



Passat 1997 ➤

Motronic injection and ignition system (1.8 ltr. engine)								
Engine ID	ADR	AEB						

Edition 01.1997



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

Passat 1997 ➤

Motronic injection and ignition system (1.8 ltr. engine)

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system

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



Contents

01 - Self-diagnosis	1
1 General to self-diagnosis	1
1.1 General to self-diagnosis	1
1.2 Features of self-diagnosis	1
1.3 Technical data of self-diagnosis	1
1.4 Connecting fault reader V.A.G 1551 and selecting engine control unit	2
2 Fault memory	4
2.1 Fault memory	4
2.2 Interrogating and erasing fault memory	4
3 Fault table, fault codes 00515...01262	6
3.1 Fault table, fault codes 00515...01262	6
4 Fault table, fault codes 16486...18020	14
4.1 Fault table, fault codes 16486...18020	14
5 Final control diagnosis	25
5.1 Final control diagnosis	25
5.2 Performing final control diagnosis	25
6 Measured value blocks	32
6.1 Measured value blocks	32
6.2 Safety precautions	32
6.3 Read measured value block	32
6.4 Evaluating measured value blocks	33
6.5 Evaluating display zone 8, display zones 2 and 3 - Lambda learnt values	41
24 - Mixture preparation, Injection	52
1 Servicing injection system	52
1.1 Servicing injection system	52
1.2 Fitting locations overview	52
1.3 General notes on injection	58
1.4 Removing and installing parts of the injection system	59
1.5 Dismantling and assembling air cleaner	74
1.6 Dismantling and assembling fuel rail with injectors	77
1.7 Removing and installing parts of intake manifold change-over	78
1.8 Removing and installing throttle valve control part	83
1.9 Safety precautions	85
1.10 Rules for cleanliness	86
1.11 Technical data	86
2 Checking components	87
2.1 Checking components	87
2.2 Checking Lambda probe heating	87
2.3 Checking air mass meter	89
2.4 Checking throttle valve control part	92
2.5 Checking coolant temperature sender	98
2.6 Checking intake air temperature sender	102
2.7 Checking engine speed sender	105
2.8 Testing altitude sender	106
2.9 Checking injectors	107
2.10 Checking fuel pressure regulator and holding pressure	112
2.11 Checking intake air system for leaks (unmetered air)	114
3 Checking functions	115
3.1 Checking functions	115
3.2 Idling check	115
3.3 Adapting idling speed	117
3.4 Checking Lambda control	118



3.5	Checking engine operating mode	122
3.6	Checking intake manifold change-over	124
3.7	Checking driving characteristics after a cold start	125
4	Engine control unit	126
4.1	Engine control unit	126
4.2	Checking control unit voltage supply	126
4.3	Procedure after voltage supply open circuit	128
4.4	Replacing engine control unit	129
4.5	Coding engine control unit	130
4.6	Coding variations of engine control unit	131
4.7	Adapting engine control unit to throttle valve control part	131
4.8	Adapting engine control unit to electronic immobilizer	132
5	Checking additional signals	134
5.1	Checking additional signals	134
5.2	Checking speed signal	134
5.3	Checking air conditioner compressor signal	135
5.4	Checking ignition retardation during gear selection	137
5.5	Checking driving range signal	138
28	- Ignition system	140
1	Servicing ignition system	140
1.1	Servicing ignition system	140
1.2	General notes on ignition system	140
1.3	Removing and installing parts of the ignition system	141
1.4	Safety precautions	148
1.5	Test data, spark plugs	149
1.6	Checking Hall sender	149
1.7	Checking ignition coils with output stage	150
1.8	Checking knock sensor	155



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 between 60 different fault codes => 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 or the vehicle system tester V.A.G 1552 => Page 4 .

The fault memory must be erased after the faults has been eliminated => Page 4 .

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 is in the fault reader V.A.G 1551 and the vehicle system tester V.A.G 1552 instruction manuals.

1.3 - Technical data of self-diagnosis

Equipment

- ◆ The data transfer between control unit and fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 is carried out in the operating mode "Rapid data transfer".
- ◆ The fault memory is a non-volatile memory and is therefore dependent on the voltage supply.

Control unit identification

The control unit version is displayed when the fault reader V.A.G 1551 or the vehicle system tester V.A.G 1552 is connected and engine electronics control unit selected => Page 2 .



Selectable functions when using the fault reader V.A.G 1551 or V.A.G 1552

The prerequisites for selecting the desired functions can be taken from the following table.

Function		Prerequisite		
		Engine stopped, ignition switched on	Engine running at idling speed	Vehicle being driven
Functions on fault reader V.A.G 1551 or on system tester V.A.G 1552				
01	Interrogate control unit version	yes	yes	yes
02	Interrogate fault memory	yes1)	yes	yes
03	Final control diagnosis	yes	no	no
04	Basic setting2)	yes	yes	no
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
11	Login procedure	no	yes	no

1) Only carry out with ignition switched on, when engine does not start.

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

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

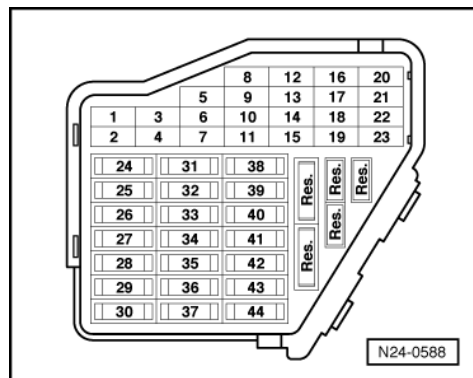
Special tools, testers, measuring instruments and auxiliary items required

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

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.

Test conditions

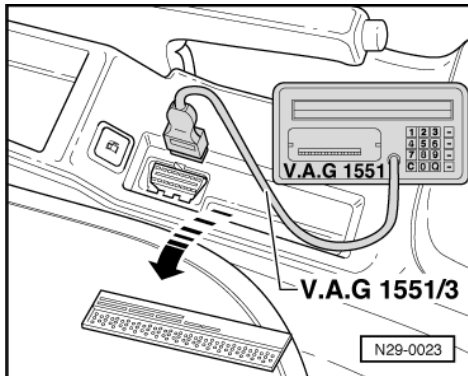


- -> The fuses 12, 28, 29, 32 and 34 must be OK.
- The battery voltage must be at least 11.5 V.
- Earth connections on right engine carrier and on body OK.



(Earth connection body: =>Page 54 , Item 19).

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 => Fault finding programme in "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.

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

```
8B0 907 558 F 1.8L R4/5V MOTR HS D01
Coding 04001      WSC XXXXX
```

- ◆ 8B0 907 558F = Part No. of the control unit (for latest control unit version see parts catalogue)
- ◆ 1.8 ltr. = Engine displacement
- ◆ R4/5V = Engine configuration (4-Cyl. in-line engine, 5 valve turbo)
- ◆ R4/5VT = Engine configuration (4-Cyl. in-line engine, 5 valve)
- ◆ MOTR = System designation (Motronic)
- ◆ HS = Manual gearbox (hand change)
AT = Automatic gearbox
- ◆ D01 = Programme level number
- ◆ Coding xxxxx = Control unit coding, coding table => 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 129.

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.

2 - Fault memory

2.1 - Fault memory

2.2 - Interrogating and erasing fault memory

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

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 2.)

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.
- Eliminate the printed out faults using the appropriate fault table:
Fault codes 00515...01262 => Page 14

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.

Note:

If the self-diagnosis has not detected a fault, use the appropriate fault table in "Fault finding engine" binder for further fault finding.

3 - Fault table, fault codes 00515...01262

3.1 - Fault table, fault codes 00515...01262

Notes:

- ♦ The fault tables are listed according to the 5 digit fault code on the left.
Fault code 00515...01120 from Page 21
- ♦ 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).

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
No fault recognized!	If a complaint exists: Fault not recognised during self-diagnosis	---	Continue fault finding according to fault table, in "Engine fault finding" binder.

Fault code 00515...01120

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 Open circuit/short to positive	- Wiring open circuit or short to positive - Sender disc of Hall sender twisted - -G40 defective	- Engine has no performance at full throttle - Emission values not OK - Higher fuel consumption	- Check G40 =>Page 149
Short to earth	- Short to earth - -G40 defective		



005281) Altitude sender -F96 Signal too large	- Wiring open circuit or short to positive - -F96 defective	- Possibly poor starting behaviour	- Check F96 =>Page 106
Signal too small	- Short to earth - Voltage supply for -F96 interrupted - -F96 defective	- Reduced charge pressure (safety limit for turbocharger revs)	

1) Only engine code AEB

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

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00532 Supply voltage Signal too large	- Voltage supply above 16 V (alternator defective) - Excessive voltage through starting aid	- Engine control unit rendered inoperative	- Check alternator Check voltage supply of engine control unit => Page 126
Signal too small	- Voltage supply less than 10 V - Engine control unit has poor earth connection - Battery discharged - Current draw when ignition is off	- Idling speed not in specified range	- Check engine control unit voltage supply => Page 126 Check charge state of battery
		- Engine control unit learnt values lost	- Match engine control unit to throttle valve control part => Page 131 .

Note to fault code 00532:

- ◆ If the fault is indicated as a sporadic fault, ignore the fault information! This fault can be stored when the engine is running for a long time at idling with lots of electrical consumers switched on and the battery is heavily discharged.
- ◆ The fault type "Signal too small" will be stored 60 seconds after starting if the voltage supply drops below 10.08 V for longer than 2 seconds (the control unit will not function below 6.0 V).

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00543 Maximum revs exceeded	- Speed was above 7100 rpm (e.g. missed gear)	- Possible damage to valves and pistons (contact)	- Check engine for damage and erase fault memory
005441) Maximum charge pressure exceeded	- Hoses interchanged, not connected, blocked, leaking - Turbocharger vacuum unit defective	- Output interruption (overrun cut-off until charge pressure drops to uncritical level)	- Check charge pressure control: => Repair group 21; Checking charge pressure system; Checking charge pressure control
	- Solenoid valve for charge pressure control (N75) defective		- Check N75 => Page 25 , Final control diagnosis



	- Altitude sender F96 defective	- Possible poor starting behaviour - Reduced charge pressure (safety limit for turbocharger revs)	- Check F96 =>Page 106
--	---------------------------------	--	------------------------

1) Only engine code AEB

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00561 Mixture adaption Adaption limit (add) exceeded	- Fuel tank empty - Fuel pressure too low - Fuel pump defective - Incorrect signal from air mass meter (G70) - Unmetered air to G70 - Exhaust system leaking up to catalyst - Activated charcoal filter solenoid valve 1 (N80) sticking - Injectors defective (coked-up, blocked)	- Vehicle jerks in certain circumstances - Increased fuel consumption - Rough idling in certain circumstances	- Fill fuel tank Check fuel pressure regulator => Page 107
Adaption limit (mul) exceeded			
Continued on next page			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00561 Mixture adaption Adaption limit (add) not reached	- Fuel pressure too high - Incorrect signal from air mass meter (G70) - Fuel in engine oil (short journeys) - Injector(s) defective (not closing fully)	- Vehicle jerks in certain circumstances - Increased fuel consumption - Rough idling in certain circumstances - Black exhaust smoke, spark plugs coked-up	- Check fuel pressure regulator => Page 89 - Motorway drive for 15 min. or carry out oil change Check injectors => Page 107
Adaption limit (mul) not reached			

Note on fault code 00561:

- ♦ add = additive - The fault (e.g. unmetered air) has less effect as engine speed increases.
- ♦ mul = multiplicative - The fault (e.g. injector fault) has more effect as the engine speed increases.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
005751) Intake manifold pressure Control limit not reached	- Air mass meter signal (G70) too small	- Increased output	- Check G70 => Page 89
	- Unmetered air between air mass meter (G70) and Turbo-charger		- Check intake system for leaks (unmetered air) => Page 114
	- Charge pressure control valve vacuum unit on turbocharger sticking - Short or wiring open circuit to N75	- Reduced output	- Check charge pressure control: => Repair group 21; checking charge pressure system

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



	- Solenoid valve for charge pressure control (N75) defective		- Check N75 => Page 25 , Final control diagnosis
Continued on next page			

1) Only engine code AEB

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
005751) Intake manifold pressure Control limit exceeded	- Air mass meter signal (G70) too large	- Reduced output	- Check G70 => Page 89
	- Charge pressure control valve vacuum unit on turbocharger sticking	- Increased output	- Check charge pressure control: => Repair group 21; checking charge pressure system
	- Solenoid valve for charge pressure control (N75) defective		- Check N75 => Page 25 , Final control diagnosis

1) Only engine code AEB

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Sender for throttle valve positioner - G1271) Signal too small	- Short to earth in signal wire between G127 and engine control unit (J220) - Fault in the voltage supply for G127 - G127 defective - Signal input in engine control unit (J220) defective (control unit defective)	- Throttle valve positioner is switched off - engine runs with a mechanically determined quantity of air via the emergency running slot when idling (slightly increased idling speed) - Load change jolt when decelerating - Air conditioner compressor will not switch in until 1520 rpm	- Check G127 =>Page 92 , Checking throttle valve control part - Renew engine control unit =>Page 129 .
Continued on next page			

1) The throttle valve positioner (G127) is a component of the throttle valve control part (J338).

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
00670 Throttle valve positioner sender - G1271)			



Signal too large	<ul style="list-style-type: none"> - Open circuit or short to positive in the signal wire between G127 and engine control unit (J220) - G127 has a faulty earth - G127 defective 	<ul style="list-style-type: none"> - Throttle valve positioner is switched off - engine runs with a mechanically determined quantity of air via the emergency running slot when idling (slightly increased engine speed) - Increased idling speed - Load change jolt when decelerating - Air conditioner compressor will not switch in until 1520 rpm 	<ul style="list-style-type: none"> - Check G127 =>Page 92 , Checking throttle valve control part
Implausible signal	<ul style="list-style-type: none"> - Signal input in engine control unit (J220) defective (control unit defective) 	<ul style="list-style-type: none"> - Load change jolt when decelerating - Air conditioner compressor will not switch in until 1520 rpm 	<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .

1) The throttle valve positioner sender (G127) is a component of the throttle valve control part (J338). It informs the control unit of the position of the throttle valve positioner.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01119 Gear recognition signal Open circuit/short to positive	<ul style="list-style-type: none"> - Wiring open circuit or short to positive in the wiring to selector lever switch 	<ul style="list-style-type: none"> - Handling problems (gear shift jerk, load change jolt) - Idling speed not within tolerance - Idling speed fluctuates 	<ul style="list-style-type: none"> - Check wiring from engine control unit (J220) to selector lever switch: => Current flow diagrams, Electrical fault finding and Fitting locations binder
Short to earth	<ul style="list-style-type: none"> - Short to earth in the wiring to selector lever switch 		

Note on fault code 01119:

On vehicles with an automatic gearbox the engine control unit recognises whether the selector lever is in "P" or "N" or whether a gear is engaged via this signal.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
011201) Camshaft timing control 1 Mechanical fault	<ul style="list-style-type: none"> - Voltage supply for camshaft adjustment valve defective - Open circuit/short to earth or positive in the wiring between camshaft adjustment valve (N205) and engine control unit (J220) - N205 defective - Mechanical camshaft adjuster defective 	<ul style="list-style-type: none"> - Reduced output 	<ul style="list-style-type: none"> - Check N205 => Page 25 , final control diagnosis Check camshaft adjustment => Repair group 15; Servicing valve gear; Checking camshaft adjustment



	- Fuse 29 defective		- Check fuse
--	---------------------	--	--------------

1) Only engine code ADR

Note on fault code 01120:

The faults will not be stored until 10 minutes after starting and a coolant temperature of above 60 °C.

Fault code 01165...16487

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01165 Throttle valve control part -J338 Control limit not reached	<ul style="list-style-type: none"> - Throttle valve sticking - Throttle valve positioner sticking/mechanically damaged - Open circuit in the wiring for throttle valve positioner (V60) - V60 defective - Output for V60 in engine control unit (J220) defective (control unit defective) 	<ul style="list-style-type: none"> - Throttle valve positioner is switched off. Engine runs with a mechanically determined quantity of air via the emergency running slot when idling (slightly increased idling speed). - Increased idling speed - Load change jolt when decelerating - Air conditioner compressor will not switch in until 1520 rpm 	<ul style="list-style-type: none"> - Match engine control unit to the throttle valve control part => Page 129 .
Control limit exceeded			
Control difference			

Note on fault code 01165:

If fault "01165" is stored in fault memory, the fault "17953" will also be stored after the next time the vehicle is started.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
011821) Altitude adaption Signal outside tolerance	<ul style="list-style-type: none"> - Throttle valve sticking - Throttle valve positioner sticking/mechanically damaged 	<ul style="list-style-type: none"> - Starting difficulties - Poor throttle response - Problems in driving away 	<ul style="list-style-type: none"> - Check throttle valve control part=> Page 92
	<ul style="list-style-type: none"> - Incorrect throttle valve control part 		<ul style="list-style-type: none"> - Check part number
	<ul style="list-style-type: none"> - Unmetered air between air mass meter (G70) and throttle valve control part 		<ul style="list-style-type: none"> - Check intake system for leaks (unmetered air) => Page 114
	<ul style="list-style-type: none"> - Air cleaner blocked 		<ul style="list-style-type: none"> - Renew air cleaner

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01247 Activated charcoal filter solenoid valve 1 -N80			



Short to earth	- Short to earth in the wiring between N80 and engine control unit (J220) - N80 defective	- Possible jerking in part load range - Possible fuel smells in vehicle	- Check N80 => Page 25, final control diagnosis
Short to positive	- Short to positive in the wiring between N80 and engine control unit (J220) - N80 defective		
Output open	- Wiring open circuit between N80 and engine control unit (J220) - Voltage supply for N80 defective - N80 defective		
	- Fuse 29 defective		- Check fuse

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01249 No.1 cyl. injector -N30 Short to earth	- Short to earth in the wiring between N30 and engine control unit (J220) - N30 defective	- Rough engine running or engine stalls	- Check injectors => Page 25, final control diagnosis
Short to positive	- Short to positive in the wiring between N30 and engine control unit (J220) - N30 defective		
Output open	- Open circuit in the wiring between N30 and engine control unit (J220) - Voltage supply for N30 faulty - N30 defective		
	- Fuse 34 defective		- Check fuse

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01250 No. 2 cyl. injector -N31 Short to earth		see fault code 01249, No. 1 Cyl. for N31	
Short to positive			
Output open			
01251 No. 3 cyl. injector -N32 Short to earth		see fault code 01249, No. 1 Cyl. for N32	
Short to positive			
Output open			

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01252 No. 4 cyl. injector -N33 Short to earth		see fault code 01249, No. 1 Cyl. for N33	
Short to positive			



Output open	
-------------	--

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
01259 Fuel pump relay -J17 Open circuit/short to earth	- Short to earth or wiring open circuit in the wiring between J17 and engine control unit (J220) - Fault in the voltage supply for J17 - J17 defective	- With open circuit: Engine does not run - For short to earth: Engine runs normally however with ignition on a higher current draw, as the relay is permanently pulled-in and the fuel pump runs permanently, even when engine is not running	- Check fuel pump relay => Current flow diagrams, Electrical fault finding and Fitting locations Rectify short or open circuit using current flow diagram
Short to positive	- Short to positive in the wiring between J17 and engine control unit (J220)	- For short to positive: Engine does not run	- Check fuel pump relay => Current flow diagrams, Electrical fault finding and Fitting locations Rectify short or open circuit using current flow diagram

Note on fault code 01259:

If the fault "01259" is stored the faults "01247, 01249...01252, 01262, 16486, 17924 and additionally 17936 for ADR engine could also be stored as these components are supplied with voltage via the fuel pump relay.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
012621) Solenoid valve for charge pressure control -N75			
Short to earth	- Short to earth - -N75 defective	- Output interruption (overrun cut-off until charge pressure drops to uncritical level) - Charge pressure too high - Fault 0544, maximum charge pressure exceeded is stored	- Check N75 => Page 25 , final control diagnosis Check charge pressure control: => Repair group 21; checking charge pressure system
Short to positive	- Short to positive - -N75 defective	- Reduced output - Charge pressure too low	
Output open	- Wiring open circuit - -N75 defective - Fuse 29 defective		- Check fuse

1) Only engine code AEB



4 - Fault table, fault codes 16486...18020

4.1 - Fault table, fault codes 16486...18020

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16486 Air mass meter -G70 Signal too small	- Unmetered air between G70 and engine - Fault in the voltage supply to G70 - Wiring open circuit or short to earth in the signal wire between G70 and engine control unit (J220) - G70 defective	- Emergency running (replacement value from throttle valve angle and engine speed), therefore the driving characteristics will not change noticeably	- Locate and eliminate leaks Check G70 => Page 89
	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .
	- Fuse 29 defective		- Check fuse

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16487 Air mass meter -G70 Signal too great	- Short to positive in the signal wire between G70 and engine control unit (J220) - Fault in the earth for G70 - G70 defective	- Emergency running (replacement value from throttle valve angle and engine speed), therefore the driving characteristics will not change noticeably	- Check G70 => Page 89
	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .

Fault code 16496...16507

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16496 Intake air temperature sender - G42 Signal too small	- Short to earth in the wiring between G42 and engine control unit (J220) - G42 defective	- Emergency running (replacement value constant 19.5 °C)	- Check G42 =>Page 102
	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .

Note on fault code 16496:

- ◆ The fault "Signal too small" will be stored at idling approx. 3 minutes after starting.



- ♦ The fault could also be that the intake air temperature sender connector and twin path intake manifold change-over valve connector have been interchanged.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16497 Intake air temperature sender - G42 Signal too large	<ul style="list-style-type: none"> - Wiring open circuit or short to positive in the wiring between G42 and engine control unit (J220) - G42 defective - Fault in earth to G42 	<ul style="list-style-type: none"> - Emergency running (replacement value constant 19.5 °C) 	<ul style="list-style-type: none"> - Check G42 =>Page 102
	<ul style="list-style-type: none"> - Signal input in engine control unit defective (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16500 Coolant temperature sender - G62 Implausible signal	<ul style="list-style-type: none"> - G62 supplies an implausible signal due to loose contact or corrosion caused by moisture in connector 	<ul style="list-style-type: none"> - Cold starting problems at very low temperatures - Handling problems in warm-up phase - Increased fuel consumption - Increased exhaust gas emissions 	<ul style="list-style-type: none"> - Check G62 =>Page 98
	<ul style="list-style-type: none"> - Coolant thermostat defective 		<ul style="list-style-type: none"> - Check coolant thermostat: => Repair group 19; Removing and installing parts of cooling system, Dismantling and assembling coolant pump
	<ul style="list-style-type: none"> - Signal input in engine control unit defective (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .

Note on fault code 16500:

A comparison is carried out in the range from 20 °C to 60 °C with a model path which is stored in the control unit. The model path increases slower than the real value. If the real values are too slow because of a fault at some time the real value and the model value will correspond with each other. The engine control unit will recognise this fault as not plausible.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16501 Coolant temperature sender - G62			



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Signal too small	<ul style="list-style-type: none"> - Short to earth in the wiring between G62 and engine control unit (J220) - G62 defective 	<ul style="list-style-type: none"> - Cold starting problems at very low temperatures - Handling problems in warm-up phase - Increased fuel consumption - Increased exhaust gas emissions 	<ul style="list-style-type: none"> - Check G62 =>Page 98
	<ul style="list-style-type: none"> - Signal input in engine control unit defective (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16502 Coolant temperature sender - G62 Signal too great	<ul style="list-style-type: none"> - Wiring open circuit or short to positive in the wiring between G62 and engine control unit (J220) - G62 defective - Fault in earth to G62 	<ul style="list-style-type: none"> - Cold starting problems at very low temperatures - Handling problems in warm-up phase - Increased fuel consumption - Increased exhaust gas emissions 	<ul style="list-style-type: none"> - Check G62 =>Page 98
	<ul style="list-style-type: none"> - Signal input in engine control unit defective (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .

Note on fault codes 16500, 16501 and 16502:

As soon as a fault is stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine (starting temperature substitute value) and calculates the engine temperature according to a predetermined model (an increase of 5.25 °C every 65 seconds). After a certain period, a fixed substitute value will be adopted when the engine has reached operating temperature. This fixed replacement value is also dependent on the intake air temperature.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16505 Throttle valve potentiometer - G691) Implausible signal	<ul style="list-style-type: none"> - Moisture or corrosion in connector on G69 - G69 defective 	<ul style="list-style-type: none"> - Minor misfiring when accelerating - Idling control characteristics unstable - Load change jolt when decelerating 	<ul style="list-style-type: none"> - Check G69 =>Page 92 , check throttle valve control part
16506 Throttle valve potentiometer - G691) Signal too small			



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
	<ul style="list-style-type: none"> - Short to earth in signal wire between G69 and engine control unit (J220) - Fault in voltage supply system for G69 - G69 defective 	<ul style="list-style-type: none"> - Minor misfiring when accelerating - Load change jolt when decelerating 	<ul style="list-style-type: none"> - Check G69 =>Page 92, Check throttle valve control part

1) The throttle valve potentiometer (G69) is a component of the throttle valve control part (J338).

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16507 Throttle valve potentiometer - (G691) Signal too large	<ul style="list-style-type: none"> - Open circuit or short to positive in signal wire between G69 and engine control unit (J220) - Fault in the earth for G69 - G69 defective 	<ul style="list-style-type: none"> - Minor misfiring when accelerating - Load change jolt when decelerating 	<ul style="list-style-type: none"> - Check G69 =>Page 92, check throttle valve control part

1) The throttle valve potentiometer (G69) is a component of the throttle valve control part (J338).

Note on fault code 16505:

The air throughput (air mass) is compared at the particular speed with the throttle valve angle.

Notes on fault codes 16505, 16505 and 16507:

- ◆ As soon as a fault is recognised the control unit will use a replacement value worked out from the speed (rpm) and the air mass drawn in.
- ◆ If a throttle valve potentiometer and air mass meter fault occur at the same time, an emergency running function is not possible. Result: Engine stops.

Fault code 16515...16885

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16514 Bank 1, Lambda probe 1 Electrical fault in current circuit	<ul style="list-style-type: none"> - Corrosion caused by moisture in the probe heating connector or Lambda probe (G39) - Short between Lambda probes signal wire and Lambda probes earth wire - Signal voltage amplitude too small (G39 contaminated or probe slots blocked, soiled) 	<ul style="list-style-type: none"> - Lambda regulation goes onto fixed settings - Poor idling - Exhaust emissions not OK. - Increased fuel consumption 	<ul style="list-style-type: none"> - Check Lambda regulation =>Page 118 Rectify short or wiring open circuit using current flow diagram

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16515 Bank 1, Lambda probe 1			



Voltage too low	- Short to earth or screening in the Lambda probes signal wire - Short to earth or screening in Lambda probes earth wire or to screening - Lambda probe (G39) defective	- Lambda regulation goes onto fixed settings - Poor idling - Emission figures not OK - Increased fuel consumption	- Check Lambda regulation =>Page 118 Rectify short or wiring open circuit using current flow diagram
-----------------	---	--	---

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16516 Bank 1, Lambda probe 1 Voltage too great	- Short to positive in the Lambda probes signal wire - Short to positive in the Lambda probes earth wire - Lambda probe (G39) defective	- Lambda regulation goes onto fixed settings - Poor idling - Increased fuel consumption - Spark plugs coke-up - Emission figures not OK.	- Check Lambda regulation =>Page 118 Rectify short or wiring open circuit using current flow diagram

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16518 Bank 1, Lambda probe 1 No activity	- Corrosion caused by moisture in the probe heating connector or Lambda probe (G39) - Wiring open circuit between Lambda probes signal wire - Wiring open circuit in Lambda probes earth wire - Probe heating not functioning - Lambda probe (G39) defective	- Lambda regulation goes onto fixed settings - Poor idling - Increased fuel consumption - Emission figures not OK	- Check Lambda regulation =>Page 118 Rectify short or wiring open circuit using current flow diagram
16519 Bank 1, Lambda probe 1 Electrical fault in heater current circuit	- Wiring open circuit or short to earth	- Lambda probe heating not functioning	- Check Lambda probe heating=>Page 87

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16705 Engine speed sender -G28 Implausible signal	- Metal particles on G28 - Gap from G28 to sender wheel larger than 2.3 mm	- Engine misfires	- Check G28 =>Page 105

Note on fault code 16705:

- ◆ When the number of signals per crankshaft rotation starting from the reference mark gap is incorrect (60 signals), the fault "Implausible signal" will be set.
- ◆ Metal particles can cause additional signals to be generated.
- ◆ Signals may not be generated or be too small and therefore not recognised if the sender gap to sender wheel is too large or the sender wheel is damaged.
- ◆ The signals can be irregular if the sender wheel is loose.



- ◆ Interference signals can cause additional signals to be recognised.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16706 Engine speed sender -G28 No signal	<ul style="list-style-type: none"> - Signal wire has open or short circuit to earth or short to positive - Earth wire has open or short to positive - G28 defective - Wiring open circuit in screening from G28 	<ul style="list-style-type: none"> - Engine will not start - Engine stalls 	<ul style="list-style-type: none"> - Check G28 =>Page 105
	<ul style="list-style-type: none"> - Signal input in engine control unit defective (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16711 Knock sensor 1 -G61 Signal too small	<ul style="list-style-type: none"> - Knock sensor loose or corrosion on connector - Wiring open circuit or short to positive or to signal wire screening between knock sensor and engine control unit (J220) - Wiring open circuit in the sender earth wire between knock sensor and engine control unit (J220) - Knock sensor defective 	<ul style="list-style-type: none"> - Too high fuel consumption - Performance problems 	<ul style="list-style-type: none"> - Loosen G61 and tighten again to 20 Nm - Check knock sensor => Page 155
	<ul style="list-style-type: none"> - Signal input in engine control unit defective (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit =>Page 129 .
16716 Knock sensor 2 -G66 Signal too small			see fault code 16711, as per G66

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16885 Vehicle speed signal Implausible signal	<ul style="list-style-type: none"> - Speedometer sender (G22) defective - Wiring open circuit or short between (G22) and speedometer (G21) - G21 defective - Wiring open circuit or short between dash panel insert and engine control unit (J220) - Short in the signal wire between speedometer and another control unit which use this speed signal 	<ul style="list-style-type: none"> - No air conditioner compressor switch-off in 1st gear at full throttle - Idling speed briefly deviates from the specified speed - Systems which use the speed signal not functioning correctly 	<ul style="list-style-type: none"> - Check speed signal => Page 134 - Rectify wiring open circuit or short using current flow diagram



	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .
--	--	--	---

Fault code 16989...17914

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
16989 Control unit defective	- Open circuit in earth wiring to control unit (J220) - Engine control unit defective	- Engine will not start	- Check earth connections according to current flow diagram Renew engine control unit (J220) => Page 129
17733 Knock control No. 1 Cyl. Control limit reached	- Poor fuel quality (less than 91 RON) - Abnormal noises with engine running (ancillary assemblies loose, brackets/bolts broken/sheared) - Wiring open circuit in screening from knock sensor 1 - Loose contacts in connectors - Knock sensor tightened to incorrect torque	- High fuel consumption - Performance problems - Engine runs rough - Maximum speed cannot be reached	- Fill tank with fuel of at least 91 RON Rectify cause of abnormal noises when engine is running Check knock sensor => Page 155 Check short or wiring open circuit using current flow diagram Loosen knock sensor and tighten again to 20 Nm

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17734 Knock control No. 2 Cyl. Control limit reached	see fault code 17733, for knock control No. 2 Cyl.		
17735 Knock control No. 3 Cyl. Control limit reached	see fault code 17733, for knock control No. 3 Cyl.		
17736 Knock control No. 4 Cyl. Control limit reached	see fault code 17733, for knock control No. 4 Cyl.		

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17913 Idling switch -F60			



Does not close/open circuit	- Throttle valve sticking - Throttle cable adjustment - Floor mat pressing on the accelerator pedal - Wiring open circuit or short to positive between F60 and engine control unit (J220) - F60 defective	- Load change jolt when decelerating - Idling speed is not within specifications	- Check F60 =>Page 92 , checking throttle valve control part Adjust accelerator cable => Repair group 20; Removing and installing fuel system components; Servicing throttle mechanism Servicing throttle mechanism Rectify wiring open circuit or short using current flow diagram
	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17914 Idling switch -F60 Does not open/short to earth	- Moisture in throttle valve control part (J338) connector - Short to earth between F60 and engine control unit (J220) - F60 defective	- Idling control goes onto fixed settings - Load change jolt when decelerating - Idling speed is not within specifications	- Check F60 =>Page 92 , check throttle valve control part Rectify short circuit using current flow diagram
	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179151) Idling system learning value Lower limit reached	- Unmetered air in front of throttle valve control part - Intake system blocked (air cleaner or intake channel)	- Idling speed too high	- Check intake system for leaks (unmetered air) => Page 114
179161) Idling system learning value Upper limit reached		- Reduced output	- Check intake system for leaks (unmetered air) => Page 114 Renew air cleaner

1) Only engine code ADR

Fault code 17920...18020

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179201) Intake manifold change-over valve - N156			



Short to positive	- Short to positive in the wiring between N156 and engine control unit (J220) - N156 defective	- Acceleration problems	- Check N156 => Page 124
	- Output for N156 in engine control unit (J220) defective (control unit defective)		- Renew engine control unit =>Page 129 .

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179231) Intake manifold change-over valve -N156 Short to earth	- Short to earth in wiring between N156 and engine control unit (J220) - N156 defective	- Acceleration problems	- Check N156 => Page 124
	- Output for N156 in engine control unit (J220) defective (control unit defective)		- Renew engine control unit =>Page 129 .

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179241) Intake manifold change-over valve - N156 Open circuit	- Open circuit in wiring between N156 and engine control unit (J220) - Fault in the voltage supply for N156 - N156 defective	- Acceleration problems	- Check N156 => Page 124
	- Fuse 29 defective		- Check fuse
	- Output for N156 in engine control unit (J220) defective (control unit defective)		- Renew engine control unit =>Page 129 .

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179341) Bank 1, variable valve timing -N205 Short to positive	- Short to earth or positive between camshaft adjustment valve (N205) and engine control unit (J220)	- Reduced output	- Rectify short circuit => Current flow diagrams, Electrical fault finding and Fitting locations binder



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
	- N205 defective		- Check N205 => Page 25 , Final control diagnosis Check camshaft adjustment => Repair group 15; Servicing valve gear; Checking camshaft adjustment
	- Fuse 29 defective		- Check fuse
	- Signal input in engine control unit defective (control unit defective)		- Renew engine control unit =>Page 129 .

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179351) Bank 1, variable valve timing -N205 Short to earth	- Short to earth between camshaft adjustment valve (N205) and engine control unit (J220)	- Reduced output	- Rectify short circuit => Current flow diagrams, Electrical fault finding and Fitting locations binder
	- N205 defective		- Check N205 => Page 25 , Final control diagnosis Check camshaft adjustment => Repair group 15; Servicing valve gear; Checking camshaft adjustment
	- Fuse 29 defective		- Check fuse

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
179361) Bank 1, variable valve timing -N205 Open circuit	- Wiring open circuit between camshaft adjustment valve (N205) and engine control unit (J220)	- Reduced output	- Rectify wiring open circuit: => Current flow diagrams, Electrical fault finding and Fitting locations binder Check N205 => Page 25 , final control diagnosis Check camshaft adjustment => Repair group 15; Servicing valve gear; Checking camshaft adjustment
	- Fuse 29 defective		- Check fuse

1) Only engine code ADR

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17953 Throttle valve control			



Malfunction	<ul style="list-style-type: none"> - Voltage supply or earth for throttle valve potentiometer (G69) and sender for throttle valve positioner (G127) defective - Open circuit in the signal wire for G69 and G127 - G69 and G127 defective - Positioner mechanics or throttle valve tight or sticking 	<ul style="list-style-type: none"> - Increased idling speed - Load change jolt when decelerating 	<ul style="list-style-type: none"> - Check throttle valve control part=> Page 92
-------------	--	--	--

Note on fault code 17953:

If other faults are stored in the fault memory which affect the throttle valve control part, e.g. the fault "00670", the fault "17953" could be a knock-on fault. In this case begin fault finding with the other faults.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17966 Throttle valve drive Electrical fault in current circuit	<ul style="list-style-type: none"> - Short to earth - Short to positive - Throttle valve positioner (V60) defective 	<ul style="list-style-type: none"> - Idling speed too high - Air conditioner compressor will not switch in until 1520 rpm 	<ul style="list-style-type: none"> - Check throttle valve control part=> Page 92
17967 Throttle valve control part -J338 Fault in the basic setting	<ul style="list-style-type: none"> - The adaption of the engine control unit to the throttle valve control part has been interrupted. The cause could be e.g. that the starter or accelerator pedal was operated during the adaption procedure. 	<ul style="list-style-type: none"> - Idling speed not within tolerance range - Idling speed fluctuates 	<ul style="list-style-type: none"> - Repeat the adaption of the engine control unit to the throttle valve control part => Page 131 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17972 Throttle valve control part -J338 Insufficient voltage during basic setting	<ul style="list-style-type: none"> - Less than 10 volts at engine control unit when adapting (matching) engine control unit to throttle valve control part. 	<ul style="list-style-type: none"> - Idling speed not within tolerance range - Idling speed fluctuates 	<ul style="list-style-type: none"> - Check battery charge condition Check engine control unit voltage supply => Page 131 .

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
17978			



V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
Engine control unit blocked	<ul style="list-style-type: none"> - Start attempted with a non-authorized key. - Attempted manipulation - Short in communication wire - Incorrect coding - Fault in immobilizer system - Immobilizer control unit defective/missing - Engine control unit has been replaced and not adapted to the immobilizer. 	- Engine starts briefly and then stops again	<ul style="list-style-type: none"> - Adapt engine electronics control unit to electronic immobilizer => Page 132 Check electronic immobilizer: => Repair group 96; Servicing electronic immobilizer

Note to fault code 17978:

The control electronics for the immobilizer are located inside the dash panel insert and cannot be replaced separately.

If starting is attempted with an unauthorised key a permanent fault will be stored. After a subsequent start with an authorised key the fault will be converted to a sporadic fault.

V.A.G 1551 print-out	Possible causes of fault	Possible effects	Fault remedy
18010 Voltage supply terminal 30 Voltage too low	<ul style="list-style-type: none"> - Battery was disconnected - Permanent voltage supply to control unit was disconnected or wiring open circuit 	- Engine control unit learnt values lost	- Check engine control unit voltage supply => Page 128
18020 Engine control unit coding incorrect	<ul style="list-style-type: none"> - Vehicles with automatic gearbox coded for manual gearbox - Vehicles with front wheel drive and TCS coded for Syncro vehicle 	<ul style="list-style-type: none"> - Handling problems (gearchange jerks, load change jolt) - Increased exhaust emissions - No TCS function - TCS warning lamp lights up 	- Code engine control unit correctly => Page 130

5 - Final control diagnosis

5.1 - Final control diagnosis

5.2 - Performing final control diagnosis

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

1. Injector, cylinder 1 -N30



2. Injector, cylinder 2 -N31
3. Injector, cylinder 3 -N32
4. Injector, cylinder 4 -N33
5. Solenoid valve 1 for activated charcoal filter -N80

Engine code AEB:

6. Charge pressure control solenoid valve -N75

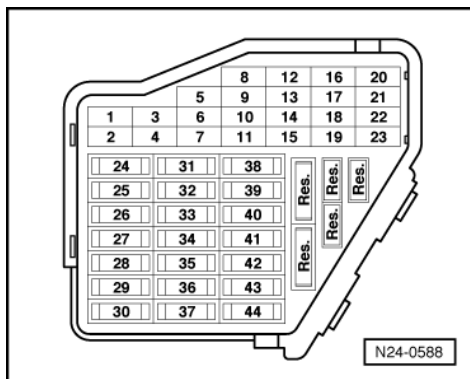
Engine code ADR:

6. Intake manifold change-over valve -N156
7. Camshaft adjustment 1 (camshaft adjustment valve 1 (N205))

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
- ♦ Test box V.A.G 1598/22
- ♦ 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



- -> Fuses 28, 29, 32 and 34 must be in order.

