



Audi 100 1991 ➤

Motronic Fuel Injection and Ignition System (5-cylinder)

Engine ID	AAN								
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Edition 12.2002

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

Audi 100 1991 ➤

Motronic Fuel Injection and Ignition System (5-cylinder)

Repair Group

01 - Self-diagnosis

24 - Mixture preparation, Injection

28 - Ignition system



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

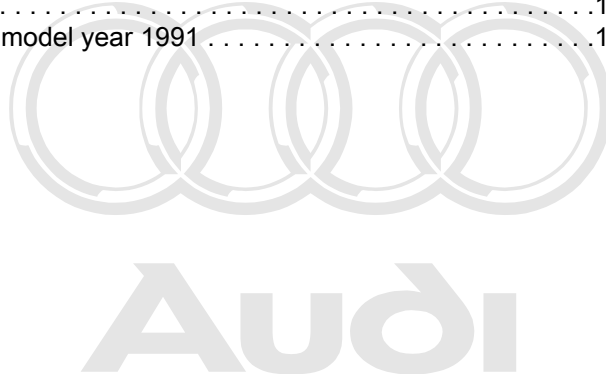
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01 - Self-diagnosis

1 - Self-diagnosis of Motronic system

1.1 - Self-diagnosis of Motronic system

1.2 - Technical data of self-diagnosis

Features

- ◆ Data transfer between the control unit and the vehicle diagnostic, testing and information system VAS 5051 occurs in the "self-diagnosis" mode.
- ◆ The fault memory is designed as a non-volatile memory. It is however dependent on the power supply. Disconnecting the permanent positive supply erases the fault memory of the engine control unit.

1.3 - Safety precautions

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Note the following points if testers and measuring instruments have to be used during a road test:

Important

- ◆ **Always** install testers and measuring instruments on the rear seat and have a second person operate them from there.
- ◆ If test equipment is operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.

1.4 - Connecting vehicle diagnostic, testing and information system VAS 5051 and selecting functions

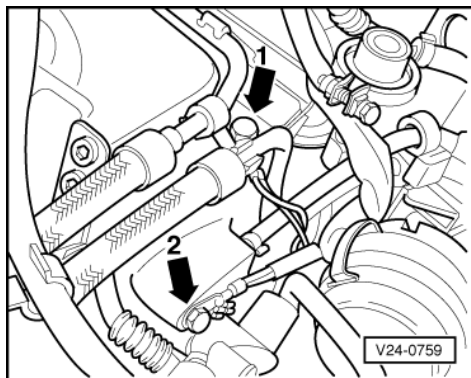
Test requirements:

- Fuses for engine electronics OK

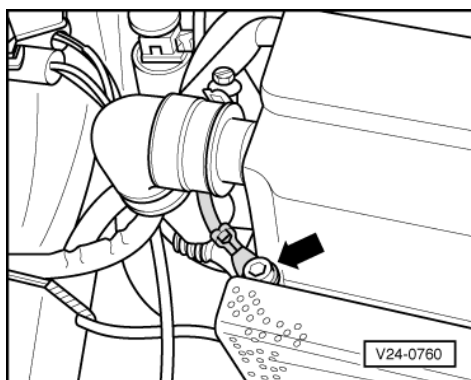
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations

- Fuel pump relay OK; checking =>Page 75 .
- Battery voltage at least 12.7 V
- Earth connections checked.

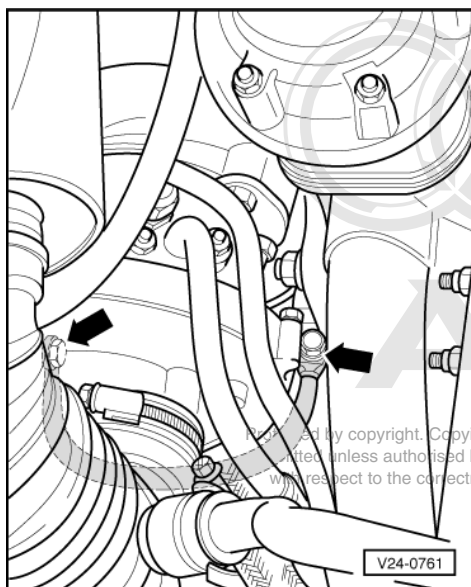
- Test following earth connections for corrosion and poor connection before interrogating fault memory, final control diagnosis, test of wiring and also before replacing components:



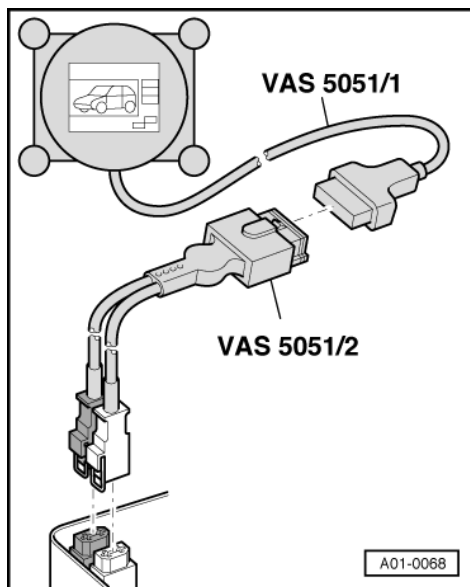
- ♦ -> Attachment point of power earth wire -arrow 1- (brown-white wires).
- ♦ Attachment point of electronics earth wire -arrow 2- (brown-red wires).



- ♦ -> Earth connection for ignition coils at the right rear cylinder head cover -arrow-.



- ♦ -> Attachment points of earth wire between engine and right longitudinal member -arrows-.



Procedure

- Remove cover from additional relay carrier I on left of plenum chamber.
- -> Connect the Vehicle Diagnostic, Testing and Information System VAS 5051 using diagnostic cable VAS 5051/1 and diagnosis adapter VAS 5051/2.

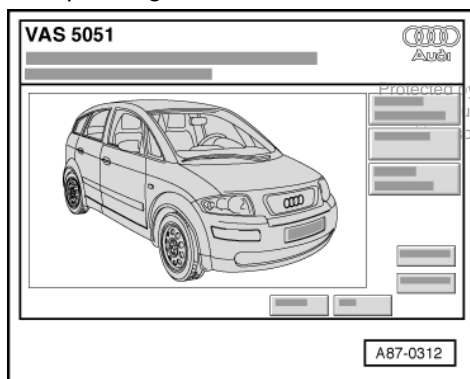
Important

Note the safety precautions =>

Note:

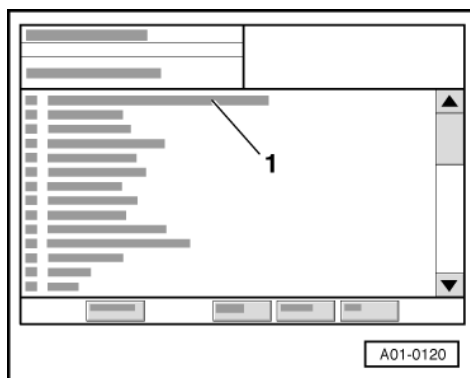
If a fault message appears in the display:

=> Operating Instructions for Vehicle Diagnostic, Testing and Information System VAS 5051



-> Display on VAS 5051:

- Press the "Vehicle self-diagnosis" key.





-> Display on VAS 5051:

Note:

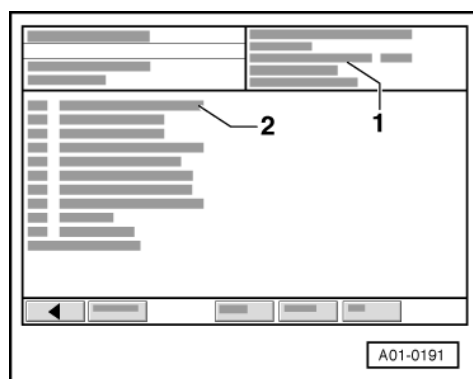
The automatic test sequence is carried out by pressing "00 - Interrogate fault memory - Total system" under -1-, i.e. the fault memories of all vehicle systems with self-diagnosis capability are interrogated.

Depending on required function => "Diagnosis functions" table, Page 01-7:

- Switch the ignition on.

or

- Start the engine.
- Select vehicle system "01 - Engine electronics" in selection -1-.



- Wait until the next display appears.

-> Display on VAS 5051:

- 1 - Control unit identification of the engine control unit => Page 4
- 2 - Overview of selectable functions => Page 5

Control unit identification Engine control unit (example)	
01 - Engine electronics	Vehicle system
4A0 907 551..	Part No.; assignment => Parts List
ENGINE1)D042)	1) Engine electronics 2) Control unit data status (software type)
Code 1	Code of control unit (check => Page 28)

or

Control unit identification Engine control unit (example)	
01 - Engine electronics	Vehicle system
4A0 907 551..	Part No.; assignment => Parts List
2.211)R52)MOTR.3)RHV4)HS5)D016)	1) Engine capacity 2) In-line engine, 5-cylinder 3) Motronic injection and ignition system 4) Ignition system (static high voltage distribution) 5) Manual gearbox (hand shift) 6) Control unit data status (software type)

Control unit identification Engine control unit (example)

Code 1	Code of control unit (check => Page 28)
--------	--

Diagnostic functions	Ignition on, engine stopped	Engine idling	Vehicle running	Page
02 Interrogating fault memory	no	yes	yes	5
03 Final control diagnosis	yes	no	no	20
04 Basic setting	no	yes	no	24
05 Erasing fault memory	yes	yes	yes	7
06 End of output	yes	yes	yes	8
07 Encoding control unit	no	no	no	-
08 Reading measured value block	yes	yes	yes	30
09 Reading individual measured value	no	no	no	-
10 Adaption	no	no	no	-
11 Log-in procedure	no	no	no	-

2 - Interrogating and erasing fault memory

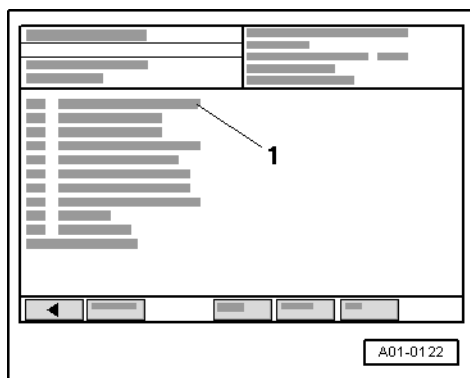
2.1 - Interrogating and erasing fault memory

2.2 - Interrogating fault memory

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics". For this purpose, the engine should be idling.

Note:

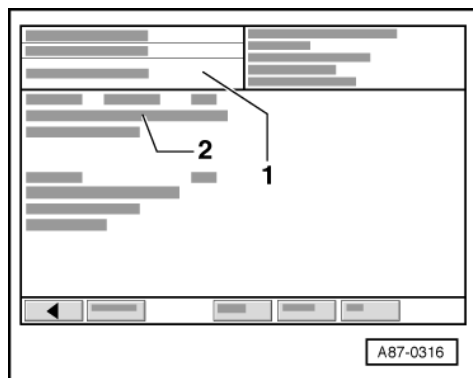
If the engine will not start, turn it for at least 5 seconds with the starter; the engine must then be left on.



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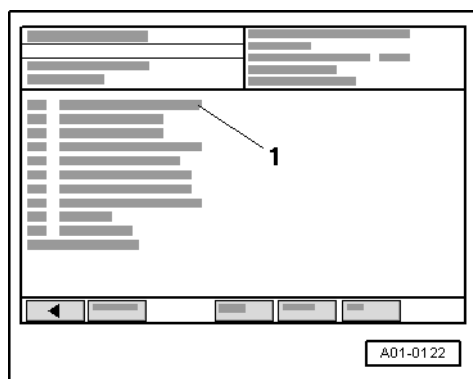
-> Display on VAS 5051:

- Under selection -1- select the diagnostic function "02 - Interrogate fault memory".



-> Display on VAS 5051:

- 1 - Content of the fault memory:
 - 0 faults recognised
 - or
 - X faults recognised
- 2 - Faults
 - Fault code
 - Fault location
 - Type of fault



A - if faults were recognised:

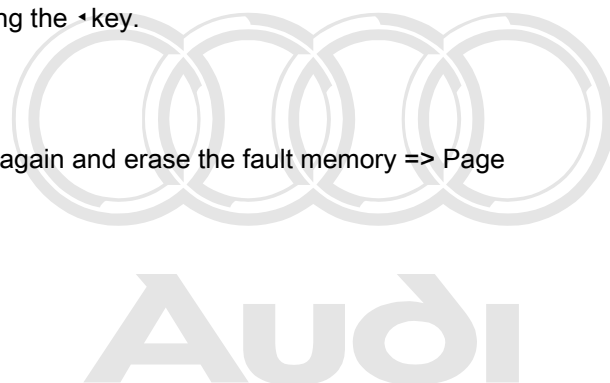
- Print out the screen contents or the self-diagnosis report.
- Exit the function "02 - Interrogate fault memory" by pressing the ↵ key.

-> Display on VAS 5051:

- Rectify the fault(s) as specified in fault table => Page 8 .
- Select diagnostic function "02 - Interrogate fault memory" again and erase the fault memory => Page 7 .
- Select diagnostic function "06 - End output" => Page 8 .

B - if no fault was recognised:

- Select diagnostic function "06 - End output" => Page 8 .



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2.3 - Erasing fault memory

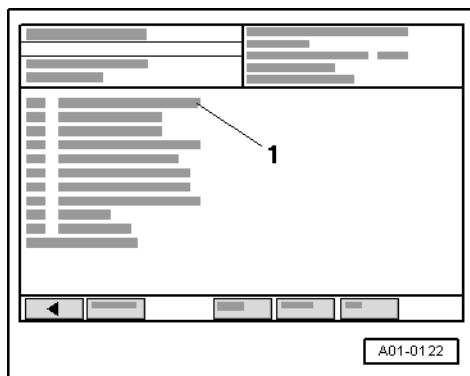
Note:

If it is not possible to erase fault memory, interrogate it once again and remedy faults.

Preconditions:

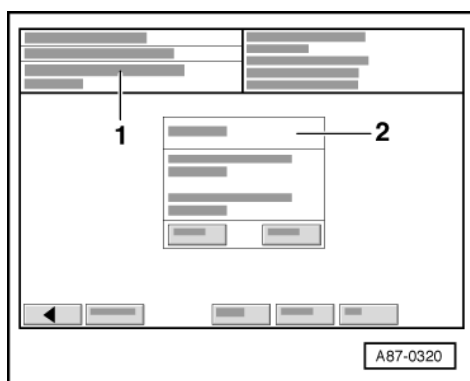
- Fault memory interrogated=> Page 5 .
- All faults rectified.

After fault memory has been successfully interrogated:



-> Display on VAS 5051:

- Under selection -1- select the diagnostic function "05 - Erase fault memory".



-> Display on VAS 5051:

- 1 - - No display (before erasing)
- or
- Fault memory erased

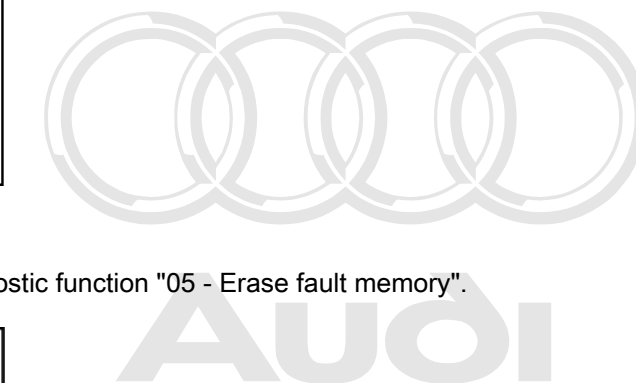
Note:

If the following note appears in display zone -1-: "Fault memory not yet interrogated", if the procedure was not adhered to exactly. The fault memory can only be erased once the fault memory has been interrogated.

The fault memory will also not be erased if :

- ◆ The ignition has been switched off after interrogating the fault memory.
- ◆ A static fault has not been rectified.

2 - Note:



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Should the function be carried out?

Note: Data will be erased.

- Press "OK" key in display -2-.
- Exit function "05 - Erase fault memory" by pressing the ◀ key.
- Initiate the basic setting of the engine => Page 24 .
- Carry out a test drive (lasting at least 5 minutes).
- Interrogate fault memory once more and re-initiate the basic setting of the engine.

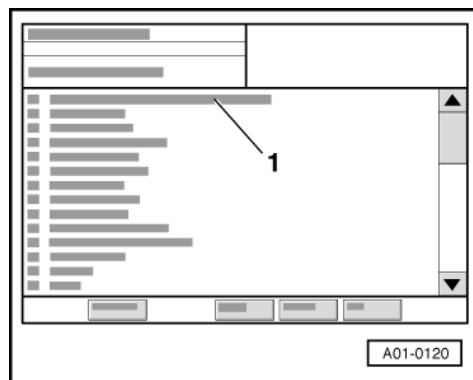
2.4 - End of output



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-> Display on VAS 5051:

- Under -1- select diagnostic function "06 - End output".



-> Display on VAS 5051:

- After this display appears, switch off ignition and detach diagnostic connector.

2.5 - Fault table

Notes:

- ♦ If faults occur in the monitored sensors and components, these are stored in the fault memory together with an indication of type of fault.
- ♦ The fault table is sorted according to the 5-digit fault code on the left.
- ♦ If a stored fault does not occur again within the next 50 engine starts, the fault code will be automatically erased.

- ◆ Sporadic faults (intermittent fault) are indicated as "sporadic" on the display. The word "sporadic" signifies individually occurring, random faults.
- ◆ Do not immediately renew components indicated as faulty by the VAS 5051 but first check the wiring and connectors of these components against the current flow diagram. Also check the earth connections against current flow diagram. This is particularly relevant for faults recorded as "sporadic".

2.6 - Fault codes 00281 - 00537

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00281 Road speed sender -G68 No signal	- Speedometer sender/road speed sender -G22/-G68 defective - Speedometer -G21 defective - Open circuit or short circuit between speedometer sender and speedometer - Open circuit or short in wiring between dash panel insert and engine control unit	- No air-conditioner compressor shut-off in first gear at full throttle - Idling speed exceeded briefly when disengaging the clutch in the deceleration phase - Engine speed limited to 5300 rpm	- Check speed signal =>Page 114 - Check wiring
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Note:

Start by checking whether speedometer reading is OK. If reading is not OK, fault can be ignored.

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00513 Engine speed sender -G28 No signal Implausible signal	- Open circuit or short in signal wire - Open circuit in screening	- Engine will not start/cuts out - Misfires	- Check wiring
	- -G28 loose or defective - Gap between -G28 and ring gear of flywheel greater than 1.2 mm - Teeth broken on flywheel starter ring gear		- Check -G28 =>Page 130 - Check flywheel
Mechanical fault	- -G4 and -G28 connectors interchanged	- Engine will not start	- Check whether -G4 and -G28 connectors interchanged
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Note:

Ignore fault with ignition on and engine off. Observe fault with ignition on after unsuccessful attempt at starting (engine does not start).

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
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00514 Ignition timing sender -G4 No signal	- Ignition timing -G4 loose - Gap between -G4 and pin of flywheel greater than 1.2 mm	- If fault occurs before starting engine: - Engine will not start (no ignition or injection) - If fault occurs after starting engine: - Engine in emergency running mode	- Check -G4 =>Page 128
	- -G4 defective		
	- Open circuit or short between -G4 and engine control unit - Open circuit in screening		- Check wiring
	- -G4 and -G28 connectors interchanged		- Check whether -G4 and -G28 connectors interchanged
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00515 Hall sender -G40 Open circuit/short to positive Short to earth Signal at positive Signal at earth Mechanical faults Fault in basic setting	- Open circuit or short between -G40 and engine control unit - Fault in power supply or earth connection for -G40 - -G40 defective	- Loss of power	- Check -G40 =>Page 142
	- Position of the sender pin for ignition timing -G4		- Check -G4 =>Page 128
	- Incorrect valve timing (toothed belt skipped)		- Check valve timing => Engine, Mechanical Components; Repair group 13
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Note:

If the fault is shown as sporadic, ignore the fault.

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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00516 Idling switch -F60 Open circuit/short to positive Short to earth	- Throttle valve sticking - -F60 defective - Moisture in connector of -F60	- Idling speed control switches to open loop control - Air-conditioner compressor deactivated - Idling speed outside nominal range	- Check idling speed switch => Page 106
	- Open circuit or short between -F60 and engine control unit		- Check wiring
	- Throttle cable setting - Floor mat pressing down on accelerator pedal		- Adjust throttle cable => Fuel Supply - Petrol Engines; Repair group 20

	- Closing damper sticks or is incorrectly adjusted		- Check closing damper => Page 109
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00518 -G69 throttle valve potentiometer Short to earth Signal too small Open circuit/short to positive Signal too great Implausible signal	- Open circuit or short between -G69 and engine control unit - -G69 defective - Moisture or corrosion in connector at -G69 - Faulty signal input in engine control unit (control unit defective)	- Boost pressure is not achieved - Loss of power	- Check wiring Check -G69 =>Page 103 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00519 Intake manifold pressure sender - G71 Signal too small Signal too great Control difference	- Vacuum line from intake manifold to engine control unit blocked, kinked or crushed - Water separator in the hose line from the intake manifold to the engine control unit full of fluid - Boost pressure limitation solenoid valve -N75 defective Mechanical boost pressure regulating valve defective - Turbocharger defective - Pressure sensor in the engine control unit defective	- Loss of power	- Check/drain vacuum lines and water separator - Check -N75 => Engine, Mechanical Components; Repair group 21 - Check turbocharger => Engine, Mechanical Components; Repair group 21 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00522 Coolant temperature sender -G62 Short to earth Open circuit/short to positive	- Open circuit or short in wiring connection between -G62 and engine control unit - -G62 defective - Moisture or corrosion in connector at -G62	- Cold starting problems - Engine running problems when warm	- Read measured value block => Page 30 - Check -G62 =>Page 135



	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60
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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00523 Intake air temperature sender -G42 Short to earth Open circuit/short to positive	- Open circuit or short in wiring connection between -G42 and engine control unit	- Engine running problems in the warm-up phase at low temperatures	- Check wiring
	- -G42 defective		- Check -G42 =>Page 132
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00524 Knock sensor 1 -G61 No signal	- Knock sensor defective	- High fuel consumption - Loss of power - Boost pressure reduction	- Check -G61 =>Page 140
	- Corrosion at connector of -G61		- Tightening torque for knock sensor: 20 Nm
	- Knock sensor loose		- Check wiring
	- Open circuit or short to positive in wiring between -G61 and engine control unit		- Replace engine control unit =>Page 60
	- Short circuit between -G61 and earth or to screening		
	- Faulty signal input in engine control unit (control unit defective)		

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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00525 Lambda probe -G39 Short to positive No signal Short to earth	- Open circuit or short circuit between -G39 and engine control unit	- Emissions not OK - Increased fuel consumption - Black smoke - Soot on spark plugs - Lambda control switches to open loop control	- Check wiring
	- Short circuit to earth or screen in Lambda probe signal wire		- Check lambda control =>Page 93
	- -G39 defective		- Check lambda probe heating => Page 24
	- Lambda probe heater - Z19 not operating - Heating resistor in -G39 defective - Open circuit or short circuit in Lambda probe heater - Z19 wiring.		
	- Failure of spark plugs/ignition coils		- Perform visual inspection

	Continued ▼		
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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00525 Lambda probe -G39 Short to positive	(Fault 00525 continued) - Fuel system pressure		- Check fuel system pressure => Page 64
No signal	- Unmetered air downstream of air mass meter - G70		- Eliminate cause
Short to earth	- Leaks in exhaust system as far as catalytic converter		- Rectify leaks
00528 Altitude sensor -F96 Short to earth Open circuit/short to positive	- Open circuit or short in wiring connection between -F96 and engine control unit - -F96 defective - Faulty signal input in engine control unit (control unit defective)	- Loss of power - Boost pressure is not achieved	- Check wiring - Check -F96 =>Page 88 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00532 Power supply Signal too small	- Poor earth connection to engine control unit - Battery discharged - Current draw with "Ignition off" (discharge)	- Voltage less than 6 V - Engine not running	- Check power supply to engine control unit => Page 138 - Check voltage Check charge
Signal too great	- Supply voltage greater than 16 V - Excess voltage from assisted start - Alternator defective	- Damage to the engine control unit	- Check voltage

Note:

If the fault is shown as a sporadic fault, ignore the fault message on the display. This fault is often stored when the engine is left idling for a long period with a large number of electrical consumers switched on, causing the battery charge to become very low.

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00533 Idling speed regulation Lower adaption limit Adaption limit exceeded	- Fuse defective - Idling speed stabilisation valve -N71 jamming when closed - Contact resistance at idling stabilisation valve connector N71 - Characteristic curve of air mass meter -G70 shifted	- Idling speed too low	- Check -N71 => Page 80 - Check -G70 =>Page 84



	Continued ▼		
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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00533 Idling speed regulation Lower adaption limit Adaption limit not reached	(Fault 00533 continued)		
	- Idling speed stabilisation valve -N71 jamming when open	- Idling speed too high	- Check -N71 => Page 80
	- Characteristic curve of air mass meter -G70 shifted		- Check -G70 =>Page 84
	- Unmetered air in intake area		- Check for leaks (unmetered air) in intake air system =>Page 92
	- Throttle valve potentiometer -G69 incorrectly set	- Engine judders - Poor throttle response - Irregular idling (surging)	- Check -G69 =>Page 84
	- Throttle valve unit sticks		- Check throttle valve unit and replace, if necessary

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00537 Lambda control Control limit exceeded	- Fuel tank empty, at least 10 l	- CO upstream of catalytic converter less than 0.3 % vol.	- Refuel the vehicle
	- Power supply defective or lambda probe heating defective		- Check lambda probe heating => Page 96
	- Fuel system pressure too low		- Check fuel system pressure => Page 64
	- Leaks in the exhaust system up to the catalytic converter		- Rectify leak
	Continued ▼		

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00537 Lambda control Regulating limit not reached	(Fault 00537 continued)		
	- Failure of spark plugs/ignition coils	- CO upstream of catalytic converter greater than 1.0 % vol.	- Perform visual inspection
	- Fuel pressure too high		- Check fuel system pressure => Page 64
	- Lambda probe defective	- Black smoke - Engine running problems	- Check lambda control =>Page 93
	- Unmetered air downstream of air mass meter -G70		- Rectify leak

	- Activated charcoal filter system solenoid valve 1 - N80 leaking, constantly open		- Check activated charcoal filter system solenoid valve 1 - N80 for leaks =>Page 99
--	--	--	---

2.7 - Fault codes 00540 - 65535

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00540 Knock sensor 2 -G66 No signal	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted without the written consent of AUDI AG. AUDI AG is not responsible for the content of this document. Copyright by AUDI AG. - Knock sensor defective - Corrosion at connector of -G66 - Knock sensor loose - Open circuit or short to positive in wiring between -G66 and engine control unit - Short circuit between -G66 and earth or to screening - Faulty signal input in engine control unit (control unit defective)	- High fuel consumption - Loss of power	- Check -G66 =>Page 140 - Tightening torque for knock sensor: 20 Nm - Check wiring - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00543 Maximum revs exceeded Signal too great	- Engine over-revving (wrong gear engaged)	- Possible engine damage	

Note on fault code 00543:

If fault 00543 is displayed, the engine speed of 7200 rpm has been exceeded. This speed can only be exceeded if the engine has been over-revved as a result of an operating error (incorrect shifting).

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00544 Maximum boost pressure exceeded Implausible signal	- Unmetered air downstream from turbocharger - Vacuum line from intake manifold to engine control unit disconnected - Boost pressure limitation solenoid valve -N75 defective - Mechanical boost pressure regulating valve defective - Turbocharger defective	- Extreme misfiring at full load - Boost pressure too high	- Check vacuum connections => Page 116 - Check -N75 => Engine, Mechanical Components; Repair group 21 - Check turbocharger => Engine, Mechanical Components; Repair group 21



Signal too great	- Pressure sensor in the engine control unit defective	- Severe boost pressure fluctuations at full load	- Check boost pressure => Engine, Mechanical Components; Repair group 21
------------------	--	---	--

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00553 Air mass meter -G70 Signal too great Signal too small	- Fault in power supply to -G70 - Open circuit or short to earth or positive in signal wire between -G70 and engine control unit - Fault in earth connection for -G70 - -G70 defective	- Slight engine running problems	- Check -G70 =>Page 84
	- Faulty signal input in engine control unit (control unit defective)		- Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00561 Mixture adaption Adaption limit (add) exceeded	- Fuel system pressure too low	- Jolting may occur	- Fill up vehicle, check fuel system pressure =>Page 64
Adaption limit (mul) exceeded	- Leaks in exhaust system as far as catalytic converter - Unmetered air downstream of air mass meter	- Poor idling may occur	- Eliminate cause
Adaption limit (add) not reached	- Fuel pressure too high	- Jolting may occur - Increased fuel consumption	- Fill up vehicle, check fuel system pressure =>Page 64
Adaption limit (mul) not reached	- Fuel in engine oil (possibly due to short journeys) - Injectors leaking	- Poor idling may occur - Formation of black smoke, soot deposits on spark plugs	- Drive vehicle on a motorway for 15 minutes or change oil - Check injection quantity =>Page 73

Notes:

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- ♦ add = additive, i.e. fault only has an effect during idling
- ♦ mul = multiplicative, i.e. fault occurs throughout the entire engine speed range and load range.

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00577 Knock control cylinder 1 Control limit exceeded	- Poor quality fuel (less than RON 91) - Signal wire of sender for engine speed -G28 or for ignition timing -G4 interrupted (loose contact) or interchanged	- High fuel consumption - Loss of power - Maximum speed is not reached - Boost pressure reduction	- Fill up with petrol of at least RON 91 - Check signal wire -G28 =>Page 128

	- Open circuit in knock sensor screen wiring		- Check knock sensor =>Page 140
	- Abnormal engine running noise (ancillaries loose)		- Rectify mechanical damage
	- Injector dirty		- Check injectors =>Page 67

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00578 Knock control cylinder 2 Control limit exceeded	- Poor quality fuel (less than RON 91)	- High fuel consumption - Loss of power - Maximum speed is not reached - Boost pressure reduction	- Fill up with petrol of at least RON 91
	- Signal wire of sender for engine speed -G28 or for ignition timing -G4 interrupted (loose contact) or interchanged		- Check signal wire -G28 =>Page 128
	- Open circuit in knock sensor screen wiring		- Check knock sensor =>Page 140
	- Abnormal engine running noise (ancillaries loose)		- Rectify mechanical damage
	- Injector dirty		- Check injectors =>Page 67

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00579 Knock control cylinder 3 Control limit exceeded	- Poor quality fuel (less than RON 91)	- High fuel consumption - Loss of power - Maximum speed is not reached - Boost pressure reduction	- Fill up with petrol of at least RON 91
	- Signal wire of sender for engine speed -G28 or for ignition timing -G4 interrupted (loose contact) or interchanged		- Check signal wire -G28 =>Page 128
	- Open circuit in knock sensor screen wiring		- Check knock sensor =>Page 140
	- Abnormal engine running noise (ancillaries loose)		- Rectify mechanical damage
	- Injector dirty		- Check injectors =>Page 67

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00580 Knock control cylinder 4 Control limit exceeded	- Poor quality fuel (less than RON 91)	- High fuel consumption - Loss of power - Maximum speed is not reached - Boost pressure reduction	- Fill up with petrol of at least RON 91
	- Signal wire of sender for engine speed -G28 or for ignition timing -G4 interrupted (loose contact) or interchanged		- Check signal wire -G28 =>Page 128
	- Open circuit in knock sensor screen wiring		- Check knock sensor =>Page 140
	- Abnormal engine running noise (ancillaries loose)		- Rectify mechanical damage



	- Injector dirty		- Check injectors =>Page 67
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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
00581 Knock control cylinder 5 Control limit exceeded	- Poor quality fuel (less than RON 91) - Signal wire of sender for engine speed -G28 or for ignition timing -G4 interrupted (loose contact) or interchanged - Open circuit in knock sensor screen wiring - Abnormal engine running noise (ancillaries loose) - Injector dirty	- High fuel consumption - Loss of power - Maximum speed is not reached - Boost pressure reduction	- Fill up with petrol of at least RON 91 - Check signal wire -G28 =>Page 128 - Check knock sensor =>Page 140 - Rectify mechanical damage - Check injectors =>Page 67

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01247 Solenoid valve 1 for activated charcoal filter -N80 Short to positive Open circuit/short to earth	- Fault in power supply to -N80 - Open circuit or short to earth between -N80 and engine control unit - -N80 defective - Signal output in engine control unit defective (control unit defective)	- Poor progression in part throttle range - Smell of petrol in vehicle - Idling speed not OK	- -Check -N80 => Page 99 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01249 Injector, cylinder 1 -N30 Short to positive Open circuit/short to earth	- Open circuit or short to earth or positive in wiring between -N30 and engine control unit - Fault in power supply to -N30 - -N30 defective - Signal output in engine control unit defective (control unit defective)	- Rough engine running	- Check injectors =>Page 67 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01250 Injector, cylinder 2 -N31			

Short to positive Open circuit/short to earth	- Open circuit or short to earth or positive in wiring between -N31 and engine control unit - Fault in power supply to -N31 - -N31 defective	- Rough engine running	- Check injectors =>Page 67
	- Signal output in engine control unit defective (control unit defective)		- Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01251 Injector, cylinder 3 -N32 Short to positive Open circuit/short to earth	- Open circuit or short to earth or positive in wiring between -N32 and engine control unit - Fault in power supply to -N32 - -N32 defective - Signal output in engine control unit defective (control unit defective)	- Rough engine running	- Check injectors =>Page 67 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01252 Injector, cylinder 4 -N33 Short to positive Open circuit/short to earth	- Open circuit or short to earth or positive in wiring between -N33 and engine control unit - Fault in power supply to -N33 - -N33 defective - Signal output in engine control unit defective (control unit defective)	- Rough engine running	- Check injectors =>Page 67 - Replace engine control unit =>Page 60

Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01253 Injector, cylinder 5 -N83 Short to positive Open circuit/short to earth	- Open circuit or short to earth or positive in wiring between -N83 and engine control unit - Fault in power supply to -N83 - -N83 defective - Signal output in engine control unit defective (control unit defective)	- Rough engine running	- Check injectors =>Page 67 - Replace engine control unit =>Page 60
01257 Idling stabilisation valve - N71			



Short to positive Open circuit/short to earth	- Open circuit or short to earth or positive in wiring between -N71 and engine control unit - Fault in power supply to -N71	- Engine speed deviates from specified speed when the engine is at operating temperature - A/C compressor cut-off at idle - Engine running problems	- Check -N71 => Page 80
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Output on VAS 5051	Possible causes of fault	Possible effects	Fault remedy
01262 Boost pressure control solenoid valve -N75 Short to positive Open circuit/short to earth	- Fault in power supply to -N75 - Open circuit or short to earth between -N75 and engine control unit - -N80 defective	- Boost pressure too high or too low - Extreme misfiring at full load (=>fault code 00544)	- Check -N75 => Engine, Mechanical Components; Repair group 21
65535 Control unit defective	- Missing earth connection to engine control unit - Engine control unit defective	- Engine will not start - With ignition on, no voltage at contact 37 of engine control unit	- Check earth connections using current flow diagram - Replace engine control unit =>Page 60

3 - Final control diagnosis

3.1 - Final control diagnosis

Notes:

- ♦ The final control diagnosis can only be performed with the engine stopped and the ignition switched on.
- ♦ The final control diagnosis is terminated if the engine is started or if an engine speed pulse is detected.
- ♦ During the final control diagnosis, the individual control elements are actuated (with the exception of the injectors) until the programme advances to the next control element by pressing the ► key.
- ♦ The control elements can be checked acoustically or by way of touch.

The final control diagnosis actuates the following components in the stated order:

Actuation sequence
1 Injector, cylinder 1 -N30
2 Injector, cylinder 2 -N31
3 Injector, cylinder 4 -N33
4 Injector, cylinder 5 -N83
5 Injector, cylinder 3 -N32
6 Idling stabilisation valve -N71
7 Solenoid valve 1 for activated charcoal filter -N80
8 Boost pressure control solenoid valve -N75

Test requirements:

- Fuses for engine electronics OK

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

- Fuel pump relay OK; checking =>Page 75 .

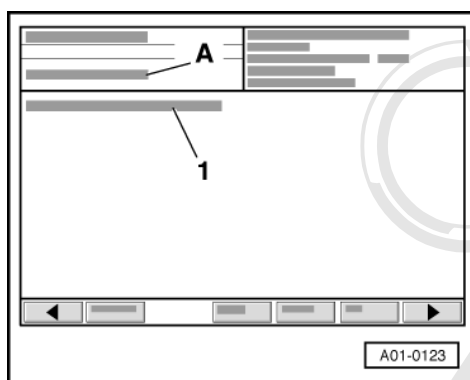


Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics". For this purpose, the ignition must be switched on.

-> Display on VAS 5051:

- Under -1- select the diagnostic function "03 - Final control diagnosis".



