

Audi A4 1995 ➤

**Motronic fuel injection and ignition system (4-cyl.turbo)
> 07.96**

Engine ID	AEB								
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Edition 07.1996



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

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**Motronic fuel injection and ignition system (4-cyl.turbo) >
07.96**

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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

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01 - Self-diagnosis

1 - Self-diagnosis

1.1 - Self-diagnosis

1.2 - Technical data for self-diagnosis

Equipment

- ◆ Fault memory: Non-volatile memory and volatile memory1).
 - ◆ Rapid data transfer
- 1) Will be erased after 50th engine start if fault has not occurred again.

Available functions

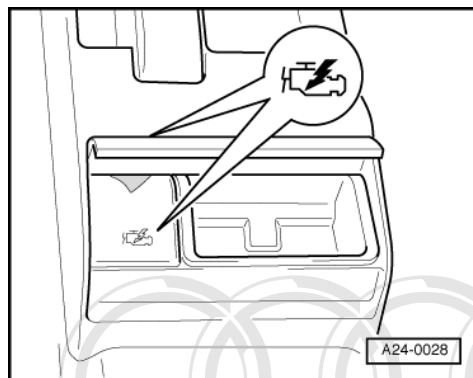
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Function	Ignition switched on	Engine idling
01 Interrogate control unit version	x	x
02 Interrogate fault memory	-	x
03 Control unit diagnosis	x	-
04 Introduce basic setting	x	x
05 Erase fault memory	x	x
06 Terminate output	x	x

Function	Ignition switched on	Engine idling
07 Encode control unit	x	x
08 Read block of measured values	x	x
09 Read individual measured value	x	x

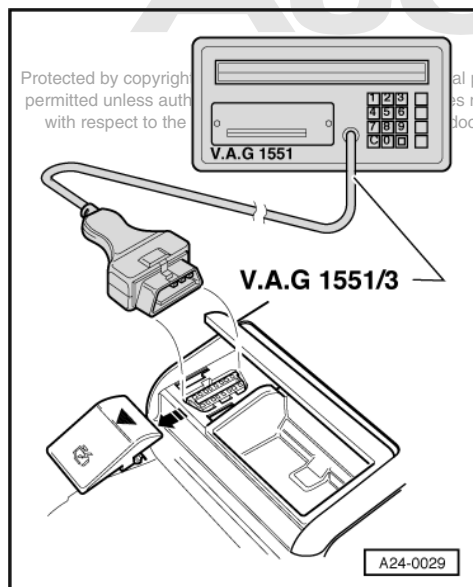


1.3 - Connecting fault reader V.A.G 1551 and selecting engine electronics control unit



Test conditions

- Battery voltage at least 11 V
 - Fuse OK.
- -> Open rear ashtray and remove cover for diagnostic connector.



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

-> Indicated on display:

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

* Appears alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on the function required:

- Switch on ignition

or

Start the engine => Page **1** , table "Available Functions".

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

-> Indicated on display:

Rapid data transfer	HELP
Insert address word XX	

Rapid data transfer	Q
01 - Engine electronics	

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

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

Rapid data transfer	HELP
Control unit does not respond	

=> Circuit diagram binder, Electrical Fault Finding and Installation Locations

Rapid data transfer	HELP
Fault in communication set-up	

Rapid data transfer	HELP
K wire not switching to earth	

Rapid data transfer	HELP
K wire not switching to positive	

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

8D0907557.. 1.8L	R4/5VT MOTR AT
D..	
Code 04051	WSC 12345

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- | | |
|---------------|---|
| - 8D0907557.. | Control unit number (see also spare parts programme) |
| - 1.8l | Engine capacity |
| - R4/5VT | In line engine, 4-cylinder 5 valve, turbo |
| - MOTR | Motronic |
| - HS | Manual gearbox |
| - AT | Automatic gearbox |
| - D | Status (software version) of control unit |
| - Code 04051 | Control unit encoding |
| - WSC 12345 | Workshop Code from V.A.G 1551 used to perform the last encoding |

- Press the =>key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	



1.4 - Interrogating and erasing fault memory

- Connect the V.A.G 1551 fault reader (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The engine must be running at idling speed during this procedure.
(Connecting the fault reader and selecting the control unit for the engine electronics => Page 2).

Only if the engine does not start:

- Interrogate fault memory with ignition switched on.

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------

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

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

X faults recognised

If no fault is stored:

- Press the ➡key.

If one or more faults are stored:

The stored faults are displayed and printed out one after another.
The display will then show:

- Locate and eliminate faults listed on printout as per fault table => Page 4 .
- Press keys 0 and 5 for the function "Erase fault memory" and confirm entry with Q key.

-> Indicated on display:

Rapid data transfer Fault memory is erased!
--

Note:

If the ignition is switched off between interrogating the fault memory and erasing the fault memory, the fault memory will not be erased.

- Press the ➡key.

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------

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

1.5 - Fault table

Notes:

- ♦ The fault table is listed according to the 5 digit fault code on the left.
- ♦ Before renewing components indicated as being faulty, check the wiring, the connectors to these components and the earth connections using the circuit diagram. This applies particularly where faults are recorded as "occurring sporadically" (SP).

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
------------------------------	-------------------------	------------------	---------------------

00515 Hall generator -G40 Open/short to positive	- Line break or short to positive - Hall sensor disc out of position - -G40 defective	- No engine power at full throttle - Exhaust emission values not OK - High fuel consumption	- Check Hall sensor =>Page 85
	Short to earth - Short to earth - -G40 defective		
00528 Altitude sensor -F96 Signal too high	- Line break or short to positive - -F96 defective	- Possibly poor starting	- Check altitude sensor =>Page 52
	Signal too low - Short to earth - Fault in power supply to -F96 - -F96 defective	- Reduced boost pressure (safety limitation for turbo-charger speed)	

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
00532 Supply voltage Signal too high Signal too low	- Excess voltage from as-sisted start - Alternator defective - Voltage supply less than 10V for more than 1 sec- ond - Poor line connection to engine control unit - Battery discharged - Current drain with igni-tion off	- Damage to the engine control unit - Engine will not start - Engine running prob- lems, engine may even stop - Learning procedure for throttle valve control unit not possible	- Check battery voltage - Check supply voltage for engine control unit => Page 68 - Check battery charge level

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
00543 Maximum revs exceeded	- Engine over-revving (e.g. wrong gear engag-ed) - Engine speed above 7100 rpm	- Possible engine damage	- Rectify mechanical damage
00544 Maximum boost pressure exceeded	- Hoses interchanged, not connected, blocked or leaking - Solenoid valve for boost pressure control defec-tive - Turbocharger pressure cell defective	- Loss of power (over-run cut-off until boost pressure falls to a non-critical level)	- Check boost pres-sure control => Page 49
	- Short to earth		- Check solenoid valve for boost pressure control => Page 50



	- Altitude sensor defective	- Poor starting	- Altitude sensor defective => Page 52
--	-----------------------------	-----------------	---

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
00561 Mixture adaptation Adaptation limit (add) exceeded	- Fuel system pressure too low	- Vehicle jerks	- Fill up vehicle, check fuel system pressure => Page 38
Adaptation limit (mul) exceeded	- Incorrect signal from airflow meter	- Increased fuel consumption	- Check airflow meter => Page 72
	- Leaks in exhaust system upstream of catalytic converter - Unmetered air downstream of airflow meter	- Possibly rough idling - Vehicle jerks	- Rectify leaks
	- Coked injectors		- Check injection quantity => Page 40

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
00575 Intake manifold pressure Control limit not reached	- Signal from airflow meter too low	- Increased power	- Check airflow meter => Page 72
	- Unmetered air between airflow meter and turbocharger		- Check intake system
	- Turbocharger pressure cell sticking - Solenoid valve for boost pressure control defective - Short circuit or line break	- Poor performance	- Check boost pressure control => Page 49
Control limit exceeded	- Signal from airflow meter too high	- Poor performance	- Check airflow meter => Page 72
	- Turbocharger pressure cell sticking - Solenoid valve for boost pressure control defective	- Increased power	- Check boost pressure control => Page 49

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
00670 Sensor for throttle valve actuator -G127 Signal too low	- Short to earth - Fault in power supply to -G127 - -G127 defective	- Idling speed too high - No idling speed control - Load change jolt on accelerator release - Air conditioning compressor only activated at high engine speeds	- Perform adaptation of the throttle valve control unit => Page 62 - Check throttle valve control unit => Page 62
	- Line break or short to positive - Fault in earth supply to -G127 - -G127 defective		

Implausible signal	- Throttle valve sticking - Fault in line connection to -G127		
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Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
01119 Gear recognition signal Open/short to positive	- Line break or short to positive - F125 defective	- Brief and slightly more pronounced engine speed fluctuations when engaging or disengaging a gear	- Check line connection to -F125 multifunction switch => Circuit diagram binder, Electrical Fault Finding and Installation Locations - Interrogate fault memory for gearbox => Automatic Gearbox 01M; Repair Group 01; Self-diagnosis, Electrical check; Perform self-diagnosis Self-diagnosis, Electrical check; Perform self-diagnosis
Short to earth	- Short to earth - F125 defective		

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
01165 Throttle control unit -J338 Control limit not reached	- Throttle valve sticking - Actuator mechanics sticking	- Increased idling speed - Load change jolt on accelerator release	- Check throttle valve control unit =>Page 62
Control limit exceeded			
Control difference	- Open circuit to throttle valve actuator (V60)		- Check throttle valve actuator => Page 67 .

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
01247 Solenoid valve 1 for active carbon canister -N80			
Short to earth	- Short to earth - N80 defective	- Possibility of jolting in part load range	- Check solenoid valve 1 for active carbon canister => Page 60
Short to positive	- Short to positive - N80 defective	- Vehicle may smell of petrol	
Output open	- Open circuit in wiring - N80 defective		

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
01249 Injector, cylinder 1 -N30			
01250 Injector, cylinder 2 -N31			
01251 Injector, cylinder 3 -N32			
01252 Injector, cylinder 4 -N33			



Short to earth	- Short to earth - Injector defective	- Irregular engine running - Engine stops	- Check injectors => Page 43
Short to positive	- Short to positive - Injector defective		
Output open	- Open circuit in wiring - Injector defective		

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
01259 Fuel pump relay -J17 Open circuit/short circuit to earth	- Open circuit in wiring - Fuel pump relay - J17 defective	- Engine will not start - Engine stops - Several faults may be recorded	- Check fuel pump relay =>Page 46
	- Short to earth	- Fuel pump runs continuously when ignition is on	
Short to positive	- Short to positive	- Engine will not start - Engine stops - Several faults may be recorded	

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
01262 Solenoid valve for boost pressure control -N75 Short to earth	- Short to earth - -N75 defective	- Loss of power (over-run cut-off until boost pressure falls to a non-critical level) - Boost pressure too high - Fault 0544 "Maximum boost pressure exceeded" stored	- Check solenoid valve for boost pressure limitation => Page 50
Short to positive	- Short to positive - -N75 defective	- Poor performance - Boost pressure too low	
Output open	- Open circuit in wiring - -N75 defective		

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16486 Airflow meter -G70 Signal too low	- Open circuit or short to earth - -G70 defective	- Scarcely perceptible change in performance	- Check airflow meter => Page 72
	- Unmetered air - Air filter blocked		- Check intake system
16487 Airflow meter -G70 Signal too high	- Open circuit or short to positive - -G70 defective	- Scarcely perceptible change in performance	- Check airflow meter => Page 72

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
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16496 Sensor for intake air temperature - G42 Signal too low	- Short to earth - -G42 defective	- Emergency operation (substitute value constant +19.5°C)	- Check sensor for intake air temperature => Page 71
16497 Sensor for intake air temperature - G42. Signal too high	- Line break or short to positive - -G42 defective	- Emergency operation (substitute value constant +19.5 °C)	- Check sensor for intake air temperature => Page 71

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16500 Coolant temperature sensor - G62 Implausible signal	- Moisture or corrosion in connector plug - Loose contact - -G62 defective	- Cold start problems at very low temperatures - Engine running problems when warm	- Check sensor for intake air temperature =>Page 70
16501 Sensor for intake air temperature -G62 Signal too low	- Short to earth - -G62 defective	- Increased fuel consumption - Exhaust emissions not OK	
16502 Coolant temperature sensor - G62 Signal too high	- Open circuit or short to positive - -G62 defective		

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16505 Throttle valve potentiometer - G69 Implausible signal	- Moisture or corrosion on plug connector - -G69 defective	- Acceleration jolting - Rough idling	- Check throttle valve potentiometer => Page 64
16506 Throttle valve potentiometer - G69 Signal too low	- Open circuit or short to earth - -G69 defective	- Acceleration jolting - Load change jolt on accelerator release	- Check throttle valve potentiometer => Page 64
16507 Throttle valve potentiometer - G69 Signal too high	- Open circuit or short to positive - -G69 defective	- Acceleration jolting - Load change jolt on accelerator release	- Check throttle valve potentiometer => Page 64

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
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16514 Bank 1, Probe 1 Electrical fault in circuit	- Corrosion due to moisture on connector - Short circuit between signal line for lambda probe and reference earth wire for lambda probe	- Lambda control not working (mixture formation is controlled)	- Check lambda probe signal line and actuation => Page 58
	- Signal line amplitude too small (lambda probe contaminated or probe slot clogged, dirty)	- Rough idling - Exhaust emissions not OK - Increased fuel consumption	- Check lambda control =>Page 55

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Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16515 Bank 1, Probe 1 Voltage too low	- Short to earth or short to screening in lambda probe signal line - Short to earth or short to screening in lambda probe reference earth line	- Lambda control not working (mixture formation is controlled) - Rough idling - Exhaust emissions not OK - Increased fuel consumption	- Check lambda probe signal line and actuation => Page 58
16516 Bank 1, Probe 1 Voltage too high	- Short to positive in signal line		

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16518 Bank 1, Probe 1 No activity	- Short to earth in reference earth line - Lambda probe defective (dirty)	- Rough idling - Exhaust emissions not OK	- Check lambda control =>Page 55
	- Lambda probe heating not functioning	- Increased fuel consumption - Soot on spark plugs	- Check lambda probe heating => Page 57
16519 Bank 1, Probe 1 Electrical fault in heating circuit	- Line break or short circuit	- Lambda probe heating not functioning	- Check lambda probe heating => Page 57

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16705 Engine speed sensor -G28 Implausible signal	- Sensor disc loose or bent	- Poor starting - Engine misfiring	- Remove oil sump and check sensor disc
	- -G28 defective - Loose contact - Screening line break		- Check engine speed sensor =>Page 69
16706			

Engine speed sensor -G28 No signal	- Line break or short circuit - G28 loose or defective	- Engine will not start - Engine cuts out	- Check engine speed sensor => Page 69
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Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16711 Knock sensor 1 -G61 16716 Knock sensor 2 -G66 Signal too low	- Knock sensor loose or corrosion on connector - Line break or short to earth - Knock sensor defective	- High fuel consumption - Poor performance	- Tightening torque for knock sensor: 20 Nm - Check knock sensor => Page 83

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
16885 Vehicle speed signal Implausible signal	- Line break between - G22 speedometer sensor and dash panel insert - Line break between dash panel insert and engine control unit - -G22 defective - Dash panel insert defective	- Engine control unit does not deactivate air conditioning compressor - Poor load change performance	- Check speed signal => Page 77
16989 Control unit defective	- Engine control unit defective	- Engine will not start	- Renew engine control unit => Page 35

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
17733 Knock control, cylinder 1 17734 Knock control, cylinder 2 17735 Knock control, cylinder 3 17736 Knock control, cylinder 4 Control limit reached	- Poor quality fuel (less than RON 91) - Knock sensor tightened with incorrect torque - Abnormal engine noise (ancillaries loose)	- High fuel consumption - Poor performance - Irregular engine running	- Fill up with petrol of at least RON 91 - Tighten knock sensor (20 Nm) - Check knock control => Page 83

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
17913 Idling switch -F60			



Does not close / open circuit	- Throttle cable setting - Floor mat pressing down on accelerator	- Idling speed too high	- Adjust throttle cable => 4-cylinder engine, mechanical components; Repair Group 20; fuel supply; repair throttle mechanism fuel supply; repair throttle mechanism
	- Throttle valve sticking - Line break or short to positive - -F60 defective	- Idling speed control not functioning - Idling speed too high - Load change jolt on accelerator release - Air conditioning compressor only activated at high engine speeds	- Test idling switch => Page 63
17914 Idling switch -F60 Does not open / short to earth	Moisture in throttle valve connector - Short to earth - -F60 defective		

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Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
17953 Throttle valve control Faulty function	- Open circuit in wiring - Throttle valve stiff or dirty - -G69 and -G127 defective	- Idling speed too high - Load change jolt on accelerator release	- Check throttle valve control unit =>Page 62
17966 Throttle valve drive Electrical fault in circuit	- Short to earth - Short to positive - Throttle valve actuator (V60) defective	- Idling speed too high	- Check throttle valve actuator => Page 67 .

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
17967 Throttle valve control unit -J338 Fault in basic setting	- Idling switch open or line break - Throttle valve sticks and will not close - Pulse from engine speed sensor detected	- Adaptation of throttle valve control unit not performed	- Check throttle valve control unit =>Page 62
17972 Throttle valve control unit -J338 Under-voltage in basic setting	- Voltage less than 10 V during basic setting		- Check battery voltage

Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
17978			

Engine control unit blocked	- Attempted tampering - Short circuit in the communication line - Immobilizer control unit defective/missing	- Engine starts but cuts out again immediately	- Adapt control unit for engine electronics to the electronic immobilizer => Page 35 - Check the electronic immobilizer => Repair Gr. 96; Repair electronic immobilizer
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Output on V.A.G 1551 printer	Possible cause of fault	Possible effects	Fault rectification
18010 Power supply terminal 30 Voltage too low	- Battery was disconnected - Open circuit in wiring	- All learned values erased	- Erase fault memory and continue to observe vehicle - Check voltage supply for testing control unit => Page 68
18020 Engine control unit incorrectly encoded	- Engine control unit incorrectly encoded	- Loss of performance - Increased emissions - Various faults in fault memory	- Encode control unit => Page 17

1.6 - Actuator diagnosis

The actuator 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 active carbon canister -N80
 6. Solenoid valve for boost pressure limitation -N75
- Connect the V.A.G 1551 fault reader (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The ignition must be switched on during this procedure.
(Connect the fault reader and select the control unit for the engine electronics => Page 2).

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------

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

-> Indicated on display:



Rapid data transfer Q
03-Actuator diagnosis

- Confirm input with Q key.

-> Indicated on display:

Actuator diagnosis
Injector, cylinder 1 -N30

- Turn the throttle mechanism on the throttle valve control unit to open the idling switch.

The valve should click five times.

If the valve does not click:

- Check the injectors => Page 43
- Press the ➡key.
- Turn the throttle mechanism on the throttle valve control unit to open the idling switch.

In this way, all the injectors are checked one after the other.

- Press the ➡key.

-> Indicated on display:

Actuator diagnosis
Solenoid valve 1 for active carbon
canister -N80

The valve must click.

If the valve does not click:

- Check the -N80 solenoid valve for the active carbon canister
=>Page 60.
- Press the ➡key.

-> Indicated on display:

Actuator diagnosis
Solenoid valve for boost pressure
limitation -N75

The solenoid valve must click.

Note:

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

If the solenoid valve does not click:

- Check solenoid valve for boost pressure limitation
=> Page 50
- Press the ➡key.

Note:

The actuator diagnosis cannot be re started until the ignition has been switched off briefly.

