

Audi A8 1994 ➤

Motronic Fuel Injection and Ignition System (6-cylinder)

Engine ID	ACK	ALG							
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List of Workshop Manual Repair GroupsList of Workshop Manual Repair Groups

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Motronic Fuel Injection and Ignition System (6-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 for Motronic system

1.1 - Self-diagnosis for Motronic system

1.2 - Technical data of self-diagnosis

Features

- ♦ The data transfer between the control unit and the fault reader V.A.G 1551 or the vehicle system tester V.A.G 1552 is carried out in the operating mode "Rapid data transfer".
- ♦ The fault memory is designed as a non-volatile memory and therefore does not depend on the power supply.

1.3 - Safety precautions

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

Warning:

- ♦ Always secure the testers and measuring instruments to the rear seat and have a second person operate them from there.
- ♦ If test equipment were 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 fault reader V.A.G 1551 and selecting engine electronics control unit

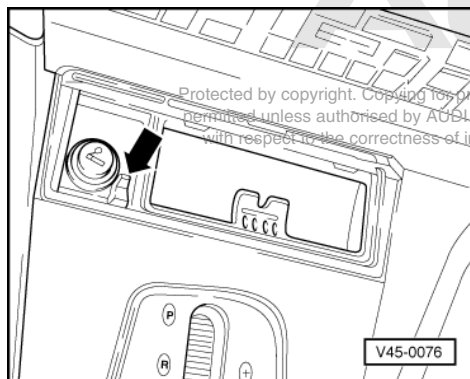
Test requirements:

- Supply voltage of vehicle electrical system OK
- Earth connections on engine and gearbox OK.
- Engine fuses OK

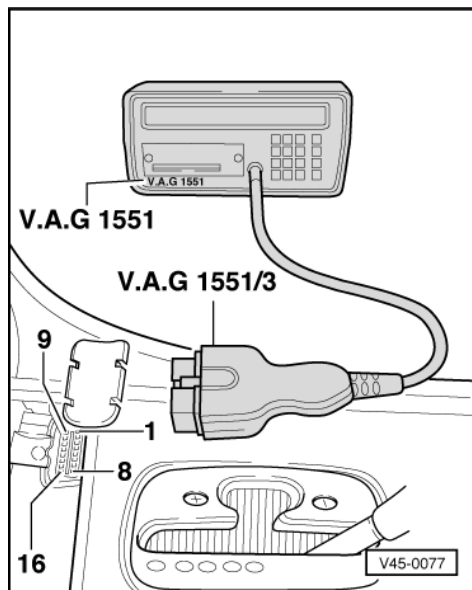
=> "Current flow diagrams, Electrical fault-finding and Fitting locations" binder

- Fuel-pump relay -J17 OK; checking => Page 93 .

Work sequence



- -> Release ashtray in centre console by pressing small lever -arrow-.
- Remove ashtray from centre console and remove cover for diagnostic connector.



- -> Make sure the ignition is switched off, then connect fault reader V.A.G 1551 using test lead V.A.G 1551/3.

-> Display readout:

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

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- 1) displayed alternately

Note:

If the display remains blank:

=> Fault reader operating instructions

Depending on required function => "Available functions" table =>Page 3.

- Switch the ignition on.

or

- Start the engine.
- Switch on the fault reader printer with the print key. The indicator lamp in the key must light up.
- Press key 1 for "Rapid data transfer".

-> When adjacent display appears:

Rapid data transfer HELP
Enter address word XX

Note:

Address word 00 implements the automatic test sequence, i.e. the interrogation of the fault memory via rapid data transfer for all vehicle systems with a self-diagnosis capability.

- Press keys 0 and 1 for address word "Engine electronics" and confirm entry with Q key.

-> The fault reader V.A.G 1551 display will show the control unit identification. For example:

4D0907551C 2.8l V6/5V MOTR HS D07
Code 04003 WSC 12345

Note:

The control unit identification can be printed out by pressing the PRINT key on fault reader V.A.G 1551.

Control unit identification (example)

- 4D0 907 551C	Part no.; assignment => Parts List
- V6/5V	Design of engine (V-engine, 6-cylinder, 5-valve)
- MOTR	Motronic injection and ignition system
- HS	Gearbox HS = manual gearbox (hand shift) AT = automatic gearbox
- D07	Data status (software status) of control unit
- Code 04003	Control unit code
- WSC 12345	Workshop Code of V.A.G 1551 with which encoding was last performed

- Press the ➡key.

-> Display readout (function selection):

Rapid data transfer HELP
Select function XX

Notes:

- ♦ The control unit identification can be displayed again by entering function "01" for "Interrogating control unit version" and confirming with the Q key.

Rapid data transfer HELP
No control unit response

-> When adjacent display appears:

- Perform fault-finding in line with "Diagnostic wire fault finding instructions".

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

Rapid data transfer HELP
K-wire not switching to earth

Rapid data transfer HELP
K-wire not switching to positive

Available functions

Fault reader V.A.G 1551 or vehicle system tester V.A.G 1552		Ignition on, engine stopped	Engine idling	Vehicle running	Page
Address words					
01	Engine electronics	yes	yes	yes	1
00	Automatic test sequence	yes	yes	yes	2
Functions					
01	Interrogating control unit version	yes	yes	yes	3

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02	Interrogating fault memory	no	yes	yes	4
03	Final control diagnosis	yes	no	no	28
04	Basic setting	yes	yes	yes	31
05	Erasing fault memory	yes	yes	yes	4
06	End output	yes	yes	yes	5
07	Encoding control unit	yes	no	no	32
08	Reading measured value block	yes	yes	yes	34

2 - Interrogating and erasing fault memory

2.1 - Interrogating and erasing fault memory

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1).

Note:

If the engine will not start, crank it for at least 5 seconds with the starter and then always leave the ignition on.

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-> Display readout:

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

- Enter "02" for the function "Interrogating fault memory" and confirm entry with Q key.

-> When adjacent display appears:

```
No fault detected
```

- Press the => key.

or

-> When adjacent display appears:

```
X fault(s) detected
```

The stored faults are displayed and printed in sequence when the printer is switched on.

- Locate and eliminate faults listed on printout as per fault table => Page 5.
- Press the =>key.

-> When adjacent display appears:

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

- Enter "05" for the function "Erasing fault memory" and confirm entry with Q key.

Notes:

-> When adjacent display appears:

```
Warning:
Fault memory has not been interrogated
```

Sequence of operations was not carried out properly.

- Interrogate fault memory:

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

-> When adjacent display appears:

Rapid data transfer
Fault memory is erased

- Press the =>key.
- Interrogate fault memory again after carrying out the repairs.

Note:

This erases faults that have been stored whilst the fault was being rectified, for example, faults that have arisen as a result of connectors being detached.

End output

-> When adjacent display appears:

Rapid data transfer HELP
Select function XX

- Enter "06" for "End output" function and confirm entry with Q key.

-> When adjacent display appears:

Rapid data transfer HELP
Enter address word XX

- Switch off ignition and detach diagnostic connector.

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2.2 - Fault table

Notes:

- ♦ The fault table is listed according to the 5 digit fault code on the left.
- ♦ Sporadic faults are faults which only occur occasionally (sporadic = at irregular intervals, intermittently).
- ♦ Before renewing components indicated as being faulty, check the wiring and connectors to these components as well as the earth connections using the current flow diagram. This is particularly relevant for faults recorded as "occurring sporadically" (SP).

2.3 - Fault codes 00282 - 16507

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00282 Throttle valve positioner - V60 Short circuit to positive	- Short to positive in wiring for throttle valve positioner -V60	- Increased idling speed - Load change jolt on accelerator release	- Read measured value block, display group 023 => Page 53



V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - V60 defective - Output for -V60 in engine control unit defective (control unit defective) 	<ul style="list-style-type: none"> - Idling speed positioner deactivated - engine idles with a mechanically regulated air flow through the emergency running slot (slightly increased idling speed) 	<ul style="list-style-type: none"> - Check throttle valve control unit -J338 =>Page 131 - Renew engine control unit => Page 78
	Continued ▼		

Note:

The throttle valve positioner -V60 is located in the throttle valve control unit -J338.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00282 Throttle valve positioner -V60 Short to earth	(Fault 00282 continued) <ul style="list-style-type: none"> - Short to earth in wiring for throttle valve positioner -V60 - -V60 defective <div>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</div> <ul style="list-style-type: none"> - Output for -V60 in engine control unit defective (control unit defective) 	<ul style="list-style-type: none"> - Increased idling speed - Load change jolt on accelerator release - Idling speed positioner deactivated - engine idles with a mechanically regulated air flow through the emergency running slot (slightly increased idling speed) 	<ul style="list-style-type: none"> - Read measured value block, display group 023 => Page 53 - Check throttle valve control unit -J338 =>Page 131 - Renew engine control unit => Page 78

Note:

The throttle valve positioner -V60 is located in the throttle valve control unit -J338.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00532 Supply voltage Signal too high	<ul style="list-style-type: none"> - Voltage regulator of alternator defective - Excess voltage from assisted start 	<ul style="list-style-type: none"> - Damage to the engine control unit 	<ul style="list-style-type: none"> - Check voltage - Read measured value block-Display Group 003, display zone 2=> Page 41
Signal too low	<ul style="list-style-type: none"> - Supply voltage less than 10 V - Poor earth connection to engine control unit - Battery discharged - Current drain with ignition off 	<ul style="list-style-type: none"> - Idling speed outside specified range 	<ul style="list-style-type: none"> - Check power supply to engine control unit =>Page 174 - Read measured value block-Display Group 003, display zone 2=> Page 41 - Check battery charge level

Note on Fault code 00532:

- ♦ 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.
- ♦ The fault message "Signal too low" is stored as soon as, 1 minute after starting, the supply voltage falls below 10.00 V for more than 2 seconds (the control unit will not function at less than 6.5 V).
- ♦ Checking for "Signal too low" does not take place during starting, as voltage may then drop below 10.00 V.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00543 Maximum revs exceeded	- Engine speed in excess of 7100 rpm (wrong gear engaged)	- Possible valve gear and piston damage (impact damage)	- Check for engine damage and erase fault memory

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00561 Mixture adaptation Adaptation limit (add) exceeded Adaptation limit (mul) exceeded	- Fuel system pressure too low - Leaks in exhaust system as far as catalytic converter - Unmetered air downstream of air mass meter - Solenoid valve 1 for activated charcoal filter -N80 sticking Continued ▼	- Jolting may occur - Poor idling may occur	- Fill up vehicle, check fuel system pressure =>Page 82 - Rectify leaks - Check -N80=>Page 127

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00561 Mixture adaptation Adaptation limit (add) not reached Adaptation limit (mul) not reached	(Fault 00561 continued) - Fuel pressure too high - Fuel in engine oil (possibly due to short journeys) - Injectors leaking	- Jolting may occur - Increased fuel consumption - Poor idling may occur - Formation of black smoke, soot deposits on spark plugs	- Fill up vehicle, check fuel system pressure => Page 82 - Drive vehicle on a motorway for 15 minutes or change oil - Check injection quantity => Page 90

Notes:

- ♦ add = additive, i.e. fault only has an effect during idling
- ♦ mul = multiplicative, i.e. fault has an effect over entire engine speed range and load range.
- ♦ If faults "00561" and "01088" have been stored in the fault memory, there must be a fault present which results in incorrect mixture formation for both cylinder banks.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00670 Sensor for throttle valve positioner -G127			



Signal too low	<ul style="list-style-type: none"> - Short to earth in signal wire between throttle valve positioner sender -G127 and engine control unit - Fault in power supply for throttle valve positioner - Throttle valve positioner defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Idling speed positioner deactivated - engine idles with a mechanically regulated air flow through the emergency running slot (slightly increased idling speed) - Load change jolt on accelerator release - AC compressor only activated at higher engine speeds 	<ul style="list-style-type: none"> - Check throttle valve positioner sender =>Page 138 - Renew engine control unit => Page 78
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V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00670 Throttle valve positioner sender - G127 Signal too high	(Fault 00670 continued) <ul style="list-style-type: none"> - Open circuit or short to positive in signal wire between throttle valve positioner sender -G127 and engine control unit - Fault in earth supply for throttle valve positioner - Throttle valve positioner defective Continued ▼	<ul style="list-style-type: none"> - Idling speed positioner deactivated - engine idles with a mechanically regulated air flow through the emergency running slot (slightly increased idling speed) - Load change jolt on accelerator release - AC compressor only activated at higher engine speeds 	<ul style="list-style-type: none"> - Check throttle valve positioner sender =>Page 138

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
00670 Throttle valve positioner sender - G127 Signal too high	(Fault 00670 continued) <ul style="list-style-type: none"> - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Renew engine control unit => Page 78

Notes:

- ♦ The throttle valve positioner sender -G127 is located in the throttle valve -control unit -J338.
- ♦ The sensor is a potentiometer, which reports the position of the throttle valve positioner to the control unit.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01088 Mixture adaptation 2 Adaptation limit (add) exceeded	<ul style="list-style-type: none"> - Fuel system pressure too low 	<ul style="list-style-type: none"> - Jolting may occur 	<ul style="list-style-type: none"> - Fill up vehicle, check fuel system pressure =>Page 82

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
Adaptation limit (mul) exceeded	<ul style="list-style-type: none"> - Unmetered air downstream of -G70 - Leaks in exhaust system as far as catalytic converter - Solenoid valve 1 for activated charcoal filter -N80 sticking Continued ▼	<ul style="list-style-type: none"> - Poor idling may occur 	<ul style="list-style-type: none"> - Read measured value block, display group 002 => Page 40 - Rectify leaks - Check -N80=>Page 127

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01088 Mixture adaptation 2 Adaptation limit (add) not reached	(Fault 01088 continued) - Fuel pressure too high	<ul style="list-style-type: none"> - Jolting may occur - Increased fuel consumption 	<ul style="list-style-type: none"> - Fill up vehicle, check fuel system pressure =>Page 82
Adaptation limit (mul) not reached	<ul style="list-style-type: none"> - Fuel in engine oil (possibly due to short journeys) - Injectors leaking 	<ul style="list-style-type: none"> - Poor idling may occur - Formation of black smoke, soot deposits on spark plugs 	<ul style="list-style-type: none"> - Drive vehicle on a motorway for 15 minutes or change oil - Check injection quantity =>Page 90.

Notes:

- ♦ add = additive, i.e. effect of fault (e.g. unmetered air) is less pronounced with increasing engine speed.
- ♦ mul = multiplicative, i.e. effect of fault (e.g. injector fault) is more pronounced with increasing engine speed.
- ♦ If faults "00561" and "01088" have been stored in the fault memory, there must be a fault present which results in incorrect mixture formation for both cylinder banks.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01119 Gear recognition signal Open circuit / short to positive	<ul style="list-style-type: none"> - Open circuit or short to positive in signal wire between engine control unit and multi-function switch -F125 - Fault in earth supply for -F125 - -F125 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Engine running problems (juddering gear changes, load change jolts) 	<ul style="list-style-type: none"> - Test wiring using current flow diagram => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Check gear signal => Page 150 - Check multi-function switch -F125 - => Automatic gearbox 01V Self-diagnosis; Repair Group 01; Electrical testing - Electrical testing - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01119 Gear recognition signal			



V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
Short to earth	<ul style="list-style-type: none"> - Short to earth in signal wire between engine control unit and multi-function switch -F125 - Fault in earth supply for -F125 - -F125 defective - Faulty signal input in engine control unit (control unit defective) 	- Engine running problems (juddering gear changes, load change jolts)	<ul style="list-style-type: none"> - Test wiring using current flow diagram => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Check gear signal => Page 150 - Check multi-function switch -F125 => Automatic gearbox 01V Self-diagnosis; Repair Group 01; Electrical testing Electrical testing - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01120 Camshaft timing control 1 Mechanical fault	<ul style="list-style-type: none"> - Fault in power supply for camshaft adjustment valve - N205 or -N208 - Open circuit/short to earth or positive in wiring between camshaft adjustment valve - N205 or -N208 and engine control unit Continued ▼	- Poor performance	<ul style="list-style-type: none"> - Check camshaft adjustment - N205 => Page 183 - Read measured value block, display groups 025/026 or 027 =>Page 54

Note:

Fault is only stored 10 minutes after starting and at a coolant temperature of more than 60 °C.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01120 Camshaft timing control 1 Mechanical fault	(Fault 01120 continued) <ul style="list-style-type: none"> - Oil pressure too low - Camshaft adjustment valve defective - Mechanical camshaft timing control defective 		<ul style="list-style-type: none"> - Check oil pressure => Engine Mechanical Components; Repair Group 19 - Read measured value block, display groups 025/026 or 027 =>Page 54 - Renew camshaft adjuster
01121 Camshaft timing control 2 Mechanical fault	=> Camshaft timing control 1, fault code 01120	=> Camshaft timing control 1, fault code 01120	=> Camshaft timing control 1, fault code 01120

Notes on fault codes 01120 and 01121:

Fault is only stored 10 minutes after starting and at a coolant temperature of more than 60 °C.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
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01165 Throttle valve control unit - J338	Control limit not reached	- Throttle valve sticking - Positioner mechanism sticking	- Increased idling speed - Load change jolt on accelerator release	- Read measured value block, Display Group 023 => Page 53
	Control limit exceeded	- Fault (open circuit/short to positive or earth) in wiring for throttle valve positioner -V60	- Idling speed positioner deactivated - engine idles with a mechanically regulated air flow through the emergency running slot (slightly increased idling speed)	- Check throttle valve control unit -J338 => Page 131
	Control difference	- Throttle valve positioner sender -G127 defective - -V60 defective - Signal output in engine control unit defective (control unit defective)	- AC compressor only activated at higher engine speeds	- Renew engine control unit => Page 78

Note:

If fault "01165" is stored in fault memory, fault "17953" will also be stored on next start.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01247 Solenoid valve 1 for activated charcoal filter -N80	Short to earth	- Short circuit to earth between activated charcoal filter system solenoid -N80 and engine control unit - -N80 defective	- Possibility of jolting in part load range - Check -N80=>Page 127
	Short circuit to positive	- Short to positive between -N80 and engine control unit - -N80 defective	- Vehicle may smell of petrol - Read measured value block, Display Group 010 => Page 48
	Output open	- Open circuit in wiring between -N80 and fuse - Open circuit in wiring between -N80 and engine control unit - Fuse defective - -N80 defective	- Rectify open circuit or short using current flow diagram => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Check fuse

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01249 Injector, cylinder 1 -N30	Short to earth	- Engine idles roughly or cuts out	- Check injectors => Page 85
	Short circuit to positive		



Output open	<ul style="list-style-type: none"> - Open circuit in wiring between injector and engine control unit - Fuse pulled off - Open circuit in wiring between injector and fuel pump relay - Injector defective 		<ul style="list-style-type: none"> - Rectify short circuit or open circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder Check fuse
-------------	---	--	---

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01250 Injector, cylinder 2 -N31. Short to earth	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249
Short circuit to positive			
Output open			
01251 Injector, cylinder 3 -N32 Short to earth	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249
Short circuit to positive			
Output open			

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01252 Injector, cylinder 4 -N33 Short to earth	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249
Short circuit to positive			
Output open			
01253 Injector, cylinder 5 -N83 Short to earth	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249
Short circuit to positive			
Output open			

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01254 Injector, cylinder 6 -N84. Short to earth	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249	=> Cyl. 1, fault code 01249
Short circuit to positive			
Output open			

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
01259 Fuel pump relay -J17			

Open/short circuit to earth	<ul style="list-style-type: none"> - Open circuit or short to earth between fuel pump relay -J17 and engine control unit - Fault in power supply to -J17 - Fuel pump relay - -J17 defective 	<ul style="list-style-type: none"> - In the event of an open circuit: Engine will not run - In the event of a short circuit to earth: Engine continues to run normally; however, high current consumption when ignition is switched on, as relay is constantly energised and fuel pump is always in operation, even when engine is not running. 	<ul style="list-style-type: none"> - Rectify open circuit or short circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder Check fuel pump relay -J17 => Page 93
Short circuit to positive	<ul style="list-style-type: none"> - Short to positive in wiring between fuel pump relay -J17 and engine control unit 	<ul style="list-style-type: none"> - In the event of a short circuit to positive: Engine will not run 	

Note:

If fault code "01259" has been stored, fault codes "01247 / 01249 / 01250 / 01251 / 01252 / 01253 / 01254 / 17923 / 17953" may also be stored, as these components are supplied with power from the fuel pump relay.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16486 Air mass meter -G70 Signal too low	<ul style="list-style-type: none"> - Unmetered air between air mass meter -G70 and engine - Power supply for -G70 defective - Open circuit or short to earth in signal wire between -G70 and engine control unit - -G70 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Emergency running mode (substitute value from throttle valve angle and engine speed), thus no noticeable effect on engine running 	<ul style="list-style-type: none"> - Locate and eliminate leak - Check -G70 => Page 98 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16487 Air mass meter -G70 Signal too high	<ul style="list-style-type: none"> - Short to positive in signal wire between air mass meter -G70 and engine control unit - Fault in earth supply for -G70 - -G70 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Emergency running mode (substitute value from throttle valve angle and engine speed), thus no noticeable effect on engine running 	<ul style="list-style-type: none"> - Check -G70 => Page 98 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16496 Intake air temperature sender - G42			



Signal too low	<ul style="list-style-type: none"> - Short to earth in wiring between intake air temperature sender -G42 and engine control unit - -G42 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Emergency operation (substitute value constant 25.5 °C) 	<ul style="list-style-type: none"> - Read measured value block, display group 003 =>Page 41 - Check -G42 => Page 166 - Renew engine control unit => Page 78
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Notes:

- ♦ The fault "Signal too low" is only stored at idling speed approx. 3 minutes after starting.
- ♦ The fault may also result from interchanging the plugs of the intake air temperature sender and the intake manifold changeover valve. The sender plug is black, the one for the valve is blue.

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V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16497 Intake air temperature sender - G42 Signal too high	<ul style="list-style-type: none"> - Open circuit or short to positive in wiring between intake air temperature sender -G42 and engine control unit - -G42 defective - Earth supply for -G42 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Emergency operation (substitute value constant 25.5 °C) 	<ul style="list-style-type: none"> - Read measured value block, display group 003 =>Page 41 - Check -G42 => Page 166 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16500 Coolant temperature sender - G62 Implausible signal	<ul style="list-style-type: none"> - Coolant temperature sender -G62 supplies implausible signal due to loose contact/corrosion caused by moisture in connector - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Cold start problems at very low temperatures - Engine running problems when warm - Increased fuel consumption - Increased emissions 	<ul style="list-style-type: none"> - Read measured value block, Display Group 003 => Page 172 - Renew engine control unit => Page 78

Notes:

- ♦ The temperature curve in the range up to 80 °C is compared to a model curve stored in the control unit. The rate of rise of the model curve is slower than the actual value. If the actual values become too slow on account of a fault, they will eventually coincide with the model values. The engine control unit detects this fault as being implausible.
- ♦ As soon as one of the faults has been stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine (starting engine substitute value) and computes the engine temperature in line with a specified model (increase of 5.25 °C) every 65 seconds). A fixed substitute value is assumed after a certain time for a warm engine. This fixed substitute value is again governed by the intake air temperature.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16501 Coolant temperature sender - G62 Signal too low	<ul style="list-style-type: none"> - Short to earth in wiring between coolant temperature sender -G62 and engine control unit - -G62 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Cold start problems at very low temperatures - Engine running problems when warm - Increased fuel consumption - Increased emissions 	<ul style="list-style-type: none"> - Read measured value block, Display Group 003 => Page 41 - Check -G62 => Page 172 - Renew engine control unit => Page 78

Note:

As soon as the fault has been stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine (starting engine substitute value) and computes the engine temperature in line with a specified model (increase of 5.25 °C) every 65 seconds). A fixed substitute value is assumed after a certain time for a warm engine. This fixed substitute value is again governed by the intake air temperature.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16502 Coolant temperature sender - G62 Signal too high	<ul style="list-style-type: none"> - Open circuit or short to positive in wiring between -G62 and engine control unit - -G62 defective - Earth supply for -G62 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Cold start problems at very low temperatures - Engine running problems when warm - Increased fuel consumption - Increased emissions 	<ul style="list-style-type: none"> - Read measured value block, Display Group 003 => Page 41 - Check -G62 => Page 172 - Renew engine control unit => Page 78

Note:

As soon as the fault has been stored in the fault memory, the engine control unit uses the intake air temperature as a substitute value for starting the engine (starting engine substitute value) and computes the engine temperature in line with a specified model (increase of 5.25 °C) every 65 seconds). A fixed substitute value is assumed after a certain time for a warm engine. This fixed substitute value is again governed by the intake air temperature.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16505 Throttle valve potentiometer - G69 Implausible signal	<ul style="list-style-type: none"> - Moisture or corrosion in connector at throttle valve potentiometer - G69 - -G69 defective 	<ul style="list-style-type: none"> - Jolting on acceleration - Load change jolt on accelerator release - Idling speed control behaviour unstable 	<ul style="list-style-type: none"> - Check throttle valve potentiometer => Page 39

**Notes:**

- ♦ The throttle valve potentiometer -G69 is located in the throttle valve control unit -J338.
- ♦ The air throughput (air mass) at the relevant speed is checked with the throttle angle.
- ♦ As soon as the error is identified, the control unit uses a substitute value formed from engine speed and air mass.
- ♦ If an error occurs simultaneously on the throttle valve potentiometer and the air mass meter, no emergency operation function is possible. Consequence: The engine stalls.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16506 Throttle valve potentiometer - G69 Signal too low	<ul style="list-style-type: none"> - Short to earth in signal wire between -G69 and engine control unit - Power supply for -G69 defective - -G69 defective 	<ul style="list-style-type: none"> - Jolting on acceleration - Load change jolt on accelerator release 	<ul style="list-style-type: none"> - Check throttle valve potentiometer => Page 39 Rectify short circuit or open circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder

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Notes:

- ♦ The throttle valve potentiometer -G69 is located in the throttle valve control unit -J338.
- ♦ As soon as the error is identified, the control unit uses a substitute value formed from engine speed and air mass.
- ♦ If an error occurs simultaneously on the throttle valve potentiometer and the air mass meter, no emergency operation function is possible. Consequence: The engine stalls.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16507 Throttle valve potentiometer - G69 Signal too high	<ul style="list-style-type: none"> - Open circuit or short to positive in signal wire between -G69 and engine control unit - Fault in earth supply for -G69 - -G69 defective 	<ul style="list-style-type: none"> - Jolting on acceleration - Load change jolt on accelerator release 	<ul style="list-style-type: none"> - Check throttle valve potentiometer => Page 39

Notes:

- ♦ The throttle valve potentiometer -G69 is located in the throttle valve control unit -J338.
- ♦ As soon as the error is identified, the control unit uses a substitute value formed from engine speed and air mass.
- ♦ If an error occurs simultaneously on the throttle valve potentiometer and the air mass meter, no emergency operation function is possible. Consequence: The engine stalls.

2.4 - Fault codes 16514 - 18259

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16514 Bank 1, probe 1			

Electrical fault in circuit	<ul style="list-style-type: none"> - Corrosion due to moisture in connector for lambda probe heating -Z19 or lambda probe -G39 - Short circuit between signal wire for lambda probe and reference earth wire for lambda probe - Signal wire amplitude too small (lambda probe -G39 contaminated or probe slot clogged, dirty) 	<ul style="list-style-type: none"> - Lambda control switches to open loop control - Rough idling - Emissions not OK - Increased fuel consumption 	<ul style="list-style-type: none"> - Rectify short circuit or open circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Check lambda control =>Page 107 - Read measured value block, Display Group 009 =>Page 52
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V.A.G 1551 printout 16515 Bank 1, probe 1 Voltage too low	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - Short to earth or short to screening in lambda probe signal wire - Short to earth or short to screening in lambda probe reference earth wire - Lambda probe defective (dirty) 	<ul style="list-style-type: none"> - Lambda control switches to open loop control - Rough idling - Emissions not OK - Increased fuel consumption 	<ul style="list-style-type: none"> - Rectify short circuit or open circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Check lambda control =>Page 46 - Read measured value block, Display Group 021 =>Page 52

V.A.G 1551 printout 16516 Bank 1, probe 1 Voltage too high	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - Short to positive in signal wire - Short to positive in earth wire - Lambda probe defective 	<ul style="list-style-type: none"> - Lambda control switches to open loop control - Increased fuel consumption - Emissions not OK - Soot on spark plugs - Rough idling 	<ul style="list-style-type: none"> - Rectify short circuit or open circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Check lambda control =>Page 52

V.A.G 1551 printout 16518 Bank 1, probe 1 No activity	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - Corrosion due to moisture in connector for lambda probe heating -Z19 or lambda probe -G39 - Lambda probe defective (dirty) - Open circuit between probe heating and engine control unit - No probe heating function 	<ul style="list-style-type: none"> - Lambda control switches to open loop control - Increased fuel consumption - Emissions not OK - Soot on spark plugs - Rough idling 	<ul style="list-style-type: none"> - Read measured value block, Display Group 009 =>Page 52 - Check probe heating =>Page 111

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
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16534 Bank 2, probe 1 Electr. fault in circuit	=>Bank 1, probe 1 Fault code 16514	=>Bank 1, probe 1 Fault code 16514	=>Bank 1, probe 1 Fault code 16514
16535 Bank 2, probe 1 Voltage too low	=>Bank 1, probe 1 Fault code 16515	=>Bank 1, probe 1 Fault code 16515	=>Bank 1, probe 1 Fault code 16515
16536 Bank 2, probe 1 Voltage too high	=>Bank 1, probe 1 Fault code 16516	=>Bank 1, probe 1 Fault code 16516	=>Bank 1, probe 1 Fault code 16516
16538 Bank 2, probe 1 No activity	=>Bank 1, probe 1 Fault code 16518	=>Bank 1, probe 1 Fault code 16518	=>Bank 1, probe 1 Fault code 16518

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16705 Engine speed sender -G28 Implausible signal	- Engine speed sender - G28 loose - Sender wheel loose - Gap between engine speed sender -G28 and sender wheel greater than 2.3 mm	- Engine misfiring	- Check engine speed sender - G28=>Page 168 - Fit engine speed sender -G28 with correct shim

Notes:

- ♦ The fault "implausible signal" is set if the number of signals per crankshaft revolution starting from the reference mark gap is incorrect (60 signals).
- ♦ -G28 is fitted with a shim to obtain a defined gap between -G28 and the sender wheel.
If the engine speed sender is fitted without the shim, it will be destroyed by the sender wheel.
- ♦ The presence of swarf can result in additional signals.
- ♦ If the gap between the sender and the sender wheel is too large or if the sender wheel is damaged, the signals may not be sent or may be too small to be picked up.
- ♦ The signal profile may be irregular if the sender wheel is loose.
- ♦ Disturbance signals may cause additional signals to be detected.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16706 Engine speed sender -G28 No signal	<div>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, accept any liability, and respect the correctness of information in this document, compiled by AUDI AG.</div> - Open circuit or short to earth or short to positive in signal wire - Open circuit or short to positive in earth wire - -G28 loose or defective - Open circuit in screening for -G28	- Engine will not start - Engine cuts out	- Rectify open circuit or short circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Read measured value block, display group 001 => Page 39 - Check -G28 => Page 168

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	- Faulty signal input in engine control unit (control unit defective)		- Renew engine control unit => Page 78

V.A.G 1551 printout 16711 Knock sensor 1 -G61 Signal too low	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - Knock sensor loose or corrosion on connector - Open circuit in sender earth wire between knock sensor and engine control unit - Knock sensor defective - Open circuit or short to earth/screen in signal wire between knock sensor and engine control unit - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - High fuel consumption - Poor performance 	<ul style="list-style-type: none"> - Tightening torque for knock sensor: 20 Nm - Check knock sensor => Page 176 - Read measured value block, display group 017 or 018 =>Page 51 - Renew engine control unit => Page 78

V.A.G 1551 printout 16712 Knock sensor 1 -G61 Signal too high	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - Knock sensor loose or corrosion on connector - Knock sensor defective - Possible engine damage 	<ul style="list-style-type: none"> - High fuel consumption - Poor performance 	<ul style="list-style-type: none"> - Tightening torque for knock sensor: 20 Nm - Check knock sensor => Page 176
16716 Knock sensor 2 -G66 Signal too low	=>Knock sensor 1 -G61 Fault code 16711	=>Knock sensor 1 -G61 Fault code 16711	=>Knock sensor 1 -G61 Fault code 16711
16717 Knock sensor 2 -G66 Signal too high	=>Knock sensor 1 -G61 Fault code 16712	=>Knock sensor 1 -G61 Fault code 16712	=>Knock sensor 1 -G61 Fault code 16712

V.A.G 1551 printout 16885 Vehicle speed signal Implausible signal	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - Speedometer sender defective - Open circuit or short circuit between speedometer sender and speedometer - Speedometer defective 	<ul style="list-style-type: none"> - No air-conditioner compressor shut-off in first gear at full throttle - Brief deviation between idling speed and specified speed - Malfunctioning of systems which use the vehicle speed signal 	<ul style="list-style-type: none"> - Check vehicle speed signal => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Read measured value block, display group 011, display zone 3 =>Page 49 - Check speed signal =>Page 145



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V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16885 Vehicle speed signal Implausible signal	(Fault 16885 continued) - Short circuit in signal wire between speedometer and another control unit which uses the vehicle speed signal - Open circuit or short in wiring between dash panel insert and engine control unit - Faulty signal input in engine control unit (control unit defective)	- Malfunctioning of systems which use the vehicle speed signal - Poor load change performance	- Check speed signal =>Page 145 - Rectify open circuit or short circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
16989 Control unit faulty	- Engine control unit defective	- Engine will not start	- Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17733 Knock control, cyl. 1 Control limit reached	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. - Poor quality fuel (less than RON 91) - Abnormal engine running noise (ancillaries loose) - Open circuit in screen wiring of knock sensor 1 or 2 - Loose contact in the connector - Knock sensor tightened to incorrect torque	- High fuel consumption - Poor performance - Rough engine running - Maximum speed is not reached	- Fill up with petrol of at least RON 91 - Check knock sensor => Page 176 - Rectify open circuit or short circuit => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Read measured value block, display group 017 or 018 =>Page 51 - Tighten knock sensor (20 Nm)

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17734 Knock control, cyl. 2 Control limit reached	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733
17735 Knock control, cyl. 3 Control limit reached	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733
17736 Knock control, cyl. 4			

Control limit reached	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733
17737 Knock control, cyl. 5 Control limit reached	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17738 Knock control, cyl. 6 Control limit reached	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733	=> Knock control, cyl. 1 Fault code 17733
17745 Bank 1, Hall sender -G163 Short to earth	<ul style="list-style-type: none"> - Short to earth in wiring between Hall sender - G163 and engine control unit - -G163 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - No engine power at full throttle - Exhaust emission values not OK - High fuel consumption (Only has an effect in the event of simultaneous failure of -G40 and -G163)	<ul style="list-style-type: none"> - Use current flow diagram to eliminate short circuit - Check -G163 =>Page 78

Note on Fault code 17745:

If both fault "17745" and "17799" have been stored in fault memory, fault "17799" may be a follow-on fault. In this case start fault-finding with fault "17745".

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17746 Bank 1, Hall sender - G163 Open circuit / short to positive	<ul style="list-style-type: none"> - Open circuit or short to positive in signal wire between Hall sender - G163 and engine control unit - Fault in power supply or earth connection for - G163 - -G163 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - No engine power at full throttle - Exhaust emission values not OK - High fuel consumption (Only has an effect in the event of simultaneous failure of -G40 and -G163)	<ul style="list-style-type: none"> - Use current flow diagram to eliminate open circuit or short circuit - Check -G163=>Page 178 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17799 Bank 2, Hall sender -G40 Short to earth	<ul style="list-style-type: none"> - Short to earth in wiring between Hall sender -G40 and engine control unit 	<ul style="list-style-type: none"> - No engine power at full throttle - Exhaust emission values not OK - High fuel consumption 	<ul style="list-style-type: none"> - Use current flow diagram to eliminate short circuit

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V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
	<ul style="list-style-type: none"> - G40 defective - Faulty signal input in engine control unit (control unit defective) 	(Only has an effect in the event of simultaneous failure of -G40 and -G163)	<ul style="list-style-type: none"> - Check -G40 => Page 78

Note:

If both fault "17745" and "17799" have been stored in fault memory, fault "17799" may be a follow-on fault. In this case start fault-finding with fault "17745".

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17800 Bank 2, Hall sender -G40 Open circuit / short to positive	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 in respect to the content of this publication or its information. © 1998 Audi AG <ul style="list-style-type: none"> - Open circuit or short to positive in signal wire between Hall sender -G40 and engine control unit - Fault in power supply or earth connection for -G40 - -G40 defective - Faulty signal input in engine control unit (control unit defective) - Sender wheel loose or incorrectly positioned 	<ul style="list-style-type: none"> - No engine power at full throttle - Exhaust emission values not OK - High fuel consumption (Only has an effect in the event of simultaneous failure of -G40 and -G163)	<ul style="list-style-type: none"> - Use current flow diagram to eliminate open circuit or short circuit - Check -G40 => Page 178 - Renew engine control unit => Page 78 - Perform visual inspection

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17829 Secondary air inlet valve -N122 Short to earth (Fault only encountered on vehicles with secondary air induction)	<ul style="list-style-type: none"> - Short to earth in wiring between secondary air inlet valve -N122 and engine control unit - -N122 defective - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Check secondary air system => Final Control Diagnosis, Page 28 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17830 Secondary air inlet valve -N122 Short circuit to positive (Fault only encountered on vehicles with secondary air induction)	<ul style="list-style-type: none"> - Short to positive in wiring between secondary air inlet valve -N122 and engine control unit - -N122 defective - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Check secondary air system => Final Control Diagnosis, Page 28 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
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17840 Secondary air inlet valve -N122 Open circuit (Fault only encountered on vehicles with secondary air induction)	<ul style="list-style-type: none"> - Open circuit in wiring between secondary air inlet valve -N122 and engine control unit - Fault in power supply to - N122 - -N122 defective - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Check secondary air system => Final Control Diagnosis, Page 28 - Renew engine control unit => Page 78
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V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17841 Secondary air pump relay - J299 Open circuit (Fault only encountered on vehicles with secondary air induction)	<ul style="list-style-type: none"> - Open circuit in wiring between secondary air pump relay -J299 and engine control unit - Power supply for -J299 defective - -J299 defective - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Check secondary air system => Final Control Diagnosis, Page 28 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17842 Secondary air pump relay - J299 Short circuit to positive (Fault only encountered on vehicles with secondary air induction)	<ul style="list-style-type: none"> - Short circuit to positive in wiring between secondary air pump relay -J299 and engine control unit - -J299 defective - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Check secondary air system => Final Control Diagnosis, Page 28 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17843 Secondary air pump relay - J299 Short to earth (Fault only encountered on vehicles with secondary air induction)	<ul style="list-style-type: none"> - Short circuit to earth in wiring between secondary air pump relay -J299 and engine control unit - -J299 defective - Faulty signal input in engine control unit (control unit defective) 		<ul style="list-style-type: none"> - Check secondary air system => Final Control Diagnosis, Page 28 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
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17913 Idling switch -F60 Does not close / open circuit	<ul style="list-style-type: none"> - Throttle valve sticking - F60 defective - Throttle cable setting - Floor mat pressing down on accelerator pedal - Open circuit or short to positive between idling speed switch -F60 and engine control unit - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Load change jolt on accelerator release - Idling speed outside specified range - AC compressor only activated at higher engine speeds 	<ul style="list-style-type: none"> - Check idling switch => Page 134 - Adjust throttle cable => 6-cylinder engine (5-valve), Mechanical components; Repair Group 20 - Rectify open circuit or short circuit - => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Renew engine control unit => Page 78
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Note:

The idling speed switch -F60 is located in the throttle valve control unit -J338.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17914 Idling switch -F60 Does not open/short to earth	<ul style="list-style-type: none"> - Moisture or corrosion on plug connector for idling speed switch -F60 - Short to earth between idling speed switch -F60 and engine control unit - F60 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - Idling speed control switches to open loop control - Idling speed outside specified range - Load change jolt on accelerator release - AC compressor only activated at higher engine speeds 	<ul style="list-style-type: none"> - Check idling switch => Page 134 - Rectify open circuit or short circuit - => "Current flow diagrams, Electrical fault-finding and Fitting locations" binder - Renew engine control unit => Page 78

Note:

The idling speed switch -F60 is located in the throttle valve control unit -J338.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17920 Intake manifold changeover valve -N156 Short circuit to positive	<ul style="list-style-type: none"> - Short circuit to positive in wiring between intake manifold changeover valve -N156 and engine control unit - N156 defective - Faulty signal input in engine control unit (control unit defective) 	<ul style="list-style-type: none"> - N156 does not open (loss of power above 4700 rpm) 	<ul style="list-style-type: none"> - Check -N156=>Page 100 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17923 Intake manifold changeover valve - N156 Short to earth	<ul style="list-style-type: none"> - Short circuit to earth in wiring between intake manifold changeover valve -N156 and engine control unit - -N156 defective - Faulty signal input in engine control unit (control unit defective) 	- -N156 does not open (loss of power above 4700 rpm)	<ul style="list-style-type: none"> - Check -N156=>Page 100 - Renew engine control unit => Page 78

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17924 Intake manifold changeover valve - N156 Open circuit	<ul style="list-style-type: none"> - Open circuit in wiring between intake manifold changeover valve -N156 and engine control unit - Fault in power supply to -N156 - -N156 defective - Faulty signal input in engine control unit (control unit defective) 	- -N156 does not open (loss of power above 4700 rpm)	<ul style="list-style-type: none"> - Check -N156=>Page 100 - Renew engine control unit => Page 78

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V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17953 Throttle valve control Malfunction	<ul style="list-style-type: none"> - Fault in power or earth supply for throttle valve potentiometer - -G69 and throttle valve positioner sender -G127 - Open circuit in signal wire for -G69 and -G127 - -G69 and -G127 defective - Throttle valve stiff or dirty 	<ul style="list-style-type: none"> - Increased idling speed - Load change jolt on accelerator release 	<ul style="list-style-type: none"> - Read measured value block, Display Group 023 => Page 53 - Check throttle valve control unit -J338 => Page 131

Note:

If other faults affecting the throttle valve control unit, e.g. fault "00670", have been stored in the fault memory, then fault "17953" may be a follow-on fault. In this case start fault-finding with the other faults.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17967 Throttle valve control unit -J338			



Fault in basic setting	- Voltage at engine control unit less than 10 V during "Adaptation of throttle valve control unit -J338 to engine control unit" Continued ▼		- Read measured value blockDisplay Group 003, display zone 2=> Page 174 . Check battery charge level
------------------------	--	--	---

Notes:

- ◆ Before dealing with the above-mentioned fault, always follow the information given on the next Page, as the "Possible fault cause" for the above fault changed with control unit no. 4D0 907 551 C as of data status D07.
- ◆ Control unit data status can be established by reading out control unit identification =>Page 1 .

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17967 Throttle valve control unit - J338 Fault in basic setting	(Fault 17967 continued) - Conditions for basic setting (adaptation of throttle valve control unit) are no longer satisfied during adaptation: Driver presses accelerator during adaptation (idling speed switch opens) Driver starts engine during adaptation (engine speed signal is detected)	- Engine control unit cannot learn stop values for throttle valve control unit because appropriate conditions have not been fulfilled	- Create conditions for basic setting (adaptation of throttle valve control unit); check learning demand display =>Page 132

Notes:

- ◆ Establish control unit data status by reading out control unit identification =>Page 1 .
- ◆ The fault "Throttle valve control unit -J338 fault in basic setting" is stored for control unit no. 4D0 907 551 C with data status lower than D07 if the voltage at the engine control unit drops below 10 V during adaptation of throttle valve control unit (for further notes =>Refer to next Page).

Notes continued:

- ◆ With control unit no. 4D0 907 551 C as of data status D07, fault is stored if adaptation conditions are no longer satisfied during adaptation of throttle valve control unit (see previous Page).
- ◆ A new fault code (17972) was created as of data status D07 for undervoltage during adaptation (voltage drops below 10 V) to provide better fault location and differentiation.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17972 Throttle valve control unit - J338 Undervoltage during basic setting	- Voltage at engine control unit dropped below 10 V during "Adaptation of throttle valve control unit -J338 to engine control unit".	- Engine control unit cannot learn stop positions of throttle valve control unit.	- Check power supply to engine control unit =>Page 132

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17973 Throttle valve control unit -J338			

Lower stop not reached	<ul style="list-style-type: none"> - Throttle cable incorrectly set - Throttle valve dirty/stiff - Floor mat pressing down on accelerator pedal - Throttle valve control unit defective 	- Engine control unit cannot learn stop positions of throttle valve control unit	- Check throttle cable setting; adjust throttle cable => 6-cylinder engine (5-valve), Mechanical components; Repair Group 20 132
------------------------	---	--	---

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
17978 Engine control unit disabled	<ul style="list-style-type: none"> - Attempted tampering - Short circuit in communication line - Immobiliser control unit defective/not fitted 	- Engine starts but cuts out again immediately	<ul style="list-style-type: none"> - Check and if necessary perform key adaptation => Electrical System; Repair Group 01; immobiliser Self-diagnosis immobiliser Self-diagnosis - Interrogate fault memory => Electrical System; Repair Group 01; Immobiliser Self-diagnosis Immobiliser Self-diagnosis

Note:

If an attempt is made to start the car with a key which has not been adapted, a static fault will be recorded. If the car is then started with a correctly adapted key, the fault will be re-classified as a sporadic fault.

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
18010 Power supply terminal 30 Voltage too low	<ul style="list-style-type: none"> - Battery disconnected - Permanent power supply at control unit disconnected or open circuit in wiring 		- Check supply voltage for engine control unit =>Page 174

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
18020 Engine control unit incorrectly encoded	<ul style="list-style-type: none"> - Engine control unit incorrectly encoded - FWD with ASR encoded for 4WD 	<ul style="list-style-type: none"> - Engine running problems - Increased emissions - Various faults in fault memory - No ASR function - ASR warning lamp lights 	- Encode control unit => Page 32

V.A.G 1551 printout	Possible fault cause	Possible effects	Fault elimination
18034 CAN bus			



No message from gearbox control unit	- Fault in data lines leading to gearbox control unit	- Automatic gearbox goes into emergency operation - Engine running problems (juddering gear changes, load change jolts)	- Check CAN bus => Page 155
18259 CAN bus No message from ABS control unit	- Fault in data lines leading to ABS control unit	- No electronic stability program	- Check CAN bus => Page 155

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, individual control elements continue to be actuated until the test programme is advanced to the next control element by pressing the ➡ key.
- ♦ The control elements can be checked acoustically or by way of touch.
- ♦ If the final control diagnosis is to be repeated without first starting the engine briefly, switch off the ignition for approx. 20 seconds.
- ♦ The electric fuel pump runs continuously throughout the final control diagnosis.
- ♦ The final control diagnosis is terminated after 10 minutes.

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

Actuation sequence
1 Injector, cylinder 1 -N30
2 Injector, cylinder 2 -N31
3 Injector, cylinder 3 -N32
4 Injector, cylinder 4 -N33
5 Injector, cylinder 5 -N83
6 Injector, cylinder 6 -N84
7 Solenoid valve 1 for activated charcoal filter -N80
8 Secondary air inlet valve -N112 (only on vehicles with secondary air induction)
9 Secondary air pump relay -J299 (only on vehicles with secondary air induction)
10 Intake manifold changeover valve -N156
11 Camshaft adjustment 1 (camshaft adjustment valve 1 -N205 and camshaft adjustment valve 2 -N208)

Test requirements:

- Engine fuses OK
- Idling switch -F60 OK
- Fuel pump relay -J17 OK
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. Engine must not be running.
(Connecting fault reader and selecting engine electronics control unit => Page 1 .)

-> When adjacent display appears:

Rapid data transfer HELP
Select function XX

- Enter "03" to select the function "Final control diagnosis".

-> When adjacent display appears:

Rapid data transfer Q
03 - Final control diagnosis

- Confirm entry with Q key.

Checking injectors

-> Display readout:

Final control diagnosis
Injector, cylinder 1 -N30

Note:

*Fuel pump relay should pull, fuel pump should run, flow noise at fuel pressure regulator is clearly audible. If fuel pump does not run, check actuation =>Page **93**.*

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

The valve should click five times.

- To switch to the next injector, press the ➡ key. (it is also possible to advance the programme without checking the injector in question.).
- Use this procedure to check all the injectors in sequence.

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

- Check injectors => Page **85**.

Actuation of activated charcoal filter system solenoid valve

- Press the ➡key.

-> Display readout:

Final control diagnosis
Solenoid valve 1 for activated charcoal
filter -N80

This solenoid valve will continue to be actuated (clicks) until the ➡ key is pressed to switch to the next control element.

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

- Check the activated charcoal filter system solenoid valve 1 -N80 =>Page **127**.

Actuation of secondary air inlet valve

(only on vehicles with secondary air induction)

- Press the ➡key.

-> Display readout:

Final control diagnosis
Secondary air inlet valve -N112

This valve will continue to be actuated (clicks) until the ➡ key is pressed to switch to the next control element.



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

- Check secondary air inlet valve -N112 =>Page **117** .

Actuation of secondary air pump relay

(only on vehicles with secondary air induction)

- Press the ➔key.

-> Display readout:

Final control diagnosis
Secondary air pump relay -J299

Secondary air pump relay -J299 actuates secondary air pump motor -V101. This runs intermittently until final control diagnosis is concluded by pressing ➔ key.

If secondary air pump does not run intermittently:

- Check secondary air pump relay -J299=>Page **122** .

Actuation of intake manifold changeover valve

- Press the ➔key.

-> Display readout:

Final control diagnosis
Intake manifold changeover valve -N156

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This valve will continue to be actuated (clicks) until the ➔ key is pressed to switch to the next control element.

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

- Check intake manifold changeover valve-N156 => Page **100** .