Actuating injectors

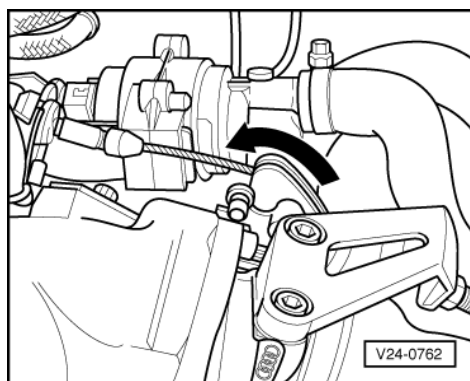
Note:

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The injectors are actuated according to the ignition sequence: cyl. 1, cyl. 2, cyl. 4, cyl. 5, cyl. 3.

-> Display on VAS 5051:

- A - 1st control element in test
- 12 - Injector, cylinder 1 -N30



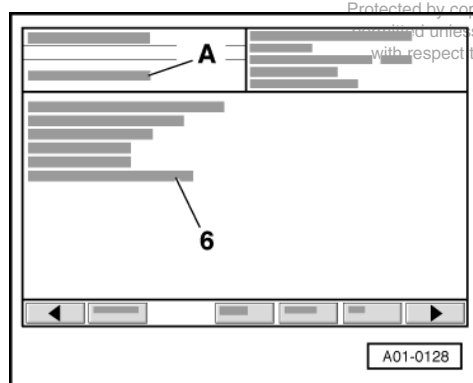
- -> Lift the throttle valve lever, hold it for 2...3 seconds and then slowly allow it to return.
- ♦ As soon as the idle speed position is reached, the injector must click five times.
- ♦ Then the control unit automatically switches to the next injector (note indication on display).
- Use this procedure to check all the injectors in sequence.

Note:

To switch to the next injector without testing, press the ▶ key.

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

- Check injectors => Page **67** .


Actuating idling stabilisation valve

- Press the ▶ key.

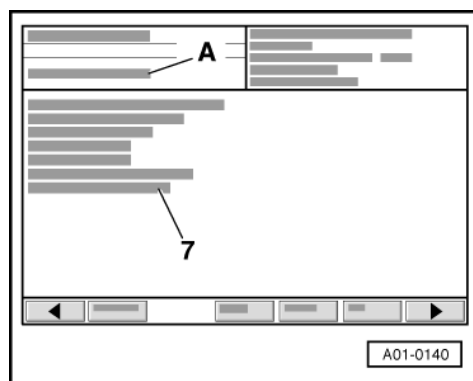
-> Display on VAS 5051:

- A - 6th control element being tested
- 6 - Idling stabilisation valve -N71

- ♦ This valve will continue to be actuated in intervals (clicks) until the ▶ key is pressed to switch to the next control element.

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

- Check idling stabilisation valve -N71 => Page **80** .



Actuating activated charcoal filter system solenoid valve (tank breather valve)

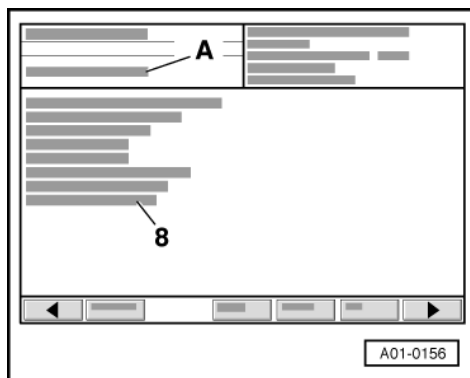
-> Display on VAS 5051:

- A - 7th control element in test
- 7 - Fuel tank breather valve -N80

- ◆ This valve will continue to be actuated in intervals (clicks) until the ► key is pressed to switch to the next control element.

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

- Check solenoid valve 1 for activated charcoal filter -N80 => Page 99 .



Actuating solenoid valve for boost pressure control

- Press the ► key.

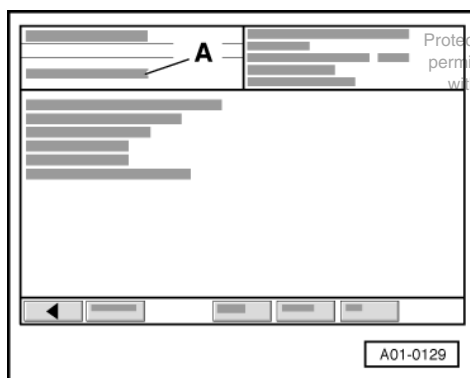
-> Display on VAS 5051:

- A - 8th control element being tested
- 8 - Solenoid valve for boost pressure limitation -N75

- ◆ This valve is actuated in intervals (clicks) until the final control diagnosis is finished by pressing the ► key.

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

=> Engine, Mechanical Components; Repair group 21



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- Press the ► key.

-> Display on VAS 5051:

- A - Control element test is completed



- Exit function "03 - Final control diagnosis" by pressing the ◀ key.

4 - Basic setting

4.1 - Basic setting

Test conditions for operations with engine running

- Test drive performed for at least 5 minutes.
- No faults stored in fault memory
- Engine still idling after the interrogation of the fault memory
- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioner switched off.

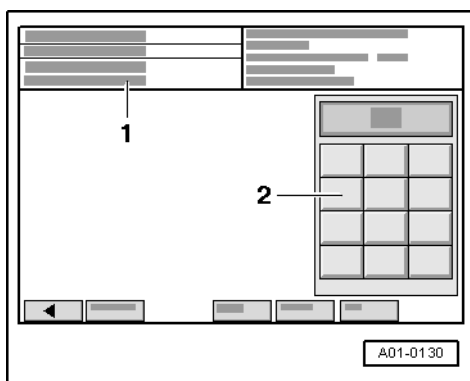


Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics". For this purpose, the engine must be running at idling speed.

-> Display on VAS 5051:

- Under -1- select diagnostic function "04 - Basic setting".



-> Display on VAS 5051:

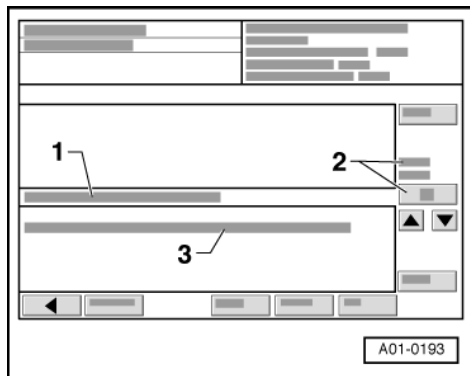
- 1 - Enter display group
- Enter the desired 3-digit display group number in zone -2- and confirm the entry by pressing the Q key.

Note:

On selection of a display group number in the basic setting, the ACF-valve is closed.

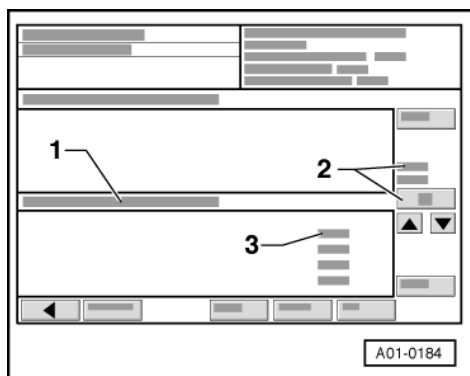
Example:

- Enter "000" for "display group number 000" and confirm the entry by pressing the Q key.



-> Display on VAS 5051 for display group 000:

- 1 - Basic setting
- 2 - Display group 0
- 3 - Display zone 1 2 3 4 5 6 7 8 9 10



-> Display on VAS 5051 for display group 001...255:

- 1 - Basic setting
- 2 - Display group X
- 3 - Display zone 1
Display zone 2
Display zone 3
Display zone 4

Note:

On selection of a display group greater than 002, the values of display group 002 are always displayed.

- End function "04 - Basic setting" by pressing the ◀ key.

Display group 000

Display zones	
---------------	--



1	2	3	4	5	6	7	8	9	10		Specified value	Corresponds to
										Ignition angle 1)	35...37	8...12°BTDC
										Lambda learned value 3)	100...150	
										Lambda control (fluctuates, after approx. 1.5 minutes) 2)	123...133	
										Idling stabilisation characteristic curve control 1)	41...61	
										Idling stabilisation load adaption 1)	123...137	
										Idling stabilisation characteristic curve zero point 1)	70...125	
										Idling stabilisation working range 1)	121...135	
										Engine speed 1)	77...83	770...830 rpm
										Engine load 1)	20...26	
										Coolant temperature 1)	184...215	+ 85...105 °C

1) The evaluation of the individual measured values takes place in the function "Read measured value block" => from Page 26

Test table - display group 000, lambda control

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
8	Outside tolerance range	- Lambda adaption not yet complete	- After re-connecting the battery/engine control unit, allow engine to run at operating temperature for at least 10 minutes at idling speed Check lambda learned value => Display zone 9
		- Lambda probe dirty or defective	- Check Lambda probe => Page 94
		- Unmetered air downstream of air mass meter	- Eliminate cause
		- Fuel system pressure	- Check fuel system pressure => Page 64
		- Injector defective - Defective spark plug	- Check injectors => Page 67 Check spark plugs
		- Leaks in exhaust system	- Eliminate cause
	Constant 128	- Lambda probe heating defective or lambda probe dirty or defective	- Check lambda probe heating => Page 94
		- Fuel reserve too low	- Fill fuel tank, at least 10 l in the tank
	Jumps	- Fuel reserve too low	
		- Lambda probe heating defective or loose contact in the wire for the lambda probe signal	- Check lambda probe heating => Page 94

Test table - display group 000, lambda learned value

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
9	Higher than 150	- Fuel reserve too low	- Fill fuel tank, at least 10 l in the tank
		- Fuel pressure too low	- Check fuel pressure => Page 64

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
		- Unmetered air between air mass meter and turbocharger or in intake manifold	- Eliminate cause
	Lower than 100	- Fuel pressure too high	- Check fuel system pressure => Page 64
		- Air mass meter -G70 defective	- Check -G70 =>Page 84
		- Lambda probe dirty or defective	- Check Lambda probe => Page 94
		- Unmetered air between turbocharger and throttle valve unit	- Eliminate cause

Display group 001

Display group 1 XXXX rpm XXX °C X.XX XX° BTDC				• Indicated on display • Display zones 1...4
			Ignition timing ▪ 8...12°BTDC: OK; if outside tolerance => read measured value block, test table - display group 001, Page 37	
			Lambda control ▪ 0.96...1.04: OK (fluctuates, after approx. 1.5 minutes); if outside tolerance => Page 27	
			Coolant temperature ▪ 85...105 °C: OK; if outside tolerance => read measured value block, test table - display group 001, Page 37	
			Engine speed ▪ 770...830 rpm OK; if outside tolerance => read measured value block, test table - display group 001, Page 37	

Test table, display group 001

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
3	Outside tolerance range	- Lambda adaption not yet complete	- After re-connecting the battery/engine control unit, allow engine to run at operating temperature for at least 10 minutes at idling speed Check lambda learned value => display group 2, display zone 2
		- Lambda probe dirty or defective	- Check Lambda probe => Page 94
		- Unmetered air downstream of air mass meter	- Eliminate cause
		- Fuel system pressure	- Check fuel system pressure => Page 64
		- Injector defective - Defective spark plug	- Check injectors =>Page 67 Check spark plugs
		- Leaks in exhaust system	- Eliminate cause
	Constant 1.0	- Lambda probe heating defective or lambda probe dirty or defective	- Check lambda probe heating => Page 94
		- Fuel reserve too low	- Fill fuel tank, at least 10 l in the tank
	Jumps	- Fuel reserve too low	



Display zone	Display on VAS 5051	Cause of fault	Fault remedy
		- Lambda probe heating defective or loose contact in the wire for the lambda probe signal	- Check lambda probe heating => Page 94

Display group 002

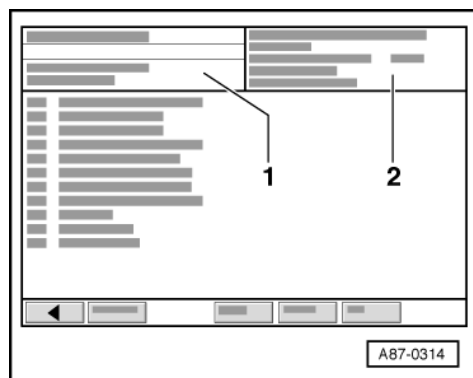
Display group 2				▪ Indicated on display ▪ Display zones 1...4
XX.X	XX.X	XXX	XXX	
				Ignore
			Ignore	
		Lambda learned value ▪ 0.78...1.17: OK; if outside tolerance => Page 28		
Lambda control =>Display group 001, display zone 3				

Test table, display group 002

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
2	Higher than 1.17	- Fuel reserve too low	- Fill fuel tank, at least 10 l in the tank
		- Fuel pressure too low	- Check fuel pressure => Page 64
		- Unmetered air between air mass meter and turbocharger or in intake manifold	- Eliminate cause
	Lower than 0.78	- Fuel pressure too high	- Check fuel system pressure => Page 64
		- Air mass meter -G70 defective	- Check -G70 => Page 84
		- Lambda probe dirty or defective	- Check Lambda probe => Page 94
		- Unmetered air between turbocharger and throttle valve unit	- Eliminate cause

5 - Encoding control unit

5.1 - Encoding control unit

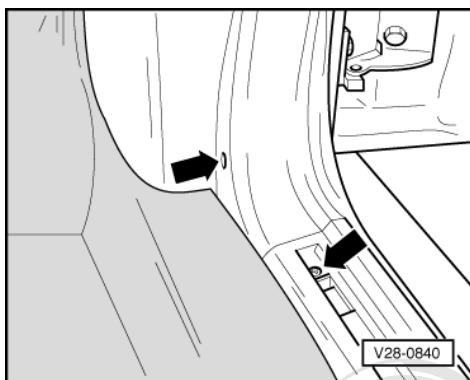


Note:

-> If the control unit identification displays a code -2- that does not correspond to the vehicle, it is necessary to code the control unit..

Encoding variations

Coding	Vehicles for	Bridge between contacts of coding connector
1	European countries	none
4	USA, Canada	1 and 4

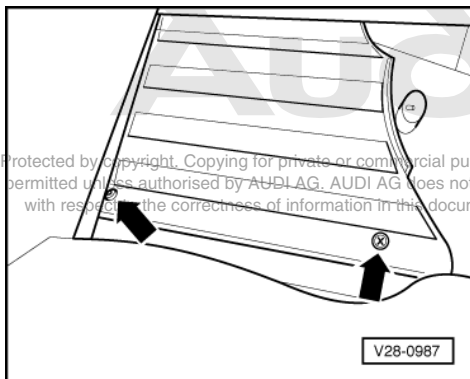


If the appropriate coding is not displayed:

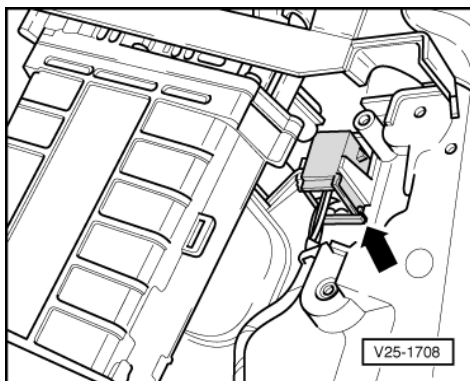
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70; Trims Trims

- Pull back floor covering at front of right footwell (if necessary, cut open the perforated seam on the left with a knife).

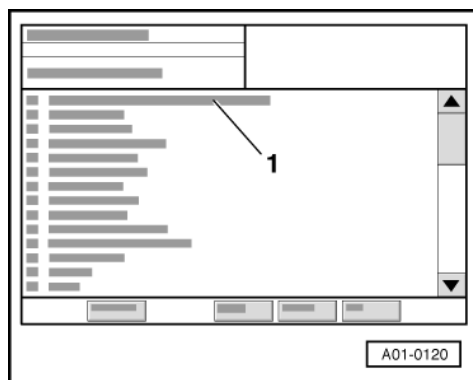


- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.





- -> Test the contacts of the coding connector -Arrow- with reference to the coding table.



-> Display on VAS 5051:

- With the vehicle diagnostic, testing and information system VAS 5051 still connected, select the vehicle system "01 - Engine electronics" from the selection -1-.



-> The control unit identification and code -2- appears on the display of the vehicle diagnostic, testing and information system VAS 5051.

If the appropriate coding is not displayed:

- Test the wiring connection of the coding connector => Page 47.

6 - Reading measured value block

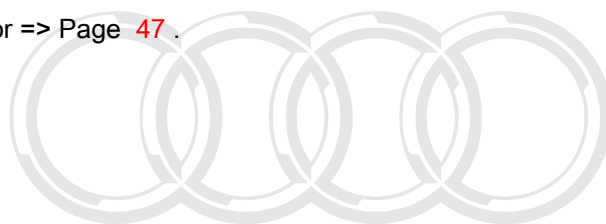
6.1 - Reading measured value block

Test requirements:

- No faults stored in fault memory
- Engine still idling after the interrogation of the fault memory
- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off.

Test sequence

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics". For this purpose, the ignition must be switched on.



Audi

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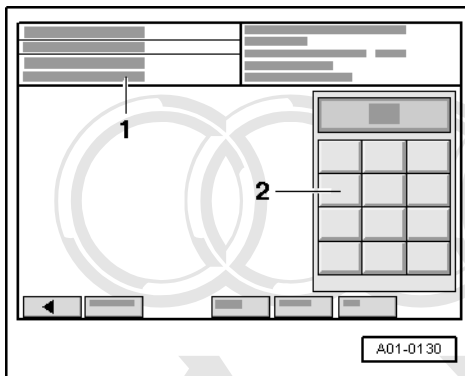
or after each required process:

- Start the engine.



-> Display on VAS 5051:

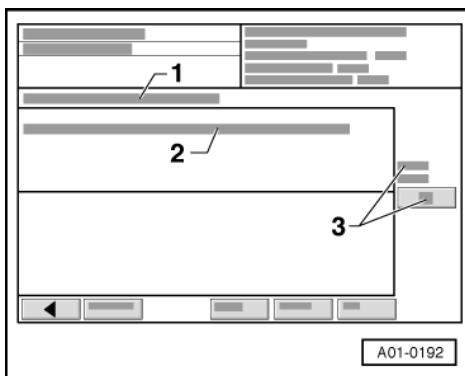
- Under -1- select diagnostic function "08 - Read measured value block".



-> Display on VAS 5051:

- 1 - Enter display group

- Enter the desired display group number (three figures) in zone -2- => Display group overview, Page 32 and confirm the entry by pressing the Q key.

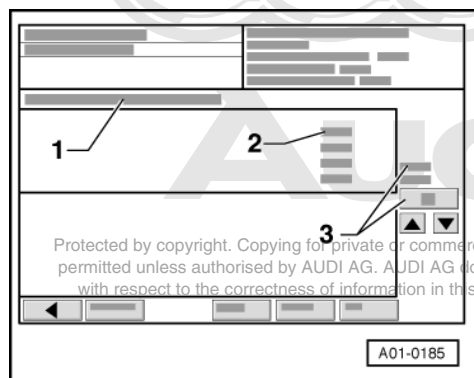


-> Display on VAS 5051 for display group 000:

- 1 - Read measured value block
- 2 - Display zone 1 2 3 4 5 6 7 8 9 10



3 - Display group 0



-> Display on VAS 5051 for display group 001...255:

- 1 - Read measured value block
- 2 - Display zone 1
- Display zone 2
- Display zone 3
- Display zone 4
- 3 - Display group X

Notes:

- ♦ To change to another display group, proceed as follows:

Display group	VAS 5051
Higher	Press s key
Lower	Press t key

- ♦ The display groups 002...009 are only displayed in newer models.
- ♦ On selection of a display group greater than 009, the values of display group 009 are always displayed.

- Exit function "08 - Read measured value block" by pressing the ◀ key.

6.2 - Display group overview

Display group no.	Display zone	Designation
000	1	Coolant temperature
	2	Engine load
	3	Engine speed
	4	Idling stabilisation working range
	5	Idling stabilisation characteristic curve zero point
	6	Idling stabilisation load adaption
	7	Idling stabilisation characteristic curve control
	8	Lambda control 1)
	9	Lambda learned value 1)
	10	Ignition timing

- 1) Assessment in "Read measured value block" not possible - use basic setting

Display group no.	Display zone	Designation
001	1	Engine speed
	2	Coolant temperature
	3	Lambda control value 1)
	4	Ignition timing
002	1	Engine speed
	2	Injection period
	3	Engine control unit power supply voltage
	4	Atmospheric pressure (ambient air pressure)
003	1	Engine speed
	2	Engine load
	3	Throttle valve angle
	4	Intake manifold temperature

1) Assessment in "Read measured value block" not possible - use basic setting

Display group no.	Display zone	Designation
004	1	Engine speed
	2	Engine load
	3	Vehicle speed
	4	Operating status: X X X X 1 Overrun cut-off X X X 1 X Idling speed switch closed X X 1 X X Partial and full load X 1 X X X Ignore 1 X X X X Ignore

Display group no.	Display zone	Designation
005	1	Engine speed
	2	Learned value 1 of characteristic curve of idling stabilisation valve -N71
	3	Duty cycle (actuation) of idling stabilisation valve -N71
	4	Operating status: X X X 0 Display always 0 X X 0 X Display always 0 X 1 X X Increased idling speed due to high heating/cooling output of air conditioner 1 X X X A/C compressor switched on
006 1)	1	Lambda control value
	2	Lambda learned value when idling with inactive tank venting (solenoid valve for activated charcoal filter system for 1 minute)
	3	Lambda learned value when idling or at partial load with active tank venting (solenoid valve for activated charcoal filter system for 6 minutes)
	4	Lambda learned value at partial load with active tank venting (solenoid valve for activated charcoal filter system for 6 minutes)

1) Assessment in "Read measured value block" not possible - use basic setting



Display group no.	Display zone	Designation
007	1	Idling stabilisation control value
	2	Learned value 1 of characteristic curve of idling stabilisation valve -N71
	3	Learned value 2 of characteristic curve of idling stabilisation valve -N71
	4	Idling stabilisation learned value (basic air requirement) ▪ A/C compressor switched on
008	1	Idling stabilisation learned value (basic air requirement) ▪ A/C compressor switched off
	2	Idling stabilisation learned value (basic air requirement) ▪ A/C compressor switched on
	3	Idling stabilisation learned value (basic air requirement) ▪ A/C compressor switched off
	4	Idling stabilisation learned value (basic air requirement) ▪ A/C compressor switched on
009	1	Engine speed
	2	Load signal (figure computed internally by control unit for injection time)
	3	Duty cycle (actuation) of solenoid valve for activated charcoal filter system -N80
	4 1)	Lambda learned value when idling or at partial load with active tank venting (solenoid valve for activated charcoal filter system for 6 minutes)

1) Assessment in "Read measured value block" not possible - use basic setting

6.3 - Specified display values

Display group 000

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Display zones										Specified value	Corresponds to
1	2	3	4	5	6	7	8	9	10		
									Ignition timing	35...37	8...12°BTDC
									Ignore	100...150	
									Ignore	123...133	
									Idling stabilisation characteristic curve control	41...61	
									Idling stabilisation load adaption	123...137	
									Idling stabilisation characteristic curve zero point	70...125	
									Idling stabilisation working range	121...135	
									Engine speed	77...83	770...830 rpm
									Engine load	20...26	
									Coolant temperature	184...215	+ 85...105 °C

Test table - display group 000

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
1	Higher than 215	- Coolant temperature sender -G62 defective - Wiring fault between coolant temperature sender -G62 and engine control unit.	- Interrogate fault memory => Page 135
		- Radiator fan not working	- Check function
	Lower than 184	- Coolant temperature sender -G62 defective - Wiring fault between coolant temperature sender -G62 and engine control unit.	- Interrogate fault memory => Page 135
		- Coolant thermostat constantly open	- Check coolant thermostat => Engine, Mechanical Components; Repair group 19

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
2	Higher than 26	- Consumers switched on, e.g. air conditioner on; steering wheel to end stop	- Switch off all electrical loads Centre steering wheel
		- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Unmetered air between turbocharger and throttle valve	- Eliminate cause
	Lower than 20	- Unmetered air between air mass meter and turbocharger - Unmetered air downstream of throttle valve - Vacuum hose disconnected - Crankcase breather leaking	- Eliminate cause
		- Air mass meter -G70 defective	- Check -G70 =>Page 84

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
3	Higher than 83	- Idling stabilisation valve -N71 at lower control stop	- Briefly press throttle 4 times at intervals of 15 seconds
		- Unmetered air downstream of throttle valve - Vacuum hose disconnected	- Eliminate cause
		- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Air Conditioner	- Check air conditioner => Heating, Air Conditioner; Repair group 01; Self-diagnosis Self-diagnosis
		- Idling stabilisation valve -N71 defective - Wiring fault between idling speed stabilisation valve -N71 and engine control unit	- Perform final control diagnosis =>Page 80



Display zone	Display on VAS 5051	Cause of fault	Fault remedy
	Lower than 77	- Idling stabilisation valve -N71 sticks	- Check -N71 => Page 80

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
4	Higher than 135	- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Battery charge state	- Check charge => Electrical System; Repair group 27
	Lower than 121	- Unmetered air downstream of throttle valve	- Eliminate cause
		- Idling stabilisation valve -N71 sticks	- Perform final control diagnosis =>Page 80
5	Higher than 125	- Leak between throttle valve/intake manifold or air mass meter and turbocharger (in vacuum circuit)	- Eliminate cause
	Lower than 70	- Idling stabilisation valve -N71 sticks	- Perform final control diagnosis =>Page 80
		- Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory => Page 84

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
6	Outside tolerance range	- Control of idling stabilisation valve -N71	- Briefly press throttle and observe readout; it must fluctuate between 123 and 137
		- Throttle valve potentiometer -G69 incorrectly set	- Adjust -G69 => Adjusting idling switch -F60, Page 84
		- Unmetered air	- Eliminate cause
7	Outside the Tolerance range	- Idling stabilisation valve -N71	- Check -N71 => Page 80
		- Unmetered air	- Eliminate cause
10	Higher than 37	- Idling stabilisation valve -N71	- Perform final control diagnosis =>Page 80
	Lower than 35	- Coolant temperature too low	- => Display zone 1
		- Idling switch -F60 defective or incorrectly set	- Perform final control diagnosis =>Page 80
			- Check -F60 and adjust => Page 106

Display group 001

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Display group 1		Indicated on display	
XXX rpm	XXX °C	XXX	XX
		Display zones 1... 4	
		Ignition timing	
		▪ 8...12° BTDC: OK	
		Ignore	
		Coolant temperature	
		▪ 85...105 °C: OK	
		Engine speed	
		▪ 770...830 rpm: OK	

Test table, display group 001

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
1	Higher than 830 rpm	- Idling stabilisation valve -N71 at lower control stop	- Briefly press throttle 4 times at intervals of 15 seconds
		- Unmetered air downstream of throttle valve	- Eliminate cause
		- Vacuum hose disconnected	
		- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Air Conditioner	- Check air conditioner => Heating, Air Conditioner; Repair group 01; Self-diagnosis Self-diagnosis
		- Idling stabilisation valve -N71 defective	- Perform final control diagnosis =>Page 80
		- Wiring fault between idling speed stabilisation valve -N71 and engine control unit	
	Lower than 770 rpm	- Idling stabilisation valve -N71 sticks	- Check -N71 => Page 80

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
2	Above 105 °C	- Coolant temperature sender -G62 defective	- Interrogate fault memory => Page 135
		- Wiring fault between coolant temperature sender -G62 and engine control unit.	
		- Radiator fan not working	- Check function
	Below 85 °C	- Coolant temperature sender -G62 defective	- Interrogate fault memory => Page 135
		- Wiring fault between coolant temperature sender -G62 and engine control unit.	
		- Coolant thermostat constantly open	- Check coolant thermostat => Engine, Mechanical Components; Repair group 19

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
4	Greater than 12° BTDC	- Idling stabilisation valve -N71	- Perform final control diagnosis =>Page 80
		- Coolant temperature too low	- => Display zone 1
	Less than 8 °BTDC	- Idling stabilisation valve -N71	- Perform final control diagnosis =>Page 80
		- Idling switch -F60 defective or incorrectly set	- Check -F60 and adjust => Page 106

Display group 002

Display group 2	◀ Indicated on display
-----------------	------------------------



XXX rpm	X.X ms	XX.X V	XXXX mbar	• Display zones 1...4
				Atmospheric pressure (ambient air pressure): No specification
				Engine control unit power supply voltage • 12.5...14.5 V: OK
				Ignore
				Engine speed =>Display group 001, display zone 1

Test table, display group 002

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
3	Greater than 14.5 V	- Voltage control on alternator defective	- Check voltage; if necessary, fit a new voltage regulator.
		- Overvoltage due to boost start or rapid charger	- Interrogate fault memory => Page 5
	Less than 12.5 V	- Alternator defective, battery heavily discharged	- Check voltage, charge battery
		- High load on electrical system shortly after starting engine due to high charge current and load from ancillaries	- Increase engine speed for several minutes and switch off ancillaries
		- Contact resistance in power supply or earth connection for engine control unit	- Check power supply to engine control unit =>Page 138
		- Current drain with ignition off	- Eliminate current drain
4	Constant 968 mbar	- Altitude sensor -F96	- Check -F96 =>Page 88

Display group 003

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Display group 3				• Indicated on display
XXX rpm	XX %	XX <°	XX °C	• Display zones 1...4
				Intake manifold temperature: No specification
				Throttle valve angle • 5...10 <°: OK
				Engine load • 26...35 %: OK
				Engine speed =>Display group 001, display zone 1

Test table, display group 003

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
2	Above 35 %	- Consumers switched on, e.g. air conditioner on; steering wheel to end stop	- Switch off all electrical loads Centre steering wheel
		- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Unmetered air between turbo-charger and throttle valve	- Eliminate cause

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
	Below 26 %	- Unmetered air between air mass meter and turbocharger - Unmetered air downstream of throttle valve - Vacuum hose disconnected - Crankcase breather leaking	- Eliminate cause
		- Air mass meter -G70 defective	- Check -G70 =>Page 84

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
3	Greater than 10 <°	- Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory => Page 84
		- Throttle cable setting	- Adjust throttle cable => Fuel Supply - Petrol Engines; Repair group 20
		- Throttle valve sticking	- Eliminate cause
	Less than 5 <°	- Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory => Page 84

Display group 004

Display group 4				Indicated on display
XXX rpm	XX %	X km/h	XXXXX	Display zones 1...4
Operating status				00010: OK (when idling - idling speed switch closed)
Vehicle speed				4 km/h: OK (below 4 km/h, 4 km/h is always displayed)
Engine load =>Display group 003, display zone 2				
Engine speed =>Display group 001, display zone 1				

Test table, display group 004

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
4	00000	- -F60 idling switch defective	- Checking idling switch -F60 => Page 106

Display group 005

Display group 5				Indicated on display
XXX rpm	XXX	XX %	XX XX	Display zones 1...4
Operating status				00 00: OK (when idling - air conditioner switched off)
Ignore				
Learned value 1 of characteristic curve of idling stabilisation valve -N71				70...125: OK
Engine speed =>Display group 001, display zone 1				



Test table, display group 005

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
2	Higher than 125	- Unmetered air between air mass meter and turbocharger - Unmetered air downstream of throttle valve	- Eliminate cause
		- Idling stabilisation valve -N71 defective	- Check -N71 => Page 80
	Lower than 70	- Idling stabilisation valve -N71 sticks or defective	- Perform final control diagnosis =>Page 80
		- Throttle valve potentiometer -G69 defective or incorrectly set	- Interrogate fault memory => Page 84
4	10 00	- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110

Display group 007

Display group 7		- Indicated on display - Display zones 1...4	
XXX	XXX	XX	XXX
			Idling stabilisation learned value ▪ 123...137: OK
			Learned value 2 of characteristic curve of idling stabilisation valve - N71 ▪ 41...61: OK
			Learned value 1 of characteristic curve for idling stabilisation valve -N71 =>Display group 005, display zone 2
			Idling stabilisation control value ▪ 121...140: OK

Test table, display group 007

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
1	Higher than 140	- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Battery discharged	- Check voltage, charge battery
	Lower than 121	- Unmetered air downstream of throttle valve	- Eliminate cause
		- Idling stabilisation valve -N71 sticks or defective	- Perform final control diagnosis =>Page 80
3	Outside tolerance range	- Idling stabilisation valve -N71 defective	- Check -N71 => Page 80
3	Idling greater than 2 <°	- -G69 throttle valve potentiometer defective	- Interrogate fault memory => Page 103
		- Idling switch -F60 defective or incorrectly set	- Check -F60 and adjust => Page 106
4	Outside tolerance range	- Control of idling stabilisation valve -N71	- Briefly press throttle and observe readout; it must fluctuate between 123 and 137

Display zone	Display on VAS 5051	Cause of fault	Fault remedy
		- Throttle valve potentiometer -G69 incorrectly set	- Adjust -G69 => Adjusting idling switch -F60, Page 84
		- Unmetered air	- Eliminate cause

Display group 009

Display group 9			- Indicated on display - Display zones 1...4
XXX rpm	X.X ms	XX	XX XX
			Ignore
			Duty cycle (actuation) of valve for solenoid valve for activated charcoal filter system -N80 Alternating for 6 minutes 0...7 % and for 1 minute 0 %: OK
			Load signal 1.0...1.3 ms: OK
Engine speed => Display group 001, display zone 1			

Test table - display group 009

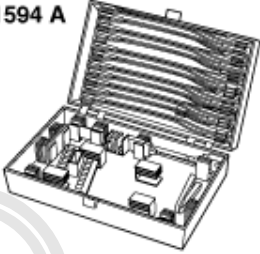
Display zone	Display on VAS 5051	Cause of fault	Fault remedy
2	Greater than 1.3 ms	- Consumers switched on, e.g. air conditioner on; steering wheel to end stop	- Switch off all electrical loads Centre steering wheel
		- A/C compressor signal present despite air conditioner switched off	- Check A/C compressor signal => Page 110
		- Unmetered air between turbo-charger and throttle valve	- Eliminate cause
		- Air mass meter -G70 defective	- Check -G70 =>Page 84
	Less than 1.0 ms	- Unmetered air between air mass meter and turbocharger	- Eliminate cause
		- Unmetered air downstream of throttle valve	
		- Vacuum hose disconnected	
		- Crankcase breather leaking	
3	Greater than 7 %	- Solenoid valve 1 for activated charcoal filter -N80 sticking	- Perform final control diagnosis => Page 99
	Constant 0 %	- Air mass meter -G70 defective	- Check -G70 =>Page 84
3	Greater than 7 %	- Solenoid valve 1 for activated charcoal filter -N80	- Perform final control diagnosis => Page 99
	Constant 0 %	- System faults	- Interrogate fault memory => Page 99

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7 - Checking diagnostic connector wiring connections

7.1 - Checking diagnostic connector wiring connections

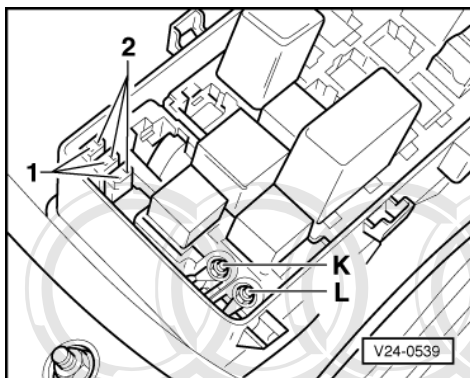
V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A  Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.	
	G24-0015

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

Important
Switch off ignition before checking wiring.

7.2 - Checking voltage supply to "black" diagnostic connector



-> Installation position of diagnostic connector: In relay carrier I

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

Contact assignment for "black" diagnostic connector:

- 1 - Earth
- 2 - Terminal 30

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Connect multimeter as follows to measure voltage.

Black diagnostic connector Contact	Measure to
1	Battery positive
2	Car body earth point

- Specification: approx. battery voltage

If the specifications are not obtained:

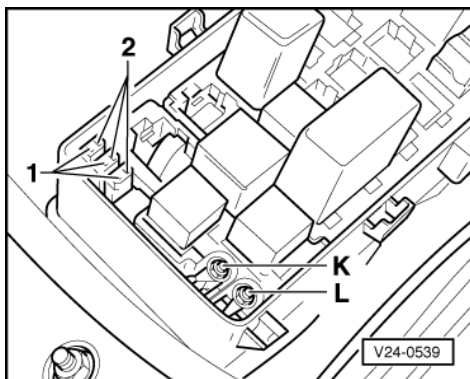
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

7.3 - Checking wiring between "white" diagnostic connector and engine control unit

Note:

This test must be performed when one of the following fault displays appears on the screen of the connected vehicle diagnostic, testing and information system VAS 5051:

- ◆ Communication problem
- ◆ K-wire not switching to earth
- ◆ K-wire not switching to positive
- ◆ L-wire not switching to earth
- ◆ L-wire not switching to positive





The wiring connection between the "white" diagnostic connector and engine control unit is routed via junctions K and L.

-> Location of diagnostic connectors and wiring junctions K and L: In relay carrier I

Contact assignment for "white" diagnostic connector:

- 1 - L-wire
- 2 - K-wire

Checking K and L wires, vehicles without immobiliser

- Switch ignition off.
- Disconnect all the wires of vehicle systems with diagnostic capability from junction K.
- Determine which is the K lead for the engine control unit and connect it to wiring junction K.

