Passat 1997 ➢

Simos injection and ignition system									
Engine ID	AZM								

Edition 10.2000

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Passat 1997 ➢

Simos injection and ignition system

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

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01 - Self-diagnosis

1 - General to self-diagnosis

1.1 - General to self-diagnosis

1.2 - Features of self-diagnosis

The Simos control unit (J361) for the fuel injection and ignition system is equipped with a fault memory.

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.

After evaluating the information, the engine control unit decides among different faults => Fault table page 13 and stores these until the contents of the fault memory is erased.

Faults which only occur sporadically will have the addendum "sporadic fault" on the print out. These faults will be indicated on the display by the addendum "/SP". The cause of sporadic faults can be e.g. a loose contact or a brief open circuit. If a sporadic fault does not occur again within 40 engine starts, it will be erased from the fault memory.

The faults stored can be read-out with the new tester VAS 5051, the fault reader V.A.G 1551 or the vehicle system tester V.A.G 1552 => Page 8 .

The fault memory must be erased after the faults has been eliminated => Page 8 .

Note:

General information for self-diagnosis can be found in the instruction manuals for the fault reader V.A.G 1551, vehicle system tester V.A.G 1552 or the new tester VAS 5051.

1.3 - Technical data of self-diagnosis

Control unit identification

The control unit version is displayed when the fault reader V.A.G 1551, the vehicle system tester V.A.G 1552 or the new tester VAS 5051 is connected and engine electronics control unit selected => Page 4 .

Equipment

Engine code	**ATM**
System designation	SIMOS 3.2
Exhaust emissions fulfil	EURO IV, EURO III, EURO II, US 83
Self-diagnosis	yes
Final control diagnosis	yes
Operating mode of data transfer to V.A.G 1551/1552	Rapid data transfer
Fault memory	Non-volatile memory1)
Memory for learnt values	Non-volatile memory1)
Control unit coding	V.A.G 1551/1552 or VAS 5051

Lambda control	2 probes
Knock control	2 knock sensors
Variable intake manifold	yes
Secondary air system	yes
Exhaust gas recirculation	no

1) Independent of voltage supply.

Functions which can be selected when using the fault readers V.A.G 1551/1552 or VAS 5051

The prerequisites to select the desired functions can be found in the following table.

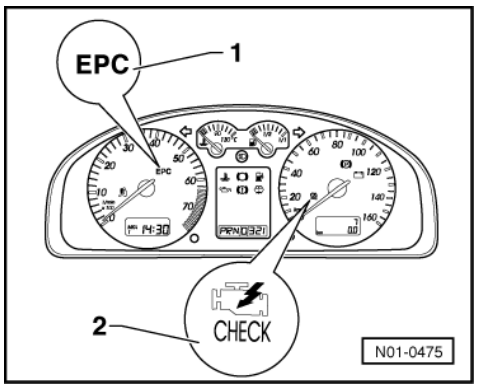
Function		Prerequisite		
Functions on V.A.G 1551/1552 or on VAS 5051		Engine stationary, ignition switched on	Engine running at idling speed	Vehicle being driven
01	Interrogate control unit version	yes	yes	yes
02	Interrogate fault memory	yes1)	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting2)	yes	yes	yes
05	Erase fault memory	yes	yes	no
06	End output	yes	yes	yes
07	Code control unit	yes	no	no
08	Read measured value block	yes	yes	yes
10	Adapting	yes	no	no
11	Login procedure	yes	no	no
15	Read-off readiness code	yes	yes	yes

1) Only carry out with ignition switched on, when engine does not start (operate starter for at least 5 seconds first).

2) Must be carried out after the following: Replacing engine control unit, throttle valve control part or engine.

1.4 - Significance of the exhaust gas warning lamp

If faults are recognised by the engine control unit, they will be indicated by switching on the exhaust gas warning lamp.



-> -> Location of exhaust gas warning lamp -2-

Note:

The exhaust gas warning lamp can be switched on in the flashing or permanently on mode. The fault memory must be interrogated in every case => Page 8 .

- Flashing: There is a fault which can cause damage to catalyst if driven in this condition. In this case the vehicle must not be driven using full performance!
- Permanently on: There is a fault present which causes the emissions to deteriorate. Interrogate engine or automatic gearbox control unit in this case.
- If the exhaust gas warning lamp does not light up, even though there is an engine running problem, or a customer has complained, the fault memory must be interrogated, because faults which do not switch the exhaust gas warning lamp on immediately can also be stored.

Functional check:

- Switch on ignition:
  the exhaust gas warning lamp must light-up.

If the exhaust gas warning lamp does not light-up with ignition switched on:

- Renewing combi-instrument:

=> Electrical system; Repair group 90; Gauges, instruments Gauges, instruments

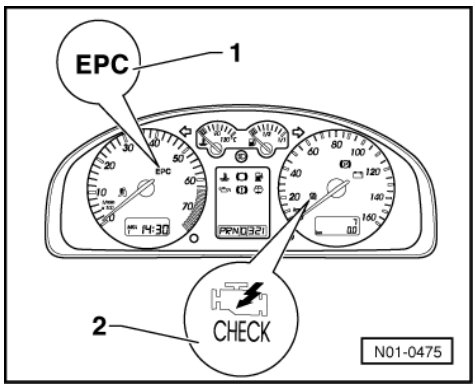
If the exhaust gas warning lamp lights-up with ignition switched on, continue check as follows:

- Start engine and run at idling speed:
  The exhaust gas warning lamp must go out after a few seconds.

If the exhaust gas warning lamp does not go out:

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 8 , interrogating and erasing fault memory.

1.5 - Significance of EPC warning lamp (fault lamp for electronic accelerator) in dash panel insert



-> -> Location of EPC warning lamp -1-

"EPC" is the abbreviation for Electronic Power Control.

When the ignition is switched on the engine control unit checks all components which are important for the correct functioning of the electronic power control.

If faults are recognised in electronic accelerator system when the engine is running, the engine control unit will switch on the EPC lamp (these faults are marked in the fault table). Simultaneously an entry is made in the engine control unit fault memory.

Functional check:

- Switch on ignition:
  the EPC warning lamp must light-up.

If the EPC warning lamp does not light-up with ignition switched on:

- Renewing combi-instrument:

=> Electrical system; Repair group 90; Gauges, instruments Gauges, instruments

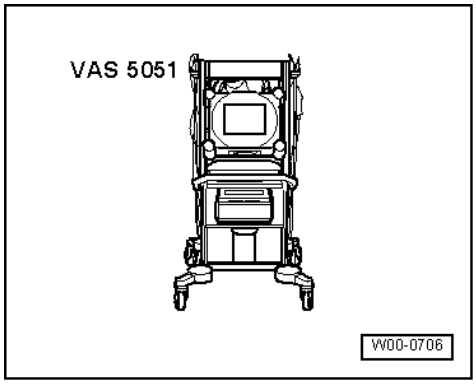
If the EPC warning lamp lights-up with ignition switched on, continue check as follows:

- Start engine and run at idling speed:
  The EPC warning lamp must go out after one second.

If the EPC warning lamp does not go out:

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 8 , interrogating and erasing fault memory.

1.6 - Connecting fault reader



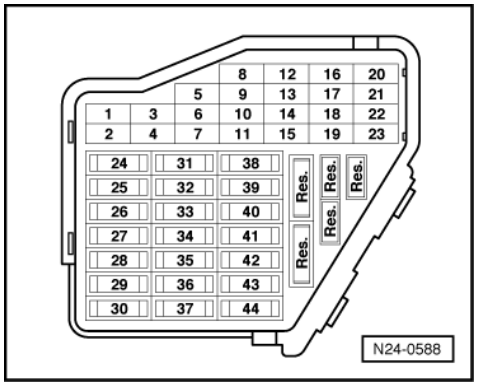
All functions which could previously be performed with V.A.G 1551/1552 can also be performed with the new tester VAS 5051 in the operating mode vehicle self-diagnosis.

=> Operating instructions for Vehicle Diagnosis, Testing and Information System VAS 5051.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- -> VAS 5051 Vehicle Diagnosis, Testing and Information System
- Diagnosis cable VAS 5051/1 or VAS 5051/3

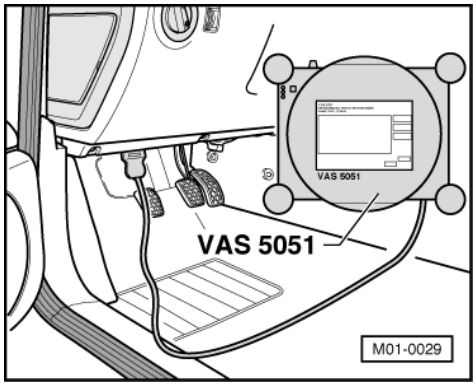
Test conditions:



- -> All fuses must be OK.

- The battery voltage must be at least 11.5 V.

- Earth connection between engine and body must be OK.
- All electrical consumers, e.g. lights and rear window heating must be switched off.
- If the vehicle is equipped with an air conditioner, this must be switched off.



- Selector lever must be in position "P" on vehicles with an automatic gearbox.

Connecting VAS 5051

- -> Connect connector of diagnosis cable VAS 5051/1 or VAS 5051/3 to diagnostic connection.

After the fault reader has been connected:

- Depending upon desired function:
  Switch ignition on
  or
  Start engine => Page 2 , Table "Selectable functions".

Selecting operating mode:

- Press button on display for "Vehicle self-diagnosis".

Selecting vehicle system:

- Press button "01 - Engine electronics" on display.

The control unit identification is indicated on the display.

Notes:

- Replace control unit if the control unit version displayed does not correspond to the vehicle => Page 135 .
- It is essential to check if the correct coding for the vehicle is being used in cases of poor driving characteristics/faults => Page 136 .

Selecting diagnosis function:

All diagnostic functions available are indicated on the display.

- Press button on display for desired function.

Notes:

The display zones in functions 04 - Basic setting or 08 - Read measured value block are shown from top to bottom.

The following test sequences are for fault reader V.A.G 1551.

Connecting V.A.G 1551

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1551 Fault reader
- V.A.G 1551/3 Cable

Note:

The vehicle system tester V.A.G 1552 can be used instead of the fault reader V.A.G 1551, however a print-out is not possible.

Work sequence

- Connect fault reader V.A.G 1551 using cable V.A.G 1551/3.

After the fault reader has been connected:

- Depending upon desired function:
  Switch ignition on
  or
  Start engine => Page 2 , Table "Selectable functions".

Notes:

- If the display remains blank, check voltage supply for diagnostic connection according to fault finding programme:

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

- If the display does not indicate as described in the work sequence:

=> Fault reader operating instructions

- If due to an input fault "Fault in the data transfer!" is displayed, pull wire off fault reader, reconnect and repeat work step.

-> Indicated on display:

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

* Appears alternately

- Operate fault reader taking into account the information on the display:
- Press key 1 for "Rapid data transfer".
- Press keys 0 and 1 for address word "Engine electronics" and confirm entry with Q key.

-> The control unit identification and the coding are indicated on display, e.g.:

```
06B906033J 2.0l/2V SIMOS32G00HS3590
Coding XXXXX     WSC XXXXX
```

- 06B906033J = Part No. of the control unit (for up-to-date control unit versions see parts catalogue)
- 2.0 ltr. = Engine displacement
- 2V = 2-valve
- SIMOS32 = System designation
- G = Cruise control system enabled activated
- 00 = Number of adaption channels that have been adjusted
- HS = Manual gearbox (hand change)
  AT = Automatic gearbox
- 3590 = Programme level number
- Coding xxxxx = Control unit coding

- WSC xxxxx = Workshop code from V.A.G 1551, of the workshop who carried out the last coding. (If the factory coding has not been changed, WSC 00000 appears)

Notes:

- Replace control unit if the control unit version displayed does not correspond to the vehicle
  => Page 135 .
- It is essential to check if the correct coding for the vehicle is being used in cases of poor driving characteristics/faults
  => Page 136 .

- Press ⇒key.

-> Indicated on display:

```
WVWZZZ3BZ1E000340     VWZ7Z0Y0064267
```

Note:

The chassis number and identification number of immobilizer are displayed.

- Press ⇒key.

-> Indicated on display:

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

- Further measures see repair procedures.

2 - Fault memory

2.1 - Fault memory

Interrogate and erase engine control unit fault memory=> Page 8 .

2.2 - Automatic test sequence for interrogation of all fault memories

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Work sequence

Note:

All functions which could previously be performed with V.A.G 1551/1552 can also be performed with the new tester VAS 5051.

The various control units/components are connected together via a data bus. This is why it is always sensible to interrogate the fault memory of all control units first with the "automatic test sequence".

During test and assembly work faults can be recognised from other control units like e.g. plug disconnected. Therefore on completion the fault memories of all control units must be interrogated and erased. To do this:

- Press key 0 twice for address word "Automatic test sequence" and confirm entry with Q key. The V.A.G 1551 transmits all known address words one after the other.

When a control unit answers with its identification the number of stored faults appears on the display or "No fault recognised".

Any system faults that are stored will be displayed one after the other and printed out. The V.A.G 1551 will then transmit the next address word.

-> The automatic test sequence has ended when following is indicated on display:

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

- Erase all fault memories and then carry out a road test.

  During the road test the following operating conditions must be fulfilled:
  - The coolant temperature must exceed 80 °C .
  - When the temperature is reached, the operating conditions
    Idling
    Part throttle
    Enrichment
    Full throttle
    Overrun
    must be attained several times.
  - At full throttle the speed must exceed 3500 rpm.

- Again interrogate the fault memories of all control units using the "automatic test sequence".

If no fault is stored:

- Press the ⇒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.
- Switch off ignition.

2.3 - Interrogating and erasing engine control unit fault memory

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Work sequence

Note:

All functions which could previously be performed with V.A.G 1551/1552 can also be performed with the new tester VAS 5051.

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

Only when engine does not start:

- Operate the starter for at least 5 seconds. Then do not switch the ignition off.

- Switch on fault reader printer with the print key. The warning lamp in key must light 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 number of faults stored or "No fault recognised!" will be shown on the display.

```
X Faults recognised!
```

If no fault is stored:

- Press ⇒key.

If one or more faults are stored:

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

-> After the stored faults have been printed out, the display will show:

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

- 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 "Interrogate fault memory" and "Erase fault memory", the fault memory will not be erased. Some faults (e.g. EPC) can only be erased after switching the ignition off and on once.

- 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.
- Rectify faults printed out using fault table:
  SAE P0 or P2 codes=> Page 13

3 - Fault table: SAE P0 and P2 codes

3.1 - Fault table: SAE P0 and P2 codes

Notes:

- The fault code overview is listed according to SAE or V.A.G code.
- Electronic accelerator "EPC" relevant faults are indicated additionally by the electronic accelerator warning lamp ("EPC warning lamp") in dash panel insert.
- Explanation of the fault types (e.g. "open circuit/short circuit to earth"):

=> Fault reader operating instructions

- If components are indicated as faulty:
  First check the wiring and connectors to these components as well as the system earth connections according to current flow diagram. This is particularly relevant if faults are output as "occurring sporadically" (SP).

- Erase fault memory after rectifying fault =>Page 8 .

V.A.G 1551 print out, e.g.:

16497 P0113 035

Intake air temperature sender -G42

Signal too large

Sporadic fault

Explanation:

- 16497 = Fault code
- P0113 = Additional fault code according to SAE
- 035 = Fault type as a number
- Intake air temperature sender -G42 = Faulty current path or incorrect location
- Signal too large = Fault type as text
- Sporadic faults = Faults that are not always present e.g. loose contact

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0102	16486	Air mass meter -G70 signal too low	- Check air mass meter => Page 95
P0103	16487	Air mass meter -G70 signal too high	- Check intake system for leaks (unmetered air) => Page 116 Check fuse 29
P0112	16496	Intake air temperature sender -G42 signal too low	- Check intake air temperature sender => Page 97
P0113	16497	Intake air temperature sender -G42 signal too high	
P0116	16500	Coolant temperature sender -G62 implausible signal	- Check coolant temperature sender => Page 104
P0117	16501	Coolant temperature sender -G62 signal too low	- Check thermostat: => Repair group 19; Removing and installing parts of cooling system; Parts of cooling system, engine-side Parts of cooling system, engine-side
P0118	16502	Coolant temperature sender -G62 signal too high	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0130	16514	Bank 1 probe 1 fault in electrical circuit	- Check Lambda probe heating before catalyst => Page 118
P0131	16515	Bank 1 probe 1 voltage too low	- Check Lambda probe and Lambda control before catalyst => Page 118
P0132	16516	Bank 1 probe 1 voltage too high	- Check Lambda probe ageing Bank 1, Lambda probe 1 => Page 127
P0133	16517	Bank 1 probe 1 signal too slow	- Check Lambda probe and Lambda control after catalyst => Page 122

P0134	16518	Bank 1 probe 1 no activity	- Check Lambda probe and Lambda control before catalyst => Page 118

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0137	16521	Bank 1 probe 1 voltage too low	- Check Lambda probe and Lambda regulation after catalyst => Page 122
P0138	16522	Bank 1 probe 2 voltage too high	- Check Lambda probe heating after catalyst => Page 92
P0140	16524	Bank 1 probe 2 no activity	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0170	16554	Bank 1, fuel measuring system, faulty	- Check intake system for leaks => Page 116
			- Check exhaust system for leaks: => Repair group 26; Removing and installing parts of exhaust system
			- Check secondary air system for leaks: => Repair group 26; Secondary air system
			- Check hoses and connecting pipes to/between components: => Repair group 26; Secondary air system
			- Check fuel pressure regulator and holding pressure => Page 113
			- Check injectors=>Page 108
			- Check fuel pump: => Repair group 20; Removing and installing parts of fuel system; Checking fuel pump Checking fuel pump

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0171	16555	Bank 1 fuel measuring system, system too lean	- Check intake system for leaks => Page 116
			- Check secondary air system for leaks: => Repair group 26; Secondary air system
			- Check fuel pressure regulator and holding pressure => Page 113
			- Check injectors=>Page 108
			- Check fuel pump: => Repair group 20; Checking fuel pump
			- Check exhaust system for leaks: => Repair group 26; Removing and installing parts of exhaust system
			- Check activated charcoal filter solenoid valve 1 => Page 20 , Final control diagnosis
			- Check Lambda probe and Lambda regulation before catalyst => Page 118

Fault code		Fault text	Fault elimination
SAE	V.A.G		

P0172	16556	Bank 1, fuel measuring system, system too rich	- Check fuel pressure regulator and holding pressure => Page 113
			- Check Lambda probe and Lambda regulation before catalyst => Page 118
			- Check injectors=>Page 108
			- Check activated charcoal filter solenoid valve 1 =>Page 20 , final control diagnosis

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0300	16684	Misfire detected	- Check injectors=>Page 108 - Check ignition cables and spark plugs => Page 152 - Check ignition transformer => Page 157 - Check misfiring detection => Page 163
P0301	16685	Cyl.1 misfiring detected	
P0302	16686	Cyl. 2 misfire detected	
P0303	16687	Cyl. 3 misfiring recognised	
P0304	16688	Cyl.4 misfire detected	

Note:

For faults in the ignition outputs of the engine control unit, misfiring is always indicated in pairs:

Ignition output 1 = Misfire in cylinders 1 and 4

Ignition output 2 = Misfire in cylinders 2 and 3

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0321	16705	Engine speed sender -G28 implausible signal	- Check engine speed sender =>Page 107
P0322	16706	Engine speed sender -G28 no signal	
P0327	16711	Knock sensor 1 -G61 signal too low	- Check knock sensors => Page 160
P0328	16712	Knock sensor 1 -G61 signal too high	
P0332	16716	Knock sensor 2 -G66 signal too low	
P0333	16717	Knock sensor 2 -G66 signal too high	
P0335	16719	Engine speed sender -G28 faulty	- Check engine speed sender =>Page 107
P0341	16725	Camshaft pos. sensor=>Sensor -G40 implausible signal	- Check Hall sender =>Page 156
P0342	16726	Camshaft pos. -sensor=>Sensor -G40, signal too low	
P0420	16804	Bank 1 catalyst system, efficiency too low	- Check catalyst: => Repair group 26; Removing and installing parts of the exhaust system

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0441	16825	Tank breathing system flow rate faulty	- Check activated charcoal filter solenoid valve 1=> Page 20 , Final control diagnosis - Check hoses and connecting pipes from fuel tank to throttle valve control part: => Repair group 20; Checking fuel tank breather

P0461	16845	Fuel status signal, implausible signal	- Check fuel gauge signal sender => Current flow diagrams, Electrical fault finding and Fitting locations binder

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0501	16885	Vehicle speed signal, implausible signal	- Check vehicle speed signal => Page 143 Read fault memory of ABS control unit 1) => Running gear self-diagnosis for ABS; Repair group 01
P0506	16890	Idling speed control, Revs below specification	- Check throttle valve control part => Page 100
P0507	16891	Idling speed regulation above specifications	
P0571	16955	Brake light switch -F2), implausible signal	- Check brake light switch signal and brake pedal switch => Page 148

1) Only model year 01 and vehicles with data bus capable ABS control unit (ESP).

2) The system monitors both brake light switch -F- and brake pedal switch -F47.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0600	16984	Drive train data bus, message missing	- Interrogate fault memory of all control units with automatic test sequence => Page 7 - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder - Evaluate measured value blocks 125 and 126
P0601	16985	Control unit defective	- Renew engine control unit (J361) => Page 135
P0604	16988	Control unit defective	
P0606	16990	Control unit defective	

4 - Fault table: SAE P1 and P3 codes

4.1 - Fault table: SAE P1 and P3 codes

Notes:

- The fault code overview is listed according to SAE or V.A.G code.
- Erase fault memory after rectifying fault =>Page 8 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1102	17510	Bank 1, probe 1 heating element circuit, short to positive	- Check Lambda probe heating before catalyst => Page 118
P1105	17513	Bank 1, probe 2 heating element circuit, short to positive	- Check Lambda probe heating after catalyst => Page 92
P1115	17523	Bank 1, probe 1 heating element circuit, short to earth	- Check Lambda probe heating before catalyst => Page 88

P1116	17524	Bank1, probe 1 heating element circuit, open circuit	
P1117	17525	Bank 1, probe 2 heating element circuit, short to earth	- Check Lambda probe heating after catalyst => Page 92
P1118	17526	Bank1, probe 2 heating element open circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1141	17549	Load determination, implausible value	- Check air mass meter => Page 116
P1171	17579	Angle sens. 2 for throt. valve drive -G188, implausible signal	- Check throttle valve control part => Page 100 - Clean throttle valve control part
P1172	17580	Angle sens. 2 for throt. valve drive -G188, signal too small	
P1173	17581	Angle sens. 2 for throt. valve drive -G188, signal too large	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1176	17584	Bank 1, Lambda correction after catalyst, control limit reached	- Check fuel pressure regul. and holding pressure => Page 113
			- Check injectors=>Page 108
			- Check fuel pump: => Repair group 20; Checking fuel pump
			- Check intake system for leaks => Page 116
			- Check Lambda probe and Lambda regulation after catalyst => Page 122
			- Check Lambda probe and Lambda regulation before catalyst => Page 118
			- Check secondary air system for leaks: => Repair group 26; Secondary air system
			- Check activated charcoal filter solenoid valve 1 => Page 20 , Final control diagnosis

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1213	17621	Injector Cyl. 1 -N30 short to positive	- Check injectors =>Page 108
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	
P1225	17633	Injector Cyl. 1 -N30 short to earth	
P1226	17634	Injector Cyl. 2 -N31 short to earth	
P1227	17635	Injector Cyl. 3 -N32 short to earth	
P1228	17636	Injector Cyl. 4 -N33 short to earth	
P1237	17645	Injector Cyl. 1 -N30 open circuit	
P1238	17646	Injector Cyl. 2 -N31 open circuit	
P1239	17647	Injector Cyl. 3 -N32 open circuit	

P1240	17648	Injector Cyl. 4 -N33 open circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1250	17658	Fuel level too low 1)	- Fill fuel tank
P1335	17743	Engine torque monitoring 2, control limit exceeded	- Check hose connections Check intake system for leaks (unmetered air) => Page 116 - Check intake air temperature sender => Page 97 - Check air mass meter => Page 95 - Check coolant temperature sender => Page 104 - Renew engine control unit (J361) => Page 135
P1336	17744	Engine torque monitoring control limit exceeded	

1) This fault code is only detected in conjunction with other fault codes. An empty fuel tank can be the cause of the other stored fault. Therefore erase fault memory after filling tank and carry out a test drive. Then interrogate the engine control unit fault memory again => Page 8 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1341	17749	Ignition output 1 Short to earth 1)	- Check ignition transformer => Page 157
P1342	17750	Ignition output 1 Short to positive 1)	
P1343	17751	Ignition output 2 Short to earth 2)	
P1344	17752	Ignition output 2 Short to positive 2)	
P1386	17794	Control unit defective	- Replace engine control unit (J361) => Page 135
P1388	17796	Control unit defective	

1) The ignition output 1 provides the high tension voltage for cylinders 1 and 4 because a double ignition coil is installed. Both cylinders are always ignited at the same time. One cylinder is just before TDC on the compression stroke and the other cylinder is on the exhaust stroke.

2) The ignition output 2 provides the high tension voltage for cylinders 2 and 3 because a double ignition coil is installed. Both cylinders are always ignited at the same time. One cylinder is just before TDC on the compression stroke and the other cylinder is on the exhaust stroke.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1397	17805	Sender wheel for engine speed, adaption limit reached	- Check engine speed sender =>Page 107 - Remove engine speed sender and check sender wheel is not damaged and is seated securely.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1410	17818	Tank breathing valve -N80 short to positive	- Check activated charcoal filter solenoid valve 1=> Page 20 , Final control diagnosis

Fault code		Fault text	Fault elimination
P1423	17831	Bank 1, secondary air system, flow rate insufficient	- Check secondary air system: => Repair group 26; Secondary air system - Check hoses and pipe connections to and between components: => Repair group 26; Secondary air system
P1425	17833	Tank venting valve -N80, short to earth	- Check activated charcoal filter solenoid valve 1=> Page 20 , Final control diagnosis
P1426	17834	Tank venting valve -N80, open circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1434	17842	Relay for secondary air pump -J299, short to positive	- Check relay for secondary air inlet valve => Page 20 , Final control diagnosis
P1435	17843	Relay for secondary air pump -J299, short to earth 1)	

1) This fault is also indicated for an open circuit in the wiring.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1427	17835	Activation of brake vacuum pump, Short to positive	- Check brake vacuum pump=> Page 20 , Final control diagnosis - Perform short test of brake vacuum pump: => Repair group 47; Brake systems
P1428	17836	Activation of brake vacuum pump, Short to earth	
P1429	17837	Activation of brake vacuum pump, Open circuit	
P1431	17839	Activation of brake vacuum pump, Open circuit/short to earth	
P1479	17887	Brake vacuum system, Mechanical fault	- Check brake system: => Repair group 47; Brake systems

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1501	17909	Fuel pump relay -J17, short to earth 1)	- Check fuel pump relay=> Page 20 , Final control diagnosis
P1502	17910	Fuel pump relay -J17 short to positive	

1) This fault is also indicated for an open circuit in the wiring.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1503	17911	Load signal from alternator terminal DF, Implausible signal	- Check wiring to alternator: => Current flow diagrams, Electrical fault finding and Fitting locations binder
P1512	17920	Intake manifold changeover valve -N156 short to positive	- Check intake manifold changeover valve=> Page 20 , Final control diagnosis
P1515	17923	Intake manifold changeover valve -N156 short to earth	

Fault code		Fault text	Fault elimination
P1516	17924	Intake manifold changeover valve -N156, open circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1542	17950	Angle sender for throt.val.drive -G187, implausible signal	- Check throttle valve control unit => Page 100 - Clean throttle valve control part
P1543	17951	Angle sender for throt.val.drive -G187, signal too small	
P1544	17952	Angle sender for throt.val.drive -G187, signal too large	
P1545	17953	Throttle valve control faulty	
P1558	17966	Throttle valve drive -G186, fault in electrical circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1559	17967	Throttle valve control part -J338, Fault in basic setting	- Adapt engine control unit to throttle valve control part => Page 139 - Clean throttle valve control part
P1560	17968	Maximum engine revs exceeded	- Interrogate and erase fault memory of engine control unit => Page 8 Repair mechanical damage
P1564	17972	Throttle valve control part -J338, Low voltage at basic setting	- Check battery, charge if necessary Adapt engine control unit to throttle valve control part => Page 139
P1565	17973	Throttle valve control part -J338, Lower limit not reached	- Check throttle valve control part=> Page 100 - Clean throttle valve control part
P1568	17976	Throttle valve control part -J338, mechanical fault	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1569	17977	Cruise cont. sys. switch -E45, implausible signal	- Check cruise control system: => Repair group 27; Electrical system - Evaluate measured value block 66
P1570	17978	Engine control unit blocked	- Adapt engine control unit (J361) to electronic immobilizer: => Electrical system self-diagnosis; Repair group 01
P1579	17987	Throttle valve control part -J338 Adaption not started	- Adapt engine control unit to throttle valve control part => Page 139

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1602	18010	Voltage supply terminal 30, Voltage supply too low	- Check voltage supply for control unit => Page 131

Fault code		Fault text	Fault elimination
P1603	18011	Control unit defective	- Renew engine control unit (J361) => Page 135
P1606	18014	Poor road info.eng.sp.torq.from ABS CU Fault in electrical circuit 1)	- Check coding Check wiring between engine control unit and ABS control unit => Current flow diagrams, Electrical fault finding and Fitting locations
P1609	18017	Crash switch-off triggered	- Interrogate and erase fault memory of engine control unit => Page 8 => Body self-diagnosis; Repair group 01; Self-diagnosis; Self-diagnosis for airbag system Self-diagnosis; Self-diagnosis for airbag system
P1610	18018	Control unit defective	- Renew engine control unit (J361) => Page 135
P1612	18020	Engine control unit incorrectly coded	- Code engine control unit => Page 136

1) Not vehicles with data bus capable ABS.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1624	18032	Request warning lamp be switched on active	- Interrogate automatic gearbox fault memory: => Autom. gearbox 01 N; Repair group 01; Performing self-diagnosis Performing self-diagnosis
P1625	18033	Drive train data bus Implausible message from gearbox CU	- Interrogate fault memory of automatic gearbox: => Autom. gearbox 01 N; Repair group 01; Performing self-diagnosis Performing self-diagnosis - Check coding => Page 136 - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder
P1626	18034	Drive train data bus No message from gearbox CU	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1630	18038	Accelerator position sender -G79, Signal too low	- Check accelerator pedal position sender: => Repair group 20; Electronic power control (EPC); Checking accelerator pedal position sender Checking accelerator pedal position sender
P1631	18039	Accelerator position sender -G79, Signal too high	
P1633	18041	Accelerator position sender 2 -G185, Signal too low	
P1634	18042	Accelerator position sender 2 -G185, Signal too high	

Fault code		Fault text	Fault elimination
SAE	V.A.G		

P1635	18043	Drive train data bus No message from AC control unit	- Interrogate fault memory of Climatronic: => Heating, Air conditioning; Repair group 01; Climatronic self-diagnosis; Interrogating fault memory - Check coding => Page 136 - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1636	18044	Drive train data bus No message from airbag CU	- Interrogate fault memory of airbag system: => Body self-diagnosis; Repair => group 01; Self-diagnosis for airbag systems - Check coding => Page 136 - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder
P1639	18047	Accelerator pedal position senders 1/2 -G79 +G185, Implausible signal	- Check accelerator pedal position sender: => Repair group 20; Electronic power control (EPC); Checking accelerator pedal position sender Checking accelerator pedal position sender
P1640	18048	Control unit defective	- Replace engine control unit (J361) => Page 135

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1648	18056	Drive train data bus defective	- Check matching resistor for data bus =>Page 142 - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder
P1649	18057	Drive train data bus no messages from ABS control unit	- Interrogate ABS control unit fault memory => Running gear self-diagnosis for ABS; Repair group 01; Performing self-diagnosis; Interrogating fault memory - Check coding => Page 136 - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1650	18058	Drive train data bus No messages from combi-instrument	- Interrogate combi-instrument fault memory => Electrical system self-diagnosis; Repair group 01; Self-diagnosis of dash panel insert - Check data bus: => Current flow diagrams, Electrical fault finding and Fitting locations binder
P1657	18065	Air conditioner input/output Short to positive	- Check signal to/from air conditioner => Page 145
P1680	18088	Reset window, emergency run active	- Check throttle valve control part => Page 100

Fault code		Fault text	Fault elimination
			- Check accelerator pedal position sender: => Repair group 20; Engine performance control (EPC); Check accelerator pedal position sender Check accelerator pedal position sender

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1912	18320	Pressure sensor for brake servo -G294 Open/short circuit to positive	- Check pressure sensor for brake servo: => Repair group 47; Brake systems Check wiring: => Current flow diagrams, Electrical fault finding and Fitting locations
P1913	18321	Pressure sensor for brake servo -G294 Short to earth	

5 - Final control diagnosis

5.1 - Final control diagnosis

5.2 - Performing final control diagnosis

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

1. Fuel pump relay -J17

1. Solenoid valve 1 for activated charcoal filter -N80

3. Intake manifold change-over valve -N156

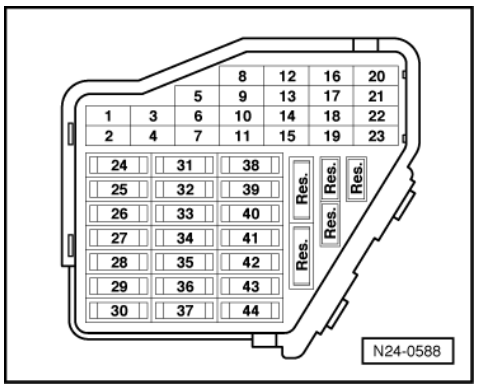
4. Secondary air pump relay -J299

Only vehicles with automatic gearbox

5. Vacuum pump for brakes -V192

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Adapter set V.A.G 1594
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Diode test lamp V.A.G 1527
- Current flow diagram



Test conditions

- -> All fuses must be OK.

Notes:

- All functions of V.A.G 1551/1552 can also be carried out with the new tester VAS 5051. Connecting VAS 5051 => Page 5 .
- The final control diagnosis can only be carried out if the engine is stationary and ignition switched on.
- The final control diagnosis will be broken off if the engine is started or a rotational impulse is recognised.
- During the final control diagnosis the individual final controls will be activated until advancing to the next final control by pressing the ⇒ button.
- During the final control diagnosis, individual final control will be activated 50 seconds (secondary air pump relay -J299 10 seconds) unless the ⇒ key is pressed to advance to the next final control.
- The final controls are checked acoustically or by touching.
- If it is necessary to repeat the final control diagnosis, without first running the engine briefly, switch the ignition off for approx. 2 seconds.
- The electric fuel pump will run during the complete final control diagnosis.
- The final control diagnosis will be aborted after 10 minutes.

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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 3 for the function "Final control diagnosis".

-> Indicated on display:

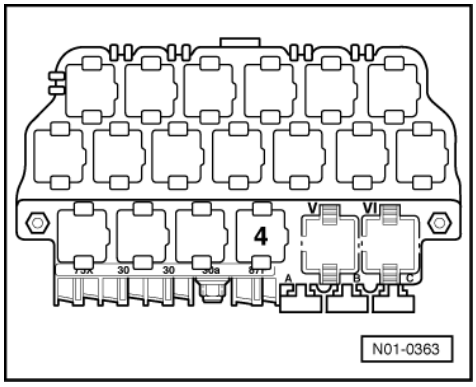
```
Rapid data transfer      Q
03 Final control diagnosis
```

Activating fuel pump relay (J17):

- Confirm input with Q key.

-> Indicated on display:

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



-> The fuel pump relay (on the relay plate, relay position 4) must click until the next control element is activated by pressing the ⇒ key (max. 50 seconds).

Note:

During the activation of the fuel pump relay the fuel pump must be heard to run at intervals.

