Audi A4 1995 ➢

Motronic injection and ignition system (6-cylinder)									
Engine ID	AQD	APR							

Edition 11.1998

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Audi A4 1995 ➤

Motronic injection and ignition system (6-cylinder)

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 of Motronic system

1.1 - Self-diagnosis of Motronic system

1.2 - Technical data for self-diagnosis

Equipment

- The advantages of self-diagnosis can only be fully exploited by using the vehicle diagnostic, testing and information system VAS 5051 or the fault reader V.A.G. 1551, in operating mode 1 "Rapid data transfer."
- The fault memory of the engine control unit is a non-volatile memory and is therefore independent of the power supply.
- Faults relating to the electronic throttle are also indicated by a warning lamp in the dash panel insert.

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Control unit identification

The control unit version is displayed when fault reader V.A.G 1551 is connected and the engine control unit is selected=>Page 1 .

Selectable functions when using fault reader V.A.G 1551

The requirementsforselecting the desired functions can be taken from the following table.

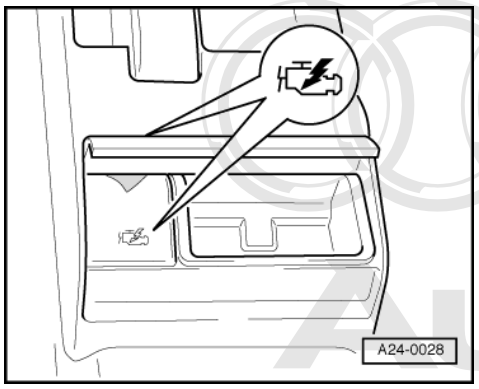
Functions on fault reader V.A.G 1551 or V.A.G 1552		Ignition on, engine not running	Engine idling	Vehicle being driven
Address words				
00	Automatic test sequence	yes	yes	yes
01	Engine electronics	yes	yes	yes
Functions				
01	Interrogate control unit version	yes	yes	yes
02	Interrogate fault memory	yes	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting	yes	yes	yes
05	Erase fault memory	yes	yes	yes
06	End output	yes	yes	yes
07	Code control unit	yes	no	no
08	Read measured value block	yes	yes	yes

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

Test conditions

- Battery voltage at least 11 V

- Earth connections on engine and gearbox OK.



- -> Open rear ashtray and remove cover for diagnostic connector.

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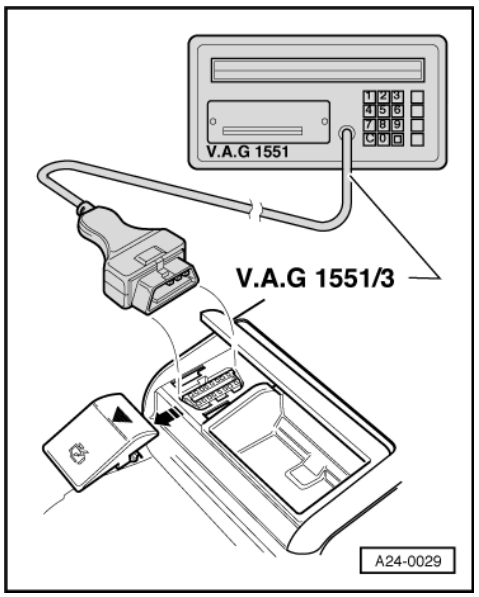

- -> Connect fault reader V.A.G 1551 with cable V.A.G 1551/3. Alternatively, connect vehicle diagnostic, testing and information system VAS 5051 with diagnostic cable VAS 5051/1.

Warning:
- **When carrying out road tests using vehicle diagnostic, testing and information system VAS 5051 or fault reader V.A.G**

Note:

The following description only covers the procedure for performing self-diagnosis with fault reader V.A.G 1551.

If using vehicle diagnostic, testing and information system VAS 5051, follow the operating instructions supplied with the equipment.

-> Indicated on display:

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

* Appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required:

- Switch ignition on.

  or
  Start the engine
  => Page 1 , table of selectable functions.

- Switch on printer with the Print button (Warning lamp in button lights up).
- Press key 1 for "Rapid data transfer".

-> Indicated on display:

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

Note:

Address word 00 is used to start the automatic test sequence (i.e. fault memory interrogation for all vehicle systems with self-diagnosis capability in "Rapid data transfer" mode).

```
Rapid data transfer      Q
01 - Engine electronics
```

-> Press keys 0 and 1 for address word "Engine electronics" and confirm entry by pressing the Q key.

-> If the display shows one of the messages reproduced here, run through the fault-finding procedure as described in the Fault-Finding Programme for diagnosis wiring.

```
Rapid data transfer      HELP
Control unit does not answer
```

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

```
Rapid data transfer      HELP
Fault in communication build up
```

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```
Rapid data transfer      HELP
K wire not switching to earth
```

```
Rapid data transfer      HELP
K wire not switching to positive
```

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

```
3B0907551.. 2.8l      V6/5V      G
D01
Coding 05201      WSC 06388
```

- 3B0907551..	Control unit number (see Parts List)
- 2.8 ltr.	Engine capacity
- V6/5V	Engine type (V engine, 6 cylinders, 5 valves per cylinder)
- "G" - or no display	With cruise control (G) or without cruise control
- D..	Software version in control unit

- Coding 05201	Engine control unit coding; Coding control unit: coding table => Page 19
- WSC 06388	Workshop Code of the V.A.G 1551 with which the last coding was performed

If the coding is not correct for the vehicle:

- Check control unit coding
  => Coding engine control unit, Page 19
- Press ⇒key.

-> Indicated on display:

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

Note:

Press the HELP key to obtain a printout of the functions which are available.

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 by entering address word "01" (=> Page 1 .)
  When doing this the engine must be idling.

Only when engine does not start:

- Interrogate fault memory with ignition switched on.

- Switch on printer with the Print button
  (Warning lamp in button lights up).

-> Indicated on display:

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

- Operate fault reader taking into account the information on the display:
- Press keys 0 and 2 for function "Interrogate fault memory" and confirm entry with Q key.

-> The display will show either the number of faults stored or the message "No fault recognised!".

```
X Faults recognised!
```

If no fault is stored:

- Press ⇒key.

If one or more faults are stored:

The faults stored will be displayed and printed out one after the other.

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-> Indicated on display:

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

- Locate and eliminate faults printed out as per fault table
  => Page 5 .

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

-> Indicated on display:

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

Note:

If the ignition is switched off between interrogating the fault memory and erasing the fault memory, the fault memory will not be erased. It is therefore important to follow the procedure exactly, i.e. first interrogate the fault memory and then erase it.

- Press ⇒key.

-> Indicated on display:

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

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

2.2 - Fault table

Notes:

- If faults occur in the sensors and components being monitored, they will be stored in the fault memory together with an indication of the type of fault.
- Faults relating to the electronic throttle are also indicated by the EPC (Electronic Power Control) warning lamp in the dash panel insert. Notes on electronic throttle system => Page 69 .
- If the connector for the engine control unit is unplugged or if the battery is disconnected, all the learned values stored in the control unit will be erased, although the contents of the fault memory will remain intact. The next time the engine is started the idling may be rough at first, in which case it should be left to idle for a few minutes until the learning process has been completed.
- The fault table is arranged according to the 5-digit fault codes in the left-hand column.
- If a fault is stored in the fault memory and then does not occur again during the next 40 engine warm-up phases, the fault code will be automatically erased.
- Sporadically occurring faults (temporary faults) will be indicated on the V.A.G 1551 display as "SP". The word "sporadic" means "intermittent" or "occurring at irregular intervals".
- Components that are indicated as being faulty by the V.A.G 1551/VAS 5051 should not be renewed immediately. Always start by checking the wiring, connectors and earth connections for the component using the current flow diagram. This is particularly important in the case of sporadic faults (indicated by the letters "SP"on the fault reader display).

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Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0102	16486	Air mass meter -G70 Signal too small	Test air mass meter => Page 51
P0103	16487	Air mass meter -G70 Signal too large	
P0112	16496	Intake air temp. sender -G42 Signal too small	Test intake air temperature sender => Page 93
P0113	16497	Intake air temp. sender -G42 Signal too large	
P0116	16500	Coolant temp. sender -G62 Implausible signal	Test coolant temperature sender => Page 97
P0117	16501	Coolant temp. sender -G62 Signal too small	

Fault code		Readout on fault reader display	Fault rectification
P0118	16502	Coolant temp. sender -G62 Signal too large	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0130	16514	Bank 1, Probe 1 Electrical fault in current circuit	Test lambda control => Page 60
P0131	16515	Bank 1, Probe 1 Voltage too low	
P0132	16516	Bank 1, Probe 1 Voltage too high	
P0134	16518	Bank 1, Probe 1 No activity	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0150	16534	Bank 2, Probe 1 Electrical fault in current circuit	Test lambda control => Page 60
P0151	16535	Bank 2, Probe 1 Voltage too low	
P0152	16536	Bank 2, Probe 1 Voltage too high	
P0154	16538	Bank 2, Probe 1 No activity	
P0321	16705	Engine speed sender -G28 Implausible signal	Test engine speed sender => Page 95
P0322	16706	Engine speed sender -G28 No signal	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P0327	16711	Knock sensor 1 -G61 Signal too small	Test knock sensor => Page 99
P0328	16712	Knock sensor 1 -G61 Signal too large	
P0332	16716	Knock sensor 2 -G66 Signal too small	
P0333	16717	Knock sensor 2 -G66 Signal too large	
P0501	16885	Vehicle speed signal Implausible signal	Test vehicle speed signal => Page 85
P0560	16944	Voltage supply Implausible signal	Test voltage supply => Page 98
P0562	16946	Voltage supply Voltage too low	
P0563	16947	Voltage supply Voltage too high	
P0571	16955	Brake light switch -F Implausible signal	Test brake light switch => Page 81

Fault code	Readout on fault reader display	Fault rectification

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SAE	V.A.G		
P0601	16985	Control unit defective	Renew engine control unit => Page 38
P0604	16988	Control unit defective	
P0605	16989	Control unit defective	
P0606	16990	Control unit defective	
P1102	17510	Bank 1 - Probe 1, Heating element circuit Short to Positive	Test lambda probe heating => Page 60
P1107	17515	Bank 2 - Probe 1, Heating element circuit Short to Positive	
P1111	17519	Lambda control (Bank 1), System too lean	Test lambda control Page => 60 .
P1112	17520	Lambda control (Bank 1), System too rich	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1113	17521	Bank 1 - Probe 1 Internal resistance too great	Test signal wires for contact resistance => Page . If there is no contact resistance, renew lambda probe.
P1115	17523	Bank 1 - Probe 1, Heating element circuit Short to Earth	Test lambda probe heating => Page 60
P1116	17524	Bank 1 - Probe 1, Heating element circuit Open circuit	
P1119	17527	Bank 2 - Probe 1, Heating element circuit Short to Earth	
P1120	17528	Bank 2 - Probe 1, Heating element circuit Open circuit	

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Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1127	17535	Bank 1, Mixture adaption (mult.) System too rich	Take car for test drive (fuel in oil) Check fuel system pressure => Page 41
P1128	17536	Bank 1, Mixture adaption (mult.) System too lean	Test air mass meter => Page 51
P1129	17537	Bank 2, Mixture adaption (mult.) System too rich	Test lambda probe => Page 60
P1130	17538	Bank 2, Mixture adaption (mult.) System too lean	Test injectors => Page 47
P1131	17539	Bank 2 - Probe 1 Internal resistance too great	Test signal wires for contact resistance => Page . If there is no contact resistance, renew lambda probe.

Note:

mult. = multiplicative, i.e. the fault occurs across the whole range of engine speeds and engine loads.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		

P1136	17544	Bank 1, Mixture adaption (add.) System too lean	Take car for test drive (fuel in oil) Check fuel system pressure => Page 41 Test air mass meter => Page 51 Test lambda probe => Page 66
P1137	17545	Bank 1, Mixture adaption (add.) System too rich	
P1138	17546	Bank 2, Mixture adaption (add.) System too lean	
P1139	17547	Bank 2, Mixture adaption (add.) System too rich	

Note:

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add. = additive, i.e. the fault only occurs at idling speed.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		Test lambda control =>Page 60 . Test angle sender for throttle valve drive => Page 74
P1147	17555	Lambda control, Bank 2: System too lean	
P1148	17556	Lambda control, Bank 2: System too rich	
P1149	17557	Lambda control, Bank 1: Implausible control value	
P1150	17558	Lambda control, Bank 2: Implausible control value	
P1171	17579	Angle sens. 2 for throt. valve drive -G188 Implausible signal 1)	
P1172	17580	Angle sens. 2 for throt. valve drive -G188 Signal too small 1)	
P1173	17581	Angle sens. 2 for throt. valve drive -G188 Signal too large 1)	

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Note:

add. = additive, i.e. the fault only occurs at idling speed.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		Test injectors =>Page 43
P1213	17621	Injector Cyl. 1 -N30 Short to Positive	
P1214	17622	Injector Cyl. 2 -N31 Short to Positive	
P1215	17623	Injector Cyl. 3 -N32 Short to Positive	
P1216	17624	Injector Cyl. 4 -N33 Short to Positive	
P1217	17625	Injector Cyl. 5 -N83 Short to Positive	
P1218	17626	Injector Cyl. 6 -N84 Short to Positive	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		Test injectors
P1225	17633	Injector Cyl. 1 -N30 Short to Earth	

P1226	17634	Injector Cyl. 2 -N31 Short to Earth	=>Page 43
P1227	17635	Injector Cyl. 3 -N32 Short to Earth	
P1228	17636	Injector Cyl. 4 -N33 Short to Earth	
P1229	17637	Injector Cyl. 5 -N83 Short to Earth	
P1230	17638	Injector Cyl. 6 -N84 Short to Earth	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1237	17645	Injector Cyl. 1 -N30 Open circuit	Test injectors =>Page 43
P1238	17646	Injector Cyl. 2 -N31 Open circuit	
P1239	17647	Injector Cyl. 3 -N32 Open circuit	
P1240	17648	Injector Cyl. 4 -N33 Open circuit	
P1241	17649	Injector Cyl. 5 -N83 Open circuit	
P1242	17650	Injector Cyl. 6 -N84 Open circuit	

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Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1325	17733	Knock control Cyl. 1 Control limit reached	Test knock control => Page 99
P1326	17734	Knock control Cyl. 2 Control limit reached	
P1327	17735	Knock control Cyl. 3 Control limit reached	
P1328	17736	Knock control Cyl. 4 Control limit reached	
P1329	17737	Knock control Cyl. 5 Control limit reached	
P1330	17738	Knock control Cyl. 6 Control limit reached	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1335	17743	Engine torque monitoring 2 Control limit surpassed 1)	Test intake air temperature sender => Page 97
P1336	17744	Engine torque monitoring Control limit surpassed	Test intake air temperature sender => Page 97

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1337	17745	Bank 1, Camshaft pos. sensor => -G163 Short to Earth	Test Hall sender => Page 102
P1338	17746	Bank 1, Camshaft pos. sensor => -G163 Open circuit / Short to Positive	
P1340	17748	Camshaft pos. / Crankshaft pos. sens. Wrong allocation	Test phase position of hall senders => Page 102
P1347	17755	Bank 2, Camshaft pos. / Crankshaft pos. sens. Wrong allocation	
P1386	17794	Control unit defective	Renew engine control unit => Page 38
P1387	17795	Control unit defective	
P1388	17796	Control unit defective 1)	

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1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Note:

The camshaft position sensor referred to under fault code 17748 is the sensor for cylinder bank 1 (Hall sender -G163).

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1391	17799	Bank 2, Camshaft pos. sensor => -G40 Short to Earth	Test Hall sender => Page 102
P1392	17800	Bank 2, Camshaft pos. sensor => -G40 Open circuit / Short to Positive	
P1393	17801	Ignition output 1: Electrical fault in current circuit	Test activation and/or wiring from engine control unit to ignition output stage => Page 92 .

P1394	17802	Ignition output 2: Electrical fault in current circuit	
P1395	17803	Ignition output 3: Electrical fault in current circuit	

Note on fault codes 17801, 17802, 17803:

"Ignition output 1", "Ignition output 2" and "Ignition output 3" refer to the outputs at the engine control unit from which the control unit activates the output stage on the ignition coils.

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1410	17818	Tank breather valve -N80 Short to Positive	Test solenoid valve 1 for activated charcoal filter => Page 66
P1420	17828	Secondary air inlet valve -N112 Electrical fault in current circuit	Test secondary air inlet valve => Page 64 => Engine, Mechanics; Repair group 26; Secondary air system, or Secondary air system, or => Current flow diagrams, Electrical Fault finding and Fitting locations
P1421	17829	Secondary air inlet valve -N112 Short to Earth	
P1422	17830	Secondary air inlet valve -N112 Short to Positive	
P1425	17833	Tank breather valve -N80 Short to Earth	Test solenoid valve 1 for activated charcoal filter => Page 66
P1426	17834	Tank breather valve -N80 Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1432	17840	Secondary air inlet valve -N112 Open circuit	Test secondary air inlet valve => Page 64 => Engine, Mechanics; Repair group 26; Secondary air system, or Secondary air system, or => Current flow diagrams, Electrical Fault finding and Fitting locations
P1433	17841	Relay for secondary air pump - J299 Open circuit	Test relay for secondary air system => Page 64 => Engine, Mechanics; Repair group 26; Secondary air system, or Secondary air system, or => Current flow diagrams, Electrical Fault finding and Fitting locations
P1434	17842	Relay for secondary air pump - J299 Short to Positive	
P1435	17843	Relay for secondary air pump - J299 Short to Earth	
P1436	17844	Relay for secondary air pump - J299 Electrical fault in current circuit	

Fault code	Readout on fault reader display	Fault rectification

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SAE	V.A.G		
P1500	17908	Fuel pump relay -J17 Electrical fault in current circuit	Test fuel pump relay => Page 49
P1501	17909	Fuel pump relay -J17 Short to Earth	
P1502	17910	Fuel pump relay -J17 Short to Positive	
P1511	17919	Intake manif. change-over valve -N156 Electrical fault in current circuit	Test intake manifold change-over function => Page 57 .
P1512	17920	Intake manif. change-over valve -N156 Short to Positive	
P1515	17923	Intake manif. change-over valve -N156 Short to Earth	
P1516	17924	Intake manif. change-over valve -N156 Open circuit	

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1519	17927	Bank 1, Variable valve timing Faulty	=> Mechanics; Repair group 15; Testing camshaft timing control; Testing operation of camshaft timing control Testing camshaft timing control; Testing operation of camshaft timing control
P1522	17930	Bank 2, Variable valve timing Faulty	
P1529	17937	Variable valve timing Short to Positive	=> Mechanics; Repair group 15; Testing camshaft timing control; Testing solenoid valves forcamshaft adjustment Testing camshaft timing control; Testing solenoid valves for-camshaft adjustment
P1530	17938	Variable valve timing Short to Earth	
P1531	17939	Variable valve timing Open circuit	
P1539	17947	Clutch pedal switch -F36: Implausible signal	Test clutch pedal switch => Page 83
P1542	17950	Angle sender for throt. val. drive -G187 Implausible signal 1)	Test angle sender for throttle valve drive

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P1543	17951	Angle sender for throt. val. drive -G187 Signal too small 1)	=> Page 74

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1544	17952	Angle sender for throt. val. drive -G187 Signal too large 1)	Test angle sender for throttle valve drive => Page 74
P1545	17953	Throttle valve control Faulty 1)	Test throttle valve control part => Page 71
P1558	17966	Throttle valve drive -G186: Electrical fault in current circuit 1)	
P1559	17967	Throttle valve control part -J338 Fault in basic setting 1)	Perform adaption => Page 72
P1560	17968	Maximum engine revs surpassed	Repair mechanical damage
P1564	17972	Throttle valve control part -J338 Low voltage at base setting	Charge battery or test throttle valve control part => Page 71 .
P1565	17973	Throttle valve control part -J338 Lower stop is not reached 1)	Test throttle valve control part => Page 71
P1568	17976	Throttle valve control part -J338 Mechanical fault 1)	
P1569	17977	CCS switch -E45 Implausible signal	=> Electrical system; Repair group 01; Self-diagnosis of cruise control system (CCS)

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1570	17978	Engine control unit blocked	Perform adaption of electronic immobilizer to engine control unit => Electrical system; Repair group 01; Self-diagnosis for immobilizer
P1579	17987	Throttle valve control part -J338 Adaption not started	Check test conditions for performing adaption => Page 72 .
P1600	18008	Voltage supply Kl. 15 Voltage too low	Test voltage supply to engine control unit => Page 98
P1602	18010	Voltage supply Kl. 30 Voltage too low	
P1603	18011	Control unit defective	Renew engine control unit => Page 38
P1604	18012	Control unit defective 1)	
P1612	18020	Engine control unit wrongly coded	Check coding => Page 19 .

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P1626	18034	Data bus drive No message from gearbox CU	Test data exchange between engine control unit, ABS control unit and gearbox control unit =>Page 85

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1630	18038	Accelerator position sender -G79 Signal too small 1)	Test accelerator position sender =>Page 76
P1631	18039	Accelerator position sender -G79 Signal too large 1)	
P1633	18041	Accelerator position sender 2 -G185 Signal too small 1)	
P1634	18042	Accelerator position sender 2 -G185 Signal too large 1)	

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1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Fault code		Readout on fault reader display	Fault rectification
SAE	V.A.G		
P1639	18047	Accelerator position sender 1/2 -G79/-G185 Implausible signal1)	Test accelerator position sender =>Page 76
P1640	18048	Control unit defective	Renew engine control unit => Page 38
P1648	18056	Data bus drive defective	Test data exchange between engine control unit, ABS control unit and gearbox control unit =>Page 85
P1649	18057	Data bus drive defective No message from ABS CU	Test data exchange between engine control unit, ABS control unit and gearbox control unit =>Page 85
P1676	18084	Electr. throttle control fault lamp -K132 Electrical fault in current circuit 1)	Notes on EPC warning lamp => Page 70
P1677	18085	Electr. throttle control fault lamp -K132 Short to Positive 1)	
P1853	18261	Data bus drive defective Implausible message from ABS CU	Test data exchange between engine control unit, ABS control unit and gearbox control unit =>Page 85

1) If this fault occurs the engine control unit activates the EPC warning lamp in the dash panel insert.

Notes on EPC warning lamp =>Page 70 .

Note:

Electronic throttle control fault lamp -K132 is also known as the EPC (Electronic Power Control) warning lamp.

3 - Final control diagnosis

3.1 - Final control diagnosis

Notes:

- The final control diagnosis can only be performed with the ignition switched on and the engine not running.
- The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.
- During the final control diagnosis, each control element is activated for about 1 minute unless the test programme is deliberately advanced to the next control element by pressing the ⇒ key.
- The control elements can be tested either by listening or by touching.
- If the final control diagnosis is to be repeated, the engine must be started. (The engine control unit needs to detect an engine speed of more than 300 rpm.)
- The electric fuel pump runs continuously throughout the final control diagnosis.

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

1. Solenoid valve 1 for activated charcoal filter -N80
   (fuel tank breather valve)

2. Secondary air inlet valve -N112
   (only on vehicles with secondary air system)

3. Relay for secondary air pump -J299
   (only on vehicles with secondary air system)

4. Intake manifold change-over valve -N156

5. Camshaft timing control 1 (camshaft adjustment valves 1 and 2,
   -N205 and -N208)

Test requirements

- Fuses for engine electronics okay
- Fuel pump relay okay

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

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

-> Indicated on display:

```
Rapid data transfer     Q
03-Final control diagnosis
```

Activating solenoid valve for activated charcoal filter

(fuel tank breather valve)

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- Confirm input with Q key.

Note:

The fuel pump relay should pick up and the fuel pump should run. Fuel flow at the fuel pressure regulator is clearly audible. If the fuel pump does not run, test activation

=>Page 49 .

-> Indicated on display:

```
Final control diagnosis
Tank breather valve -N80
```

The solenoid valve will continue to be activated (i.e. will click) for about 1 minute unless the ⇒ key is pressed to deliberately advance the programme to the next control element.

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

- Test solenoid valve 1 for activated charcoal filter -N80
  => Page 66 .

Activating secondary air inlet valve

(only on vehicles with secondary air system)

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Secondary air inlet valve -N112
```

The solenoid valve will continue to be activated (i.e. will click) for about 1 minute unless the ⇒ key is pressed to deliberately advance the programme to the next control element.

If the secondary air inlet valve does not click:

Test secondary air inlet valve=>Page 64 or

=> Mechanics; Repair Group 26; Secondary air system Secondary air system

Activating relay for secondary air pump

(only on vehicles with secondary air system)

- Press ⇒key.

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-> Indicated on display:

```
Final control diagnosis
Secondary air pump relay -J299
```

The secondary air pump relay (J299) activates the secondary air pump motor (V101) which runs at intervals for about one minute, or until the final control diagnosis is advanced to the next control element by pressing the⇒key.

If the secondary air pump motor (V101) does not run at intervals:

Test relay for secondary air pump
=>Page 64 or

=> Mechanics; Repair Group 26; Secondary air system Secondary air system

Activating intake manifold change-over valve

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Intake manifold press. change valve -
N156
```

The valve will continue to be actuated (i.e. will click) until the ⇒ key is pressed to advance the programme to the next control element.

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

- Test intake manifold change-over (pressure change) valve -N156
  => Page 55

Activating camshaft adjustment valves

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Camshaft timing control 1
```

- Camshaft adjustment valves 1 and 2 (-N205 and -N208) will continue to be activated (i.e. will click) for about 1 minute unless the ⇒key is pressed to deliberately advance to the next control element.

If the valves are not actuated (do not click):

=> Mechanics; Repair group 15; Testing camshaft timing control; Testing solenoid valves for camshaft adjustment Testing camshaft timing control Testing solenoid valves for camshaft adjustment

Note:

To terminate the final control diagnosis, press the ⇒ key again.

If the final control diagnosis needs to be repeated, first start the engine, then switch the ignition off and on again.

4 - Basic setting

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4.1 - Basic setting

With the ignition on and engine not running, the following operation can be performed in the "Basic setting" mode (function 04):

- Adaption of throttle valve control part to engine control unit
  =>Display Group 60 (=>Page 72)

With the engine running, the following operations can be performed in the basic setting mode:

- Learning process for lambda control
  => relevant Display Group
- Fault-finding by deliberate activation and deactivation of lambda control=> Display Group 99

Test conditions for operations with engine running

- No fault stored in fault memory
- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the engine must be idling.
- Interrogate and erase fault memory => Page 4 .
  There should be no faults stored in the fault memory. (If necessary rectify faults, erase fault memory and switch off engine. Start engine again, road test the vehicle and interrogate fault memory again to check.)
- Leave engine idling.

-> Indicated on display:

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

- Press keys 0 and 4.

(04 is to select the function "Basic setting")

-> Indicated on display:

```
Rapid data transfer     Q
04-Basic setting
```

- Confirm entry by pressing Q.

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-> Indicated on display:

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

Note:

Display Group 000 is used here as an example to illustrate the procedure.

Note:

When the display group is selected the ACF valve is closed and the air conditioner compressor is switched off.

- Press key 0 three times.

(000 is to select Display Group 000)

-> Indicated on display:

```
Basic setting     Q
Enter display group number     000
```

- Confirm entry by pressing Q.

-> Indicated on display:

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

Display Group 000 (decimal readouts)		
▪ Engine idling (coolant temperature not below 80 °C)		
Display zones	Specification	Corresponds to
1 2 3 4 5 6 7 8 9 10 Learned value for mixture formation, Bank 2	77...179	-10...10 %
1 2 3 4 5 6 7 8 9 Learned value for mixture formation, Bank 1	77...179	-10...10 %
1 2 3 4 5 6 7 8 Control value for mixture formation, Bank 2 (if outside tolerance, road test the vehicle)	115...141	-10...10 %
1 2 3 4 5 6 7 Control value for mixture formation, Bank 1 (if outside tolerance, road test the vehicle)	115...141	-10...10 %
1 2 3 4 5 6 Learned value for torque loss at idling speed	102...169	-5...8 %
1 2 3 4 5 Torque at idling speed	102...154	-5.0...5.0 %
1 2 3 4 Throttle valve angle	1...8	0.5...3.0 %
1 2 3 Engine speed (idling speed); vehicles with front-wheel drive Engine speed (idling speed); vehicles with four-wheel drive	72...82 63...73	720...820 rpm 630...730 rpm
1 2 Engine load (without electrical consumers)	16...34	12...26 %

Display Group 000 (decimal readouts)		
Coolant temperature (requirement for basic setting)	180...205	80...105 °C

1) Up-to-date specifications:

=> Exhaust emissions test binder

- Allow engine to idle for a few minutes (coolant temperature at least 80 °C).

