

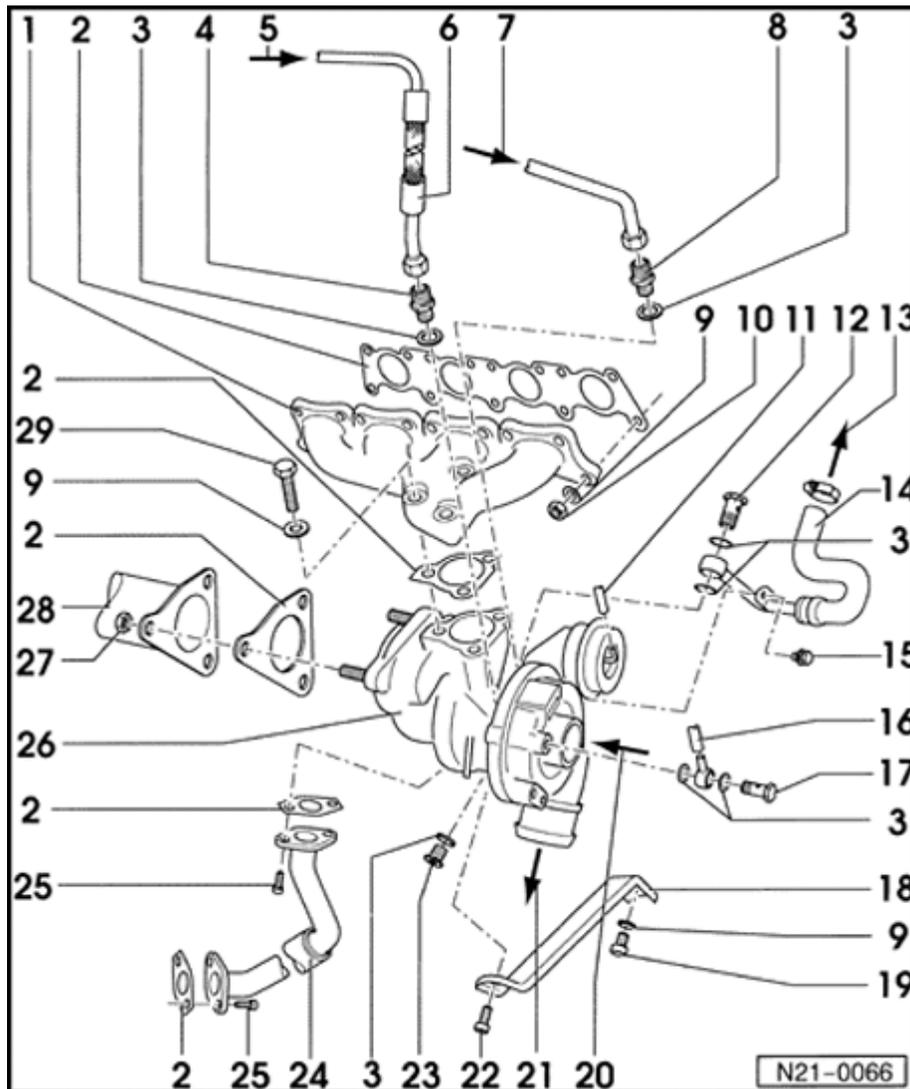
## Charge air system

### Turbocharger & components, removing and installing

Observe rules for cleanliness ⇒ [Page 21-16](#) .

**Note:**

- ◆ *All hose connections are secured with clips.*
- ◆ *Charge air system must be free of leaks.*
- ◆ *Replace self-locking nuts.*



