

## Audi A3 1997 ➤

**Diesel Direct Injection and Glow Plug System (TDI 4 cyl.) >07.99**

|           |     |     |     |  |  |  |  |  |  |
|-----------|-----|-----|-----|--|--|--|--|--|--|
| Engine ID | AGR | AHF | ALH |  |  |  |  |  |  |
|-----------|-----|-----|-----|--|--|--|--|--|--|

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

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**Diesel Direct Injection and Glow Plug System (TDI 4  
cyl.) >07.99**

### Repair Group

01 - Self-diagnosis

23 - Mixture preparation, Injection

28 - Glow plug system



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

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# 01 - Self-diagnosis

## 1 - Self-diagnosis

### 1.1 - Self-diagnosis

#### 1.2 - Technical data of self-diagnosis

##### Features

- ◆ Fault memory: Non-volatile memory and volatile memory 1)
- ◆ Rapid data transfer

1 ) Will be erased after the 50th engine start, if the fault has not reappeared.

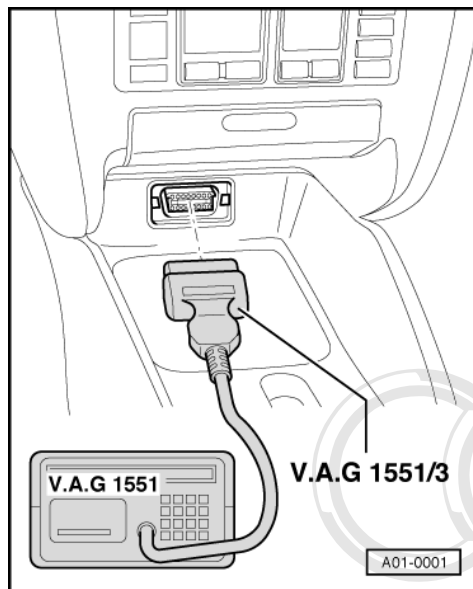
##### Available functions

| Function                              | Ignition switched on | Engine idling |
|---------------------------------------|----------------------|---------------|
| 01 Interrogating control unit version | x                    | x             |
| 02 Interrogating fault memory         | -                    | x             |
| 03 Final control diagnosis            | -                    | x             |
| 04 Basic setting                      | -                    | x             |
| 05 Erase fault memory                 | x                    | x             |
| 06 End output                         | x                    | x             |
| 07 Encode control unit                | x                    | x             |
| 08 Reading measured value block       | x                    | x             |

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



#### Test conditions

- Battery voltage at least 11 V
- Fuse OK.

- -> Unclip cover for diagnostic connectors.
- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.

-> Indicated on display:

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

\* Displays appear alternately

#### **Note:**

*If the display remains blank:*

=> Fault reader operating instructions

Depending on the function required:

- Switch on ignition

or

start engine => Page 1, "Available functions" table.

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

-> Indicated on display:

```
Rapid data transfer    HELP
Enter address word XX
```

```
Rapid data transfer    Q
01 - Engine electronics
```

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

-> If one of the messages shown appears on the display, run through the fault finding procedure as described in the diagnostic wire fault-finding program.

Rapid data transfer      HELP  
No reply from control unit

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

Rapid data transfer      HELP  
Communication problem

Rapid data transfer      HELP  
K wire not switching to earth

Rapid data transfer      HELP  
K wire not switched to positive

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

028906021.. R4 EDC  
G0002 0203  
Coding 00002      WSC 12345

|                   |                                                                         |
|-------------------|-------------------------------------------------------------------------|
| - 028906021..     | Control unit number (see also spare parts list)                         |
| - 1.9l            | Engine capacity                                                         |
| - R4              | In-line engine, 4 cylinders                                             |
| - EDC             | Electronic Diesel Control                                               |
| - G or no display | Vehicle with or without cruise control                                  |
| - 00              | Control unit maps                                                       |
| - AG              | Automatic gearbox                                                       |
| - MG              | Manual gearbox                                                          |
| - 0203            | Control unit software version                                           |
| - Coding 00002    | Coding of control unit                                                  |
| - WSC 12345       | Workshop Code from V.A.G 1551 which was used to perform the last coding |

- Press the =>key.

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

## 1.4 - Interrogating and erasing fault memory.

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

Only if engine does not start:

- Interrogate fault memory with ignition switched on.

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

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



-> The display shows the number of stored faults or "No fault detected!".

X fault(s) detected

If no fault is stored:

- Press the ➡key.

If one or more faults are stored:

The stored faults are displayed and printed out one after the other.

The display then shows the following:

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

-> Indicated on display:

Rapid data transfer  
Fault memory is erased

#### Note:

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

- Press the ➡key.

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

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

## 1.5 - Fault table

#### Notes:

- ♦ The fault table is sorted according to the 5-digit fault code on the left.
- ♦ Before renewing components shown as being faulty, check the wiring and connectors to these components and the earth connections using the current flow diagram. This is particularly relevant for faults recorded as "occurring sporadically" (SP).

| V.A.G 1551 printout                                     | Possible causes of fault                            | Possible effects                                                         | Fault remedy                            |
|---------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------|
| 00513<br>Engine speed sender -G28<br>Implausible signal | - Sensor disc bent or loose                         | - Poor starting<br>- Engine running rough, misfiring                     | - Remove oil sump and check sensor disc |
|                                                         | - -G28 defective                                    | - Poor starting<br>- Increased idling speed                              | - Check engine speed sensor =>Page 81   |
|                                                         | - Open circuit in screening                         | - Fault lamp lights up<br>- Reduced power<br>- No display on rev counter |                                         |
| No signal                                               | - -G28 defective<br>- Open circuit or short circuit |                                                                          |                                         |

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| V.A.G 1551 printout                              | Possible causes of fault                            | Possible effects | Fault remedy                                        |
|--------------------------------------------------|-----------------------------------------------------|------------------|-----------------------------------------------------|
| 00519<br>Intake manifold pressure sender<br>-G71 |                                                     |                  |                                                     |
| Short to positive                                | - Open circuit or short circuit<br>- -G71 defective | - Loss of power  | - Test intake manifold pressure sender => Page 63 . |
| Open circuit/short circuit to earth              | - Open circuit<br>- -G71 defective                  |                  |                                                     |
| Voltage supply                                   | - Open circuit or short circuit                     |                  |                                                     |

| V.A.G 1551 printout                         | Possible causes of fault                                                   | Possible effects                                                                                                           | Fault remedy                                 |
|---------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| 00522<br>Coolant temperature sender<br>-G62 |                                                                            |                                                                                                                            |                                              |
| Short to earth                              | - -G62 defective<br>- Short circuit to earth in wiring                     | - Black exhaust smoke when starting<br>- Engine preheating not working<br>- Glow plugs always operate for about 20 seconds | - Test coolant temperature sensor => Page 83 |
| Open circuit / short to positive            | - -G62 defective<br>- Open circuit or wiring has short circuit to positive |                                                                                                                            |                                              |

| V.A.G 1551 printout                              | Possible causes of fault                                | Possible effects                | Fault remedy                                          |
|--------------------------------------------------|---------------------------------------------------------|---------------------------------|-------------------------------------------------------|
| 00527<br>Intake manifold temperature sender -G72 |                                                         |                                 |                                                       |
| Short to earth                                   | - -G72 defective<br>- Short circuit to earth in wiring  | - Engine preheating not working | - Check intake manifold temperature sender => Page 62 |
| Open circuit / short to positive                 | - -G72 defective<br>- Open circuit or short to positive |                                 |                                                       |

| V.A.G 1551 printout                         | Possible causes of fault                                    | Possible effects                             | Fault remedy                                                         |
|---------------------------------------------|-------------------------------------------------------------|----------------------------------------------|----------------------------------------------------------------------|
| 00532<br>Power supply<br>Implausible signal |                                                             |                                              |                                                                      |
|                                             | - Control unit was connected while ignition was switched on |                                              | - Erase fault memory and continue observing vehicle                  |
|                                             | - Open circuit or short                                     | - Engine will not start<br>- Engine cuts out | - Checking power supply to diesel direct-injection system => Page 78 |
|                                             | - Diesel direct injection control unit -J248 defective      |                                              | - Replace control unit => Page 57                                    |

| V.A.G 1551 printout                   | Possible causes of fault | Possible effects | Fault remedy |
|---------------------------------------|--------------------------|------------------|--------------|
| 00539<br>Fuel temperature sender -G81 |                          |                  |              |

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|                                  |                                                         |                                              |                                            |
|----------------------------------|---------------------------------------------------------|----------------------------------------------|--------------------------------------------|
| Short to earth                   | - -G81 defective<br>- Short circuit to earth in wiring  | - Reduced power                              | - Check fuel temperature sensor => Page 70 |
| Open circuit / short to positive | - -G81 defective<br>- Open circuit or short to positive |                                              |                                            |
|                                  | - Plug for injection pump disconnected                  | - Several faults stored<br>- Engine cuts out | - Check connector for injection pump       |

| V.A.G 1551 printout                                                                    | Possible causes of fault                                                                             | Possible effects                                                                                              | Fault remedy                                          |
|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------------------------------------------|
| 00542<br>Needle lift sensor -G80<br>Short to earth<br>Open circuit / short to positive | - -G80 defective<br>- Open circuit or short circuit                                                  | - Fault lamp lights up<br>- Engine running rough<br>- Reduced power                                           | - Checking needle lift sensor => Page 82              |
|                                                                                        | - Sporadic open circuit (break in wiring)                                                            | - Misfiring, bucking                                                                                          |                                                       |
| Implausible signal                                                                     | - Fuel supply is/was interrupted tank empty, supply pipe or filter blocked, air entering fuel system | - Fault 00550 control of commencement of injection/control difference may be recorded<br>- Misfiring, bucking | - Check fuel system                                   |
|                                                                                        | - (Sporadic) open circuit in wiring to fuel cut off valve                                            | - Engine cuts out<br>- Misfiring                                                                              | - Check wiring and plug connections to injection pump |

| V.A.G 1551 printout                                    | Possible causes of fault                              | Possible effects                                                                                                                                | Fault remedy                            |
|--------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| 00542<br>Needle lift sensor -G80<br>Implausible signal | - Sensor disc in engine speed sensor is bent or loose | - Misfiring at exactly 3000 rpm                                                                                                                 | - Remove oil sump and check sensor disc |
|                                                        | - -G80 defective                                      | - Misfiring, jolting (especially at high engine speeds)                                                                                         | - Replace the needle lift sensor        |
|                                                        | - Injection pump defective                            | - Fault 01268 recorded (regulating difference in metering control)<br>- Engine running rough, misfiring<br>- No throttle response after overrun | - Replace the injection pump            |

| V.A.G 1551 printout                                    | Possible causes of fault        | Possible effects                                                     | Fault remedy                                                                        |
|--------------------------------------------------------|---------------------------------|----------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| 00545<br>Engine/gearbox electrical connection          | - Open circuit or short circuit | - Gearshift stiffer than normal                                      | - Check signals to and from automatic gearbox; A - signal for gear shift => Page 89 |
| 00550<br>Injection start control<br>Control difference | - Start of delivery not OK      | - Loss of power at high engine speeds<br>- Engine difficult to start | - Check and adjust injection start =>Page 52                                        |

|  |                                                                |                                       |                                                             |
|--|----------------------------------------------------------------|---------------------------------------|-------------------------------------------------------------|
|  | - Injection pump control range blocked (dirt, metal particles) | - Loss of power at high engine speeds | - Check and adjust injection timing control range =>Page 68 |
|  | - Engine has stalled (within the last 50 starts)               |                                       | - Erase fault memory and continue to monitor vehicle        |

| V.A.G 1551 printout                                    | Possible causes of fault                                                                             | Possible effects                                                                                                                                          | Fault remedy                                           |
|--------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| 00550<br>Injection start control<br>Control difference | - Fuel supply is/was interrupted tank empty, supply pipe or filter blocked, air entering fuel system | - Fault 00542 (implausible signal for needle lift sensor) may be recorded                                                                                 | - Check fuel system                                    |
|                                                        | - Open circuit in wiring to injection start valve -N108                                              | - Engine knocks when idling because injection start is always advanced                                                                                    | - Check valve for commencement of injection => Page 69 |
|                                                        |                                                                                                      | - Several faults may be recorded                                                                                                                          | - Check fuse                                           |
|                                                        | - -N108 valve for commencement of injection is worn                                                  | - No constant injection start in "Default setting" (value in display zone 2 fluctuates but stays above 10)<br>- Irregular engine operation, loss of power | - Fit new injection start valve                        |

| V.A.G 1551 printout                                | Possible causes of fault                                                                                                                                            | Possible effects                                                                                                                                  | Fault remedy                                                |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| 00553<br>Air mass meter -G70<br>Implausible signal | - Engine has stalled (within the last 50 starts)                                                                                                                    |                                                                                                                                                   | - Erase fault memory and continue to monitor vehicle        |
|                                                    | - Battery low                                                                                                                                                       | - Loss of power                                                                                                                                   | - Test battery                                              |
|                                                    | - Sporadic open circuit in wiring (cable break) to -G80 needle lift sensor                                                                                          | - Constant air mass displayed in measured value block                                                                                             | - Checking needle lift sensor => Page 82                    |
|                                                    | - Air cleaner blocked<br>- Vacuum hose system for exhaust gas recirculation incorrectly connected, or mechanical exhaust gas recirculation valve is constantly open | - Misfiring, bucking<br>- Possible fault 00542 (needle lift sender input open) or open circuit/short to positive<br>- Rough idling, loss of power | - Check intake system<br>Check vacuum hose system =>Page 76 |

| V.A.G 1551 printout                                | Possible causes of fault                                     | Possible effects                                                                         | Fault remedy                     |
|----------------------------------------------------|--------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------|
| 00553<br>Air mass meter -G70<br>Implausible signal | - Air mass meter defective                                   | - Loss of power, bucking                                                                 | - Test air mass meter => Page 73 |
| Open circuit/short circuit to earth                | - -G70 defective<br>- Open circuit or short circuit to earth | - Reduced power<br>- Possibility of black smoke when accelerating from low engine speeds |                                  |



|                   |                                                         |  |  |
|-------------------|---------------------------------------------------------|--|--|
| Short to positive | - -G70 defective<br>- Open circuit or short to positive |  |  |
| Voltage supply    | - Open circuit or short circuit                         |  |  |

| V.A.G 1551 printout                                     | Possible causes of fault                                                                                                                                                                                                                    | Possible effects                          | Fault remedy                        |
|---------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------|
| 00575<br>Intake manifold pressure<br>Control difference | - Hoses wrongly connected, not connected, blocked or leaking<br>- Vacuum unit for turbocharger defective<br>- Boost pressure limitation solenoid valve -N75 defective<br>- Fault in hose connection to intake manifold pressure sender -G71 | - Sudden loss of power<br>- Reduced power | - Test boost pressure<br>=> Page 65 |

| V.A.G 1551 printout                                                           | Possible causes of fault                                                                                                                                                                     | Possible effects                                                                                           | Fault remedy                                                                                        |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 00625<br>Vehicle speed signal<br>Implausible signal                           | - Open circuit between speedometer sensor -G22 and dash panel insert<br>- -G22 defective<br>- Speedometer -G21 defective<br>- Open circuit between dash panel insert and engine control unit | - Cruise control system not working<br>- Air conditioner not working<br>- Possibility of load change jolts | - Check speed signal => Page 92<br>Test speedometer sensor<br>=> Electrical System; Repair group 90 |
| 00626<br>Glow period warning lamp -K29<br>Open circuit/short circuit to earth | - Open circuit<br>- Bulb defective<br>- Short to earth                                                                                                                                       | - Pre-glow warning system not working<br>- Glow period warning lamp permanently lit                        | - Check preglow warning lamp => Page 102                                                            |
| Short to positive                                                             | - Short to positive                                                                                                                                                                          | - Pre-glow warning system not working                                                                      |                                                                                                     |

| V.A.G 1551 printout                                                  | Possible causes of fault                                   | Possible effects                         | Fault remedy                                                      |
|----------------------------------------------------------------------|------------------------------------------------------------|------------------------------------------|-------------------------------------------------------------------|
| 00668<br>Electrical system voltage terminal 30<br>Implausible signal | - Relay for diesel direct injection system -J322 sticking  | - Engine will not start (safety cut out) | - Check power supply for diesel direct injection system =>Page 78 |
| 00671<br>CCS switch -E45<br>Undefined switch position                | - Switch -E45 defective<br>- Open circuit or short circuit | - Cruise control system switched off     | - Check cruise control system => Page 93                          |

| V.A.G 1551 printout | Possible causes of fault | Possible effects | Fault remedy |
|---------------------|--------------------------|------------------|--------------|
| 00741               |                          |                  |              |

|                                                  |                                                                                                                                                                                                                                            |                                                                                                                                                                    |                                                                                                                                                        |
|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Brake pedal monitoring<br>Implausible signal     | <ul style="list-style-type: none"> <li>- Switch incorrectly set</li> <li>- Open circuit</li> <li>- Brake light switch -F or brake pedal switch - F47 defective</li> <li>- Fuse defective</li> <li>- Both brake lights defective</li> </ul> | <ul style="list-style-type: none"> <li>- No throttle response at times, complete loss of power</li> <li>- Preglow warning lamp flashes</li> </ul>                  | <ul style="list-style-type: none"> <li>- Test and adjust -F and -F47 =&gt; Page 84</li> <li>- Check brake light</li> </ul>                             |
| 00765<br>Modulating piston movement sender -G149 | <ul style="list-style-type: none"> <li>- 10-pin connector for injection pump disconnected</li> <li>- Injection pump defective</li> <li>- Open circuit or short circuit</li> </ul>                                                          | <ul style="list-style-type: none"> <li>- Several faults stored</li> <li>- Engine cuts out</li> <li>- Engine running problems</li> <li>- Engine cuts out</li> </ul> | <ul style="list-style-type: none"> <li>- Check connector for injection pump</li> <li>- Test modulating piston movement sender =&gt; Page 85</li> </ul> |

| V.A.G 1551 printout                                                | Possible causes of fault                                                                                                | Possible effects                                                                                                                | Fault remedy                                                                                        |
|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| 00777<br>Accelerator position sender -G79<br>Implausible signal    | <ul style="list-style-type: none"> <li>- Open circuit</li> <li>- -G79 defective (idling speed switch)</li> </ul>        | <ul style="list-style-type: none"> <li>- Safety speed regulation at approx. 1100 rpm</li> <li>- No throttle response</li> </ul> | <ul style="list-style-type: none"> <li>- Check accelerator position sender =&gt; Page 87</li> </ul> |
| Short to positive                                                  | <ul style="list-style-type: none"> <li>- Open circuit or short circuit to positive</li> <li>- -G79 defective</li> </ul> |                                                                                                                                 |                                                                                                     |
| Voltage supply                                                     | <ul style="list-style-type: none"> <li>- Open circuit or short circuit</li> </ul>                                       |                                                                                                                                 |                                                                                                     |
| 01028<br>Blower relay -J323<br>Open circuit/short circuit to earth | <ul style="list-style-type: none"> <li>- Open circuit</li> <li>- Relay defective</li> <li>- Short to earth</li> </ul>   | <ul style="list-style-type: none"> <li>- Radiator fan run-on not working</li> <li>- Radiator fan permanently on</li> </ul>      | <ul style="list-style-type: none"> <li>- Test signal for radiator fan =&gt; Page 96</li> </ul>      |
| Short to positive                                                  | <ul style="list-style-type: none"> <li>- Short to positive</li> </ul>                                                   | <ul style="list-style-type: none"> <li>- Radiator fan run-on not working</li> </ul>                                             |                                                                                                     |

| V.A.G 1551 printout                                                            | Possible causes of fault                                                        | Possible effects                                                                  | Fault remedy                                                                                                                                    |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| 01044<br>Control unit incorrectly encoded                                      | <ul style="list-style-type: none"> <li>- Invalid control unit coding</li> </ul> | <ul style="list-style-type: none"> <li>- Preglow warning lamp flashes</li> </ul>  | <ul style="list-style-type: none"> <li>- Encode control unit =&gt; Page 17</li> </ul>                                                           |
| 01117<br>Load signal for DF alternator terminal<br>Implausible signal          | <ul style="list-style-type: none"> <li>- Open circuit or short</li> </ul>       | <ul style="list-style-type: none"> <li>- Engine preheating not working</li> </ul> | <ul style="list-style-type: none"> <li>- Checking wiring =&gt; Current Flow Diagrams, Electrical Fault-finding and Fitting Locations</li> </ul> |
| 01180<br>Electrical connection for engine / air conditioner compressor shutoff |                                                                                 |                                                                                   |                                                                                                                                                 |



|                   |                                |                                                   |                                                          |
|-------------------|--------------------------------|---------------------------------------------------|----------------------------------------------------------|
| Short to positive | - Short in the line connection | - Reduced acceleration when air conditioner is on | - Checking signals from/to air conditioner<br>=> Page 91 |
|-------------------|--------------------------------|---------------------------------------------------|----------------------------------------------------------|

| V.A.G 1551 printout                                                                                            | Possible causes of fault                                                                                                                                                          | Possible effects                                                                                                                    | Fault remedy                                                                                  |
|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 01193<br>Low heating output relay<br>01194<br>High heating output relay<br>Open circuit/short circuit to earth | <ul style="list-style-type: none"> <li>- Open circuit</li> <li>- -J359 low heating output relay or -J360 high heating output relay defective</li> <li>- Short to earth</li> </ul> | <ul style="list-style-type: none"> <li>- Engine preheating not working</li> <li>- Engine pre heating stays on constantly</li> </ul> | - Checking wiring<br>=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |
| Short to positive                                                                                              | - Short to positive                                                                                                                                                               | - Engine preheating not working                                                                                                     |                                                                                               |

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| V.A.G 1551 printout                                   | Possible causes of fault                                                                                              | Possible effects                                                                             | Fault remedy                                                                                  |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| 01237<br>-N109 fuel cut-off valve<br>Mechanical fault | - -N109 defective, leaking or sticking                                                                                | <ul style="list-style-type: none"> <li>- Reduced power</li> <li>- Engine cuts out</li> </ul> | - Check -N109<br>=> Page 13, Final control diagnosis                                          |
| Open circuit/short circuit to earth                   | <ul style="list-style-type: none"> <li>- -N109 defective</li> <li>- Open circuit or short circuit to earth</li> </ul> | - Engine cuts out                                                                            | - Checking wiring<br>=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

| V.A.G 1551 printout                                                                           | Possible causes of fault                                                                                                       | Possible effects                                                                                                                                                             | Fault remedy                                                       |
|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------|
| 01262<br>Boost pressure limitation solenoid valve -N75<br>Open circuit/short circuit to earth | <ul style="list-style-type: none"> <li>- Open circuit</li> <li>- Solenoid valve defective</li> <li>- Short to earth</li> </ul> | <ul style="list-style-type: none"> <li>- Reduced power</li> <li>- Boost pressure too low</li> <li>- Reduced power</li> <li>- Boost pressure too high</li> </ul>              | - Check solenoid valve for boost pressure limitation<br>=> Page 61 |
| Short to positive                                                                             | - Short to positive                                                                                                            | - Reduced power<br>- Boost pressure too low                                                                                                                                  |                                                                    |
| 01265<br>EGR valve -N18<br>Open circuit/short circuit to earth                                | <ul style="list-style-type: none"> <li>- Open circuit</li> <li>- Solenoid valve defective</li> <li>- Short to earth</li> </ul> | <ul style="list-style-type: none"> <li>- No exhaust gas recirculation</li> <li>- Too much exhaust gas recirculation</li> <li>- Reduced power, black exhaust smoke</li> </ul> | - Test EGR valve => Page 72                                        |
| Short to positive                                                                             | - Short to positive                                                                                                            | - No exhaust gas recirculation                                                                                                                                               |                                                                    |

| V.A.G 1551 printout | Possible causes of fault | Possible effects | Fault remedy |
|---------------------|--------------------------|------------------|--------------|
|---------------------|--------------------------|------------------|--------------|

|                                                                      |                                                               |                                                |                                                                          |
|----------------------------------------------------------------------|---------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------|
| 01266<br>Glow plug relay -J52<br>Open circuit/short circuit to earth | - Open circuit<br>- Relay defective                           | - Preglow system not working                   | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |
|                                                                      | - Short to earth                                              | - Glow plug system stays on constantly         |                                                                          |
| Short to positive                                                    | - Short to positive                                           | - Preglow system not working                   |                                                                          |
| 01268<br>Metering control -N146<br>Control difference                | - Injection pump defective<br>- Open circuit or short circuit | - Engine running problems<br>- Engine cuts out | - Test quantity adjuster<br>=> Page 85<br>Replace the injection pump     |
| Lower stop value                                                     | - Quantity adjuster incorrectly set                           | - Engine stops (safety cut out)                |                                                                          |
| Upper stop value                                                     | - Quantity adjuster incorrectly set                           |                                                |                                                                          |

| V.A.G 1551 printout                                                         | Possible causes of fault                   | Possible effects                                                         | Fault remedy                                           |
|-----------------------------------------------------------------------------|--------------------------------------------|--------------------------------------------------------------------------|--------------------------------------------------------|
| 01269<br>Injection start valve -N108<br>Open circuit/short circuit to earth | - Open circuit (fuse)<br>- Valve defective | - Engine knocks when idling because injection start is always advanced   | - Check valve for commencement of injection => Page 69 |
|                                                                             | - Short to earth                           | - Loss of power because commencement of injection is constantly retarded | - Check fuse                                           |
|                                                                             | - Short to positive                        | - Engine knocks when idling because injection start is always advanced   | - Check valve for commencement of injection => Page 69 |

| V.A.G 1551 printout                                   | Possible causes of fault           | Possible effects                               | Fault remedy                                               |
|-------------------------------------------------------|------------------------------------|------------------------------------------------|------------------------------------------------------------|
| 01282<br>Intake manifold flap change-over valve -N239 |                                    |                                                |                                                            |
| Short to positive                                     | - Short to positive                | - Engine starts but cuts out again immediately | - Test intake manifold flap changeover valve<br>=> Page 97 |
| Open circuit/short circuit to earth                   | - Open circuit<br>- Short to earth |                                                |                                                            |

| V.A.G 1551 printout          | Possible causes of fault | Possible effects | Fault remedy |
|------------------------------|--------------------------|------------------|--------------|
| 17958P1550<br>Boost pressure |                          |                  |              |



| V.A.G 1551 printout | Possible causes of fault                                                                                                                                                                                                                                               | Possible effects                                                  | Fault remedy                                                                                                                                                                                                                                                                                                                                    |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Control difference  | <ul style="list-style-type: none"> <li>- Boost pressure limitation solenoid valve -N75 defective</li> <li>- Hose connections interchanged, not attached</li> <li>- Leak between turbocharger and engine (charge air path)</li> <li>- Turbocharger defective</li> </ul> | <ul style="list-style-type: none"> <li>- Reduced power</li> </ul> | <ul style="list-style-type: none"> <li>- Check -N75 =&gt; perform final control diagnosis</li> <li>Page 13</li> <li>Checking the boost pressure control</li> <li>=&gt; 4 cyl. TDI Engine, Mechanical Components; Repair group 21; Checking charge air system with turbocharger</li> <li>Checking charge air system with turbocharger</li> </ul> |

| V.A.G 1551 printout                   | Possible causes of fault                                                                                                                                                        | Possible effects                                                                                 | Fault remedy                                                                                                                                                                                                                          |
|---------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17978<br>Engine control unit disabled | <ul style="list-style-type: none"> <li>- Attempted tampering</li> <li>- Short circuit in communication wire</li> <li>- Immobiliser control unit defective/not fitted</li> </ul> | <ul style="list-style-type: none"> <li>- Engine starts but cuts out again immediately</li> </ul> | <ul style="list-style-type: none"> <li>- Adapt control unit for engine electronics to electronic immobiliser =&gt; Page 58</li> <li>- Test electronic immobiliser: =&gt; Repair group 96; Servicing electronic immobiliser</li> </ul> |

| V.A.G 1551 printout                            | Possible causes of fault                                                                 | Possible effects                                                                                                                                       | Fault remedy                                                                                                                                  |
|------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| 18034<br>CAN-Bus error Message from gearbox-SG | <ul style="list-style-type: none"> <li>- Open circuit to gearbox control unit</li> </ul> | <ul style="list-style-type: none"> <li>- Gearbox in emergency running mode</li> </ul>                                                                  | <ul style="list-style-type: none"> <li>- Test signal wire between engine control unit and gearbox control unit</li> <li>=&gt; Page</li> </ul> |
| 18259<br>CAN-Bus error Message from ABS-SG     | <ul style="list-style-type: none"> <li>- Open circuit to ABS control unit</li> </ul>     | <ul style="list-style-type: none"> <li>- Traction control system (TCS) warning lamp on</li> <li>- Traction control system (TCS) not working</li> </ul> | <ul style="list-style-type: none"> <li>- Test signal wire between engine control unit and ABS control unit</li> <li>=&gt; Page 98</li> </ul>  |

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| V.A.G 1551 printout                        | Possible causes of fault                                                                               | Possible effects                                                                                       | Fault remedy                                                                                                              |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| 18262<br>Data bus drive hardware defective | <ul style="list-style-type: none"> <li>- Open circuit or short circuit to earth or positive</li> </ul> | <ul style="list-style-type: none"> <li>- Engine running problems</li> </ul>                            | <ul style="list-style-type: none"> <li>- Find data lead breaks between the various control units =&gt; Page 99</li> </ul> |
| 65535<br>Control unit defective            | <ul style="list-style-type: none"> <li>- Internal fault in control unit</li> </ul>                     | <ul style="list-style-type: none"> <li>- Engine running problems</li> <li>- Engine cuts out</li> </ul> | <ul style="list-style-type: none"> <li>- Replace control unit</li> <li>=&gt; Page 57</li> </ul>                           |

## 1.6 - Final control diagnosis

### Test requirements for vehicles with air-conditioners

- Vehicle at room temperature (warmer than + 15 °C)
- Air conditioner switched on
- Lowest temperature and fastest fan speed selected

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

1. Injection start valve (N108)
2. Valve for exhaust gas recirculation (N18)
3. Air conditioner compressor cut-in
4. Fuel cut-off valve (N109)
5. Solenoid valve for boost pressure limitation (N75)
6. Glow plug relay (J52)
7. Pre-glow time warning lamp (K29)
8. Low heating output relay (J359)  
only in vehicles with manual gearboxes
9. High heating output relay (J360)  
only in vehicles with manual gearboxes
10. Blower relay (J323)  
only for engine code AHF

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

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

- Press keys 0 and 3 for "Final control diagnosis" function

-> Indicated on display:

Rapid data transfer      Q  
03 - Final control diagnosis

- Confirm input with Q key.