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1.7 - Basic setting

With the engine stopped, the following operation can be performed with the basic setting:

- ♦ Adaptation of the throttle valve control unit to the engine control unit => Display Group 98

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

- ♦ Learning process for lambda control
=> each display group
- ♦ Fault finding by selective actuation and deactuation of the lambda control => Display Group 99
- ♦ Testing the ignition timing
=> Display Group 95

Test conditions for operations with engine running

- Coolant temperature at least 80°C.
 - Electrical consumption units switched off (radiator fan must not run during the check)
 - Air conditioning system switched off
 - Gear selector lever in P or N position
 - No fault stored in fault memory
- Connect the V.A.G 1551 fault reader (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The ignition must be switched on during this procedure.
(Connect the fault reader and select the control unit for the engine electronics => Page 2).

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 0 and 4 for function "Basic Setting" and confirm entry by pressing the Q key.

-> Indicated on display:

Basic setting	HELP
Enter display group number XX	

- Enter the desired display group number and confirm entry with the Q key.

-> Indicated on display (for example):

System in basic setting 98			
1	2	3	4

Display group 08 on idling (warm engine, coolant temperature not less than +85°C)

To carry out the learning process of the lambda control, the solenoid valve for the active carbon canister is closed and the air conditioning compressor is switched off when a display group is selected.

System in basic setting 8				⇒	Indicated on display			
2.37 ms	0.4 %	0.1 %	λ-Adaptation					
					Tank venting ▪ λ-Adaptation: instantaneous mixture formation learning process (solenoid valve 1 for active carbon canister closed) ▪ Ten active: conditions for learning mixture formation not met (solenoid valve 1 for active carbon canister closed)			
					Learned value for mixture formation at part load (multiplicative) ▪ - 12...+ 12 %: OK ▪ Outside tolerance: Check lambda control => Page 54			



Learned value for mixture formation at idling speed (additive)	
▪ - 12...+ 12 %: OK. ▪ Outside tolerance: Check lambda control => Page 54	
Injection period (per working stroke)	
▪ 1.50...3.00 ms: OK ▪ < 1.50 ms: High proportion from tank breather system => Page 60 ▪ > 3.00 ms: Engine loaded => Switch off consumption units	

Display group 95 on idling (warm engine, coolant temperature not less than +85 °C)

With this display group, the idling stabilization is blocked and a fixed ignition angle of 12° before TDC is output.

System in basic setting 95			⇒	◀ Indicated on display
860 rpm	1.15 ms	12.0° before TDC	93.5 °C	
			Coolant temperature	
			Ignition timing	
			▪ Specified as fixed value by engine control unit	
			Engine load (injection period per crankshaft revolution)	
			Engine speed	

Display group 98 with ignition on

The learning process (adaptation) of the throttle valve to the engine control unit is carried out and checked with this display group.

System in basic setting 98			⇒	◀ Indicated on display
4.420 V	3.880 V	Idling	ADP. OK	
			Adaptation status	
			▪ ADP. OK ▪ ADP. running. Adaptation is currently being carried out => wait ▪ ADP. ERROR Fault occurred during adaptation => Check throttle valve control unit - Page 62	
			Operating status	
			▪ Idling: OK ▪ Other display: Idling switch open => check - Page 63	
			Voltage from throttle valve actuator -G127	
			▪ No specified result	
			Voltage from throttle valve potentiometer -G69	
			▪ No specified result	

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Display group 99 on idling (warm engine, coolant temperature not less than +85°C)

For fault finding, it is possible to jump between "basic setting" and "read measured values block" by pressing the keys 4 and 8. This switches the lambda control off and on.

System in basic setting 99			⇒	◀ Indicated on display
860 rpm	93.5 °C	0.0 %	λ-Control off	
			Lambda control switched off	

		Control value for mixture formation (lambda control)
		Coolant temperature
		Engine speed

Read measured value block 99	⇒	Indicated on display
860 rpm	93.5 °C	- 0.7 %
		λ-Control on
		Lambda control switched on
		Control value for mixture formation (lambda control)
		Coolant temperature
		Engine speed

1.8 - Encoding control unit

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

- Connect the V.A.G 1551 fault reader (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The ignition must be switched on during this procedure.
(Connect the fault reader and select the control unit for the engine electronics => Page 2).

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

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

-> Indicated on display:

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

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

Encoding variants =>Page 18

Compose the code number as follows (example):

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

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

8D0907557.. 1.8l	R4/5VT M0TR HS
D..	
Code 04001	WSC 12345

- Switch the ignition off and then on again.

**Note:**

The next time the ignition is switched on, the code entered will be activated.

- Press the ➡key.

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------

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

Encoding variants for the engine control unit

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Country/emissions	Drive/auxiliary functions	Gearbox	Vehicle type
00 = ---	0 = Front wheel drive without traction slip control	0 = 5-speed manual gearbox	0 = ---
01 = ---	1 = ---	1 = ---	1 = Audi A4
02 = Non Member State of the European Union (MVEG I)	2 = Four wheel drive without traction slip control	2 = ---	2 = ---
03 = ---	3 = ---	3 = ---	3 = ---
04 = Member States of the European Union (MVEG II)	4 = ---	4 = ---	4 = ---
05 = ---	5 = ---	5 = Automatic gearbox 01V	5 = ---
06 = ---	6 = ---	6 = ---	6 = ---
07 = ---	7 = ---	7 = ---	7 = ---
08 = China and Commonwealth of Independent States (CIS)	8 = ---	8 = ---	8 = ---

1.9 - Reading measured value block

- Connect the V.A.G 1551 fault reader (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The engine must be running at idling speed during this procedure.
(Connect the fault reader and select the control unit for the engine electronics => Page 2).

-> Indicated on display:

Rapid data transfer Select function XX	HELP
---	------

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

-> Indicated on display:

Read measured value block Enter display group number XX	HELP
--	------

- Enter the desired display group number and confirm entry with the Q key.

-> Display readout, e.g.:

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

List of display groups

Display Group No.	Indicated on display	Designation
00 Basic function	Read measured value block 00 1 2 3 4 5 6 7 8 9 10	1 = Coolant temperature 2 = Engine load 3 = Engine speed 4 = Battery voltage 5 = Throttle angle 6 = Control value for idling airflow 7 = Learned value for idling airflow 8 = Control value for mixture formation (lambda control value) 9 = Learned value for mixture formation (lambda learned value) 10 = Learned value for mixture formation (lambda learned value)

Display Group No.	Indicated on display	Designation
01 Basic function	Read measured value block 1 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Throttle angle 4 = Ignition timing
02 Basic function	Read measured value block 2 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Injection period (per working stroke) 4 = Intake airflow
03 Basic function	Read measured value block 3 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Coolant temperature 4 = Intake air temperature

Display Group No.	Indicated on display	Designation
04 Idling stabilization	Read measured value block 4 1 2 3 4	1 = Throttle angle 2 = Learned value for idling stabilisation with manual gearbox and with automatic gearbox with no gear engaged 3 = Learned value for idling stabilisation for automatic gearbox with gear engaged 4 = Operating status Idling Part load Full load Overrun Enrichment
05 Idling speed	Read measured value block 5 1 2 3 4	1 = Engine speed (actual) 2 = Engine speed (specified)



Display Group No.	Indicated on display	Designation
Stabilization		3 = Control value for idling stabilisation (idling speed control) 4 = Intake airflow

Display Group No.	Indicated on display	Designation
06 Idling speed Stabilization	Read measured value block 6 1 2 3 4	1 = Engine speed 2 = Control value for idling stabilisation (idling speed control) 3 = Control value for mixture formation (lambda control) 4 = Ignition timing
07 Lambda control	Read measured value block 7 1 2 3 4	1 = Control value for mixture formation (lambda control) 2 = Lambda probe voltage 3 = Signal ratio of solenoid valve 1 for active carbon canister -N80 4 = Correction factor for mixture formation with active fuel tank breather system
08 Lambda learned values	Read measured value block 8 1 2 3 4	1 = Injection period (per working stroke) 2 = Learned value for mixture formation at idling speed (additive) 3 = Learned value for mixture formation at part load (multiplicative) 4 = Fuel tank breather system: TB active Fuel tank breather system active TB not active Fuel tank breather system not active λ-Adaptation Fuel tank breather system not active, learning process for mixture formation in progress

Display Group No.	Indicated on display	Designation
09 Lambda learned values	Read measured value block 9 1 2 3 4	1 = Engine speed 2 = Control value for mixture formation (lambda control) 3 = Lambda probe voltage 4 = Learned value for mixture formation at idling speed (additive)
10 Tank breather	Read measured value block 10 1 2 3 4	1 = Signal ratio of solenoid valve 1 for active carbon canister -N80 2 = Correction factor for mixture formation with active fuel tank breather system 3 = Fill level of active carbon canister -N80 4 = Air from fuel tank breather system as a proportion of total airflow
11 Fuel consumption	Read measured value block 11 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Speed 4 = Fuel consumption

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Display Group No.	Indicated on display	Designation
12 Fuel consumption	Read measured value block 12 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Fuel consumption 4 = Ignition timing
13 Knock control	Read measured value block 13 1 2 3 4	1 = Ignition timing retardation by knock control, cylinder 1 2 = Ignition timing retardation by knock control, cylinder 2 3 = Ignition timing retardation by knock control, cylinder 3 4 = Ignition timing retardation by knock control, cylinder 4
14 Knock control	Read measured value block 14 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing retardation by knock control, cylinder 1 4 = Ignition timing retardation by knock control, cylinder 2

Display Group No.	Indicated on display	Designation
15 Knock control	Read measured value block 15 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing retardation by knock control, cylinder 3 4 = Ignition timing retardation by knock control, cylinder 4
16 Knock control	Read measured value block 16 1 2 3 4	1 = Knock sensor signal, cylinder 1 2 = Knock sensor signal, cylinder 2 3 = Knock sensor signal, cylinder 3 4 = Knock sensor signal, cylinder 4
17	Read measured value block 17 1 2 3 4	(Ignore)
18 Altitude adaptation	Read measured value block 18 1 2 3 4	1 = Engine speed 2 = Engine load without altitude correction 3 = Engine load with altitude correction 4 = Correction factor for mixture formation based on air density (altitude)

Display Group No.	Indicated on display	Designation
19 Torque reduction	Read measured value block 19 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Gearbox intervention 1 X X (Ignore) X 0 X Torque reduction X X 1 (Ignore) 4 = Ignition timing

Display Group No.	Indicated on display	Designation
20	Read measured value block 20	1 = Engine speed



Display Group No.	Indicated on display	Designation
Operating conditions	1 2 3 4	2 = Selector lever position Neutral Selector lever in position P or N Gear engaged Selector lever at 1, 2, 3, D, or manual gearbox 3 = (Ignore) 4 = Air conditioning compressor Compr. OFF Air conditioning compressor off Compr. ON Air conditioning compressor on
21 Operating conditions Lambda control	Read measured value block 21 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Coolant temperature 4 = Lambda control λ-Control OFF Lambda control off λ-Reg.ON Lambda control on

Display Group No.	Indicated on display	Designation
22	Read measured value block 22 1 2 3 4	(Ignore)
23 Throttle valve control unit	Read measured value block 23 1 2 3 4	1 = Learning demand display 1 X X X X X Potentiometer characteristics learned X 0 X X X X Adaptation to engine control unit completed X X 0 X X X Upper stop position learned by throttle valve potentiometer -G69 X X X 0 X X Lower stop position learned by throttle valve potentiometer -G69 X X X X 0 X Upper stop position learned by throttle valve actuator -G127 X X X X X 0 Upper stop position learned by throttle valve actuator -G127 2 = Lower stop of throttle valve actuator 3 = Emergency running stop for throttle valve actuator 4 = Upper stop of throttle valve actuator

Display Group No.	Indicated on display	Designation
24 Knock control	Read measured value block 24 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing 4 = Total of ignition timing retardation for cylinders 1 to 4
25 Boost pressure control	Read measured value block 25 1 2 3 4	1 = Specified engine load (driver's requirement via accelerator pedal) 2 = Specified engine load after correction based on knock control, altitude and coolant temperature 3 = Actual engine load 4 = Signal ratio for solenoid valve for boost pressure control (N75)
26	Read measured value block 26	1 = Control value for idling stabilisation (idling speed control)

Display Group No.	Indicated on display	Designation
	1 2 3 4	2 = Learned value for idling stabilisation with manual gearbox and with automatic gearbox with no gear engaged 3 = Coolant temperature 4 = Engine speed

Display Group No.	Indicated on display	Designation
27	Read measured value block 27 1 2 3 4	1 = Engine load reduction by knock control 2 = Engine load (actual) after reduction 3 = Engine speed 4 = Signal ratio for solenoid valve for boost pressure control (N75)
28...94		Vacant
95 Basic function	Read measured value block 95 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Ignition timing 4 = Coolant temperature
96	Read measured value block 96 1 2 3 4	(Ignore)
97	Read measured value block 97 1 2 3 4	(Ignore)

Display Group No.	Indicated on display	Designation
98 Throttle control unit	Read measured value block 98 1 2 3 4	1 = Voltage from throttle valve potentiometer (G69) 2 = Voltage from throttle valve actuator (G127) 3 = Operating status Leerlauf Part load Full load Overrun Enrichment 4 = Adaptation status (ADP = adaptation) ADP running Adaptation in progress ADP. OK Adaptation successfully completed ADP. ERROR An error has occurred in the adaptation process

Display Group No.	Indicated on display	Designation
99 Lambda control	Read measured value block 99 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Control value for mixture formation (lambda control) 4 = Lambda control λ-Control OFF Lambda control off λ-Reg.ON Lambda control on



1.10 - Specified display values

Display group 00 on idling (warm engine, coolant temperature not less than +85 °C)

Read measured value block 0										⇒	Indicated on display
190	44	78	191	9	128	129	137	127	128		
											Learned value for mixture formation 118...138 O.K. (=> Display group 08, Page 27)
											Learned value for mixture formation 118...138 OK (=> Display group 08, Page 27)
											Control value for mixture formation 78...178 OK (=> Display group 07, Page 27)
											Learned value for idle stabilisation 112...144 OK (=> Display group 04, Page 25)
											Control value for idle stabilisation 112...144 OK. (=> Display Group 05, Page 26)
											Throttle angle 0...12 OK (=> Display group 01, Page 24)
											Battery voltage 146...212 OK. (=> Check supply voltage, Page 68)
											Engine speed: 76...96 OK. (=> Check idling speed, Page 36)
											Engine load 10...40 OK. (=> Display Group 01, Page 24)
											Coolant temperature: 170...204 OK. (=> Display Group 03, Page 25)

Display group 01 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 1					⇒	Indicated on display
860 rpm	1.15 ms	3 <°	12.0°	before TDC		
						Ignition timing
						▪ 12.0° before TDC OK
						▪ < 12.0° before TDC Engine loaded => Switch off consumption units
						Throttle angle
						▪ 0...5 <°: OK.
						▪ > 5 <°: No adaptation of the throttle valve control unit => Page 62
						▪ Throttle cable incorrectly adjusted => Adjust
						▪ Throttle valve control unit defective => Renew
						Engine load (injection period per crankshaft revolution)
						▪ 0.50...1.50 ms: OK
						▪ < 0.50 ms: Unmetered air downstream of airflow meter => Check intake system
						▪ Fuel pressure too high => Check - Page 38
						▪ > 1.50 ms: Engine loaded => Switch off consumption units
						Engine speed
						▪ 820...900 rpm: OK
						▪ Outside tolerance: Check idling speed => Page 36

Display group 02 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 2					⇒	Indicated on display
860 rpm	1.15 ms	2.37 ms	3.7 g/s			

			Intake airflow ▪ 1.8...4.0 g/s: OK ▪ < 1.8 g/s: Unmetered air downstream of airflow meter ▪ => Check ▪ > 4.0 g/s: Engine loaded => Switch off consumption units
			Injection period (per working stroke) ▪ 1.00...3.00 ms: OK ▪ < 1.00 ms: High proportion from tank breather system => Page 60 ▪ > 3.00 ms: Engine loaded => Switch off consumption units
			Engine load (injection period per crankshaft revolution) ▪ 0.50...1.50 ms: OK ▪ < 0.50 ms: Unmetered air downstream of airflow meter => Check intake system ▪ Fuel pressure too high => Check - Page 38 ▪ > 1.50 ms: Engine loaded => Switch off consumption units
			Engine speed ▪ 820...900 rpm: OK ▪ Outside tolerance: Check idling speed => Page 36

Display group 03 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 3				⇒	◀ Indicated on display
860 rpm	13.580 V	93.6°C	37.9 °C		
					Intake air temperature (at sensor for intake air temperature -G42) ▪ In the event of a line break, a constant temperature of 19.5 °C will be displayed as a substitute value.
					Coolant temperature (at coolant temperature sensor -G62) ▪ 80...105°C: OK ▪ < 80 °C: Run engine until warm
					Battery voltage ▪ 10.000...14.500 V: OK ▪ Outside tolerance: Check supply voltage from engine control unit => Page 68
					Engine speed ▪ 820...900 rpm: OK ▪ Outside tolerance: Check idling speed => Page 36

Display group 04 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 4				⇒	◀ Indicated on display
3 <°	0.27 g/s	- 0.04 g/s		Idling	
					Operating status ▪ Idling: OK ▪ Other display: Check idling speed switch => Page 63
					Learned value for idling stabilisation for automatic gearbox with gear engaged ▪ - 1.70 1.70 g/s: OK ▪ Less than - 1.70 g/s: Unmetered air downstream of throttle valve ▪ => Check ▪ higher than + 1.70 g/s: Engine loaded => Switch off consumption units ▪ Intake system blocked => Check



	Learned value for idling stabilisation with manual gearbox and with automatic gearbox with no gear engaged ▪ - 1.10 + 1.10 g/s: OK ▪ Less than - 1.10 g/s: Unmetered air downstream of throttle valve => Check ▪ higher than + 1.10 g/s: Engine loaded => Switch off consumption units ▪ Intake system blocked => Check
	Throttle angle ▪ 0...5 <°: OK ▪ > 5 <°: No adaptation of throttle valve control unit => Page 62 ▪ Throttle cable incorrectly adjusted => Adjust ▪ Throttle valve control unit defective => Renew

Display group 05 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 5	⇒	◀ Indicated on display
860 rpm	860 rpm	0.7 % 3.7 g/s
		Intake airflow ▪ 1.8...4.0 g/s: OK ▪ < 1.8 g/s: Unmetered air downstream of airflow meter ▪ => Check ▪ > 4.0 g/s: Engine loaded => Switch off consumption units
		Control value for idling stabilisation (idling speed control) ▪ - 10...+ 10 %: OK
		Required engine speed demanded by engine control unit ▪ 820...900 rpm: OK.
		Engine speed (actual) ▪ 820...900 rpm: OK ▪ Outside tolerance: Check idling speed => Page 36

Display group 06 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 6	⇒	◀ Indicated on display
860 rpm	0.7 %	0.3 % 12°before TDC
		Ignition timing ▪ 12.0°before TDC OK ▪ < 12.0°before TDC Engine loaded => Switch off consumption units
		Control value for mixture formation (lambda control) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 54
		Control value for idling stabilisation (idling speed control) ▪ - 10...+ 10 %: OK.
		Engine speed ▪ 820...900 rpm: OK ▪ Outside tolerance: Check idling speed => Page 36

Display group 07 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 7 ⇒				• Indicated on display
- 0.7 %	0.755 V	6 %	0.87	
			Correction factor for mixture formation with active fuel tank breather system ▪ < 1.00: Tank breather supplying rich mixture, lambda control reduces the quantity injected ▪ = 1.00: No fuel tank breather function or fuel tank breather supplying ideal mixture ($\lambda = 1$) ▪ > 1.00: Tank breather supplying lean mixture, lambda control increases the quantity injected	
			Signal ratio of solenoid valve 1 for activated charcoal filter -N80 ▪ 0 %: Solenoid valve closed ▪ 99 %: Solenoid valve open	
			Lambda probe voltage (relative to reference earth: 260...300 mV) ▪ Voltage constantly fluctuates back and forth between 0.1 V and 1.0 V: OK. ▪ - 0.1...+ 0.3 V: Large amount of residual oxygen, mixture too lean ▪ 0.7...1.0 V: Small amount of residual oxygen, mixture too rich ▪ Constant 0.45...0.50 V: Lambda probe not functioning ▪ => Test lambda control - Page 54 .	
			Control value for mixture formation (lambda control) ▪ - 10...+ 10 %: OK ▪ Outside tolerance: Check lambda control => Page 54	