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.
- ♦ The final control diagnosis will be aborted after 10 minutes.

Work sequence

- Connect the fault reader V.A.G 1551 (V.A.G 1552). Then switch ignition on and select engine control unit with the "Address word" 01.
(Connecting fault reader and selecting engine control unit => Page 2.)

-> 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
```

Activate injectors (N30...N33):

- Confirm input with Q key.

-> Indicated on display:

```
Final control diagnosis
Injector cylinder 1 -N30
```

Note:

The fuel pump must run and the flow noise must be distinctly audible at the fuel pressure regulator. If the fuel pump does not run, check activation.

=> Repair group 20; Removing and installing parts of the fuel system; Checking fuel pump Removing and installing parts of the fuel system Checking fuel pump

- Open the throttle valve. As soon as the idling switch opens, the number 1 Cyl. injector will click 5 times.
- Press the =>key each time to advance to the next injector (advancing is also possible without testing each individual injector).
- All injectors can be checked one after the other in this way.

If one of the injectors is not activated (does not click):

- Checking injectors => Page 107 .

Activating activated charcoal filter solenoid valve 1 (N80):

- Press =>key.

-> Indicated on display:

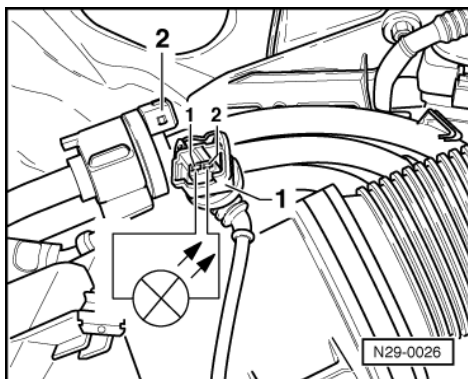
```
Final control diagnosis
Activ. charcoal filter solenoid valve
1 -N80
```

The activated charcoal filter solenoid valve 1 (on air cleaner housing) must click until the next final control is activated by pressing =>key.

The valve clicks but a fault is still suspected (valve does not open or close):

- Pull hose off activated charcoal filter at solenoid valve.
- Connect an auxiliary hose to the vacant valve connection.
- Blow into auxiliary hose during final control diagnosis (in direction of throttle valve control part).
Valve must open and close

If the solenoid valve does not click:



Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



- -> 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

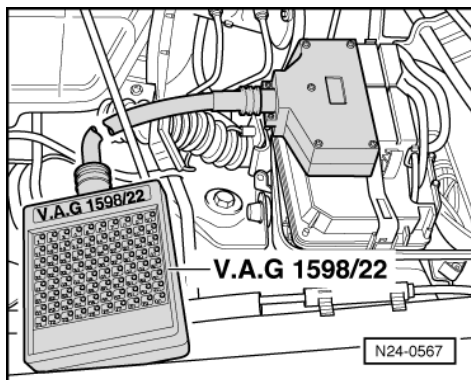
LED flashes:

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

=> Repair group 20; Removing and installing parts of 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 1598/22 to control unit wiring harness.
- Check wire between test box socket 15+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.
Specification: $\infty\omega$
- 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 wiring fault is detected:

- Renew engine control unit => Page 129 .

Engine code AEB:

Activating charge pressure limitation solenoid valve (N75):

- Press =>key.

-> Indicated on display:

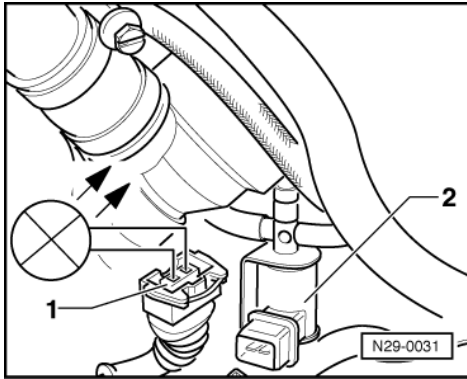
Final control diagnosis
Charge pressure control solenoid valve -
N75

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:



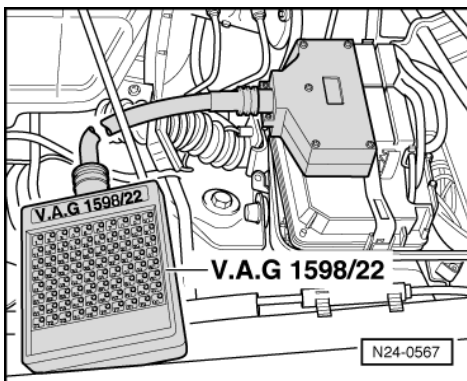
- -> Pull connector -1- off solenoid valve -2- and connect diode test lamp V.A.G 1527 with aux. cables from V.A.G 1594 to disconnected connector.
The LED must flash

LED flashes:

- Renew solenoid valve.

=> Repair group 21; Turbocharging overview Turbocharging overview

LED does not flash:



- Proceed with final control diagnosis until completed.
- Switch off ignition.
- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- 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.
Specification: $\infty\omega$
- 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 in wire is detected:

- Renew engine control unit => Page 129 .

Engine code ADR:

Activating intake manifold change-over valve (N156):

- Press =>key.

-> Indicated on display:

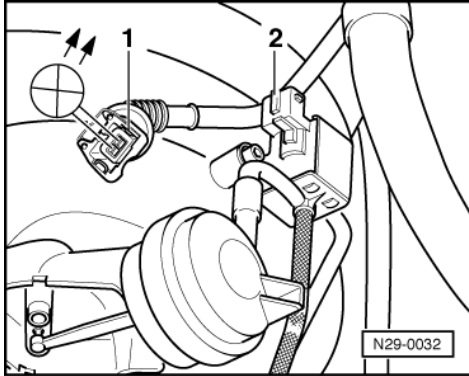
Final control diagnosis
Intake manifold change-over valve -N156



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 124 .



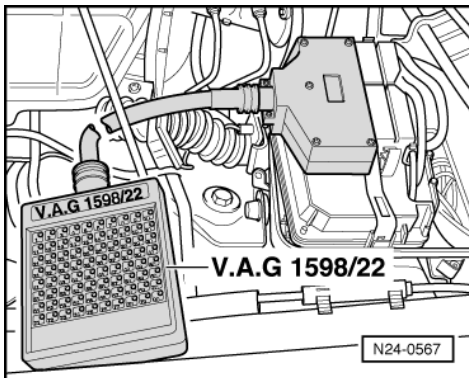
- -> Pull connector -1- off solenoid valve -2- and connect diode test lamp V.A.G 1527 with aux. cables from V.A.G 1594 to disconnected connector.
The LED must flash

LED flashes:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew solenoid valve -2-
Page 78 , item 2 .

LED does not flash:

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



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- 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.
Specification: $\infty\omega$
- 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 wiring fault is detected:

- Renew engine control unit => Page 129 .



Activate camshaft adjustment valve (N205):

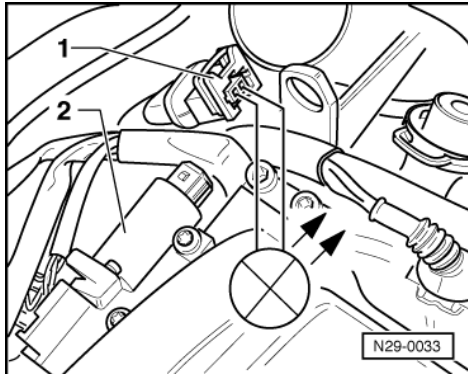
- Press =>key.

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

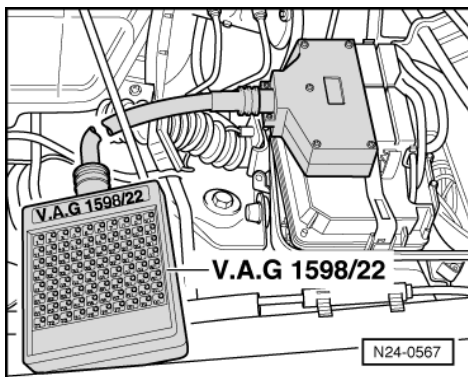
LED flashes:

- Proceed with final control diagnosis until completed.
- Switch off ignition.
- Renew solenoid valve -2-.

=> 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 1598/22 to control unit wiring harness.
- Check wire between test box socket 55+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.
Specification: $\infty\omega$
- 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 wiring fault is detected and the LED does not flash on any valve:

- Renew engine control unit => Page 129 .

Continuation for all vehicles

- 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.

Note:

After completion of the final control diagnosis switch off ignition. If the ignition is not switched off before attempting to start, the engine will not run, as the injectors and the ignition transformer will not be activated.

6 - Measured value blocks

6.1 - Measured value blocks

6.2 - 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.

6.3 - Read measured value block

Special tools, testers, measuring instruments and auxiliary items required

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

Test conditions

- Coolant temperature at least 85 °C.
- 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 4 , 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 2.)

-> 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 function "End output" and confirm entry 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.

6.4 - Evaluating measured value blocks

Display group 00 (decimal displayed value)													
▪ Engine running at idling speed													
Read measured value block 0										[ltrif] Indicated on display			
x	x	x	x	x	x	x	x	x	x	x	[ltrif] Display zones	Specification	Corresponds to
1	2	3	4	5	6	7	8	9	10		Mixture formation learnt value	118...138	-8...8 %
											Mixture formation learnt value	115...141	-0.7...0.7 ms



Display group 00 (decimal displayed value)			
	Lambda regulator	78...178	-10...10 %
	Idling stabilisation learnt value	120...136	-4...4 Kg/h
	Idling regulator	122...134	-0.5...0.5 ms
	Throttle valve angle	0...12	0...5 <°
	Engine control unit voltage supply	170...206	12...14.5 V
	Engine speed (idling speed)	76...96	760...960 rpm
	Engine load	20...50	1...2.5 ms
	Engine code: ADR	10...30	0.5...1.5 ms
	Engine code: AEB		
	Coolant temperature	170...204	80...105 °C

1) Up-to-date specifications:

=> Exhaust emissions test binder

Display group 1 -Basic functions-				
Read measured value block 1			=>	[Itrif] Indicated on display
xxxx rpm	x.xx ms	x <°	xx.x°BTDC	
1	2	3	4	[Itrif] Display zones
				Ignition angle
				Throttle valve angle
				Engine load
				Engine code ADR
				Engine code AEB
				Engine speed (idling speed)
				Specification
				Evaluation
				9...15 ° BTDC
				0...5 <°
				1.00...2.50 ms
				0.50...1.50 ms
				760...960 rpm

				=> Page 35
				=> Page 34
				=> Page 34

Notes on display zone 2:

- ♦ The maximum engine load decreases by about 10 % per 1000 m above sea level.
- ♦ The engine load also decreases by up to 10 % if the ambient temperatures are very high.
- ♦ When driving at full load the following minimum values must be obtained:
At 4000 rpm approx. 6.5 ms
At 6000 rpm approx. 6.0 ms

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

Appears on display	Possible fault cause	Fault elimination
Less than 760 rpm	- Throttle valve control part sticking or defective - Large amount of unmetered air (cannot be compensated for by the idling stabilisation)	- Check throttle valve control part => Page 92 - Check intake air system for leaks => Page 114
More than 960 rpm	- Idling switch not closed/defective - Large amount of unmetered air (cannot be compensated for by the idling stabilisation) - Throttle valve control part sticking/defective	- Interrogate fault memory, => Page 4 - Check intake air system for leaks => Page 114 - Check throttle valve control part => Page 92

Evaluating display group 1, display zone 2 - Engine load

Appears on display	Possible fault cause	Fault elimination



Motronic injection and ignition system (1.8 ltr. engine) - Edition 01.1997

Less than 1.00 ms or 0.50 ms	- Smaller values can only occur when driving in overrun	
More than 2.50 ms or 1.50 ms	- Rough idling (not running on all cylinders) - Air mass meter defective - Throttle valve control part defective - Electric consumers switched on - Steering wheel at full lock - Gear selected (automatic gearbox)	- Injectors or spark plugs defective - Interrogate fault memory => Page 4 - Check throttle valve control part => Page 92 - Switch off electric consumers - Set steering wheel to centre position - Place selector lever in P or N

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

Appears on display	Possible fault cause	Fault elimination
More than 5 <°	- Engine control unit not matched to throttle valve control part - Throttle valve potentiometer in throttle valve control part defective - Accelerator cable adjustment - Throttle valve sticking	- Perform matching to throttle valve control part => Page 4 - Check throttle valve control part => Page 92 - Adjust accelerator cable => Repair group 20; Fuel supply system; Servicing throttle linkage Servicing throttle linkage - Eliminate cause

Note:

If the accelerator pedal is floored the value will be 75...95 <°.

Display group 2 -Basic functions-				[trif] Indicated on display		
Read measured value block 2				[trif] Display zones		
xxxx rpm	x.xx ms	x.xx ms	x.x g/s	Specification	Evaluation	
1	2	3	4	Air mass drawn in Engine code ADR Engine code AEB	2.0...4.0 g/s 1.8...4.0 g/s	=> Page 36
				Injection period (per Otto cycle) Engine code ADR Engine code AEB	2.00...5.00 ms 1.00...3.00 ms	=> Page 35
				Engine load Engine code ADR Engine code AEB	1.00...2.50 ms 0.50...1.50 ms	=> Page 34
Engine speed (idling speed)					760...960 rpm	=> Page 34

Evaluating display group 2, display zone 3 - Injection period (per Otto cycle)

Appears on display	Possible fault cause	Fault elimination
Less than 1.00 ms or 0.50 ms	- Large amount of fuel from the activated charcoal filter system - Incorrect injectors with greater throughput installed	- Check activated charcoal filter solenoid valve => Repair group 20; Fuel system; checking activated charcoal filter system checking activated charcoal filter system - Check injection rate => Page 107



More than 2.50 ms or 1.50 ms	- Increased engine load due to electric consumers, air conditioner, gear selected or P.A.S. steering 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 or 1.8 g/s	- Large amount of unmetered air between intake manifold and air mass meter	- Eliminate unmetered air
More than 4.0 g/s	- Gear selected (automatic gearbox) - Engine loaded due to ancillaries	- Place selector lever in P or N - Eliminate load (air conditioner, power assisted steering etc.)

Notes on display group 2

- ◆ Display group 2 shows the injection period, corresponding to the air mass drawn in and the engine load at idling speed. It is therefore a purely calculated, theoretical value, which due to the processor relates to only one rotation of the crankshaft. Engine load at idling speed means the internal friction of the engine which must be overcome and the drive for the ancillaries. The air mass drawn in is shown in display zone 4.
- ◆ In comparison display zone 3 shows the injection period resulting from a complete Otto cycle, therefore two complete revolutions of the crankshaft. However display zone 3 does not show approx. double the value of display zone 2, but a corrected, factual injection period. Corrected by influence levels like:
 - Lambda control
 - Mixture enrichment from activated charcoal filter
 - Air specific gravity, air temperature
 - Battery voltage (faster/slower opening of the injectors)
- ◆ If the engine for example is drawing in unmetered air, only the calculated value in display zone 2 should change (injection period per crankshaft revolution). The factual injection period per Otto cycle will be held to specification by the Lambda control.

Note on display zone 4:

- ◆ Displayed is the air mass measured by the air mass meter.
- ◆ In emergency running caused by a fault on the throttle valve control part the engine runs without idling stabilisation at an increased idling speed (approx. 1000...1300 rpm) via the emergency running gap. In this case the air throughput is approx. 4.5...5.5 g/s.
- ◆ The replacement value in g/s from throttle valve potentiometer will be displayed if the engine control unit detects a fault on the air mass meter.

Display group 3 -Basic functions-						
Read measured value block 3				⇒	[Itrif] Indicated on display	
xxxx rpm	xx.xxx V	xxx.x °C	xxx.x °C			
1	2	3	4	[Itrif] Display zones	Specification	Evaluation
				Intake air temperature	-45...108.5 °C	⇒ Page 37
				Coolant temperature	80...105 °C	⇒ Page 37
				Engine control unit voltage supply	12.000...14.500 V	⇒ Page 37
				Engine speed (idling speed)	760...960 rpm	⇒ Page 34

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:**

Exact information on specifications is not possible as the display is largely dependent on the ambient temperature.

Evaluating display group 3, display zone 2 - Control unit voltage supply

Appears on display	Possible fault cause	Fault elimination
Less than 12.000 V	<ul style="list-style-type: none"> - Generator defective, battery heavily discharged - Battery heavily charged shortly after starting due to high charging current and current consumers - Transfer resistance in the current supply or the engine control unit earth connection - Current draw when ignition is off 	<ul style="list-style-type: none"> - Check voltage, charge battery - Increase revs slightly for a few minutes and switch off current consumers - Check engine control unit voltage supply => Page 126 - Eliminate current draw
More than 14.500 V	<ul style="list-style-type: none"> - Voltage regulator in alternator defective - Excess voltage due to jump starting or quick charging unit 	<ul style="list-style-type: none"> - Check voltage, replace regulator if necessary - Interrogate fault memory => Page 4

Evaluating display group 3, display zone 3 - Coolant temperature

Appears on display	Possible fault cause	Fault elimination
Less than 80 °C	<ul style="list-style-type: none"> - Engine too cold - Coolant temperature sender or wiring to engine control unit 	<ul style="list-style-type: none"> - If necessary carry out test drive - Check coolant temperature sender =>Page 98
More than 105 °C	<ul style="list-style-type: none"> - Radiator soiled - Radiator fan not functioning - Thermostat defective - Coolant temperature sender or wiring to engine control unit 	<ul style="list-style-type: none"> - Clean radiator - Check function - Check thermostat => Repair group 19; Removing and installing parts of cooling system - Check coolant temperature sender =>Page 98

Evaluating display group 3, display zone 4 - Intake air temperature

Appears on display	Possible fault cause	Fault elimination
Constant 19.5 °C	- Fault recognised on intake air temperature sender -G42	- Interrogate fault memory => Page 4
	- Intake air temperature sender -G42	- Check intake air temperature sender =>Page 102

Display group 4 -Idling stabilisation-			
Read measured value block 4			
x <°	x.xx g/s	x.xx g/s	XXXXXXX
1	2	3	4
[trif] Indicated on display			
[trif] Display zones			
Operating mode (idling, part throttle, full throttle, enrichment, overrun)		Specification	Evaluation
		Idling	---



	Idling air mass learnt value (manual gearbox in neutral/automatic gearbox with gear selected) Engine code ADR Engine code AEB	-1.70...1.70 g/s -1.10...1.10 g/s	---
	Idling air mass learnt value (automatic gearbox selector lever in P or N) Engine code ADR Engine code AEB	-1.70...1.70 g/s -1.10...1.10 g/s	=> Page 38
Throttle valve angle		0...5 °	=> Page 35

Note on display zone 1:

With the accelerator pedal floored the display value is about 75...95 °.

Notes on display zones 2 and 3:

- ◆ Displayed is how far the idling stabilisation has "learnt" and moved away from the predetermined design average. If the engine is new the value will be in the positive range due to the high engine friction, and when run-in in the negative range. Values at the lower tolerance limit in conjunction with a value which is too low in display group 5, display zone 3 indicates unmetered air.
- ◆ The value displayed is not measured by the air mass meter, but calculated from the throttle valve potentiometer information.
- ◆ Display zone 3 will always show 0 on vehicles with a manual gearbox.

Note on display zone 4:

The following operating conditions are displayed:

- ◆ Idling speed
- ◆ Part throttle
- ◆ Full throttle (only ADR engine)
- ◆ Overrun
- ◆ Enrichment (full throttle enrichment)

Evaluating display group 4, display zone 2 - idling air mass learning value

Appears on display	Possible fault cause	Fault elimination
Lower than -1.70 g/s or -1.10 g/s	- Unmetered air behind the throttle valve	- Rectify unmetered air
Higher than +1.70 g/s or +1.10 g/s	- High load due to ancillaries - Restriction or foreign substance in area of intake	- Switch off air conditioner and electric consumers - Rectify restriction or foreign substance

Display group 5 - Idling stabilisation-							
Read measured value block 5		⇒		[Itrif] Indicated on display			
xxxx rpm	xxxx rpm	xx.x %	x.x g/s	[Itrif] Display zones		Specification	Evaluation
1	2	3	4	Air mass drawn in Engine code ADR Engine code AEB		2.0...4.0 g/s 1.8...4.0 g/s	=> Page 36
Idling air mass regulating value (idling regulator)						-10.0...10.0 %	---



	Idling speed (idling speed specification) Manual gearbox Automatic gearbox with gear selected: Engine code ADR Engine code AEB	860 rpm 800 rpm 780 rpm	---
	Engine speed (idling speed)	760...960 rpm	=> Page 34

Note on display zone 1:

The actual engine speed in steps of 10 is displayed (max. 2550 rpm).

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 matched => Page 117. The idling speed figures with gear selected are then automatically modified.

Notes continued:**Notes on display zone 3:**

- ◆ The required idling air mass at a constant speed changes due to the changes in the load ratios at idling.
- ◆ Displayed is the change in the idling air mass in %. As soon as the idling stabilisation learning process has compensated for this change, the average value is set again. The amount of deviation from the average value depends upon the level of the load change (e.g. caused by switching electric consumers on or off).
- ◆ After each time the idling switch closes the learning process is performed in small steps. More steps are required for large deviations. Therefore the accelerator pedal must be depressed briefly (throttle burst) at intervals of approx. 20 seconds. Using this method a further step of the learning process is performed each time.
- ◆ The "learnt and moved away" deviation then appears in display group 4, display zone 2. If the learnt values in display group 4, display zone 2 have moved to the limit the value for the idling regulator remains outside the tolerance.
- ◆ Min. values ADR: -1.70 or +1.70 g/s
- ◆ Min. values AEB: -1.10 or +1.10 g/s

Display group 6 -Idling stabilisation-							
Read measured value block 6				=>	[Itrif] Indicated on display		
xxxx rpm	xx.x %	xx.x %	xx.x %				
1	2	3	4	[Itrif] Display zones	Specification	Evaluation	
				Ignition angle	9...15 ° BTDC	---	
				Lambda regulator	-10.0...10.0 %	=> Page 39	
				Idling air mass regulating value (idling regulator)	-10.0...10.0 %	---	
				Engine speed (idling speed)	760...960 rpm	=> Page 34	

Notes on display zone 3:

- ◆ 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 4.
- ◆ Operating condition Lambda regulation: Display group 21, checking display zone 4 => Page 47.

Evaluating display group 6, display zones 3 - Lambda regulator control value

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

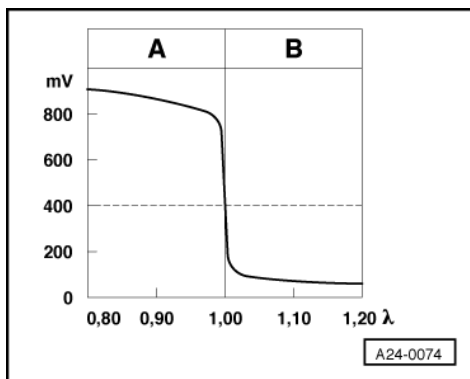


<ul style="list-style-type: none"> - Unmetered air - Injector defective - Lambda learnt value on limit 	<ul style="list-style-type: none"> - Check intake system for leaks => Page 114 - Check injection rate => Page 107 - Check Lambda learnt value in display groups 7...9
---	--

Display group 7 -Lambda learnt values-						
Read measured value block 7 =>				[Itrif] Indicated on display		
xx.x %	xx.xxx V	xx %	x.xx	[Itrif] Display zones	Specification	Evaluation
1	2	3	4	Lambda correction factor with active fuel tank venting	0.30...1.20	Display group 10
				Activated charcoal filter solenoid valve 1 duty cycle	0...99 %	Display group 10
				Lambda probe voltage	0.000...1.100 V	=> Page 42
				Lambda regulator control value	-10.0...10.0 %	=> Page 39

Note on display zone 2:

- ♦ The voltage signal "rich mixture (low level of residual oxygen)" is approx. 0.7...1.1 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 will jump from between 0.7 and 1.1 V to between 0.0 and 0.3 V (and 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".