If the relay does not click:

- Check fuel pump relay:

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

Activating activated charcoal filter solenoid valve 1 (N80):

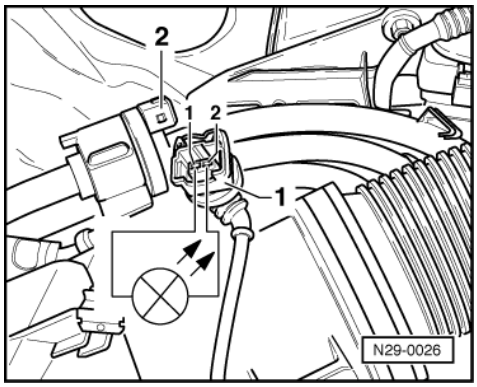
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Activ. charcoal filter solenoid valve
1     -N80
```

The activated charcoal filter system solenoid valve 1 (on activated charcoal filter) must click until the next control element is activated by pressing the ⇒ key (max. 50 seconds).

If the solenoid valve does not click:



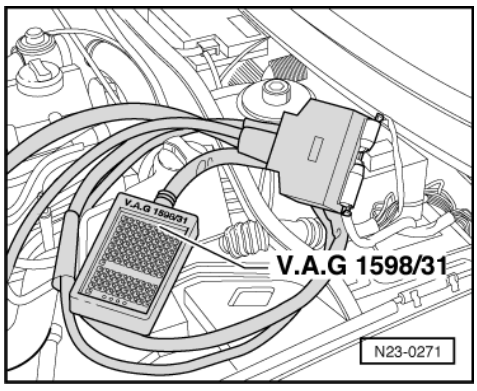
- -> Pull connector -1- off solenoid valve -2- and connect diode test lamp V.A.G 1527 with aux. cables from V.A.G 1594 to disconnected connector.
  The LED must flash

LED flashes:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew solenoid valve.

=> Repair group 20; Activated charcoal filter system; Removing and installing parts of activated charcoal filter system Activated charcoal filter system Removing and installing parts of activated charcoal filter system

LED does not flash:



- Proceed with final control diagnosis until completed.
- Switch off ignition.
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Check wire between test box socket 61+2 pin connector contact 2 for open circuit using current flow diagram.
  Wire resistance: Max. 1.5 ω
- Additionally check wire for short to battery positive and earth.

If no wiring fault is detected:

- Check wire between 2 pin connector contact 1 and fuel pump relay (J17) for open circuit using current flow diagram.
  Wire resistance: max. 1.5 ω

If no fault is detected in the wiring:

- Renew engine control unit => Page 135 .

Activating intake manifold change-over valve (N156):

- Press ⇒key.

-> Indicated on display:

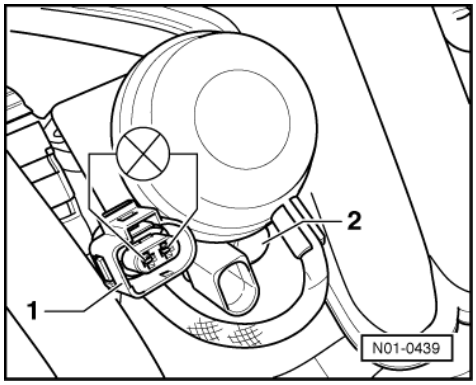
```
Final control diagnosis
Intake manifold change-over valve     -
N156
```

The twin path intake manifold change-over valve must click until the next final control is activated by pressing the ⇒key (max. 50 seconds).

Note:

Check intake manifold change-over => Page 129 .

If the solenoid valve does not click:



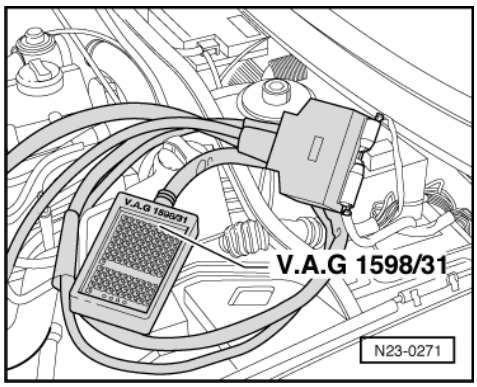
- -> Pull connector -1- off solenoid valve -2- and connect diode test lamp V.A.G 1527 with aux. cables from V.A.G 1594 to disconnected connector.
  The LED must flash

LED flashes:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew solenoid valve -2-
  Page 66 , item 18 .

LED does not flash:

- Proceed with final control diagnosis until completed.



- Switch off ignition.
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Check wiring for open circuit between test box socket 117 and 2-pin connector contact 2 using current flow diagram.
  Wire resistance: max. 1.5 ω
- Additionally check wire for short to battery positive and earth.

If no wiring fault is detected:

- Check wire between 2 pin connector contact 1 and fuel pump relay (J17) for open circuit using current flow diagram.
  Wire resistance: max. 1.5 ω

If no fault is detected in the wiring:

- Renew engine control unit => Page 135 .

Activating secondary air pump relay (J299):

- Press ⇒key.

-> Indicated on display:

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

The secondary air pump relay (J299) is activated once for approx. 10 seconds. At the same time the secondary air pump motor (V101) starts. It also runs for approx 10 seconds if the next control element is not activated beforehand by pressing ⇒ key.

If the secondary air pump runs:

- Press ⇒key.

Continuation for vehicles with automatic gearbox =>Page 28

-> Indicated on display:

```
Final control diagnosis
END
```

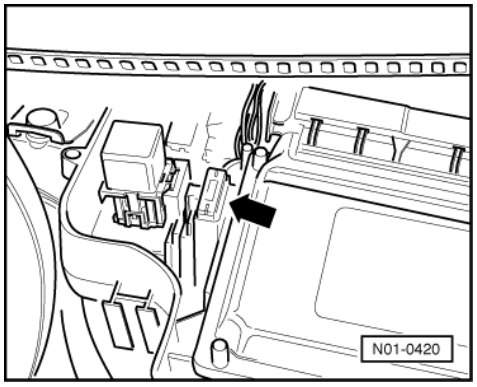
- Press ⇒key.

-> 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.
- Switch off ignition.

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

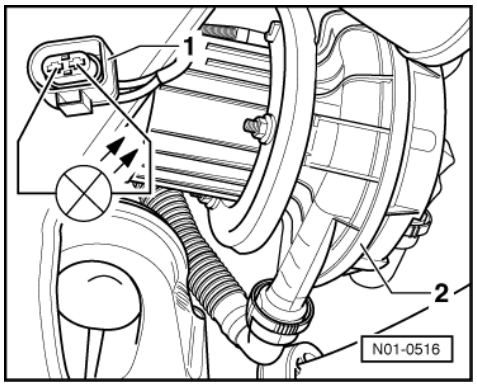


- -> Check fuse -arrow- for secondary air pump relay (J299).

If no faults are found with the fuse:

- Removing front noise insulation:

=> General body repairs; Repair group 50; Front body; Noise insulation - assembly overview Front body Noise insulation - assembly overview



- -> Pull 2-pin connector -1- off secondary air pump motor -2- and connect diode test lamp V.A.G 1527 to disconnected connector using auxiliary cables from V.A.G 1594. Activate the secondary air pump relay again.
  The LED must light up

Note:

Final control diagnosis must be introduced several times during the checks due to the fact that the secondary air pump relay(J299) is activated once for approx. 10 seconds only.

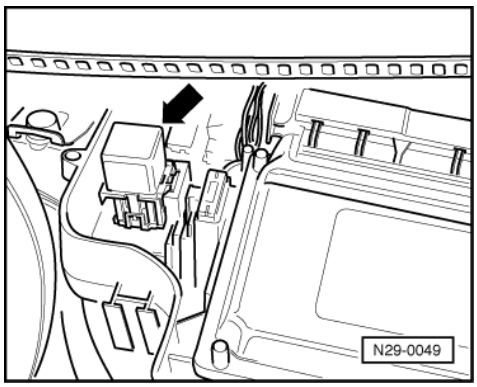
LED lights up:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew secondary air pump motor (V101):

=> 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

If the LED does not light up, but the secondary air pump relay clicks:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Check the wire between secondary air pump motor (V101) and contact 1 and body earth for open circuit.

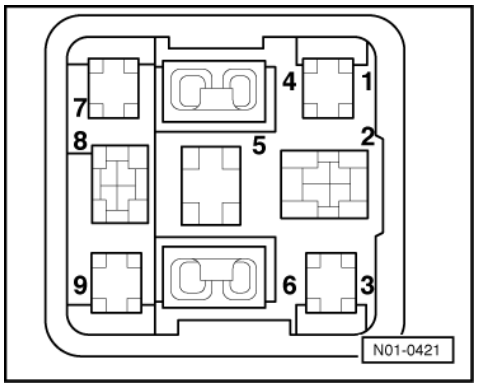


If no wiring fault is detected:

- -> Pull secondary air pump relay -arrow- off relay plate in control unit protective housing.

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.



- -> Check wire between secondary air pump motor (V101) contact 2 and contact 2 on relay plate for open circuit referring to current flow diagram.
  Wire resistance: max. 1.5 ω

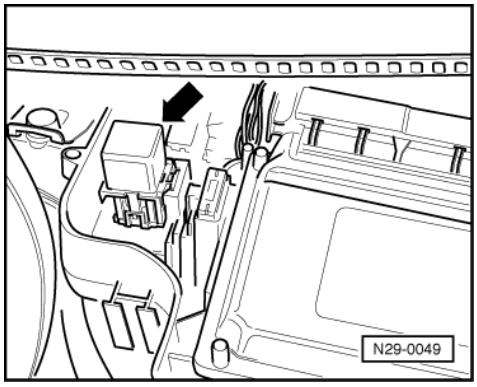
If no wiring fault is detected:

- Using current flow diagram, check the voltage supply at contact 8 (terminal 87) for secondary air pump relay (J299).

If voltage supply is OK:

- Renew secondary air pump relay (J299).

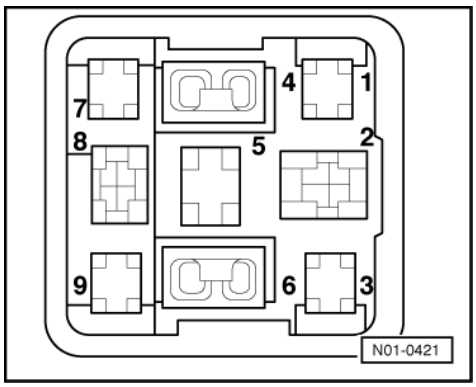
If the LED does not light up and the secondary air pump relay does not click:



- Proceed with final control diagnosis until completed.
- Switch off ignition.
- -> Pull secondary air pump relay -arrow- off relay plate in control unit protective housing.

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.



- -> Using adapter cables from V.A.G 1594 connect the diode test lamp V.A.G 1527 to contacts 4 and 6 on the relay plate.
- Introduce final control diagnosis again and activate secondary air pump relay (J299).
  The LED must light up

LED lights up:

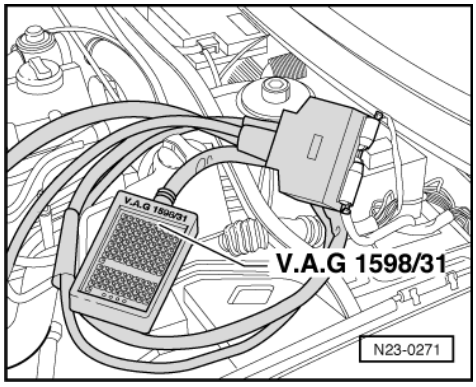
- Renew secondary air pump relay (J299).

LED does not light-up:

- Using adapter cables from V.A.G 1594 connect the diode test lamp V.A.G 1527 to contact 4 of relay plate and body earth. Introduce final control diagnosis again and activate the fuel pump relay (J17).
  The LED must flash

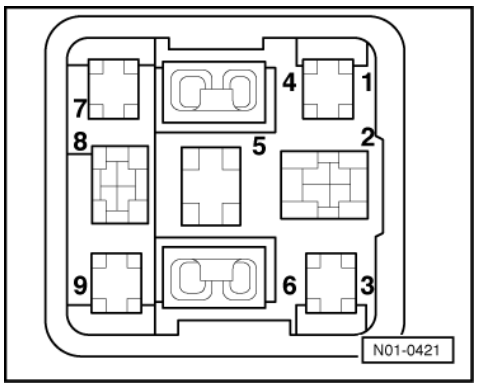
LED does not flash:

- Check wiring for open circuit between contact 4 of relay plate and fuel pump relay using current flow diagram.



LED flashes:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wire for open circuit between test box socket 72 and contact 6 of relay plate referring to current flow diagram.
  Wire resistance: max. 1.5 ω

If no wiring fault is detected:

- Renew engine control unit => Page 135 .

Continuation for vehicles with automatic gearbox

Activating vacuum pump for brakes -V192

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Brake servo vacuum system
```

If vacuum pump runs:

- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
END
```

- 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.
- Switch off ignition.

If the vacuum pump for brakes (V192) does not run:

- Check activation of vacuum pump

=> Brake systems; Repair group 47

and

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

6 - Readiness code

6.1 - Readiness code

Function

The readiness code is an 8-digit number code which displays the status of the emission relevant diagnosis.

When the diagnosis for a system (e.g. secondary air system) has been successfully completed, the corresponding position in the number code will change from 1 to 0.

The diagnosis is performed at regular intervals during normal driving. It is recommended that the readiness code be generated after performing repairs on an emission relevant system, to guarantee that these systems function correctly. If a fault is detected during the diagnosis it will be entered in the fault memory.

Each time the fault memory is erased the readiness code will be erased.

6.2 - Reading readiness code

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> Indicated on display:

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

- Press keys 1 and 5 for the "Readiness code" function and confirm entry with Q key.

Must appear on display when all diagnosis functions have been successfully completed:

-> Indicated on display:

```
Readiness code
00000000 - Test complete
```

- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

-> Indicated on display:

```
Readiness code
00101101 - Test not complete
```

One of the diagnostic checks has not run through successfully:

- Press ⇒key.
- Generate readiness code => Page 30

Significance of 8 digit number block for readiness code

The readiness code is generated only when all display zones show 0								
1	2	3	4	5	6	7	8	Diagnostic function

The readiness code is generated only when all display zones show 0								
							0	Catalyst
						0		Catalyst heating (currently no diagnosis/always "0")
					0			Activated charcoal filter system (tank venting system)
				0				Secondary air system
			0					Air conditioner (currently no diagnosis/always "0")
		0						Lambda probes
	0							Lambda probe heating
0								Exhaust gas recirculation system (not fitted/always "0")

6.3 - Generating readiness code

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 (or vehicle system tester V.A.G 1552) with cable V.A.G 1551/3

Test conditions

- Vehicle stationary
- Selector lever must be in position "P" on vehicles with an automatic gearbox.
- All electrical consumers, e.g. lights and rear window heating must be switched off.
- Intake air temperature less than 60°C
  =>display group 04, display zone 4
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

Work step 1: Interrogate fault memory

-> Indicated on display:

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

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

-> The number of faults stored or "No fault recognised!" will be shown on the display.

```
X Faults recognised!
```

If a fault is stored:

- Rectify faults printed out using fault table:
  SAE P0 or P2 codes=> Page 13

If no fault is stored:

- Press ⇒key.

Work step 2: Erase fault memory

-> Indicated on display:

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

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

Note:

The readiness code is reset or erased each time fault memory is erased.

-> Indicated on display:

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

Note:

If the ignition is switched off between "Interrogate fault memory" and "Erase fault memory", the fault memory will not be erased. Some faults (e.g. EPC) can only be erased after switching the ignition off and on once.

- Press ⇒key.

Work step 3: Matching the throttle valve control part to the engine control unit

-> 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
Input display group number XXX
```

- Press keys 0, 6 and 0 for the "Display group number 60" and confirm entry with Q key.
- Check specifications in display zone 4:
  Display zone 4: ADP. OK

If the display indicates as described:

- Start engine and run at idling speed.

- Continue with work step 4, activated charcoal filter system diagnosis (tank breathing system)
  => Page 32

If the display does not indicate as described:

- Press ⇒key.

-> 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
Input display group number XXX
```

- Press keys 0, 6 and 0 for the "Display group number 60" and confirm entry with Q key.

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

```
System in basic setting     60
     xxx %     xxx %     x     ADP. runs
```

- Check specifications in display zones 3 and 4:
  Display zone 3: Idling speed

Display zone 4: ADP. runs, ADP. OK

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

```
System in basic setting 60
     xxx %     xxx %     0     ADP. OK
```

- Terminate engine basic setting at earliest after 30 seconds by pressing the⇒ key.

If the display does not indicate as described:

- Check throttle valve control part
  => Page 100 .

If the display indicates as described:

- Start engine and run at idling speed.

Note:

- During the work sequence the engine must not be switched off.

Work step 4: Activated charcoal filter system diagnosis (tank breathing system)

-> Indicated on display:

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

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

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 7 and 0 for "Display group number 70" and confirm entry with Q key.

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

```
System in basic setting     70
     1     2     3     4
```

When the diagnosis is initiated by the engine control unit the display in display zone 4 jumps from "Test OFF" to "Test ON"

- Run engine at idling speed until the
  specification "TVV OK"
  is displayed in display zone 4.

If the display does not indicate as described:

- Interrogate fault memory => Page 8 .

If the display indicates as described:

- Press C key.

Work step 5: Secondary air system diagnosis

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 7 and 7 for the "Display group number 77" and confirm entry with Q key.

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

```
System in basic setting     77
     1     2     3     4
```

- Depress brake pedal.

  The engine speed is increased by the control unit to approx. 1400 rpm.

During diagnosis the display in display zone 4 jumps from "Test OFF" to "Test ON" and back to "Test OFF" again.

- Allow engine continue to run at an increased idling speed and hold brake pedal down until the result of the functional test is displayed in display zone 4:
  Specification: "Syst. OK"

If the display does not indicate as described:

- Interrogate fault memory => Page 8 .

If the display indicates as described:

- Press ⇒key.

Work step 6: Lambda probe before catalyst ageing diagnosis

-> 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
Input display group number XXX
```

- Press keys 0, 3 and 0 for the "Display group number 30" and confirm entry with Q key.

-> Indicated on display:
(1...2 = Display zones)

```
Read measured value block 30
     1     2
```

- Check Lambda control status before catalyst (display zone 1):
  Specification: 1 1 1
  (Significance => Page 47)
- Check Lambda control status after catalyst (display zone 2):
  Specification: 1 1 1
  (Significance => Page 47)

Notes:

- The first position of the 3 digit number block fluctuates between 0 and 1 (Lambda probe heating on and off).
- Depending upon the status of the Lambda control the 3 digit number block can show 0 or 1.
- The bits in display zones 1 and 2 will not be set to 1 until the catalyst temperature has risen to above 400.0 °C (=> display group 34, display zone 2).

If the specifications are not obtained:

- Interrogate fault memory => Page 8 .

If the specifications are obtained:

- Press ⇒key.

-> Indicated on display:

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

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

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 3 and 4 for "Display group number 34" and confirm entry with Q key.

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

```
System in basic setting     34
     1     2     3     4
```

- Depress brake pedal.

  The engine speed is increased by the control unit to approx. 1400 rpm.

- Maintain the engine speed until the display in display zone 4 jumps from "Test OFF" to "Test ON". The catalyst temperature in display zone 2 must be min. 400 °C.

Note:

This process can take a few minutes.

- Maintain the increased engine speed until the display in display zone 4 shows the result of the brief test:
  Specification "B1-P1 OK"

If the display does not indicate as described:

- Interrogate fault memory => Page 8 .

If the display indicates as described:

- Press ⇒key.

Work step 7: Lambda probe after catalyst ageing diagnosis

-> 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
Input display group number XXX
```

- Press keys 0, 3 and 0 for the "Display group number 30" and confirm entry with Q key.

-> Indicated on display:

(1...2 = Display zones)

```
Read measured value block 30
     1     2
```

- Check Lambda control status before catalyst (display zone 1):
  Specification: 1 1 1
  (Significance => Page 47)
- Check Lambda control status after catalyst (display zone 2):
  Specification: 1 1 1
  (Significance => Page 47)

Notes:

- The first position of the 3 digit number block fluctuates between 0 and 1 (Lambda probe heating on and off).
- Depending upon the status of the Lambda control the 3 digit number block can show 0 or 1.
- The bits in display zones 1 and 2 will not be set to 1 until the catalyst temperature has risen to above 400.0 °C (=> display group 34, display zone 2).

If the specifications are not obtained:

- Interrogate fault memory => Page 8 .

If the specifications are obtained:

- Press ⇒key.

-> Indicated on display:

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

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

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 4 and 3 for "Display group number 43" and confirm entry with Q key.

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

```
System in basic setting     43
     1     2     3     4
```

- Raise engine speed to 2200...2800 rpm.
- Run engine at increased speed until the catalyst temperature in display zone 2 increases to min. 400 °C.
- Maintain the increased engine speed until the display in display zone 4 shows the result of the brief test: specification "B1-P2 OK.

Note:

This process can take a few minutes.

If the display does not indicate as described:

- Interrogate fault memory => Page 8 .

If the display indicates as described:

- Press C key.

Work step 8: Catalyst diagnosis

Note:

The diagnosis will only be terminated if the Lambda probe ageing diagnosis is first successfully completed.

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 4 and 6 for "Display group number 46" and confirm entry with Q key.

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

