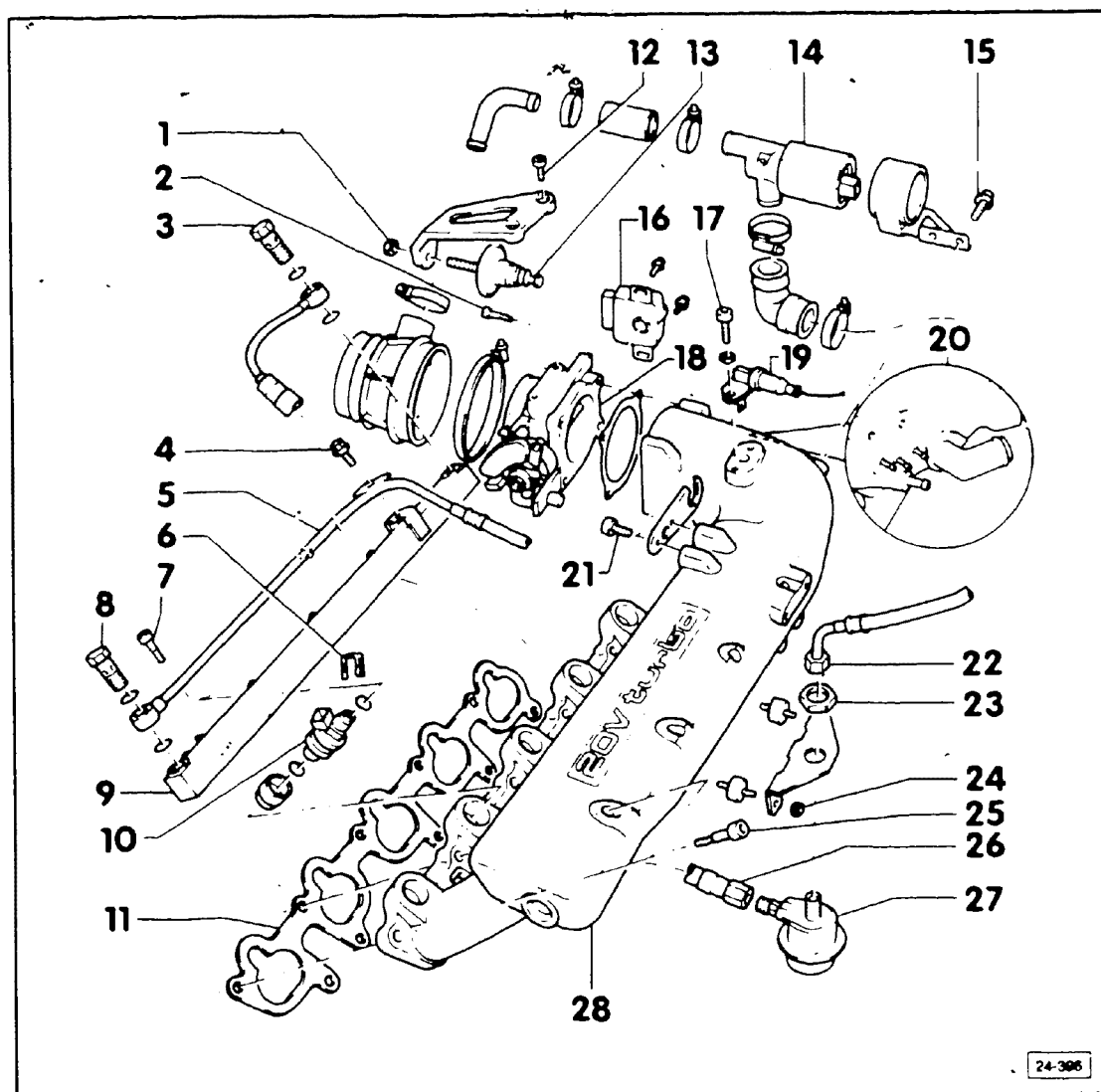


Index

20-valve Turbo/Engine code 3B

- Altitude sensor
 - checking 24-140
- Air mass sensor
 - checking 24-160
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 - checking 24-110
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Fuel Injection, AFC System



Note

Replace gaskets as necessary

Before performing repair work on the fuel injection system activate fault memory and perform Output checks. See Repair Group D2 for additional information

- 1 — 10 Nm (7 ft lb)
- 2 — 10 Nm (7 ft lb)
- 3 — Banjo bolt
25 Nm (18 ft lb)
- 4 — 10 Nm (7 ft lb)
- 5 — Fuel supply line

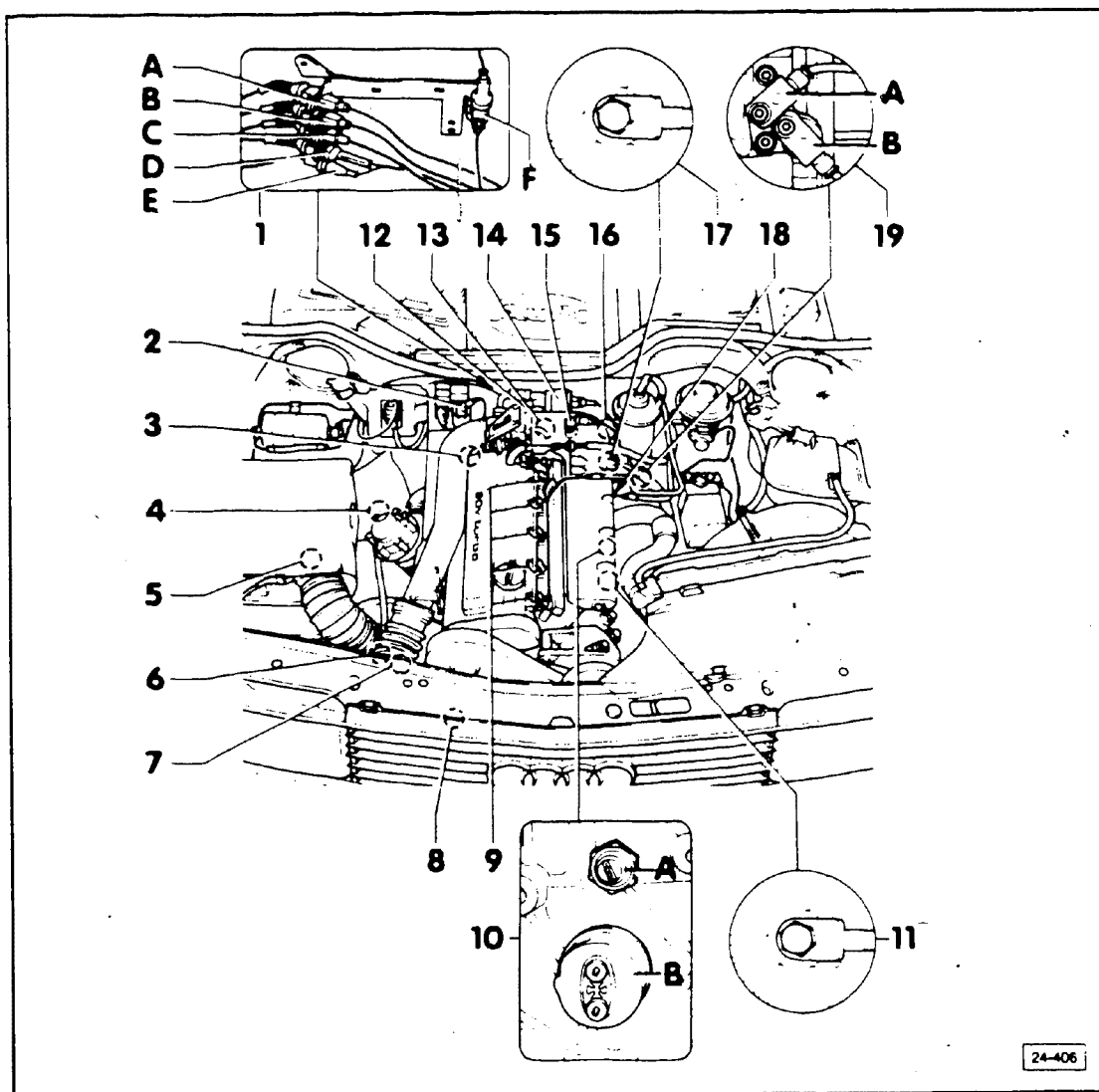
- 6 — Retaining clip
- 7 — 10 Nm (7 ft lb)
- 8 — Banjo bolt
25 Nm (18 ft lb)
- 9 — Fuel rail
- 10 — Fuel injector
when removing, replace upper and lower O-rings
- 11 — Manifold gasket
- 12 — 10 Nm (7 ft lb)
- 13 — Dashpot
checking adjusting. See Repair Group 20