Notes:

- When the PRINT key is pressed the current display will be printed out.
- Press C before selecting further display groups.

- If the readouts in all the display zones match the specifications, press the ⇒ key.

-> Indicated on display:

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

- Press keys 0 and 6.

(06 is to select the function "End output".)

-> Indicated on display:

```
Rapid data transfer     Q
06 - End output
```

- Confirm entry by pressing Q.

-> Indicated on display:

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

5 - Coding control unit

5.1 - Coding control unit

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

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

-> Indicated on display:

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

- Press keys 0 and 7 for the function "Code control unit" and confirm entry with Q key.

-> Indicated on display:

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

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

  Coding variants =>Page 20

-> If the following display is shown:

```
Function is unknown or
cannot be carried out at the moment
```

An unauthorised code number has been entered.

-> The display on fault reader V.A.G 1551 will show the control unit identification code (example).

```
3B0907551.. 2.8l     V6/5V     G
D01□
Coding 05201     WSC 06388
```

- Press ⇒key.

-> Indicated on display:

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

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

Coding variants for engine control unit

Country/emissions	Drive / extra functions	Gearbox	Vehicle model
00 = ---	0 = Front-wheel drive without traction control system	0 = 5-speed manual gearbox	0 = ---
01 = ---	1 = ---	1 = ---	1 = Audi A4
02 = ---	2 = Four-wheel drive without traction control system	2 = ---	2 = Audi A6
03 = ---	3 = ---	3 = ---	3 = Audi A8
04 = Member State of the European Union (MVEG II)	4 = ---	4 = ---	4 = ---
05 = Engines with secondary air system (MVEG III)	5 = Front-wheel drive with traction control system and CAN data bus system	5 = Automatic gearbox 01V	5 = ---
06 = ---	6 = ---	6 = ---	6 = ---
07 = ---	7 = Four-wheel drive with electronic stability program (ESP) and CAN data bus system	7 = ---	7 = ---
08 = China and Commonwealth of Independent States (CIS)	8 = ---	8 = Continuously-variable transmission VL30	8 = ---

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Compose the code number as per the following example:

Member State of the European Union(MVEG II)	04
Front-wheel drive without traction control system	0
5-speed manual gearbox	0
Audi A4	1
Code number	04 0 0 1

Note:

Vehicles with traction control system (ASR) can be identified by the ASR warning lamp located in the dash panel insert, or by means of the ABS/ASR self-diagnosis => Workshop Manual, "Running Gear".

6 - Reading measured value block

6.1 - Reading measured value block

Test conditions

- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Steering in straight-ahead position

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the engine must be idling.

-> Indicated on display:

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

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

-> Indicated on display:

```
Read measured value block
Enter display group number XXX
```

- Enter relevant Display Group number (3 figures) and confirm entry by pressing Q.

Note:

The choice of display group number depends on which functions and components are to be tested.

-> Indicated on display:

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

Note:

To change to another display group proceed as follows:

Display group	V.A.G 1551	VAS 5051
Higher	Press key 3	Press skey
Lower	Press key 1	Press tkey

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24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

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1.2 - Safety precautions

Observe the following points if test and measuring instruments are required during a test drive:

- Test and measuring instruments must be secured to rear seat and operated by a 2nd person from this location.

  If test and measuring instruments are operated from front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.

Warning!
Secure fault reader to rear seat and operate from this position.

To prevent injuries to persons and/or damage to the fuel injection and ignition system, note the following points:

- Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.

- To operate the engine at starting speed without actually starting it (for example, in order to test compression), unplug the connectors from the output stages for the ignition coils and also the connectors on the injectors.
- During some of the tests the control unit may identify and record faults. The fault memory should therefore be interrogated and (if necessary) erased after completing the tests and any repair work that may be required.
- Always switch off the ignition before cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

Warning!
The fuel system is pressurised. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

1.3 - Rules for cleanliness

When working on the fuel supply/injection system, pay careful attention to the following "5 rules":

- Thoroughly clean all unions and the adjacent areas before disconnecting.
- Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- Carefully cover over or seal opened components if the repair cannot be carried out immediately.
- Only install clean components:
  Only unpack replacement parts immediately prior to installation.
  Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- When the system is open:
  Do not work with compressed air if this can be avoided.

Do not move vehicle unless absolutely necessary.

1.4 - Technical data

Engine code letters	APR (2.8 ltr./5V/142 kWengine without secondary air system AQD (2.8 ltr./5V/142 kW engine with secondary air system	
Idling speed Not adjustable - controlled by idling speed stabilisation	Four-wheel drive: 630...730 rpm Front-wheel drive: 720...820 rpm	
Maximum engine rpm (limited by shutting off injectors)	6800 rpm	
Fuel pressure at idling speed	Vacuum hose connected	approx. 3.2...3.8 bar
	Vacuum hose disconnected	approx. 3.8...4.2 bar
Holding pressure after 10 minutes	Engine cold - approx. 2.2 bar Engine warm - approx. 3.0 bar	
Injectors	Spray pattern	Two-hole injector
	Injection qty. (30 sec.)	90....125 ml
	Resistance (room temperature)1)	13.5....15.5 ω

1) When the engine is at operating temperature the resistance is increased by approx. 4...6 ω.

1.5 - Fitting locations overview

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Components A to F are not shown in the exploded drawing.

A - Brake light switch (F) and brake pedal switch (F47)

- In footwell on pedal bracket near brake pedal

B - Diagnostic connector

- In rear ashtray in centre console

C - Fuel pump relay

- Relay position 4 in central electrics beneath dash panel

D - Clutch pedal switch (F36)

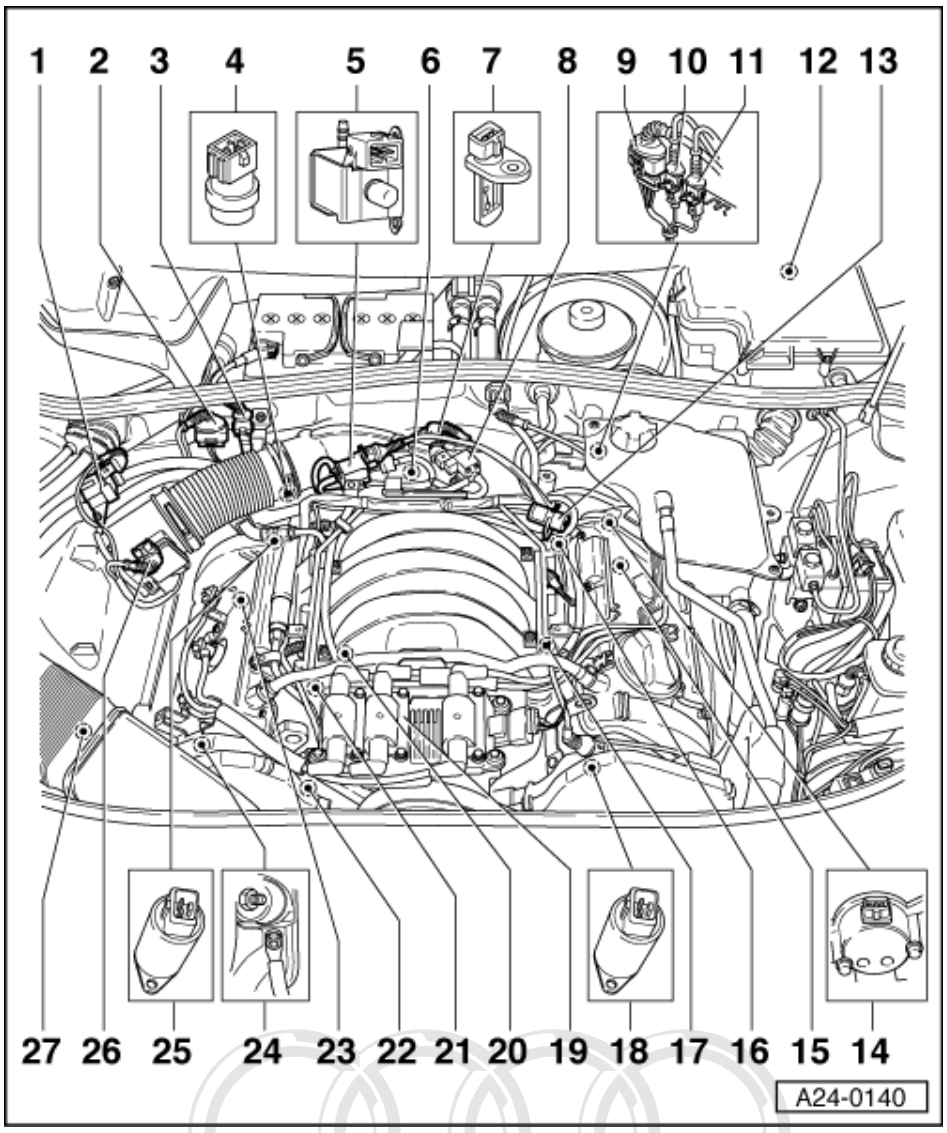
- In footwell on pedal bracket near clutch pedal

E - Accelerator pedal sender (G79) and accelerator pedal sender 2 (G185)

- In footwell on accelerator pedal (both senders are fitted in one housing)

F - EPC warning lamp

- In dash panel insert
(Notes on warning lamp
=>Page 70)



1 Activated charcoal filter solenoid valve 1 -N80
2 4 pin connector
- For Lambda probe 1 -G39

3 3 pin connector
- For knock sensor 1 -G61

4 Coolant temperature sender -G62
- On coolant pipe behind cylinder head Bank 1

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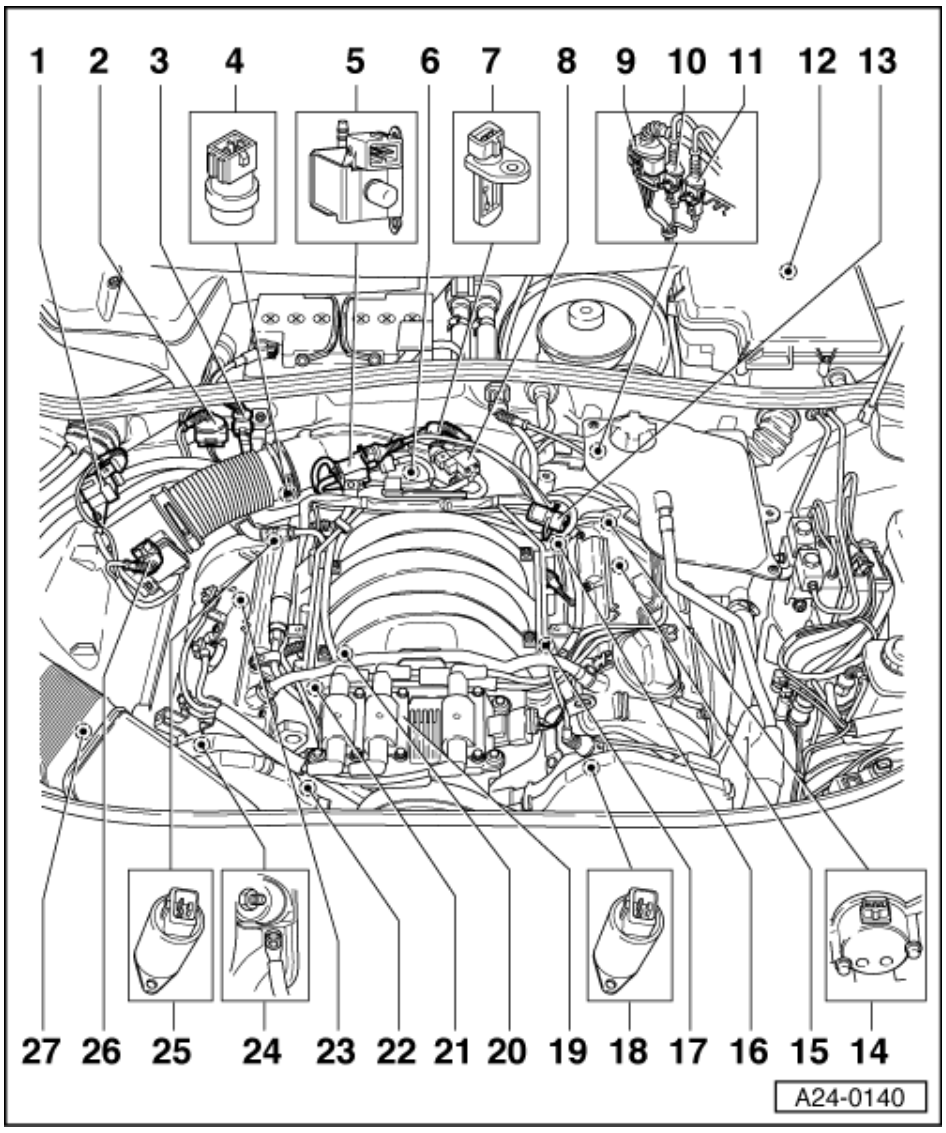

5 Secondary air inlet valve -N112
- Only on vehicles with secondary air system

6 Throttle valve control part -J338

7 Intake air temperature sender -G42

8 Intake manifold change-over valve -N156

9 4 pin connector
- For Lambda probe 2 -G108 and Lambda probe heating -Z28

10 3 pin connector
- For engine speed sender -G28

11 3 pin connector
- For knock sensor 2 -G66

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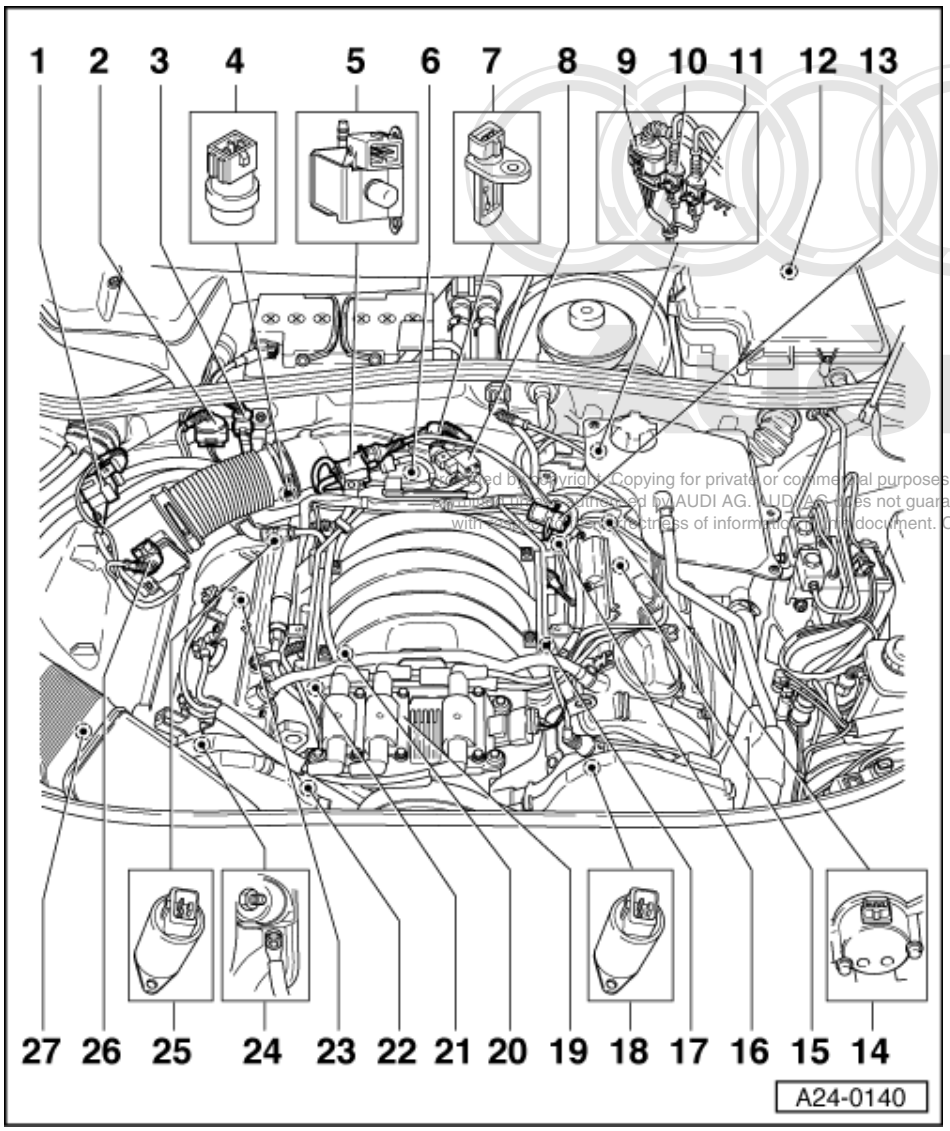

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12 Electronics box in plenum chamber

- Engine control unit -J220
- Secondary air pump relay -J299
  (only on vehicles with secondary air system)

13 Fuel pressure regulator

14 Hall sender -G40

- Cylinder bank 2

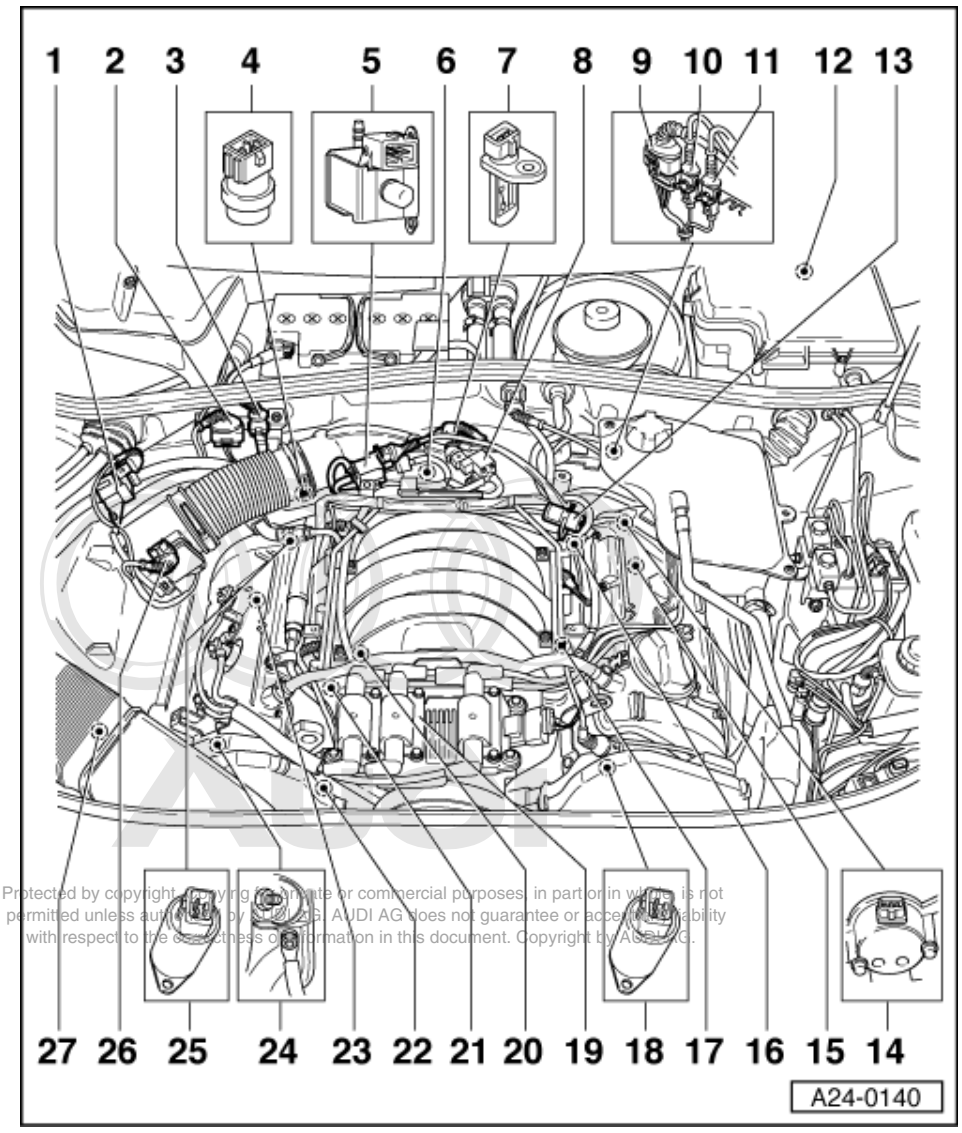
15 Lambda probe 2 -G108

16 Engine speed sender -G28

- In gearbox housing above starter ring gear

17 Knock sensor 2 -G66

18 Camshaft adjustment valve 2 -N208



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19 Ignition coils -N, -N128 and -N158

- With output stage -N122

20 Knock sensor 1 -G61

21 Injector -N30...-N33, -N83, -N84

22 Hall sender -G163

- Cylinder bank 1

23 Lambda probe 1 -G39

24 Earth connection

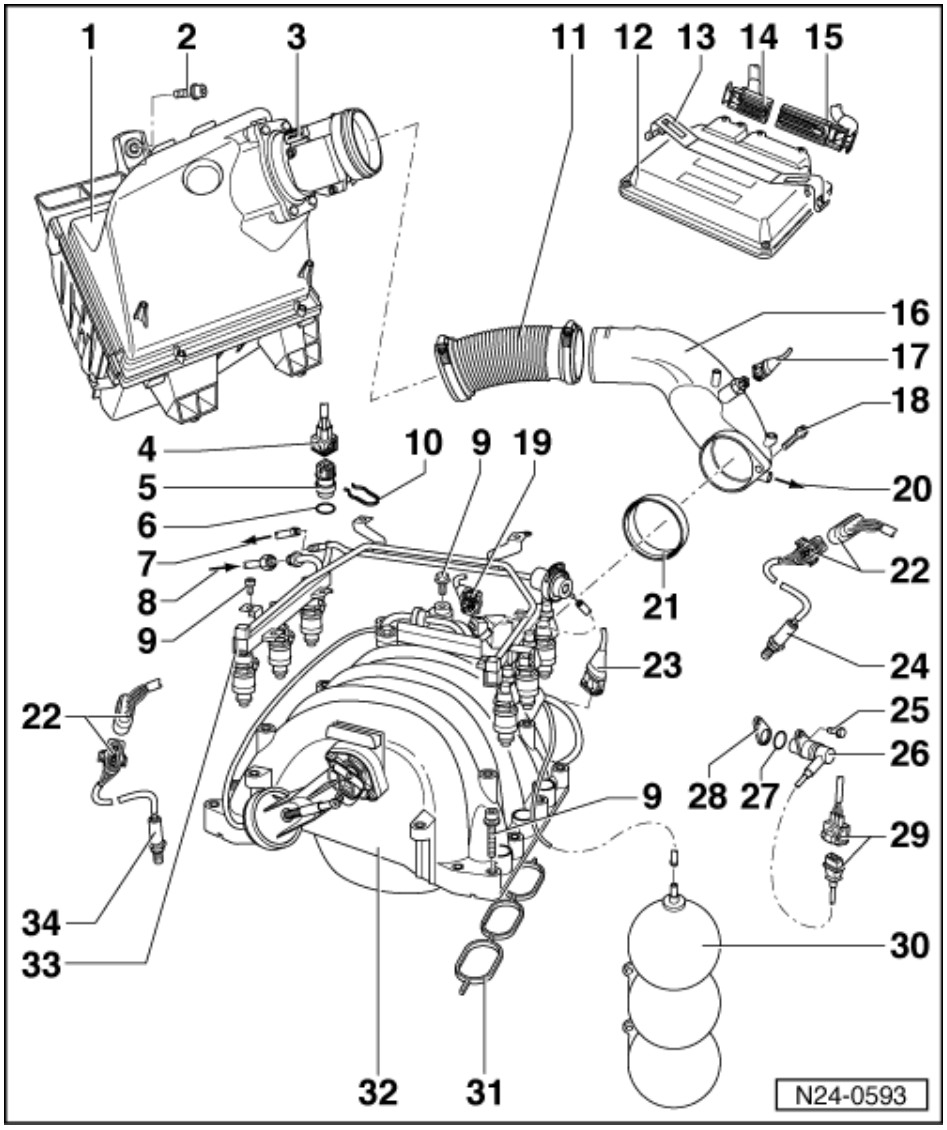
- On engine support, right

25 Camshaft adjustment valve 1 -N205

26 Air mass meter -G70

27 Secondary air pump motor -V101

1.6 - Removing and installing parts of the injection system



1 Air cleaner
- Dismantling and assembling
  => Page 34

2 20 Nm

3 Air mass meter -G70

4 Connector
- Blue, 4 pin
- For coolant temperature sender -G62

5 Coolant temperature sender -G62
- Blue
- For engine control unit
- With coolant temperature gauge sender -G2
- If necessary release pressure in cooling system before removing

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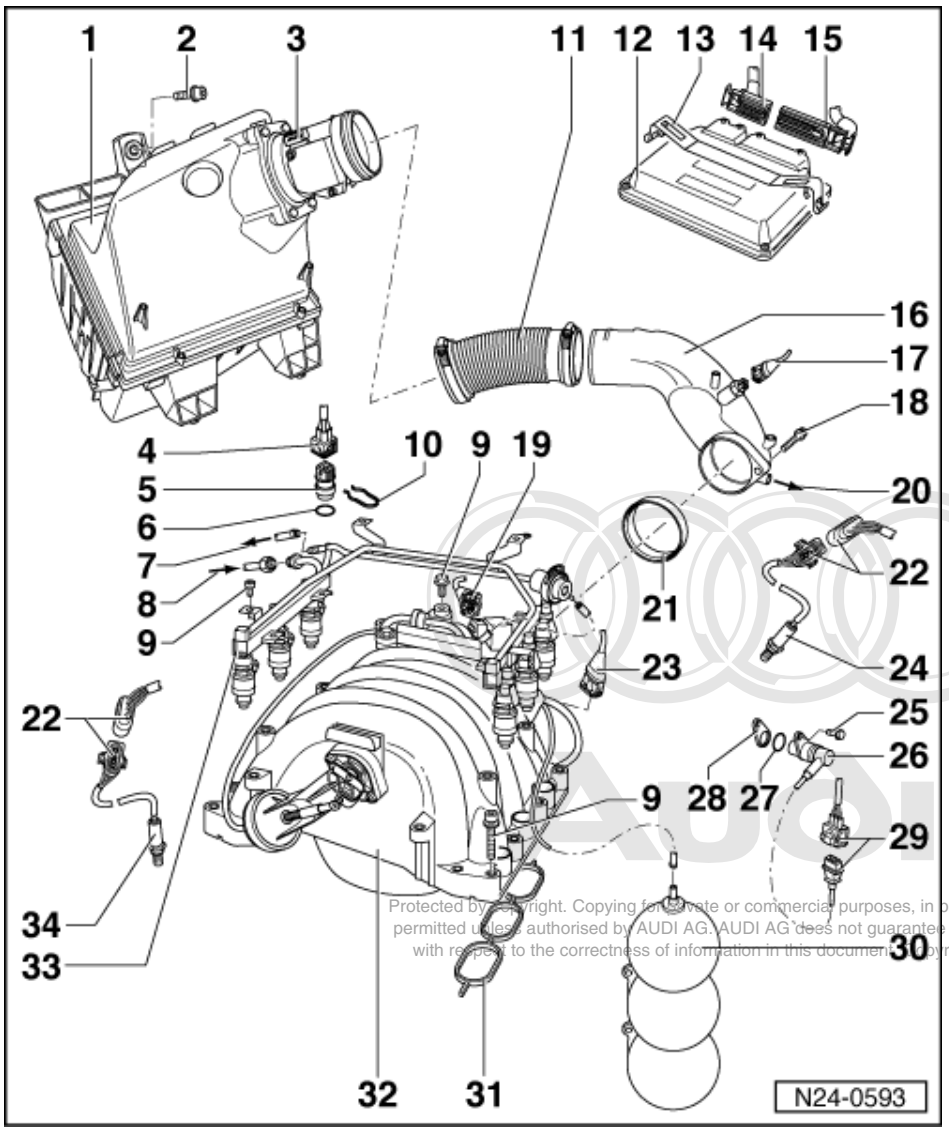