Display group 08 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 8 ⇒				• Indicated on display
2.37 ms	0.4 %	0.1 %	TB active	
			Tank breather ▪ TB active. Solenoid valve for active carbon canister is pulsed ▪ Tank breather active: Solenoid valve 1 for active carbon canister closed ▪ λ-Adaptation: Mixture formation learning process in progress (solenoid valve 1 for active carbon canister closed)	
			Learned value for mixture formation at part load (multiplicative) ▪ - 12...+ 12 %: OK ▪ Outside tolerance: Check lambda control => Page 54	
			Control value for mixture formation at idling speed (additive) ▪ - 12...+ 12 %: OK ▪ Outside tolerance: Check lambda control => Page 54	
			Injection period (per engine cycle) ▪ 1.00...3.00 ms: OK ▪ < 1.00 ms: High proportion from tank breather system => Page 60 ▪ > 3.00 ms: Engine loaded => Switch off consumption units	

Display group 09 on idling (warm engine, coolant temperature not less than +85°C)

Read measured value block 9 ⇒				• Indicated on display
-------------------------------	--	--	--	------------------------



860 rpm	- 0.7 %	0.755 V	0.4 %	
				Learned value for mixture formation at idling speed (additive) - 12...+ 12 %: OK - Outside tolerance: Check lambda control => Page 54
				Lambda probe voltage (relative to reference earth: 260...300 mV) - Voltage constantly fluctuates between 0.1...+ 0.3 V and 0.7...1.0 V: OK. - 0.1...+ 0.3 V: Large amount of residual oxygen, mixture too lean - 0.7...1.0 V: Small amount of residual oxygen, mixture too rich - Constant 0.45...0.50 V: Lambda probe not functioning => Test lambda control - Page 54 .
				Control value for mixture formation (lambda control) - 10...+ 10 %: OK - Outside tolerance: Check lambda control => Page 54
				Engine speed - 820...900 rpm: OK - Outside tolerance: Check idling speed => Page 36

Display group 10 on idling (warm engine, coolant temperature not less than +85 °C)

Read measured value block 10				⇒	Indicated on display
9 %	0.87	17	0.02		
					Air from fuel tank breather system as a proportion of total airflow - 0.00: Tank breather not active - 0.30: 30 % of the intake air is from tank breather
					Fill level of active carbon canister - 3 %: No petrol vapour in active carbon canister + 32 %: Active carbon canister completely filled with petrol vapour
					Correction factor for mixture formation with active fuel tank breather system - < 1.00: Tank breather supplying rich mixture, lambda control reduces the quantity injected - = 1.00: ($\lambda = 1$) No tank breather supplies ideal mixture ($\lambda = 1$) - > 1.00: Tank breather supplying lean mixture, lambda control increases the quantity injected
					Signal ratio of solenoid valve 1 for active carbon canister -N80 - 0 %: Solenoid valve closed - 99 %: Solenoid valve open

Display group 13 at full throttle (test drive in 3rd gear, coolant temperature not less than +85°C)

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

Read measured value block 13				⇒	Indicated on display
2.3 °KW	1.9 °KW	2.5 °KW	2.4 °KW		
					Ignition timing retard, 0.0...12.0 °KW: OK. - Deviation of Cylinders relative to one another less than 6.0 °KW: OK - Deviation greater than 6.0 °KW: loose ancillaries, mechanical damage, corrosion on connectors - All cylinders greater than 12.0 °KW: poor fuel, knock sensor defective, loose ancillaries
					Ignition timing retardation by knock control, cylinder 4

		Ignition timing retardation by knock control, cylinder 3
		Ignition timing retardation by knock control, cylinder 2
		Ignition timing retardation by knock control, cylinder 1

Display Group 16 at idling speed

Read measured value block 16 ⇒ • Indicated on display			
0.800 V	0.840 V	0.800 V	0.760 V
			Knock sensor signals of all cylinders ▪ Deviation of cylinders relative to one another less than 0.500 V: OK ▪ Deviation greater than 0.500 V. loose ancillaries, mechanical damage, corrosion on connectors
			Knock sensor signal, cylinder 4 ▪ 0.400...1.400 V: OK
			Knock sensor signal, cylinder 3 ▪ 0.400...1.400 V: OK
			Knock sensor signal, cylinder 2 ▪ 0.400...1.400 V: OK
			Knock sensor signal, cylinder 1 ▪ 0.400...1.400 V: OK

Display Group 18 at idling speed

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Read measured value block 18 ⇒				▪ Indicated on display
860 rpm	1.15 ms	2.15 ms	- 0.7 %	
			Correction factor for mixture formation based on air density (altitude) ▪ No specified result ▪ - 30.0 %: corresponding to an air pressure of approx. 700 mbar (30 % under 1000 mbar) ▪ + 20.0 %: corresponding to an air pressure of approx. 1200 mbar (20 % under 1000 mbar)	
			Engine load (injection period per crankshaft revolution) after altitude correction ▪ No specified result	
			Engine load (injection period per crankshaft revolution) ▪ 0.50...1.50 ms: OK ▪ < 0.50 ms: Unmetered air downstream of airflow meter => Check intake system ▪ Fuel pressure too high => Check - Page 38 ▪ > 1.50 ms: Engine loaded => Switch off consumption units	
			Engine speed ▪ 820...900 rpm: OK ▪ Outside tolerance: Check idling speed => Page 36	

Display group 23 with ignition switched on (engine not running)

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Read measured value block 23 ➔				Indicated on display
100000	84.3 %	75.2 %	23.9 %	
				Upper stop of throttle valve actuator ▪ 18...54 %: OK ▪ Outside tolerance: Perform adaptation of the throttle valve control unit ▪ =>Page 62 . ▪ Throttle valve control unit defective ▪ => Renew
				Emergency running stop for throttle valve actuator ▪ 60...91 %: OK ▪ Outside tolerance: Perform adaptation of the throttle valve control unit ▪ => Page 62 ▪ -Throttle valve control unit defective => Renew
				Lower stop of throttle valve actuator ▪ 72...95 %: OK ▪ Outside tolerance: Perform adaptation of the throttle valve control unit ▪ => Page 62 Throttle valve control unit defective => Renew
				Learning demand display ▪ 100000: OK ▪ Other display: Perform adaptation of the throttle valve control unit => Page 62

Display group 25 at full load (test drive in 3rd at approx. 4000 rpm, coolant temperature not less than +85°C)

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

Read measured value block 25 ➔				Indicated on display
7.40 ms	7.10 ms	7.05 ms	67 %	
				Signal ratio (actuation) of the solenoid valve for boost pressure control -N75 ▪ No specified result ▪ Constant 5 %: Boost pressure controlled => Interrogate the fault memory
				Actual engine load (regulated by boost pressure to specified engine load) ▪ As specified engine load after correction, display zone 2 (Tolerance ▪ ±0.50 ms) OK ▪ Outside tolerance: Fault in boost pressure control => Page 49
				Specified engine load after correction (reduced driver requirement due to knock control, altitude adaptation and coolant temperature) ▪ 3.00...8.00 ms: OK
				Specified engine load before correction (driver's requirement indicated via accelerator pedal) ▪ 3.00...8.00 ms: OK

Display group 27 at full throttle (test drive in 3rd gear, coolant temperature not less than +85°C)

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

Read measured value block 27 ➔				Indicated on display
1.40 ms	5.10 ms	2890 rpm	67 %	

			Signal ratio (actuation) of the solenoid valve for boost pressure control -N75 ▪ No specified result ▪ Constant 5 %: Boost pressure controlled => Interrogate the fault memory
			Engine speed
			Engine load (injection period per crankshaft revolution) ▪ 0.50...8.00 ms: OK
			Reduction in the specified engine load due to knock control ▪ < 5.00 ms: OK

Display group 99 on idling (warm engine, coolant temperature not less than +85 °C)

For fault search, it is possible to jump between "basic setting" and "read measurement value block" by pressing keys 4 and 8. This specifically switches the lambda control off and on.

Read measured value block 99				⇒	◀ Indicated on display
860 rpm	93.5 °C	- 0.7 %	λ-Control ON		
				Lambda control switched on	
				Control value for mixture formation (lambda control)	
				Coolant temperature	
				Engine speed	

Basic setting 99				⇒	◀ Indicated on display
860 rpm	93.5 °C	0.0 %	λ-Control OFF		
				Lambda control switched off	
				Control value for mixture formation (lambda control)	
				Coolant temperature	
				Engine speed	

Audi

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24 - Mixture preparation, Injection

1 - Repairing the Motronic fuel injection system

1.1 - Repairing the Motronic fuel injection system

1.2 - Safety precautions

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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 turning at starter speed.
- ♦ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ♦ To operate the engine at starting speed without actually starting it (for example, to check the compression), disconnect the connector from the power output stage for the ignition coils and the connector from the injectors. After completing the work, interrogate the fault memory.
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 - Cleanliness rules

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

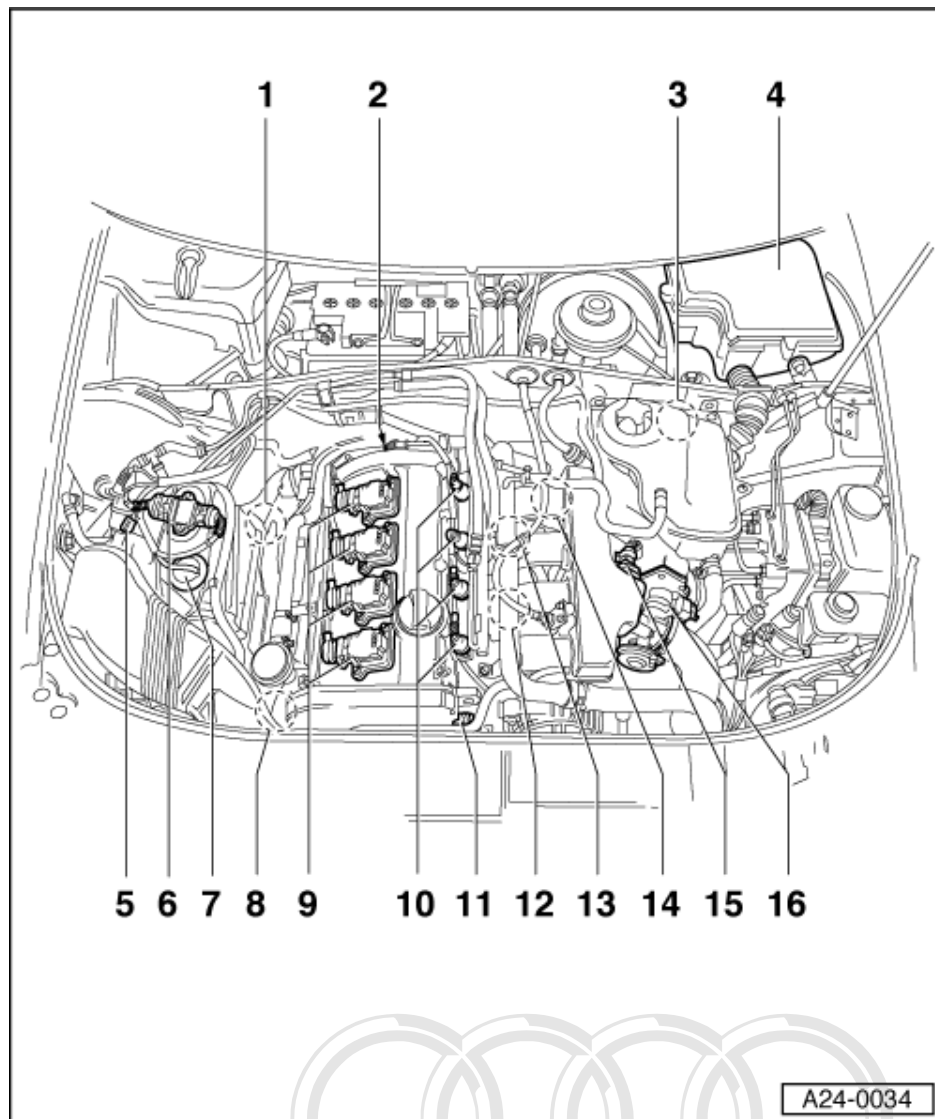
1.4 - Technical data

Engine code letters	AEB	
Idling speed (not adjustable)	780... 900 rpm	
Engine speed limitation by shutting off injectors	6800 rpm	
Fuel pressure (at idling speed)		
Vacuum hose connected	approx. 3.5 bar vacuum	
Vacuum hose disconnected	approx. 4 bar gauge	
Pressure held after 10 minutes	at least 2.5 bar	
Injectors	Spray pattern	Two hole nozzle
	Injection quantity (30 s)	130...150 ml

	Resistance (room temperature) ¹⁾	11....13 ω
--	---	-------------------

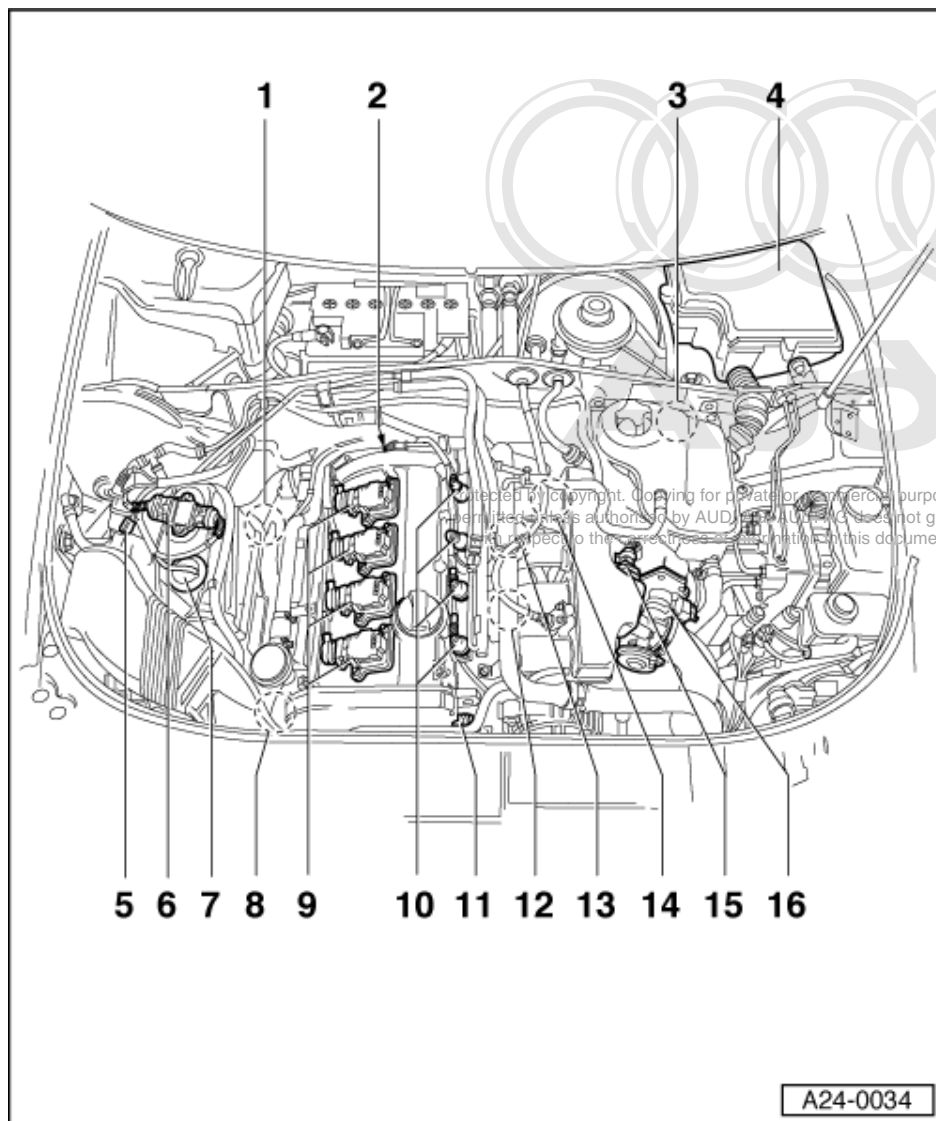
- 1) When the engine is at operating temperature the resistance of the injectors is increased by approx. 4...6 ω .

1.5 - Installation locations overview



- 1 Lambda probe (G39) with lambda probe heating (Z19)
- 2 Sensor for coolant temperature (G62)
- 3 Connector
 - ◆ For Lambda probe and Lambda probe heating (black)
 - ◆ For engine speed sensor (grey)
 - ◆ Knock sensor (green)
 - ◆ Knock sensor 2 (blue)
- 4 Engine control unit
- 5 Solenoid valve 1 for active carbon canister (N80)
- 6 Output stage for ignition coils (N122)

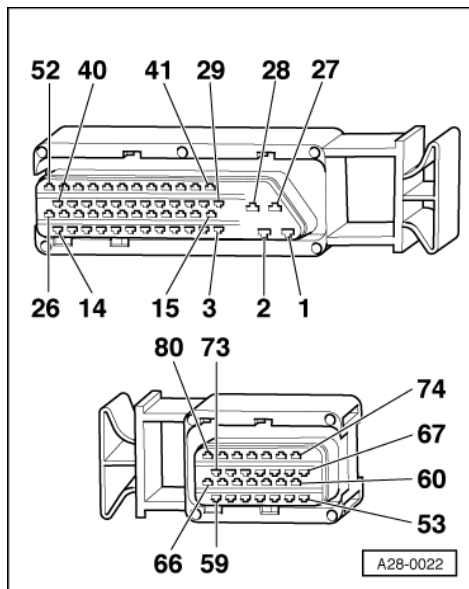
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- 7 Airflow meter (G70)**
 - ♦ in upper part of air filter housing
- 8 Solenoid valve for boost pressure control (N75)**
- 9 Ignition coils (N, N128, N158, N163)**
- 10 Injector (N30...N33)**
- 11 Hall sensor (G40)**
- 12 Knock sensor 1 (G61)**
- 13 Knock sensor 2 (G66)**
- 14 Engine speed sensor (G28)**
- 15 Intake air temperature sensor (G42)**
- 16 Throttle valve control unit (J338)**

1.6 - Wiring and component check with test box V.A.G 1598/22



Notes:

- ◆ Use the V.A.G 1526 hand multimeter or the V.A.G 1715 multimeter and the diode test lamp V.A.G 1527 for the checks.
- ◆ To connect the testers to the test box use the auxiliary cables from adapter set V.A.G 1594.
- ◆ The contact numbers of the plugs correspond to the socket numbers in the test box.
- With ignition switched off, disconnect connectors from control unit.
- Connect test box to wiring harness connector.
- Carry out test as described in the particular repair instructions.

Caution!

To prevent damage to the electronic components, switch to the respective measuring range before connecting the measuring cable and observe the test conditions.

1.7 - Replacing engine control unit

Removing and installing

Installation location => Installation locations overview - Page 33

Only disconnect and connect the control unit connector with the ignition switched off.

- Encode control unit => Page 17 .
- Carry out adaptation of the throttle valve control unit => Page 62

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Adapting engine electronics control unit to electronic immobilizer

Test conditions

- Authorised vehicle key required
- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.
- Switch the ignition on.
- Press key 1 for "Rapid data transfer".



- Press keys 2 and 5 for address word "Immobilizer" and confirm entry by pressing Q.
- Press the ⇒key.