**1 - Exhaust manifold**

**2 - Gasket**

◆ Note installation position

**3 - Seal**

◆ Always replace

**4 - Connection, 30 Nm**

**5 - From oil filter bracket**

**6 - Oil supply line**

◆ Tighten to 25 Nm

**7 - From coolant pipe on intake manifold**

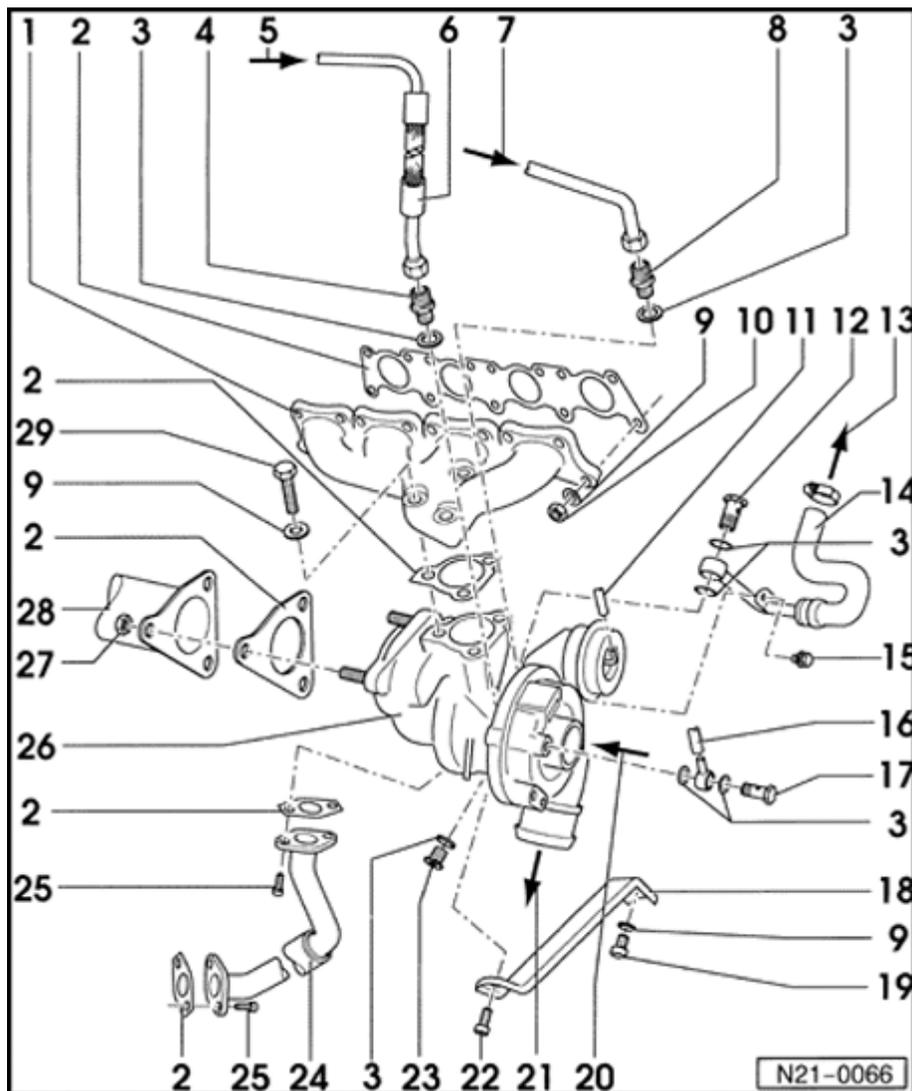
◆ Tighten to 30 Nm

**8 - Connection, 35 Nm**

**9 - Washer**

**10 - 25 Nm**

◆ Coat threads with G 052 112 A3



**11 - Hose**

- ◆ To Wastegate Bypass Regulator valve - N75- ⇒ [Page 21-10](#) , item 13

**12 - Banjo bolt, 25 Nm**

**13 - To cylinder block**

**14 - Coolant supply pipe**

**15 - 10 Nm**

**16 - Hose**

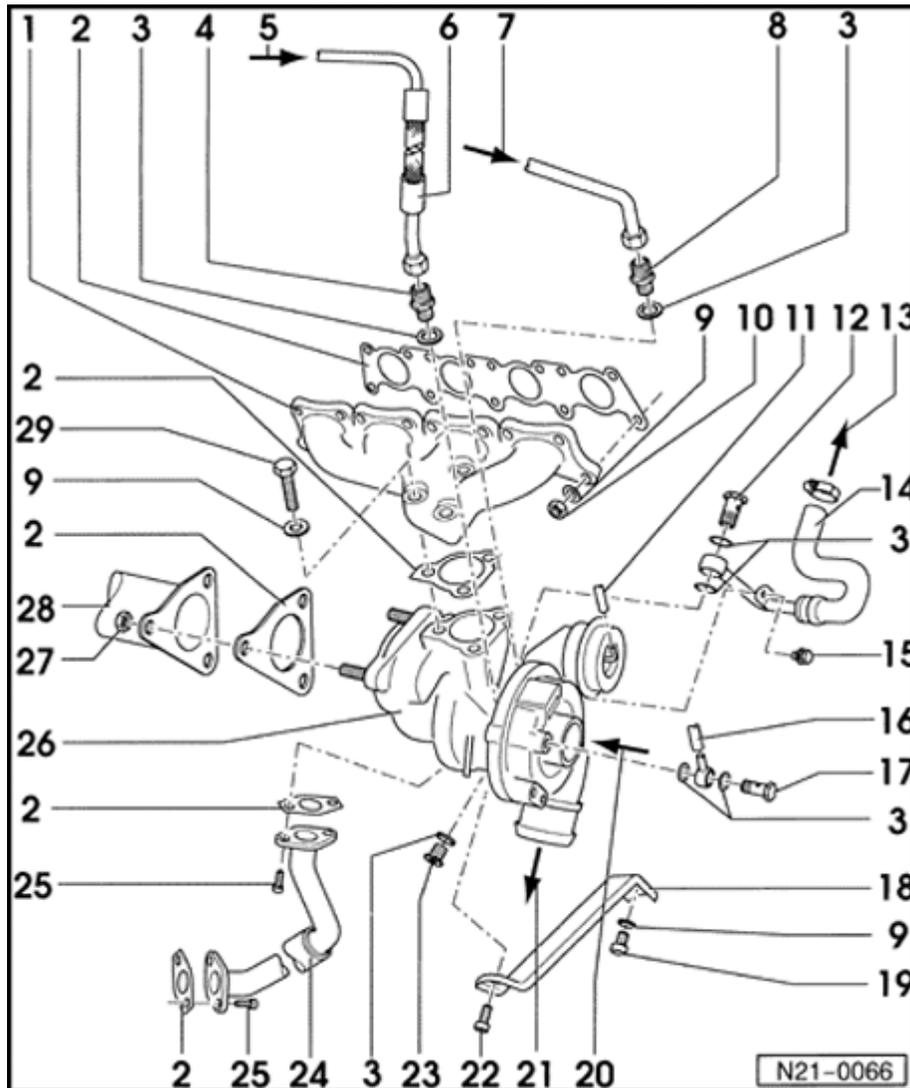
- ◆ To Wastegate Bypass Regulator valve - N75- ⇒ [Page 21-10](#) , item 13

**17 - Banjo bolt, 15 Nm**

**18 - Retainer**

- ◆ Between turbocharger and cylinder block

**19 - 40 Nm**



20 - From air cleaner

21 - To charge air cooler

22 - 10 Nm

23 - Plug, 15 Nm

24 - Oil return line

◆ To oil pan

25 - 10 Nm

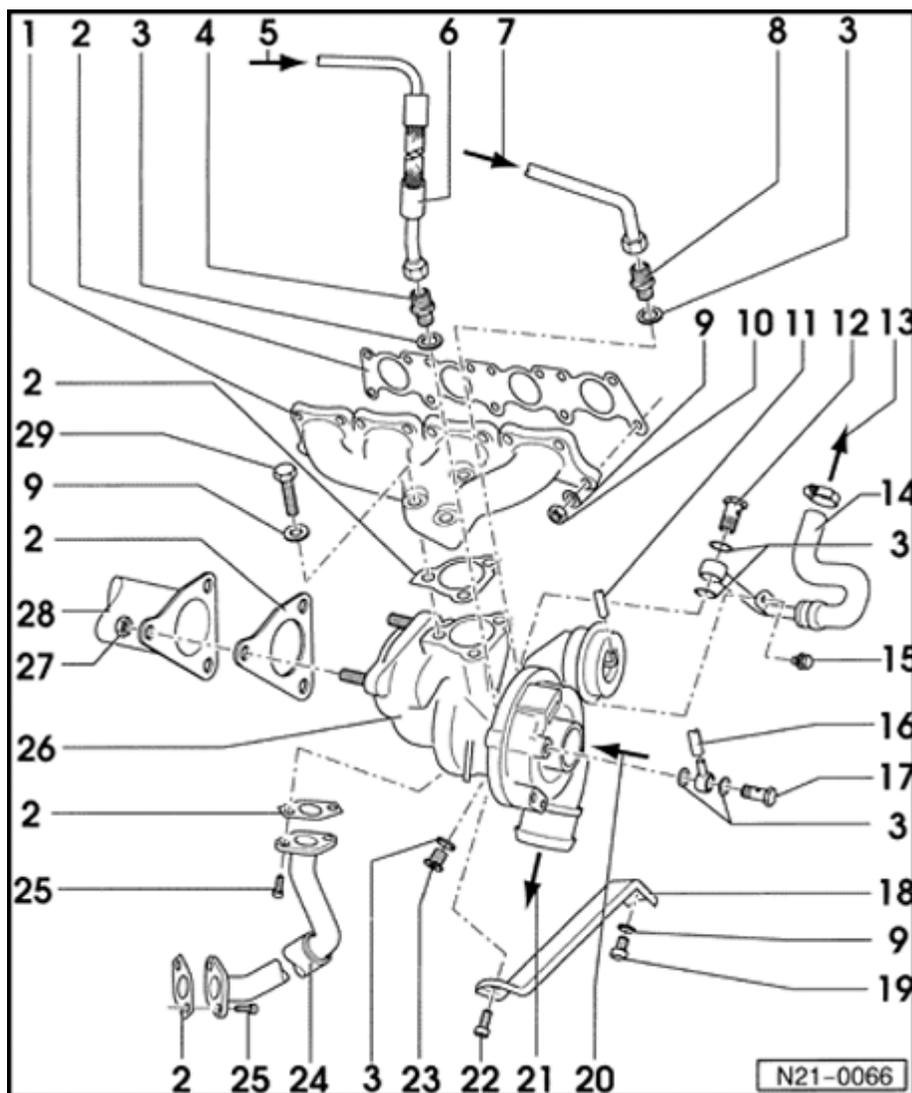
26 - Turbocharger

◆ Checking charge air pressure regulation ⇒ [Page 21-18](#)

◆ Charge pressure regulator valve and pressure unit are components of the turbocharger and cannot be replaced individually

27 - 25 Nm

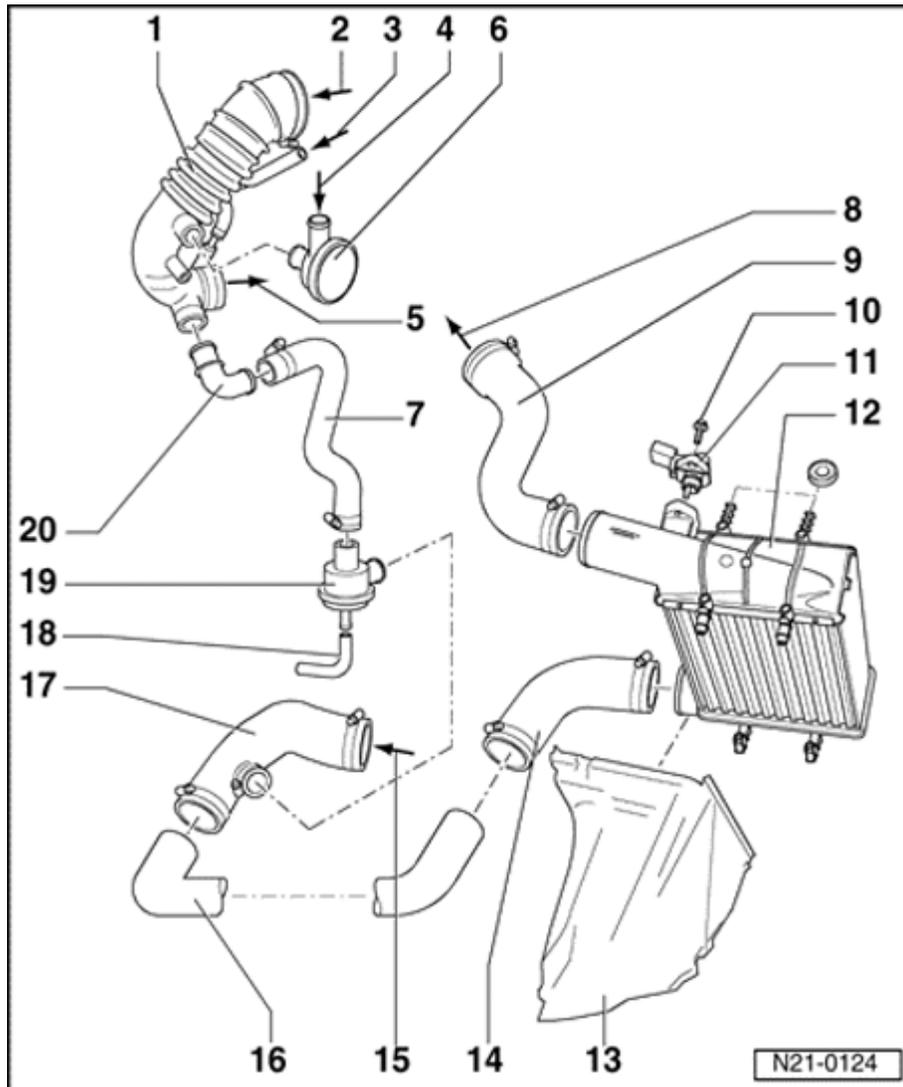
◆ Coat threads with G 052 112 A3



## 28 - Three-Way Catalytic Converter

29 - 35 Nm

- ◆ Always replace
- ◆ Coat threads and bolt head seating surface with G 052 112 A3



## Charge air system cooling components, removing and installing

### Note:

- ◆ All hose connections secured by clips.
- ◆ Charge air system must be free of leaks.
- ◆ When installing, note the assembly markings on the hoses and components.