Notes:

- ♦ If wires of different colours are connected to junction K, determine the wire colour:

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

- ♦ If wires of the same colour are connected to wiring junction K, determine wire assignment using test box V.A.G 1598 A (resistance measurement).
- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics". For this purpose, the ignition must be switched on.

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-> If the control unit identification -2- of the engine control unit appears on the display of the vehicle diagnostic, testing and information system VAS 5051:

- ♦ The fault is located in another system with self-diagnosis capability.
- Determine which other systems are capable of self-diagnosis, connect each one to wiring junction K in turn and test.

If the control unit identification is again not displayed:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59.
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

White diagnosis- connector Contact	Wiringjunction	Test box V.A.G 1598 A Socket
1	L	13

2	K	55
---	---	----

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

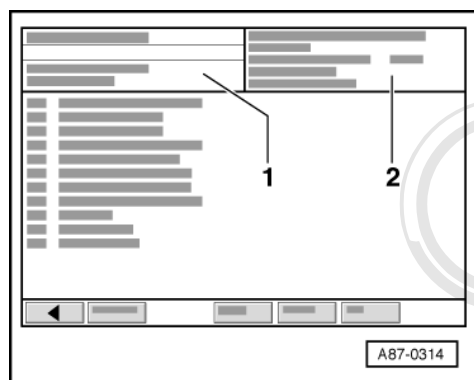
Note:

Proceed in the same way to test the L wire.

Checking K and L wires in vehicles with immobiliser

The wiring between the "white" diagnostic connector and the engine control unit is routed via junction K in the relay carrier with fuse box and the immobiliser control unit:

Junction	White diagnostic connector Contact	Immobilizer control unit		Engine control unit Contact
		IN	OUT	
K	2	10	9	55
L	1	-	-	13



- Connect the vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "25 - Immobiliser" from the selection. For this purpose, the ignition must be switched on.

-> If the control unit identification -2- of the immobiliser appears on the display of the vehicle diagnostic, testing and information system VAS 5051:

- Continue with check A => Page 45 .

If immobiliser control unit identification is not displayed:

- Continue with check B => Page 46 .

Check A

- Test the immobiliser control unit and the wiring connection as follows:
- Switch ignition off.
- Pull connector off immobiliser control unit -J362.

=> Electrical system; Repair group 96; Servicing immobiliser; Removing and installing immobiliser control unit
Servicing immobiliser Removing and installing immobiliser control unit

- Use cable link to jumper contacts 9 and 10 in connector.
- Switch the ignition on and on the vehicle diagnostic, testing and information system VAS 5051 select the vehicle system "25 - Immobiliser" from the selection.

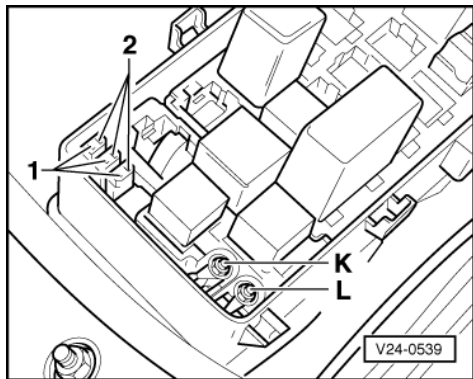
If engine control unit identification is displayed:



- Renew immobiliser control unit.

If engine control unit identification is not displayed:

- Use current flow diagram to check wiring between immobiliser control unit -J362 and engine control unit for open circuit or short to earth/positive.



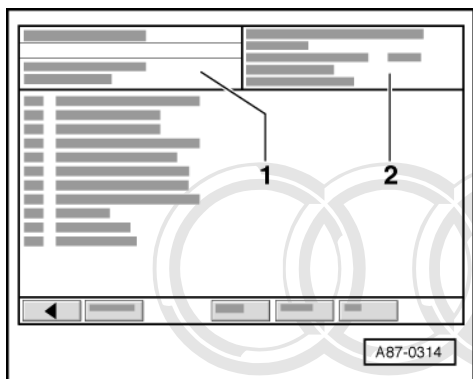
Check B

- Switch ignition off.

Note:

-> All the diagnostic wiring of the various systems come together in wiring junction K. A defective wire (short to earth or positive) or a defective control unit may also lead to one of the fault messages mentioned.

- Disconnect all the wires of vehicle systems with diagnostic capability from junction K.
- Determine which is the K lead for the immobiliser -J362 and the engine control unit and connect it to wiring junction K.



- Switch the ignition on and on the vehicle diagnostic, testing and information system VAS 5051 select the vehicle system "25 - Immobiliser" from the selection.

-> If the control unit identification -2- of the immobiliser appears on the display of the vehicle diagnostic, testing and information system VAS 5051:

- ♦ The fault is located in another system with self-diagnosis capability.
- Determine the other systems with self-diagnosis capability, connect to junction K and test.

If immobiliser control unit identification is not displayed:

- Pull connector off immobiliser control unit -J362.

=> Electrical System; Repair group 96; Servicing immobiliser; Removing and installing immobiliser control unit
 Servicing immobiliser Removing and installing immobiliser control unit

- Using the current flow diagram test the wire connection between contact 10 of the connector of the immobiliser control and junction K for open circuit or short circuit to earth or positive.
- Rectify any open/short circuit as necessary.
- Replace immobiliser control unit if neither an open circuit nor a short circuit is found.

7.4 - Checking cable connection of coding connector

The following test only needs to be carried out if the correct coding does not appear in the display of the vehicle diagnostic, testing and information system VAS 5051 despite the coding connector not being occupied.

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Test the following wiring connections for short circuit to earth and positive:

Coding connector Contact	Test box V.A.G 1598 A Socket
1	38
2	39
3	12
4	30

- Rectify short circuit using current flow diagram.

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If the wiring connection is OK, but the correct coding still does not appear in the display of vehicle diagnostic, testing and information system VAS 5051:

- Replace engine control unit => Page 60 .



24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

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

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- ♦ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ♦ Do not touch or disconnect ignition cables when the engine is running or at starter speed.
- ♦ To run the engine at starting speed without actually starting it (for example, in order to test compression), detach connectors from both output stages for ignition coils and also detach connectors from the injectors. After completing the work, interrogate the fault memory.
- ♦ For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.
- ♦ Always switch off the ignition before washing the engine.
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ♦ Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.)

Note the following points if testers and measuring instruments have to be used during a road test:

Important

- ♦ **Always install testers and measuring instruments on the rear seat and have a second person operate them from there.**
- ♦ **If test equipment is operated from the front passenger seat, the person sitting there could be injured if the front passenger airbag were triggered in the event of an accident.**

1.3 - Rules for cleanliness

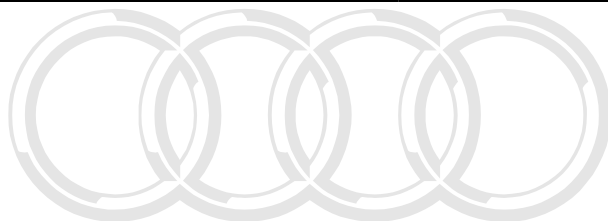
When working on the fuel supply/injection system, carefully observe the following 6 cleanliness rules:

- ♦ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ♦ Place removed parts on a clean surface and cover. Use lint-free 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 toolboxes etc.).
- ♦ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.

- ♦ Unplugged electrical connectors:
Protect from dirt and moisture.
Make sure connections are dry when attaching.

1.4 - Technical data

Engine code letters		AAN (2.2 l / 4V / 169 kW-engine)
Engine control unit	Part no.	=>Parts list
	Speed governing by deactivation of injectors	approx. 7200 rpm
Idling speed adjustment	Not adjustable - controlled by the idling speed stabilisation	800 ± 30 rpm
Fuel pressure regulator	Fuel pressure at idling	
	Vacuum hose connected	3.4...3.7 bar
	Vacuum hose detached	4.0...4.2 bar
Holding pressure after 10 minutes	Engine cold	approx. 3.5 bar
	Engine warm	approx. 3.8 bar
Injectors	Injection quantity (30 s)	150...170 ml
	Resistance (ambient temperature)	15...17 Ω

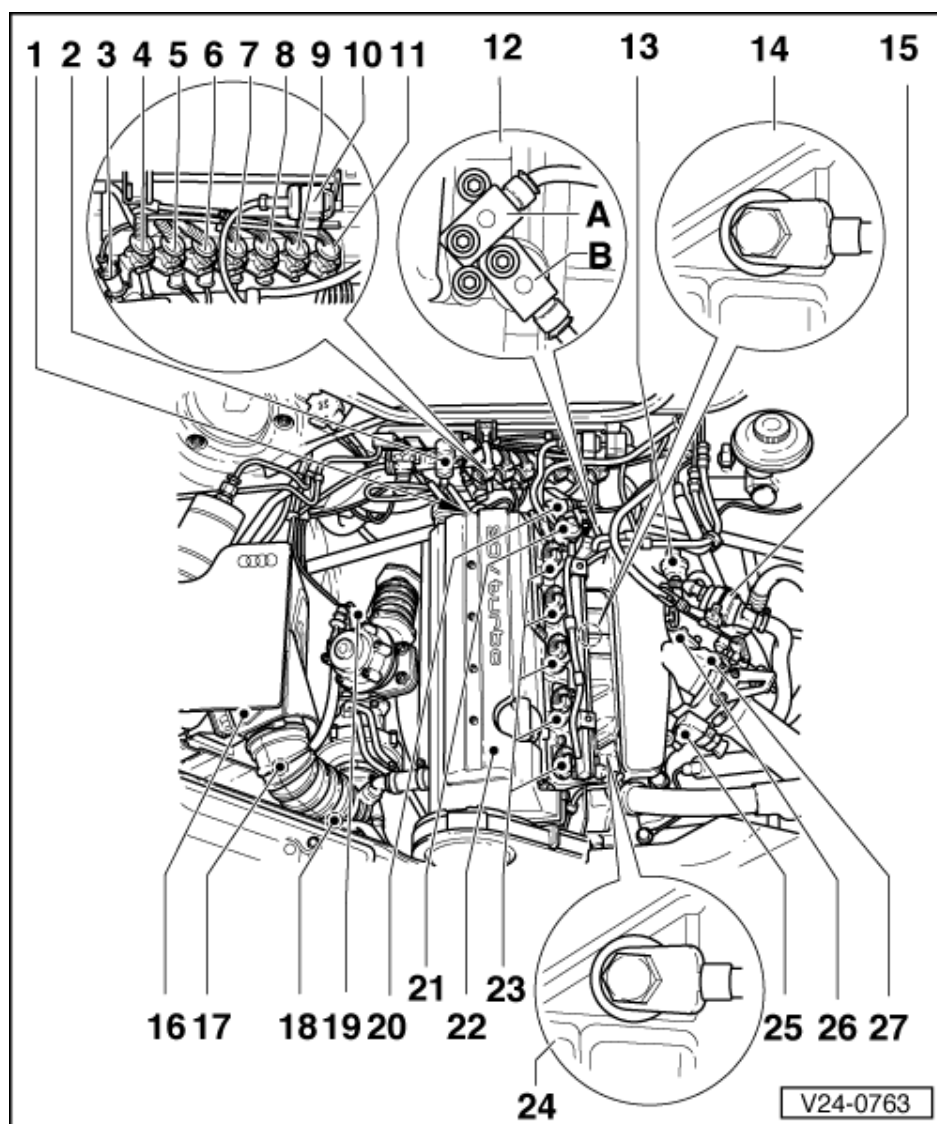


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1.5 - Fitting locations overview



- Engine control unit -J220

- ◆ In electronics box in passenger footwell
- ◆ Removing and installing=>Page 60

- Altitude sender -F96

- ◆ In electronics box in passenger footwell
- ◆ Checking => Page 88

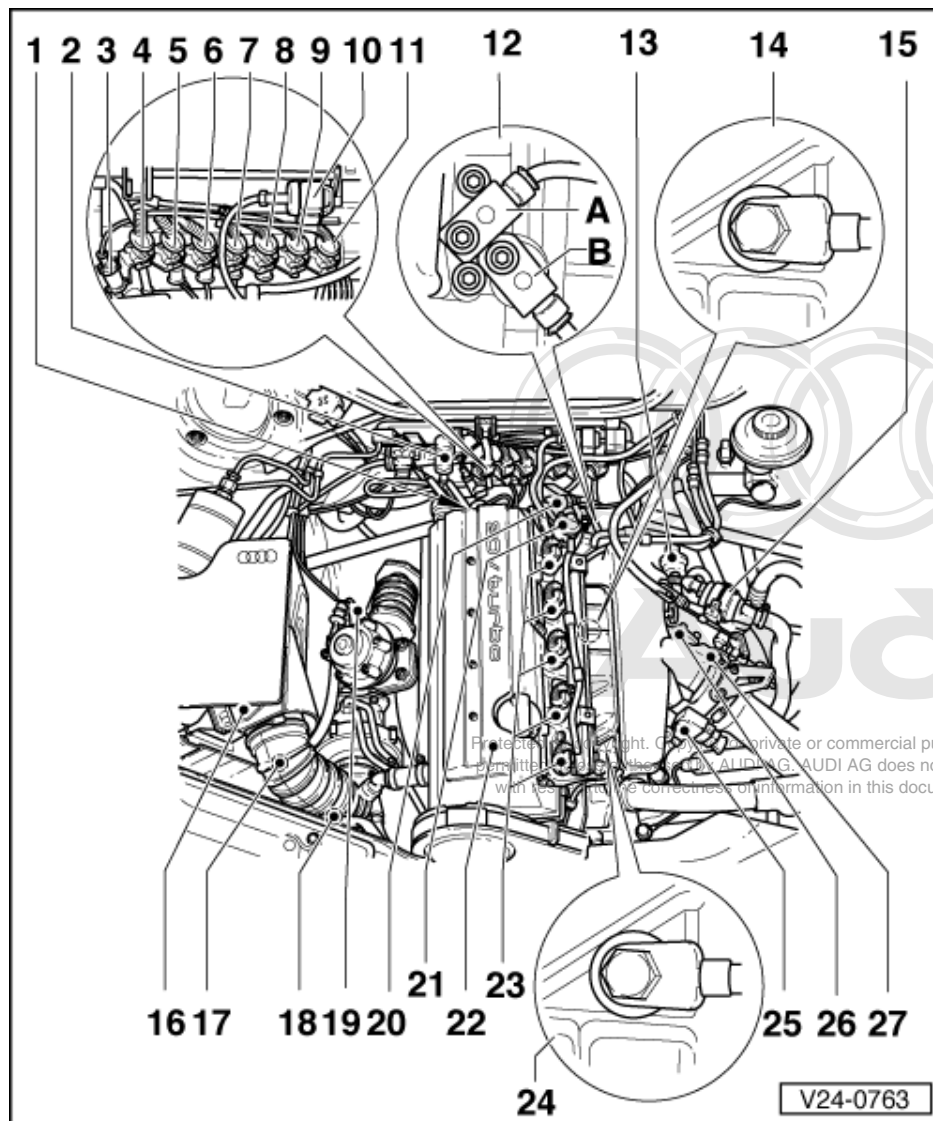
- Coding connector (6-pin)

- ◆ Black
- ◆ In electronics box in passenger footwell

1 Coolant temperature sender -G62

- ◆ Checking => Page 135
- ◆ If necessary, release cooling system pressure before removal

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2 Output stages

- ◆ -N122 for actuation for cylinders 1, 2 and 3
- ◆ -N127 for actuation for cylinders 4 and 5

3 Connector

- ◆ 1-pin, for lambda probe signal -G39

4 Connector

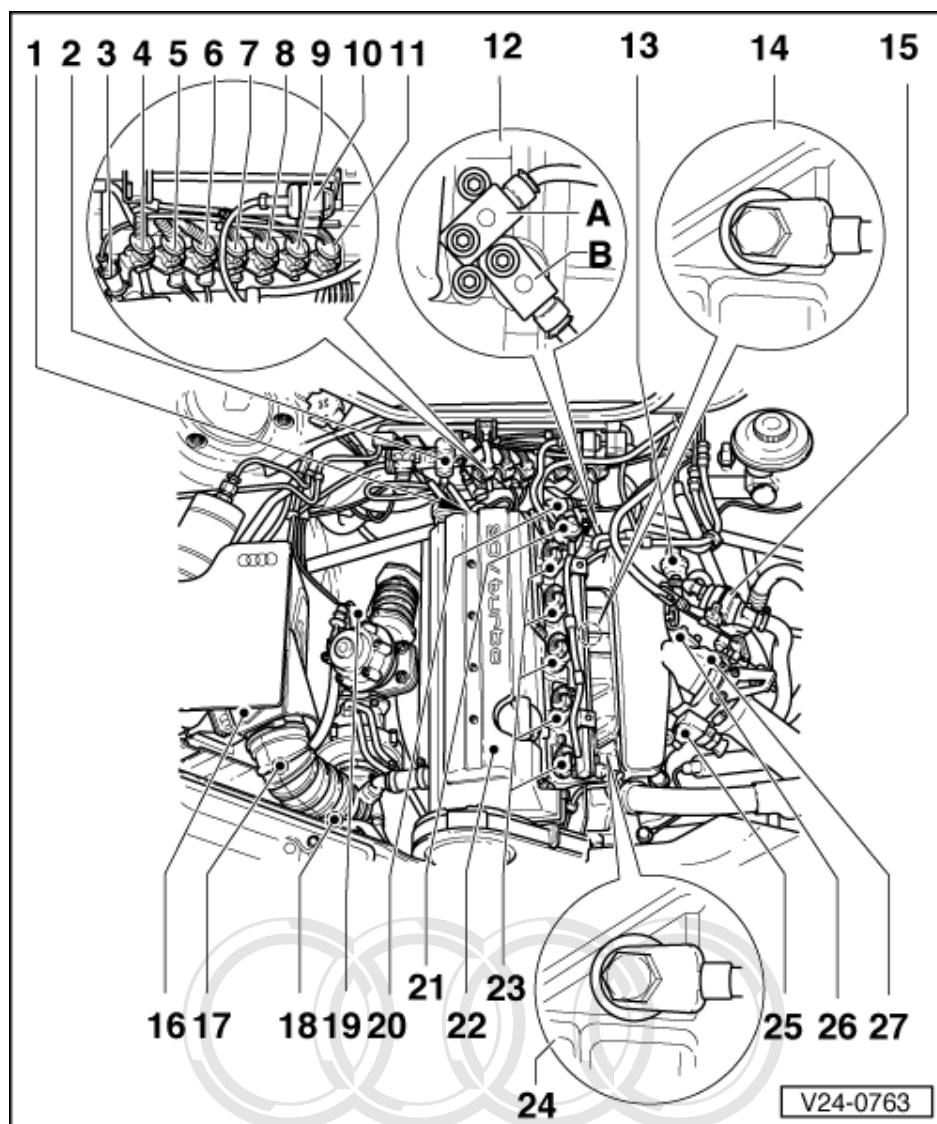
- ◆ Black 2-pin, for lambda probe heating -Z19

5 Connector

- ◆ White
- ◆ For ignition coil -N163 (cylinder 4) and -N164 (cylinder 5)

6 Connector

- ◆ White
- ◆ For ignition coil -N (cylinder 1), -N125 (cylinder 2) and -N158 (cylinder 3)

**7 Connector**

- ◆ Black
- ◆ For ignition timing sender -G4

8 Connector

- ◆ Grey
- ◆ For engine speed sender -G28

9 Connector

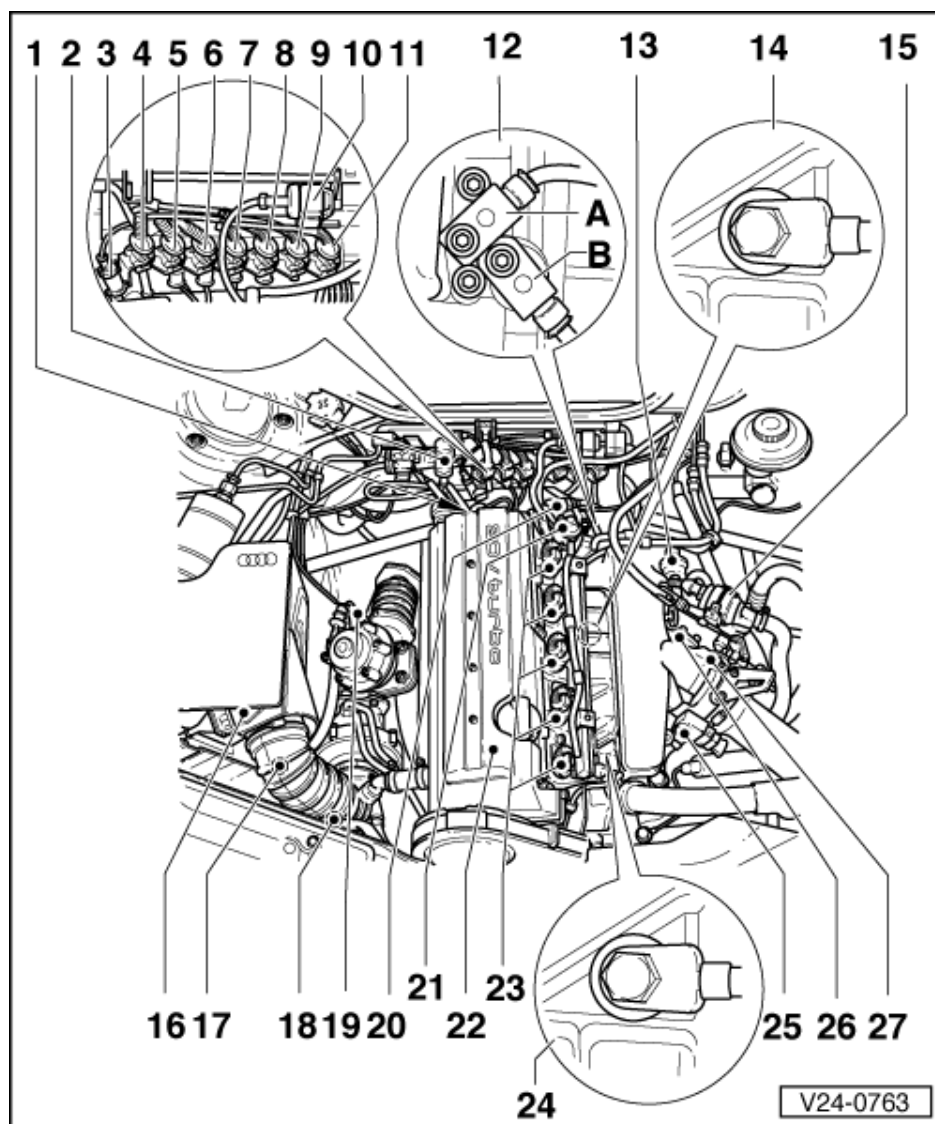
- ◆ Blue
- ◆ For knock sensor 1 -G61

10 Water separator**11 Connector**

- ◆ Green
- ◆ For knock sensor 2 -G66

12 Sender

- ◆ A - Ignition timing sender -G4, (reference mark sender) black
- ◆ B - Sender for engine speed -G28, grey



13 Solenoid valve 1 for activated charcoal filter -N80

- ♦ Checking => Page 99

14 Knock sensor 2 -G66

- ♦ Rear

15 Idling stabilisation valve -N71

- ♦ Checking => Page 80

16 Air mass meter -G70

- ♦ Checking => Page 84

17 Boost pressure control solenoid valve -N75

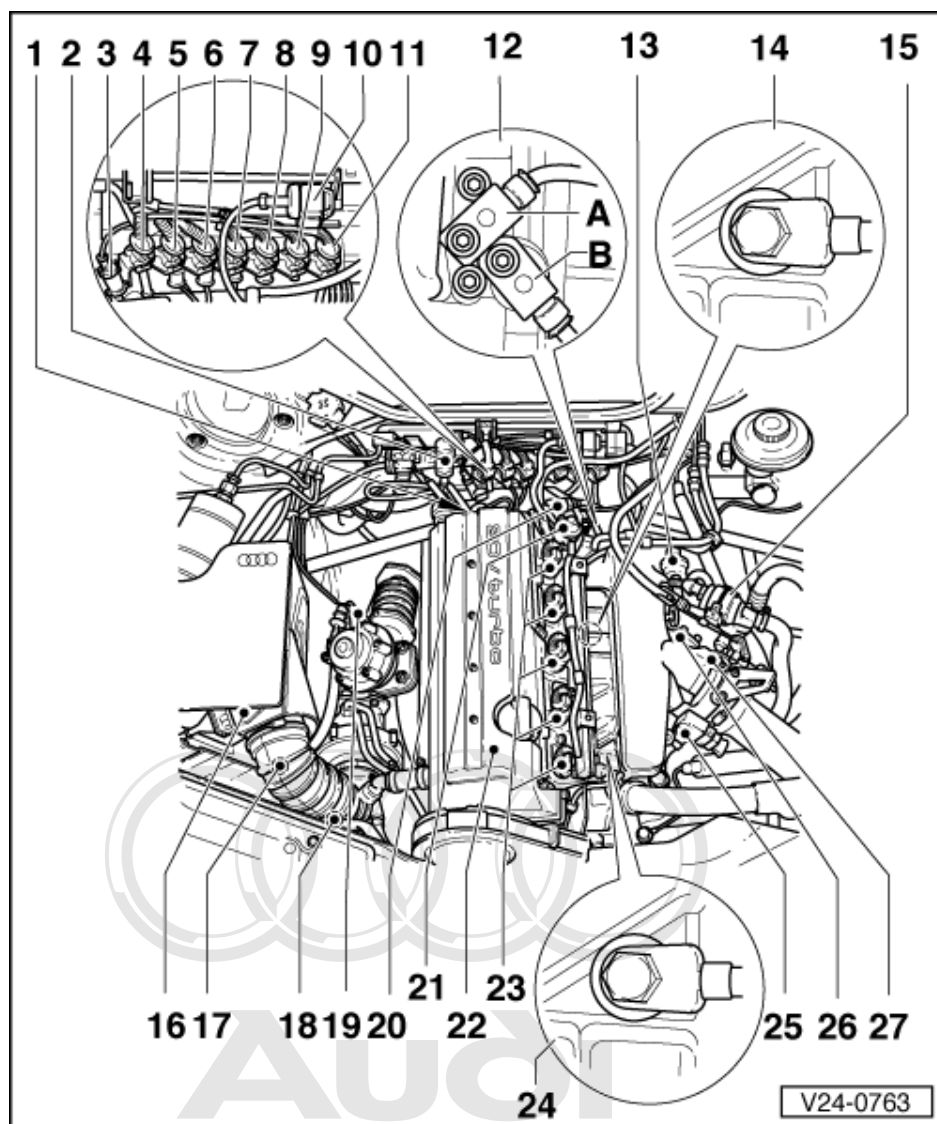
- ♦ Checking:

=> Engine, Mechanical Components; Repair group 21

18 Deceleration cut-off valve

- ♦ Checking:

=> Engine, Mechanical Components; Repair group 21

**19 Lambda probe -G39 with lambda probe heating -Z19**

- ◆ Check lambda probe and lambda control => Page 94
- ◆ Check lambda probe heating => Page 96
- ◆ Removing and installing => Page 97

20 Hall sender -G40

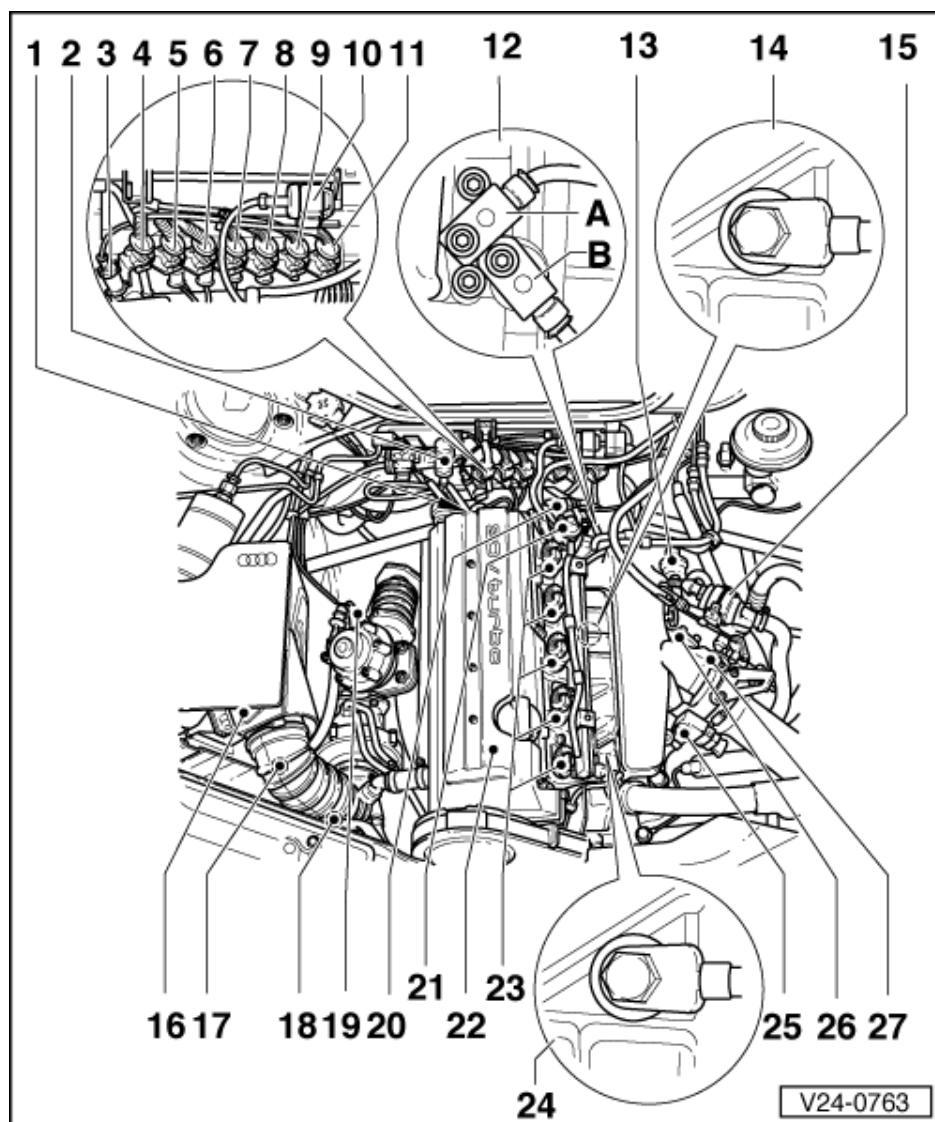
- ◆ Fitting location for model year 1991: at rear on cylinder head
- ◆ Fitting location as of model year 1992 => Fig. 1
- ◆ Checking => Page 142

21 Fuel pressure regulator

- ◆ Checking => Page 64

22 Ignition coil

- ◆ Cylinder 1 -N
- ◆ Cylinder 2 -N128
- ◆ Cylinder 3 -N158
- ◆ Cylinder 4 -N163
- ◆ Cylinder 5 -N164
- ◆ Checking => Page 119



23 Injectors

- ♦ Cylinder 1 -N30
- ♦ Cylinder 2 -N31
- ♦ Cylinder 3 -N32
- ♦ Cylinder 4 -N33
- ♦ Cylinder 5 -N83
- ♦ Checking => Page 67
- ♦ Removing and installing=>Page 71

24 Knock sensor 1 -G61

- ♦ Front

25 -G69 throttle valve potentiometer

- ♦ With idling switch -F60
- ♦ Checking => Page 103

26 Intake air temperature sender -G42

- ♦ Checking => Page 132

27 Throttle valve unit

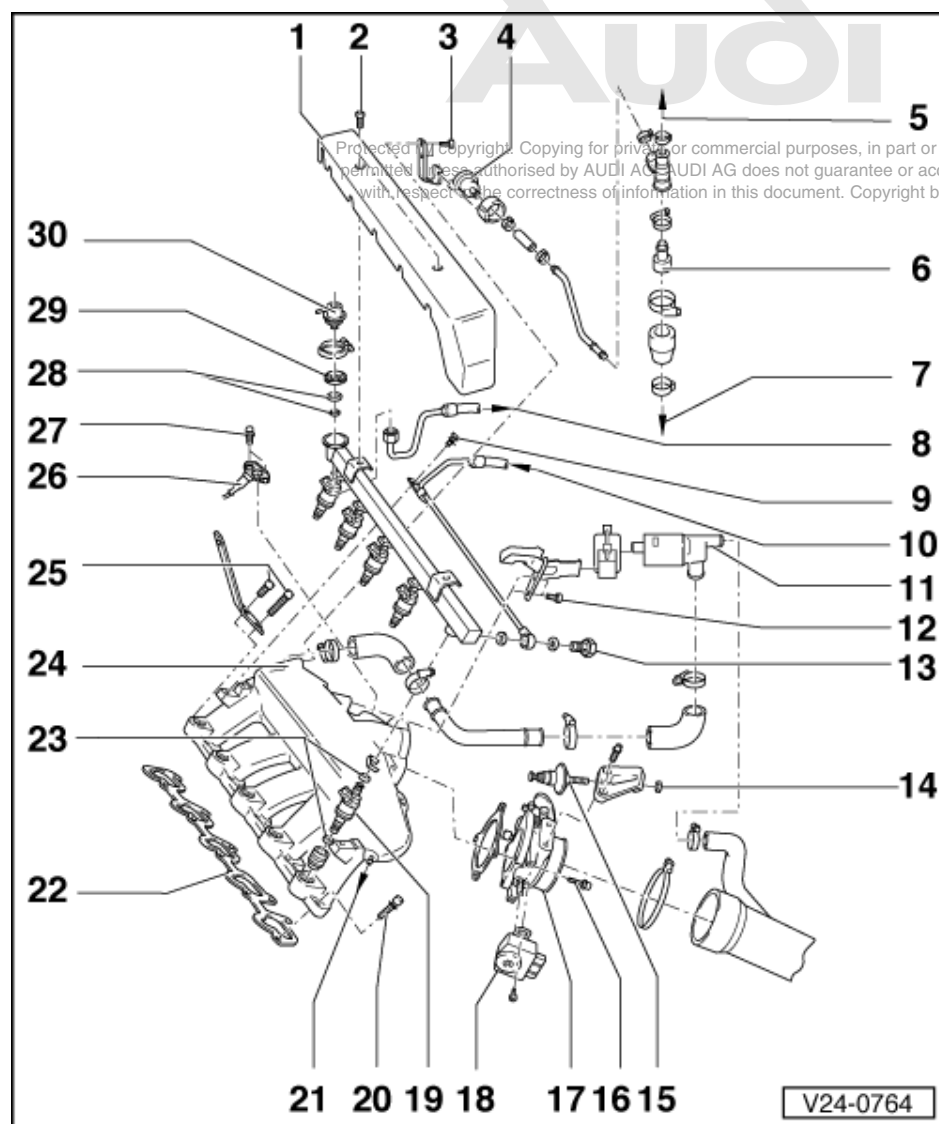
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-> Fig.1 Fitting location of Hall sender -G40 as of model year 1992

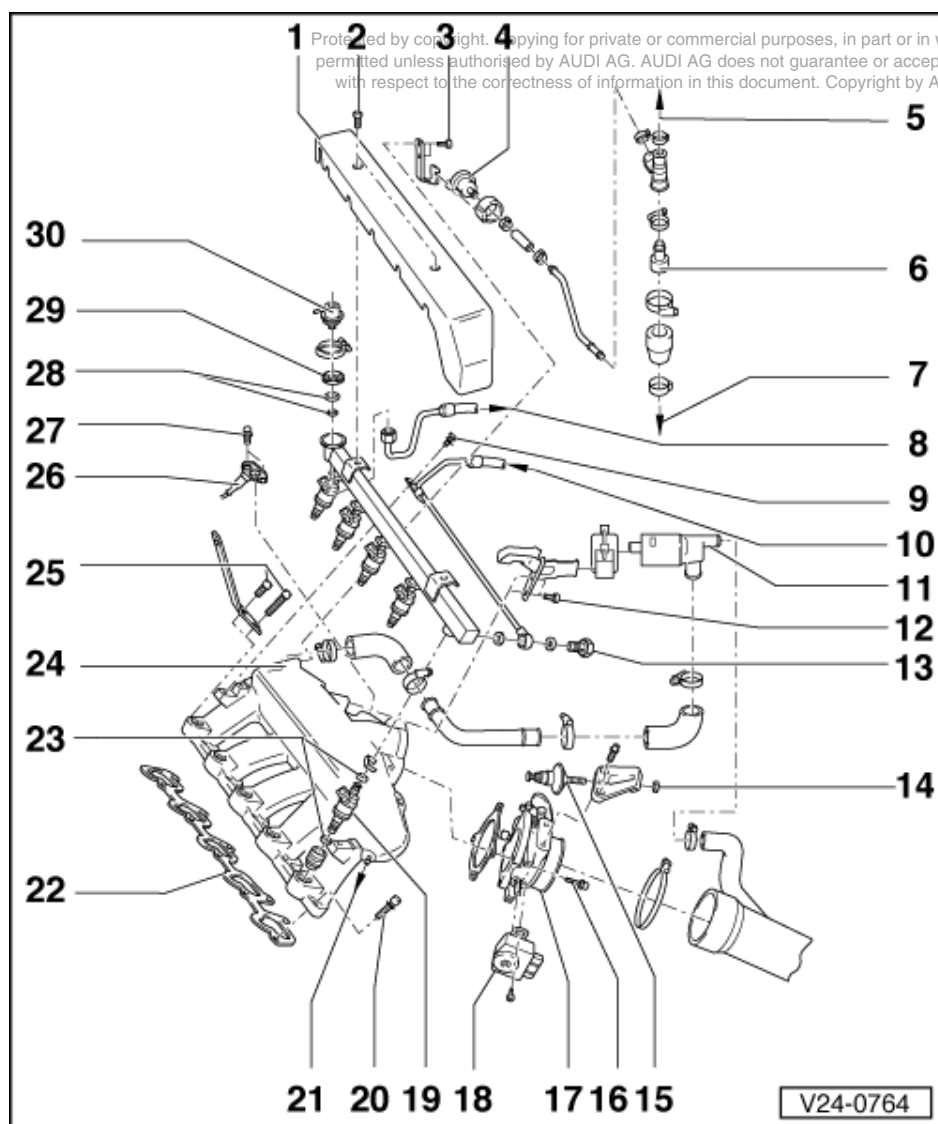
The Hall sender is seated behind the camshaft pulley. For removal, the camshaft pulley must be removed.

