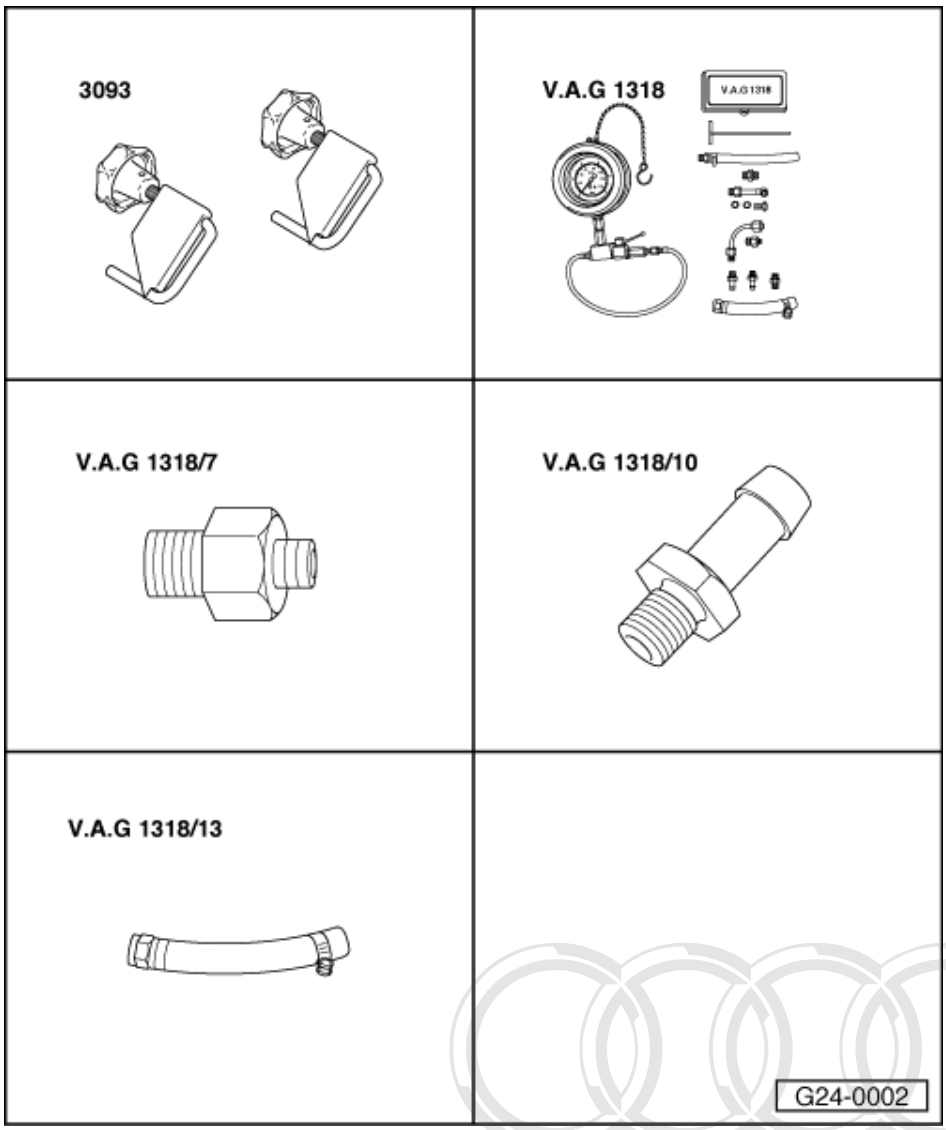
- Read off idling speed from display zone 1.
  - Specification: 650 ... 750 rpm
- Press the ⇒key.
- Enter "06" for "End output" function and confirm entry with Q key.
- If the value does not match the specification, interrogate the fault memory again =>Page 4 .

If the idling speed is too high or too low and there are no faults recorded in the fault memory, carry out the following tests marked with a dot:

- Test idling switch =>Page 132 .
- Large volume of unmetered air => Reading measured value block, display groups 001, 005, 006 or 010, Page 27 onwards.

- Check idling stabilisation valve => Page 98
- Check learned values of idling speed stabilisation => Basic setting of engine, Display group 004, Page 27 .

1.12 - Checking system pressure, fuel pressure regulator and holding pressure



**Special tools,
testers and auxiliary items required**

- Special tool 3093
- V.A.G 1318
- V.A.G 1318/6
- V.A.G 1318/7

Note:

The fuel pressure regulator regulates the fuel pressure according to the intake manifold pressure at the throttle valve unit.

Test requirements:

- Fuel pump relay OK; checking =>Page 93 .

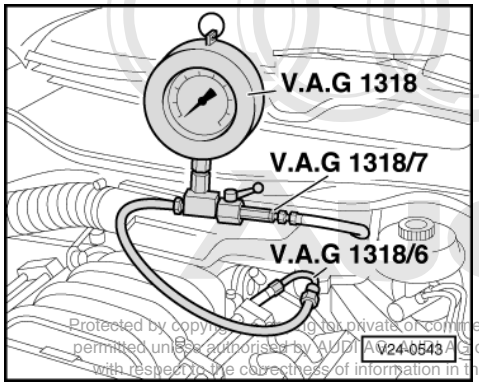
- Fuel pump OK; checking:

=> 6-cyl. Injection engine (2-valve), Mechanical components; Repair Group 20; Removing and installing parts of fuel system, Testing fuel pump Removing and installing parts of fuel system, Testing fuel pump

- Fuel filter OK
- Battery voltage at least 11 V

Warning:
Fuel system is pressurised. Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

Checking system pressure and fuel pressure regulator



- -> Connect up pressure gauge V.A.G 1318 with test adapters 1318/6 and 1318/7 between fuel supply pipe and fuel manifold; lever on pressure gauge set to -open- position (lever in direction of flow).
- Disconnect vacuum pipe between pressure regulator and intake manifold at the pressure regulator and seal off pipe with hose clamp 3093.

Notes:

- Renew pressure regulator if fuel emerges at the vacuum connection of the pressure regulator in the course of the following test procedure.
- When performing the following test, do not leave the engine running for an unnecessarily long time with the vacuum hose detached, because the higher fuel pressure causes the fuel/air mixture to be enriched. This could lead to the lambda control limits to be exceeded, which would then result in a fault being recorded.

- Start the engine and run at idling speed.
- Switch off air conditioner.
- Measure the fuel pressure.
  - Specification: 3.8 ... 4.2 bar

- If the specified value is not attained, try renewing the pressure regulator and repeating the pressure test.
- If the specified value is still not attained, check the fuel pump/feed pipe for damage (e.g. crushing) and renew if necessary.
- If the specified value is exceeded, check the return pipe for damage (e.g. crushing) and renew if necessary.
- Attach vacuum hose to pressure regulator and observe drop in pressure on pressure gauge.
- Fuel pressure must decrease by approx. 0.5 bar when vacuum hose is attached.

  Perform the following checks if there is no change in pressure as described above:
  - Check vacuum hose for cracks and damage.
  - Check vacuum hose at intake manifold for blockage; to do so, pull off hose at pressure regulator and blow into it.

- Renew the pressure regulator if no leakage is found and the vacuum connection is not blocked.

Checking holding pressure:

- Holding pressure 10 minutes after switching off engine (minimum pressure).
  - Specified value for cold engine: approx. 2.2 bar

- Specified value for warm engine: approx. 3.0 bar

If the specification is not obtained:

Note:

The increase in pressure in a warm engine due to fuel expansion is normal.

- Start the engine and run at idling speed.
- Allow the pressure to build up, then switch off the ignition. At the same time close the cut off valve on the pressure gauge V.A.G 1318 (valve lever at right angles to direction of flow).

If the pressure does not drop, the following faults are possible:

- Union between pressure gauge and fuel supply pipe leaking
- Supply pipe leaking at fuel tank
- Non-return valve in fuel pump leaking

=> 6-cylinder engine (2-valve), Mechanical components; Repair Group 20

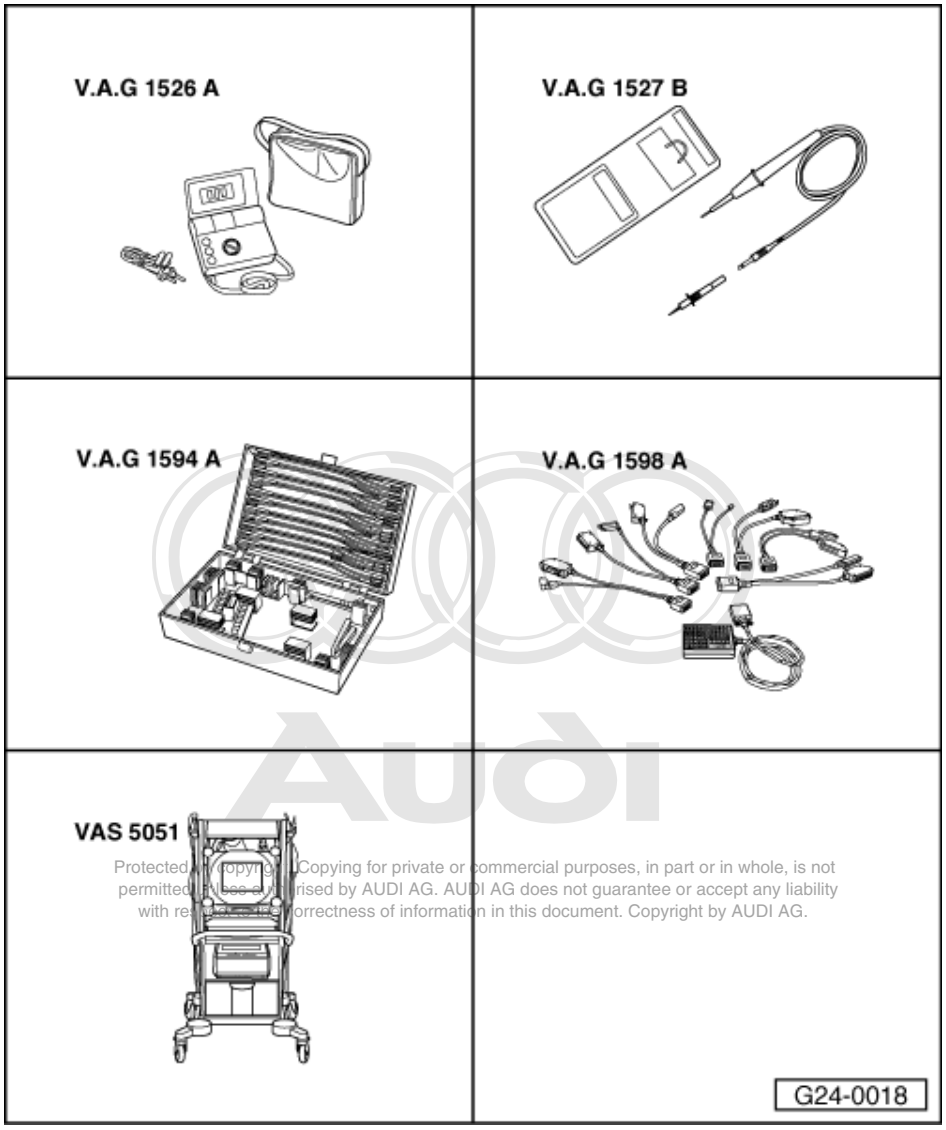
If the pressure drops again, the following faults are possible:

- Fuel pressure regulator defective
- Injectors leaking
- Unions on pressure gauge downstream of cut-off valve leaking

Note:

To disconnect the pressure gauge, close the shut-off valve, unscrew the union on adapter V.A.G 1318/6, then open the shut-off valve to drain off excess fuel into a suitable container.

1.13 - Checking injectors

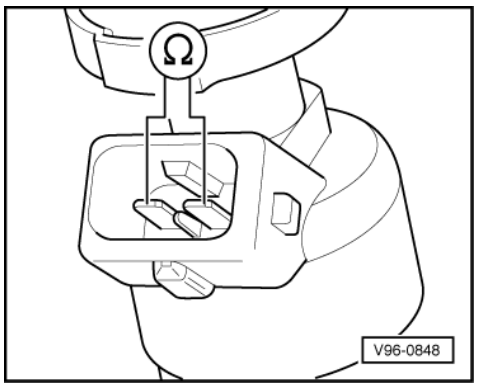


Special tools,
Prüfgeräte und Hilfsmittel

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/12
- VAS 5051

or

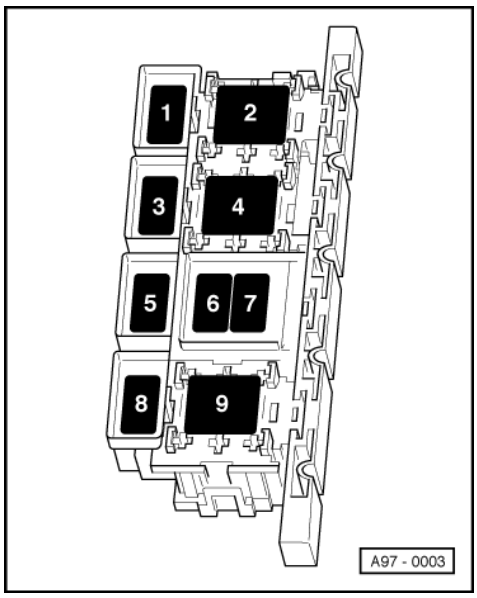
- V.A.G 1551 with V.A.G 1551/3 A



Checking internal resistance

- Unplug connector on injector to be checked.
- -> Connect multimeter to valve to measure resistance.
  - Specification{
    Bosch injector: 15 ... 17 ω
    Siemens injector: 13.5 ... 15.5 ω

If the specification is not obtained:



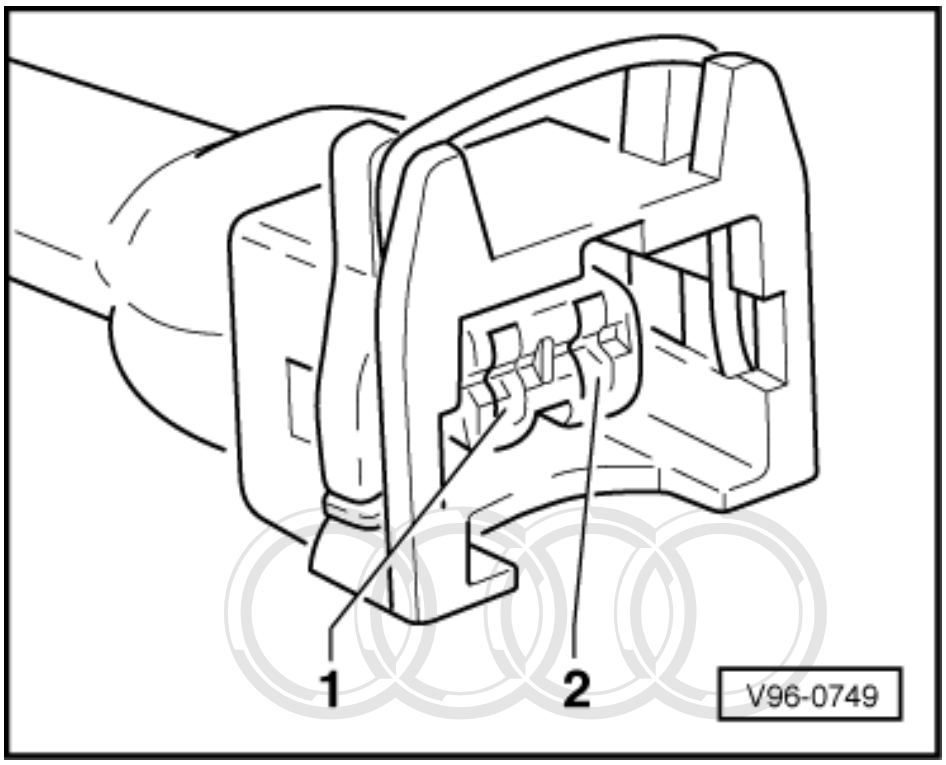
- Renew injector.

Testing power supply

Test requirements:

- Fuel pump relay OK, testing =>Page 93 .
- -> Fuse S116 OK (in relay and fuse carrier, electronics box, plenum chamber ‣ 06.95: Position 6, 07.95 ‣: position 7)

- Unplug connector on injector to be checked.



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

Injector connector Contact	Measure to
1	Engine earth

- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
  - The LED should light up.

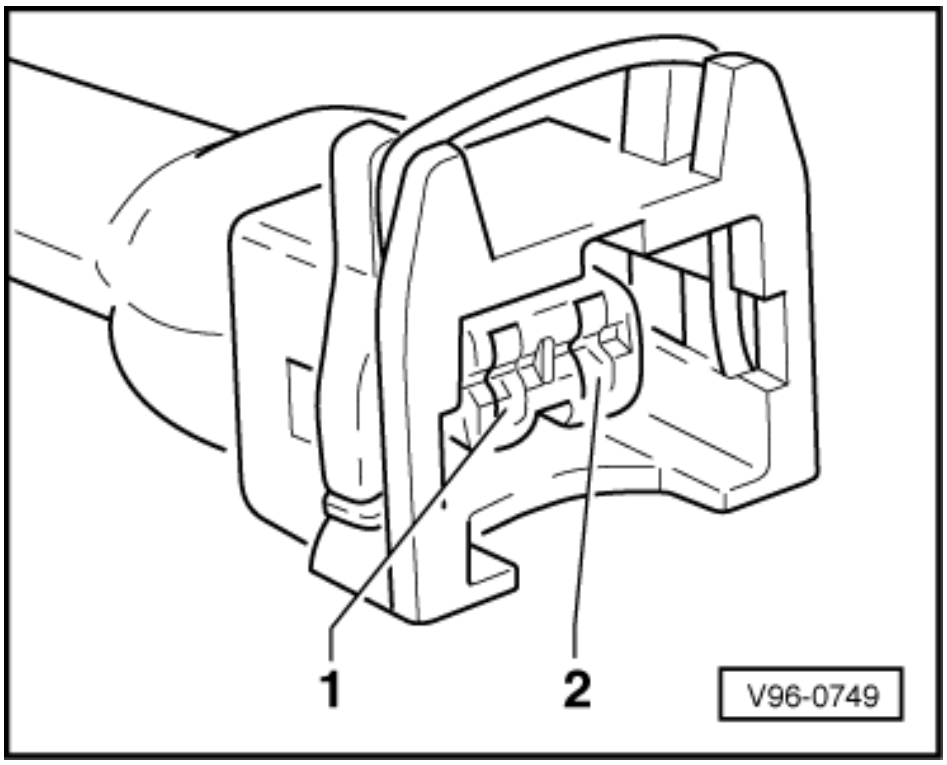
If the LED does not light up:

- Check wiring from contact 1 via fuse S116 (in relay and fuse carrier, electronics box, plenum chamber; ä 06.95: Position 6, 07.95 ä: Position 7) to fuel pump relay.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Testing actuation

- Unplug connector on injector to be checked.



- -> Connect up voltage tester V.A.G 1527 B as follows with auxiliary leads from V.A.G 1594 A:

Injector connector contact	Measure to
2	Battery positive

- Operate the starter briefly (the engine may start).
  - The LED should flash.

If the LED lamp does not flash:

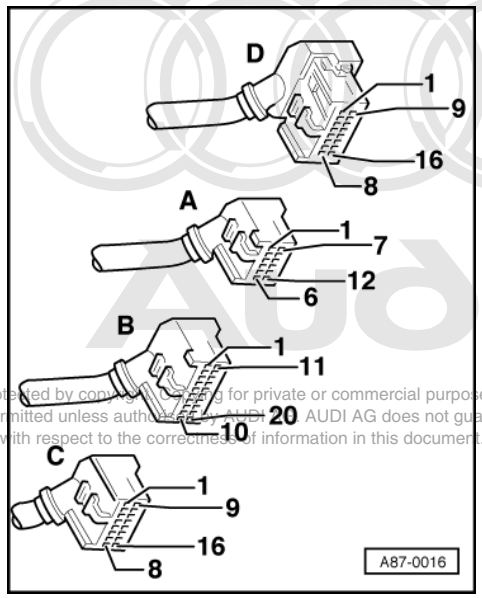
- Check wiring => Page 88

If the LED does not flash for any of the injectors:

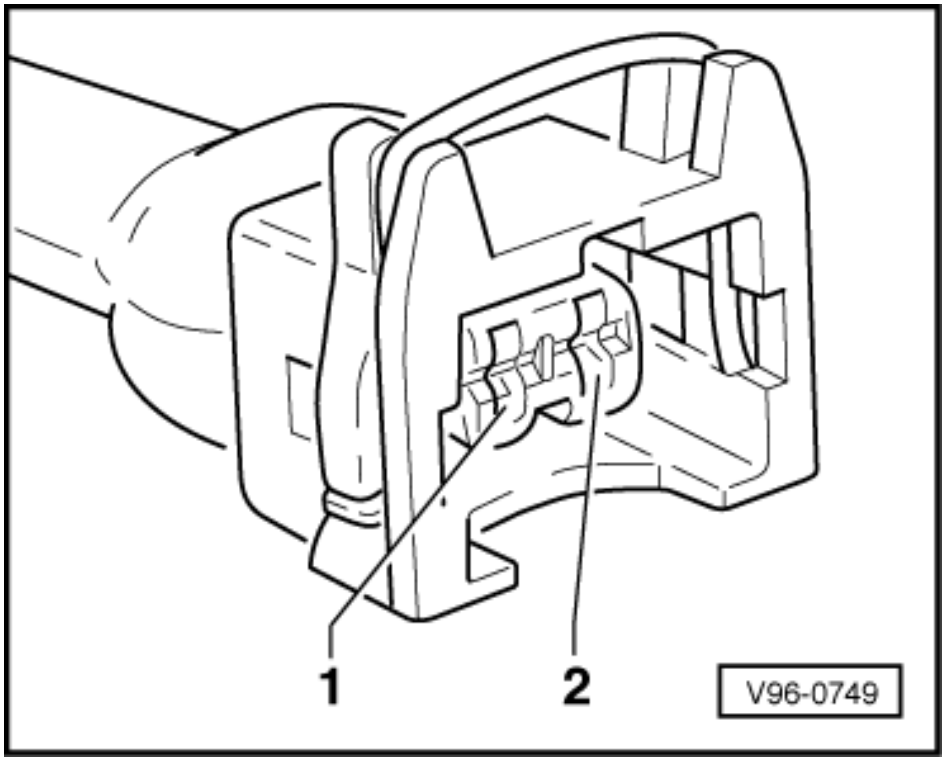
- Check the power supply to the engine control unit => Page 180 .

Check wiring

- Unplug connector on injector to be checked.



- -> With the ignition switched off, use adapter V.A.G 1598/12 to connect test box V.A.G 1598 A to connector D only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to earth/positive or earth in the following wiring connections:

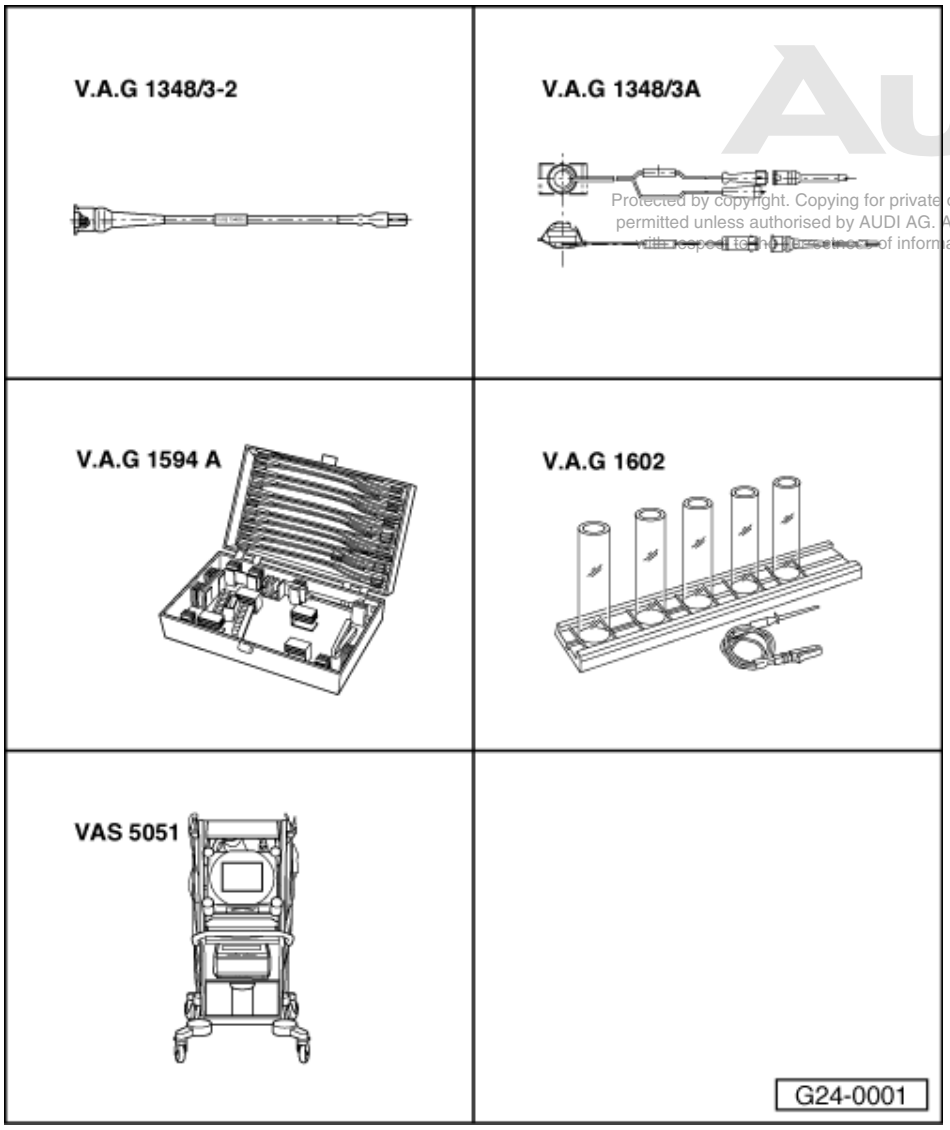
Cylinder	Injector connector contact	Test box V.A.G 1598 A socket
1	2	4
2	2	5
3	2	6
4	2	9
5	2	10

Cylinder	Injector connector contact	Test box V.A.G 1598 A socket
6	2	13

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

1.14 - Checking injection quantity, leak tightness and spray pattern of injectors



**Special tools,
testers and auxiliary items required**

- V.A.G 1348/3-2
- V.A.G 1348/3A
- V.A.G 1594 A
- V.A.G 1602
- VAS 5051

or

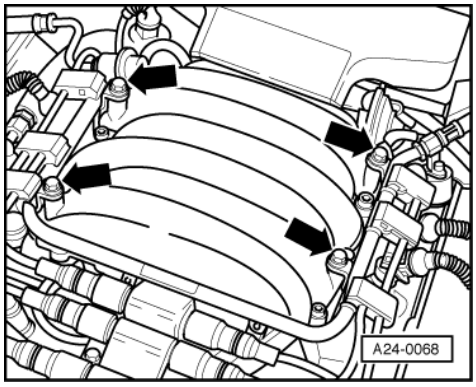
- V.A.G 1551 with V.A.G 1551/3 A

Test requirements:

- Fuel pressure OK, testing =>Page 82 .

Work sequence

- Remove the intake hose between air mass meter and air cleaner.
- Unplug connectors from injectors.



- -> Unscrew fuel manifold from intake manifold.
- Pull vacuum hose off fuel pressure regulator.
- Lift fuel manifold, together with injectors, off intake manifold and support it.

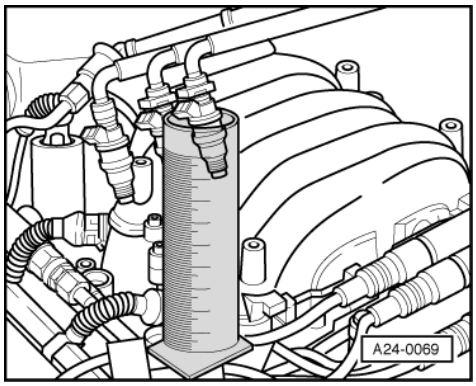
Leak test

- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
  - The fuel pump should run.

Note:

This step is merely designed to make the fuel pump run with the engine stopped.

- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops a minute should escape from each injector.



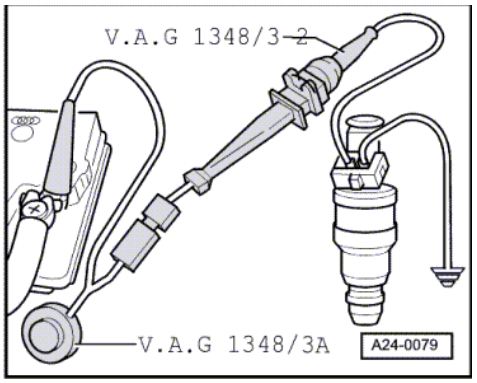
- If the fuel loss is greater, switch off the fuel pump (terminate final control diagnosis) and renew the faulty injector.

Note:

Renew O-ring.

Checking injection quantity

- -> Place the injector which is to be tested into a measuring glass from injection quantity tester V.A.G 1602.



- -> Connect one of the injector contacts to the engine earth using a test cable and crocodile clip from the V.A.G 1594 A.
- Connect second contact of injector with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable to positive.

- Activate remote control V.A.G 1348/3A for 30 seconds.
- Once all three injectors of a cylinder bank have been actuated, place the three measuring glasses on a flat surface.
  - Specified value per injector: 85 ... 100 ml
- If the measured value for one or more of the injectors is outside the tolerance range, renew the defective injector(s).
- Repeat the check on injectors of second cylinder bank.
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 82 .

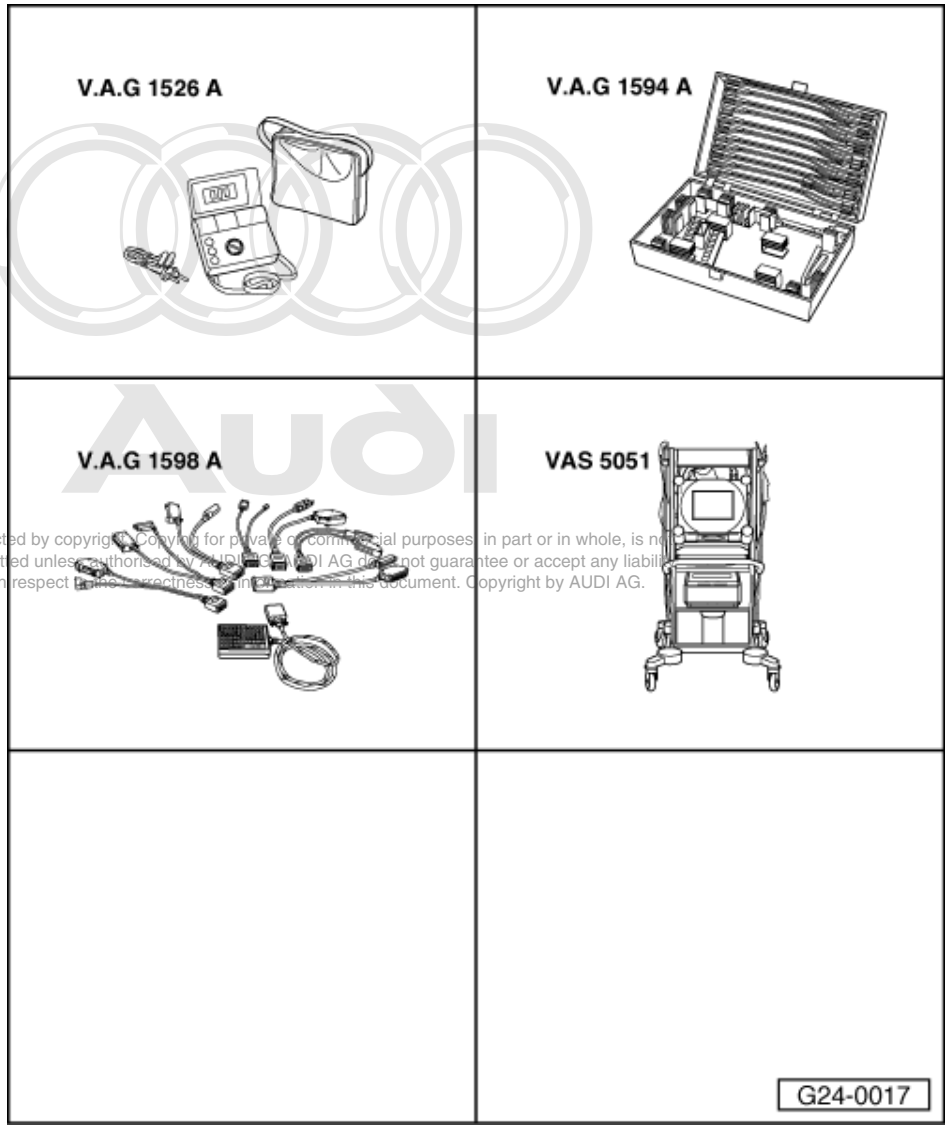
Note:

When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

Installation of the fuel manifold together with injectors is performed in the reverse sequence. The following points should be noted when installing:

- Renew the O-rings at all opened connections. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- Moisten the O-rings with clean engine oil.
- Insert injectors perpendicularly and in correct position into fuel manifold and secure with fasteners.
- Place fuel manifold with secured injectors in position at intake manifold and press in evenly.

1.15 - Checking fuel pump relay -J17 and actuation



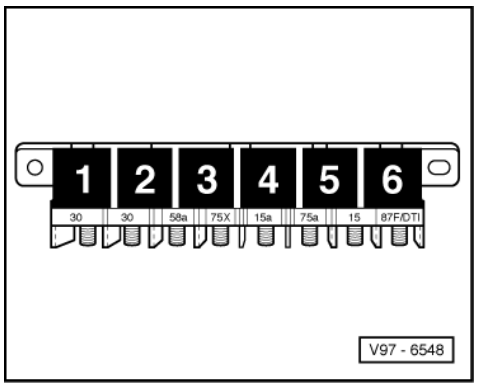
Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/12
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Voltage is supplied to the fuel pump and some injection system components via the fuel pump relay (J17).