-> Indicated on display:

Final control diagnosis  
Injection start valve -N108

Valve actuation has a considerable effect on combustion noise (pre ignition).

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**If no change in the combustion noise is heard:**

- Check the injection timing control range  
=> Page 68



- Press the ➡key.

-> Indicated on display:

Final control diagnosis  
Exhaust gas recirculation valve -N18

The injector valve should click.

**Notes:**

- ♦ Due to the engine noise, the clicking of the valve is not audible and therefore may only be detected by feel.
- ♦ The piston movement of the mechanical exhaust gas recirculation valve is clearly visible in the side slot.

If the injector does not click:

- Test EGR valve => Page 72
- Press the ➡key.

-> Indicated on display:

Final control diagnosis  
Air conditioner compressor cut-in

Check the air conditioner compressor shutoff.  
This test step is also invoked for vehicles without air conditioners.

The air conditioning conditioner compressor must stop within 5 secs. (visual check), and then start approx. every 5 secs. and then stop again.

If the conditioner compressor is not switched off:

- Checking the air conditioner compressor shutoff  
=> Page 91
- Press the ➡key.

-> Indicated on display:

Final control diagnosis  
Fuel cut-off valve -N109

The engine must stop.

If the engine does not stop:

- Switch ignition off.
- Unscrew the fuel cut-off valve and remove any metallic parts or dirt
- Repeat final control diagnosis and if the engine will still not stop, replace the fuel cut off valve.
- Press the ➡key.

-> Indicated on display:

Final control diagnosis  
Boost press. limitat. solenoid valve -  
N75

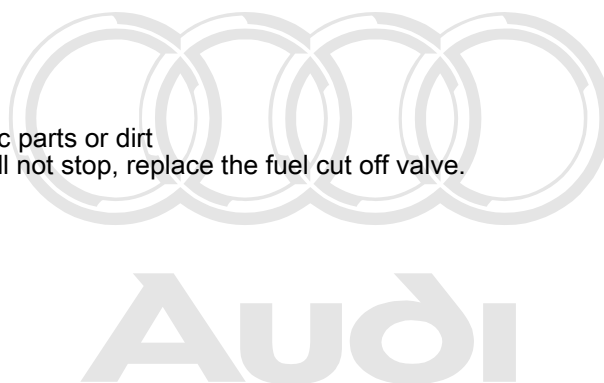
The solenoid valve must click.

**Note:**

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

If the solenoid valve does not click:

- Test boost pressure control solenoid valve  
=> Page 61



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- Press the  $\Rightarrow$ key.

-> Indicated on display:

Final control diagnosis  
Glow plug relay -J52

The relay must click.

Due to the high current consumption, the switching on and off of the relay may also be observed from the interior light becoming brighter and darker.

If the relay does not click:

- Check the glow plug relay:

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

- Press the  $\Rightarrow$ key.

-> Indicated on display:

Final control diagnosis  
Glow period warning lamp -K29

The warning lamp must blink.

Warning lamp does not blink:

- Check preglow warning lamp => Page 102
- Press the  $\Rightarrow$ key.

-> Indicated on display:

Final control diagnosis  
Low heating output relay -J359

The relay must click.

If the relay does not click:

- Test low heating output relay:

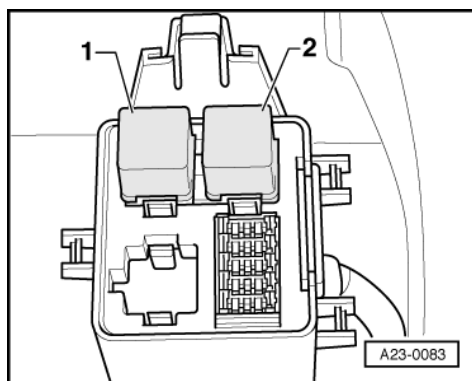
=> Current Flow Diagrams, Electrical Fault-finding and Fitting Locations

- Press the  $\Rightarrow$ key.

-> Indicated on display:

Final control diagnosis  
-J360 high heating output relay

The relay must click.





If the relay does not click:

- Test high heating output relay

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

-> Fitting location Relay box on bulkhead

- 1- Low heating output relay
- 2- High heating output relay

- Press the =>key.

-> Indicated on display:

Final control diagnosis  
Blower relay -J323

Only for engine code AHF

Radiator fan must come on every 5 seconds and then stop again

If the radiator fan does not start:

- Check radiator fan actuation  
=> Page 96 .

**Note:**

*The radiator fan may also be activated by the thermoswitch, the automatic gearbox or the air conditioner. When performing the final control diagnosis, ensure that the fan has not been activated for this reason.*

- If necessary, allow engine to cool down.

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

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

## 1.7 - Basic setting

### Test conditions

- Coolant temperature at least 80 °C.
- Electrical consumers switched off (radiator fan must not run during the check)
- Air conditioner switched off
- Selector lever in position P or N.
- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. For this purpose the engine must be running at idling speed.  
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

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

-> Indicated on display:

Default setting      HELP  
Enter Display Group number XX

- Press the 0 key twice for Display Group "00" and confirm entry by pressing Q.

-> Indicated on display:  
(1...10 = display zones)

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

### Display group 00 during idling (engine warm, coolant temperature not below +85°C)

*This display group is used for a dynamic check on the commencement of injection. The injection start valve (N108) is activated constantly so that the injection timing control will move to the retarded position.*

|                 |    |   |    |    |     |    |     |     |  |    |                                                                                                                                      |
|-----------------|----|---|----|----|-----|----|-----|-----|--|----|--------------------------------------------------------------------------------------------------------------------------------------|
| Basic setting 0 |    |   |    |    |     |    |     |     |  | ⇒  | ◀ Indicated on display                                                                                                               |
| 42              | 46 | 0 | 20 | 90 | 201 | 64 | 153 | 127 |  | 83 |                                                                                                                                      |
|                 |    |   |    |    |     |    |     |     |  |    | Ignore                                                                                                                               |
|                 |    |   |    |    |     |    |     |     |  |    | Fuel temperature: approx. 40 °C (not reached at low outside temperature, no desired value)                                           |
|                 |    |   |    |    |     |    |     |     |  |    | Ignore                                                                                                                               |
|                 |    |   |    |    |     |    |     |     |  |    | Coolant temperature: at approx. 90 °C                                                                                                |
|                 |    |   |    |    |     |    |     |     |  |    | Ignore                                                                                                                               |
|                 |    |   |    |    |     |    |     |     |  |    | Ignore                                                                                                                               |
|                 |    |   |    |    |     |    |     |     |  |    | Ignore                                                                                                                               |
|                 |    |   |    |    |     |    |     |     |  |    | Accelerator pedal position: 0                                                                                                        |
|                 |    |   |    |    |     |    |     |     |  |    | Start of injection is governed by fuel temperature,<br>Specified values => perform dynamic injection start test and adjust - Page 52 |
|                 |    |   |    |    |     |    |     |     |  |    | Idling speed: 41...44                                                                                                                |

## 1.8 - Encoding control unit

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

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. For this purpose the ignition must be switched on.  
(Connecting fault reader and selecting engine electronics control unit => Page 2.)

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

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

-> Indicated on display:

Code control unit      Q  
Enter code number xxxxx (0-32000)

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

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| Code number | For vehicles with |
|-------------|-------------------|
| 00001       | autom. gearbox    |
| 00002       | manual gearbox    |

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

|                  |           |     |
|------------------|-----------|-----|
| 028906021.. 1.9l | R4        | EDC |
| G00SG            | 0203      |     |
| Coding 00002     | WSC 12345 |     |

- Switch the ignition off and then on again.

**Note:**

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

*If the ignition is not switched off and on after the correct code has been entered, it will not be possible to erase fault "01044 Control unit incorrectly coded").*

- Press the ➡key.

-> Indicated on display:

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

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

## 1.9 - Reading measured value block

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

-> Indicated on display:

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

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

-> Indicated on display:

|                                |
|--------------------------------|
| Read measured value block HELP |
| Enter Display Group number XX  |

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

-> Display readout (for example):

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

### Display group overview

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| Display group no. | Indicated on display        | Designation                    |
|-------------------|-----------------------------|--------------------------------|
| 00                | Read measured value block 0 | 1 = Engine speed               |
| General           | 1 2 3 4 5 6 7 8 9 10        | 2 = Injection start            |
| Vehicle           |                             | 3 = Accelerator pedal position |
| inspection        |                             | 4 = Injection quantity         |

| Display group no.        | Indicated on display                   | Designation                                                                                                                                                                                                    |
|--------------------------|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |                                        | 5 = Intake manifold pressure (boost pressure)<br>6 = Atmospheric pressure (ambient air pressure)<br>7 = Coolant temperature<br>8 = Intake manifold temperature<br>9 = Fuel temperature<br>10 = Intake air mass |
| 01<br>Injection quantity | Read measured value block 1<br>1 2 3 4 | 1 = Engine speed<br>2 = Injection quantity<br>3 = Voltage from modulating piston movement sender G149<br>4 = Coolant temperature                                                                               |

| Display group no.               | Indicated on display                   | Designation                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 02<br>Idling speed              | Read measured value block 2<br>1 2 3 4 | 1 = Engine speed<br>2 = Accelerator pedal position<br>3 = Operating status:<br>X X 1 Air conditioner signal on<br>X 1 X Idling speed switch closed<br>1 X X Increased idling speed:<br>▪ Due to request from air conditioner 1)<br>▪ Because acceleration and braking detected<br>▪ Because sheathed-element additional heater is on<br>4 = Coolant temperature |
| 03<br>Exhaust gas recirculation | Read measured value block 3<br>1 2 3 4 | 1 = Engine speed<br>2 = Intake air mass (specified)<br>3 = Intake air mass (actual)<br>4 = Duty cycle (activation) of exhaust gas recirculation valve -N18                                                                                                                                                                                                      |

1) The idling speed is not increased in all control units. However, a "1" will appear in spite of this if the air conditioner request is received.

| Display group no.      | Indicated on display                   | Designation                                                                                                                                                         |
|------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 04<br>Injection start  | Read measured value block 4<br>1 2 3 4 | 1 = Engine speed<br>2 = Injection start (specified)<br>3 = Start of injection (actual)<br>4 = Duty cycle (activation) of injection start valve -N108                |
| 05<br>Start conditions | Read measured value block 5<br>1 2 3 4 | 1 = Engine speed<br>2 = Injection quantity for starting (recorded from last start)<br>3 = Injection start<br>4 = Coolant temperature                                |
| 06<br>Switch positions | Read measured value block 6<br>1 2 3 4 | 1 = Vehicle speed<br>2 = Brake pedal monitoring:<br>X X 1 Brake light switch -F closed<br>X 1 X Brake pedal switch -F47 open<br>1 X X Clutch pedal switch -F36 open |

| Display group no. | Indicated on display        | Designation                                   |
|-------------------|-----------------------------|-----------------------------------------------|
| 06                | Read measured value block 6 | 3 = Cruise control system (CCS) control unit: |



| Display group no.<br>Switch positions | Indicated on display<br>1 2 3 4 | Designation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------|---------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                       |                                 | X X X X X 1 CCS on<br>X X X X X 1 X CCS switched off with memory<br>X X X 1 X X Speed reduction<br>X X 1 X X X Resume/accelerate<br>X 1 X X X X Brake pedal depressed<br>1 X X X X X Clutch pedal depressed<br>4 = Operating status of the cruise control system:<br>0 Control unit with CCS function<br>1 CCS switched off<br>2 Accelerate<br>4 Decelerate<br>8 Reactivation<br>1 6 Brake depressed<br>3 2 Maintain speed<br>6 4 Ignore<br>1 2 8 Ignore<br>2 5 5 Control unit without CCS function |

| Display group no.                   | Indicated on display                   | Designation                                                                                                                                                                                                                                                   |
|-------------------------------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 07<br>Temperatures                  | Read measured value block 7<br>1 2 3 4 | 1 = Fuel temperature<br>2 = No display<br>3 = Intake manifold temperature<br>4 = Coolant temperature                                                                                                                                                          |
| 08<br>Injection quantity limitation | Read measured value block 8<br>1 2 3 4 | 1 = Engine speed<br>2 = Desired injection quantity (driver's requirement via accelerator pedal)<br>3 = Injection quantity limitation via engine speed (torque limitation)<br>4 = Injection quantity limitation based on intake air mass (avoid exhaust smoke) |
| 09<br>Injection quantity limitation | Read measured value block 9<br>1 2 3 4 | 1 = Engine speed<br>2 = Injection quantity (cruise control system activated)<br>3 = Injection quantity limitation by automatic gearbox during gear change<br>4 = Emergency quantity (modulating piston movement sender voltage)                               |

| Display group no.             | Indicated on display                    | Designation                                                                                                                                               |
|-------------------------------|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 10<br>Air quantities          | Read measured value block 10<br>1 2 3 4 | 1 = Intake air mass<br>2 = Atmospheric pressure (ambient air pressure)<br>3 = Intake manifold pressure (boost pressure)<br>4 = Accelerator pedal position |
| 11<br>Boost pressure control. | Read measured value block 11<br>1 2 3 4 | 1 = Engine speed<br>2 = Boost pressure (specified)<br>3 = Boost pressure (actual)                                                                         |

| Display group no. | Indicated on display                    | Designation                                                                                                         |
|-------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------|
|                   |                                         | 4 = Duty cycle (activation) of boost pressure control solenoid N75                                                  |
| 12<br>Glow plug   | Read measured value block 12<br>1 2 3 4 | 1 = Ignore display<br>2 = Glow time (in seconds)<br>3 = Supply voltage from control unit<br>4 = Coolant temperature |

| Display group no.                         | Indicated on display                    | Designation                                                                                                                                                                                                                                        |
|-------------------------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13<br>Idling speed smooth running control | Read measured value block 13<br>1 2 3 4 | 1 = Idling difference between injection quantities for cylinders 4 and 3<br>2 = Idling difference between injection quantities for cylinders 2 and 3<br>3 = Idling difference between injection quantities for cylinders 1 and 3<br>4 = No display |
| 14<br>Not used                            | Read measured value block 14            | No display                                                                                                                                                                                                                                         |
| 15<br>Fuel consumption                    | Read measured value block 15<br>1 2 3 4 | 1 = Engine speed<br>2 = Injection quantity (actual)<br>3 = Fuel consumption<br>4 = Desired injection quantity (driver's requirement via accelerator pedal)                                                                                         |

| Display group no.       | Indicated on display                    | Designation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16<br>Additional heater | Read measured value block 16<br>1 2 3 4 | 1 = Alternator load<br>2 = Additional heater switched off because:<br>X X X X X X X 1 Coolant temperature above 70 °C...80 °C1) or intake air temperature above 5 °C<br><br>X X X X X X X 1 X Alternator defective<br>X X X X X 1 X X Battery voltage less than 9 V<br>X X X X 1 X X X Engine speed less than 800 rpm<br>X X X 1 X X X X Engine started within the last 10 seconds<br>X X 1 X X X X X Sensor for coolant temperature (G62) or Intake manifold temperature sender (G72) defective<br><br>X 1 X X X X X X Ignore<br>1 X X X X X X X Ignore<br>3 = Actuation of heating elements<br>X 1 Low heating output relay (J359) on<br>1 X High heating output relay (J360) on<br>4 = Supply voltage from control unit |

1) If the intake temperature is 5 °C when the engine is started, the additional heater is switched off when a coolant temperature of 70 °C is reached. However, if the air temperature is -10 °C, the heater is not switched off until the coolant temperature reaches 80 °C.



| Display group no.       | Indicated on display                    | Designation                                                                                                                                                                            |
|-------------------------|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17<br>Not used          | Read measured value block 17            | No display                                                                                                                                                                             |
| 18                      | Read measured value block 18<br>1 2 3 4 | Ignore                                                                                                                                                                                 |
| 19<br>Quantity adjuster | Read measured value block 19<br>1 2 3 4 | 1 = Lower stop value (voltage from sensor for modulating piston movement)<br>2 = Upper stop value (voltage from modulating piston movement sender)<br>3 = No display<br>4 = No display |

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## 1.10 - Readout specifications for general vehicle inspection

Display group 00 during idling (engine warm, coolant temperature not below +85°C)

|                                 |   |                                                                                             |
|---------------------------------|---|---------------------------------------------------------------------------------------------|
| Read measured value block 0     | ⇒ | ◀ Indicated on display                                                                      |
| 42 50 0 20 90 201 64 153 127 83 |   |                                                                                             |
|                                 |   | Intake air mass: 70...110 OK<br>▪ If outside tolerance => display group 03, Page 27         |
|                                 |   | Fuel temperature: no specification                                                          |
|                                 |   | Intake manifold temperature: no specification                                               |
|                                 |   | Coolant temperature: 80...51 OK<br>▪ > 80: run engine until warm                            |
|                                 |   | Ambient air pressure: no specification                                                      |
|                                 |   | Boost pressure: Ignore                                                                      |
|                                 |   | Injection quantity: 10...30 OK<br>▪ If outside tolerance => display group 01, Page 23       |
|                                 |   | Accelerator pedal position: 0                                                               |
|                                 |   | Commencement of injection: 20...60 OK<br>▪ If outside tolerance=> display group 04, Page 25 |
|                                 |   | Idling speed: 41...44 OK<br>▪ If outside tolerance => display group 02, Page 25             |

Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine codes AGR and ALH

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

|                                        |   |                        |
|----------------------------------------|---|------------------------|
| Read measured value block 0            | ⇒ | ◀ Indicated on display |
| 186 225 255 186 186 201 64 138 175 233 |   |                        |

|  |  |  |  |  |  |  |  |  |                                                                                                                                                                            |
|--|--|--|--|--|--|--|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  | Intake air mass: > 210 OK<br>▪ < 210: => display group 10, Page 29                                                                                                         |
|  |  |  |  |  |  |  |  |  | Fuel temperature: no specification                                                                                                                                         |
|  |  |  |  |  |  |  |  |  | Intake manifold temperature: no specification                                                                                                                              |
|  |  |  |  |  |  |  |  |  | Coolant temperature: 80...51 OK<br>▪ > 80: run engine until warm                                                                                                           |
|  |  |  |  |  |  |  |  |  | Ambient air pressure: Ignore                                                                                                                                               |
|  |  |  |  |  |  |  |  |  | Boost pressure: 171...191 OK<br>▪ If outside tolerance => display group 11, Page 30                                                                                        |
|  |  |  |  |  |  |  |  |  | Injection quantity: 170...195 (injection quantity at full throttle) okay<br>▪ 125: Emergency injection quantity, system error detected => interrogate fault memory, Page 3 |
|  |  |  |  |  |  |  |  |  | Accelerator pedal: 255 (fully depressed)                                                                                                                                   |
|  |  |  |  |  |  |  |  |  | Commencement of injection: 180...245 (depending on engine speed)<br>▪ If outside tolerance=> display group 04, Page 25                                                     |
|  |  |  |  |  |  |  |  |  | Engine speed: 160...190 (do not exceed 4000 rpm; engine speed is controlled)                                                                                               |

Display group 00 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine code AHF

|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     |                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|----|-----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| Read measured value block 0                                                                                                                                                                                                                                          |     |     |     |     |     |    |     |     |                                                                                                                                                                            |
| 186                                                                                                                                                                                                                                                                  | 225 | 255 | 199 | 190 | 201 | 64 | 138 | 175 | 255                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Intake air mass: greater than 240 okay<br>▪ Less than 240 => display group 10, Page 29                                                                                     |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Fuel temperature: no specification                                                                                                                                         |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Intake manifold temperature: no specification                                                                                                                              |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Coolant temperature: 80...51 OK<br>▪ Above 80 Run engine until warm                                                                                                        |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Ambient air pressure: Ignore                                                                                                                                               |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Boost pressure: 180...200 OK<br>▪ If outside tolerance => display group 11, Page 30                                                                                        |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Injection quantity: 190...210 (injection quantity at full throttle) okay<br>▪ 125: Emergency injection quantity, system error detected => interrogate fault memory, Page 3 |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Accelerator pedal: 255 (fully depressed)                                                                                                                                   |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Commencement of injection: 180...245 (depending on engine speed)<br>▪ If outside tolerance=> display group 04, Page 25                                                     |
|                                                                                                                                                                                                                                                                      |     |     |     |     |     |    |     |     | Engine speed: 160...190 (do not exceed 4000 rpm; engine speed is controlled)                                                                                               |

1.11 - Readout specified values for injection pump

Display group 01 during idling (engine warm, coolant temperature not below +85°C)

|                             |   |                        |
|-----------------------------|---|------------------------|
| Read measured value block 1 | ⇒ | ▪ Indicated on display |
|-----------------------------|---|------------------------|



|         |               |         |         |                                                                                                                                                                                                                                                                                                                |
|---------|---------------|---------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 900 rpm | 5.6 mg/stroke | 1.480 V | 87.3 °C |                                                                                                                                                                                                                                                                                                                |
|         |               |         |         | Coolant temperature <ul style="list-style-type: none"><li>▪ 85...100 °C ok</li><li>▪ &lt; 85 °C: =&gt; Run engine until warm</li></ul>                                                                                                                                                                         |
|         |               |         |         | Voltage from modulating piston movement sender -G149 <ul style="list-style-type: none"><li>▪ 1.250...1.700 V okay</li><li>▪ &lt; 1.250 V: Injection pump too rich =&gt; replace</li><li>▪ &gt; 1.700 V: Engine loaded =&gt; switch consumers off, injection pump too lean =&gt; renew injection pump</li></ul> |
|         |               |         |         | Injection quantity <ul style="list-style-type: none"><li>▪ 2.0...6.0 mg/stroke OK</li><li>▪ &lt; 2.0 mg/stroke: Injection pump too rich =&gt; replace</li><li>▪ &gt; 6.0 mg/stroke: Engine loaded =&gt; switch consumers off, injection pump too lean =&gt; renew injection pump</li></ul>                     |
|         |               |         |         | Engine speed <ul style="list-style-type: none"><li>▪ 860...940 rpm OK</li></ul>                                                                                                                                                                                                                                |

## Display group 01 with attempted start (if engine does not start) 1)

|                             |                |         |                                                                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------|----------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Read measured value block 1 |                | ⇒       | ◀ Indicated on display                                                                                                                                                                                                                                                                                                                                                                  |
| 230 rpm                     | 37.4 mg/stroke | 2.780 V | 14.3 °C                                                                                                                                                                                                                                                                                                                                                                                 |
|                             |                |         | Coolant temperature                                                                                                                                                                                                                                                                                                                                                                     |
|                             |                |         | Voltage from modulating piston movement sender -G149 (quantity adjuster returns modulating piston position to control unit) <ul style="list-style-type: none"><li>▪ Periodic voltage increases: okay (pump is injecting)</li><li>▪ &lt; 1.000 V: Metering control closed =&gt; observe display zone 2, only if specified injection quantity okay =&gt; replace injection pump</li></ul> |
|                             |                |         | Specified injection quantity (control unit activating metering control in injection pump) <ul style="list-style-type: none"><li>▪ Periodic injection quantity increases: okay (pump is being activated)</li><li>▪ 0.0 mg/stroke System fault =&gt; interrogate fault memory, Page 3</li></ul>                                                                                           |
|                             |                |         | Engine speed                                                                                                                                                                                                                                                                                                                                                                            |

1) If the electrical system voltage falls below 10.8 V during the attempted start, the V.A.G 1551 fault reader will abort the diagnosis.

## Display group 19 with ignition on

|                              |         |   |                                                                                                                                                                                                                                                                                                                                    |
|------------------------------|---------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Read measured value block 19 |         | ⇒ | ◀ Indicated on display                                                                                                                                                                                                                                                                                                             |
| 0.780 V                      | 4.150 V |   |                                                                                                                                                                                                                                                                                                                                    |
|                              |         |   | No display                                                                                                                                                                                                                                                                                                                         |
|                              |         |   | No display                                                                                                                                                                                                                                                                                                                         |
|                              |         |   | Voltage at sensor for modulating piston movement with metering control at maximum stop <ul style="list-style-type: none"><li>▪ 3.800...4.400 V okay</li><li>▪ If outside tolerance: Check contact resistance in wiring =&gt; Page 86</li><li>▪ injection pump quantity adjuster maladjusted =&gt; replace injection pump</li></ul> |

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- Voltage at sensor for modulating piston movement with metering control at minimum stop
- 0.600...0.900 V okay
  - If outside tolerance: Check contact resistance in wiring => Page 86
  - injection pump quantity adjuster maladjusted => replace injection pump

**Display group 04 during idling (engine warm, coolant temperature not below +85°C)**

|                             |           |           |     |                                                     |                        |
|-----------------------------|-----------|-----------|-----|-----------------------------------------------------|------------------------|
| Read measured value block 4 |           |           |     | ⇒                                                   | ▪ Indicated on display |
| 900 rpm                     | 0.9 °BTDC | 0.9 °BTDC | 3 % |                                                     |                        |
|                             |           |           |     | Duty cycle (activation) of injection start valve    |                        |
|                             |           |           |     | ▪ no specification                                  |                        |
|                             |           |           |     | Current injection start                             |                        |
|                             |           |           |     | ▪ 2° after TDC...4° before TDC okay.                |                        |
|                             |           |           |     | ▪ Later 2°after TDC: Injection timing control stuck |                        |
|                             |           |           |     | ▪ Commencement of injection valve defective         |                        |
|                             |           |           |     | ▪ Injection pump excessively retarded               |                        |
|                             |           |           |     | ▪ => Check injection timing control range, Page 68  |                        |
|                             |           |           |     | Injection start specified by control unit           |                        |
|                             |           |           |     | ▪ 2° after TDC...4° before TDC OK                   |                        |
| Engine speed                |           |           |     |                                                     |                        |
| ▪ 860...940 rpm OK          |           |           |     |                                                     |                        |

**Display group 04 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)**

|                             |            |            |      |                                                                 |                        |
|-----------------------------|------------|------------|------|-----------------------------------------------------------------|------------------------|
| Read measured value block 4 |            |            |      | ⇒                                                               | ▪ Indicated on display |
| 4060 rpm                    | 16.3 °BTDC | 16.1 °BTDC | 84 % |                                                                 |                        |
|                             |            |            |      | Duty cycle (activation) of injection start valve                |                        |
|                             |            |            |      | ▪ No specification                                              |                        |
|                             |            |            |      | Current injection start                                         |                        |
|                             |            |            |      | ▪ If as specified in display group 2 (tolerance ±2°) okay.      |                        |
|                             |            |            |      | ▪ If outside tolerance: Injection pump delivery start incorrect |                        |
|                             |            |            |      | ▪ => check commencement of injection,                           |                        |
|                             |            |            |      | ▪ Page 68                                                       |                        |
|                             |            |            |      | Injection start specified by control unit                       |                        |
|                             |            |            |      | ▪ 14...18 °BTDC okay.                                           |                        |
| Engine speed                |            |            |      |                                                                 |                        |
| ▪ 3800...4200 rpm OK        |            |            |      |                                                                 |                        |

## 1.12 - Readout specifications for engine idling speed

**Display group 02 during idling (engine warm, coolant temperature not below +85°C)**

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|                             |   |                        |
|-----------------------------|---|------------------------|
| Read measured value block 2 | ⇒ | ▪ Indicated on display |
|-----------------------------|---|------------------------|



|         |       |       |         |                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------|-------|-------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 900 rpm | 0.0 % | 0 1 0 | 88.4 °C |                                                                                                                                                                                                                                                                                                                                                                                                   |
|         |       |       |         | Coolant temperature <ul style="list-style-type: none"><li>▪ 85...100 °C ok</li><li>▪ &lt; 85 °C: =&gt; Run engine until warm</li></ul>                                                                                                                                                                                                                                                            |
|         |       |       |         | Operating status <ul style="list-style-type: none"><li>▪ 0 1 0: Okay (idling speed switch closed)</li><li>▪ 1 1 0: Air conditioner signal =&gt; switch off air conditioner</li><li>▪ accelerator and brake detected =&gt; test brake pedal switch</li><li>▪ Glow plug-auxiliary heater on =&gt; warm engine up</li><li>▪ 1 1 1: Air conditioner signal =&gt; switch off air conditioner</li></ul> |
|         |       |       |         | accelerator pedal position <ul style="list-style-type: none"><li>▪ 0.0 % OK</li><li>▪ &gt; 0.0 %: accelerator pedal position sensor incorrectly set or defective =&gt; adjust</li></ul>                                                                                                                                                                                                           |
|         |       |       |         | Engine speed <ul style="list-style-type: none"><li>▪ 860...940 rpm OK</li></ul>                                                                                                                                                                                                                                                                                                                   |

**Display group 13 during idling (engine warm, coolant temperature not below +85°C)**

The injection system is equipped with an idling speed smooth running control function. There may be power differences between the individual cylinders (component tolerances, injector delivery rate, compression etc.) which are recognised and equalised by means of selective injected quantities during idling.

The recognition at idling speed is performed using the signal from the engine-speed sensor which delivers four signals per crankshaft revolution to the control unit. If the signals are delivered at the same rate then all the cylinders are performing equally. If one cylinder is weaker, then the crankshaft will require longer for the next half crankshaft revolution. Conversely, a more powerful cylinder accelerates the crankshaft, ensuring that less time is taken. Conversely, a more powerful cylinder accelerates the crankshaft, meaning that less time is taken.

If the control unit detects a difference, the relevant cylinder is injected with more or less fuel until the engine is running evenly again.

