Audi 80 1992 ➤

Digifant injection and ignition system 07.93 >									
Engine ID	ABK	ADW							

Edition 03.1998

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

Audi 80 1992 ➢

Digifant injection and ignition system 07.93 >

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system

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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

1.1 - Self-diagnosis

1.2 - Technical data of self-diagnosis

Features

- Fault memory: Non-volatile memory (a maximum of 4 different faults can be stored at the same time) 1)
- Rapid data transfer

1) Erased after 40th engine start if fault has not re-occurred.

1.3 - Safety precautions

Pay attention to the following if testers and measuring instruments have to be used in the course of a test drive on vehicles fitted with front passenger's airbag.

Attention:

- **Always attach testers and measuring instruments to back seat and have them operated from there by a second person.**
- **If testers and measuring instruments were to be operated from front passenger's seat, person sitting there could suffer injury in the event of an accident due to triggering of front passenger's airbag.**

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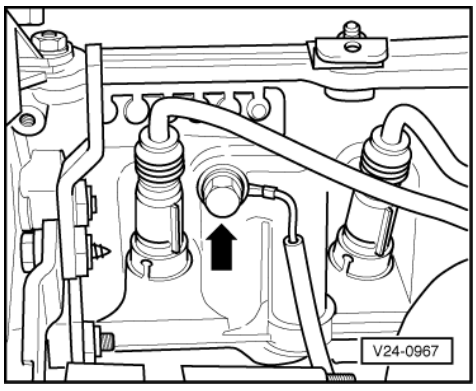
1.4 - Connecting vehicle diagnostic, testing and information system VAS 5051/ fault reader V.A.G 1551 and selecting functions

Test requirements:

- Vehicle supply voltage OK
- Fuses OK

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

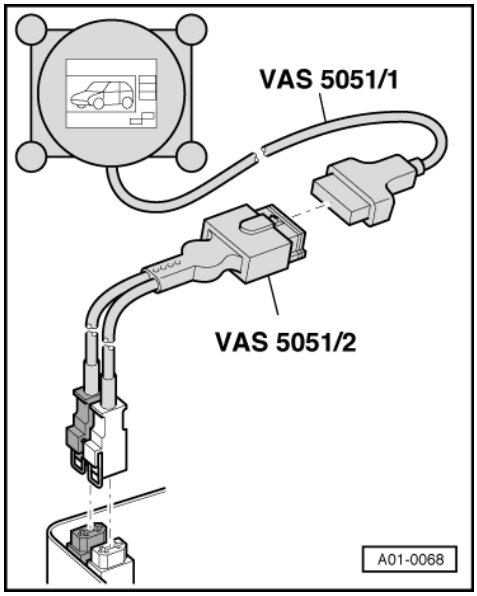
- Fuel-pump relay -J17 and current supply relay for Digifant control unit -J176 OK; checking => Pages 126
- Earth connections checked



- Prior to fault memory interrogation, final control diagnosis, engine basic setting, wiring check and component replacement, check following earth connections for corrosion and poor contact:

◆ -> Earth attachment point on left of cylinder head -arrow-
◆ Battery earth strap and earth strap between engine and longitudinal member

- Detach cover from relay plate with fuse box in plenum chamber.



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- -> Use diagnostic wire VAS 5051/1 and diagnostic adapter VAS 5051/2 to connect up vehicle diagnostic, testing and information system VAS 5051. Alternatively, use can be made ofdiagnostic wire V.A.G 1551/1 to connect up fault reader V.A.G 1551.

Attention:
Heed safety precautions => Page 1 .

Note:

The following description refers solely to implementation of self-diagnosis using fault reader V.A.G 1551.

Proceed in line with equipment operating instructions if use is made of vehicle diagnostic, testing and information system VAS 5051.

- With ignition switched off, attach black connector to black diagnostic connection.

-> Indicated on display:

```
V.A.G SELF-DIAGNOSIS     HELP
1 - Rapid data transfer 1)
2 - Flash code output1)
```

1) Displayed alternately

Note:

If display remains blank, check power supply for black diagnostic connector => Page 25 .

- Attach white connector to white diagnostic connection (blue connector is not used).

Depending on desired function=>"Available functions" table, Page 4 :

- Switch on ignition.

or

- Start engine.
- Switch on printer of fault reader by pressing Print key. Lamp in key must light.
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

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

Note:

Address word 00 implements automatic test sequence, i.e. the fault memories of all vehicle systems with self-diagnosis capability are interrogated by way of rapid data transfer.

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

-> Fault reader V.A.G 1551 displays control unit identification (example).

```
039906022     Digifant     1.6     1003
□
Code 11
```

Note:

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

Control unit identification (example)

- 039 906 022	Part No.; Assignment => Parts List
- Digifant 1.6	Digifant injection and ignition system
- 1003	Data level (software version) of control unit
- Code 11	Control unit code =>Page 13

- Press ⇒key.

-> Indicated on display (function selection):

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

Notes:

- Control unit identification can be displayed again after entering function "01" for "Interrogating control unit version" and providing confirmation with Q key.

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- ◆

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

-> If adjacent display appears:

- Press HELP key for printout of possible causes of trouble.

```
Rapid data transfer      HELP
K-wire not switched to earth
```

Check wiring of white diagnostic connector => Page 25 .

```
Rapid data transfer      HELP
K-wire not switched to positive
```

- ◆

```
Rapid data transfer
Fault in communication link
```

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

- After eliminating possible causes of trouble, enter "01" again for address word "Engine electronics" => Page 1 .

Available functions

Vehicle diagnostic, testing and information system VAS 5051/ fault reader V.A.G 1551		Ignition on, engine stopped	Engine idling	Vehicle in operation	Page
Address words					
01	Engine electronics	yes	yes	yes	1
00	Automatic test sequence	yes	yes	yes	3
Functions					
01	Interrogating control unit version	yes	yes	yes	1
02	Interrogating fault memory	yes	yes	yes	4
03	Final control diagnosis	yes	no	no	10
04	Basic setting	no	yes	no	12
05	Erasing fault memory	yes	yes	yes	4
06	End of output	yes	yes	yes	5
08	Reading measured value block	yes	yes	yes	14

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2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Engine should be idling.

Note:

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

-> Indicated on display:

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

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

-> Indicated on display:

```
No faults detected
```

- Press ⇒key.

Note:

In the event of problems not detected by self-diagnosis:

- Perform final control diagnosis => Page 14 .

or

-> Indicated on display:

```
X faults detected
```

The stored faults are consecutively displayed and printed out, provided that printer is on.

- Use fault table to locate and eliminate faults printed out=>Page 6 .
- Press ⇒key.

-> Indicated on display:

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

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

Notes:

-> If adjacent display appears:

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```
Attention:
Fault memory not interrogated
```

Sequence of operations not precisely observed.

- Interrogate fault memory.

Fault memory is also not erased under the following conditions:

- Ignition switched off following fault memory interrogation
- Static fault not rectified

-> Indicated on display:

```
Rapid data transfer
Fault memory erased
```

- Press ⇒key.

- Interrogate fault memory again after performing repair work.

Note:

This erases faults stored during fault elimination e.g. on account of connectors being unplugged.

- Perform test drive. Conditions:
  - Duration at least 5 minutes
  - Coolant temperature at least 80 ° C
  - Engine speed greater than 3000 rpm
  - Accelerator briefly floored
- Enter "00" for address word "Automatic test sequence" and confirm with Q key.

End of output

-> Indicated on display:

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

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

-> Indicated on display:

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

- Switch off ignition and unplug diagnostic connector.

2.2 - Fault table

Notes:

- The fault table is arranged according to the 5-digit fault codes on the left.
- Before replacing components found to be defective, use current flow diagram to check wiring and connectors to these components as well as earth connections. This is particularly important if faults are output as being "sporadic" (SP).
- If engine is switched off between performing test drive and interrogating fault memory, all stored faults are displayed as being "sporadic". If faults only occur intermittently or if fault memory is not erased after fault elimination, such faults are displayed as being "sporadic faults". This is indicated by "/SP" on right of V.A.G 1551 display.
- Faults relating to injectors, knock control and Lambda control are not detected by the self-diagnosis.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00513 Engine speed sender -G28 No signal	- Fault in power or earth supply for Hall sender -G40	- Engine cuts out/will not start (fuel pump and injectors deactivated)	- Check Hall sender -G40 => Page 132
	- Open circuit or short to earth/positive in signal wire between -G40 and engine control unit		
	- Hall sender -G40 defective		
	- Signal input in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 41

Notes on fault code 00513:

- Engine control unit receives engine speed information from Hall sender in ignition distributor.
- Hall sender -G40 is monitored instead of engine speed sender -G28.
- Fault code can be ignored with ignition on and engine not running.
  Observe fault code with ignition on following unsuccessful attempted starting (engine does not start).

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00518 Throttle valve potentiometer -G69 Open circuit/short to earth1) Implausible signal1)	- Power supply for -G69 defective	- Loss of power - Pick-up fault	- Check throttle valve potentiometer -G69=>Page 89
	- Open circuit or short to earth in signal wire between -G69 and engine control unit		
	- -G69 defective		
	- Signal input in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 41

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	Continued ▼		

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00518 Throttle valve potentiometer -G69 Short to positive 1) Implausible signal1)	(Fault 00518 continued) - Fault in earth supply to -G69	- Loss of power - Pick-up fault	- Check throttle valve potentiometer -G69=>Page 89
	- Short to positive in signal wire between -G69 and engine control unit		
	- -G69 defective		
	- Signal input in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 41

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00522 Coolant temperature sender -G62 Implausible signal1)	- Loose contact/corrosion caused by moisture in connector	- Cold starting problems at very low temperatures	- Check coolant temperature sender -G62 => Page 121
Open circuit/short to positive1)	- Fault in earth supply to -G62	- Pick-up fault during warm-up	- Eliminate open circuit in wiring/short circuit
	- Open circuit/short to positive in wiring between -G62 and engine control unit		
	- -G62 defective		
	- Signal input in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 41

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1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00523 Intake-air temperature sender -G42 Short to earth 1)	- Short to earth	- Reduced power	- Check intake-air temperature sender -G42=>Page 119
Open circuit/short to positive1)	- Open circuit/short to positive in wiring between -G42 and engine control unit		- Eliminate open circuit in wiring/short circuit
	- -G42 defective		

	- Signal input in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 41

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00524 Knock sensor 1 -G61 No signal	- Knock sensor 1 -G61 loose/corrosion caused by moisture in connector	- High fuel consumption - Loss of power - Abrupt loss of power (like misfiring)	- Check knock sensor 1 -G61 => Page 130
	- Open circuit/short to positive in wiring between -G61 and engine control unit		- Eliminate open circuit in wiring/short circuit
	- Short circuit between -G61 and earth or to screen		
	- -G61 defective		
	- Signal input in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 41

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00525 Lambda probe -G39 No signal1)	- Open circuit/short circuit in wiring between -G61 and engine control unit	- Emissions not OK - Lambda control switches to open-loop control	- Eliminate open circuit in wiring/short circuit

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Continued ▾

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00525 Lambda probe -G39 No signal1)	(Fault 00525 continued) - Wiring of Lambda-probe heating	- Emissions not OK - Lambda control switches to open-loop control	- Eliminate open circuit in wiring/short circuit
	- Short to earth or screen in Lambda probe signal wire		- Read measured value block, display group 001, display zone 3, constant display value between 0.40 V and 0.50 V=>Page 14 onwards
	- -G39 defective		- Check Lambda-probe heater -Z19 => Page 82

Short to positive1)	- Short to positive in Lambda probe signal wire		- Check Lambda probe - G39 and Lambda control => Page 80

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00532 Supply voltage			
Signal too high 1)	- Supply voltage greater than 16 V - Overvoltage caused by boost starting - Alternator defective	- Destruction of engine control unit	- Check voltage - Read measured value block,display group 003, display zone 4=>Page 22
Signal too low 1)	- Power supply relay for engine control unit defective - Poor earth connection to engine control unit - Battery flat - Current draw with ignition off	- Voltage less than 6 V - Engine does not run	- Check power supply of engine control unit => Page 124 - Read measured value block,display group 003, display zone 4=>Page 22 - Check battery charge

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00545 Engine/gearbox electrical connection			
No signal	- Open circuit in wiring or short to positive/ earth - Automatic gearbox control unit-J217 defective	- Cold starting problems	- Eliminate open circuit in wiring/short circuit => Page 100

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
00552 Air-flow meter potentiometer -G19			
Open circuit/short to earth1) Short to positive1)	- Air-flow meter potentiometer -G19 defective	- Reduced power - Jolting - Poor acceleration	- Check air-flow meter potentiometer -G19=>Page 74

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Type of fault not detected1) Implausible signal1)	- Open circuit or short to positive/earth in signal wire between air-flow meter potentiometer -G19 and engine control unit		- Eliminate open circuit in wiring/ short circuit

1) One of these displays will appear in addition to the component concerned.

Output on printer of V.A.G 1551	Possible cause of trouble	Possible effects	Fault remedy
65535 Control unit defective	- Earth connection to engine control unit at contacts 1 and 42	- Engine will not start	- Use current flow diagram to check earth connection
	- Internal fault in control unit	- Engine running problems - Engine cuts out	- Replace engine control unit => Page 41
	- Communication problem between fault reader and engine control unit	- None	- Erase fault memory and continue to monitor vehicle

3 - Final control diagnosis

3.1 - Final control diagnosis

The final control diagnosis function actuates the following components in the stated sequence:

Actuation sequence
1 Fuel pump relay -J17
2 Idling-speed stabilisation valve -N71
3 Activated charcoal filter solenoid valve -N80
4 Cold start valve -N17 1)

1) Vehicles with cold start valve only

Notes:

- Before starting final control diagnosis, engine must have been switched off for at least 2 minutes. Failure to comply with the above period could result in the engine no longer starting as the current supply relay for the Digifant control unit -J176 remains actuated. As a remedy, pull current supply relay for Digifant control unit -J176 (on auxiliary relay carrier at front left beneath dash panel, position 14) for several seconds out of auxiliary relay carrier.
- Each time ignition is switched on full final control diagnosis procedure can be implemented once .
- If final control diagnosis is to be repeated, ignition must be switched off for 30 seconds and "white" diagnostic connector unplugged for approx. 5 seconds.

- Engine cannot be started after initiating final control diagnosis, as injectors and ignition transformer are not actuated. Ignition must be switched off and on again to start engine.

Sequence of operations

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Engine must not be running.

-> Indicated on display:

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

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

-> Indicated on display:

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

Relay must be energised and fuel pump must run. Flow noise at fuel pressure regulator is distinctly audible.

If relay is not energised:

- Check actuation of fuel pump relay -J17 => Page 61 .
- Press ⇒key.

-> Indicated on display:

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

Idling-speed stabilisation valve must hum and vibrate.

Note:

Humming of valve is not easy to hear and can best be established by way of touch.

If valve does not hum and vibrate:

- Check idling-speed stabilisation valve -N71 => Page 63 .
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Activated charcoal filter solenoid valve
-N80
```

Valve must click.

If valve does not click:

- Check activated charcoal filter solenoid valve -N80 => Page 85 .
- Press ⇒key.

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-> Indicated on display:

```
Final control diagnosis
Cold start valve -N17
```

Valve must click.

Note:

Press ⇒ key at the latest when cold start valve has been actuated

2 - 3 times.

If valve does not click:

- Check cold start valve -N17 => Page 63 .
- Press ⇒key.

-> Indicated on display (function selection):

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

4 - Basic setting

4.1 - Basic setting

The engine control unit implements the following as part of the basic setting function:

- Blocking of ignition timing intervention and closing of ACF valve
- Re-learning of values learnt for idling-speed control (idling speed and CO value are set automatically)
- Matching of engine control unit and throttle valve potentiometer

Basic setting is only implemented if the test requirements are satisfied.

Test requirements:

- Coolant temperature at least 85 °C
- Electr. loads switched off (radiator fan must not run during test)
- Air conditioner switched off
- Vehicles with automatic gearbox: Selector lever set to P or N
- Accelerator pedal not pressed
- No faults stored in fault memory

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Sequence of operations

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Engine must be idling.

-> Indicated on display:

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

- Enter "04" for "Starting basic setting" function and confirm with Q key.

-> Indicated on display:

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

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

-> The display for display group number 000 is presented in 10 display zones; explanatory notes => Page 13 .

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

Note:

Provided that printer is switched on, current display can be printed out on record slip by pressing PRINT key.

- If readings match specifications in all display zones, press ⇒key and end output => Page 4 .

Notes:

- If engine cuts out after entering "04" for "Starting basic setting" function, it may run at high idling speed for up to 4 minutes after being re-started. Wait for engine speed to decrease again prior to renewed entry of "04" for "Starting basic setting" function.

```
Function unknown or cannot
be implemented at present
```

-> If adjacent display appears:
- Interrogate control unit version => Page 1 .
- Test requirements have not been met. Action to be taken if readings do not match specifications and fault-finding procedure => Reading measured value block, test table on Page 17 .

Display group 000

System in basic setting 0 ⇒ 1 2 3 4 5 6 7 8 9 10 — Indicated on display	Specification	Corresponds to
Engine speed	211 ... 186	770 ... 870 rpm
Injection period (internal control unit arithmetic value); ignore	3 ... 7	1.5 ... 3.5 ms
Throttle valve potentiometer voltage	10 ... 130	0.2 ... 2.6 V
Probe status counter	0 ... 10	-
Lambda control time counter; ignore	0	-
Lambda probe voltage (fluctuating)	230 ... 80	0.1 ... 1,1 V
Engine load; ignore	20 ... 150	-
Coolant temperature	0 ... 8	+ 85 ... 115 ° C
Engine control-unit power supply	115 ... 150	10.8 ... 14 V
Intake-air temperature	15 ... 70	+ 65 ... 12 ° C

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Note:

If adjustment conditions are satisfied (measured values displayed within tolerance range), engine control unit is set to adjustment mode and idling speed and CO content are set automatically.

5 - Encoding control unit

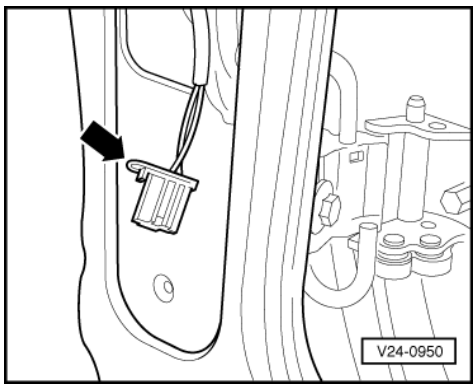
5.1 - Encoding control unit

Note:

-> Control unit must be encoded if the control unit identification feature displays a code which does not correspond to the vehicle concerned or if the engine control unit is replaced.

```
039906022    Digifant    1.6    1003

Code 11
```



-> Engine control unit is encoded at encoding connector -arrow- (behind lower A-pillar trim).

Encoding alternatives

Code	For vehicles	Link between contacts of encoding connector
01	With no cold start valve	1 + 5
11	With cold start valve	-

Sequence of operations

- Remove lower right A-pillar trim.

=> General Body Repairs, Interior; Repair Group 70; Trim; Removing and installing lower right A-pillar trim Trim Removing and installing lower right A-pillar trim

- Fit link between contacts 1 + 5 of encoding connector/remove link.

Note:

Contact designation is stamped on encoding connector.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Ignition must be on.

-> Fault reader V.A.G 1551 displays control unit encoding, e.g.:

```
039906022    Digifant    1.6    1003
□
Code 01
```

If corresponding code is not displayed:

- Check wiring of encoding connector => Page 27 .

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6 - Reading measured value block

6.1 - Reading measured value block

Test requirements:

- Electr. loads switched off (radiator fan must not run during test)
- Air conditioner switched off
- Vehicles with automatic gearbox: Throttle cable setting OK

Sequence of operations

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Engine must be idling.

-> Indicated on display:

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

- Switch on printer of fault reader by pressing Print key. Lamp in key must light.
- Enter "08" for "Reading measured value block" function and confirm with Q key.

-> Indicated on display:

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

- Enter desired display group number =>List of display groups, Page 15 .

- Confirm entry with Q key.

-> Indicated on display for display group 000:

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

-> Indicated on display (example) for Display group 001:

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

Notes:

- The measured values are presented in decimal form for display group number 000.
- Provided that printer is switched on, current display can be printed out on record slip.
- Proceed as follows to switch to a different display group:

Display group	V.A.G 1551	VAS 5051
Up	Press key 3	Press s key
Down	Press key 1	Press t key

- If readings match specifications in all display zones, press ⇒key and end output => Page 4 .
- If readings do not match specifications in display group 000 => test table, Page 17 .
- If readings do not match specifications in display groups 001 ... 005 => appropriate test table, Page 19 onwards.

6.2 - List of display groups

Display group number	Indicated on display	Designation
000	Reading measured value block 0 1 2 3 4 5 6 7 8 9 10	1 = Intake-air temperature 2 = Engine control-unit power supply 3 = Coolant temperature 4 = Engine load 5 = Lambda probe voltage 6 = Time counter active/not active 7 = Probe status counter; ignore 8 = Throttle valve potentiometer voltage 9 = Injection period 10 = Engine speed

Notes:

- Display zone 6 indicates length of time for which Lambda control is deactivated in certain operating statuses (e.g. overrun shutoff). Deactivation is displayed by a time counter. If time counter is not "0", Lambda control has been deactivated for a specific period.
- Display zone 7 shows how often the Lambda probe supplies a signal which cannot be processed or no signal at all. The display is incremented with each ignition operation.

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Display group number	Indicated on display	Designation
001	Reading measured value block 1 1 2 3 4	1 = Coolant temperature 2 = Engine speed 3 = Lambda probe voltage 4 = Injection period
002	Reading measured value block 2 1 2 3 4	1 = Coolant temperature 2 = Engine speed 3 = Throttle valve angle 4 = Engine load signal
003	Reading measured value block 3 1 2 3 4	1 = Coolant temperature 2 = Engine speed 3 = Intake-air temperature 4 = Engine control-unit power supply

Display group number	Indicated on display	Designation
004	Reading measured value block 4 1 2 3 4	1 = Coolant temperature 2 = Engine speed 3 = Calculated ignition point 4 = Engine load signal
005	Reading measured value block 5 1 2 3 4	1 = Coolant temperature 2 = Engine speed 3 = Throttle valve angle 4 = Engine control-unit power supply

Display group 000

Reading measured value block 1 2 3 4 5 6 7 8 9 ⇒ 10	Indicated on display	Specification	Corresponds to
9	Engine speed	211 ... 186	770 ... 870 rpm
9	Injection period (internal control unit arithmetic value); ignore	3 ... 7	1.5 ... 3.5 ms
8	Throttle valve potentiometer voltage	10 ... 130	0.2 ... 2.6 V
7	Probe status counter	0 ... 10	-
6	Lambda control time counter; ignore	0	-
5	Lambda probe voltage (fluctuating)	230 ... 80	0.1 ... 1.1 V
4	Engine load; ignore	35 ... 65	14 ... 25 %
3	Coolant temperature	0 ... 8	+ 85 ... 115 ° C
2	Engine control-unit power supply	115 ... 150	10.8 ... 14 V
1	Intake-air temperature	15 ... 70	+ 65 ... 12 ° C

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Test table: Display group 000

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
1	Deviation from tolerance range	- Intake-air temperature sender -G42 defective - Fault in wiring between intake-air temperature sender -G42 and engine control unit	- Interrogate fault memory =>Page 119
2	Deviation from tolerance range	- Alternator defective - Battery flat (current draw) - Poor earth connection to engine control unit - Power supply relay for engine control unit defective	- Check power supply =>Page 124
3	Deviation from tolerance range	- Coolant temperature sender -G62 defective - Fault in wiring between coolant-temperature sender -G62 and engine control unit	- Interrogate fault memory =>Page 121

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
4	Deviation from tolerance range	- Rough idling (not running on all cylinders)	- Check spark plugs =>Page 50
		- Air-flow meter potentiometer -G19 defective	- Interrogate fault memory =>Page 74
		- Idling-speed stabilisation valve -N71 defective - Fault in wiring between idling-speed stabilisation valve -N71 and engine control unit	- Check idling-speed stabilisation valve -N71 => Page 63
		- Intake system drawing in unmetered air	- Check intake system for leaks => Vacuum connections, Page 103
		- Loads switched on, e.g. air conditioner on; steering wheel on full lock; selector lever of automatic gearbox not set to "P" or "N"	- Switch off all electr. loads Move steering wheel to centre position Move selector lever to position "P" or "N"

Audi
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Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
5	Deviation from tolerance range	- Injector defective - Spark plug defective	- Check injectors=>Page 106
		- Intake system drawing in large quantities of unmetered air	- Check intake system for leaks => Vacuum connections, Page 103
		- Coolant temperature sender -G62 defective	- Interrogate fault memory =>Page 121
		- Activated charcoal filter solenoid valve -N80 defective	- Perform final control diagnosis => Page 10
		- Lambda probe -G39 dirty	- Interrogate fault memory =>Page 81
Continuation ▼		- Lambda probe heater -Z19 defective	- Check Lambda probe heater -Z19 => Page 82

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
5	Deviation from tolerance range	- Fuel system pressure too low/too high	- Check fuel pressure regulator and holding pressure => Page 46
	Constant value between 0 and 3	- Short to positive caused by: - - Lambda probe -G39 - - Lambda probe wiring - - Engine control unit	- Check Lambda probe -G39 =>Page 81
	Constant value between 164 and 168	- Open circuit in wiring caused by: - - Lambda probe -G39 - - Lambda probe wiring - - Engine control unit	
	Constant value greater than 230	- Short to earth caused by: - - Lambda probe -G39 - - Lambda probe wiring - - Engine control unit	

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
6	...	Ignore	
7	Deviation from tolerance range or 127 constantly displayed	- Fault stored in fault memory	- Interrogate fault memory =>Page 4
		- Lambda probe heater -Z19 defective	- Check Lambda probe heater -Z19 => Page 82
		- Open circuit in wiring between Digifant control unit -J169 and Lambda probe - -G39	- Check Lambda probe -G39 =>Page 81
8	Deviation from tolerance range	- Throttle valve potentiometer -G69 defective - Fault in wiring between throttle valve potentiometer -G69 and engine control unit	- Interrogate fault memory =>Page 89

Note on display zone 7:

If 127 is displayed, Lambda control is set to open-loop control.

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
9	...	Ignore	
10	Deviation from tolerance range	- Intake system drawing in large quantities of unmetered air	- Check intake system for leaks => Vacuum connections, Page 4
		- Engine control unit not encoded	- Encode engine control unit => Page 13
		- Idling-speed stabilisation valve -N71 sticking or stiff	- Perform final control diagnosis => Page 63
		- Throttle valve potentiometer -G69 defective	- Check throttle valve potentiometer -G69 => Page 89 /display group 002, display zone 3

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Display group 001

Reading measured value block 1 ⇒				◂ Indicated on display
95 ° C	820 rpm	0.75 V	2.0 ms	
			Injection period (internal control unit arithmetic value at idle) ▪ 1.5 ... 3.5 ms OK	
		Lambda probe voltage (fluctuating) ▪ 0.1 ... 1.1 V		
	Engine speed (idling speed) ▪ 770 ... 870 rpm OK			
Coolant temperature				

Test table: Display group 001

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
1	Greater than 115 °C or less than 85 °C 1)	- Coolant temperature sender -G62 defective - Fault in wiring between coolant-temperature sender -G62 and Digi-fant control unit -J169	- Interrogate fault memory =>Page 121
2	Greater than 870 rpm	- Throttle valve potentiometer -G69 - Defective	- Check throttle valve potentiometer -G69 => Page 89 /display group 003, display zone 3
		- Idling-speed stabilisation valve -N71 sticking or stiff	- Perform final control diagnosis => Page 63
		- Intake system drawing in large quantities of unmetered air	- Check intake system for leaks => Vacuum connections, Page 103
Continuation ▾		- Unmetered air at throttle valve 2nd stage	- Perform basic setting of throttle valve => Page 92

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1) Vehicle at operating temperature

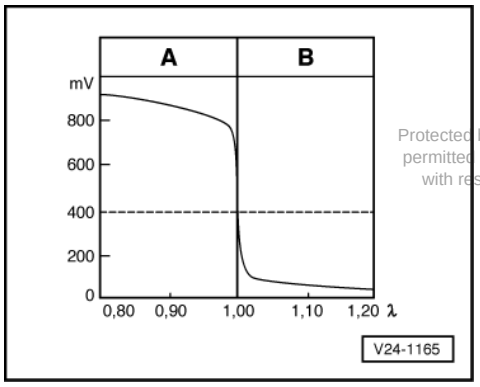
Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
2	Greater than 870 rpm	- Incorrect throttle cable setting	- Adjust throttle cable => Fuel Supply System - Petrol Engines; Repair Group 20; Servicing accelerator mechanism Servicing accelerator mecha-nism
	Less than 770 rpm	- Idling-speed stabilisation valve -N71 sticking or stiff	- Perform final control diagnosis => Page 63
		- Load switched on, e.g. air con-ditioner on; steering wheel on full lock	- Switch off all electr. loads Move steering wheel to centre position
3	Deviation from tol-erance range	- Injector defective - Spark plug defective - Cold start valve -N17 defective	- Check injectors=>Page 63
Continuation ▾		- Intake system drawing in large quantities of unmetered air	- Check intake system for leaks => Vacuum connections, Page 103

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
3	Deviation from tolerance range	- Coolant temperature sender -G62 defective	- Interrogate fault memory =>Page 121
		- Activated charcoal filter solenoid valve -N80 defective	- Perform final control diagnosis => Page 85
		- Lambda probe -G39 dirty	- Interrogate fault memory =>Page 81
		- Lambda probe heater -Z19 defective	- Check Lambda probe heater -Z19 => Page 82
		- Fuel system pressure too low/too high	- Check fuel pressure regulator and holding pressure => Page 46
Continuation ▼	Constant value of 1.60 V	- Short to positive caused by: - - Lambda probe -G39 - - Lambda probe wiring - - Engine control unit	- Check Lambda probe -G39 =>Page 81

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
3	Constant value between 0.40 and 0.50 V	- Open circuit in wiring caused by: - Lambda probe -G39 - Lambda probe wiring - Engine control unit	- Check Lambda probe -G39 =>Page 81
	Constant value of 0.00 V	- Short to earth caused by: - Lambda probe -G39 - Lambda probe wiring - Engine control unit	
4	... ms	Injection period (internal control unit arithmetic value at idle)	

Note on display zone 3:

Probe voltage U in mV



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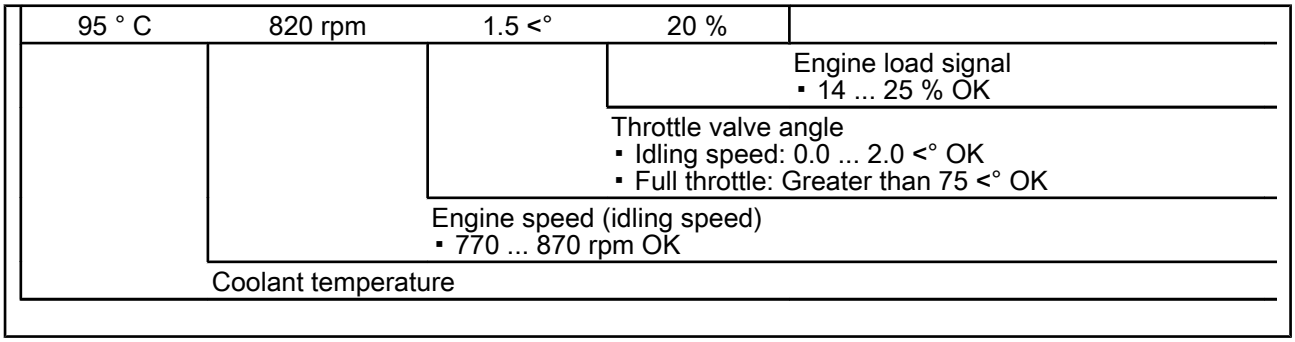
Excess air factor

A - -> Lambda probe voltage (mV) high, rich mixture (excess fuel/lack of air), high CO value
B - Lambda probe voltage (mV) low, lean mixture (lack of fuel/excess air), low CO value

Display group 002

Reading measured value block 2	⇒	◂ Indicated on display



Test table: Display group 002

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
1	... ° C	Coolant temperature => Display group 001, display zone 1	
2	... rpm	Engine speed => Display group 001, display zone 2	
3	At idle greater than 2 <°	- Throttle valve potentiometer -G69 defective	- Interrogate fault memory =>Page 89
		- Throttle cable setting	- Adjust throttle cable => Fuel Supply System - Petrol Engines; Repair Group 20; Servicing accelerator mechanism Servicing accelerator mechanism
		- Throttle valve sticking	- Eliminate cause
	At full throttle less than 75 <°	- Throttle valve potentiometer -G69 defective	- Interrogate fault memory =>Page 89
		- Throttle cable setting	- Adjust throttle cable => Fuel Supply System - Petrol Engines; Repair Group 20; Servicing accelerator mechanism Servicing accelerator mechanism

Note on display zone 3:

For checking at full throttle, switch engine off and ignition on.

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
4	Deviation from tolerance range	- Rough idling (not running on all cylinders)	- Check spark plugs =>Page 50
		- Air-flow meter potentiometer -G19 defective	- Interrogate fault memory =>Page 74
		- Idling-speed stabilisation valve -N71 defective - Fault in wiring between idling-speed stabilisation valve -N71 and engine control unit	- Check idling-speed stabilisation valve -N71 => Page 63
		- Intake system drawing in unmetered air	- Check intake system for leaks => Vacuum connections, Page 103

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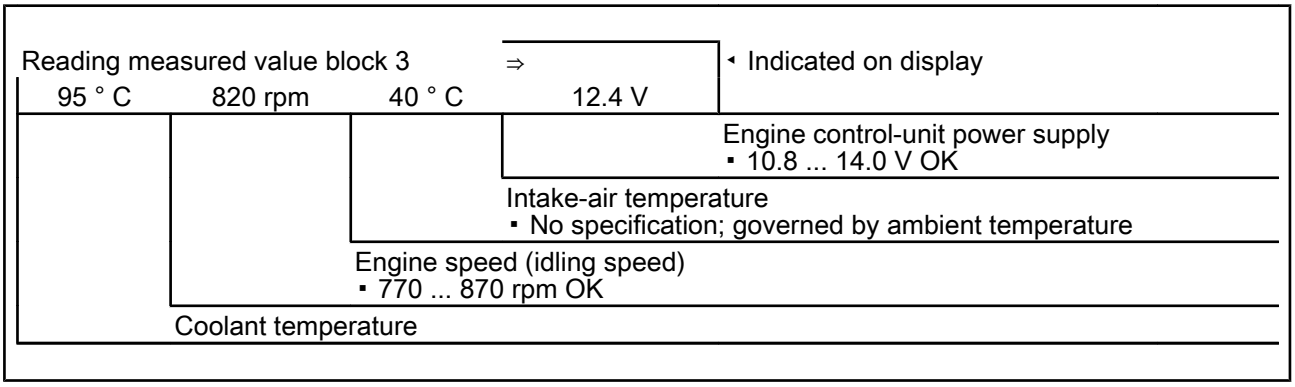
Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
		- Loads switched on, e.g. air conditioner on; steering wheel on full lock; selector lever of automatic gearbox not set to "P" or "N"	- Switch off all electr. loads Move steering wheel to centre position Move selector lever to position "P" or "N"

Note on display zone 2:

Engine load is calculated by way of intake manifold vacuum using air-flow meter signal.