Fuel Injection, AFC System

- 14 — Idle stabilizer valve (N 71)
checking section 24-80
- 15 — 10 Nm (7 ft lb)
- 16 — Throttle potentiometer (G 69)
(integrated into idle switch)
checking section 24-130
- 17 — 10 Nm (7 ft lb)
- 18 — Throttle body
- 19 — Intake air temperature sensor (G 42)
checking see Repair Group 28
- 20 — Vacuum connections
exploded view section 24-180
- 21 — 20 Nm (15 ft lb)
- 22 — Fuel return line
20 Nm (18 ft lb)
- 23 — 20 Nm (15 ft lb)
- 24 — 10 Nm (7 ft lb)
- 25 — 25 Nm (18 ft lb)
- 26 — 20 Nm (15 ft lb)
- 27 — Fuel pressure regulator
- 28 — Intake manifold

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Fuel Injection, AFC System



1 — Harness connector mounting bracket (for harness connectors A through F)

A Ignition timing sender (G 4)
(Black connector)

B Engine speed sensor (G 28)
(Gray connector)

C Knock sensor I (Front) (G 61)
(Brown connector)

D Oxygen sensor heater connector (D 19)
(2 pin Black connector)

E Oxygen sensor (G 39)
(Green signal wire)

F Knock sensor II (Rear) (G 66)
(Blue connector)

2 — Ignition coil (N)
checking, see Repair Group 28

3 — Engine coolant temperature sensor (G 62)
(on right rear of cylinder head)
checking, see Repair Group 28

4 — Oxygen sensor (G 39)
checking, section 24-90

5 — Air mass sensor (G 19)
checking, section 24-160

6 — Wastegate frequency valve (N 75)
checking, section 24-110

7 — By-pass valve (N 65)
checking, see Repair Group 21

- 8 — Oil temperature sensor (G 68)
- 9 — Fuel injector (N 30, 31, 32, 33, 83)
checking, section 24-60
- 10 — Dynamic oil pressure switches
 - A Oil pressure switch (F 1)
 - B Oil pressure sensor (G 10)
- 11 — Knock sensor I (Front) (G 61)
- 12 — Throttle potentiometer (G 69)
(Integrated with idle switch)
- 13 — Carbon canister frequency valve (N 80)
checking, section 24-100
- 14 — Idle stabilizer valve (N 71)
checking, section 24-80
- 15 — Intake air temperature sensor (G 42)
checking, see Repair Group 28
- 16 — Ignition distributor (O) with Hall sender (G 40)
 - checking Hall sender, see Repair Group 28
 - Basic adjustments, see Repair Group 28
- 17 — Knock sensor II (Rear) (G 66)
- 18 — Fuel pressure regulator
system pressure and residual pressure checking,
section 24-40
- 19 — Flywheel sensors
 - A Ignition timing sender (G 4)
(Black connector)
checking, see Repair Group 28
 - B Engine speed sensor (G 28)
(Gray connector)
checking, see Repair Group 28

Safety Precautions

Rules of cleanliness

CAUTION

When working on the fuel supply/injection system, carefully observe the following rules:

- 1 — Thoroughly clean connection and surrounding areas before loosening connection.
- 2 — After removing components, place in clean area and cover with foil or paper. Avoid using rags!
- 3 — Components which have been opened or disassembled must be carefully covered or sealed if repair cannot be carried out immediately.
- 4 — Install clean parts only.
 - Remove replacement parts from package just before installing.
 - do **NOT** use spare parts that were stored loose or unpackaged (e.g. in tool boxes, etc.).
- 5 — When fuel system is open:
 - Avoid using compressed air whenever possible.
 - Avoid moving the vehicle whenever possible.

Safety measures

CAUTION

Observe the following precautions to prevent personal injury as well as possible damage to the ignition system components.

- do **NOT** disconnect the Motronic control unit until at least 20 seconds after switching off the ignition
- switch **OFF** the ignition before connecting or disconnecting components or test equipment
- connect and disconnect battery **ONLY** with ignition switched **OFF** otherwise the Motronic control unit could be damaged
- if the engine must be cranked but not started (for compression testing etc.) disconnect power output stage of ignition coil and fuse **13**
- after each start attempt wait at least one minute before trying again
- do **NOT** crank engine with injectors removed
- do **NOT** use battery booster longer than one minute nor should 16.5 volts be exceeded
- do **NOT** wash engine unless ignition is switched **OFF**
- disconnect **BOTH** battery terminals whenever arc or spot welding
- before towing, vehicles with a defective ignition system (or where this is suspected) must have terminal **1** (green) of the ignition coil disconnected
- do **NOT** connect a condenser of any kind to terminal **1** of the ignition coil
- when installing noise suppressors, **ONLY** use 1000 ohms for high tension wires and 5000 ohms for spark plug connectors
- do **NOT** replace distributor rotor (marked R1) with a different type
- if the vehicle is heated up (e.g. in a painting booth) do **NOT** start the engine until it has had sufficient time to return to room temperature

CAUTION

Before disconnecting a customers battery: **ALWAYS** ask for the radio code (if equipped with an anti-theft radio).

Note

A variety of electrical connectors are used on this vehicle. **ALWAYS** use the **VW 1594** adaptor kit to connect test instruments to these connectors.