Using No. 3 cylinder as a reference, the measured value block displays the injected quantity adjustments that are required for the individual cylinders in order to attain an even engine idling speed.

+... mg/stroke: The cylinder in question is less powerful than cylinder No. 3 and is therefore supplied with more fuel.

-... mg/stroke: The respective cylinder is more powerful than cylinder No. 3 and is therefore supplied with less fuel.

|                              |                 |               |   |                                                                                                                                                                                                                                                                         |
|------------------------------|-----------------|---------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Read measured value block 13 |                 |               | ⇒ | ▪ Indicated on display                                                                                                                                                                                                                                                  |
| 0.82 mg/stroke               | -0.12 mg/stroke | 0.49mg/stroke |   |                                                                                                                                                                                                                                                                         |
|                              |                 |               |   | No display                                                                                                                                                                                                                                                              |
|                              |                 |               |   | Difference between injection quantities for cyl. 4/2/1 and cyl. 3 <ul style="list-style-type: none"><li>▪ -1.5 mg/stroke...+ 1.5 mg/stroke OK</li><li>▪ All display zones too large: cylinder 3 strong</li><li>▪ All display zones too small: cylinder 3 weak</li></ul> |
|                              |                 |               |   | Difference between injection quantities for cylinder 1 and cylinder 3 <ul style="list-style-type: none"><li>▪ -1.5 mg/stroke...+1.5 mg/stroke okay</li><li>▪ &gt; +1.5 mg/stroke: cylinder 1 weak</li><li>▪ &lt; -1.5 mg/stroke: cylinder 1 strong</li></ul>            |
|                              |                 |               |   | Difference between injection quantities for cylinder 2 and cylinder 3 <ul style="list-style-type: none"><li>▪ -1.5 mg/stroke...+1.5 mg/stroke okay</li><li>▪ &gt; +1.5 mg/stroke: cylinder 2 weak</li><li>▪ &lt; -1.5 mg/stroke: cylinder 2 strong</li></ul>            |
|                              |                 |               |   | Difference between injection quantities for cylinder 4 and cylinder 3 <ul style="list-style-type: none"><li>▪ -1.5 mg/stroke...+1.5 mg/stroke okay</li><li>▪ &gt; +1.5 mg/stroke: cylinder 4 weak</li><li>▪ &lt; -1.5 mg/stroke: cylinder 4 strong</li></ul>            |

## 1.13 - Readout specifications for exhaust gas recirculation

Display group 03 during idling (engine warm, coolant temperature not below +85°C)

|                             |               |                                                                                   |                      |
|-----------------------------|---------------|-----------------------------------------------------------------------------------|----------------------|
| Read measured value block 3 |               | ⇒                                                                                 | Indicated on display |
| 900 rpm                     | 290 mg/stroke | 308 mg/stroke                                                                     | 54 %                 |
|                             |               | Duty cycle (activation) of exhaust gas recirculation valve                        |                      |
|                             |               | ▪ 30...80 % okay                                                                  |                      |
|                             |               | Intake air mass                                                                   |                      |
|                             |               | ▪ Like specified air mass in display zone 2 (tolerance ±20 mg/stroke)             |                      |
|                             |               | OK                                                                                |                      |
|                             |               | ▪ Air mass too small: Unmetered air in intake area                                |                      |
|                             |               | ▪ excessive exhaust gas recirculation                                             |                      |
|                             |               | ▪ => test, Page 71                                                                |                      |
|                             |               | ▪ Engine running at idle for 10 min.                                              |                      |
|                             |               | ▪ => give short burst of throttle                                                 |                      |
|                             |               | ▪ Constant 425 mg/stroke: Substitute value => interrogate fault memory            |                      |
|                             |               | Air mass specified by control unit                                                |                      |
|                             |               | ▪ 230...370 mg/stroke okay                                                        |                      |
|                             |               | ▪ > 370 mg/stroke: Engine too cold => run until warm injection quantity too great |                      |
|                             |               | ▪ => readout specifications for injection pump                                    |                      |
|                             |               | ▪ intake manifold temperature too high => no correction possible                  |                      |
|                             |               | Engine speed                                                                      |                      |
|                             |               | ▪ 860...940 rpm OK                                                                |                      |

## 1.14 - Readout specifications for temperature senders

Display group 07 with ignition switched on (engine cold and not running)

|                             |         |                                                                                                                  |                      |
|-----------------------------|---------|------------------------------------------------------------------------------------------------------------------|----------------------|
| Read measured value block 7 |         | ⇒                                                                                                                | Indicated on display |
| 15.4 °C                     | 15.9 °C | 16.7 °C                                                                                                          |                      |
|                             |         | Coolant temperature (at -G62 coolant temperature sensor)                                                         |                      |
|                             |         | ▪ If the wiring has an open circuit the approximate fuel temperature will be displayed as a substitute value.    |                      |
|                             |         | Intake manifold temperature (at intake manifold temperature sender -G72)                                         |                      |
|                             |         | ▪ If the wiring has an open circuit, a constant temperature of -136.8°C will be displayed as a substitute value. |                      |
|                             |         | No display                                                                                                       |                      |
|                             |         | Fuel temperature (at fuel temperature sender -G81)                                                               |                      |
|                             |         | ▪ If the wiring has an open circuit, a constant temperature of - 5.4°C will be displayed as a substitute value.  |                      |

**Notes:**

- ♦ No specifications can be given for temperature values.
- ♦ When the engine is cold, the fuel, intake manifold and coolant temperatures should be approximately the same as the ambient temperature. If one of the temperature readings differs noticeably, the sender in question should be checked.

**1.15 - Readout specifications for vehicle performance**

Display group 08 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine codes AGR and ALH

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

| Read measured value block 8      |                |                | ⇒              | ◀ Indicated on display                                                                                                                                                                                                           |
|----------------------------------|----------------|----------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3290 rpm                         | 40.4 mg/stroke | 37.2 mg/stroke | 39.7 mg/stroke |                                                                                                                                                                                                                                  |
|                                  |                |                |                | Injection quantity limitat. according to recognised air mass<br>▪ > 39 mg/stroke OK<br>▪ < 39 mg/stroke: detected air mass insufficient<br>▪ => Check air mass meter, Page 71                                                    |
|                                  |                |                |                | Injection quantity controlled according to engine speed (torque limitation) 34...39 mg/stroke OK<br>▪ < 34 mg/stroke: engine speed too high or too low<br>▪ > 39 mg/stroke: increase in injection quantity as a result of tuning |
|                                  |                |                |                | Desired injection quantity (accelerator pedal position) 39 mg/stroke okay<br>▪ < 39 mg/stroke: accelerator pedal not fully depressed, incorrectly adjusted or defective<br>▪ => check, Page 87                                   |
| Engine speed, 2800...4000 rpm OK |                |                |                |                                                                                                                                                                                                                                  |

Display group 08 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine code AHF

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

| Read measured value block 8 |                |                | ⇒              | ◀ Indicated on display                                                                                                                                                                          |
|-----------------------------|----------------|----------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3290 rpm                    | 41.4 mg/stroke | 39.8 mg/stroke | 41.4 mg/stroke |                                                                                                                                                                                                 |
|                             |                |                |                | Injection quantity limitation according to recognised air mass greater than 40 mg/stroke OK<br>▪ Less than 40 mg/stroke: detected air mass insufficient<br>▪ => Check air mass meter => Page 71 |

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|  |  |                                                                                                                                                                                                                                                                                                                |
|--|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |  | <p>Injection quantity controlled according to engine speed (torque limitation) 38...42 mg/stroke OK</p> <ul style="list-style-type: none"> <li>▪ Less than 38 mg/stroke engine speed too high or too low</li> <li>▪ Greater than 42 mg/stroke: increase in injection quantity as a result of tuning</li> </ul> |
|  |  | <p>Desired injection quantity (accelerator pedal position) greater than 40 mg/stroke okay</p> <ul style="list-style-type: none"> <li>▪ Less than 40 mg/stroke accelerator pedal not fully depressed, incorrectly adjusted or defective test accelerator position sender -G79 =&gt; Page 87</li> </ul>          |
|  |  | Engine speed, 2800...4000 rpm OK                                                                                                                                                                                                                                                                               |

Display group 10 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine codes AGR and ALH

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

|                                         |   |                                                                                                                                                                                                                                                                                                                                         |
|-----------------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Read measured value block 10            | ⇒ | ▪ Indicated on display                                                                                                                                                                                                                                                                                                                  |
| 830 mg/stroke 1030 mbar 1850 mbar 100 % |   |                                                                                                                                                                                                                                                                                                                                         |
|                                         |   | <p>Accelerator pedal position: 100 % OK</p> <ul style="list-style-type: none"> <li>▪ &lt; 100 %: accelerator pedal not fully depressed</li> <li>▪ Accelerator pedal position sensor -G79 incorrectly adjusted or defective =&gt; check, Page 87</li> </ul>                                                                              |
|                                         |   | <p>Current boost pressure: 1800...2050 mbar okay</p> <p>If outside tolerance: boost pressure control defective<br/>=&gt; display group 11, Page 30</p>                                                                                                                                                                                  |
|                                         |   | Current air pressure: no specification                                                                                                                                                                                                                                                                                                  |
|                                         |   | <p>Intake air mass: 750...850 mg/stroke okay</p> <ul style="list-style-type: none"> <li>▪ &lt; 750 mg/stroke: Engine speed below 2000 rpm or above 4000 rpm</li> <li>▪ Boost pressure too low =&gt; note display zone 3</li> <li>▪ Unmetered air between air mass meter and turbocharger</li> <li>▪ Air mass meter defective</li> </ul> |

Display group 10 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine code AHF

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

|                                           |   |                                                                                                                                                                                                                                                                         |
|-------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Read measured value block 10              | ⇒ | ▪ Indicated on display                                                                                                                                                                                                                                                  |
| 963 mg/stroke 1030 mbar 1968 mbar 100.0 % |   |                                                                                                                                                                                                                                                                         |
|                                           |   | <p>Accelerator pedal position: 100.0 % OK</p> <ul style="list-style-type: none"> <li>▪ Less than 100.0 %: accelerator pedal not fully depressed</li> <li>▪ Accelerator pedal position sensor -G79 incorrectly adjusted or defective =&gt; test =&gt; Page 87</li> </ul> |
|                                           |   | <p>Current boost pressure: 1800...2250 mbar okay</p> <p>If outside tolerance: boost pressure control defective<br/>=&gt; display group 11, Page 30</p>                                                                                                                  |
|                                           |   | Current air pressure: no specification                                                                                                                                                                                                                                  |



- Intake air mass: 800...1100 mg/stroke okay
- Less than 800 mg/stroke: Engine speed below 2000 rpm or above 4000 rpm
  - Boost pressure too low => note display zone 3
  - Unmetered air between air mass meter and turbocharger
  - Air mass meter defective

## 1.16 - Readout specifications for boost pressure control

Display group 11 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine codes AGR and ALH

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

|                                                                      |           |           |                        |
|----------------------------------------------------------------------|-----------|-----------|------------------------|
| Read measured value block 11                                         |           | ⇒         | ▪ Indicated on display |
| 3340 rpm                                                             | 1830 mbar | 1850 mbar | 68 %                   |
| Duty cycle (activation) of boost pressure control solenoid -N75      |           |           |                        |
| Current boost pressure                                               |           |           |                        |
| ▪ If as specified in display zone 2 (tolerance ±100 mbar) okay.      |           |           |                        |
| ▪ Boost pressure too low: no boost pressure control => test, Page 59 |           |           |                        |
| Boost pressure specified by control unit                             |           |           |                        |
| ▪ 1800...2050 mbar okay                                              |           |           |                        |
| ▪ > 2050 mbar: boost pressure increased as a result of tuning        |           |           |                        |
| Engine speed 2900...4000 rpm OK                                      |           |           |                        |

Display group 11 at full throttle (test drive in 3rd or 4th gear, coolant temperature not below +85 °C)

- engine code AHF

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|                                                                  |           |           |                        |
|------------------------------------------------------------------|-----------|-----------|------------------------|
| Read measured value block 11                                     |           | ⇒         | ▪ Indicated on display |
| 3340 rpm                                                         | 1948 mbar | 1917 mbar | 57 %                   |
| Duty cycle (activation) of boost pressure control solenoid -N75  |           |           |                        |
| Current boost pressure                                           |           |           |                        |
| ▪ If as specified in display zone 2 (tolerance ±100 mbar) OK     |           |           |                        |
| ▪ Boost pressure too low: Check load pressure control =>Page 59  |           |           |                        |
| Boost pressure specified by control unit                         |           |           |                        |
| ▪ 1800...2250 mbar OK                                            |           |           |                        |
| ▪ Over 2250 mbar: boost pressure increased as a result of tuning |           |           |                        |
| Engine speed, 2900...4000 rpm OK                                 |           |           |                        |

## 23 - Mixture preparation, Injection

### 1 - Servicing diesel direct injection system

#### 1.1 - Servicing diesel direct injection system

#### 1.2 - Safety precautions

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

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- ◆ Switch off the ignition before connecting or disconnecting injection or glow plug system wiring or tester cables.
- ◆ If the engine is to be operated at starting speed without starting, e.g. for checking compression, pull the connector off the injection pump.
- ◆ For radios with anti-theft coding, ask for code before disconnecting battery.
- ◆ Only disconnect and connect the battery with the ignition switched off, otherwise the diesel direct injection system control unit may be damaged.

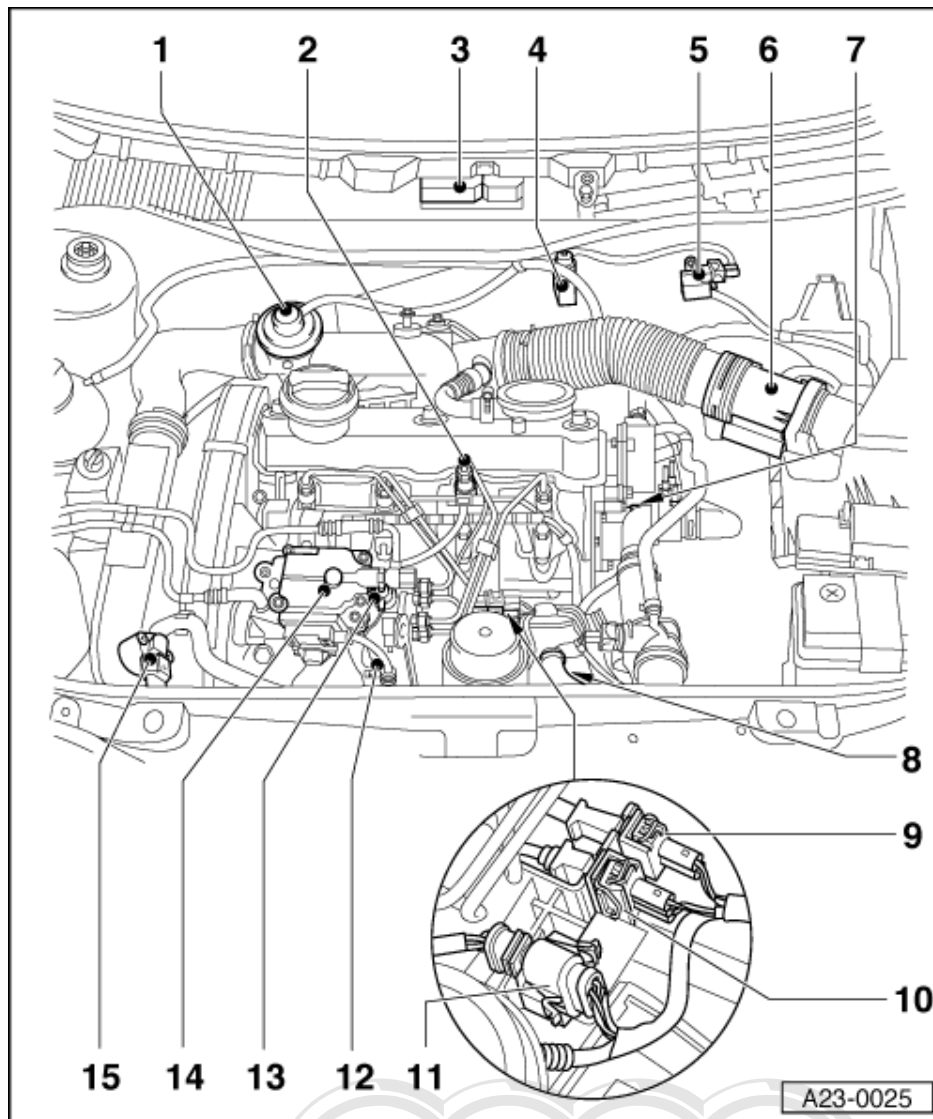
#### 1.3 - Rules for cleanliness

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

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place removed parts on a clean surface and cover. Use lint-free cloths.
- ◆ Carefully cover or seal open components if repairs cannot be carried out immediately.
- ◆ Only install clean components:  
Only remove replacement parts from packaging immediately prior to installation.  
Do not use parts that have been stored loose (e.g. in toolboxes etc.).
- ◆ When the system is open:  
Do not work with compressed air if this can be avoided.  
Do not move vehicle unless absolutely necessary.
- ◆ Also ensure that no diesel fuel runs onto the coolant hoses. If necessary, the hoses must be cleaned again immediately. Affected hoses must be replaced.



## 1.4 - Fitting locations overview



Engine code AGR

Components A to D are not shown on the illustration.

**A - Relay for diesel direct injection system (J322)**

- ♦ Central electrics, relay position 5

**B - Glow plug relay (J52)**

- ♦ Central electrics, relay position 4

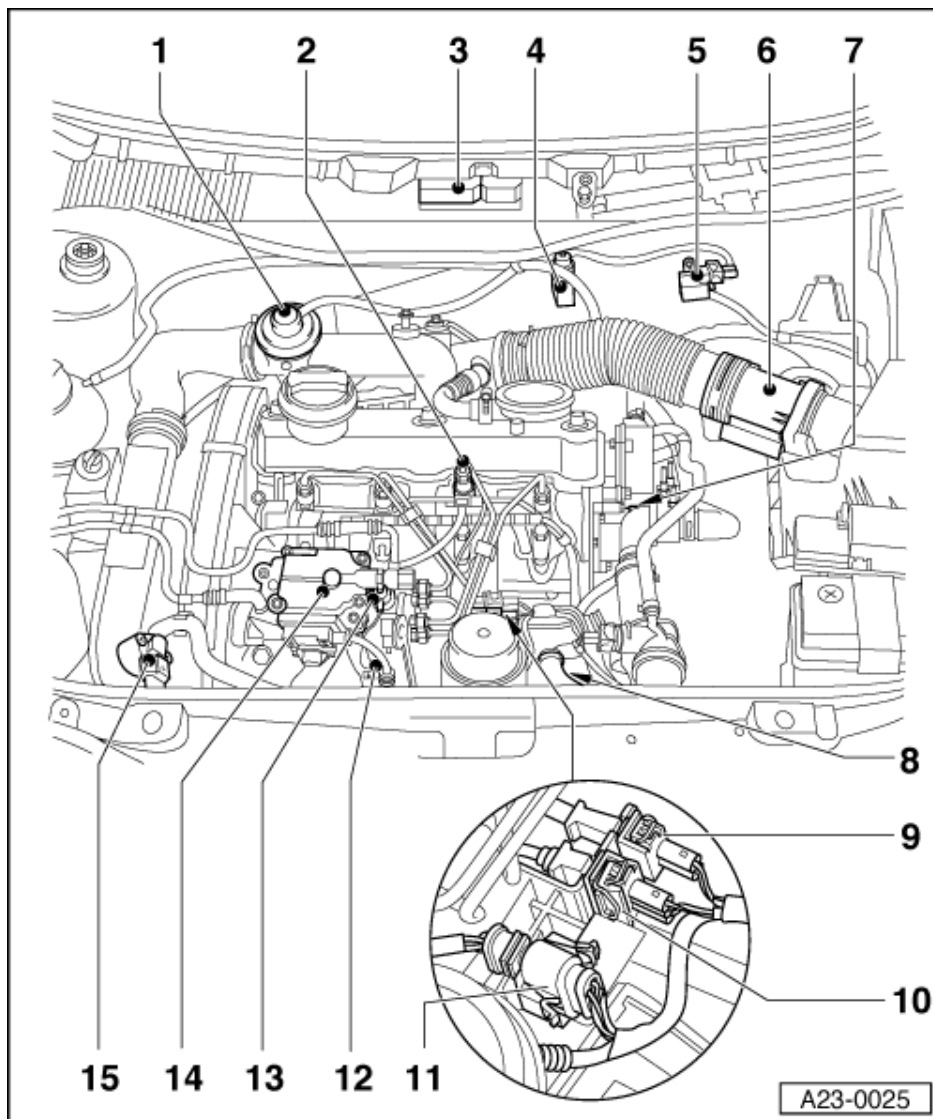
**C - Accelerator position sensor (G79)**

- ♦ In footwell on accelerator

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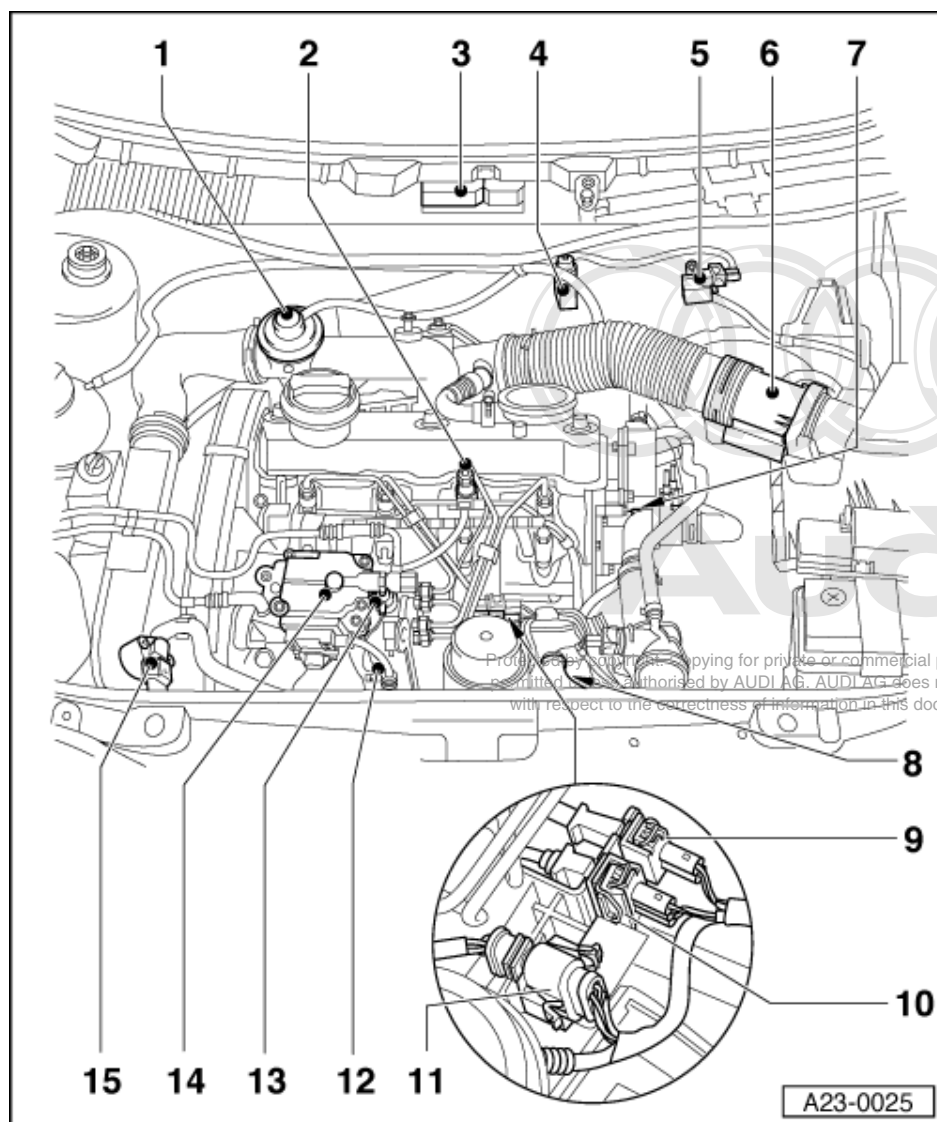
**D - Brake light switch (F) and brake pedal switch (F47)**

- ♦ In footwell at brake pedal



- 1 Mechanical exhaust gas recirculation valve
- 2 Injector with needle lift sensor (G80)
- 3 Diesel direct injection control unit -J248 defective
  - ♦ With altitude sender (F96)
- 4 Valve for exhaust gas recirculation (N18)
- 5 Solenoid valve for boost pressure limitation (N75)
- 6 Air mass meter (G70)
- 7 Coolant temperature sender (G62)
- 8 Engine speed sender (G28)

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**9 Connector**

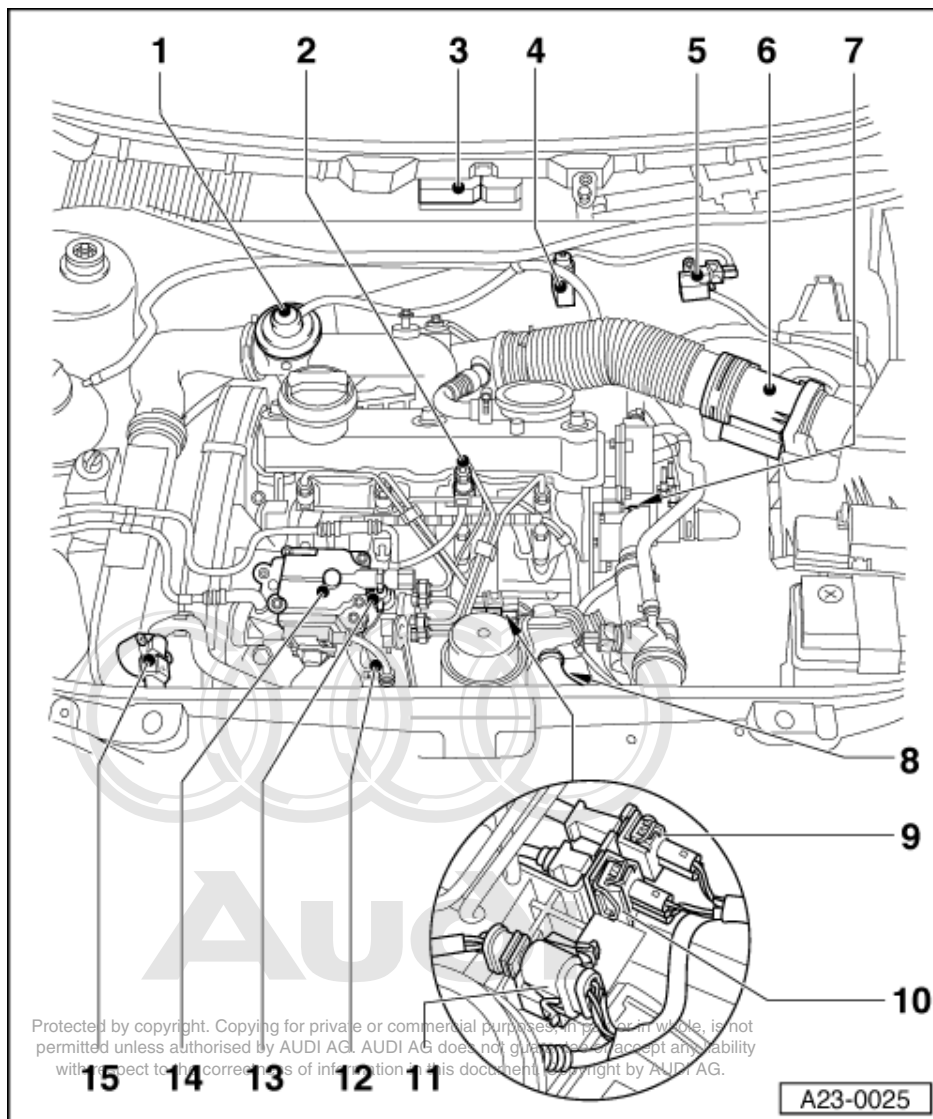
- ◆ 2-pin
- ◆ For needle lift sensor (G80)

**10 Connector**

- ◆ 3-pin
- ◆ For engine speed sender (G28)

**11 Connector**

- ◆ 10-pin
- ◆ For fuel temperature sender (G81)
- ◆ For metering control (N146)
- ◆ For modulating piston movement sensor (G149)
- ◆ For injection start valve (N108)
- ◆ For fuel shut off valve (N109)



**12 Injection start valve (N108)**

**13 Fuel cut-off valve (N109)**

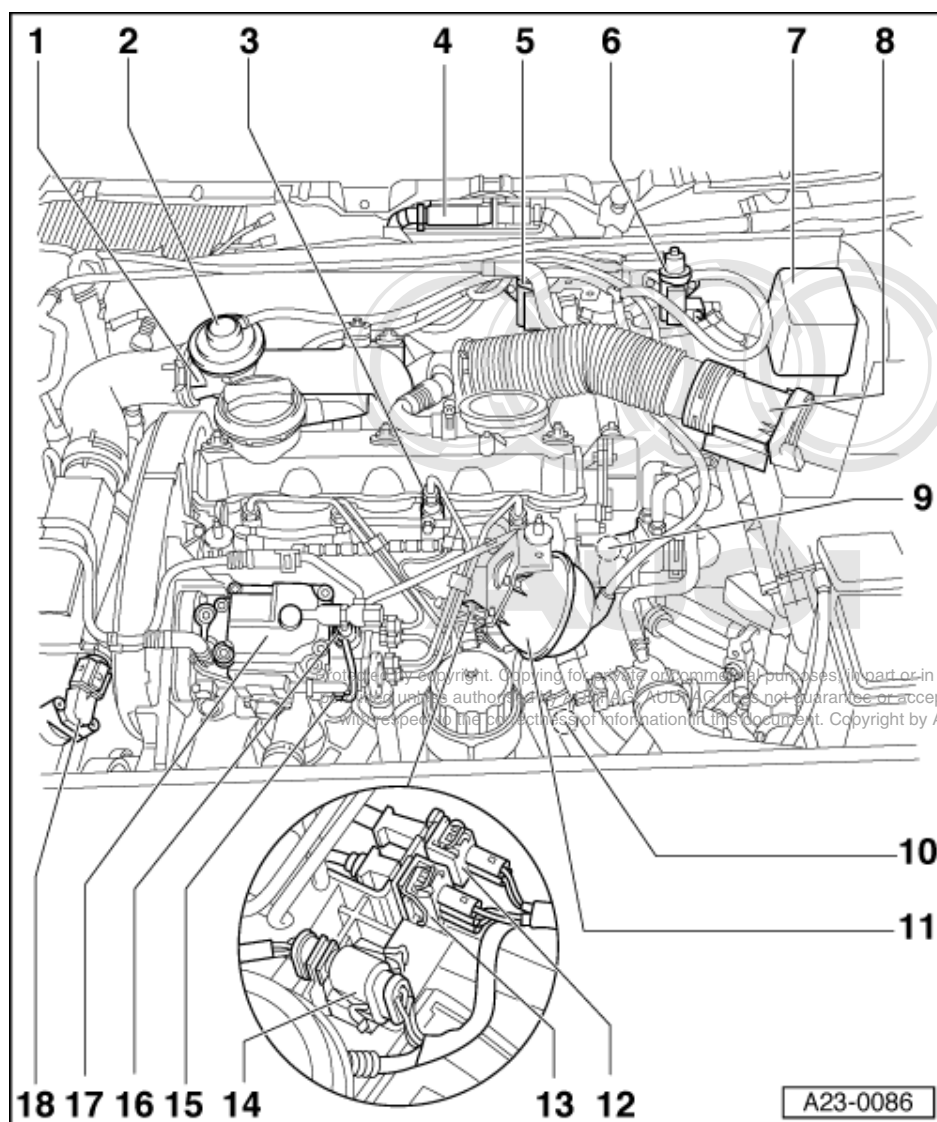
**14 Injection pump metering control assembly**

- ◆ With fuel temperature sensor
- ◆ With quantity adjuster (N146)
- ◆ With sensor for modulating piston movement (G149)

**15 Intake manifold pressure sender (G71) and intake manifold temperature sender (G72)**



## 1.5 - Fitting locations overview



Engine codes ALH and AHF

Components A to D are not shown on the illustration.