-> Indicated on display:

Rapid data transfer	HELP
Select function XX	

- Press keys 1 and 0 for function "Adaptation" and confirm entry with Q key.

-> Indicated on display:

Adaptation
Enter channel number XX

- Press key 0 twice for "Channel number 0" and confirm entry with Q key.

-> Indicated on display:

Adaptation	Q
Erase learned values?	

- Confirm input with Q key.

-> Indicated on display:

Adaptation
Learnt values have been erased

- Conclude adaptation by pressing ⇒ key.

Note:

The identity of the engine control unit is read into the immobilizer control unit the next time the ignition is switched on.

1.8 - Testing idling speed

The idling speed is specified by the engine control unit and is not adjustable.

Test conditions

- Coolant temperature at least 80°C.
- Electrical consumption units switched off (radiator fan must not run during the check)
- Air conditioning system switched off
- Selector lever in position P or N
- Throttle control cable adjustment OK

- Read measured value block, Display Group 03, engine at idling speed => Page 18

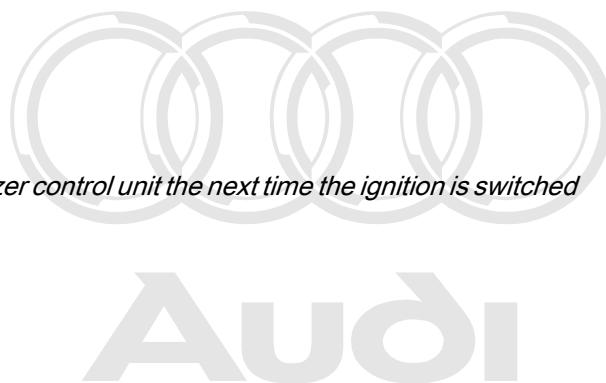
-> Indicated on display:

Read measured value block 3
860 rpm 13.580 V 93.6 5C
43.9 5C

- Check display in display zone 3.

Read measured value block 3
860 rpm 13.580 V 93.6 5C 43.9
5C

-> Specified result: at least 80 °C



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Do not continue with check until coolant temperature is reached.

- Check display in display zone 1.

Read measured value block 3
860 rpm 13.580 V 93.6 50C 43.9
5C

-> Specified result: 820...900 rpm

If the specified result is not attained:

- Press the C key.
- Press keys 2 and 0 for "Display Group 20" and confirm entry by pressing Q.

-> Indicated on display:

Read measured value block 20
860 rpm Neutral A/C-Low
Compr. OFF

- Check display in display zone 2.

Read measured value block 20
860 rpm Neutral A/C-Low Compr.
OFF

-> Specified result: Neutral (automatic gearbox)
For cars with manual gearboxes, the display will always show "Driving position engaged".

- If necessary, set the selector lever to P or N.
- Check display in display zone 4.

Read measured value block 20
860 rpm Neutral A/C-Low Compr.
OFF

-> Specified result: Compr. OFF
For vehicles with no air conditioning system, "Compr. off" is always shown.

- If necessary, switch off air conditioning system.
- Check display in display zone 1.

Read measured value block 20
860 rpm Neutral A/C-Low Compr.
OFF

-> Specified result: 820...900 rpm

If the specified result is not attained:

- Press the C key.
- Press keys 0 and 4 for "Display Group 04" and confirm entry by pressing Q.

-> Indicated on display:

Read measured value block 4
3 -5 0.27 g/s - 0.00 g/
s Idling speed

- Check display in display zone 4.

Read measured value block 4
3 -5 0.27 g/s - 0.00 g/s
Idling speed

-> Specified result: Idling speed



If another readout appears on the display:

- Check the idling switch => Page 63 .
- Check display in display zone 1.

Read measured value block 4			
3 -5	0.27 g/s	-	0.00 g/s
Idling speed			

-> Specified result: 0...5 <°

If specified result is not attained:

- Check the adaptation of the throttle valve control unit => Page 62 .

If the specified result is attained:

- Press the C key.
- Press keys 0 and 5 for "Display Group 05" and confirm entry by pressing the Q key.

-> Indicated on display:

Read measured value block 5			
860 rpm	860 rpm	0.7 %	3.7 g/s

- Check display in display zone 1.

Read measured value block 5			
860 rpm	860 rpm	0.7 %	3.7 g/s

-> Specified result: 820...900 rpm

If the idling speed is too low, the following faults are possible:

- ♦ Engine under load
- ♦ Throttle valve control unit not adapted to engine control unit.
- ♦ Throttle valve control unit defective.

If the idling speed is too high, the following faults are possible:

- ♦ Unmetered air in intake system.
 - ♦ Throttle valve control unit not adapted to engine control unit.
 - ♦ Throttle valve control unit defective.
 - ♦ Solenoid valve for active carbon canister constantly open.
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1.9 - Testing fuel pressure regulator and holding pressure

Test conditions

- Fuel pump relay OK, testing =>Page 46 .
- Fuel pump OK.
- Fuel filter OK.
- Battery voltage OK.

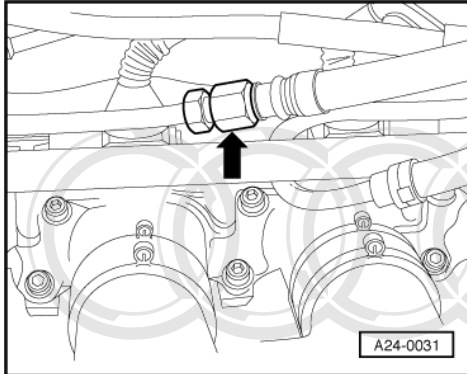
Note:

The fuel pressure regulator regulates the fuel pressure according to the intake pressure at the throttle valve unit.

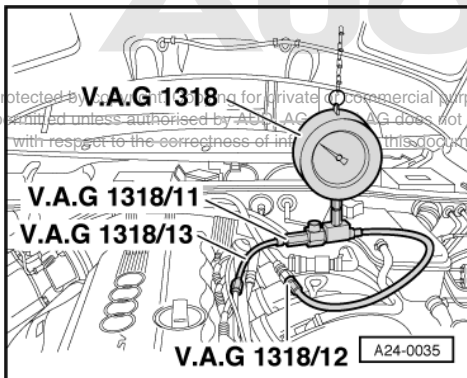
Caution!

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

- Briefly open the fuel tank filler cap (to release pressure).
- Cover the pressurised screw connection with a cloth.

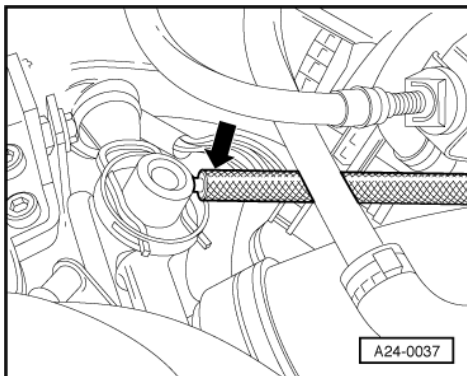


- -> Open the screw connection -arrow- and catch the emerging fuel with a cloth.



- Connect pressure gauge V.A.G 1318 to fuel supply pipe using adapters 1318/11, 1318/12 and 1318/13.
- -> Open isolating valve on pressure gauge. The lever points in the direction of flow.
- Start the engine and run at idling speed.
- Measure the fuel pressure.

Specified result: approx. 3.5 bar gauge.



- -> Pull vacuum hose -arrow- from fuel pressure regulator.

The fuel pressure must rise to approx. 4.0 bar gauge.

- Put the vacuum hose back on.
- Switch off ignition.



- Observe the pressure drop on the gauge.

After 10 minutes the remaining pressure should be at least 2.5 bar.

If the pressure held drops below 2.5 bar:

- Start the engine and run at idling speed.
- Allow the pressure to build up, then switch off the ignition. At the same time, you must close the isolating valve on the pressure gauge V.A.G 1318 (valve lever at right angles to direction of flow).
- Observe the pressure drop on the gauge.

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

- ♦ Fuel pressure regulator defective
- ♦ Injectors leaking
- ♦ Screw connections of the pressure gauge after the isolation valve leaking

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

- ♦ Screw connection between pressure gauge and fuel supply line leaking
- ♦ Fuel supply line leaking at petrol tank
- ♦ Non-return valve in the fuel pump leaking

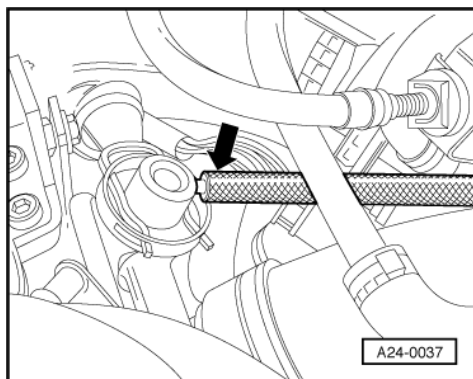
=> 4-cylinder engine, mechanical components; Repair Group 20; remove and install fuel pump remove and install fuel pump

Note:

To remove the pressure gauge, close the isolation valve, release the screw connection on the adapter V.A.G 1318/12 and drain excess fuel into the collecting vessel by opening the isolation valve.

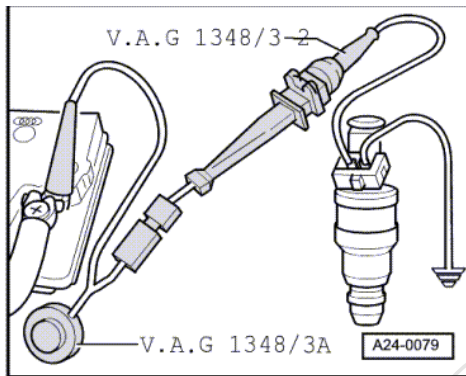
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1.10 - Testing injection quantity, leak tightness and spray pattern of injectors



Test conditions

- Fuel pressure OK, testing =>Page 38 .
- -> Pull vacuum hose -arrow- from fuel pressure regulator.
- Withdraw the connectors from the injectors and the Hall sensor.
- Unbolt the fuel rail from the intake manifold and pull it upwards and off the intake manifold together with the injectors.



- Place the injector which is to be tested into measuring glass from injection quantity tester V.A.G 1602.
- -> Connect one of the injector contacts to engine earth using test cable and crocodile clamp from V.A.G 1594.
- Connect second injector contact to positive using remote control V.A.G 1348/3 A, adapter cable V.A.G 1348/3-2 and auxiliary cable.
- Start the final control diagnosis => Page 13 .

-> Indicated on display:

Actuator diagnosis
Injector, cylinder 1 -N30

The fuel pump must be running.

- Check injectors for leaks (visual check). When the fuel pump is running only 1 or 2 drops a minute should escape from each injector.
- If the fuel loss is greater than this, switch off the fuel pump (terminate actuator diagnosis) and renew the faulty injector.

Note:

The actuator diagnosis cannot be re started until the ignition has been switched off briefly.

- Activate the V.A.G 1348/3 A remote control for 30 seconds.
- Perform measurements on all injectors.
- Once all four injectors have been actuated, place the measuring glasses on a level surface.

Specified result: 130...150 ml

If the specified result is not attained for all injectors:

- Test fuel pressure =>Page 38 .

If the specified results not attained for one injector:

- Renew injector.

Note:

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

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

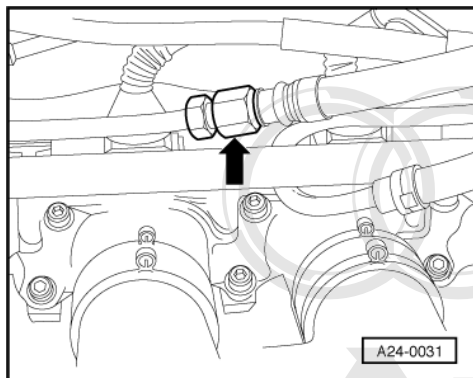
- Renew the O-rings at all opened connections. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- O-Moisten the O-rings with clean engine oil.
- Check to make sure that the retainer clamps are properly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



1.11 - Removing and installing injectors

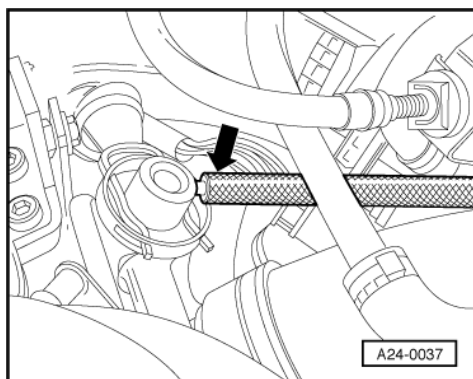
Caution!

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



Removing

- Briefly open the fuel tank filler cap (to release pressure).
- Cover the pressurised screw connection with a cloth.
- -> Open the screw connection arrow and catch the emerging fuel with a cloth.



- -> Pull vacuum hose -arrow- from fuel pressure regulator.
- Withdraw the connectors from the injectors and the Hall sensor.
- Unbolt the fuel rail from the intake manifold and pull it upwards and off the intake manifold together with the injectors.
- Withdraw the retention clamp at the injector/fuel rail connection and pull the injector out of the fuel rail.

Installing

Notes:

- ♦ Replace O-rings. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled off over the plastic cap.)
- ♦ Check to make sure that the retainer clamps are properly seated.
- Moisten the O-rings with clean engine oil.
- Push injectors vertically into the fuel rail until they meet a stop and secure with retainer clamps.
- Insert fuel rail with the secured injectors on the intake manifold and press in evenly until a stop is met.

- Place fastening screws in position, press intake manifold gently by hand in the direction of the intake manifold and tighten fastening screws.

Further installation takes place in the reverse sequence to removal.

1.12 - Testing injectors

Electrical checks on injectors

- Start actuator diagnosis and activate injectors => Page 13 .

-> Indicated on display:

Actuator diagnosis
Injector, cylinder 1 -N30

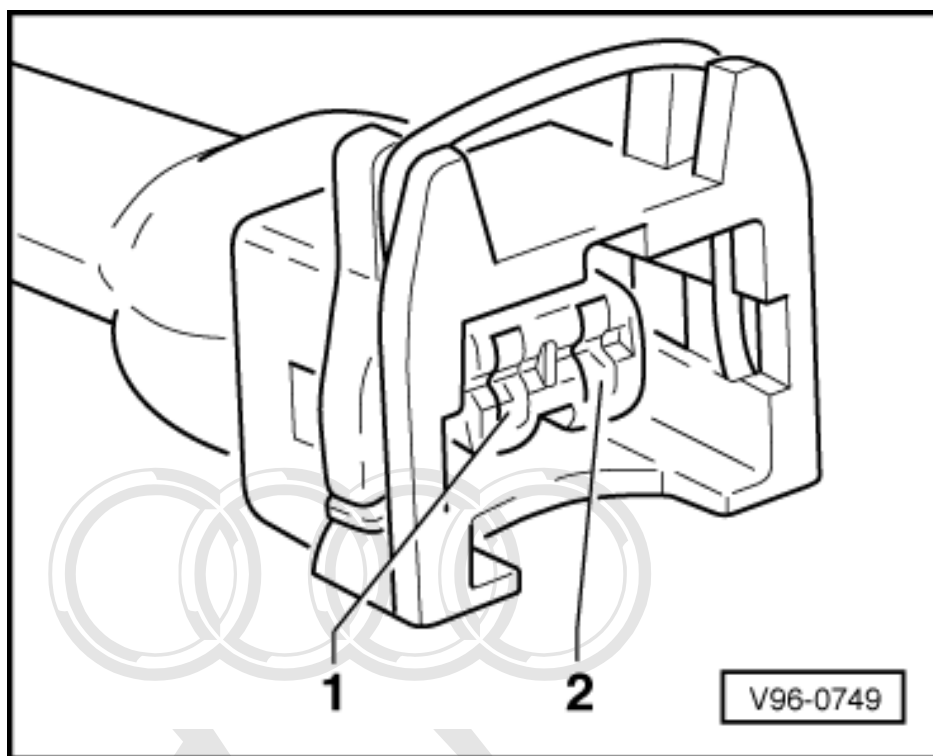
- Turn the throttle mechanism on the throttle valve control unit to open the idling switch.

The valve should click five times.

If the valve clicks:

- Activate the next injector.

If the valve does not click:



- Remove connector from the injector which is to be tested.
- -> Connect the V.A.G 1527 diode test lamp between contact 1 and contact 2 in the connector.
- Repeat the actuator diagnosis and again actuate the injector.

The diode test lamp should flash five times

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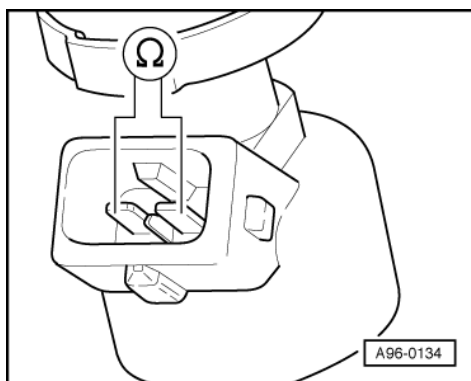
Note:

Diode test lamps with a low current consumption do not go out completely between the flashing pulses, but continue to glow slightly and become much brighter during the flashing pulses.

If the diode test lamp does not flash:

- Check the voltage supply
=> Page 44

If the diode test lamp flashes:

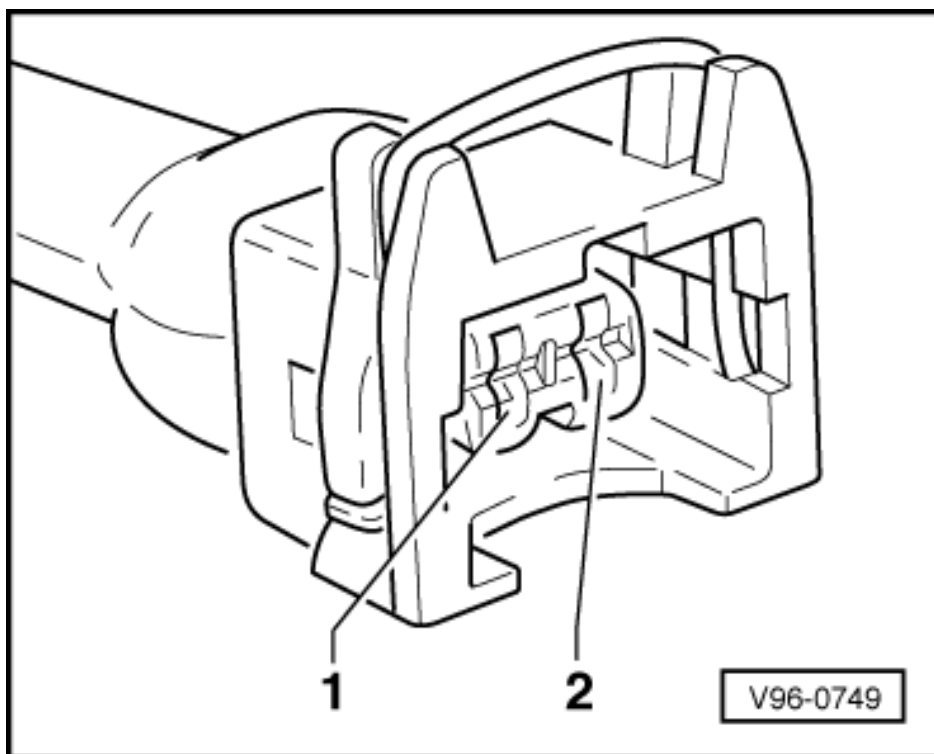


- -> Connect multimeter to valve for resistance measurement

Specified result: 11...13 Ω

If specified result is not attained:

- Renew injector.

Testing power supply

- Remove connector from the injector which is to be tested.
- -> Connect the multimeter for voltage measurement to contact 1 on the connector and to earth.