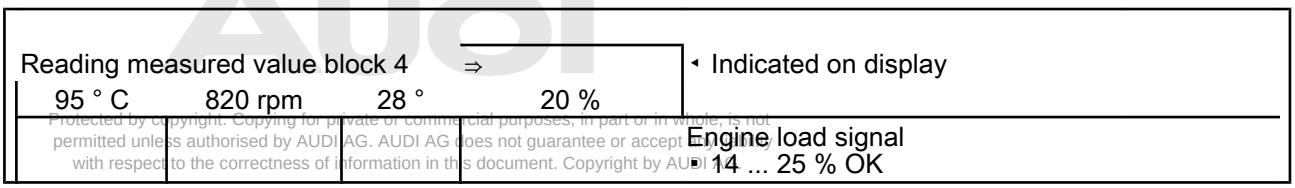
Display group 003



Test table: Display group 003

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
1	... ° C	Coolant temperature => Display group 001, display zone 1	
2	... rpm	Engine speed => Display group 001, display zone 2	
3	Different from ambient temperature	- Intake-air temperature sender - G42 defective - Fault in wiring between intake-air temperature sender -G42 and engine control unit	- Interrogate fault memory =>Page 119
4	Less than 10.8 V or Greater than 14.0 V	- Alternator defective - Battery flat (current draw)	- Check voltage
		- Poor earth connection to engine control unit - Power supply relay for engine control unit defective	- Check power supply =>Page 124

Display group 004



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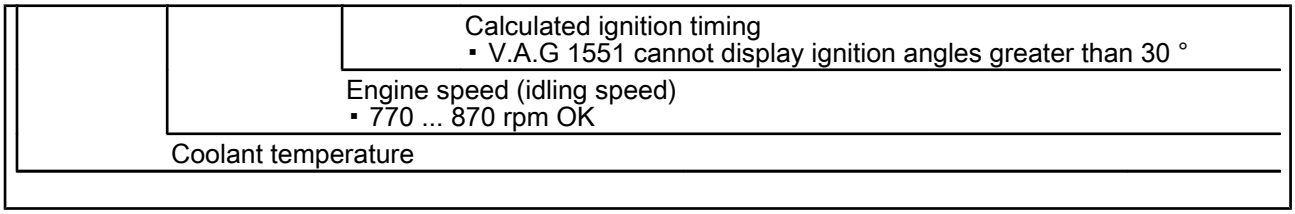
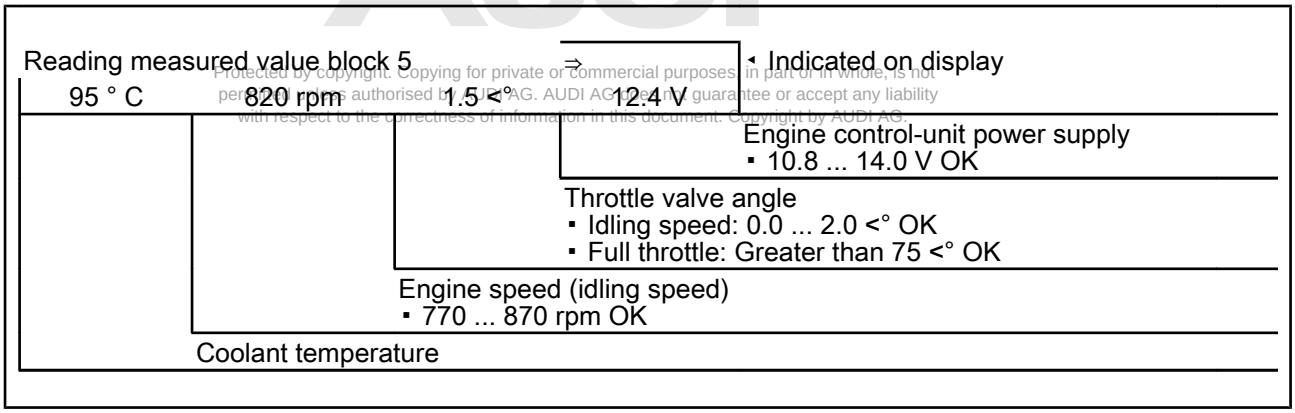


Test table: Display group 004

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
1	... ° C	Coolant temperature => Display group 001, display zone 1	
2	... rpm	Engine speed => Display group 001, display zone 2	
3	°	Ignition timing; V.A.G 1551 cannot display ignition angles greater than 30 °	
4	... %	Engine load signal => Display group 002, display zone 4	

Display group 005



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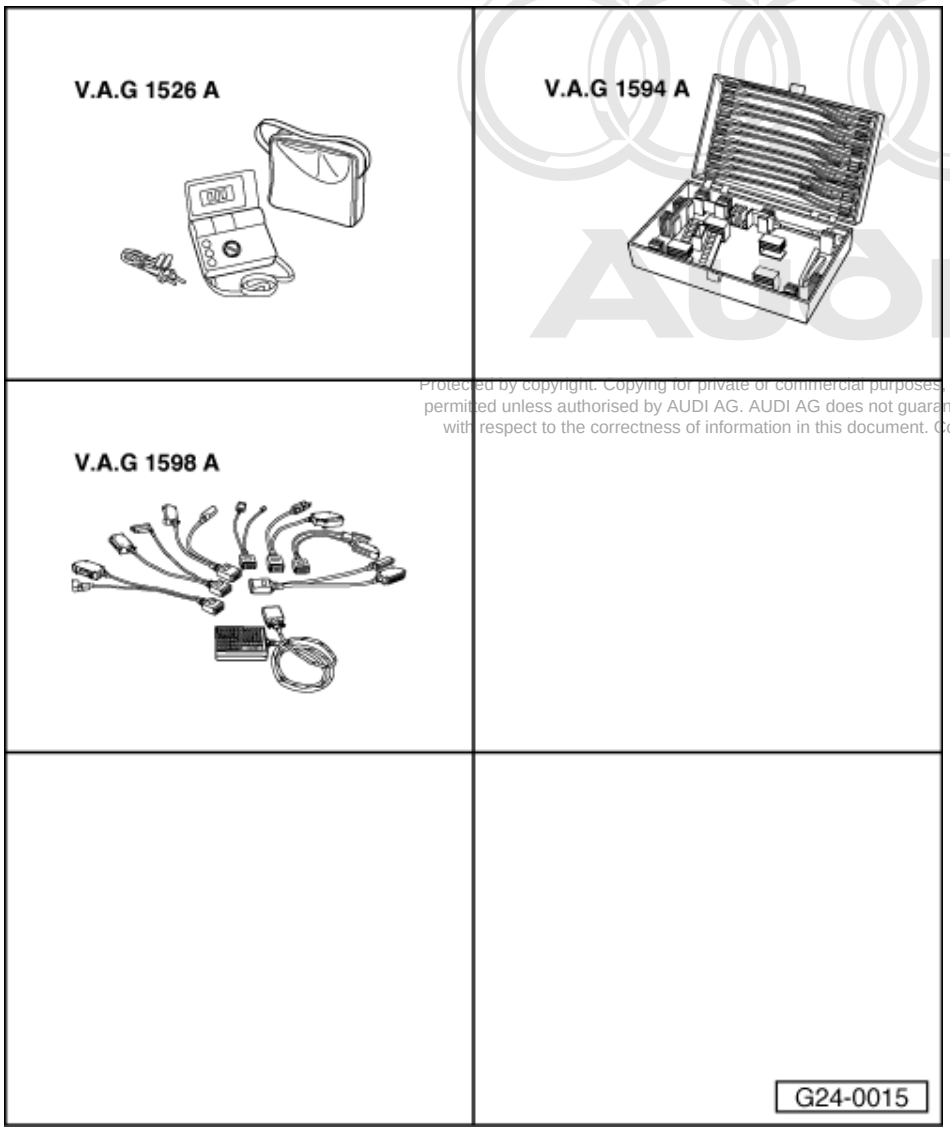
Test table: Display group 005

Display zone	Display on V.A.G 1551	Cause of trouble	Fault remedy
1	... ° C	Coolant temperature => Display group 001, display zone 1	
2	... rpm	Engine speed => Display group 001, display zone 2	
3	... <°	Throttle valve angle => Display group 002, display zone 3	
4	... V	Engine control-unit power supply => Display group 003, display zone 4	

7 - Checking wiring of diagnostic connectors

7.1 - Checking wiring of diagnostic connectors



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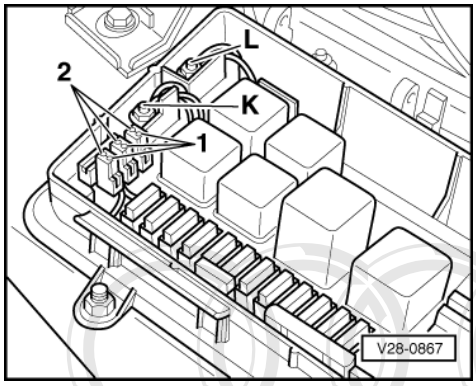
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Attention:
Switch off ignition before checking wiring.

7.2 - Checking power supply for "black" diagnostic connector



-> Installation position of diagnostic connectors: In relay plate with fuse box in plenum chamber

Contact assignment for "black" diagnostic connector:

1 - Earth
2 - Terminal 30 (fused via fuse 21)

- Connect up multimeter for voltage measurement as follows:

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Black diagnostic connector Contact	Measure to
1	Battery positive
2	Body earth

- Specification: approx. battery voltage in each case

If readings do not match specifications:

- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

7.3 - Checking wiring between "white" diagnostic connector and engine control unit

Note:

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

-> Indicated on display:

```
Rapid data transfer
Fault in communication link
```

or

```
Rapid data transfer     HELP
K-wire not switched to earth
```

or

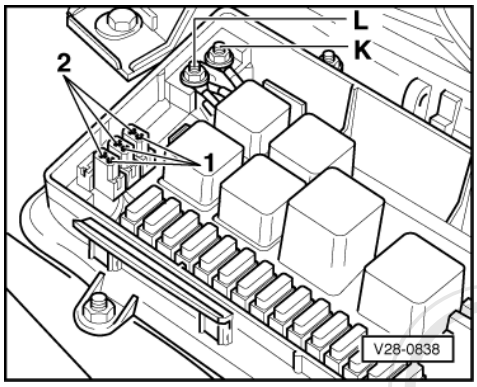
```
Rapid data transfer     HELP
K-wire not switched to positive
```

or

```
Rapid data transfer     HELP
L-wire not switched to earth
```

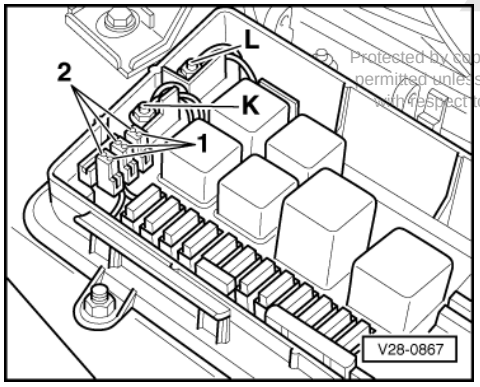
or

```
Rapid data transfer     HELP
L-wire not switched to positive
```



Wiring connection between "white" diagnostic connector and engine control unit is routed via wiring junctions K and L.

-> Installation position of wiring junctions K and Lä06.92: In relay plate with fuse box in plenum chamber



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-> Installation position of wiring junctions K and L07.92ä: In relay plate with fuse box in plenum chamber

Checking K and L-wires

Notes:

- Determine wiring colour if wires with different cable colours are connected to wiring junction K.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

- If wires of the same colour are connected to wiring junction K, use test box V.A.G 1598 A (resistance measurement) to establish wire.

In this case proceed as follows for fault-finding purposes:

- Consecutively disconnect wires of other vehicle systems with self-diagnosis from wiring junction K.
- After unplugging connector to one vehicle system in each case, switch on ignition and then enter address word "01" for engine electronics again.

If engine control unit identification is then displayed:

- After switching on ignition, enter address word "00" for automatic test sequence to establish the control unit to which the disconnected wire determined belongs.
- Check diagnostic wire of disconnected control unit/replace control unit.

If control unit identification is still not displayed:

- Remove engine control unit and engage it in service position => Page 42 .
- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .

- Check for open circuit and short to earth/positive in the following wiring.

White diagnostic connector Contact	Wiring junction	Test box V.A.G 1598 A Socket
1	L	17
2	K	36

- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

Note:

Proceed in the same manner to check L-wire.

7.4 - Checking wiring of encoding connector

The following test need only be performed if the correct code is not displayed by the fault reader V.A.G 1551 on encoding engine control unit although the correct procedure has been employed.

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .

Code 11

- Check for open circuit and short to earth/positive in the following wiring.

Encoding connector Contact	Test box V.A.G 1598 A Socket
1	21
2	22
5	20

- If necessary, eliminate short circuit.

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=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

Code 01

- Check for open circuit in the following wiring.

Test box V.A.G 1598 A	
Socket	Socket
20	21

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- Eliminate open circuit in wiring if necessary.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If wiring is OK, but fault reader V.A.G 1551 does not display correct code:

- Replace engine control unit => Page 41 .

24 - Mixture preparation, Injection

1 - Servicing Digifant injection system

1.1 - Servicing Digifant injection system

1.2 - Safety precautions

Attention:

Heed the following so as to avoid possible injury and/or the destruction of the injection and ignition system:

- Never touch/disconnect ignition cables with engine running or at cranking speed.
- Always switch off ignition before disconnecting and connecting ignition system wires (also applies to H.T. wires and measuring instrument leads).
- If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from output stage for ignition coil and injectors. Interrogate fault memory on completion of work.

- Boost starting with rapid charger is only permitted for up to 1 minute at a maximum of 16.5 V.
- Always switch off ignition before washing engine.
- Always switch off ignition before disconnecting and connecting battery so as not to damage engine control unit.
- For connection of measuring instruments (e.g. voltage tester V.A.G 1527 B, portable multimeter V.A.G 1526 A), always make use of adapter set V.A.G 1594 A.

Pay attention to the following if testers and measuring instruments have to be used in the course of a test drive on vehicles fitted with front passenger's airbag.

Attention:
- **Always attach testers and measuring instruments to back seat and have them operated from there by a second person.**
- **If testers and measuring instruments were to be operated from front passenger's seat, person sitting there could suffer injury in the event of an accident due to triggering of front passenger's airbag.**

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1.3 - Rules for cleanliness

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

- Carefully clean all joints and adjacent areas before disconnecting.
- Place parts removed on a clean surface and cover them over. Do not use fluffy cloths.
- Carefully cover or seal opened components if repairs are not to be performed immediately.
- Only install clean components:
  Do not remove replacement parts from wrapping until immediately prior to installation.
  Do not use parts that have been stored loose (e.g. in tool boxes).
- When system is open:
  Do not work with compressed air if at all possible.
  Do not move vehicle unless absolutely necessary.
- Unplugged connectors:
  Protect against dirt and damp.

Only connect when dry.

1.4 - Technical data

Engine codes			ABK (2.0 l / 85 kW engine)
Digifant control unit	Part no.		=>Parts List
	Speed governing	rpm	6400 ... 6500
Idling-speed setting	Idling speed	rpm	770 ... 870 1)
	CO content at measurement pipe	% by vol.	0.6 + 0.4
	Workshop more than 300 m above sea level plus	% by vol.	0.2 for every additional 100 m above sea level
Fuel pressure regulator	Fuel pressure at idle		
	Vacuum hose	Connected	approx. 2.5 bar
		Disconnected	approx. 3.0 bar
	Holding pressure	After 10 min.	min. 2.0 bar
Injectors	Spray pattern		Same for all injectors
	Resistance in ω		
	Manufacturer	Bosch	15 ... 17
		Siemens	13.5 ... 15.5

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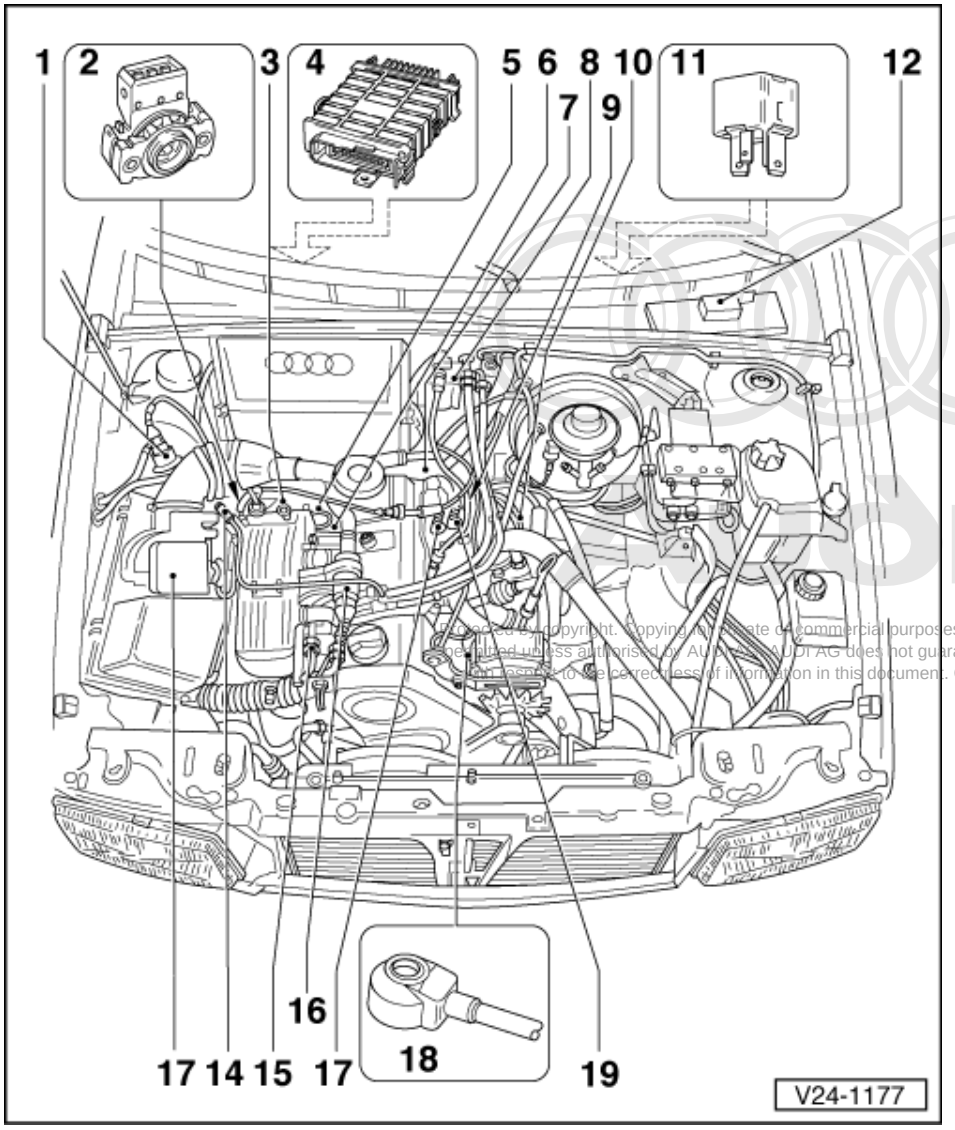
1) Current values:

=> Exhaust emission test binder

1.5 - Exploded view of fitting locations



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1 **Activated charcoal filter solenoid valve -N80**
- Checking => Page 10

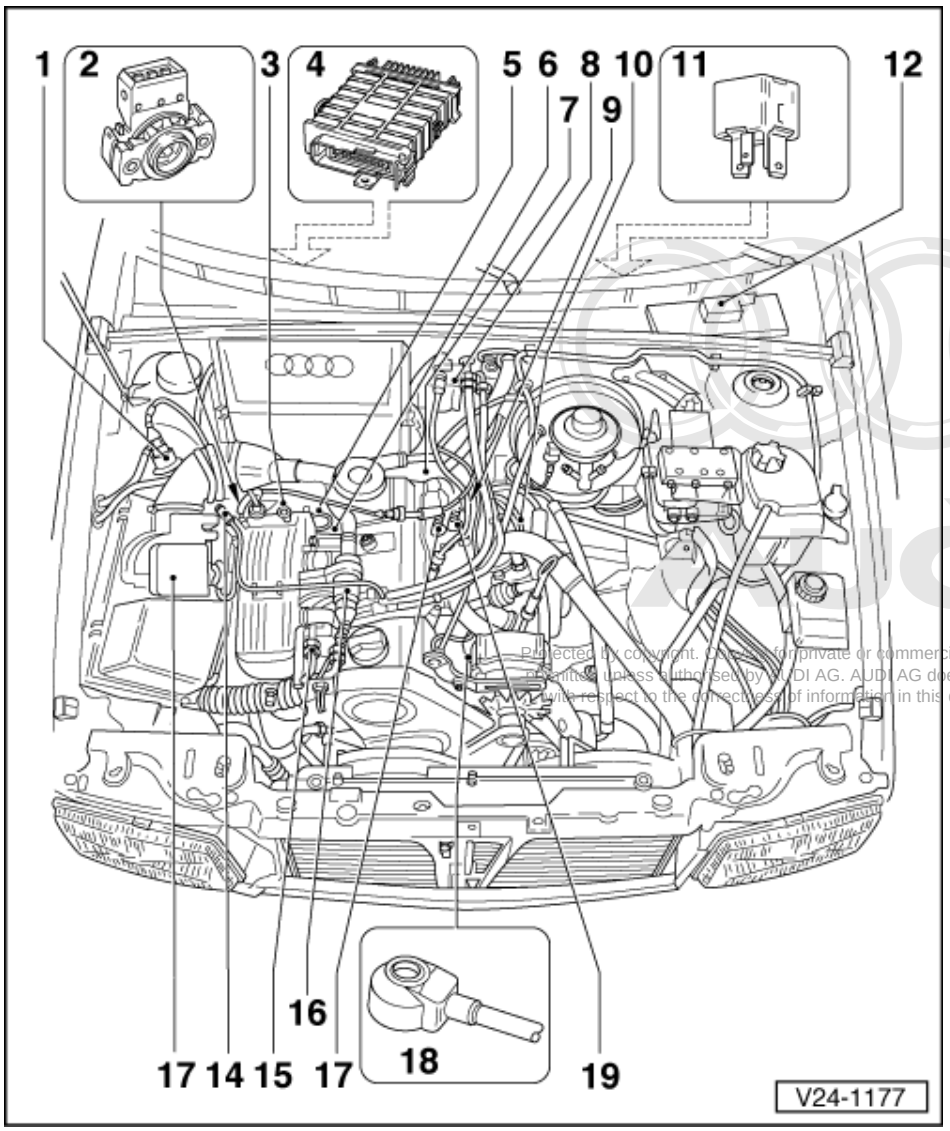
2 **Throttle valve potentiometer -G69**
- Checking => Page 89

3 **Throttle valve assembly**

4 **Digifant control unit -J169**
- Between bulkhead and air duct in passenger's footwell

5 **Fuel pressure regulator**

6 **Connector**
- For pipe guide of injectors



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7 Connector

- For knock sensor 1 -G61

8 Ignition transformer -N152

- With output stage for ignition transformer

9 Ignition distributor -O

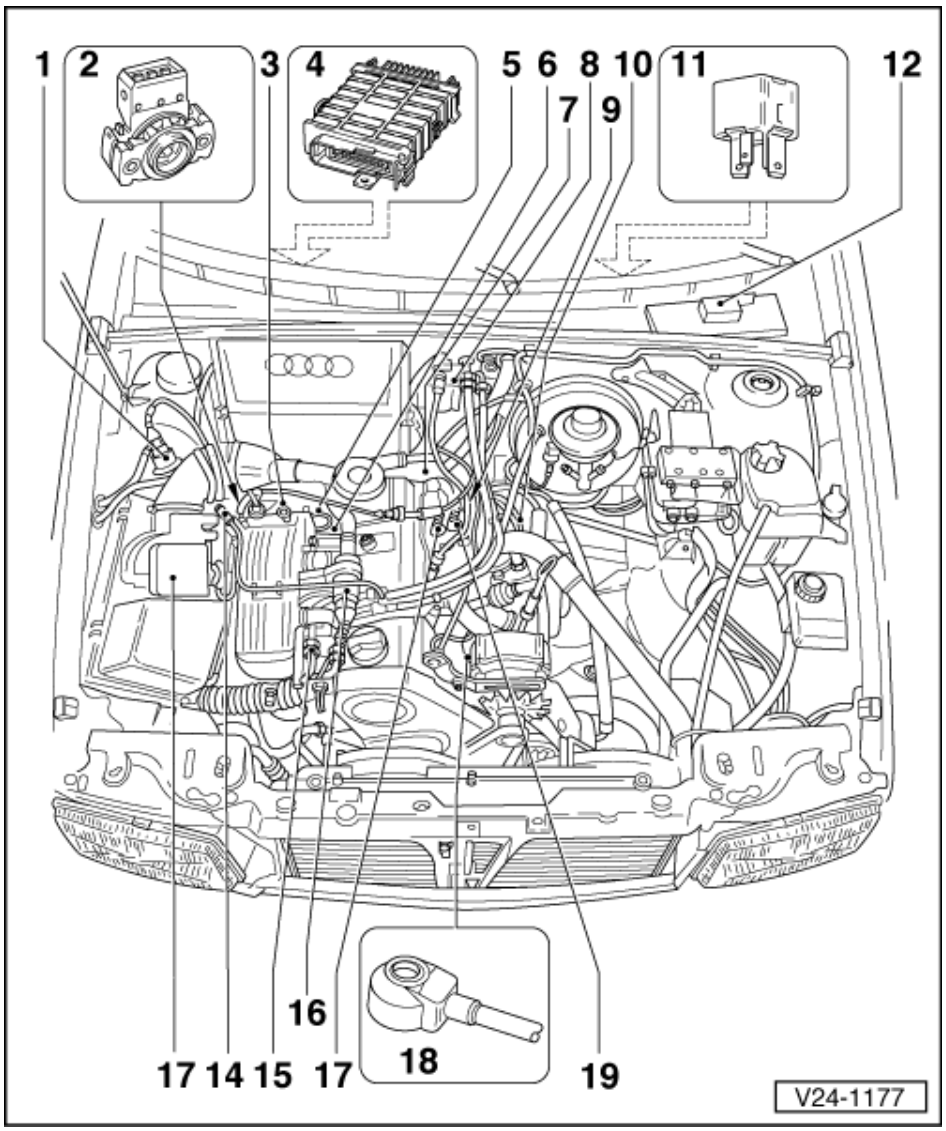
- With Hall sender -G40

10 Connector

- For Lambda probe -G39 and Lambda probe heater -Z19

11 Current supply relay for Digifant control unit -J176

- For Digifant control unit
- On auxiliary relay carrier at front left beneath dash panel, position 14



12 Relay plate with fuse box

- With diagnostic connections
- With fuel-pump relay -J17, position 10

13 Air flow meter potentiometer -G19

- With intake-air temperature sender -G42
- Checking =>Page 74

14 Cold start valve -N17

- Not always fitted
- Heed engine control unit encoding => Page 13
- Checking => Page 63

15 Injectors -N30 ... -N33

- With noise insulation
- Checking => Page 50

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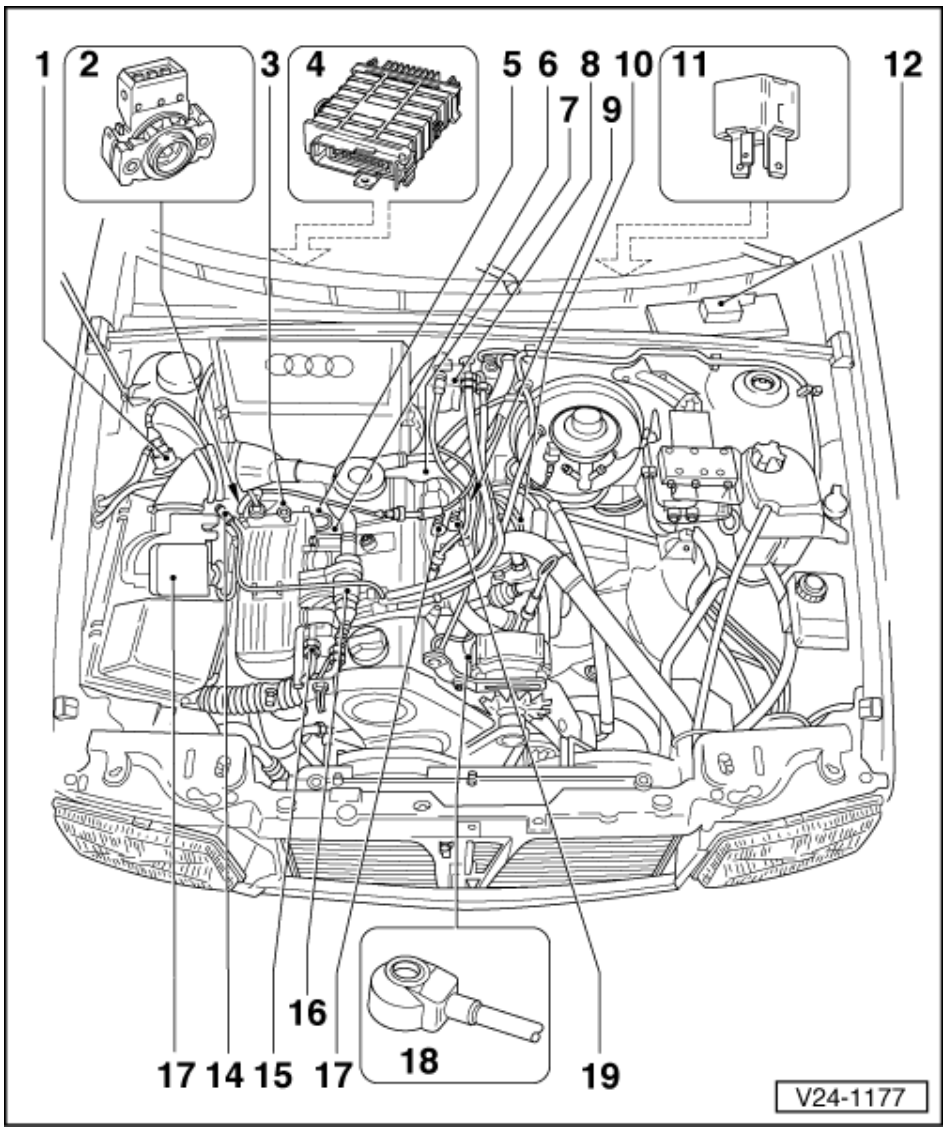

16 Idling-speed stabilisation valve -N71

- Checking => Page 63

17 Coolant temperature sender -G2

- 3-pin
- With coolant-temperature warning switch (overheating) -F14

18 Knock sensor 1 -G61

19 Coolant temperature sender -G62

- 2-pin
- Resistance values => Page 121

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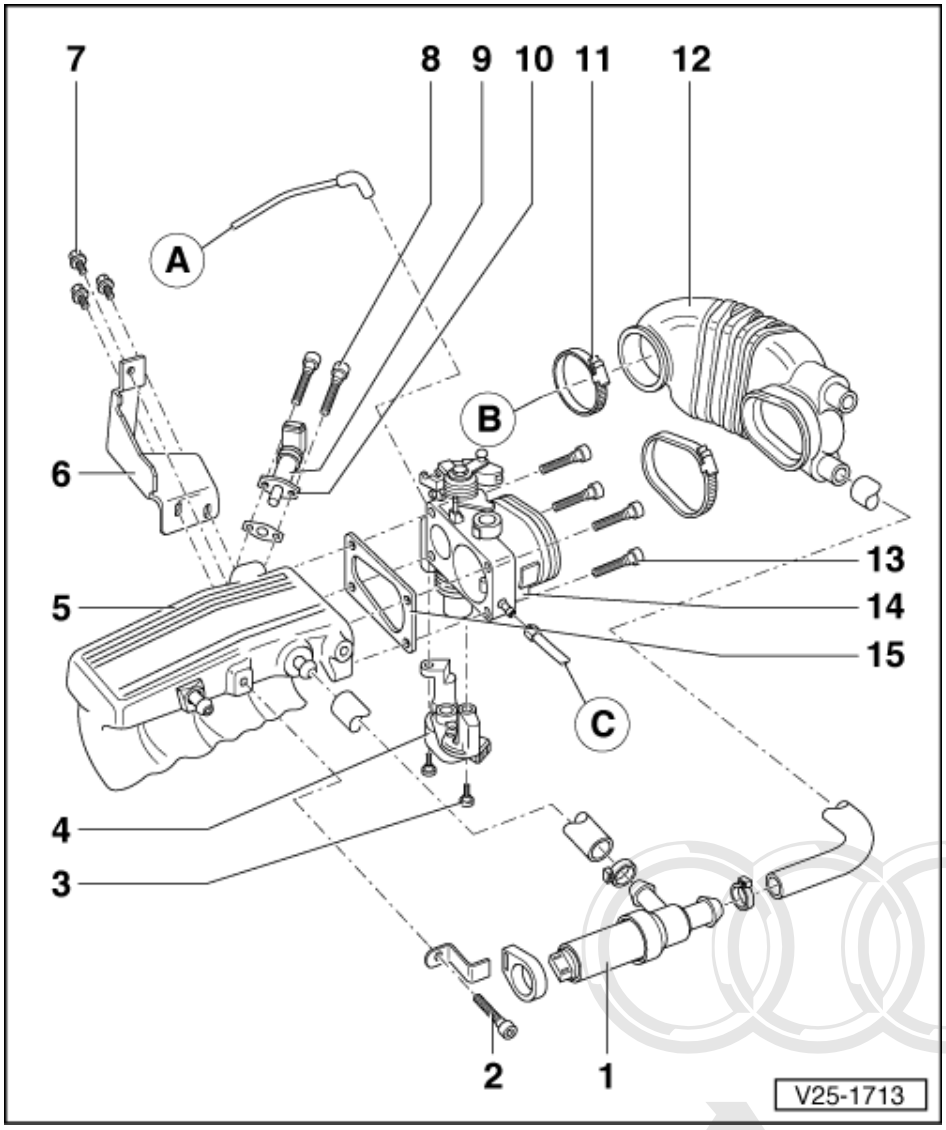
1.6 - Removing and installing injection system components



A - => Page 38
B - => Page 38
C - => Page 48

1 Idling-speed stabilisation valve -N71
- Checking => Page 63

2 10 Nm

3 10 Nm

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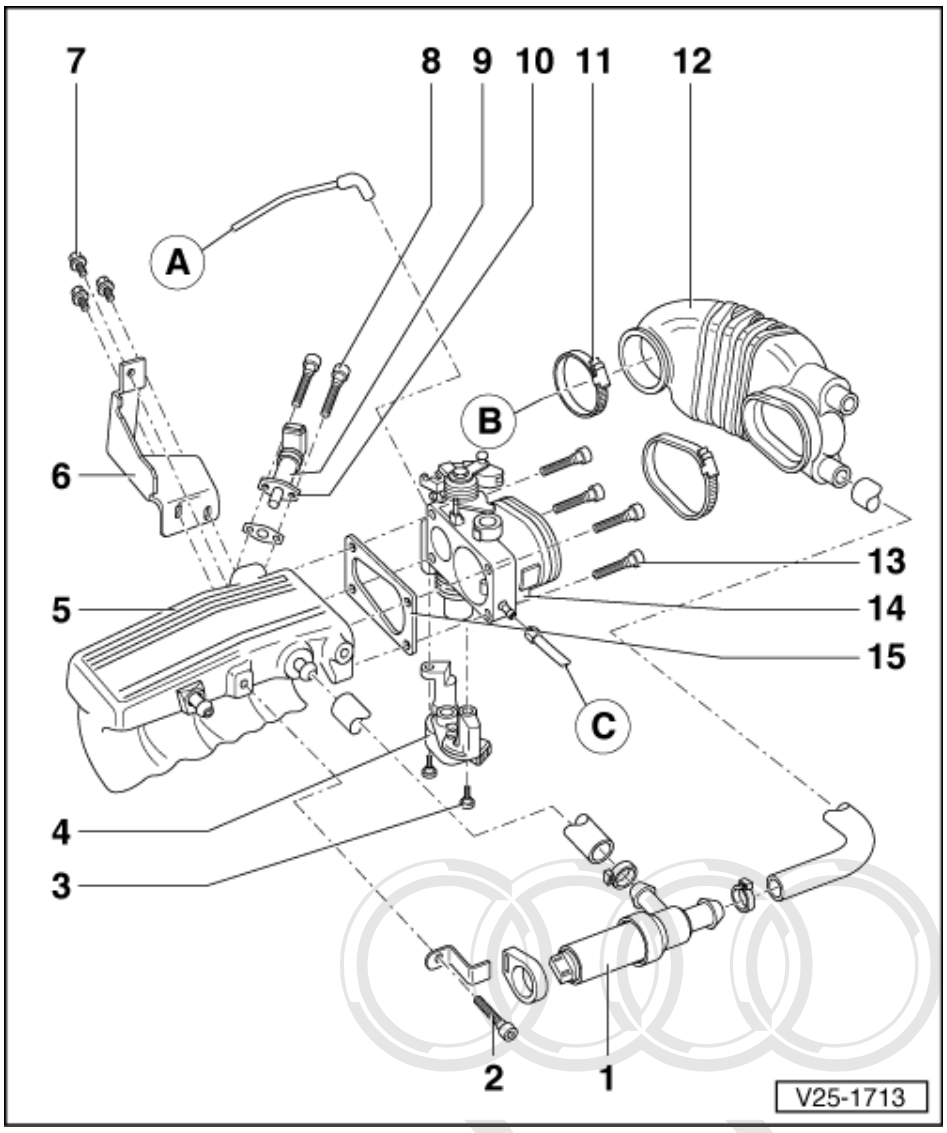

4 Throttle-valve potentiometer -G69

- With holder
- Checking => Page 89
- Following replacement:
  Matching Digifant control unit and throttle-valve potentiometer => Page 92

5 Intake manifold

6 Heat shield

7 10 Nm

8 10 Nm

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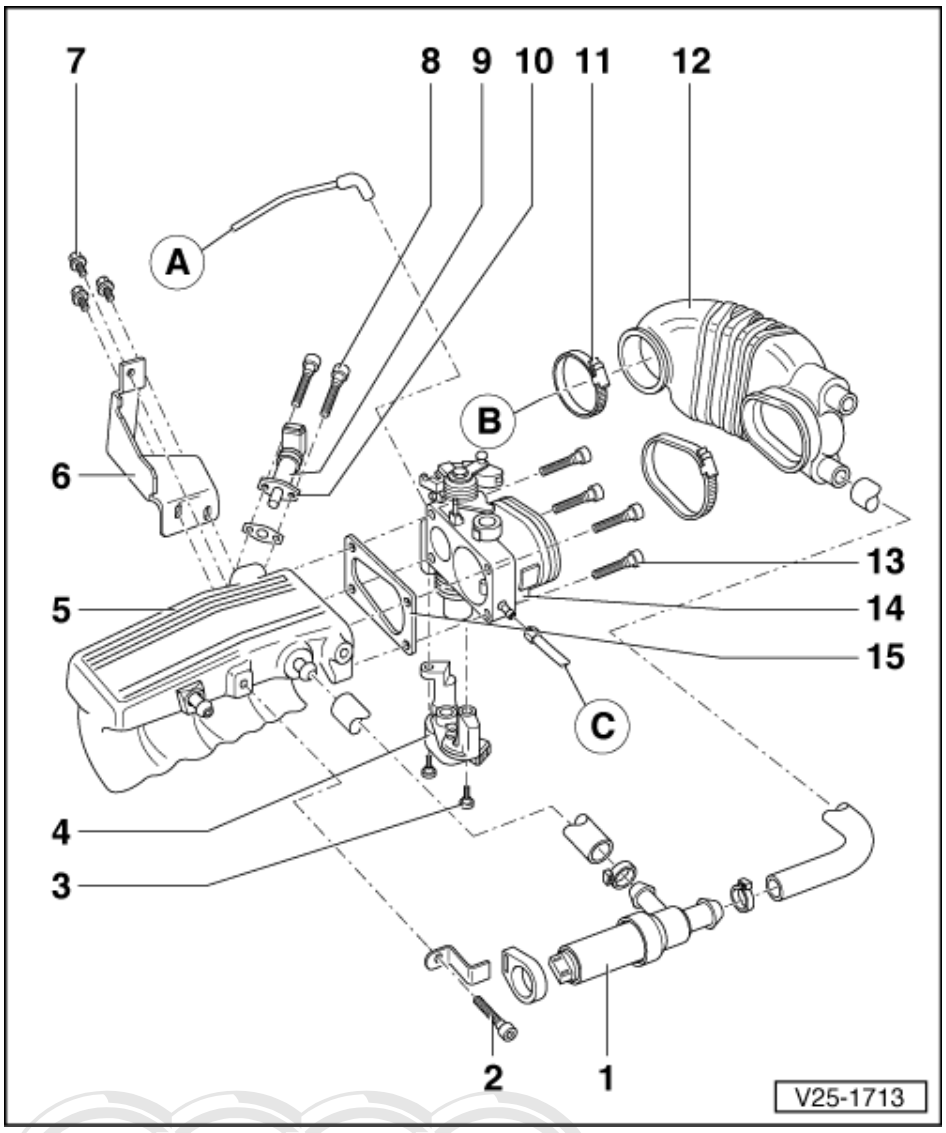

9 Cold start valve -N17

- Not always fitted
- Heed engine control unit encoding => Page 13
- Checking => Page 63