**A - Relay for diesel direct injection system (J322)**

- ♦ Central electrics, relay position 5

**B - Glow plug relay (J52)**

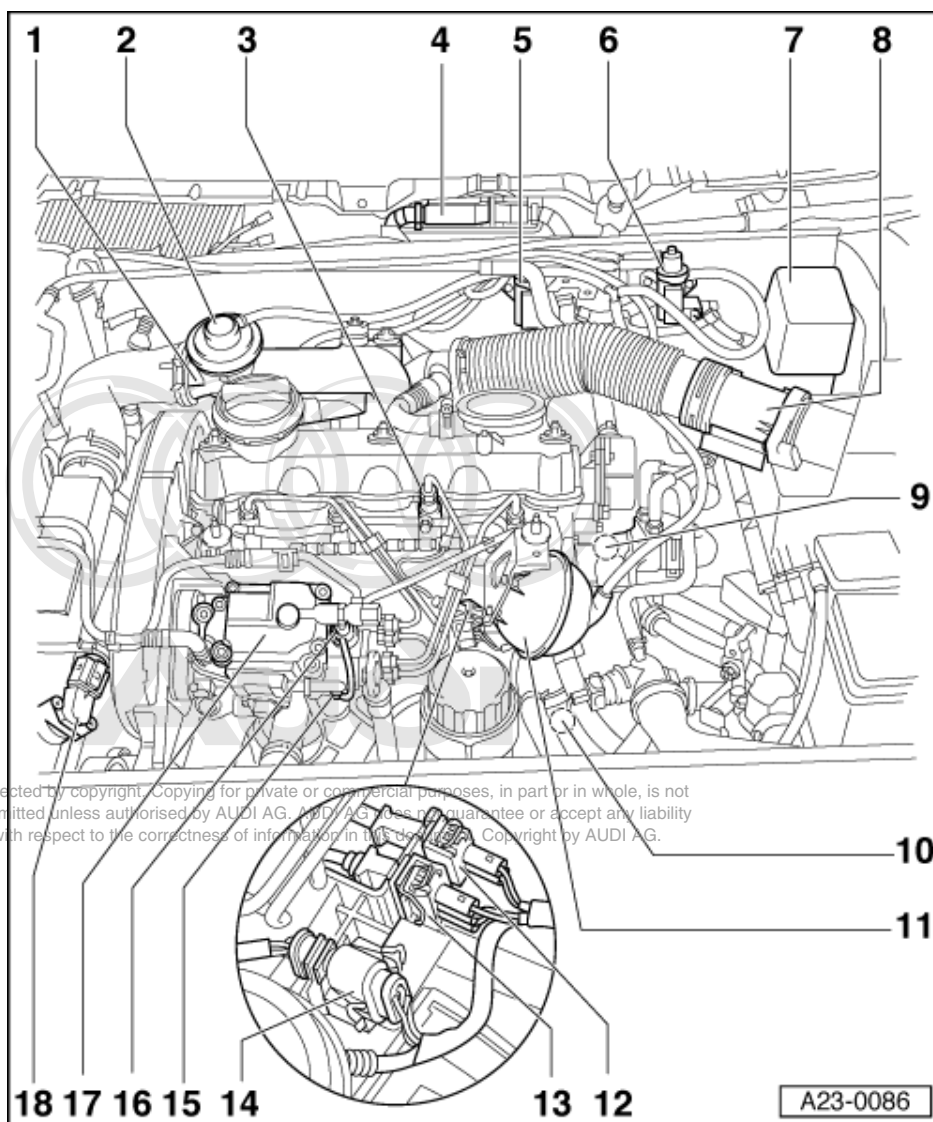
- ♦ Central electrics, relay position 4

**C - Accelerator position sensor (G79)**

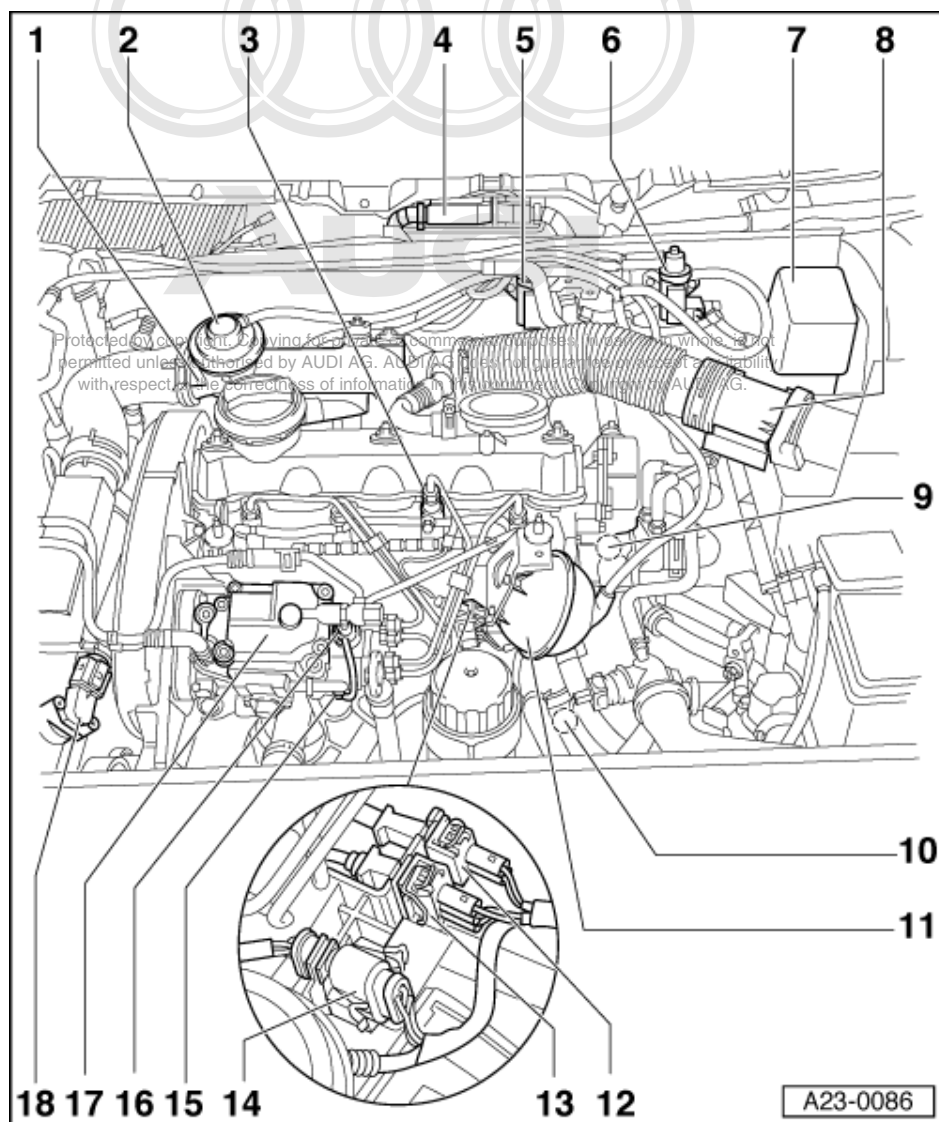
- ♦ In footwell on accelerator  
=>Page 46

**D - Brake light switch (F) and brake pedal switch (F47)**

- ♦ In footwell at brake pedal



- 1 Shut-off valve with changeover valve
  - ♦ Throttle valve unit
- 2 Mechanical exhaust gas recirculation valve
- 3 Injector with needle lift sensor (G80)
- 4 Diesel direct injection control unit -J248 defective
  - ♦ With altitude sender (F96)
- 5 Exhaust gas recirculation solenoid valve (N18)
- 6 Solenoid valve for boost pressure limitation (N75)
- 7 Relay box
  - ♦ Relay for low and high heater output
- 8 Air mass meter (G70)



**9 Coolant temperature sender (G62)**

**10 Engine speed sender (G28)**

**11 Vacuum reservoir**

**12 Connector**

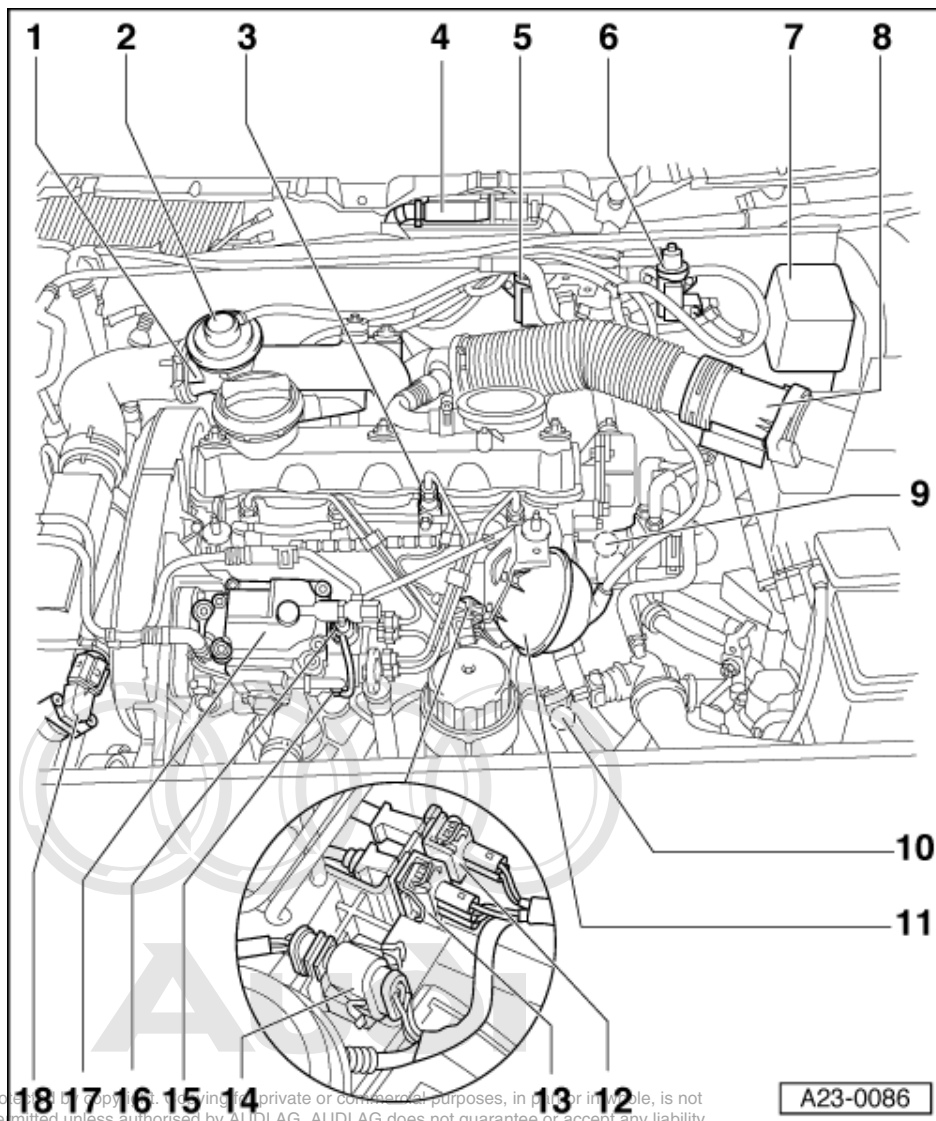
- ◆ 2-pin
- ◆ For needle lift sensor (G80)

**13 Connector**

- ◆ 3-pin
- ◆ For engine speed sender (G28)

**14 Connector**

- ◆ 10-pin
- ◆ For fuel temperature sender (G81)
- ◆ For metering control (N146)
- ◆ For modulating piston movement sensor (G149)
- ◆ For injection start valve (N108)
- ◆ For fuel shut off valve (N109)



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**15 Injection start valve (N108)**

**16 Fuel cut-off valve (N109)**

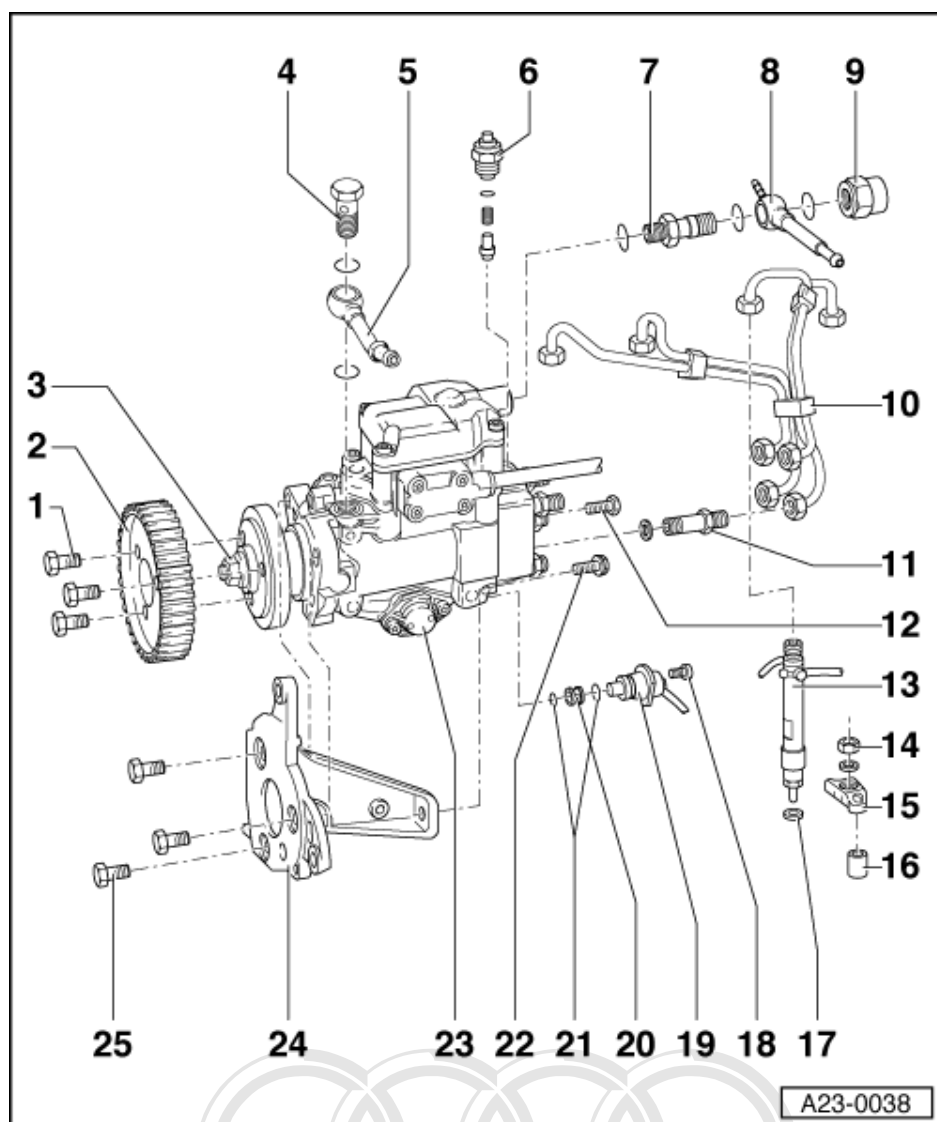
**17 Injection pump metering control assembly**

- ◆ With fuel temperature sensor
- ◆ With quantity adjuster (N146)
- ◆ With sensor for modulating piston movement (G149)

**18 Intake manifold pressure sender (G71) and intake manifold temperature sender (G72)**



## 1.6 - Repairing injection pump



- ♦ Observe safety precautions  
=> Page 31
- ♦ Observe rules for cleanliness  
=> Page 31
- ♦ Removing and installing injection pump => Page 47
- ♦ Check and adjust commencement of injection => Page 52

## 1 Stretch bolt

- ♦ Always replace
- ♦ 20 Nm + 1/4 turn (90°)

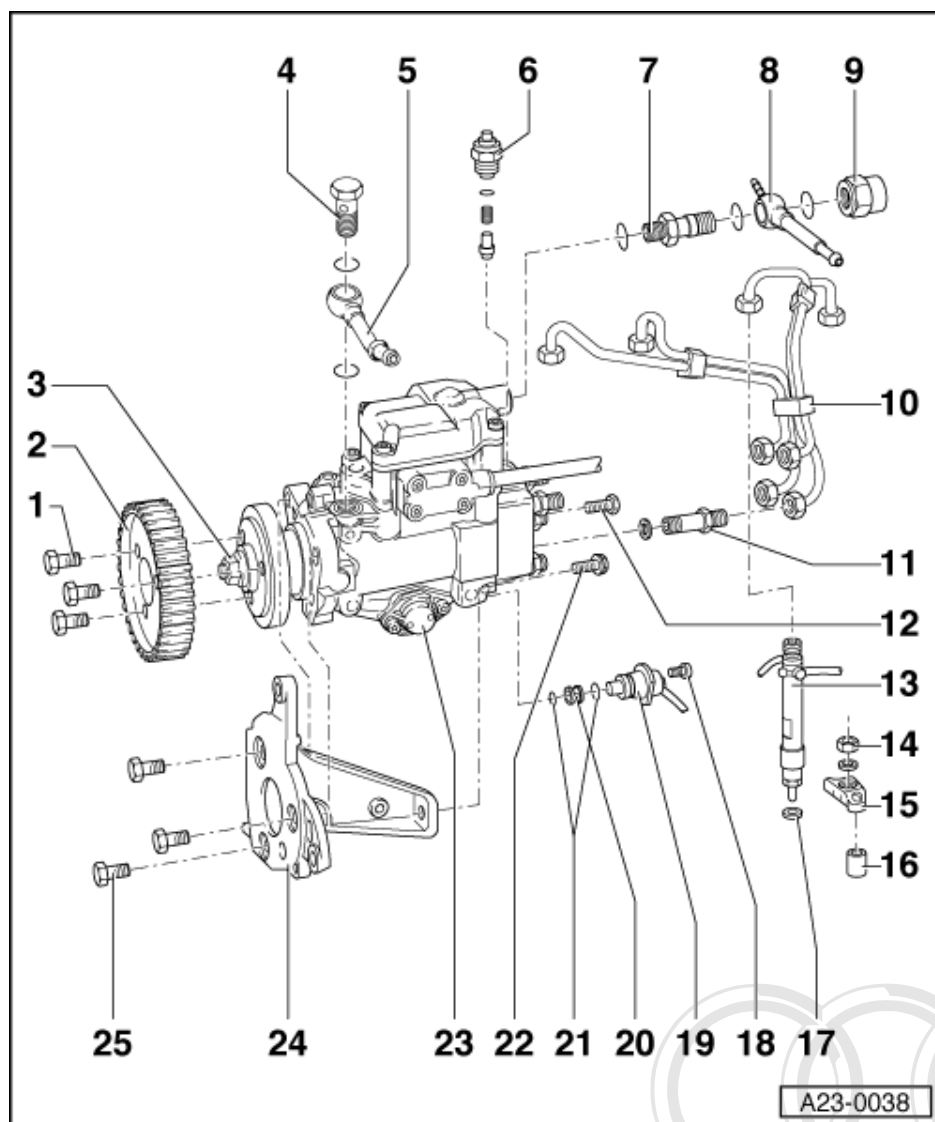
## 2 Injection pump sprocket

## 3 Hub nut

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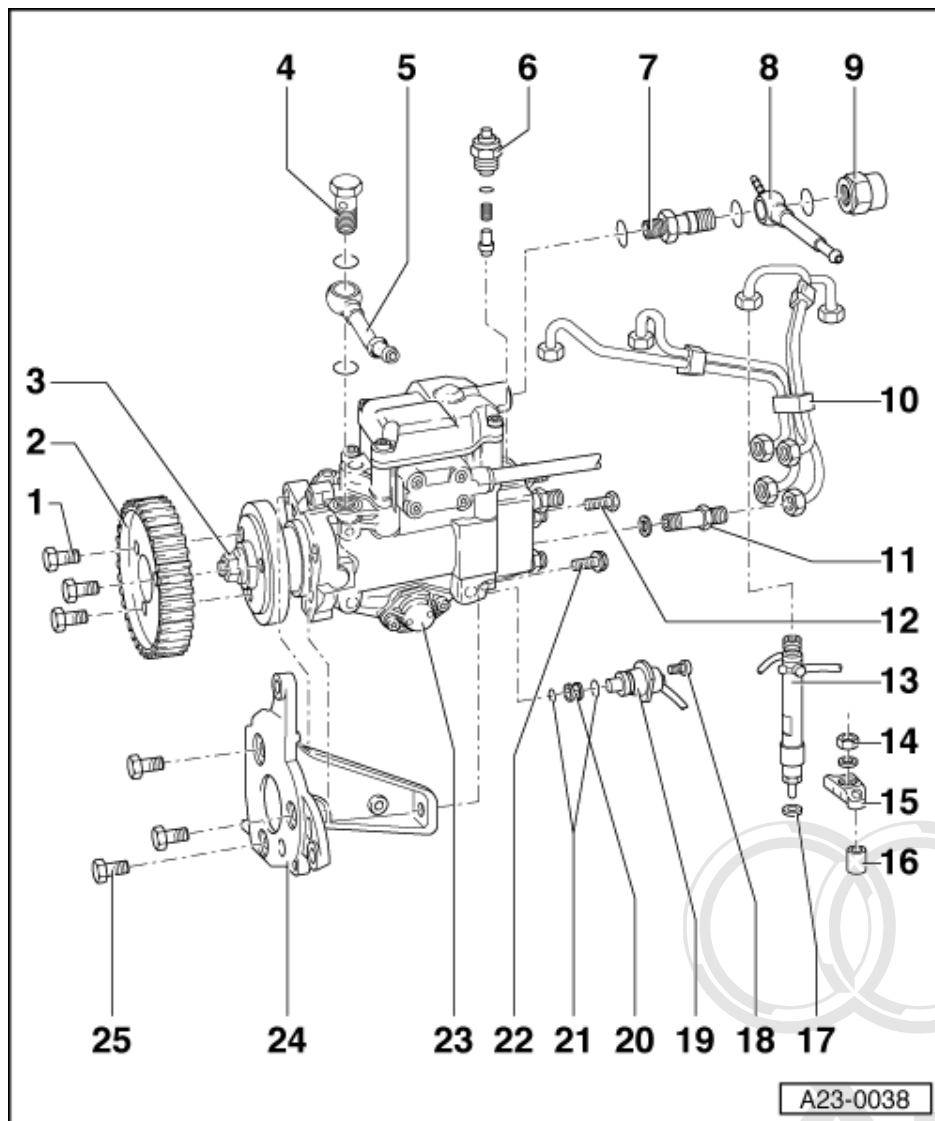
- ♦ Never slacken

## 4 25 Nm



- 5 Supply pipe**
  - ◆ From fuel filter
- 6 Fuel cut-off valve**
  - ◆ 20 Nm
- 7 Pipe union**
  - ◆ For return pipe
  - ◆ 28 Nm
- 8 Return line**
  - ◆ To control valve/fuel filter
- 9 25 Nm**
- 10 Injector pipes**
  - ◆ Tighten to 25 Nm
  - ◆ Remove with 3035
  - ◆ Always remove pipework completely
  - ◆ Do not alter shape
- 11 Pressure valve**
  - ◆ 45 Nm
- 12 25 Nm**

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**13 Injector**

- ♦ For 3rd cylinder with needle lift sensor
- ♦ Remove, install and test => Page 54

**14 20 Nm**

**15 Retainer**

**16 Mounting bracket**

**17 Copper seal**

**18 12 Nm**

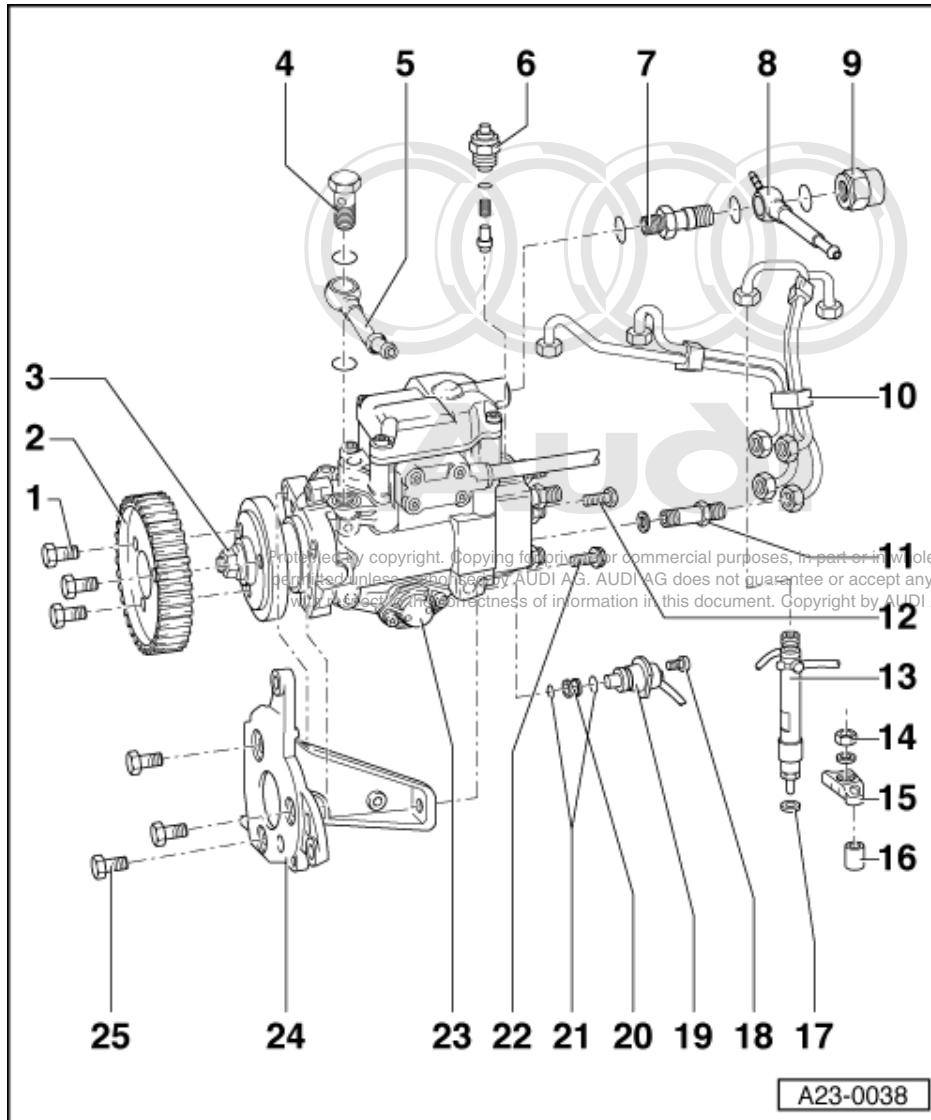
**19 Injection start valve (N108)**

**20 Strainer**

**21 O-ring**

**22 25 Nm**

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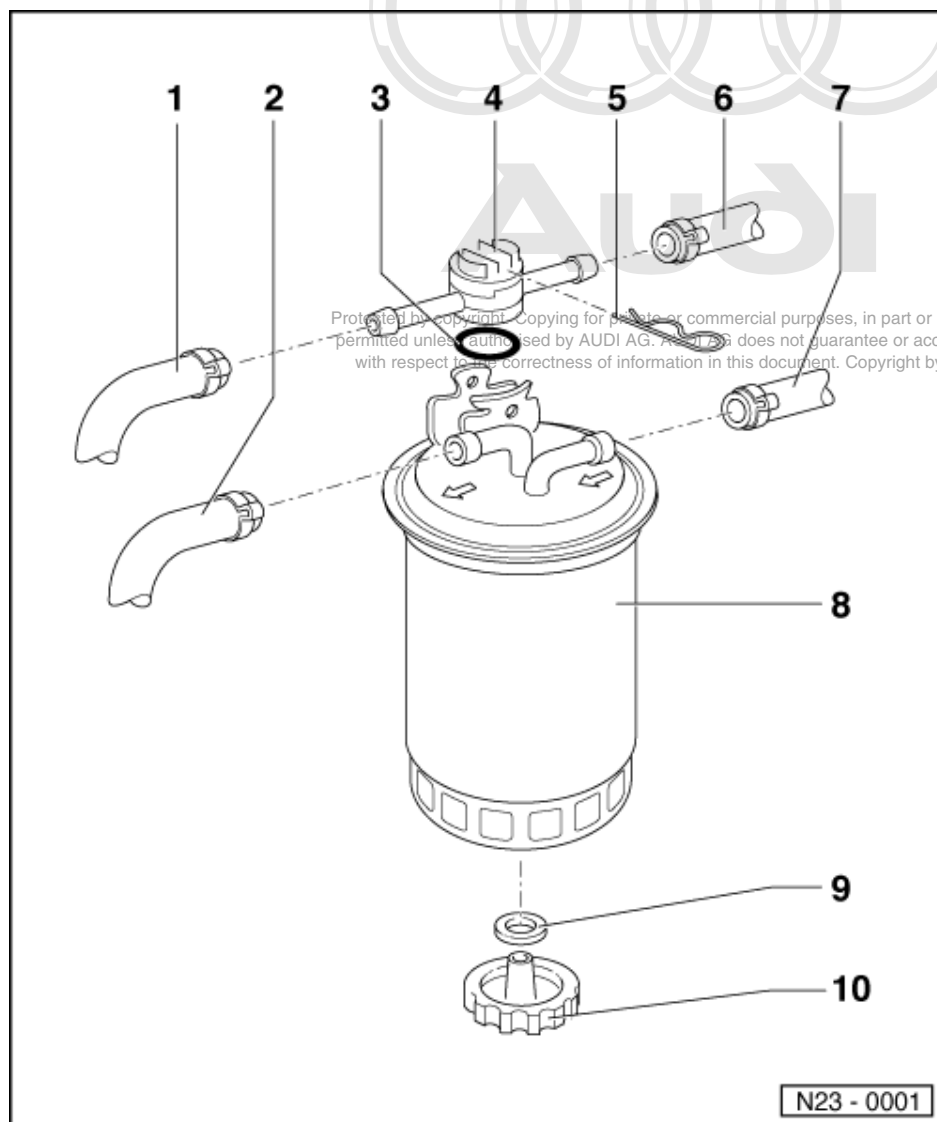
**23 Timing control cover**