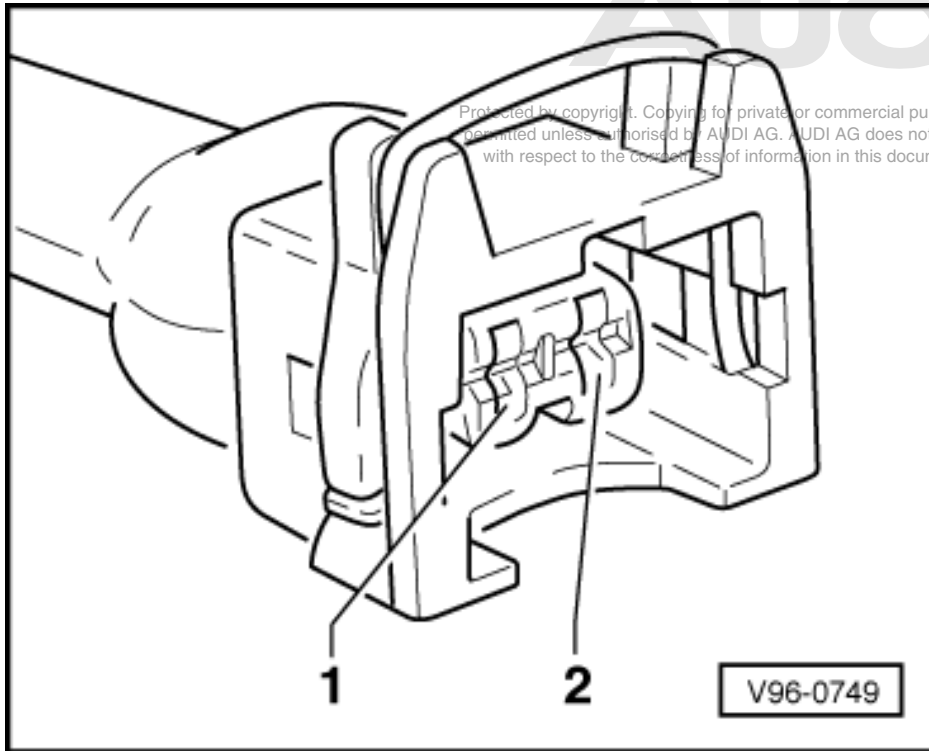
- Operate the starter for a few seconds (the engine can be allowed to start).

Specified result: The diode test lamp should light up.

If the diode test lamp lights up:

- Check the wiring connections => Page 45

If the diode test lamp does not light up:



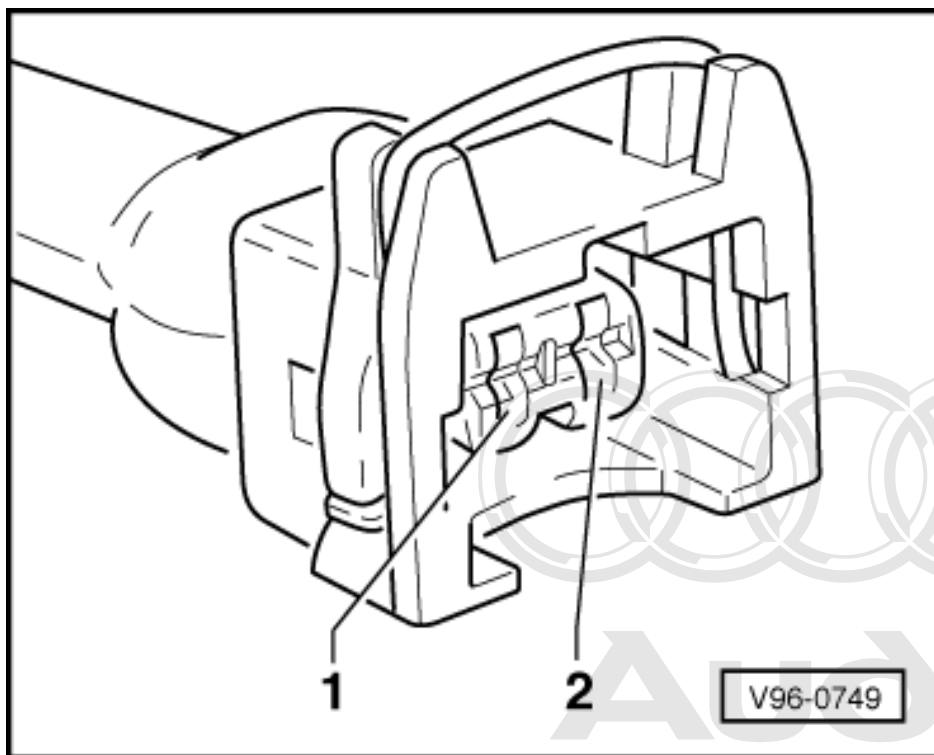
- -> Check wiring connection from Contact 1 to the fuse for injector.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

Check wiring connections

- Switch off ignition.
- Remove connector from the injector which is to be tested.
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit
=> Page 35

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



Cylinder	2-pin connector on the wiring harness contact.	Test box V.A.G 1598/22 socket.
1	2	73
2	2	80
3	2	58
4	2	65

- If necessary, rectify open circuit or short circuit.

1.13 - Testing fuel pump relay

Voltage is supplied to the fuel pump and some injection system components via the fuel pump relay (J17).

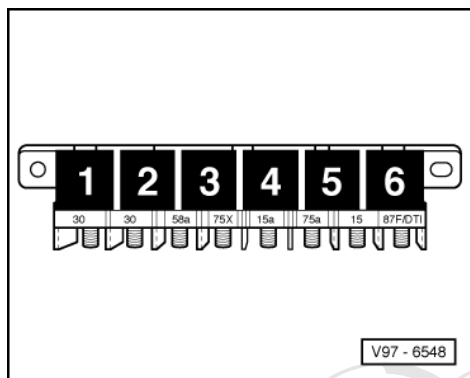
The condition for the closing of the fuel pump relay (J17) is that the engine should be turning. This means that the relay only acquires an earth (via the engine control unit) when a revolution pulse is recognised in the engine control unit.

Test conditions

- Battery voltage OK.

Functional testing of fuel pump relay

- Start actuator diagnosis and activate an injector => Page 13 .



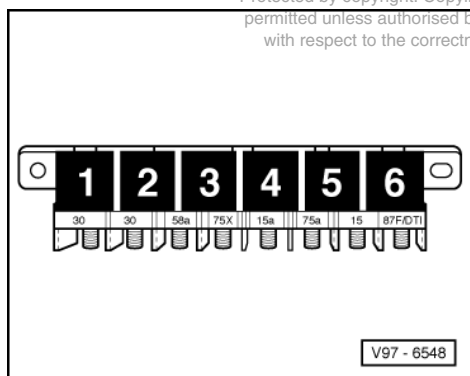
-> The fuel pump relay (central electrics, relay position 6) must pick up...

- If the relay does not pick up, test activation of fuel pump relay
=>Page 47
- ...and the fuel pump must run.
- If the fuel pump does not run, check activation for fuel pump and components
=>Page 49

Check activation of fuel pump relay

- Switch off ignition.

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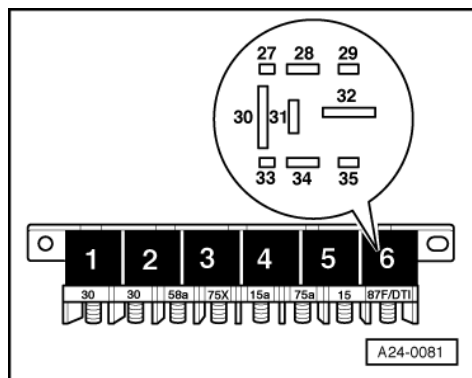


- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit
=> Page 35 .
- Connect together sockets 4 and 2 on the test box using an auxiliary cable from V.A.G 1594.
- Switch the ignition on.

-> Specified result: The fuel pump relay (central electrics, relay position 6) must pick up.

If the relay picks up but not during the actuator diagnosis:

- Renew engine control unit



If the relay does not pick up:

- Switch off ignition.
- -> Remove fuel pump relay from relay base (central electrics, relay position 6).
- Connect the multimeter for voltage measurement to contact 2 on the relay base and to earth.
- Switch the ignition on.

Specified result: approx. battery voltage

If specified result is not attained:

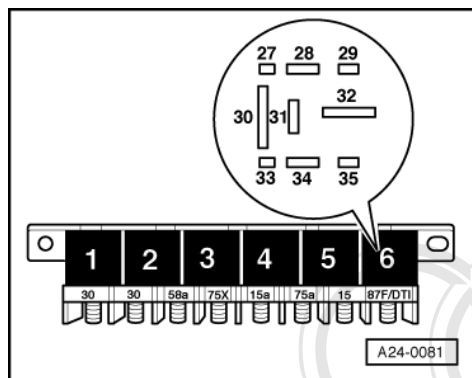
- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

If the specified result is attained:

- Switch off ignition.

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



Central electrics, relay base 6, contact	Test box V.A.G 1598/22, socket.
29	4

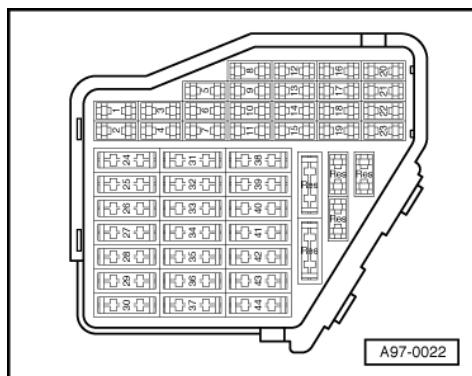
- If necessary, rectify open circuit or short circuit.

If no fault is detected in the line:

- Renew the fuel pump relay (J17).

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Check activation of fuel pump and components



- -> Withdraw the fuses 28, 29 and 34.
- Start actuator diagnosis and activate an injector => Page 13 .
- Connect the multimeter for voltage measurement to the left-hand and right-hand contacts of the following fuses:

Fuse No.	Specified result at left-hand or right-hand contact
28	ca. Battery voltage
29	approx. battery voltage
34	approx. battery voltage

If specified result is not attained:

- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

If no fault is detected in the line:

- Renew the fuel pump relay (J17).

2 - Testing the boost pressure system

2.1 - Testing the boost pressure system

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2.2 - Testing the boost pressure control

- Read measured value block, Display Group 25, engine at idling speed =>Page 18 .

-> Indicated on display

Read measured value block 25
7.40 ms 7.10 ms 7.05 ms
67 %

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

- Perform a test drive at full load at approx. 4000 rpm.

Read measured value block 25
7.40 ms 7.10 ms 7.05 ms 67 %



-> Observe the display in display zone 4 (signal ratio of solenoid valve for boost pressure limitation).

Specified result: 5...95 %

If the specified result is not achieved, change the engine speed until the signal ratio is within the specified range.

Read measured value block 25
7.40 ms 7.10 ms 7.05 ms 67 %

-> Observe the display in display zone 2 (corrected specified -engine load)

Specified result: 3.00...8.00 ms

Read measured value block 25
7.40 ms 7.10 ms 7.05 ms 67 %

-> Observe the display in display zone 3 (actual-engine load)

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Specified result: Agreement with corrected specified engine load in display zone 2 (tolerance ± 0.50 ms)

If the actual engine load is outside the tolerance, this may be due to one of the following faults:

- ♦ Electrical fault in solenoid valve for the boost pressure control.
- ♦ Charge pressure control hoses disconnected, leaking or blocked.
- ♦ -N75 solenoid valve for boost pressure control blocked.
- ♦ Leak between turbocharger and intake manifold.
- ♦ Actuation mechanism (linkage, shaft) for the by-pass valve stiff or jamming.
- ♦ Turbocharger defective (turbine jammed by foreign body).

2.3 - Testing the solenoid valve for boost pressure control

Check function

- Pull the hoses off the (N75) solenoid valve for boost pressure control
=> Installation location-overview => Page **33** .
- Connect auxiliary hose.
- Start the actuator diagnosis and activate the (N75) solenoid valve for boost pressure control => Page **13** .

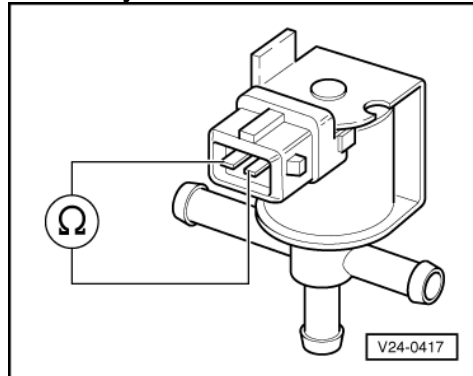
-> Indicated on display:

Actuator diagnosis -N75 solenoid valve for boost pressure control

The valve should click...

- If the valve does not click, check the solenoid valve for boost pressure control electrically => Page **50** .
...and should open and close (check by blowing into the auxiliary hose).
In the absence of electrical current, the long connection is closed.
- If the valve does not open and close correctly, renew solenoid valve for boost pressure limitation (N75).

Electrically check solenoid valve for boost pressure limitation (N75).



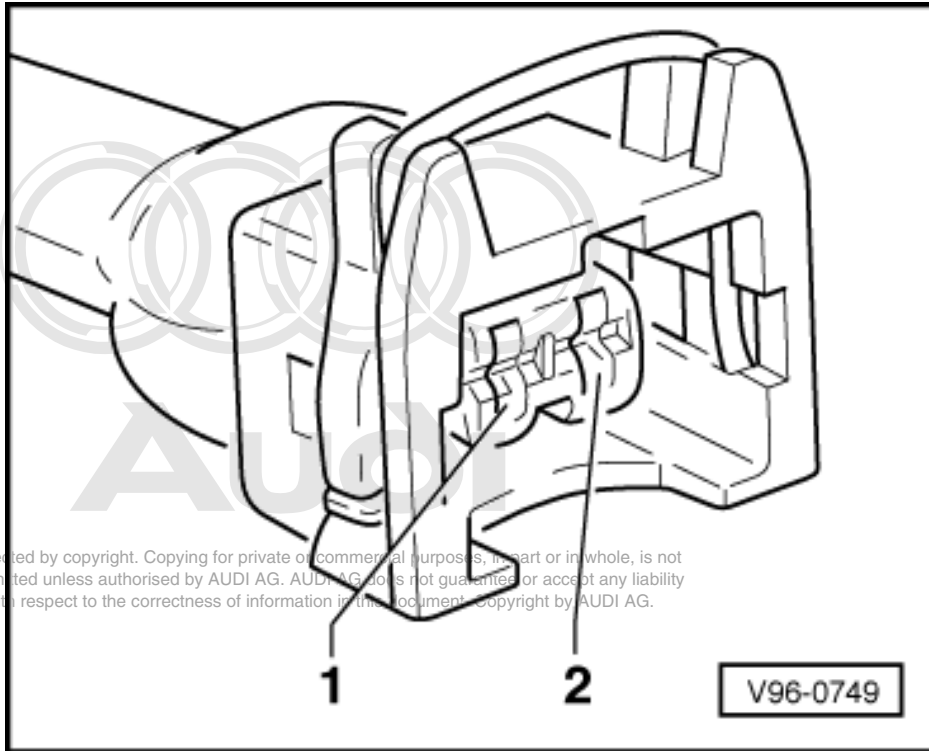
- Withdraw the connector from the valve
=> Installation location-overview - Page 33 .
- -> Connect multimeter to valve for resistance measurement

Specified result: 25...35 Ω

If specified result is not attained:

- Renew the solenoid valve for boost pressure limitation (N75).

If the specified result is attained:



- -> Connect the multimeter for voltage measurement to contact 1 on the connector and to earth.
- Operate the starter briefly (the engine may also start briefly).

Specified result: approx. battery voltage

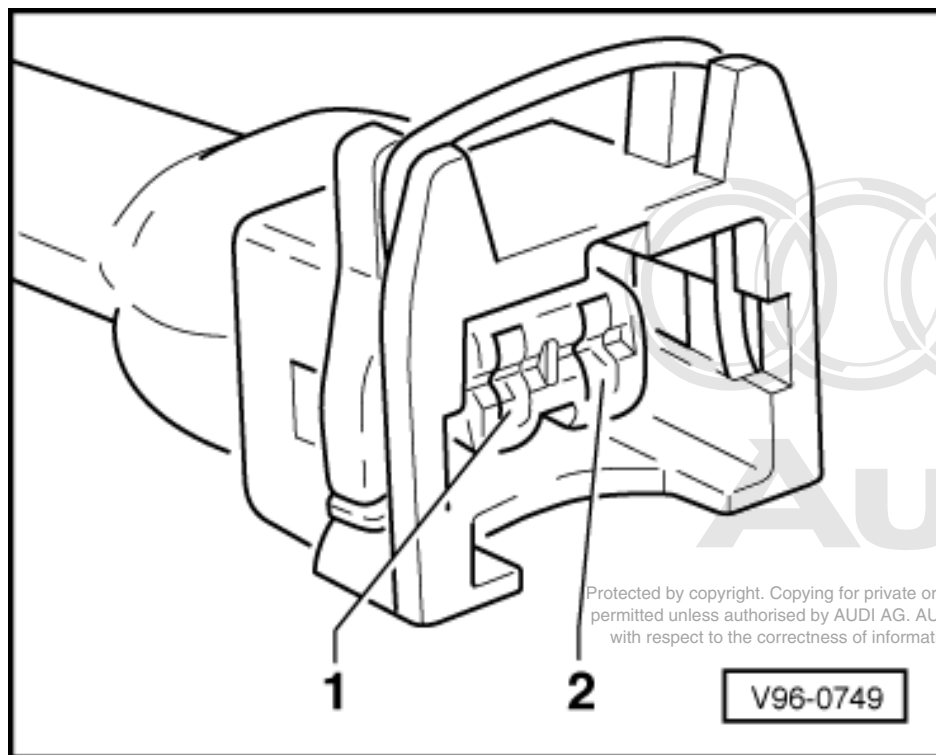
If specified result is not attained:

- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

If the specified result is attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=> Page 35 .



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

2-pin connector on wiring harness contact.	Test box V.A.G 1598/22, socket.
2	64

- Rectify short circuit or open circuit if necessary.

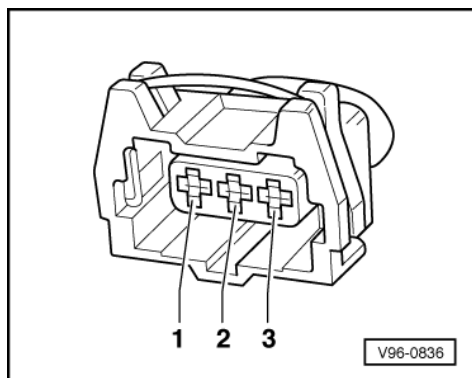
2.4 - Testing the altitude sensor

- Select function individual measurement, read Channel 06, engine stopped.

->

Read individual measurement
Channel 06 Measurement 193

Channel 06 Measurement	Air pressure in mbar
204	1013
188	970
153	900
107	800
66	700



- Compare the measurement in Channel 06 with a barometer (e.g. Turbocharger test unit V.A.G 1397/A).

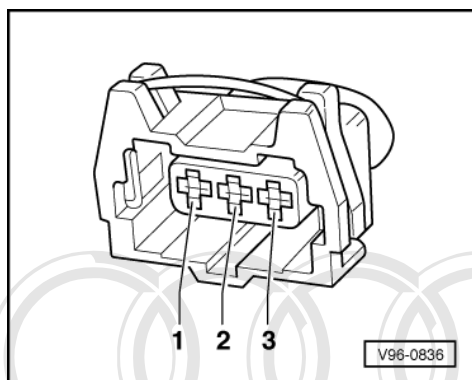
If no realistic measurement occurs in Channel 06:

- -> Pull off the connector on the sensor => Installation locations Overview, Page 33 .
- Switch the ignition on.
- -> Connect the multimeter for voltage measurement to the following contacts on the connector:

3-pin connector on the wiring harness contact.	Specified result
1 + 3	ca. 5 V
2 + 3	ca. 5 V

If the specified results are not obtained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=> Page 35



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

3-pin connector on the wiring harness contact.	Test box V.A.G 1598/22, socket.
1	61
2	62
3	67

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Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew the altitude sensor (F96).