Technical data

System pressure (with engine running)	without vacuum	3.0 to 3.2 bar (43.5 to 46.4 psi)
	with vacuum	2.4 to 2.7 bar (34.8 to 39.2 psi)
Residual pressure (after 10 minutes)	with engine cold	2.5 bar (36.3 psi) minimum
	with engine warm	2.8 bar (40.6 psi) minimum
Injector pressure	ml per 30 seconds	150 to 170
*Idle speed	checking value	800 $\pm$ 30 rpm
* CO content	checking value	0.7 $\pm$ 0.2 vol. %

■ Checking conditions

- Activate fault memory, see Repair Group D2 for additional information
- Engine warm, oil temperature 80°C (176°F) minimum
- Throttle in idle position (against stop)
- All electrical consumers switched **OFF**
- A/C switched **OFF**
- NO fuel pressure measuring devices connected
- Radiator cooling fan NOT running during measurements

Fuel Pressure, Checking

WARNING

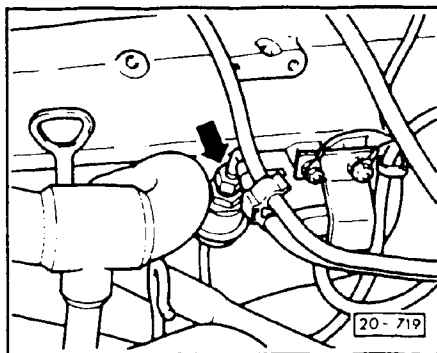
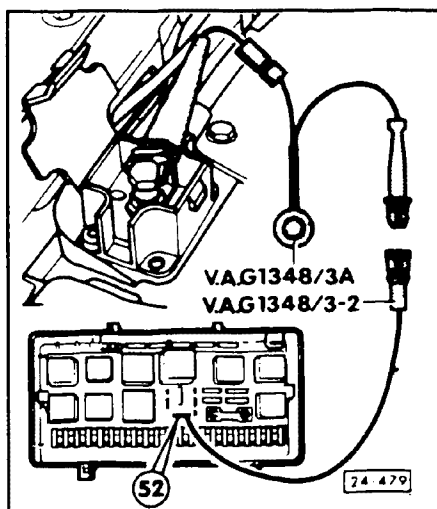
Fire hazard Do **NOT** smoke or have anything in area that can ignite fuel.

Requirements

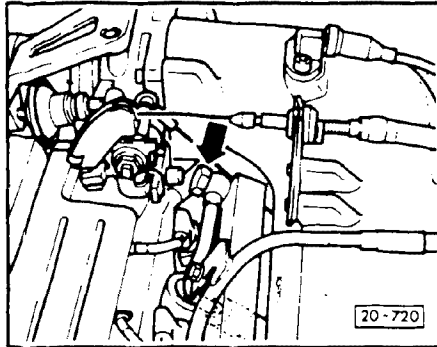
- fuse number **13 OK**
- fuel filter **OK** (not plugged)
- Battery voltage 12 volts minimum
- All electrical consumers switched **OFF**
- A.C switched **OFF**

Remote control VAG 1348/3A, connecting

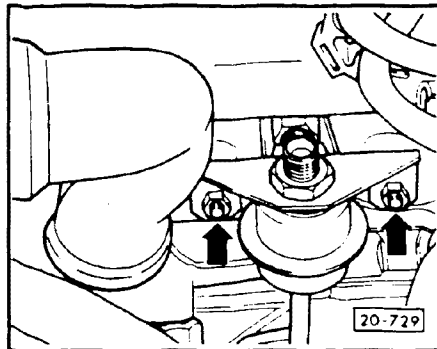
- remove fuel pump relay from fuse/relay panel position 10
 - connect **VAG 1348/3A** remote control adaptor to terminal **52** of fuel pump relay socket
 - connect alligator clip of remote control to jump start terminal (battery -) in engine compartment
-
- remove fuel return line from fuel pressure regulator (**arrow**)



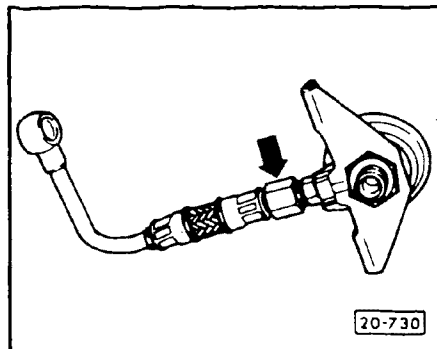
Fuel Injection, AFC System



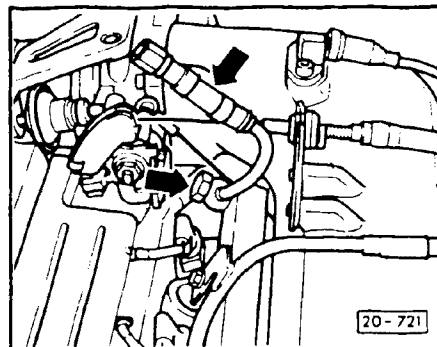
- disconnect fuel line from fuel rail (**arrow**)
 - this fuel line is connected to the fuel pressure regulator



- remove mounting bolts (**arrows**) from fuel pressure regulator
- remove fuel pressure regulator complete with bracket from intake manifold
 - carefully pull off fuel line from intake manifold

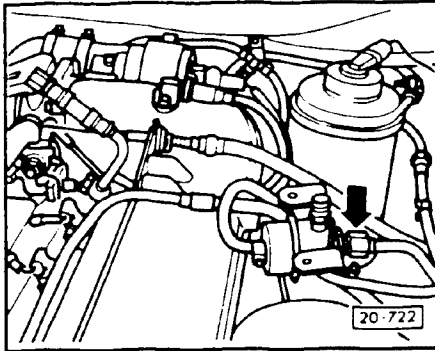


- disconnect fuel line (**arrow**) from fuel pressure regulator

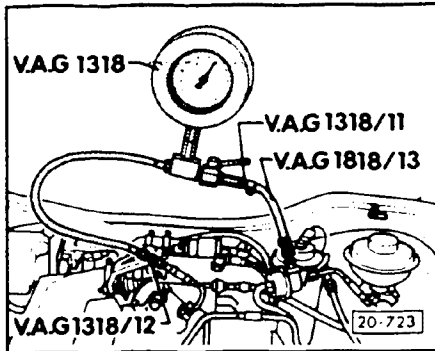


- reconnect fuel line removed from fuel pressure regulator to fuel rail
 - rotate fuel line 180° from normal installed position

Fuel Injection, AFC System



- reconnect fuel return line to fuel pressure regulator (**arrow**)



- connect pressure tester **VAG 1318** between pressure regulator and rotated fuel line on fuel rail
 - lever on tester must be open (handle parallel to line)
- disconnect vacuum line from fuel pressure regulator and plug off line

Note

Replace the fuel pressure regulator if fuel leaks out of the vacuum port during the following test.

- briefly operate remote control
 - fuel pump must run

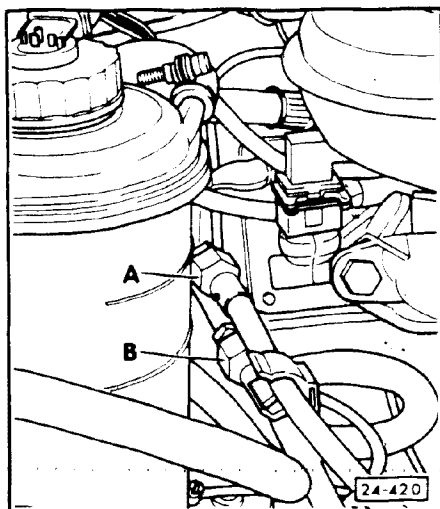
If NO

- check fuel pump operation, see Repair Group 20
- operate remote control until pressure no longer increases
 - must be 3.0 to 3.2 bar (43.5 to 46.4 psi) with pump running
 - must be 2.5 to 2.7 bar (36.3 to 39.2 psi) immediately after fuel pump is switched off

Note

If there is no pressure increase, check if fuel supply and return lines are reversed.

Fuel Injection, AFC System



A— Supply line (to fuel supply rail)

B— Return line (from fuel pressure regulator)

If specified pressure **NOT** obtained

- check fuel pump. Repair Group 20
- check fuel supply line for leaks, damage or possible pinching, e.g. in area of floor
- repair or replace as necessary

If **NO** damage is detected but pressure is still **NOT** obtained

- replace fuel pressure regulator and repeat test

If specified pressure is exceeded

- check fuel return line for damage or pinching, e.g. in area of floor
- check for flow, repair or replace as necessary

CAUTION

Excessive fuel pressure can rupture the pressure regulator diaphragm, allowing fuel to enter the engine through the vacuum connection.