- ♦ If any leaks are found, replace O-ring =>Page **56**

**24 Bracket**

**25 25 Nm**

## 1.7 - Servicing fuel filter



### 1 Return line

- ♦ From injection pump

### 2 Supply pipe

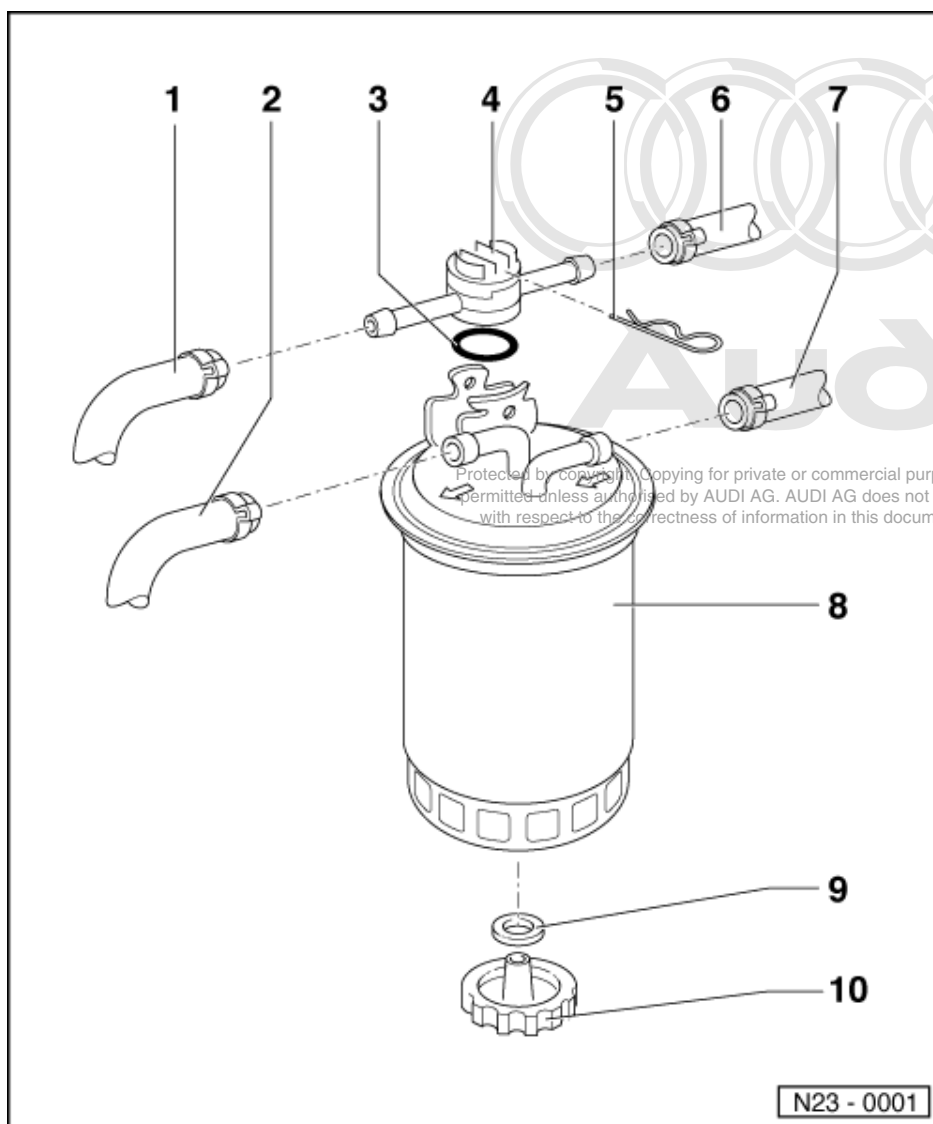
- ♦ To injection pump

### 3 O-ring

- ♦ Replace

### 4 Control valve

- ♦ Installation position: arrow points towards fuel tank
- ♦ When changing filter, remove securing clip and take control valve off with fuel pipes attached
- ♦ At below + 15 °C  
Passageway to filter open
- ♦ At below + 31 °C  
Passageway to filter closed



**5 Bracket**

**6 Return line**

- ♦ To fuel tank

**7 Supply pipe**

- ♦ From fuel tank

**8 Fuel filter**

- ♦ Flow direction is marked by arrows
- ♦ Do not interchange connections
- ♦ Replace, if damaged

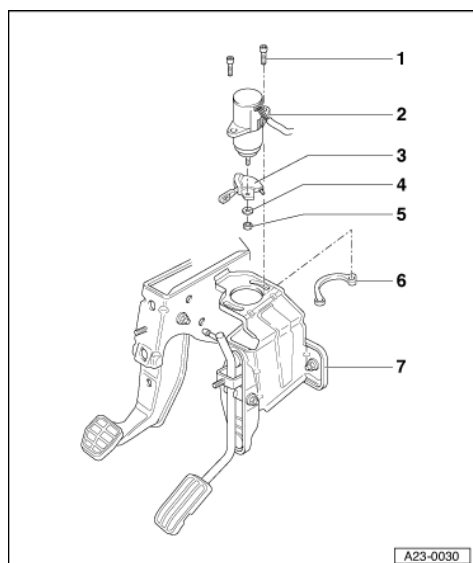
**9 Gasket**

- ♦ Replace, if damaged

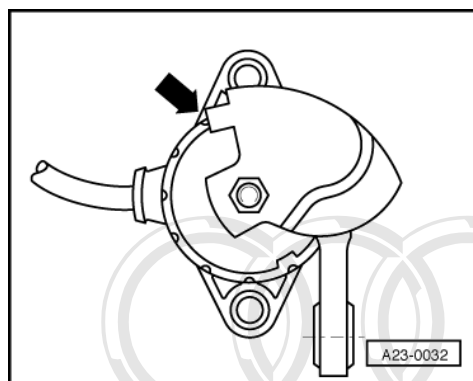
**10 Water drain plug**

- ♦ To bleed remove control valve securing clip and take control valve off with fuel pipes attached
- ♦ Undo and allow approx. 100 cm<sup>3</sup> of liquid to run off

## 1.8 - Servicing accelerator mechanism



- 1 Hexagon socket-head bolt
  - ◆ 10 Nm
- 2 Accelerator position sender (G79)
  - ◆ Checking => Page 87
  - ◆ Adjusting => Page 46
- 3 Cable pulley
- 4 Spring lock washer
- 5 10 Nm
- 6 Threaded retainer
- 7 Pedal bracket



### Adjust accelerator pedal position sender

*If the sender has been removed:*

- -> Fit cable cam as shown.
  - Install sender with cable cam already fitted.
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- Read measured value block, display group 02, engine not running => Page 25 .

-> Indicated on display:

Read measured value block 2  
0 rpm 0.0 % 0 1 0  
18.4 5C

- Check display in display zone 2 (accelerator pedal position).

Read measured value block 2  
0 rpm 0.0 % 0 1 0 18.4  
5C

-> Specification: 0.0 % (accelerator pedal not depressed)

- Slowly depress accelerator pedal.

Read measured value block 2  
0 rpm 100.0 % 0 0 0  
18.4 5C

-> Specification: Display zone 2 must increase steadily up to 100 % (with accelerator depressed).  
At 100 % the accelerator pedal should be at the full throttle stop on the floor.

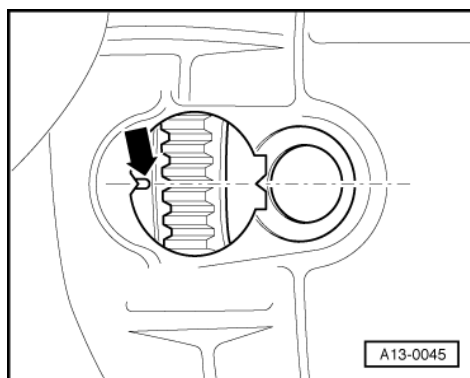
If the final readout is not as specified or the pedal has not reached the full throttle stop:

- Turn the sender within the elongated holes on the pedal bracket.

## 1.9 - Removing and installing injection pump

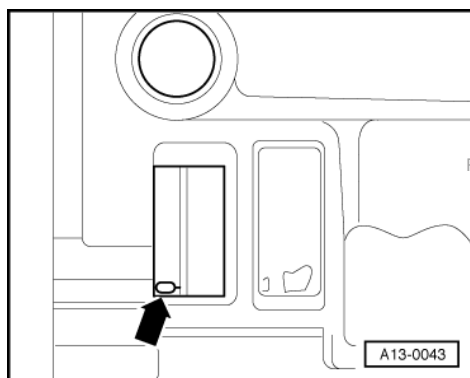
### Removing

- Unscrew fuel pipes from injection pump.



- Remove intake hose from between boost air cooler and intake manifold.
- Remove upper toothed belt guard, vacuum pump and cylinder head cover.
- Turn crankshaft to No. 1 cylinder TDC (arrow).

-> TDC in vehicles with manual gearbox



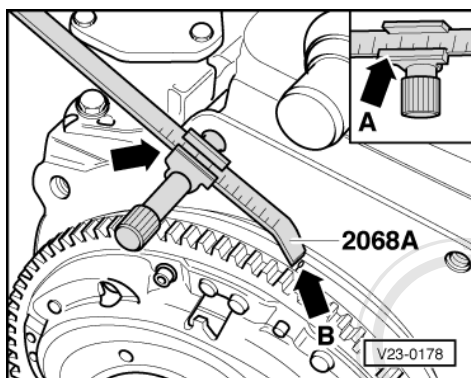
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-> TDC in vehicles with automatic gearbox

**Note:**

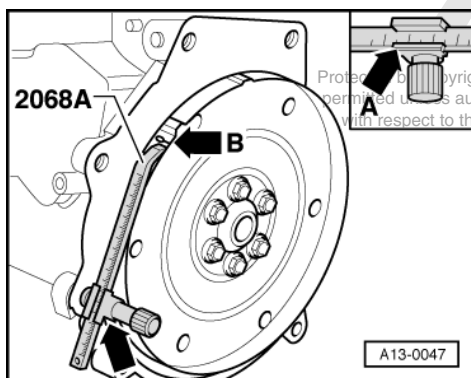
To turn the engine by hand, use special tool 3098 on hydraulic pump.

With engine removed - vehicles with manual gearbox:

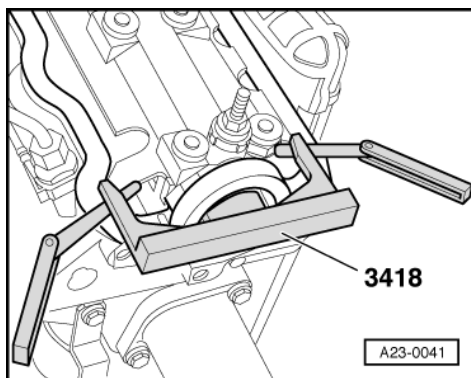


- -> Screw in the adjusting device 2068 A as shown.
- Set the adjusting device to 96 mm -arrow A-. The left notch on the vernier scale is the reference point.
- Turn crankshaft until flywheel TDC marking lines up with point of setting device arrow B.

With engine removed - vehicles with automatic gearbox:

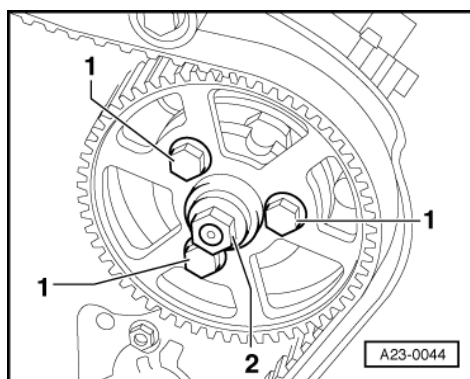


- -> Screw in the adjusting tool 2068 A as shown.
- Set the adjusting tool to 30 mm -arrow A-. The left notch on the vernier scale is the reference point.
- Turn crankshaft until flywheel TDC marking lines up with point of setting device -arrow B-.



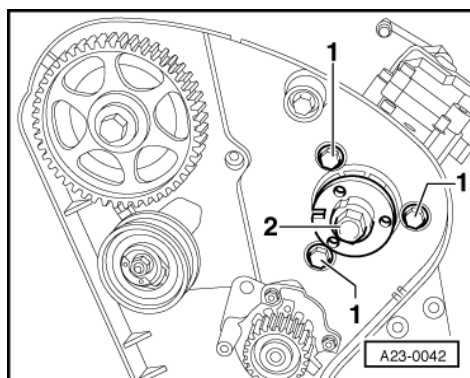
- -> Lock the camshaft with the setting bar.
- Centre the setting bar as follows:  
Turn locked camshaft so that one end of setting bar contacts the cylinder head. Measure the gap at the other end of the setting bar using a feeler gauge. Place a feeler gauge corresponding to half the gap between

the setting bar and the cylinder head. Turn camshaft until the setting bar contacts the feeler gauge. Insert a 2nd feeler gauge of the same thickness at the other end, between the setting bar the and cylinder head.



- -> Undo injection pump sprocket attachment screws -1-.
- Remove the nuts from the tensioning roller.
- Remove toothed belt from camshaft and injection pump sprockets.
- Unscrew the injection pipes from pump using the slotted ring spanner 3035.
- Cover openings with a clean cloth.

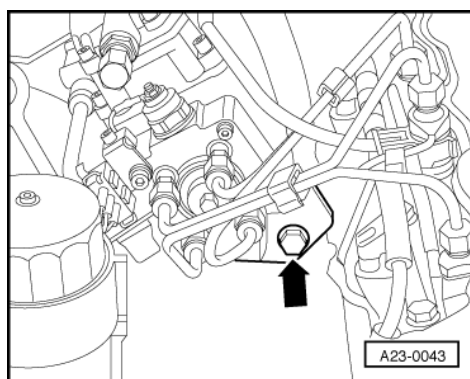
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- -> Unscrew the securing bolts from the console -1-.

## Note:

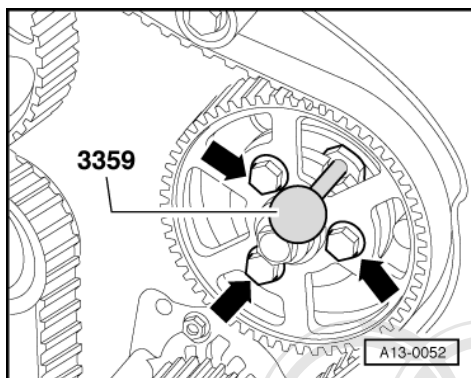
*Do not undo hub nut -2-. Otherwise the injection pump basic setting is maladjusted and cannot be corrected using workshop tools.*



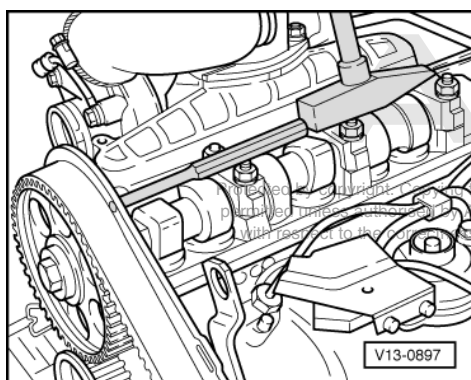
- -> Then remove securing bolt from rear support (arrow).
- Remove injection pump.

## Installing

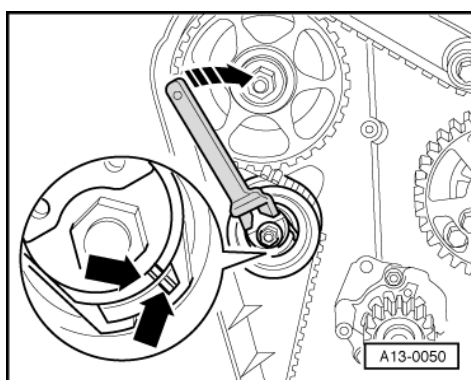
- Insert the injection pump into the console and then first tighten the securing bolt on the rear support with the conical nut.



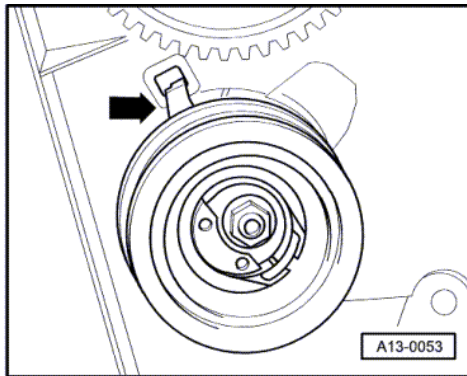
- Insert front securing bolts and tighten to 25 Nm.
- Fit the injection pump sprocket loosely to the hub using new securing bolts.
- Centre the injection pump sprocket in the slots.
- -> Lock the injection pump sprocket with pin 3359.
- Loosen the securing bolt in the camshaft gear wheel by 1/2 a turn.



- -> Insert a drift through the hole in the rear of the toothed belt guard and release the camshaft sprocket from the camshaft taper by tapping with a hammer.
- Check whether TDC mark on flywheel and the reference mark line up.
- Fit toothed belt.



- -> Tension the toothed belt. To do this, rotate spanner (e.g. Matra V159) on eccentric clockwise until the notch and the raised arrows line up.



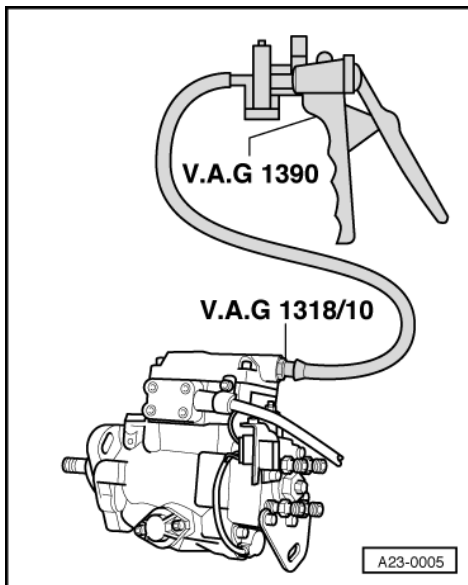
**Note:**

-> Ensure that the holding claw is correctly positioned.

- Tighten securing nut to 20 Nm.
- Check TDC mark on flywheel again.
- Tighten the new securing bolts for the injection pump sprocket to 20 Nm

**Notes:**

- ◆ After the injection start dynamic test, screws 1/4 must be tightened by a (90°) turn.
- ◆ The securing bolts are stretch bolts and can therefore only be used once.
- Tighten camshaft sprocket securing bolt to 45 Nm.
- Remove the locking pin 3359.
- Remove setting bar 3418 from camshaft.
- Turn the crankshaft two rotations in the engine direction of rotation until the crankshaft is set to the TDC for cylinder No. 1 again.
- Reconnect injection pipes, fuel supply pipe and electrical wiring.



-> Fill injection pump with clean diesel fuel as follows:

- Screw pipe union 1318/10 into the return pipe connection on the injection pump.
- Connect vacuum hand pump 1390 to return pipe connection using about 1 m of transparent plastic tubing.

- Operate vacuum hand pump until fuel comes out of return pipe connection. Do not draw fuel into the vacuum pump.
- Connect return pipe.
- Install cylinder head cover and intake hose.
- Dynamically checking and adjusting commencement of injection =>Page 52 .

## 1.10 - Dynamically checking and adjusting commencement of injection

### Notes:

- ♦ The injection start must always be checked after renewing the toothed belt or loosening the injection pump bolts or toothed belt sprockets and adjusted if necessary.
- ♦ The dynamic checking and correction of the commencement of injection is only possible in function 04 "Basic Engine Setting". This is because in function 04 the commencement of injection valve is activated continuously and therefore the injection timing control is set to "retarded".
- Make basic settings => Page 16 .

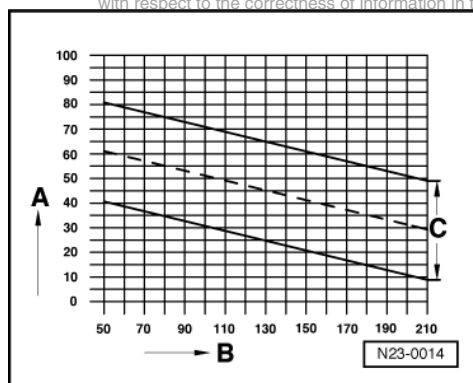
-> Indicated on display:  
(1...10 = display zones)

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

- Observe the display in display zone 7 (coolant temperature).

Specified value: less than 73 (corresponding to 85 °C)

Do not continue with the test until the coolant has reached the specified temperature.



- -> The commencement of injection in display zone 2 is determined by the fuel temperature value in display zone 9.

Specified value: => Range C illustration

A - Zone 2 Commencement of injection

B - Zone 9 Fuel temperature

### Note:

*If injection start is within specified range C when tested, no adjustment is required.*

If the commencement of injection is outside the specified range, adjust the injection pump as follows:

- Switch ignition off.
- Unscrew fuel pipes from injection pump.
- Remove intake hose from between boost air cooler and intake manifold.

- Remove upper toothed belt guard.
- Check toothed belt tension.

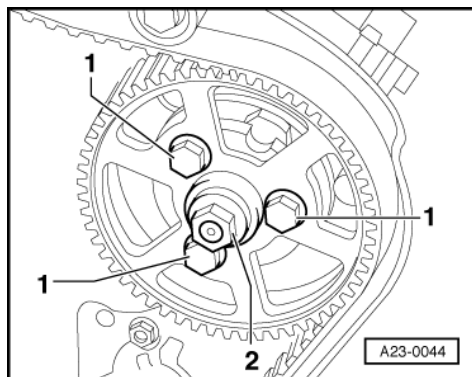
The marks must be opposite each other.

If the markings are not aligned:

- Adjust the toothed belt tension:

=> Repair group 13: Dismantling and assembling engine; Removing and installing toothed belt and adjusting tension

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- -> Undo two injection pump sprocket attachment screws -1-.
- Apply a ring spanner (22 mm A/F) to hub nut 2 to hold the pump shaft in position.
- Loosen the third securing bolt on the injection pump sprocket and turn the pump shaft slightly.

anticlockwise => injection starts sooner

clockwise => injection starts later

## Note:

*Do not undo hub nut -2-. Otherwise the injection pump basic setting is maladjusted and cannot be corrected using workshop tools.*

- Tighten the new securing bolts for the injection pump sprocket to 20 Nm.

## Note:

*The securing bolts are stretch bolts and can therefore only be used once.*

- Re-check that injection start meets specified value.

*If injection start is outside tolerance range:*

- Correct the setting at the injection pump sprocket.
- Tighten injection pump sprocket securing bolts 1/4 by (90°) turns.
- Install toothed belt guard and intake hose.

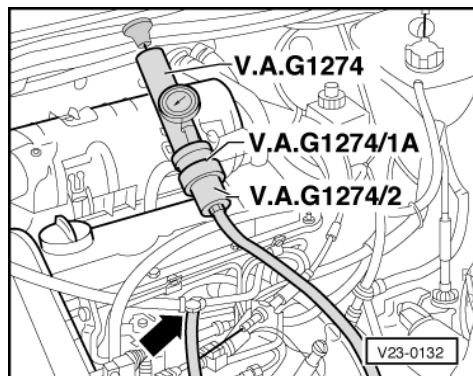
## 1.11 - Testing fuel system for leaks

A leaking fuel system can cause:

- ◆ Foam build up or air bubbles in the supply pipe
- ◆ Lack of power, misfiring



- ♦ Starting problems
- Attach adapter 1274/2 A to cooling system tester 1274.



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- -> Unscrew return pipe from injection pump and connect adapter hose in its place.
- Attach hose clamps 3093 or 3094 at the following points:
  - Feed line behind fuel filter
  - On return hose downstream of fuel filter
  - On return hose to injection pump
- Use hand pump on tester to create a pressure of between 1.0 and 1.5 bar.
- If the pressure constantly drops, locate leak and eliminate fault.

**Note:**

*The fuel hoses can also be tested by moving the hose clamps from the filter to the fuel tank connections.*

## 1.12 - Removing, installing and testing injectors

**Note:**

*Defective injectors cause the following faults:*

- ♦ Loss of power
- ♦ Excessive black exhaust smoke
- ♦ Excessive blue smoke when starting from cold
- ♦ High fuel consumption
- ♦ Engine overheating
- ♦ Knocking in one or more cylinders
- ♦ Misfiring

### Removing

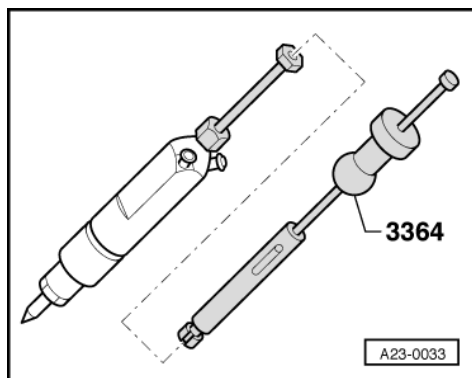
- Remove injection pipes using open ring spanner 3035.

**Note:**

*Always complete remove pipe set. Do not alter pipe shape.*

- Remove securing nut, take off retainer and take out injector.

*If the injectors are seized, construct the following auxiliary tool:*



- Saw off an injection pipe about 5 cm away from the injector union nut.
- Braze an M6 nut onto the sawn off end of the pipe section.
- Clean the auxiliary tool thoroughly. Any dirt will render the injector unusable.
- -> Screw the union nut end of the auxiliary tool to the seized injector, then apply special tool 3364 to the end with the brazed-on nut.

### Installing

#### Note:

*Always renew copper seals between cylinder head and injectors.*

- Insert the injectors.
- Check mounting bracket is seated correctly in the cylinder head.
- Fit retainer.

#### Tightening torque:

Injection pipes: 25 Nm  
Retainer clip nut: 20 Nm.

### Checking

- ->

Read measured value block 13  
0.82 mg/stroke 0.12 mg/stroke 0.49mg/stroke

Read measured value block, display group 13, Engine idling => Page 26

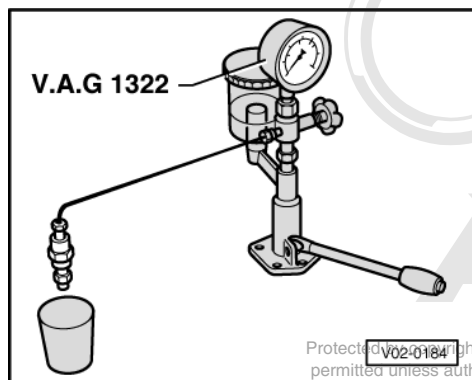
Specified value: -1.50 mg/stroke...+1.50 mg/stroke (milligrams per stroke)

- If one or more of the specified values is out of range, swap round the injectors (except the injector for No.3 cylinder).
- If the fault moves along with the injector, fit a new injector.
- If the fault remains on the cylinder, check the compression.
- If the compression is OK, renew the relevant pressure valve and sealing ring  
=>Repair injection pump - Page 40.

#### Notes:

- ◆ When removing the sealing ring from the pump, always use a soft object (plastic or wood) in order not to scratch the sealing surface.
- ◆ After 15,000 km, the complete set of pressure valves must always be replaced.

This engine is equipped with dual spring injectors. The fuel injection therefore takes place in 2 stages. If faults occur in these injectors they must be replaced, since neither repair nor pressure adjustment is possible.



-> Test injectors using V.A.G 1322 and pressure pipe V.A.G 1322/2.

**Important:**

When testing injectors, care should be taken to ensure that the jet of fuel does not come into contact with the hands, as the high pressure will cause the fuel to penetrate the skin and it could cause severe injuries.