=> Engine, Mechanical Components; Repair group 13

1.6 - Removing and installing injection system components



- 1 Cover
 - ♦ For injectors
- 2 10 Nm
- 3 10 Nm
- 4 Solenoid valve 1 for activated charcoal filter -N80
- 5 To intake manifold
- 6 Non-return valve
- 7 To crankcase breather
- 8 Fuel return pipe
 - ♦ Tighten to 25 Nm
- 9 10 Nm
- 10 Fuel feed pipe
 - ♦ Tighten to 25 Nm



- 11 Idling stabilisation valve -N71
- 12 10 Nm
- 13 Banjo bolt - 25 Nm
- 14 10 Nm
- 15 Closing damper
 - ♦ Check and adjust =>Page 109
- 16 10 Nm



17 Throttle valve unit

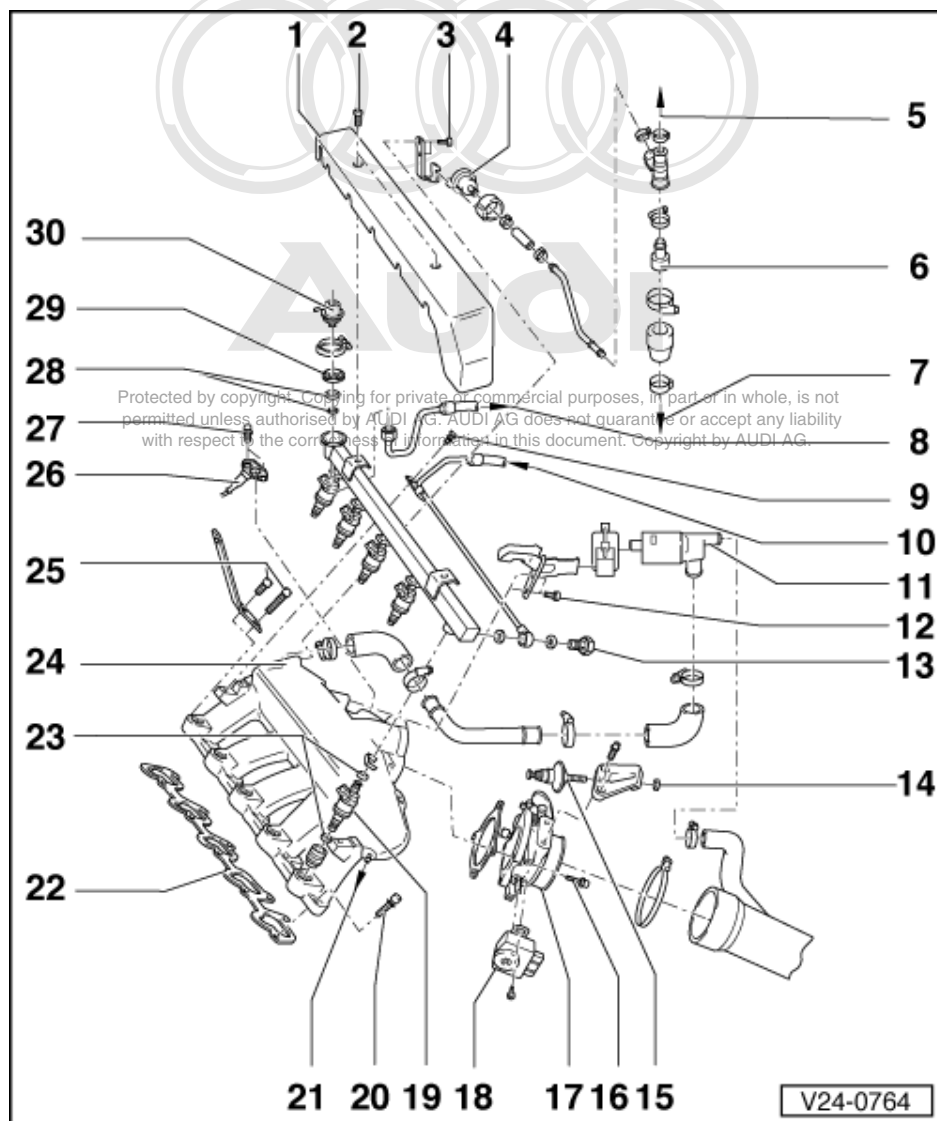
18 -G69 throttle valve potentiometer

- ♦ With idling switch -F60

19 Injector

- ♦ Removing and installing=>Page 71

20 25 Nm



21 Vacuum connection

- ♦ For deceleration cut-off valve

22 Seal

- ♦ Replace

23 O-ring

- ♦ Replace

24 Intake manifold

25 25 Nm

26 Intake air temperature sender -G42

27 10 Nm

28 O-ring

- ♦ Replace

29 Strainer

30 Fuel pressure regulator

1.7 - Checking wiring and components with test box V.A.G 1598 A and adapter 1598/5

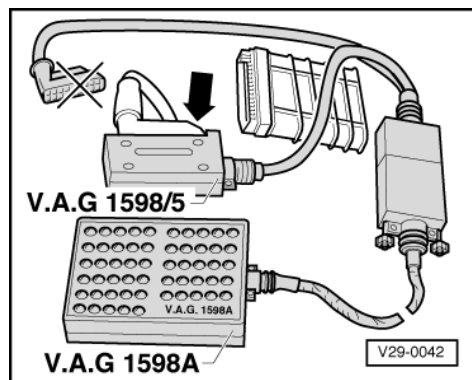
Notes:

- ◆ During the diagnosis with the vehicle diagnostic, testing and information system VAS 5051, the test box V.A.G 1598 A must not be connected.
- ◆ Allow 30 seconds after switching off ignition before detaching or attaching connector of engine control unit.
- ◆ Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.)

Important

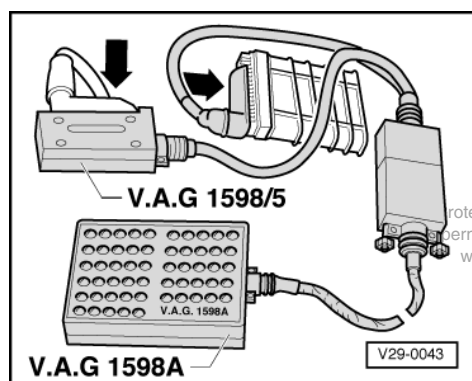
To prevent damage to the electronic components, select appropriate measuring range before connecting the measuring cables and observe the test requirements.

- Switch ignition off.
- Remove engine control unit => Page 60 .
- Disengage retaining clip and unplug control unit connector.



-> Tests on the connector of engine control unit

- With the ignition switched off, connect test box V.A.G 1598 A only to the connector of the engine control unit (control unit remains disconnected) using adapter V.A.G 1598/5.

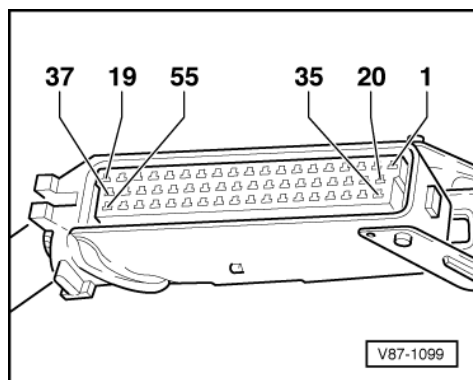


-> Tests with connected engine control unit

- Connect test box V.A.G 1598 A with adapter V.A.G 1598/5 in addition to control unit.

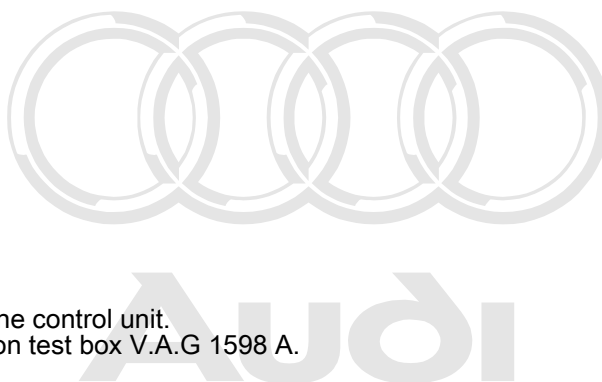


- Carry out test as described in the appropriate repair procedures.



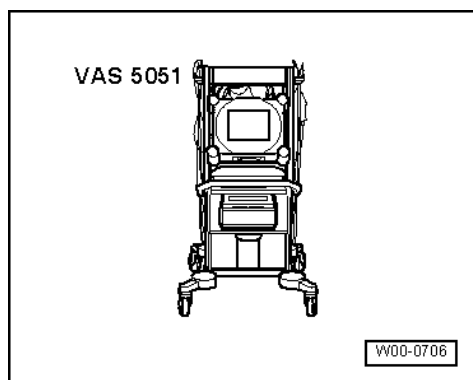
Notes:

- ♦ -> Contact assignment at the connector of the engine control unit.
- ♦ The contact layout is identical to the socket layout on test box V.A.G 1598 A.



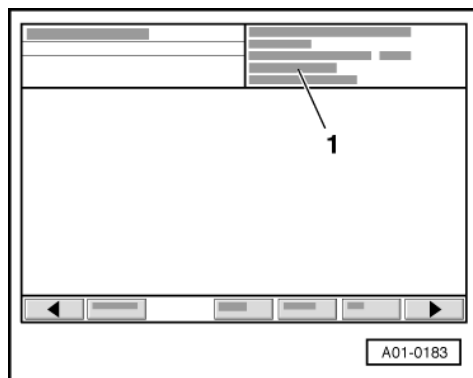
1.8 - Replacing engine control unit

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Special tools and workshop equipment required

- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

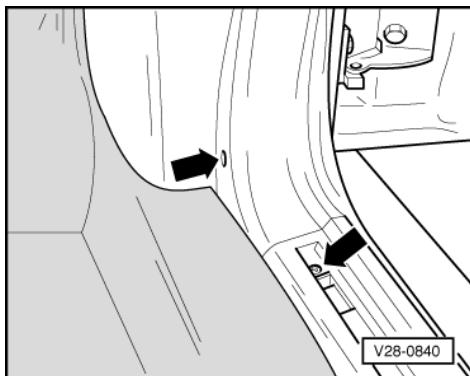


Removing

- Connect vehicle diagnostic, testing and information system VAS 5051 => Page 1 and select vehicle system "01 - Engine electronics". For this purpose, the ignition must be switched on.

-> Display on VAS 5051:

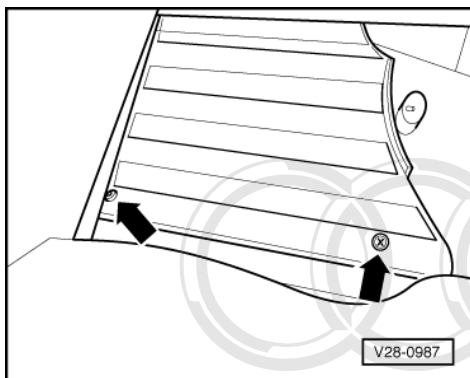
- 1 - Control unit identification of the engine control unit => Page 4
- Always start by displaying and printing out the control unit identification.
- Switch ignition off.



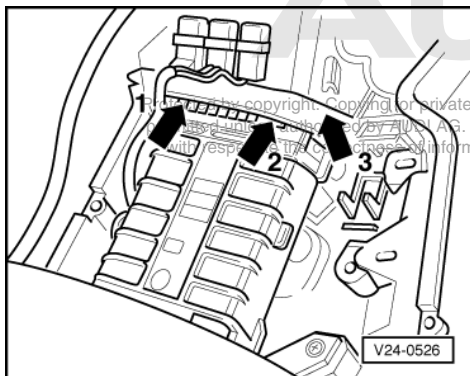
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70; Trims Trims

- Pull back floor covering at front of right footwell (if necessary, cut open the perforated seam on the left with a knife).



- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



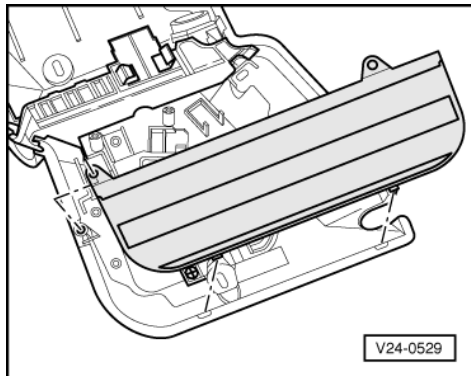
- -> Pull out the cross strut -3- with the attached parts.
- Unscrew bolts -1- and -2-.
- Remove engine control unit.



- Release catches and detach connectors from control unit.

Note:

Allow 30 seconds after switching off ignition before detaching or attaching the control unit connector.

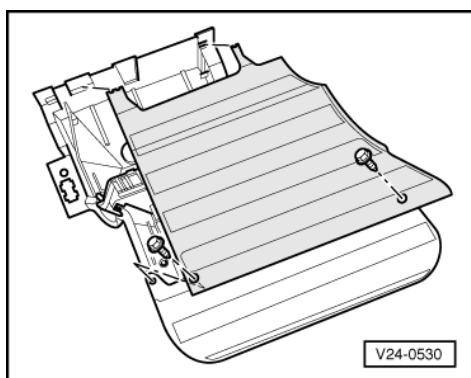


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Installing

Installation is carried out in the reverse order; note the following:

- -> Guide the bottom cover part into both openings of the electronics box in the right footwell.



- -> Attach the top cover part into both openings of the electronics box in the right footwell.

Note:

Allow 30 seconds after switching off ignition before detaching or attaching the control unit connector.

- Code the control unit, if necessary => Page 28 .
- Make basic settings => Page 24 .

Vehicles with immobiliser:

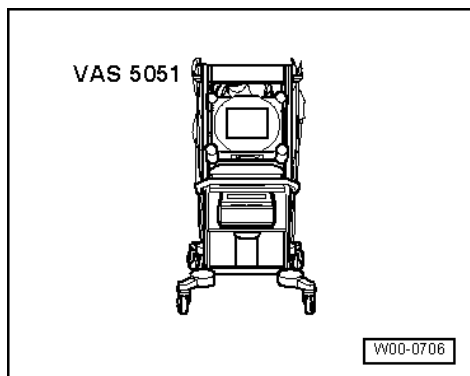
- Adapt engine electronics control unit to the immobiliser control unit:

=> Electrical System; Repair group 01; Self-diagnosis; Adaption procedure after renewing engine control unit
Self-diagnosis Adaption procedure after renewing engine control unit

1.9 - Checking idling speed

Notes:

- ♦ The idling speed cannot be adjusted.
- ♦ The idling speed is tested during the basic setting of the engine.



Special tools and workshop equipment required

- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 85 °C.
- No faults stored in fault memory
- Electrical consumers switched off (radiator fan must not run during the test).
- Air conditioner switched off.
- Pressure gauge not connected.
- Accelerator cable correctly adjusted

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism

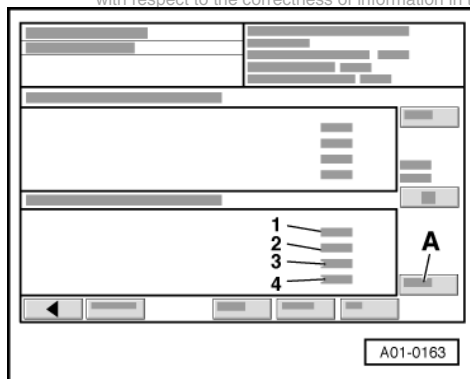
Test sequence

- Interrogate fault memory => Page 5. The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine, then start up again. Perform road test and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.

Important

The electric radiator fan should not be running.

- Initiate the basic setting, display group 001 => Page 24.





-> Display on VAS 5051:

- Check display in display zone -2-.
- Specification: at least 85 °C

Do not continue with check until coolant temperature is reached.

- Check display in display zone -1-.
- Specification: 770...830 rpm

If specification is attained:

- End function "04 - Basic setting" by pressing the ◀ key.

If specification is not attained:

- Interrogate fault memory again =>Page 5 .

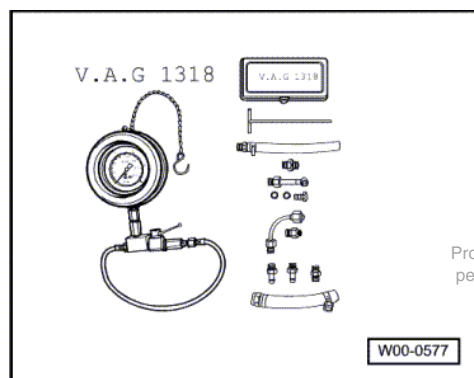
If the idling speed is too high or too low and there are no faults stored in the fault memory, perform the following tests marked with a dot:

- Check intake air system for unmetered air => Page 92 .
- Test idling switch =>Page 106 .
- Check whether solenoid valve for activated charcoal filter is continuously open =>Page 99 .

1.10 - Checking system pressure, fuel pressure regulator and holding pressure

Note:

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



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Special tools and workshop equipment required

- ♦ V.A.G 1318 with V.A.G 1318/11, V.A.G 1318/13 and V.A.G 1318/15

Test requirements:

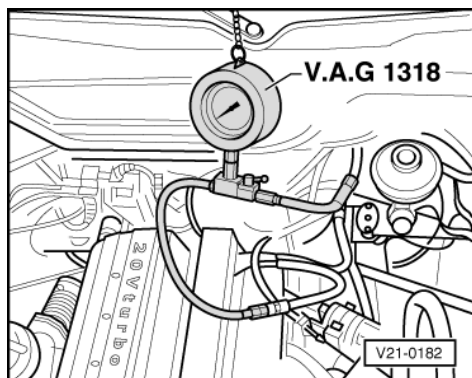
- Fuel pump relay OK; checking =>Page 75 .
- Fuel pump OK; checking:

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism

- Fuel filter OK
- Battery voltage at least 12.7 V

Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.



Checking system pressure and fuel pressure regulator

- -> Connect pressure gauge V.A.G 1318 between fuel supply line and fuel distributor as illustrated in the Fig.
- Open cut-off valve on pressure gauge. The lever points in the direction of flow.
- Detach vacuum line from pressure regulator to induction manifold at pressure regulator and close off line.

Notes:

- ◆ Replace pressure regulator if fuel emerges at the vacuum connection of the pressure regulator in the course of the following pressure test.
- ◆ When performing the following test, do not leave the engine running for an unnecessarily long time with the vacuum hose detached, because the higher fuel pressure causes the fuel/air mixture to be enriched. This could lead to the lambda control limits being exceeded, which would then result in a fault being recorded.

- Start the engine and run at idling speed.
- Switch off electrical consumers (air conditioner system, etc).
- Measure the fuel pressure.
 - Specification: 4.0...4.2 bar
- If specification is not attained, try replacing the pressure regulator and repeating the pressure test.
- If specification is still not attained, check the fuel pump/feed pipe for damage (e.g. crushing) and replace, if necessary.
- If specification is exceeded, check the return pipe for damage (e.g. crushing) and replace, if necessary.
- Attach vacuum hose to pressure regulator and observe drop in pressure on pressure gauge.
- Fuel pressure must decrease by approx. 0.5 bar when vacuum hose is attached.

Perform the following checks if there is no change in pressure as described above:

- Check vacuum hose for cracks and damage.
- Check vacuum hose at intake manifold for blockage by detaching hose at pressure regulator and blowing into it.

Renew the pressure regulator if no leakage is found and the vacuum connection is not blocked.

Checking holding pressure:

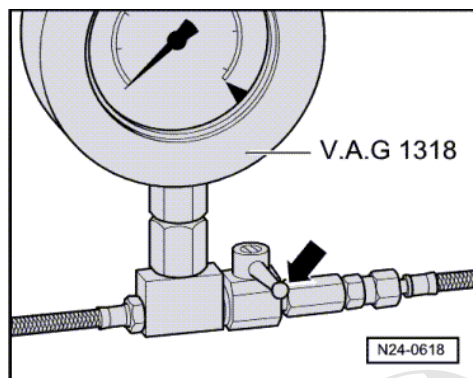
- 10 minutes after switching off the engine, check for absence of leaks and check holding pressure by monitoring the pressure drop on the gauge.
 - Specified value for cold engine: approx. 3.5 bar
 - Specified value for warm engine: approx. 3.8 bar

Note:

The increase in pressure in a warm engine due to fuel expansion is normal.

If specification is not attained:

- Start engine and run at idling speed.



- -> Allow the pressure to build up, then switch off the ignition. At the same time close the cut off valve on the pressure gauge V.A.G 1318 (valve lever at right angles to direction of flow -arrow-).

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

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

=> Fuel Supply - Petrol Engines; Repair group 20

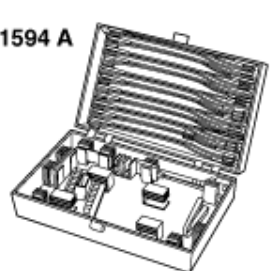
If the pressure drops again, the following faults are possible:

- ♦ Fuel pressure regulator defective
- ♦ Injectors leaking
- ♦ Pressure gauge unions downstream of cut-off valve leaking

Note:

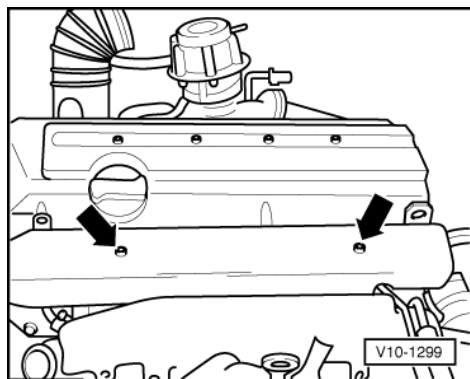
Before removing the pressure gauge, release the fuel pressure by opening the cut off valve; hold a container over the connection.

1.11 - Checking injectors

V.A.G 1526 A  Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598 A 
	G24-0019

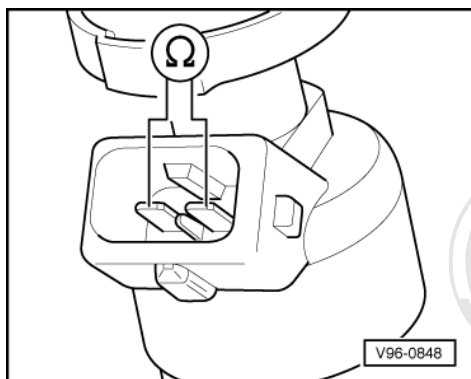
Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5



Preliminary measures

- -> Unscrew the cover for injectors -arrows-.



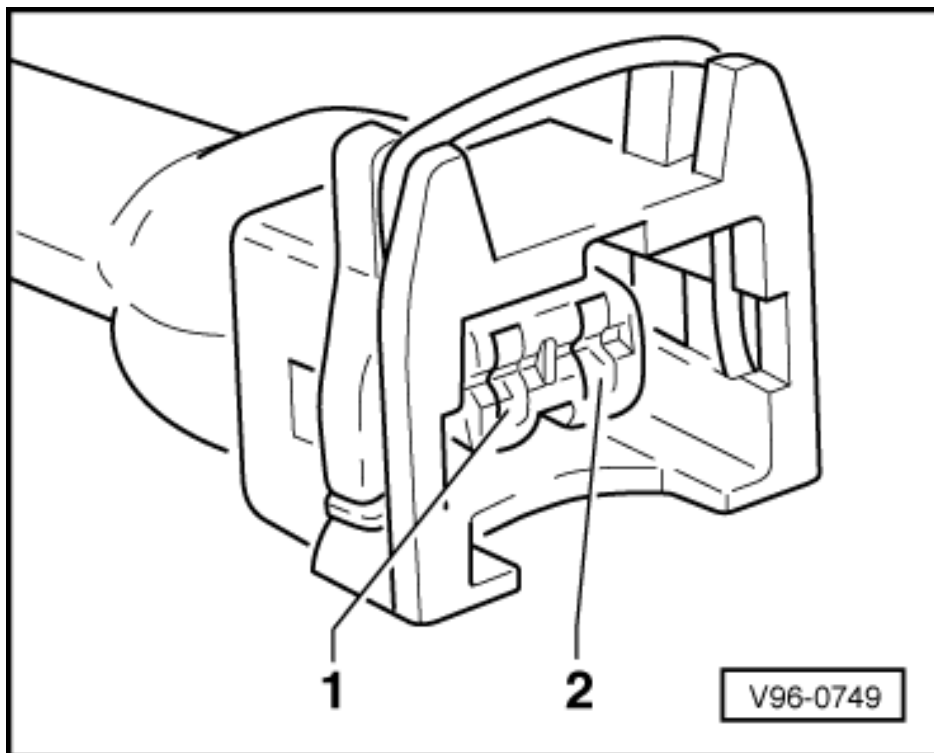
Checking internal resistance

- Unplug connector on injector to be checked.
- -> Connect multimeter to injector to measure resistance.
- Specification: 15...17 Ω (at room temperature)

If specification is not attained:

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- Replace injector.



If specification is attained:

Checking power supply

Test requirements:

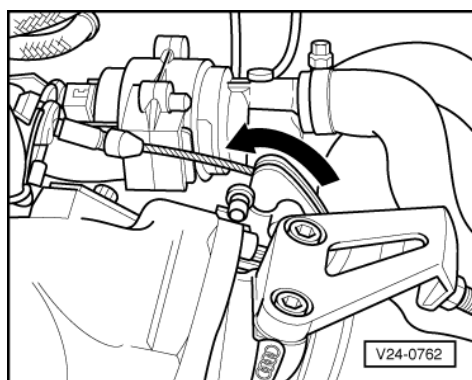
- Fuse for injectors OK
- => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations
- Fuel pump relay OK; checking =>Page **75** .
 - -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth

- Operate the starter briefly (the engine may start).
 - The LED should illuminate.

If the LED does not illuminate:

- Check wiring connection between contact 1 and fuse for injectors for open circuit using the current flow diagram.



If the LED illuminates:

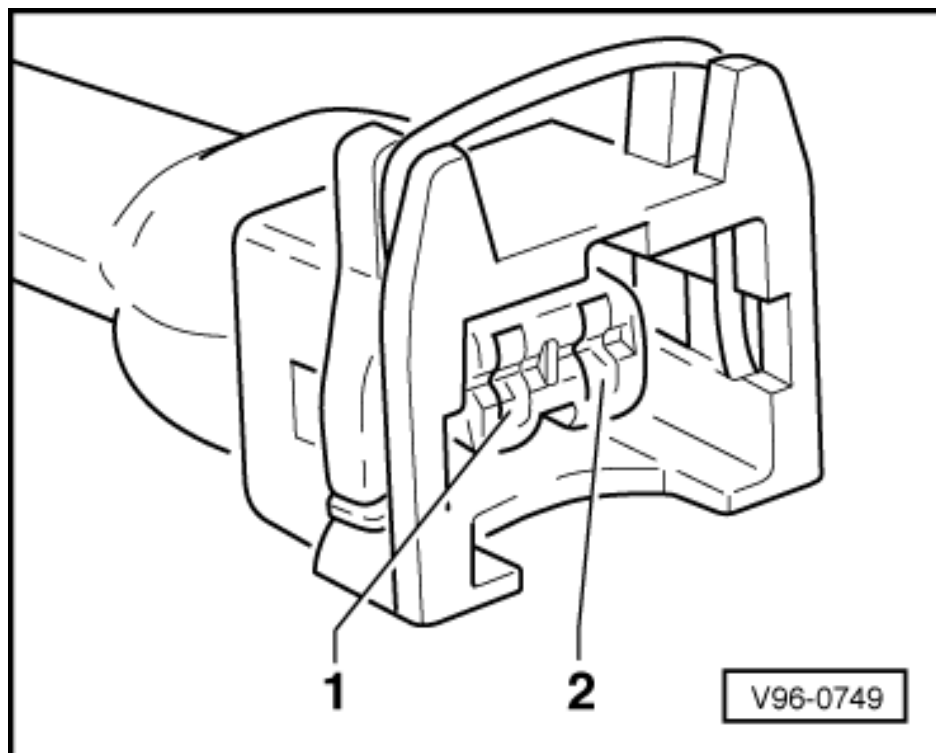
Checking actuation

Test requirements:

- Internal resistance of the valve OK
- Start final control diagnosis => Page **20** and actuate injector, cylinder 1 -N30.
- -> Lift the throttle valve lever, hold it for 2... 3 seconds and then slowly allow it to return.
 - As soon as the idle speed position is reached, the injector must click five times

If the injector clicks:

- Activate the next injector.



If the injector does not click:

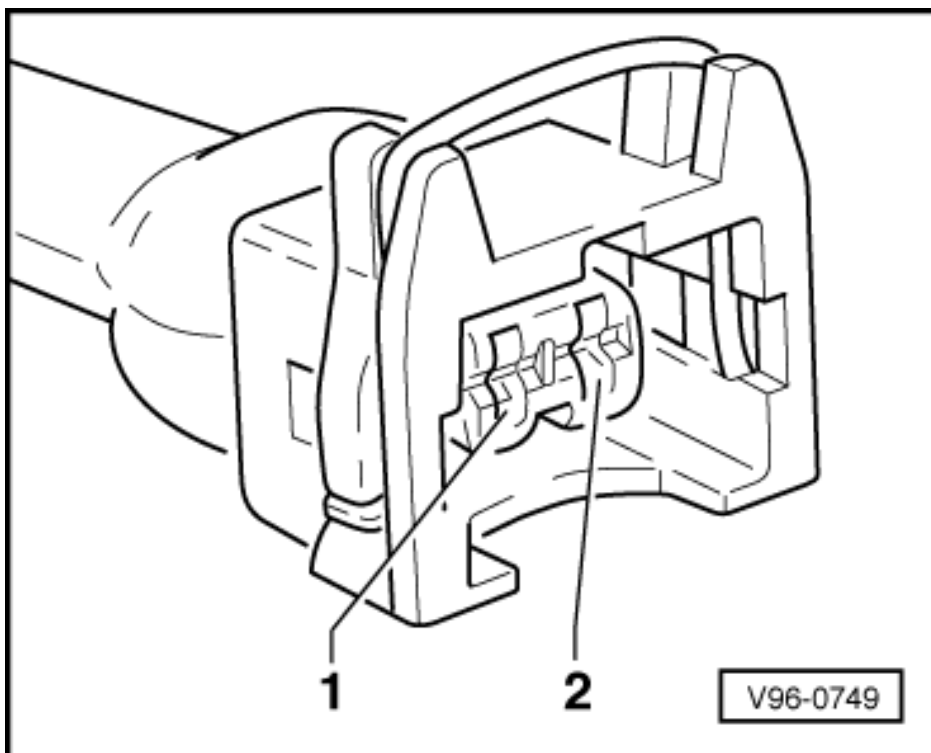
- Unplug connector on injector to be checked.
- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Repeat the final control diagnosis and again actuate the injector.
 - The LED should flash five times

Note:

Voltage testers with a low current draw continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become slightly brighter when actuated.

If LED does not flash:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59.



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

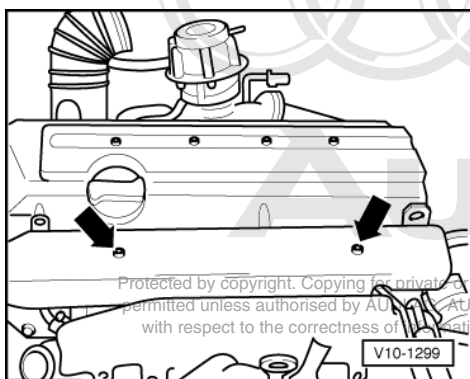
Cylinder	Injector connector Contact	Test box V.A.G 1598 A Socket
1	2	36
2	2	17
3	2	34
4	2	35
5	2	16

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace engine control unit => Page 60 .

1.12 - Removing and installing injectors



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Removing

- -> Unscrew the cover for injectors -arrows-.
- Pull vacuum hose off fuel pressure regulator.
- Unbolt fuel distributor.
- Pull fuel distributor complete with injectors evenly off the intake manifold and place it on a clean cloth in the engine compartment.

Important

The fuel system is pressurised. Before opening the system place a cloth around the connection point. Then release pressure by carefully loosening the connection.

- Detach connector.
- Detach ~~retainer and remove injector~~ for non-commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.

Installing

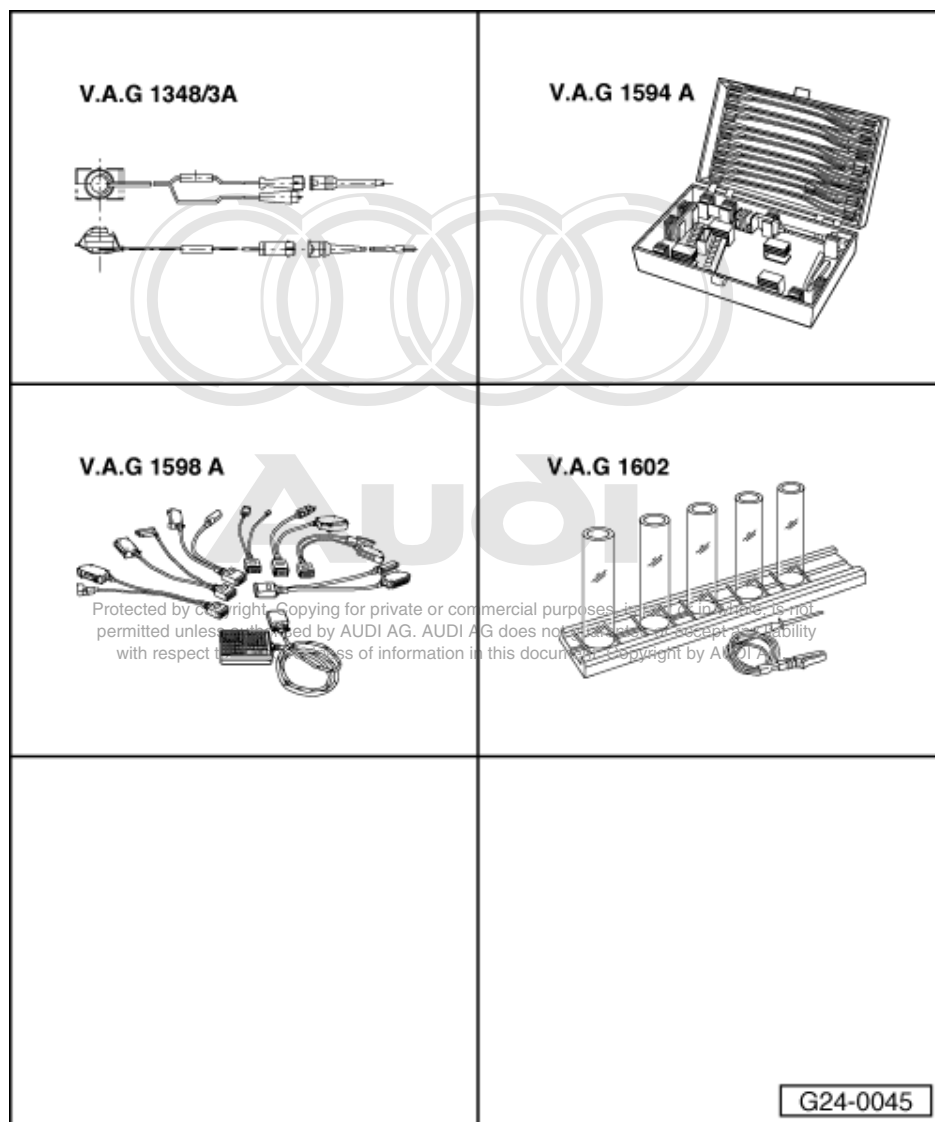
Install in reverse order, paying attention to the following:

- Renew the O-rings at all opened connections. (when renewing the front O-ring, ensure that the plastic cap is not removed from the injector head. The O-ring must be pulled off over the plastic cap).
- Coat the O-rings with clean engine oil.
- Make sure that the injectors are installed in the correct positions.
- Check to make sure that the retainer clamps are properly seated.
- Position fuel distributor with secured injectors on intake manifold and press evenly into place.

Tightening torque

Component	Nm
Fuel distributor to intake manifold	10

1.13 - Checking injection quantity, leak tightness and spray pattern of injectors



Special tools and workshop equipment required

- ◆ V.A.G 1348/3A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5
- ◆ V.A.G 1602

Test requirements:

- Fuel pressure OK, checking =>Page 64 .