**1 - Intake hose**

**2 - From air cleaner**

**3 - From EVAP canister**

**4 - From crankcase breather**

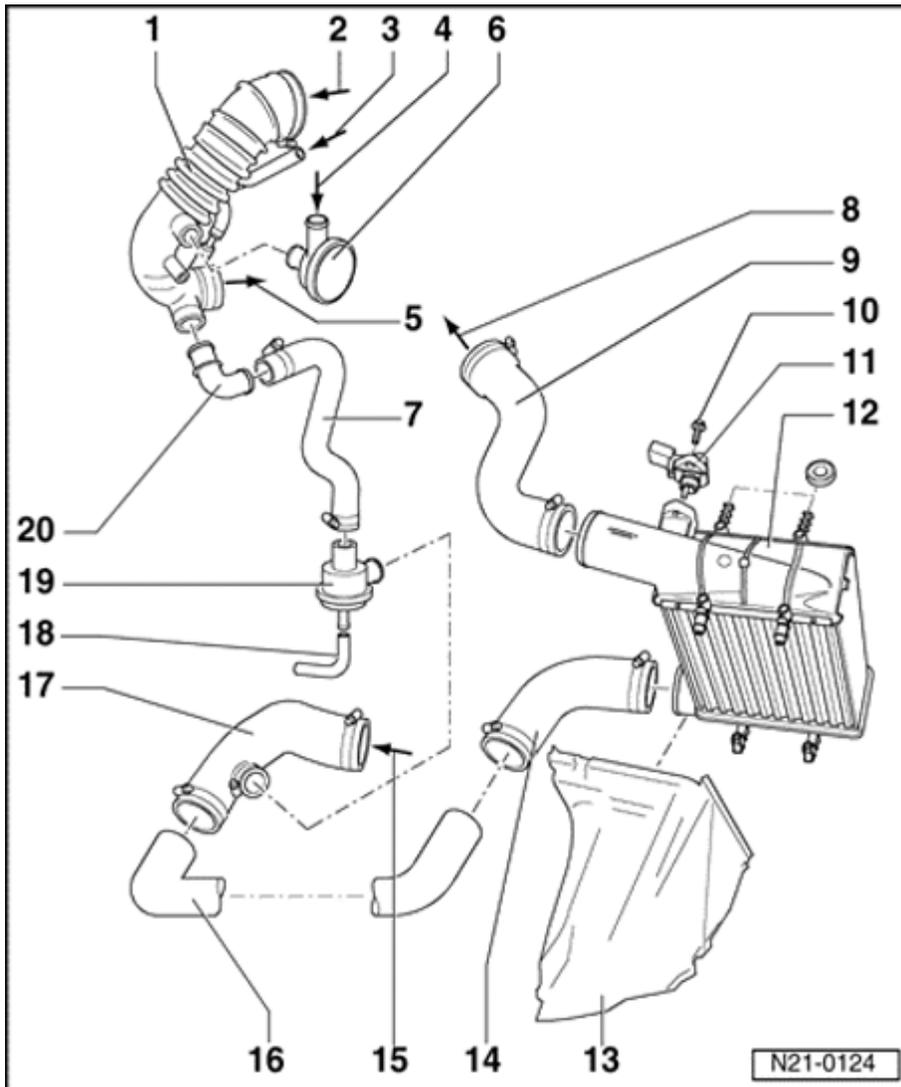
**5 - To turbocharger**

**6 - Pressure regulator valve**

- ◆ For Positive Crankcase Ventilation valve

**7 - Connecting line/hose**

- ◆ Note assembly markings



**8 - To throttle valve control module**

**9 - Connecting pipe/hose**

- ◆ Charge air cooler/throttle valve control module
- ◆ Note assembly markings

**10 - 10 Nm**

**11 - Charge air pressure sensor -G31-\***

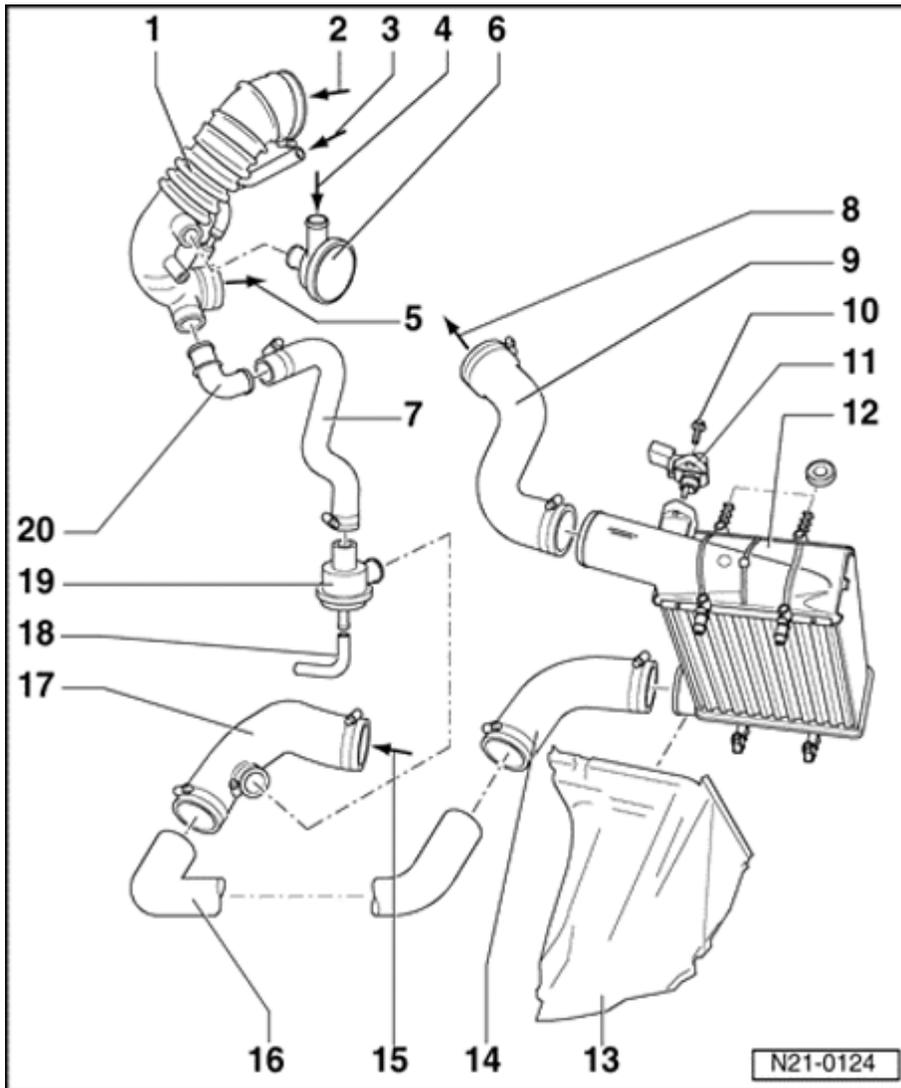
- ◆ Only for engine code ATW
- ◆ Replace O-ring if damaged
- ◆ Checking ⇒ [Page 21-33](#)