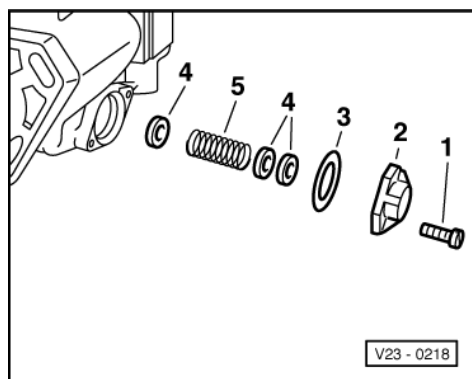
- Pressure gauge on
- Slowly depress the pump lever. When injection begins, read off spray pressure. If the pressure does not match the specified value, fit a new injector.

|               |               |
|---------------|---------------|
| New injectors | 190...200 bar |
| Wear limit    | 170 bar       |

**Testing for leaks**

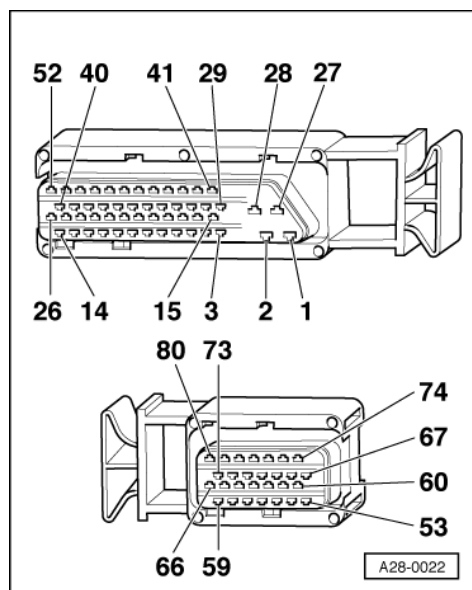
- Pressure gauge on
- Move pump lever down slowly and maintain a pressure of approx. 150 bar for 10 seconds. No fuel should leak from the nozzle opening.
- If injector leaks, replace.

### 1.13 - Replacing the O-ring on the injection timing device cover



- Place a clean cloth beneath the injection pump.
- -> Unscrew cover bolts -1- using commercially available offset screwdriver for Torx socket bolts, e.g. Hazet 2115-T30.
- Remove and clean cover -2-.
- Replace O-ring -3- and attach cover using existing shims -4-.

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



### Notes:

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

### Important:

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

## 1.15 - Replacing control unit for engine electronics

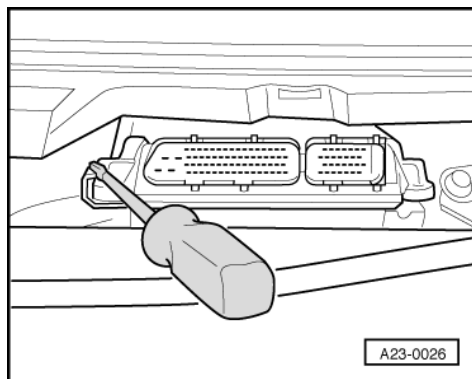
### Removing

- Switch ignition off.
- Remove the windscreen wiper arms (screw connections) and take off the plenum chamber cover.

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### Note:

When removing the cover disconnect the hoses and plugs for the spray nozzles.





- -> Use a screwdriver to press retainer tab on bracket to one side, then pull engine control unit towards the front of the vehicle.
- Release the plug holders and disconnect the control unit plugs.

### Installing

Installation is performed in the reverse sequence.

### Adapting engine electronics control unit to electronic immobiliser

#### Test conditions

- Authorised vehicle key available
- Connect fault reader V.A.G 1551 or vehicle system tester V.A.G 1552 with cable V.A.G 1551/3.
- Switch the ignition on.
- Press key 1 for "Rapid data transfer".
- Press keys 1 and 7 for address word "Dash panel insert" and confirm entry by pressing Q.

-> Indicated on display:

8L0919860. AB-DASH PANEL INSERT  
VDO...  
Coding XXXXX WSC 12345

- Press the ⇒key.

-> Indicated on display:

IMMO-IDENTNR: AUZXXXXXXXXXX

- Press the ⇒key.

-> Indicated on display:

Rapid data transfer HELP  
Select function XX

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

-> Indicated on display:

Adaption  
Feed in channel No.

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

-> Indicated on display:

Adaption Q  
Erase learned values?

- Confirm input with Q key.

-> Indicated on display:

Adaption  
Learnt values have been erased

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- Finish adjustment by pressing ⇒ key.

#### Note:

*The engine control unit identity is read into the immobiliser control unit the next time the ignition is switched on.*

## 2 - Testing the boost pressure system

### 2.1 - Testing the boost pressure system

### 2.2 - Test boost pressure - engine code AGR

In order to check the boost pressure control it is essential to first measure the boost pressure without boost pressure control

- Remove the connector from the boost pressure control solenoid -N75 => Installation location overview- Page 32.
- Checking boost pressure The boost pressure is measured with the fault reader V.A.G 1551 during a test drive.

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**Important:** Second person is required to operate V.A.G 1551.

- Read measured value block, display group 11, Engine idling => Page 30

|                              |          |          |    |  |
|------------------------------|----------|----------|----|--|
| Read measured value block 11 |          |          |    |  |
| 900 rpm                      | 938 mbar | 978 mbar | 92 |  |
| %                            |          |          |    |  |

-> Indicated on display:

- Accelerate vehicle in 3rd gear from about 1500 rpm using full throttle.
- Press PRINT key on V.A.G 1551 at about 3000 rpm.

|                              |           |           |    |  |
|------------------------------|-----------|-----------|----|--|
| Read measured value block 11 |           |           |    |  |
| 3040 rpm                     | 1846 mbar | 1693 mbar | 39 |  |
| %                            |           |           |    |  |

-> Specification for display zone 3: 1550...1750 mbar

If the measured boost pressure is too low, this may be due to the following:

- ◆ Intake manifold pressure sender defective
- ◆ Leak between turbocharger and intake manifold
- ◆ Turbocharger defective (turbine sticking because of foreign body)
- ◆ Bypass valve actuation (linkage, shaft) stiff or stuck (bypass valve permanently open)

If the measured boost pressure is too high, this may be due to the following:

- Boost pressure control hoses fallen off, leaking or clogged.
- -N75 solenoid valve for boost pressure control blocked.
- Actuator (linkage, shaft) of bypass valve stiff or stuck (bypass valve always closed)
- Aneroid box leaking

If measured boost pressure is OK, repeat boost pressure measurement with boost pressure control:

- Connector on boost pressure control solenoid valve N75 is connected.
- Read measured value block, display group 11, Engine idling => Page 30

|                              |          |          |    |  |
|------------------------------|----------|----------|----|--|
| Read measured value block 11 |          |          |    |  |
| 900 rpm                      | 938 mbar | 978 mbar | 92 |  |
| %                            |          |          |    |  |

-> Indicated on display:

- Accelerate vehicle in 3rd gear from about 1500 rpm using full throttle.
- Press PRINT key on V.A.G 1551 at about 3000 rpm.

|                              |           |           |  |  |
|------------------------------|-----------|-----------|--|--|
| Read measured value block 11 |           |           |  |  |
| 3090 rpm                     | 1866 mbar | 1917 mbar |  |  |
| 62 %                         |           |           |  |  |



-> Specification for display zone 3: 1800...2050 mbar

If the measured boost pressure is too low, this may be due to the following:

- ♦ No electrical function of solenoid valve for boost pressure limitation.
- ♦ Boost pressure control solenoid valve -N75 is stuck in the open position

If the measured boost pressure is too high, this may be due to the following:

- ♦ Solenoid valve for boost pressure limitation -N75 sometimes stuck closed.
- ♦ boost pressure increased as a result of tuning

## 2.3 - Checking boost pressure for engine codes ALH, AHF

- Checking boost pressure The boost pressure is measured with the fault reader V.A.G 1551 during a test drive.
- Perform a road test.

Important:

Secure fault reader to the rear seat and operate from this location. For this purpose, always observe the relevant safety precautions => Page 12.

- Read measured value block, display group 11, Engine idling => Page 30

|                                             |
|---------------------------------------------|
| Read measured value block 11                |
| 900 rpm      938 mbar      978 mbar      92 |
| %                                           |

-> Indicated on display:

- Accelerate vehicle in 3rd gear from about 1500 rpm using full throttle.
- Press PRINT key on V.A.G 1551 at about 3000 rpm.

|                                        |
|----------------------------------------|
| Read measured value block 11           |
| 3090 rpm      1948 mbar      1989 mbar |
| 62 %                                   |

-> Specification for display zone 3: 1850...2200 mbar

If measured boost pressure is not OK:

- Initiate basic setting "Function 04" and select display group 11
- Run engine at idling speed.

|                                        |
|----------------------------------------|
| System in basic setting 11             |
| 900 rpm      on      969 mbar      0 % |

-> Indicated on display:

*This display group is used for checking the boost pressure control. The boost pressure control solenoid valve -N75 opens and closes alternately for periods of 10 seconds.*

System in basic setting 11

|         |    |          |     |
|---------|----|----------|-----|
| 900 rpm | on | 969 mbar | 0 % |
|---------|----|----------|-----|

Indicated on display

Boost pressure control solenoid valve actuation

Boost pressure

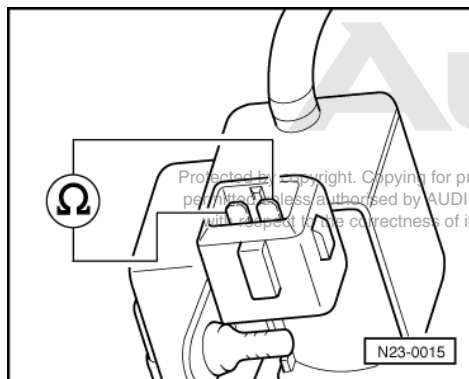
Boost pressure control solenoid valve open

Engine speed

|                                                  |     |          |      |   |                      |
|--------------------------------------------------|-----|----------|------|---|----------------------|
| System in basic setting 11                       |     |          |      | ⇒ | Indicated on display |
| 900 rpm                                          | off | 948 mbar | 99 % |   |                      |
| Boost pressure control solenoid valve actuation  |     |          |      |   |                      |
| Boost pressure                                   |     |          |      |   |                      |
| Solenoid valve for boost pressure control closed |     |          |      |   |                      |
| Engine speed                                     |     |          |      |   |                      |

If the boost pressure control solenoid valve is not actuated every 10 seconds "Display field 2" check the boost pressure control solenoid valve => page **61**.

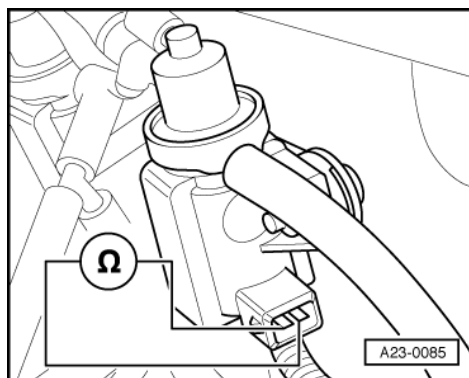
## 2.4 - Test boost pressure control solenoid valve



- Switch ignition off.
- -> Remove connector from valve => installation positions overview, page **32** Item 5.
- Connect multimeter to valve to measure resistance.

### Engine code AGR

Specified value: 25...45  $\omega$



### Engine codes ALH and AHF

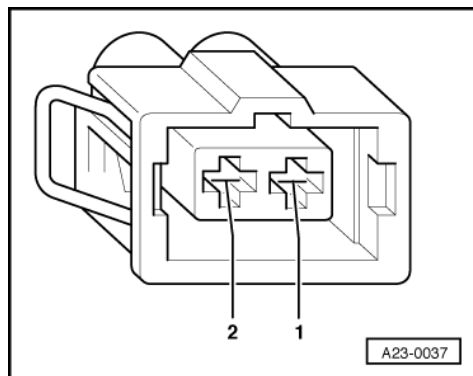
- -> Remove connector from valve => installation positions overview, page **36** Item 6.

Specified value: 14...20  $\omega$



If specified value is not attained:

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



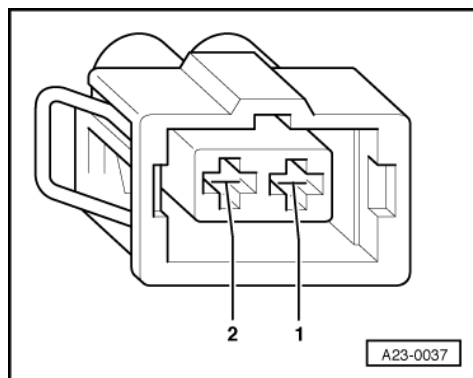
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- -> Connect hand-held multimeter between earth and contact 1 on the connector in order to measure the voltage.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

- Switch ignition off.
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



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

| 2-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|--------------------------------------------|--------------------------------|
| 1                                          | 2 (positive)                   |
| 1                                          | 28 (positive)                  |
| 2                                          | 15 (earth)                     |

- Rectify any open/short circuit as necessary.

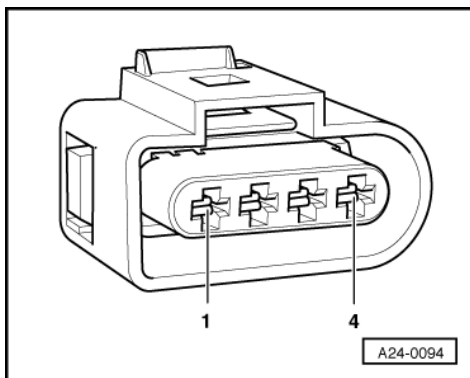
## 2.5 - Checking intake manifold temperature sender

Read measured value block 7  
15.4 5C      15.9 5C      16.7 5C

-> Read measurement block display group 07, engine cool and not running => Page 27

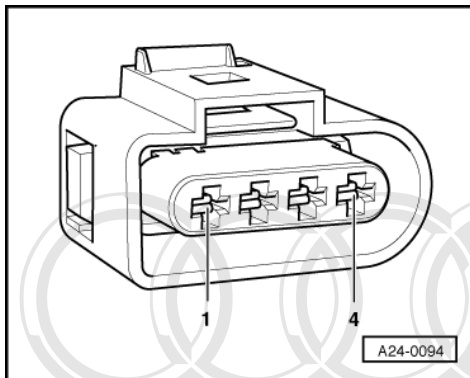
- Observe readout in display zone 3.

If the wiring to the sensor has an open circuit, a substitute value of 136.8 °C will be displayed.



An implausible value or a substitute value of 136.8°C is displayed:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .
- -> Remove the connector from the sensor => overview of fitting locations Page 32 .



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

| 4-pin connector on the wiring harness, contact | Test box V.A.G 1598/22, socket |
|------------------------------------------------|--------------------------------|
| 1                                              | 25                             |
| 2                                              | 13                             |

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- Rectify any open/short circuit as necessary.

## 2.6 - Checking intake manifold pressure sender and altitude sender

The altitude sender is located in the diesel direct injection system control unit. The intake manifold pressure sender is a separate component and is located together with the intake manifold temperature sender in a joint housing in the charge air cooler. The intake manifold pressure sender is a separate component and is located on the intake manifold.

Read measured value block 10  
0 mg/stroke      1027 mbar      1013 mbar  
0.0 %

- > Read measurement block display group 10, engine not running => Page 29



- Compare reading in display field 2 (altitude sender -F96) to that in display field 3 (intake manifold pressure sender -G71).

Specified value: Pressures match  
(Tolerance  $\pm 30$  mbar)

If specified value is not attained:

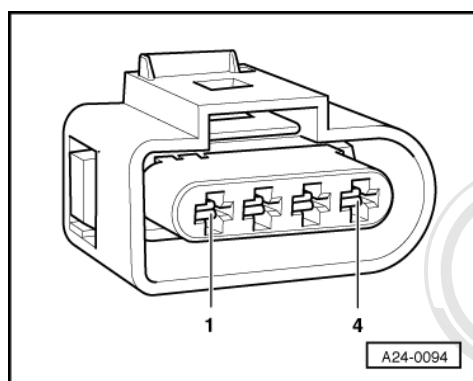
- Compare displayed pressures using a barometer (e.g. turbocharger tester V.A.G 1397/A),  
Tolerance  $\pm 30$  mbar

If the value in display zone 2 does not correspond:

- Renew Diesel direct-injection system control unit.

If the value in display zone 3 does not correspond:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



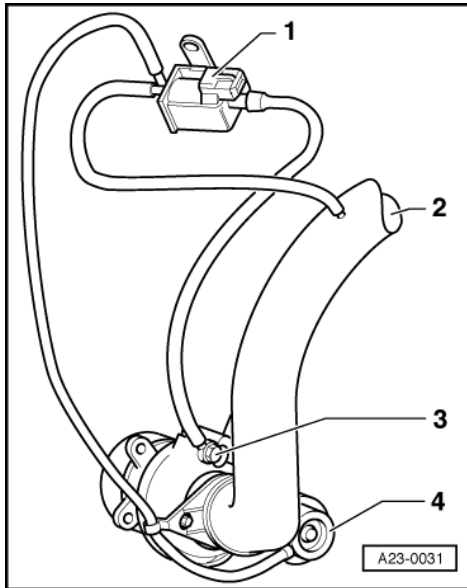
- -> Remove the connector from the sensor => overview of fitting locations Page 32 .

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

| 4-pin connector on the wiring harness, contact | Test box V.A.G 1598/22, socket |
|------------------------------------------------|--------------------------------|
| 3                                              | 39                             |
| 4                                              | 40                             |

- Rectify any open/short circuit as necessary.

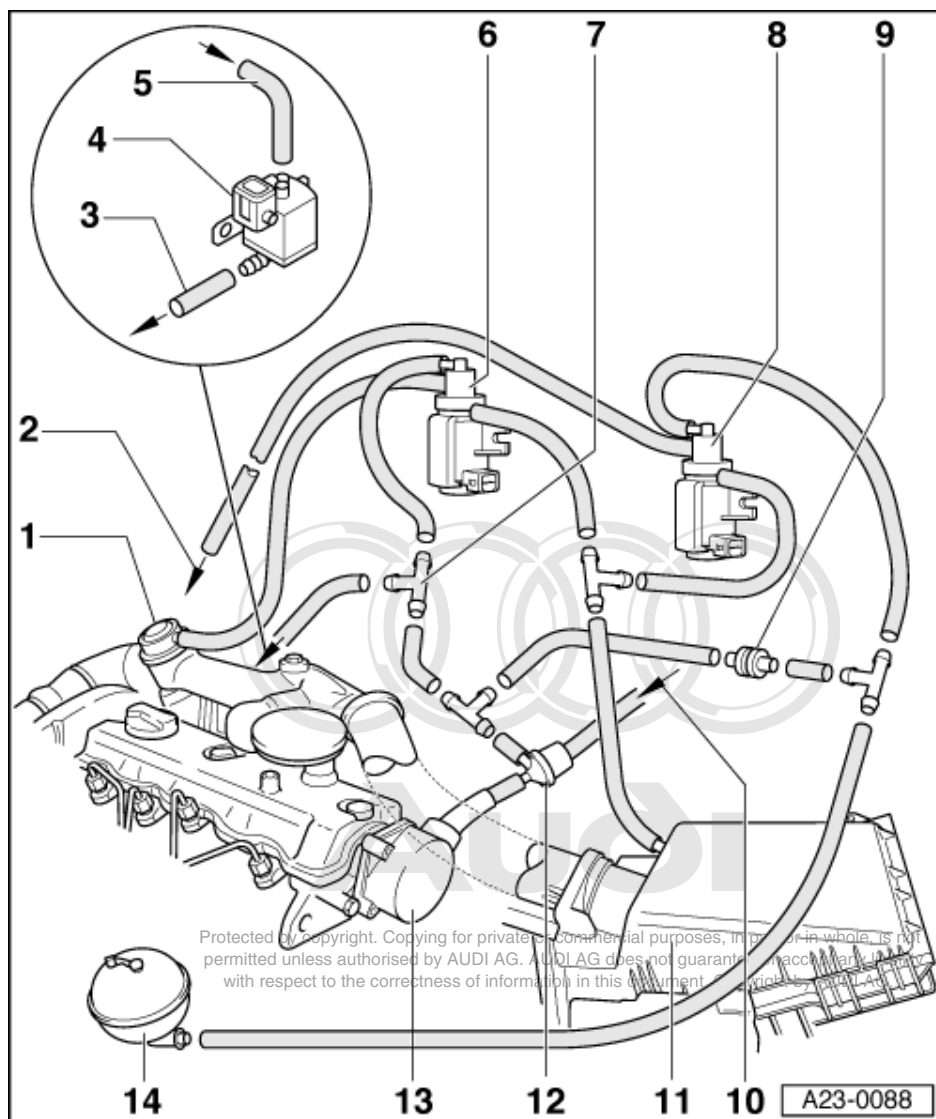
## 2.7 - Hose connection plan for boost pressure control - engine code AGR



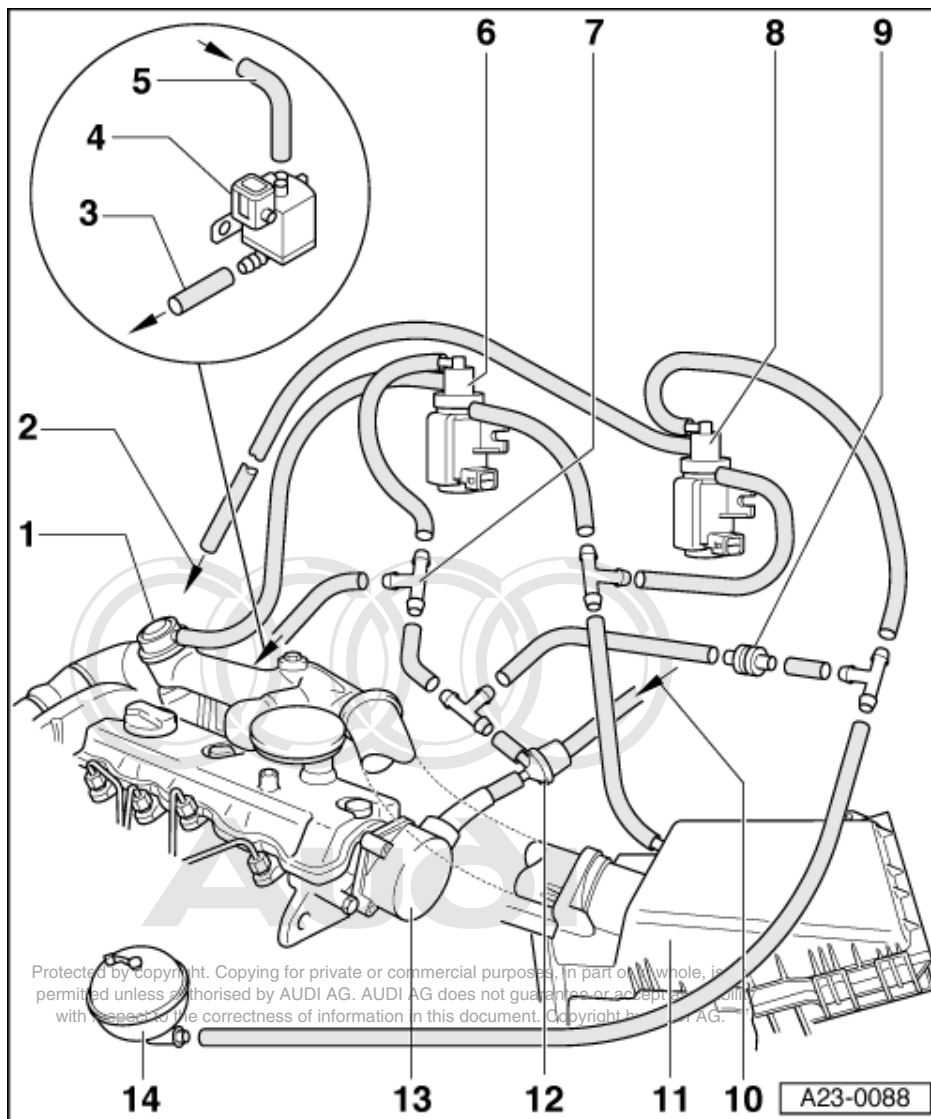
- 1 - Boost pressure control solenoid valve (N75)
- 2 - Intake hose
- 3 - Turboboost pressure connection (pressure supply for boost pressure control)
- 4 - Vacuum unit for boost pressure control

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## 2.8 - Hose connection plan for boost pressure control and exhaust gas recirculation - engine codes ALH and AHF



- 1 Mechanical exhaust gas recirculation valve
- 2 Vacuum hose to boost pressure control vacuum unit
  - ♦ On Turbocharger
- 3 Connection to intake manifold flap vacuum unit
- 4 Intake manifold flap changeover valve
- 5 Vacuum hose from T-connector  
Item 7
- 6 Exhaust gas recirculation solenoid valve (N18)



- 7 T-piece
- 8 Boost pressure control solenoid valve -N75
- 9 Non-return valve
- 10 Vacuum supply
  - ♦ For brake servo
- 11 Air cleaner
- 12 Non-return valve
- 13 Vacuum pump
- 14 Vacuum reservoir

## 3 - Testing injection control

### 3.1 - Testing injection control

### 3.2 - Checking the injection timing control range

- Start the final control diagnosis and activate the valve for the commencement of injection => Page 13 .

-> Indicated on display:

Final control diagnosis  
Injection start valve -N108

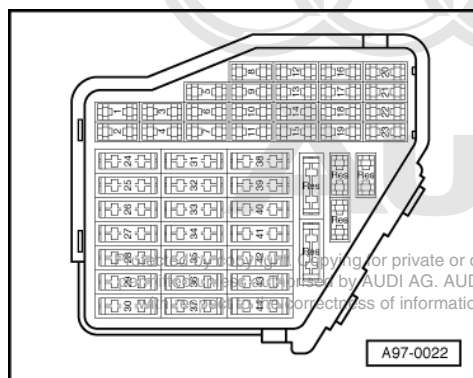
Valve actuation has a considerable effect on combustion noise (pre ignition).

- Make basic settings => Page 16 .

-> Display readout (for example):

Basic setting 0  
42 46 0 20 90 201  
64 153 127 83

- If necessary, correct injection start  
=>Page 52 .



- -> Pull out fuse 43.
- Observe display in display zone 2.

Basic setting 0  
42 255 0 20 90 201  
64 153 127 83

-> The display should go up to 255

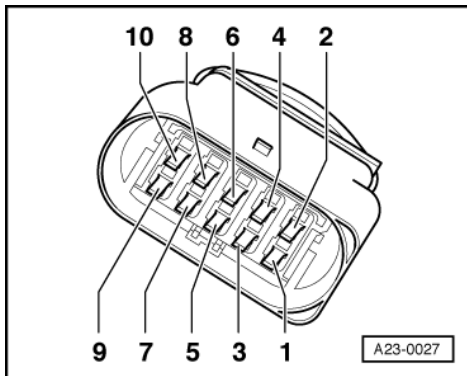
#### Note:

*The interruption to the power supply will cause the valve for the commencement of injection to close. The interior pressure in the pump cannot be reduced further, and therefore the full pressure is applied to the injection timing control piston. This moves the injection timing control to the "advanced" stop.*

If specified value is not attained:

- Renew injection pump.
- Interrogate and delete fault memory => Page 3 .

### 3.3 - Checking commencement of injection valve

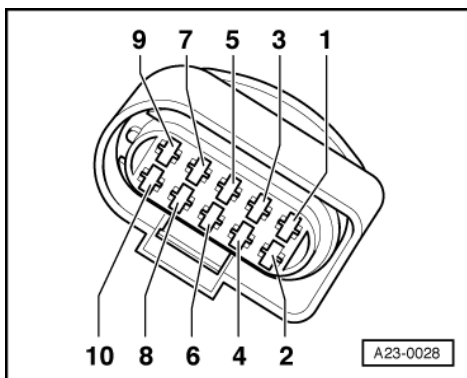


- Remove connector from injection pump => Installation position overview, Page 32 .
- -> Connect multimeter between contacts 9 and 10 to measure resistance.

Specified value: 12...20  $\omega$

If specified value is not attained:

- Replace injection start valve (N108)  
=>Page 35



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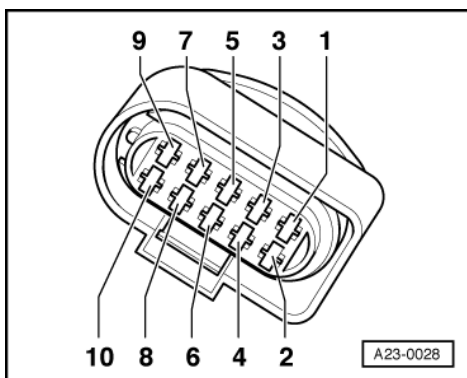
If specified value is attained:

- -> Connect multimeter (voltage measurement) between engine earth and contact 10 on the connector.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .





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

| 10-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|---------------------------------------------|--------------------------------|
| 9                                           | 79                             |
| 10                                          | 2, 28                          |

- Rectify any open/short circuit as necessary.

### 3.4 - Checking fuel temperature sensor

- Read measurement block display group 07, engine cool and not running => Page 27

-> Indicated on display:

|                             |         |         |
|-----------------------------|---------|---------|
| Read measured value block 7 |         |         |
| 15.4 5C                     | 15.9 5C | 16.7 5C |

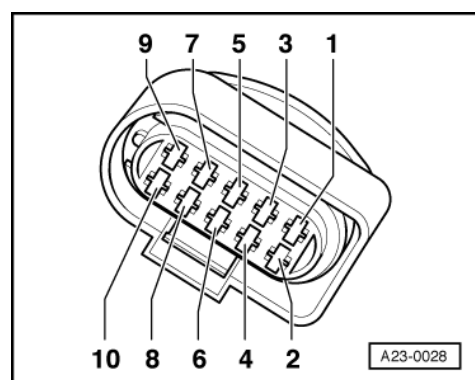
- Observe readout in display zone 1.

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If the wiring to the sensor has an open circuit, a substitute value of - 5.4 °C will be displayed.