10 Gasket

- Replace

11 Clamp

12 Intake hose

13 25 Nm

14 Throttle valve unit

15 Gasket

- Replace

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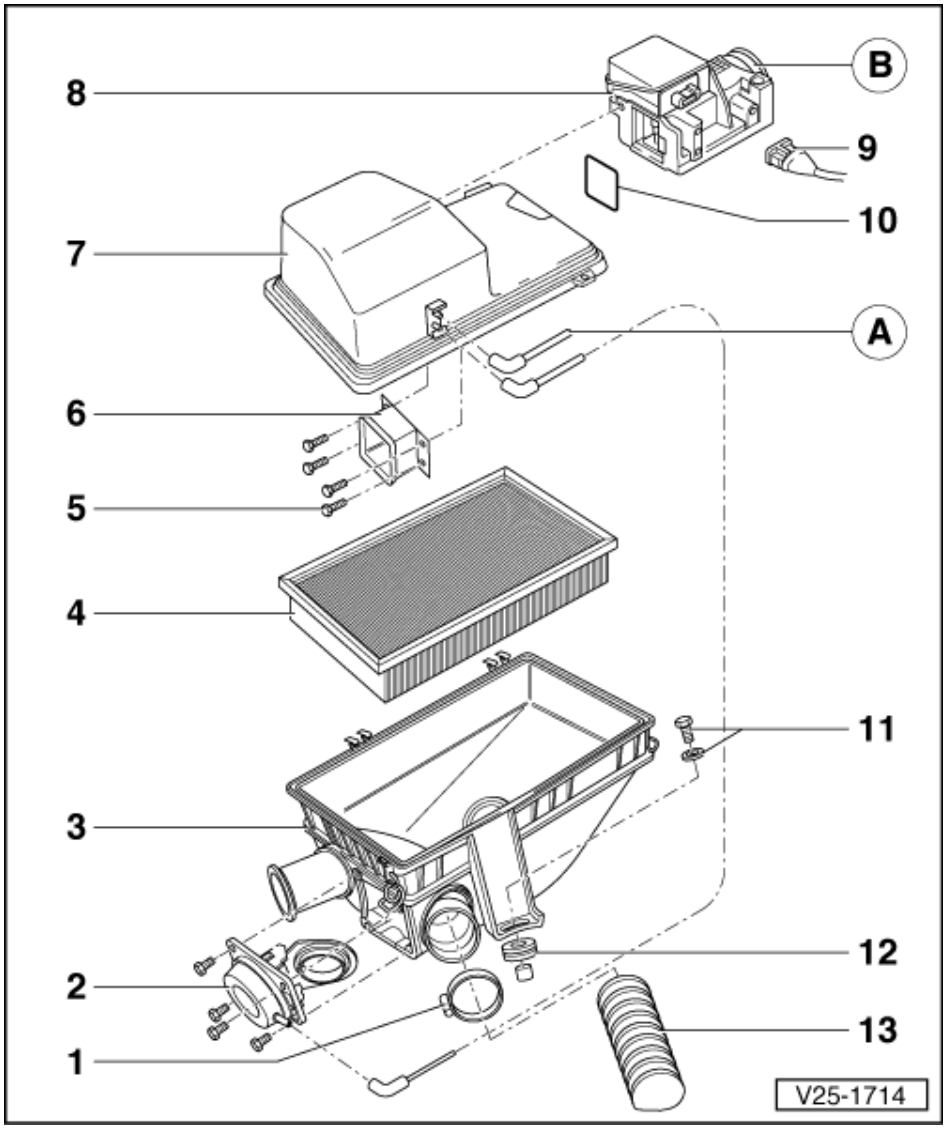
1.7 - Dismantling and assembling air cleaner



A - => Page 35
B - => Page 35

1 Clip
2 Vacuum unit
- Checking => Page 94

3 Lower part of air cleaner
4 Filter element
5 5 Nm
6 Air duct
7 Upper part of air cleaner

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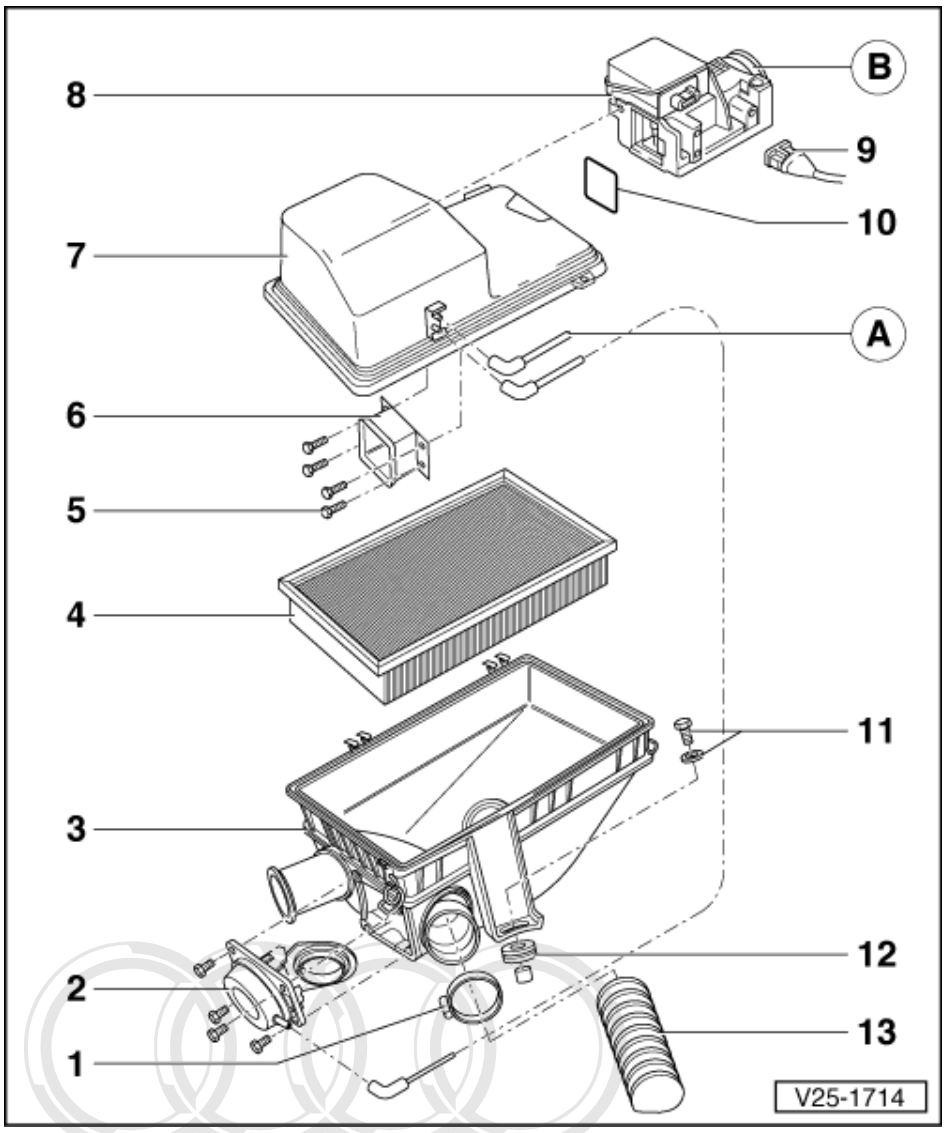

8 Air flow meter potentiometer -G19
- With intake-air temperature sender -G42
- Checking =>Page 74

9 Connector

10 Rubber seal

11 20 Nm

12 Rubber disc
- With bush

13 Hose
- To exhaust manifold

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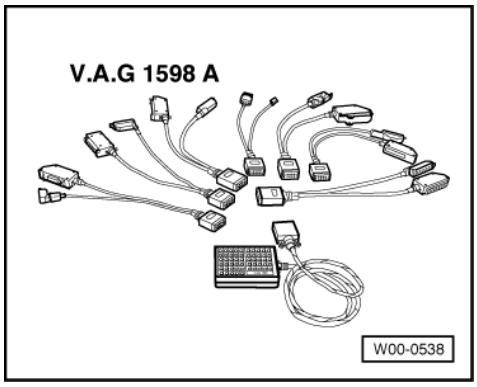
1.8 - Wiring and component check with test box V.A.G 1598 A and adapter 1598/9

Special tools and workshop equipment required



- Test box V.A.G 1598 A with adapter V.A.G 1598/9

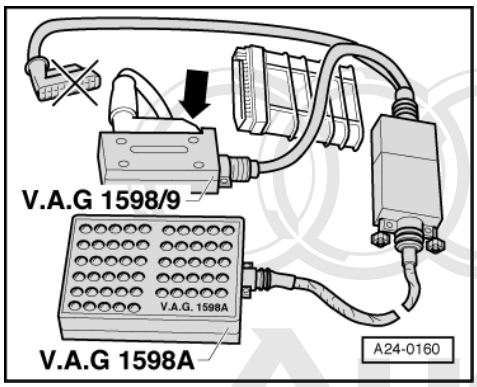
Notes:

- Always switch off ignition before disconnecting or connecting engine control unit connector.
- Test box V.A.G 1598 A is not to be connected during diagnosis using fault reader V.A.G 1551.
- For connection of measuring instruments (e.g. voltage tester V.A.G 1527 B, portable multimeter V.A.G 1526 A), always make use of adapter set V.A.G 1594 A.

Attention:
So as not to destroy electronic components, select required measuring range before connecting test leads and observe test conditions.

Sequence of operations

- Switch off ignition.



- Remove engine control unit and engage it in service position => Page 42 .

-> Checks at engine control-unit connector

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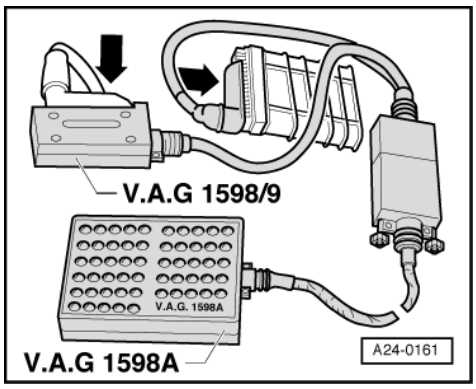
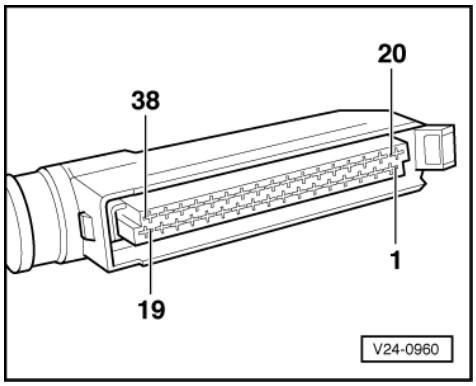
- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit).



-> Checks with engine control unit connected

- Additionally connect test box V.A.G 1598 A to control unit using adapter V.A.G 1598/9.

Notes:



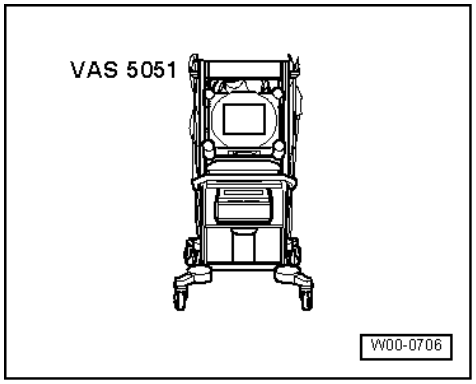
- -> Contact assignment at connector of Digifant control unit -J169.
- Contact assignment is identical to socket assignment of test box V.A.G 1598 A.

- Perform testing as described in appropriate repair operations.

1.9 - Replacing engine control unit

Fitting location => Exploded view of fitting locations - Page 31

Special tools and workshop equipment required



- VAS 5051 with VAS 5051/1 and VAS 5051/2

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or

- V.A.G 1551 with V.A.G 1551/1

Removing

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Ignition must be on.

-> Fault reader V.A.G 1551 displays control unit identification (example).

```
039906022    Digifant    1.6    1003
□
Code 11
```

- Always start by displaying control unit identification and printing it out => Page 3 .
- Switch off ignition.

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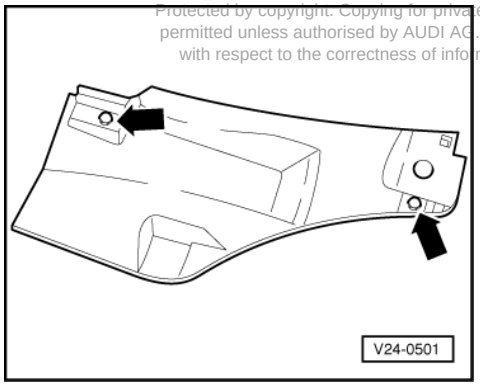
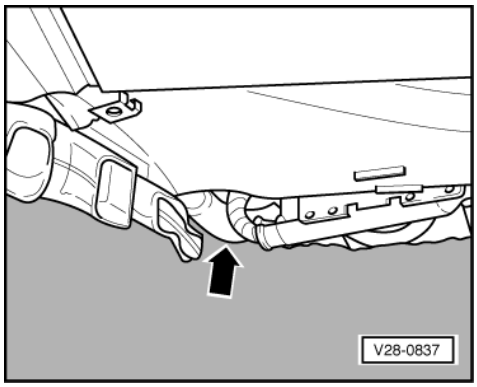
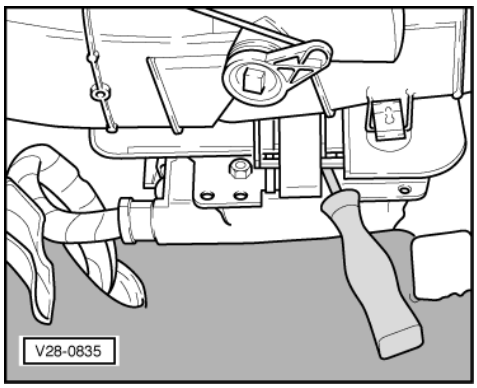


- -> Remove cover beneath glove box -arrows-.
- Unscrew plastic clip for cover.



- -> Pull off condensate hose -arrow- on vehicles with air conditioner.



- -> Insert screwdriver next to retainer between control-unit mounting plate and plastic slot.
- Turn screwdriver if necessary to disengage retainer tabs at mounting plate above retainer from plastic slot recess.
- Pull down control unit slightly and remove screwdriver.
- Pull down control unit 3 ... 4 cm. In this position, control unit engages in a second recess (service position).
- Disconnect control-unit plug after releasing clip.

Notes:

- Connector of engine control unit is only to be unplugged or attached 30 seconds after switching off ignition.
- In service position, test box V.A.G 1598 A can be connected with adapter V.A.G 1598/9 for measurement and test purposes to engine wiring harness.

Note:

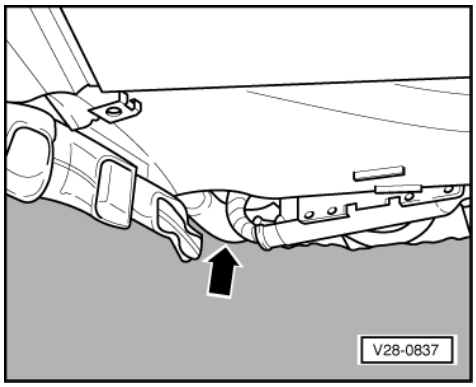
The following operations are only necessary if the control unit is to be completely removed.

- Unfasten catch as described and carefully pull control unit downwards out of slot.
- To remove control unit on vehicles with air conditioner, carefully press detached condensate drain hose aside so that side flange of control unit does not damage drain hose.

Installing

Notes:

- Connector of engine control unit is only to be unplugged or attached 30 seconds after switching off ignition.



- -> On vehicles with air conditioner, check whether condensate drain hose -arrow- has been connected before installing cover beneath glove box.

- If necessary, encode control unit => Page 13 .
- Perform basic setting => Page 12 .
- On vehicles with automatic gearbox, automatic gearbox control unit and throttle valve potentiometer must also be matched => Page 92 .

1.10 - Checking idling speed

Notes:

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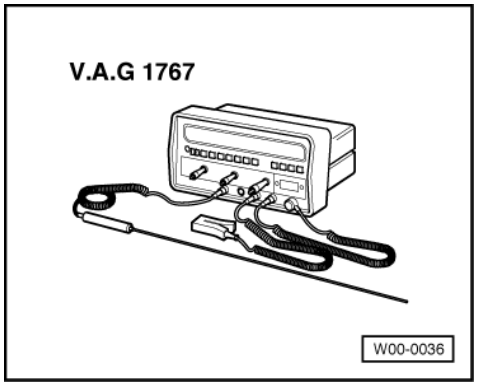
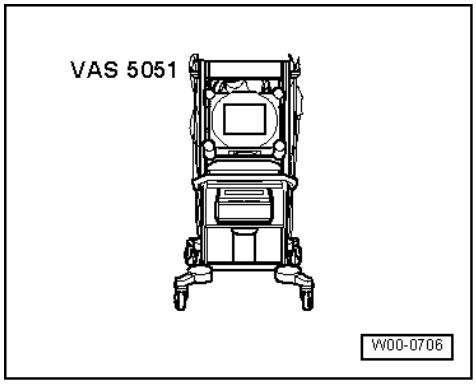
- Idling speed cannot be adjusted.
- Idling speed is checked during basic setting of engine.
- Basic setting function matches Digifant control unit at idling speed to throttle valve potentiometer. Ignition point adjustment is deactivated.

Special tools and workshop equipment required



- Ignition tester V.A.G 1767 or V.A.G 1367 with clip-on trigger V.A.G 1367/8



- VAS 5051 with VAS 5051/1 and VAS 5051/2

  or

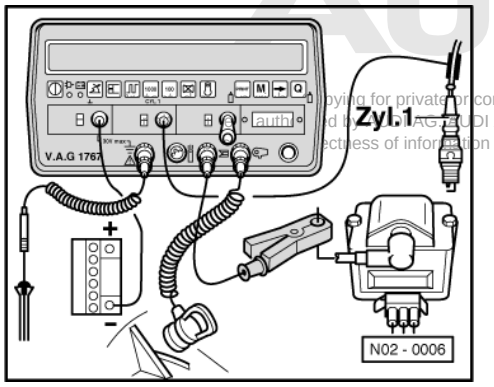
- V.A.G 1551 with V.A.G 1551/1

Test requirements:

- Coolant temperature at least 85 °C
- Electr. loads switched off (radiator fan must not run during test)
- Air conditioner switched off
- Vehicles with automatic gearbox: Selector lever set to P or N
- No leaks in exhaust system
- Throttle cable correctly adjusted

=> Fuel Supply System - Petrol Engines; Repair Group 20; Servicing accelerator mechanisn; Adjusting throttle cable Servicing accelerator mechanisn Adjusting throttle cable

Test sequence



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- -> With ignition switched off, connect up ignition tester V.A.G 1767 (or V.A.G 1367).

=> Operating instructions

Notes:

- Take particular care to ensure that TDC sender of ignition tester V.A.G 1367 is fully inserted in gearbox housing.
- Ignition point is displayed directly on V.A.G 1767 (or V.A.G 1367). There is no need to aim timing light at ignition point notches.

- Connect vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G 1551 and select engine electronics control unit with "address word" 01 => Page 1 .
  Engine must be idling.
- Interrogate fault memory => Page 4 . There must not be any faults stored. If necessary, eliminate fault, erase fault memory, switch off and re-start engine, perform test drive and re-interrogate fault memory as a check.
- Leave engine idling.

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

  -> Start basic setting, display group 000=>Page 12 .
- Maintain engine speed at 2000 ... 2500 rpm and read off ignition point on ignition tester V.A.G 1767 (or V.A.G 1367).
  - Test specification: 4 ... 8° before TDC

Note:

If ignition point displayed is outside tolerance, it must be adjusted prior to checking idling speed whilst system is still set to "Basic setting".

- Adjust ignition point by turning ignition distributor at 2000 ... 2500 rpm.
  -Setting 6 ±1°

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- Leave engine idling for at least 1 minute.
- Exit from basic setting by pressing ⇒key. Electric radiator fan must not run.

- Read off idling speed on ignition tester V.A.G 1767 (or V.A.G 1367).
  - Specification: 770 ... 870 rpm 1)

  1) Current values:

=> Exhaust emission test binder

-> Indicated on display:

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

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

If reading does not match specification:

- Interrogate fault memory again =>Page 4 .

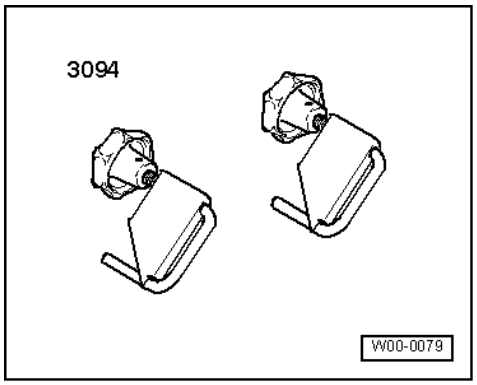
Perform the following tests if idling speed is too high/too low and no faults have been stored in the fault memory:

- Check intake system for leaks (unmetered air) => Page 103 .
- Check idling-speed stabilisation valve => Page 63 .

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

Note:
The fuel pressure regulator controls the fuel pressure as a function of the intake manifold pressure at the throttle valve unit.

Special tools and workshop equipment required

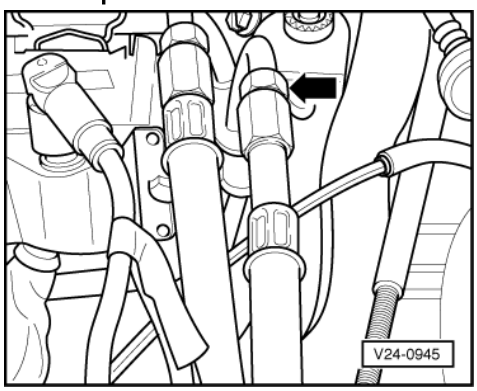


- V.A.G 1318 with V.A.G 1318/7 and V.A.G 1318/15

Test requirements:
- Fuel pump relay OK; checking => Page 59
- Fuel pump OK; checking

=> Fuel Supply System - Petrol Engines; Repair Group 20; Fuel Supply Fuel Supply
- Battery voltage at least 11 V

Test sequence



Attention:

- -> Unfasten bolted joint -arrow- of fuel supply pipe.

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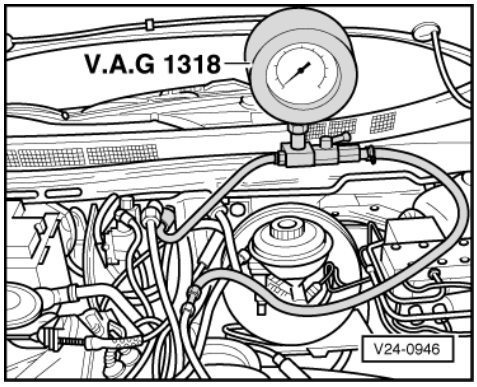


- -> Connect pressure gauge V.A.G 1318 with adapters V.A.G 1318/7 and V.A.G 1318/15 to fuel supply pipe .

Note:

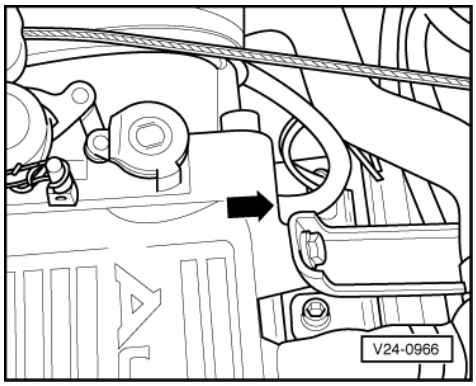
Cut-off valve of pressure gauge must be open (lever in direction of flow).

- Start engine and let it idle.

- Measure fuel pressure.
  - Specification: approx. 2.5 bar

Note:

If fuel pressure is not built up, check whether fuel supply and return pipes have been interchanged.



- -> Pull off vacuum hose at fuel pressure regulator.
  - Fuel pressure must increase to approx. 3.0 bar
- Switch off ignition.
- Check freedom from leaks and holding pressure by way of pressure drop on pressure gauge.
  - After 10 minutes pressure must still be at least 2 bar

If holding pressure drops below 2 bar:

- Start engine and let it idle.
- Following pressure build-up, switch off ignition and at the same time pinch off hose of return pipe at fuel rail.

- Observe drop in pressure on gauge.

If pressure does not decrease:

- Replace fuel pressure regulator.

Possible faults if pressure decreases again:

- Pipe connections/O-rings at fuel rail leaking
- Injectors leaking
- Cold start valve leaking
- Non-return valve in fuel pump leaking

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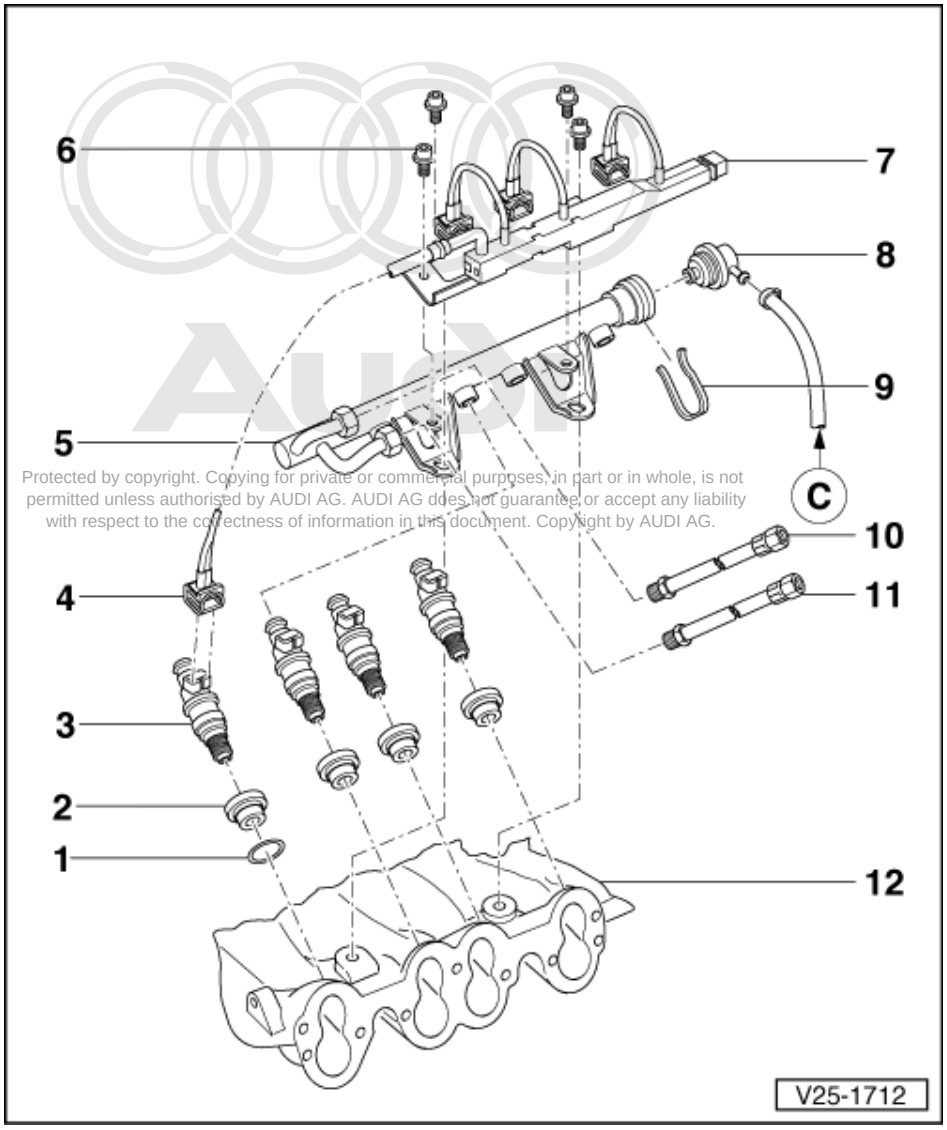
=> Fuel Supply System - Petrol Engines; Repair Group 20; Fuel Supply Fuel Supply

Note:

Drain fuel at measuring device before detaching pressure gauge.

1.12 - Dismantling and assembling fuel rail with injectors



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C - => Page 35

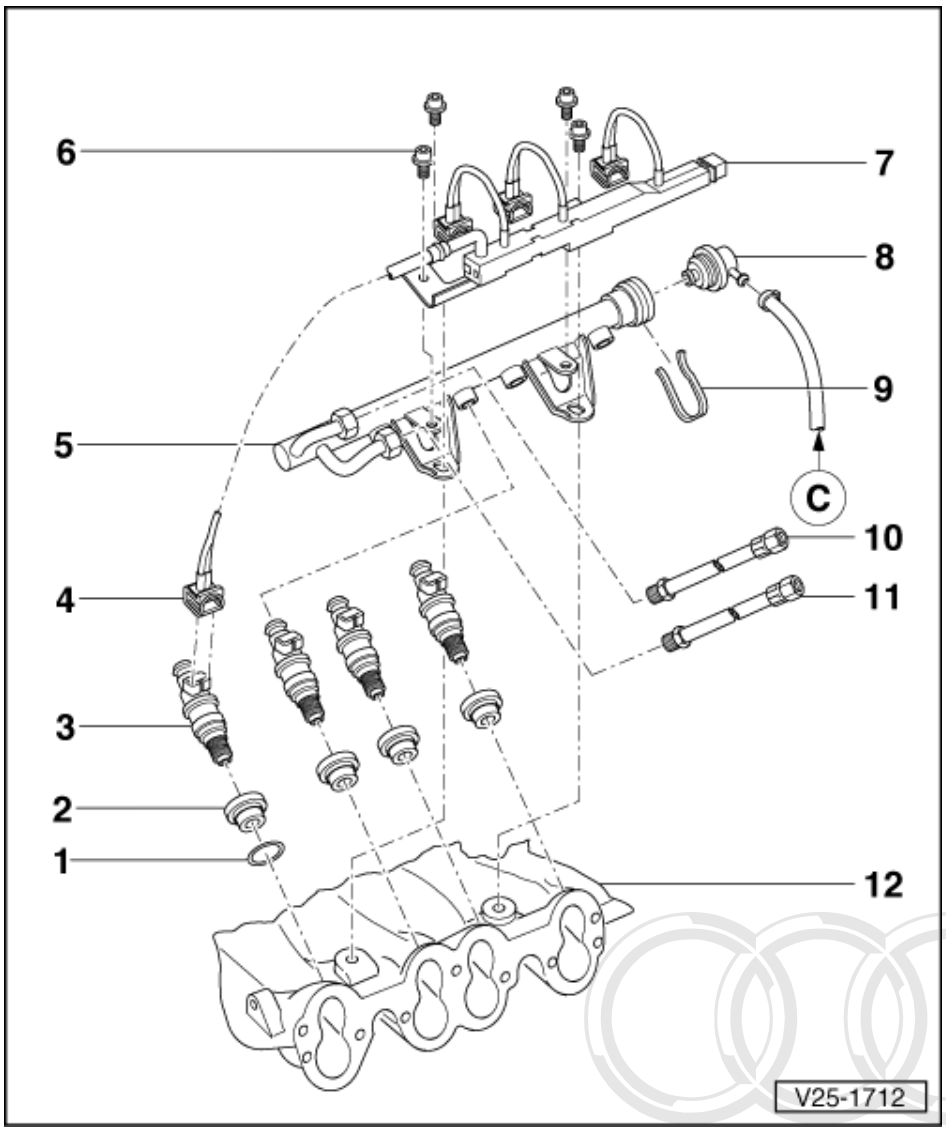
1 **O-ring**
- Replace if damaged

2 **Nozzle insert**

3 **Injectors -N30 ... -N33**
- Checking => Page 50
- Removing and installing=>Page 54

4 **Connector**
- Switch off ignition before unplugging or attaching connector

5 **Fuel rail**
- Removing and installing => Removing and installing injectors, Page 54



6 10 Nm
7 Pipe guide
- For injectors

8 Fuel pressure regulator
- Checking system pressure, fuel pressure regulator and holding pressure => Page 46

9 Clip
10 Return pipe
- Tighten to 25 Nm

11 Supply pipe
- Tighten to 25 Nm

12 Intake manifold

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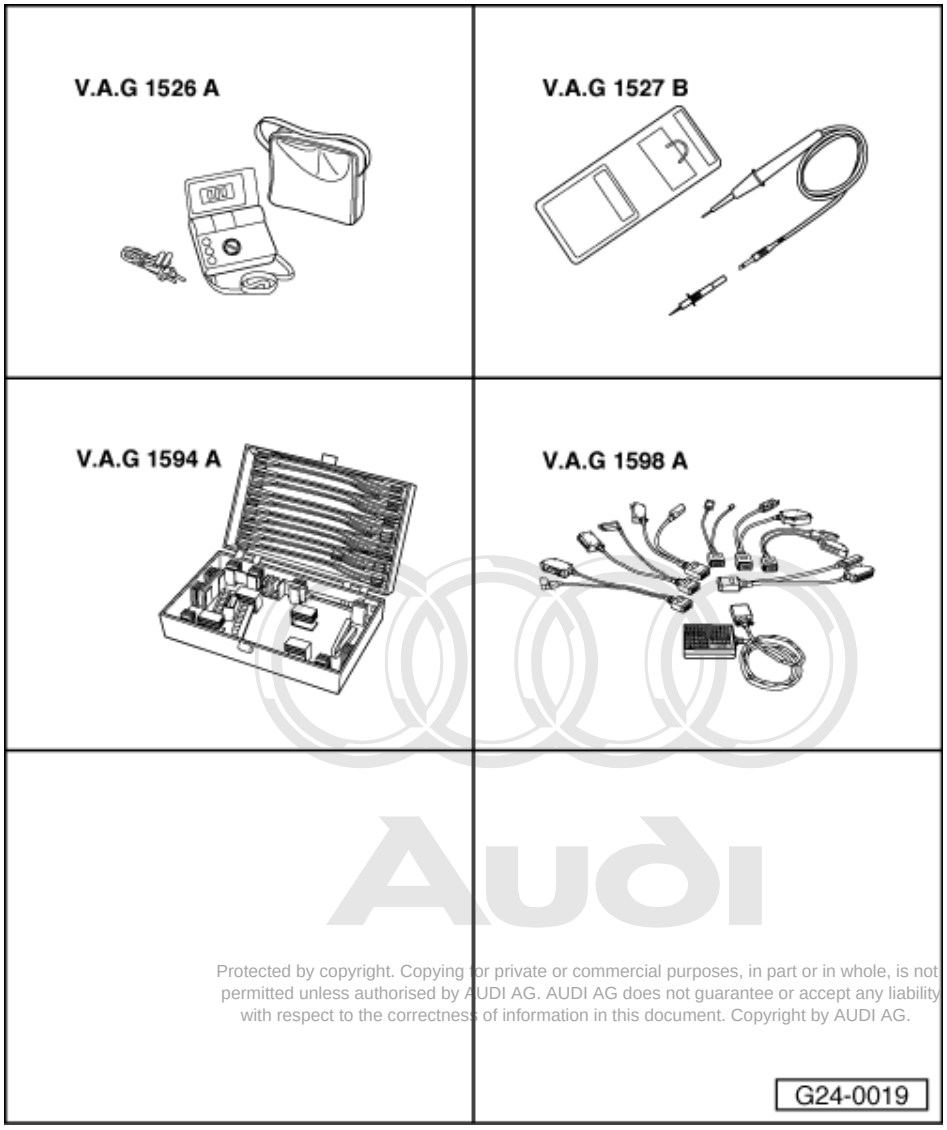
1.13 - Checking injectors



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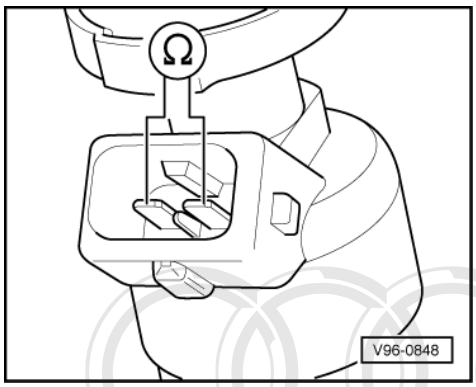
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Checking internal resistance

- Unplug connector at injector to be checked.



- -> Connect multimeter to injector for resistance measurement.
  - Specification
    Bosch injector: 15 ... 17 ω
    Siemens injector: 13.5 ... 15.5 ω

If reading does not match specification:

- Replace injector => Page 54 .

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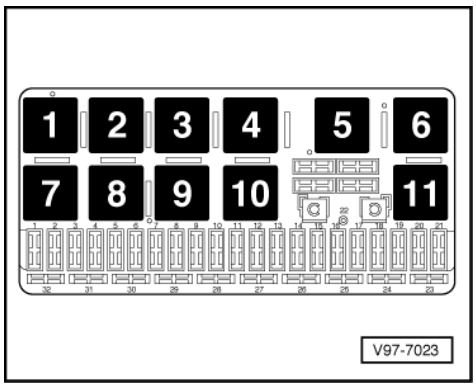
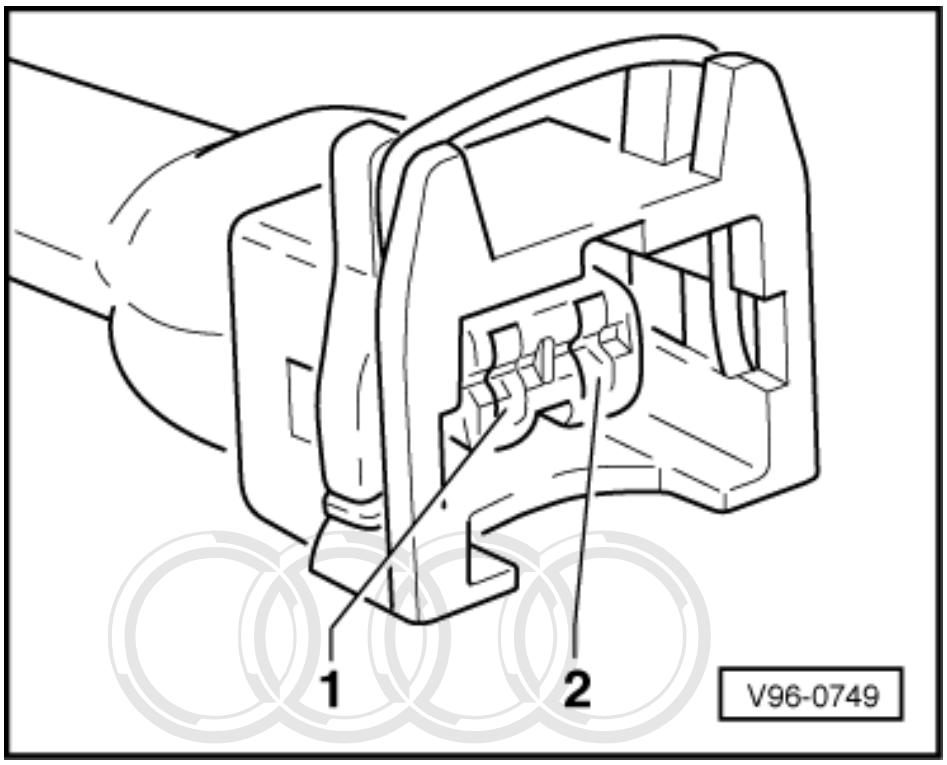
Checking power supply

Test requirements:



- -> Fuse S28 OK (in fuse box)
- Fuel pump relay OK; checking => Page 59

- If fitted, unplug connector at cold start valve.
- Unplug connector at injector to be checked.