Note

During the following tests, the engine must not run any longer than necessary with the vacuum hose to the pressure regulator disconnected. Disconnecting it raises the fuel pressure causing a mixture enrichment. This in turn can cause the oxygen sensor control to exceed its limits which will then generate a fault in memory.

- start engine and let run at idle
- switch **OFF** all electrical consumers
- switch **OFF** A/C
- connect hand vacuum pump **US 8026** to fuel pressure regulator and apply vacuum
- observe pressure drop on gauge
 - must drop approx. 0.5 bar (7 psi)

If pressure does **NOT** drop

- check vacuum hose for leaks, cracks or damage
- check installed vacuum hose for flow by disconnecting from pressure regulator and blowing through
- replace or repair as necessary

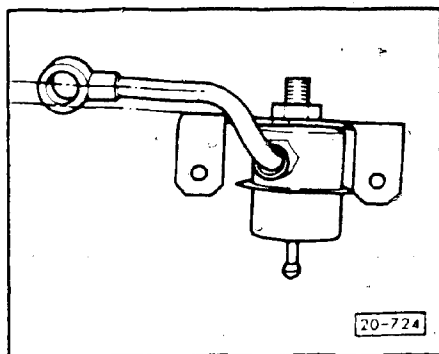
If **NO** damage and flow **OK**

- replace fuel pressure regulator

Note

Installation is reverse of removal procedure.

- connect and tighten fuel line parallel with bracket (as shown)



Residual pressure, checking

- switch OFF ignition
- observe pressure on gauge 10 minutes after shutting off engine
 - must be 2.5 bar (36.3 psi) minimum (engine cold) or 2.8 bar (40.6 psi) minimum (engine hot)

Note

An increase in pressure with a warm engine is due to fuel expansion and is normal.

If pressure is below specification:

- check **VAG 1318** pressure tester for leaks
- check fuel lines for leaks
- check fuel pump check valve, see Repair Group 20
- check fuel injectors for leakage, section 24-60
- replace or repair as necessary

If **NO** leakage and check valve **OK**

- replace fuel pressure regulator
- repeat residual pressure check
- erase fault memory after checking system and residual pressures, see Repair Group D2 for additional information

Fuel Pump Relay (J 17), Checking

- remove fuses 13, 24 and 28
- connect **US 1115 (VAG 1527B)** LED tester between ground and right terminal for fuse 13
- operate starter briefly
 - fuel pump relay must click in (audibly) and LED tester must light up

If fuel pump relay does **NOT** click in

- check fuel pump relay triggering (this section)

If LED tester does **NOT** light up

- check fuel pump relay wiring and connections (this section)

Note

First connect LED tester **US 1115 (VAG 1527B)** between ground and the left terminal of fuse 24 and perform the following steps then connect the tester between ground and the left terminal of fuse 28 and repeat the steps.

- switch **ON** ignition
 - LED tester must not light up until engine is cranked

If LED tester lights up

- connect LED tester to right terminal of respective fuse
- switch **ON** ignition
 - LED tester must not light up until engine is cranked
- operate starter briefly
 - LED tester must light up while cranking

If **NO**

- check fuel pump relay wiring (this section)

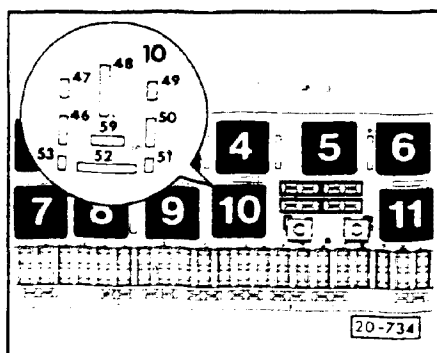
If LED tester lights up during cranking

- reinstall fuses 13, 24 and 28

Fuel pump relay wiring, checking

- switch ignition **OFF**

Fuel Injection, AFC System



- remove fuel pump relay from fuse relay panel, location 10
- switch multimeter **US 1119 (VAG 1526)** to resistance range
- check for continuity (0.5 ohms maximum) between the following terminals
 - between fuse 13 and terminal 52 of fuel pump relay socket
 - between fuse 24 and terminal 59 of fuel pump relay socket
 - between fuse 28 and terminal 59 of fuel pump relay socket

If continuity **NOT** obtained

- check for open circuit in wiring using wiring diagram, replace or repair as necessary

If wiring **OK**

- replace fuel pump relay

Fuel pump relay triggering, checking

- remove fuel pump relay from fuse relay panel, location 10
- switch multimeter **US 1119 (VAG 1526)** to 20 Volt range
- switch ignition **ON**
- connect multimeter between terminals 46 and 50 then between 48 and 50 of fuel pump relay socket
 - must be approx. battery voltage

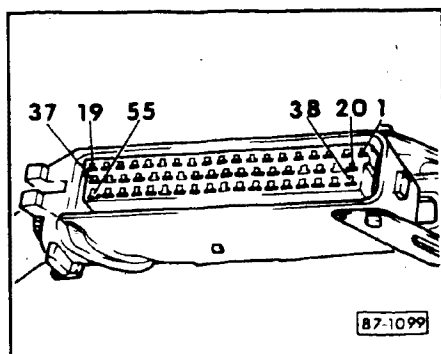
If **NO**

- check for open circuit in wiring using wiring diagram, repair or replace as necessary
- connect **US 1115 (VAG 1527B)** LED tester as follows: red lead to terminal 46 and black lead to terminal 47 of fuel pump relay socket
- switch ignition **ON**
 - LED tester must light up dimly
- crank engine with starter
 - LED tester must light up more brightly during cranking

If LED tester does **NOT** get brighter during cranking

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is **NOT** connected

Fuel Injection, AFC System



- check wiring between terminal 47 in fuel pump relay socket and terminal 3 of Test box for continuity
 - must not be greater than 0.5 ohms

If continuity **NOT** obtained

- check for open circuit in wiring using wiring diagram, repair or replace as necessary

If wiring **OK** and LED tester does **NOT** light up

- replace Motronic control unit
- reinstall fuses 13, 24 and 28

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Fuel Injectors, Checking

- perform Output checks diagnosis, see Repair Group D2 for additional information

If ALL injectors do **NOT** click

- check fuel injector triggering (this section)

If ONE or more injectors do **NOT** click

- switch multimeter **US 1119** to resistance range

- connect multimeter across fuel injector terminals
 - must be 15 to 17 ohms

If **NO**

- replace fuel injector

If injector resistance **OK**

- install substitute injector and repeat Output check

If substitute injector clicks

- replace defective injector

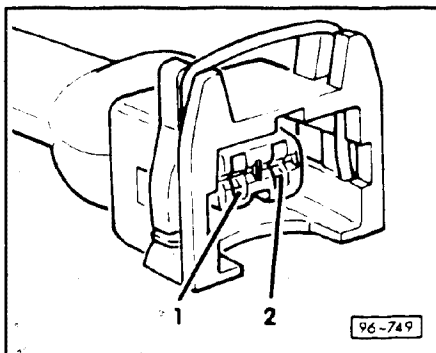
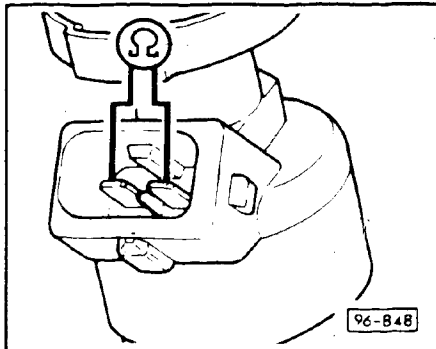
Fuel injector triggering, checking