```
System in basic setting     46
     1     2     3     4
```

- Maintain engine speed at 2200...2800 rpm until the display in display zone 4 jumps from "Test OFF" to "Test ON". The catalyst temperature in display zone 2 must be at least 400 °C.
- Continue to maintain speed at 2200...2800 rpm until the result of the functional test is displayed in display zone 4.
  Specification: "Cat B1 OK"

If the specifications are not attained:

- Interrogate fault memory => Page 8 .

If the specification is obtained:

- Read readiness code=> Page 29

7 - Measured value blocks

7.1 - Measured value blocks

7.2 - Safety precautions

Observe following 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.

7.3 - Read measured value block

- Fault reader V.A.G 1551 with cable V.A.G 1551/3

Test conditions

- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- If the vehicle is equipped with an air conditioner, this must be switched off.
- Selector lever must be in position "P" on vehicles with an automatic gearbox.

- No faults must be stored in fault memory
  => Page 8 , interrogating fault memory

Work sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Select required display group number.

Note:

The display group number 1 is an example, to illustrate the sequence.

- Press keys 0, 0 and 1 for "Display group number 1" and confirm entry with Q key.

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

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

Note:

To change to another display group proceed as follows:

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

- If the specifications in all display zones are obtained, press ⇒key.

-> Indicated on display:

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

- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

Note:

Measured value blocks which are not described in this chapter are currently only intended for the research and development and production. The values displayed are not relevant for service department fault finding.

8 - Evaluating measured value blocks, display groups 0...9 -Basic functions-

8.1 - Evaluating measured value blocks, display groups 0...9 -Basic functions-

Display group 1 -Basic functions-						
▪ Engine running at idling speed						
Read measured value block 1 ⇒				◂ Indicated on display		
xxxx rpm	xx.x °C	x.x %	xxxxxxxx			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Adjustment conditions for basic setting	1x111111	=> Page 38
				Lambda regulator	-10.0...10.0 %	=> Page 50
				Coolant temperature	80...110 °C	=> Page 41
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 1:

The specification refers to the entire idling speed range for vehicles with automatic and manual gearboxes.

Significance of figures in 8-digit number block, display zone 4 - adjustment conditions

Significance if display = 1								
1	2	3	4	5	6	7	8	Significance
							1	Coolant temperature above 80 °C
						1		Speed below 2000 rpm
					1			Throttle valve closed
				1				Lambda regulation OK.
			1					Operating mode: idling speed
		1						Air conditioner compressor switched off
	1							Catalyst temperature above 400 °C
1								No faults recognised by self-diagnosis

Evaluating display group 1, display zone 1 - Engine speed (idling speed)

Appears on display	Possible fault cause	Fault elimination
Less than 740 rpm	- Throttle valve control part sticking or defective	- Check throttle valve control part => Page 100 - Perform idling check => Page 117
More than 860 rpm	- Idling speed not recognised	- Interrogate fault memory, => Page 8
	- Large amount of unmetered air (cannot be compensated for by the idling stabilisation)	- Check intake air system for leaks => Page 116
	- Throttle valve control part sticking/defective	- Check throttle valve control part => Page 100 - Perform idling check => Page 117
	- Alternator defective, battery charge state low	- Check alternator and battery voltage, charge battery: => Binder Electrical system

Note on display zone 1:

If the supply voltage for the engine control unit drops below 9...10.5 Volt the idling speed is raised in stages to 1200 rpm.

Display group 2 -Basic functions- Air mass meter						
▪ Engine running at idling speed						
Read measured value block 2			⇒	◂ Indicated on display		
xxxx rpm	xxx %	x.x ms	x.x g/s			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Air mass drawn in	2.5...6.0 g/s	=> Page 39
				Injection period	1.0...5.0 ms	=> Page 39
				Engine load	15...35 %	=> Page 43
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 4:

No fault detected on air mass meter by self-diagnosis:

- Displayed is the air mass measured by the air mass meter.

Fault detected on air mass meter by self-diagnosis:

- A replacement value calculated by engine control unit from revolutions and throttle valve angle is displayed.

Evaluating display group 2, display zone 3 - Injection period

Appears on display	Possible fault cause	Fault elimination
Less than 1.0 ms	- Large amount of fuel from the activated charcoal filter system - Incorrect injectors with greater throughput installed	- Check activated charcoal filter solenoid valve 1 => Page 20 , Final control diagnosis - Check injection rate => Page 108
More than 5.0 ms	- Increased engine load due to electric consumers, air conditioner, gear selected or P.A.S. on full lock	- Eliminate increased load (air conditioner, power assisted steering etc.)

Evaluating display group 2, display zone 4 - Air mass drawn in 1)

Appears on display	Possible fault cause	Fault elimination
Less than 2.5 g/s	- Large amount of unmetered air between intake manifold and air mass meter	- Rectify unmetered air
More than 6.0 g/s	- Gear selected (automatic gearbox) - Engine loaded due to ancillaries	- Place selector lever in P or N - Eliminate load (air conditioner, power assisted steering etc.)

1) Applies only when the self-diagnosis does not detect a fault with air mass meter. When faulty a value is displayed which has been calculated from the revolutions and throttle valve angle.

Display group 3 -Basic function- Air mass meter				
▪ Engine running at idling speed				
Read measured value block 3			⇒	◂ Indicated on display
xxxx rpm	x.xx ms	x.x %	xx.x°BTDC	

1	2	3	4	◂ Display zones	Specification	Evaluation
				Ignition timing	0...15 ° BTDC	---
			Throttle valve angle (potentiometer 1 -G187)		0.9...5.6 %	=> Page 43
		Air mass drawn in			2.5...6.0 g/s	=> Page 39
	Engine speed (idling speed)				740...860 rpm	=> Page 38

Note on display zone 3:

Display values must be approx. 100 % when accelerator pedal is fully depressed.

Display group 4 -Basic functions-

▪ Engine running at idling speed

Read measured value block 4 ⇒ ◂ Indicated on display

xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Intake air temperature	-40.5...80 °C	=>Page 41
			Coolant temperature		80...110 °C	=> Page 41
		Voltage supply for engine control unit			11.5...14.5 V	=> Page 40
	Engine speed (idling speed)				740...860 rpm	=> Page 38

Note on display zone 3:

The engine control unit will use the intake air temperature as a replacement value for an engine start (start temperature - replacement value) as soon as there is a fault stored in the fault memory, which affects the coolant temperature sender (G62). The temperature then rises according to a model stored in the control unit. When the engine has reached normal working temperature a fixed replacement value will be displayed after a certain period. This fixed value is also dependent upon the intake air temperature (below or above 20 °C).

Note on display zone 4:

The total temperature range is given as the specification. The displayed value must be above ambient temperature.

Evaluating display group 4, display zone 2 - Control unit voltage supply

Appears on display	Possible fault cause	Fault elimination
Less than 11.5 V	- Alternator defective, battery charge state low	- Check alternator and battery voltage, charge battery: => Binder Electrical system
	- Battery heavily charged shortly after starting due to high charging current and current consumers	- Increase revs slightly for a few minutes and switch off current consumers
	- Transfer resistance in the current supply or the engine control unit earth connection	- Check engine control unit voltage supply => Page 131
	- Current draw when ignition is off	- Eliminate current draw
More than 14.5 V	- Voltage regulator on alternator defective	- Check voltage, replace regulator if necessary => Binder Electrical system
	- Excess voltage due to jump starting or quick charging unit	- Interrogate fault memory => Page 8

Note:

If the supply voltage for the engine control unit drops below 9...10.5 Volt the idling speed is raised in stages to 1200 rpm.

Evaluating display group 4, display zone 3 - Coolant temperature

Appears on display	Possible fault cause	Fault elimination
Less than 80 °C	- Engine too cold - Coolant temperature sender or wiring to engine control unit	- If necessary carry out test drive - Check coolant temperature sender =>Page 104
Greater than 110 °C	- Radiator soiled - Radiator fan not functioning - Thermostat defective - Coolant temperature sender or wiring to engine control unit	- Clean radiator - Check function => Binder Electrical system - Check thermostat => Repair group 19; Removing and installing parts of cooling system: Parts of cooling system - engine side - Check coolant temperature sender =>Page 104
Constant -10.5 °C or 60.0 °C	- Wiring open circuit or short circuit	- Check coolant temperature sender =>Page 104

Evaluating display group 4, display zone 4 - Intake air temperature

Appears on display	Possible fault cause	Fault elimination
Constant 9 or 30 °C	- Wiring open circuit or short to positive or earth	- Check intake air temperature sender =>Page 97

Display group 5 -Basic functions-

▪ Engine running at idling speed

Read measured value block 5 ⇒ ◂ Indicated on display

xxxx rpm	xxx %	xxx km/h	Text	◂ Display zones	Specification	Evaluation
1			4	Operating mode (idling, part load, enrichment, overrun, full load)	Idling	---
		3		Road speed	0 km/h	---
	2			Engine load	15...35 %	=> Page 43
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Display group 6 -Basic function-

▪ Engine running at idling speed

Read measured value block 6 ⇒ ◂ Indicated on display

xxxx rpm	xxx %	xxx.x °C	xx.x %	◂ Display zones	Specification	Evaluation
1			4	Altitude correction factor	-50.0...10.0 %	---
		3		Intake air temperature	-40.5...80 °C	=> Page 41
	2			Engine load	15...35 %	=> Page 43

Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 3:

The total temperature range is given as the specification. The displayed value must be above ambient temperature.

Note on display zone 4:

Elevation	Display value
Sea level	+5...-10
1000 m	-5...-20
2000 m	-10...-30

Vehicles with automatic gearboxes

Display group 8 -Basic function-

- Engine running at idling speed
- Control unit in mode 04-Basic setting

- Depress brake pedal

Read measured value block 8 ⇒ ◂ Indicated on display

Text 1	Text 2	Text 3	Text 4 ◂ Display zones	Specification	Evaluation
			Result of brief test of brake vacuum pump (Test on, Test off, Syst. OK., Syst.n.OK.)	Syst. OK.	---
			Brake servo pressure	---	---
			Brake vacuum pump status (Pump on, Pump off)	---	---
			Brake status (Depress, Operated, Not operated)	---	---

9 - Evaluating measured value blocks, display groups 10...29 -Ignition-

9.1 - Evaluating measured value blocks, display groups 10...29 -Ignition-

Display group 10 -Ignition-

- Engine running at idling speed

Read measured value block 10 ⇒ ◂ Indicated on display

xxxx rpm 1	xxx % 2	x.x % 3	xx.x°BTDC 4 ◂ Display zones	Specification	Evaluation
			Ignition timing	0...15 ° BTDC	---
			Throttle valve angle (potentiometer 1 -G187)	0.9...5.6 %	=> Page 43
			Engine load	15...35 %	=> Page 43
			Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 3:

Display values must be approx. 100 % when accelerator pedal is fully depressed.

Evaluating display group 10, display zone 2 - Engine load

Appears on display	Possible fault cause	Fault elimination
Less than 15 %	- Lesser values can only occur when driving in overrun - Unmetered air	 - Check intake system for leaks => Page 95
More than 35 %	- Rough idling (not running on all cylinders) - Electric consumers switched on - Steering wheel at full lock - Gear selected (automatic gearbox) - Air mass meter defective	- Injectors or spark plugs defective - Switch off electric consumers - Set steering wheel to centre position - Place selector lever in P or N - Check air mass meter => Page 95

Evaluating display group 10, display zone 3 - Throttle valve angle

Appears on display	Possible fault cause	Fault elimination
More than 5.6 %	- Engine control unit not adapted to throttle valve control part - Throttle valve potentiometer in throttle valve control part defective - Throttle valve sticking	- Adapt engine control unit to throttle valve control part => Page 139 - Check throttle valve control part => Page 100 - Eliminate cause

Evaluating display group 12, display zones 3 and 4 -position of camshaft in relation to crankshaft

Display group 12 -Ignition- Position of camshaft in respect to crankshaft

▪ Engine running at idling speed

Read measured value block 12 ⇒ ◂ Indicated on display

xxxx rpm	xxx %	xx	xx	◂ Display zones	Specification	Evaluation
1	2	3	4	No. of tooth on sender wheel mounted on crankshaft when camshaft goes from high to low	86...90	---
				No. of tooth on crankshaft mounted sender wheel when camshaft changes from low to high	26...30	---
				Engine load	15...35 %	=> Page 43
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Notes on display zones 3 and 4:

- The engine speed sender on the crankshaft transmits both an engine speed signal and a reference mark signal. The reference mark signal is generated by a gap in the sender wheel.
- The Hall sender rotor ring on the camshaft has a 180°division so that for one half of each camshaft revolution it covers the window on the Hall sender and for the other half-revolution the window is exposed.
- Continued on next page

Notes continued:

- To synchronise the components when starting, the instant when the rotor moves into the magnetic window air gap (signal change from - to +) or when it leaves the air gap (signal change from + to -) is recorded.
- When the reference mark signal on the crankshaft is detected, the engine control unit counts the number of teeth on the crankshaft mounted sender wheel. As soon as it has counted between 26...30 teeth after the gap, the signal sent by the Hall sender on the camshaft should change from - to + (rotor begins to move into air gap of the magnetic window). After between 86...90 teeth, with the camshaft already making its second

revolution, the Hall sender signal should change from + to - (rotor begins to leave air gap of the magnetic window).

- If the signal does not change within the tooth range as described above, this can indicate that the toothed belt has jumped off the correct settings. Check timing; Repair group 15.

Display group 14 -Ignition- Misfire recognition						
▪ Engine running at idling speed						
Read measured value block 14			⇒	◂ Indicated on display		
xxxx rpm	xxx %	xxx	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Misfire detection (active, blocked)	active	---
				Misfire total	0	=> Page 44
				Engine load	15...35 %	=> Page 43
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 3:

Total number of misfire since engine was started are displayed.

Evaluating display group 14, display zone 3 - Total number of misfires

Appears on display	Possible fault cause	Fault elimination
More than specification	- Spark plug defective - Spark plug connector defective - Ignition transformer defective	- Check spark plugs and ignition/HT wiring with connector => Page 157
	- Injector defective	- Check injectors=> Page 108
	- Unmetered air	- Check intake system for leaks=> Page 116

Display group 15 -Ignition- Misfire recognition Cyl. 1 to Cyl. 3						
▪ Whilst driving						
Read measured value block 15			⇒	◂ Indicated on display		
xxx	xxx	xxx	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Misfire recognition (activated, blocked)	activated	---
				Misfire Cyl. 3	0	=> Page 45
				Misfire Cyl. 2	0	=> Page 45
				Misfire Cyl. 1	0	=> Page 45

Display group 16 -Ignition- misfire recognition Cyl. 4						
▪ Whilst driving						
Read measured value block 16			⇒	◂ Indicated on display		
xxx	---	---	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Misfire recognition (activated, blocked)	activated	---

Misfire Cyl. 4	0	=> Page 45

Evaluating display group 15 display zones 1 to 3 or display group 16 display zone 1 - Misfire recognition Cyl. 1 to Cyl. 4

Appears on display	Possible fault cause	Fault elimination
More than specification	- Spark plug defective - Spark plug connector defective - Ignition transformer defective	- Check spark plugs and ignition/HT wiring with connector => Page 157
	- Injector defective	- Check injectors=> Page 108
	- Unmetered air	- Check intake system for leaks=> Page 116

Display group 20 -Ignition- Knock control Cyl. 1 to Cyl. 4

▪ Whilst driving

Read measured value block 20 ⇒ ◂ Indicated on display

xx.x °CA	xx.x °CA	xx.x °CA	xx.x °CA	◂ Display zones	Specification	Evaluation
1	2	3	4	Cyl. No. 4 retardation of ignition by knock control	0.0...12.0 °CA	=> Page 46
				Cyl. No. 3 retardation of ignition by knock control	0.0...12.0 °CA	=> Page 46
				Cyl. No. 2 retardation of ignition by knock control	0.0...12.0 °CA	=> Page 46
				Cyl. No. 1 retardation of ignition by knock control	0.0...12.0 °CA	=> Page 46

Note on display zones 1 to 4:

Display value should be 0.0 °CA at idling speed.

Display group 22 -Ignition- Knock control

▪ Whilst driving

Read measured value block 22 ⇒ ◂ Indicated on display

xxxx rpm	x.x %	xx.x °CA	xx.x °CA	◂ Display zones	Specification	Evaluation
1	2	3	4	Cyl. No. 2: retardation of ignition timing by knock control	0...12 °CA	=>Page 46
				Cyl. No. 1: retardation of ignition timing by knock control	0...12 °CA	=>Page 46
				Engine load	0...100 %	---
				Engine speed	740...6500 rpm	---

Display group 23 -Ignition- Knock control

▪ Whilst driving

Read measured value block 23 ⇒ ◂ Indicated on display

xxxx rpm	x.x %	xx.x °CA	xx.x °CA	◂ Display zones	Specification	Evaluation
1	2	3	4	Cyl. No. 4: retardation of ignition timing by knock control	0...12 °CA	=>Page 46
				Cyl. No. 3: retardation of ignition timing by knock control	0...12 °CA	=>Page 46
				Engine load	0...100 %	---

Engine speed	740...6500 rpm	---

Evaluating display groups 22/23, display zones 3 and 4 - Retardation of ignition

Appears on display	Possible fault cause	Fault elimination
All cylinders 12 °CA	- Knock sensor defective	- Check knock sensors => Page 160
	- Connector corroded	
	- Knock sensor incorrectly tightened	- Loosen knock sensor and tighten to 20 Nm
	- Ancillary components on engine loose	- Tighten ancillary components
	- Poor fuel quality	- Change type of fuel
One cylinder deviates greatly from the others	- Connector corroded	- Check knock sensors => Page 160
	- Engine damaged	- Check compression pressures: => Repair group 15; Removing and installing cylinder head; Checking compression pressure Checking compression pressure
	- Ancillary components on engine loose	- Tighten ancillary components

Display group 28 -Ignition- Knock sensor test

- Control unit in mode 04-Basic setting
- Whilst driving

Read measured value block 28 ⇒ ◂ Indicated on display

xxxx rpm	x.xx %	xxx.x °C	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Knock sensor test (test on, test off, syst.OK, syst.n.OK)	Syst.OK	---
				Coolant temperature	80...110 °C	=> Page 41
				Engine load	40.0...100.0 %	---
				Engine speed	2500...6500 rpm	---

10 - Evaluating measured value blocks, display groups 30...49, 99 -Lambda regulation-

10.1 - Evaluating measured value blocks, display groups 30...49, 99 -Lambda regulation-

Display group 30 -Lambda regulation-

- Engine running at idling speed

Read measured value block 30 ⇒ ◂ Indicated on display

xxx	xxx			◂ Display zones	Specification	Evaluation
1	2	3	4			
		Lambda regulation status after catalyst			110	=> Page 47

Lambda regulation status before catalyst	111	=> Page 47

Notes on display zones 1 and 2:

- The Lambda probe heating may be switched on or off depending on the operating condition of the engine, i.e. the 1st position in display zones 1 or 2 may show 1 or 0.

  The 3rd position in display zone 2 is not set to 1 until in part throttle range.

Significance of figures in 3-digit number block, display zones 1 and 2 - status of Lambda regulation before and after catalyst

Significance if display = 1			
1	2	3	
		1	Lambda regulation active
	1		Lambda probe operationally ready
1			Lambda probe heating on

Display group 31 -Lambda probe voltage-

- Engine running at idling speed

Read measured value block 31 ⇒ ◂ Indicated on display

x.xx V x.xx V

1	2	3	4	◂ Display zones	Specification	Evaluation
				Lambda probe voltage after catalyst	0.0...1.0	---
				Lambda probe voltage before catalyst	0.0...1.0	---

Notes on display zone 1 and 3:

- The voltage signal "rich mixture (low level of residual oxygen)" is approx. 0.7...1.0 V.
- The voltage signal "lean mixture (high level of residual oxygen)" is approx. 0.0...0.3 V.
- When changing from "rich" to "lean" and back again (λ = 1.0) the voltage jump will change from 0.7...1.0 V to 0.0...0.3 V or back again.
- Due to the steep voltage jumps the Lambda control cannot keep the ideal mixture composition λ = 1.0 constant. The control fluctuates constantly between conditions "slightly too lean" and "slightly too rich".

Display group 32 -Lambda regulation- Lambda learnt values

- Engine running at idling speed

Read measured value block 32 ⇒ ◂ Indicated on display

xx.x % xx.x %

1	2	3	4	◂ Display zones	Specification	Evaluation
				Lambda learnt value at part load (multiplicative)	-10.0...10.0 %	=> Page 48
				Lambda learnt value at idling speed (additive)	-10.0...10.0 %	=> Page 48

Notes on display zones 1 and 2:

Low values indicate that the engine is running too rich and therefore the Lambda regulation is leaning the mixture.

- High values indicate that the engine is running too lean and therefore the Lambda regulation enriches the mixture.
- add = additive - The effects of the fault (e.g. unmetered air) will reduce as the engine speed increases. The injection period will be modified by a fixed amount for additive learnt values. This amount is not dependent upon the basic injection period.
- mul = multiplicative - The effects of the fault (e.g. faulty injector) will increase as the engine speed increases. A multiplicative learnt value is a proportional change to the injection period. This change is dependent on the basic injection period.

Evaluating display zone 32, display zones 1 and 2 - Lambda learnt values

Appears on display	Possible fault cause	Fault elimination
Low Lambda learnt values	- Low learnt values at idling but with normal learnt values at part throttle: possible oil dilution (high level of fuel in oil)	- Disappears after motorway drive or oil change
	- Injector leaking	- Check injector =>Page 108
	- Fuel pressure too high	- Check fuel pressure regulator and holding pressure => Page 113
	- Activated charcoal filter solenoid valve 1 permanently open	- Check activated charcoal filter solenoid valve 1 => Page 20 , Final control diagnosis
	- Air mass meter defective	- Check air mass meter => Page 95
	- Lambda probe heating defective or Lambda probe soiled	- Check Lambda probe heating =>Page 88

Appears on display	Possible fault cause	Fault elimination
High Lambda learnt values	- High learnt values at idling speed, not so high learnt values at part throttle: possible unmetered air in area of intake manifold	- Check intake air system for leaks =>Page 116
	- Unmetered air between air mass meter and throttle valve	- Rectify cause
	- Injector blocked	- Check quantity injected rate =>Page 108
	- Display zones 1 and 2 high: air mass meter defective	- Check air mass meter => Page 95
	- Fuel pressure too low	- Check fuel pressure regulator and holding pressure => Page 113
	- Unmetered air at exhaust manifold gasket or cracks in exhaust manifold	

	- Lambda probe heating defective or Lambda probe soiled	- Check Lambda probe heating =>Page 88

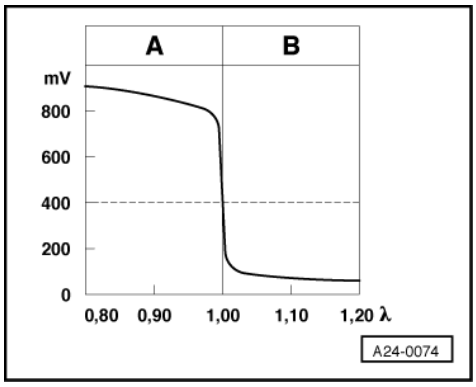
Display group 33 -Lambda regulation- Lambda regulation before catalyst values						
▪ Engine running at idling speed						
Read measured value block 33			⇒	◂ Indicated on display		
xx.x %	x.xx V					
1	2	3	4	◂ Display zones	Specification	Evaluation
		Lambda probe voltage, Lambda probe before catalyst			0.00...1.00 V	=> Page 50
	Lambda regulator before catalyst				-10.0...10.0 %	=> Page 50

Notes on display zone 1:

- The display must fluctuate around 0. If constant 0 is displayed, the Lambda regulation has switched from regulation to control, because there is a fault in the Lambda regulation. Interrogate fault memory => Page 8 .

Notes on display zone 2:

- The voltage signal "rich mixture (low level of residual oxygen)" is approx. 0.7...1.0 V.
- The voltage signal "lean mixture (high level of residual oxygen)" is approx. 0.0...0.3 V.
- When changing from "rich" to "lean" and back again (λ = 1.0) the voltage jump will change from 0.7...1.0 V to 0.0...0.3 V or back again.
- Due to the steep voltage jumps the Lambda control cannot keep the ideal mixture composition λ = 1.0 constant. The control fluctuates constantly between conditions "slightly too lean" and "slightly too rich".



-> Lambda probe voltage Uλ in mV

A: High Lambda probe voltage

- Rich mixture (excess of fuel or shortage of air)
- Higher CO value

B: Low Lambda probe voltage

- Lean mixture (shortage of fuel or excess air)
- Lower CO value

Evaluating display group 33, display zone 1 - Lambda regulator before catalyst

Appears on display	Possible fault cause	Fault elimination
Outside tolerance range	- Minus range: Mixture too rich, Lambda control weakens mixture - Positive range: Mixture too lean, Lambda control enriches mixture	- Wait 30 seconds until the display has stabilised
	- Unmetered air	- Check intake system for leaks => Page 116
	- Injector defective	- Check injection rate => Page 108
	- Lambda learnt value on limit	- Check Lambda learnt value in display group 32

Evaluating display group 33, display zone 2 - Lambda probe voltage Lambda probe before catalyst

Appears on display	Possible fault cause	Fault elimination
Constant 1.100 V	- Short to positive via: - Lambda probe, probe wiring, earth wiring, engine control unit	- Check Lambda probe wiring => Page 122
Constant between 0.390...0.500 V	- Open circuit via: - Lambda probe, probe wiring, earth wiring, engine control unit	
Constant 0.000 V	- Short to earth via: - Lambda probe, probe wiring, earth wiring, engine control unit	

Display group 34 -Lambda regulation- Lambda probe diagnosis before catalyst (checking ageing)

▪ Control unit in mode 04-Basic setting
- Depress brake pedal
▪ Vehicle stationary, engine runs at increased idling speed

Read measured value block 34 ⇒ ◂ Indicated on display

xxxx rpm	xxx.x °C	x.xx s	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Result of Lambda probe before catalyst age check (test OFF/test ON/B1-P1 OK / B1-P1 n.OK)	B1-P1 OK	---
				Lambda probe before catalyst time period	0.1...5 s	---
				Catalyst temperature	min. 400 °C	---
				Engine speed	approx. 1400 rpm	---

Note on display zone 2:

Value calculated from engine speed and engine load.

Note on display zone 3 and 4:

The cycle duration of the lambda probe indicates the time between two voltage pulses (e.g. rich - lean - rich). It is therefore a means of evaluating lambda probe ageing (i.e. the condition of the lambda probe). If the indicated cycle duration is exceeded, "B1-P1 n. OK" will appear in display zone 4.

Display group 41 -Lambda regulation- Lambda probe heating

▪ Engine running at idling speed

Read measured value block 41 ⇒				◂ Indicated on display		
xxx ω	Text	xxx ω	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Lambda probe heating after catalyst	Htg.bC.ON Htg.aC.OFF	---
				Internal resistance of Lambda probe after catalyst	up to 1000 ω	---
				Lambda probe heating before catalyst	Htg.bC.ON Htg.bC.OFF	---
				Internal resistance of Lambda probe before catalyst	up to 1000ω	---

Notes on display zones 1 and 3:

- This value is temperature dependent. Specifications are for engine at operating temperature.
- When engine is cold 65535 ωis displayed.

Note on display zones 2 and 4:

The Lambda probe heating may be switched ON or OFF depending on the operating conditions of the engine, therefore the display in display zone 2 or 4 may show "Htg.b(a)C.ON" or alternating from "Htg.b(a)C.ON" to Htg.b(a)C.OFF".

Display group 43 -Lambda regulation- Lambda probe after catalyst diagnosis						
▪ Control unit in mode 04-Basic setting ▪ Vehicle stationary, engine runs at increased idling speed						
Read measured value block 43 ⇒				◂ Indicated on display		
xxxx rpm	xxx.x °C	x.xx V	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Check Lambda probe after catalyst (Test ON / test OFF / B1-P2 OK. / B1-P2 n.OK)	B1-P2 OK	---
				Lambda probe voltage, Lambda probe after catalyst	0...1 V	=>Page 51
				Catalyst temperature	min. 400 °C	---
				Engine speed	2200...2800 rpm	---

Note on display group 60:

The Lambda regulation after catalyst is the primary system and is used to guide the Lambda regulation before catalyst. It corrects light rich and lean displacements of the Lambda probe before catalyst by means of map-dependent correction displacements (max. + / - 2.5 %).

Evaluating display group 43, display zone 3 - Lambda probe voltage, Lambda probe after catalyst

Appears on display	Possible fault cause	Fault elimination
Constant 1.100 V	- Short to positive via: - Lambda probe, probe wiring, earth wiring, engine control unit	- Check Lambda probe wiring => Page 126
Constant between 0.390...0.500 V	- Open circuit via: - Lambda probe, probe wiring, earth wiring, engine control unit	
Constant 0.000 V	- Short to earth via: - Lambda probe, probe wiring, earth wiring, engine control unit	

Display group 46 -Lambda regulation- Catalyst diagnosis (conversion test)						
▪ Control unit in mode 04-Basic setting ▪ Vehicle stationary, engine runs at increased idling speed						
Read measured value block 46 ⇒				◂ Indicated on display		
xxxx rpm	xxxx °C	x.xx	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Result of catalyst conversion test (Test OFF/test ON/Cat B1 OK/Cat B1 n.OK)	Cat B1 OK	---
				Measured value of catalyst conversion	---	---
				Catalyst temperature	min. 400 °C	---
				Engine speed	2200...2800 rpm	---

Display group 99 -Lambda regulation- Lambda regulation operating condition						
▪ Engine running at idling speed ▪ Control unit in mode 04-Basic setting, Lambda regulation off ▪ Control unit in mode 08-Read measured value block, Lambda regulation on						
Read measured value block 99 ⇒				◂ Indicated on display		
xxxx rpm	xx.x °C	x.x %	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Lambda regulation operating mode	λ-Reg. OFF or λ-Reg. ON	---
				Lambda regulator before catalyst	-10.0...10.0 %	=> Page 50
				Coolant temperature	80...110 °C	=> Page 41
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Notes on display zone 4:

- For a defined fault finding the Lambda regulation is switched off when selecting display group 99 under "Basic setting" or switched on under "Read measured value block".
  When the function 04 "Basic setting" is exited the Lambda regulation is automatically active again.
- It is possible to switch between the function 04 "Basic setting" and the function 08 "Read measured value block" by pressing the keys 4 and 8 on V.A.G 1551/1552.

11 - Evaluating measured value blocks, display groups 50...69 -Speed regulation-

11.1 - Evaluating measured value blocks, display groups 50...69 -Speed regulation-

Display group 50 -Speed regulation- Idling speed boost						
▪ Engine running at idling speed						
Read measured value block 50 ⇒				◂ Indicated on display		
xxxx rpm	xxxx rpm	Text	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Air conditioner compressor operating mode ON/OFF	Compr. ON or Compr. OFF	---
				Not relevant	On or off	---
				Engine speed (specified idling speed)	HS approx. 770 rpm AT approx. 830 rpm	---

Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 2:

The specified engine speed from the engine control unit is displayed (control unit internal, temperature dependent calculated value).

HS = Manual gearbox; AT = Automatic gearbox

Notes on display zone 4:

- "Compr. OFF" is always displayed on vehicles without air conditioner.
- Checking signal from and to air conditioning compressor =>Page 145

Display group 51 -RPM- Gear shift intervention

- Engine running at idling speed

Read measured value block 51 ⇒

xxxx rpm xxxx rpm x xx.x V

1 2 3 4

◂ Indicated on display

◂ Display zones	Specification	Evaluation
Engine control unit voltage supply	11.5...14.5 V	=>Page 40
Driving range (automatic only)	0...6	---
