

Charge air system with turbocharger

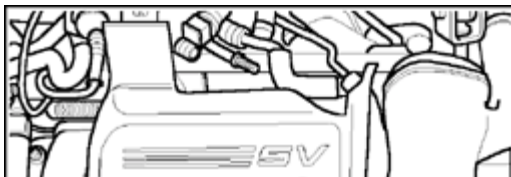
Turbocharger, removing and installing

Observe rules for cleanliness ⇒ [Page 21-8](#) .

Notes:

- ◆ *Turbochargers must be replaced in pairs.
Manufacturing tolerances may prevent matched operation.*
- ◆ *All hose connections are secured with clips.*
- ◆ *Charge air system must be free of leaks.*
- ◆ *Replace self-locking nuts.*
- ◆ *Replace all seals and gaskets*
- Remove engine ⇒ [Page 10-1](#) .

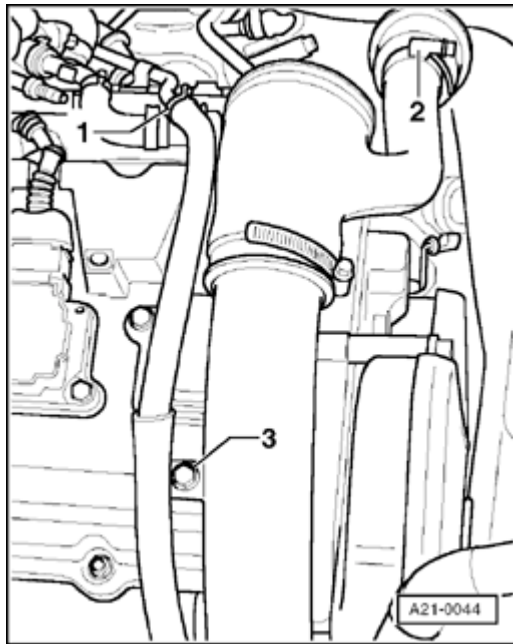
Removing right-hand turbocharger



4

- Remove cover panel from right-hand cylinder head cover -arrows-.

21-2

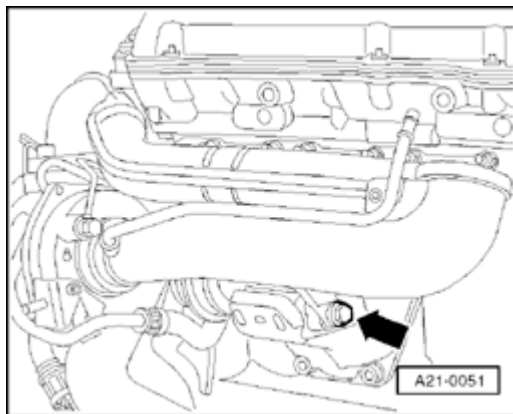


A

- Disconnect hose -1-.
- Disconnect hose -2-.
- Unbolt upper section of intake line -3-.

Note:

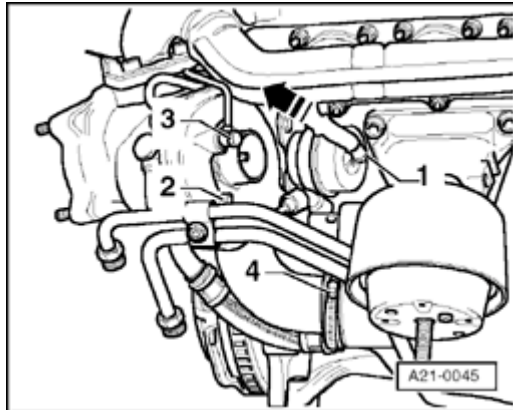
Plug lower section of intake line.



A

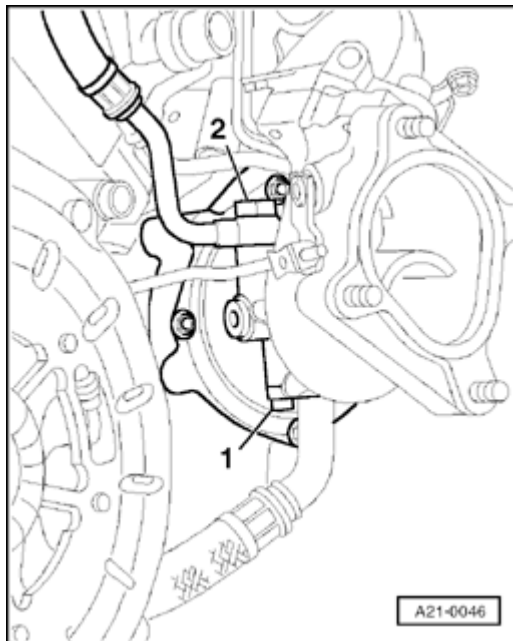
- Remove lower section of intake line -arrow-.

