

## Diesel Turbo Direct Injection (TDI) system, servicing

The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) is equipped with Diagnostic Trouble Code (DTC) memory.

Before starting repairs, adjustments and/or troubleshooting:

- Check DTC memory for possible stored Diagnostic Trouble Codes (DTCs) ⇒ [page 01-15](#) .
- Check Diesel DFI ECM output signals to components using output Diagnostic Test Mode (DTM) ⇒ [page 01-51](#) .

During checking and adjusting procedures, the Diesel DFI ECM may recognize malfunctions and store DTCs.

For this reason, after completing all checking and adjusting procedures, you must:

- Check and erase DTC memory ⇒ [page 01-41](#) .
- Re-create readiness code ⇒ [page 01-47](#) .



## Safety precautions

### **WARNING!**

**Fire hazard! Do not have anything in the area that can ignite Diesel fuel. To guard against personal injury, and damage to vehicle components.**

**Be sure the ignition is switched OFF, when:**

- ◆ **Disconnecting or connecting Diesel fuel injection and glow plug system wiring or test equipment**
- ◆ **Disconnecting the battery**

**BEFORE cranking the engine at starting RPM (such as for compression testing):**

- ◆ **Disconnect the harness connector for fuel cut-off valve -N109- on the Diesel injection pump.**
- ◆ **After the work is completed, check and erase Diagnostic Trouble Code (DTC) memory.**

### **CAUTION!**

***BEFORE disconnecting (or connecting) the battery:***

- ◆ ***Be sure the ignition is switched OFF. Failure to do so may damage the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM).***
- ◆ ***Be sure of the proper radio code (for vehicles equipped with coded anti-theft radio).***



## Rules for cleanliness

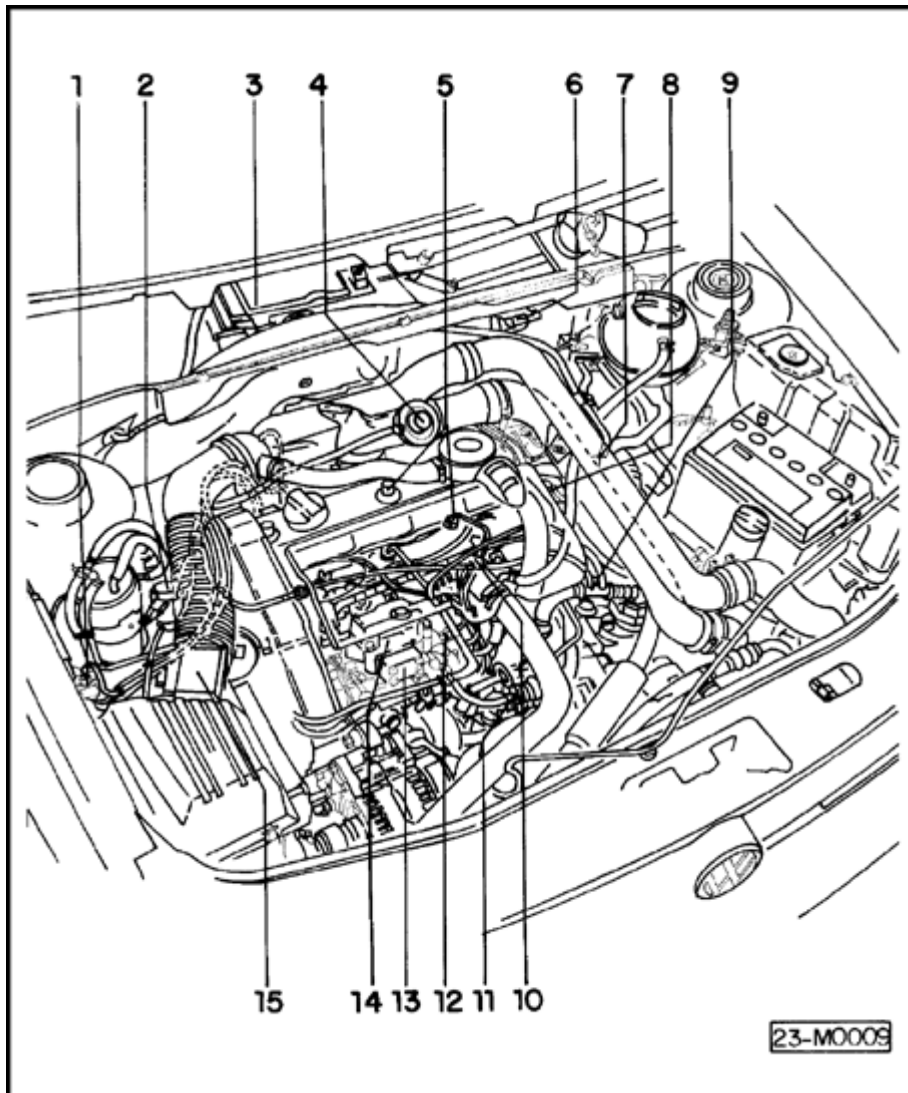
### **CAUTION!**

***When working on the fuel supply or Diesel injection system, always observe the following rules of cleanliness.***

1. Thoroughly clean fuel system line and hose connections and the surrounding area before disconnecting.
2. Place removed components on a clean surface and cover. Use plastic sheet or paper. Do not use fluffy rags that leave lint!
3. Carefully cover over or seal any components that have been opened if repairs are not carried out immediately.
4. Install only clean parts:
  - ◆ Do not remove replacement parts from the packaging until immediately before they are to be installed.
  - ◆ Do not use parts that have been stored without packaging (e.g. in toolboxes, etc.).
5. When the fuel system has been opened, avoid

working with compressed air whenever possible, and also avoid moving the vehicle if possible.

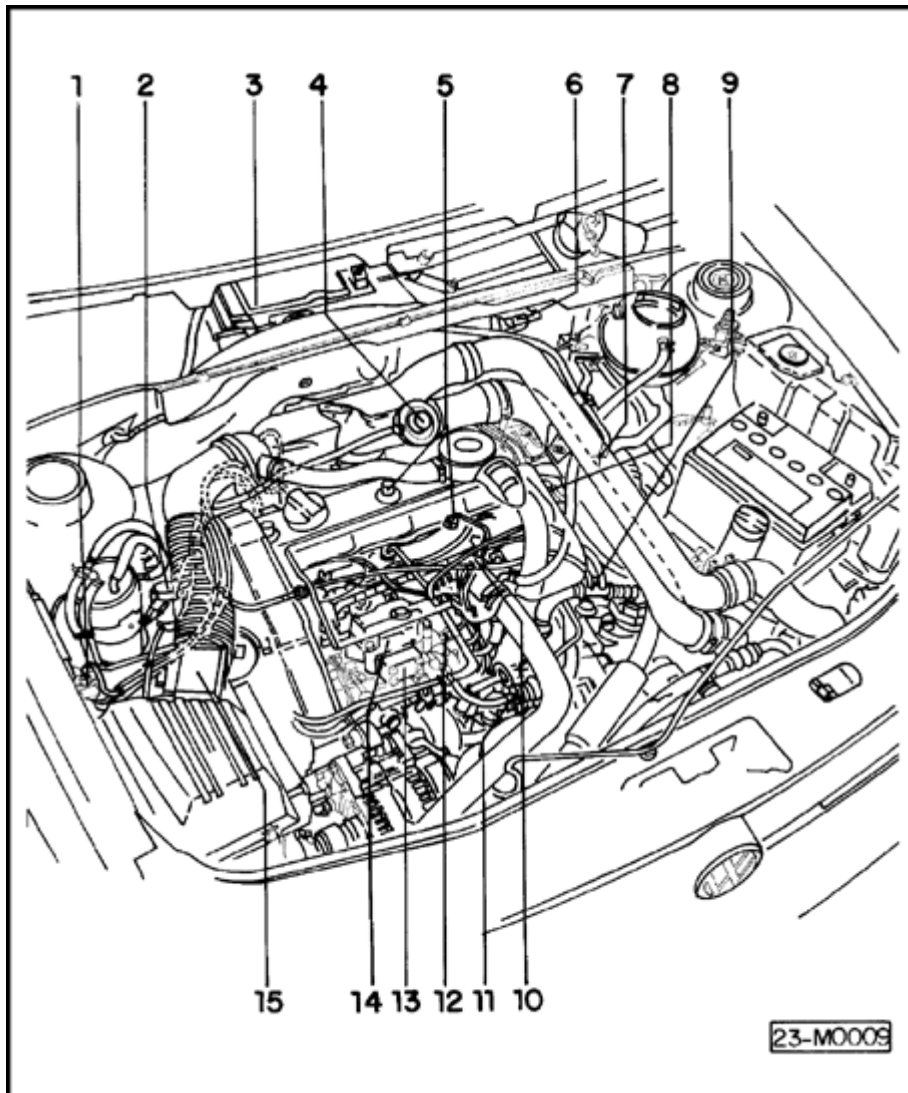
6. Do not let Diesel fuel come in contact with engine coolant hoses and, if necessary, immediately clean any hose that has been contaminated by fuel. Replace hoses if Diesel fuel has had time to soak into the hose material.



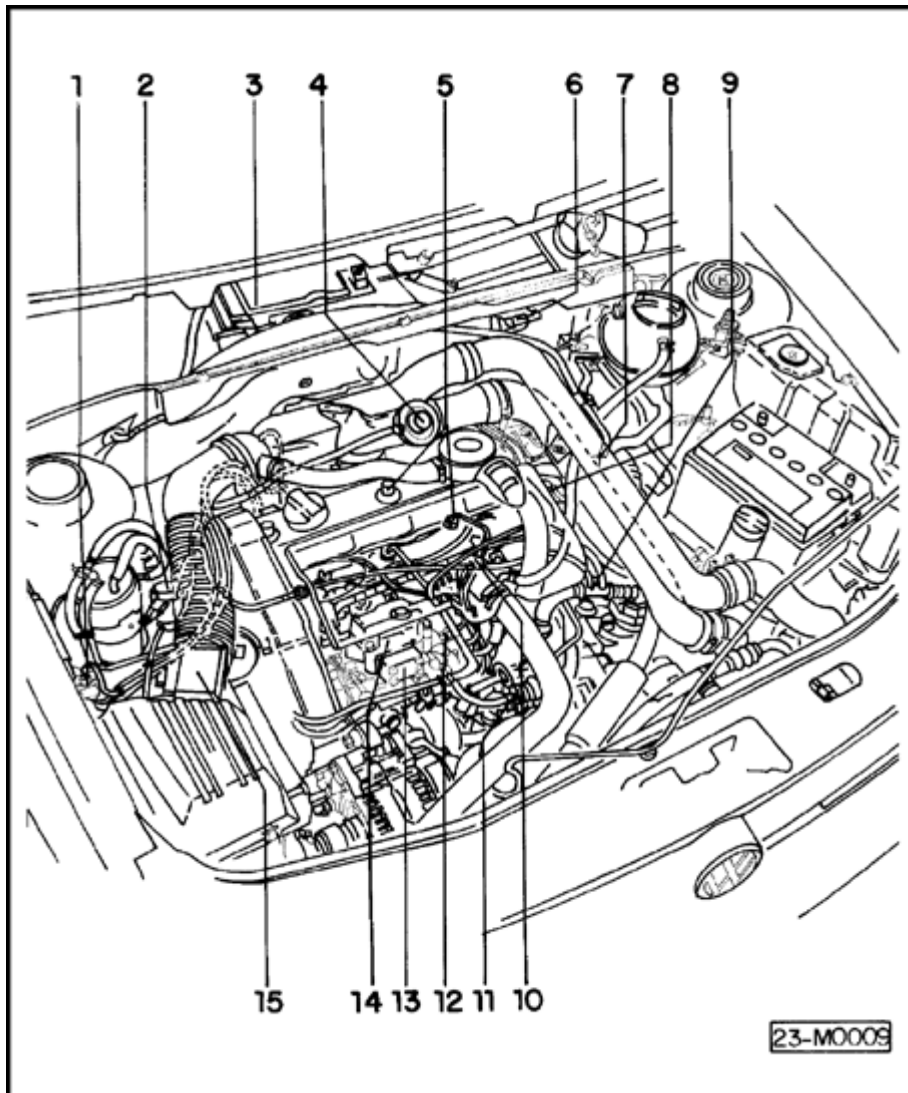
## Diesel Direct Fuel Injection (DFI) system components, overview

Components -A- through -D- below are not shown in the illustration.

- A - Brake light switch -F-, Brake vacuum vent valve switch -F47-**
  - ◆ Combined into one assembly in footwell on brake pedal
- B - Throttle Position (TP) sensor -G79-**
  - ◆ In footwell, on accelerator pedal ⇒ [page 23-13](#)
  - ◆ Displayed as "Throttle position sensor-G69" in case of malfunction
- C - Clutch vacuum vent valve switch -F36-**
  - ◆ In footwell, on clutch pedal
- D - Barometric pressure (BARO) sensor -F96-**
  - ◆ Internal component of Diesel DFI Engine Control Module (ECM) -J248-



- 1 - Wastegate bypass regulator valve -N75-**
- 2 - EGR vacuum regulator solenoid valve - N18-**
- 3 - Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) -J248-**
  - ◆ With Manifold Absolute Pressure (MAP) sensor -G71-
  - ◆ With Barometric Pressure (BARO) sensor - F96-
- 4 - Exhaust Gas Recirculation (EGR) valve**
- 5 - Fuel injector**
  - ◆ With needle lift sensor -G80-
- 6 - Coolant glow plug relay -J325-**
- 7 - Intake Air Temperature (IAT) sensor -G72-**
- 8 - Harness connector**
  - ◆ For needle lift sensor -G80-
- 9 - Harness connector**
  - ◆ For engine speed (RPM) sensor -G28-



**10 - Engine Coolant Temperature (ECT) sensor -G62-**

**11 - Central harness connector**

For:

- ◆ Fuel temperature sensor -G81-
- ◆ Quantity adjuster -N146-
- ◆ Modulating piston displacement sensor -G149-

**12 - Harness connector**

- ◆ For fuel cut-off valve -N109-
- ◆ For cold start injector -N108-

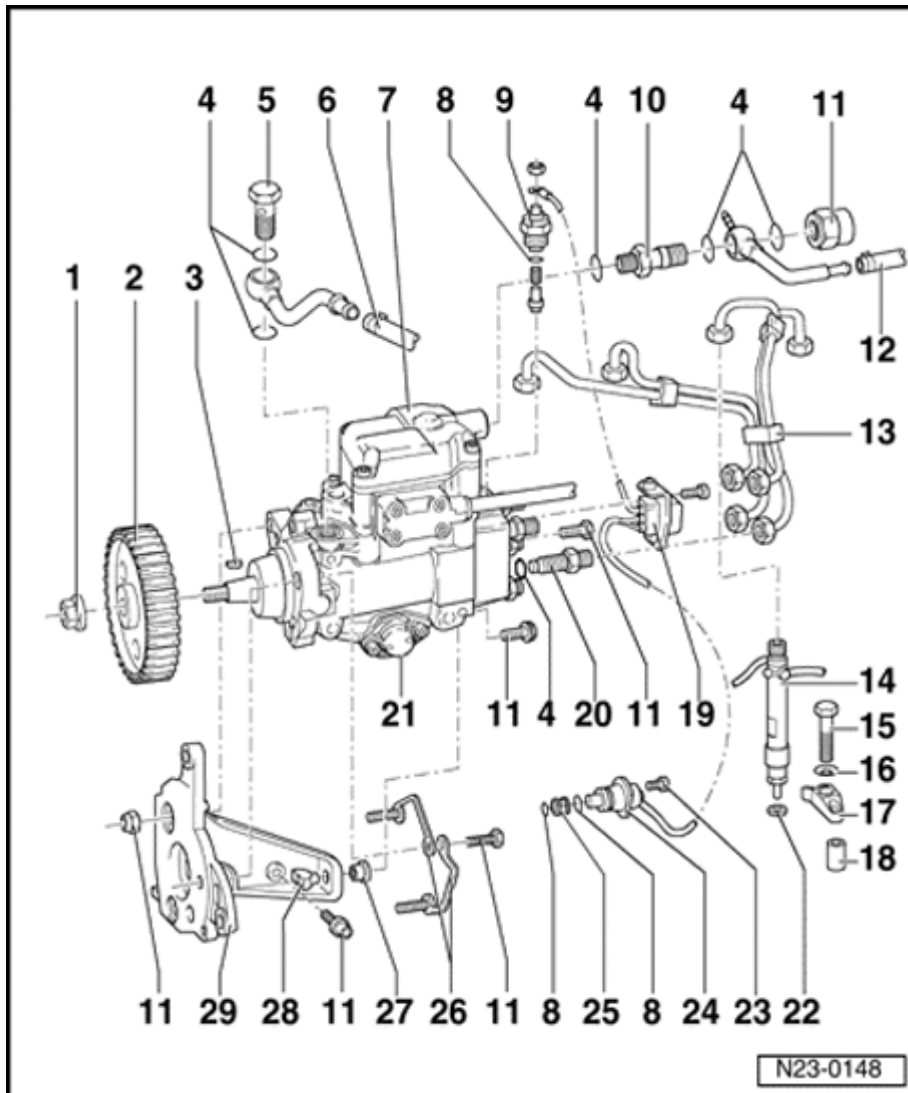
**13 - Injection pump quantity adjuster**

With:

- ◆ Fuel temperature sensor -G81-
- ◆ Quantity adjuster -N146-
- ◆ Modulating piston displacement sensor -G149-

**14 - Fuel cut-off valve -N109-**

**15 - Mass Air Flow (MAF) sensor -G70-**



## Diesel injection pump, servicing

Refer to Rules for cleanliness.