- ♦ The displayed value must temporarily drop below 0.3 V and exceed 0.6 V. Displayed values below 0.45 V signifies lean, above 0.45 V 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

Display group 8 -Lambda learnt values-



Read measured value block 8 ⇒				[[trif] Indicated on display		
xx.x %	xx.x %	xx.x %	xxxxxxx			
1	2	3	4	[[trif] Display zones	Specification	Evaluation
				Fuel tank venting operating mode	V active or V not active font=symbol charset=font-specific code=108 TeX='\lambda ' descr='[lambda]'-adaption	---
				Lambda learnt value at part throttle (multiplicative)	-8.0...8.0 %	---
				Lambda learnt value at idling (additive)	-10.0...10.0 %	---
				Injection period (per Otto cycle)	2.00...5.00 ms	=> Page 35
				Engine code ADR	1.00...3.00 ms	
				Engine code AEB		

Noes on display zones 2 and 3:

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.

6.5 - Evaluating display zone 8, display zones 2 and 3 - 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) - Injector leaking - Fuel pressure too high - Activated charcoal filter solenoid valve 1 permanently open - Air mass meter defective - Lambda probe heating defective or Lambda probe soiled	- Disappears after motorway drive or oil change - Check injector =>Page 107 - Check fuel pressure regulator => Page 112 - Check solenoid valve => Repair group 20; Removing and installing parts of the activated charcoal filter system - Check air mass meter => Page 89 - Check Lambda probe heating =>Page 87

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 114



- Injector blocked	- Check quantity injected rate =>Page 107
- Display zones 2 and 3 high: Air mass meter defective	- Check air mass meter => Page 89
- Fuel pressure too low	- Check fuel pressure regulator => Page 112
- Unmetered air between air mass meter and throttle valve	- Rectify cause
- Unmetered air at exhaust manifold gasket	
- Lambda probe heating defective or Lambda probe soiled	- Check Lambda probe heating =>Page 87

Display group 9 -Lambda learnt values-						
Read measured value block 9 =>				[Itrif] Indicated on display		
xxxx rpm	xx.x %	xx.xxx V	xx.x %	[Itrif] Display zones	Specification	Evaluation
1	2	3	4	Lambda learnt value at idling (additive)	-10.0...10.0 %	=> Page 39
				Lambda probe voltage	0.000...1.100 V	=> Page 42
				Lambda regulator control value	-10.0...10.0 %	=> Page 39
				Engine speed (idling speed)	760...960 rpm	=> Page 34

Note on display zone 3:

- ◆ The voltage signal "rich mixture (low level of residual oxygen)" is approx. 0.7...1.1 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 will jump from between 0.7 and 1.1 V to between 0.0 and 0.3 V (and 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".
- ◆ The displayed value must temporarily drop below 0.3 V and exceed 0.6 V. Displayed values below 0.45 V signifies lean, above 0.45 V rich.

Note on display zone 4:

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.

Evaluating display group 9, display zone 3 - Lambda probe voltage

Appears on display	Possible fault cause	Fault elimination
Display does not fluctuate	- Large amount of unmetered air	- Check air intake system for leaks =>Page 114


Motronic injection and ignition system (1.8 ltr. engine) - Edition 01.1997

(Constant 0.000... 0.300 V or Constant 0.700...1.100 V) Cont. on next page	- Spark plug defective - Fuel pressure too low or too high	- Check spark plugs - Check fuel pressure regulator and holding pressure => Page 112
--	---	--

Appears on display Continued	Possible fault cause - Injector defective - Coolant temperature sender defective - Activated charcoal filter solenoid valve 1 - Lambda probe heating not functioning - Lambda probe(s) defective or soiled	Fault elimination - Check injectors => Page 107 - Check coolant temperature sender =>Page 98 - Check solenoid valve 1 => Repair group 20; removing and installing parts of activated charcoal filter system - Check Lambda probe heating => Page 87 - Check Lambda probe => Page 118
Constant 1.100 V	- Short to positive via: - Lambda probe, probe wiring, earth wiring, engine control unit	
Constant between 0.400...0.500 V	- Wiring 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	- Check Lambda probe wiring => Page 121

Display group 10 -Fuel tank breather-				
Read measured value block 10 =>				[trif] Indicated on display
xx %	x.xx	xx	x.xx	
1	2	3	4	[trif] Display zones
				Fuel tank venting system, purge rate
				Charge level of activated charcoal filter
				Lambda correction factor with active tank venting
				Activated charcoal filter solenoid valve 1 duty cycle
				Specification
				Evaluation
				0.00...0.30

				-3...32

				0.30...1.20

				0...99 %

Notes on display group 10:

- ◆ The engine control unit specifies the amount of fuel vapour which is fed into the engine via the activated charcoal filter solenoid valve 1 (N80). If the activated charcoal filter has a high charge level and solenoid valve 1 must remain closed to maintain the specified purge rate (low duty cycle), the reaction of the Lambda regulation will be seen by a change in the Lambda correction factor. If this reaction is lower than expected (because in the meantime the charge level has been increased due to the fuel vapours from the fuel tank), the control unit will calculate a higher charge level from this.
- ◆ Check fuel tank breather:

=> Repair group 20; Checking fuel tank breather

Notes on display zone 1:

- ◆ When the Lambda regulation commences the activated charcoal filter solenoid valve 1 (N80) is pulsed at intervals of approx. 220...900 seconds (tank venting is performed) and switched off for approx. 70 seconds (no tank venting). During the 70 seconds the Lambda regulation learns the operating conditions without the influence of fuel vapours from the activated charcoal filter.
- ◆ Duty cycle 0 % indicates that the activated charcoal filter solenoid valve 1 is closed. For a duty cycle of 99 % the solenoid valve 1 is fully open.
- ◆ At idling the engine can only accept a certain maximum amount of fuel vapours from the activated charcoal filter system. Therefore the activated charcoal filter solenoid valve 1 opening is limited at idling. The duty cycle can rise to 99 % at part throttle and full throttle.



- ♦ The influence of the activated charcoal filter system can be assessed by comparing the displayed values during the "Basic setting" (solenoid valve 1 closed) and during "Read measured value block" (solenoid valve 1 approx. 220...900 seconds open/approx. 70 seconds closed).
- ♦ It is possible to switch between function 04 "Basic setting" and function 08 "Read measured value block" by pressing keys 4 and 8 on V.A.G 1551/1552.

Notes on display zone 2:

- ♦ If a very rich mixture is being given off by the activated charcoal filter system, it must be leaned by the Lambda regulation. This leaning can be up to 0.6. This means in this case that the Lambda regulation must reduce the injection rate by 40 %.

Notes continued:

- ♦ If the displayed value is 1.0 (Lambda regulation in neutral range, which means no correction factor) either an ideal mixture is coming from the activated charcoal filter system (it is not necessary to alter the mixture) or the solenoid valve 1 is closed => display zone 1.
- ♦ If the displayed value is between 1.01...1.10 the mixture coming from the activated charcoal filter system is too lean. Therefore the Lambda regulation must enrich the mixture.

Notes on display zone 3:

- ♦ -3 indicates that there are no fuel vapours in activated charcoal filter.
- ♦ +32 indicates that there are fuel vapours in the activated charcoal filter.

Notes on display zone 4:

- ♦ The display shows the proportion of the total intake volume that comes from the activated charcoal filter system.
- ♦ 0.00 indicates nothing has been fed in from the activated charcoal filter system (solenoid valve 1 closed).
- ♦ 0.30 indicates that 30 % of the intake air mass comes from the activated charcoal filter system.

Display group 11 -Fuel consumption-						
Read measured value block 11				⇒ [ltrif] Indicated on display		
xxxx rpm	x.xx ms	xxx km/h	x.xx l/h			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Fuel consumption	0.50...1.50 l/h	---
				Road speed	0 km/h	---
		Engine load			1.00...2.50 ms	=> Page 34
		Engine code ADR			0.50...1.50 ms	
		Engine code AEB				
Engine speed (idling speed)					760...960 rpm	=> Page 34

Note on display zone 3:

Checking speed signal => Page 134

Notes on display zone 4:

- ♦ The specification is only valid for an idling speed which is not loaded due to ancillaries (e.g. automatic gearbox, air conditioning/heating, alternator, P.A.S. pump).
- ♦ ltr./100 km not suitable for fuel consumption measurement.

Display group 14 -Knock control-						
Read measured value block 14				⇒ [ltrif] Indicated on display		
xxxx rpm	x.xx ms	xx.x °CA	xx.x °CA			
1	2	3	4	[ltrif] Display zones	Specification	Evaluation
				Cyl. No. 2 retardation of ignition timing by knock control	0...12.0 °CA	---



			Cyl. No. 1 retardation of ignition timing by knock control	0...12.0 °CA	---
			Engine load	1.00...2.50 ms	=> Page 34
			Engine code ADR	0.50...1.50 ms	
			Engine code AEB		
			Engine speed (idling speed)	760...960 rpm	=> Page 34

Display group 15 -Knock control-						
Read measured value block 15 =>				[[trif] Indicated on display		
xxxx rpm	x.xx ms	xx.x °CA	xx.x °CA			
1	2	3	4	[[trif] Display zones	Specification	Evaluation
				Cyl. No. 4 retardation of ignition timing by knock control	0...12.0 °CA	---
				Cyl. No. 3 retardation of ignition timing by knock control	0...12.0 °CA	---
				Engine load	1.00...2.50 ms	=> Page 34
				Engine code ADR	0.50...1.50 ms	
				Engine code AEB		
				Engine speed (idling speed)	760...960 rpm	=> Page 34

Notes on display groups 14 and 15:

- ◆ The knock control is active from an engine load above 40 %.
- ◆ The current ignition timing retardation is displayed when 40 % engine load is exceeded, if below 40 % the last value used will be displayed as a constant.
- ◆ If pinking is audible but ignition retardation is not noticeable, increase the revs to above 3500 rpm for 5 seconds to initiate the knock sensor fault recognition (diagnosis).

Notes continued:

- ◆ If the ignition timing retardation of one cylinder deviates greatly from the others, the following faults are possible:
 - Loose sub-assemblies
 - Corrosion on the connector
 - Engine damage (e.g. oil being burnt due to defective piston)
- ◆ If the ignition timing retardation is excessive on all cylinders the following faults are possible:
 - Corrosion on the connector
 - Knock sensor tightened to incorrect tightening torque (correct tightening torque is 20 Nm)
 - Wiring open circuit
 - Knock sensor defective
 - Loose sub-assemblies
 - Poor quality fuel (below 95 RON)

Display group 16 -knock control-						
Read measured value block 16 =>				[[trif] Indicated on display		
xxxx V	x.xxx V	x.xxx V	x.xxx V			
1	2	3	4	[[trif] Display zones	Specification	Evaluation
				Cyl. No. 4 knock sensor voltage signal	0.400...1.400 V	---
				Cyl. No. 3 knock sensor voltage signal	0.400...1.400 V	---
				Cyl. No. 2 knock sensor voltage signal	0.400...1.400 V	---
				Cyl. No. 1 knock sensor voltage signal	0.400...1.400 V	---

Notes on display group 16:

- ◆ If no wiring or connector fault is determined when checking the knock sensor, check the engine for loose ancillaries or engine damage -see display groups 14 and 15-.
- ◆ At high engine speeds the displayed signal voltage for the knock sensors can reach 5.1 Volt.



- ♦ If there is more than 50 % difference between the smallest and largest knock sensor signal, the cause could be corrosion on the connector.

Display group 18 -Altitude adaption-						
Read measured value block 18				⇒ [Itrif] Indicated on display		
xxxx rpm	x.xx ms	x.xx ms	xx.x %	[Itrif] Display zones		Evaluation
1	2	3	4	Altitude correction factor	-30.0...25.0 %	---
				Engine code ADR	-50.0...10.0 %	
				Engine code AEB		
				Engine load throttle valve angle	---	---
				Engine load	1.00...2.50 ms	=> Page 34
				Engine code ADR	0.50...1.50 ms	
				Engine code AEB		
Engine speed (idling speed)					760...960 rpm	=> Page 34

Notes on display group 18, display zone 4:

Engine code ADR:

- ♦ The Motronic control unit compares the air mass meter load signal with a load value that is calculated from the throttle valve angle and engine speed. The difference between the two values equates to the altitude correction value.

Engine code AEB:

- ♦ Altitude sender value

For all vehicles:

- ♦ - 30 % correspond to an ambient pressure of approx. 700 mbar (30 % below 1000 mbar)
- ♦ 25 % correspond to an ambient pressure of approx. 1250 mbar (25 % above 1000 mbar)

Display group 19 -Torque reduction for automatic gearbox-						
Read measured value block 19				⇒ [Itrif] Indicated on display		
xxxx rpm	x.xx ms	x <°	xx.x°BTDC	[Itrif] Display zones		Evaluation
1	2	3	4	Ignition angle	9...15 ° BTDC	---
				Operating condition	_ x 1 _ _ _ _ x	---
				x 1 x = no ignition timing retardation		
				x 0 x = ignition timing retardation		
				Engine load	1.00...2.50 ms	=> Page 34
				Engine code ADR	0.50...1.50 ms	
				Engine code AEB		
Engine speed (idling speed)					760...960 rpm	=> Page 34

Notes on display group 19:

- ♦ How the retardation of the ignition timing reduces the engine torque and thereby the shift jerk during a gear shift can be assessed in this display group.
- ♦ Due to the very short signals the retardation of the ignition timing is not always recognised and therefore not displayed on V.A.G. 1551/1552.
- ♦ Checking ignition timing retardation during gear shift => Page 137

Display group 20 -Operating modes-	
Read measured value block 20	⇒ [Itrif] Indicated on display



xxxx rpm XXXXXXXX XXXXXXXX XXXXXXXX						
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	---
				Automatic gearbox operating mode (gear selected signal)	Neutral or gear selected ON	---
Engine speed (idling speed)					760...960 rpm	=> Page 34

Notes on display zone 2:

- ◆ Neutral = Selector lever in P or N
Gear selected ON = Selector lever in 2/3/4/R/D
- ◆ "Neutral" or "Gear selected ON" will be displayed for vehicles with a manual gearbox.
- ◆ Checking gear selected signal =>Page 138

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 air conditioner compressor signal =>Page 135

Display group 21 -Lambda control-						
Read measured value block 21 =>						
xxxx rpm	x.xx ms	°C	XXXXXXX	[[ltrif] Indicated on display		
1	2	3	4	[[ltrif] Display zones	Specification	Evaluation
				Lambda control operating mode	font=symbol charset=font-specific code=108 TeX='\lambda ' descr='[lambda]-Reg. OFF or font=symbol charset=font-specific code=108 TeX='\lambda ' descr='[lambda]-Reg. ON	---
				Coolant temperature	-40...125 °C	---
				Engine load	0...10.00 ms	---
Engine speed (idling speed)					760...960 rpm	=> Page 34

Notes on display group 21:

- ◆ At a starting temperature of below 15 °C (intake air temperature) the engine control unit will not switch the Lambda regulation on until a coolant temperature of 55 °C is reached.
- ◆ For a starting temperature above 15 °C (intake air temperature) the Lambda regulation will commence functioning when the probes are recognised as being operationally ready.
- ◆ If the Lambda regulation is switched off the engine runs controlled by the engine map.

Display group 23 -Adaption of throttle valve control part-						
Read measured value block 23 =>						
xxxxxx	xx.x %	xx.x %	xx.x %	[[ltrif] Indicated on display		
1	2	3	4	[[ltrif] Display zones	Specification	Evaluation



		Throttle valve positioner max. stop	18.0...54.0 %	---
		Throttle valve positioner emergency stop	67.0...83.0 %	---
		Engine code ADR	60.0...91.0 %	
		Engine code AEB		
		Throttle valve positioner min. stop	72.0...95.0 %	---
		Learning requirement display	100000	=> Page 48

Note on display zone 1:

If the specification is not obtained, match throttle valve control part to engine control unit => Page 131.

Note on display zones 2, 3 and 4:

Displayed is the stop value learnt at the last matching.

Note on all display zones:

If the specification still is not obtained after performing the matching: Check wiring for open and short circuits also the connectors for soiling and corrosion. Only when no wiring fault is found should the throttle valve control part be replaced.

Significance of figures in 6 digit number block, display zone 1 - Learning requirements display

X	X	X	X	X	X	Significance
						Learning process throttle valve positioner sender (G127) Min. stop 0 = Learning process carried out, learning process OK. 1 = Learning process not carried out, learning process n. OK.
						Learning process throttle valve positioner sender (G127) Max. stop 0 = Learning process carried out, learning process OK. 1 = Learning process not carried out, learning process n. OK.
						Learning process throttle valve potentiometer (G69) Min. stop 0 = Learning process carried out, learning process OK. 1 = Learning process not carried out, learning process n. OK.
						Learning process throttle valve potentiometer (G69) Max. stop 0 = Learning process carried out, learning process OK. 1 = Learning process not carried out, learning process n. OK.
						Not relevant
						Balancing throttle valve potentiometer (G69) to throttle valve positioner sender (G127) 0 = Balancing must be carried out 1 = Balancing carried out, balancing OK.

Display group 24 -knock control-						
Read measured value block 24 →				[trif] Indicated on display		
xxxx rpm	x.xx ms	xx.x°BTDC	xx.x °CA	[trif] Display zones		Specification
1	2	3	4			Evaluation
				Sum of cyl. No. 1...4 ignition retardation angles		0...72.0 °CA
				Ignition timing		20°ATDC...40°BTDC
		Engine load				0...10.00 ms
	Engine speed					0...6800 rpm

Notes on display group 24:

- ♦ To prevent engine damage the knock control must retard the ignition timing as soon as pinking is recognised.
- ♦ Retarding the ignition will though increase the exhaust gas temperature. There is a danger that the catalyst will overheat.



- ◆ To prevent this overheating, the mixture is enriched to lower the exhaust gas temperature when at full load the sum retardation of approx. 10 °CA is reached.

Engine code: ADR

Display group 25 -Intake manifold change-over and camshaft adjustment-					
Read measured value block 25				⇒	[ltrif] Indicated on display
xxxxxxx	x.x °CA	x xx	x.x °CA		
1	2	3	4	[ltrif] Display zones	Specification
				Active camshaft adjustment angle	-3...25 ° CA
				Operating mode (intake manifold change-over/camshaft adjustment)	x 00
				Hall sender adjustment deviation	-30...30 ° CA
				Engine operating mode	---
					==> Page 49

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 and 16.0 °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

Display group 26 -Camshaft adjustment-					
Read measured value block 26				⇒	[ltrif] Indicated on display
xxxx rpm	x.xx ms	x xx	xx.x °CA		
1	2	3	4	[ltrif] Display zones	Specification
				Active camshaft adjustment angle	-3...25 ° CA
				Operating mode (intake manifold change-over/camshaft adjustment)	x 00
				Engine load	0...10.00 ms
				Engine speed	0...6800 rpm
					==> Page 49

Significance of the figures in the 3 digit display, display zone 3 - Operating mode

X				X	X	Significance
						Value "0" = Conditions not fulfilled, activation not active
						Value "1" = Conditions fulfilled, activation active
						Camshaft adjustment (1 = advanced)
						Intake manifold change-over (1 = long intake tract)
						Vacant
						Not relevant



Engine code: AEB

Display group 25 -Charge pressure control-							
Read measured value block 25 ⇒				[[trif] Indicated on display			
x.xx ms	x.xx ms	x.xx ms	xx %	[[trif] Display zones		Specification	
1	2	3	4	Charge pressure limitation solenoid valve duty cycle		0...99 %	---
				Actual engine load (regulated via charge pressure to specified engine load)		0.50...8.00 ms	---
				Specified engine load after correction (reduced by knock control, altitude adaption and coolant temperature)		0.00...8.00 ms	---
				Specified engine load before correction (driver's requirement via accelerator pedal)		3.00...8.00 ms	---

Continuation for all engine codes

Display group 95 -Basic functions-							
Read measured value block 95 ⇒				[[trif] Indicated on display			
xxxx rpm	xx.x ms	xx.x°BTDC	xxx.x °C	[[trif] Display zones		Specification	
1	2	3	4	Coolant temperature		80...105 °C	=> Page 37
				Ignition timing		12.0 ° BTDC1)	=> Page 35
				Engine load		1.00...2.50 ms	=> Page 34
				Engine code ADR		0.50...1.50 ms	
				Engine code AEB			
				Engine speed (idling speed)		760...960 rpm	=> Page 34

1) When selecting the display group 95 under function 04 "Basic setting" the engine control unit will set a fixed ignition timing of approx. 12.0 °BTDC at idling.

Display group 098 -Matching throttle valve control part-1)							
Read measured value block 98 ⇒				[[trif] Indicated on display			
x.xxx V	x.xxx V	XXXXXXXX	XXXXXXXX	[[trif] Display zones		Specification	
1	2	3	4	Adapting mode		ADP. is running or ADP. OK. or ADP ERROR	---
				Engine operating mode		Idling or part throttle	Display group 4
				Throttle valve positioner sender voltage (G127)		0.5...4.9 V	---
				Throttle valve potentiometer voltage (G69)			---

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

Note on display group 98:

The throttle valve control part will be matched to the engine control unit when the display group 98 under function 04 "Basic setting" is selected. This matching must always be carried out when a different throttle valve control part (or other complete engine) or a different engine control unit is fitted.



If the voltage supply is interrupted (battery disconnected) adaption must also be performed.