Test sequence

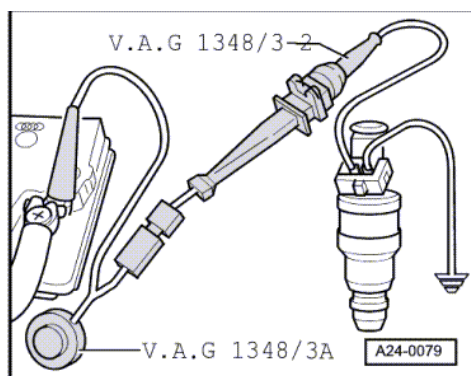
- Remove fuel distributor with fitted injectors from intake manifold => Page 71 .
- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .

Leak test

- Jumper contacts 3 and 10 at test box with leads from adapter set V.A.G 1594 A.
- Switch the ignition on.
 - The fuel pump should run.



- 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 switch off fuel pump (remove cable bridge) and replace defective injector => Page 71 ;



Checking injection quantity

- Place the injector which is to be checked into the measuring glass of injection quantity tester V.A.G 1602.
- -> Connect one of the injector contacts to the engine earth using a test cable and crocodile clamp from V.A.G 1594 A.
- Connect second contact of injector with remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable to positive.
- Activate remote control V.A.G 1348/3A for 30 seconds.
- Once all 5 injectors have been actuated, place measuring glasses on a level surface.
 - Specified value per injector: 150...170 ml
- If measured values for one or more injectors are outside tolerance, switch off fuel pump (switch off ignition) and replace defective injector => Page 71 .
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 64 .

Note:

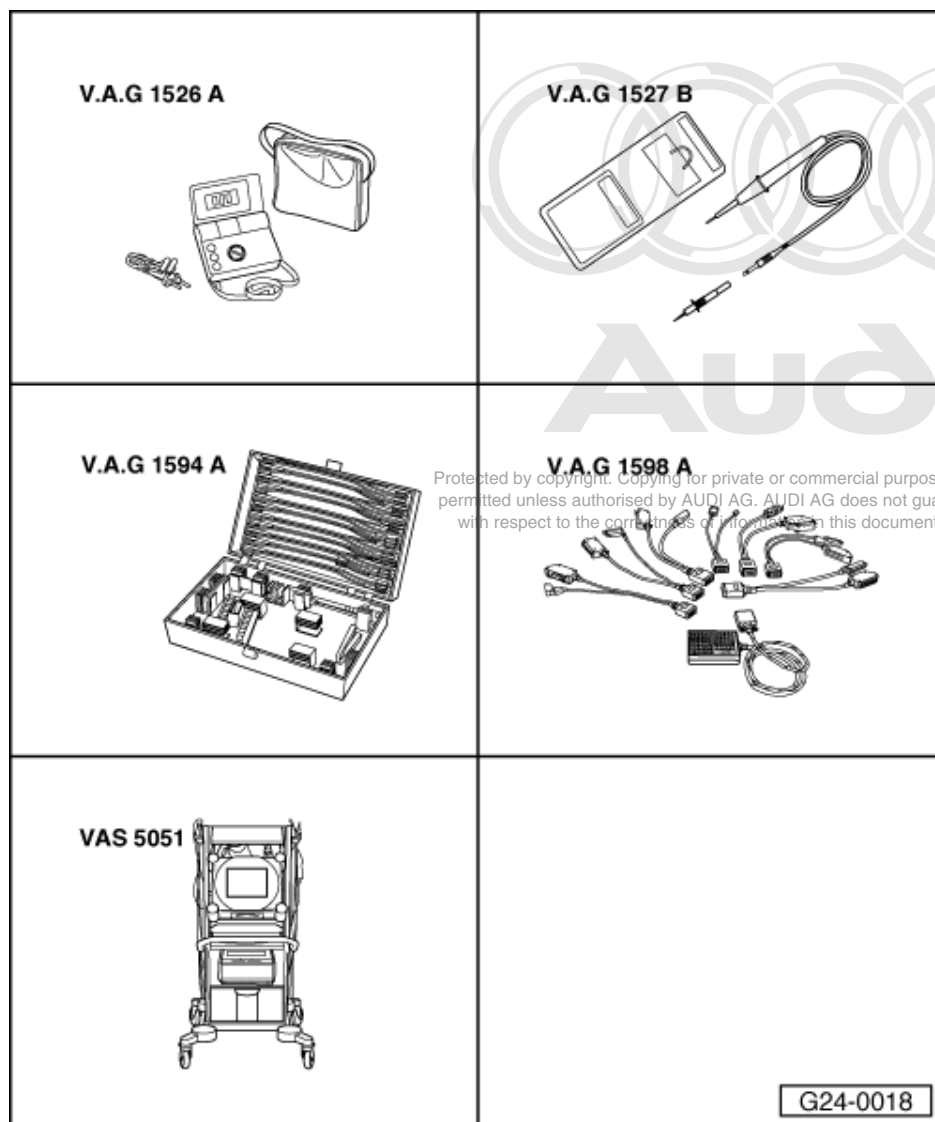
When checking the injection quantity, also check the spray pattern. The spray pattern should be the same for all the injectors.

- Install injectors with fuel distributor => Page 72 .



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1.14 - Checking fuel pump relay -J17 and relay actuation



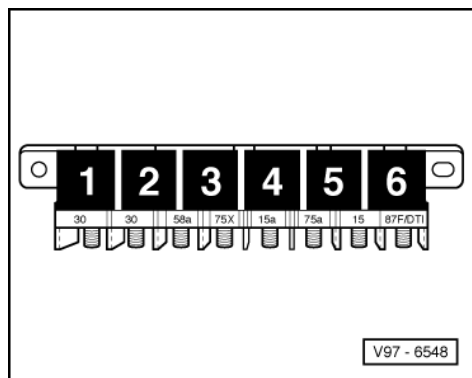
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Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5
- ◆ VAS 5051 with VAS 5051/1 and VAS 5051/2

The fuel pump and certain components of the injection system are supplied with power by way of the fuel pump relay -J17.

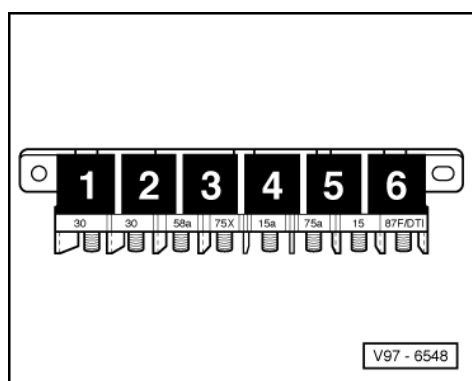
The fuel pump relay -J17 is only energised when the engine is running, i.e. the relay is only connected to earth (via the engine control unit) when engine speed pulses are detected in the engine control unit.

**Note:**

-> Fitting location of fuel pump relay: On central electrics below dash panel on left, contact point 6

Test requirements:

- Battery voltage at least 12.7 V

**Functional check of fuel pump relay**

- Remove driver's storage compartment.

=> General Body Assembly; Repair group 70; Instrument panel: Removing and installing storage compartment and glove box Instrument panel Removing and installing storage compartment and glove box

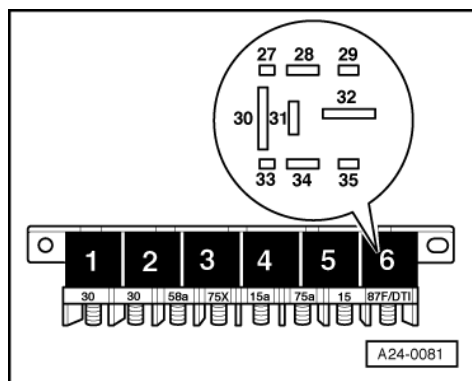
- Start final control diagnosis => Page 20 and actuate injector cylinder 1-N30.
 - -> The fuel pump relay (in central electrics on left below the dash panel, position 6) must respond and the fuel pump must run.
- Exit function "03 - Final control diagnosis" by pressing the ◀ key.

A - If relay does not respond:

- Check voltage supply of fuel pump relay => Page 77 .
- Check actuation of fuel pump relay =>Page 77 .

B - If relay responds but fuel pump does not run:

- Check voltage supply for fuel pump and components (via fuel pump relay) =>Page 78 .



Checking voltage supply of fuel pump relay

- Disconnect fuel pump relay.
- -> Connect the multimeter to contact 32 of relay socket and to earth to measure voltage.
 - Specification: approx. battery voltage

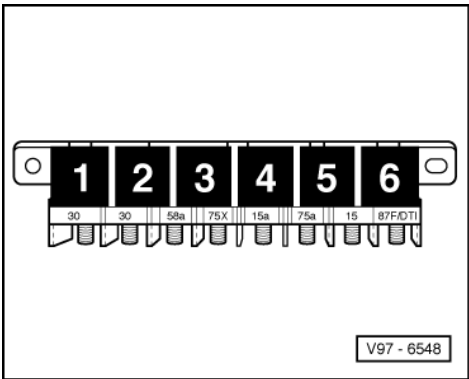
If specification is not attained:

- Replace central electrics.

If specification is attained:

Checking actuation of fuel pump relay

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Jumper contacts 3 and 10 at test box with leads from adapter set V.A.G 1594 A.



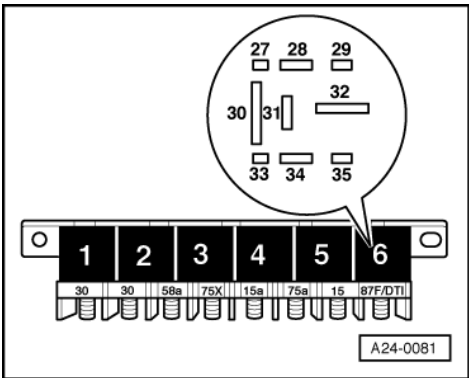
- Switch the ignition on.
 - -> The fuel pump relay (on central electrics on left below dash panel, position 6) must respond.
- Switch ignition off.

If the relay responds now, but not during final control diagnosis:

- Replace engine control unit => Page 60 .
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If the relay does not respond:

- Disconnect cable link.
- Disconnect fuel pump relay.



- -> Connect multimeter as follows to measure voltage.

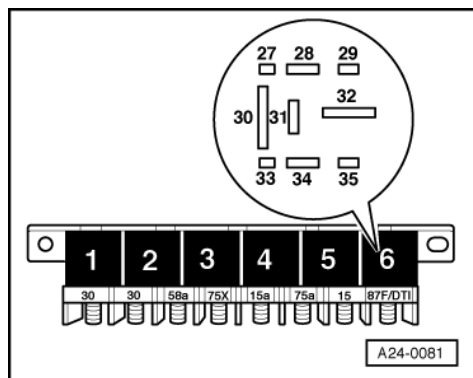
Front central electrics on left below dash panel, position 6	Measure to
Contact	
28	Engine earth



- Switch the ignition on.
 - Specification: approx. battery voltage
- Switch ignition off.

If specification is not attained:

- Check the wiring connection using the current flow diagram.



If specification is attained:

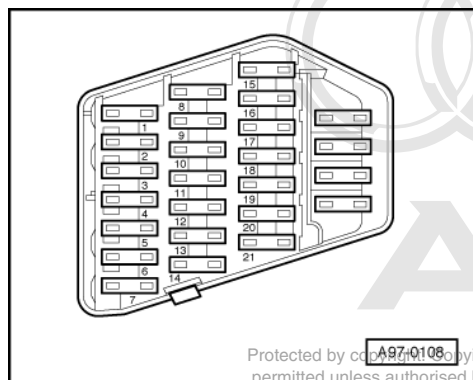
- -> Check for open circuit and short to positive or earth in the following wiring connection:

Front central electrics on left below dash panel, position 6 Contact	Test box V.A.G 1598 A Socket
29	3

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no fault is found:

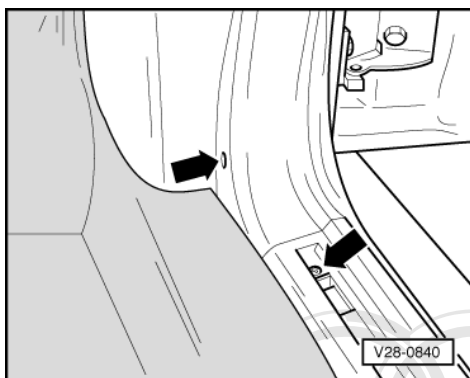
- Replace the fuel pump relay -J17.
- Reconnect engine control unit.



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Checking voltage supply of fuel pump and components

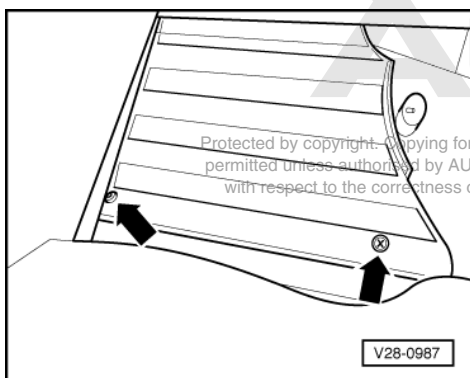
- Remove the cover of the left fuse holder.
- -> Pull out fuse S17.



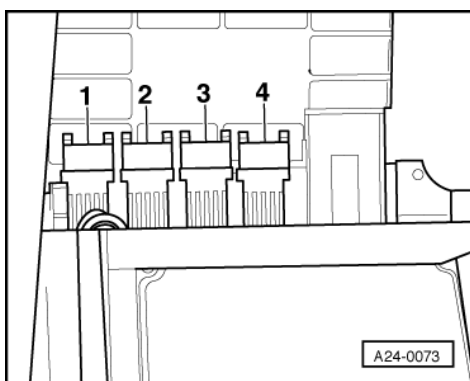
- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

=> General Body Assembly; Repair group 70; Trims Trims

- Pull back floor covering at front of right footwell (if necessary, cut open the perforated seam on the left with a knife).



- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



- -> In the electronics box in the passenger footwell, pull out fuse S75 (in the black holder -1-).
- Start final control diagnosis => Page 20 and actuate injector, cylinder 1 -N30.
- To measure the voltage, connect the multimeter to earth and to one of the contacts of the following fuses.

Fuse	Specified value at one of the contacts
S17 (No. 17 in fuse box)	approx. battery voltage
S75 (In the black holder)	approx. battery voltage



If the specifications are not attained:

- Repeat the test at the other contact of the fuse base.

If the specifications are still not attained:

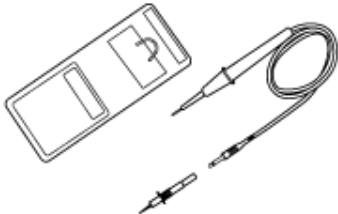
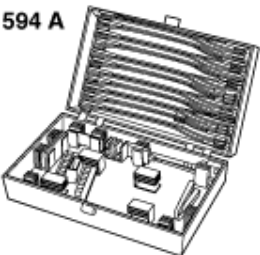
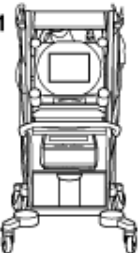
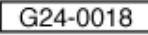
- Check the wiring connections using the current flow diagram.

If no wiring fault is detected:

- Replace the fuel pump relay -J17.
- Reinsert the fuses.

1.15 - Checking idling stabilisation valve -N71

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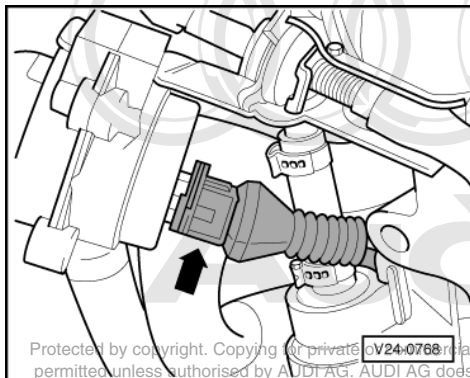
V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598 A 
VAS 5051 	

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

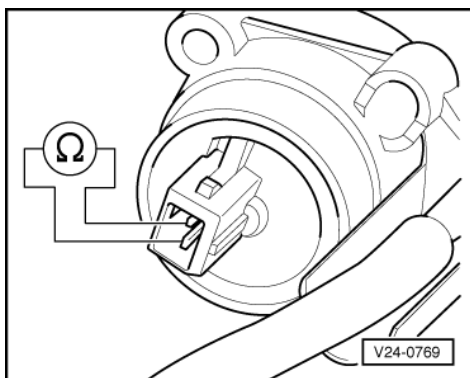
Fitting location => Fitting locations overview, Page 50



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Checking internal resistance

- Switch ignition off.
- -> Detach connector -arrow- from idling stabilisation valve.



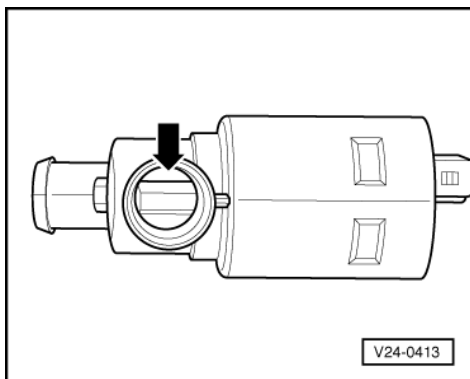
- -> Connect multimeter to injector to measure resistance.
- Specification: 7...11 Ω

Note:

Resistance is in the lower tolerance range at ambient temperature and in the upper tolerance range when the engine is warm.

If specification is not attained:

- Renew idling stabilisation valve.





Mechanical checking

- Remove idling stabilisation valve
- -> Check rotary slide -arrow- for scoring (visual inspection).

Note:

Never use a screwdriver or similar tool to move the rotary slide when checking for freedom of movement.

- Attach connector to removed idle stabilisation valve
- Switch the ignition on.
- Start final control diagnosis and actuate the idling speed stabilisation -N71 an => Page 20 .
- Check whether the rotary slide runs properly from stop to stop.

If scoring is found which impairs the freedom of movement or if the rotary slide does not move freely (sticking, sluggish or without full range of travel):

- Renew idling stabilisation valve.

If idling stabilisation valve does not react in final control diagnosis:

Checking power supply

Test requirements:

- Fuse for idling stabilisation valve OK

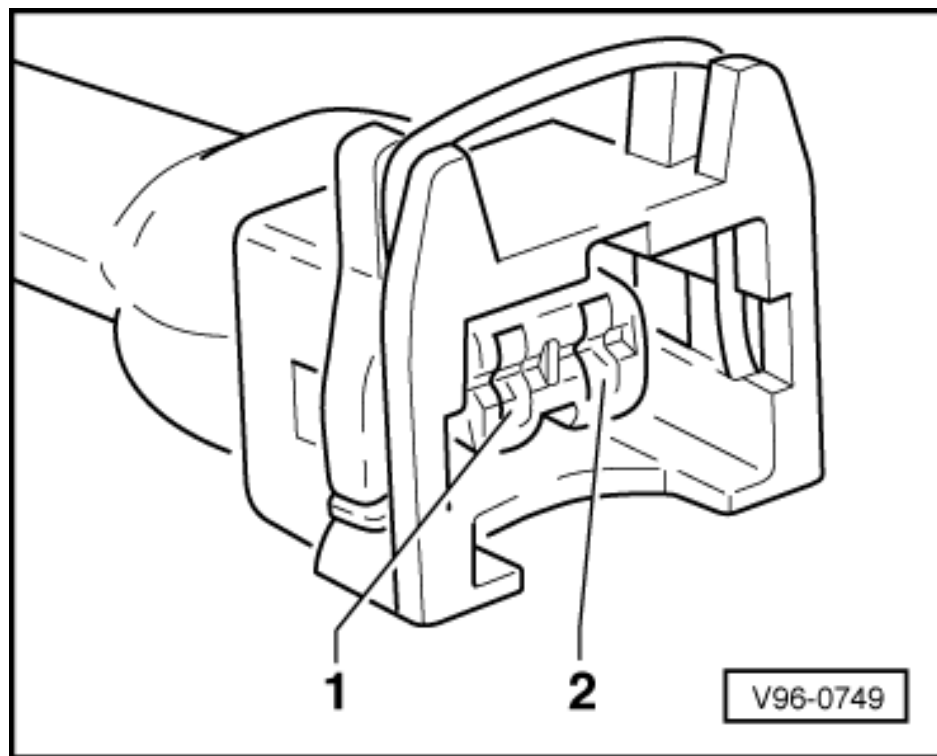
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations

- Fuel pump relay OK; checking =>Page 75 .

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Note:

Voltage supply to idling stabilisation valve is from fuel pump relay.



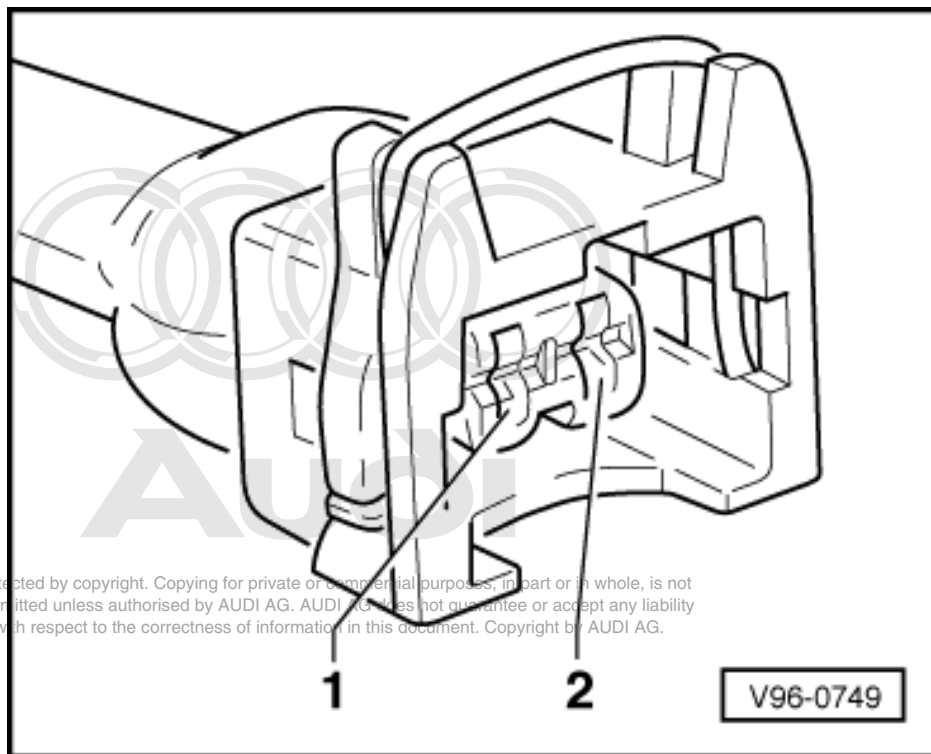
- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
1	Engine earth

- Operate the starter briefly (the engine may start).
 - Specification: approx. battery voltage

If specification is not attained:

- Use current flow diagram to eliminate open circuit in wiring/short circuit.



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If specification is attained:

Check actuation of the idling speed stabilisation valve

- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and actuate the idling speed stabilisation -N71 an => Page 20 .
 - The LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
2	4

- Use current flow diagram to eliminate open circuit in wiring/short circuit.
- If actuation and wiring are OK, but idling stabilisation valve does not react, valve is seized up. Renew idling stabilisation valve.



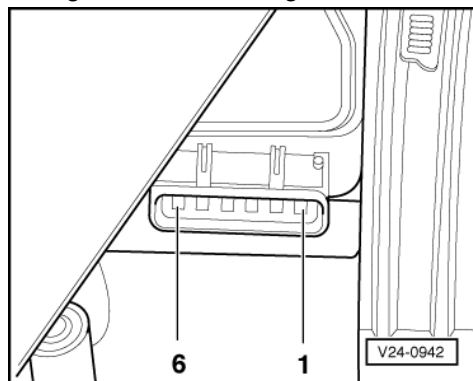
1.16 - Checking air mass meter -G70



Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

Fitting location => Fitting locations overview, Page **50**



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Check function

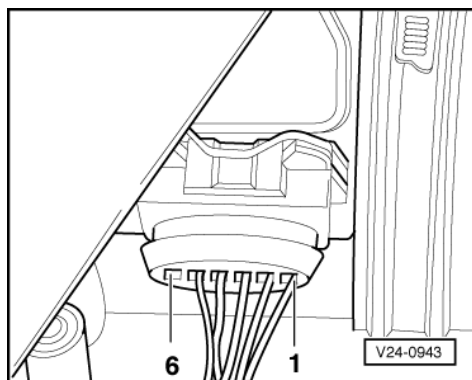
- Switch ignition off.
- Pull connector off air mass meter.
- -> Connect multimeter between contacts 1 and 2 to measure resistance.
 - Specification: 0...0.1 ω
- Disconnect the measuring cables at the air mass meter and connect them together. Read the measured value.
 - Setpoint the same as for the first measurement

Note:

The displayed value must be the same for both measurements (the earth bridge in the air mass meter is measured). The measured value corresponds to the internal resistance of the measuring cables.

If the measured values differ by more than 0.1 ω from each other:

- Renew air mass meter -G70.



- Reconnect the connector at the air mass meter.
- -> Push back rubber grommet at connector of air mass meter.
- Connect the multimeter for voltage measurement range (direct voltage) between contact 1 and contact 2.

Note:

Pin assignment is marked on back of connector.

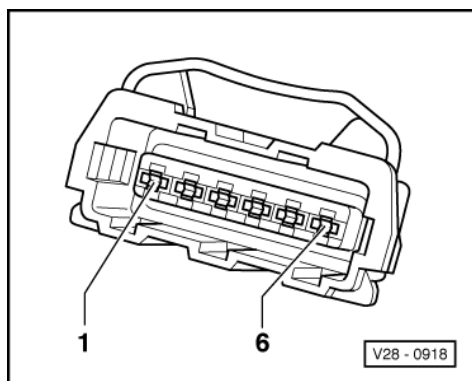
- Switch the ignition on.
 - Specification: 1.2...1.5 V
- Start engine and run at idling speed.
 - Specification: approx. 2.5 V
- Fully depress the accelerator pedal and release again (brief actuation).

- ◆ Specification: Clear voltage rise to 3...5 V

If the specifications are not obtained:

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- Renew air mass meter -G70.





Checking voltage supply to air mass meter

Test requirements:

- Fuse for air mass meter OK.

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

- Fuel pump relay OK; checking =>Page **75** .

Note:

Voltage supply to air mass meter is from fuel pump relay.

- Pull connector off air mass meter.
- -> Connect multimeter as follows to measure voltage.

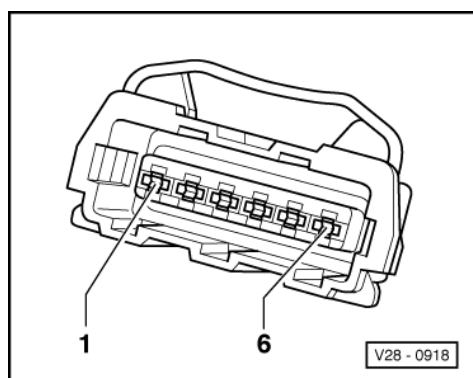
Connector Contact	Measure to
5	Engine earth

- Operate starter briefly.
 - Specification: approx. battery voltage

If specification is not attained:

- Check the wiring connection from contact 5 of the connector via the fuse to the fuel pump relay for open circuit or short to earth.
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

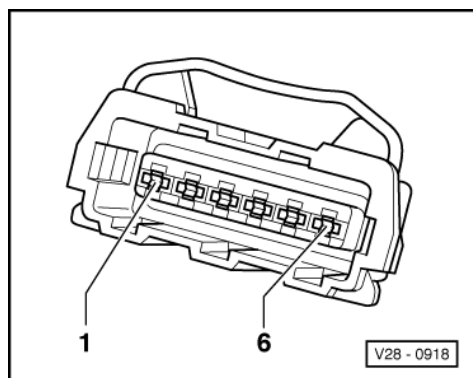
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- -> Connect hand-held multimeter to contacts 1 and 5 of the connector to measure voltage.
- Operate starter briefly.
 - Specification: approx. battery voltage

If specification is not attained:

- Check the wiring connection from contact 1 of the connector to vehicle body earth for open circuit.
- Eliminate open circuit using the current flow diagram.



Checking wiring to air mass meter

Note:

The signal wire is also checked during the wiring check.

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59.
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
2	26
3	7
4	25

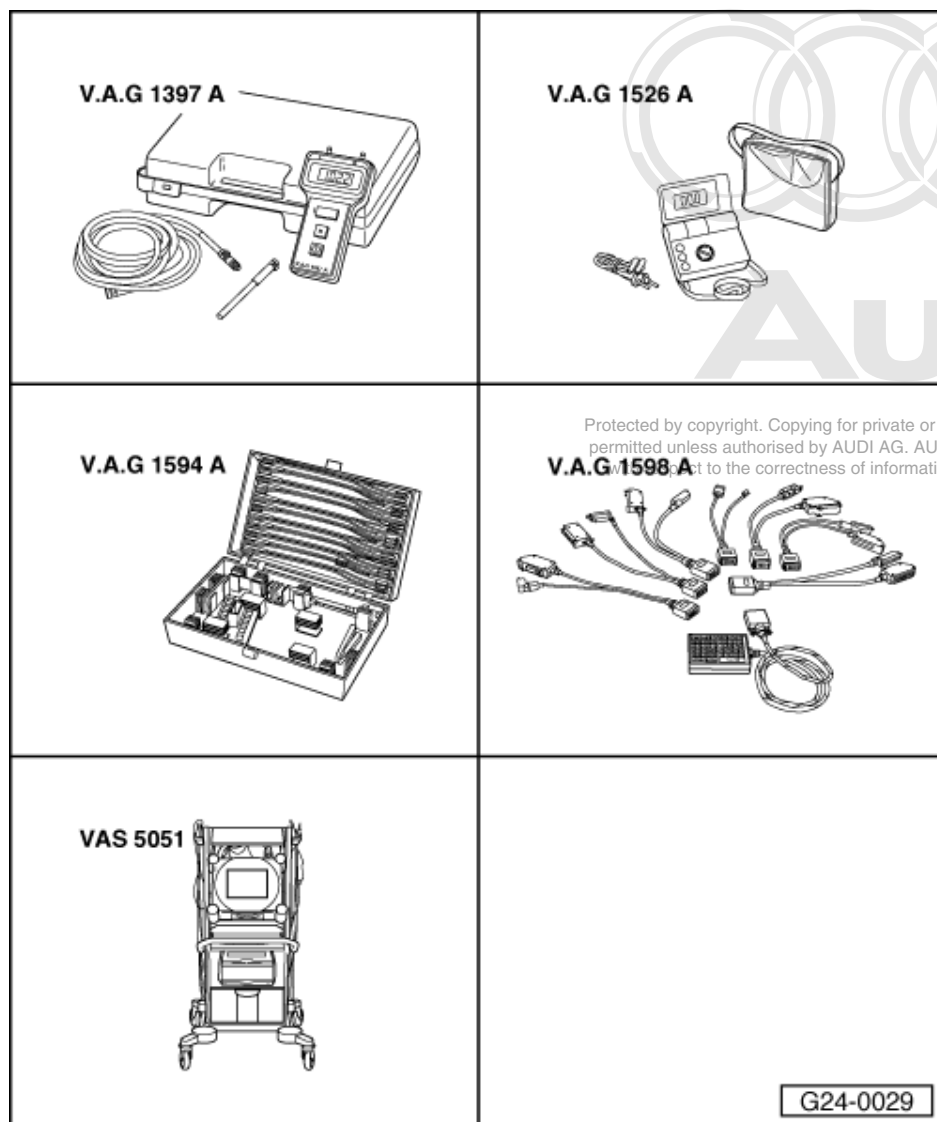
- Additionally check all wires for short to one another.
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Renew air mass meter -G70.

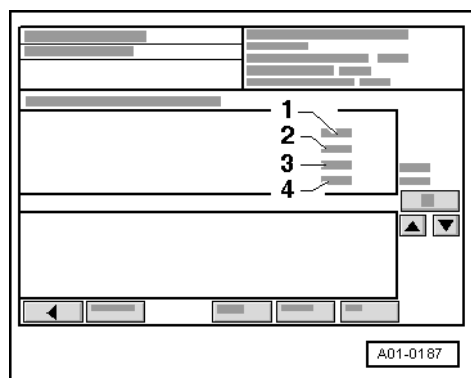


1.17 - Checking altitude sender -F96



Special tools and workshop equipment required

- ♦ V.A.G 1397 A
- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

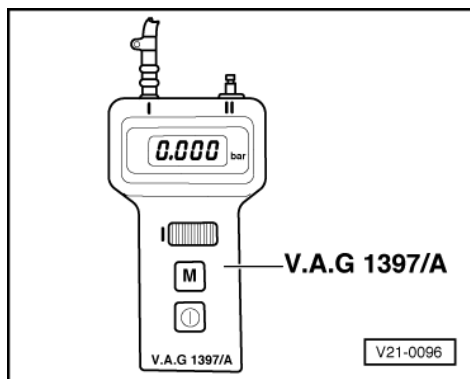


Check function

- Read measured value block, display group 002, ignition switched on => Page 30 .

-> Display on VAS 5051:

- Check display in display zone -4-.
 - Specification: current air pressure in mbar

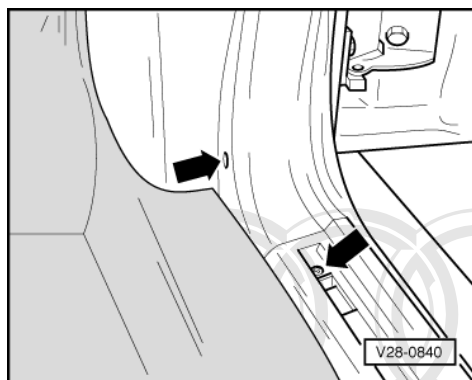


- -> Switch on turbocharger tester V.A.G 1397 A and set measuring range selector switch to position -I- (absolute pressure).
- The display must approximately correspond to that on the display of VAS 5051

Notes:

- ◆ The current air pressure is dependent on the altitude and the pressure conditions affected by the weather.
- ◆ The air pressure at sea level is approx. 1013 mbar in normal weather conditions. It decreases approx. 100 mbar for every 1000 m above sea level.
- ◆ The pressure fluctuations caused by the weather are usually less than ± 50 mbar (except for extreme weather situations and tropical countries).
- ◆ When the altitude sender fails, the control unit uses a substitute value of 968 mbar (corresponds to 3000 m above sea level).

If the display in display zone 4 is unrealistic or if 968 is constantly displayed:



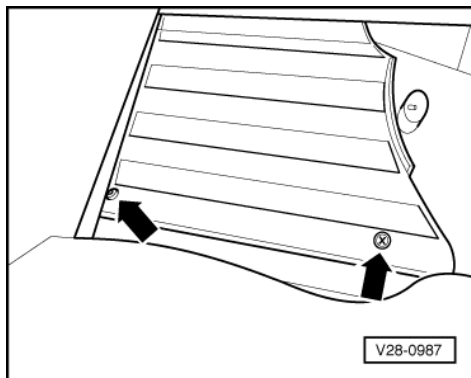
Check power supply

- -> Remove the lower part of the right A pillar trim and the front door sill panel tread strip

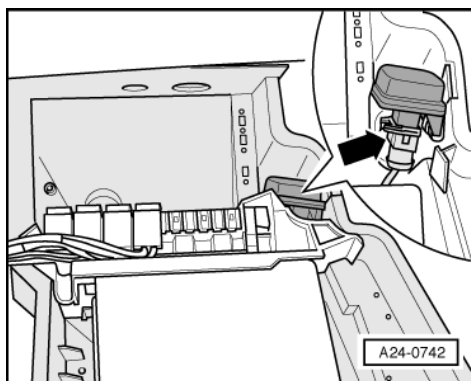
=> General Body Assembly; Repair group 70; Trims Trims

- Pull back floor covering at front of right footwell (if necessary, cut open the perforated seam on the left with a knife).

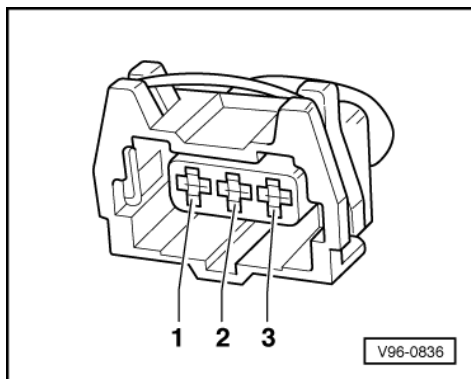
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- -> Unscrew bolts -arrows- for electronics box cover.
- Carefully detach upper and lower sections of cover.



- -> Unplug electrical connector -arrow- from altitude sender.



- -> Connect multimeter as follows to measure voltage.

Connector Contact	Measure to
2	Engine earth

- Switch the ignition on.
 - Specification: approx. 5 V

If specification is not attained:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
-------------------	------------------------------



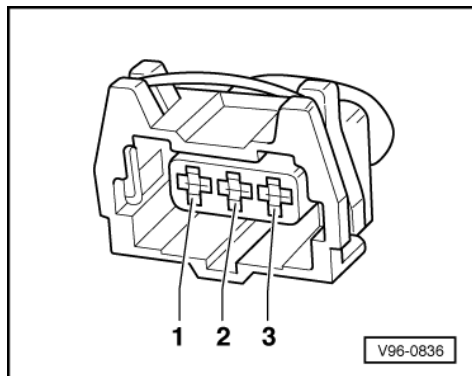
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2	12
---	----

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace engine control unit => Page 60 .