⇒ [page 23-3](#)

Diesel injection pump, removing and installing ⇒ [page 23-18](#) .

Diesel injection pump, checking and adjusting dynamically ⇒ [page 23-23](#) .

**1 - 55 Nm (41 ft lb)**

**2 - Injection pump sprocket**

◆ Removing ⇒ [page 23-19](#)

**3 - Woodruff key**

◆ Make sure it fits securely

**4 - Oil seal**

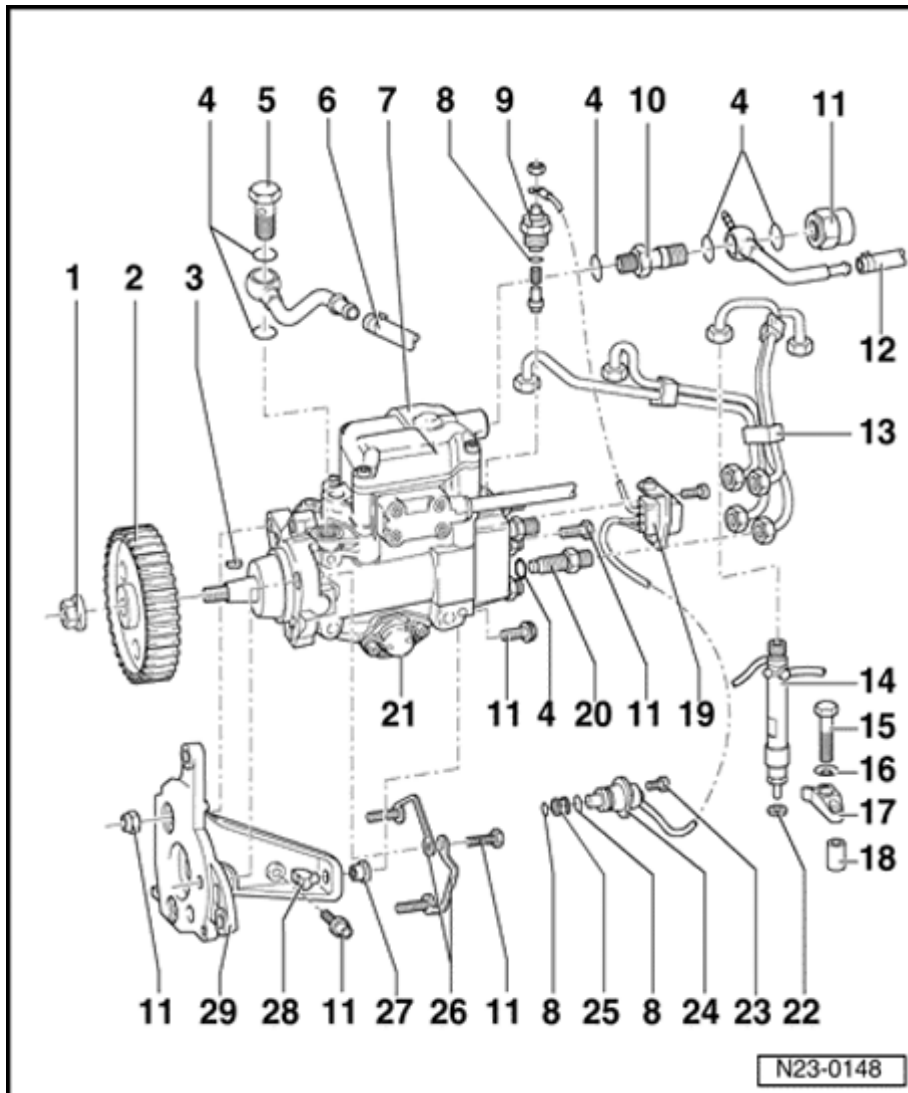
◆ Always replace

**5 - Banjo bolt**

◆ 25 Nm (18 ft lb)

**6 - Supply hose**

◆ From fuel filter



## 7 - Injection pump

With:

- ◆ Quantity adjuster -N146-
- ◆ Modulating piston displacement sensor - G149-
- ◆ Fuel temperature sensor -G81-

## 8 - O-ring

- ◆ Replace if damaged

## 9 - Fuel cut-off valve

- ◆ 40 Nm (30 ft lb)

## 10 - Union

- ◆ For return line

## 11 - 25 Nm (18 ft lb)

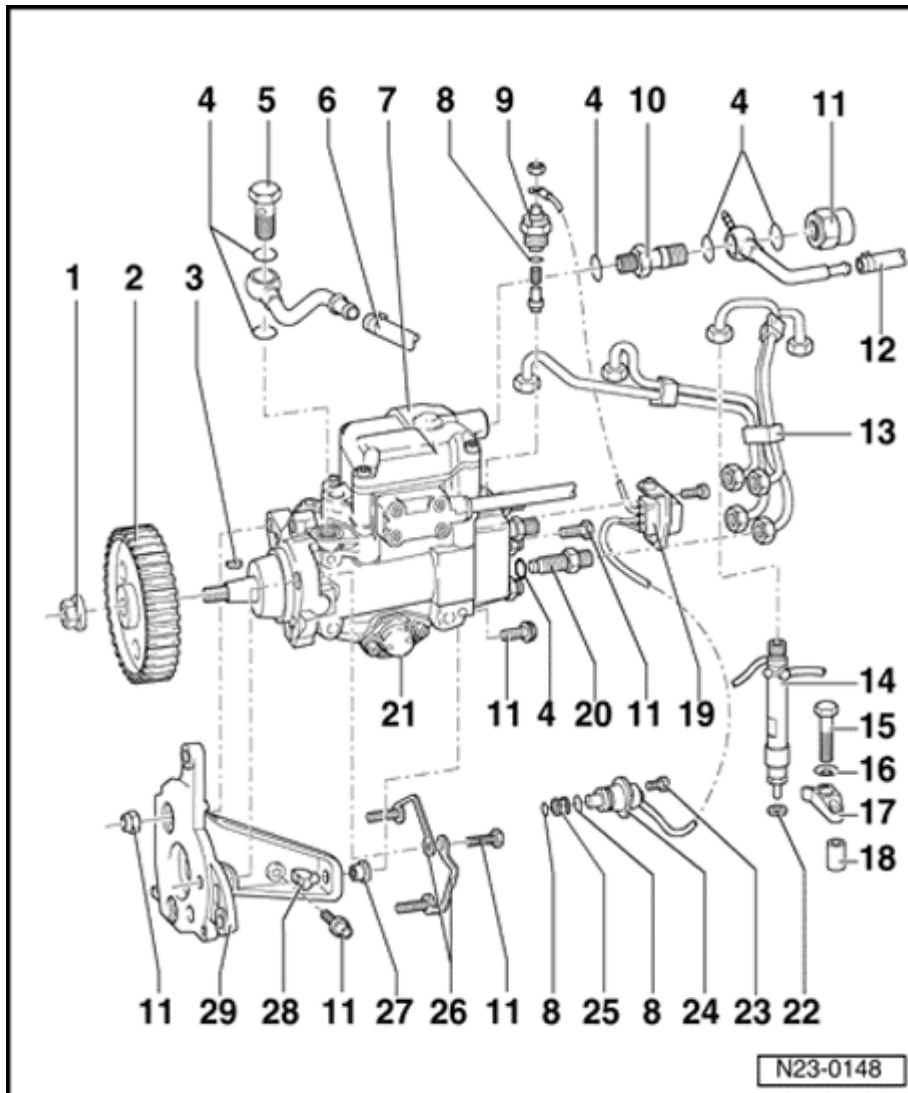
## 12 - Return hose

- ◆ To control valve/fuel filter

## 13 - Injector lines

- ◆ 25 Nm (18 ft lb)
- ◆ Remove using 3035 tubing wrench
- ◆ Always remove injector lines as an assembly

◆ Do not bend or otherwise alter shape



#### 14 - Fuel injector

- ◆ For 3rd cylinder with needle lift sensor
- ◆ Removing and installing ⇒ [page 23-29](#)
- ◆ Servicing ⇒ [page 23-31](#)

#### 15 - 20 Nm (15 ft lb)

#### 16 - Dished washer

#### 17 - Retainer

#### 18 - Mounting

#### 19 - 3-pin harness connector

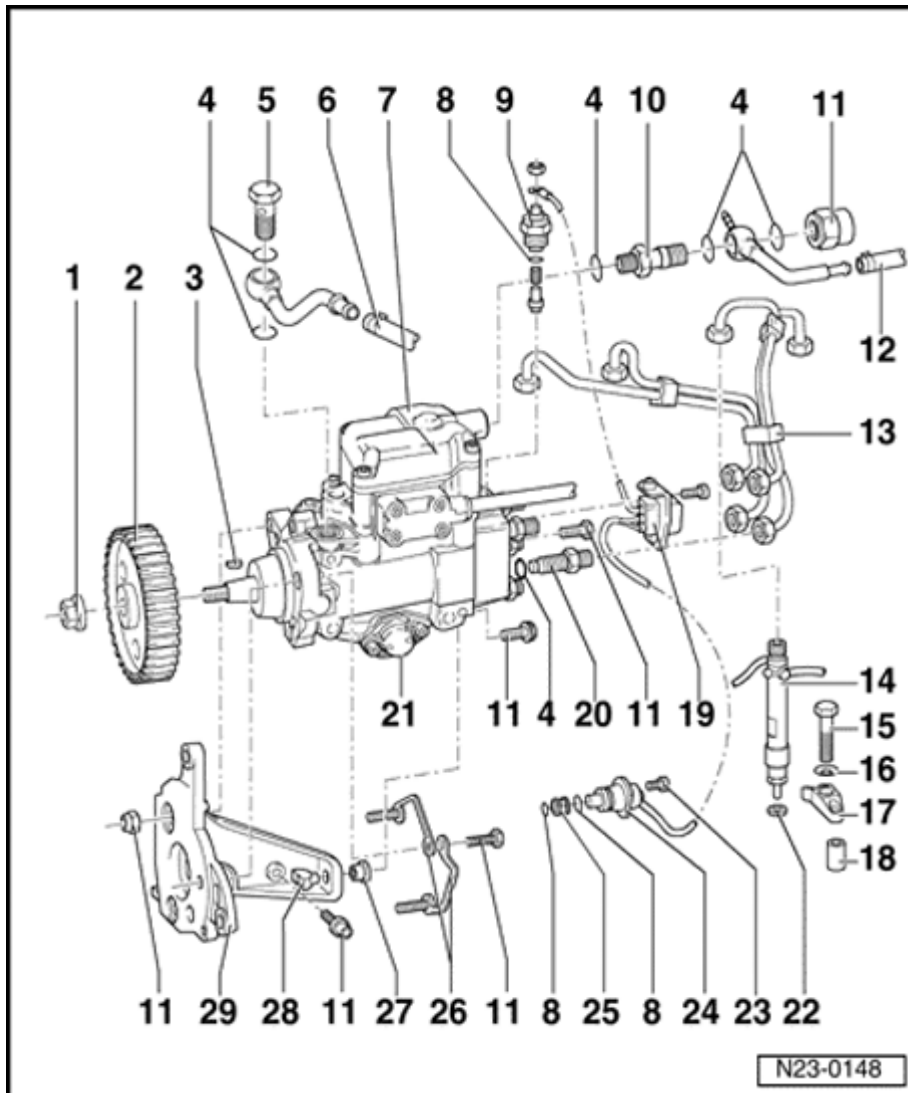
- ◆ For fuel cut-off valve and cold start injector

#### 20 - Union

- ◆ With pressure valve
- ◆ 45 Nm (33 ft lb)

#### 21 - Timing control cover

- ◆ If leaking, replace O-ring ⇒ [page 23-33](#)



**22 - Heat shield**

- ◆ Always replace

**23 - 10 Nm (7 ft lb)**

**24 - Cold start injector N108**

- ◆ Checking ⇒ [page 01-51](#)

**25 - Strainer**

**26 - Retainer**

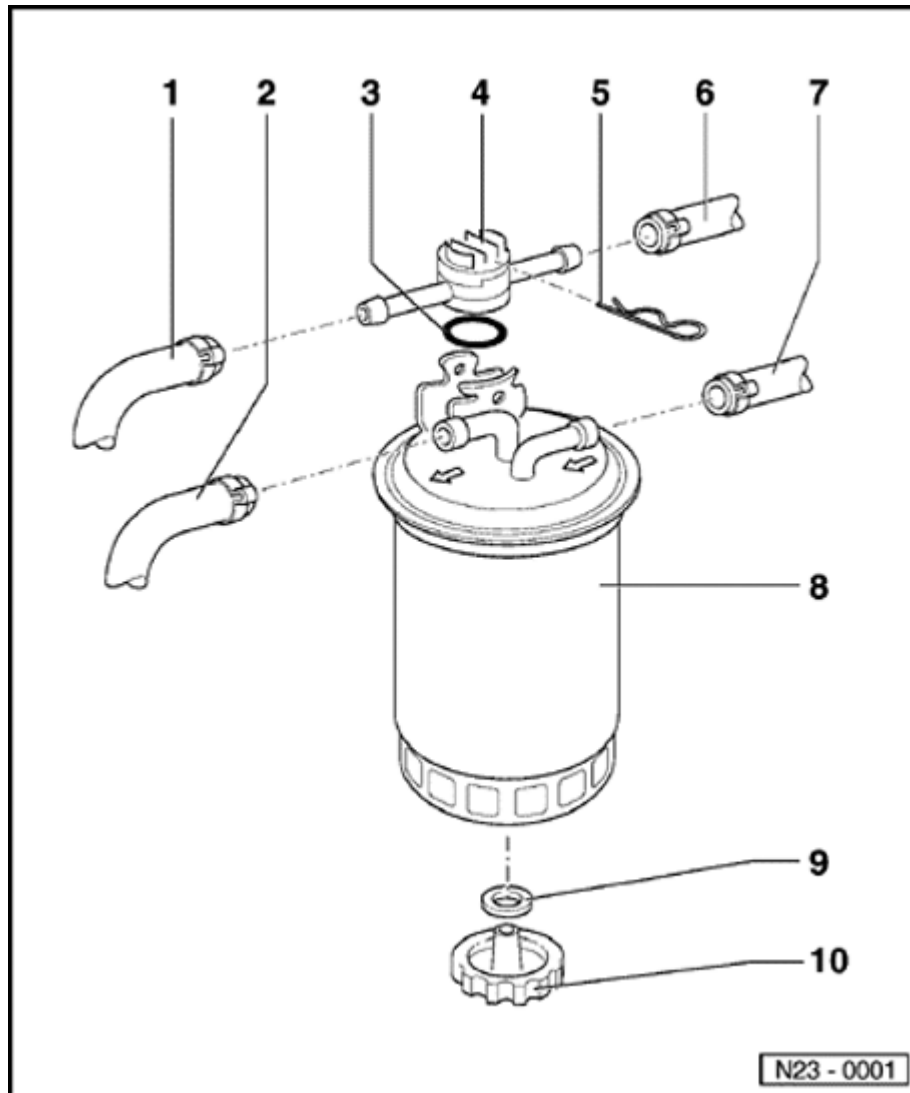
**27 - Sleeve**

- ◆ Tapered

**28 - 25 Nm (18 ft lb)**

- ◆ Nut with taper

**29 - Console**



## Fuel filter, servicing

### 1 - Return line

- ◆ From Diesel injection pump

### 2 - Supply line

- ◆ To Diesel injection pump

### 3 - O-ring

- ◆ Always replace

### 4 - Control valve

- ◆ Installed position: arrow points towards fuel tank
- ◆ When changing filter, remove retaining clip and control valve as an assembly (complete with fuel lines)
- ◆ Below +15 ° C (59 ° F): passageway to filter is open
- ◆ Above +31 ° C (88 ° F): passageway to filter is closed