Actuation of camshaft adjustment valves

- Press the ➔key.

-> Display readout:

Final control diagnosis
Camshaft timing control 1

Camshaft adjustment valve 1 -N205 and camshaft adjustment valve 2 are actuated -N208 (click) until final control diagnosis is concluded by pressing ➔ key.

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

- Check camshaft adjustment valve =>Page **183** .
- Press the ➔key.

Note:

Before selecting function 03 "Final control diagnosis" again, switch off the ignition for approx. 20 seconds.

4 - Basic setting

4.1 - Basic setting

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

- ♦ Adaptation of the throttle valve control unit to the engine control unit => Display Group 098

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

- ♦ Learning process for lambda control => Respective display group
- ♦ Fault finding by means of pin-pointed activation and deactivation of the lambda control => Page 56 , display group 099

Test conditions for operations with engine running

- Coolant temperature at least 85 °C.
 - Electrical consumers switched off (radiator fan must not run during the test)
 - Air conditioner switched off
 - Selector lever in position P or N
 - No faults stored in fault memory
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> When adjacent display appears:

Rapid data transfer	HELP
Select function XX	

- Enter "04" to select "Start basic setting" and confirm with Q key.

-> When adjacent display appears:

Basic setting	Q
Enter display group number XXX	

- Enter the required display group number => Reading measured value block display groups, Page 35 .

Example:

- Enter "000" for "Display group number 000" and confirm entry with Q key.

-> Display readout:

Basic setting 0 Q							
1	2	3	4	5	6	7	
8	9	10					

Notes:

- ♦ In display group 000 the measured values are shown in decimal form.
- ♦ If the printer is switched on, the current display can be printed out on the record slip.
- ♦ Proceed as follows to switch to a different display group:

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

- If all the display zones show the specified values, press the =>key.

-> When adjacent display appears:



Rapid data transfer HELP
Select function XX

- Enter "06" for "End output" function and confirm entry with Q key.

Display Group 000

Display group 000 (decimal values) ¹⁾									
Basic setting 0 ⇒									
1	2	3	4	5	6	7	8	9	10
• Display									
• Display zones									
Lambda learned value, bank 2 (mul.)						Specification		Corresponds to	
Lambda learned value, bank 1 (mul.)						115...141		-10...10 %	
Lambda control value, bank 2						115...141		-10...10 %	
Lambda control value, bank 1						115...141		-10...10 %	
Learned value for idling speed air mass						118...138		-5...5 kg/h	
Control value for idling speed air mass						115...141		-10...10 %	
Throttle valve angle						0...12		0...5 <°	
Engine speed						64...76		640...760 rpm	
Engine load						20...50		1.0...2.5 ms	
Coolant temperature						171...204		80...105 °C	

1) This table is only intended to give an outline. Where appropriate, the individual measured values are evaluated in display groups 001...099 in the "Reading measured value block" function => Page 34 onwards.

5 - Encoding control unit

5.1 - Encoding control unit

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

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. The ignition must be switched on
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> When adjacent display appears:

Rapid data transfer HELP
Select function XX

- Enter "07" for the function "Encode control unit" and confirm entry with Q key.

-> When adjacent display appears:

Encoding control unit Q
Enter code number XXXXX (0-32000)

- Enter the control unit code in accordance with the encoding table => Page 33.

Key to code

XX	Country/emissions	
	X	Drive/auxiliary functions
	X	Gearbox

	X	Vehicle type
--	---	--------------

Example of encoding	
04003	European Union member state, FWD with no traction control system, 5-speed manual gearbox, Audi A8

-> If adjacent display appears (example):

Encoding control unit Q
Enter code number 04003 (0 - 32000)

- Confirm entry with Q key.

-> The fault reader V.A.G 1551 display will show the control unit identification. For example:

4D0907551L 2.8l V6/5V MOTR HS D07
Code 04003 WSC 12345

Note:

-> When adjacent display appears:

Function unknown or cannot
be carried out at present.

The code number that was entered was not authorised.

- Press the ➡key.

-> Display readout (function selection):

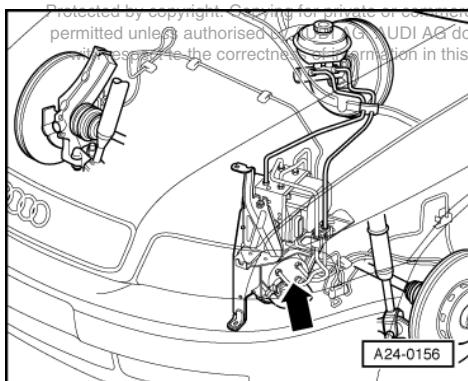
Rapid data transfer HELP
Select function XX

5.2 - Encoding table

Country/emissions	02	Non-member states of the European Union (MVEG I)
	04	Member states of the European Union (MVEG II)
	05	Engines with secondary air induction (MVEG III)
	08	China and Confederation of Independent States (CIS)
Drive/auxiliary functions	0	FWD without traction control system
	1	FWD with traction control system
	2	4WD without traction control system
	3	4WD with electronic stability program
Gearbox	0	5-speed manual gearbox
	5	Automatic gearbox 01V
Vehicle type	3	Audi A8

Notes:

- ♦ Vehicles with traction control system (ASR) can be recognised from ASR warning lamp in centre section of dash panel. Control unit -J104 responds in self-diagnosis with designation "ABS/ASR" or "ABS/EDS/ASR".



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- ♦ -> Vehicles with electronic stability program (ESP) can be recognised from ESP warning light in centre section of dash panel or from hydraulic pump for electronic stability program -V156 -arrow- on left of engine compartment beneath hydraulic unit. Control unit -J104 responds in self-diagnosis with designation "ABS/ESP 4WD".

6 - Reading measured value block

6.1 - Reading measured value block

Test requirements:

- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Selector lever in position P or N
- No faults stored in fault memory
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit with the "Address word" 01. When doing this the engine must be running at idling speed.
(Connecting fault reader and selecting engine electronics control unit => Page 1.)

-> When adjacent display appears:

Rapid data transfer HELP
Select function XX
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- Switch on the fault reader printer with the print key. The indicator lamp in the key must light up.
- Enter "08" to select the function "Reading measured value block" and confirm entry with Q key.

-> When adjacent display appears:

Reading measured value block Q
Enter display group number XXX

- Enter the required display group number => Display groups, Page 35.
- Confirm entry with Q key.

-> Display for display group 000:

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

-> Display for display group 001 (example):

Reading measured value block 1
1 2 3 4

Notes:

- ♦ If the printer is switched on, the current display can be printed out on the record slip.
- ♦ Proceed as follows to switch to a different display group:

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

- If all the display zones show the specified values, press the =>key.

6.2 - Display groups

Display Group No.	Display	Designation
000 Basic function	Reading measured value block 1 2 3 4 5 6 7 8 9 10	1 = Coolant temperature 2 = Engine load 3 = Engine speed 4 = Throttle valve angle 5 = Idling speed air mass control value (idling speed control) 6 = Learned value for idling speed air mass 7 = Mixture formation control value, bank 1 8 = Mixture formation control value, bank 2 9 = Mixture formation learned value, bank 1 10 = Mixture formation learned value, bank 2

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Display Group No.	Display	Designation
001 Basic function	Reading measured value block 1 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Throttle valve angle 4 = Ignition timing
002 Basic function	Reading measured value block 2 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Injection period (per engine cycle) 4 = Intake air mass
003 Basic function	Reading measured value block 3 1 2 3 4	1 = Engine speed 2 = Battery voltage 3 = Coolant temperature 4 = Intake air temperature

Display Group No.	Display	Designation
004 Idling speed stabilisation	Reading measured value block 4 1 2 3 4	1 = Throttle valve angle 2 = Idling speed air mass learned value (in selector lever position P or N on automatic gearbox) 3 = Idling speed air mass learned value for automatic gearbox in selector lever position 2, 3, 4, D 4 = Operating status: Idling Part load Full throttle Overrun Enrichment
005	Reading measured value block 5	1 = Engine speed (actual)



Display Group No.	Display	Designation
Idling speed stabilisation	1 2 3 4	2 = Engine speed (specified) 3 = Control value for idling speed stabilisation (idling speed control) 4 = Air mass

Display Group No.	Display	Designation
006 Idling speed stabilisation	Reading measured value block 6 1 2 3 4	1 = Engine speed 2 = Idling speed air mass control value (idling speed control) 3 = Lambda control, bank 1 4 = Lambda control, bank 2
007 Lambda learned values	Reading measured value block 7 1 2 3 4	1 = Lambda learned value, bank 1 (multiplicative) 2 = Lambda learned value, bank 2 (multiplicative) 3 = Lambda learned value, bank 1 (additive) 4 = Lambda learned value, bank 2 (additive)
008 Lambda learned values	Reading measured value block 8 1 2 3 4	1 = Engine speed 2 = Injection period (injection period per engine cycle) 3 = Lambda learned value, bank 1 (additive) 4 = Lambda learned value, bank 2 (additive)

Display Group No.	Display	Designation
009 Lambda probe voltage	Reading measured value block 9 1 2 3 4	1 = Lambda probe voltage, bank 1 2 = Lambda probe voltage, bank 2 3 = Duty cycle of ACF solenoid 1 -N80 4 = Lambda correction factor with fuel tank breather system active
010 Fuel tank breather	Reading measured value block 10 1 2 3 4	1 = Duty cycle of ACF solenoid 1 -N80 2 = Lambda correction factor with fuel tank breather system active 3 = Fill level of activated charcoal canister -N80 4 = Fuel tank breather system purging rate
011 Fuel consumption	Reading measured value block 11 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Vehicle speed 4 = Fuel consumption

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Display Group No.	Display	Designation
012 Knock control	Reading measured value block 12 1 2 3 4	1 = Engine speed 2 = Ignition timing retardation by knock control, cylinder 1 3 = Ignition timing retardation by knock control, cylinder 2 4 = Ignition timing retardation by knock control, cylinder 3
013 Knock control	Reading measured value block 13 1 2 3 4	1 = Engine load 2 = Ignition timing retardation by knock control, cylinder 1 3 = Ignition timing retardation by knock control, cylinder 2 4 = Ignition timing retardation by knock control, cylinder 3

Display Group No.	Display	Designation
014 Knock control	Reading measured value block 14 1 2 3 4	1 = Engine speed 2 = Ignition timing retardation by knock control, cylinder 4 3 = Ignition timing retardation by knock control, cylinder 5 4 = Ignition timing retardation by knock control, cylinder 6

Display Group No.	Display	Designation
015 Knock control	Reading measured value block 15 1 2 3 4	1 = Engine speed 2 = Ignition timing retardation by knock control, cylinder 4 3 = Ignition timing retardation by knock control, cylinder 5 4 = Ignition timing retardation by knock control, cylinder 6
016 Knock control	Reading measured value block 16 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing 4 = Sum total of ignition timing retardation by knock control
017 Knock sensor	Reading measured value block 17 1 2 3 4	1 = Engine speed 2 = Knock sensor voltage signal, cylinder 1 3 = Knock sensor voltage signal, cylinder 2 4 = Knock sensor voltage signal, cylinder 3

Display Group No.	Display	Designation
018 Knock sensor	Reading measured value block 18 1 2 3 4	1 = Engine speed 2 = Knock sensor voltage signal, cylinder 4 3 = Knock sensor voltage signal, cylinder 5 4 = Knock sensor voltage signal, cylinder 6
019 Torque reduction	Reading measured value block 19 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Required engine torque (specified torque) 4 = Actual engine torque (actual torque)
020 Operating status	Reading measured value block 20 1 2 3 4	1 = Engine speed 2 = Gear recognition signal 3 = Engine speed increase, air conditioner 4 = Air conditioner compressor

Display Group No.	Display	Designation
021 Operating status Lambda control	Reading measured value block 21 1 2 3 4	1 = Engine speed 2 = Engine load (injection period per crankshaft revolution) 3 = Coolant temperature 4 = Lambda control OFF/ON
022		Ignore
023	Reading measured value block 23	1 = Learning demand display



Display Group No.	Display	Designation
Adaptation of throttle valve positioner	1 2 3 4	2 = Lower stop of throttle valve positioner 3 = Emergency running stop for throttle valve positioner 4 = Upper stop of throttle valve positioner

Display Group No.	Display	Designation
024 Traction control system	Reading measured value block 24 1 2 3 4	1 = Engine speed 2 = Reduction stages 3 = Required engine torque (engine specified torque / MMS) 4 = Actual engine torque (engine actual torque / MMI)
025 System status	Reading measured value block 25 1 2 3 4	1 = Engine speed 2 = Engine load 3 = System status 4 = Not allocated

Display Group No.	Display	Designation
026 Camshaft timing control	Reading measured value block 26 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Camshaft timing control, bank 1 4 = Camshaft timing control, bank 2
027 Camshaft timing control	Reading measured value block 27 1 2 3 4	1 = System status 2 = Not allocated 3 = Camshaft timing control, bank 1 4 = Camshaft timing control, bank 2
028...094		Ignore
095 Basic function	Reading measured value block 95 1 2 3 4	1 = Engine speed 2 = Engine load 3 = Ignition timing 4 = Coolant temperature
096...097		For development and production only

Display Group No.	Display	Designation
098 Adaptation of throttle valve control unit	Reading measured value block 98 1 2 3 4	1 = Throttle valve potentiometer voltage 2 = Throttle valve positioner potentiometer voltage 3 = Operating status: idling speed / part throttle 4 = Adaptation status: Adaptation running Adaptation OK Adaptation ERROR
099 Lambda control	Reading measured value block 99 1 2 3 4	1 = Engine speed 2 = Coolant temperature 3 = Lambda control 4 = Lambda control ON/OFF

6.3 - Reading measured value block: Display Groups 001 to 010

Display group 001, basic function:

Reading measured value block 1	⇒	• Display
640...760 rpm	1.0....2.5 ms	0...5 <°
		9...15 ° BTDC
		Ignition timing
		Throttle valve angle
		Engine load (injection period per crankshaft revolution)
		Idling speed is shown in increments of 40

Notes on display zone 2:

- ◆ The maximum engine load decreases by about 10% for every 1000 m above sea level.
- ◆ The maximum engine load also falls by up to 10% at very high ambient temperatures.
- ◆ The following minimum values are attained when driving at full load:
At 4000 rpm - approx. 7.5 ms
At 6000 rpm - approx. .6.5 ms

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1	Less than 640 rpm	- Throttle valve control unit -J338 sticking or defective	- Check throttle valve control unit - J338 =>Page 131
	Greater than 760 rpm	- Idling speed switch -F60 not closed/defective - Large quantity of unmetered air (cannot be compensated by idling speed stabiliser) - Throttle valve control unit -J338 sticking or defective	- Interrogate fault memory, => Page 4 - Eliminate air leak - Check throttle valve control unit - J338 =>Page 131

Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
2	Less than 1.0 ms	- Lower values can only occur when vehicle is in overrun	
	Greater than 2.5 ms	- Poor idling (not running on all cylinders) - Air mass meter -G70 defective - Throttle valve control unit -J338 defective - Electrical consumers on - Steering wheel at full lock - Gear engaged (automatic gear-box) - Lambda control on rich or lean stop	- Injector or spark plugs defective - Interrogate fault memory => Page 4 - Check throttle valve control unit - J338 =>Page 131 - Switch off the consumers - Centre steering wheel - Move selector lever to P or N - Check lambda control => Display Group 006



Test table, Display Group 001

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3	Less than 0 <°	- Not possible	
	Greater than 5 <°	- Adaptation of throttle valve control unit -J338 not performed - Throttle valve potentiometer in throttle valve control unit -J338 defective or incorrectly adjusted - Throttle cable setting - Throttle valve sticking	- Perform adaptation of throttle valve control unit -J338 => Page 4 - Check throttle valve control unit -J338 =>Page 131 - Adjust throttle cable => 6-cylinder engine (5-valve), Mechanical components; Repair Group 20 - Eliminate cause

Note on display zone 3:

The value displayed when the accelerator pedal is fully depressed is around 75...95 <°.

Display group 002, basic function:

Reading measured value block 2				⇒	Display
640...760 rpm	1.0...2.5 ms	1.0...4.0 ms	3.0...5.0 g/s		
Intake air mass					
Injection period (injection period per engine cycle)					
Engine load - see Display Group 001					
Idling speed is shown in increments of 40					

Notes on Display Group 002:

- Display zone 2 shows the injection period corresponding to the intake air mass and the engine load when idling. This value is a calculated, theoretical value which, because of the processor technology, only relates to a single crankshaft revolution. The engine load when idling is the load created by the internal friction which the engine has to overcome and the power required to drive the ancillaries. The intake air mass is shown in display zone 4.
- Display zone 3, on the other hand, shows the injection period for a complete engine cycle, i.e. two crankshaft revolutions.

Notes on display group 002 continued:

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- However, the value shown in display zone 3 is not approximately twice the value in display zone 2, but a corrected actual injection period. Correction for variables such as:

- Lambda control
- Fuel supply from the activated carbon canister
- Air density, air temperature
- Vehicle voltage (faster / slower opening of injectors)

- For example, if the engine takes in unmetered air, only the calculated value in display zone 2 (injection period per crankshaft revolution) should change. The lambda control will ensure that the actual injection period per complete engine cycle remains at the specified value.

Notes on display zone 4:

- ♦ The display shows the air mass measured by the air mass meter.
- ♦ In the event of emergency running caused by a fault in the throttle valve control unit, the engine runs without idling speed stabilisation at an increased idling speed (1100...1300 rpm) produced by the emergency running slot. The air throughput is roughly 4.5...5.5 g/s.
- ♦ If the engine control unit detects a fault at the air mass meter, the throttle valve potentiometer substitute value is displayed in g/s.

Test table, Display group 002

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1		- Refer also to display group 001, display zone 1 => Page 39	
2		- Refer also to display group 001, display zone 2 => Page 39	
3	Less than 1.0 ms	- Large quantity of fuel from the activated charcoal filter (ACF) system - Wrong injectors installed (delivery rate too high)	- Check solenoid valve for activated charcoal canister =>Page 127 . - Check injection quantity => Page 90
	Greater than 2.5 ms	- Increased engine load due to electrical consumers, air conditioner, gear engaged, power assisted steering on full lock	- Eliminate load
4	Less than 3.0 g/s	- Large quantity of unmetered air between intake manifold and air mass meter	- Eliminate air leak
	Greater than 5.0 g/s	- Gear engaged (automatic gear-box) - Engine load from ancillaries	- Move selector lever to P or N - Remove load (air conditioner, power steering etc.)

Display group 003, basic function:

Reading measured value block 3			⇒	◀ Display
640...760 rpm	10...14.5 V	80...105 °C	...	°C
		Intake air temperature		
		Coolant temperature		
		Battery voltage		
Idling speed is shown in increments of 40				

Note on display zone 3:

As soon as a fault relating to the coolant temperature sender (-G62) has been stored in the fault memory, the engine control unit uses the intake air temperature as substitute value for engine start (starting temperature substitute value). The temperature then increases in line with a model curve stored in the control unit. A fixed substitute value is displayed after a certain time for a warm engine. This fixed substitute value is again governed by the intake air temperature.

Note on display zone 4:

It is not possible to give specified values as the display readout is heavily affected by the ambient temperature.



Test table, Display group 003

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1		- Refer also to display group 001, display zone 1 => Page 39	
2	Less than 10 V	- Alternator defective, battery heavily discharged - High load on electrical system shortly after starting engine due to high charge current and load from ancillaries - Contact resistance in power supply or earth connection for engine control unit - Current drain with ignition off	- Check voltage, charge battery - Increase engine speed for several minutes and switch off ancillaries - Check power supply to engine control unit => Page 174 - Eliminate current drain
	Greater than 14.5 V	- Voltage control on alternator defective - Excess voltage from assisted start or high speed charger	- Check voltage; if necessary, fit a new voltage regulator. - Interrogate fault memory =>Page 4

Test table, Display group 003

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3	Less than 80 °C	- Engine too cold - Coolant temperature sender or wiring to engine control unit - Coolant temperature sender supplies implausible signal due to loose contact/corrosion (moisture in connector)	- Perform test drive if necessary - Coolant temperature sender-Check -G62 => Page 172
	Greater than 105 °C	- Radiator dirty - Radiator fan not working - Thermostat defective - Coolant temperature sender or wiring to engine control unit	- Clean radiator - Check function - Check coolant thermostat - Check coolant temperature sender -G62 => Page 172
4	Constant 25.5 °C	- Fault detected at intake air temperature sender -G42	- Interrogate fault memory =>Page 4
		- Intake air temperature sender -G42	- -Check -G42 => Page 166

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Display group 004: Idling speed stabilisation:

Reading measured value block 4			⇒	• Display
0...5 °	-0.7...+0.7 g/s	-0.7...+0.7 g/s	Idling	
			Operating status (idling, part throttle, full throttle, enrichment, overrun)	
			Idling speed air mass learned value for automatic in selector lever position 2, 3, 4, D	
			Idling speed air mass learned value (manual gearbox in idling speed position/automatic gearbox in selector lever position P or N)	
Throttle valve angle				

Test table, Display group 004

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
2	Less than -0.7 g/s	- Unmetered air downstream of throttle valve	- Eliminate air leak
	Higher than +0.7 g/s	- Heavy load caused by ancillaries - Constriction/foreign matter in intake area	- Switch off air conditioner and electrical consumers - Eliminate constriction/foreign matter

Note on display zone 1:

The value displayed when the accelerator pedal is fully depressed is around 75...95 <°.

Notes on display zones 2 and 3:

- ♦ The display shows how far the learned values of the idle stabilisation have "drifted away" from the pre-programmed mean value. With a new engine, the display will show a positive value because of the greater friction; if the engine has been run in it will show a negative value. A value of -0.70 g/s combined with too low a value in Display Group 005, display zone 3, indicates the presence of unmetered air.
- ♦ The value displayed is not measured by the air mass meter but calculated from information from the throttle valve potentiometer.
- ♦ The display in zone 3 is always 0 for vehicles with manual gearbox.

Note on display zone 4:

The following operating statuses are displayed:

- ♦ Idling
- ♦ Part throttle
- ♦ Full throttle
- ♦ Overrun
- ♦ Enrichment (full throttle enrichment)

Display group 005: Idling speed stabilisation:

Reading measured value block 5			⇒	• Display
640...760 rpm	700 rpm	-10...+10 %	3.0...5.0 g/s	
				Air mass
				Control value for idling speed air mass
				Engine speed (specified value - internal control unit computed value)
				Engine speed (actual) is shown in increments of 10 Display: max. 2550 rpm in increments of 10

Notes on display zone 3:

- ♦ The change in air mass during idling is shown as a percentage. As soon as the change has been compensated by the idle stabilisation learning process, the mean value is restored. The amount of deviation from the mean value depends on the extent of the load change (e.g. as a result of switching electrical consumers on or off).
- ♦ During idling, the air mass requirement varies with changing load conditions, even though the engine speed is constant.
- ♦ The learning process proceeds in small stages each time the idling switch closes. In the event of a large deviation, several stages are required. A brief burst of throttle must be given for this purpose at intervals of roughly 20 seconds. Each time this is done, a further stage of the learning process is performed.
- ♦ The "drifted" deviation then appears in display group 004, display zone 2. The values from the idling speed control remain outside the tolerance if the learned values in display group 004, display zone 2 have reached the stop.



- ♦ Stop values: -1.70 or +1.70 g/s

Display group 006: Idling speed stabilisation:

Reading measured value block 6				⇒	◀ Display
640...760 rpm	-10...+10 %	-10...+10 %	-10...+10 %	-10...+10 %	
					Lambda control, bank 2
					Lambda control, bank 1
					Idling speed air mass control value - refer to display group 005
					Engine speed (actual) is shown in increments of 10 Display: Max. 2550 rpm in increments of 10

Test table, Display group 006

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
3/4	Outside tolerance range	Negative display - engine too rich, consequence: Lambda control effects leaning - Positive display ("+" is not displayed) - engine too lean, consequence Lambda control effects enrichment - Unmetered air - Injector defective - Lambda learned values at stop	Wait 30 seconds for the display to stabilise - Eliminate air leak - Check injection quantity => Page 90 - Check lambda learned values, refer to display group 007

Notes on display zones 3 and 4:

- ♦ The display must fluctuate around zero. If a constant 0 is displayed, the lambda control has switched from closed-loop control to open-loop control because there is a fault in the lambda control: Interrogate fault memory =>Page 4 .
- ♦ Operating status of lambda control: Check display group 021, display zone 4 =>Page 52

Display group 007: Lambda learned values

Reading measured value block 7				⇒	◀ Display
-10...+10 %	-10...+10 %	-10...+10 %	-10...+10 %	-10...+10 %	
					Lambda learned value, bank 2 at idling speed (additive)
					Lambda learned value, bank 1 at idling speed (additive)
					Lambda learned value, bank 2 at part throttle (multiplicative)
					Lambda learned value, bank 1 at part throttle (multiplicative)

Notes on all display zones:

Low values mean that the engine is running too rich, and the lambda control is compensating by leaning out the mixture.

- ♦ High values mean that the engine is running too lean, and therefore the lambda control is compensating by enriching the mixture.
- ♦ If there is no voltage in the control unit, all the learned values will be reset.

- ♦ add = additive, i.e. effect of fault (e.g. unmetered air) is less pronounced with increasing engine speed. For the additive learned value, the injection period is altered by a fixed amount. This amount is not governed by the basic injection period.
- ♦ mul = multiplicative, i.e. effect of fault (e.g. injector fault) is more pronounced with increasing engine speed. The multiplicative learned value represents a percentage change in the injection period. This change is governed by the basic injection period.

Notes continued:

- ♦ Differences in lambda learned values of more than 15% between cylinder bank 1 and cylinder bank 2 may be due to the following:
 - Spark plug defective
 - Injector defective (leaking, clogged)
 - Lambda probe defective, dirty
 - Unmetered air at one end
 - Mechanical basic setting (valve timing) of engine not OK

Test table, Display group 007

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2/3/4	Low lambda learned values	- Lambda learned values low for idling and normal for part throttle: oil may be diluted (high petrol content in oil) - Injector leaking - Fuel pressure too high - Solenoid valve 1 for activated charcoal filter -N80 is constantly open - Air mass meter -G70 defective - Lambda probe heating defective or lambda probe dirty	- Problem eliminated after motorway drive or oil change Display group 009, display zones 1 and 2 =>Page 46 - Check the injector=> Page 85 - Check fuel pressure => Page 82 - -Check N80 => Page 127 - Check -G70 => Page 98 - Check lambda probe heating => Page 111

Test table, Display group 007

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2/3/4	High lambda learned values	- Lambda learned values high for idling and less high for part throttle: unmetered air possible around intake manifold - Injector clogged - Display zones 2 and 3 high: Air mass meter -G70 defective - Fuel pressure too low - Unmetered air between -G70 and throttle valve - Unmetered air at manifold gasket - Lambda probe heating defective or lambda probe dirty	- Eliminate causes Display group 009, display zones 1 and 2 =>Page 46 - Check injection quantity =>Page 90 - Check -G70 => Page 98 - Check fuel pressure =>Page 82 - Eliminate cause - Check lambda probe heating =>Page 111



Display group 008: Lambda learned values

Reading measured value block 8 ⇒ 640...760 rpm 1.00...4.00 ms -10...+10 % -10...+10 %			◀ Display
			Lambda learned value, bank 2 at idling speed (additive) - refer to display group 007
			Lambda learned value, bank 1 at idling speed (additive) - refer to display group 007
			Injection period (injection period per engine cycle) - see display group 002
			Idling speed is shown in increments of 10 Display: max. 2550 rpm in increments of 10

Display group 009, Lambda probe voltage:

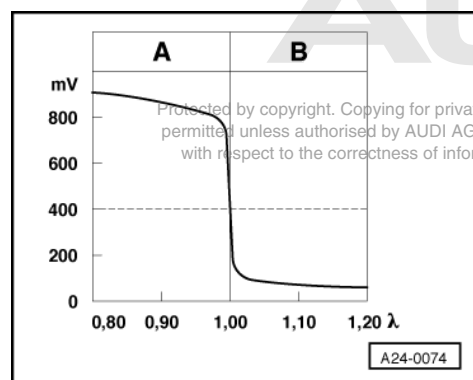
Reading measured value block 9 ⇒ 0.00...1.10 V 0.00...1.10 V 0....99 % 0.3....1.1			◀ Display
			Lambda correction value with fuel tank breather system active - refer to display group 010
			Activated charcoal filter system solenoid valve 1 duty cycle - refer to display group 010
			Lambda probe voltage, bank 2
			Lambda probe voltage, bank 1

Notes on display zones 1 and 2:

- ♦ The voltage signal for "Mixture rich" (low residual oxygen) is between 0.7...1.1 V (referenced to reference earth).
- ♦ The voltage signal for "Mixture rich" (low residual oxygen) is between 0.0...0.3 V (referenced to reference earth).
- ♦ During the transition from "rich" to "lean" and vice versa ($\lambda = 1.0$), there is a voltage jump from 0.7...1.0 V to 0.1...0.3 V or vice versa.

Notes continued:

- ♦ 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".
- ♦ The display value must intermittently drop below 0.3 V and increase beyond 0.7 V. Display values less than 0.45 V indicate "lean", whilst values over 0.45 V indicate "rich".



-> Lambda probe voltage U_{λ} in mV

A: High lambda probe voltage

- ◆ Rich mixture (excess fuel or lack of air)
- ◆ High CO value

B: Low lambda probe voltage

- ◆ Lean mixture (lack of fuel or excess air)
- ◆ Low CO value

Notes continued:

Notes on display zone 3:

- ◆ Activated charcoal filter system solenoid valve 1 -N80 is closed with duty cycle 0.
- ◆ Activated charcoal filter system solenoid valve 1 -N80 is fully open with duty cycle 99.

Notes on display zone 4:

- ◆ If value displayed is 0.6, engine is receiving an extremely rich mixture from ACF system. Lambda control therefore has to reduce injection quantity to 40%.
- ◆ If value displayed is 1.0, ACF system is providing an ideal mixture (neither leaning nor enrichment necessary) or ACF valve is closed (adaptation: display group 008, display zone 4).
- ◆ If value displayed is 1.01... 1.1, mixture from ACF system is too lean. Lambda control therefore has to effect enrichment.

Test table, Display group 009

Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2	Readout not alternating (constant 0.0... 0.3 V or constant 0.7... 1.1 V)	<ul style="list-style-type: none"> - Large quantity of unmetered air - Defective spark plug - Fuel system pressure too high or too low - Injector defective - Coolant temperature sender - G62 - Solenoid valve 1 for activated charcoal filter -N80 - Lambda probe heating not functioning - Lambda probe defective or dirty 	<ul style="list-style-type: none"> - Eliminate cause - Check spark plug - Check fuel pressure regulator and holding pressure =>Page 82 . - Check injectors => Page 85 - Interrogate fault memory => Page 172 - Perform final control diagnosis =>Page 127 - Check lambda probe heating => Page 111 - Interrogate fault memory =>Page 109 .

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Display zone	Readout on V.A.G 1551	Cause of fault	Fault elimination
1/2	Constant 1.105 V	<ul style="list-style-type: none"> - Short to positive through: - Lambda probe - Signal wire - Earth wire - Engine control unit 	- Check lambda probe=>Page 109
	Constant value between 0.400...0.500 V	<ul style="list-style-type: none"> - Open circuit through: - Lambda probe -G39 - Signal wire - Earth wire - Engine control unit 	- Check lambda probe=>Page 109



	Constant 0.000 V	- Short to earth through: - Lambda probe -G39 - Signal wire - Earth wire - Engine control unit	- Check lambda probe=>Page 109
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Display Group 010, Fuel tank breather

Reading measured value block 10 0...99 % 0.6...1.1 -5...+95 0.00...1.50	⇒	• Display
		Fuel tank breather system purging rate
		Fill level of activated charcoal filter
		Lambda correction factor with fuel tank breather system active
		Duty cycle of ACF solenoid 1 -N80

Notes on Display Group 010:

- ♦ By way of the activated charcoal filter system solenoid valve 1 -N80, the engine control unit determines the amount of fuel vapours to be supplied to the engine from the activated charcoal filter system. If, in the event of a high activated charcoal filter fill, the solenoid valve 1 remains closed to maintain the specific purging rate (lower duty cycle), the Lambda control reaction takes the form of a change in the Lambda correction factor. If this reaction is lower than expected on account of fuel vapours from the fuel tank having increased the fill in the mean time, then the control unit calculates a higher fill.
- ♦ Checking fuel tank breather system => Page **125**

Notes continued:**Notes on display zone 1:**

- ♦ Lambda control action causes the activated charcoal filter system solenoid valve 1 -N80 to be intermittently clocked for 220...900 seconds (implementation of fuel tank breather function) and deactivated for approx. 70 seconds (no fuel tank breather function). During the approx. 70 second period, the Lambda control learns the operating conditions without the deviation caused by fuel vapours from the activated charcoal filter.
- ♦ Duty cycle 0% = activated charcoal filter system solenoid valve 1 closed. Duty cycle 99% = solenoid valve 1 fully open.
- ♦ At idling speed, the engine can only process a certain maximum volume of fuel vapours from the activated charcoal filter system. Opening of activated charcoal filter system solenoid valve 1 is thus restricted at idling speed. At part and full throttle, the duty cycle may increase up to 99%.
- ♦ The influence of the activated charcoal filter system can be assessed by comparing the value displayed during "Basic setting" (solenoid valve 1 closed) and during "Reading measured value block" (solenoid valve 1 open for 220...900 seconds/closed for approx. 70 seconds).
- ♦ By pressing the keys 4 and 8 on the V.A.G 1551/1552, it is possible to switch back and forth between function 04 "Basic setting" and function 08 "Reading measured value block".

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Notes continued:**Notes on display zone 2:**

- ♦ If activated charcoal filter system is providing an extremely rich mixture, the Lambda control has to effect leaning. Leaning may be up to 0.6. In this case, the Lambda control therefore has to reduce injection quantity by 40%.
- ♦ If value displayed is 1.0 (Lambda control in neutral range, i.e. no correction factor), activated charcoal filter system is either providing an ideal mixture (neither leaning nor enrichment necessary), or solenoid valve 1 is closed => display zone 1.
- ♦ If value displayed is 1.01...1.10, mixture from activated charcoal filter system is too lean. Lambda control therefore has to effect enrichment

Notes on display zone 3:

- ♦ -5 indicates that there are no fuel vapours in the activated charcoal filter or that the ACF system is leaking.

- ◆ +95 indicates that activated charcoal filter is completely filled with fuel vapours or that ACF valve is defective.

Notes on display zone 4:

- ◆ The display shows the percentage by volume of the activated charcoal filter system referenced to the total intake volume.
- ◆ 0.00 indicates no supply from activated charcoal filter system (solenoid valve 1 closed).
- ◆ 1.50 indicates that 30% of intake air mass is from activated charcoal filter system.

6.4 - Reading measured value block: Display groups 011 to 099

Display group 011, Fuel consumption:

Reading measured value block 11 ➔				◀ Display
640...760 rpm	1.0...2.5 ms	0 km/h	0.8...1.8 l/h	
				Fuel consumption: The specified value shown on the display relates only to idling without any additional load from ancillaries (automatic gearbox, air conditioner, alternator, power steering pump). Not suitable for fuel consumption measurement (l/100 km).
				Vehicle speed
				Engine load
				Idling speed is shown in increments of 40

Display group 012, Knock control:

Reading measured value block 12 ➔				◀ Display
0...6800 rpm	0...12° crankshaft	0...12° crankshaft	0...12° crankshaft	
				Ignition timing retardation by knock control, cylinder 3
				Ignition timing retardation by knock control, cylinder 2
				Ignition timing retardation by knock control, cylinder 1
				Engine speed

Display group 013, Knock control:

Reading measured value block 13 ➔				◀ Display
0...10 ms	0...12° crankshaft	0...12° crankshaft	0...12° crankshaft	
				Ignition timing retardation by knock control, cylinder 3
				Ignition timing retardation by knock control, cylinder 2
				Ignition timing retardation by knock control, cylinder 1
				Engine load

Display group 014, Knock control:

Reading measured value block 14 ➔	◀ Display
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0...6800 rpm	0...12° crankshaft	0...12° crankshaft	0...12° crankshaft	
			Ignition timing retardation by knock control, cylinder 6	
			Ignition timing retardation by knock control, cylinder 5	
		Ignition timing retardation by knock control, cylinder 4		
Engine speed				

Display group 015, Knock control:

Reading measured value block 15 ⇒				◀ Display
0...10 ms	0...12° crankshaft	0...12° crankshaft	0...12° crankshaft	
			Ignition timing retardation by knock control, cylinder 6	
			Ignition timing retardation by knock control, cylinder 5	
			Ignition timing retardation by knock control, cylinder 4	
	Engine load			

Notes on display groups 012, 013, 014 and 015:

- ♦ The knock control is active from an engine load of greater than 40%.
- ♦ At engine loads of more than 40%, the display will show the current ignition timing retardation values. At engine loads of less than 40% the display will constantly show the last values used.
- ♦ If there is audible knocking and no perceptible ignition timing retardation, increase the engine speed to above 3500 rpm for 5 seconds in order to activate the knock sensor fault detection (diagnosis) function.
- ♦ If there is a significant difference between the ignition timing retardation value for one of the cylinders and the values for the other cylinders, the following faults are possible:

- Loose ancillaries

- Corrosion on connector

- Engine damage (e.g. oil combustion *because of defective piston*)

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- ♦ If the ignition timing retardation values for all the cylinders are high, the following faults are possible:

- Corrosion on connector

- Tightening torque (20 Nm) not OK

- Open circuit in wiring

- Knock sensor defective

- Loose ancillaries

- Poor quality fuel (less than RON 95)

Display group 016, Knock control:

Reading measured value block 16				⇒	◀ Display
0...6800 rpm	0...10 ms	-20...+40° ATDC/BTDC	0.0...72.0 °crankshaft		
			Total ignition timing retardation for cylinders 1 to 6		
			Ignition timing		
		Engine load			

Engine speed

Notes on display group 016:

- ♦ The knock control must retard the ignition timing as soon as knocking is detected in order to prevent damage to the engine.
- ♦ However, the ignition timing retardation does increase the exhaust gas temperature. There is a risk of the catalytic converter overheating.
- ♦ To avoid such overheating, the mixture is enriched at full throttle as of a total retardation of approx. 10° crankshaft to reduce the exhaust gas temperature.

Display group 017, Knock sensor:

Reading measured value block 17				⇒	◀ Display
640...760 rpm	0.50...1.40 V	0.50...1.40 V	0.50...1.40 V		
			Knock sensor voltage signal, cylinder 3		
			Knock sensor voltage signal, cylinder 2		
			Knock sensor voltage signal, cylinder 1		
Idling speed is shown in increments of 40					

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- ♦ If no faults are found when checking the knock sensor, wiring and connector, check the engine for loose ancillaries or engine damage => display groups 012, 013, 014 and 015.
- ♦ At higher engine speeds, the voltage signal displayed for the knock sensors may reach values of up to 5.1 V.
- ♦ If the difference between the highest and lowest knock control signals is more than 50%, this may be due to corrosion on the connector.

Display group 018, Knock sensor:

Reading measured value block 18				⇒	◀ Display
640...760 rpm	0.50...1.40 V	0.50...1.40 V	0.50...1.40 V		
			Knock sensor voltage signal, cylinder 6		
			Knock sensor voltage signal, cylinder 5		
			Knock sensor voltage signal, cylinder 4		
Idling speed is shown in increments of 40					

Notes on display group 018:

- ♦ If no faults are found when checking the knock sensor, wiring and connector, check the engine for loose ancillaries or engine damage => display groups 012, 013, 014 and 015.
- ♦ At higher engine speeds, the voltage signal displayed for the knock sensors may reach values of up to 5.1 V.
- ♦ If the difference between the highest and lowest knock control signals is more than 50%, this may be due to corrosion on the connector.

Display group 019, Torque reduction (automatic gearbox):

Reading measured value block 19				"	◀ Display
0...6800 rpm	0.0...10.0 ms	0...410 Nm	-100...300 Nm		
				Actual engine torque (actual torque)	



		Required engine torque
		Engine load
		Engine speed

Notes on display group 019:

- ♦ This display group can be used to assess how the ignition timing retardation reduces the engine torque on changing gear and thus makes gear shifts smoother.
- ♦ On account of the brief signal, the ignition timing retardation is not always recognised and is therefore not always displayed by V.A.G 1551/1552.
- ♦ Display zone 3 shows the engine torque required for changing gear (specified torque).
- ♦ Display zone 4 shows the actual engine torque (clutch torque/actual torque).
- ♦ Checking ignition timing retardation on changing gear => Page 152

Display group 020 - Operating status:

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Reading measured value block 20 ⇒				◀ Display
rpm	Neutral Gear ENG.	A/C-high A/C-low	Compr.ON Compr.OFF	
				Air conditioner compressor ON/OFF For vehicles with no air conditioner, "Compr. OFF" is always displayed.
				Engine speed increase, air conditioner <ul style="list-style-type: none"> ▪ A/C-high = high heating or cooling output ▪ A/C-low = low heating or cooling output
				Selector lever position, neutral or gear ENG.
				Engine speed is shown in increments of 10

Notes on display zone 2:

- ♦ "Neutral" or "Gear ENG." is always displayed for vehicles with manual gearbox.
- ♦ As of control unit no. 4D0 907 551 M with data status D02, "Gear ENG." is always displayed.

Display group 021, Operating status of lambda control:

Reading measured value block 21 ⇒				◀ Display
rpm	ms	°C	λ-control OFF λ-control ON	
				Lambda control OFF/ON
				Coolant temperature
				Engine load
				Engine speed is shown in increments of 40

Notes on display group 021:

- ♦ At starting temperatures below 15 °C (intake air temperature), Lambda control is only activated by engine control unit as of a coolant temperature of +5 °C.
- ♦ At starting temperatures above 15 °C (intake air temperature), Lambda control cuts in if readiness for probe operation is detected.
- ♦ Map control is implemented for engine when Lambda control is deactivated.

Display group 022

This display group is only intended for development and production.

The values shown have no relevance for fault finding in the workshop.

Display group 023, Adaptation of the throttle valve positioner:

Reading measured value block 23				⇒	• Display
01000000	72...95 %	65...85 %	16...51 %		
					Max. stop of throttle valve positioner -V60
					▪ Vehicles with manual gearbox 18 ... 54%
					▪ Vehicles with automatic gearbox 34 ... 70%
					Emergency running stop for throttle valve positioner -V60
					Min.- stop for throttle valve positioner -V60
Learning demand display					

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Note on display zone 1:

If specified display value is not attained, perform adaptation of throttle valve control unit -J338 => Page 132.

Note on display zones 2, 3 and 4:

Display shows stop values learnt during last adaptation.

Note on display zones 1, 2, 3 and 4:

If specified display value is still not attained after performing adaptation, check wiring for open circuit/short circuit and connectors for dirt/corrosion before renewing throttle valve control unit.

Meaning of digits in 8-digit number block, display zone 1 - learning demand display

X	X	X	X	X	X	X	X	Meaning
								No meaning
								Min. stop learning process for throttle valve positioner sender -G127
								0 = Learning performed, learning OK
								1 = Learning not performed, learning not OK
								Max. stop learning process for throttle valve positioner sender -G127
								0 = Learning performed, learning OK
								1 = Learning not performed, learning not OK
								Min. stop learning process for throttle valve potentiometer -G69
								0 = Learning performed, learning OK
								1 = Learning not performed, learning not OK
								Max. stop learning process for throttle valve potentiometer -G69
								0 = Learning performed, learning OK
								1 = Learning not performed, learning not OK
								No meaning
								Calibration of throttle valve potentiometer -G69 with throttle valve positioner sender -G127
								0 = Calibration required
								1 = Calibration performed, calibration OK
								No meaning

Display group 024, traction control system:

Reading measured value block 24				⇒	• Display
0...6800 rpm	0 ... 12	-100...410 Nm	-100...300 Nm		



			Actual engine torque (engine actual torque / MMI)
			Required engine torque (engine specified torque / MMS)
			Reduction stages
			Engine speed

Notes on display group 024:

- Display group 024 need only be heeded on vehicles fitted with traction control system (ASR).
- Vehicles with traction control system can be identified by way of ASR warning lamp in dash panel insert or ABS/ASR self-diagnosis.

This display group can be used to assess how, on detection of slip, the engine torque is reduced so as to prevent slip.

The engine control unit informs the ABS/ASR control unit of the instantaneous engine torque (actual torque). If slip is detected, the required specified torque signal is calculated in the ABS/ASR control unit and relayed to the engine control unit for torque reduction, which is subdivided into 12 reduction stages. The ABS/ASR control unit receives feedback on the extent to which engine torque has been reduced from the actual torque signal.

Notes continued:

- If the engine is cold (coolant temperature less than 30 °C), the reduction in engine torque is attained in low reduction stages (0...2) by ignition timing retardation ("0" is displayed in zone 2) in high reduction stages (3...12) by briefly deactivating individual injectors.
- If the engine is warm (coolant temperature greater than 45 °C), the engine torque is reduced by way of brief deactivation of individual injectors and ignition timing retardation.

Notes on display zones 3 and 4:

- Display zone 3 shows the required engine torque calculated by the ABS/ASR control unit (engine specified torque).
- Checking engine specified torque signal from ABS/ASR control unit => Page 149 .
- Display zone 4 shows the actual engine torque (clutch torque/engine actual torque).
- Checking engine actual torque signal => Page 149 .
- When the traction control system is not active, i.e. when no torque reduction is requested by the traction control system, the value in display zone 3 is considerably higher than the maximum possible 300 Nm for the engine. This value is a purely theoretical value (up to 410 Nm), which was selected at such a high level solely for the purpose of having a clear "safety margin" with respect to the actual torque. It is thus ensured that the engine control unit always detects the torque reduction request.
- The values in display zones 3 and 4 become assimilated during the period in which the traction control system is active.

Display group 025, System status:

Reading measured value block 25			⇒	◀ Display
0...6800 rpm	0.0...10.0 ms	X X X		
			Not used	
			System status - refer to display group 027	
			Engine load	
			Engine speed	

Display group 026, Camshaft position:

Reading measured value block 26			⇒	◀ Display
0...6800 rpm	0.0...10.0 ms	Normal position: -3.0 ... 6.0 °crankshaft		
			Switched position: 16.0 ... 25.0 °crankshaft	

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			Camshaft position, bank 2 - refer to display group 027
			Camshaft position, bank 1 - refer to display group 027
		Engine load	
	Engine speed		

Display group 027, System status and camshaft position:

Reading measured value block 27 X X X	⇒	• Display
	Normal position: -3.0 ... 6.0 °crankshaft Switched position: 16.0 ... 25.0 °crankshaft	
		Camshaft position, bank 2
		Camshaft position, bank 1
	Not used	
	System status	

Note on display zone 1:

The display shows which system is actuated by the engine control unit/not actuated (system status),

i.e. if the conditions (e.g. load, engine speed) for a system are satisfied, the engine control unit actuates this system. Actuation of a system cannot however be taken to mean that the system concerned is functional.

Meaning of digits in 3-digit display, display zone 1 - system status

X					X	X	Meaning Value "0" = Condition not satisfied, actuation not active Value "1" = Condition satisfied, actuation active
							Camshaft timing control
							Intake manifold changeover
							Not used
							Energy balance for catalytic converter heating

Notes on display zones 3 and 4:

- ◆ There are only two positions for the adjustable camshaft, namely the normal and the switched position. The camshaft switched position is attained by accelerating the vehicle in first gear from standstill. Display zones 3 and 4 show the actual position of the adjustable camshafts. If actuation of the camshaft timing control is active (=> display zone 1), display zones 3 and 4 show whether the camshafts have actually been adjusted (feedback).
-Camshaft in normal position = -3.0...+6.0 °crankshaft
-Camshaft in switched position = 16.0...25.0 °crankshaft
- ◆ If a value between 6.0 °crankshaft and 16.0 °crankshaft is displayed in fields 3 and/or 4 during test drive, the camshaft adjustment solenoid valves are switching the oil pressure properly to the respective mechanical camshaft adjuster, but this is not able to reach its end position (e.g. on account of stiffness).
- ◆ Checking camshaft timing control => Page 181.

Display group 095, Basic function:

Basic setting 95 640...760 1.00...2.50 12.0°BTDC - 40...125 rpm ms °C	⇒	• Display
		Coolant temperature - refer to display group 003



Ignition timing - refer to display group 001	
Engine load	
Up to engine control unit 4D0 907 551:...%	
As of engine control unit 4D0 907 551 F/G:1.00...2.50 ms	
Engine speed	

Display group 096/097

*This display group is only intended for development and production.
The values shown have no relevance for fault finding in the workshop.*

Display Group 098, Adaptation of throttle valve control unit:

Basic setting 98		⇒	◀ Display
0...5 V	0...5 V	Idling Part throttle	ADP running ADP OK ADP ERROR
		Adaptation status ADP = adaptation, throttle valve control unit	
		Operating status	
		Idling speed positioner potentiometer voltage (current values)	
		Throttle valve potentiometer voltage (current values)	

Note on display zone 4:

ADP = Adaptation => Checking throttle valve control unit, Page **131**.

Display group 099, Lambda control:

Reading measured value block 99		⇒	◀ Display
rpm	°C	-10...+10 %	λ-control OFF λ-control ON
		Lambda control OFF/ON Basic setting 04: λ-control OFF Reading measured value block 08: λ-control ON	
		Lambda control	
		Coolant temperature	
		Engine speed	

Notes on display zone 4:

- ♦ For defined fault finding, the lambda control is switched off when display group 099 is selected under "Basic setting 04" and switched on when it is selected in "Reading measured value block 08".
- ♦ Lambda control is automatically re-activated on exit from function 04 "Basic setting".
- ♦ By pressing the keys 4 and 8 on the V A G 1551/1552, it is possible to switch back and forth between function 04 "Basic setting" and function 08 "Reading measured value block".