Display group 99 -Lambda regulation-			
Read measured value block 99 =>			
xxxx rpm	xx.x ms	°C	XXXXXXXX
1	2	3	4
[[trif] Indicated on display			
[[trif] Display zones			
Lambda regulation operating mode		Specification	
		font=symbol charset=font-specific code=108 TeX='\lambda ' descr='[lambda]-Reg. OFF or font=symbol charset=font-specific code=108 TeX='\lambda ' descr='[lambda]-Reg. ON	
		-10...10 %	
		-40...125 °C	
Coolant temperature		---	
Engine speed (idling speed)		760...960 rpm	
		=> Page 34	

Notes on display zone 4:

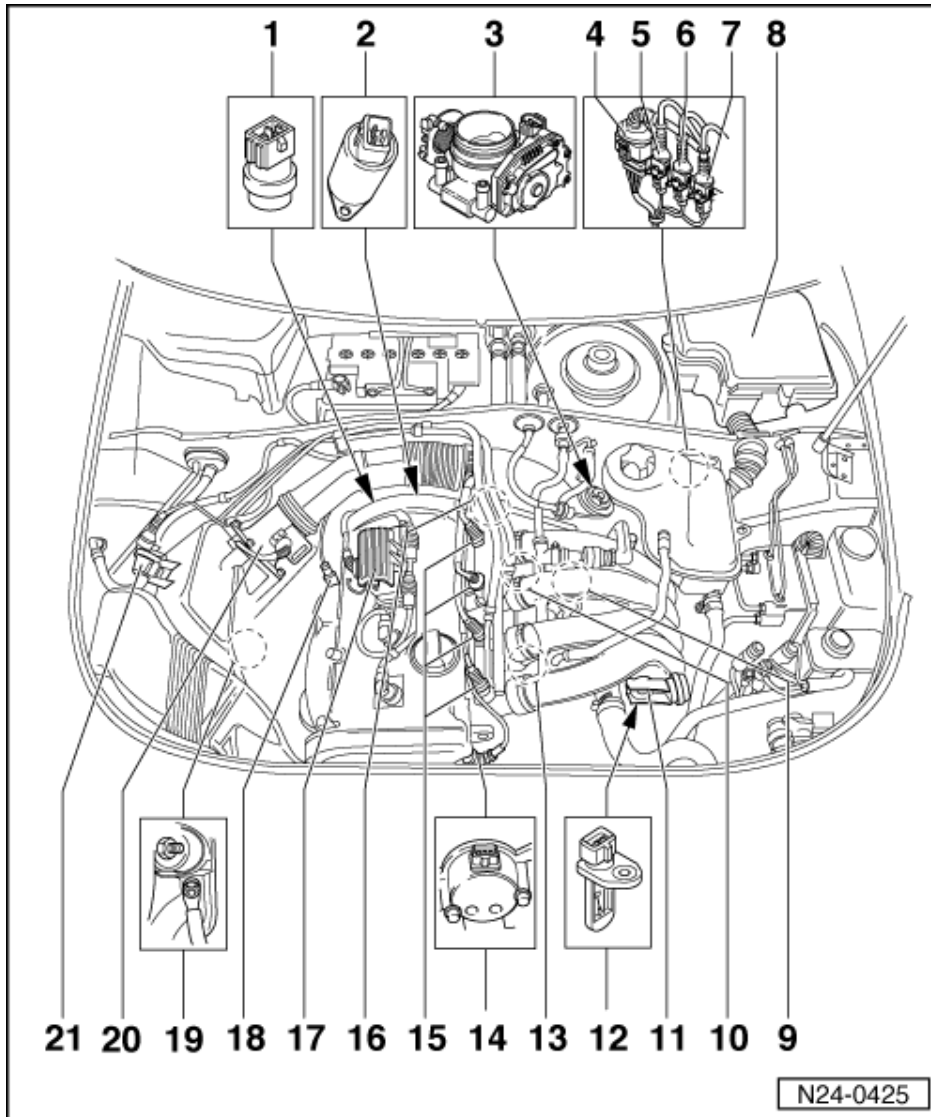
- ◆ For a defined fault finding the Lambda regulation is switched off when selecting display group 99 under "Basic setting" or switched on under "Read measured value block". When the function 04 "Basic setting" is exited the Lambda regulation is automatically active again.
- ◆ It is possible to switch 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.



24 - Mixture preparation, Injection

1 - Servicing injection system

1.1 - Servicing injection system



1.2 - Fitting locations overview

Engine code ADR

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

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



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

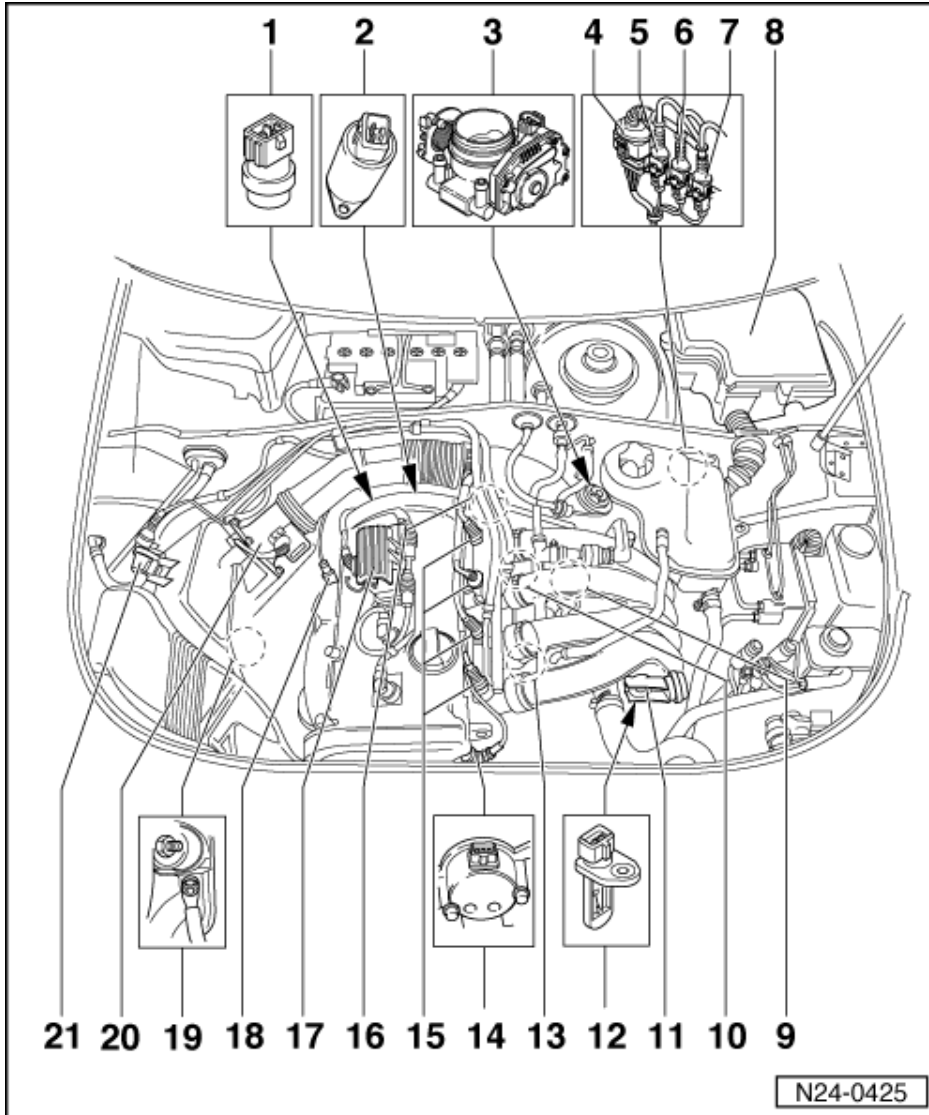
3 Throttle valve control part (J338)

4 4 pin connector

- ◆ Black for Lambda probe 1 (G39)

5 3 pin connector

- ◆ Grey for engine speed sender (G28)



6 3 pin connector

- ◆ Green for knock sensor 1 (G61)

7 3 pin connector

- ◆ Blue for knock sensor 2 (G66)

8 Engine control unit

(Motronic control unit -J220)

- ◆ Fitting location: In protective housing, plenum chamber, left

9 Engine speed sender (G28)

- ◆ Inductive sender

10 Knock sensor 2 (G66)

- ◆ => Page 142, item 10

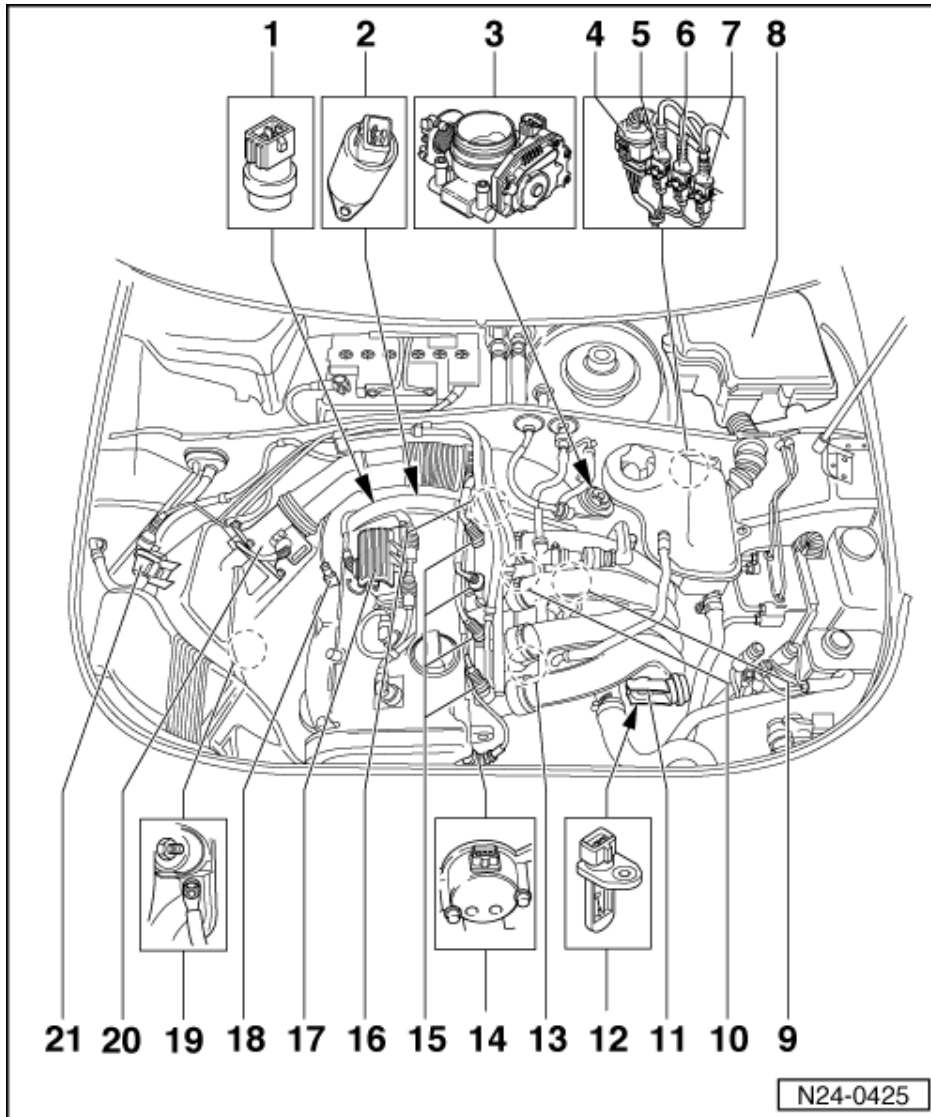
11 Intake manifold change-over valve (N156)

12 Intake air temperature sender (G42)



13 Knock sensor 1 (G61)

- ◆ =>Page 142 , item 9



14 Hall sender (G40)

- ◆ => Page 143 , item 13

15 Injector (N30...N33)

16 Fuel pressure regulator

17 Ignition coils (N, N128)

- ◆ With output stage (N122)
- ◆ =>Page 141 , item 1

18 Lambda probe (G39), 55 Nm

19 Earth connection

- ◆ On right engine support

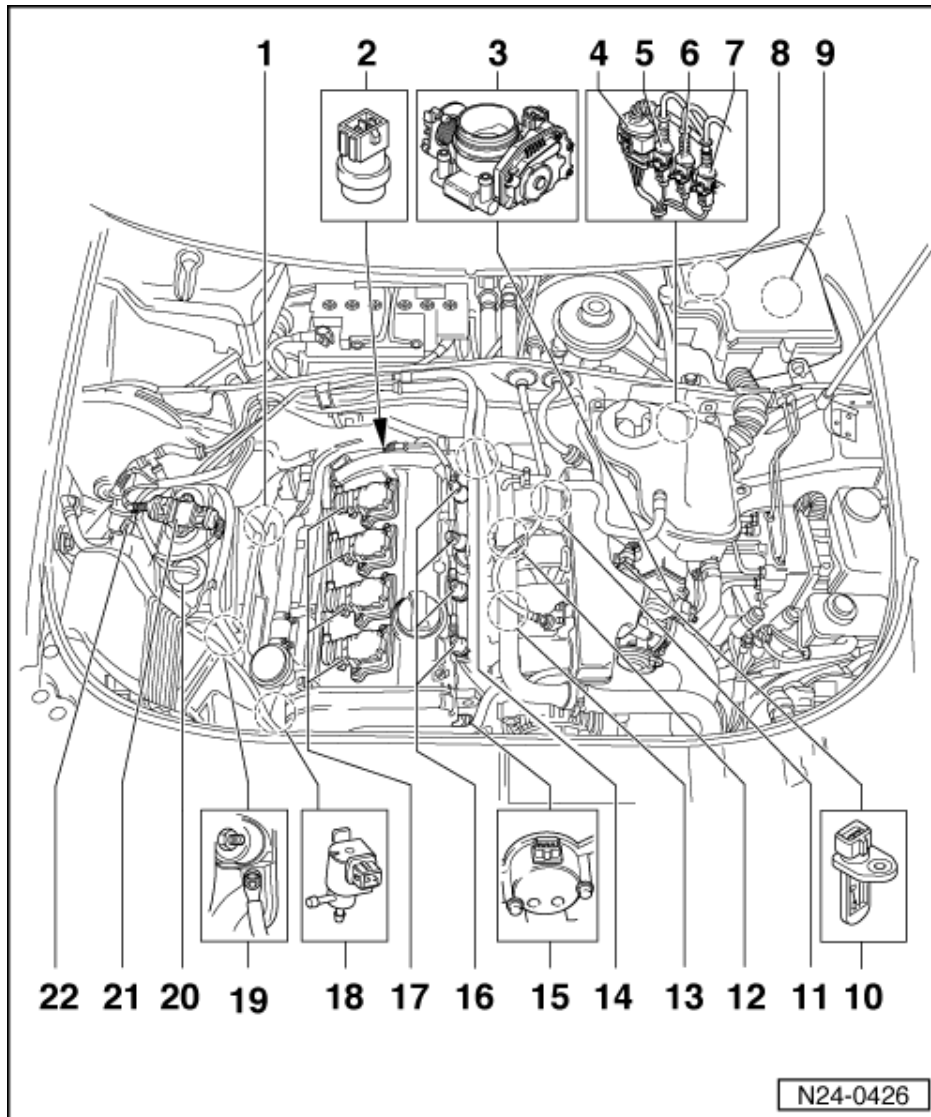
20 Air mass meter (G70)

21 Activated charcoal filter solenoid valve 1 (N80)

- ◆ On air cleaner
- ◆ Activated charcoal filter system



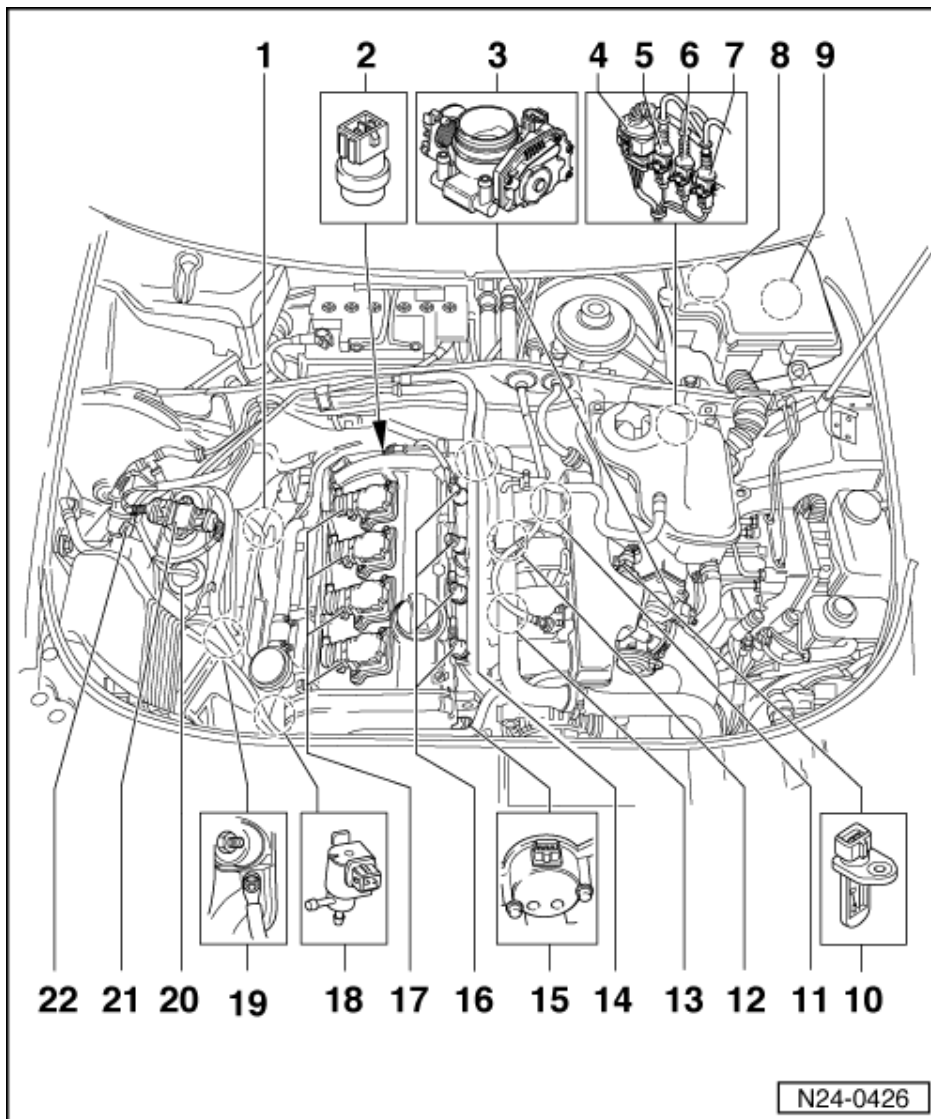
=> Repair group 20; Removing and installing parts of the fuel supply system; Servicing parts of the activated charcoal filter system
 Removing and installing parts of the fuel supply system
 Servicing parts of the activated charcoal filter system


Engine code AEB

- 1 Lambda probe (G39), 55 Nm
- 2 Coolant temperature sender (G62)
- 3 Throttle valve control part (J338)
- 4 4 pin connector
 - ◆ Black for Lambda probe 1 (G39)
- 5 3 pin connector
 - ◆ Grey for engine speed sender (G28)
- 6 3 pin connector
 - ◆ Green for knock sensor 1 (G61)
- 7 3 pin connector
 - ◆ Blue for knock sensor 2 (G66)
- 8 Altitude sender (F96)



- ◆ Fitting location: In protective housing, plenum chamber, left



9 Engine control unit

(Motronic control unit -J220)

- ◆ Fitting location: In protective housing, plenum chamber, left

10 Intake air temperature sender (G42)

11 Engine speed sender (G28)

- ◆ Inductive sender

12 Knock sensor 2 (G66)

- ◆ => Page 147 , item 15

13 Knock sensor 1 (G61)

- ◆ =>Page 146 , item 14

14 Fuel pressure regulator

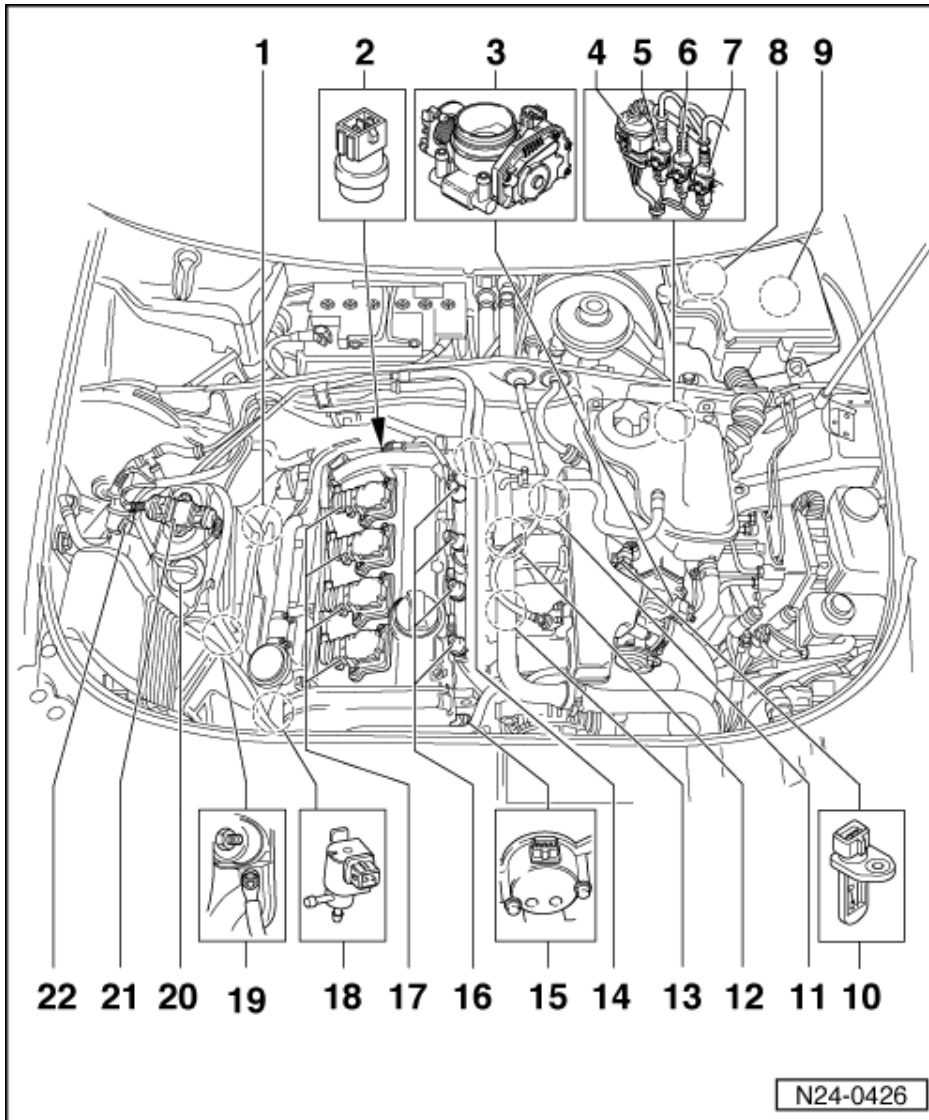
15 Hall sender (G40)

- ◆ => Page 147 , item 18

16 Injector (N30...N33)

17 Ignition coils (N, N128, N158 and N163)

- ◆ =>Page 146 , item 9



18 Charge pressure limitation 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

19 Earth connection

- ◆ On right engine support

20 Air mass meter (G70)

21 Output stage (N122)

- ◆ =>Page 145 , item 2

22 Activated charcoal filter solenoid valve 1 (N80)

- ◆ On air cleaner
- ◆ Activated charcoal filter system

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



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 4 , interrogating and erasing fault memory.
- ◆ Components marked with ** can be checked with the final control diagnosis => Page 25 .
- ◆ 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 132 .
- ◆ 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 4 , interrogating and erasing fault memory

Safety precautions =>Page 85

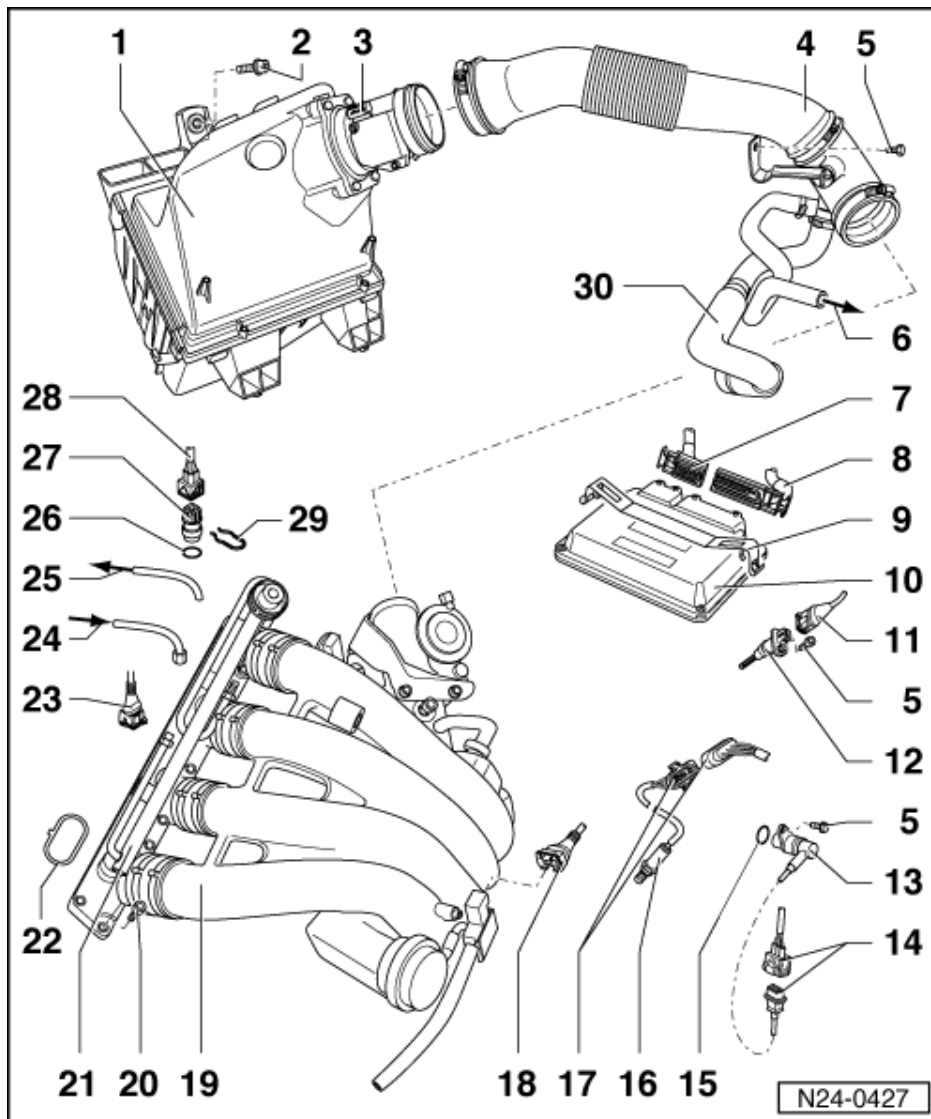
Rules for cleanliness => Page 86

Technical data => Page 86

Checking engine operating mode => Page 122

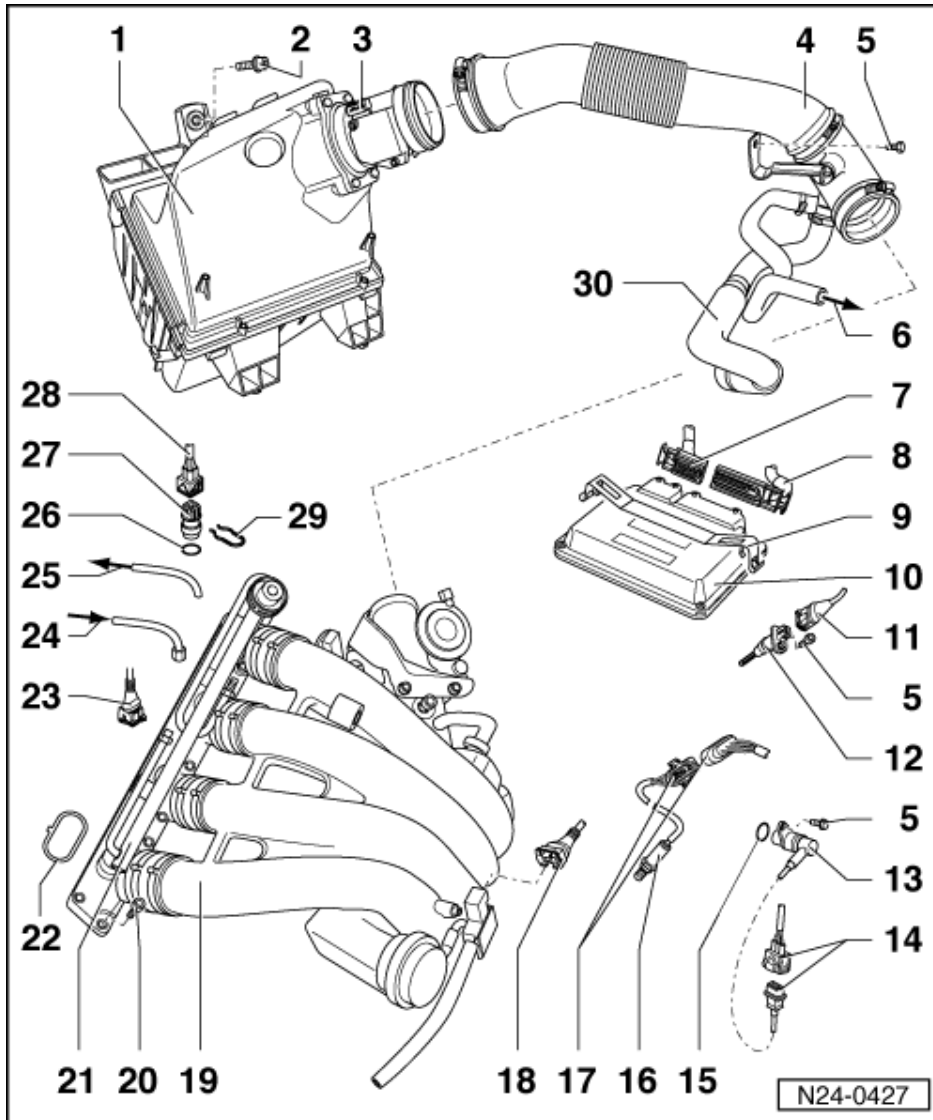


1.4 - Removing and installing parts of the injection system



Engine code ADR

- 1 Air cleaner
 - ◆ Dismantling and assembling => Page 74
- 2 20 Nm
- 3 Air mass meter (G70)*
 - ◆ Checking => Page 89
- 4 Air intake elbow
- 5 10 Nm
- 6 To vacuum booster
- 7 Connector, 28 pin
 - ◆ Only disconnect or connect with ignition switched off
 - ◆ Release to disconnect



8 Connector, 52-pin

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

9 Securing plate

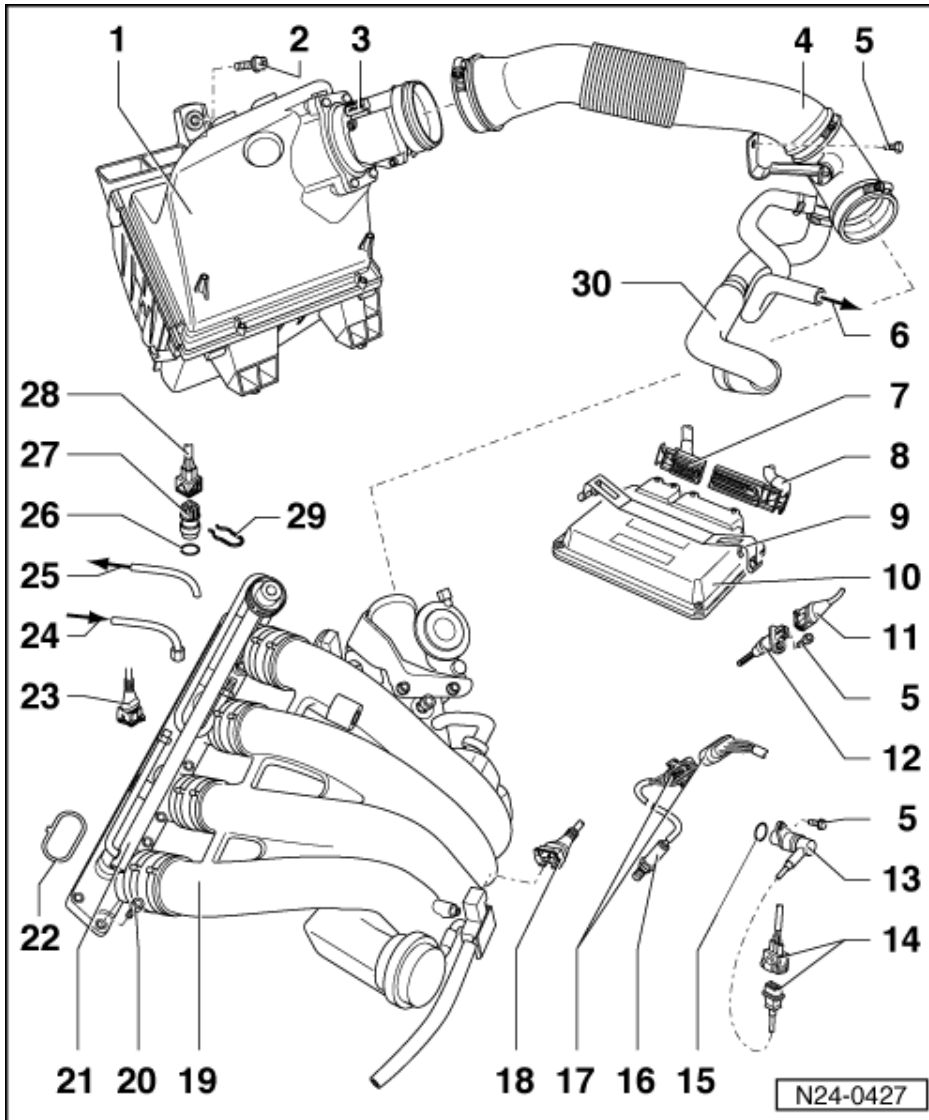
10 Engine control unit*

(Motronic control unit -J220)

- ◆ Fitting location: In protective housing, plenum chamber, left
- ◆ Checking voltage supply => Page 126
- ◆ Procedure after voltage supply open circuit => Page 128
- ◆ Renew => Page 126

11 Connector

- ◆ Black, 2-pin
- ◆ For intake air temperature sender (G42)



12 Intake air temperature sender (G42)*

- ◆ Checking => Page 102
- ◆ Resistance graph =>Page 85, Fig. 1

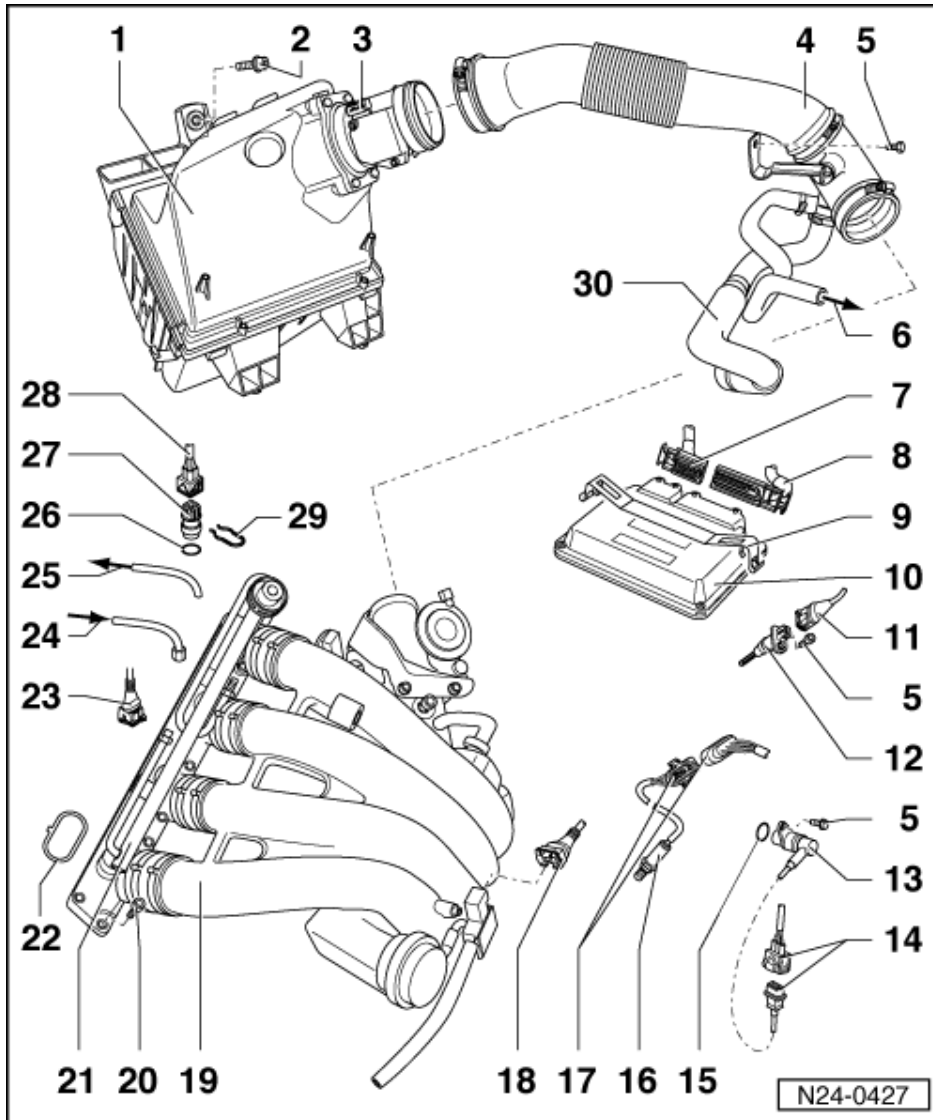
13 Engine speed sender (G28)*

- ◆ Inductive sender
- ◆ Checking => Page 105

14 3 pin connector

- ◆ Grey
- ◆ For engine speed sender
- ◆ Fitting location => Page 52, engine compartment overview

15 O ring

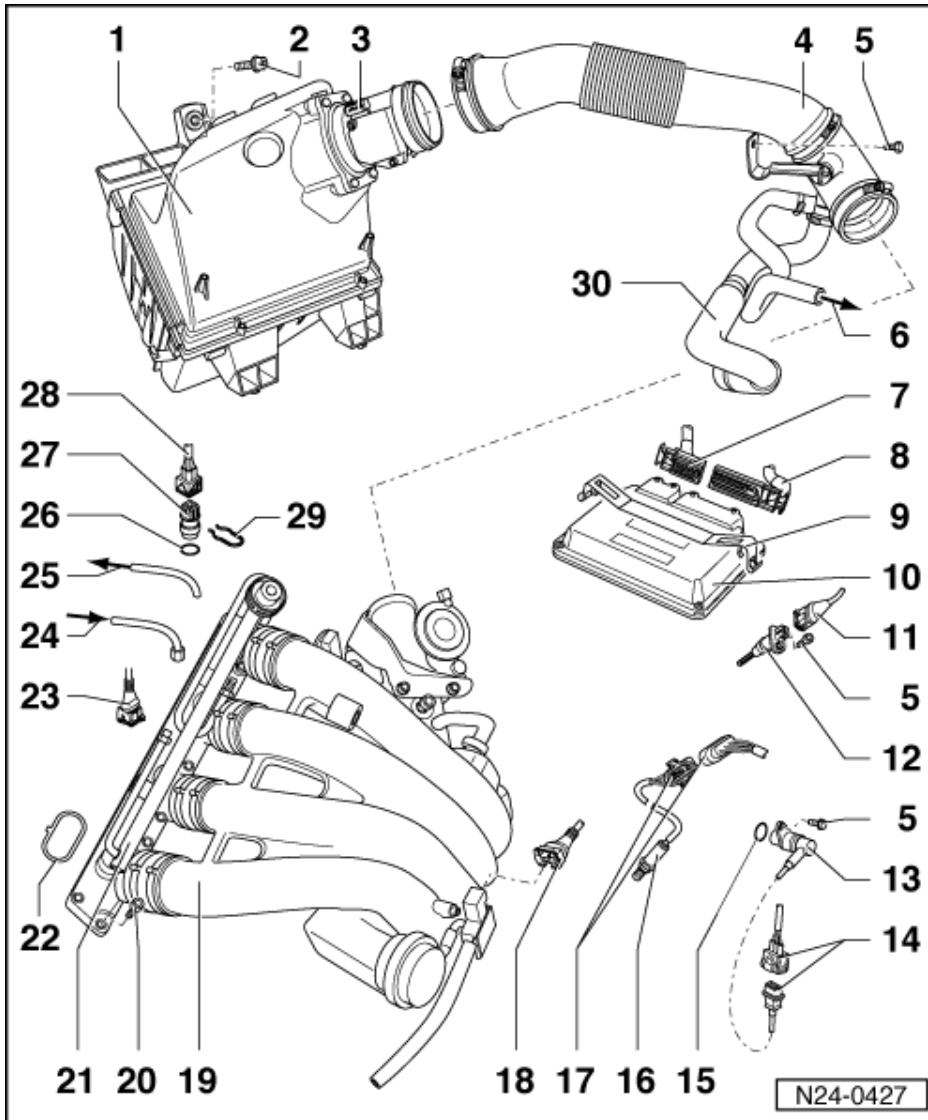


16 Lambda probe 1 (G39)*, 50Nm

- ◆ Location: In front exhaust pipe
- ◆ Grease only the threads with "G5"; "G5" must not get into the slots on the probe body
- ◆ Checking Lambda control
=> Page 118
- ◆ Probe heating voltage supply via fuel pump relay (J17)
- ◆ Checking Lambda probe heating => Page 87
- ◆ Check probe heating for continuity
- ◆ Fitting location => Page 52 , engine compartment overview

17 4-pin connector

- ◆ Black
- ◆ For Lambda probe and Lambda probe heating
- ◆ Fitting location => Page 52 , engine compartment overview



18 Connector

- ◆ Black, 2-pin
- ◆ For twin path intake manifold change-over valve (N156)

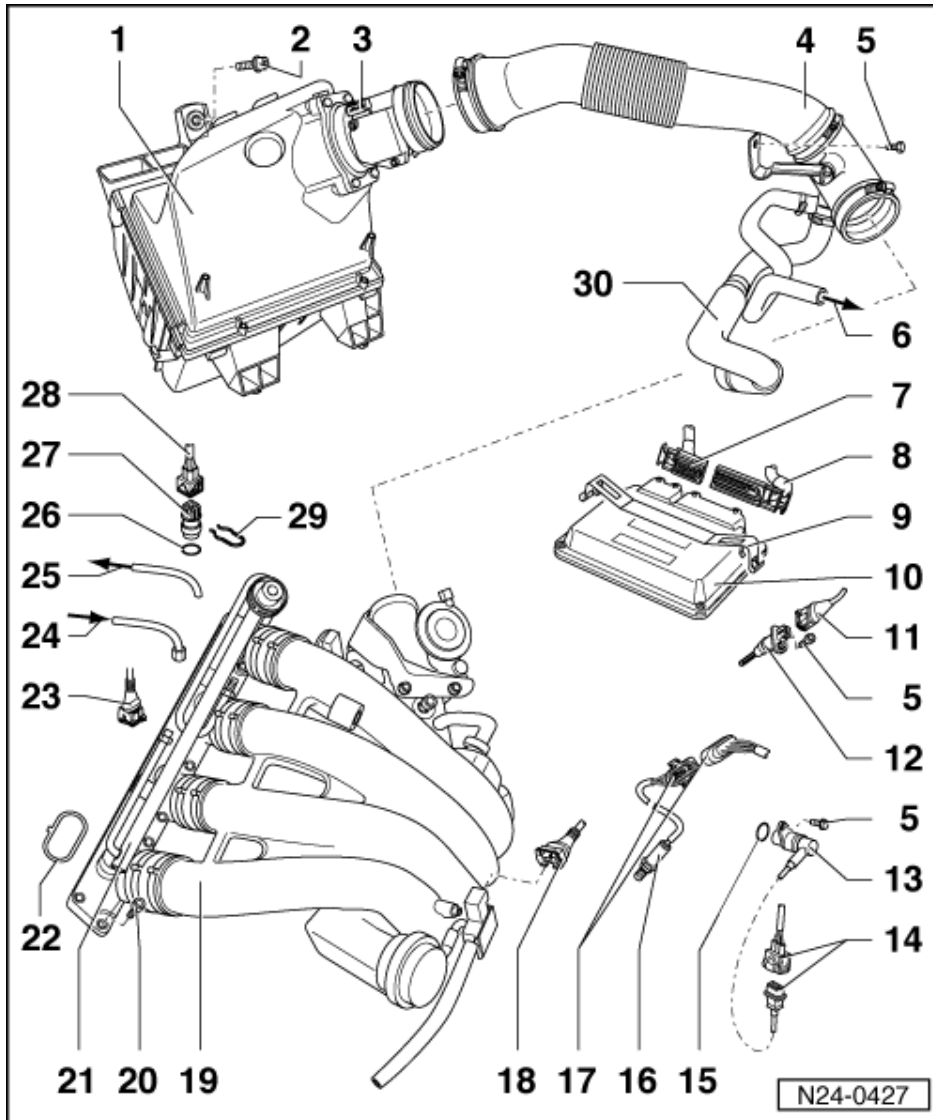
19 Intake manifold

- ◆ Removing and installing throttle valve control part
=> Page [83](#)
Vehicles > 04.98:
- ◆ Removing and installing parts of intake manifold change-over => Page [78](#)
Vehicles 05.98 > (plastic intake manifold):
- ◆ Removing and installing parts of intake manifold change-over => Page [80](#)

20 10 Nm

21 Fuel rail with injectors

- ◆ Dismantling and assembling => Page [77](#)



22 Seal

- ◆ With locating tap
- ◆ Renew if damaged

23 Connector

- ◆ Black, 2-pin
- ◆ For injector (N30...N33)

24 Supply pipe/hose

- ◆ From fuel filter:

=> Repair group 20; Removing and installing parts of fuel supply system; Removing and installing fuel tank with attachments and fuel filter
 Removing and installing parts of fuel supply system
 Removing and installing fuel tank with attachments and fuel filter

25 Return pipe

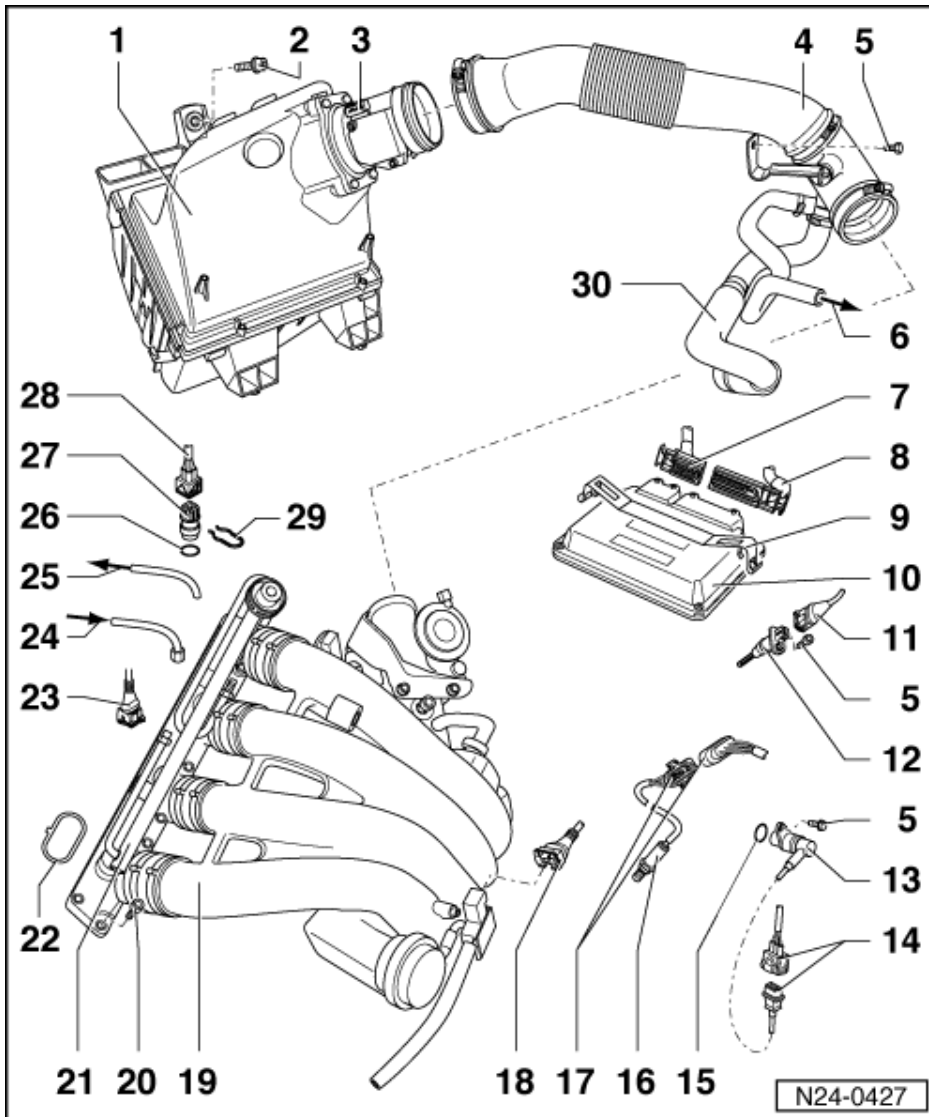
- ◆ Secure with spring-type clips
- ◆ Check securely seated
- ◆ To the fuel delivery unit in fuel tank

=> Repair group 20; Removing and installing parts of fuel supply system; Removing and installing fuel tank with attachments and fuel filter
 Removing and installing parts of fuel supply system
 Removing and installing fuel tank with attachments and fuel filter

26 O ring



- ◆ Renew if damaged



27 Coolant temperature sender (G62)*

- ◆ Blue
- ◆ For engine control unit
- ◆ With coolant temperature gauge sender (G2)
- ◆ Checking =>Page 98
- ◆ If necessary release pressure in cooling system before removing
- ◆ Resistance graph =>Page 85 , Fig. 1

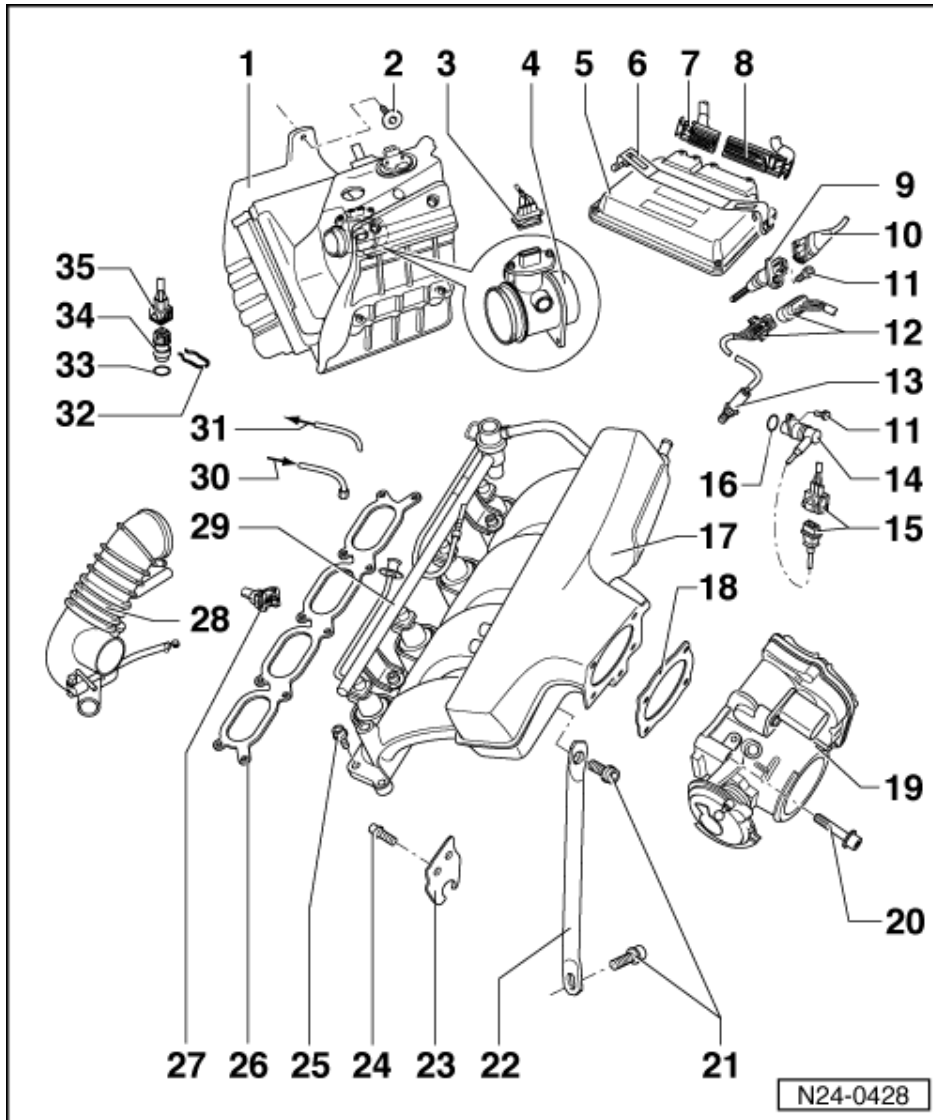
28 Connector

- ◆ Blue, 4 pin
- ◆ For coolant temperature sender (G62)

29 Retaining clip

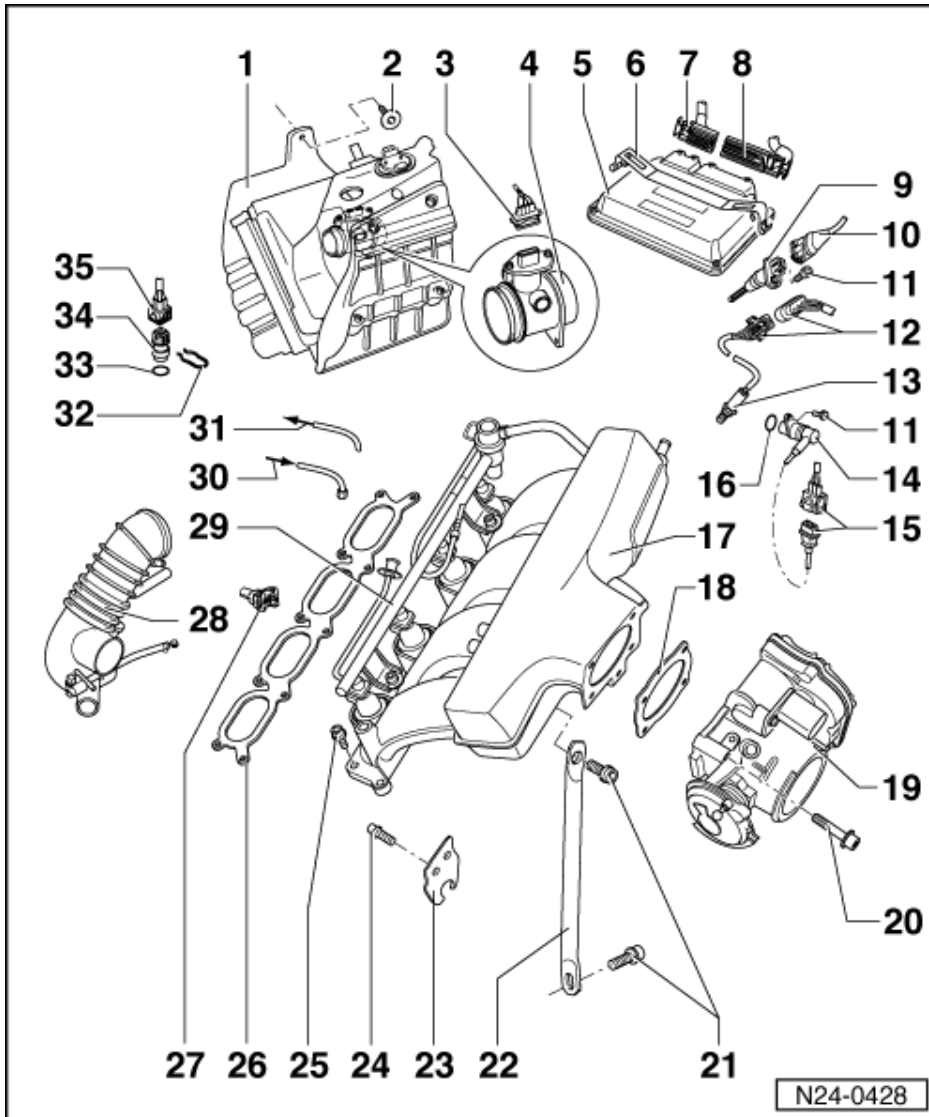
- ◆ Check seated securely

30 To crankcase breather valve

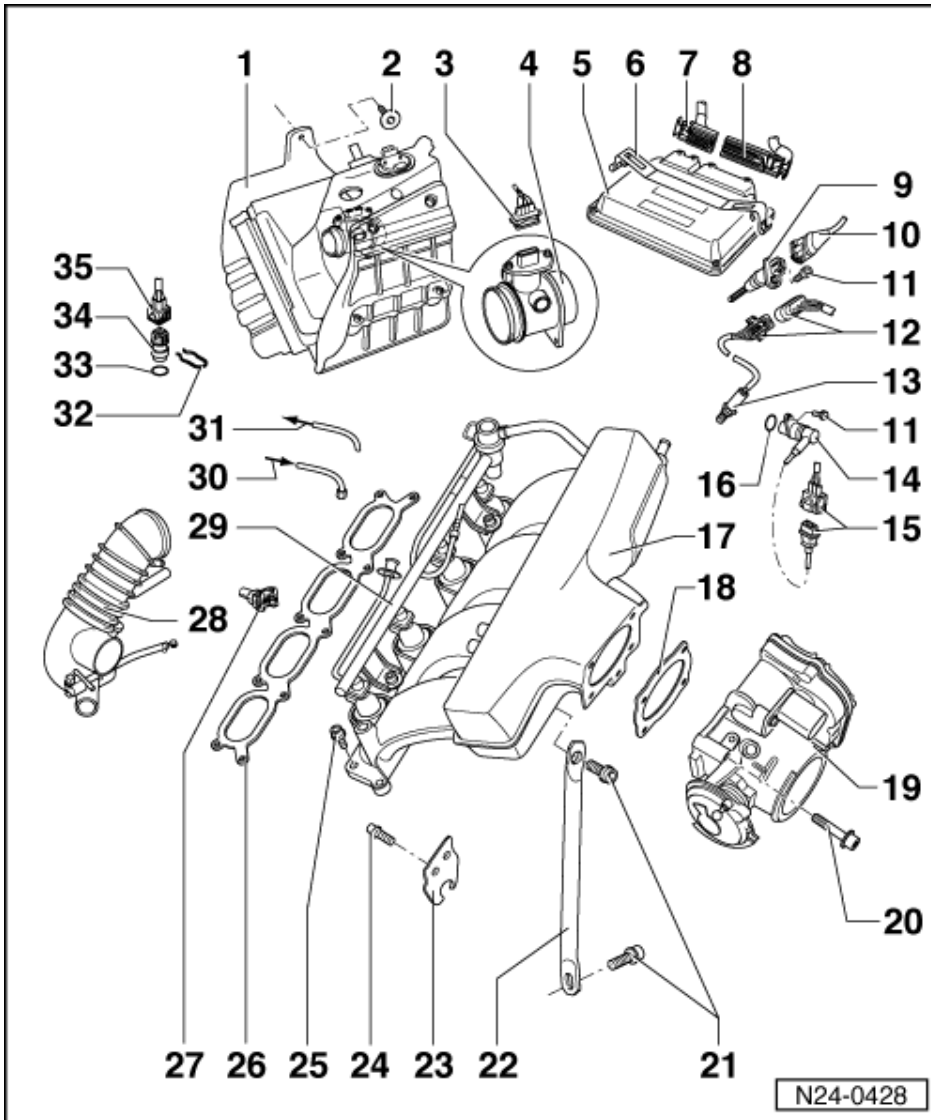


Engine code AEB

- 1 Air cleaner**
 - ◆ Dismantling and assembling => Page **74**
- 2 20 Nm**
- 3 Connector**
 - ◆ Black, 4-pin
 - ◆ For air mass meter (G70)
- 4 Air mass meter (G70)***
 - ◆ Fitting location: In air cleaner housing
 - ◆ Checking => Page **89**
- 5 Engine control unit***
 - (Motronic control unit -J220)
 - ◆ Fitting location: In protective housing, plenum chamber, left
 - ◆ Checking voltage supply => Page **126**
 - ◆ Procedure after voltage supply open circuit => Page **128**
 - ◆ Renew => Page **126**



- 6 Securing plate
- 7 Connector, 28 pin
 - ◆ Only disconnect or connect with ignition switched off
 - ◆ Release to disconnect
- 8 Connector, 52-pin
 - ◆ Only disconnect or connect with ignition switched off
 - ◆ Release to disconnect
- 9 Intake air temperature sender (G42)*
 - ◆ Checking => Page 102
 - ◆ Resistance graph =>Page 85, Fig. 1
- 10 Connector
 - ◆ Black, 2-pin
 - ◆ For intake air temperature sender (G42)
- 11 10 Nm

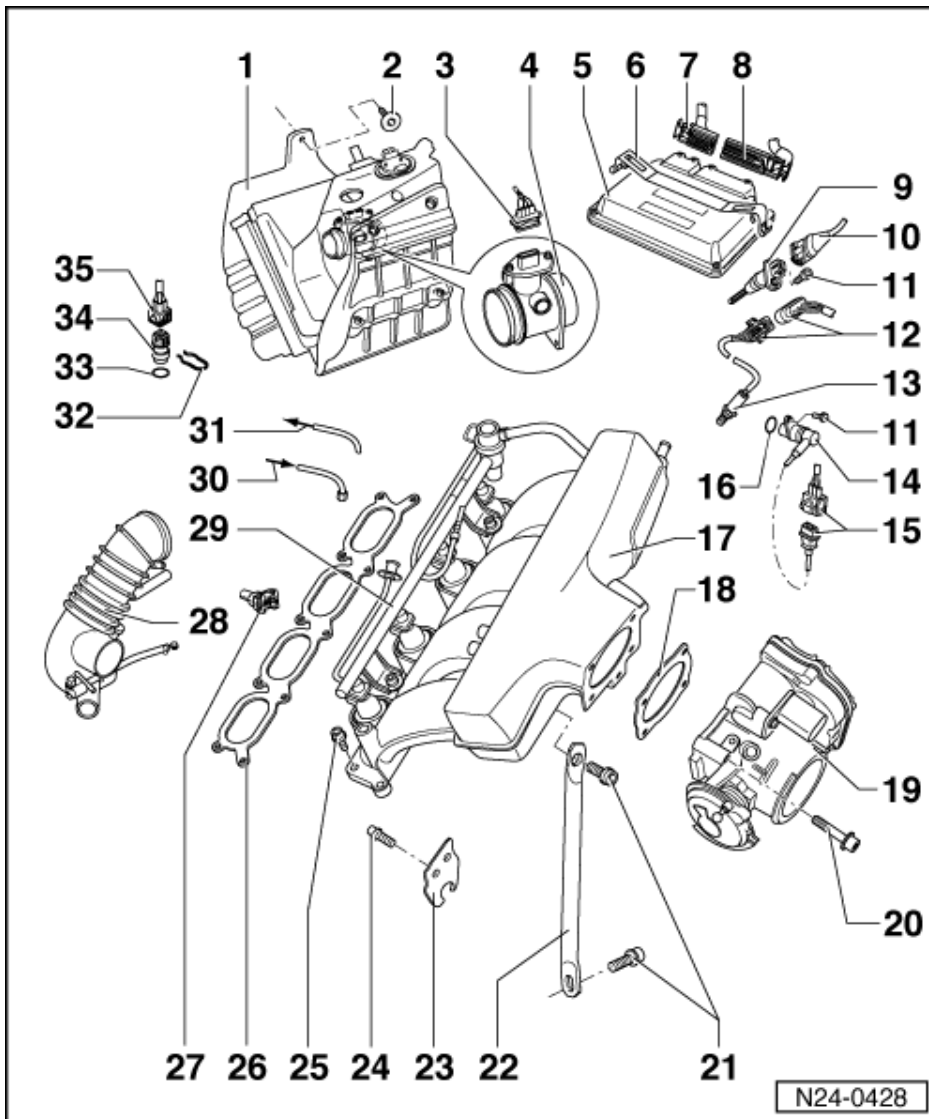


12 4-pin connector

- ◆ Black
- ◆ For Lambda probe and Lambda probe heating
- ◆ Fitting location => Page 52 , engine compartment overview

13 Lambda probe 1 (G39)*, 50Nm

- ◆ Fitting location: catalyst
- ◆ Grease only the threads with "G5"; "G5" must not get into the slots on the probe body
- ◆ Checking Lambda control
=> Page 118
- ◆ Probe heating voltage supply via fuel pump relay (J17)
- ◆ Checking Lambda probe heating => Page 87
- ◆ Check probe heating for continuity
- ◆ Fitting location => Page 52 , engine compartment overview



14 Engine speed sender (G28)*

- ◆ Inductive sender
- ◆ Checking => Page 105

15 3 pin connector

- ◆ Grey
- ◆ For engine speed sender
- ◆ Fitting location => Page 52 , engine compartment overview

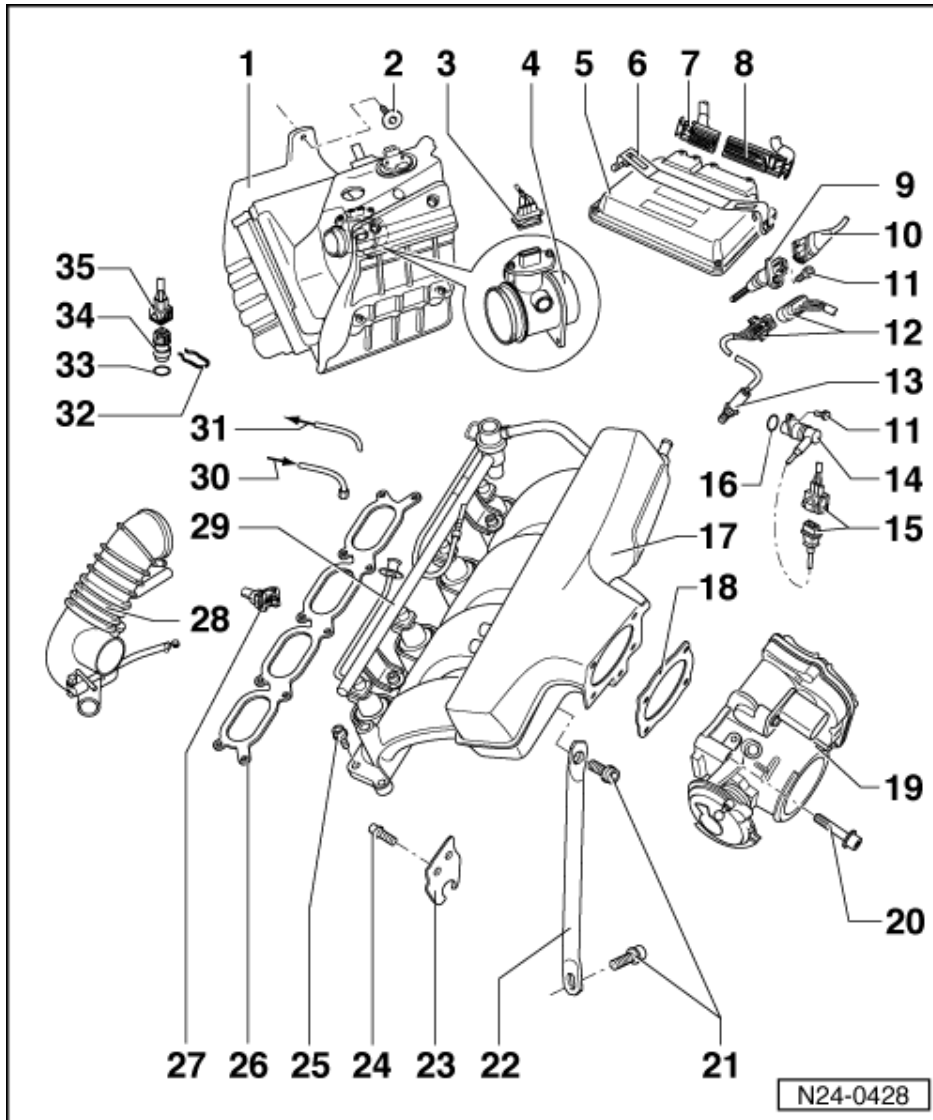
16 O ring

17 Intake manifold

- ◆ Removing and installing parts of intake manifold change-over => Page 78
- ◆ Removing and installing throttle valve control part => Page 83

18 Gasket

- ◆ Renew



19 Throttle valve control part (J338)*

- ◆ Checking => Page 92
- ◆ If replaced match 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

20 10 Nm

21 20 Nm

22 Support

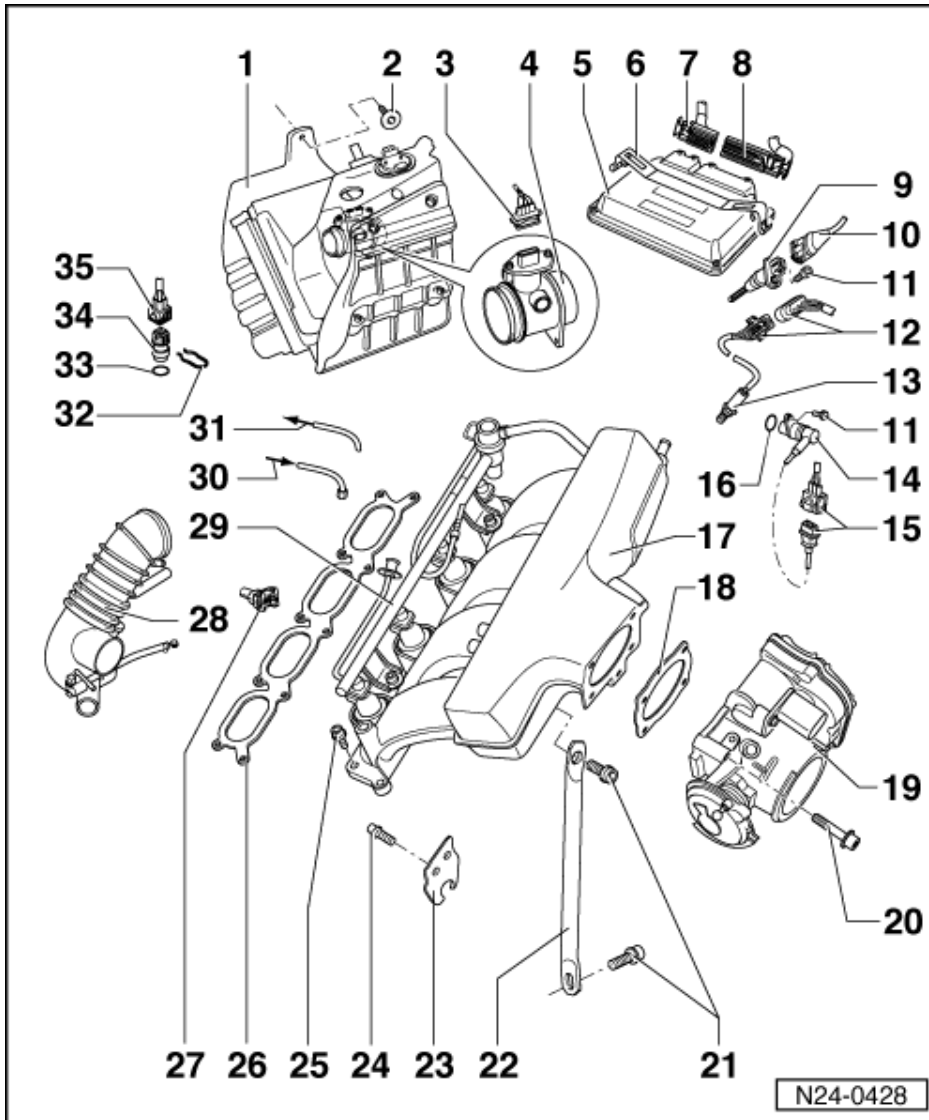
- ◆ Between intake manifold and compact bracket

23 Support bracket

- ◆ For throttle cable

24 10 Nm

25 10 Nm



26 Gasket

- ◆ Renew

27 Connector

- ◆ Black, 2-pin
- ◆ For injector (N30...N33)

28 Intake hose

=> Repair group 21; Removing and installing parts of charge air cooling Removing and installing parts of charge air cooling

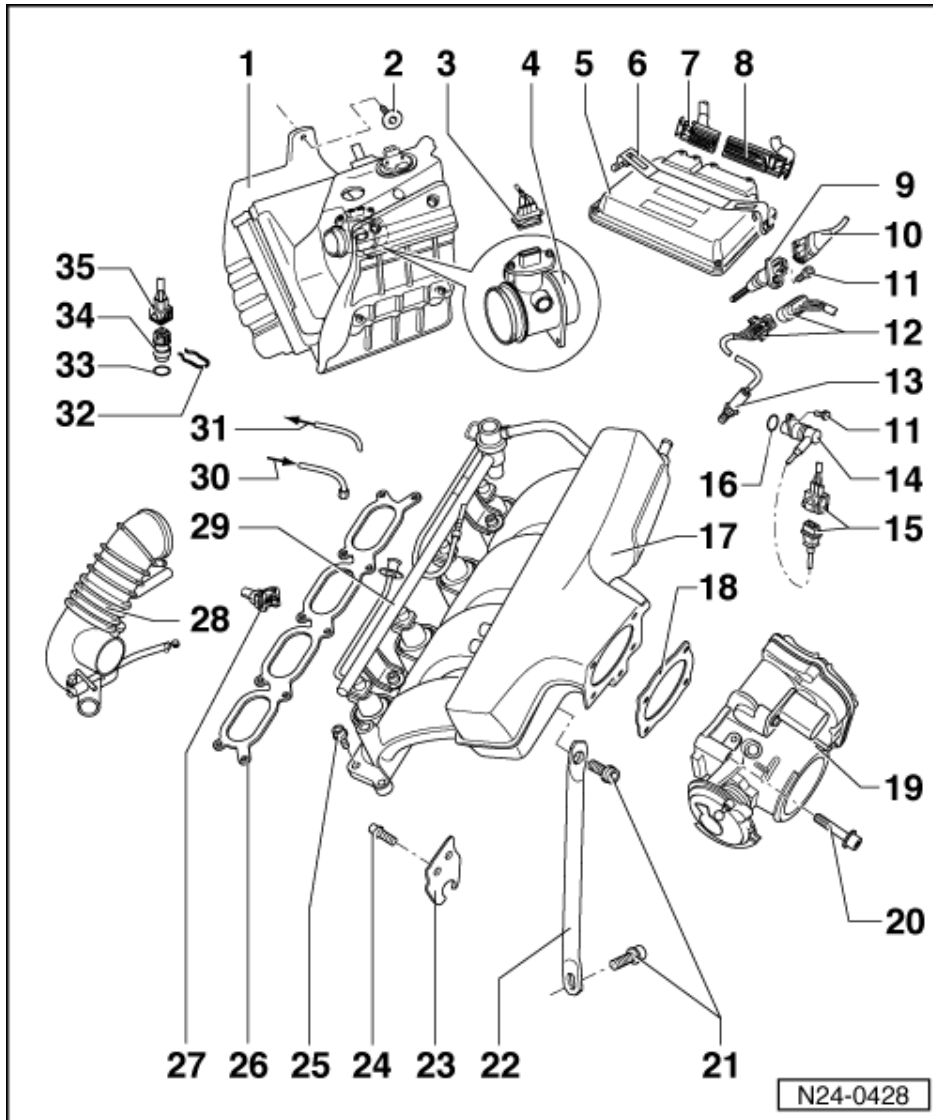
29 Fuel rail with injectors

- ◆ Dismantling and assembling => Page 77

30 Supply pipe/hose

- ◆ Black
- ◆ From fuel filter:

=> Repair group 20; Removing and installing parts of fuel supply system; Removing and installing fuel tank with attachments and fuel filter Removing and installing parts of fuel supply system Removing and installing fuel tank with attachments and fuel filter



31 Return pipe

- ◆ Secure with spring-type clips
- ◆ Check securely seated
- ◆ Blue
- ◆ To the fuel delivery unit in fuel tank

=> Repair group 20; Removing and installing parts of fuel supply system; Removing and installing fuel tank with attachments and fuel filter Removing and installing parts of fuel supply system Removing and installing fuel tank with attachments and fuel filter

32 Retaining clip

- ◆ Check seated securely

33 O ring

- ◆ Renew if damaged

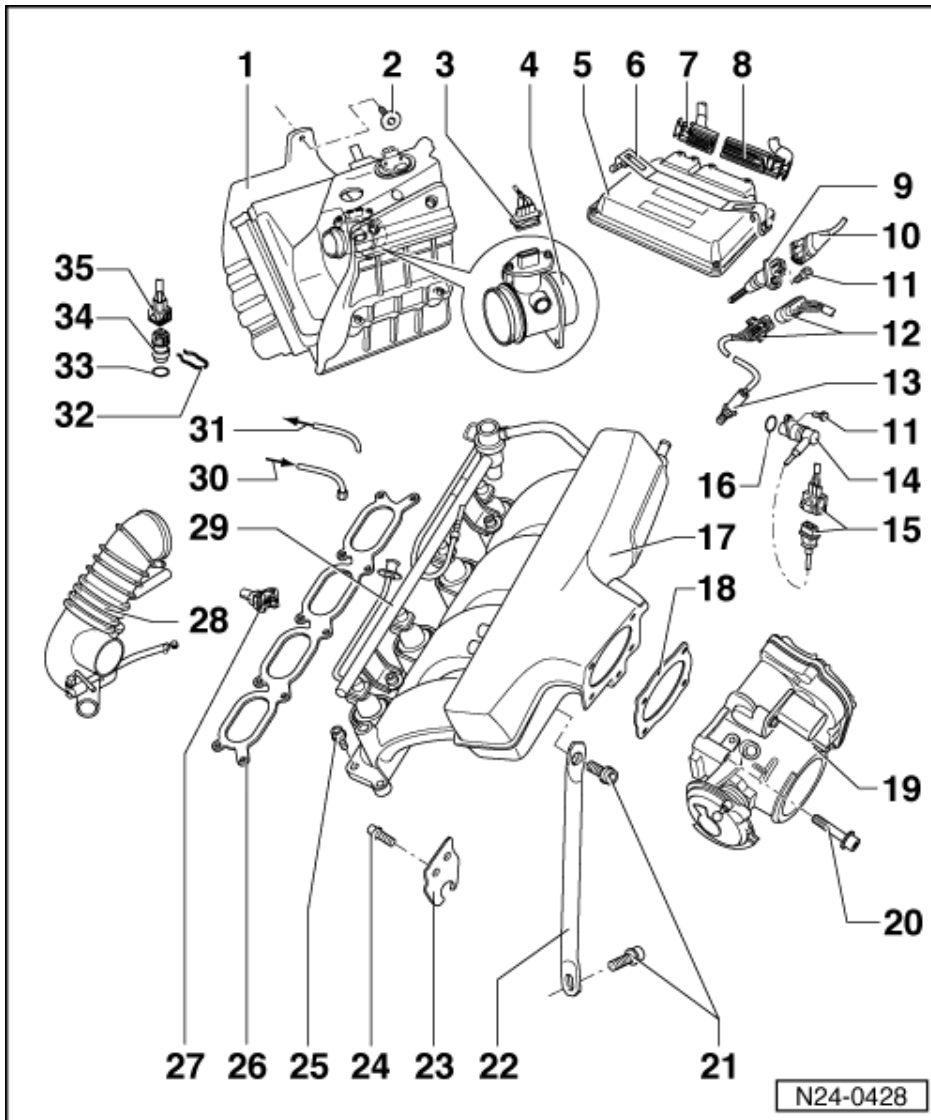
34 Coolant temperature sender (G62)*

- ◆ Blue
- ◆ For engine control unit
- ◆ With coolant temperature gauge sender (G2)
- ◆ Checking =>Page 98
- ◆ If necessary release pressure in cooling system before removing
- ◆ Resistance graph

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



=>Page 85 , Fig. 1

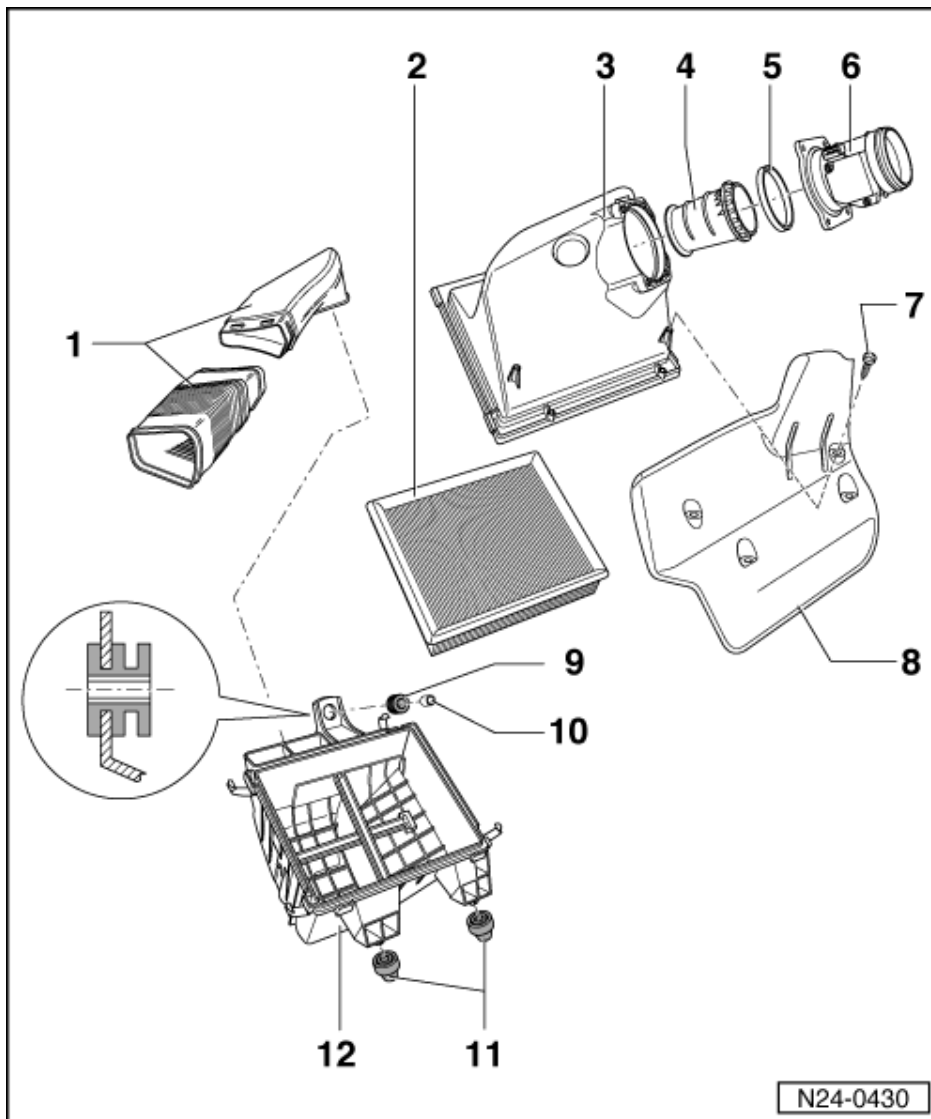


35 Connector

- ◆ Blue, 4 pin
- ◆ For coolant temperature sender (G62)

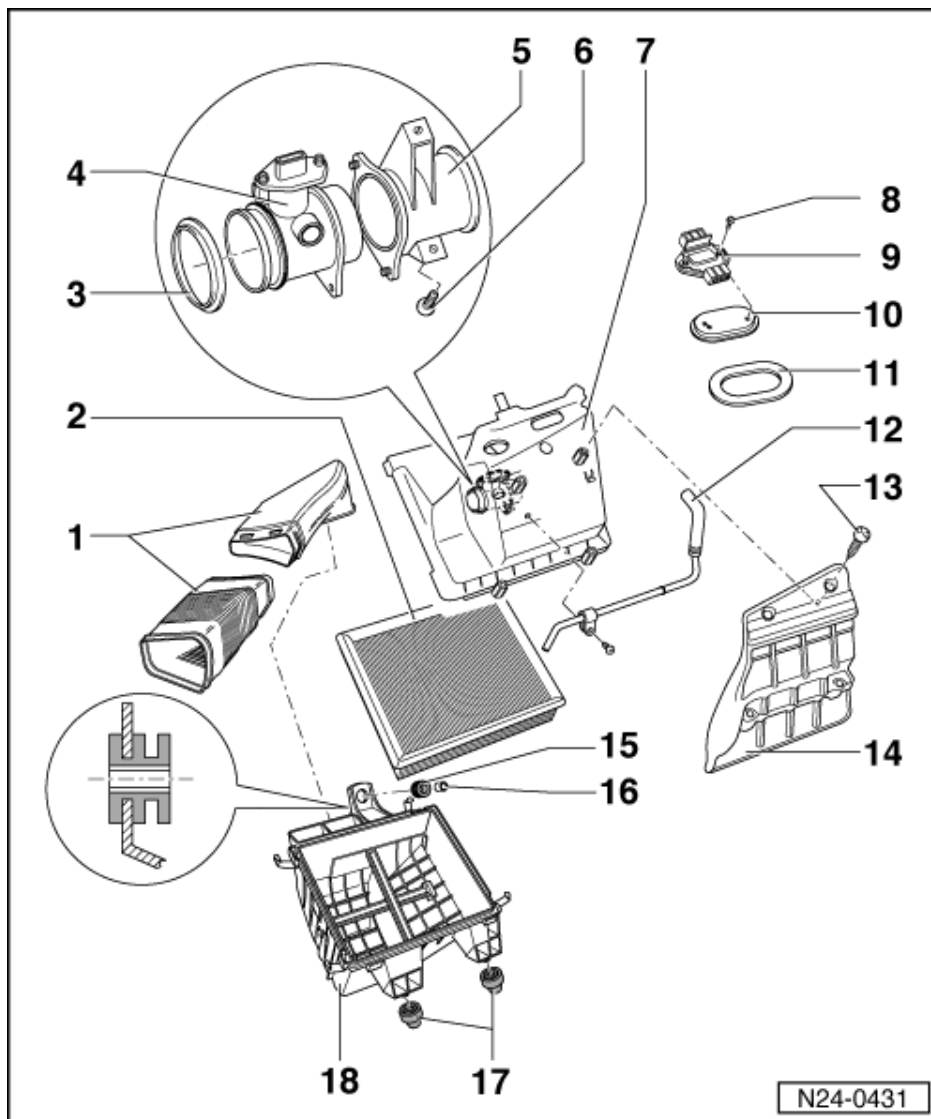


1.5 - Dismantling and assembling air cleaner



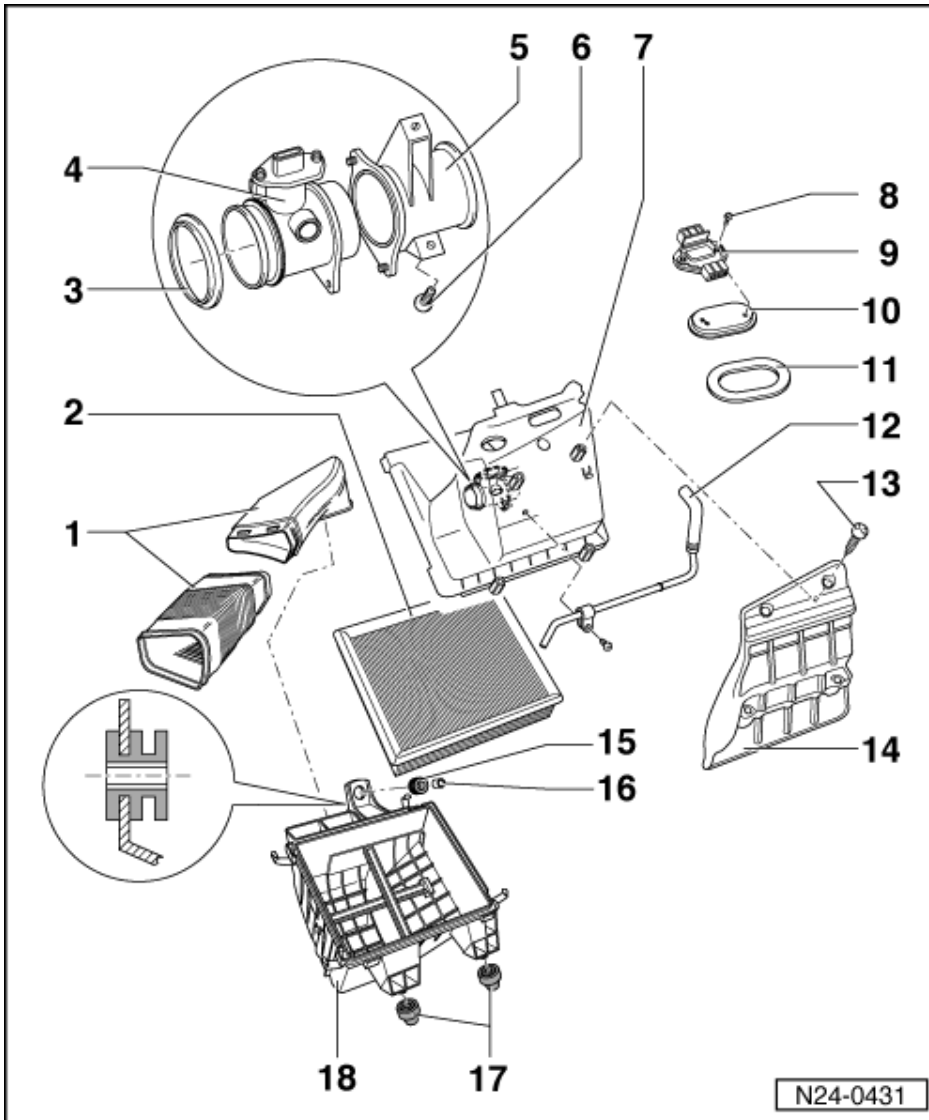
Engine code ADR

- 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 89
 - ◆ Tighten to 10 Nm
- 7 10 Nm
- 8 Heat shield
- 9 Rubber grommet
- 10 Spacer sleeve
- 11 Packing
- 12 Air cleaner lower part



Engine code AEB

- 1 Air ducting**
 - ◆ To lock carrier
- 2 Filter element**
- 3 Seal**
- 4 Air mass meter (G70)***
 - ◆ Checking => Page 89
- 5 Air duct**
- 6 6 Nm**
- 7 Air cleaner upper part**
- 8 6 Nm**
- 9 Output stage (N122)**
 - ◆ =>Page 145 , 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

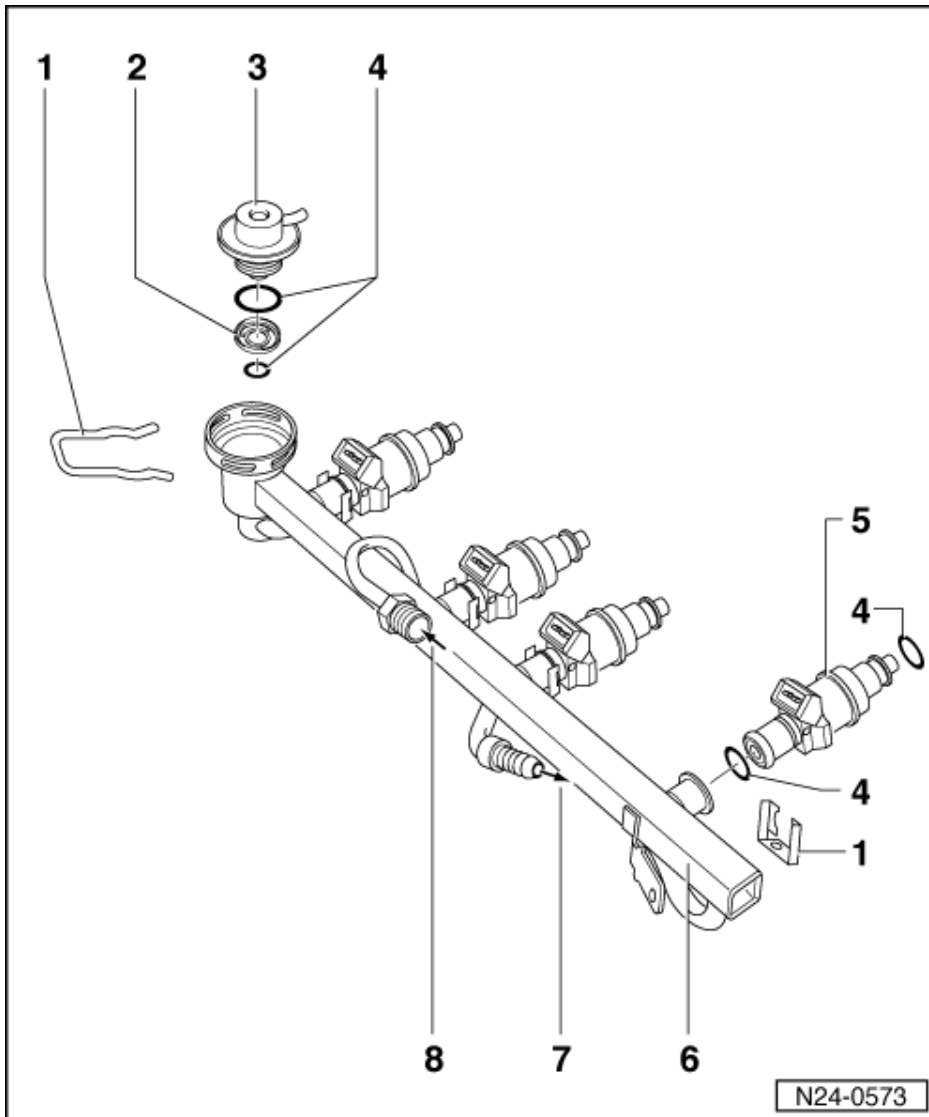
15 Rubber grommet

16 Spacer sleeve

17 Packing

18 Air cleaner lower part

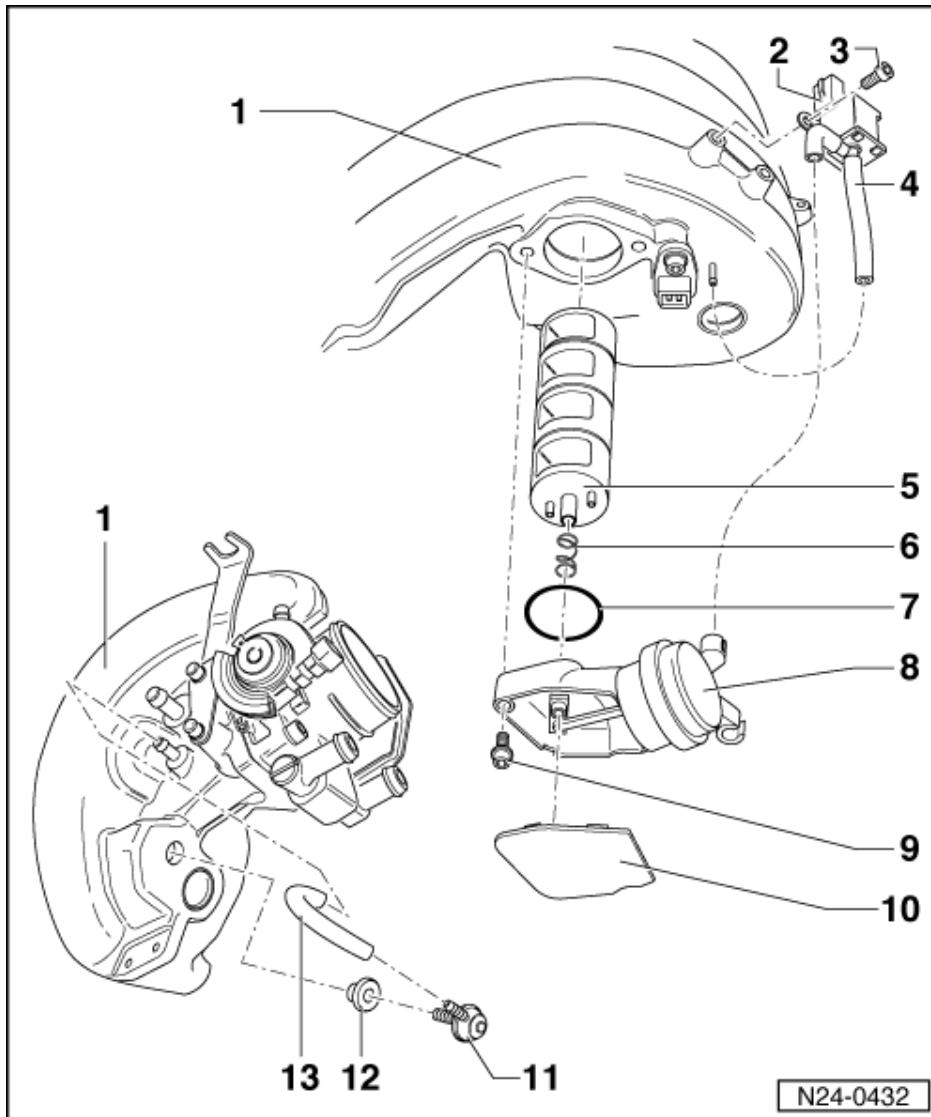
1.6 - Dismantling and assembling fuel rail with injectors



- 1 **Retaining clip**
 - ◆ Ensure seated correctly at injector and fuel rail
- 2 **Strainer**
- 3 **Fuel pressure regulator**
 - ◆ Checking => Page **112**
- 4 **O ring**
 - ◆ Renew if damaged
- 5 **Injectors (N30...N33)***
 - ◆ Checking => Page **107**
 - ◆ Resistance 12...15 ω
- 6 **Fuel rail**
 - ◆ Tighten to 10 Nm
- 7 **Return flow connection**
- 8 **Supply connection**



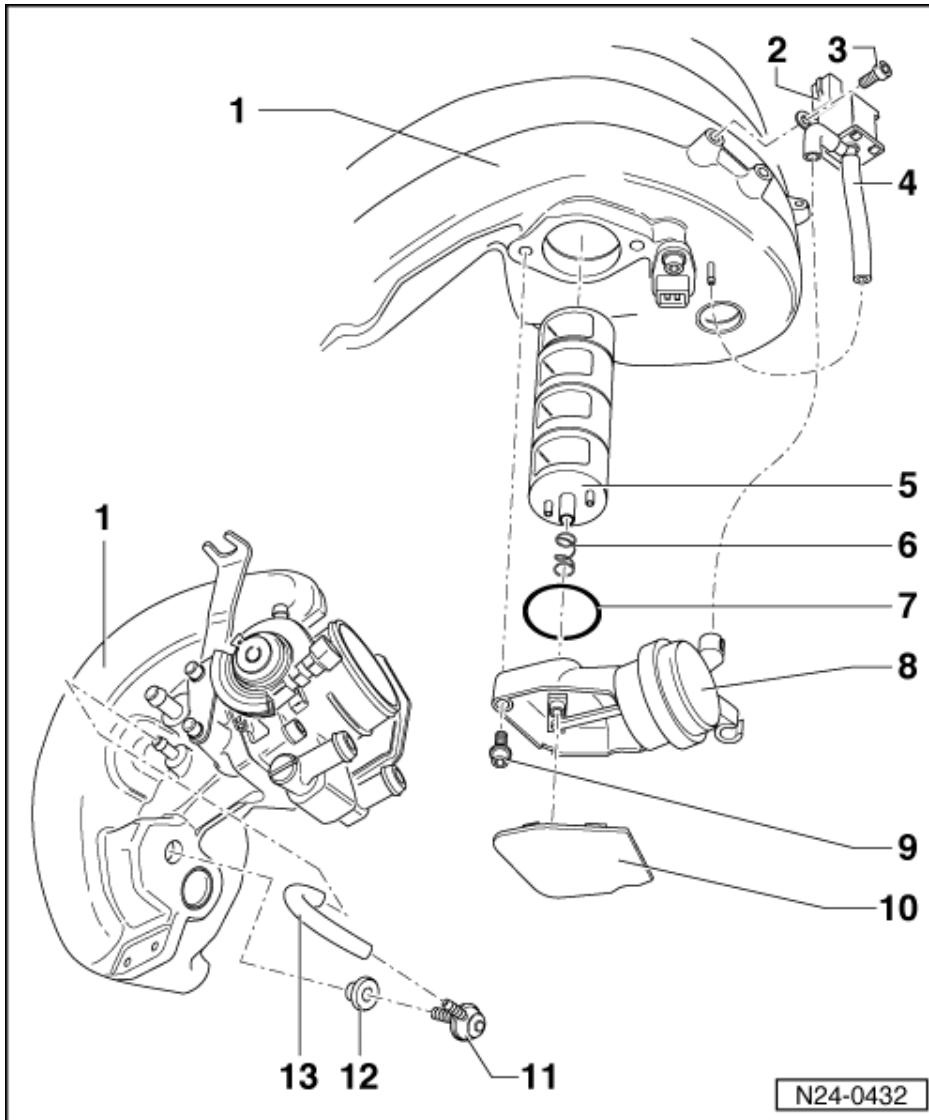
1.7 - Removing and installing parts of intake manifold change-over



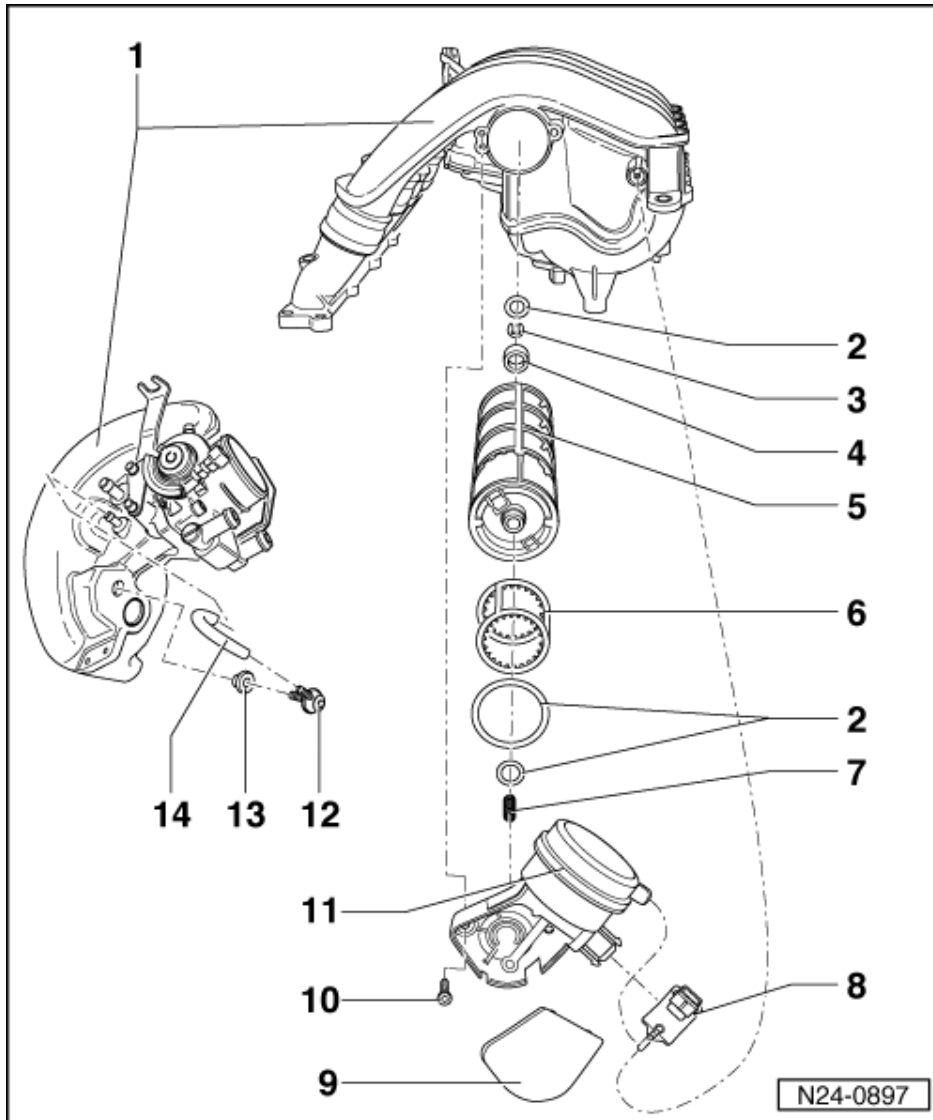
Engine code ADR ▶ 04.98

Engine code ADR with plastic intake manifold 05.98 ▶ => Page **80**

- 1 Intake manifold
- 2 Intake manifold change-over valve (N156)*/**
 - ♦ Checking intake manifold change-over valve => Page **124**
 - ♦ Resistance: 25...35 ω
- 3 6 Nm
- 4 Vacuum hose
- 5 Change-over barrel
- 6 Spring



- 7 Seal
 - ◆ Renew if damaged
- 8 Vacuum control element
- 9 10 Nm
- 10 Cover
- 11 Non-return valve
 - ◆ Installation position: White side faces intake manifold
- 12 Rubber grommet
- 13 Vacuum hose



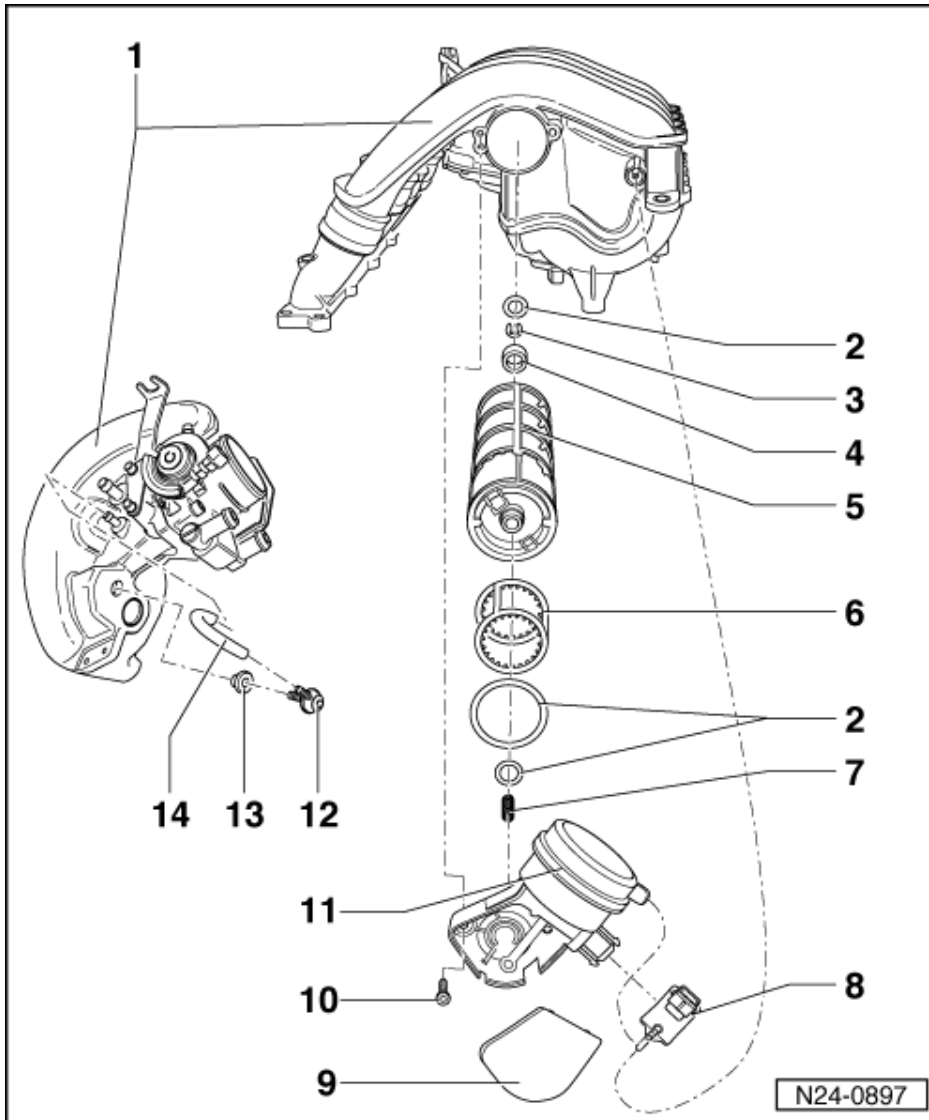
Engine code ADR with plastic intake manifold 05.98 >

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).

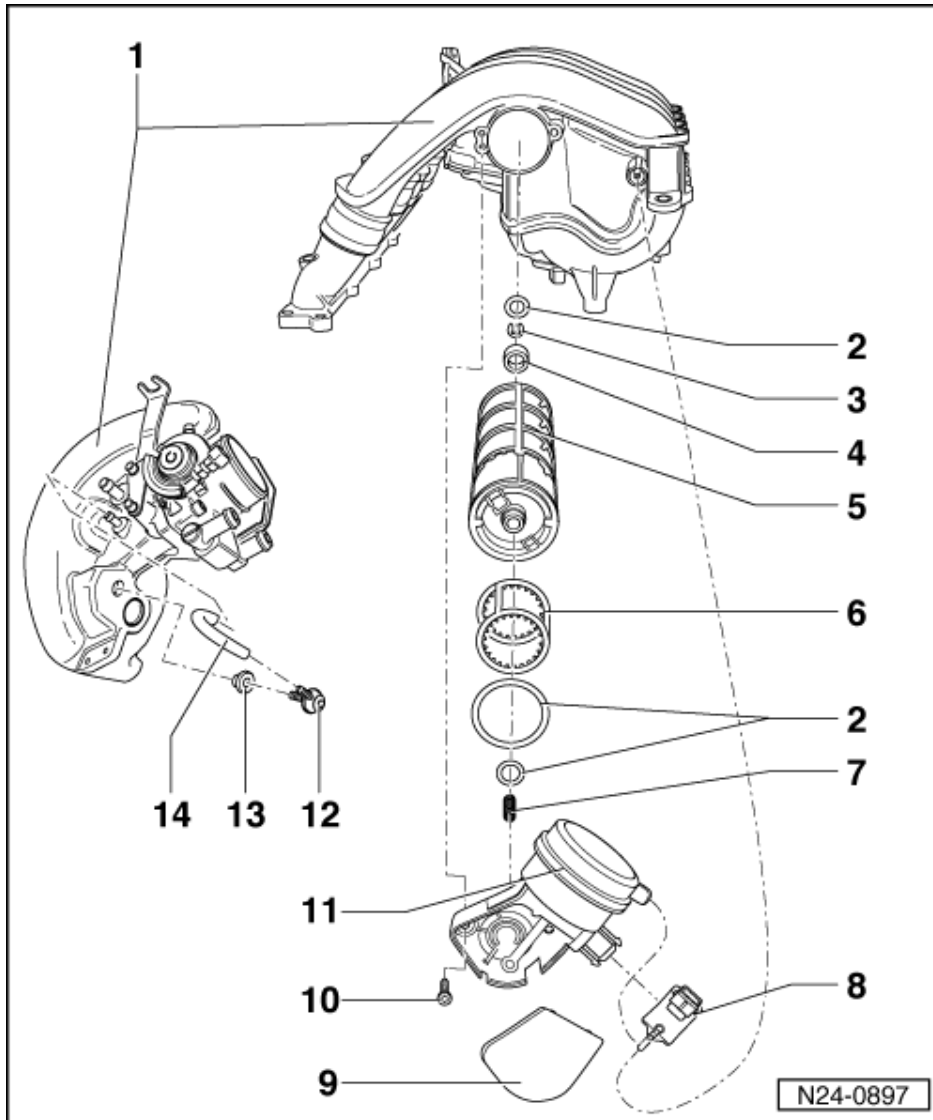
6 Sealing cage

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

7 Spring

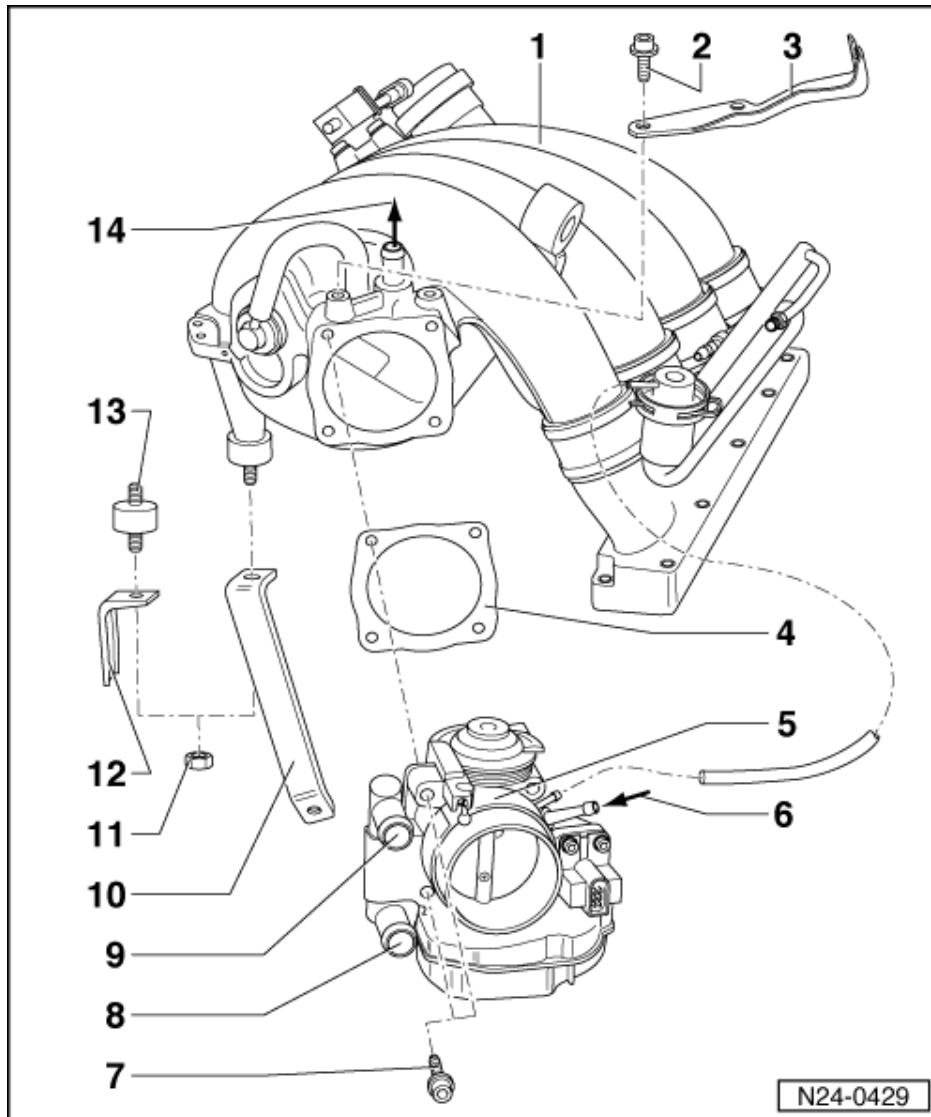
8 Intake manifold change-over valve (N156)*/**

- ◆ Checking intake manifold change-over valve => Page 124
- ◆ 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

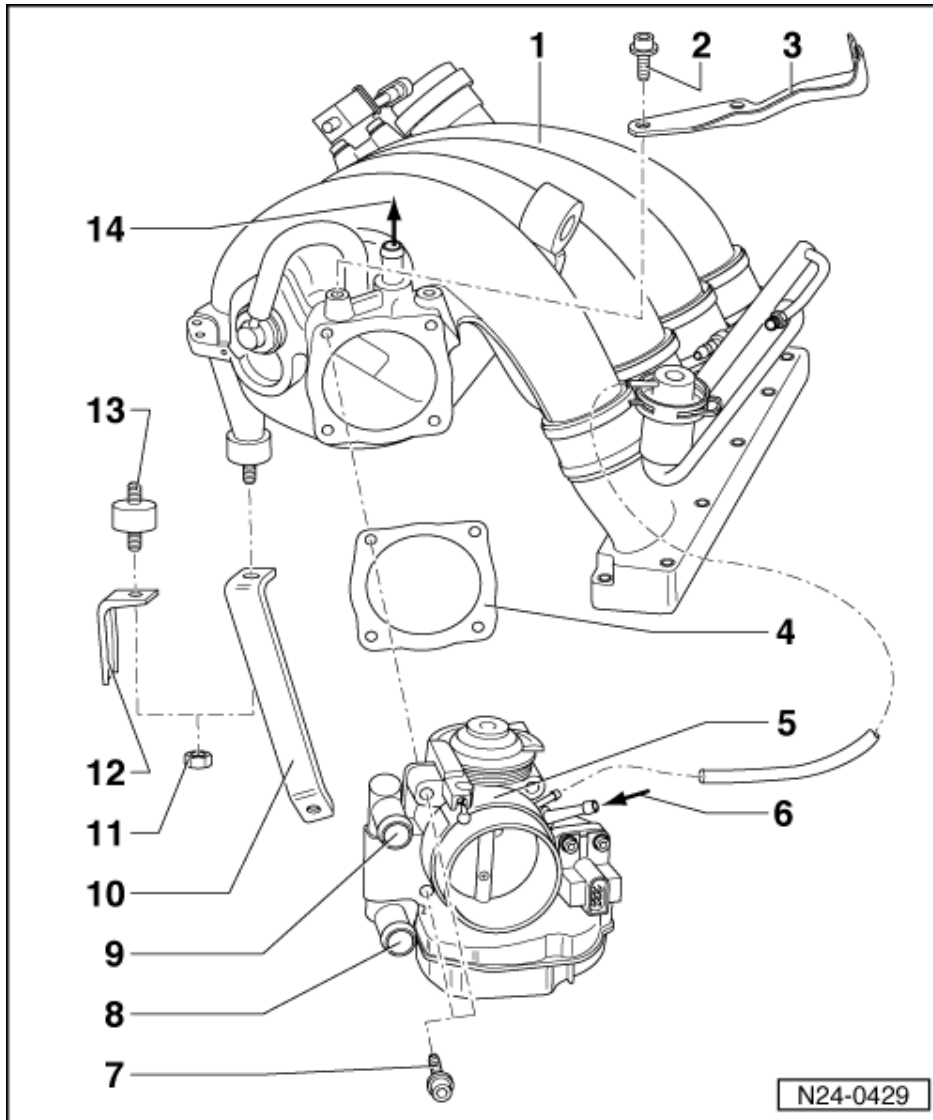
1.8 - Removing and installing throttle valve control part



Engine code ADR

- 1 Intake manifold
- 2 10 Nm
- 3 Support bracket
 - ◆ For throttle cable
- 4 Gasket
 - ◆ Renew
 - For plastic intake manifold seal:
 - ◆ Renew if damaged
- 5 Throttle valve control part (J338)*
 - ◆ Checking => Page 92
 - ◆ If replaced match 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



6 From activated charcoal filter solenoid valve 1 (N80)

- ◆ Activated charcoal filter system

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

7 10 Nm

8 From expansion tank

9 To top of radiator

10 Support

- ◆ Between intake manifold and engine block

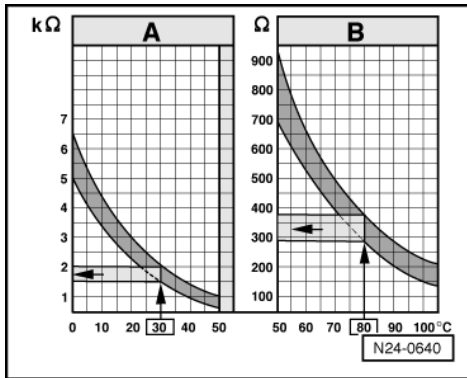
11 10 Nm

12 Support

- ◆ Between intake manifold and compact bracket

13 Bonded rubber mounting

14 To vacuum booster



-> Fig. 1 Resistance graph

The diagram is valid for coolant temperature sender (G62) and intake air sender (G42).

The diagram is divided into two temperature ranges:

- A - From 0...50 °C
- B - From 50...105 °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

1.9 - Safety precautions

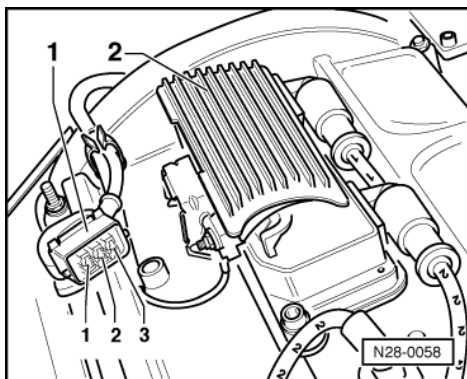
Warning!

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.
- ◆ If the engine is to be turned at starter speed, without starting, e.g. when checking compressions, pull connector off output stage:

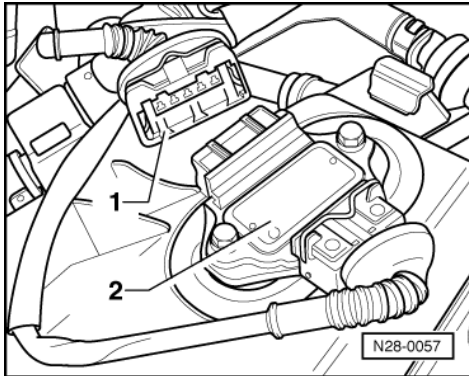
Engine code ADR:





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

Engine code AEB:



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

Continued for all vehicles

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.

1.10 - Rules for cleanliness

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

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

1.11 - Technical data

Engine code	ADR, AEB
Idling check Idling speed ²⁾	760...9601)
Engine control unit³⁾ System Part number	Motronic M 3.8.2 => Parts catalogue



Engine code	ADR, AEB	
Engine governed speed	rpm	from approx. 6500

- 1) Up-to-date specifications:
=> Exhaust emissions test binder
- 2) Not adjustable
- 3) Replacing engine control unit => Page 126

2 - Checking components

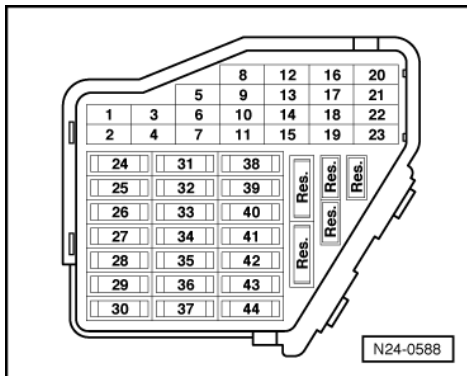
2.1 - Checking components

2.2 - Checking Lambda probe heating

Special tools, testers, measuring instruments and auxiliary items required

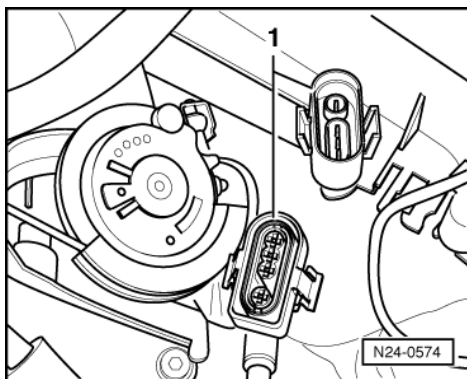
- ◆ Test box V.A.G 1598/22
- ◆ Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- ◆ Adapter set V.A.G 1594
- ◆ Current flow diagram

Check conditions



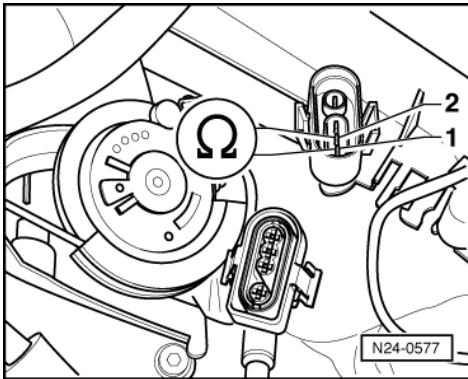
- -> Fuse 29 must be OK.
- The battery voltage must be at least 11.5 V.
- Fuel pump relay must be OK

Test sequence





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

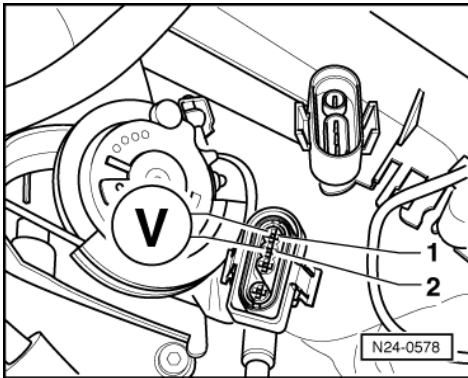


- -> Check probe heating at connector contacts 1+2 for continuity

If the specification is not attained:

- Replace Lambda probe (G39).

If the specification is attained:

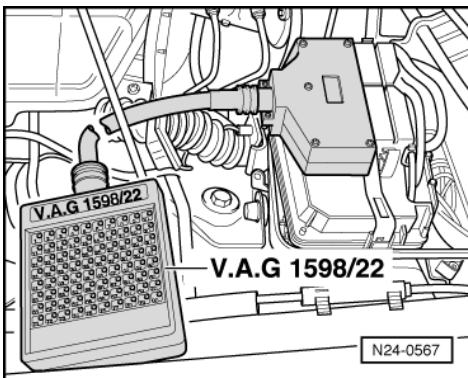


- -> Connect multimeter to measure voltage at contacts 1+2 of connector.
- Start engine and run at idling speed.

Specification: 11...15 V

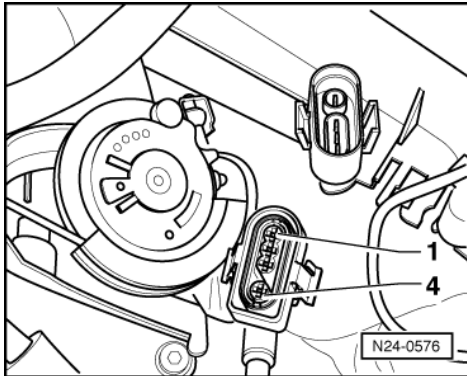
- Switch off ignition.

If no voltage is present:



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



- -> Check wiring between test box and 4 pin connector for open circuit according to current flow diagram.
Contact 2+socket 27
Wire resistance: Max. 1.5 ω

If the specification is obtained:

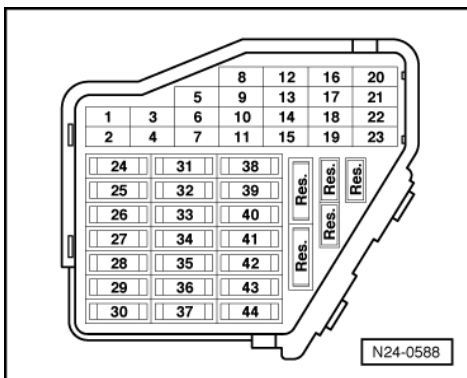
- Check wiring from contact 1 to fuel pump relay (J17) according to current flow diagram.
- => Current flow diagrams, Electrical fault finding and Fitting locations binder

2.3 - Checking air mass meter

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
- ◆ 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

Check conditions



- -> Fuse 29 must be OK.
- Coolant temperature at least 85 °C.
- 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 2.)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

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

Read measured value block 3
1 2 3 4

- Check whether the coolant temperature is above 85 °C in display zone 3.
- Change to display group 2 as follows:
V.A.G 1551: Press key 1
V.A.G 1552: Press key ↓

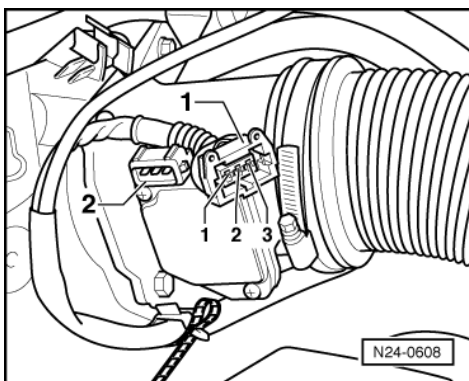
-> Indicated on display:
(1...4 = Display zones)

Read measured value block 2
1 2 3 4

- Check air mass drawn in, in display zone 4.
Specifications:
Engine code ADR: 2.00...4.00 g/s
Engine code AEB: 1.80...4.00 g/s
- 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 specifications are not attained or there is a fault in fault memory relating to the air mass meter,

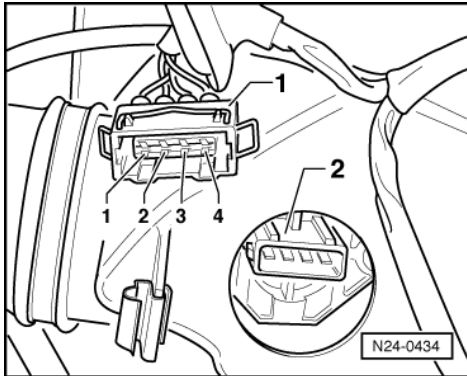
- Check the voltage supply for the air mass meter (G70) => Page 90 .



Testing power supply to air mass meter

Engine code ADR:

- -> Pull the 3 pin connector -1- off air mass meter -2-.

**Engine code AEB:**

- -> Pull 4 pin connector -1- off air mass meter -2-.

Continued for all vehicles

- Connect multimeter to measure voltage on connector contacts 3 and engine earth.
- Start engine and run at idling speed.

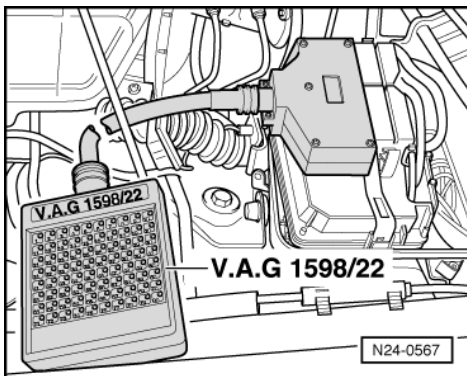
Specification: 11...15 V

- Switch off ignition.
- If the voltage supply is OK, test the signal wire and earth wire => Page 91 .

If no voltage was present:

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

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

Testing signal wiring for air mass meter

- -> Connect test box V.A.G 1598/22 to control unit wiring loom.

Engine code ADR:

- Check wiring between test box and 3 pin connector for open circuit using current flow diagram.
Contact 1+socket 13
Contact 2+socket 12
Wire resistance: Max. 1.5 ω

Engine code AEB:

- Check wiring between test box and 4 pin connector for open circuit according to current flow diagram.
Contact 4+socket 13
Contact 2+socket 12
Wire resistance: Max. 1.5 ω
- Check wiring between 4 pin connector and earth for open circuit according to current flow diagram.



Contact 1+earth
Wire resistance: Max. 1.5 ω

Continued for all vehicles

- Additionally check wires all for short to one another.
Specification: $\infty\omega$

If no wiring fault is detected:

- Renew air mass meter (G70).

2.4 - Checking throttle valve control part

Components of the throttle valve control part (J338):
Throttle valve positioner (V60), throttle valve positioner sender (G127), throttle valve potentiometer (G69) and idling switch (F60)

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 an automatic gearbox the gearbox control unit must also be adapted:

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

Special tools, 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

Checking idling switch (F60)

- 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 2 .)

-> 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, 9 and 8 for "Display group number 98" and confirm entry with Q key.

-> Indicated on display:

