

# V.A.G Service.

## Repair Group Index to Workshop Manual

## Audi 80 1987 ►, Audi 90 1987 ►

Engine Code letters	7A																		
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Booklet

MPI Injection and Ignition System until 01.90 / Edition 05.90

When filing a Workshop Bulletin enter the Bulletin No. next to the appropriate column. When using the Workshop Manual you can then see at a glance whether Workshop Bulletins have been published in respect of the particular Repair Group in which you are looking.

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Technical Information should always be available to all foremen and mechanics, because compliance with the instructions given is essential to ensure vehicle roadworthiness and safety. In addition, the normal safety precautions to be observed when working on motor vehicles are also applicable.

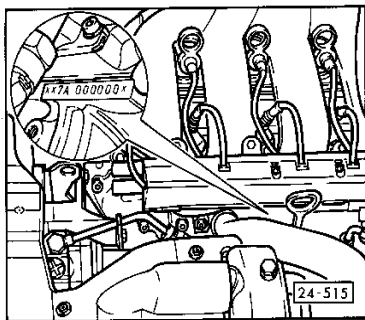
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#### SELF DIAGNOSIS

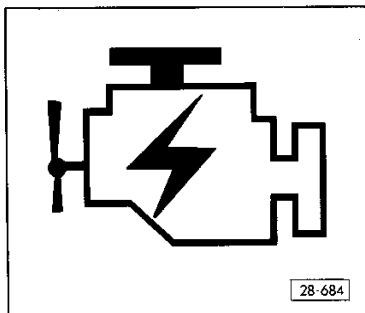
- Check whether engine code letters "7A" are die-stamped in the engine block of the concerned engine prior to commencing with self diagnosis.

#### FAULT LAMP IN DASHBOARD ⇒ 07.88

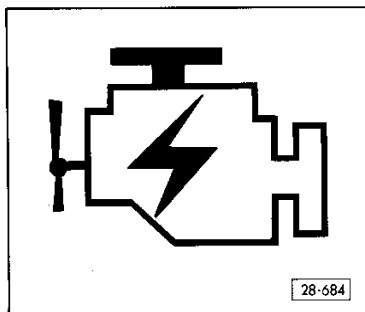
- Fault lamp must light up after turning on the ignition.

Fault lamp goes out after starting the engine if there are no faults which could lead to damage on the engine.

Fault lamp must flash while interrogating the fault memory.



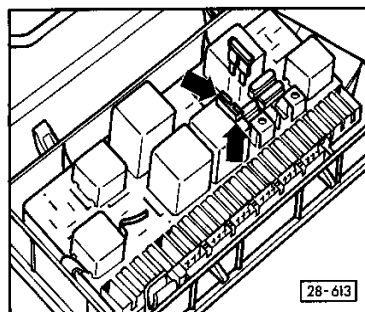
01-1



Faults, which have occurred during operation of the vehicle, are stored in the fault memory of the control unit until the fault memory is cancelled.

- If a fault occurs, which could lead to damage on the engine, it is reported additionally by a fault lamp in the dash panel insert.

Fault lamp must light up each time the ignition is turned on.



Fault lamp does not light up after turning on the ignition:

- Bridge pins on fuel pump relay with a spare fuse. Fault lamp should light up as long as the pins are bridged. If not, check leads to the current flow diagram or replace fault lamp.

Output of stored faults is accomplished with an output of flash codes on V.A.G 1551 or the fault lamp in the dash panel insert.

Cancellation of fault memory – see page 01-5.

01-2

#### TECHNICAL DATA OF SELF DIAGNOSIS

<u>Memory</u>	
• Nonvolatile storage	yes
• Volatile storage	no
<u>Data output</u>	
• Rapid data transfer	no
• Flash code output	yes
<u>Final control diagnosis</u>	yes
<u>Engine basic adjustments</u>	no
<u>Read measuring value block</u>	no
<u>Read individual measuring value</u>	no
<u>Location of components</u>	see Repair Group 24

After evaluation of the information the MPI control unit makes a difference between 19 different faults, see fault table on page 01-16.

MPI control unit is also equipped with final control diagnosis for 8 control elements – see page 01-9.

#### Note:

- Final control diagnosis can be carried out only when the engine is stopped.
- Interrogating the fault memory on the other hand should always be carried out with the engine running whenever possible.

01-3

#### INTERROGATING FAULT MEMORY WITH FAULT READER V.A.G 1551:

##### Test Prerequisites:

- Fuses 12, 13, 27 and 28 OK.
- Fuel pump relay OK.
- During interrogation of the fault memory do not accelerate engine, as the control unit would terminate the fault output.
- Check earth connections.
- Air conditioner switched off.

#### Note:

Check the following earth connections for corrosion or faulty connection and, if applicable, repair prior to interrogation of the fault memory and final control diagnosis as well as checking electric leads and replacing components.

- Check both earth connection points on rear of intake manifold.
- Check battery earth strap and earth strap between the left engine support and side member.

01-4

### Interrogating Fault Memory

#### Notes:

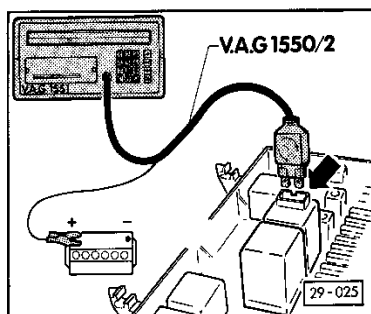
- Fault reader V.A.G 1551 can be operated in the following modes:
    - 1 – Rapid data transfer
    - 2 – Flash code output
    - 3 – Self test
    - 4 – Dealership identifier
  - Operating modes 3 (self test) and 4 (dealership identifier) only concern the fault reader and are described in the operating instructions of V.A.G 1551.
  - For the described control unit only the operating mode 2 – flash code output is possible.
  - Note test prerequisites – see Interrogating Fault Memory on page 01-4.
- Run engine. If engine cannot be started, operate starter for approx. 5 seconds and then do not switch off the ignition.

### Erasing Fault Memory

The ignition must be turned off and final control diagnosis carried out after interrogation of the fault memory.

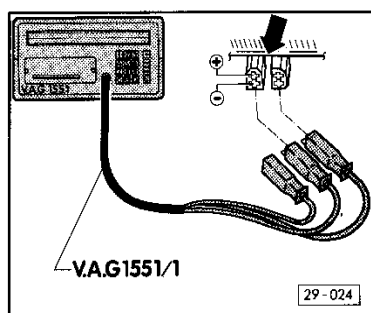
The fault memory can be cancelled only after final control diagnosis has been carried out and not already after interrogation of the fault memory. Fault memory content is erased by briefly pressing the → key again after the display of code 0000 during final control diagnosis.

01-5



#### • Up to Model Year 1988

- Remove fuse box/relay plate cover.
- Connect fault reader V.A.G 1551 with lead V.A.G 1550/2 to vehicle battery (+) and on fuel pump relay – arrow –.



#### • From Model Year 1989

- Connect fault reader V.A.G 1551 to diagnostic plugs in driver's side footwell with diagnostic lead V.A.G 1551/1 as follows.
- Plug black to diagnostic socket black.
- Plug white to diagnostic socket brown.
- Plug blue is not required.
- Voltage supply is via fuse 21.

01-6

V.A.G – Self Diagnosis      HELP  
 1 – Rapid data transfer\*  
 2 – Flash code output\*

➡ Indicated on display:  
 \* Indicates alternately

Notes:

- Additional operating information can be called-up with the HELP key of V.A.G 1551.
- The → key serves to proceed with the programme sequence.
- Switch on printer with print key (warning lamp in key lights up).
- Press key 2 for "flash code output" operating mode.

Initiate flash code output with  
 "→" key.

➡ Display indicates:

- Briefly press → key.  
 Faults or flash codes are indicated consecutively on display and printed by printer.

Note:

If printer is not switched on, press → key again after each flash code output until the flash code 0000 output end appears on display.

01-7

Flash code: 4 4 4 4  
 No fault recognised

➡ If no fault is stored, display shows:

Notes:

The following display appears after display of the last fault or after display of flash code 4 4 4 4:

Flash code: 0 0 0 0  
 Output end

➡ Display shows:

- Switch off ignition. Eliminate faults according to fault table on page 01-16.

Notes:

- A test drive lasting at least 5 minutes must be carried out and the fault memory recalled after elimination of faults, which are displayed on the fault reader.
- If a fault exists and is not recognised by self diagnosis, continue with fault finding according to the fault finding table in the "Engine Fault Finding" publication.

01-8

## FINAL CONTROL DIAGNOSIS WITH FAULT READER V.A.G 1551

### Note:

- Final control diagnosis can only be carried out when the engine is not running.
- For checking each component has its own flash code which is shown in the display on fault reader V.A.G 1551. Injectors are activated only one ms long each time.
- Ambient noise must be avoided during an acoustic test of injectors, as the switching noise (clicking) of injectors is very quiet and short.

### Important!

Engine must not be operated with the starter before or during final control diagnosis, as the MPI control unit would then switch off final control diagnosis.

- Let engine run briefly prior to repeating entire final control diagnosis, as otherwise injectors would not be activated during the repetition. Final control diagnosis can be repeated only after first switching off the ignition. This is also applicable for interruption of final control diagnosis. Restore all original plug connections after conclusion of testing.

01-9

### Activation Sequence:

Flash code	Final control element	
4 4 3 3	Fuel pump relay	(J 17) *
4 4 1 1	Injector - cylinder 1	(N 30) *
4 4 1 2	Injector - cylinder 2	(N 31) *
4 4 1 3	Injector - cylinder 3	(N 32) *
4 4 1 4	Injector - cylinder 4	(N 33) *
4 4 2 1	Injector - cylinder 5	(N 83) *
4 4 3 1	Idling stabilisation control valve	(N 71) *
4 3 4 3	Activated charcoal filter valve	(N 80) *

\* Designation in current flow diagram

### Initiating Final Control Diagnosis

- Switch off ignition.
- Connect fault reader V.A.G 1551 - see page 01-5.
- Pull off fuse 13 (fuel pump).

V.A.G - Self Diagnosis      HELP  
1 - Rapid data transfer \*  
2 - Flash code output \*

← Indicated on display:

\* Indicates alternately

- Switch on printer with print key (warning lamp in key lights up).
- Press key 2 for "flash code output" operating mode.

01-10

Initiate flash code output  
with "→" key

➡ Indicated on display:

Permanent earth on exciter wire

- ➡ Press → key until the display shows permanent earth on exciter wire.
- Switch on ignition.
- Install fuse 13 four seconds after switching on the ignition.

01-11

Flash code: 4 4 3 3  
Fuel pump relay – J 17

- Briefly press → key.

➡ Indicated on display:

- Fuel pump relay must attract and fuel pump must run.

Note:

Flowing noise can be clearly heard on the fuel pressure regulator when the fuel pump is running.

- Check activation of the fuel pump relay (see page 24-14), if the fuel pump does not run.
- Pull off fuse 13 (fuel pump).

Note:

Avoid ambient noise for the following procedures, as the switching noise of injectors is very quiet.

- If in doubt, pull off connector on the concerned injector and apply diode test lamp V.A.G 1527 with adapter leads 1594 (set of testing adapters).
- Briefly press → key.

Flash code: 4 4 1 1  
Injector, cylinder 1 – N 30

➡ Indicated on display:

01-12



- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 1 is activated 1 ms and the calling-up of cylinder no. 2 injector initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code: 4 4 1 2  
Injector, cylinder 2 – N 31

► Indicated on display:

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 2 is activated 1 ms and the calling-up of cylinder no. 3 injector is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code: 4 4 1 3  
Injector, cylinder 3 – N 32

► Indicated on display:

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 3 is activated 1 ms and the calling-up of cylinder no. 4 injector is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–13

Flash code: 4 4 1 4  
Injector, cylinder 4 – N 33

► Indicated on display:

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 4 is activated 1 ms and the calling-up of cylinder no. 5 injector is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code: 4 4 2 1  
Injector, cylinder 5 – N 83

► Indicated on display:

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 5 is activated 1 ms and the calling-up of idling stabilisation control valve is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code: 4 4 3 1  
Idling stabilisation control valve – N 71

► Indicated on display:

- Note:
- This valve is activated (clicks) so long by pressing the → key until the next final control element is switched.
  - If idling stabilisation control valve does not work, it must be checked – see page 24–30.

01–14

Flash code: 4 3 4 3  
Solenoid valve 1 for activated  
charcoal filter system – N 80

➡ Indicated on display:

**Note:**

This valve is activated (clicks) so long until final control element diagnosis is ended by pressing → key again.

- If the activated charcoal filter valve does not work, it must be checked – see page 24–36.

**Caution!**

Pull off connector on final output stage of the ignition coil after finishing tests. Operate engine with the starter approx. 6 seconds to remove fuel from the combustion chamber, which had been injected during a test.  
Restore all original plug connections.

- Switch off ignition and, if applicable, eliminate faults.

01–15

**FAULT TABLE**

**Note:**

If it is determined that components are defective, check wiring to the components in accordance with current flow diagram.

Flash code or display on V.A.G 1551	Possible fault cause	Fault elimination
1 1 1 1      Control unit defective	Fault in computer of MPI control unit	Renew MPI control unit
1 2 3 1      Road speed sender – G 22	Break or short in wire from road speed sender to instrument cluster or in wire from instrument cluster to MPI control unit. Road speed sender defective.	Check road speed signal – page 24–53.
2 1 1 1      Engine speed sender – G 28	Break or short in sender wire. Engine speed sender defective.	Check engine speed sender – page 28–12.
2 1 1 2      Firing point sender – G 4	Break or short in sender wire. Firing point sender defective.	Check firing point sender – page 28–10.
	Engine speed sender mixed up with firing point sender.	Connect senders in accordance with color code marks.
2 1 1 3      Hall sender – G 40	Break or short in sender wire. Hall sender defective.	Check Hall sender – page 28–20.

01–16

Flash code or display on V.A.G 1551	Possible fault cause	Fault elimination
2 1 1 4      Hall sender not on reference mark	Ignition distributor maladjusted.	Ignition distributor's basic setting – page 28–21.
2 1 2 1      Idling switch – F 60	Break or short in wire. Idling switch defective.	Check idling switch – page 24–36.
2 1 4 1      First knock sensor knock sensor 1 – G 61 or 2 1 4 3      Second knock sensor knock sensor 2 – G 66	Engine knocks.  Fuel octane number too low.	Check compression pressure and injection.  Fill tank with specified fuel.
2 1 4 2      Knock sensor 1 – G 61 or 2 1 4 4      Knock sensor 2 – G 66	Break or short in sensor wire.  Knock sensor defective.	Check wiring of concerned knock sensor in accordance with current flow diagram.  Renew knock sensor.
2 2 1 2 *      Throttle valve potentiometer – G 69	Throttle valve potentiometer's output voltage too low or too high in comparison with the air volume.	Check throttle valve potentiometer and wiring – page 24–35.

\* 2 1 2 1 could be displayed additionally; neglect it.

01–17

Flash code or display on V.A.G 1551	Possible fault cause	Fault elimination
2 2 4 2      CO potentiometer – G 74	Output voltage of CO potentiometer is excessive.	Check air volume meter – page 24–37.
2 2 3 2      Air volume meter – G 70	Output voltage of air volume meter is too low or too high in comparison with the speed.	Check air volume meter and wiring – page 24–37.
2 2 3 3      Air volume meter – G 19	Reference voltage on air volume meter greater than 1 volt.	Check air volume meter wiring – page 24–44.
2 2 3 4      Power supply	Battery voltage too low, break in wire to pin 18 of connector (A) or fuel pump relay.	Check voltage supply to control unit – page 28–16. Check fuel pump relay – page 24–14.
2 3 1 2      Coolant temperature sender – G 62	Break or short in sender wire. Coolant temperature sender defective.	Check coolant temperature sender – page 28–14.
2 3 4 2      Lambda probe – G 39	Break or short in lambda probe wire to positive or earth.	Check lambda probe – page 24–34.

01–18

Flash code or display on V.A.G 1551	Possible fault cause	Fault elimination
4 4 3 1     Idling stabilisation control valve – N 71	Break or short in wire to idling stabilisation control valve.	Check idling stabilisation control valve – page 24–30.
4 4 4 4     No faults recognised!	---	---
0 0 0 0     Output end	---	---

**Important!**

Set of testing adapters V.A.G 1594 is required for all fault finding tests to avoid damaging the plug pins.

01–19

**RECALLING FAULT MEMORY WITH FUSE AND FAULT LAMP OR WITH DIODE TEST LAMP  
V.A.G 1527**

**Note:**

- Final control diagnosis can only be carried out if engine is not running.
- Contrary to this, the fault memory should be recalled with engine running, if possible. Otherwise turn over engine with starter for approx. 5 seconds without switching off ignition afterwards.