21-3



A

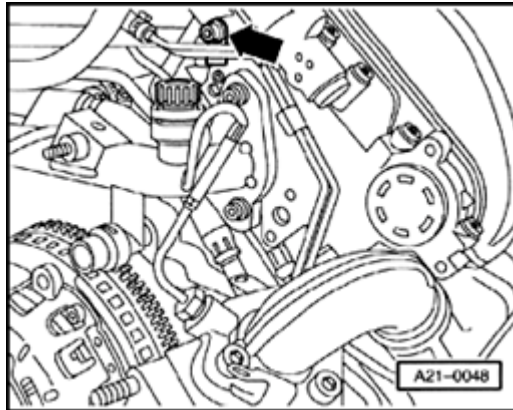
- Push back heat insulation hose in direction of arrow.
- Disconnect vacuum hose -1-.
- Unbolt bracket -2- with gearbox oil lines.
- Disconnect line -3-.
- Disconnect pressure hose -4- from turbocharger.



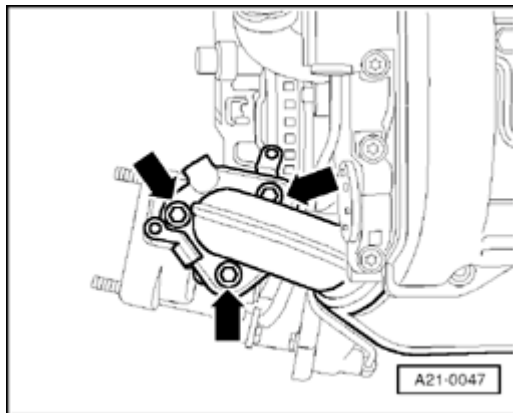
A

- Disconnect oil return line -1-.
- Disconnect water line -2-.

21-4



- A**
- Disconnect hose -arrow- from cylinder head.



- A**
- Remove turbocharger -arrows-.

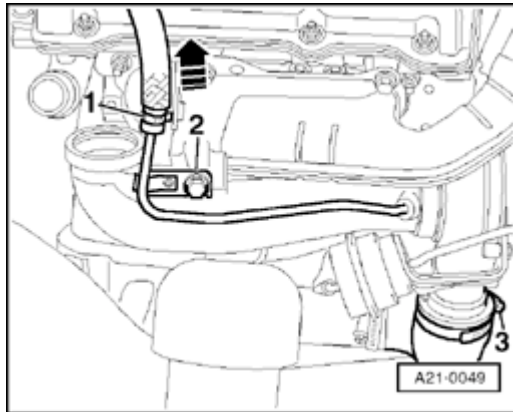
Installing

- Install in reverse sequence.

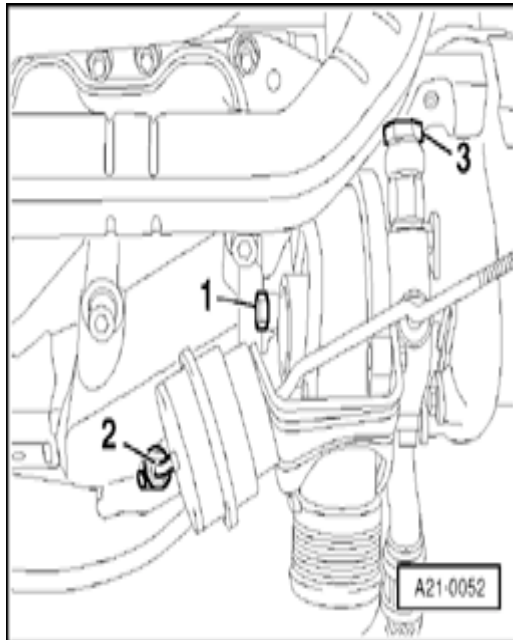
Notes:

When installing turbocharger, ensure that O-ring for oil return is not damaged.

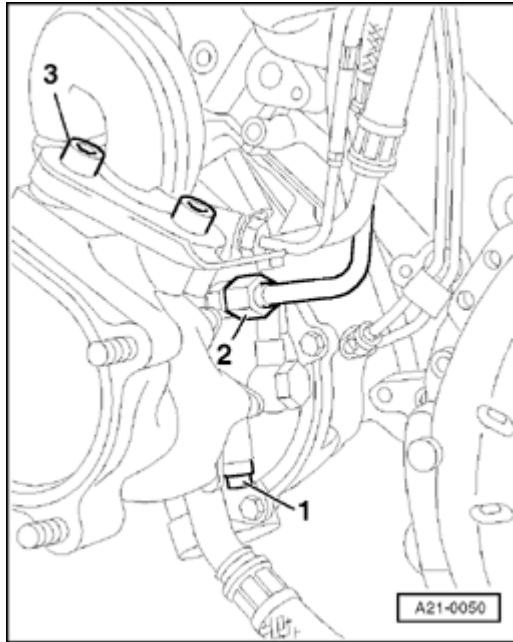
Removing left-hand turbocharger

**A**

- Push back heat insulation hose in direction of arrow.
- Disconnect vacuum hose -1-.
- Remove lower section of pressure line -2-.
- Disconnect pressure hose -3- from turbocharger.