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6 O ring
- Renew if damaged

7 Return pipe
- Blue
- Secure with spring-type clips
- Check that pipe is securely seated

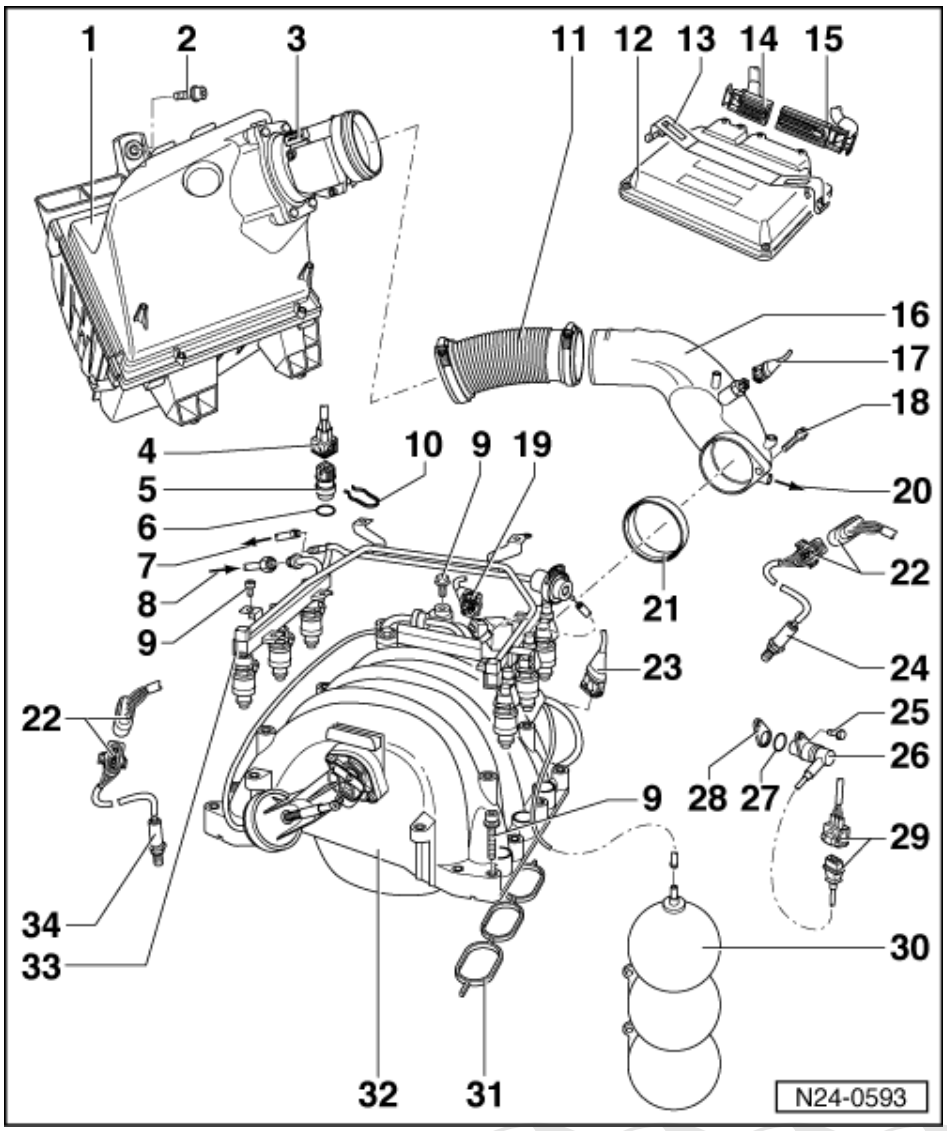
8 Supply pipe/hose
- Black

9 10 Nm

10 Retaining clip
- Check that clip is securely seated

11 Connecting hose

12 Engine control unit
(Motronic control unit -J220)
- Located in electronics box in plenum chamber (left-hand side)



13 Securing plate

14 Connector, 40 pin

- Only disconnect or connect with ignition switched off
- Release to disconnect

15 Connector, 81-pin

- Only disconnect or connect with ignition switched off
- Release to disconnect

16 Air intake elbow

17 Connector

- Black, 2-pin
- For intake air temperature sender -G42

18 10 Nm

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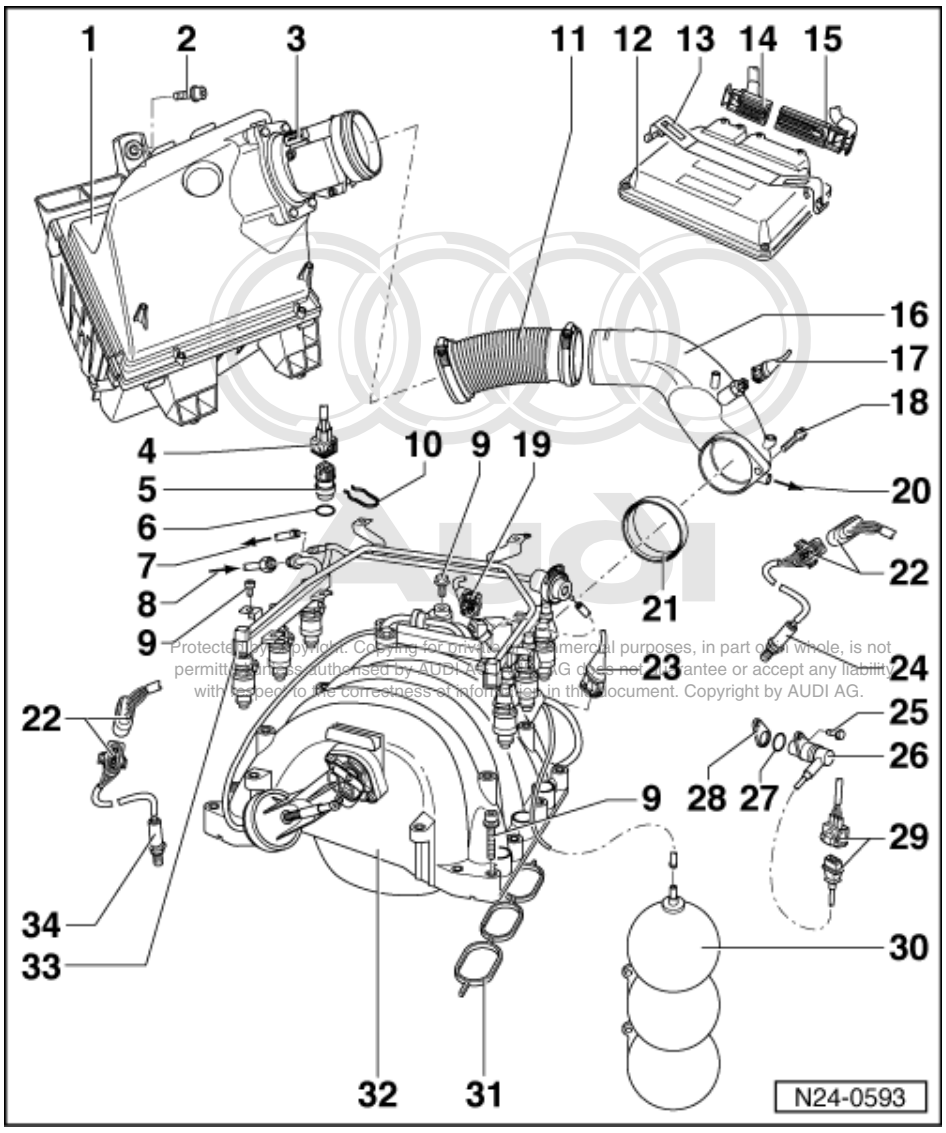

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19 Connector

- Blue, 2 pin
- For intake manifold change-over valve -N156

20 To crankcase breather valve

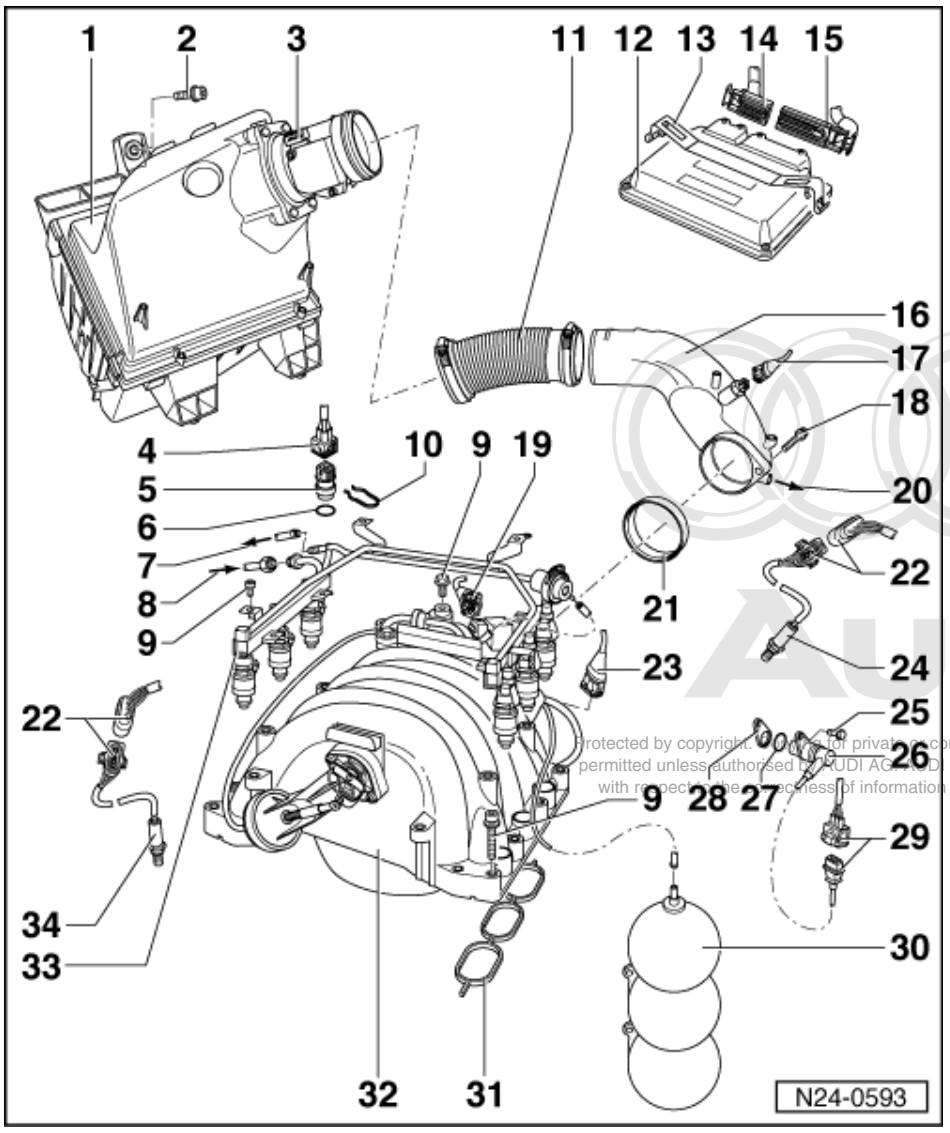
21 Seal

22 4-pin connector

- Black
- For Lambda probe and Lambda probe heating

23 Connector

- Black, 2-pin
- For injectors -N30...-N33, -N83, -N84



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24 Lambda probe 2 -G108, 50 Nm

- Cylinder bank 2

25 10 Nm

26 Engine speed sender -G28

- In gearbox housing above starter ring gear

27 O ring

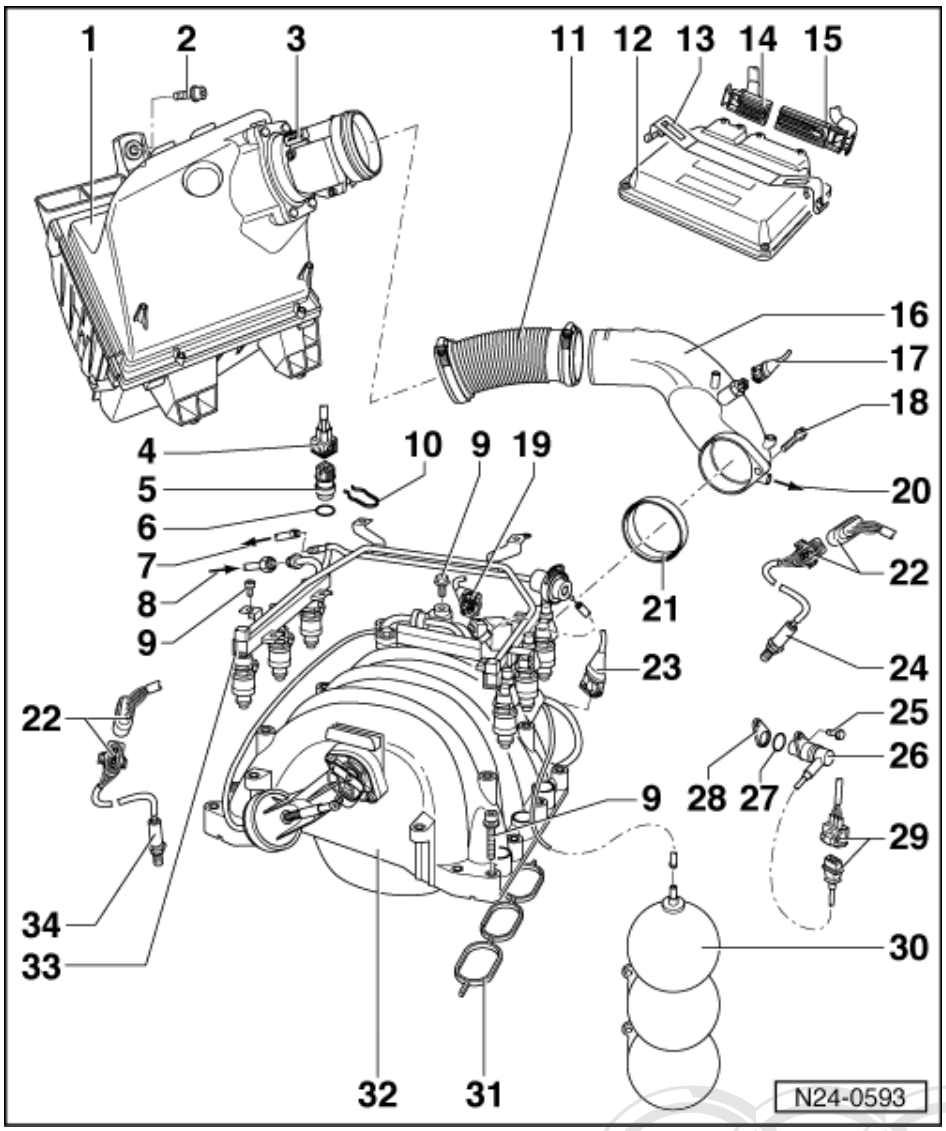
28 Spacer

29 3 pin connector

- Grey
- For engine speed sender

30 Vacuum reservoir

- For intake manifold change-over at full load



31 Gasket

32 Intake manifold

- Removing and installing parts of intake manifold change-over
  =>Page 36

33 Fuel rail with injectors

- Dismantling and assembling
  =>Page 35

34 Lambda probe 1 -G39, 50 Nm

- Cylinder bank 1
- Voltage supply for Lambda probe heating via fuel pump relay -J17

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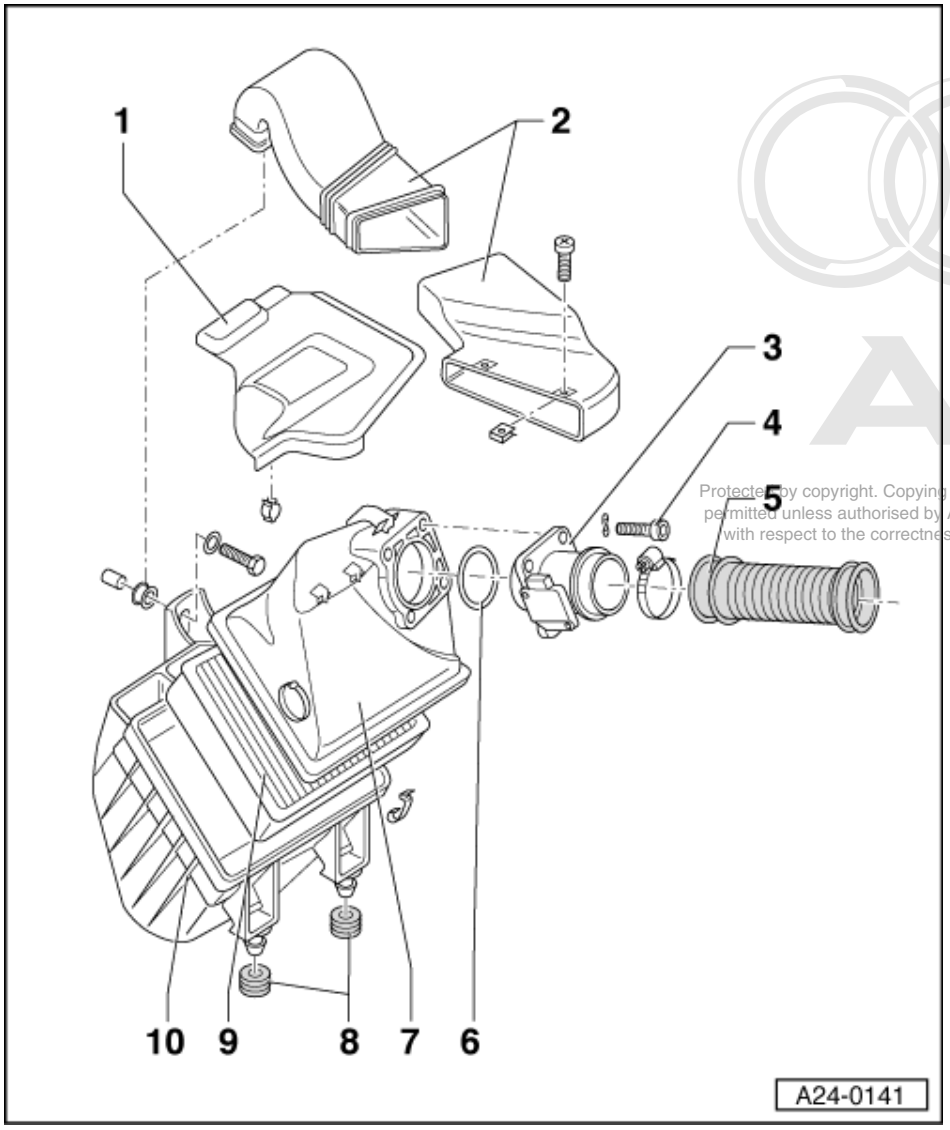
1.7 - Dismantling and assembling air cleaner



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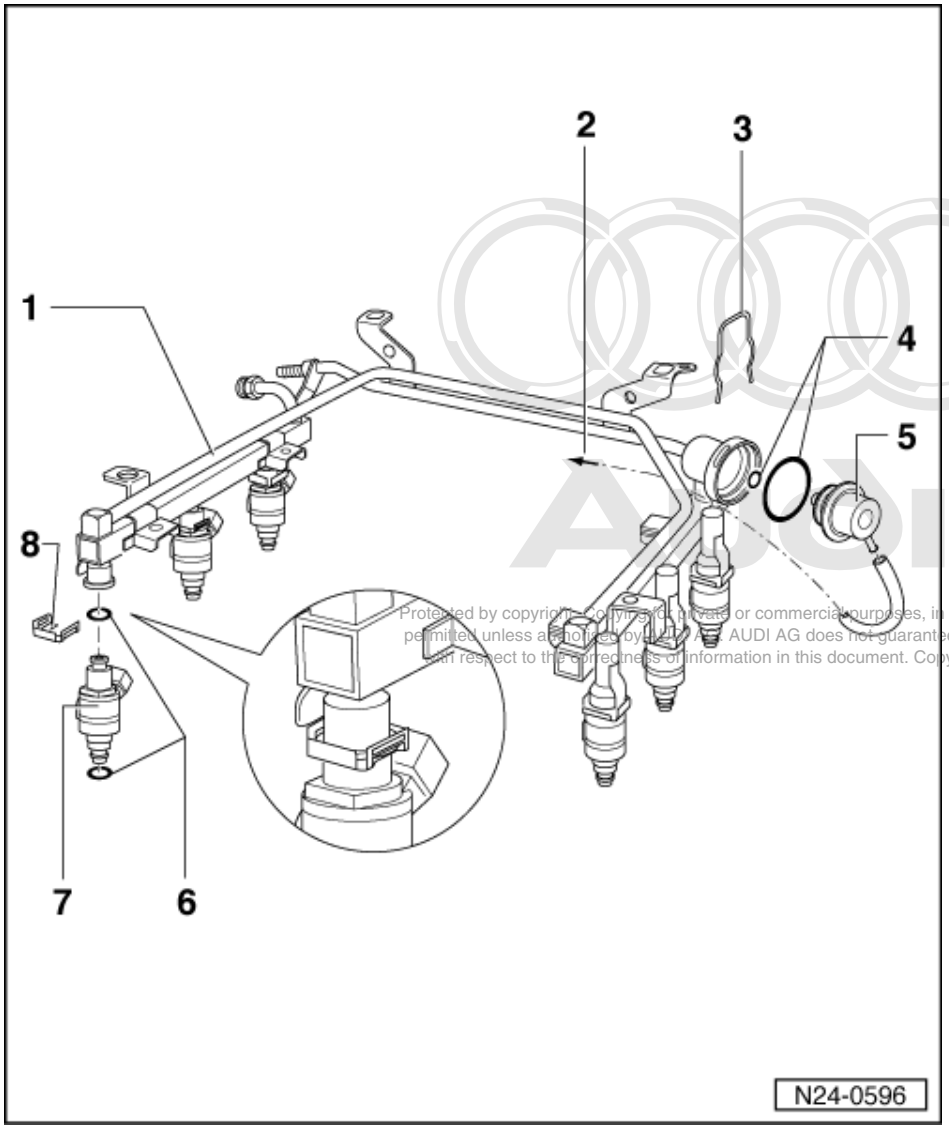
1 Cover
2 Spacer sleeve
- To lock carrier

3 Air mass meter -G70
4 10 Nm
5 Connector hose
6 Seal
7 Air cleaner upper part
8 Packing
9 Filter element
10 Air cleaner lower part

1.8 - Dismantling and assembling fuel rail with injectors



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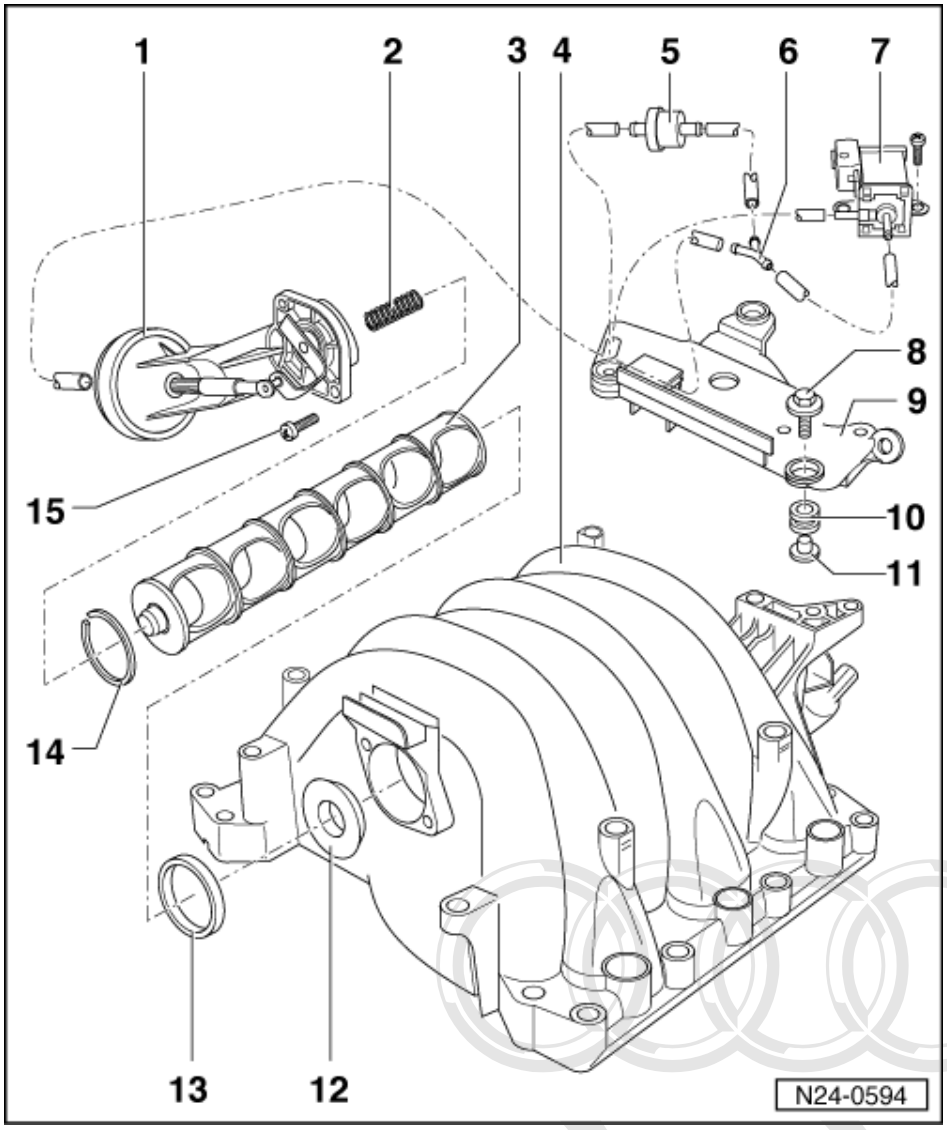
1 Fuel rail
2 To T piece
3 Retaining clip
4 O ring
- Renew

5 Fuel pressure regulator
6 O ring
- Renew

7 Injector -N30...-N33, -N83, -N84
8 Retaining clip
- Ensure clip is seated correctly on injector and fuel rail

1.9 - Removing and installing parts of intake manifold change-over



1 Vacuum unit
2 Spring
3 Change-over barrel
4 Intake manifold
5 Non-return valve
- Installation position: Blue end to Y-piece

6 Y piece
7 Intake manifold change-over valve -N156

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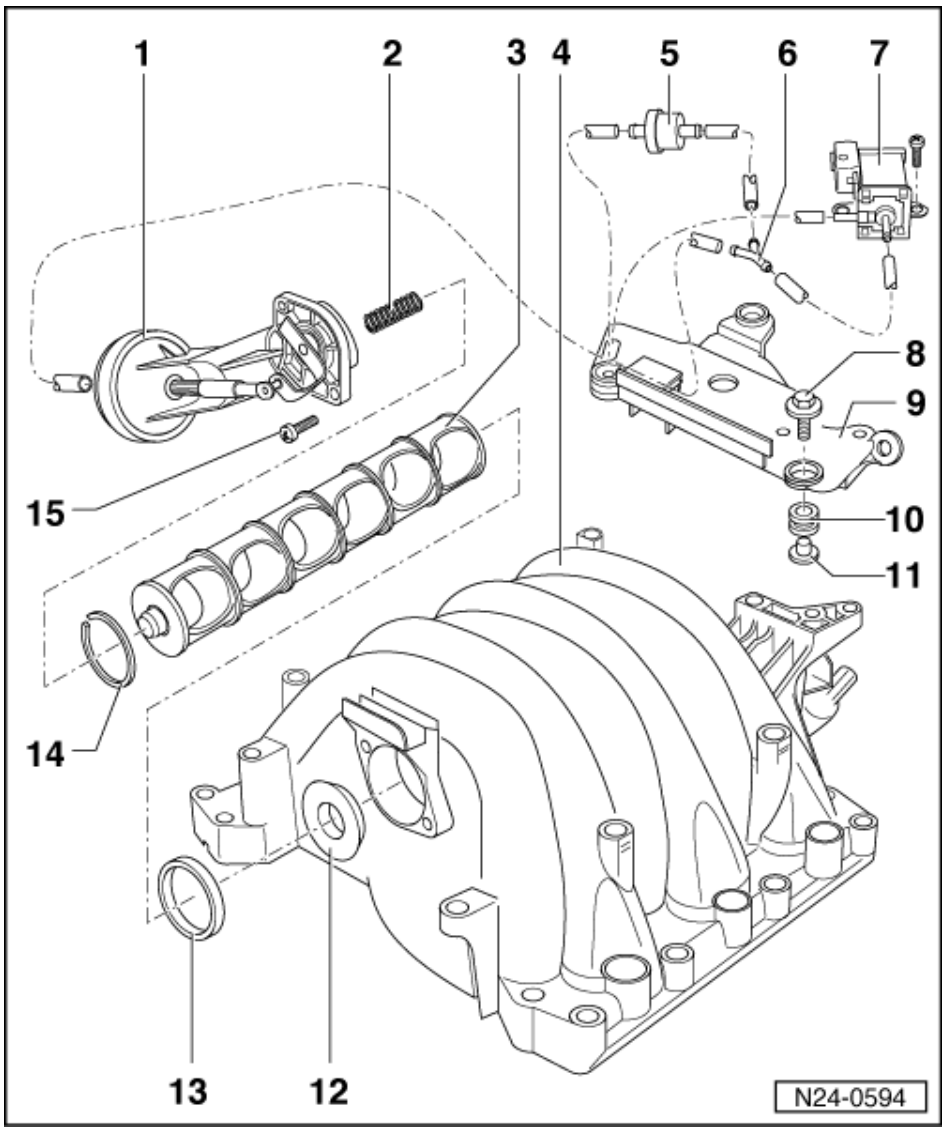

8 10 Nm
9 Securing plate
10 Rubber grommet
11 Spacer sleeve
12 Washer
- Conical side to intake manifold

13 Seal
- Renew if damaged

14 Seal
- For change-over barrel

15 6 Nm

1.10 - Wiring and component check with test box V.A.G 1598/31

Notes:
- Test box V.A.G 1598/31 is designed so that it can be connected to the wiring harness for the engine control unit and to the engine control unit itself at the same time.
- This has the advantage of enabling the engine management system to remain fully operational even with the test box connected (for example, when testing signals while the engine is running).