**Reading flash code**

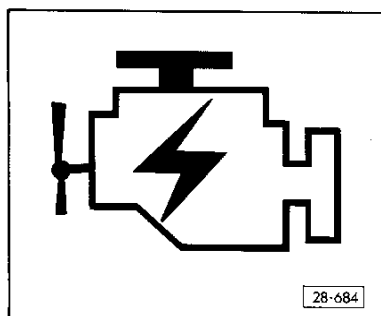
- Up to Model Year 1988:

➡ Reading flash code on fault lamp in dash panel insert.

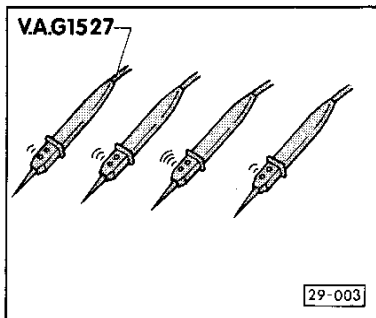
If ignition is switched on, fault lamp must light up.

If no fault is present which could lead to engine damage, fault lamp goes out after engine is started.

When interrogating fault memory, fault lamp must flash.



01–20



- From Model Year 1989:

#### ➡ Reading flash code with diode test lamp V.A.G 1527

When interrogating fault memory, faults can be read with a flash code. During final control diagnosis, respective final control element is indicated by a flash code.

- Each flash code consists of 4 flashing impulse groups of max. 4 flashing impulses. Between each flashing impulse there is a pause (fault lamp or diode test lamp off) of approx. 2.5 sec.

By adding together individual flashing impulses within flashing impulse groups (each flashing impulse group results in a figure between 1 and 4), differing flash codes are read with fault lamp or diode test lamp V.A.G 1527.

For fault elimination, all possible flash codes are listed in fault table on page 01–16.

For final control diagnosis flash codes, see activation sequence on page 01–10.

During fault memory recall and final control diagnosis, the display of the various flash codes runs as follows.

After a start signal (fault lamp or diode test lamp on) and subsequent pause (fault lamp or diode test lamp off) of 2.5 sec. respectively, transmission of flashing impulses within 4 flashing impulse groups of respective flash code is transmitted.

01–21

After transmission of 4 flashing impulse groups, a pause of approx. 2.5 seconds follows. Then a start signal of the respective flash code is repeated until next memory location or next component is called up during the final control element diagnosis.

#### Erasing fault memory

Ignition must be switched off and final control diagnosis carried out after interrogation of the fault memory.

Fault memory can only be erased after completion of final control diagnosis and not already after finished interrogation of the fault memory.

Fault memory content is erased if pins on fuel pump relay (⇒ model year 1988) or respective pins of the diagnostics plug (model year 1989 ⇒) are bridged again for 3 seconds after code 0 0 0 0 is displayed during final control diagnosis.

Interrogating fault memory with fuse and fault lamp  
(in dash panel insert)

- Up to Model Year 1988

Note:

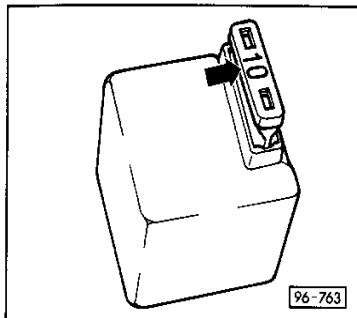
Interrogating fault memory with diode test lamp  
V.A.G 1527 and adapter leads from V.A.G 1594  
(from Model Year 1989) – see page 01–25.

- Observe test prerequisites – see page 01–4.
- Let engine run. If engine cannot be started,  
operate engine with starter at least 5 seconds  
without switching off ignition afterwards.

Note:

- If the engine stalls during interrogation of the fault  
memory, do not switch off ignition and carry out  
interrogation of the fault memory content up to  
flash code 0 0 0 0 (fault output end).

01–23



- ← Bridge contacts on fuel pump relay J 17 with a  
fuse for at least 4 seconds.

The light of the fault lamp in the dash panel insert  
must change to flashing after the fuse is removed.

- Count and note the number of flashing impulses.

Note:

The respective flash code will be repeated until the  
fault memory is switched to the next memory loca-  
tion by again bridging the contacts on the fuel  
pump relay.

- If the flash code 4 4 4 4 (no fault recognised) is  
displayed, no faults are stored.
- Keep bridging the fuel pump contacts for at least 4  
seconds until the flash code 0 0 0 0 (fault out-  
put end) is displayed.
- Switch off ignition and eliminate faults in accord-  
ance with the fault table on page 01–16.

01–24

Interrogating fault memory with diode test lamp  
V.A.G 1527

- From Model Year 1989

Note:

Interrogating fault memory with fuse and fault lamp in dash panel insert (up to Model Year 1988) – see page 01–23.

- Observe test prerequisites – see page 01–4.

- Let engine run. If engine cannot be started, operate engine with starter at least 5 seconds without switching off ignition afterwards.

Note:

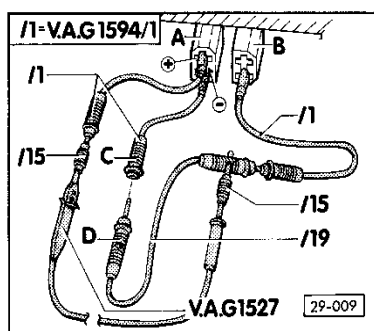
- If the engine stalls during fault memory interrogation, do not switch off ignition and carry out interrogation of the fault memory content up to flash code 0 0 0 0 (fault output end).

01–25

- Connect diode test lamp V.A.G 1527 with adapter leads from V.A.G 1594 to diagnostic plugs –A– and –B–.

Notes:

- Terminal 2 (positive) of black diagnostic plug –A– is fused via fuse 21. Terminal 1 is earthed.
- Only terminal –1– is used in brown diagnostic plug –B–.



- Connect connectors –C– (earth) and –D– for at least 4 seconds and then separate.

Light of the diode test lamp must change to flashing.

- Count and note the number of flashing impulses.

Notes:

The respective flash code will be repeated until switching to the next memory location of the fault memory by connecting the connectors –C– and –D– for at least 4 seconds and then separating again.

- If flash code 4 4 4 4 (no fault recognised) is displayed, there are no faults stored.

- Keep connecting connector –C– (earth) and –D– for at least 4 seconds and then separating until the flash code 0 0 0 0 (fault output end) is displayed.

- Switch off ignition and eliminate faults in accordance with the fault table on page 01–16.

01–26

# **FINAL CONTROL DIAGNOSIS WITH FUSE AND FAULT LAMP OR DIODE TEST LAMP V.A.G 1527**

## **Notes:**

- Final control diagnosis can only be carried out if the engine is not running.
- MPI control unit is equipped with final control diagnosis, with which the operation of following components can be checked acoustically or by touching.
- Each component is given its own flash code for checking, which is displayed on the fault lamp or diode test lamp.  
Injectors are activated for only 1 ms each.

## **Important!**

The engine must not be operated with the starter before or during final control diagnosis, as the MPI control unit would then interrupt final control diagnosis.

01-27

- Disconnect plug on final output stage of ignition coil before repeating final control diagnosis.  
Operate engine with starter approx. 6 seconds.  
Restore all original plug connections after completion of tests.
- Final control diagnosis can only be repeated after first switching off the ignition. This also applies to interruption of final control diagnosis.

## **Activation sequence:**

Flash code	Final control element	
4 4 3 3	Fuel pump relay	(J 17) *
4 4 1 1	Injector - cylinder 1	(N 30) *
4 4 1 2	Injector - cylinder 2	(N 31) *
4 4 1 3	Injector - cylinder 3	(N 32) *
4 4 1 4	Injector - cylinder 4	(N 33) *
4 4 2 1	Injector - cylinder 5	(N 83) *
4 4 3 1	Idling stabilisation control valve	(N 71) *
4 3 4 3	Activated charcoal filter valve	(N 80) *

\* Designation in current flow diagram

01-28



Test prerequisite:

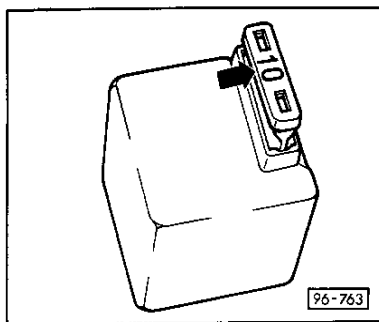
- Full load switch OK.

Final control diagnosis with fuse and fault lamp (in dash panel insert)

- Up to Model Year 1988

Notes:

- Final control diagnosis with diode test lamp V.A.G 1527 (from Model Year 1989) – see page 01–35.
- After initiating the final control diagnosis the fault lamp indicates which final control element is being activated by the MPI control unit.



- Activation sequence – see page 01–10.
- Bridge terminals on fuel pump relay with a fuse.
- Pull off fuse 13 (fuel pump).
- Switch on ignition and remove fuse after at least four seconds.
- Install fuse 13.

Flash code 4 4 3 3 is displayed.

- Fuel pump relay is activated, after which the fuel pump runs.

Notes:

Flowing noise can be clearly heard on the fuel pressure regulator when the fuel pump is running.

01–29

- If the fuel pump does not run, check activation of the fuel pump relay – see page 24–14.
- Pull off fuse 13 (fuel pump).

Note:

Ambient noise must be avoided during acoustic testing of injectors, as the switching noise (clicking) of injectors is very quiet and short. If in doubt, pull off plug on concerned injector and apply diode test lamp V.A.G 1527 with adapter leads 1594 (set of testing adapters).

- Bridge terminals on fuel pump relay for at least four seconds.

Flash code 4 4 1 1 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 1 is activated 1 ms and calling up the injector for cylinder no. 2 is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–30

Flash code 4 4 1 2 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 2 is activated 1 ms and calling up the injector for cylinder no. 3 is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code 4 4 1 3 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 3 is activated 1 ms and calling up the injector for cylinder no. 4 is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–31

Flash code 4 4 1 4 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 4 is activated 1 ms and calling up the injector for cylinder no. 5 is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code 4 4 2 1 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 5 is activated 1 ms and calling up the idling stabilisation control valve is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–32

Flash code 4 4 3 1 is displayed.

- Idling stabilisation control valve is activated (rhythmic ticking noise).
- If idling stabilisation control valve does not work, it must be checked – see page 24–30.
- Bridge terminals on fuel pump relay at least four seconds.

Flash code 4 3 4 3 is displayed.

- Activated charcoal filter solenoid valve is activated (rhythmic ticking noise).
- If activated charcoal filter solenoid valve does not work, it must be checked – see page 24–36.

Note:

Activated charcoal filter solenoid valve is activated until terminals of the fuel pump relay are again bridged at least 4 seconds and final control diagnosis is ended in this manner.

01-33

Important!

Pull off connector on final output stage of the ignition coil after finishing tests. Operate engine with the starter approx. 6 seconds to remove fuel injected into the combustion chamber during the tests.

Restore all original plug connections.

- Switch off ignition and, if applicable, eliminate faults.

01-34

# Final control diagnosis with diode test lamp V.A.G 1527

- From Model Year 1989

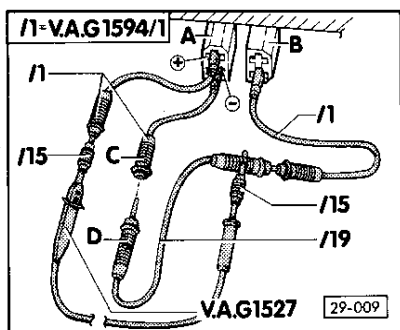
## Notes:

- Final control diagnosis with fuse and fault lamp (up to Model Year 1988) – see page 01–27.
- After initiating final control element diagnosis, LED of diode test lamp V.A.G 1527 indicates which final control element is currently being activated by MPI control unit.

- Activation sequence – see page 01–10.

## Important!

Four seconds after plug –C– (earth) has been connected to plug –D–, final control elements (components) are activated. Respective flash code is displayed by LED of diode test lamp V.A.G 1527 after disconnection plugs –C– and –D–.



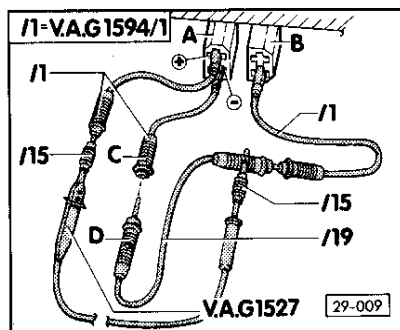
- ◀ Connect diode test lamp V.A.G 1527 with adapter leads from V.A.G 1594 to diagnostic plugs –A– and –B–.

## Notes:

- Terminal 2 of black diagnostic plug –A– (positive) via fuse 21. Terminal 1 is earthed.
- Only terminal –1– is used in brown diagnostic plug –B–.

- Pull off fuse 13 (fuel pump).

01–35



- ◀ Connect plug –C– (earth) with plug –D–.

- Switch on ignition.
- Disconnect plug –C– from plug –D– again after approx. 4 seconds.
- Install fuse 13.

Flash code 4 4 3 3 is displayed.

## Note:

Flowing noise will be clearly heard on the fuel pressure regulator when the fuel pump is running.

- If fuel pump does not run, activation of the fuel pump relay must be checked – see page 24–14.
- Pull off fuse 13 (fuel pump).

01–36

**Note:**

Ambient noise must be avoided for the following test steps, as the switching noise of injectors is very quiet and short.

In case of doubt, pull off connector on the concerned injector and apply diode test lamp V.A.G 1527 with adapter leads 1594 (set of testing adapters).

- Connect plug -C- (earth) with plug -D-.
- Disconnect plug -C- from -D- again after approx. 4 seconds.

Flash code 4 4 1 1 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 1 is activated 1 ms and calling up the injector for cylinder no. 2 is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–37

Flash code 4 4 1 2 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 2 is activated 1 ms and calling up the injector for cylinder no. 3 is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code 4 4 1 3 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 3 is activated 1 ms and calling up the injector for cylinder no. 4 is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–38

Flash code 4 4 1 4 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 4 is activated 1 ms and calling up the injector for cylinder no. 5 is initiated.
- If injector does not work, it must be checked – see page 24–17.

Flash code 4 4 2 1 is displayed.

- Briefly open throttle valve wide (full load position).
- Injector for cylinder no. 5 is activated 1 ms and calling up the idling stabilisation control valve is initiated.
- If injector does not work, it must be checked – see page 24–17.

01–39

Flash code 4 4 3 1 is displayed.

- Idling stabilisation control valve is activated (rhythmical ticking noise).
- If idling stabilisation control valve does not work, it must be checked – see page 24–30.
- Connect plug –C– (earth) with plug –D–.
- Disconnect plug –C– from –D– again after approx. 4 seconds.

Flash code 4 3 4 3 is displayed.

- Activated charcoal filter solenoid valve is activated (rhythmical ticking noise).
- If activated charcoal filter solenoid valve does not work, it must be checked – see page 24–36.

Note:

Activated charcoal filter solenoid valve is activated until plugs –C– and –D– are again connected with each other and final control diagnosis is ended in this manner.

01–40

**Important!**

Pull off connector on final output stage of the ignition coil after finishing tests. Operate engine with the starter approx. 6 seconds to remove fuel injected into the combustion chamber during the tests.  
Restore all original plug connections.

- Switch off ignition and, if applicable, eliminate faults.

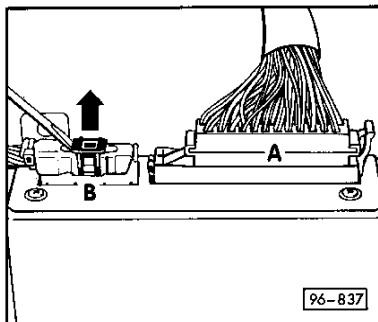
01-41

**REMOVING AND INSTALLING MPI CONTROL UNIT**

- Switch on ignition.
- Remove trim panel below glove box.

**Important!**

Plugs of MPI control unit must not be disconnected or connected with the ignition switched on.



- ← - Unlock secondary lock (black) of plug (B) and pull both plugs (A and B) off of the control unit.
- Unscrew control unit on bracket and pull downward out of the clamp.

Installation is in reverse order.

01-42

#### CONNECTING TEST BOX V.A.G 1598

- Remove MPI control unit – see page 01–42.
- Connect adapter cable V.A.G 1598/4 on plug (B) of wiring loom.
- Connect adapter cable V.A.G 1598/6 on plug (A) of wiring loom.
- Connect test box on concerned adapter cable depending on the test being carried out.

#### Notes:

- The numbering of contacts on wiring loom plugs (A and B) is identical with that of sockets on the test box.
- MPI control unit must not be connected on the concerned adapter cable for any of the continuity tests.