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

Connector Contact	Measure to
1	Engine earth

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- Briefly operate starter.
  - LED must light

If LED does not light:

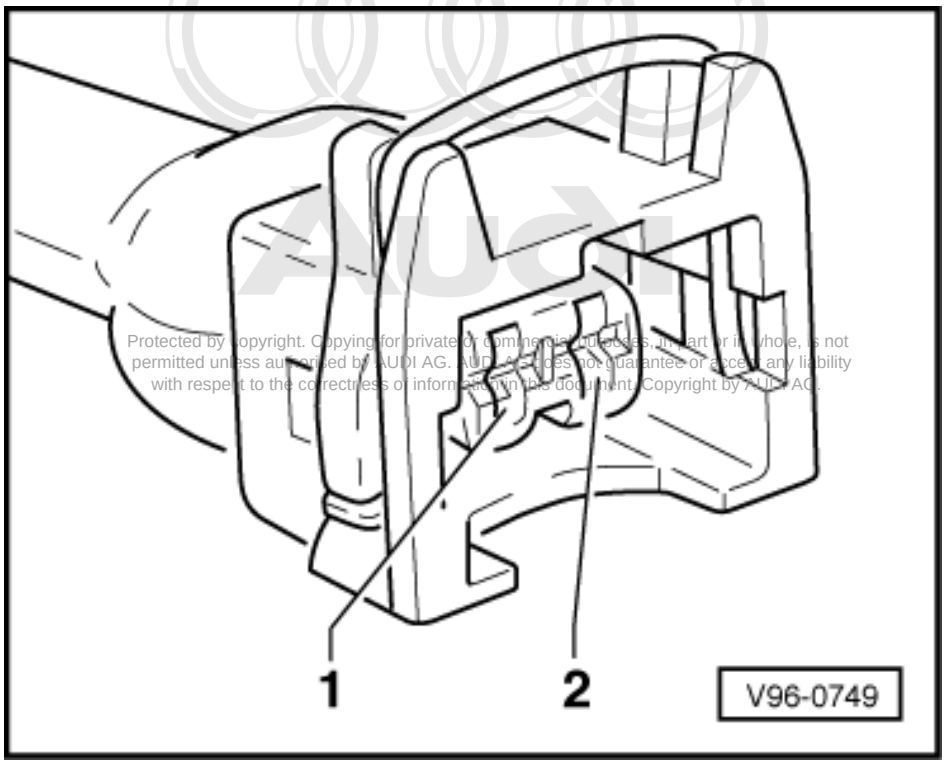
- Use current flow diagram to check for open circuit in wiring between contact 1 and fuse no. 28.
- Eliminate open circuit in wiring if necessary.

Checking actuation

Test requirement:

- Hall sender -G40 OK; checking => Page 132

- Unplug connector at injector to be checked.



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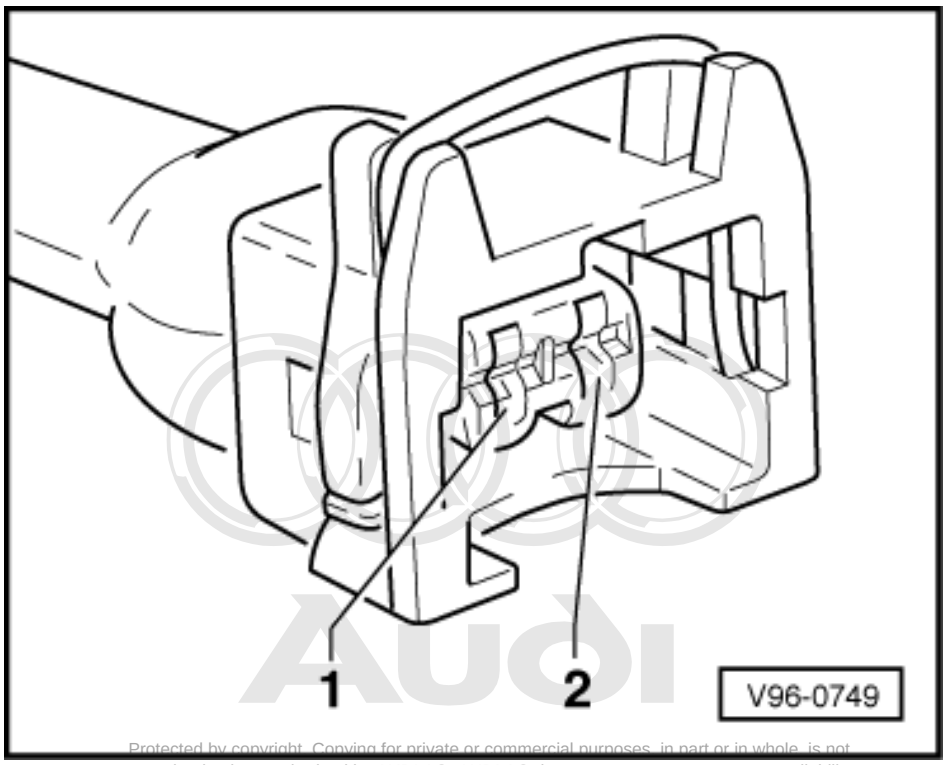
- -> Connect up voltage tester V.A.G 1527 B as follows.

Connector Contact	Measure to
2	Battery positive

- Briefly operate starter (engine may start).
  - LED must flash

If LED does not flash or if it is permanently lit:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .



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

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

- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

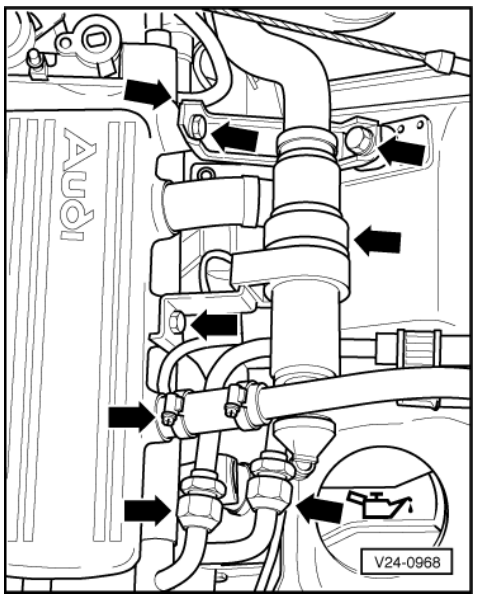
If wiring is OK although LED does not flash or is permanently lit:

- Check power supply of Digifant control unit => Page 124 .

1.14 - Removing and installing injectors

Removing

- Remove intake hose between air-flow meter and throttle valve assembly.
- Disengage throttle cable at throttle valve assembly, support bracket and fuel pipes (do not remove retainer). Lay throttle cable aside.

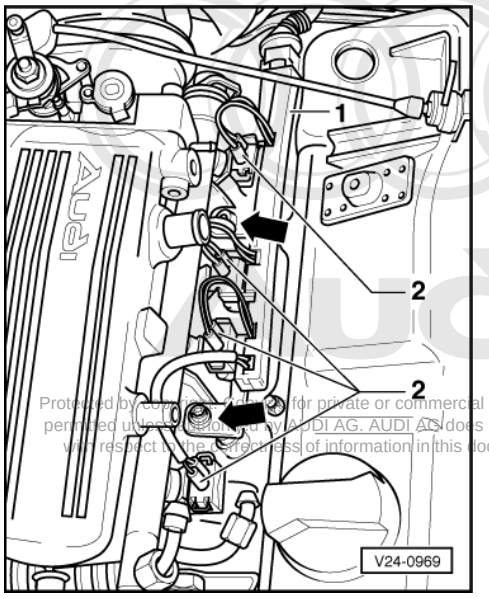


- -> Detach vacuum pipe to brake servo, idling-speed stabilisation valve with holder and intake manifold/ cylinder head cover brace -arrows-.
- Pull the two thin vacuum pipes off the throttle valve assembly.
- Detach heat shield for throttle valve potentiometer on side of throttle valve assembly.
- Detach throttle valve assembly at intake manifold and lay it aside to rear.
- If fitted, unplug connector at cold start valve.

- If fitted, detach cold start valve with connected fuel pipe from intake manifold.

Attention:

- Unfasten fuel supply and return pipe at fuel rail.



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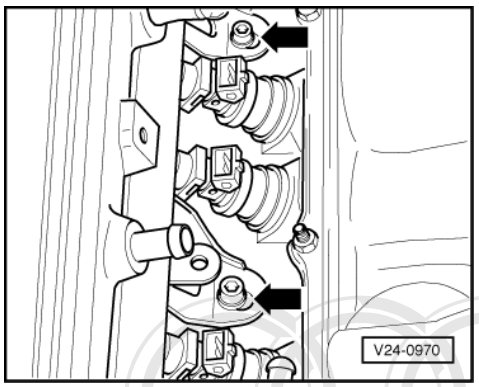
- -> Unplug connectors -2- at injectors and connector at pipe guide for injectors -1-.
- Screw out bolts -arrows- of pipe guide for injectors at fuel rail.
- Pull out pipe guide for injectors.
- Fit retainers (part no. 035 906 037) at injector/fuel rail connection.



- -> Unscrew fuel rail from intake manifold -arrows-.
- Pull fuel rail with injectors out of intake manifold.
- Pull retainers at injector/fuel rail connection off again and pull injectors out of fuel rail.

Installing

Note:

Replace damaged O-rings and nozzle inserts (in intake manifold) of injectors.

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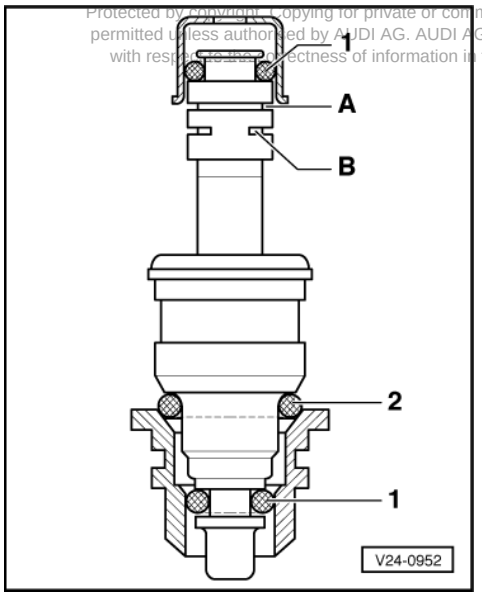


- -> Moisten small O-rings -1- at injectors with a small quantity of fresh engine oil.
- Slide injectors into fuel rail as far as first notch -A- such that they are correctly positioned and secure injectors with retainers (part no. 035 906 037).

Note:

Injection noise will be transmitted if injectors are inserted in fuel rail as far as second notch -B- and secured with retainers.

- Insert fuel rail with secured injectors at intake manifold and press in as far as stop at large O-ring -2-.
- Fit bolts, press fuel rail slightly towards intake manifold and tighten bolts.

- Remove retainers at injector/fuel pipe connection.

Note:

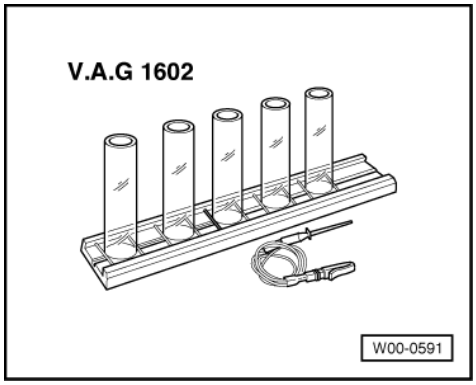
Fuel pipes are to be attached to fuel rail such that they do not make contact with cylinder head cover.

Perform remaining installation operations in reverse order of removal.

Tightening torques

Component	Nm
Idling-speed stabilisation valve with holder to intake manifold	10
Intake manifold/cylinder head cover brace	10
Throttle valve assembly to intake manifold	25
Fuel supply and return pipe to fuel rail	25

1.15 - Checking freedom from leaks and spray pattern of injectors



Special tools and workshop equipment required

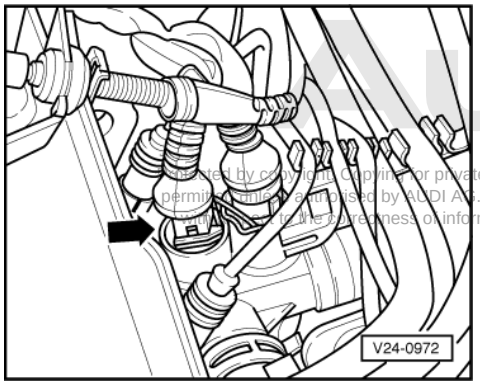
- Injection quantity tester V.A.G 1602

Test requirement:

- Connector at cold start valve unplugged

Test sequence

- Remove fuel rail with injectors => Removing and installing injectors, Page 54 .



- -> Unplug connector from coolant temperature sender -G62 -arrow-.
- Screw fuel supply and return pipe to fuel rail.

- If fitted, detach cold start valve with connected fuel pipe from intake manifold.

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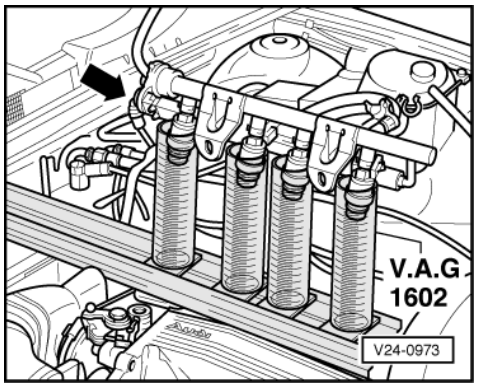
Note:

Do not remove retainer (part no. 035 906 037) at injector/fuel rail connection until after installation in intake manifold.



- -> Attach connector to pipe guide and connectors to injectors.
- Insert injectors in openings in measuring device V.A.G 1602.
- Operate starter.
  - Injectors must exhibit an even pulsating spray pattern
- Unplug connectors at all injectors.
- Switch on ignition for approx. 5 seconds and check injectors for leaks.
  - Max. 2 droplets/minute may emerge per injector
- Install injectors with fuel rail => Page 56 .

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1.16 - Checking fuel-pump relay -J17 and actuation

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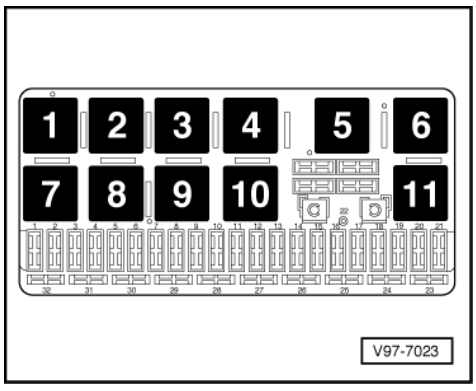
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Note:



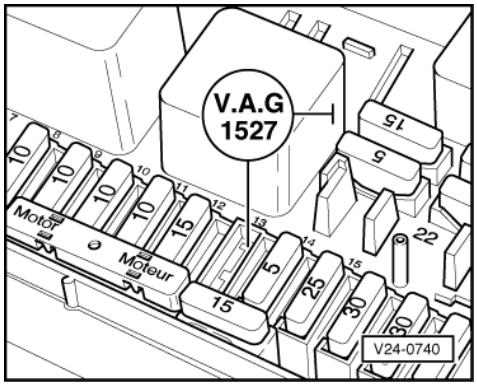
-> Fitting location of fuel-pump relay: On relay plate with fuse box in plenum chamber, position 10

Test requirement:

- Battery voltage at least 11 V

Checking operation of fuel-pump relay

- Detach cover from relay plate with fuse box in plenum chamber.



- -> Pull out fuse 13 and connect up voltage tester V.A.G 1527 B with test leads from V.A.G 1594 A between earth and rear contact for fuse 13.

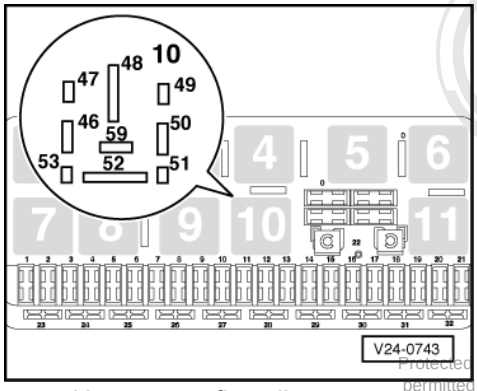
- Briefly operate starter.
  - Energisation of fuel-pump relay must be heard and felt; LED must light

If relay is not energised:

- Check actuation => Page 61 .

If relay is energised but LED does not light:

- Pull off fuel-pump relay.



- -> Use current flow diagram to check for open circuit in connection between fuse 13 and contact 52, position 10.
- Replace relay plate if necessary.
- Replace fuel-pump relay if no open circuit is found.
- Re-insert fuel-pump relay and fuse 13.
- Pull out auxiliary fuse 25.
- Connect up voltage tester V.A.G 1527 B with test leads from V.A.G 1594 A between earth and one of the two contacts for fuse 25.

- Briefly operate starter.
  - Energisation of fuel-pump relay must be heard and felt; LED must light

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If relay is not energised:

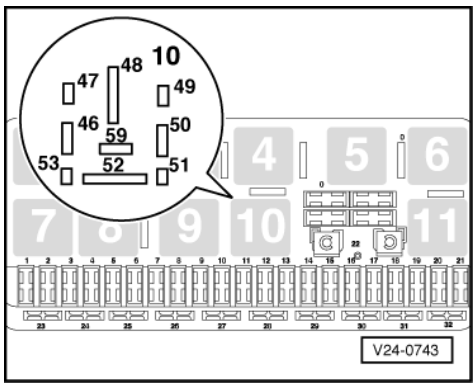
- Check actuation => Page 61 .

If relay is energised but LED does not light:

- Repeat test at other contact for fuse 25.

If LED still does not light:

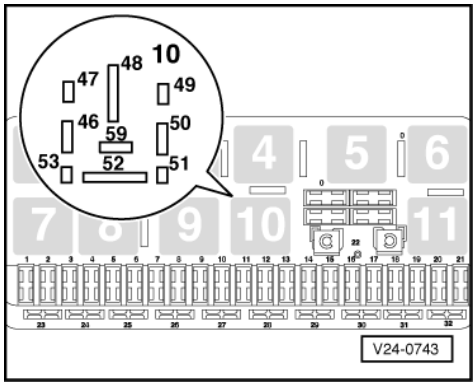
- Pull off fuel-pump relay.



- -> Use current flow diagram to check for open circuit in wiring between fuel-pump relay socket, contact 59 and auxiliary fuse 25.
- Eliminate open circuit in wiring if necessary.
- Replace fuel-pump relay if wiring is OK.
- Re-insert auxiliary fuse 25.

Checking power supply and actuation of fuel-pump relay

- Detach cover from relay plate with fuse box in plenum chamber.



- Pull off fuel-pump relay.

Checking power supply

- Switch on ignition.
- -> Connect up multimeter for voltage measurement as follows.

Contacts	Specification
46 + 50	approx. battery voltage
48 + 50	approx. battery voltage

- Switch off ignition.

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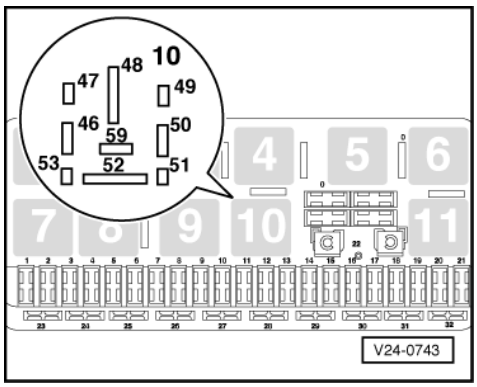


If readings do not match specifications:

- Check wiring.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

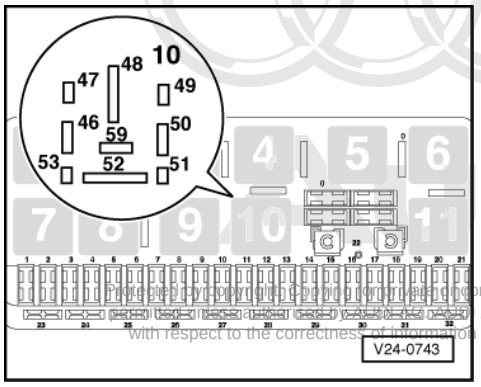
Checking actuation

- -> Connect up voltage tester V.A.G 1527 B between contacts 46 and 47.

- Switch on ignition.
  - LED must light for approx. 1 second
- Operate starter.
  - LED must light constantly during starting

If LED does not light:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .



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

Relay plate, position 10 Contact	Test box V.A.G 1598 A Socket
47	24

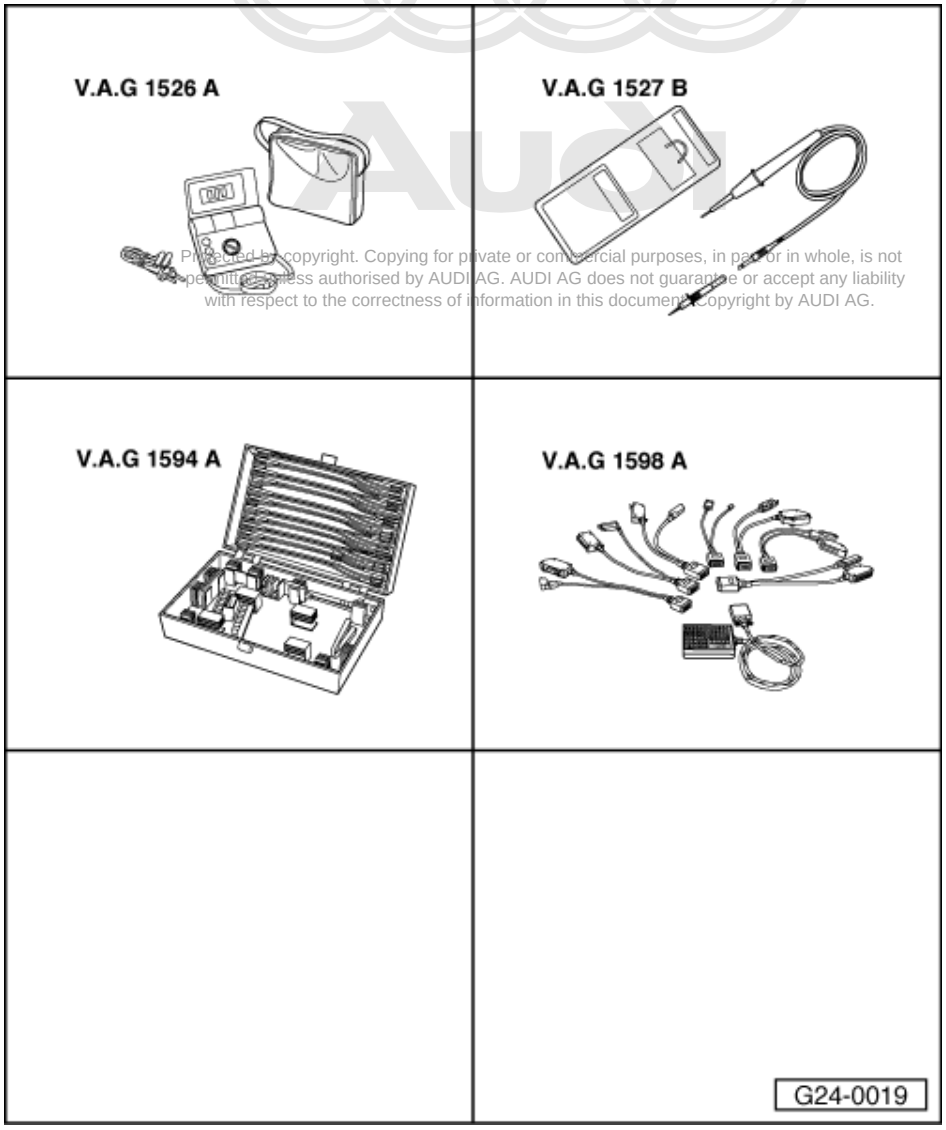
- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If no fault is found:

- Replace fuel pump relay -J17.

1.17 - Checking cold start valve -N17



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

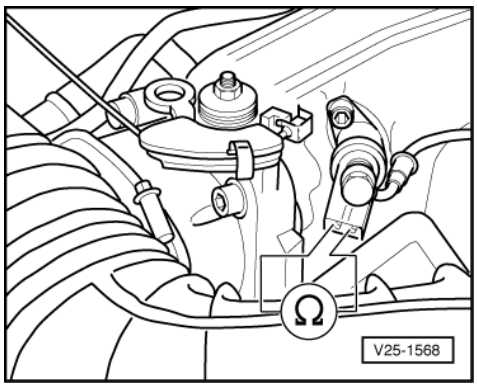
Fitting location => Exploded view of fitting locations - Page 31

Note:

Cold start valve only injects at coolant temperatures below 15 °C.

Checking internal resistance

- Unplug connector at cold start valve.

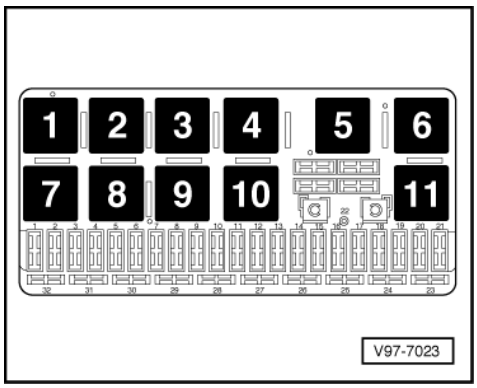


- -> Connect multimeter to valve for resistance measurement.
  - Specification: 8 ... 15 ω

If reading does not match specification:

- Replace cold start valve.

Checking power supply and actuation



Test requirements:

- -> Fuse S27 OK (in fuse box)
- Start signal applied; checking => Page 101

- Unplug connectors at all injectors.
- Unplug connector at cold start valve.

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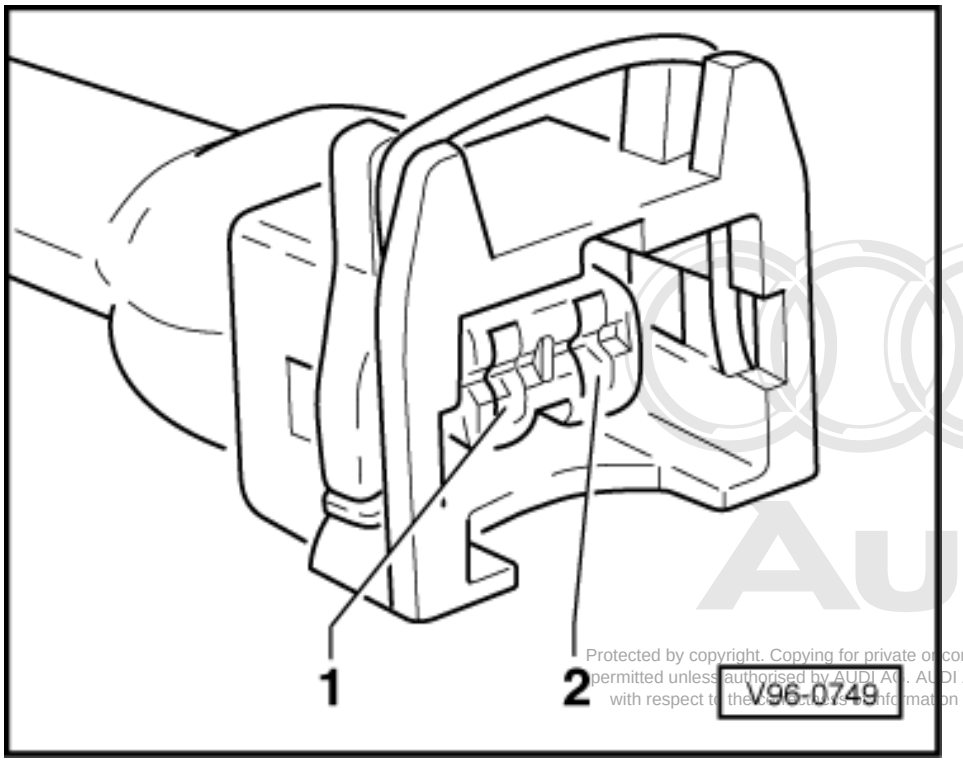

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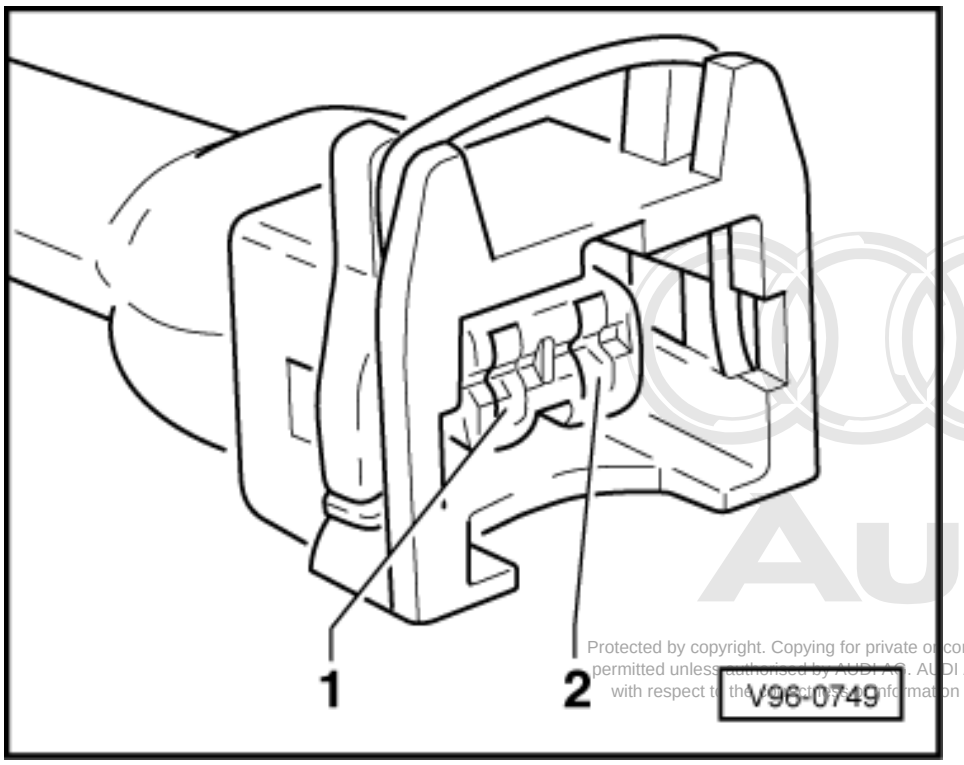
- -> Connect up voltage tester V.A.G 1527 B as follows.

Connector Contact	Measure to
1	Engine earth

- Switch on ignition.
  - LED must light

If LED does not light:

- Use current flow diagram to eliminate open circuit in wiring.



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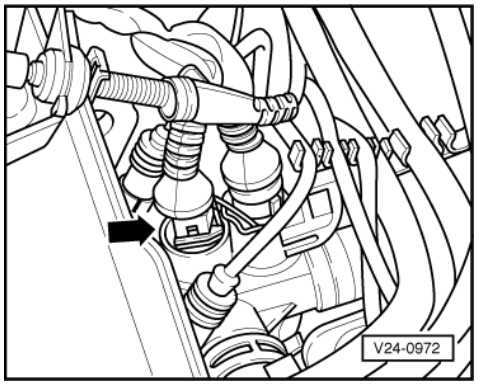
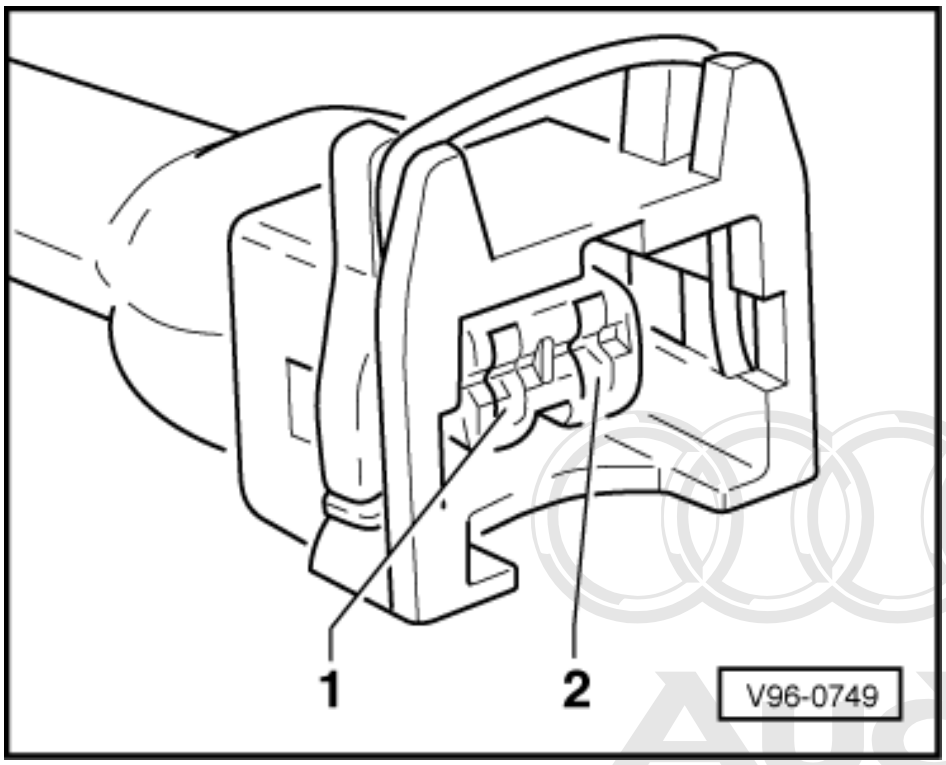
- -> Connect up voltage tester V.A.G 1527 B between contacts 1 and 2.



- -> Unplug connector from coolant temperature sender -G62 -arrow-.
- Operate starter.
  - LED must light for 1 ... 4 seconds

If LED does not light or if it is permanently lit:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .



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

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Connector Contact	Test box V.A.G 1598 A Socket
2	5

- If necessary, eliminate open circuit in wiring/short circuit.

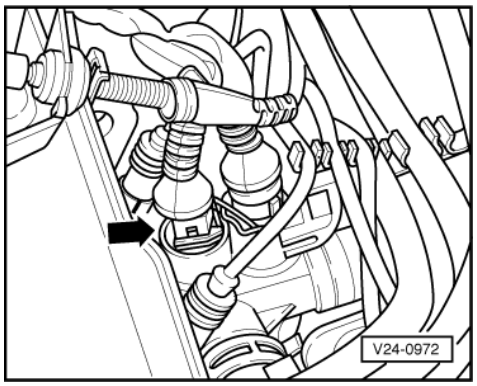
=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If wiring is OK and there is no actuation:

- Replace engine control unit => Page 41 .

Checking spray pattern, injection period and freedom from leaks of cold start valve

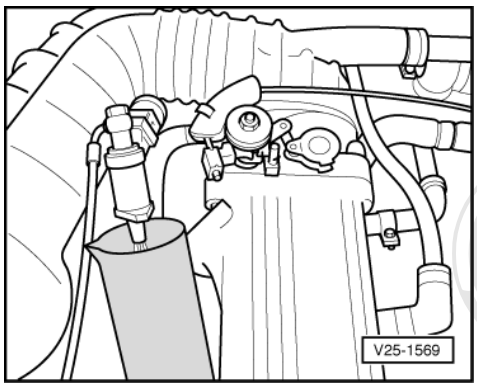
- Unplug connectors at all injectors.



- -> Unplug connector from coolant temperature sender -G62 -arrow-.

- Detach cold start valve with connected fuel pipe from intake manifold.

Attention:



- Unfasten fuel supply pipe at fuel rail.
- -> Turn cold start valve with fuel supply pipe and hold cold start valve over a graduated beaker.

- Re-connect fuel supply pipe to fuel rail.
- Operate starter.
  - Cold start valve must exhibit a pulsating even conical spray pattern for 1 ... 4 seconds
- Dry off nozzle of cold start valve.
  - Cold start valve must not dribble within 1 minute; outside of cold start valve must also not become moist

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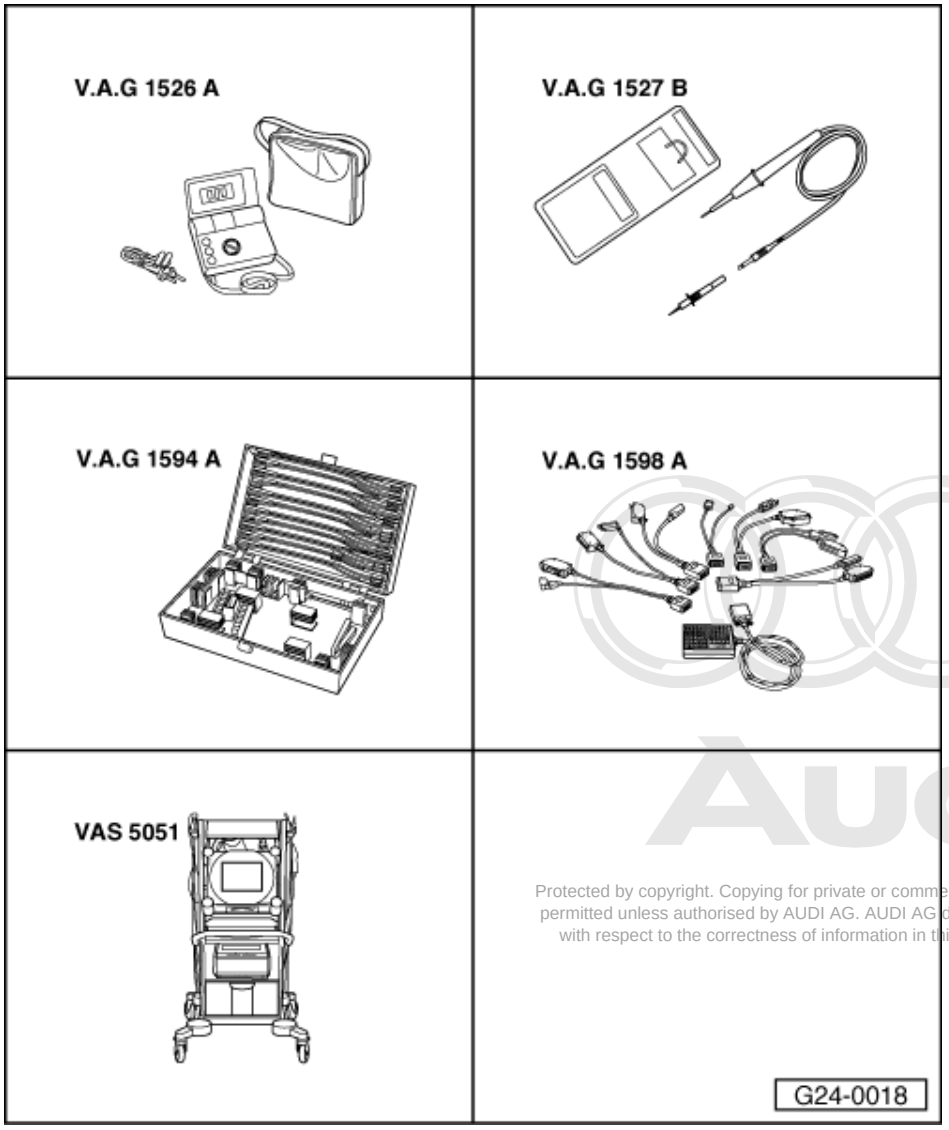
1.18 - Checking idling-speed stabilisation valve -N71



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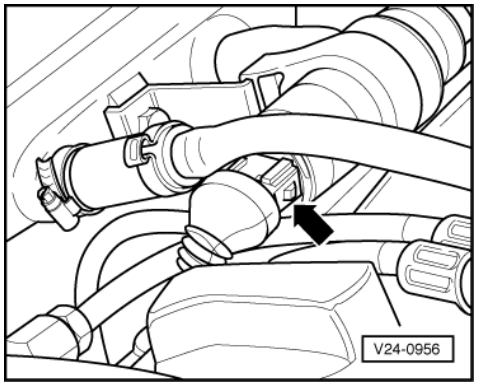
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1 and VAS 5051/2

or

- V.A.G 1551 with V.A.G 1551/1

Checking internal resistance



- Switch off ignition.
- -> Unplug connector -arrow- at idling-speed stabilisation valve.