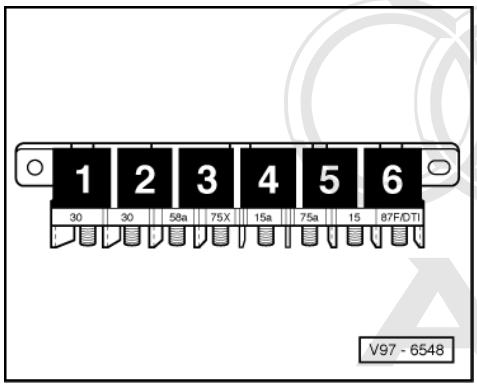
The condition for the closing of the fuel pump relay (J17) is that the engine should be turning. i.e. the relay is only connected to earth (via the engine control unit) when engine speed pulses are detected in the engine control unit.

Notes:

- -> Fitting location of fuel pump relay: On central electrics, electronics box, passenger's footwell, position 6.
- Central electrics must be removed for pulling off fuel pump relay and for measurement work at relay socket.

Test requirements:

- Battery voltage at least 11 V



Functional check of fuel pump relay

- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
  - -> Fuel pump relay (in the central electrics, electronics box, passenger's footwell, position 6) should pull and fuel pump should run.

If the relay does not pull:

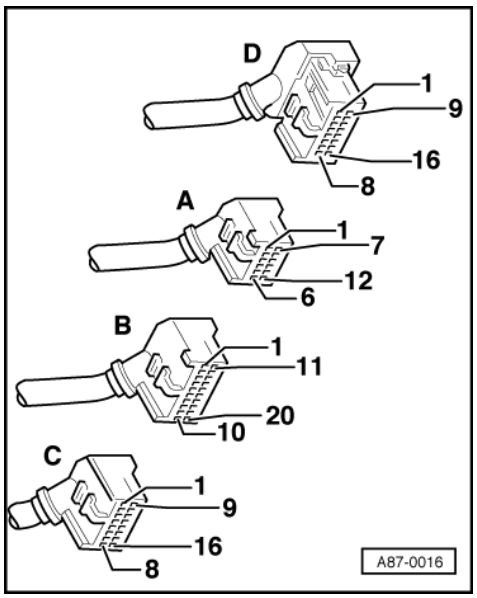
- Check actuation of fuel pump relay

If the fuel pump does not run:

- Check power supply for fuel pump and components (via fuel pump relay) =>Page 96 .

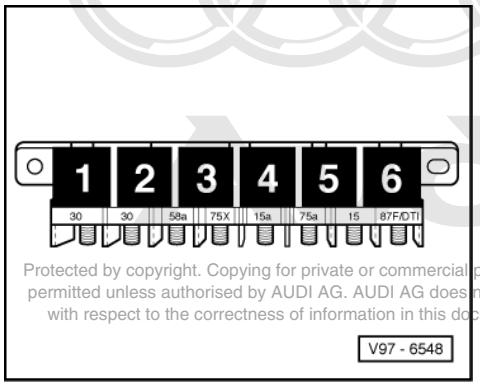
Checking actuation of fuel pump relay

- Switch off ignition.



- -> With the ignition switched off, use adapter V.A.G 1598/12 to connect test box V.A.G 1598 A to connector D only of engine control unit (control unit remains disconnected) => Page 77 .
- Connect together sockets 1 and 15 on the test box using an auxiliary cable from V.A.G 1594 A.

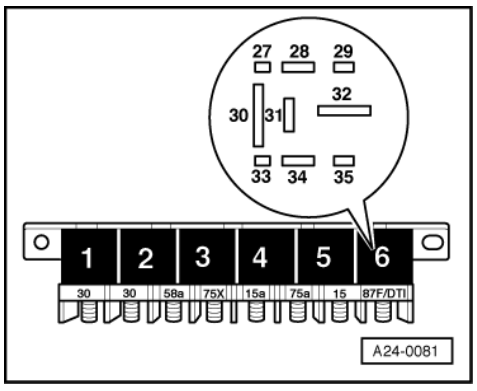
- Switch the ignition on.



- -> Fuel pump relay (in the central electrics, electronics box, passenger's footwell, position 6) should pull.

If the relay pulls now, but not during final control diagnosis:
- Fit a new engine control unit => Page 78 .

If the relay does not pull:
- Switch off ignition.
- Disconnect fuel pump relay.



- -> Connect the multimeter to contact 28 of relay socket and earth to measure voltage.
- Switch the ignition on.
  - Specification: approx. battery voltage

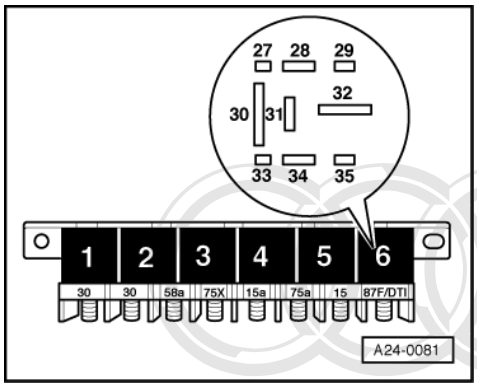
If the specification is not obtained:

- Check the wiring.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

If the specification is obtained:

- Switch off ignition.



- -> Check for open circuit and short to positive or earth in the following wiring connections:

Central electrics, electronics box, passenger's footwell, position 6, contact	Test box V.A.G 1598 A Socket
29	15

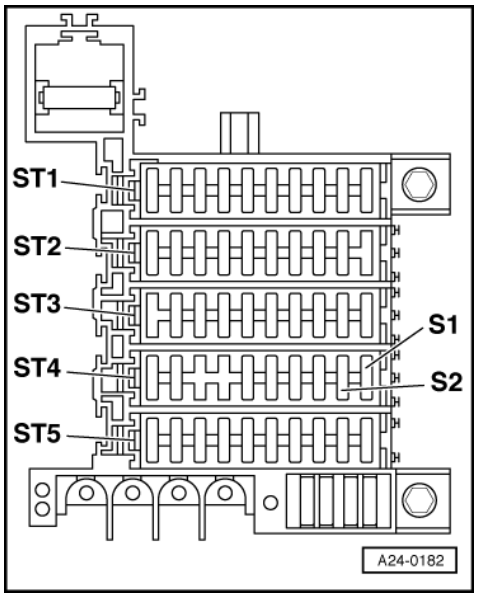
- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, renew the fuel pump relay -J17.

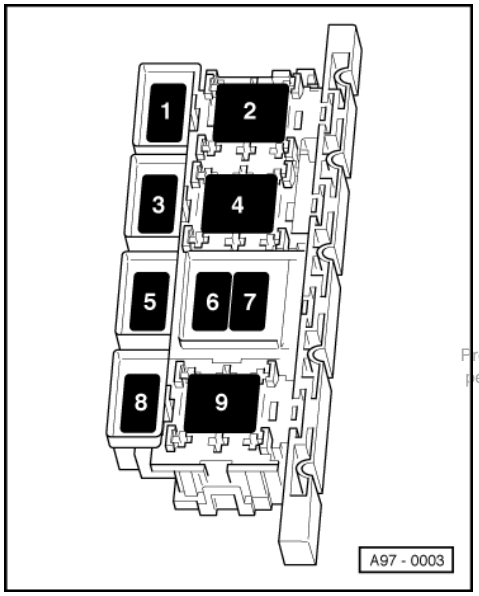
Checking actuation of fuel pump and components (via fuel pump relay)

- Slacken off knurled screw and detach cover at A-pillar from fuse holder.



- -> Pull fuses S1 and S2 out of fuse carrier ST4 in fuse holder.

  ST1 - Black fuse carrier
  ST2 - Red fuse carrier
  ST3 - Yellow fuse carrier
  ST4 - Blue fuse carrier
  ST5 - Brown fuse carrier



- -> Pull fuse S116 (ä 06.95: Position 6, 07.95 ä: position 7) out of relay and fuse carrier, electronics box, plenum chamber.
- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
- Connect the multimeter for voltage measurement to earth and the left or right contact of the following fuses:

Fuse	Specified value at left or right contact
S1 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage
S2 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage
S116 (in relay and fuse carrier, electronics box, plenum chamber ä 06.95: Position 6, 07.95 ä: Position 7)	approx. battery voltage

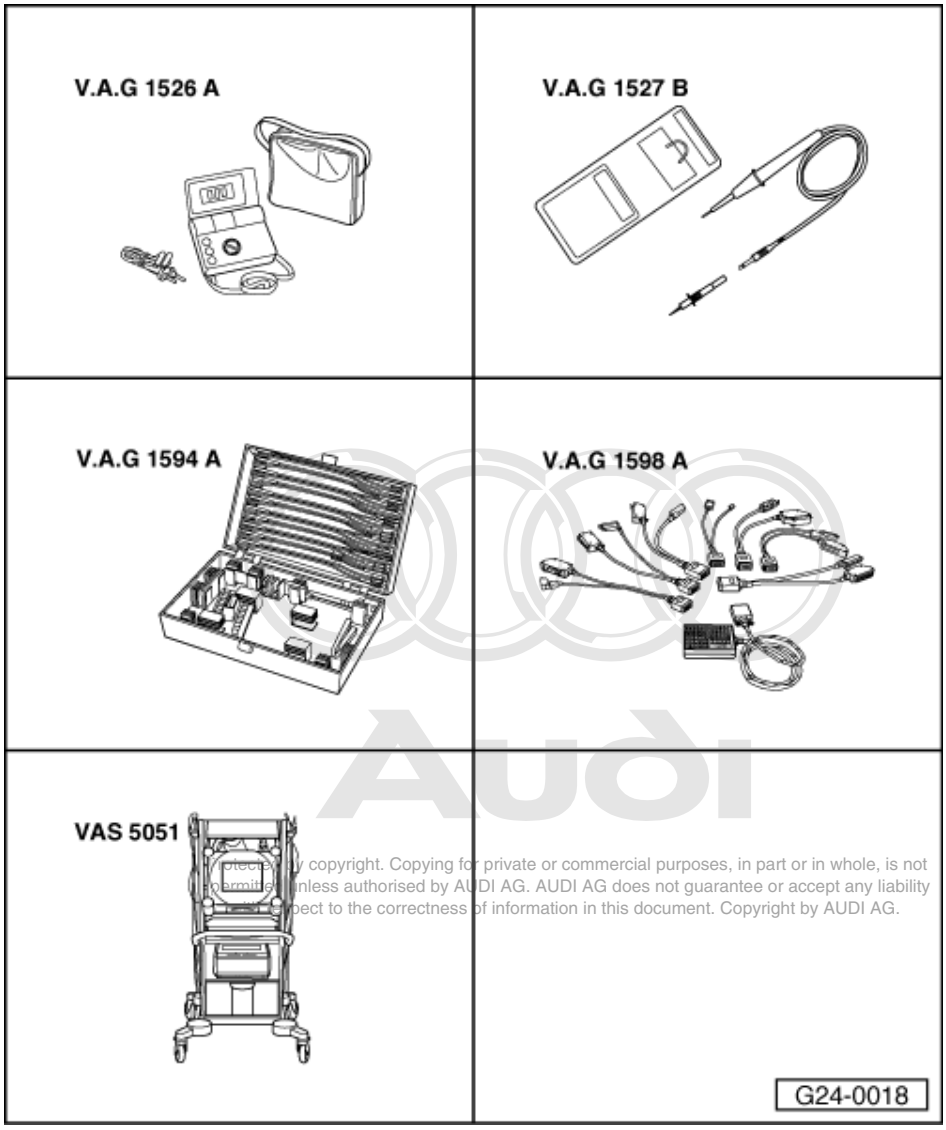
If the specification is not obtained:

- Check the wiring.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, renew the fuel pump relay -J17.

1.16 - Checking idling stabilisation valve -N71



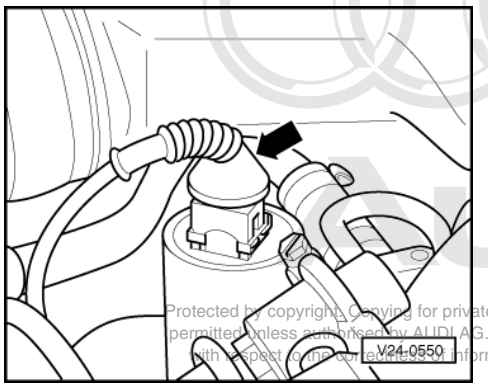
Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/12
- VAS 5051

or

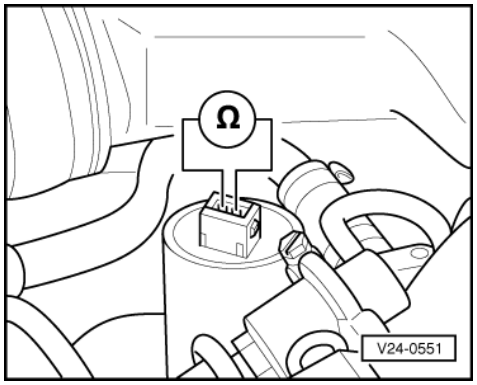
- V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 66



Checking internal resistance

- Switch off ignition.
- -> Pull connector -arrow- off idling stabilisation valve.



- -> Connect multimeter to valve to measure resistance.
  - Specification: 7 ... 11 ω

Note:

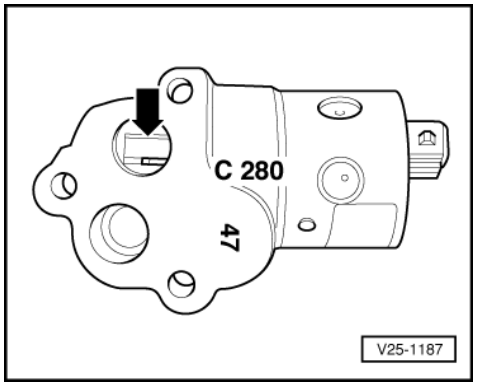
Resistance is in the lower tolerance range at ambient temperature and in the upper tolerance range when the engine is warm.

If the specification is not obtained:

- Renew idling stabilisation valve.

Mechanical checking

- Remove idling stabilisation valve



- -> Check piston slide -arrow- for scoring (visual inspection).

Note:

Never use a screwdriver or similar tool to move the piston slide when checking for freedom of movement.

- Attach connector to removed idle stabilisation valve
- Switch the ignition on.
- Start final control diagnosis => Page 25 and actuate idle stabilisation valve -N71.
- Check whether piston slide moves properly from stop to stop.

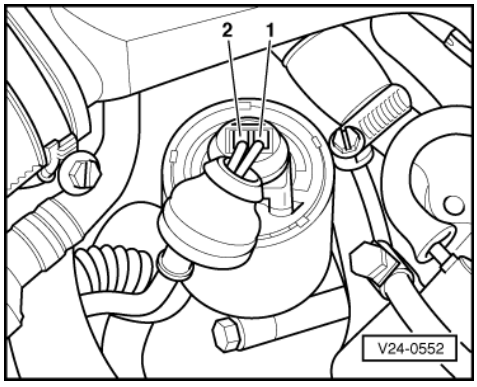
If scoring is found which impairs freedom of movement or if piston slide does not move freely (sticking, sluggish or not full range of travel):

- Renew idling stabilisation valve.

If idling stabilisation valve does not react in final control diagnosis:

Checking actuation

- Push back protective cap at connector
- Start final control diagnosis => Page 25 and actuate idling stabilisation valve -N71.



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

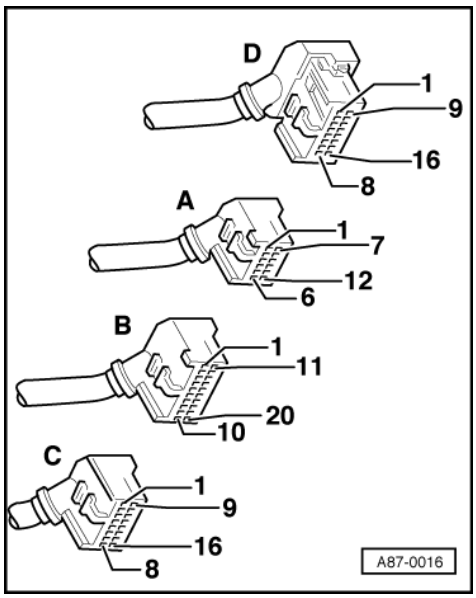
Idling stabilisation valve contact	Measure to
1	Engine earth

- The LED should flash.

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

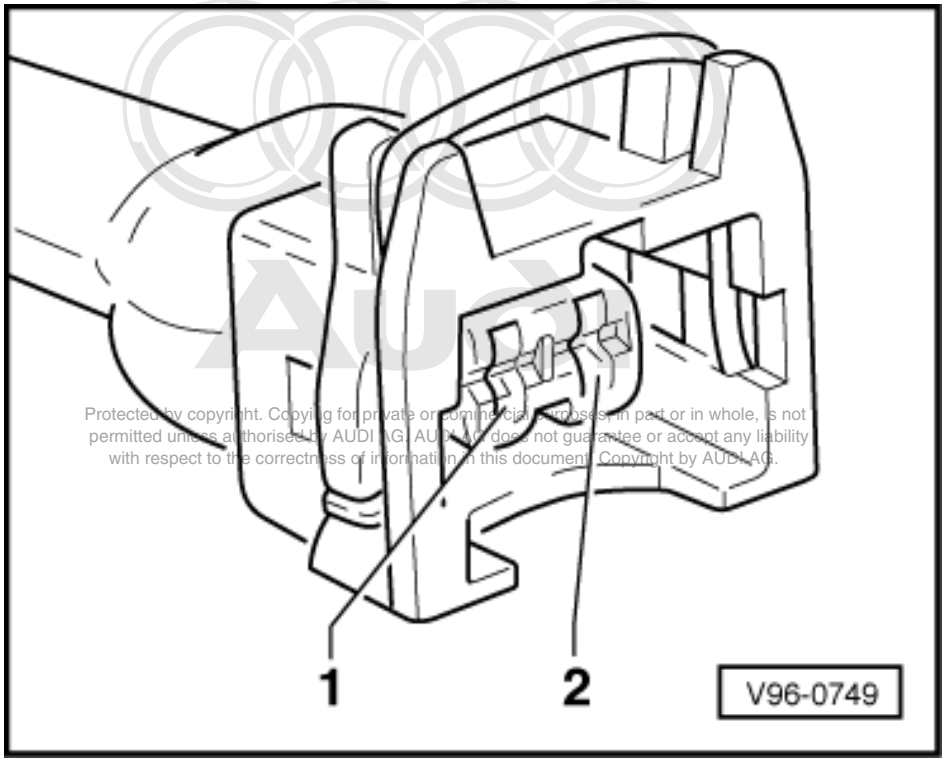
Idling stabilisation valve contact	Measure to
2	Battery positive

- The LED should light up.



If the specified values are not obtained:

- -> With the ignition switched off, use adapter V.A.G 1598/12 to connect test box V.A.G 1598 A to connector D only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

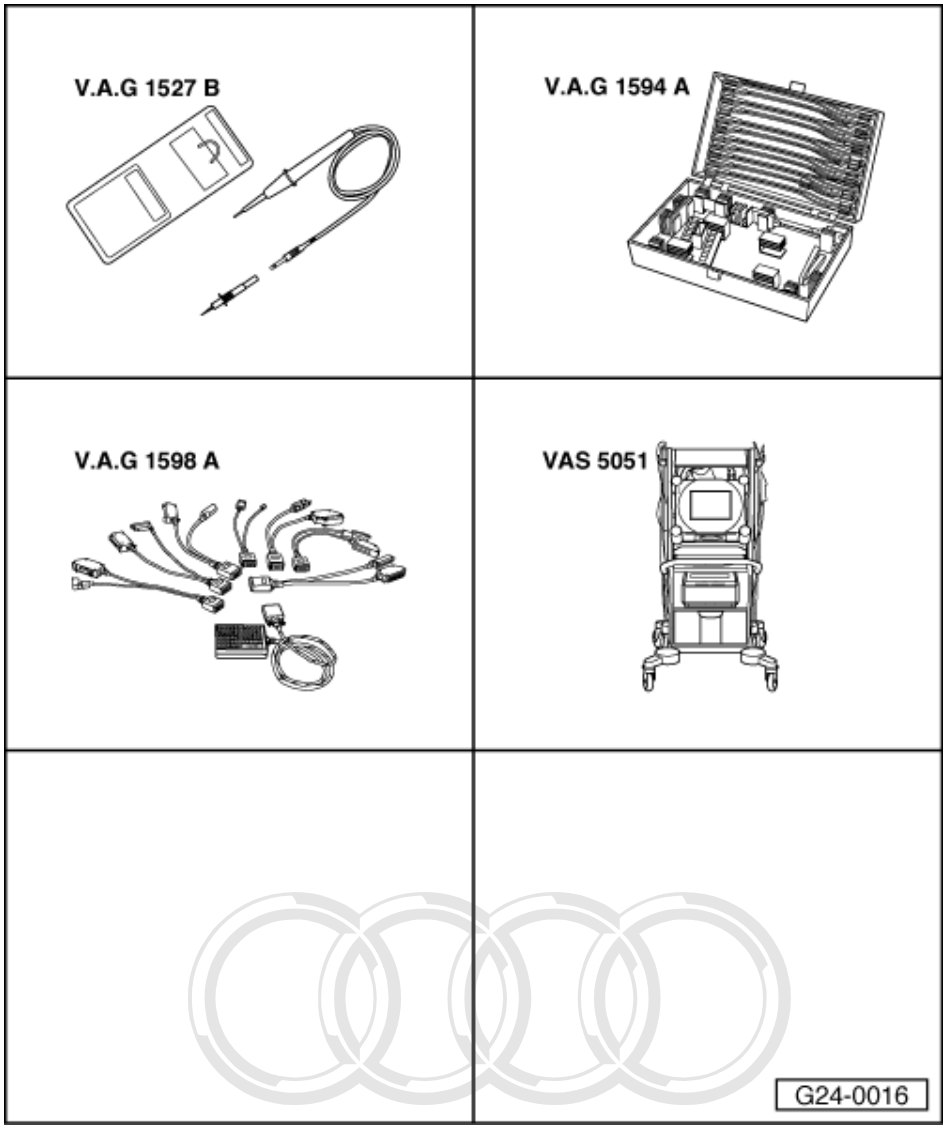
Connector Contact	Test box V.A.G 1598 A Socket
1	11
2	7

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If actuation and wiring are OK, but idling stabilisation valve does not react, valve is seized up. Renew idling stabilisation valve.

1.17 - Checking air mass meter -G70



**Special tools,
testers and auxiliary items required**

- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 66

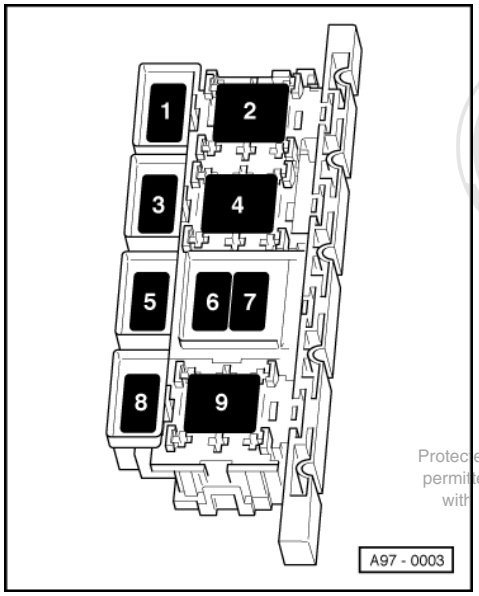
Check operation

- Read measured value block, Display Group 001, engine at idling speed =>Page 35 .

-> If adjacent display appears:

```
Read measurement block 1
     1     2     3     4
```

- Check display in display zone 1.
  - Specification: 1.450 ... 1.580 V



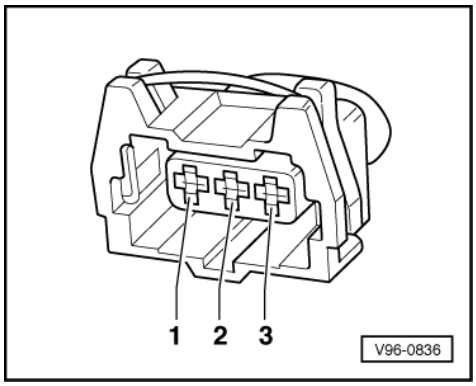
- If the values are not as specified or if the fault memory has recorded a fault relating to the air mass meter, check the power supply to the air mass meter.

Testing power supply

Test requirements:

- -> Fuse S115 OK (in relay and fuse carrier, electronics box, plenum chamber ‣ 06.95: Position 7, 07.95 ‣: position 9)

- Pull connector off air-mass meter.



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

Connector contact	Measure to
3	Engine earth

- Switch the ignition on.
  - The LED should light up.

If the LED does not light up:

- Check the wiring between contact 3 of connector and fuse for open circuit/short to earth and repair if necessary..

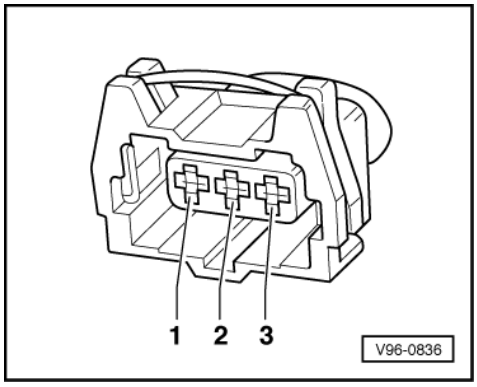
=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Note:

Use only gold-plated contacts when repairing the contacts in the plug connectors.

Checking earth supply

- Pull connector off air-mass meter.



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

Connector contact	Measure to
2	Battery positive

  - The LED should light up.

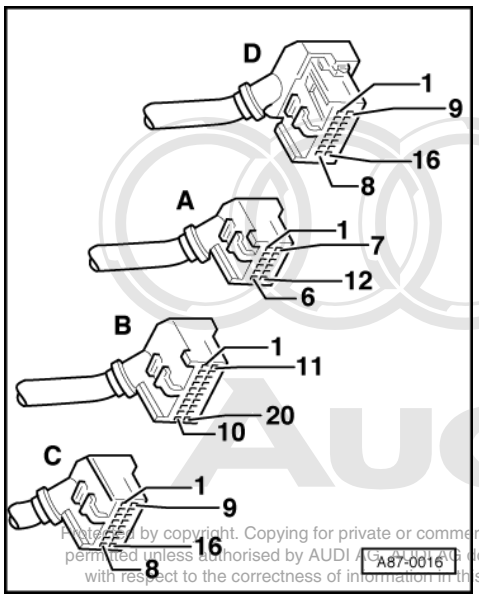
If the LED does not light up:

- Check wiring between contact 2 of connector and earth connection 1 in engine compartment wiring harness for open circuit and repair if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

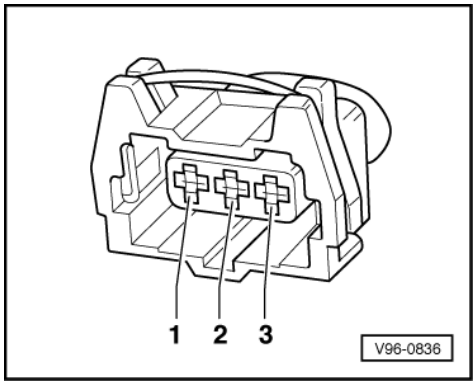
Note:

Use only gold-plated contacts when repairing the contacts in the plug connectors.



Checking signal wiring for air mass meter

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector A only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598 A Socket
1	42

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new air mass meter -G70.

Checking signal voltage

Test requirements:

- Wiring OK
- Air mass meter connected
- Electrical consumers switched off (radiator fan must not run during the test)

- Push back rubber grommet at connector of air mass meter

- Connect multimeter to contacts 1 and 2 of air mass meter connector to measure the voltage.

Note:

Pin assignment is marked on back of connector.

- Switch the ignition on.
  - Specification: 0.3 ... 1.1 V

- Start engine and run at idling speed.
- Increase engine speed and observe change in voltage.
  - Specification:
    With increasing engine speed, and thus increasing air throughput, signal voltage increases proportionally up to approx. 3.4 V at 4000 rpm.

If voltage does not change, or if voltage dips with increasing engine speed:

- Renew air mass meter.

2 - Testing intake manifold changeover system

2.1 - Testing intake manifold changeover system

This test should only be carried out if the engine is losing power.

The intake manifold changeover system switches over from the long intake tract to the short intake tract at about 4000 rpm.

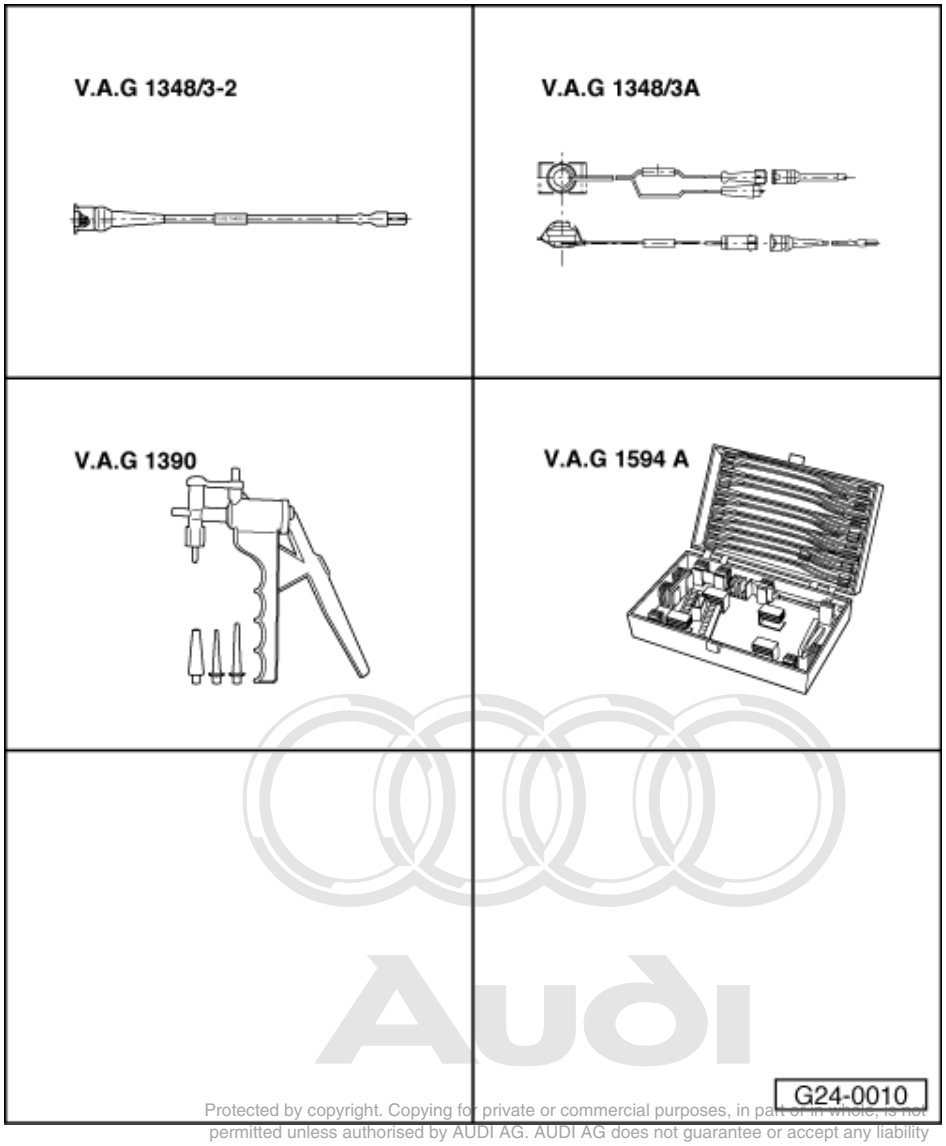
2.2 - Checking function

- Increase the engine speed to well above 4000 rpm; the vacuum unit for the intake manifold change over system should "pull". (Fitting location: at front left of intake manifold beneath ignition coils).

If the changeover is not taking place, carry out the following tests:

- Check intake manifold changeover valve -N156 (if necessary, check valve and actuation => Page 112).
- Checking vacuum system for leaks
  =>Page 107 .
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that change over mechanism operates freely (move push rod by hand).

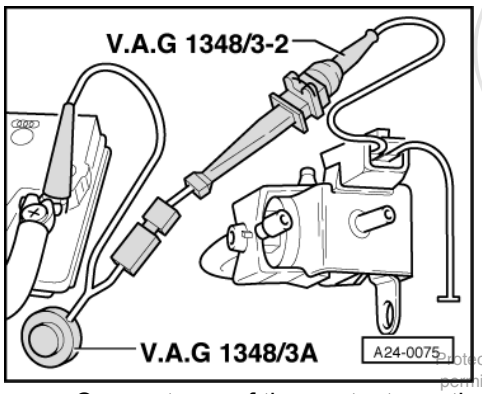
2.3 - Checking vacuum system for leaks



Special tools,
testers and auxiliary items required

- V.A.G 1348/3-2
- V.A.G 1348/3A
- V.A.G 1390
- V.A.G 1594 A

- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch off ignition.
- Unplug connector from intake manifold changeover valve -N156.

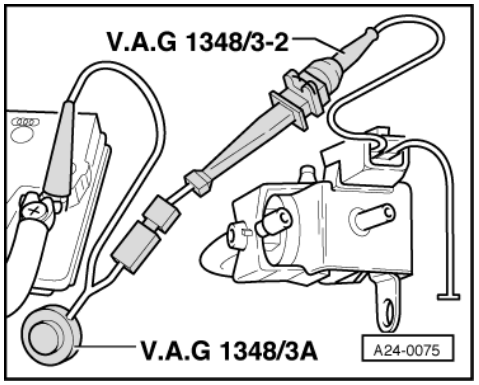


- -> Connect one of the contacts on the solenoid valve to engine earth using test leads and crocodile clamp from V.A.G 1594 A.
- Connect second contact on -N156 to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A approx. 2 to 3 minutes; throughout this period, the vacuum unit should pick up.