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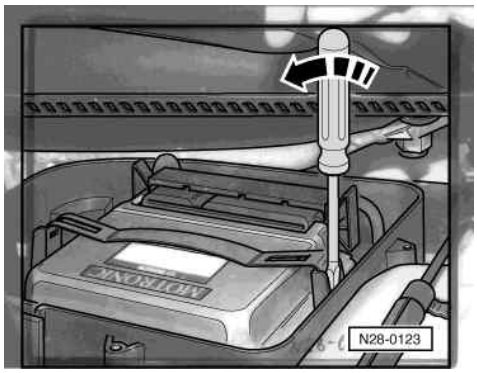
- The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.

- Use the hand multimeter V.A.G 1526 or the multimeter V.A.G 1715 and the diode test lamp V.A.G 1527 for the checks.
- To connect the testers to test box 1598/31, always use the adapter leads from adapter set V.A.G 1594.

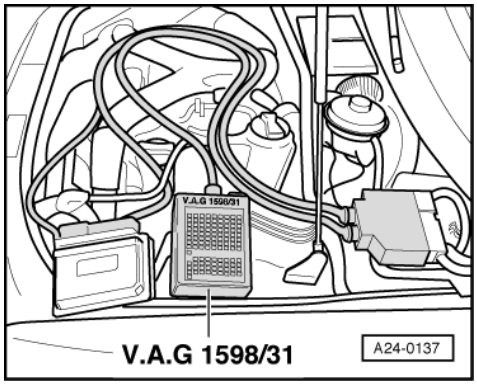
After re-connecting the engine control unit, perform adaption of engine control unit to throttle valve control part

=>Page 72 .

Warning!
To prevent damage to the electronic components, switch to the respective measuring range before connecting the measuring cable and observe the test requirement



- Switch off ignition.
- Remove cover of protective housing for control units.
- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Then release connectors on control unit and pull off.



- -> Connect test box V.A.G 1598/31 to wiring harness connector. Also connect the earth clamp on the test box (not shown in the illustration) to the battery negative terminal. The instructions for performing the individual tests indicate whether or not the engine control unit itself also needs to be connected to the test box.
- Carry out test as described in the repair instructions.

1.11 - Renewing engine control unit

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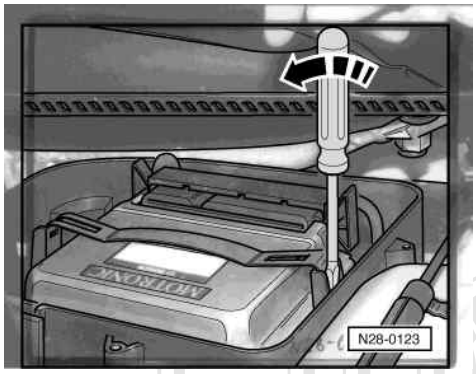
Note:

When the engine control unit is disconnected the learned values are erased but the contents of the fault memory remain intact.

Removing engine control unit

- Switch off ignition.
- Remove cover of protective housing for control units.



- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Then release connectors on control unit and pull off.
- Take out the old engine control unit and install the new one.

Installing engine control unit

Installation is performed in the reverse sequence.

Note:

During the initial learning phase for the engine control unit the idling may be slightly rough and the engine may pull a little unevenly.

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Note:

After installing the new engine control unit the following operations must be performed:

- Interrogate fault memory and erase if necessary
  => Page 4
- See notes on coding the new engine control unit
  => Page 19
- Adapting the throttle valve control part -J338
  => Page 72

- On vehicles with cruise control (identifiable from the steering column switch), activate the cruise control function in the engine control unit.

=> Electrical system; Repair group 01; Self-diagnosis of cruise control system (CCS); Testing cruise control system (CCS) Self-diagnosis of cruise control system (CCS) Testing cruise control system (CCS)

- Perform adaption of immobilizer to engine control unit

=> Electrical System; Repair Group 01; Self-diagnosis of electronic immobilizer; Adaptation procedure when engine control unit is replaced Self-diagnosis of electronic immobilizer Adaptation procedure when engine control unit is replaced

1.12 - Testing idling speed

Test conditions

- No leaks in exhaust system
- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off

- Pressure gauge not connected
- Selector lever in position P or N (vehicles with automatic gearbox)

Testing idling speed

Notes:

- The idling speed cannot be adjusted.
- The idling speed is tested during the basic setting of the engine.
- During the basic setting of the engine the air conditioner compressor is automatically switched off and the solenoid valve for the activated charcoal filter (ACF valve) is closed.

- Interrogate fault memory. The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Take the vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Run the engine at idling speed.

Warning!
The electric radiator fan should not be running.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with the Q key.

-> Indicated on display:

```
Introduction of basic setting      HELP
Enter display group number XXX
```

- Press keys 0, 5 and 6 for Display Group 56 and confirm entry with the Q key.

-> Indicated on display:
(1...4 = display zones)

```
Basic setting      56
     1     2     3     4
```

- Check whether the engine speed shown in display zone 1 (actual engine speed) is within the specified tolerance range:

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- 630...730 rpm on vehicles with four-wheel drive
- 720...820 rpm on vehicles with front-wheel drive

	Display zones			
	1	2	3	4
Display Group 56: Idling speed stabilisation with engine idling at normal operating temperature				
Display	**xxx rpm**	**xxx rpm**	**x.x %**	**0 0 0 0**
Indicates	**Engine speed (actual)**	**Engine speed (specified)**	**Idling speed control - torque change**	**Operating status**
Specification	**630...730 rpm (four-wheel drive) 720...820 rpm (front-wheel drive)**	**approx. 680 rpm (four-wheel drive) approx. 770 rpm (front-wheel drive)**	x.x %	0 0 0 0
Note	**If readout does not match specification =>Page 41**			**Relevance of figures => Page 41**

Note:

- The value shown in display zone 1 is the actual engine speed.
- The value shown in display zone 2 (specified engine speed) is a theoretical value calculated by the engine control unit.
- When the engine is idling the engine control unit tries constantly to adjust the actual engine speed so that it matches the specified value.
- This means that the actual engine speed when idling should always be approximately the same as the specified engine speed.
- Display zones 3 and 4 provide additional information which is not relevant when checking the idling speed.

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- If the readout does not match the specification, interrogate fault memory again.

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

- Test for unmetered air in the intake system =>Page 55 .
- Test throttle valve control part =>Page 69 .
- Solenoid valve for activated charcoal filter constantly open Test =>Page 66 .
- Perform adaption of throttle valve control part =>Page 72 .

Relevance of figures in 4-digit readout for Display Group 56

x	x	x	x	Display zone 4
			0	Air conditioner compressor off/on 0 = AC compressor off 1 = AC compressor on
		0		Selector lever in position P or N 0 = selector lever in P or N 1 = selector lever in 2, 3, 4, R or D
	0			Air conditioner status, maximum hot/cold air output
0				Always "0"

1.13 - Checking fuel pressure regulator and holding pressure

Test conditions

- Fuel pump relay OK. Testing => Page 49 .
- Fuel pump OK
- Fuel filter OK
- Battery voltage at least 11 V

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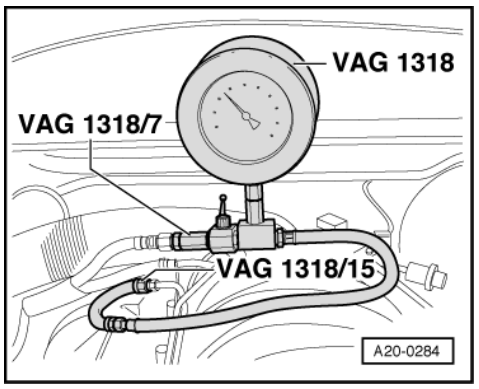
Note:

The fuel pressure regulator regulates the fuel pressure according to the intake manifold pressure. This ensures that the drop in pressure at the injectors remains the same throughout all engine speed and engine load ranges.

Warning!
The fuel system is pressurised. Before loosening hose connections or opening the test connection (to measure fuel pressure), place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

Testing system pressure



- -> Connect pressure gauge V.A.G 1318 to supply pipe using adapters 1318/7, 1318/8 (pressure hose) and 1318/15.
- Disconnect vacuum hose between fuel pressure regulator and intake manifold at fuel pressure regulator end; seal off end of hose.

Note:

If fuel flows out at the vacuum connection on the fuel pressure regulator during the following pressure test, fit a new fuel pressure regulator.

- Start the engine and run at idling speed.
- Measure fuel pressure.

  Specification: approx. 3.8...4.2 bar

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- If fuel pressure does not match specification, fit a new fuel pressure regulator for test purposes and repeat pressure test.
- If fuel pressure still does not match specification, check fuel pump and supply pipe for damage (e.g. pinching) and renew if necessary.

- If pressure is higher than specification, check return pipe for damage (e.g. pinching) and renew if necessary.

Note:

During the following test, do not allow the engine to run for too long with the vacuum hose disconnected, otherwise the increased fuel pressure will enrich the air/fuel mixture and may cause the lambda control limits to be exceeded. This would be stored as a fault in the fault memory.

- Start the engine and run at idling speed.
- Switch off electrical consumers (air conditioner etc.).
- Re-connect vacuum hose to fuel pressure regulator and observe drop in pressure on pressure gauge.

- When the vacuum hose is re-connected the fuel pressure should drop by around 0.5 bar.

  If the pressure does not change as specified, carry out the following tests:
  - Check vacuum hose for cracks and other damage.
  - Test vacuum hose for blockages at intake manifold.
    To do this, disconnect hose at fuel pressure regulator and blow into it.

- If there are no leaks and no blockages in the vacuum hose, fit a new fuel pressure regulator.

Testing holding pressure

- Holding pressure 10 minutes after switching off engine (minimum pressure)

  With engine cold: at least 2.2 bar
  With engine at operating temperature: at least 3.0 bar

Note:

A rise in pressure (due to fuel expansion) when the engine is at operating temperature is normal.

- Start the engine and run at idling speed.
- Switch ignition off after the pressure has built-up. At the same time close pressure gauge cut-off tap (lever at 90° to throughflow direction).

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

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

=> 6-cylinder Engine, Mechanics; Repair Group 20; Removing and installing fuel pump Removing and installing fuel pump

Note:

When the cut-off tap is closed the pressure gauge will indicate the pressure downstream of the cut-off tap, i.e. on the same side as the intake manifold, injectors and fuel pressure regulator. If there is then a drop in pressure upstream of the cut-off tap (same side as fuel tank), the change will not be registered by the pressure gauge. This is why the paragraph beginning "If the pressure does not drop..." has been included above.

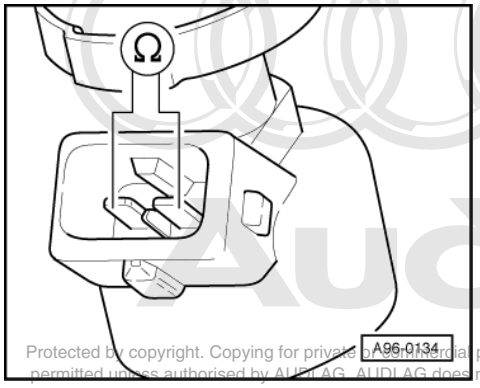
If the pressure drops again, the following faults are possible:

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

Note:

When disconnecting the pressure gauge, close the cut-off valve, unscrew the union on adapter V.A.G 1318/15, then open the cut-off valve to drain off excess fuel into a suitable container.

1.14 - Checking injectors



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A - Electrical testing of injectors

- Remove plug connector from the injector which is to be tested.
- -> Measure resistance between the injector contacts using V.A.G 1526.

  Specification: 13.5...15.5 ω

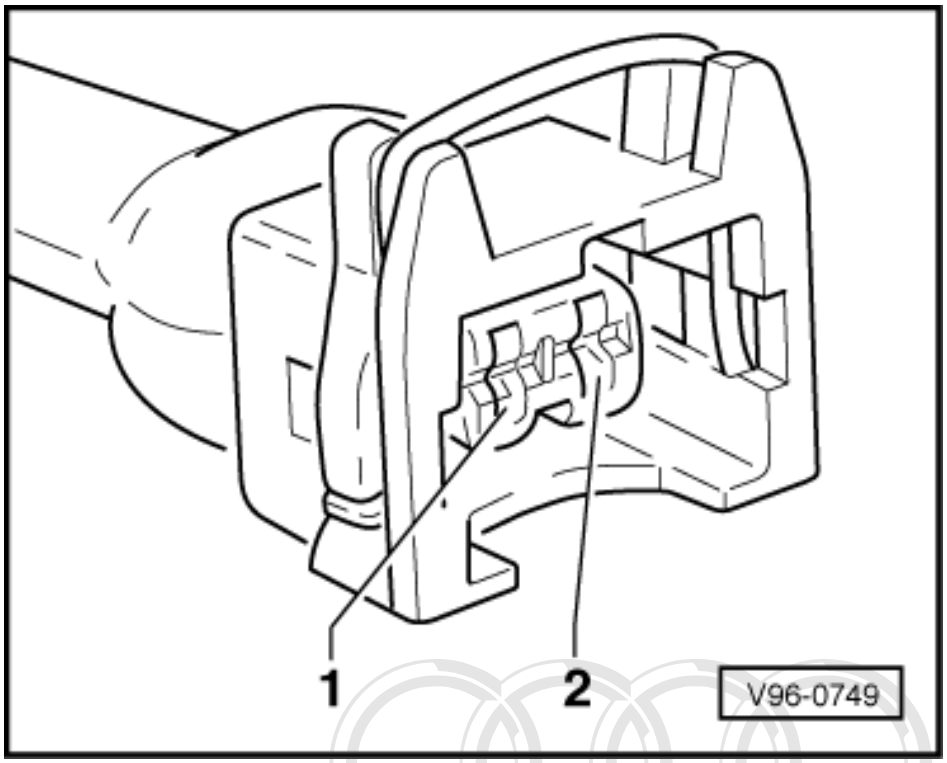
When the engine is warm the resistance will be approx. 4...6 ωhigher.

- If the measured value is not as specified, renew the injector.

B - Testing power supply

Test conditions

- Fuel pump relay OK. Testing =>Page 49 .



- Fuse for injectors OK

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Remove plug connector from the injector which is to be tested.
- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 on the connector.

- Operate starter for a few seconds (the engine can be allowed to start). The diode test lamp should light up.
- If the diode test lamp does not light up, test for open circuits in the wiring between contact 1 and the fuse for the injectors. If necessary, rectify open circuit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

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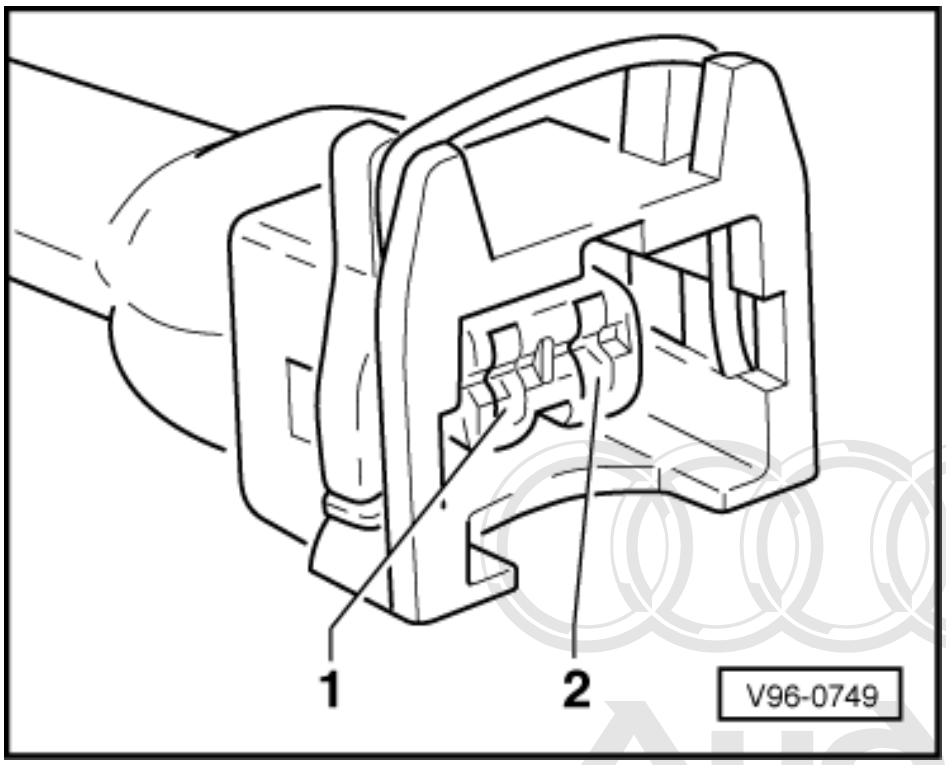

- If the diode test lamp lights up, test activation of injectors.

C - Testing activation of injectors

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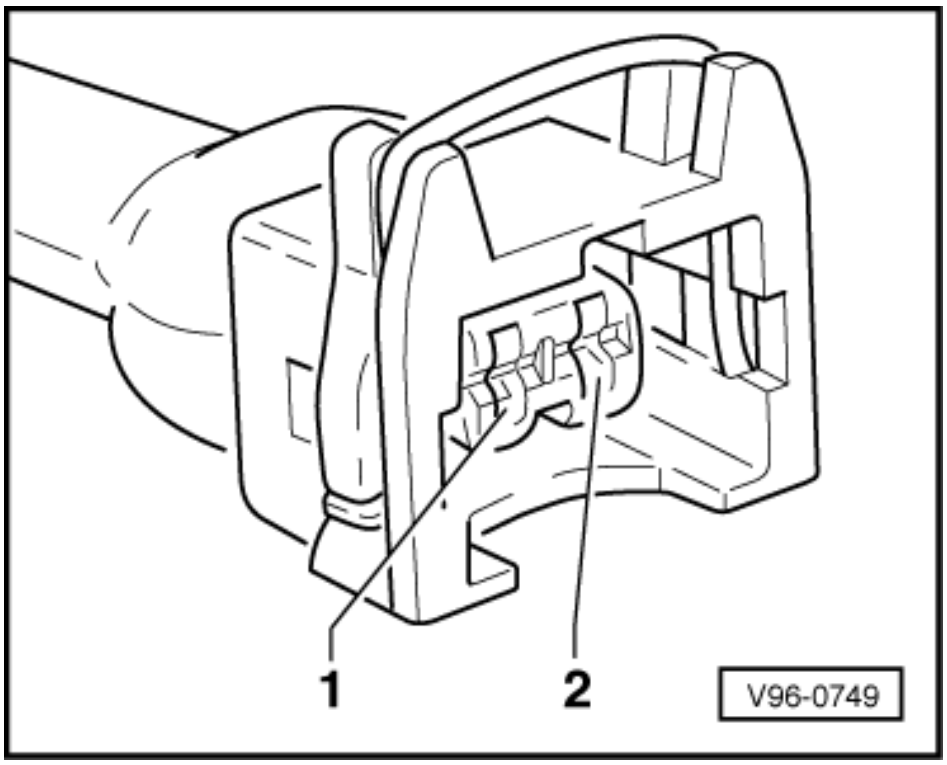
- Remove plug connector from the injector which is to be tested.
- -> Connect diode test lamp V.A.G 1527 between the battery positive terminal (+) and contact 2 on the connector.
- Operate starter for a few seconds (the engine can be allowed to start).

Specification: the diode test lamp should start flashing.

Note:

Diode test lamps with a low current draw continue to glow faintly between impulses from the engine control unit (rather than going out completely) and become brighter when receiving an impulse.



If the diode test lamp does not flash:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- -> Test for open circuit or short to positive in the wiring between the engine control unit and contact 2 on the plug connector for the injector being tested.

Contact 2 on connector for injector, Cylinder No.	Test box V.A.G 1598/31, socket
1	96
2	112
3	88
4	97
5	113
6	89

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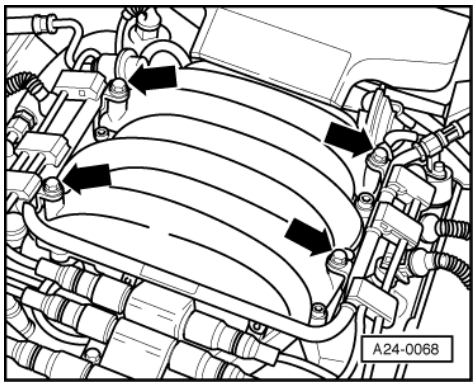
- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit
  => Page 38 .

1.15 - Testing injection quantity, leak-tightness and spray pattern of injectors

Test conditions



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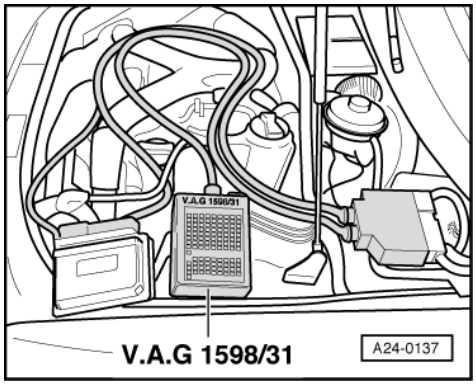
- Fuel pressure OK; testing => Page 41 .

- Remove intake hose between air mass meter and intake silencer.
- Unplug connectors from injectors.
- -> Unbolt fuel rail from intake manifold.
- Disconnect vacuum hose from fuel pressure regulator.
- Lift fuel rail off intake manifold together with injectors and support fuel rail.



- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- Bridge contacts 1 and 65 on the test box using test leads from adapter set V.A.G 1594. (This creates an earth connection to one side of the fuel pump relay coil.)

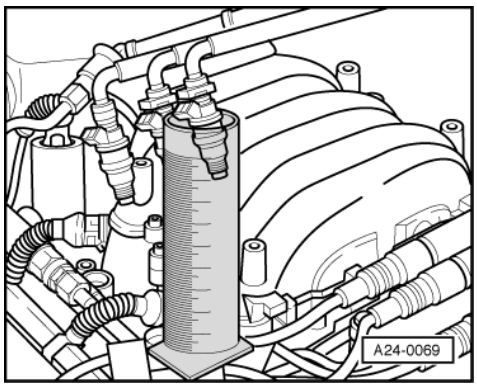
Testing for leaks

- Switch ignition on.

Note:

Once the ignition has been switched on the fuel pump runs continuously, even if the engine is not running. This is because when the ignition is switched on the fuel pump relay receives its positive voltage supply via the central electrics. The negative voltage supply for the fuel pump relay comes via the cable bridge on the test box.

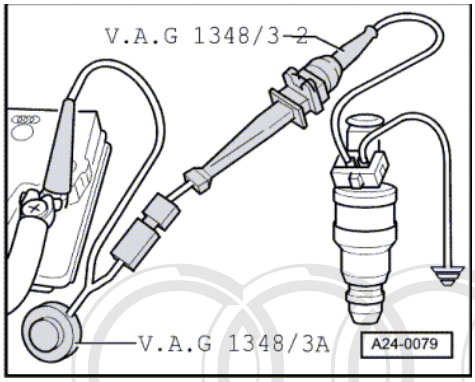
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops should escape per minute from each injector.



- If the fuel loss is greater, switch off the fuel pump (i.e. switch off the ignition) and renew the faulty injector.
  - Renew seals.

Checking injection quantity

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



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

The fuel pump should run.

- Activate remote control V.A.G 1348/3 A for 30 seconds.
- When all three injectors from the first bank of cylinders have been activated, place the three measuring glasses on a level surface.

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Specification for each injector: 90 ... 125 ml

- If the measured value for one or more of the injectors is outside the tolerance range, switch off the fuel pump (i.e. switch off the ignition) and renew the defective injector.

- Repeat test for injectors from second bank of cylinders.
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 41 .

Note:

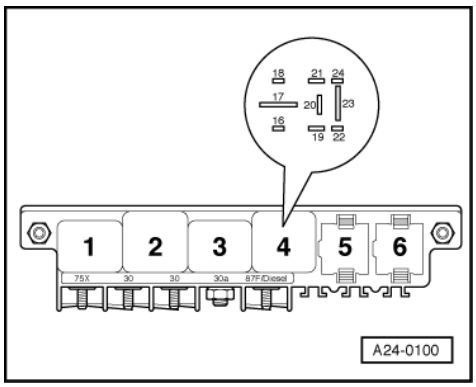
When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

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

- Renew the O-rings at all opened connections. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- Moisten the O-rings with clean engine oil.

- Make sure injectors are correctly positioned, insert vertically into fuel rail and secure with retainer clips.
- Position fuel rail together with injectors (properly secured) against intake manifold and press into place evenly all round.

1.16 - Testing fuel pump relay and activation

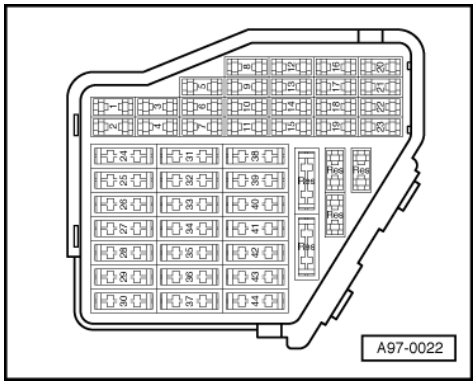


Note:

-> The fuel pump relay is located in the central electrics in the left-hand footwell, relay position 4.

A - Testing fuel pump relay -J17

- Remove storage bin in front left-hand footwell.



- -> Remove fuel pump fuse from fuse holder and connect diode test lamp V.A.G 1527 between earth and one of the two contacts for the fuel pump fuse.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Operate the starter briefly.

The fuel pump relay should pick up (can be felt and heard) and the diode test lamp should light up.

- If the fuel pump relay does not pick up, test activation
  => Page 50 .

- If the fuel pump relay picks up but the diode test lamp does not light up, repeat the test on the other contact.

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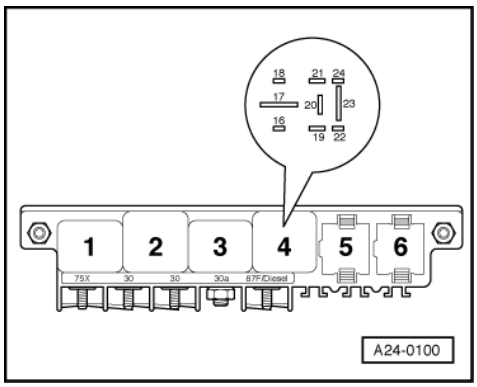


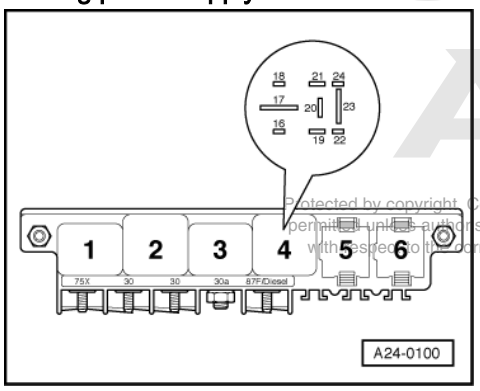
- -> If the diode test lamp still does not light up, test for open circuit in wiring between fuel pump fuse and contact 23 in relay position 4. If necessary, rectify open circuit.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder
- If the power supply, activation and wiring for the fuel pump relay are OK, fit a new fuel pump relay.

B - Testing power supply and activation of fuel pump relay

Note:
Activation of the fuel pump relay can also be tested using the final control diagnosis.
=>Page 15 .
- Remove fuel pump relay -J17 from central electrics, relay position 4.

Testing power supply



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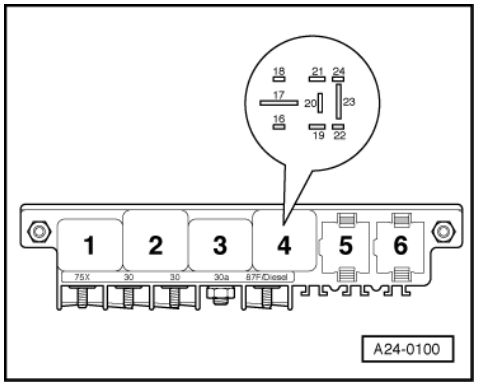
- -> Connect hand-held multimeter V.A.G 1526 between earth and relay panel contact 19 (permanent positive; terminal 30 from battery). Disconnect, then re-connect between earth and relay panel contact 17 (permanent positive; terminal 30 from battery).

