Passat 1997 ➢

Motronic injection and igni- tion system (1.8 ltr. engine)									
Engine ID	ANB	APT	APU	ARG					

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

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Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system

Contents

01 - Self-diagnosis

1 - General to self-diagnosis

1.1 - General to self-diagnosis

1.2 - Features of self-diagnosis

The engine control unit (Motronic control unit J220) 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 14 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 warm-up phases (engine start below 50° C coolant temperature - switched off above 72° C), it will be erased from the fault memory.

The faults stored can be read-out with the fault reader V.A.G 1551, the vehicle system tester V.A.G 1552 or the new tester VAS 5051 => Page 9 .

Engine code ANB

The fault memory must be erased after the faults have been eliminated => Page 35 .

Continued for all engine codes

All values learnt by the engine control unit will be erased when the engine control unit connector is pulled off or the battery is disconnected. However the contents of the fault memory are retained. When the engine is subsequently started the idling could be rough for a brief period. In this case leave the engine running for a few minutes at idling speed or perform a longer test drive, until the learning process is completed.
Procedure after voltage supply open circuit =>Page 128 .

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 3 .

Equipment

Engine code	ANB	APT	APU	ARG
System designation	Motronic ME7.5	Motronic ME7.1	Motronic ME7.5	Motronic ME7.1

Engine code	ANB	APT	APU	ARG
Exhaust emissions conform to	D4 Standard	MVEG 2	MVEG 2	D3 Standard
EPC system	Yes	Yes	Yes	Yes
Self-diagnosis	Yes	Yes	Yes	Yes
Final control diagno- sis	Yes	Yes	Yes	Yes
Operating mode of data transfer to V.A.G 1551/1552	Rapid data trans- fer	Rapid data trans- fer	Rapid data trans- fer	Rapid data trans- fer
Control unit coding	V.A.G 1551/1552 VAS 5051	V.A.G 1551/1552 VAS 5051	V.A.G 1551/1552 VAS 5051	V.A.G 1551/1552 VAS 5051
Fault memory	Non-volatile memory1)	Non-volatile memory1)	Non-volatile memory1)	Non-volatile memory1)
Memory for learnt values	Volatile memo- ry2)	Volatile memo- ry2)	Volatile memo- ry2)	Volatile memo- ry2)

1) Independent of voltage supply.

2) Values are erased when voltage supply is interrupted.

Engine code	ANB	APT	APU	ARG
Lambda regulation	2 probes	Yes	Yes	Yes
Knock control	2 knock sensors	2 knock sensors	2 knock sensors	2 knock sensors
Twin path intake manifold	No	Yes	No	Yes
Variable valve timing	No	Yes	No	Yes
Charge pressure control	Yes	No	Yes	No
Secondary air system	Yes	No	No	Yes3)

3) Only vehicles with automatic gearbox

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 ver- sion	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	yes
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

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
15	Read readiness code3)	yes	yes	yes

1) Only carry out with ignition switched on, when engine does not start (operate starter for at least 6 seconds first).

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

3) Only for engine code ANB

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

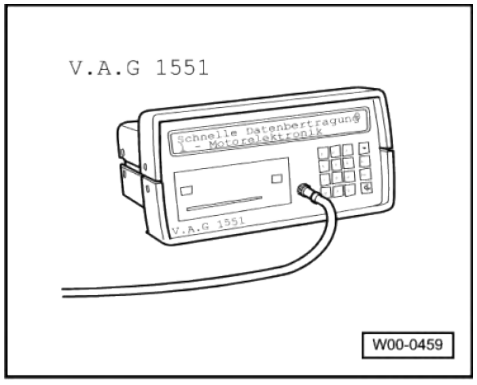
"EPC" is the abbreviation for Electronic Power Control.

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.

The engine control unit will switch the EPC lamp on for about 1 second whilst the components are being checked. If a fault is detected during the check the lamp will be permanently switched on.

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.

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



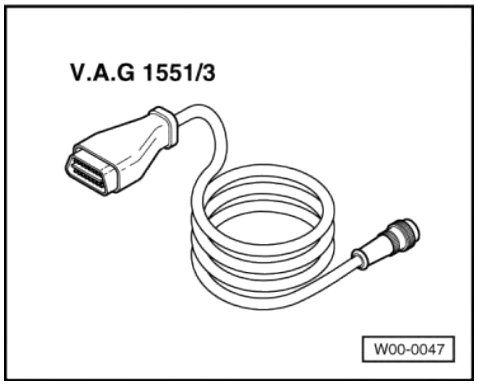
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1551 Fault reader

Note:

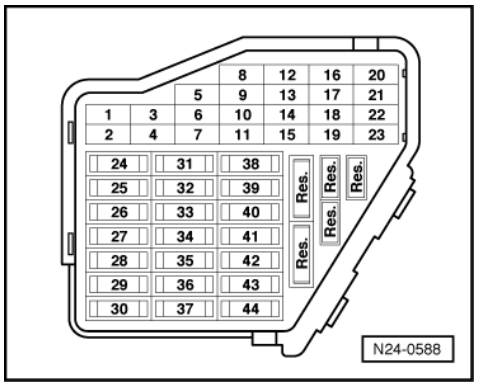
The vehicle system tester V.A.G 1552 can be used instead of the fault reader V.A.G 1551, however a print-out is not possible.

All functions of V.A.G 1551/1552 can also be carried out with the new tester V.A.S 5051. Connecting VAS 5051 =>Page 6 .



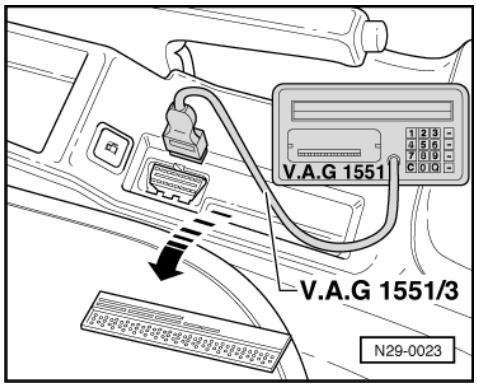
- V.A.G 1551/3 Cable

Test conditions



- -> The fuses 7, 28, 29, 32 and 34 must be OK.
- The battery voltage must be at least 11.5 V.
- Earth connection between engine and body must be OK.

Work sequence



- -> Remove the cover above the diagnostic connection on right next to the handbrake lever.
- Connect fault reader V.A.G 1551 with 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:

=> 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.

- Operate fault reader taking into account the information on the display:

-> 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 coding are indicated on the display, e.g.:

```
4B0906018F 1.8 R4/5VT MOTR G 0001
Coding 05501     WSC 00000
```

- 4B0 906 018F = Part No. of the control unit (for latest control unit version see parts catalogue)
- 1.8 ltr. = Engine displacement
- R4S/5V = Engine configuration (4-cylinder in-line engine, 5-valve)
- R4T/5V = Engine configuration (4-cylinder in-line engine, 5-valve turbo)
- MOTR = System designation (Motronic)
- G = CCS available
- HS = Manual gearbox (hand change)
  AT = Automatic gearbox
- 0001 = Programme level number
- Coding xxxxx = Control unit coding, coding variants of engine control unit => Page 131 .
- 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 version displayed does not correspond to the vehicle

=> Page 128 .

An incorrectly coded engine control unit leads 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.).
- Reduced gearbox life

If the coding differs from the vehicle version, then:

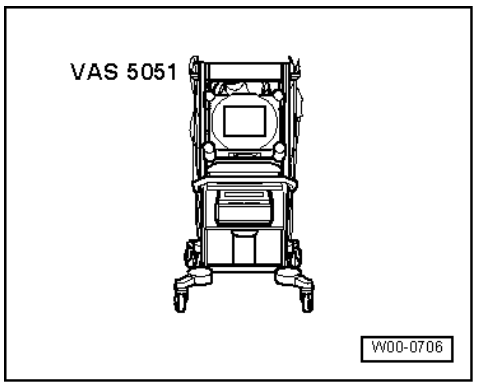
- Checking control unit coding => Page 130 ,
  coding engine control unit
- Press ⇒key.

-> Indicated on display:

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

- Further measures see repair procedures.

1.6 - Connecting vehicle diagnosis, testing and information system VAS 5051 and selecting engine control unit



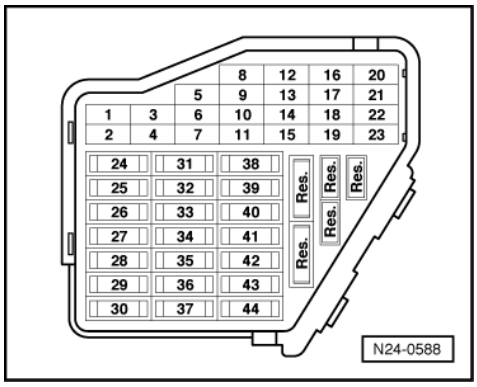
All functions which could previously be performed with V.A.G 1551/1552 can also be performed with the new tester VAS 5051 in the operating mode vehicle self-diagnosis:

=> 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

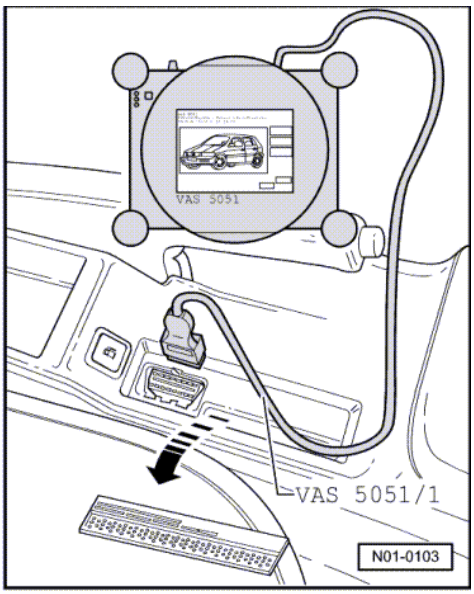
Test conditions



- -> The fuses 7, 28, 29, 32 and 34 must be OK.
- The battery voltage must be at least 11.5 V.
- Earth connection between engine and body must be OK.

Work sequence

- Connect the tester VAS 5051 using diagnostic cable VAS 5051/1 or VAS 5051/3 as follows:

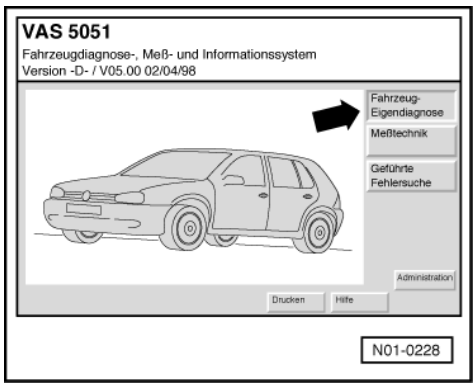


- -> Remove the cover above the diagnostic connection on right next to the handbrake lever.
- Connect diagnosis cable connector on to diagnosis connection.
- Depending upon desired function:
  Switch ignition on
  or
  Start engine => Page 2 , Table "Selectable functions".

Notes:

- In the functions 04 - Basic setting/08 - Read data block, the display zones will be listed from top to bottom.
- If the display does not indicate as described in the work sequence:

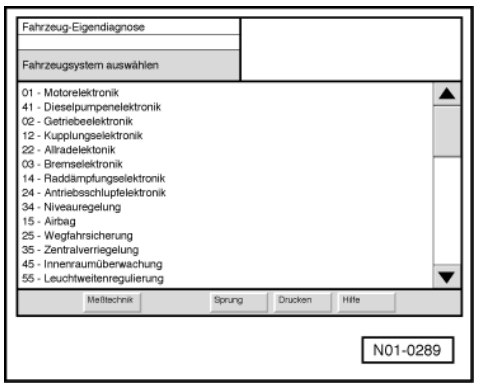
=> Operating instructions for Vehicle Diagnosis, Testing and Information System VAS 5051.



-> Indicated on display:

Select operating mode:

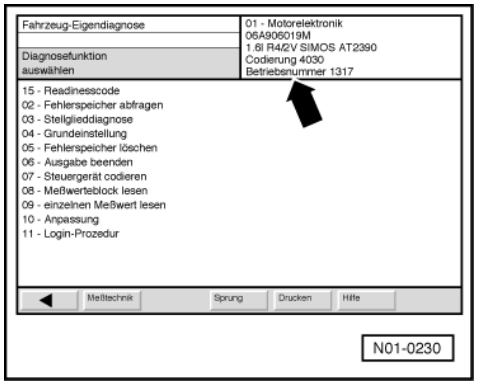
- Press the button on the display for "Vehicle self-diagnosis" -arrow-.



-> Indicated on display:

Select vehicle system:

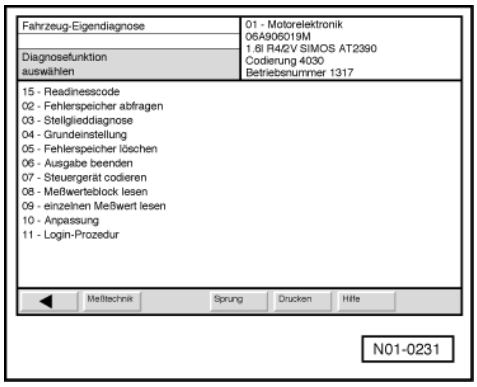
- Press "01 - Engine electronics" on the display.



-> On the display the control unit identification and coding are displayed, e.g.:

If the coding differs from the vehicle version, then:

- Checking control unit coding => Page 130 ,
  coding engine control unit



-> Indicated on display:

Select diagnostic function:

At this point all diagnostic functions are available.

- Press the desired function on the display.
- Further measures see repair procedures.

2 - Fault memory

2.1 - Fault memory

Interrogate fault memory of all control units
=> Page 10 , Automatic test sequence

2.2 - Interrogating and erasing 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 3 .)

Only when engine does not start:

- Operate starter for approx. 6 seconds and then do not switch off the ignition.

- 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.

- 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 codes=> Page 14

2.3 - 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
    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.

3 - Fault table: SAE P0 codes

3.1 - Fault table: SAE P0 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 9 .

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 (only for USA at present and disregard)
- 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		
P0101	16485	Air mass meter -G70 implausible signal	- Check air mass meter => Page 87
P0102	16486	Air mass meter -G70 signal to low	- Check intake system for leaks (unmetered air) => Page 110
P0103	16487	Air mass meter -G70 signal to high	
P0106	16490	Intake manifold pressure/air pressure => -G71/-F96 1)implausible signal	=> Repair group 21; Checking charge air system; Checking charge pressure sender -G31

1) The intake manifold pressure is established by the charge pressure sender -G31 (not -G71 as indicated), the air pressure is established by the altitude sender -F96 (in engine control unit).

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0112	16496	Intake air temperature sender -G42 signal too low	- Check intake air temperature sender => Page 96

Fault code		Fault text	Fault elimination
P0113	16497	Intake air temperature sender -G42 signal too high	
P0116	16500	Coolant temperature sender -G62 implausible signal	- Check coolant temperature sender => Page 92 - Check thermostat: => Repair group 19; Removing and installing parts of cooling system; Parts of cooling system, engine-side Parts of cooling system, engine-side
P0117	16501	Coolant temperature sender -G62 signal too low	
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 electrical fault in current circuit	- Check Lambda probe heating before catalyst => Page 82
P0131	16515	Bank 1 probe 1 voltage too low	- Check Lambda probe and Lambda regulation before catalyst=> Page 114
P0132	16516	Bank 1 probe 1 voltage too high	
P0133	16517	Bank 1 probe 1 signal to slow	
P0134	16518	Bank 1 probe 1 no activity	
P0136	16520	Bank 1 probe 2 electrical fault in circuit	- Check Lambda probe heating after catalyst => Page 84
P0137	16521	Bank 1 probe 2 voltage too low	- Check Lambda probe and Lambda regulation after catalyst => Page 117
P0138	16522	Bank 1 probe 2 voltage too high	- Check Lambda probe heating after catalyst => Page 84
P0139	16523	Bank 1 probe 2 signal too slow	
P0140	16524	Bank 1 probe 2 no activity	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0236	16620	Charge pressure sender -G31 implausible signal	=> Repair group 21; Checking charge pressure system; Checking charge pressure sender-G31
P0237	16621	Charge pressure sender -G31 signal too low	
P0238	16622	Charge pressure sender -G31 signal too high	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0300	16684	Misfiring recognised	- Check injectors=>Page 101 - Check ignition cables and spark plugs => Page 146 - Check ignition coils with output stage => Page 156 - Check misfiring recognition => Page 162
P0301	16685	Cyl.1 misfiring recognised	
P0302	16686	Cyl.2 misfiring recognised	
P0303	16687	Cyl. 3 misfiring recognised	
P0304	16688	Cyl. 4 misfiring recognised	
P0321	16705	Engine speed sender -G28 implausible signal	- Check engine speed sender =>Page 100

P0322	16706	Engine speed sender -G28 no signal	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0327	16711	Knock sensor 1 -G61 signal too low	- Check knock sensors => Page 161
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	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0411	16795	Secondary air system incorrect flow detected	- Check secondary air pump motor: => Repair group 26; Secondary air system
			- Check combi valve: => Repair group 26; Secondary air system
			- Check secondary air inlet valve: => Repair group 26; Secondary air system
			- Check hoses and connecting pipes to/between components: => Repair group 26; Secondary air system
P0422	16806	Bank 1 main catalyst efficiency to low	- Check catalyst: => Repair group 26; Removing and installing parts of exhaust system; Checking catalyst Checking catalyst

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0440	16824	Tank breathing system faulty	- Check activated charcoal filter solenoid valve 1=> Page 22 , Final control diagnosis
			- Check activated charcoal filter solenoid valve 1: => Repair group 20; Activated charcoal filter system; Checking solenoid valve 1 for activated charcoal filter Checking solenoid valve 1 for activated charcoal filter
			- Check hoses and connecting pipes from fuel tank to throttle valve control part: => Repair group 20; Checking fuel tank breather

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 22 , Final control diagnosis
			- Check activated charcoal filter solenoid valve 1: => Repair group 20; Activated charcoal filter system; Checking solenoid valve 1 for activated charcoal filter Checking solenoid valve 1 for activated charcoal filter
			- Check hoses and connecting pipes from fuel tank to throttle valve control part: => Repair group 20; Checking fuel tank breather

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

P0501	16885	Vehicle speed signal implausible	- Check speed signal => Page 135
P0506	16890	Idling speed control, Revs below specification	- Check throttle valve control part => Page 89
P0507	16891	Idling speed regulation above specifications	
P0560	16944	Voltage supply signal implausible	- Check voltage supply => Page 126
P0562	16946	Voltage supply too low	- Procedure after interrupting voltage supply => Page 128
P0563	16947	Voltage supply too high	
P0571	16955	Brake light switch -F1)implausible signal	- Check brake light switch and brake pedal switch => Page 140

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

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P0601	16985	Control unit defective	- Renew engine control unit (J220) => Page 128
P0604	16988	Control unit defective	
P0605	16989	Control unit defective	
P0606	16990	Control unit defective	

4 - Fault table: SAE P1 codes

4.1 - Fault table: SAE P1 codes

Notes:

- The fault code overview is listed according to SAE or V.A.G code.
- Erase fault memory after rectifying fault =>Page 9 .

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 82
P1105	17513	Bank 1, probe 2 heating element circuit short to positive	- Check Lambda probe heating after catalyst => Page 84
P1111	17519	Lambda control Bank 1 system too lean	- Check Lambda probe and Lambda control before catalyst => Page 114
P1112	17520	Lambda control Bank 1 system too rich	
P1113	17521	Bank 1, probe 1 internal resistance too high	- Check Lambda probe heating before catalyst => Page 82
P1114	17522	Bank 1, probe 2 internal resistance too high	- Check Lambda probe heating after catalyst => Page 84

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1115	17523	Bank 1, probe 1 heating element circuit short to earth	- Check Lambda probe heating before catalyst => Page 82

P1116	17524	Bank 1, probe 1 heating element circuit, open circuit	
P1117	17525	Bank1, probe 2 heating current circuit short to earth	- Check Lambda probe heating after catalyst => Page 84
P1118	17526	Bank 1, probe 2 heating element circuit open circuit	
P1127	17535	Bank 1, mixture adaption (mult.) system too rich	- Check fuel pressure regulator and holding pressure => Page 107
			- Check injectors=>Page 105 , Check quantity injected and for leaks
			- Check activated charcoal filter solenoid valve 1: => Repair group 20; Activated charcoal filter system; Checking activated charcoal filter solenoid valve 1 Checking activated charcoal filter solenoid valve 1

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1128	17536	Bank 1, mixture adaption (mult.) system too lean	- Check fuel pressure regulator and holding pressure => Page 107
			- Check injectors=>Page 105 , Check quantity injected and for leaks
			- Check fuel pump: => Repair group 20; Checking fuel pump
			- Check intake system for leaks => Page 110
			- 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 vacuum pipes for leaks

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1136	17544	Bank 1, mixture adaption (add.) system too lean	- Check fuel pressure regulator and holding pressure => Page 107
			- Check injectors=>Page 105 , Check quantity injected and for leaks
			- Check fuel pump: => Repair group 20; Checking fuel pump
			- Check intake system for leaks => Page 110
			- Check exhaust system for leaks: => Repair group 26; Removing and installing parts of exhaust system

Note:

add. = additive means, the fault only has an effect at idling speed.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1137	17545	Bank 1, mixture adaption (add.) system too rich	- Check fuel pressure regulator and holding pressure => Page 107

Fault code		Fault text	Fault elimination
			- Check injectors=>Page 105 , Check quantity injected and for leaks
			- Check activated charcoal filter solenoid valve 1: => Repair group 20; Activated charcoal filter system; Checking activated charcoal filter solenoid valve 1 Checking activated charcoal filter solenoid valve 1

Note:

add. = additive means, the fault only has an effect at idling speed.

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1149	17557	Lambda control Bank 1 implausible control value	- Check Lambda probe and Lambda control before catalyst => Page 114
P1171	17579	Angle sender 2 for throttle valve drive -G188 implausible signal 1)	- Check throttle valve control part => Page 89
P1172	17580	Angle sender 2 for throttle valve drive -G188 signal too low 1)	
P1173	17581	Angle sender 2 for throttle valve drive -G188 signal too high 1)	

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1176	17584	Bank 1, Lambda correction after catalyst, control limit reached	- Check Lambda probe ageing Lambda probe 1 => Page 122
			- Check Lambda probe and Lambda control after catalyst => Page 117
P1198	17606	Bank 1, probe 2 heating element circuit electrical fault	- Check Lambda probe heating after catalyst => Page 84
P1201	17609	Injector Cyl. 1 -N30 electrical fault in current circuit	- Check injectors =>Page 101
P1202	17610	Injector Cyl. 2 -N31 electrical fault in current circuit	
P1203	17611	Injector Cyl. 3 -N32 electrical fault in current circuit	
P1204	17612	Injector Cyl. 4 -N33 electrical fault in current circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1213	17621	Injector Cyl. 1 -N30 short to positive	- Check injectors =>Page 101
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	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1237	17645	Injector Cyl. 1 -N30 open circuit	- Check injectors =>Page 101
P1238	17646	Injector Cyl. 2 -N31 open circuit	
P1239	17647	Injector Cyl. 3 -N32 open circuit	
P1240	17648	Injector Cyl. 4 -N33 open circuit	
P1250	17658	Fuel level too low	- Fill fuel tank
P1287	17695	Turbocharger divert valve -N249 open circuit	=> Repair group 21; Checking charge air system; Checking turbocharger divert air valve - N249
P1288	17696	Turbocharger divert valve -N249 short to positive	
P1289	17697	Turbocharger divert valve -N249 short to earth	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1325	17733	Cylinder 1 knock control, control limit reached	- Fill tank with minimum 91 RON
P1326	17734	Cylinder 2 knock control, control limit reached	- Check connectors
P1327	17735	Cylinder 3 knock control, control limit reached	- Eliminate cause for abnormal engine running noises
P1328	17736	Cylinder 4 knock control, control limit reached	- Loosen knock sensor and tighten again to 20 Nm - Check knock sensors => Page 161

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1335	17743	Engine torque monitoring 2 control limit exceeded 1)	- Check hoses: => Repair group 21; Charge air system with turbocharger; Turbocharging overview - Check intake air temperature sender => Page 96
P1336	17744	Engine torque monitoring control limit exceeded	- Check air mass meter => Page 87 - Check coolant temperature sender => Page 92

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1337	17745	Bank 1, camshaft position sensor => -G163 short to earth	- Check Hall sender => Page 155
P1338	17746	Bank 1, camshaft position sensor => -G163 open circuit / short to positive	
P1340	17748	Camshaft position / crankshaft position sensor wrong allocation	

P1355	17763	Cyl. 1 ignition activation open circuit	- Check ignition coils with output stage => Page 156
P1356	17764	Cyl. 1 ignition activation short to positive	
P1357	17765	Cyl. 1 ignition activation short to earth	
P1358	17766	Cyl. 2 ignition activation open circuit	
P1359	17767	Cyl. 2 ignition activation short to positive	
P1360	17768	Cyl. 2 ignition activation short to earth	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1361	17769	Cyl. 3 ignition activation open circuit	- Check ignition coils with output stage => Page 156
P1362	17770	Cyl. 3 ignition activation short to positive	
P1363	17771	Cyl. 3 ignition activation short to earth	
P1364	17772	Cyl. 4 ignition activation open circuit	
P1365	17773	Cyl. 4 ignition activation short to positive	
P1366	17774	Cyl. 4 ignition activation short to earth	
P1386	17794	Control unit defective	- Replace engine control unit (J220) => Page 128
P1387	17795	Control unit defective	
P1388	17796	Control unit defective 1)	

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1409	17817	Tank breathing valve -N80 electrical fault in current circuit	- Check activated charcoal filter solenoid valve 1=> Page 22 , Final control diagnosis
P1410	17818	Tank venting valve -N80 short to positive	
P1420	17828	Secondary air inlet valve -N112 electrical fault in current circuit	- Check secondary air inlet valve =>Page 22 , Final control diagnosis
P1421	17829	Secondary air inlet valve -N112 short to earth	
P1422	17830	Secondary air inlet valve -N112 short to positive	
P1424	17832	Bank 1 secondary air system leak recognised	- Check secondary air system for leaks: => Repair group 26; Secondary air system
P1425	17833	Tank venting valve -N80, short to earth	- Check activated charcoal filter solenoid valve 1=> Page 22 , Final control diagnosis
P1426	17834	Tank venting valve -N80, open circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1432	17840	Secondary air inlet valve -N112 open circuit	- Check secondary air inlet valve =>Page 22 , Final control diagnosis
P1433	17841	Relay for secondary air inlet valve -J299 open circuit	- Check relay for secondary air inlet valve => Page 22 , Final control diagnosis
P1434	17842	Relay for secondary air pump -J299, short to positive	
P1435	17843	Relay for secondary air pump -J299, short to earth	

Fault code		Fault text	Fault elimination
P1436	17844	Relay for secondary air inlet valve -J299 electrical fault in current circuit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1500	17908	Fuel pump relay -J17 fault in electrical circuit	- Check fuel pump relay: => Current flow diagrams, Electrical fault finding and Fitting locations
P1502	17910	Fuel pump relay -J17, short to positive	
P1511	17919	Intake manifold change-over valve -N156 electrical fault in current circuit	- Check intake manifold change-over valve => 22 , Final control diagnosis
P1512	17920	Intake manifold change-over valve -N156 short to positive	
P1515	17923	Intake manifold change-over valve -N156 short to earth	
P1516	17924	Intake manifold change-over valve -N156 open circuit	
P1517	17925	Main relay -J271 electrical fault in current circuit	- Check Motronic current supply relay -J271: => Current flow diagrams, Electrical fault finding and Fitting locations binder - Check control unit voltage supply via main relay => Page 126

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1519	17927	Bank 1 variable valve timing faulty	- Check valve for variable valve timing => 22 , Final control diagnosis
P1529	17937	Variable valve timing short to positive	
P1530	17938	Variable valve timing short to earth	
P1531	17939	Variable valve timing open circuit	
P1539	17947	Clutch pedal switch -F36 implausible signal	- Check clutch pedal switch => Page 137
P1542	17950	Angle sender for throttle valve drive -G187 implausible signal1)	- Check throttle valve control part => Page 89
P1543	17951	Angle sender for throttle valve drive -G187 signal too low 1)	
P1544	17952	Angle sender for throttle valve drive -G187 signal too high 1)	
P1545	17953	Throttle valve control malfunction 1)	

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1546	17954	Charge pressure control solenoid valve -N75 short to positive	- Check charge pressure controlsolenoid valve => Page 22 , final control diagnosis => Repair group 21; Checking charge pressure system; Checking charge pressure control
P1547	17955	Solenoid valve for charge pressure control -N75 short to earth	
P1548	17956	Solenoid valve for charge pressure control -N75 open circuit	

P1555	17963	Maximum charge pressure exceeded	
P1556	17964	Charge pressure control, control limit not reached	
P1557	17965	Charge pressure control, control limit exceeded	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1559	17967	Throttle valve control part -J338 fault in basic setting 1)	- Adapt engine control unit to the throttle valve control part => Page 131
P1560	17968	Maximum engine revs surpassed	- Repair mechanical damage
P1564	17972	Throttle valve control part -J338 low voltage at base setting 1)	- Check battery, charge if needed Adapt engine control unit to throttle valve control part => Page 131
P1565	17973	Throttle valve control part -J338 lower limit not reached	- Check throttle valve control part=> Page 89
P1568	17976	Throttle valve control part -J338 mechanical fault 1)	- Check that throttle valve is not sticking, clean if necessary
P1569	17977	CCS switch -E45 implausible signal	- Check cruise control system: => Repair group 27; Electrical system - Evaluate measured value block 66

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1570	17978	Engine control unit blocked	- Adapt engine control unit (J220) to immobilizer => Page 133
P1579	17987	Throttle valve control part -J338 Adaption not started1)	- Adapt engine control unit to throttle valve control part => Page 131

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

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 126
P1603	18011	Control unit defective	- Renew engine control unit (J220) => Page 128
P1604	18012	Control unit defective 1)	
P1606	18014	Poor road info/specified engine torque from ABS control unit electrical fault in current circuit	- Check data bus => Page 143
P1609	18017	Crash shut-off triggered	=> Body self-diagnosis; Repair group 01; Self-diagnosis; Self-diagnosis for airbag system Self-diagnosis; Self-diagnosis for airbag system
P1612	18020	Engine control unit incorrectly coded	- Code engine control unit => Page 130

Fault code		Fault text	Fault elimination
P1626	18034	Drive train data bus no messages from gearbox control unit	- Check data bus => Page 143

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1630	18038	Accelerator pedal position sender -G79 signal too low 1)	- Check accelerator pedal position sender: => Repair group 20; Accelerator mechanism; Servicing accelerator mechanism Servicing accelerator mechanism
P1631	18039	Accelerator pedal position sender -G79 signal too high 1)	
P1633	18041	Accelerator pedal position sender 2 -G185 signal too low 1)	
P1634	18042	Accelerator pedal position sender 2 -G185 signal too high 1)	
P1636	18044	Drive train data bus no message from airbag CU	- Check data bus => Page 143
P1639	18047	Accelerator position sender 1/2 -G79+G185 implausible signal1)	- Check accelerator position sender: => Repair group 20; Accelerator mechanism; Servicing accelerator mechanism Servicing accelerator mechanism
P1640	18048	Control unit defective	- Replace engine control unit (J220) => Page 128

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1642	18050	Interrogate airbag CU fault memory	- Read airbag control unit fault memory: => General body repairs; Repair group 01; Self-diagnosis for airbag systems Self-diagnosis for airbag systems
P1645	18053	Drive train data bus no messages from four-wheel drive electronics	- Check data bus => Page 143
P1648	18056	Drive train data bus defective	
P1649	18057	Drive train data bus no messages from ABS control unit	

Fault code		Fault text	Fault elimination
SAE	V.A.G		
P1676	18084	Electr. throttle control fault lamp -K132 electrical fault in current circuit 1)	- Check fault lamp: => Repair group 20; Electronic power control (EPC); Checking fault lamp for electronic accelerator operation Checking fault lamp for electronic accelerator operation
P1677	18085	Electr. throttle control fault lamp -K132 short to positive 1)	
P1683	18091	Drive train data bus implausible info from airbag control unit	- Check data bus => Page 143

Fault code		Fault text	Fault elimination
P1853	18261	Drive train data bus implausible info from ABS control unit	- Check data bus => Page 143

1) If this fault occurs the engine control unit switches on the EPC warning lamp in dash panel insert. Significance of EPC warning lamp => 3 .

5 - Final control diagnosis

5.1 - Final control diagnosis

5.2 - Performing final control diagnosis

Component check sequence:

1. Activated charcoal filter solenoid valve 1 -N80
2. Intake manifold change-over valve -N156
3. Camshaft adjustment 1 (camshaft adjustment valve 1 (N205)
4. Charge pressure control solenoid valve -N75
5. Turbocharger divert air valve -N249
6. Secondary air inlet valve -N112
7. Secondary air pump relay -J299

Depending on differing engine equipment levels perform component checks as follows:

Engines without turbocharger and without secondary air system:

1. Activated charcoal filter solenoid valve 1 -N80
2. Intake manifold change-over valve -N156
3. Camshaft adjustment 1 (camshaft adjustment valve 1 (N205)

Engines without turbocharger but with secondary air system:

1. Activated charcoal filter solenoid valve 1 -N80
2. Intake manifold change-over valve -N156
3. Camshaft adjustment 1 (camshaft adjustment valve 1 (N205)
6. Secondary air inlet valve -N112
7. Secondary air pump relay -J299

Engines with turbocharger but without secondary air system:

1. Activated charcoal filter solenoid valve 1 -N80

4. Charge pressure control solenoid valve -N75

5. Turbocharger divert air valve -N249

Engines with turbocharger and secondary air system:

1. Activated charcoal filter solenoid valve 1 -N80

4. Charge pressure control solenoid valve -N75

5. Turbocharger divert air valve -N249

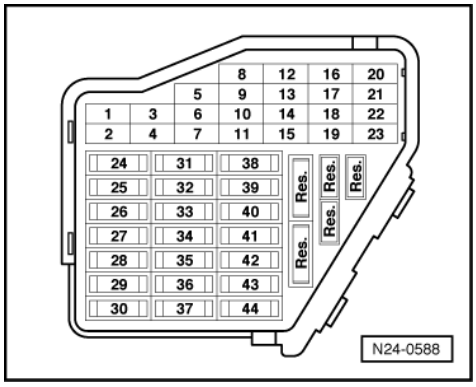
6. Secondary air inlet valve -N112

7. Secondary air pump relay -J299

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



- -> The fuses 7, 28, 29, 32 and 34 must be OK.
- The fuse for secondary air system must be OK.
- Ignition on, engine not running

Notes:

- 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.
- 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.

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 3 .)