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24 - Mixture preparation, Injection

1 - Servicing Motronic injection system

1.1 - Servicing Motronic injection system

1.2 - Safety precautions

Warning:

Fuel system is pressurised. Before loosening hose connections or opening the test connection, place a cloth around the connection. Then release pressure by carefully pulling off the hose or cap.

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

- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ Always switch off the ignition before connecting or disconnecting injection or ignition system wiring or tester cables.
- ◆ To operate the engine at starting speed without actually starting it (for example, to check the compression), unplug the connector from the power output stage for the ignition coils and the 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 cleaning 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.)

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

Warning:

- ◆ **Always secure the testers and measuring instruments to the rear seat and have a second person operate them from there.**
- ◆ **If test equipment were 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, pay careful attention to the following 6 rules for cleanliness:

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Never use fluffy cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components:
Only remove replacement parts from packaging immediately prior to installation.
Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open:
Do not work with compressed air if this can be avoided.
Do not move vehicle unless absolutely necessary.



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

1.4 - Technical data

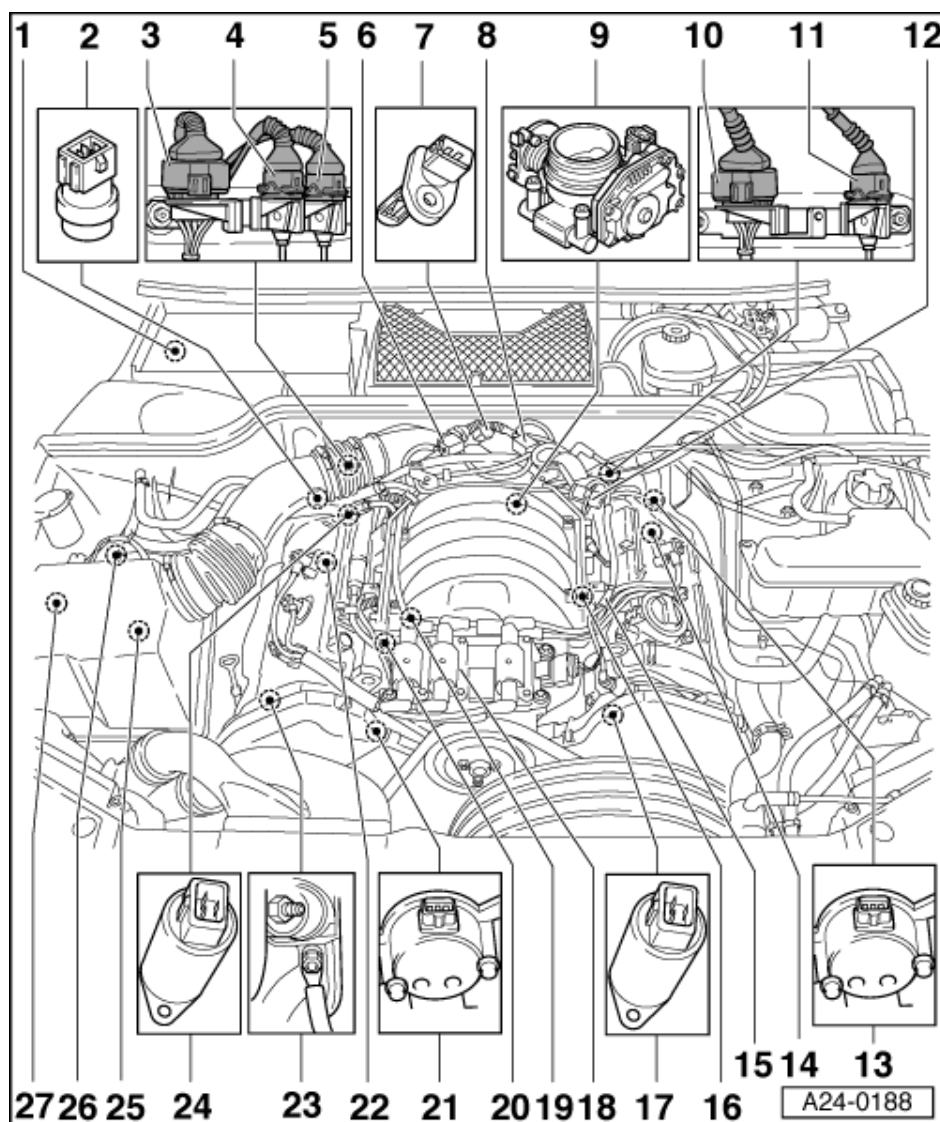
Engine code letters		ACK (2.8 l / 5V / 142 kW engine) ALG (2.8 l / 5V / 142 kW engine with secondary air induction)
Idling speed Speed not adjustable, controlled by the idling speed stabilisation		640...760 rpm
Engine speed limitation by deactivation of injectors		6500 rpm
Fuel pressure at idling speed	Vacuum hose connected	3.2 ... 3.8 bar
	Vacuum hose detached	3.8 ... 4.2 bar
Holding pressure after 10 minutes	Engine cold	approx. 2.2 bar
	Engine warm	approx. 3.0 bar
Injectors	Spray pattern	Two-hole nozzle / same for all injectors
	Injection quantity (30 s)	90 ... 125 ml
	Resistance (ambient temperature) 1)	13.5 ... 15.5 ω

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



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1.5 - Fitting locations overview



1 Engine control unit -J220

- ♦ In electronics box on right of plenum chamber

2 Coolant temperature sender -G62

- ♦ On coolant pipe behind cylinder head, bank 1

3 4-way connector

- ♦ For lambda probe 1 -G39 and lambda probe heating -Z19

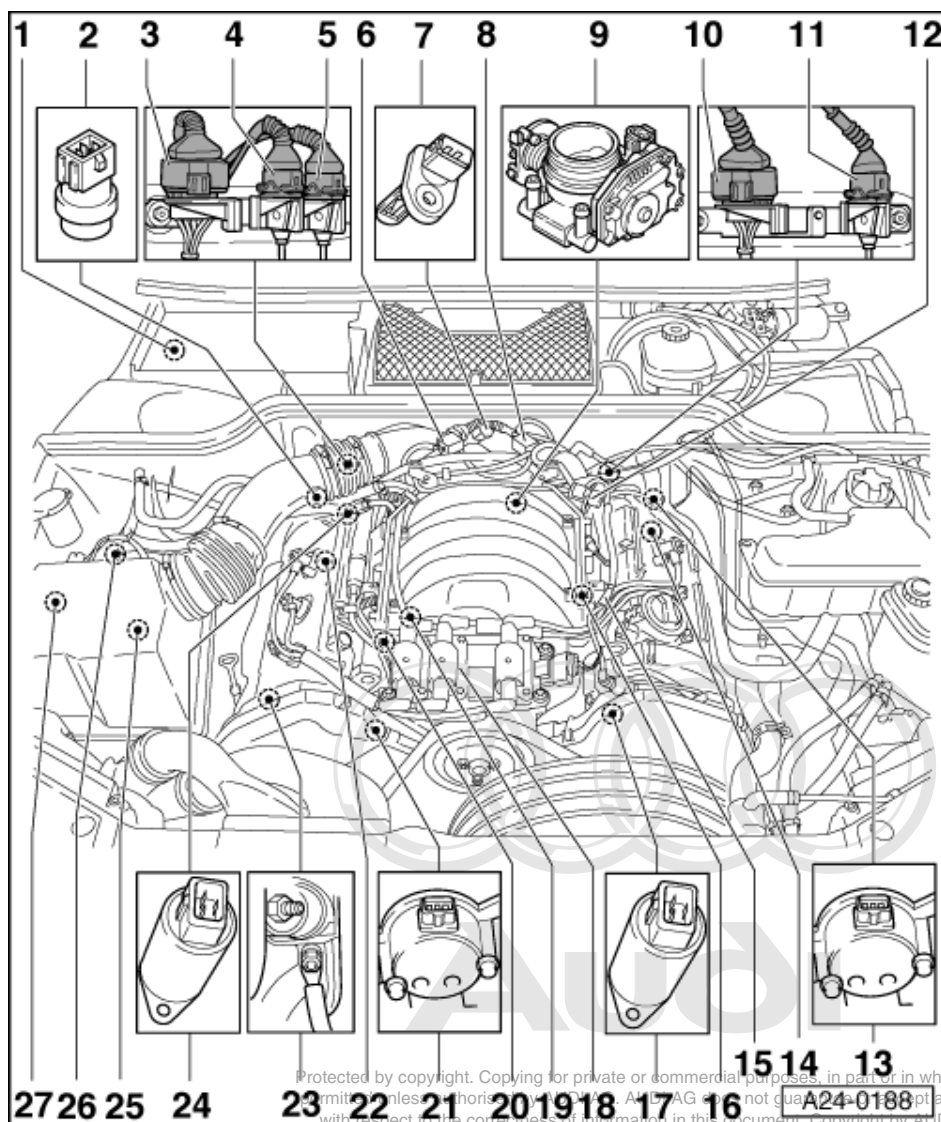
4 3-way connector

- ♦ For knock sensor 1 -G61

5 3-way connector

- ♦ For engine speed sender -G28

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**6 Secondary air inlet valve -N112**

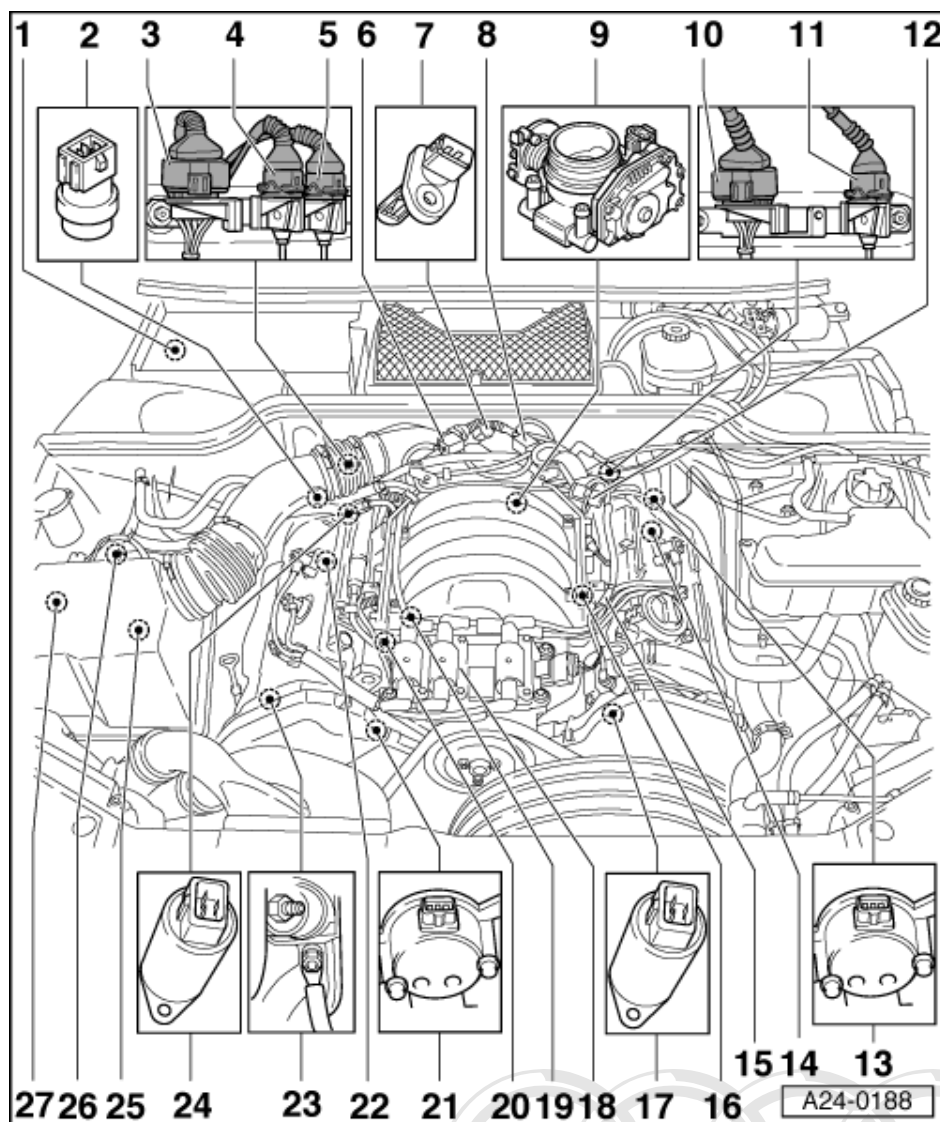
- ♦ Only on vehicles with secondary air induction

7 Intake air temperature sender -G42**8 Intake manifold changeover valve -N156****9 Throttle valve control unit -J338**

- ♦ With throttle valve potentiometer -G69, throttle valve positioner -G127 and idling speed switch -F60

10 4-way connector

- ♦ For lambda probe 2 -G108 and lambda probe heating -Z28



11 3-way connector

- ♦ For knock sensor 2 -G66

12 Fuel pressure regulator

13 Hall sender -G40

- ♦ Cylinder bank 2

14 Lambda probe 2 -G108

15 Engine speed sender -G28

- ♦ In gear case above ring gear

16 Knock sensor 2 -G66

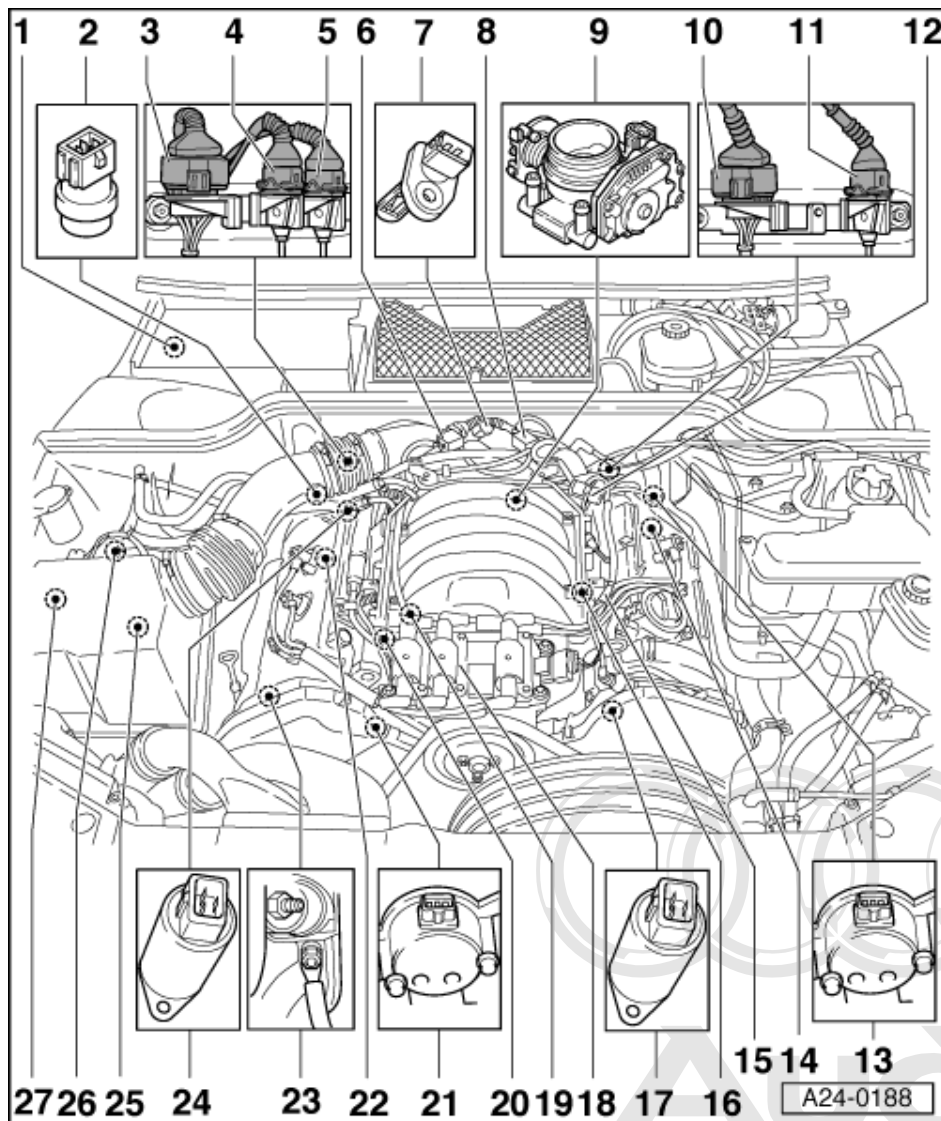
17 Camshaft adjustment solenoid valve 2 -N208

18 Ignition coils -N, -N128, -N158

- ♦ With output stage -N122

19 Knock sensor 1 -G61

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20 Injectors -N30...-N33, -N83, -N84

21 Hall sender -G163

- ♦ Cylinder bank 1

22 Lambda probe 1 -G39

23 Earth connection

- ♦ On right hand engine support

24 Camshaft adjustment solenoid valve 1 -N205

25 Air mass meter -G70

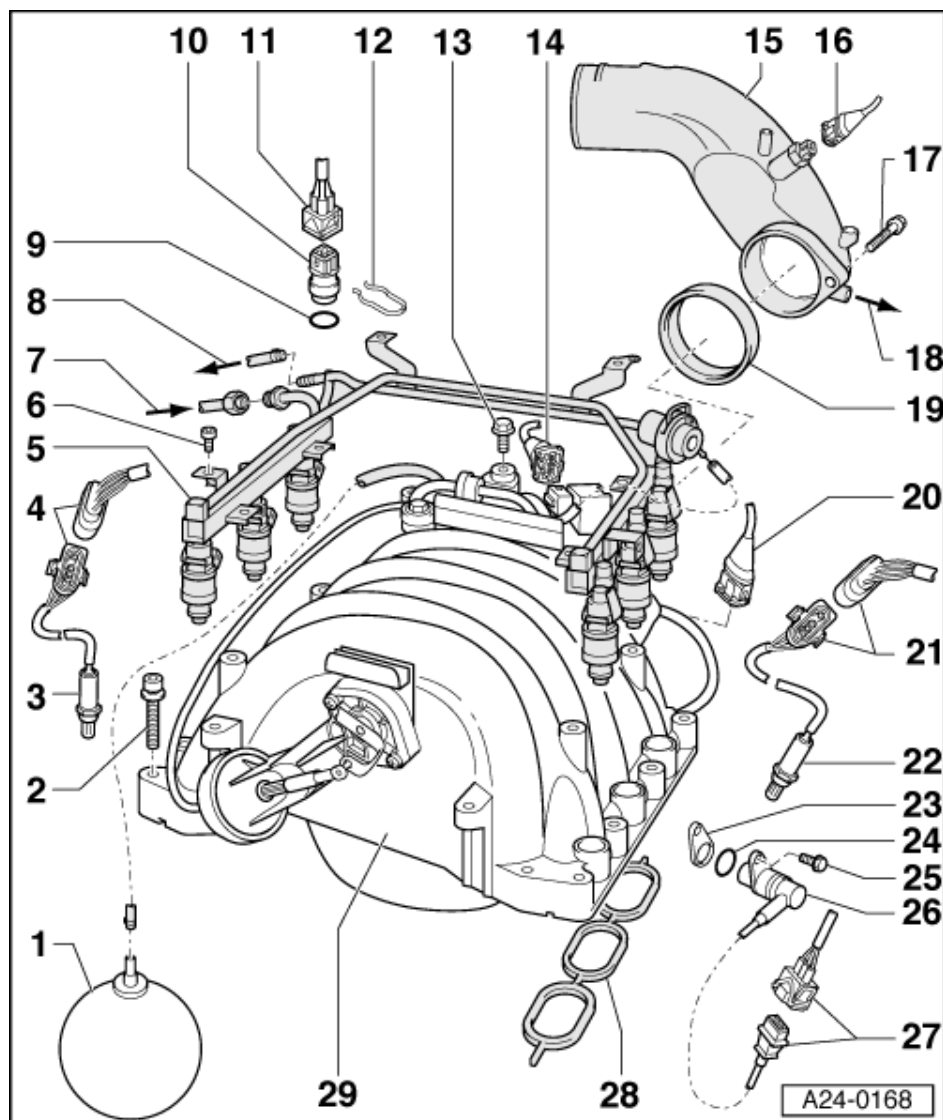
26 Solenoid valve 1 for activated charcoal filter -N80

27 Secondary air pump motor -V101

- ♦ Only on vehicles with secondary air induction
- ♦ Location: In air cleaner housing

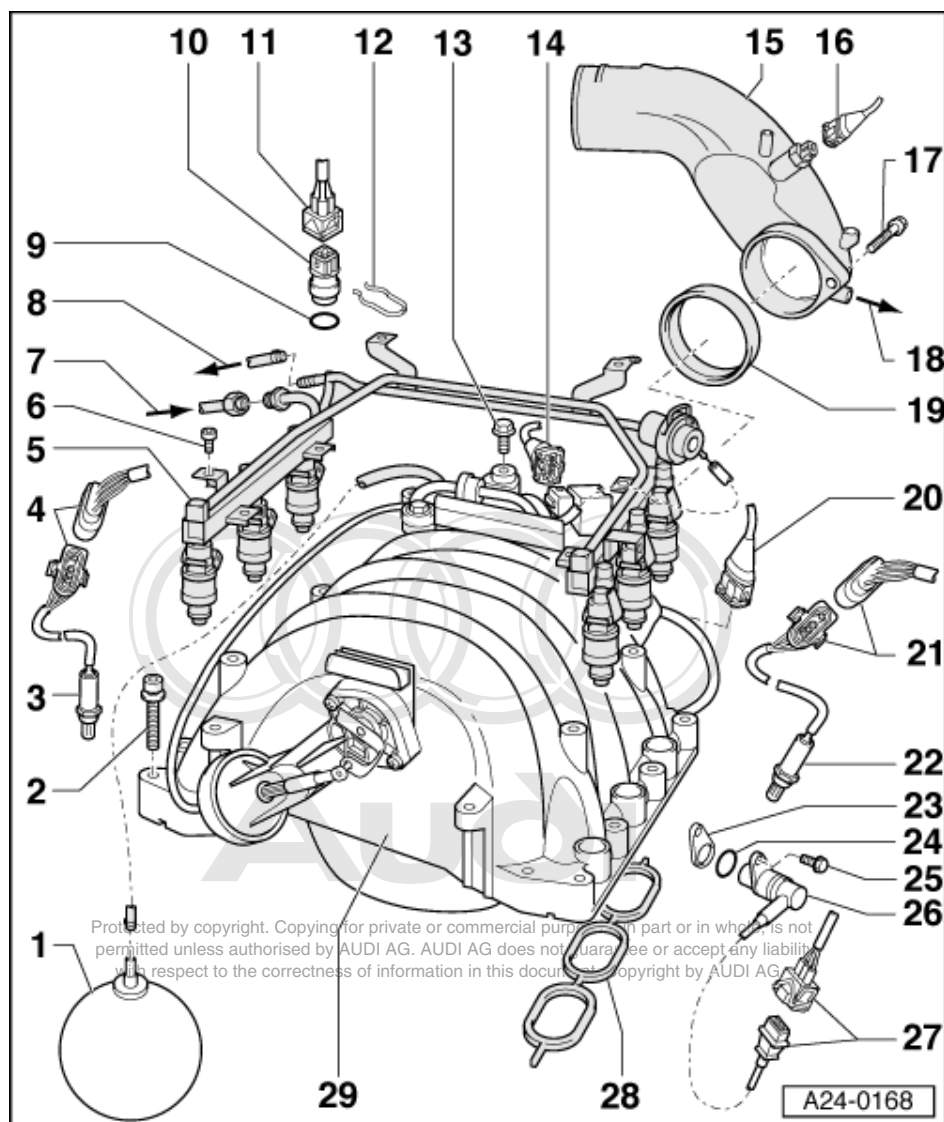
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1.6 - Removing and installing injection system components

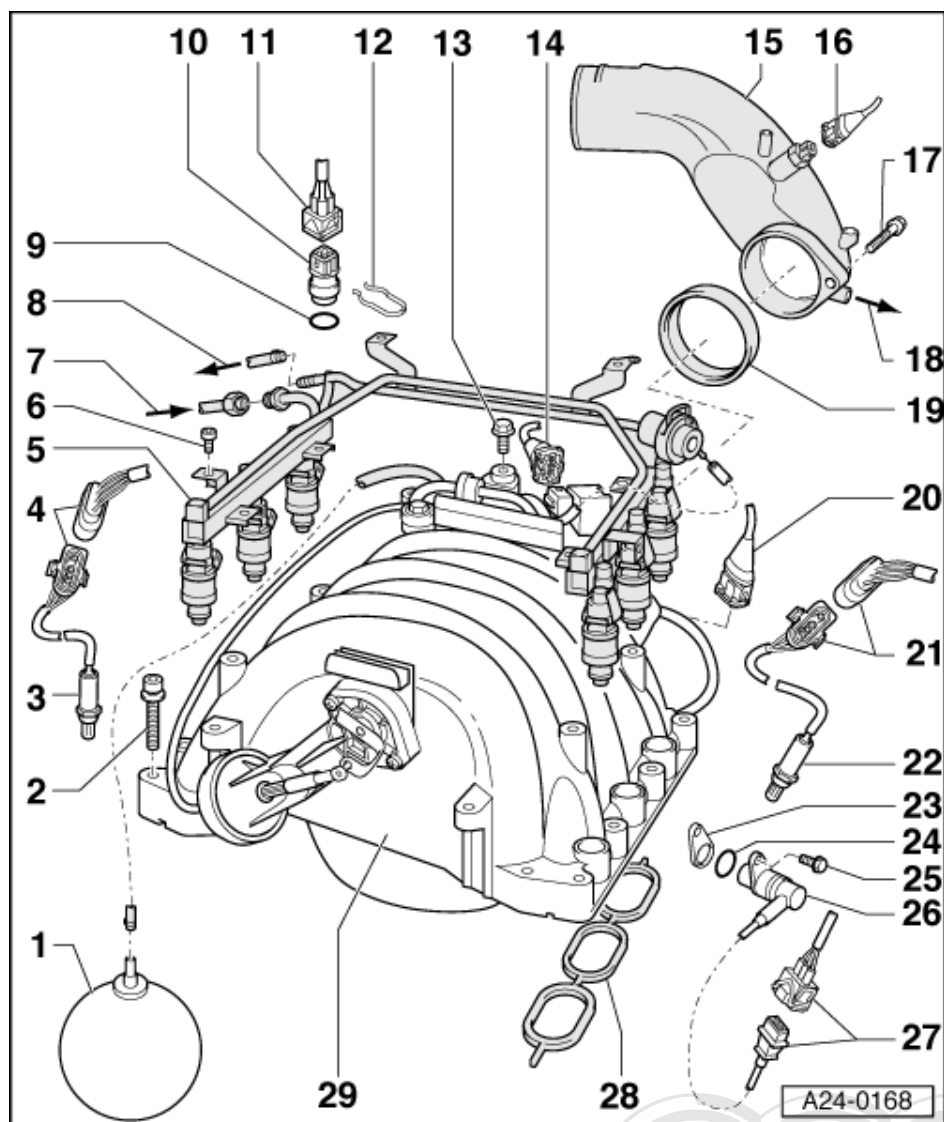


- 1 Vacuum reservoir
 - ♦ For intake manifold changeover at full throttle
- 2 10 Nm
- 3 Lambda probe 1 -G39 - 50 Nm
 - ♦ Cylinder bank 1
 - ♦ Probe heating is supplied with power via fuel pump relay -J17
- 4 4-way connector
 - ♦ For lambda probe and lambda probe heating
- 5 Fuel manifold with injectors
 - ♦ Dismantling and assembling =>Page 70

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- 6 10 Nm
- 7 **Supply pipe**
- ♦ From fuel filter
- 8 **Return pipe**
- ♦ Secure with spring clips
 - ♦ Ensure tight fit
- 9 **O-ring**
- ♦ Renew if damaged
- 10 **Coolant temperature sender -G62**
- ♦ For engine control unit
 - ♦ With coolant temperature gauge sender -G2
 - ♦ If necessary, release cooling system pressure before removal



11 Connector

- ♦ For coolant temperature sender -G62

12 Fastener

- ♦ Ensure tight fit

13 10 Nm

14 Connector

- ♦ For intake manifold changeover valve -N156

15 Air intake elbow

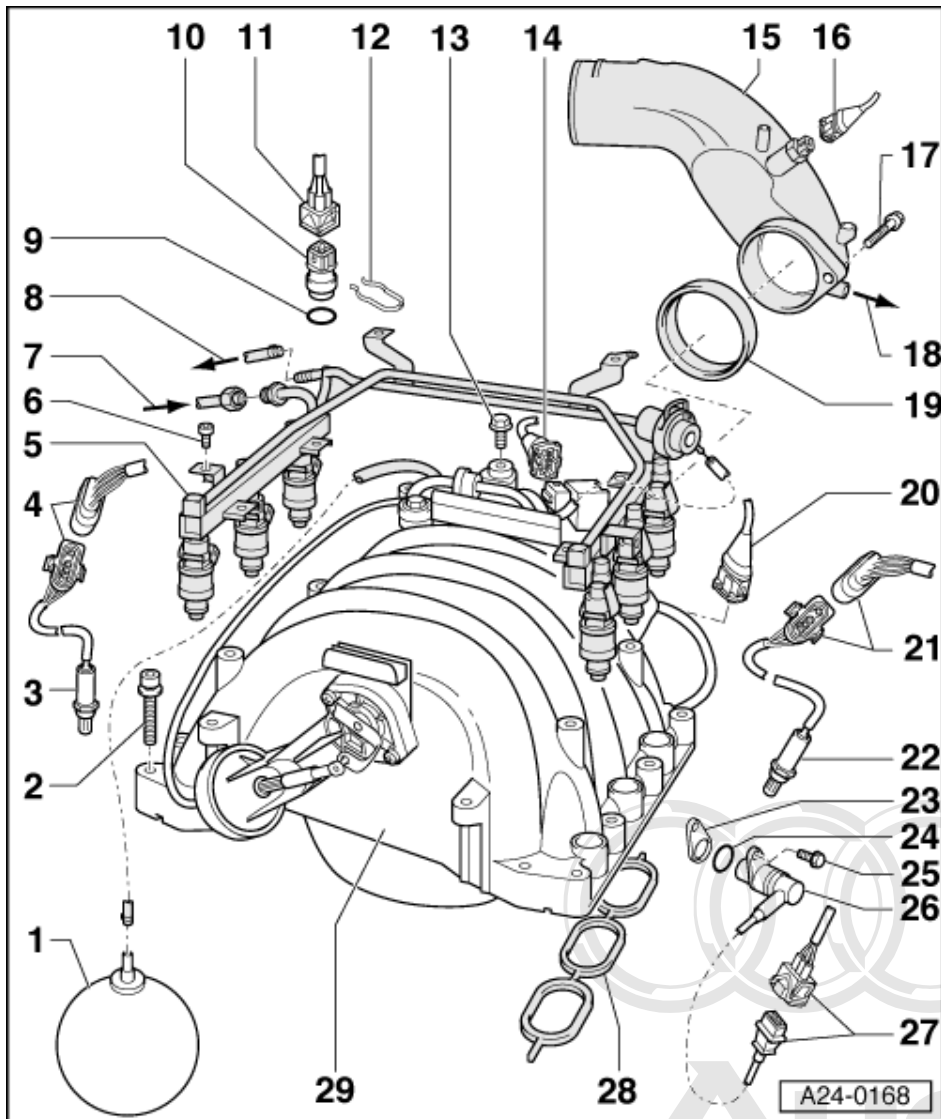
16 Connector

- ♦ For intake air temperature sender -G42

17 10 Nm

18 To crankcase breather valve

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19 Sealing ring

20 Connector

- ♦ For injectors -N30...-N33, -N83, -N84

21 4-way connector

- ♦ For lambda probe and lambda probe heating

22 Lambda probe 2 -G108 - 50 Nm

- ♦ Cylinder bank 2

23 Spacer

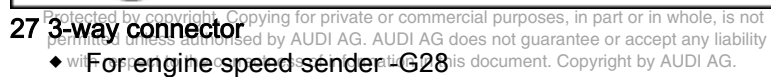
24 O-ring

25 10 Nm

26 Engine speed sender -G28

- ♦ In gear case above starter ring gear

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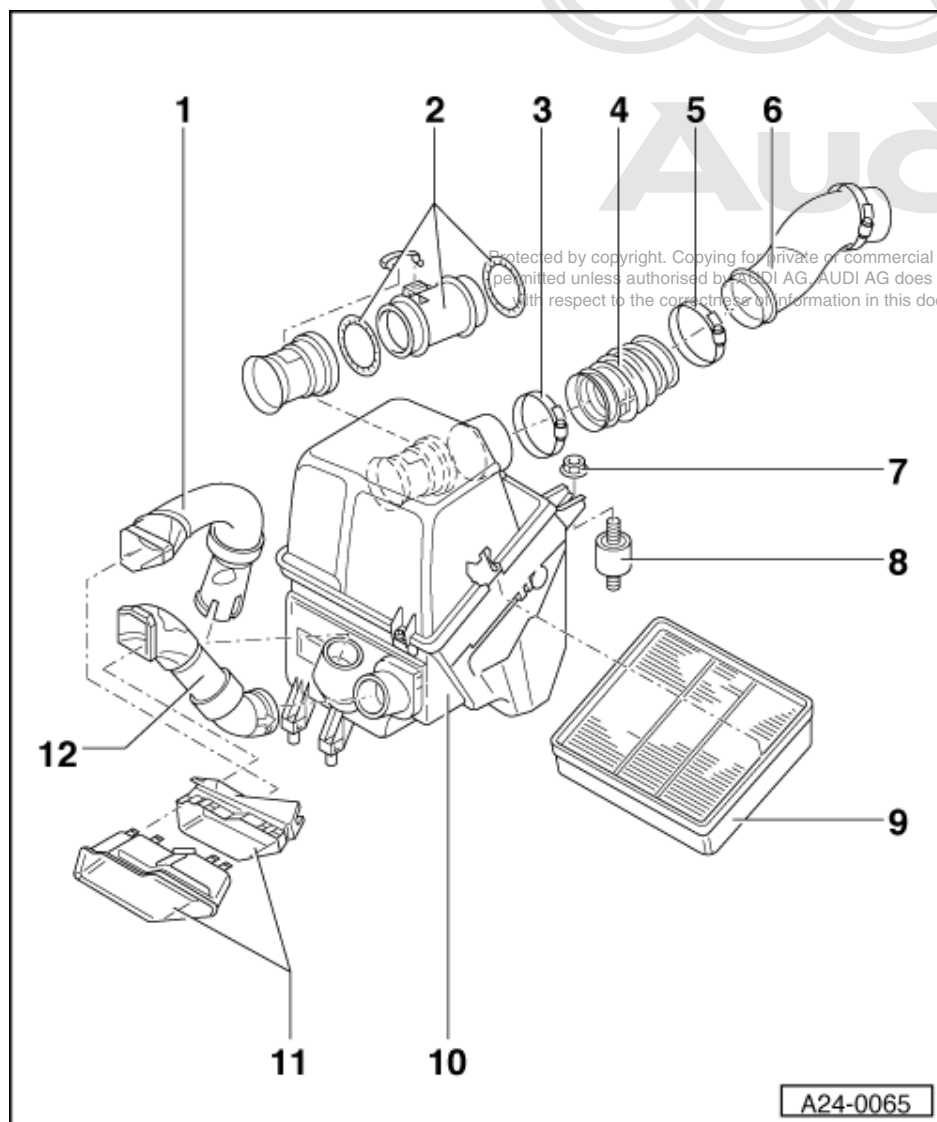


◆ For engine speed sender -G28

- ◆ Removing and installing intake manifold changeover system components=> Page 71
- ◆ Removing and installing throttle valve control unit=> Page 73



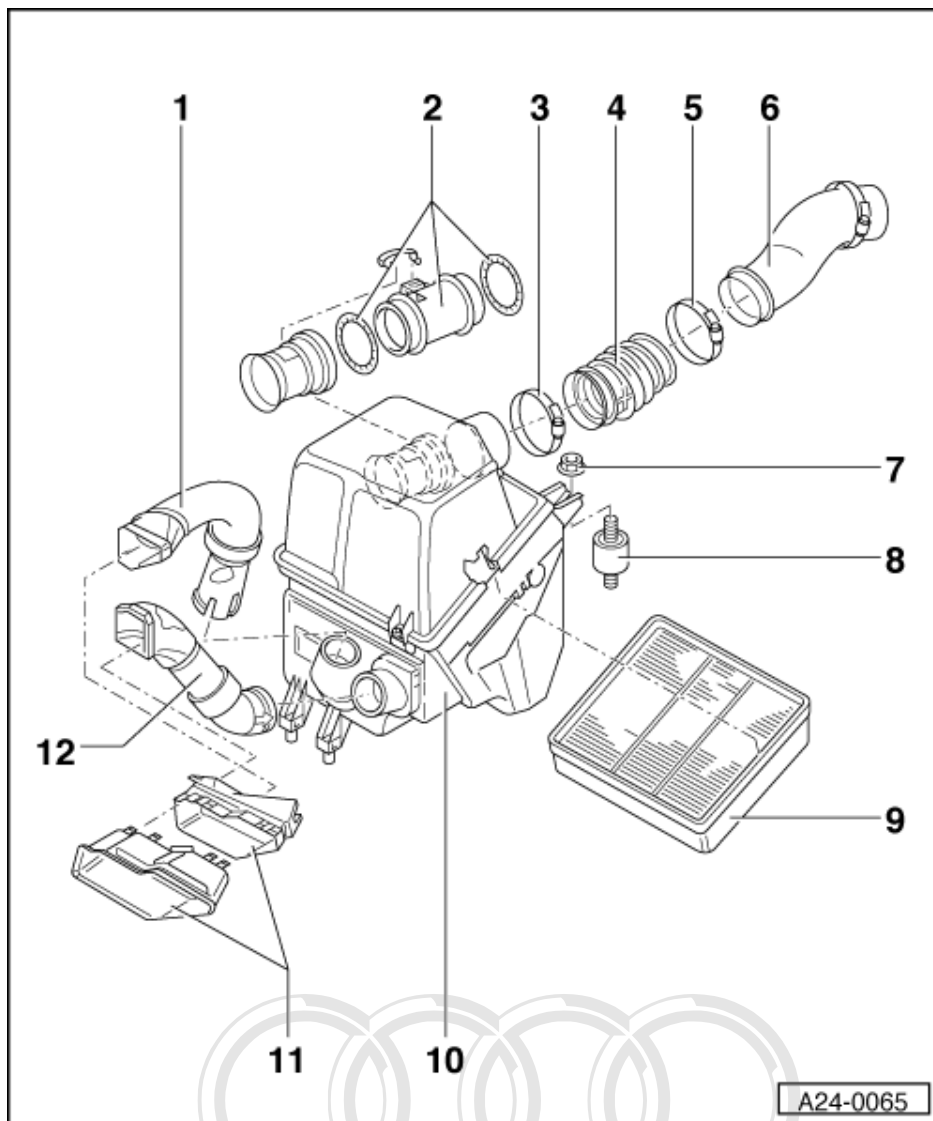
1.7 - Dismantling and assembling air cleaner



Note:

The illustration shows the air cleaner housing for vehicles without secondary air induction. On vehicles with secondary air induction, the secondary air pump motor -V101 is located in the air cleaner housing.

- 1 Air duct
- 2 Air mass meter -G70
- 3 Hose clip
- 4 Intake hose
- 5 Hose clip
- 6 Intake pipe

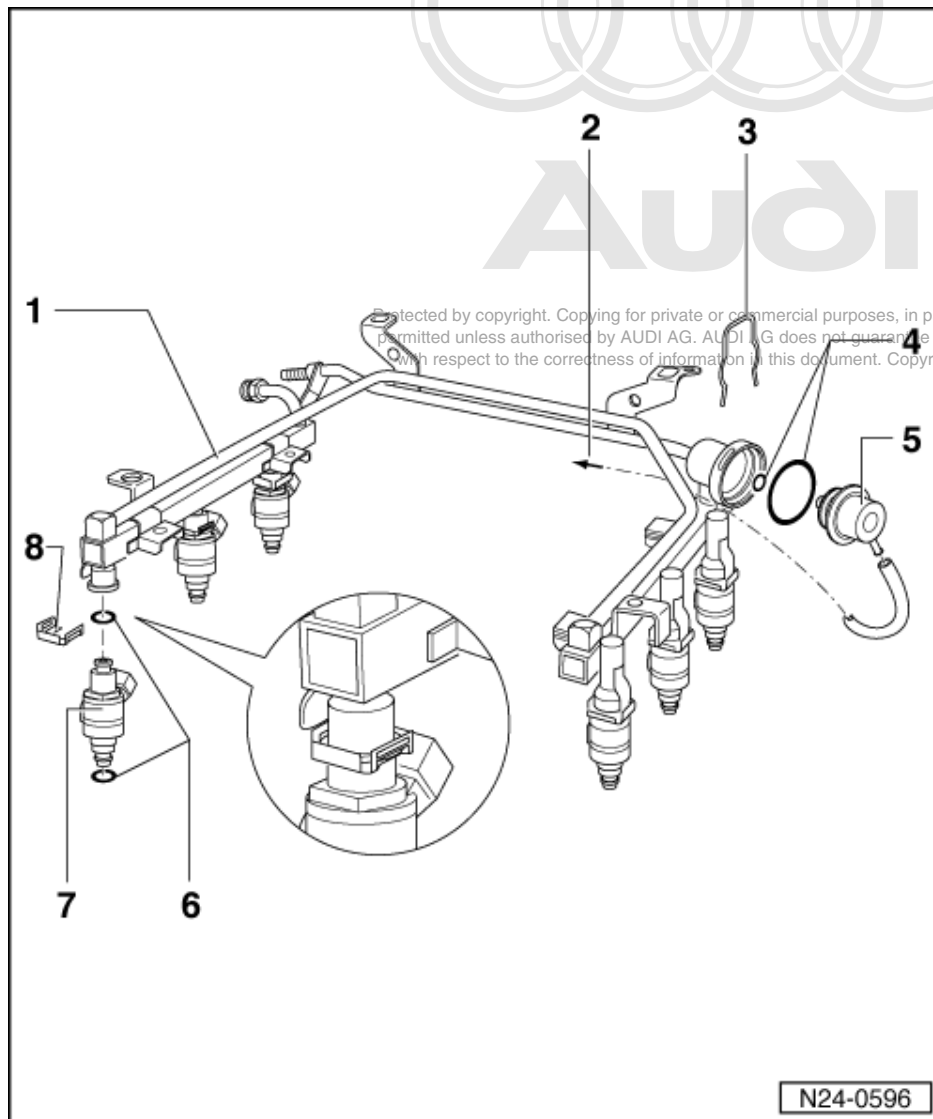


- 7 Nut
- 8 Bonded rubber bush
- 9 Filter element
- 10 Air cleaner housing
- 11 Air duct
- 12 Air duct

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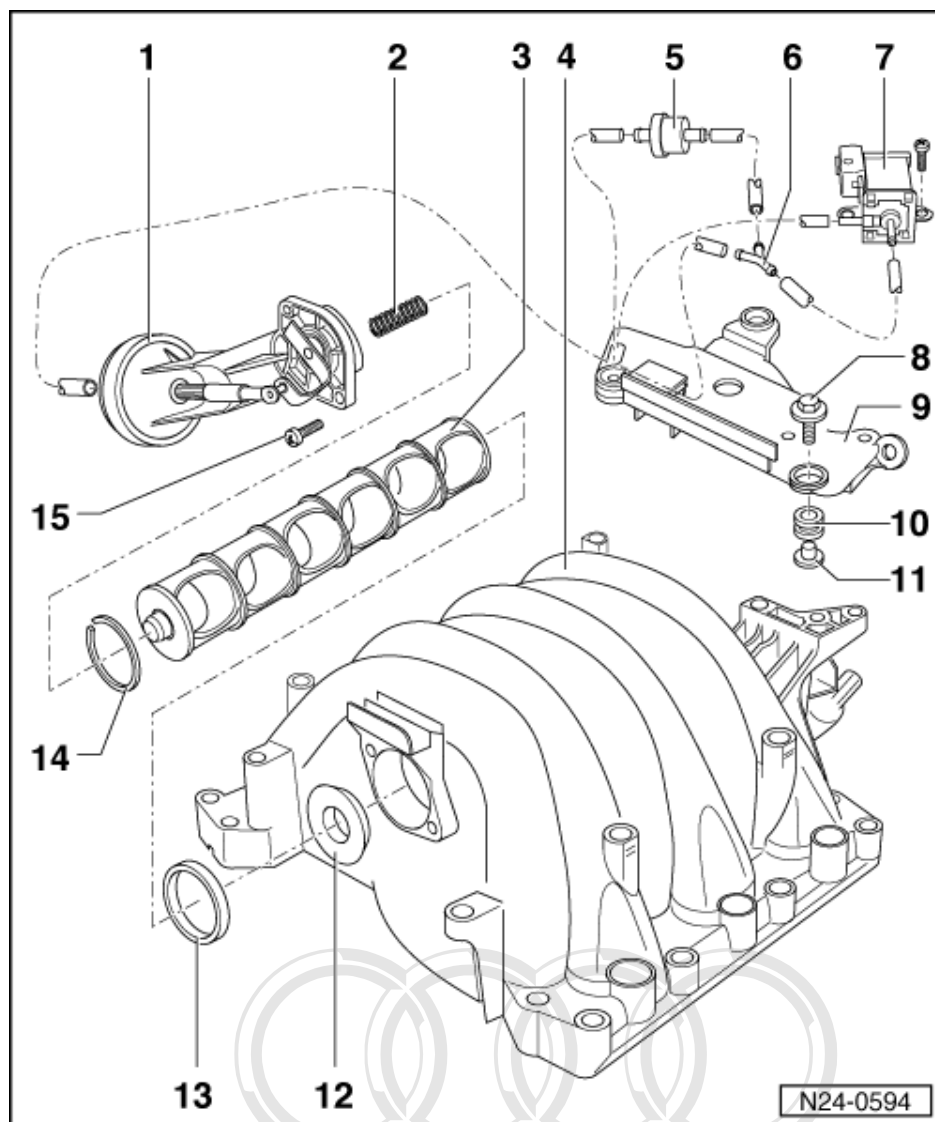


1.8 - Dismantling and assembling fuel manifold with injectors



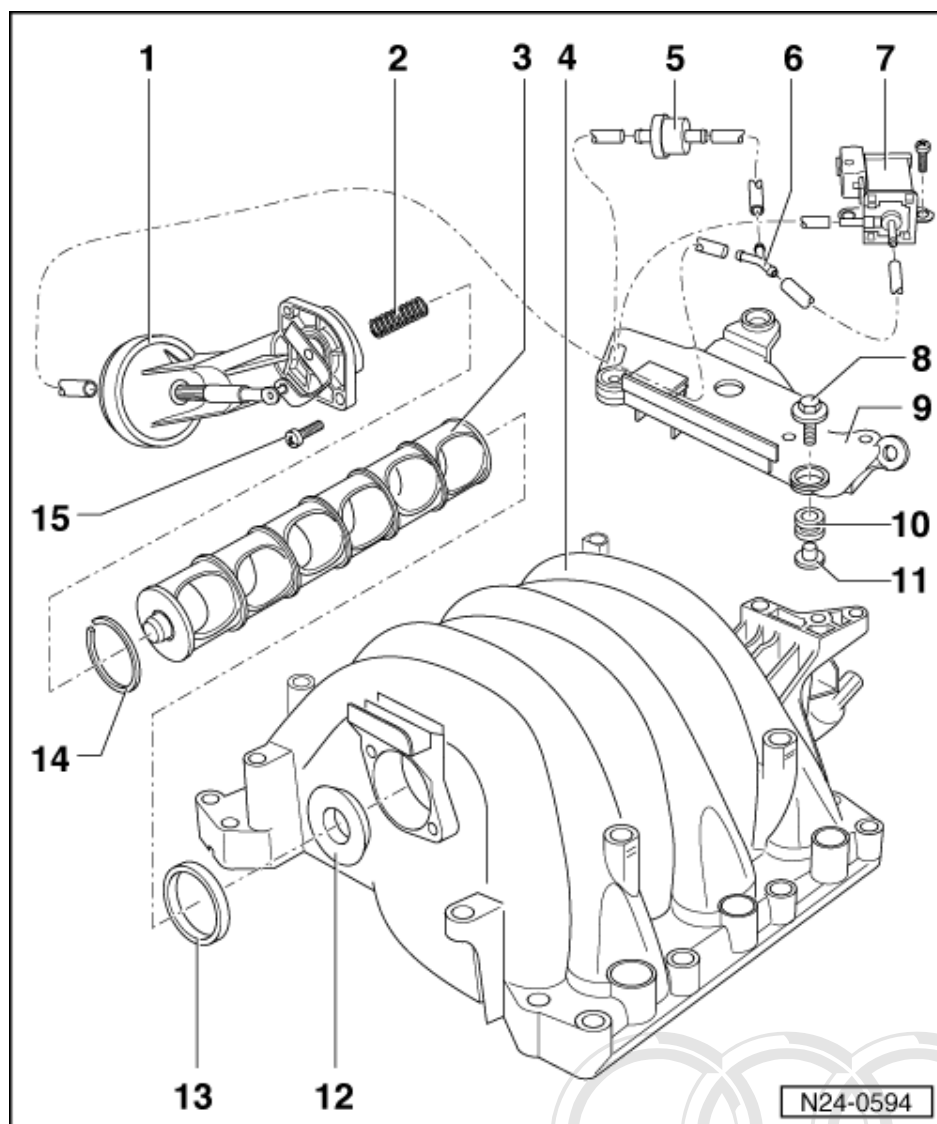
- 1 Fuel manifold
- 2 To T-piece
 - ♦ => Page 73 , Item. 4
- 3 Fastener
- 4 O-ring
 - ♦ Renew
- 5 Fuel pressure regulator
- 6 O-ring
 - ♦ Renew
- 7 Injectors -N30...-N33,
-N83, -N84
- 8 Fastener
 - ♦ Ensure it is positioned correctly on injector and fuel manifold