- remove harness connector from injector to be tested
- remove fuse **28**, ensure that fuse **27** is **OK**

- connect **US 1115 (VAG 1527B)** LED tester between terminal **2** of injector harness connector and ground
- switch **ON** ignition
 - LED tester must light up

If **NO**

- connect **VAG 1598** Test box between Motronic control unit and control unit harness connector using adaptor cable **VAG 1598/5**
- connect LED tester between terminal **19** (ground) and terminal **37** of Test box
- switch **ON** ignition
 - LED tester must light up

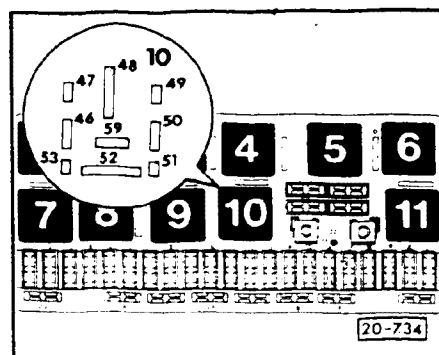
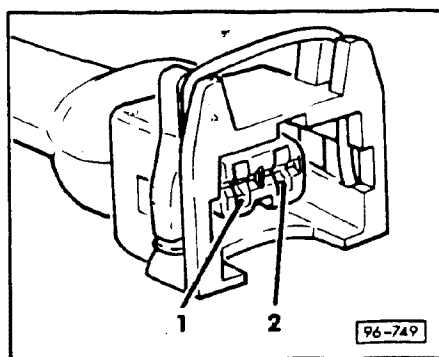
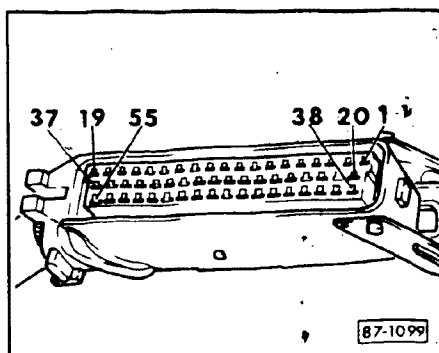


If NO

- check for open circuit between terminal 37 of control unit harness connector and terminal 2 of respective injector harness connector using wiring diagram, repair or replace as necessary

If wiring OK

- replace control unit
- reinstall fuse 28

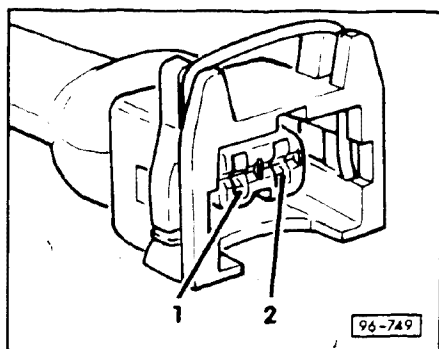


- connect LED tester between terminal 2 of injector harness connector and ground
- switch **ON** ignition and operate starter motor for a few seconds
 - LED tester must light up when ignition is switched **ON** and remain **ON** during cranking

If LED tester goes out during cranking

- check fuse 28
- using wiring diagram, check wiring for continuity between terminal 2 of respective injector harness connector and fuse 28
- using wiring diagram, check wiring for continuity between terminal 59 of fuel pump relay socket and fuse 28
- check fuel pump relay and triggering, see section 24-50

Fuel Injection, AFC System,



- connect LED tester black lead to terminal 1 and red lead to terminal 2 of injector harness connector
- perform Output check diagnosis, see Repair Group D2 for additional information
 - when triggering the injector under test: LED tester must flash briefly no more than 5 times

If LED tester does **NOT** flash or stays **ON** continuously

- connect **VAG 1598** Test box to Motronic control unit harness connector using adapter cable **VAG 1598/5**
 - control unit is **NOT** connected
- using wiring diagram, check for continuity or short to ground between terminal 1 for each injector harness connector and following terminals of Test box:

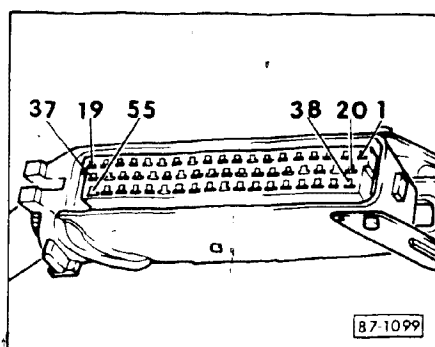
Cylinder #	Test box terminal #
1	17
2	16
3	15
4	35
5	34

If wiring **NOT OK**

- replace or repair wiring between fuel injector harness connector and control unit harness connector as necessary

If wiring **OK**

- replace Motronic control unit



Fuel injection quantity, comparative measurement

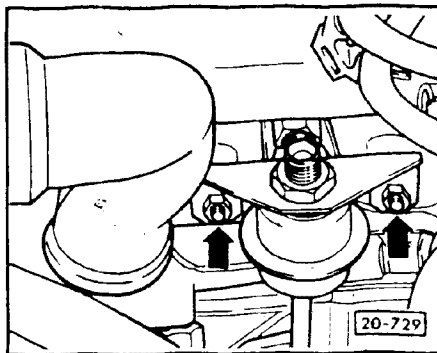
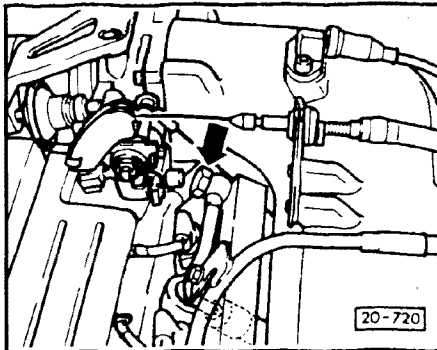
WARNING

Fire hazard. Do **NOT** smoke or have anything in area that can ignite fuel.

Test preparations

Requirement

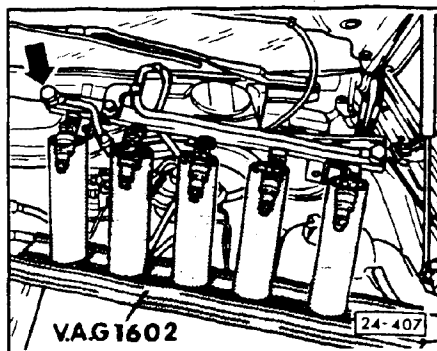
- System pressure **OK**
- disconnect fuel supply line from fuel rail (**arrow**)
- remove fuel return line from fuel pressure regulator



- remove mounting bolts (**arrows**) from fuel pressure regulator
- remove fuel pressure regulator complete with bracket from intake manifold
 - carefully pull off fuel line from intake manifold

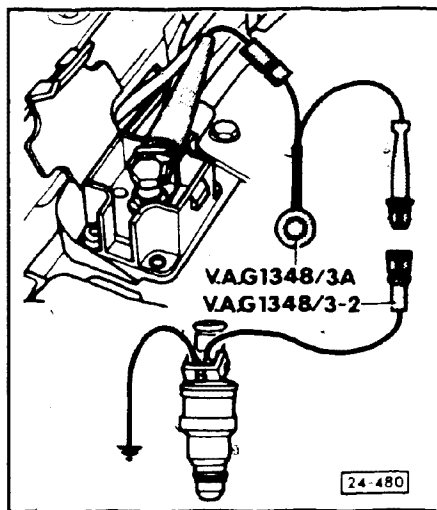
Note

Before installing, lightly lubricate fuel injector o-rings with clean engine oil. Use care during installation to avoid damaging the o-rings.