-> 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
```

- Confirm input with Q key.

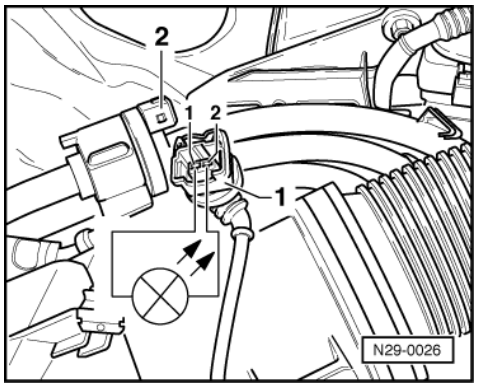
1 - Activating activated charcoal filter solenoid valve 1 (N80):

-> Indicated on display:

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

The activated charcoal filter solenoid valve 1 must click until the next final control is activated by pressing ⇒key.

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

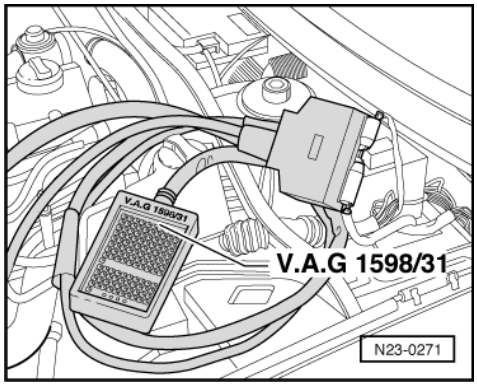
LED flashes:

- 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 64+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 pipes:
- Renew engine control unit => Page 128 .

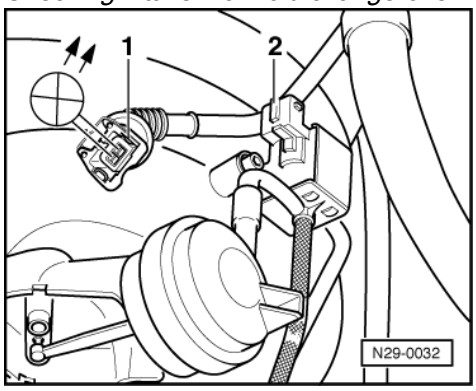
2 - Activating intake manifold change-over valve (N156):
- Press ⇒key.

-> 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.

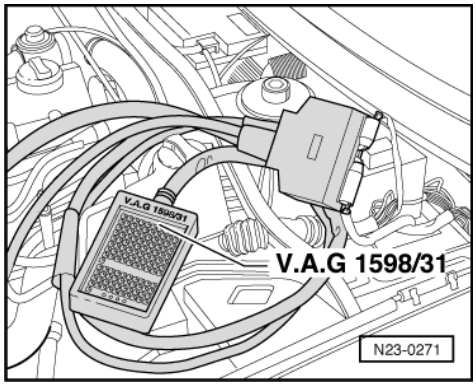
Note:
Checking intake manifold change-over => Page 125 .



- -> Pull connector -1- off 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 valve => Page 65 , item 11 .

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 104 and 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 pipes:

- Renew engine control unit => Page 128 .

3 - Activating camshaft adjustment valve (N205):

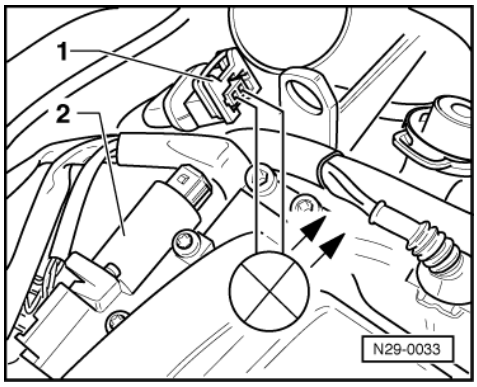
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Camshaft adjustment 1
```

The camshaft adjustment valve 1 (N205) must click, until the final control diagnosis is completed by pressing ⇒key.

If valve does not click:



- -> Pull connector -1- off 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:

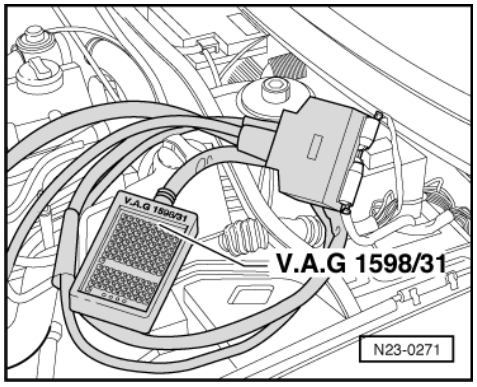
- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew valve.

=> Repair group 15; Servicing valve gear Servicing valve gear

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 115 and 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 pipes:

- Renew engine control unit => Page 128 .

4 - Activating charge pressure control solenoid valve (N75):

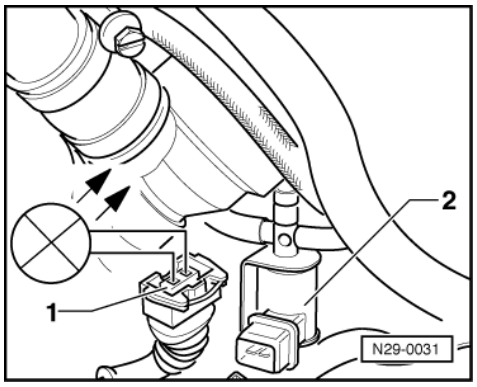
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Charge pressure control solenoid valve -
N75
```

The solenoid valve must click.

Note:



The clicking of the valve is difficult to hear and is therefore best checked by touch.

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

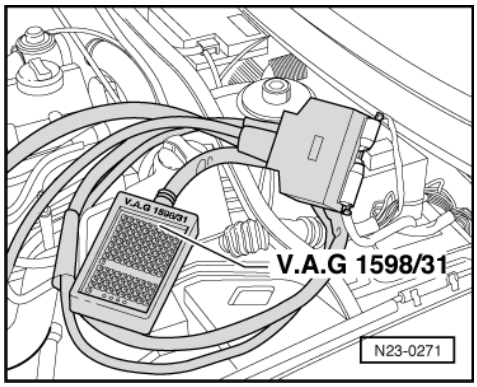
LED flashes:

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

=> Repair group 21; Air charge system with turbocharger; Turbocharging overview Air charge system with turbocharger Turbocharging overview

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 104+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 fault in wire 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 pipes:

- Renew engine control unit => Page 128 .

5 - Activating turbocharger divert air valve (N249):

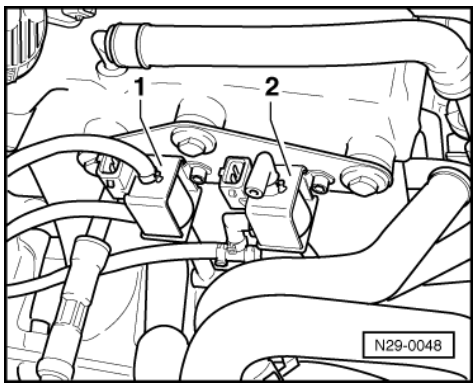
- Press ⇒key.

-> Indicated on display:

```
Final control diagnosis
Turbocharger divert valve -N249
```

The solenoid valve must click.

If the solenoid valve does not click:



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

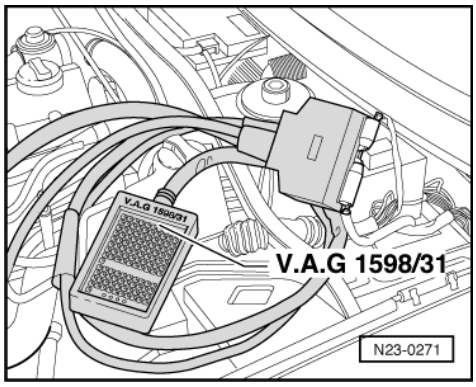
LED flashes:

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

=> Repair group 21; Air charge system with turbocharger; Turbocharging overview Air charge system with turbocharger Turbocharging overview

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 105+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 fault in wire 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 pipes:

- Renew engine control unit => Page 128 .

6 - Activating secondary air inlet valve (N112):

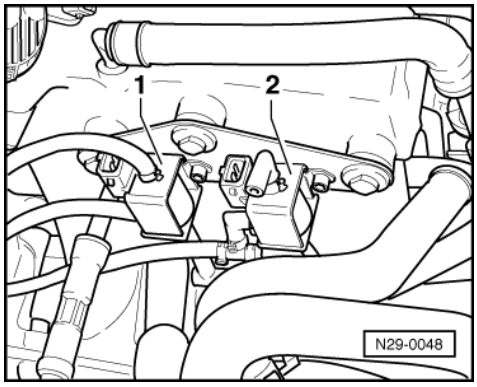
- Press ⇒key.

-> Indicated on display:

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

The secondary air inlet valve must run until the next control element is activated by pressing the ⇒ key.

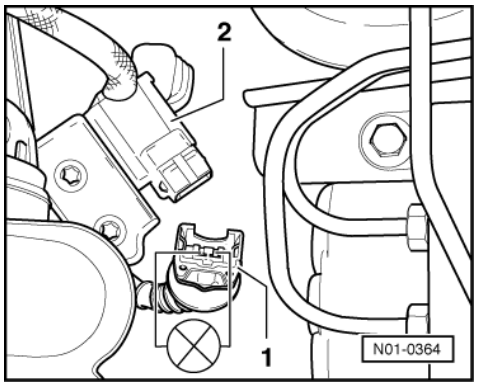
If the valve does not click:



Vehicles with turbocharger

- -> Pull connector of secondary air inlet valve -2- and connect diode test lamp V.A.G 1527 with auxiliary cables from V.A.G 1594 to disconnected connector.
  The LED must flash

Vehicles without turbocharger



- -> Pull connector of secondary air inlet valve -2- and connect diode test lamp V.A.G 1527 with auxiliary cables from V.A.G 1594 to disconnected connector.
  The LED must flash

Continued for all vehicles

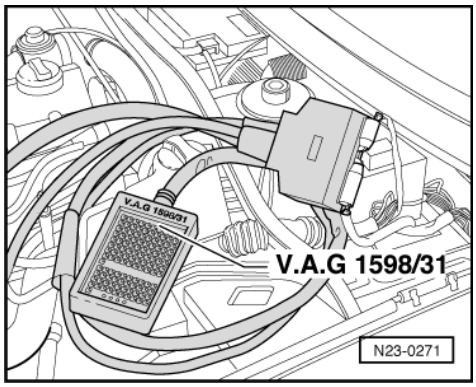
LED flashes:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew secondary air inlet valve:

=> Repair group 26; Secondary air system; Removing and installing parts of the secondary air system Secondary air system Removing and installing parts of the secondary air 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 for open circuit between test box socket 9 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 pipes:

- Renew engine control unit => Page 128 .

7 - 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) activates the secondary air pump motor, and this must run at intervals until the next control element is activated by pressing the ⇒ key.

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

- -> Pull 2-pin connector off secondary air pump motor and connect diode test lamp V.A.G 1527 with auxiliary 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 secondary air pump motor (V101):

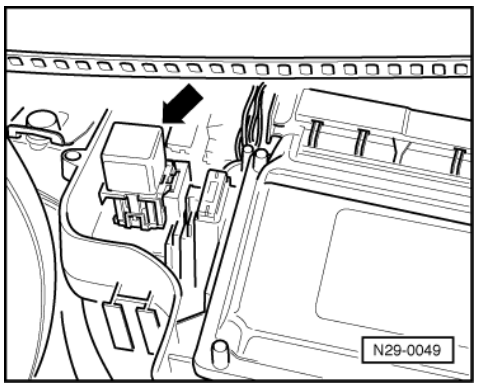
=> Repair group 26; Secondary air system; Removing and installing parts of secondary air system Secondary air system Removing and installing parts of secondary air system

If the LED does not flash 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 for open circuit between secondary air pump motor (V101) contact 2 and contact 2 on relay plate using current flow diagram.

If no wiring fault is detected:

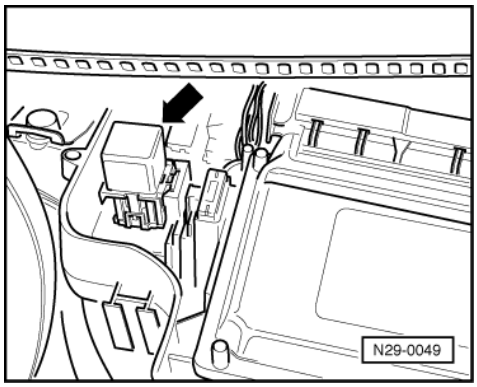
- Using current flow diagram check the voltage supply (terminal 30) for secondary air pump relay (J299).

If voltage supply is OK:

- Renew secondary air pump relay (J299).

If the LED does not flash 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.
- Initiate final control diagnosis again and activate secondary air pump relay.
- Connect the diode test lamp V.A.G 1527 with aux. cables from V.A.G 1594 to contacts 6 and 8 on the relay plate.
  The LED must flash

LED flashes:

- Renew secondary air pump relay (J299).

LED does not flash:

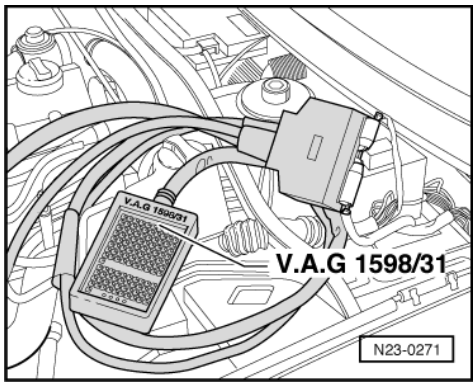
- Connect the diode test lamp V.A.G 1527 with aux. cables from V.A.G 1594 to contact 8 on relay carrier and body earth.
  The LED must light-up

LED does not light-up:

- Check the wire for open circuit between contact 8 on relay carrier and the relay plate using current flow diagram.

LED lights up:

- 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 the wire between for open circuit between test box socket 66 and contact 6 on relay carrier.
  Wire resistance: max. 1.5 ω

If no wiring fault is detected:

- Renew engine control unit => Page 128 .
- 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.

6 - Readiness code

6.1 - Readiness code

Engine code ANB only

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 or the voltage supply is interrupted 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 3 .)

-> 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 35

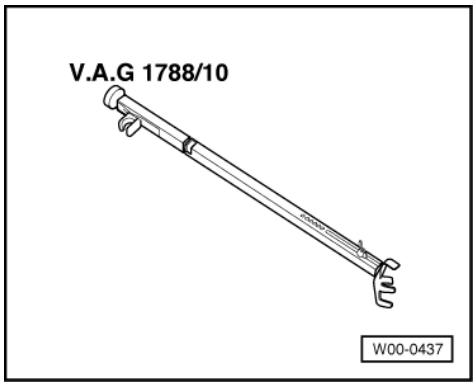
Significance of 8 digit number block for readiness code

The readiness code is generated only when all display zones show 0								
1	2	3	4	5	6	7	8	Diagnostic function
							0	Catalyst
						0		Catalyst heating (currently no diagnosis/always "0")
					0			Activated charcoal filter system (tank venting system)
				0				Secondary air system (not fitted/always "0")
			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



- -> V.A.G 1788/10 Engine speed adjuster

Test conditions

- Vehicle stationary
- On vehicles with automatic gearbox selector lever in "P" or "N" position
- 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 3 .)

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 codes=> Page 14

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.

- 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 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: 0...9
  Display zone 4: ADP. runs, ADP. OK

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

```
System in basic setting 60
     xxx %     xxx %     9     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 89 .

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 "Introduce 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 9 .

If the display indicates as described:

- Press C key.

Work step 5: Lambda regulation system diagnosis

- Press keys 0, 3 and 7 for "Display group number 37" and confirm entry with Q key.

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

```
Read measured value block      37
     1     2     3     4
```

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

- Continue to run engine at idling speed until the specification "Syst. OK" is indicated in display zone 4.

If the display does not indicate as described:

- Interrogate fault memory => Page 9 .

If the display indicates as described:

- Press ⇒key.

Work step 6: Lambda probe ageing diagnosis (cycle duration monitor)

-> 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 4 for "Display group number 34" and confirm entry with Q key.

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

```
Read measured value block     34
     1     2     3     4
```

- Set engine speed to 1800...2200 rpm using speed regulator V.A.G 1788/10:
- Maintain this engine speed until the catalyst temperature in
  Display zone 2 rises above 350 °C
- Press C 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...4 = Display zones)

```
Read measured value block     30
     1     2     3     4
```

- Check the operating condition of the Lambda control in front of catalyst (display zone 1):
  Specification: 111
- Check the operating condition of the Lambda regulation after catalyst (display zone 2):
  Specification: 111

Note:

The bits in display zone 2 will not be set to 1 until the catalyst temperature rises above 350 °C (=> Display group 34, display zone 2).

Significance of 3 digit number block in display zones 1 and 2:

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

If the specifications are not obtained:

- Interrogate fault memory => Page 9 .

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
```

- Maintain the engine speed at 1800...2200 rpm until the display in display zone 4 jumps from "Test OFF" to "Test ON".
  The catalyst temperature in
  display zone 2 must be between 350 and 500 °C.
- Check cycle duration in display zone 3:
  Specification: maximum 1.0 s
- Continue to maintain the speed at 1800...2200 rpm until the specification "B1-P1 OK" appears in
  display zone 4.

If the specifications are not attained:

- Interrogate fault memory => Page 9 .

If the specification is obtained:

- Press C key.

Work step 7: 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 1800...2200 rpm until display in display zone 4 jumps from "Test OFF" to "Test ON".
  Catalyst temperature in
  display zone 2 must be at least 350 °C.
- Check amplitude ratio in display zone 3:
  Specification: max. 0.4
- Continue to maintain engine speed at 1800...2200 rpm until
  Specification "Cat B1 OK" appears in
  display zone 4.

If the specifications are not attained:

- Interrogate fault memory => Page 9 .

If the specification is obtained:

- Press C key.

Work step 8: 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
```

- Set engine speed to 2000...2200 rpm using speed regulator V.A.G 1788/10:

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

- Continue to maintain engine speed at 2000...2200 rpm until specification "Syst. OK" appears in display zone 4.
- Remove the engine speed adjuster V.A.G 1788/10 from accelerator pedal.

If the display does not indicate as described:

- Interrogate fault memory => Page 9 .

If the display indicates as described:

- Press ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Read readiness code=> Page 34

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.

- On vehicles with automatic gearbox selector lever in "P" or "N" position
- No faults must be stored in fault memory
  => Page 9 , 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 3 .)