1.9 - Removing and installing intake manifold changeover system components



- 1 Vacuum actuator
- 2 Compression spring
- 3 Changeover mechanism
- 4 Intake manifold
- 5 Non-return valve
 - ♦ Installation position: Blue side facing Y-piece
- 6 Y-piece
- 7 Intake manifold changeover valve - N156

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8 10 Nm

9 Mounting plate

10 Rubber grommet

11 Spacer sleeve

12 Washer

♦ Tapered side facing intake manifold

13 Sealing ring

♦ Renew if damaged

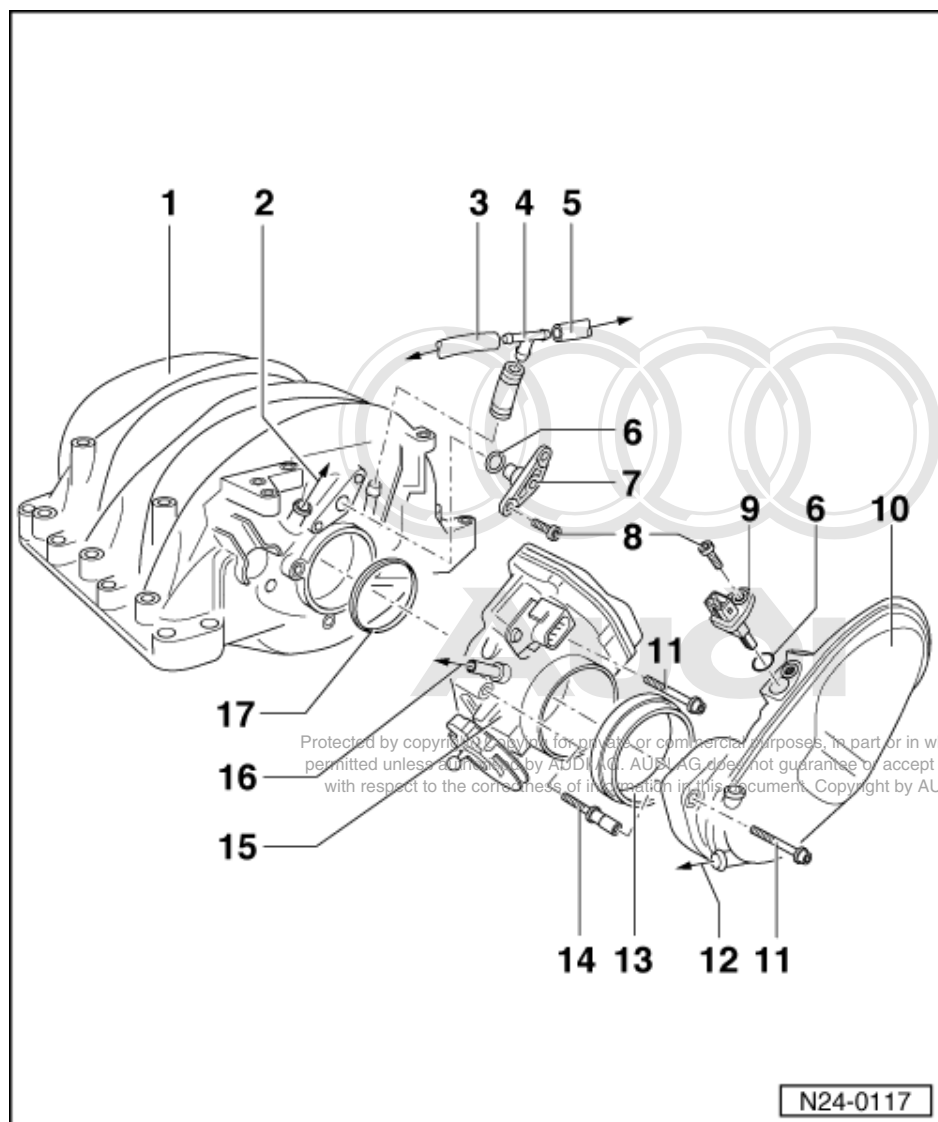
14 Sealing ring

♦ For changeover mechanism

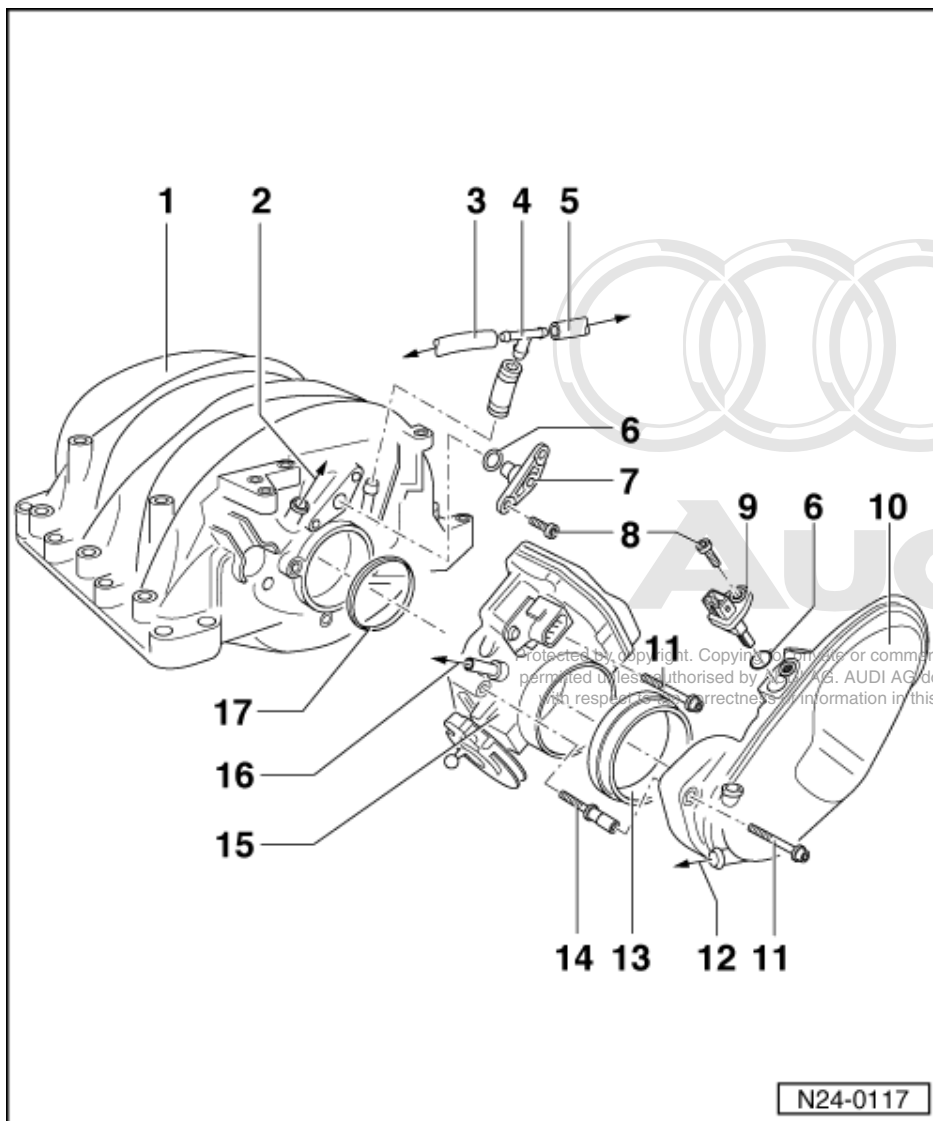
15 6 Nm

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1.10 - Removing and installing throttle valve control unit



- 1 Intake manifold
- 2 To suction jet pump
- 3 To fuel pressure regulator
 - ♦ => Page 70 , item 5
- 4 T-piece
- 5 To non-return valve
 - ♦ => Page 71 , item 5
- 6 O-ring
 - ♦ Renew if damaged
- 7 Support bracket
 - ♦ For changeover mechanism
- 8 6 Nm



9 Intake air temperature sender -G42

10 Air intake elbow

11 10 Nm

12 To crankcase breather valve

13 Sealing ring

14 10 Nm

- ♦ Install with locking fluid D 000 600 A2

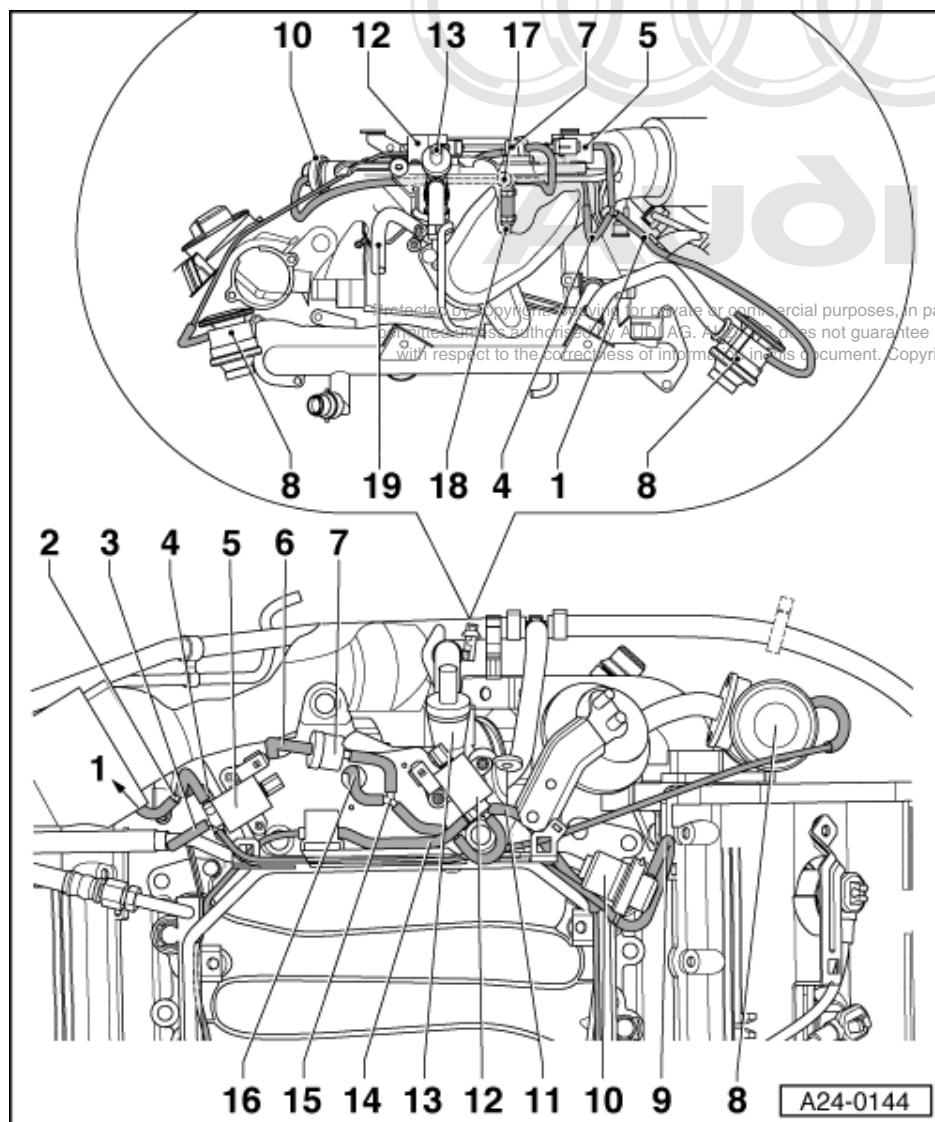
15 Throttle valve control unit -J338

16 To solenoid valve 1 for activated charcoal filter -N80

17 Sealing ring

- ♦ Renew if damaged

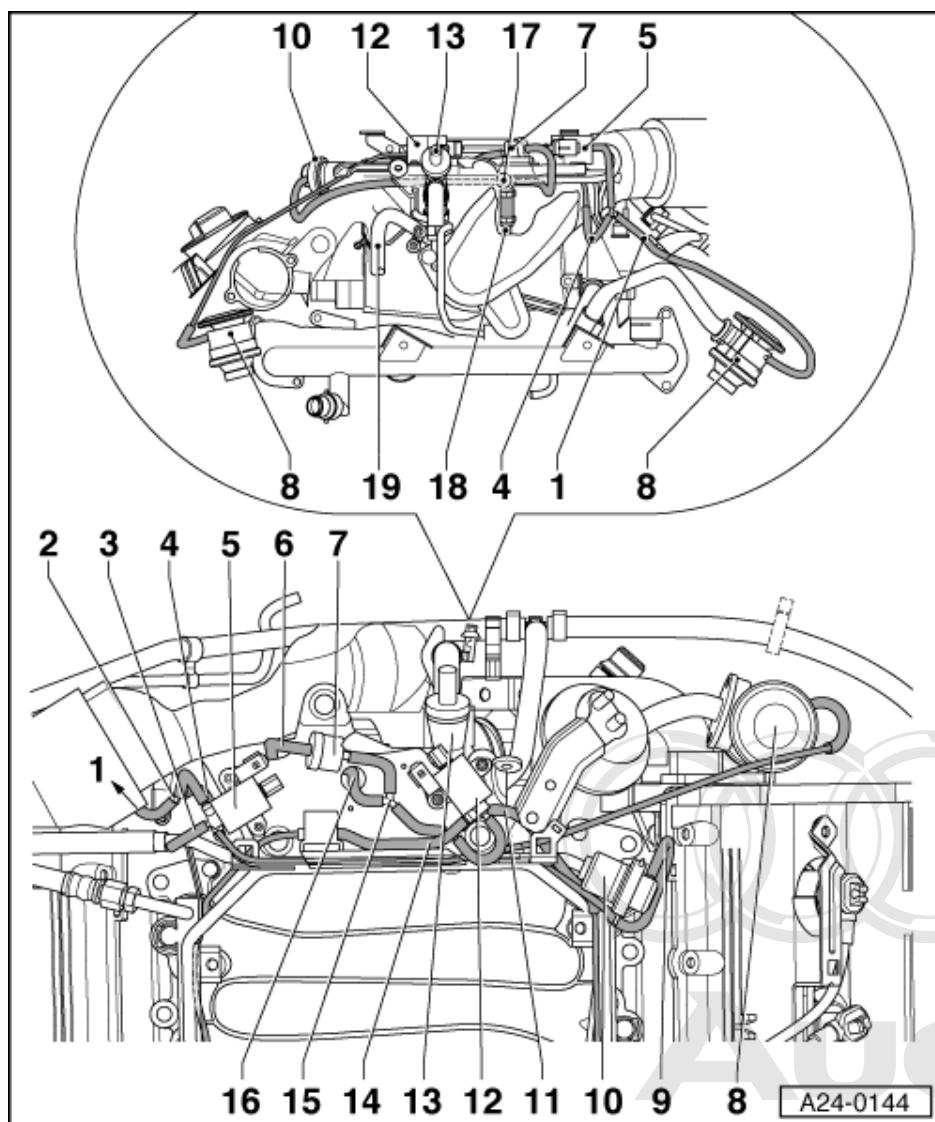
1.11 - Vacuum connections



Top part of Fig. - back of engine

Bottom part of Fig. - top view of engine

- 1 Pipe to combi valve for secondary air induction
- 2 T-piece
- 3 To Y-piece
 - ♦ -Item 15 -
- 4 Pipe to combi valve for secondary air induction
- 5 Secondary air inlet valve -N122
- 6 To T-piece at intake manifold
 - ♦ -Item 17 -



7 Non-return valve

8 Combi valve for secondary air induction

- ♦ Combi valve 1 for bank 1
- ♦ Combi valve 2 for bank 2

9 To T-piece at intake manifold

- ♦ -Item **17** -

10 Fuel pressure regulator

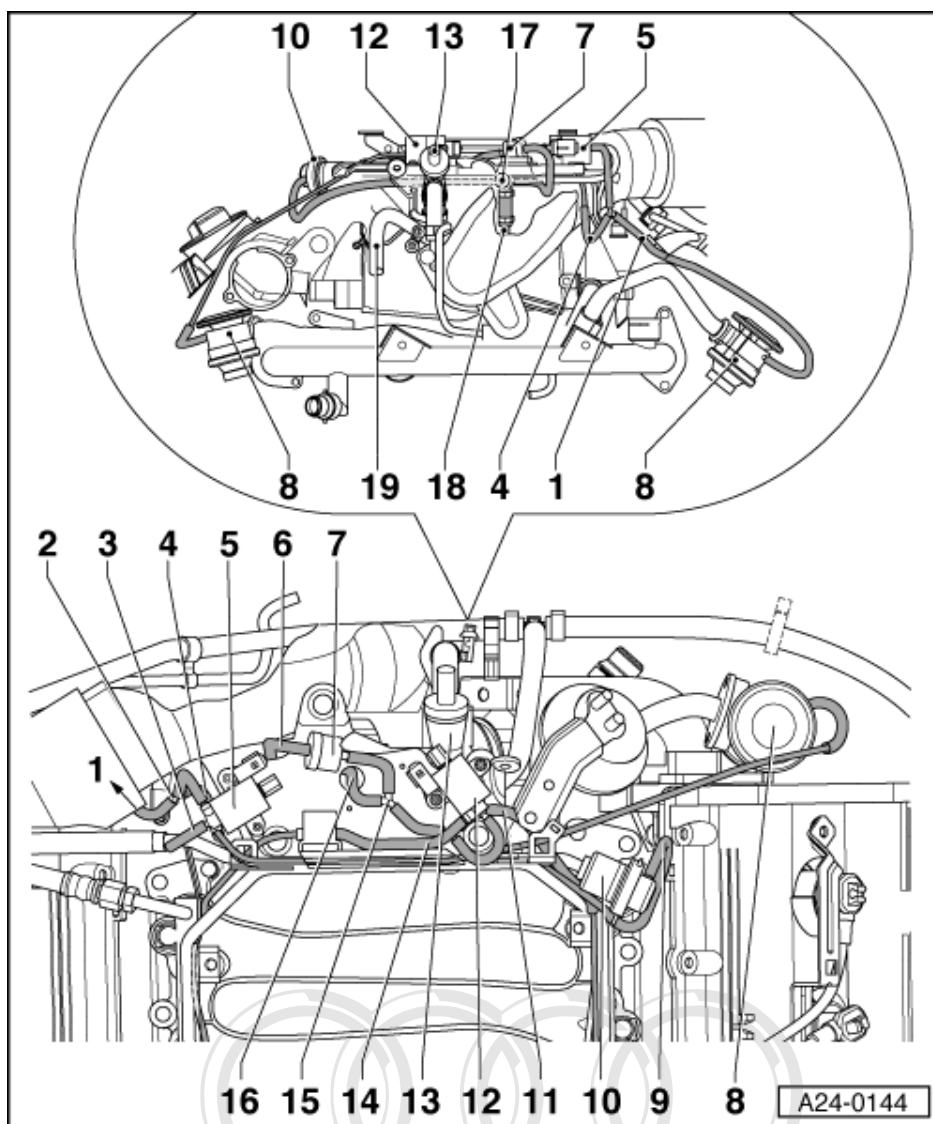
11 Pipe to vacuum reservoir in left wheel housing

12 Intake manifold changeover valve -N156

13 Suction jet pump

14 To vacuum actuator for intake manifold changeover

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15 Y-piece

16 Pipe to secondary air inlet valve -N122

♦ -Item 5 -

17 T-piece at intake manifold

18 Pipe to intake manifold connection

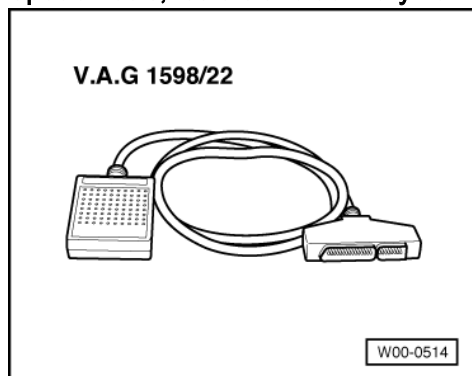
19 Hose to activated charcoal filter

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

Special tools, testers and auxiliary items required



- ♦ V.A.G 1598/22

Notes:

- ♦ Always switch off ignition before detaching or attaching connectors of engine control unit.
- ♦ The contact numbers of the plugs and the socket numbers in the test box are identical.

Warning:

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

- Switch off ignition.
- Remove engine control unit => Page 79 .
- Release catches and detach connectors from control unit.

Note:

Always switch off ignition before detaching or attaching connectors of control unit.

- Connect test box V.A.G 1598/22 to connectors.
- Carry out test as described in the appropriate repair procedures.

Note:

Throttle valve control unit of engine has to be adapted after reconnecting engine control unit =>Page 132 .

1.13 - Renewing engine control unit

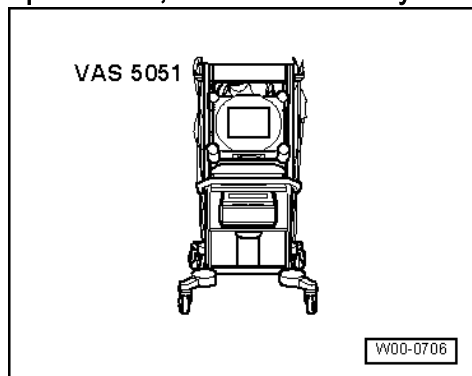
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Fitting location => Fitting locations overview, Page 59

Note:

When the engine control unit is disconnected, the learned values are erased but the contents of the fault memory remain intact.

Special tools, testers and auxiliary items required



♦ VAS 5051

or

♦ V.A.G 1551 with V.A.G 1551/3 A

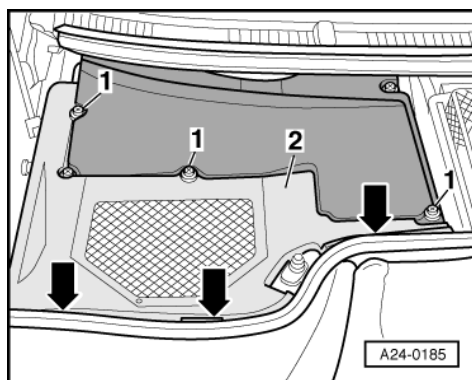
Removing

- Connect fault reader V.A.G 1551 and select engine electronics control unit => Page **1** .

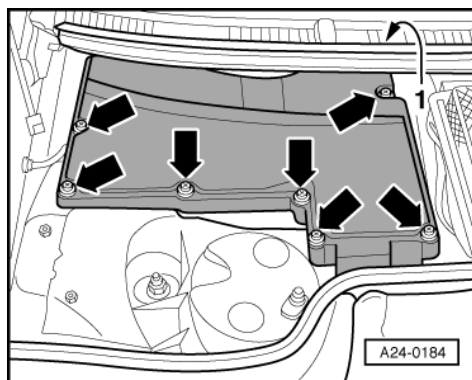
-> The control unit identification is shown in the display:

4D0907551C 2.8l V6/5V MOTR HS D01
 Code 04003 WSC 12345

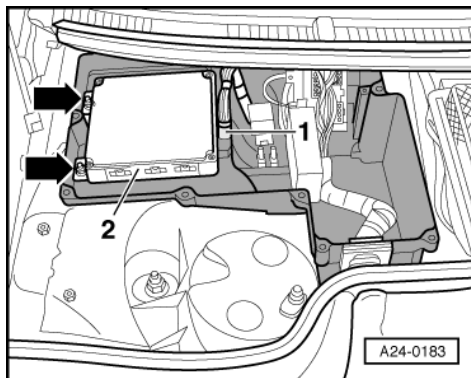
- Always start by displaying and printing out the control unit identification => Page **3** .
- Compare code to encoding versions => Page **32**
- Switch off ignition.



- -> Slacken off cross-head bolts -1- at electronics box (plenum chamber).
- Unclip plenum chamber cover -2- at front at bulkhead -arrows-.
- Take out plenum chamber cover.



- -> Prise out cover -1- in scuttle trim and slacken off rear cross-head bolt -rear right arrow-.
- Slacken off remaining cross-head bolts -arrows-.
- Detach cover for electronics box (plenum chamber).



- -> Unfasten catch and pull off control unit plugs -1-.

Note:

Always switch off ignition before detaching or attaching connectors of control unit.

- Unscrew engine control unit -2- from electronics box (plenum chamber) -arrows-.

Note:

There is a further bolt under the engine control unit connectors.

- Take out engine control unit.

Installing

Installation is carried out in the reverse order, when doing this note the following:

Notes:

- ♦ Always switch off ignition before detaching or attaching connectors of engine control unit.
- ♦ In the first learning phase, during the basic setting operation for the engine, slightly irregular idling and slight jolting during driving are possible.

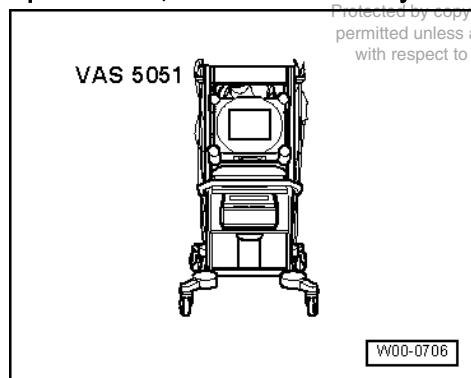
- Interrogate and erase fault memory => Page 4 .
- Encode control unit => Page 32 .
- Carry out adaptation of the throttle valve control unit => Page 132
- Adapt engine electronics control unit to the immobiliser control unit:

=> Electrical system; Repair Group 01; Immobiliser self-diagnosis - fixed code; Adaptation after replacement of the engine control unit Immobiliser self-diagnosis - fixed code Adaptation after replacement of the engine control unit

=> Electrical system; Repair Group 01; Immobiliser self-diagnosis - alternating code; Adaptation after replacement of the engine control unit Immobiliser self-diagnosis - alternating code Adaptation after replacement of the engine control unit

1.14 - Checking idling speed

Special tools, testers and auxiliary items required



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- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Notes:

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

Test requirements:

- No leaks in exhaust system
- Coolant temperature at least 85 °C.
- Electrical consumers switched off (radiator fan must not run during the test)
- Air conditioner switched off
- Pressure gauge not connected
- Selector lever in position P or N
- Connect fault reader V.A.G 1551 => Page 1 .
- Switch the ignition on.
- Interrogate fault memory => Page 4 . The fault memory must be clear. If necessary, rectify any faults and erase the fault memory. Switch off the engine then start up again. Take vehicle for a test drive and interrogate the fault memory again to make sure it is clear.
- Leave engine idling.
- Start basic setting of engine with V.A.G 1551 until "Basic setting 5" is displayed. =>Page 31 .

-> Display readout:

System in basic setting 5			
1	2	3	4

- Read off idling speed from display zone 1.
- Specification: 640 ... 760 rpm

If the specification is obtained:

- Press the ➔key.
- Enter "06" for "End output" function and confirm entry with Q key.

If the specification is not obtained:

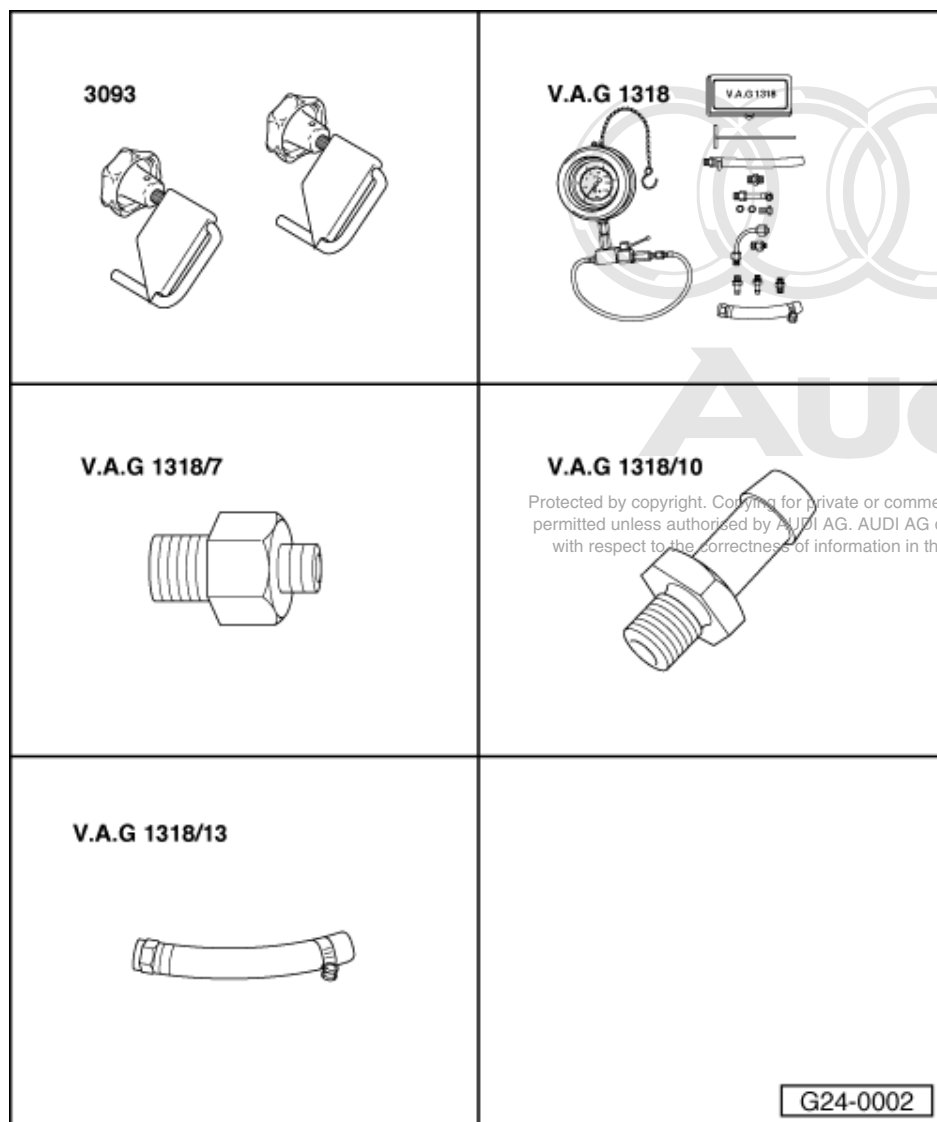
- Interrogate fault memory again =>Page 4 .

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

- Check idling switch =>Page 134 .
- Large volume of unmetered air => Basic setting of engine, display groups 001, 005, 006 or 009.
- Check throttle valve control unit =>Page 131 .



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



Special tools, testers and auxiliary items required

- ♦ Special tool 3093
- ♦ V.A.G 1318
- ♦ V.A.G 1318/7
- ♦ V.A.G 1318/10
- ♦ V.A.G 1318/13

Note:

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

Test requirements:

- Fuel pump relay OK; checking =>Page 93 .
- Fuel pump OK; checking:

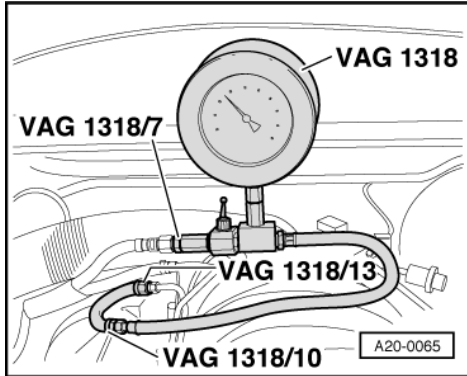
=> 6-cyl. injection engine (5-valve), Mechanical components; Repair Group 20

- Fuel filter OK
- Battery voltage at least 11 V

Warning:

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

Checking system pressure and fuel pressure regulator



- -> Connect up pressure gauge V.A.G 1318 with test adapters 1318/7, 1318/10 and 1318/13 between fuel supply pipe and fuel manifold; lever on pressure gauge set to -open- position (lever in direction of flow).
- Disconnect vacuum pipe between pressure regulator and intake manifold at the pressure regulator and seal off pipe with hose clamp 3093.

Notes:

- ♦ Renew 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 to be exceeded, which would then result in a fault being recorded.
- Start the engine and run at idling speed.
- Switch off air conditioner.
- Measure the fuel pressure.
 - Specification: 3.8 ... 4.2 bar
- If the specified value is not attained, try renewing the pressure regulator and repeating the pressure test.
- If the specified value is still not attained, check the fuel pump/feed pipe for damage (e.g. crushing) and renew if necessary.
- If the specified value is exceeded, check the return pipe for damage (e.g. crushing) and renew 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; to do so, pull off hose at pressure regulator and blow into it.
- Renew the pressure regulator if no leakage is found and the vacuum connection is not blocked.

Checking holding pressure:

- Holding pressure 10 minutes after switching off engine (minimum pressure).
 - Specified value for cold engine: approx. 2.2 bar
 - Specified value for warm engine: approx. 3.0 bar

If the specification is not obtained:



Note:

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

- Start the 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).

If the pressure drops, 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

=> 6-cylinder engine (5-valve), Mechanical components; Repair Group 20

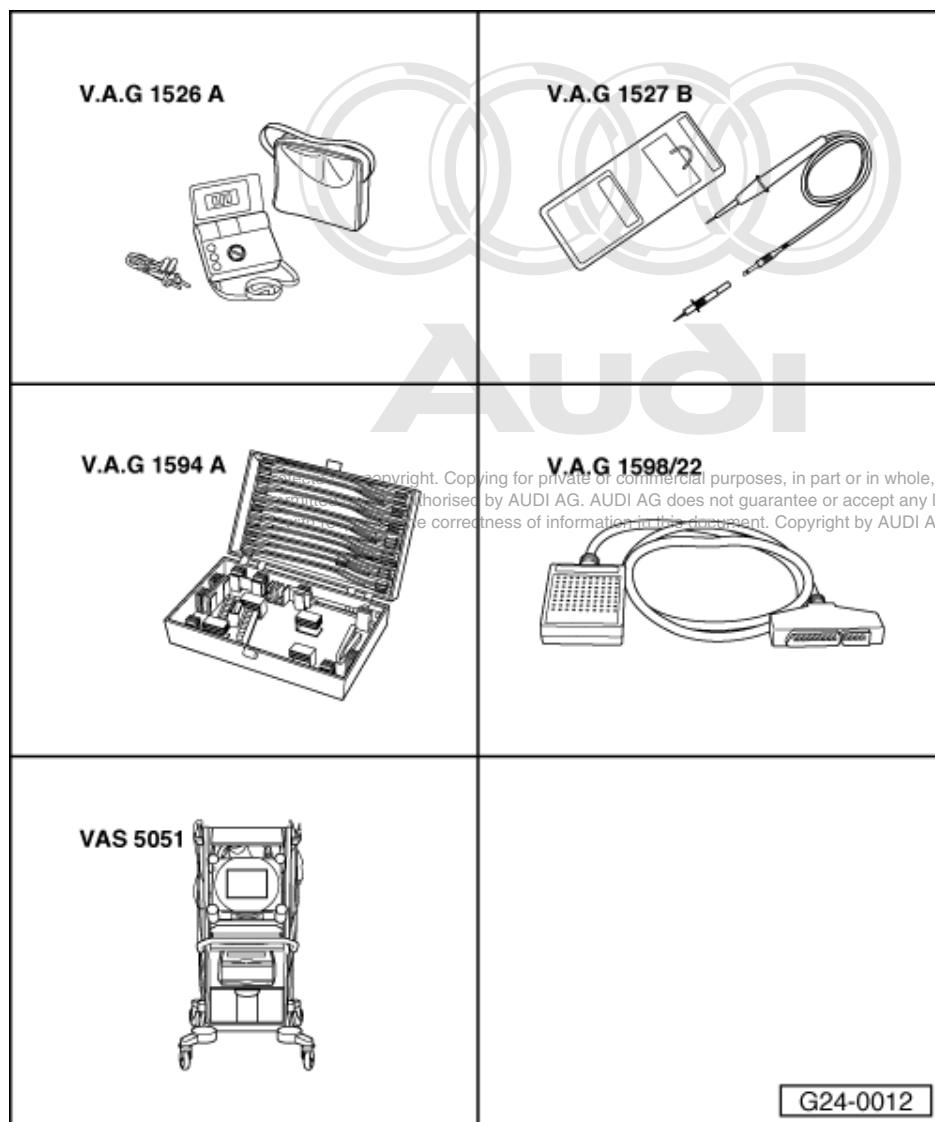
If the pressure drops again, the following faults are possible:

- ♦ Fuel pressure regulator defective
- ♦ Injectors leaking
- ♦ Unions on pressure gauge downstream of cut-off valve leaking

Note:

To remove the pressure gauge, close the shut-off valve, unscrew the union on adapter V.A.G 1318/13, then open the shut-off valve to drain off excess fuel into a suitable container.

1.16 - Checking injectors



Special tools, testers and auxiliary items required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/22
- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Electrical checks on injectors

- Connect fault reader V.A.G 1551 => Page 1 .
- Switch the ignition on.
- Start final control diagnosis and actuate injectors => Page 28 .

-> Display readout:



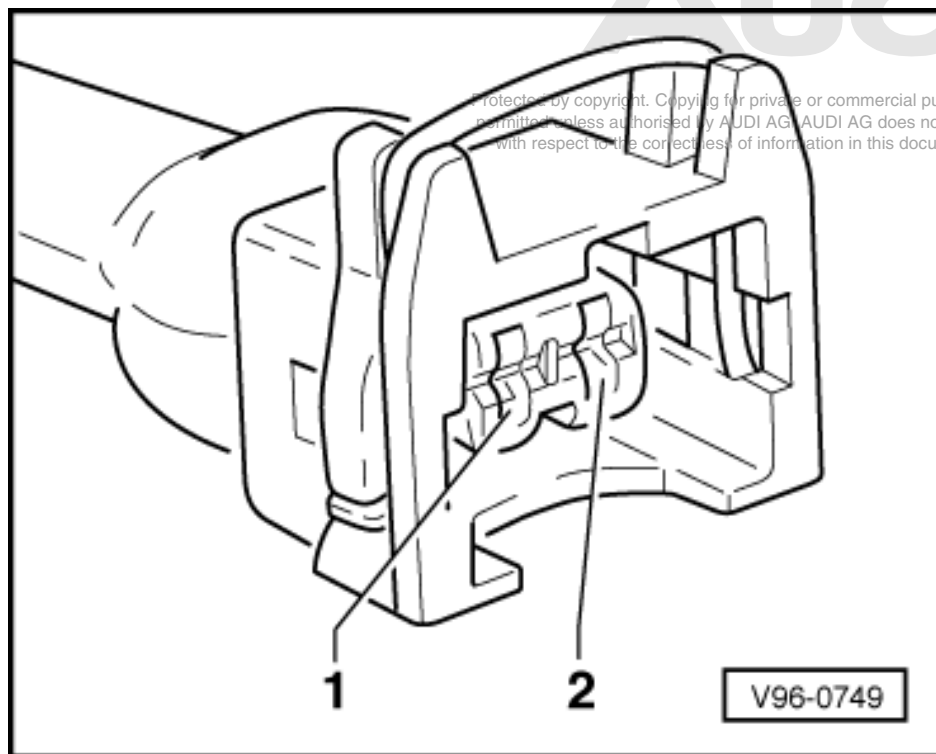
Final control diagnosis
Injector, cylinder 1 -N30

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

The injector should click five times.

If the injector clicks:

- Activate the next injector.



If the injector does not click:

- Remove connector from the injector which is to be tested.
- -> Connect voltage tester V.A.G 1527 B to contacts 1 and 2 of the connector.
- Repeat the final control diagnosis and again actuate the injector.

Note:

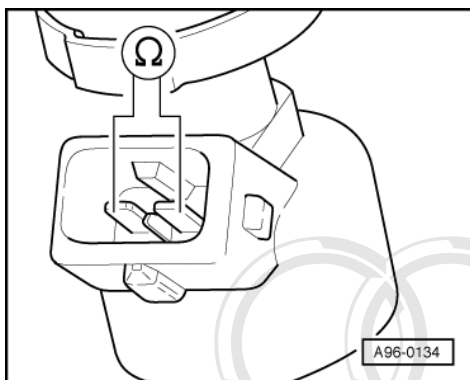
The final control diagnosis cannot be re-started until the ignition has been switched off briefly.

- LED of voltage tester must flash 5 times.

Note:

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

If LED does not flash:



- Check the voltage supply =>Page 87 .

If LED does flash:

- -> Connect multimeter to injector to measure resistance.
- Specification: 13.5 ... 15.5 ω

If the specification is not obtained:

- Renew injector.

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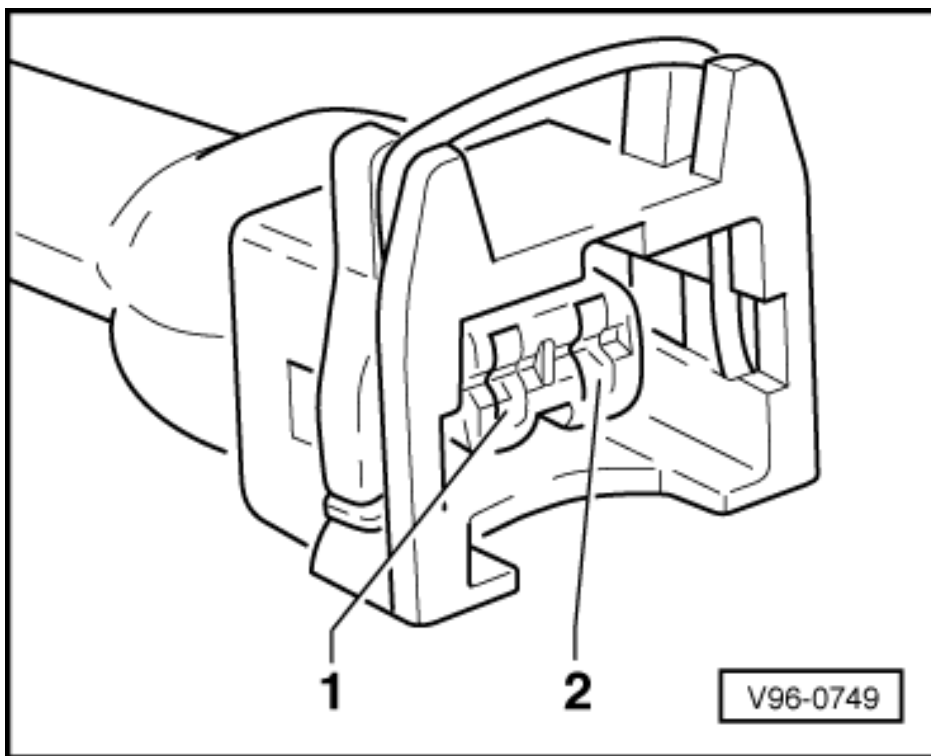
Checking power supply

Test requirements:

- Fuel pump relay OK, checking =>Page 93 .
- Fuel pump OK; checking:

=> 6-cyl. injection engine (5-valve), Mechanical components; Repair Group 20

- Remove connector from the injector which is to be tested.





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

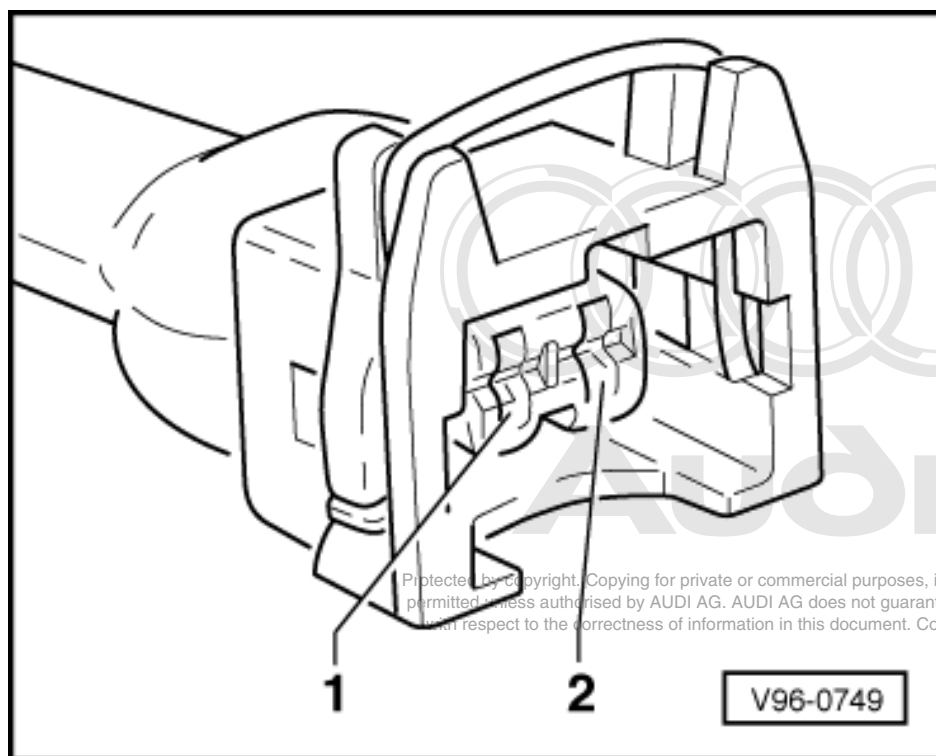
Injector connector contact	Measure to
1	Engine earth

- Operate starter for a few seconds (the engine can be allowed to start).
 - The LED should light up.

If the LED lights up:

- Check wiring => Page 88

If the LED does not light up:

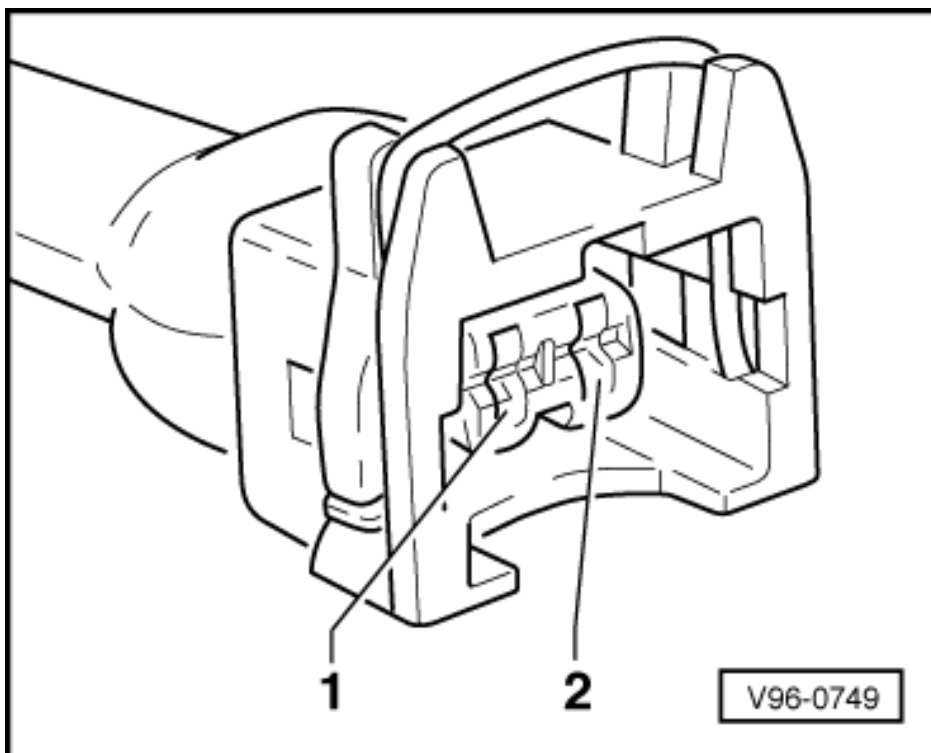


- -> Check wiring from contact 1 via fuse for injectors to fuel pump relay.

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

Checking wiring

- Switch off ignition.
- Remove connector from the injector which is to be tested.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=>Page 78 .



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


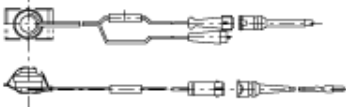

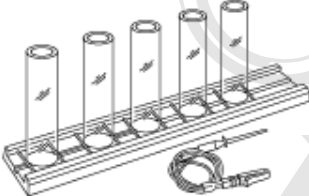
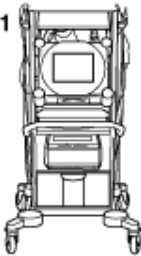
Cyl.	Injector connector contact	Test box V.A.G 1598/22 socket
1	2	73
2	2	80
3	2	58
4	2	65
5	2	72
6	2	79

- Rectify short circuit or open circuit if necessary.



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

<p>V.A.G 1348/3-2</p> 	<p>V.A.G 1348/3A</p> 
<p>V.A.G 1594 A</p> 	<p>V.A.G 1602</p> 
<p>VAS 5051</p> 	<p>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.</p> <p>G24-0001</p>

Special tools, testers and auxiliary items required

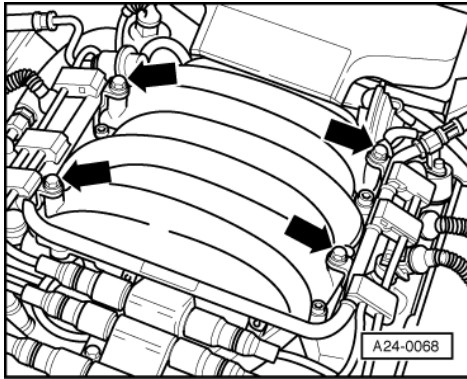
- ♦ V.A.G 1348/3-2
- ♦ V.A.G 1348/3A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1602
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test requirements:

- Fuel pressure OK, checking =>Page 82 .
- Remove intake hose between air mass meter and intake silencer.
- Unplug connectors from injectors.



- -> Unbolt fuel manifold from intake manifold.
- Pull vacuum hose off fuel pressure regulator.
- Lift fuel manifold, together with injectors, off intake manifold and support it.

Leak test

- Connect fault reader V.A.G 1551 => Page 1 .
- Switch the ignition on.
- Start final control diagnosis => Page 28 and actuate injector, cylinder 1 -N30.
 - The fuel pump should run.