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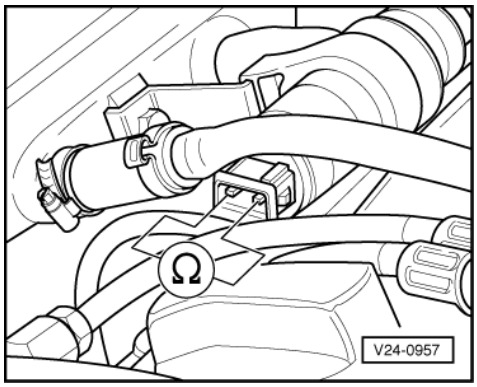


- -> Connect multimeter to valve for resistance measurement.
  - Specification: 2 ... 10 ω

Note:

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

If reading does not match specification:

- Replace idling-speed stabilisation valve.

Mechanical checking

- Remove idling-speed stabilisation valve.
- Check for scoring of piston slide (visual inspection).

Note:

To check freedom of movement, never use screwdriver or the like to move piston slide.

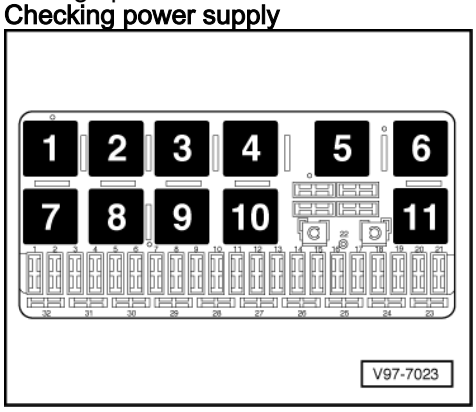
- Attach connector to removed idling-speed stabilisation valve.
- Switch on ignition.
- Start final control diagnosis and actuate idling-speed stabilisation valve -N71 => Page 10 .
- Check whether piston slide moves properly from stop to stop.

If scoring is found which impairs freedom of movement or if piston slide does not move freely (sticking, sluggish or not moving from stop to stop):

- Replace idling-speed stabilisation valve.

If idling-speed stabilisation valve does not react during final control diagnosis:

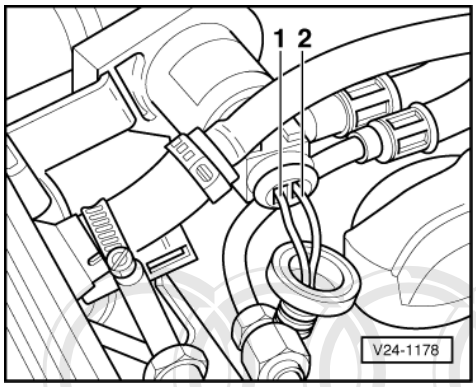
Checking power supply



Test requirement:

- -> Fuse S27 OK (in fuse box)

- Push back protective cap at connector.



- -> Connect up multimeter for voltage measurement as follows.

Connector Contact	Measure to
1	Engine earth

- Switch on ignition.
  - Specification: approx. battery voltage

If reading does not match specification:

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

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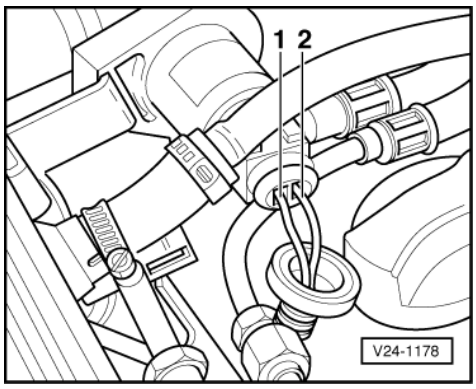
Checking actuation of idling-speed stabilisation valve

- Push back protective cap at connector.



- -> Connect up voltage tester V.A.G 1527 B between contacts 1 (positive) and 2 (signal) of connector.

Note:

In certain current flow diagrams, contact 2 is shown as being contact 3.

- Start final control diagnosis and actuate idling-speed stabilisation valve -N71 => Page 10 .
  - LED must flash

If LED does not flash or if it is permanently lit:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .
- Check for open circuit and short to earth/positive in the following wiring.

Connector Contact	Test box V.A.G 1598 A Socket
2	23

Note:

In certain current flow diagrams, contact 2 is shown as being contact 3.

- If necessary, eliminate open circuit in wiring/short circuit.

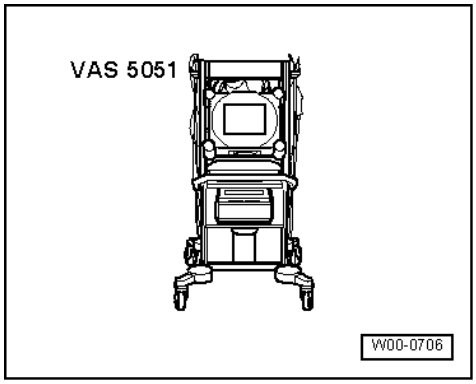
=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

- If actuation and wiring are OK, but idling-speed stabilisation valve does not react, then valve has seized. Replace idling-speed stabilisation valve.

1.19 - Checking acceleration/full throttle enrichment and overrun shutoff

Note:

The following test is designed to check overrun shutoff. If this test is OK, then the acceleration and full throttle enrichment are also OK.



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Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1 and VAS 5051/2

  or

- V.A.G 1551 with V.A.G 1551/1

Test sequence

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

-> Read measured value block, Display group 001 => Page 18 .

- Do not continue with test until coolant temperature has reached 80 °C and engine has then been allowed to idle for a further 2 minutes.

- Check display in zone 4.
  - Specification: 1.5 ... 3.5 ms
- Increase engine speed (=> Display zone 2) to at least 3000 rpm by giving burst of throttle and release accelerator mechanism again.
- Read off injection period in display zone 4.
  - Specification:
    Injection period must increase, drop off to 0.0 ms and increase again to value previously read off

If value displayed does not increase and also fails to drop off to 0.0 ms:

- Match Digifant control unit and throttle valve potentiometer => Page 92 .
- Match automatic gearbox control unit -J217 and throttle valve potentiometer => Page 92 .
- Check throttle valve potentiometer => Page 89 .

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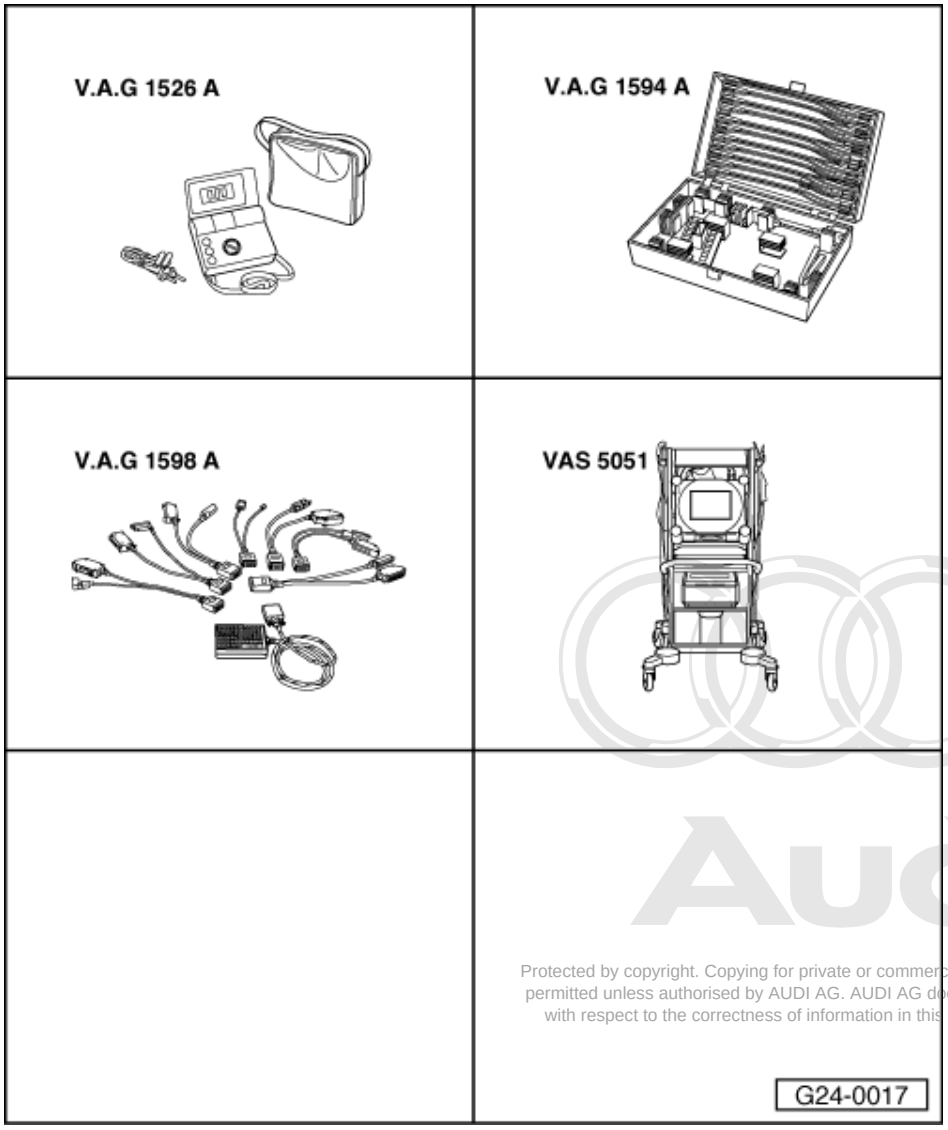
1.20 - Checking air-flow meter potentiometer -G19



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1 and VAS 5051/2

or

- V.A.G 1551 with V.A.G 1551/1

Note:

There is no acceleration enrichment if a fault is detected in air-flow meter.

Test sequence

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

-> Read measured value block, Display group 002 => Page 20 .

- Do not continue with test until coolant temperature has reached 80°C.

- Check display in zone 4.
  - Specification: 14 ... 25 %

If reading exceeds or drops below specification:

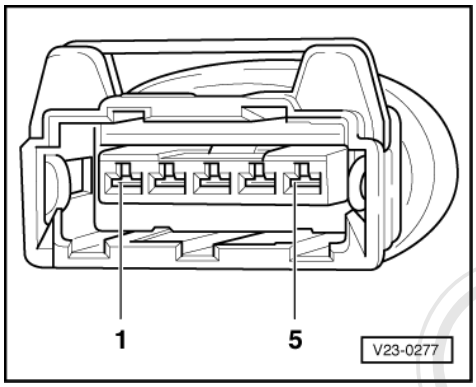
- Check idling-speed stabilisation valve => Page 69 .
- Check air-intake system for leaks.
- Perform the following test if no fault is found.

Notes:

- The air-flow meter contains a pre-amplifier for the output signal. For this reason, the resistance track cannot be checked by way of a simple resistance measurement.
- Contact 5 in connector at air-flow meter is not used.

Checking wiring

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .



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

Connector Contact	Measure to
2	Test box V.A.G 1598 A Socket 13
3	Socket 15
4	Engine earth

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- If necessary, eliminate open circuit in wiring/short circuit.

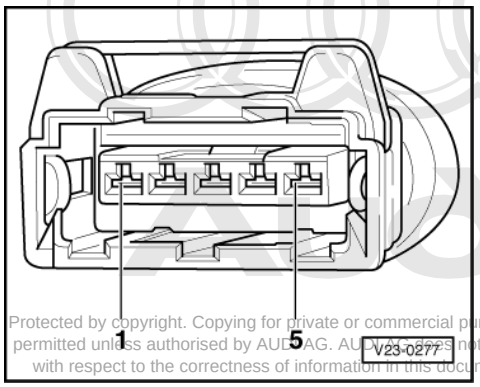
=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

Checking power supply

Test requirements:

- Wiring OK
- Engine control unit connected

- Unplug connector at air-flow meter.



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- -> Connect up multimeter for voltage measurement between contacts 3 and 4.
- Switch on ignition.
  - Specification: approx. 5 V

If reading does not match specification:

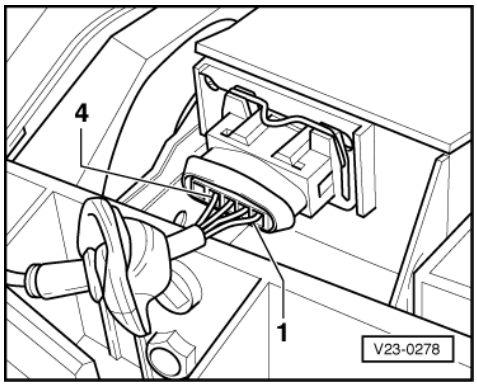
- Replace engine control unit => Page 41 .

Checking signal voltage

Test requirements:

- Wiring OK
- Air-flow meter connected

- Push back protective cap at connector.



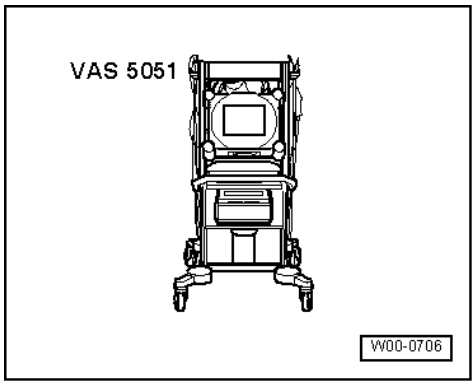
- -> Connect up multimeter for voltage measurement between contacts 2 and 4 of connector.
- Start engine and let it idle.
  - Specification: 0.5 ... 1.5 V
- Increase engine speed and observe change in voltage.
  - Specification:
    With increasing engine speed and thus increasing air throughput, signal voltage increases proportionally up to approx. 4.5 V at maximum speed

If there is no change in voltage or in the event of a voltage dip with increasing engine speed:

- Replace air-flow meter.

1.21 - Checking intake system for leaks (unmetered air)

Special tools and workshop equipment required



- VAS 5051 with VAS 5051/1 and VAS 5051/2

  or

- V.A.G 1551 with V.A.G 1551/1
- Engine leak detector spray G 001 800 A1

Notes:

- Due to the vacuum in the intake system, the leak detector spray is drawn in with the unmetered air. The spray reduces the ignition performance of the mixture, thus causing a drop in engine speed and a sharp increase in CO content.
- Always heed the safety instructions on the can.

Test sequence

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

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-> Read measured value block, Display group 001 => Page 18 .

- Note down engine speed in display zone 2.
- Systematically apply engine leak detector spray to intake system components.

If engine speed does not change:

- Press ⇒key.

-> Indicated on display (function selection):

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

If engine speed decreases:

- Press ⇒key.
- Enter "06" for "End output" function and confirm with Q key.
- Switch off ignition.
- Check sprayed section of intake system for leaks and rectify fault.

2 - Checking Lambda control

2.1 - Checking Lambda control

Notes:

Lambda probe compares oxygen content of air to residual oxygen in exhaust gas and provides control unit with a voltage signal.

Voltage signal "Rich mixture (low residual oxygen level)" is approx. 0.7...1.1 V.

Voltage signal "Lean mixture (high residual oxygen level)" is approx. 0.0..+0.3 V.

Transition from "rich" to "lean" and vice versa (λ = 1.0) results in a voltage step change from 0.7...1.1 V to 0.0... +0.3 V and vice versa.

On account of the steep voltage step change, the Lambda control cannot maintain the ideal mixture composition (corresponding to λ = 1.0) at a constant level. The control constantly fluctuates between the two statuses "slightly too lean" and "slightly too rich".

If there is no change in voltage or if the voltage change is sluggish, this may be due to the following:

- Slits or holes in probe head clogged
- Thermal overloading of probe
- Contact resistance in signal wire
- Probe too cold, no probe heating function
- Lambda control off (fault detected in injection system by control unit => Interrogate fault memory and Read measured value block, display group 006).
- Probe damaged by contact spray or the like (on account of thermal fluctuations and capillary action, contact spray is drawn through the fine cavities in the wires into the probe)
- Probe damaged by silicone vapours (the use of sealants containing silicone causes traces of silicone constituents to be drawn in by the engine; these are not burnt and damage the Lambda probe)

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2.2 - Engine running problems following cold start

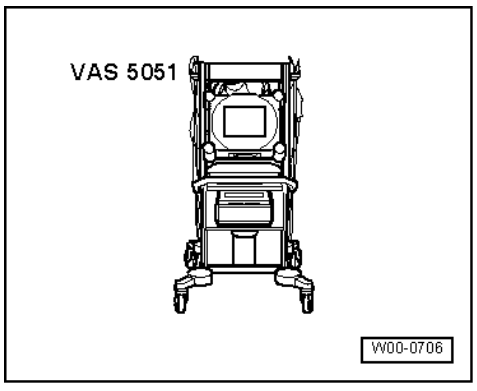
Test requirement:

- No fault stored relating to Lambda control; if necessary, eliminate fault and erase fault memory

The time prior to commencement of control action (probe temperature of approx. 300 °C required) is primarily influenced by the following factors:

- Ambient temperature (summer/winter)
- Operating conditions after starting
- Operation of probe heater

If faults are encountered following cold starting, check whether problem arises before or after commencement of control action.



Special tools and workshop equipment required

- VAS 5051 with VAS 5051/1 and VAS 5051/2

  or

- V.A.G 1551 with V.A.G 1551/1

Test sequence

Checking vehicle under cold starting conditions:

Attention:
Attach fault reader to rear seat and operate it from there. Pay attention to safety precautions => Page 29 .

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

-> Read measured value block, Display group 001 => Page 18 .

Display zone 3 shows signal voltage of Lambda probe 1.

Vehicle cold/no control action: 0.45...0.50 V

- Perform test drive.
- Whilst doing so observe display zone 3.

-> On commencement of control action, voltage signal in display zone 3 must fluctuate between the ranges 0.0...+0.3 and +0.7...+1.1 V.

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

Voltage values greater than +0.7 V are an indication of a rich mixture composition (low level of oxygen in exhaust gas).

Voltage values less than +0.3 V are an indication of a lean mixture composition (high level of oxygen in exhaust gas).

- Lambda control cannot be the cause of the trouble if engine running problems are encountered prior to commencement of Lambda control action.
- If engine running problems only occur after commencement of Lambda control action, check operation => Page 80 .

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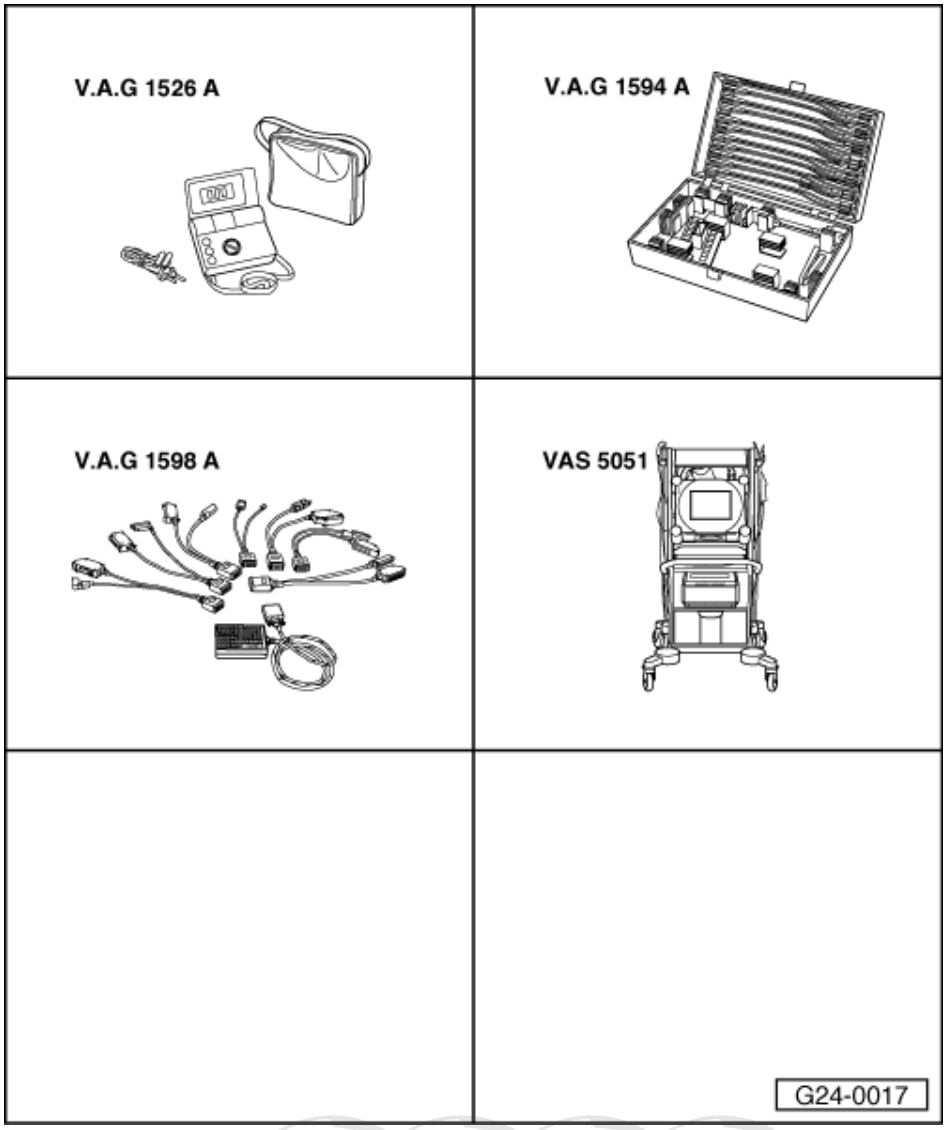
2.3 - Checking Lambda probe -G39 and Lambda control



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1 and VAS 5051/2

  or

- V.A.G 1551 with V.A.G 1551/1

Note:

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A fault affecting the Lambda control function can only be interrogated after a test drive of at least 5 minutes duration (time-related fault detection).

Test requirements:

- No leaks in exhaust system between catalytic converter and cylinder head

- Lambda-probe heater OK; checking => Page 82

Test sequence

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

-> Read measured value block, Display group 001 => Page 18 .
- Do not continue with test until the following conditions are satisfied:
  - Display in zone 1 greater than 80 °C
- Read off value in display zone 3.
  - Specification: Fluctuating between 0.1 and 1.1 V
- If probe voltage fluctuates very slowly, check Lambda probe heating => Page 82 .

- If a constant probe voltage of 0.45 ... 0.50 V is displayed, there is an open circuit in the signal wire and the wiring is to be checked => Page 81 .

If reading does not match specification:

- Check Lambda probe => Page 81 .

Checking wiring

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- Connect up multimeter for voltage measurement between connector of signal wire to engine control unit and engine earth.
- Switch on ignition.
  - Specification: 450 ± 50 mV

If reading does not match specification:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .

- Check for open circuit in the following wiring.

Connector Contact	Test box V.A.G 1598 A Socket
Signal wire	16

- Eliminate open circuit in wiring if necessary.

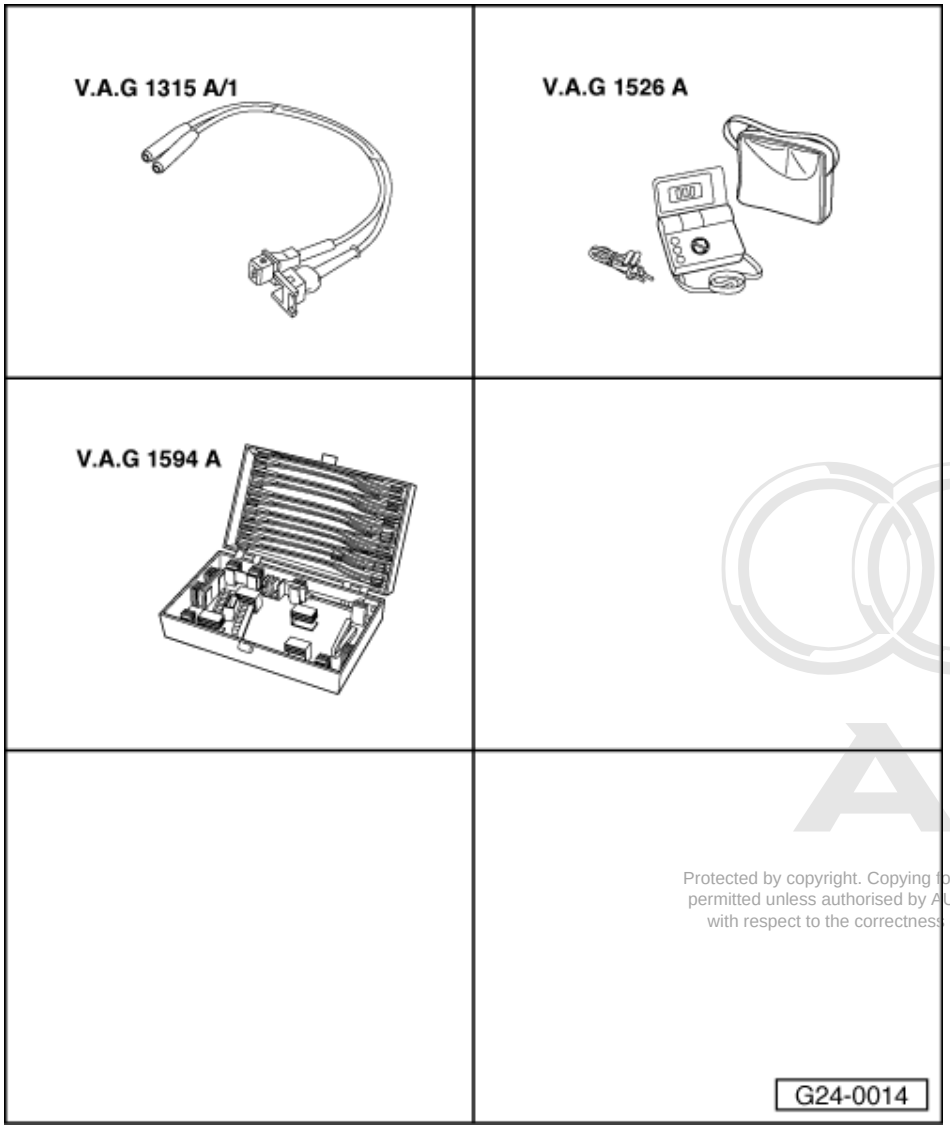
Checking Lambda probe

- Switch off ignition.
- Unplug connector for signal wire of Lambda probe => item 32 .
- Connect up multimeter for resistance measurement between signal wire and engine earth.
  - Specification: ∞ ω (no continuity)

If reading does not match specification:

- Replace Lambda probe.

2.4 - Checking Lambda probe heater -Z19



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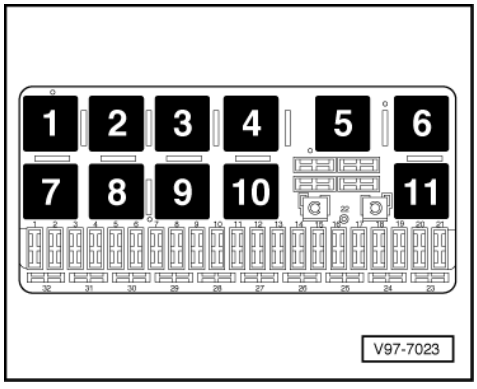
Special tools and workshop equipment required

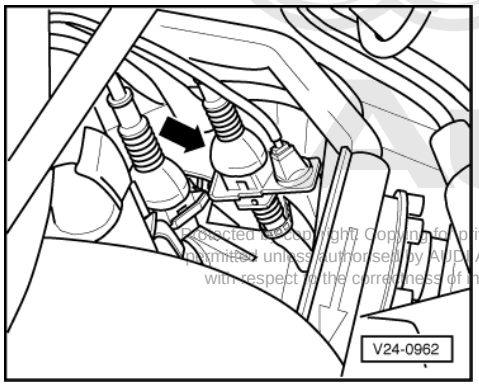
- V.A.G 1315 A/1
- V.A.G 1526 A
- V.A.G 1594 A

Test requirements:



- -> Fuse S25 OK (in fuse box)
- Fuel pump relay OK; checking => Page 59
- Engine cold

Test sequence



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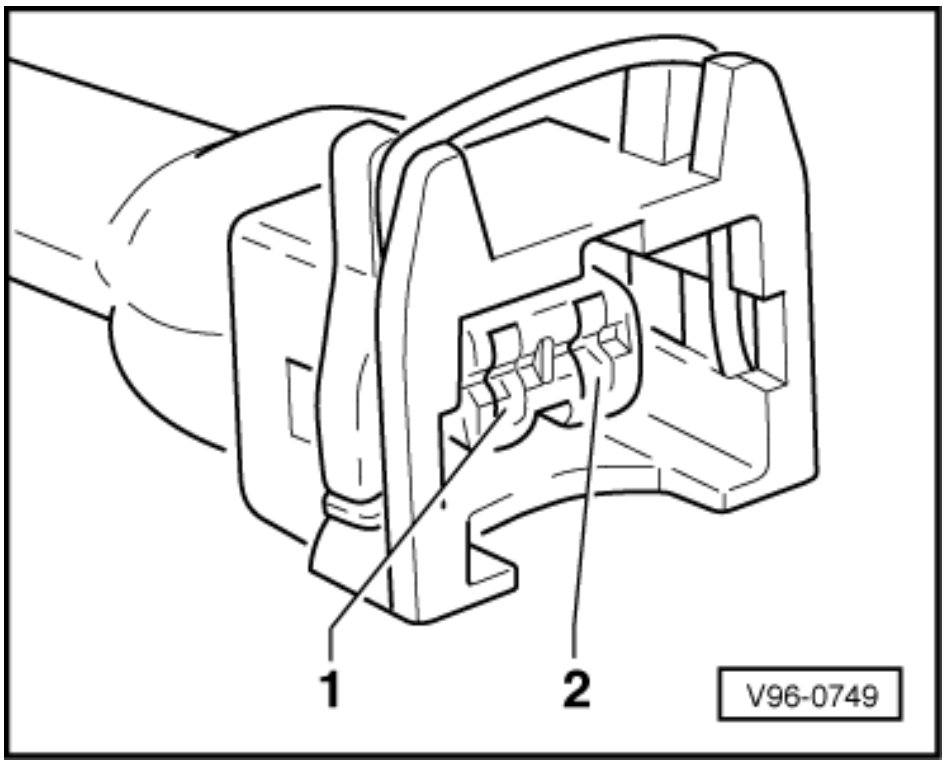
- -> Unplug connector for Lambda probe heating -arrow-.



- -> Connect up multimeter for voltage measurement between contacts 1 and 2.
- Start engine and let it idle.
  - Specification: approx. battery voltage

If reading does not match specification:

- Eliminate open circuit in wiring.

If reading matches specification:

- Connect auxiliary test lead V.A.G 1315 A/1 to 2-pin connector.
- Switch multimeter to 10 A measuring range (connect test lead to 10 A connection).
- Start engine and let it idle.

- Specification: 0.5 ... 3.0 A

Note:

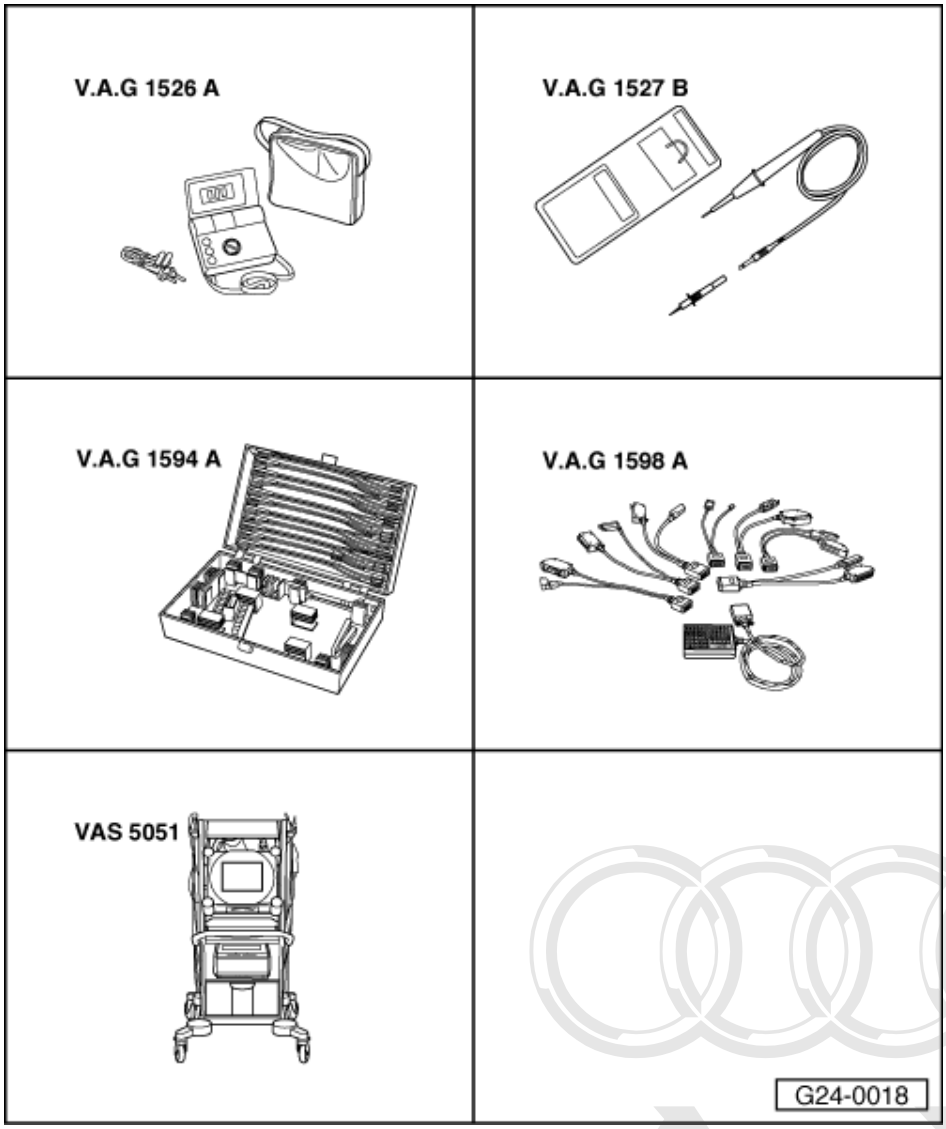
Current input decreases as Lambda probe becomes warmer.

If reading does not match specification:

- Check Lambda probe => Page 81 .

3 - Checking fuel tank breather system

3.1 - Checking fuel tank breather system



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3.2 - Checking activated charcoal filter solenoid valve -N80

Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1 and VAS 5051/2

or

- V.A.G 1551 with V.A.G 1551/1

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Notes:

- Activated charcoal filter solenoid valve is closed under the following conditions:
  At idle and as long as Lambda control is not active
- Fitting location => Item 31

Leak test

Activated charcoal filter solenoid valve -N80 is closed when deenergised.

- Pull hoses off ACF valve; leave connector attached.
- Connect test hose to one connection of ACF valve.
- Start final control diagnosis =>Page 10 and actuate activated charcoal filter solenoid valve -N80.

-> Indicated on display:

```
Final control diagnosis
Activated charcoal filter solenoid valve
-N80
```

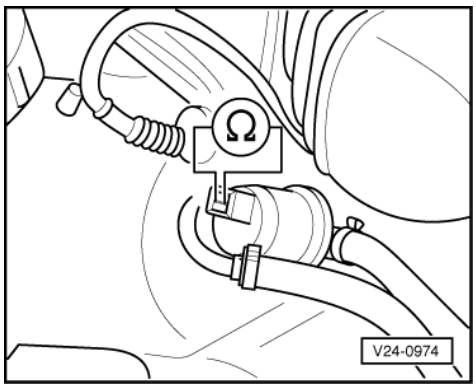
Valve must click...
...and must open and close (can be checked by blowing into test hose).

If valve does not open and close properly:

- Replace ACF valve.

If valve does not click:

- Check internal resistance of ACF valve.



Checking internal resistance

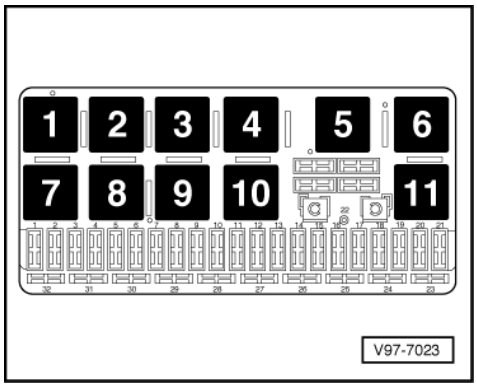
- Unplug connector at ACF valve.
- -> Connect multimeter to valve for resistance measurement.
  - Specification: 20 ... 28 ω

If reading does not match specification:

- Replace ACF valve.

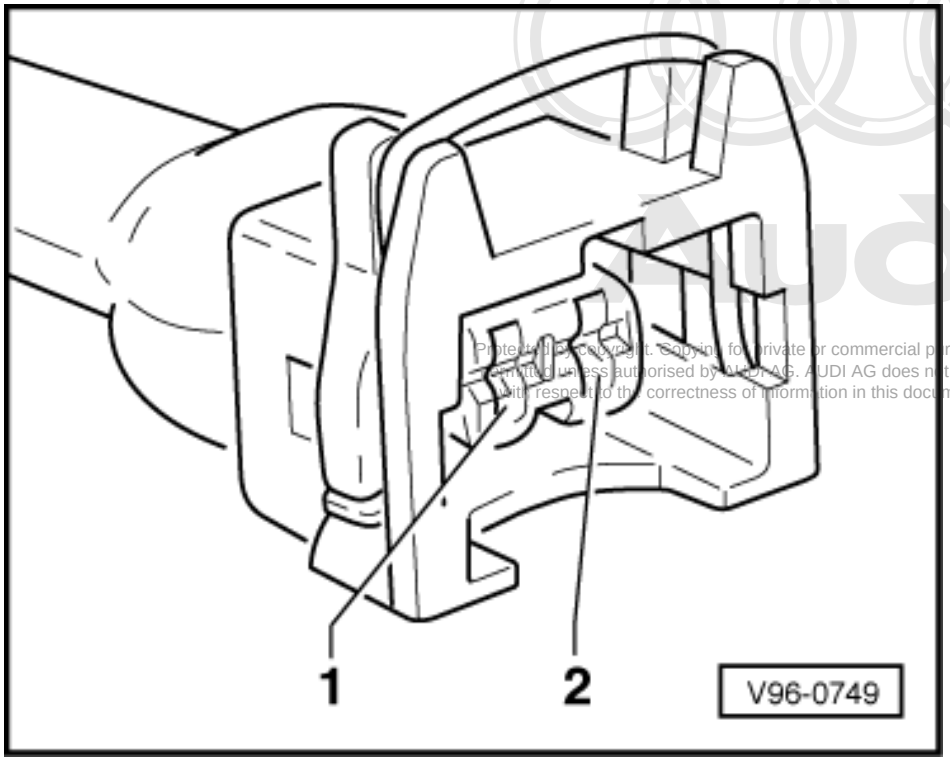
Checking power supply

Test requirement:



- -> Fuse S27 OK (in fuse box)

- Unplug connector at ACF valve.