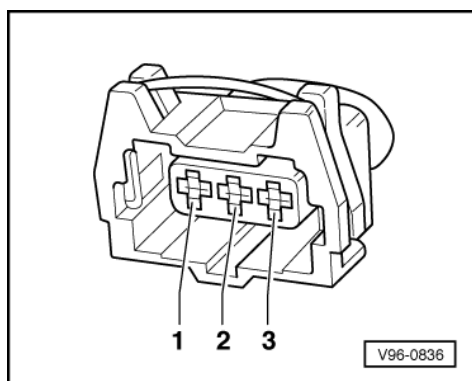
If specification is attained:

- Switch the ignition on.
- -> Connect multimeter as follows to measure voltage.

Connector Contact	Specified value
1 + 3	4.5...5.0 V
2 + 3	4.5...5.0 V

If the specifications are not obtained:

- Eliminate open circuit using the current flow diagram.



If specifications are attained:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
1	9



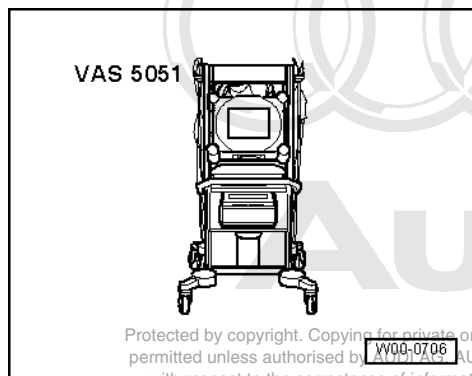
3	30
---	----

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace altitude sender.

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

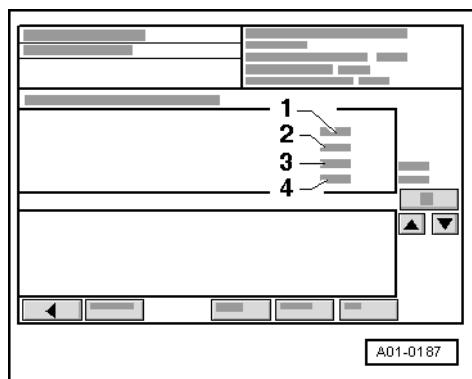


Special tools, workshop equipment and other items required

- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2
- ♦ Engine leak detector spray G 001 800 A1

Notes:

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



Test sequence

- Read measured value block, display group 001, engine idling => Page 30 .
- > Display on VAS 5051:
- Monitor engine speed in display zone -1-.
- Systematically spray parts of the intake system with engine leak detector spray.

If engine speed drops:

- Check sprayed areas of intake system for leaks and rectify if necessary.
- Exit function "08 - Read measured value block" by pressing the ◀ key.
- Press "06 - End output".
- Switch ignition off.

2 - Checking lambda control

2.1 - Checking lambda control

Notes:

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 too rich (low residual oxygen)" is between about 0.7 and 1.1 V.

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

During the transition from "rich" to "lean" and vice versa ($\lambda = 1.0$), there is a voltage jump from 0.7...1.1 V to -0.0...+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".

In the basic setting, display group 001, the lambda control can be monitored => Page 24. The value displayed there λ -must fluctuate between 0.96 and 1.04.

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

- ◆ Slots or holes in probe head are blocked.
- ◆ Lambda probe has been subjected to excessive thermal stress.
- ◆ Contact resistance in signal wiring.
- ◆ Lambda probe too cold; lambda probe heating not working.
- ◆ Lambda control switched off (control unit has recognised 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 Lambda probe via the fine cavities in the electrical wiring as a result of temperature 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. The silicone does not burn and damages the lambda probe).

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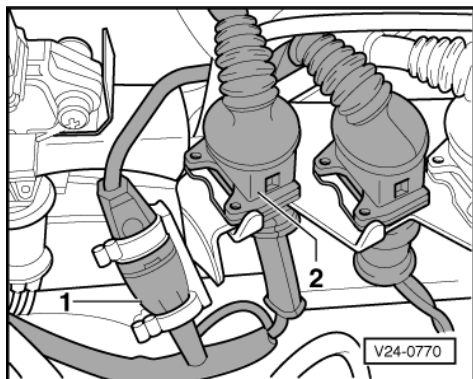


2.2 - Checking lambda probe signal wiring and actuation

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
	G24-0015

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5



Test sequence

- -> Detach connector -1-.
- Connect the multimeter between the connector to the engine control unit and engine earth to measure voltage.
- Switch the ignition on.
 - Specification: 450 ± 50 mV

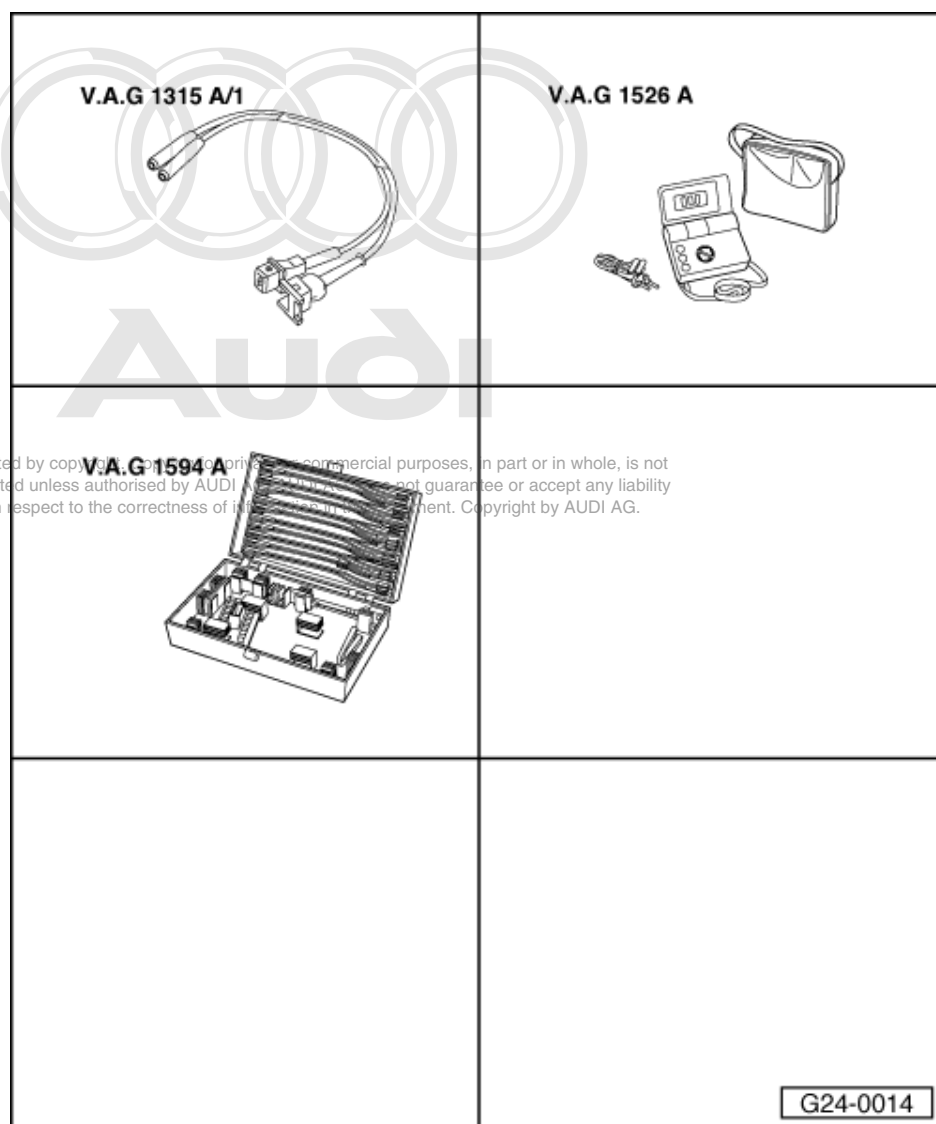
If specification is not attained:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Test for open circuit and short circuit to positive and earth in the wiring connection from connector to test box V.A.G 1598 A, socket 28.
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace engine control unit => Page 60 .

2.3 - Checking lambda probe heater -Z19



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Special tools and workshop equipment required

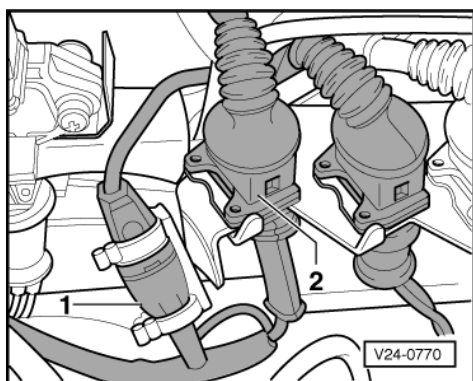
- ♦ V.A.G 1315 A/1
- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A

Test requirements:

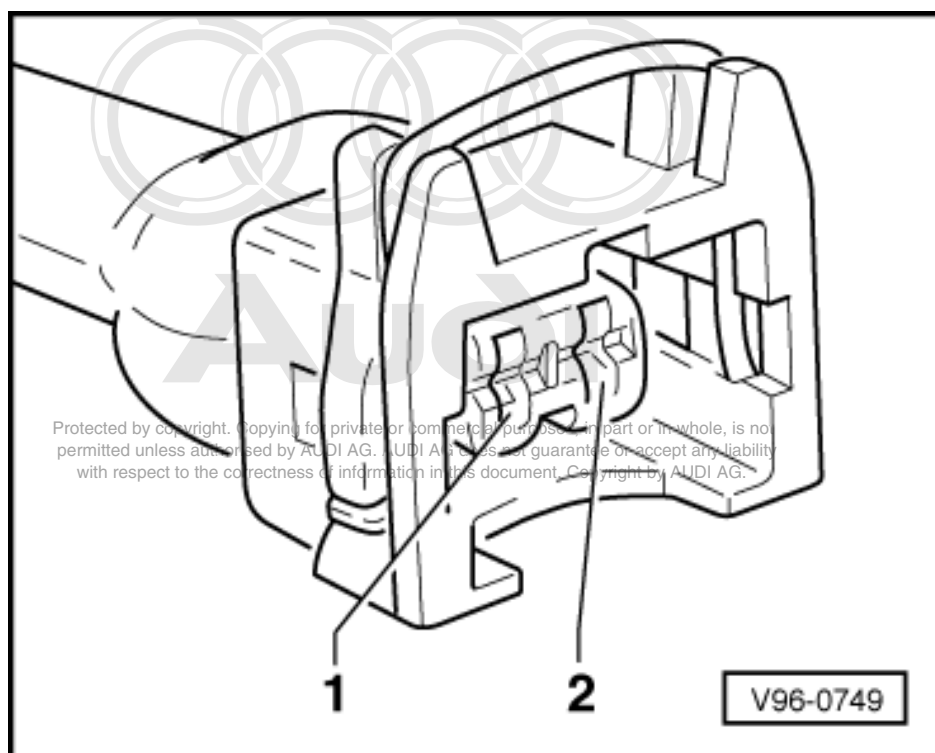
- Fuse for Lambda probe heating OK.

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

- Fuel pump relay OK; checking =>Page 75 .
- Engine cold

**Test sequence**

- -> Detach connector-2-.



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

- Specification: approx. battery voltage

If specification is not attained:

- Eliminate open circuit using the current flow diagram.

If specification is attained:

- Connect auxiliary measurement lead V.A.G 1315 A/1 to the 2-way connector.
- Switch multimeter to 10 A measuring range (connect measurement lead to 10 A connection).
- Start engine and run at idling speed.
 - Specification: 0.5...3.0 A

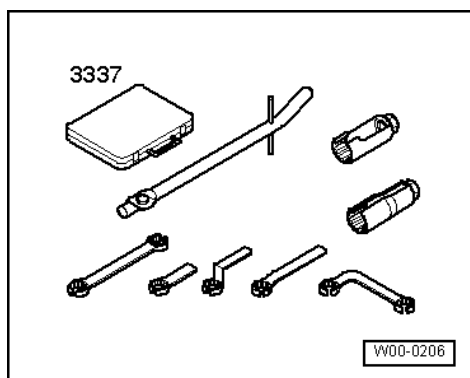
Note:

The current input decreases as the lambda probe becomes warmer.

If specification is not attained:

- Fit a new Lambda probe.

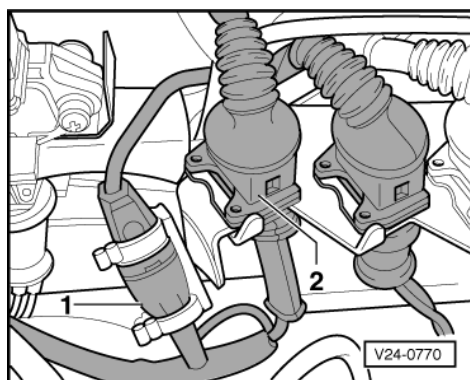
2.4 - Removing and installing lambda probe



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Special tools, workshop equipment and other items required

- ◆ Ring spanner set 3337
- ◆ High-temperature lubricant G 052 112 A3



Removing

- -> Unplug the connectors -1- and -2-.
- Lay wiring aside.



- Screw out Lambda probe using special tool 3337.

Installing

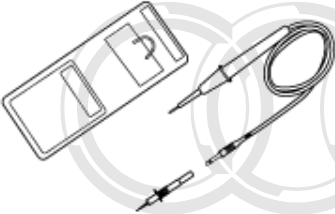
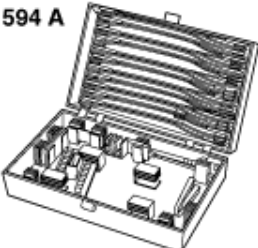
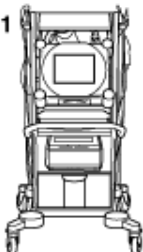
When installing, note the following points:

Notes:

- ♦ 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.
- ♦ Tightening torque 55 Nm.
- ♦ When installing, the wires and the cable ties must be refitted at exactly the same points in order to prevent contact between the lambda probe wire and the exhaust pipe.

3 - Checking fuel tank breather

3.1 - Checking fuel tank breather

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598 A  Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
VAS 5051 	G24-0018

3.2 - Checking activated charcoal filter system solenoid valve 1 -N80

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5
- ◆ VAS 5051 with VAS 5051/1 and VAS 5051/2

Fitting location => Fitting locations overview, Page **50**

Checking for leaks

ACF solenoid valve -N80 remains closed when de-energised.

- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Connect auxiliary hose to one connection of ACF valve.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page **20**.

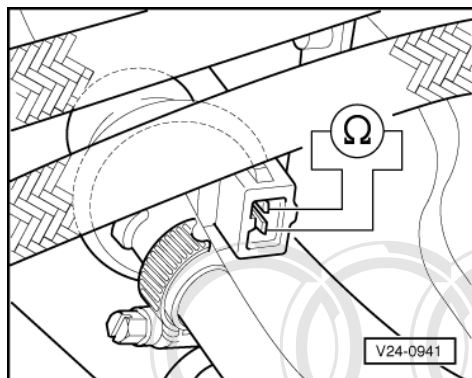
- ◆ The valve should click...
- ◆ ...and should open and close (check by blowing into the auxiliary hose).

If the injector does not click:

- Checking internal resistance to ACF valve.

If valve does not open or close properly:

- Fit a new ACF valve.



Checking internal resistance

- Unplug connector on ACF valve.
- -> Connect multimeter to injector to measure resistance.
 - Specification: 40...50 Ω

If specification is not attained:

- **Fit a new ACF valve.**

If specification is attained:



Checking power supply

Test requirements:

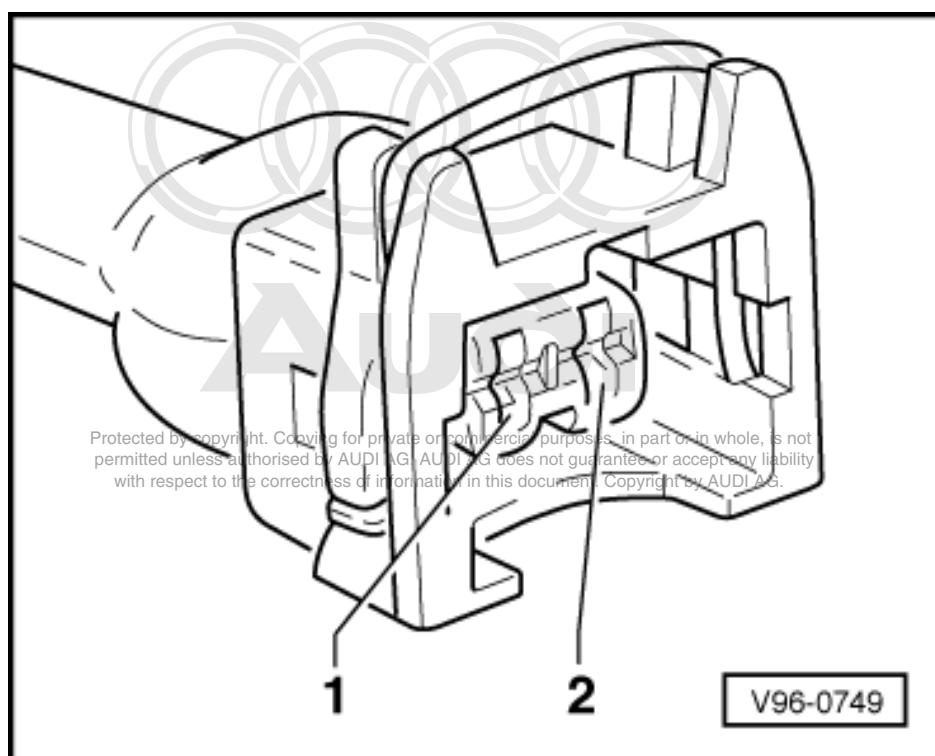
- Fuse for ACF valve OK.

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

- Fuel pump relay OK; checking =>Page **75** .

Note:

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



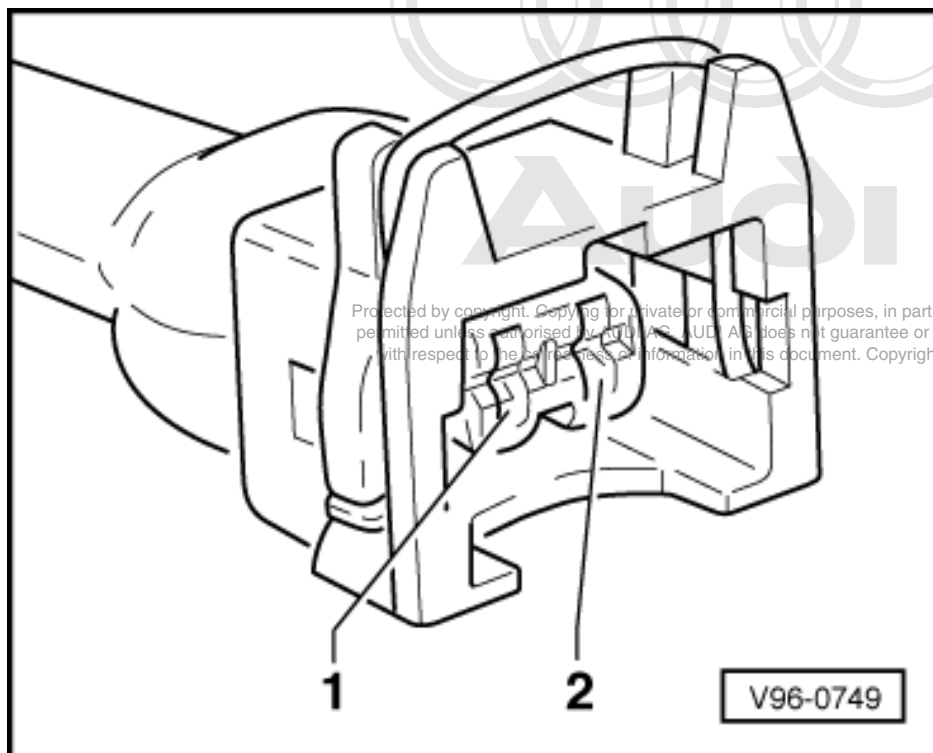
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
2	Engine earth

- Operate starter.
 - The LED should illuminate.

If the LED does not illuminate:

- Check the wiring from contact 2 on the connector via the fuse to the fuel pump relay for an open circuit.
- Eliminate open circuit using the current flow diagram.



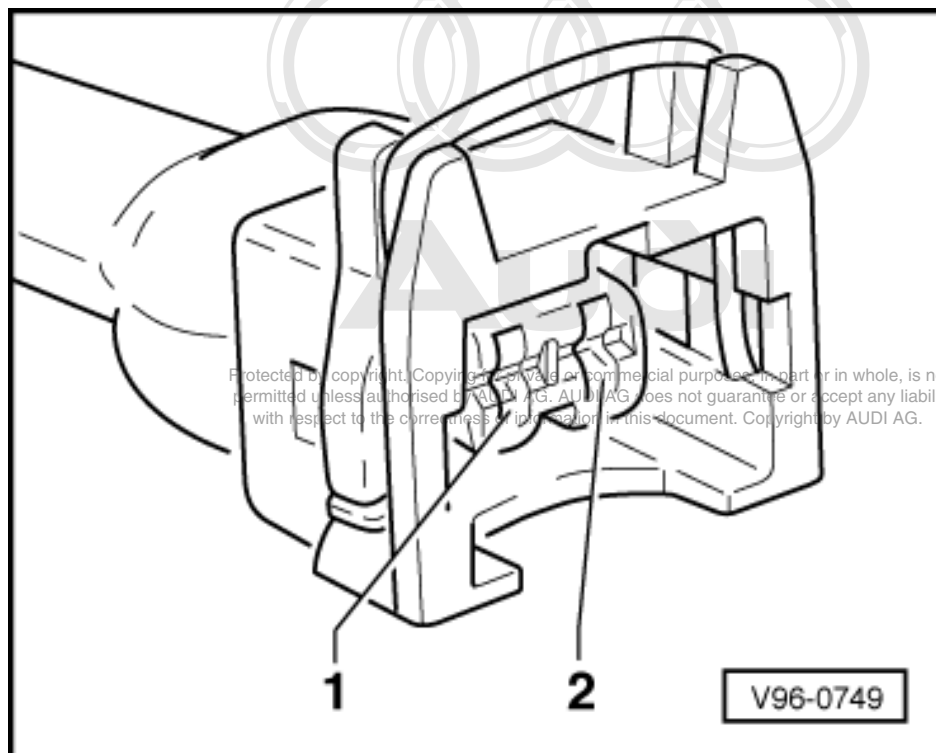
If the LED illuminates:

Check actuation

- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2.
- Initiate final control diagnosis and actuate ACF solenoid valve -N80 =>Page 20 .
 - The LED should flash.

If the LED lamp does not flash or if it illuminates continuously:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .



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

Connector Contact	Test box V.A.G 1598 A Socket
1	5

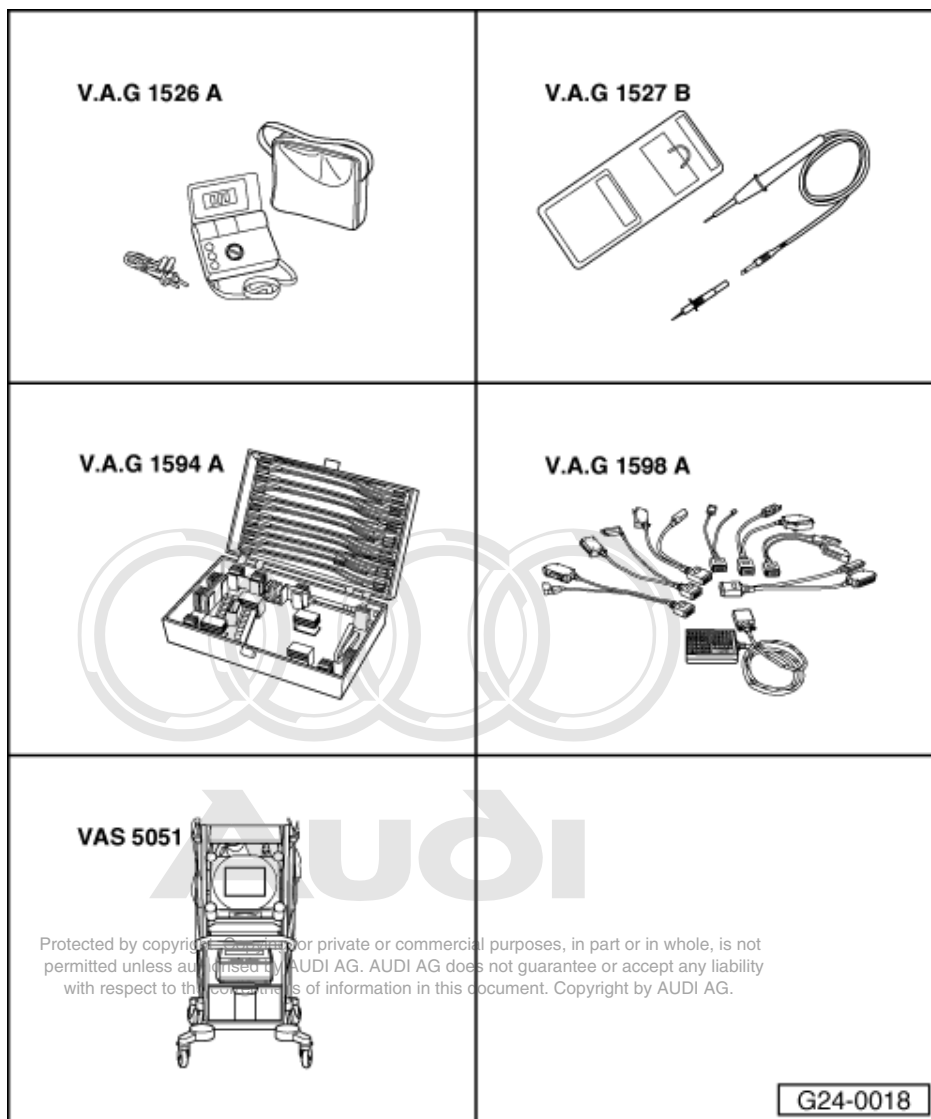
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace engine control unit => Page 60 .

4 - Checking throttle valve potentiometer -G69

4.1 - Checking throttle valve potentiometer -G69



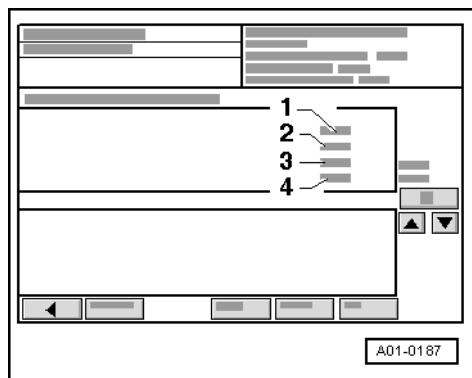
Note:

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

Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5
- ◆ VAS 5051 with VAS 5051/1 and VAS 5051/2

Fitting location => Fitting locations overview, Page **50**



Check function

- Read measured value block, display group 003, ignition switched on => Page 30 .

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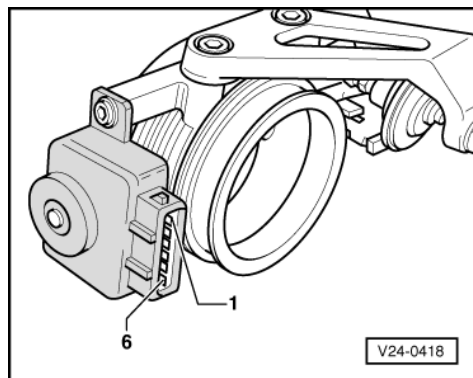
-> Display on VAS 5051:

- Check display in display zone -3-.
 - Specification: $0...5^{\circ}$
- Slowly depress accelerator pedal.
 - Specification: The readout must increase steadily until it reaches $90...102^{\circ}$ (with accelerator pedal fully depressed)
- Switch ignition off.

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

- Check throttle cable setting

=> Fuel Supply - Petrol Engines; Repair group 20; Servicing throttle mechanism Servicing throttle mechanism



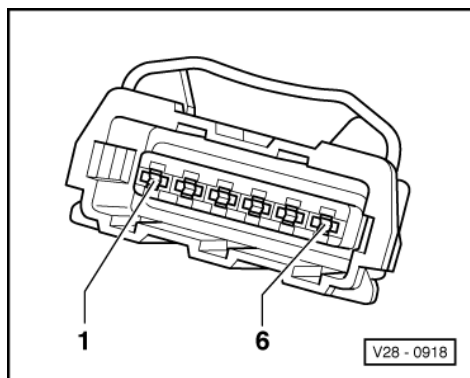
If the display does not change or only changes irregularly:

Check internal resistance

- Detach connector from throttle valve potentiometer.
- -> Connect multimeter between contacts 1 and 2 to measure resistance.
 - Specification: $1.5...2.6\text{ k}\Omega$
- Connect multimeter between contacts 2 and 3 to measure resistance.
 - Specification: $0.75...1.3\text{ k}\Omega$
- Slowly move the throttle valve lever to full throttle position.
 - Specification: Increasing resistance up to max. $3.6\text{ k}\Omega$

If a specification is not met:

- Renew throttle valve potentiometer.



If specifications are attained:

Check power supply

- Detach connector from throttle valve potentiometer.
- -> Connect multimeter between contacts 1 and 2 to measure voltage.
 - Specification: 4.5...5.5 V
- Connect the multimeter for voltage measurement range (direct voltage) between contact 2 and contact 3.
 - Specification: 4.5...5.5 V

If a specification is not met:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
1	12
2	30
3	53

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

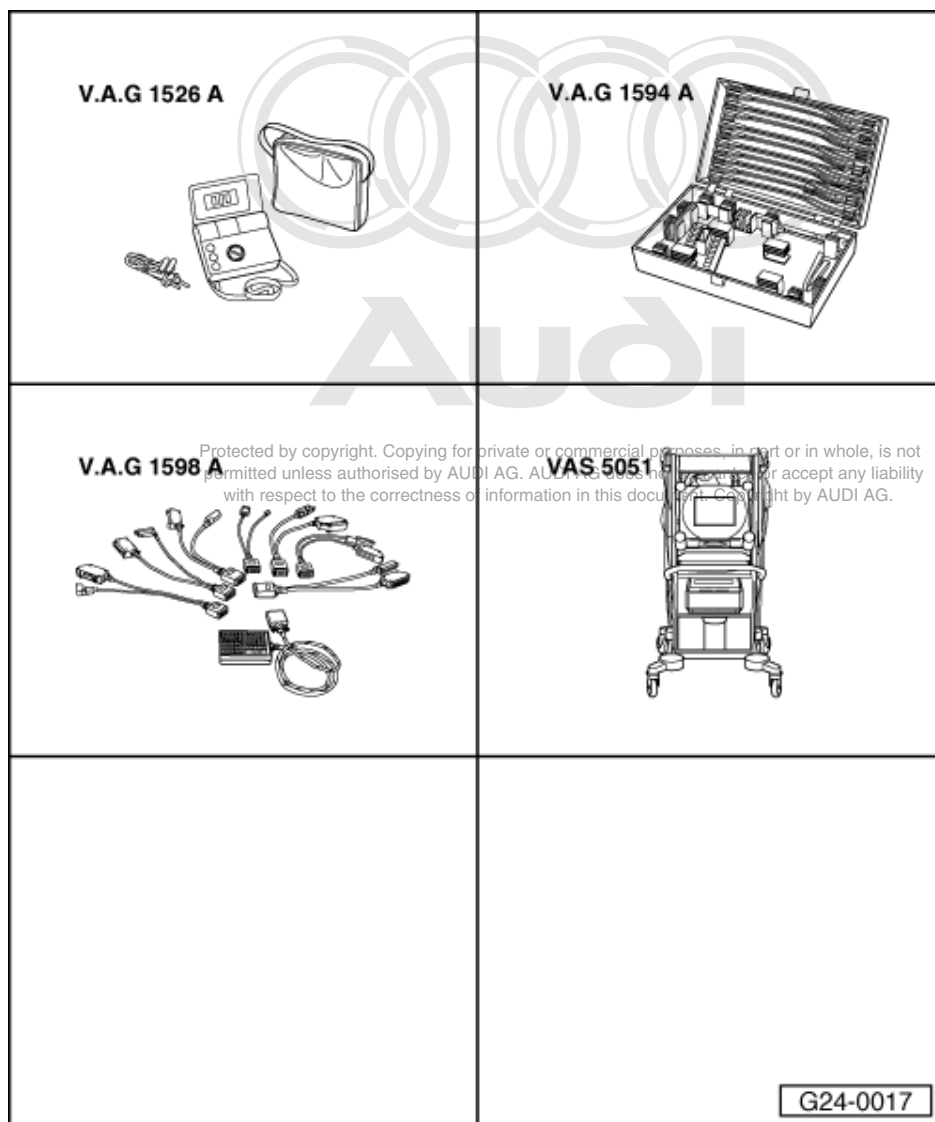
Note:

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Use only gold-plated contacts when repairing the contacts in the connectors.



4.2 - Checking and adjusting idling speed switch -F60

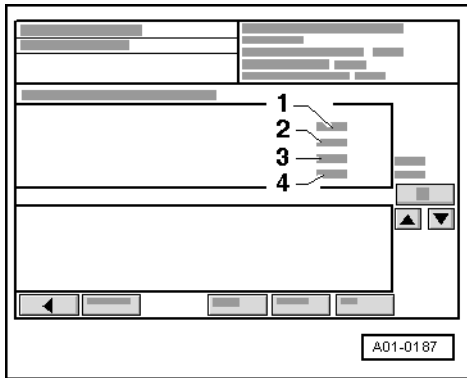


Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Note:

The idling switch is located in the throttle valve potentiometer.



Check function

- Read measured value block, display group 004, ignition switched on => Page 30 .

-> Display on VAS 5051:

- Check display in display zone -4-.
 - Specification: 00010
- Open throttle valve slightly.
 - Specification: 00100

If this readout changes only after a relatively long pedal displacement or if "00100" is displayed even without the accelerator pedal being actuated:

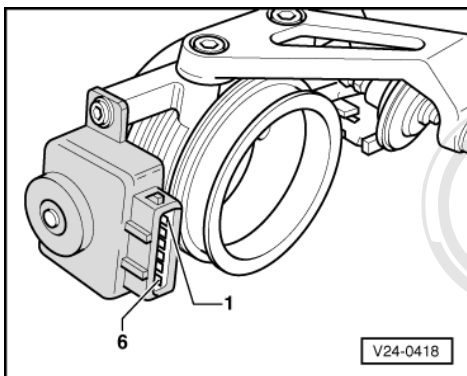
- Adjust idling switch =>Page 109 .

If the display does not change:

Checking idling switch -F60

Test requirements:

- Throttle cable setting OK
- Throttle cable setting OK
- Closing damper and adjustment OK
- Detach connector from throttle valve potentiometer.



- -> Connect multimeter between contacts 4 and 6 to measure resistance.
 - Specification: 0 ω
- Open throttle valve slightly.
 - Specification: $\infty \omega$ (no continuity)

If the display is not as described or if only after a relatively long pedal displacement:

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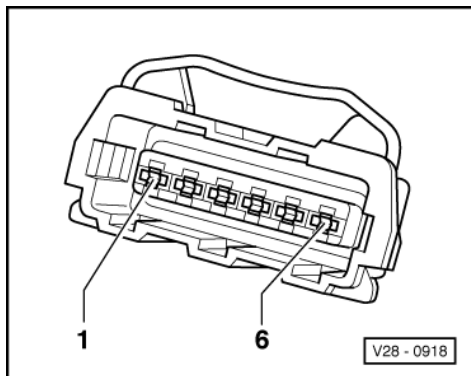
- Adjust idling switch =>Page **109** .

If the readout is as described, but no values or incorrect values are displayed in the measured value block:

- Check the wiring connections.

If the specifications are still not attained:

- Renew throttle valve potentiometer.



Checking wiring

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page **59** .
- -> Check for open circuit and short to positive or earth in the following wiring connection:

Connector Contact	Test box V.A.G 1598 A Socket
6	52

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

Note:

Use only gold-plated contacts when repairing the contacts in the connectors.

If no wiring fault is detected:

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

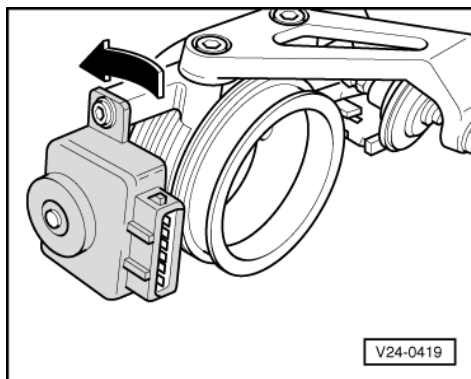
Connector Contact	Measure to
4	Battery positive

- The LED should illuminate.