```
(1...4 = Display zones)
Read measured value block 98
1      2      3      4
```

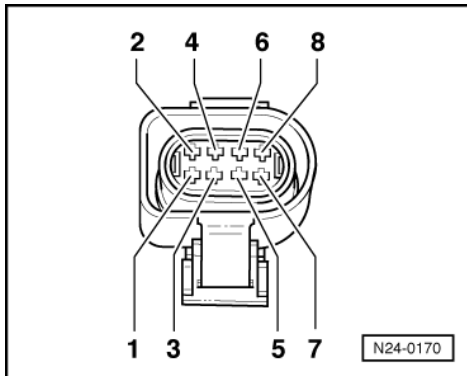
- Check the operating mode display in display zone 3.
Display: Idling



- Slowly open throttle valve. After free travel, a stop is reached when opening throttle valve further the 4th position from left must jump to part throttle
Display: Part throttle

If the specifications are not obtained:

Display	Cause	Continuation of check
Part throttle	Open circuit or short to positive	=> Page 93
Idling	Short to earth	=> Page 93



Continuation of check when display shows part throttle

- -> Separate 8 pin connector to throttle valve control part.
- Bridge connector contacts 3+7 with aux. cables from V.A.G 1594 and observe display.

Display Idling:

- Press => key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Replace throttle valve control part (J338).

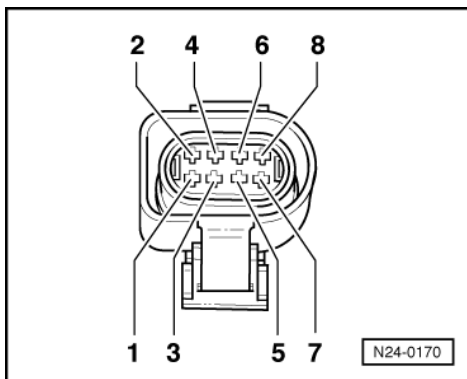
Display Part throttle:

- Press => key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Check voltage supply of throttle valve control part and wiring to control unit => Page 97 .

If the voltage supply and wiring is OK:

- Renew engine control unit => Page 129 .

Continuation of check when display constantly shows idling





- -> Separate 8 pin connector to throttle valve control part.

Display Part throttle:

- Press => key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Replace throttle valve control part (J338).

Display Idling:

- Press => key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Check voltage supply of throttle valve control part and wiring to control unit => Page 97 .

If the voltage supply and wiring is OK:

- Renew engine control unit => Page 129 .

Checking throttle valve positioner (V60) and sender for throttle valve positioner (G127)

Test conditions

- Coolant temperature at least 85 °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 2 .)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

- Check whether the coolant temperature is above 85 °C in display zone 3.
- Change to display group 98 as follows:
- Press C key.

-> Indicated on display:

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

- Press keys 0, 9 and 8 for "Display group number 98" and confirm entry with Q key.

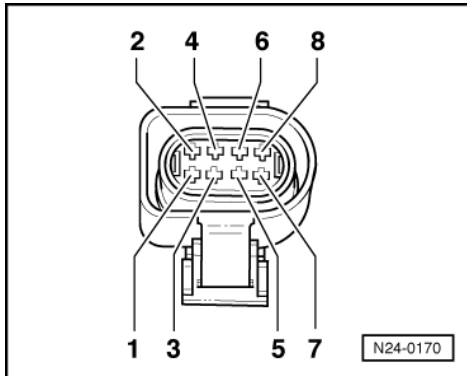
-> Indicated on display:

(1...4 = Display zones)