**A**

- Disconnect vacuum line -1-.
- Disconnect vacuum hose -2-.
- Disconnect line -3- going to right-hand turbocharger.



A

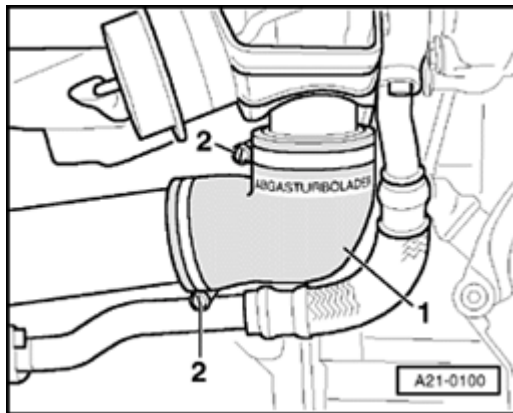
- Disconnect oil return line -1-.
- Disconnect water line -2-.
- Remove turbocharger -3- (3 bolts).

Installing

- Installation is the reverse of removal.

Notes:

When installing turbocharger, be sure that o-ring at connection flange for oil return is not damaged.



A

The text "Abgasturbocharger" must be readable as shown in illustration, install turbocharger hose -1- properly if necessary.

The hose clamps -2- must be installed as shown in illustration. The bolt-locks on the screw clamps must be placed at the X-marking on the hose.

Tightening torque

Bolted mountings	Tightening torque
Turbocharger	20 Nm
Intake line to cylinder head	10 Nm
Heat shield to turbocharger	10 Nm
Exhaust manifold to exhaust pipe	25 Nm
Injector pipes	30 Nm
Intake pipe to engine support	10 Nm
Oil pipe to turbocharger	15 Nm
Oil pipe to intake manifold	20 Nm

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 vehicle unless absolutely necessary.

Turbocharger and charge pressure regulating valve, checking

Safety notes

Note the following points if test equipment has to be used during a road test:

WARNING!

- ♦ *Test equipment must always be secured on the rear seat and operated from there by a second person.*
- ♦ *If test equipment is operated from the front passenger seat, the occupant could be injured by the passenger's airbag in an accident.*

Special tools, testers and auxiliary items

- ♦ Turbocharger tester VAG 1397 A
- ♦ VAG 1551 Scan Tool or VAG 1552 with cable VAG 1551/3

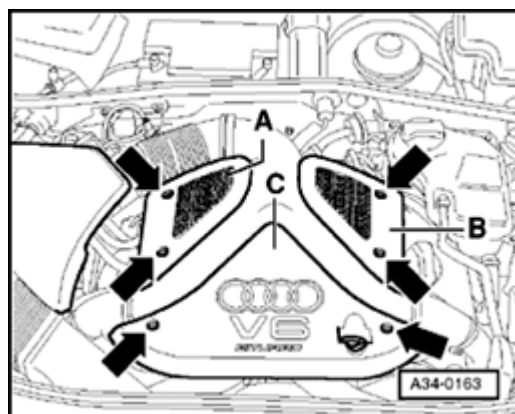
21-10

Requirements for test:

- Diagnostic Trouble Code (DTC) memory has been interrogated

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)

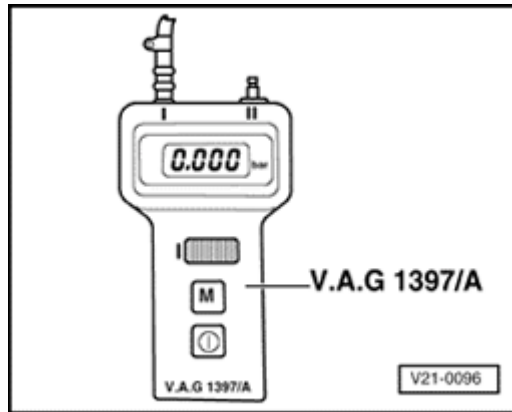
- Output Diagnostic Test Mode (DTM) has been performed
- Engine oil temperature at least 60° C
- All vacuum connections airtight



- Loosen bolts -arrows- and remove engine cover panel -B-.



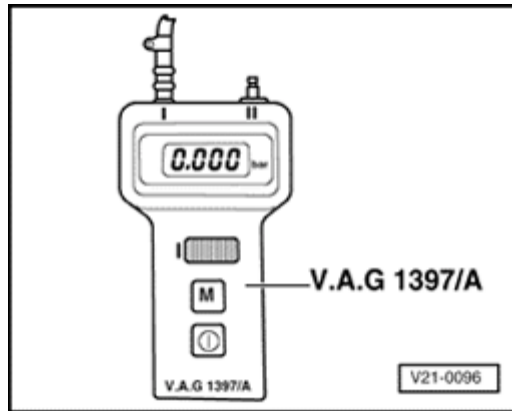
- Connect T-piece with measuring hose of turbocharger tester VAG 1397 A to fuel pressure regulator -arrow-.
- Route measuring hose under rear edge of hood and into passenger compartment via right-hand window.