**12 - Charge air cooler**

**13 - Air duct**

**14 - Connecting pipe/hose**

- ◆ Cross tube/charge air cooler
- ◆ Note assembly markings



15 - From turbocharger

16 - Cross tube

17 - Connecting pipe/hose

◆ Turbocharger/cross tube

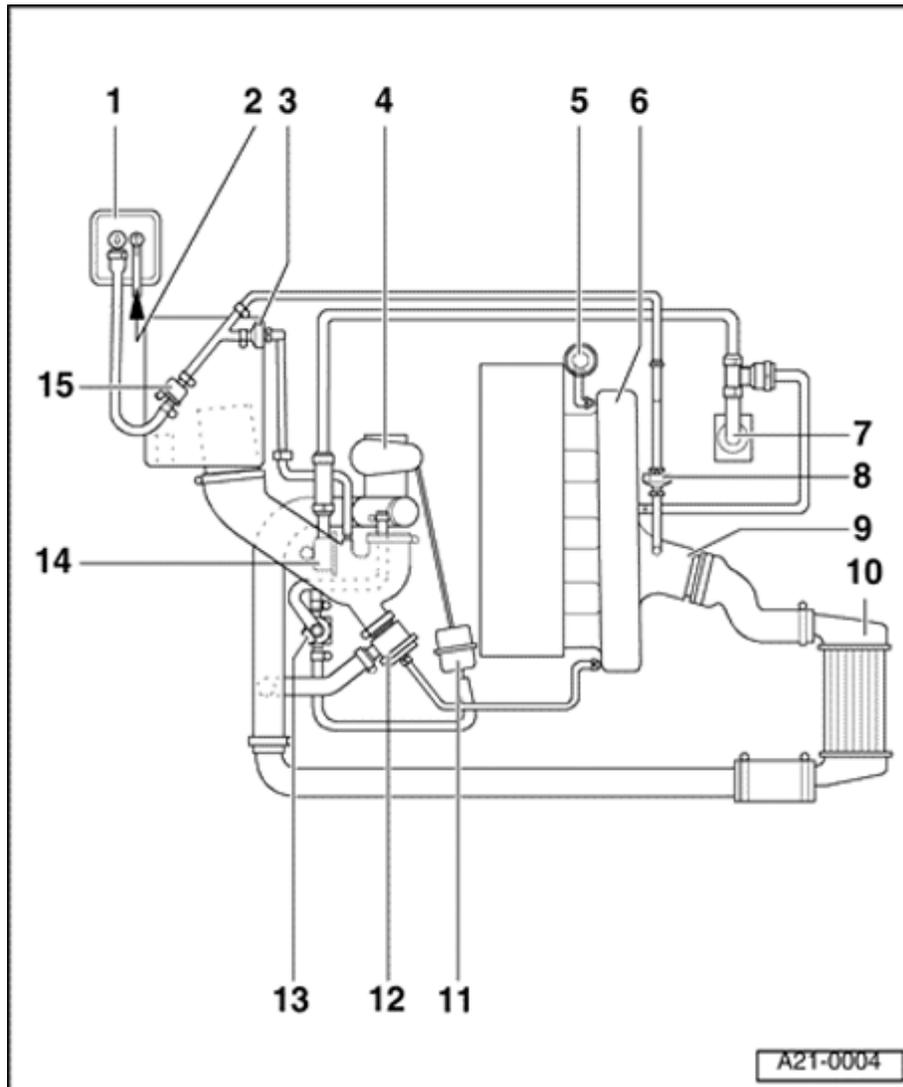
◆ Note assembly markings

18 - Vacuum hose/line

19 - Recirculating valve for turbocharger - N249-

◆ Checking ⇒ [Page 21-31](#)

20 - Angle piece



## Charge air system diagram

### Engine code AEB

**1 - EVAP canister**

**2 - Vent pipe**

- ◆ From gravity valve on fuel tank ⇒ [Page 20-2](#), Item 5

**3 - Check valve**

- ◆ For EVAP canister

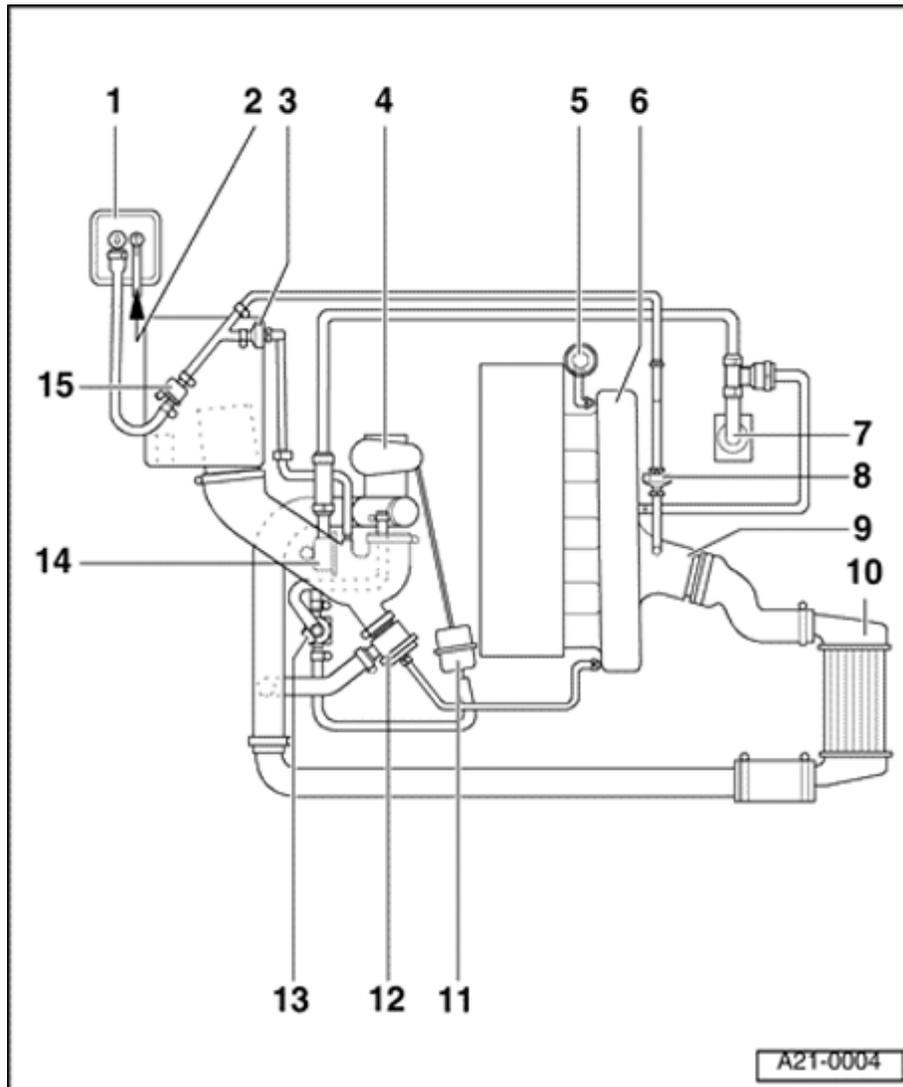
**4 - Turbocharger**

- ◆ Charge pressure regulator valve and pressure unit are components of the turbocharger and cannot be replaced individually

**5 - Fuel pressure regulator**

**6 - Intake manifold**

**7 - Crankcase ventilation**



### 8 - Check valve

- ◆ For EVAP canister

### 9 - Throttle valve control module

### 10 - Charge air cooler

### 11 - Pressure unit

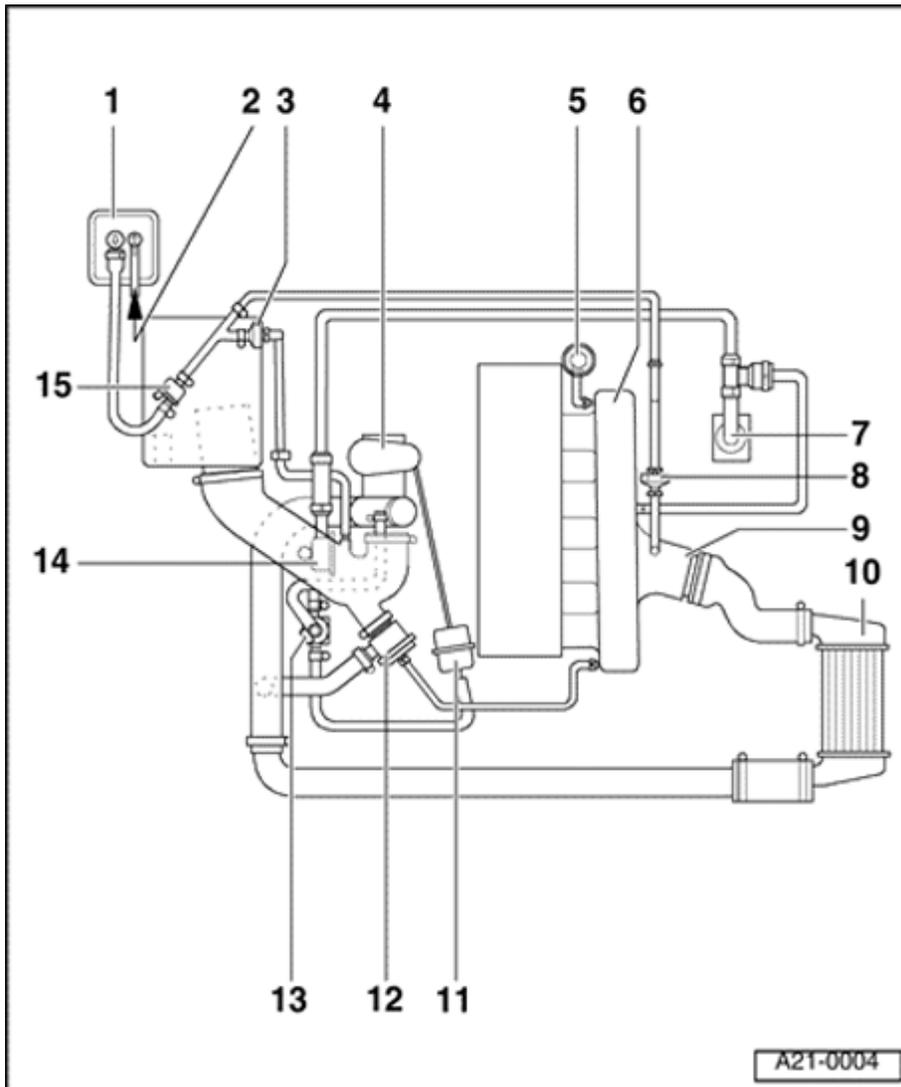
- ◆ For wastegate
- ◆ Integral part of turbocharger; cannot be replaced

### 12 - Recirculating valve for turbocharger - N249-

### 13 - Wastegate Bypass Regulator valve -N75-

- ◆ The valve will be activated from the Engine Control Module (pulsed)
- ◆ Closed with no current, charge pressure limited
- ◆ Checking activation:

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*



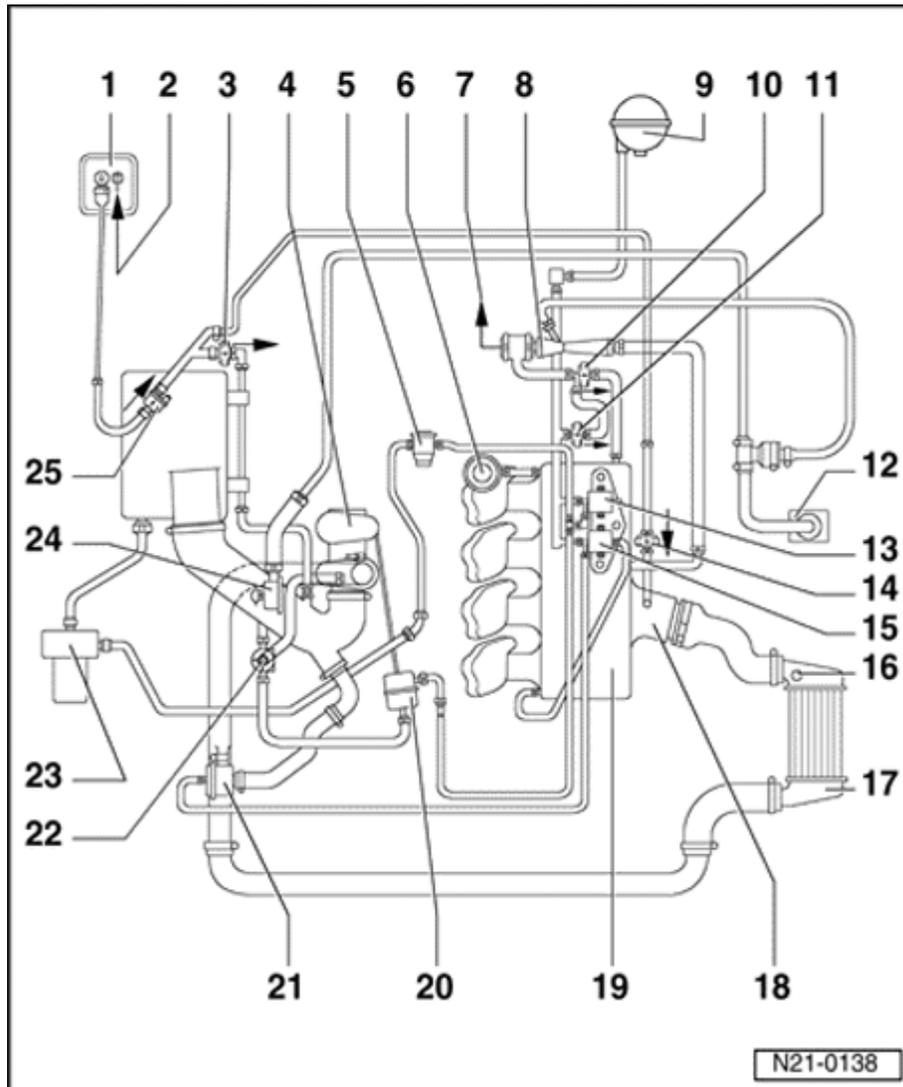
#### 14 - Pressure regulator valve

- ◆ For Positive Crankcase Ventilation

#### 15 - EVAP Canister Purge Regulator valve - N80-

- ◆ Checking:

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*



### Engine code ATW

**1 - EVAP canister**

**2 - Vent pipe**

- ◆ From gravity valve on fuel tank ⇒ [Page 20-2](#), Item 5

**3 - Check valve**

- ◆ For EVAP canister

**4 - Turbocharger**

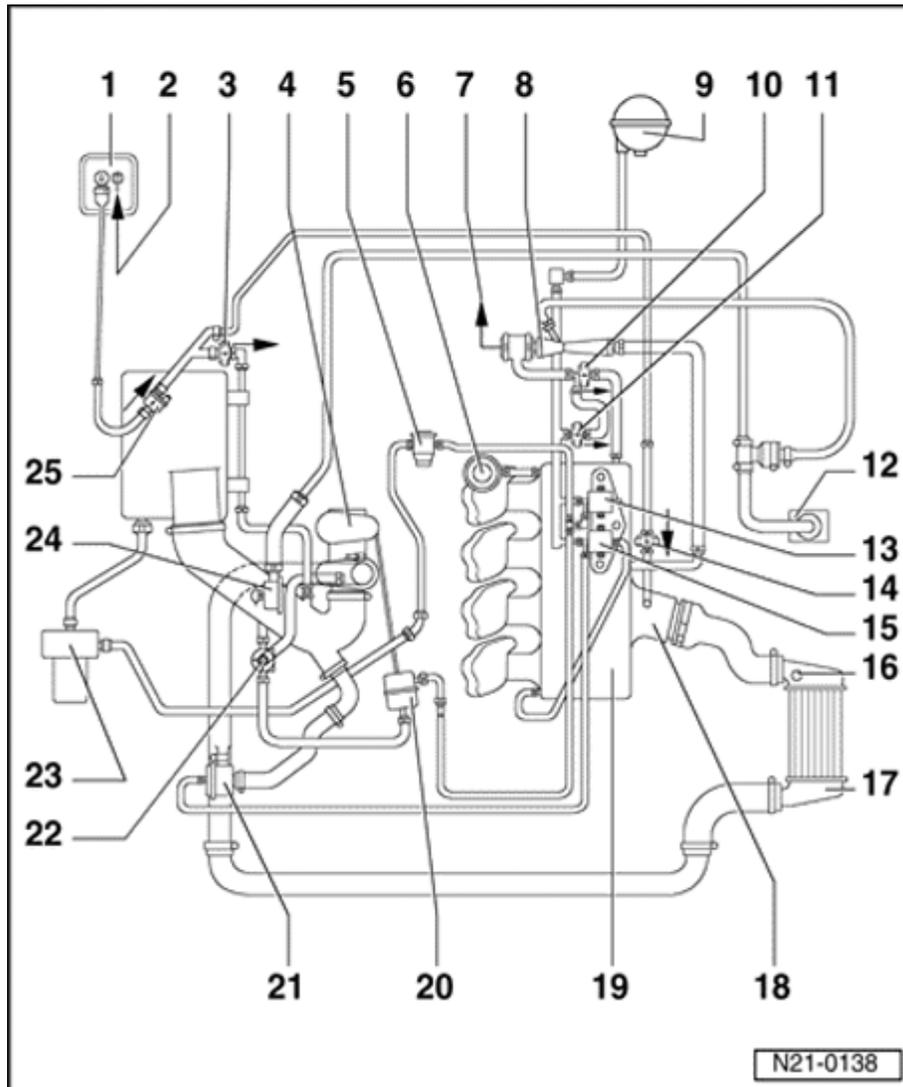
- ◆ Charge pressure regulator valve and pressure unit are components of the turbocharger and cannot be replaced individually

**5 - Combination valve**

- ◆ For secondary air system
- ◆ Checking ⇒ Page ⇒ [Page 26-17](#)

**6 - Fuel pressure regulator**

**7 - To brake servo**



**8 - Vacuum booster**

**9 - Vacuum reservoir**

- ◆ Secured in wheel housing, front left

**10 - Check valve**

**11 - Check valve**

**12 - Crankcase ventilation**

**13 - Secondary Air Injection (AIR) solenoid valve -N112-**

- ◆ Checking ⇒ [Page 26-21](#)

**14 - Check valve**

- ◆ For EVAP canister

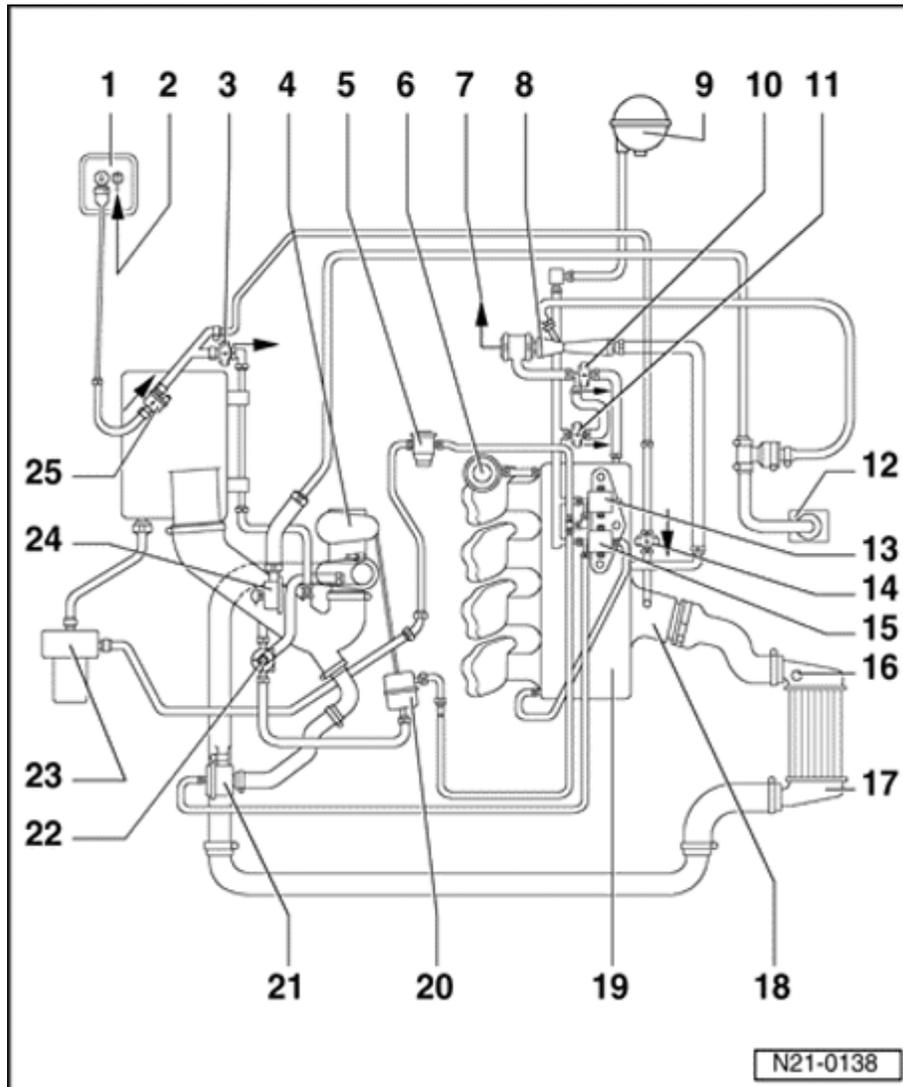
**15 - Recirculating valve for turbocharger - N249-**