Engine speed (specified idling speed)	HS approx. 770 rpm AT approx. 830 rpm	---
Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 2:

The specified engine speed from the engine control unit is displayed (control unit internal, temperature dependent calculated value).

HS = Manual gearbox; AT = Automatic gearbox

Notes on display zone 4:

If the supply voltage for the engine control unit drops below 9...10.5 Volt the idling speed is raised in stages to 1200 rpm.

Display group 53 -Increased revolutions due to alternator loading

- Engine running at idling speed

Read measured value block 53 ⇒

xxxx rpm xxxx rpm V xx.x V

1 2 3 4

◂ Indicated on display

◂ Display zones	Specification	Evaluation
Alternator load	0...100 %	---
Voltage	11.5...14.5 V	---
Engine speed (specified idling speed)	HS approx. 770 rpm AT approx. 830 rpm	---
Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 2:

The specified engine speed from the engine control unit is displayed (control unit internal, temperature dependent calculated value).

HS = Manual gearbox; AT = Automatic gearbox

Notes on display zone 4:

Idling speed adapted according to alternator loading.

Display group 54 -Speed regulation-						
▪ Whilst driving						
Read measured value block 54			⇒	◂ Indicated on display		
xxxx rpm	Text	xxx %	xxx %			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Throttle valve angle (potentiometer 1 - G187)	0...100 %	---
				Accelerator pedal position sender 1 -G79	6...96%	---
				Operating mode (idling, part load, enrichment, overrun, full load)	---	---
				Engine speed	740...6500 rpm	---

Display group 55 -Speed regulation- Idling stabilisation						
▪ Engine running at idling speed						
Read measured value block 55			⇒	◂ Indicated on display		
xxxx rpm	xx.xx %	xx.xx %	xxxxx			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Operating condition	xxxxx	=> Page 54
				Idling stabilisation learning value	-10...10 %	---
				Idling speed regulator	-30.0...30.0 %	---
				Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 3:

Displayed is the amount that the idling speed stabilisation has moved away from the prescribed average. For a new engine the values lie in the positive range, because of the higher friction and in the negative range with an engine that has run-in.

Significance of figures in 5-digit number block, display zone 4 - operating modes

Significance if display = 1					
1	2	3	4	5	Significance
				1	Air conditioner compressor switched on
			1		Driving range (gear) selected (automatic gearbox only)
		x			Not relevant
	x				Not relevant
x					Not relevant

Display group 56 -Speed regulation- Idling speed stabilisation						
▪ Engine running at idling speed						
Read measured value block 56			⇒	◂ Indicated on display		
xxxx rpm	xxxx rpm	xx %	xxxxx			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Operating mode	xxxxx	=> Page 54
				Idling speed regulator	-30.0...30.0 %	---

	Engine speed (specified idling speed)	HS approx. 770 rpm AT approx. 830 rpm	---
Engine speed (idling speed)		740...860 rpm	=> Page 38

Note on display zone 2:

The specified engine speed from the engine control unit is displayed (control unit internal, temperature dependent calculated value).

HS = Manual gearbox; AT = Automatic gearbox

Display group 60 -Speed regulation- Adaption EPC system 1)

- Ignition on, engine not running
- Control unit in mode 04 basic setting

Read measured value block 60 ⇒ ◂ Indicated on display

xx %	xx %	x	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Adaption condition (ADP runs, ADP OK or ADP ERROR)	ADP OK	---
				Learning step counter	0...8	---
				Throttle valve angle (potentiometer 2 -G188)	97...3 %	---
				Throttle valve angle (potentiometer 1 -G187)	3...97 %	---

1) Erasing learnt values and adapting engine control unit to throttle valve control part => Page 139 .

Note on display group 60:

- The throttle valve control unit potentiometers are opposed. The value from both potentiometers must always add up to approx. 100 %.
- Matching the throttle valve control part is performed with ignition switched on.
- Engine control unit is adapted to throttle valve control unit when selecting function 04 "Basic setting" in display group 60. This adaption must always be carried out when erasing learnt values or when another throttle valve control part (or another complete engine) or another engine control unit is fitted.
- The specifications indicated in display zones 1 and 2 do not fully reach the max. min. figures.
- During adaption, the counter in display zone 3 counts up to 8.

Display group 61 -Speed regulation- Electronic accelerator system

- Whilst driving

Read measured value block 61 ⇒ ◂ Indicated on display

xxxx rpm	xx.xxx V	xxx %	xxxxx	◂ Display zones	Specification	Evaluation
1	2	3	4	Operating mode	xxxxx	=> Page 54
				Throttle valve drive -G186 activation	0...100 %	---
				Voltage supply for engine control unit	11.5...14.5 V	=> Page 40
				Engine speed	740...6500 rpm	---

Display group 62 -Speed regulation- Electronic accelerator system

- Ignition on, engine not running

Read measured value block 62 ⇒ ◂ Indicated on display

xx %	xx %	xx %	xx %	◂ Display zones	Specification	Evaluation
1	2	3	4	Accelerator pedal position sender 2 (G185)	3.0...48.0 %	---
				Accelerator pedal position sender 1 (G79)	6.0...96.0 %	---

	Throttle valve angle (potentiometer 2 -G188)	97...3 %	---
	Throttle valve angle (potentiometer 1 -G187)	3...97 %	---

Notes on display group 62:

- The potentiometer for the throttle valve control part and the accelerator pedal sender are featured in pairs for reasons of safety. The engine control unit constantly checks the plausibility of the potentiometers.
- The throttle valve control unit potentiometers are opposed. The value from both potentiometers must always add up to approx. 100 %.
- The value from accelerator pedal position 2 (G185) has to display half the value of sender 1 at all times.
- The specifications do not fully reach the max. min. figures.

Vehicles with automatic gearboxes

Display group 63 -Speed regulation- Kick down adaption						
▪ Ignition on, engine not running						
▪ Control unit in mode 04 basic setting						
▪ Accelerator pedal fully depressed						
Read measured value block 63 ⇒				◂ Indicated on display		
xx %	xx %	Text	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Operating mode (ERROR, actuate, ADP. runs, ADP. OK	ADP. OK	---
				Kick-down switch	Kick-down	---
				Accelerator pedal position sender 2 -G185	---	---
				Accelerator pedal position sender 1 -G79	---	---

Vehicles with cruise control system (CCS)

Display group 66 -Cruise control system						
▪ Engine running at idling speed						
Read measured value block 66 ⇒				◂ Indicated on display		
km/h	xxxxxxxx	km/h	xxxxxxxx			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Switch position of CCS controls switch	xxxxxxxx	=> Page 57
				Specified road speed (last value stored by CCS)	---	---
				Brakes, clutch and CCS switches position	xxxx1xxx	=> Page 56
				Road speed (actual)	0 km/h	---

Significance of the figures in the 8 digit display, display zone 2, brakes, clutch and CCS switches

1	2	3	4	5	6	7	8	Significance
							1	Brake pedal depressed (brake light switch)
						1		Brake pedal depressed (brake pedal switch)
					1			Clutch pedal depressed or always 1 for automatic gearbox
				1				Cruise control system has been authorized
			0					Vacant
		0						Vacant
	0							Vacant

0								Vacant

Notes:

- Checking clutch pedal switch signal => Page 147
- Checking brake light and brake pedal switch signal => Page 148
- Set cruise control system to operational with log-in code 11463; deactivate with log-in code 16167.

Significance of the figures in the 8 digit display, display zone 4, CCS control switches

1	2	3	4	5	6	7	8	Significance
							0	CCS slide switch at OFF (only when in detent)
						0		CCS slide switch at OFF (not in detent or in detent) or when multi-function steering wheel OFF button is depressed
					1			SET button depressed
				1				CCS slide switch at RES or when multi-function steering wheel RES button is depressed
			0					Vacant
		0						Vacant
	0							Vacant
0								Vacant

Notes:

Checking control switches for cruise control system:

=> Electrical system; Repair group 27

Checking multi-function steering wheel:

=> Radio, Telephone, Navigation Self-diagnosis; Repair group 01

Function of cruise control system:

=> Owner's Manual in vehicle

12 - Evaluating measured value blocks, display groups 70...89 -Reducing emissions-

12.1 - Evaluating measured value blocks, display groups 70...89 -Reducing emissions-

Display group 70 -Reducing emissions- Activated charcoal filter system diagnosis (tank breathing system)

- Engine running at idling speed
- Coolant temperature minimum 60 °C (display group 04, display zone 3)
- Control unit in mode 04-Basic settings

Read measured value block 70 ⇒				◂ Indicated on display		
xxx %	xx.x %	xx.x %	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Result of diagnosis (Test ON / OFF or TBV OK / n.OK)	TBV OK	---
				Idling speed regulator deviation during TBV diagnosis	---	---

	Lambda regulation deviation in TBV diagnosis	---	---
	Activated charcoal filter system solenoid valve 1 duty cycle	0...99 %	---

Note:

TBV means fuel tank breathing valve (activated charcoal filter system solenoid valve 1). The diagnosis can only be initiated once per engine start.

Notes on display zone 2:

- Lambda regulator deviation in negative range: Activated charcoal filter full
- Lambda regulator deviation in positive range: Activated charcoal filter empty

Display group 77 -Reducing emissions- Secondary air system diagnosis

- Control unit in mode 04-Basic setting
- Depress brake pedal
- Vehicle stationary, engine runs at increased idling speed

Read measured value block 77 ⇒ ◂ Indicated on display

xxx rpm	xxx.x °C		Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Result of diagnosis (Test ON/ OFF, Syst. OK / n.OK)	Syst. OK	---
				Air mass drawn in	2.5...6.0 g/s	=> Page 39
				Engine speed (idling speed)	Approx. 1400 rpm	=> Page 38

Display group 89 -Trip recorder- Exhaust gas warning lamp lights up

- Engine running at idling speed

Read measured value block 89 ⇒ ◂ Indicated on display

xxxx km	Text			◂ Display zones	Specification	Evaluation
1	2	3	4			
				Condition "tank empty" (OK. / too low)	---	---
				Distance travelled with exhaust warning lamp "MIL" on	---	---

Note:

Significance of exhaust gas warning lamp => Page 2

12.2 - Evaluating measured value blocks, display group 95 -Variable intake manifold-

Display group 95 -variable intake manifold- single stage changeover

- Engine running at idling speed

Read measured value block 95 ⇒ ◂ Indicated on display

xxxx rpm	xx.x %	x.x %	Text	◂ Display zones	Specification	Evaluation
1	2	3	4	Variable intake manifold status	ON or OFF	---
				Coolant temperature	80...110 °C	=> Page 41

	Load	---	---
	Engine speed (idling speed)	740...860 rpm	=> Page 38

Note on display zone 4:

With a powerful burst on the throttle the status must change from OFF to ON.

13 - Evaluating measured value blocks, display group 100 -Readiness code-

13.1 - Evaluating measured value blocks, display group 100 -Readiness code-

Display group 100 -Readiness code-						
▪ Engine running at idling speed						
Read measured value block 100			⇒	◂ Indicated on display		
xxxxxxxx	xxx.x °C	xxxx s	xxxxxxxx			
1	2	3	4	◂ Display zones	Specification	Evaluation
				Diagnosis status	---	---
				Period since last engine start	---	---
				Coolant temperature	80...110 °C	=>Page 41
				Readiness code	00000000	=> Page 59

Significance of 8 digit number block for readiness code

Display of "0" indicates: Diagnosis successfully completed								
1	2	3	4	5	6	7	8	Diagnostic function
							0	Catalyst
						0		Catalyst heating (currently no diagnosis/always "0")
					0			Activated charcoal filter system (tank venting system)
				0				Secondary air system
			0					Air conditioner (currently no diagnosis/always "0")
		0						Lambda probes
	0							Lambda probe heating
0								Exhaust gas recirculation system (not fitted/always "0")

14 - Evaluating measured value blocks, display groups 120...129 -Communication-

14.1 - Evaluating measured value blocks, display groups 120...129 -Communication-

Display group 120 -Traction control -TC-						
▪ Whilst driving						
Read measured value block 120			⇒	◂ Indicated on display		
xxxx rpm	xxx Nm	xxx Nm	Text			
1	2	3	4	◂ Display zones	Specification	Evaluation

			Status	TC active / TC n.active	---
			Actual engine load	0...260 Nm	---
		Specified engine load		0...399 Nm	---
	Engine speed			740...6500 rpm	---

Display group 122 -Gearbox (automatic only)

- Whilst driving

Read measured value block 122 ⇒ ◂ Indicated on display

xxxx rpm	xxx Nm	xxx Nm	Text	◂ Display zones	Specification	Evaluation
1	2	3	4			
				Status	Torque red./ No.tor red.	---
			Actual engine load		0...260 Nm	---
		Specified gearbox torque			0...399 Nm	---
	Engine speed				740...6500 rpm	---

Display group 125 -Communication -data bus messages-

- Engine running at idling speed

Read measured value block 125 ⇒ ◂ Indicated on display

Text	Text	Text	Text	◂ Display zones	Specification	Evaluation
1	2	3	4			
				Air conditioner status	AC 1	---
			Combi-instrument status		Combi 1	---
		Anti-locking system status			ABS 1	---
	Gearbox status				G/box 1	---

Note on display group 125:

Specification = 1; Control units with active data bus are displayed.

Display group 126 -Communication -data bus messages-

- Engine running at idling speed

Read measured value block 126 ⇒ ◂ Indicated on display

Text						
1	2	3	4	◂ Display zones	Specification	Evaluation
			Airbag system status		Airbag 1	---

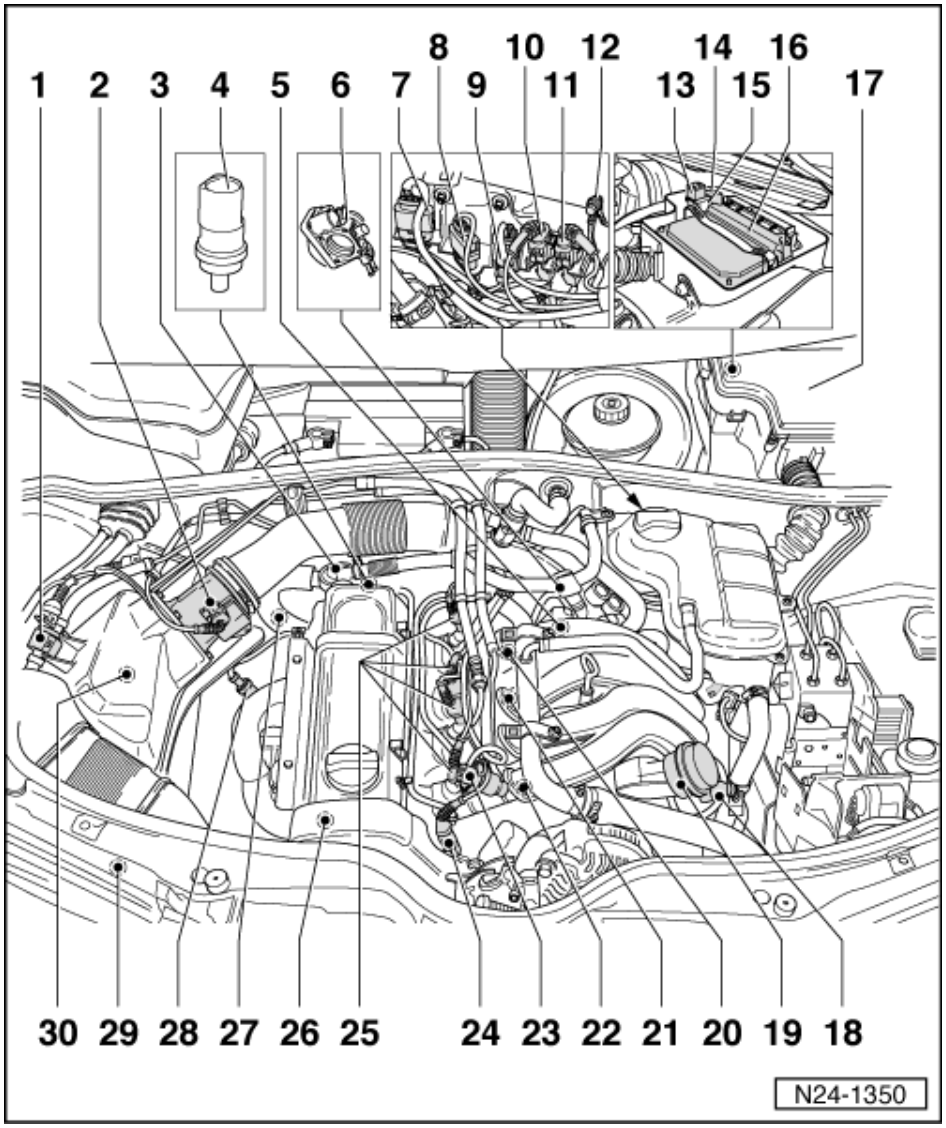
Note on display group 126:

Specification = 1; Control units with active data bus are displayed.

24 - Mixture preparation, Injection

1 - Servicing injection system

1.1 - Servicing injection system



1.2 - Fitting locations overview

Components A, B and C are not shown in the illustration.

A - Brake pedal switch (F47)* or brake light switch (F)*

- Together in one housing, in footwell
- Checking signal => Page 148

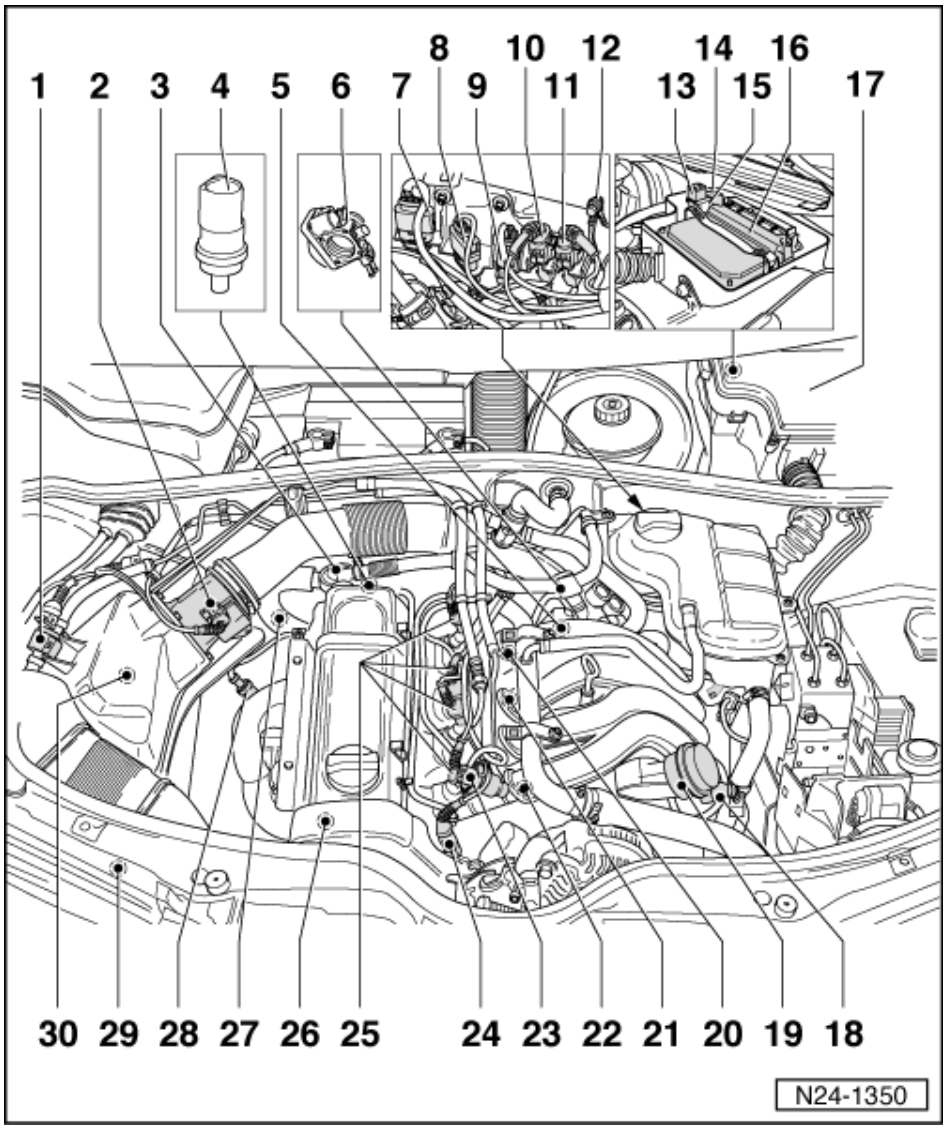
B - Accelerator pedal position sender (G79 and G185)*

- In footwell on accelerator pedal:

=> Repair group 20; Removing and installing parts of fuel supply system; Servicing electronic power control (EPC) Removing and installing parts of fuel supply system Servicing electronic power control (EPC)

C - Clutch pedal switch (F36)

- In footwell
- Checking signal => Page 147



1 Activated charcoal filter solenoid valve 1 (N80)*/**

- On air cleaner
- Activated charcoal filter system

=> Repair group 20; Removing and installing parts of the fuel supply system; Servicing parts of the activated charcoal filter system Removing and installing parts of the fuel supply system Servicing parts of the activated charcoal filter system

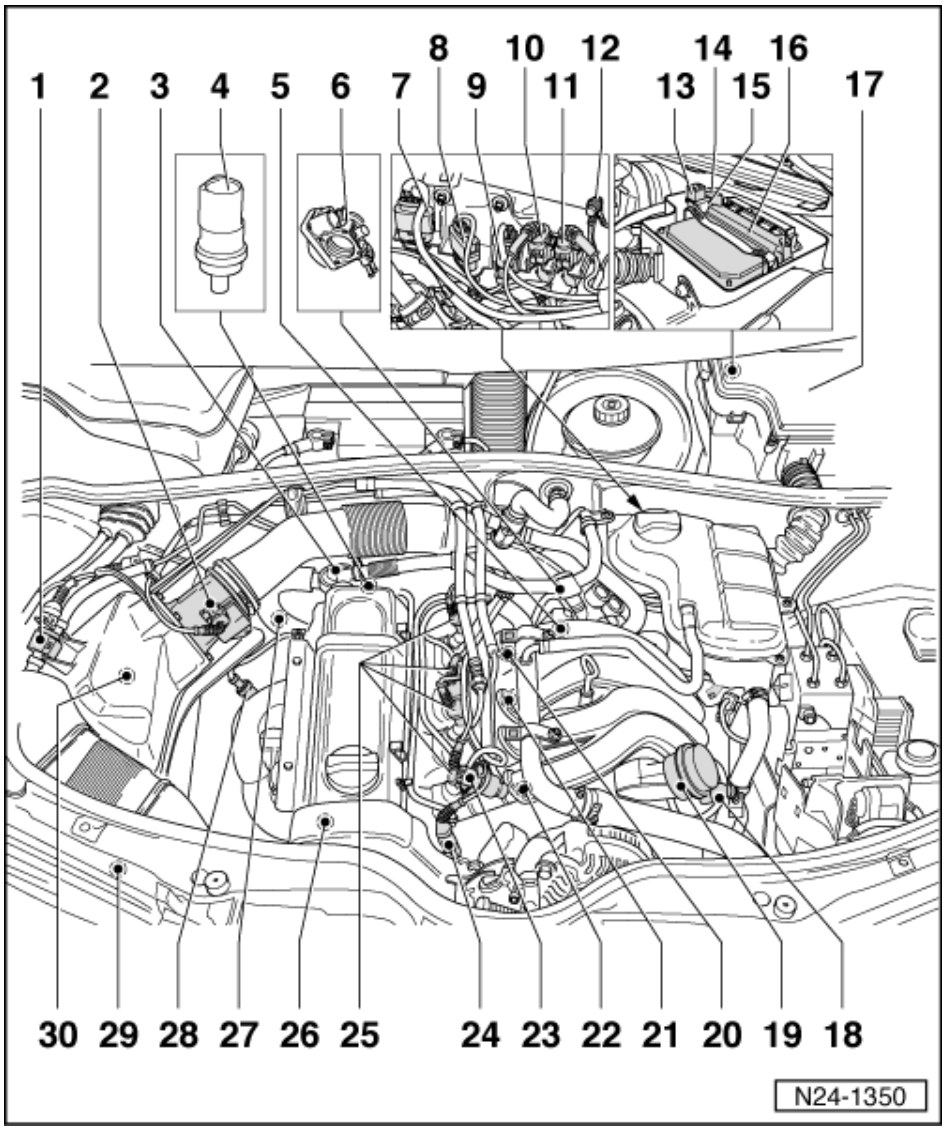
2 Air mass meter (G70)* with intake air temperature sender (G42)*

- Sensor and connector contacts are gold-plated
- Checking air mass meter => Page 95
- Checking intake air temperature sender => Page 97

3 Combi-valve

- Secondary air system:

=> 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



4 Coolant temperature sender (G62)*

- Black
- For engine control unit
- With coolant temperature gauge sender (G2)
- Checking =>Page 104
- If necessary release pressure in cooling system before removing

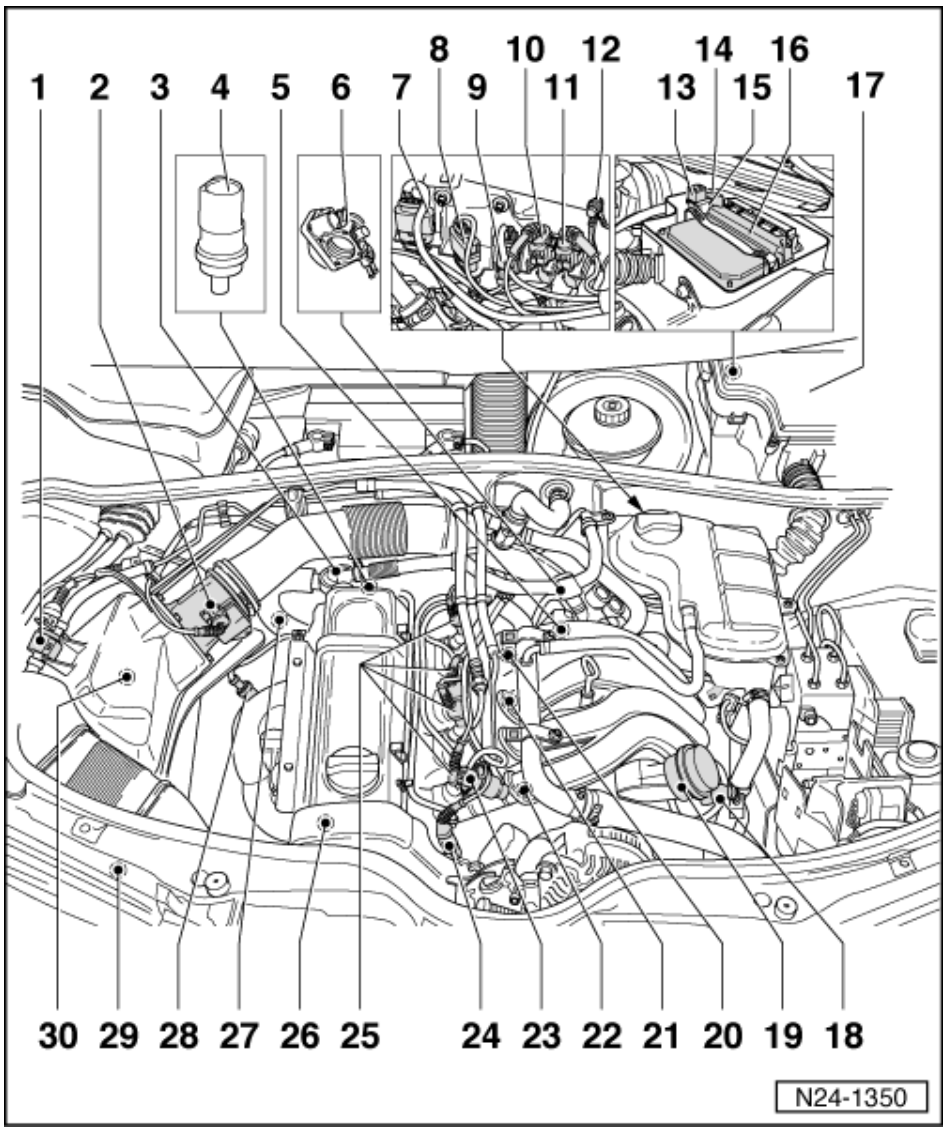
5 Ignition transformer (N152)

- => Page 152 , item 2

6 Throttle valve control part (J338)*

- No cable disc for accelerator cable as this is an electronic accelerator system
- 6-pin connector
- Contacts gold plated
- Tighten to 10 Nm
- Checking => Page 100
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- If replaced adapt control unit for automatic gearbox:

=> Self-diagnosis for automatic gearbox 01N; Repair group 1; Performing self-diagnosis; Initiating basic settings



7 4-pin connector

- Brown
- For Lambda probe after catalyst (G130) and Lambda probe heating (Z29)
- Connector contacts 3 and 4 are gold-plated

8 4-pin connector

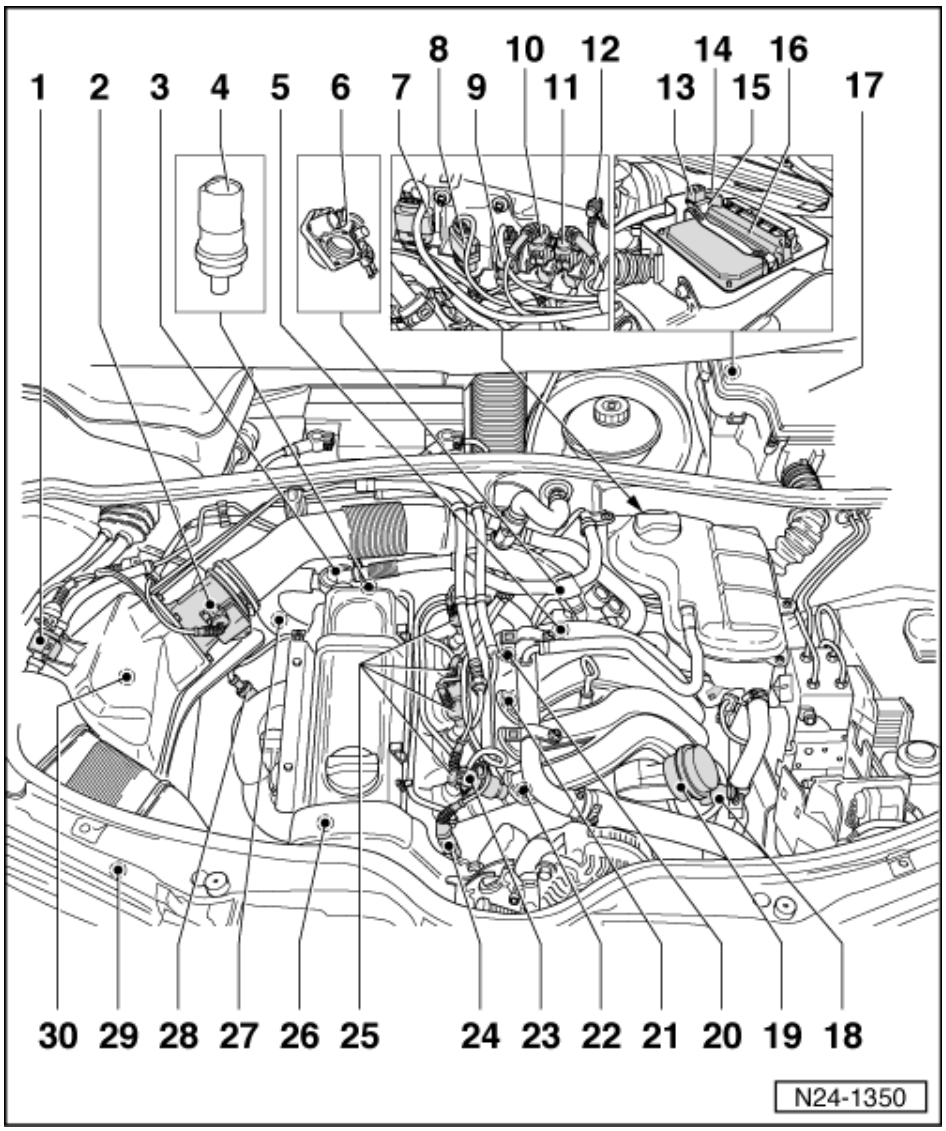
- Black for Lambda probe before catalyst (G39) and Lambda probe heating (Z19)
- Connector contacts 3 and 4 are gold-plated

9 3 pin connector

- Grey
- For engine speed sender (G28)

10 3 pin connector

- Green for knock sensor 1 (G61)
- Contacts gold plated



11 3 pin connector

- Brown, for knock sensor 2 (G66)
- Contacts gold plated

12 Earth connection

13 Secondary air pump motor (J299)*/**

=> 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

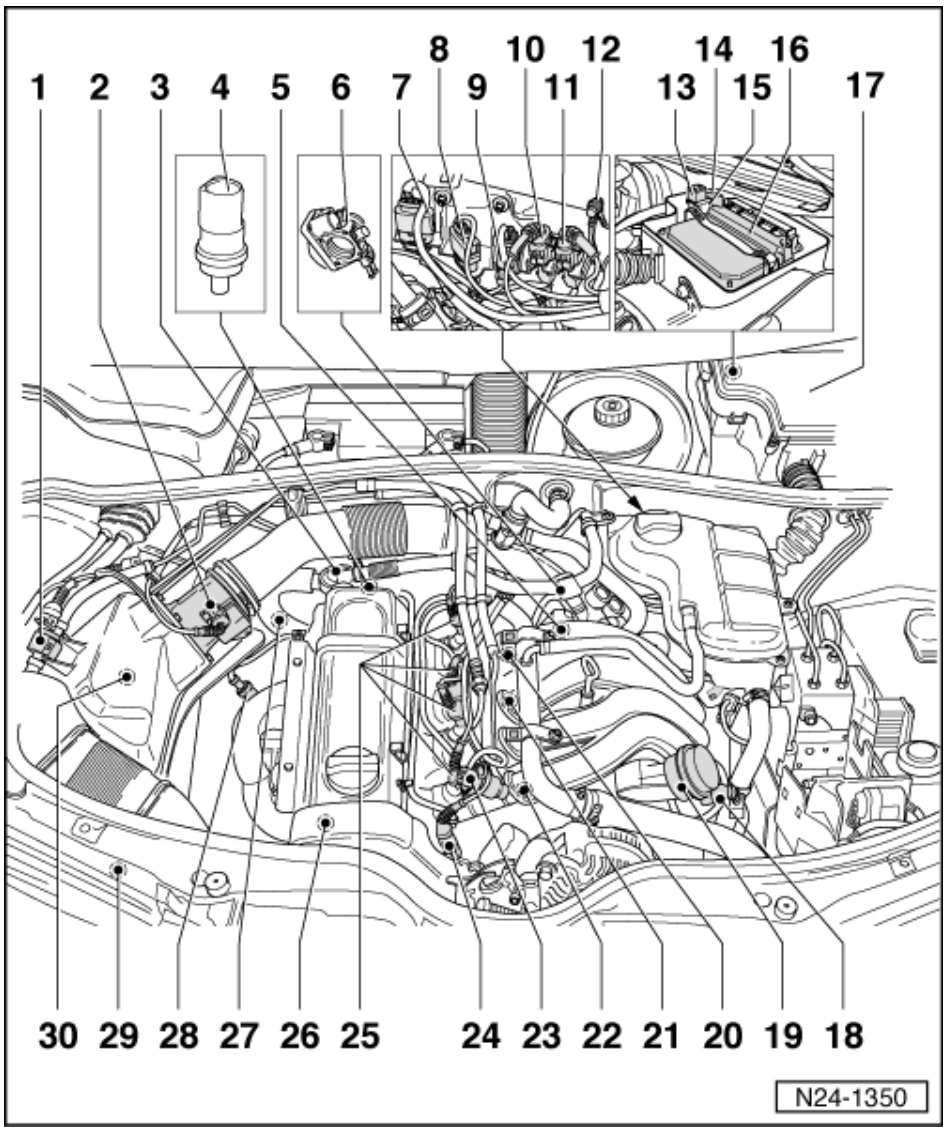
14 Current supply relay for Simos control unit (J363)

15 Fuse for secondary air pump (S130)

16 Engine control unit*

(Control unit for Simos injection and ignition system -J361)

- Checking voltage supply => Page 131
- Renew => Page 131



17 Protective housing

18 Intake manifold change-over valve (N156)*/**

- Checking activation

=> Repair Group 01; Self-diagnosis; Final control diagnosis Self-diagnosis Final control diagnosis

19 Vacuum control element

- Checking intake manifold change-over valve => Page 129

20 Engine speed sender (G28)*

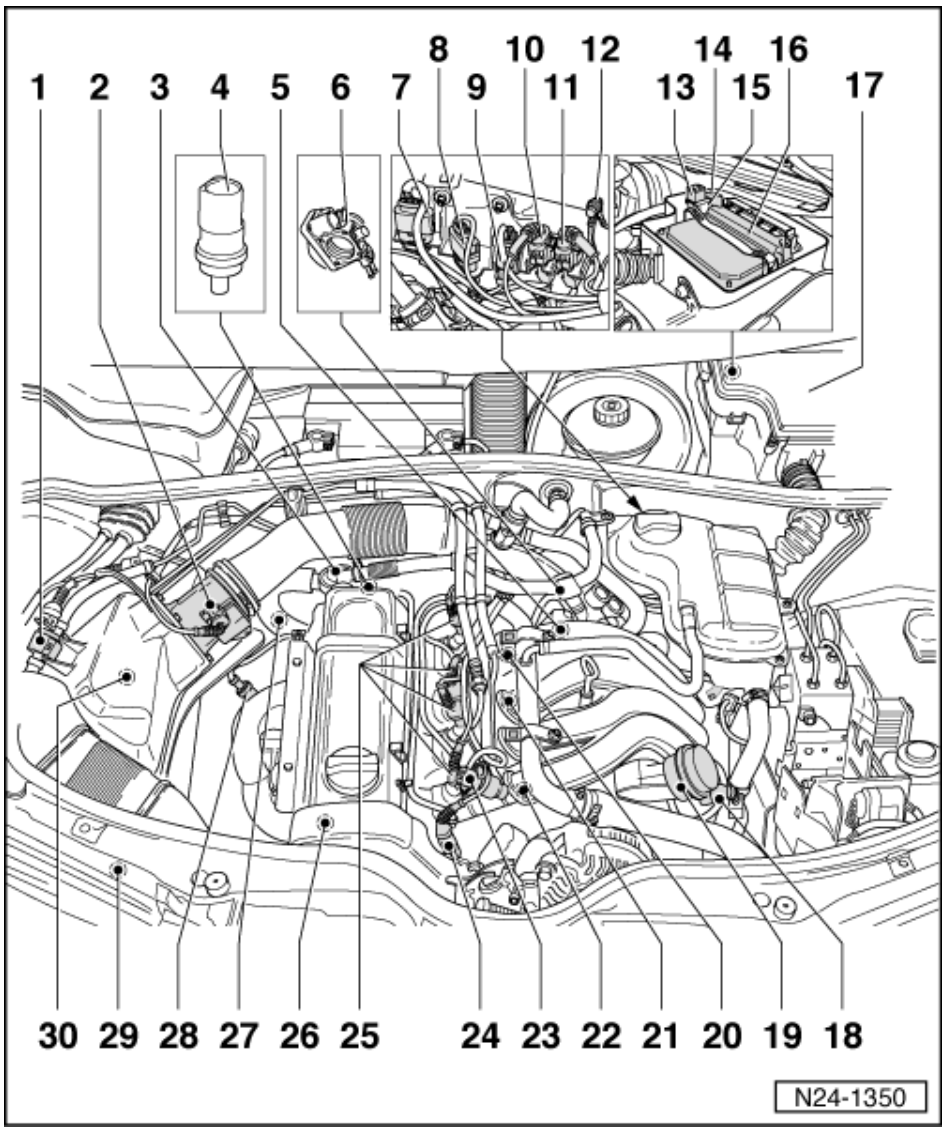
- Checking => Page 107

21 Knock sensor 1 (G61)*

- Contacts gold plated
- Above engine mounting
- Checking => Page 160

22 Knock sensor 2 (G66)*

- Contacts gold plated
- Next to ignition transformer
- Checking => Page 160



23 Fuel pressure regulator

- Checking => Page 113
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139

24 3 pin connector

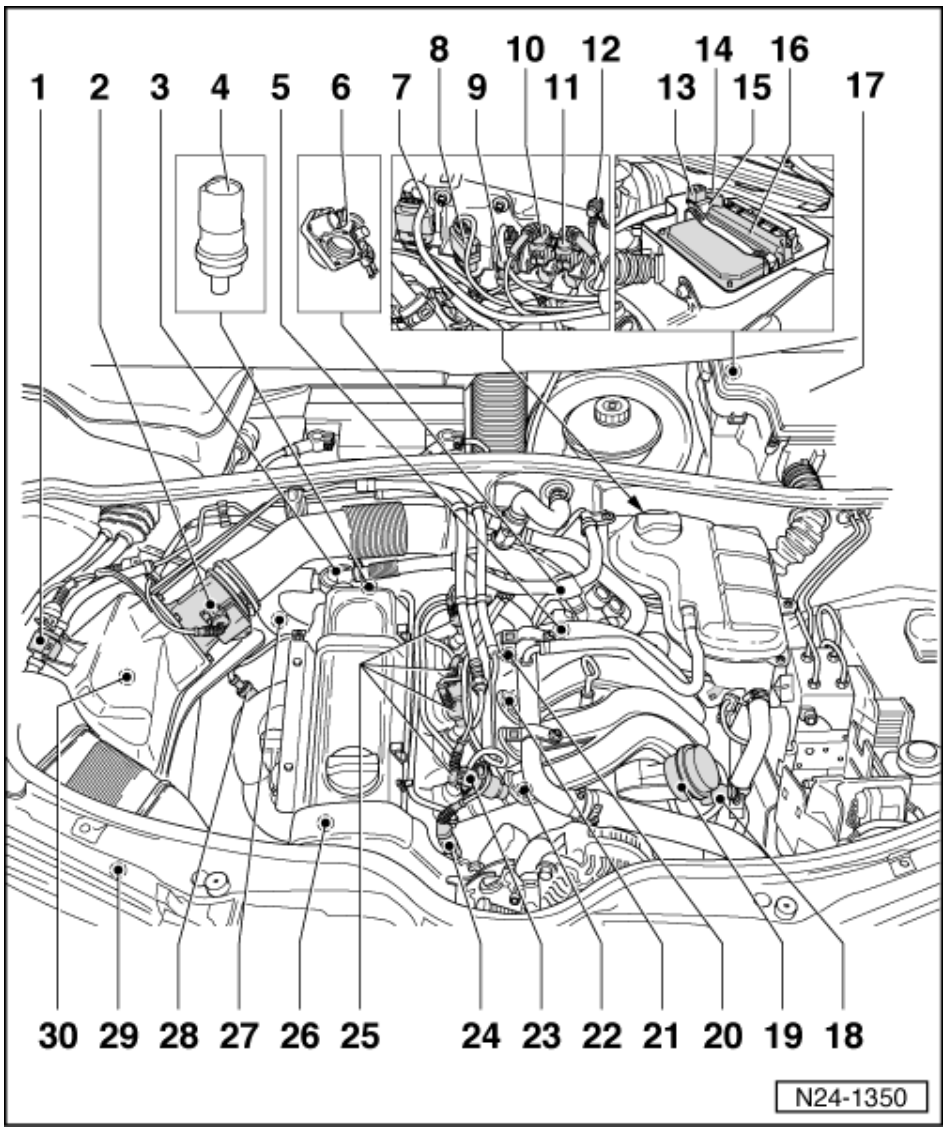
- Black
- For Hall sender (G40)*

25 Injectors (N30...N33)*

- Checking => Page 108
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139

26 Hall sender (G40)*

- Below the upper toothed belt guard
- Checking => Page 156

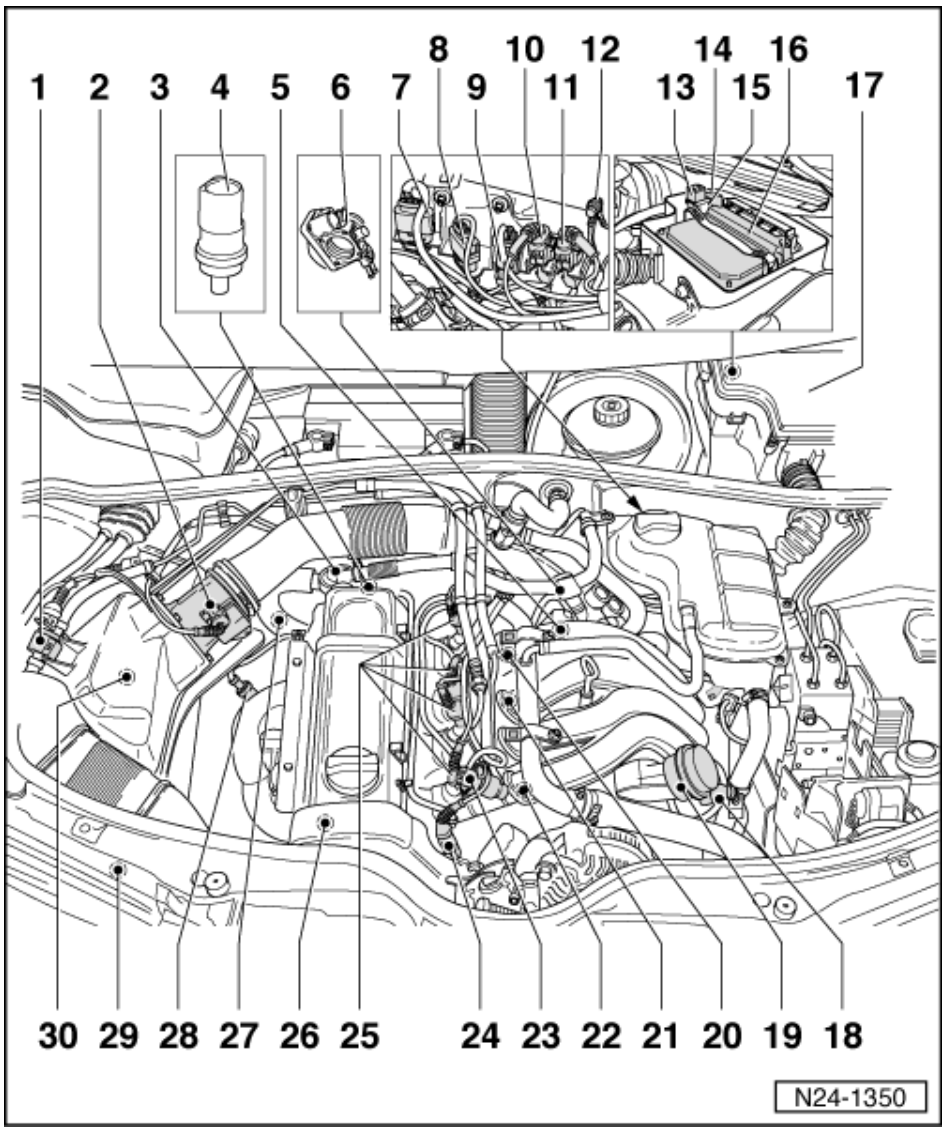


27 Lambda probe after catalyst (G130)*, 50 Nm

- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- Probe heating voltage supply via fuel pump relay (J17)
- Checking Lambda probe heating for Lambda probe after catalyst => Page 92
- Checking Lambda probe and Lambda regulation after catalyst => Page 122

28 Lambda probe before catalyst (G39)*, 50Nm

- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- Probe heating voltage supply via fuel pump relay (J17)
- Checking Lambda probe heating before catalyst => Page 88
- Checking Lambda probe and Lambda regulation before catalyst => Page 118



29 Secondary air pump motor (V101)*

- Secondary air system:

=> 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

30 Air cleaner

- Dismantling and assembling => Page 82

1.3 - General notes on injection

- The engine control unit is equipped with self-diagnosis. Before carrying out repairs and fault finding the fault memory of all control units must be interrogated using the automatic test sequence. This is necessary as various control units are connected to each other via a data bus. The vacuum hoses and connections must also be checked (unmetered air).
- Fuel hoses in engine compartment must only be secured with spring type clips. The use of clamp or screw type clips is not permissible.
- Disconnecting the battery must only be done with the ignition switched off. If the radio is coded, obtain code before disconnecting the battery.
- Components marked with * are checked via the self diagnosis.
- Components marked with **can be checked with the final control diagnosis => Page 20 .
- For trouble-free operation of the electrical components, a voltage of at least 11.5 V is necessary.

- Do not use sealants containing silicone. Particles of silicone drawn into the engine, will not be burnt in the engine and damage the Lambda probe.

- If the engine starts, runs for a short period and then stops, after fault finding, repairs or component tests, then the fault may lie with the immobilizer which is blocking the engine control unit. The fault memory must be interrogated and if necessary the control unit adapted.

=> Electrical system self-diagnosis; Repair group 01

- During some checks it is possible that the control unit will recognise and store a fault. Therefore after completing all checks and repairs the fault memory must be interrogated and if necessary erased.
  => Page 8 , interrogating and erasing fault memory
- Vehicles with an airbag are fitted with a crash/fuel shut-off. It reduces the risk of a vehicle burning in the event of a crash in that the fuel pump is switched off by the fuel pump relay.
- When driver's door is opened, the fuel pump is activated for 2 seconds so that pressure can build-up in the fuel system. Thus a better starting behaviour is obtained.

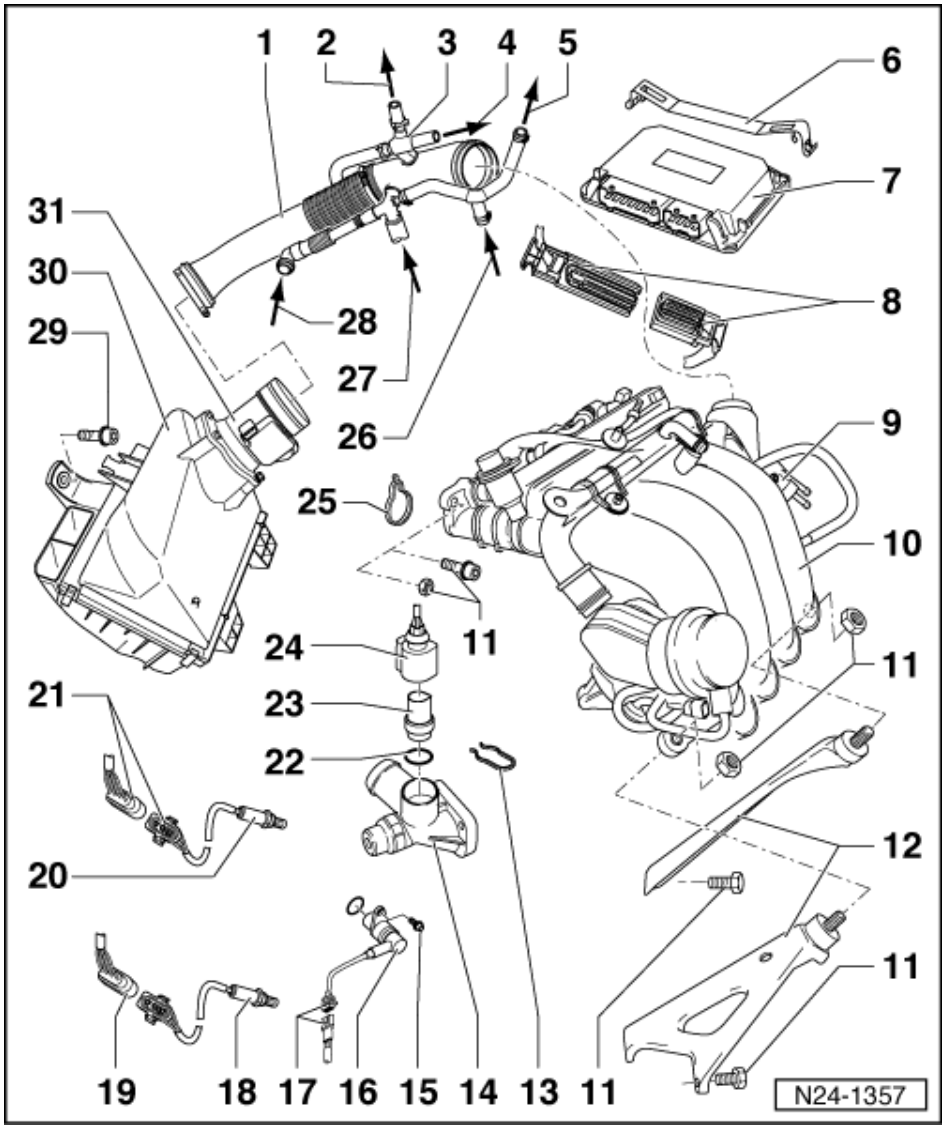
Safety precautions =>Page 87

Rules for cleanliness => Page 88

Technical data => Page 88

Checking intake system for leaks (unmetered air) => Page 116 .

1.4 - Removing and installing parts of the injection system



1 Intake hose
- Dismantling and assembling => Page 84

2 To brake servo

3 Vacuum booster pump

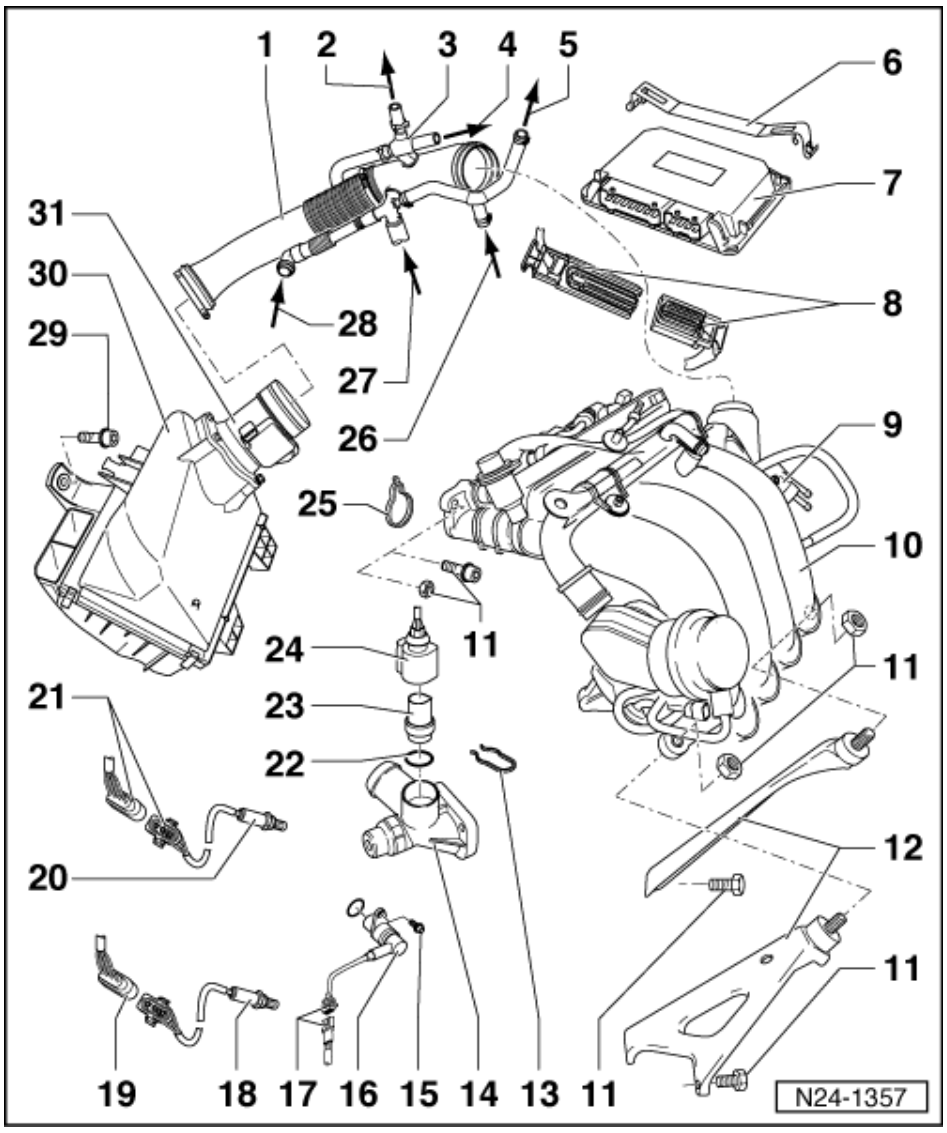
4 To intake manifold

5 To activated charcoal filter solenoid valve (N80)*/**

6 Securing plate
- For engine control unit

7 Engine control unit*

(Control unit for Simos injection and ignition system -J361)
- Fitting location: In protective housing, plenum chamber, left
- Checking voltage supply => Page 131
- Renew => Page 131



8 Connector

- For engine control unit
- 81-pin and 40-pin
- Only disconnect or connect with ignition switched off
- Release to disconnect

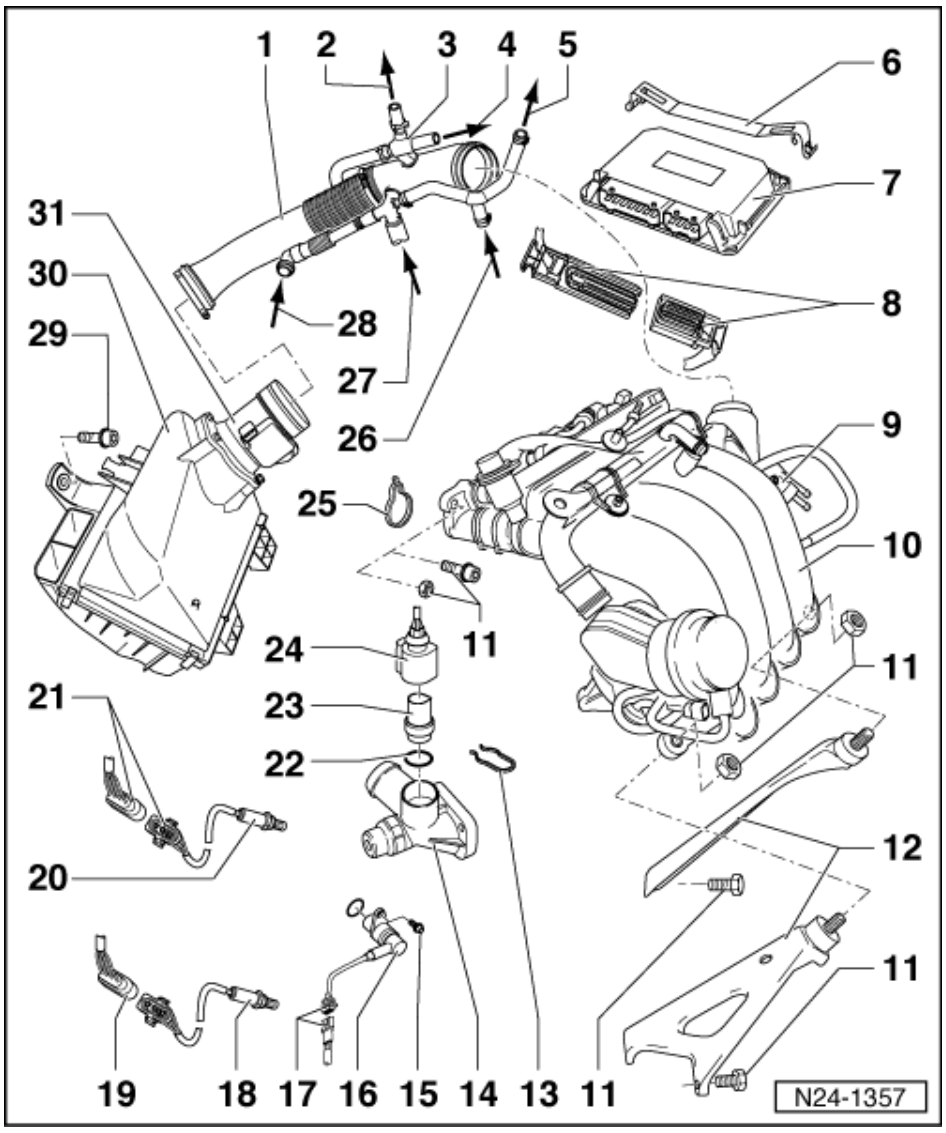
9 Throttle valve control part (J338)*

- 6-pin connector
- Contacts gold plated
- Tighten to 10 Nm
- Checking => Page 100
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- If replaced adapt control unit for automatic gearbox:

=> Self-diagnosis for automatic gearbox 01N; Repair group 1; Performing self-diagnosis; Initiating basic settings

10 Intake manifold

- Dismantling and assembling => Page 78



11 20 Nm

12 Support

- For intake manifold

13 Retaining clip

- Check seated securely

14 Connection

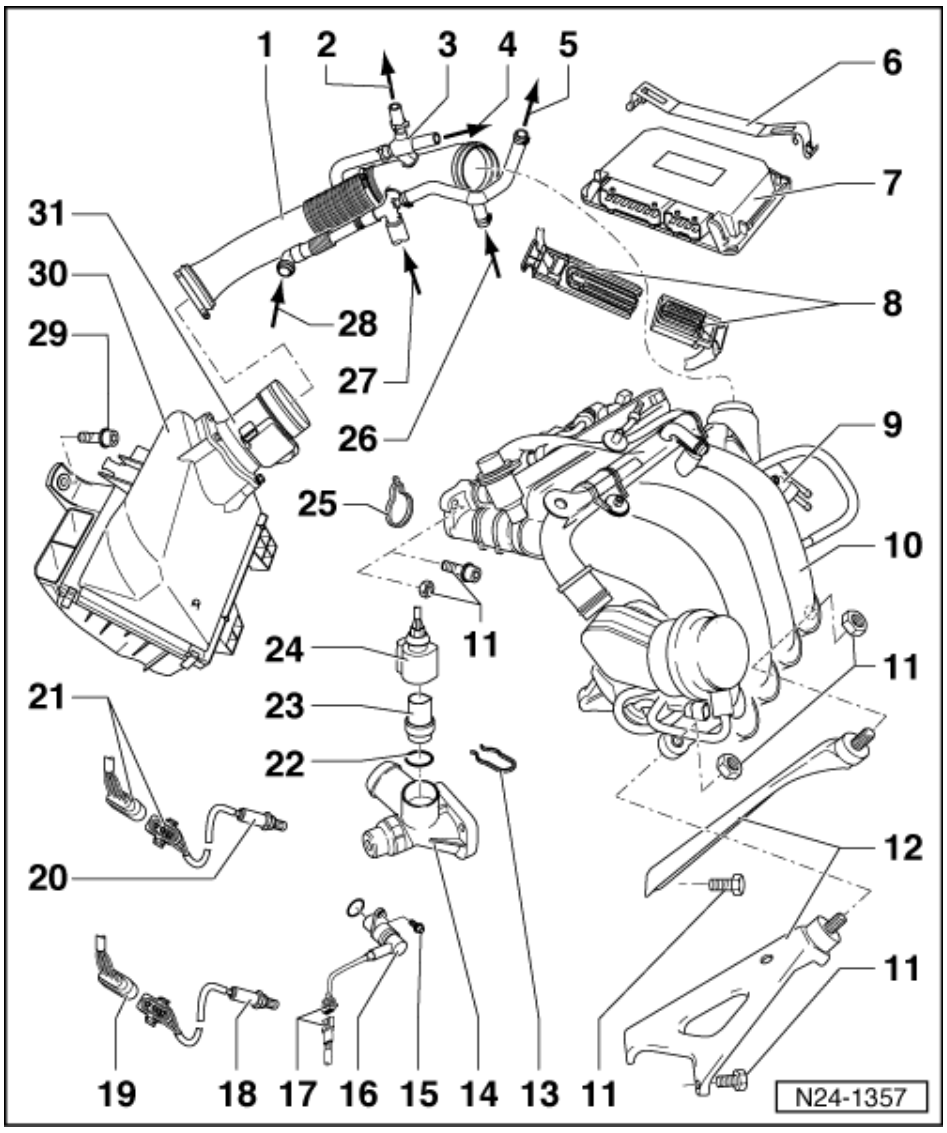
15 10 Nm

16 Engine speed sender (G28)*

- Checking => Page 107

17 3 pin connector

- For engine speed sender
- Grey
- Secured to the bulkhead on left (below expansion tank)
- Contacts gold plated

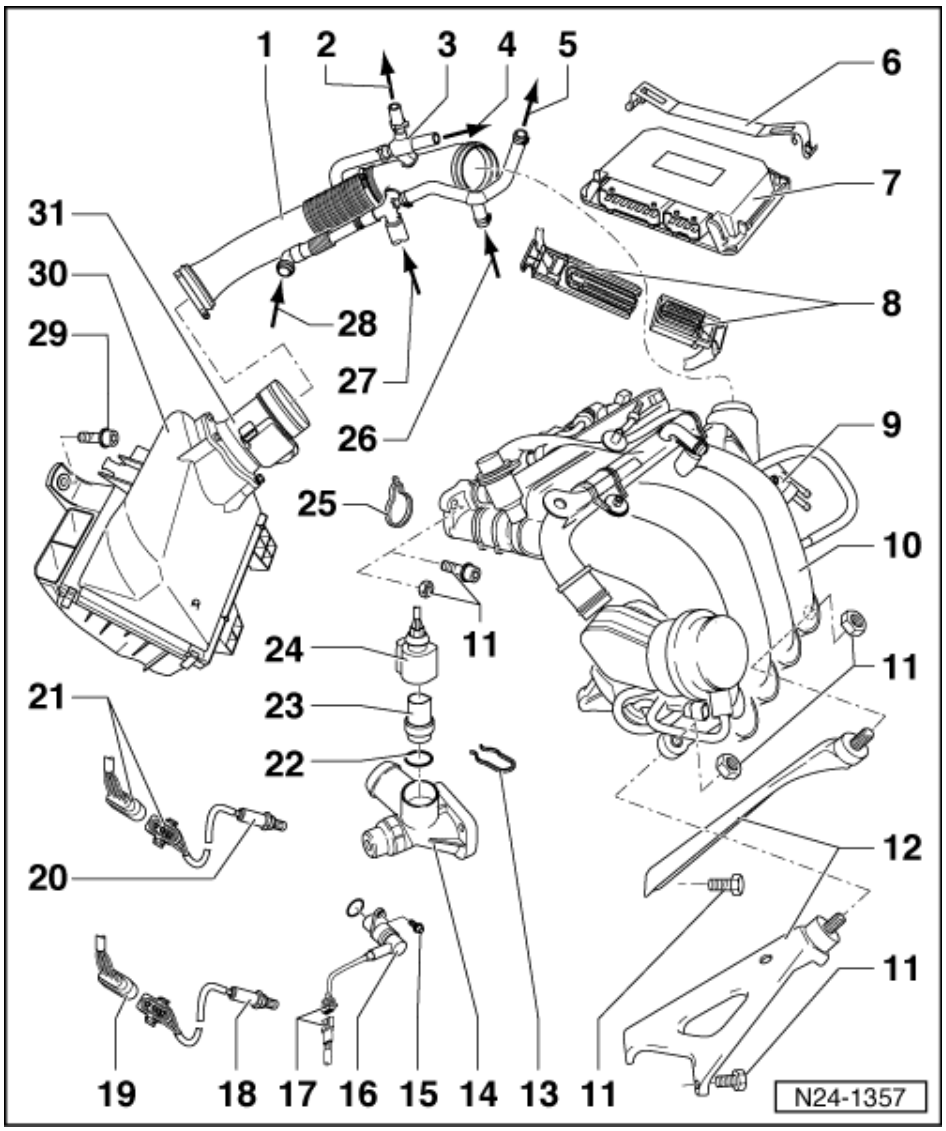


18 Lambda probe after catalyst (G130)*, 50 Nm

- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- Grease only the threads with "G 052 112 A3"; "G 052 112 A3" must not get into the slots on the probe body
- Probe heating voltage supply via fuel pump relay (J17)
- Checking Lambda probe heating for Lambda probe after catalyst => Page 92
- Checking Lambda probe and Lambda regulation after catalyst => Page 122

19 4-pin connector

- Brown
- For Lambda probe after catalyst (G130) and Lambda probe heating (Z29)
- Secured to the bulkhead on left (below expansion tank)
- Connector contacts 3 and 4 are gold-plated

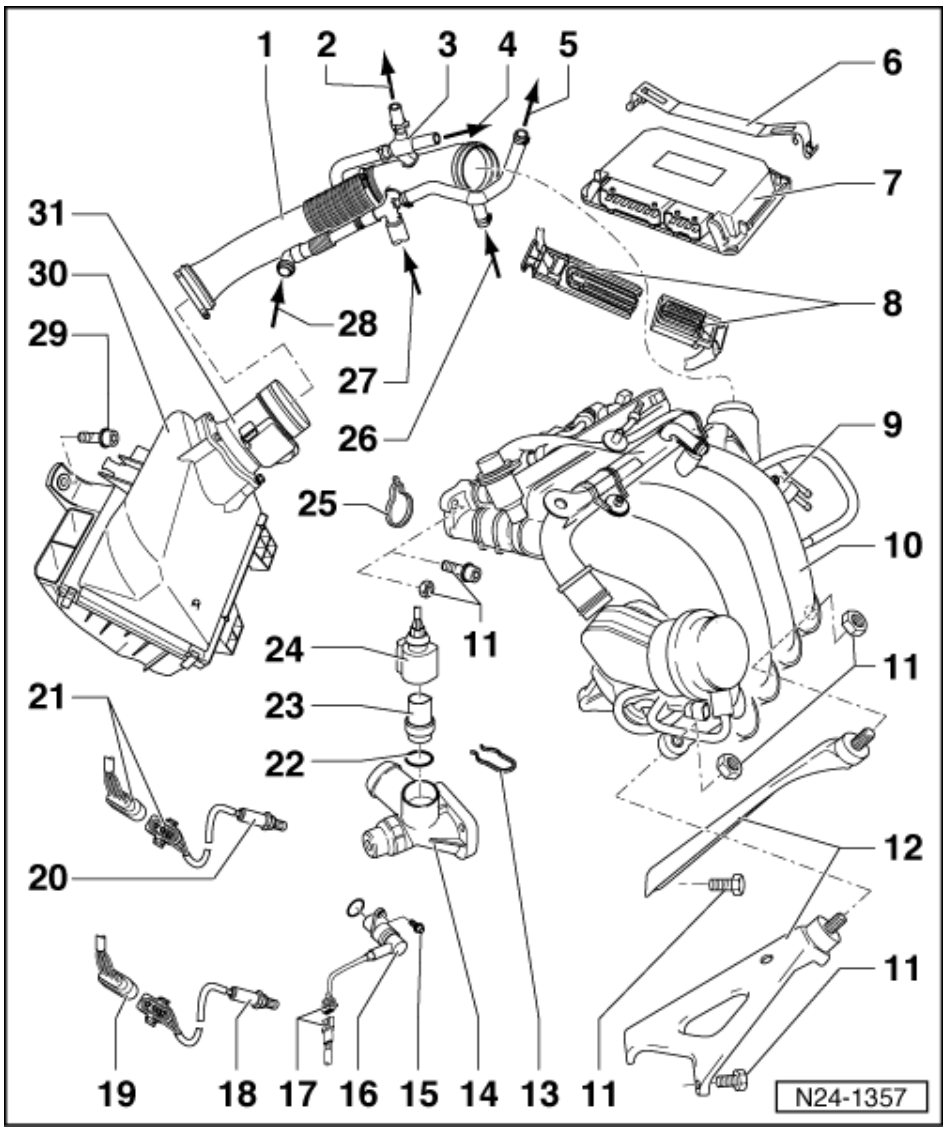


20 Lambda probe before catalyst (G39)*, 50Nm

- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- Grease only the threads with "G 052 112 A3"; "G 052 112 A3" must not get into the slots on the probe body
- Probe heating voltage supply via fuel pump relay (J17)
- Checking Lambda probe heating before catalyst => Page 88
- Checking Lambda probe and Lambda regulation before catalyst => Page 118

21 4-pin connector

- Black for Lambda probe before catalyst (G39) and Lambda probe heating (Z19)
- Secured to the bulkhead on left (below expansion tank)
- Connector contacts 3 and 4 are gold-plated



22 O ring

- Renew if damaged

23 Coolant temperature sender (G62)*

- For engine control unit
- With coolant temperature gauge sender (G2)
- Checking =>Page 104
- If necessary release pressure in cooling system before removing
- Contacts gold plated

24 Connector

- 4 pin
- Contacts gold plated

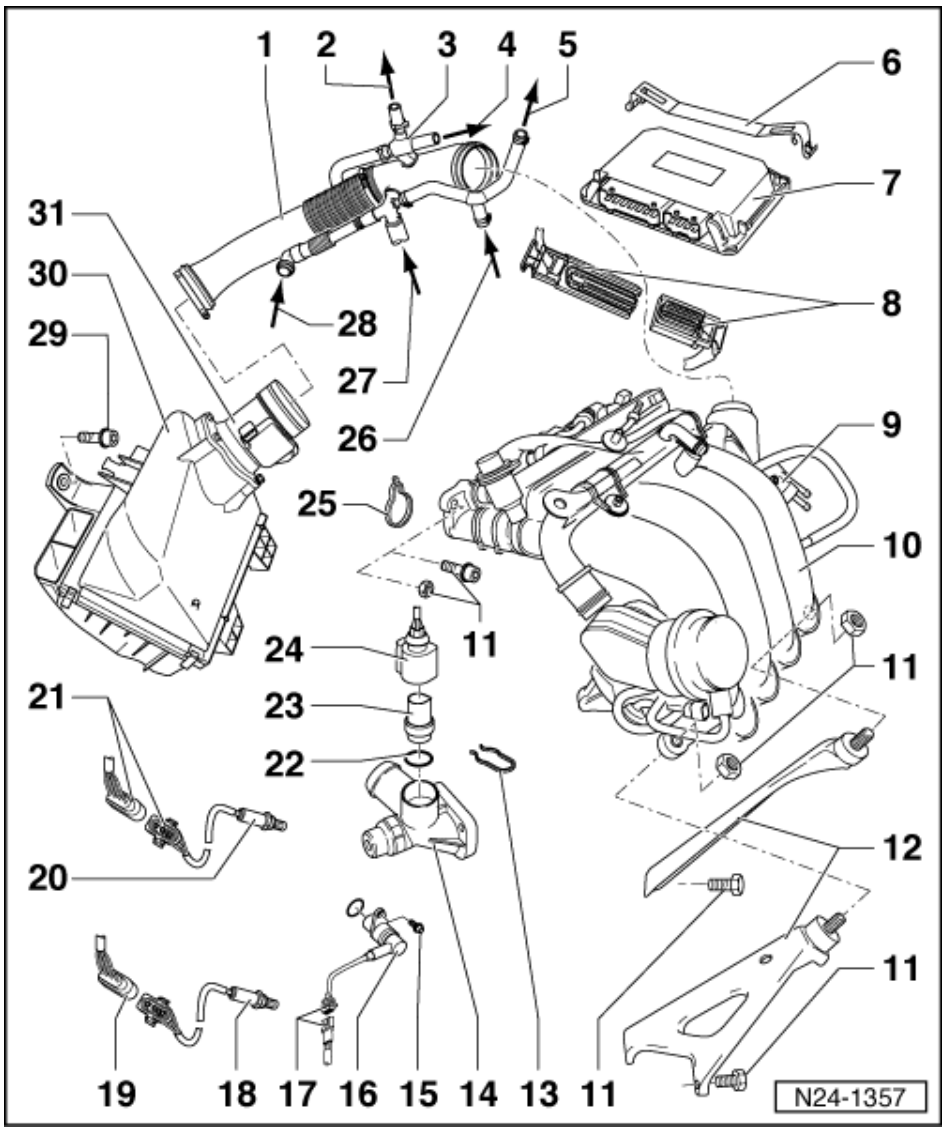
25 Gasket

- Renew

26 From throttle valve control part

27 To connecting pipe

- On cylinder head cover



28 From connecting pipe

- On oil filter bracket

29 10 Nm

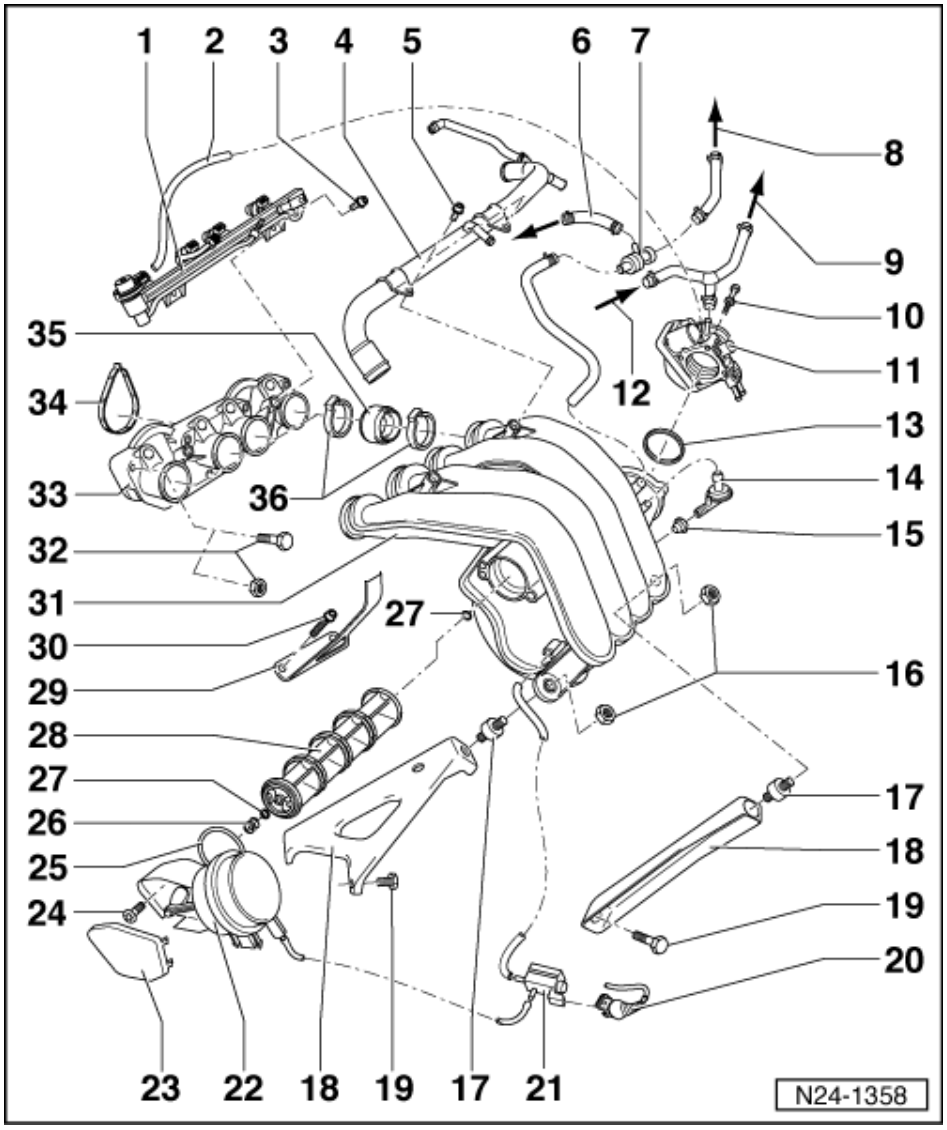
30 Air cleaner

- Dismantling and assembling => Page 82

31 Air mass meter (G70)* with intake air temperature sender (G42)*

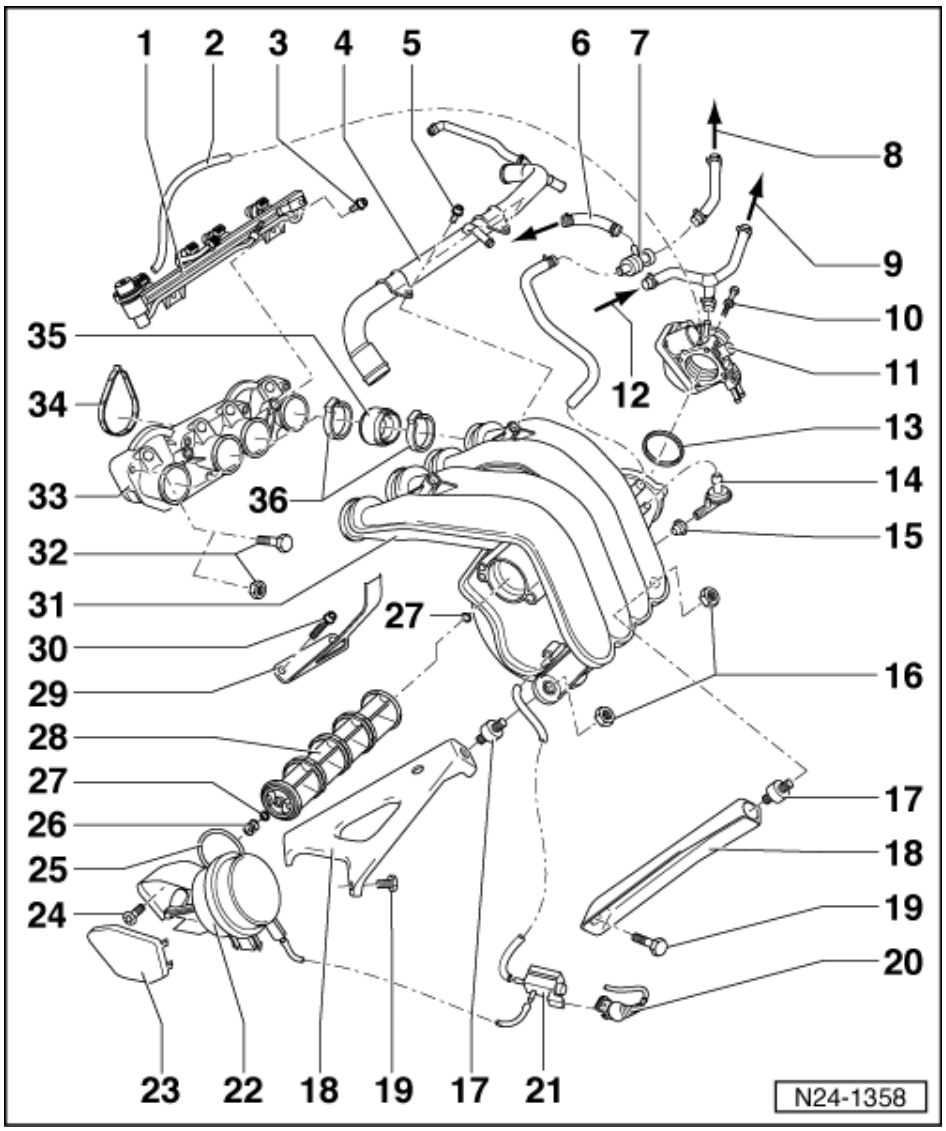
- Contacts gold plated
- Checking air mass meter => Page 95
- Checking intake air temperature sender => Page 97

1.5 - Dismantling and assembling intake manifold



1 Fuel rail with injectors
- Dismantling and assembling => Page 86

2 Vacuum hose
3 10 Nm
4 Coolant pipe
5 10 Nm
6 To brake servo
7 Vacuum booster pump
8 To intake hose
9 To activated charcoal filter solenoid valve (N80)*/**
10 10 Nm



11 Throttle valve control part (J338)*

- 6-pin connector
- Contacts gold plated
- Checking => Page 100
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139
- If replaced adapt control unit for automatic gearbox:

=> Self-diagnosis for automatic gearbox 01N; Repair group 1; Performing self-diagnosis; Initiating basic settings

12 To junction

- => Page 85 , item 8

13 Seal

- Renew if damaged

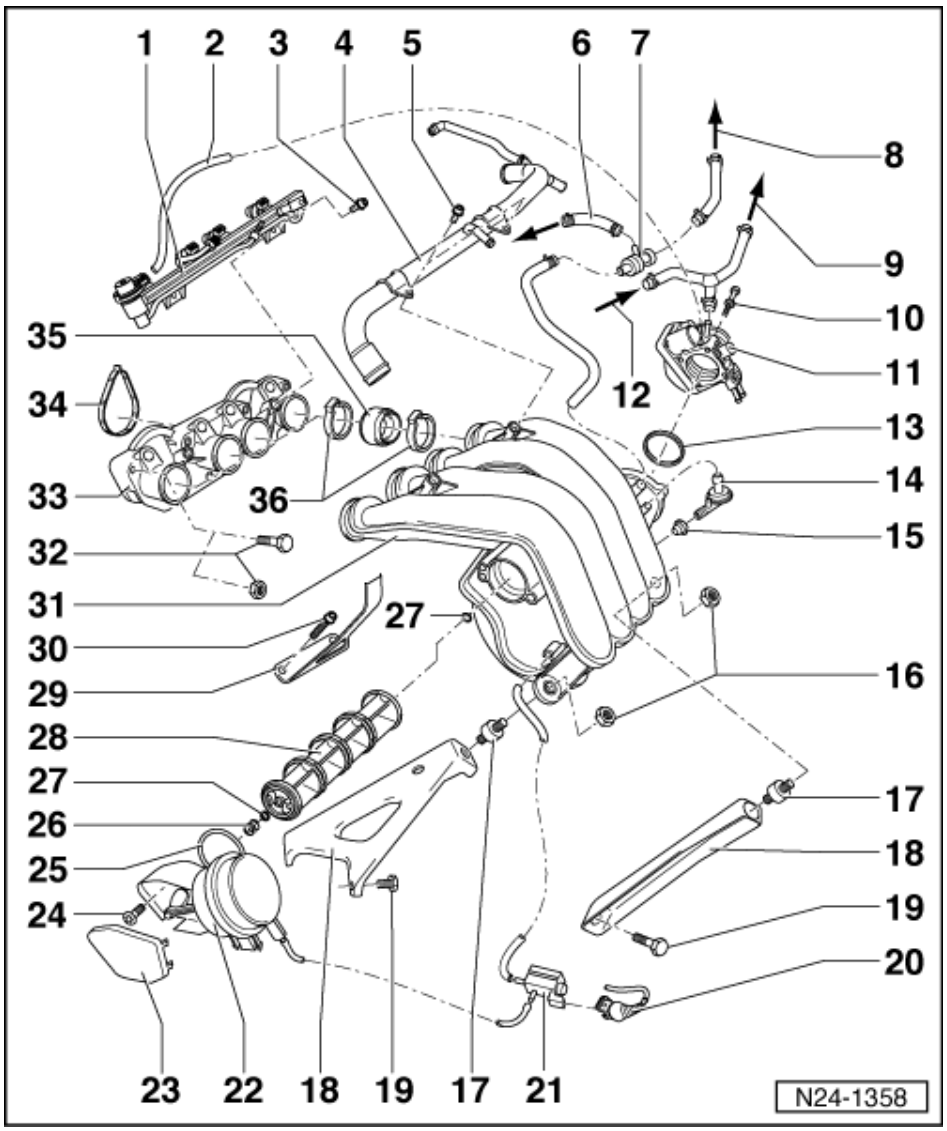
14 Non-return valve

- Note installation position

15 Gasket

- Renew if damaged

16 20 Nm



17 Bonded rubber mounting

18 Support

- For intake manifold

19 20 Nm

20 Connector

21 Intake manifold change-over valve (N156)*/**

- Checking activation

=> Repair Group 01; Self-diagnosis; Final control diagnosis Self-diagnosis Final control diagnosis

22 Vacuum control element

- Checking intake manifold change-over valve => Page 129

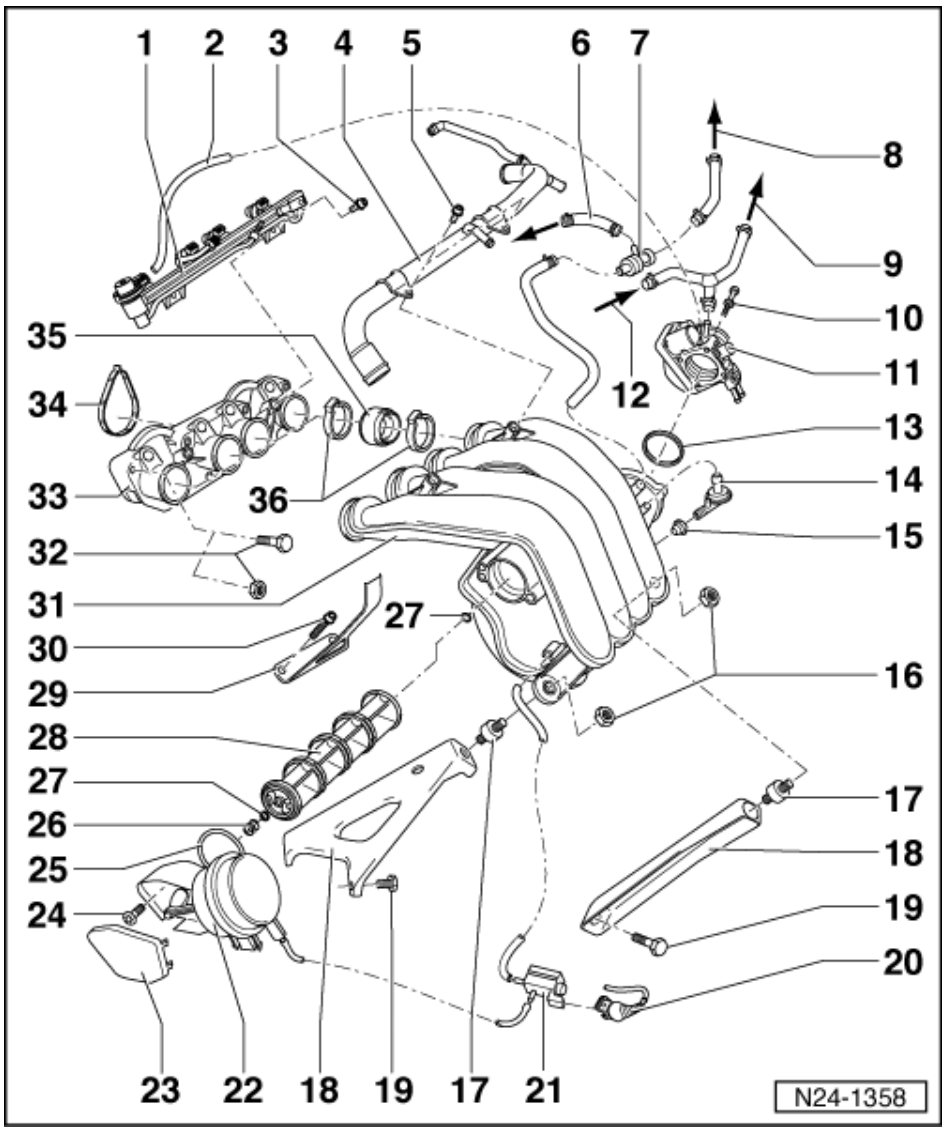
23 Cover

24 10 Nm

25 O ring

- Renew if damaged

26 Spring



27 O ring
- Renew if damaged

28 Change-over roller

29 Bracket
- For dipstick

30 20 Nm

31 Intake manifold

32 20 Nm

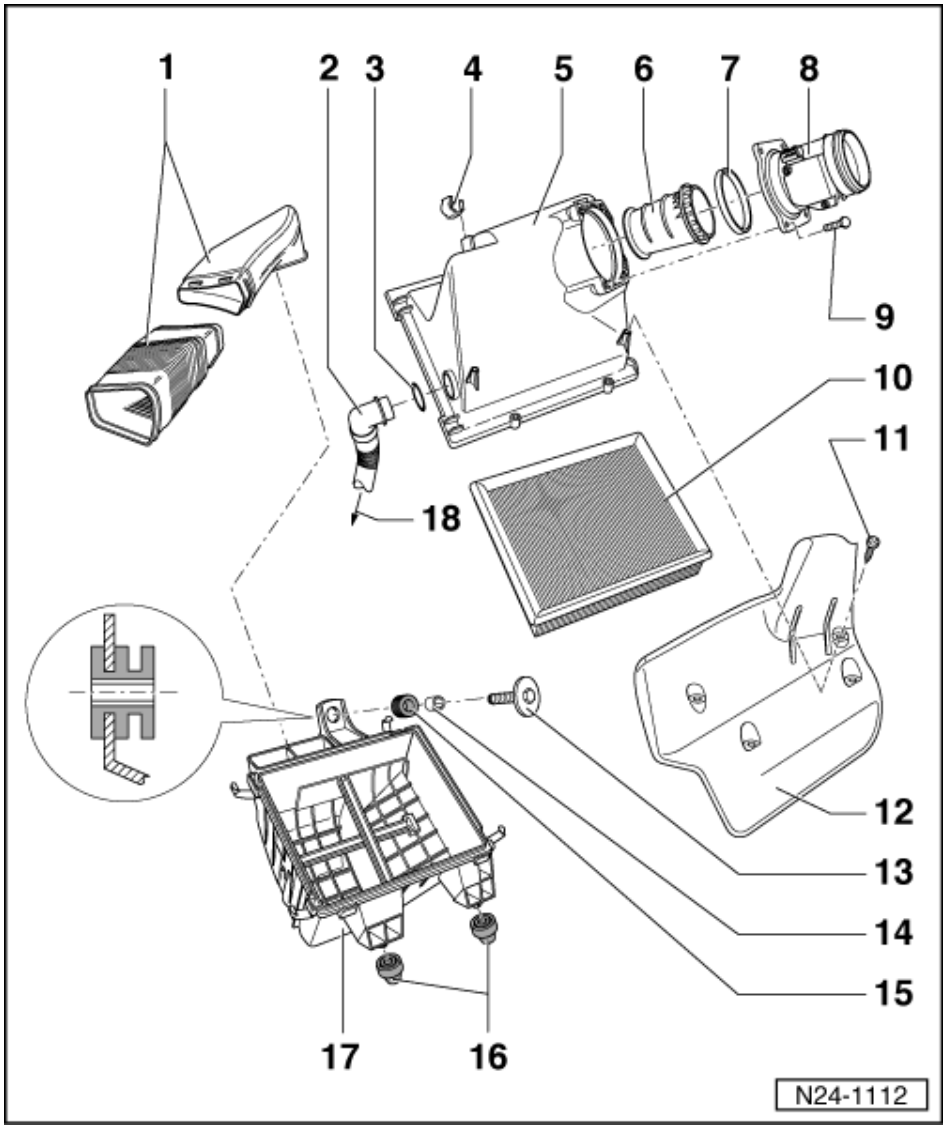
33 Intake manifold - lower part

34 Seal
- Renew

35 Connecting boots
- Renew if damaged

36 Clamp-type clip

1.6 - Dismantling and assembling air cleaner



1 Air ducting
- To lock carrier

2 Intake hose
- Ensure seated tightly
- To secondary air pump motor (V101):

=> 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

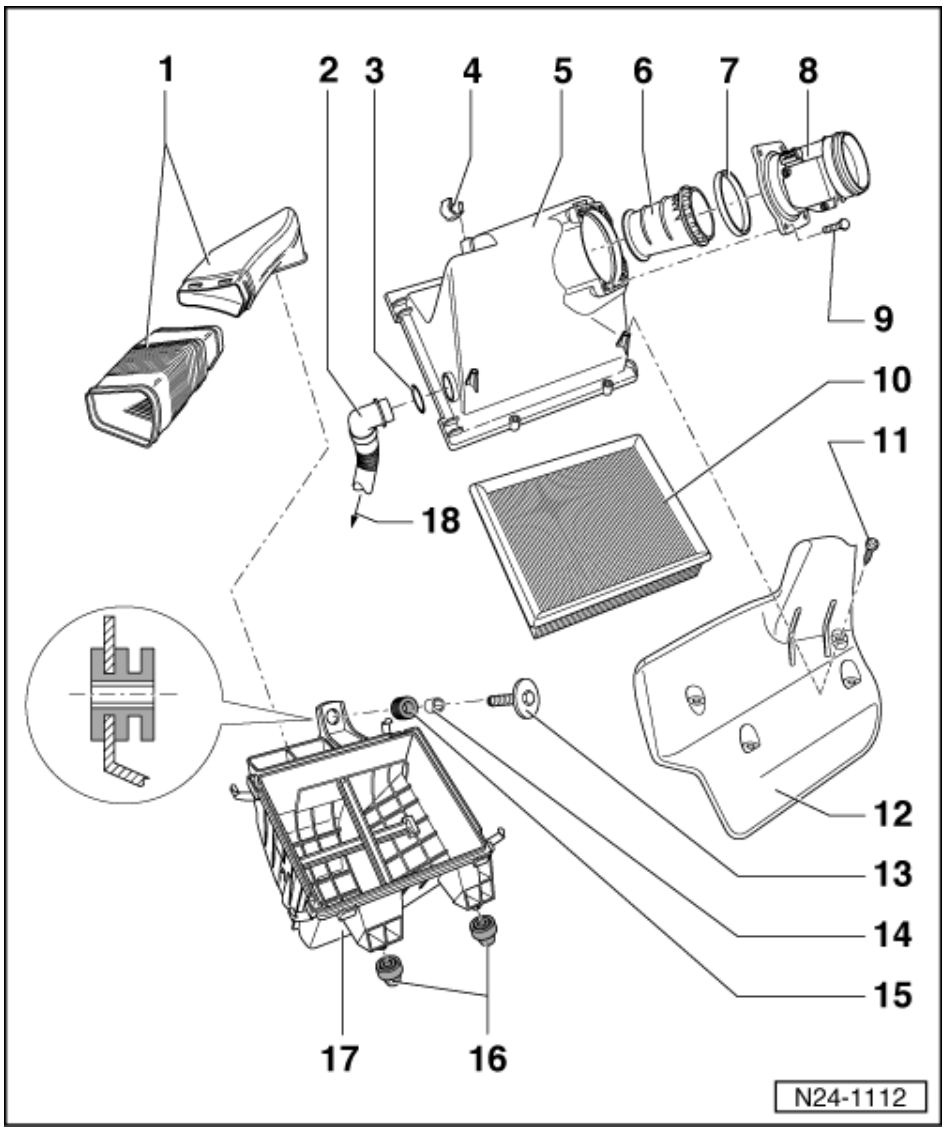
3 O ring
- Renew if damaged

4 Clip

5 Air cleaner upper part

6 Air duct

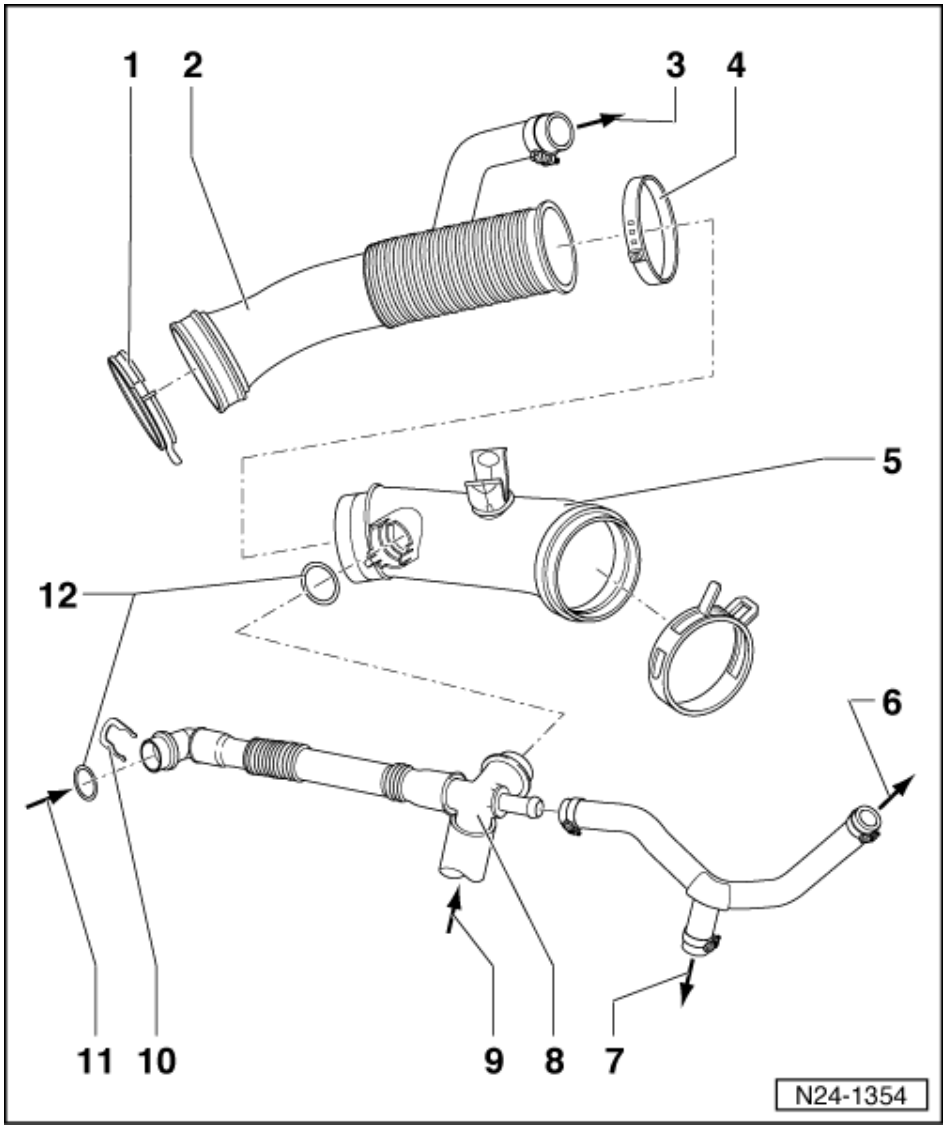
7 Seal



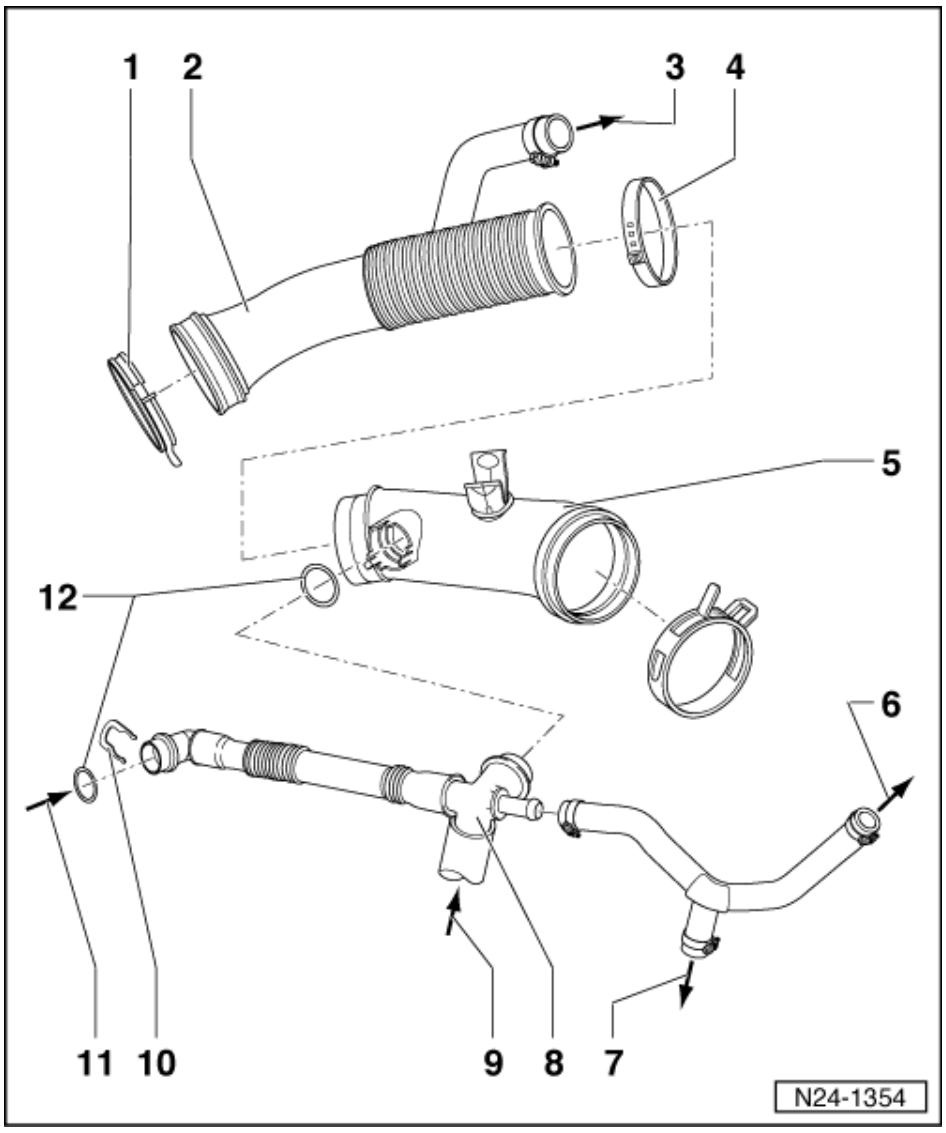
8 Air mass meter (G70)* with intake air temperature sender (G42)*
- Checking G70 => Page 95
- Checking G42 => Page 97

9 10 Nm
10 Filter element
11 10 Nm
12 Heat shield
13 10 Nm
14 Spacer sleeve
15 Rubber grommet
16 Packing
17 Air cleaner lower part
18 To secondary air pump motor (V101)

1.7 - Dismantling and assembling intake hose



1 Spring-type clip
2 Intake hose
3 To vacuum booster pump
◆ => Page 78 , item 7
4 Clamp-type clip
5 Connecting hose
6 To activated charcoal filter solenoid valve (N80)*/**
7 From throttle valve control part



8 Junction

- With crankcase breather valve
- For cold climates: Crankcase breathing with heating resistor

9 From connecting piece

- On oil filter bracket

10 Retaining clip

- Check seated securely

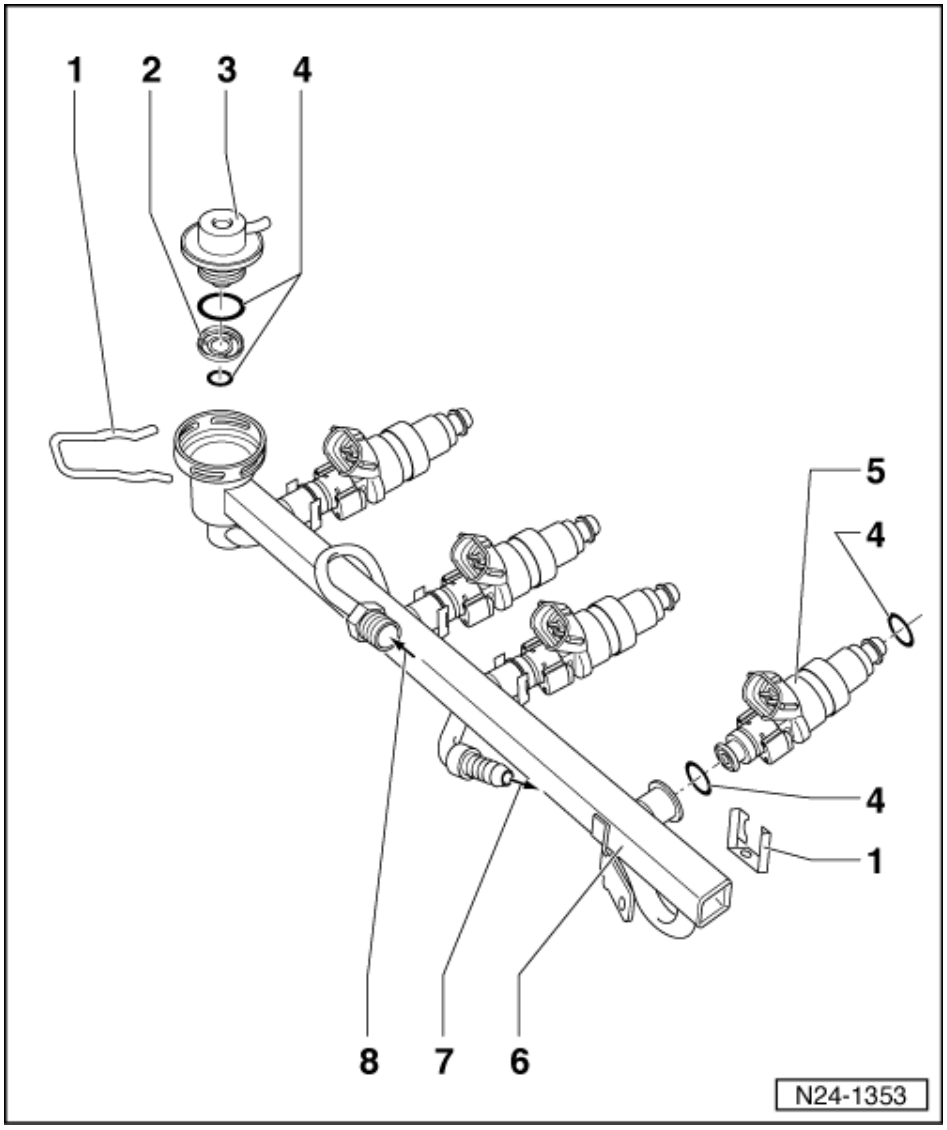
11 From connecting piece

- On cylinder head cover

12 O ring

- Renew if damaged

1.8 - Dismantling and assembling fuel rail with injectors



1 Retaining clip
- Check securely seated

2 Strainer

3 Fuel pressure regulator
- Checking => Page 113
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139

4 O ring
- Renew if damaged

5 Injectors (N30...N33)*
- Checking => Page 108
- If renewed, erase learnt values and adapt engine control unit to throttle valve control part=> Page 139

6 Fuel rail

7 Return flow connection

8 Supply connection

1.9 - Safety precautions

Warning!
Fuel system is under pressure! Before opening the system place a cloth around the connection and remove fuse 28. Then release pressure by carefully loosening the connection.

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

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- For safety reasons the fuse No. 28 must be removed from the fuse holder before opening the fuel system, otherwise the fuel pump can be activated by the door contact switch.

Warning!
When doing any repair work, especially in the engine compartment, due to the cramped conditions, pay attention to the following:

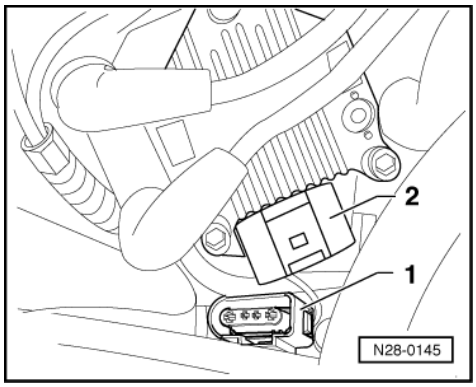
- **Route all sorts of pipes (e.g. for fuel, hydraulics, activated charcoal filter system, coolant, refrigerant, brake fluid and vacuum pipes and hoses) and electrical wiring so that the original positions are restored.**
- **Ensure sufficient clearance to all moving or hot components.**

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

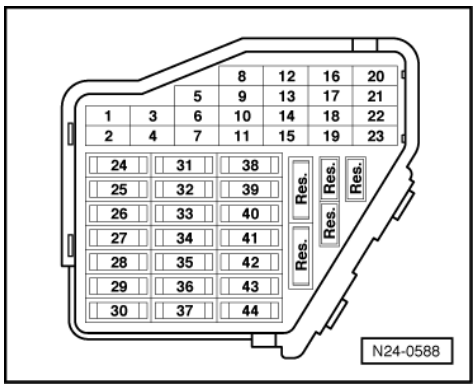
- Test and measuring instruments must be secured to rear seat and operated by a 2nd person from this location.

  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.

- If the engine is to be turned over at starter speed without starting (e.g. for compression pressure test):



- -> Pull 4 pin connector -1- off ignition transformer (N152) -2-.



- -> Remove fuse 34.

Note:

Removing fuse 34 interrupts the voltage supply to the injectors.

1.10 - 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 opened components or seal, 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.

1.11 - Technical data

Engine code		AZM
Idling speed check Idling speed2)		740...8601)
Simos control unit3) Part number		=> Parts catalogue
Governed speed	rpm	approx. 6500

1) Up-to-date specifications:

=> Exhaust emissions test binder

2) Not adjustable

3) Replacing engine control unit => Page 131

2 - Checking components

2.1 - Checking components

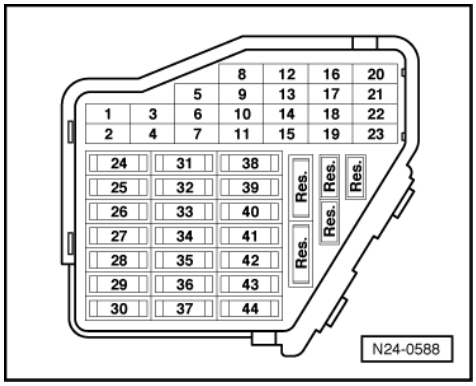
2.2 - Checking Lambda probe heating for Lambda probe before catalyst

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594

- Current flow diagram

Check conditions



- -> Fuse 29 must be OK.
- The battery voltage must be at least 11.5 V.
- Fuel pump relay must be OK

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

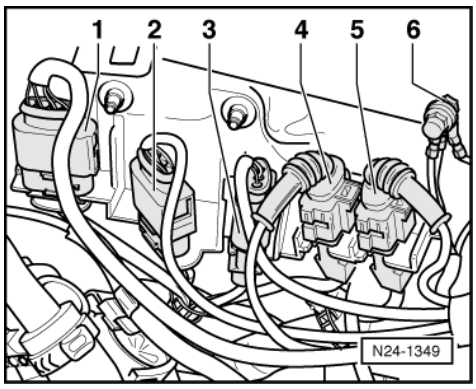
- Press keys 0, 4 and 1 for "Display group number 41" and confirm entry with Q key.

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

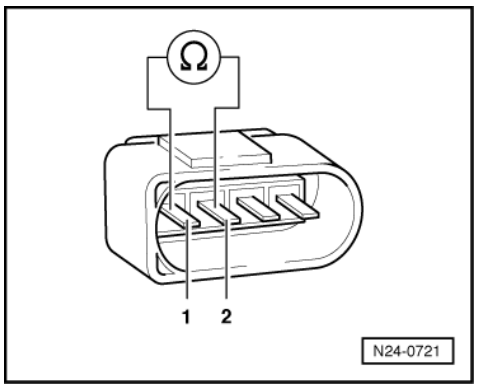
```
Read measured value block 41
     1     2     3     4
```

- Check the status of the Lambda probe heating in display zone 2:
  Display: Htg.bC.ON

If the specification is not obtained:



- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- -> Separate 4-pin connector -2- (black) to Lambda probe 1 before catalyst (G39).



- -> Check probe heating for continuity at Lambda probe connector contacts 1 and 2.

Note:

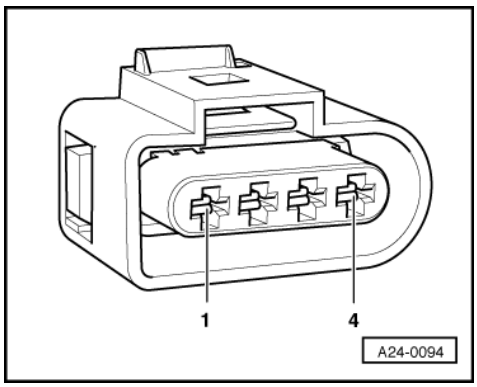
The heater element resistance is approx. 1...10 ω at room temperature. Even slight increases in room temperature increase the resistance greatly.

If it is determined that probe heating has an open circuit:

- Replace the Lambda probe before catalyst (G39).
- Erase learnt values and adapt engine control unit=> Page 139

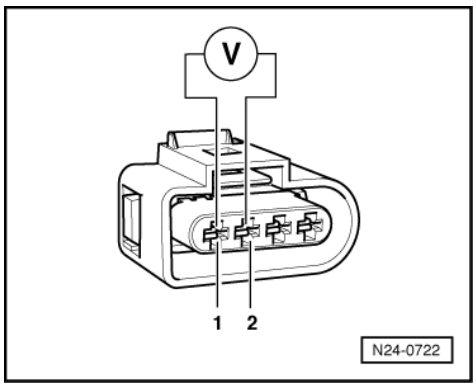
If the specification is obtained:

Checking voltage supply



- -> Set multimeter to measure voltage and connect to contact 1 and earth (connector to engine control unit) using cables from adapter set 1594.
- Start engine and run at idling speed.
- Measure voltage supply and observe display group 41, display zone 2.
  Display Htg.bC.ON
  Specification: 11.5...14.5 V

If the specification is not obtained:

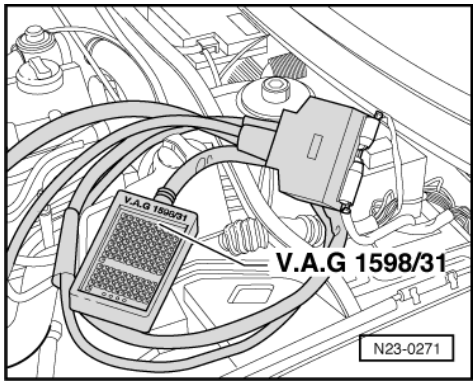


- Check wiring from contact 1 to fuel pump relay (J17) using current flow diagram.

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

If the specification is obtained:

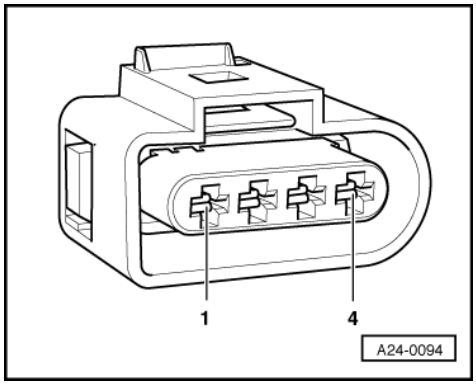
- -> Connect multimeter to contacts 1 and 2 (connector to engine control unit).



- Now check actuation from engine control unit while observing display group 41, display zone 2.
  Display Htg.bC.ON:
  Specification: 11.5...14.5 V
- Switch off ignition.

If the specification is not obtained:

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring for open circuit between test box and 4-pin connector using current flow diagram:
  Contact 2 and test box socket 5 of
  Wire resistance: max. 1.5 ω
- Additionally check wiring for short to battery positive and earth.

If the specification is obtained:

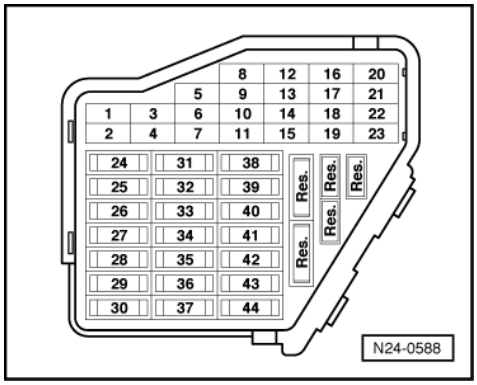
- Renew engine control unit => Page 135 .

2.3 - Checking Lambda probe heating for Lambda probe after catalyst

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions



- -> Fuse 29 must be OK.
- The battery voltage must be at least 11.5 V.
- Fuel pump relay must be OK

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 4 and 1 for "Display group number 41" and confirm entry with Q key.

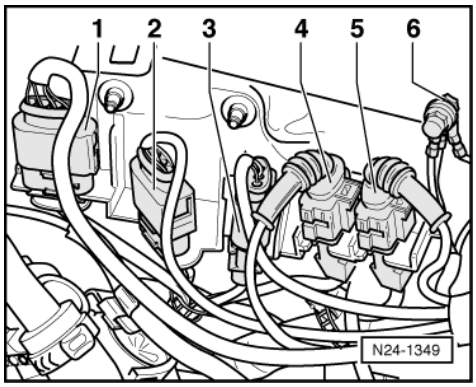
-> Indicated on display:
(1...4 = Display zones)