3 - Test lambda control

3.1 - Test lambda control

The lambda probe compares the oxygen content in the air with the residual oxygen content in the exhaust gas and sends a voltage signal to the control unit.

The voltage signal for "Mixture rich" (low residual oxygen) is between about 0.7 and 1.1 V (referred to reference earth).

The voltage signal for "Mixture weak" (high residual oxygen) is between about - 0.1 and +0.3 V (referred to reference earth).

*During the transition from 2 "rich" to "lean" and vice versa
($\lambda = 1.0$), there is a voltage jump from 0.7 ... 1.1 V to -0.1 ... +0.3 V or vice versa.*

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

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

- ♦ Slots or holes in probe head are blocked.
- ♦ Lambda probe has been thermally overloaded.
- ♦ Probe poisoned by leaded fuel, test with "PLUMBTESMO" test strip for lead content.
- ♦ Contact resistance in signal wiring or reference earth line.
- ♦ Lambda probe too cold; lambda probe heating not working.
- ♦ Lambda control switched off (control unit has recognized a fault in the injection system => interrogate fault memory).
- ♦ Lambda probe damaged by contact spray or similar product. (The contact spray is drawn into the probe through the fine cavities in the electrical wiring as a result of thermal fluctuations and capillary effects).
- ♦ Lambda probe damaged by silicone vapours. (The engine draws in traces of any silicone based sealants that may have been used. These silicone constituents are not burnt and damage the lambda probe).

3.2 - Poor performance after cold start

If performance faults occur after a cold start, check whether the problem arises before or after the lambda control cuts in.

Test conditions

- No fault stored in fault memory
=> Page 4, Interrogate fault memory.
- Read measured value block, Display Group 21, engine at idling speed => Page 18.

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

- Take the vehicle for a test drive.

-> Indicated on display:

Read measured value block 21
860 rpm 1.15 ms 13.7 5C
l-control OFF

- Check display in display zone 4.

Specified result: λ -I-Control OFF (lambda control not active)

If the engine running problems occur before the lambda control cuts in, the following faults are possible:

- ◆ Carbon deposits on the inlet valves.
- ◆ Unmetered air in intake system.
- ◆ Fuel supply system defective.

The lambda control cuts in at a probe temperature of approx. 300°C. The time it takes for this temperature to be reached is influenced by the following factors:

- ◆ Ambient temperature (summer or winter).
- ◆ Operating conditions after starting.
- ◆ Operation of lambda probe heating.

-> Indicated on display:

Read measured value block 21			
860 rpm	1.15 ms	34.2	5C
l-control ON			

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- Check display in display zone 4.

Specified result: λ -Control ON (lambda control active)

If the engine running problems only occur after the lambda control sets in:

- Check function => Page 55

3.3 - Testing operation

Check lambda probe voltage

- Read measured value block, Display Group 21, engine at idling speed =>Page 18.

-> Indicated on display:

Read measured value block 21			
860 rpm	1.15 ms	34.2	5C
l-control ON			

- Check display in display zone 4.

Specified result: λ -Control ON (lambda control active)

Do not continue with check until lambda control is active.

- Press the C key.
- Press keys 0 and 9 for "Display Group 09" and confirm entry by pressing Q key.

-> Indicated on display:

Read measured value block 9			
860 rpm	- 0.7 %	0.755 V	
0.4 %			

- Check display in display zone 3.

Read measured value block 9			
860 rpm	- 0.7 %	0.185 V	0.4 %

-> Specified result: Display fluctuates between - 0.1 V and 1.0 V.



Note:

The voltage must fluctuate about 15 ... 30 times per minute.

If the voltage fluctuates too slowly, the following faults are possible:

- ♦ Lambda probe heating defective
- ♦ Lambda probe defective

-> If a constant voltage of 0.45 ... 0.50 V is displayed, the following faults are possible:

Read measured value block 9			
860 rpm	- 0.7 %	0.475 V	
0.4 %			

- ♦ Line break to lambda probe.
- ♦ Lambda probe heating defective.
- ♦ Lambda probe defective.

-> If the display shows a constant voltage reading of - 0.0 ... +0.3 V (mixture too lean), this means that the lambda control has reached the control stop in the "enrich" direction but the lambda probe is still registering "Mixture too lean". The following faults are possible:

Read measured value block 9			
860 rpm	- 0.7 %	0.185 V	
0.4 %			

- ♦ Unmetered air in intake system.
- ♦ Fuel pressure too low.

-> If the display shows a constant voltage reading of + 0.7 ... 1.0 V (mixture too rich), this means that the lambda control has reached the control stop in the "lean" direction but the lambda probe is still registering "Mixture too rich". The following faults are possible:

Read measured value block 9			
860 rpm	- 0.7 %	0.830 V	
0.4 %			

- ♦ Intake system blocked.
- ♦ Fuel pressure too high.
- ♦ Solenoid valve for active carbon canister constantly open.

Check learned value for mixture formation.

The mixture adaptation system has learning ability, i.e. the lambda control can recognise differences between various engines (injector nozzle delivery, compression, fuel pressure etc.) and compensates by adjusting the pre-programmed basic injection periods in the map in the control unit. The injection periods are extended or reduced until a mixture of $\lambda = 1$ is achieved. The difference between the actual injection period and the basic injection time programmed in the map is given in %.

- Read measured value block, Display Group 08, engine at idling speed =>Page 18 .

-> Indicated on display:

Read measured value block 8			
4.37 ms	0.4 %	0.1 %	TB
active			

- Check display in display zone 2.

Specified result: - 12...+ 12 %

- Check display in display zone 3.

Specified result: - 12...+ 12 %

Positive learned value (+...%): Pre programmed basic injection period is too short, actual injection period longer by ...% in order to achieve a " $\lambda = 1$ " mixture composition.

If the learned value is too high, the following faults are possible:

- ◆ Unmetered air in intake system.
- ◆ Unmetered air at exhaust manifold.
- ◆ Airflow meter defective.
- ◆ Fuel pressure too low.
- ◆ Injector blocked.

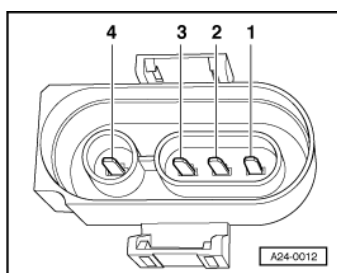
Negative learned value (-...%): Pre programmed basic injection period is too long, actual injection period shorter by ...% in order to achieve " $\lambda = 1$ ".

If the learned value is too low, the following faults are possible:

- ◆ Oil may be diluted (high petrol content in oil).
- ◆ Airflow meter defective.
- ◆ Fuel pressure too high.
- ◆ Injector leaking.
- ◆ Solenoid valve for active carbon canister constantly open.

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3.4 - Check lambda probe heating



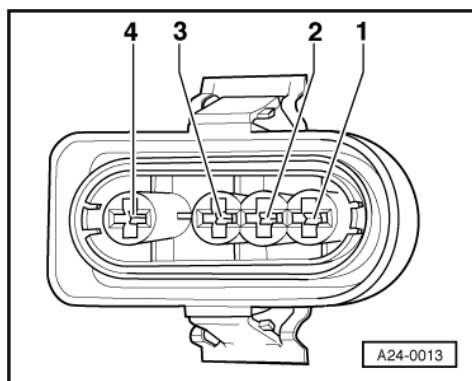
- Disconnect the connector to the lambda probe => Installation locations-overview - Page 33 .
- -> Connect multimeter for resistance measurement to Contacts 1 and 2 of the lambda probe connector.

Specified result: 6...15 ω

Note:

The resistance of the heating element at room temperature is approx. 1...5 ω . With even a small temperature rise this value will increase sharply.

If specified result is not attained:





- Renew the lambda probe.

If the specified result is attained:

- -> Connect the multimeter for voltage measurement to contact 1 on the connector and to earth.
- Operate the starter briefly (the engine may also start briefly).

Specified result: approx. battery voltage

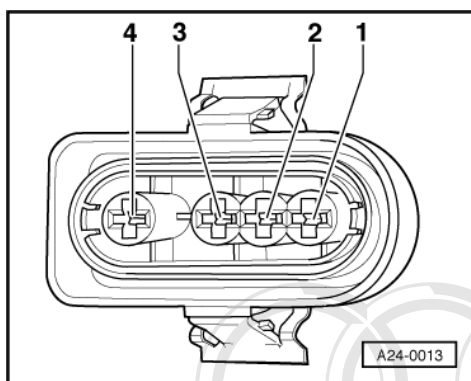
If specified result is not attained:

- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

If the specified result is attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .



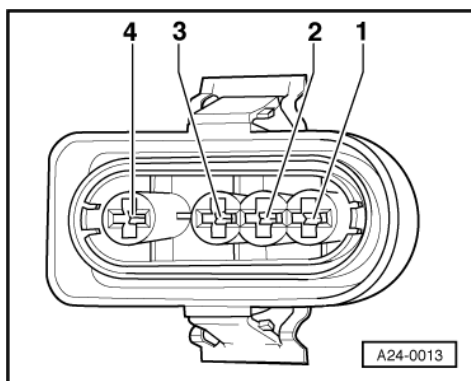
The following wiring connections should be checked for open circuits and/or short to positive or negative:

4-pin connector on the wiring harness contact.	Test box V.A.G 1598/22, socket.
2	27

- Rectify short circuit or open circuit if necessary.

3.5 - Testing lambda probe signal wiring and activation

- Disconnect the connector to the lambda probe => Installation locations-overview - Page 33 .
- Switch the ignition on.

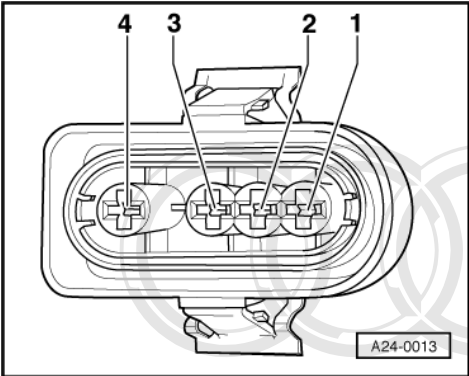


- -> Connect the multimeter for voltage measurement to the following contacts on the connector:

4-pin connector on the wiring harness contact.	Specified result
3 + earth	280 ± 20 mV
3 + 4	450 ± 50 mV

If the specified results are not obtained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .



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

4-pin connector on the wiring harness contact.	Test box V.A.G 1598/22, socket.
3	25
4	26

- Rectify short circuit or open circuit if necessary.

3.6 - Removing and installing lambda probe

Removing

- Disconnect the connector to the lambda probe => Installation locations-overview - Page 33 .
- Unscrew the lambda probe using V.A.G 3337/9.

Installing

Installation is performed in the reverse sequence to removal.

Tightening torque: 50 Nm

Note:

The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.



4 - Testing fuel tank breather system

4.1 - Testing fuel tank breather system

4.2 - Checking function

If the lambda control is active, the tank breather system is under closed-loop control. The venting of the active carbon canister is active for 12 minutes (cycled) and closed for 1 Minute.

If the lambda control is not active, the tank breather system has open-chain control. The venting of the active carbon canister is cycled with a specified signal ratio.

- Read measured value block, Display Group 10, engine at idling speed =>Page 18 .

-> Indicated on display:

Read measured value block 10
9 % 0.87 17 0.23

- Observe readouts in display zones 1 and 4.

Display zone 1	Display zone 4	Possible cause of fault
0 %	0.00	▪ OK, Fuel tank breather system not active.
1...99 %	0.01...0.30	▪ OK, tank breather system ▪ active.

- Let the vehicle run at idle for a few minutes so that both operating conditions, "active" and "not active" can be checked.

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4.3 - Testing solenoid valve 1 for active carbon canister

Check function

- Pull off hoses from solenoid valve 1 for active carbon canister -N80
=> Installation locations-overview - Page 33 .
- Connect auxiliary hose.
- Start actuator diagnosis and actuate solenoid valve 1 for active carbon canister -N80 =>Page 13 .

-> Indicated on display:

Actuator diagnosis Solenoid valve 1 for activated charcoal filter -N80
--

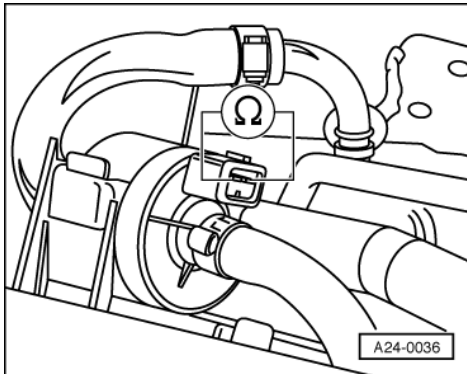
The valve should click...

- If the valve does not click, electrically check the solenoid valve for active carbon canister => Page 61 .

...and should open and close (check by blowing into the auxiliary hose).
When there is no electrical supply, solenoid valve remains closed.

- If the valve does not open and close correctly, renew solenoid valve for active carbon canister.

Electrically check solenoid valve 1 for activated charcoal filter -N80



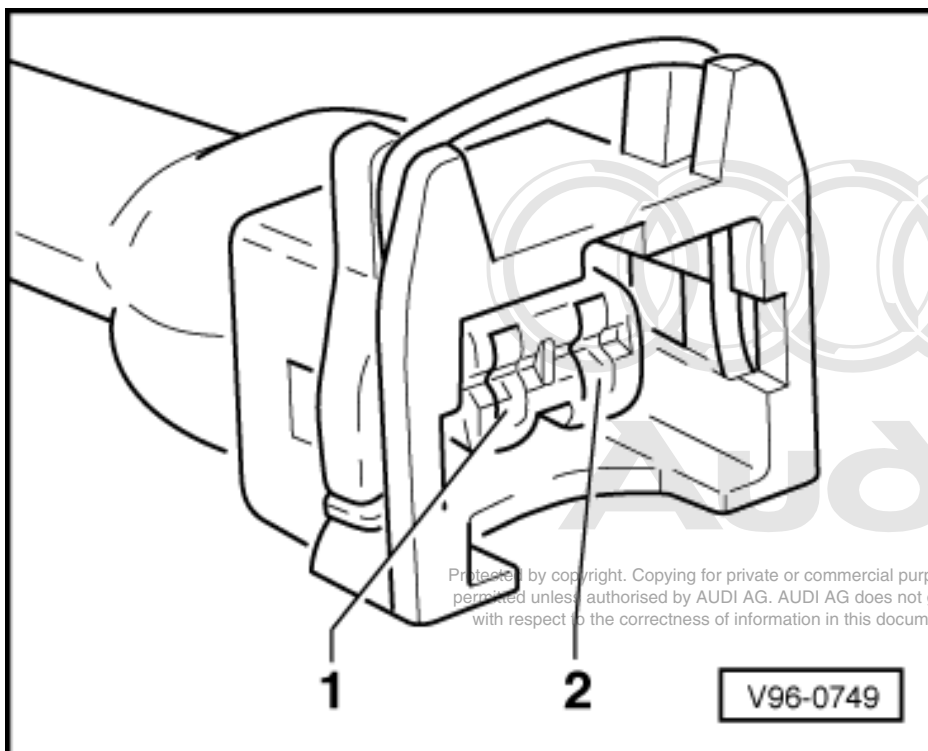
- Withdraw the connector from the valve
=> Installation locations-overview - Page 33 .
- -> Connect multimeter to valve for resistance measurement

Specified result: 22...30 Ω .

If specified result is not attained:

- Renew solenoid valve 1 for active carbon canister (N80).

If specified result is attained:



- -> Connect the multimeter for voltage measurement to contact 1 on the connector and to earth.
- Operate the starter briefly (the engine may also start briefly).

Specified result: approx. battery voltage.

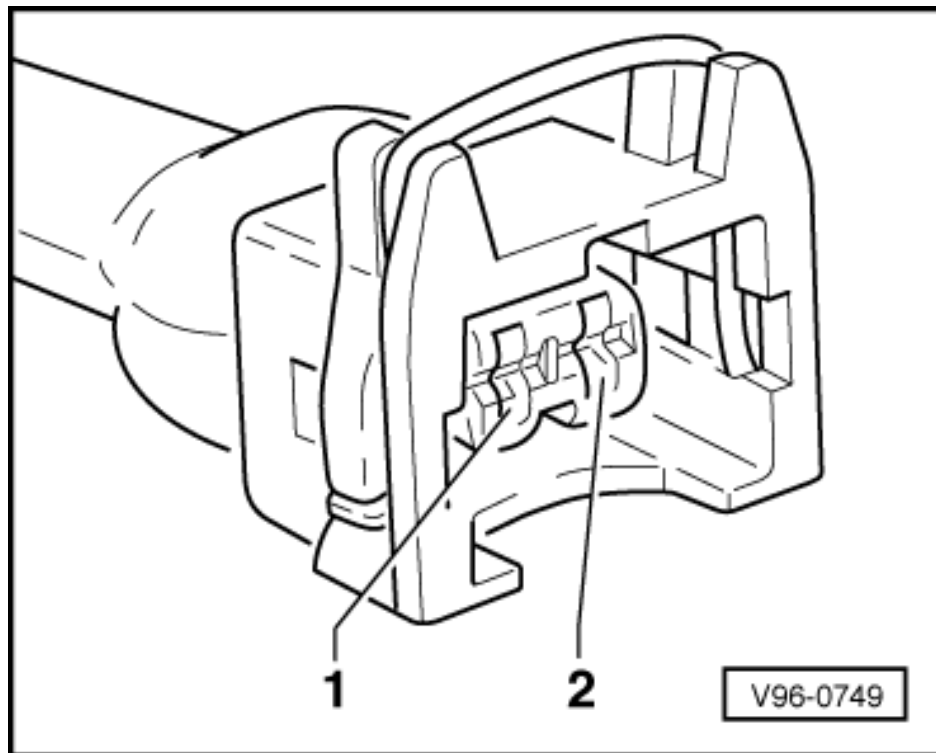
If specified result is not attained:

- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

If specified result is attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .



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

2-pin connector on wiring harness contact.	Test box V.A.G 1598/22, socket.
2	15

- Rectify short circuit or open circuit if necessary.

5 - Testing throttle valve control unit

5.1 - Testing throttle valve control unit

5.2 - Adaptation of the throttle valve control unit to the engine control unit

The idle stabilisation requires the engine control unit to know the stop positions of the throttle valve actuator (V60) and the potentiometer characteristics of the throttle valve actuator sensor (G127) and throttle valve potentiometer (G69).

The learning process (adaptation) is necessary if:

- ♦ The voltage supply to the engine control unit has been interrupted (e.g. the battery disconnected).
- ♦ The throttle valve control unit was renewed.
- ♦ The engine control unit was renewed.

- ♦ The fault number exists in the fault memory.

The learning process (adaptation process) is performed:

- ♦ Automatically if the ignition is switched on once for at least 6 seconds without actuating the starter or the accelerator pedal.
 - ♦ By initiating the "Basic setting," Display Group 98, with the engine stopped.
- Select "Basic setting", Display Group 98, with engine stopped
=> Page **15**.

-> Indicated on display:

Basic setting 98			
4.420 V	3.880 V	Idle	
ADP. running			

When the Q key is pressed, the throttle valve actuator moves to min, max, and five intermediate positions and the control unit stores the respective throttle angles in the permanent memory. This process takes no more than 10 seconds. The throttle then moves into the start position for approx. 20 s, then into the rest position (no electrical supply).