-> 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
```

- 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 ⇒				[ltrif] Indicated on display		
xxxx rpm	xx.x °C	xx.x %	xxxxxxxx			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Adjustment conditions for basic setting	1x111111	=> Page 42
				Lambda regulator before catalyst	-10.0...10.0 %	=> Page 51
				Coolant temperature	80...110 °C	=> Page 44
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

Significance of 8-digit number block for readiness code

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					Idling recognised
		1						Air conditioner compressor switched off
	1							Not relevant
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 specification	- Throttle valve control part sticking or defective	- Check throttle valve control part => Page 89 - Perform idling check => Page 111
Greater than specification	- Throttle valve control part sticking or defective - Large amount of unmetered air (cannot be compensated for by the idling stabilisation)	- Interrogate fault memory, => Page 9 - Check intake air system for leaks => Page 110 - Check throttle valve control part => Page 89 - Perform idling check => Page 111

Display group 2 -Basic functions- Air mass meter		
▪ Engine running at idling speed		
Read measured value block 2	⇒	[ltrif] Indicated on display

xxxx rpm	xxx %	x.x ms	x.x g/s			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Air mass drawn in	2.0...4.5 g/s	=> Page 43
				Injection period Engines without turbocharger Engines with turbocharger	1.0...4.0 ms 2.0...4.0 ms	=> Page 43
				Engine load	15...25 %	=> Page 46
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

Note on display zone 4:

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

Evaluating display group 2, display zone 3 - Injection period

Appears on display	Possible fault cause	Fault elimination
Less than specification	- Large amount of fuel from the activated charcoal filter system - Incorrect injectors with greater throughput installed	- Check activated charcoal filter solenoid valve 1 => Page 22 , Final control diagnosis - Check injection rate => Page 101
More than 4.0 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

Appears on display	Possible fault cause	Fault elimination
Less than 2.0 g/s	- Large amount of unmetered air between intake manifold and air mass meter	- Rectify unmetered air
Greater than 4.5 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.)

Display group 3 -Basic function- Air mass meter

- Engine running at idling speed

Read measured value block 3 ⇒ [ltrif] Indicated on display

xxxx rpm	x.xx ms	x.x %	xx.x°BTDC			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Timing Engines without turbocharger Engines with turbocharger	5...15 ° BTDC 6...12 ° BTDC	---
				Throttle valve angle (potentiometer 1 -G187) Engines without turbocharger Engines without turbocharger	0.4...2.75 % 0.2...4.0 %	=> Page 46
				Air mass drawn in	2.0...4.5 g/s	=> Page 43
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

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 ⇒				[ltrif] Indicated on display		
xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Intake air temperature Engines without turbocharger Engines with turbocharger	-40.0...125.0 °C -40.5...135.0 °C	=> Page 45
				Coolant temperature	80...110 °C	=> Page 44
				Supply voltage for engine control unit Engines without turbocharger Engines with turbocharger	10.0...14.5 V 12.0...15.0 V	=> Page 44
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

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.

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 specification	- 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 126
	- Current draw when ignition is off	- Eliminate current draw
Greater than specification	- Voltage regulator on alternator defective	- Check voltage regulator, replace if necessary => Binder Electrical system
	- Excess voltage due to jump starting or quick charging unit	- Interrogate fault memory => Page 9

Evaluating display group 4, display zone 3 - Coolant temperature

Appears on display	Possible fault cause	Fault elimination
Less than 80 °C	- Engine too cold	- If necessary carry out test drive

	- Coolant temperature sender or wiring to engine control unit	- Check coolant temperature sender =>Page 92
Greater than 110 °C	- Radiator soiled	- Clean radiator
	- Radiator fan not functioning	- Check function => Binder Electrical system
	- Thermostat defective	- Check thermostat => Repair group 19; Removing and installing parts of cooling system: Parts of cooling system - engine side
	- Coolant temperature sender or wiring to engine control unit	- Check coolant temperature sender =>Page 92
Constant -48.0 °C	- Wiring open circuit	- Check coolant temperature sender =>Page 92
Constant 143 °C	- Short between wires 1 and 3	

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

Appears on display	Possible fault cause	Fault elimination
Constant -48.0 °C	- Wiring open circuit	- Check intake air temperature sender =>Page 96
Constant 143 °C	- Short between wires 1 and 2	

Display group 5 -Basic functions-

▪ Engine running at idling speed

Read measured value block 5 ⇒ [Itrif] Indicated on display

xxxx rpm | xxx % | xxx km/h | Text

1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Operating mode (idling, partial load, enrichment, overrun, full load 1))	Idling	---
				Road speed	0 km/h	---
				Engine load	15...25 %	=> Page 46
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

1) Only engines without turbocharger

Display group 6 -Basic function-

▪ Engine running at idling speed

Read measured value block 6 ⇒ [Itrif] Indicated on display

xxxx rpm | xxx % | xxx.x °C | xx.x %

1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Altitude correction factor	-50.0...20.0 %	---
				Intake air temperature Engines without turbocharger Engines with turbocharger	-40.0...125.0 °C -40.5...135.0 °C	=> Page 45
				Engine load	15...25 %	=> Page 46
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

Note on display zone 3:

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

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			⇒	[ltrif] Indicated on display		
xxxx rpm	xxx %	x.x %	xx.x°BTDC			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Timing Engines without turbocharger Engines with turbocharger	5...15 ° BTDC 6...12 ° BTDC	---
				Throttle valve angle (potentiometer 1 -G187) Engines without turbocharger Engines without turbocharger	0.4...2.75 % 0.2...4.0 %	=> Page 46
				Engine load	15...25 %	=> Page 46
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

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	
More than 25 %	- 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 87

Evaluating display group 10, display zone 3 - Throttle valve angle potentiometer 1

Appears on display	Possible fault cause	Fault elimination
Greater than specification	- Engine control unit not matched to throttle valve control part - Throttle valve potentiometer in throttle valve control part defective - Throttle valve sticking	- Match engine control unit to throttle valve control part => Page 131 - Check throttle valve control part => Page 89 - Eliminate cause

Engine code ANB only

Display group 14 -Ignition- Misfire recognition						
▪ Whilst driving						
Read measured value block 14			⇒	[Itrif] Indicated on display		
xxxx rpm	xxx %	xxx	Text			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Misfire recognition (active, blocked)	active	=> Page 47
				Misfire total	0...5	---
				Engine load	15...175 %	---
				Engine speed	750...6800 rpm	---

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

Appears on display	Possible fault cause	Fault elimination
Larger than 5	- Spark plug defective - Spark plug connector defective - Ignition coil defective - Ignition coil output stage defective	- Check ignition coils with output stage => Page 145
	- Injector defective	- Check injectors => Page 101

All engine codes

Display group 22 -Ignition- Knock control						
▪ Whilst driving						
Read measured value block 22			⇒	[Itrif] Indicated on display		
xxxx rpm	x.xx %	xx.x °CA	xx.x °CA			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Cyl. No. 2 retardation of ignition timing by knock control	0...12.0 °CA	=> Page 48
				Cyl. No. 1 retardation of ignition timing by knock control	0...12.0 °CA	=> Page 48
				Engine load Engine without turbocharger Engine with turbocharger	0...120 % 15...175 %	---
				Engine speed	750...6800 rpm	---

Note on display zones 3 and 4:

The displayed value should be 0.0 °CA at idling.

Display group 23 -Ignition- Knock control						
▪ Whilst driving						
Read measured value block 23			⇒	[Itrif] Indicated on display		
xxxx rpm	x.xx %	xx.x °CA	xx.x °CA			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Cyl. No. 4 retardation of ignition timing by knock control	0...12.0 °CA	=> Page 48
				Cyl. No. 3 retardation of ignition timing by knock control	0...12.0 °CA	=> Page 48

	Engine load Engine without turbocharger Engine with turbocharger	0...120 % 15...175 %	---
	Engine speed	750...6800 rpm	---

Note on display zones 3 and 4:

The displayed value should be 0.0 °CA at idling.

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 161
	- 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 161
	- 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

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

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

Display group 30 -Lambda regulation-						
▪ Engine running at idling speed ▪ Catalyst temperature at least 350 °C (Engine code ANB, display group 34, display zone 2)						
Read measured value block 30 ⇒				[ltrif] Indicated on display		
xxx	xxx					
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
		Lambda regulation status after catalyst			111	=> Page 49
	Lambda regulation status before catalyst				111	=> Page 49

1) Engine code ANB only

Significance of 3 digit number block in display zones 1 and 2

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

Display group 32 -Lambda regulation- Lambda learnt values						
▪ Engine running at idling speed						
Read measured value block 32			⇒	[ltrif] Indicated on display		
xx.x %	xx.x %					
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Lambda learnt value at part load (multiplicative)	-10...10 %	=> Page 49
				Lambda learnt value at idling speed (additive)	-10...10 %	=> Page 49

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.
- If there is no voltage supply to the control unit all the values learnt will be cancelled.
- 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.

Initiating learning process: Control unit in mode 04, Basic settings

- Learning conditions for idling: Idling, coolant temperature min. 75 °C, intake air temperature max. 90 °C
- Learning conditions for part load: coolant temperature min. 75 °C, intake air temperature max. 90 °C

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 101
	- Fuel pressure too high	- Check fuel pressure regulator and holding pressure => Page 107
	- Activated charcoal filter solenoid valve 1 permanently open	- Check activated charcoal filter solenoid valve 1 => Page 22 , Final control diagnosis
	- Air mass meter defective	- Check air mass meter => Page 87

	- Lambda probe heating defective or Lambda probe soiled	- Check Lambda probe heating =>Page 82

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 110
	- Unmetered air between air mass meter and throttle valve	- Rectify cause
	- Injector blocked	- Check quantity injected rate =>Page 101
	- Display zones 1 and 2 high: Air mass meter defective	- Check air mass meter => Page 87
	- Fuel pressure too low	- Check fuel pressure regulator and holding pressure => Page 107
	- Unmetered air at exhaust manifold gasket	
	- Lambda probe heating defective or Lambda probe soiled	- Check Lambda probe heating =>Page 82

Display group 33 -Lambda regulation- Lambda regulation values

▪ Engine running at idling speed

Read measured value block 33 ⇒ [ltrif] Indicated on display

xx.x % x.xxx V

1	2	3	4	[ltrif] Display zones	Specification	Evaluation
		Lambda probe voltage, Lambda probe before catalyst			0.000...1.000 V	=> Page 51
	Lambda regulator before catalyst				-10.0...10.0 %	=> Page 51

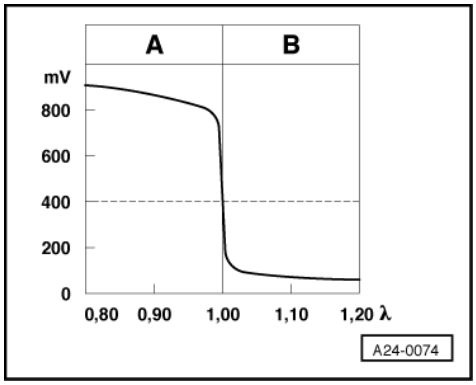
Notes on display zone 1:

- 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 9 .

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 (font=symbol charset=fontspecific code=108 TeX='\lambda ' descr='[lambda]' = 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 font=symbol charset=fontspecific code=108 TeX='\lambda ' descr='[lambda]' = 1.0 constant. The control fluctuates constantly between conditions "slightly too lean" and "slightly too rich".



-> Lambda probe voltage Ufont=symbol charset=fontspecific code=108 TeX='\lambda ' descr='[lambda]' 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 110
	- Injector defective	- Check injection rate => Page 101
	- 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 117
Constant between 0.400...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	

Engine code ANB only

Display group 34 -Lambda regulation- Lambda probe diagnosis before catalyst (checking age via cylce duration monitoring)						
▪ Vehicle stationary, engine running at increased idling speed ▪ Control unit in mode 04-Basic settings						
Read measured value block 34 ⇒				[ltrif] Indicated on display		
xxxx rpm	xxx.x °C	xx.xx s	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Result of Lambda probe before catalyst age check (test OFF/test ON/B1-P1 OK / B1-P1 n.OK)	B1-P1 OK	---
				Cycle duration Lambda probe before catalyst	max. 1.0 s	---
				Catalyst temperature	350...500 °C	---
				Engine speed	1800...2200/min	---

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.

Evaluating display group 36, display zone 1 - 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 121
Constant between 0.400...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	

Engine code ANB only

Display group 37 -Lambda regulation- Lambda probe-						
▪ Engine running at idling speed ▪ Control unit in mode 04-Basic settings						
Read measured value block 37 ⇒				[ltrif] Indicated on display		
xxx %	x.xxx V	xxxx ms	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Result (Test On / OFF / Syst. OK / n.OK)	Syst. OK	
				Dwell period Lambda regulation before catalyst	-150...150 ms	
				Lambda probe voltage, Lambda probe after catalyst	0.000...1.000 V	=> Page 52

Engine load	15...35 %	---

Note on display zone 3:

The Lambda regulation after catalyst is the master regulation of the Lambda regulation before catalyst and serves as a controlling regulation. It corrects slight rich or lean shifts by means of the Lambda probe before catalyst by holding the Lambda regulation before catalyst on the upper or lower point for a certain period -t- (dwell period). If the period is in the positive range (e.g. 50 ms) the mixture is moved towards "rich". If the period is in the negative range (e.g. -50 ms),the mixture is moved towards "lean".

If the value rises above 200 ms, the exhaust system is leaking.

All engine codes

Display group 41 -Lambda regulation- Lambda probe heating						
▪ Engine running at idling speed						
Read measured value block 41 ⇒				[Itrif] Indicated on display		
xx.x ω	Text	xx.x ω	Text			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Lambda probe heating after catalyst1)	Htg.aC.ON Htg.aC.OFF	---
				Lambda probe heating after catalyst, resistance	---	---
				Lambda probe heating before catalyst	Htg.bC.ON Htg.bC.OFF	---
				Lambda probe heating before catalyst, resistance	---	---

1) Engine code ANB only

Note:

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".

Engine code ANB only

Display group 46 -Lambda regulation- Catalyst diagnosis (conversion test)						
▪ Vehicle stationary, engine running at increased idling speed						
▪ Control unit in mode 04-Basic settings						
Read measured value block 46 ⇒				[Itrif] Indicated on display		
xxxx rpm	xxxx °C	x.xx	Text			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Result of catalyst conversion test (Test OFF/test ON/Cat B1 OK/Cat B1 n.OK)	Cat B1 OK	---
				Amplitude ratio	0.0...0.4	---
				Catalyst temperature	min. 350 °C	---
				Engine speed	1800...2200/min	---

All engine codes

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 ⇒				[ltrif] Indicated on display		
xxxx rpm	xx.x °C	x.x %	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Lambda regulation operating mode	font=symbol charset=fontspecific code=108 TeX='\lambda ' descr='[lambda]'-Reg. OFF or font=symbol charset=fontspecific code=108 TeX='\lambda ' descr='[lambda]'-Reg. ON	---
				Lambda regulator	-10.0...10.0 %	=> Page 51
				Coolant temperature	80...110 °C	=> Page 44
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

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- Operating condition						
▪ Engine running at idling speed						
Read measured value block 50 ⇒				[ltrif] Indicated on display		
xxxx rpm	xxxx rpm	Text	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Air conditioner compressor operating mode ON/OFF	Compr. ON or Compr. OFF	---
				Air conditioner operating mode	A/C-High or A/C-Low	---
				Engine speed (idling speed specification): Engines without turbocharger Engines with turbocharger	860/min 800/min	---
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

Note on display zone 2:

The specified engine speed from engine control unit (calculated in control unit) is displayed. In exceptional cases the idling speed can be adapted => Page 113 . The idling speed figures with gear selected are then automatically modified.

Notes on display zone 3:

- A/C-High = Air conditioner demands too high a heating or cooling output
  A/C-Low = Air conditioner not switched on.

Notes on display zone 4:

- "Compr. OFF" is always displayed on vehicles without air conditioner.
- Checking signal from and to air conditioner compressor =>Page 136

Display group 54 -Speed regulation-						
▪ Whilst driving						
Read measured value block 54			⇒	[ltrif] Indicated on display		
xxxx rpm	Text	xxx %	xxx %			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Throttle valve angle (potentiometer 1 -G187)	0...100 %	---
				Accelerator pedal position sender 1 -G79	0...100%	---
				Operating mode (idling, partial load, enrichment, overrun, full load 1))	---	---
				Engine speed	750...6800 rpm	---

1) Only engines without turbocharger

Display group 55 -Speed regulation- Idling stabilisation						
▪ Engine running at idling speed						
Read measured value block 55			⇒	[ltrif] Indicated on display		
xxxx rpm	xx.x g/s	xx.x g/s	xxxx			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Operating condition	xxxx	=> Page 55
				Idling regulator learnt value Engines without turbocharger Engines with turbocharger	-5.0...5.0 % -3.0...3.0 %	---
				Idling regulator Engines without turbocharger Engines with turbocharger	-5.0...5.0 % -4.3...12.2 %	---
				Engine speed (idling speed) Engines without turbocharger Engines with turbocharger	810...910/min 750...850/min	=> Page 42

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 5 digit number block

Significance if display = 1					
1	2	3	4	5	Significance
				1	Air conditioner compressor switched on
			1		Driving range (gear) selected
		1			Air conditioning system switched on
	1				Not relevant
1					Not relevant

Display group 56 -Speed regulation- Idling speed stabilisation

- Engine running at idling speed

Read measured value block 56 ⇒ [ltrif] Indicated on display

xxxx rpm	xxxx rpm	xx.x %	xxxxx			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Operating mode	xxxxx	=> Page 55
			Idling regulator Engines without turbocharger Engines with turbocharger		-5.0...5.0 % -4.3...12.2 %	---
		Engine speed (idling speed specification): Engines without turbocharger Engines with turbocharger			860/min 800/min	---
	Engine speed (idling speed) Engines without turbocharger Engines with turbocharger				810...910/min 750...850/min	=> Page 42

Display group 60 -Speed regulation- Adaption of electronic accelerator system

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

Read measured value block 60 ⇒ [ltrif] Indicated on display

xx %	xx %	x	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Adaption condition (ADP runs, ADP OK or ADP ERROR)	ADP OK	---
			Learning step counter		0...9	---
		Throttle valve angle (potentiometer 2 -G188)			80...97 %	---
	Throttle valve angle (potentiometer 1 -G187)				3...20 %	---

1) Adapting engine control unit to throttle valve control part => Page 131 .

Note on display group 60:

- Matching the throttle valve control part is performed with ignition switched on.
- Engine control unit is adapted to throttle valve control unit when selecting display group 60 under function 04 "Basic setting". This adaption must always be carried out when another throttle valve control part (or another complete engine) or another engine control unit is fitted.