- Switch on turbocharger tester and set measuring range selector switch to position -I- (absolute pressure).
- Connect measuring hose to connection -I-.

Notes:

- ◆ *Hose connections must be completely airtight, otherwise measurements will not be correct.*
- ◆ *Ensure that measuring hose is not pinched at hood or side window.*
- ◆ *Pressing memory key M on turbocharger tester will store the last measured value until memory key M is pressed again or tester is switched off.*
- ◆ *The decimal point in the display flashes to indicate that the value is being stored.*
- ◆ *If the battery voltage of the turbocharger tester drops below the minimum level, an arrow will appear at the top left of the display.*
- ◆ *Before performing the test, drive the vehicle at a brisk speed for at least 3 km (without stopping at traffic lights etc.).*
- ◆ *A second mechanic is required to note the readings on the tester when the vehicle is moving.*
- ◆ *Observe safety notes ⇒ [Page 21-9](#) .*



- Accelerate vehicle from 2000 RPM at full throttle in fourth gear, and watch rev counter.
- - Press memory key -M- on turbocharger tester at 3000 RPM.
 - ◆ Specification: 1.550 ... 1.650 bar

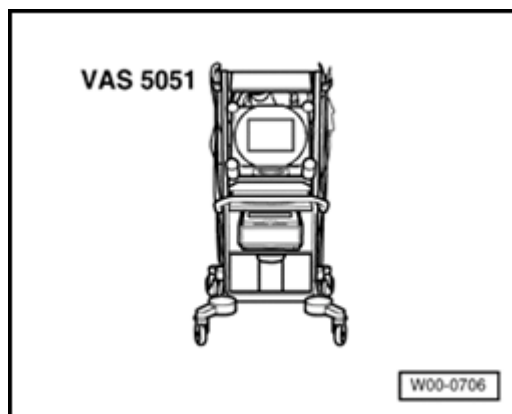
Note:

If no charge pressure is obtained and a throbbing noise can be heard in the engine compartment, the causes can be as follows:

- ◆ *Air recirculation valve faulty.*
- ◆ *Vacuum line to air recirculation valve leaking or has become disconnected.*

Charge air pressure regulation, checking

Special tools and equipment



◆ VAS 5051 with VAG 5051/1

or

◆ VAG 1551 with VAG 1551/3A

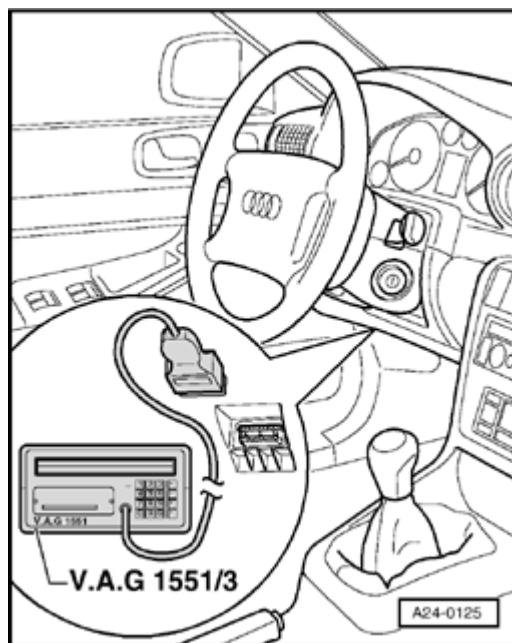
Test requirement:

- Coolant Temperature at least 80 ° C.

WARNING!

- ◆ *During a road test in an airbag-equipped vehicle, test equipment must always be fastened to and operated from the rear seat by a second technician.*
- ◆ *When driving or riding in an airbag-equipped vehicle, NEVER hold the scan tool or other test equipment in your hands or lap while in motion. Objects between you and the airbag increase the risk of injury in an accident.*

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Test sequence

Rapid data transfer **HELP**
Select function XX

Read measuring value block **Q**
Input display group number XXX

Read Measuring Value Block 115 **→**



- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)



When indicated on display

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



When indicated on display

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



Indicated on display (1...4 = display fields)

1

2

3

4

- Check charge air pressure regulation.

21-15

- Road test vehicle.

◆ Wide Open Throttle (WOT) must be reached

- Measurement must be taken at Wide Open Throttle (WOT).

	Display fields			
	1	2	3	4
Display group 115: Charge air pressure regulation				
Display	1 RPM	%	mbar	mbar
Indicated	Engine speed (RPM)	Actual load	Specified pressure	Actual pressure
Specified value			XXX	Must not deviate more than +/- 20 mbar from specified
Note:				

Actual pressure must not deviate from specified pressure by more than ± 20 mbar.