- ◆ Checking ⇒ [Page 21-38](#)

**16 - Charge air pressure sensor -G31-\***

- ◆ Checking ⇒ [Page 21-33](#)

**17 - Charge air cooler**



**18 - Throttle valve control module**

**19 - Intake manifold**

**20 - Pressure unit**

- ◆ For wastegate
- ◆ Integral part of turbocharger; cannot be replaced

**21 - Recirculating valve for turbocharger - N249-**

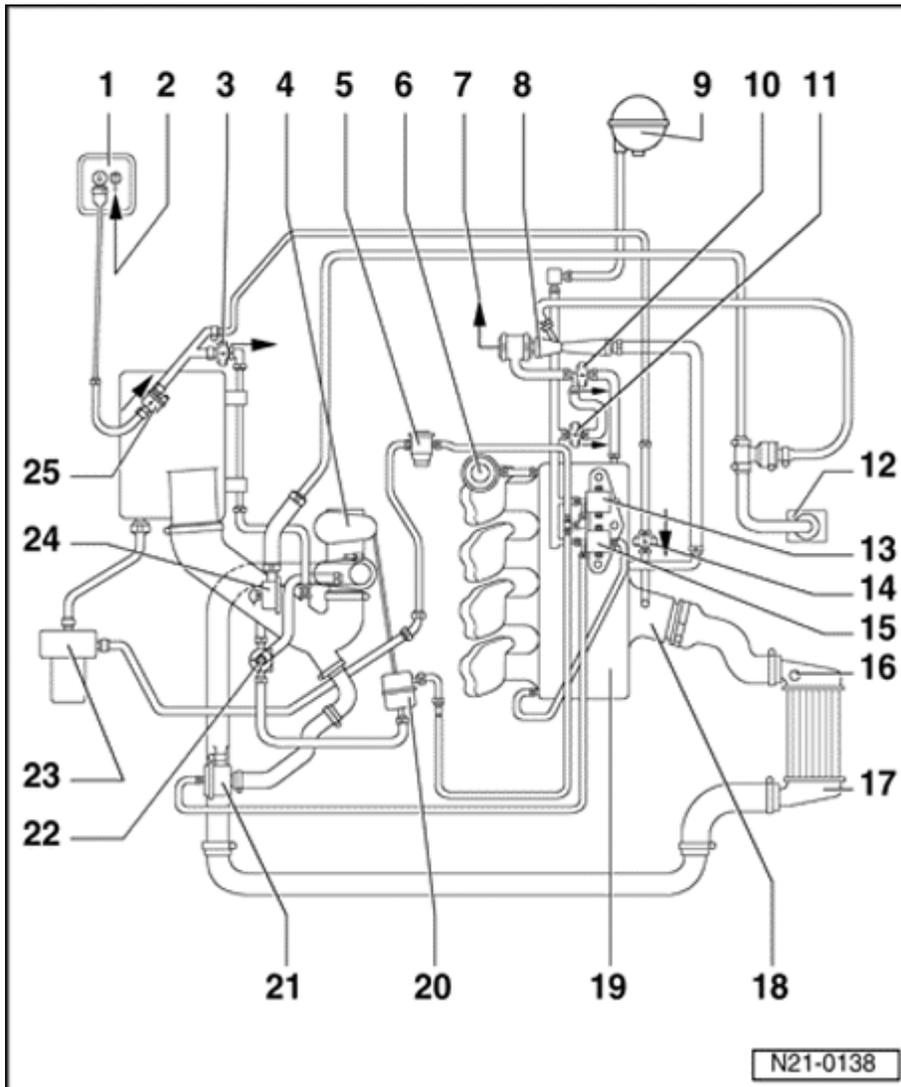
**22 - Wastegate Bypass Regulator valve -N75)**

- ◆ The valve will be activated from the engine control module (pulsed)
- ◆ Closed with no current, charge pressure limited
- ◆ Checking activation:

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*

**23 - Secondary Air Injection (AIR) pump motor -V101-\***

- ◆ Checking function ⇒ [Page 26-19](#)



#### 24 - Pressure regulator valve

- ◆ For Positive Crankcase Ventilation

#### 25 - EVAP Canister Purge Regulator valve - N80-

- ◆ Checking:

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*



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## Rules for cleanliness

When working on the exhaust gas turbocharger, pay careful attention to the following 5 rules:

- ◆ Thoroughly clean all unions and the adjacent areas before disconnecting.
- ◆ Place parts that have been removed on a clean surface and cover. Do not use fluffy cloths!
- ◆ Carefully cover opened components or seal, if the repair cannot be carried out immediately.
- ◆ Only install clean components: Only unpack replacement parts immediately prior to installation. Do not use parts that have been stored loose (e.g. in tool boxes etc.).
- ◆ When the system is open: Do not work with compressed air if this can be avoided. Do not move the vehicle unless absolutely necessary.



## Safety precautions

Observe the following if test and measuring instruments are required during a test drive:

- ◆ Test and measuring instruments must be secured to the rear seat and operated by a 2nd person from this location.

### **CAUTION!**

***If test and measuring instruments are operated from the front passenger's seat and the vehicle is involved in an accident, there is a possibility that the person sitting in this seat may receive serious injuries when the airbag is triggered.***



## Charge air pressure regulation, checking

Vehicles with E-Gas system ⇒ [Page 21-24](#)

### Special tools and equipment

- ◆ V.A.G 1551 Scan Tool or vehicle system tester  
V.A.G 1552 with cable V.A.G 1551/3

### Engine code AEB

- ◆ V.A.G 1397 A Turbocharger tester

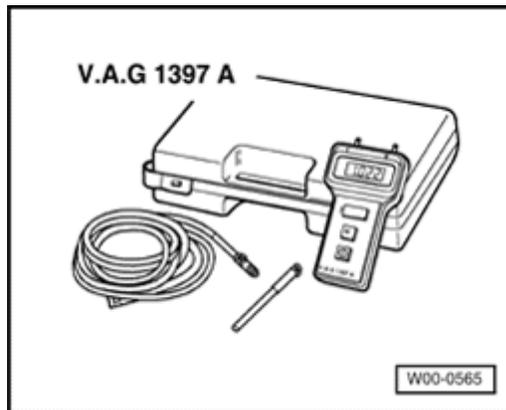
### Checking conditions

- ◆ No leaks on intake and exhaust systems.
- ◆ Engine oil temperature min. 80 °C

### Test sequence

- Connect V.A.G 1551 (V.A.G 1552). Start engine and select engine electronics control module with "Address word" 01.

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*



- ◆ V.A.G 1397 A Turbocharger tester



Indicated on display

Select function XX

- Press -0- and -8- buttons to select "Read measured value block" and confirm entry with -Q- button.

Read measured value block      HELP



Indicated on display

Input display group number XXX



Read Measured value block 114 →

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

- Press -1-, -1- and -4- buttons for "Display group number 114" and confirm entry with -Q- button.



Indicated on Display

- Check on/off ratio of Wastegate Bypass Regulator valve -N75- during a test drive or on a rolling test stand (at Wide Open Throttle 1800 to 2300 rpm) in display field 4.
  - Specification: 5 to 95 %

If the specification is obtained:

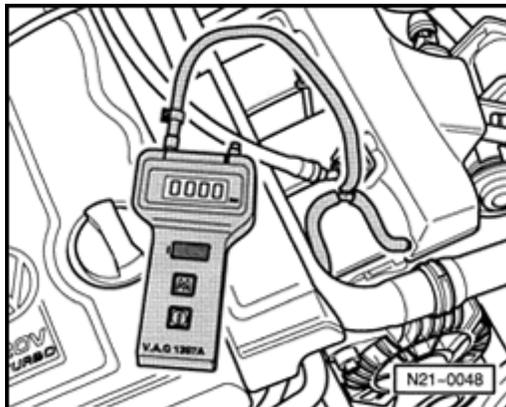
⇒ [Page 21-21](#) (Engine code ATW)

### Engine code AEB

The charge pressure is measured under full load while driving or on a rolling test stand. Test period per measurement = max. 10 seconds.