- During adaption, the counter in display zone counts from 0 to 9.

Display group 62 -Speed regulation- Electronic accelerator system

- Ignition on, engine not running

Read measured value block 62 ⇒ [ltrif] Indicated on display

xx %	xx %	xx %	xx %			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Accelerator pedal position sender 2 -G185	4...49 %	---
			Accelerator pedal position sender 1 -G79		12...97 %	---
		Throttle valve angle (potentiometer 2 -G188)			97...3 %	---
	Throttle valve angle (potentiometer 1 -G187)				3...93 %	---

Vehicles with automatic gearboxes

Display group 63 -Speed regulation- Kick down adaption

▪ Ignition on, engine not running ▪ Control unit in mode 04 basic setting						
Read measured value block 63 ⇒				[Itrif] Indicated on display		
xx %	xx %	Text	Text			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Operating mode (ERROR, actuate, ADP. runs, ADP. OK	ADP. OK	=> Page 55
				Acceleratorpedal position	Kick down	---
				Sender 2 for accelerator pedal position -G185	4...49 %	---
				Sender 1 for accelerator pedal position -G79	12...97 %	---

Vehicles with cruise control system (CCS)

Display group 66 -Cruise control system						
▪ Engine running at idling speed						
Read measured value block 66 ⇒				[Itrif] Indicated on display		
km/h	xxxx	km/h	xxxx			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Switch position of CCS controls switch	0000	=> Page 57
				Specified road speed (last value stored by CCS)	---	---
				Brakes, clutch and CCS switches position	1000	=> Page 57
				Road speed (actual)	0 km/h	---

Significance of the figures in the 4 digit display, display zone 2, brakes, clutch and CCS switches position

1	1	1	1	Significance
				Brake depressed (brake light switch)
				Brake depressed (brake pedal switch)
				Clutch depressed (on automatic gearbox always 0)
				Cruise control system operational

- Checking clutch pedal switch => Page 137
- Checking brake light and brake pedal switch => Page 140

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

1	1	0	0	Significance
				CCS sliding switch at off (switch locked only)
				CCS sliding switch at off (switch not locked or locked)
				SET button depressed
				CCS sliding switch at RES

Checking control switches for cruise control system:

=> Electrical system; Repair group 27

Function of cruise control system:

=> Owner's Manual in vehicle

12 - Evaluating measured value blocks, display groups 70...79 -Reducing emissions-

12.1 - Evaluating measured value blocks, display groups 70...79 -Reducing emissions-

Engine code ANB only

Display group 70 -Reducing emissions- Activated charcoal filter system diagnosis (fuel tank venting system)						
▪ Engine running at idling speed ▪ Coolant temperature at least 60 °C ▪ Control unit in mode 04-Basic settings						
Read measured value block 70 ⇒				[ltrif] Indicated on display		
xxx %	xx.x %		Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Result of diagnosis (Test ON / OFF or TVV OK / n.OK)	TVV OK	---
				Idling regulator deviation in TVV diagnosis	---	---
				Lambda regulation deviation in TVV diagnosis	-10...10 %	---
				Activated charcoal filter system solenoid valve 1 duty cycle	0...99 %	---

Note:

TVV means fuel tank venting 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

Only for vehicles with secondary air system

Display group 77 -Reducing emissions- Secondary air system diagnosis						
▪ Engine running at idling speed ▪ Control unit in mode 04-Basic settings						
Read measured value block 77 ⇒				[ltrif] Indicated on display		
xxxx rpm	xx.x °C	x.x g/s	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Result of diagnosis (Test ON/ OFF, Syst. OK / n.OK)	Syst. OK	---
				Secondary air system air mass	0.0...7.0 g/s	---
				Coolant temperature	80...110 °C	=> Page 44
				Engine speed (idling speed)	810...910 rpm	=> Page 42

13 - Evaluating measured block values, display groups 80...89, 100 -Readiness code-

13.1 - Evaluating measured block values, display groups 80...89, 100 -Readiness code-

Engine code ANB only

Display group 100 -Readiness code-						
▪ Engine running at idling speed						
Read measured value block 100			⇒	[Itrif] Indicated on display		
xxxxxxxx	xxx.x °C	xxxx s	xxxxxxxx			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Diagnosis status	---	---
				Period since last engine start	---	---
				Coolant temperature	80...110 °C	=> Page 44
				Readiness code	00000000	=> Page 59

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
							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 block values 90...97 -Performance increase-

14.1 - Evaluating measured block values 90...97 -Performance increase-

Engines without turbocharger only

Display group 91 -Performance increase- Camshaft adjustment						
▪ Whilst driving						
Read measured value block 91			⇒	[Itrif] Indicated on display		
xxxx rpm	xxx %	Text	x.x ° CA			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Active camshaft adjustment angle	-3...25 ° CA	---
				Camshaft adjustment operating mode	CS-ctrl ON/OFF	---
				Engine load	0...120 %	---

Engine speed	750...6800 rpm	---

Notes on display zones 3 and 4:

- There are only two positions for the adjustable camshaft, the normal position and the switched position. To bring the camshaft into the switched position, accelerate the vehicle in 1st gear from rest. Display zone 4 shows the actual position of the adjustable camshaft. If the activation of the adjustable camshaft is active - see display zone 3- it can be seen in display zone 4 whether in fact an adjustment of the camshaft has occurred (feed-back information). -Camshaft in normal position = -3.0...+6.0 °CA -Camshaft in switched position = 16.0...25.0 °CA
- If during test drive display zone 4 displays a value between 6.0 °CA and16.0 °CA, the electric camshaft adjustment valve is correctly directing oil pressure to the mechanical camshaft adjuster, but it cannot attain its end position (e.g. for reasons of stiffness/tightness).
- Checking camshaft adjustment:

=> Repair group 15; Servicing valve gear, checking camshaft adjustment Servicing valve gear, checking camshaft adjustment

Engines without turbocharger only

Display group 95 -Performance increase- Intake manifold change over						
▪ Whilst driving						
Read measured value block 95			⇒	[ltrif] Indicated on display		
xxxx rpm	xx.x %	xx.x °C	Text			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Status	---	---
				Coolant temperature	80...110 °C	=> Page 44
				Engine load	0...120 %	---
				Engine speed	750...6800 rpm	---

15 - Evaluating measured value blocks, display groups 110...119 -Charge pressure control-

15.1 - Evaluating measured value blocks, display groups 110...119 -Charge pressure control-

Engines with turbocharger only

Display group 114 -Charge pressure control-						
▪ Whilst driving						
Read measured value block 114			⇒	[ltrif] Indicated on display		
xxx.x %	xxx.x %	xxx.x %	xxx.x %			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Charge pressure control solenoid valve duty cycle	0...100 %	---
				Actual engine load (regulated via charge pressure to specified engine load)	15...175 %	---
				Specified engine load after correction (reduced via knock control, altitude adaption and coolant temperature)	max. 175 %	---
				Specified engine load (mapped value via accelerator pedal position)	max. 175 %	---

Engines with turbocharger only

Display group 115 -Charge pressure control-						
▪ Whilst driving						
Read measured value block 115			⇒	[Itrif] Indicated on display		
xxxx rpm	xxx.x %	xxx mbar	xxx mbar			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Actual charge value	max. 2000 mbar	---
			Specified charge pressure		990...2000 mbar	---
		Engine load			15...175 %	---
	Engine speed				750...6800 rpm	---

Engines with turbocharger only

Display group 117 -Charge pressure control-						
▪ Whilst driving						
Read measured value block 117			⇒	[Itrif] Indicated on display		
xxxx rpm	xxx.x %	xxx.x %	xxx mbar			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Specified charge pressure	990...2000 mbar	---
			Throttle valve angle (potentiometer 1 -G187)		0...100 %	---
		Accelerator pedal position sender -G79			0...100%	---
	Engine speed				750...6800 rpm	---

Engines with turbocharger only

Display group 118 -Charge pressure control-						
▪ Whilst driving						
Read measured value block 118			⇒	[Itrif] Indicated on display		
xxxx rpm	xxx.x °C	xxx.x %	xxx mbar			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Actual charge value	max. 2000 mbar	---
			Charge pressure control solenoid valve duty cycle		0...100 %	---
		Intake air temperature			max. 110 °C	---
	Engine speed				750...6800 rpm	---

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

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

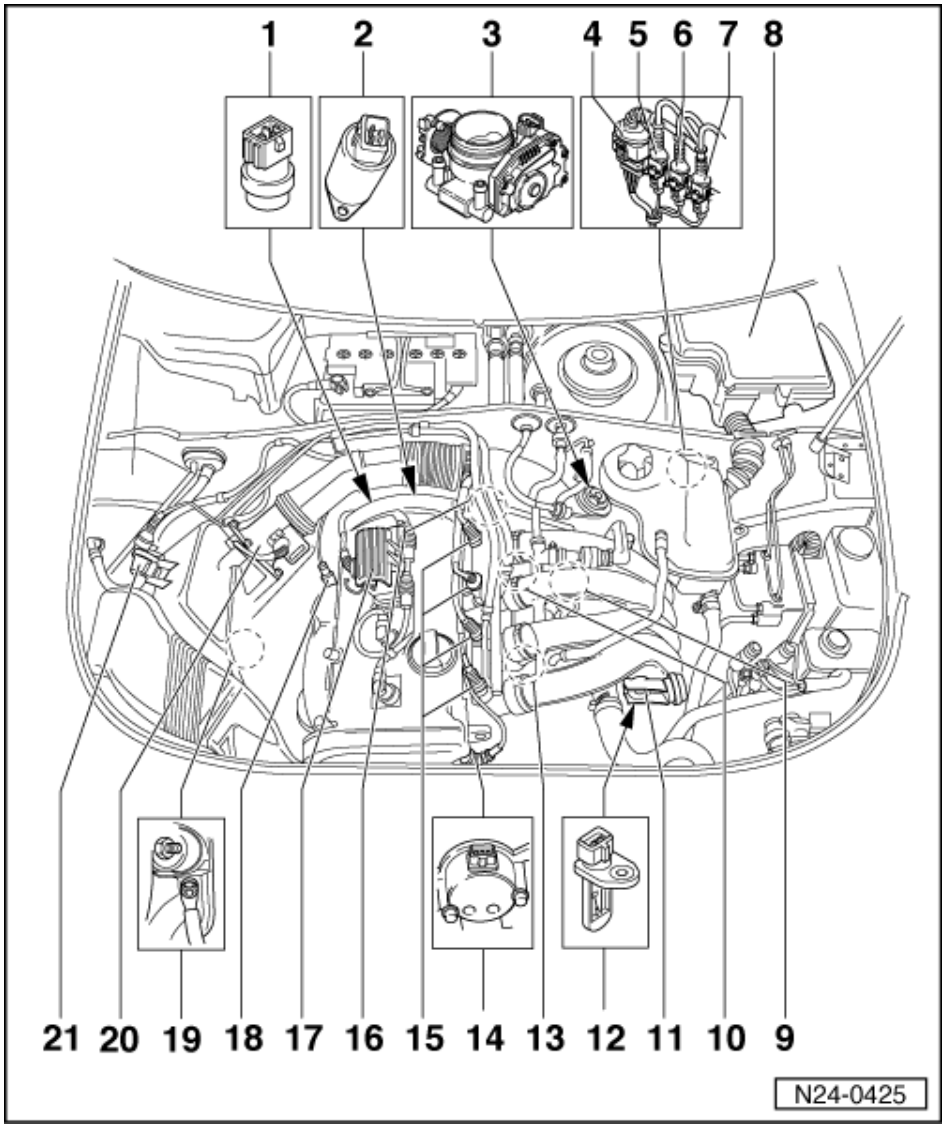
Display group 120 -Traction control -TC-						
▪ Whilst driving						
Read measured value block 120			⇒	[Itrif] Indicated on display		
xxxx rpm	xxx Nm	xxx Nm	Text			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation

			Status	TC active / TC n.active	---
			Actual engine load	0...260 Nm	---
		Specified engine load		0...399 Nm	---
	Engine speed			750...6800 rpm	---

24 - Mixture preparation, Injection

1 - Servicing injection system

1.1 - Servicing injection system



1.2 - Fitting locations overview

Engines without turbocharger

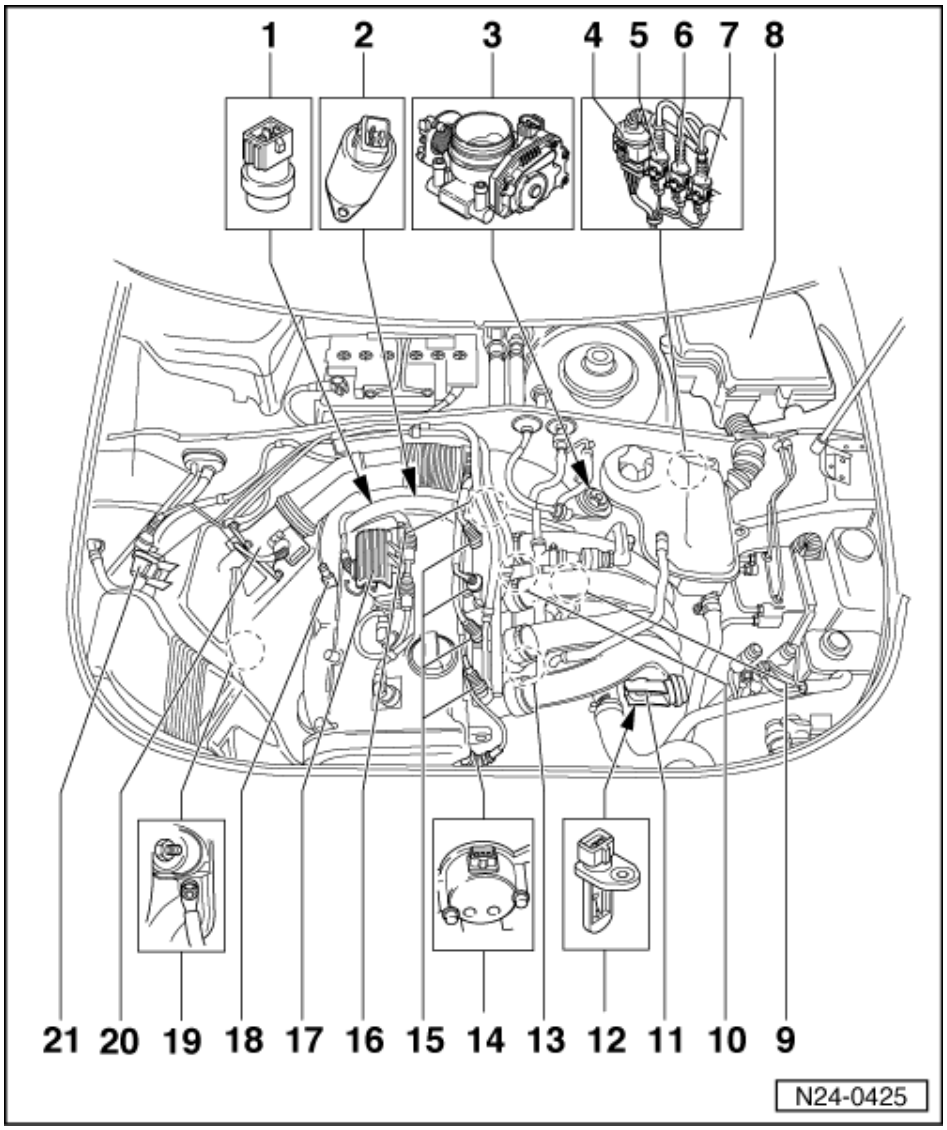
1 Coolant temperature sender (G62)*
2 Camshaft adjustment valve 1 (N205)*

=> Repair group 15; Servicing valve gear; checking camshaft adjustment Servicing valve gear checking camshaft adjustment

3 Throttle valve control part (J338)*

- Tighten to 10 Nm
- If replaced adapt engine control unit => Page 131 :
- If replaced adapt control unit for automatic gearbox:

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



4 4 pin connector

- Black for Lambda probe 1 before catalyst (G39) and Lambda probe heater (Z19)

5 3 pin connector

- Grey for engine speed sender (G28)

6 3 pin connector

- Blue for knock sensor 2 (G66)

7 3 pin connector

- Green for knock sensor 1 (G61)

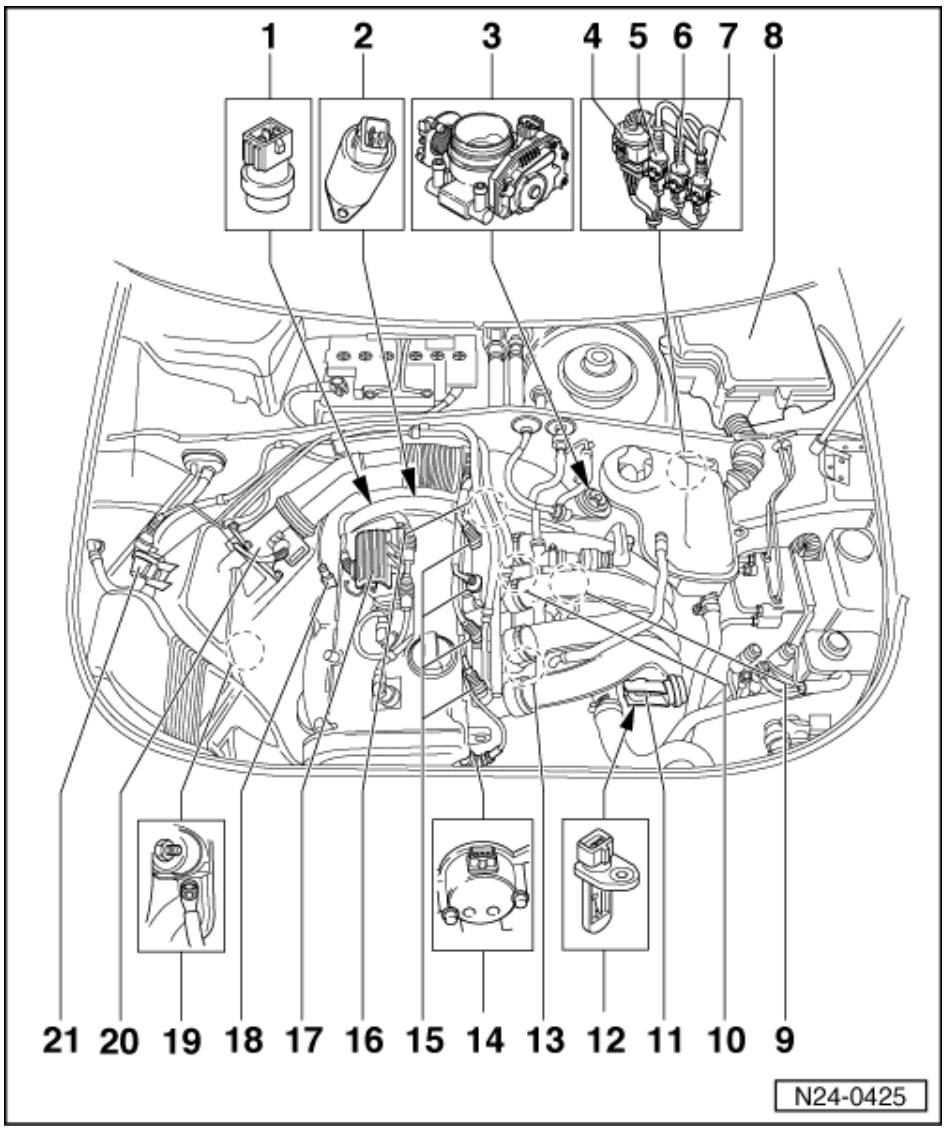
8 Engine control unit*

(Motronic control unit -J220)

- Checking voltage supply => Page 126
- Procedure after voltage supply open circuit => Page 128
- Renew => Page 128

9 Engine speed sender (G28)*

- Inductive sender
- Tighten to 10 Nm



10 Knock sensor 2 (G66)*

- => Page 151 , item 10

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

- Removing and installing parts of intake manifold change-over => Page 77

12 Intake air temperature sender (G42)*

- Tighten to 10 Nm

13 Knock sensor 1 (G61)*

- =>Page 151 , item 9

14 Hall sender (G163)*

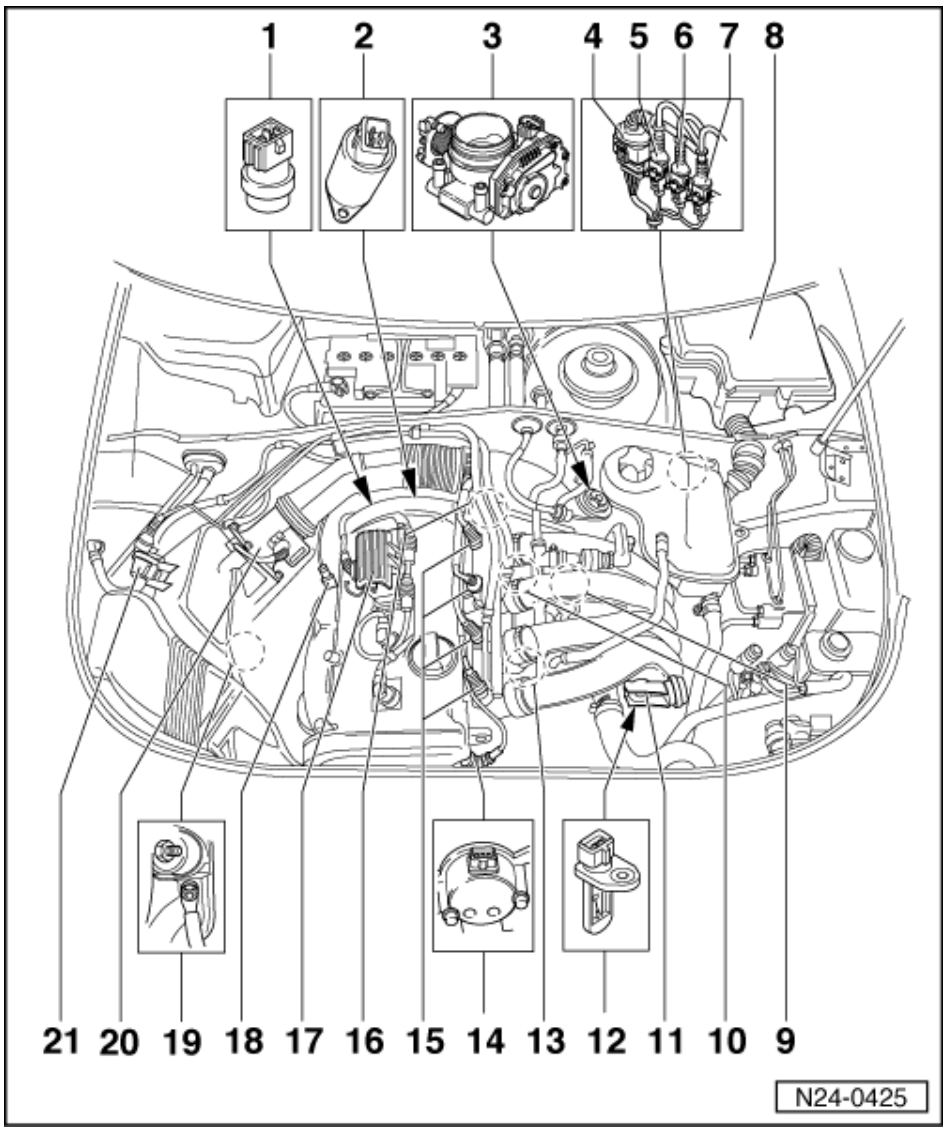
- => Page 148 , item 18

15 Injectors (N30...N33)*

16 Fuel pressure regulator

17 Ignition coils (N, N128)

- With output stage (N122)
- =>Page 150 , item 1



18 Lambda probe 1 before catalyst (G39)*, 50Nm

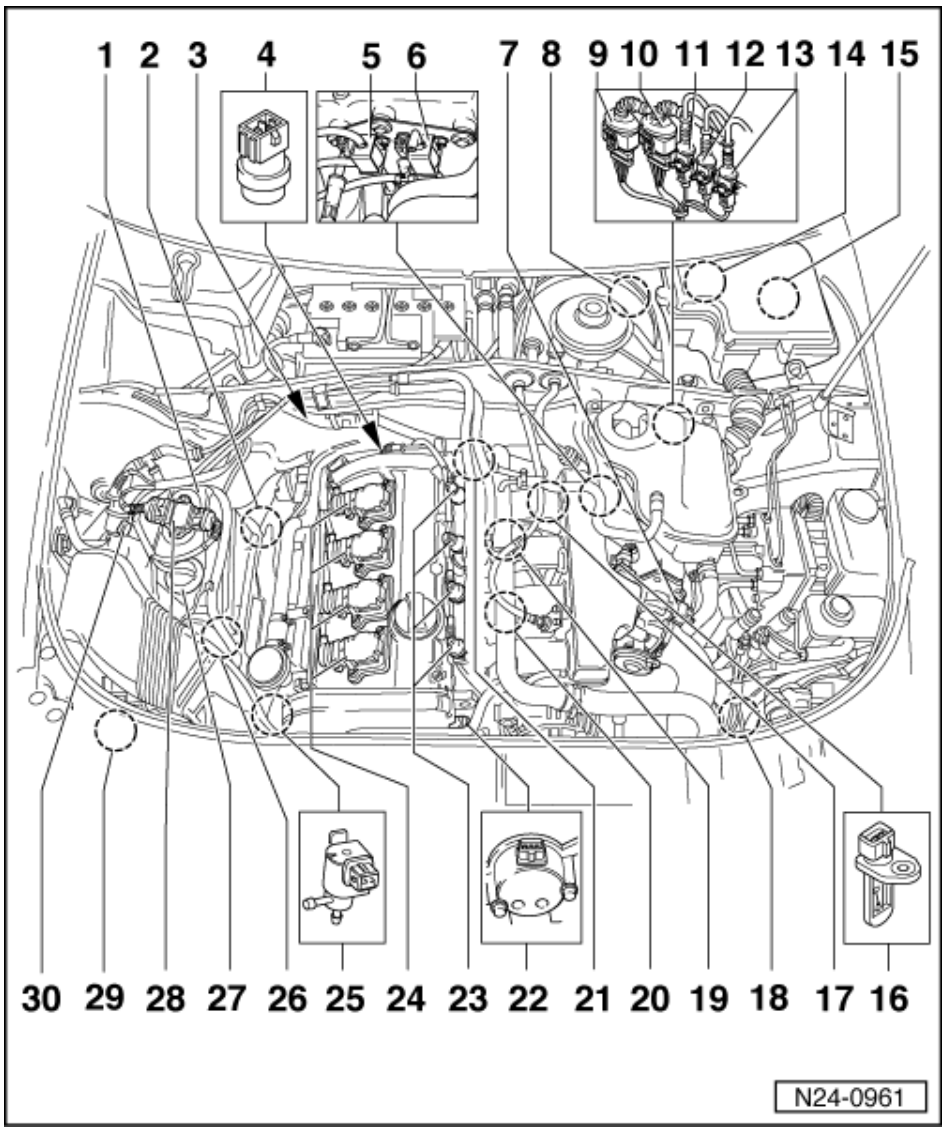
19 Earth connection

- On right engine support

20 Air mass meter (G70)*

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

=> Repair group 20; Activated charcoal filter system Activated charcoal filter system



Engines with turbocharger

1 **Air cleaner**
- Dismantling and assembling => Page 73

2 **Lambda probe 1 before catalyst (G39)*, 50Nm**

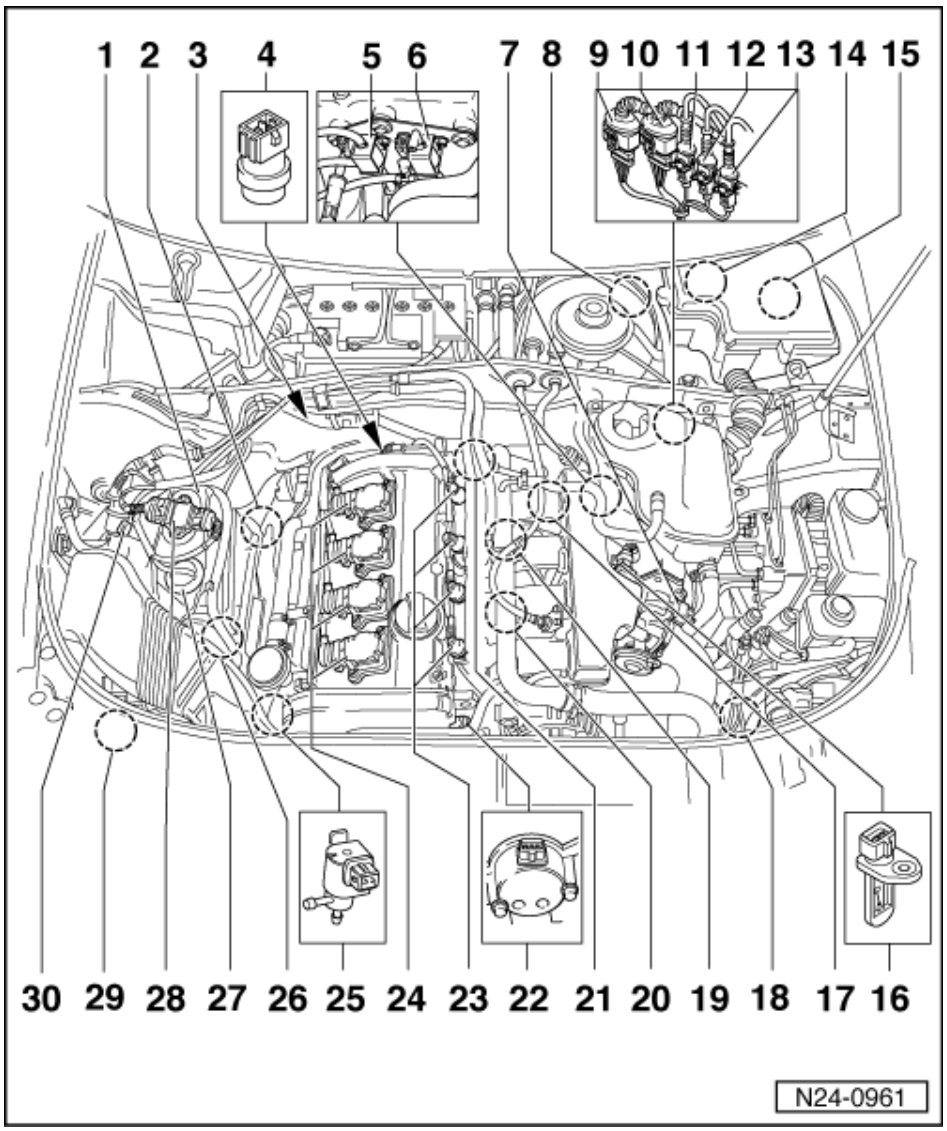
3 **Lambda probe 2 after catalyst (G130)*, 50 Nm**
- Engines fulfilling D4 standard only

4 **Coolant temperature sender (G62)***

5 **Divert air valve (N249)*/****

6 **Secondary air inlet valve (N112)*/****
- Engines fulfilling D4 standard only

=> 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



7 Throttle valve control part (J338)*

- Tighten to 10 Nm
- If replaced adapt engine control unit => Page 131 :

8 Clutch pedal switch (F36)*, Brake light switch (F)*, Brake pedal switch (F47)* and Accelerator position senders (G79 and G185)*

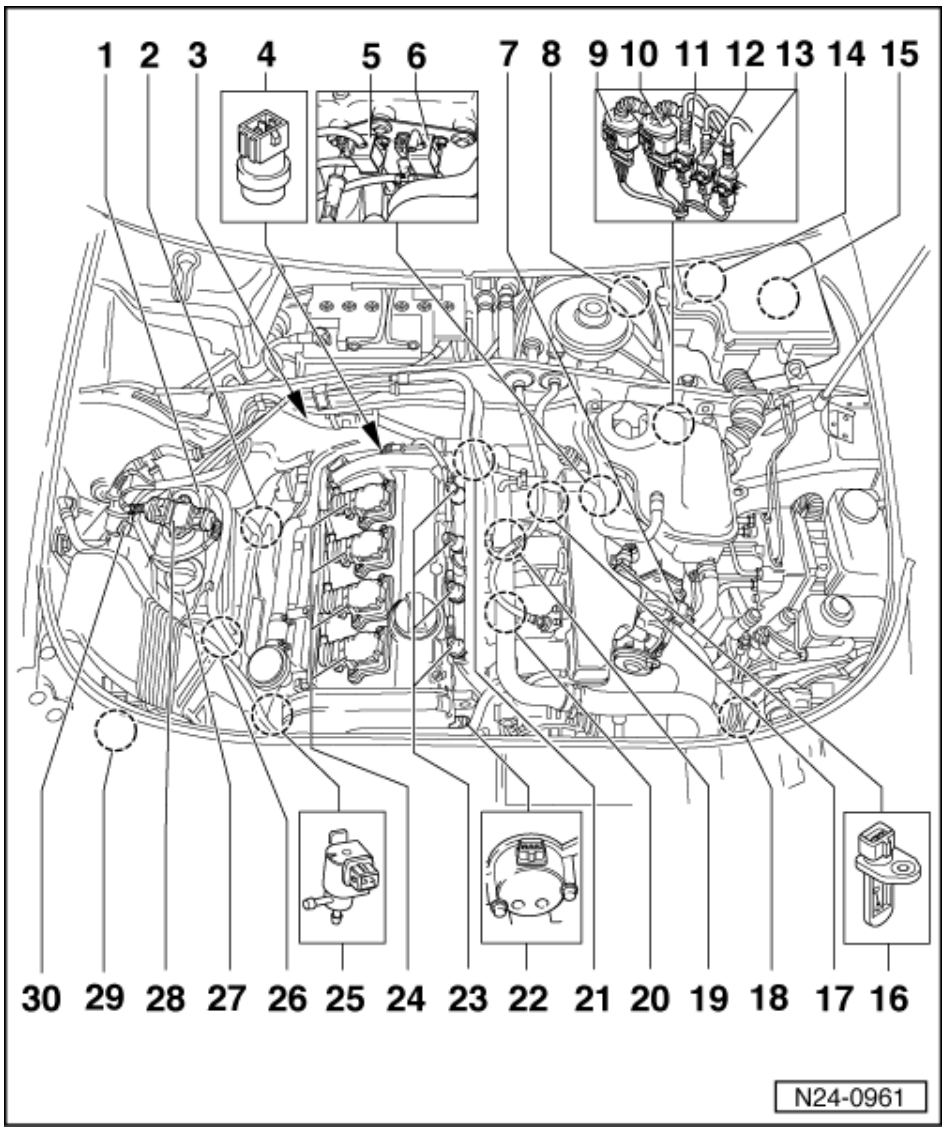
- In driver's footwell

9 4 pin connector

- Black for Lambda probe 1 before catalyst (G39) and Lambda probe heater (Z19)

10 4 pin connector

- Engines fulfilling D4 standard only
- Brown for Lambda probe 2 after catalyst (G130) and Lambda probe heater (Z19)



11 3 pin connector

- Grey for engine speed sender (G28)

12 3 pin connector

- Green for knock sensor 1 (G61)

13 3 pin connector

- Blue for knock sensor 2 (G66)

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

- Engines fulfilling D4 standard only

=> 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

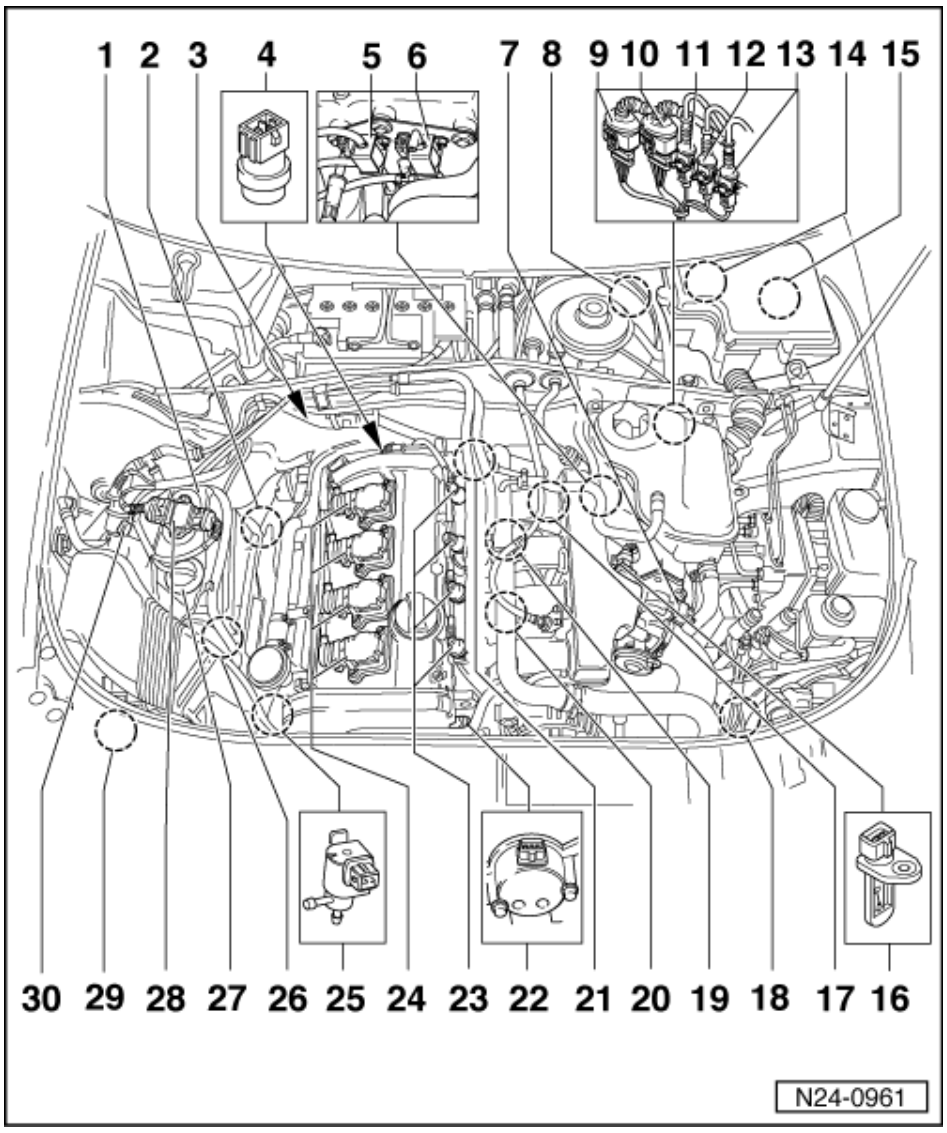
15 Engine control unit*

(Motronic control unit -J220)

- Checking voltage supply => Page 126
- Procedure after voltage supply open circuit => Page 128
- Renew => Page 128

16 Intake air temperature sender (G42)*

- Tighten to 10 Nm



17 Engine speed sender (G28)*
- Inductive sender
- Tighten to 10 Nm

18 Charge pressure sender (G31)*

19 Knock sensor 2 (G66)*
- => Page 151 , item 10

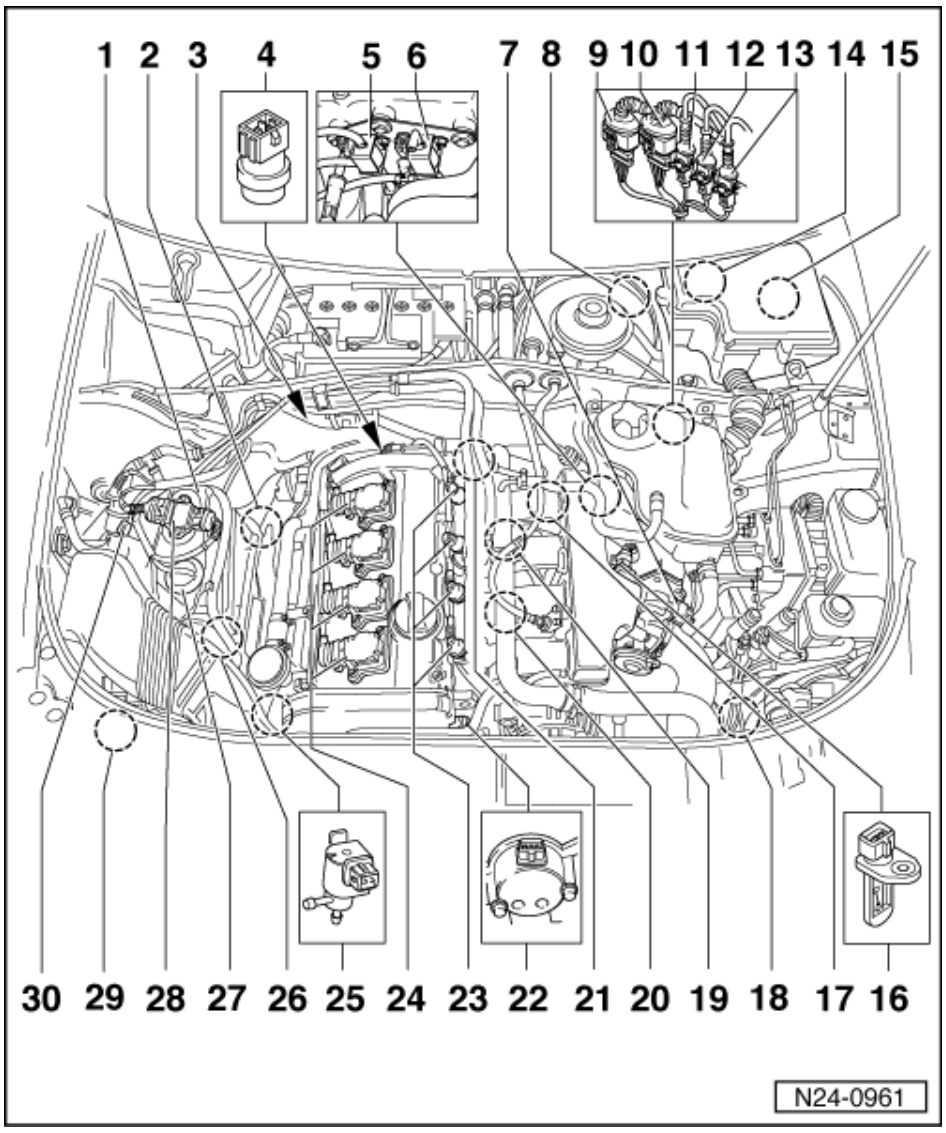
20 Knock sensor 1 (G61)*
- =>Page 151 , item 9

21 Fuel pressure regulator

22 Hall sender (G163)*
- => Page 148 , item 18

23 Injectors (N30...N33)*

24 Ignition coils (N, N128, N158 and N163)
- =>Page 147 , item 9



25 Charge pressure control solenoid valve (N75)*/**

- Charge pressure system:

=> Repair group 21; Checking charge pressure system; Checking charge pressure control solenoid valve Checking charge pressure system Checking charge pressure control solenoid valve

26 Earth connection

- On right engine support

27 Air mass meter (G70)*

28 Output stage (N122)

- =>Page 146 , item 2

29 Secondary air pump motor (V101)*

- Engines fulfilling D4 standard only

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

=> Repair group 20; Activated charcoal filter system Activated charcoal filter system

1.3 - General notes on injection

Servicing ignition part:

=> Repair group 28

- The engine control unit is equipped with self-diagnosis. Before carrying out repairs and fault finding the fault memory must be interrogated. Also the vacuum hoses and connections must 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 and connecting the battery must only be done with the ignition switched off, otherwise the engine control unit could be damaged.
- Components marked with * are checked via the self diagnosis
  => Page 9 , interrogating and erasing fault memory.
- Components marked with **can be checked with the final control diagnosis => Page 22 .
- 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.

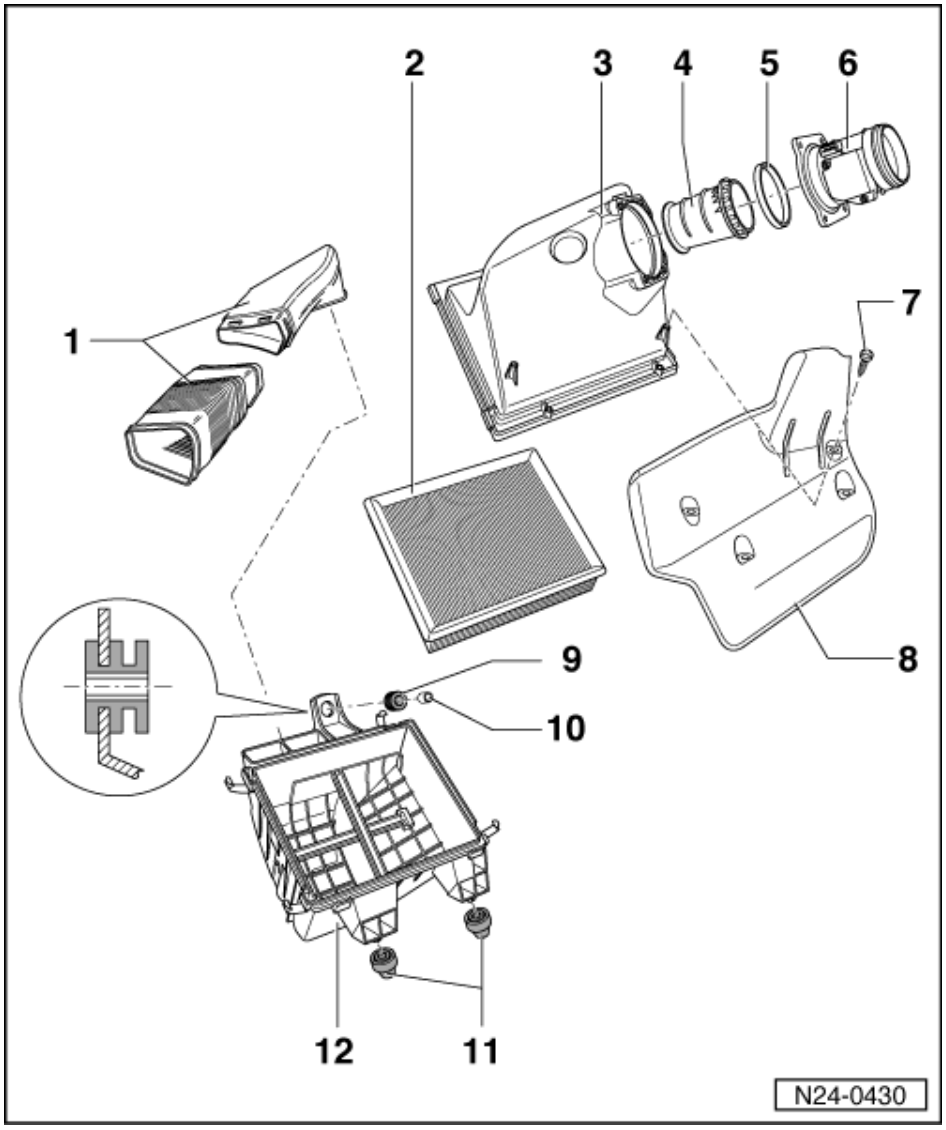
- If the engine starts, runs for a short period and then stops, after fault finding, repairs or component tests, then the fault may lie with the immobilizer which is blocking the engine control unit. The fault memory must be interrogated and if necessary the control unit matched => Page 133 .
- During 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 9 , interrogating and erasing fault memory

Safety precautions =>Page 80

Rules for cleanliness => Page 81

Technical data => Page 81

1.4 - Dismantling and assembling air cleaner

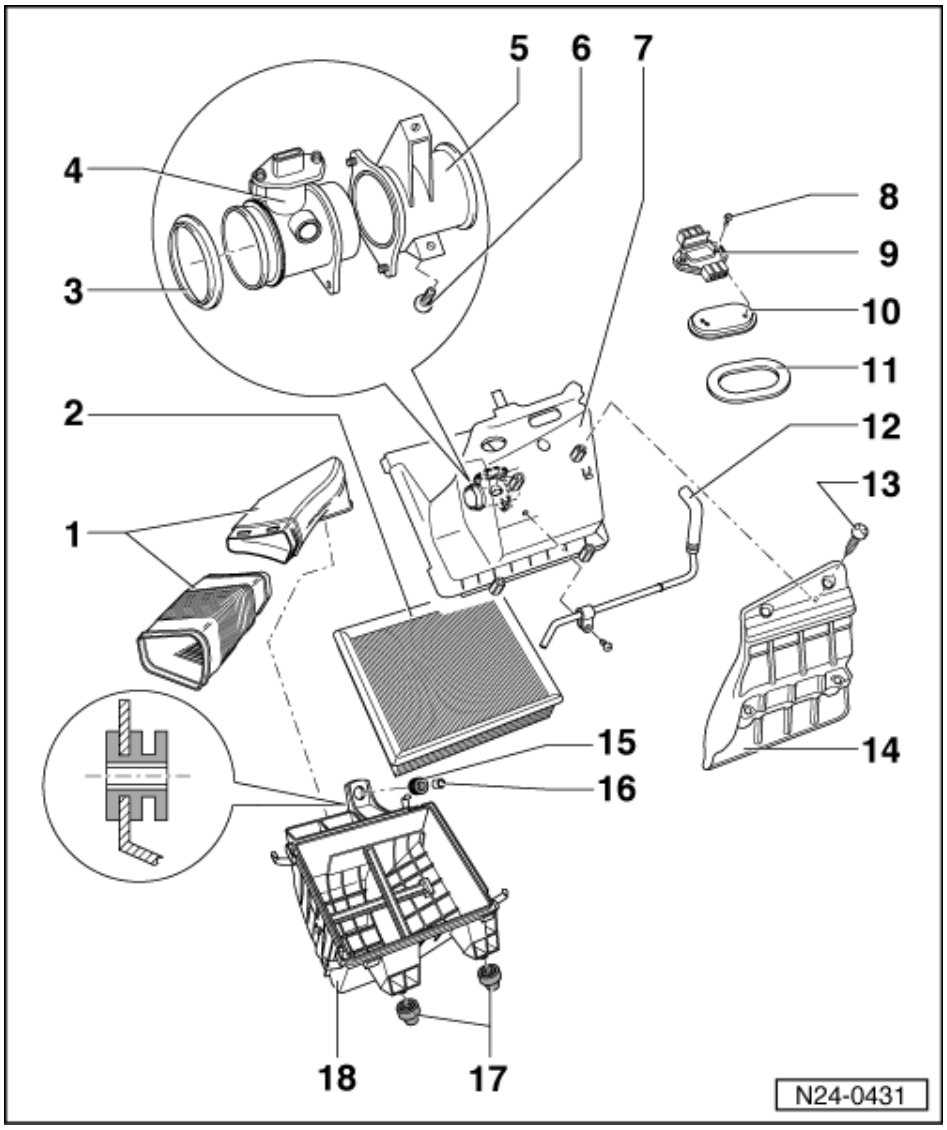


Engines without turbocharger

1 Air ducting
- To lock carrier

2 Filter element
3 Air cleaner upper part
4 Air duct
5 Seal
6 Air mass meter (G70)*
- Checking => Page 87
- Tighten to 10 Nm

7 10 Nm
8 Heat shield
9 Rubber grommet
10 Spacer sleeve
11 Packing
12 Air cleaner lower part



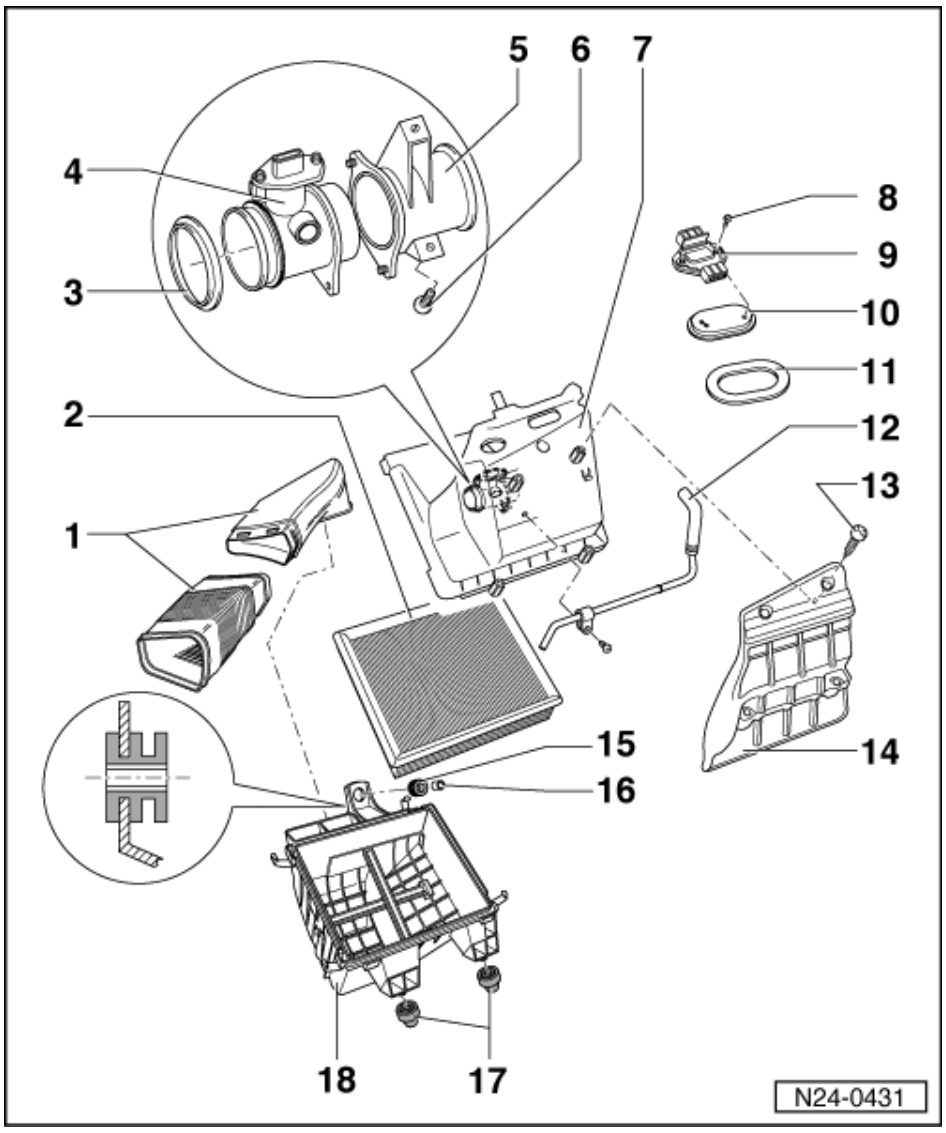
Engines with turbocharger

1 Air ducting
- To lock carrier

2 Filter element
3 Seal
4 Air mass meter (G70)*
- Checking => Page 87

5 Air duct
6 6 Nm
7 Air cleaner upper part
8 6 Nm
9 Output stage (N122)
- =>Page 146 , item 2
- Coat lower part with heat conductive paste G 052 170 A2

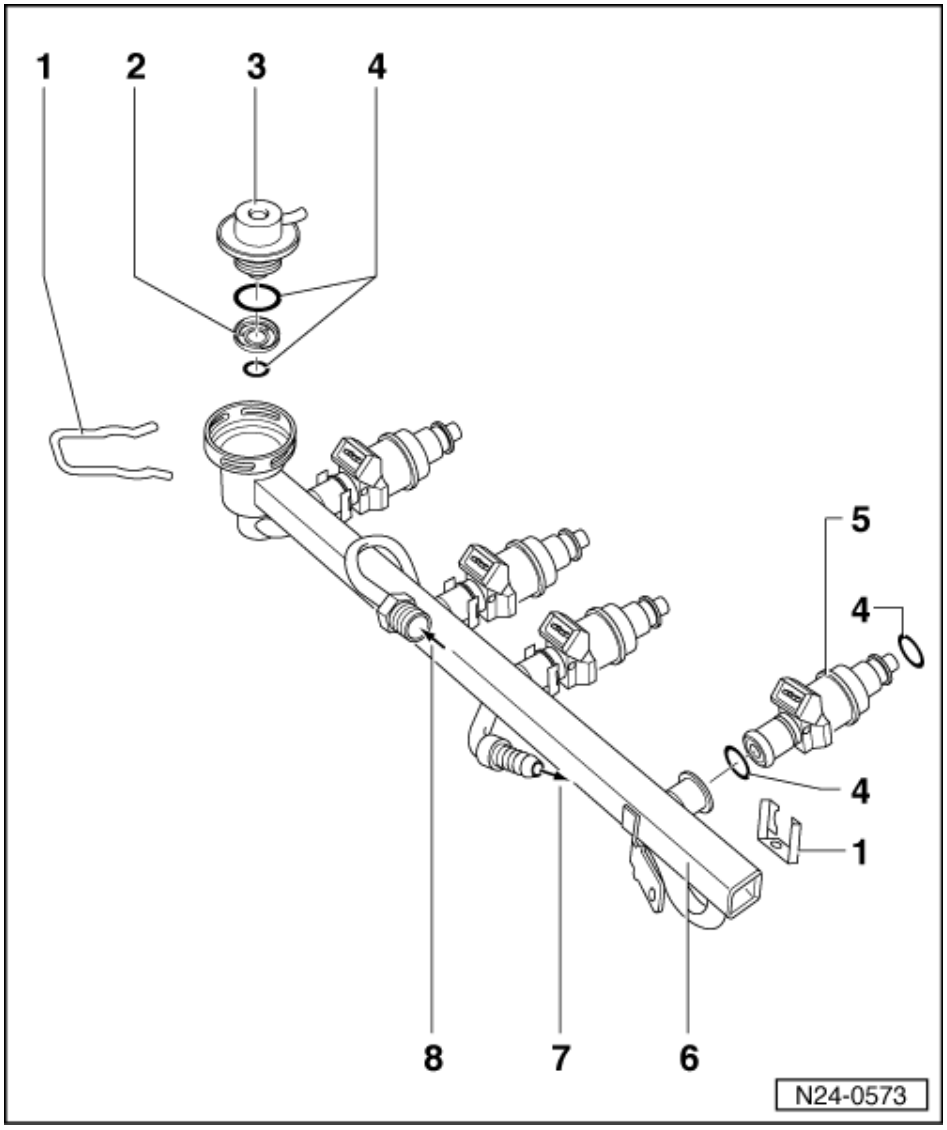
10 Cooling element
11 Rubber grommet



12 Pipe
- For activated charcoal filter system

13 10 Nm
14 Heat shield
15 Rubber grommet
16 Spacer sleeve
17 Packing
18 Air cleaner lower part

1.5 - Dismantling and assembling fuel rail with injectors



1 Retaining clip
- Ensure seated correctly at injector and fuel rail

2 Strainer

3 Fuel pressure regulator
- Checking => Page 107

4 O ring
- Renew if damaged

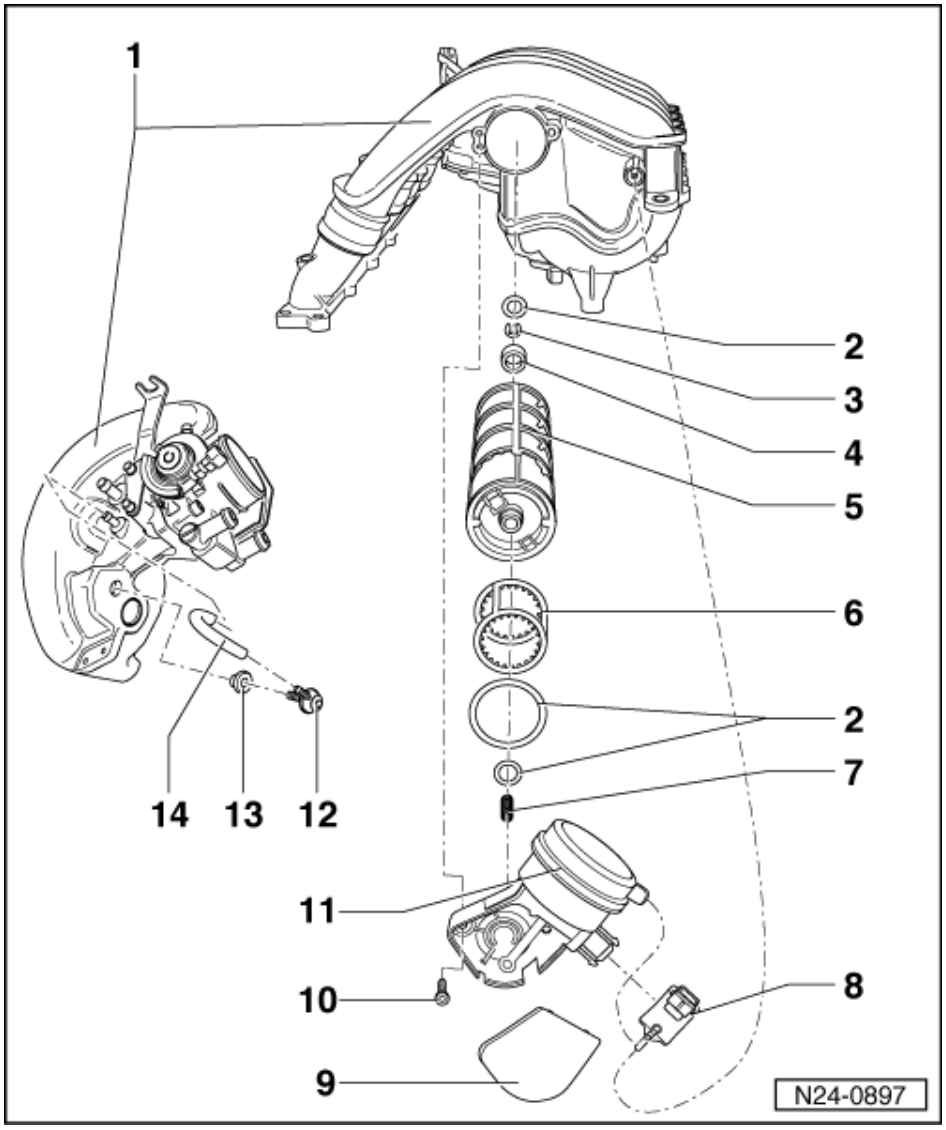
5 Injectors (N30...N33)*
- Checking => Page 101
- Resistance 12...17 ω

6 Fuel rail
- Tighten to 10 Nm

7 Return flow connection

8 Supply connection

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



Engines without turbocharger

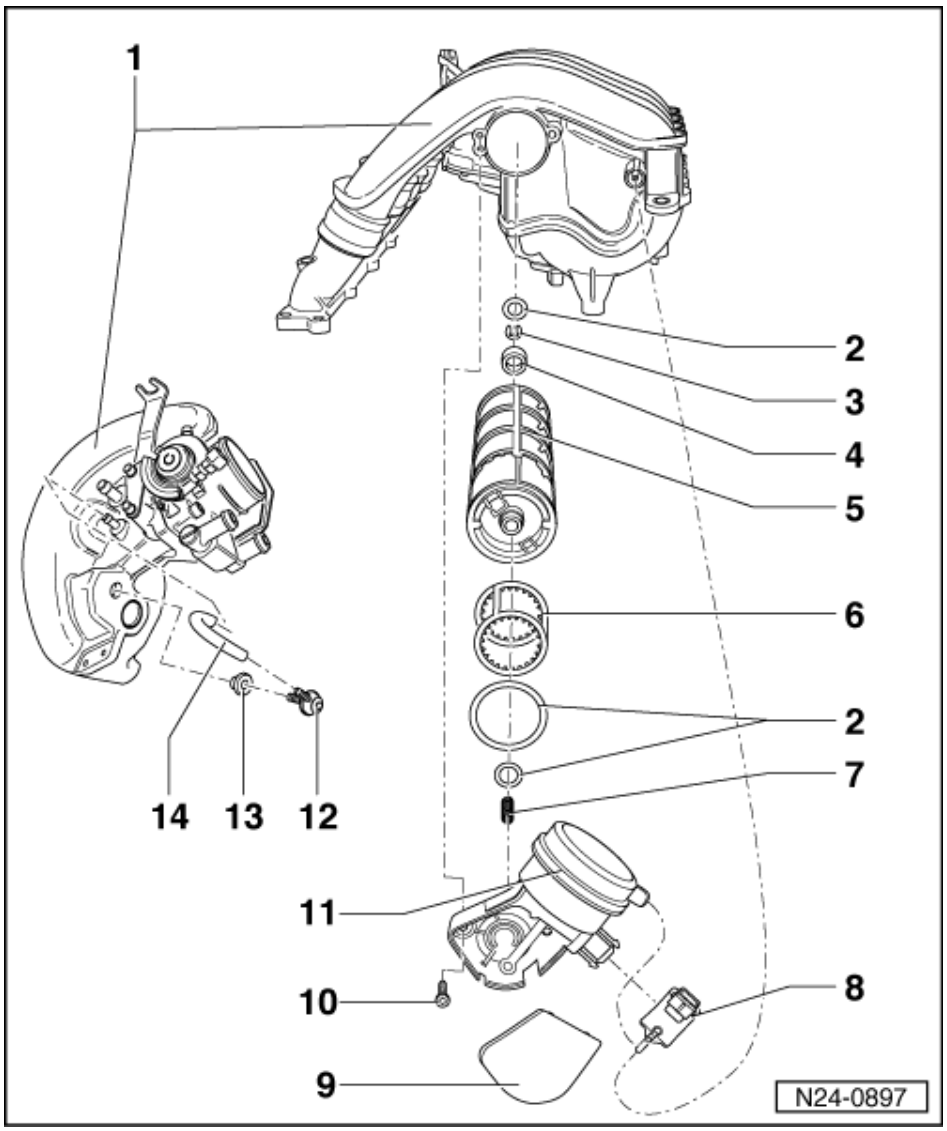
Prerequisite:

- Upper coolant hose removed:

=> Repair group 19; Parts of cooling system Parts of cooling system

1 Intake manifold
2 Seal
- Renew if damaged

3 Circlip
4 Seal mounting



5 Change-over barrel

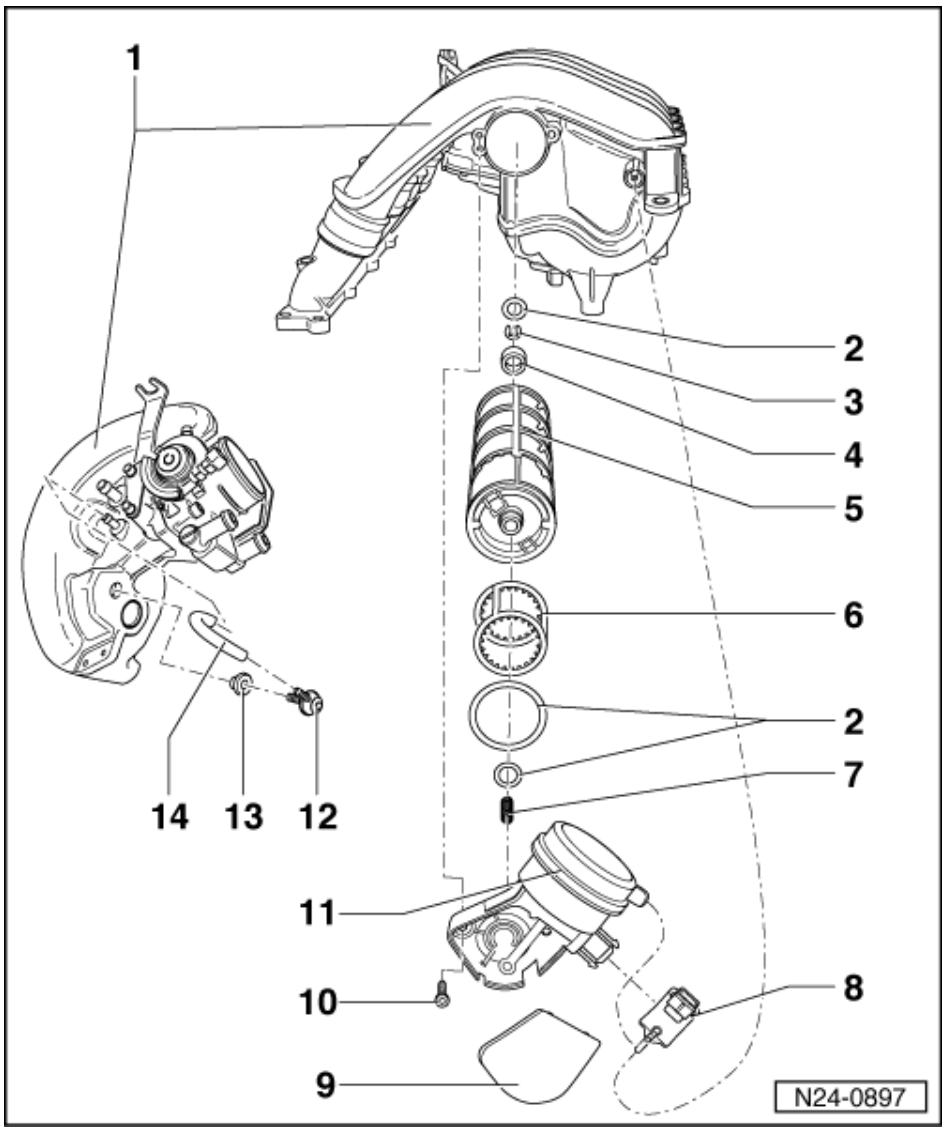
Installation:

- Clip completely assembled change-over barrel onto vacuum actuator (only possible in one position). Then slide actuator into correct position in intake manifold where it is screwed/bolted in position. The change-over barrel must not be turned when doing this (danger of damaging sealing cage).

6 Sealing cage

- Clipped onto change-over barrel
- Renew complete with change-over barrel only

7 Spring



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

- Checking intake manifold change-over valve => Page 125
- Resistance: 25...35 ω
- Clipped onto vacuum actuator

9 Cover

10 10 Nm

11 Vacuum control element

12 Non-return valve

- Installation position: White side faces intake manifold

13 Rubber grommet

14 Vacuum hose

1.7 - Safety precautions

Warning!
The fuel system is pressurized! Before loosening hose connections or opening the test connection, wrap a cloth around the connection. Then release pressure by carefully pulling off the hose or carefully unscrewing sealing plug.

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

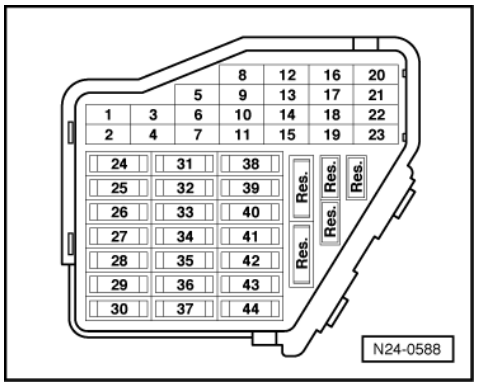
- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.

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 at starter speed, without starting:

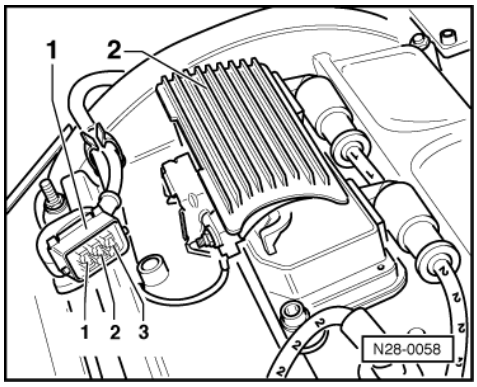


- -> Remove fuse 32

Note:

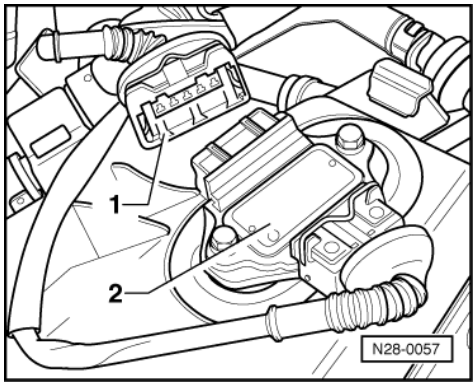
Removing fuse 32 interrupts the voltage supply to the injectors.

Engines without turbocharger:



- -> Pull 3 pin connector -1- off output stage for ignition coils -2-.

Engines with turbocharger:



- -> Pull 5 pin connector -1- off output stage for ignition coils -2-.

1.8 - 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.

1.9 - Technical data

Engine codes		ANB	APT	APU	ARG
Idling check					
Idling speed2)	rpm	750...8501)	800...9201)	750...8501)	800...9201)
Engine control unit 3)					
System designation		Motronic ME7.5	Motronic ME7.1	Motronic ME7.5	Motronic ME7.1
Part number 4)		4B0 906 018 F	8D0 906 018 A	4B0 906 018 B	8D0 906 018 A
Governor	rpm	from about 6800	from about 6800	from about 6800	from about 6800

1) Up-to-date specifications:

=> Exhaust emissions test binder

2) Not adjustable

3) Replacing engine control unit => Page 126

4) For latest part number for engine control unit:

=> Parts microfiche

2 - Checking components

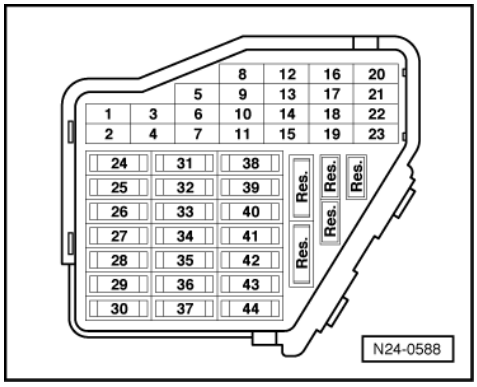
2.1 - Checking components

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 34 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 3 .)

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

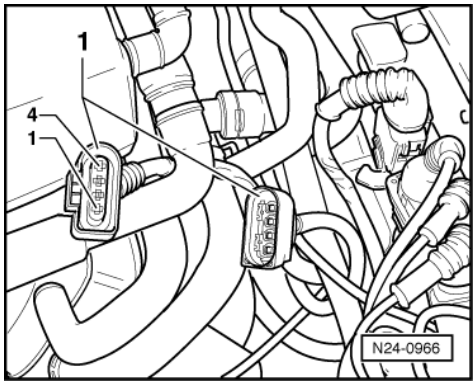
-> Indicated on display:
(1...4 = Display zones)

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

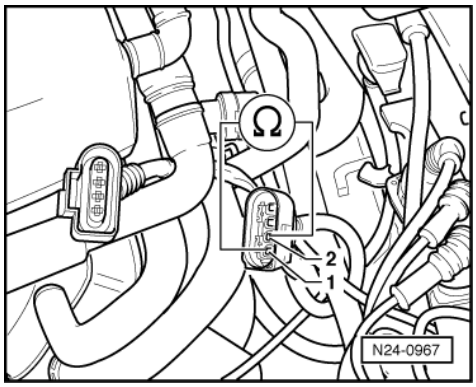
- Check the status of the Lambda probe heating in display zone 2:

Display: Htg.bC.ON

If the specification is not obtained:



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

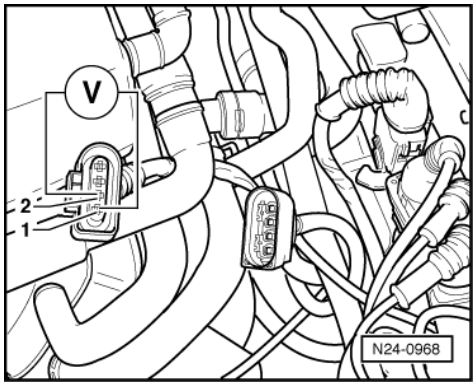


- -> Check probe heating for continuity at Lambda probe connector contacts 1 and 2.

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

- Replace the Lambda probe before catalyst (G39).

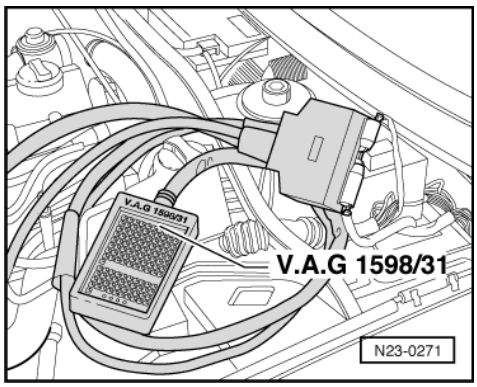
If probe heating has continuity:



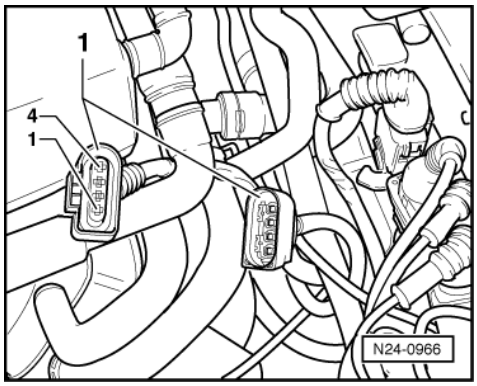
- -> Set multimeter to measure voltage and connect to contacts 1 and 2 on connector to control unit.
- Start engine and run at idling speed.
- Measure the voltage supply:
  When display group 41, display zone 2 displays
  Display, Htg.bC.ON:
  Specification: 11.0...14.5 V
  Display, Htg. bC.ON/Htg.bC.OFF (alternating)
  Specification: Between 0.0...12.0 V fluctuating

- 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 4-pin connector for open circuit according to current flow diagram.
  Contact 2+socket 5
  Wire resistance: Max. 1.5 ω

If the specification is obtained:

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

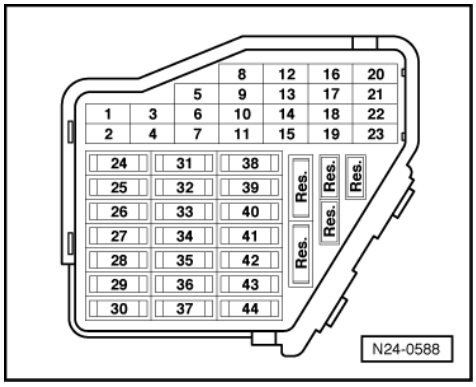
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

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 34 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 3 .)

-> 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
```