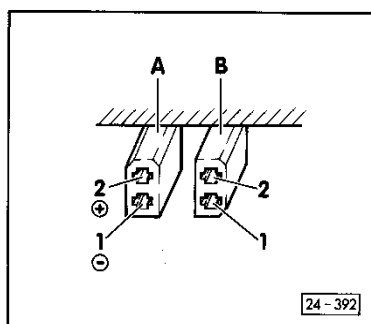
01–43

#### CHECKING CABLE CONNECTIONS OF DIAGNOSTIC PLUGS (From Model Year 1989)

#### Note:

Diagnostic plugs are located in a clamp holder on left side in the driver's footwell.

- Continuity of the following cable connections must be checked with hand multimeter V.A.G 1526 to check the diagnostic plugs.



#### ➡ Diagnostic plug –A– black (voltage supply):

Contact 1 – connected to earth

Contact 2 – positive (terminal 30 fused via fuse 21)

#### ➡ Diagnostic plug –B– brown (flash code output):

Contact 1 – MPI control unit, contacts 14A and 22A

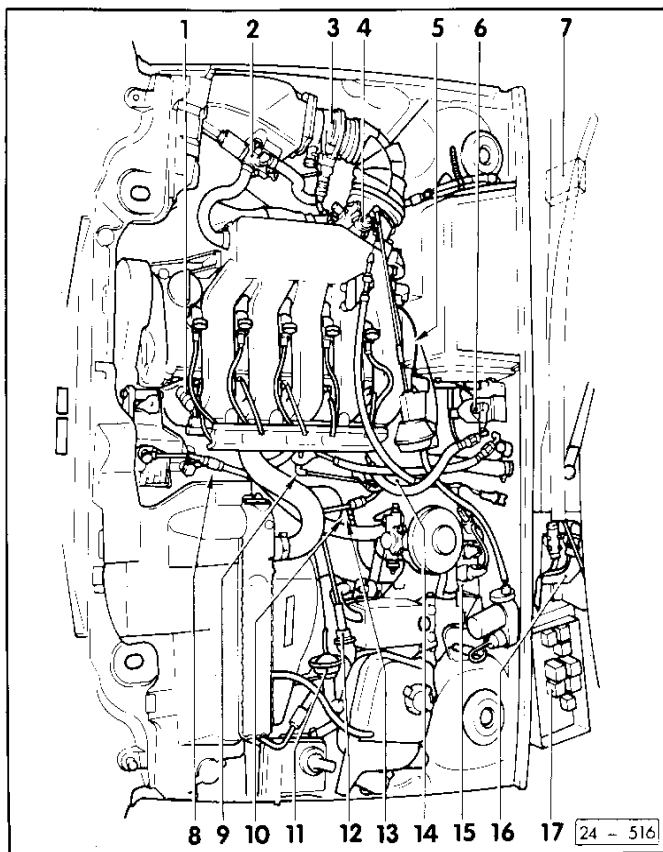
Contact 2 – MPI control unit, contact 6A

#### Note:

Use test box V.A.G 1598 to check cable connections to the MPI control unit – see page 01–43.  
(Plug on MPI control unit is not connected.)

01–44





## MULTIPOINT INJECTION (MPI)

### SURVEY/LOCATION OF COMPONENTS

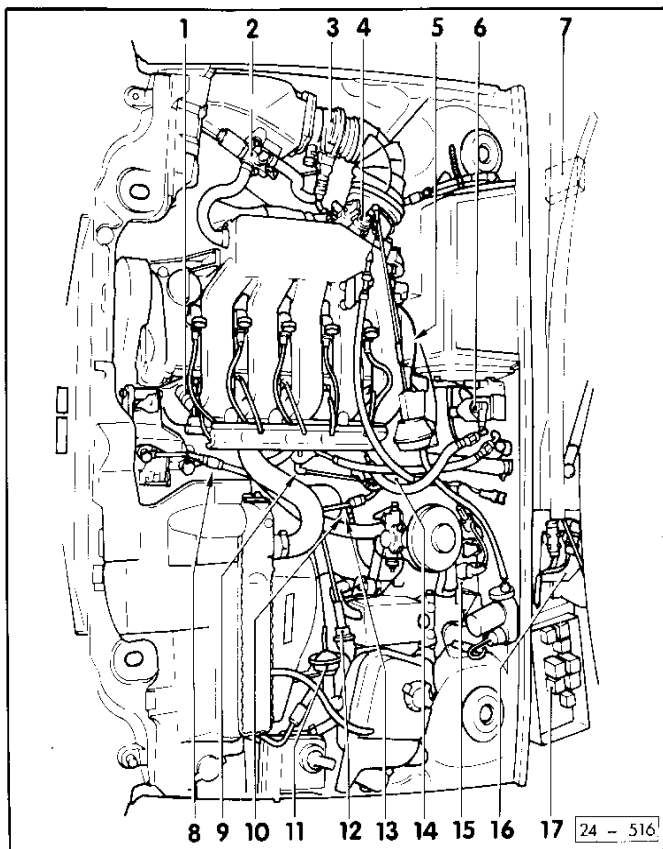
- Observe safety precautions – see page 28–5.

#### Note:

Testing requires application of control unit V.A.G 1526, LED test lamp V.A.G 1527 and testing adapter set V.A.G 1594.

- 1- Injector - N 30
  - Checking activation – see page 24–17
- 2- Idling stabilisation control valve - N 66
  - Checking activation – see page 24–30
- 3- Air mass meter - G 70
  - Checking – see page 24–44
- 4- Throttle valve body
  - Checking – see page 24–40
- 5- Coolant temperature sender - G 62
  - Checking – see page 28–14
- 6- Ignition coil with final output stage - N 70
  - Checking – see page 28–7
- 7- MPI control unit - J 192
  - Located below glove box
  - Checking power supply – see page 26–16

24–1

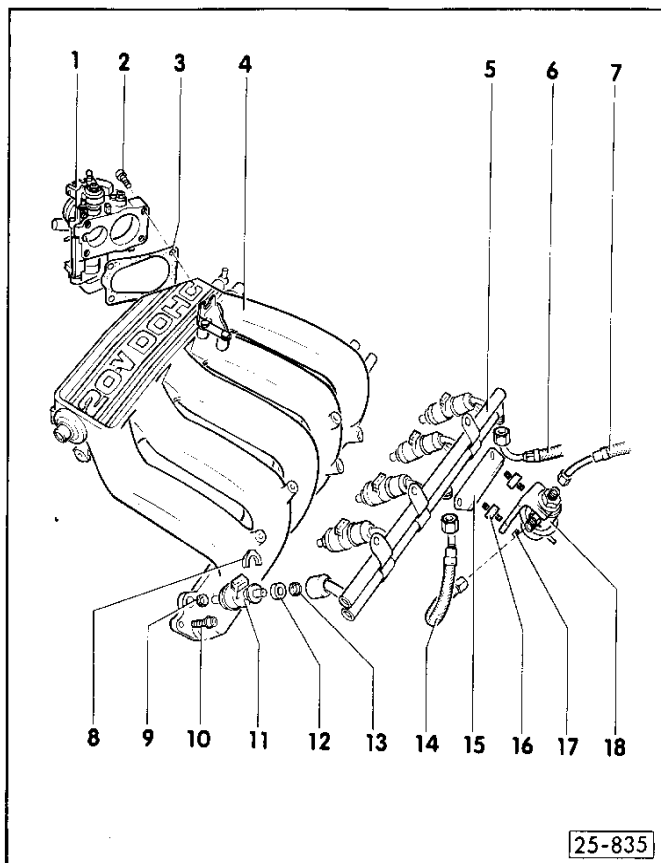


- 8- Knock sensor I 10 Nm - G 61
- 9- Knock sensor II 10 Nm - G 66
- 10- Firing point sender - G 4
  - Checking – see page 28–10
- 11- Cut-off valve
  - Checking – see page 20–13
- 12- Activated charcoal filter valve - N 80
  - Checking – see self diagnosis Rep. Gr. 01
- 13- Engine speed sender - G 28
  - Checking – see page 28–12
- 14- Ignition distributor with Hall sender - G 40
  - Basic setting – see page 28–21
- 15- Plug holder
- 16- Ballast resistor for injectors - N 34
- 17- Fuel pump relay - J 17
  - Checking activation – see page 24–14

#### Note:

- Interrogate fault memory and carry out final control diagnosis before repairing the injection system – see Repair Group 01.
- Seals and gaskets must always be renewed.

24–2



## REPAIRING MULTIPOINT INJECTION (MPI)

### Notes:

- Interrogate fault memory and carry out final control diagnosis before repairing the injection system – see Repair Group 01.
- Seals and gaskets must always be renewed.
- Safety precautions – see page 24-8.
- Rules for cleanliness – see page 24-7.
- Connecting pressure testers – see page 24-10.
- Checking system pressure – see page 24-10.

- 1 - Throttle body
  - Checking/adjusting throttle valve potentiometer – see page 24-38
  - Checking/adjusting idling switch – see page 24-42

- 2 - 20 Nm

- 3 - Gasket

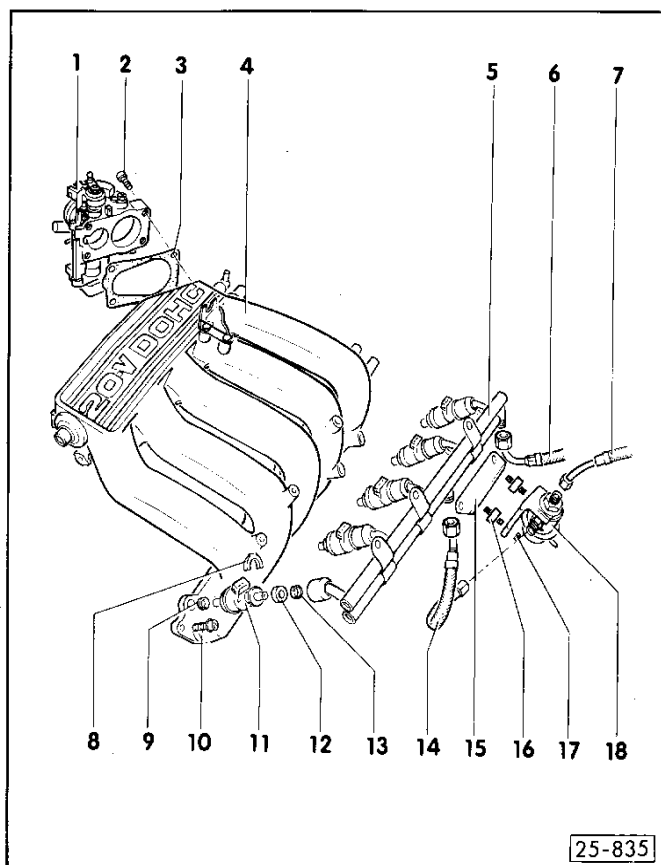
- 4 - Intake manifold

- 5 - Fuel manifold

- 6 - Feed pipe

- 7 - Return pipe

24-3



- 8 - Securing clip for injector

- 9 - Seal
  - Renew seal after removal

- 10 - 20 Nm

- 11 - Injectors
  - Checking – see page 24-17

- 12 - Ring strainer

- 13 - Seal
  - Renew seal after removal

- 14 - Intermediate pipe

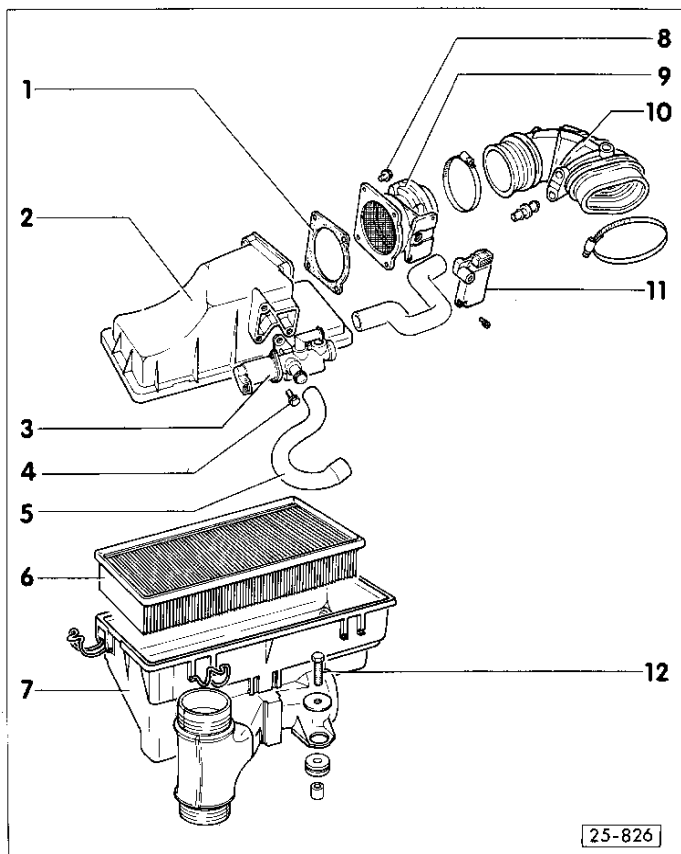
- 15 - Bracket

- 16 - Bonded rubber mounting

- 17 - 10 Nm

- 18 - Pressure regulator
  - Checking system pressure – see page 24-10

24-4



- 1 - Seal
- 2 - Air cleaner housing, upper part
- 3 - Idling stabilisation control valve  
• Checking – see page 24–30
- 4 - 10 Nm
- 5 - Hose
- 6 - Air cleaner element
- 7 - Air cleaner housing, lower part
- 8 - 10 Nm
- 9 - Air mass meter housing
- 10 - Air intake elbow
- 11 - Air mass meter
- 12 - 15 Nm

24–5

#### TECHNICAL DATA

System pressure	bar	3.8 ... 4.2
Holding pressure:		
Min. after 10 minutes	bar	3.2
Min. after 20 minutes	bar	3.0
Injectors: *		
Injection rate	ml/20 sec.	100 ... 120
Idling speed adjustment: **	Speed in rpm	800 ± 50
	CO content in % vol.	0.75 ± 0.25

- \*) Observe test conditions – see page 24–17.
- \*\*) Observe test and adjust conditions – see page 24–26.

Current values – see Emission and Idling Test publication.

24–6

## RULES FOR CLEANLINESS

### Important!

There must be strict conformance with the following "5 rules" for cleanliness when working on the fuel system.

- 1- Thoroughly clean all connections and the area near connections before disconnecting.
- 2- Removed parts must be placed on a clean surface and covered with paper or plastic sheet. Do not use fluffy cloths.
- 3- Opened components must be covered or plugged if the repair cannot be carried out immediately.
- 4- Only install clean components.
  - Only unpack replacement parts immediately before they are installed.
  - Never use parts that have been stored loose (for instance, in toolboxes, etc.).
- 5- When the fuel system is open:
  - Avoid working with compressed air whenever possible.
  - Avoid moving the car whenever possible.

24-7

## SAFETY PRECAUTIONS

Conform with the following points to avoid injuries to persons and/or damage to the ignition and injection systems.

- Never touch or pull off ignition wires with the engine running or operated with the starter.
- Always switch off the ignition first before disconnecting or connecting wires of the ignition and injection systems – including leads for testers.
- Disconnect three-pin plug on final output stage of the ignition coil and remove fuse no. 13, if the engine has to be operated with the starter without that it is started (e.g. when checking the compression).
- Outside starting with a quick charger is only permissible for 1 minute at a maximum of 16.5 volts. A pause of at least 1 minute is required between each attempt to start the engine.
- Ignition must be switched off when washing engine.
- Disconnect battery completely for electric and spot welding.
- Never disconnect battery with engine running.

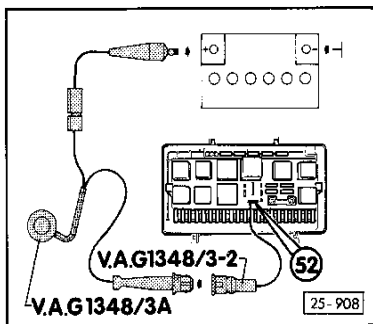
### Important!

- Call the code of a radio with an anti-theft code prior to disconnection of the battery.
- Ignition must be switched off first when disconnecting and connecting the battery, as the MPI control unit could be damaged.

24-8

- Always use testing adapter set V.A.G 1594 for connection of testers (diode test lamp, etc.).
- Engine must not be started immediately after a hot phase with heating to more than 80° C (e.g. painting or steam cleaning vehicle).
- Never supply voltage for simulation of output signals on the control unit.
- Only connect injectors via ballast resistors (see current flow diagram).
- Never start engine after removal of injectors.
- Never connect shielded capacitors or test lamps on terminal 1 (-).