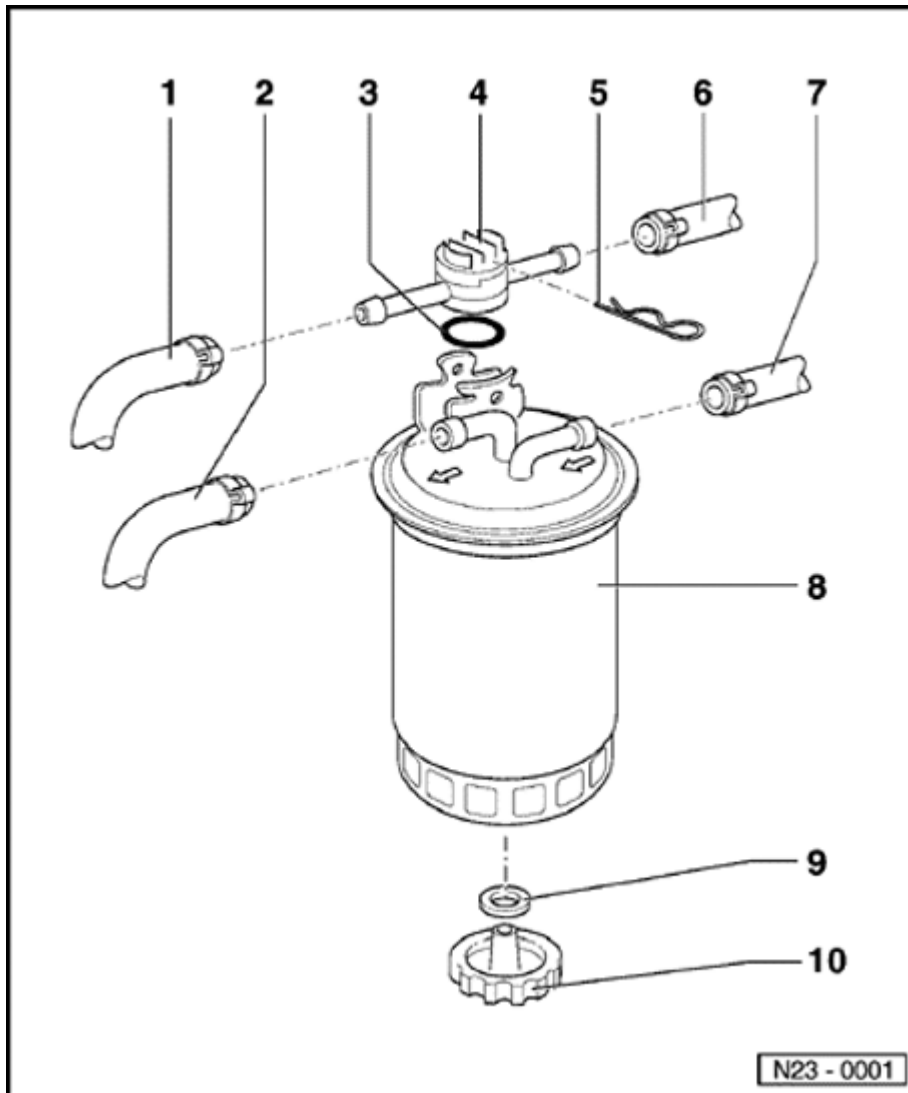
### 5 - Retaining clip

### 6 - Return line

- ◆ To fuel tank

### 7 - Supply line

◆ From fuel tank



### 8 - Fuel filter

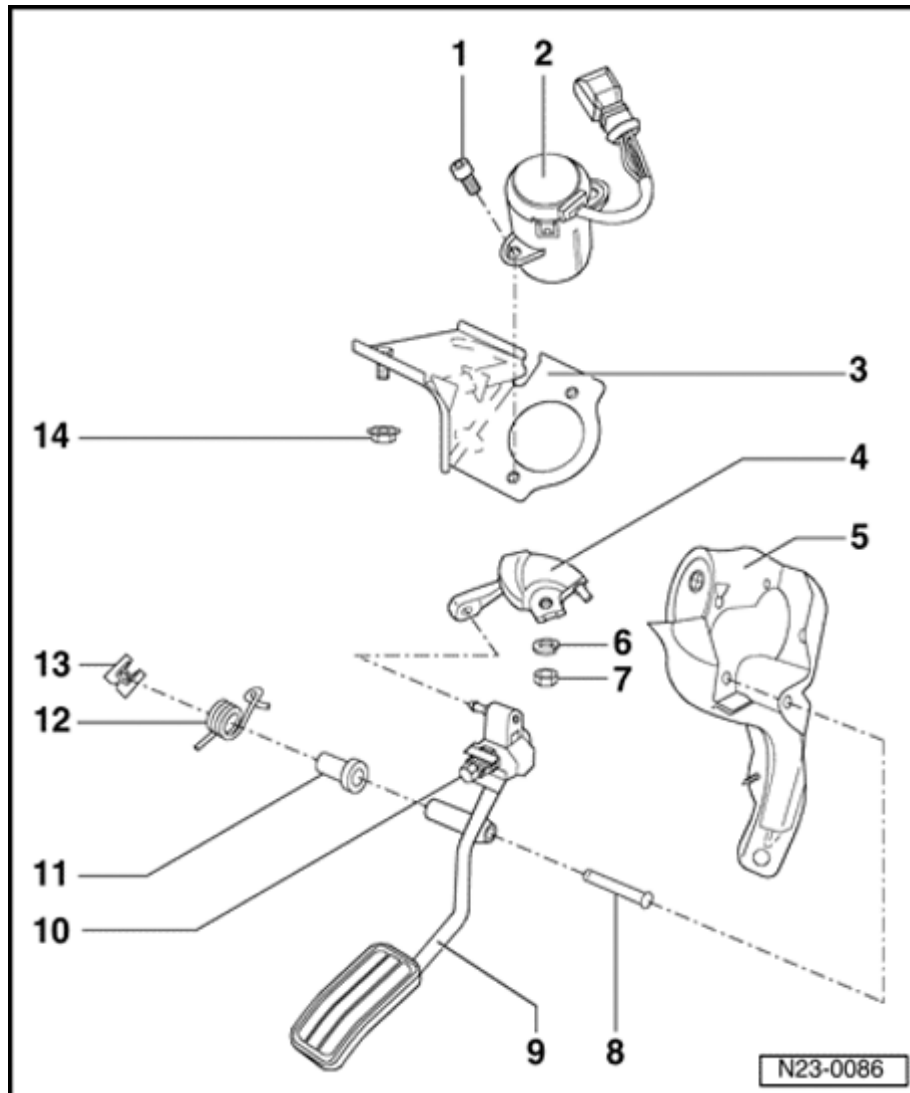
- ◆ Arrow marks direction of flow
- ◆ Do not interchange connections
- ◆ Replace if damaged

### 9 - Gasket

- ◆ Replace if damaged

### 10 - Water drain plug

- ◆ To bleed, remove mounting clip and control valve as a complete assembly (with fuel lines attached)
- ◆ Loosen and allow fluid to drain (approx. 100 cc or 3-4 fl. oz.)



## Accelerator pedal control, servicing

1 - 10 Nm (7 ft lb)

2 - Throttle Position (TP) sensor -G79-

◆ Removing, installing, adjusting ⇒ [page 23-15](#)

3 - Bracket

4 - Cable cam

5 - Mounting pedestal

6 - Spring washer

7 - 10 Nm (7 ft lb)

8 - Pivot pin

9 - Accelerator pedal

10 - Adjustment bolt

11 - Bushing

12 - Torsion spring

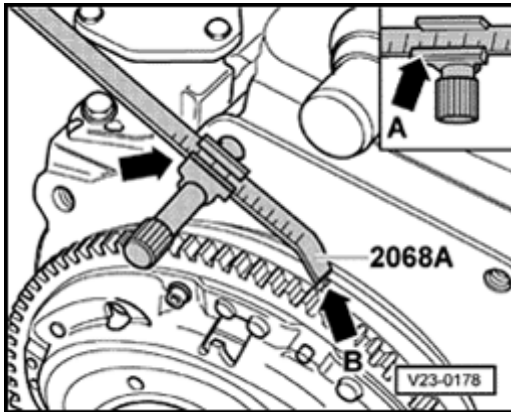
13 - Circlip

14 - 20 Nm (15 ft lb)



## Cylinder 1 at Top Dead Center (TDC), setting

(Engine removed)



A

- Attach adjusting gauge 2068A as shown.
- Set adjusting gauge to 96.0 mm.  
Refer to marking on left of vernier scale (arrow -A-).
- Rotate crankshaft until TDC mark on flywheel is aligned with tip of adjusting gauge (arrow -B-).



## Throttle Position (TP) sensor, removing, installing and adjusting

### Special tools, testers and auxiliary items

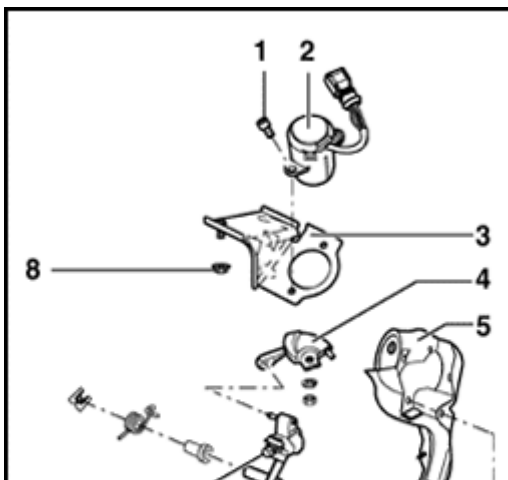
- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- Box wrench, e.g. Hazet 4561

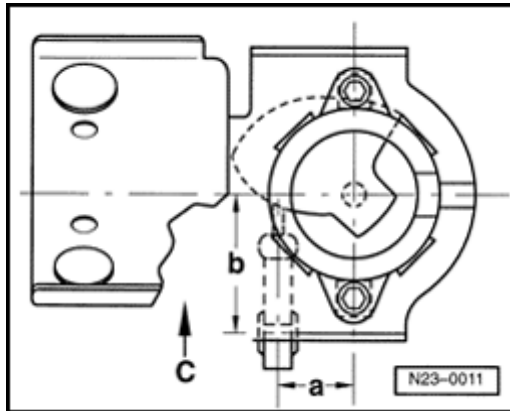
### Removing

- Remove instrument panel and pedal cluster cover.
- Remove accelerator pedal -6-.
- Remove throttle position sensor -2- with bracket -3-, by removing both mounting nuts -8- with 1/4-in. drive tools.
- Remove cable cam -4- and unscrew sensor from bracket.

### Installing

- Secure throttle position sensor to bracket.
- Attach cable cam to sensor.





A

- Check attachment to make sure that dimensions -a- and -b- are as specified when facing forward (arrow -c-).

$$a = 22 \pm 0.05 \text{ mm (0.866} \pm 0.002 \text{ in.)}$$

$$b = 41 \pm 0.05 \text{ mm (1.614} \pm 0.002 \text{ in.)}$$

#### Note:

*The cable cam eye must be parallel to the forward direction.*

- Install sensor with bracket.
- Install accelerator pedal cable and mount cable cam eye to pin on accelerator pedal.

#### Adjusting

- Connect VAG1551 or VAG1552 scan tool.
- Switch ignition on.
- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01 ⇒ [page 01-9](#) .

Rapid data transfer

HELP

Select function XX

A

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block

HELP

A

Indicated on display

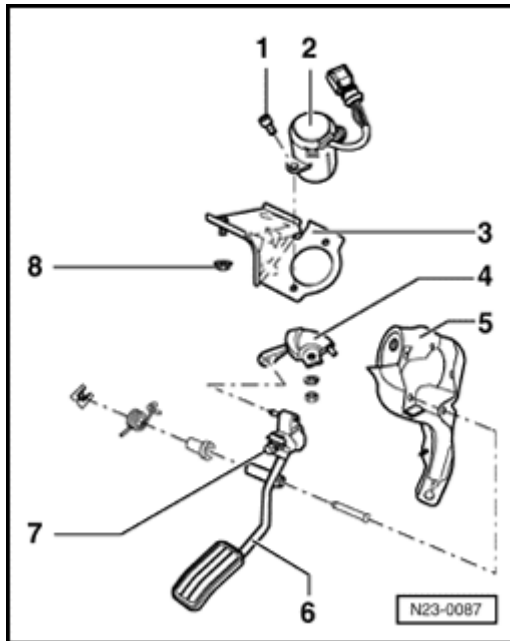
Input display group number XXX

- Press buttons -0-, -0- and -2- to input display group no. 2 (002), and press -Q- button to confirm input.



Read Measuring Value Block 2 →  
0 rpm 0.0 % 0 1 0 18.4 ° C

Read Measuring Value Block 2 →  
0 rpm 0.0 % 0 1 0 18.4 ° C



- Check throttle position in display field 2.
  - ◆ Accelerator pedal not depressed (at rest position)
  - ◆ Specification: 0.0 %



- Fully (slowly) depress accelerator pedal while watching value in display field 2.
  - Throttle position value must increase continuously and then display 100% just before Wide Open Throttle (WOT) stop.

If necessary, adjust throttle position as follows:



- Turn adjustment screw -7- until Closed Throttle Position (CTP) display shows 0.0 %.
- Depress accelerator pedal to point just before Wide Open Throttle (WOT).
  - Display must show 100 %
- Check and erase DTC memory ⇒ [page 01-41](#) .
- Re-create readiness code ⇒ [page 01-47](#) .



## Diesel injection pump, removing and installing

### **WARNING!**

***Fire hazard! Do not have anything in the area that can ignite Diesel fuel.***

### Special tools, testers and auxiliary items

- 2064 lock pin
- 2065A setting bar
- 3032 puller
- 3035 injector line wrench
- V159 pin wrench
- Torque wrench (VAG1331 or equivalent)-5 to 50 Nm (approx. 40 ft lb)

### Removing

- Remove air cleaner and upper toothed belt

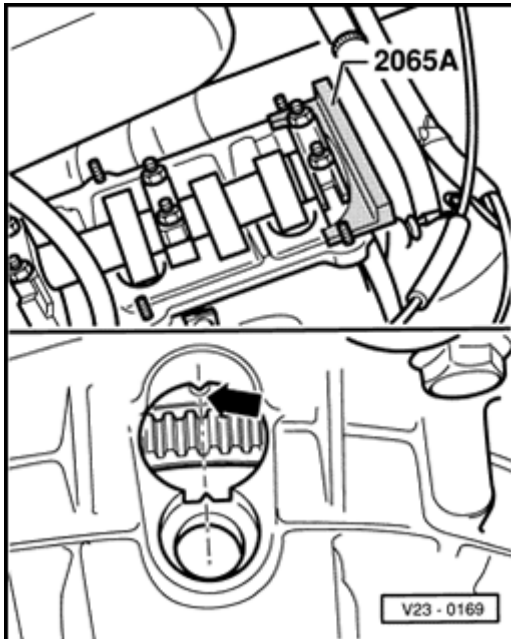
guard.

- Remove cylinder head cover.