```
Read measured value block 98
 1      2      3      4
```

- Check voltage value from throttle valve positioner sender in display zone 2. The voltage must be between 0.5...4.9 V



If the specification is not obtained:

- Press \Rightarrow key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- \rightarrow Separate 8 pin connector to throttle valve control part.
- Measure throttle valve positioner resistance between connector contacts 1+2.
Specification: 3...200 ω
- Check voltage supply of throttle valve control part and wiring to control unit \Rightarrow Page 97 .

If no fault is detected:

- Replace throttle valve control part (J338).

Checking throttle valve potentiometer (G69)

Test conditions

- Coolant temperature at least 85 °C.

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 \Rightarrow Page 2 .)

\rightarrow 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.

\rightarrow Indicated on display:

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

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

\rightarrow Indicated on display:

(1...4 = Display zones)



Read measured value block 3
1 2 3 4

- Check whether the coolant temperature is above 85 °C in display zone 3.
- Change to display group 1 as follows:
- Press C 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

- Read off throttle valve angle in display zone 3.
- Slowly open throttle valve fully and observe angle display in display zone 3. The figure must increase uniformly over the complete range.
- Press => key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition

Note:

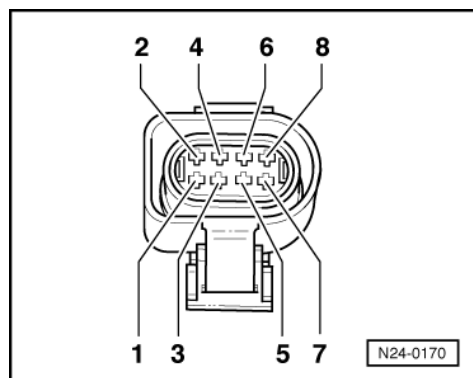
The displayed figure is dependent on the tolerances of the throttle valve potentiometer and does not correspond to the actual opening angle.

If the figure does not increase uniformly:

- Replace throttle valve control part (J338).

If the display constantly shows 0 <° or is above 90 <°:

Display	Cause	Continuation of check
0 <°	Open circuit or short to positive	=> Page 96
above 90 <°	Short to earth	=> Page 97



Continuation of check when display 0 <°:

- -> Separate 8 pin connector to throttle valve control part.
- Bridge connector contacts 5+7 with auxiliary cables from V.A.G 1594 and observe display.



Display above 90 <°:

- Press ⇒ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Replace throttle valve control part (J338).

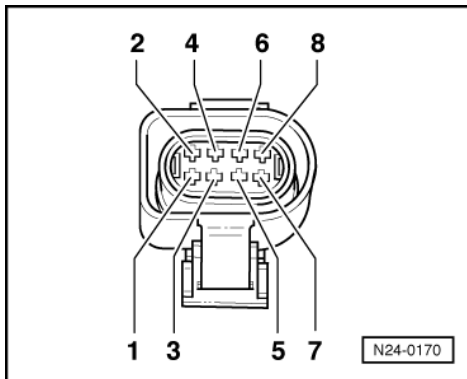
Display 0 <°:

- Press ⇒ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Check voltage supply of throttle valve control part and wiring to control unit => Page 97 .

If the voltage supply and wiring is OK:

- Renew engine control unit => Page 129 .

Continuation of check when display is above 90 <°:



- -> Separate 8 pin connector to throttle valve control part.

Display 0 <°:

- Press ⇒ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Replace throttle valve control part (J338).

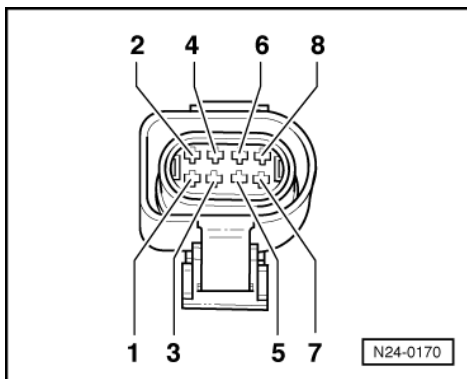
Display above 90 <°:

- Press ⇒ key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition
- Check voltage supply of throttle valve control part and wiring to control unit => Page 97 .

If the voltage supply and wiring is OK:

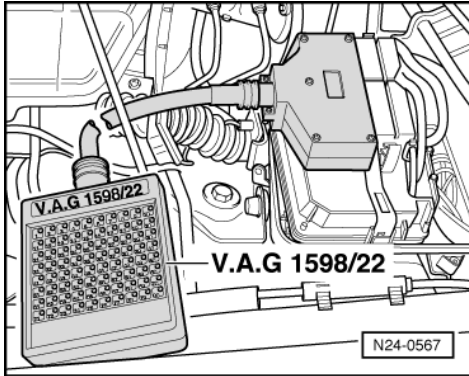
- Renew engine control unit => Page 129 .

Checking voltage supply and wiring to control unit

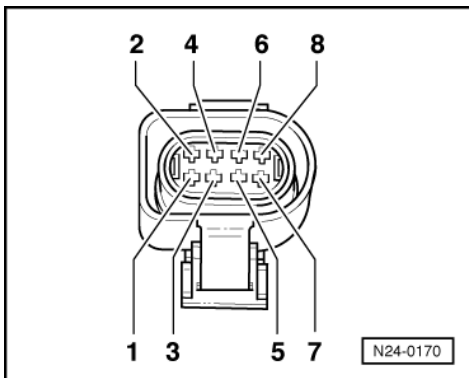




- -> Separate 8 pin connector to throttle valve control part.
- Connect multimeter to measure voltage at connector contacts 4+7.
- Switch on ignition.
Specification: min. 4.5 V
- Switch off ignition
- Connect multimeter to measure voltage at connector contacts 3+7.
- Switch on ignition.
Specification: min. 9 V
- Switch off ignition



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.



- -> Check wiring between test box and connector for open circuit according to current flow diagram.
Contact 1+socket 66
Contact 2+socket 59
Contact 3+socket 69
Contact 4+socket 62 for ADR engine
Contact 4+socket 11 for AEB engine
Contact 5+socket 75
Contact 7+socket 67
Contact 8+socket 74
Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.
Specification: $\infty\omega$

If no fault is detected in the pipes:

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

2.5 - Checking coolant temperature sender

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
- ♦ 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

Note:

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.

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 2.)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

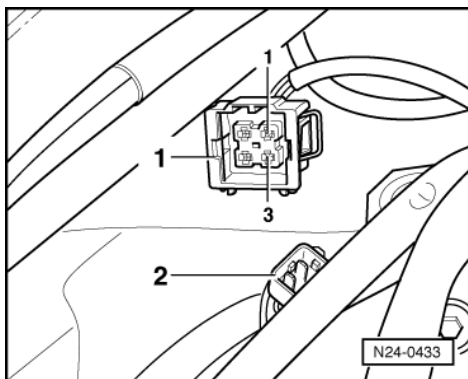
- Read off coolant temperature value in display zone 3.

Display	Cause	Continuation of check
Approx. -46 °C	Open circuit or short to positive	=> Page 99
Approx. 141 °C	Short to earth	=> Page 100
Approx. coolant temperature ¹⁾	---	Only if sporadic faults have been detected: ²⁾ => Page 101

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

2) Check is only possible when the engine is cold.

Continuation of check when display approx. -46 °C:





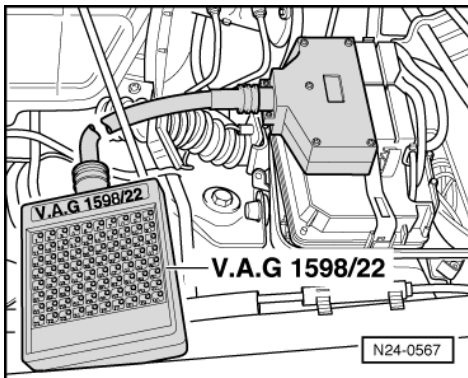
- -> Pull 4 pin connector -1- off coolant temperature sender (G62) -2-.
- Bridge connector contacts 1+3 using aux. cables from V.A.G 1594 and observe display.

Display approx. 141 °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).

Display -46 °C:

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

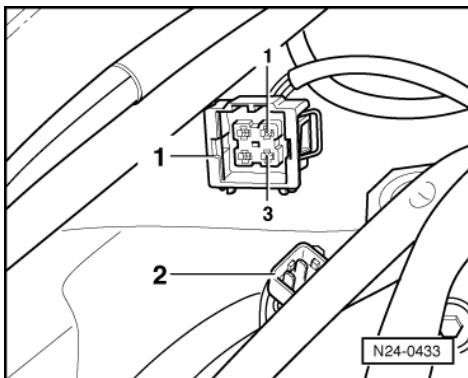


- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- Check wire between test box socket 67 and 4 pin connector contact 3 for open circuit using current flow diagram.
Wire resistance: Max. 1.5 ω
- Check wiring additionally for short circuit to battery positive.
Specification: $\infty\omega$
- Check wire between test box socket 53 and 4 pin connector contact 1 for open circuit according to current flow diagram.
Wire resistance: Max. 1.5 ω

If no fault in wire is detected:

- Renew engine control unit => Page 129 .

Continuation of check when display approx. 141 °C:



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

Display -46 °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).

Display approx. 141 °C:

- Press ⇒key.
- Press keys 0 and 6 for the "End data transfer" function and confirm input with the Q key.
- Switch off ignition.
- Pull connector off Motronic control unit.
- Check wire between control unit connector and 4 pin connector contact 1 for short to wire contact 3 and to vehicle earth, using current flow diagram.
Specification: ∞Ω

If no fault in wire is detected:

- Renew engine control unit => Page 129 .

Continuation of check when display = coolant temperature:

Test conditions

- Engine must be cold.

Functional check of sender

- 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 2 .)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

- With engine running observe coolant temperature value in display zone 3. The temperature figure must increase uniformly and without interruption.

Notes:

- ◆ If the display on fault reader jumps by 2...5 °C, it is a control unit fault and not caused by a defective sender.
- ◆ 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.



2.6 - Checking intake air temperature sender

Special tools, testers, measuring instruments and auxiliary items required

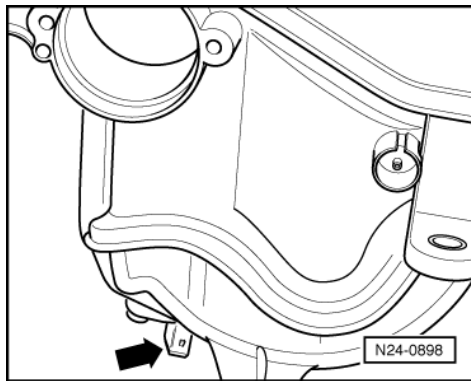
- ♦ Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ♦ Test box V.A.G 1598/22
- ♦ Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- ♦ Adapter set V.A.G 1594
- ♦ Current flow diagram
- ♦ Chilling spray (commercially available)

Note:

If sender or connecting wiring is defective the control unit operates with a substitute temperature of 19.5 °C.

Engine code ADR with plastic intake manifold

Installation position:



-> The intake air temperature sender (G42) -arrow- is located in lower area of intake manifold and must be tightened to 10 Nm.

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 2 .)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

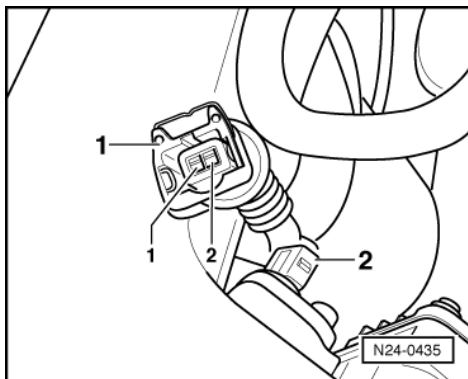
- Read off intake air temperature value in display zone 4.



Display	Cause	Continuation of check
approx. -46 °C	Open circuit or short to positive	=> Page 103
approx. 141 °C	Short to earth	=> Page 104
Approx. ambient temperature ¹⁾	---	=> Page 104

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.

Continuation of check when display reads approx. -46 °C:



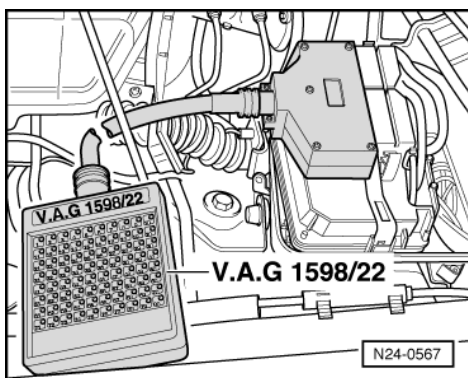
- -> Pull connector -1- off intake air temperature sender (G42) -2-.
- Bridge connector contacts using aux. cables from V.A.G 1594 and observe display.

Display approx. 141 °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).

Display -46 °C:

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



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- Check wire between test box socket 67+2 pin connector contact 2 for open circuit using current flow diagram.
Wire resistance: Max. 1.5 ω
- Check wiring additionally for short circuit to battery positive.
Specification: $\infty\omega$
- Check wire between test box socket 54+2 pin connector contact 1 for open circuit using current flow diagram.

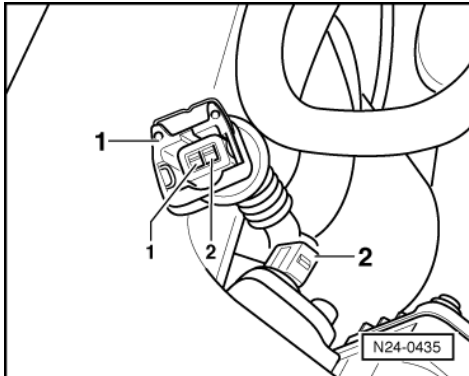


Wire resistance: Max. 1.5 ω

If no fault in wire is detected:

- Renew engine control unit => Page 129 .

Continuation of check when display reads approx. 141 °C:



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

Display -46 °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).

Display approx. 141 °C:

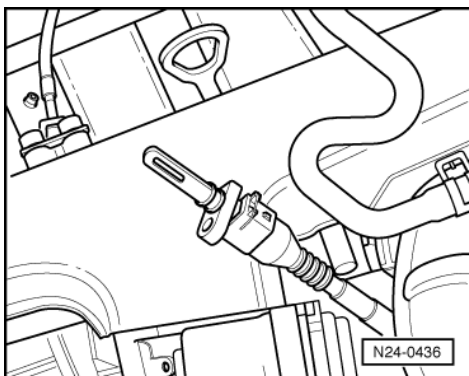
- Press =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.
- Switch off ignition.
- Pull connector off Motronic control unit.
- Check wiring to control unit connector at 2 pin connector contact 2 for short to wire contact 1 and to vehicle earth.

Specification: $\infty\omega$

If no fault is detected in the pipes:

- Renew engine control unit => Page 129 .

Continuation of check when display = ambient temperature:



- -> 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.

2.7 - 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.

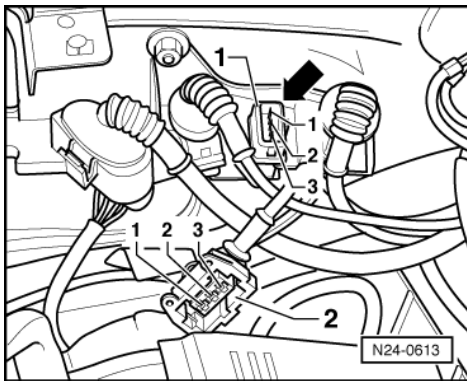
Special tools, testers, measuring instruments and auxiliary items required

- ◆ 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

Test conditions

- The battery voltage must be at least 11.5 V.

Test sequence

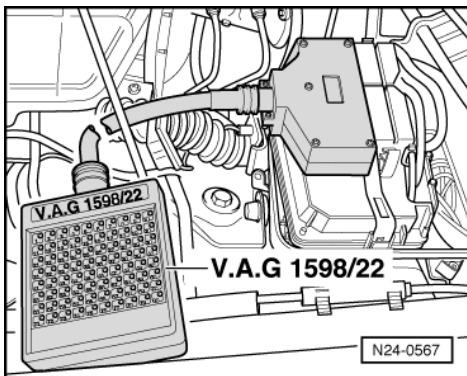


- -> Detach grey 3 pin connector to engine speed sender -arrow-.
- Measure sender resistance between contacts 1+2 of connector -1-.
Specification: 480...1000 ω
- Check the sender for short between contacts 1+3 also 2+3.
Specification: $\infty\omega$

If the specifications are not obtained:

- Replace engine speed sender (G28).

If no sender fault is detected:



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- Check wiring between test box and 3 pin connector -2- for open circuit according to current flow diagram.
Contact 1+socket 56
Contact 2+socket 63



Contact 3+socket 2
Wire resistance: Max. 1.5 ω

- Additionally check wires for short to one another.
Specification: $\infty\omega$

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 129 .

2.8 - Testing altitude sender

Only engine code AEB

Test conditions

- Vehicle stationary, engine runs at idling

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 2 .)

-> 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 1, 1 and 3 for "Display group number 113" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

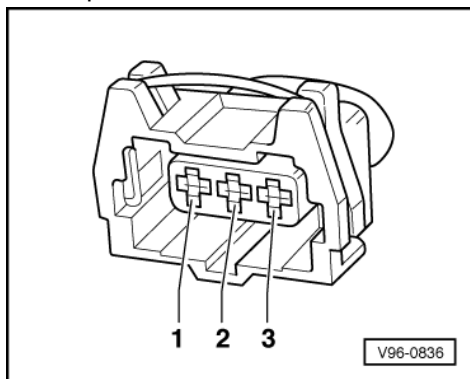
```
Read measured value block 113
 1      2      3      4
```

- Check displayed value of altitude sender in display zone 4.
Specification: Actual ambient air pressure (approx. 1000 mbar)

Note:

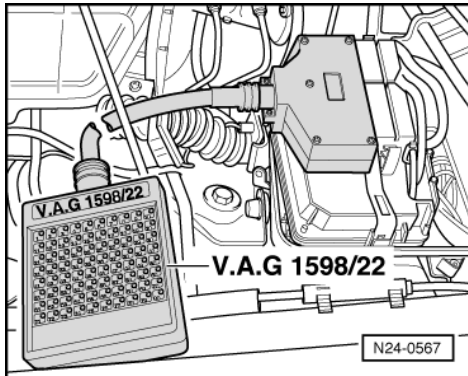
Compare the displayed value in display zone 4 with turbocharger tester V.A.G 1397/A if necessary

If the specification is not obtained:



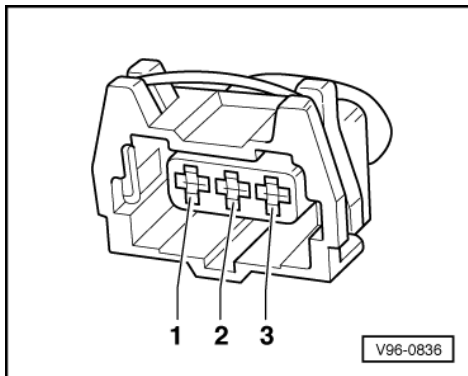


- Pull 3 pin connector off sender
=> Page 52, Fitting locations overview
- Switch ignition on.
- -> Connect multimeter to measure voltage at connector contacts as follows:
Contact 1 + 3
Contact 2 + 3
Specification: 4.5...5.5 V



If the specifications are not obtained:

- -> Connect test box V.A.G 1598/22 to control unit wiring harness.



- -> Check wiring between test box and 3 pin connector for open circuit according to current flow diagram.
Contact 1+socket 61
Contact 2+socket 62
Contact 3+socket 67
Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.
Specification: $\infty\omega$
- Check wiring additionally for short circuit to battery positive.
Specification: $\infty\omega$

If no fault is detected in the pipes:

- Fit a new altitude sender (F96).

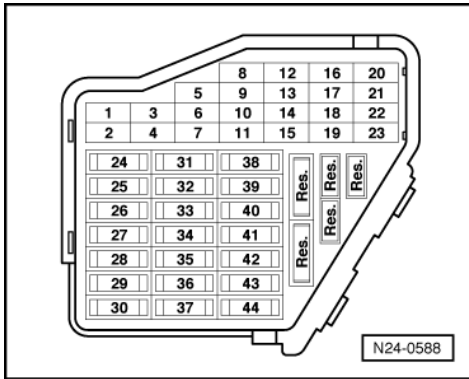
2.9 - Checking injectors

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
- ◆ Test box V.A.G 1598/22
- ◆ Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- ◆ Remote control V.A.G 1348/3A with adapter cable V.A.G 1348/3-2
- ◆ Diode test lamp V.A.G 1527



- ◆ Adapter set V.A.G 1594



- ◆ Current flow diagram

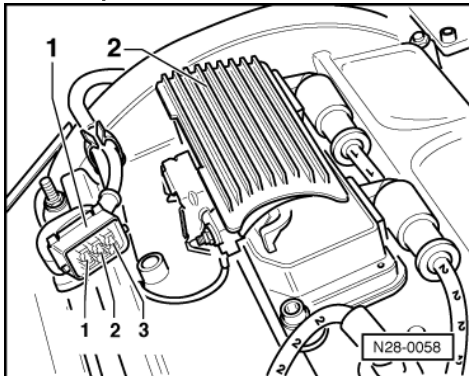
Check conditions

- Engine speed sender must be OK, checking =>Page 105 .
- Fuel pump relay must be OK
- -> Fuse 34 must be OK.

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



- First check the activation of the injectors via final control diagnosis => Page 25 .

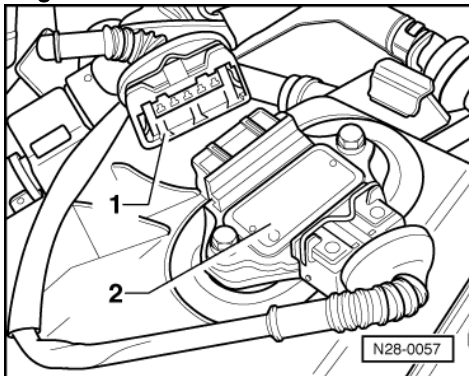
If one or more injectors do not click:

Checking activation

Engine code ADR:

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

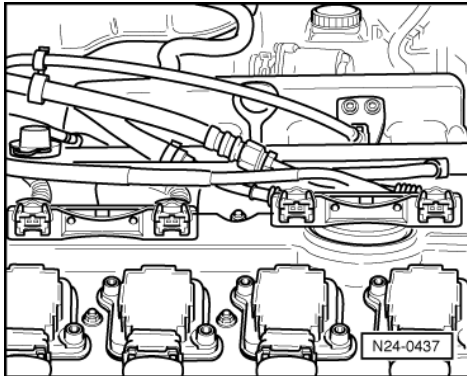
Engine code AEB:





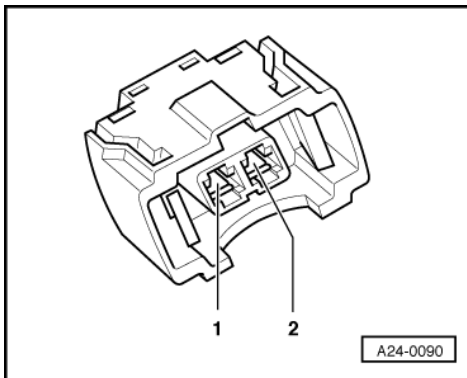
- -> Pull 5 pin connector -1- off output stage for ignition coils -2-.

Continuation for all vehicles



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

If the LED does not flicker on any cylinder:

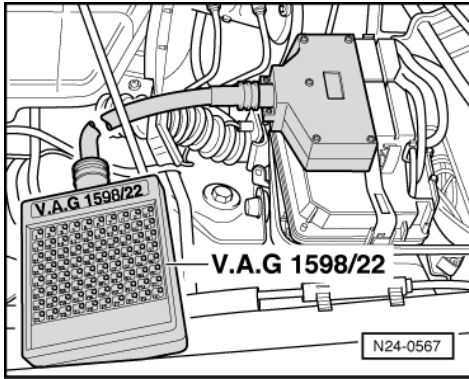


- -> Connect diode test lamp to Cyl. 1 connector, contact 1 and earth.
- Operate starter.
The LED must light

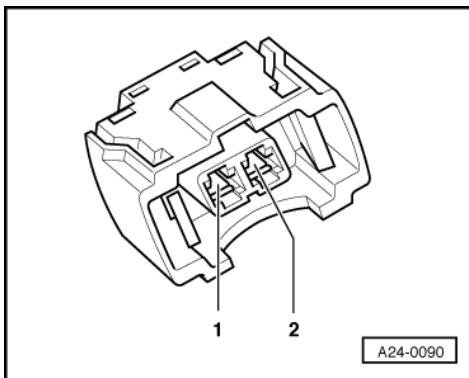
If the LED does not light up:

- 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

If the LED flickers on one or several cylinders:

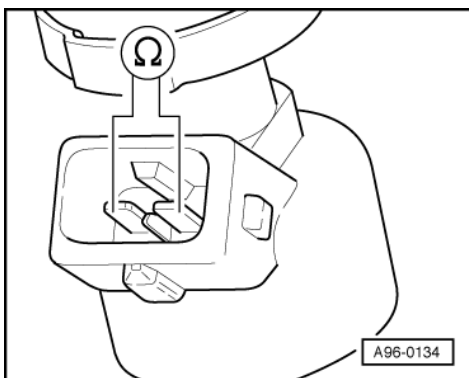


- -> Connect test box V.A.G 1598/22 to control unit wiring loom.



- -> Check wiring between test box and connector for open circuit according to current flow diagram.
 - Injector 1: Contact 2+socket 73
 - Injector 2: Contact 2+socket 80
 - Injector 3: Contact 2+socket 58
 - Injector 4: Contact 2+socket 65
 - Wire resistance: Max.1.5 ω
- Additionally check wires for short to one another.
 - Specification: $\infty\omega$
- Check wiring between connector contacts 1 of injectors for open circuit.
 - Wire resistance: Max. 1.5 ω

Checking resistance of injectors



- -> Check resistance of injectors between contacts.
 - Specification: 12.0...15.0 ω

If the specification is not attained:

- Renew defective injector

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



Checking injection rate and injectors for leaks

Test conditions

- The fuel pressure must be in order, checking
=> Page 112.

Test sequence

- Pull connector off all 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

- Introduce final control diagnosis and activate injector Cyl. 1 (N30) => Page 25 ; 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:

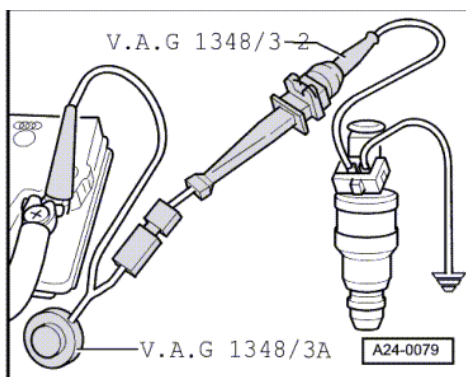
- Switch off ignition and renew leaking injector.

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 other injector contact and auxiliary cable to remote control V.A.G 1348/3A using adapter cable V.A.G 1348/3-2.
- Connect crocodile clip to battery (+).
- Introduce final control diagnosis and activate injector Cyl. 1 (N30) => Page 25 ; the fuel pump must run.
- Operate remote control V.A.G 1348/3A 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.

Specifications:

Engine code ADR: 85...105 ml



Engine code AEB: 110...130 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 conditions

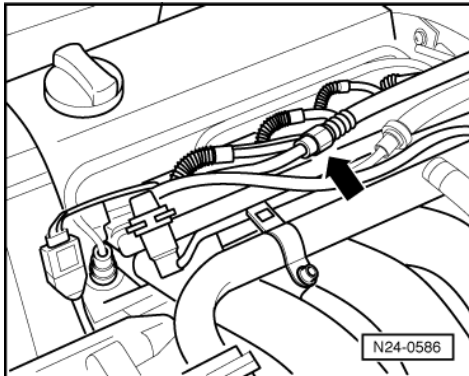
- Fuel pump delivery rate OK, checking:

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

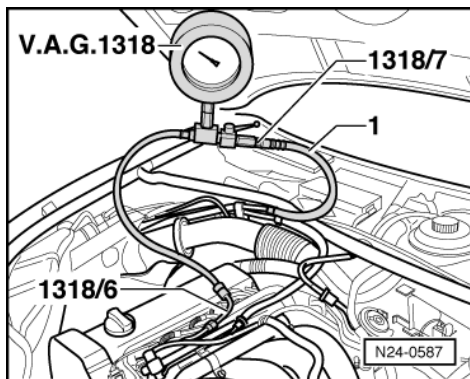
Test sequence

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.

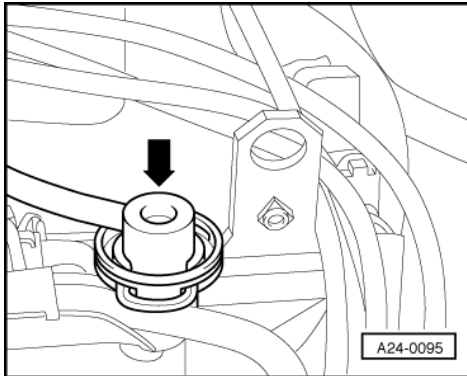




Motronic injection and ignition system (1.8 ltr. engine) - Edition 01.1997

- -> 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

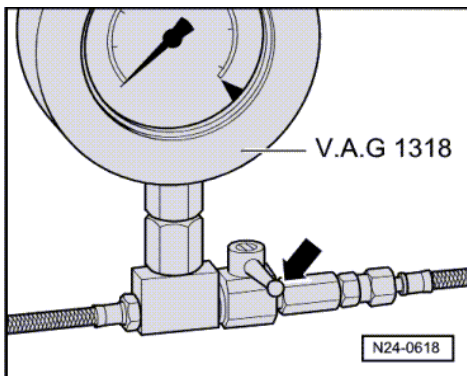
If the specification is obtained:



- -> Pull the vacuum hose off fuel pressure regulator -arrow-. The fuel pressure must increase to approx. 4.0 bar.
- 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.



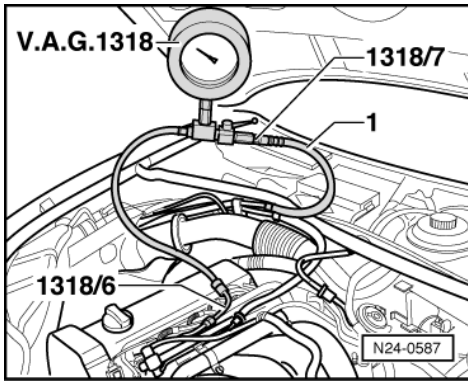
- -> Switch ignition off after the pressure has built-up. At the same time close pressure measured device cut-off tap (handle cross through-flow direction -arrow-).
- Observe pressure drop on gauge.

If the pressure does not drop:

- Check fuel pump non-return valve.

=> Repair group 20; Removing and installing parts of the fuel supply system; Checking fuel pump non-return valve. Removing and installing parts of the fuel supply system Checking fuel pump non-return valve.

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, 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 at least 85 °C.

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 2 .)

-> 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 9 for "Display group number 0" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