-> Display readout:

Final control diagnosis
Injector, cylinder 1 -N30

Note:

This step is merely designed to make the fuel pump run with the engine stopped.

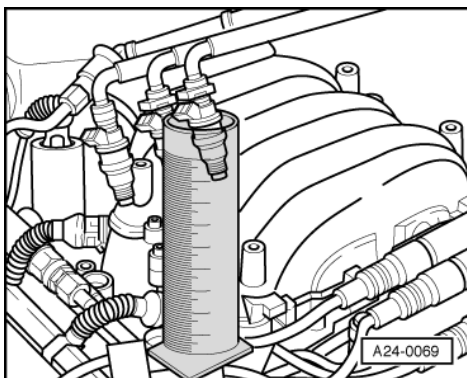
- Check injectors for leaks (visual check). When the fuel pump is running, only 1 or 2 drops a minute should escape from each injector.
- If the fuel loss is greater, switch off the fuel pump (terminate final control diagnosis) and renew the faulty injector.

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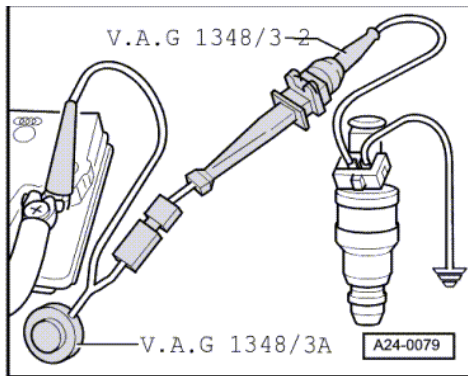
Note:

Renew O-ring.

Checking injection quantity



- -> Place the injector which is to be tested into a measuring glass from injection quantity tester V.A.G 1602.



- -> Connect one of the injector contacts to the engine earth using a test cable and crocodile clip 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.
- Start the final control diagnosis => Page 28 . The fuel pump should run.

Note:

The final control diagnosis cannot be re-started until the ignition has been switched off briefly.

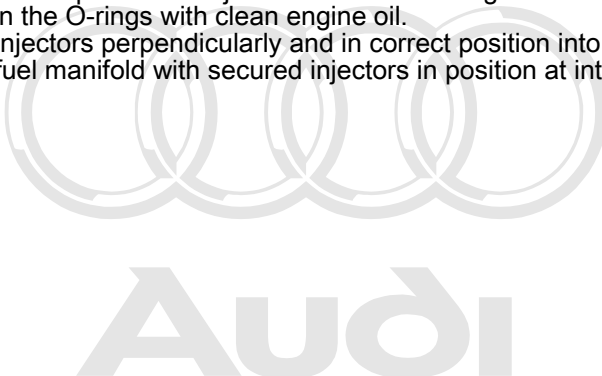
- Activate remote control V.A.G 1348/3A for 30 seconds.
- Once all three injectors of a cylinder bank have been actuated, place the three measuring glasses on a flat surface.
 - Specified value per injector: 90 ... 125 ml
- If the measured value for one or more of the injectors is outside the tolerance range, switch off the fuel pump (terminate final control diagnosis) and renew the defective injector.
- Repeat the check on injectors of second cylinder bank.
- If the measured values for all the injectors are outside the tolerance range, check the fuel pressure => Page 82 .

Note:

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


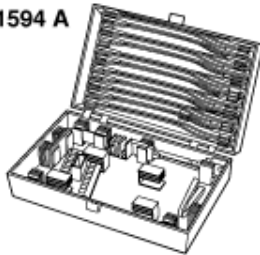

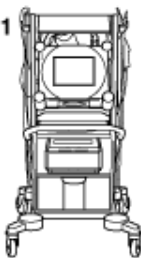
Installation of the fuel manifold together with injectors is performed in the reverse sequence. The following points should be noted when installing:

- Renew the O-rings at all opened connections. (When renewing the front O-ring, make sure not to remove the plastic cap from the injector head. The O-ring must be pulled over the plastic cap).
- Moisten the O-rings with clean engine oil.
- Insert injectors perpendicularly and in correct position into fuel manifold and secure with fasteners.
- Place fuel manifold with secured injectors in position at intake manifold and press in evenly.



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1.18 - Checking fuel pump relay -J17 and actuation

<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1598/22</p> 	<p>VAS 5051</p> 
	<p>G24-0003</p>

Special tools, testers and auxiliary items required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/22
- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

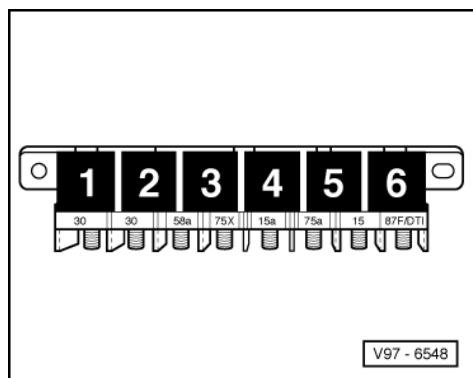
The fuel pump and certain components of the injection system are supplied with power by way of the fuel pump relay -J17.

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.

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Notes:



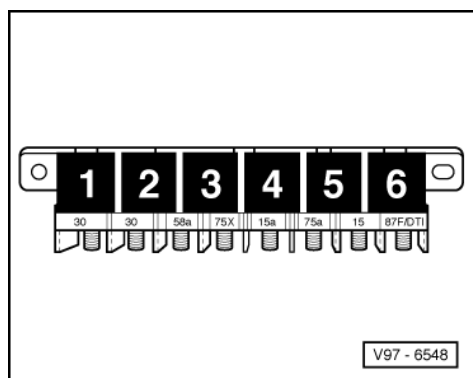
- ♦ -> Fitting location of fuel pump relay: On central electrics, electronics box, passenger's footwell, position 6.
- ♦ Central electrics must be removed for pulling off fuel pump relay and for measurement work at relay socket.

Test requirements:

- Battery voltage at least 11 V

Functional check of fuel pump relay

- Connect fault reader V.A.G 1551 => Page **1**.
- Switch the ignition on.
- Start final control diagnosis => Page **28** and actuate injector, cylinder 1 -N30.



- -> Fuel pump relay (in the central electrics, electronics box, passenger's footwell, position 6) should pull and fuel pump should run.

If the relay does not pull:

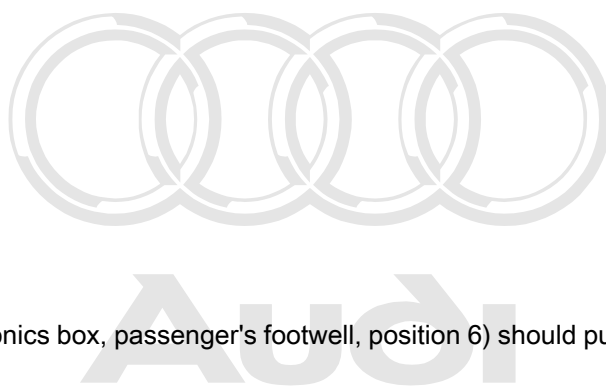
- Check actuation of fuel pump relay

If the fuel pump does not run:

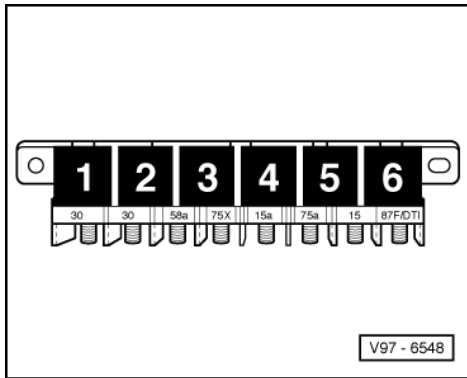
- Check actuation of fuel pump and components =>Page **96**.

Checking actuation of fuel pump relay

- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78**.



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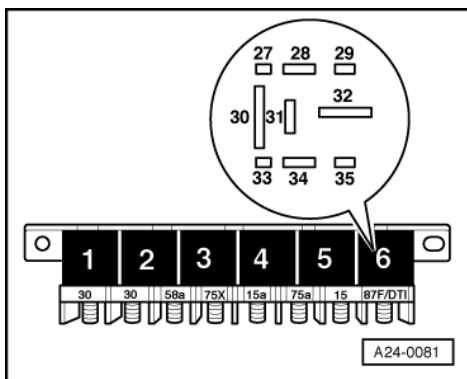
- Connect together sockets 4 and 2 on the test box using an auxiliary cable from V.A.G 1594A.
- Switch the ignition on.
 - -> Fuel pump relay (in the central electrics, electronics box, passenger's footwell, position 6) should pull.

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

- Fit a new engine control unit => Page 78 .

If the relay does not pull:

- Switch off ignition.
- Disconnect fuel pump relay.



- -> Connect the multimeter to contact 28 of relay socket and earth to measure voltage.
- Switch the ignition on.
 - Specification: approx. battery voltage

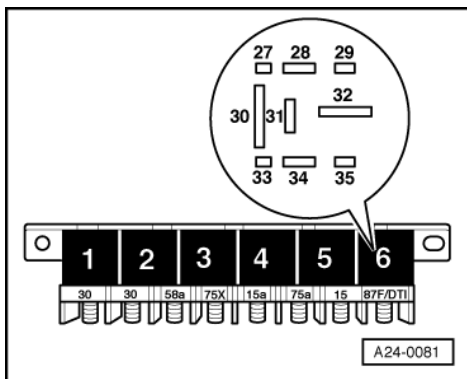
If the specification is not obtained:

- Check the wiring.

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

If the specification is obtained:

- Switch off ignition.





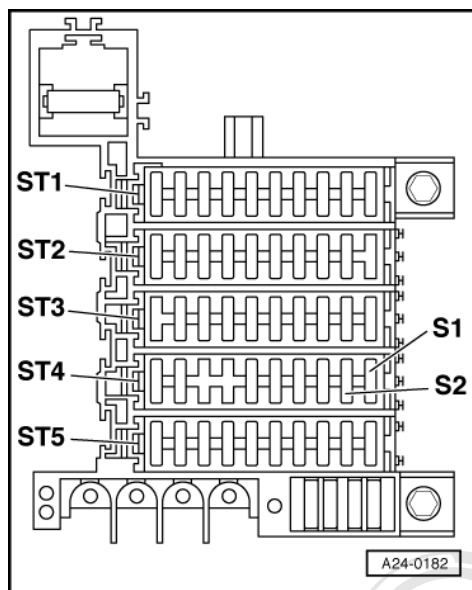
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Central electrics, electronics box, passenger's footwell, position 6, contact	Test box V.A.G 1598/22 socket
29	4

- Rectify short circuit or open circuit if necessary.
- If wiring is OK, renew the fuel pump relay -J17.

Checking actuation of fuel pump and components

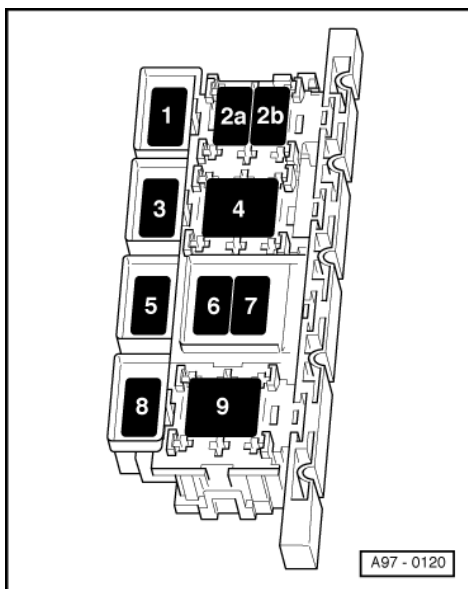
- Slacken off knurled screw and detach cover at A-pillar from fuse holder.



- -> Pull fuses S1 and S2 out of fuse carrier ST4 in fuse holder.

ST1 - Black fuse carrier
ST2 - Red fuse carrier
ST3 - Yellow fuse carrier
ST4 - Blue fuse carrier
ST5 - Brown fuse carrier

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- -> Pull fuse S116 (position 7) out of relay and fuse carrier, electronics box, plenum chamber.
- Start final control diagnosis => Page 28 and actuate injector, cylinder 1 -N30.
- Connect the multimeter for voltage measurement to earth and the left or right contact of the following fuses:

Fuse	Specified value at left or right contact
S1 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage
S2 (in fuse holder, fuse carrier ST4 - blue)	approx. battery voltage
S116 In relay and fuse carrier, electronics box, plenum chamber, position 7	approx. battery voltage

If the specification is not obtained:

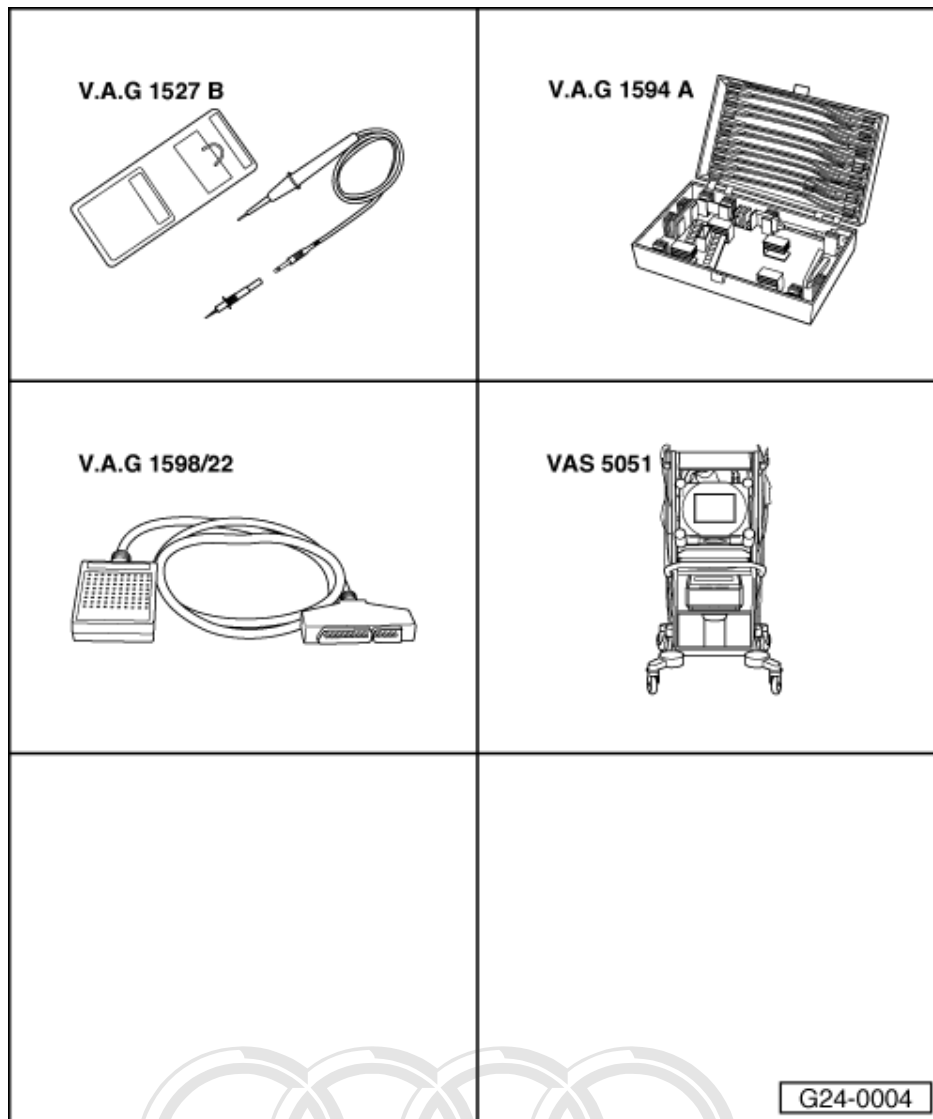
- Check the wiring.

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

- If wiring is OK, renew the fuel pump relay -J17.



1.19 - Checking air mass meter -G70

Special tools,
testers and auxiliary items required

- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

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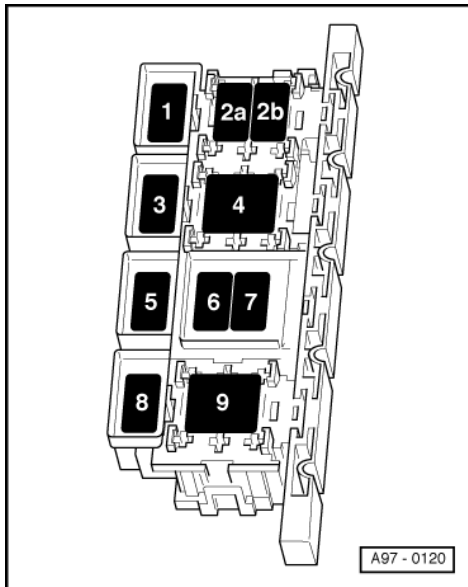
Checking function

- Connect fault reader V.A.G 1551 => Page 1 .
- Start the engine.
- Read measured value block, Display Group 002, Engine idling =>Page 40 .

-> Display readout:

Read measured value block 2			
1	2	3	4

- Check display in display zone 4.
 - Specification: 3.0 ... 5.0 g/s
- If the values are not as specified or if the fault memory has recorded a fault relating to the air mass meter, check the power supply to the air mass meter.



Testing power supply to air mass meter

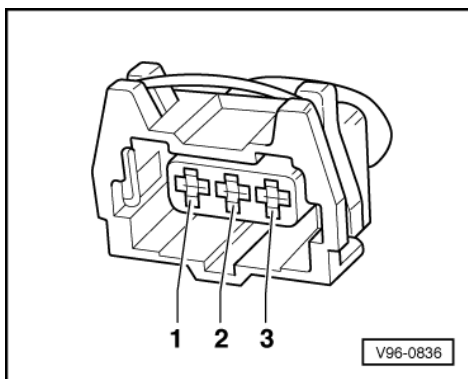
Test requirements:

- -> Fuse S115 OK (in relay and fuse carrier, **electronics box, plenum chamber position 9**;

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Test sequence

- Pull connector off air mass meter.



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

Connector contact	Measure to
3	Engine earth

- Switch the ignition on.
 - The LED should light up.



If the LED does not light up:

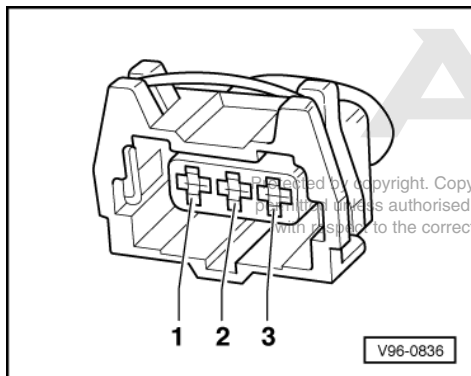
- Check the wiring between contact 3 of connector and fuse for open circuit and repair if necessary.

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

If power supply is OK:

Checking signal wire for air mass meter

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78** .



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

Connector contact	Test box V.A.G 1598/22 socket
1	13
2	12

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new air mass meter -G70.

2 - Checking intake manifold changeover system

2.1 - Checking intake manifold changeover system

This test should only be carried out if the engine is losing power.

The intake manifold change over function switches over from the long intake tract to the short intake tract at about 4700 rpm.


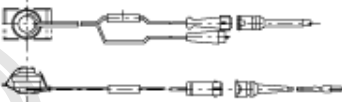
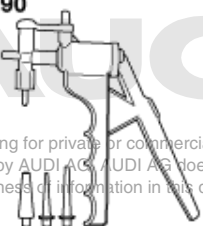
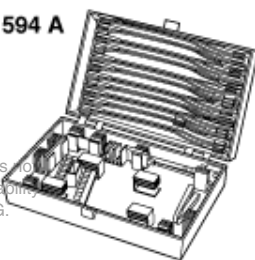
2.2 - Checking function

- Increase the engine speed to well above 4700 rpm; the vacuum unit for the intake manifold change over system should "pull". (Fitting location: at front of intake manifold)

If the changeover is not taking place, carry out the following tests:

- Check intake manifold changeover valve -N156 (if necessary, check valve and actuation => Page **106**).
- Check vacuum system for leaks =>Page **101** .
- Check that vacuum hoses are properly connected and free of leaks and obstructions.
- Check that changeover mechanism operates freely (move push rod by hand).

2.3 - Checking vacuum system for leaks

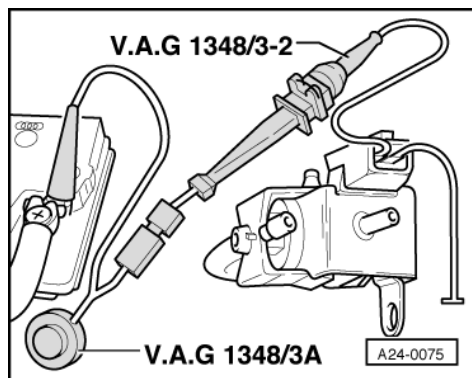
<p>V.A.G 1348/3-2</p> 	<p>V.A.G 1348/3A</p> 
<p>V.A.G 1390</p> 	<p>V.A.G 1594 A</p> 
	<p>G24-0010</p>

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Special tools, testers and auxiliary items required

- ◆ V.A.G 1348/3-2
- ◆ V.A.G 1348/3A
- ◆ V.A.G 1390
- ◆ V.A.G 1594 A

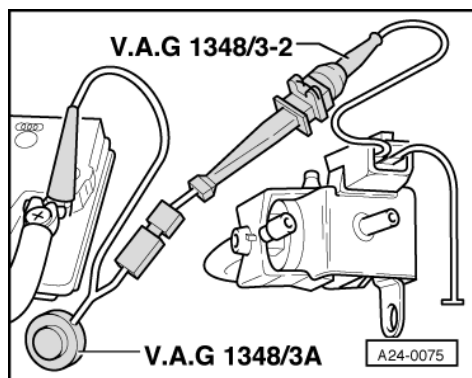
- Run engine at idling speed for 2 or 3 minutes to build up vacuum pressure.
- Switch off ignition.
- Unplug connector from intake manifold changeover valve -N156.



- -> Connect one of the contacts on the solenoid valve to engine earth using test leads and crocodile clamp from V.A.G 1594 A.
- Connect second contact on -N156 to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A approx. 2 to 3 minutes; throughout this period, the vacuum unit should remain energised.

If the vacuum unit returns to its original "rest" position, carry out the following test:


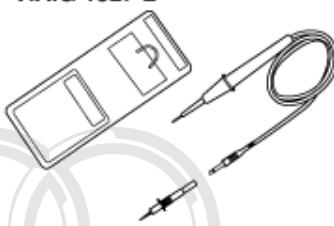
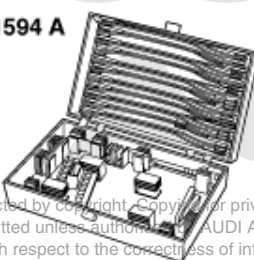
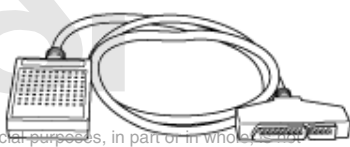
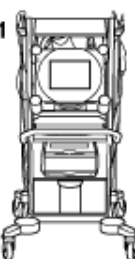
- Disconnect vacuum hoses from vacuum unit for intake manifold changeover system.
- Connect hand vacuum pump V.A.G 1390 to vacuum unit.
- Operate hand pump and check whether changeover function is working.
- Check vacuum unit for leaks. (The vacuum unit should not return to rest position until the hand pump is vented to atmosphere.)
- If necessary, renew vacuum unit.
- If the vacuum unit is not energised, check -N156 as follows for blockage:



- -> Connect one of the contacts of -N156 to engine earth using test leads and crocodile clamp from V.A.G 1594 A.
- Connect second contact on -N156 to positive using remote control V.A.G 1348/3A, adapter lead V.A.G 1348/3-2 and auxiliary cable.
- Operate remote control V.A.G 1348/3A.
- Check valve for obstructions (remove vacuum hoses and blow through).
- If necessary, renew intake manifold changeover valve.
- If no faults have been found in any of the tests so far, check the vacuum system for leaks.

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2.4 - Checking intake manifold changeover valve

<p>V.A.G 1526 A</p> 	<p>V.A.G 1527 B</p> 
<p>V.A.G 1594 A</p>  <p>Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorized 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.</p>	<p>V.A.G 1598/22</p> 
<p>VAS 5051</p> 	<p style="text-align: right; border: 1px solid black; padding: 2px;">G24-0012</p>

Special tools, testers and auxiliary items required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/22
- ◆ VAS 5051

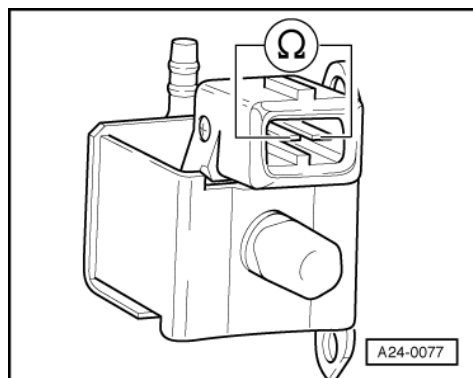
or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Fitting location =>Page **59** .

Test requirements:

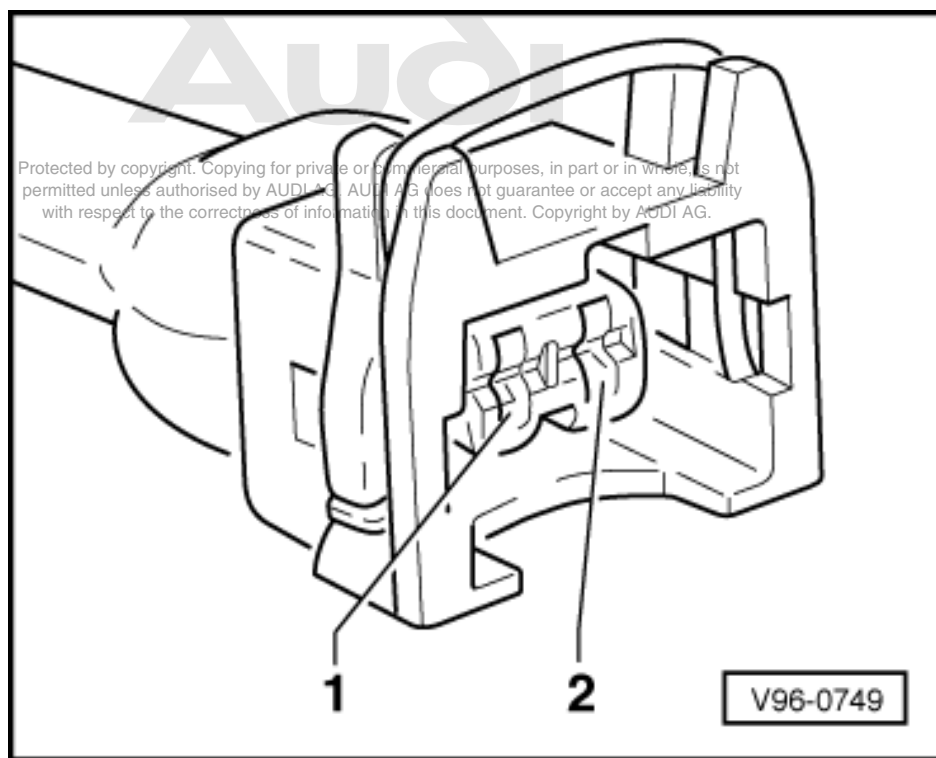
- Final control diagnosis has been performed



Checking internal resistance

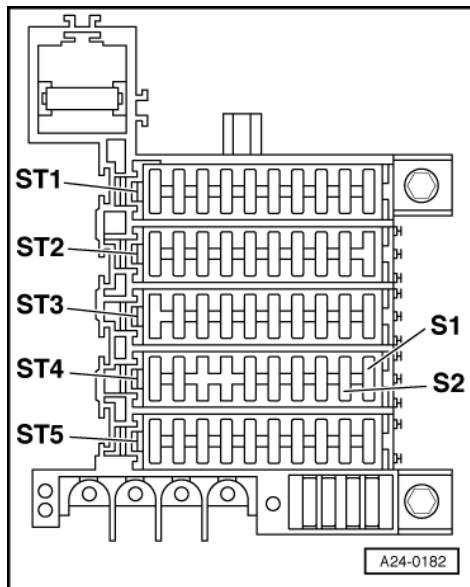
- Unplug connector from intake manifold changeover valve -N156.
- -> Connect multimeter to injector to measure resistance.
 - Specification: 25 ... 35 ω
- If the reading does not match the specification, renew intake manifold changeover valve -N156.

Checking power supply



- Unplug connector from intake manifold changeover valve -N156.
- -> Connect voltage tester V.A.G 1527 B as follows:

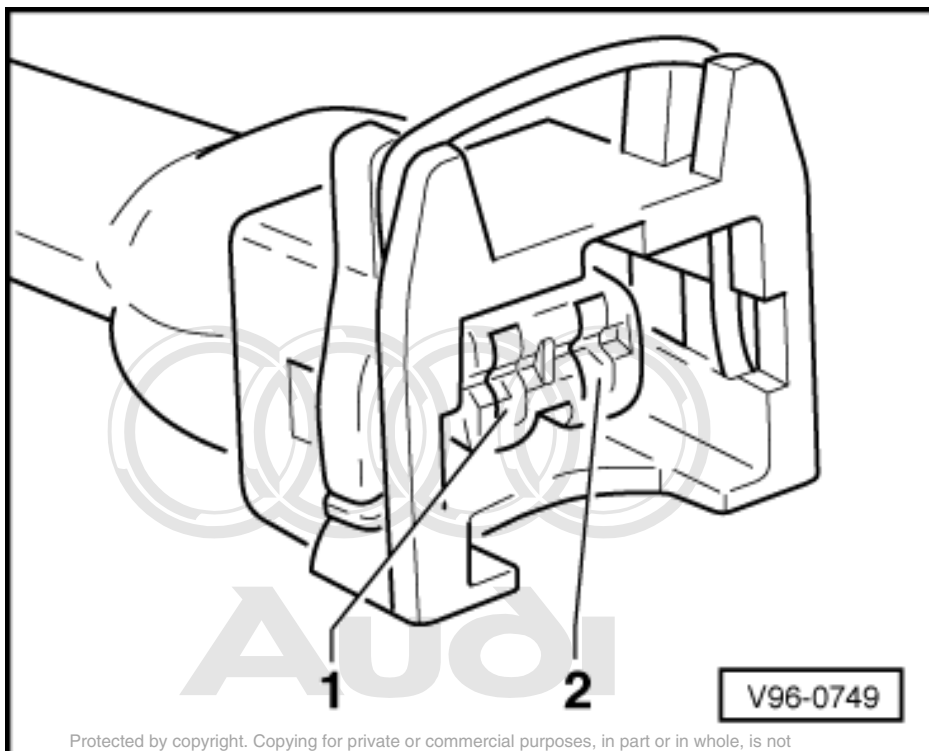
Connector contact	Measure to
1	Engine earth



- Operate starter briefly.
 - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):
 - -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



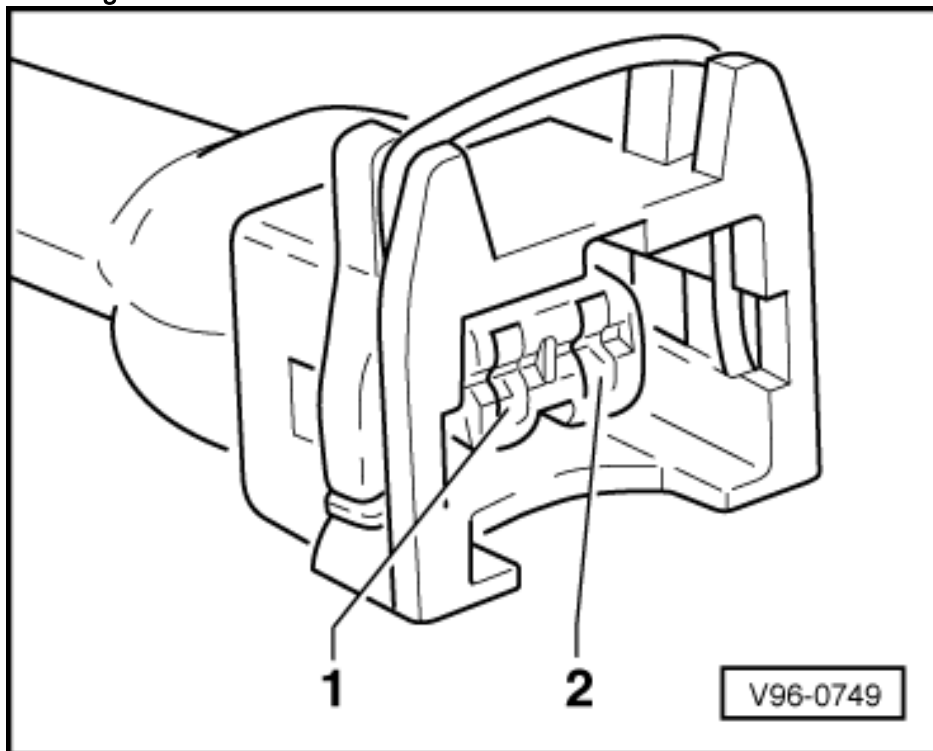
- -> Check for open circuit between contact 1 on connector and fuse in fuse holder.

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

- Check fuel pump relay => Page 93 .



Checking actuation



- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2 using auxiliary cables from V.A.G 1594 A.
- Connect fault reader V.A.G 1551 => Page 1 .
- Start final control diagnosis and actuate the intake manifold changeover valve
=>Page 28 .

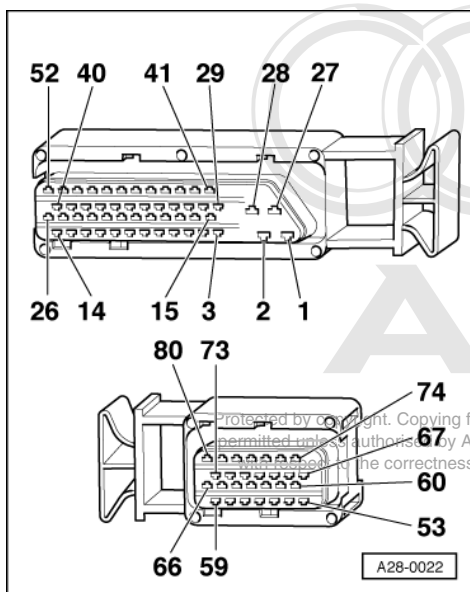
-> Display readout:

Final control diagnosis
Intake manifold changeover valve -N156

- The LED should flash.

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

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



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

Connector contact	Test box V.A.G 1598/22 socket
2	64

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .

3 - Checking lambda control

3.1 - 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 rich" (low level of residual oxygen) is between about 0.7 and 1.0 V (referenced to reference earth).

The voltage signal for "Mixture weak" (high level of residual oxygen) is between about 0.0 and + 0.1 V (referenced to reference earth).

The transition from "rich" to "lean" is accompanied by a voltage jump from between 0.7 and 1.0 V to between 0.0 and +0.3 V and vice versa ($\lambda = 1.0$).

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

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

- ◆ Slots or holes in probe head are blocked.
- ◆ Lambda probe has been subjected to excessive thermal stress.
- ◆ Contact resistance in signal wiring or reference earth line.
- ◆ Lambda probe too cold; lambda probe heating not working.
- ◆ Lambda control switched off (control unit has registered a fault in the injection system => interrogate fault memory and read measured value block, display group 021).
- ◆ Lambda probe damaged by contact spray or similar product (the contact spray is drawn into the 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.)

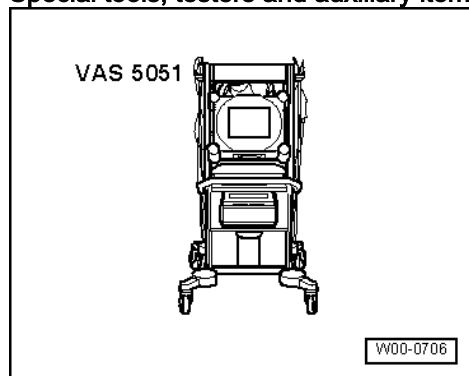
3.2 - Engine running problems after cold start

The time it takes for the lambda control to cut in (lambda probe temperature must be approx. 300 °C) is mainly determined by the following factors.

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

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

Special tools, testers and auxiliary items required





- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test requirements:

- No faults relating to lambda control function recorded in fault memory. If faults are recorded, rectify them and erase the fault memory.

Test sequence

Check vehicle under cold start conditions:

- Connect fault reader V.A.G 1551 => Page 1 .
- Start the engine.
- Read measured value block, display group 009, Engine idling =>Page 46 .

-> Display readout:

Read measured value block 9			
1	2	3	4

Display zone 1 will show the signal voltage for lambda probe 1.

Display zone 2 will show the signal voltage for lambda probe 2.

Engine cold or lambda control not running: 0.45...0.50 V.

- Take the vehicle for a test drive.

Warning:

Attach fault reader to rear seat and operate it from there. When doing this, always observe the relevant safety precautions.

Page 57 .

- Observe display zones 1 and 2 during test drive.

-> When the control action cuts in, voltage signal in display zones 1 and 2 must fluctuate between the ranges 0.0...+0.3 and +0.7...+1.1 V.

Read measured value block 9			
1	2	3	4

Voltages of more than +0.7 V indicate a rich fuel mixture (low oxygen level in exhaust gas).

Voltages of less than +0.3 V indicate a lean fuel mixture (high oxygen level in exhaust gas).

- If the engine performance is poor before the lambda control cuts in, the lambda control is not the cause of the problem.
- If the engine running problems only occur after the lambda control has cut in, test the operation of the lambda control =>Page 109 .

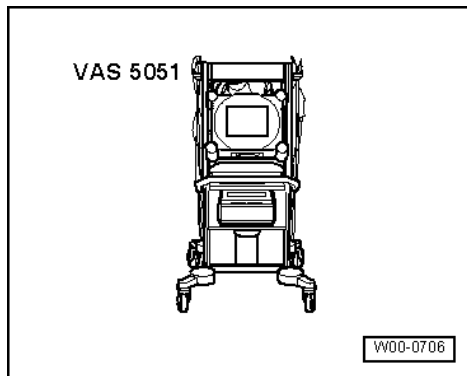
Notes:

- ♦ If the performance improves once the lambda control has cut in, this means that the lambda control is counteracting the problem (e.g. unmetered air or defective injector, etc.). Check the lambda learned values to confirm this.
- Read measured value block, Display Group 008, Engine idling =>Page 46 . If the values are not as specified, rectify the fault.
- Also check the measured value blocks in function 04 (Basic setting). The ACF solenoid -N80 is closed for this function.

- ♦ The lambda control can be selectively activated and deactivated with the help of display group 099. Pressing keys 4 and 8 will switch between the "Basic setting" (lambda control off) and "Reading measured value block" (lambda control on).

3.3 - Checking function of lambda probes

Special tools, testers and auxiliary items required



- ♦ VAS 5051
- or
- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Connect fault reader V.A.G 1551 => Page 1.
- Start the engine.
- Read measured value block, Display Group 003, Engine idling => Page 41.

-> Display readout:

Read measured value block 3

1	2	3	4
---	---	---	---

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Do not proceed with the test until the coolant temperature shown in display zone 3 has reached at least 80 °C.

- Press C key.
- Enter "009" for "Display group number 009" and confirm entry with Q key.

-> Display readout:

Read measured value block 9

1	2	3	4
---	---	---	---

Display zone 1 will show the signal voltage for lambda probe 1.

Display zone 2 will show the signal voltage for lambda probe 2.

- If the lambda probe voltage fluctuates very slowly, test the lambda probe heating => Page 111.
- If the display shows a constant lambda probe voltage reading of 0.000 V, this means there is a short circuit to earth; check wiring => Page 111.
- If the display shows a constant lambda probe voltage reading of 0.45...0.50 V, this means there is an open circuit in the signal wiring, check the wiring => Page 114.
- If the display shows a constant lambda probe voltage reading of 1.105 V, this means there is a short circuit to positive; check wiring => Page 114.



- If the display shows a constant voltage reading of 0.0 - +0.3 V (mixture too lean), this means that the lambda control has reached the control stop in the "enrich" direction, but the lambda probe is still registering "Mixture too lean".
- If the display shows a constant voltage reading of 0.7 - 1.0 V (mixture too rich), this means that the lambda control has reached the control stop in the "lean" direction, but the lambda probe is still registering "Mixture too rich".
- Press C key.

-> Display readout:

Read measured value block
Enter display group number XXX

- If Lambda probe is functioning properly, select display group 008 and check Lambda learned values =>Page 46 .

-> Display readout:

Read measured value block 8
1 2 3 4

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Display zone 3 shows Lambda learned value of cylinder bank 1; display zone 4 shows Lambda learned value of cylinder bank 2.

The lambda control is adaptive, i.e. it has a learning capability. Faults such as unmetered air or defective injectors have the effect of changing the air/fuel mixture composition. The lambda probes detect this and compensate by adjusting the basic injection periods programmed in the maps. The injection periods are extended or reduced until a " $\lambda = 1$ " mixture composition is achieved. The difference between the actual injection period and the basic period programmed in the map is given as a percentage.

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

Specifications: Reading measured value block => Page 46 .

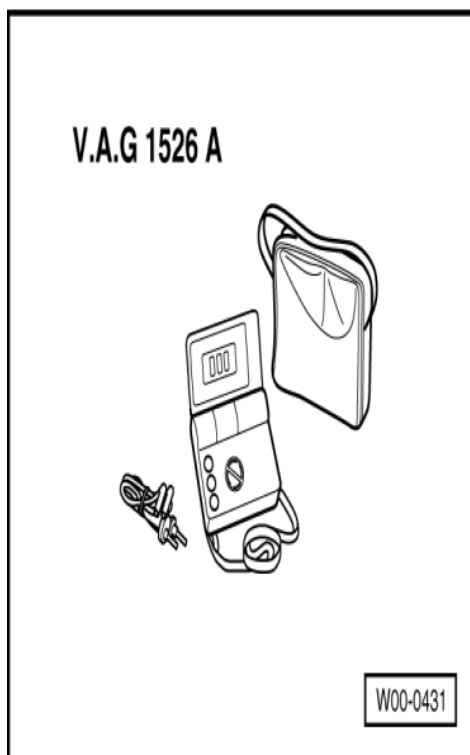
- If the specified values are not obtained: Test table display group 007 =>Page 45

Note:

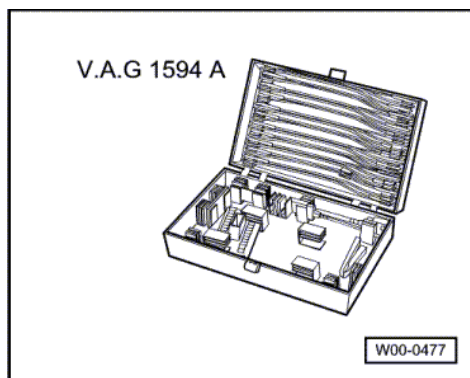
If necessary, display group 007 can also be checked and printed out in the "Basic setting" mode (function 04) for the purposes of fault finding. This function excludes, for example, the influence of the ACF =>Page 31 .

3.4 - Checking lambda probe heating

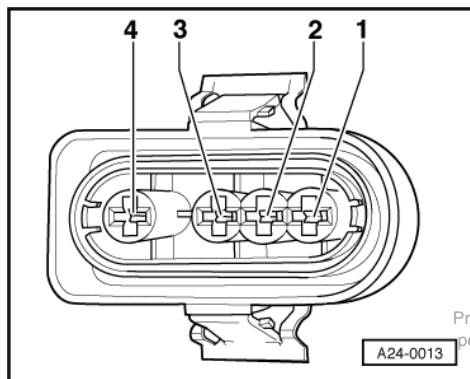
Special tools, testers and auxiliary items required



♦ V.A.G 1526 A



♦ V.A.G 1594 A



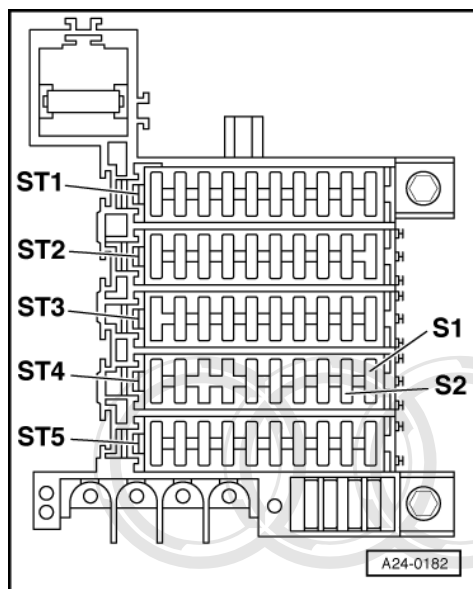
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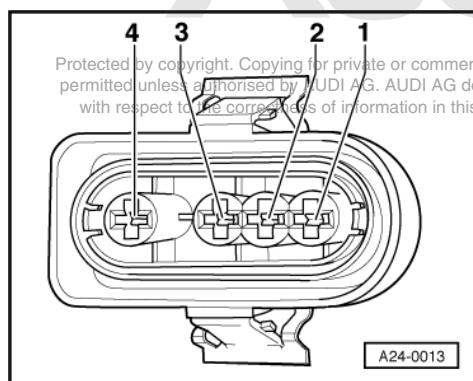
Test sequence

- Unplug lambda probe connector for left hand or right hand cylinder bank.
(Fitting location => Page 60)
- -> Connect multimeter between contacts 1 (positive) and 2 (earth) to measure voltage.
- Start the engine.
 - Specification: 12 ... 14 V

If the specification is not obtained:



- Carry out the following tests (marked with dots):
 - -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).

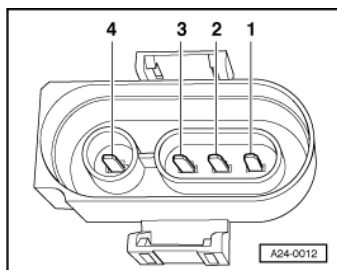


- -> Check for open circuit between contact 1 of connector and fuse in fuse holder (if necessary, check contact assignment).

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

- Check wiring between contact 2 and engine earth for open circuit.
- Check fuel pump relay => Page 93 .

If the specification is obtained:



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
- Specified value at room temperature 2 ... 5 ω

Note:

The resistance of the heating element at room temperature is approx. 2...5 ω . With even a small temperature rise this value will increase sharply.

If the specification is not obtained:


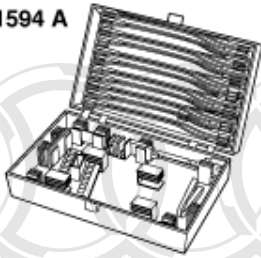

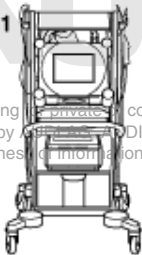
- Fit a new lambda probe.



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3.5 - Checking lambda probe signal wiring and activation

<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1598/22</p> 	<p>VAS 5051</p> 
	<p>G24-0003</p>

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Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

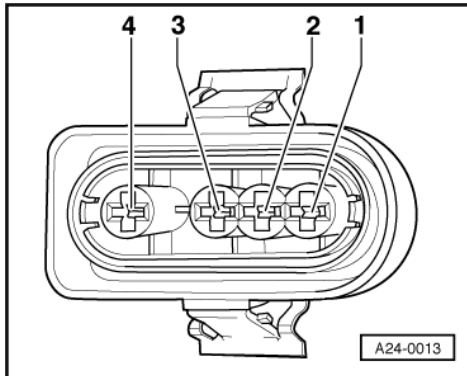
Note:

The lambda probe signal is monitored by the self-diagnosis system.

Test sequence

- Connect fault reader V.A.G 1551 => Page 1 .
- Switch the ignition on.
- Interrogate fault memory =>Page 4 .

- If a fault in the lambda probe has been registered and the lambda probe heating is OK, unplug the lambda probe connector, right/left cylinder bank. Fitting location =>Page 60 .



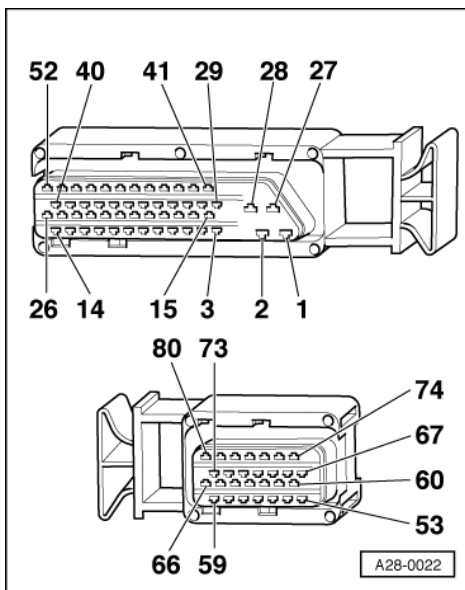
- -> Connect multimeter between contacts 3 and 4 to measure voltage.
- Switch the ignition on.
 - Specification: 450 ± 50 mV

If the specification is obtained:

- Fit a new lambda probe.

If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=>Page 78 .



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

Lambda probe Bank 1 -G39

Connector contact	Test box V.A.G 1598/22 socket
3	25
4	26

Lambda probe, bank 2 -G108



Connector contact	Test box V.A.G 1598/22 socket
3	39
4	40

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .

3.6 - Removing and installing lambda probe

Special tools, testers and auxiliary items required

- ♦ Hot bolt paste G 052 112 A3

Removing

- Unplug lambda probe connector for left hand or right hand cylinder bank.
(Fitting location => Page 60)
- Undo cable ties.
- Unscrew lambda probe.

Installing

When installing, note the following points:

Notes:

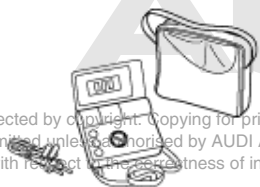



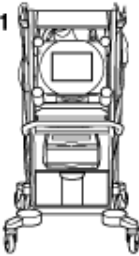
- ♦ Tightening torque 50 Nm.
- ♦ The screw thread on the lambda probe is coated with assembly paste. This paste must not be allowed to penetrate the openings on the probe.
- ♦ When installing, the cable ties must be re fitted at exactly the same points in order to prevent contact between the lambda probe wire and the exhaust pipe.