If the vacuum unit returns to its original "rest" position, carry out the following test:

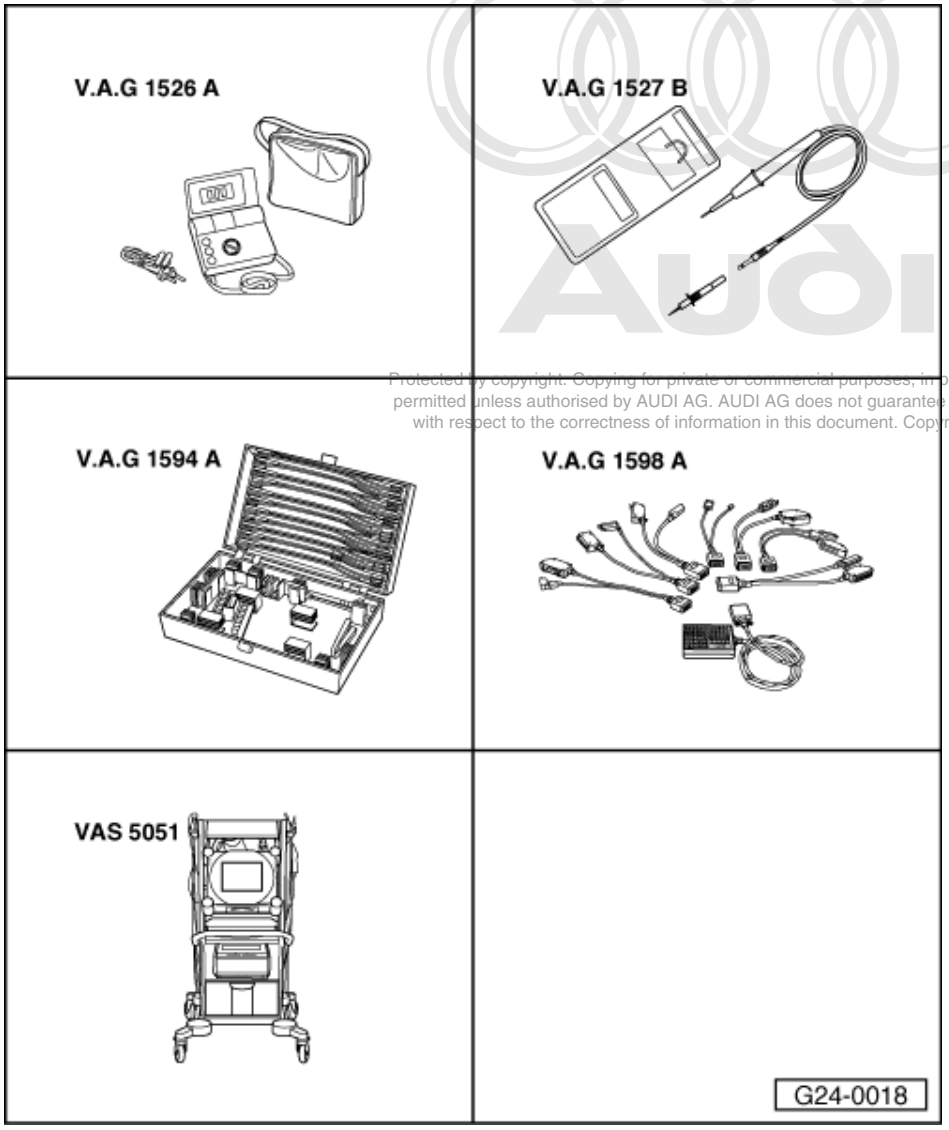
- Disconnect vacuum hoses from vacuum unit for intake manifold changeover system.
- Connect hand vacuum pump V.A.G 1390 to vacuum unit.
- Operate hand pump and check whether changeover function is working.

- Check vacuum unit for leaks. (The vacuum unit should not return to rest position until the hand pump is vented to atmosphere.)
- If necessary, renew vacuum unit.
- If the vacuum unit does not pick up, check -N156 as follows for blockage:



- -> Connect one of the contacts of -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594 A.
- Connect second contact on -N156 to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Check valve for obstructions (remove vacuum hoses and blow through).
- If necessary, renew intake manifold changeover valve.
- If no faults have been found in any of the tests so far, check the vacuum system for leaks.

2.4 - Checking intake manifold changeover valve -N156



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

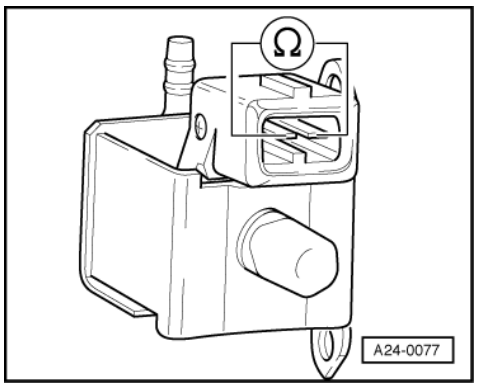
or

- V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 66

Test requirements:

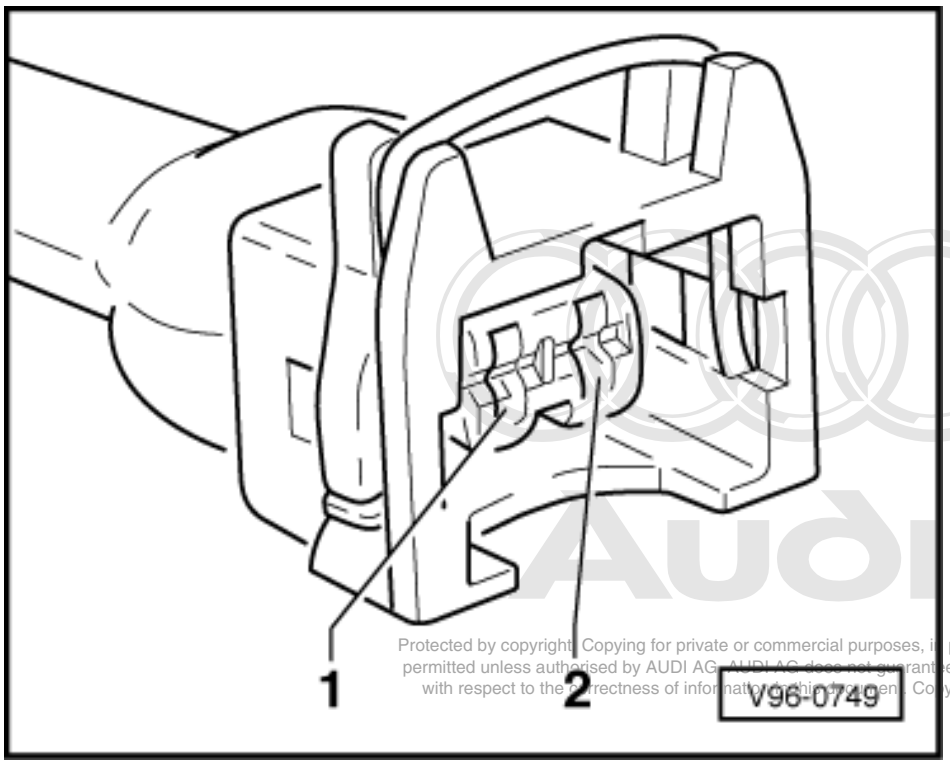
- Final control diagnosis has been performed



Checking internal resistance

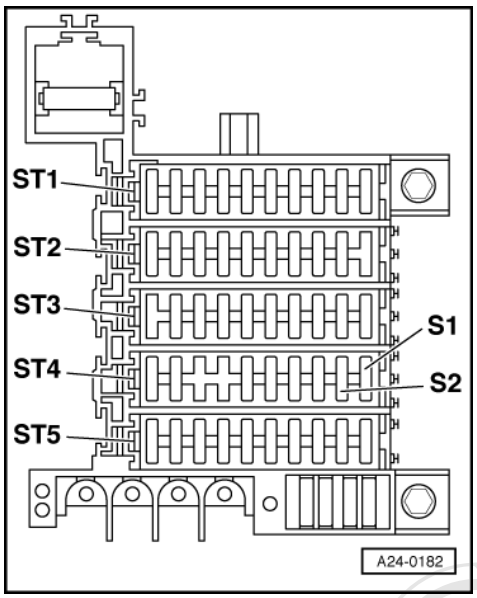
- Unplug connector from intake manifold changeover valve -N156.
- -> Connect multimeter to valve to measure resistance.
  - Specification: 25 ... 35 ω
- If the reading does not match the specification, renew intake manifold changeover valve -N156.

Testing power supply



- Unplug connector from intake manifold changeover valve -N156.
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector contact	Measure to
1	Engine earth

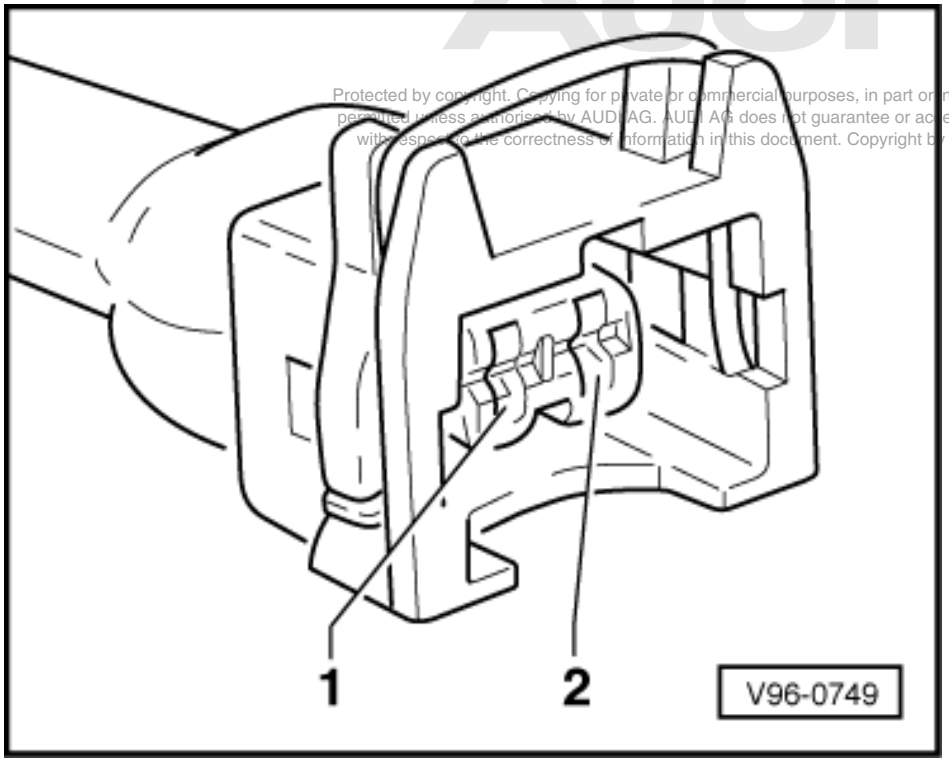


- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
  - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):

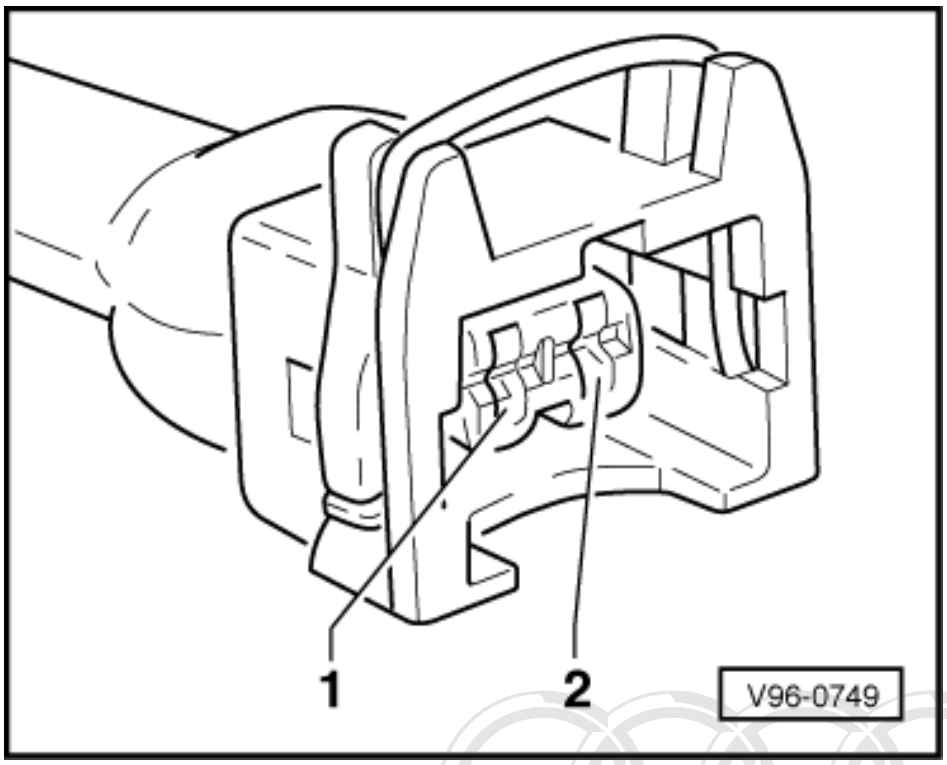
• -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



• -> Check for open circuit between contact 1 on connector and fuse in fuse holder .

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

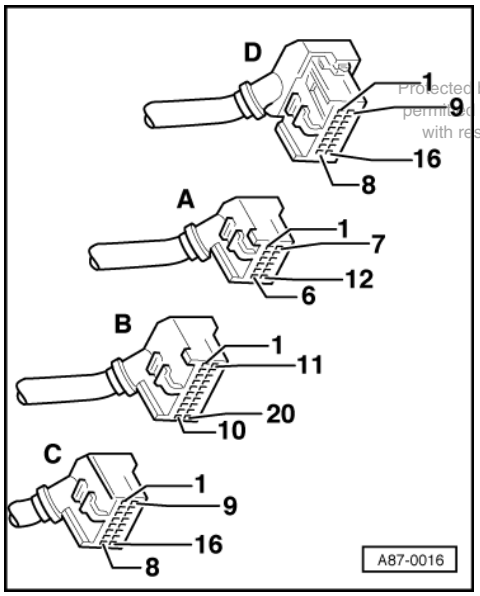
• Check fuel pump relay => Page 93



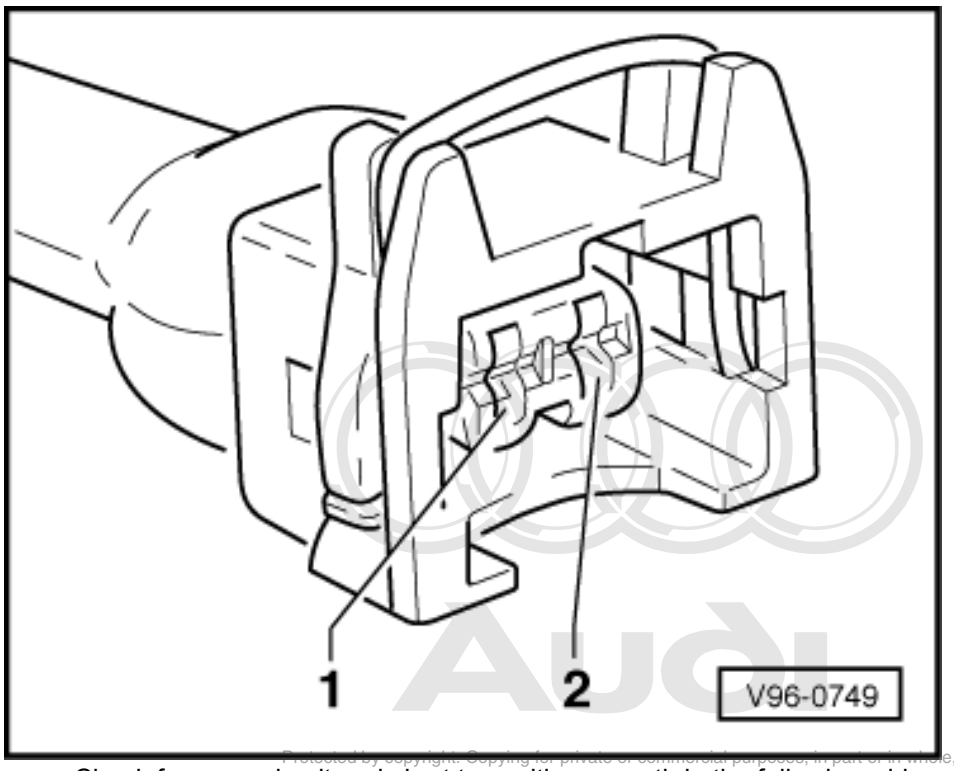
Checking actuation

- -> Connect up voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis => Page 25 and actuate the intake manifold changeover valve.
  - The LED should flash.

If the LED lamp does not flash or if it lights up continuously:



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598 A Socket
2	3

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

3 - Checking lambda control

3.1 - Checking lambda control

Notes:

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

The voltage signal for "Rich mixture" (low level of residual oxygen) is at approx. 0.6 ... 1.0 V.

The voltage signal for "Lean mixture (high level of residual oxygen) " is at approx. 0.0 ... +0.3 V.

A voltage jump from 0.6 ...1.0 V to 0.0 ... +0.3 V and vice versa occurs during the transition from "rich" to "lean" and vice versa (λ= 1.0) .

Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of λ = 1.0. The system fluctuates continuously between "slightly too lean" and "slightly too rich".

If the voltage does not change or only changes slowly the following faults are possible:

- Slots or holes in probe head are blocked.
- Lambda probe has been subjected to excessive thermal stress.
- Contact resistance in signal wiring .
- Lambda probe too cold; lambda probe heating not working.
- Lambda control switched off (control unit has registered a fault in the injection system => interrogate fault memory and read measured value block, display group 010).
- Lambda probe damaged by contact spray or similar product. (The contact spray is drawn into the probe via the fine cavities in the electrical wiring as a result of temperature fluctuations and capillary effect.)
- Lambda probe damaged by silicone vapours. (The engine draws in traces of any silicone based sealants that may have been used. The silicone does not burn and damages the lambda probe.)

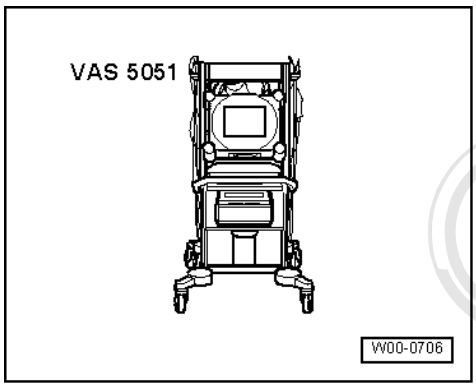
3.2 - Engine running problems after cold start

The time it takes for the lambda control to cut in (lambda probe temperature must be approx. 300 oC) is mainly determined by the following factors.

- Ambient temperature (summer or winter)
- Operating conditions after starting
- Functioning of lambda probe heating

If faults occur after a cold start, check whether the problem arises before or after the lambda control cuts in.

Special tools, testers and auxiliary items required



- VAS 5051

  or

- V.A.G 1551 with V.A.G 1551/3 A

Test requirements:

- No faults relating to lambda control function recorded in fault memory. If faults are recorded, rectify them and erase the fault memory.

Checking vehicle under cold start conditions:

- Read measured value block, Display Group 010, engine at idling speed =>Page 46 .

-> Display readout:

```
Read measurement block 10
     1     2     3     4
```

Display zone 3 will show the signal voltage for lambda probe 1.

Display zone 4 will show the signal voltage for lambda probe 2.

Engine cold or lambda control not running: 0.35 ...0.45 V

- Take the vehicle for a test drive.

Warning:
Attach fault reader to rear seat and operate from this location. When doing this, always observe the relevant safety precautions.
Page 64

- Observe display zones 3 and 4 during test drive.

-> When the control action cuts in, voltage signal in display zones 3 and 4 must fluctuate between the ranges 0.0 ... +0.3 and +0.6 ... +1.0 V.

```
Read measured value block 10
     1     2     3     4
```

Voltages of more than +0.6 V indicate a rich fuel mixture (low oxygen level in exhaust gas).

Voltages of less than +0.3 V indicate a lean fuel mixture (high oxygen level in exhaust gas).

- If the engine performance is poor before the lambda control cuts in, the lambda control is not the cause of the problem.
- If the engine running problems only occur after the lambda control has cut in, test the operation of the lambda control
  =>Page 115 .

Notes:

- If the performance improves once the lambda control has cut in, this means that the lambda control is counteracting the problem (e.g. unmetered air or defective injector, etc.). Check the lambda learned values to confirm this.

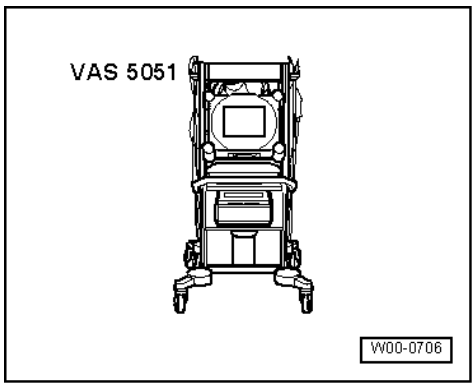
- Read measured value block, display groups 005 and 006, engine at idling speed =>Page 41 . If the values are not as specified, rectify the fault.

- Also check the measured value blocks in function 04 (Basic setting). The ACF solenoid -N80 is closed for this function.

- The lambda control can be selectively activated and deactivated with the help of display group 099. Pressing keys 4 and 8 will switch between the "Basic setting" (lambda control off) and "Reading measured value block" (lambda control on).

3.3 - Checking function of lambda probes

Special tools, testers and auxiliary items required



- VAS 5051

  or

- V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Read measured value block, Display Group 001, Engine idling =>Page 35 .

-> Display readout:

```
Read measurement block 1
     1     2     3     4
```

Do not proceed with the test until the coolant temperature shown in display zone 1 has reached at least 85 oC.

- Press C key.
- Enter "010" for "Display group number 010" and confirm entry with Q key.

-> Display readout:

```
Read measured value block 10
     1     2     3     4
```

Display zone 3 will show the signal voltage for lambda probe 1.

Display zone 4 will show the signal voltage for lambda probe 2.

- If the lambda probe voltage fluctuates very slowly, test the lambda probe heating => Page 117 .
- If the display shows a constant lambda probe voltage reading of 0.000 V, this means there is a short circuit to earth; check wiring => Page 117 .
- If the display shows a constant lambda probe voltage reading of 0.35 - 0.45 V, this means there is an open circuit in the signal wiring, check the wiring => Page 120 .
- If the display shows a constant lambda probe voltage reading of 2.550 V, this means there is a short circuit to positive; check wiring => Page 120 .
- If the display shows a constant voltage reading of 0.0 ... +0.3 V (mixture too lean), this means that the lambda control has reached the control stop in the "enrich" direction, but the lambda probe is still registering "Mixture too lean".

- If the display shows a constant voltage reading of 0.6 ... 1.0 V (mixture too rich), this means that the lambda control has reached the control stop in the "lean" direction, but the lambda probe is still registering "Mixture too rich".
- Press C key.

-> Display readout:

```
Reading measured value block     Q
Enter display group number XXX
```

- If the lambda probe is functioning properly, select display group 005/006 and check the lambda learned values =>Page 41 .

-> Display readout:

```
Read measured value 5
     1     2     3     4
```

Display zone 1 will show the lambda learned value at idling speed for cylinder bank 1.

-> Display readout:

```
Read measured value block 6
     1     2     3     4
```

Display zone 1 will show the lambda learned value at idling speed for cylinder bank 2.

The lambda control is adaptive, i.e. it has a learning capability. Faults such as unmetered air or defective injectors have the effect of changing the air/fuel mixture composition. The lambda probes detect this and com-

pensate by adjusting the basic injection periods programmed in the maps. The injection periods are extended or reduced until a λ = 1 mixture composition is achieved. The difference between the actual injection period and the basic period programmed in the map is given as a percentage.

- Positive learned value (+...%): Pre-programmed basic injection period is too short, actual injection period ... % longer in order to achieve a λ = 1 mixture composition.
- Negative learned value (-...%): Pre-programmed basic injection period is too long, actual injection period ... % shorter in order to achieve a λ = 1 mixture composition.

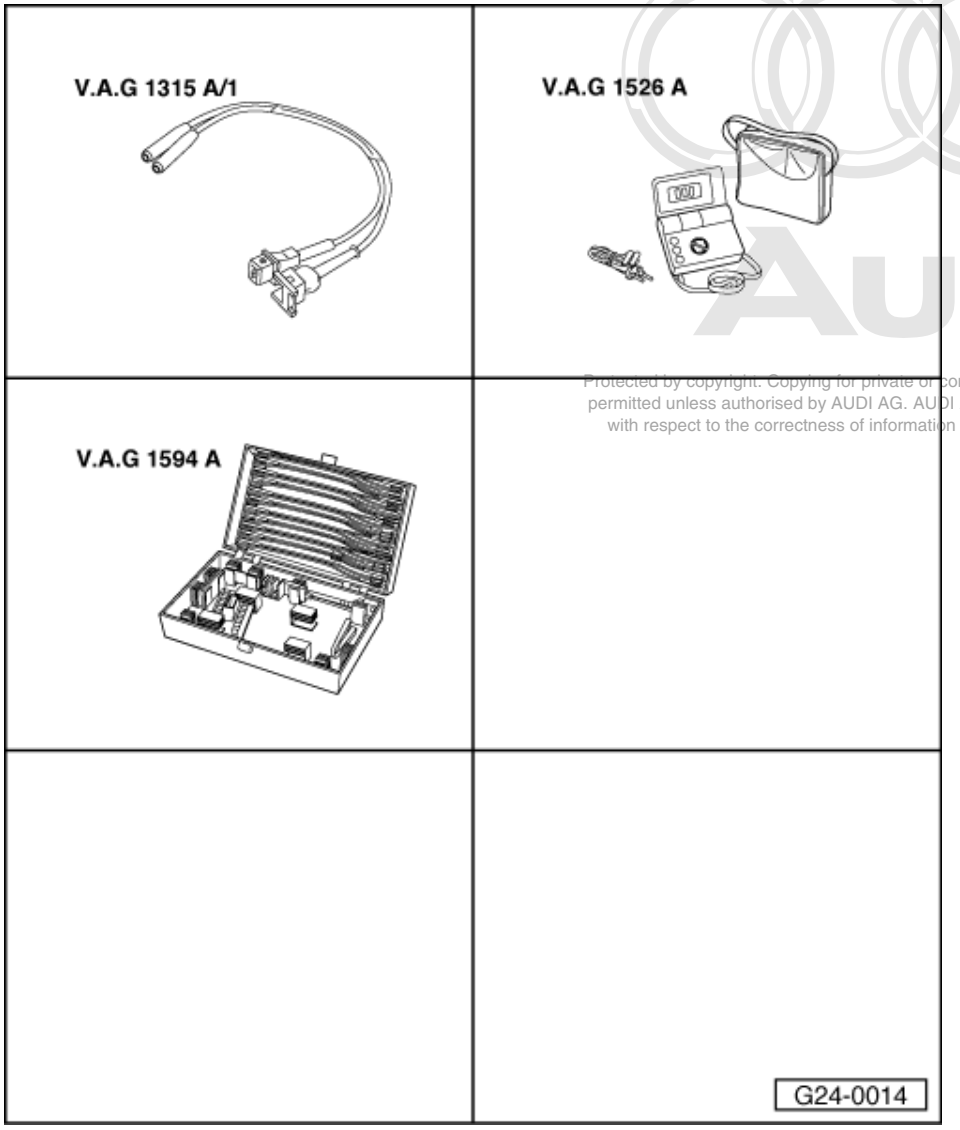
Specifications: Reading measured value block => Page 46 .

- If the specified values are not obtained: Test table display group 007 =>Page 44

Note:

If necessary, display group 007 can also be checked and printed out in the "Basic setting" mode (function 04) for the purposes of fault finding. This function excludes, for example, the influence of the ACF =>Page 27 .

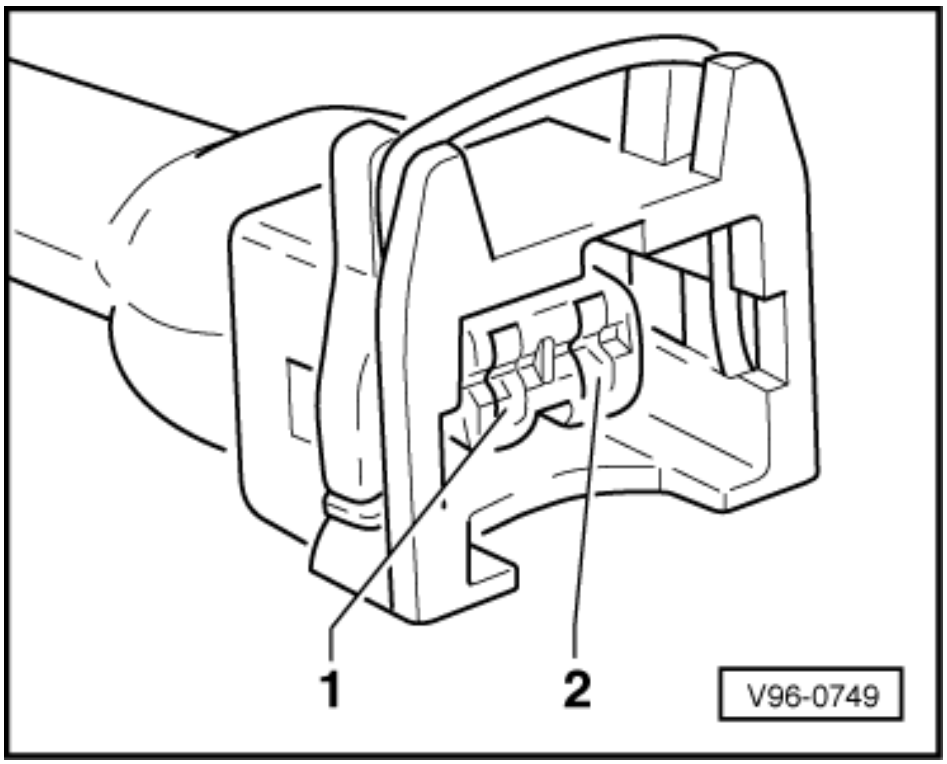
3.4 - Checking lambda probe heating



Special tools,

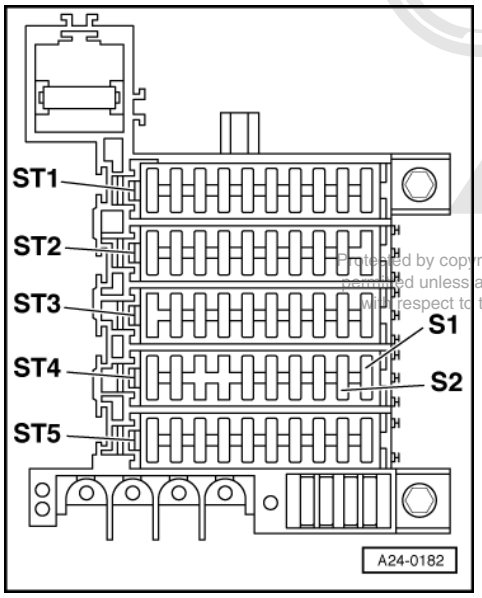
testers and auxiliary items required

- V.A.G 1315 A/1
- V.A.G 1526 A
- V.A.G 1594 A



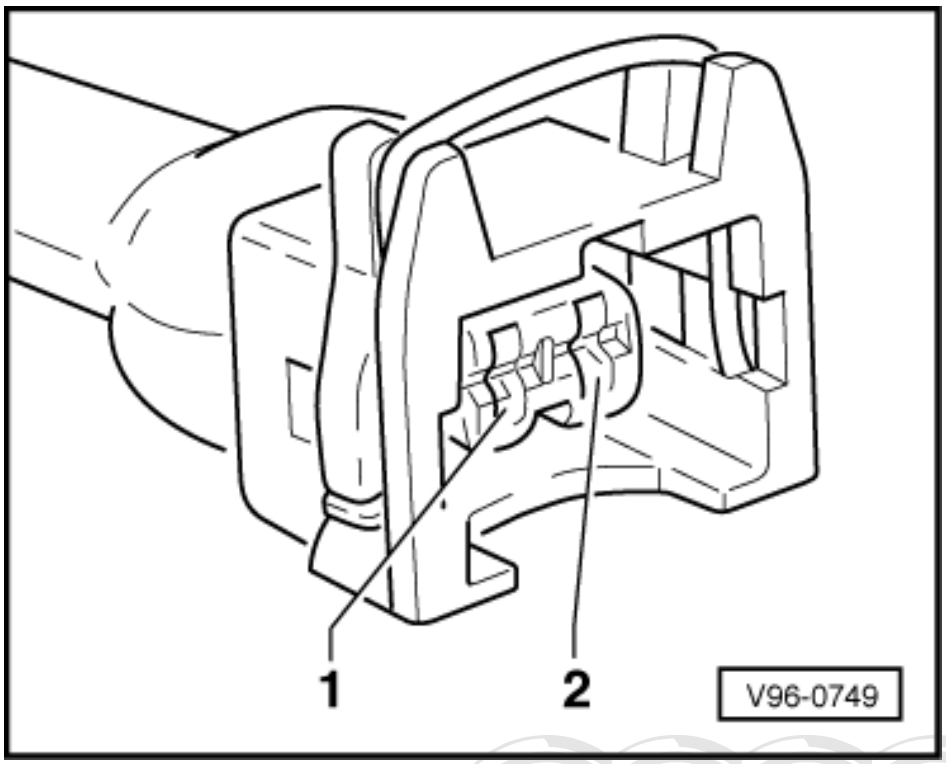
- Detach connector for lambda probe heating, right/left cylinder bank.
  (Fitting location => Page 67)
- -> Connect multimeter between contacts 2 (positive) and 1 (earth) to measure voltage.
- Start the engine.
  - Specification: 12 ... 14 V

If the specification is not obtained:



- Carry out the following tests (marked with dots):

- -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



- -> Check for open circuit between contact 2 of connector and fuse in fuse holder (if necessary, check contact assignment).