```
Read measured value block 41
     1     2     3     4
```

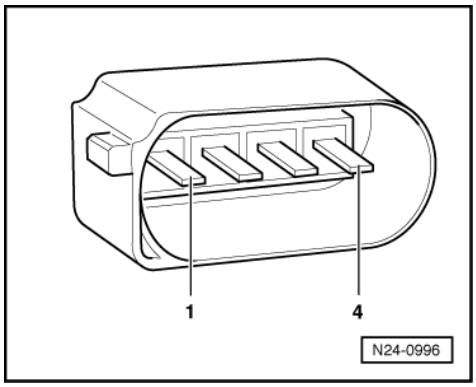
- Check the status of the Lambda probe heating in display zone 4:
  Display: Htg.aC.ON

If the specification is not obtained:

- Press ⇒key.



- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- -> Separate 4-pin connector -1- (brown) to Lambda probe 2 after catalyst (G130).



- -> Check probe heating for continuity at Lambda probe connector contacts 1 and 2.

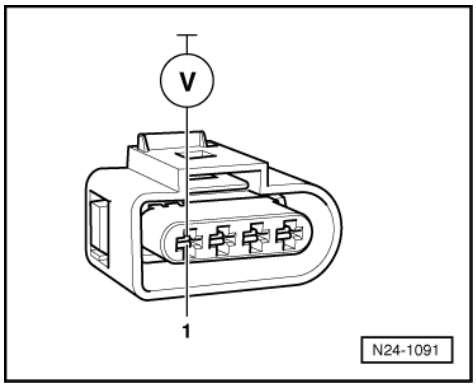
Note:

The heater element resistance is approx. 1...10 ω at room temperature. Even slight increases in room temperature increase the resistance greatly.

If it is determined that probe heating has an open circuit:

- Renew Lambda probe after catalyst (G130).
- Erase learnt values and adapt engine control unit=> Page 139

If the specification is obtained:

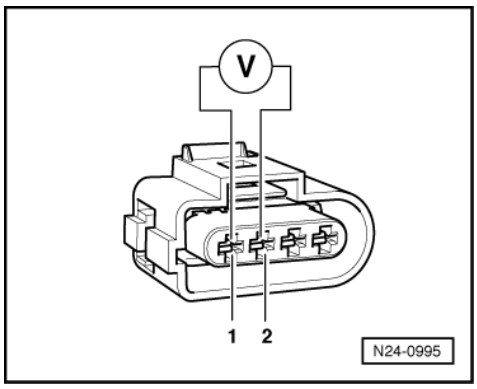


- -> Set multimeter to measure voltage and connect to contact 1 and earth (connector to engine control unit) using cables from adapter set V.A.G 1594.
- Start engine and run at idling speed.

- Measure voltage supply and observe display group 41, display zone 4.
  Display Htg.aC.ON
  Specification: 11.5...14.5 V

If the specification is not obtained:

- Check wiring from contact 1 to fuel pump relay (J17) using current flow diagram.

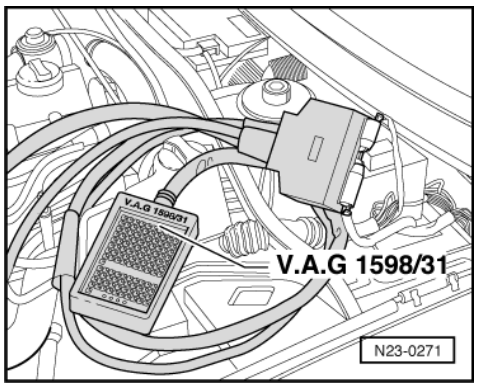


=> Current flow diagrams, Electrical fault finding and Fitting locations binder

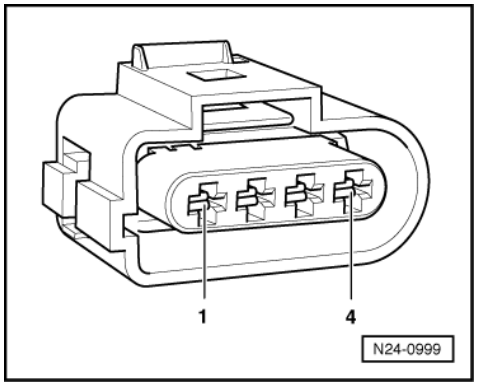
If the specification is obtained:

- -> Connect multimeter to contacts 1 and 2 (connector to engine control unit).
- Check activation of engine control unit and observe display group 41, display zone 4
  Display Htg.aC.ON
  Specification: 11.5...14.5 V
- Switch off ignition.

If the specification is not obtained:



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 4-pin connector for open circuit using current flow diagram:
  Contact 2 and test box socket 5
  Wire resistance: max. 1.5 ω
- Additionally check wiring for short to battery positive and earth.

If the specification is obtained:

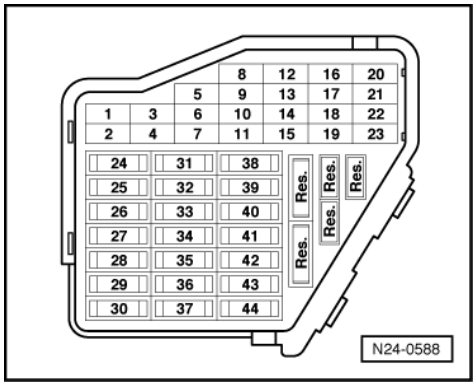
- Renew engine control unit => Page 135 .

2.4 - Checking air mass meter

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions



- -> Fuse 29 must be OK.
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- If the vehicle is equipped with an air conditioner, this must be switched off.
- Selector lever must be in position "P" on vehicles with an automatic gearbox.

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 2 for "Display group number 2" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

- Check the mass of air drawn in in display zone 4
  Specification: 2.5...6.0 g/s

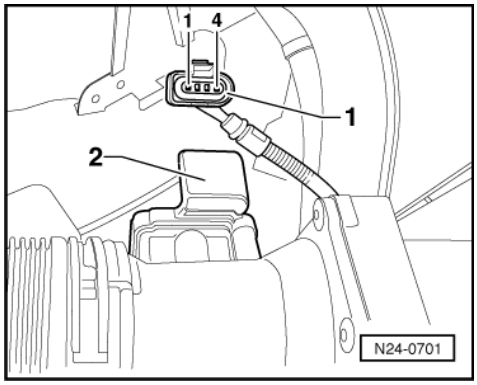
If the specification is not obtained or there is a fault in fault memory referring to air mass meter:

- Check the voltage supply for the air mass meter => Page 96 .
- Check the signal and earth wires for the air mass meter => Page 97 .

If the specification is obtained:

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

Checking voltage supply for air mass meter

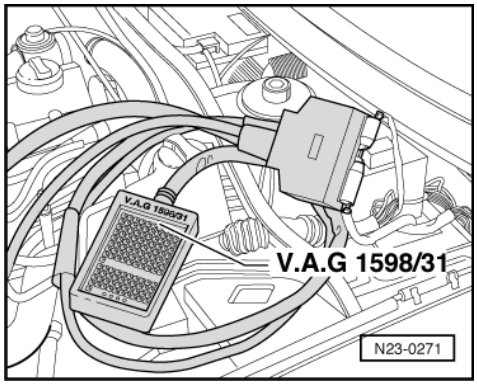


- -> Pull 4 pin connector -1- off air mass meter -2-.
- Connect multimeter to measure voltage on connector contacts 3 and engine earth.
- Start engine and run at idling speed.

  Specification: 11.5...14.5 V

- Switch off ignition.
- If the voltage supply is OK, check the signal wire and earth wire => Page 97 .

If no voltage is present:

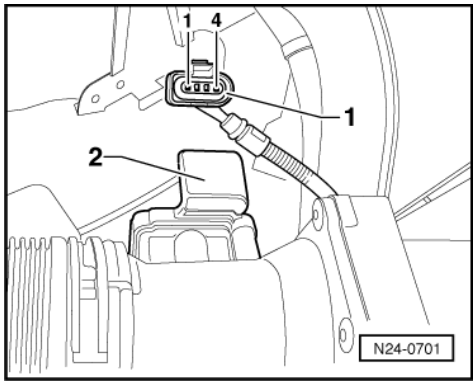


- Check wiring from contact 3 to fuel pump relay (J17) according to current flow diagram.

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

Testing signal and earth wires for air mass meter

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 4-pin connector for open circuit using current flow diagram.
  Contact 1 and test box socket 10
  Contact 2 and test box socket 11
  Wire resistance: max. 1.5 ω
- Additionally check wiring for short to one another, and for short to positive or earth.

Note:

When servicing connectors only gold-plated contacts are to be used.

If no wiring fault is detected:

- Renew air mass meter (G70).

2.5 - Checking intake air temperature sender

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram
- Chilling spray (commercially available)

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 4 for "Display group number 4" and confirm entry with Q key.

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

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

- Observe intake air temperature in display zone 4 for at least 60 seconds:
  Specification: approx. ambient temperature

If the specification is not obtained:

- Perform check according to following table:

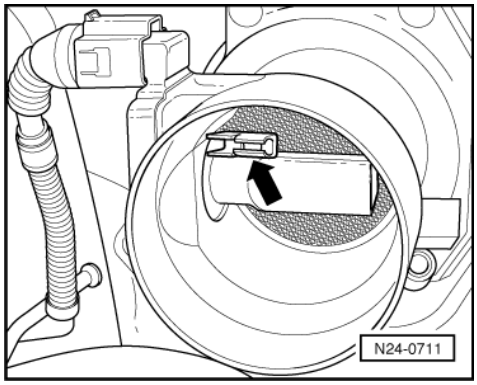
Display	Cause	Continuation of check
Approx. ambient temperature1)	---	=> Page 98
9 °C or 30 °C constant2)	Open circuit or short to positive or earth	=> Page 99

1) If a temperature is displayed which is below the ambient air temperature of the sender, check sender wiring for transfer resistances. Note when doing this that sender is heated from external sources, e.g. radiated heat when engine is not running.

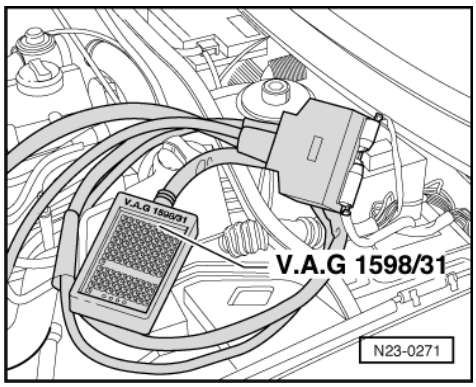
2) If the engine control unit detects a fault with G42, after a short period a constant 9 °C will be displayed if coolant temperature is below 70 °C and a constant 30 °C will be displayed if coolant temperature is above 70 °C. With an open circuit (∞ω) 40.5 °C is displayed initially and then after approx. 60 seconds the display will change to 9 °C or 30 °C.

Continuation of check when display = ambient temperature:

- Switch off ignition.
- Remove intake hose on air mass meter.
- Switch ignition on and select measured value block 4 again.
- Note intake air temperature value in display zone 4.

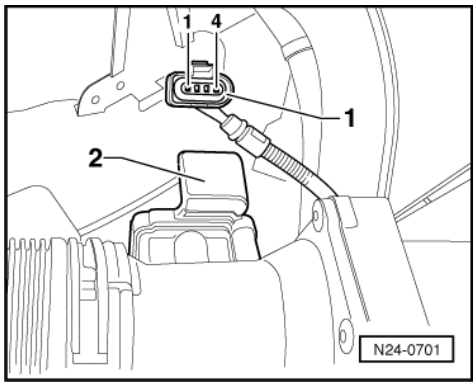


- -> Spray sender -arrow- with commercial chilling agent whilst observing the temperature value. The temperature value must
  decrease.
- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.



Continuation of test if 9 °C or 30 °C is displayed:

- Switch off ignition.
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.

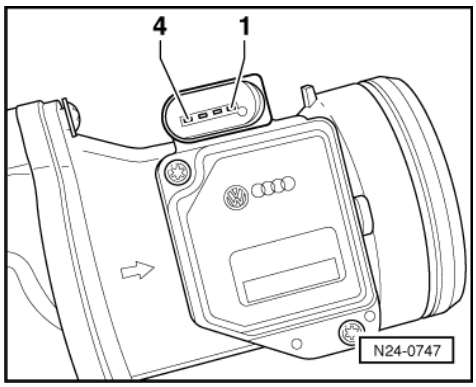


- -> Pull 4 pin connector -1- off air mass meter -2-.
- Check wiring between test box and 4-pin connector for open circuit using current flow diagram.
  Contact 2 and test box socket 11
  Contact 4 and test box socket 44
  Wire resistance: max. 1.5 ω
- Additionally check wires for short to one another and to positive and earth.
  Specification: ∞ω

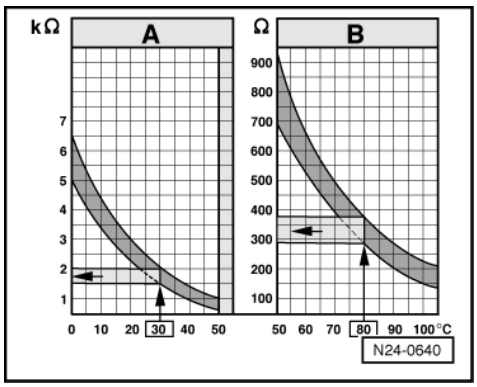
Note:

When servicing connectors only gold-plated contacts are to be used.

If no wiring fault is detected:



- -> Test resistance between contacts 2 and 4 of 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 is in range A and corresponds to a resistance of 1.5...2.0 kω
- 80 °C is in range B and corresponds to a resistance of 275...375 ω

If the specification is not obtained:

- Renew air mass meter with intake air temperature sender (G42).

If there is no fault in the wiring and the resistance measurement values are OK.:

- Renew engine control unit => Page 135 .

2.6 - Checking throttle valve control part

Components of throttle valve control part (J338):
Throttle valve drive (G186), angle sender 1 for throttle valve drive (G187) and angle sender 2 for throttle valve drive (G188).

Note:

If the throttle valve control part is replaced, the new control part must without fail be adapted to the engine control unit => Page 139 .

On vehicles fitted with an automatic gearbox the gearbox control unit must also be adapted:

=> Self-diagnosis for automatic gearbox 01N; Repair group 01; Performing self-diagnosis; Initiating basic setting Performing self-diagnosis Initiating basic setting

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions

- The fault memory has been interrogated => Page 8 , interrogating fault memory of engine control unit.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- If the vehicle is equipped with an air conditioner, this must be switched off.
- The battery voltage must be at least 11.5 V.
- Throttle valve not damaged or dirty.

- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.

Test sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 6 and 2 for the "Display group number 62" and confirm entry with Q key.

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

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

- Check throttle valve angle from sender 1 (G187) at idling stop in display zone 1
  Specification: 3...25 %
- Check throttle valve angle from sender 2 (G188) at idling stop in display zone 2.
  Specification: 97...75 %
- Depress accelerator slowly to full throttle position and observe angles displayed in display zones 1 and 2:

  The percentage indicated in display zone 1 must increase evenly, although the tolerance range 3...93 % will not be fully exploited.
  The percentage figure in display zone 2 must decrease evenly, although the tolerance range 97...3 % will not be fully exploited.

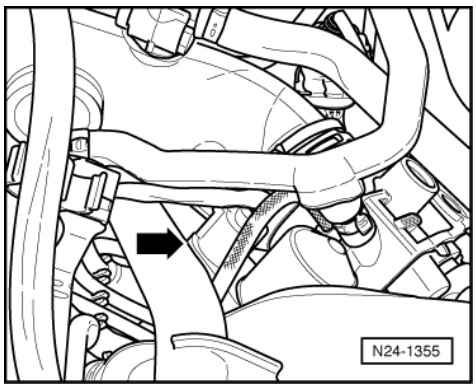
Notes:

- The reason why the display in display zone 1 increases and the display in display zone 2 decreases is because the potentiometers (angle senders) in the throttle valve control part run in opposite directions.
- The percentage indicated in display zones 1 and 2 must always total approx. 100 %.
- This means that the voltage of one angle sender moves towards 5 volts. (The more the throttle valve is opened the higher the voltage; percentage figure increases).

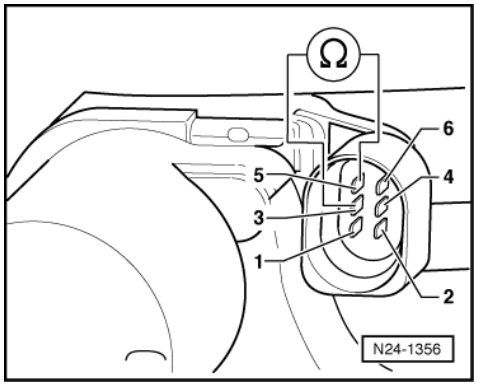
- Whilst the voltage of angle sender 2 decreases from 5 volts towards 0 volts. (The more the throttle valve is opened the lower the voltage; percentage figure decreases).

If the displays do not indicate as described:

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



- -> Pull 6-pin connector off throttle valve control part -arrow-.



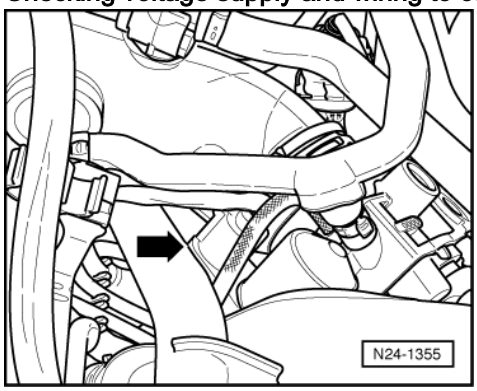
- -> Measure resistance at throttle valve drive between contacts 3 + 5
  Specification: 3...200 ω

If the specification is not obtained:
- Replace throttle valve control part (J338).
- Erase learnt values and adapt engine control unit=> Page 139

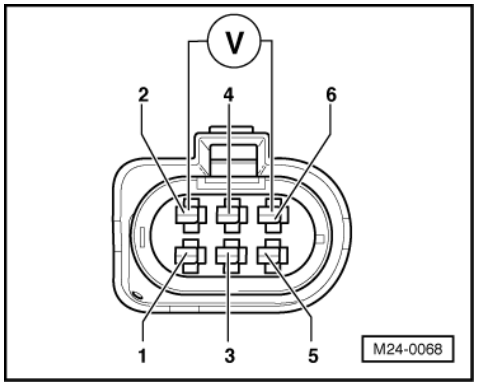
If the specification is obtained:
- Check voltage supply of throttle valve control part and wiring to control unit => Page 102 .
- Check the accelerator pedal position sender.

=> Repair group 20; Electronic engine output regulation (electronic accelerator (EPC)); Checking accelerator pedal position sender Electronic engine output regulation (electronic accelerator (EPC)) Checking accelerator pedal position sender
If the voltage supply and wiring is OK:
- Renew engine control unit => Page 135 .

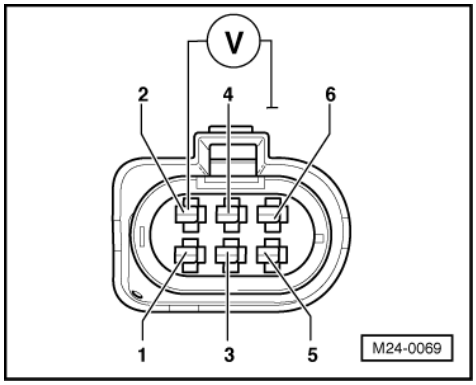
Checking voltage supply and wiring to control unit



- -> Pull 6-pin connector off throttle valve control part -arrow-.

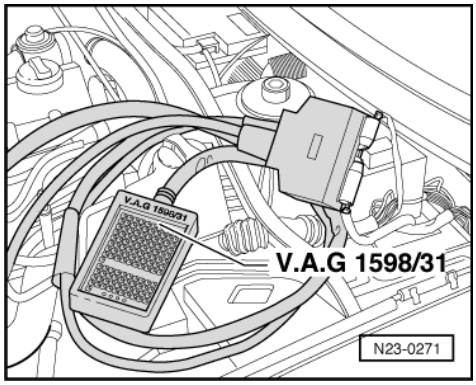


- -> Connect Multimeter to measure voltage at connector contacts 2 (positive) and 6 (earth).
- Switch on ignition.
  Specification: min. 4.5 V

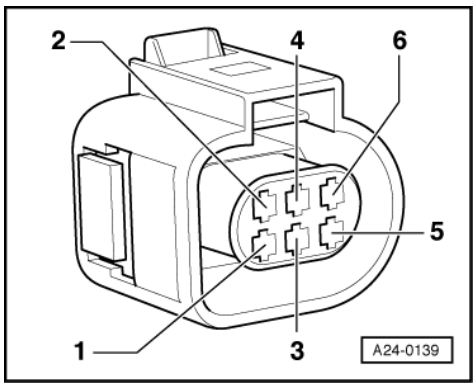


- -> Connect Multimeter to measure voltage at connector contact 2 (positive) and earth:
  Specification: at least 4.5 V
- Switch off ignition.

If the specifications are not attained:



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box socket and 6-pin connector for open circuit using current flow diagram:
  Contact 1 and test box socket 90
  Contact 2 and test box socket 97
  Contact 3 and test box socket 119
  Contact 4 and test box socket 92
  Contact 5 and test box socket 121
  Contact 6 and test box socket 91
  Wire resistance: max. 1.5 ω
- Additionally check wiring for short to one another, and for short to battery positive or earth.
  Specification: ∞ω

Note:

When servicing connectors only gold-plated contacts are to be used.

If no fault is detected in the wiring:

- Check engine control unit voltage supply => Page 131 .

2.7 - Checking coolant temperature sender

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Test conditions

- Engine must be cold.

Test sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 4 for "Display group number 4" and confirm entry with Q key.

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

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

- Read off coolant temperature value in display zone 3.
  Specification: approx. coolant temperature

If a constant 60 °C or -10.5 °C is displayed:

- Check resistance values =>Page 106
- Start engine and run at idling speed.
  The temperature value must
  increase uniformly

Note:

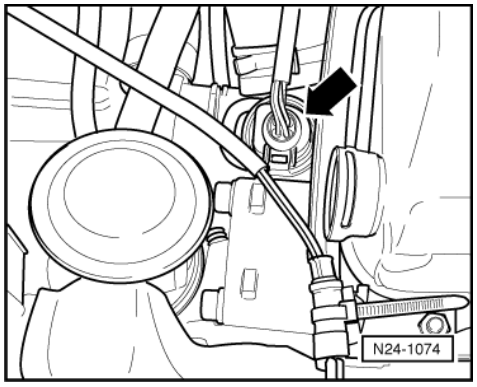
The display on the fault reader is graduated in 1.5 °C increments.

If the engine control unit detects a fault with the coolant temperature sender (G62) with "ignition on" two fixed replacement values (-10.5 °Cor 60 °C) are displayed dependent on the intake air temperature (below or above

approx. 20 °C). A model sequence set in the control unit (continual rise in temperature in specific increments) is used when starting. The temperature display on the fault reader therefore rises even though the connector G62 is disconnected.

If the figure does not increase uniformly:

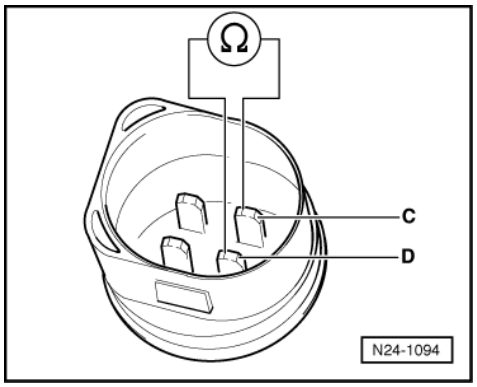
- Press ⇒key.



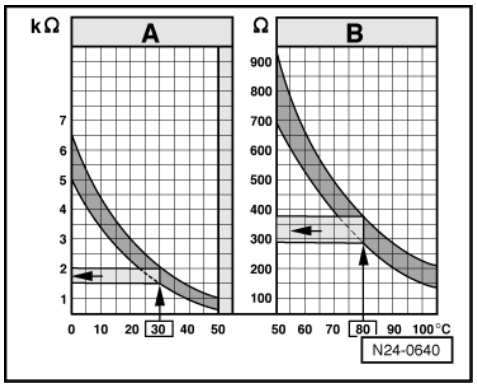
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.

Checking resistance of temperature sender

- -> Pull the 4-pin connector off coolant temperature sender (G62) -arrow-.



- -> Perform resistance measurement between contacts C and D on coolant temperature sender (G62).



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

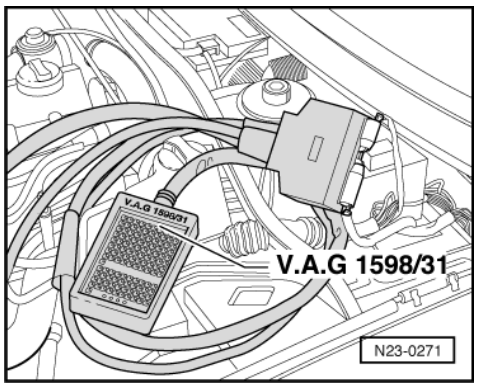
Examples:

- 30 °C is in range A and corresponds to a resistance of 1.5...2.0 kω
- 80 °C is in range B and corresponds to a resistance of 275...375 ω

If the specification is not obtained:

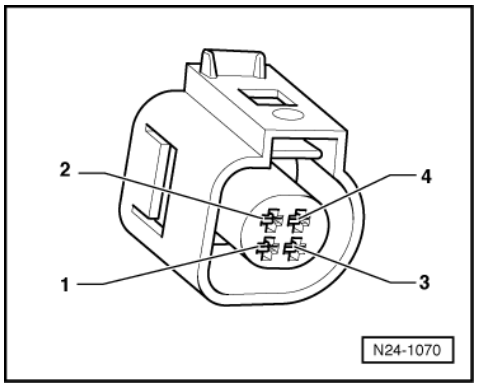
- Renew coolant temperature sender (G62).

If the specification is obtained:



Checking wiring

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring for open circuit between test box and 4-pin connector using current flow diagram.
  Contact 3 and test box socket 83
  Contact 4 and test box socket 104
  Wire resistance: max. 1.5 ω

- Additionally check wiring for short to one another, and for short to battery positive or earth.
  Specification: ∞ω

Note:

When servicing connectors only gold-plated contacts are to be used.

If there is no fault in the wiring and the resistance measurement values are OK.:

- Renew engine control unit => Page 135 .

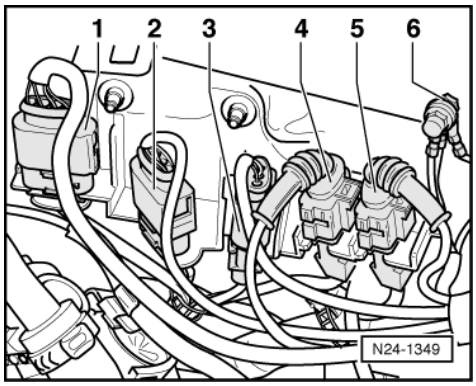
2.8 - Checking engine speed sender

Notes:

- The correct setting of the valve timing can be checked in measured value block 12 =>Page 43
- The engine speed sender is a combined speed sender and reference mark sender.
- The engine can run without a signal from -G28. It is also possible (with considerable difficulty) to start the engine without a signal from -G28 (emergency running function).

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

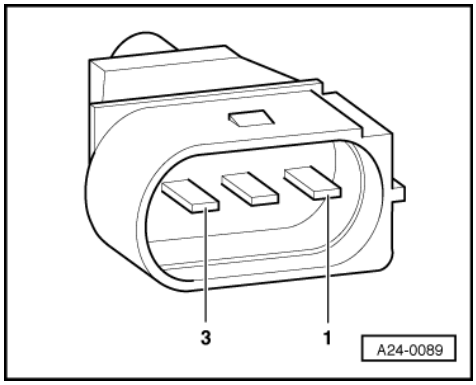
- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31



- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Test sequence

- -> Disconnect the grey connector -3- for engine speed sender.



- -> Connect multimeter V.A.G 1526 using aux. cables from V.A.G 1594 to connector contacts 2 and 3 of engine speed sender
  Specification: approx. 730...1000 ω

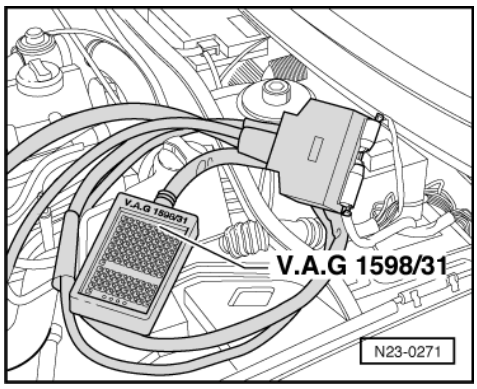
Note:

The resistance figures are valid for approx. 20 °C. At higher temperatures the resistance figures will increase.

- Check the sender for short between contacts 1 + 2 as well as 1 + 3.
  Specification: ∞ω

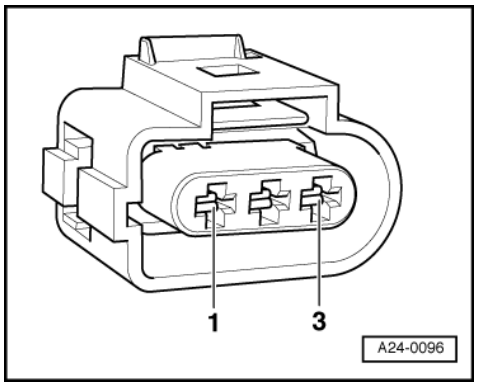
If the specifications are not obtained:

- Renew engine speed sender (G28).



If no sender fault is detected:

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 3-pin connector for open circuit using current flow diagram
  Contact 1 and test box socket 99 (screening)
  Contact 2 and test box socket 98
  Contact 3 and test box socket 106
  Wire resistance: max. 1.5 ω
- Additionally check wires for short to one another.
  Specification: ∞ω

If no fault is detected in the wiring:

- Remove sender and check sender that wheel is fitted securely and not damaged.

Note:

There is a larger gap on the sender wheel. This gap is the reference mark and does not mean that the sender wheel is damaged.

If no fault is detected on sender wheel:

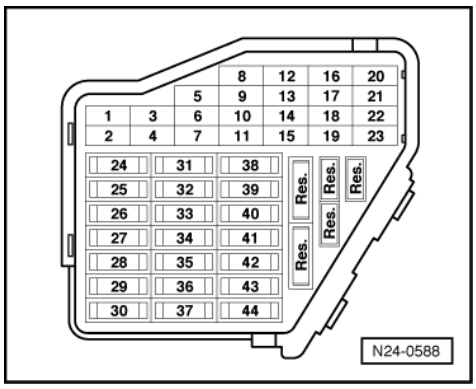
- Renew engine control unit => Page 135 .

2.9 - Checking injectors

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31

- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Diode test lamp V.A.G 1527 B
- Adapter set V.A.G 1594
- Current flow diagram



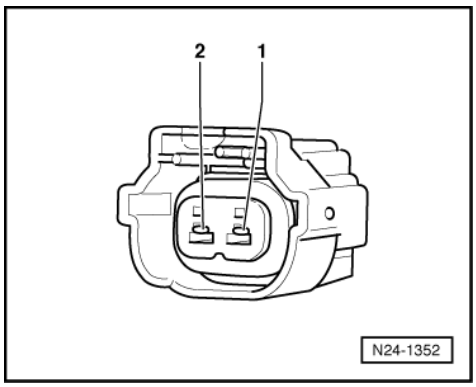
Check conditions

- Engine speed sender must be OK, checking =>Page 107 .
- Fuel pump relay must be OK
- -> The fuses 28, 32, 34 and 43 must be OK.

Checking activation and voltage supply

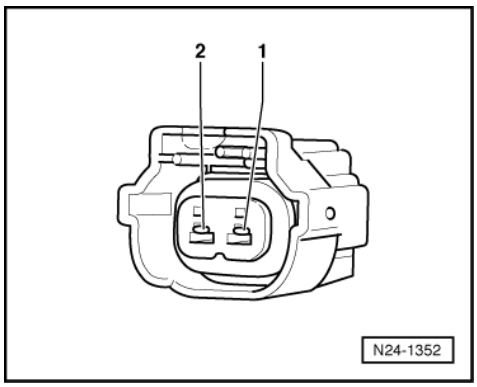
Warning!
Fuel system is under pressure! Before opening the system remove fuse 28 and place a cloth around the connection. Then release pressure by carefully loosening the connection.

- Pull plug off all injectors.



- -> Connect diode test lamp V.A.G 1527 B using aux. cables from V.A.G 1594 to connector contacts 1 and 2 of injector 1.
- Operate the starter and check the voltage supply for No. 1 cylinder injector.
  The LED must flicker
- Repeat check at the injector connectors for Cyls. 2...4.

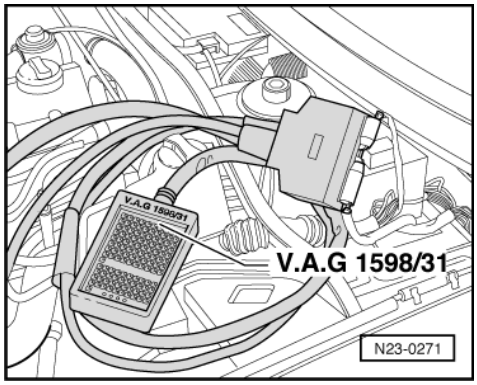
If the LED flickers on one or several cylinders:



- -> Connect diode test lamp to contact 1 and earth of relevant injector connector.
- Allow a second person to operate the starter and check the voltage supply for the injector.
  The LED must light up

If the LED does not light up:

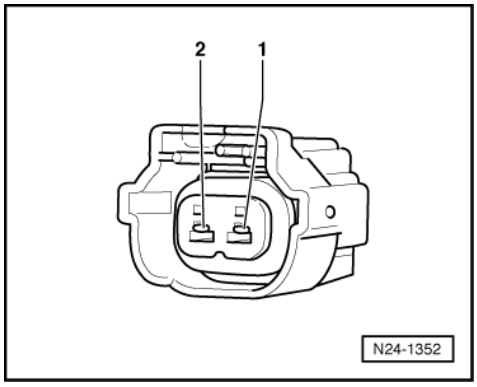
- Switch off ignition.
- Check wiring between 2-pin connector contact 1 and fuel pump relay (J17) for open circuit using current flow diagram.
  Wire resistance: max. 1.5 ω



If no fault is detected in voltage supply:

Check activation:

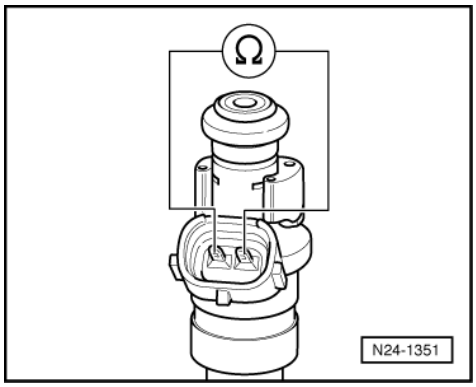
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 2-pin connector for open circuit using current flow diagram.
  Injector 1: Contact 2 and socket 88
  Injector 2: Contact 2 and socket 87
  Injector 3: Contact 2 and socket 85
  Injector 4: Contact 2 and socket 86
  Wire resistance: max. 1.5 ω

- Additionally check wiring for short to one another, and for short to battery positive or earth.
  Specification: ∞ω

If no fault is detected in the wiring:



- -> Check resistance of injectors between contacts.
  Specification: 14...17 ω

Note:

The resistance figures are valid for approx. 20 °C. At higher temperatures the resistance figures will increase.

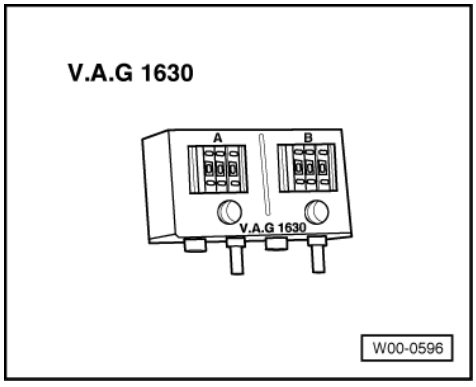
If the specification is not attained:

- Renew defective injector
- Erase learnt values and adapt engine control unit=> Page 139

If the resistance values are OK and no wiring fault has been detected:

- Renew engine control unit => Page 135 .

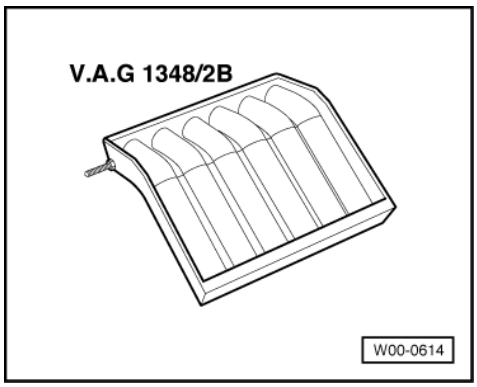
Checking spray pattern and for leaks



Warning!
Fuel system is under pressure! Before opening the system remove fuse 28 and place a cloth around the connection. Then release pressure by carefully loosening the connection.

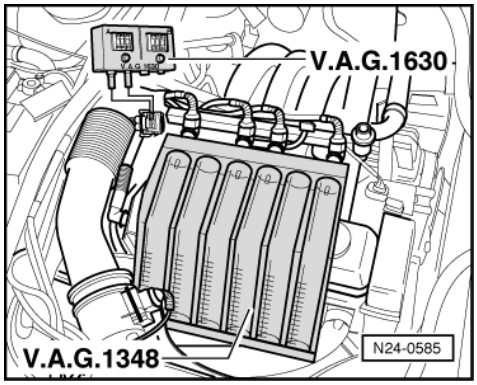
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1630 Digital potentiometer

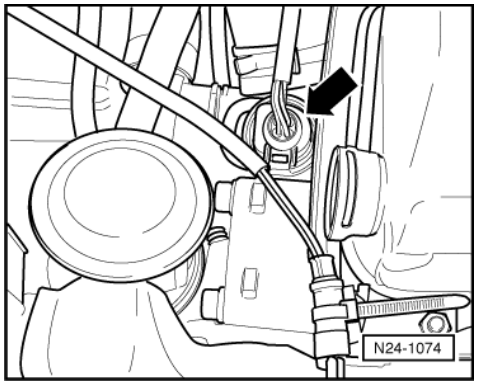


- V.A.G 1348/2B Fuel-quantity comparison meter

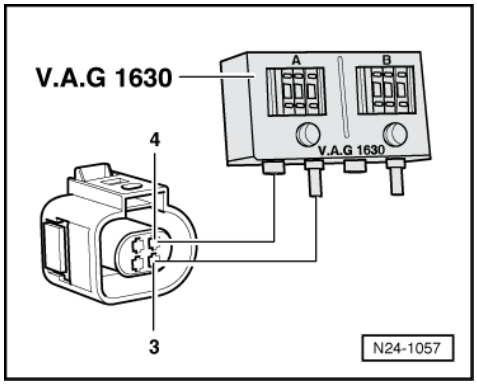
Test sequence



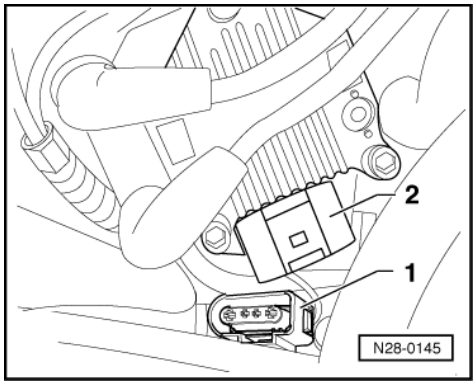
- -> Remove fuel rail with injectors and hold them in the test appliance V.A.G 1348/2B.



- -> Pull the 4-pin connector off coolant temperature sender (G62) -arrow-.



- -> Connect digital potentiometer V.A.G 1630 to contacts 3 and 4 of disconnected plug using adapter cables from V.A.G 1594 and set the connected side to 15 kω.

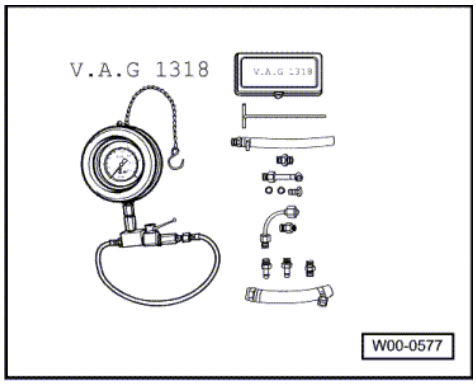


- -> Pull 4 pin connector -1- off ignition transformer (N152) -2-.
- Operate starter (2nd person required). The injectors must pulsate and spray in accordance with firing order.
- Switch off ignition and check injectors for leaks. No more than
  2 drops/min
  may leak from each injector.

Notes:

- Always use new seals
- If injectors are renewed, erase learnt values and adapt engine control unit anew: =>Page 139 .

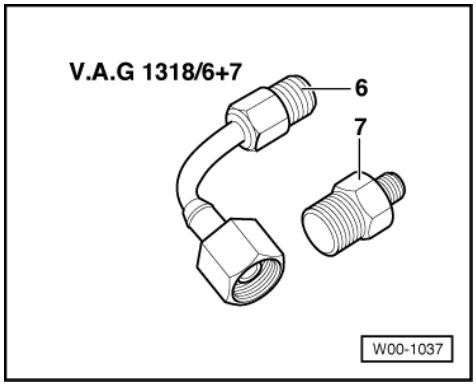
2.10 - Checking fuel pressure regulator and holding pressure



The fuel pressure regulator controls the fuel pressure dependent upon intake manifold pressure.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

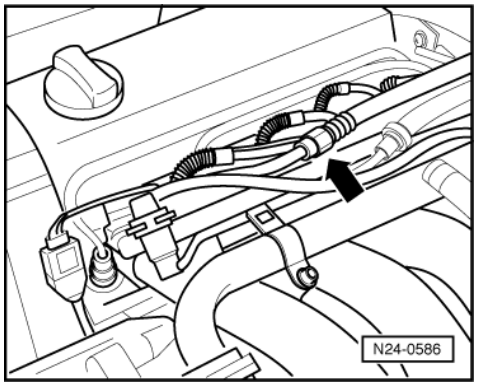
- Pressure tester V.A.G 1318



- V.A.G 1318/6+7 Adapter

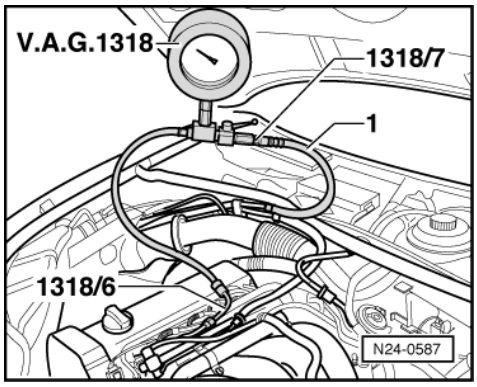
Test sequence

- Remove fuse 28 (fuel pump) from fuse holder.

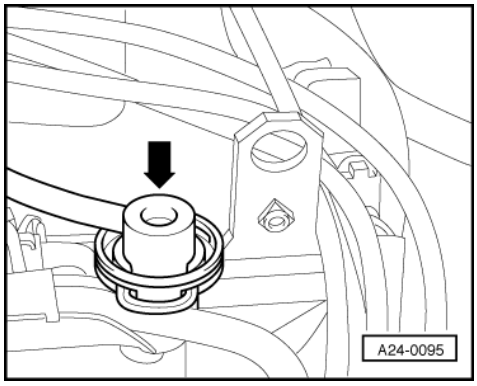


Warning!
Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> Open the union -arrow- and catch escaping fuel with a cloth.



- -> Connect pressure gauge V.A.G 1318 to fuel supply pipe -1- and to fuel rail using adapters 1318/6 and 1318/7.
- Open shut-off tap on pressure gauge. The handle points in direction of flow.
- Refit fuse 28 (fuel pump) in fuse holder.
- Start the engine and run at idling speed.
- Measure fuel pressure.
  Specification: Approx. 3.5 bar



- -> Pull the vacuum hose off fuel pressure regulator -arrow- . The fuel pressure must increase to

approx. 4.0 bar.

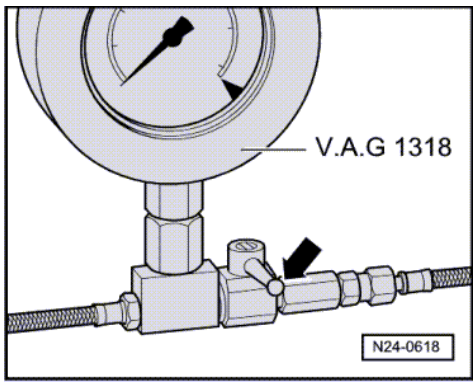
If the specification is not obtained:

- Check quantity supplied by fuel pump.

=> Rep. Gr. 20; Removing and installing parts of fuel system; checking fuel pump

If the specification is obtained:

- Switch off ignition.



- Check for leaks and holding pressure by observing pressure drop on gauge. After 10 minutes there must be
  a residual pressure of
  at least 2.0 bar.

If the holding pressure drops below 2 bar:

- Start the engine and run at idling speed.
- -> Switch ignition off after the pressure has built-up. At the same time close pressure measured device cut-off tap (handle cross through-flow direction -arrow-).
- Observe pressure drop on gauge.

If the pressure does not drop:

- Check fuel pump non-return valve.

=> Rep. Gr. 20; Removing and installing parts of fuel system; checking fuel pump

If the pressure drops again:

- Check pressure gauge for leaks.
- Check pipe connections, O rings on fuel manifold and injectors for leaks.

If no leaks can be found:

- Renew fuel pressure regulator
- Erase learnt values and adapt engine control unit=> Page 139

Note:

Before removing pressure gauge place a cloth around the connections to be loosened and remove fuse 28 (fuel pump) from fuse holder.

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

Checking with engine leak detector spray G 001 800 A1

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Engine leak detector spray G 001 800 A1

Test conditions

- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.

Test sequence

Notes:

- The vacuum in the intake system will cause the leak detector spray to be drawn in with the unmetered air. The leak detector spray reduces the ignitability of the mixture. This leads to a drop in engine speed and to a change of Lambda probe reading.
- The safety precautions listed on the container must be adhered to.

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 1 for "Display group number 1" and confirm entry with Q key.

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

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

- Observe the engine speed in display zone 1 and the Lambda regulation in display zone 3.
- Systematically spray parts of the intake system with engine leak detector spray.

If the engine speed drops or the Lambda regulator changes:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- Check sprayed areas of intake system for leaks and rectify if necessary.
- Erase learnt values and adapt engine control unit=> Page 139

3 - Checking functions

3.1 - Checking functions

3.2 - Idling check

Notes:

- Idling speed, ignition timing and CO content are not adjustable.
- The idling speed is regulated to specification by the throttle valve control part.
- CO content regulated by Lambda regulation. Faults in Lambda control are detected in self-diagnosis and stored in fault memory.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Check conditions

- Exhaust system between cylinder head and catalyst free of leaks
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- If the vehicle is equipped with an air conditioner, this must be switched off.
- On vehicles with automatic gearbox the selector lever must be in "P" position.
- No faults must be stored in fault memory
  => Page 8 , interrogating fault memory
- Steering not on full lock

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 1 for "Display group number 1" and confirm entry with Q key.

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

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

- Check setting conditions in display zone 4. Continue with test once specification has been obtained:
  Specification: 1x111111
  Significance of figures => Page 38
- Press ⇒key.

-> Indicated on display:

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

- Press keys 0, 5 and 1 for "Display group number 51" and confirm entry with Q key.

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