```
Read measured value block 9
 1      2      3      4
```

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

If the engine speed drops or the Lambda probe voltage changes:

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

Engine speed or Lambda probe voltage does not change:

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

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, 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 at least 85 °C.
- 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
- Throttle cable adjustment must be OK, checking:



=> Repair group 20; Removing and installing parts of fuel supply system; Adjusting throttle mechanism Removing and installing parts of fuel supply system Adjusting throttle mechanism

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 2.)
- Interrogate fault memory, if necessary, repair fault and then erase fault memory. => Page 4, 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

- Check whether the coolant temperature is above 85 °C in display zone 3.

Checking idling speed

- Change to display group 1 as follows:
- Press C 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
```

- Check idling speed in display zone 1. Specification: 760...960 rpm1)

1) Up-to-date specifications:

=> Exhaust emissions test binder

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 function "End output" and confirm entry 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 92 .
- Check specifications in display group 5
=> Page 33 evaluating measured value block.

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, 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 at least 85 °C.

Work sequence

- Connect fault reader V.A.G 1551 (V.A.G 1552) and with the "Address word" 01 select the engine electronics control unit. When doing this the engine should be idling.
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)

-> Indicated on display:

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

- Press keys 1 and 1 for the "Login procedure" function and confirm input with Q key.

-> Indicated on display:

```
Login procedure          HELP
Input code number XXXXX
```

Engine code ADR:

- Press keys 0, 6, 5, 8 and 9 for the Login code 06589 and confirm input with Q key.

Engine code AEB:

- Press keys 0, 1, 2, 8 and 3 for the Login code 01283 and confirm input with Q key.

Continued for all vehicles

-> Appears on display:



Data transfer fault

- Switch off ignition and repeat procedure.

-> 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      x.x %      x.x g/
s
```

- 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      Q
xxx rpm      xxx rpm      x.x %      x.x g/
s
```

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 control

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
- ♦ 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

Check conditions

- The engine control unit must be matched to the throttle valve control part=> Page 131
- Coolant temperature at least 85 °C.
- 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 2.)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

- Check whether the coolant temperature is above 85 °C in display zone 3.
- Change to display group 9 as follows:
- Press C key.

-> Indicated on display:

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

- Press keys 0, 0 and 9 for "Display group number 0" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

```
Read measured value block 9
 1      2      3      4
```

- Note Lambda probe voltage in display zone 3. The voltage must fluctuate at least 30 times per minute in range of 0... 1.0 V.
- Press => key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

If the Lambda regulation does not fluctuate as stated:

- Carry out road test and burn Lambda probes clean and repeat check.

If the specifications are not obtained again:

- Check Lambda probe heating => Page 87 .
- Evaluate the measured value blocks 7 to 9 => Page 40 .



If the voltage change is slower, determine cause of fault. => Page 120 .

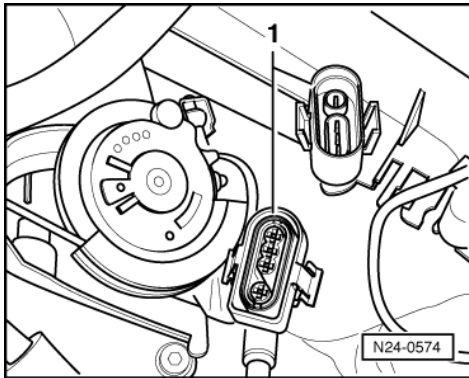
If the displayed figure remains constant:

- 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	

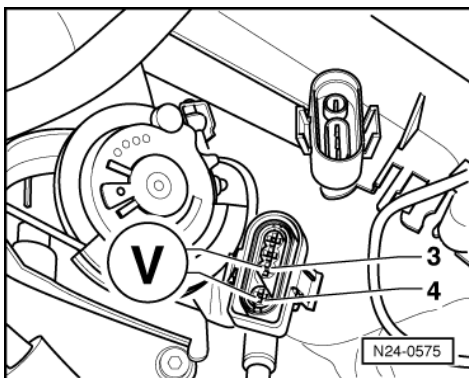
Possible causes of fault if probe control frequency is too slow:

- ◆ The slots or holes in probe body are blocked
- ◆ The probe vent hole in area of connecting wire is blocked
- ◆ The probe has been overheated (glazed)
- ◆ The probe has been damaged by leaded fuel



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

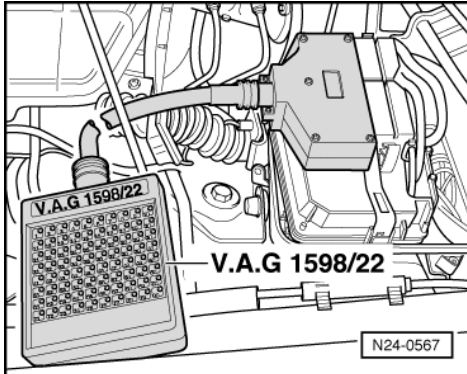


=> Page 121

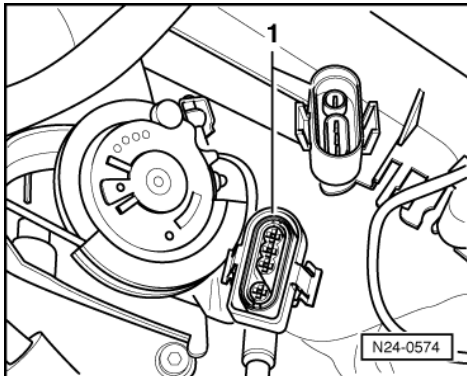
If the specification is obtained:

- Replace Lambda probe (G39).

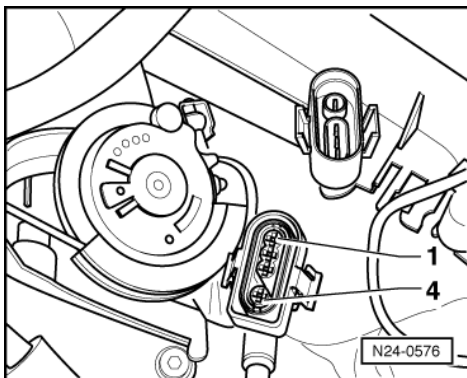
Checking Lambda probe wiring



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.



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



- -> Check wiring between test box and 4 pin connector (to control unit) for open circuit according to current flow diagram.
 Contact 3+socket 25
 Contact 4+socket 26
 Wire resistance: Max. 1.5 ω
- Check wiring at connector contacts 3+4 for short circuit to contacts 1+2 using current flow diagram.
 Specification: $\infty\omega$

If no fault is detected in the pipes:

- Replace Lambda probe (G39).



3.5 - Checking engine operating mode

Note:

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

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

Check conditions

- Coolant temperature at least 85 °C.
- Throttle cable adjustment must be OK, checking:

=> Repair group 20; Removing and installing parts of fuel supply system; Adjusting throttle mechanism Removing and installing parts of fuel supply system Adjusting throttle mechanism

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 2.)

-> 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 3 for "Display group number 3" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

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

- Check whether the coolant temperature is above 85 °C in display zone 3.
- Change to display group 4 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 4
 1      2      3      4
```

Display for operating modes in 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.

◆ Enrichment:

- Quickly increase engine speed.

Enrichment must be displayed briefly
Display: Enrichment

Only engine code ADR

◆ Full throttle:

- Floor accelerator pedal (onto throttle valve stop).

Full throttle must be displayed briefly
Display: Full throttle

Continued for all vehicles**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.

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

If the specifications are not attained:

- Interrogate fault memory, if necessary, repair any faults and then erase fault memory => Page 4 , interrogating and erasing fault memory.
- Check accelerator mechanism for ease of operation.
- Check throttle valve potentiometer
=> Page 92 , Checking throttle valve control part.



3.6 - Checking intake manifold change-over

Only engine code ADR

The check need only be carried out when performance is poor.

Special tools, testers, measuring instruments and auxiliary items required

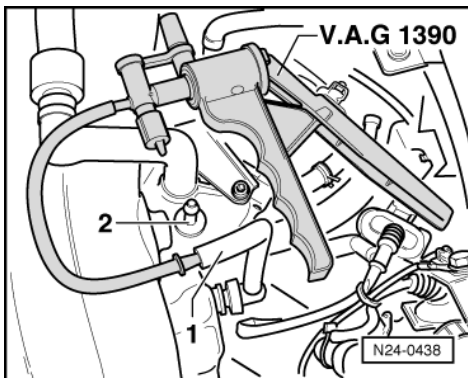
- ♦ Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3
- ♦ Hand multimeter V.A.G 1526 or multimeter V.A.G 1715
- ♦ Adapter set V.A.G 1594
- ♦ Hand vacuum pump V.A.G 1390

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).

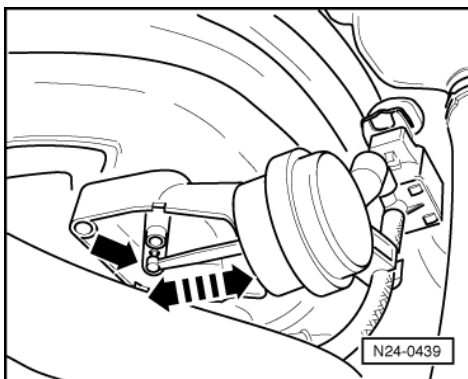
If change-over does not occur, the following checks must be carried out.

- First check activation of twin path intake manifold change-over valve (N156) via final control diagnosis => Page 25 .



If activation is OK:

- The fault reader or the vehicle system tester must remain connected.
- -> Pull vacuum hose -1- off intake manifold connection -2- and connect hand vacuum pump V.A.G 1390 to disconnected hose.



- -> Perform final control diagnosis again. When the valve for intake manifold change-over is activated, operate hand pump at the same time. 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.

3.7 - Checking driving characteristics after a cold start

If faults appear after a cold start check if problem occurs before or after the Lambda regulation is effected.

The Lambda regulation is introduced when the relevant probe temperature is approx. 300 °C.

The time taken to reach this temperature is dependent upon the following factors:

- ◆ Ambient temperature (summer/winter)
- ◆ Operating conditions after starting
- ◆ Probe heater function

Test conditions

- No faults regarding Lambda regulation are stored
=> Page 4, interrogating fault memory

Test sequence

Check vehicle under cold start conditions during a test drive.

Note:

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

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 2.)

-> 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 9 for "Display group number 09" and confirm entry with Q key.

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

```
Read measured value block 9
  1      2      3      4
```

- Now carry out a test drive and observe probe voltage in display zone 3.



The voltage for a cold vehicle when the Lambda regulation is not working must be 0.45...0.50 V.

->

Read measured value block 9			
1	2	3	4

When the Lambda regulation operates, the voltage signal in display zone 3 must fluctuate between 0.0...1.1 V.

Note:

Voltage values above 0.7 V indicate a rich mixture.

Voltage values below 0.3 V indicate a lean mixture.

If poor engine running characteristics are observed before the Lambda regulation commences:

The fault does not lie within the Lambda regulation.

Notes:

- ♦ If the fault gets somewhat better after the regulation commences the cause of the fault (e.g. unmetered air, defective injectors, etc.) is somewhat neutralised by the regulation measures. This can be recognised when reading the Lambda learnt values.
- ♦ With the aid of display group 99 the Lambda regulation can be switched on and off at will. Pressing buttons 4 or 8 switches back and forth between "Basic setting" (Lambda regulation off) and "Read measured value block" (Lambda regulation on).

If poor engine running characteristics occur after the Lambda control commences:

- Check Lambda regulation =>Page 118 .

4 - Engine control unit

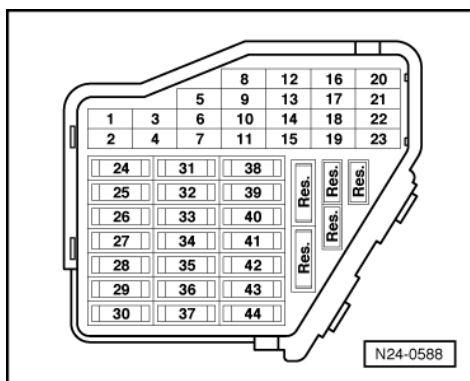
4.1 - Engine control unit

4.2 - Checking control unit voltage supply

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
- ♦ 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

Check conditions





- The battery voltage must be at least 11.5 V.
- -> Fuse 32 must be OK.
- Alternator OK, checking:

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

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 2.)

-> 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
```

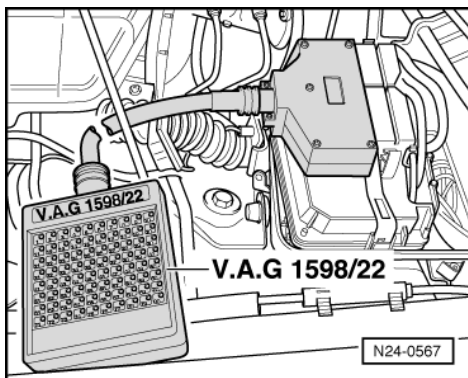
- Press keys 0, 0 and 3 for "Display group number 3" and confirm entry with Q key.

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

```
Read measured value block 3
 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 function "End output" and confirm entry with the Q key.
- Switch off ignition.

If the specification is not attained:



- -> Connect test box V.A.G 1598/22 to control unit wiring loom.

Checking voltage supply terminal 30

- Measure supply voltage between test box sockets 2+3 using multimeter and adapter cables from V.A.G 1594:
Specification: at least 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 supply voltage between test box sockets 1+2 using multimeter and cables from V.A.G 1594.
- 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

4.3 - Procedure after voltage supply open circuit

If the voltage supply is interrupted, the engine control unit loses all the "learnt" and/or "basic" values. Therefore considerable driving characteristic problems may occur depending on vehicle mileage.

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

Work sequence

Perform the following operations after voltage supply open circuit:

- Switch ignition on for at least 10 seconds.
- Switch off ignition.
- Adapt the engine control unit to the throttle valve control part => Page 131
- Perform idling check
=> Page 115
- Adapt control unit for automatic gearbox:

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

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

The engine control unit regulates the injection, throttle valve control part, Lambda control, ignition, knock control, activated charcoal filter solenoid valve 1, engine speed governor via injectors or fuel pump relay, camshaft adjustment, charge control as well as self-diagnosis.

Special tools, 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 2.)

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

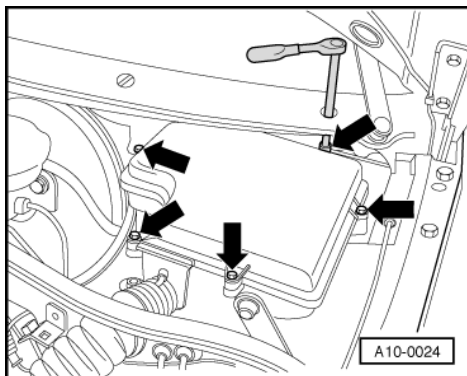
```
8B0 907 558 F 1.8L R4/5V MOTR HS D01
Coding 04001      WSC XXXXX
```

- Print out the control unit identification by pressing the fault reader print button.
- Press the =>key.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

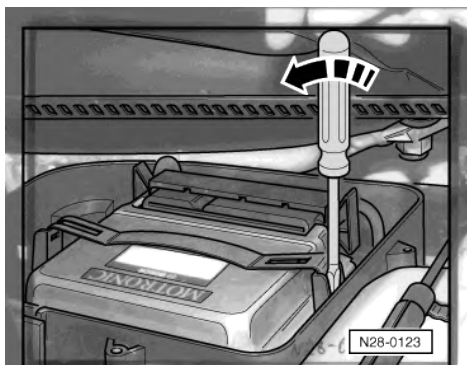
-> Indicated on display:

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

- Switch off ignition.



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



- -> Carefully lever off the retainer bar with a screwdriver -arrow-.
- Then release connectors on control unit and pull off.
- Remove the old control unit and insert the new one.
- Check the previous coding and the coding of the new control unit => Page 130 .



- Match new control unit to throttle valve control part => Page 131

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

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

- Match new control unit to the electronic immobilizer => Page 132
- Then subsequently interrogate the fault memory of the new engine control unit and erase the fault memory if necessary.

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, 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 2.)

-> Indicated on display:

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

- Press keys 0 and 7 for the function "Coding 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 .

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

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

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

```
8B0 907 558 F 1.8L R4/5V MOTR HS D01
Coding 04001      WSC XXXXX
```

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



4.6 - Coding variations of engine control unit

Country/emission	Drive/additional functions	Gearbox	Vehicle type
00 =	0 = Front wheel drive	0 = 5-speed manual gearbox	0 =
01 =	1 =	1 =	1 = B class: e.g. Passat
02 =	2 = Four wheel drive	2 =	2 =
03 =	3 =	3 = Automatic gearbox 01N	3 =
04 = Exhaust emissions in accordance with EURO2 standard or D3 standard	4 =	4 =	4 =
05 = Exhaust emissions in accordance with EURO3 Norm	5 =	5 = Automatic gearbox 01V (Tiptronic)	5 =
06 =	6 =	6 =	6 =
07 =	7 =	7 =	7 =
08 =	8 =	8 =	8 =

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

Passat:					1
5-speed manual gearbox:			0		
Front wheel drive without traction control:		0			
Emissions in accordance with EURO II standard:	04				
Code number:	04	0	0		1

4.7 - Adapting engine control unit to throttle valve control part

Adapting teaches the engine control unit (with ignition switched on and engine not running) the throttle valve control part stop positions and a comparison graph between throttle valve potentiometer and throttle valve positioner sender.

Adapting sequence must be performed if:

- ◆ The voltage supply is interrupted
- ◆ The throttle valve control unit is removed and installed
- ◆ The throttle valve control unit is renewed
- ◆ If when installing another engine another throttle valve control unit is installed

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

Test conditions

- No faults must be stored in fault memory
=> Page 4, interrogating fault memory
- The battery voltage must be at least 11.5 V.
- All electrical consumers, e.g. lights and rear window heating must be switched off
- The throttle valve must be at idling speed position.
- The cruise control system must be functioning correctly if installed.

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



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 2.)

-> 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, 9 and 8 for "Display group number 98" and confirm entry with Q key.

-> Indicated on display:

```
System in basic setting    98
x.xxx V      x.xxx V      Idling ADP.
runs
```

After pressing the Q-key the throttle valve positioner is driven to Min., Max. and five intermediate positions and the relevant throttle valve angle stored in non-volatile memory. This procedure takes approx. 10 seconds. The throttle valve then remains in the start position for a brief period then closes.

-> Indicated on display:

```
System in basic setting    98
x.xxx V      x.xxx V      Idling ADP.
OK.
```

Adapting has been performed successfully.

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:

- ♦ Throttle valve cannot reach the mechanical stop because of contamination e.g. oil deposits or an incorrectly adjusted throttle cable.
- ♦ Battery voltage too low.
- ♦ Throttle valve control unit or wiring is defective. Check => Page 92.

After an interruption the fault "17967 or 17972" is stored in fault memory. When next switching on ignition the basic setting is automatically performed again.

- End the engine basic setting by pressing the⇒ key.
- Check specifications of throttle valve control part in display group 23, => Page 33, evaluating measured value blocks. If the specifications are not attained, repeat matching.
- Press keys 0 and 6 for the function "End output" and confirm entry with the Q key.

4.8 - Adapting engine control unit to electronic immobilizer

Special tools, testers, measuring instruments and auxiliary items required

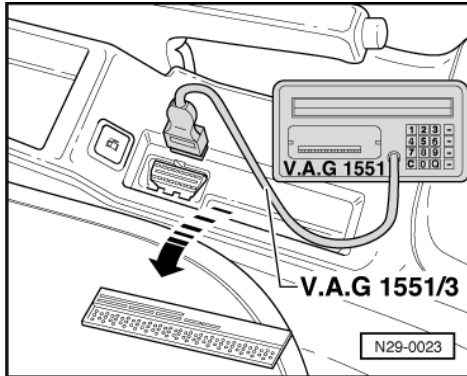
- ♦ Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3



Conditions

- Authorized vehicle key required.

Work sequence



- -> Remove the cover above the diagnostic connection on right next to the handbrake lever.
- 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:

```
B0919880 B5 Combi-instr. VDO X06
Coding 00042 WSC XXXXX
```

- Press the =>key.

-> Indicated on display:

```
IMMO-IDENT NO: VWZ7Z0T2000307
```

- 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.

5 - Checking additional signals

5.1 - Checking additional signals

5.2 - Checking speed signal

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
- ♦ 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

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 2.)

-> 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, 1 and 1 for "Display group number 11" and confirm entry with Q key.

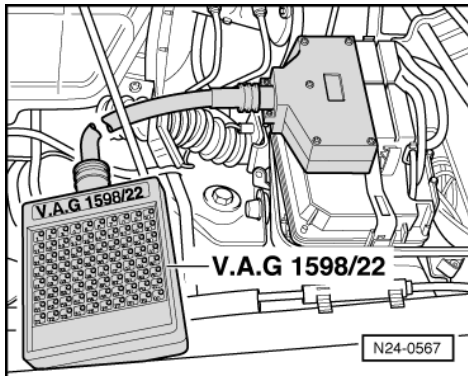
-> Indicated on display:
(1...4 = Display zones)



Read measured value block	11		
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
- Drive slower. The displayed value must decrease.
- Press the \Rightarrow 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 indicated or the display values reduce when driving slowly:



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- Connect multimeter to measure voltage between test box sockets 2+20.
- 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 air conditioner compressor signal

Air conditioner compressor signal:

Voltage is supplied to the engine control unit shortly before switching on the air conditioner compressor. The signal ensures that the control unit keeps the idling speed constant for the differing power requirements of the air conditioning system.

Air conditioner cut-off:

The air conditioner compressor is switched off for approx. 12 seconds by the engine control unit when accelerating from standstill and from low speeds to ensure that the full engine power is available when accelerating. If the accelerator is released earlier the time is shortened to a minimum of 3 seconds. At full throttle the air conditioner is switched off by the gearbox control unit (Kick-down switch).

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
- ◆ 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



Test conditions

- Air conditioner functioning OK.
- Air conditioner must be switched off
- No faults must be stored in fault memory
=> Page 4 , 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 2 .)

-> 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, 2 and 0 for "Display group number 20" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

```
Read measured value block 20
 1      2      3      4
```

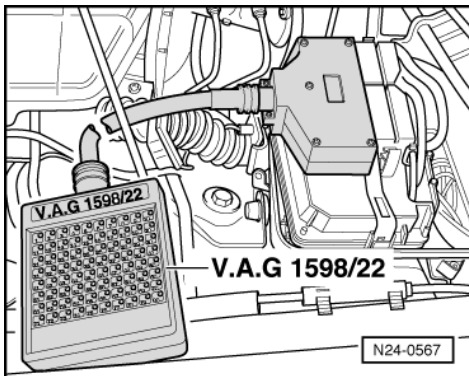
- Observe display in display zone 4. It must show
Compr. OFF.
- Switch on air conditioning system.
- Select lowest temperature and highest blower speed.

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

- Floor accelerator pedal quickly and release again (short throttle burst).

When quickly pressing the accelerator pedal down the display in display zone 4 must change from "ON" to "OFF" for a few seconds (compressor cut-off for vehicle acceleration).

- 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 1598/22 to control unit wiring harness.
- Check wiring between test box sockets 8 and air conditioner for open circuit using current flow diagram.
Wire resistance: Max. 1.5 ω

If no fault can be found in the wiring:

- Check function of air conditioner control unit.

=> Air conditioner; Repair group 01; Air conditioning system self-diagnosis Air conditioning system self-diagnosis

5.4 - Checking ignition retardation during gear selection

The engine control unit receives the gear selection signal via the gearbox control unit. The engine then, depending on road and engine speeds, retards the ignition briefly. This reduces the torque and gear jolt.

The V.A.G 1551 does not always recognise and display the signal for torque reduction because it is sent for an extremely short period.

Note:

To check the ignition retardation 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.

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
- ◆ 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

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 2.)

-> 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, 1 and 9 for "Display group number 19" and confirm entry with Q key.

-> Indicated on display:

(1...4 = Display zones)

```
Read measured value block 19
  1      2      3      4
```



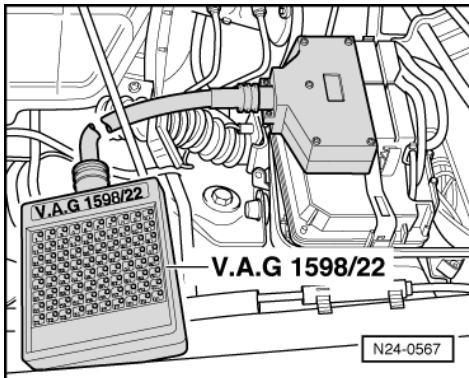
- Observe figure displayed in display zone 3 (3rd digit from left)
Specification: _ x 1 _ _ _ x
- Carry out test drive with a 2nd person to observe display.
- Observe figure displayed in display zone 3. Whilst selecting a gear the display in display zone 3 (3rd digit from left) must briefly display
Specification: _ x 0 _ _ _ x.

Note:

It is possible that several gear changes must be performed before the display in display zone 3 jumps to 0 as the signal from the automatic gearbox is very brief.

- Press the \Rightarrow 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 1598/22 to control unit wiring harness.
- Check wiring between test box socket 23 and automatic gearbox for open circuit according to current flow diagram.
Wire resistance: Max. 1.5 ω

5.5 - Checking driving range signal

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, 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

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 2.)

-> 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
```

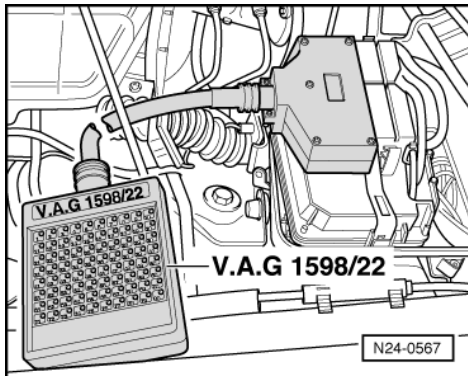
- Press keys 0, 2 and 0 for "Display group number 20" and confirm entry with Q key.