- Disconnect hose between intake manifold and charge pressure bypass valve at intake manifold and connect turbocharger tester V.A.G 1397 A using T piece.
- Select measuring range I.



**Note:**

- ◆ *To operate turbocharger tester see operating instructions.*
  - ◆ *The hoses must be connected so that there is no possibility of leaks.*
  - ◆ *If charge pressure is measured while driving, for safety reasons a second person must operate the turbocharger tester.*
  - ◆ *Ensure that the pressure hose is not trapped between the hood and the body.*
- Measure charge pressure at Wide Open Throttle.

**On a rolling test stand**

Test in 3rd gear (manual transmission), 2nd gear (automatic transmission).

**During test drive**

Vehicles with manual transmission

- Accelerate vehicle in 2nd gear at Wide Open Throttle.

Vehicles with automatic transmission

- Manually select 4th gear range and begin accelerating from low speed at Wide Open Throttle (avoid kickdown; transmission must not shift into a lower gear).
- At engine speed of 1800 to 2300 rpm press memory button "M" on turbocharger tester (V.A.G. 1397 A) and read display.
- Specification: (absolute pressure) 1.350 to 1.750 bar

**Note:**

*If the full charge pressure was not attained, repeat the test.*

If the charge pressure is exceeded:

- Test Wastegate Bypass Regulator valve -N75-
  - Hose from turbocharger via valve to pressure unit not blocked when connector is pulled off
- Check that pressure unit for charge pressure regulator valve is securely mounted on turbocharger.
- Check pressure unit, Page ⇒ [Page 21-29](#)
- Check charge pressure regulator valve shaft mounting in turbocharger for ease of movement.

If corroded together:

- Replace turbocharger.

If the charge pressure is not attained:

- Replace turbocharger assembly.

### **Engine code ATW**

- Press -C- button.
- Press -0-, -7- and -7- buttons to select "Display group number 77" and confirm entry with -Q- button.



Read Measured value block 115 →

1      2      3      4



Indicated on Display

- Check actual charge pressure value at Wide Open Throttle in display group 4.

### On a rolling test stand

Test in 3rd gear (manual transmission), 2nd gear (automatic transmission).

### During test drive

Vehicles with manual transmission

- Accelerate vehicle at Wide Open Throttle in 2nd gear.

Vehicles with automatic transmission

- Manually select 4th gear range and begin accelerating from low speed at Wide Open Throttle (avoid kickdown; transmission must not shift into a lower gear).
- Press memory button "M" on turbocharger tester and read display.
  - Specification: (Relative pressure) 1.350 to 1.650 bar
- Compare actual charge pressure value with value shown in display field 3.
  - Difference: max. 100 mbar

**Note:**

*Repeat the test if the full charge pressure was not attained or if the difference between the actual value and the displayed value is exceeded.*

If the charge pressure is exceeded:

- Check Charge air pressure sensor -G31- ⇒ [Page 21-33](#) .
- Test Wastegate Bypass Regulator valve -N75- .
  - Hose from turbocharger via valve to pressure unit not blocked when connector is pulled off
- Check pressure unit for charge pressure regulator valve is securely mounted on turbocharger.
- Check wastegate bypass regulator valve pressure unit, Page ⇒ [Page 21-29](#)
- Check charge pressure regulator valve shaft mounting in turbocharger for ease of movement.

If corroded together:

- Replace turbocharger.

If the charge pressure is not attained:

- Replace turbocharger.



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## Charge pressure regulation, checking (vehicles with E-Gas system)

### Special tools and equipment

- ◆ VAG1551 Scan Tool (ST) or VAG1552 mobile scan tool with VAG1551/3 adapter cable.

### Test requirements

- No leaks on intake and exhaust side.
- Engine oil temperature at least 80 °C.



## Test sequence

- Connect VAG1551 (VAG1552) scan tool. Start engine and select Engine Control Module (ECM) via "address word" 01.

⇒ [Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Engine Code\(s\) AEB, Repair Group 01; Connecting VAG1551 Scan Tool \(ST\) and selecting Engine Control Module \(ECM\).](#)

Rapid data transfer      HELP  
Select function XX



Indicated on display:

- Press buttons -0- and -8- to select function "Read measuring value block" and press -Q- button to confirm input.

Read measuring value block      HELP  
Enter display group number XXX



Indicated on display:

- Press buttons -1-, -1- and -4- to select "display group number 114" and press -Q- button to confirm input.

Read measuring value block 114      →  
1 2 3 4



Indicated on display

- During a road test or on a dynamometer (at Wide Open Throttle between 1800 and 2300 RPM), check the duty cycle of Wastegate Bypass Regulator valve in display field 4

Specified value: 5 to 95%

If specified value is obtained:

- Press -C- button



Read measuring value block 115 →

1 2 3 4



Indicated on display

- Press buttons -1-, -1- and -5- to select "display group number 115" and press -Q- button to confirm.

- Check actual charge pressure value in display field 4 at Wide Open Throttle (WOT):

### **On dynamometer**

In 3rd gear or in 2nd drive mode

### **While driving**

Vehicles with manual transmission

- Accelerate vehicle in 2nd gear at Wide Open Throttle (WOT).

Vehicles with automatic transmission

- Manually select (Tiptronic) 4th gear and accelerate vehicle from low speed at Wide Open Throttle (WOT) (without kick down, transmission will not downshift).
- Press print button between 1800 and 2300 RPM and read actual charge pressure value in display field 4.

Specified value: 1350 to 1750 mbar

- Compare actual charge pressure value to specified value in display field 3.

Deviation: max. 100 mbar

**Note:**

*Repeat measurement if the full charge pressure has not yet built up or if the deviation between specified and actual value is too large.*

If charge pressure is exceeded:

- Check Charge air pressure sensor -G31- ⇒ [Page 21-33](#)
- Check Wastegate bypass regulator valve -N75-. (throughput in hose from turbocharger via valve to vacuum diaphragm with connector disconnected)
- Check vacuum diaphragm for for proper seating at turbocharger.
- Check Recirculating valve for turbocharger - N249- ⇒ [Page 21-31](#) .
- Check bearing for shaft of charge pressure regulator valve in turbocharger for ease of movement. If rusted solid, replace turbocharger.

If lower limit for charge pressure is not met:

- Check Charge air pressure sensor -G31- ⇒ [Page 21-33](#)
- Check Wastegate bypass regulator valve - N75-.
- Check bearing for shaft of charge pressure regulator valve in turbocharger for ease of movement. If rusted solid, replace turbocharger.



## Wastegate Bypass Regulator valve -N75- , checking

### Special tools and equipment

- ◆ Multimeter V.A.G 1526, V.A.G 1715 or Fluke 83
- ◆ Adapter set V.A.G 1594

### Checking conditions

- ◆ Output Diagnostic Test Mode (DTM) must be performed.

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*

### Checking sequence

- Switch ignition off.
- Disconnect connector from wastegate bypass regulator valve.
- Measure resistance between valve contacts.



- Specification: 25 to 35  $\Omega$

If the specification is not obtained:

- Replace Wastegate Bypass Regulator valve -N75-.



## Pressure unit for charge pressure regulator valve, checking

### Special tools and equipment

- ◆ V.A.G 1551 Scan Tool or vehicle system tester  
V.A.G 1552 with cable V.A.G 1551/3

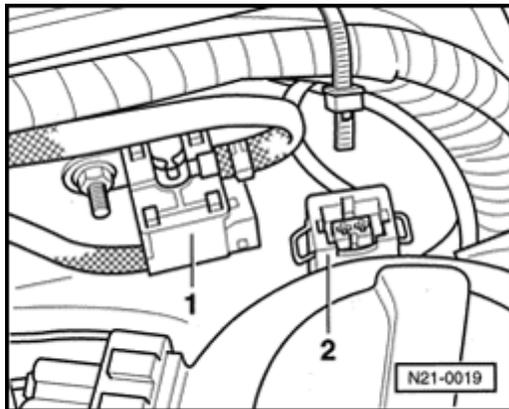
### Checking conditions

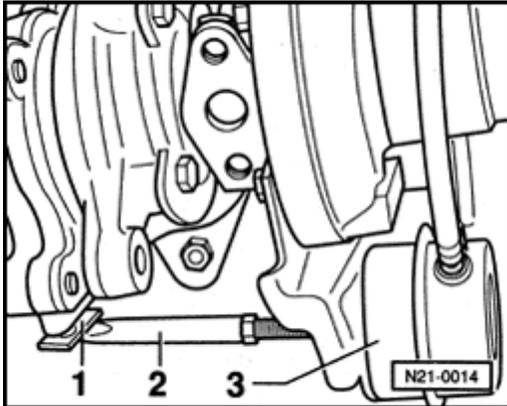
- ◆ Engine oil temperature min. 80 ° C

### Checking sequence

A

- Disconnect connector -2- from Wastegate Bypass Regulator valve - N75- -1-.