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- Check wiring between contact 1 and engine earth for open circuit.
- Check fuel pump relay => Page 93

If the specification is obtained:

- Connect auxiliary measurement lead V.A.G 1315 A/1 to the 2-way connector.
- Switch multimeter to 10 A measuring range (connect measurement lead to 10 A connection).
- Start engine and run at idling speed.
  - Specification: 0.5 ... 3.0 A

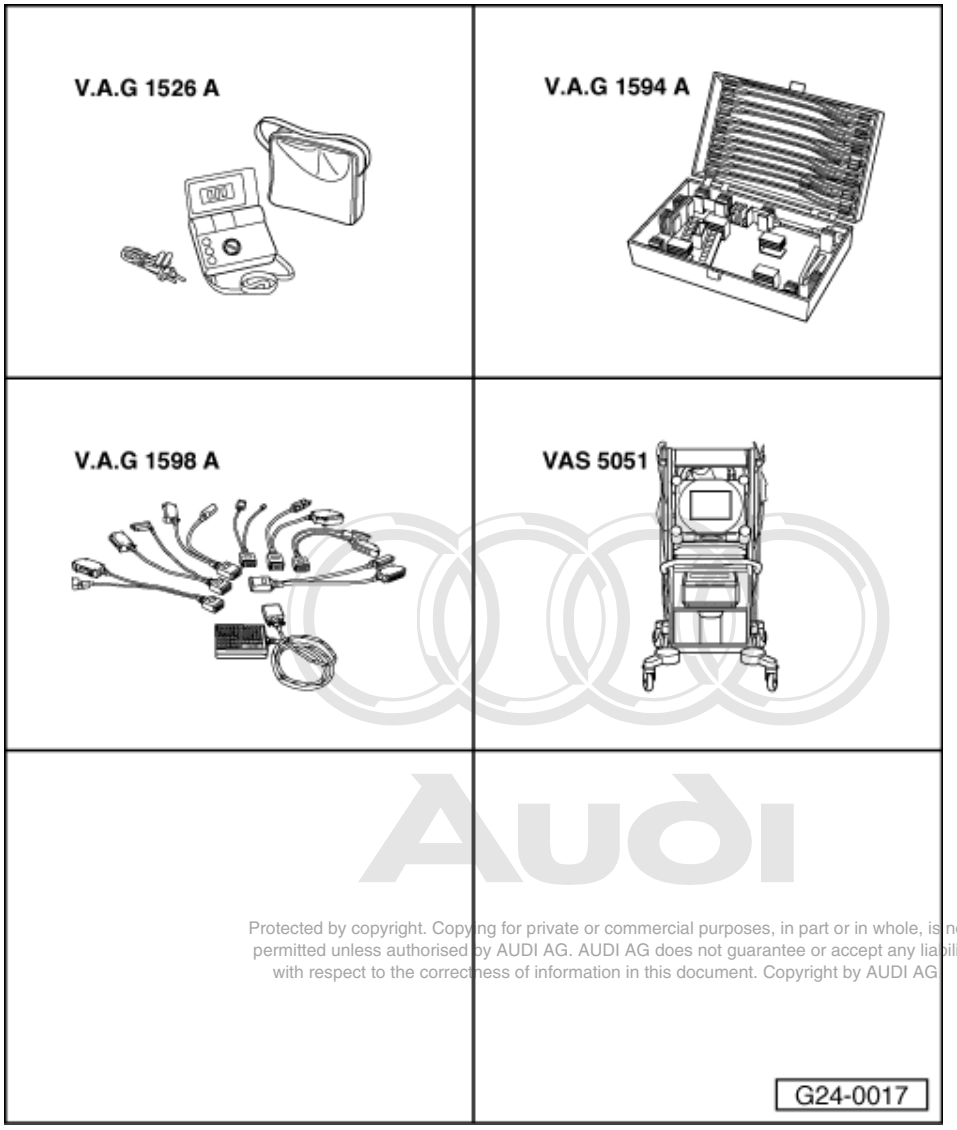
Note:

The current input decreases as the lambda probe becomes warmer.

If the specification is not obtained:

- Fit a new lambda probe.

3.5 - Checking lambda probe and signal wire



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

or

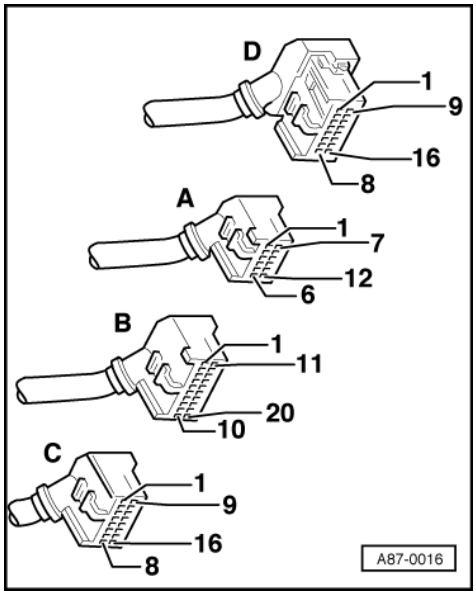
- V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Detach connector for lambda probe signal, right/left cylinder bank.
  (Fitting location => Page 67)
- Connect multimeter between signal wire and engine earth to measure resistance.
  - Specification: ∞ ω

If the specification is not obtained:

- Fit a new lambda probe.



If the specification is obtained:

- Connect up multimeter between connector of signal wire to engine control unit and engine earth to measure voltage.
- Switch the ignition on.
  - Specification: 400 ± 50 mV.

If the specification is not obtained:

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector A only of engine control unit (control unit remains disconnected) => Page 77 .

- Check for open circuit and short to earth/positive or earth in the following wiring connections:

Signal wire	Test box V.A.G 1598 A socket
Lambda probe bank 1 -G39	48
Lambda probe bank 2 -G108	50

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

3.6 - Removing and installing lambda probe

Special tools, testers and auxiliary items required

- Hot bolt paste G 052 112 A3

Removing

- Unplug lambda probe connector for left hand or right hand cylinder bank. (Fitting location => Page 67)
- Release cable ties.
- Unscrew lambda probe.

Installing

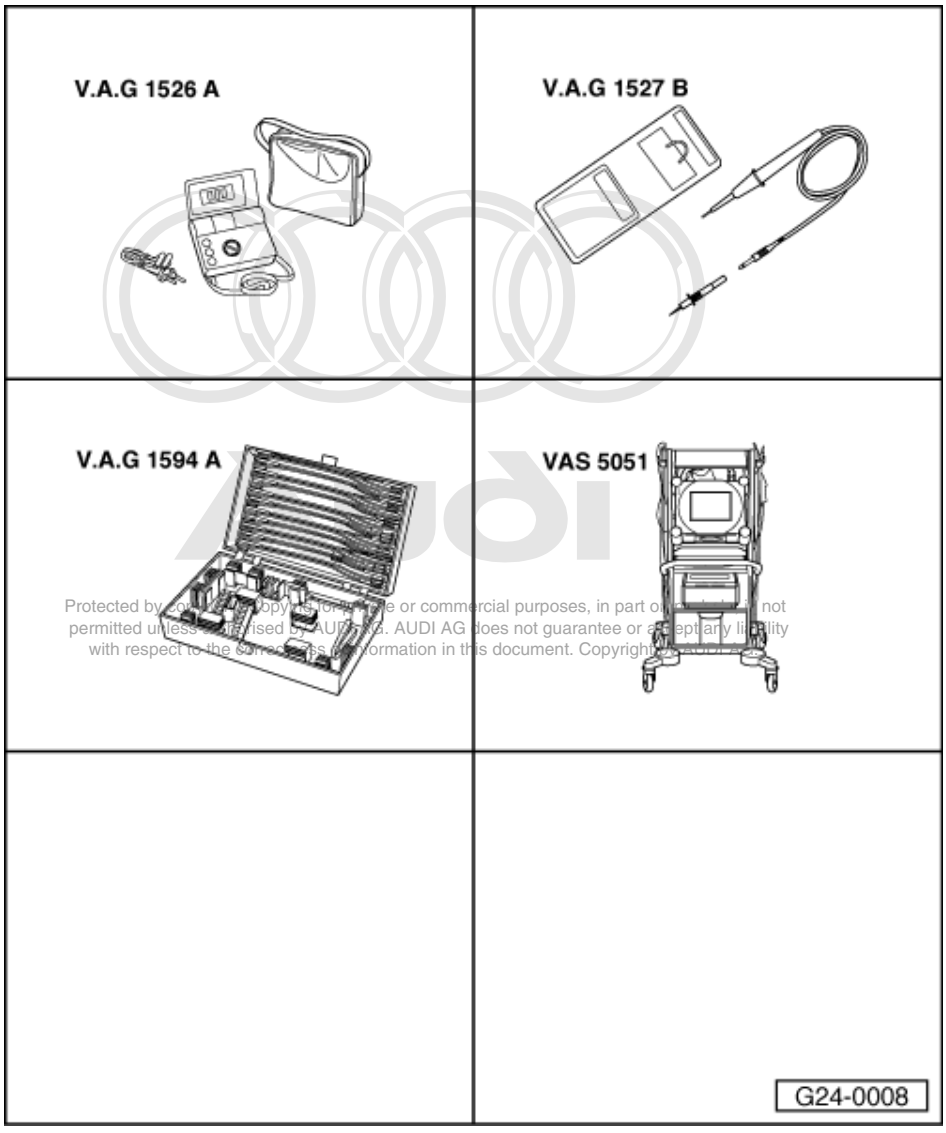
When installing, note the following points:

Notes:

- Tightening torque 50 Nm.
- The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.
- When installing, the cable ties must be re fitted at exactly the same points in order to prevent contact between the lambda probe wire and the exhaust pipe.

4 - Checking fuel tank breather

4.1 - Checking fuel tank breather



4.2 - Checking ACF solenoid 1 -N80

**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Fitting location => Fitting locations overview, Page 66

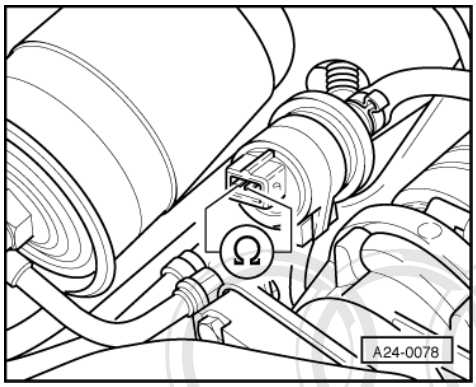
Note:

Check operation=> Reading measured value block display group 009, Page 46 .

Testing for leaks

ACF solenoid valve -N80 remains closed when deenergised.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Start final control diagnosis => Page 25 and actuate ACF valve.
- While final control diagnosis is running, blow into solenoid valve to check whether it opens properly. If necessary, fit a new solenoid valve.



Checking internal resistance

- Unplug connector on ACF valve.
- -> Connect multimeter to valve to measure resistance.
  - Specification: 20 ... 28 ω

If the specification is not obtained:

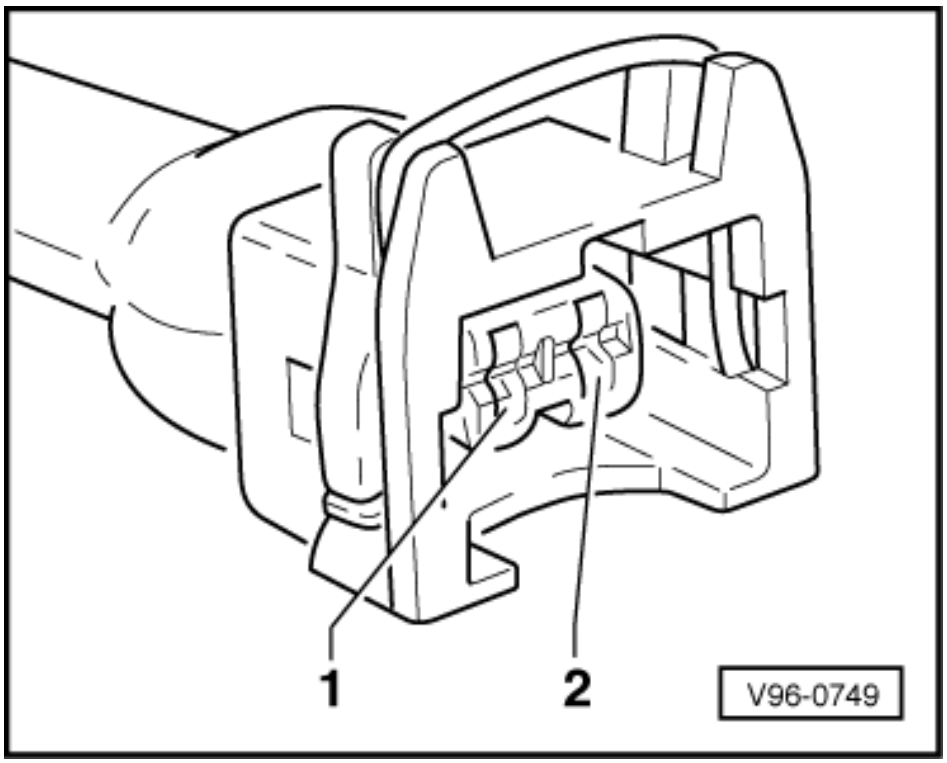
- Fit a new ACF valve.

Testing power supply

Note:

The ACF valve receives its power supply via the fuel pump relay.

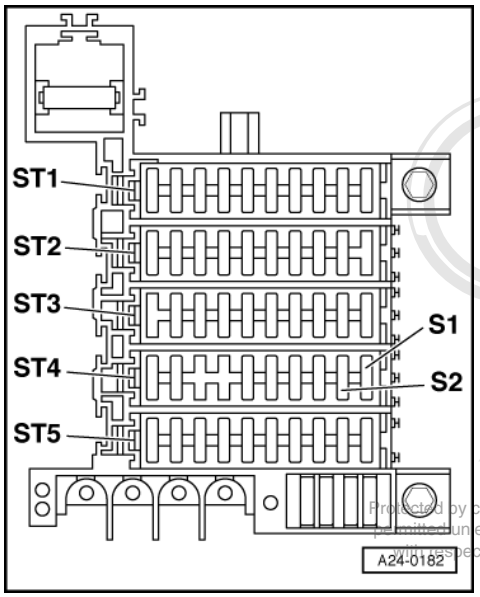
- Unplug connector on ACF valve.



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

Connector contact	Measure to
1	Engine earth

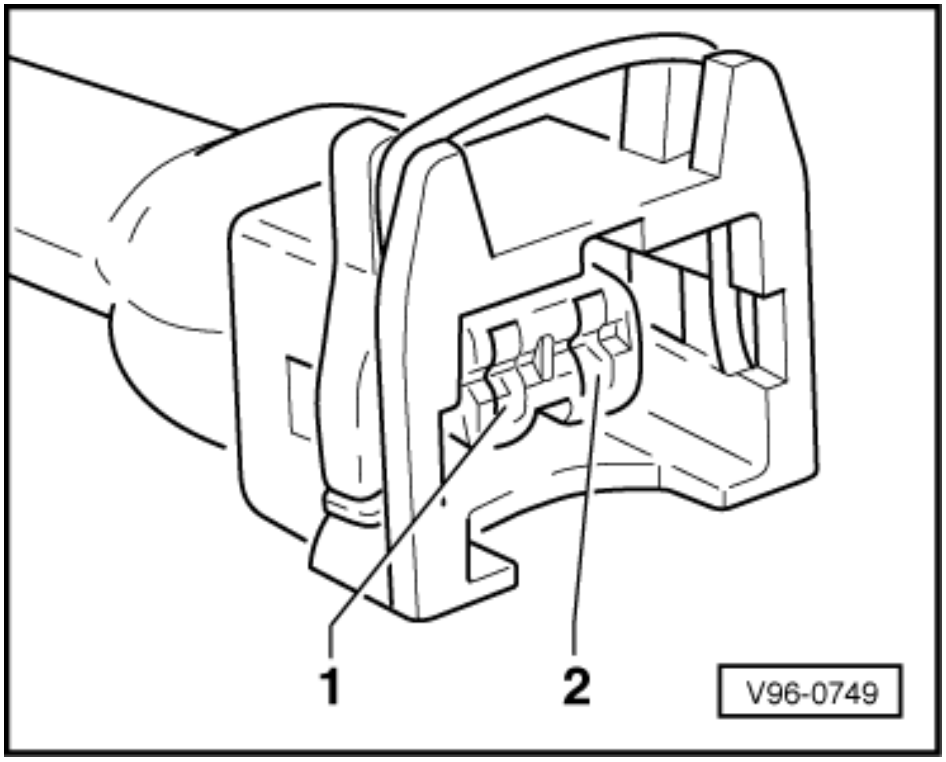
- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
  - The LED should light up.



If the LED does not light up:

- Carry out the following tests (marked with dots):

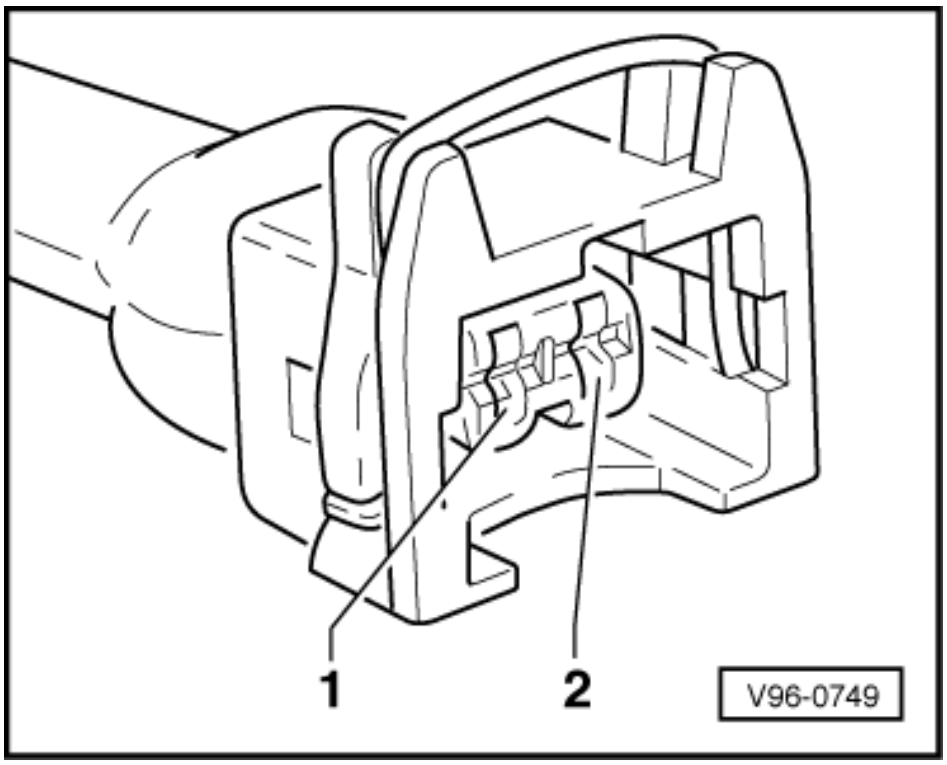
• -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



• -> Check for open circuit between contact 1 on connector and fuse in fuse holder .

=> Binder "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations"

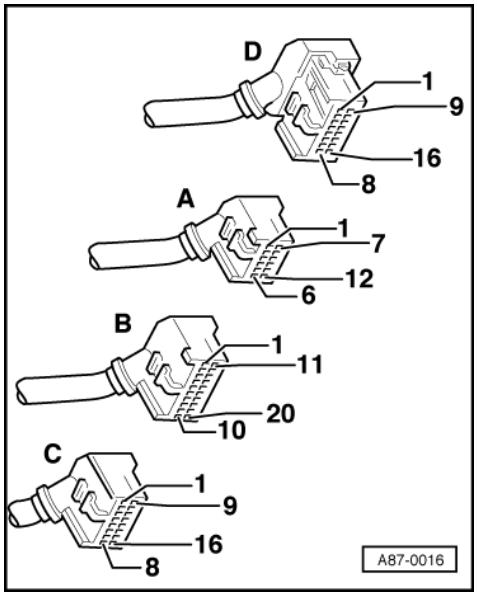
• Check fuel pump relay => Page 93



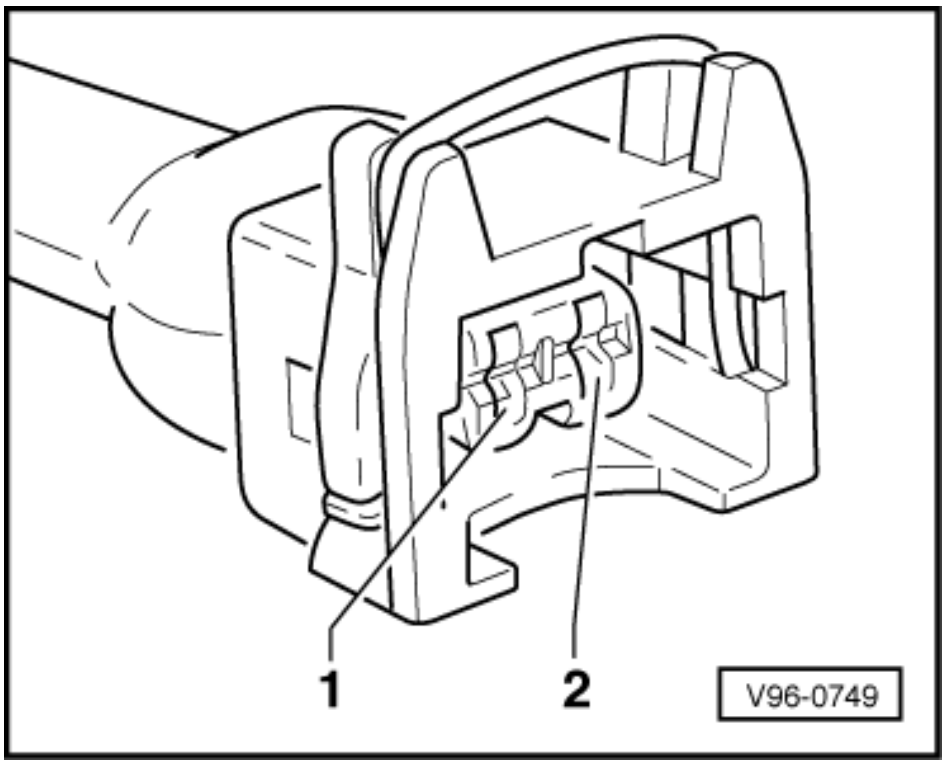
Checking actuation

- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2 using auxiliary cables from V.A.G 1594 A.
- Start final control diagnosis =>Page 25 and actuate ACF solenoid -N80.
  - The LED should flash.

If the LED lamp does not flash or if it lights up continuously:



- -> With the ignition switched off, use adapter V.A.G 1598/12 to connect test box V.A.G 1598 A to connector D only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598 A Socket
2	12

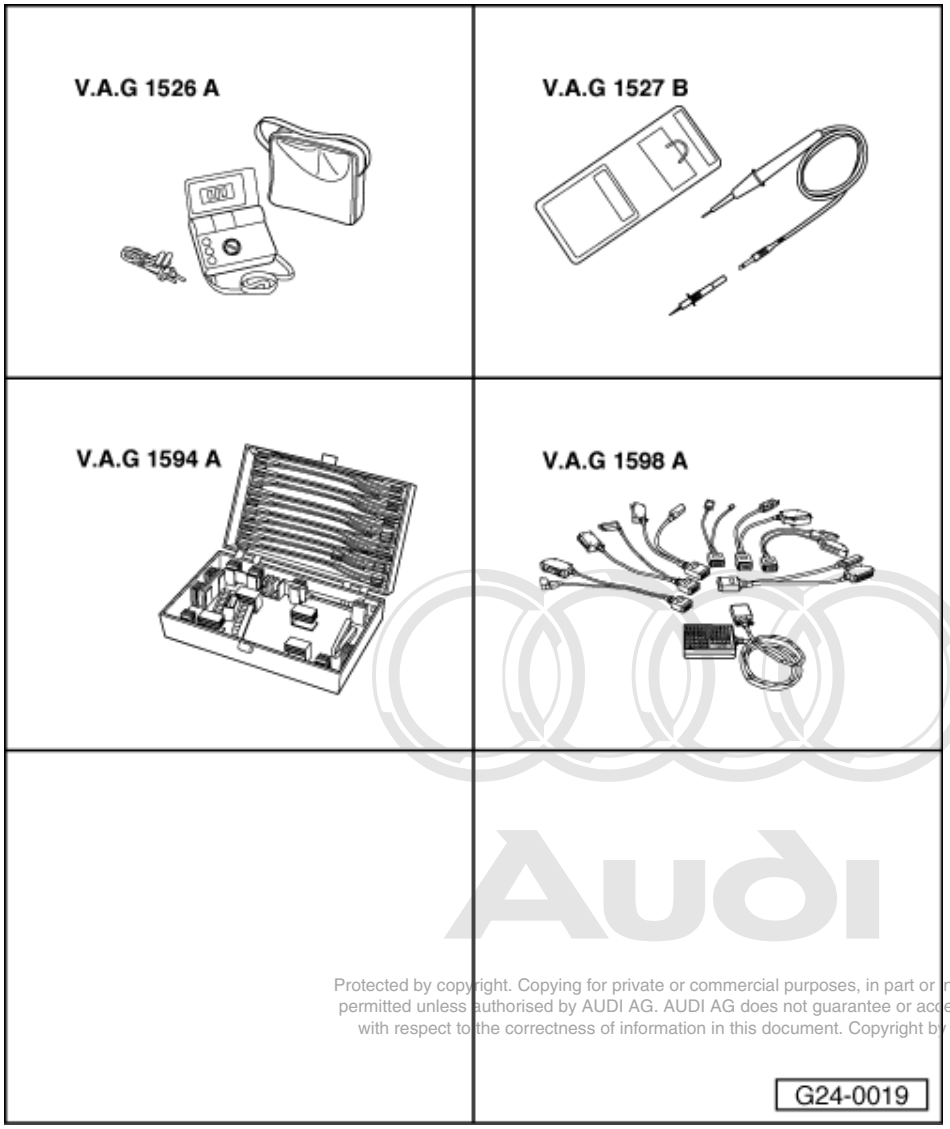
- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => page 78 .

5 - Checking throttle valve potentiometer -G69

5.1 - Checking throttle valve potentiometer -G69



**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

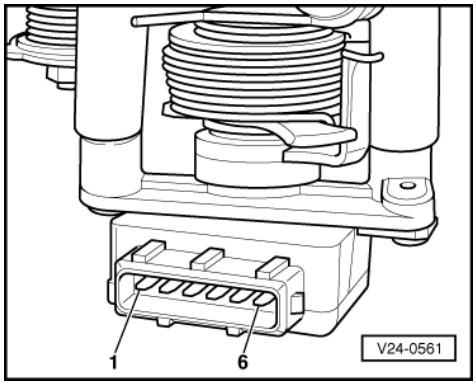
Fitting location => Fitting locations overview, Page 66

Notes:

- The throttle valve potentiometer -G69 informs the engine control unit of the position of the throttle valve.
- Check operation=> Reading measured value block display group 002, Page 36 .

Checking internal resistance

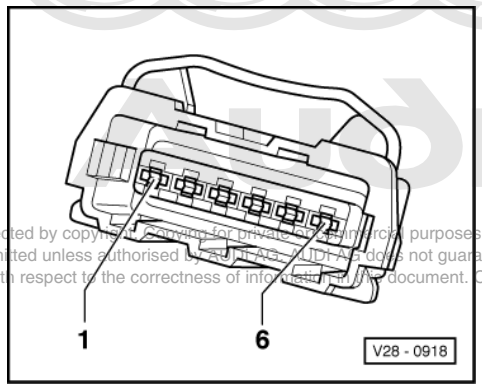
- Pull connector off throttle valve potentiometer.



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
  - Specification: 1.5 ... 2.6 kω
- Connect multimeter between contacts 2 and 3 to measure resistance.
  - Specification: 0.75 ... 1.3 kω
- Slowly move the throttle valve lever to full throttle position.
  - Specification: Increasing resistance up to max. 3.6 kω

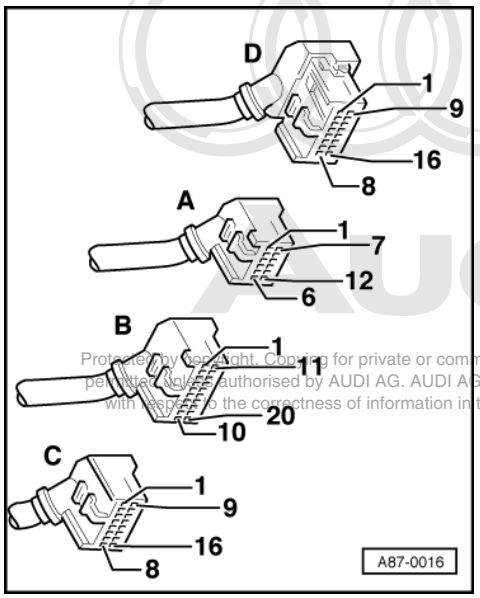
If a specification is not met:

- Renew throttle valve potentiometer.



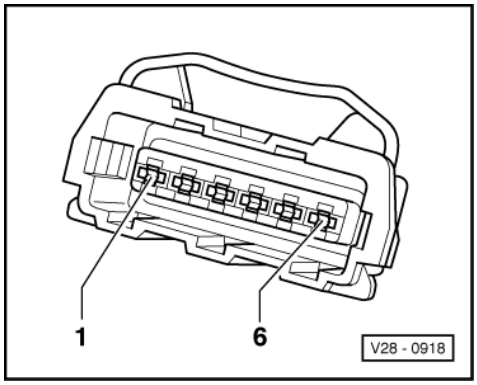
Testing power supply

- Pull connector off throttle valve potentiometer.
- -> Connect multimeter between contacts 1 (positive) and 2 (earth) to measure voltage.
  - Specification: 4.5 ... 5.5 V
- Connect multimeter between contacts 1 (positive) and 3 (signal) to measure voltage.
  - Specification: 4.5 ... 5.5 V



If a specification is not met:

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector A only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
1	46
3	47

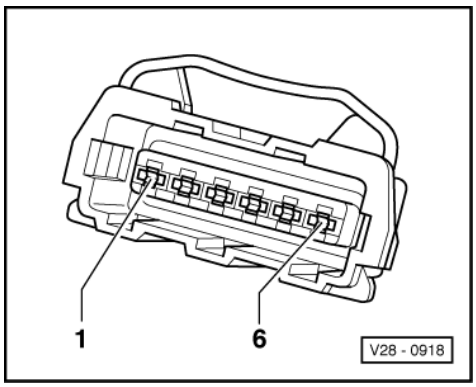
- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Note:

Use only gold-plated contacts when repairing the contacts in the plug connectors.

If no wiring fault is detected:



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

Connector Contact	Measure to
2	Battery positive

  - The LED should light up.

If the LED does not light up:

- Check wiring between contact 2 of connector and earth connection 1 in engine compartment wiring harness for open circuit and repair if necessary.

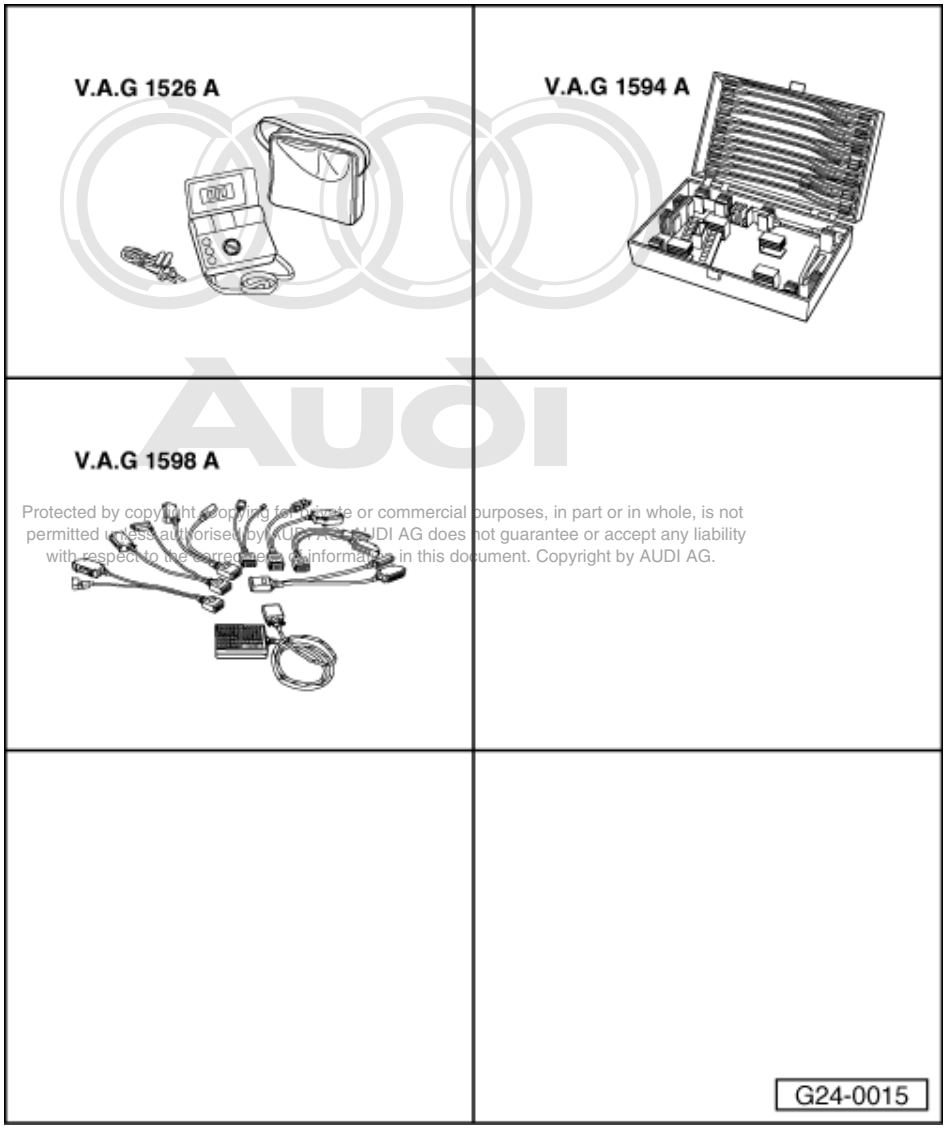
=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Note:

Use only gold-plated contacts when repairing the contacts in the plug connectors.

- If the wiring is OK, fit a new engine control unit => Page 78 .