- connect fuel supply line to fuel rail and place rail/injector assembly in analyzer **VAG 1602**
- connect fuel return line to pressure regulator
- perform following checks for each injector starting with cylinder number 1

Fuel Injection, AFC System



- connect one terminal of fuel injector to ground using adaptor from **VW 1594** adaptor kit
- connect other terminal of injector to jumpstart post (battery +) using adaptor wire **VAG 1348/3-2** and remote control **VAG 1348/3A**
- connect **VAG 1598** Test box to Motronic control unit using adaptor cable **VAG 1598/5**
- switch **ON** ignition
- jumper terminals **3** and **10** of Test box using adaptor wire from **VW 1594** kit and 15 Amp fusible link
 - fuel pump must activate
- inspect tip of injector while fuel pump is running
 - leakage must **NOT** exceed 2 drops per minute

If YES

- replace defective injector(s)

After establishing that ALL of the injectors are leak-tight

- perform following checks for each injector starting with cylinder number 1
- switch **ON** ignition
- operate remote control **VAG 1348/3A** for 30 seconds

After ALL five injectors have been triggered

- switch **OFF** ignition
- remove fuel injector/rail assembly from **VAG 1602** analyzer
- place analyzer on flat surface and compare quantities of accumulated fuel
 - must be between 150 and 170 ml

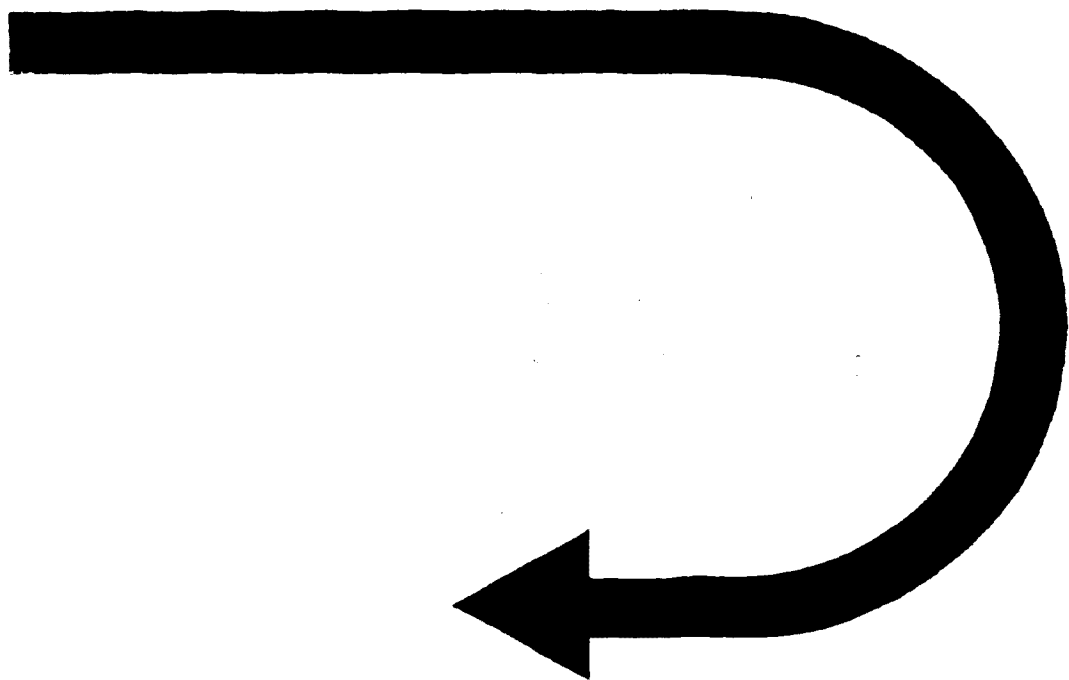
If measured value of one or more injectors is above or below spec

- replace defective injector(s)

Note

Always replace the upper and lower o-rings if a fuel injector is removed.

CONTINUED IN THE
BEGINNING OF NEXT ROW



Idle Speed And CO Content, Checking

Idle speed, checking

Note

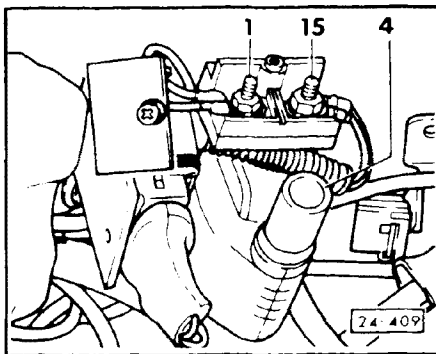
Idle speed **CANNOT** be adjusted.

Checking requirements

- Fault memory read and all faults eliminated
- engine warm, oil temperature 80°C (176°F) minimum
- Throttle against idle stop
- All electrical consumers switched **OFF**
- A/C switched **OFF**
- **NO** pressure measuring devices attached to fuel system

CAUTION

Do **NOT** take any measurements while the radiator cooling fan is running.



- connect **VAG 1367** engine tester
 - negative terminal to ground
 - Positive terminal to jumpstart terminal in engine compartment
 - Green wire to terminal 1 of ignition coil
- 5 Cylinder setting selected
- start engine and let idle
 - idle speed must be 770 to 830 rpm

If NO

- activate fault memory again, see Repair Group D2 for additional information
- perform Output checks diagnosis, see Repair Group D2 for additional information
- check Basic Settings, see Repair Group D2 for additional information

CO content, checking

Note

CO content **CANNOT** be adjusted.

Checking requirements

- Fault memory read and all faults eliminated
- Engine warm, oil temperature 80°C (176°F) minimum
- Throttle against idle stop

Fuel Injection, AFC System

- All electrical consumers switched **OFF**
- A/C switched **OFF**
- Crankcase breather remains connected
- **NO** pressure measuring devices attached to fuel system

CAUTION

Do **NOT** take any measurements while the radiator cooling fan is running.

- connect CO tester **EPA 75** (or EPA approved equivalent) to CO tap tube (near Oxygen sensor) using adaptor **VAG 1363/3**
- start engine and let idle
 - CO content must be 0.5 to 0.9 % vol.

If **NO**

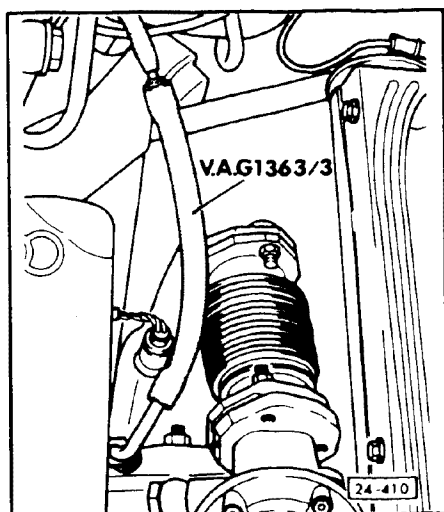
- verify that all spark plugs and related ignition components are **OK**

CAUTION

Failure of just one spark plug can cause a sharp rise in CO content.