24-9



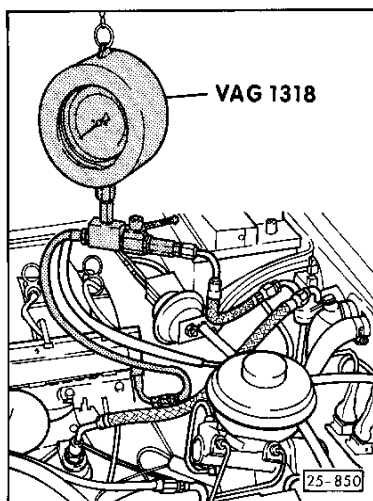
#### CHECKING SYSTEM PRESSURE AND HOLDING PRESSURE

##### Test Conditions:

- Fuse no. 13 OK.
- Fuel filter in perfect condition.
- At least 12 V battery voltage.

— Pull fuel pump relay out of relay plate (relay location 10).

← Connect remote control V.A.G 1348/3A with adapter lead V.A.G 1348/3-2 on terminal 52 of relay plate (relay location 10) and positive pole of the battery.



##### Checking System Pressure

← Connect pressure gauge V.A.G 1318 between fuel feed pipe and fuel manifold. Set lever on pressure gauge to "open" position.

— Operate remote control briefly – fuel pump must run.

— If fuel pump does not run, check fuel pump – see Repair Group 20.

— Operate remote control until pressure is no longer built up.

Specification: 3.8 ... 4.2 bar pressure

24-10

- If the specified pressure is not obtained, install a different pressure regulator for comparison and repeat pressure test.
- If the specified pressure is still not obtained, check and, if applicable, renew fuel pump and feed pipe.
- If the specified pressure is exceeded, connect pressure gauge V.A.G 1318 between fuel manifold and pressure regulator (short fuel pipe).
- Repeat pressure test.

Specification: 3.8 ... 4.2 bar pressure

- If the specified pressure is not obtained, renew fuel manifold.
- If the pressure is less than that specified, renew pressure regulator.
- If the specified pressure is exceeded, check return pipe for damage and free passage. Renew, if necessary.
- Remove remote control and install fuel pump relay.

24-11

Note:

Engine must not be run too long with a disconnected vacuum hose in the following test, as the air/fuel mixture would be too rich due to the high fuel pressure.

- Run engine at idle speed.
- Switch off electric power consuming equipment (air conditioner, etc.).
- Connect vacuum hose on pressure regulator and observe pressure drop on pressure gauge.
- Fuel pressure must drop by about 0.5 bar after connecting the vacuum hose. Carry out the following tests if this change in pressure does not take place:
  - Check vacuum hose for leaks (cracks, damage).
  - Check vacuum connection on intake manifold for free passage by pulling off hose on the pressure regulator and blowing in air.
- Renew pressure regulator, if there are no leaks and the vacuum connection has free passage.

24-12

#### Checking Holding Pressure

- Holding pressure 10 minutes after stopping the engine (minimum pressure).

Specification: 3.2 bar pressure

- If the holding pressure is less than that specified, carry out the following tests.
  - Check connections of pressure gauge for leaks.
  - Check fuel pipes for leaks.
  - Check check valve in electric fuel pump – see Repair Group 20.
  - Check injectors for leaks – see page 24–24.
- If none of the mentioned faults can be found, renew pressure regulator and repeat holding pressure test.

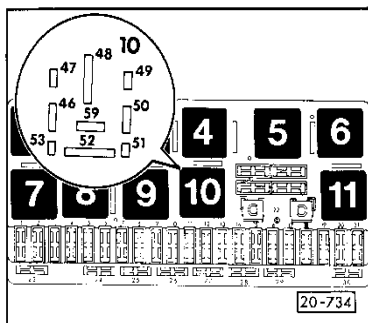
24–13

#### CHECKING FUEL PUMP RELAY AND ACTIVATION

##### A – Checking Fuel Pump Relay – J 17

- Remove fuse 13 and 28. Connect diode test lamp V.A.G 1527 between earth and rear terminal for fuse 13.
- Operate starter briefly.
- Specification: fuel pump relay must attract – diode test lamp must light up.
- If the fuel pump relay does not attract (felt and heard), check activation – see page 24–15.
- If the diode test lamp does not light up, check wire connection – see page 24–15.
- Connect diode test lamp on earth and left terminal of fuse 28.
- Operate starter briefly.
- Specification: diode test lamp must light up.
- If the diode test lamp does not light up, connect diode test lamp on right terminal of fuse 28.
- Specification: diode test lamp must light up.
- If the diode test lamp does not light up, check wire connection – see page 24–15.
- If the diode test lamp lights up, install fuses 13 and 28.

24–14



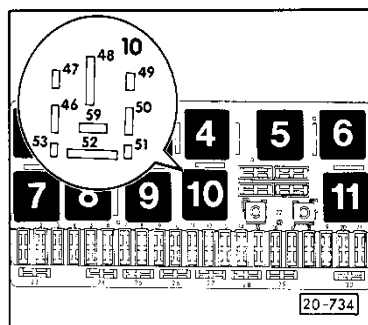
#### B – Checking Wire Connections

- Ignition switched off, fuse 13 and 28 removed.
  - ➡ Pull fuel pump relay J 17 out of relay plate (relay location 10).
  - ➡ Check wire connections between fuse 13 and terminal 52 as well as between fuse 28 and terminal 59 of relay location 10.
- Specification: max. 0.5  $\Omega$ .
- If the specified value is not obtained, eliminate break in wire using the current flow diagram.
  - If no breaks in wires are found, check activation of the fuel pump relay.

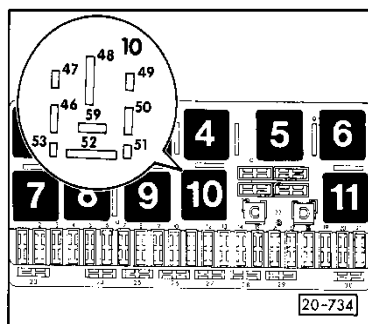
#### C – Checking Activation of Fuel Pump Relay

- ➡ Pull fuel pump relay J 17 out of relay plate (relay location 10).
- Switch on ignition.
- ➡ Connect hand multimeter V.A.G 1526 in turn between terminals 46 and 50 as well as 48 and 50 of the relay socket.

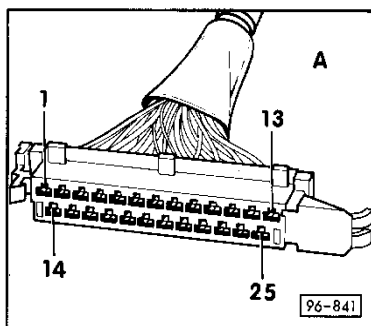
Specification: approx. 12 volts



24-15



- If specifications are not obtained, eliminate breaks in wires using the current flow diagram.
- ➡ Connect diode test lamp V.A.G 1527 on terminals 46 and 47.
- Operate starter briefly, whereby the diode test lamp must light up.
- If the diode test lamp does not light up, connect test box V.A.G 1598 on plug (A) – see page 01-43.



- ➡ Check following wires between relay location 10 and plug (A) for breaks or shorts.

Test Box V.A.G 1598 Socket	Relay Location 10
7	47
22	49
18	59

Specification: max. 1  $\Omega$

- If the specifications are not obtained, eliminate breaks in wires or shorts between relay location 10 and plug (A) in accordance with the current flow diagram.

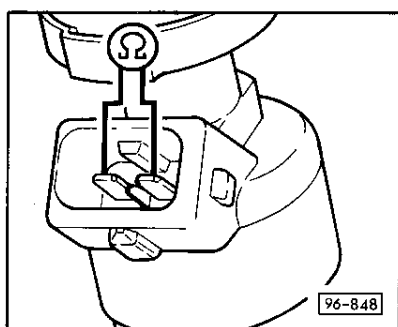
24-16



- If there are no breaks and the diode test lamp does not light up, renew MPI control unit.
- If activation of the fuel pump relay and wire connections are okay, renew fuel pump relay.
- Install fuses 13 and 28.
- Restore original plug connections and install trim panel.

## CHECKING INJECTORS

### A – Electric Injector Test



#### Important!

Injectors are operated via ballast resistors. For this reason vehicle voltage must not be applied to the injectors for testing.

- Pull off plug on injector to be checked.
- ➡ - Measure resistance of concerned injector.

Specification: 1 ... 3 Ω

24-17

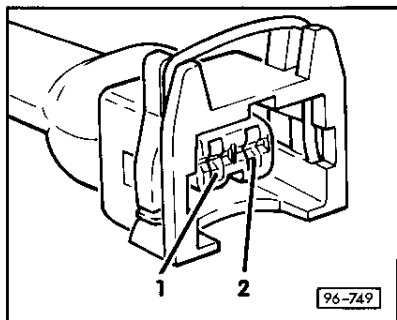
- If the specification is not obtained, renew concerned injector.
- Carry out final control diagnosis – see Repair Group 01.

If one or more injectors are not activated in final control diagnosis, carry out tests B through E.

### B – Checking Power Supply to Injectors

#### Test Conditions:

- Fuel pump relay OK.
- Activation of fuel pump relay OK.
- Fuse 13 OK.



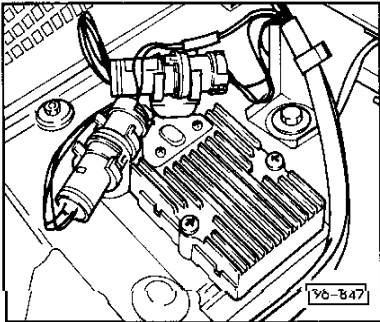
#### Important!

Injectors are operated via ballast resistors. For this reason vehicle voltage must not be applied to the injectors for testing.

- Pull off plug on injector to be checked.
- ➡ - Connect diode test lamp V.A.G 1527 on terminal 2 of plug and engine earth.
- Operate starter several seconds, whereby the diode test lamp must light up.

24-18

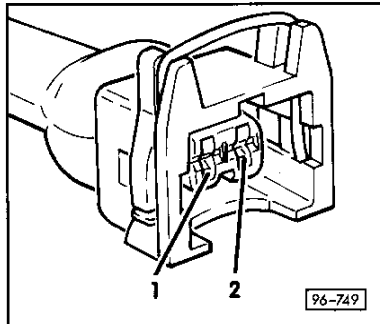
- If the diode test lamp lights up, check activation of injectors – see page 24–20.
- If the diode test lamp does not light up, check ballast resistors of injectors.



#### C – Checking Ballast Resistors of Injectors

- ➡ Disconnect both plugs on ballast resistors.
  - Measure resistance on plug of ballast resistors (not on wiring loom) in order between the white wire and each of the black wires).
- Specification: each 5.0 ... 8.0  $\Omega$
- If the specified values are not obtained, renew ballast resistors.

24–19

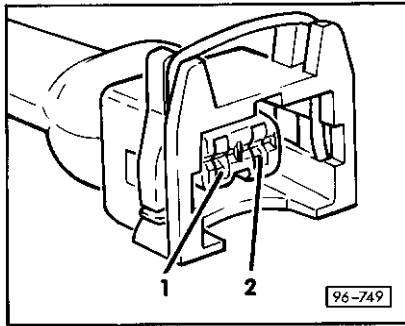


#### D – Checking Activation of Injectors

- Pull off plug on injector to be checked.
- ➡ Connect diode test lamp V.A.G 1527 with leads from testing adapter set V.A.G 1594 on terminal 1 and battery positive (+).
- Operate starter several seconds (engine could even start). The diode test lamp must flash.
- If the diode test lamp does not flash, connect test box V.A.G 1598 on plug (A) – see page 01–43.
- Connect diode test lamp V.A.G 1527 on positive (socket 18) and socket for concerned injector on the test box.

Injector	Test Box Socket
Cylinder 1	3
Cylinder 2	4
Cylinder 3	5
Cylinder 4	16
Cylinder 5	17

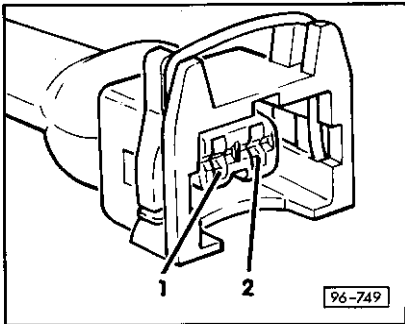
24–20



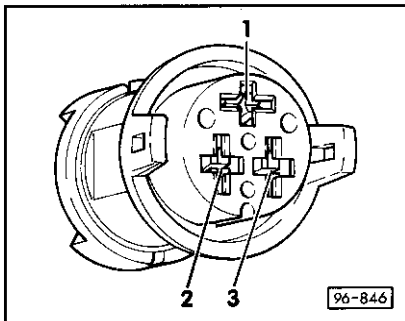
- Operate starter several seconds, whereby the diode test lamp must flash.
- If the diode test lamp does not flash, check power supply to MPI control unit – see page 28-16.
- If the power supply is okay, renew control unit.
- ← If the diode test lamp flashes, eliminate break in wire between terminal 1 of plug on concerned injector and concerned terminal on plug (A) in accordance with the current flow diagram.

#### E – Checking Power Supply Wire Connection

- ← Check for breaks in connecting wire from terminal of plug on concerned injector ...



24-21



- ← ... to plug on ballast resistors in accordance with the current flow diagram.

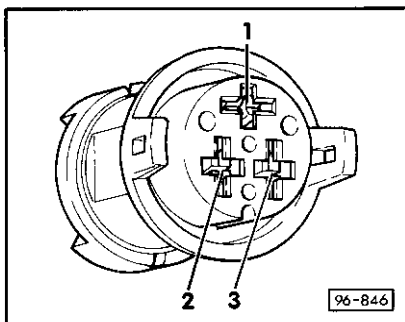
#### Plug Connections on Ballast Resistors:

##### Gray Plug

Terminal 1: power supply from fuse 13  
Terminal 2: to injector of cylinder 1  
Terminal 3: to injector of cylinder 2

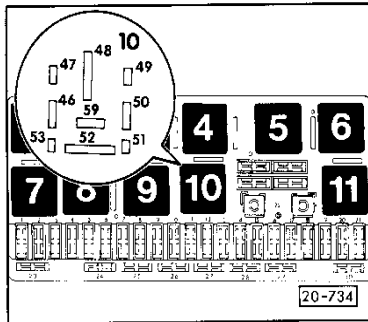
##### Brown Plug

Terminal 1: to injector of cylinder 3  
Terminal 2: to injector of cylinder 4  
Terminal 3: to injector of cylinder 5



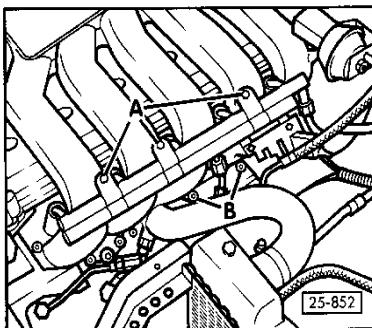
- ← Check for breaks in connecting wire from gray plug terminal 1 to fuse 13.

24-22



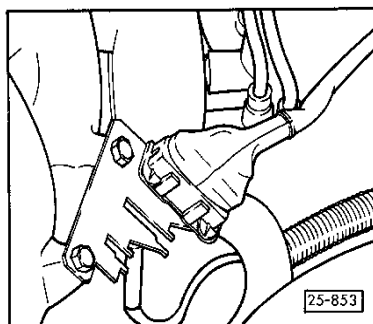
- ◄ Check for breaks in connecting wire in relay plate from fuse 13 to terminal 52 on fuel pump relay (relay location 10).
- If a break is detected in this test, renew relay plate.

24-23



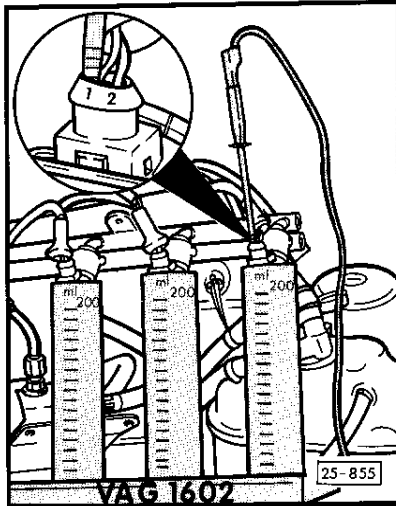
#### CHECKING INJECTION RATE AND INJECTORS FOR LEAKS

- ◄ Unscrew fuel manifold bolts -A- (pipes remain connected).
- Unscrew pressure regulator with bracket on intake manifold (-B-).
- Unscrew pipe holder on intake manifold at rear or on bracket for cruise control vacuum unit.



- ◄ Disconnect plug on intake manifold.
- Unclip ignition distributor cap.
- Push back rubber grommets on plugs of injectors.
- Pull out fuel manifold complete with injectors from above and insert in injection rate tester V.A.G 1602.

24-24



- Initiate final control diagnosis – see Repair Group 01 – and activate fuel pump relay J 17. Fuel pump must run.