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4 - Checking secondary air system

4.1 - Checking secondary air system

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/22 
VAS 5051 	G24-0012

4.2 - Checking secondary air inlet valve

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A



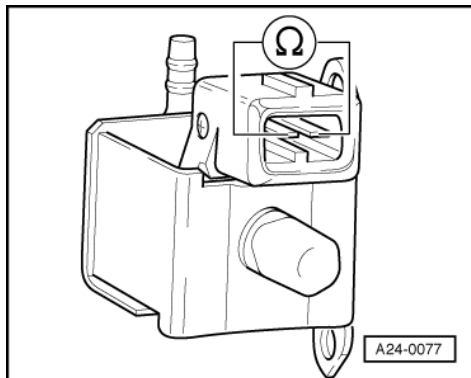
Fitting location =>Page **59** .

Test requirements:

- Final control diagnosis has been performed

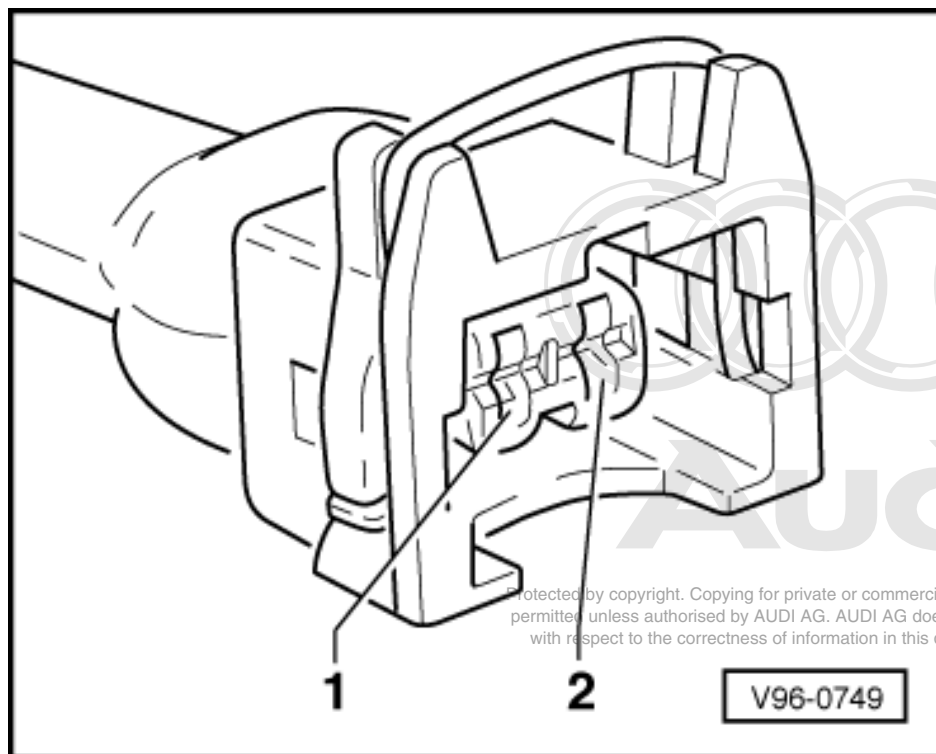
Checking internal resistance

- Disconnect plug from secondary air inlet valve -N122.



- -> Connect multimeter to valve to measure resistance.
- Specification: 25 ... 35 ω
- If the value is not as specified, fit a new secondary air inlet valve -N122.

=> 6-cylinder Engine (5-valve), Mechanical Components Repair Group 26; Secondary air system, Removing and installing secondary air system components

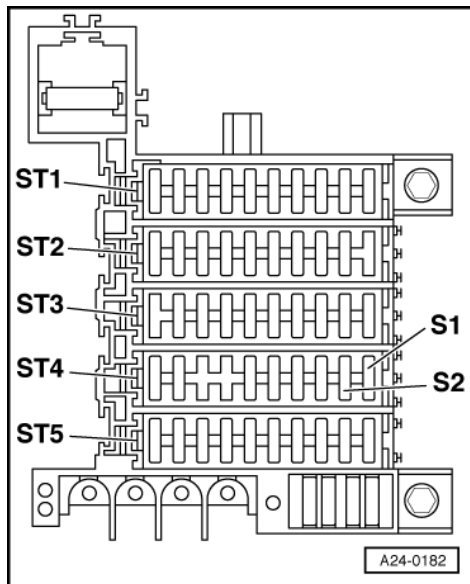


Checking power supply

- Disconnect plug from secondary air inlet valve -N122.

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

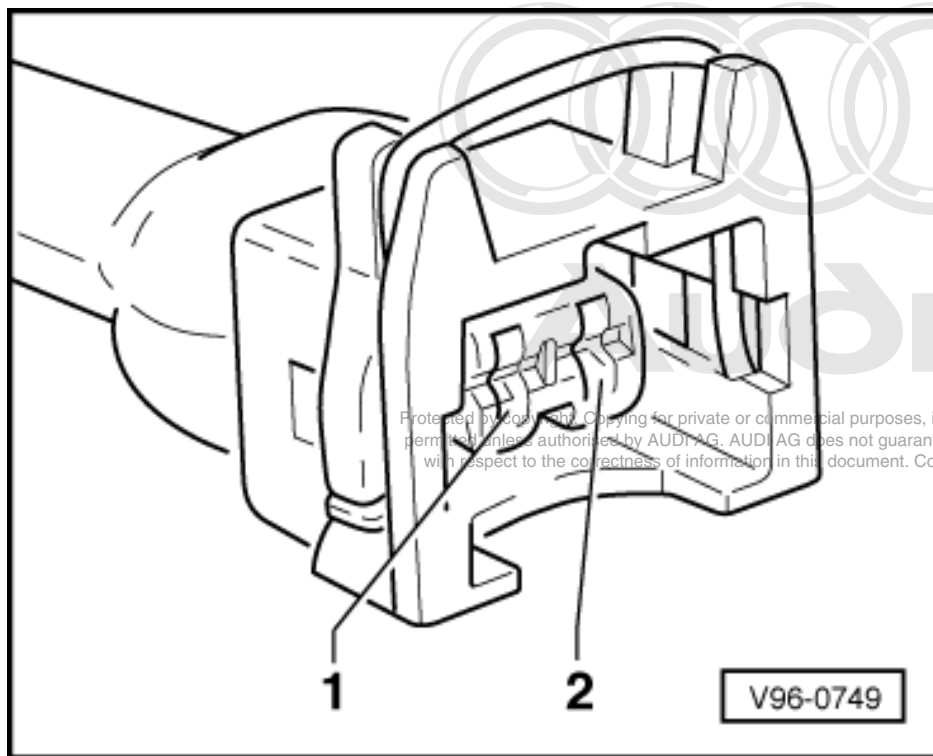
Connector contact	Measure to
1	Engine earth



- Operate starter briefly.
 - The LED should light up.

If the LED does not light up:

- Carry out the following tests (marked with dots):
 - -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



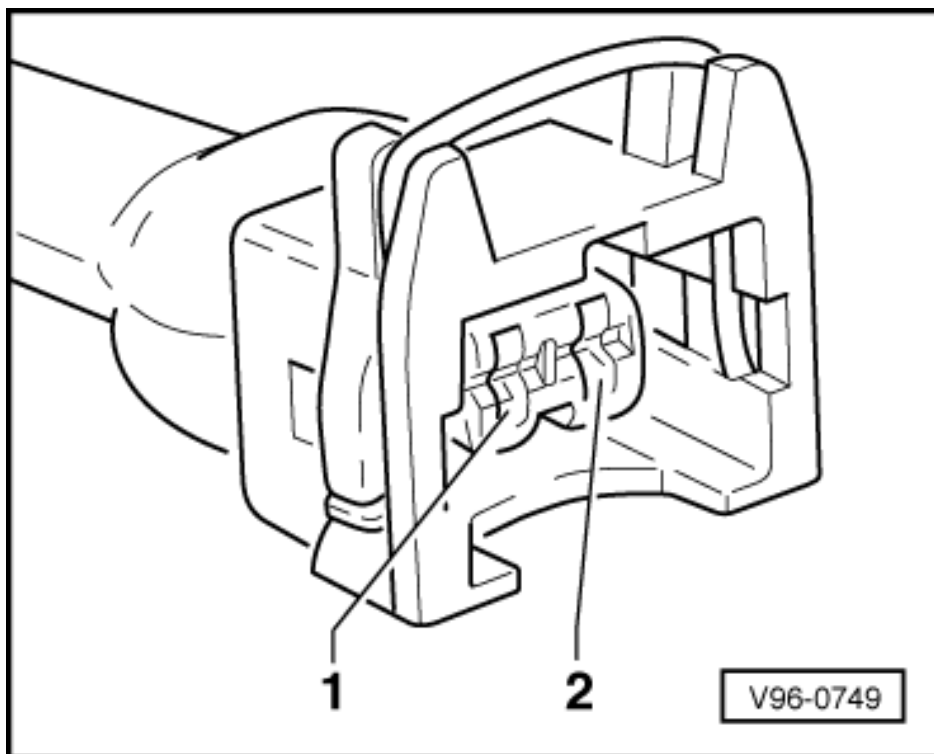


- -> Check for open circuit between contact 1 on connector and fuse in fuse holder .

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

- Check fuel pump relay => Page **93** .

Checking actuation



- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2 using auxiliary cables from V.A.G 1594 A.
- Connect fault reader V.A.G 1551 => Page **1** .
- Start final control diagnosis and actuate secondary air inlet valve -N122
=>Page **28** .

-> Display readout:

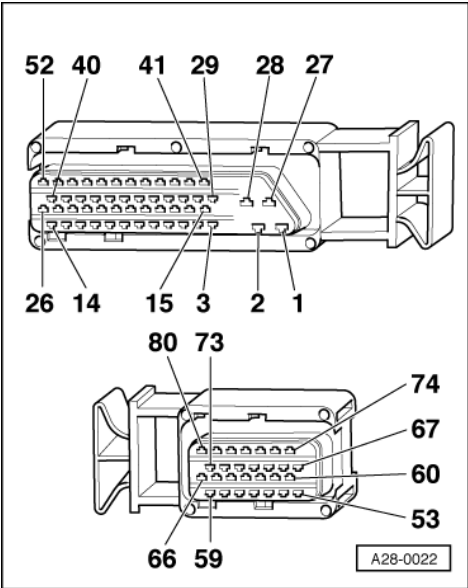
Final control diagnosis Secondary air inlet valve -N112
--

- The LED should flash.

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

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=>Page **78** .

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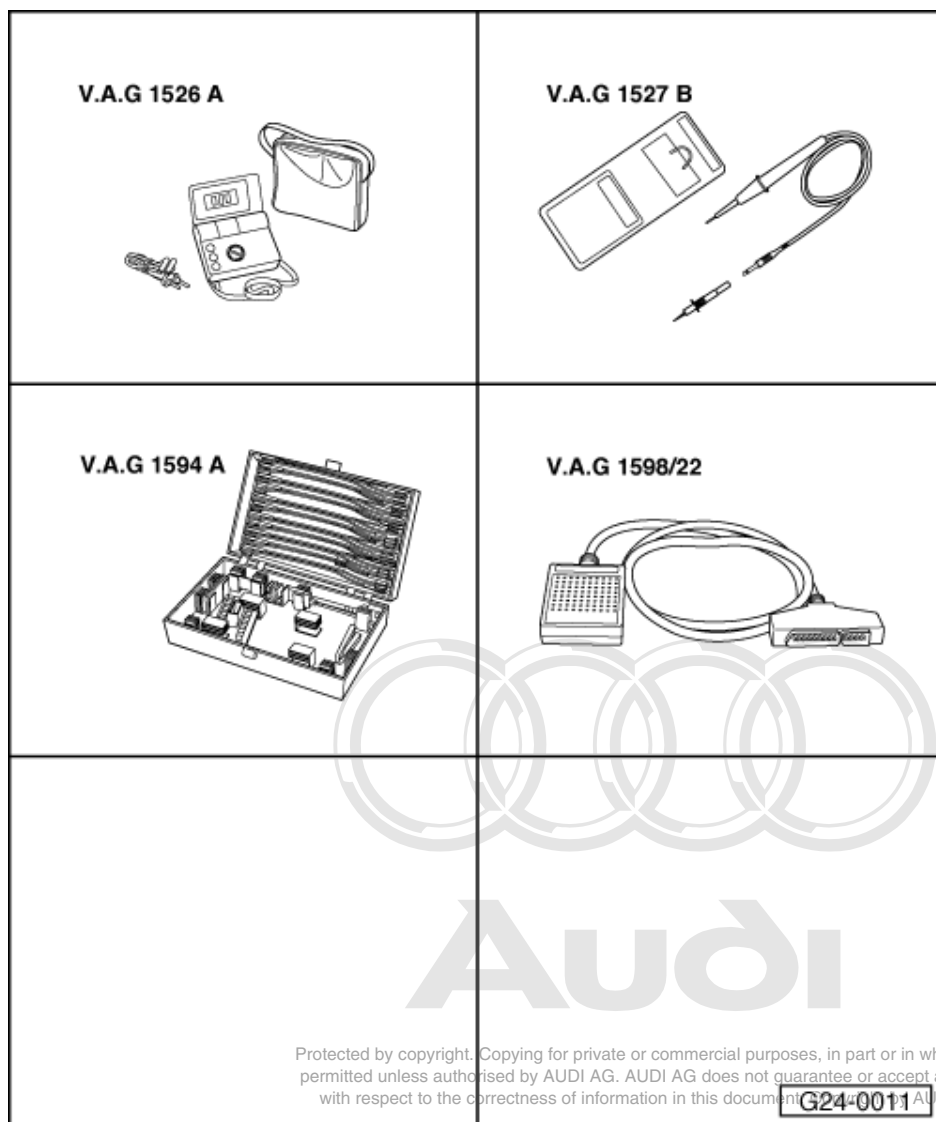
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector contact	Test box V.A.G 1598/22 socket
2	33

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .



4.3 - Checking secondary air pump relay



Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22

Test requirements:

- Final control diagnosis has been performed
- Operate starter briefly.
 - Secondary air pump motor -V101 must start up

If secondary air pump motor -V101 does not start up:

Checking power supply

- Pull plug off secondary air pump motor -V101.

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

Connector contact	Measure to
2	Engine earth

- Operate starter briefly.
 - The LED should light up.

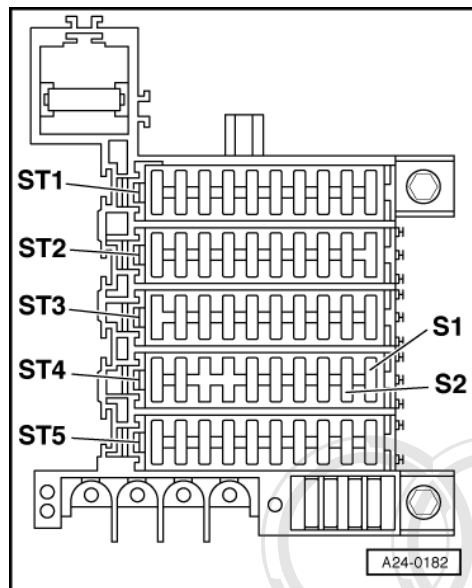
If LED lights, but motor did not run on actuating starter:

- Fit a new secondary air pump motor -V101:

=> 6-cylinder Engine (5-valve), Mechanical Components Repair Group 26; Secondary air system, Removing and installing secondary air system components

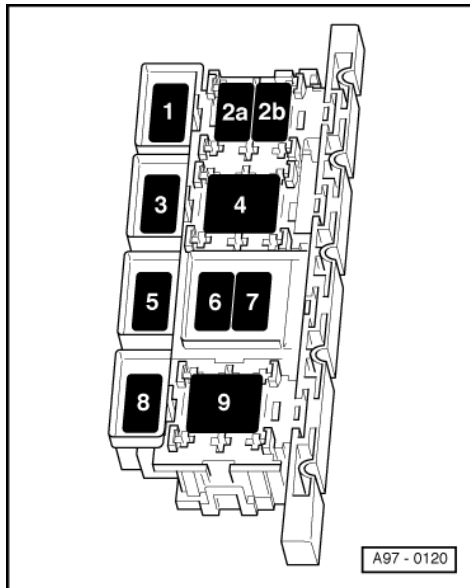
If the LED does not light up:

- Carry out the following tests (marked with dots):



- -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).
- Check fuse S130 (60 A) in fuse holder.
- Check fuel pump relay => Page 93 .

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- -> Check for open circuit in wiring between connector at motor -V101 and secondary air pump relay -J299 (in relay and fuse carrier, electronics box, plenum chamber, position 4).

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

- Check for open circuit in wiring between battery + (terminal 30) and fuse S130 (in fuse holder) as well as between fuse S130 and secondary air pump relay -J299 (in relay and fuse carrier, electronics box, plenum chamber, position 4).

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

- If wiring is OK, check actuation of secondary air pump relay -J299.

Checking actuation

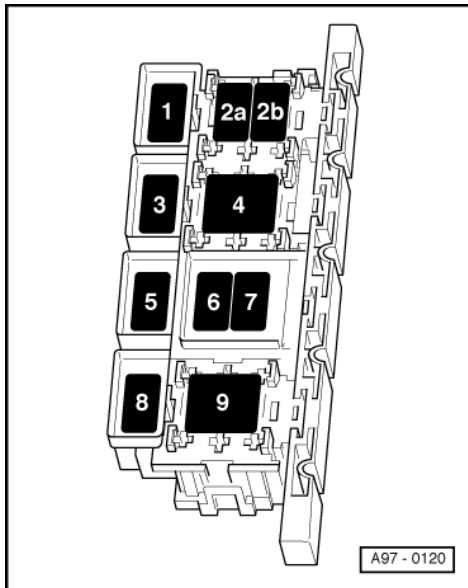
- Pull off secondary air pump relay -J299.
- Connect the multimeter to contact 4 of relay socket and earth to measure voltage.
- Operate starter briefly.
 - Specification: approx. battery voltage

If the specification is not obtained:

- Check fuel pump relay => Page 93 .

If the specification is obtained:

- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=>Page 78 .



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

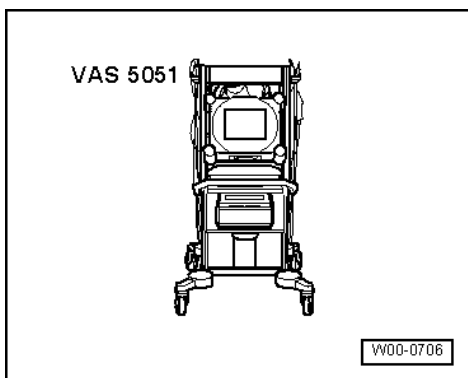
Relay and fuse carrier, electronics box, plenum chamber, position 4 contact	Test box V.A.G 1598/22 socket
6	30

- Rectify short circuit or open circuit if necessary.
- If wiring is OK, fit a new secondary air pump relay -J299.

5 - Checking fuel tank breather

5.1 - Checking fuel tank breather

Special tools, testers and auxiliary items required



- ♦ VAS 5051
- or
- ♦ V.A.G 1551 with V.A.G 1551/3 A

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5.2 - Checking function

Test requirements:

- No faults stored in fault memory

Test sequence

- Connect fault reader V.A.G 1551 => Page **1** .
- Start the engine.
- Read measured value block, Display Group 010, engine at idling speed =>Page **48** .

-> Display readout:

Read measured value block 10			
1	2	3	4

- Observe display in display zone 1.

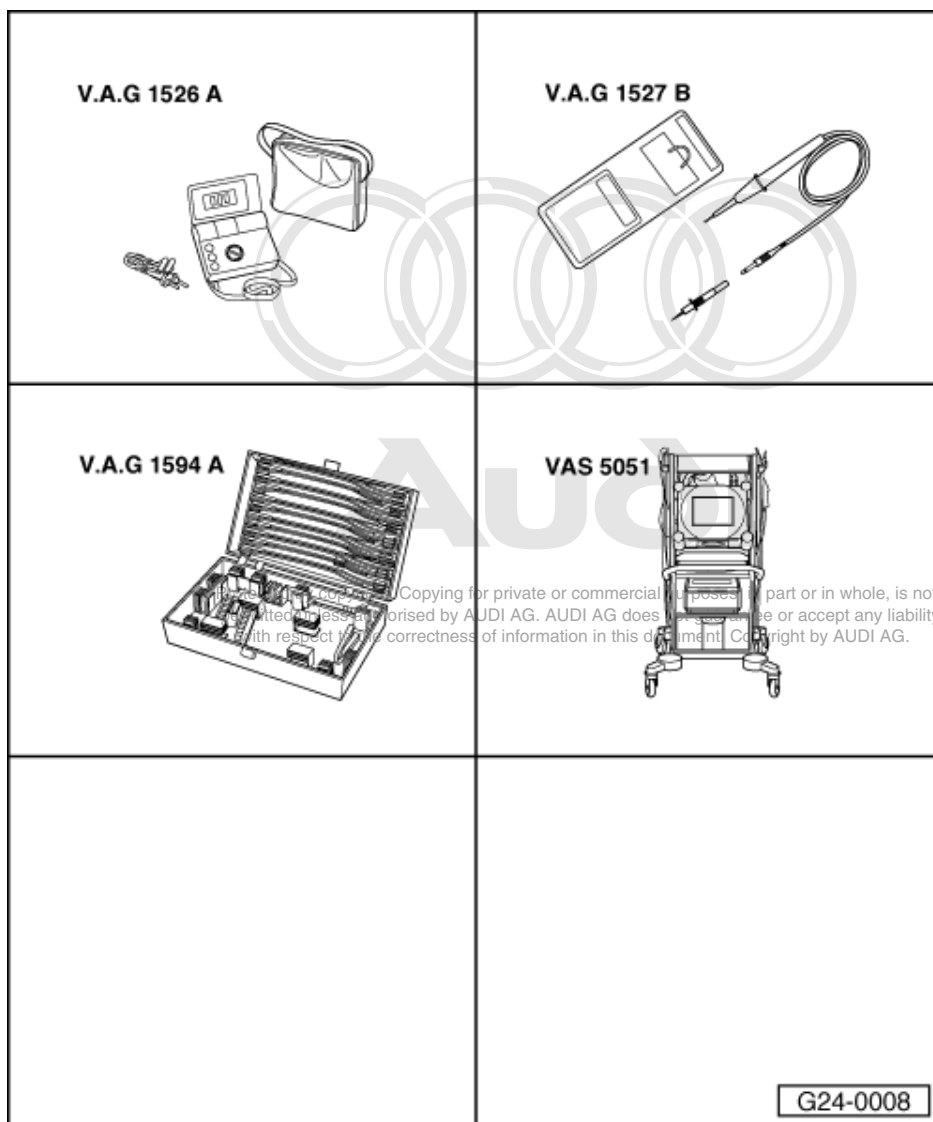
The ACF valve is intermittently clocked for 220... 900 seconds (implementation of fuel tank breather function) and deactivated for approx. 70 seconds (no fuel tank breather function). During the approx. 70 second period, the Lambda control learns the operating conditions without the deviation caused by fuel vapours from the activated charcoal filter.

- If fuel tank breather function is not active, wait approx. 70 seconds for the fuel tank breather function to be repeated.
 - Observe display in display zone 3.
- ♦ -5 = ACF new (no fuel vapours in ACF)
 - ♦ 0 to +95 = level of fuel vapour fill in ACF



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



Special tools, testers and auxiliary items required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1527 B
- ◆ V.A.G 1594 A
- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Fitting location =>Page **59**.

Testing for leaks

ACF solenoid valve -N80 remains closed when deenergised.

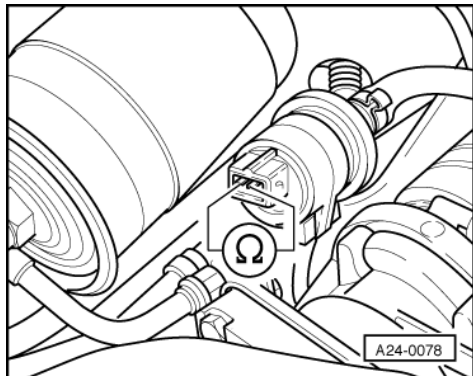
- Disconnect hoses from ACF valve but leave the electrical connector plugged in.
- Start final control diagnosis and actuate ACF valve => Page **28**.



- While final control diagnosis is running, blow into solenoid valve to check whether it opens properly. If necessary, fit a new ACF solenoid valve.

Checking internal resistance

- Unplug connector on ACF valve.



- -> Connect multimeter to valve to measure resistance.
- Specification: 20 ... 28 ω

If the specification is not obtained:

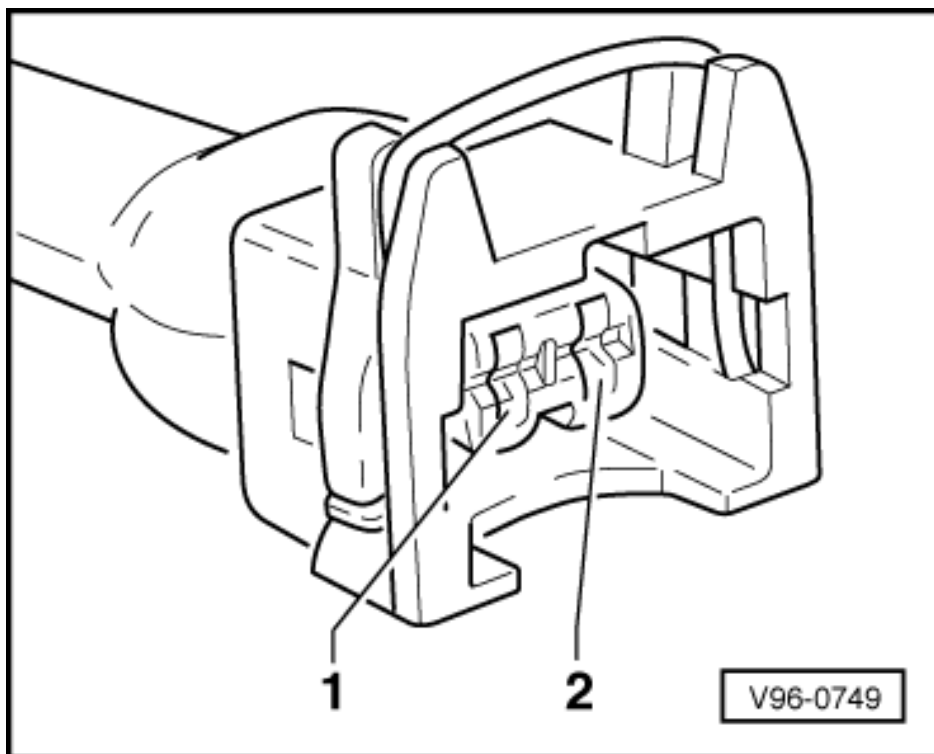
- Fit a new ACF valve.

Checking power supply to ACF valve

Note:

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

- Unplug connector on ACF valve.



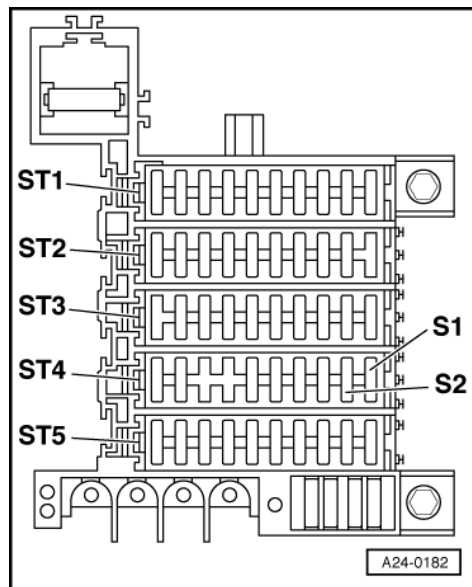
- -> Connect voltage tester V.A.G 1527 B as follows:



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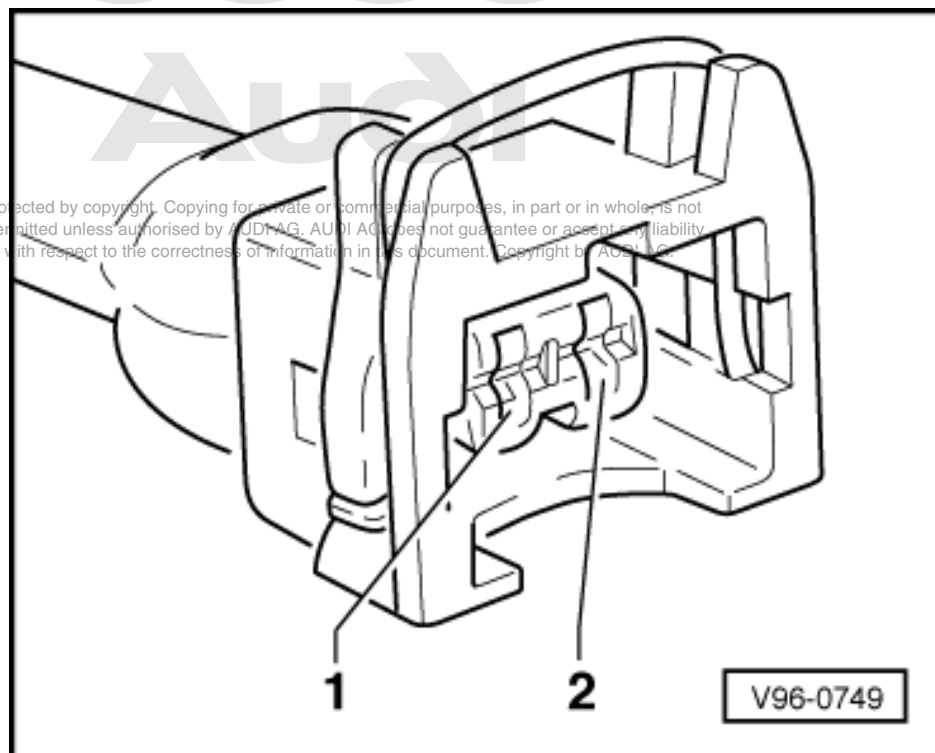
Connector contact	Measure to
1	Engine earth

- Operate starter briefly.
- The LED should light up.



If the LED does not light up:

- Carry out the following tests (marked with dots):
- -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



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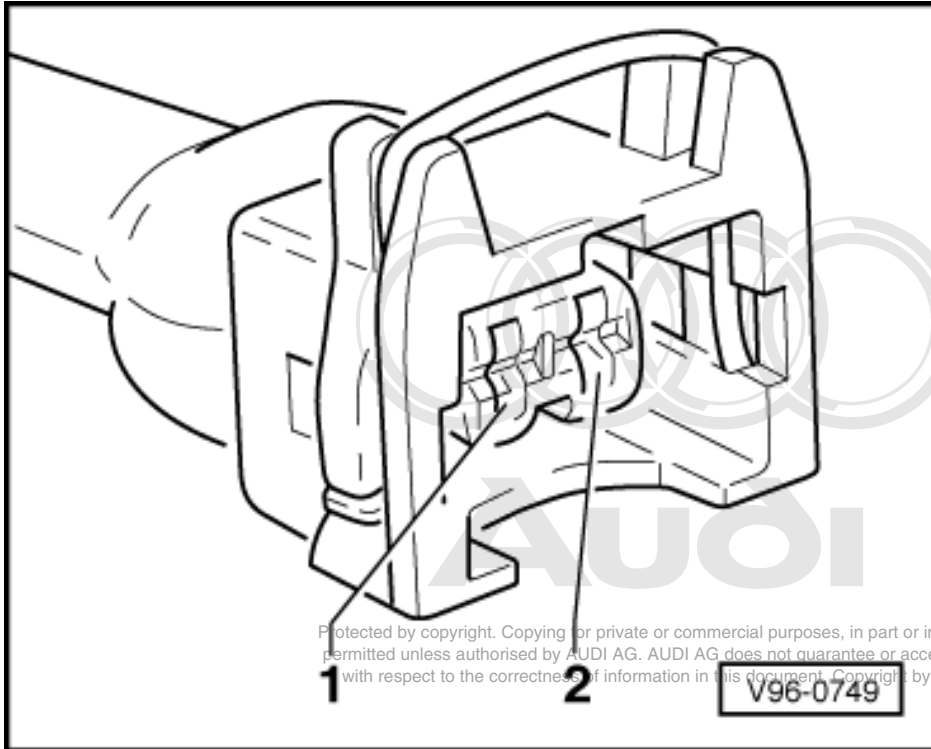


- -> Check for open circuit between contact 1 on connector and fuse in fuse holder .

=> Binder "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations"

- Check fuel pump relay => Page 93 .

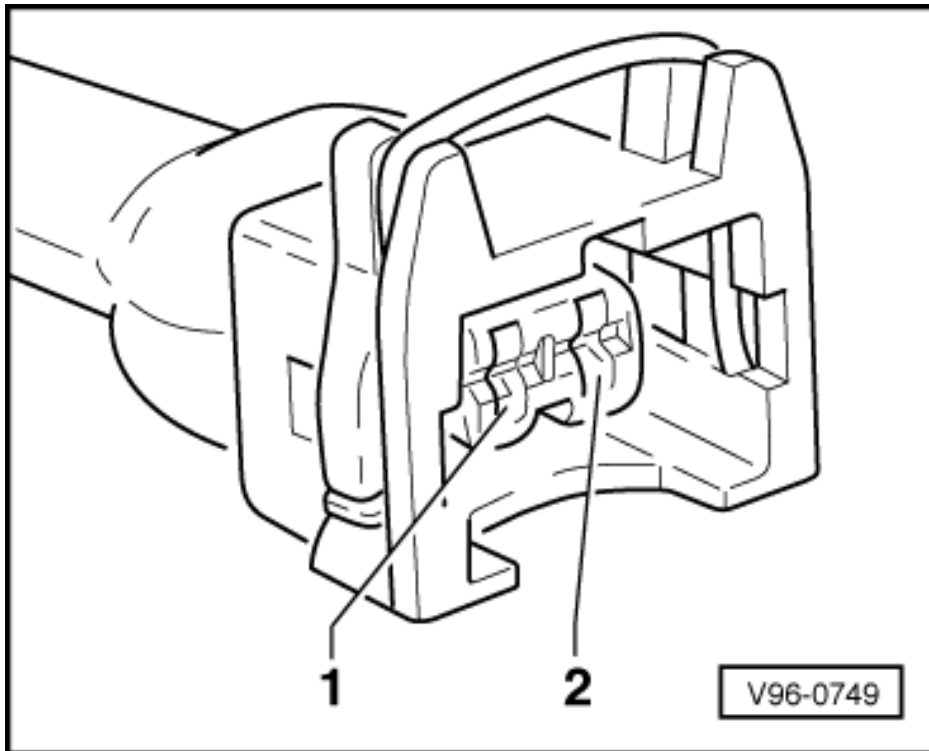
Checking actuation of ACF valve



- -> Connect voltage tester V.A.G 1527 B between contacts 1 and 2 using auxiliary cables from V.A.G 1594 A.
- Connect fault reader V.A.G 1551 => Page 1 .
- Start final control diagnosis and actuate ACF solenoid -N80 =>Page 28 .
 - The LED should flash.

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

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=>Page 78 .



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

Connector contact	Test box V.A.G 1598/22 socket
2	15

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .

6 - Checking throttle valve control unit

6.1 - Checking throttle valve control unit

The idling speed stabilisation is integrated in the throttle valve control unit.

The housing opposite the cable pulley contains the following components (this housing must not be opened):

- ◆ Throttle valve potentiometer -G69
- ◆ Throttle valve positioner sender -G127
- ◆ Idling switch -F60
- ◆ -Throttle valve positioner -V60 (electric motor)

None of the potentiometers and switches may be adjusted mechanically. The settings are performed as part of the basic setting (function 04) using the V.A.G 1551 or 1552 fault reader.

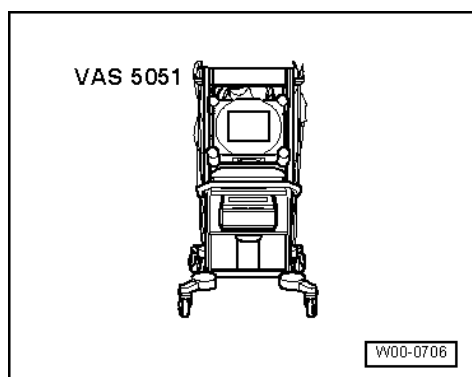
6.2 - Checking learning demand display

During "Adaptation of throttle valve control unit -J338 to engine control unit", the engine control unit learns the stop positions of the throttle valve control unit -J338 and a characteristic comparison curve between throttle valve potentiometer -G69 and throttle valve positioner sender -G127.



Display group 023 shows the adaptation values learnt during the last adaptation process and the learning demand display.

Special tools, testers and auxiliary items required



- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Connect fault reader V.A.G 1551 => Page 1 .
- Read measured value block, Display Group 023, Engine idling =>Page 53 .

-> Display readout:

Read measured value block 23		
01000000	72...95%	65...85%
16...51%		

- Check display values => Page 53

If the specified values are not obtained:

- Perform adaptation of throttle valve control unit to engine control unit
=>Page 132 .
- Repeat test.

6.3 - Performing adaptation of throttle valve control unit

The idle stabilisation requires the engine control unit to know the stop positions of the throttle valve positioner -V60 and the potentiometer characteristics of the throttle valve positioner sender -G127 and throttle valve potentiometer -G69.

The learning process (adaptation) is necessary if:

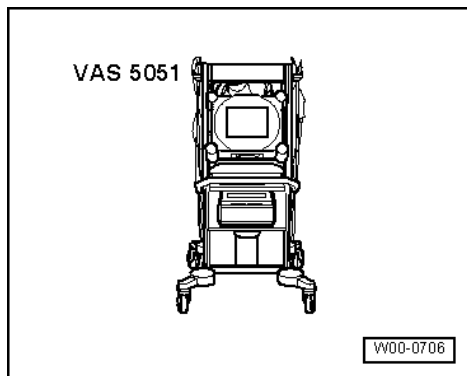
- ♦ The power supply to the engine control unit has been interrupted (e.g. battery disconnected) .
- ♦ The throttle valve control unit has been replaced.
- ♦ The engine control unit has been renewed.

The learning process (adaptation process) is performed:

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- ♦ automatically if the ignition is switched on once for at least 6 seconds without actuating the starter or the accelerator pedal.
- ♦ By initiating the "Basic setting" , Display Group 098, with the engine stopped.

Special tools, testers and auxiliary items required



- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Prerequisite:

- No faults stored in fault memory

Work sequence

- Connect fault reader V.A.G 1551 => Page 1.
- Start "Basic setting", Display Group 098, with engine stopped =>Page 56.

-> Display readout:

Basic setting 98			
4.420 V	3.880 V	Idling	
ADP running			

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

-> Display readout:

Basic setting 98			
4.420 V	3.880 V	Idling	
ADP OK			

Adaptation has been successfully carried out.

- Press the ➔key.

Note:

-> If wither of these messages appears on the display, adaptation has been terminated.

Basic setting 98			
4.420 V	3.880 V	Idling	
ADP ERROR			

Following faults are possible:

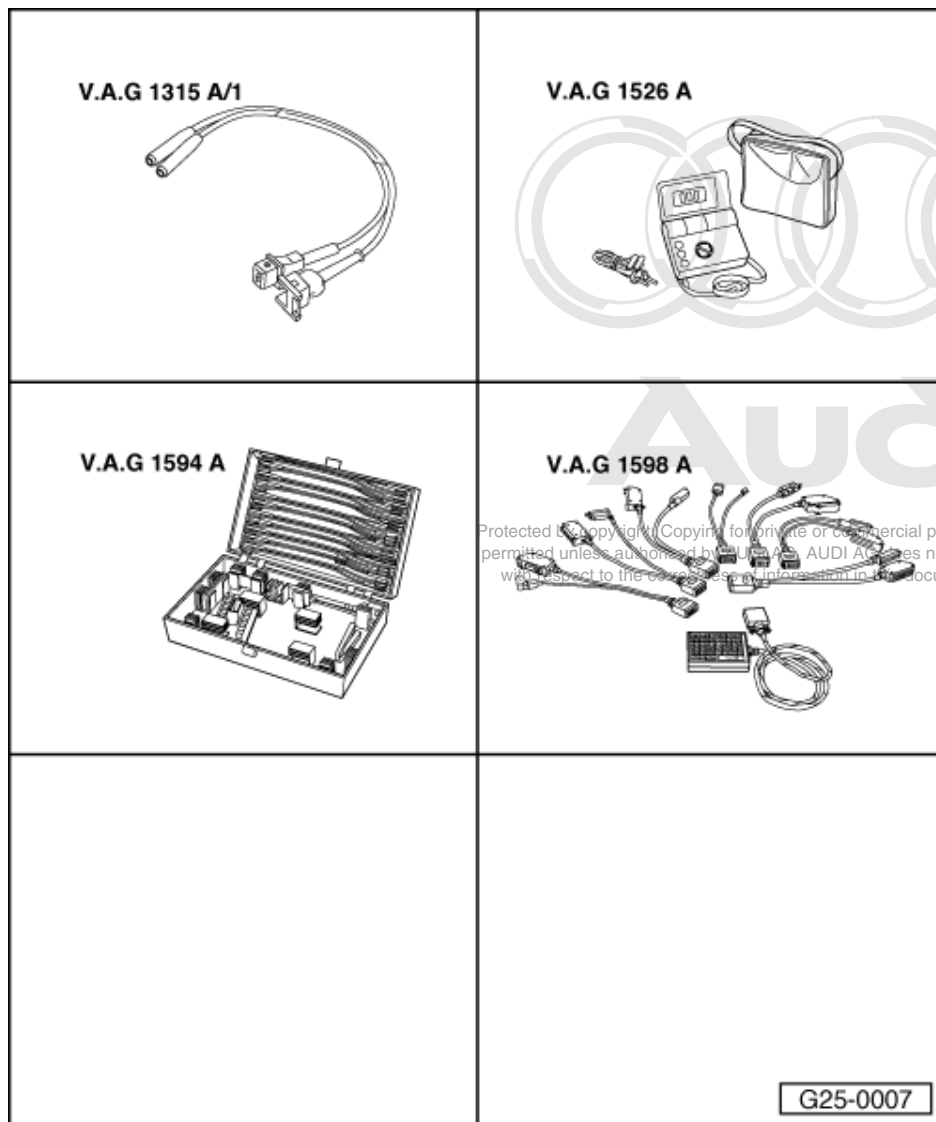
Function is unknown or cannot be carried out at the moment

- ◆ Engine started during adaptation.
- ◆ Battery voltage less than 10 V.
- ◆ Throttle cable setting not OK.



- ♦ Wiring connection between throttle valve control unit and engine control unit defective.
- ♦ Throttle valve control unit defective.

6.4 - Checking idling switch -F60



Special tools, testers and auxiliary items required

- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Connect fault reader V.A.G 1551 => Page **1** .
- Read measured value block, Display Group 098, engine stopped =>Page **56**

-> Display readout:

Read measured value block 98
4.420 V 3.880 V Idling
ADP OK

- Check display in display zone 3.

Read measured value block 98
4.420 V 3.880 V Idling ADP OK

-> Specified value: Idling

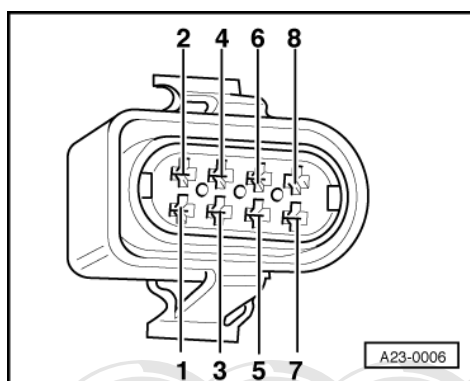
- Press accelerator pedal.

Read measured value block 98
4.420 V 3.880 V Part throttle
ADP OK

-> Specified value: Part throttle

If the specification is not obtained:

- Switch off ignition.
- Unplug the connector from the throttle valve control unit.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit
=>Page 78 .



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


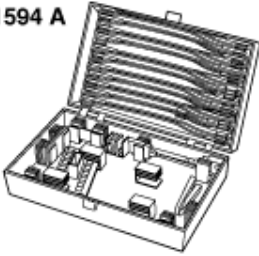

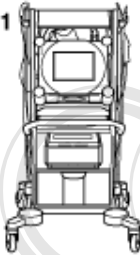
Connector contact	Test box V.A.G 1598/22 socket
3	69
7	67

- Rectify short circuit or open circuit if necessary.
- If wiring is OK, fit a new throttle valve control unit -J338.

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6.5 - Checking throttle valve potentiometer -G69

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/22 	VAS 5051 
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Note:

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

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Connect fault reader V.A.G 1551 => Page **1** .
- Read measured value block, Display Group 001, engine stopped =>Page **39**

-> Display readout:

Read measurement block 1
0 rpm 0.00 ms 4 -5
12.05BTDC

- Check display in display zone 3.
- Specified value: 0...5 <°
- Slowly floor accelerator pedal.

Read measurement block 1
0 rpm 0.00 ms 86 -5 12.05BTDC

-> Specified value: Display in display zone 3 must increase steadily to 75 ... 95 <° (with accelerator pedal floored).

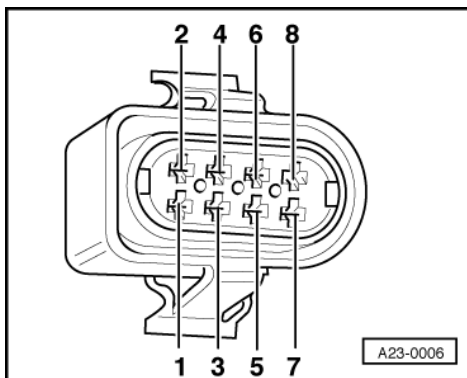
If either the initial or final specified result is not achieved:

- Check throttle cable setting

=> 6-cylinder engine (5-valve), Mechanical components; Repair Group 20

If the reading does not change or only changes irregularly:

- Switch off ignition.
- Unplug the connector from the throttle valve control unit.



- -> Connect up multimeter as follows to measure voltage.

Connector contact	Measure to
4	Engine earth

- Switch the ignition on.
- Specified value: approx. 5 V
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:

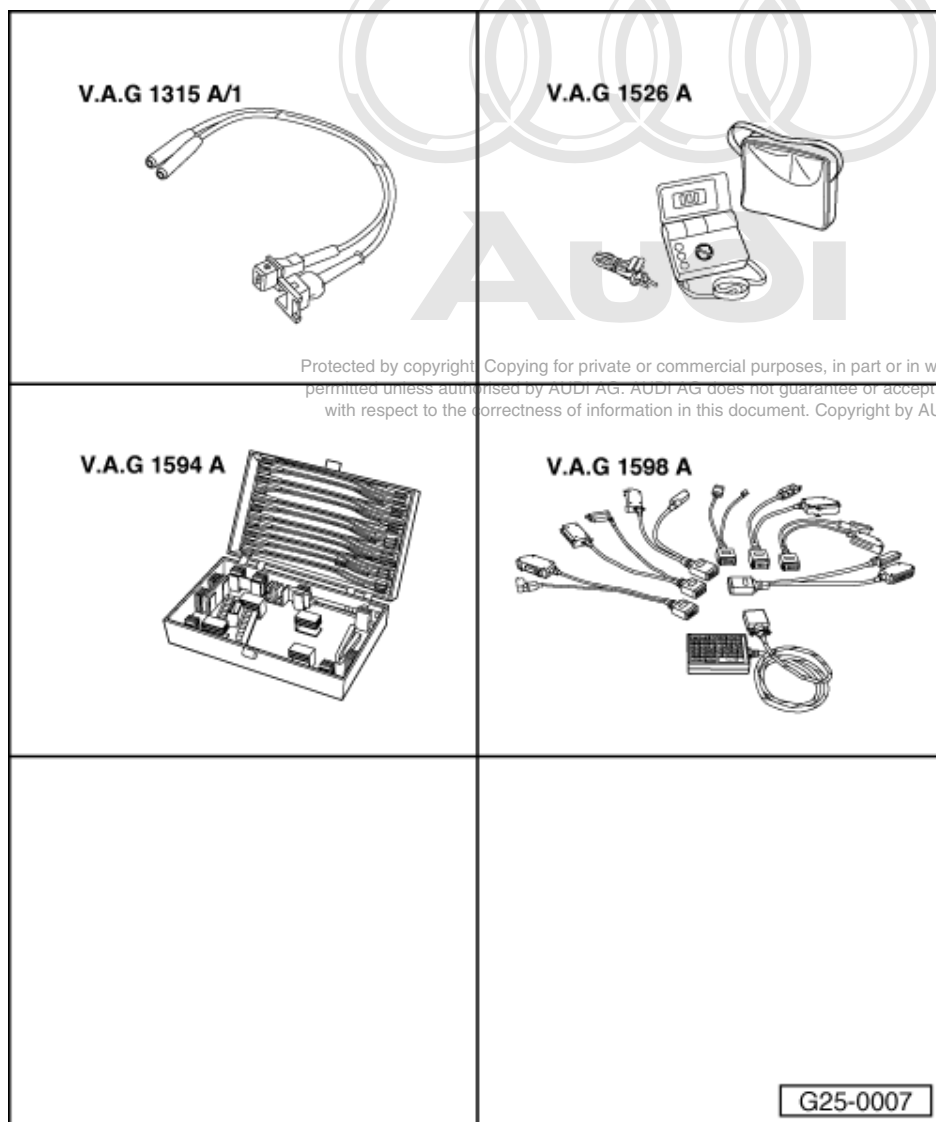
Connector contact	Test box V.A.G 1598/22 socket
4	62
5	75
7	67

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- Rectify short circuit or open circuit if necessary.
- If wiring is OK, fit a new throttle valve control unit -J338.