21-16

- Select measuring value block 117.
- Check function of accelerator pedal in display field 2 by briefly depressing pedal to Wide Open Throttle.

	Display fields			
	1	2	3	4
Display group 117: Charge air pressure regulation				
Display	1 RPM	%	%	mbar
Indicated	Engine speed (RPM)	Accelerator pedal position	Throttle valve angle	Specified charge air pressure
Specified value		0...100		
Note:				

If the specified value 100% is not reached at Wide Open Throttle (WOT):

- Check accelerator pedal.
- Select measuring value block 116.

21-17

- Check correction factors in display fields 2 to 4.

	Display fields			
	1	2	3	4
Display group 116: Charge air pressure regulation				
Display	1 RPM	%	%	mbar
Indicated	Engine speed (RPM)	Correction factor Fuel	Correction factor Coolant temp.	Correction factor Intake air temp.
Specified value				
Note:				

If display field 2 indicates a correction factor <0 %, fuel quality is probably incorrect.

- Fill tank with prescribed fuel quality.

If display field 3 indicates a correction factor <0 %, coolant temperature is too high (heat warning lamp lit in instrument cluster) or the Engine Control Module is receiving an incorrect temperature signal from the instrument cluster.

- Check coolant temperature display.

⇒ [Repair Manual, Electrical Equipment, Repair Group 90](#)

21-18

If display field 4 indicates a correction factor <0 %, intake air is too hot or the sensor for intake air temperature is faulty.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 24](#)

- Select measuring value block 114.

	Display fields			
	1	2	3	4
Display group 114: Charge air pressure regulation				
Display	%	%	%	%
Indicated	Specified engine load (without correction)	Specified engine load (after correction)	Actual load	Duty cycle CAPR-cyclical valve
Specified value	136,0	134,3	137,5	55,2
Note:				

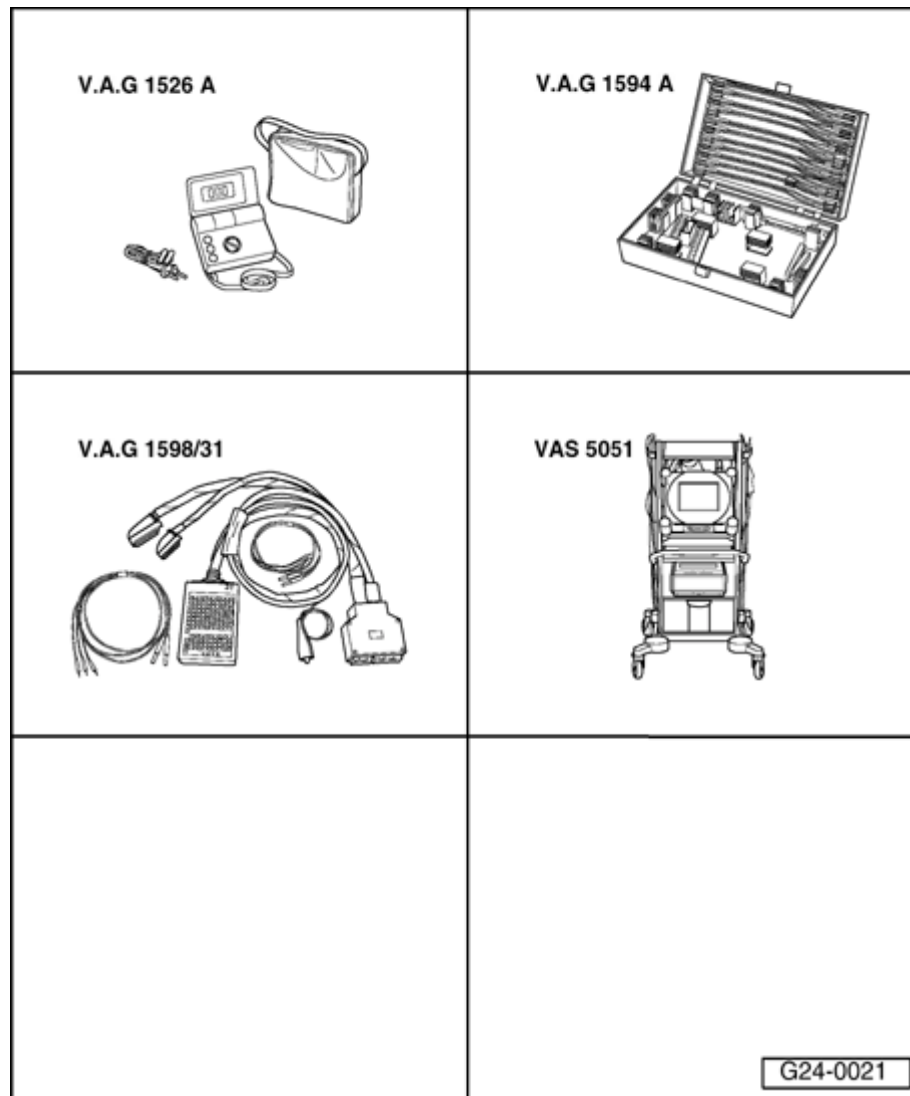
Load values in display fields 1 to 3 can deviate from each other by up to ± 5 %.