- Check injectors for leaks (visual check). Leak rate for each injector must not exceed 1 to 2 drops per minute with the fuel pump running. If the leak rate is greater:

- Push back rubber grommets of plugs on all injectors and hold each brown wire of plug on the injector to be checked (terminal 1) to earth with an adapter lead 20 seconds each.

Specification: 90 ... 110 ml

If the test value of one or more injectors is less or more than the specified value:

- Renew faulty injector.

Notes:

- Renew lower O-rings on all injectors prior to installation.
- Make sure O-rings on injectors are not damaged during installation.
- If the test values of all injectors are less or more than the specified value, check the system pressure – see page 24-10.

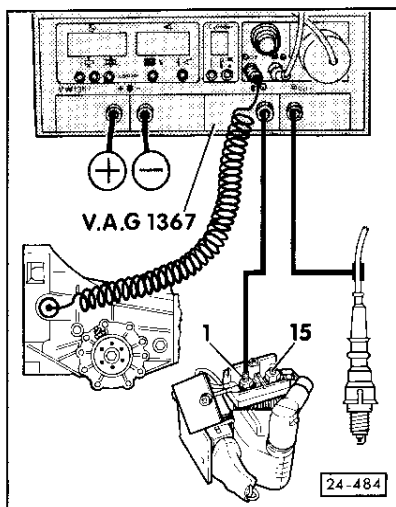
24-25

CHECKING AND ADJUSTING IDLE SPEED AND CO CONTENT

Note:

Idle speed and CO content must be checked and adjusted together.

- Carry out vehicle diagnosis – see Rep. Gr. 01
- Engine temperature at least 85° C
- Throttle valve in idling position
- All electric equipment switched off
- Exhaust system without leaks
- Pressure gauge not connected
- Air conditioner switched off



Important!

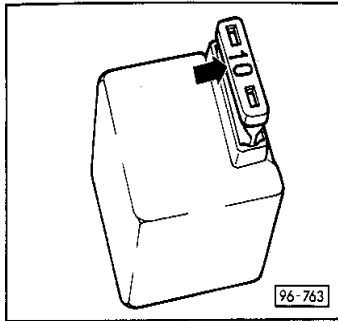
Electric fan must not be running for any test or adjustment.

- Connect tester V.A.G 1367 in accordance with the operating instructions.

Important!

It is especially important to make sure that the TDC sender of the tester is inserted in the transmission case against the stop.

24-26



- Pull crankcase breather hose off of engine block and plug open end of hose with a suitable piece of 32 mm dia. round stock, e.g. Special Tool 30-23.
- Connect CO tester V.A.G 1363 in accordance with the operating instructions.
- Connect CO probe on CO test pipe.
- Connect fault reader V.A.G 1551 – see page 01-6.

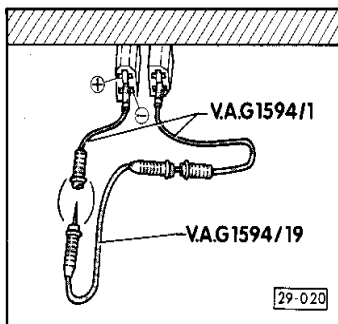
**Note:**  
Use the following procedures if fault read V.A.G 1551 is not available.

⇒ 7.88

- ◀ - Bridge terminals on fuel pump relay with a fuse.

8.88 ⇒

- ◀ - Connect and bridge diagnostic plugs with adapter leads from V.A.G 1594 as shown.
- Run engine at idle speed.
- Check idle speed – see page 24-26.
- Check CO content – see page 24-26.



24-27

#### Checking with Fault Reader V.A.G 1551

- Run engine at idle speed.
- ◀ - Displayed on fault reader:  
\* Displayed alternately
- Press key 2 for "flash code output" operating mode.

V.A.G - Self Diagnosis      HELP  
1 - Rapid data transfer \*  
2 - Flash code output: \*

- ◀ - Displayed:

Initiate flash code output  
with the "→" key.

- ◀ - Press → key so long until permanent earth on exciter wire is displayed.

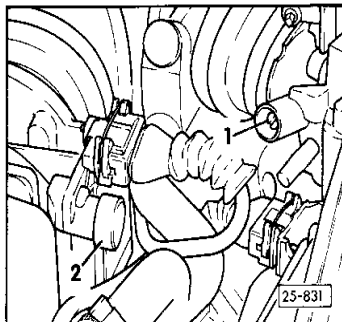
Permanent earth on exciter wire.

- Read idle speed on V.A.G 1367.

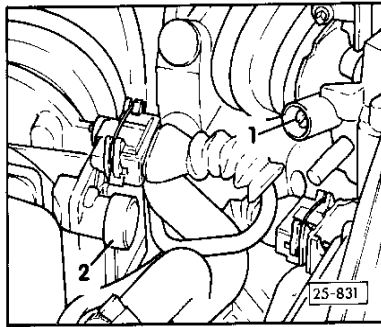
Specification: 750 ... 850 rpm\*

- ◀ - If applicable, correct the idle speed on idle adjusting screw (1).

\* Current values – see Emission and Idle Test publication.



24-28

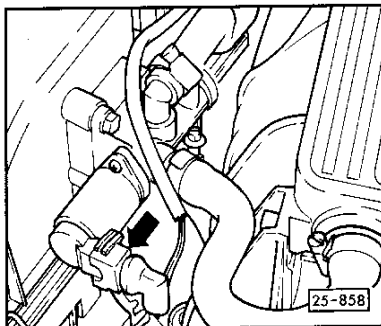


- ← Adjust CO content after removing anti-tamper cap (2).  
Turning clockwise – CO content higher  
Turning anticlockwise – CO content lower

Specification: 0.5 ... 1.0 % by volume \*

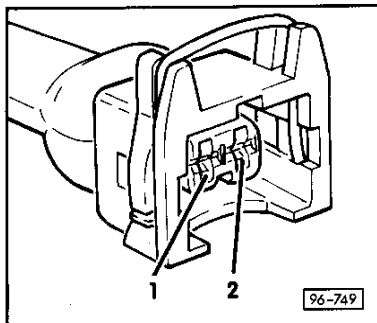
- Recheck and, if necessary, correct idle speed after adjusting the CO content.  
If idle speed and CO content are adjusted, reset fault reader V.A.G 1551 by operating key "C" or remove fuse on the fuel pump relay or remove adapter leads on the diagnostic plugs, through which permanent earth on the exciter wire is eliminated.
- Accelerate engine briefly to more than 2000 rpm.  
If the CO content or idle speed deviates from the specified values afterwards, initiate self diagnosis – see Repair Group 01.
- \* Current values – see Emission and Idle Test publication.

24-29



#### CHECKING ACTIVATION OF IDLING STABILISATION CONTROL VALVE

- ← Pull off plug on idling stabilisation control valve.



- ← Connect test lamp V.A.G 1527 with adapter leads from V.A.G 1594 on terminals 1 and 2 of the plug.

24-30

- Initiate self diagnosis – see Repair Group 01.
- Call activation of idling stabilisation control valve (Code No. 4 4 3 1).

Diode test lamp must light up (flash).

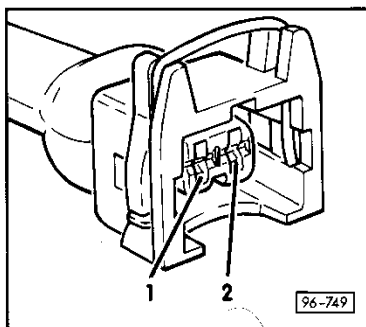
- If the diode test lamp lights up, renew idling stabilisation control valve.
- If the diode test lamp does not light up, connect a voltmeter between terminal 1 and engine earth.

Specification: approx. 12 volts

- If the specified value is not obtained, eliminate breaks in wires according to current flow diagram.
- If the specified value is obtained:
- Switch off ignition.
- Connect test box V.A.G 1598 on plug (A) – see page 01-43.

- ← Check following wires between plug on the idling stabilisation control valve and plug (A) for breaks and shorts.

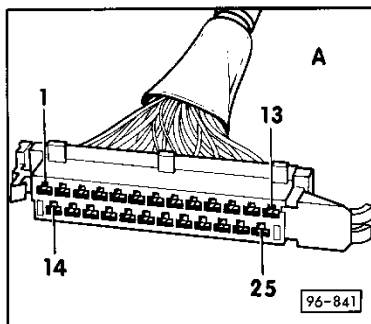
Test Box V.A.G 1598 Sockets	Idling Stabilisation Control Valve Plug
18	1
19	2



24-31

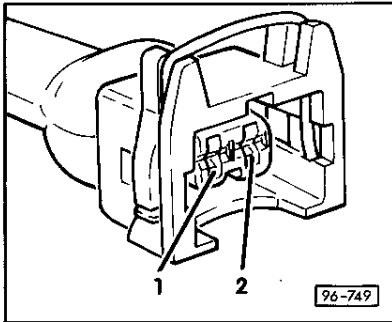
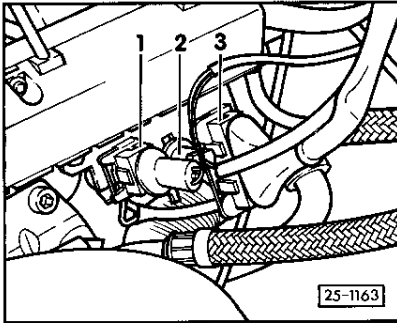
Specification: max. 1  $\Omega$

- ← If the specified values are not obtained, eliminate breaks in wires or shorts between plug on the idling stabilisation control valve and plug (A) in accordance with the current flow diagram.
- If the specified values are obtained, renew idling stabilisation control valve and repeat self diagnosis.
- If the idling stabilisation control valve is still not activated, renew MPI control unit.



24-32





#### CHECKING LAMBDA PROBE HEATING

- Disconnect plug -1- next to the intake manifold.

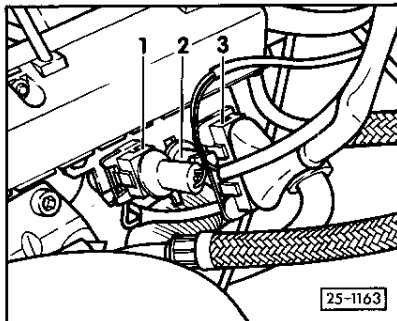
- Connect a voltmeter between terminals 1 and 2.

- Let engine run

Specification: approx. 12 volts

- If the specified value is not obtained, eliminate breaks in wires in accordance with the current flow diagram.

24-33



- If the specified value is not obtained, connect V.A.G 1315/A1 in plug -1-.

- Connect hand multimeter V.A.G 1526.

Specification: 0.5 ... 3.0 A  
(current drops as probe temperature increases)

- If the specified value is not obtained, renew lambda probe.

#### CHECKING LAMBDA CONTROL

- Disconnect plug -2- next to the intake manifold.

- Connect hand multimeter V.A.G 1526 with adapter leads from V.A.G 1594 between the plug and engine earth.

- Switch on ignition.

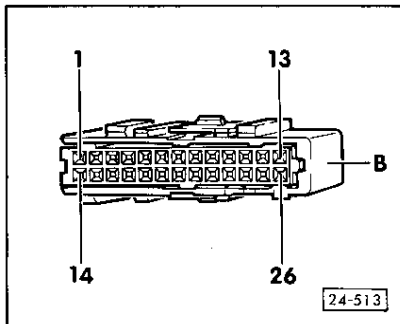
Specification:  $400 \pm 50$  mV

- If the specified value is not obtained, connect test box V.A.G 1598 on plug (B) - see page 01-43.

- Check wire between socket 7 on test box and plug -2- for breaks and shorts.

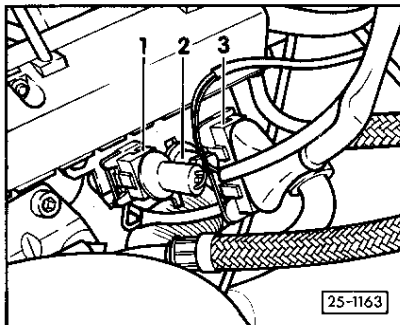
Specification: max. 1  $\Omega$

24-34



- ➡ If the specified value is not obtained, eliminate break in wire or short between plug in engine compartment and plug (B) in accordance with current flow diagram.
- If the specified value is obtained, renew control unit.

#### REMOVING AND INSTALLING LAMBDA PROBE



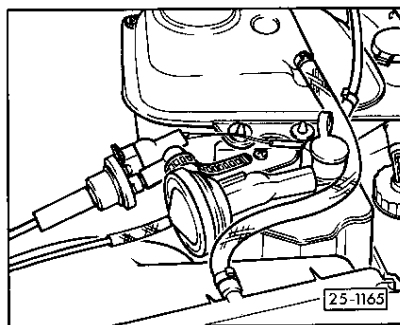
- ➡ Disconnect plugs –1– and –2– (probe heating and signal wire).
- Unscrew lambda probe.  
(Location and tightening torque – see Repair Group 26.)

Conform with the following points when installing the lambda probe.

- Clamps must always be reinstalled at the same location to avoid contact between the probe wire and exhaust pipe.
- Coat threads of lambda probe with a mounting paste.  
This paste must be kept out of the probe's slot.

24-35

#### CHECKING SOLENOID VALVE FOR ACTIVATED CHARCOAL FILTER



- Disconnect plug on activated charcoal filter valve.
- ➡ Connect diode test lamp V.A.G 1527 with adapter lead on terminals 1 and 2 of plug.

- After initiation of final control diagnosis, call activation of the activated charcoal filter solenoid valve (Code No. 4 3 4 3) in the given sequence.

Specification: diode test lamp must light up (flash)

- If the diode test lamp lights up, renew activated charcoal filter solenoid valve.

- ➡ If the diode test lamp does not light up, connect voltmeter between terminal 1 of plug and earth.

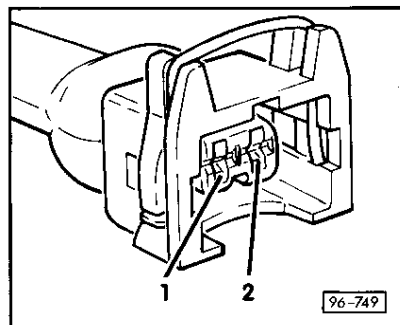
Specification: approx. 12 volts

- If the specified value is not obtained, eliminate break in wire in accordance with current flow diagram.

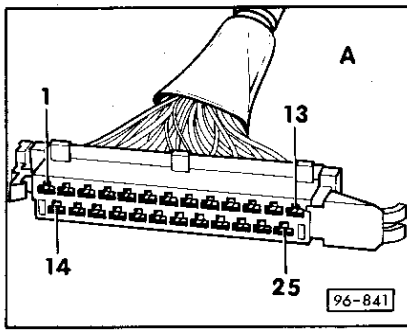
- If the specified value is obtained, connect test box V.A.G 1598 on plug (A) – see page 01-43.

- Check wire between socket 20 on test box and terminal 2 of plug on activated charcoal filter solenoid valve for breaks and shorts.

Specification: max. 1  $\Omega$

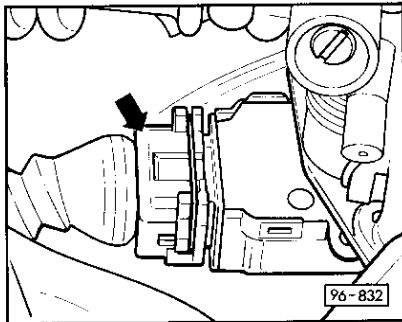


24-36



- ➡ If the specified value is not obtained, eliminate break in wire or short between plug on activated charcoal filter solenoid valve and terminal 20 of plug (A) in accordance with current flow diagram.
- If the specified value is obtained, replace control unit.

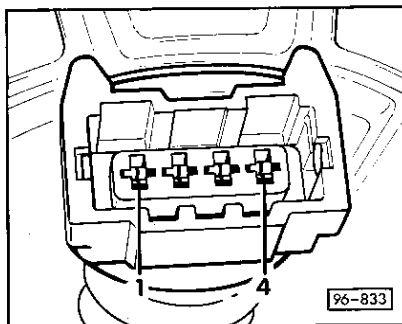
24-37



#### CHECKING THROTTLE VALVE POTENTIOMETER

##### Checking Power Supply:

- ➡ Disconnect plug on throttle valve body.
- Switch on ignition.

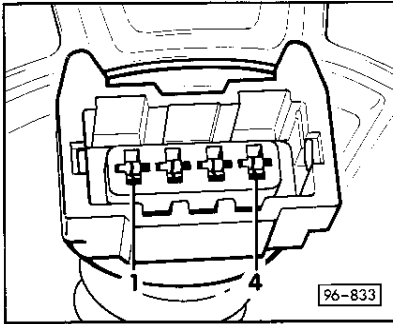


- ➡ Connect hand multimeter V.A.G 1526 in succession between terminals 2 and 4 as well as 3 and 4.