6.6 - Checking throttle valve positioner sender -G127



Note:

The throttle valve positioner sender -G127 informs the engine control unit of the position of the throttle valve positioner -V60.

Special tools, testers and auxiliary items required

- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test sequence

- Connect fault reader V.A.G 1551 => Page **1** .
- Read measured value block, Display Group 098, engine at idling speed =>Page **56**

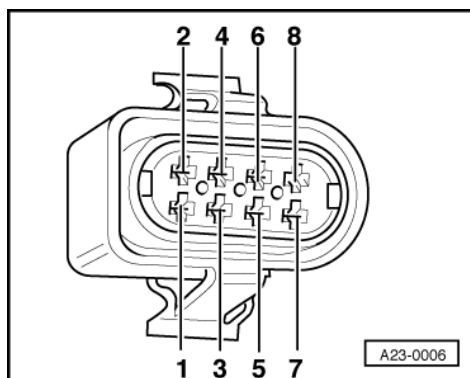
-> Display readout:

Read measured value block 98
4.420 V 3.880 V Idling
ADP OK

- Check display in display zone 2.
 - Specified value: 0.500 ... 4.900 V

If the specification is not obtained:

- Switch off ignition.
- Unplug the connector from the throttle valve control unit.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



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

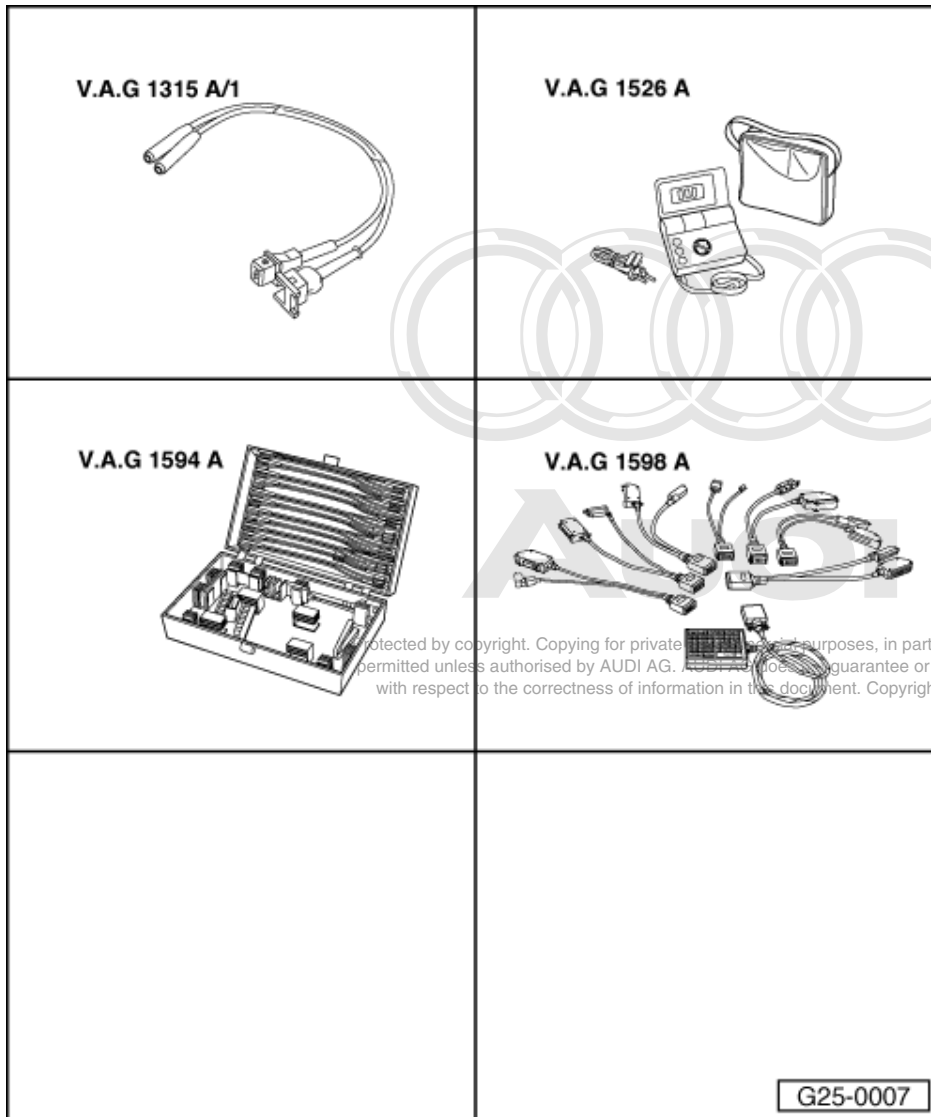
Connector contact	Test box V.A.G 1598/22 socket
4	62
7	67
8	74

- Rectify short circuit or open circuit if necessary.
- If wiring is OK, fit a new throttle valve control unit -J338.

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6.7 - Checking throttle valve positioner -V60



Special tools, testers and auxiliary items required

- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Note:

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

Test sequence

- Connect fault reader V.A.G 1551 => Page **1** .
- Start "Basic setting", display group 098, engine stopped => Page **56** .

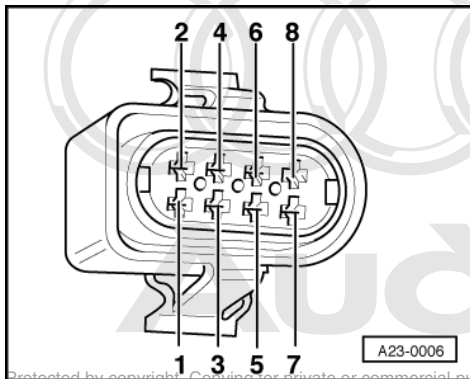
-> Display readout:

Basic setting 98
4.420 V 3.880 V Idling
ADP running

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

If the throttle valve positioner does not move:

- Switch off ignition.
- Unplug the connector from the throttle valve control unit.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



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

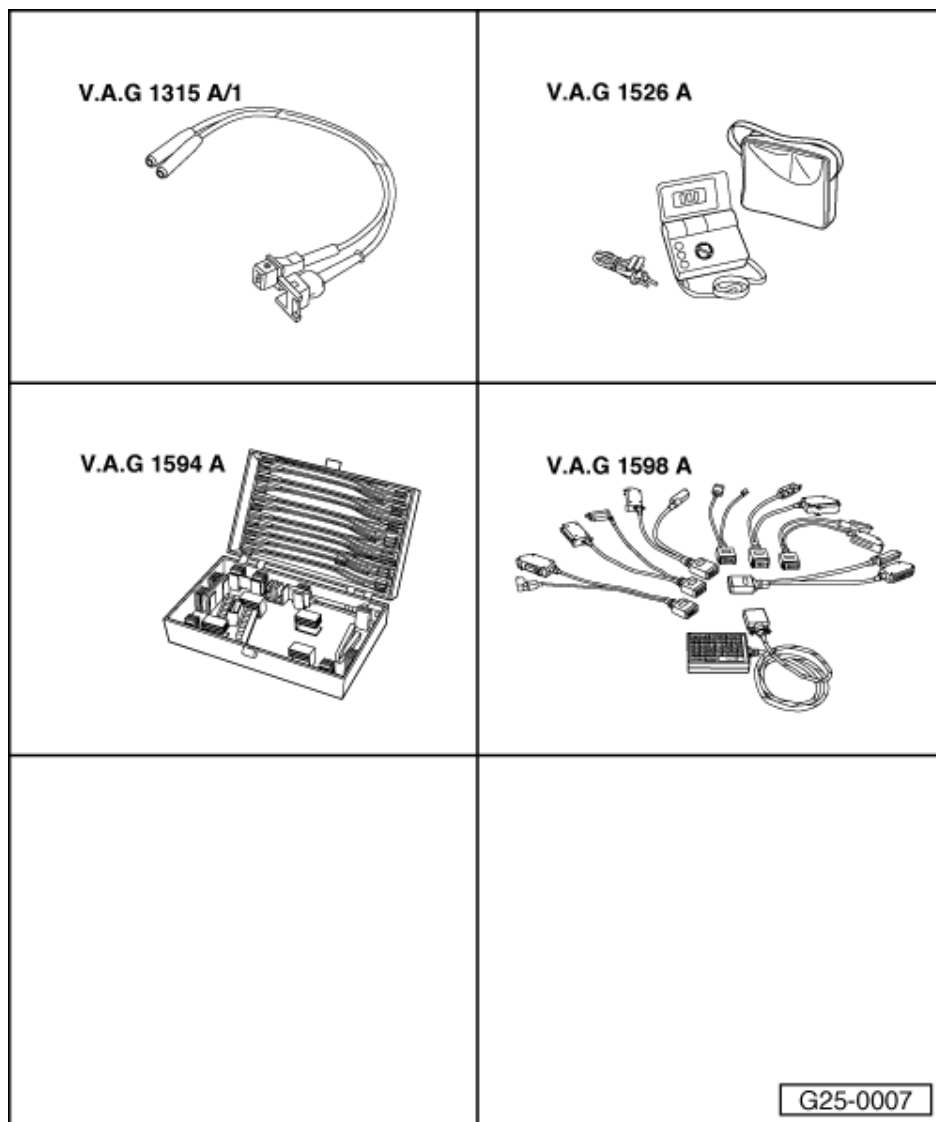
Connector contact	Test box V.A.G 1598/22 socket
1	66
2	59

- Rectify short circuit or open circuit if necessary.
- If wiring is OK, fit a new throttle valve control unit -J338.



7 - Checking auxiliary signals

7.1 - Checking auxiliary signals



7.2 - Checking signals from / to air conditioning system

Special tools, testers and auxiliary items required

- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A



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Checking engine speed adaptation and compressor shut-off

Notes:

- ◆ When the air conditioner is switched on a positive signal is sent to contact 8 on the engine control unit.
- ◆ The signal causes the engine control unit to maintain a constant idling speed despite the varying power requirement of the air conditioner.
- ◆ The air conditioning compressor signal informs the engine control unit that the compressor will be switched on in 140 ms.
- ◆ The engine control unit can send a signal via the same wire to shut off the air conditioner compressor.
- ◆ The engine control unit will shut off the air conditioning compressor in the following cases:
 - In the event of heavy acceleration (full throttle)
 - In the emergency programme (emergency running mode)
 - If the coolant temperature is more than 120°C

Test requirements:

- Air conditioning system OK
- No faults recorded in fault memory of engine control unit
- Vehicle at room temperature (warmer than + 15 °C)

Test sequence

- Connect fault reader V.A.G 1551 => Page **1**.
- Read measured value block, Display Group 020, Engine idling =>Page **52**.

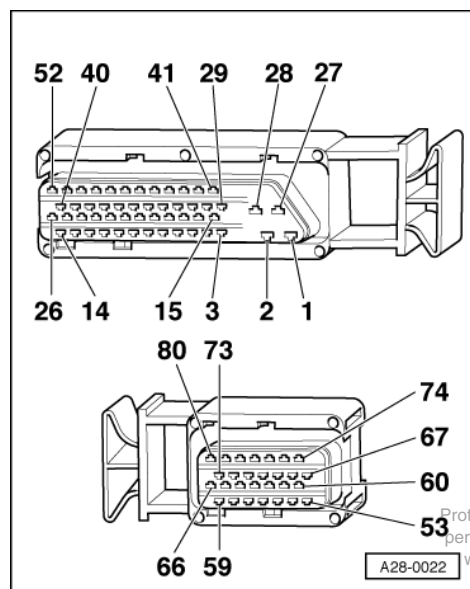
-> Display readout:

Read measured value block 20			
1	2	3	4

- Switch off air conditioner.
 - Specification for display zone 4: Compr. OFF
 - Switch on the air conditioner by pressing the "Auto" key. The compressor must run.
 - Specification for display zone 1: Idling speed must remain constant (brief drop in speed for less than 1 s is permitted).
 - Specification for display zone 3: A/C-high
 - Specification for display zone 4: Compr. ON
- Abruptly depress the accelerator and release again (brief burst of throttle).
- Specification for display zone 4: Display switched for several seconds from "ON" to "OFF" (compressor shut-off on vehicle acceleration).

If the display is not as described:

- Switch off ignition.



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- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78**.
- -> Use current flow diagram to check for open circuit and short to earth or positive in wiring between contact 8 on engine control unit and air conditioner.

=> "Current Flow Diagrams, Electrical Fault Finding and Fitting Locations" binder

- If there are no faults in the wiring, check the operation of air conditioner.

=> Air conditioner; Repair Group 01; Self-diagnosis for air conditioner Self-diagnosis for air conditioner

7.3 - Checking engine speed signal

Notes:


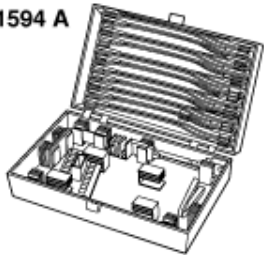

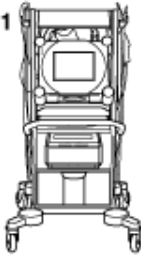
- ♦ The signal is generated by the engine speed sender -G28, processed in the engine control unit and relayed by the engine control unit to various electronic systems (e.g. control unit for air conditioner, automatic gearbox or ABS/EDL). The engine speed signal and wiring are monitored by these systems.
- ♦ Checking engine speed signal:

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



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7.4 - Checking vehicle speed signal

<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1598/22</p> 	<p>VAS 5051</p> 
	<p>G24-0003</p>

Special tools, testers and auxiliary items required

- ◆ V.A.G 1526 A
- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/22
- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Notes:

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- ◆ The speed signal is generated by the speedometer sender -G22 (at the gearbox) and processed in the dash panel insert.
- ◆ The processed signal goes to contact 20 on the engine control unit and is used for idling speed stabilisation and for the damping of load change jolts when changing gear.

**Test requirements:**

- Speedometer function and display OK, fault-finding:

=> Electrical System; Repair Group 90; Dash panel insert, Checking vehicle speed signal Dash panel insert, Checking vehicle speed signal

Test sequence

- Connect fault reader V.A.G 1551 => Page **1** .
- Read measured value block, Display Group 011, Engine idling =>Page **49** .

-> Display readout:

Read measured value block 11			
1	2	3	4

Warning:

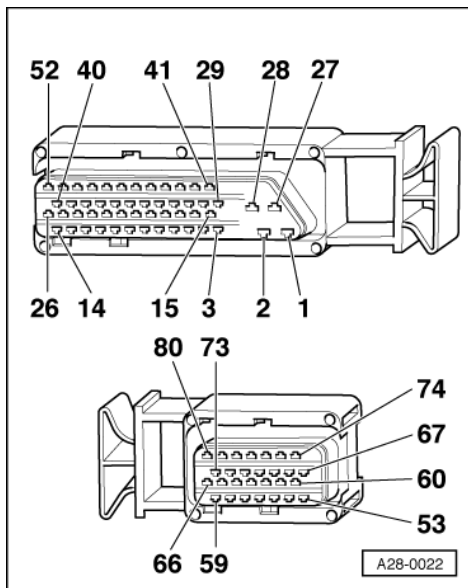
Attach fault reader to rear seat and operate it from there. When doing this, always observe the relevant safety precautions.
Page **57** .

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- Take vehicle for a test drive and check whether the vehicle speed appears in display zone 3.

If the vehicle speed is not displayed:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78** .



- -> Check for open circuit and short circuit in wiring between dash panel insert and contact 20 on connector for engine control unit.

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

If no wiring fault is detected:

- Establish which "recipients" of the road speed signal (e.g. radio, automatic gearbox, 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.

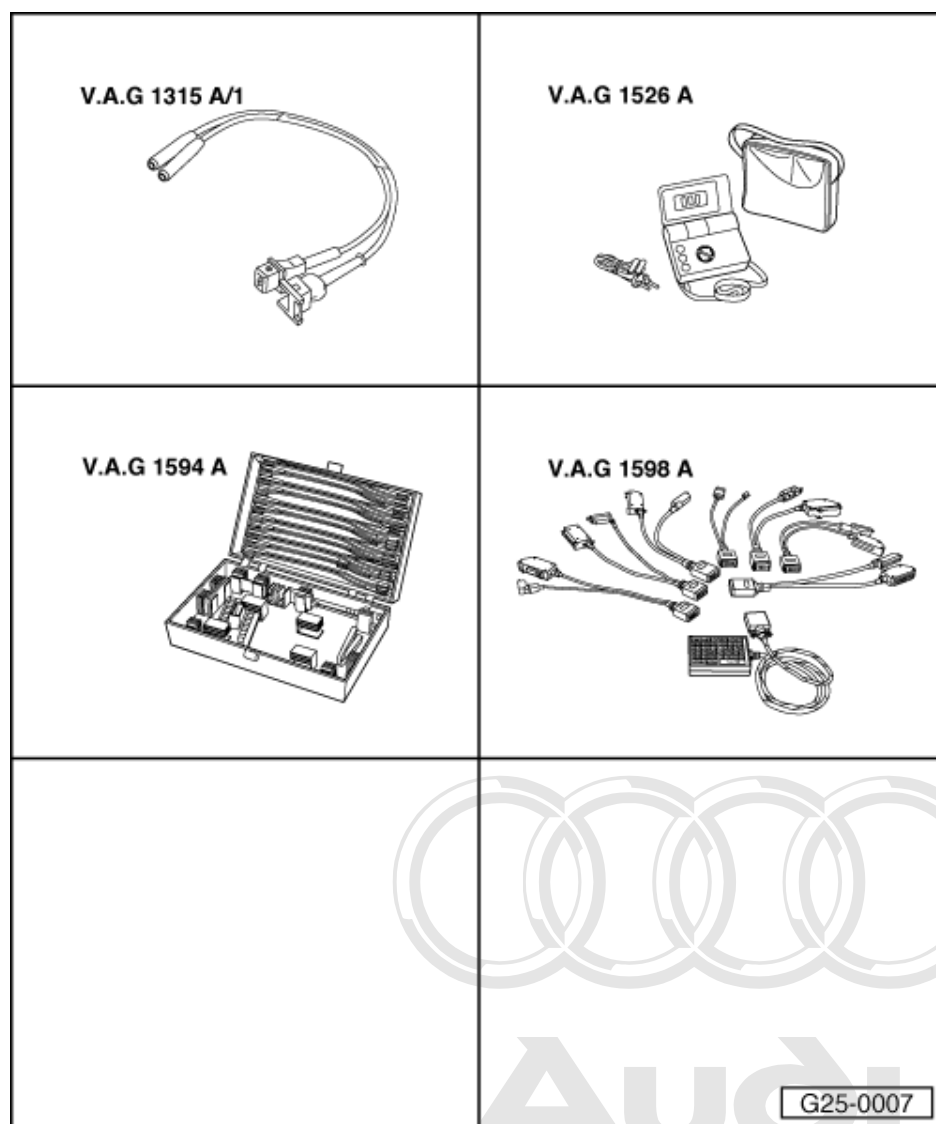
7.5 - Checking consumption signal for vehicle computer

Notes:

- ♦ The consumption signal is calculated by the engine control unit from the injection period and relayed to the on-board computer.
- ♦ Checking fuel consumption signal

=> "Current flow diagrams, Electrical fault-finding and Fitting locations" binder, vehicle computer fault-finding

7.6 - Checking output signal for throttle valve position



Special tools, testers and auxiliary items required

- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or



- ♦ V.A.G 1551 with V.A.G 1551/3 A

Note:

In conjunction with the engine speed signal this signal enables the automatic gearbox control unit to calculate the gearshift intervals.

Vehicles with engine control unit no.**4D0 907 551 C with data status less than D07**

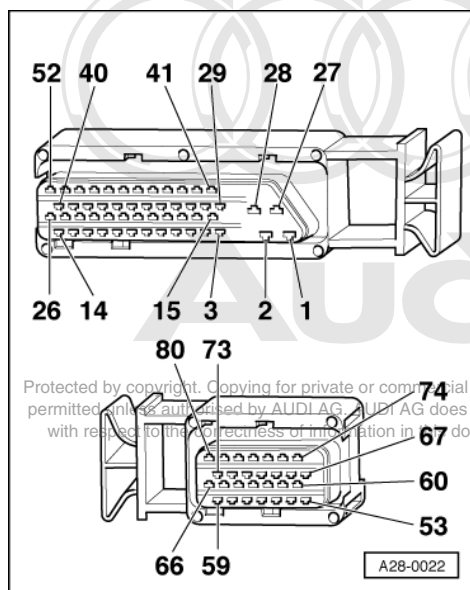
- Connect fault reader V.A.G 1551 => Page **1** .
- Start self-diagnosis of gearbox control unit:

=> Automatic gearbox 01V, Self-diagnosis; Repair group 01; Performing self-diagnosis Performing self-diagnosis

- If the gearbox control unit displays fault 00638 "Engine/gearbox electrical connection 2", interrogate fault memory of engine control unit => Page **4** .
- If the engine control unit has recorded a fault relating to the throttle valve potentiometer, rectify this fault first. (in this case the fault in the gearbox is a result of the fault in the potentiometer).

If no fault relating to the throttle valve potentiometer is displayed:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78** .



- -> Use current flow diagram to check wiring between contact 7 and gearbox control unit for open circuit/short circuit.

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

Vehicles with engine control unit no.**4D0 907 551 C as of data status D07**

Data exchange between engine control unit and gearbox control unit is handled by way of a CAN bus.

=> Checking CAN bus, Page **155** .

7.7 - Checking engine actual torque signal

Notes:

- ♦ The engine actual torque signal (engine actual torque/clutch torque) is relayed by the engine control unit to various electronic systems, e.g. the control units for automatic gearbox and ABS/ASR (traction control system).
- ♦ On vehicles with engine control unit no. 4D0 907 551 C with data status less than D07, the engine actual torque signal is transmitted on a single wire from the engine control unit to the ABS/ASR control unit and to the gearbox control unit.
- ♦ The wiring/engine actual torque signal (MMI) is monitored by the ABS/ASR control unit and the gearbox control unit.

=> Running Gear Self-Diagnosis; Repair Group 01

=> Automatic gearbox 01V, Self-diagnosis; Repair group 01; Performing self-diagnosis Performing self-diagnosis

Vehicles with engine control unit no.

4D0 907 551 C as of data status D07

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Data exchange between engine control unit and gearbox control unit is handled by way of a CAN bus.
=> Checking CAN bus, Page **155**.

7.8 - Checking engine specified torque signal from ABS/ASR control unit

Notes:

- ♦ The wiring/engine specified torque signal (MMS signal for rough road detection) is monitored by the ABS/ASR control unit.

=> Running Gear Self-Diagnosis; Repair Group 01


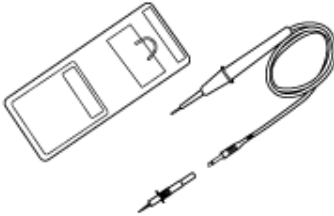
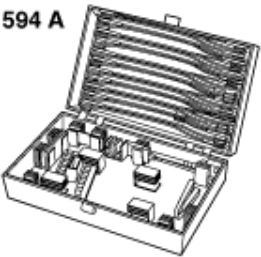

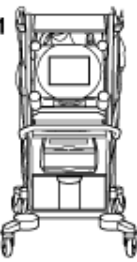
- ♦ For checking engine specified torque signal, refer to Reading measured value block / display group 024.

Test requirements:

- Control unit encoding OK => Page **32**.



7.9 - Checking gear signal

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/22 
VAS 5051 	<p>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.</p> <p>G24-0012</p>

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Note:

By way of the multi-function switch -F125 on the gearbox, the engine control unit detects whether a gear is engaged (selector lever set to 2 / 3 / 4 / R / D) or not (selector lever set to P or N).

Vehicles with engine control unit no.

4D0 907 551 C with data status less than D07

- Connect fault reader V.A.G 1551 => Page 1.
- Read measured value block, Display Group 020, engine stopped =>Page 52

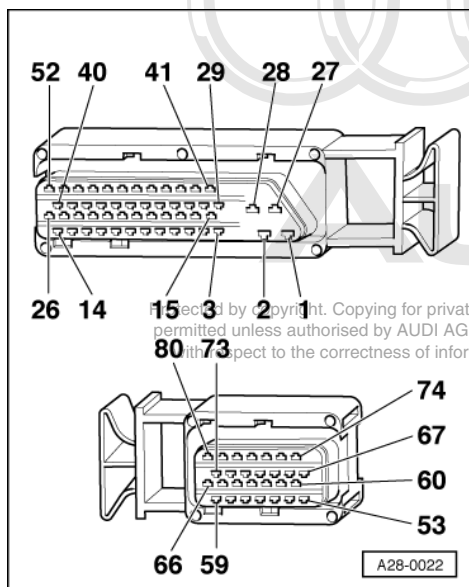
-> Display readout:

Read measured value block 20			
1	2	3	4

- Check display in display zone 2.
 - Specified value: "Neutral" (selector lever in P or N)
- Depress the brake pedal and engage a gear.
 - Specified value: "Gear ENG"

If the display is not as described:

- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78.



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

Test box V.A.G 1598/22	
socket	socket
3 (positive)	22 (signal)

- Move selector lever to position P or N.
 - The LED should light up.
- Press brake pedal and engage gear (selector lever set to 2 / 3 / 4 / R / D).
 - The LED should go out.

If LED does not light at all or lights continuously:

- Check for open circuit and short circuit in wiring between contact 22 on connector for engine control unit and multi-function switch.

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

- If there are no faults in the wiring, test the multi-function switch.



=> Automatic gearbox 01V Self-diagnosis; Repair Group 01; Electrical testing Electrical testing


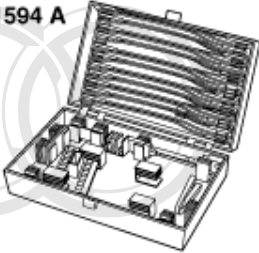
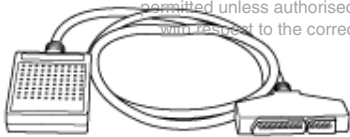
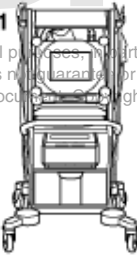
Vehicles with engine control unit no.

4D0 907 551 C as of data status D07

Data exchange between engine control unit and gearbox control unit is handled by way of a CAN bus.

=> Checking CAN bus, Page **155** .

7.10 - Checking ignition timing retardation on changing gear

<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1598/22</p> 	<p>VAS 5051</p> 
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<p>G24-0003</p>	

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Notes:

- ♦ The engine control unit receives the gearshift signal from the gearbox control unit. As a function of vehicle speed and engine speed, the engine control unit then briefly retards the ignition timing, thus reducing torque and making the gear change smoother.
- ♦ On account of the brief signal, the torque reduction prompt is not always recognised and is therefore not always displayed by V.A.G 1551.

Test sequence

- Connect fault reader V.A.G 1551 => Page 1.
- Read measured value block, Display Group 019, Engine idling =>Page 51.

-> Display readout:

Read measured value block 19			
1	2	3	4

- Apply handbrake and also press brake pedal.
- On engaging gear, observe display in zones 3 and 4.
 - Display zone 3 shows the engine torque required for changing gear (specified torque).
 - Display zone 4 shows the actual engine torque (clutch torque/actual torque).

The values in the two display zones must become assimilated on engaging gear. Ignition timing retardation is then active.

- If ignition timing retardation is not active, continue testing as follows:

Vehicles with engine control unit no.

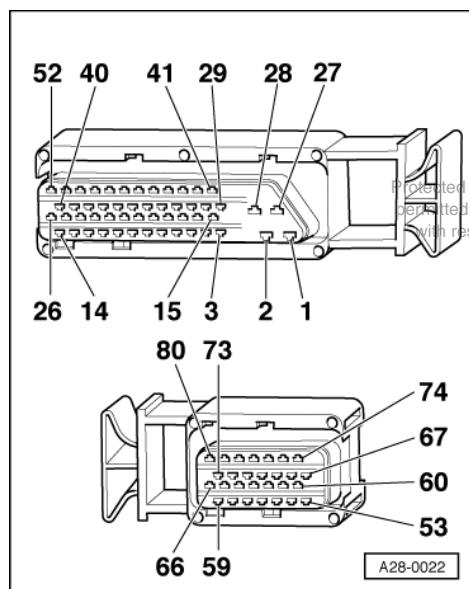
4D0 907 551 C with data status less than D07

The wiring/gearshift signal is monitored by the gearbox self-diagnosis (fault code 00545).

=> Automatic gearbox 01V; Repair Group 01; Self-diagnosis Self-diagnosis

If no torque reduction is displayed on the measured value block during a gearshift, or if fault code 00545 appears (in the gearbox control unit):

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78.



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- -> Use current flow diagram to check wiring between engine control unit and gearbox control unit for open circuit/short circuit.

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

Vehicles with engine control unit no.

4D0 907 551 C as of data status D07

Data exchange between engine control unit and gearbox control unit is handled by way of a CAN bus.

=> Checking CAN bus, Page **155** .

7.11 - Checking change up/changedown signal

Notes:

- ♦ The engine control uses these signals in conjunction with the gearshift signal (ignition timing retardation on shifting gear) to detect whether the gear is being changed up or down.
- ♦ The wiring and change-up/change-down signal are monitored by the gearbox control unit:

=> Automatic gearbox 01V, Self-diagnosis; Repair group 01; Performing self-diagnosis Performing self-diagnosis

Test requirements:

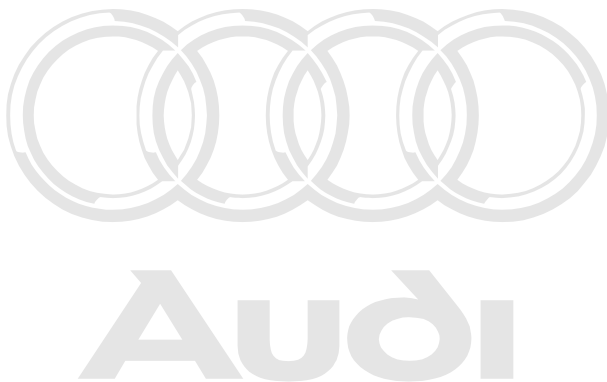
- Control unit encoding OK => Page **32** .

Vehicles with engine control unit no.

4D0 907 551 C as of data status D07

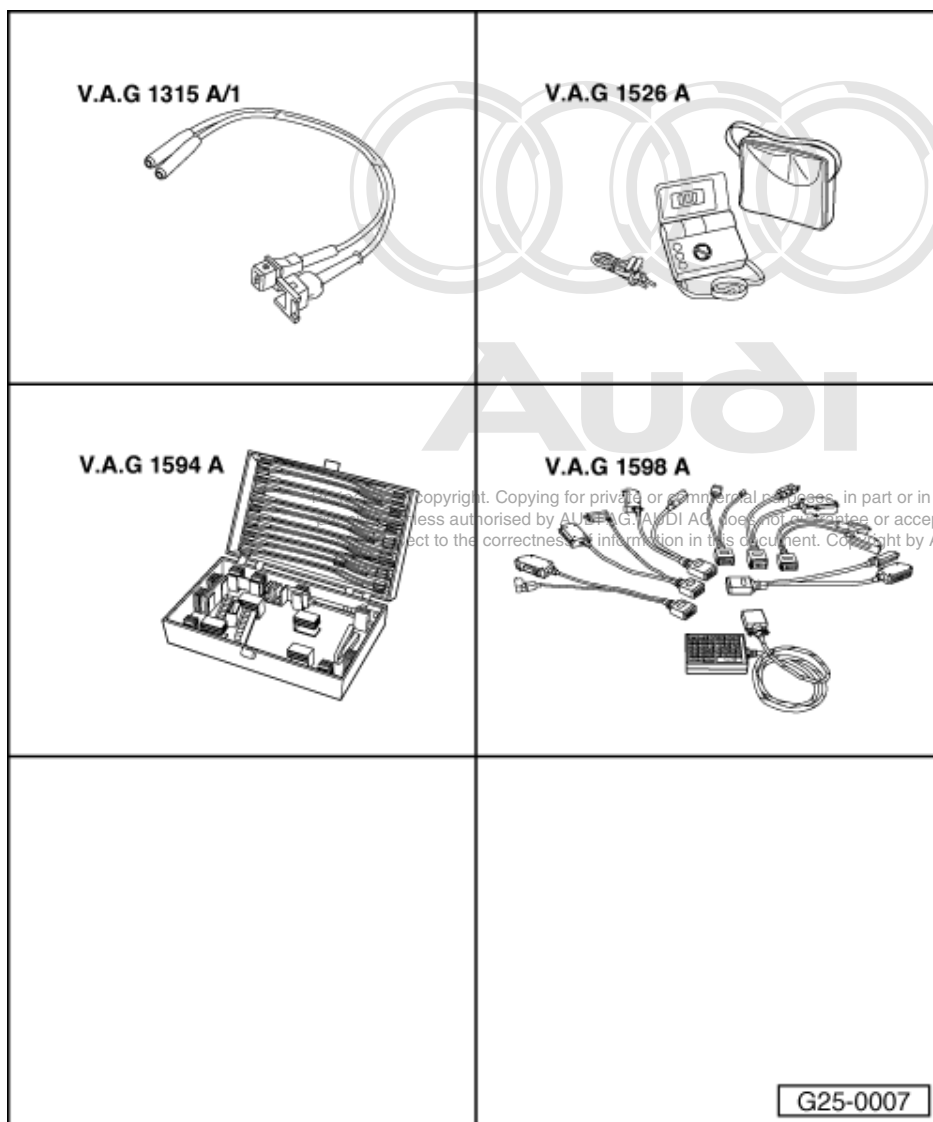
Data exchange between engine control unit and gearbox control unit is handled by way of a CAN bus.

=> Checking CAN bus, Page **155** .



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7.12 - Checking CAN bus



Special tools, testers and auxiliary items required

- ◆ V.A.G 1594 A
- ◆ V.A.G 1598/22
- ◆ VAS 5051

or

- ◆ V.A.G 1551 with V.A.G 1551/3 A

Checking data exchange between engine control unit and gearbox control unit (CAN bus)

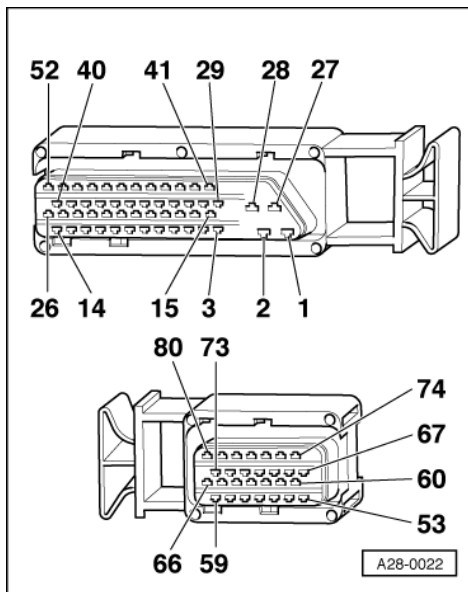
Engine control unit no. 4D0 907 551 C as of data status D07

- Connect fault reader V.A.G 1551 => Page 1.
- Read out fault memory of gearbox control unit.

=> Automatic gearbox 01V, Self-diagnosis; Repair group 01; Performing self-diagnosis Performing self-diagnosis



If a fault relating to the CAN bus appears on the display:



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- Switch off ignition.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78**.
- -> Check for open/short circuit in wiring between contacts 29 and 41 at engine control unit and gearbox control unit.

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

- If wiring is OK, try replacing gearbox control unit or engine control unit.

28 - Ignition system

1 - Checking ignition system

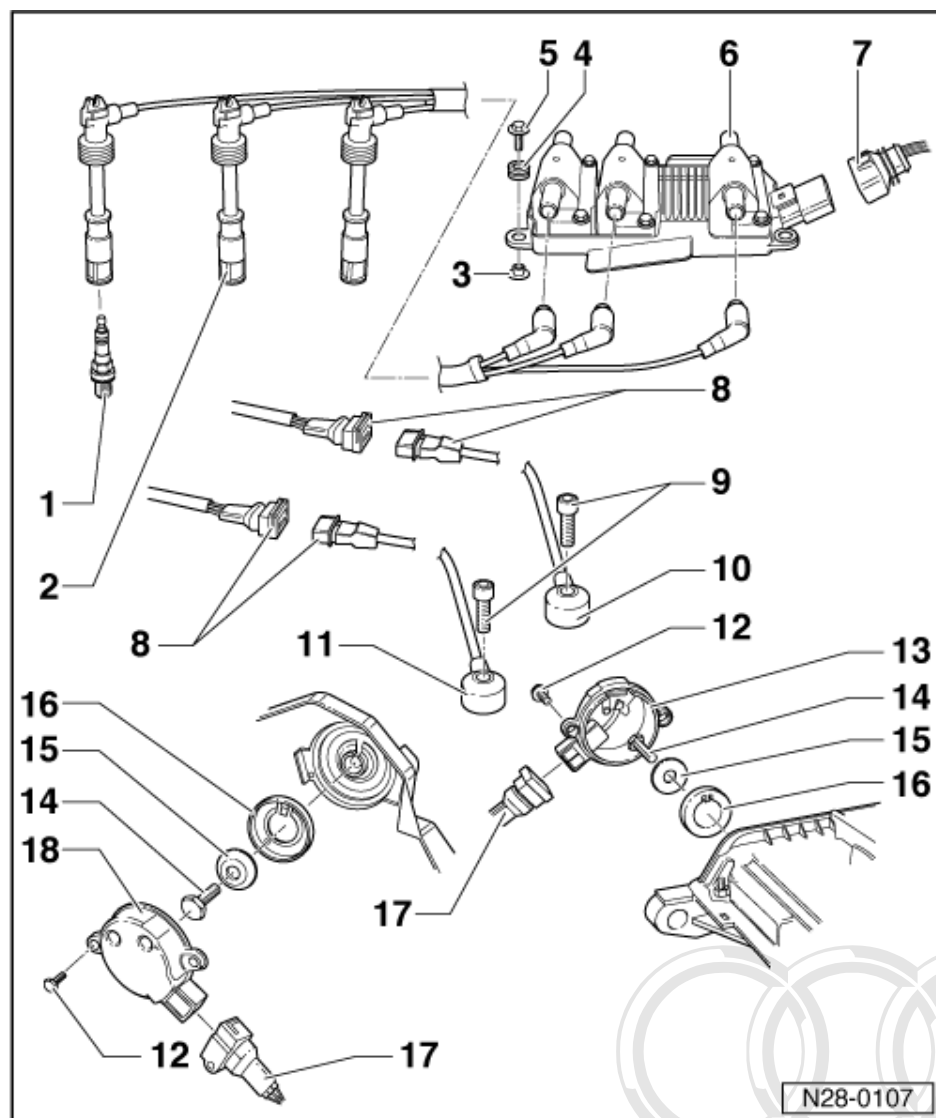
1.1 - Checking ignition system

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1.2 - Safety precautions

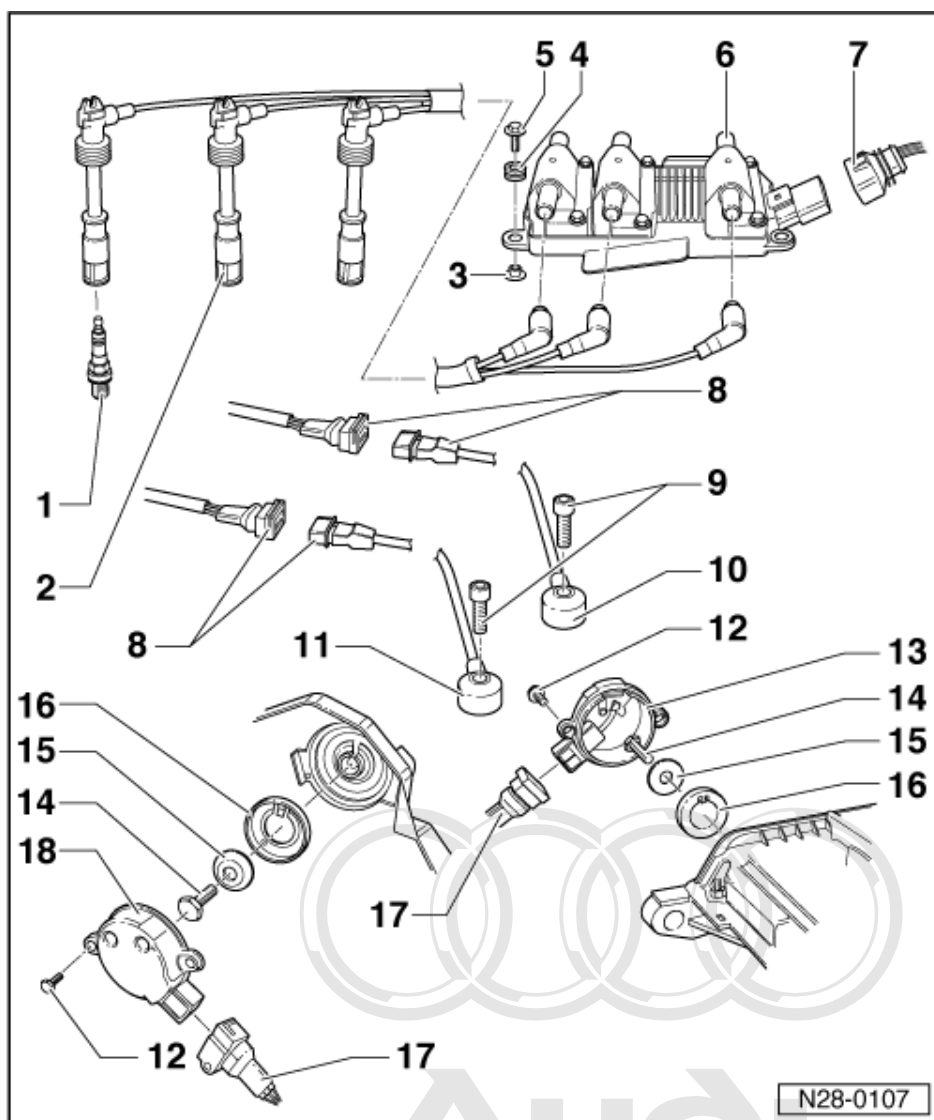
To prevent injuries to persons and/or damage to the fuel injection and ignition system, the following must be noted:

- ◆ Do not touch or disconnect ignition wiring when the engine is running or being turned at starter speed.
- ◆ Always switch off the ignition before connecting or disconnecting ignition system wiring. This also applies to HT cables and measuring instrument leads.
- ◆ To operate the engine at starting speed without actually starting it (for example, to check the compression), unplug the connector from the power output stage for the ignition coils and the connectors from the injectors. After completing the work, interrogate the fault memory.
- ◆ Always switch off the ignition before cleaning the engine.
- ◆ Always switch off the ignition before connecting or disconnecting the battery, otherwise the engine control unit may be damaged.
- ◆ For assisted starts with a rapid charging unit the maximum permissible voltage is 16.5 V and the maximum charging time is 1 minute.

**1.3 - Removing and installing ignition system components**

- 1 Spark plug - 30 Nm
 - ♦ Use 3122 B to remove and install
- 2 Spark plug connector with ignition cable
- 3 Spacer sleeve
- 4 Rubber grommet
- 5 10 Nm
- 6 Ignition coils -N, -N128, -N158
 - ♦ With output stage -N122
 - ♦ With ignition cable identification, do not interchange

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7 Connector

- ♦ Black, 5-pin

8 3-way connector

- ♦ Gold plated contacts

9 20 Nm

- ♦ Tightening torque affects function of knock sensor

10 Knock sensor 2 -G66

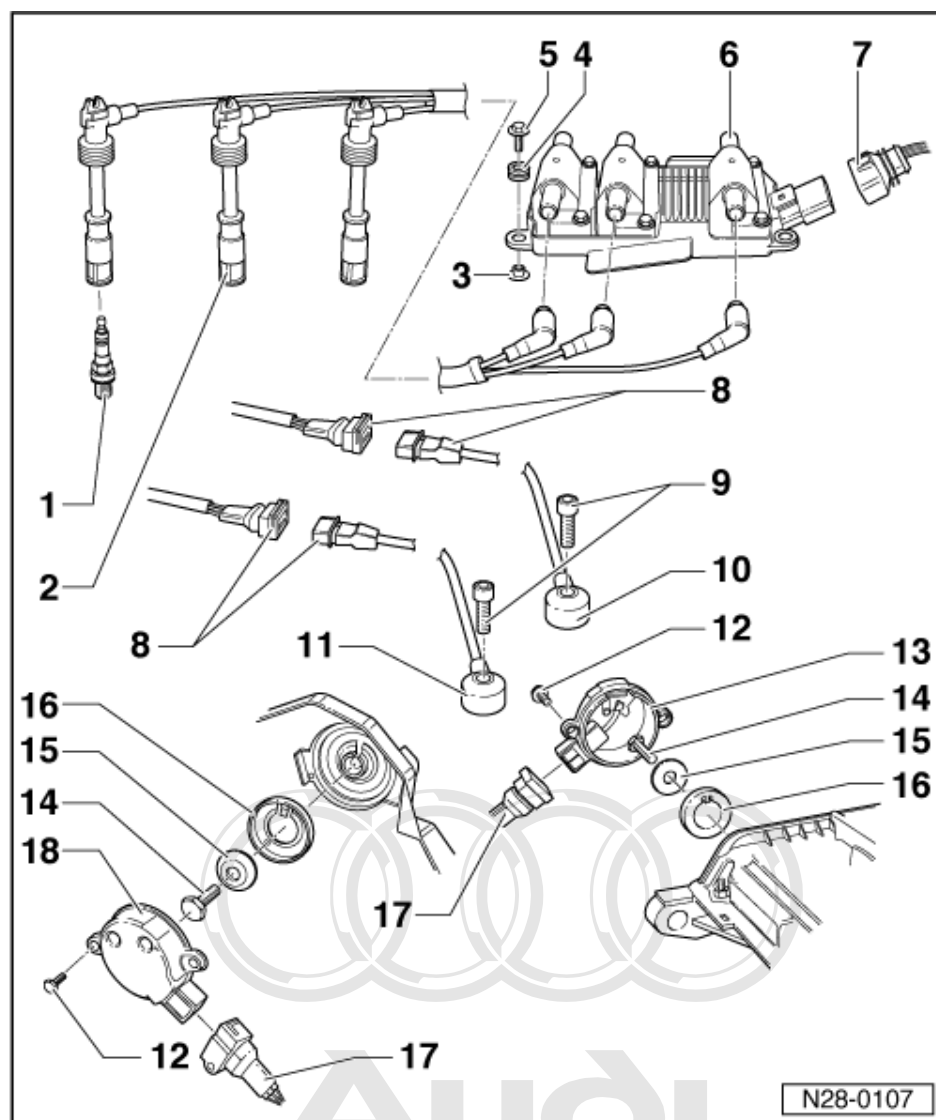
- ♦ Cylinder bank 2
- ♦ Sensor and connector contacts gold plated

11 Knock sensor 1 -G61

- ♦ Cylinder bank 1
- ♦ Sensor and connector contacts gold plated

12 10 Nm

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13 Hall sender -G40

- ◆ Cylinder bank 2

14 25 Nm

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15 Washer

- ◆ Tapered

16 Rotor ring

- ◆ For Hall sender
- ◆ Pay attention to locating element on assembly

17 Connector

- ◆ Black, 3-pin
- ◆ For Hall sender -G40/-G163

18 Hall sender -G163

- ◆ Cylinder bank 1


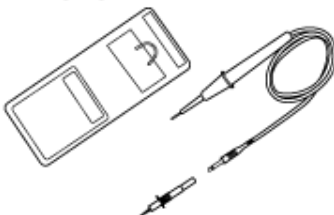
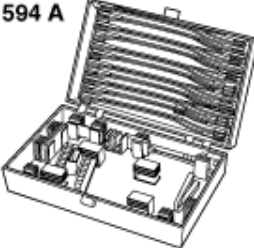
1.4 - Technical data

Engine code letters	ACK (2.8 l / 5V / 142 kW engine) ALG (2.8 l / 5V / 142 kW engine with secondary air induction)
Ignition timing is determined by the control unit. Ignition timing cannot be adjusted.	
Ignition system	Twin-spark ignition system with three ignition coils
Spark plugs 1)	Tightening torque: 30 Nm.
Firing order	1-4-3-6-2-5
Engine speed limitation by Motronic system Cut off speed	approx. 6500 rpm

1) Up-to-date specifications:
=> "Emissions test" binder

1.5 - Checking ignition coils

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V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	

G24-0006



**Special tools,
testers and auxiliary items required**

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A

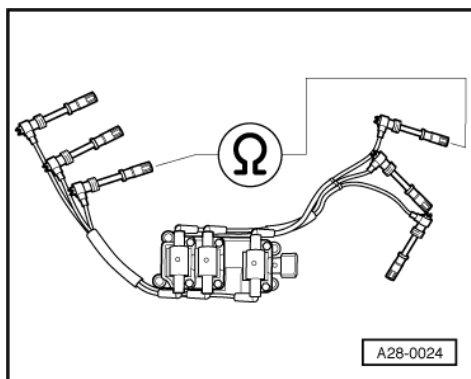
Notes:

- ♦ Ignition coils and output stage form a joint component.
- ♦ Primary resistance of ignition coils cannot be measured.
- ♦ Secondary resistance should be measured first with ignition cables connected to ignition coils by way of spark plug connectors of respective cylinders (interference suppression resistances of ignition cables are also measured in the course of this).
- ♦ Fitting location =>Page 59 .

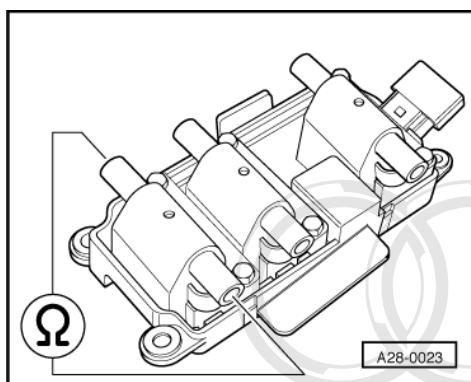
- Unplug 5-pin connectors from ignition coils.