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

Connector Contact	Measure to

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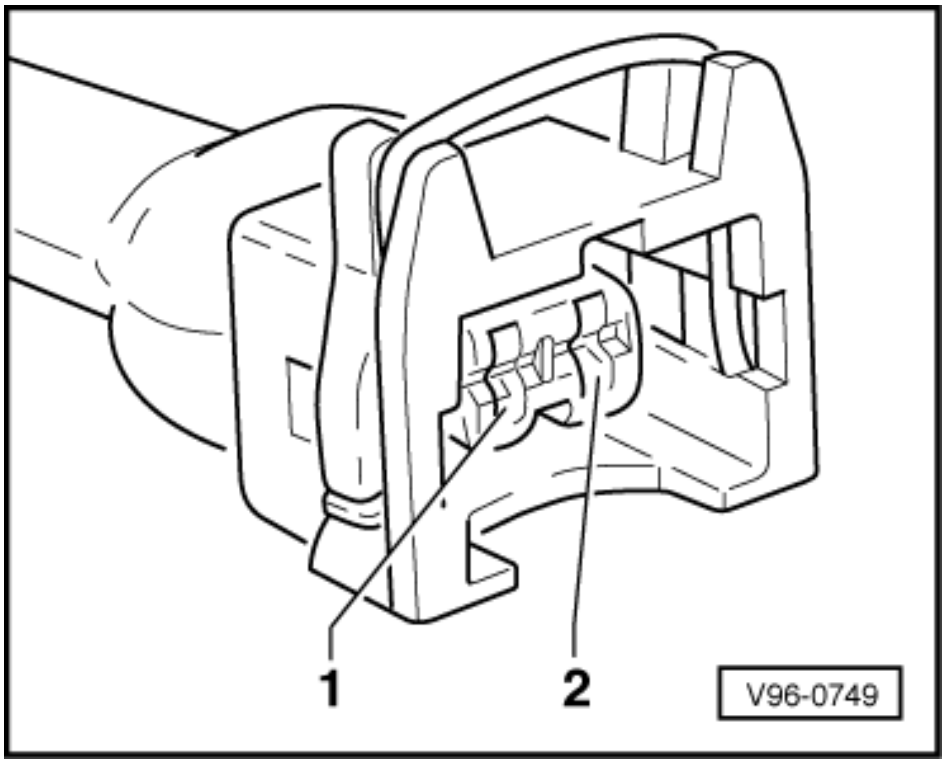
1	Engine earth

- Switch on ignition.
  - LED must light

If LED does not light:

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

Checking actuation



- Unplug connector at ACF valve.
- -> Connect up voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and actuate ACF valve => Page 10 .
  - LED must flash

If LED does not flash or if it is permanently lit:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .

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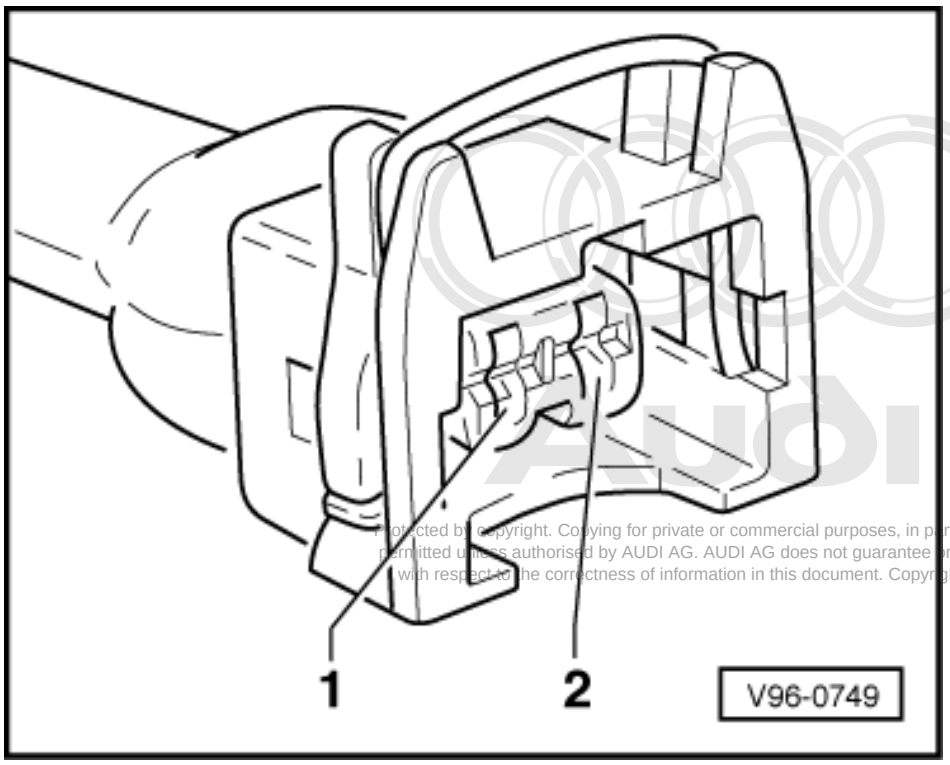

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- -> Check for open circuit and short to earth/positive in the following wiring.

Connector Contact	Test box V.A.G 1598 A Socket
2	26

- If necessary, eliminate open circuit in wiring/short circuit.

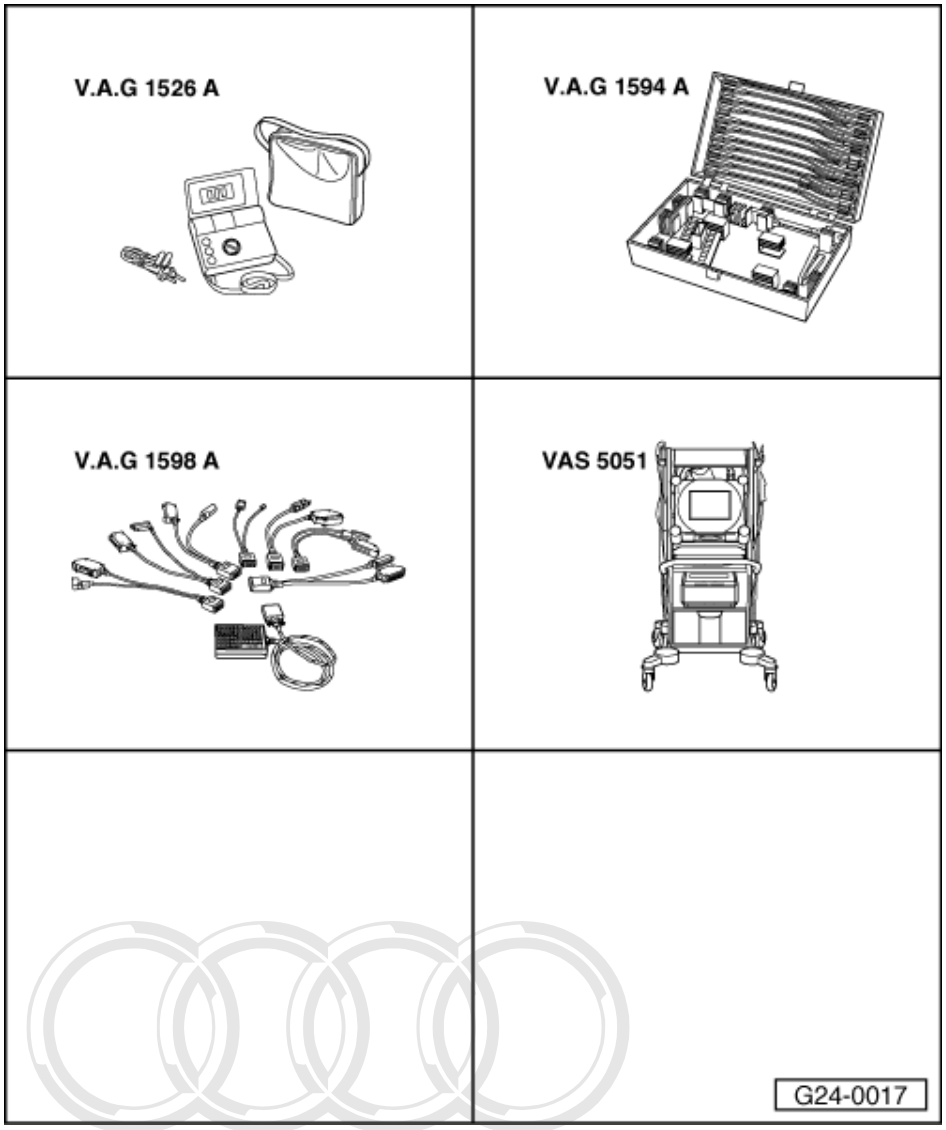
=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If wiring is OK:

- Replace engine control unit => Page 41 .

4 - Checking throttle valve potentiometer -G69

4.1 - Checking throttle valve potentiometer -G69



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1 and VAS 5051/2

or

- V.A.G 1551 with V.A.G 1551/1

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The throttle valve potentiometer has a 3-pin connector. The Digifant control unit receives the following information:

Throttle valve closed:
- Overrun shutoff

-Idling-speed stabilisation
-Ignition timing at idle (DIS function)

Throttle valve fully open:
-Injection quantity for full throttle enrichment

Test sequence

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

-> Read measured value block, Display group 002 => Page 20 .
- Read off throttle valve angle in display zone 3.
  - Specification with accelerator pedal not pressed: 0.0 ... 2.0 <°
  - Specification with accelerator pedal floored: Greater than 75.0 <°

Note:

Uniform opening of throttle valve must result in even and steady increase in value displayed in zone 3.

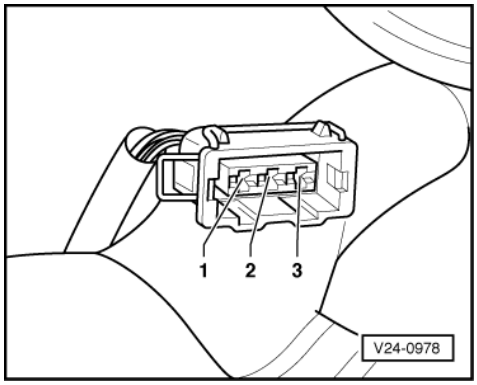
If readings do not match specifications:

- Continue testing in line with table.

Display value	Possible cause of trouble	Continue with
On opening throttle valve and at full throttle, value remains on 0.0 <°	Open circuit in wiring/short to earth caused by: Throttle valve potentiometer, wiring, Digifant control unit	Test A => Page 90
At idle value already greater than 75.0 <°	Short to positive caused by: Throttle valve potentiometer, wiring, Digifant control unit	Test B => Page 91

Test A

- Unplug connector at throttle valve potentiometer.



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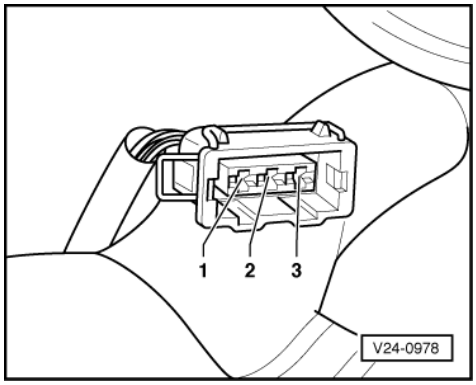
- -> Bridge contacts 2 and 1 in connector of throttle valve potentiometer using test leads from V.A.G 1594 A.

If display value increases to in excess of 75.0 <°:

- Switch off ignition.
- Replace throttle valve potentiometer.
- Interrogate and erase fault memory => Page 4 .

If display value remains on 0.0 <°:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .



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

Connector Contact	Measure to
1 (positive)	Test box V.A.G 1598 A Socket 34
2 (signal)	Socket 33
3 (earth)	Engine earth

- If necessary, eliminate open circuit in wiring/short circuit.

If wiring is OK:

- Replace engine control unit => Page 41 .

Test B

- Unplug connector at throttle valve potentiometer.

If display value drops to 0.0 <°:

- Switch off ignition.
- Replace throttle valve potentiometer.
- Interrogate and erase fault memory => Page 4 .

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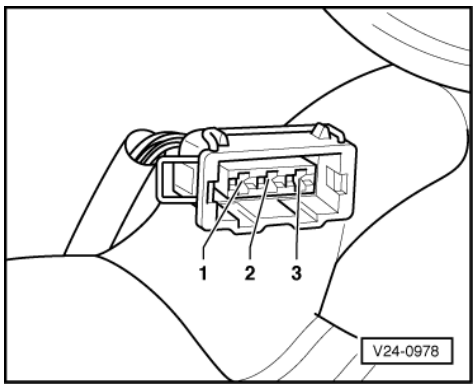
If display value remains in excess of 75.0 <°:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .



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

Connector Contact	Measure to
1 (positive)	Test box V.A.G 1598 A Socket 34
2 (signal)	Socket 33
3 (earth)	Engine earth

- If necessary, eliminate open circuit in wiring/short circuit.

If wiring is OK:

- Replace engine control unit => Page 41 .

4.2 - Matching Digifant control unit -J169 and throttle valve potentiometer -G69

Note:

Digifant control unit and throttle valve potentiometer must be matched after performing the following work:

- Replacement of Digifant control unit
- Removal and installation/replacement of throttle valve potentiometer

Sequence of operations

- Attach connector to throttle valve potentiometer.
- Perform basic setting => Page 12 .
- On vehicles with automatic gearbox, automatic gearbox control unit and throttle valve potentiometer must also be matched => Page 92 .

4.3 - Matching automaticgearboxcontrol unit and throttle valve potentiometer -G69

Note:

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Automatic gearbox control unit and throttle valve potentiometer must be matched after performing the following work:

- Replacement of automatic gearbox control unit
- Removal and installation/replacement of throttle valve potentiometer

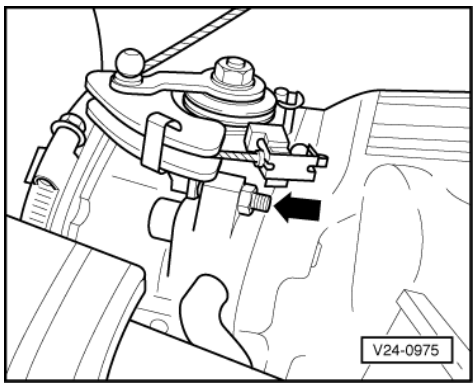
- Attach connector to throttle valve potentiometer.
- Start basic setting.

=> Automatic Gearbox 097; Repair Group 01; Self-diagnosis of automatic gearbox 097; Starting basic setting Self-diagnosis of automatic gearbox 097 Starting basic setting

4.4 - Basic setting of throttle valve

Note:

Limiting screw is set at factory and is not to be altered. If screw has been inadvertently turned, perform the following adjustment procedure and mark the screw with locking fluid again.



- -> Screw out limiting screw -arrow- until there is a gap between limiting screw and stop.
- Then screw in limiting screw until it makes contact with stop.

Note:

For precise determination of limiting screw stop point, insert a thin sheet of paper between limiting screw and stop. Establish exact stop point by constantly moving sheet of paper and at the same time turning limiting screw.

- Screw in limiting screw 1/2 a turn from stop point determined in the above manner.
- Mark screw with locking fluid.
- Check idling speed => Page 43 .

4.5 - Checking and adjusting throttle damper

Test requirement:

- Basic setting of throttle valve OK

Checking

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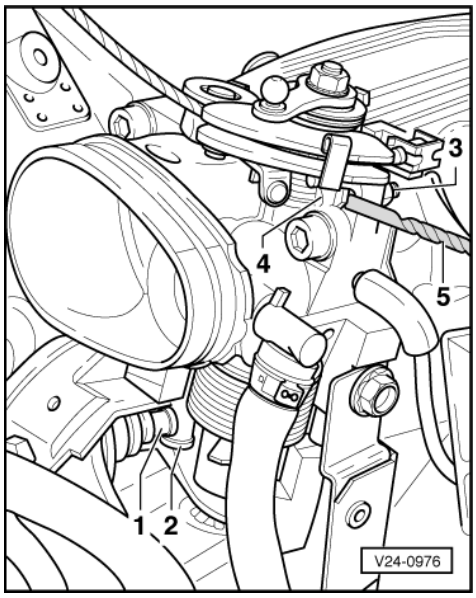

- -> Open throttle valve stage I and close again until stem -1- of throttle damper makes contact with roller -2-.
- In this position, use drill bit to check gap between limiting screw -3- and throttle valve lever -4-.
  - Specification: 2.5 ... 3.5 mm

Adjusting

- Jam drill bit ø 3 mm between limiting screw -3- and throttle valve lever -4-.

- Adjust throttle damper such that its stem -1- just makes contact with roller -2-.

5 - Checking intake air preheating

5.1 - Checking intake air preheating

Test requirement:

- Engine cold (intake-air temperature less than + 20 °C)

Test sequence

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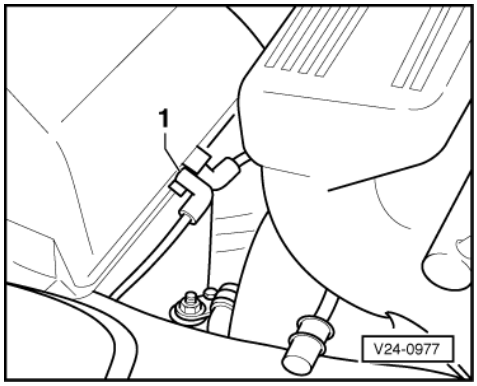
- Lift air cleaner cover with air flow meter and take out filter element.
- Check position and freedom of movement of control flap in air cleaner housing.
  - Control flap must seal off warm-air connection
- Start engine and leave it idling.
  - Control flap must seal off cold-air connection



If control flap does not react as described:

- -> Pull off vacuum pipes at temperature regulator-1- and connect them together.
  - Vacuum unit is defective if warm-air connection remains sealed off
  - Temperature regulator is defective if control flap now seals off cold-air connection

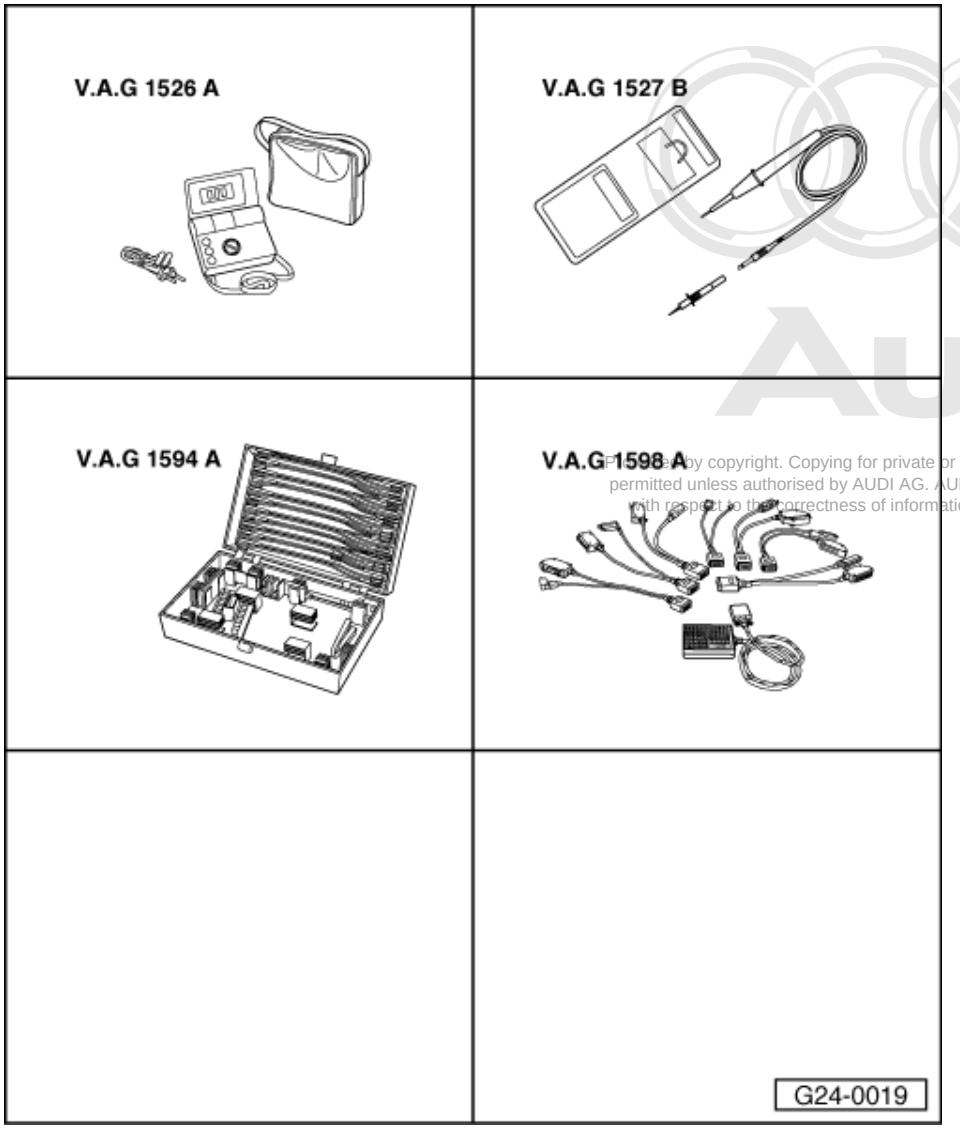
Note:

When the engine is running, the position of the control flap is governed by the temperature of the temperature regulator.

Temperature	Position
Below 20 °C	Temperature regulator open
	Cold-air connection sealed off
Above 30 °C	Temperature regulator closed
	Warm-air connection sealed off

6 - Checking additional signals

6.1 - Checking additional signals



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6.2 - Checking air-conditioner compressor signal and air-conditioner compressor shutoff

Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Checking air-conditioner compressor signal

Note:

The Digifant control unit opens the idling-speed stabilisation valve slightly further on application of a voltage to pin 32 of the Digifant control unit by the air conditioner. This is the case on pressing the A/C button.

Test sequence

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .
- Connect up multimeter for voltage measurement as follows.

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

- Switch on ignition.
- Switch off air conditioner.
  - Specification: Less than 1.5 V

- Switch on air conditioner.
  - Specification: Greater than 8 V

If readings do not match specifications:

- Check for open circuit and short to earth/positive in the following wiring.

Test box V.A.G 1598 A Socket	Air-conditioner switch -E30 Contact
32	=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

- If necessary, eliminate open circuit in wiring/short circuit.
- If there is no fault in the wiring, check operation of air conditioner.

=> Heating, Air Conditioner; Repair Group 87; Air Conditioner; Servicing components of manually controlled air conditioner Air Conditioner Servicing components of manually controlled air conditioner

Checking air-conditioner compressor shutoff

Note:

Air-conditioner compressor shutoff takes two different forms ("In" and "Out"):

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- In: Shortly prior to cut-in of air-conditioner compressor, voltage is applied to pin 12. Digifant control unit opens idling-speed stabilisation valve slightly further to offset load caused by high idling speed.
- Out: On accelerating from a standstill and from low vehicle speed, air-conditioner compressor is shut off by Digifant control unit for max. 12 seconds. If accelerator pedal is released sooner, time descreases to min. 3 seconds.
  The compressor is also shut off on starting and in the event of idling-speed stabilisation faults.

Test requirements:

- Air conditioner OK
- No faults stored in fault memory
- Vehicle at ambient temperature (more than +15 °C)

Test sequence

- Start engine and let it idle.
- Switch on air conditioner.

- Give short burst of full throttle; engine does not have to reach maximum speed.
  - Air-conditioner compressor must come to a halt for several seconds (visual inspection)

If air-conditioner compressor is not shut off:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .
- Connect up multimeter for voltage measurement as follows.

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

- Switch on ignition.

- Switch on air conditioner.
  - Specification: Greater than 8 V (after approx. 10 seconds)

If reading does not match specification:

- Check for open circuit and short to earth/positive in the following wiring.

Test box V.A.G 1598 A Socket	Magnetic coupling control unit -J153 Contact
12	=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

- If necessary, eliminate open circuit in wiring/short circuit.
- If wiring is OK, check magnetic coupling control unit signal.

6.3 - Checking engine-speed signal

Notes:

- Rev counter in dash panel insert is actuated by Digifant control unit.
- Checking engine-speed signal

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

6.4 - Checking fuel consumption signal

Notes:

- On-board computer in dash panel insert is actuated by Digifant control unit.
- Fuel consumption signal is calculated directly from injection period and purge control rate.
- Fuel consumption signal is used by on-board computer in dash panel insert for display of fuel consumption.
- Checking wiring:

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

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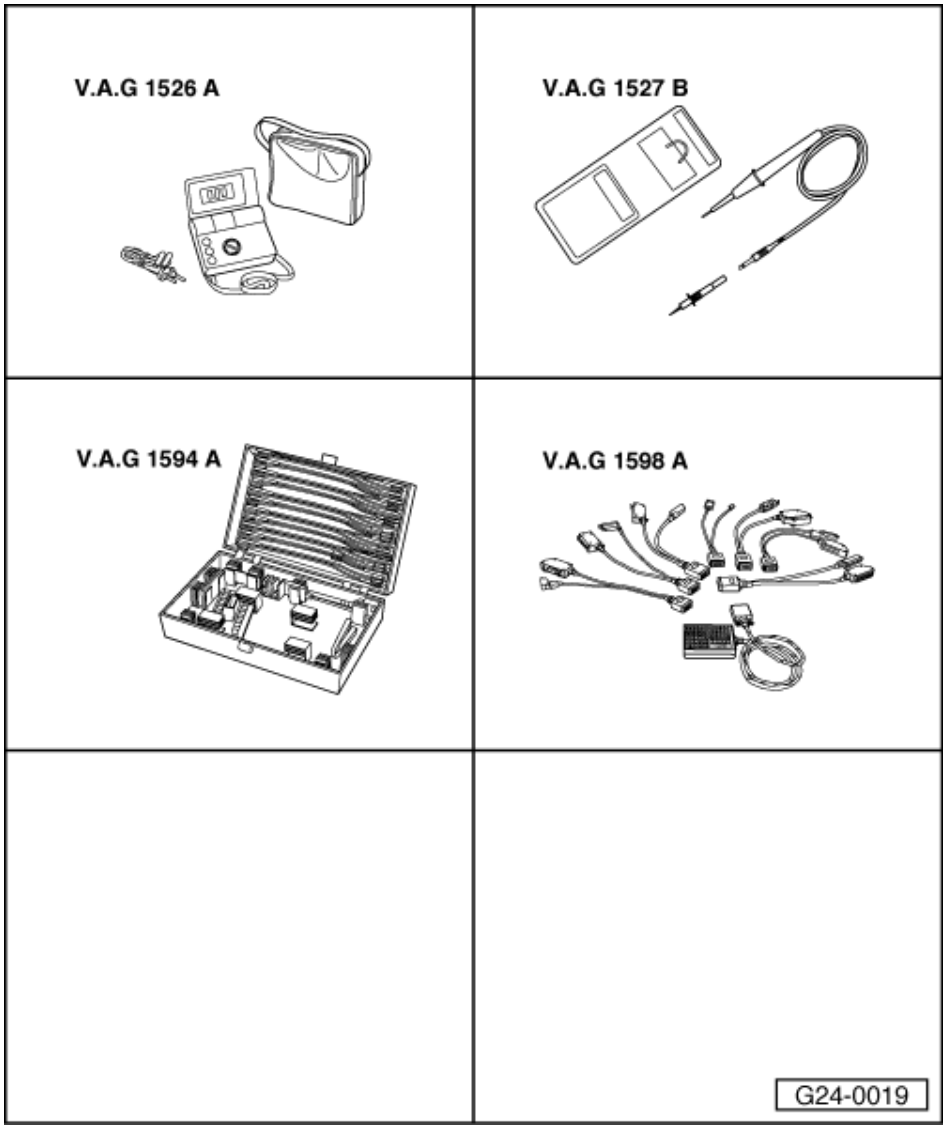
6.5 - Checking vehicle-speed signal



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Test requirement:

- Speedometer function and display OK

Test sequence

- Raise vehicle (if at all possible using lifting platform) until front left wheel is free to turn.
- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to engine control-unit connector and also to actual engine control unit => Page 40.
- Connect up voltage tester V.A.G 1527 B as follows.

Test box V.A.G 1598 A Socket	Measure to

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10	Battery positive

- Switch on ignition.
  - LED must light faintly
- Turn front left wheel.
  - LED must flash

If LED does not flash:

- Check for open circuit and short to earth/positive in the following wiring.

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Test box V.A.G 1598 A Socket	Dash panel insert Contact
10	=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If no fault is found in wiring:

- Pull adapter V.A.G 1598/9 off engine control unit.

If LED now flashes:

- Replace engine control unit => Page 41 .

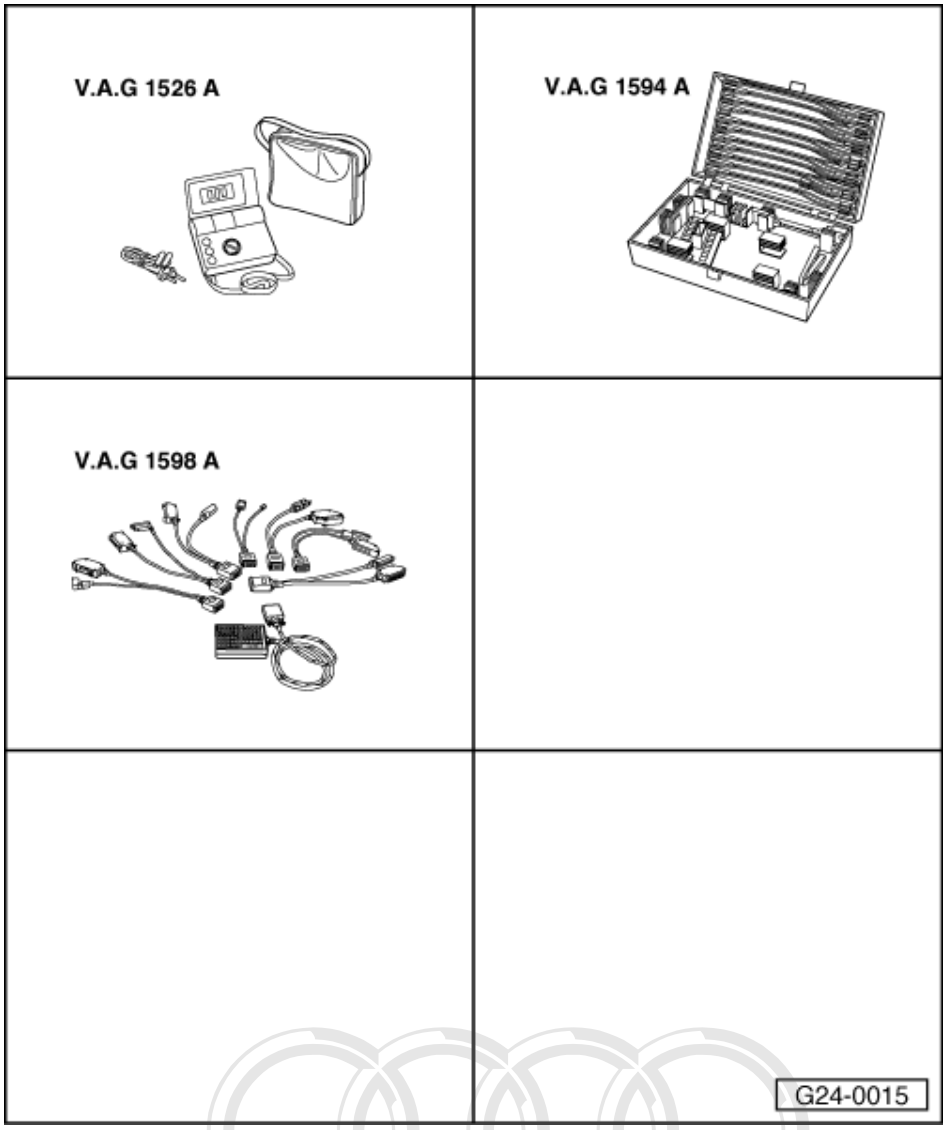
Note:

After replacing engine control unit, control unit and throttle valve potentiometer must be matched => Page 92 .

If LED still does not flash:

- Identify all components making use of vehicle-speed signal (e.g. radio, air conditioner), consecutively disconnect them from dash panel insert and repeat test until cause has been established.

6.6 - Checking wiring to automatic gearbox control unit



Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Gearshift signal wire

Notes:

- Only perform the following test if fault 00545 is displayed on V.A.G 1551.
- This signal briefly retards the ignition timing on changing gear to reduce gearshift jolt.

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Test requirements:

- Battery voltage OK
- Engine control unit encoding OK => Page 13

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .
- Connect up voltage tester V.A.G 1527 B with test leads from V.A.G 1594 A to contacts 14 and 35 of test box V.A.G 1598 A.

- Switch on ignition.
  - LED must light

If LED does not light:

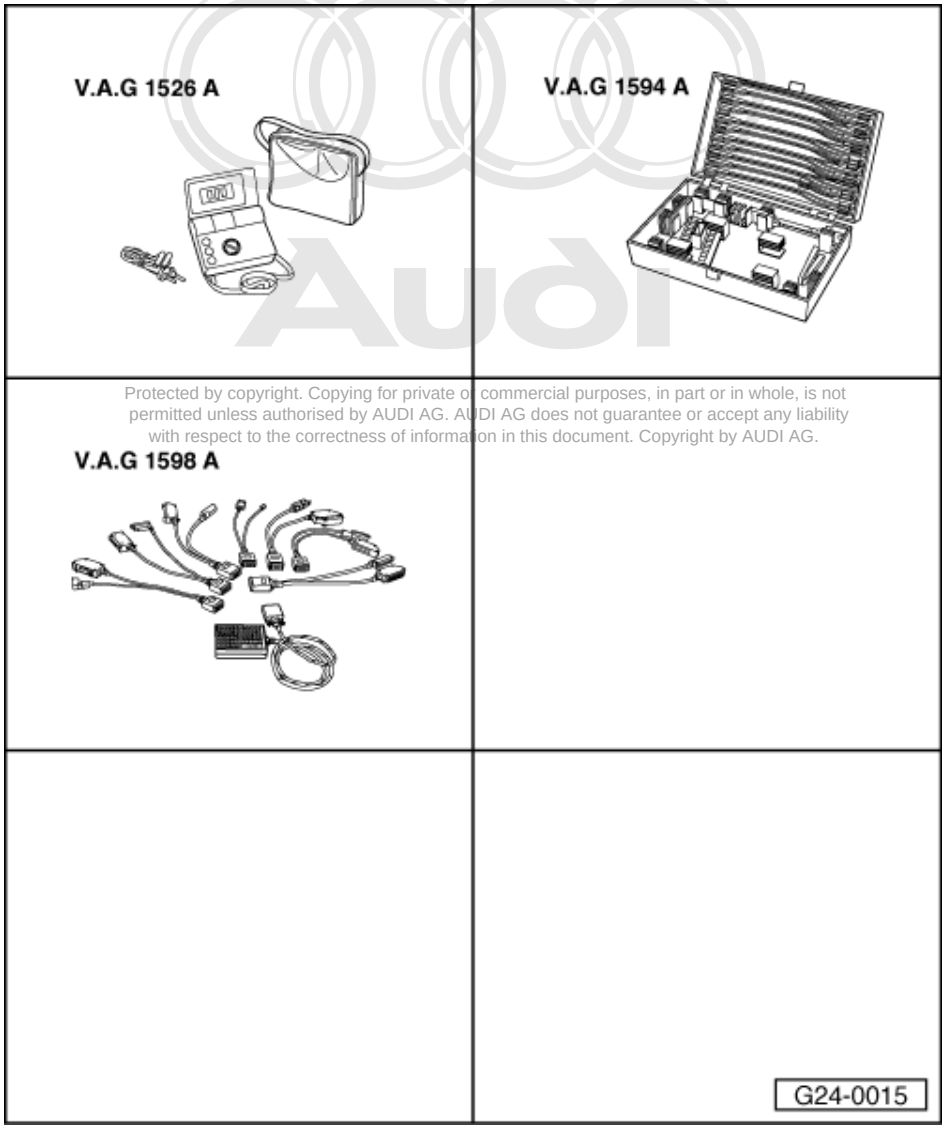
- Check for open circuit/short to earth in wiring between contact 14 of Digifant control unit connector and automatic gearbox control unit.
- If wiring is OK, check automatic gearbox control unit.

=> Automatic Gearbox 097; Repair Group 01; Self-diagnosis of automatic gearbox 097 Self-diagnosis of automatic gearbox 097

If LED lights:

- Replace engine control unit => Page 41 .

6.7 - Checking start signal



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A

- V.A.G 1598 A with V.A.G 1598/9

Notes:

- On starting, terminal 50 signal is applied to pin 25 of Digifant control unit.
- Once engine has started, earth is applied on vehicles with manual gearbox to pin 25 by way of starter winding. On vehicles with automatic gearbox, pin 25 is open after starting.

Test requirement:

- Battery voltage OK

Test sequence

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of engine control unit only (not to control unit) => Page 40 .
- Connect up multimeter for voltage measurement as follows.