Specification: approx. 5 volts

- If the specified value is obtained, check throttle valve potentiometer and idling switch – see page 24-40.
- If the specified value is not obtained, connect test box V.A.G 1598 on plug (B) – see page 01-43.

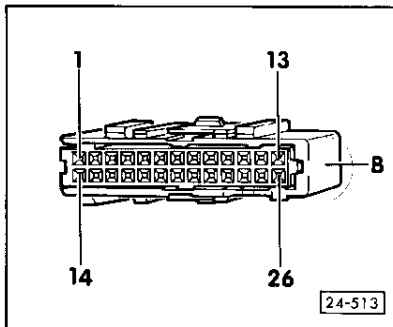
24-38



- Check following wires between the 4-pin plug and plug (B) for breaks or shorts.

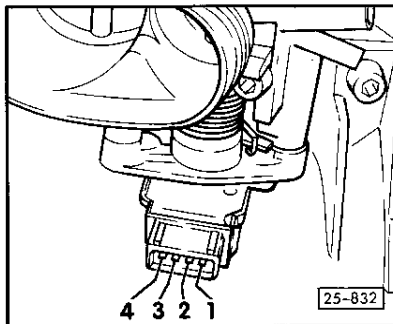
4-pin Plug	Test Box V.A.G 1598 Sockets
2	21
3	10
4	9

Specification: max. 1  $\Omega$



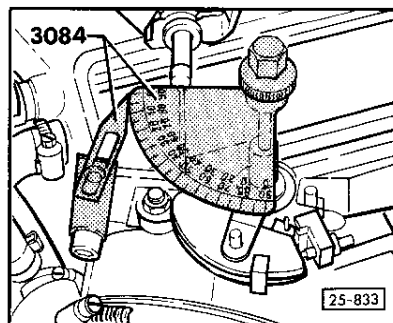
- If the specified value is not obtained, eliminate breaks in wires or shorts between 4-pin plug and plug (B) in accordance with current flow diagram.
- If the specified value is obtained, renew MPI control unit.

24-39



#### CHECKING THROTTLE VALVE POTENTIOMETER

- Remove air intake elbow.
- Pull off plug on throttle valve.
- Connect ohmmeter between terminals 2 and 4.  
Specification: 3.5 ... 6.5 k $\Omega$
- Connect ohmmeter between terminals 2 and 3.  
Specification: 3 ... 6 k $\Omega$
- Operate throttle valve lever to final position.  
Specification: 0 ... 600  $\Omega$
- If one of the specified values is not reached, renew throttle valve potentiometer.

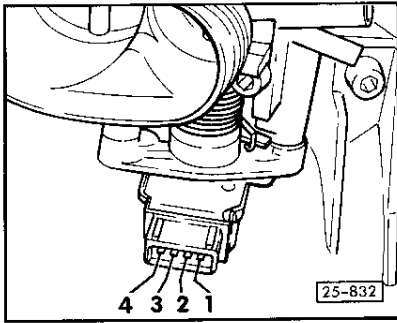


#### CHECKING AND ADJUSTING THROTTLE VALVE SWITCH

##### Checking Throttle Valve Switch:

- Mount indicator for angle tester 3084 on throttle body.
- Screw degree dial on throttle valve shaft.

24-40



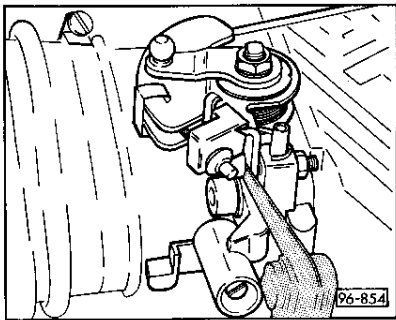
- Connect ohmmeter between terminals 1 and 2 of throttle valve switch.
- Set degree dial to 0 degree.
- Open throttle valve approx. 20° and then close slowly.
- Specified switching point: 1.5 ... 2.5°
- Ohmmeter must show continuity (0 ohm) before the final position of the throttle valve. If not, adjust or renew switch.
- Throttle valve body must be removed for adjustment or replacement of the switch.

#### Adjusting Throttle Valve Switch

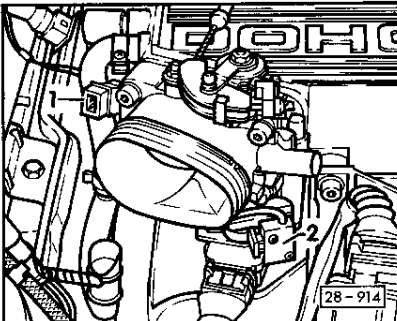
- Remove throttle valve body.
- Connect ohmmeter as described above (Checking Throttle Valve Switch).
- Loosen mounting screws of throttle valve switch and adjust switch in slots until the switch just opens when inserting a 0.75 mm thick feeler gauge blade between the basic setting screw and stop.

#### Specifications:

Feeler gauge blade inserted  $\infty \Omega$   
 Feeler gauge blade not inserted approx. 0  $\Omega$



24-41



#### CHECKING AND ADJUSTING IDLING SWITCH

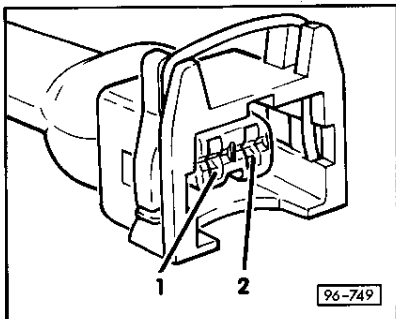
##### Checking Idling Switch (Electric Test):

- Pull off idling switch plug (1) on the throttle valve body.
- Connect ohmmeter between both terminals.

#### Specifications:

Throttle valve closed approx. 0  $\Omega$   
 Throttle valve opened  $\infty \Omega$

- If the specified values are not obtained, check wiring and, if applicable, adjust or renew throttle valve switch.

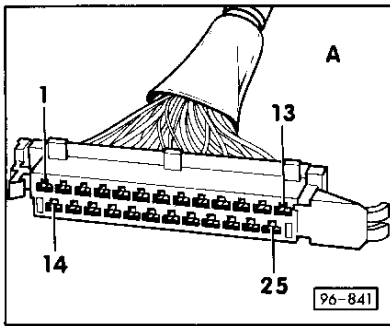


##### Checking Wiring from Idling Switch to Control Unit

- Pull off plug for idling switch on the throttle valve body.
- Connect test box V.A.G 1598 on plug (B) – see page 01-43.
- Check following wires between idling switch plug and test box V.A.G 1598 for breaks or shorts.

Idling Switch Plug Terminals	Test Box V.A.G 1598 Sockets
2	21
1	22

24-42

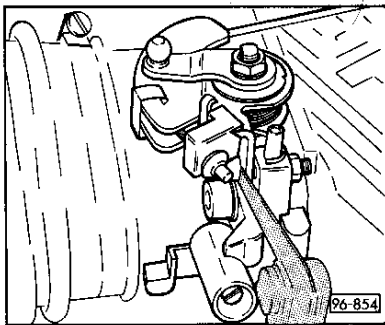


Specification: max. 1  $\Omega$

- If the specified values are not obtained, eliminate breaks in wire or shorts between plug (B) and idling switch plug in accordance with current flow diagram.

#### Checking or Correcting Idling Switch Adjustment

- Connect ohmmeter as described on page 24-41.



- Open throttle valve slightly and hold a 0.5 mm thick feeler gauge blade on the stop when closing the throttle valve.

Specification:  $\infty \Omega$

- Pull out feeler gauge blade.

Specification: 0  $\Omega$

- Insert feeler gauge blade against stop carefully, whereby the throttle valve must not be opened more than necessary for insertion of the feeler gauge blade.

Specification:  $\infty \Omega$

24-43

If the specified values are not obtained, adjust idling switch as described below.

- Loosen mounting screws of idling switch and adjust switch in the slots until the idling switch just opens when inserting a 0.4 mm thick feeler gauge blade between the basic setting screw and stop.

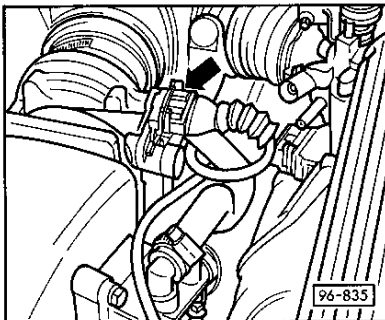
#### CHECKING AIR MASS METER

Test Conditions:

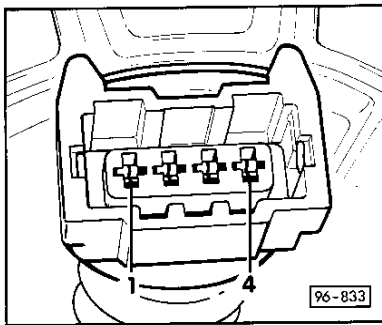
- Fuse no. 27 OK.

#### Checking Power Supply

- Pull off plug on air mass sensor.



24-44



← Connect hand multimeter V.A.G 1526 between terminal 3 and engine earth.

– Switch on ignition.

Specification: 12 volts

– If the specified value is not obtained, eliminate break in wire in accordance with current flow diagram.

– Connect hand multimeter V.A.G 1526 between terminals 3 and 2.

Specification: 12 volts

– Connect hand multimeter V.A.G 1526 between terminals 2 and 4.

Specification: approx. 8 volts

– If the specified values are obtained, check air mass meter – see page 24–46.

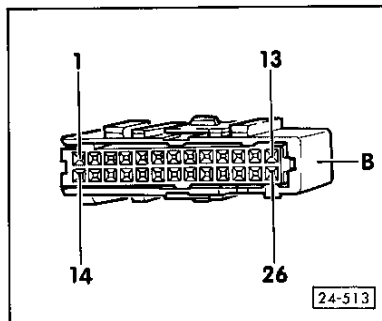
– If one of the specified values is not obtained, connect test box V.A.G 1598 on plug (B) – see page 01–43.

– Check following wires between 4-pin plug and plug (B) for breaks or shorts.

4-pin Plug	Test Box V.A.G 1598 Sockets
1	3
2	6
3	16
4	4

Specification: approx. 1  $\Omega$

24–45



← If the specified values are not obtained, eliminate breaks in wires or shorts between 4-pin plug and plug (B) in accordance with current flow diagram.

– If the specified values are obtained, check air mass meter.

#### Checking Air Mass Meter Function

← Push back cap on connected plug of the air mass meter.

– Switch on ignition.

– Connect hand multimeter V.A.G 1526 with adapter leads from V.A.G 1594 between term. 2 and 4.

Specification: 1.0 ... 7.5 volts

– If the specified value is not obtained, potentiometer in the air mass meter is faulty. Renew air mass meter.

– Connect hand multimeter between term. 2 and 1.

– Switch on ignition.

Specification: 0.3 ... 1.1 volts

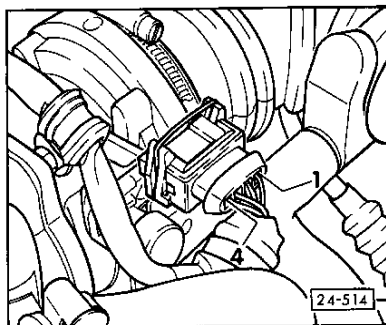
– Run engine and change speed continuously between idling speed and 4,000 rpm.

Specification:

Voltage fluctuates between 1.5 and max. 3.4 volts depending on the engine speed.

– If the specified values are not reached, renew air mass meter.

24–46



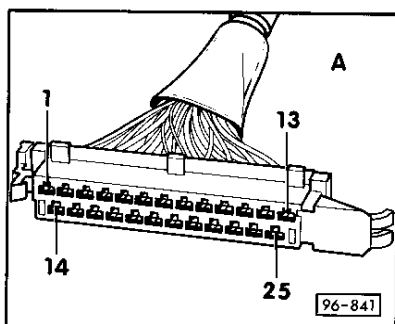
#### CHECKING AIR CONDITIONER COMPRESSOR CUT-OFF

##### Test Conditions:

- Function of air conditioner OK.
- Connect test box V.A.G 1598 on plug (A) and MPI control unit – see page 01–43.
- Connect hand multimeter V.A.G 1526 with adapter leads from V.A.G 1594 on sockets 1 and 24 of the test box.
- Switch on ignition.
- Switch on air conditioner (operating mode "AUTO" and temperature "LO").
- Specification: voltage rise from 0 to 10 ... 12 volts after approx. 6 seconds.
- Floor accelerator pedal very quickly and hold down.
- Voltage must drop to 0 ... 1 volt about 12 seconds long while flooring the accelerator pedal and rise again to 10 ... 12 volts afterwards. If the accelerator pedal is released earlier, the time of voltage drop is reduced up to a minimum of 3 seconds.

24–47

- If the specified values are not obtained, switch off ignition.
- Pull plug of adapter lead V.A.G 1598-6 off of the MPI control unit.
- Check connecting wire (bridge) between sockets 8 and 24 of test box for breaks with an ohmmeter.



- ← If applicable, eliminate break between terminal 8 and 24 of plug –A–.
- Check whether installed MPI control unit and solenoid coupling switch unit (J 153) are as specified in the Parts List.

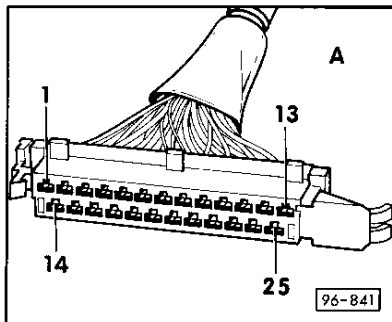
##### Note:

The switch unit for solenoid coupling (J 32/J 153) is located on an additional relay plate on left side below the dash panel – see files with current flow diagrams, electric fault finding and locations.

24–48



- Switch hand multimeter V.A.G 1526 to 200 mA measuring range and connect between sockets 1 and 24 of the test box.
- Switch on ignition.
- Switch on air conditioner (operating mode "AUTO" and temperature "LO").
- Specification: approx. 30 ... 35 mA



- If the specified value is not obtained, check connecting wire from terminal 24 of solenoid coupling switch unit (J 32/J 153) for breaks or shorts to positive or earth in accordance with current flow diagram.

Note:

If there is a short to positive, this has damaged the MPI control unit – renew MPI control unit.

- If there are no faults in the connecting wire, renew switch unit for solenoid coupling.
- If the specified value is obtained in a test without the MPI control unit, although the specified values had not been obtained with a connected MPI control unit, renew MPI control unit.

24-49

#### CHECKING ACTIVATION OF TACHOMETER

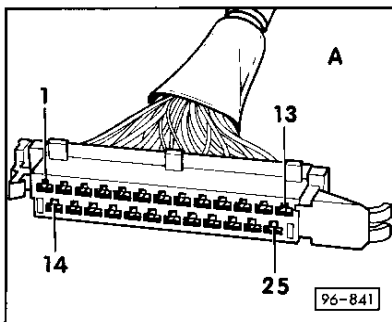
Notes:

- Only perform the following test, if the tachometer in the dash panel insert does not display speed.
- Tachometer in dash panel insert is not activated by the ignition coil, but instead by a signal from the MPI control unit.

- Connect test box V.A.G 1598 on plug (A) – see page 01-43.
- Connect both adapter leads on MPI control unit.
- Connect speed measuring tester V.A.G 1367 in accordance with operating instructions. Signal lead (green clip) is not connected on the ignition coil, but on socket 10 of the test box (use testing adapter set V.A.G 1594).
- Run engine at idling speed.

Specification: display of speed

- If the speed is displayed on V.A.G 1367, stop engine and remove dash panel insert.



- Check connecting wire between MPI control unit and dash panel insert for breaks in accordance with current flow diagram.
- If there is no break in wire, eliminate fault in dash panel insert – see workshop manual "Electrical System".

24-50

- If the speed is not displayed on V.A.G 1367, stop engine, remove dash panel insert and pull off yellow 26-pin plug.
- Run engine at idling speed.
- If the speed is now displayed on V.A.G 1367, the fault is in the dash panel insert – see workshop manual "Electrical System".
- If the speed is not displayed on V.A.G 1367, check the connecting wire between MPI control unit and dash panel insert for a short to positive or earth in accordance with current flow diagram.
- If the speed is still not displayed, although there is no short circuit, renew MPI control unit.

24-51

#### CHECKING ACTIVATION OF ON-BOARD COMPUTER (ECONOMY CONTROL)

##### Note:

- Only perform the following test, if the fuel consumption signal is missing or wrong while checking the on-board computer.

- Connect test box V.A.G 1598 on plug (A) – see page 01-43.
- Connect both adapter leads on MPI control unit.
- Connect voltmeter between socket 1 (earth) and socket 23 (signal).
- Run engine and change speed continuously between 1000 and 4000 rpm.