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If the LED does not illuminate:

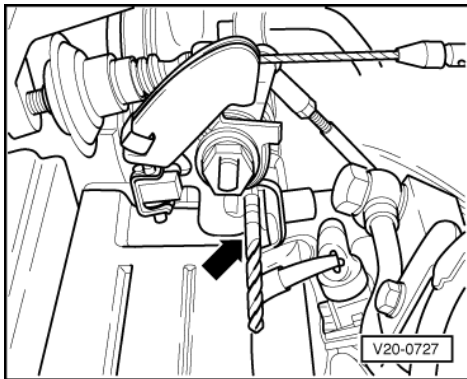
- Check wiring connection for open circuit between contact 4 of connector and earth connection (control unit) in Motronic wiring harness.
- Eliminate open circuit using the current flow diagram.



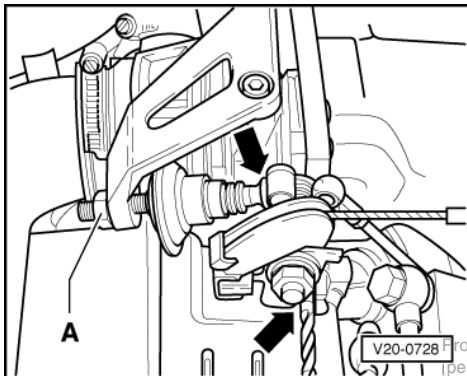
Adjusting idling switch

- Slacken off both bolts of throttle valve potentiometer.
- -> Connect multimeter between contacts 4 and 6 to measure resistance.
- Turn the throttle valve potentiometer in the direction of the arrow to the stop.
- Tighten bolts of throttle valve potentiometer in this position.
- Check the idling speed switch -F60 again => Page 107 .

4.3 - Checking and adjusting closing damper



- Open throttle valve.
- -> Clamp a $\varnothing$ 5.5 mm drill bit in the centre between the stop and the throttle lever -arrow-.

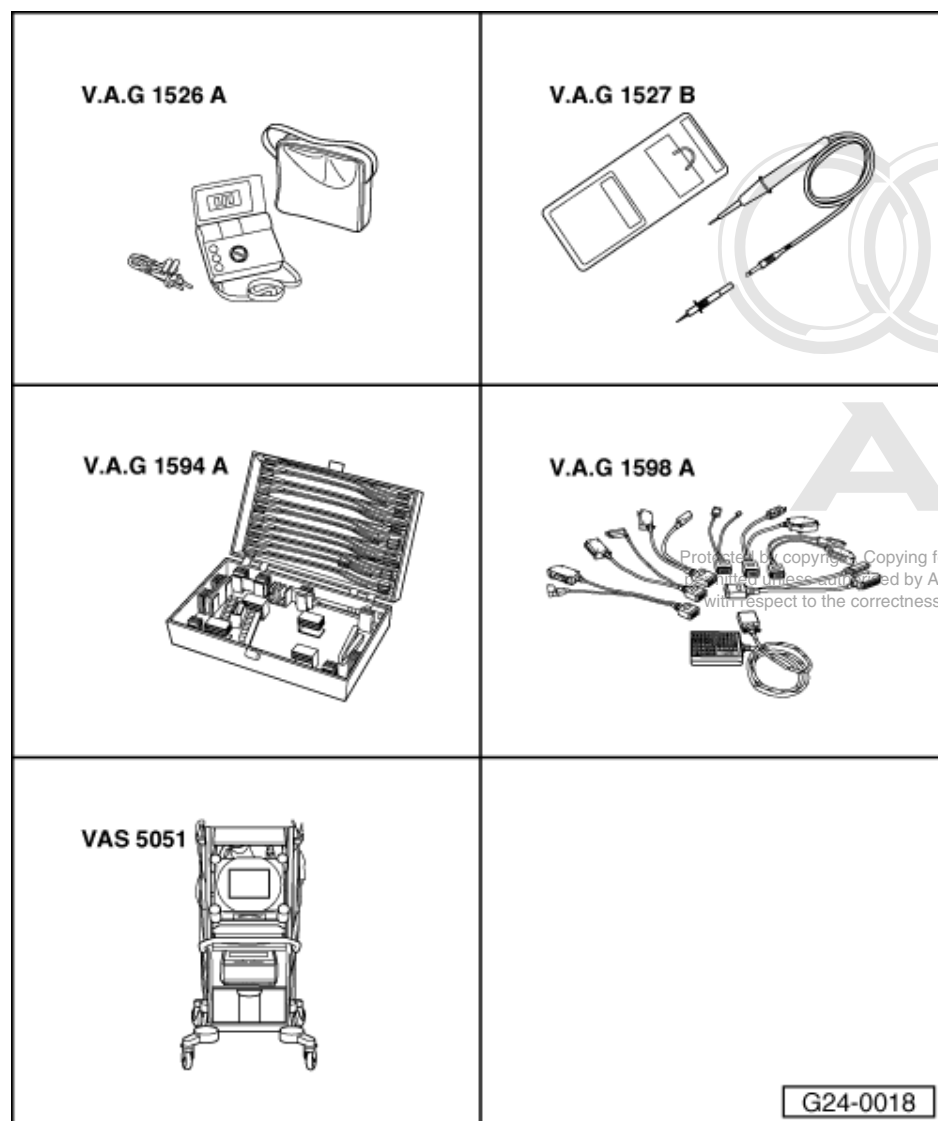


- Check the adjustment:
 - -> The closing damper must lift straight up from the roller of the throttle valve -arrow at top-
- If necessary, release the lock nut -A- and twist the closing damper until it no longer touches the roller.
- Tighten the lock nut securely in this position and remove the drill bit -arrow at bottom-.

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5 - Checking auxiliary signals

5.1 - Checking auxiliary signals



5.2 - Checking signals from/to air conditioner

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Checking engine speed adaption and compressor shut-off

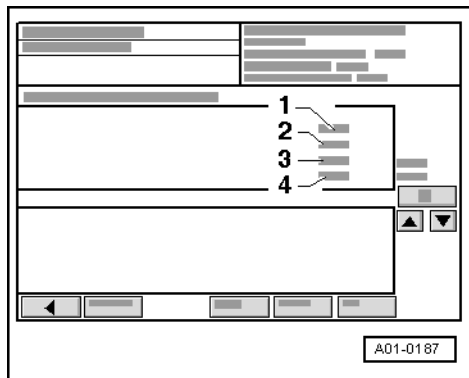
Notes:

- ♦ Shortly after the air conditioner is switched on, a positive signal is sent to contact 6 on the engine control unit. The idling stabilisation pilot control value is raised by means of the signal from the air conditioner to ensure that the idling stabilisation remains in the mid-range of the regulating zone.

- ♦ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor briefly when accelerating from standstill and from a low speed.

Test requirements:

- Air conditioner system OK
- No faults recorded in fault memory of engine control unit
- Vehicle at ambient temperature (warmer than +15 °C)
- Air conditioner switched off.



Test sequence

- Read measured value block, display group 005, engine idling => Page 30 .

-> Display on VAS 5051:

- Check display in display zone -4-.
 - Specification: 00 00
- Switch on air conditioner system.
 - Specification: 11 00
- Fully depress the accelerator pedal and release again (brief actuation).
 - Specification in display zone 4: Display switched for several seconds from "11 00" to "01 00" (compressor cut-off on vehicle acceleration).
- Switch ignition off.

If the display is not as described:

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the engine control unit => Page 59 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
6	Engine earth

- Start engine and run at idling speed.
- Switch on air conditioner system.
 - The LED should come on after 1...6 seconds
- Fully depress the accelerator pedal and release again (brief actuation).
 - The LED should go off for a few seconds
- Switch ignition off.

If the display is not as described:

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

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Test box V.A.G 1598 A Socket	Operating and display unit -E87 Contact
6	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Check operation of air conditioner.

=> Heating, Air Conditioner; Repair group 87; Air conditioner Air conditioner

If both air conditioner and wiring OK:

- Replace engine control unit => Page 60 .

Checking engine speed increase

Note:

Through this signal from the air conditioner, the idling speed is increased by approx. 80 rpm with high heating/cooling output.

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- Air conditioner system OK
- No faults recorded in fault memory of engine control unit
- Vehicle at ambient temperature (warmer than +15°C)
- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
41	Engine earth

- Start engine and run at idling speed.
- Switch on air conditioner and set air conditioner to maximum cooling/heating. The compressor must run.
 - The LED should illuminate.
- Switch off air conditioner.
 - The LED should go out.
- Switch ignition off.

If the display is not as described:

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

Test box V.A.G 1598 A Socket	Operating and display unit -E87 Contact
41	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Check operation of air conditioner.

=> Heating, Air Conditioner; Repair group 87; Air conditioner Air conditioner

If both air conditioner and wiring OK:

- Replace engine control unit => Page 60 .

5.3 - Checking engine speed signal

Notes:

- ♦ The engine speed signal is output at contact 40 of the engine control unit. The signal is necessary, among other things, for the engine speed display in the dash panel insert.
- ♦ Checking engine speed signal:

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

5.4 - Checking consumption signal for on-board computer

Notes:

- ♦ The consumption signal is calculated by the engine control unit from the injection period and relayed at contact 31 to the onboard computer.
- ♦ Checking consumption signal

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

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5.5 - Checking boost pressure signal for onboard computer

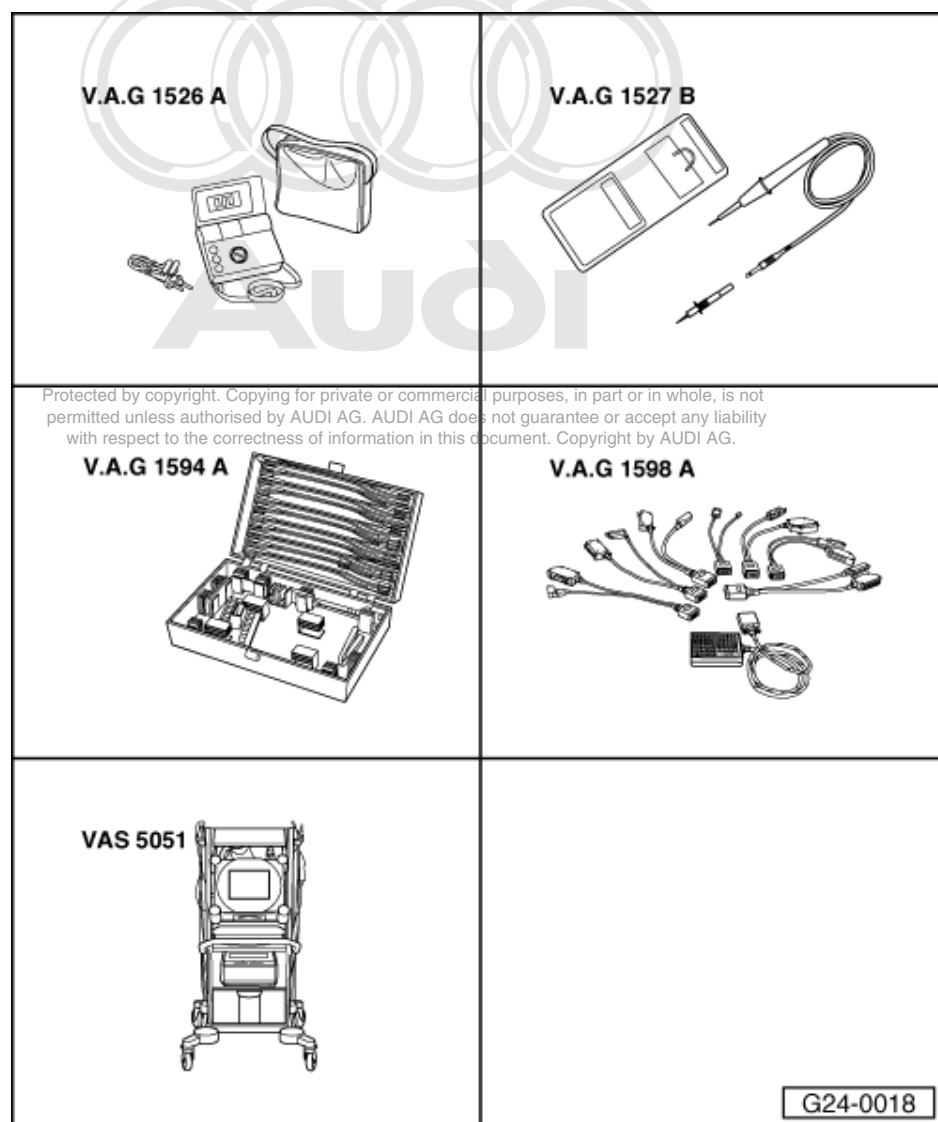
Notes:

- ♦ The boost pressure signal is relayed by the engine control unit at contact 32 to the onboard computer.
- ♦ Checking consumption signal:

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



5.6 - Checking vehicle speed signal



Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

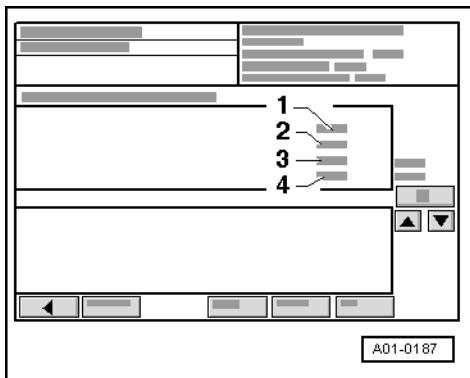
The vehicle speed signal is required for the air conditioner compressor cut-off when accelerating, for shutting off the idling stabilisation above 6 km/h and for limiting speed to 210 km/h (for vehicles with comfort tyres or USA/Canada).

Note:

If the vehicle speed signal fails, the engine speed is limited to 5320 rpm at full load after 4 seconds.

Test requirements:

- Speedometer function and display OK



Test sequence

- Read measured value block, display group 004, engine idling => Page 30 .

-> Display on VAS 5051:

- Check display in display zone -3-.
 - Specification when stationary: 4 km/h

Note:

When stationary, 4 km/h is always displayed.

- Perform a road test.
 - The current road speed should be displayed (compare with speedometer).

If the vehicle speed is not displayed:

- Raise vehicle using a vehicle hoist until the front left wheel is off the ground.
- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the control unit => Page 59 .
- Connect voltage tester V.A.G 1527 B as follows:

Test box V.A.G 1598 A Socket	Measure to
50	Battery positive

- Switch the ignition on.
 - The LED must light up dimly.
- Rotate the front left wheel.
 - The LED should flash.
- Switch ignition off.

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If LED does not flash:

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

Test box V.A.G 1598 A Socket	Dash panel insert Contact
50	=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations

If no wiring fault is detected:

- Disconnect adapter V.A.G 1598/5 from engine control unit.



If LED now flashes:

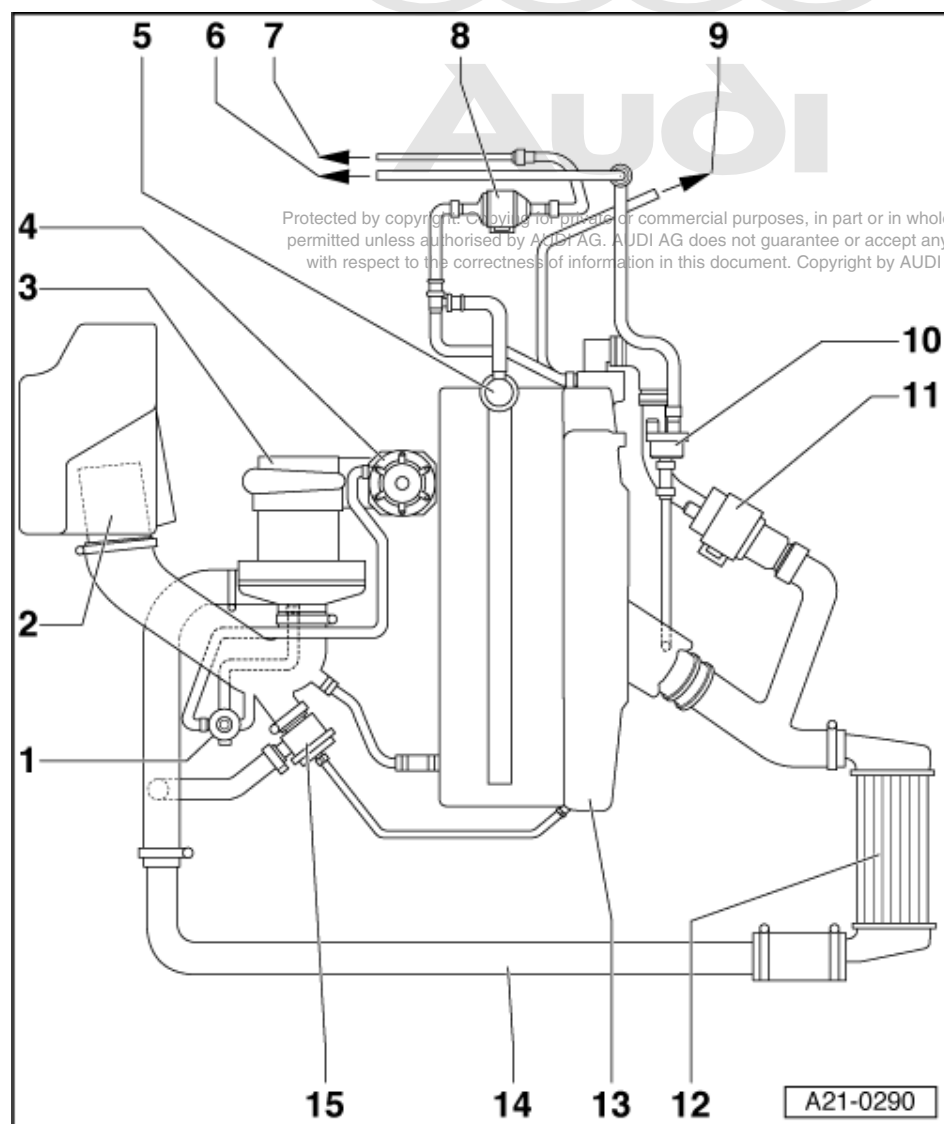
- Replace engine control unit => Page **60** .

If LED still does not flash:

- Establish which "recipients" of the vehicle speed signal (e.g. radio, air conditioner 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.

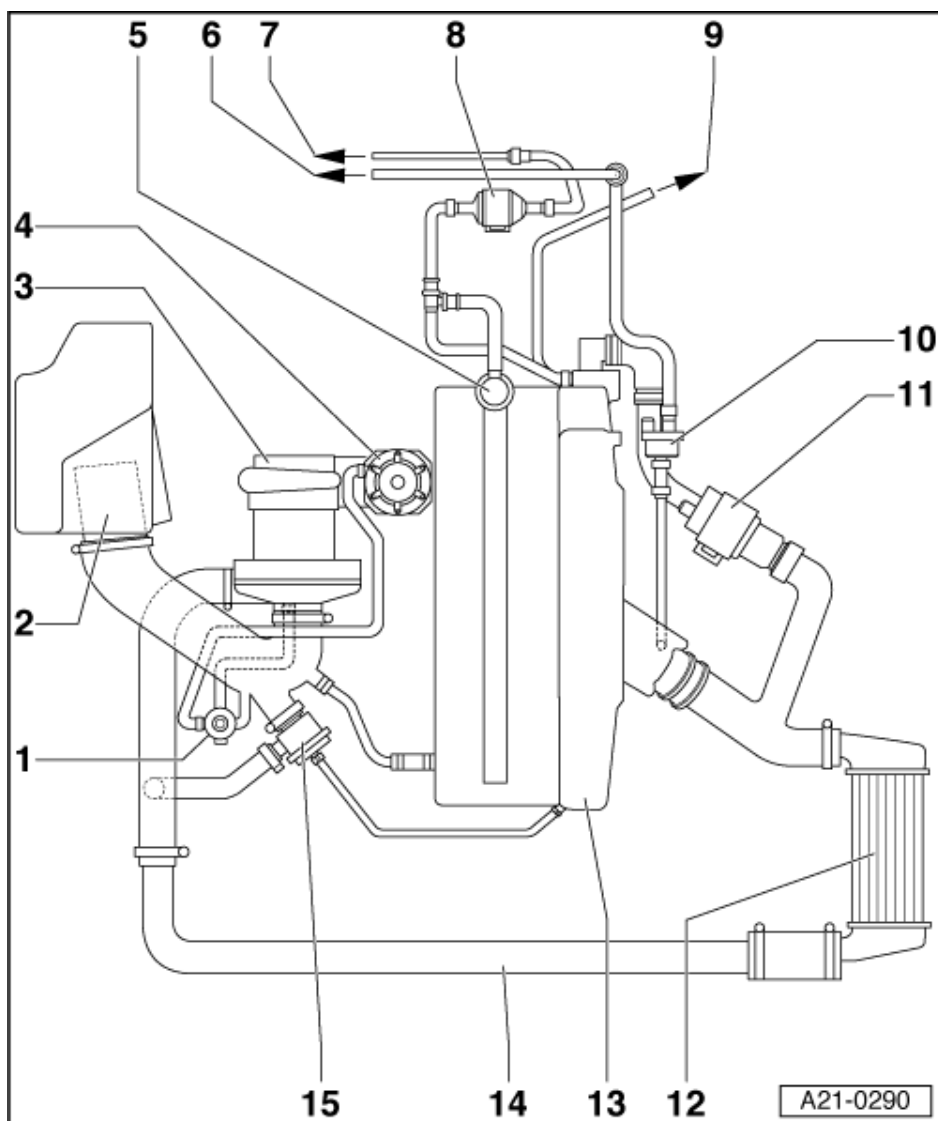
6 - Vacuum diagram

6.1 - Vacuum diagram



- 1 Boost pressure control solenoid valve -N75
- 2 Air mass meter -G70
- 3 Turbocharger
- 4 Mechanical boost pressure regulating valve
- 5 Fuel pressure regulator
- 6 To activated charcoal filter
- 7 to engine control unit

- 8 Water separator
- 9 Connection for differential lock and AC
- 10 Solenoid valve 1 for activated charcoal filter -N80



- 11 Idling stabilisation valve -N71
- 12 Intercooler
- 13 Intake manifold
- 14 Pressure pipe
- 15 Deceleration cut-off valve

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28 - Ignition system

1 - Checking ignition system

1.1 - Checking 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:

- ♦ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ♦ Do not touch or disconnect ignition cables when the engine is running or at starter speed.
- ♦ To run the engine at starting speed without actually starting it (for example, in order to test compression), detach connectors from both output stages for ignition coils and also detach connectors from the injectors. After completing the work, interrogate the fault memory.
- ♦ For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.
- ♦ Always switch off the ignition before washing the engine.
- ♦ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ♦ Always use adapter set V.A.G 1594 A for connecting up measuring instruments (e.g. voltage tester V.A.G 1527 B, hand-held multimeter V.A.G 1526 A etc.)

1.3 - Technical data

Engine code letters	AAN
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Spark plugs 1)	Tightening torque 30 Nm
Spark plug connectors	Resistance approx. 5 kΩ
Firing order	1-2-4-5-3
Engine speed limitation by deactivation of injectors	approx. 7200 rpm

1) Current values:

=> Exhaust emissions test

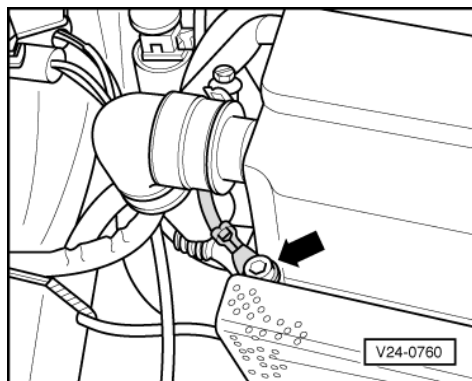
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1.4 - Checking ignition coils and output stages



Special tools and workshop equipment required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5



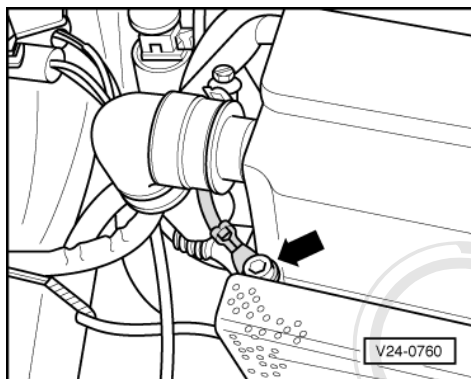


Checking ignition coils

- -> Before testing, check earth connection for ignition coils at the right rear cylinder head cover -arrow-.
- In addition, test the spark plug connector (connected to ignition coil). For this purpose, connect a handheld multimeter for resistance measurement to the spark plug connector.
- Specification: approx. 5 kW

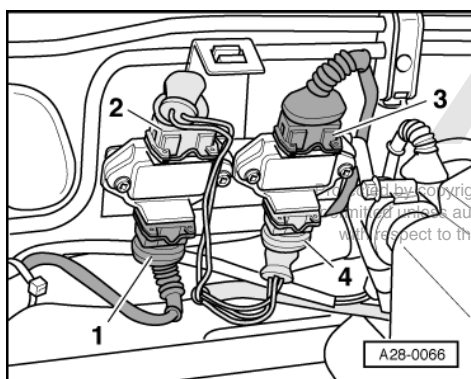
Identify an inoperative or misfiring cylinder as follows:

- Disconnect connectors from the injectors in sequence with the engine running, and observe how the engine runs.

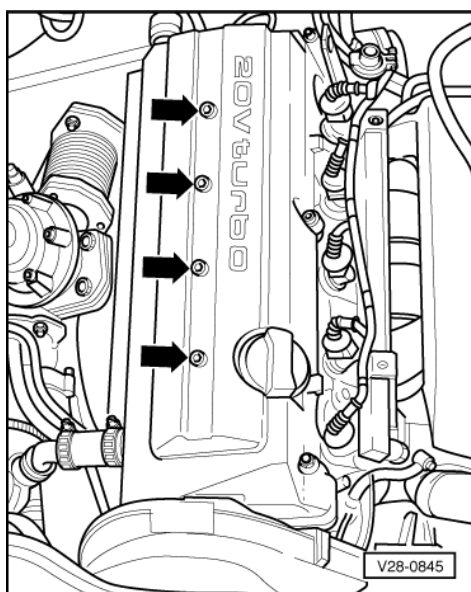


If the defective cylinder has been identified:

- -> Unscrew the earth wire -arrow- from the cylinder head cover.



- -> Unplug connectors -1 ...4-.



- -> Unscrew mountings of ignition coil carrier -arrows- and evenly detach carrier upwards.
- Replace the spark plug of the defective cylinder with one from another cylinder.

If the fault moves with the spark plug:

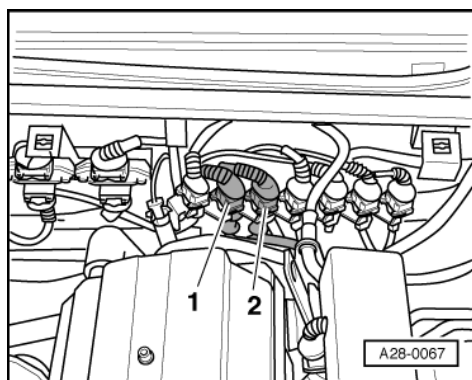
- Renew the spark plug.

If the fault remains in the same cylinder:

- Check supply voltage for ignition coils => Page 121 .
- Check trigger wires to the ignition coils => Page 122 .
- Check output stages => Page 126 .

If no fault is found:

- Replace the ignition coil.



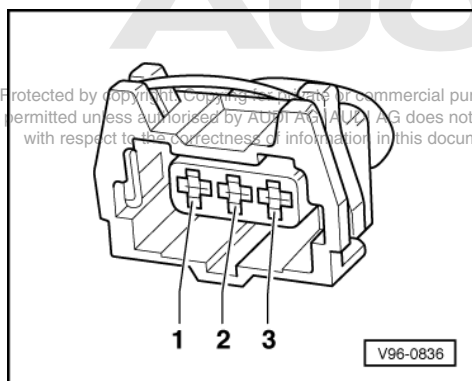
Checking the power supply to the ignition coil

Test requirements:

- Fuse for ignition coils OK.

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

- -> Unplug the connectors -1- and -2-.



- -> Connect multimeter as follows to measure voltage at both disconnected connectors.

Connector Contact	Measure to
1	Engine earth
2	Engine earth

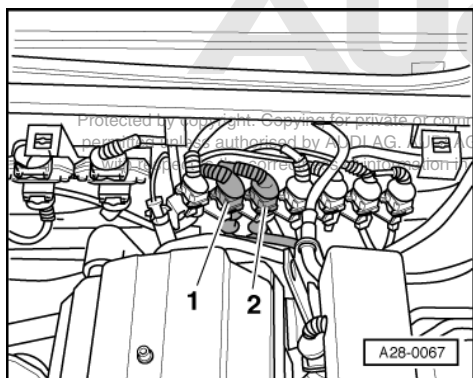


Connector Contact	Measure to
3	Engine earth

- Switch the ignition on.
 - Specification: approx. battery voltage
- Switch ignition off.

If specification is not attained:

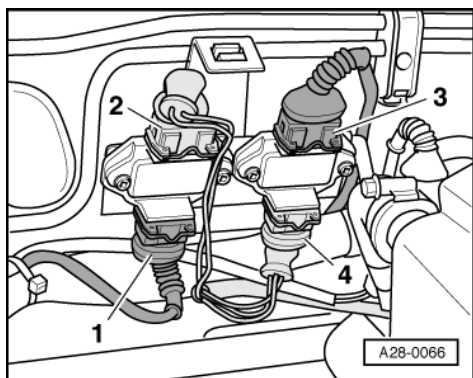
- Check the wiring connection for open circuit using the current flow diagram.



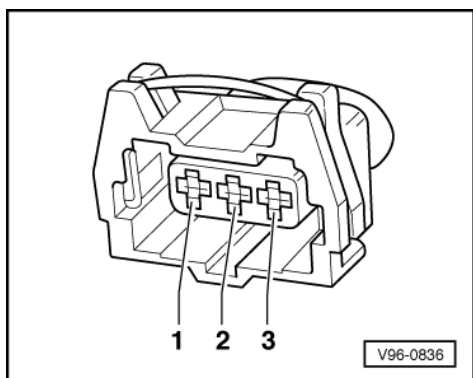
If specification is attained:

Check trigger wires to the ignition coils

- -> Connectors -1- and -2- connected to the ignition coils



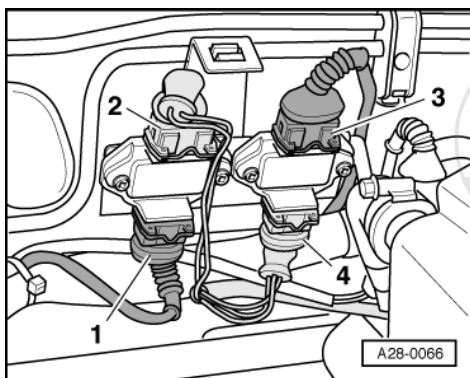
- -> Unplug the 3-pin connector -Item 4- at output stage 1 -N122.



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

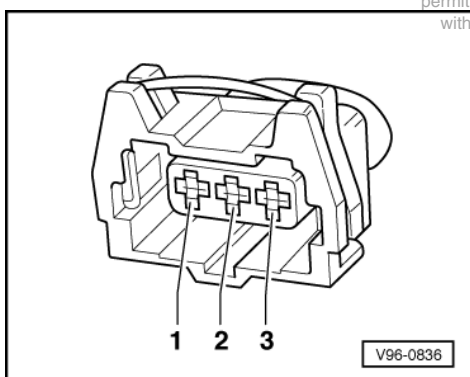
Connector Contact	Measure to
1	Engine earth
2	Engine earth
3	Engine earth

- Switch the ignition on.
 - The LED should light up each time.
- Switch ignition off.



- -> Unplug the 3-pin connector -Item 2- at output stage 2 -N127.

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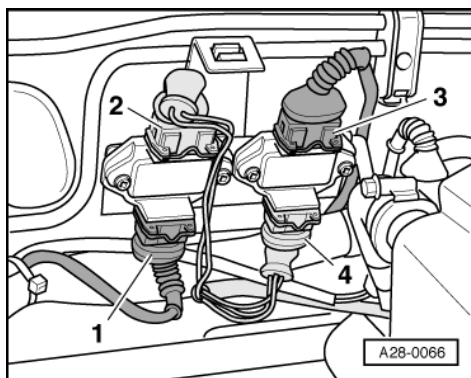
- -> Connect voltage tester V.A.G 1527 B as follows:

Connector Contact	Measure to
1	Engine earth
2	Engine earth

- Switch the ignition on.
 - The LED should light up each time.
- Switch ignition off.

If the specified value is not attained for one of the contacts:

- Eliminate open circuit using the current flow diagram.



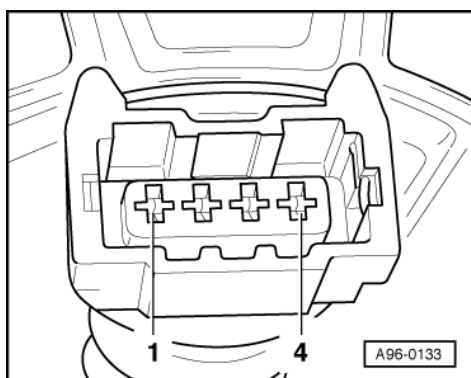
Checking output stage -N122

Test actuation of power output stage:

Note:

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

- -> Unplug the 4-pin connector -Item 3- at output stage 1 -N122.



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

Connector Contact	Measure to
1	Engine earth
3	Engine earth
4	Engine earth

- Operate the starter for a few seconds.
 - The LED should flash.
- Switch ignition off.

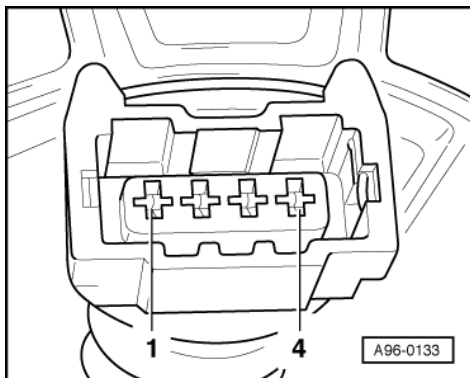
If specifications are attained:

- Check output of output stage => Page 125 .

If the specifications are not obtained:

- With the ignition switched off use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59

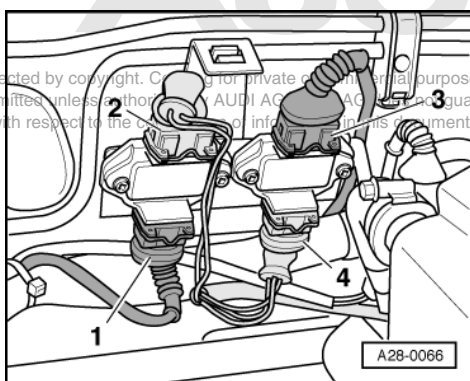
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- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
1	23
2	10, 14, 19 or 24
3	2
4	1

- Rectify any open/short circuit as necessary.
- Connect the electric 4-pin-connector to the output stage.



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If no wiring fault is detected:

Check output of output stage 1 -N122

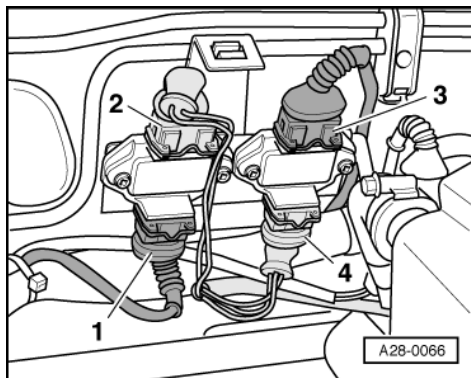
- -> Unplug the 3-pin connector -Item 4- at output stage 1 -N122.
- Connect voltage tester V.A.G 1527 B as follows at 3-pin output of output stage:

Output of output stage Contact	Measure to
1	Battery positive
2	Battery positive
3	Battery positive

- Operate the starter for a few seconds.
 - The LED should flash.

If the LED does not flash when testing one or more of the outputs, although the actuation was OK:

- Replace the output stage.



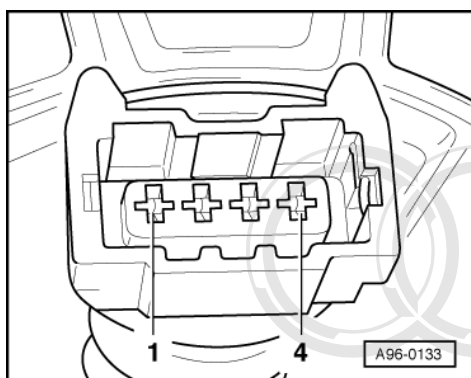
Check output stage 2 -N127

Test actuation of output stage:

Note:

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

- -> Unplug the 4-pin connector -Item 1- at output stage 2 -N127.



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

Connector Contact	Measure to
3	Engine earth
4	Engine earth

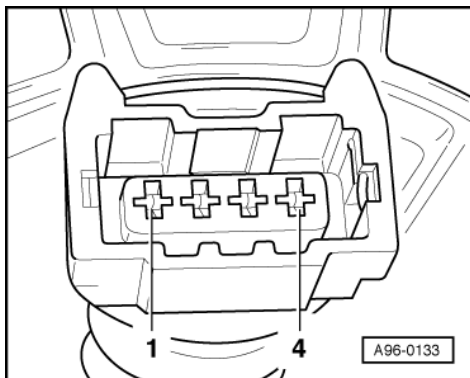
- Operate the starter for a few seconds.
 - The LED should flash.
- Switch ignition off.