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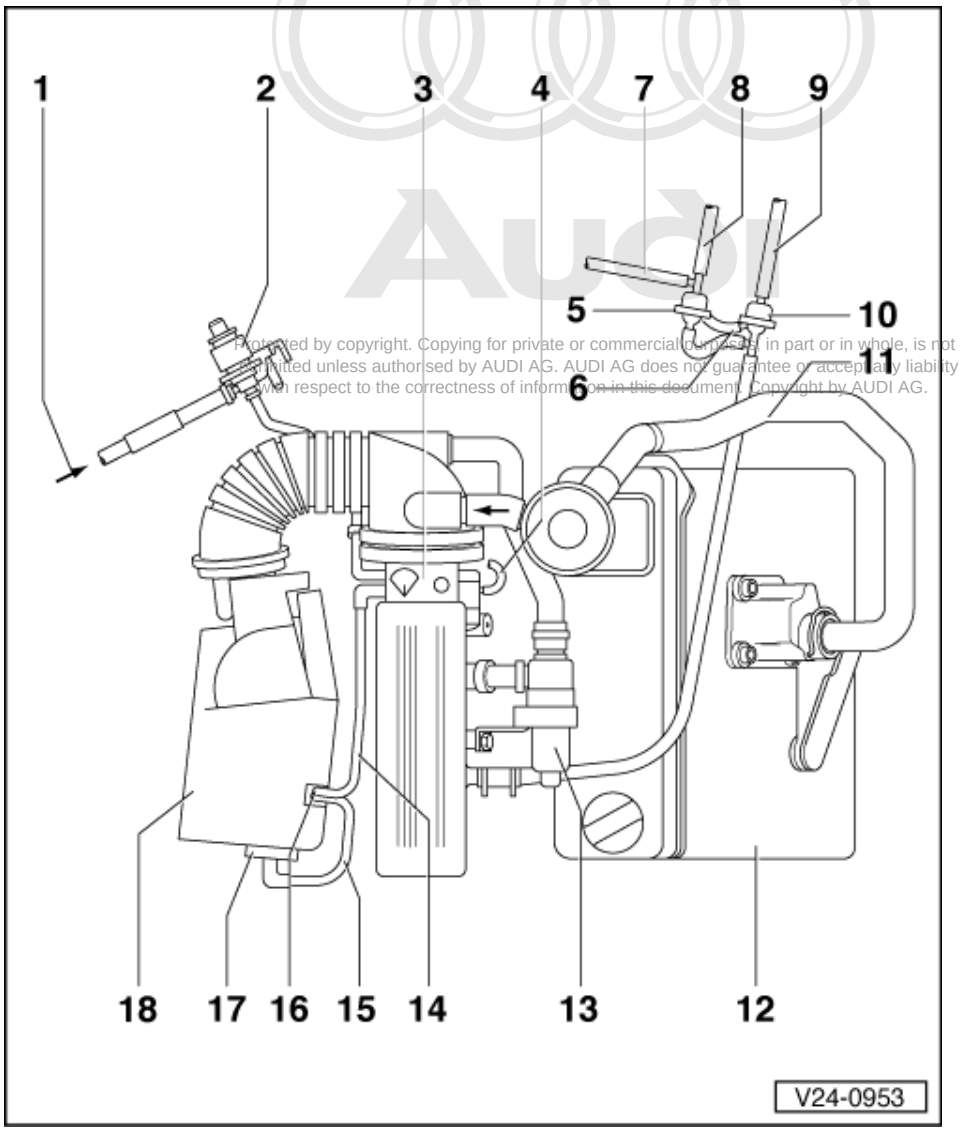
Test box V.A.G 1598 A Socket	Measure to
25	Engine earth

- Operate starter.
  - Specification: approx. battery voltage
- If reading does not match specification, use current flow diagram to check wiring.

7 - Vacuum diagram

7.1 - Vacuum diagram



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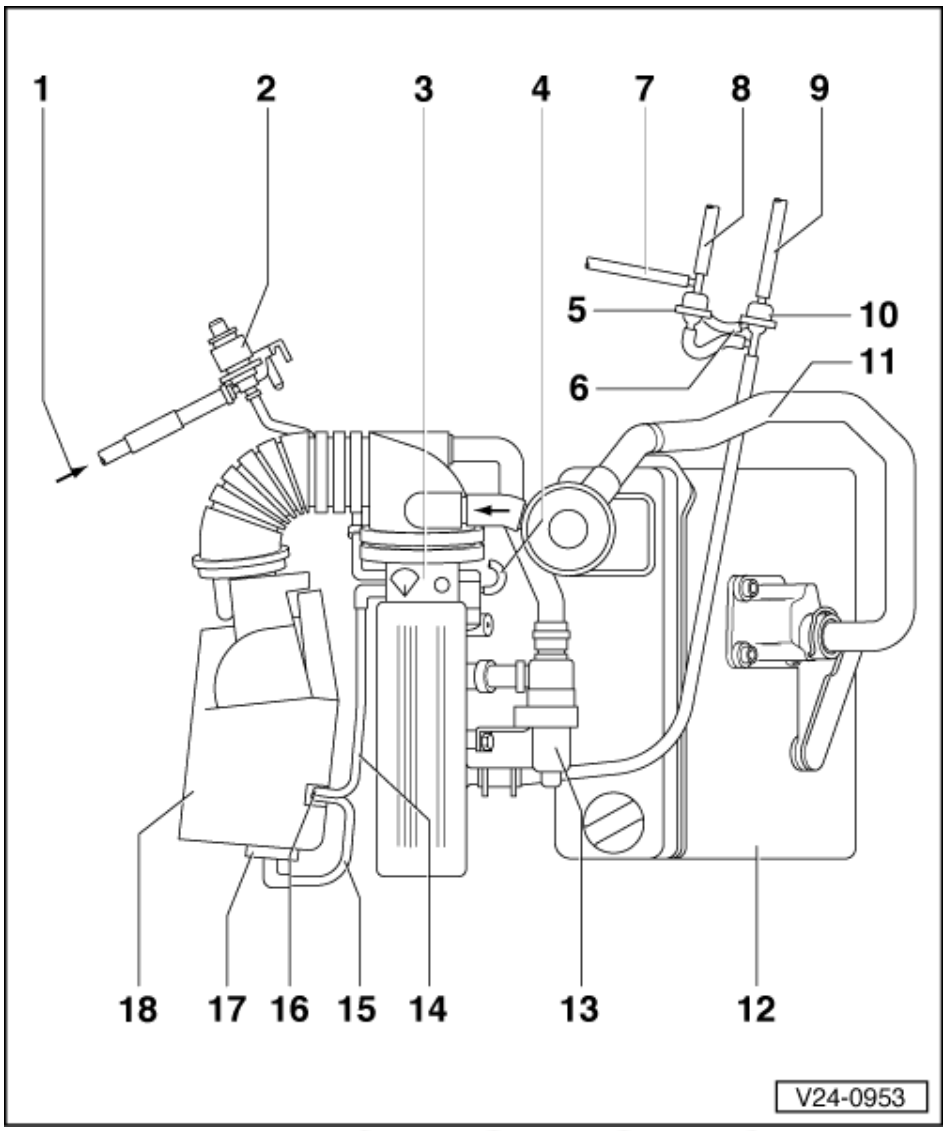
1 From activated charcoal filter
2 Activated charcoal filter solenoid valve -N80
3 Throttle valve assembly
4 To fuel pressure regulator
5 Non-return valve
- For air conditioner

6 Connection
- Sealed with dummy plug

7 To 2-way valve
- For fresh/recirculated air flap

8 To vacuum reservoir
- For air conditioner



9 To brake servo
10 Non-return valve
11 Crankcase breather
12 Cylinder block
13 Idling-speed stabilisation valve -N71
14 From throttle valve assembly to temperature regulator for intake-air pre-heating
15 From temperature regulator to vacuum unit for intake-air pre-heating

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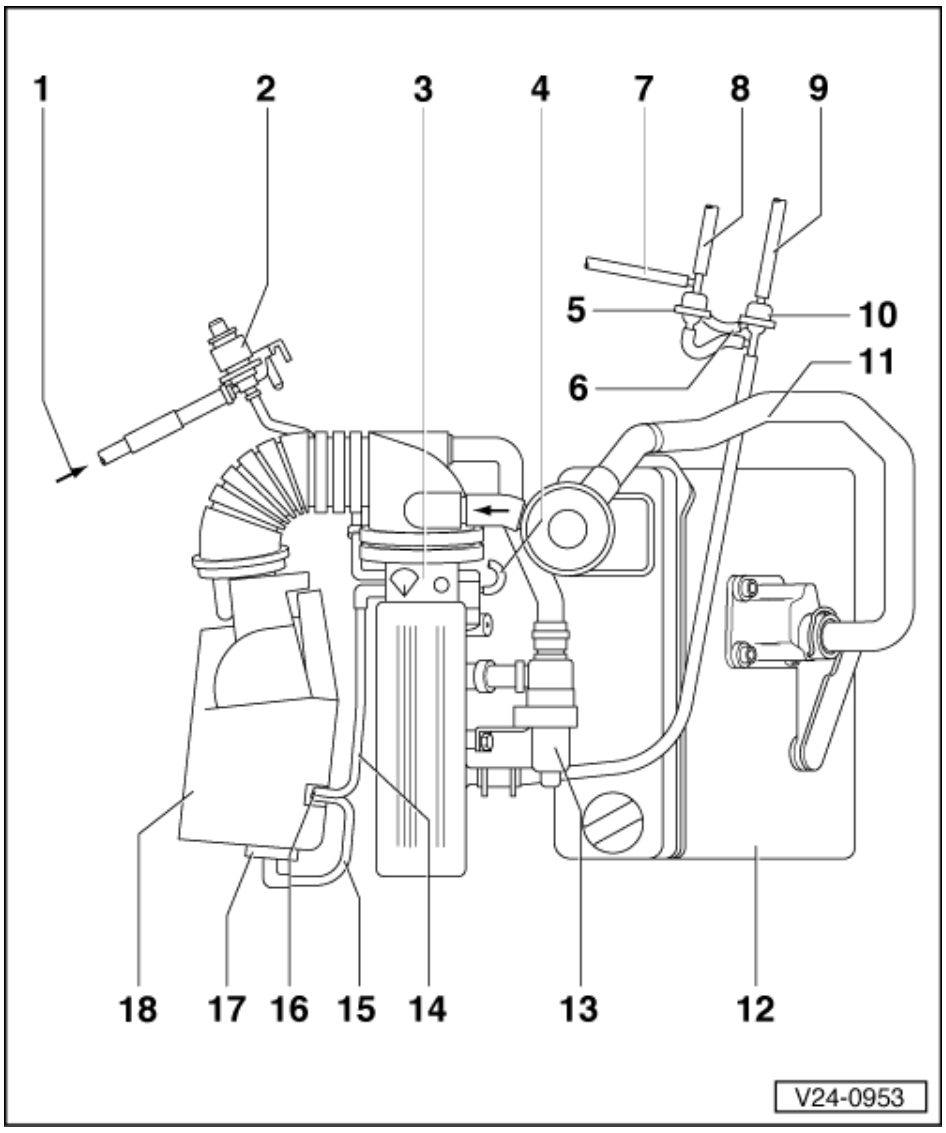

16 Temperature regulator

- For intake-air preheating
- Installation position: Brass hose connection faces vacuum unit for intake-air preheating
- Checking intake-air preheating
  => Page 94

17 Vacuum unit

- For intake-air preheating

18 Air cleaner

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28 - Ignition system

1 - Checking ignition system

1.1 - Checking ignition system

1.2 - Safety precautions

Heed the following so as to avoid possible injury and/or the destruction of the injection and ignition system:

- Never touch/disconnect ignition cables with engine running or at cranking speed.
- Always switch off ignition before disconnecting and connecting ignition system wires (also applies to H.T. wires and measuring instrument leads).
- If engine is to be operated at cranking speed without it starting (e.g. compression test), unplug connectors from output stage for ignition coil and injectors. Interrogate fault memory on completion of work.
- Boost starting with rapid charger is only permitted for up to 1 minute at a maximum of 16.5 V.
- Always switch off ignition before washing engine.
- Always switch off ignition before disconnecting and connecting battery so as not to damage engine control unit.

- Vehicles with a definite or suspected fault in the ignition system are only to be towed after unplugging connector at output stage.
- Never connect capacitor to terminal 1 (-).
- 1 kω ignition distributor rotor (identification: R1) is never to be replaced with a different rotor (including radio interference suppression).
- For connection of measuring instruments (e.g. voltage tester V.A.G 1527 B, portable multimeter V.A.G 1526 A), always make use of adapter set V.A.G 1594 A.

1.3 - Adjustment data, spark plugs

Engine codes			ABK (2.0 l / 85 kW engine)
Digifant control unit	Part no.		=>Parts List
Ignition point 1)	Test specification	° before TDC	4 ... 8
	Setting	° before TDC	6 ± 1
	Engine speed	rpm	2000 ... 2500
Firing order			1-3-4-2
Spark plugs 2)	Tightening torque	Nm	30

1) Engine-oil temperature at least 80 ° C

2) Current values:

=> Exhaust emission test binder

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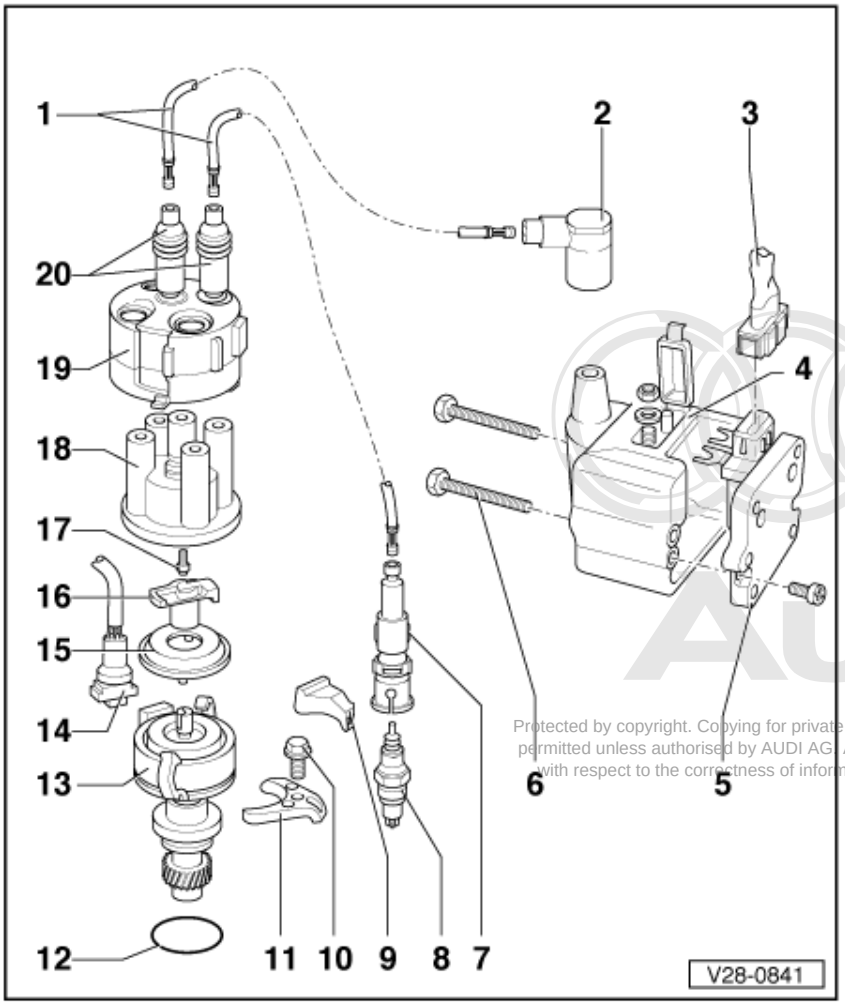
1.4 - Servicing ignition system



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1 Ignition cable
- Check for continuity

2 Interference suppression connector
- 0.6...1.4 kω

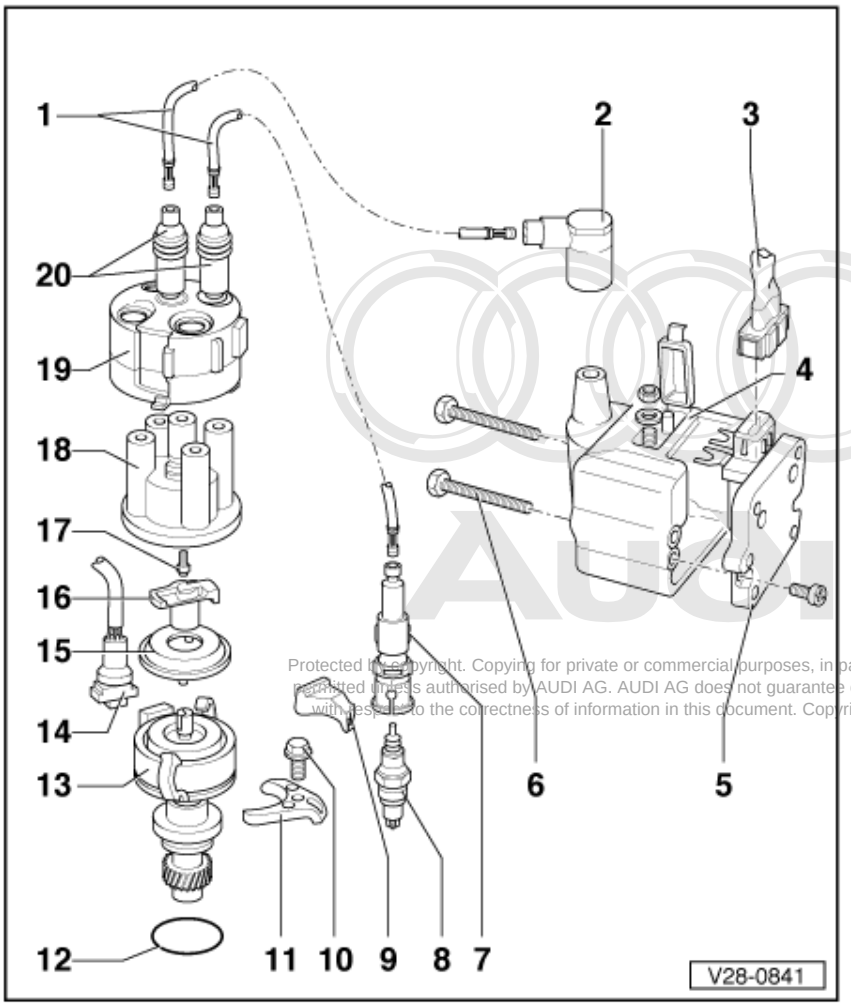
3 3-pin connector
- Press wire clip to unplug

4 Ignition transformer -N152
- Checking => Page 113

5 Output stage for ignition transformer
- Checking => Page 115
- Cannot be replaced separately

6 10 Nm

7 Spark plug connector
- 4...6 kω



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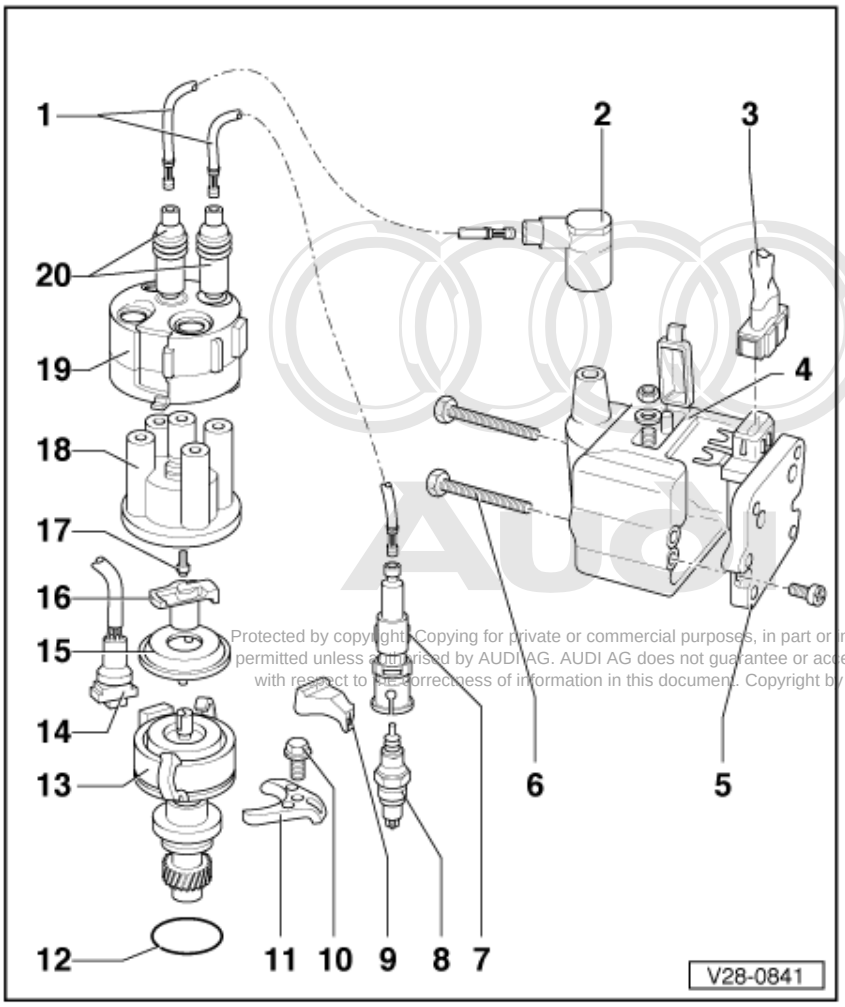
8 Spark plug, 30 Nm
- Type and spark gap

=> Exhaust emission test binder

9 Securing cap
10 25 Nm
11 Clamp
12 O-ring
- Replace if damaged

13 Ignition distributor
- Installing =>Page 110
- Checking and adjusting ignition point => Page 111
- Checking Hall sender => Page 132

14 3-pin connector
- For Hall sender -G40
- Press wire clip to unplug



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15 Dust cap

16 Ignition distributor rotor

- 0.6...1.4 kω

17 Carbon brush with spring

- Check for wear, damage and freedom of movement

18 Distributor cap

- Watch out for cracks and traces of leakage current
- Check contact wear
- Clean before fitting

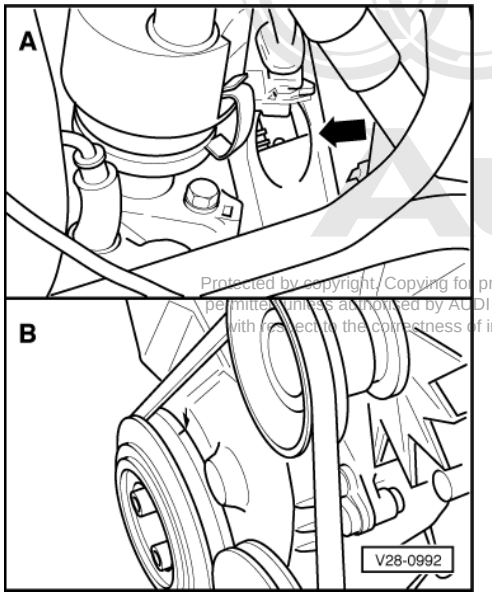
19 Screen

- For radio interference suppression

20 Interference suppression connector

- 0.6...1.4 kω

1.5 - Installing ignition distributor



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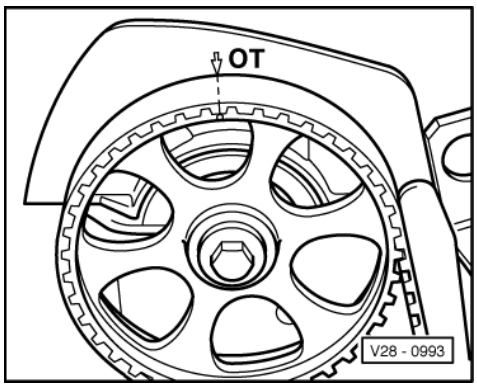
Engine in position:

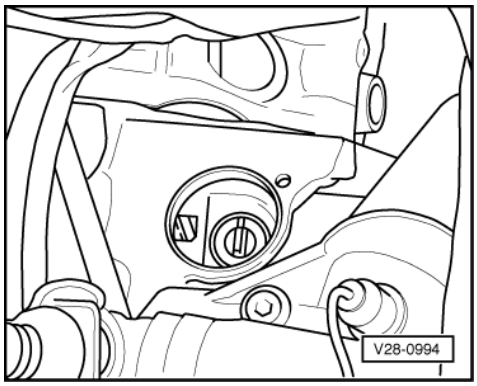
- -> Set flywheel/drive plate to no. 1 cylinder TDC.

Engine removed:

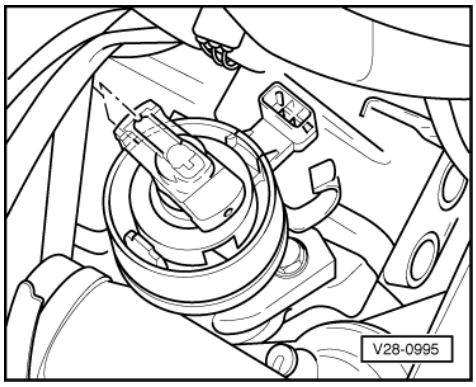
- Mark on vibration damper (pulley) must coincide with arrow on toothed belt guard.



- -> Mark on camshaft sprocket must coincide with arrow on upper toothed belt guard.



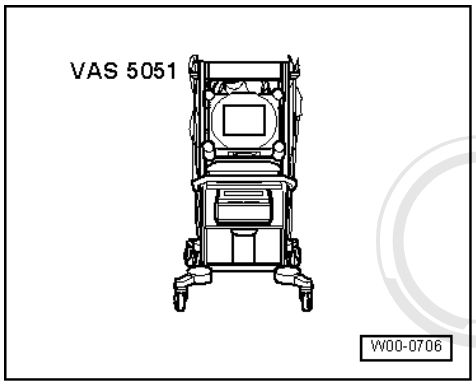
- -> Position locating lug of oil pump shaft in parallel with crankshaft.



- -> Position distributor rotor such that it faces mark for no. 1 cylinder at distributor housing.
- Insert ignition distributor.
- Clean ignition distributor cap before fitting, watch out for cracks and traces of leakage current and replace if necessary.
- Check and adjust ignition point => Page 111 .

1.6 - Checking and adjusting ignition point

Special tools and workshop equipment required



- VAS 5051 with VAS 5051/1 and VAS 5051/2

or

- V.A.G 1551 with V.A.G 1551/1

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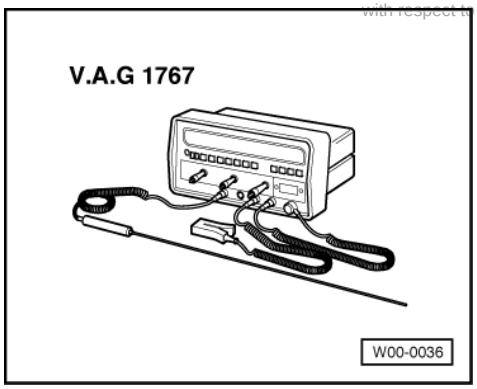


- V.A.G 1767

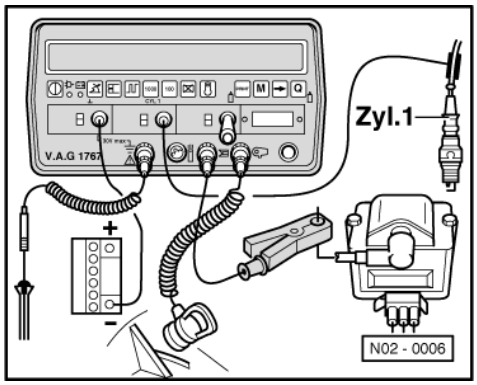
or

- V.A.G 1367 with V.A.G 1367/8

Note:

Ignition point is only to be adjusted if a deviation is found when checking idling speed => Page 43 .

Test sequence



- -> With ignition switched off, connect up ignition tester V.A.G 1767 (or V.A.G 1367).

=> Operating instructions

Notes:

- Take particular care to ensure that TDC sender of ignition tester V.A.G 1367 is fully inserted in gearbox housing.
- Ignition point is displayed directly on V.A.G 1767 (or V.A.G 1367). There is no need to aim timing light at ignition point notches.

- Interrogate and erase fault memory => Page 4 .

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

-> Start basic setting=>Page 12 , Display group 000, engine idling.

- Maintain engine speed at 2000 ... 2500 rpm and read off ignition point on ignition tester V.A.G 1767 (or V.A.G 1367).
  - Test specification: 4 ... 8° before TDC

Note:

If ignition point displayed is outside tolerance, it must be adjusted prior to checking idling speed whilst system is still set to "Basic setting 0".

- Adjust ignition point by turning ignition distributor.
  -Setting 6 ±1° before TDC

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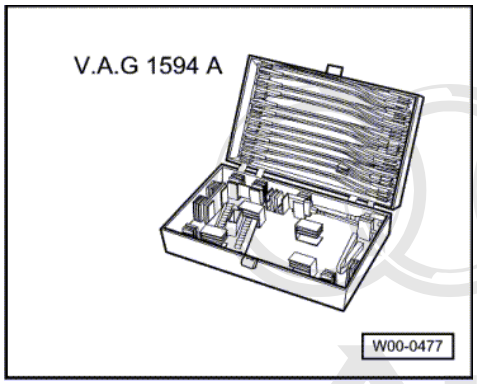
- Leave engine idling.
- Press ⇒key.
  - Ignition point may fluctuate in range 2 ... 10 ° before TDC
- After adjusting ignition point, check idling speed => Page 43 .

1.7 - Checking ignition transformer -N152

Special tools and workshop equipment required

- V.A.G 1526 A



- V.A.G 1594 A

Notes:

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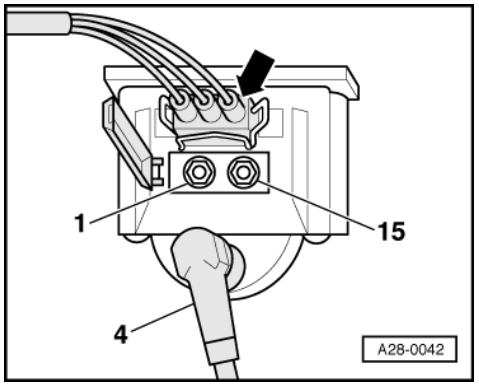
- Check for corrosion/damage in wiring between output stage and ignition transformer.
- Checking output stage for ignition transformer => Page 115.

Test sequence



- -> Unplug connector -arrow- from output stage and main ignition cable -4- from ignition transformer.
- Open cap for screw connection.
- Check primary resistance with portable multimeter V.A.G 1526 A between terminals 1 and 15.
  - Specification: 0.5 ... 1.5 ω
- Check secondary resistance with portable multimeter between terminals 4 and 15.
  - Specification: 5 ... 9 kω

If a reading does not match specification:

- Replace ignition transformer.

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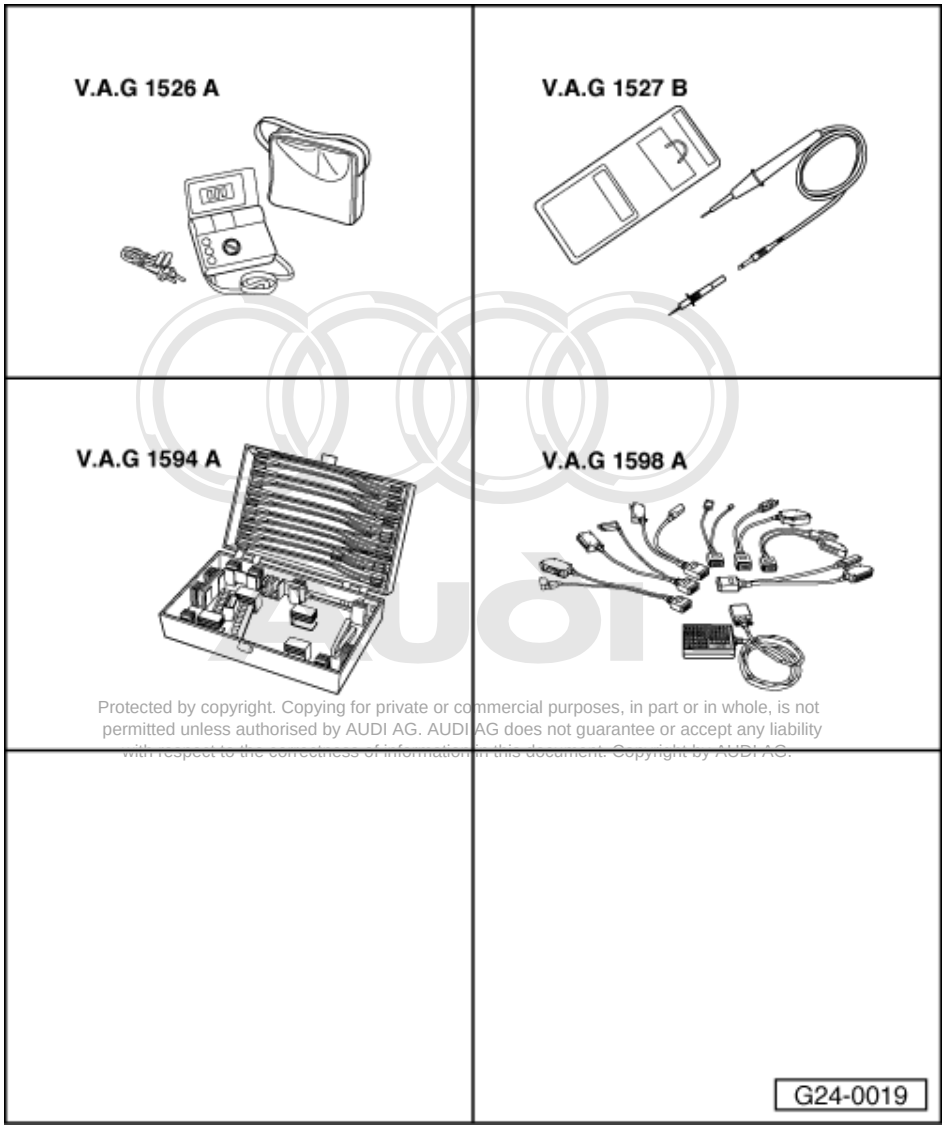
1.8 - Checking output stage for ignition transformer



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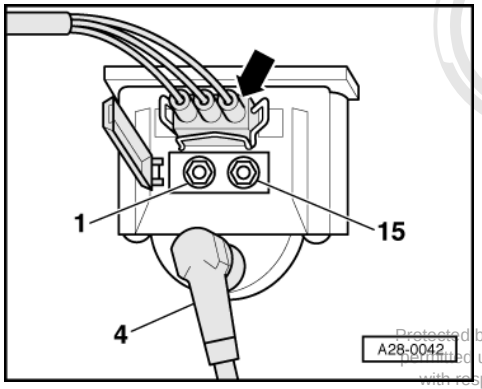
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Test requirement:

- Ignition transformer OK; checking => Page 113

Checking power supply



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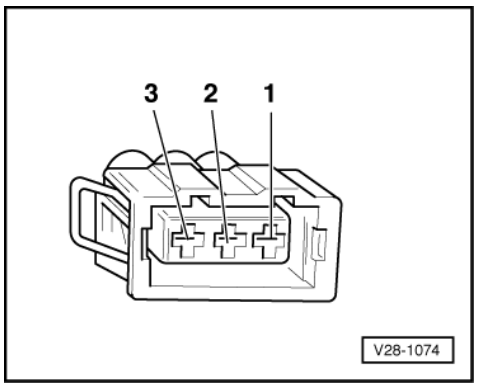
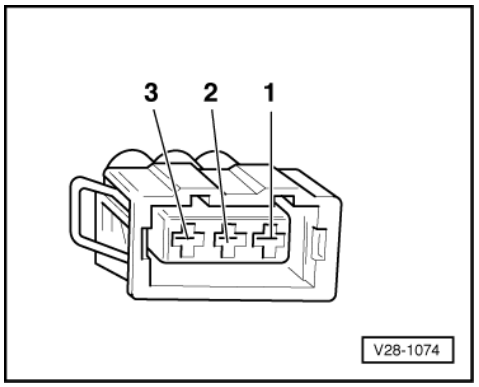
- -> Unplug connector -arrow- from output stage.



- -> Connect up multimeter for voltage measurement between contacts 1 and 3.
- Switch on ignition.
  - Specification: approx. battery voltage

If reading does not match specification:



- -> Connect up multimeter for voltage measurement as follows.

Connector Contact	Measure to
1 (brown wire)	Battery positive
3 (black wire)	Engine earth

- Switch on ignition.
  - Specification: approx. battery voltage in each case

If a reading does not match specification:

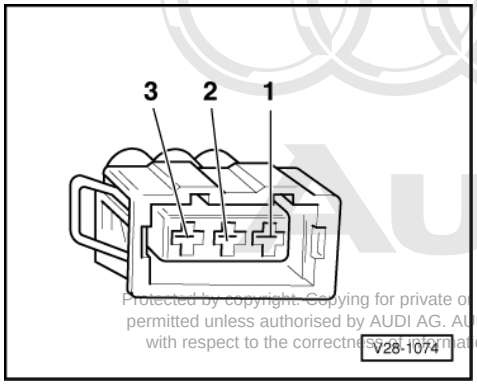
- Use current flow diagram to eliminate open circuit in wiring.

Checking actuation

Test requirement:

- Hall sender OK; checking => Page 132

- Unplug connectors at all injectors.



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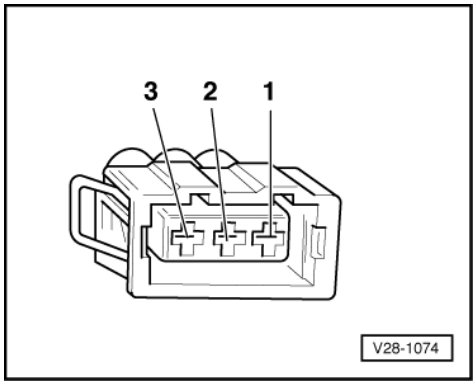
- -> Connect up voltage tester V.A.G 1527 B between contacts 2 (signal) and 3 (positive).
- Operate starter.
  - LED must flash

If LED does not flash:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of font=symbol charset=fontspecific code=101font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'γfont=symbol charset=fontspecific code=105 TeX='\iota ' descr='[iota]'font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'font=symbol charset=fontspecific code=101control unit only (not to control unit) => Page 40 .



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

Connector Contact	Test box V.A.G 1598 A Socket
2	6

- If necessary, eliminate open circuit in wiring/short circuit.

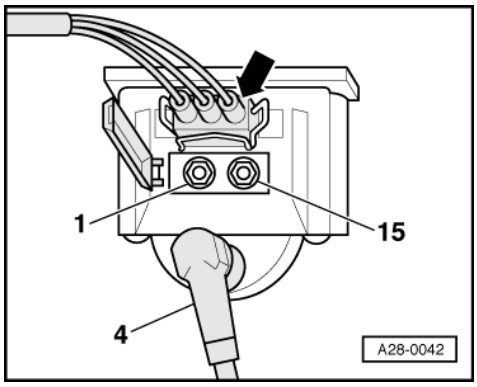
=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If wiring is OK:

- Replace engine control unit => Page 41 .

If power supply and actuation are OK:

- Switch off ignition.
- Re-attach connector and ignition cable at ignition transformer.



- -> Connect voltage tester V.A.G 1527 B with test leads and terminals to contacts 1 and 15 at ignition transformer.

Attention:
When performing following test, avoid contact with connecting elements of ignition transformer and test leads.

- Operate starter.
  - LEDs must flash

If LEDs do not flash:

- Replace output stage with ignition transformer.