Specification: approx. battery voltage in each case
- If the values are not as specified, rectify the open circuit.

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



Testing activation

- -> Connect diode test lamp V.A.G 1527 between positive and contact 16 on relay panel (switched earth connection via engine control unit).
- Operate the starter briefly.
- The diode test lamp should light up and remain lit when the starter is operated.

Note:

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

- If the activation, wiring and power supply for the fuel pump relay are OK but the fuel pump relay still does not pick up, fit a new fuel pump relay.

If the diode test lamp does not light up, test the wiring as follows:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .

- Connect hand-held multimeter between contact 16 on relay panel and socket 65 on the test box, then test wiring for open circuits.
- Rectify open circuit if necessary.

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

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- If there is no open circuit and the diode test lamp still does not light up, fit a new engine control unit
  => Page 38 .
- Refit the fuel pump fuse.

1.17 - Checking air mass meter

Test conditions

- Coolant temperature at least 80 °C
- Electrical consumers switched off (radiator fan must not run during test)
- Air conditioner switched off
- Fuse for air mass meter OK

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Testing operation

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the engine must be idling.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with the Q key.

Note:

During the basic setting the engine control unit closes the activated charcoal filter solenoid valve (ACF valve - N80) and switches off the air conditioner compressor.

-> Indicated on display:

```
Introduction of basic setting      HELP
Enter display group number XXX
```

- Press keys 0, 0 and 2 for Display Group 02 and confirm entry with the Q key.

-> Indicated on display:

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

- Check display values for engine load.

	Display zones			
	1	2	3	4
Display Group 2: Intake air mass at idling speed with engine at normal operating temperature				
Display	xxx rpm	**xx.x %**	x.x ms	**xxx.x g/s**
Indicates	Engine speed (in steps of 40 rpm)	**Load**	Average injection period	**Air mass**
Range	min.: 630 rpm max.: 6800 rpm	min.: 12 % max.: 100 %	**min.: 1.0 ms max.: 20.0 ms**	**min.: 3.0 g/s max.: approx. 150 g/s**
Specification	630...820 rpm	**12.0...26.0 %**	1.0...4.0 ms	**3.0...5.0 g/s**
Note	---	---	**If readout does not match specification, see table for display zone 3 => Page 52**	**If readout does not match specification, see table for display zone 4 => Page 52**

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If the specification is obtained:

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

Reading Display Group 2

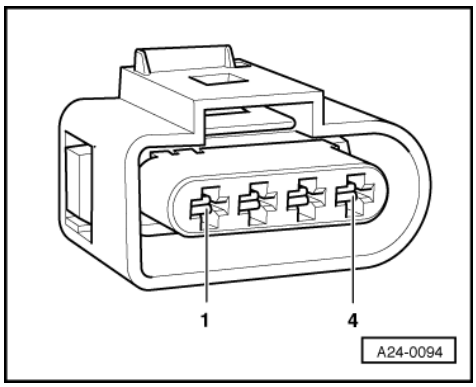
Display zone 3	Possible cause of fault	Fault remedy
Less than 1.0 ms	- Lower values can only occur when vehicle is on overrun	
More than 4.0 ms	- Load on engine due to ancillaries	- Eliminate load (air conditioner, power steering, alternator)
	- Rough idling (engine not running on all cylinders)	- Test spark plugs Test injectors => Page 43
	- Throttle valve control part -J338 defective	- Test throttle valve control part => Page 69

Reading Display Group 2

Display zone 4	Possible cause of fault	Fault remedy
Less than 3.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter - Voltage supply to air mass meter or wiring to - engine control unit	- Check intake system for leaks (unmetered air) => Page 53
More than 5.0 g/s	- Load on engine due to ancillaries	- Eliminate load (air conditioner, power steering, alternator)

Display zone 4	Possible cause of fault	Fault remedy
	- Voltage supply to air mass meter or wiring to - engine control unit	- Test voltage supply and wiring => Page 53

Testing power supply to air mass meter



- -> Unplug connector from air mass meter.
- Connect hand-held multimeter (voltage test range) between engine earth and contact 3 of connector.
- Operate the starter briefly.

  Specification: approx. battery voltage

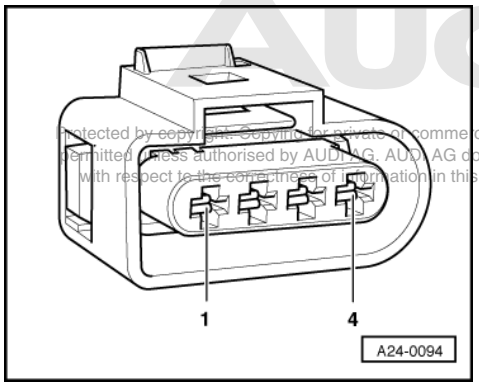
Note:

The air mass meter receives its voltage supply via the fuel pump relay.

If the reading does not match the battery voltage:

- Test for open circuit or short to earth in wiring between fuel pump relay and contact 3 on connector via fuse. Repair if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder



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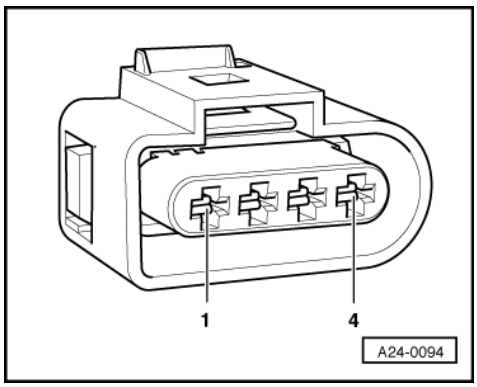
- -> Connect hand-held multimeter (voltage measurement range) between contacts 2 and 3 of connector.
- Operate the starter briefly.

  Specification: approx. battery voltage

Note:

Contact 2 on the connector is for the earth connection from the engine control unit.

If the specification is not attained:



- -> Connect hand-held multimeter (voltage measurement range) between contacts 1 and 2 of connector.
- Switch ignition on.

  Specification: approx. 5 V

If the specification is not attained, test wiring => Page 54 .

Testing wiring for air mass meter

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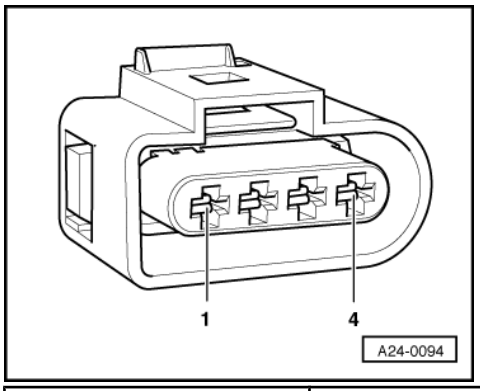
Note:

The wiring test also tests the signal wire.

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .

The following wiring connections are to be checked for open circuits and/or short to positive or negative.



Connector for air mass meter -G70	Test box V.A.G 1598/31 Contact
1	53
2	27
4	29

Resistance in wiring: max. 1.5 ω

- Test all wires for short circuits with each other.

  Specification: infinity ω(open circuit)

- If the wiring and the power supply are OK, fit a new air mass meter -G70.

1.18 - Checking intake air system for leaks (unmetered air)

Checking with engine leak detector spray G 001 800 A1

Notes:

- The vacuum in the intake system will cause the leak detector spray to be drawn in with the outside air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a significant increase of the CO content.
- The safety precautions listed on the container must be adhered to.

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- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the engine must be idling.

-> Indicated on display:

```
Rapid data transmission      HELP
Select function XX
```

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

-> Indicated on display:

```
Read measured value block
Enter Display Group number XXX
```

- Press keys 0, 0 and 1 for "Display Group 01" and confirm entry by pressing Q.

-> Indicated on display:
(1...4 = Display zones)

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

- Note engine speed in display zone 1.
- Systematically spray parts of the intake system with engine leak detector spray.

If the engine speed does not change:

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

If the engine speed drops:

- Press the ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Check sprayed areas of intake system for leaks and rectify if necessary.

2 - Testing intake manifold change-over function

2.1 - Testing intake manifold change-over function

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

The intake manifold change-over function switches over from the long intake tract to the short intake tract at about 4700 rpm.

2.2 - Testing operation

- Increase the engine speed to well above 4700 rpm; the vacuum unit for the intake manifold change-over system should "pull". (The vacuum unit is located on the front of the intake manifold, on the left-hand side below the ignition coils.)

If the intake manifold does not switch over, carry out the following tests:

- Test intake manifold change-over valve -N156 by performing final control diagnosis=>Page 59 .
- Test vacuum reservoir for leaks =>Page 56 .

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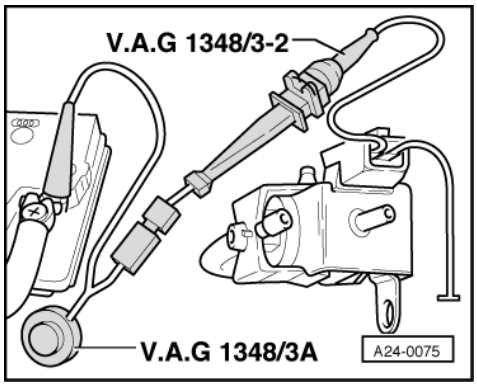
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that change-over mechanism operates freely (move push-rod by hand).

2.3 - Testing vacuum system



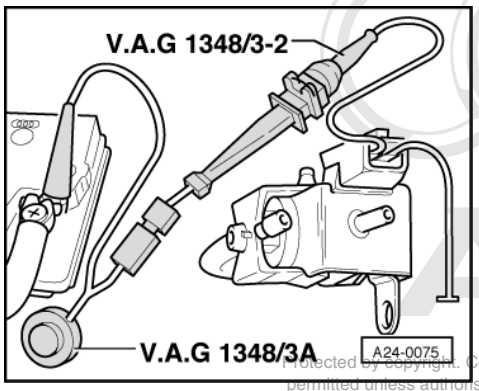
- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch off ignition.
- Unplug connector from intake manifold change-over valve -N156.
- -> Connect one of the contacts on the solenoid valve to engine earth using test leads and crocodile clamp from V.A.G 1594.
- Connect the other contact on the solenoid valve to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.

- Operate remote control V.A.G 1348/3A for about 2 or 3 minutes. During this time the vacuum unit should remain in the "pulled-in" position.

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

- Disconnect vacuum hoses from vacuum unit for intake manifold change-over system.
- Connect hand pump V.A.G 1390 to vacuum unit.
- Operate hand pump and check whether change-over function is working.
- Test vacuum unit for leaks. (The vacuum unit should not return to the "rest" position while a vacuum is being maintained via the hand pump.)

- If necessary, renew vacuum unit.



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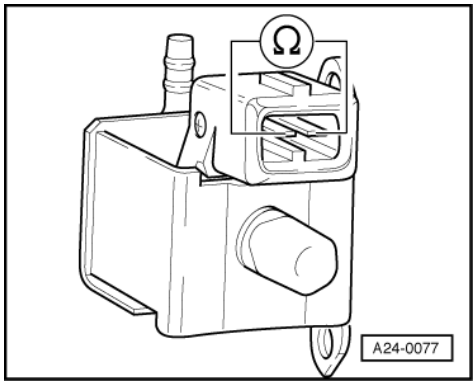
- If the vacuum unit does not pull, test -N156 for obstructions as follows:
- -> Connect one of the contacts on -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594.
- Connect the other contact on -N156 to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Test valve for obstructions (remove vacuum hoses and blow through).
- If necessary, renew intake manifold change-over valve.
- If no faults have been found in any of the tests so far, test the vacuum system for leaks.

2.4 - Testing intake manifold change-over valve



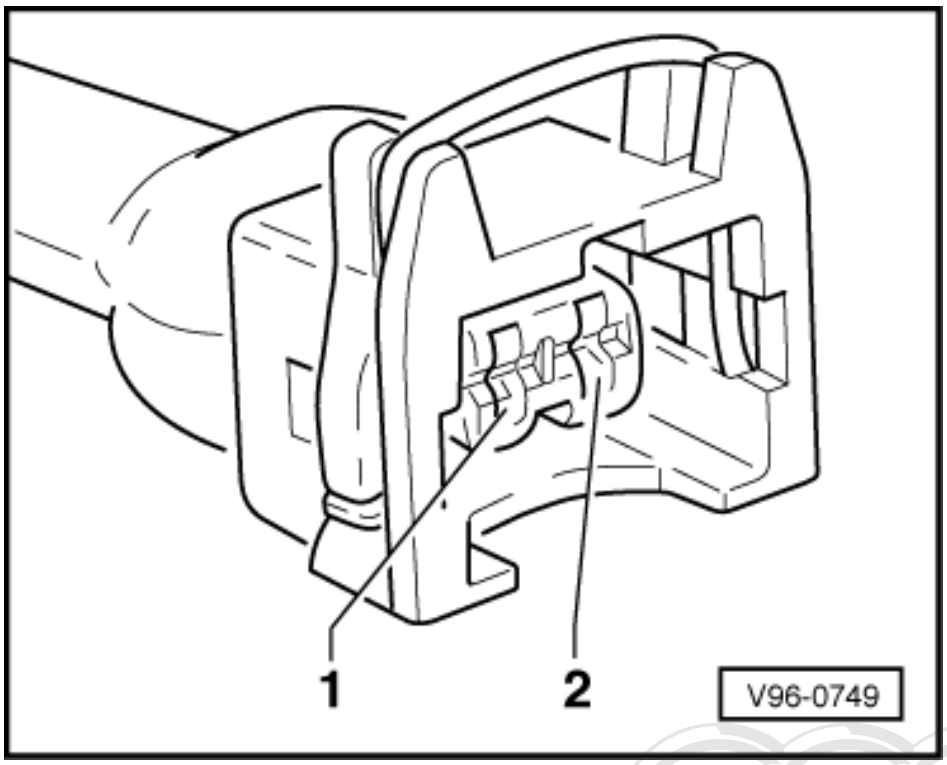
Electrical test of intake manifold change-over valve -N156

Fitting location=>Page 23 .

- Unplug connector from intake manifold change-over valve -N156.
- -> Measure resistance between valve contacts using V.A.G 1526.

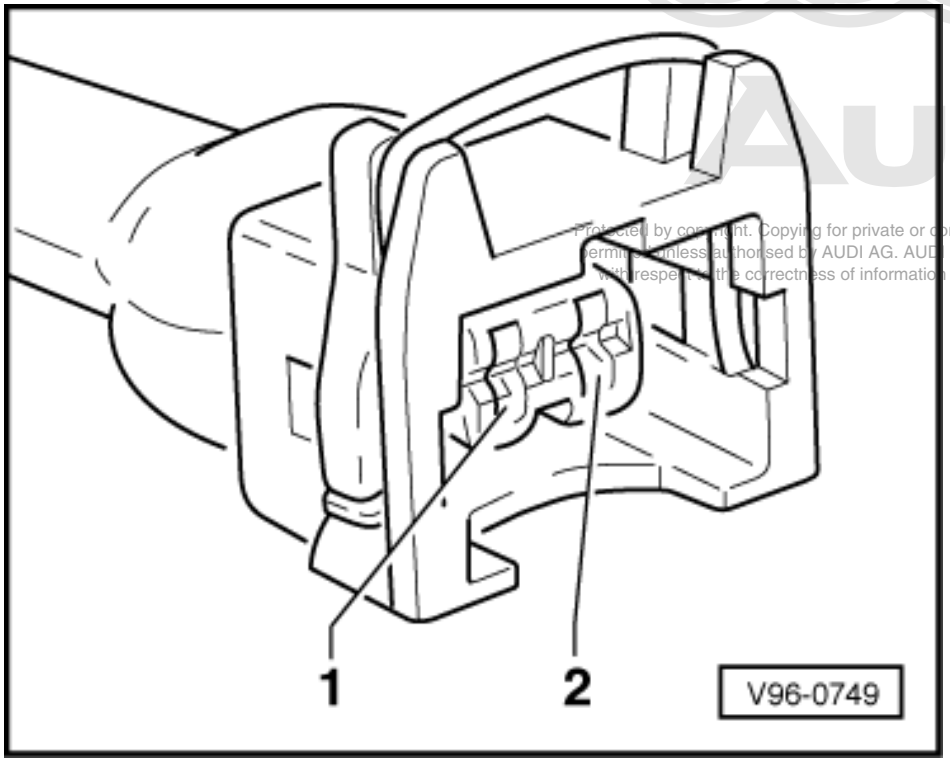
  Specification: 25...35 ω

- If the reading does not match the specification, renew intake manifold change-over valve -N156.



Testing power supply to intake manifold change-over valve -N156

- -> Unplug connector from intake manifold change-over valve -N156.



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- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 on connector using test leads from auxiliary cable set V.A.G. 1594.
- Operate the starter briefly.

The diode test lamp should light up.

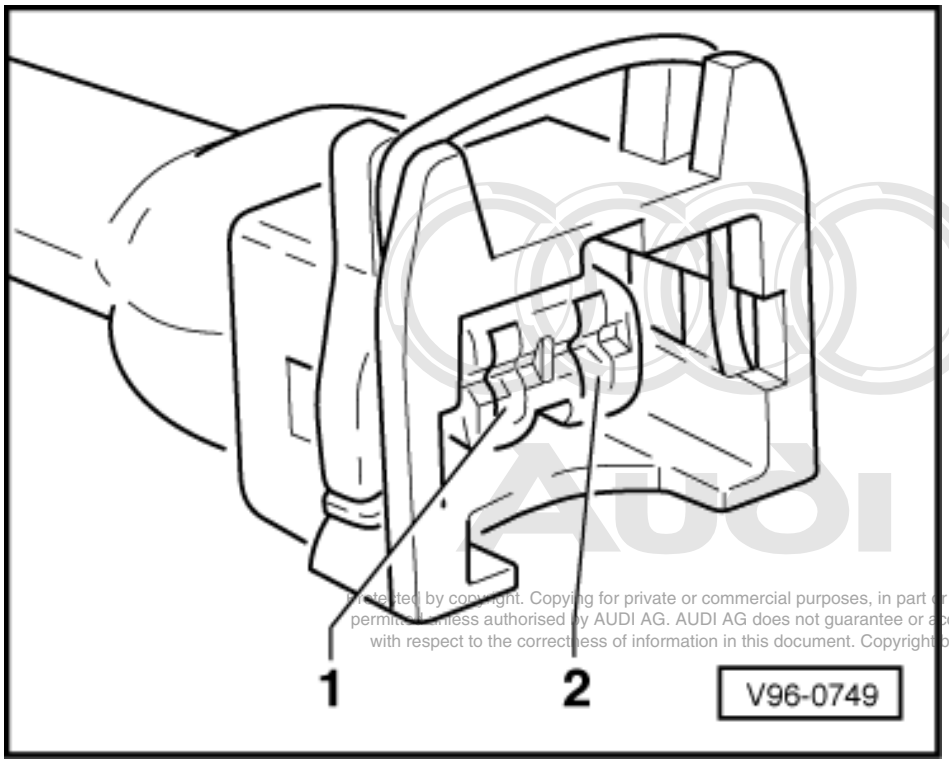
If the diode test lamp does not light up, carry out the following tests:

- Test fuse for -N156.
- Test for open circuit in wiring between fuse and contact 1 on connector for intake manifold change-over valve using current flow diagram.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Specification: max. 1 ω.

- Test fuel pump relay and activation
  =>Page 49 .



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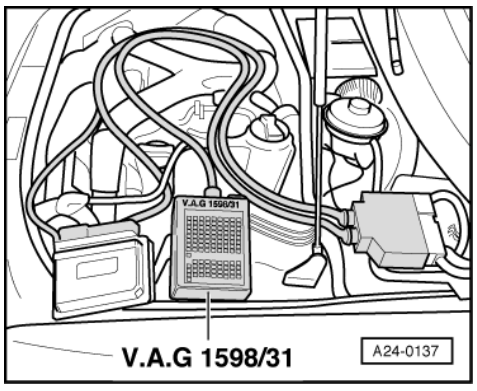
Testing activation of intake manifold change-over valve

- -> Connect diode test lamp V.A.G 1527 between contacts 1 (positive) and 2 on connector for intake manifold change-over valve using test leads from auxiliary cable set V.A.G 1594.
- Perform final control diagnosis=>Page 15 . The diode test lamp should flash when the intake manifold change-over valve is activated.



- If the diode test lamp does not flash or lights up continuously, connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect engine control unit=>Page 37 .
- If the diode test lamp lights up continuously, test for short circuit to earth in wiring between socket 104 on test box V.A.G 1598/31 and contact 2 on connector for intake manifold change-over valve.

- If the diode test lamp does not flash, test for open circuit or short to positive in wiring between socket 104 on test box and contact 2 on connector for intake manifold change-over valve.

Specification: max. 1ω.

- If necessary, rectify short to earth or open circuit.
- If no short circuits or open circuits are found, fit a new engine control unit => Page 38 .

3 - Testing lambda control

3.1 - Testing lambda control

3.2 - Operation of lambda control

The lambda probes compare the oxygen content in the air with the residual oxygen content in the exhaust gas and send a voltage signal to the control unit.

The voltage signal for "Mixture too rich" (low residual oxygen) is between about 0.7 and 1.0 V.

The voltage signal for "Mixture too lean" (high residual oxygen) is between about 0.0 and +0.3 V.

The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.7 and 1.0 V to between 0.0 and +0.3 V, and vice versa (λ = 1.0).

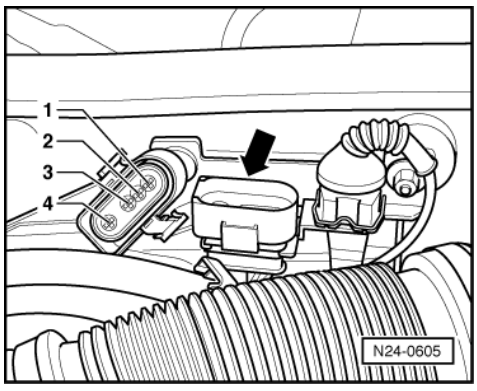
Because of the sharp voltage jump the lambda control cannot maintain a constant ideal mixture composition of λ = 1.0. The system fluctuates continuously between "slightly too lean" and "slightly too rich".

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

- Slots or holes in probe head are blocked.
- Lambda probe has been subjected to excessive thermal stress.
- Contact resistance in signal wire or earth wire.
- Lambda probe too cold; lambda probe heating not working.
- Lambda probe damaged by contact spray or similar product. (The contact spray is drawn through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effect.)
- Lambda probe damaged by silicone vapours. (The engine draws in traces of any silicone-based sealants that may have been used. The silicone does not burn and damages the lambda probe.)

3.3 - Testing lambda probe heating

Notes:

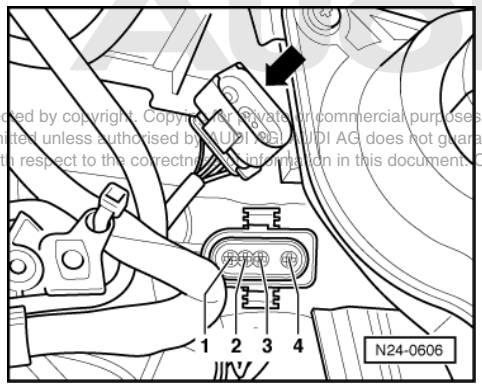


- Connector for Bank1 Probe 1 (G39) and lambda probe heating (Z19): 4-pin, black
- Connector for Bank 2 Probe 1 (G108) and lambda probe heating (Z28): 4-pin, black

Test conditions

- Coolant temperature at least 80 °C
- Fuse for lambda probe heating OK

-> Lambda probe, Bank 1 (G39)



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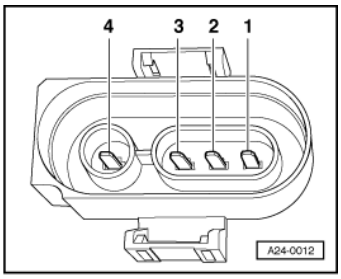
-> Lambda probe, Bank 2 (G108)

- Unplug the 4-pin connector for the relevant lambda probe.



- -> Connect hand-held multimeter (resistance measurement range) between contacts 1 and 2 of the lambda probe connector using test leads from V.A.G 1594.
- Measure the resistance.

  Specification at room temperature: 2...15 ω

Note:

The resistance will increase sharply at higher temperatures.

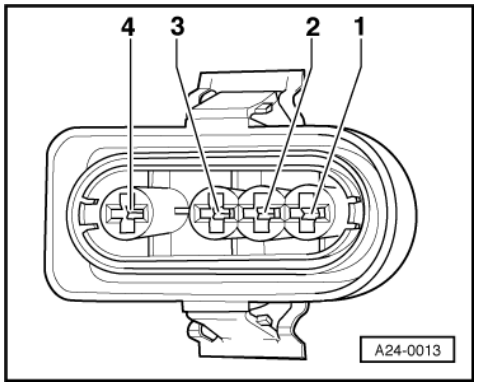
If the specification is not attained:

- Renew the lambda probe.

If the specification is obtained:

- Test voltage supply for lambda probe heating
  => Page 62 .

Testing voltage supply for lambda probe heating



- -> Connect hand-held multimeter (voltage measurement range) between contacts 1 (positive) and 2 (earth) using test leads from V.A.G 1594.
- Start the engine.

  Specification: approx. battery voltage

If there is no voltage reading:

- -> Connect hand-held multimeter (voltage measurement range) between contact 1 (positive) and engine earth using test leads from V.A.G 1594.
- Operate the starter briefly.

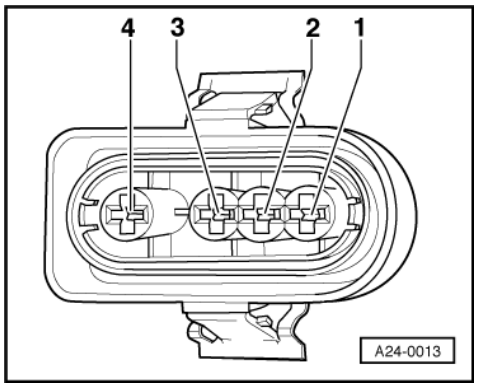
  Specification: approx. battery voltage

If there is still no voltage reading:

- Test for open circuit and/or short circuit in wiring between fuel pump relay and contact 1 on the relevant lambda probe connector (on wiring harness) via fuse.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

If the voltage supply is OK:



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- -> Connect hand-held multimeter (voltage measurement range) between contact 2 (switched earth connection from engine control unit) and battery positive terminal using test leads from V.A.G 1594.
- Start the engine.

  Specification: approx. battery voltage (fluctuating)

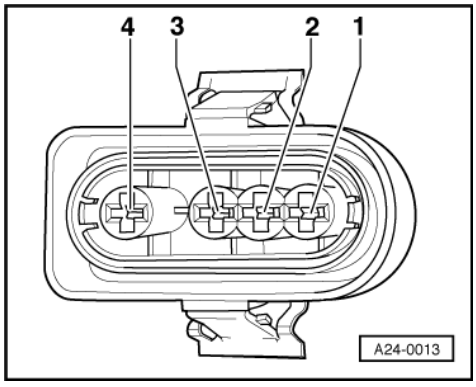
Note:

At certain points in the operating range the engine control unit continuously "switches" the earth connection to the lambda probe heating. In other words, it repeatedly makes and breaks the earth connection at these points. For this reason the voltage reading on the tester may fluctuate.

- Switch off ignition.

If there is no voltage reading:

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
=>Page 37 .



- -> Test for open circuit in wiring between engine control unit and contact 2 of the relevant lambda probe connector.

Connector on wiring harness for lambda probe - G39 (Bank 1), contact	Test box V.A.G 1598/31 or - J220
2	5

Connector on wiring harness for lambda probe - G108 (Bank 2), contact	Test box V.A.G 1598/31 or - J220
2	4

If the wiring is OK but the lambda probe heating has no earth connection, fit a new engine control unit
=>Page 38 .

3.4 - Removing and installing lambda probe

Special tools, testers and auxiliary items

- Hot paste G 052 112 A3

Removing

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- Unplug lambda probe connector for left-hand or right-hand cylinder bank.
(Fitting locations => Pages 25)
- Release cable ties.
- Unscrew lambda probe.

Installing

When installing, note the following points:

Notes:

- Tightening torque: 50 Nm.
- The screw thread on the lambda probe is coated with a special paste. This paste must not be allowed to penetrate the openings on the probe.