```
Read measured value block 51
     1     2     3     4
```

- Briefly increase engine speed (rev- up) and then allow engine to run at idling speed for 2 minutes.
- Check idling speed in display zone 1.
  Specification: 740...860 rpm1)

1) Up-to-date specifications:

=> Exhaust emissions test binder

If higher revolutions are displayed:

- Check voltage supply for engine control unit in display zone 4.
  Specification: 11.5...14.5

Note:

If the voltage supply is below 9...10.5 V the idling speed will be increased in stages up to 1200 rpm.

If the specification is not obtained:

- Check alternator.

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

If the specification is obtained:

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

If the idling speed is not obtained:

- Erase learnt values and adapt engine control unit=> Page 139
- Carry out test drive.
- Again interrogate the control unit fault memory.
- Repeat the idling check.

If the specifications are not obtained again:

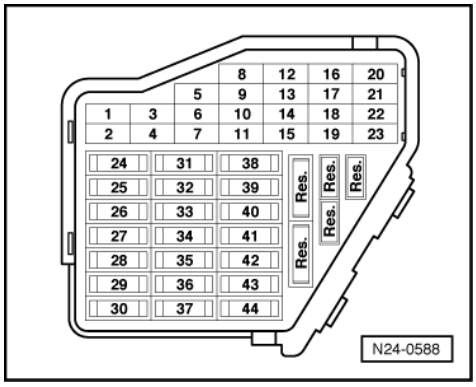
- Check throttle valve control part
  => Page 100 .
- Check the operating condition of engine
  => Page 128 .
- Check the intake air system for unmetered air
  => Page 116

3.3 - Checking Lambda probe and Lambda regulation before catalyst

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions



- -> Fuse 29 must be OK.
- The battery voltage must be at least 11.5 V.
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- No faults must be stored in fault memory
  => Page 8 , interrogating fault memory
- Exhaust system between catalyst and cylinder head must be free of leaks

Functional check

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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      HELP
Input display group number XXX
```