5.2 - Checking idling switch -F60



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Notes:

- The idling switch is located in the throttle valve potentiometer.
- Check operation=> Reading measured value block display group 002, Page 36 .

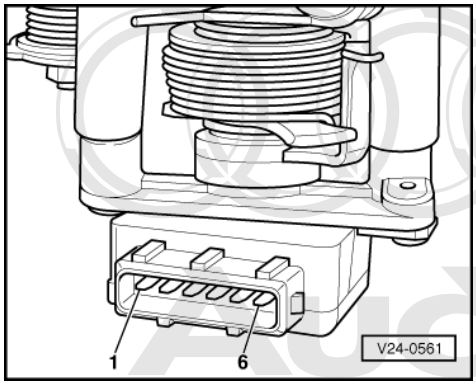
Test requirements:

- Throttle cable setting OK

=> 6-cylinder engine, Mechanical components; Repair Group 20

Test sequence

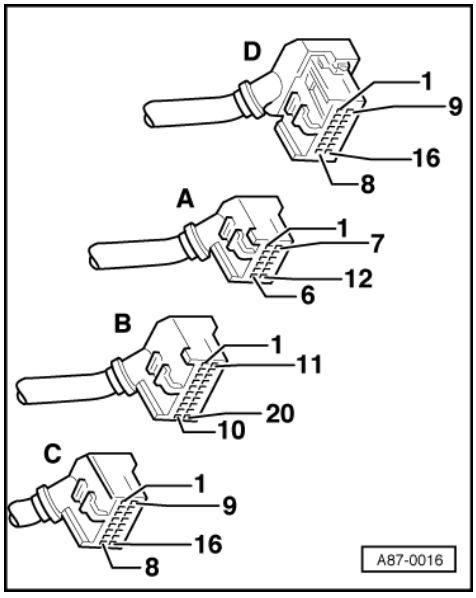
- Pull connector off throttle valve potentiometer.



- -> Connect multimeter between contacts 4 and 6 to measure resistance.
  - Specification: 0 ω
- Open throttle valve slightly.
  - Specification: ∞ ω

If the specified values are not obtained:

- Adjust idling switch =>Page 134 .

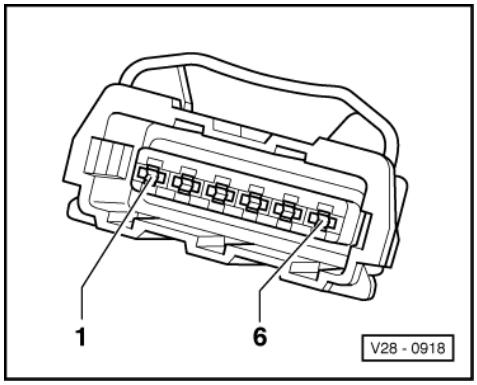


If the specifications are still not attained:

- Renew throttle valve potentiometer.

Check wiring

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector A only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598 A Socket
6	49

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Note:

Use only gold-plated contacts when repairing the contacts in the plug connectors.

If no fault in wire is detected:

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

Connector contact	Measure to
4	Battery positive

- The LED should light up.

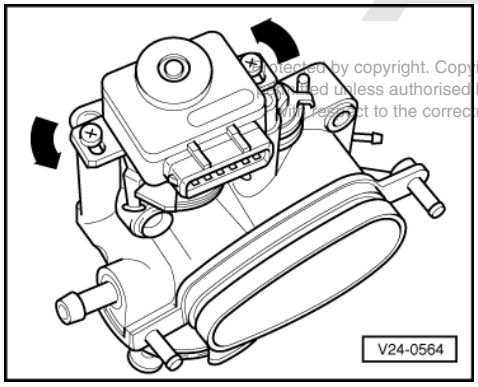
If the LED does not light up:

- Check wiring between contact 4 of connector and earth connection 1 in engine compartment wiring harness for open circuit and repair if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Adjusting idling switch

- Remove the throttle valve unit.
- Slacken off both bolts of throttle valve potentiometer.



- -> Turn throttle valve potentiometer in direction of arrow until a stop is felt.

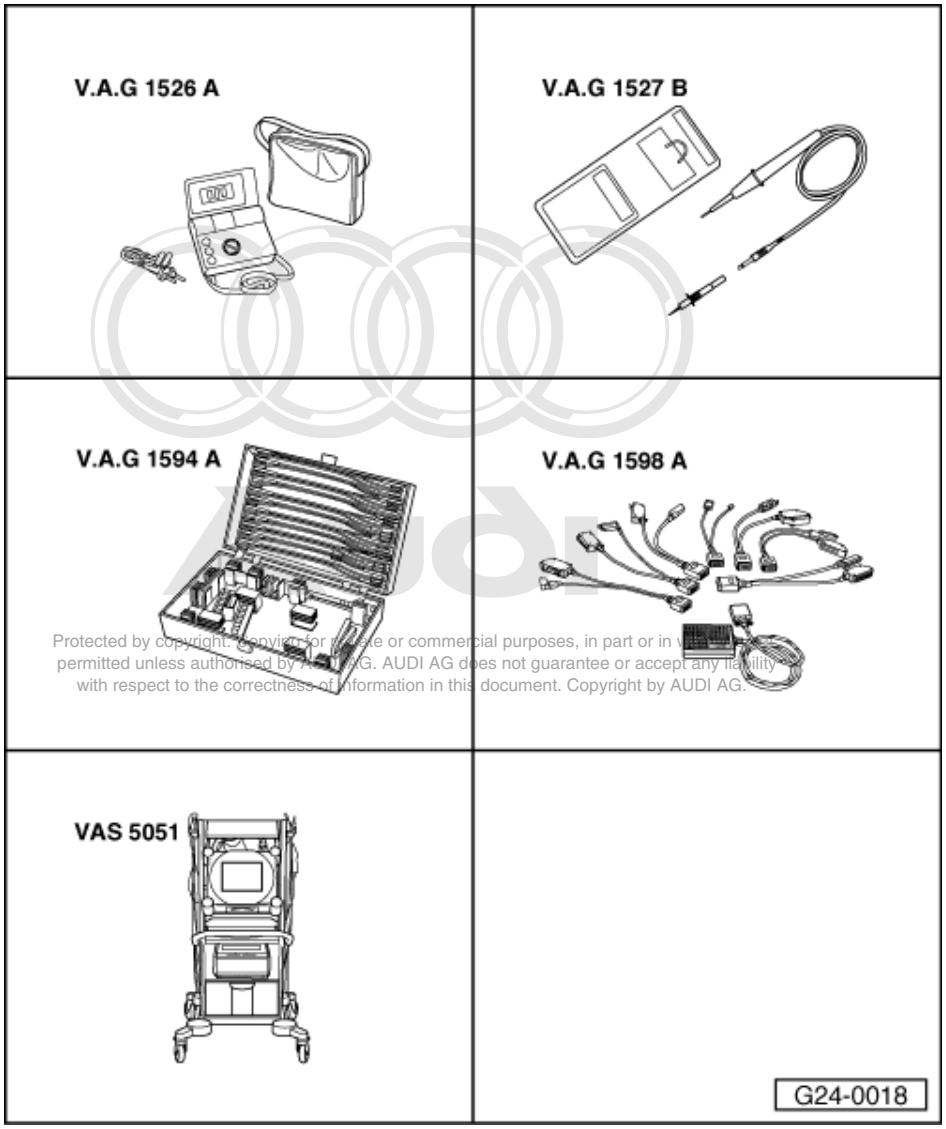
Note:

Do not move the throttle valve.

- Tighten bolts of throttle valve potentiometer in this position.
- Check adjustment => Page 133 .

6 - Checking EGR

6.1 - Checking EGR



6.2 - Checking EGR valve -N18

Special tools,

testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/12
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Note:

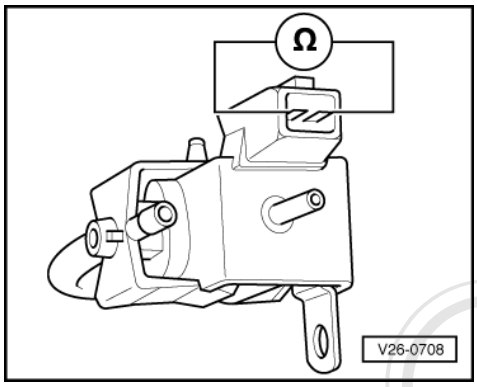
Checking function=> Reading measured value block display group 01, Page 51 .

Test requirements:

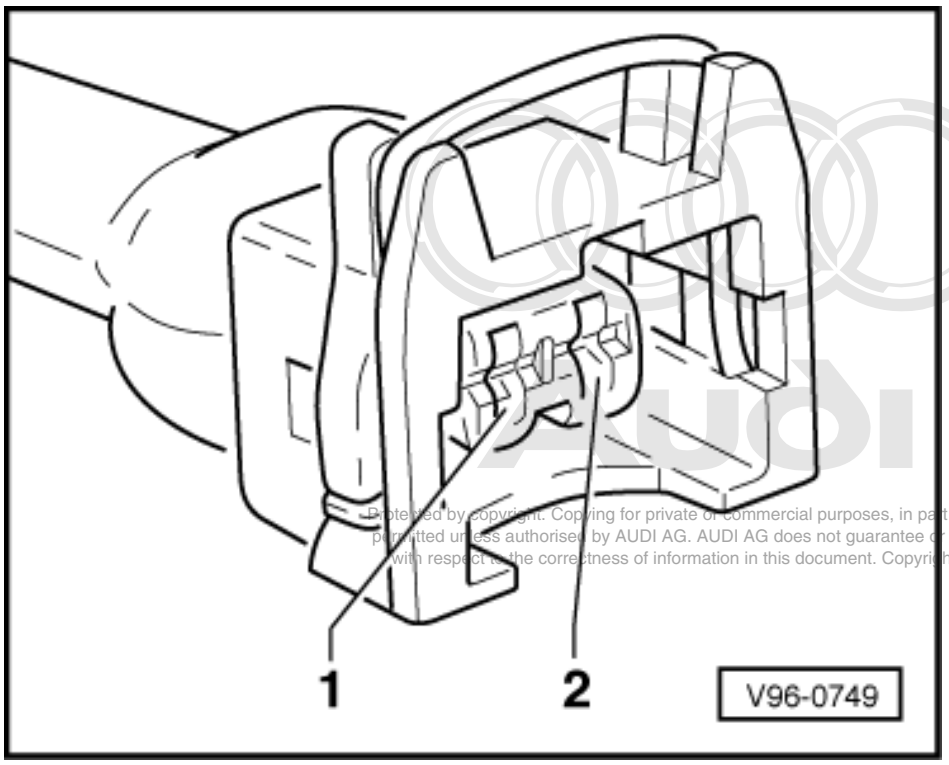
- Final control diagnosis has been performed

Checking internal resistance

- Pull connector off EGR valve -N18



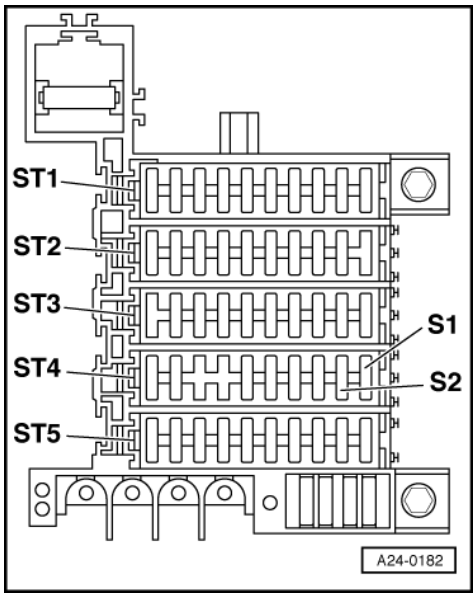
- -> Connect multimeter to valve to measure resistance.
  - Specification: 25 ... 35 ω
- If the specification is not attained, renew EGR valve -N18.



Testing power supply

- Pull connector off EGR valve -N18
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector contact	Measure to
1	Engine earth

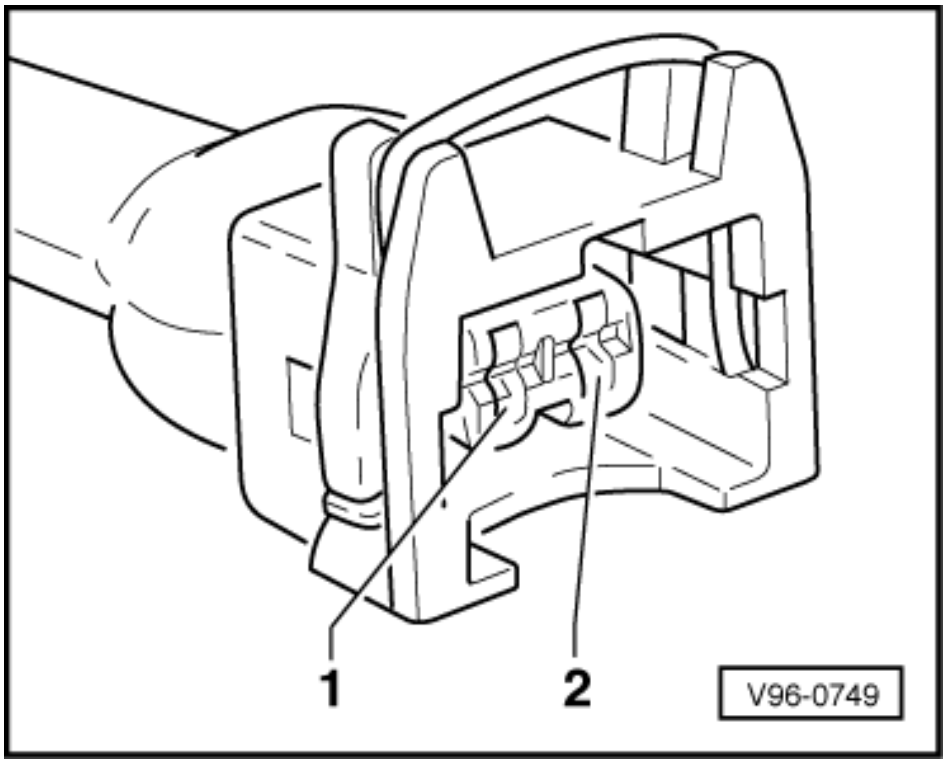


- Start final control diagnosis => Page 25 and actuate fuel pump relay -J17.
  - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):

• -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).

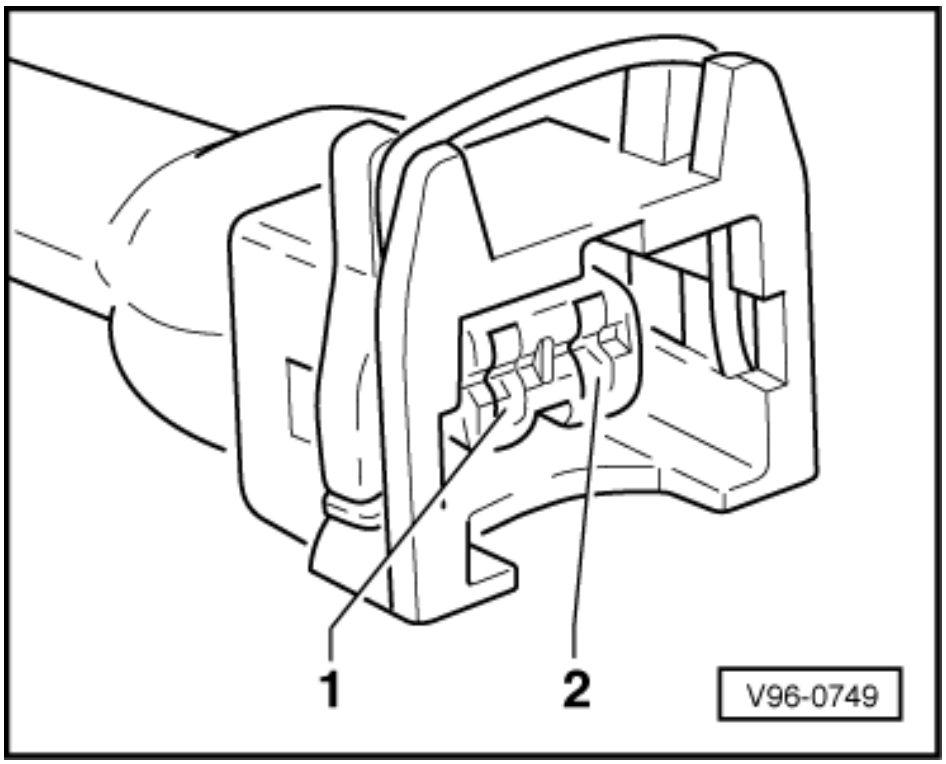


• -> Check for open circuit between contact 1 on connector and fuse in fuse holder.

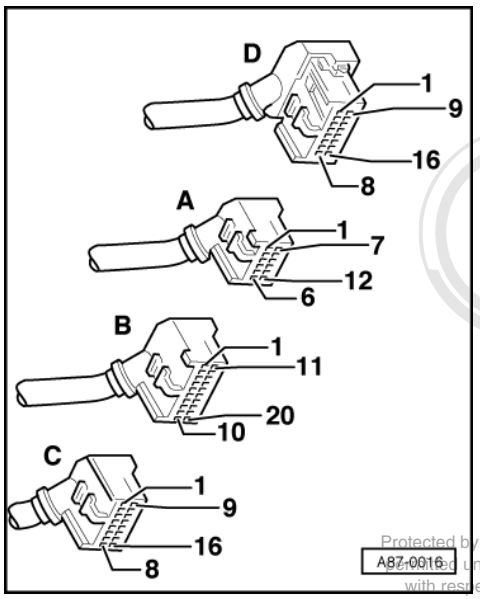
=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

• Check fuel pump relay => Page 93

Checking actuation

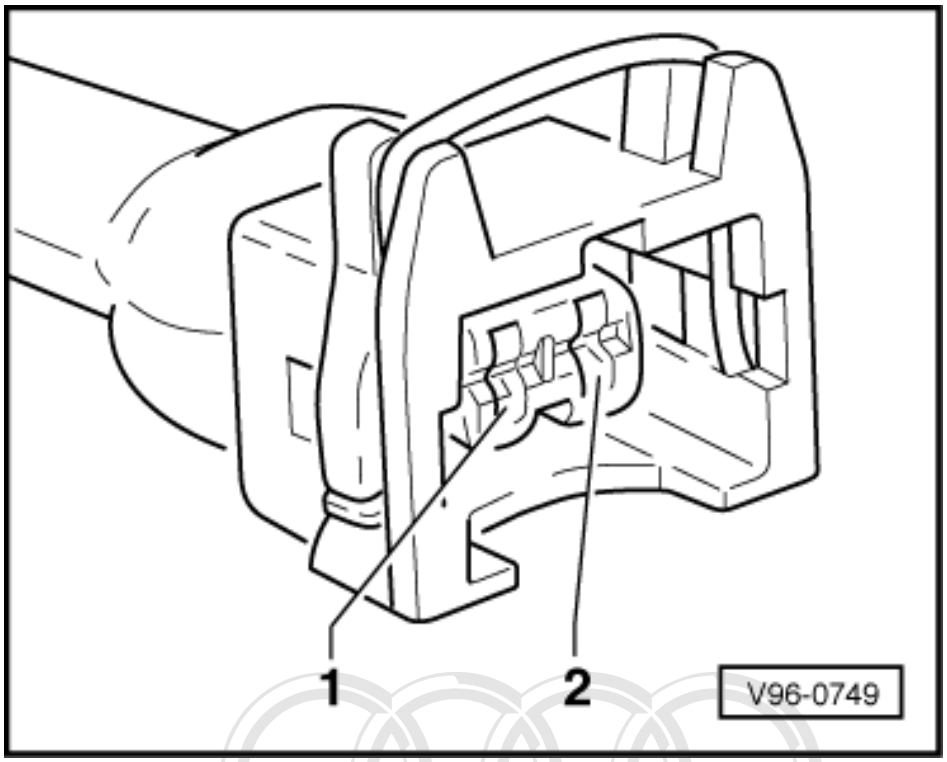


- -> Connect voltage tester V.A.G 1527 B to contacts 1 and 2 of the connector.
- Start final control diagnosis => Page 25 and actuate EGR valve -N18.
  - The LED should flash.



If the LED lamp does not flash or if it lights up continuously:

- -> With the ignition switched off, use adapter V.A.G 1598/12 to connect test box V.A.G 1598 A to connector D only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598 A Socket
2	14

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

6.3 - Checking EGR temperature sensor -G98

**Special tools,
testers and auxiliary items required**

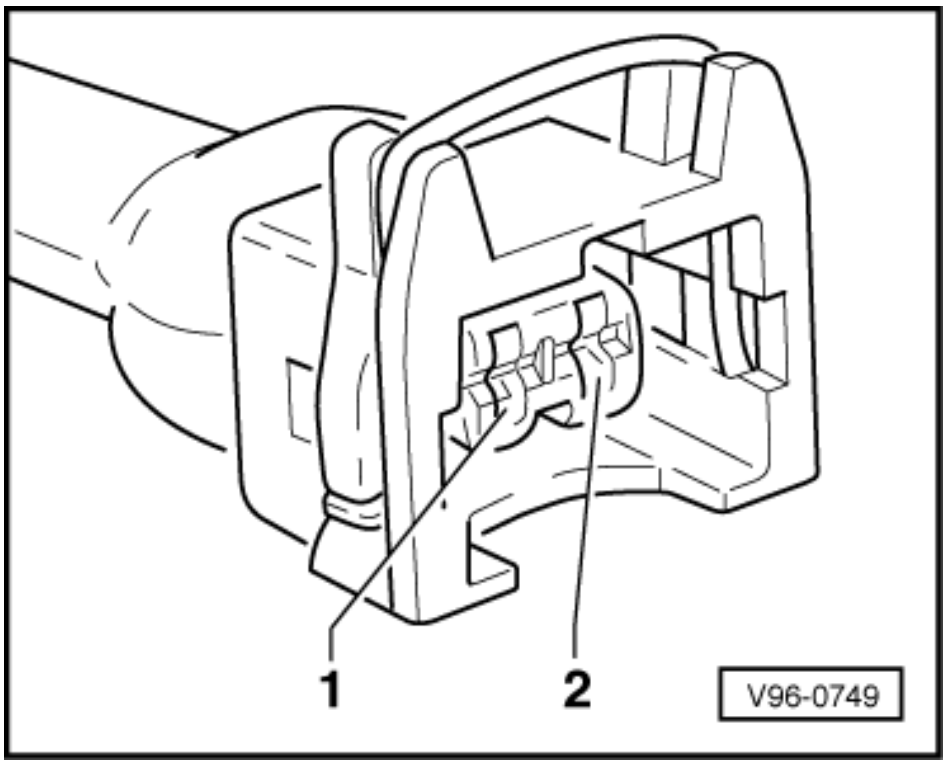
- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Note:

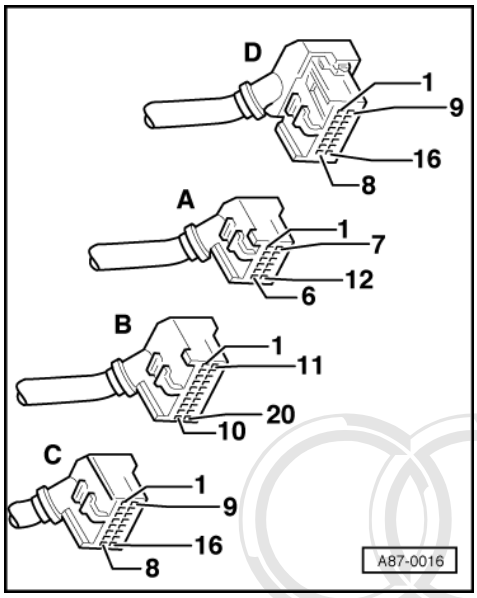
Checking function=> Reading measured value block display group 017, Page 51 .

Testing power supply

- Pull connector off EGR temperature sensor -G98

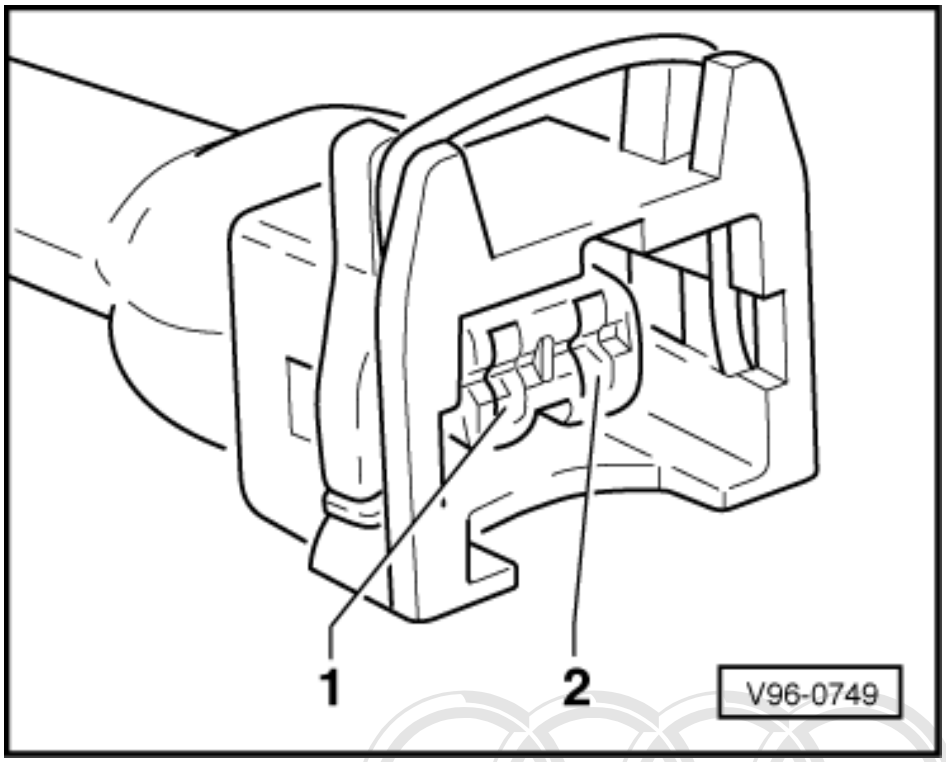


- -> Connect multimeter between contacts 1 and 2 to measure voltage.
- Switch the ignition on.
  - Specification: 4.5 ... 5.0 V



If the specification is not obtained:

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector contact	Test box V.A.G 1598 A socket
1	27

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Note:

Use only gold-plated contacts when repairing the contacts in the plug connectors.

Checking function

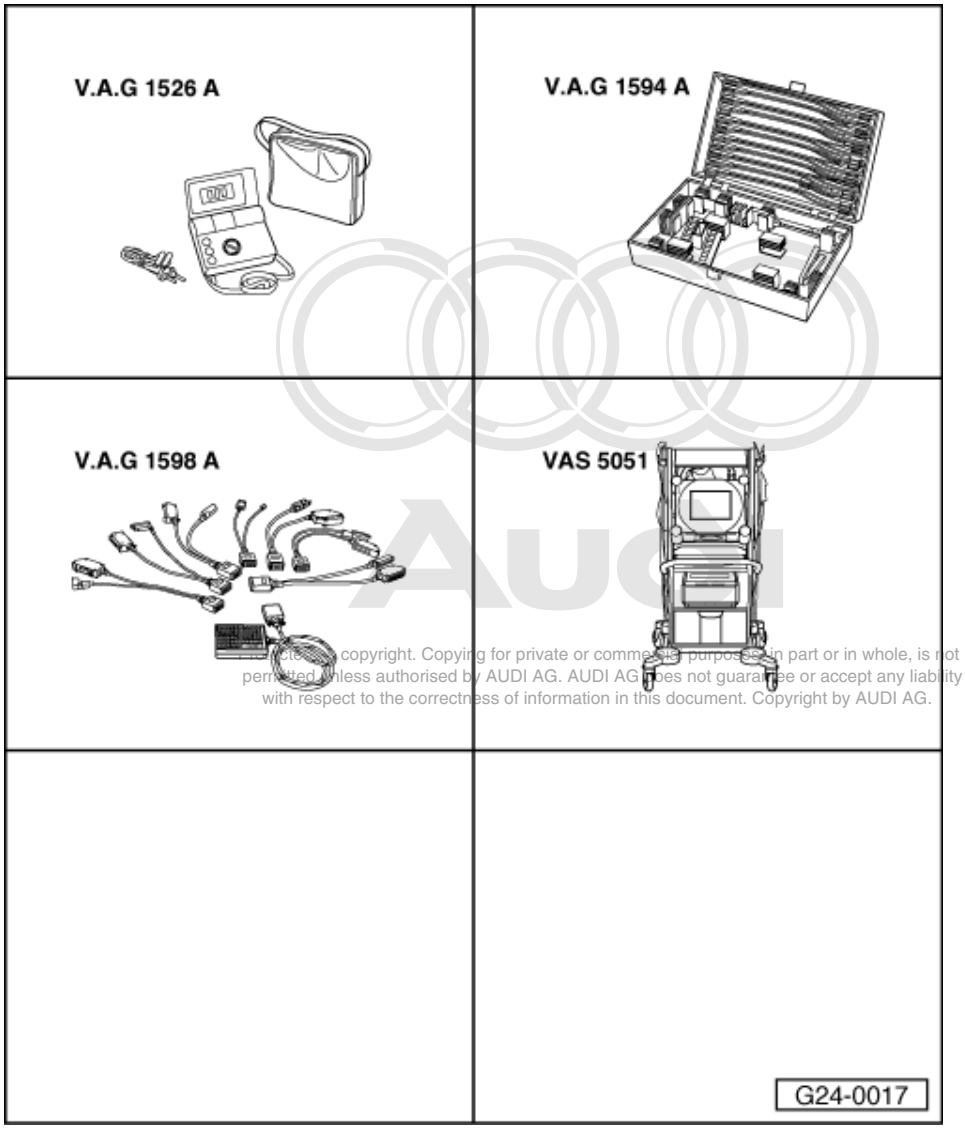
- Unscrew EGR temperature sensor -G98 out of mechanical EGR valve.
- Connect multimeter to temperature sensor to measure resistance.
- Hold temperature sensor in boiling water and observe the multimeter.
  - Specification: The resistance value should change.

If the display does not change:

- Renew the EGR temperature sensor -G98.

7 - Checking auxiliary signals

7.1 - Checking auxiliary signals



7.2 - Checking air conditioner compressor shut-off

**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Notes:

- The air conditioner compressor is shut off by the engine control unit on accelerating from standstill and from low vehicle speed for approx. 12 seconds. If the accelerator pedal is released sooner, the time is reduced to min. 3 seconds.
- The air conditioner compressor is also shut off by the engine control unit after initiating function 04 "Basic setting".

Test requirements:

- No faults stored in fault memory
- Engine running at idling speed
- Vehicle at room temperature (warmer than + 15 oC)
- Air conditioning system OK

Test sequence

- Switch on air conditioner as follows:
  - "Auto" mode for driver's and passenger's side.
  - Temperature preselection "LO" for driver's and passenger's side.
  - "ECON" button not switched on (compressor on).

- Start basic setting, display group 004, engine idling =>Page 27 .

-> Display readout:

```
Basic setting 4
     1     2     3     4
```

  - Air-conditioner compressor must come to a halt (visual inspection)

If the conditioner compressor is not switched off:

- Switch off air conditioner and leave engine idling.
- Enter "8" for switching to "Reading measured value block" function.

-> Display readout:

```
Read measured value block 4
     1     2     3     4
```

  - Specified value in display zone 4 for control unit no. 8A0 906 266 lower than index "E": X0X X
  - Specified value in display zone 4 as of control unit no. 8A0 906 266 E: X0X XX

Note:

Switching inputs at locations marked "X" can be ignored for this test.

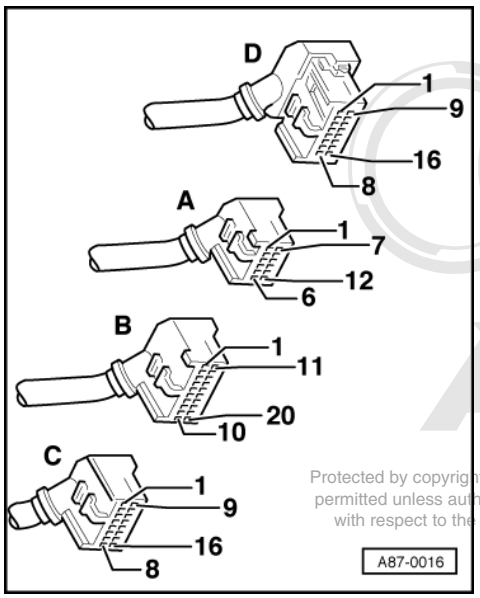
- Switch on air conditioner =>Page 145 .

-> Display readout:

```
Read measured value block 4
     1     2     3     4
```


  - Specified value in display zone 4 for control unit no. 8A0 906 266 lower than index "E": X1X X
  - Specified value in display zone 4 as of control unit no. 8A0 906 266 E: X1X XX

If the displays are not as described:



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598 A Socket	operating and display unit -E87 Contact
10	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If there are no faults in the wiring, check the operation of air conditioner.

=> Heating, Air Conditioner; Repair Group 01, Performing self-diagnosis - fully automatic air conditioner

If both air conditioner and wiring OK:

- Renew engine control unit =>Page 78 .