- When installing, the cable ties must be re-fitted at exactly the same points in order to prevent contact between the lambda probe wire and the exhaust pipe.

4 - Testing secondary air system

4.1 - Testing secondary air system

4.2 - Testing secondary air inlet valve

Fitting location=>Fitting locations overview, Page 23

- Pull 2-pin connector off valve and connect diode test lamp V.A.G 1527 to disconnected connector using test leads from V.A.G1594.
- Start final control diagnosis and select secondary air inlet valve -N112 =>Page 15 .

The diode test lamp should flash.

If test lampflashes:

- Replace secondary air inlet valve:

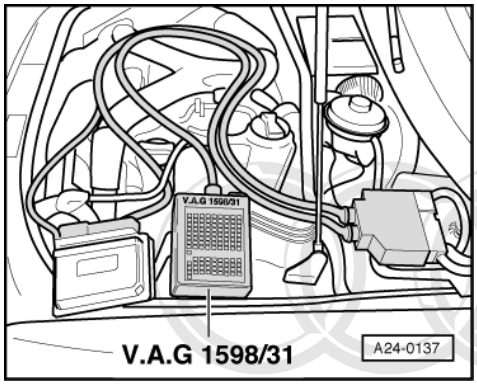
=> 6-cylinder engine (5-valve), Mechanics; Repair group 26; Secondary air system; Removing and installing parts of secondary air system

If LED does not flash:

- Switch off ignition.
- Test voltage supply to valve using current flow diagram.

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

If voltage supply is OK:



- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect engine control unit=>Page 37 .
- Test for open circuit in wiring between socket 44 on test box and contact 2 on 2-pin connector using current flow diagram.
  Wiring resistance: max. 1.5ω

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4.3 - Testing secondary air pump replay

- Unplug 2-pin connector from secondary air pump motor and connect diode test lamp V.A.G 1527 to disconnected connector using test leads from V.A.G 1594.

- Start final control diagnosis and select secondary air pump relay -J299 =>Page 15 .

Notes:

This test can give three possible results; these are described below:

1st possible result: diode test lamp flashes

This means that the supply voltage at the relay is OK (both the power circuit and the relay control circuit) and the activation via the engine control unit is working properly, so the relay is supplying power to the motor. The fault is in the secondary air pump motor=>Page 65 (top).

Please note that the final control diagnosis will stop after about 1 minute. To repeat the final control diagnosis, start the engine, switch off the ignition and then switch on again.

2nd possible result: diode test lamp does not flash but secondary air pump relay clicks.

This means that the supply voltage for the relay control circuit is OK and the activation via the engine control unit is working properly. The fault can be in the supply voltage for the relay power circuit (fuse), an open circuit in the wiring between the fuse and the secondary air pump, the earth connection to the secondary air pump, or in the relay itself=>Page 65 (centre).

3rd possible result: diode test lamp does not flash and secondary air pump relay does not click.

This means that the supply voltage for the relay control circuit is not OK or the activation via the engine control unit is not working. The fault may also be in the relay itself (open circuit in relay coil)=>Page 65

1st possible result: diode test lamp flashes

- Renew secondary air pump motor (V101):

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=> 6-cylinder engine (5-valve), Mechanics; Repair group 26; Secondary air system; Removing and installing parts of secondary air system Secondary air system Removing and installing parts of secondary air system

2nd possible result: diode test lamp does not flash but secondary air pump relay clicks.

- Check fuse for secondary air pump relay -J299.

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

If the fuse is not faulty:

- Remove secondary air pump relay from relay carrier.

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

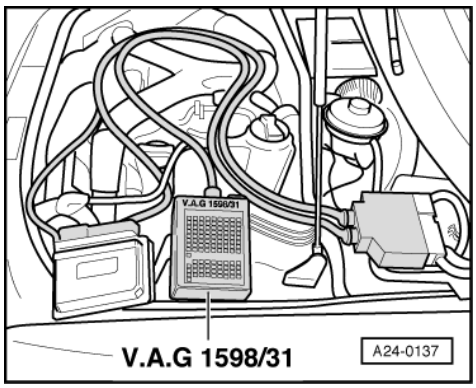
Notes:

- If tools are necessary to pull relays or control units out of the relay plate, first disconnect battery earth strap.
- Before disconnecting battery earth strap obtain code for radios with anti-theft coding.

- Test voltage supply (terminal 30) to relay using current flow diagram. If necessary, renew secondary air pump relay -J299.

3rd possible result: diode test lamp does not flash and secondary air pump relay does not click.

- Switch off ignition.



- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit=>Page 37 . Do not connect engine control unit.
- Test for open circuit in wiring between socket 46 of test box and relay carrier for secondary air pump rely (use current flow diagram).

If no fault in wire is detected:

- Renew engine control unit => Page 38 .

5 - Testing fuel tank breather system

5.1 - Testing fuel tank breather system

5.2 - Testing solenoid valve 1 for activated charcoal filter

Note:

In this context, solenoid valve 1 for activated charcoal filter (ACF valve) is also known as the fuel tank breather valve.

Testing for leaks

When there is no electrical signal the solenoid valve remains closed.

- Disconnect hoses from solenoid valve for activated charcoal filter -N80.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80 =>Page 15 .

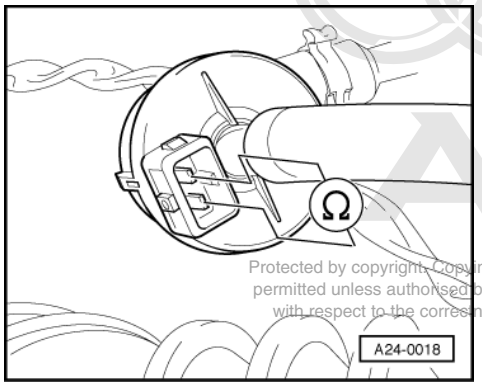
-> Indicated on display:

```
Final control diagnosis
ACF solenoid -N80
```

The valve should click...
...and should open and close (test by blowing into auxiliary hose).

- If the valve does not click, carry out electrical test of solenoid valve 1 for activated charcoal filter => Page 66 .
- If valve does not open and close properly, renew solenoid valve 1 for activated charcoal filter.

Electrical test of solenoid valve 1 for activated charcoal filter -N80



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- Unplug connector on ACF valve.

- -> Measure resistance between contacts on valve using hand-held multimeter V.A.G 1526.

  Specification: 22...30 ω

If the specification is not attained:

- Renew activated charcoal filter system solenoid valve -N80.

If the specification is attained, test power supply
=> Page 67 .

Testing power supply to solenoid valve

Note:

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

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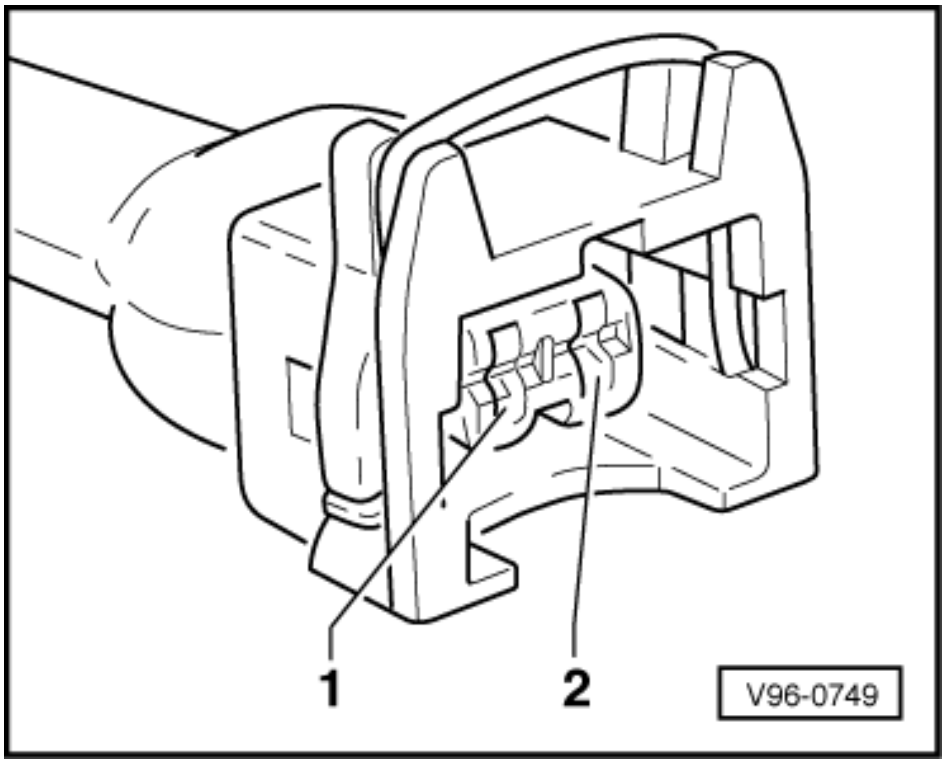
Test conditions

- Fuse for ACF valve OK



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

The diode test lamp should light up.

If diode test lamp does not light up:

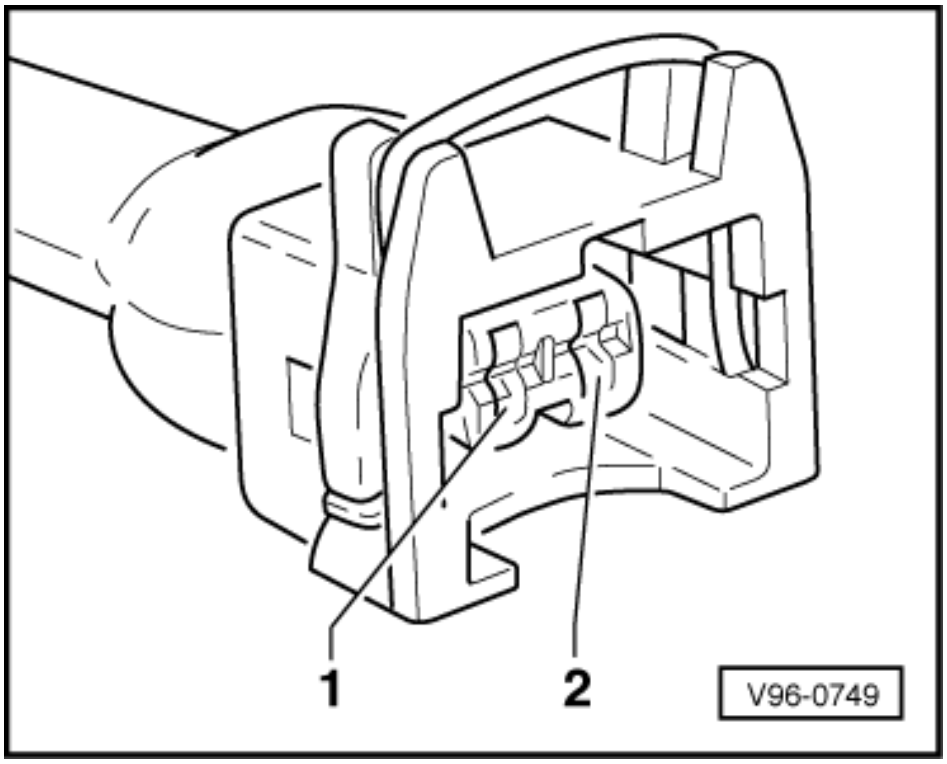
- Test for open circuit in wiring from contact 1 to fuel pump relay via fuse. Rectify open circuit if necessary.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- If wiring is OK, test fuel pump relay

=> Page 49 .

If the diode test lamp lights up, test activation
=> Page 68 .

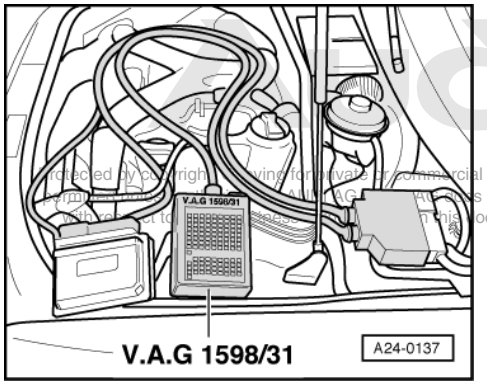


Testing activation of ACF solenoid valve

- -> Connect diode test lamp V.A.G 1527 between contacts 2 and 1 (positive) of plug connector.
- Start final control diagnosis and select solenoid valve for activated charcoal filter -N80
  =>Page 15 .

The diode test lamp should flash.

If the diode test lamp does not flash or lights up continuously:



- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .

If the diode test lamp lights up continuously:

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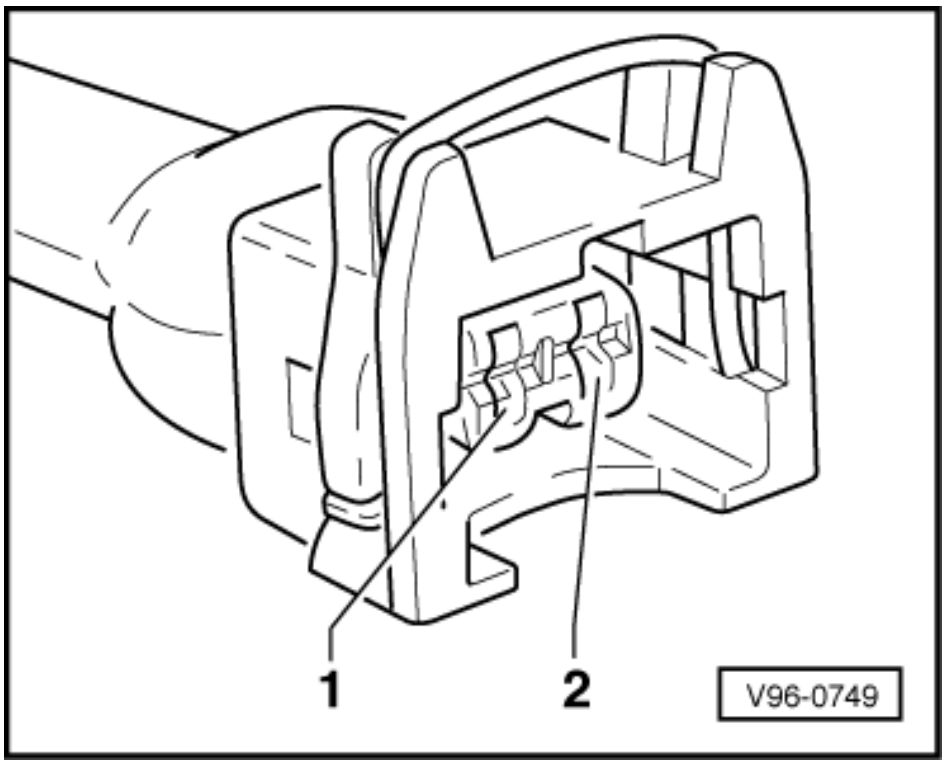

- -> Test for short circuit to earth in wiring between contact 2 on ACF valve connector and socket 64 on test box.

If the diode test lamp does not flash:

- Test for open circuit and short circuit to positive in wiring between contact 2 on ACF valve connector and socket 64 on test box.

  Resistance in wiring: max. 1.5 ω

- If necessary, rectify short circuit to earth or open circuit.
- If no short circuit or open circuit is found, fit a new engine control unit => Page 38 .

6 - Testing electronic engine power control (electronic throttle)

6.1 - Testing electronic engine power control (electronic throttle)

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6.2 - Operation of electronic throttle system

With the electronic throttle the throttle valve is not operated by a cable connected to the accelerator pedal. There is no mechanical link between the accelerator and the throttle valve.

The throttle valve is actuated by a servomotor (throttle valve positioner) in the throttle valve control part over the full range of engine speeds and load conditions.

The throttle valve positioner actuates the throttle valve according to the commands it receives from the engine control unit.

The position of the accelerator pedal is communicated to the engine control unit by two accelerator position senders (variable resistors, both fitted in a single housing). The senders are connected to the accelerator pedal.

The accelerator position (as determined by the driver) is one of the main input values for the engine control unit.

When the ignition is on and the engine is not running, the engine control unit operates the throttle valve positioner in exact accordance with the signals from the accelerator position senders. For example, when the accelerator is pressed down half way, the throttle valve positioner opens the throttle valve by an equivalent amount, i.e. about half way.

When the engine is running (i.e. under load) the engine control unit can open and close the throttle valve freely (i.e. independently of the signals being sent by the accelerator position sender).

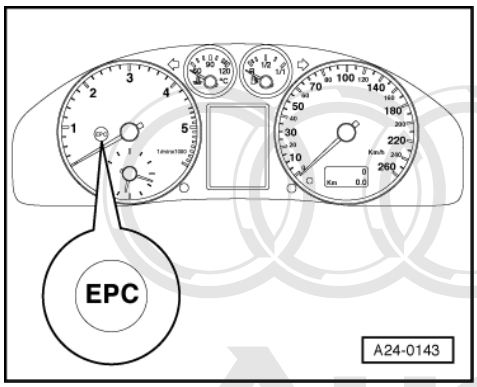
For example, the throttle valve might already be fully open even though the accelerator is only pressed down half way. This has the advantage of preventing throttling losses at the throttle valve.

Under certain engine load conditions there is also a significant reduction in harmful emissions and noticeably improved fuel consumption.

The electronic throttle is not simply a combination of two or three components, but rather a complete system comprising all the elements that together determine the position of the throttle valve and also control and monitor it. For example, the accelerator position sender, throttle valve control part, EPC warning lamp, engine control unit etc.

6.3 - Notes on EPC warning lamp (fault warning lamp for electronic throttle) in dash panel insert

"EPC" stands for Electronic Power Control and refers to the electronic throttle control system.



-> Fitting location of EPC warning lamp

When the ignition is switched on the engine control unit tests all the components whose functions relate to the electronic throttle system.

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The engine control unit activates the EPC warning lamp when the ignition is switched on. The warning lamp will go out soon after the engine starts, provided that the engine control unit does not detect any faults in the electronic throttle system and the activation of the lamp via the engine control unit is working properly.

If a fault is detected in the electronic throttle system while the engine is running, the engine control unit will activate the EPC warning lamp (see Fault Table for list of possible faults). At the same time a fault code is stored in the fault memory of the engine control unit.

Testing operation of warning lamp

- Switch ignition on.

Specification: the EPC warning lamp should light up

If the EPC warning lamp does not light up:

- Test wiring from engine control unit to EPC warning lamp as follows:

Problem: EPC warning lamp is not activated or does not light up because of an open circuit.	Remedy: - Switch off ignition. - Connect test box V.A.G 1598/31. Do not connect the engine control unit. - Bridge sockets 1 and 48 on test box. - Switch on ignition. The EPC warning lamp should light up. If the EPC warning lamp does not light up: - Switch off ignition. - Check whether lamp has burned out and test voltage supply to lamp using current flow diagram. If the warning lamp and the voltage supply are OK: - Test for open circuit or short circuit in wiring between engine control unit and EPC warning lamp using current flow diagram. Trace and eliminate fault.
	If there are no faults in the wiring to the EPC warning lamp:
Cause of fault:	Engine control unit defective =>Fit a new engine control unit =>Page 38 .

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- Start the engine and allow it to run at idling speed.
  Specification: the EPC warning lamp should go out soon after the engine starts

If the EPC warning lamp does not go out:

- Interrogate fault memory of engine control unit.

If no faults are stored:

Problem: EPC warning lamp is activated continuously because of a short circuit to earth.	Remedy: - Switch off ignition. - Connect test box V.A.G 1598/31. Do not connect the engine control unit. - Measure resistance between vehicle earth and socket 48 on test box. Specification: infinity (because the wire should not have any direct earth connection) If the reading does not match the specification: - Trace and eliminate short circuit to earth in wiring between engine control unit and EPC warning lamp using current flow diagram.
	If there are no faults in the wiring to the EPC warning lamp:
Cause of fault:	Engine control unit defective =>Fit a new engine control unit =>Page 38 .

6.4 - Testing throttle valve control part

The housing for the throttle valve control part contains the following components (the housing must not be opened):

- Throttle valve drive -G186
  (This is an electric motor activated by the engine control unit. The motor opens the throttle valve by applying force to overcome the spring pressure.)
- Angle sender for throttle valve drive -G187
- Angle sender 2 for throttle valve drive -G188

Note:

The angle senders are in the form of potentiometers (variable resistors). Each sends its own separate signal to inform the engine control unit of the position of the throttle valve (i.e. one of the signals is redundant).

The potentiometers cannot be adjusted mechanically. Settings are made using the basic setting function (function 04) with fault reader V.A.G 1551.

6.5 - Performing adaption of throttle valve control part

The adaption process enables the engine control unit to learn the different positions of the throttle valve with the ignition switched on and the engine not running. These positions are stored in the control unit. The feedback signal indicating the position of the throttle valve comes from the two angle senders for throttle valve drive.

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If the throttle valve control part -J338 or the engine control unit is removed and refitted or replaced, or if the power supply to the engine control unit is interrupted, an adaption must be performed.

The learning process (adaption process) is carried out:

- Automatically if the ignition is switched on for at least 6 seconds without operating the starter or depressing the accelerator, and if the engine control unit registers a "learning requirement". (In this case, however, there is no way of knowing whether the adaption process was successful or not.) The engine control unit will register a learning requirement if the previously stored voltage readings from the angle senders do not correspond (within a certain tolerance range) to the new voltage readings.
- By selecting "Basic setting" (function 04), Display Group 60 with the ignition switched on.

Test conditions

- No faults stored in fault memory
  => Page 4 , Interrogating fault memory
- Engine not running, ignition switched on
- Accelerator not depressed
- Coolant temperature between 5°C and 100°C
- Intake air temperature less than 100°C
- Power supply to engine control unit more than 11 V
  Testing =>Page 98

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

- Press keys 0 and 4 for the function "Introduction of basic setting" and confirm entry with Q key.

-> Indicated on display:

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

- Press keys 0, 6 and 0 for Display Group 60 and confirm entry with Q key.

When the Q key is pressed the current supply to the throttle valve positioner will be disconnected.

In this condition the throttle valve is pulled into an "emergency running" or default position by a spring in the throttle valve control part. The values supplied by the two angle senders for this position are stored in the engine control unit.

The throttle valve is then opened by a predetermined amount. As soon as it reaches this position the current supply to the throttle valve positioner is again disconnected. The spring should then close the throttle valve mechanically to the previously learned default position within a specified period of time (spring test).

The throttle valve positioner then closes the throttle valve and the values supplied by the angle senders in the throttle valve control part are stored in the engine control unit.

If the engine control unit disconnects the current supply to the throttle valve positioner while the vehicle is being driven, the result will be an increase in idling speed with fluctuating engine rpm (hunting) and very slow throttle response.

-> Indicated on display:

```
Basic setting 60
     1     2     3     4
```

- Check display values for throttle valve control part (display zones 3 and 4).

	Display zones			
	1	2	3	4
Display Group 060: Adaption of throttle valve control part				
Display	xx %	xx %	---	---
Indicates	Throttle valve angle (angle sender 1)	Throttle valve angle (angle sender 2)	**Learning stage counter**	**Adaption status**
Range	min.: 0 % max.: 100 %	min.: 0 % max.: 100 %	**0 to 9**	**ADP. runs** **ADP. O.K.** **ADP. ERROR**
Specification	3...93 %	97...3 %	**9**	**ADP O.K.**
Note			**During the adaption process the learning stage counter should count from 0 to 9. (Some of the figures may not appear.)**	**If readout does not match specification, see note =>** Page 73

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Note:

The abbreviation "ADP" in display zone 4 stands for "Adaption".

Note:

If the adaption process is interrupted by the control unit, the cause could be one of the following:

- The throttle valve is unable to close completely (e.g. because of dirt)
- Battery voltage too low.
- Throttle valve control part or wiring is defective.
- The engine was started or the accelerator depressed during the adaption process.
- Distortion of throttle valve housing (check bolts)

When the adaption process is interrupted the message "Function is unknown or cannot be carried out at the moment" will appear on the fault reader display. The adaption process will start again automatically the next time the ignition is switched on (for several seconds).

- End the engine basic setting by pressing the⇒ key.

-> Indicated on display (function selection):

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

6.6 - Testing angle senders for throttle valve drive

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

- Switch ignition on.
- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

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

-> Indicated on display:

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

- Press the keys 0, 6 and 2 to select Display Group 62 and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 62
     1     2     3     4
```

- Check display values for electronic throttle potentiometer voltages.

	Display zones			
	1	2	3	4
Display Group 62: Electronic throttle potentiometer voltages				
Display	xx %	**xx %**	xx %	**xx %**
Indicates	Throttle valve angle (angle sender 1)	**Throttle valve angle (angle sender 2)**	Accelerator position sender	**Accelerator position sender 2**
Range	min.: 0 % max.: 100 %	**min.: 0 % max.: 100 %**	min.: 0 % max.:100 %	**min.: 0 % max.:100 %**
Specification	3...93 %	**97...3 %**	12...97 %	**4...49 %**

Note:

The engine control unit converts the voltage readings from the angle senders into percentages of 5 V and displays them as percentages. (A supply voltage of 5 V is equivalent to 100%.)

- Observe display zones 1 and 2.
- Slowly depress accelerator to full throttle position.

The percentage value in display zone 1 should rise steadily,but without covering the full tolerance rangefrom 3...93 %.

The percentage value in display zone 2 should fall steadily,but without covering the full tolerance rangefrom 97...3 %.

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Notes:

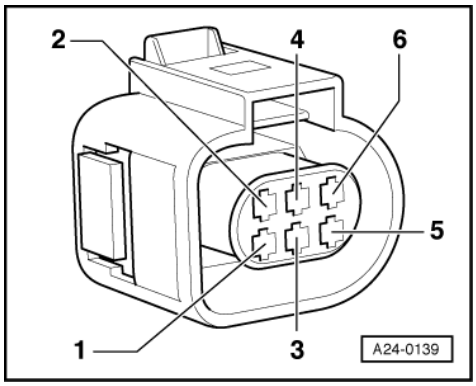
- The reason why the value in display zone 1 rises and the value in display zone 2 falls is because the potentiometers (angle senders) in the throttle valve control part work in opposite directions.
- The percentage value for the first potentiometer increases as the voltage rises towards 5 V because the voltage at this potentiometer increases as the throttle valve opens.

- The percentage value for the second potentiometer decreases as the voltage drops away from 5 V and towards 0 V because the voltage at this potentiometer decreases as the throttle valve opens.

If the display values do not appear as described:

- Test voltage supply and wiring to throttle valve control part =>Page 75 . Pay particular attention to the connectors, which may have corroded or become detached.
- Test accelerator position senders =>Page 76 .

Testing voltage supply to throttle valve control part



- Unplug connector from throttle valve control part.
- Switch ignition on.
- -> Connect hand-held multimeter (voltage range) between the following contacts on the connector:

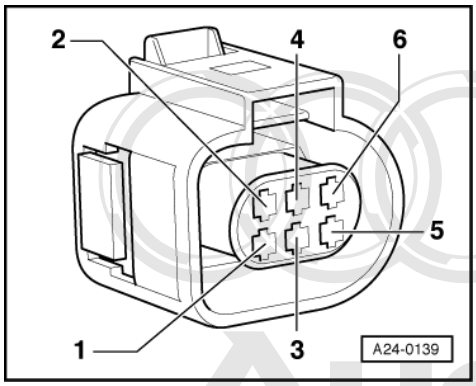
6-pin connector on wiring harness, contact	Specification
2 + earth	approx. 5 V
2 + 6	approx. 5 V

If the readouts match the specifications, test also the signal wires and activation wires for the throttle valve positioner => Page 75 .

If the specifications are not obtained:

Test wiring between engine control unit and throttle valve control part => Page 75 .

Testing wiring



- -> Unplug connector from throttle valve control part.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself. =>Page 37

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The following wiring connections are to be checked for open circuits and/or short to positive or negative.

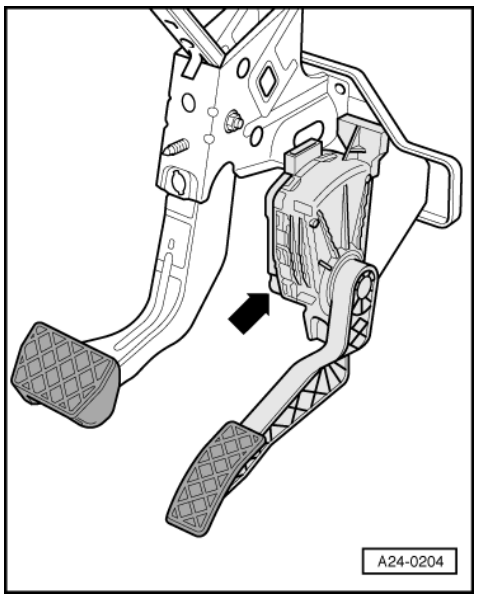
6-pin connector on wiring harness, contact	Test box V.A.G 1598/31, socket
1	92
2	83
3	117
4	84
5	118
6	91

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Fit a new throttle valve control part.

6.7 - Checking accelerator position senders



-> Fitting location of accelerator position sender -G79 and accelerator position sender 2 -G185

The accelerator pedal position senders -G79 and -G185 are located on accelerator pedal. Both senders inform the engine control unit of the driver's throttle requirement (pedal position) but function completely independently of each other (redundancy principle). Both are located in a single housing.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

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

- Enter "062" for Display Group 062 and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 62
     1     2     3     4
```

- Check display values for electronic throttle potentiometer voltages.