If the display is implausible or if a substitute value of -5.4 °C is displayed:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .
- Remove connector from injection pump =>Installation position overview, Page 32 .



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

| 10-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|---------------------------------------------|--------------------------------|
| 4                                           | 76                             |
| 7                                           | 53                             |

- Rectify any open/short circuit as necessary.

## 4 - Checking exhaust gas recirculation system

### 4.1 - Checking exhaust gas recirculation system

### 4.2 - Checking EGR

The operation of the exhaust gas recirculation system is tested by measuring the intake air mass. If the exhaust gas is being recirculated the proportion of fresh air detected by the air mass meter will be smaller. The larger the quantity of recirculated exhaust gas, the weaker the signal from the air mass meter.

- Read measured value block, display group 01, engine at idling speed => Page 23

-> Indicated on display:

|                             |               |         |
|-----------------------------|---------------|---------|
| Read measured value block 1 |               |         |
| 900 rpm                     | 6.5 mg/stroke | 1.480 V |
| 87.3 5C                     |               |         |

- Check display in display zone 4 (coolant temperature).

Specified value: at least 85 °C

Do not continue with check until coolant temperature is reached.

- Press C key.
- Press keys 0 and 3 for "display group 03" and confirm entry by pressing Q key.

-> Indicated on display:

|                             |               |               |
|-----------------------------|---------------|---------------|
| Read measured value block 3 |               |               |
| 900 rpm                     | 272 mg/stroke | 268 mg/stroke |
| 54 %                        |               |               |

- Briefly depress the accelerator pedal, then allow the engine to continue running at idling speed.

|                             |               |               |
|-----------------------------|---------------|---------------|
| Read measured value block 3 |               |               |
| 900 rpm                     | 272 mg/stroke | 268 mg/stroke |
| 54 %                        |               |               |

-> Observe display in display zone 2 (specified air mass).

Specified value: 230...370 mg/stroke

If the air mass is greater than the specified value, the reason may be as follows:

- ◆ Coolant temperature too low
- ◆ Intake manifold temperature very high
- ◆ Injection quantity too high
- ◆ Fault in fault memory

|                             |               |               |
|-----------------------------|---------------|---------------|
| Read measured value block 3 |               |               |
| 900 rpm                     | 272 mg/stroke | 268 mg/stroke |
| 54 %                        |               |               |

-> Observe display in display zone 3 (specified air mass).

Specified value: Correspondence with specified air mass in display zone 2 (tolerance  $\pm 20$  mg/stroke).

If the actual air mass is more than 20 mg/stroke below the specified air mass, the following faults are possible:

- ◆ Unmetered air in intake area
- ◆ Too much exhaust gas recirculation



If the actual air mass is more than 20 mg/stroke below the specified air mass, the following faults are possible:

- ♦ Engine has been running for 10 minutes at idling speed
- ♦ Not enough exhaust gas recirculation or none at all

If the actual air mass is constant at 425 mg/stroke, the following faults are possible:

- ♦ Open circuit in wiring to air mass meter
- ♦ Implausible air mass measured

If specified values are not attained:

- Start final control diagnosis and activate exhaust gas recirculation start valve => Page 13 .

-> Indicated on display:

Final control diagnosis  
Exhaust gas recirculation valve -N18

The injector valve should click.

If the injector does not click:

- Test EGR valve => Page 72

If the injector clicks:

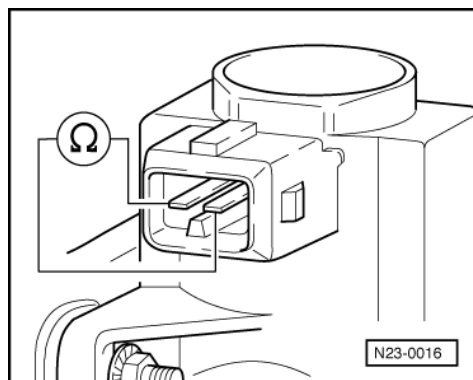
- Check vacuum hose system =>Page 76

If vacuum hoses are OK:

- Checking mechanical EGR valve

=> Engine Mechanics; Repair group 26

### 4.3 - Testing exhaust gas recirculation valve

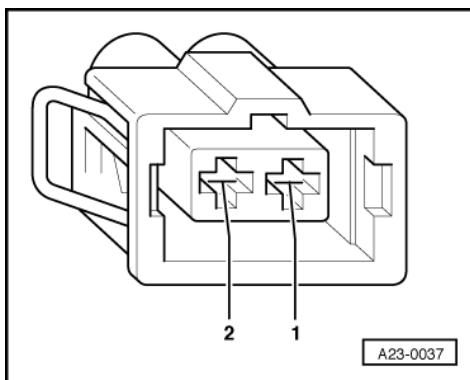


- Remove connector from valve => installation positions overview, Page 32 .
- -> Connect multimeter to injector to measure resistance.

Specified value: 14...20  $\Omega$

If specified value is not attained:

- Replace valve.



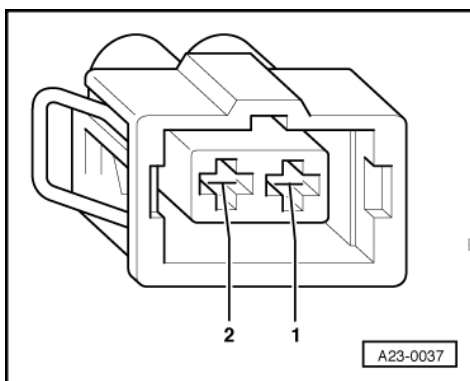
If specified value is attained:

- -> Connect multimeter between earth and contact 2 on the connector to measure the voltage.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



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

| 2-pin connector on wiring harness, contact. | Test box V.A.G 1598/22, socket |
|---------------------------------------------|--------------------------------|
| 1                                           | 2, 28                          |
| 2                                           | 29                             |

- Rectify any open/short circuit as necessary.

## 4.4 - Testing air mass meter

The signal from the air mass meter is required by the control unit to calculate the required injection quantity and to control the exhaust gas recirculation. The weaker the signal from the mass air flow meter, the less fuel can be injected.

Important:  
Second person is required to operate V.A.G 1551.



- Read measured value block, display group 10, Engine idling => Page 29

-> Indicated on display:

|                              |           |      |  |
|------------------------------|-----------|------|--|
| Read measured value block 10 |           |      |  |
| 309 mg/stroke                | 1030 mbar | 1011 |  |
| mbar                         | 0.0 %     |      |  |

- Observe readout in display zone 1.

|                              |           |      |  |
|------------------------------|-----------|------|--|
| Read measured value block 10 |           |      |  |
| 309 mg/stroke                | 1030 mbar | 1011 |  |
| mbar                         | 0.0 %     |      |  |

-> Specification: 230...370 mg/stroke

If specified value is not attained:

- Check exhaust gas recirculation system =>Page 71

If specified value is attained:

- Accelerate vehicle in 3rd gear from about 1500 rpm using full throttle.
- Press PRINT key on V.A.G 1551 at about 3000 rpm.

|                              |           |      |  |
|------------------------------|-----------|------|--|
| Read measured value block 10 |           |      |  |
| 830 mg/stroke                | 1030 mbar | 1850 |  |
| mbar                         | 100 %     |      |  |

-> Specification for display zone 4: 100 % (accelerator pedal position)

If specified value is not attained:

- Repeat test and accelerate vehicle at full throttle.

|                              |           |      |  |
|------------------------------|-----------|------|--|
| Read measured value block 10 |           |      |  |
| 830 mg/stroke                | 1030 mbar | 1850 |  |
| mbar                         | 100 %     |      |  |

-> Specification for display zone 3: 1800...2050 mbar (boost pressure)

If specified value is not attained:

- Check boost pressure => Page 59

|                              |           |      |  |
|------------------------------|-----------|------|--|
| Read measured value block 10 |           |      |  |
| 830 mg/stroke                | 1030 mbar | 1850 |  |
| mbar                         | 100 %     |      |  |

-> Specification for display zone 1: >750 mg/stroke (intake air mass)

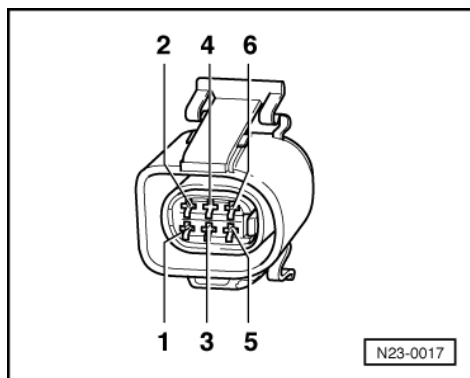
If specified value is not attained:

- Replace air mass meter (G70).

If display zone 1 shows a constant reading of 425 mg/stroke (fixed substitute value):

- Switch ignition off.
- Remove connector from air mass meter =>Fitting location overview, Page 32
- Switch the ignition on.

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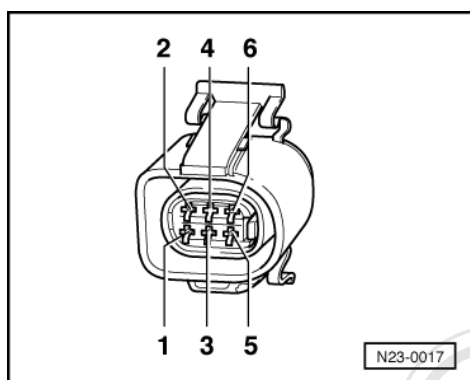


- -> Connect the multimeter for voltage measurement to the following contacts on the connector:

| 6-pin connector on wiring harness, contact | Specified value |
|--------------------------------------------|-----------------|
| 3 + earth                                  | Battery voltage |
| 3 + 5                                      | Battery voltage |
| 1 + earth                                  | approx. 5 V     |
| 1 + 5                                      | approx. 5 V     |

If specified values are not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **57** .



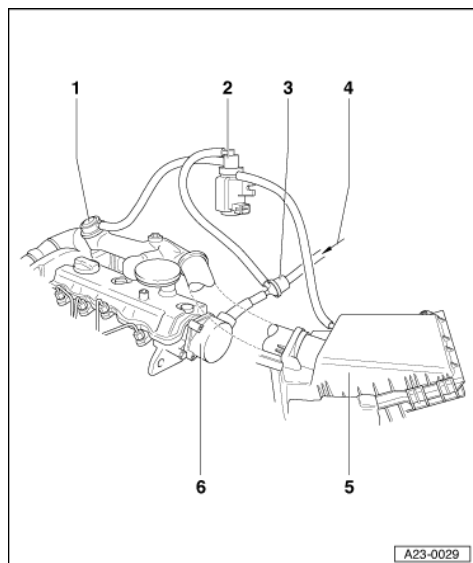
The following wiring connections are to be checked for open circuits and/or short to positive or negative.

| 6-pin connector on the wiring harness, contact. | Test box V.A.G 1598/22, socket |
|-------------------------------------------------|--------------------------------|
| 1                                               | 50                             |
| 2                                               | 25                             |
| 3                                               | 2, 28                          |
| 4                                               | -                              |
| 5                                               | 1, 27                          |
| 6                                               | 52                             |

- Rectify any open/short circuit as necessary.



#### 4.5 - Vacuum plan for exhaust gas recirculation without intake manifold flap - engine code AGR

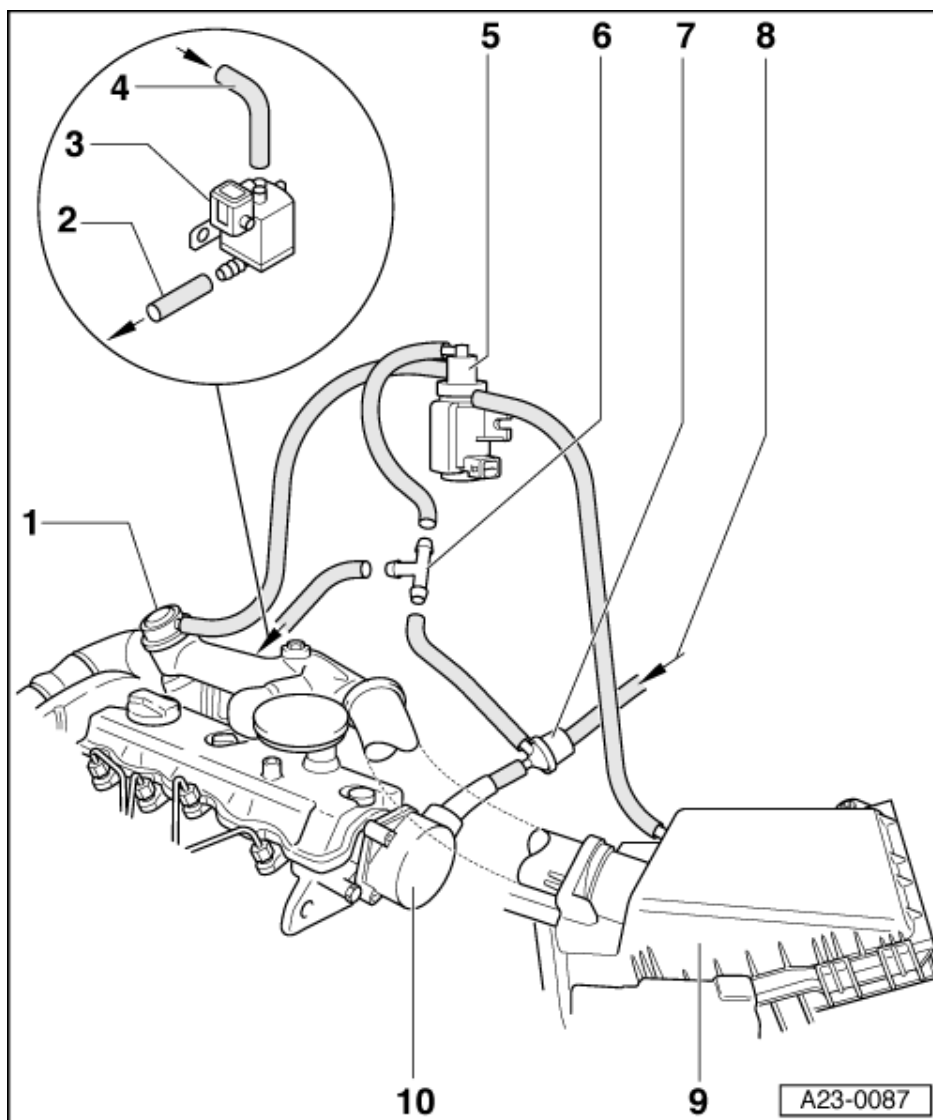


- 1 Mechanical exhaust gas recirculation valve
- 2 Valve for exhaust gas recirculation (N18)
- 3 Non-return valve
- 4 Vacuum supply
  - ♦ For brake servo
- 5 Air cleaner
- 6 Vacuum pump

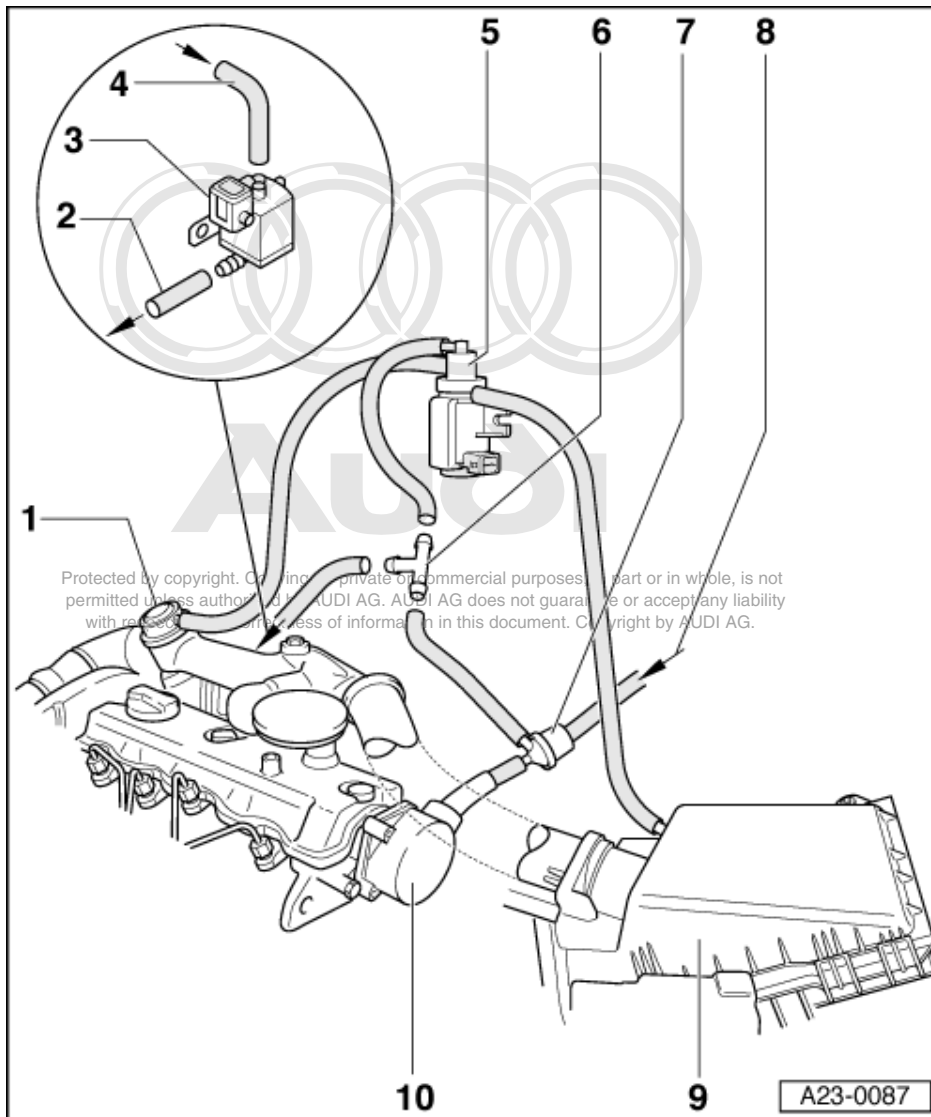


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#### 4.6 - Vacuum plan for exhaust gas recirculation with intake manifold flap - engine code AGR



- 1 Mechanical exhaust gas recirculation valve
- 2 Connection to intake manifold flap vacuum unit
- 3 Intake manifold flap changeover valve
  - ♦ Only in vehicles with a throttle valve
- 4 Vacuum hose from T-connector Item 6
- 5 Exhaust gas recirculation solenoid valve (N18)



- 6 T-piece
- 7 Non-return valve
- 8 Vacuum supply
  - ♦ For brake servo
- 9 Air cleaner
- 10 Vacuum pump

## 5 - Testing control unit input values

### 5.1 - Testing control unit input values

### 5.2 - Checking power supply to diesel direct-injection system

The injection system receives its current supply via the diesel direct injection system relay (J322).

Precondition for the closing of the relay (J322) is the application of voltage via terminal 15 at the control device for the diesel direct-injection system. This means that the relay (J322) is only earthed (via the control device for the diesel direct-injection system), if the control unit receives voltage via terminal 15.

## Test conditions

- Battery voltage OK.

## Testing voltage supply at terminal 15

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .
- Connect multimeter between earth and socket 47 of the test box to measure the voltage.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

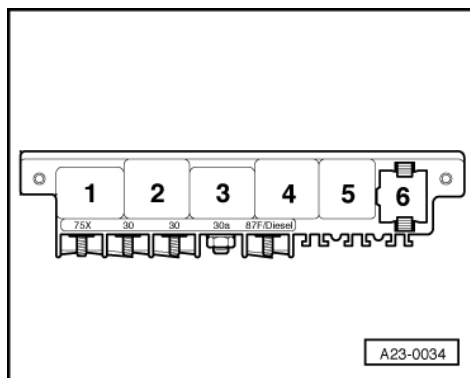
- Check the wiring connections.

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

## Testing earth activation for Diesel direct injection system relay -J322

### Test conditions

- Battery voltage OK.
- Terminal 15 power supply OK



- Switch the ignition on.

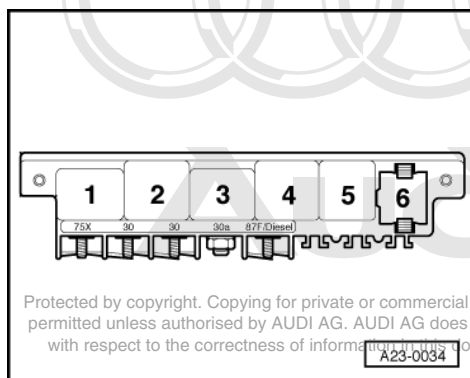
-> Specification: Diesel direct injection system relay (central electrical system, relay position 5) should pick up

### Note:

*The clicking of the valve is difficult to hear and is therefore best checked by touching the relay.*

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .
- Connect together sockets 33 and 1 on the test box using an auxiliary cable from V.A.G 1594.



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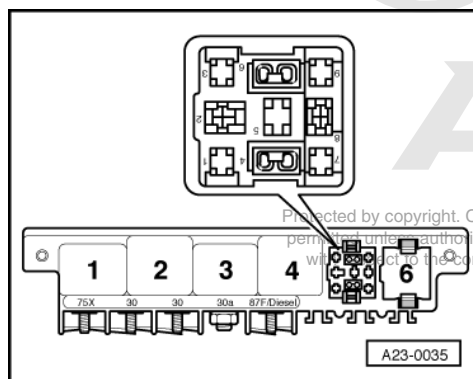
-> Specification: Diesel direct injection system relay (central electrical system, relay position 5) should pick up

If the relay picks up now, but not when the control unit is connected:

- Renew Diesel direct-injection system control unit.

If the relay does not respond:

- Switch ignition off.



- -> Remove diesel direct injection system relay -J322 from relay panel (central electrics, relay position 5).

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

| Central electrics, relay<br>base 5, contact | Test box V.A.G 1598/22,<br>socket |
|---------------------------------------------|-----------------------------------|
| 9                                           | 33                                |

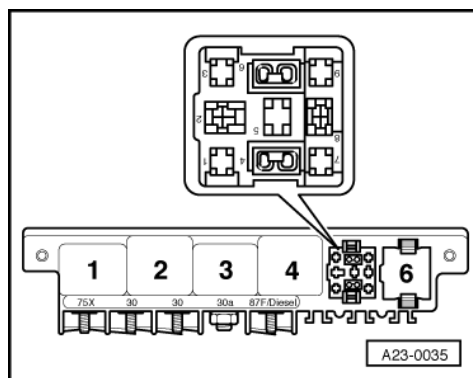
- Rectify any open/short circuit as necessary.

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

### Testing voltage supply at terminal 30

#### Test conditions

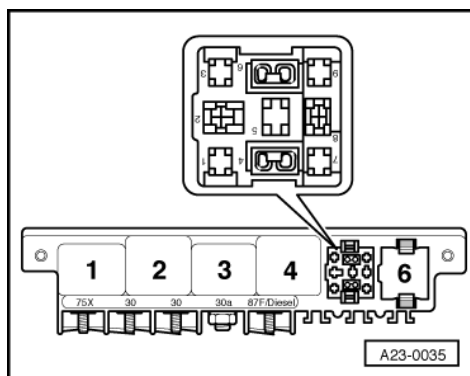
- Battery voltage OK.



- Terminal 15 power supply OK
- Earth activation for relay -J322 OK

- Switch ignition off.

- -> Remove diesel direct injection system relay -J322 from relay panel (central electrics, relay position 5).
- Connect multimeter (voltage test range) between the following contacts on the relay panel:



| Central electrics, relay base 5, contact | Specified value         |
|------------------------------------------|-------------------------|
| 2 + earth                                | approx. battery voltage |

If specified value is not attained:

- Check the wiring connections.

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

If specified value is attained:

- Reconnect relay to relay panel (central electrical system, relay position 5).
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57.
- Connect together sockets 33 and 1 on the test box using an auxiliary cable from V.A.G 1594.
- Connect multimeter between the following contacts on the test box to test the voltage:

| Test box V.A.G 1598/22, socket | Specified value         |
|--------------------------------|-------------------------|
| 2 + 1                          | approx. battery voltage |
| 28 + 1                         | approx. battery voltage |
| 2 + 27                         | approx. battery voltage |
| 28 + 27                        | approx. battery voltage |

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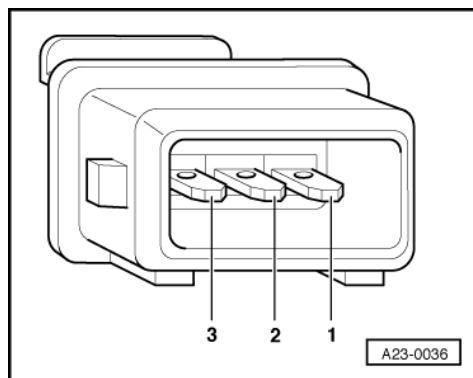
If specified value is not attained:

- Check the wiring connections.

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

### 5.3 - Testing engine speed sender

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



- Switch ignition off.
- Remove connector from injection pump =>Installation position overview, Page 32 .
- -> Connect the multimeter for resistance measurement between contacts 1 and 2 on the sensor connector.

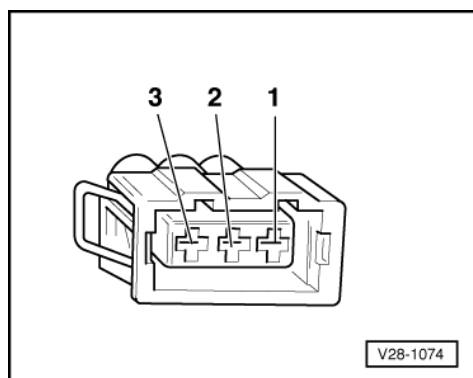
Specified value: approx. 1 kΩ

If specified value is not attained:

- Replace engine speed sender (G28).

If specified value is attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



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

| 3-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|--------------------------------------------|--------------------------------|
| 1                                          | 69                             |
| 2                                          | 67                             |
| 3                                          | 71                             |

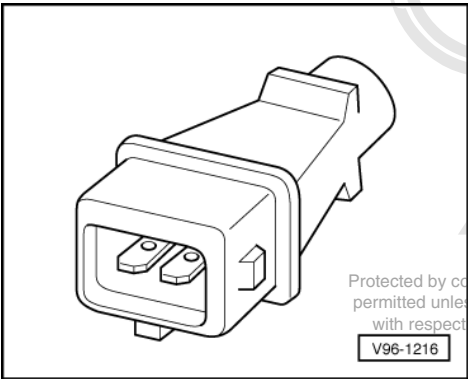
- Rectify any open/short circuit as necessary.

## 5.4 - Checking needle lift sensor

The needle lift sensor signal is used to determine the commencement of injection. If it fails, injection start switches to open loop control (according to engine speed and engine load). During normal operation, injection start is controlled by a closed loop function (according to engine speed, engine load and temperature).

- Switch ignition off.

- Remove connector from injection pump =>Installation position overview, Page 32 .



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

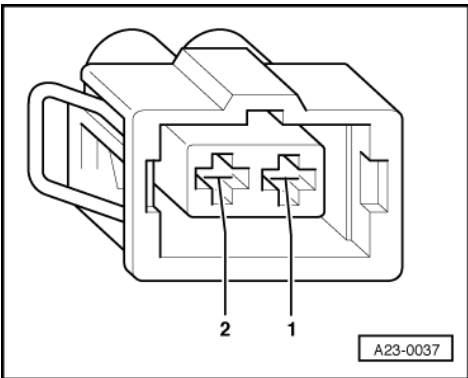
Specified value: 90...120  $\omega$  (with a hot engine the resistance may be up to 20  $\omega$  higher)

If specified value is not attained:

- Injection nozzle cyl. injection nozzle and needle lift sensor (G80).

If specified value is attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



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

| 2-pin connector on wiring harness, contact. | Test box V.A.G 1598/22, socket |
|---------------------------------------------|--------------------------------|
| 1                                           | 62                             |
| 2                                           | 55                             |

- Rectify any open/short circuit as necessary.

### 5.5 - Testing coolant temperature sensor

- Read measured value block, Display Group 07, cold engine, idling => Page 27

-> Indicated on display:

|                             |         |         |
|-----------------------------|---------|---------|
| Read measured value block 7 |         |         |
| 15.4 5C                     | 15.9 5C | 16.7 5C |

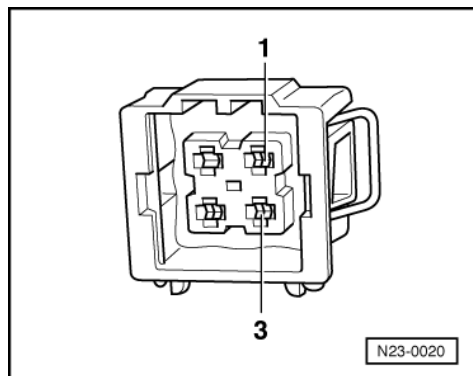
- Check display in display zone 4 (coolant temperature).



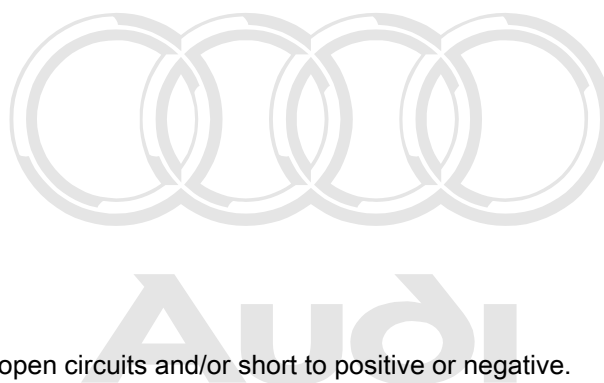
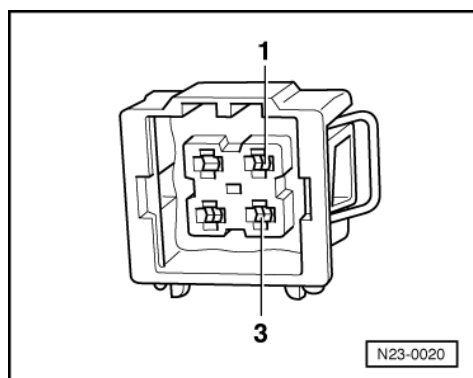
Specified value: The temperature reading should increase at a uniform rate.