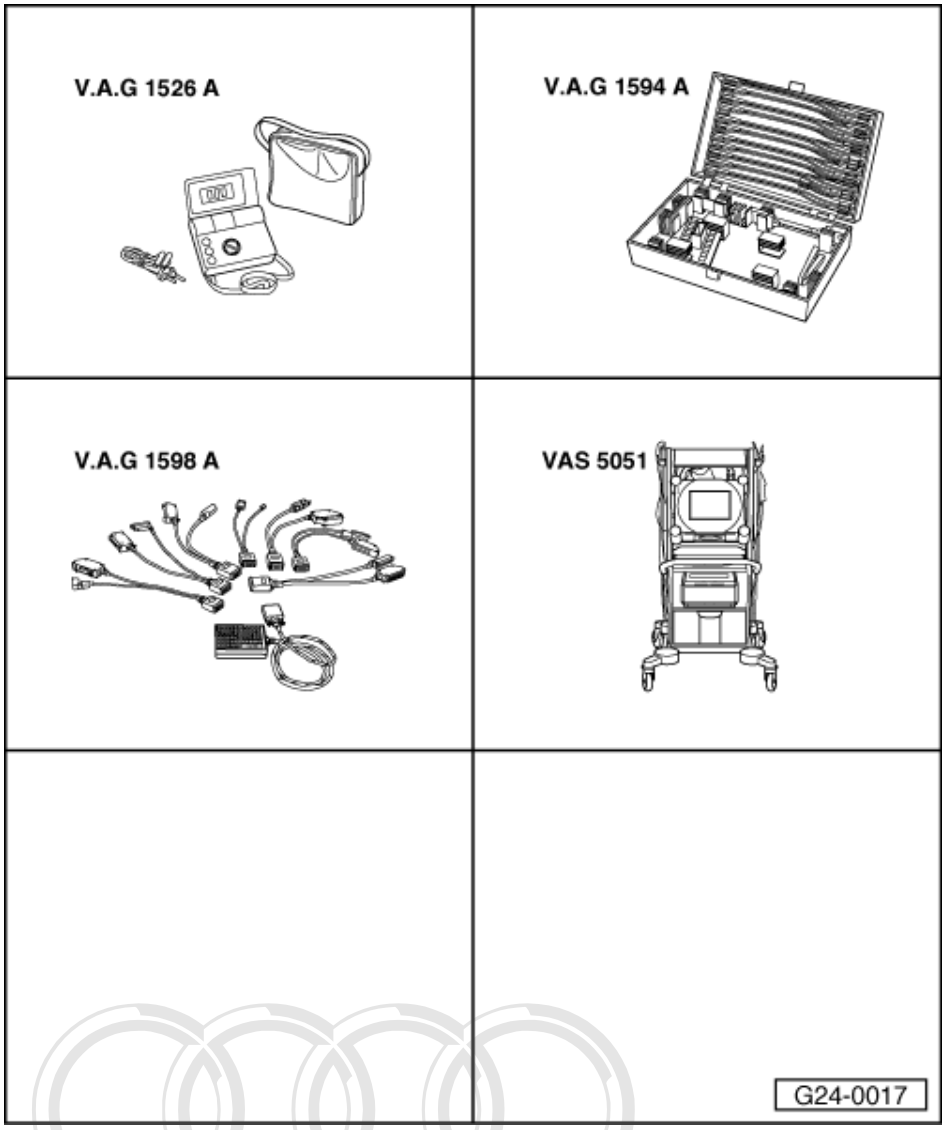
7.3 - Checking engine speed signal

Notes:

- The signal is generated by the engine speed sender -G28, processed in the engine control unit and relayed by the engine control unit to various electronic systems (e.g. control unit for air conditioner, automatic gearbox or ABS/EDL). The engine speed signal and wiring are monitored by these systems.
- Checking engine speed signal:

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

7.4 - Checking speed signal



**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Note:

The speed signal is generated by the speedometer sender -G22 (at the gearbox) and processed in the dash panel insert.

Test requirements:

- Speedometer function and display OK, fault-finding:

=> Electrical System; Repair Group 90; Dash panel insert, Checking vehicle speed signal Dash panel insert, Checking vehicle speed signal

Test sequence

- Read measured value block, Display Group 003, Engine idling =>Page 37 .

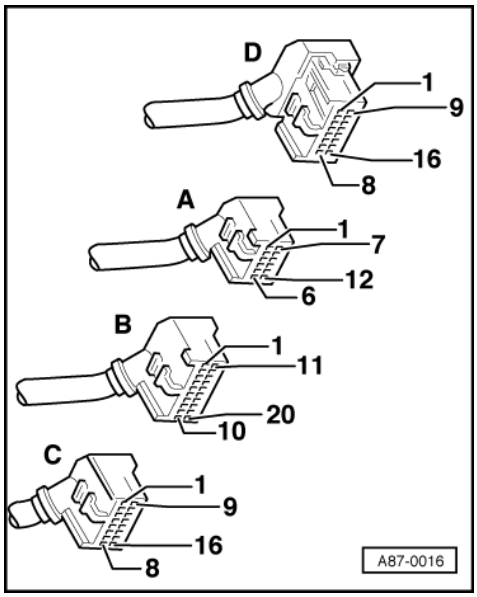
-> Display readout:

```
Read measured value block 3
     1     2     3     4
```

Warning:
Attach fault reader to rear seat and operate from this location. When doing this, always observe the relevant safety precautions.
Page 64 .

- Take the vehicle for a test drive.
- Check display in display zone 4.
  - The current road speed should be displayed (compare with speedometer).

If the road speed is not displayed:



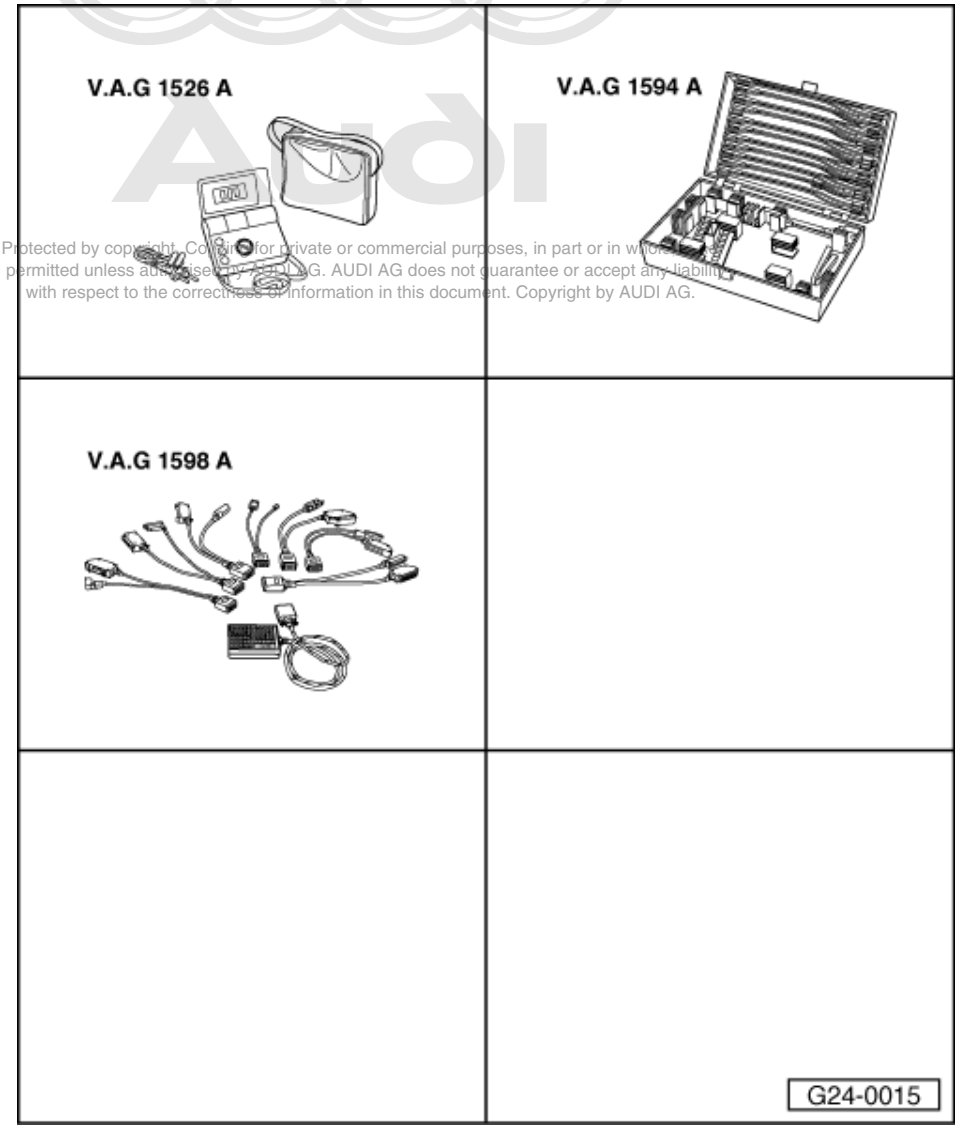
- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B only of engine control unit (control unit remains disconnected) => Page 77 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598 A Socket	Dash panel insert Contact
29	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

If no fault in wire is detected:

- Establish which "recipients" of the road speed signal (e.g. radio, automatic gearbox, air conditioner etc.) are using the speed signal, disconnect them one by one from the dash panel insert, then keep repeating the test until the cause of the problem has been identified.

7.5 - Checking consumption signal for vehicle computer

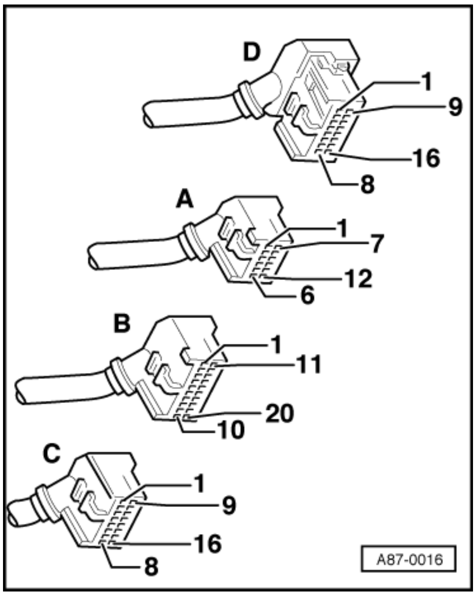


Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Note:

The following check is only to be performed if no or an incorrect consumption signal is found when the vehicle computer is tested.



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B and additionally to the engine control unit => Page 77 .
- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598 A Socket	Measure to
31	Engine earth

- Start the engine.
- Continuously vary engine speed between 1000 and 4000 rpm and in doing so observe the change in voltage.
  - Specification: 0.3 ... 6.0 V (according to engine speed)

If specified value is attained despite the vehicle computer not displaying the consumption value:

- Remove dash panel insert.

- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598 A Socket	Dash panel insert Contact
31	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

If the specification is not obtained:

- Remove dash panel insert.
- Pull red 26-way connector off dash panel insert, start engine and allow it to idle.
  - Specification: 0.3 ... 0.6 V
- Switch off ignition.
- Remove automatic gearbox control unit.
- Pull connector off automatic gearbox control unit, start engine and allow it to idle.
  - Specification: 0.3 ... 0.6 V

If the specification is attained:

- Establish defect in dash panel insert/automatic gearbox control unit.

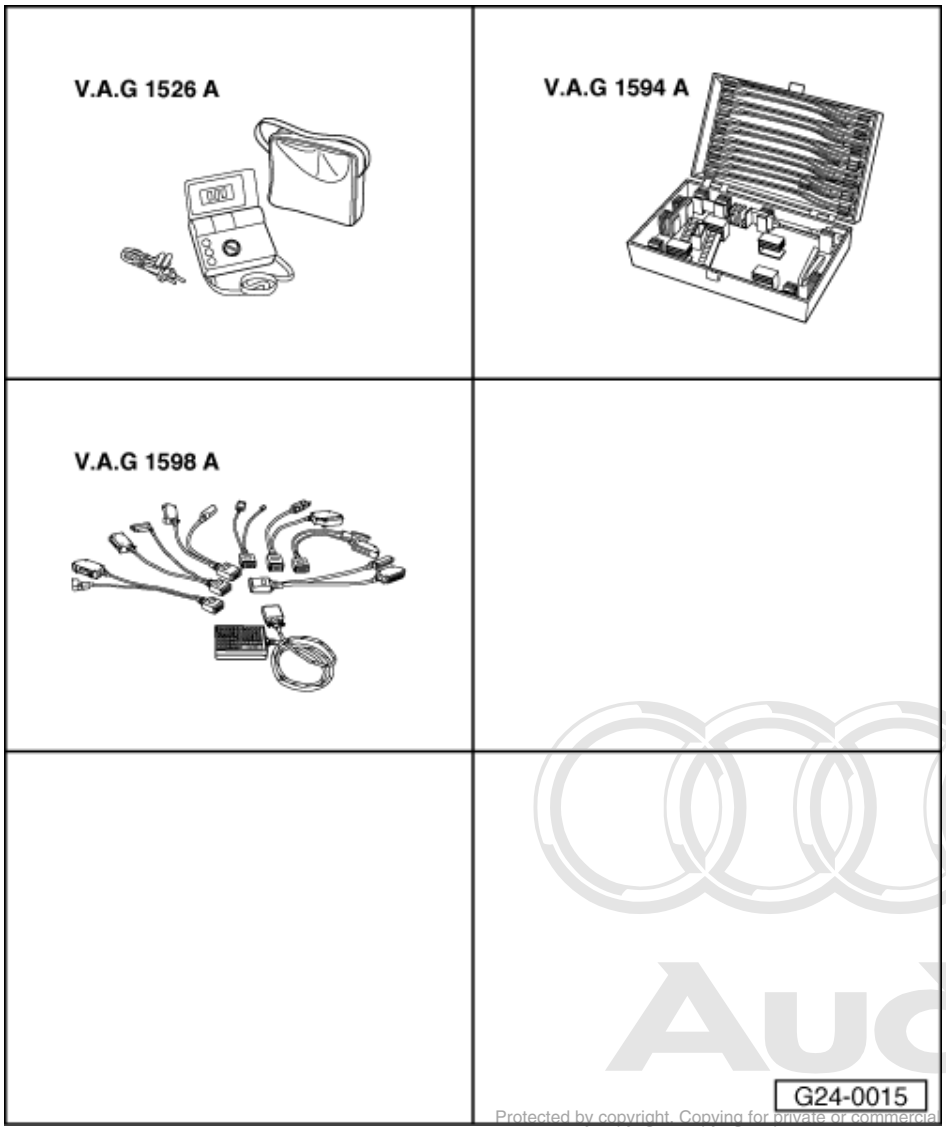
If the specification is not obtained:

- Check for open circuit and short to earth/positive or earth in the following wiring connections:

Test box V.A.G 1598 A Socket	Dash panel insert /control unit for automatic gearbox Contact
31	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

7.6 - Checking output signal for throttle valve position

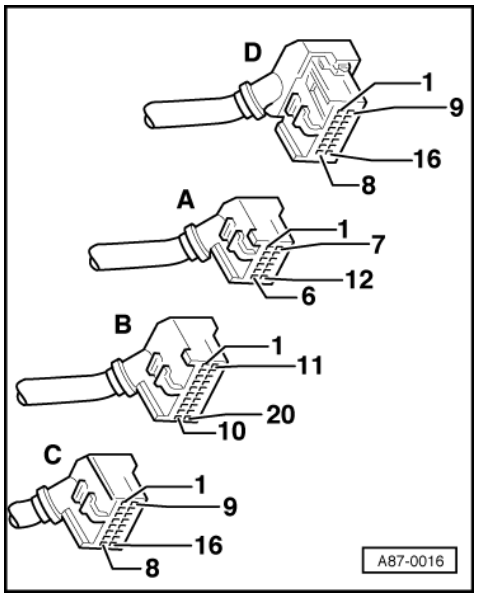


Special tools, testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Note:

This signal is used, for example, as load signal for the automatic gearbox. The following check is only to be performed if the signal is actually used for a different assembly.



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B and additionally to the engine control unit => Page 77 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
28	Engine earth

- Switch the ignition on.
  - The LED must light dimly and become brighter on pressing the accelerator pedal.

If the LED does not light up and does not become brighter:

- Check throttle valve potentiometer =>Page 128 .
- If the throttle valve potentiometer is OK, fit a new engine control unit => Page 78 .

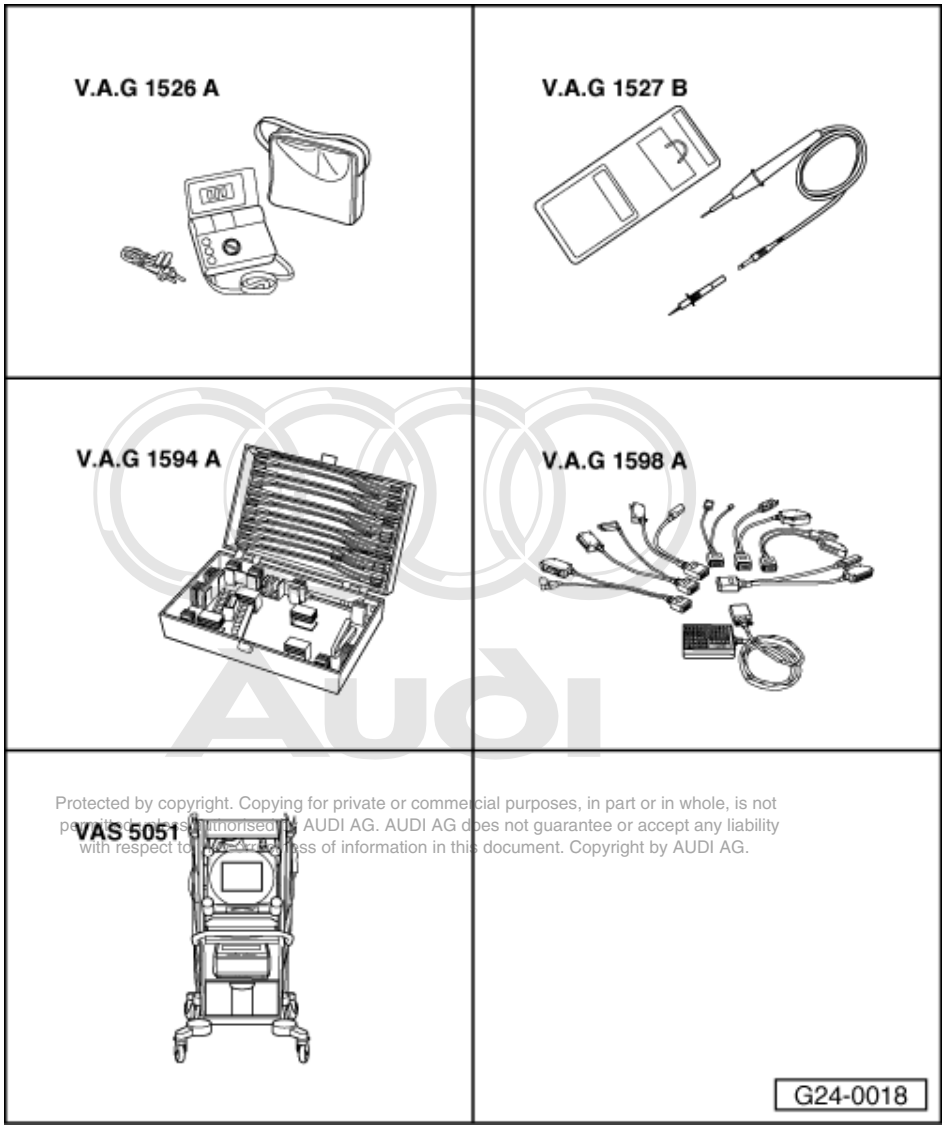
If the LED lights up and becomes brighter:

- Pull connector off automatic gearbox control unit.
- Check for open circuit and short to positive or earth in the following wiring connections:

Test box V.A.G 1598 A Socket	Control unit for automatic gearbox Contact
28	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, establish defect in automatic gearbox control unit.

7.7 - Checking gear signal



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Note:

By way of the multi-function switch -F125 on the gearbox, the engine control unit detects whether a gear is engaged (selector lever set to 2 / 3 / D / R) or not (selector lever set to P or N).

Test requirements:

- Control unit encoding OK => Page 29 .

Test sequence

- Read measured value block, Display Group 004, Engine idling =>Page 39 .

-> Display readout:

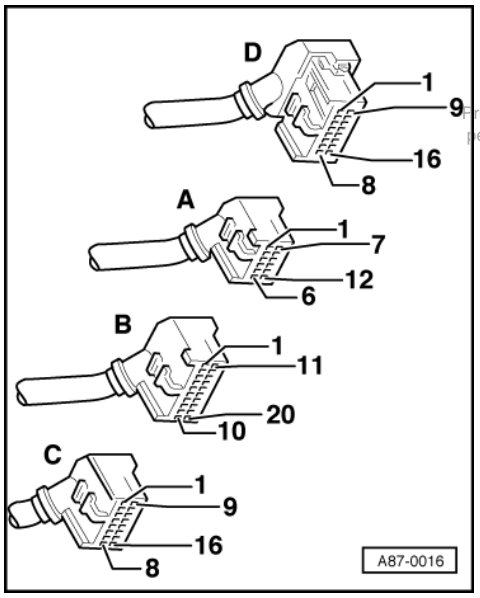
```
Read measured value block 4
     1     2     3     4
```

- Move selector lever to position P or N.
  - Specified value in display zone 4 for control unit no. 8A0 906 266 lower than index "E": XXX 1
  - Specified value in display zone 4 as of control unit no. 8A0 906 266 E: XXX 1X
- Depress the brake pedal and engage a gear.
  - Specified value in display zone 4 for control unit no. 8A0 906 266 lower than index "E": XXX 0
  - Specified value in display zone 4 as of control unit no. 8A0 906 266 E: XXX 0X

Note:

Switching inputs at locations marked "X" can be ignored for this test.

If the displays are not as described:



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B and additionally to the engine control unit => Page 77 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
32	Engine earth

- Switch the ignition on.
- Depress the brake pedal and engage a gear.
  - The LED must light up when a gear is engaged.

If the LED does not light up:

- Pull connector B off adapter V.A.G 1598/11.

If the LED still does not light up (irrespective of selector lever position):

- Renew engine control unit =>Page 78 .

If the LED then lights up:

- Check the following wiring for short to earth:

Test box V.A.G 1598 A Socket	Control unit for automatic gearbox Contact
32	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, establish defect in automatic gearbox control unit.

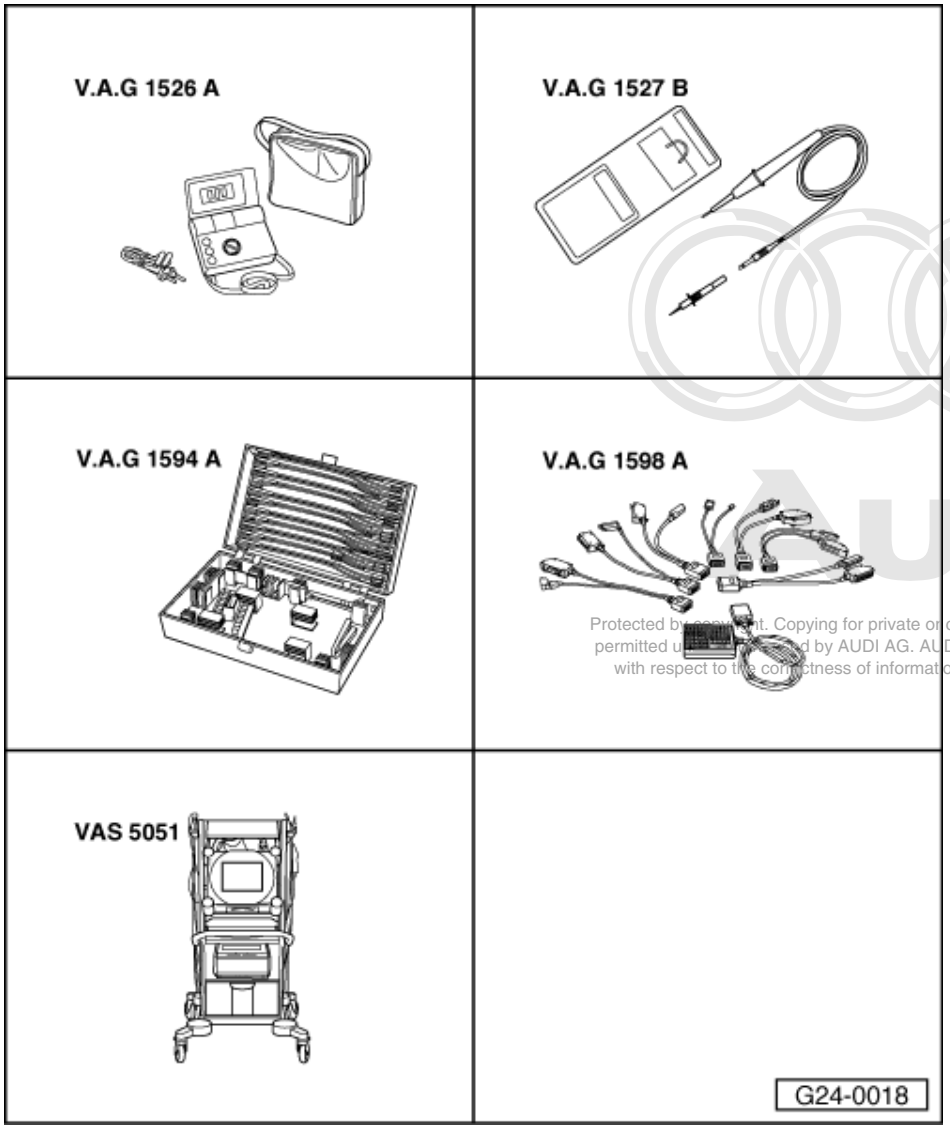
If the LED lights up with connector B attached and does not go out on engaging gear:

- Check for open circuit in the following wiring connections:

Test box V.A.G 1598 A Socket	Control unit for automatic gearbox Contact
32	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, establish defect in automatic gearbox control unit.

7.8 - Checking ignition timing retardation on changing gear



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- VAS 5051

or

- V.A.G 1551 with V.A.G 1551/3 A

Note:

The engine control unit receives the gearshift signal from the gearbox control unit. As a function of vehicle speed and engine speed, the engine control unit then briefly retards the ignition timing, thus reducing torque and making the gear change smoother.

Test requirements:

- Control unit encoding OK => Page 29 .

Test sequence

- Read measured value block, Display Group 000, Engine idling =>Page 32 .

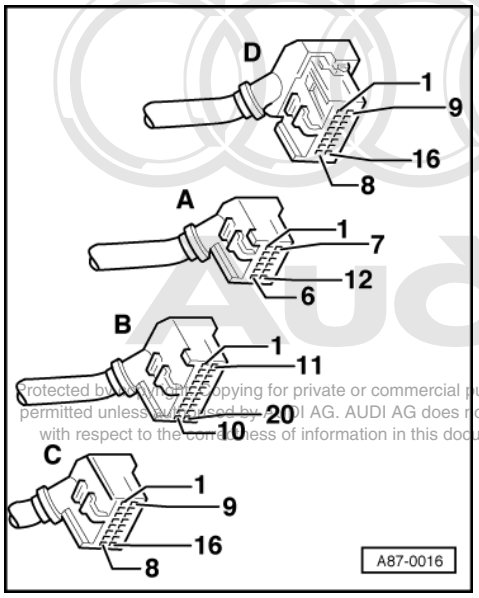
-> Display readout:

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

Warning:
Attach fault reader to rear seat and operate it from there. When doing this, always observe the relevant safety precautions.
Page 64 .

- Take the vehicle for a test drive.
- Check display in display zone 7.
  - On changing gear, the value must be briefly incremented by 2.

If the display is not as described:



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B and additionally to the engine control unit => Page 77 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
33	Engine earth

- Switch the ignition on.
  - The LED should light up.

If the LED does not light up:

- Pull connector B off adapter V.A.G 1598/11.

If LED still does not light:

- Renew engine control unit =>Page 78 .

If the LED then lights up:

- Check the following wiring for short to earth:

Test box V.A.G 1598 A Socket	Control unit for automatic gearbox Contact
33	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, establish defect in automatic gearbox control unit.

If the LED lights up with connector B attached:

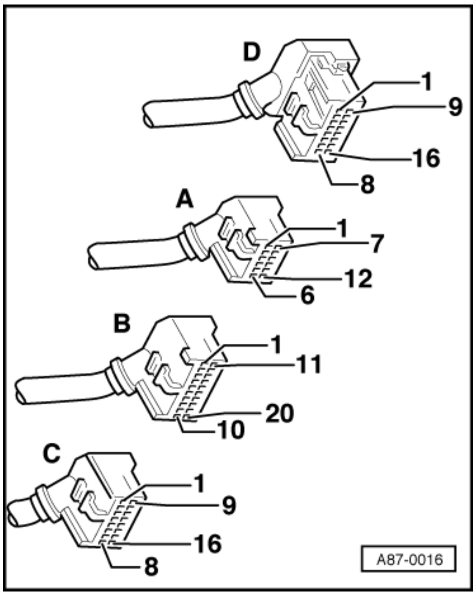
- Read measured value block, Display Group 000, Engine idling =>Page 32.

-> Display readout:

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

- Connect socket 33 of test box to engine earth for approx. 3 seconds.
- Check display in display zone 7.
  - Value must be briefly incremented by 2.

If value is not incremented:



- Renew engine control unit =>Page 78 .

If value is now incremented:

- Check for open circuit in the following wiring connections:

Test box V.A.G 1598 A Socket	Control unit for automatic gearbox Contact
33	=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If wiring is OK, establish defect in automatic gearbox control unit.

7.9 - Checking engine torque signal from ABS/ASR control unit

Note:

On vehicles with traction control system (ASR), the specified engine torque signal (MMS) and the actual engine torque signal (MMI) are monitored by the ABS / ASR control unit.

=> Running Gear Self-Diagnosis; Repair Group 01

28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - Safety precautions

To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- Always switch off the ignition before connecting or disconnecting ignition system wiring. This also applies to HT cables and measuring instrument leads.
- To operate the engine at starting speed without actually starting it (for example, to check the compression), unplug the connector from the power output stage for the ignition coils and the connector from the injectors. After completing the work, interrogate the fault memory.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.