-> Indicated on display:

Basic setting 98			
4.420 V	3.880 V	Idle	ADP.
OK.			

Adaptation has been successfully carried out.

-> If one of these messages appears on the display, the adaptation would then be terminated.

Basic setting 98			
4.420 V	3.880 V	Idle	
ADP.ERROR			

Following faults are possible:

Function is unknown or cannot be performed at present!
--

- ♦ Engine started during adaptation.
- ♦ Battery voltage less than 10 V.
- ♦ Throttle control cable not OK.
- ♦ Wiring connection between throttle valve control unit and engine control unit defective.
- ♦ Throttle valve control unit defective.

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5.3 - Testing idling switch

- Read measured value block, Display Group 98, engine stopped =>Page **18**

-> Indicated on display:

Read measured value block 98			
4.420 V	3.880 V	Idle	ADP.
OK			

- Check readout in display zone 3.

Read measured value block 98			
4.420 V	3.880 V	Idle	ADP. OK.

-> Specified result: Idling speed.

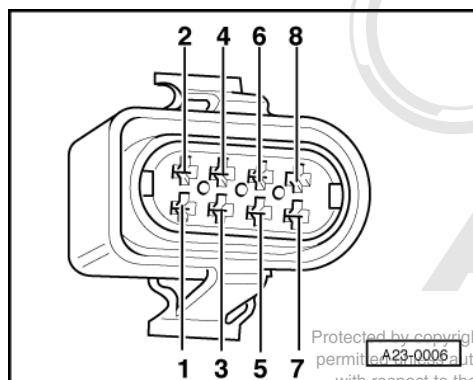
- Operate accelerator.

Read measured value block 98			
4.420 V	3.880 V	Part load	ADP.
OK.			

-> Specified result: Part load.

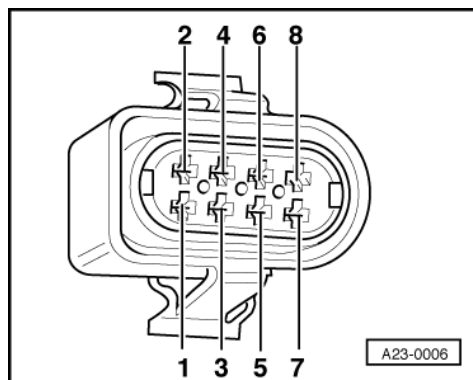
If specified result is not attained:

- Switch off ignition.



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- -> Disconnect the connector from the throttle valve control unit.
 - Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
- =>Page 35 .



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

8-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
3	69
7	67

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew the throttle valve control unit (J338).

5.4 - Testing throttle valve potentiometer

The throttle valve potentiometer (G69) informs the engine control unit of the position of the throttle valve.

- Read measured value block, Display Group 01, engine stopped =>Page 18

-> Indicated on display:

```
Read measured value block 1
0.rpm      0.00 ms      4 -5
12.0 5before TDC
```

- Check readout in display zone 3.

```
Read measured value block 1
0 rpm      0.00 ms      4 -5      12.0
5before TDC
```

-> Specified result: 0...5 <°

- Slowly depress accelerator pedal.

```
Read measured value block 1
0 rpm      0.00 ms      86 -5      12.0
5before TDC
```

-> Specified result: The readout in display zone 3 should increase steadily until it reaches 85...90 <° (with accelerator pedal fully depressed).

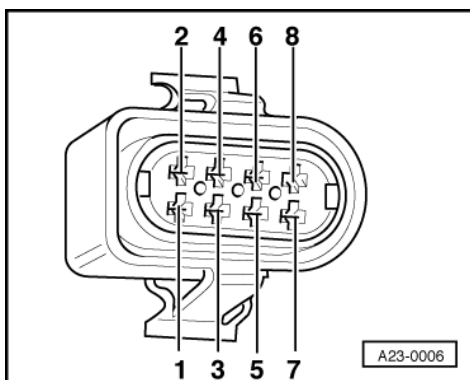
If either the initial or final specified result is not achieved:

- Check accelerator cable setting.

=> Engine mechanics; Rep.-Gr. 20;

If the display does not change or only changes irregularly:

- Switch off ignition.



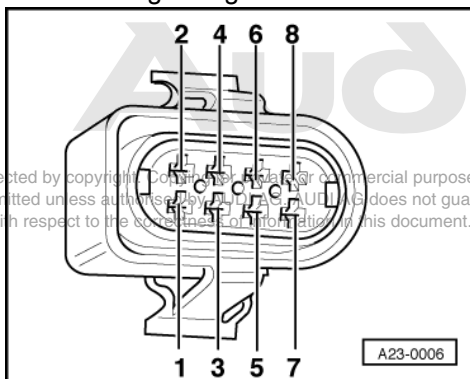
- -> Disconnect the connector from the throttle valve control unit.
- Connect the multimeter for voltage measurement to contact 4 on the connector and to earth.
- Switch the ignition on.

Specified result: approx. 5 V.

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

=>Page 35 .

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



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8-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
4	11
5	75
7	67

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew the throttle valve control unit (J338).

5.5 - Testing throttle valve actuator sensor

The sensor for the throttle valve actuator (G127) informs the engine control unit of the position of the throttle valve actuator (V60).

- Read measured value block, Display Group 98, engine at idling speed=> Page 18

-> Indicated on display:

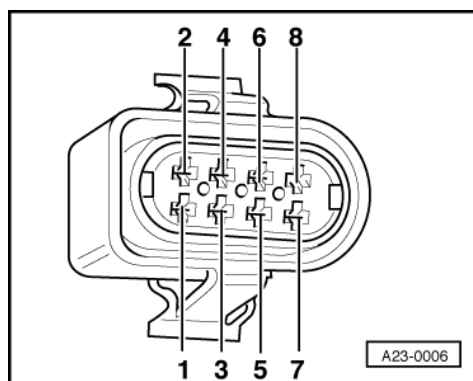
Read measured value block 98
4.420 V 3.880 V Idle ADP.
OK.

- Check readout in display zone 2.

Specified result: 0.500...4.900 V

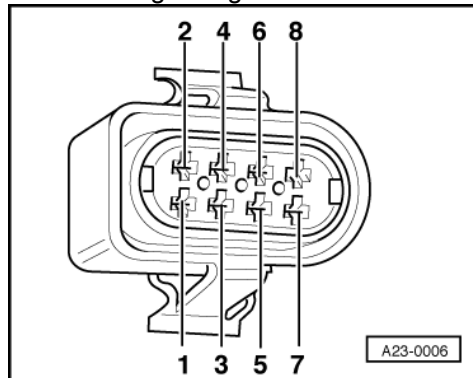
If specified result is not attained:

- Switch off ignition.



- -> Disconnect the connector from the throttle valve control unit.
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35.

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



8-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
4	11
7	67
8	74

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew the throttle valve control unit (J338).

5.6 - Testing throttle valve actuator

The throttle valve actuator (V60) is an electric motor. When the engine is idling, it actuates the throttle valve via a gear mechanism in order to control the idling speed.

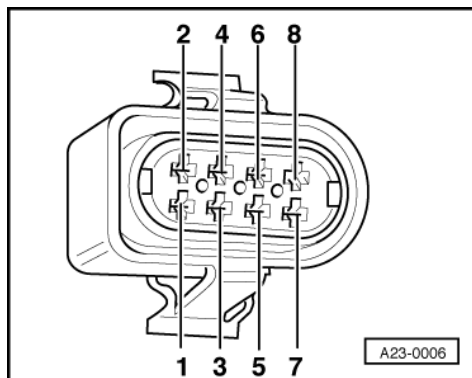
- Select "Basic setting", Display Group 98, with engine stopped
=> Page 15.

-> Indicated on display:

Basic setting 98
4.420 V 3.880 V Idle
ADP. running

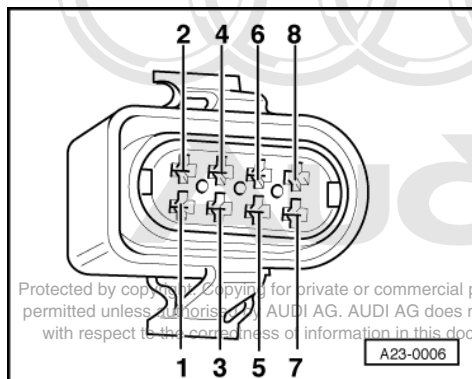
When the Q key is pressed, the throttle valve actuator moves to the min. and max. stops (visible and audible at the throttle valve control unit).

If the throttle valve actuator does not move:



- Switch off ignition.
- -> Disconnect the connector from the throttle valve control unit.
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35.

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



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8-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	66
2	59

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew the throttle valve control unit (J338).

6 - Testing control unit input values

6.1 - Testing control unit input values

6.2 - Testing control unit voltage supply

Test conditions

- Battery voltage OK.

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- Read measured value block, Display Group 03, engine stopped =>Page 18

-> Indicated on display:

Read measured value block 3
0.rpm 12.760 V 18.6 5C
17.8 5C

- Check readout in display zone 2.

Specified result: approx. battery voltage.

If specified result is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit.
=>Page 35 .
- Connect multimeter for voltage measurement between the following contacts on the test box:

	Test box, socket.	Specified result
Ignition off.	3 + 2	approx. battery voltage
Ignition on.	1 + 2	approx. battery voltage

If the specified results are not obtained:

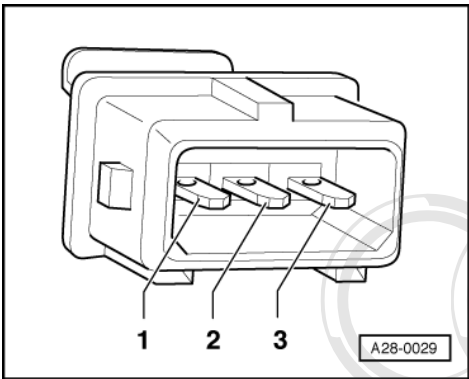
- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

6.3 - Testing engine speed sensor

The engine speed sensor is both a speed sensor and a reference mark sensor. If it fails, the engine will cut out.

- Switch off ignition.
- Detach the connector for the sensor =>Overview of installation locations, Page 33 .



- -> Connect the multimeter for resistance measurement between contacts 1 and 2 on the sensor connector.

Specified result: 480...1000 ω

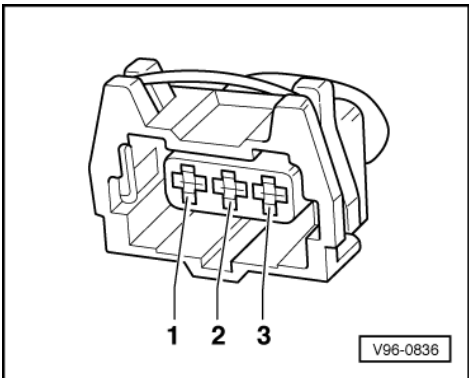
If specified result is not attained:

- Renew engine speed sensor (G28).

If specified result is attained:

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- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit. =>Page 35 .



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

3-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	56
2	63
3	2

- Rectify short circuit or open circuit if necessary.



6.4 - Testing coolant temperature sensor

- Read measured value block, Display Group 03, cold engine at idling speed => Page 18 .

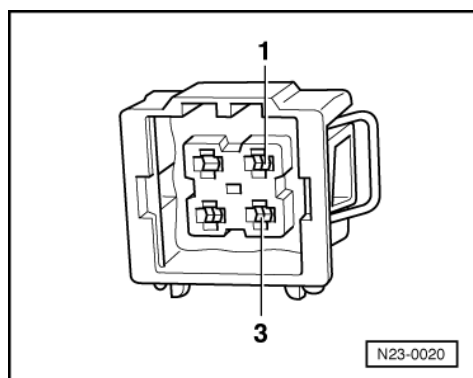
-> Indicated on display:

Read measured value block 3
860 rpm 13.580 V 17.6 5C
16.9 5C

- Observe readout in display zone 3.

Specified result: The temperature reading should increase at a uniform rate.

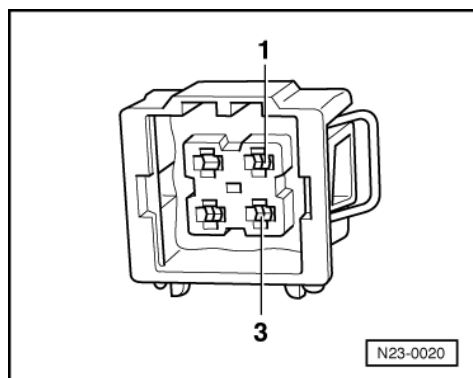
If there is no realistic readout in display zone 3:



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- Switch off ignition.
- -> Pull off the connector on the sensor => Installation locations Overview, Page 33 .
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit
=>Page 35 .

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



4-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	53
3	67

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew the sensor for coolant temperature (G62).

6.5 - Checking the intake air temperature sensor

- Read measured value block, Display Group 03, cooled stationary engine=>Page 18

-> Indicated on display:

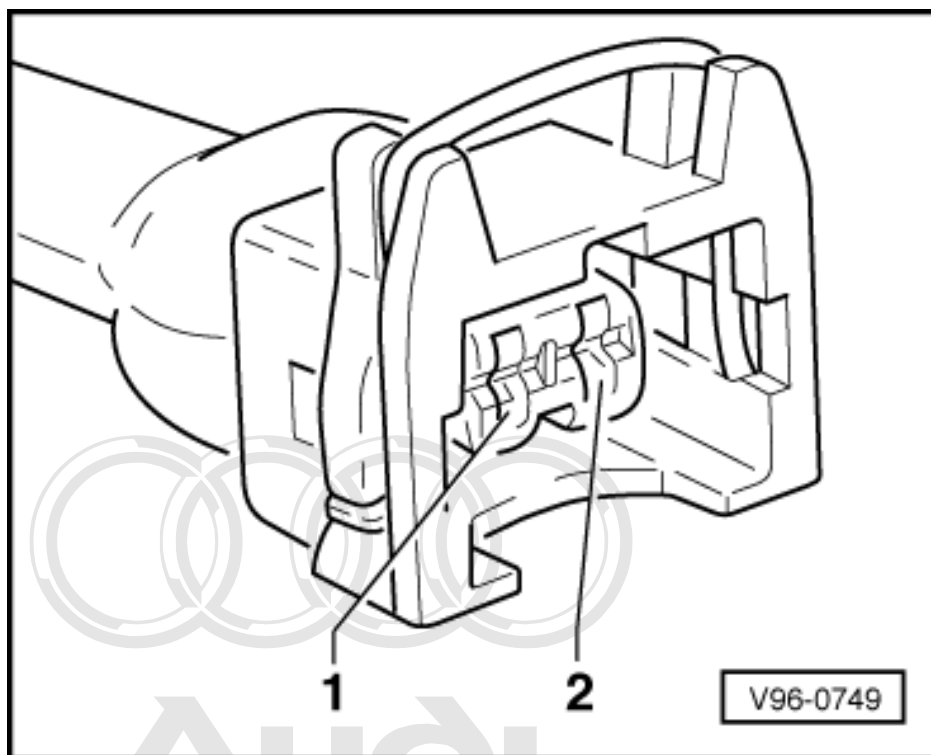
Read measured value block 3		
860 rpm	13.580 V	17.6 5C
16.9 5C		

- Check readout in display zone 4.

Specified result: approx. the same as the ambient temperature.

If there is an open circuit in the wiring to the sensor, a substitute value of 19.5°C will be displayed.

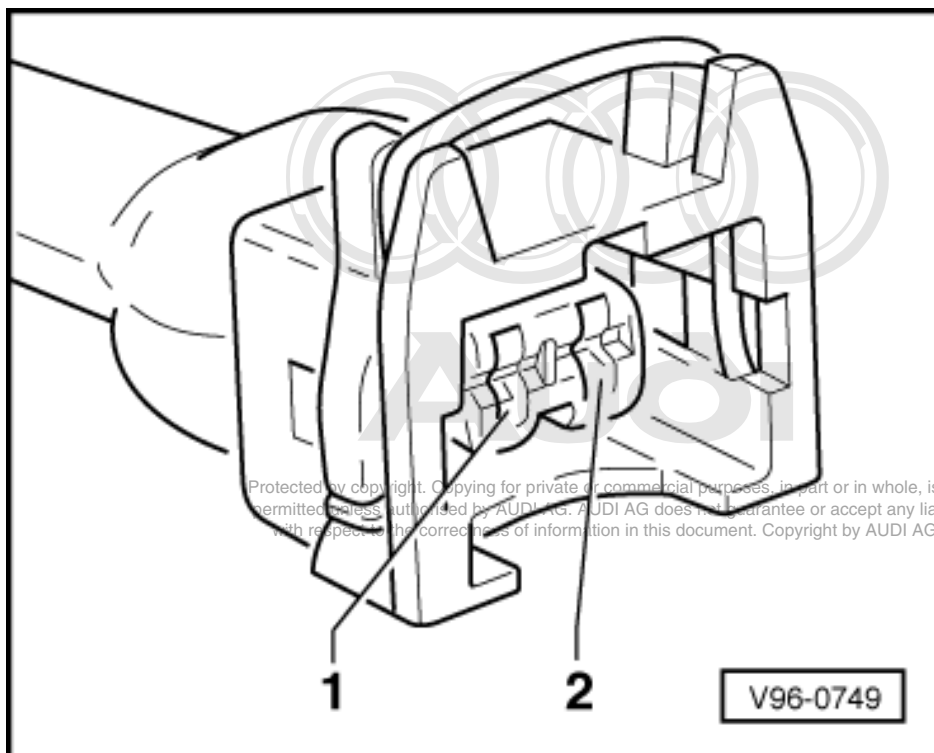
If there is no realistic readout in display zone 4:



- Switch off ignition.
- -> Pull off the connector on the sensor => Installation locations Overview, Page 33 .
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.

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



2-pin connector on wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	54
2	67

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew intake air temperature sensor (G42).

6.6 - Testing airflow meter

- Read measured value block, Display Group 02, engine at idling speed=> Page 18

-> Indicated on display:

Read measured value block 2

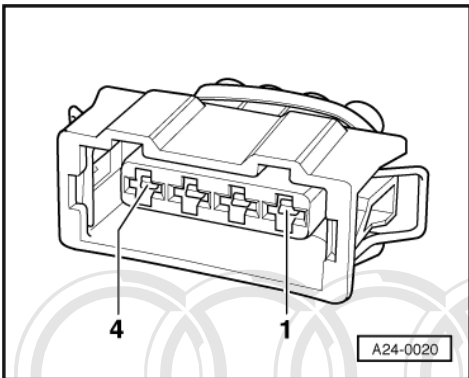
1 2 3 4

- Check readout in display zone 4.

Specified result: 1.8...4.0 g/s

If specified result is not attained:

- Switch off ignition.
- Detach the connector for the airflow meter =>Overview of installation locations, Page 33 .
- Switch the ignition on.



- -> Connect the multimeter for voltage measurement to the following contacts on the connector:

4-pin connector on the wiring harness, contact.	Specified result
3 + earth	Battery voltage
3 + 1	Battery voltage
3 + 2	Battery voltage

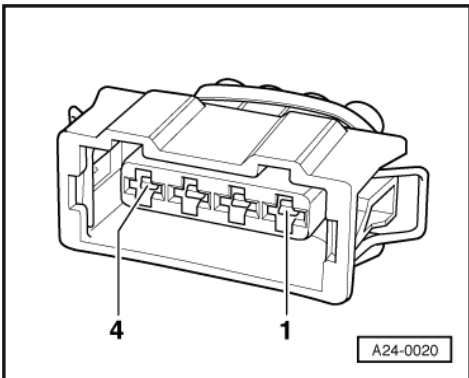
If the specified results are not obtained:

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Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.