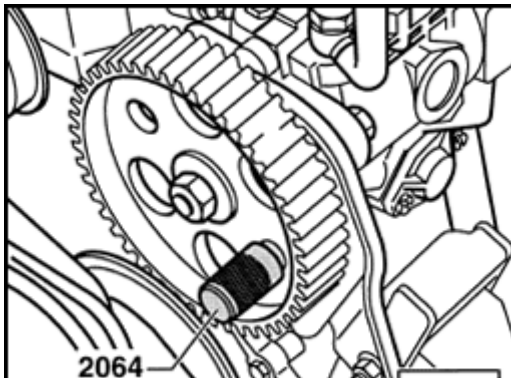
- Rotate crankshaft to TDC for cylinder 1 (arrow).

- Lock camshaft with 2065A setting bar.



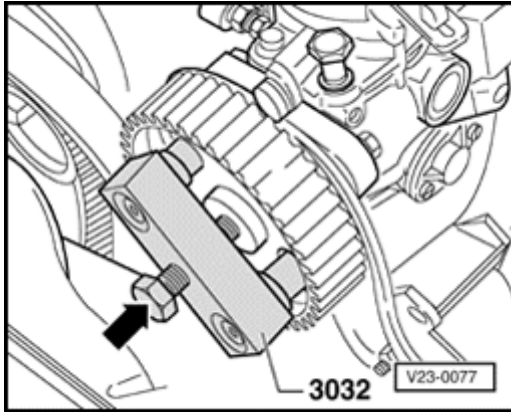


- Position camshaft with 2065A setting bar as follows:
  - Turn camshaft until one end of bar contacts cylinder head, then use feeler gauge to measure gap at other end of bar.
  - Place another feeler gauge (thickness = 1/2 measured gap) between setting bar and cylinder head.
  - Turn camshaft until setting bar contacts feeler gauge, then place another feeler gauge of equal thickness at other side, between setting bar and cylinder head.
- Remove idler roller, remove nut from tensioner roller, and release tension of toothed drive belt.



A

- Remove belt from sprockets, and lock Diesel injection pump sprocket in position using lock pin 2064.
- Remove injection pump sprocket mounting nut.
- Loosen arms of 3032 puller, place arms in position through holes in injection pump sprocket, and tighten.
- Place injection pump sprocket under tension with puller.



A

- Hold onto sprocket and tap lightly on puller spindle to release sprocket from injection pump tapered shaft (arrow).

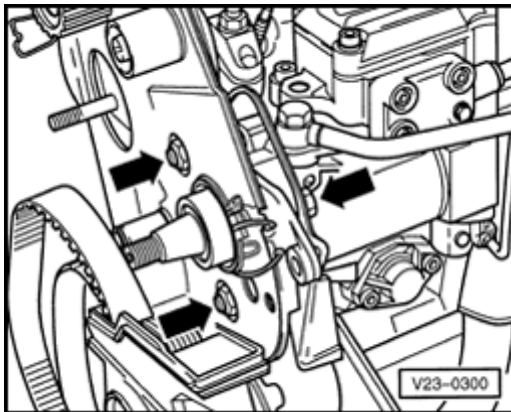


- Unbolt all fuel lines at fuel pump

**Note:**

*Use 3035 tubing wrench to remove high pressure fuel lines.*

- Cover openings with clean lint free cloth
- Disconnect fuel cut-off valve/cold start injector connector.
- Disconnect quantity adjuster harness connector and unclip connector retainer.
- ◀ - Remove mounting bolts from bracket -arrows-



- ◀ - Remove bolt from rear support (arrow).

- Remove Diesel injection pump.

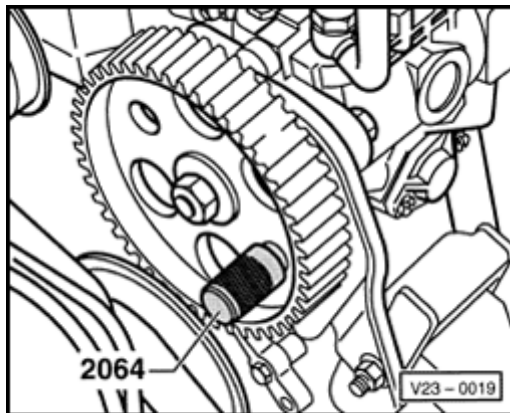


## Installing

- Insert injection pump into bracket and then tighten mounting bolt on rear support with conical nut first.
- Align so injection pump is centered in elongated holes in bracket, and hand-tighten in this position.

### Note:

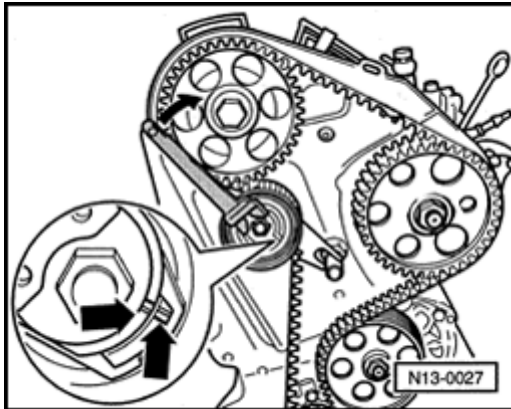
*Adjust start of injection dynamically using VAG1551 scan tool.*



A

- Install injection pump sprocket and lock into position using 2064 lock pin. Make sure spring washer is correctly seated.
- Tighten mounting nut.  
Tightening torque: 55 Nm (41 ft lb)
- Loosen camshaft sprocket mounting bolt 1/2-turn.
- Place drift through hole in rear belt guard, tap carefully with hammer to release sprocket from tapered end of camshaft, and remove camshaft sprocket.
- Check to make sure that TDC mark on flywheel and reference mark on transmission housing are aligned.
- Place belt on injection pump sprocket and tensioner roller.

- Install camshaft sprocket on toothed belt and secure sprocket so camshaft can still turn.
- Install idler roller.



A

- Remove locking pin from injection pump sprocket.
- Adjust toothed belt tension using pin wrench on eccentric (e.g. Matra V159); turn clockwise until notch and raised mark (arrows) are aligned.
- Tighten mounting nut.  
Tightening torque: 20 Nm (15 ft lb)
- Check TDC mark on flywheel again.
- Tighten camshaft sprocket mounting bolt.  
Tightening torque: 45 Nm (33 ft lb)
- Remove 2065A setting bar from camshaft.
- Fill injection pump with clean Diesel fuel through return line union.  
New pump fill quantity: 180 ml minimum
- Re-connect injector lines, fuel lines and wiring.
- Install belt guard, cylinder head cover and air cleaner.
- Dynamically check start of injection and adjust if necessary.

⇒ [page 23-23](#)

- Check and erase DTC memory ⇒ [page 01-41](#) .
- Re-create readiness code ⇒ [page 01-47](#) .



## Start of injection, dynamically checking and adjusting

Dynamically checking and correcting start of injection is only possible using "Basic Setting" scan tool function 04.

### **Note:**

*Start of injection must always be checked and adjusted after:*

- ◆ *Replacing the toothed belt*
- ◆ *Loosening the Diesel injection pump mounting bolts*
- ◆ *Loosening the toothed belt sprockets*

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

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- 3035 injector line wrench

- Torque wrench (VAG1331 or equivalent)-5 to 50 Nm (approx. 40 ft lb)



## Checking and adjustment conditions

- Mechanical engine basic settings OK
- Toothed belt tension OK

## Checking

- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .
- Start engine and let idle.
- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Rapid data transfer  
Select function XX

HELP



Indicated on display

- Press buttons -0- and -4- to select "Basic Setting" function 04.
- Press -Q- button to confirm input.

Basic Setting  
Input display group number XXX

HELP



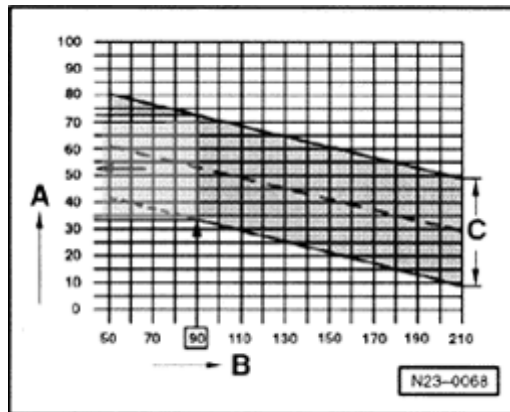
Indicated on display

- Press -0- button three times to input display group no. 0 (000).
- Press -Q- button to confirm input.



System in Basic Setting →

1 2 3 4 5 6 7 8 9 10



↖ Indicated on display (1-10 = display fields)

**Note:**

*The start of injection value in display field 2 varies depending on the fuel temperature value in display field 9.*

↖ A - Display field 2-Start of injection value  
 B - Display field 9-Fuel temperature value  
 C - Specified range for start of injection  
 (depending on fuel temperature)

Example:

The fuel temperature value "B" in display field 9 (e.g. 90) corresponds to the start of injection value "A" in display field 2, which should fall within the range "C" between 34 and 73.

**Notes:**

- ◆ *If, when checking the start of injection, the results fall within zone -C-, no adjustment is required.*
- ◆ *After repairs e.g. removing and installing Diesel injection pump, set the start of injection to the mean value (dashed line) of the specified zone -C-.*
- ◆ *If the start of injection is too far advanced, adjust by turning the injection pump in the direction of engine rotation.*

- ◆ *If start of injection is too far retarded, adjust by turning the injection pump against the direction of engine rotation.*



- Loosen Diesel injection pump mounting bolts approx. 1 turn, but leave easiest-to-reach bolt until last.
- Hold injection pump under tension by hand, in direction to be adjusted.
- Carefully loosen last mounting bolt until injection pump can just be turned slightly, then re-tighten last mounting bolt.
- Check values in scan tool display field 2; if necessary adjust again until display equals mean value for specified range -C-.
- Tighten injection pump mounting bolts.  
  
Tightening torque: 25 Nm (18 ft lb)
- Check start of injection again.
- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06.

- Press -Q- button to confirm input.

**Note:**

*Loosen and re-tighten the injector lines on the injection pump (25 Nm, 18 ft lb) after it has been dynamically adjusted. This relieves any line strain and prevents damage due to vibration.*

- Check and erase DTC memory ⇒ [page 01-41](#) .
- Re-create readiness code ⇒ [page 01-47](#) .



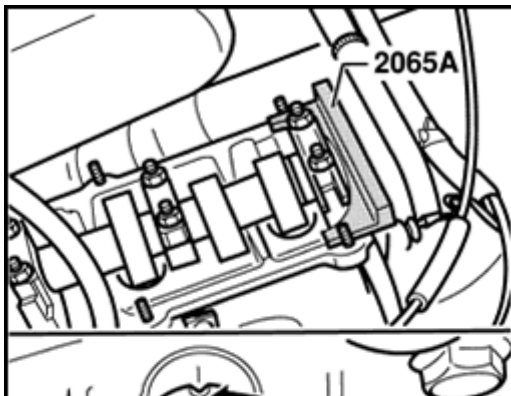
## Valve timing, checking

### Special tools, testers and auxiliary items

- 2064 lock pin
- 2065A setting bar
- Torque wrench (VAG1331 or equivalent)-5 to 50 Nm (approx. 40 ft lb)

### Checking

- Remove upper toothed belt guard and cylinder head cover.
- Check toothed belt tension.



A

- Rotate crankshaft to TDC for cylinder 1 (arrow).
- Setting bar 2065A must fit into slot in camshaft.

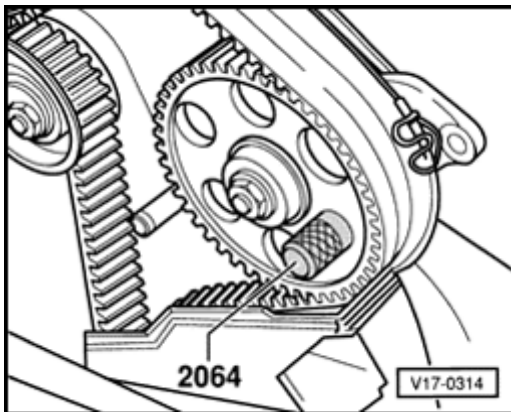
If not, adjust valve timing as follows:

- Rotate camshaft until setting bar can be inserted.
- Position camshaft with 2065A setting bar:

- Turn camshaft until one end of bar contacts cylinder head, then use feeler gauge to measure gap at other end of bar.
- Place another feeler gauge (thickness =  $1/2$  measured gap) between setting bar and cylinder head.

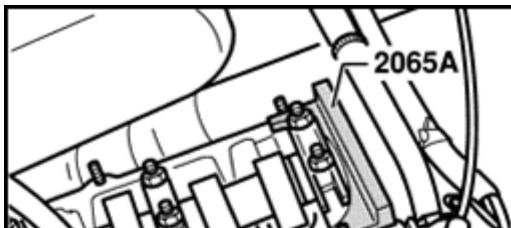


- Turn camshaft until setting bar contacts feeler gauge, then place another feeler gauge of equal thickness at other side, between setting bar and cylinder head.
- Loosen camshaft sprocket mounting bolt one-half turn.
- Place drift through hole in rear belt guard, and use hammer to release sprocket from tapered camshaft with careful tap.



A

- Lock Diesel injection pump sprocket using pin 2064



A

- Check to make sure that TDC mark on flywheel and reference mark on transmission housing are aligned (arrow).

If markings do not align, set crankshaft to TDC for cylinder 1.

- Remove locking pin.
- Tighten camshaft sprocket mounting bolt.  
Tightening torque: 45 Nm (33 ft lb)
- Remove setting bar from camshaft.
- Dynamically check start of injection ⇒ [page 23-23](#) .
- Check and erase DTC memory ⇒ [page 01-41](#) .
- Re-create readiness code ⇒ [page 01-47](#) .



## Fuel injectors, removing and installing

### **WARNING!**

***Fire hazard! Do not have anything in the area that can ignite Diesel fuel.***

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

- 3035 injector line wrench
- Torque wrench (VAG1331 or equivalent)-5 to 50 Nm (approx. 40 ft lb)

### **Notes:**

*Faulty fuel injectors can cause the following malfunctions:*

- ◆ *Misfiring*
- ◆ *Knocking in one or more cylinders*
- ◆ *Engine over-heating*
- ◆ *Loss of power*

- ◆ *Excessive black exhaust smoke*
- ◆ *Higher fuel consumption*
- ◆ *Excessive blue smoke when starting from cold*

*Faulty injectors can be isolated by loosening the high pressure union for each injector in sequence, with the engine running at high idle. If engine speed remains constant after loosening a particular fuel line union, then that fuel injector is faulty.*



## Removing

- Remove fuel injection lines with 3035 injector line wrench.

### **Note:**

*Always remove injector lines as a complete set. Do not bend or otherwise alter the shape of the fuel lines.*

- Remove mounting nut, take off retainer, and remove fuel injector.

## Installing

### **Note:**

*Always replace the heat shield located between the cylinder head and each of the fuel injectors.*

- Insert fuel injector.
- Make sure that mounting is seated correctly in cylinder head.
- Install retainer.

Tightening torques:

◆ Injector lines: 25 Nm (18 ft lb)

◆ Retainer nut: 20 Nm (15 ft lb)

- Check and erase DTC memory ⇒ [page 01-41](#) .

- Re-create readiness code ⇒ [page 01-47](#) .



## Fuel injectors, servicing

### **WARNING!**

***Fire hazard! Do not have anything in the area that can ignite Diesel fuel.***

This engine is equipped with dual-spring injectors, which means that injection occurs in 2 stages. These injectors must be replaced if malfunctions occur, because neither servicing nor pressure adjustment is possible.