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

```
Read measured value block 20
  1      2      3      4
```

- Observe display zone 2. The display must read "Neutral".
- Depress foot brake and select driving range. The display must jump to "Gear engag".
- Press the \Rightarrow 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 1598/22 to control unit wiring harness.
- Check wiring between test box socket 22 and automatic gearbox for open circuit according to current flow diagram.
Wire resistance: Max. 1.5 ω



28 - Ignition system

1 - Servicing ignition system

1.1 - Servicing ignition system

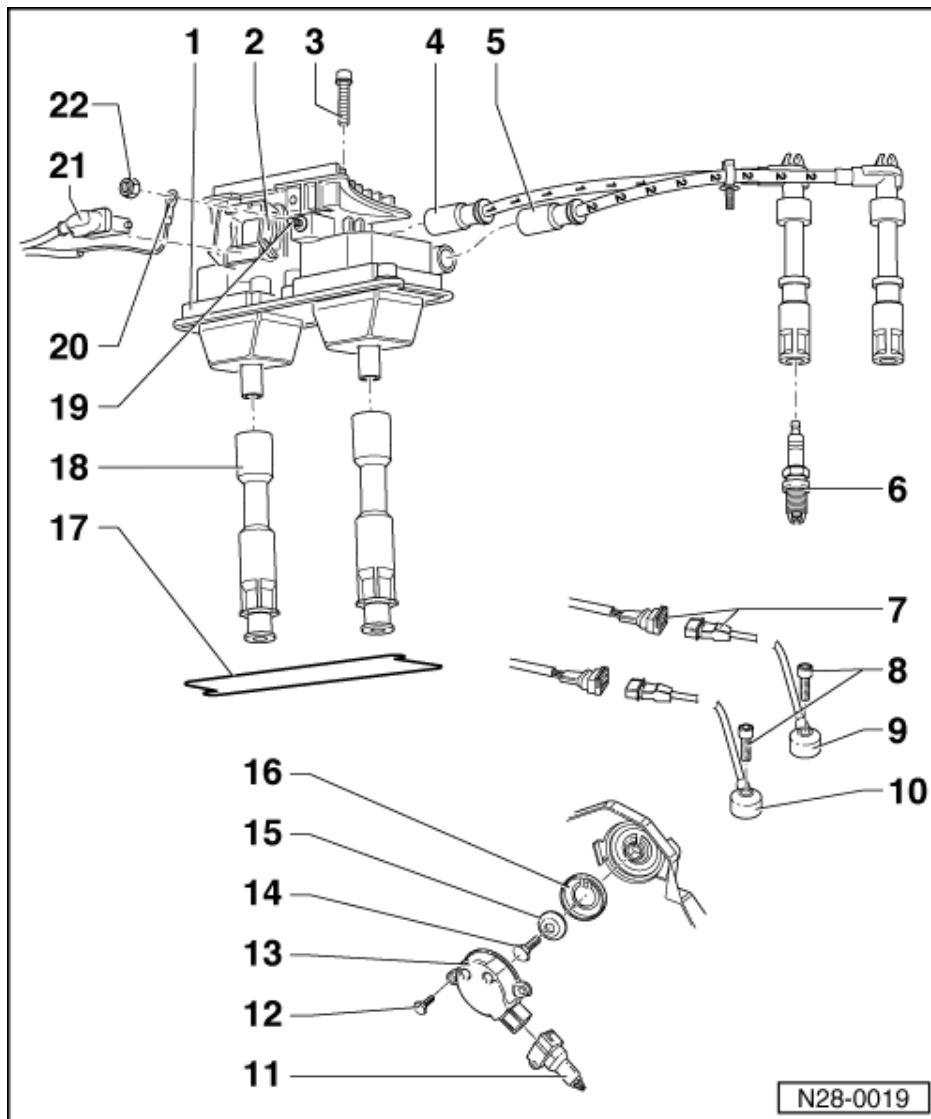
1.2 - General notes on ignition system

- ◆ 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.
- ◆ Disconnecting and connecting the battery must only be done with the ignition switched off, otherwise the engine control unit could be damaged.
- ◆ The engine control unit is equipped with self diagnosis.
- ◆ Components marked with * are checked via the self diagnosis.
=> Page 4 , 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 4 , 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 132 .

Safety precautions => Page 148

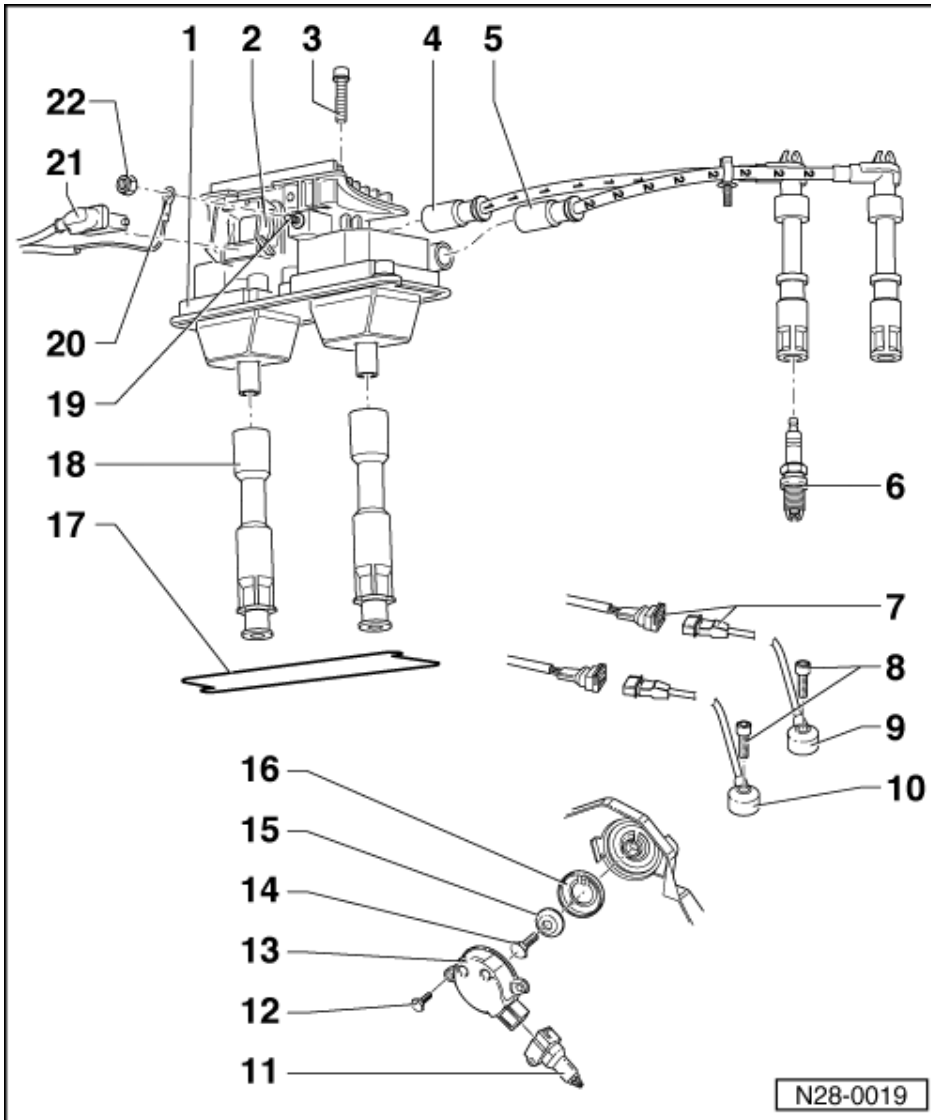
Test data, spark plugs => Page 149

1.3 - Removing and installing parts of the ignition system



Engine code ADR

- 1 Ignition coils (N, N128)
 - ◆ With output stage (N122)
 - ◆ Checking => Page 150
- 2 Locking device
 - ◆ For connector
- 3 6 Nm
- 4 Spark plug connector
 - ◆ for Cyl. 1
 - ◆ 4...6 kW
- 5 Spark plug connector
 - ◆ For Cyl. 2
 - ◆ 4...6 kW



6 Spark plug, 30 Nm

- ◆ Remove and install with 3122B
- ◆ Type and electrode gap
=> Page 149 , 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

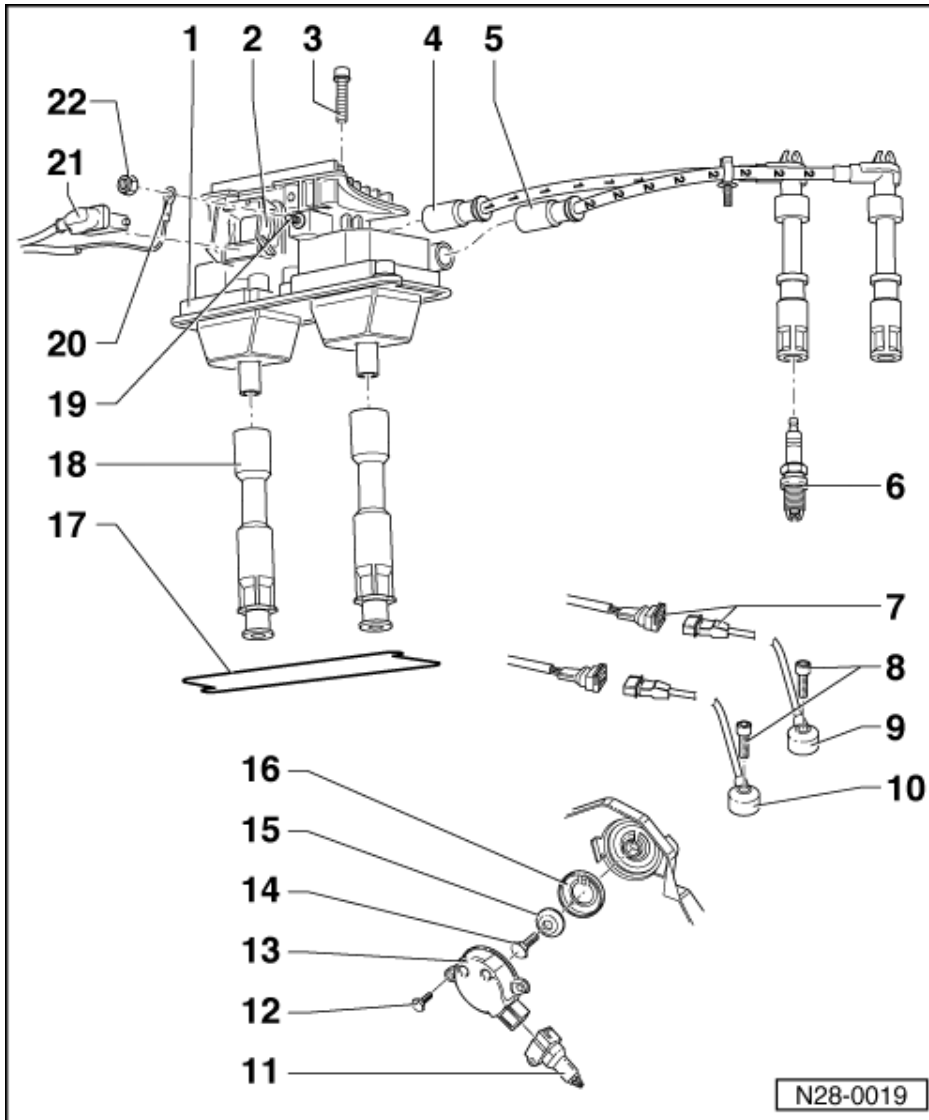
- ◆ Tightening torque influences the function of the knock sensor

9 Knock sensor 1 (G61)*

- ◆ Sensor and connector contacts are gold-plated
- ◆ Checking => Page 155

10 Knock sensor 2 (G66)*

- ◆ Sensor and connector contacts are gold-plated
- ◆ Checking => Page 155



11 Connector

- ◆ Black, 3-pin
- ◆ For Hall sender (G40)

12 10 Nm

13 Hall sender (G40)*

- ◆ Checking => Page 149

14 25 Nm

15 Washer

- ◆ Conical

16 Hood

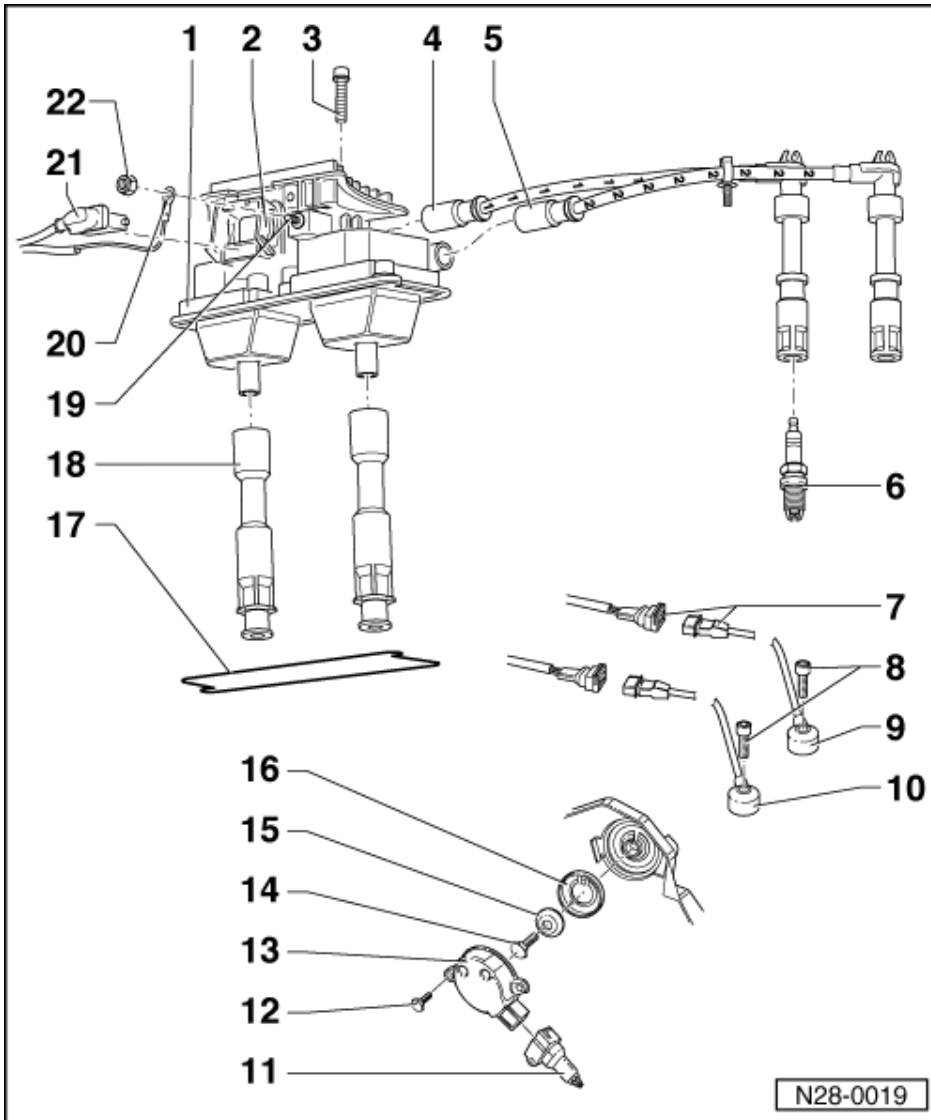
- ◆ For Hall sender (G40)
- ◆ When installing note fixing arrangement
- ◆ 09.97 ▸with four openings

17 Seal

- ◆ Renew if damaged

18 Spark plug connector

- ◆ 4...6 kW
- ◆ For Cyls. 3 and 4



19 Connecting stud

20 Earth wire

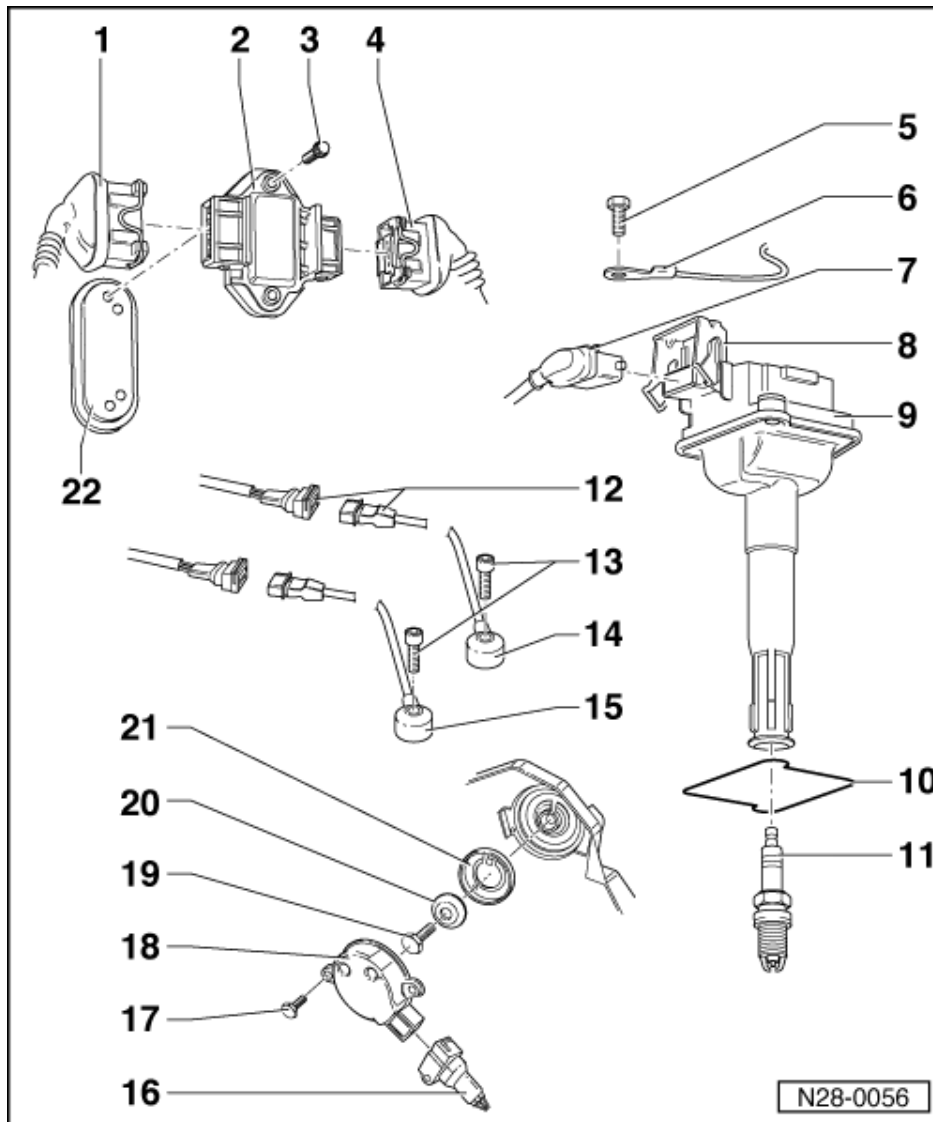
- ◆ Only loosen or tighten with ignition switched off

21 Connector

- ◆ Black, 5 pin

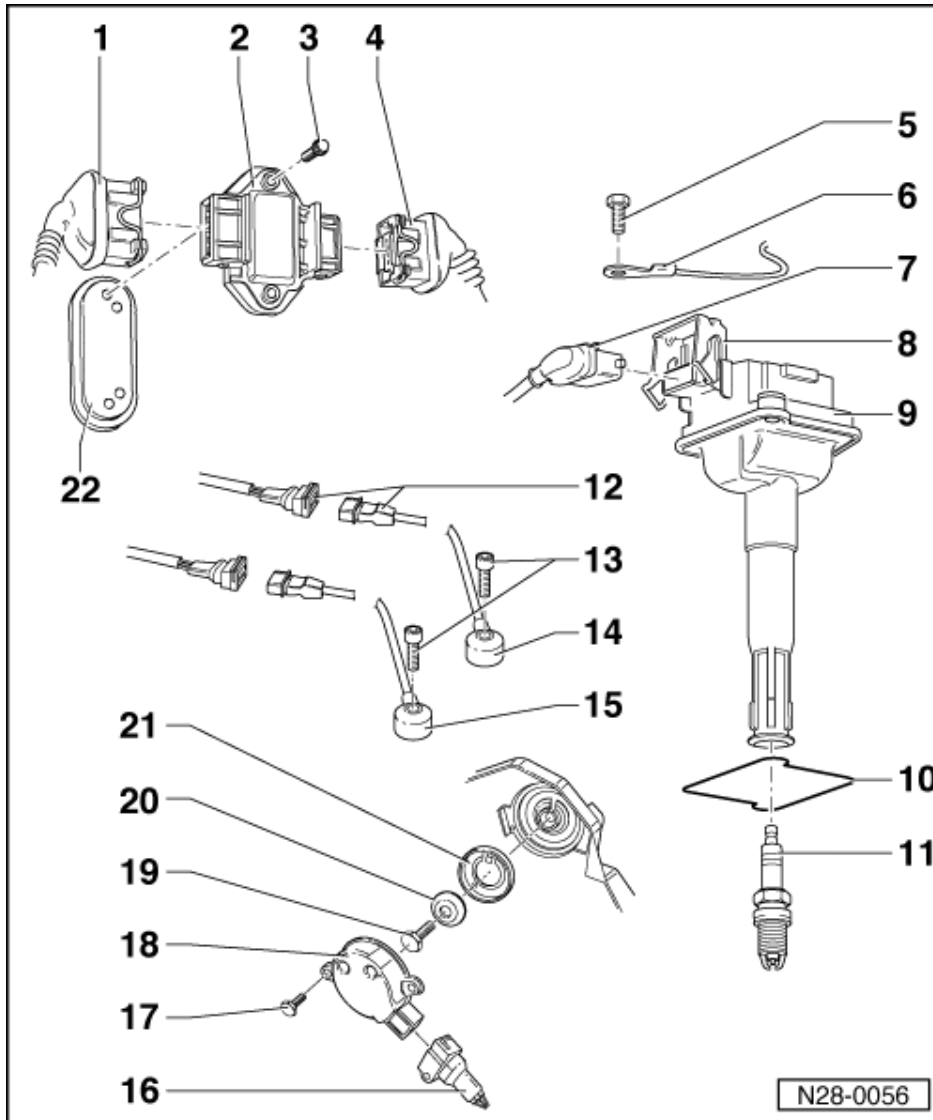
22 6 Nm

- ◆ Only loosen or tighten with ignition switched off



Engine code AEB

- 1 Connector**
 - ◆ Black, 5 pin
- 2 Output stage (N122)**
 - ◆ Checking => Page [150](#)
 - ◆ Coat lower part with heat conductive paste G 052 170 A2
- 3 6 Nm**
- 4 Connector**
 - ◆ Black, 4 pin
- 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 150

10 Seal

- ◆ Renew if damaged

11 Spark plug, 30 Nm

- ◆ Remove and install with 3122B
- ◆ Type and electrode gap
=> Page 149 , test data, spark plugs

12 3-pin connector

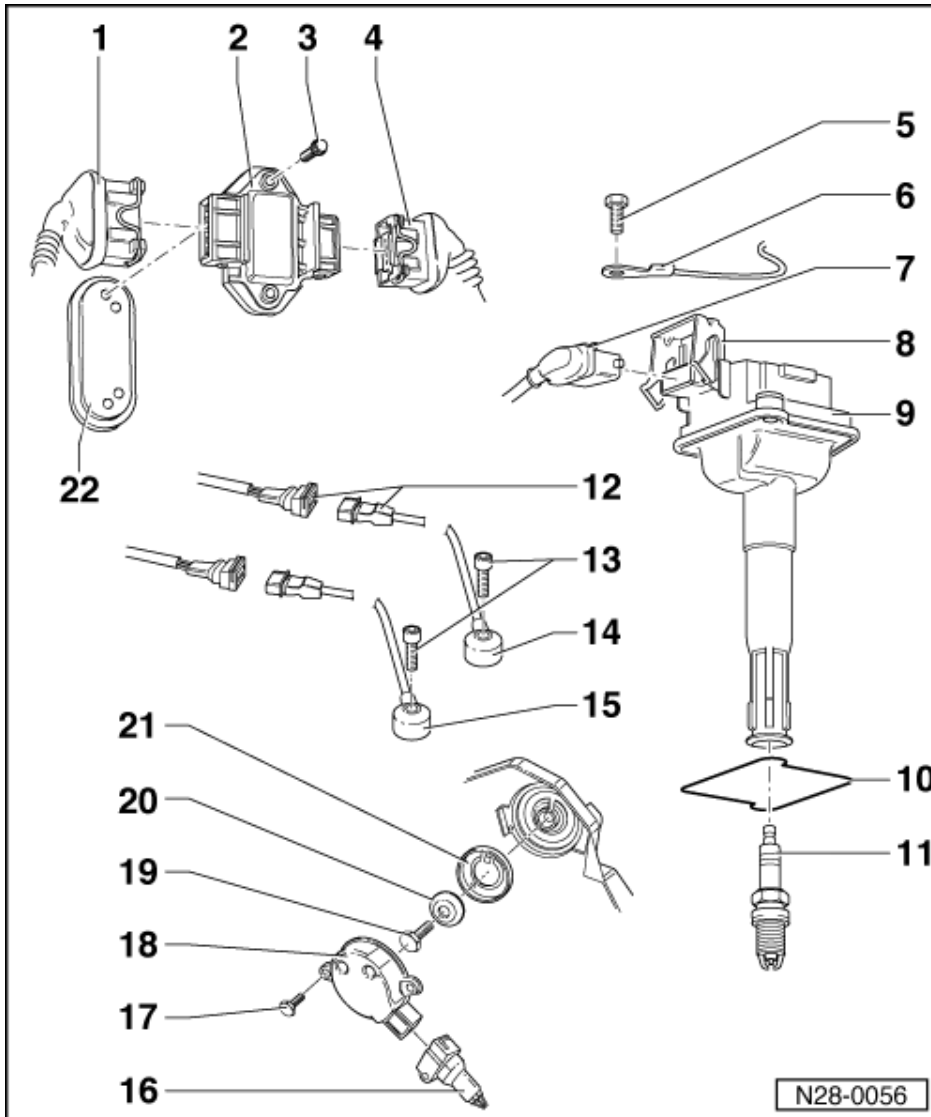
- ◆ Contacts gold plated
- ◆ Green for knock sensor 1 (G61)
- ◆ Blue for knock sensor 2 (G66)

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 155

**15 Knock sensor 2 (G66)***

- ◆ Sensor and connector contacts are gold-plated
- ◆ Checking => Page 155

16 Connector

- ◆ Black, 3-pin
- ◆ For Hall sender (G40)

17 10 Nm**18 Hall sender (G40)**

- ◆ Checking => Page 149

19 25 Nm**20 Washer**

- ◆ Conical

21 Hood

- ◆ For Hall sender (G40)
- ◆ When installing note fixing arrangement
- ◆ 09.97 ▶with four openings

22 Heat sink

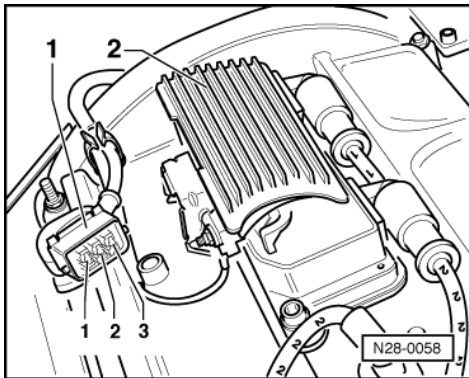


1.4 - Safety precautions

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

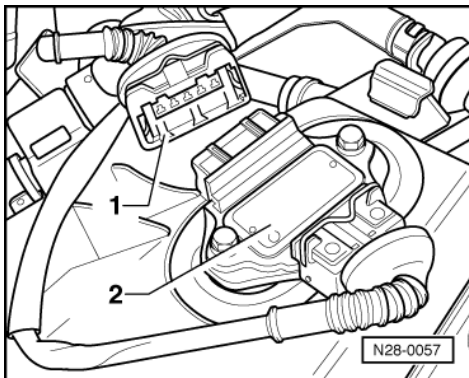
- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ The ignition must be switched off before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ If the engine is to be turned at starter speed, without starting,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

Engine code ADR:



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

Engine code AEB:



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

Continued for all vehicles

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

Code letters	ADR	AEB
Firing order	1-3-4-2	1-3-4-2
Spark plugs¹⁾		
VW/Audi	101 000 051 AA	101 000 051 AA
Manufacturer's designation	F 7 LTCR	F 7 LTCR
VW/Audi	101 000 033 AA	---
Manufacturer's designation	BKUR 6 ET-10	---
VW/Audi	101 000 041 AC	---
Manufacturer's designation	14 FGH-7 DTURX	---
Electrode gap	0.9...1.1 mm	0.9...1.1 mm
Tightening torque	30 Nm	30 Nm

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

=> Exhaust emissions test binder

1.6 - Checking Hall sender

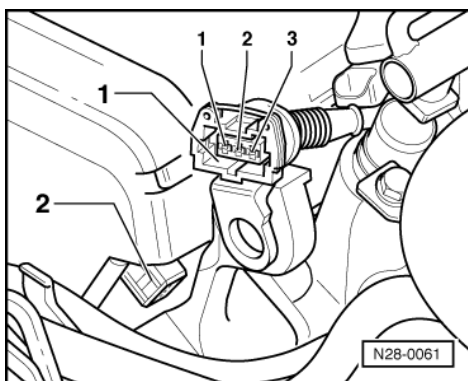
Special tools, testers, measuring instruments and auxiliary items required

- ◆ 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

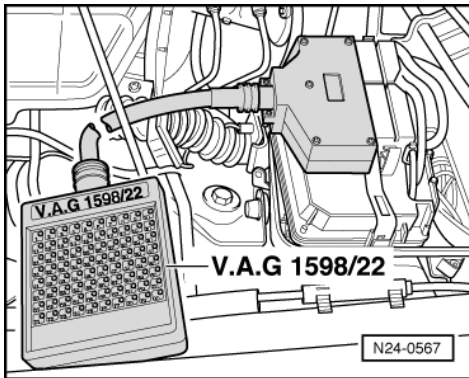
Test conditions

- The battery voltage must be at least 11.5 V.

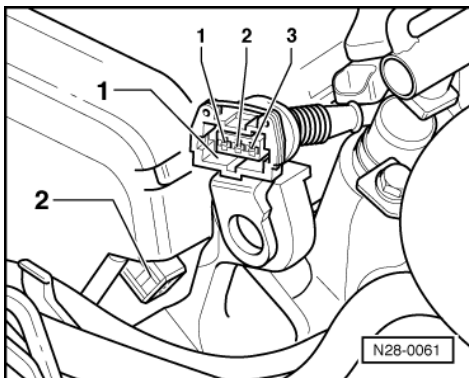
Test sequence



- -> 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 1598/22 to control unit wiring harness.



- -> Check wiring between test box sockets for open circuit according to current flow diagram.
 - Contact 1+socket 62 for ADR engine
 - Contact 1+socket 11 for AEB engine
 - Contact 2+socket 76
 - Contact 3+socket 67
 - Wire resistance: Max. 1.5 ω
- Additionally check wires for short to one another.
 - Specification: $\infty\omega$

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

- Renew Hall sender (G40).

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

- Renew engine control unit => Page 129 .

1.7 - Checking ignition coils with output stage

Special tools, testers, measuring instruments and auxiliary items required

- ◆ 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
- ◆ 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 149 .
- Engine speed sender must be OK, checking Page 105 .
- Fuse 32 must be OK.



- Earth connections => Page 145 , item 6 , must be OK.

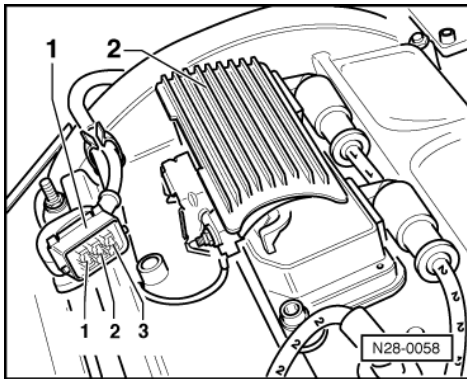
Engine code ADR:

Engine code AEB => Page 152

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

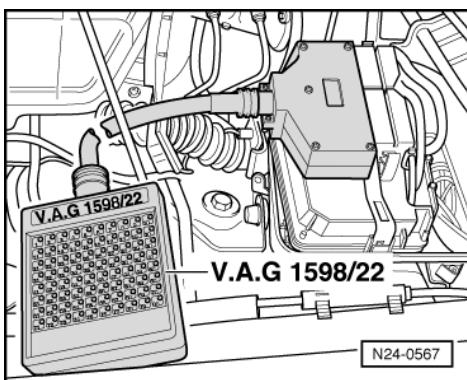


- -> Pull 3 pin connector -1- off output stage for ignition coils -2-.
- Connect multimeter to measure voltage using aux. cables from V.A.G 1594 to centre contact and earth.
- Switch on ignition.
Specification: Min. 11.5 V

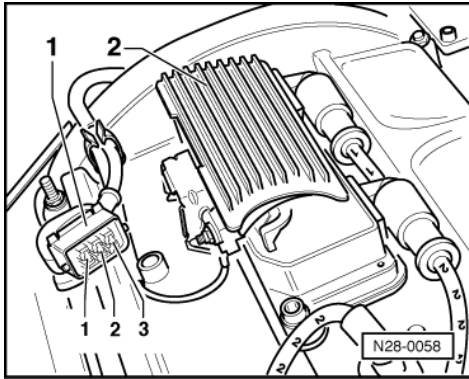
If no voltage is present:

- Switch off ignition.
- Check wiring => Page 151

Checking wiring



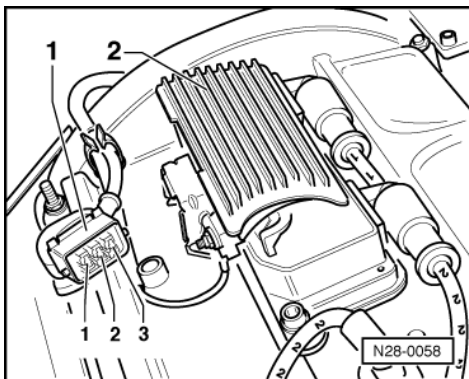
- -> Connect test box V.A.G 1598/22 to control unit wiring harness.



- -> Check wiring between test box and 3 pin connector for open circuit according to current flow diagram.
Contact 1+socket 78
Contact 3+socket 71
Wire resistance: Max. 1.5 ω
- Check wire between 3 pin connector contact 2 and relay plate for open circuit according to 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 151

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

- Renew engine control unit => Page 129 .

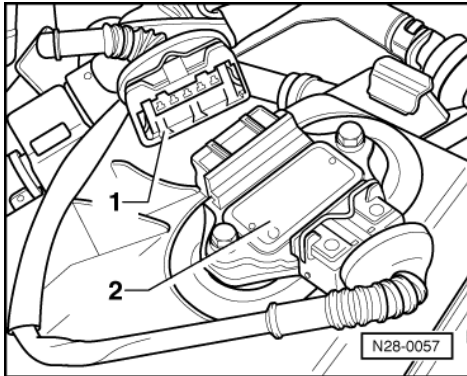
If voltage supply and activation is OK:

- Renew ignition coils and output stage => Page 141 , item 1 .

Engine code AEB:

Checking activation of output stage

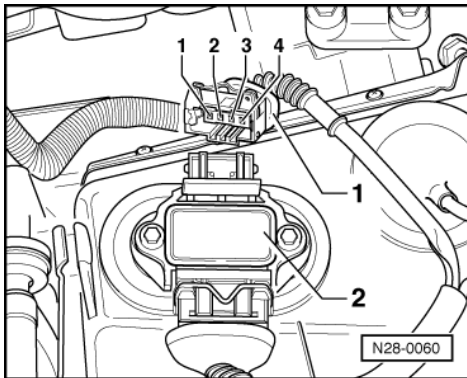
- Pull connector off injectors.



- -> 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:

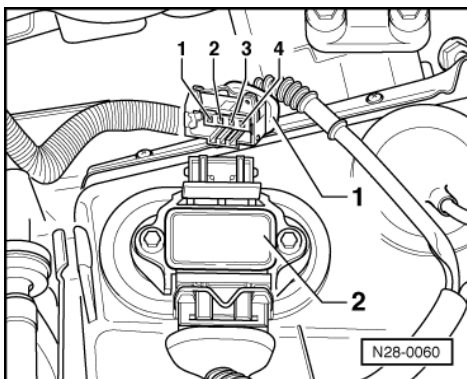
- Check wiring => Page 154



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:

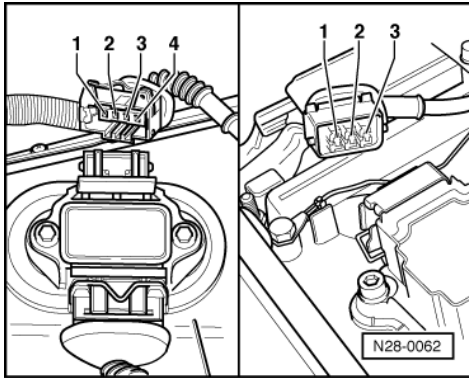




- Renew output stage => Page 145 , item 2 .

Checking ignition coils

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



If LED does not flicker on one contact:

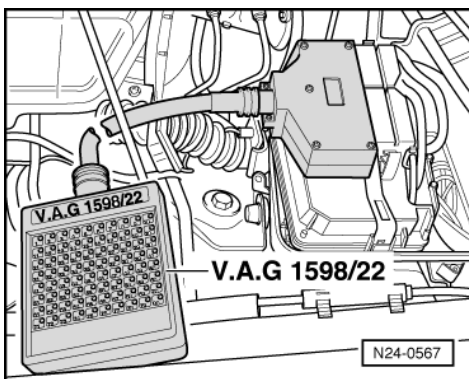
- -> Check wire between 4 pin connector and 3 pin connector of ignition coil for open circuit according to current flow diagram.
Wire resistance: Max. 1.5 ω

If no fault in wire is detected:

- Renew ignition coil.

Checking wiring

- Switch off ignition.



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- Check wiring between test box and connector for open circuit according to current flow diagram.
Contact 1+socket 70
Contact 2+socket 78
Contact 3+socket 2
Contact 4+socket 77
Contact 5+socket 71
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, testers, measuring instruments and auxiliary items required

- ◆ 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

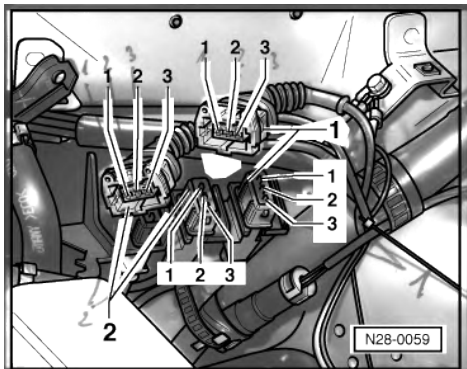
Test conditions

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

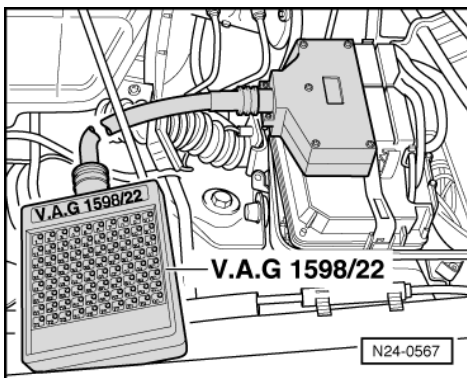
Checking function

- Functional check of knock control and knock sensors => Page 32 read measured value block, display groups 14 to 16 and 24.

Checking resistances and wiring



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



- -> Connect test box V.A.G 1598/22 to control unit wiring harness.
- Check wiring between test box and 3 pin connector for open circuit according to current flow diagram.

G61: G66:

Contact 1+socket 68 60

Contact 2+socket 67 67

Contact 3+socket 2 2

Wire resistance: Max. 1.5 Ω

- Additionally check wires at socket 67 for short to sockets 60 and 68.

Volkswagen Technical Site: <http://vwts.ru> <http://vwts.info>



Specification: ∞ω

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
 - Overrunmust 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)