=>Page 35 .

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



4-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	2
2	12
3	to fuse
4	13

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Renew airflow meter (G70).



7 - Testing auxiliary signals

7.1 - Testing auxiliary signals

7.2 - Testing signals from/to automatic gearbox

A - Gear change signal

This signal causes the ignition timing to be briefly retarded (torque reduction) during gearshifts in order to smooth out the jolts experienced when changing gear.

- Read measured value block, Display Group 19, engine at idling speed=>Page 18

-> Indicated on display:

Read measured value block 19			
	860 rpm	2.20 ms	1
1	1	8.5 5before TDC	

- Observe readout in display zone 3.

Specified result: X 1 X

Caution

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

- Take the vehicle for a test drive.

Read measured value block 19			
	860 rpm	2.20 ms	1 0
1		4.5 5before TDC	

-> Observe display zone 3 during a gear change.

Specified result: X 0 X

If specified result is not attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .

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

Test box V.A.G 1598/22, socket.	Automatic gearbox control unit, contact
23	=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

- Rectify short circuit or open circuit if necessary.

B - Accelerator position signal

This signal is required for load-dependent calculation of the gearshift times.

The signal is monitored by the self-diagnosis function (fault memory, read measured value block) of the automatic gearbox control unit.

Checking signal

=> Automatic gearbox; Repair Group 01

C - engine speed signal

This signal is required for calculating how to smooth out the gearshifts.

Checking signal

=> Checking engine speed signal, Page 77

D - Selector lever position signal

This signal is required for idling speed stabilization.

When a gear is selected, the idling speed is reduced in order to alleviate vehicle "creeping".

- Read measured value block, Display Group 20, engine at idling speed=> Page 18

-> Indicated on display:

Read measured value block 19		
860 rpm	Neutral	A/C-Low
Compr. OFF		

- Observe readout in display zone 2.

Specified result: Neutral

- Operate the foot brake and engage a gear.

Read measured value block 19		
860 rpm	Gear selected	A/C-Low
Compr. OFF		

-> Specified result: Gear selected.

If specified result is not attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .

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

Test box V.A.G 1598/22, socket.	Automatic gearbox control unit, contact
22	=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

- Rectify short circuit or open circuit if necessary.

E - Signal for changing up or down

In conjunction with the signal for gear change, this signal tells the engine control unit whether the gearbox has changed up or down. This influences the ignition timing retardation.

The signal is monitored by the self-diagnosis function (fault memory, read measured value block) of the automatic gearbox control unit.

Checking signal

=> Automatic gearbox; Repair Group 01



7.3 - Testing signals from/to air conditioning system

Testing air conditioning compressor signal and air conditioning compressor shut-off

The air conditioning compressor signal informs the engine control unit that the compressor will be switched on in 140 ms.

The engine control unit can send a signal to shut off the air conditioning compressor via the same connection.

The engine control unit will shut off the air conditioning compressor in the following cases:

- ♦ During strong acceleration from low road speed for approx. 4 s (recognition from angle change at throttle valve potentiometer and road speed signal).
- ♦ At full load in 1st gear for approx. 12 seconds.
- ♦ If the throttle valve control unit is defective and the engine speed is less than 1500 rpm.
- ♦ After every start, for approx. 6 seconds.
- ♦ During the learning process for idle stabilisation for approx. 15 s.

Test conditions

- Air conditioning system OK
- No fault stored in fault memory

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- Read measured value block, Display Group 20, engine at idling speed => Page 18

-> Indicated on display:

Read measured value block 19
860 rpm Neutral A/C-Low
Compr. OFF

- Observe readout in display zone 4.

Specified result: Compr. OFF

- Switch on air conditioning system.

Read measured value block 19
860 rpm Neutral A/C-Low Compr.
OFF

-> Specified result: Compr. ON

- Abruptly depress the accelerator and release again (brief burst of throttle).

Read measured value block 19
860 rpm Neutral A/C-Low Compr.
OFF

-> Specified result: Compr. OFF (for a few seconds)

If specified result is not attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .

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

Test box V.A.G 1598/22, socket.	Air conditioning system operating and display unit, contact
8	=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

- Rectify short circuit or open circuit if necessary.

7.4 - Testing engine speed signal

The engine speed signal is required for the rev counter, air conditioning system and automatic gearbox.

However, since the signal cannot be read in the form in which it is generated by the engine speed sensor (G28), it has to be processed beforehand by the engine control unit.

Identify the engine speed signal as follows:

Dash panel insert

- Observe rev counter display.

Specified result: The current engine speed should be displayed.

Air conditioning system

The signal is monitored by the self-diagnosis function (fault memory, read measured value block) of the air conditioning system.

Checking signal

=> Heating, air conditioning systems; Repair Group 01

Specified result: The current engine speed should be displayed in the measured values block.

Automatic gearbox

The signal is monitored by the self-diagnosis function (fault memory, read measured value block) of the automatic gearbox control unit.

Checking signal

=> Automatic gearbox; Repair Group 01

Specified result: The current engine speed should be displayed in the measured values block.

If the specified result is not obtained from all the engine speed signal "consumers", the following faults are possible:

- ♦ Open circuit or short circuit between engine control unit and harness connector.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

- ♦ Short circuit between connector in harness and "consumer".
- ♦ Engine control unit defective.

If the specified result is obtained by at least one of the engine speed signal "consumers", the following faults are possible:

- ♦ Open circuit between connector in harness and "consumer".
- ♦ "Consumer" defective.

7.5 - Testing road speed signal

The road speed signal is required to ensure that the air conditioning compressor is switched off when accelerating and to ensure smoother driving (jolt damping).



Test conditions

- Speedometer OK., check:

=> Electrical System; Repair Group 90

- Read measured value block, Display Group 11, engine at idling speed=> Page 18

-> Indicated on display:

Read measured value block 19			
860 rpm	1.15 ms	0 km/h	
0.84 l/h			

Caution!

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

- Take the vehicle for a test drive.
- Observe readout in display zone 3.

Read measured value block 19			
2430 rpm	5.60 ms	45 km/h	3.38 l/h

-> Specified result: The current road speed should be displayed (compare with speedometer).

If specified result is not attained:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .

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

Test box V.A.G 1598/22, socket.	Dash panel insert, contact
20	=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the line:

- Establish which electrical "consumers" (e.g. radio, automatic gearbox, air conditioning system etc.) are using the speed signal, disconnect them one by one from the dash panel insert, then keep repeating the test until the cause of the problem has been identified.

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28 - Ignition system

1 - Testing ignition system

1.1 - Testing ignition system

1.2 - 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 turning at starter speed.
- ◆ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ To operate the engine at starting speed without actually starting it (for example, to check the compression), disconnect the connector from the power output stage for the ignition coils and the connector from the injectors. After completing the work, interrogate the fault memory.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.

1.3 - Technical data

Engine code letters	AEB
Ignition timing is determined by the control unit Ignition timing cannot be adjusted	
Ignition system	Single coil ignition system with four ignition coils
Spark plugs	Tightening torque: 30 Nm.
Spark plug connectors	Resistance approx. 2 kw
Firing order	1-3-4-2
Engine speed limitation by Motronic system Cut-off speed	6800 ± 40 rpm

1.4 - Testing ignition coils

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Identify an inoperative or misfiring cylinder as follows:

- Disconnect the connectors from the injectors in sequence with the engine running, and observe how the engine runs.
- or
- Compare the spark plugs of all cylinders with each other and check for soot on the electrodes.

If the defective cylinder has been identified:

- Connect multimeter to spark plug connector for resistance measurement.



Specified result: approx. 2 kW

If specified result is not attained:

- Renew the spark plug connector.

If specified result is attained:

- Replace the spark plug of the defective cylinder with one from another cylinder.

If the fault moves with the spark plug:

- Renew the spark plug.

If the fault remains in the same cylinder:

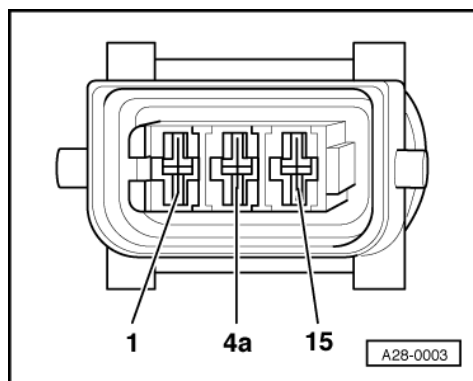
- Replace the ignition coil from the defective cylinder with one from another cylinder.

If the fault moves with the ignition coil:

- Renew the ignition coil.

If the fault remains in the same cylinder:

- Disconnect the connector from the ignition coil.



- -> Check the earth connection from contact 4a to the engine earth for an open circuit or short to positive.
- Rectify short circuit or open circuit if necessary.

If the earth connection is OK:

- -> Connect the multimeter for voltage measurement to contact 15 on the connector and to earth.

Specified result: approx. battery voltage.

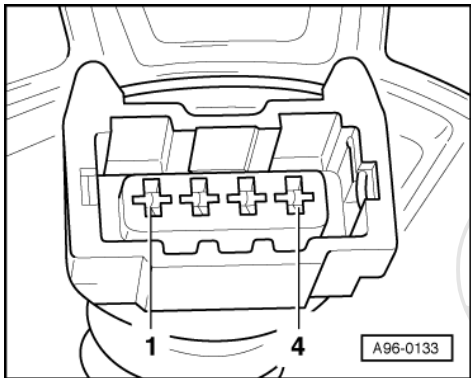
If specified result is not attained:

- Check the wiring connections.

=> Circuit diagrams, Electrical Fault Finding and Installation Location binder

If specified result is attained:

- Remove the 4-pin connector from the power output stage => Overview of installations locations - Page 33.
- Switch the ignition on.



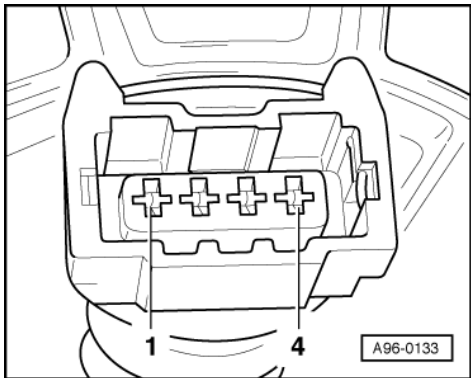
- -> Connect the V.A.G 1527 diode test lamp to the following contacts on the connector:

4-pin connector on the wiring harness, contact.	Specified result
1 + earth	Diode test lamp should light up
2 + earth	
3 + earth	
4 + earth	

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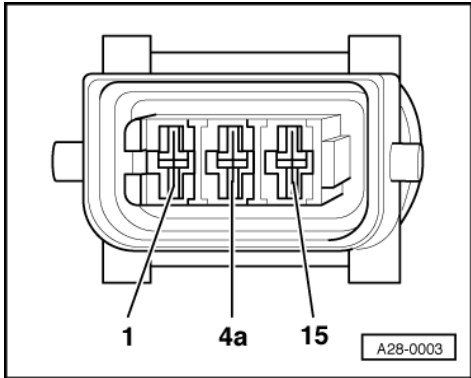
If the specified results are not obtained:

- Switch off ignition.



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

4-pin connector on the power stage, contact.	3-pin connector on the ignition coil, contact.
1	1 (Cylinder 1)
2	1 (Cylinder 2)
3	1 (Cylinder 3)
4	1 (Cylinder 4)





- Rectify short circuit or open circuit if necessary.

1.5 - Testing power output stages for ignition coils

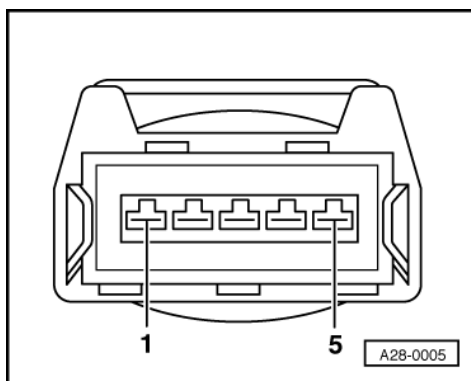
Testing actuation of power output stages

- Pull the connectors off all four injectors.

Note:

It is important to ensure that no fuel is injected during the test, as this would damage the catalytic converter. Therefore, the connectors must be withdrawn from the injectors.

- Remove the 5-pin connector from the power output stage => Overview of installation locations - Page 33 .



- -> Connect the V.A.G 1527 diode test lamp to the following contacts on the connector:
- Operate the starter for a few seconds.

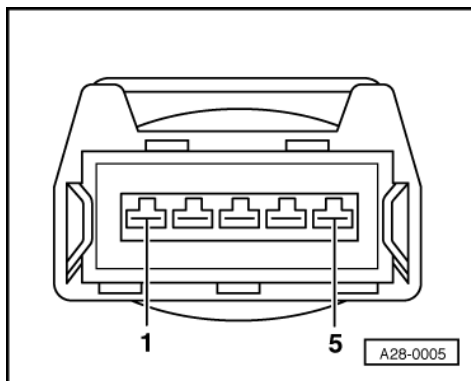
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5-pin connector on the wiring harness, contact.	Specified result
1 + earth	Diode test lamp should flash (short pulse)
2 + earth	
4 + earth	
5 + earth	

If the specified results are not obtained:

- Switch off ignition.
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
=>Page 35 .

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



5-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	70
2	78
3	2
4	77
5	71

- Rectify short circuit or open circuit if necessary.

If no fault is detected in the wiring:

- Connect the 5-pin connector to the power output stage.
- Pull the 4-pin connector off the power output stage.
- Connect the V.A.G 1527 diode test lamp to battery positive (+) and to one of the contacts on the 4-pin connector on the power output stage.
- Operate the starter for a few seconds.

Diode test lamp should flash.

- Carry out the test with all 4 contacts on the power output stage.

The diode test lamp should flash each time.

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If the diode test lamp does not flash when testing one or more of the contacts:

- Renew power output stage.

2 - Testing knock control

2.1 - Testing knock control

2.2 - Testing knock sensors

- Read measured value block, Display Group 16, engine at idling speed => Page 18

-> Indicated on display:

Read measured value block 16		
0.800 V	0.840 V	0.800 V
0.760 V		

- Observe all display zones.

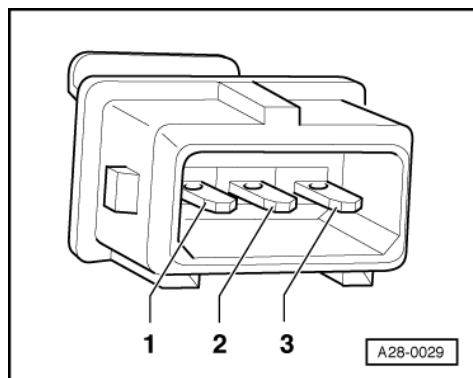
Specified result: 0.400...1.400 V

- Compare the display zones with each other.

Specified result: Difference less than 0.500 V.

If the specified results are not obtained:

- Loosen knock sensors and retighten to 20 Nm.



- Repeat the test.

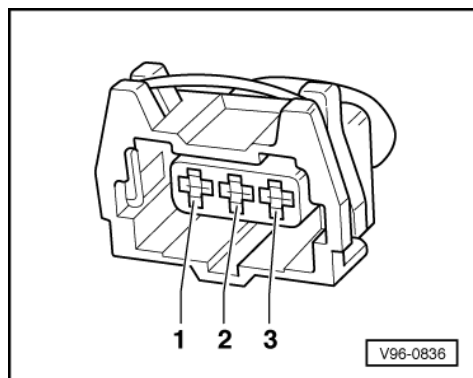
If the specified results are still not attained:

- Disconnect the connector for the relevant knock sensor in the engine compartment.
- -> Test for a short circuit between all three contacts in the knock sensor connector. There must be no connection between any of the wires.
- If there is a connection between the contacts, fit a new knock sensor.

If no fault is detected in the line:

- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
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The following wiring connections should be checked for open circuits and/or short to positive or negative:



3-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
Knock sensor 1 (G61)	
1	68
2	67
3	2
Knock sensor 2 (G66)	
1	60
2	67
3	2

- Rectify short circuit or open circuit if necessary.

2.3 - Testing Hall sensor

The Hall sensor indicates the ignition position for cylinder 1.

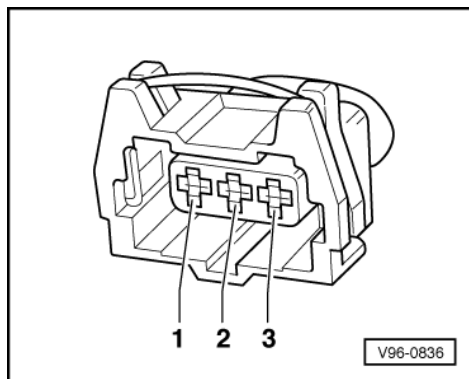
If the Hall sensor fails to function, the knock control is switched off and the ignition timing is retarded slightly because the signals can no longer be assigned to the cylinders.

Even without a signal from the Hall sensor, the engine will continue to run and can also be restarted.

- ♦ When a fault is detected, the engine control unit produces one spark for each cylinder on every crankshaft revolution.
- ♦ The fact that the control unit is out of phase by one engine revolution does not have any noticeable effect on the injection system. If this happens, the fuel is injected "upstream" (before the closed inlet valve) instead of while the inlet valve is open. This has only a minor influence on the quality of the air/fuel mixture.

Note on signal testing with an oscilloscope:

The centre point of the window of the Hall sensor must lie on the third falling flank of the engine speed signal after the reference mark gap.



- Push back the rubber sleeve on the Hall sensor connector.
- -> Connect the V.A.G 1527 diode test lamp to contacts 1 and 2 on the Hall sensor connector from behind (the connector remains attached to the Hall sensor).

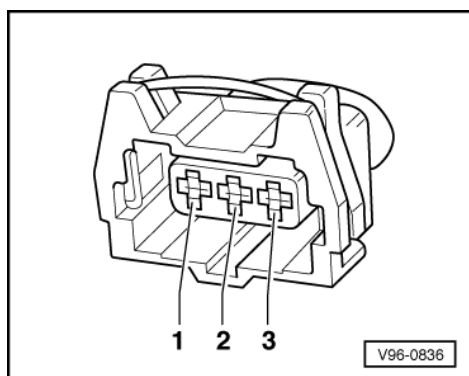
Note:

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

- Operate the starter for a few seconds.

The diode test lamp must flash briefly on each second engine revolution.

If the diode test lamp does not flash:



- Disconnect connector from Hall sender.
- Switch the ignition on.



- -> Connect multimeter to measure voltage at contacts 1 and 3 of the connector:

Specified result: 4.5 ... 5.5 V

- Connect multimeter to measure voltage at contacts 2 and 3 of the connector:

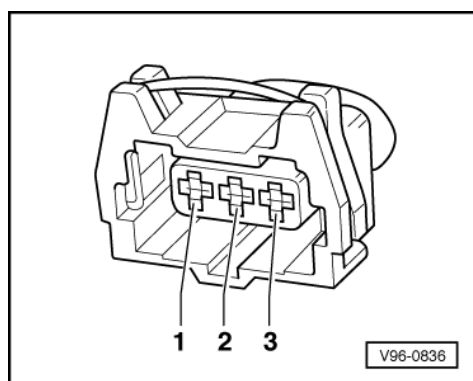
Specified result: approx. battery voltage

If specified result is attained:

- Renew Hall sensor (G40).

If specified result is not attained:

- Switch off ignition.
- Connect the V.A.G 1598/22 test box to the wiring harness for the engine control unit.
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The following wiring connections should be checked for open circuits and/or short to positive or negative:

3-pin connector on the wiring harness, contact.	Test box V.A.G 1598/22, socket.
1	11
2	76
3	67

- Rectify short circuit or open circuit if necessary.