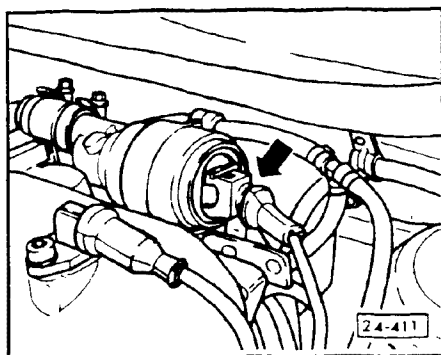
If **NO**

- activate fault memory again, see Repair Group D2 for additional information
- perform Output checks diagnosis, see Repair Group D2 for additional information
- check Basic Settings, see Repair Group D2 for additional information

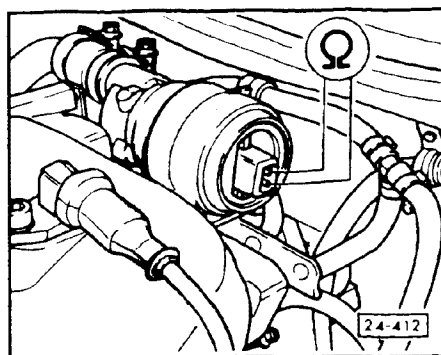


Idle Stabilization System, Checking

Idle stabilizer valve (N 71), electrical checking



- disconnect idle stabilizer valve harness connector
- switch multimeter **US 1119 (VAG 1526)** to 200 Ohm range



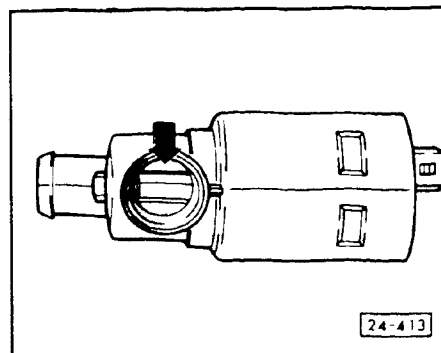
- connect multimeter to idle stabilizer valve
 - must be 7.5 to 8.5 ohms

If **NO**

- replace idle stabilizer valve (N 71)

Idle stabilizer valve, mechanical checking

- remove idle stabilizer valve (N 71)



- visually inspect rotary valve for scoring
- check for ease of movement

CAUTION

Check movement by hand only. Do **NOT** try to move the valve using a tool.

- re-connect harness connector to valve (still removed)
- perform Output checks diagnosis; see Repair Group D2 for additional information
- advance through Output checks until step for idle stabilizer valve
- energize valve and observe movement from stop to stop

If scratching or scoring is present which adversely affects ease of movement or if the rotary valve does not move easily (sticks, runs with difficulty, or does not travel fully from stop to stop)

- replace idle stabilizer valve

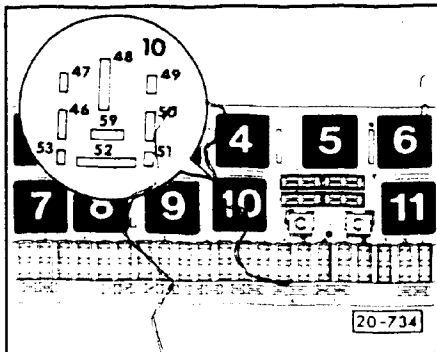
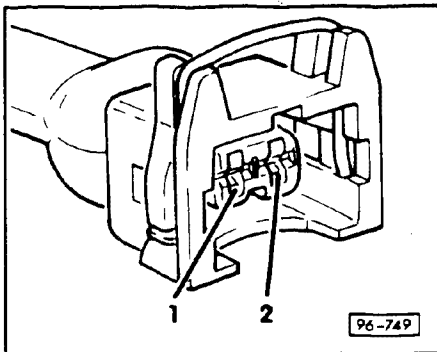
Fuel Injection, AFC System

Idle stabilizer valve triggering, checking

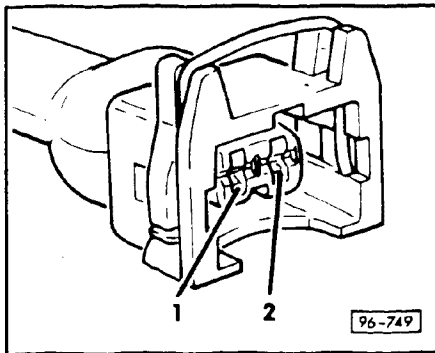
- remove harness connector from idle stabilizer valve
- connect **US 1115 (VAG 1527B)** LED tester between terminal 2 of harness connector and ground
- operate starter for a few seconds
 - LED tester must light up

If **NO**

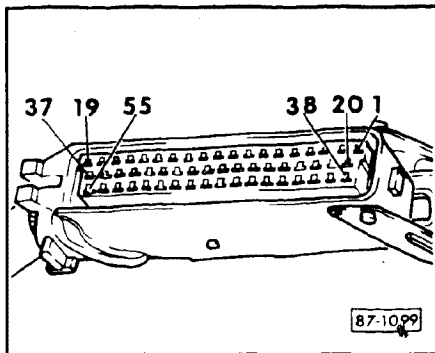
- check fuses 24 and 28
- check for continuity between terminal 1 of harness connector and fuse 24 using wiring diagram



Fuel Injection, AFC System



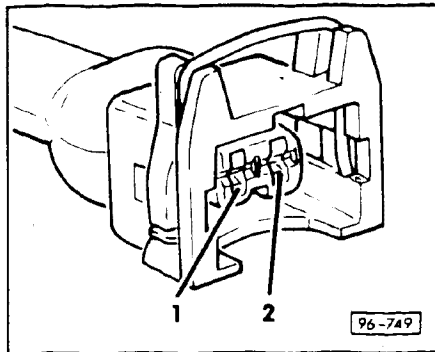
- using wiring diagram, check for continuity between terminal 1 of idle stabilizer valve harness connector and terminal 37 on Test box, replace or repair as necessary



- terminal 37 of Test box corresponds to terminal 37 of control unit harness connector

If wiring OK

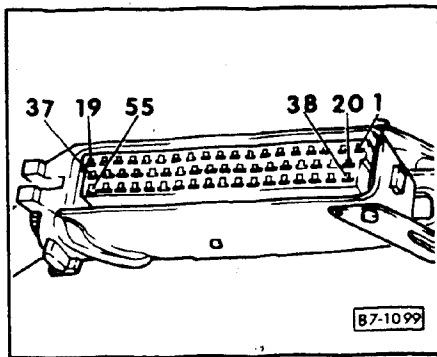
- replace control unit
- disconnect **VAG 1598** Test box and adaptor cable
- re-connect control unit to harness connector



- connect LED tester with red wire to terminal 1 and black wire to terminal 2 of idle stabilizer valve harness connector
- perform Output checks diagnosis, see Repair Group D2 for additional information
- during triggering of the idle stabilizer valve step, LED tester must blink (LED tester becomes slightly brighter and dimmer but does not go out completely)
- If LED tester does **NOT** blink or if it lights up continuously
- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected

If LED tester lights up continuously

Fuel Injection, AFC System



- check for continuity between terminal 1 of idle stabilizer valve harness connector and terminal 4 of Test box. replace or repair as necessary
 - terminal 4 of Test box corresponds to terminal 4 of control unit harness connector

If LED tester does **NOT** blink

- check for continuity between terminal 2 of idle stabilizer valve harness connector and terminal 4 of Test box, replace or repair as necessary
 - terminal 4 of Test box corresponds to terminal 4 of control unit harness connector

If wiring **OK**

- replace Motronic control unit

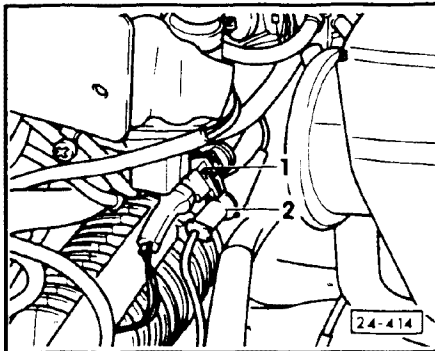
cardiagn.com

Oxygen Sensor System, Checking

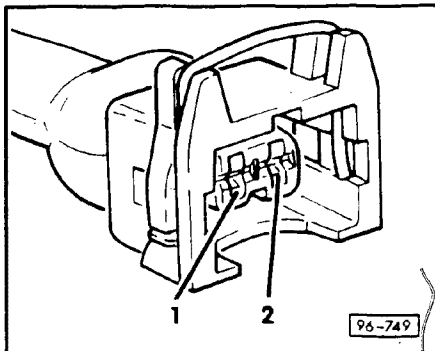
Oxygen sensor heating (Z 19), checking

Note

The Harness connector for the Oxygen sensor heater is located at the back of the engine compartment on the firewall.