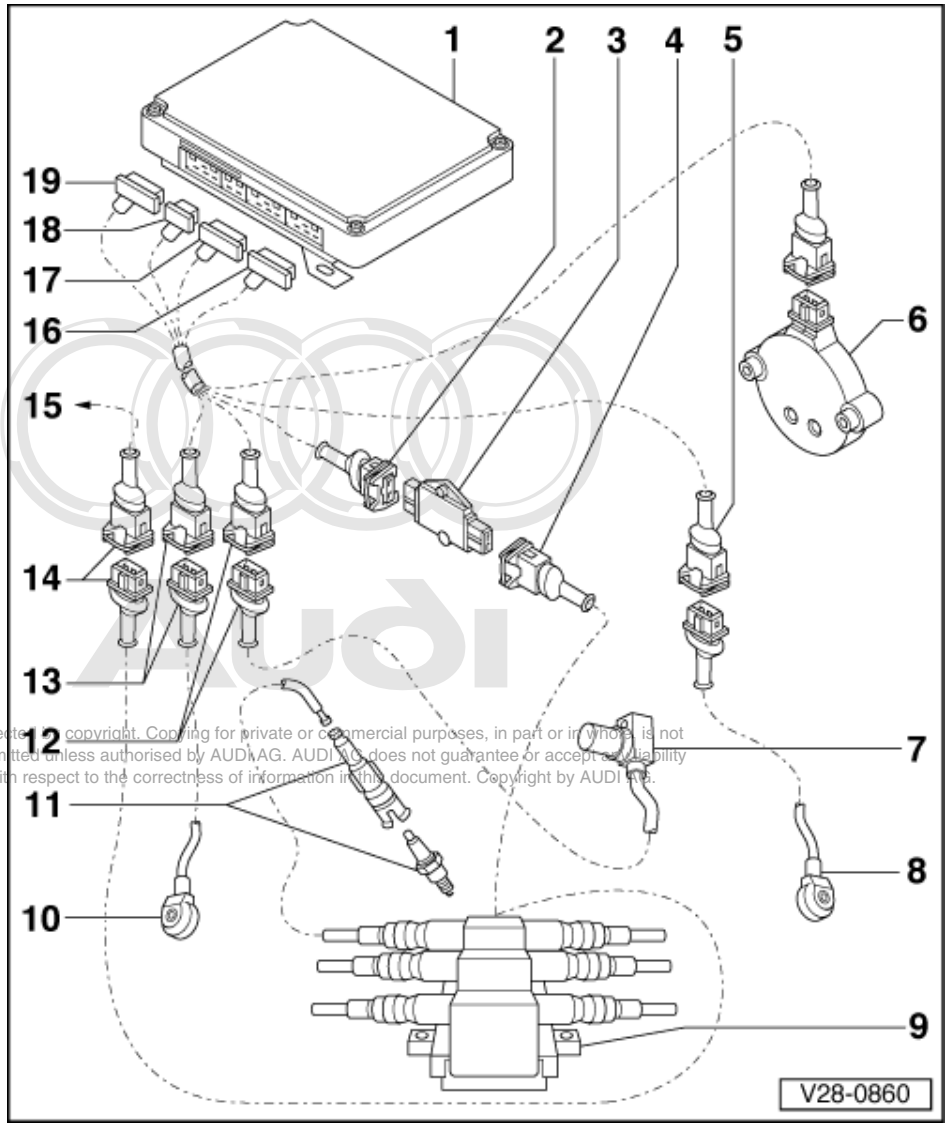
1.3 - Technical data

Engine code letters		AAH (2.8 l / 2V / 128 kW-engine)
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.		
Ignition system		Twin-spark ignition system with three ignition coils
Spark plugs 1)		Tightening torque: 30 Nm.
Firing order		1-4-3-6-2-5
Ignition coils	Secondary resistance	9 ... 14 kω
	Primary resistance	0.5 ... 1.2 ω

1) Up-to-date specifications:

=> Binder "Emissions test"

1.4 - Removing and installing ignition system components



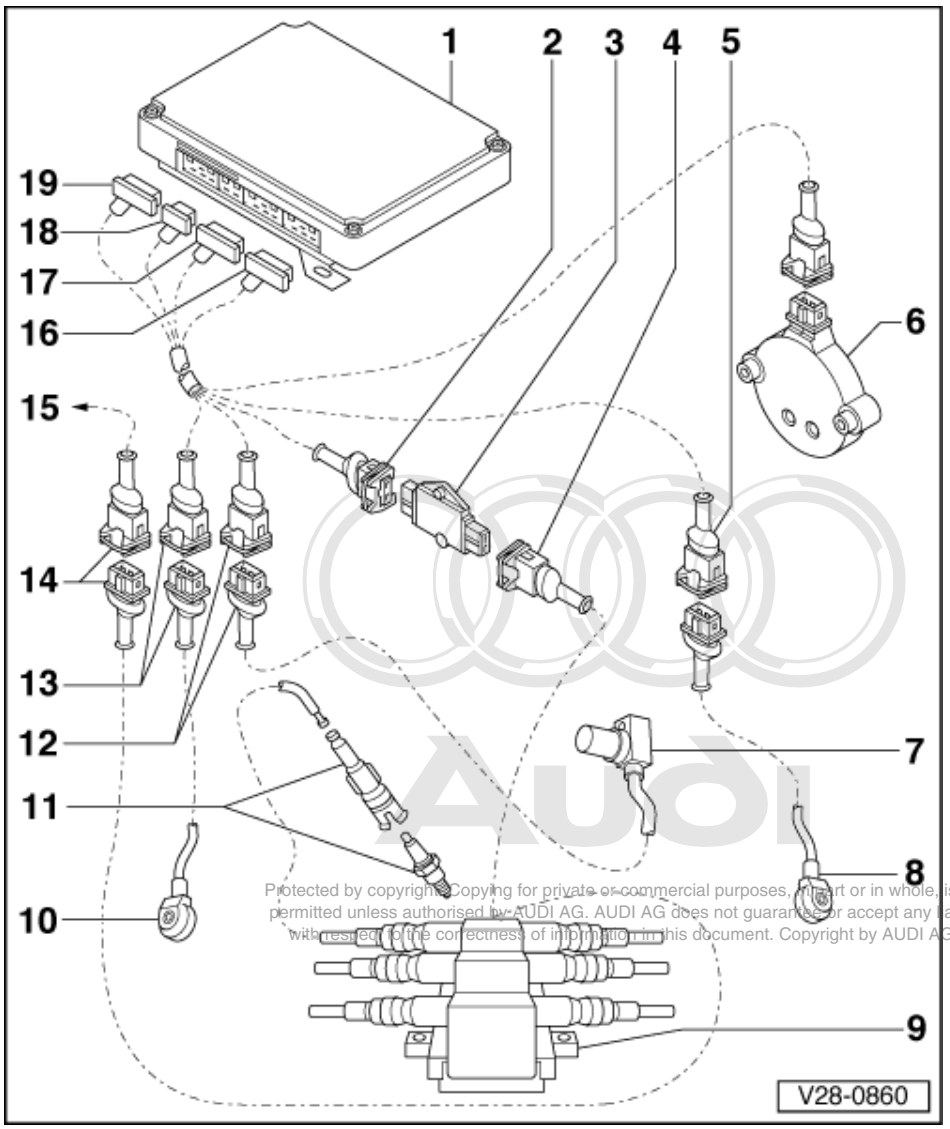
1 Engine control unit -J192
- In electronics box on right of plenum chamber

2 4-way connector
- Light brown
- Signal wires from engine control unit

3 Output stage -N122

4 3-way connector
- Dark brown
- Primary connections for ignition coils

5 3-way connector
- Blue
- For knock sensor 2 -G66



6 Hall sender -G40

7 Ignition timing sender -G4
- Reference mark sender on left on cylinder block

8 Knock sensor 2 -G66

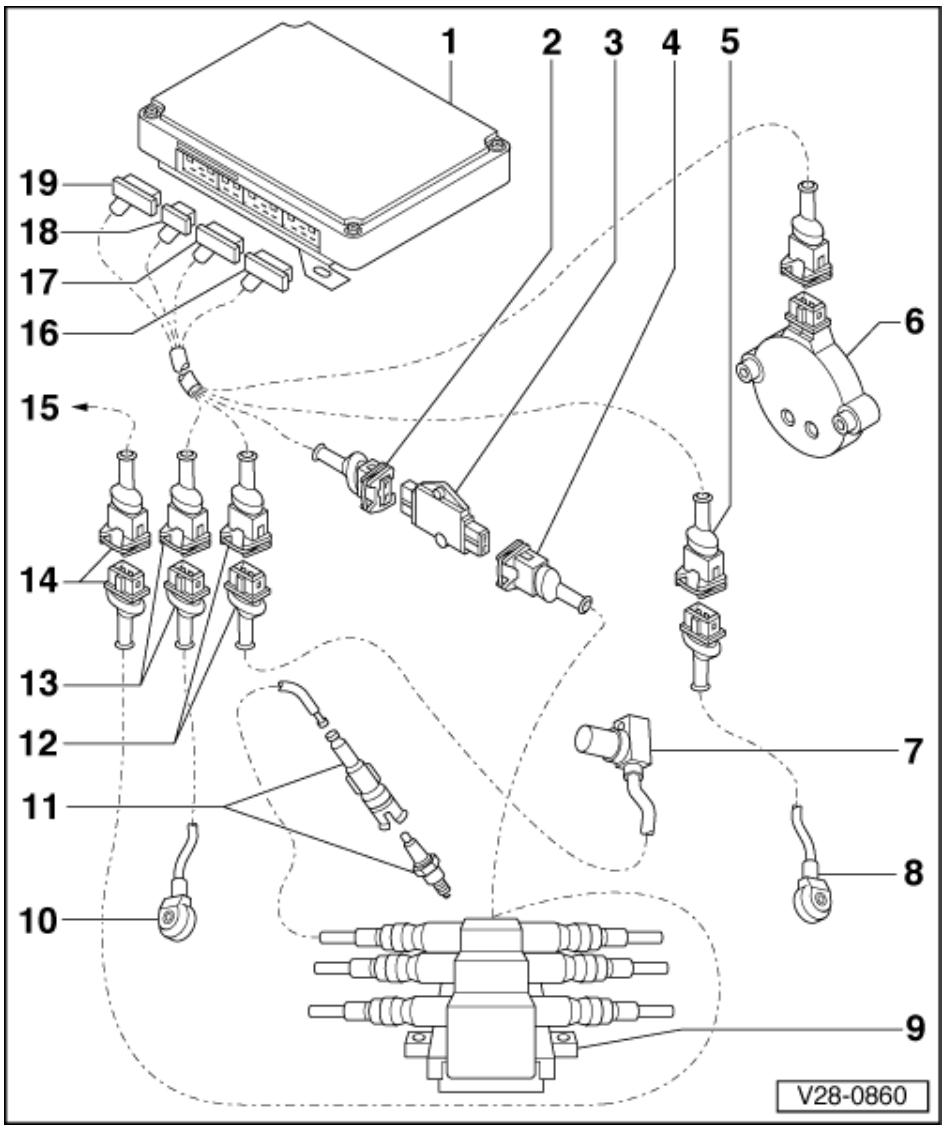
9 Ignition coils -N, -N128, -N158
- With ignition cable identification, do not interchange

10 Knock sensor 1 -G61

11 Spark plug connector with spark plug

12 Connector
- Ignition timing sender -G4

13 Connector
- For knock sensor 1 -G61



14 Connector

- For ignition coils

15 To fuse S115

- In relay and fuse carrier, electronics box, plenum chamber
  ä 06.95: position 7,
  07.95 ä: position 9

16 Connector C

- 16-way, brown

17 Connector B

- 20-way, red

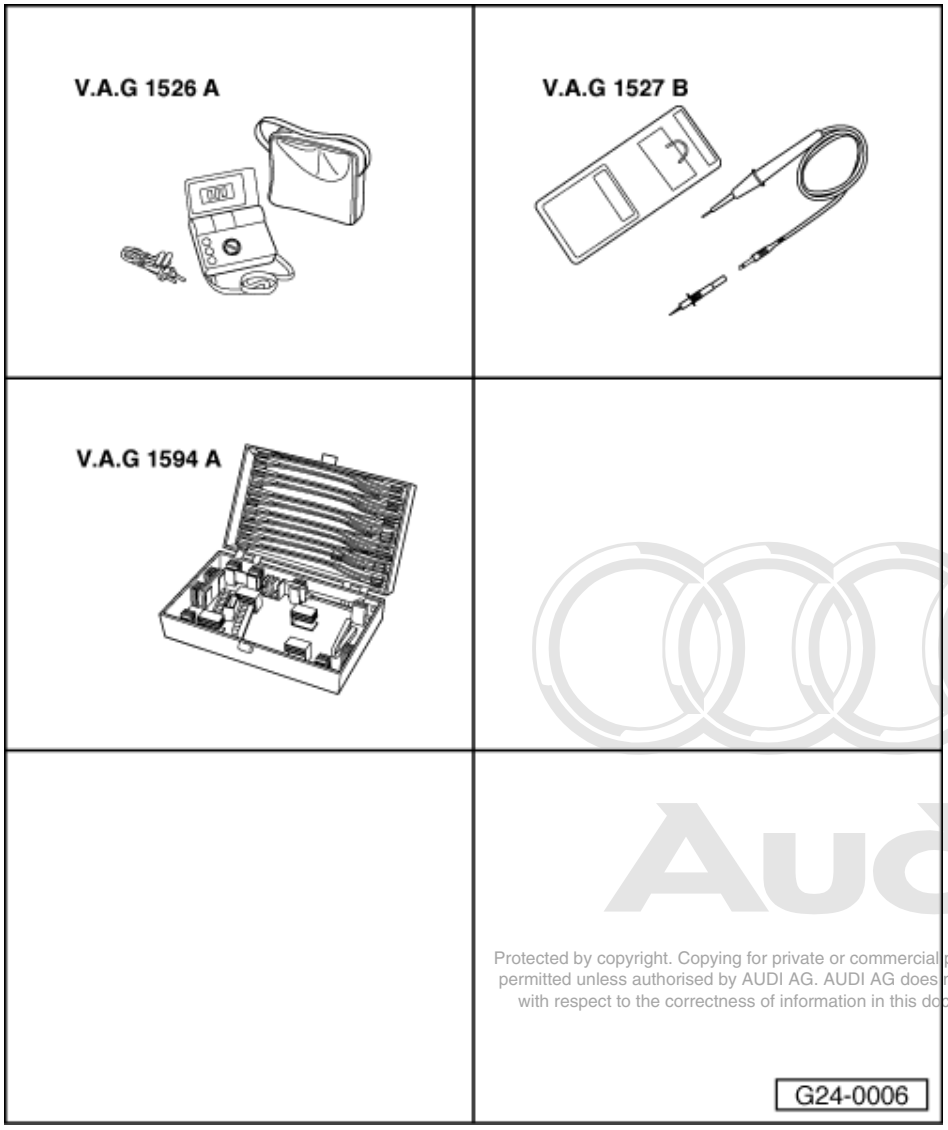
18 Connector A

- 12-way, black

19 Connector D

- 16-way, black

1.5 - Checking ignition coils -N, -N128, and -N158



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A

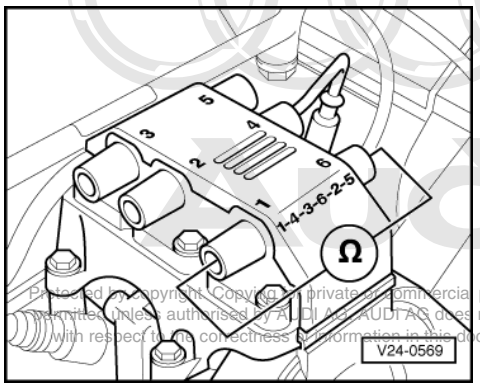
Fitting location => Fitting locations overview, Page 66

Note:

Check connecting leads between output stage and ignition coils as well as between ignition coils and plug connection for insulation damage.

Checking secondary resistance

- Disconnect ignition cables from ignition coils.



- -> Connect up multimeter between the two ignition cable connections of the respective ignition coil to measure resistance.
  - Specification: 9 ... 14 kω

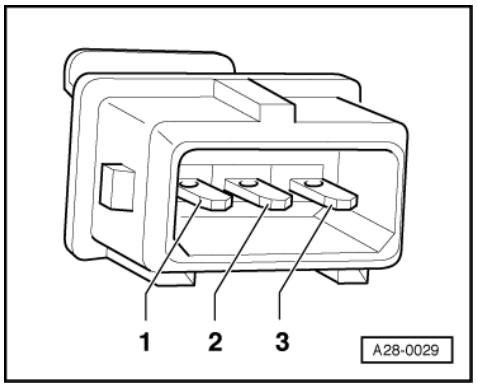
If the specification is not attained at one ignition coil:

- Renew ignition coils.

Checking primary resistance

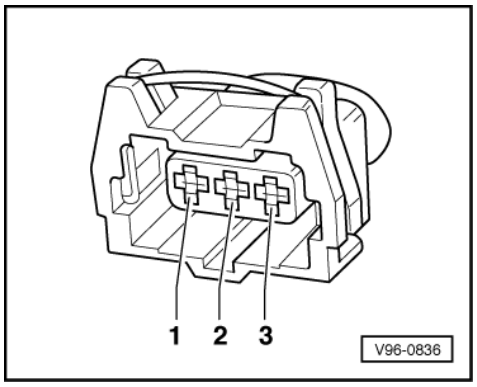
- Pull 3-way connector off output stage
- Check connector for loose, corroded or disengaged contacts and service if necessary.

Note:



For test purposes, the contact assignment at the plug connection is of no significance, as voltage is routed to the ignition coils by way of all 3 contacts.

- -> Connect multimeter in each case to one contact of output stage...

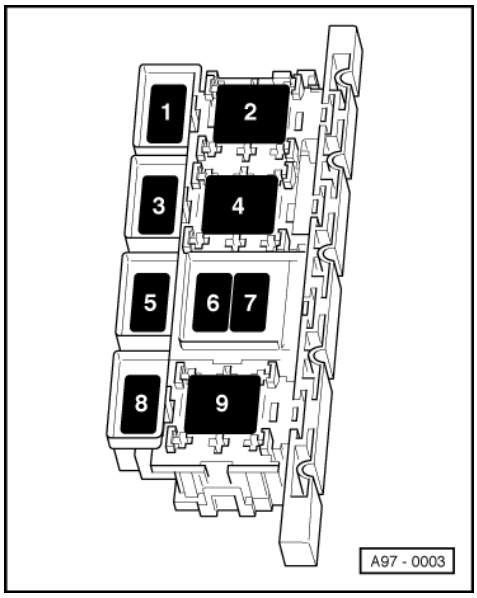


- -> ... and one contact of 3-way connector to measure resistance.

- Specification: 0.5 ... 1.0 ωin each case

If the specification is not attained during a measurement:

- Renew ignition coils.

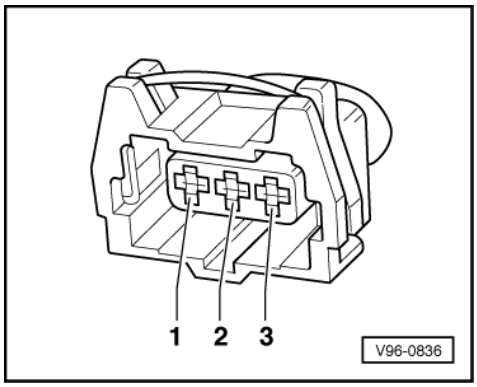


Checking power supply

Test requirements:

- -> Fuse S115 OK (in relay and fuse carrier, electronics box, plenum chamber ‣ 06.95: Position 7, 07.95 ‣: Position 9)

- Pull white 3-way connector off ignition coils.



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

Connector contact	Measure to
1	Engine earth
2	Engine earth
3	Engine earth

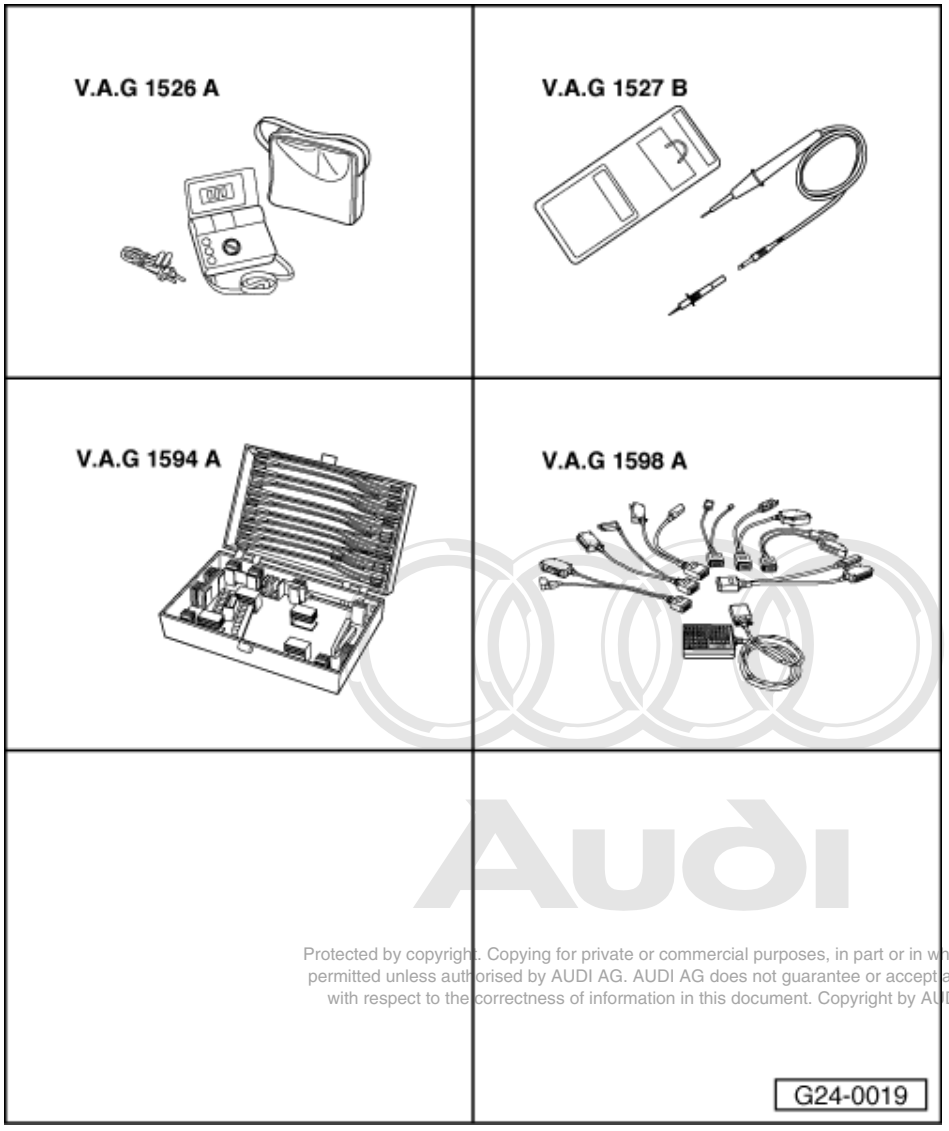
- Switch the ignition on.
  - The LED should light up each time.

If the LED does not light up:

- Check appropriate wiring for open circuit and service if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

1.6 - Checking output stage -N122



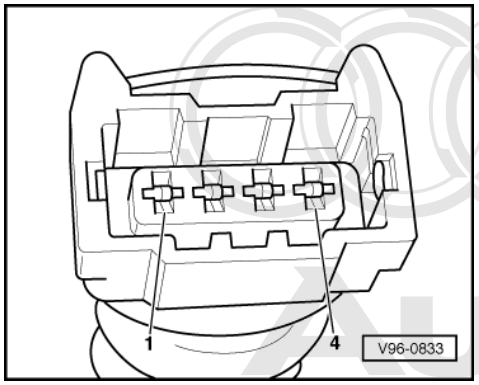
**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Fitting location => Fitting locations overview, Page 66

Checking earth supply

- Pull 4-way connector off output stage



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

Connector Contact	Measure to
2	Battery positive

  - The LED should light up.

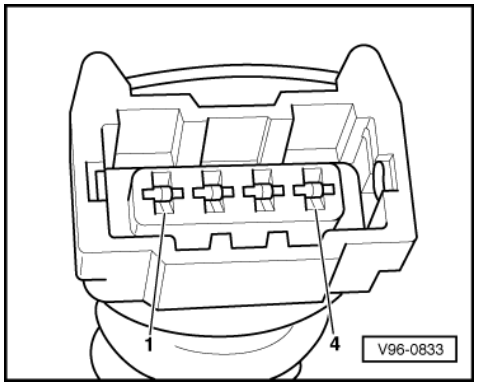
If the LED does not light up:

- Check wiring for open circuit and service if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

Checking actuation

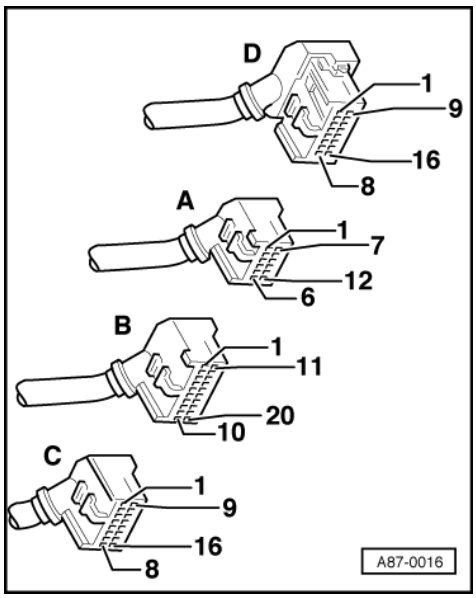
- Pull 4-way connector off output stage
- Pull connectors off all 6 injectors. (then interrogate fault memory).



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

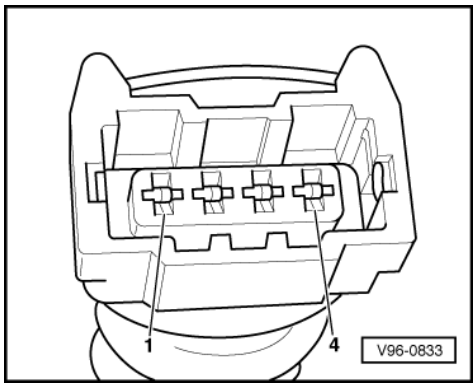
Connector contact	Measure to
1	Engine earth
3	Engine earth
4	Engine earth

- Operate starter briefly.
  - The LED should flash.



If the LED lamp does not flash:

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

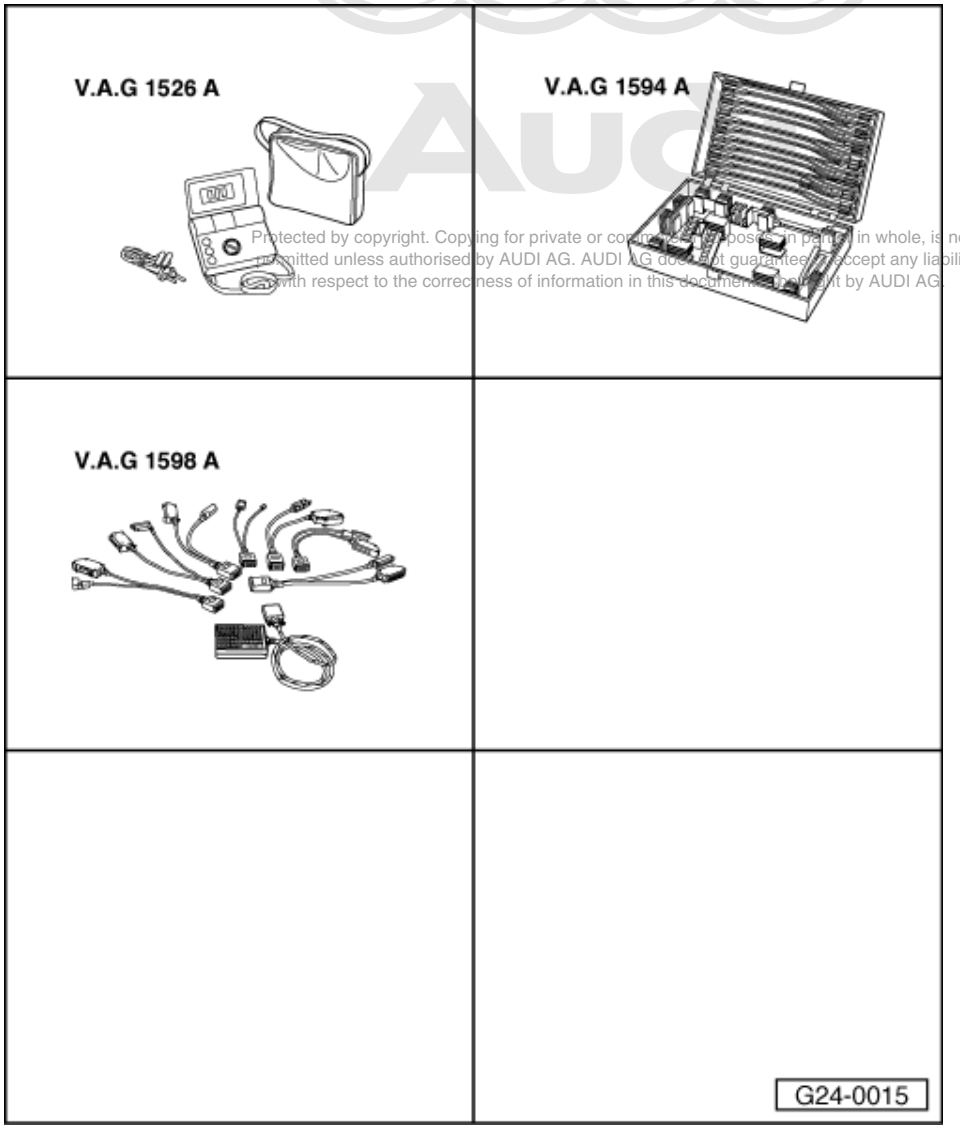
Connector Contact	Test box V.A.G 1598 A Socket
1	35
3	38
4	37

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

1.7 - Checking ignition timing sender -G4



Special tools,
testers and auxiliary items required

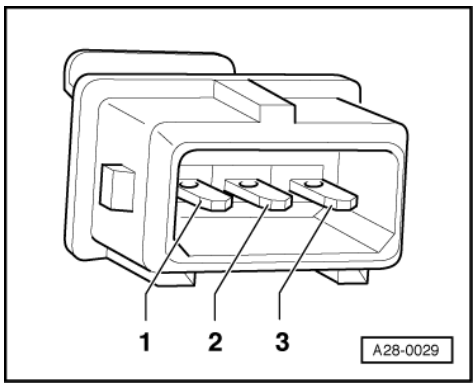
- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Fitting location => Fitting locations overview, Page 66

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.

Checking internal resistance

- Pull black 3-way connector off ignition timing sender

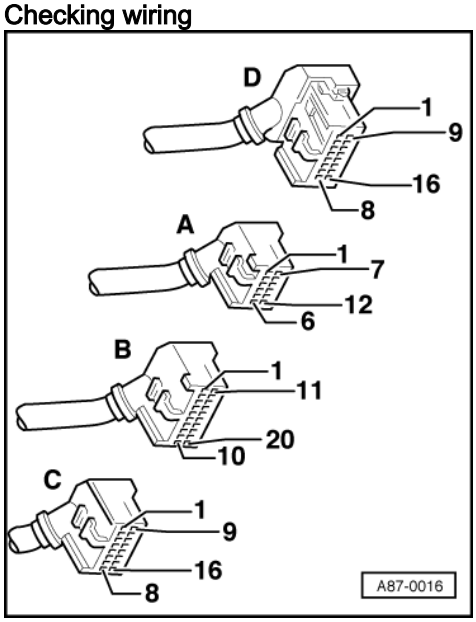


- -> Connect multimeter between contacts 1 and 2 on sender to measure resistance.
  - Specification: approx. 1 kω

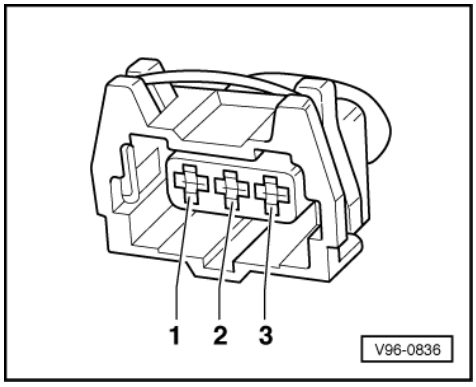
If the specification is not obtained:
- Renew ignition timing sender.
- Connect multimeter between contacts 1 and 3 and 2 and 3 on sender to measure resistance.
  - Specification: ∞ ω

If the specified values are not obtained:
- Renew ignition timing sender.

Checking wiring



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

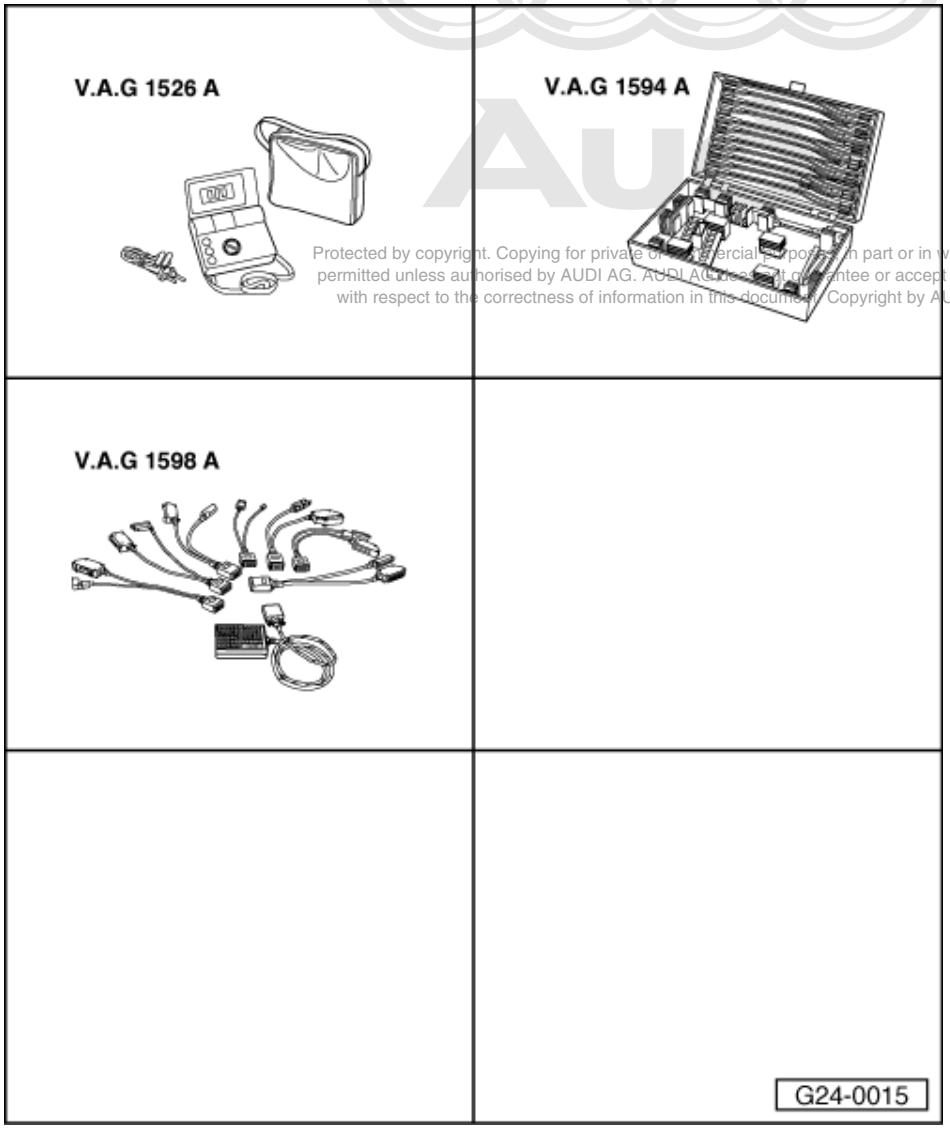
Connector Contact	Measure to
1 (earth)	Test box V.A.G 1598 A Socket 5
2 (signal)	Test box V.A.G 1598 A Socket 4
3 (screening)	Engine earth

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

1.8 - Checking engine speed sender -G28



Special tools,

testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Fitting location => Fitting locations overview, Page 66

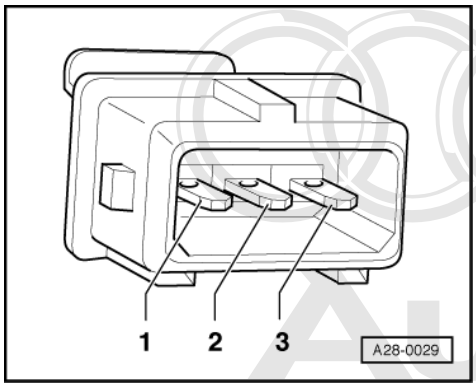
Note:

Checking function=> Reading measured value block display group 003, Page 37 .

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.

Checking internal resistance

- Pull grey 3-way connector off engine speed sender



- -> Connect multimeter between contacts 1 and 2 on sender to measure resistance.
  - Specification: approx. 1 kω

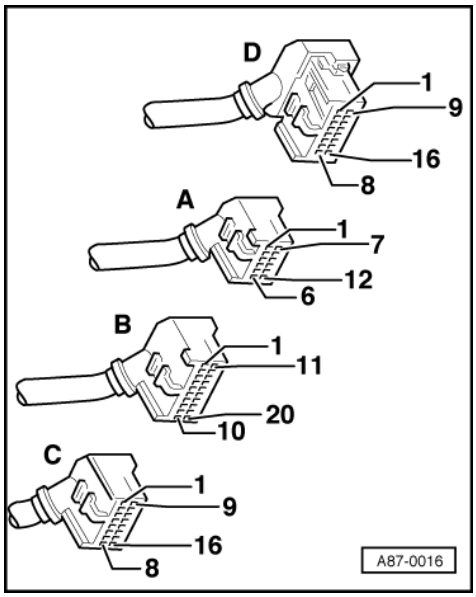
If the specification is not obtained:

- Fit a new engine speed sender.
- Connect multimeter between contacts 1 and 3 and 2 and 3 on sender to measure resistance.
  - Specification: ∞ ω

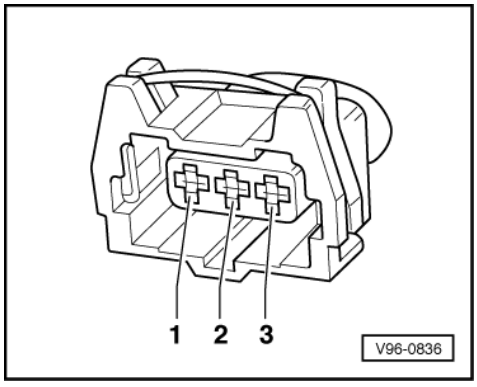
If the specified values are not obtained:

- Fit a new engine speed sender.