If specifications are attained:

- Check output of the output stage => Page 127 .

If the specifications are not obtained:

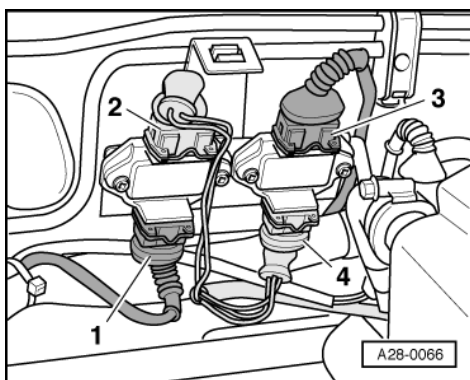
- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .



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

Connector Contact	Test box V.A.G 1598 A Socket
2	10, 14, 19 or 24
3	21
4	20

- Rectify any open/short circuit as necessary.
- Connect the electric 4-pin-connector to the output stage.



If no wiring fault is detected:

Check output of output stage:

- -> Unplug the 3-pin connector -Item 2- at output stage 2 -N127.
- Connect voltage tester V.A.G 1527 B as follows at 3-pin output of output stage:

Output of output stage Contact	Measure to
1	Battery positive
2	Battery positive

- Operate the starter for a few seconds.
- The LED should flash.

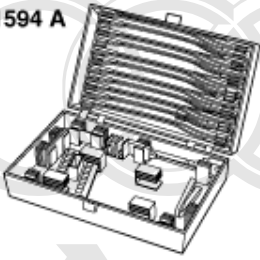
If the LED does not flash when testing one or more of the outputs, although the actuation was OK.

- Replace the output stage.

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1.5 - Checking ignition timing sender -G4

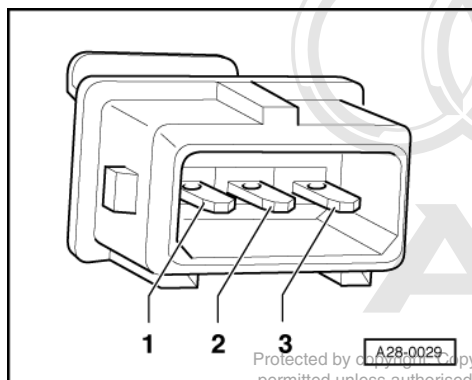
V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
	G24-0015

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

Fitting location => Fitting locations overview, Page **50**

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.



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Checking internal resistance

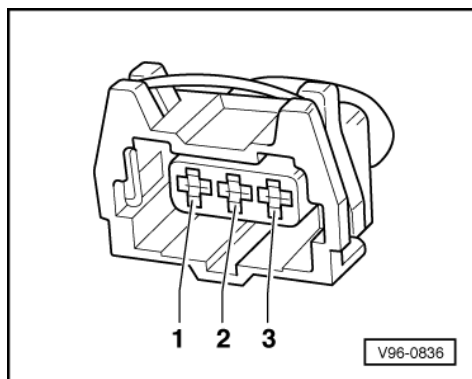
- Pull black 3-way connector off ignition timing sender
- -> Connect multimeter between contacts 1 and 2 on sender to measure resistance.
 - Specification: approx. 1 kΩ

If specification is not attained:

- Renew ignition timing sender.
- Connect multimeter between contacts 1 and 3 as well as 2 and 3 on sender to measure resistance.
 - Specification: infinity in each case (no continuity).

If the specifications are not obtained:

- Renew ignition timing sender.



Checking wiring

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the control unit => Page 59.
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Measure to
1 (earth)	Test box V.A.G 1598 A Socket 48
2 (signal)	Test box V.A.G 1598 A Socket 47
3 (screening)	Engine earth

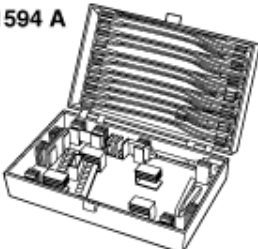
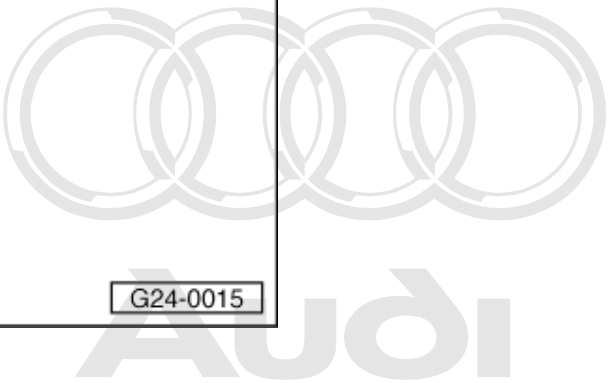
- Use current flow diagram to eliminate open circuit in wiring/short circuit.



If no wiring fault is detected:

- Replace engine control unit => Page **60** .

1.6 - Checking engine speed sender -G28

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	
	 G24-0015

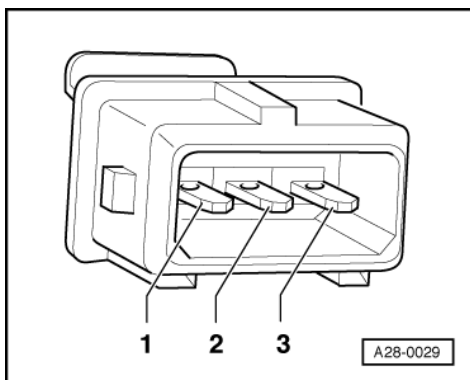
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

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Fitting location => Fitting locations overview, Page **50**

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.



Checking internal resistance

- Switch ignition off.
- Pull grey 3-way connector off engine speed sender
- -> Connect multimeter between contacts 1 and 2 to measure resistance.
 - Specification: approx. 1 kw

If specification is not attained:

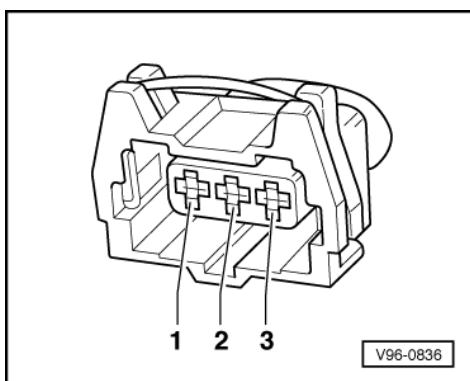
- Fit a new engine speed sender.

If specification is attained:

- Connect multimeter between contacts 1 and 3 as well as 2 and 3 on sender to measure resistance.
 - Specification: infinity in each case ω (no continuity).

If the specifications are not obtained:

- Fit a new engine speed sender.



Checking wiring

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the control unit => Page 59 .
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Measure to
1 (earth)	Test box V.A.G 1598 A Socket 48
2 (signal)	Test box V.A.G 1598 A Socket 49



3 (screening)

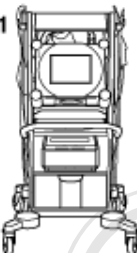
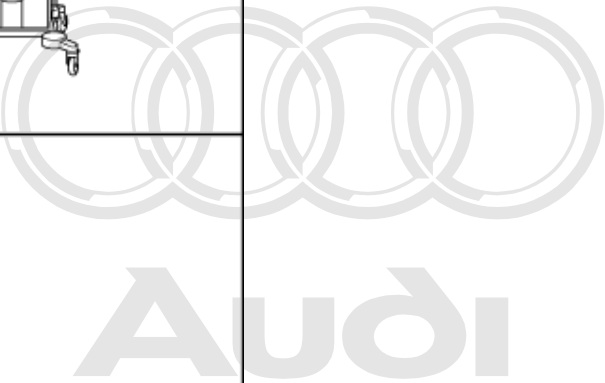
Engine earth

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace engine control unit => Page 60 .

1.7 - Checking intake air temperature sender -G42

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	VAS 5051 
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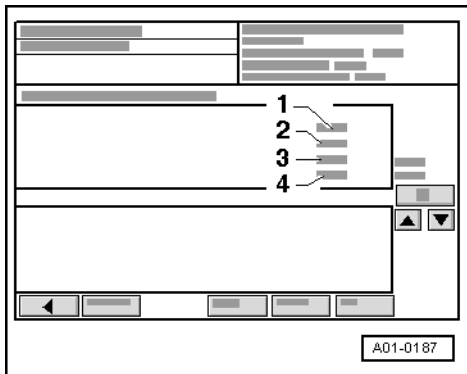
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Fitting location => Fitting locations overview, Page 50

Test requirements:

- Engine cold

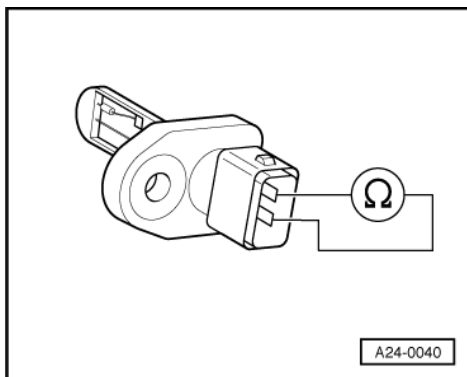


Test sequence

- Read measured value block, display group 003, ignition switched on => Page 30 .

-> Display on VAS 5051:

- Check display in display zone -4-.
 - Specification: approx. the same as the ambient temperature
- Switch ignition off.



If display zone 4 shows an implausible value:

Checking internal resistance

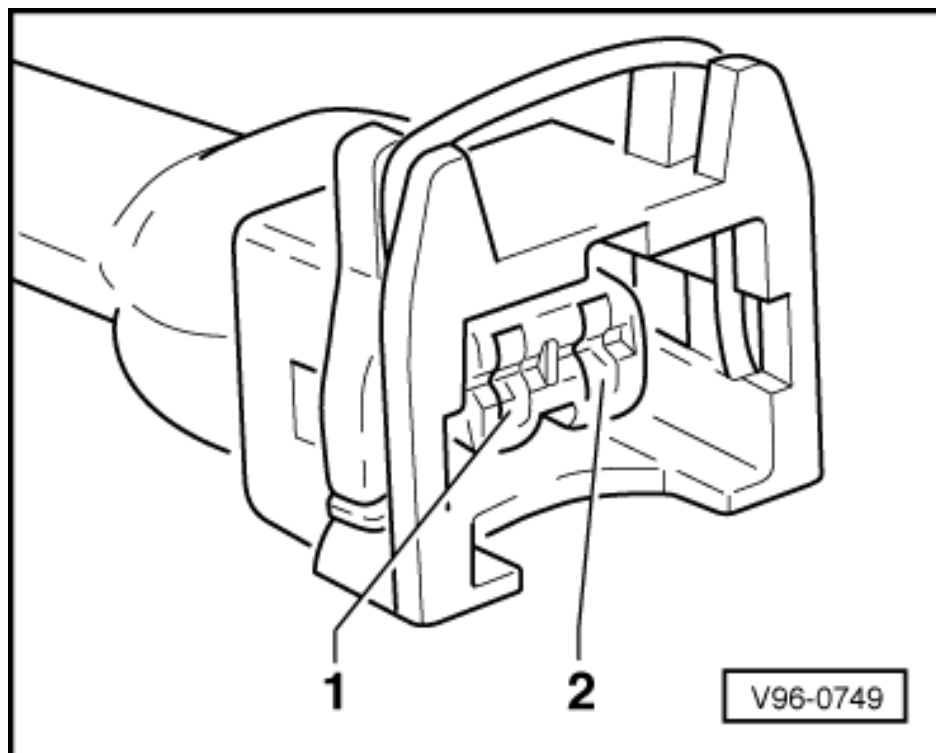
- Remove the connector from the intake air temperature sensor.
- -> Connect multimeter between contacts 1 and 2 on sender to measure resistance.

Ambient temperature	Resistance
approx. 20 °C	450...650 ω

If specification is not attained:

- Replace intake air temperature sender.

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If specification is attained:

Checking wiring

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the control unit => Page 59 .
- -> Check for open circuit and short to positive or earth in the following wiring connections:

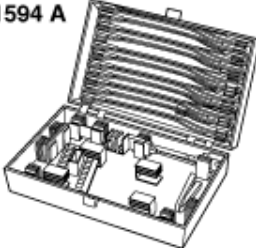
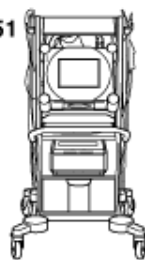
Connector Contact	Test box V.A.G 1598 A Socket
1	44
2	30

- Test for short circuits between the two wires.
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no wiring fault is detected:

- Replace engine control unit => Page 60 .

1.8 - Checking coolant temperature sender -G62

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598 A 	VAS 5051 
	G24-0017

Special tools and workshop equipment required

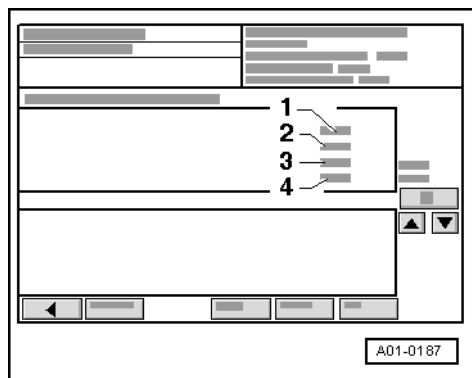
- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598 A with V.A.G 1598/5
- ◆ VAS 5051 with VAS 5051/1 and VAS 5051/2

Fitting location => Fitting locations overview, Page **50**

Test requirements:

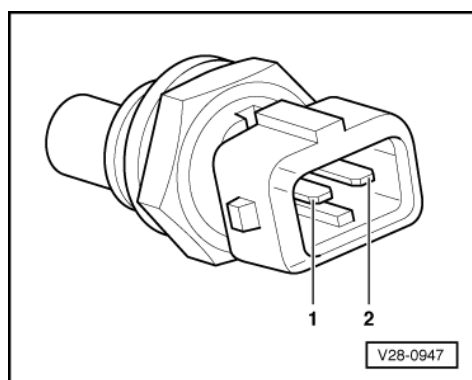
- Engine cold

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Test sequence

- Read measured value block, display group 001, engine idling => Page 30 .
- > Display on VAS 5051:
 - Check display in display zone -2-.
 - Specification: The temperature reading should increase at a uniform rate.
 - Switch ignition off.



If display zone 2 shows an implausible value:

Check internal resistance

- Unplug connector on coolant temperature sender.
- -> Connect multimeter between contacts 1 and 2 on sender to measure resistance.

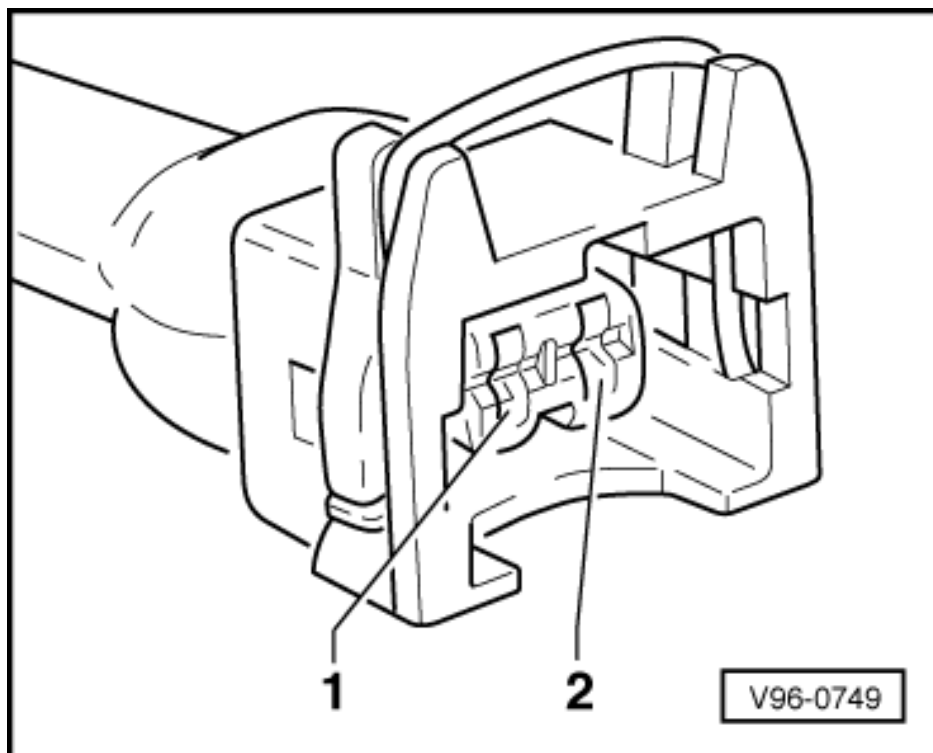
Coolant temperature	Resistance
approx. 20 °C	1.5...3.0 kw

If specification is not attained:

- Replace coolant temperature sender.



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If specification is attained:

Check wiring

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the control unit => Page 59 .
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector Contact	Test box V.A.G 1598 A Socket
1	45
2	30

- Test for short circuits between the two wires.
- Use current flow diagram to eliminate open circuit in wiring/short circuit.

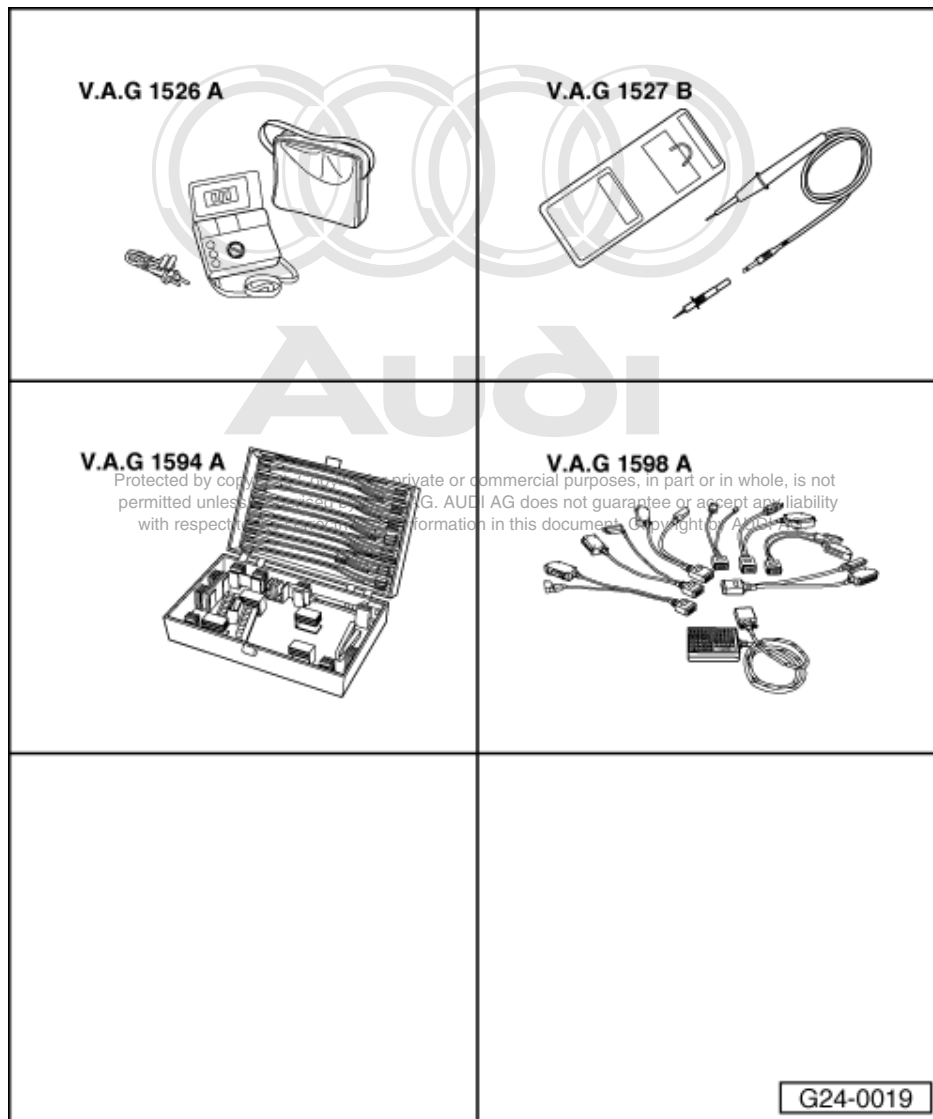
If no wiring fault is detected:

- Replace engine control unit => Page 60 .

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1.9 - Checking control unit power supply



Special tools and workshop equipment required

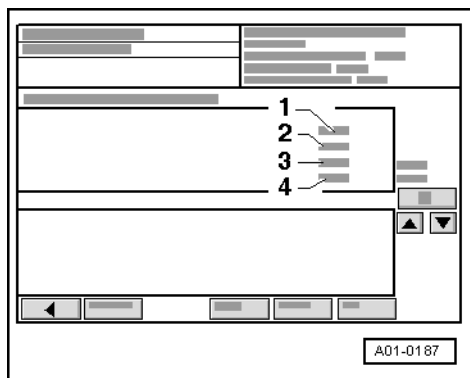
- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5
- ♦ VAS 5051 with VAS 5051/1 and VAS 5051/2

Test requirements:

- Fuses for engine electronics OK

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

- Battery voltage at least 12.7 V
- Alternator OK



Test sequence

- Read measured value block, display group 002, ignition switched on => Page 30 .

-> Display on VAS 5051:

- Check display in display zone -3-.
 - Specification: approx. battery voltage
- Switch ignition off.

If specification is not attained:

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- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to the connector of the engine control unit and also to the control unit => Page 59 .

- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598 A Socket	Measure to
18	Engine earth
10	Battery positive
14	Battery positive
19	Battery positive
24	Battery positive

- Specification: approx. battery voltage
- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598 A Socket	Measure to
27	Engine earth

- Switch the ignition on.
 - Specification: approx. battery voltage
- Connect multimeter as follows to measure voltage:

Test box V.A.G 1598 A Socket	Measure to
37	Engine earth

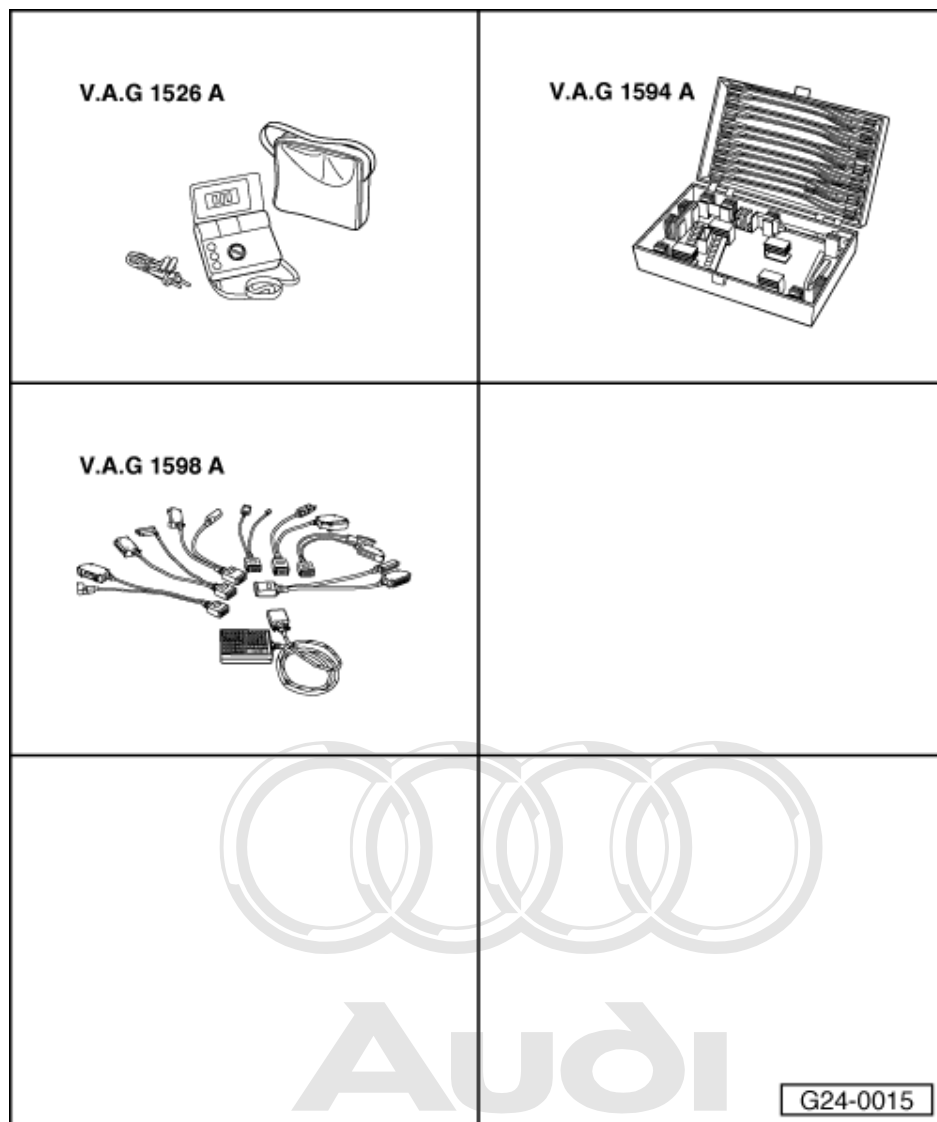
- Operate starter briefly.
 - Specification: approx. battery voltage
- Switch ignition off.

If the specifications are not obtained:



- Eliminate open circuit using the current flow diagram.

1.10 - Checking knock sensors



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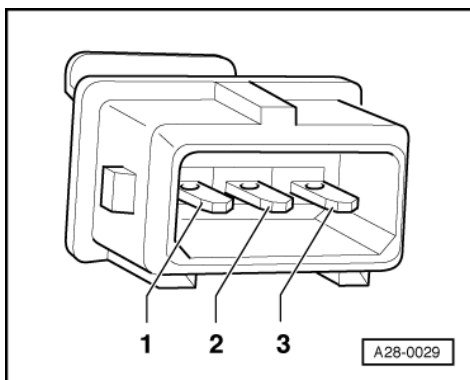
Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

Fitting location => Fitting locations overview, Page **50**

Notes:

- ♦ The knock sensors -G61 and -G66 cannot themselves be tested electrically.
- ♦ Use only gold-plated contacts when repairing the cable connectors for the knock sensors.
- ♦ To ensure that the knock sensors function properly it is important to keep exactly to the specified tightening torque of 20 Nm.
- ♦ Check connector between knock sensor and wiring harness for corrosion.

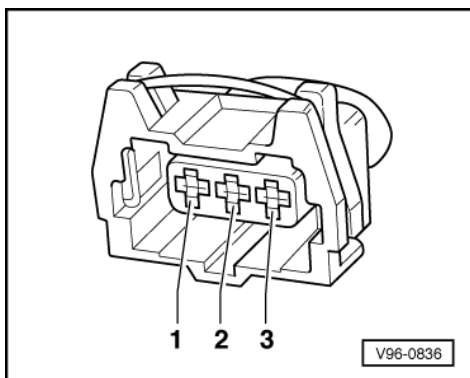


Test sequence

- Unplug the connector for the relevant knock sensor in the engine compartment.
- -> Check for short between all three contacts in the knock sensor connector (contacts 1+2, 1+3, 2+3).
 - Specification: $\infty \omega$ (no continuity) - the wires must not be interconnected.
- If there is a connection between the contacts, fit a new knock sensor.
- If no short is found, check knock sensor wiring.

Checking wiring from knock sensors to engine control unit

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:



- -> Knock sensor 1

Connector Contact	Test box V.A.G 1598 A Socket
1 (signal)	11
2 (earth)	30
3 (screening)	10, 14, 19, 24

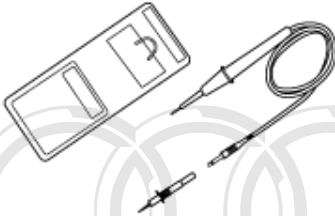
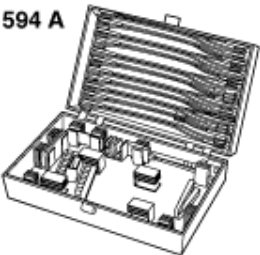
- Knock sensor 2

Connector Contact	Test box V.A.G 1598 A Socket
1 (signal)	29
2 (earth)	30
3 (screening)	10, 14, 19, 24

- Use current flow diagram to eliminate open circuit in wiring/short circuit.



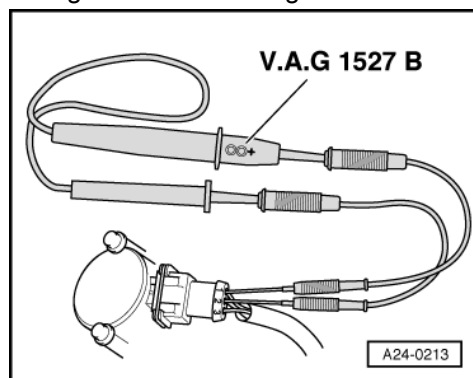
1.11 - Checking Hall sender -G40

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598 A  Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
	G24-0019

Special tools and workshop equipment required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598 A with V.A.G 1598/5

Fitting location => Fitting locations overview, Page **50**



Test sequence

- Push back rubber grommet of plug of Hall sender back but leave connector attached.
- -> Connect voltage tester V.A.G 1527 B between receptacle 2 (Hall sensor signal) and receptacle 1 (positive).

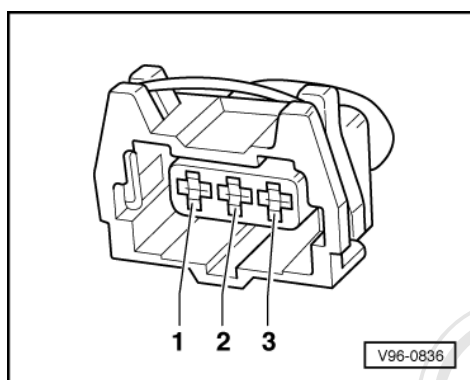
Note:

Pin assignment is marked on back of connector.

- Operate the starter for a few seconds.
 - The LED should flash.

Note:

Voltage testers with a low current consumption continue to glow faintly between actuation from the engine control unit (rather than extinguishing completely) and become much brighter when actuated.



If LED does not flash:

Checking power supply

- Detach connector from Hall sender.
- -> Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
1	Engine earth

- Specification: approx. 5 V

Checking signal wire

- Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
2	Engine earth

- Specification: approx. 5 V

Checking earth wire

- Connect multimeter as follows to measure voltage:

Connector Contact	Measure to
-------------------	------------



3	Battery positive
---	------------------

- Specification: approx. battery voltage
Eliminate open circuit using the current flow diagram.

If the specified values are all achieved and the diode test lamp does not flash (measured between contacts 1 and 2 with starter connector attached),

- Fit a new Hall sender.

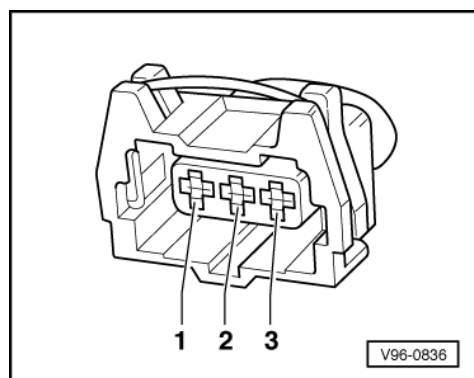


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Note:

-> Removal of Hall sender as of model year 1992 involves detaching camshaft pulley.

=> Engine, Mechanical Components; Repair group 13



If the specifications are not obtained:

Checking wiring between Hall sender and engine control unit

- With the ignition switched off, use adapter V.A.G 1598/5 to connect test box V.A.G 1598 A to connector of engine control unit (control unit remains disconnected) => Page 59 .
- -> Check for open circuit and short to positive or earth in the following wiring connections:

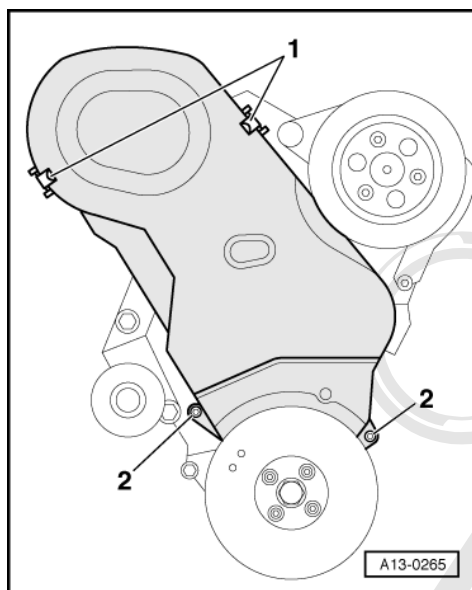
Connector Contact	Test box V.A.G 1598 A Socket
1 (positive)	12
2 (signal)	8

- Use current flow diagram to eliminate open circuit in wiring/short circuit.

If no fault is found:

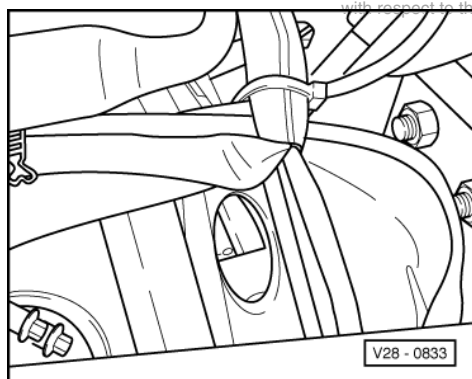
- Replace engine control unit => Page 60 .

1.12 - Basic setting of Hall sender - vehicles of model year 1991

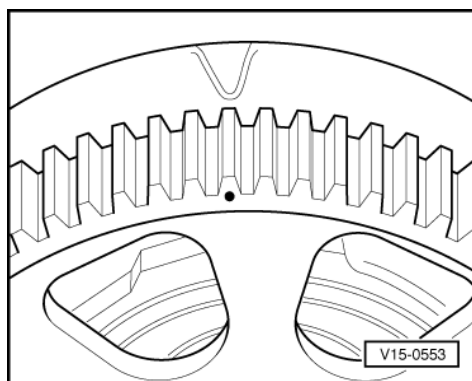


- -> Remove top toothed belt guard by releasing fasteners -1-. Bottom toothed belt guard -2- remains installed.

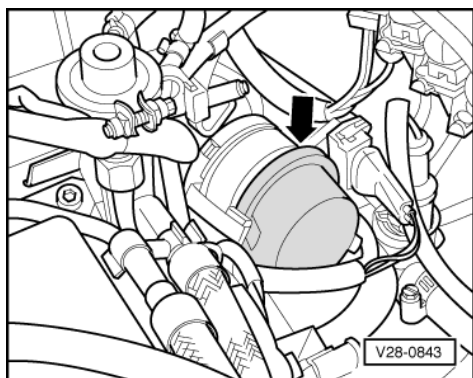
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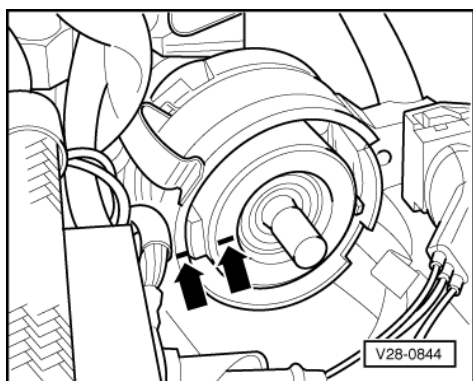
- -> Set crankshaft to TDC marking of No. 1 cylinder, turning at the central bolt of crankshaft toothed belt pulley, in direction of engine rotation...



- -> ...at the same time the marking on the camshaft pulley must align with the arrow marking on the cylinder head cover. If necessary, rotate crankshaft 1 additional turn.



- -> Remove cap -arrow- of Hall sender housing, for this purpose release tension clamps.



- Check the position of the Hall sender:
 - -> The notch on the Hall sender panel must be flush with the notch on the edge of the Hall sender housing -arrows-

If the notches are not flush:

- Release the clamping device on the Hall sender housing.
- Rotate the Hall sender housing until the notches are flush.
- Tighten the clamping device.
 - The Hall sender connector must point to the rear.

If the position of the connector differs significantly:

- Remove the Hall sender and insert it again with the shaft rotated.
- Check whether the Hall sender shaft can be easily moved by rotating by hand.
 - Backlash must be noticeable
- With jammed Hall sender shaft, remove Hall sender and install 2 or max. 3 gaskets between Hall sender and cylinder head.
- Check the axial play of the Hall sender.
 - Axial play: max. 0.3 mm
- With a relatively large axial play, fit a new Hall sender.
- With a large play in the drive, check the splines of the driving pinion.

Note:

If the teeth of the driving pinion are damaged or have been sheared off, perform the following tests:

- ♦ Check drive chain of inlet camshaft for inadmissible elongation.
- ♦ Check toothed belt tension and adjust if necessary.
- ♦ Check front vibration damper on the crankshaft for cracks or deformation of the rubber insert, replace vibration damper if necessary.

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