	Display zones			
	1	2	3	4
Display Group 062: Electronic throttle potentiometer voltages				
Display	xx %	**xx %**	xx %	**xx %**
Indicates	Throttle valve angle (angle sender 1)	**Throttle valve angle (angle sender 2)**	Accelerator position sender	**Accelerator position sender 2**
Range	min.: 0 % max.: 100 %	**min.: 0 % max.: 100 %**	min.: 0 % max.: 100 %	**min.: 0 % max.: 100 %**
Specification	3...93 %	**97...3 %**	12...97 %	**4...49 %**

Note:

The engine control unit converts the voltage readings from the angle senders into percentages of 5 V and displays them as percentages. (A supply voltage of 5 V is equivalent to 100%.)

- Observe display zones 3 and 4.
- Slowly depress accelerator to full throttle position.

The percentage value in display zone 3 should rise steadily between 12 and 97 % but without covering the full range of values.

The percentage value in display zone 4 should also rise steadily but without covering the full range of values (in this case 4...49 %).

Note:

The value shown in display zone 3 should always be about twice as high as the value shown in display zone 4.

If the display values do not appear as described:

- Test voltage supply and wiring to accelerator position senders =>Page 77 .
- Adjust accelerator position senders (right-hand drive vehicles only).

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=> Fuel supply system, Petrol engines; Repair group 20; Servicing accelerator linkage - right-hand drive vehicles Servicing accelerator linkage - right-hand drive vehicles

Testing voltage supply to accelerator position senders

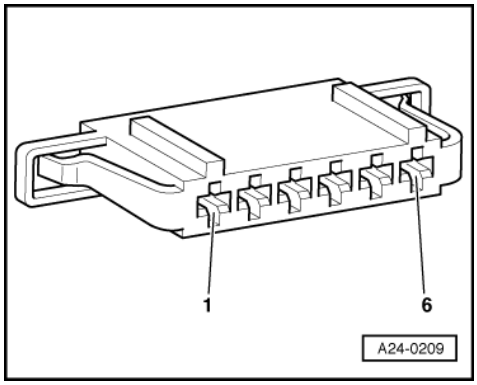
- Remove storage compartment on driver's side.

=> General body repairs, Interior; Repair group 68; Storage compartments, covers and trim parts; Removing and installing driver's storage compartment Storage compartments, covers and trim parts Removing and installing driver's storage compartment

- Unplug connector for accelerator position sender.

Left-hand drive vehicles

- Switch ignition on.



- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Specification
1 + earth	approx. 5 V
1 + 5	approx. 5 V
2 + earth	approx. 5 V
2 + 3	approx. 5 V

Right-hand drive vehicles

- Switch ignition on.

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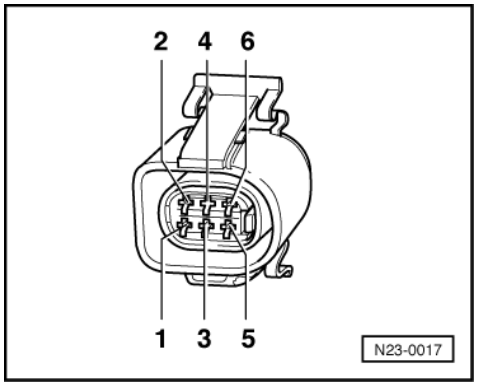


- -> Connect multimeter (voltage measurement range) as follows:

Connector Contact	Specification
2 + earth	approx. 5 V
2 + 3	approx. 5 V
5 + earth	approx. 5 V
5 + 4	approx. 5 V

All models

If the specifications are obtained:

- Test the signal wires.

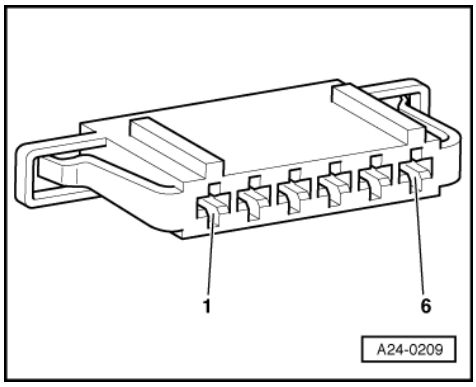
If the specifications are not obtained:

- Test wiring between engine control unit and accelerator position senders.

Testing wiring

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .

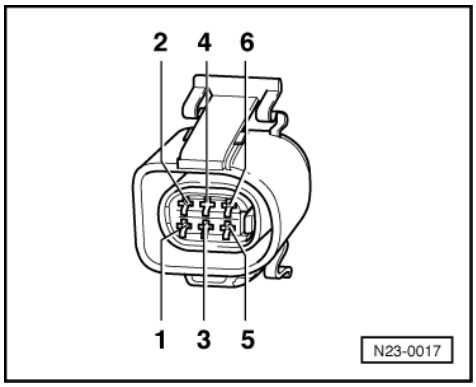
Left-hand drive vehicles



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

Connector Contact	Test box V.A.G 1598/31 Socket
1	72
2	73
3	36
4	35
5	33
6	34

Right-hand drive vehicles



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

Connector Contact	Test box V.A.G 1598/31 Socket
1	35
2	73
3	36
4	33

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Connector Contact	Test box V.A.G 1598/31 Socket
5	72
6	34

All models

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Renew accelerator position senders.

=> Fuel supply system, Petrol engines; Repair group 20; Servicing accelerator linkage - right-hand drive vehicles Servicing accelerator linkage - right-hand drive vehicles

7 - Testing auxiliary signals

7.1 - Testing auxiliary signals

7.2 - Checking engine speed signal

Note:

The engine speed signal is taken from contact 37 on the engine control unit. The signal is used for various functions including the rev counter display on the dash panel insert.

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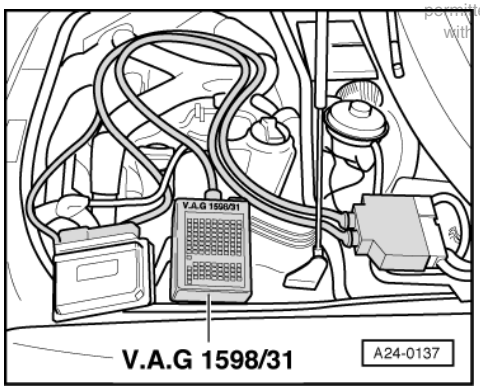

- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit Do not connect to the engine control unit itself.
  =>Page 37 .
- Test for open circuit in wiring between dash panel insert and contact 37 on the test box using current flow diagram.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

7.3 - Testing fuel consumption signal for on-board computer

Notes:

- The fuel consumption signal is calculated by the engine control unit (on the basis of the injection period) and passed on to the on-board computer.

- Testing fuel consumption signal

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

7.4 - Testing brake light switch and brake pedal switch

Note:

For safety reasons, the signal from the accelerator position sender (potentiometer) instructing the engine control unit to open the throttle valve is suppressed whenever the brake is operated. The engine control unit therefore needs the brake light signal and also the brake pedal signal.

If the brake is operated while the accelerator is held down at a constant position, the engine is immediately governed down to idling speed. A defective switch can cause the engine to be throttled back when this is not desired.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

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

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- Enter "066" for Display Group 066 and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 66
     1     2     3     4
```

- Check display value for brake light switch / brake pedal switch (display zone 2).

	Display zones			
	1	2	3	4
Display Group 066: Signals to engine control unit				
Display	xxx km/h	**XXXX**	xxx km/h	XXXX
Indicates	Actual road speed	**Switch positions**	Specified road speed	Switch positions
Range		**XX00 XX11**		
Specification		**XX00 (brake pedal not depressed)**		
		XX11 (brake pedal depressed)		
Note		**X = irrelevant The switching points do not coincide exactly.**		

If the display values do not appear as described:

Testing switches

- Remove storage compartment on driver's side.

=> General body repairs, Interior; Repair group 68; Storage compartments, covers and trim parts; Removing and installing driver's storage compartment Storage compartments, covers and trim parts Removing and installing driver's storage compartment

- Unplug connector from brake light switch / brake pedal switch.

Note:

The contact numbers are identified on the back of the connector.

- Connect multimeter (resistance test range) between contacts 1 and 2.
  - Specification: ∞ ω (no continuity)

- Depress the brake pedal.
  - Specification: approx. 0 ω
- Connect multimeter (resistance test range) between contacts 3 and 4.
  - Specification: approx. 0 ω
- Depress the brake pedal.
  - Specification: ∞ ω (no continuity)

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If the specifications are not obtained:

- Check adjustment of switch, or
- Renew brake light switch / brake pedal switch.

If the specifications are obtained:

Checking voltage supply

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

Connector Contact	Measure against
1	Body earth

  - The LED should light up.

Switch on ignition.

Connector Contact	Measure against
3	Body earth

  - The LED should light up.

If the LED does not light up:

- Test for open circuit or short to earth in wiring from contact 1 and/or contact 3 of connector

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

- Rectify short circuit or open circuit if necessary.

If the LED lights up:

Checking activation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .

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

Connector Contact	Test box V.A.G 1598/31 Socket
2	56
4	55

- Rectify short circuit or open circuit if necessary.

7.5 - Testing clutch pedal switch

Note:

This signal is used to avoid over-revving and load change jolts when disengaging the clutch. It is also needed for the cruise control system.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

- Enter "08" to select the function "Read measured value block" and confirm entry with Q key.

-> Indicated on display:

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

- Enter "066" for Display Group 066 and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 66
    1     2     3     4
```

- Check display value for clutch pedal switch (display zone 2).

	Display zones			
	1	2	3	4
Display Group 066: Signals to engine control unit				
Display	xxx km/h	XXXX	xxx km/h	XXXX
Indicates	Actual road speed	Switch positions	Specified road speed	Switch positions
Range		X0XX X1XX		
Specification		X0XX (clutch pedal not depressed)		
		X1XX (clutch pedal depressed)		
Note		X = irrelevant		

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If the display values do not appear as described:

Testing switch

- Remove storage compartment on driver's side.

=> General body repairs, Interior; Repair group 68; Storage compartments, covers and trim parts; Removing and installing driver's storage compartment Storage compartments, covers and trim parts Removing and installing driver's storage compartment

- Unplug connector from clutch pedal switch.

Note:

The contact numbers are identified on the back of the connector.

- Connect multimeter (resistance measurement range) between contacts 1 and 2.
  - Specification: approx. 0 ω
- Depress the clutch pedal.
  - Specification: ∞ ω (no continuity)

If the specification is not attained:

- Check adjustment of switch, or
- Renew clutch pedal switch.

If the specification is attained:

Testing voltage supply

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

Connector Contact	Measure against
1	Body earth

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

If the LED does not light up:

- Test for open circuit or short to earth in wiring between fuse and contact 1 on connector

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

If the LED lights up:

Checking activation

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- Test for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598/31 Socket
2	39

- Rectify short circuit or open circuit if necessary.

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7.6 - Testing road speed signal

Notes:

- The road speed signal is generated by the road speed sender -G68 (on the gearbox) and is processed in the dash panel insert.
- The processed signal goes to contact 54 on the engine control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear.

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the engine must be idling.
- Start the engine.
- Select "Read measured value block" (function 08) and Display Group 5.

-> Indicated on display:

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

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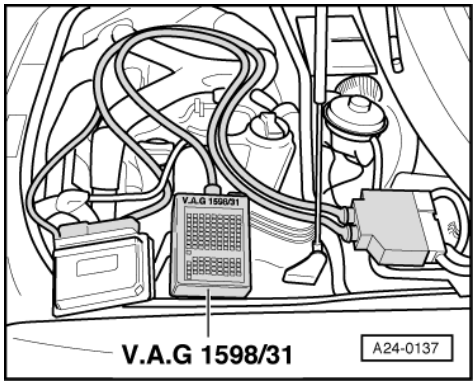
Warning!
The V.A.G 1551 must be operated by a second person.

- Take vehicle for a test drive and check whether the road speed appears in display zone 3.
- If the road speed does not appear, raise the vehicle (preferably using a lifting platform) until the front left wheel is clear of the ground.



- -> Connect test box V.A.G. 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  =>Page 37 .
- Connect diode test lamp between socket 3 (positive) and socket 54 (road speed signal).
- Switch on the ignition and turn the front left wheel by hand.
- The diode test lamp should flash (very brief flashes).
- If the diode test lamp does not flash, test for open circuit or short to positive or earth in wiring between dash panel insert and contact 54 on engine control unit connector.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

7.7 - Testing data exchange between engine control unit, ABS control unit and gearbox control unit

Notes:

- The data exchange between the various control units is carried out via a data bus.
- The term "bus" refers to a system for transmitting and distributing data.
- The wires which connect the control units and convey the data between them are called data wires.

- The data is transmitted to the various control units in series (i.e. to each control unit in turn) via the data wires.

Testing bus system

The fault table indicates that the data exchange between the engine control unit, ABS control unit and gearbox control unit should be tested.

- Interrogate fault memory of gearbox control unit.

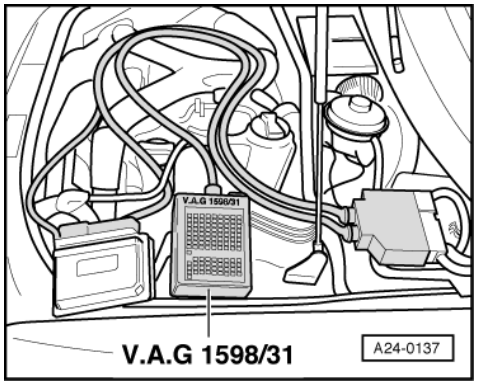
=> Automatic gearbox; Repair group 01; Performing self-diagnosis Performing self-diagnosis

- Interrogate fault memory of ABS control unit.

=> Running gear, Front-wheel and four-wheel drive; Repair group 01; Self-diagnosis, Electrical test Self-diagnosis, Electrical test

If faults have been stored relating to the "data bus" or to "communication":

- Check to make sure that the vehicle is fitted with the correct engine control unit, gearbox control unit and ABS control unit. If the correct versions are installed:
- Switch off ignition.



- -> Connect test box V.A.G. 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  =>Page 37 .
- Using the current flow diagram, test for open circuit and short circuit in the data wires from pins 60 and 58 at the engine control unit to the gearbox control unit (if fitted) and to the ABS control unit. (The data wires to the control unit for continuously-variable transmission are connected to pins 79 and 77 at the engine control unit; see "Important note" below.)

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=> Current flow diagrams, Electrical fault finding and Fitting locations binder

Important note:

The data wires going to the control unit for continuously-variable transmission (if fitted) are connected to pins 79 and 77 at the engine control unit. For all other systems using the data bus, measure at contacts 60 and 58 at the engine control unit.

- If the wiring is OK, try renewing first the engine control unit, then the gearbox control unit and/or the ABS control unit.

28 - Ignition system

1 - Testing ignition system

1.1 - Testing ignition system

1.2 - General notes on ignition system

- Disconnecting and connecting the battery must only be done with the ignition switched off, otherwise the engine control unit could be damaged.
- The engine control unit is equipped with self diagnosis.
- For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- During some of the tests it is possible that the control unit will detect and record a fault. The fault memory must therefore be interrogated and if necessary erased when all tests and repair work have been completed.
- After completing fault finding, repairs or component tests, it is possible that the engine will start, run for a short period and then cut out. If this happens it may be that the immobilizer is blocking the engine control unit. In such cases the fault memory must be interrogated and if necessary the control unit must be adapted.

1.3 - Safety precautions

To prevent injuries to persons and/or damage to the fuel injection and ignition system, note the following points:

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- In order to run the engine at starting speed without actually starting it (e.g. to test compression), unplug the connectors from the output stages of the ignition coils and from all the injectors. After completing the work, interrogate and erase the fault memory.
- The ignition must always be switched off when cleaning the engine.
- Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.4 - Technical data for ignition system

Engine code letters	APR (2.8 ltr. / 5V / 142 kW engine) AQD (2.8 ltr. / 5V / 142 kW engine with secondary air system)
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Twin-spark ignition system with three ignition coils
Spark plugs	Tightening torque: 30 Nm
Firing order	1-4-3-6-2-5
Maximum engine speed limited by Motronic system Cut-off speed	approx. 6800 rpm

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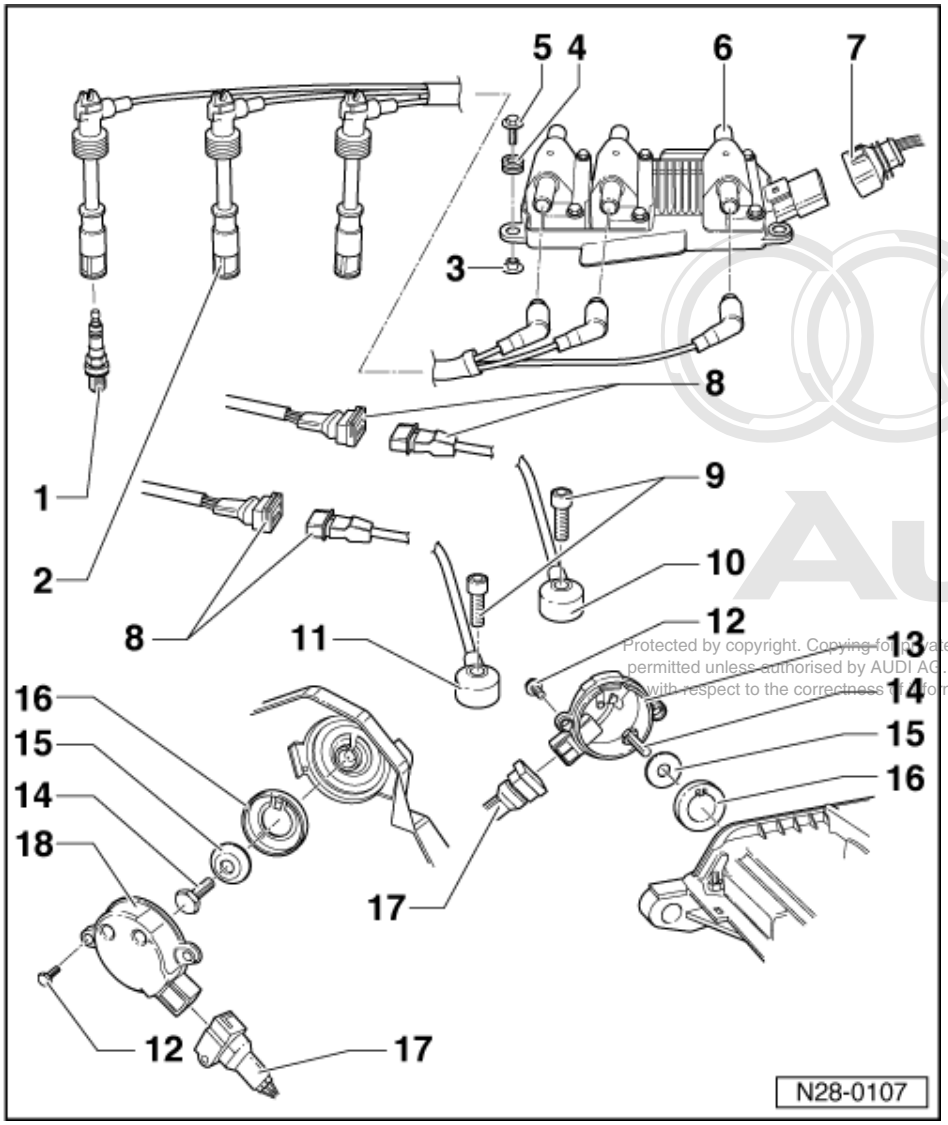
1.5 - Removing and installing parts of the ignition system



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1 Spark plug, 30 Nm
- Remove and install with 3122B

2 Spark plug connector

3 Spacer sleeve

4 Rubber grommet

5 10 Nm

6 Ignition coils -N, -N128 and -N158
- With output stage -N122
- With ignition cable identification, do not interchange

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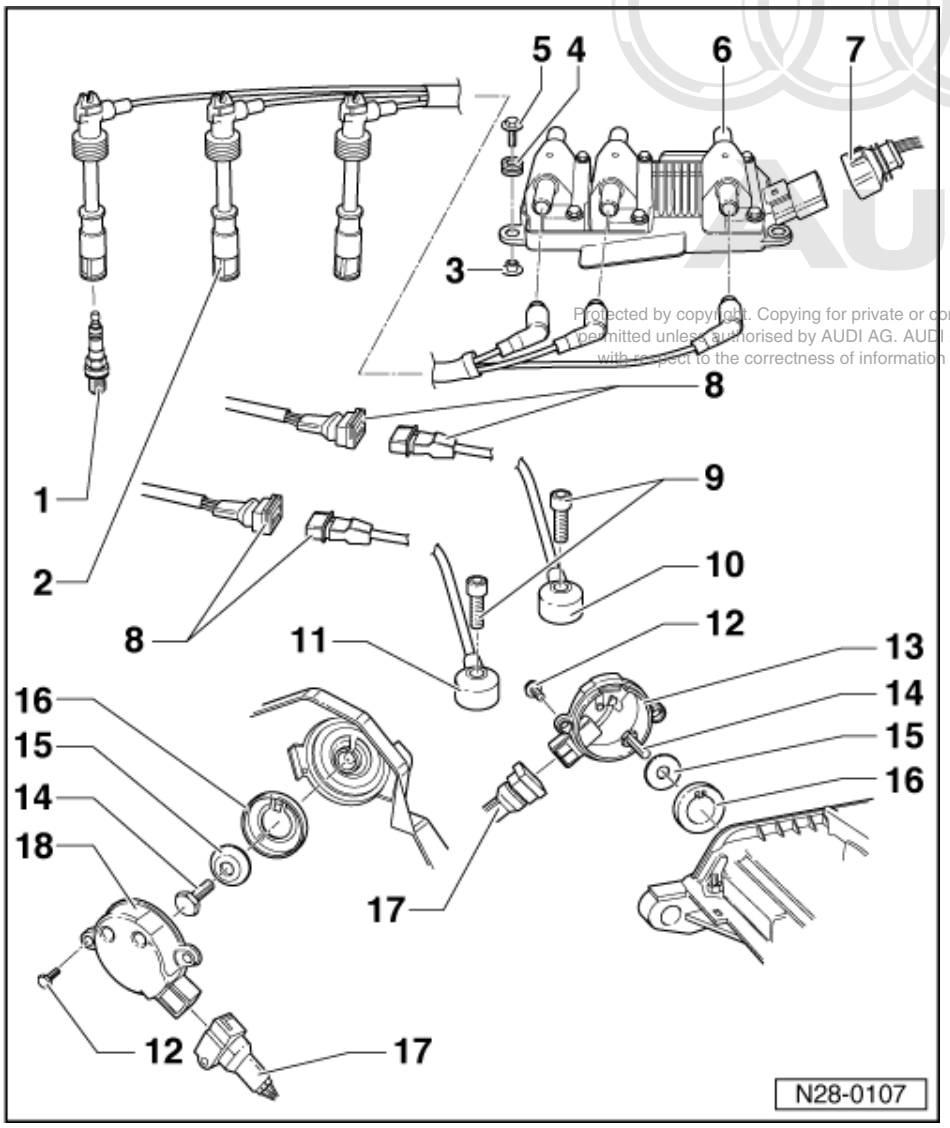


7 Connector

- Black, 5 pin

8 3-pin connector

- Contacts gold plated

9 20 Nm

- Tightening torque influences the function of the knock sensor

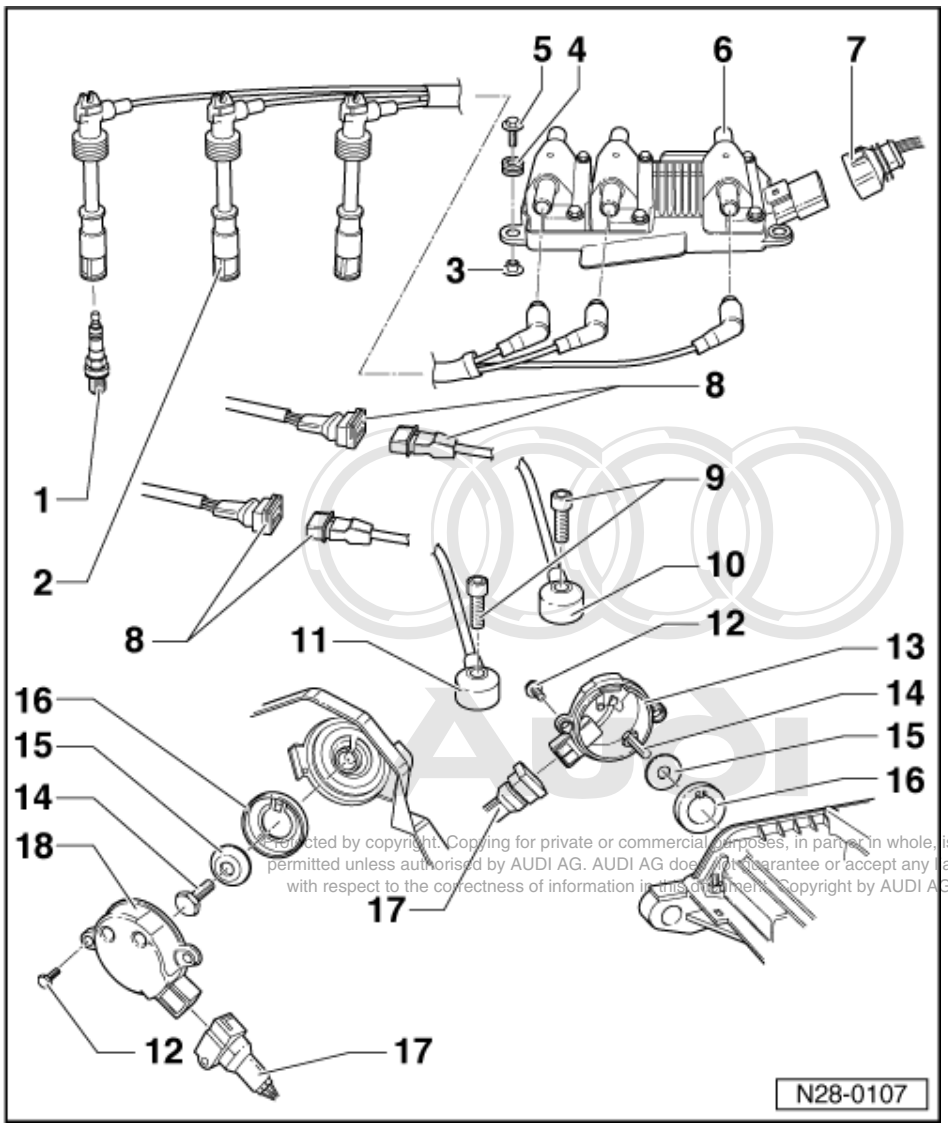
10 Knock sensor 2, -G66

- Cylinder bank 2
- Sensor and connector contacts are gold-plated

11 Knock sensor 1, -G61

- Cylinder bank 1
- Sensor and connector contacts are gold-plated

12 10 Nm



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13 Hall sender -G40

- Cylinder bank 2

14 25 Nm

15 Washer

- Conical

16 Rotor ring

- For Hall sender
- When installing note fixing arrangement

17 Connector

- Black, 3-pin
- For Hall sender -G40 or -G163

18 Hall sender -G163

- Cylinder bank 1

1.6 - Testing ignition coils

Notes:

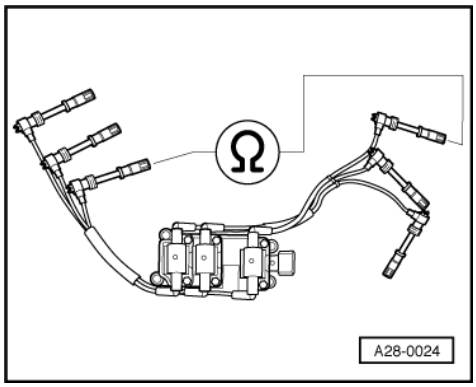
- The ignition coils and the output stage are combined as a single component.
- The primary resistance of the ignition coils cannot be measured.