- Press keys 0, 3 and 0 for the "Display group number 30" and confirm entry with Q key.

-> Indicated on display:
(1...2 = Display zones)

```
Read measured value block 30
     1     2
```

- Check Lambda regulation status before catalyst (display zone 1):
  Specification: 1 1 1

Significance of 3 digit number block in display zone 1:

Significance if display = 1			
1	2	3	
		1	Lambda regulation active
	1		Lambda probe operationally ready
1			Lambda probe heating on

If the specification is not obtained:

- Check the Lambda probe heating before catalyst

=> Page 88 .

If the specification is obtained:

- Change to display group 32 as follows:
- Press C key.
- Press keys 0, 3 and 2 for "Display group number 32" and confirm entry with Q key.

-> Indicated on display:
(1...2 = Display zones)

```
Read measured value block 32
     1     2
```

- Check Lambda learnt values at idling speed (additive) in display zone 1.
  Specification: -10.0...10.0 %
- Check Lambda learnt values at part load (multiplicative) in display zone 2.
  Specification: -10.0...10.0 %

If the specification is not obtained:

- =>Page 48 , Evaluating display group 32

If the specification is obtained:

- Change to display group 33 as follows:
  V.A.G 1551: Press key 3
  V.A.G 1552: Press key ↑

-> Indicated on display:
(1...2 = Display zones)

```
Read measured value block 33
     1     2
```

- Observe Lambda regulation in display zone 1. The display must fluctuate at least 2 % in the range -10.0...10.0 %

- Check Lambda probe voltage in display zone 2. The voltage must fluctuate at least 20 times per minute
  in range of
  0... 1.0 V.

If the display in display zone 2 remains constantly at a value:

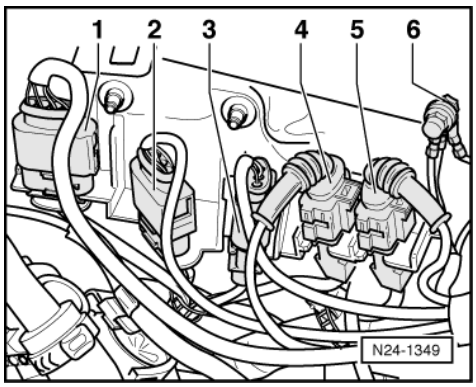
- Continue check according to following table.

Display	Cause	Continuation of check
Between 0.400... 0.500 V	Open circuit	=> Page 126 checking Lambda probe wiring
More than 1.100 V	Short to positive	=> Page 122 checking Lambda probe wiring
0.000 V	Short to earth	

If the Lambda regulation in display zone 1 does not fluctuate as stated:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Clear Lambda probes by taking vehicle for test drive and repeat test.

Observe the valid safety precautions when carrying out a road test => Page 87 .

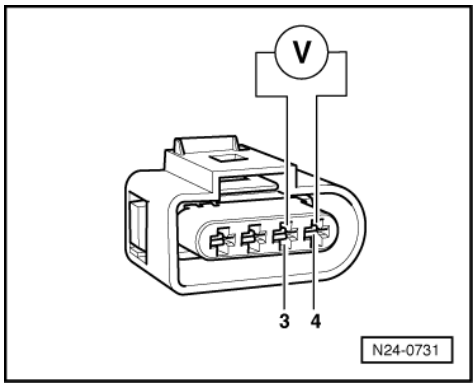


If specifications are not obtained after test drive:

- Check Lambda probe before catalyst for ageing =>Page 127

Checking basic voltage

- -> Separate 4 pin connector (black) to Lambda probe before catalyst (G39) -1-.



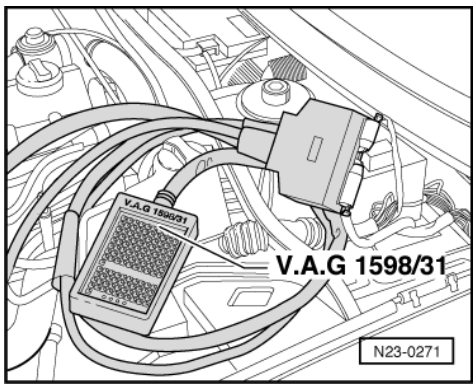
- -> Connect multimeter with aux. cables from V.A.G 1594 to measure voltage at contacts 3+4 (connector to engine control unit).
- Switch on ignition and measure basic voltage.
  Specification: 0.40...0.50 V
- Switch off ignition.

If the specification is not obtained:

- Check Lambda probe wiring
  => Page 122

If the specification is obtained:

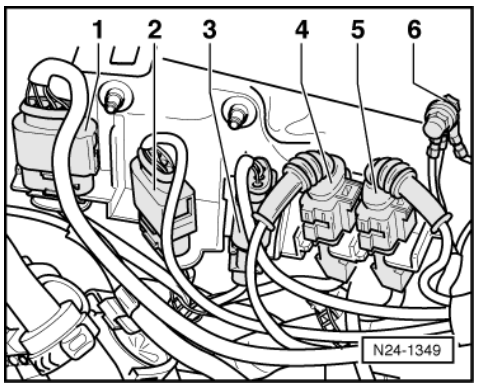
- Replace the Lambda probe before catalyst (G39).



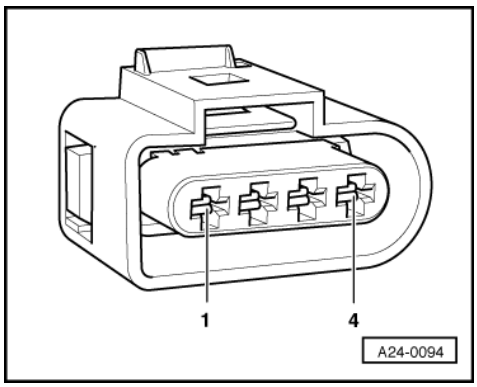
- Erase learnt values and adapt engine control unit=> Page 139

Checking Lambda probe wiring

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Separate 4-pin connector -2- (black) to Lambda probe before catalyst (G39).



- -> Check wiring for open circuit between test box and 4-pin connector to engine control unit using current flow diagram.
  Contact 3 and test box socket 31
  Contact 4 and test box socket 14
  Wire resistance: max. 1.5 ω
- Additionally check wiring for short to one another, and for short to battery positive or earth.
  Specification: ∞ω

Note:

When servicing connectors only gold-plated contacts are to be used.

If no fault is detected in the wiring:

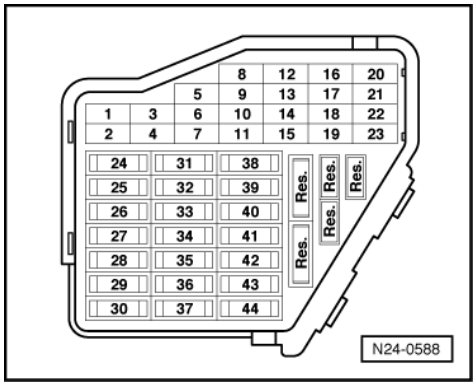
- Replace the Lambda probe before catalyst (G39).
- Erase learnt values and adapt engine control unit=> Page 139

3.4 - Checking Lambda probe and Lambda regulation after catalyst

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594

- Current flow diagram



Check conditions

- -> Fuse 29 must be OK.
- Exhaust system between catalyst and cylinder head must be free of leaks
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- The catalyst temperature must be at least 400 °C, =>display group 43, display zone 2
- The battery voltage must be at least 11.5 V.
- The signals from brake light switch and brake pedal switch must be OK, checking => Page 148 .
- No faults must be stored in fault memory => Page 8 , interrogating fault memory

Functional check

Note:

The Lambda regulation after catalyst is master of the Lambda regulation before catalyst and serves as a corrective regulation.

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 3 and 0 for the "Display group number 30" and confirm entry with Q key.

-> Indicated on display:
(1...2 = Display zones)

```
Read measured value block 30
     1     2
```

- Check the operating condition of the Lambda regulation after catalyst (display zone 2):
  Specification: 11x

Note:

- The third position of the 3 digit number block will be set to 1 only at increased exhaust temperature and part load.

Significance of 3 digit number block in display zone 1:

Significance if display = 1			
1	2	3	
		1	Lambda regulation active
	1		Lambda probe operationally ready
1			Lambda probe heating on

If the Lambda probe heating is not active:

- Check the Lambda probe heating after catalyst => Page 92 .

If the Lambda probe is not operationally ready:

- Check the basic voltage
  => Page 125
- Check Lambda probe wiring
  => Page 126

If the specification is obtained:

- Press ⇒key.

-> Indicated on display:

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

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

-> Indicated on display:

```
Basic setting
Input display group number XXX
```

- Press keys 0, 4 and 3 for "Display group number 43" and confirm entry with Q key.

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

```
System in basic setting     43
     1     2     3     4
```

- Raise engine speed to 2200...2800 rpm.
- Run engine at increased speed until the catalyst temperature in display zone 2 increases to min. 400 °C.

- Maintain the increased engine speed until the display in display zone 4 shows the result of the short test: Specification "B1 P2 OK.

If "B1-P2 nOK is displayed:

- Check the Lambda probe voltage after catalyst in display zone 1:
  Specification: 0.000...1.000 V
  (can fluctuate slightly)

If the specification is obtained:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Carry out a test drive to remove possible residue on Lambda probe and repeat check.

Observe the valid safety precautions when carrying out a road test => Page 87 .

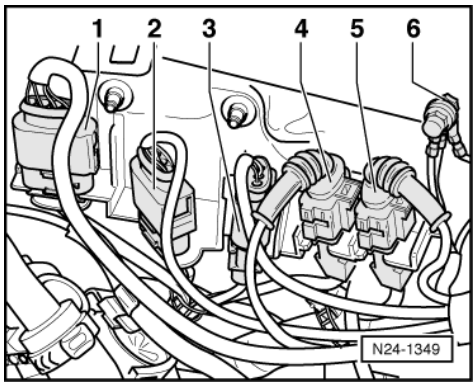
If the specifications are again not attained:

- Replace Lambda probe after catalyst (G130).
- Erase learnt values and adapt engine control unit=> Page 139

If the display in display zone 3 remains at a constant value:

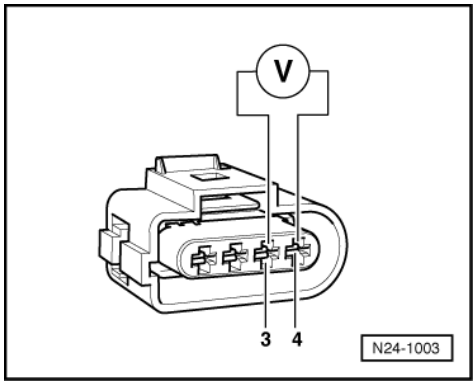
- Continue check according to following table.

Display	Cause	Continuation of check
Between 0.390... 0.500 V	Open circuit	=> Page 126 checking Lambda probe wiring
More than 1.100 V	Short to positive	=> Page 126 checking Lambda probe wiring
0.000 V	Short to earth	



Checking basic voltage

- -> Separate 4 pin connector (black) to Lambda probe before catalyst (G39) -1-.



- -> Connect multimeter using aux. cables from V.A.G 1594 to measure voltage at contacts 3 + 4 (connector to engine control unit).
- Start engine and measure the basic voltage.
  Specification: 0.39...0.50 V
- Switch off ignition.

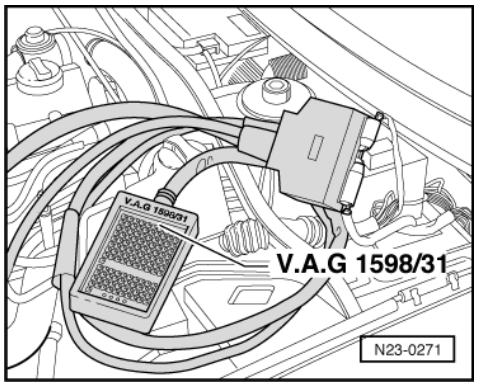
If the specification is not obtained:

- Check Lambda probe wiring

=> Page 126

If the specification is obtained:

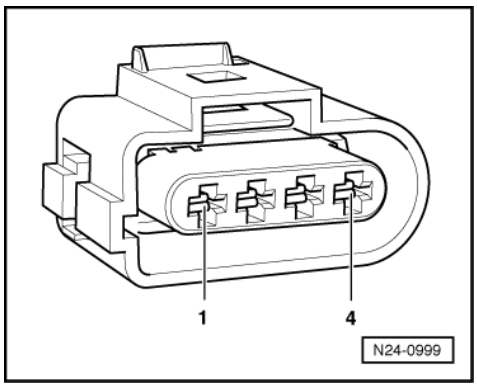
- Renew Lambda probe after catalyst (G130).



- Erase learnt values and adapt engine control unit=> Page 139

Checking Lambda probe wiring, Lambda probe after catalyst (G130)

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.

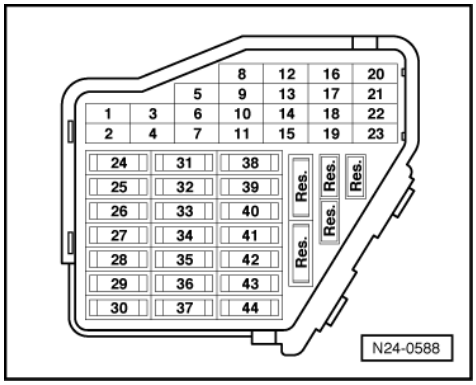


- -> Check wiring between test box and 4-pin connector to engine control unit for open circuit using current flow diagram.
  Contact 3 and test box socket 35
  Contact 4 and test box socket 16
  Wire resistance: max. 1.5 ω
- Additionally check wiring for short to one another, and for short to battery positive or earth.
  Specification: ∞ω

If no fault is detected in the wiring:

- Renew engine control unit => Page 135 .

3.5 - Checking Lambda probe ageing, Lambda probe before catalyst



Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Check conditions

- -> Fuse 29 must be OK.
- Exhaust system between catalyst and cylinder head must be free of leaks
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- The catalyst temperature must be at least 400 °C, =>display group 34, display zone 2
- The signals from brake light switch and brake pedal switch must be OK, checking => Page 148 .
- The battery voltage must be at least 11.5 V.

Functional check

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 3 and 4 for "Display group number 34" and confirm entry with Q key.

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

```
System in basic setting      34
     1     2     3     4
```

- Depress and hold brake pedal until display in display zone 4 changes from "Test OFF" to "Test ON".

  The engine speed is increased by the control unit to approx. 1100...1300 rpm.

- Keep brake pedal depressed until the result of ageing test is displayed in display zone 4:
  Specification: "B1-P1 OK"

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 ignition.

If the specification is not obtained:

- Carry out a road test to free Lambda probe of possible residues and repeat the test.

Observe the valid safety precautions when carrying out a road test => Page 87 .

If the specifications are again not attained:

- Replace Lambda probe (G39).
- Erase learnt values and adapt engine control unit=> Page 139

3.6 - Checking engine operating mode

Note:

Check establishes whether Simos control unit (J361) recognises the engine operating modes.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test conditions

- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 5 for "Display group number 5" and confirm entry with Q key.

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

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

- Check whether the control unit recognises the operating mode (display zone 4):

- Idling:

  As long as the engine is running at idling speed idling must be displayed

Display: Idling

- Overrun mode:

- Increase engine speed to above 3000 rpm.
- Quickly release accelerator pedal.

As long as the engine speed is above 1400 rpm overrun must be displayed
Display: Overrun

Note:

Below 1400 rpm idling speed will be recognised.

- Part throttle:

- Rev up evenly.

As long as the engine is being revved up evenly, part throttle must be displayed
Display: Part throt.

- Enrichment and full throttle:

- Depress accelerator pedal completely (throttle burst)

Enrichment and then full throttle should be displayed briefly
Display: Enrich. and then full throtl.

Note:

A test drive may have to be performed to show "Full throttle" in display.

Observe the valid safety precautions when carrying out a road test => Page 87 .

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

If the specifications are not attained:

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 8 , interrogating and erasing fault memory.
- Check throttle valve control part
=> Page 100 .
- Check parts of the electronic throttle control (EPC) for ease of movement:

=> Repair group 20; Electronic throttle control (EPC); Servicing parts of the electronic throttle control (EPC)
Electronic throttle control (EPC) Servicing parts of the electronic throttle control (EPC)

3.7 - Checking intake manifold change-over

The check need only be carried out when performance is poor.

Special tools, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594

Checking function

- Remove cover for intake manifold change-over => Page 80 item 23
- Start engine and run at idling speed.

- Allow a second person to give a sharp burst of the throttle (rev-up) and observe the vacuum control element for intake manifold change-over:
  The control element must pull on

If change-over does not occur, the following checks must be carried out.

- Allow engine to run at idling speed for some time.

Note:

This allows a vacuum to be built up in the vacuum reservoir (part of variable intake manifold).

- Switch off ignition.
- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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 3 for the function "Final control diagnosis".
- Confirm input with Q key.

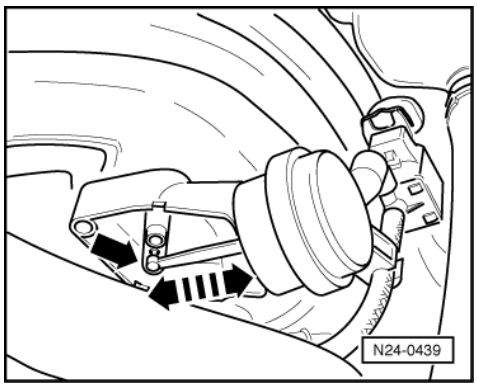
-> Indicated on display:

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

- Press ⇒key twice.

-> Indicated on display:

```
Final control diagnosis
Intake manifold change-over valve     -
N156
```



- -> Observe vacuum control element for intake manifold change-over:
  The actuator must move back and forth between both positions.
  (But only until the vacuum reserves have been used).

If the change-over does not function, but the variable intake manifold change-over valve clicks:

- Switch off ignition.
- Check change-over mechanics for freedom of movement. To do this operate rods by hand.

- Check vacuum pipes for correct connection.
- Check vacuum system for leaks including vacuum reservoir in intake pipe.

If the change-over does not function and the variable intake manifold valve does not click:

- Check activation of variable intake manifold change-over valve (N156) via final control diagnosis => Page 20 .

4 - Engine control unit

4.1 - Engine control unit

4.2 - Function

The engine control unit, after evaluating injection system input signals, controls the throttle valve control part, ignition, activated charcoal filter solenoid valve 1, speed governor, overrun switch-off, intake manifold change-over, secondary air system, cruise control system as well as self-diagnosis.

4.3 - Checking control unit voltage supply

Note:

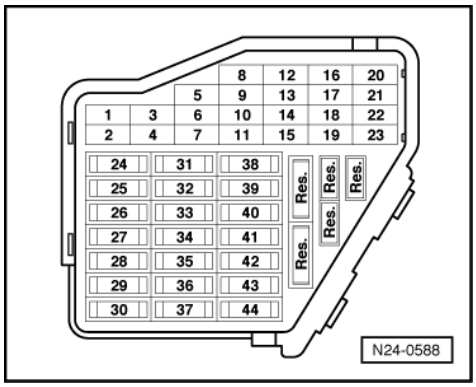
The voltage supply (positive) is supplied to the engine control unit (contact 3) via Simos control unit current supply relay (J363) when ignition is switched on. When the ignition is switched off it must be supplied with current for approx. 40 seconds, to allow the learnt values to be stored. Therefore the engine control unit is supplied with current (contact 23), until it has "run-down", via the current supply relay coil. Only then is the supply switched off and the voltage supply via the voltage supply relay (J363) to the engine is disconnected. The engine control unit detects the fact that the driver has switched the ignition off via contact 62 (terminal 15).

The earth supply for the engine control unit is via contacts 1 and 2.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions



- -> Fuses 32 and 43 must be OK.
- All electrical consumers, e.g. lights and rear window heating must be switched off.
- The battery voltage must be at least 11.5 V.

- Earth connection OK; Checking

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

- Alternator OK, checking:

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

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 0 and 4 for "Display group number 4" and confirm entry with Q key.

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

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

- Read off figure displayed in display zone 2.
  Specification: At least 11.5 V
- Switch off ignition.
- Now check the control unit run-on.
- Observe display on tester:
  Measured value block 4 must continue to be displayed for approx. 40 seconds.

After approx. 40 seconds the supply is interrupted and the display must change.

-> Indicated on display:

```
Tester sends address word 01
```

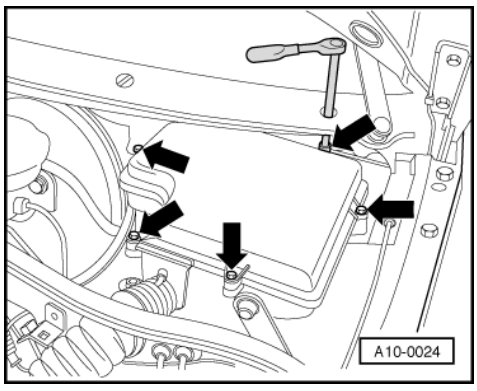
- Then:

-> Indicated on display:

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

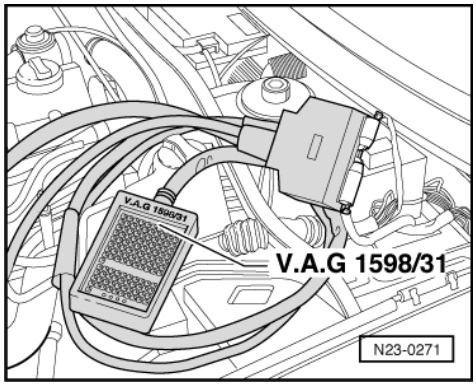
If the display does not change as described:

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



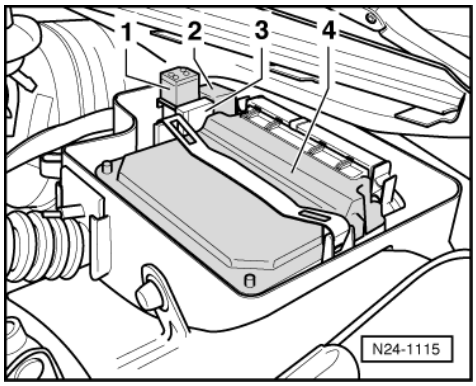
- -> Remove cover of protective housing for control units.

Checking voltage supply for Simos control unit (J361)



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Switch on ignition.
- Measure supply voltage with multimeter and adapter cables from V.A.G 1594 between sockets 1 + 3 and 2 + 3 of test box:
  Specification: at least 11.5 V

Checking terminal 15 signal

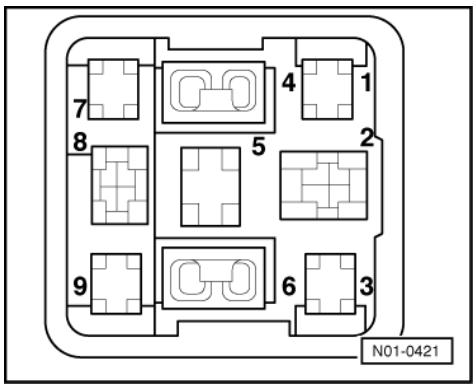


- Measure supply voltage between test box sockets 1 + 62 and 2 + 62 using a multimeter and adapter cables from V.A.G 1594.
  Specification: at least 11.5 V

If the specifications are not attained:

- Switch off ignition.
- -> Pull current supply relay (J363) item 2 out of relay socket.

Notes:

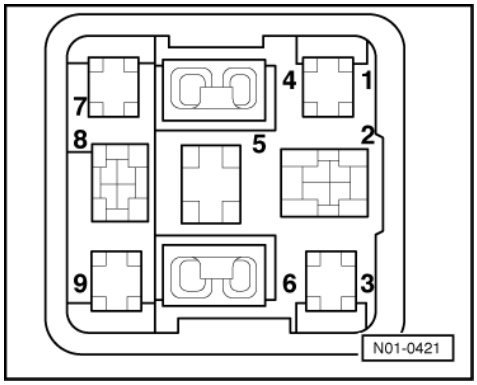


- If tools are necessary to pull relays or control units out of the relay plate, first disconnect battery earth strap.
- Before disconnecting battery earth strap obtain code for radios with anti-theft coding.

Checking voltage supply relay for Simos control unit (J363) and wiring connections to engine control unit

- -> Connect multimeter to relay plate contact 2 and earth using adapter cables from V.A.G 1594.
  Specification: 11.5...14.5

If the specification is not obtained:



- Check wiring to current supply relay (J363) using current flow diagram:

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

If the specification is obtained:

- -> Set multimeter to measure resistance. Check wiring between test box and relay socket.
  Contact 6 and test box socket 3
  Wire resistance: max. 1.5 ω
- As continuation of test, check control unit run-on.
  Contact 9 and test box socket 23
  Wire resistance: max. 1.5 ω

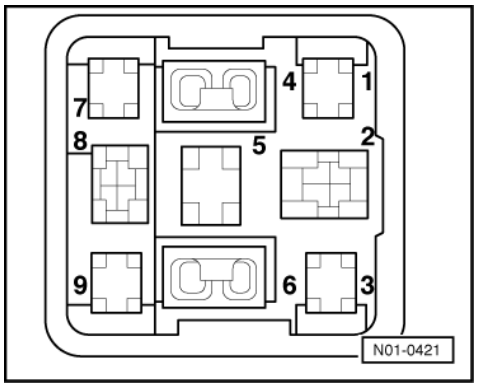
If the specifications are not attained:

- Check wiring connections from current supply relay (J363) to engine control unit referring to current flow diagram:

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

If the specifications are attained:

Checking activation of Simos control unit current supply relay (J363)



- -> Set multimeter to measure voltage and connect it to relay plate contacts 4 and 8 using adapter cables from V.A.G 1594.
- Switch on ignition.

Specification: min. 11.5 V

If the specification is not obtained:

- Check wiring to current supply relay (J363) using current flow diagram:

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

If no fault is detected in the wiring:

- Renew voltage supply relay (J363) for Simos control unit.

4.4 - Replacing engine control unit

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 with cable V.A.G 1551/3

Work sequence

- First print out the control unit identification and thereby the previous control unit coding as follows:
- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> The control unit identification and the coding are indicated on display, e.g.:

```
06B906033J 2.0l/2V SIMOS32G00HS3590
Coding XXXXX     WSC XXXXX
```

- Print out the control unit identification by pressing the fault reader print button.
- Press the ⇒key.

-> Indicated on display:

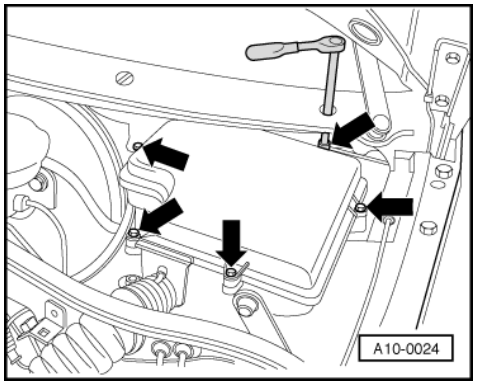
```
WVWZZZ3BZ1E000340     VWZ7Z0Y0064267
```

- Print out chassis number and immobilizer identification number by pressing the Print key.
- Press the ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

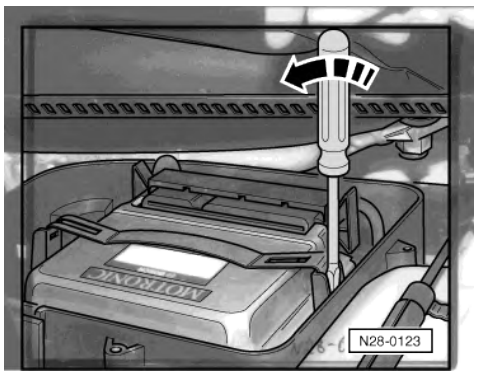
-> Indicated on display:

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

- Switch off ignition.



- -> Remove cover of protective housing for control units.



- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Release connector from control unit and pull off.
- Remove the old control unit and insert the new one.
- Check the previous coding and the coding of the new control unit => Page 136 .
- Match new control unit to throttle valve control part => Page 139
- Adapt new control unit to the electronic immobilizer.

=> Electrical system self-diagnosis; Repair group 01

- On vehicles with cruise control system: Check whether this function has been enabled (activated) => Page 4 . If "G" is not evident in the control unit identification, activate the cruise control system.

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

- Perform idling check
  => Page 117

Vehicles with automatic gearboxes:

- Adapt control unit for automatic gearbox:

=> Self-diagnosis for automatic gearbox 01N; Repair group 01; Performing self-diagnosis; Initiating basic setting Performing self-diagnosis Initiating basic setting

- Learning kick-down point => Page 141

Continued for all vehicles

- Then subsequently interrogate the fault memory of the new engine control unit and erase the fault memory if necessary => Page 8 .
- Carry out test drive.

  During the road test the following operating conditions must be fulfilled:
  - The coolant temperature must exceed 80 °C .
  - When the temperature is reached, the operating conditions
    Idling
    Part throttle
    Enrichment
    Full throttle
    Overrun
    must be attained several times.

- Again interrogate the control unit fault memory.

4.5 - Coding engine control unit

Notes:

- A 5-character code must always be displayed during the control unit identification.

- The control unit must be recoded if the vehicle relevant coding is not displayed or the control unit has been renewed.
- Measured value blocks 125 and 126 indicate which control units are connected via data bus to the engine control unit =>Page 59 .

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 with cable V.A.G 1551/3

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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:

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

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

  Coding variations => Page 138 .

-> The control unit identification and the coding are indicated on display, e.g.:

```
06B906033J 2.0l/2V SIMOS32G00HS3590
Coding XXXXX     WSC XXXXX
```

- Press the ⇒key.

-> Indicated on display:

```
WVWZZZ3BZ1E000340     VWZ7Z0Y0064267
```

- Press the ⇒key.

-> Indicated on display:

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

- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition for at least 40 seconds (control unit run-on).

-> Indicated on display when a non-authorised code number has been entered.

```
FAULT
Code xxxxx not accepted
```

Notes:

The engine control unit does not store the entered code (shown on display) until ignition has been switched off and control unit run-on has ended (40 seconds). Incorrect coding could lead to:

- Engine running faults (gear change jerks, load change jerks, etc.)
- Increased fuel consumption
- Increased exhaust gas emissions
- Faults stored in fault memory which are not actually present
- Functions will not be performed (Lambda regulation, activation of the activated charcoal filter system, etc.).
- On vehicles with front-wheel drive the traction control system does not function (TCS warning lamp lights up)

- Reduced gearbox life

4.6 - Coding variations of engine control unit

Note:

When replacing the engine control unit the coding for vehicles 05.01 ‣ must be used.

Vehicles ‣05.01

Vehicle/exhaust	Special code	Data bus	Gearbox
00 = No coding	0 = No coding for vehicles with front-wheel drive	0 = ABS and airbag not fitted or without data bus	0 =
01 =	1 = Four-wheel drive	1 = ABS with ESP	1 = 5-speed manual gearbox
02 =	2 =	2 = Airbag with data bus	2 =
03 =	3 =	3 = ABS with ESP and airbag with data bus	3 = Automatic gearbox
04 =	4 =	4 =	4 =
05 =	5 =	5 =	5 =

Vehicles 05.01 ‣

Vehicle/exhaust	Special code	Data bus	Gearbox
00 = No coding	0 = No coding for vehicles with front-wheel drive	0 = ABS, Airbag and Clima-tronic not fitted or without data bus	0 =
01 =	1 = Four-wheel drive	1 = ABS with ESP	1 = 5-speed manual gearbox
02 =	2 =	2 = Airbag with data bus	2 =
03 =	3 =	3 = ABS with ESP and Airbag with data bus	3 = Automatic gearbox
04 =	4 =	4 = Climatronic	4 =
05 =	5 =	5 = Climatronic and ABS with ESP	5 =
06 =	6 =	6 = Climatronic and Airbag with data bus	6 =
07 =	7 =	7 = Climatronic, Airbag with data bus and ABS with ESP	7 =

Note:

Which control units are actively connected to the engine control unit via data bus, can be read in measured value blocks 125 and 126 =>Page 59 .

The code number is compiled as shown in the following example:

5-speed manual gearbox:				1
ABS with ESP and airbag with data bus			3	
Four-wheel drive		1		
Vehicle/exhaust presently no coding	00			

Code number:	00	1	3	1

4.7 - Erasing learnt values and adapting engine control unit to throttle valve control part

First erase old learnt values. This is required to bring the learnt value which may possibly be at the limit stop back to a neutral value. The engine control unit learns various positions of the throttle valve part during adaption when the ignition is switched on but the engine is not running. These positions are stored in the control unit.

Adapting sequence must be performed if:

- The throttle valve control unit has been removed and installed or possibly cleaned
- The throttle valve control unit is renewed
- If when installing another engine another throttle valve control unit is installed
- Defective components such as Lambda probes, injectors or the pressure regulator have been replaced.
- When leaks in the intake system (unmetered air) have been detected and rectified.
- The engine control unit is renewed.
- Catalyst has been replaced

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Check conditions

- Ignition on, engine not running
- No faults must be stored in fault memory
  => Page 8 , interrogating fault memory
- The battery voltage must be at least 11.5 V.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- If the vehicle is equipped with an air conditioner, this must be switched off.
- The throttle valve must be at idling speed position (The accelerator must not be operated during the test).
- The intake air temperature must be at least 6 °C =>display group 04, display zone 4.
- Coolant temperature must be 5...110 °C =>display group 04, display zone 3.
- Throttle valve not damaged or dirty.

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> Indicated on display:

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

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

-> Indicated on display:

```
Adaption
Feed in channel number XX
```

- Press key 0 twice for "Channel number 0" and confirm entry with Q key.

-> Indicated on display:

```
Adaption     Q
Erase learnt values?
```

- Confirm input with Q key.

-> Indicated on display:

```
Adaption
Learnt values have been erased
```

- Press the ⇒key.