If specified values are not achieved in the

measuring value blocks:

- Check the charge air pressure sensor -G31-.

21-19



Recirculating valve for turbocharger - N249-, checking

Special tools and equipment

- ◆ VAG 1526A
- ◆ VAG 1527B
- ◆ VAG 1594A
- ◆ VAG 1598/31
- ◆ VAS 5051 with VAG 5051/1
- or
- ◆ VAG 1551 with VAG 1551/3A

Note:

The recirculating valve for turbocharger -N249 and wire connections are monitored by the Engine Control Module (ECM).

- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle for this.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)

- Check DTC memory of Engine Control Module (ECM).

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)

If a Diagnostic Trouble Code (DTC) relating to the recirculating valve for turbocharger -N249- is displayed:

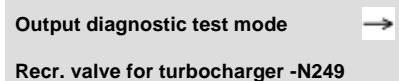
- Disconnect hoses from valve; harness connector

remains connected.

- Attach assisting hose to one connection of valve.

- Initiate output Diagnostic Test Mode (DTM) and activate recirculating valve for turbocharger - N249-.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)



Indicated on display

Valve must click...

...and must open and close (can be tested by blowing into assisting hose).

If valve does not click:

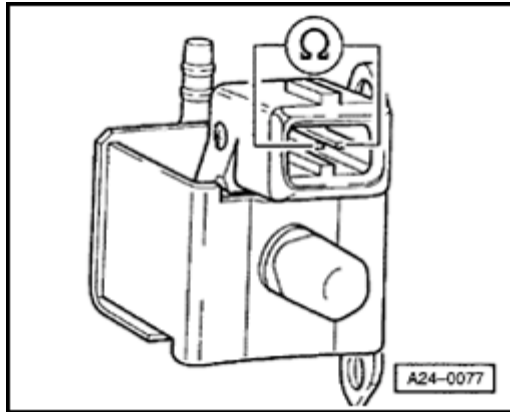
- Check internal resistance of valve.

If valve does not open and close properly:

- Replace recirculating valve for turbocharger -N249-.

Checking internal resistance

- Disconnect connector at valve.



A

- Connect multimeter at valve for resistance measurement.
 - ◆ Specified value: 27 ... 30 Ω

If specified value is not obtained:

- Replace recirculating valve for turbocharger -N249-.

If the specified value is met:

- Check voltage supply

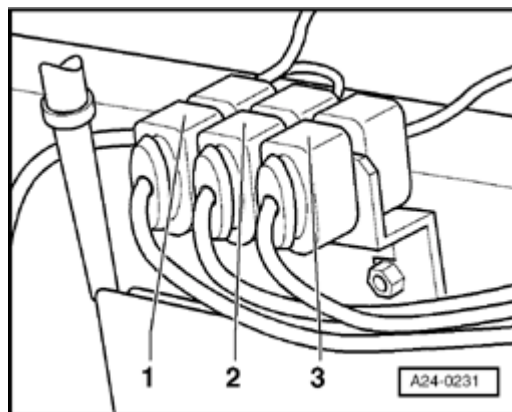
Checking voltage supply

Note:

Voltage is supplied to the recirculation valve via the Fuel Pump (FP) relay.

Test requirement:

- Fuse for recirculation valve OK
- Disconnect connector at valve.



A

- Connect VAG1527B voltage tester as follows:

Harness connector terminal	Measure to
1	Engine Ground (GND)

- Operate starter briefly.
 - ◆ LED must light.

If LED does not light:

- Check wire connection from terminal 1 to Fuel Pump (FP) relay via fuse for open circuit.

⇒ *Electrical Wiring Diagrams, Troubleshooting & Component Locations*

- Repair open circuit if necessary.

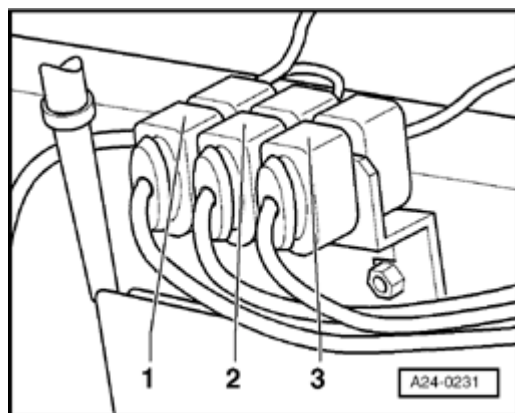
If wire connection is OK:

- Check Fuel Pump (FP) relay.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 24](#)

If LED lights:

- Check activation, ⇒ [Page 21-25](#) .