Checking ignition coils -N, -N128, and -N158

- Disconnect ignition cables from ignition coils.



- -> Connect up multimeter between the two spark plug connectors of the ignition circuit to be checked to measure resistance.
 - Specified value: 16 ... 27 k Ω in each case
- If the specified values are not attained, pull ignition cables off ignition coils and measure ignition cables/ignition coils separately.



- -> To measure resistance, connect up multimeter between the two ignition cable connections of the ignition coil that is to be checked.

or

- To measure resistance, connect up multimeter between the two ignition cable connections of the ignition cable that is to be checked.

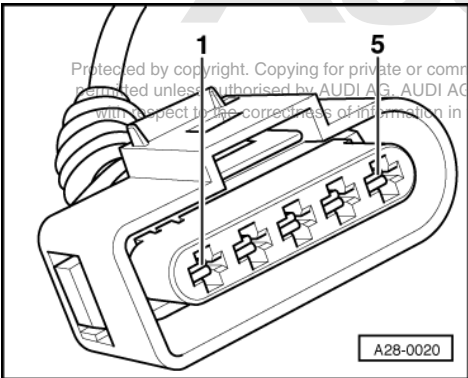
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Specifications:

Ignition coils	Ignition cables
8.0 ... 14.0 kW	3.0 ... 7.0 kW

- Replace defective components if specified values are still not attained.

Checking earth supply of output stage



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

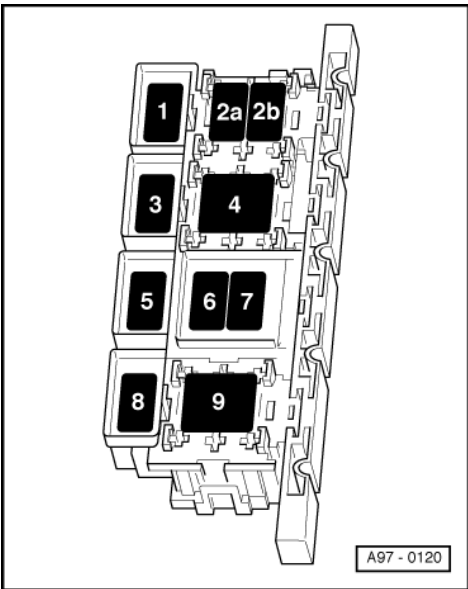
Connector contact	Measure to
2	Battery positive

- The LED should light up.

If the LED does not light up:

- Use current flow diagram to check wiring and rectify short circuit.

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



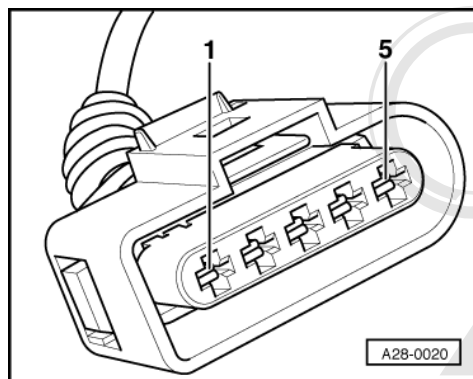


Checking power supply of ignition coils

Test requirements:

- -> Fuse S115 OK (in relay and fuse carrier, electronics box, plenum chamber, position 9:

Test sequence



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

Connector contact	Measure to
1	Engine earth

- Switch the ignition on.
 - The LED should light up.

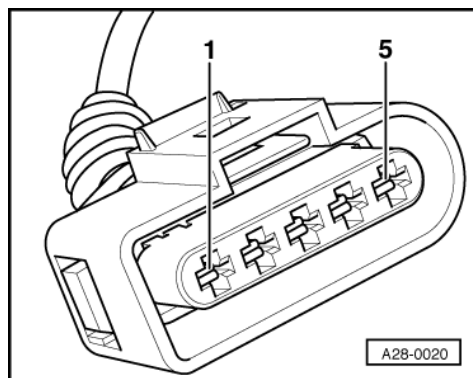
If the LED does not light up:

- Use current flow diagram to check wiring for open circuit. Repair if necessary / check fuse.

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

Checking actuation

- Pull connectors off all 6 injectors. (then interrogate fault memory).



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

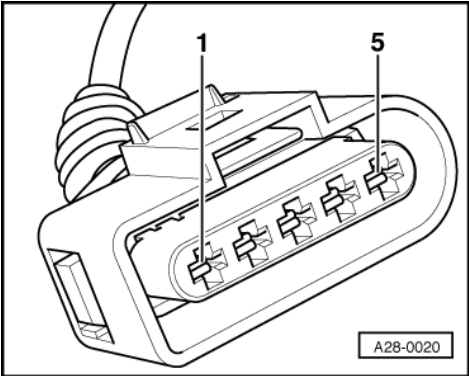
Connector contact	Measure to
3	Engine earth
4	Engine earth

Connector contact	Measure to
5	Engine earth

- Operate starter briefly.
- The LED should flash.

If LED does not flash:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



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

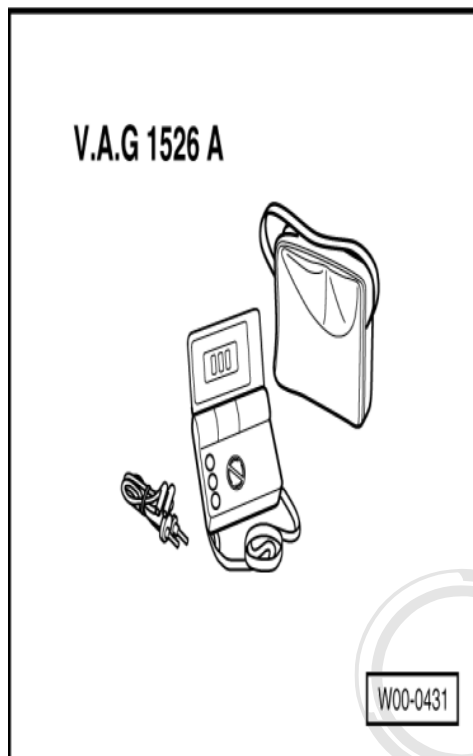
Connector contact	Test box V.A.G 1598/22 socket
3	71
4	78
5	70

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .

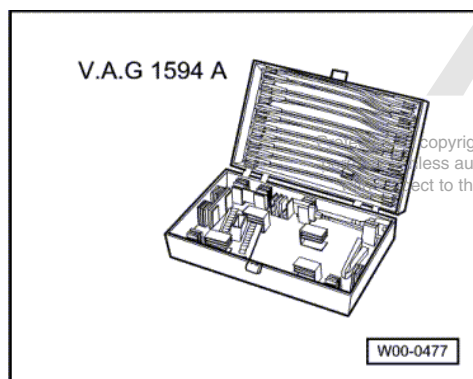


1.6 - Checking intake air temperature sender

Special tools, testers and auxiliary items required



- ♦ V.A.G 1526 A



- ♦ V.A.G 1594 A

Notes:

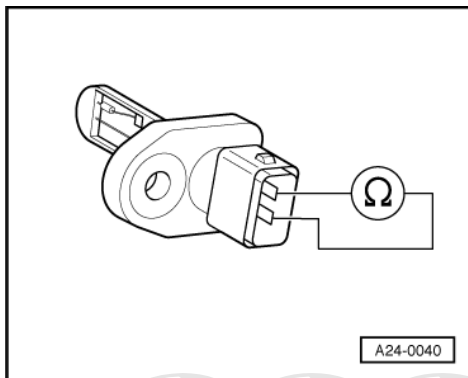
- ♦ For checking function of intake air temperature sender, see also "Reading measured value block" Display Group 003, display zone 4.
- ♦ Fitting location of intake air temperature sender => Page 59 .

Test requirements:

- Engine cooled to room temperature (approx. 20 °C).

Test sequence

- Unplug connector from intake air temperature sender.



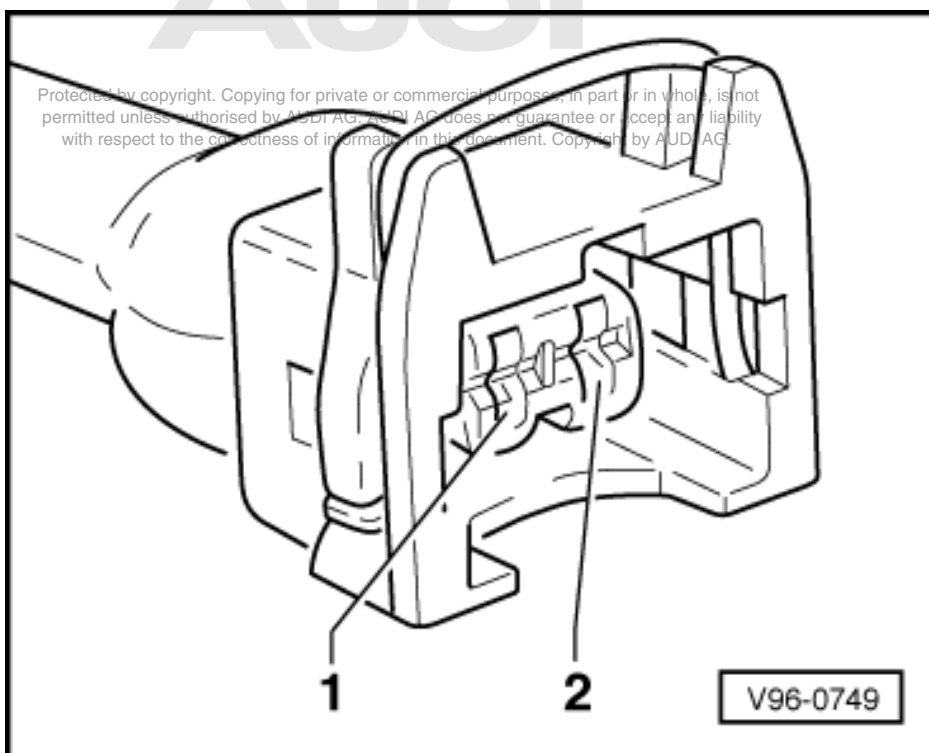
- -> Connect multimeter to sender to measure resistance.
- Specified value: 5.7 ... 6.7 kΩ

If the specification is not obtained:

- Renew intake air temperature sender.

If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .




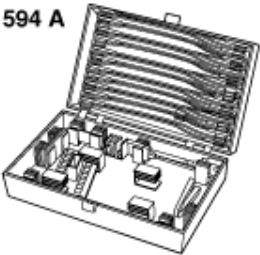

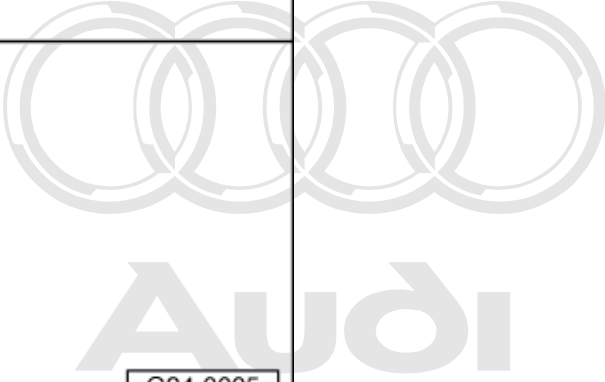
- -> Check for open circuit and short to positive or earth in the following wiring connections:

Connector contact	Test box V.A.G 1598/22 socket
1	54
2	67

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .



1.7 - Checking engine speed sender -G28

V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/22 	
	 G24-0005

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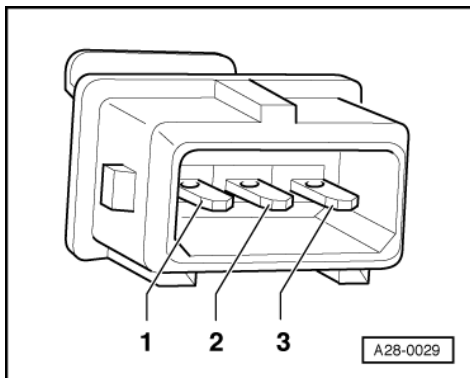
Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22

Notes:

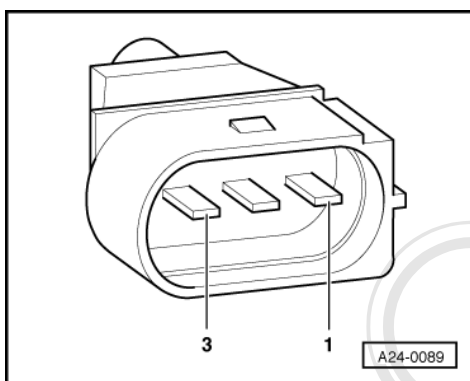
- ♦ The engine speed sender is a combined speed sender and reference mark sender. The engine cannot be started without a signal from the -G28 engine speed sensor. If the signal from the -G28 engine speed sensor fails while the engine is running, the engine will cut out immediately.
- ♦ -G28 is provided with a shim to obtain a defined gap between -G28 and the sender wheel.
If the engine speed sender is fitted without a shim, the sender will be destroyed by the sender wheel.
- ♦ For testing the operation of the engine speed sender, see also "Reading measured value block", Display Group 003, display zone 1.

Various engine speed senders, which can be distinguished by way of their connectors and contact assignments, have been fitted in the current series:



-> Rectangular plug for engine speed sender

- Checking engine speed sender =>Page 169

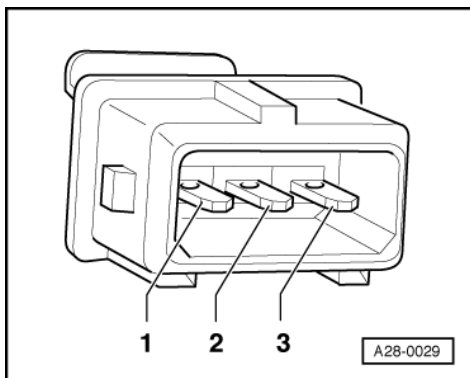


- -> Oval plug for engine speed sender
- Checking engine speed sender =>Page 170

Checking engine speed sender with rectangular plug

Fitting location for sender and connector =>Page 61

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- Disconnect connector for engine speed sensor (identification: grey connector).



- -> Connect multimeter between contacts 1 and 2 to measure resistance.
- Specified value: 730 ...1000 Ω

If the specification is not obtained:

- Fit a new engine speed sender.



If the specification is obtained:

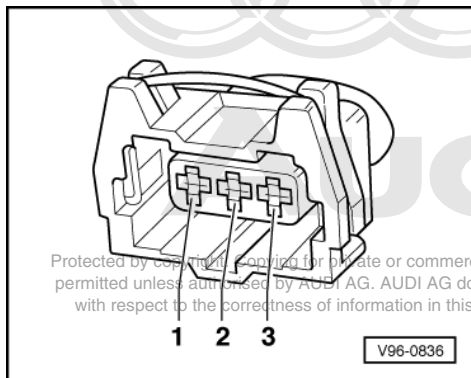
- Connect multimeter between contacts 1 and 3 (earth) and 2 and 3 (earth) to measure resistance.
 - Specified value: infinity in each case ω (no continuity).

If the specification is not obtained:

- Fit a new engine speed sender.

If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **78**.



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

Connector contact	Test box V.A.G 1598/22 socket
1 (signal)	56
2 (earth)	63
3 (screening)	67

- Rectify short circuit or open circuit if necessary.
- If no fault has yet been found, check tightness of sender wheel at crankshaft.

Checking of sender wheel involves removing sender.

- Slowly crank engine and check sender wheel for concentricity/tight fit.

Note:

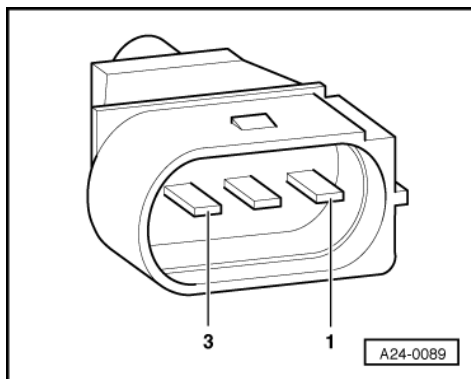
It is normal for there to be a larger gap at a certain point in the sender wheel, as this is the reference mark.

- If no faults have been found in any of the above tests, fit a new engine control unit =>Page **78**.

Checking engine speed sender with oval plug

Fitting location for sender and connector =>Page **61**

- Before carrying out the test, make sure that the sender is correctly installed and firmly seated.
- Disconnect connector for engine speed sensor (identification: grey connector).



- -> Connect multimeter between contacts 2 and 3 to measure resistance.
- Specified value: 730 ...1000 Ω

If the specification is not obtained:

- Fit a new engine speed sender.

If the specification is obtained:

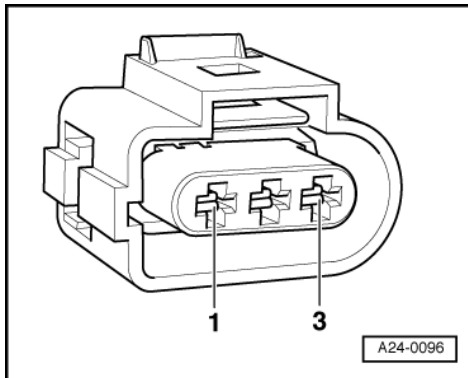
- Connect multimeter between contacts 2 and 1 (earth) and 3 and 1 (earth) to measure resistance.
- Specified value: infinity in each case Ω (no continuity).

If the specification is not obtained:

- Fit a new engine speed sender.

If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



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

Connector contact	Test box V.A.G 1598/22 socket
1 (signal)	56
2 (earth)	63
3 (screening)	67

- Rectify short circuit or open circuit if necessary.
- If no fault has yet been found, check tightness of sender wheel at crankshaft.

Checking of sender wheel involves removing sender.

- Slowly crank engine and check sender wheel for concentricity/tight fit.

Note:


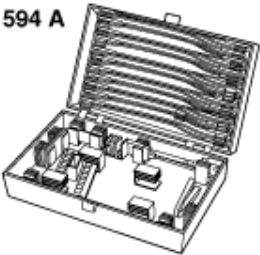

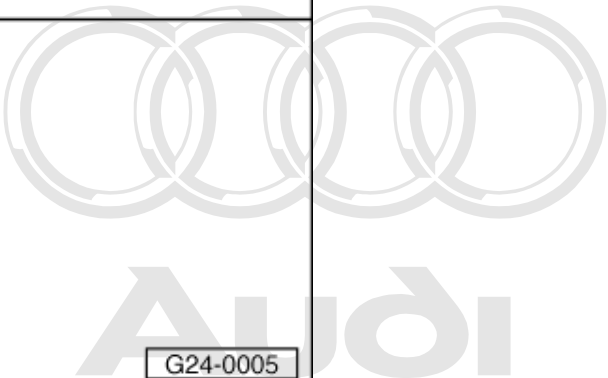
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It is normal for there to be a larger gap at a certain point in the sender wheel, as this is the reference mark.

- If no faults have been found in any of the above tests, fit a new engine control unit =>Page 78 .



1.8 - Checking coolant temperature sender -G62

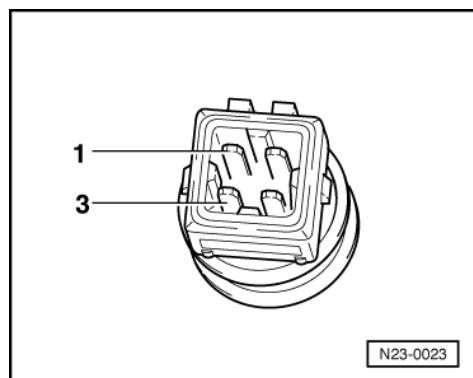
V.A.G 1526 A 	V.A.G 1594 A 
V.A.G 1598/22 	
	 G24-0005

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22

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Notes:

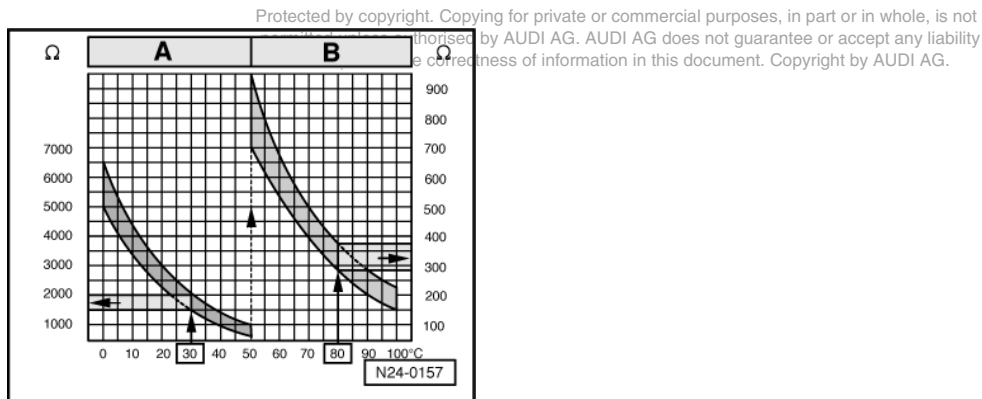


- ♦ For testing the operation of the coolant temperature sender, see also "Reading measured value block", Display Group 003, display zone 3.
- ♦ Fitting location of coolant temperature sender => Page 59 .

Test sequence

- Disconnect connector on coolant temperature sender.
- -> Check resistance between contacts 1 and 3 on the sender.

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



-> Sample readings:

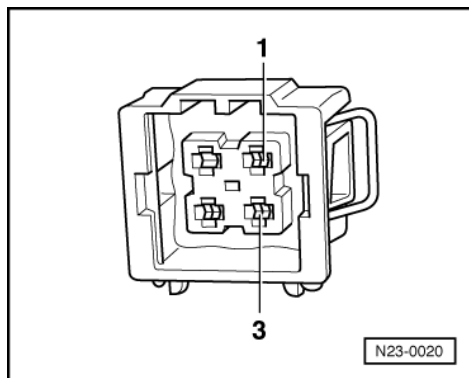
- ♦ 30 °C corresponds to a resistance of 1500...2000 ω
- ♦ 80 °C corresponds to a resistance of 275...375 ω

If the specification is not obtained:

- Renew coolant temperature sender.

If the specification is obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



- -> Check the following wires for open circuit and short to positive or earth (or short circuit to each other):

Connector contact	Test box V.A.G 1598/22 socket
1 (signal)	53
3 (earth)	67

- Rectify short circuit or open circuit if necessary.
- If the wiring is OK, fit a new engine control unit => Page 78 .

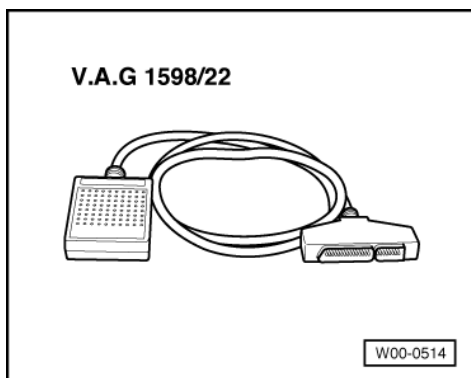


1.9 - Checking control unit power supply



Special tools, testers and auxiliary items required

- ♦ V.A.G 1527 B

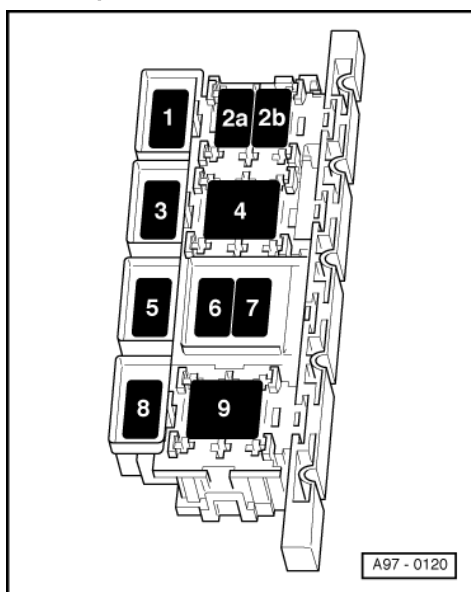


- ♦ V.A.G 1598/22

Notes:

- ♦ For testing the power supply to the engine control unit, see also "Reading measured value block", Display Group 003, display zone 2.
- ♦ Fitting location of engine control unit: In electronics box, plenum chamber, right-hand side.

Test requirements:



- -> Fuse S115 OK (in relay and fuse carrier, electronics box, plenum chamber, position 9:
- Battery voltage at least 11 V
- Alternator OK

Test sequence

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .
- Connect voltage tester V.A.G 1527 B as follows:

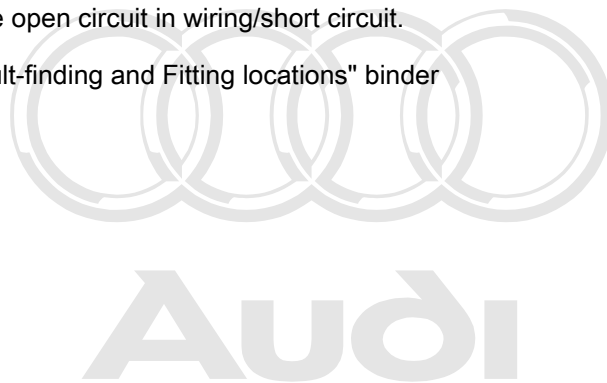
Test box V.A.G 1598/22 socket	Measure to
1 (positive via ignition)	Engine earth
1 (positive via ignition)	V.A.G 1598/22 Socket 2 (earth)
3 (permanent positive)	Engine earth

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

If the LED does not light up:

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


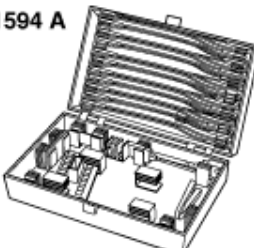

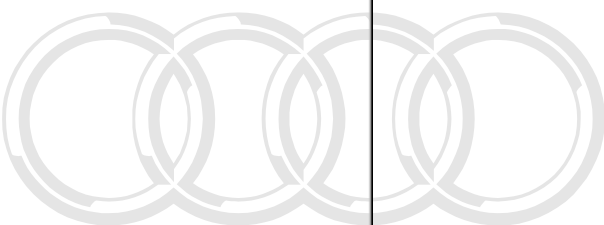
=> "Current flow diagrams, Electrical fault-finding and Fitting locations" binder



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1.10 - Checking knock sensors

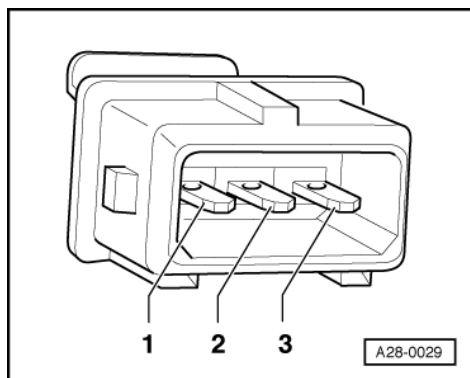
<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1598/22</p> 	
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Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22

Notes:

- ♦ For testing the operation of the knock sensors, see "Reading measured value block", Display Groups 012, 013, 014 and 015.
- ♦ Fitting locations of plug connectors and knock sensors => Page 59 .
- ♦ It is not possible to carry out an electrical test of the knock sensors themselves (interrogating fault memory =>Page 4).
- ♦ Detach intake manifold when removing and installing 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 connectors for corrosion.
- ♦ Use only gold plated contacts when repairing the contacts in the plug connectors for the knock sensors.

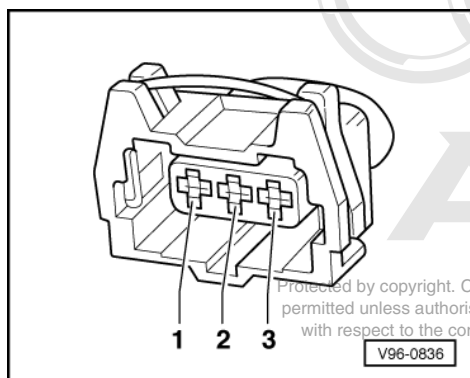


Checking knock sensor wiring

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

Checking wiring from knock sensors to engine control unit

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .
- Check for open circuit and short to earth/positive or earth in the following wiring connections:



- -> Knock sensor 1

-G61 connector contact	Test box V.A.G 1598/22 socket
1 (signal)	68
2 (earth)	67
3 (screening)	67


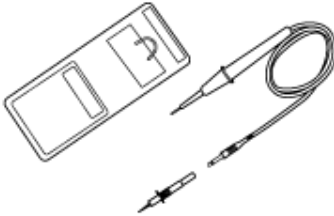
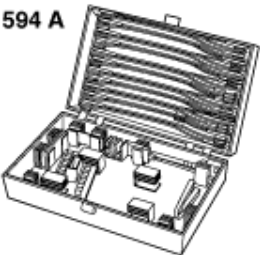

- Knock sensor 2

-G66 connector contact	Test box V.A.G 1598/22 socket
1 (signal)	60
2 (earth)	67
3 (screening)	67

- Rectify short circuit or open circuit if necessary.



1.11 - Checking Hall sensor

V.A.G 1526 A 	V.A.G 1527 B 
V.A.G 1594 A 	V.A.G 1598/22 
	<div>G24-0011</div>

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22

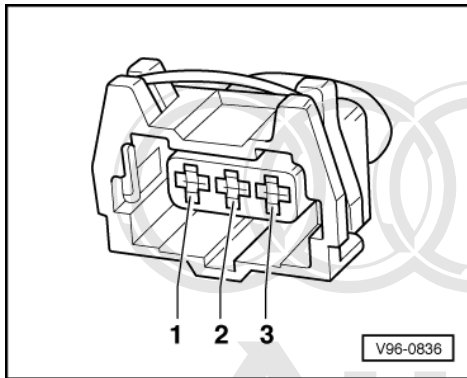
Notes:

- ♦ Hall sender -G40 is located at rear of left-hand cylinder head (bank 2).
- ♦ Hall sender -G163 is located at front of right-hand cylinder head (bank 1).
- ♦ Fitting location =>Page 61 .

Checking power supply

- Disconnect 3-pin connector from relevant Hall sender.

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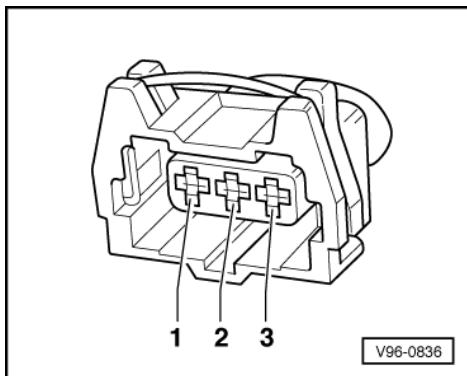


- -> Connect multimeter between contacts 1 (positive) and 3 (earth) to measure voltage.
- Switch the ignition on.
 - Specified value: at least 9 V

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If the specification is not obtained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .



- -> Check the following wires for open circuit and short to positive or earth (or short circuit to each other):

-G40 connector contact	Test box V.A.G 1598/22 socket
1 (positive)	11
3 (earth)	67

-G163 connector contact	Test box V.A.G 1598/22 socket
1 (positive)	11
3 (earth)	14

- If the wiring is OK, fit a new engine control unit => Page 78 .

Checking function

Note:

To check function of Hall sender, pull 5-pin plug off output stage with ignition coils and then interrogate fault memory.

Test requirements:

- Power supply of Hall sender OK, checking =>Page 178 .

Test sequence

- Slide back rubber grommets on connectors for Hall senders but leave connectors plugged in.



- Connect up voltage tester V.A.G 1527 B between receptacle 2 (Hall sender signal) and receptacle 1 (positive).

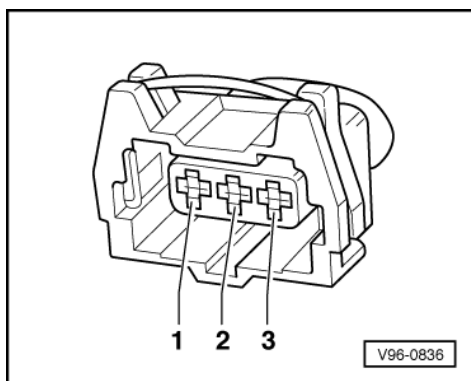
Note:

Receptacles are numbered accordingly on the back of the connector.

- Operate the starter for a few seconds.
 - The LED should flash briefly every second engine revolution.

If LED does not flash:

- Switch off ignition.
- Disconnect 3-pin connector from relevant Hall sender.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 78 .

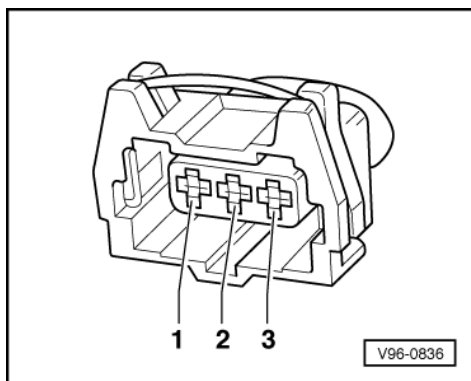


- -> Check for open circuit and short to positive or earth in the following wiring connections:

-G40 connector contact	Test box V.A.G 1598/22 socket
2 (signal)	76

-G163 connector contact	Test box V.A.G 1598/22 socket
2 (signal)	44

- Rectify short circuit or open circuit if necessary.
- If there are no open circuits or short circuits, reconnect engine control unit to engine wiring harness.



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- -> Connect multimeter between contacts 2 and 3 of connector to measure voltage.
- Switch the ignition on.
 - Specified value: at least 9 V

If the specification is not obtained:

- Fit a new engine control unit => Page 78 .

If the specification is obtained:

- Fit a new Hall sender.

2 - Checking camshaft timing control

2.1 - Checking camshaft timing control

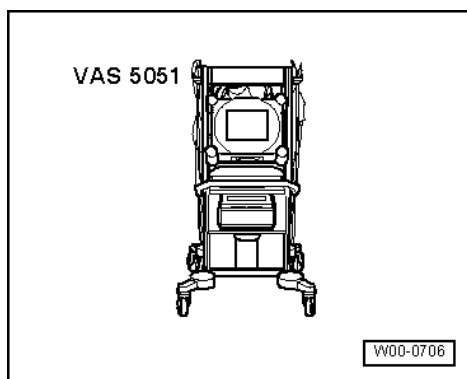
The adjustment of the intake camshaft is dependent on the engine load and engine speed. The solenoid valve of the camshaft positioner switches oil pressure to the camshaft adjuster (mechanical adjustment device).

Note:

Camshaft timing control only becomes active 25 seconds after starting engine.

2.2 - Checking camshaft timing control function

Special tools, testers and auxiliary items required



- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Test requirements:

- Coolant temperature at least 80 °C.

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Test sequence

- Connect fault reader V.A.G 1551 => Page 1 .
- Read measured value block, Display Group 027, Engine idling =>Page 55 .

-> Display readout:

Read measured value block 27			
1	2	3	4

- Observe display in display zones 1, 3 and 4.

Notes:

- ♦ Display zone 1 shows status of camshaft timing control:
 - Value "0": Actuation of camshaft timing not active



- Value "1": Actuation of camshaft timing active (Value "1" can only be obtained by way of a test drive)
- ♦ Positions marked "X" in display zone 1 can be ignored as regards checking of camshaft timing control.
- ♦ Display zones 3 and 4 show whether camshafts have actually been adjusted (feedback):
 - Normal position: -3.0°crankshaft...6.0°crankshaft
 - Switched position: 16.0°crankshaft...25.0°crankshaft

Specified values (engine idling):

Display zone 1	Display zone 3	Display zone 4
X.....X0	-3.0...6.0°crankshaft	-3.0...6.0°crankshaft

- Take the vehicle for a test drive.

Warning:

Attach fault reader to rear seat and operate it from there. When doing this, always observe the relevant safety precautions.

Page 57 .

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- Accelerate vehicle rapidly from standstill in first gear.

Specified values (test drive):


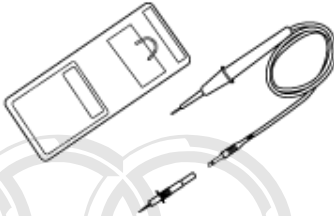
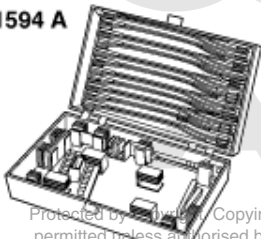

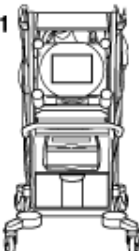
Display zone 1	Display zone 3	Display zone 4
X.....X1	16.0...25.0°crankshaft	16.0...25.0°crankshaft

Note:

If a value between 6.0 °crankshaft and 16.0 °crankshaft is displayed in fields 3 and/or 4 during test drive, the camshaft adjustment solenoid valves are switching the oil pressure properly to the respective mechanical camshaft adjuster, but this is not able to reach its end position (e.g. on account of stiffness).

- If specified values are not attained, check camshaft adjustment solenoid valves=>Page 183 .

2.3 - Checking camshaft adjustment solenoid valves

<p>V.A.G 1526 A</p> 	<p>V.A.G 1527 B</p> 
<p>V.A.G 1594 A</p> 	<p>V.A.G 1598/22</p> 
<p>VAS 5051</p> 	<p>G24-0012</p>

Special tools, testers and auxiliary items required

- ♦ V.A.G 1526 A
- ♦ V.A.G 1527 B
- ♦ V.A.G 1594 A
- ♦ V.A.G 1598/22
- ♦ VAS 5051

or

- ♦ V.A.G 1551 with V.A.G 1551/3 A

Note:

Fitting location of solenoid valves =>Page 62 .

Test sequence

- Connect fault reader V.A.G 1551 => Page 1 .



- Start final control diagnosis and actuate camshaft timing control => Page **28**.

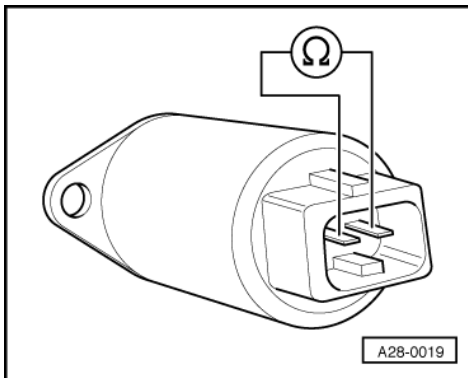
-> Display readout:

Final control diagnosis
Camshaft timing control 1

Camshaft adjustment valve 1 -N205 and camshaft adjustment valve 2 -N208 must be clearly heard to click.

If valves do not click:

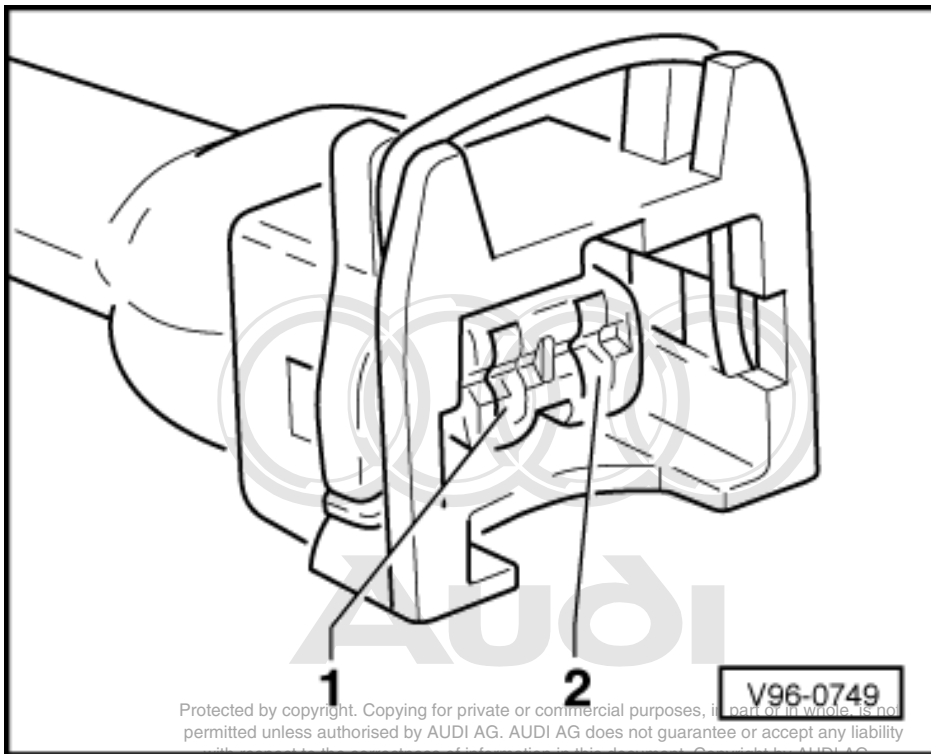
- Switch off ignition.



- Pull respective plug off solenoid valve.
- -> Connect multimeter to valve to measure resistance.
 - Specified value: 10 ... 18 Ω

If the specification is not obtained:

- Replace valve.

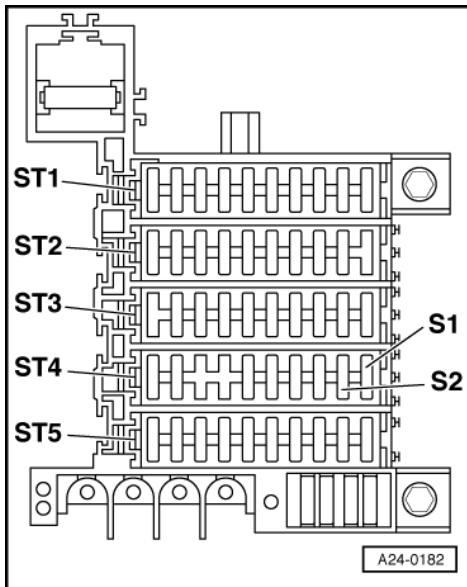


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Checking power supply of camshaft adjustment valves -N205 and -N208

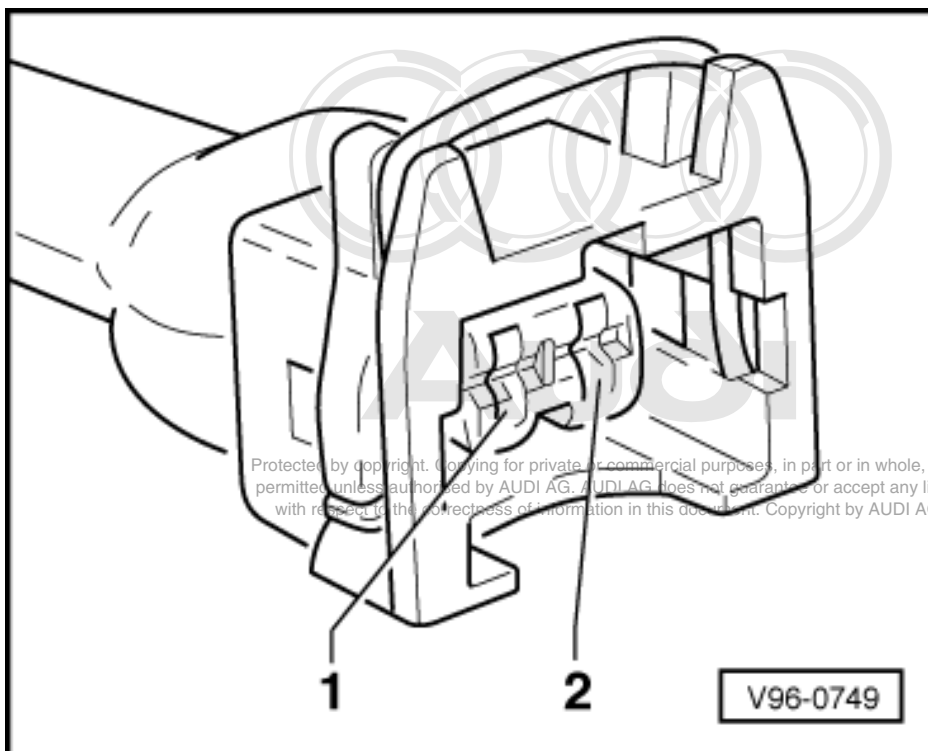
- Disconnect connector from relevant solenoid valve.

- -> Connect up voltage tester V.A.G 1527 B between contact 1 and engine earth.
- Operate the starter for a few seconds. Engine may start.
 - The LED should light up.



If the LED does not light up:

- Carry out the following tests (marked with dots):
- -> Check fuse S2 (in fuse holder, fuse carrier ST4 - blue).



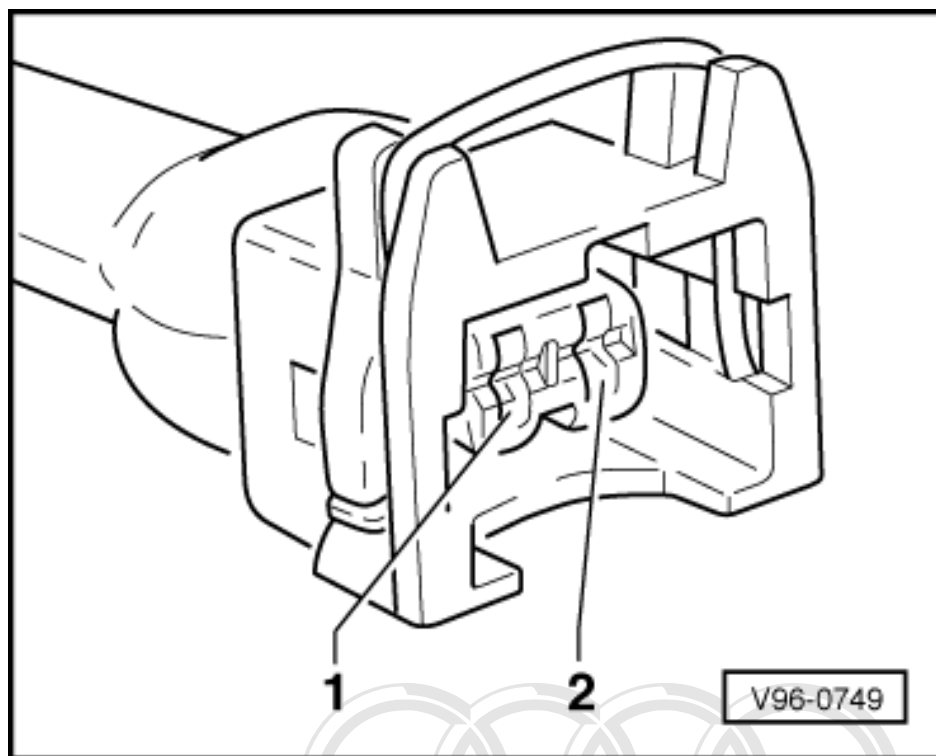
- -> Check for open circuit between contact 1 on connector and fuse in fuse holder .

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

- Check fuel pump relay => Page 93 .



Checking actuation of camshaft timing control



- -> Connect up voltage tester V.A.G 1527 B between contacts 1 and 2.
- Start final control diagnosis and actuate camshaft timing control => Page 28 .

-> Display readout:

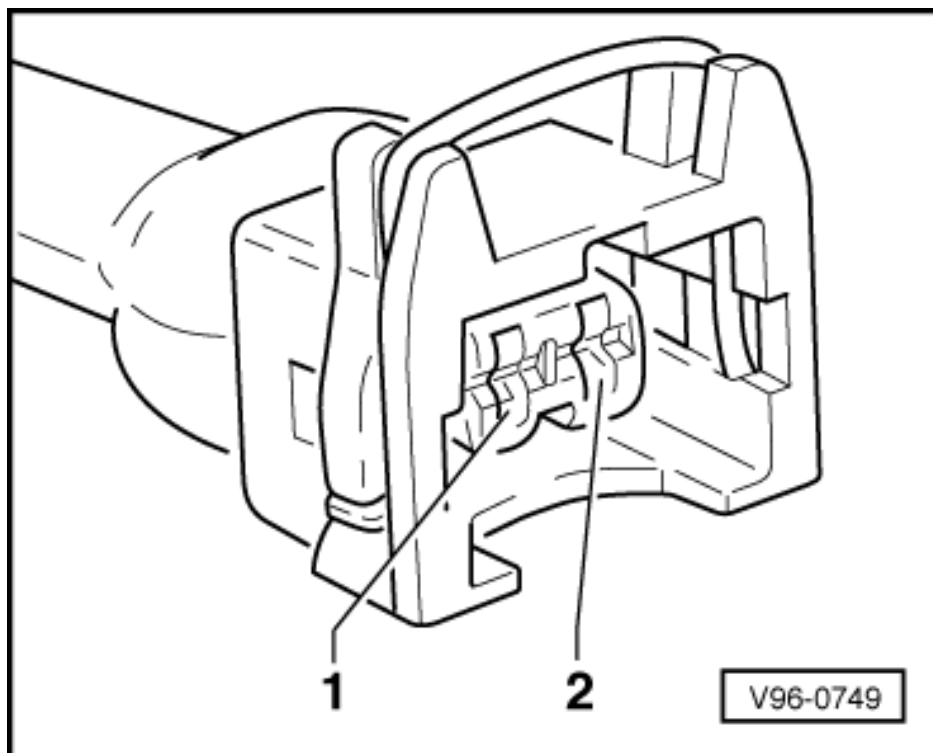
Final control diagnosis
Camshaft timing control 1

- The LED should flash.

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

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit => Page 78 .

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

-N205 connector contact	Test box V.A.G 1598/22 socket
2	55

-N208 connector contact	Test box V.A.G 1598/22 socket
2	55

- If necessary, rectify short circuit to earth or open circuit.
- If no open circuits or short circuits are found, fit a new engine control unit =>Page 78 .
- If wiring is OK, replace mechanical camshaft adjuster.

=> 6-cylinder engine (5-valve), Mechanical Components; Repair Group 15; Servicing Valve Gear; Removing and installing camshafts Servicing Valve Gear Removing and installing camshafts



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