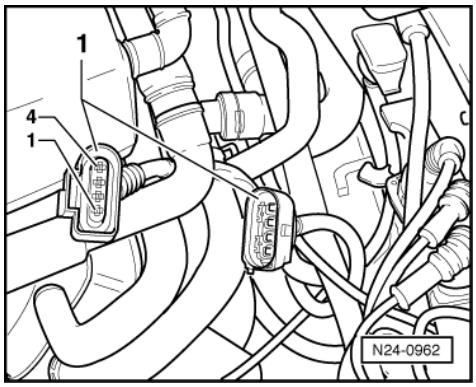
- Press keys 0, 4 and 1 for "Display group number 41" and confirm entry with Q key.

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

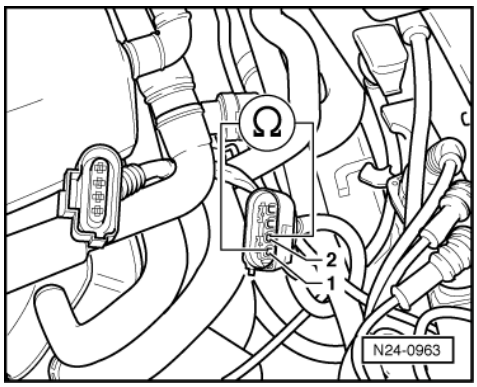
```
Read measured value block 41
     1     2     3     4
```

- Check Lambda probe heater status in display zone 4:
  Display: Htg.aC.ON, Htg.aC.OFF (alternating)

If the specifications are not attained:



- -> Separate 4-pin connector (brown) to Lambda probe after catalyst (G130) -1-.

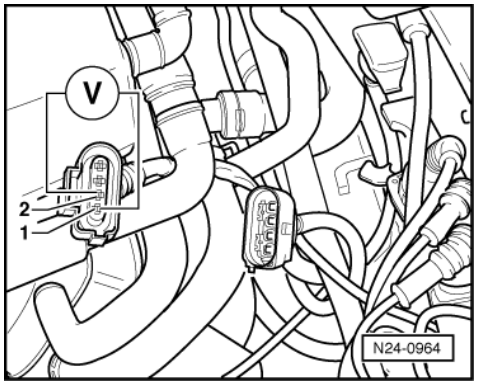


- -> Check probe heating for continuity at Lambda probe connector contacts 1 and 2.

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

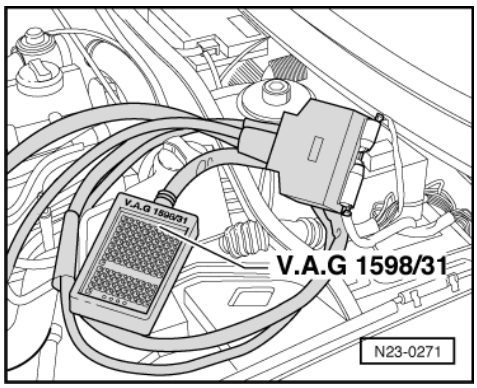
- Renew the Lambda probe after catalyst (G130).

If probe heating has continuity:

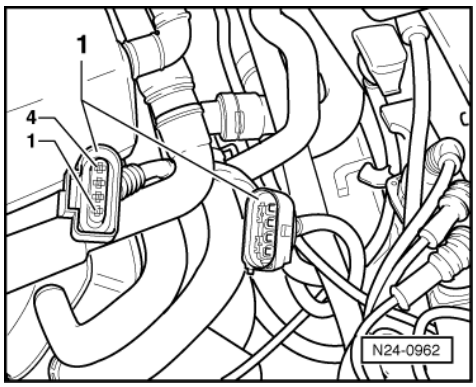


- -> Set multimeter to measure voltage and connect to contacts 1 and 2 on connector to control unit.
- Start engine and run at idling speed.
- Measure the voltage supply:
  When display group 41, display zone 4 displays
  Display, Htg.aC.ON:
  Specification: 11.0...14.5 V
  Display, Htg. aC.ON/Htg.aC.OFF (alternating)
  Specification: Between 0.0...12.0 V fluctuating
- 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 4-pin connector for open circuit using current flow diagram.
  Contact 2 and socket 63
  Wire resistance: Max. 1.5 ω

If the specification is obtained:

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

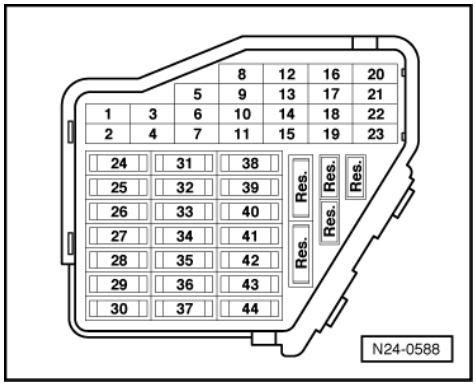
=> Current flow diagrams, Electrical fault finding and Fitting locations binder

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 34 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.
- On vehicles with automatic gearbox selector lever in "P" or "N" position

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 3 .)

-> 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, 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 air mass drawn in in display zone 4
  Specification: 2.0...4.5 g/s

If the specification is obtained but there is a fault regarding air mass meter registered in the fault memory:

- Check the voltage supply for the air mass meter => Page 88 .

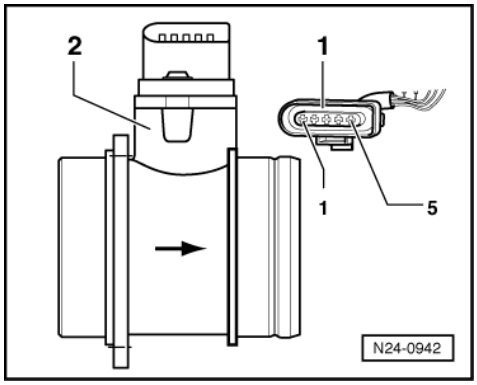
If the specification is not obtained:

- Check the signal and earth wires for the air mass meter => Page 89 .

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 5 pin connector -1- off air mass meter -2-.
- Connect multimeter to measure voltage on connector contact 2 and engine earth.
- Start engine and run at idling speed.

  Specification: 11...15 V

If no voltage is present:

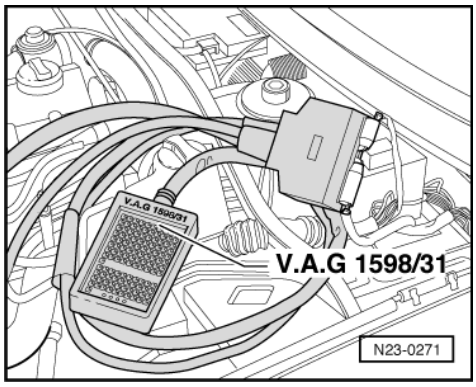
- Switch off ignition.
- Check wiring from contact 2 to fuel pump relay (J17) according to current flow diagram.

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

If the voltage supply and wiring is OK:

- Switch ignition on.

- Connect multimeter to measure voltage on connector contact 4 and engine earth:
  Specification: 4.5...5.5 V

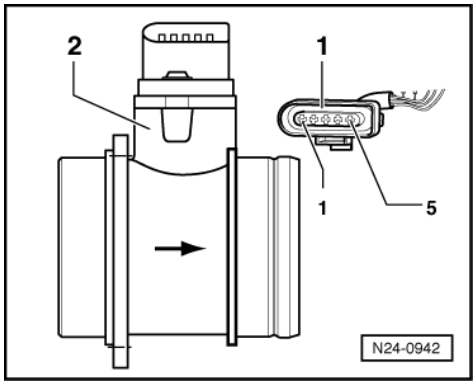


If no voltage is present:

- Switch off ignition.
- Check the signal and earth wires => Page 89 .

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 for open circuit between test box and 5-pin connector using current flow diagram.
  Contact 5+socket 29
  Contact 4+socket 53
  Contact 3+socket 27
  Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.
- Additionally check the wiring for short to battery positive or earth.

If no wiring fault is detected:

- Renew air mass meter (G70).

2.5 - 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 131 .

On vehicles fitted with a 4-speed 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

Test conditions

- Throttle valve not damaged or dirty.
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.
- Ignition on, engine not running

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 3 .)

-> 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, 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 at idling stop from sender 1 (G187) in display zone 1
  Specification: 3...93 %
- Check throttle valve at idling stop from sender 2 (G188) in display zone 2.
  Specification: 97...3 %
- Depress accelerator slowly to full throttle position and observe angles displayed in display zones 1 and 2:

  The percentage figure 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.

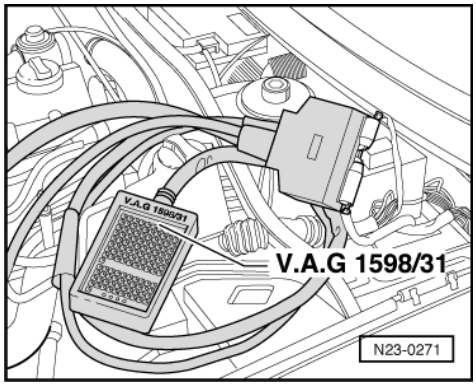
Notes:

- 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.

- 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 "End data transfer" function and confirm input with the Q key.
- Switch off ignition.



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Measure resistance between throttle valve drive and contacts 117 and 118
  Specification: 1...5 ω

If the specification is not obtained:

- Replace throttle valve control part (J338).

If the specification is obtained:

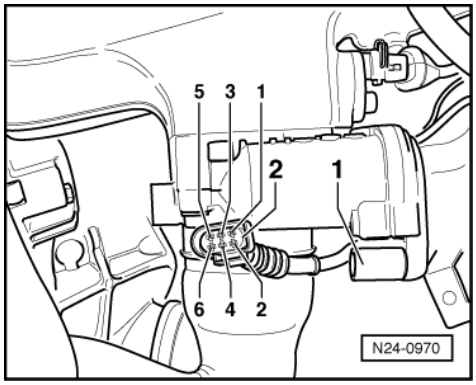
- Check voltage supply of throttle valve control part and wiring to control unit => Page 91 .
- Check the accelerator pedal position sender.

=> 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:

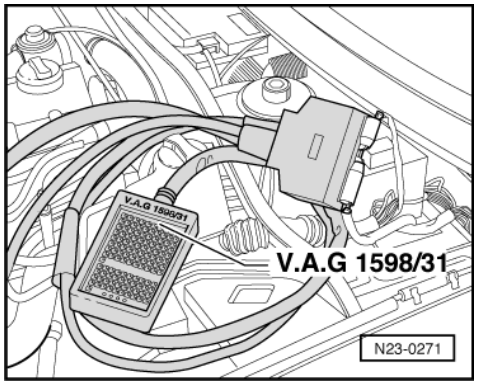
- Renew engine control unit => Page 128 .

Checking voltage supply and wiring to control unit



- -> Pull the 6-pin connector -2- off the throttle valve control part -1-.
- Connect the multimeter to measure voltage to contacts 2 + 6 of the connector.
- Switch on ignition.
  Specification: min. 4.5 V

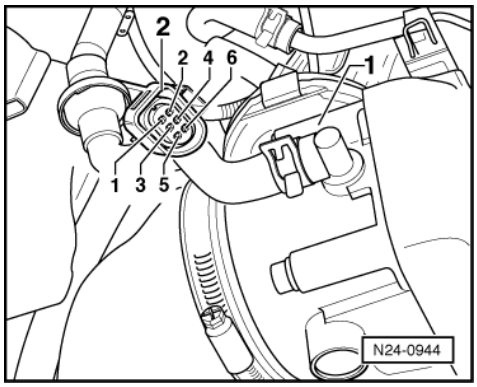
- Switch off ignition.
- Connect the multimeter to measure voltage to contact 2 of the connector and earth.



- Switch on ignition.
  Specification: min. 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 text box and connectors for open circuit using current flow diagram:
  Contact 1 and socket 92
  Contact 2 and socket 83
  Contact 3 and socket 117
  Contact 4 and socket 84
  Contact 5 and socket 118
  Contact 6 and socket 91
  Wire resistance: max. 1.5 ω
- Additionally check wires for short to one another.
- Additionally check the wiring for short to battery positive or earth.

If no fault is detected in the pipes:

- Check engine control unit voltage supply => Page 126 .

2.6 - 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 3 .)