Checking activation



- Connect VAG 1527B voltage tester to connector terminals 1 (B+) and 2.
- Initiate output Diagnostic Test Mode (DTM) and activate recirculating valve for turbocharger -N249-.

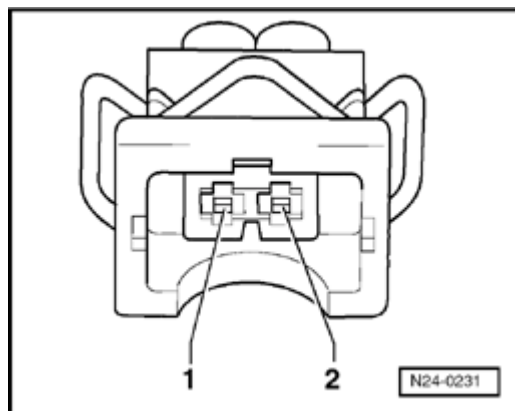
⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)

◆ LED must blink.

If LED does not blink or if it remains constantly lit:

- Connect VAG 1598/31 test box at wiring harness to ECM. Do not connect ECM.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 24](#)



- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 test box
	Bushing
2	9

- Repair open circuit or short circuit if necessary.

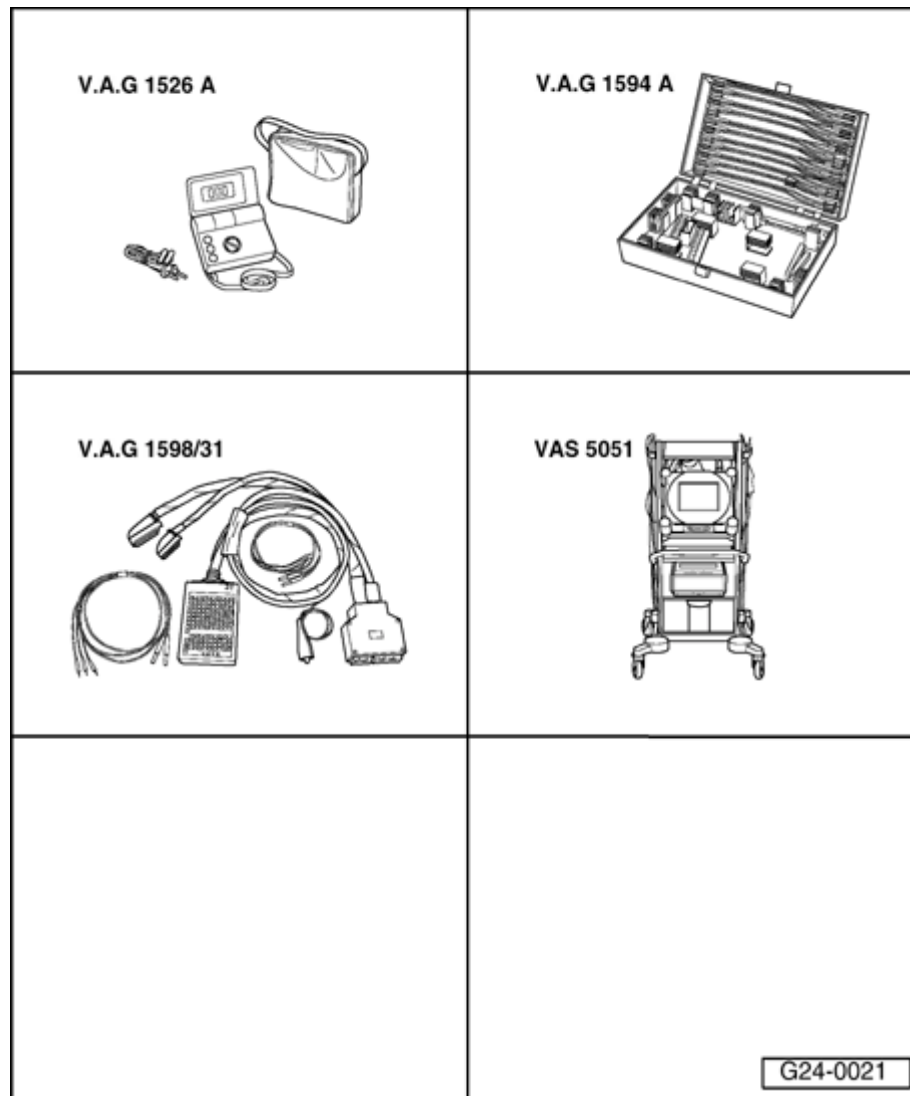
21-26

If wire connection is OK:

- Replace Engine Control Module (ECM).