A

- Start engine and raise to maximum rpm briefly using throttle.
- Operating rod -2- must move.

If the operating rod does not move:

- Check valve lever -1- for ease of movement.

If corroded together:

- Replace turbocharger.

If the operating rod does not move, even though the lever is free to move:

- Test Wastegate Bypass Regulator valve -N75-.
- Hose from turbocharger via valve to pressure unit not blocked when connector is pulled off

If the valve -N75- is OK:

- Replace turbocharger ⇒ [Page 21-4](#) , item 26 .



## Charge pressure bypass valve, checking

### Engine code AEB

Charge pressure bypass valve, Engine code ATW, ⇒ [Page 21-38](#)

### Special tools and equipment



- ◆ V.A.G 1390 Hand vacuum pump

### Checking conditions

- ◆ Noticeable reduced performance or load change judders

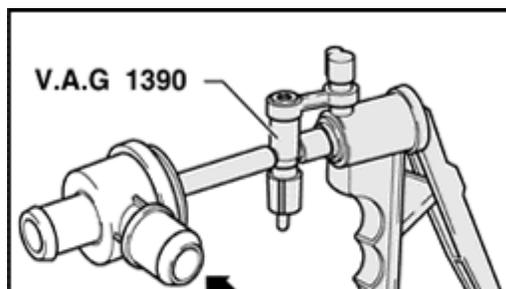
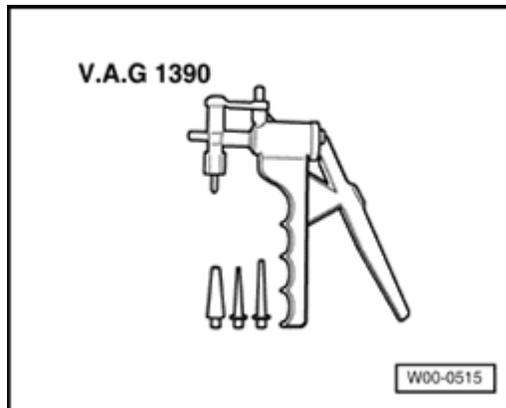
### Checking sequence

#### **Note:**

*The charge pressure bypass valve is located in front of the turbocharger. It is opened by vacuum pressure during the overrun phase and at idling speed.*



- Connect hand vacuum pump V.A.G 1390 to vacuum connection on valve.





- Operate hand vacuum pump.
  - Valve must open (arrow).
- Operate vent valve on hand vacuum pump.
  - Valve must close (arrow).

If valve does not open or close:

- Replace charge pressure bypass valve.

**Note:**

*The charge pressure bypass valve connections are secured with screw-type clips.*



## **Charge air pressure sensor -G31-, checking**

**Only for engine code ATW**

### **Checking conditions**

- ◆ A code has been recognized by the On Board Diagnostic and stored in the Diagnostic Trouble Code (DTC) memory



<p>V.A.G 1526 A</p> 	<p>V.A.G 1594 A</p> 
<p>V.A.G 1598/31</p> 	
	<p>W20-0036</p>

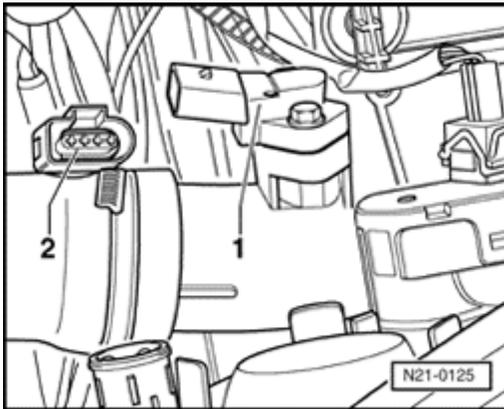
### Special tools and equipment

- ◆ V.A.G 1526 or Fluke 83 multimeter
- ◆ V.A.G 1594 A Adapter set
- ◆ V.A.G 1598/31 Test box
- ◆ Wiring diagram



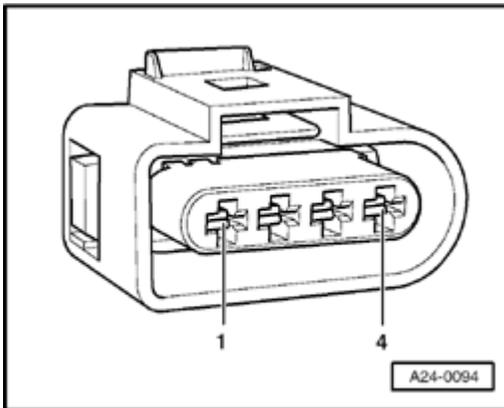
### Checking voltage supply and wiring to control module

- Switch ignition off.



A

- Disconnect 4-pin connector -2- from Charge air pressure sensor -G31-,  
-1-.



A

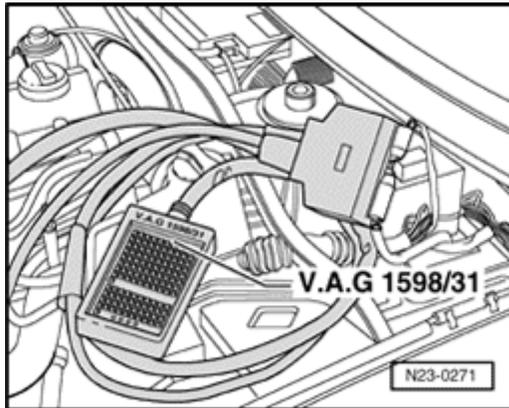
- Connect multimeter to measure voltage using auxiliary cables from V.A.G 1594 to connector contacts 1 + 3.

- Switch ignition on.

- Specification: min. 4.5 V

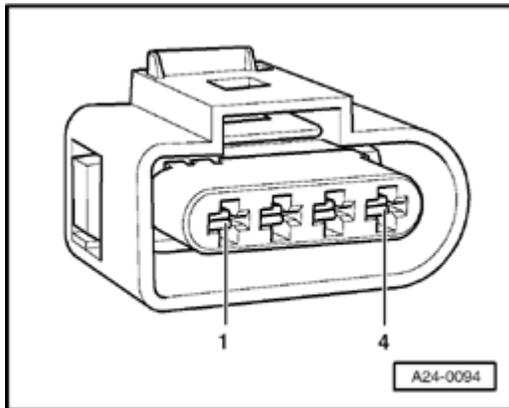
- Switch ignition off.

If the specification is not obtained:



A

- Connect test box V.A.G 1598/31 to control module wiring harness (Engine control module remains disconnected).



A

- Check wiring between test box and connector for open circuit according to wiring diagram.

Contact 1 + socket 108

Contact 2 + socket 98

Contact 3 + socket 101

- Wire resistance: Max. 1.5  $\Omega$

- Additionally check wires for short to one another.

If no faulty wiring is detected and voltage was present between contacts 1 + 3:

- Check function,  $\Rightarrow$  [Page 21-37](#) .

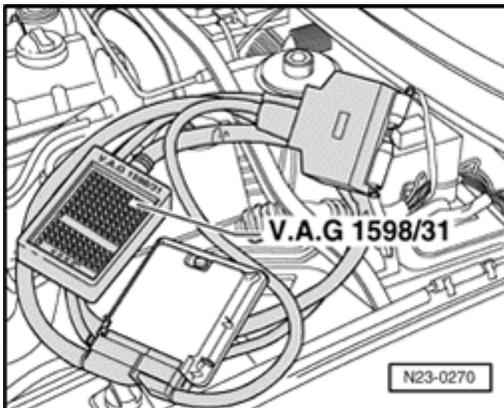


If no faulty wiring is detected and no voltage was present between contacts 1 + 3:

- Replace engine control module.

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 24*

### Checking function



A

- Connect test box V.A.G 1598/31 to engine control module wiring harness and to engine control module.
- Reconnect connector to Charge air pressure sensor -G31-.
- Connect multimeter to sockets 101 and 108.
- Start engine and measure basic voltage.
  - Specification: 1.80 to 2.00 V
- Raise engine revs by pressing accelerator to:
  - Specification: 2.00 to 3.00 V

If the specifications are not attained:

- Replace Charge air pressure sensor -G31-.



## Recirculating valve for turbocharger - N249-, checking

### Only for engine code ATW

*The valve in the hose between the intake manifold and the recirculating valve is open if it is without current. The hose to the vacuum reservoir is closed.*

### Checking conditions

- ◆ Output Diagnostic Test Mode (DTM) must be performed.

⇒ *Repair Manual, 1.8 Liter 4-Cyl. 5V Turbo Fuel Injection & Ignition, Repair Group 01*

### Checking sequence

- Switch off ignition.
- Disconnect connector from Recirculating valve for turbocharger -N249-.
- Measure resistance between valve contacts.

**A**

- Specification: 25 to 35  $\Omega$

If the specification is not obtained:

- Replace Recirculating valve for turbocharger -N249-.