If there is a fault the fuel temperature will be displayed as a substitute value.

If an implausible value is displayed in display zone 4, or if the fuel temperature is displayed as a substitute value:



- Switch ignition off.
- -> Pull off the connector on the sensor => Installation locations Overview, Page 32 .
- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



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

| 4-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|--------------------------------------------|--------------------------------|
| 1                                          | 70                             |
| 3                                          | 54                             |

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- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Replace coolant temperature sender (G62).

## 5.6 - Checking brake light switch and brake pedal switch

Because the injection system operates with an accelerator pedal sensor (potentiometer) which may be defective, the engine is regulated for reasons of safety when the brakes are operated. To do this the control unit requires signals from both the brake light switch and the brake pedal switch. This means that if the brakes are operated when the accelerator pedal is held at a constant position, the engine is immediately reduced to idling speed. Incorrectly adjusted switches may lead to undesired control action

- Read measured value block, display group 06, engine at idling speed => Page **18**

-> Indicated on display:

|                             |   |   |   |        |
|-----------------------------|---|---|---|--------|
| Read measured value block 6 |   |   |   |        |
| 0 km/h                      | 0 | 0 | 0 | 000000 |
| 255                         |   |   |   |        |

- Observe readout in display zone 2.

|                             |   |   |   |        |
|-----------------------------|---|---|---|--------|
| Read measured value block 6 |   |   |   |        |
| 0 km/h                      | 0 | 0 | 0 | 000000 |
| 255                         |   |   |   |        |

-> Specification: 0 0 0

- Operate brake pedal slowly.

|                             |   |   |   |        |
|-----------------------------|---|---|---|--------|
| Read measured value block 6 |   |   |   |        |
| 0 km/h                      | 0 | 1 | 1 | 000000 |
| 255                         |   |   |   |        |

-> Specification: 0 1 1

Both displays should change from 0 to 1.

- Allow brake pedal to return slowly to its normal position.

|                             |   |   |   |        |
|-----------------------------|---|---|---|--------|
| Read measured value block 6 |   |   |   |        |
| 0 km/h                      | 0 | 0 | 0 | 000000 |
| 255                         |   |   |   |        |

-> Specification: 0 0 0

Both displays should change from 1 back to 0.

If one or both of the displays does not change from 0 to 1:

- Check the wiring connections.

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

## 5.7 - Testing modulating piston movement sender and quantity adjuster

The quantity adjuster is an electromagnetic swivelling positioner that is controlled by the control unit by a specific duty cycle. The eccentric shaft on the quantity adjuster moves the modulating piston on the high pressure piston and thereby regulates the quantity of fuel injected.

The modulating piston movement sender informs the control unit of the modulating piston position, thereby indicating the quantity of fuel injected.

- Read measured value block, display group 01, engine at idling speed => Page **23**

-> Indicated on display:

|                             |               |       |  |
|-----------------------------|---------------|-------|--|
| Read measured value block 1 |               |       |  |
| 900 rpm                     | 5.6 mg/stroke | 1.480 |  |
| V                           | 87.3 5C       |       |  |

- Check display in display zone 4 (coolant temperature).

|                             |               |         |  |
|-----------------------------|---------------|---------|--|
| Read measured value block 6 |               |         |  |
| 900 rpm                     | 5.6 mg/stroke | 1.480 V |  |
| 87.3 5C                     |               |         |  |

-> Specification: at least 85 °C

Do not continue with check until coolant temperature is reached.

- Switch off any electrical consumers that may be on (air conditioner, rear window heater, lights etc.).
- Check display in display zone 3 (voltage supplied from modulating piston movement).

Read measured value block 6  
900 rpm      5.6 mg/stroke      1.480 V  
87.3 5C

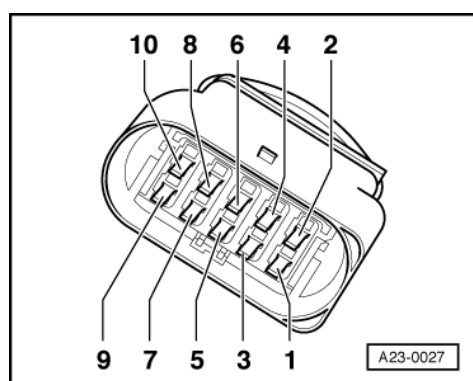
-> Specification: 1.250...1.700 V

If specified value is not attained:

- Renew injection pump.

#### Electrical check of modulating piston movement sender (G149) and quantity adjuster (N146)

- Switch ignition off.
- Remove connector from injection pump => Installation position overview, Page 32 .



- -> Connect multimeter for resistance measurement between the following contacts on the injection pump connector:

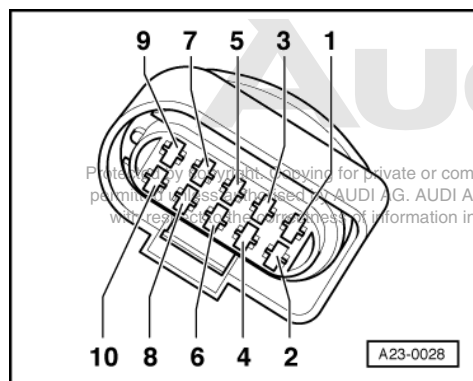
| Injection pump connector | Specified value    |
|--------------------------|--------------------|
| 1 + 2                    | 4.9...7.5 $\omega$ |
| 3 + 2                    | 4.9...7.5 $\omega$ |
| 6 + 5                    | 0.4...1.1 $\omega$ |

If specified values are not attained:

- Renew injection pump.

#### Checking power supply and wiring connections

- Switch ignition off.
- Remove connector from injection pump => Installation position overview, Page 32 .
- Switch the ignition on.



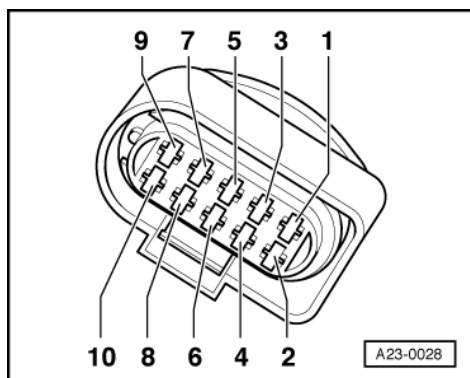
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- -> Connect multimeter for voltage measurement between the following contacts on the wiring harness connector:

| 10-pin connector on wiring harness, contact | Specified value         |
|---------------------------------------------|-------------------------|
| 1 + earth                                   | approx. 2.5 V           |
| 3 + earth                                   | approx. 2.5 V           |
| 5 + earth                                   | approx. battery voltage |

If specified values are not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .



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

| 10-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|---------------------------------------------|--------------------------------|
| 1                                           | 56                             |
| 2                                           | 57                             |
| 3                                           | 64                             |
| 5                                           | 2, 28                          |
| 6                                           | 59, 66, 80                     |

- Rectify any open/short circuit as necessary.

## 5.8 - Checking accelerator position sender

The accelerator pedal position sensor is located on the accelerator pedal and conveys driver inputs to the control unit.

- Read measured value block, display group 02, engine not running => Page 25 .

-> Indicated on display:

Read measured value block 2  
0 rpm 0.0 % 0 1 0  
18.4 5C

- Check display in display zone 2 (accelerator pedal position).

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Read measured value block 2  
0 rpm 0.0 % 0 1 0 18.4  
5C

-> Specification: 0.0 % (accelerator pedal not depressed)

- Check display in display zone 3.

Read measured value block 2  
0 rpm 0.0 % 0 1 0 18.4  
5C

-> Specification:

0 1 0 (accelerator pedal not depressed)

0 0 0 (accelerator pedal depressed)

- Slowly depress accelerator pedal.

Read measured value block 2  
0 rpm 100.0 % 0 0 0  
18.4 5C

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-> Specification: Display zone 2 must increase steadily up to 100 % (with accelerator depressed).

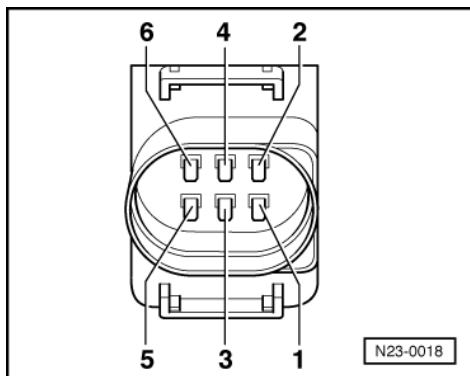
On vehicles with an automatic gearbox the kickdown switch pressure point must be distinctly felt before the full throttle stop position is reached.

If the final specified value is not reached:

- Adjust accelerator pedal position sender  
=> Page 46

If the display does not change or only changes irregularly:

- Switch ignition off.
- Remove connector from injection pump => Installation position overview, Page 32 .



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

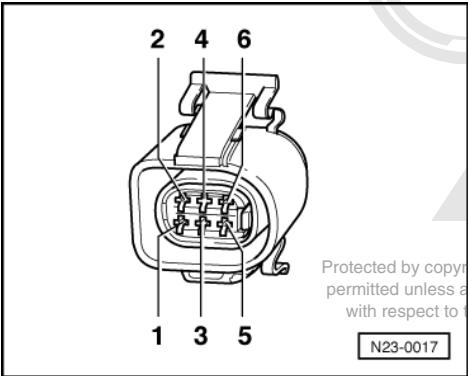
| Accelerator     | Contacts                                            | Specified value |
|-----------------|-----------------------------------------------------|-----------------|
| Not pressed     | 1 + 3                                               | 0.8...1.4 kΩ    |
| Not pressed     | 2 + 3                                               | 0.8...1.4 kΩ    |
| Not pressed     | 4 + 6                                               | 0.8...1.2 kΩ    |
| Depressed       |                                                     | Indefinite ω    |
| Not pressed     | 5 + 6<br>only in vehicles with<br>automatic gearbox | Indefinite ω    |
| fully depressed |                                                     | 0.8...1.2 kΩ    |

If specified value is not attained:

- Fit a new accelerator position sensor (G79).

If specified value is attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **57** .



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

| 6-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|--------------------------------------------|--------------------------------|
| 1                                          | 24                             |
| 2                                          | 11                             |
| 3                                          | 23                             |
| 4                                          | 12                             |
| 6                                          | 25                             |
| Only in vehicles with automatic gearbox:   |                                |
| 5                                          | 8                              |

- Rectify any open/short circuit as necessary.

## 6 - Checking auxiliary signals

### 6.1 - Checking auxiliary signals

### 6.2 - Test signals from and to automatic gearbox

#### A - gearshift signal

This signal causes the injection quantity to be briefly reduced (torque reduction) during gearshifts in order to smooth out the jolts experienced when changing gear.

- Read measured value block, display group 09, engine at idling speed => Page **18**

-> Indicated on display:

Read measured value block 9

- Check display in display zone 3.

Specified value: 51 mg/stroke



Important:  
Second person is required to operate V.A.G 1551.

- Accelerate the vehicle from a stationary position with full throttle, but without using kick down.

Read measured value block 9

1 2 3 4

-> Observe display zone 3 when shifting into 2nd gear

Specified value: display should drop briefly below 51 mg/stroke

**Note:**

*Because of the lag in data transfer, there might be a delay before the display reaches the specified value.*

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .

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

| Test box V.A.G 1598/22, socket | Automatic gearbox control unit, contact                                  |
|--------------------------------|--------------------------------------------------------------------------|
| 36                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

**B - Accelerator pedal position signal**

This signal is required for calculating gearshift points according to engine load.

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

Signal testing

=> Automatic Gearbox; Repair group 01

**C - Engine speed signal**

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

Signal testing

=> Check engine speed signal, Page 95

**D - Kickdown signal**

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

Signal testing

=> Automatic Gearbox; Repair group 01

6.3 - Checking signals from / to air conditioner

Checking the air conditioner compressor shutoff

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

- ◆ Heavy acceleration from low speeds (control unit detects angle change at sensor for accelerator pedal position and receives road speed signal)
- ◆ In the emergency programme (emergency running mode)
- ◆ If coolant temperature is above 120 °C
- ◆ After every start, for approx. 6 seconds.

Test conditions

- Air conditioning system OK
- Air conditioner switched on
- No fault stored in fault memory

Final control diagnosis

-> Start final control diagnosis and activate exhaust gas recirculation start valve => Page 13 .

The AC compressor must come to a stop within 5 s (visual inspection) and then start up and stop again every 5 s.

If the conditioner compressor is not switched off:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .

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

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| Test box V.A.G 1598/22, socket | Air conditioner operating and display unit, contact                      |
|--------------------------------|--------------------------------------------------------------------------|
| 16                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

Checking air conditioner signal

The air conditioner signal informs the engine control unit that the air conditioner needs a higher idling speed in order to provide the desired interior temperature (both when cooling and heating).

The increase in idling speed resulting from the air conditioner signal depends on the control unit version and is not activated in all vehicles.

- Read measured value block, display group 02, engine at idling speed => Page 25

-> Indicated on display:

|                             |         |   |   |  |
|-----------------------------|---------|---|---|--|
| Read measured value block 2 |         |   |   |  |
| 900 rpm                     | 0.0 %   | 0 | 1 |  |
| 0                           | 18.4 5C |   |   |  |

- Switch on air conditioner, press the "Auto" key and select the lowest temperature.
- Check display in display zone 3.

|                             |       |   |   |   |
|-----------------------------|-------|---|---|---|
| Read measured value block 2 |       |   |   |   |
| 900 rpm                     | 0.0 % | 1 | 1 | 1 |
| 18.4 5C                     |       |   |   |   |

-> Specification: X X 1 (AC compressor signal)



If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **57** .

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

| Test box V.A.G 1598/22, socket | Air conditioner operating and display unit, contact                      |
|--------------------------------|--------------------------------------------------------------------------|
| 48                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

## 6.4 - Testing clutch pedal switch

This signal is designed to prevent speed overshoots and jerkiness on switching from throttle open to throttle closed and vice versa when disengaging clutch. It is needed for the cruise control system.

- Read measured value block, display group 06, engine not running => Page **18** .

-> Indicated on display:

```
Read measured value block 6
0 km/h    255    0    0
000000    0
```

- Check display in display zone 2.

```
Read measured value block 6
0 km/h    255    0    0    000000
0
```

-> Specification: 0 X X

- Depress clutch pedal.

```
Read measured value block 6
0 km/h    1    255    0    000000
0
```

-> Specification: 1 X X

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **57** .

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

| Test box V.A.G 1598/22, socket | Clutch pedal switch, contact                                             |
|--------------------------------|--------------------------------------------------------------------------|
| 46                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

## 6.5 - Checking vehicle speed signal

The speed signal is required for shutting off the air conditioner compressor when accelerating, for the cruise control system and to ensure smoother driving (jolt damping).

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Test conditions

- Speedometer OK, checking:
- => Electrical System; Repair group 90
- Read measured value block, display group 06, engine at idling speed => Page 18

-> Indicated on display:

Read measured value block 6  
0 km/h      255      0      0  
000000      0

Important:

Second person is required to operate V.A.G 1551.

- Perform a road test.
- Observe readout in display zone 1.

Read measured value block 6  
45 km/h      255      0      0      000000  
0

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

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .

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

| Test box V.A.G 1598/22, socket | Dash panel insert, contact                                               |
|--------------------------------|--------------------------------------------------------------------------|
| 51                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

If no wiring fault is detected:

- Find all the speed signal "consumers" (e.g. radio, automatic gearbox, air conditioner etc.), disconnect them one by one from the dash panel insert, then repeating the test until the cause of the problem has been identified.

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6.6 - Testing Cruise Control System (CCS)

The CCS has no components of its own (except for operating switch). All CCS functions are performed by diesel direct injection system.

- Read measured value block, display group 06, engine at idling speed => Page 18

-> Indicated on display:

Read measured value block 6  
0 km/h      0      0      0      000000  
0

- Check display in display zone 4.

Read measured value block 6  
0 km/h      0      0      0      000000      0



-> Specification: 0

-> If the value 255 is displayed in display zone 4:

```
Read measured value block 6
0 km/h    255    0    0
000000    0
```

- Activate cruise control system  
=>Page 95 .

*Only for vehicles with automatic gearbox:*

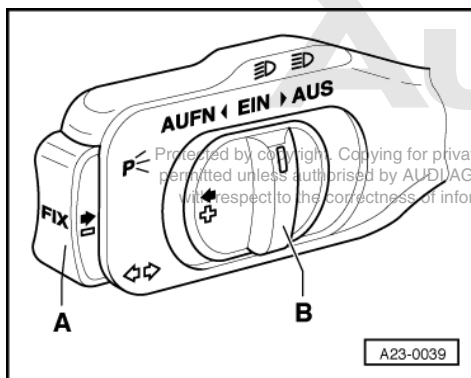
- Take vehicle for a test drive and go beyond a speed of 30 km/h once. After completing the test drive, leave the engine running and engage the selector lever in position 2, 3 or D.
- Apply handbrake.

**Note:**

*On vehicles with automatic transmission the voltage supply for the CCS switch is only supplied at speeds above 30 km/h and with selector lever in position 2, 3 or D. The power supply is then retained even when idling as long as a driving position is engaged (not 1 or R).*

```
Read measured value block 6
0 km/h    0    0    0    000000    0
```

-> Test display in display zone 3.



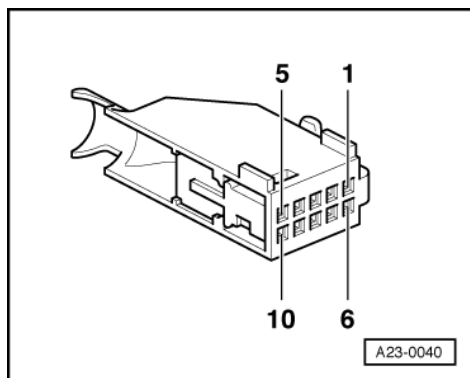
| Test conditions                                            | Display zone 3 |
|------------------------------------------------------------|----------------|
| Switch B in "OFF" position                                 | 000000         |
| Switch B in "OFF/AUS" position but before engagement point | 000010         |
| Switch B at "ON/EIN"                                       | 000011         |
| Switch B at "RES/AUFN"                                     | 001011         |
| Key A pressed in                                           | 000111         |
| Brake depressed                                            | 010011         |
| Clutch depressed                                           | 100011         |

If specified values are not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .
- Detach connector at CCS switch

=> Electrical System; Repair group 94

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



| 10-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket    |
|---------------------------------------------|-----------------------------------|
| 2                                           | 21                                |
| 3                                           | 10                                |
| 4                                           | 19                                |
| 5                                           | 35                                |
| 61)                                         | to fuse                           |
| 62)                                         | to automatic gearbox control unit |
| 7                                           | 19                                |

1) Vehicles with manual gearbox

2) Vehicles with automatic gearbox

- Rectify any open/short circuit as necessary.

### Activating cruise control system

- Connect fault reader V.A.G 1551 (V.A.G 1552) and select the engine electronics control unit using "Address word" 01. For this purpose, the ignition must be switched on.  
(Connecting fault reader and selecting engine electronics control unit => Page 2 .)

-> Indicated on display:

Rapid data transfer      HELP  
Select function XX

- Press the "1" key twice for "Log-in procedure" function and confirm entry with Q key.

-> Indicated on display:

Login-procedure      HELP  
Enter code number XXXXX

- Enter code number 11463 and confirm entry with Q key.

## 6.7 - Checking engine speed signal

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

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

Identify the engine speed signal as follows:



### Dash panel insert

- Observe rev counter reading.

Specified value: The current engine speed must be displayed.

### Air conditioner

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

Signal testing

=> Heating, air conditioning systems; Repair group 01

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

### Automatic gearbox

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

Signal testing

=> Automatic Gearbox; Repair group 01

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

If the engine speed signal specified values is not achieved for all "consumers", the following faults are possible:

- ♦ Open circuit or short in wiring between diesel direct injection system control unit and wiring harness connector

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

- ♦ Short circuit between connector in harness and "consumer".
- ♦ Diesel direct injection system control unit defective

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

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

## 6.8 - Checking radiator fan after-run control unit -J138

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The -V7 coolant fan is only controlled by the engine control unit for engine code AHF.

Fan actuation after switching off the engine is only implemented:

- ♦ If coolant temperature is above 100 °C
- and
- ♦ Calculated fuel consumption in the last 10 minutes exceeds a certain value, i.e. the engine was under a considerable load.

|                                               |
|-----------------------------------------------|
| Final control diagnosis<br>Blower relay -J323 |
|-----------------------------------------------|

-> perform final control diagnosis and activate fan relay => Page 13 .

Radiator fan must switch on every 5 seconds and then stop again

**Note:**

*The radiator fan may also be activated by the thermoswitch, the automatic gearbox or the air conditioner. Please ensure that actuation does not occur for any of these reasons during final control diagnosis*

- If necessary, allow engine to cool down.
- If radiator fan is not actuated, connect up test box => Page 57 .
- Connect socket 31 (relay cable) to socket 27 (earth).

The radiator fan must run.

- If the radiator fan now runs, but did not during final control diagnosis, replace diesel direct injection system =>Page 57 .
- If the radiator fan does not run, test cable connections for continuity and repair if necessary.

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

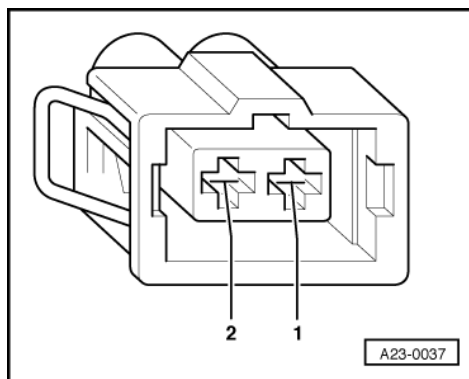
## 6.9 - Testing intake manifold flap changeover valve

- Remove connector from changeover valve => installation positions overview, Page 36
- Connect multimeter to valve to measure the resistance.

Specified value: 30...40  $\Omega$

If specified value is not attained:

- Replace the changeover valve.



If specified value is attained:

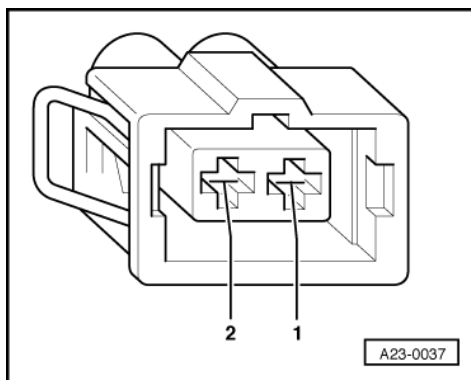
- -> Connect the handheld multimeter (voltage range) between earth and contact 1 on the connector.
- Switch the ignition on.

Specified value: approx. battery voltage

If specified value is not attained:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .

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

| 2-pin connector on wiring harness, contact | Test box V.A.G 1598/22, socket |
|--------------------------------------------|--------------------------------|
| 1                                          | 2                              |
| 1                                          | 28                             |
| 2                                          | 3                              |

- Rectify any open/short circuit as necessary.

## 6.10 - Testing signal wire between engine control unit and gearbox control unit

The engine control unit and the gearbox control unit are connected to each other via a CAN (Controller Area Network) bus. The CAN bus consists of two signal wires which are used to transmit information (e.g. engine speed and accelerator pedal position).

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .

Check the following wiring connections for open circuit and short circuit to positive or negative.

| Test box V.A.G 1598/22, socket | Automatic gearbox control unit, contact                                  |
|--------------------------------|--------------------------------------------------------------------------|
| 68                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |
| 75                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

## 6.11 - Testing signal wire between engine control unit and ABS control unit

The engine control unit and the ABS control unit are connected to each other via a CAN (Controller Area Network) bus. The CAN bus consists of two signal wires which are used to transmit information (e.g. engine torque and engine speed).

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page 57 .

Check the following wiring connections for open circuit and short circuit to positive or negative.

| Test box V.A.G 1598/22, socket | ABS control unit, contact                                                |
|--------------------------------|--------------------------------------------------------------------------|
| 68                             | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

|                                       |                                                                          |
|---------------------------------------|--------------------------------------------------------------------------|
| <b>Test box V.A.G 1598/22, socket</b> | <b>ABS control unit, contact</b>                                         |
| 75                                    | => Current Flow Diagrams, Electrical Fault-finding and Fitting Locations |

- Rectify any open/short circuit as necessary.

## 6.12 - Checking a "two-wire bus system"

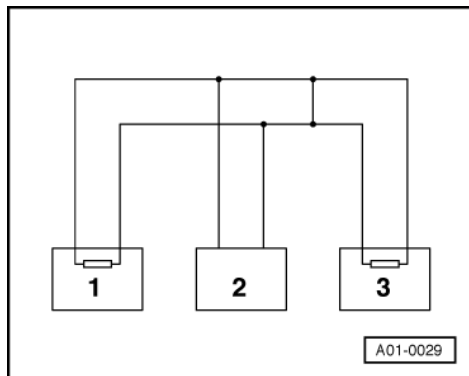
- By referring to the appropriate current flow diagram, establish how many control units are connected to the CAN (Controller Area Network) data bus.
- Check that the multi-pin connectors on the control units are properly seated.
- Connect fault reader V.A.G 1551 or V.A.G 1552 and press key 0 twice to select the function "Automatic test sequence"

Before checking the bus wires, ensure that none of the control units attached to the bus are defective.

If a fault exists, rectify this fault first.

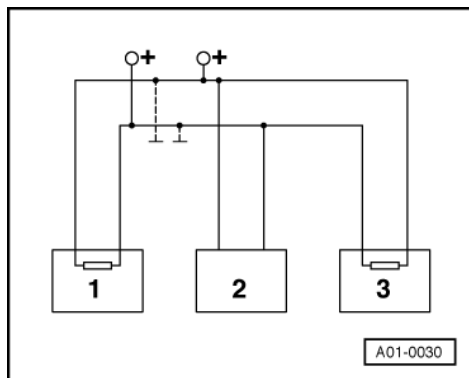
- Make a note of any faults and erase the fault memories in all the control units.
- Press keys 0 and 6 for the "End output" function and press the Q key to confirm entry.
- Rectify the faults as described in the fault table in the relevant Workshop Manual.

If all faults have been remedied and communication between the control units is still not working properly, the data bus wires must be tested.



- Switch ignition off.
- -> Disconnect the control units that are linked by the bus wires and check for a short circuit between the bus wires

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



- -> Check the bus wires for short to positive and short to earth.



If the reason for "Hardware defect" cannot be established in the bus wires, check whether one of the control units is responsible for the fault.

All the control units that communicate via the CAN data bus are still disconnected. The ignition is switched off.

- Connect one of the control units.
- Connect fault reader V.A.G 1551 or V.A.G 1552.
- Switch the ignition on and erase the fault memory of the control unit that has just been connected
- Terminate fault readout by selecting function 06 "End output".
- Switch the ignition off and then on again.
- Leave the ignition switched on for 10 seconds. Then interrogate the fault memory of the control unit that has just been connected, using the fault reader.
  
- If the "Hardware defect" is indicated, replace the control unit that has just been connected.
- If the "Hardware defect" fault is not indicated, connect the next control unit and repeat the above procedure.



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## 28 - Glow plug system

### 1 - Checking glow plug system

#### 1.1 - Checking glow plug system

#### 1.2 - Checking function

##### Test conditions

- Battery voltage at least 11.5 V
- Diesel direct injection control unit -J248 okay
- Switch ignition off.
- Remove connector from coolant temperature sender (G62).

##### Note:

*Engine condition "cold" is simulated by removing connector G62 and the relevant glowing procedure is performed when the ignition is switched on.*

- Pull glow plug connector off glow plugs.
- Connect multimeter between the engine earth and one of the glow plug connectors to test the voltage.

##### Switch the ignition on.

Specified value: battery voltage for approx. 20 seconds

If specified value is not attained:

- Rectify any open/short circuit as necessary.

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

Glow period warning lamp -K29 should light up during the simulated glow period.

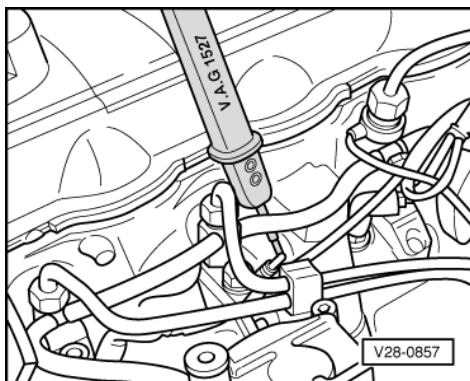
If the warning lamp does not light up:

- Check preglow warning lamp => Page 102

#### 1.3 - Checking glow plugs

##### Test conditions

- Battery voltage at least 11.5 V





- Switch ignition off.
- Pull glow plug connector off glow plugs.
- -> Connect diode test lamp V.A.G 1527 to battery positive and apply to each glow plug in succession.

Diode lights up: glow plug OK.

If diode does not light up: Renew glow plug.

- Remove and install glow plugs with jointed spanner 3220.

Tightening torque: 15 Nm.

## 1.4 - Checking glow period warning lamp

- Start final control diagnosis and activate glow period warning lamp => Page **13**.

-> Indicated on display:

|                                                          |
|----------------------------------------------------------|
| Final control diagnosis<br>Glow period warning lamp -K29 |
|----------------------------------------------------------|

The warning lamp must blink.

Warning lamp does not blink:

- Connect test box V.A.G 1598/22 to wiring harness for engine control unit =>Page **57**.
- Connect together sockets 1 and 41 on the test box using an auxiliary cable from V.A.G 1594.
- Switch the ignition on.

Specified value: The warning lamp should light up.

If the warning lamp does not light up:

- Rectify any open/short circuit as necessary.

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

If the warning lamp lights up now but did not light up during the final control diagnosis:

- Renew diesel direct injection system control unit.

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