-> 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
Input display group number XXX
```

- Press keys 0, 6 and 0 for the "Display group number 60" and confirm entry with Q key.

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

```
System in basic setting     60
     xxx.x %     xxx.x %     x     ADP.
runs
```

After pressing the Q key, the following learning steps will be performed:

- Learning step 1: The engine control unit checks if all test conditions are fulfilled.
- Learning step 2: The throttle valve part is switched to no voltage (emergency operation position). The angle sender values of the emergency operation position are stored in engine control unit.
- Learning step 3: The throttle valve is set to a value above the emergency operation point.
- Learning step 4: The final stage of the throttle valve positioner is switched off. Now the mechanical spring must set the throttle valve to the previously learnt emergency operation position within a certain time (spring closing test).
- Learning step 5: The throttle valve is closed by the throttle valve positioner (lower mechanical stop).
- Learning step 6: The angle sender values from the lower mechanical limit stop are stored in the engine control unit. On this basis, the lower electronic stop is then defined (calculated) and stored in the control unit.
- Learning step 7: The final stage is switched off at the lower mechanical stop. Now the mechanical spring must set the throttle valve in the emergency operation position (spring opening test).
- Learning step 8: The sender angle values are checked.

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

```
System in basic setting     60
     xx.x %     xx.x %     0     ADP. OK
```

Adapting has been performed successfully.

- End basic setting of throttle valve control part by pressing⇒ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

To store the values:

- Switch off ignition for at least 40 seconds (control unit run-on).
- On vehicles with automatic gearbox, the gearbox control unit must be adapted.

=> Self-diagnosis for automatic gearbox 01N; Repair group 01; Performing self-diagnosis; Initiating basic setting Performing self-diagnosis Initiating basic setting

- Vehicles with an automatic gearbox, the kick-down point must be learnt again. Learning kick-down point => Page 141

If the basic setting of the control unit is interrupted, the cause could be one of the following:

- The test conditions were not fulfilled.
- Throttle valve control unit or wiring is defective. Check => Page 100 .

After an interruption a fault is stored in fault memory. When next switching on ignition the basic setting is automatically performed again.

4.8 - Learning kick-down point

Vehicles with automatic gearbox only

If the engine control unit, the throttle valve control part or the electric accelerator mechanism was renewed, the kick-down point must be learnt again.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Check conditions

- Ignition on, engine not running
- No faults must be stored in fault memory
  => Page 8 , interrogating fault memory
- The selector lever of the automatic gearbox must be in "P" position.

Test sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press the keys 0, 6 and 3 for "Display group number 63" and confirm with Q key.

-> Indicated on display:

```
System in basic setting      63
     1     2     3     4
```

- Observe display zones:
  Display: Operate kick down
- Immediately after the direction -Press down pedal and hold-, press accelerator pedal beyond kick-down point to floor.
- Hold pedal at stop.
- Observe display zones:
  Specification: ADP. runs
  then
  Specification: ADP. OK

To store the values:

- Switch off ignition for at least 40 seconds (control unit run-on).

- If the following appears in display zones:
  Display: ERROR
- Exit the basic setting mode and repeat the test.

Note:

ERROR- can be displayed if you do not immediately follow the direction -Press down pedal and hold- and have waited a while, or if you have released the accelerator pedal while the adaption is running.

If the displays do not indicate as described:

- Check the accelerator pedal position sender.

=> Repair group 20; Electronic engine output regulation (electronic accelerator (EPC)); Checking accelerator pedal position sender Electronic engine output regulation (electronic accelerator (EPC)) Checking accelerator pedal position sender

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 8 , interrogating and erasing fault memory.

4.9 - Checking matching resistor for data bus

Function

The engine control unit communicates with other data bus-compatible control units.

The control units are connected via a twisted pair of data bus wires ("high" and "low") and exchange information (messages). Information missing from the data bus will be recognised as a fault by both the engine control unit and other data bus control units.

The data bus requires a matching resistor to function fault free. This central matching resistor is located in the engine control unit.

Note:

You can read out which control units are actively connected via data bus to the engine control unit in measured value blocks 125 and 126 =>Page 59 .

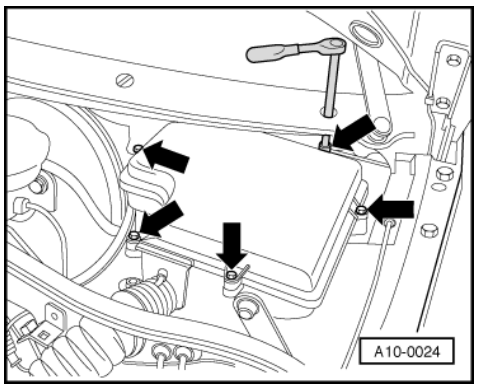
Test conditions

- A data bus fault has been recognised by the self-diagnosis.
- Ignition off

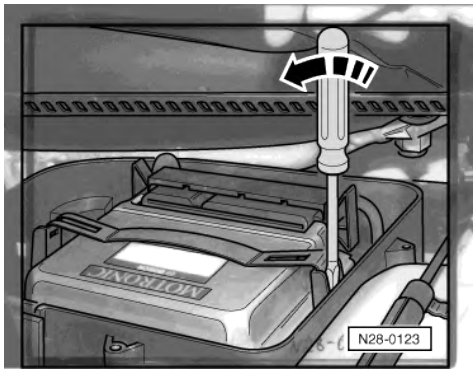
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Test sequence



- -> Remove cover of protective housing for control units.



- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Release connector from control unit and pull off.
- Take out control unit.
- Connect test box V.A.G 1598/31 to engine control unit. The control unit wiring harness is not connected by this action.
- Check centralized matching resistor in engine control unit.
- To do this, measure resistance between test box
  Sockets 20 + 21:
  Specification: 60 ...72 ω

If the resistance measurement is outside the specified range:

- Renew engine control unit => Page 135 .

If the resistance value is within the specified range:

- Check drive train data bus:

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

5 - Checking additional signals

5.1 - Checking additional signals

5.2 - Checking speed signal

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Diode test lamp V.A.G 1527 B
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions

- The battery voltage must be at least 11.5 V.
- Speedometer must be OK., checking speedometer:

=> Electrical system; Repair group 90

Test sequence

Note:

To check the speed signal the vehicle must be driven. To do this a second person is necessary.

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

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

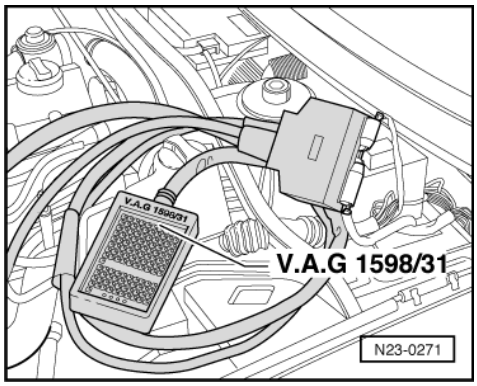
- Press keys 0, 0 and 5 for "Display group number 5" and confirm entry with Q key.

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

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

- Carry out test drive with a 2nd person to observe display.
- Observe figure displayed in display zone 3:
  Specification: approx. driven speed
- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.

If no speed is displayed:



Vehicles ‣ 05.01 with data bus capable ABS control unit (ESP):

- Interrogate fault memory of ABS control unit.

=> Running gear self-diagnosis for ABS; Repair group 01

Continuation for all other vehicles:

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.

- Connect diode test lamp between socket 3 (positive) and socket 9 (road speed signal).
- Raise front left side of vehicle.
- Switch on the ignition and turn the front left wheel by hand.
- The diode test lamp must flash.
- If the diode test lamp does not flash, check the wiring from contact 9 of engine control unit connector to dash panel insert for open/short circuit.

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

5.3 - Checking signal from/to air conditioning system

Checking signals from/to air conditioner compressor

Air conditioner compressor signal:
Just before the air conditioner compressor is switched on, the voltage is sent to the engine control unit. The signal ensures that once the air conditioner is switched on, idling speed will not drop drastically.

Switching off air conditioner compressor:
In order that engine performance is not impaired when accelerating, the A/C compressor is switched off briefly when accelerating from start or from low engine revs.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Test conditions

- Air conditioner functioning OK.
- Air conditioner must be switched off
- No faults must be stored in fault memory => Page 8 , interrogating and erasing fault memory.
- Vehicle at room temperature (warmer than + 15 °C).

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 5 and 0 for "Display group number 50" and confirm entry with Q key.

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

```
Read measured value block 50
     1     2     3     4
```

- Check the display in display zone 4.

Indicated in display zone 4:
Compr.OFF

- Switch on air conditioning system.
- Select lowest temperature and highest blower speed.

The display in display 4 must change to
Compr.ON.

Vehicles with automatic gearbox

- Floor accelerator pedal quickly and then release (brief burst of throttle).

The display in display zone 4 must change from
Compr.ON
to
Compr. OFF
for a few seconds (compressor switched off when accelerating).

Vehicles with manual gearbox

Note:

A road test is required to test the shut-off function on a vehicle with manual gearbox.

Observe the valid safety precautions when carrying out a road test => Page 87 .

- Engage 1st gear and accelerate moderately hard. Then release accelerator pedal.

The display in display zone 4 must change from
Compr.ON
to
Compr. OFF
for a few seconds (compressor switched off when accelerating).

Continued for all vehicles

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

If the displays do not change as described:

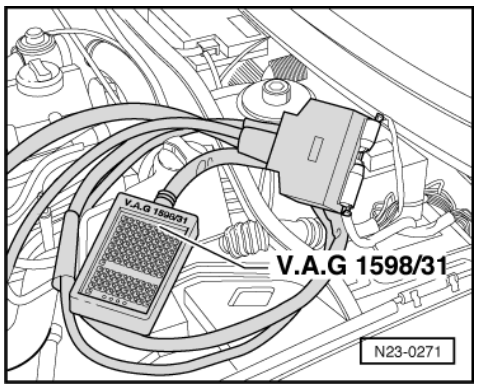
Vehicles with Climatronic 05.01 ▸

- Interrogating Climatronic fault memory:

=> Heating, air conditioning; Repair group 01; Climatronic self-diagnosis; Interrogating fault memory

- Check coding => Page 136
- Check drive train data bus:

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



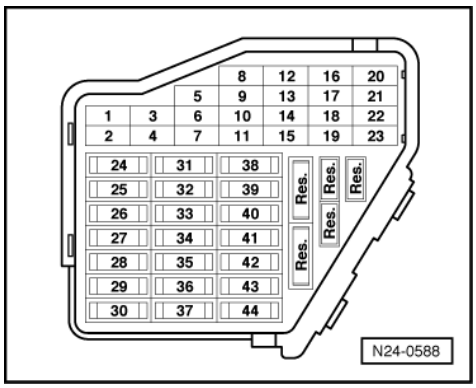
Continued for all vehicles

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Check wiring between test box sockets 76 and the air conditioner for open circuit using current flow diagram.
  Wire resistance: Max. 1.5 ω

5.4 - Checking signal from clutch pedal switch

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715



- Adapter set V.A.G 1594
- Current flow diagram

Check conditions

- -> Fuse 7 must be OK.
- The battery voltage must be at least 11.5 V.

Test sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 6 and 6 for "display group 66" and confirm with Q key.

-> Indicated on display:

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

- Observe display in display zone 2 (3rd digit from right).
  Specification: x x x x 0 x x
- Depress clutch pedal fully and observe display in display zone 2.

Specification: x x x x x 1 x x
- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.

If the display does not change:

- Remove the shelf on driver's side:

=> General body repairs, interior; Repair group 68; Dash panel; Removing driver's side shelf Dash panel Removing driver's side shelf

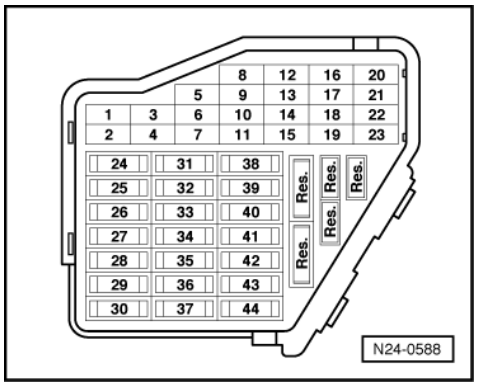
- Check clutch pedal switch (F36) and wiring connections referring to current flow diagrams:

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

5.5 - Checking signal from brake light switch and brake pedal switch

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31



- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Test conditions

- -> Fuses 7 and 13 must be OK.

Test sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 6 and 6 for "display group 66" and confirm with Q key.

-> Indicated on display:

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

- Observe display in display zone 2:
  (1st and 2nd position from right)
  Specification: x x x x x x 0 0
- Depress brake pedal and observe display in display zone 2.
  Specification: x x x x x x 1 1
- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.

If the display does not change:

- Remove the shelf on driver's side:

=> General body repairs, interior; Repair group 68; Dash panel; Removing driver's side shelf Dash panel Removing driver's side shelf

- Check brake light switch (F), brake pedal switch(F47) and wiring connections referring to current flow diagram:

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

5.6 - Checking driving range signal

Vehicles with automatic gearbox only

Engine control unit receives following information from gearbox control unit:
Driving range selected (selector lever in 2/3/4/R/D)
or
No driving range selected (selector lever in P or N)

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3

Test conditions

- The selector lever of the automatic gearbox must be in "P" position.

Test sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 5 and 5 for "Display group number 55" and confirm entry with Q key.

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

```
Read measured value block 55
     1     2     3     4
```

- Observe display zone 4. The display must read
  Specification: x x x 0 x "Neutral".
- Depress foot brake and select driving range. The display must jump to
  Specification: x x x 1 x "Gear engaged".
- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.

If the display does not change:

- Check drive train data bus:

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

28 - Ignition system

1 - Servicing ignition system

1.1 - Servicing ignition system

1.2 - General notes on ignition system

- Only the components which specifically relate to the ignition system are dealt with here. For the other components of the injection and ignition system.

=> Repair group 24

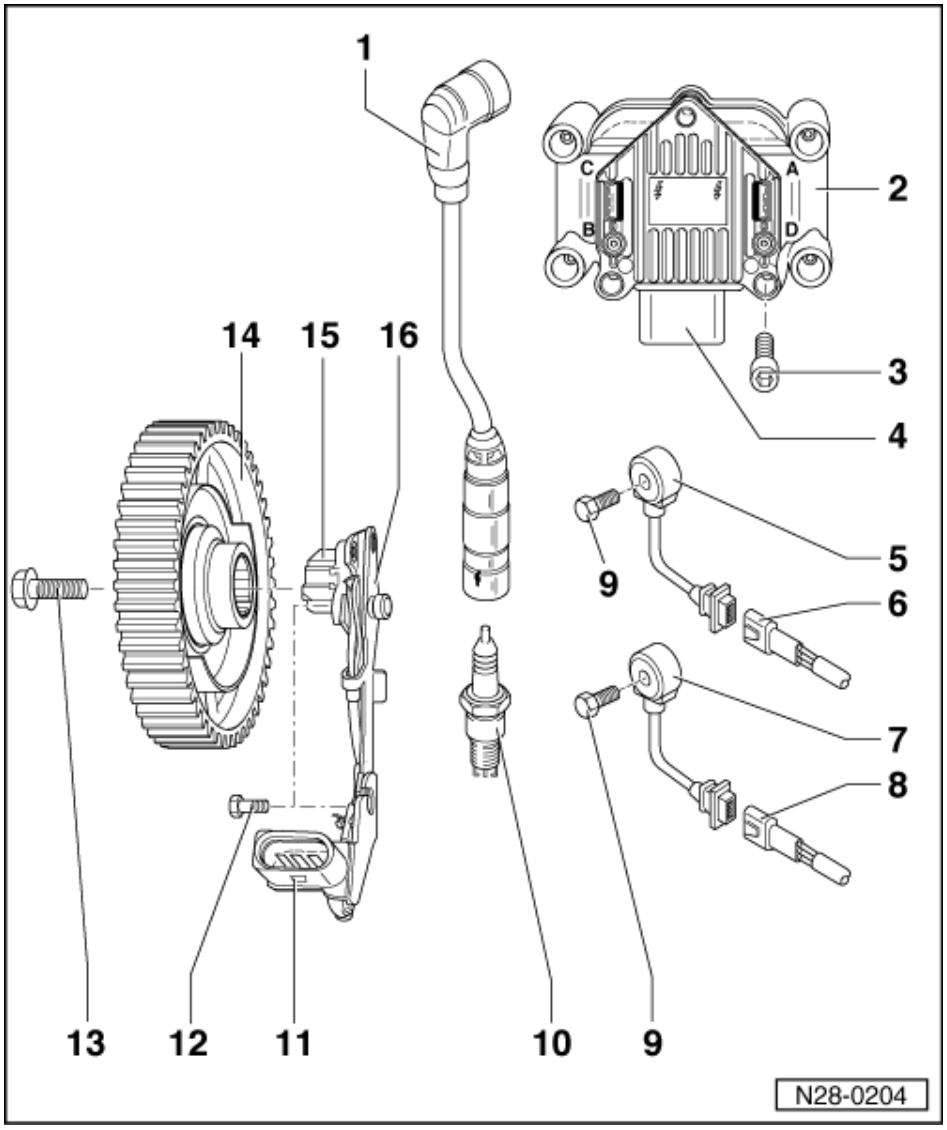
- Components marked with * are checked via the self diagnosis.
- For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- Before carrying out repairs and for fault finding, interrogate fault memory => Page 8 , interrogating and erasing fault memory of engine control unit.
- During some checks it is possible that the control unit will recognise and store a fault. Therefore after completing all checks and repairs the fault memory must be interrogated and if necessary erased. => Page 8 .
- If the engine starts, runs for a short period and then stops, after fault finding, repairs or component tests, then the fault may lie with the immobilizer which is blocking the engine control unit. The fault memory must be interrogated and if necessary the control unit adapted.

=> Electrical system self-diagnosis; Repair group 01

Safety precautions => Page 155

Test data, spark plugs => Page 155

1.3 - Removing and installing parts of the ignition system



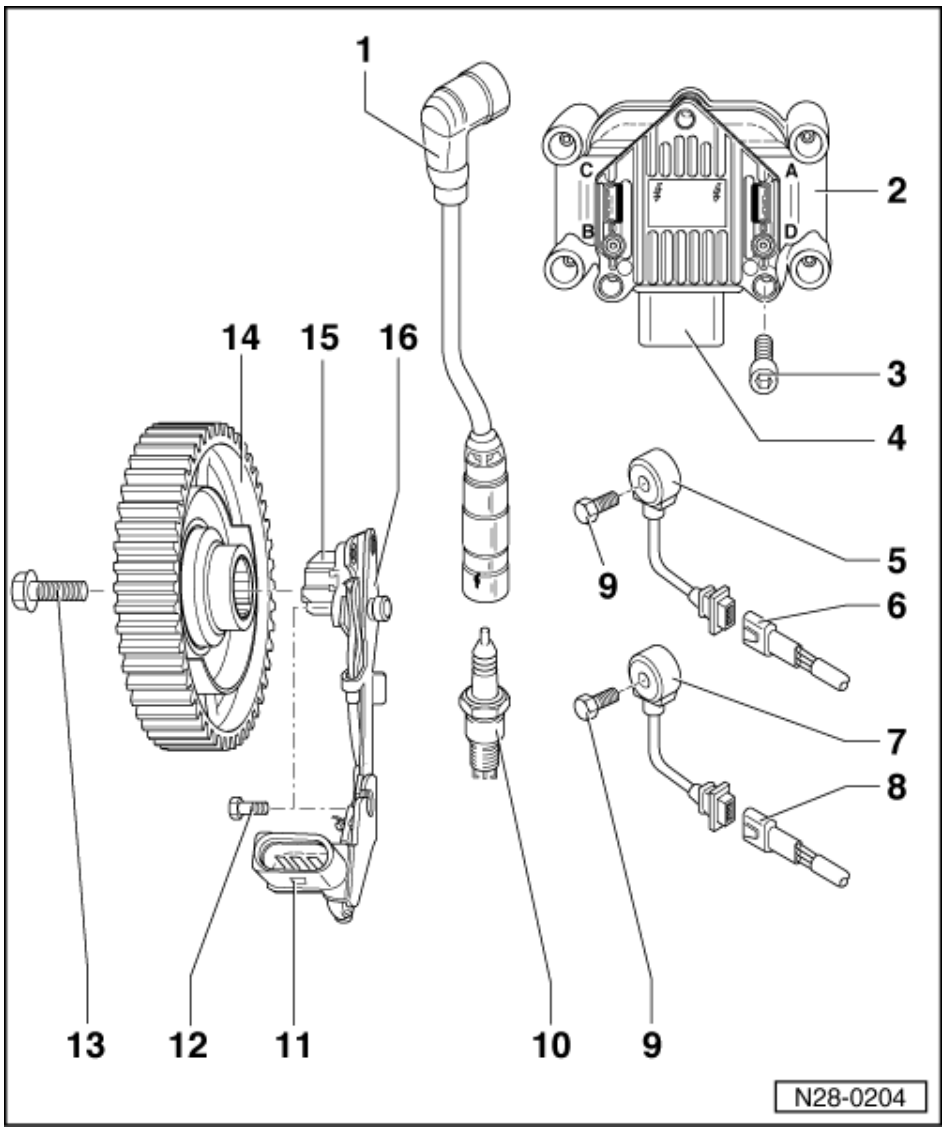
1 H.T. cable
- 4...8 kω
- With suppression connector and spark plug connector
- Check for continuity

2 Ignition transformer (N152)
- Marked for H.T. cables:
  A = Cylinder 1
  B = Cylinder 2
  C = Cylinder 3
  D = Cylinder 4
- Checking => Page 157

3 10 Nm

4 Connector
- 4 pin

5 Knock sensor 1 (G61)*
- Contacts gold plated
- Checking => Page 160
- Above engine mounting



6 3 pin connector

- For knock sensor 1 (G61)
- Contacts gold plated
- Green
- Do not interchange

7 Knock sensor 2 (G66)*

- Contacts gold plated
- Checking => Page 160
- Next to ignition transformer

8 3-pin connector

- For knock sensor 2 (G66)
- Contacts gold plated
- Brown
- Do not interchange

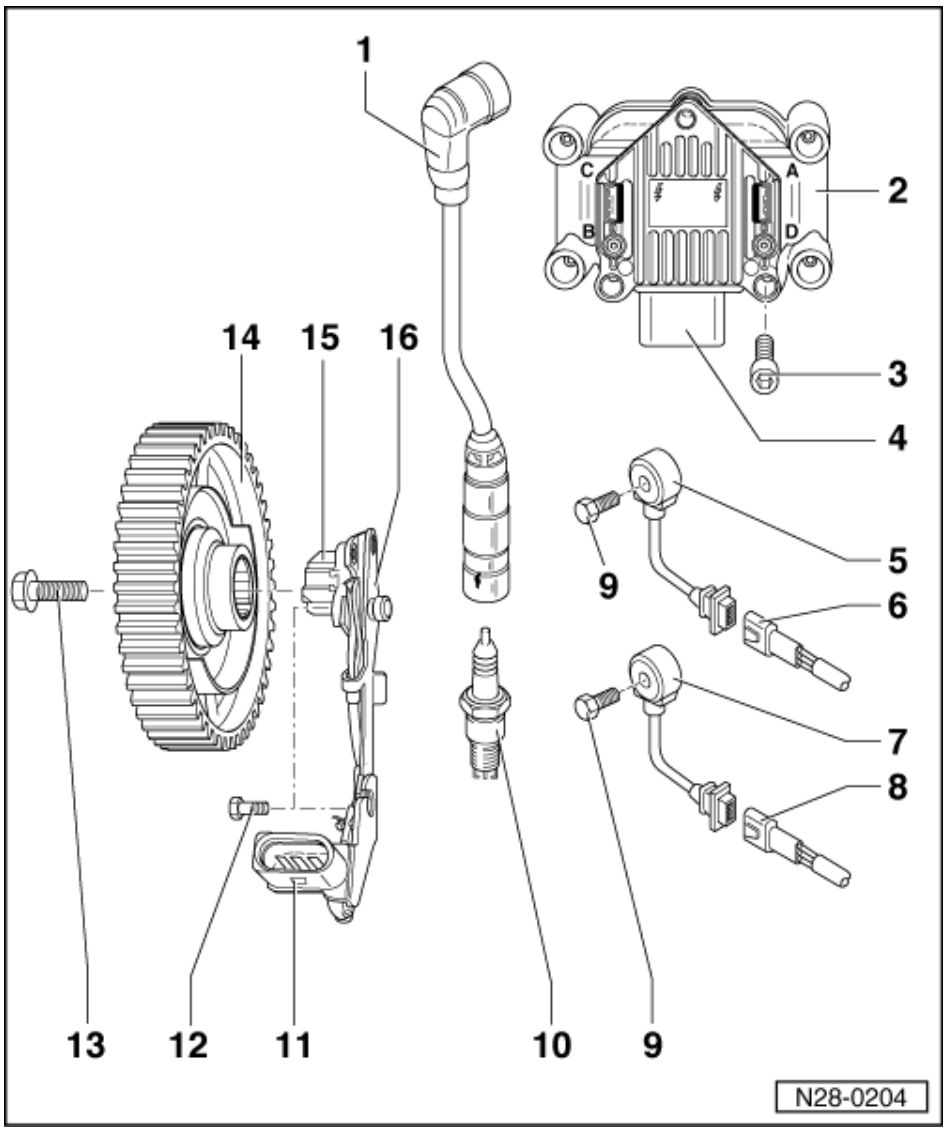
9 20 Nm

- Tightening torque influences the function of the knock sensor

10 Spark plug, 25 Nm

- Type and electrode gap
  => Page 155 , test data, spark plugs
- To remove and install pull off the connectors for the outer injectors

- Remove and install with 3122B



11 Connector

- Contacts gold plated
- 3 pin

12 10 Nm

13 100 Nm

- Use counter-hold tool 3415 to loosen and tighten

14 Camshaft sprocket

- With rotor for Hall sender
- Removing and installing:

=> Repair group 15; Servicing valve gear Servicing valve gear

15 Hall sender (G40)*

- Checking => Page 156

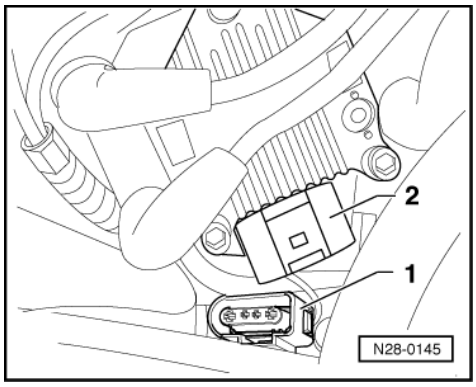
16 Bracket

- For Hall sender

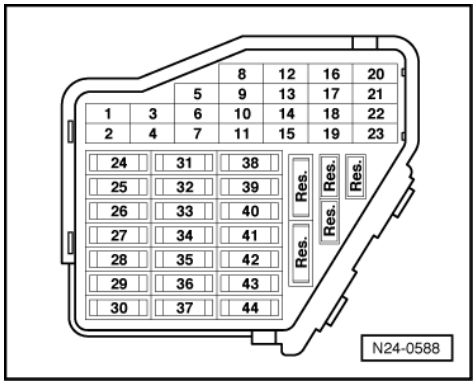
1.4 - Safety precautions

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

- Do not touch or pull off ignition wiring when engine is running or turning at starter speed.
- The ignition must be switched off when disconnecting or connecting injection and ignition system wiring as well as test instrument cables.
- If the engine is to be turned at starter speed, without starting:



- -> Pull 4 pin connector -1- off ignition transformer (N152) -2-.



- -> Remove fuse 28 for fuel pump.

Observe following 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.

1.5 - Test data, spark plugs

Engine code	AZM
Firing order	1-3-4-2
Spark plugs1)	
VW/Audi	101 000 033 AA
Manufacturer's designation	BKUR 6 ET-10

Engine code	AZM
Electrode gap	0.9...1.1 mm
Tightening torque	25 Nm

1) For up-to-date specifications also for spark plug change intervals.

=> Exhaust emissions test binder

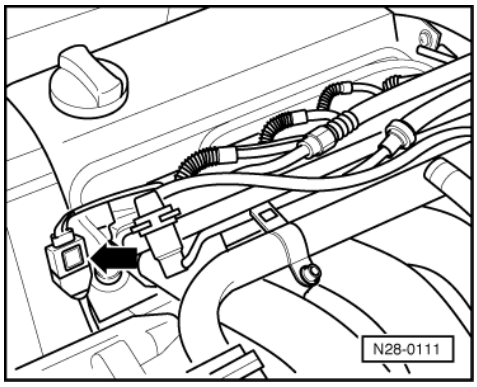
1.6 - Checking Hall sender

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Test conditions

- Sender fault is recognised by self diagnosis

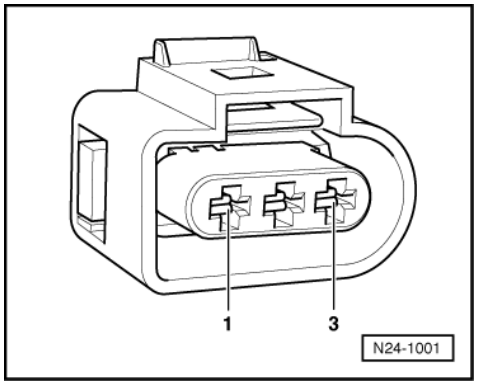


Note:

- The correct valve timing setting can be checked in measured value block 12 =>Page 43

Test sequence

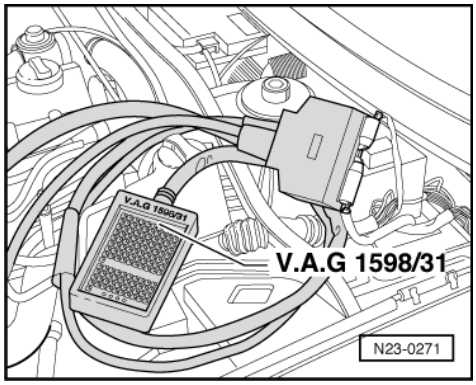
- -> Pull 3-pin connector off Hall sender -arrow-.



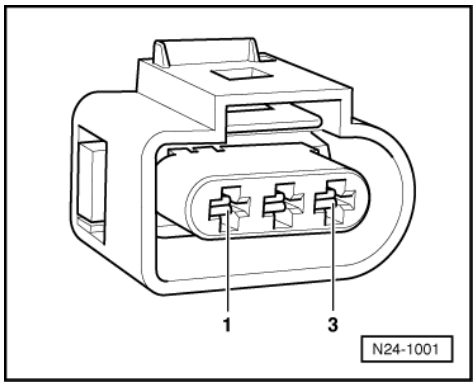
- -> Connect multimeter using aux. cables from V.A.G 1594 to measure voltage at contacts 1 (positive) and 3 (earth) of Hall sender connector.
- Switch on ignition.
  Specification: 4.0...6.0 V

- Switch off ignition.

If no voltage is present:



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 3-pin connector for open circuit using current flow diagram:
  Contact 1 and test box socket 89
  Contact 2 and test box socket 105
  Contact 3 and test box socket 111
  Wire resistance: max. 1.5 ω
- Additionally check wires for short to one another.
  Specification: ∞ω

If no wiring fault is detected and voltage was present between contacts 1+3:

- Replace Hall sender (G40)
  =>Page 154 , item 15 .

If no wiring fault is detected and no voltage was present between contacts 1+3:

- Renew engine control unit => Page 135 .

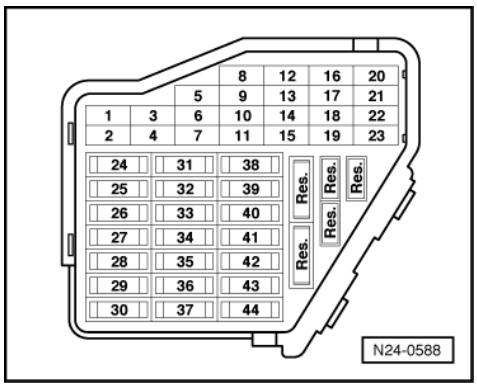
1.7 - Checking ignition transformer

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Diode test lamp V.A.G 1527 B
- Current flow diagram

Check conditions

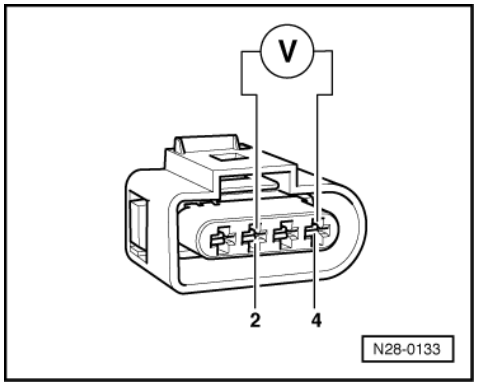
- Battery voltage at least 11.5 V
- Engine speed sender OK, checking =>Page 107
- Hall sender OK, checking =>Page 156



- -> Fuse 32 must be OK.

Checking voltage supply

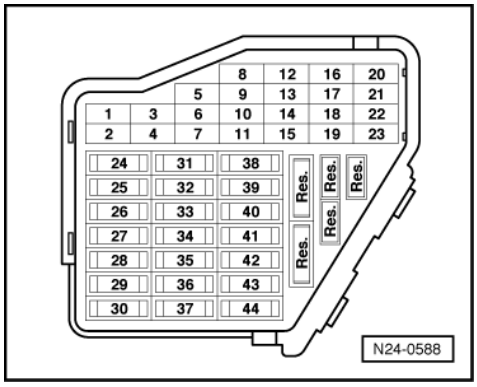
- Pull 4-pin connector off ignition transformer (N152).



- Using multimeter and adapter cables from V.A.G 1594, measure supply voltage between contacts 2 + 4 of disconnected connector.
- Switch on ignition.
  Specification: min. 11.5 V
- Switch off ignition.

If no voltage is present:

- Check wiring for open circuit between contact 2 of 4-pin connector and relay plate using current flow diagram.
  Wire resistance: max. 1.5 ω
- Check wire between 4 pin connector contact 4 and earth for open circuit according to current flow diagram.
  Wire resistance: max. 1.5 ω



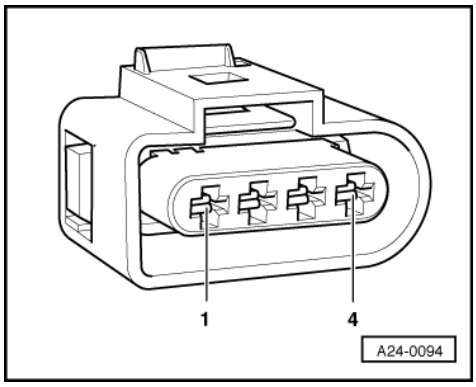
Checking activation

- -> Pull fuse No. 34 out of fuse holder.

Note:

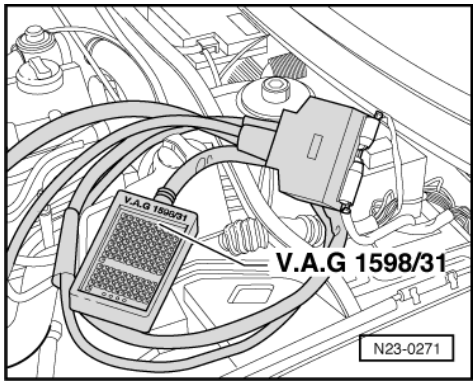
Removing fuse 34 interrupts the voltage supply to the injectors.

- Pull 4-pin connector off ignition transformer (N152).



- Connect diode test lamp V.A.G 1527 with adapter cables from V.A.G 1594 to
  Contacts 1 + 4 (ignition output 1),
  Contacts 3 + 4 (ignition output 2)
  of disconnected connector.
- Get a 2nd person to operate starter and check the ignition signal from engine control unit.
  The LED must flicker
- Switch off ignition.

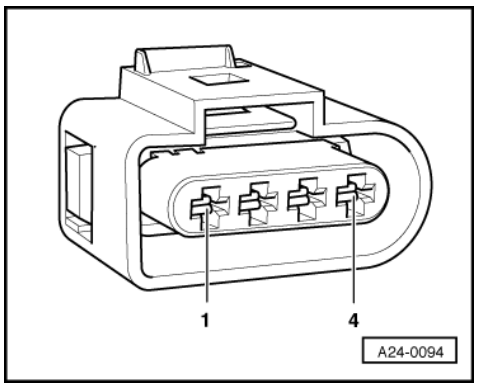
If the LED flickers and there is voltage between contacts 2 + 4:



- Replace ignition transformer (N152)
  => Page 152 , item 2 .

The LED does not flicker:

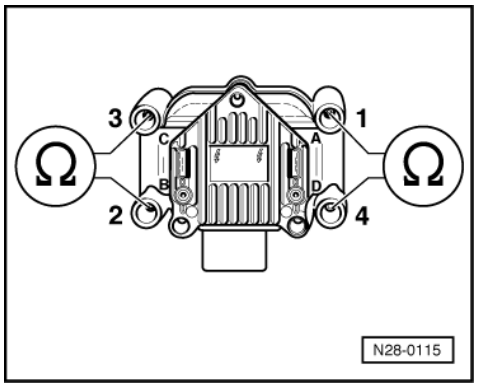
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 4-pin connector for open circuit using current flow diagram.
  Contact 1 and test box socket112
  Contact 3 and test box socket 113
  Wire resistance: max. 1.5 ω
- Additionally check wires for short to one another and to positive and earth.
  Specification: ∞ω

If no wiring fault is detected and voltage was present between contacts 2+4:

- Replace engine control unit
  => Page 135 .



Checking secondary resistance

- -> Check the secondary winding on terminal 4 between
  Cyl. 1+Cyl. 4,
  Cyl. 2+Cyl. 3.
  Specification: 4.0... 6.0 kω (at 20 °C)

If the specifications are not attained:

- Replace ignition transformer (N152)
  => Page 152 , item 2 .

1.8 - Checking knock sensor

Notes:

- It is extremely important to keep to the tightening torque of 20 Nm to ensure the knock sensors perform perfectly.
- The knock sensor might misinterpret vibrations of loose components as knocking noises. Therefore check that engine ancillaries are securely mounted.

- Only gold-plated contacts may be used when servicing the knock sensor connector contacts.

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- Test box V.A.G 1598/31
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram

Check conditions

- Self-diagnosis has detected a fault in the knock sensor => Page 8 , Interrogating and erasing fault memory.
- The engine speed must be at least 2500 rpm =>display group 28, display zone 1
- The engine load musts be at least 40.0 % =>display group 28, display zone 2
- Coolant temperature must be at least 80 °C, =>display group 28, display zone 2.

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 2 and 8 for the "Display group number 28" and confirm entry with Q key.

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

```
Read measured value block 28
     1     2     3     4
```

Note:

Checking the knock sensors must be performed during a test drive because the diagnosis of the knock sensors is not activated until the engine speed exceeds 2500 rpm and the engine is loaded by more than 40 %.

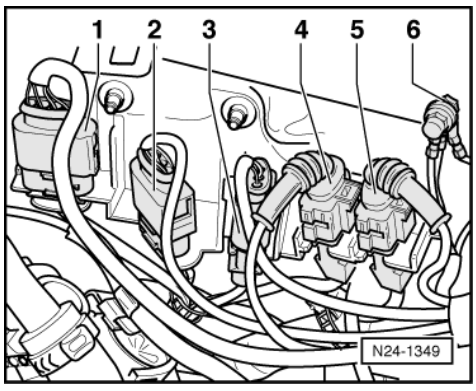
- Carry out test drive with a 2nd person to observe display.

Observe the valid safety precautions when carrying out a test drive => Page 155 .

- Check specification for knock control in display zone 4.
  Specification: Syst. OK

If the specification is obtained:

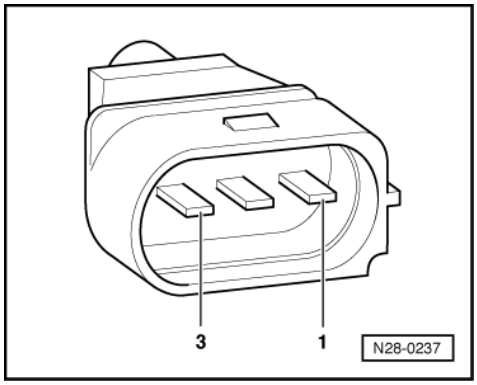
- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.



If the specification is not obtained:

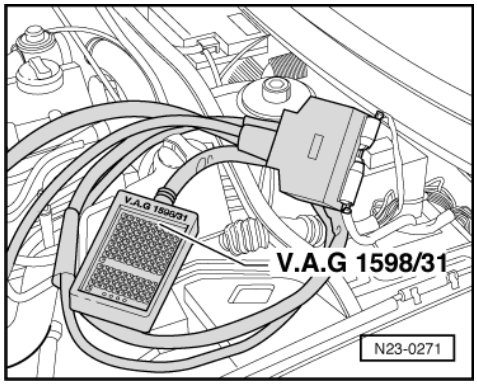
Checking resistances and wiring

- -> Separate the 3-pin connector to knock sensor 1 (G61) -4- and/or 3-pin connector to knock sensor 2 (G66) -5-.



- -> Measure resistance between the contacts 1+2, 1+3 and 2+3 at connectors to knock sensors.
  Specification ∞ω

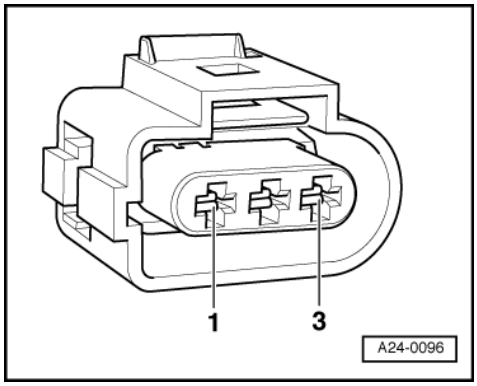
If the specification is not obtained:



- Replace knock sensor(s)

If the specification is obtained:

- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 3-pin connector for open circuit using current flow diagram.

	G61:	G66:
Contact 1+socket	109	110
Contact 2+socket	101	102
Contact 3+socket	100	103

Wire resistance: Max. 1.5 ω

- Additionally check wires for short to one another.
  Specification: ∞ω

If no fault is detected in the wiring:

- Loosen knock sensor and tighten again to 20 Nm.
- Carry out test drive again.

  During the road test the following operating conditions must be fulfilled:
  - The coolant temperature must exceed 80 °C .
  - When the temperature is reached, the operating conditions
    Idling
    Part throttle
    Enrichment
    Full throttle
    Overrun
    must be attained several times.
  - At full throttle the speed must exceed 3500 rpm.

- Again interrogate the control unit fault memory.

If the fault is still present:

- Replace knock sensor(s)

1.9 - Check misfiring recognition

Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3A

Test sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552). Start engine and select "Address word" 01 of engine control unit. When doing this the engine must be running at idling speed.
  (Connecting fault reader and selecting engine control unit => Page 4 .)

-> 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
Input display group number XXX
```

- Press keys 0, 1 and 4 for "Display group number 14" and confirm entry with Q key.

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

```
Read measured value block 14
     1     2     3     4
```

- Check the misfire recognition status in display zone 4.
  Specification: "activated"
- Check total misfires in display zone 3.
  Specification: 0

If the specifications are obtained:

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

If the specifications are not attained:

- Change to display group 15 as follows:
  V.A.G 1551: Press key 3
  V.A.G 1552: Press key ↑

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

```
Read measured value block 15
     1     2     3     4
```

- Check the misfire recognition status in display zone 4.
  Specification: "activated"

- Check misfiring of Cyl. 1...Cyl. 3 in display zones 1...3.
  Specification: 0

If the specifications are not attained:

- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.
- =>Page 45 , Evaluating display group 15 and display group 16.

If the specifications are obtained:

- Change to display group 16 as follows:
  V.A.G 1551: Press key 3
  V.A.G 1552: Press key ↑

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

```
Read measured value block 16
     1               4
```

- Check misfire recognition status in display zone 4.
  Specification: "activated"

- Check misfiring of Cyl. 4 in display zone 1
  Specification: 0
- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.

If the specification is not attained:

- =>Page 45 , Evaluating display group 15 and display group 16.