-> 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 XX
```

- 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 the specification is not obtained:

- Perform check according to following table:

Display1)	Cause	Continuation of check
Approx. -48 °C	Open circuit or short to positive	=> Page 94
Approx. 143 °C	Short to earth	=> Page 94

1) If a temperature is displayed which deviates greatly from the ambient temperature of the sender, check sender wiring for transfer resistances.

If the specification is obtained:

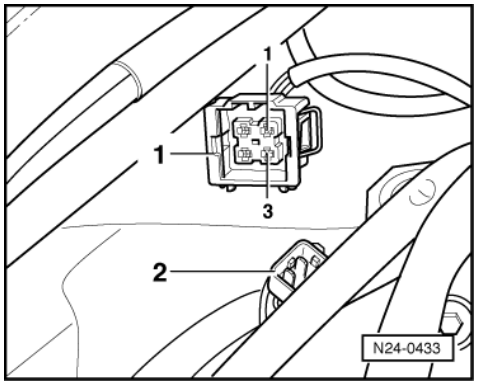
- Start engine and run at idling speed.
  The temperature value must
  increase uniformly

Notes:

- Temperature increases in steps of 1.0 °C.
- If irregular engine running occurs in certain temperature ranges and the temperature figure does not increase without interruption, the temperature signal is temporarily interrupted and the sender must be renewed.

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

Continuation of check when display approx. -48 °C:



- -> Pull 4 pin connector -1- off coolant temperature sender (G62) -2-.
- Bridge connector contacts 1+3 using aux. cables from V.A.G 1594 and observe display.

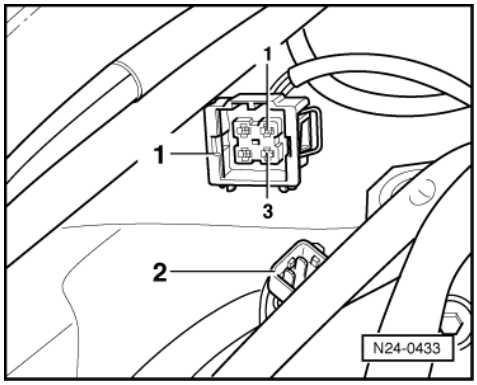
If display jumps to approx. 143 °C:

- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.
- Renew coolant temperature sender (G62).

If display remains at approx. -48 °C:

- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.
- Check wiring using current flow diagram
  => Page 95

Continuation of check when display approx. 143 °C:



- -> Pull 4 pin connector -1- off coolant temperature sender (G62) -2-.

If display jumps to approx. -48 °C:

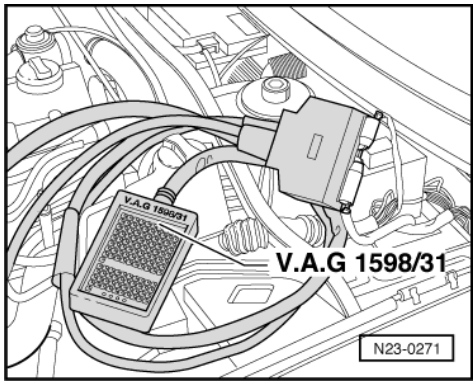
- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.
- Renew coolant temperature sender (G62).

If display remains at approx. 143 °C:

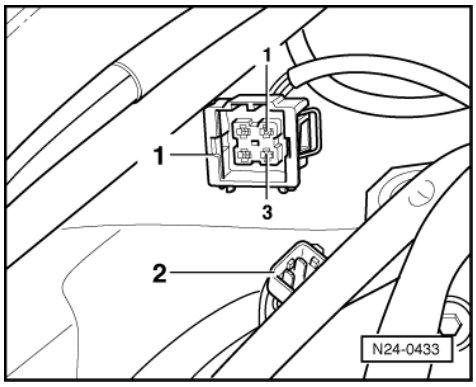
- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.
- Check wiring using current flow diagram

=> Page 95

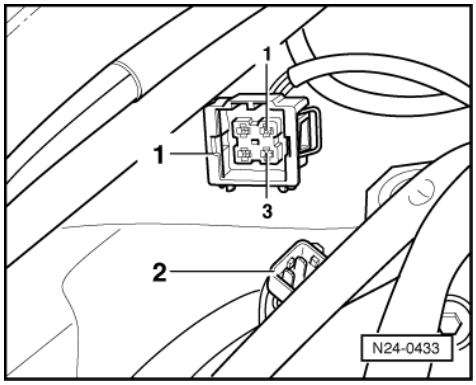
Checking wiring



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

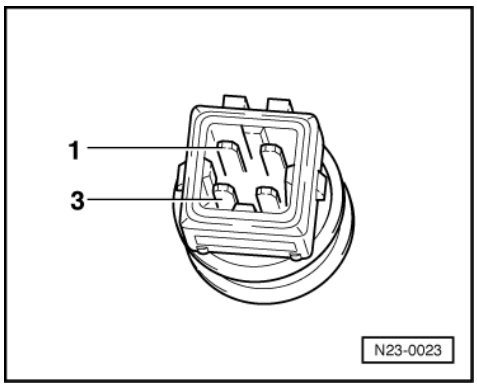


- -> Pull 4 pin connector -1- off coolant temperature sender (G62) -2-.
- Check wiring between test box and 4-pin connector for open circuit using current flow diagram.
  Contact 1 and socket 93
  Contact 3 and socket 108
  Wire resistance: max. 1.5 ω

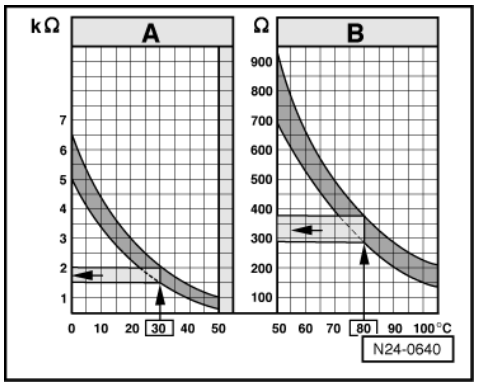


- Check wire for short circuit between test box and 4-pin connector contact 1 to wire contact 3 and to vehicle earth using current flow diagram.
  Contact 3+socket 108
  Contact 3+vehicle earth
  Specification: ∞ω
- Additionally check both wires for short to battery positive.

If no fault in wire is detected:



- -> Perform resistance measurement on coolant temperature sender (G62) contact 1 (earth) and 3 (signal).



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

- Renew engine control unit => Page 128 .

2.7 - 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 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 3 .)

-> 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, 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 intake air temperature value in display zone 4.
  Specification: approx. ambient temperature

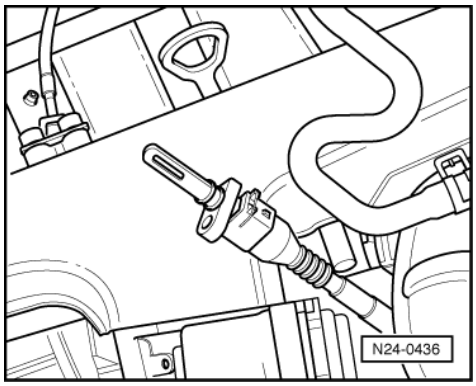
If the specification is not obtained:

- Perform check according to following table:

Display	Cause	Continuation of check
approx. -48 °C	Open circuit or short to positive	=> Page 98
approx. 143 °C	Short to earth	=> Page 98

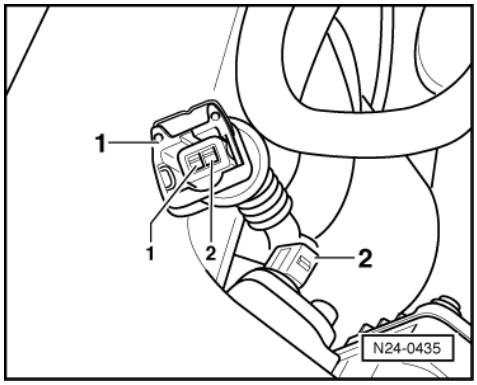
1) If a temperature is displayed which is below the ambient air temperature of the sender, check sender wiring for transfer resistances. Note when doing this that sender is heated from external sources, e.g. radiated heat when engine is not running.

If the specification is obtained:



- -> Remove the intake air temperature sender. Attach connector again.
- Note intake air temperature value in display zone 4.
- Spray sender 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 check when display reads approx. -48 °C:



- -> Pull connector -1- off intake air temperature sender (G42) -2-.

- Bridge connector contacts using aux. cables from V.A.G 1594 and observe display.

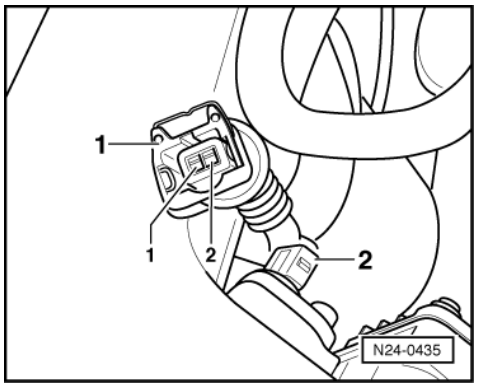
If display jumps to approx. 143 °C:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- Renew intake air temperature sender (G42).

If display remains at approx. -48 °C:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- Check wiring using Current flow diagram
  => Page 99

Continuation of check when display reads approx. 143 °C:



- -> Pull connector -1- off intake air temperature sender (G42) -2-.

If display jumps to approx. -48 °C:

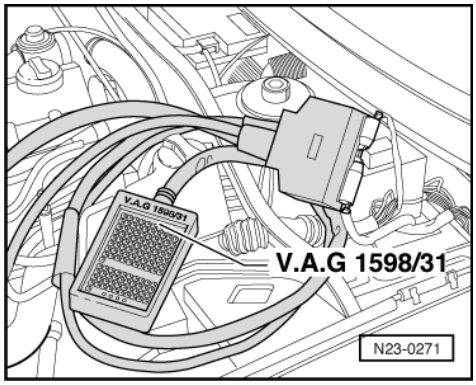
- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- Renew intake air temperature sender (G42).

If display remains at approx. 143 °C:

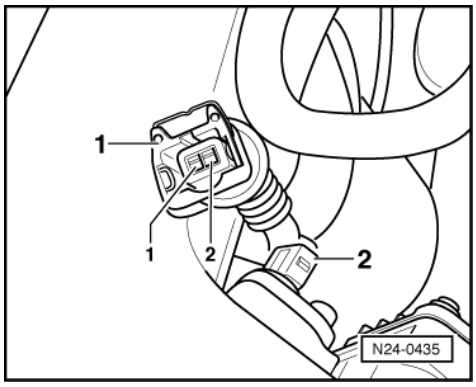
- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- Check wiring using Current flow diagram

=> Page 99

Checking wiring

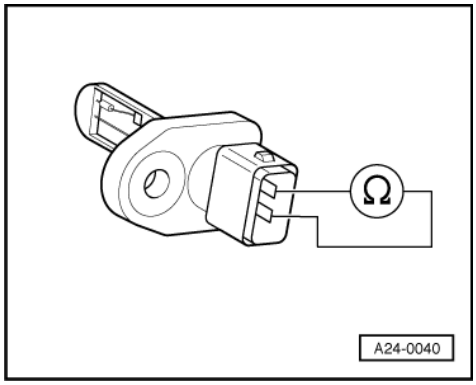


- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.

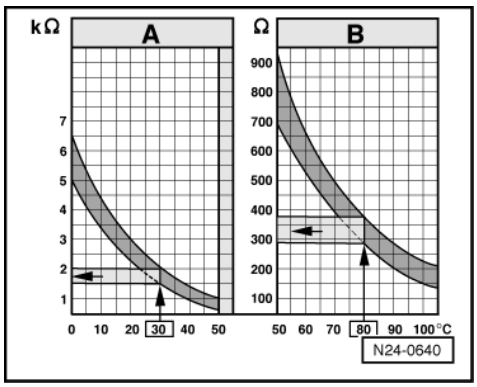


- -> Pull connector -1- off intake air temperature sender (G42) -2-.
- Check the wiring between test box and 2-pin connector -1- for open circuit using current flow diagram.
  Contact 1+socket 85
  Contact 2+socket 108
  Wire resistance: max. 1.5 ω
- Additionally check both wires for short to battery positive.

If no fault in wire is detected:



- -> Perform resistance measurement at intake air temperature sender (G42) contacts 1 (signal) and 2 (earth)



-> 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 intake air temperature sender (G42).

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

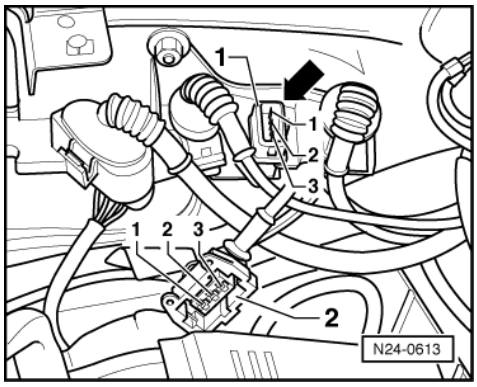
- Renew engine control unit => Page 128 .

2.8 - Checking engine speed sender

The engine speed sender (G28) is a speed and reference mark sender. The engine will not start if there is no speed signal. If the speed signal fails when the engine is running, it will cause the engine to stall immediately.

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

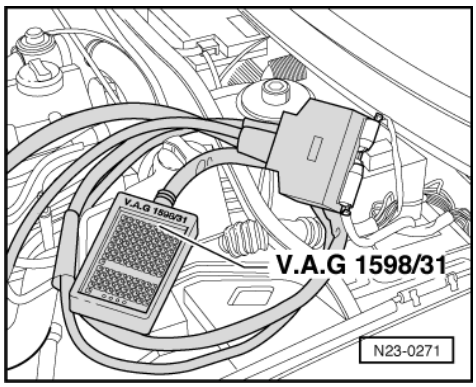
- -> Detach grey 3 pin connector to engine speed sender -arrow-.
- Measure sender resistance between contacts1+2 of connector -1-.

Specification: 400...1000 ω
- Check the sender for short between contacts 1+3 also 2+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 3 and socket 108
  Contact 2 and socket 90
  Contact 1 and socket 82
  Wire resistance: max. 1.5 ω
- Additionally check wires for short to one another.

If no fault is detected in the pipes:

- Remove sender and check sender wheel for secure fit, damage and run-out.

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 128 .

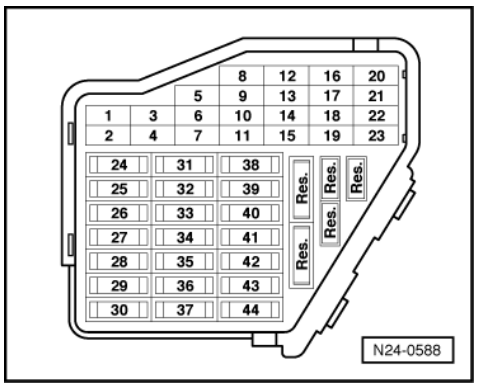
2.9 - Checking injectors

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
- Adapter set V.A.G 1594
- Current flow diagram

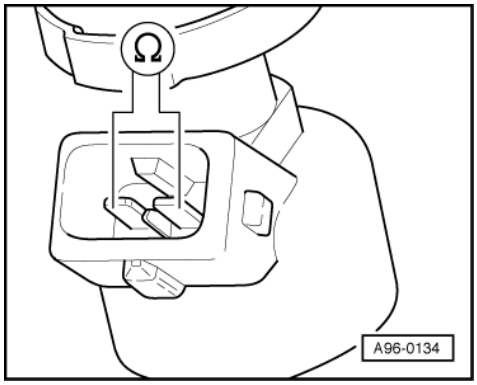
Check conditions

- Engine speed sender must be OK, checking =>Page 100 .



- Fuel pump relay must be OK
- -> Fuses 28 and 32 must be OK.

Checking resistance of injectors



- -> Check resistance of injectors between contacts.
  Specification: 12...17 ω

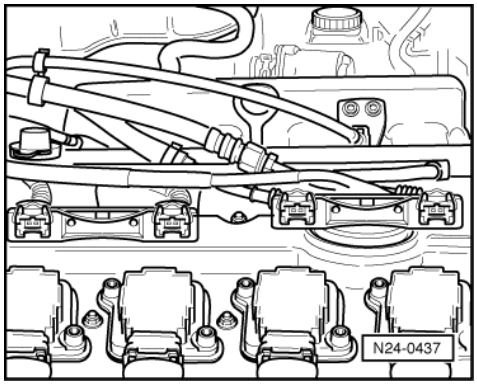
Note:

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

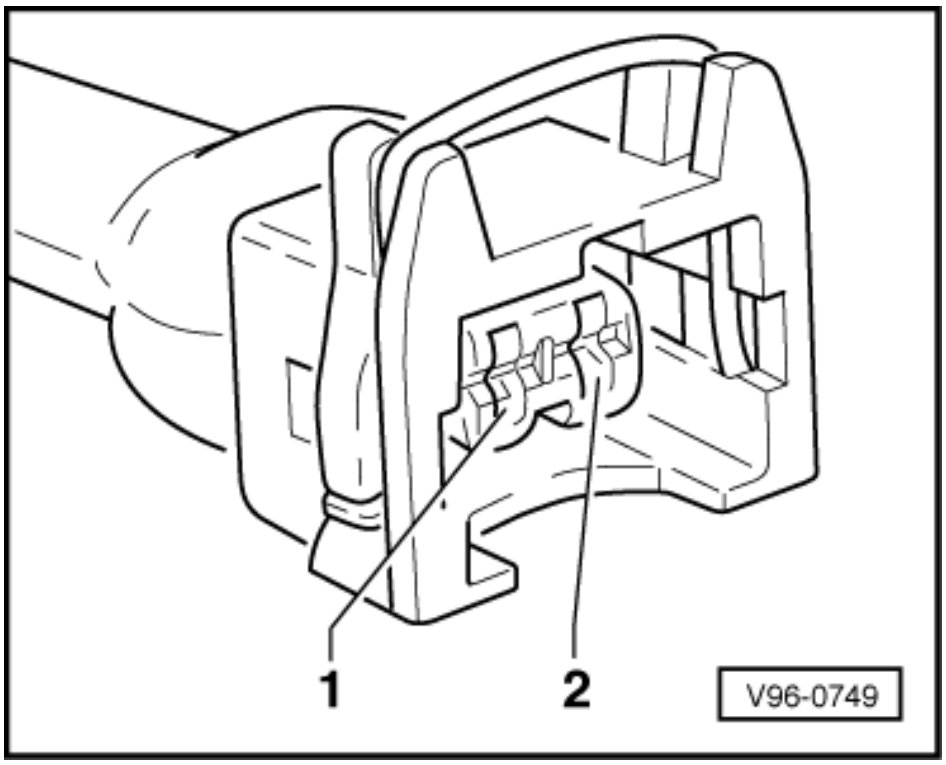
If the specification is not attained:

- Renew defective injector

Checking voltage supply



- -> Pull connectors off injectors.

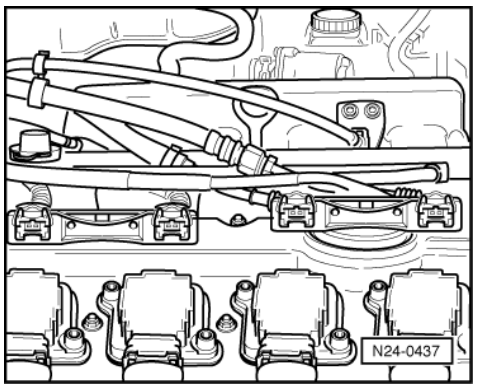


- -> Connect diode test lamp to contact 1 and earth of relevant injector connector.
- Operate the starter and check the voltage supply for the injector.
  The LED must light up

If the LED does not light up:

- Switch off ignition.
- Check 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

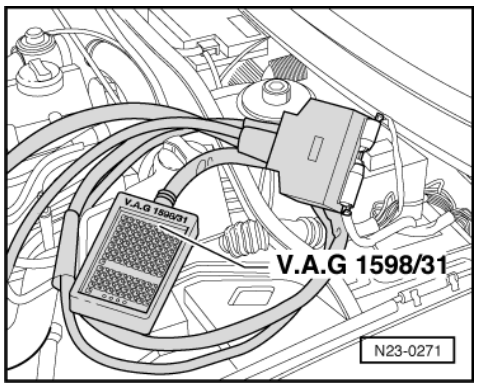
Checking activation and voltage supply



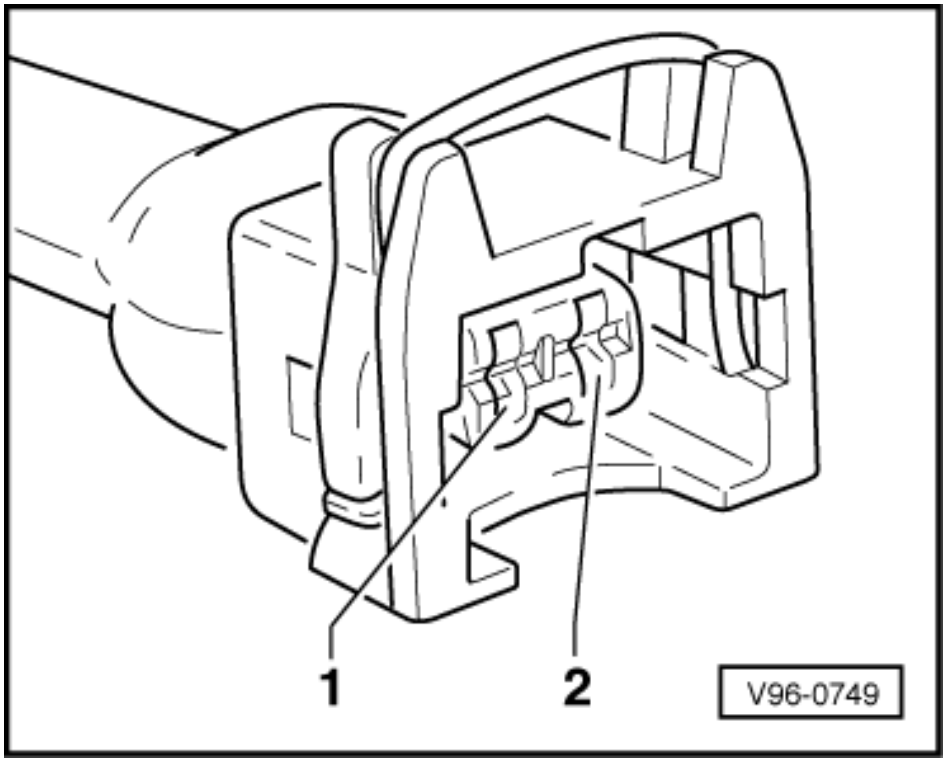
- -> Pull connectors off injectors.
- Connect the diode test lamp V.A.G 1527 to the connector contacts of the injector to be tested using adapter cables from V.A.G 1594.
- Operate starter and check the activation for the injector.
  The LED must flicker

If the LED does not flicker:

- Switch off ignition.



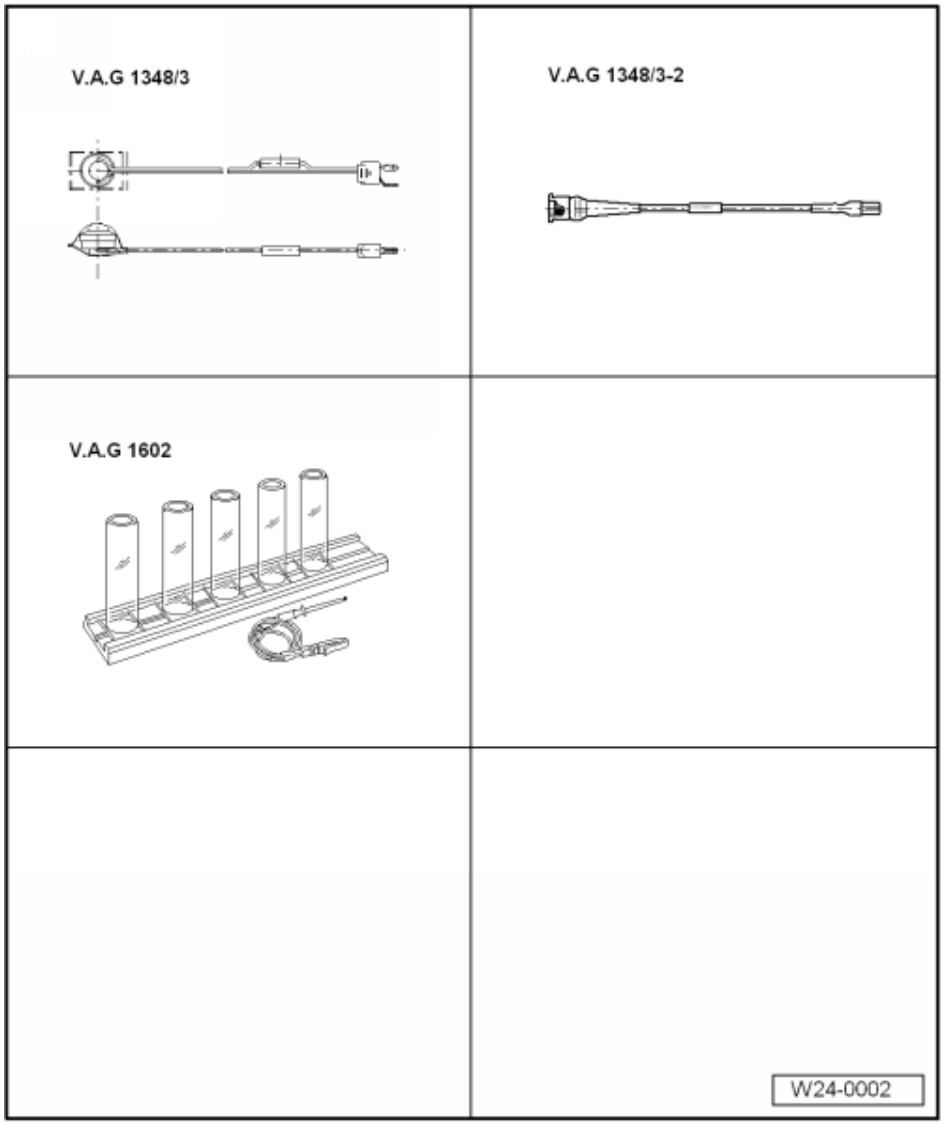
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check the wiring between the test box and connector for open circuit, short circuit to earth or positive using current flow diagram:
  Injector 1: contact 2+socket 96
  Injector 2: contact 2+socket 89
  Injector 3: contact 2+socket 97
  Injector 4: contact 2+socket 88
  Wire resistance: max. 1.5 ω

If no fault can be found in the wiring:

- Renew engine control unit => Page 128 .



Check injectors for leaks and quantity injected

Special tools, workshop equipment, test and measuring appliances and aux. items required

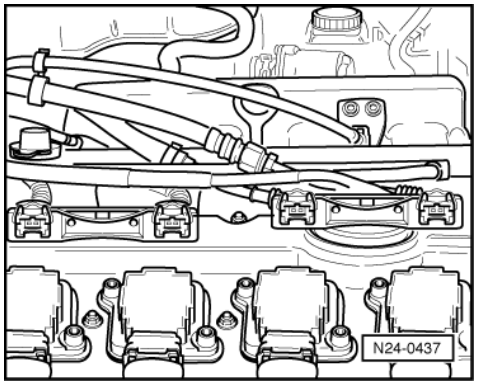
- V.A.G 1348/3 Remote control
- V.A.G 1348/3-2 Adapter
- V.A.G 1602 Calibration tester

Test conditions

- The fuel pressure must be in order; check
  => Page 107 .

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

Test sequence



- -> Pull connectors off injectors.
- Then remove fuel rail complete.
- Pull off vacuum hose from fuel pressure regulator.
- Lift fuel rail with injectors off intake manifold and support it.

Checking for leaks

- Initiate final control diagnosis => Page 22 ; the fuel pump must run.

Note:

This work sequence allows the fuel pump to run when the engine is not running. The idling speed switch must remain closed for this check, otherwise the selected injector will inject 5 times. Check injector for leaks (visual check).

- Check injector for leaks (visual check). Only 1 to 2 drops per minute must emit from each valve when fuel pump is running.

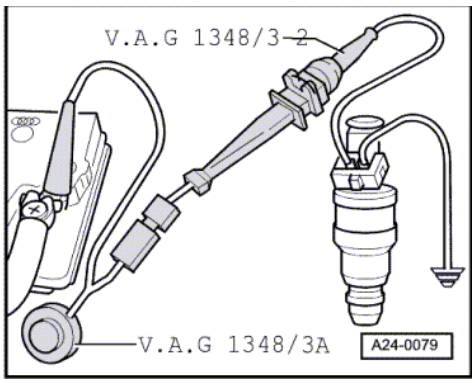
If the fuel loss is greater:

- Switch off ignition and renew leaking injector.

Note:

Always renew seals.

Checking injected quantity



- Insert injector to be checked in a measuring glass of tester for injected quantity V.A.G 1602.
- -> Connect one contact of the injector to be tested to engine earth using auxiliary cables from V.A.G 1594.
- Connect the second injector contact with auxiliary cable to remote control V.A.G 1348/3 using adapter cable V.A.G 1348/3-2.
- Connect crocodile clip to battery (+).
- Initiate final control diagnosis => Page 22 ; the fuel pump must run.
- Operate remote control V.A.G 1348/3 for 30 seconds.
- Repeat check on the other injectors. To do this use new measuring beakers.

- After all injectors have been activated, place the measuring glasses on a horizontal surface and compare the injected quantity.
  Specification: 133...157 ml per injector

If the measured values of one or more injectors are above or below the prescribed specifications:

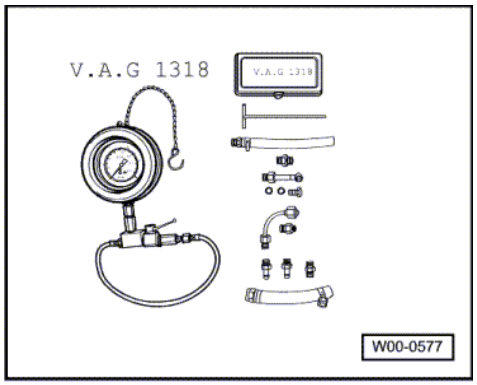
- Renew defective injector.

Perform installation of injectors in reverse order. When doing this note the following:

- Renew O-rings on all injectors and lightly moisten with clean engine oil.
- Insert injectors vertically and in the correct position into the fuel rail and secure with retaining clips.
- Fit fuel rail with secured injectors onto intake manifold and press in evenly.

2.10 - Checking fuel pressure regulator and holding pressure

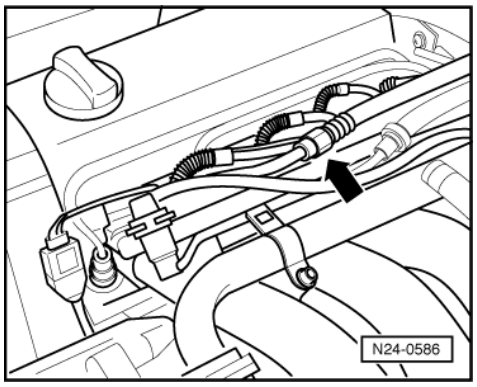
The fuel pressure regulator controls the fuel pressure dependent upon intake manifold pressure.



Special tools, testers, measuring instruments and auxiliary items required

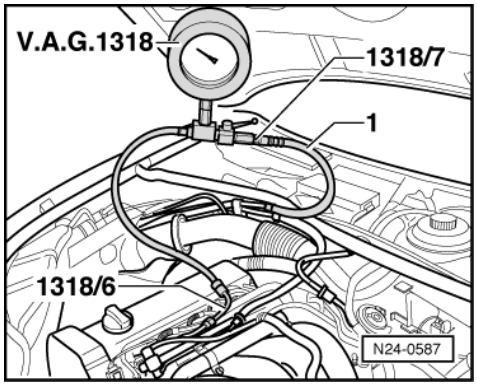
- Pressure tester V.A.G 1318
- Adapter 1318/6
- Adapter 1318/7

Test sequence

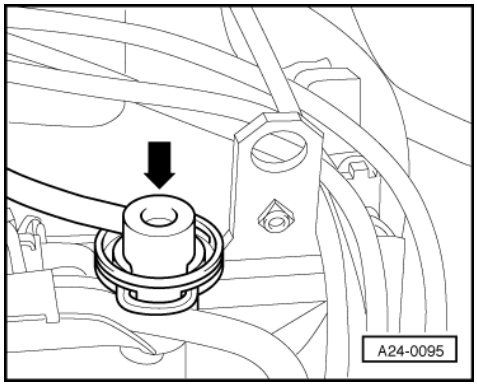


Warning!
Fuel system is under pressure! Before opening the system place a cloth around the connection. Then release pressure by carefully loosening the connection.

- -> 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.
- 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.

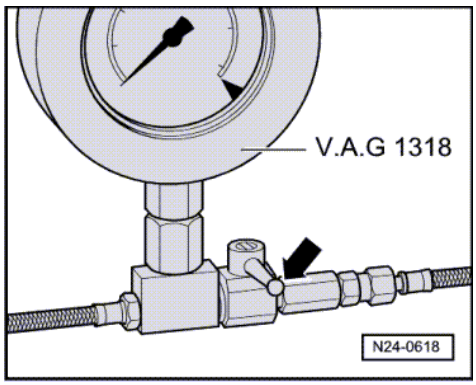
If the specification is not obtained:

- 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.



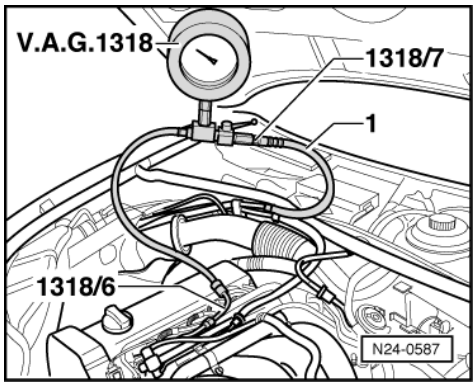
If the holding pressure drops below 2 bar:

- 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:

- -> Open pressure tester V.A.G 1318 shut-off tap (handle in through-flow direction).
- Start the engine and run at idling speed.
- Switch ignition off after the pressure has built-up. At the same time pinch/seal the return hose together.

If the pressure does not drop:

- Renew fuel pressure regulator

If the pressure drops again:

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

Note:

Before removing pressure gauge place a cloth around the connections to be loosened.

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 3 .)

-> 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, 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 "End data transfer" function and confirm input with the Q key.
- Switch off ignition.
- Check sprayed areas of intake system for leaks and rectify if necessary.

3 - Checking functions

3.1 - Checking functions

3.2 - Idling check

Notes:

- Idling speed, ignition timing and CO content not adjustable.
- The idling speed is regulated to specification by the throttle valve positioner in conjunction with the DIS function.
- 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 selector lever in "P" or "N" position

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 3 .)
- Interrogate fault memory, if necessary, repair fault and then erase fault memory.
  => Page 9 , interrogating and erasing fault memory
- Then:
  - Leave fault reader V.A.G 1551 connected.
  - Continue running engine at idling speed.

-> 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     HELP
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)

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

Note:

In the "System in basic setting" function the activated charcoal filter solenoid valve 1 (N80) is closed and the air conditioner compressor switched off.

- Check the adjustment conditions for basic setting in display zone 4:
  Specification: 1x111111
  Significance of the numbers => Page 42
- Briefly increase engine speed (rev- up) and then allow engine to run at idling speed for 2 minutes.

Checking idling speed

- Change to display group 56 as follows:
- Press C key.
- Press keys 0, 5 and 6 for "Display group number 56" and confirm entry with Q key.

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

```
System in basic setting     56
     1     2     3     4
```

- Check the operating mode in display zone 4
  Specification: 0x000
  (Significance => Page 55)

Engines without turbocharger:

- Check the specified idling speed in display zone 2.
  Specification: 860 rpm
- Check idling speed in display zone 1.
  Specification: 810...910 rpm1)

1) Up-to-date specifications:

=> Exhaust emissions test binder

Engines with turbocharger:

- Check idling speed specification in display zone 2.
  Specification: 860 rpm
- Check idling speed in display zone 1.
  Specification: 750...850 rpm1)

1) Up-to-date specifications:

=> Exhaust emissions test binder

Continuation for all engines

Note:

During idling check the activated charcoal filter solenoid valve and the air conditioner are switched off and the Lambda regulation learning procedure is initiated.

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

If the idling speed is not obtained:

- Adapt the engine control unit to the throttle valve control part => Page 131
- 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 89 .
- Check the operating condition of engine

=> Page 123 .
- Check the intake air system for unmetered air
  => Page 110

3.3 - Adapting idling speed

In exceptional circumstances e.g. customer complaints concerning droning noises, vibrations at idling speeds, it is permitted to adjust the idling speed slightly. But ensure, that the idling speed is not outside the range printed in the Exhaust emissions test binder, (if the speed is outside the tolerance range it is possible that the vehicle will fail the next exhaust emissions test).

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

- No fault stored in fault memory
- Coolant temperature must be at least 80 °C, =>display group 04, display zone 3.

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 3 .)

-> Indicated on display:

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

- Press keys 1 and 0 for the "Adaption" function and confirm input with the Q key.

-> Indicated on display:

```
Adaption
Feed in channel number XX
```

- Press keys 0 and 1 for channel number 1 and confirm input with the Q key.

-> Indicated on display:

```
Channel 1      Adaption xxx
xxx rpm      xxx rpm      Text      Text
```

- Change the specified speed in display zone 2 in jumps of 10 rpm with the following keys:
  V.A.G 1551: keys 1 and 3
  V.A.G 1552: keys ↑ and ↓

-> Indicated on display:

```
Channel 1      Adaption xxx
xxx rpm      xxx rpm      Text      Text
```

Note:

The idling speed must not be adjusted to outside the permissible idling speed range. The up-to-date figures for the idling speed can be found in:

=> Exhaust emissions test binder

- Confirm input by pressing Qkey.

-> Indicated on display:

```
Channel 1     Adaption xxx     Q
Store amended figure?
```

- Confirm entry by pressing Qkey.

-> Indicated on display:

```
Channel 1     Adaption xxx
Amended figure is stored
```

- Conclude adaption by pressing ⇒ button.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.

3.4 - 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

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

-> 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...4 = Display zones)

```
Read measured value block     30
     1     2     3     4
```

- 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	

Significance if display = 1			
		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 82 .

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...4 = Display zones)

```
Read measured value block     32
     1     2     3     4
```

- 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 49 , 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...4 = Display zones)

```
Read measured value block 33
     1     2     3     4
```

- 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 117 checking Lambda probe wiring
1.105 V	Short to positive	
0.000 V	Short to earth	

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

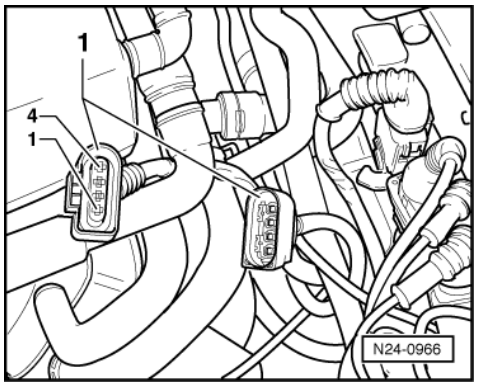
- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Carry out road test and burn Lambda probes clean and repeat check.

Observe the valid safety precautions when carrying out a road test => Page 80 .

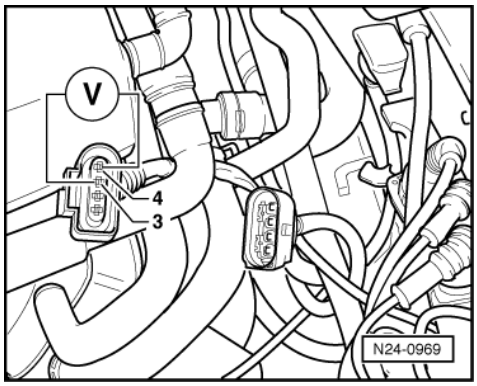
If the the specifications in display zone 1 are not obtained even after a test drive, or the value does not fluctuate by at least 2 %:

- Replace the Lambda probe before catalyst (G39).

Checking basic voltage



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



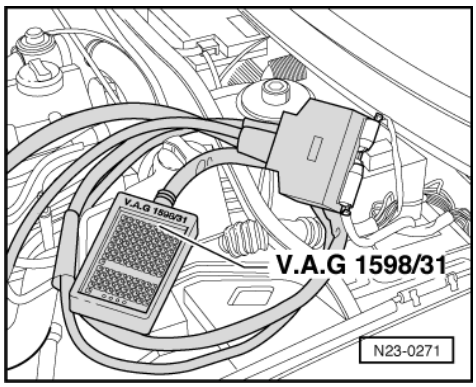
- -> Connect multimeter with aux. cables from V.A.G 1594 to measure voltage at contacts 3+4 (connector to engine control unit).
- Switch on ignition and measure basic voltage.
  Specification: 0.40...0.50 V
- Switch off ignition.

If the specification is not obtained:

- Check Lambda probe wiring
  => Page 117

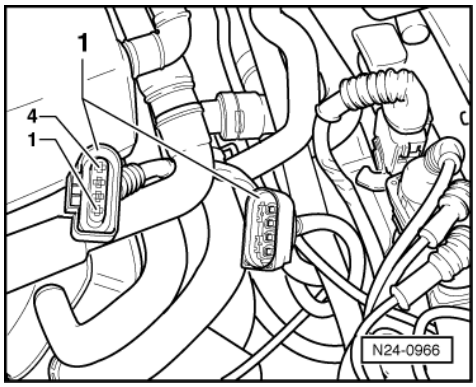
If the specification is obtained:

- Replace the Lambda probe before catalyst (G39).



Checking Lambda probe wiring

- -> 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 control unit) for open circuit using current flow diagram.
  Contact 3+socket 51
  Contact 4+socket 70
  Wire resistance: Max. 1.5 ω
- Check the wiring at connector contacts 3+4 for short circuit to contacts 1+2.

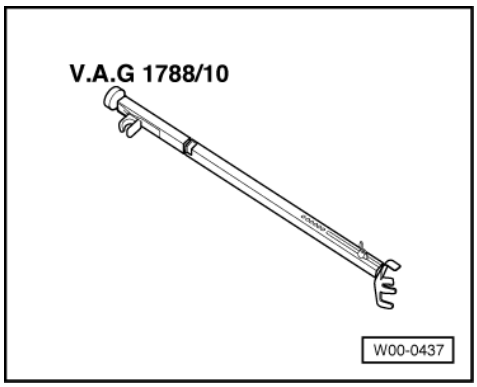
If no fault is detected in the pipes:

- Replace the Lambda probe before catalyst (G39).

3.5 - 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 1598/22
- Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- Adapter set V.A.G 1594
- Current flow diagram



◆ -> V.A.G 1788/10 Engine speed adjuster

Check conditions

- Exhaust system between catalyst and cylinder head must be free of leaks
- Coolant temperature must be at least 85 °C, =>display group 04, display zone 3.

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 3 .)

-> 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 4 for "Display group number 34" and confirm entry with Q key.

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

```
Read measured value block     34
     1     2     3     4
```

- Set engine speed to 1800...2200 rpm using speed regulator V.A.G 1788/10:
- Hold engine speed to 1800...2200 rpm until catalyst temperature in
  Display zone 2
  rises to 350...500 °C.

Note:

This process can take a few minutes.

- Press C 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...4 = Display zones)

```
Read measured value block     30
     1     2     3     4
```

- Check the operating condition of the Lambda regulation after catalyst (display zone 2):
  Specification: 111

Note:

The bits in display zone 2 will not be set to 1 until the catalyst temperature has risen to above 350 °C (=> display group 34, display zone 2).

Significance of 3 digit number block in display zone 2:

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

- Change to display group 37 as follows:
- Press C key.
- Press keys 0, 3 and 7 for "Display group number 37" and confirm entry with Q key.

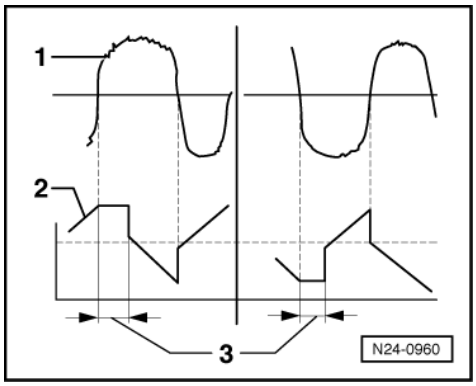
-> Indicated on display:
(1...4 = Display zones)

```
Read measured value block 37
     1     2     3     4
```

- Check duty cycle of Lambda regulator before catalyst in display zone 3:
  Specification: 0...200 ms
  and the diagnosis result in display zone 4:
  Specification: Syst. OK

Note:

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



-> It corrects slight shifts in mixture (e.g. too rich) by means of the Lambda probe before catalyst -1- by holding the Lambda regulator -2- before catalyst on the upper or lower point for a certain period -t- (dwell period) -3-. If the period is in the positive range (e.g. 50 ms) the mixture is moved towards "rich". If the period is in the negative range (e.g. -50 ms),the mixture is moved towards "lean".

- Check Lambda probe voltage in display zone 2:

Specification: 0...1 V (can fluctuate slightly)

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 121 checking Lambda probe wiring
1.105 V	Short to positive	
0.000 V	Short to earth	

If Syst. OK appears in display zone 4 and the value displayed in display zone 3 is above 200 ms:

- Check the exhaust system for leaks.

If Syst. n.OK appears in display zone 4 and the value displayed in display zone 3 is above 800 ms:

- Press ⇒key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- 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 80 .

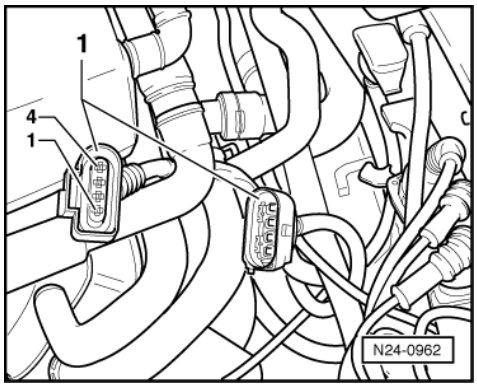
If the specifications are again not attained:

- Renew Lambda probe 2 (G130).

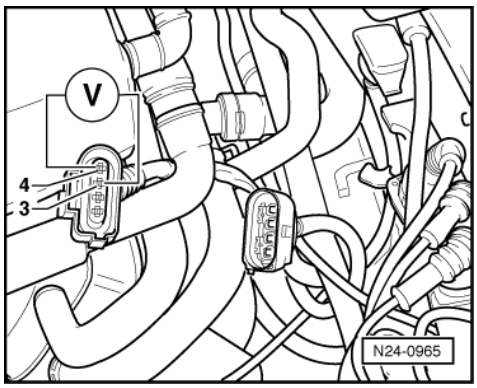
Note:

If the Lambda probe voltage is OK and the dwell time of the Lambda regulator after catalyst is still above 150 even after a test drive, this indicates an aged Lambda probe before catalyst.

Checking basic voltage



- -> Separate 4-pin connector (brown) to Lambda probe after catalyst (G130) -1-.



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

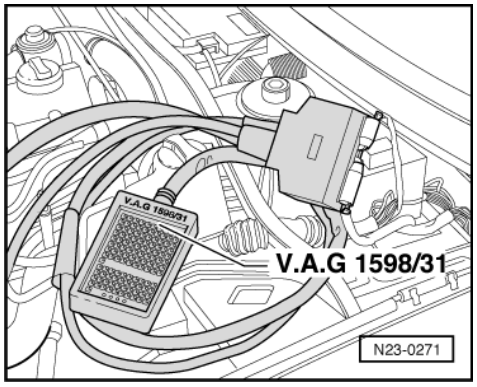
If the specification is not obtained:

- Check Lambda probe wiring
  => Page 121

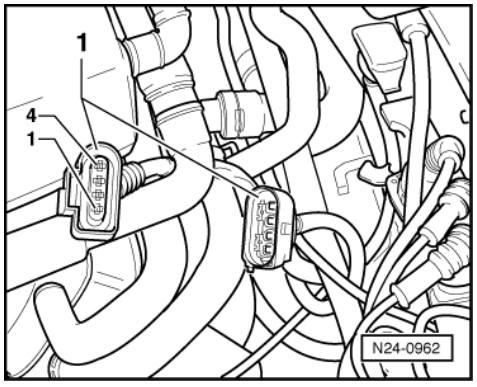
If the specification is obtained:

- Renew Lambda probe 2 (G130).

Checking Lambda probe wiring, Lambda probe 2



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

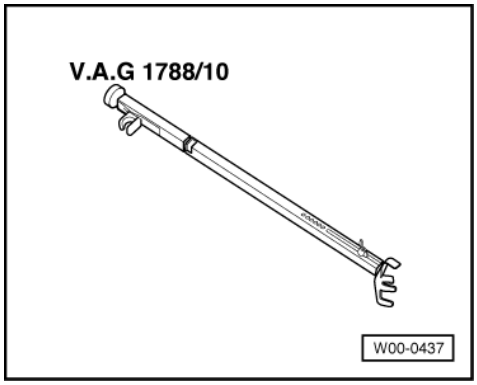


- -> Check wiring between test box and 4-pin connector to Motronic control unit for open circuit using current flow diagram.
  Contact 3 and socket 68
  Contact 4 and socket 69
  Wire resistance: max. 1.5 ω
- Additionally check wiring at 4-pin connector for short to one another.
  Contact 4 and socket 68
  Specification: ∞ω

If no fault is detected in the pipes:

- Renew engine control unit => Page 128 .

3.6 - Checking Lambda probe ageing Lambda probe 1



Engines fulfilling D4 standard only

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
- V.A.G 1788/10 Engine speed adjuster

Test conditions

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

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 3 .)

-> 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
```

- Set engine speed to 1800...2200 rpm using speed regulator V.A.G 1788/10:
- Maintain the engine speed at 1800...2200 rpm until the display in display zone 4 jumps from "Test OFF" to "Test ON".
  The catalyst temperature in display zone 2 must be 350...500 °C
- Check dwell time in display zone 3:
  Specification: maximum 1.0 s
- Continue to maintain the speed at 2200...2800 rpm until the specification "B1-S1 OK" appears in display zone 4.

If the specifications are 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 specifications are not attained:

- 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 80 .

If the specifications are again not attained:

- Replace Lambda probe (G39).

3.7 - Checking engine operating mode

Note:

Checks whether engine control unit recognises the engine operating modes idling, overrun, part throttle, enrichment, full throttle.

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 3 .)

-> 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.
- Close throttle abruptly.

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.

Engines without turbocharger:

- Full throttle:

- Floor accelerator pedal (onto throttle valve stop).

Full throttle must be displayed briefly
Display: Full throttle

Note:

A test drive may have to be performed to show "Full throttle" in display.

A 2nd person is required when performing a test drive.

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

Continuation for all engines

- Enrichment:

- Floor accelerator pedal (onto throttle valve stop).

Acceleration enrichment must be displayed briefly
Display: Enrichment

Observe the valid safety precautions when carrying out a road test=> Page 80 .

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

If the specifications are not attained:

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 9 , interrogating and erasing fault memory.
- Check throttle valve control part
=> Page 89 .

3.8 - Checking intake manifold change-over

Engines without turbochargers only

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
- Hand vacuum pump V.A.G 1390

Checking function

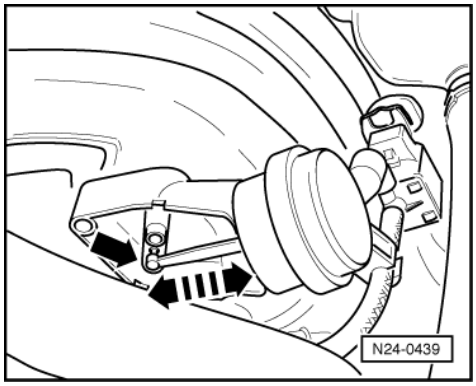
- Start engine and run at idling speed.
- Increase engine speed abruptly (throttle burst). The intake manifold change-over vacuum unit must operate when doing this. (Location: front left on intake manifold).