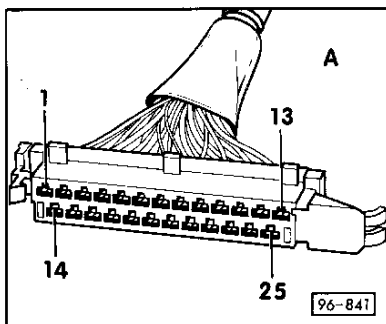
Specification: approx. 0.3 ... 0.8 volt (depending on engine speed)

- If the specified value is not obtained, remove dash panel insert and pull off black 10-pin plug for on-board computer.

- Run engine.

Specification: approx. 0.10 ... 0.30 volt

- ← If the specified value is not reached, check wire between terminal 23 of plug (A) and on-board computer for breaks or shorts in accordance with current flow diagram.



24-52

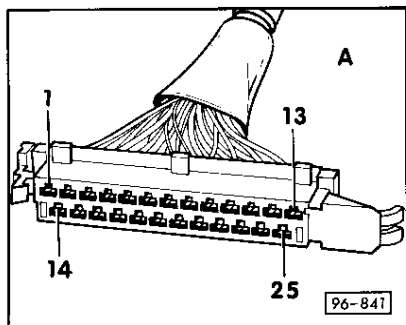
- If wire does not have a break, eliminate fault in dash panel insert or on-board computer – see workshop manual "Electrical System".
- If the specified value is not obtained, although there is no fault in the dash panel insert or on-board computer, renew MPI control unit.

#### CHECKING ROAD SPEED SIGNAL

##### Test Conditions:

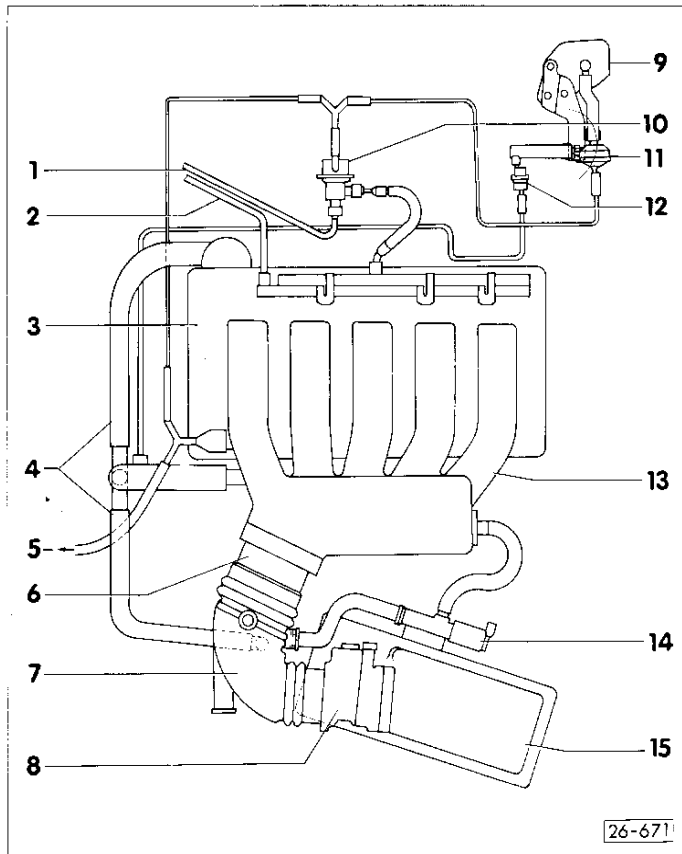
- Fuse no. 27 OK.
- Connect test box V.A.G 1598 on plug (A) – see page 01–43.  
(MPI control unit is not connected.)
- Connect diode test lamp V.A.G 1527 on sockets 14 and 25 of the test box.
- Lift vehicle at front left until wheel has cleared floor.
- Switch on ignition – diode test lamp lights up at about half its full brightness.
- Turn left front wheel slowly by hand. Diode test lamp must then light up brighter (flash).

24–53



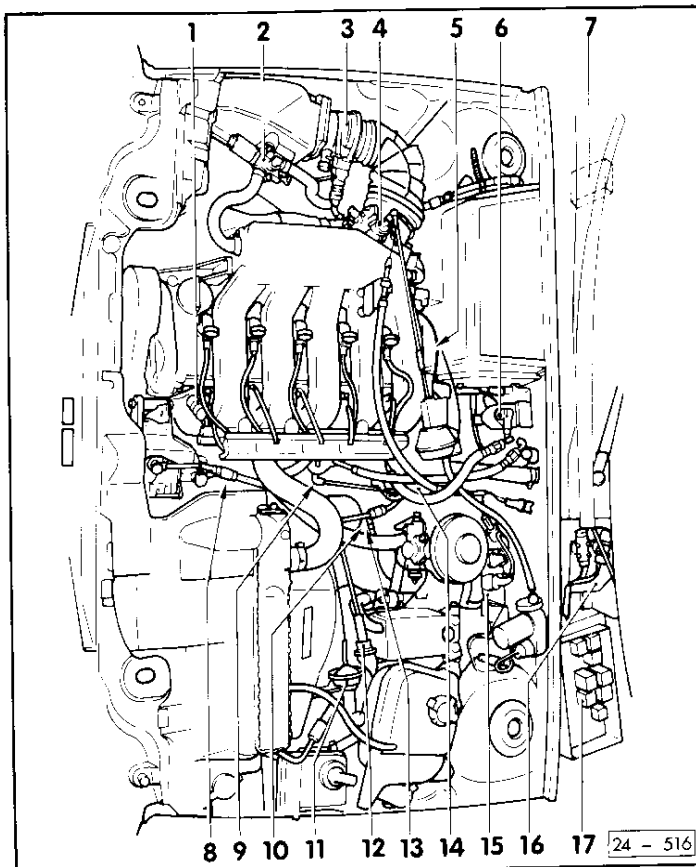
- ← If the diode test lamp does not light up and flash, check connecting wire from terminal 14 to dash panel insert for breaks with an ohmmeter in accordance with current flow diagram.
- If the connecting wire does not have a break, continue fault finding with the "Checking Road Speed Signal" fault finding programme in the files with current flow diagrams, electric fault finding and locations.
- If the diode test lamp lights up and flashes, switch off ignition and connect adapter lead V.A.G 1598-6 on the MPI control unit.
- Connect diode test lamp on sockets 14 and 25 of the test box.
- Switch on ignition; diode test lamp lights up at about half the full brightness.
- Turn left front wheel slowly by hand. Diode test lamp must then light up brighter (flash).
- If the diode test lamp does not light up and flash, although there was no fault in the test without MPI control unit, renew MPI control unit.

24–54



#### VACUUM CONNECTIONS

- 1 - Fuel return pipe
- 2 - Fuel feed pipe
- 3 - Cylinder head
- 4 - Crankcase breather
- 5 - To differential lock
- 6 - Throttle valve body
- 7 - Air intake elbow
- 8 - Air mass meter  
• Checking – see page 24–44
- 9 - Activated charcoal filter
- 10 - Pressure regulator  
• Checking – see page 24–10
- 11 - Cut-off valve  
• Checking – see page 20–13
- 12 - Activated charcoal filter valve  
• Checking – see final control diagnosis
- 13 - Intake manifold
- 14 - Idling stabilisation control valve  
• Checking -- see page 24–30
- 15 - Air cleaner

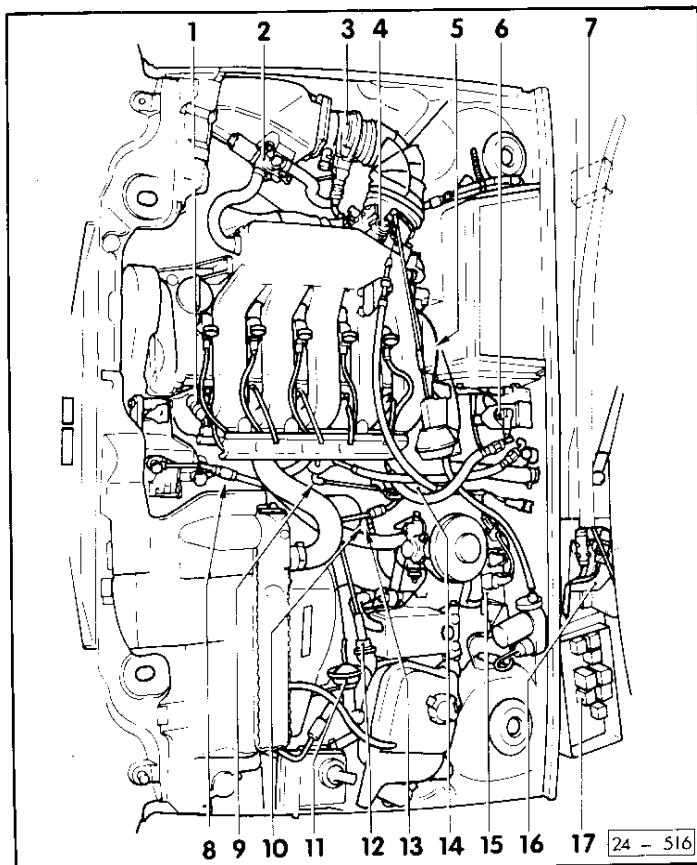


#### MULTIPOINT INJECTION (MPI) COMPONENTS FOR FULLY ELECTRONIC ENGINE MANAGE- MENT

- Observe safety precautions – see page 28–5.
- Introduction of self diagnosis – see Repair Group 01.

- 1 – Injector
  - Checking activation – see page 24–17
- 2 – Idling stabilisation control valve
  - Checking activation – see page 24–30
- 3 – Air mass sensor
  - Checking – see page 24–44
- 4 – Throttle valve body
  - Checking – see page 24–40
- 5 – Coolant temperature sender
  - Checking – see page 28–14
- 6 – Ignition coil with final output stage
  - Checking – see page 28–7
- 7 – MPI control unit
  - Checking power supply – see page 28–16

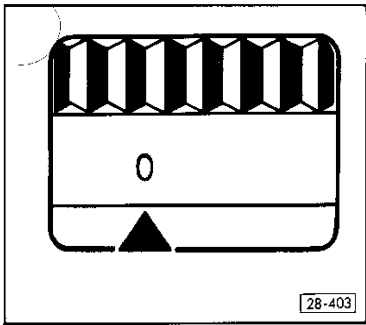
28 –1



- 8 – Knock sensor I (10 Nm)
- 9 – Knock sensor II (10 Nm)
- 10 – Ignition timing sender
  - Checking – see page 28–10
- 11 – Engine speed sender
  - Checking – see page 28–12
- 12 – Distributor with Hall sender
  - Basic setting – see page 28–21
- 13 – Plug bracket
- 14 – Ballast resistor for injectors
- 15 – Fuel pump relay
  - Checking activation – see page 24–14

28 –2

# TECHNICAL DATA – IGNITION SYSTEM

Engine code letters	7A	
Distributor basic setting *	TDC	
Mark		
Ignition timing sender **	Resistance kΩ	approx. 1.0
Engine speed sender ***	Resistance kΩ	approx. 1.0

- \* Distributor basic setting – see page 28–21
- \*\* Checking ignition timing setting – see page 28–10
- \*\*\* Checking engine speed sender – see page 28–12

Note:  
The ignition timing is controlled by a map in the control unit.  
It is not possible to adjust the ignition timing.

28–3

Spark plugs	Part number	191 905 450 J
	Bosch	F 6 DTC
	Champion	C 6 BYC
	Beru	14F-6DTU
Electrode gap	mm	0.8 ± 0.1
Tightening torque	Nm	20
Firing order		1 - 2 - 4 - 5 - 3
Engine speed limitation via fully electronic ignition Cut-off speed	rpm	7200 – 200
Ignition coil		
Secondary resistance	kΩ	6.5 ... 8.0
Primary resistance	Ω	approx. 0 ... 1
Distributor rotor		
Resistance	kΩ	1.0

28–4

#### SAFETY PRECAUTIONS FOR MPI

Conform with the following points to avoid injuries to persons and/or damage to the ignition and injection systems.

- Never touch or pull off ignition wires with the engine running or operated with the starter.
- Always switch off the ignition first before disconnecting or connecting wires of the ignition and injection systems – including leads for testers.
- Disconnect three-pin plug on final output stage of the ignition coil and remove fuse no. 13, if the engine has to be operated with the starter without that it is started (e.g. when checking the compression).
- Outside starting with a quick charger is only permissible for 1 minute at a maximum of 16.5 volts. A pause of at least 1 minute is required between each attempt to start the engine.
- Ignition must be switched off when washing engine.
- Disconnect battery completely for electric and spot welding.
- Never disconnect battery with engine running.

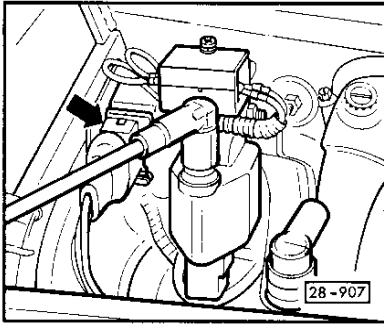
#### Important!

- Call the code of a radio with an anti-theft code prior to disconnection of the battery.
- Ignition must be switched off first when disconnecting and connecting the battery, as the MPI control unit could be damaged.

28-5

- Always use testing adapter set V.A.G 1594 for connection of testers (diode test lamp, etc.).
- Never replace the ignition coil with a conventional ignition coil.
- Engine must not be started immediately after a hot phase with heating to more than 80° C (e.g. painting or steam cleaning vehicle).
- Secondary end of ignition coil must be shielded with at least 2 k $\Omega$ , whereby the distributor rotor must have 1 k $\Omega$ .
- Never supply voltage for simulation of output signals on the control unit.
- Only connect injectors via ballast resistors (see current flow diagram).
- Never start engine after removal of injectors.
- Never connect shielded capacitors or test lamps on terminal 1 (-).

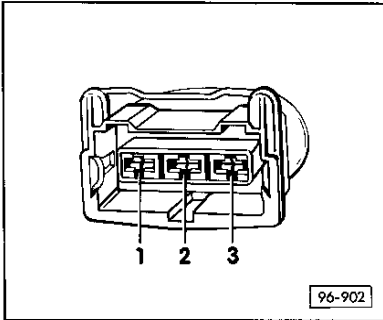
28-6



## CHECKING IGNITION COIL AND FINAL OUTPUT STAGE FOR IGNITION SYSTEM

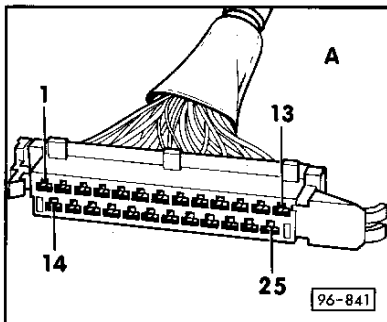
### Checking Activation of Ignition Coil

- Disconnect plug on final output stage of ignition coil.



- Connect hand multimeter V.A.G 1526 in turn between terminal 1 and earth as well as terminals 1 and 3.
- Switch on ignition.
- Specification: approx. 12 volts each
- If the specified values are not obtained, eliminate break in wire using current flow diagram.

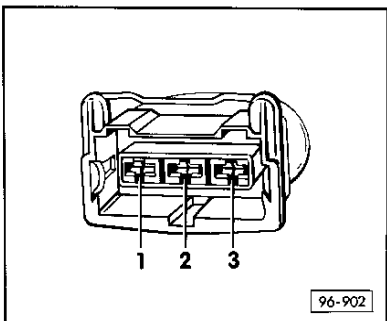
28-7



- Connect hand multimeter V.A.G 1526 between terminals 2 and 3.
- Operate engine with starter.
- Specification: at least 0.2 volt

Note:  
Switch off ignition before disconnecting plug on MPI control unit.

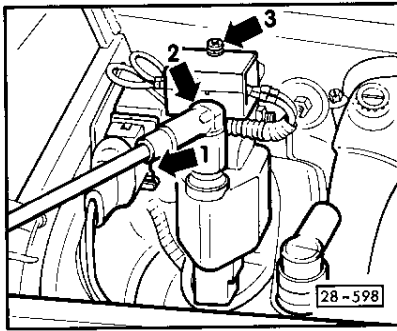
- If the specified value is not obtained, connect test box V.A.G 1598 on plug (A) - see page 01-43.



- Check wire between terminal 2 of final output stage plug and socket 9 of test box for breaks or shorts.
- Specification: max. 1Ω
- If the specified value is not obtained, eliminate break in wire or short using current flow diagram.
- If there are no wire breaks or shorts, renew MPI control unit.

28-8





#### Checking Ignition Coil

- Check connecting wires between final output stage and ignition coil as well as final output stage and engine for corrosion or damaged insulators.
- ➡ Disconnect plug -1- on final output stage and plug -2- on terminal 4 of the ignition coil. Unscrew screw -3-.