Checking wiring



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Measure to
1 (earth)	Test box V.A.G 1598 A Socket 1
2 (signal)	Test box V.A.G 1598 A Socket 2
3 (screening)	Engine earth

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

If no wiring fault is detected:

- Remove starter.

=> Electrical system; Repair group 27; Removing and installing starter Removing and installing starter

- Slowly crank engine and check ring gear for concentricity and broken/damaged teeth; renew if necessary

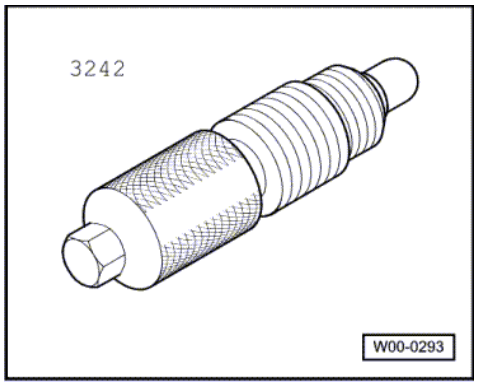
If no fault is found:

- Renew engine control unit =>Page 78 .

Adjusting holder for engine speed sender

Notes:

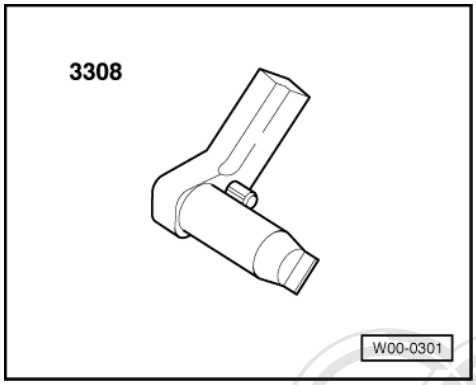
- The holder for the engine speed sender can be moved in slots. The position is set at the factory and must not be altered.



- If the bolts have been accidentally slackened off and the holder moved, carry out the adjustment as follows:

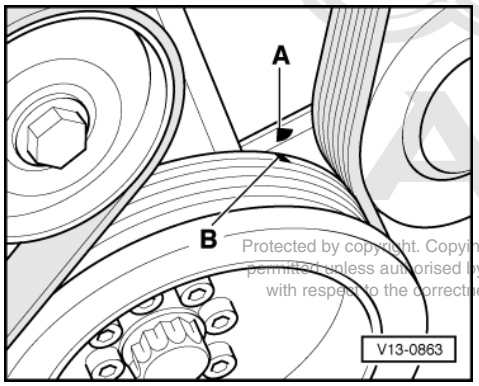
Special tools, testers and auxiliary items required

- Special tool 3242



- Special tool 3308

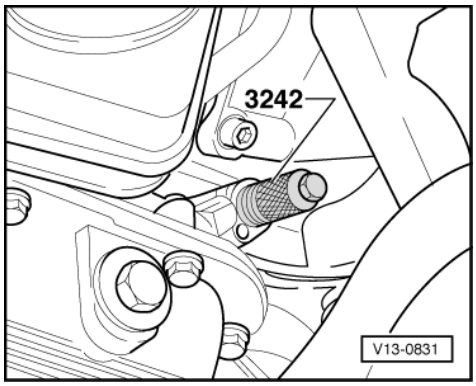
Work sequence



- -> Move crankshaft in direction of engine rotation to cylinder 1 TDC mark (notch -B- opposite mark -A-)
- Unscrew ignition timing sender -G4 from the cylinder block on the left.

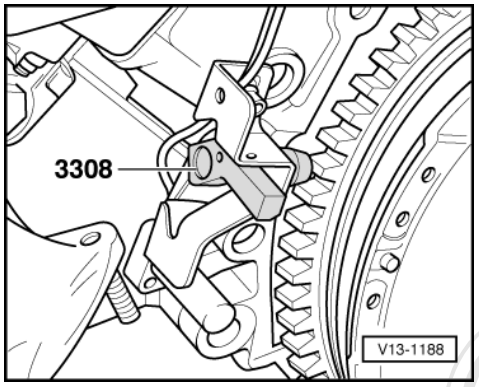
Note:

TDC hole is located exactly behind the sender in the crankshaft (can be felt).



- -> Screw clamping bolt 3242 into threaded hole where plug has been removed, and tighten.
- Unscrew heat shield over engine speed sender.

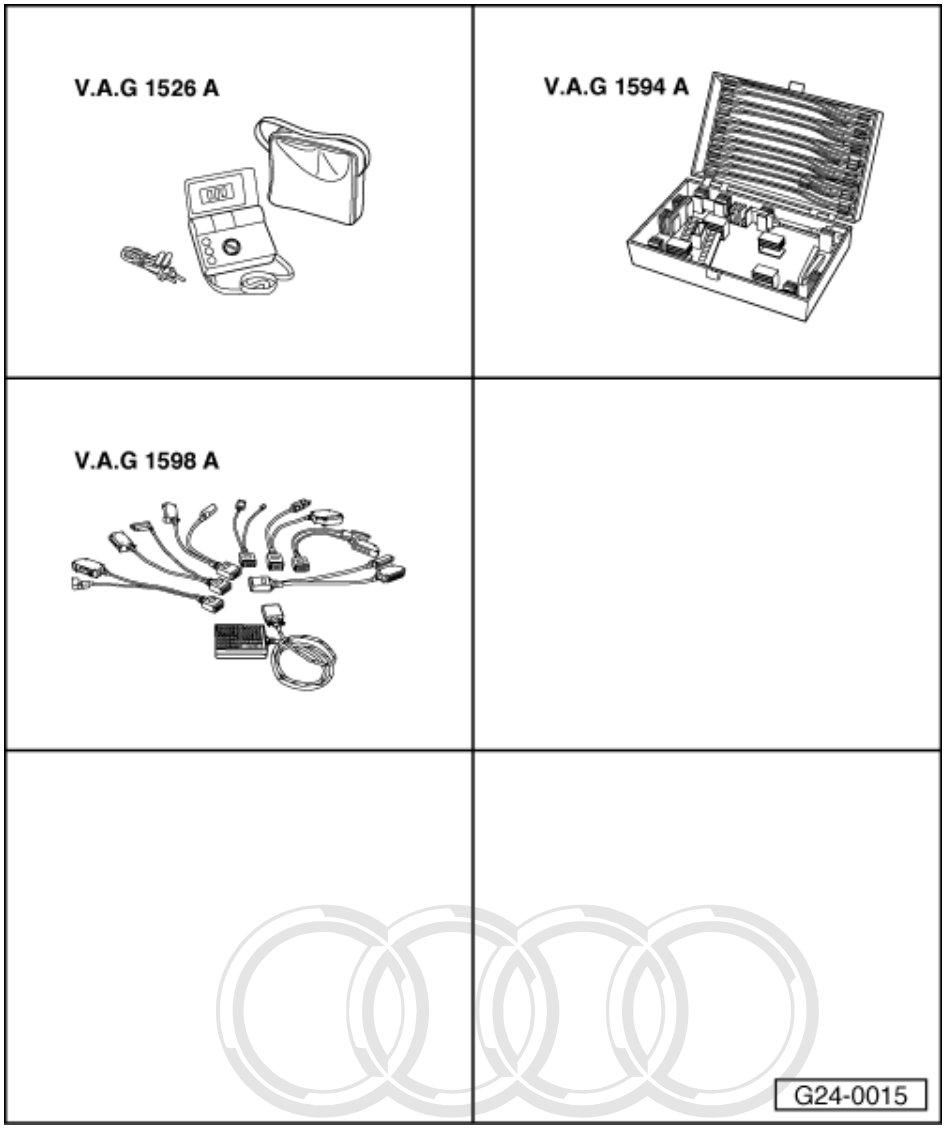
- Remove engine speed sender and unfasten holder.



- -> Insert special tool 3308 in place of sender, so that it engages in ring gear.
- Screw on holder.

The remaining installation steps are carried out in the reverse sequence:

1.9 - Checking coolant temperature sender -G62



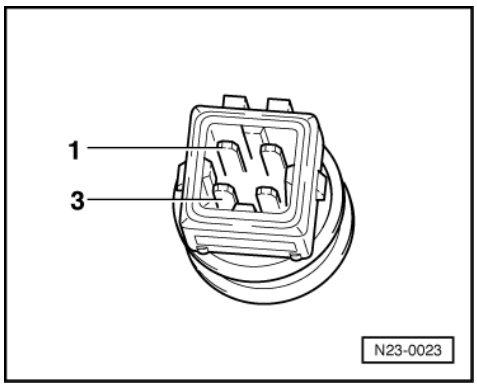
**Special tools,
testers and auxiliary items required**

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Fitting location => Fitting locations overview, Page 66

Note:

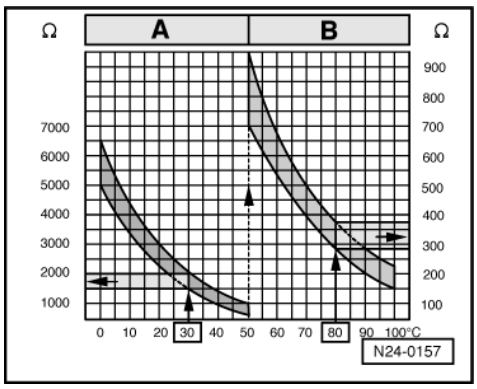
Checking function=> Reading measured value block display group 001, Page 35 .



Checking internal resistance

- Unplug connector on coolant temperature sender.
- -> Connect multimeter to contacts 1 and 3 of sender to measure resistance.

Scale A shows resistance values for temperature range 0...50 oC and scale B the values for temperature range 50...100 oC.



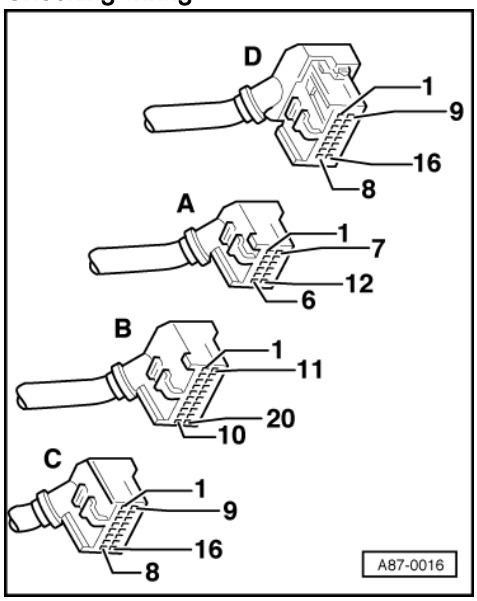
-> Sample readings:

- 30 oC corresponds to a resistance of 1500...2000 ω
- 80 oC corresponds to a resistance of 275..375 ω

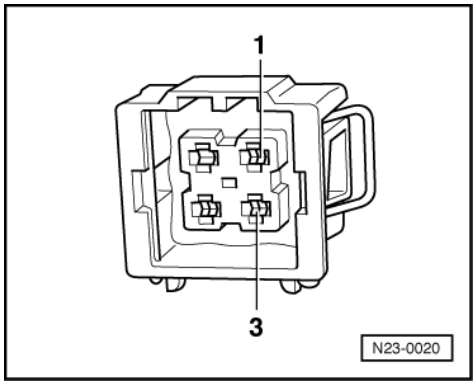
If the specified values are not obtained:

- Renew coolant temperature sensor.

Checking wiring



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check for open circuit and short to positive or earth in the following wiring connections:

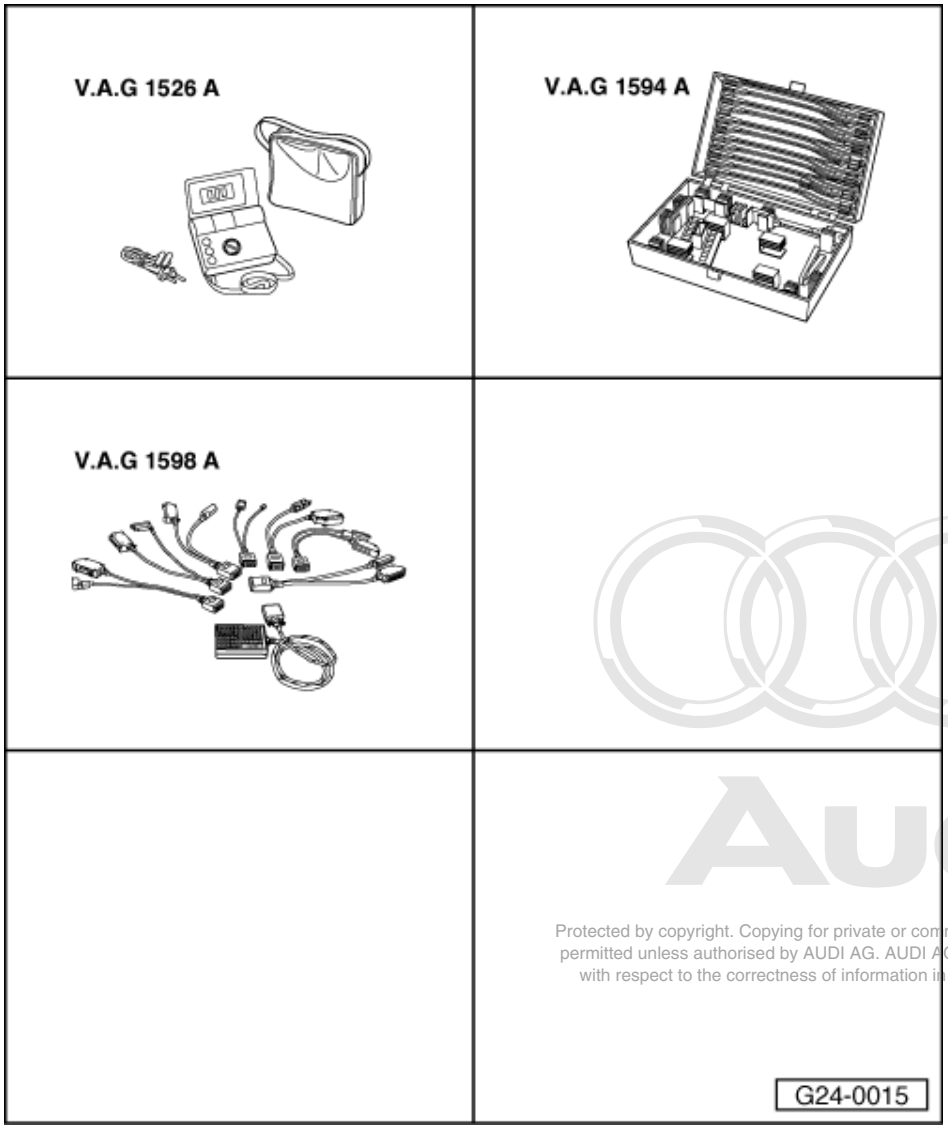
Connector Contact	Measure to
1	Test box V.A.G 1598 A Socket 15
3	Engine earth

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

1.10 - Checking control unit voltage supply



Special tools,
testers and auxiliary items required

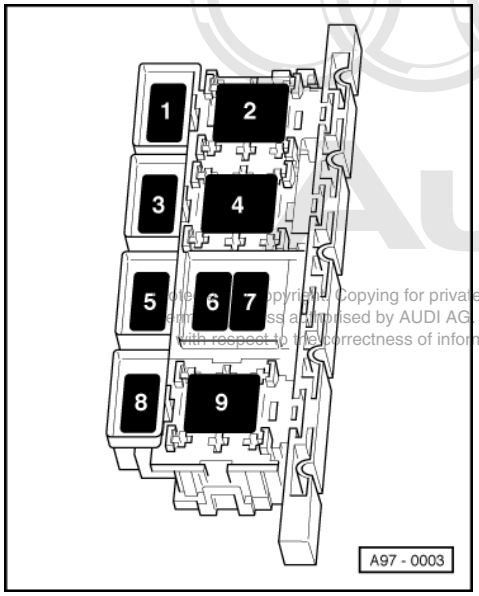
- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11
- V.A.G 1598/12

Fitting location => Fitting locations overview, Page 66

Note:

Checking power supply=> also reading measured value block display group 001, Page 35 .

Test requirements:



- -> Fuse S115 OK (in relay and fuse carrier, electronics box, plenum chamber ‣ 06.95: Position 7, 07.95 ‣: Position 9)
- Vehicles ‣ 06.94: Immobilizer relay -J341 OK
- Battery voltage at least 11 V
- Alternator OK

Test sequence

- With the ignition switched off, use adapter V.A.G 1598/12 to connect test box V.A.G 1598 A to connector D only of engine control unit (control unit remains disconnected) => Page 77 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
8 (positive via ignition)	Engine earth
8 (positive via ignition)	Test box V.A.G 1598 A Socket 1 (earth) Socket 2 (earth) Socket 3 (earth) Socket 16 (earth)

- Switch the ignition on.
  - The LED should light up each time.

If the LED does not light up:

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B only of engine control unit (control unit remains disconnected) => Page 77 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A socket	Measure to
40 (permanent positive)	Engine earth

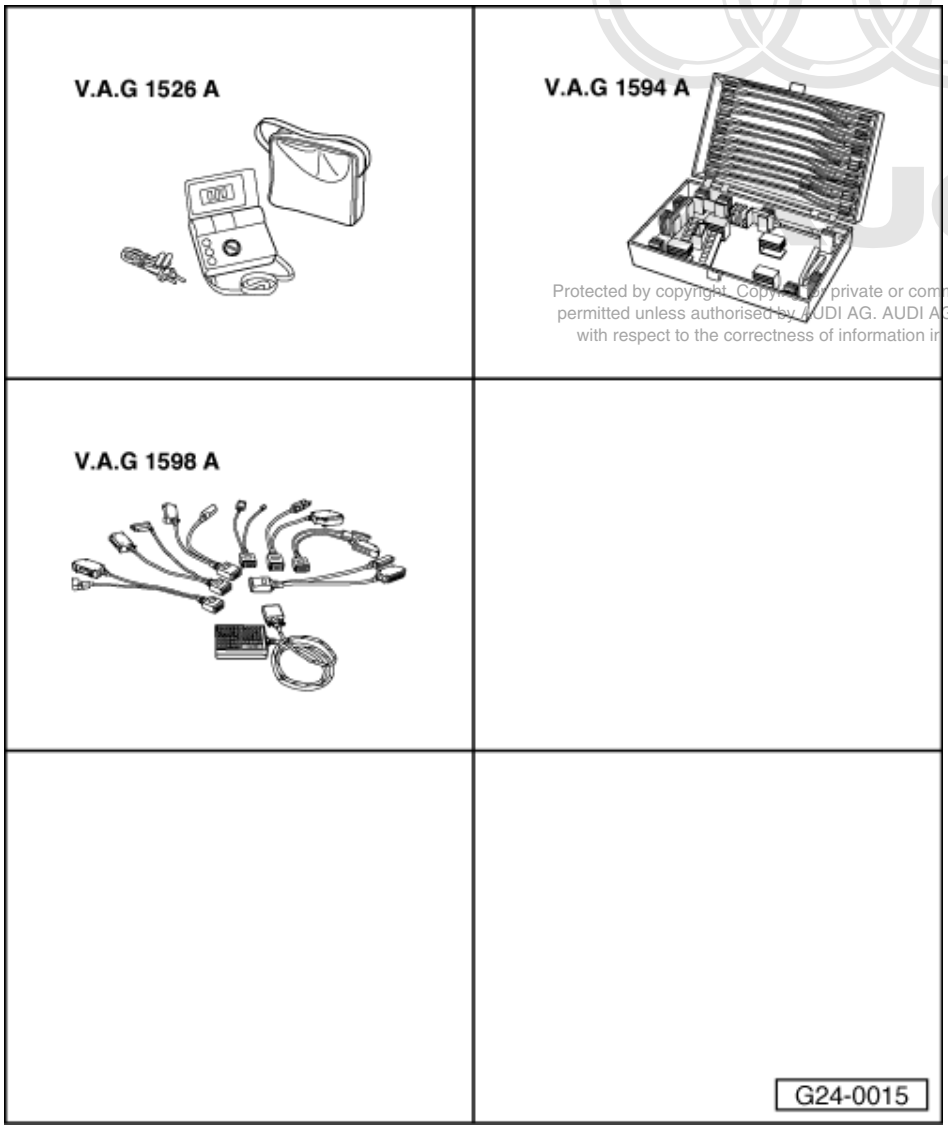
  - The LED should light up.

If the LED does not light up:

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

1.11 - Checking knock sensors



**Special tools,
testers and auxiliary items required**

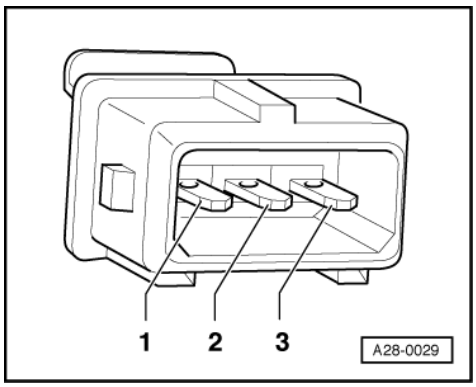
- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

Fitting location => Fitting locations overview, Page 66

Notes:

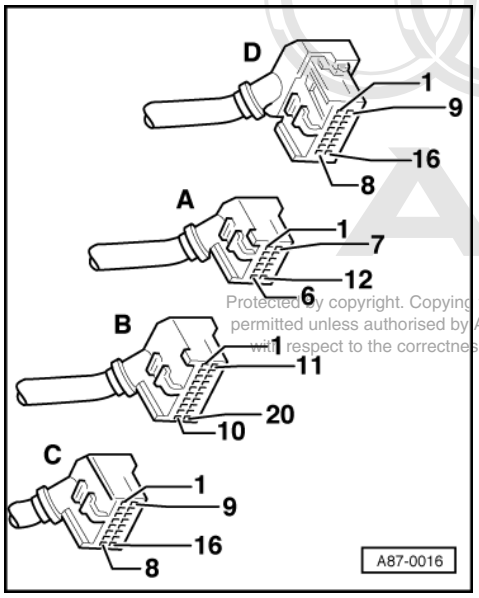
- Checking function => Reading measured value block, display groups 015 and 016, Page 50 .
- It is not possible to carry out an electrical test of the knock sensors themselves (interrogating fault memory =>Page 4).

- Use special tool 3247 when removing and installing knock sensors.
- To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- Check connectors for corrosion.
- Use only gold-plated contacts when repairing the contacts in the plug connectors.



Testing knock sensor wiring

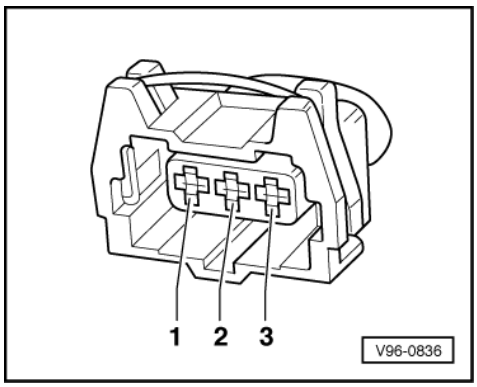
- Unplug the connector for the relevant knock sensor in the engine compartment.
- -> Test for short circuits between all three contacts in the knock sensor connector. The must be no connection between any of the wires.
- If there is a connection between the contacts, fit a new knock sensor.



Testing wiring from knock sensors to engine control unit

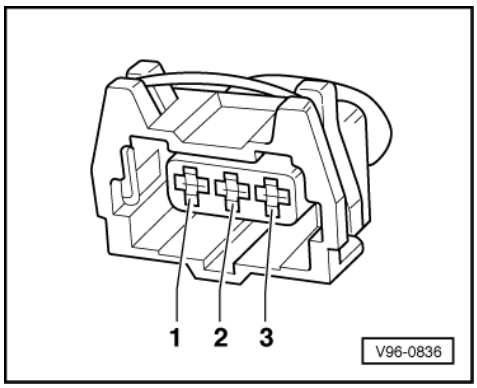
- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector B only of engine control unit (control unit remains disconnected) => Page 77 .

- Check for open circuit and short to earth/positive or earth in the following wiring connections:



- -> Knock sensor 1

-G61 connector Contact	Test box V.A.G 1598 A Socket
1 (earth)	25
2 (signal)	24
3 (screening)	26



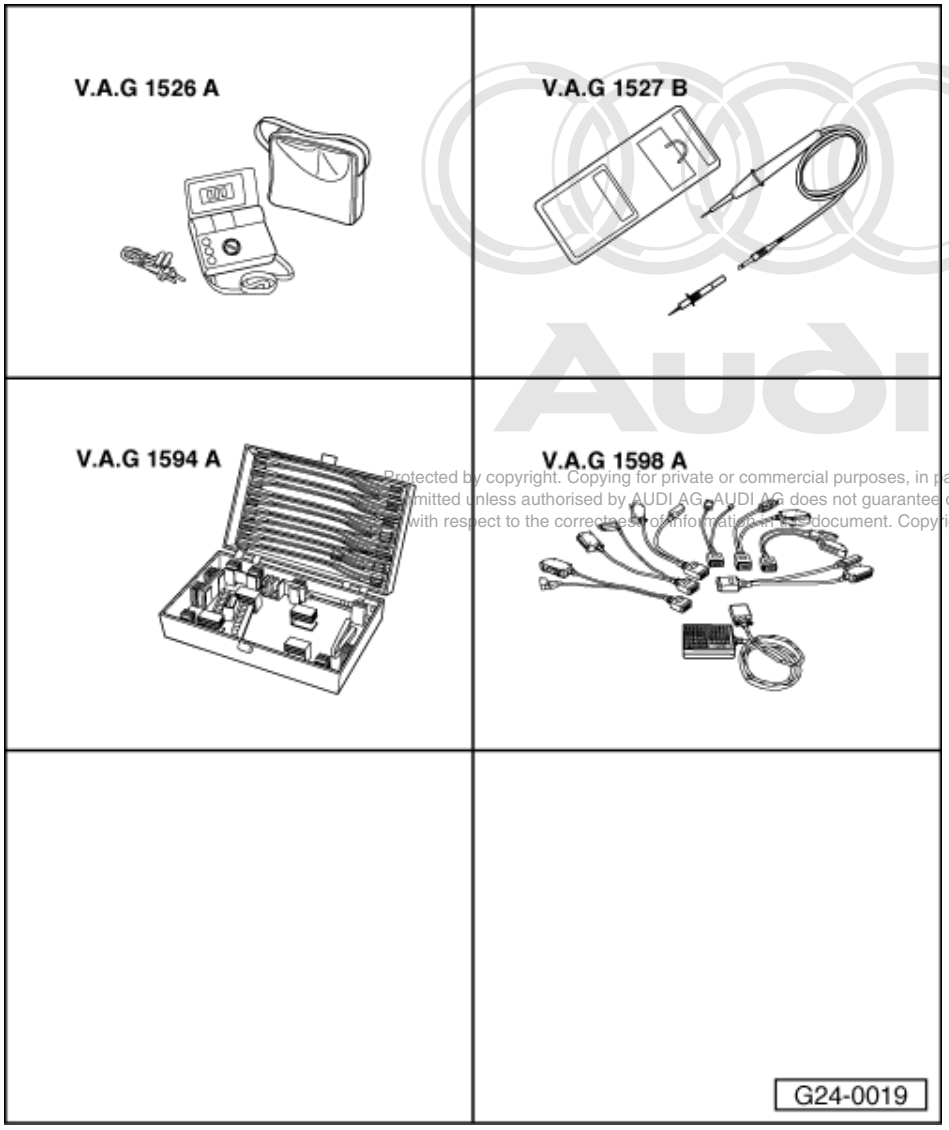
- -> Knock sensor 2

-G66 connector contact	Test box V.A.G 1598 A socket
1 (earth)	22
2 (signal)	21
3 (screening)	23

- Rectify short circuit or open circuit if necessary.

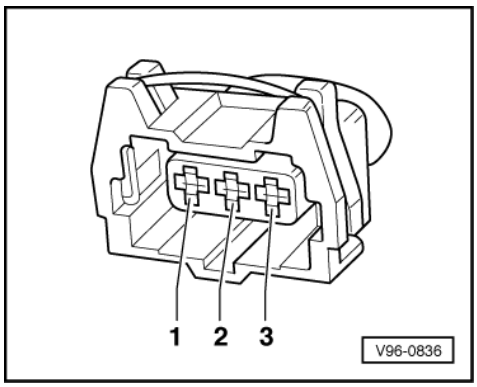
=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

1.12 - Checking Hall sender -G40



Special tools,
testers and auxiliary items required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A
- V.A.G 1598/11

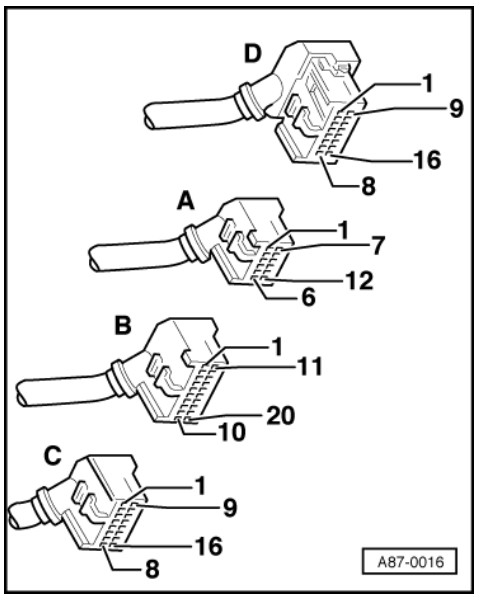


Fitting location => Fitting locations overview, Page 66

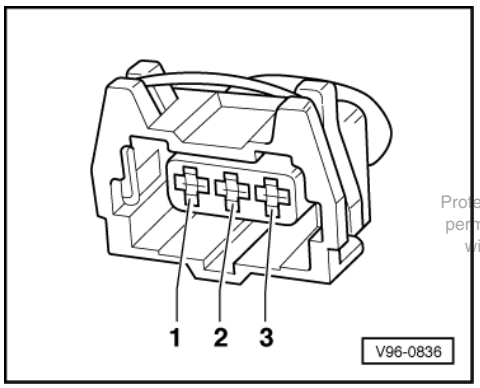
Checking power supply

- Pull connector off Hall sender.
- -> Connect multimeter between contacts 1 (positive) and 3 (earth) to measure voltage.
- Switch the ignition on.
  - Specification: at least 9 V

If the specification is not obtained:



- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .



- -> Check the following wires for open circuit and short to positive or earth (or short circuit to each other):

Connector Contact	Measure to
1 (positive)	Test box V.A.G 1598 A Socket 7
3 (earth)	Engine earth

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If the wiring is OK, fit a new engine control unit => Page 78 .

Checking function

Note:

To check the operation of the Hall sender, unplug the 4-way connector from the output stage and interrogate fault memory after performing functional check.

Test requirements:

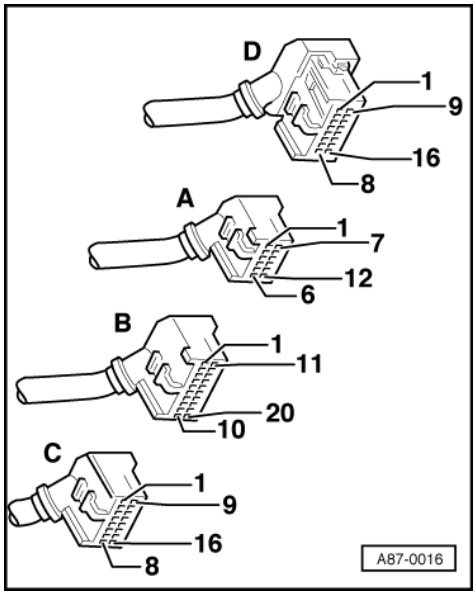
- Power supply of Hall sender OK; checking => Page 186 .

- Slide back rubber grommets on connector for Hall sender but leave connector plugged in.
- Connect up voltage tester V.A.G 1527 B between receptacle 2 (Hall sender signal) and receptacle 1 (positive).

Note:

Receptacles are numbered accordingly on the back of the connector.

- Operate the starter for a few seconds.

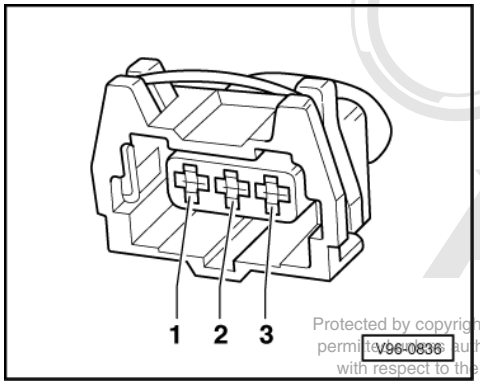


- The LED should flash briefly every second engine revolution.

If the LED lamp does not flash:

- Switch off ignition.
- Pull connector off Hall sender.

- -> With the ignition switched off, use adapter V.A.G 1598/11 to connect test box V.A.G 1598 A to connector C only of engine control unit (control unit remains disconnected) => Page 77 .



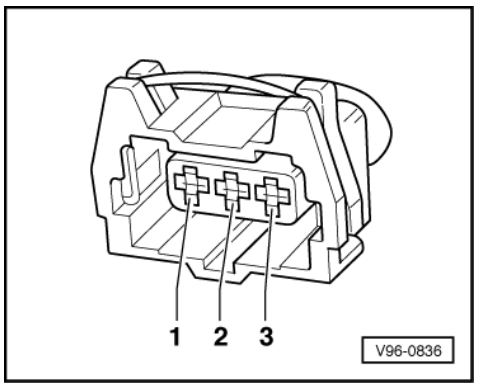
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
2 (signal)	8

- Rectify short circuit or open circuit if necessary.

=> Binder "Current flow diagrams, Electrical fault-finding and Fitting locations"

- If there are no open circuits or short circuits, reconnect engine control unit to engine wiring harness.



- -> Connect multimeter between contacts 2 and 3 of connector to measure voltage.
- Switch the ignition on.
  - Specification: at least 4 V

If the specification is not obtained:

- Fit a new engine control unit => Page 78 .

If the specification is obtained:

- Fit a new Hall sender.