If change-over does not occur, the following checks must be carried out.

- Switch off ignition.
- First check activation of twin path intake manifold change-over valve (N156) via final control diagnosis => Page 22 .

If activation is OK:

- The fault reader or the vehicle system tester must remain connected.
- Start engine and run at idling speed.
- Switch off ignition.



- -> Perform final control diagnosis again. When the valve for intake manifold change-over is activated, the actuator must switch to and fro between both positions

If the change-over does not function as described:

- 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.

4 - Engine control unit

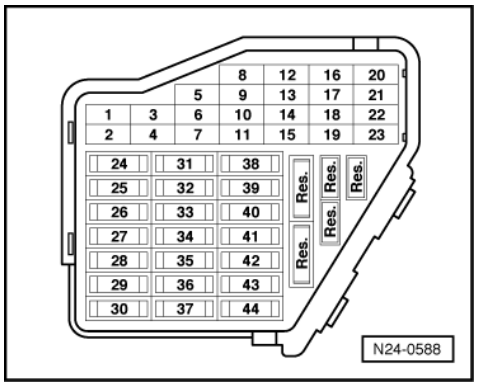
4.1 - Engine control unit

4.2 - Checking control unit voltage supply

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 battery voltage must be at least 11.5 V.
- -> Fuses No. 7, 29 and 32 must be OK.

Vehicles 05.99 ▸

- Current supply relays for Motronic 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 3 .)

-> 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
```

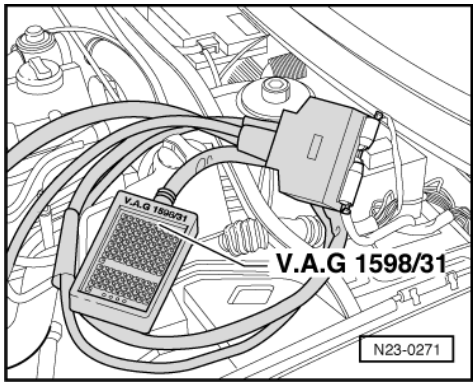
- Press keys 0, 0 and 4 for "Display group number 4" and confirm entry with Q key.

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

If the specification is not attained:



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

Checking voltage supply terminal 30

- Measure voltage supply with multimeter and aux. cables from V.A.G 1594 between test box sockets 1 + 62 (+) and 2 + 62 (+):
  Specification: min. 11.5 V

If the specification is not attained:

- Check wiring connections to relay plate according to current flow diagram.

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

Checking voltage supply terminal 15

- Measure voltage supply with multimeter and aux. cables from V.A.G 1594 between test box sockets 1 + 3 (+) and 2 + 3 (+):
- Switch on ignition.
  Specification: min. 11.5 V

If the specification is not attained:

- Check wiring connections to relay plate according to current flow diagram.

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

Check voltage supply via current supply relays for Motronic (main relay)

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- Now also connect engine control unit to test box V.A.G 1598/31.
- Measure supply voltage between test box sockets 2 (earth) + 121 (+) using multimeter and adapter cables from V.A.G 1594:
- Switch on ignition.
  Specification: min. 11.5 V

Note:

The supply voltage will be maintained for about 50 seconds after the ignition has been turned off.

If the specification is not attained:

- Check wiring connections to relay plate according to current flow diagram.
- Check activating wires from engine control unit pin 21 to current supply relay for Motronic -J271 using current flow diagram:

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

4.3 - Procedure after voltage supply open circuit

All values learnt by the engine control unit and the basic setting values as well as the readiness code will be erased if the voltage supply is interrupted. Therefore, depending upon the vehicle mileage it can lead to serious engine running problems.

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

Perform the following operations after voltage supply open circuit:

- Switch ignition on for at least 10 seconds.
- Switch off ignition.
- Perform idling check
  => Page 111

On vehicles fitted with a 4-speed 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

Note:

During idling check the activated charcoal filter solenoid valve and the air conditioner are switched off and the Lambda regulation learning procedure is initiated.

- Perform a longer test drive until the poor driving characteristics are eliminated.

  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
    Full throttle
    Overrun
    must be attained several times.
  - At full throttle the speed must exceed 3500 rpm.

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 3 .)

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

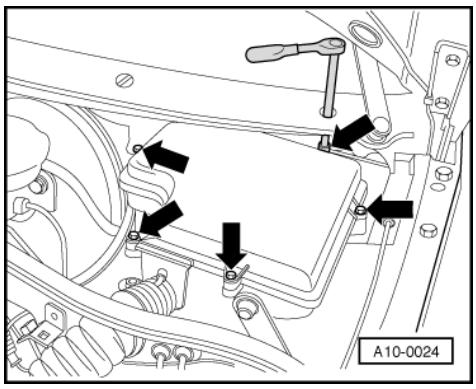
```
4B0906018F 1.8 R4/5VT MOTR G 0001
Coding 05501     WSC 00000
```

- Print out the control unit identification by pressing the fault reader print button.
- Press the ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.

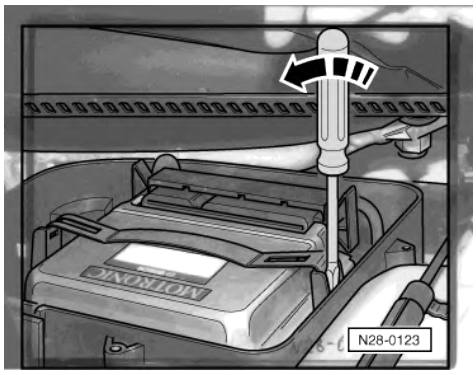
-> Indicated on display:

```
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.
- Insert new control unit and press to the left.
- Check the previous coding and the coding of the new control unit => Page 130 .
- Match new control unit to throttle valve control part => Page 131
- Match new control unit to the electronic immobilizer => Page 133

Vehicles with automatic gearboxes:

- Learning kick-down point => Page 134

On vehicles fitted with a 4-speed 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

Continued for all vehicles

- Then subsequently interrogate the fault memory of the new engine control unit and erase the fault memory if necessary.
- Perform idling check
  => Page 111

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.

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 3 .)

-> 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 131 .

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

```
4B0906018F 1.8 R4/5VT MOTR G 0001
Coding 05501     WSC 00000
```

-> Indicated on display when a non-authorised code number has been entered.

```
Function is not recognised or cannot
□
be performed at the moment.
```

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

Note:

The code unit entered and shown on the display will not be used by the Motronic control unit until the ignition has been switched off once.

An incorrect coding leads 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 front wheel drive vehicles the traction control will not function (TC warning lamp comes on)
- Reduced gearbox life

4.6 - Coding variations of engine control unit

Country/emission	Drive/additional functions	Gearbox	Vehicle type
00=	0 = Front wheel drive	0 = 5-speed man. gearbox	0 =
01 =	1 =	1 =	1 = B class: e.g. Passat
02 = Vehicles without turbocharger: Exhaust emissions fulfil ECE15/04 Standard	2 = Four-wheel drive	2 =	2 =
03 = Vehicles with turbocharger: Exhaust emissions fulfil ECE15/04 Standard	3 =	3 = Automatic gearbox 01N	3 =
04 = Exhaust emissions fulfil MVEG2 standard	4 =	4 =	4 =
05 = Exhaust emissions fulfil D3/ D4 standard	5 = Front wheel drive with traction control (TC), data bus	5 = Automatic gearbox 01V (Tiptronic)	5 =
06 =	6 =	6 =	6 =
07 =	7 = Four-wheel drive with traction control (TC), data bus	7 =	7 =

The code number is compiled as shown in the following example:

Passat:				1
5-speed manual gearbox:			0	
Front wheel drive with TC and data bus:		5		
Exhaust emissions in accordance with D3/D4 standard:	05			
Code number:	05	5	0	1

4.7 - Adapting engine control unit to throttle valve control part

The adaption teaches the engine control unit the various positions of the throttle unit when the ignition is switched on and the engine is not running. These positions are stored in the control unit. The feedback of the throttle valve position is via both angle senders for throttle valve drive.

Adapting sequence must be performed if:

- The throttle valve control unit is removed and installed or cleaned
- The throttle valve control unit is renewed
- If when installing another engine another throttle valve control unit is installed
- The engine control unit is renewed.

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

- Ignition on, engine not running
- All electrical consumers, e.g. lights and rear window heating must be switched off
- The battery voltage must be at least 11.5 V.
- The cruise control system must be functioning correctly if installed.
- The throttle valve must be at idling speed position (The accelerator must not be operated during the test).
- The throttle valve part must not be dirty (carbonization).
- No faults must be stored in fault memory
  => Page 9 , interrogating fault memory
- Coolant temperature must be 5...105 °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 3 .)

-> 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      HELP
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)

```
Basic setting      60
     xxx %     xxx %     x     ADP. runs
```

After pressing the Q key the throttle valve positioner is switched so that it is not supplied with voltage at start of test.

- 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 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.
- Learning step 9. End of adaption.

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

```
Basic setting      60
     xxx %     xxx %     9     ADP. OK.
```

Adapting has been performed successfully.

- End the engine basic setting by pressing the⇒ 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.

Note:

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 89 .

After an interruption a fault is stored in fault memory. When next switching on ignition the basic setting is automatically performed again.

4.8 - Adapting engine control unit to electronic immobilizer

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

Conditions

- Authorized vehicle key required.

Work sequence

- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.
- Switch on ignition.
- Operate fault reader or vehicle system tester taking into account the information on the display:
- Press key 1 for "Rapid data transfer".
- Press keys 1 and 7 for address word "dash panel insert" and confirm entry with Q key.

-> Indicated on display:

```
3B1919890 B5 Combi-instr. VDO X01
Coding 20142     WSC XXXXX
```

- Press the ⇒key.

-> Indicated on display:

```
IMMO IDENTNO.: VWZ7Z0555153
```

- Press the ⇒key.

-> 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
```

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

Note:

The identity of the engine control unit is read into the immobilizer control unit when next switching the ignition on.

4.9 - Learning kick-down point

Following renewal of the engine control unit or the accelerator pedal, vehicles with automatic gearboxes must relearn the kick-down point.

Test conditions

- Ignition on, engine not running

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 3 .)

-> 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     HELP
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 in display zones 3 and 4:
  Display: Operate kick down
- Press accelerator pedal beyond kick-down pressure point to floor.
- Hold pedal at this point for at least 2 seconds.
- Observe display in display zones 3 and 4:
  Specification: Kick Down ADP. runs
  then
  Specification: Kick Down ADP. OK
- Appears in display zones 3 and 4:
  Display: Kick Down ERROR
- Check accelerator position sender:

=> Repair group 20; Accelerator mechanism, Servicing accelerator mechanism Accelerator mechanism, Servicing accelerator mechanism

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
- 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 3 .)

-> 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, 0 and 5 for "Display group number 5" and confirm entry with Q key.

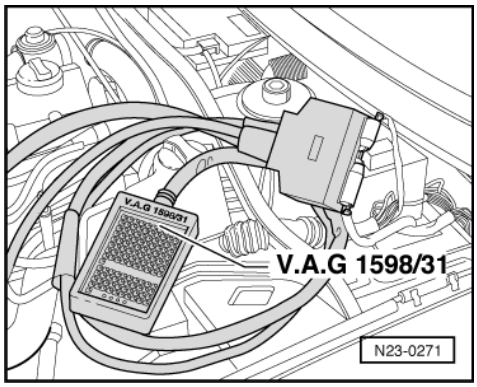
-> Indicated on display:
(1...4 = Display zones)

```
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:



- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Connect multimeter to measure voltage between test box sockets 3 (terminal 15) + 54 (speed signal).
- Switch on ignition.
- Lift vehicle at front left.
- Rotate front wheel and observe voltage display.
  Specification: between 0 and at least 4 Volt fluctuating

If the display does not fluctuate:

- Check wiring to speedometer/speedometer sender.

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

5.3 - Checking signal from/to air conditioning system

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 9 , interrogating 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 3 .)

-> 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, 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
```

- Observe display in display zone 4. It must show
  Compr. OFF.
- Switch on air conditioning system.
- Select lowest temperature and highest blower speed.

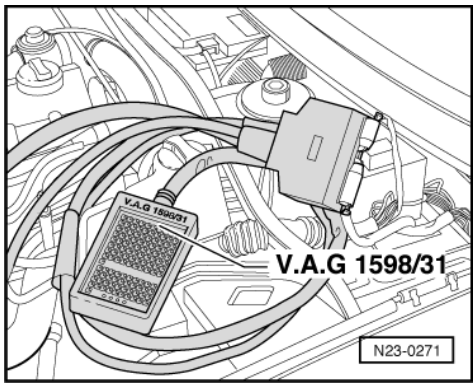
  The display in display zone 4 must change to
  Compr. ON.

- 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 switch-off when vehicle is accelerating).

- 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:



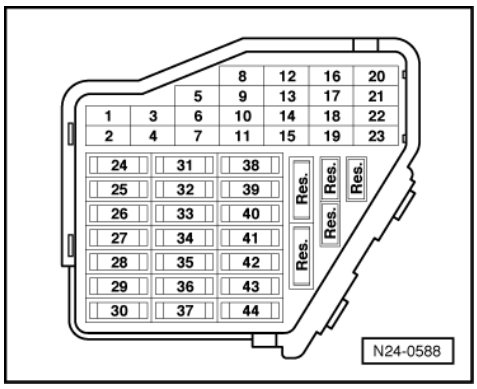
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.
- Check wiring for open circuit between test box sockets 40 + 41 and air conditioner system using current flow diagram.
  Wire resistance: max. 1.5 ω

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



Test conditions

- -> Fuse 7 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 3 .)

-> 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, 6 and 6 for "display group 66" and confirm with Q key.

-> Indicated on display:

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

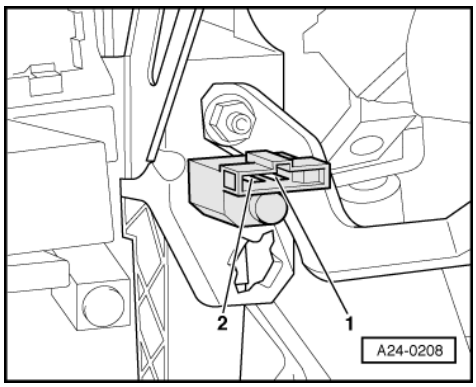
- Observe values displayed in display zone 2 (2nd digit from left).
  Specification: x 0 x x
- Depress clutch pedal fully and observe values in display zone 2.
  Specification: x 1 x x
- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.
- Switch off ignition.

If the specification is not obtained:

- Remove 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

- Pull the connector off the clutch pedal switch.

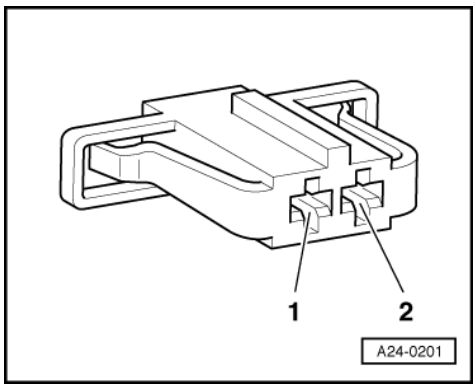


- -> Connect multimeter to measure resistance between contacts 1 and 2.
  Specification: approx. 0 ω
- Depress the clutch pedal.
  Specification: ∞ ω (no continuity)

If the specification is not attained:

- Renew clutch pedal switch.

If the specification is obtained:



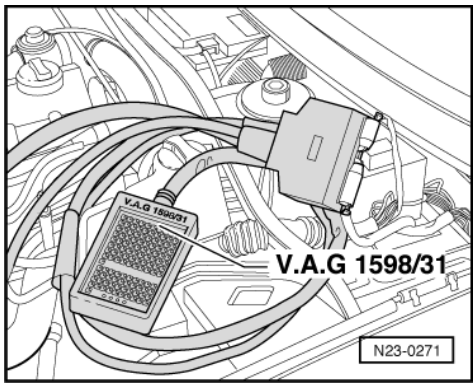
- -> Connect multimeter to measure voltage between contact 1 and earth.
  Specification: at least 11.5 V

If the specification is not attained:

- Check the wiring between 2-pin connector contact 1 and central electrics using current flow diagram.

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

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 2-pin connector for open circuit using current flow diagram.

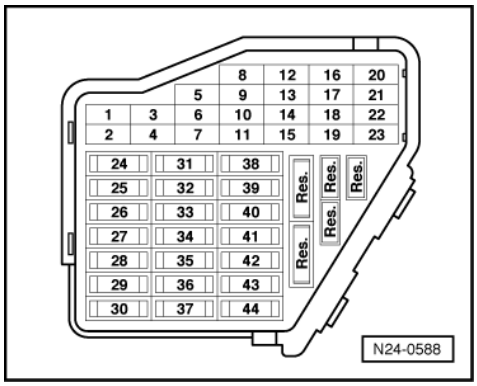
Contact 2+socket 39
Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.
- Additionally check the wiring for short to battery positive or earth.

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



- -> Fuse 7 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 3 .)

-> 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, 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 and 4th positions from left)
Specification: x x 0 0
- Depress brake pedal fully and observe display in display zone 2.
Specification: x x 1 1
- Press the ⇒key.
- Press keys 0 and 6 for the "End output" function and confirm input with the Q key.

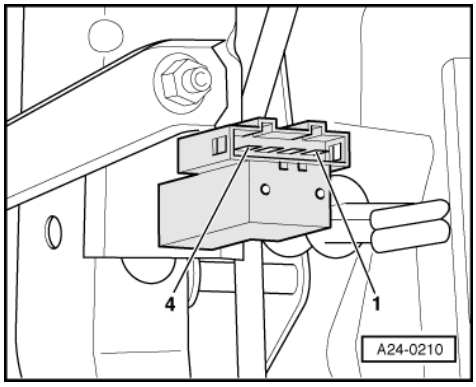
- Switch off ignition.

If the specification is not obtained:

- 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

- Pull the connector off brake light/brake pedal switch.

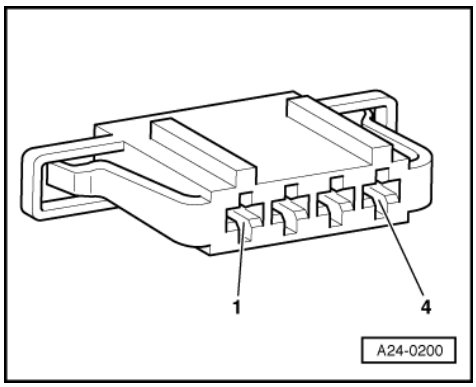


- -> Connect multimeter to measure resistance between contacts 1 and 2.
  Specification: ∞ ω (no continuity)
- Depress brake pedal.
  Specification: approx. 0 ω
- Connect multimeter to measure resistance between contacts 3 and 4
  Specification: approx. 0 ω
- Depress the brake pedal.
  Specification: ∞ ω (no continuity)

If the specifications are not attained:

- Replace the brake light/brake pedal switch.

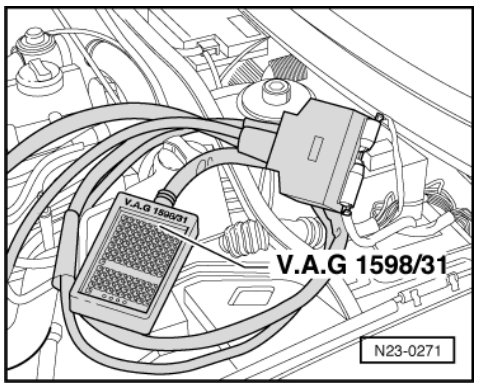
If the specifications are obtained:



- -> Connect multimeter to measure voltage between contact 1 and earth.
  Specification: at least 11.5 V
- Switch ignition on.
- Connect multimeter to measure voltage between contact 3 and earth.
  Specification: at least 11.5 V

If the specifications are not obtained:

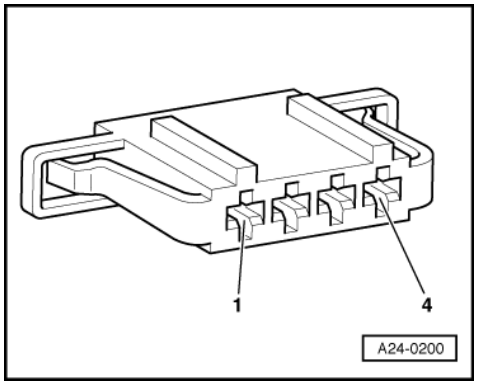
- Check the wire between 4-pin connector contact 1 and main fuse/contact 2 and central electrics using current flow diagram.



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

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 for open circuit between test box and 4-pin connector using current flow diagram.
  Contact 4 and socket 55
  Contact 2 and socket 56
  Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.
- Additionally check the wiring for short to battery positive or earth.

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 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

- The selector lever of the automatic gearbox must be in "P" or "N" 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 3 .)

-> 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, 5 and 6 for "Display group number 56" and confirm entry with Q key.

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

```
Read measured value block 56
     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:

- Checking data bus => Page 143

5.7 - Checking data bus

Function

The engine control unit communicates with all control units capable of data bus via a CAN data bus.

Data bus-compatible control units are connected together via two data bus wires twisted together (CAN high and CAN low) and exchange information (messages). Information not available in the data bus will be recognised as a fault by the engine control unit as well as other CAN data bus control units.

Further information:

=> Self study programme No. 186 "The CAN data bus".

Test conditions

- A fault has been recognised by the CAN data bus self-diagnosis.

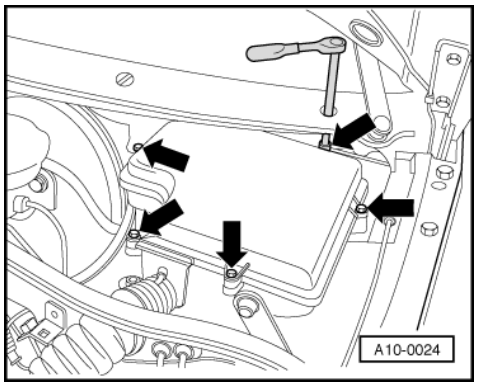
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- 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

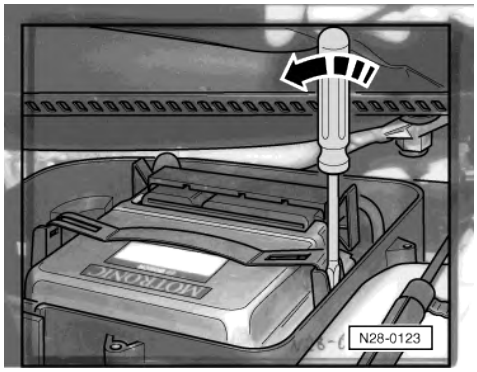
- Current flow diagram

Test sequence

- Switch off ignition.



- -> Remove cover of protective housing for control units.



- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Unlock the engine control unit connector and pull it off.
- 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 perform a resistance measurement between the test box
  Sockets 58 + 60 and
  Sockets 77 + 79 (only automatic gearbox):
  Vehicles ‣04.99 and vehicles with TCS
  Specification: 115... 135 ω
  Vehicles 05.99 ‣ Specification: 60 ...72 ω

If the resistance measurement is outside the specified range:

- Renew engine control unit => Page 128 .

If the resistance value is within the specified range:

- Repair the fault in the wiring using current flow diagram:

=> 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.

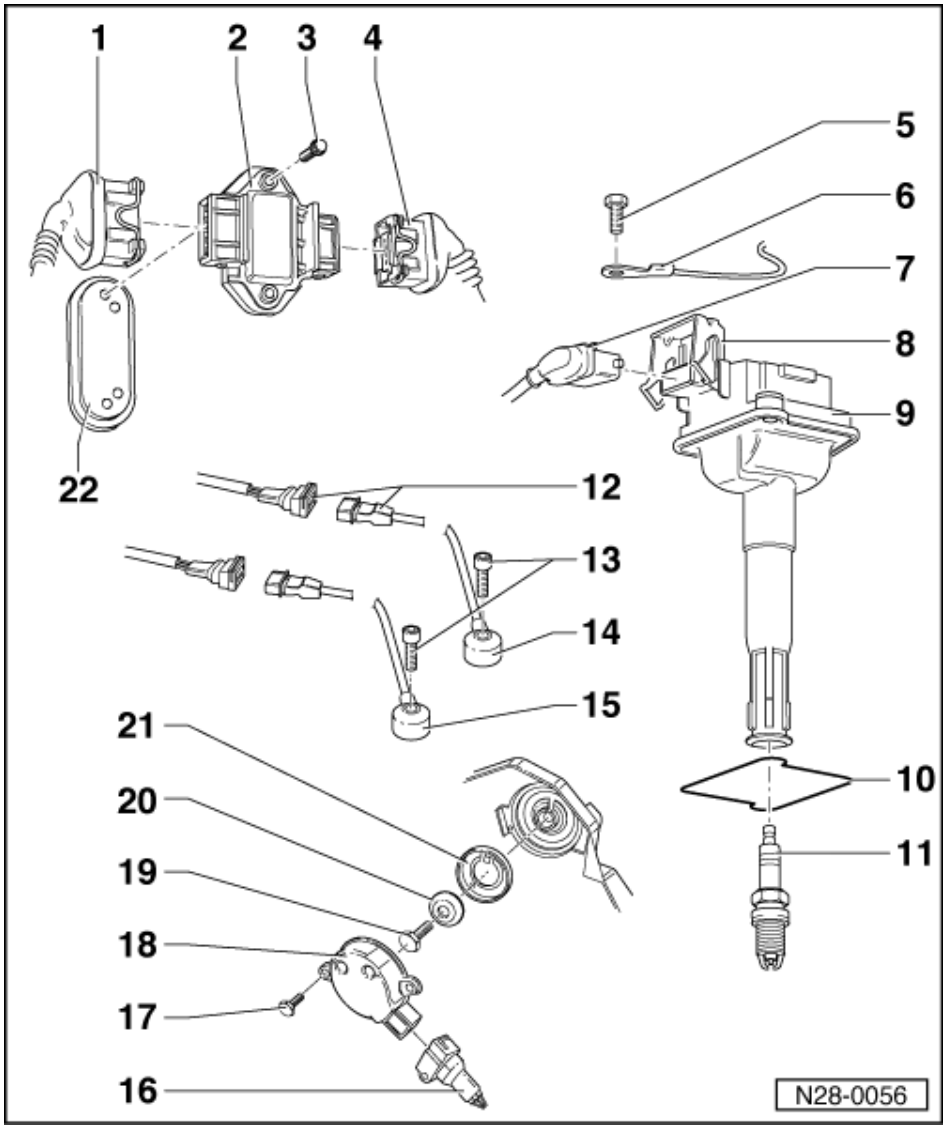
=> Repair group 24

- The engine control unit is equipped with self diagnosis.
- Components marked with * are checked via the self diagnosis.
  => Page 9 , interrogating fault memory
- For trouble-free operation of the electrical components a voltage of at least 11.5 V is necessary.
- 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 9 , interrogating fault memory
- 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 matched => Page 133 .

Safety precautions => Page 153

Test data, spark plugs => Page 155

1.3 - Removing and installing parts of the ignition system



Engines with turbocharger

1 Connector
- Black, 5 pin
- To control unit

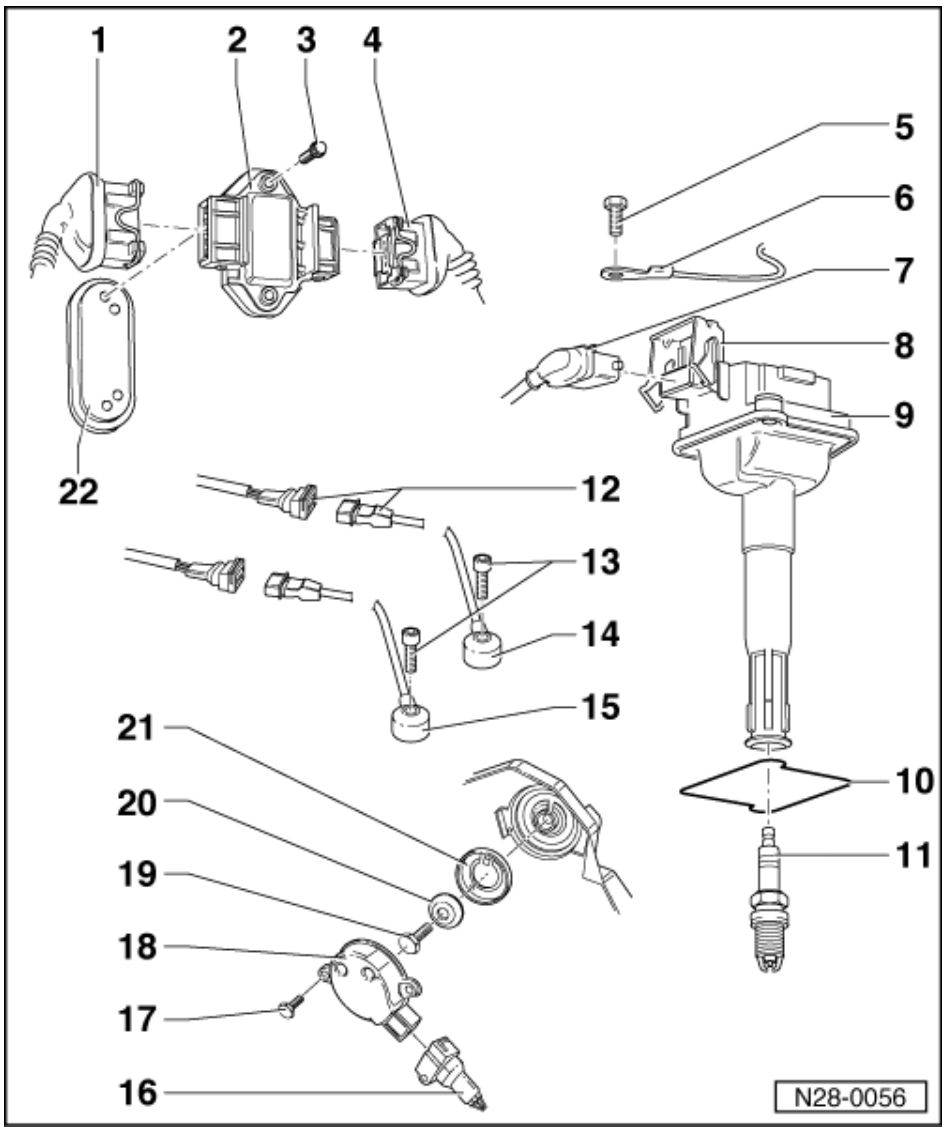
2 Output stage (N122)
- Checking => Page 156
- Coat lower part with heat conductive paste G 052 170 A2

3 6 Nm

4 Connector
- Black, 4 pin
- To ignition coil

5 10 Nm
- Only loosen or tighten with ignition switched off

6 Earth wire
- Only loosen or tighten with ignition switched off



7 Connector
- Black, 3-pin

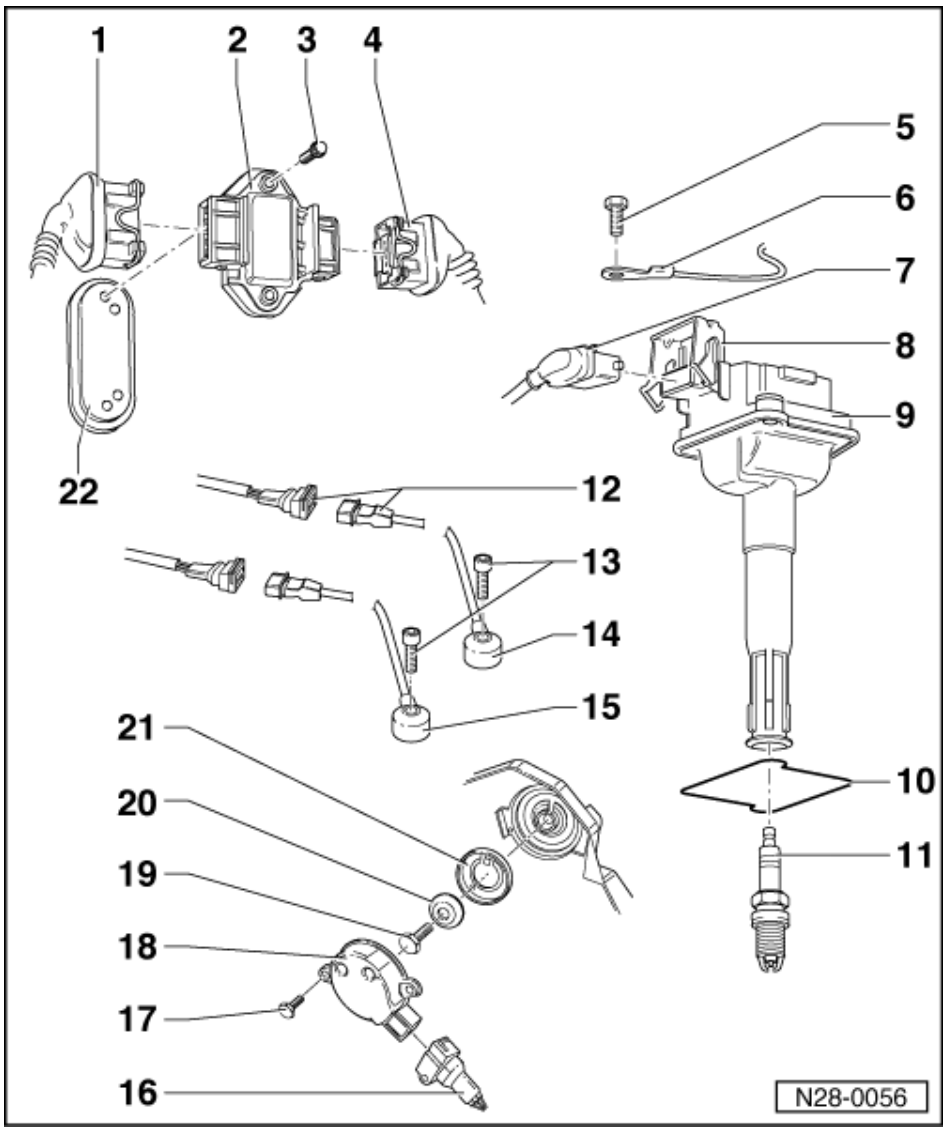
8 Locking device
- For connector

9 Ignition coils (N, N128, N158 and N163)
- Spark plug connector can be pulled off
- Checking => Page 156

10 Seal
- Renew if damaged

11 Spark plug, 30 Nm
- Remove and install with 3122B
- Type and electrode gap
  => Page 155 , test data, spark plugs

12 3-pin connector
- Contacts gold plated
- Green for knock sensor 1 (G61)
- Blue for knock sensor 2 (G66)