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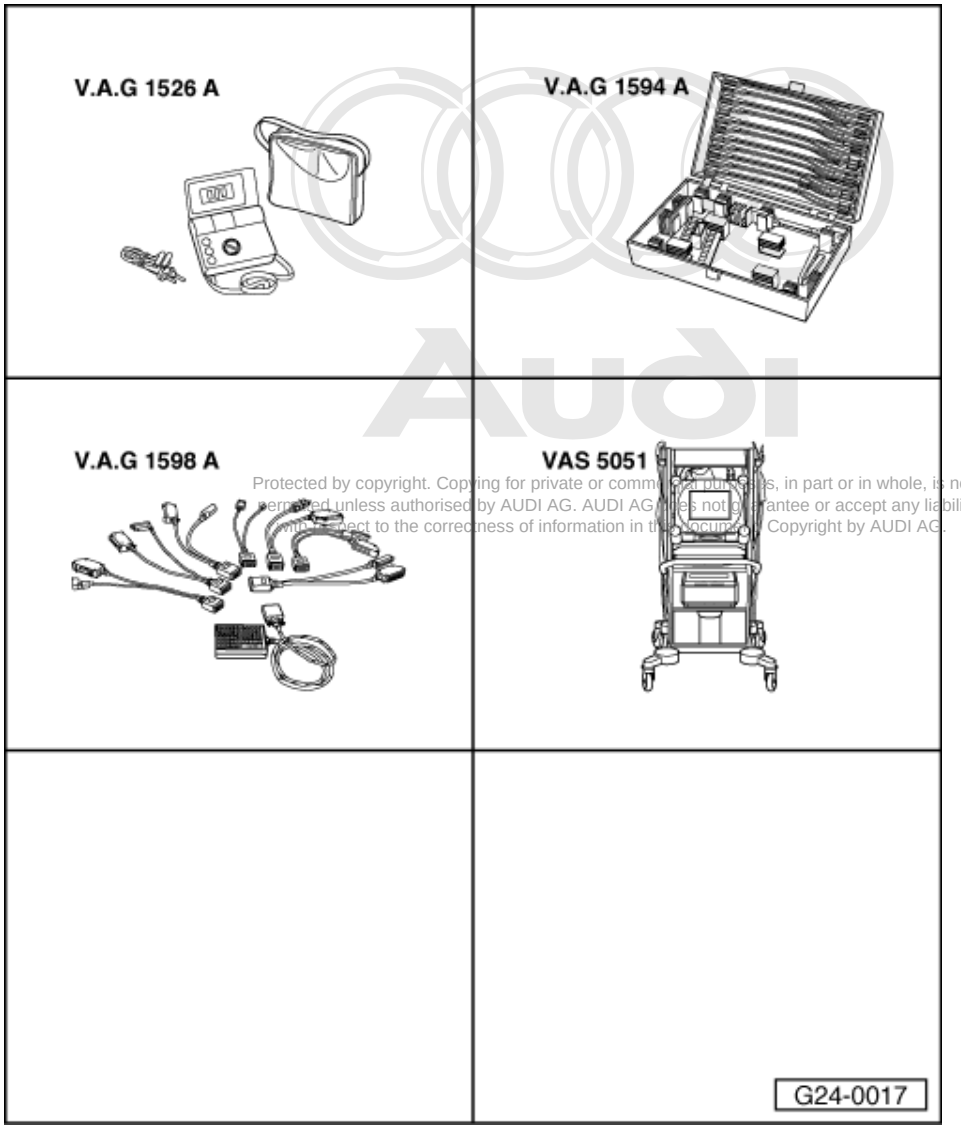
1.9 - Checking intake-air temperature sender -G42



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1

or

- V.A.G 1551 with V.A.G 1551/3 A
- Refrigerant spray (commercially available)

Notes:

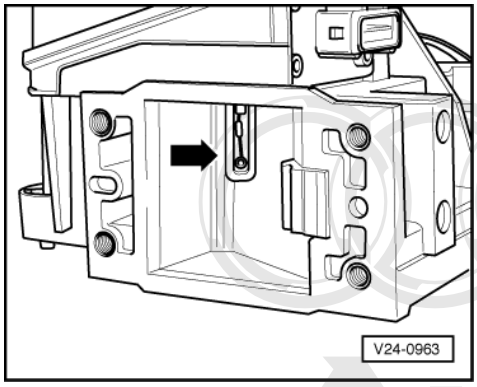
- Intake-air temperature sender -G42 is shown as temperature sensor -G18 in current flow diagrams.
- Fitting location: In air-flow meter potentiometer -G19

Test sequence

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

-> Read measured value block, Display group 003 => Page 22 .

- Note value in display zone 3 (intake-air temperature).



- -> Lift upper part of air cleaner and apply refrigerant spray to intake-air temperature sender -G42.

Note:

Fig. shows intake-air temperature sender in air-flow meter following removal.

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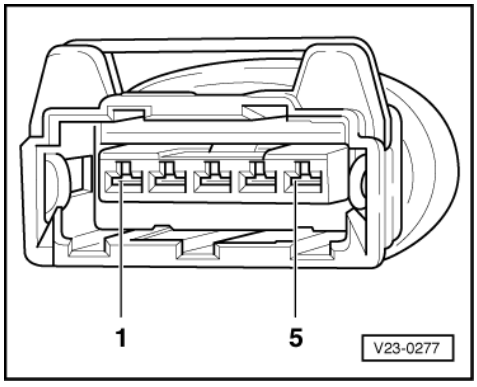
- Check display in zone 3.
  - Specification: Temperature value must decrease

Note:

A specific substitute value is displayed by the Digifant control unit if the intake-air temperature sender is defective.

If value displayed in zone 3 does not change:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of font=symbol charset=fontspecific code=101font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'γfont=symbol charset=fontspecific code=105 TeX='\iota ' descr='[iota]'font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'font=symbol charset=fontspecific code=101control unit only (not to control unit) => Page 40 .



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

Connector Contact	Measure to
1	Test box V.A.G 1598 A Socket 30
4	Engine earth

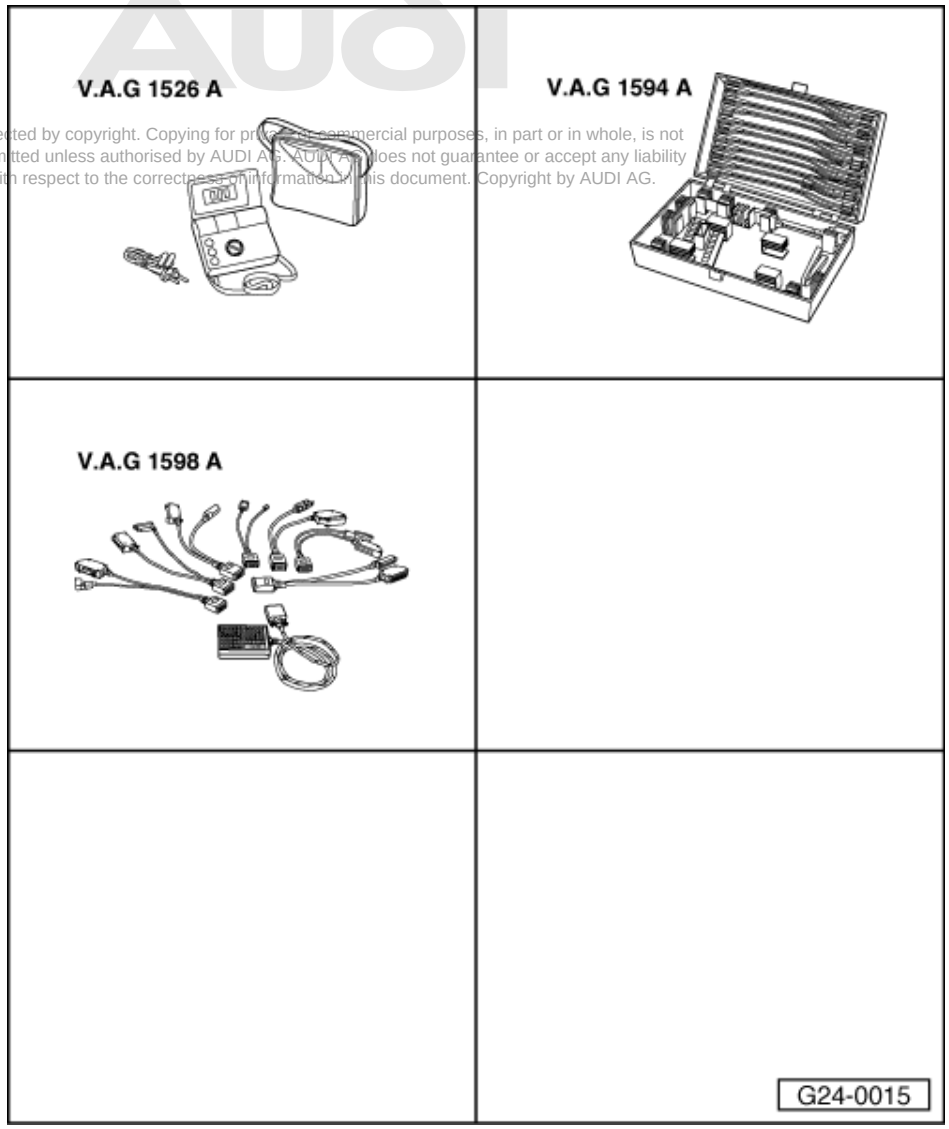
- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If no fault is found:

- Replace engine control unit => Page 41 .

1.10 - Checking coolant temperature sender -G62



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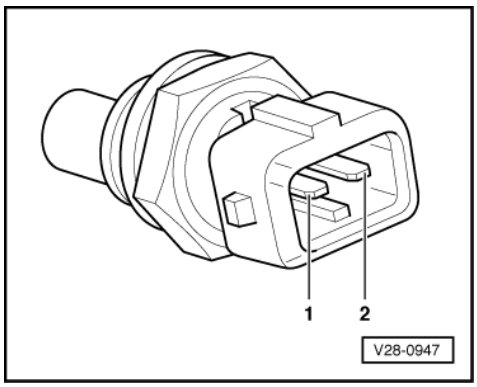
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

Fitting location => Exploded view of fitting locations - Page 31

Note:

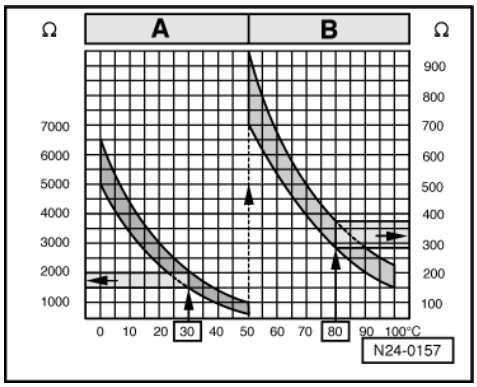
Checking operation => Read measured value block, Display group 001, Page 18 .



Checking internal resistance

- Unplug connector at coolant temperature sender.
- -> Connect up multimeter for resistance measurement between contacts 1 and 2 at sender.

Ranges A and B indicate resistance values for temperature ranges 0...50 °C and 50...100 °C respectively.



-> Specimen readings:

- 30 °C corresponds to a resistance of 1500...2000 ω
- 80 °C corresponds to a resistance of 275...375 ω

If readings do not match specifications:

- Replace coolant temperature sender.

Checking wiring

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of font=symbol charset=fontspecific code=101font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'γfont=symbol charset=fontspecific code=105 TeX='\iota ' descr='[iota]'font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'font=symbol charset=fontspecific code=101control unit only (not to control unit) => Page 40 .

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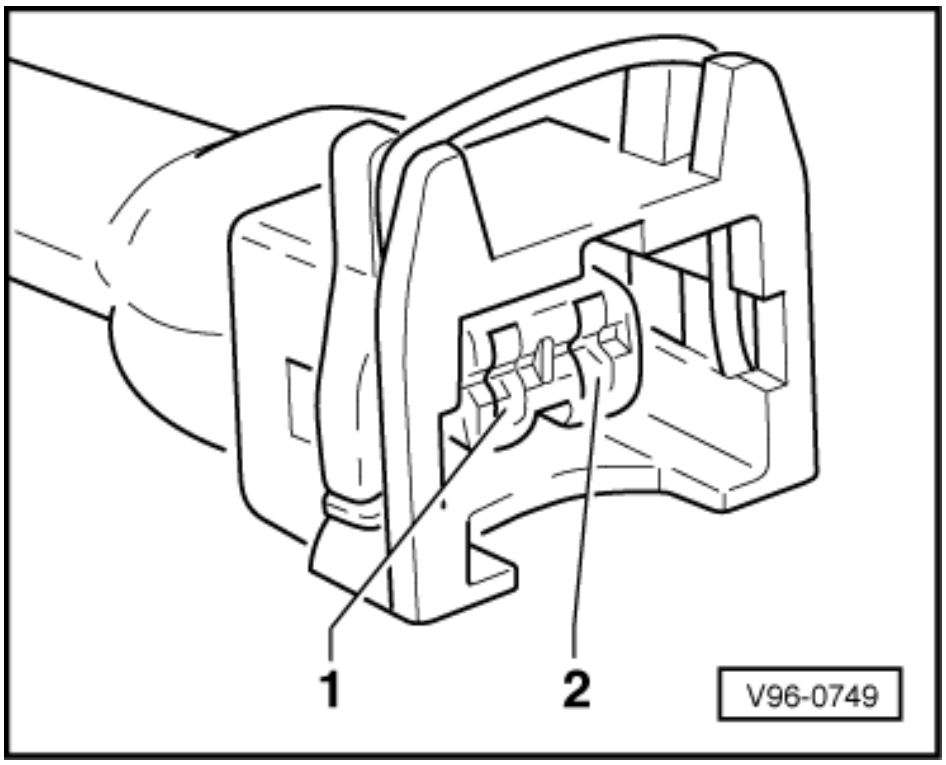

- -> Check for open circuit and short to earth/positive in the following wiring.

Connector Contact	Measure to
1	Test box V.A.G 1598 A Socket 11
2	Engine earth

- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If no fault is found:

- Replace engine control unit => Page 41 .

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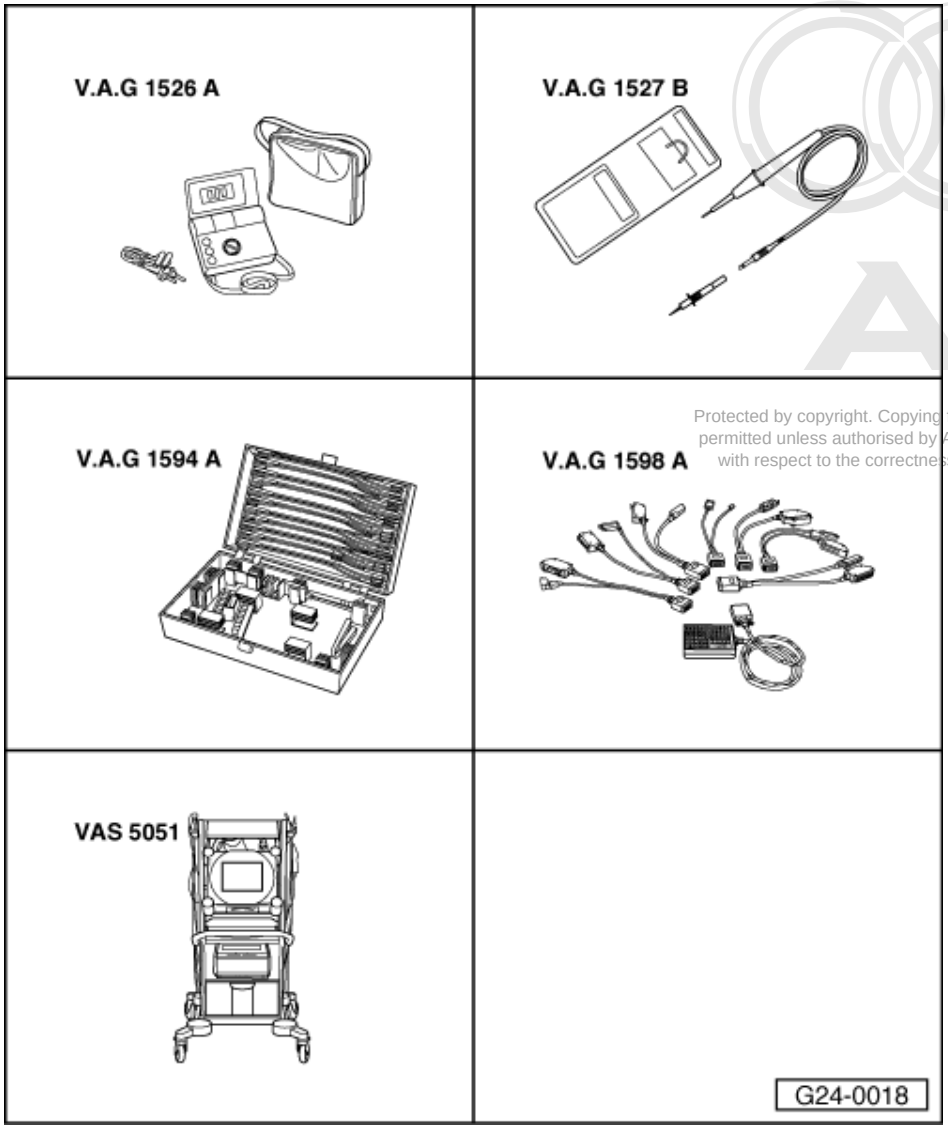
1.11 - Checking power supply for control unit



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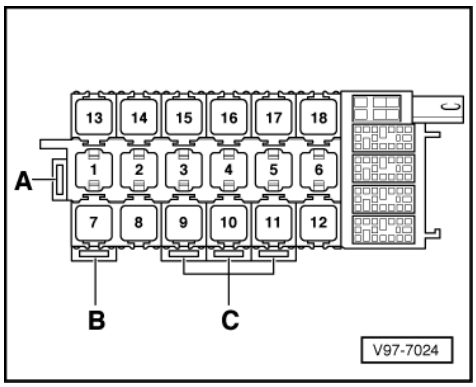
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9
- VAS 5051 with VAS 5051/1

or

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



Digifant control unit is supplied with power by way of current supply relay for Digifant control unit -J176.

Note:

-> Fitting location of current supply relay for Digifant control unit -J176: On auxiliary relay carrier at front left beneath dash panel, position 14

Test sequence

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

-> Read measured value block, Display group 003 => Page 22 .

- Check display in zone 4.
  - Specification: approx. battery voltage

If reading does not match specification:

Checking power supply

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .

- Connect up multimeter for voltage measurement as follows.

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

- Switch on ignition.
  - Specification: approx. battery voltage

If reading does not match specification:

- Use current flow diagram to check wiring between connector of Digifant control unit and current supply relay for Digifant control unit -J176.

If wiring is OK:

- Check power supply of current supply relay for Digifant control unit -J176 => Page 128 .
- Check actuation of current supply relay for Digifant control unit -J176 => Page 129 .
- If power supply and actuation of current supply relay are OK, replace relay.

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Checking earth supply

- Connect up multimeter for voltage measurement as follows.

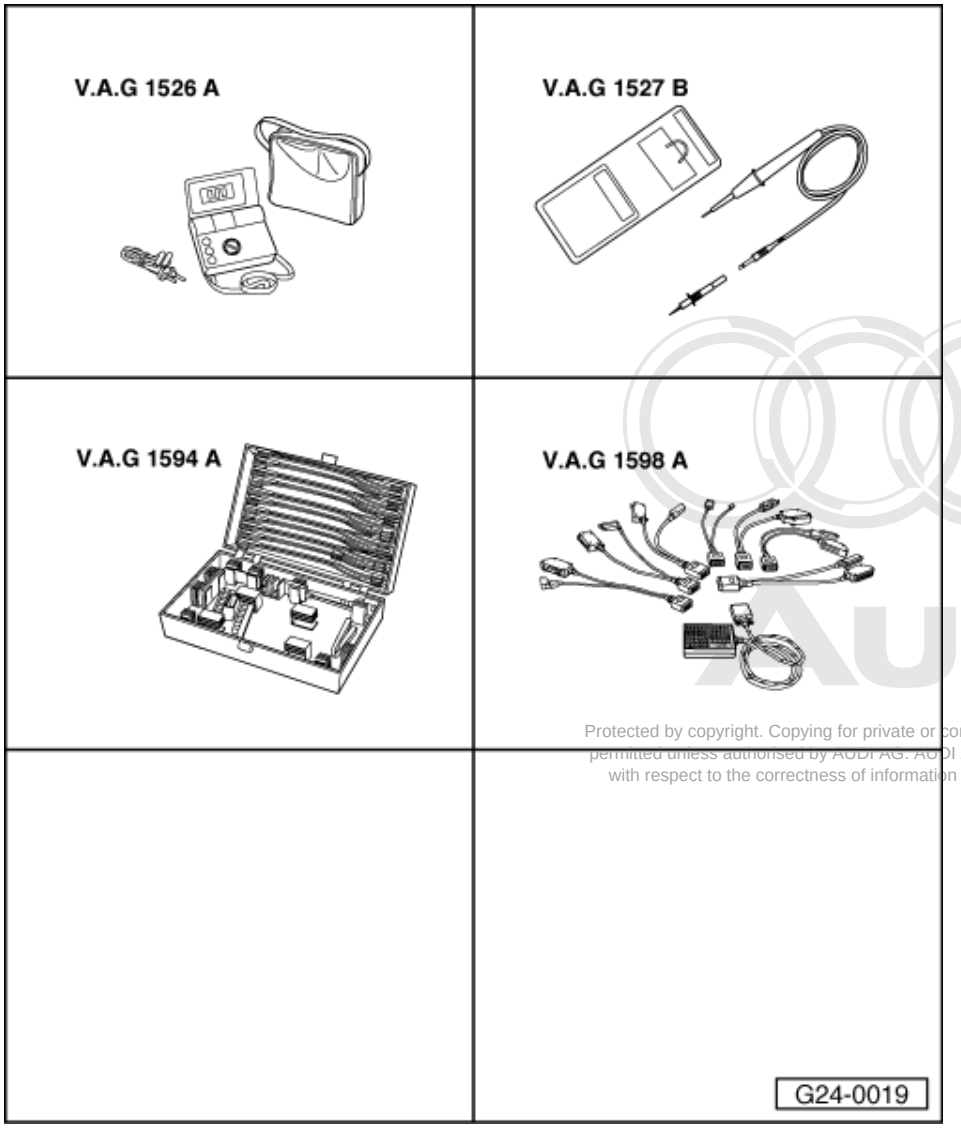
Test box V.A.G 1598 A Socket	Measure to
1	Battery positive
28	Battery positive
35	Battery positive

- Specification: approx. battery voltage in each case

If readings do not match specifications:

- Use current flow diagram to check wiring between connector of Digifant control unit and earth points.
- Eliminate open circuit in wiring if necessary.

1.12 - Checking current supply relay for Digifant control unit -J176



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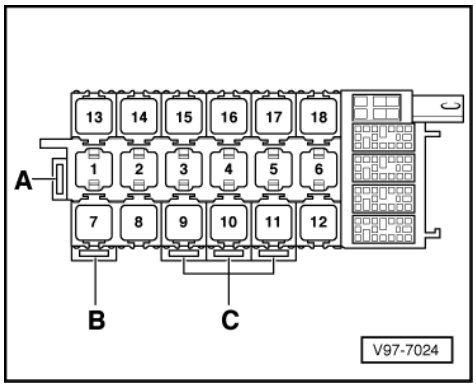
Special tools and workshop equipment required

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

- V.A.G 1598 A with V.A.G 1598/9

Note:



-> Fitting location of current supply relay for Digifant control unit -J176: On auxiliary relay carrier at front left beneath dash panel, position 14

Checking operation

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of font=symbol charset=fontspecific code=101font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'γfont=symbol charset=fontspecific code=105 TeX='\iota ' descr='[iota]'font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'font=symbol charset=fontspecific code=101control unit only (not to control unit) => Page 40 .
- Connect up voltage tester V.A.G 1527 B as follows.

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

- Switch on ignition.
  - Current supply relay for Digifant control unit -J176 (in auxiliary relay carrier at front left beneath dash panel, position 14) must click ...
  - ... and LED must light

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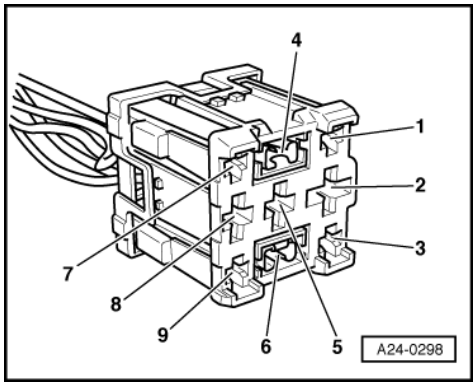
A - If relay clicks, but LED does not light:

- Pull out current supply relay.



- -> Check for open circuit in the following wiring.

Auxiliary relay carrier at front beneath dash panel on left, position 14 Contact	Test box V.A.G 1598 A Socket

6	19

- Eliminate open circuit in wiring if necessary.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

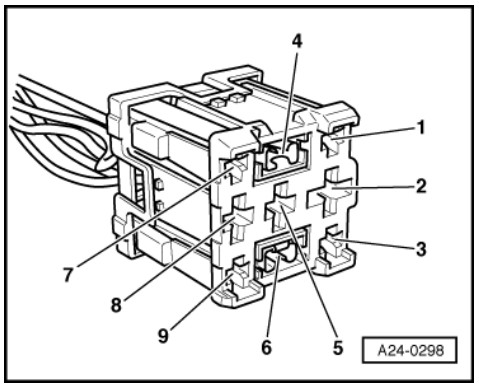
If wiring is OK:

- Replace current supply relay for Digifant control unit -J176.

B - If LED does not light and relay does not click:

Checking power supply

- Pull out current supply relay.



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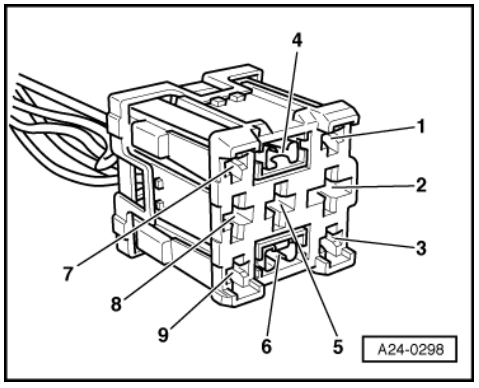
- -> Connect up multimeter for voltage measurement as follows.

Auxiliary relay carrier at front beneath dash panel on left, position 14 Contact	Measure to
2	Engine earth
4	Battery positive

- Specification: approx. battery voltage in each case



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

Auxiliary relay carrier at front beneath dash panel on left, position 14 Contact	Measure to
8	Engine earth

- Switch on ignition.

- Specification: approx. battery voltage

If readings do not match specifications:

- Use current flow diagram to check for open circuit/short circuit in wiring.

If no fault is found in wiring:

Checking actuation

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of font=symbol charset=fontspecific code=101font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'γfont=symbol charset=fontspecific code=105 TeX='\iota ' descr='[iota]'font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'font=symbol charset=fontspecific code=101control unit only (not to control unit) => Page 40 .
- Check for open circuit in the following wiring.

Auxiliary relay carrier at front beneath dash panel on left, position 14 Contact	Test box V.A.G 1598 A Socket
9	7

- Eliminate open circuit in wiring if necessary.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If no fault is found:

- Replace engine control unit => Page 41 .

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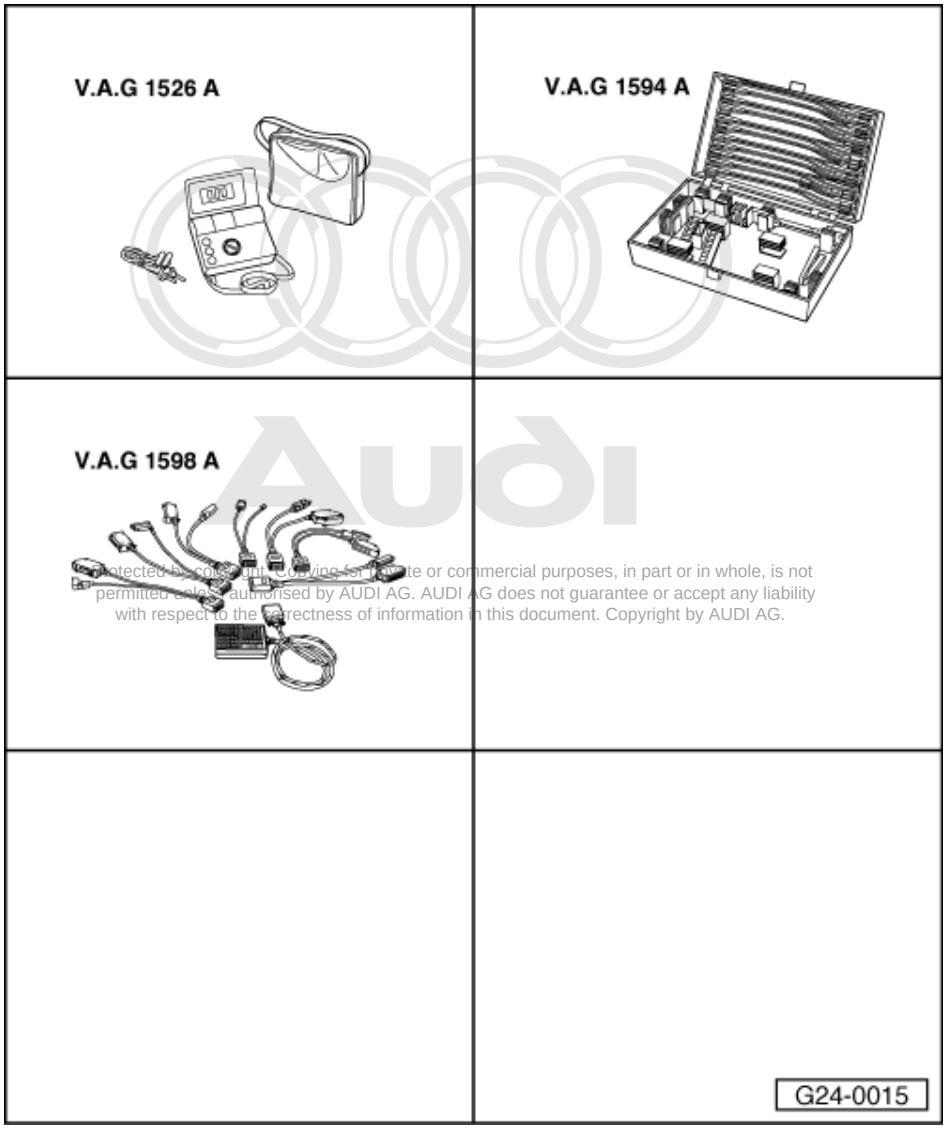
1.13 - Checking knock sensor



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Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

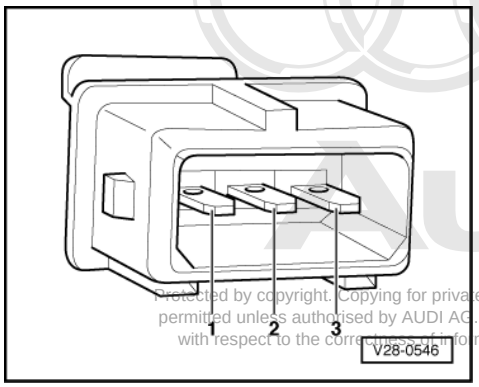
Fitting location => Exploded view of fitting locations - Page 31

Notes:

- Electrical checking of actual knock sensor is not possible => Interrogating fault memory, Page 4 onwards.
- Knock sensor will only operate properly if it has been tightened to exactly 20 Nm.
- Check connectors for traces of corrosion.
- Exclusive use is to be made of gold-plated contacts when repairing contacts in knock sensor connector.

Checking knock sensor wiring

- Unplug knock sensor connector in engine compartment => item 32 .



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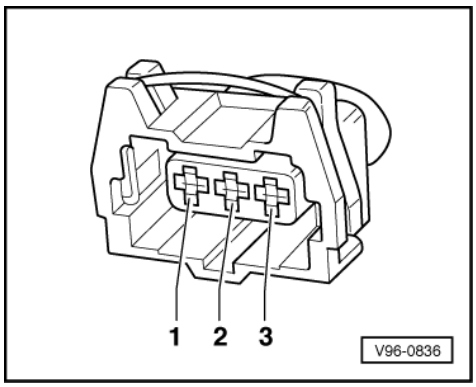
- -> Connect up multimeter for resistance measurement between connector contacts.
  - Specification: ∞ ω
    (No mutual connection between wires)
- Replace knock sensor if there is a connection between wires.

Checking wiring between knock sensor and Digifant control unit

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .



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

Connector Contact	Test box V.A.G 1598 A Socket
1 (signal)	29
2 (earth)	27
3 (screen)	8

- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

1.14 - Checking Hall sender -G40

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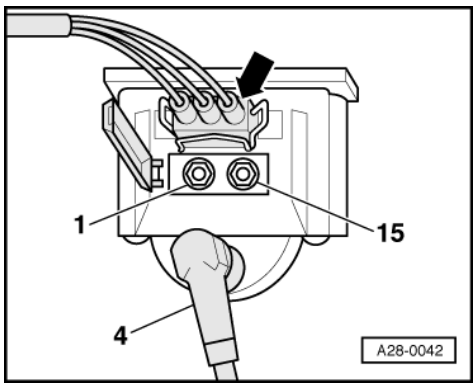
Special tools and workshop equipment required

- V.A.G 1526 A
- V.A.G 1527 B
- V.A.G 1594 A
- V.A.G 1598 A with V.A.G 1598/9

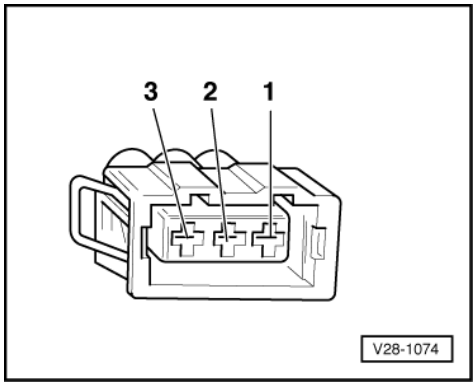
Fitting location => Exploded view of fitting locations - Page 31

Test sequence

- Unplug connectors at all injectors.



- -> Unplug connector -arrow- from output stage.



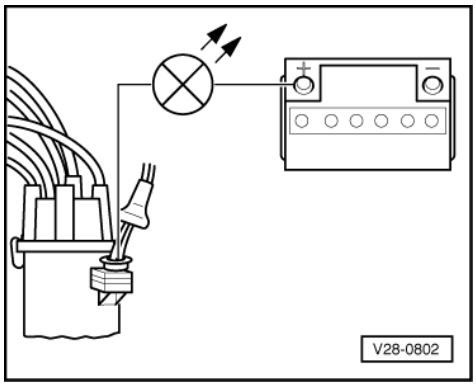
- -> Connect up voltage tester V.A.G 1527 B as follows.

Connector Contact	Measure to
2 (signal)	Engine earth

- Briefly operate starter.
  - LED must flash

If LED does not flash:

- Push back rubber grommet of Hall sender connector but leave connector attached.



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

Connector Contact	Measure to
2 (signal)	Battery positive

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Note:

Pin assignment is marked on back of connector.

- Briefly operate starter.
  - LED must flash

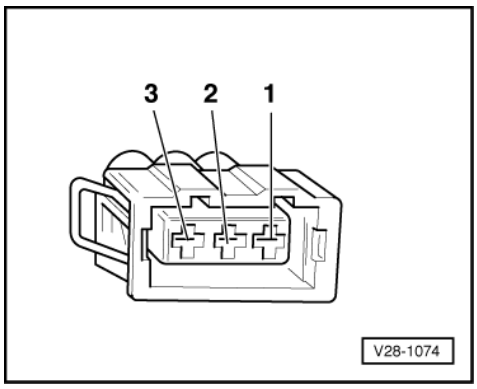
Note:

Voltage testers with a low current input do not go out completely between actuation of engine control unit, but rather continue to glow slightly and become distinctly brighter on actuation.

If LED does not flash:

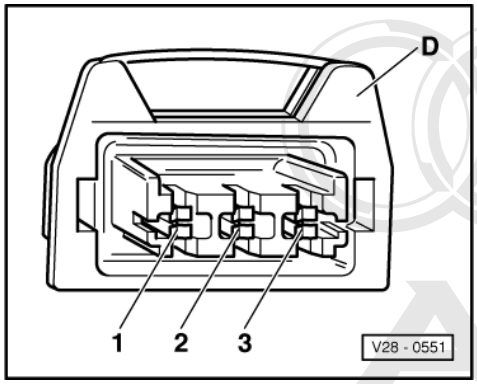
- Check power supply for Hall sender => Page 135 .

If LED now flashes:



- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of font=symbol charset=fontspecific code=101font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'γfont=symbol charset=fontspecific code=105 TeX='\iota ' descr='[iota]'font=symbol charset=fontspecific code=110 TeX='\nu ' descr='[nu]'font=symbol charset=fontspecific code=101control unit only (not to control unit) => Page 40 .
- -> Check for open circuit and short to earth/positive in the following wiring.

Connector of output stage Contact	Test box V.A.G 1598 A Socket
2	6



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

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Connector of Hall sender Contact	Test box V.A.G 1598 A Socket
2	37

If no fault is found in wiring:

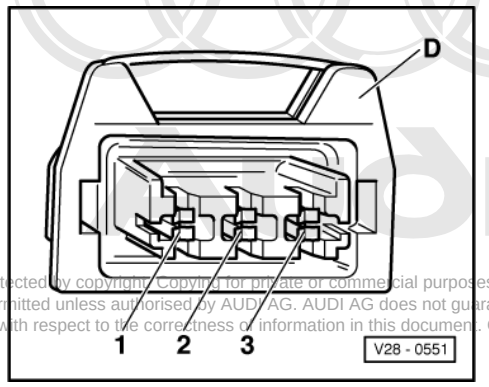
- Replace engine control unit => Page 41 .

Note:

After replacing engine control unit, control unit and throttle valve potentiometer must be matched => Page 92 .

Checking power supply

- Unplug connector of Hall sender at ignition distributor.



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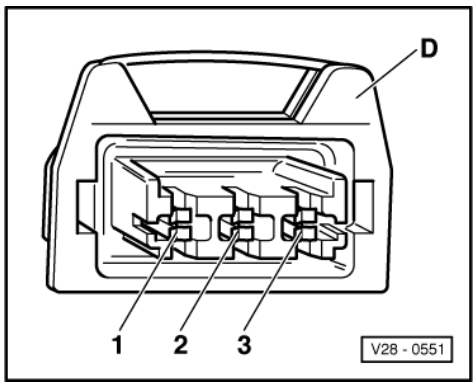
- -> Connect up multimeter for voltage measurement to contacts 3 (positive) and 1 (earth).
- Switch on ignition.
  - Specification: min. 9 V

If reading matches specification, but LED does not flash:

- Replace Hall sender.

If reading does not match specification:

- With ignition switched off, use adapter V.A.G 1598/9 to connect test box V.A.G 1598 A to connector of enginecontrol unit only (not to control unit) => Page 40 .



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

Connector Contact	Measure to
3 (positive)	Test box V.A.G 1598 A Socket 38
1 (earth)	Engine earth

- If necessary, eliminate open circuit in wiring/short circuit.

=> "Current Flow Diagrams, Electrical Fault-finding and Fitting Locations" binder

If no fault is found in wiring:

- Replace engine control unit => Page 41 .

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