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

- VAG1322 fuel injector test stand

### **Test conditions**

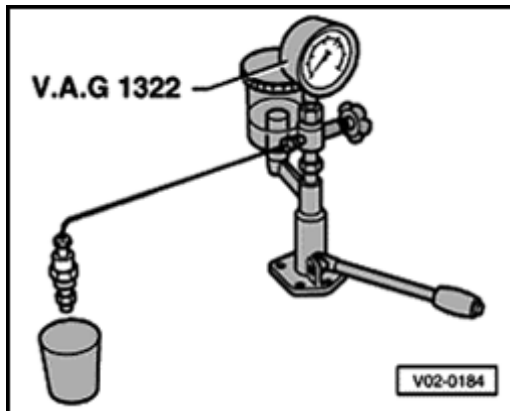
- Pressure gauge installed

### **Checking injector pressure**

### **WARNING!**

***When testing fuel injectors, make sure that the stream of fuel does not contact the hands or any other bare skin. The fuel (expelled under high pressure) can penetrate the skin, and this could cause severe injuries or health***

*complications.*



A

- Connect fuel injector to injector test stand.
- Move pump lever down slowly to increase pressure.
- Read opening pressure when spray begins.
  - ◆ Specification (new): 190 to 200 bar (2750-2900 psi)
  - ◆ Wear limit: 170 bar (2465 psi)

If injector opening pressure is not as specified:

- Replace that fuel injector.

### Leak checking

- Pressure gauge connected
- Move pump lever down slowly to maintain steady pressure of approx. 150 bar (2175 psi) for 10 seconds.
- No fuel should leak from injector nozzle
- Replace any leaking injectors.



## Timing control cover O-ring, replacing

### **WARNING!**

**Fire hazard! Do not have anything in the area that can ignite Diesel fuel.**

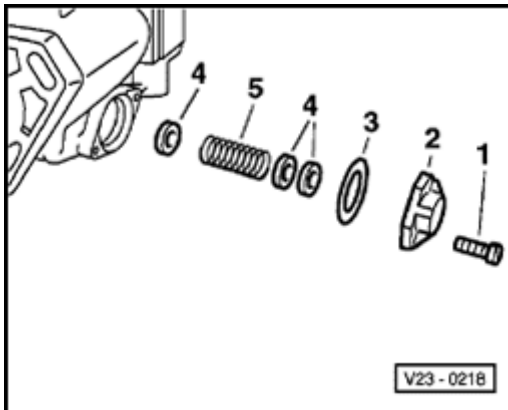
- Place clean cloth under Diesel injection pump.

- Remove cover screws -1-.

Use commercially available tool for Torx<sup>®</sup> socket-head screws, e.g. Hazet 2115-T30

- Remove cover -2- and carefully clean.

- Replace O-ring -3- and install cover using existing shims -4-.





## Wiring and component checks, using VAG1598/18 test box

### **WARNING!**

**To guard against damage to electronic components:**

- ◆ **Be sure ignition is switched off, and the correct measuring range is selected before connecting test leads!**
- ◆ **Always observe test conditions and requirements!**

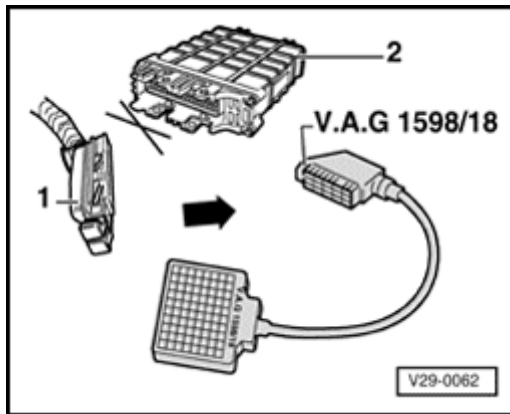
### **Notes:**

- ◆ *Use the Fluke 83 multimeter and VAG1527B voltage tester, or equivalent, for the following checks.*
- ◆ *The specifications listed are valid for ambient temperatures between 0° and +40° C (32° and 104° F).*
- ◆ *If measurements deviate only slightly from specified values, clean test equipment sockets and connectors, then repeat the tests. Before*

*replacing any component, check wiring and connections, particularly when a specified resistance value is less than 10 ohms ( W), and repeat the measurement.*

◆ *Make test box connections using adapters from the VW1594 connector test kit.*

◆ *Terminal numbers for vehicle connectors and the test box sockets are identical.*



- With ignition off, disconnect harness connector -1- from Diesel DFI ECM -2-, and connect test box to harness connector.
- Check as described by appropriate repair procedure.



## Engine speed (RPM) sensor, checking

The RPM sensor provides an engine speed signal. If the sensor fails, the engine continues to run using a back-up program. The signal from needle lift sensor -G80- is used as a substitute.

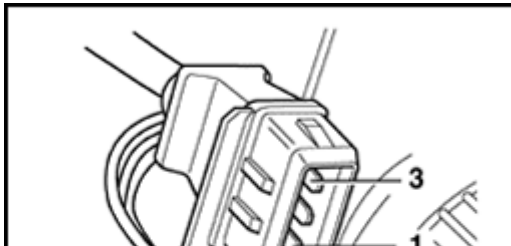
### Special tools, testers and auxiliary items

- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test sequence

- Switch ignition off.
- Disconnect RPM sensor harness connector ( ⇒ [page 23-5](#) ), connect multimeter, and check resistance between harness connector terminals 1 and 2.

Specification: 1000 to 1500 ohms ( $\Omega$ )



A

If resistance is not as specified:

- Replace engine speed sensor -G28-

⇒ Repair Manual, 1.9 Liter Turbo Diesel General, Engine (engine code AHU), Repair Group 13.

- Display readiness code ⇒ [page 01-43](#) .

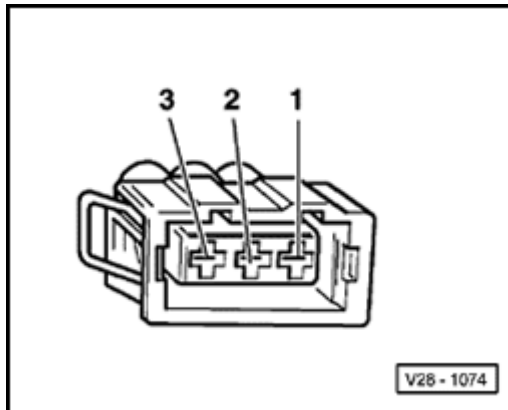


If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .

If resistance is OK:

- Connect VAG1598/18 test box to Diesel DFI ECM harness connector ⇒ [page 23-34](#) .



A

- Check wiring for open circuit between 3-pin connector and test box, using wiring diagram:
  - ◆ Terminal 1 + test box socket 33
  - ◆ Terminal 2 + test box socket 8
  - ◆ Terminal 3 + test box socket 1
  - ◆ Wire resistance: 1.5 ohms ( $\Omega$ ) maximum
- Check wiring for short circuit between terminals at 3-pin connector, using wiring diagram.

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

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## Manifold Absolute Pressure (MAP) and barometric pressure (BARO) sensors, checking

Both pressure sensors are located inside the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM).

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1397A turbocharger tester

### Test sequence

- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .
- Switch ignition on (but do not start engine).
- Press buttons -0- and -1- to insert "Engine Electronics" address word 01.



Select function XX

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Read Measuring Value Block      HELP



Indicated on display

Input display group number XXX

- Press buttons -0-, -1- and -0- to select display group no. 10 (010).



Read Measuring Value Block 10 →

0 mg/H 1027 mbar 1013 mbar 0.0 %



- Press -Q- button to confirm input.

- Compare values in display field 2 (BARO sensor -F96-) and display field 3 (MAP sensor -G71-).

Specification: pressures equal ( $\pm 30$  mbar)

If pressures are not equal (as specified):

- Compare scan tool values with pressure measured using VAG1397A turbocharger tester.

Specification: pressures equal ( $\pm 30$  mbar)

If value in display field 3 deviates:

- Disconnect pressure hose from Diesel DFI ECM.

If value in display field 3 still deviates:

- Press → button.

- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.

- Switch ignition off.

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .

- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



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## Engine Coolant Temperature (ECT) sensor, checking

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test sequence

- Connect VAG1551 or VAG1552 scan tool.

⇒ [page 01-9](#) .

- Start engine and let idle.

Rapid data transfer

HELP

Select function XX



- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.



Read Measuring Value Block HELP

Input display group number XXX

Read Measuring Value Block 7 →

15.4 °C      15.9 °C 16.7 °C



Indicated on display

- Press buttons -0-, -0- and -7- to input display group no. 7 (007).
- Press -Q- button to confirm input.



- Indicated on display

- Check ECT value in display field 4.

Value must increase uniformly and without interruption

**Note:**

*If the ECT sensor malfunctions, the fuel temperature sensor values are substituted to provide a back-up.*

If an unreasonable value appears in display field 4, or the fuel temperature has been supplied as a substitute, check the ECT sensor and wiring connections to the sensor as follows:

- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.
- Switch ignition off.

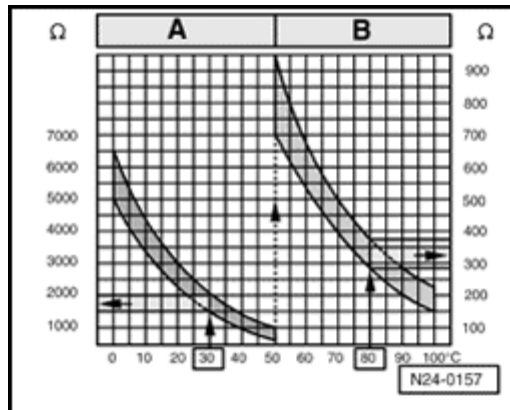




- Disconnect harness connector from ECT sensor -1-.



- Measure resistance between sensor terminals 1 and 3.



A

- ◆ Specifications: refer to diagram for resistance values
- ◆ Scale A: for temperatures 0 ° -50 ° C (32 ° -122 ° F)
- ◆ Scale B: for temperatures 50 ° -100 ° C (122 ° -212 ° F)

Examples:

- ◆ 30 ° C (86 ° F) corresponds to 1500-2000 ohms (Ω) resistance
- ◆ 80 ° C (176 ° F) corresponds to 275-375ohms (Ω) resistance

If resistance is outside the specified range:

- Replace engine coolant temperature sensor -G62-.
- Display readiness code ⇒ [page 01-43](#) .

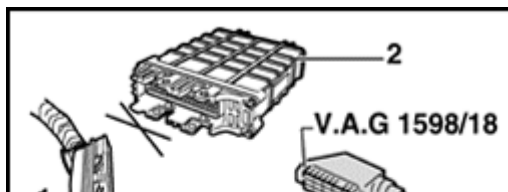
If DTC memory was erased:

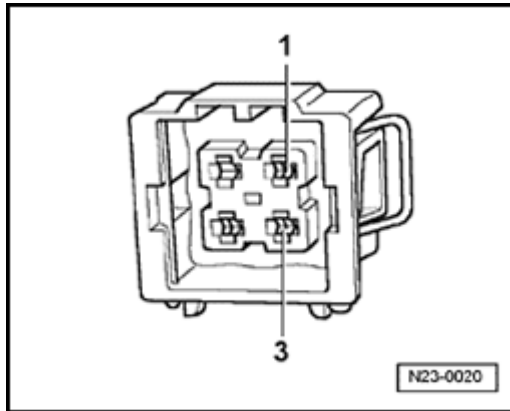
- Create readiness code again ⇒ [page 01-47](#) .

If resistance is OK:

A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.





A

- Check wiring for open circuit between 4-pin connector and test box, using wiring diagram.
  - ◆ Terminal 1 + test box socket 33
  - ◆ Terminal 3 + test box socket 14
  - ◆ Wire resistance: 1.5 ohms ( $\Omega$ ) maximum
- Check wiring for short circuit between terminals at 4-pin connector.  
Specification:  $\infty \Omega$  (no continuity)

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Check and erase DTC memory ⇒ [page 01-41](#) .

**Note:**

*Disconnecting the engine coolant temperature sensor always generates a DTC, which must be erased.*



## **Brake light switch and brake vacuum vent valve switch, checking**

Because the Diesel injection system uses a throttle position sensor that could malfunction, for reasons of safety, the engine is regulated when the brakes are applied. The Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) requires signals from the brake light switch and the brake vacuum vent valve switch for this function.

If the brakes are operated while the accelerator pedal remains in a constant position, engine speed is immediately reduced to idle. Incorrectly adjusted switches could lead to unnecessary control.

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

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)

- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### **Test sequence**

- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .



- Switch ignition on.

- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Rapid data transfer  
Select function XX

HELP



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.

- Press -Q- button to confirm input.

Read Measuring Value Block  
Input display group number XXX

HELP



Indicated on display

- Press buttons -0-, -0- and -6- to input display group no. 6 (006).

- Press -Q- button to confirm input.

- Check value in display field 2.

Read Measuring Value Block 6  
0 km/h 0 0 0 000000 255



Specified display: 0 0 0

- ◆ Center display element = Brake vacuum vent valve switch

- ◆ Right display element = Brake light switch

- Press brake pedal slowly.

Read Measuring Value Block 6  
0 km/h 0 1 1 000000 255



Specified display: 0 1 1

**Note:**

*Both display elements must change from "0" to "1" at the same time.*



Read Measuring Value Block 6 →

0 km/h 0 0 0 000000 255

- Release brake pedal slowly into rest position again

A

Both display elements must change from "1" to "0" again.

If one or both elements do not change:

- Adjust brake vacuum vent valve switch activation point by turning switch.
- Adjust brake light switch activation point by moving plunger.

If center display element does not change:

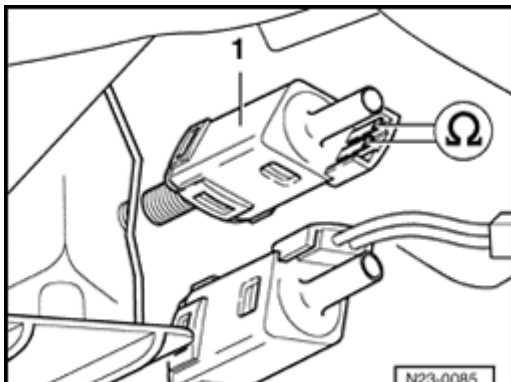
- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Switch ignition off.

A

- Disconnect harness connector from brake vacuum vent valve switch -1-.
- Measure resistance across switch terminals.

Specifications:

- ◆ Brake pedal not depressed: less than 10 ohms ( $\Omega$ )
- ◆ Brake pedal depressed:  $\infty \Omega$  (no continuity)



N23-0085

If resistance is not as specified:

- Replace brake vacuum vent valve switch -F47-.



- Display readiness code ⇒ [page 01-43](#) .

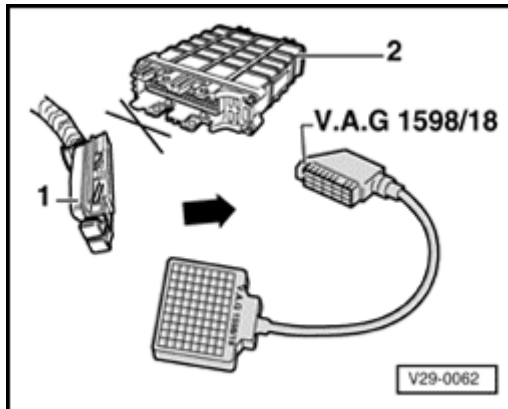
If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .

If resistance values are OK:

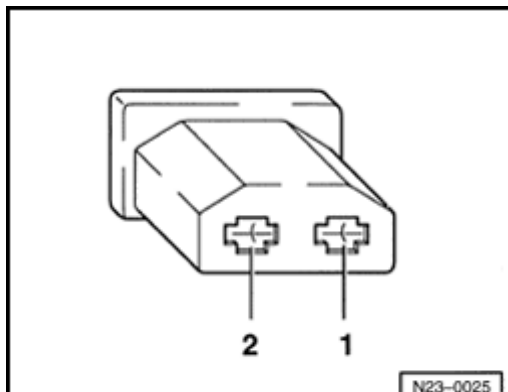
A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check wiring for open circuit between test box and harness connector, using wiring diagrams:
  - ◆ Terminal 1 and test box socket 20
  - ◆ Terminal 2 and test box socket 33
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.



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

If the right display element in display field 2 (brake light switch) does not change:

- Press  $\rightarrow$  button.



- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Switch ignition off.
- Switch multimeter to 20 volt range.
- Connect multimeter using adapters from VW1594 connector test kit, and check voltage between test box sockets 1 and 44.

Specifications:

- ◆ Brake pedal not depressed: 0 (no voltage)
- ◆ Brake pedal depressed: approx. battery voltage (B+)

If there is no voltage:

- Check brake lights.

If the brake lights are OK:

- Check wiring to brake light switch for open or

short circuit, using wiring diagrams.