13 20 Nm
- Tightening torque influences the function of the knock sensor

14 Knock sensor 1 (G61)*
- Sensor and connector contacts are gold-plated
- Checking => Page 161

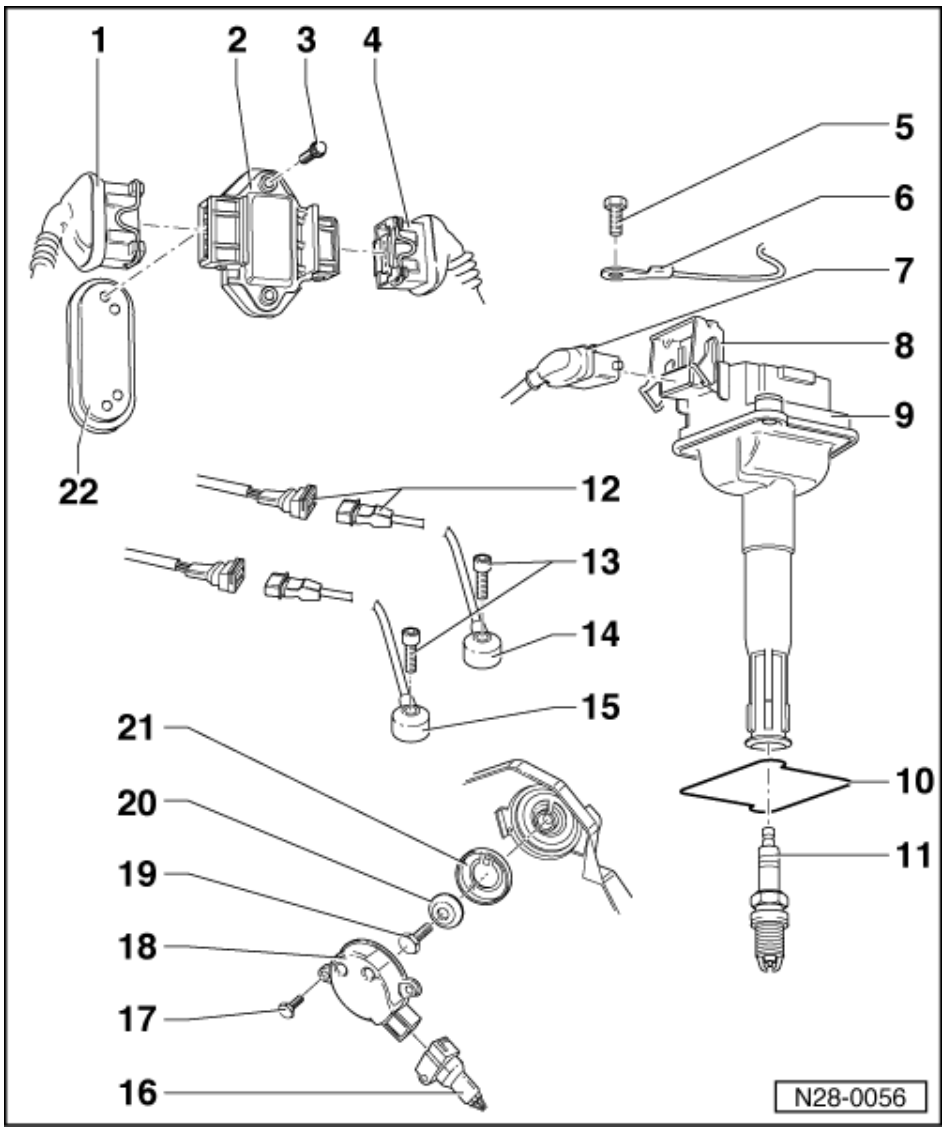
15 Knock sensor 2 (G66)*
- Sensor and connector contacts are gold-plated
- Checking => Page 161

16 Connector
- Black, 3-pin

17 10 Nm

18 Hall sender (G163)*
- Checking => Page 155

19 25 Nm



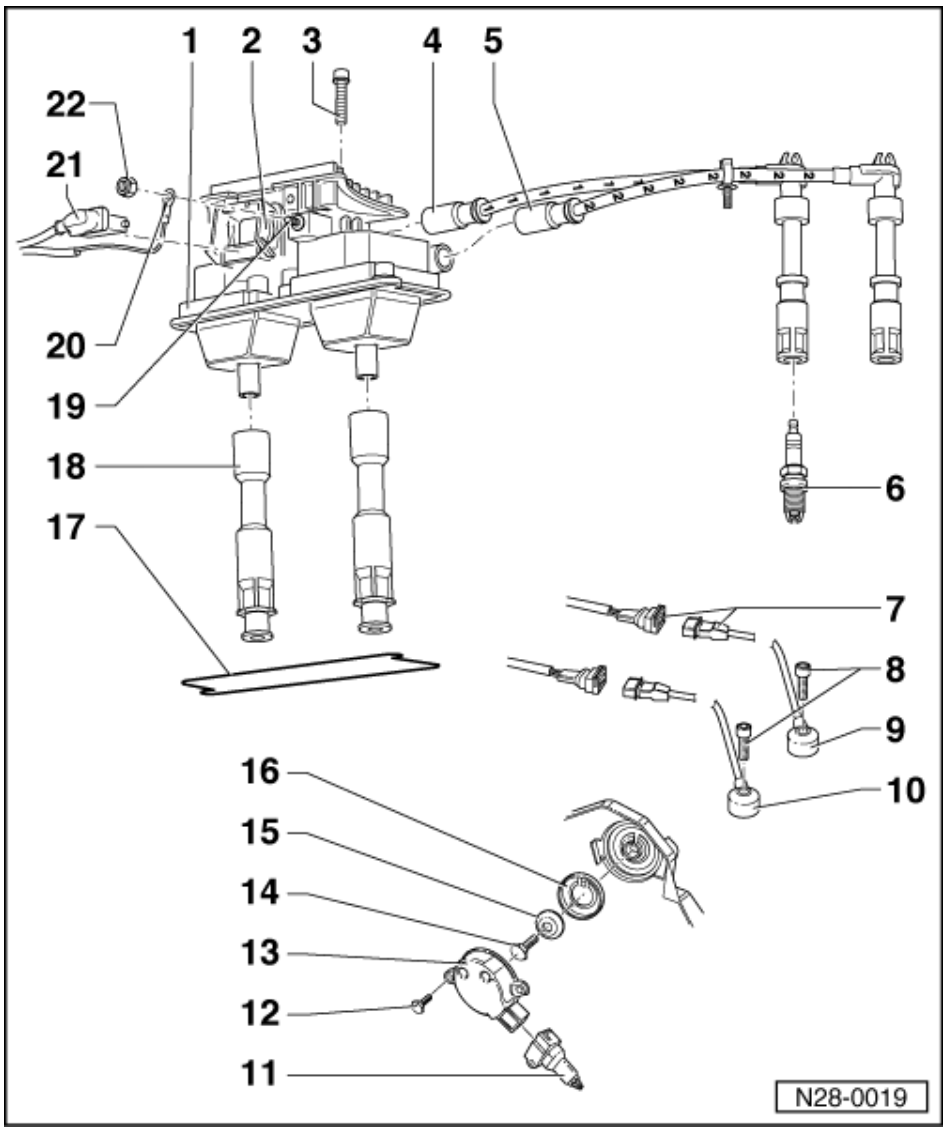
20 Washer

- Conical

21 Hood

- With four openings
- For Hall sender (G163)
- When installing note fixing arrangement

22 Heat sink



Engines without turbochargers

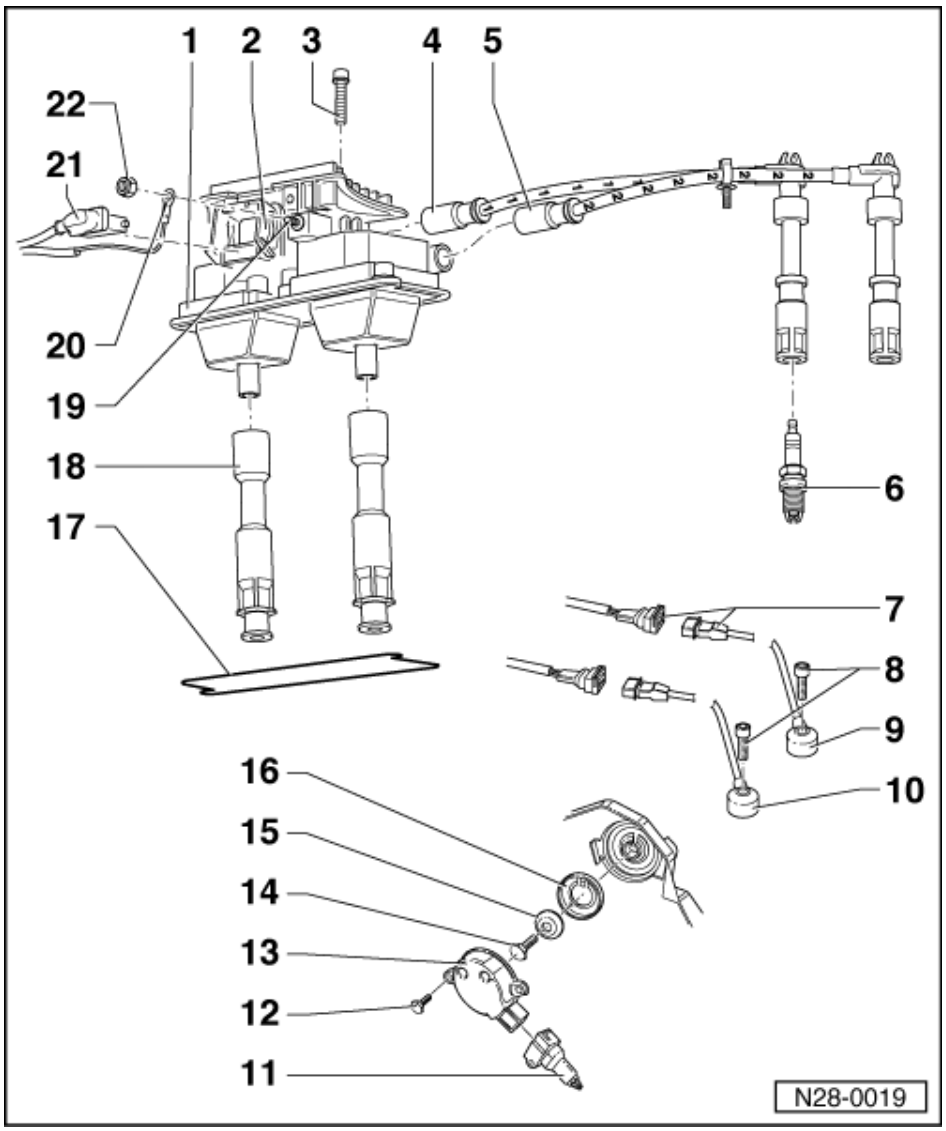
1 Ignition coils (N, N128)
- With output stage (N122)
- Checking => Page 156

2 Locking device
- For connector

3 6 Nm

4 Spark plug connector
- for Cyl. 1
- 4...6 kω

5 Spark plug connector
- For Cyl. 2
- 4...6 kω



6 Spark plug, 30 Nm

- Remove and install with 3122B
- Type and electrode gap
  => Page 155 , test data, spark plugs

7 3-pin connector

- Contacts gold plated
- Green for knock sensor 1 (G61)
- Blue for knock sensor 2 (G66)

8 20 Nm

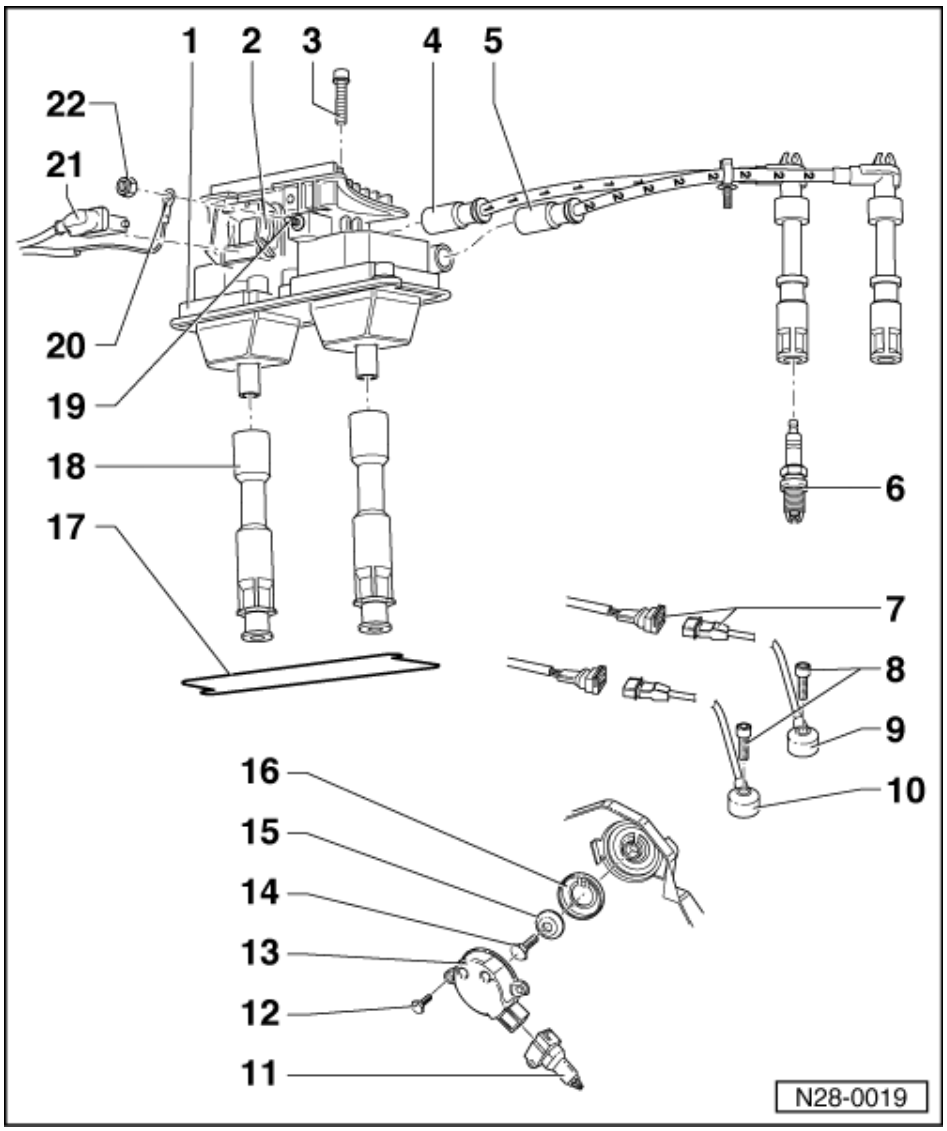
- Tightening torque influences the function of the knock sensor

9 Knock sensor 1 (G61)*

- Sensor and connector contacts are gold-plated
- Checking => Page 161

10 Knock sensor 2 (G66)*

- Sensor and connector contacts are gold-plated
- Checking => Page 161



11 Connector
- Black, 3-pin
- For Hall sender (G163)

12 10 Nm

13 Hall sender (G163)*
- Checking => Page 155

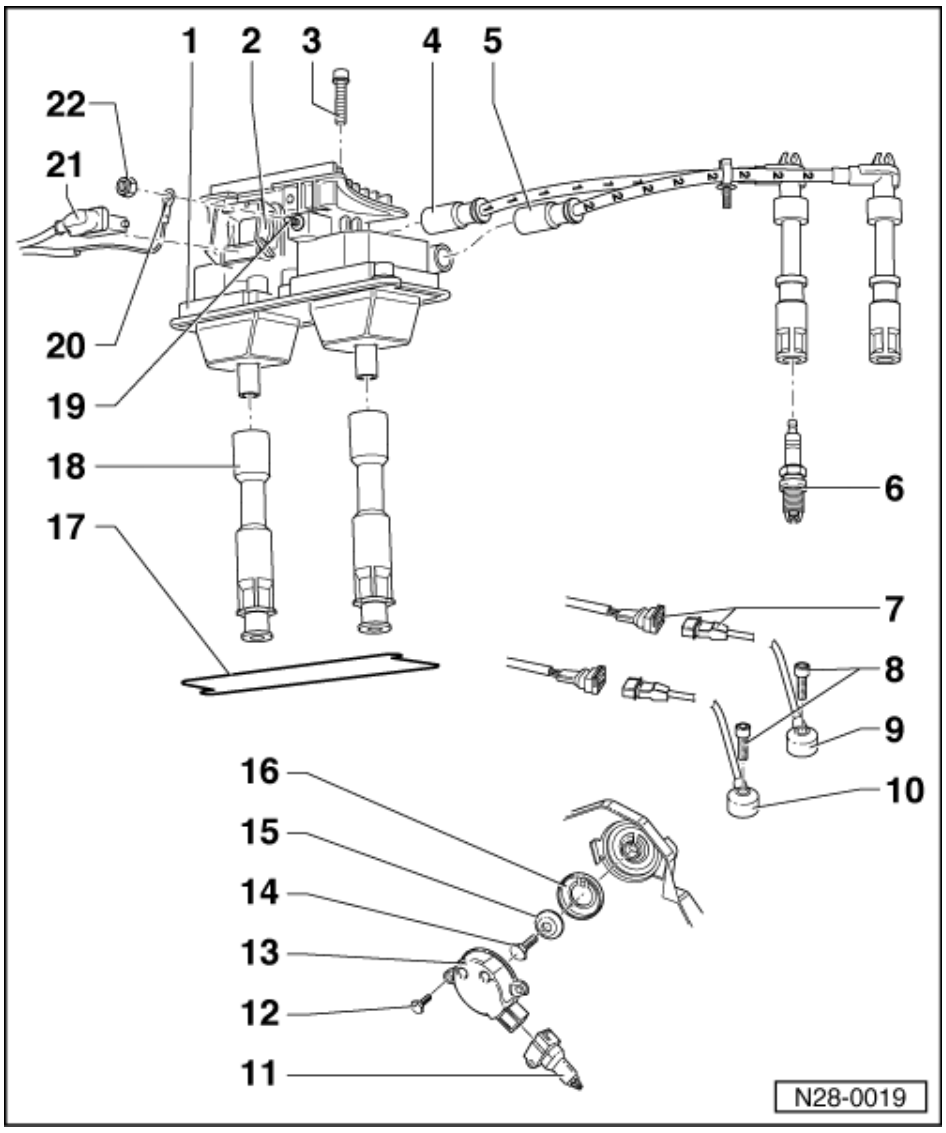
14 25 Nm

15 Washer
- Conical

16 Hood
- With four openings
- For Hall sender (G163)
- When installing note fixing arrangement

17 Seal
- Renew if damaged

18 Spark plug connector
- 4...6 kω
- For Cyls. 3 and 4



19 Connecting stud

20 Earth wire

- Only loosen or tighten with ignition switched off

21 Connector

- Black, 5 pin

22 6 Nm

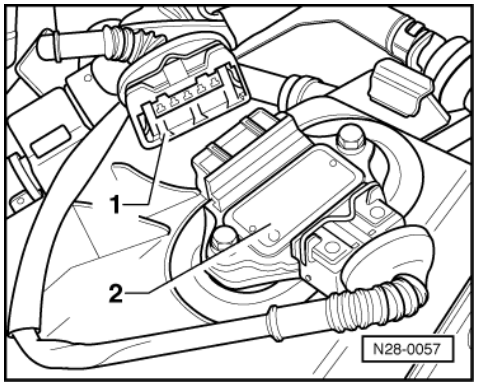
- Only loosen or tighten with ignition switched off

1.4 - Safety precautions

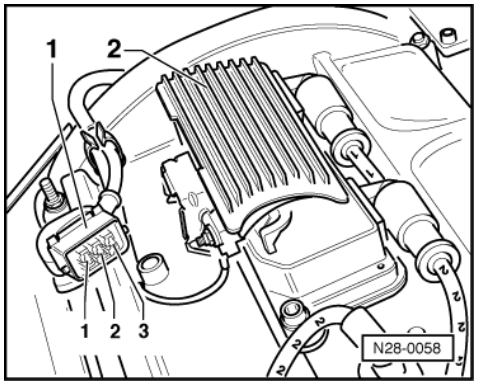
To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- If the engine is to be turned at starter speed, without starting, e.g. when checking compressions, pull connector off output stage:

Engines with turbocharger:



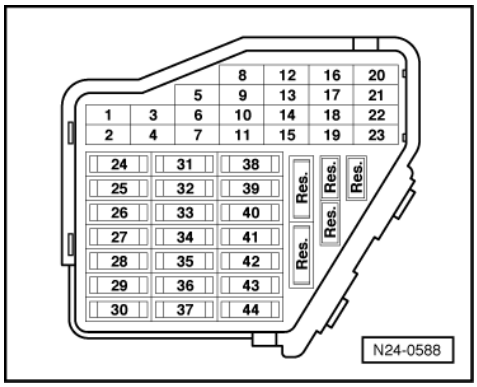
- -> Pull 5 pin connector -1- off output stage for ignition coils -2-.



Engines without turbocharger:

- -> Pull 3 pin connector -1- off output stage for ignition coils -2-.

Continuation for all engines



- -> Remove fuse 32

Note:

Removing fuse 32 interrupts the voltage supply to the injectors.

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 codes	ARG, APT	ANB, APU	APU
Firing order	1-3-4-2	1-3-4-2	1-3-4-2
Spark plugs1)			
VW/Audi	---	101 000 063 AA	---
Manufacturer's code	---	PFR 6 Q	---
VW/Audi	101 000 033 AA	---	101 000 051 AA
Manufacturer's code	BKUR 6 ET-10	---	F 7 LTCR
VW/Audi	101 000 041 AC	---	---
Manufacturer's code	14 FGH-7 DTURX	---	---
Electrode gap	0.9...1.1 mm	max. 0.8 mm	0.9...1.1 mm
Tightening torque	30 Nm	30 Nm	30 Nm

1) The up-to-date figures and the spark plug change intervals:

=> Exhaust emissions test binder

2) Remove and install spark plugs with 3122B

1.6 - Checking Hall sender

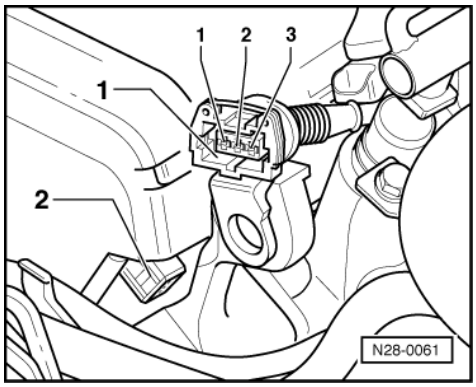
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- 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

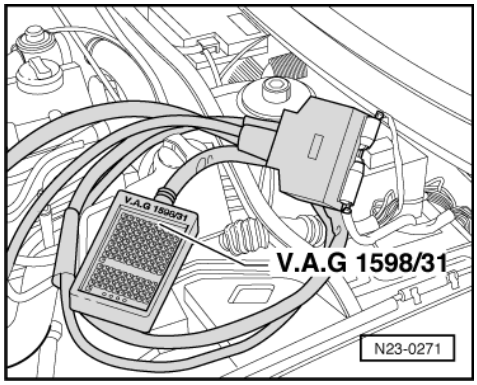
- The battery voltage must be at least 11.5 V.

Test sequence

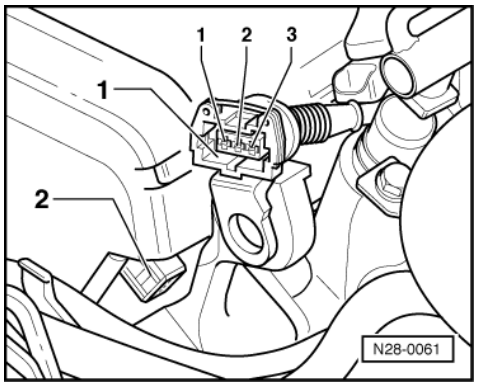


- -> Pull 3 pin connector -1- off Hall sender -2-.
- Connect multimeter to measure voltage using aux. cables from V.A.G 1594 to the outer contacts of the connector.

- Switch on ignition.
  Specification: min. 4.5 V
- 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 and connector using current flow diagram.
  Contact 1+socket 98
  Contact 2+socket 86
  Contact 3+socket 108
  Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.

If no wiring fault is detected and voltage was present between contacts 1+3:

- Renew Hall sender (G163).

If no wiring fault is detected and no voltage was present between contacts 1+3:

- Renew engine control unit => Page 128 .

1.7 - Checking ignition coils with output stage

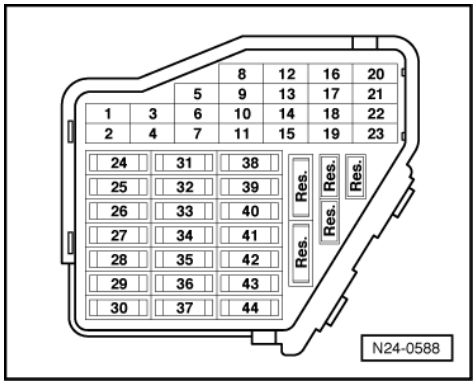
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- 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
- Current flow diagram

Check conditions

- The battery voltage must be at least 11.5 V.
- Hall sender must be OK, checking

=>Page 155 .
- Engine speed sender must be OK, checking Page 100 .
- Earth connections => Page 146 , item 6 , must be OK.



- -> Fuse 32 must be OK.

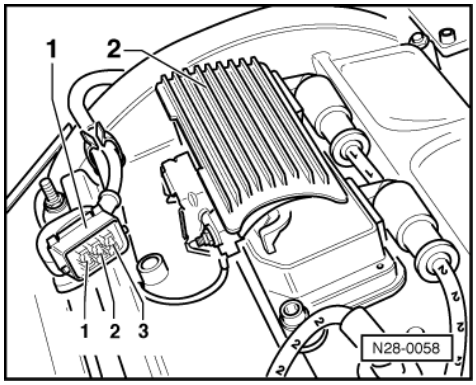
Engines without turbocharger:

Engine code AEB => Page 159

Notes:

- Ignition coils and output stages are a combined unit.
- The ignition coil primary resistance cannot be measured.
- The secondary resistance can be measured first when the ignition cables have been connected to the ignition coil. To do this measure between the spark plug connectors of the relevant ignition coil. For this measurement the complete suppression resistance of the complete ignition cable is also measured.

Checking voltage supply

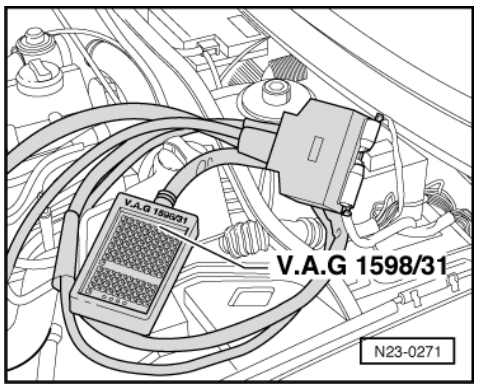


- Pull connector off injectors.
- -> Pull 3 pin connector -1- off output stage for ignition coils -2-.
- Connect diode test lamp V.A.G 1527 using auxiliary cables from V.A.G 1594 to contact 2 and earth.
- Operate starter.
  LED must flicker

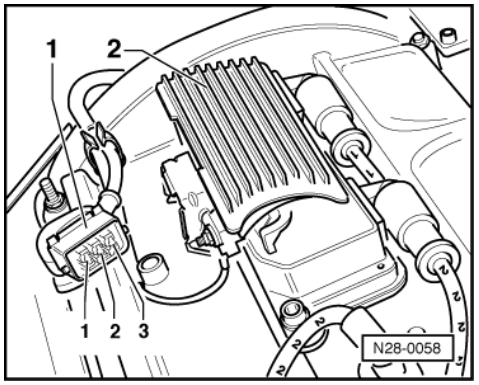
If no voltage is present:

- Switch off ignition.
- Check wiring => Page 158

Checking wiring



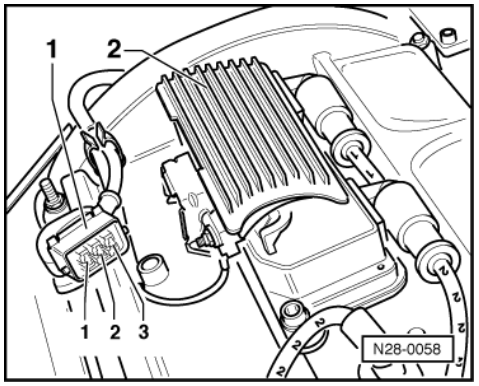
- -> Connect test box V.A.G 1598/31 to control unit wiring harness. The engine control unit remains disconnected.



- -> Check wiring between test box and 3-pin connector for open circuit using current flow diagram.
  Contact 1 and socket 103
  Contact 3 and socket 102
  Wire resistance: Max. 1.5 ω
- Check wire between 3-pin connector contact 2 and fuel pump relay for open circuit using current flow diagram.
  Wire resistance: Max. 1.5 ω

Checking activation

- Pull connector off injectors.



- -> Pull 3 pin connector -1- off output stage for ignition coils -2-.
- Connect diode test lamp V.A.G 1527 using aux. cables from V.A.G 1594 to contacts 1 and earth.
- Operate starter and check ignition signal from engine control unit.
  LED must flicker
- Repeat check between contact 3 and earth.

The LED does not flicker:

- Check wiring => Page 158

If no wiring fault is detected and voltage was present between contact 2 and earth:

- Renew engine control unit => Page 128 .

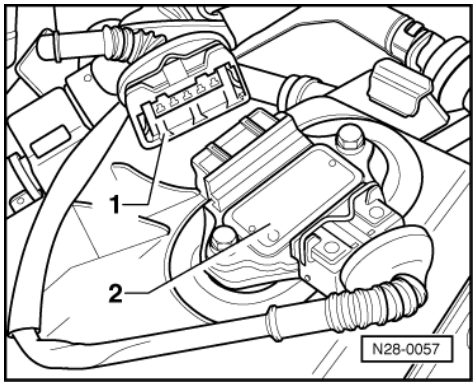
If voltage supply and activation is OK:

- Renew ignition coils and output stage => Page 150 , item 1 .

Engines with turbocharger:

Checking activation of output stage

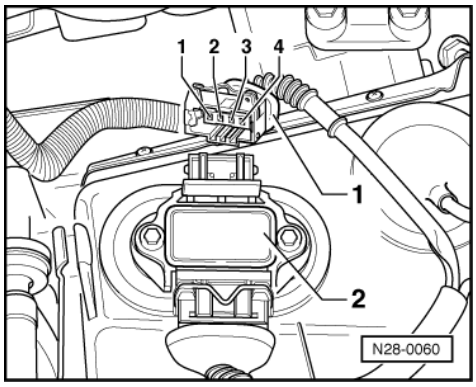
- Pull connector off injectors.



- -> Pull 5 pin connector -1- off output stage for ignition coils -2-.
- Connect diode test lamp V.A.G 1527 using aux. cables from V.A.G 1594 to contacts 1+3.
- Operate starter and check ignition signal from engine control unit.
  LED must flicker
- Repeat check between contacts 2, 4, 5 and contact 3 (earth).

The LED does not flicker:

- Check wiring => Page 160

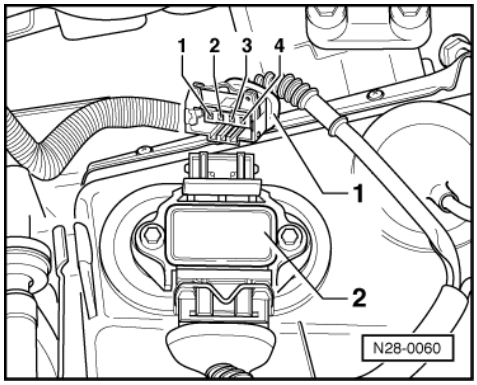


Checking output stage

- Reconnect 5 pin connector on output stage.
- -> Pull 4 pin connector -1- off output stage for ignition coils.
- Connect diode test lamp V.A.G 1527 using aux. cables from V.A.G 1594 to contact 1 of output stage -2- and battery positive (+).
- Operate starter.
  LED must flicker

- Repeat check between contacts 2, 3 and 4.

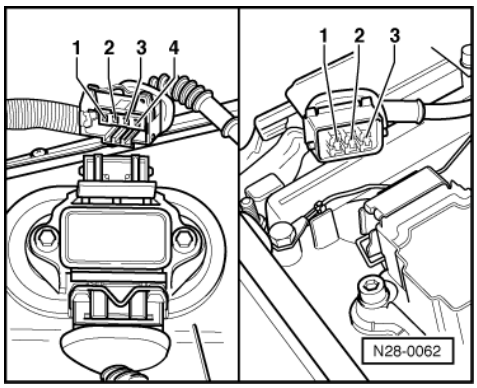
The LED does not flicker:



- Renew output stage => Page 146 , item 2 .

Checking ignition coils

- -> Connect diode test lamp V.A.G 1527 with auxiliary cables from V.A.G 1594 to contact 1 of 4-pin connector and to battery negative (-)
  LED must light up.
- Operate starter.
  LED must flicker.
- Repeat check between contacts 2, 3 and 4.



If LED does not flicker on one contact:

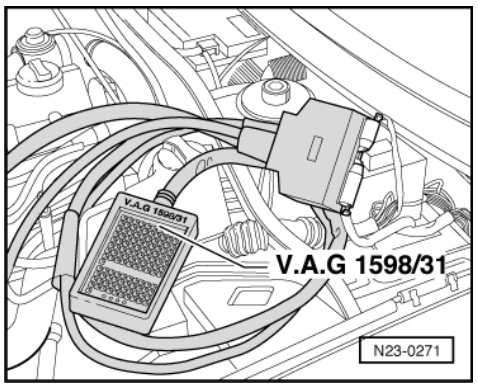
- -> Check wire between 4 pin connector and 3 pin connector of ignition coil for open circuit according to current flow diagram.
  Wire resistance: Max. 1.5 ω

If no fault in wire is detected:

- Renew ignition coil.

Checking wiring

- Switch off ignition.



- -> 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 5-pin connector for open circuit according to current flow diagram.
  Contact 1 and socket 94
  Contact 2 and socket 103
  Contact 3 and socket 2
  Contact 4 and socket 95
  Contact 5 and socket 102
  Wire resistance: Max. 1.5 ω

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.
- Only gold-plated contacts may be used when servicing the knock sensor connector contacts.

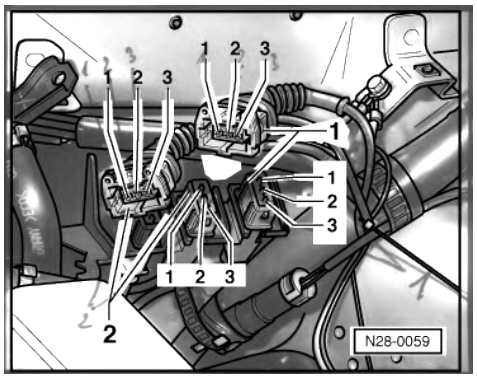
Special tools, workshop equipment, testers, measuring instruments and auxiliary items required

- 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

- Self-diagnosis must have recognized a fault on one or both knock sensors.

Checking resistances and wiring



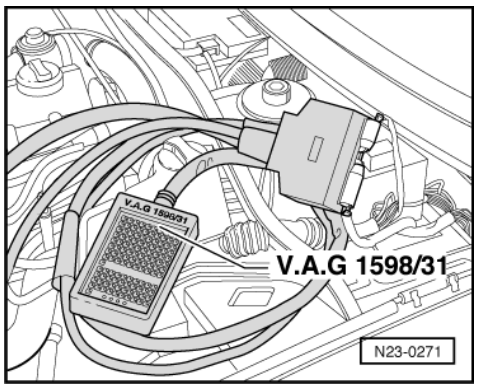
- -> Detach 3-pin connector to knock sensor 1 (G61 -green) -1- and/or 3-pin connector to knock sensor 2 (G66 -blue) -2-.
- Measure resistance between the contacts 1+2, 1+3 and 2+3 at connections to knock sensors.

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	106	107
Contact 2+socket	99	99
Contact 3+socket	108	108

Wire resistance: Max. 1.5 ω

- Additionally check wires for short to one another.

If no fault is detected in the pipes:

- Loosen knock sensor and tighten again to 20 Nm.
- 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
  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

Engines fulfilling D4 standard only

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 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 3 .)

-> 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 total number of misfires in display zone 3:
  Specification: 0...5
- Check misfire recognition status in display zone 4:
  Specification: activated

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:

- Check the spark plugs and ignition/HT cables
  => Page 146 , Removing and installing parts of the ignition system
- Check ignition coils with output stages
  => Page 156
- Check injectors => Page 101