- The secondary resistance must first be measured between the spark plug connectors for the relevant cylinders, without disconnecting the ignition cables from the ignition coils. This measurement also includes the interference-suppression resistance in the ignition cables.
- Fitting location=>Page 23 .

- Unplug 5-pin connector from ignition coils.

Testing ignition coils -N, -N128 and -N158

- Disconnect ignition cables from spark plugs.



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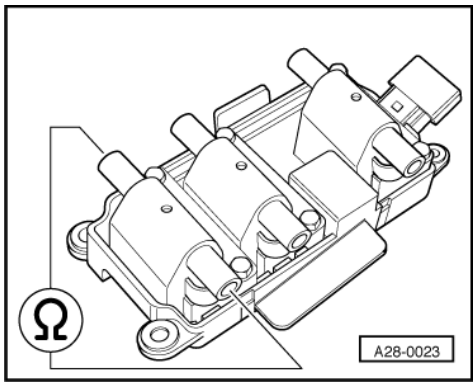
- -> Connect hand-held multimeter V.A.G 1526 between the two spark plug connectors for the ignition circuit which is to be tested.
  - Specification: 16 ... 27 kωeach
- If the values do not match the specifications, disconnect the ignition cables from the ignition coils and then measure the resistance in the cables and the coils separately.

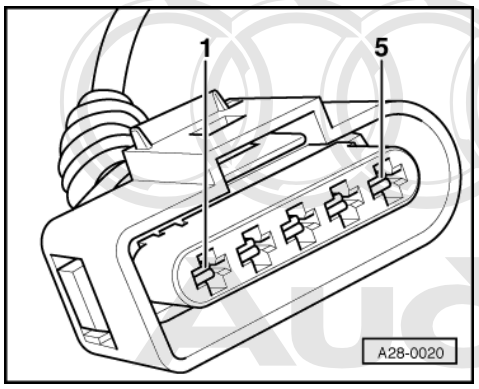


- -> Connect hand-held multimeter V.A.G 1526 between the two ignition cable connections on the ignition coil which is to be tested.
- Connect hand-held multimeter V.A.G 1526 between the two connections on the ignition cable which is to be tested.
  - Specifications:

Ignition coils	Ignition cables
8.0 ...14.0 kω	3.0 ... 7.0 kω

- If the values do not match the specifications, renew the defective components.

Testing earth connection to output stage



- -> Connect diode test lamp V.A.G 1527 between battery positive terminal and contact 2 (earth) on the connector.

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Specification: The diode test lamp should light up.

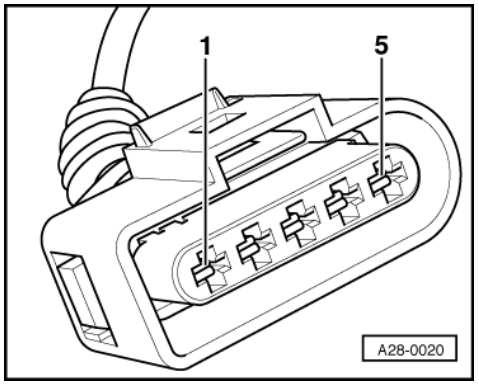
- If the diode test lamp does not light up, test wiring using current flow diagram and rectify any open circuits.

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

Testing power supply to ignition coils

Test requirement:

- Fuse for ignition coils OK



- -> Connect diode test lamp V.A.G 1527 between engine earth and contact 1 (positive) on the connector.
- Operate starter motor.

Specification: The diode test lamp should light up.

Note:

The supply voltage for the ignition coils is taken from the fuel pump relay.

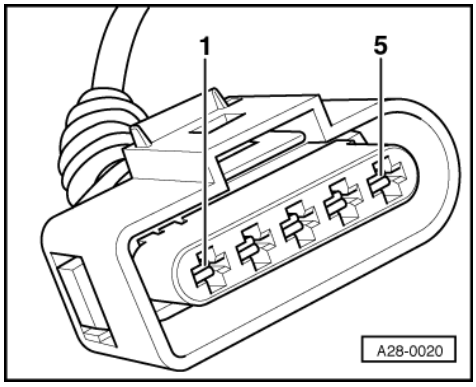
- If specified results are not obtained, test for open circuit using current flow diagram. Rectify any open circuits and test the fuse.

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

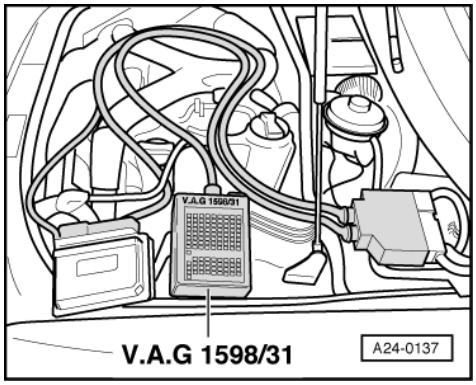
Testing activation

- Unplug connectors from all six injectors (interrogate fault memory after testing).

- Switch ignition on.



- -> Connect diode test lamp between engine earth and contacts 3, 4 and 5 in turn.
- Operate the starter for a few seconds in each case. The diode test lamp should flash each time.



- -> If the diode test lamp does not flash, test for open circuit or short circuit in wiring between connector and engine control unit using current flow diagram. (Connect test box V.A.G 1598/31 to wiring harness for engine control unit.)

Contact on 5-pin connector for output stage	Contact on control unit connector
3	102
4	103
5	94

- Rectify any open circuits or short circuits.
- If no open circuits or short circuits to earth are found, fit a new engine control unit.
  => Page 38

1.7 - Checking intake air temperature sender

Fitting location of sender and connector
=> Page 23 .

- Connect vehicle diagnostic, testing and information system VAS 5051 (or fault reader V.A.G 1551) and select engine electronics control unit by entering address word "01" (=> Page 1 .)
  When doing this the ignition must be switched on.

-> Indicated on display:

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

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

-> Indicated on display:

```
Read measured value block     HELP
Input display group number XXX
```

- Press keys 0, 0 and 4 to select Display Group 4 and confirm entry with Q key.

-> Indicated on display:
(1...4 = display zones)

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

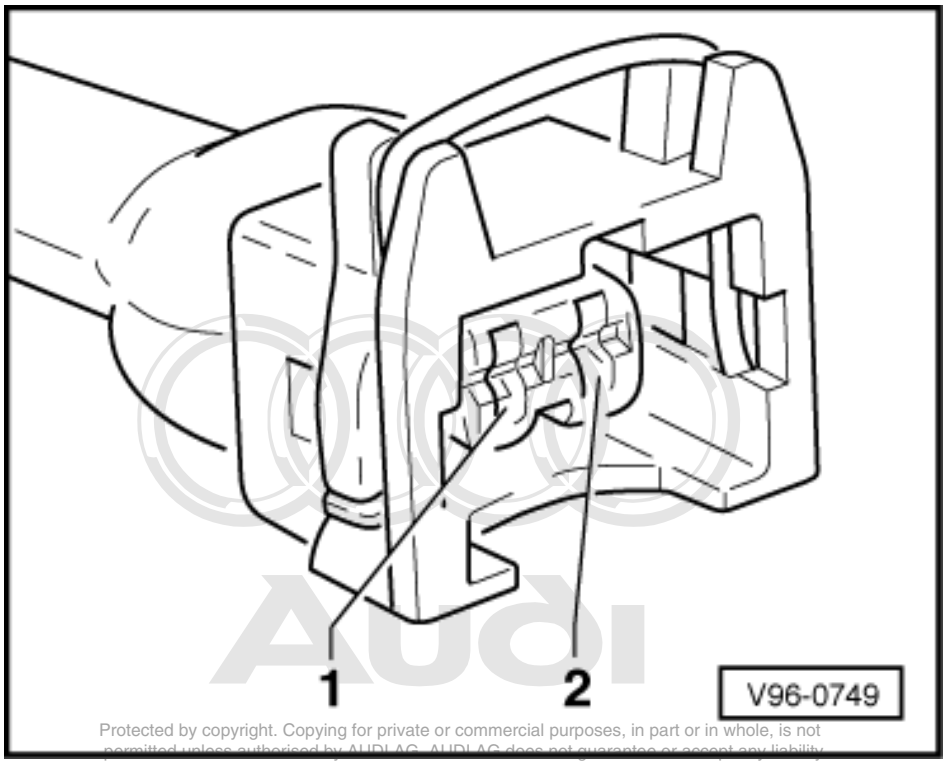
- Check display value for intake air temperature sender(display zone 4):

	Display zones			
	1	2	3	4
Display Group 4: Intake air temperature with engine idling				
Display	xxxx rpm	xx.xxx V	xxx.x °C	**xxx.x °C**
Indicates	Engine speed	Battery voltage	Coolant temperature	**Intake air temperature**
Range	min.: 630 rpm max.: 6800 rpm	min.:10.000 V max.: 15.000 V	min.: -48.0 °C max.: 143.0 °C	**min.: -48.0 °C max.: 143.0 °C**
Specification	xxxx rpm	12,000...15,000 V	80.0...110.0 °C	**Between ambient temperature and 120 °C 1)**

1) If there is a large difference between the temperature displayed and the ambient temperature at the sender, check the sender and sender wiring for contact resistance and open circuit.

Checking wiring:

- Switch off ignition.
- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .



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- -> Test for open circuit in wiring between test box and 2 pin connector using current flow diagram. (Specification: max. 1.5 ω)

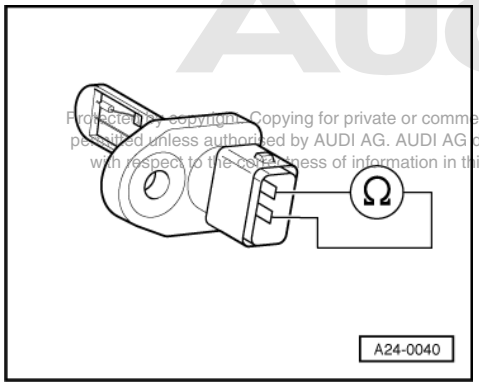
Contact on 2-pin connector	Contact on control unit connector or test box
1	85
2	108

- Test the wires for short circuits to each other between contacts 1 and 2 on the 2-pin connector. Also test for short circuits to positive or earth.

If no fault in wire is detected:

Testing sender

- Unplug connector from intake air temperature sender.



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- -> Measure resistance at intake air temperature sender -G42.

Specifications:

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

Example:

If the air temperature is between 0 °C and 20 °C, the resistance should be between 5.5 kωand 2.4 kω.

- If the value does not match the specification, fit a new intake air temperature sender.

1.8 - Checking engine speed sender

Note:

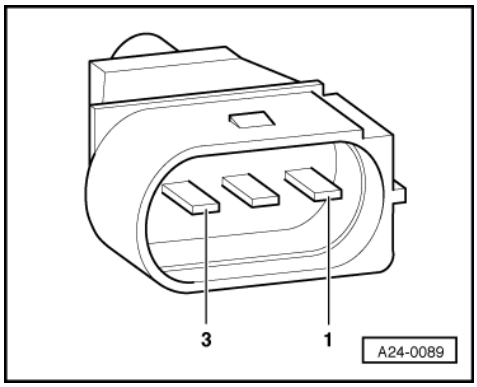
- The engine speed sender is a combined speed sender and reference mark sender. Without a signal from the -G28 the engine cannot be started. If the signal from the -G28 fails while the engine is running, the engine will cut out immediately.

Testing engine speed sender

Fitting location of sender and connector

=> Page 23 .

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- Unplug connector for engine speed sender (grey connector).



- -> Connect hand-held multimeter V.A.G 1526 (resistance test range) to contacts 2 and 3 on connector for engine speed sender using test lead from V.A.G 1594.

Specification: approx. 730...1000 ω

Note:

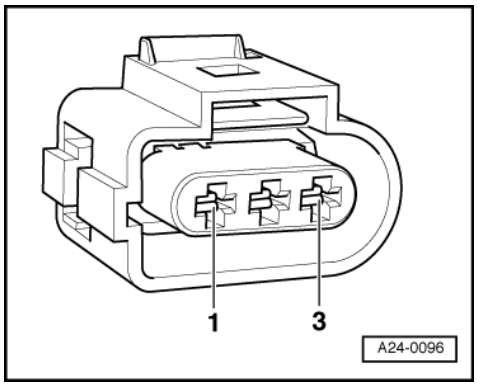
The resistance value for the engine speed sender is based on a temperature of 20 °C.

The resistance increases as the temperature rises.

- If the value does not match the specification, fit a new engine speed sender.
- If the value does match the specification, connect hand-held multimeter (resistance measurement range) to contacts 2 and 1 (earth) and to contacts 3 and 1 (earth).

Specification: ∞ω(open circuit) in each test

- If the value does not match the specification, fit a new engine speed sender.
- If the value does match the specification,test the wiring between the sender connector and the engine control unit as follows:



- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- -> Test continuity of screening between contact 1 on engine speed sender connector and socket 108 on test box.

Specification: max. 1 ω.

- Test continuity of negative wire from contact 2 on sender connector to socket 90 on test box.

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Specification: max. 1 ω.

- Test continuity of signal wire from contact 3 on sender connector to socket 82 on test box.

Specification: max. 1 ω.

- If the values are not as specified, rectify short or open circuit in wiring between sender connector and control unit connector.

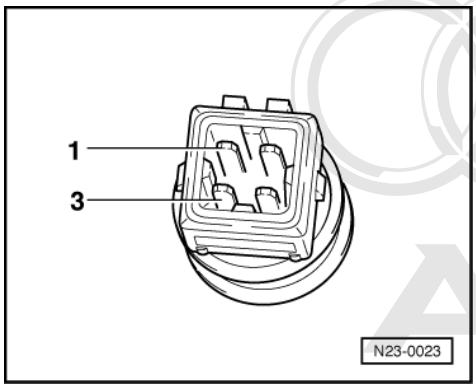
Contact on sender connector	Contact on control unit connector
1	108
2	90
3	82

- If no open circuits or short circuits are found, fit a new engine control unit =>Page 38 .

1.9 - Testing coolant temperature sender

Notes:

- Fitting location of coolant temperature sender => Page 23 .
- For access tocoolant temperature sender, remove air intake hose between air mass meter and intake silencer.



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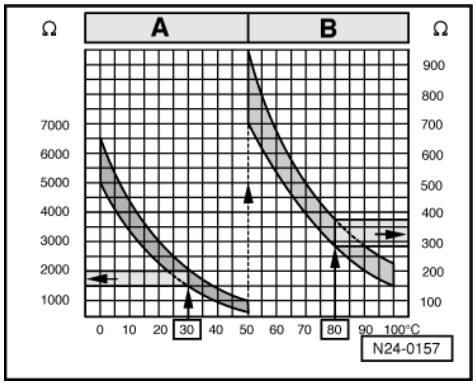
- Unplug connector on coolant temperature sender.
- -> Test resistance between contact 1 (signal) and contact 3 (earth) on sender.



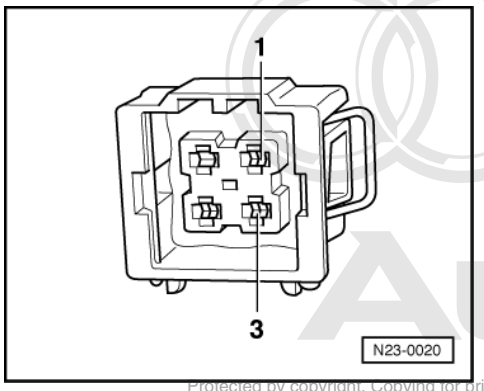
Scale A shows resistance values for temperature range 0...50 °C and scale B the values for temperature range 50...100 °C.

Examples:

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

- If the value does not match the specification, fit a new sender.

If the value does match the specification, test the wiring between the sender and the engine control unit as follows:



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- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- -> Test continuity of wiring between contact 3 on coolant temperature sender connector and socket 108 on test box.

Specification: max. 1 ω.

- Test continuity of signal wire between contact 1 on coolant temperature sender connector and socket 93 on test box.

Specification: max. 1 ω.

- Test for short circuits between the two wires.
- If the values obtained do not match the specifications, rectify short circuit or open circuit in wiring between coolant temperature sender connector and control unit connector.

Contact on sender connector	Contact on control unit connector or test box
1	93
3	108

- If there are no short circuits or open circuits and the coolant temperature sender is OK, fit a new engine control unit.
  => Page 38

1.10 - Checking control unit voltage supply

Test requirements:

- Fuse for engine control unit OK

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

- Battery voltage at least 11 V

- Alternator OK

- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- Switch ignition on.

Note:

- The positive voltage supply for the engine control unit comes via contact 3 (terminal 15) and contact 62 (terminal 30).
- The earth connection for the engine control unit is via contacts 1 and 2.

- Connect hand-held multimeter V.A.G 1526 (voltage measurement range) to the following contacts on the test box:

Contact	Specification
3 + 2	approx. battery voltage
3 + 1	approx. battery voltage
62 + 2	approx. battery voltage

If the specifications are not obtained:

- Check the wiring.

=> Current flow diagrams, Electrical fault finding and Fitting locations binder

1.11 - Testing knock sensor control limit

If the fault message "Knock sensor - control limit reached" is recorded in the fault memory the following tests must be carried out:

	Possible cause of fault	Fault remedy
Fault message relating to all cylinders or fault message relating to all cylinders on one bank	- Poor fuel quality	- Change to higher quality fuel (see Owner's Manual)
	- Wrong tightening torque used on knock sensor	- Slacken knock sensor and tighten to 20 Nm
	- Knock sensor defective	- Test knock sensor => Page 99 .
	- Corrosion on connector	
	- Loose components on engine	- Secure loose components
Fault message relating to one cylinder	- Mechanical engine fault	- Test compression pressure
	- Loose components on engine	- Secure loose components

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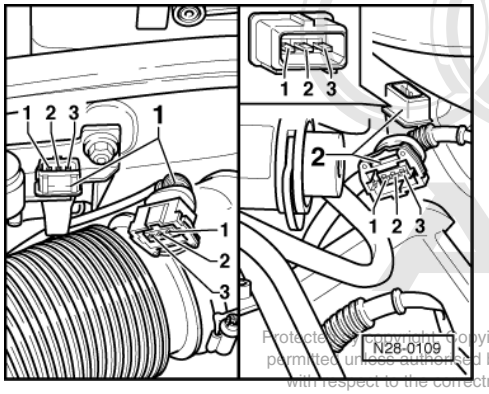
1.12 - Testing knock sensors

Notes:

- It is not possible to carry out an electrical test of the knock sensors themselves (-G61 and -G66).
- Always use gold-plated contacts when repairing the knock sensor connectors.

- To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- Check for corrosion in connection between knock sensor and wiring harness.



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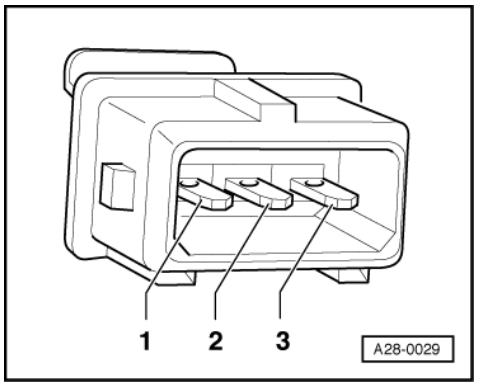
Testing knock sensors

- -> Unplug the connector for the relevant knock sensor in the engine compartment.

Note:

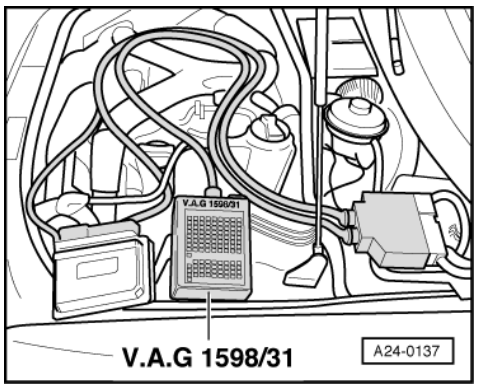
- Fitting locations overview =>Page 23 .
- In order to reach the connector for the knock sensor for cylinder bank 2, first remove the bolts securing the coolant reservoir and move the coolant reservoir to one side. Do not disconnect the hoses.



- -> Test for short circuits between all three contacts in the knock sensor connector (contacts 1+2, 1+3 and 2+3).

  Specification: There must be no contact between the wires (infinity ω).

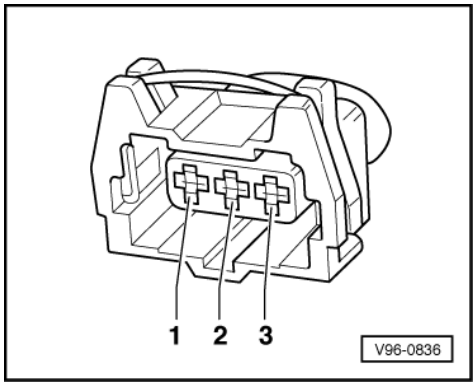
- If there is a connection between the contacts, fit a new knock sensor.



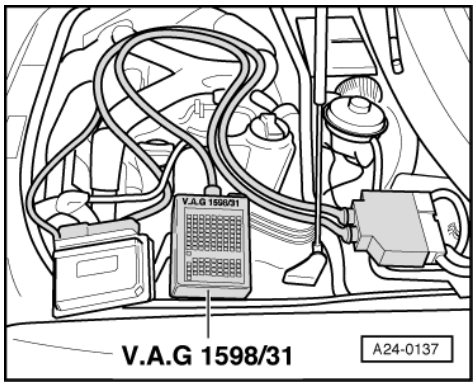
- If there is no short circuit, test wiring for knock sensors.

Testing wiring between knock sensors and engine control unit

- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .



- -> Test wiring connection from the relevant sensor connector ...



- -> ... to engine control unit for open circuit and/or short to positive or earth.

Knock sensor 1 -G61 (Bank 1)

3-pin connector on wiring harness, contact	Test box V.A.G 1598/31 or engine control unit
1 (signal)	106
2 (earth)	99
3 (screening)	108

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Knock sensor 2 -G66 (Bank 2)

3-pin connector on wiring harness, contact	Test box V.A.G 1598/31 or engine control unit
1 (signal)	107
2 (earth)	99
3 (screening)	108

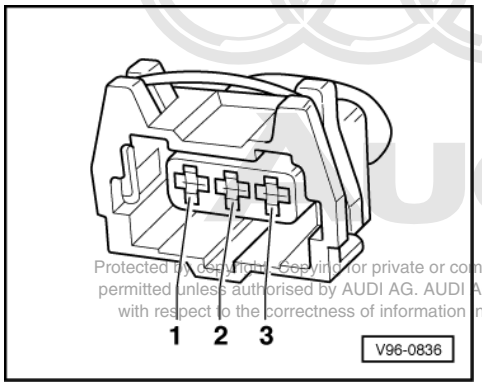
Resistance in wiring: max. 1.5 ω

- Rectify any open/short circuit as necessary.

1.13 - Testing Hall sender

Notes:

- Fitting locations of Hall senders =>Page 23 .
- Hall sender -G40 is located at the rear of the left-hand cylinder head (Bank 2).
- Hall sender -G163 is located at the front of the right-hand cylinder head (Bank 1).



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Testing activation of Hall sender

Use test leads from adapter set V.A.G 1594 when carrying out the following tests.

- Push back rubber sleeve on the relevant Hall sender connector.
- -> Connect diode test lamp V.A.G 1527 to contacts 1 and 2 of the Hall sender connector from behind (without unplugging the connector from the Hall sender).

Note:

The connector contacts are numbered on the back of the connector.

- Operate starter for a few seconds.

The diode test lamp should flash briefly once every two engine revolutions.

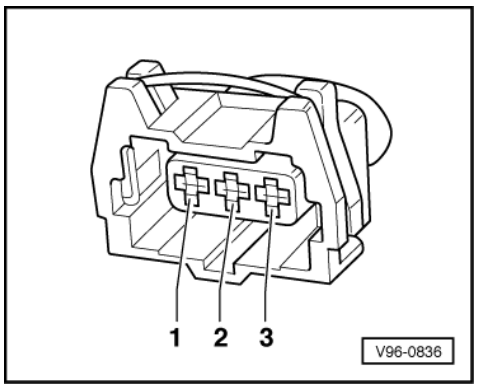
Note:

Diode test lamps with a low current draw continue to glow faintly between impulses from the engine control unit (rather than going out completely) and become much brighter when receiving an impulse.

If the diode test lamp does not flash, test the voltage supply.

Test voltage supply for Hall sender:

- Unplug connector from the relevant Hall sender.
- Switch ignition on.



- -> Connect hand-held multimeter V.A.G 1526 (voltage measurement range) between engine earth and contact 1 of the relevant connector.

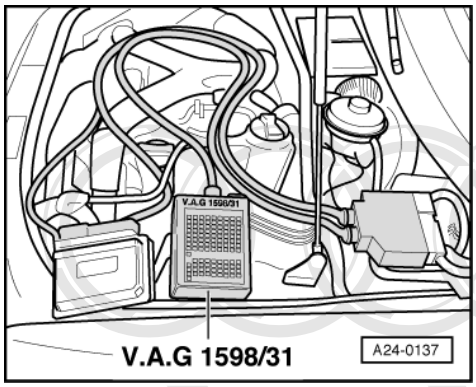
  Specification: approx. 5 V

Testing signal wire for Hall sender:

- -> Connect hand-held multimeter V.A.G 1526 (voltage measurement range) between engine earth and contact 2 of the relevant connector.

  Specification: approx. battery voltage

Testing earth connection for Hall sender:



- -> Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  => Page 37 .
- Connect hand-held multimeter V.A.G 1526 (resistance measurement range) between contact 3 on the relevant connector and socket 108 on the test box.

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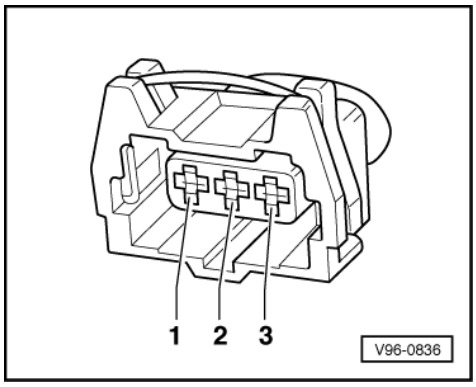
Specification: Continuity
Resistance in wiring: max. 1.5 ω

If all the readouts match the specifications but the diode test lamp does not flash (measurement taken between contacts 1 and 2 without unplugging connector and while operating starter):

- Renew the relevant Hall sender.

If the readouts do not match the specification, test the wiring.

Testing wiring between Hall sender and engine control unit



- Connect test box V.A.G 1598/31 to wiring harness for engine control unit. Do not connect to the engine control unit itself.
  =>Page 37 .
- -> Test wiring connection from Hall sender ....

- .... to engine control unit for open circuit and/or short circuit to positive or earth.

Hall sender -G40 (Bank 2)

3-pin connector on wiring harness, contact	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	86
3 (earth)	108

Hall sender -G163 (Bank 1)

3-pin connector on wiring harness, contact	Test box V.A.G 1598/31, socket
1 (positive)	98
2 (signal)	87
3 (earth)	108

Resistance in wiring: max. 1.5 ω

- Rectify any open/short circuit as necessary.

- If all the test results so far have been OK but a fault related to the camshaft sensor (Hall sender) is displayed again after erasing the fault memory as a test measure, the cause may be as follows:
  - Rotor ring for Hall sender misaligned; test phase position.

Testing phase position of Hall sender

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

-> Indicated on display:

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

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

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-> Indicated on display:

```
Read measured value block
Enter display group number XXX
```

- Press keys 0, 9 and 3 to select Display Group 93 and confirm entry with Q key.

-> Indicated on display:

```
Read measured value block 93
     1     2     3     4
```

- Check display values for Hall senders.

	Display zones			
	1	2	3	4
Display Group 93: Phase positions of Hall senders (Bank 1 and Bank 2) with engine idling				
Display	xxx rpm	xx %	**0 ± 6 ° crankshaft**	**0 ± 6 ° crankshaft**
Indicates	Engine speed	Engine load	**Phase position Bank 1**	**Phase position Bank 2**
Range	min.: 630 rpm max.: 6800 rpm	min.: 12 % max.: 100 %	**-20.3....14.8 ° crankshaft**	**-20.3....14.8 ° crankshaft**

	Display zones			
Specification	630...820 rpm	12...26 %	0 ± 6 ° crankshaft	0 ± 6 ° crankshaft
Note	If the readouts do not match the specifications, unbolt the Hall sender and check whether the rotor ring is properly mounted on the camshaft. If it is not properly mounted, the retainer lug will be squashed flat when the securing bolt is tightened. - Also check the engine timing. => Engine, Mechanics; Repair group 13; Crankshaft group; Removing and installing ribbed belt; Removing and installing toothed belt			

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