If the brake lights do not come on:

- Replace brake light switch -F-.
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## Clutch vacuum vent valve switch, checking

The clutch vacuum vent valve switch -F36- signal provides the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM) with information about clutch engagement. This signal is used to provide smoother disengaging and engaging, and to prevent the engine racing when cruise control is in use.

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test sequence

Rapid data transfer  
Select function XX

HELP



- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .
- Switch ignition on.
- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Indicated on display



Read Measuring Value Block    HELP  
Input display group number XXX



- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.

Indicated on display

Read Measuring Value Block 6    →  
0 km/h 0 0 0 000000 255



- Press buttons -0-, -0- and -6- to input display group no. 6 (006), and press -Q- button to confirm input.
- Check value in display field 2.

Specification: 0 0 0

- Depress clutch pedal.

Read Measuring Value Block 6    →  
0 km/h 1 0 0 000000 255



Specification: 1 0 0 (left display element must change to 1)

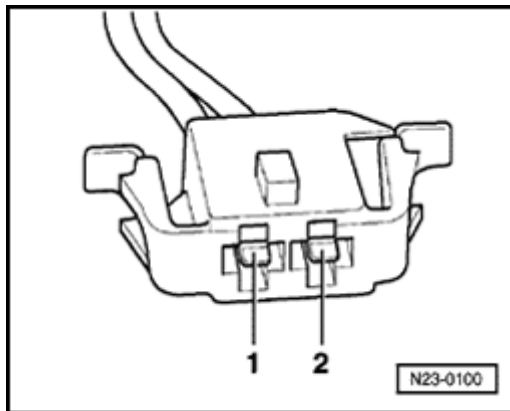
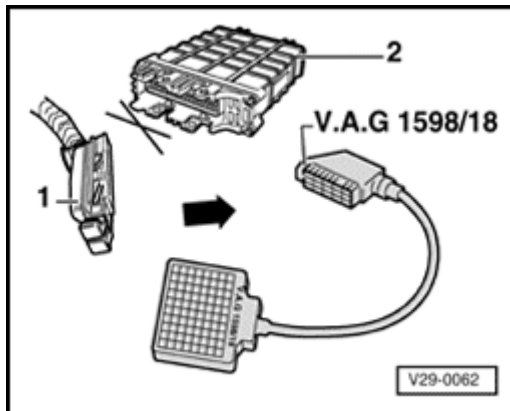
If left display element does not change:

- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06, and press -Q- button to confirm input.
- Switch ignition off.
- Disconnect harness connector from clutch vacuum vent valve switch ⇒ [page 23-4](#) .



- Measure resistance across switch terminals. Specifications:

- ◆ Clutch pedal not depressed: max. 10 ohms ( $\Omega$ )
- ◆ Clutch pedal depressed:  $\infty \Omega$  (no continuity)



If resistance is not as specified:

- Replace clutch vacuum vent valve switch -F36-.
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .

If resistance values are OK:



- Connect VAG1598/18 test box to Diesel DFI ECM connector.
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



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## Intake Air Temperature (IAT) sensor, checking

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations

### Test sequence

- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .
- Start engine and let idle.

Rapid data transfer

HELP

Select function XX



- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.
- Press -Q- button to confirm input.



Read Measuring Value Block    **HELP**  
 Input display group number XXX



Indicated on display

- Press buttons -0-, -0- and -7- to input display group no. 7 (007).
- Press -Q- button to confirm input.

Read Measuring Value Block 7    **→**

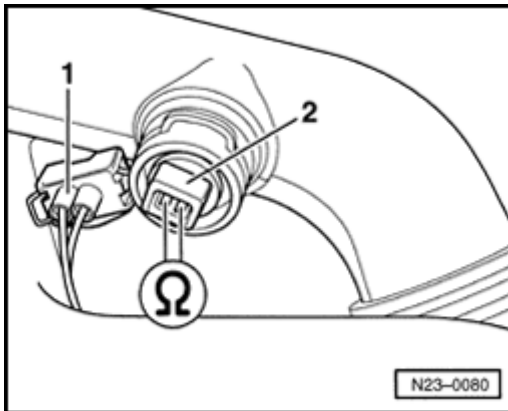
15.4 ° C 15.9 ° C 16.7 ° C



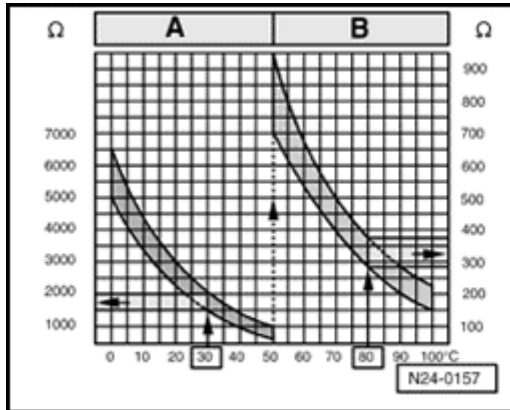
- Indicated on display

If an implausible value appears in display field 3, or a substitute value of 136.8 ° C is displayed, check intake air temperature sensor and sensor wiring:

- Press **→** button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.
- Switch ignition off.



- Disconnect harness connector -1- from intake air temperature sensor -2-.



A

- Measure resistance across sensor terminals.

- ◆ Specifications: refer to diagram for resistance values
- ◆ Scale A: for temperatures 0 ° -50 ° C (32 ° -122 ° F)
- ◆ Scale B: for temperatures 50 ° -100 ° C (122 ° -212 ° F)

Examples:

- ◆ 30 ° C (86 ° F) corresponds to 1500-2000 ohms (Ω) resistance
- ◆ 80 ° C (176 ° F) corresponds to 275-375ohms (Ω) resistance

If resistance is outside the specified range:

- Replace Intake Air Temperature (IAT) sensor -G72-.
- Display readiness code ⇒ [page 01-43](#) .

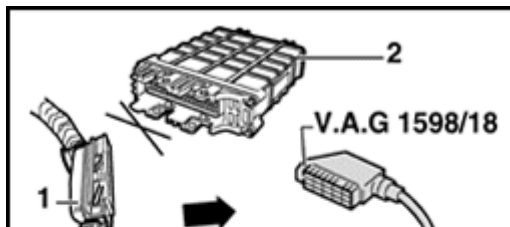
If DTC memory was erased:

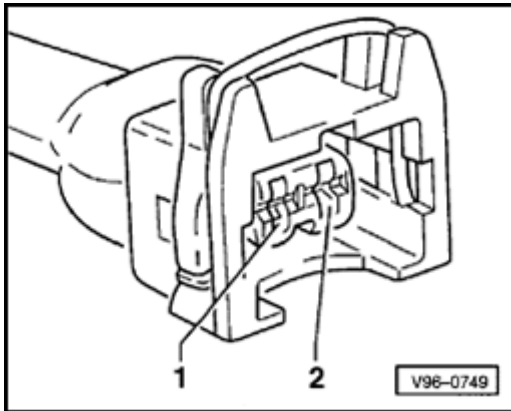
- Create readiness code again ⇒ [page 01-47](#) .

If resistance is OK:

A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.





A

- Check wiring for open circuit between test box and harness connector, using wiring diagrams:
  - ◆ Terminal 1 and test box socket 64
  - ◆ Terminal 2 and test box socket 33
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## TDI system current supply, checking

### Special tools, testers and auxiliary items

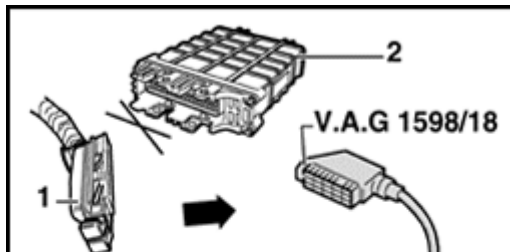
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test requirements

- Battery voltage OK

### Checking

- Switch ignition off.
- Connect VAG1598/18 test box to Diesel DFI ECM connector.
- Bridge sockets 42 and 46 using adapters from VW1594 connector test kit.





- Measure voltage between test box sockets:

- ◆ 45 and 1
- ◆ 68 and 1
- ◆ 23 and 1
- ◆ 23 and 24
- ◆ Specification: approx. battery voltage (B+)

If voltage is not OK:

- Check power supply (terminal 30. B+) relay - J317- at terminal 30.
- Check wiring connections for open circuit, short circuit and contact resistance at terminals, using wiring diagrams.

If the wiring and the relay are OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .

- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## Fuel temperature sensor, checking

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test sequence

- Connect VAG1551 or VAG1552 scan tool.

⇒ [page 01-9](#)

- Start engine and let idle.

Rapid data transfer

HELP

Select function XX



- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.
- Press -Q- button to confirm input.



Read Measuring Value Block    HELP  
Input display group number XXX

↖ Indicated on display

- Press buttons -0-, -0- and -7- to input display group no. 7 (007).
- Press -Q- button to confirm input.

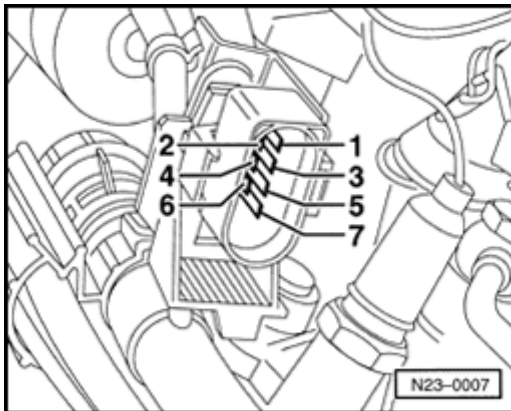
Read Measuring Value Block 7    →

15.4 °C 15.9 5C 16.7 °C

↖ - Indicated on display

If an implausible value appears in display field 1, or a substitute value of -5.4 °C is displayed, check fuel temperature sensor and sensor and wiring:

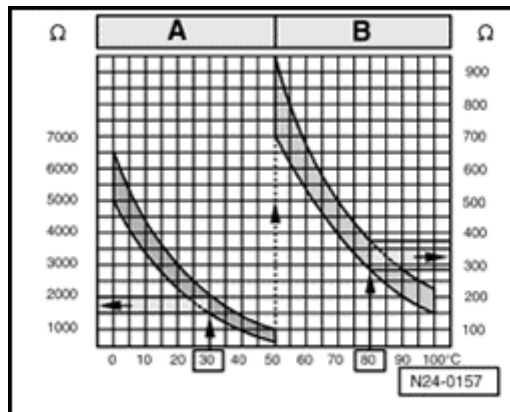
- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.
- Switch ignition off.



↖ - Disconnect fuel temperature sensor harness connector (connection to Diesel injection pump metering control).



- Measure sensor resistance at terminals 4 and 7
- Measure resistance across sensor terminals 4 and 7.



A

- ◆ Specifications: refer to diagram
- ◆ Scale A: for temperatures 0 ° -50 ° C (32 ° -122 ° F)
- ◆ Scale B: for temperatures 50 ° -100 ° C (122 ° -212 ° F)

Examples:

- ◆ 30 ° C (86 ° F) corresponds to 1500-2000 ohms ( $\Omega$ ) resistance
- ◆ 80 ° C (176 ° F) corresponds to 275-375ohms ( $\Omega$ ) resistance

If resistance is outside the specified range:

- Replace diesel fuel injection pump ⇒ [page 23-18](#) .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

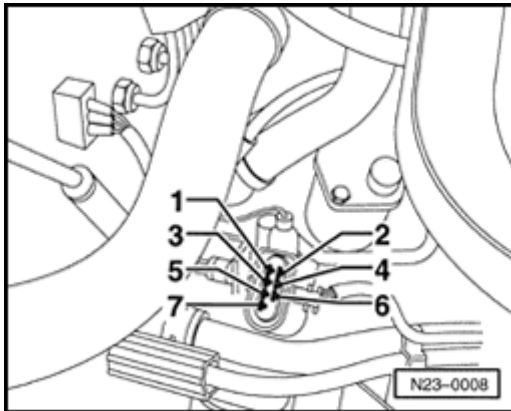
- Create readiness code again ⇒ [page 01-47](#) .

If resistance is OK:





- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check wiring for open circuit between test box and harness connector, using wiring diagrams:
  - ◆ Terminal 7 and test box socket 63
  - ◆ Terminal 4 and test box socket 33
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## **Modulating piston displacement sensor and quantity adjuster, checking**

The quantity adjuster -N146- is an electro-magnetic positioner, controlled by the Diesel Direct Fuel Injection (DFI) ECM via duty cycle (on-off ratio). The eccentric shaft on the quantity adjuster moves the modulating piston (on the high-pressure piston), regulating the amount of fuel injected.

The modulating piston displacement sensor provides the ECM with information on quantity adjuster position, and the ECM then calculates the required amount of fuel for injection.

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

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit

- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### **Checking**

- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .
- Start engine and let idle



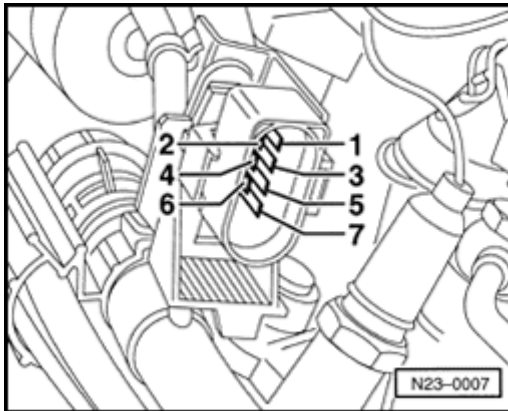
<p>Rapid data transfer      HELP Select function XX</p>		<p>- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.</p>
<p>Read Measuring Value Block      HELP Input display group number XXX</p>		<p>Indicated on display</p> <p>- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.</p>
<p>Read Measuring Value Block 1      → 840 rpm 6.5 mg/H 1.480 V 87.3 °C</p>		<p>Indicated on display</p> <p>- Press buttons -0-, -0- and -1- to input display group no. 1 (001), and press -Q- button to confirm input.</p> <p>- Check engine coolant temperature value in display field 4. Specification: at least 85 °C</p>
<p><b>Note:</b></p> <p><i>Continue only when temperature display is as specified.</i></p>		
<p>Read Measuring Value Block 1      → 840 rpm 6.5 mg/H 1.480 V 87.3 5C</p>		<p>- Check voltage supply value in display field 3 (for modulating piston displacement sensor). Specification: 1.250 to 1.750 volts</p>
<p>If voltage is not as specified:</p>		

- Check modulating piston displacement sensor ⇒ [page 23-63](#) .
- Check quantity adjuster ⇒ [page 23-65](#) .



## Modulating piston displacement sensor, checking

- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.
- Switch ignition off.



A

- Disconnect fuel temperature sensor harness connector (connection to fuel pump quantity adjuster).
- Measure resistance across connector terminals 1 and 2, and terminals 2 and 3.

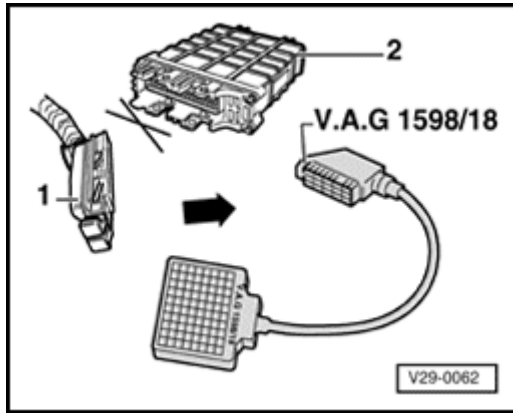
Specification: 5 to 7 ohms ( $\Omega$ )

If resistance is not as specified:

- Replace diesel fuel injection pump ⇒ [page 23-18](#) .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

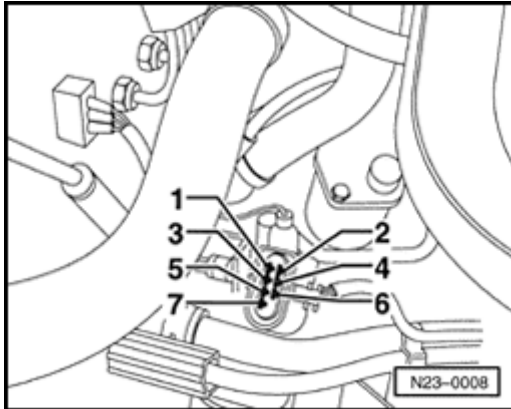
- Create readiness code again ⇒ [page 01-47](#) .