#### Checking Secondary Resistance

- ➡ Connect hand multimeter V.A.G 1526 between terminals 1 and 4 of the ignition coil.

Specification: 5 ... 9 k $\Omega$

- If the specified value is not obtained, renew ignition coil.

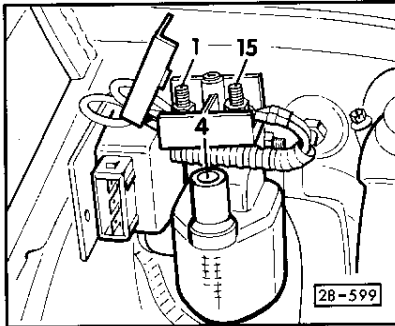
#### Checking Primary Resistance

- ➡ Connect ohmmeter between terminals 1 and 15 of the ignition coil.

Specification: 0.5 ... 1.5  $\Omega$

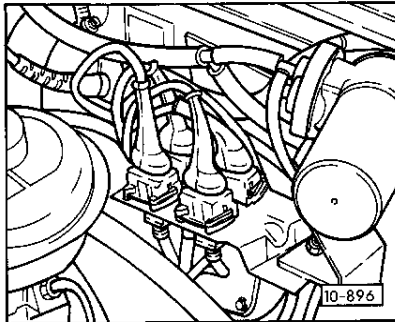
- If the specified value is not obtained, renew ignition coil.
- If all of the specified values for checking the ignition coil with final output stage are obtained and the engine does not run (no ignition impulse), renew ignition coil with final output stage. (The function of the final output stage cannot be checked.)

28-9



#### CHECKING IGNITION TIMING SENDER

- ➡ Disconnect plug (black) of ignition timing sender.



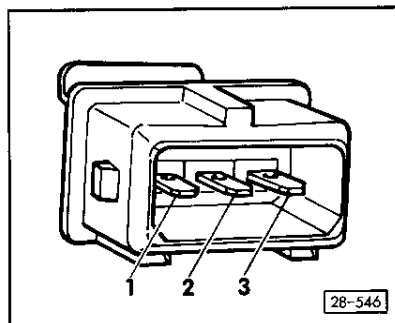
- ➡ Connect hand multimeter V.A.G 1526 with adapter leads from V.A.G 1594 on terminals 1 and 2.

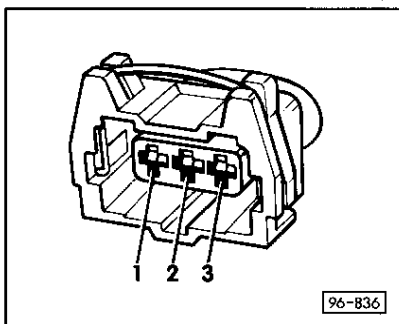
Specification: approx. 1 k $\Omega$

- If the specified value is not obtained, renew ignition timing sender.
- If the specified value is obtained, connect the hand multimeter between terminals 1 and 3 as well as terminals 2 and 3.

Specification:  $\infty$   $\Omega$  each (no continuity)

- If the specified value is not obtained, renew ignition timing sender.



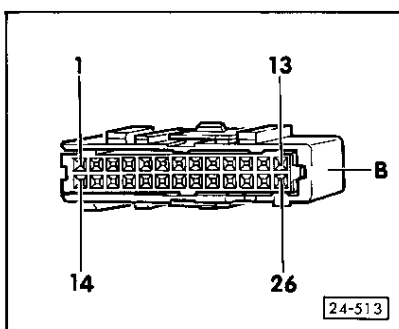


- If the specified value is obtained, connect test box V.A.G 1598 on plug (B) – see page 01–43.

➡ Check following wires between sender connection and plug (B) for breaks or shorts.

Sender Connection Terminals	Test Box V.A.G 1598 Sockets
1	12
2	24
3	24

Specification: max. 1  $\Omega$



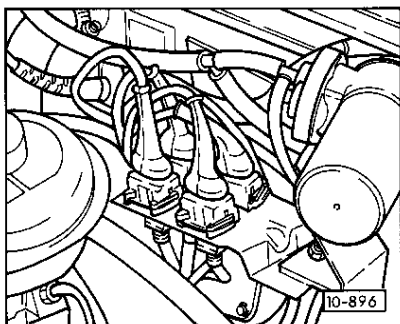
➡ If the specified values are not obtained, eliminate breaks or shorts in wires between the sender connection and plug (B) using current flow diagram.

- If the specified values are obtained, check distance between pin and ignition timing sender – see page 13–20.

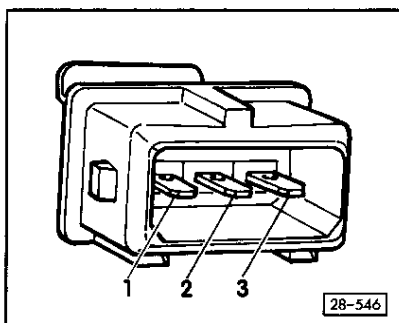
- If the distance is correct and the fault appears again after a test drive, renew MPI control unit.

28–11

#### CHECKING ENGINE SPEED SENDER



➡ Disconnect plug (gray) of engine speed sender and pull plug out of the bracket.



➡ Connect hand multimeter V.A.G 1526 on terminals 1 and 2.

Specification: approx. 1 k $\Omega$

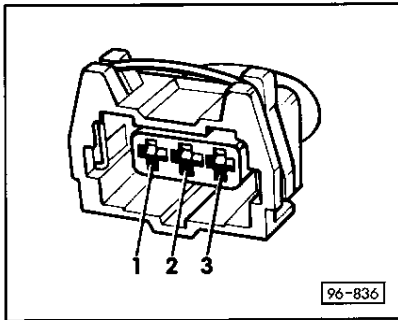
- If the specified value is not obtained, renew engine speed sender.

- If the specified value is obtained, connect hand multimeter on terminals 1 and 3 as well as terminals 2 and 3.

Specification:  $\infty \Omega$  each (no continuity)

- If the specified value is not obtained, renew engine speed sender.

28–12

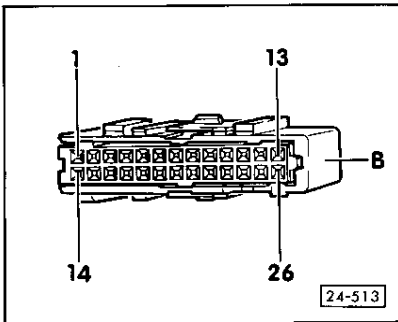


- If the specified value is obtained, connect test box V.A.G 1598 on plug (B) – see page 01-43.

- ➡ Check following wires between the sender connection and plug (B) for breaks or shorts.

Sender Connection Terminals	Test Box V.A.G 1598 Sockets
1	13
2	25
3	25

Specification: max. 1  $\Omega$



- ➡ If the specified values are not obtained, eliminate breaks or shorts in wires between the sender connection and plug (B) using current flow diagram.

- If no fault is found up to this point, inspect teeth of the starter gear ring.

Inspection of the teeth requires removal of the bracket with engine speed and ignition timing senders.

- Crank the engine slowly and inspect the gear ring for out-of-true as well as broken or damaged teeth. Renew gear ring, if necessary.

- If no faults have been found in any of the tests up to this point, renew MPI control unit.

28-13

#### CHECKING COOLANT TEMPERATURE SENDER

##### Test Conditions:

- Coolant temperature approx. 20° C.

- Disconnect plug on coolant temperature sender.

- ➡ Connect hand multimeter on terminals 1 and 2 of sender.

##### Note:

The resistance is lower with higher coolant temperature.

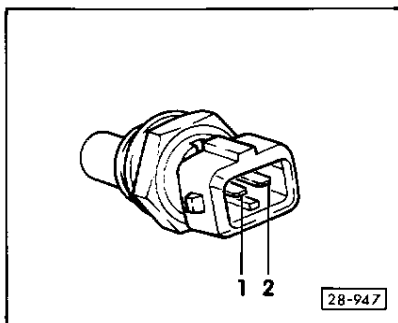
##### Specifications:

approx. 2.5 k $\Omega$  for approx. 20° C coolant temperature

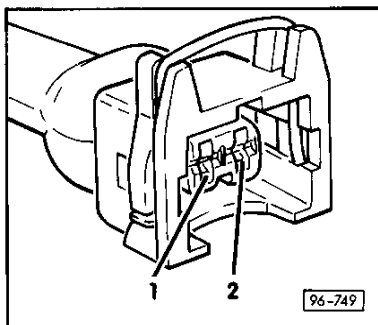
approx. 330  $\Omega$  for approx. 80° C coolant temperature

- If the specified values are not obtained, renew coolant temperature sender.

- If the specified values are obtained, connect test box V.A.G 1598 on plug (A) – see page 01-43.



28-14

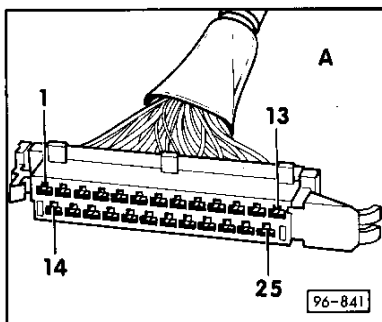


- Check following wires between plug on coolant temperature sender and plug (A) for breaks or shorts.

Coolant Temperature Sender Plug Terminals	Test Box V.A.G 1598 Sockets
1	11
2	15

Specification: max. 1  $\Omega$

- If a break is found in both tests, repeat the continuity test on mixed pins of the two-pin plug.



- If the specified values are still not obtained, eliminate breaks or shorts in wire between the plug on the coolant temperature sender and plug (A) using current flow diagram.

- If no faults were found in the tests up to this point, renew MPI control unit.

28-15

#### CHECKING POWER SUPPLY FOR MPI CONTROL UNIT

- Connect test box V.A.G 1598 on plug (A) – see page 01-43.
- Connect hand multimeter V.A.G 1526 between terminals 18 and 21.

Specification: approx. 12 volts

- If the specified value is not obtained, check connecting wires.
- Switch on ignition.
- Measure voltage between socket 25 (positive supply via ignition) and sockets (earth points) specified below with hand multimeter V.A.G 1526.

V.A.G 1598 Sockets	V.A.G 1598 Sockets
25	1
25	2
25	13

Specification: approx. 12 volts

- If the specified values are not obtained, eliminate breaks in wires using current flow diagram.
- Switch off ignition.

28-16

## CHECKING KNOCK SENSORS - G 61 and G 66

### Notes:

- Knock sensors cannot be tested electrically (interrogate fault memory – see Repair Group 01).
- Precise tightening torque of 10 Nm is important for perfect operation of the knock sensors.
- Check knock sensor plug connection on wiring loom for corrosion.

### Checking Knock Sensor Wires

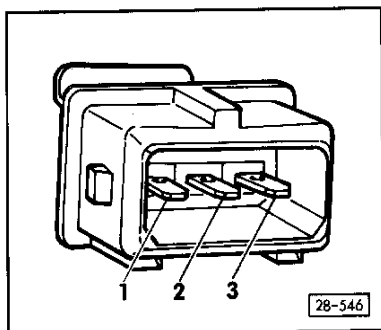
- Disconnect plug of concerned knock sensor in the engine compartment.

➡ Check all three terminals of knock sensor plug to each other for short circuit. Wires must not have contact to each other.

- If there is contact, renew knock sensor.

### Checking Wires from Knock Sensor to MPI Control Unit

- Connect test box V.A.G 1598 on plug (B) – see page 01–43.



28-17

- Check following wires to each other for breaks or shorts using current flow diagram.

### ➡ Knock Sensor 1 (front):

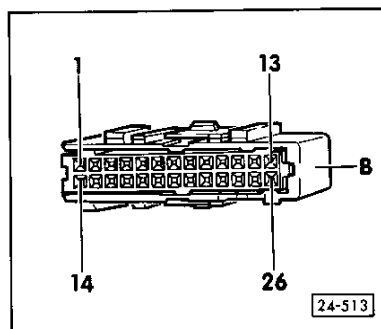
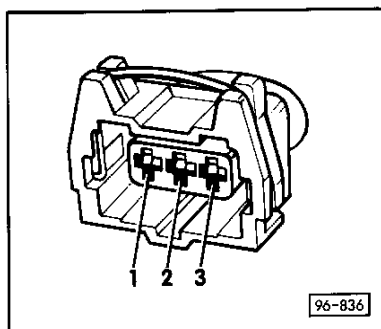
Red Sensor Connection Terminals	V.A.G. 1598 Sockets
1 (signal)	8
2 (earth)	20
3 (shielding)	20

### • Knock Sensor 2 (rear):

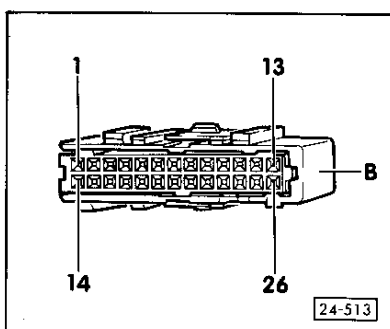
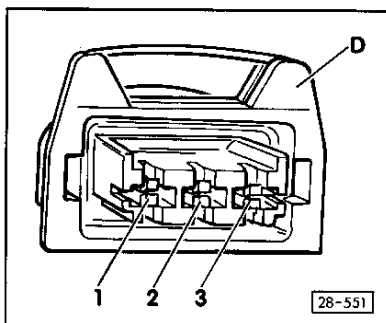
White Sensor Connection Terminals	V.A.G 1598 Sockets
1 (signal)	15
2 (earth)	14
3 (shielding)	14

Specification: max. 1  $\Omega$

- ➡ If the specified values are not obtained, eliminate breaks or shorts in wires between the sensor connection and plug (B).



28-18



#### CHECKING HALL SENDER

- Connect test box V.A.G 1598 on plug (B) – see page 01–43.
- Connect diode test lamp V.A.G 1527 on sockets 11 and 23.
- Operate starter several seconds.
- The diode test lamp must flash briefly for every second engine revolution.
- If the diode test lamp does not flash, switch off ignition and disconnect three-pin plug for Hall sender on the distributor.
- Check following wires to each other for breaks or shorts using current flow diagram.

Hall Sender Plug Terminals	V.A.G 1598 Sockets
1 (earth)	23
2 (signal)	11
3 (positive)	1

Specification: max. 1  $\Omega$

- If the specified values are not obtained, eliminate breaks or shorts in wires between the Hall sender plug and plug (B) using current flow diagram.

28–19

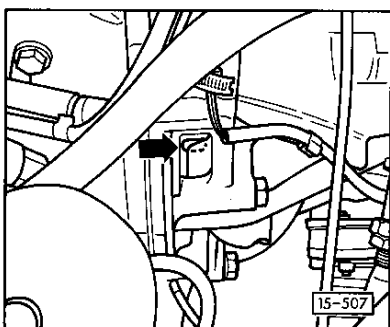
- If there neither breaks nor shorts, switch on ignition.
  - Connect hand multimeter V.A.G 1526 on sockets 1 and 23.
- Specification: at least 9 volts
- Connect hand multimeter V.A.G 1526 on sockets 11 and 23.

Specification: at least 4.0 volts

- If the specified values are not obtained, renew MPI control unit.
- If the specified values are obtained, renew distributor.

#### Important!

As the distributor rotor is cemented on the shaft, it can no longer be pulled off. Renew the distributor if the rotor is damaged.



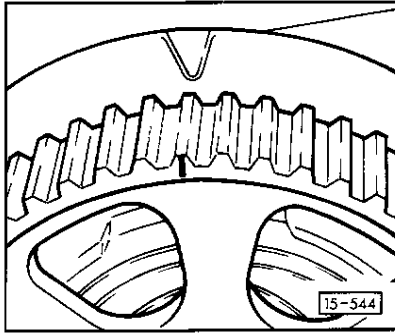
#### DISTRIBUTOR INSTALLATION AND BASIC SETTING

##### Note:

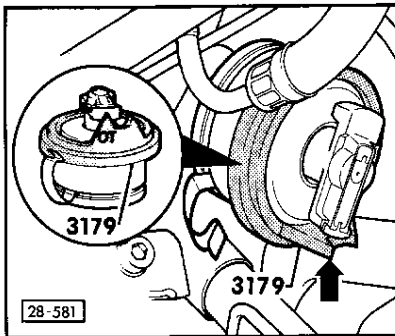
The distributor rotor is cemented and cannot be pulled off.

- Turn crankshaft to TDC with Special Tool 2079.

28–20



- ← Mark on camshaft sprocket must be aligned with arrow on cylinder head cover.



**Note:**

Select basic installed position of distributor as shown in Fig. 28-581 because of wire lengths.

- ← Apply Special Tool 3179 on distributor and engage in groove.
- Align centre of distributor with TDC mark.
- Install distributor and turn distributor housing until centre of distributor rotor points precisely to TDC mark on Special Tool 3179.
- Tighten distributor screws.