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 24](#)

21-27



Charge air pressure sensor -G31-, checking

Special tools and equipment

- ◆ VAG 1526A
- ◆ VAG 1594A
- ◆ VAG 598/31
- ◆ VAS 5051 with VAG 5051/1
- or
- ◆ VAG 1551 with VAG 1551/3A

Note:

The charge air pressure sensor -G31- and wire connections are monitored by the Engine Control Module (ECM).

- Connect VAS 5051 tester or VAG 1551 scan tool and select control module for engine electronics using "address word" 01. Engine must run at idle.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)

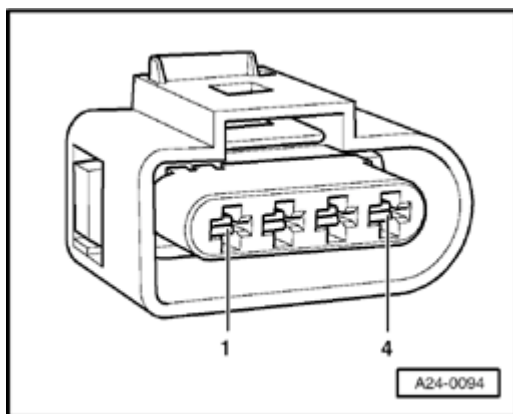
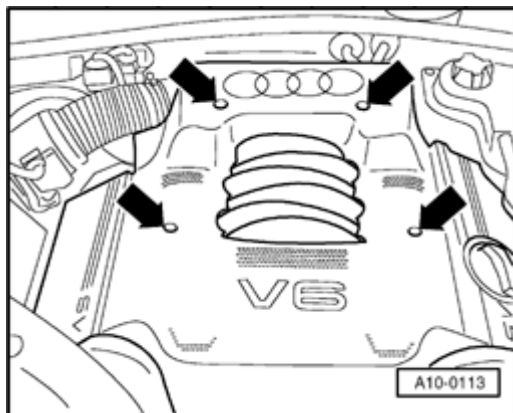
- Check DTC memory of Engine Control Module (ECM).

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 01](#)

If a Diagnostic Trouble Code (DTC) relating to the charge air pressure sensor -G31- is indicated:

Checking voltage supply

- Switch ignition off.
- Remove engine cover (arrows).
- Disconnect connector at charge air pressure sensor.

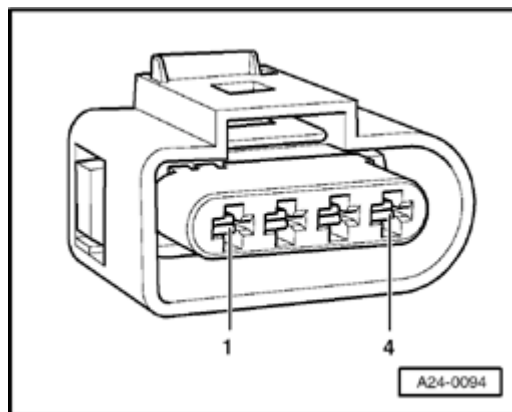


- Connect multimeter between terminal 1 and 3 of harness connector for voltage measurement.
- Switch ignition on.
 - ◆ Specification: about 5 V

If specified value is not obtained:

- Connect VAG 1598/31 test box to wiring harness for Engine Control Module (ECM), also connect ECM -1-.

⇒ [Repair Manual, 2.7 Liter V6 5V BiTurbo Fuel Injection & Ignition, Engine Code\(s\): APB, Repair Group 24](#)



4

- Check the following wire connections for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 or test box
	Bushing
1	108
3	98

- Repair open circuit or short circuit if necessary.

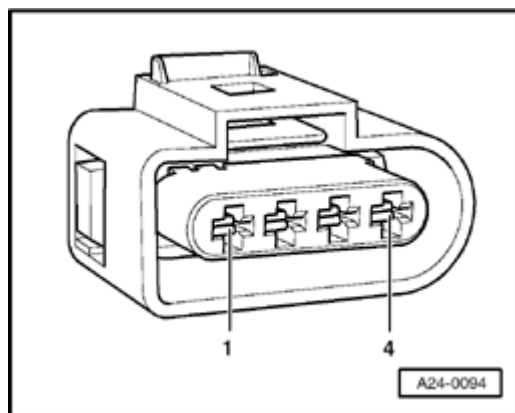
If the specified value is met:

- Check signal wire, ⇒ [Page 21-31](#) .

Checking signal wire

- Disconnect harness connector at charge air pressure sensor.
- Connect multimeter to socket 101 and socket 108 of test box for voltage measurement.
- Start engine and run at idle.
 - ◆ Specification: about 1.90 V
- Bring engine to RPM by depressing pedal suddenly.
 - ◆ Specification: approx. 2.00 ... 3.00 V

21-32



If specified values are not obtained:



- Check following wire connection for open circuit and short circuit to Ground (GND) and B+:

Harness connector terminal	VAG 1598/31 or test box
	Bushing
4	101

- Repair open circuit or short circuit if necessary.

If wire connection is OK:

- Replace charge air pressure sensor -G31-.