If resistance is OK:



- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check wiring for open circuit between test box and harness connector, using wiring diagrams:
  - ◆ Terminal 1 and test box socket 29
  - ◆ Terminal 2 and test box socket 7
  - ◆ Terminal 3 and test box socket 52
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

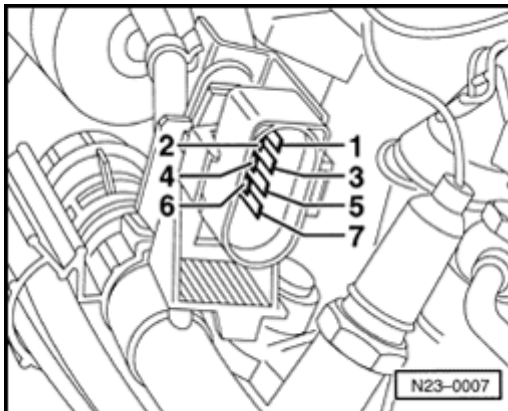
If DTC memory was erased:

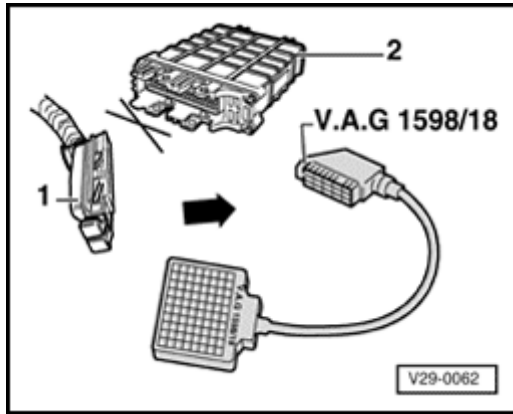
- Create readiness code again ⇒ [page 01-47](#) .



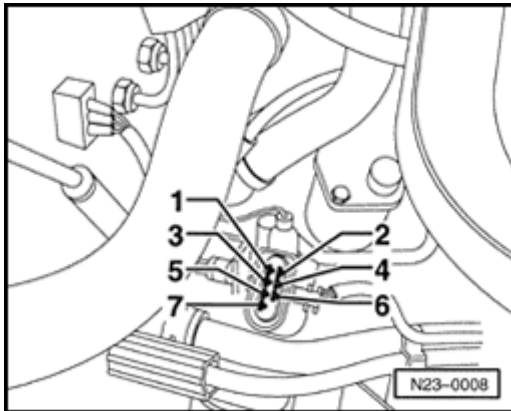
### Quantity adjuster, checking

- Press → button.
  - Press buttons -0- and -6- to select "End Output" function 06.
  - Press -Q- button to confirm input.
  - Switch ignition off.
  - Disconnect quantity adjuster harness connector (connector to Diesel injection pump quantity adjuster).
  - Measure resistance between connector terminals 5 and 6.  
Specification: 0.5-2.5 ohms ( $\Omega$ )
- If resistance is not as specified:
- Replace diesel fuel injection pump ⇒ [page 23-18](#) .
  - Display readiness code ⇒ [page 01-43](#) .
- If DTC memory was erased:
- Create readiness code again ⇒ [page 01-47](#) .
- If resistance is OK:





- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check wiring for open circuit between test box and harness connector, using wiring diagrams:
  - ◆ Terminal 5 and test box socket 23
  - ◆ Terminal 5 and test box socket 45
  - ◆ Terminal 5 and test box socket 68
  - ◆ Terminal 6 and test box socket 4
  - ◆ Terminal 6 and test box socket 5
  - ◆ Terminal 6 and test box socket 49
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## Needle lift sensor, checking

The needle lift sensor signal determines the start of injection during normal operation by closed-loop control based on RPM, load and temperature. If the sensor malfunctions, control switches to open-loop, based on RPM and load.

### Special tools, testers and auxiliary items

- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test sequence

- Switch ignition off.
- Disconnect harness connector -1- for needle lift sensor.
- Measure resistance across connector terminals.

Specification: 80 to 120 ohms ( $\Omega$ )



A

If resistance is not as specified:

- Replace cyl. 3 injector ⇒ [page 23-9](#) , item 14 .
- Display readiness code ⇒ [page 01-43](#) .



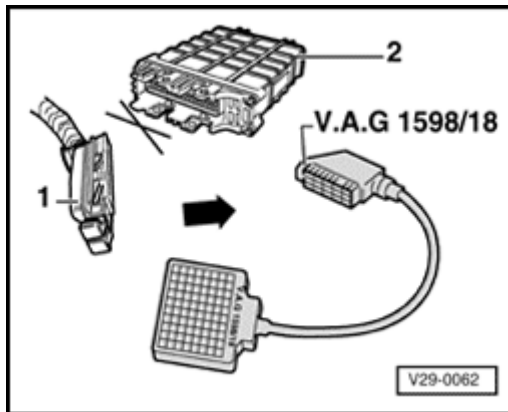
If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .

If resistance is OK:

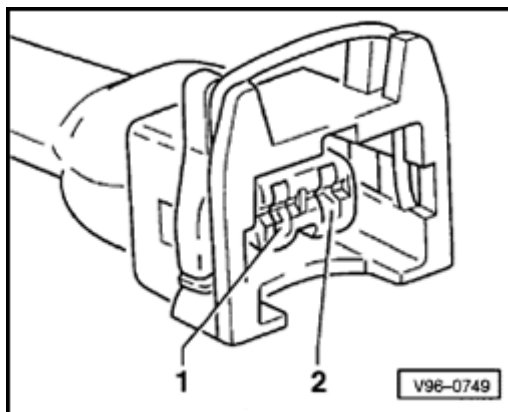
A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check for open circuit between test box and connector:
  - ◆ Terminal 1 and test box socket 12
  - ◆ Terminal 2 and test box socket 11
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)



If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 , and display readiness code ⇒ [page 01-43](#) .
- If DTC memory was erased, create readiness code again ⇒ [page 01-47](#) .



## Quantity adjuster control range, checking

The control range of the fuel injection quantity adjuster can be checked using output Diagnostic Test Mode (DTM) function 03, and "Read Measuring Value Block" function 08. In the output DTM, activate cold start injector -N108-, then exit using the -C- button. With this sequence, the cold start injector continues to be pulsed, and the quantity adjuster control range can be displayed using "Read Measuring Value Block" display group 4.

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit

Electrical Wiring Diagrams, Troubleshooting

- & Component Locations binder



## Checking

- Connect VAG1551 or VAG1552 scan tool ⇒ [page 01-9](#) .
- Start engine and let idle.
- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Rapid data transfer      HELP  
Select function XX



Indicated on display

- Press buttons -0- and -3- to select "Output Diagnostic Test Mode" function 03, and press -Q- button to confirm input.

Rapid data transfer      Q  
03 - Output Diagnostic Test Mode



Indicated on display

### **Note:**

*Individual DTM components are activated for 30seconds. Various work sequences must be carried out with the scan tool within this period as well as reading the displayed values. Read over the following work sequence first to familiarize yourself with the procedure.*

- Press -Q- button to confirm input.

Output Diagnostic Test Mode      →  
Cold Start Injector-N108



Indicated on display

- Press -C- button.
- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.
- Press -Q- button to confirm input.



Read Measuring Value Block    HELP  
Input display group number XXX



Indicated on display

- Press buttons -0-, -0- and -4- to input display group no. 4 (004).
- Press -Q- button to confirm input.

Read Measuring Value Block 4    →  
840 rpm 0.9° BTDC 0.9° BTDC 3 %



Indicated on display

**Note:**

*The displays in display fields 3 and 4 must fluctuate within following control range:*

- Specification display field 3:
  - ◆ Lower range: 1° ATDC to 4.0° BTDC
  - ◆ Upper range: 14.0 to 17.4° BTDC
- Specification display field 4:
  - ◆ Lower range: 2 to 5%
  - ◆ Upper range: 90 to 95%

**Note:**

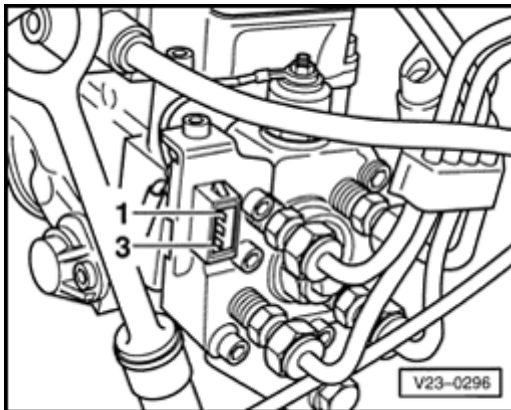
*Due to the slow refresh rate of the VAG1551 scan tool, the displayed values can greatly vary. Ensure that the lowest value only in display field 3 lies between 1.0 and 4.0 and the highest value lies between 14.0 and 17.4. Ensure that the lowest value in display field 4 lies between 2 and 5, and the highest value between 90 and 95.*



If the values are not as specified, check the cold start injector as follows:

- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.
- Switch ignition off.
- Disconnect Diesel injection pump harness connector.

⇒ [page 23-4](#)



A

- Measure resistance between connector terminals 2 and 3.  
Specification: 12 to 20 ohms ( $\Omega$ )

If resistance is not as specified:

- Replace cold start injector -N108-.

⇒ [page 23-10](#)

- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

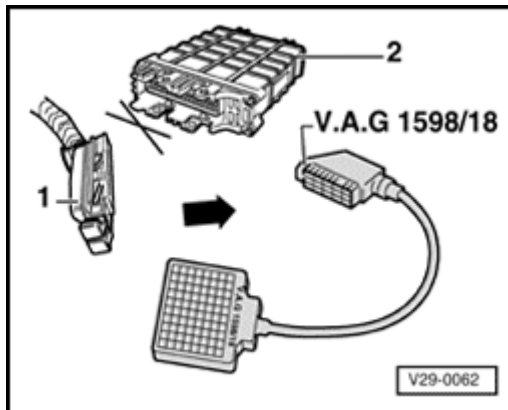
- Create readiness code again ⇒ [page 01-47](#) .



If resistance is OK:

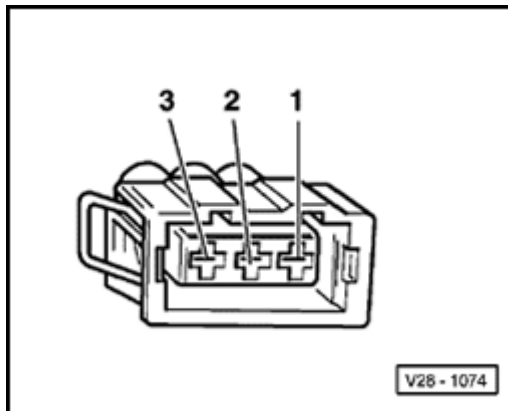
A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check wiring for open circuit between test box and 3-pin harness connector, using wiring diagrams:
    - ◆ Terminal 2 and test box socket 51
    - ◆ Terminal 3 and test box socket 68
    - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
  - Check wiring for short circuit between connector terminals.
- Specification:  $\infty \Omega$  (no continuity)





---

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) ,  
item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## **Boost pressure control, checking**

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

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1397A turbocharger tester
- VAG1598/18 test box
- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

- Connect VAG1551 or VAG1552 scan tool

⇒ [page 01-9](#)

- Start engine and let idle.

- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

**Note:**

*To check boost pressure control, it is essential that boost pressure first be measured without the influence of pressure limiting (control).*

⇒ Repair Manual, 1.9 Liter Turbo Diesel  
General, Engine (engine code AHU), Repair  
Group 21



- Measure boost pressure using VAG1551 scan tool during a test drive.

**CAUTION!**

***When "on the road" measurements are required for diagnosis, for obvious safety reasons, always use a second technician to take the instrument readings.***

- Ensure that wastegate bypass regulator valve - N75- harness connector is connected.
- Connect VAG1551 or VAG1552 scan tool.

⇒ [page 01-9](#)

- Start engine and let idle.
- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.

Rapid data transfer  
Select function XX

HELP



Indicated on display

- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.
- Press -Q- button to confirm input.

Read Measuring Value Block    **HELP**

Input display group number XXX



Indicated on display

- Press buttons -0-, -1- and -1- to input display group no. 11 (011).
- Press -Q- button to confirm input.



Read Measuring Value Block 11 →

840 rpm 938 mbar 978 mbar 92 %



- Indicated on display
- Accelerate vehicle in 3rd gear from about 1500 RPM using wide open throttle.
- Press "PRINT" button on VAG1551 at about 3000 RPM.

Read Measuring Value Block 11 →

3090 rpm 1866 mbar 1917 mbar 62 %



Specification: 1720 to 1950 mbar (display field 3)

If measured boost pressure is too low:

- Check wastegate bypass regulator valve.

⇒ [page 23-78](#)



### Wastegate bypass regulator valve, electrical checks

- Switch ignition off.
- Disconnect wastegate bypass regulator valve harness connector.

⇒ [page 23-4](#)

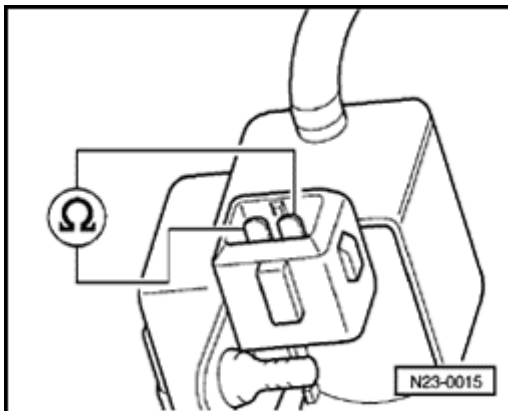
- Switch multimeter to resistance range.
- Connect multimeter between valve terminals and measure resistance.  
Specification: 25 to 45 ohms ( $\Omega$ )

If specification not obtained:

- Replace wastegate bypass regulator valve -N75-.
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



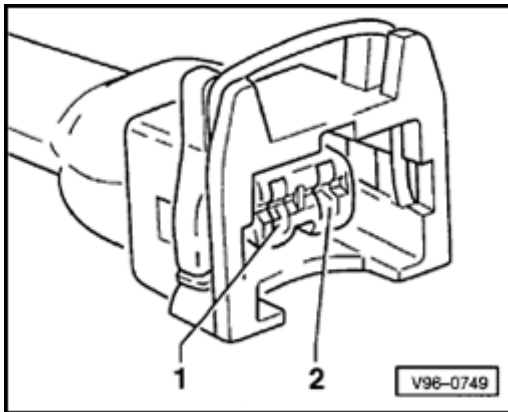


### Wastegate bypass regulator valve -N75- voltage supply, checking

- Switch ignition off.
- Disconnect wastegate bypass regulator valve harness connector.

⇒ [page 23-4](#)

- Switch multimeter to 20 volt measurement range.

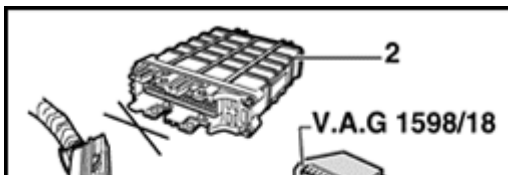


A

- Connect multimeter between terminal 1 and Ground using adapters from VW1594 connector test kit.
  - Switch ignition on.
- Specification: approx. battery voltage (B+)

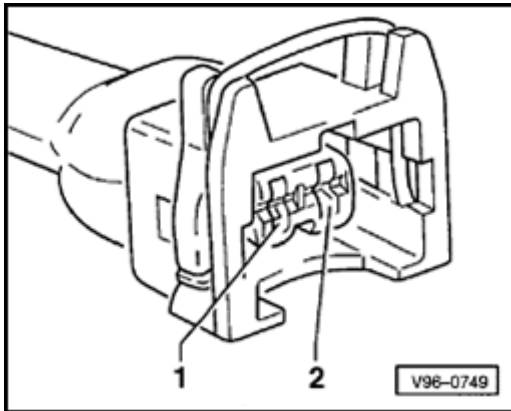
If specification not obtained:

- Check wiring connection to wastegate bypass regulator valve -N75-.
- Switch ignition off.



A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.



A

- Check wiring for open circuit between test box and 3-pin harness connector, using wiring diagrams:
  - ◆ Terminal 1 and test box socket 68
  - ◆ Terminal 2 and test box socket 47
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.  
Specification:  $\infty \Omega$  (no continuity)
- Repair any open or short circuit as necessary.

If neither an open nor short circuit exists:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## **Exhaust Gas Recirculation (EGR) and Mass Air Flow (MAF) sensor functions, checking**

Exhaust Gas Recirculation and Mass Air Flow sensor function can be checked via Output Diagnostic Test Mode (Function 03) and by also calling-up measuring value block 03 (Function 08). To do this, activate the Output DTM component: EGR Vacuum Regulator Solenoid valve N18 and then after exiting the Output Diagnostic Test Mode, check N18 via the -C- button.

By using this sequence, the EGR valve continues to be pulsed so that with the help of measuring value block 03 (display field 3) the extreme values for the EGR valve/Mass Air Flow sensor can be displayed.

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

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box

- Multimeter (Fluke 83 or equivalent)
- VW1594 connector test kit
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder



## Checking

- Connect VAG1551 or VAG1552 scan tool.

⇒ [page 01-9](#)

- Start engine and let idle.
- Press buttons -0- and -1- to insert "Engine Electronics" address word 01.

Rapid data transfer  
Select function XX

HELP



Indicated on display

- Press buttons -0- and -3- to select "Output Diagnostic Test Mode" function 03.
- Press -Q- button to confirm input.

Rapid data transfer

Q



Indicated on display

03 - Output Diagnostic Test Mode

### **Note:**

*Individual DTM components are activated for 30seconds. Various work sequences must be carried out with the scan tool within this period as well as reading the displayed values. Read over the following work sequence first to familiarize yourself with the procedure.*

Output Diagnostic Test Mode



Indicated on display

Cold Start Injector-N108

Output Diagnostic Test Mode →  
Exhaust Gas Recirculation Valve-N18

- Press → button.

← Indicated on display

- Press -C- button.



Read Measuring Value Block    HELP

Input display group number XXX



Indicated on display

- Press buttons -0-, -0- and -3- to input display group no. 3 (003).
- Press -Q- button to confirm input.

Read Measuring Value Block 3    →

840 rpm 272 mg/H 268 mg/H 54 %



- Indicated on display

**Note:**

*The values in display fields 3 and 4 must fluctuate within the following control range:*

- Specification display field 3:
  - ◆ Lower range: 230-310 mg/stroke
  - ◆ Upper range: 360-480 mg/stroke
- Specification display field 4:
  - ◆ Lower range: 2 to 5%
  - ◆ Upper range: 90 to 95%

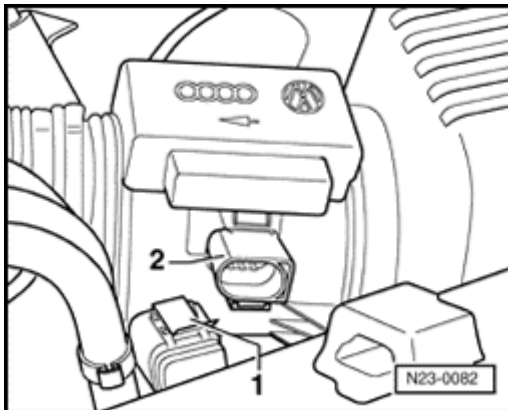
**Note:**

*Due to the slow refresh rate of the VAG1551 scan tool, the displayed values can greatly vary. Ensure that the upper and lower range values in display fields 3 and 4 are obtained. Only regard the minimum or maximum values!*



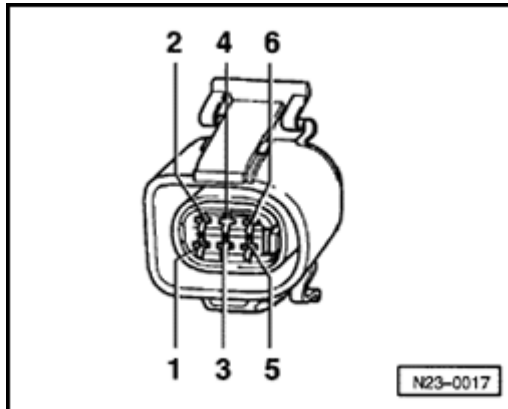
If specifications not obtained

- Check Mass Air Flow sensor and EGR valve voltage supply as follows.
- Press → button.
- Press buttons -0- and -6- to select "End Output" function 06.
- Press -Q- button to confirm input.
- Switch ignition off.



A

- Disconnect harness connector -1- from Mass Air Flow sensor -2-
- Switch ignition on.
- Select 20 Volt measurement range



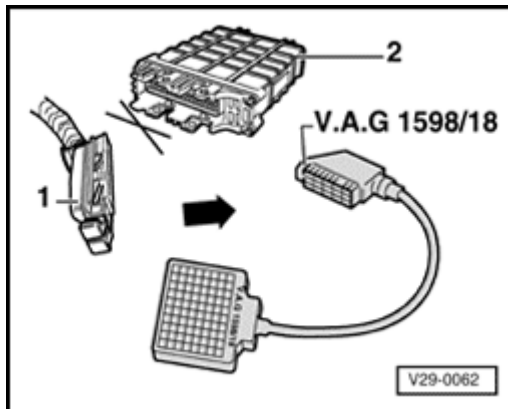
A

- Perform voltage measurement using multimeter between following connector terminals

Connector on terminal -G70-	Specification
3 and Ground	Battery voltage (approx)
3 and 5	Battery voltage (approx)
1 and Ground	Approx. 5 Volts
1 and 5	Approx. 5 Volts

If specifications not obtained

- Switch ignition off.



A

- Connect VAG1598/18 test box to Diesel DFI ECM connector.



- Check wiring for open circuit between test box and harness connector, using wiring diagrams:

◆ Terminal 1 and test box socket 19

◆ Terminal 2 and test box socket 33

◆ Terminal 3 and test box socket 23

◆ Terminal 5 and test box socket 1

◆ Terminal 6 and test box socket 13

◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )

- Check wiring for short circuit between connector terminals.

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

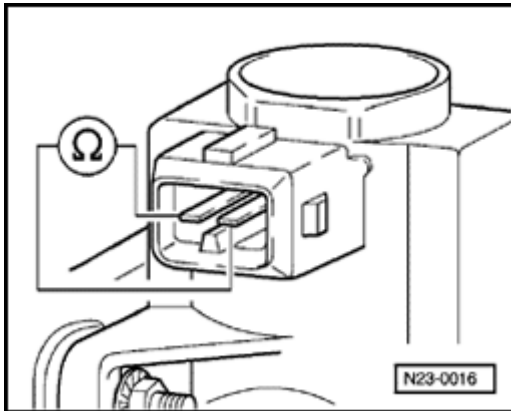
If specifications obtained:

- Check EGR vacuum regulator solenoid valve N18 as follows:

- Disconnect N18 valve harness connector.

⇒ [page 23-5](#) , item 16

- Switch multimeter to resistance range.



A

- Connect multimeter between valve terminals and measure resistance  
Specification: 14 to 18 ohms ( $\Omega$ )

If specification not obtained:

- Replace EGR vacuum regulator solenoid valve -N18-

⇒ [page 23-5](#) , item 16

- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .

If specification obtained:

- Switch ignition on.

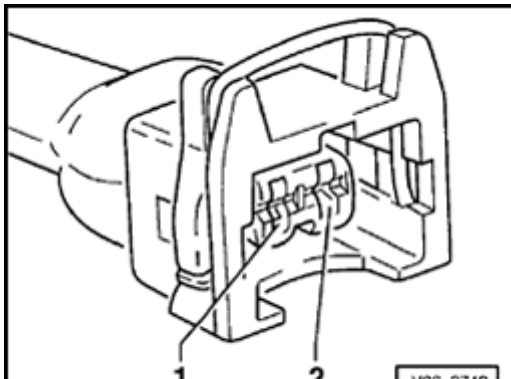
A

- Connect multimeter between connector terminal 1 and engine Ground using adapters from VW1594 connector test kit.

Specification: approx. battery voltage

If specification not obtained:

- Switch ignition off.





- Check wiring for open circuit/short to positive or negative between test box and connector using wiring diagrams.
  - ◆ Terminal 1 and test box socket 68
  - ◆ Terminal 2 and test box socket 25
  - ◆ Wire resistance: max. 1.5 ohms ( $\Omega$ )
- Check wiring for short circuit between connector terminals.

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

If wiring is OK:

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .



## Vehicle speed signal, checking

Vehicle speed is required for A/C compressor cut-off during acceleration, for the cruise control system and to improve driving comfort (shift-jerk).

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/22 test box
- VW1594 connector test kit
- VAG1527B voltage tester
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test conditions

- Speedometer function and speedometer display OK

### **Test sequence**

- Connect VAG1551 or VAG1552 scan tool.

⇒ [page 01-9](#)

- Start engine and let idle.



Rapid data transfer Select function XX	HELP	↖	<p>- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.</p> <p>Indicated on display</p> <p>- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08.</p> <p>- Press -Q- button to confirm input.</p>
Read Measuring Value Block Input display group number XXX	HELP	↖	<p>Indicated on display</p> <p>- Press buttons -0-, -0- and -6- to input display group no. 6 (006).</p> <p>- Press -Q- button to confirm input.</p>
Read Measuring Value Block 6 1 2 3 4	→	↖	<p>Indicated on display (1 to 4 = display fields)</p> <p>- Road test and observe display during drive.</p>

**CAUTION!**

***When "on the road" measurements are required for diagnosis, for obvious safety reasons, always use a second technician to take the instrument readings.***

- Check value in display field 1.

Specification: approx. equal to speedometer display

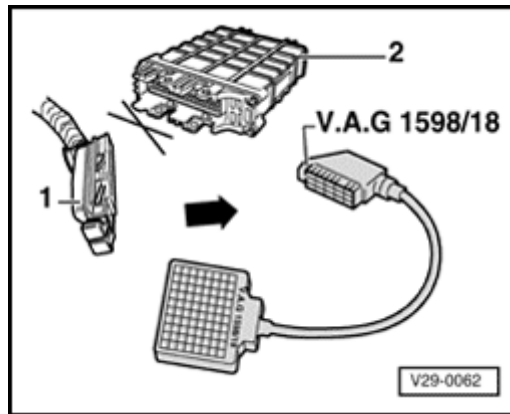


If there is no speed indicated:

- Switch ignition off.
- Connect VAG1598/18 test box to Diesel DFI ECM connector.
- Check wiring for continuity or short circuit between test box socket 43 and instrument cluster wiring.
- Using wiring diagrams, individually determine all additional speed signal "users" (e.g. radio, automatic transmission, A/C etc.), rule out each one as a source of interference and repeat check each time until cause has been established.
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .





## Throttle Position (TP) sensor, checking

The throttle position sensor -G79- is located on the accelerator pedal and transfers throttle position information to the Diesel Direct Fuel Injection (DFI) Engine Control Module (ECM).

### Special tools, testers and auxiliary items

- VAG1551 or VAG1552 Scan Tool (ST)
- VAG1551/3 adapter cable
- VAG1598/18 test box
- VW1594 connector test kit
- VAG1527B voltage tester
- Multimeter (Fluke 83 or equivalent)
- Electrical Wiring Diagrams, Troubleshooting & Component Locations binder

### Test sequence

- Connect VAG1551 or VAG1552 scan tool.

⇒ [page 01-9](#)

- Switch ignition on.



<p>Rapid data transfer      HELP Select function XX</p>		<p>- Press buttons -0- and -1- to insert the "Engine Electronics" address word 01.</p>
<p>Read Measuring Value Block      HELP Input display group number XXX</p>		<p>Indicated on display</p> <p>- Press buttons -0- and -8- to select "Read Measuring Value Block" function 08, and press -Q- button to confirm input.</p>
<p>Read Measuring Value Block 2      → RPM 0.0 % 0 1 0 18.4 °C</p>		<p>- Refer to display field 2 (accelerator pedal position). Specified display: 0.0 % (accelerator pedal not operated)</p>
<p>Read Measuring Value Block 2      → RPM 0.0 % 0 1 0 18.4 °C</p>		<p>- Refer to display field 3. Specified display: 0 1 0 (accelerator pedal not operated)</p>



- Press accelerator pedal down slowly.

Specified displays (accelerator pedal fully depressed):

Read Measuring Value Block 2 →

RPM 100.0 % 0 0 0 18.4 °C



- ◆ Display field 2 must increase steadily to 100 %

Read Measuring Value Block 2 →

RPM 0.0 % 0 0 0 18.4 °C



- ◆ Display field 3 must change to: 0 0 0

**Note for vehicles with automatic transmission ONLY:**

*The kick down switch actuation point must be distinctly felt before the pedal reaches Wide Open Throttle (WOT) position.*

If the displays are not as specified:

- Adjust throttle position sensor.

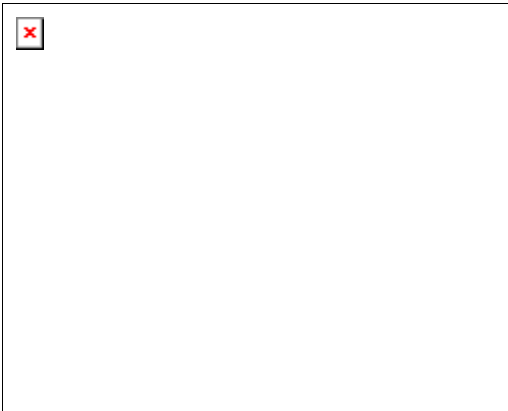
⇒ [page 23-16](#)

If displays do not change or are irregular:

- Check throttle position sensor -G79- as follows:
- Switch ignition off.
- Disconnect throttle position sensor harness connector.

⇒ [page 23-4](#)

- Switch multimeter to resistance range.



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- Measure resistance between sensor terminals 1 and 3 using adapters from VW1594 connector test kit.

Accelerator not depressed (closed throttle position):

- ◆ Specification: 1000 to 1500 ohms ( $\Omega$ )

Accelerator depressed (wide open throttle):

- ◆ Specification: 1500 to 2500 ohms ( $\Omega$ )

If resistance is not as specified:

- Replace throttle position sensor -G79-.
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .

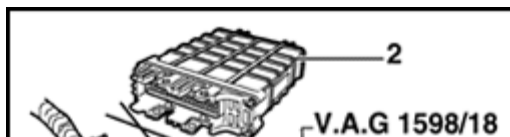
If specifications are obtained:

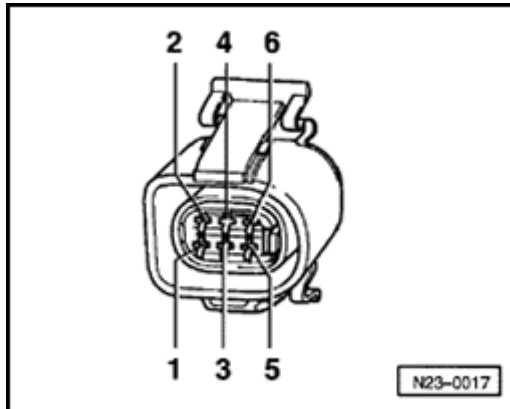
- Switch ignition off.
- Disconnect throttle position sensor harness connector.

⇒ [page 23-4](#)

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- Connect VAG1598/18 test box to Diesel DFI ECM connector.





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- Check following wiring connections for open circuits and/or short circuit to positive or negative:
  - ◆ Terminal 1 to test box socket 15
  - ◆ Terminal 2 to test box socket 57
  - ◆ Terminal 3 to test box socket 55
  - ◆ Terminal 4 to test box socket 65
  - ◆ Terminal 5 to test box socket 62
  - ◆ Terminal 6 to test box socket 33
- Repair any open or short circuit as necessary.

If neither an open or short circuit exists

- Replace Diesel DFI ECM -J248- ⇒ [page 23-5](#) , item 17 .
- Display readiness code ⇒ [page 01-43](#) .

If DTC memory was erased:

- Create readiness code again ⇒ [page 01-47](#) .