- disconnect harness connector 1 from Oxygen sensor heater
- switch **US 1119 (VAG 1526)** multimeter to 20 Volt range

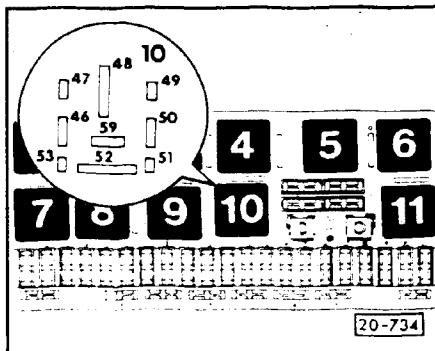


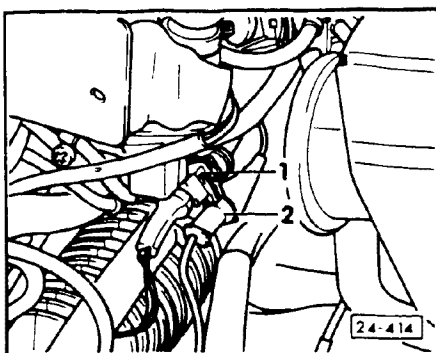
- connect multimeter between terminals 1 and 2 of harness connector
- start engine and let idle
 - must be approximately 12 to 14 volts

If NO

- check fuse 29
- check for continuity between terminal 2 and fuse 29 using wiring diagram
- check correctness of pin assignments in connectors, using wiring diagram
- check for continuity between terminal 1 of harness connector and ground
- repair or replace for the above conditions as necessary

- check for continuity between terminal 52 of fuel pump relay socket and fuse 29 using wiring diagram





If wiring **OK**

- connect test adaptor **VAG 1315A/1** to harness connector 1
- switch multimeter or equivalent to 10 Amp range
- connect multimeter to test adaptor
- start engine and let idle
 - must be 0.5 to 3.0 Amps (current increases as sensor warms up)

If current value **NOT** obtained

- replace oxygen sensor

Oxygen sensor triggering, checking

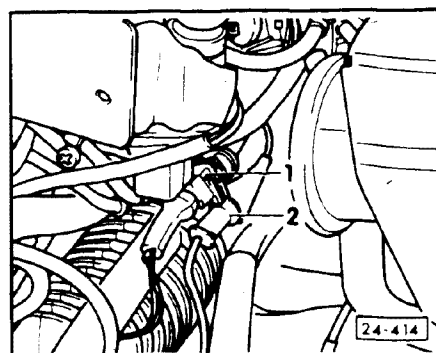
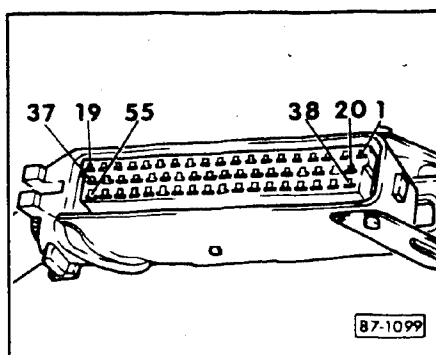
- disconnect Oxygen sensor harness connector 2 (signal wire)
- switch multimeter **US 1119 (VAG 1526)** to 20 Volt range
- connect multimeter between harness connector and ground
- switch **ON** ignition
 - must be 450 ± 50 mV

If **NO**

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected
- check for continuity between Oxygen sensor harness connector (signal wire) and terminal **28** of Test box, replace or repair as necessary
 - terminal **28** of Test box corresponds to terminal **28** of control unit harness connector
- check for continuity between engine ground and terminal **10** of Test box using wiring diagram, repair or replace as necessary

Note

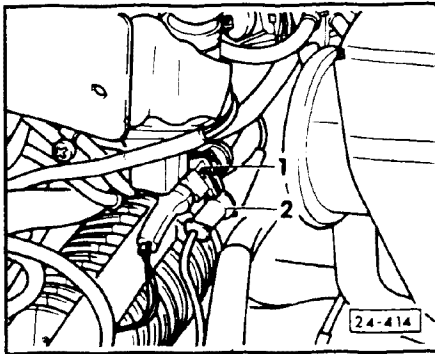
To functionally test the Oxygen sensor system, check basic adjustment of the engine, see Repair Group D2 for additional information. When observing the **VAG 1551** display during the Basic settings function, channel **8** value **MUST** fluctuate around an average of 128.



Oxygen sensor (G 39), removing/installing

Note

The Harness connectors for the Oxygen sensor heater and signal wire is located at the back of the engine compartment on the firewall.



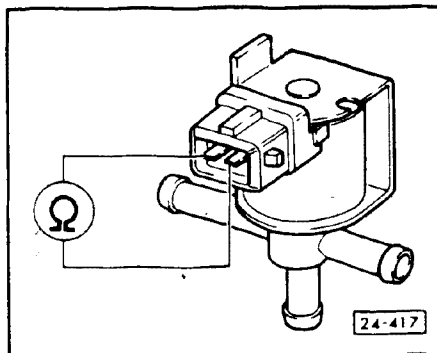
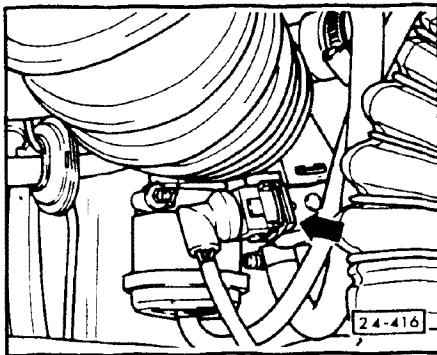
- disconnect harness connectors 1 and 2 for Oxygen sensor heater and signal wire
- bend bracket for connector 1 and push connector out
- cut tie wraps
- unscrew Oxygen sensor, for installation location and tightening torques see Repair Group 26
- observe the following points during Oxygen sensor installation
 - Tie wraps **MUST** be installed in same position and locations as original to prevent contact between the wiring and the exhaust pipes.
 - Coat the Oxygen sensor threads with an anti-sieze compound before installing.
 - Do **NOT** allow anti-sieze compound to enter slots on tip of sensor.

Wastegate Frequency Valve (N 75), Checking

The wastegate frequency valve is located in front of the turbocharger. The valve limits boost pressure by controlling the wastegate. The valve operates on a duty cycle based on manifold pressure and is controlled by the Motronic control unit.

Valve resistance, checking

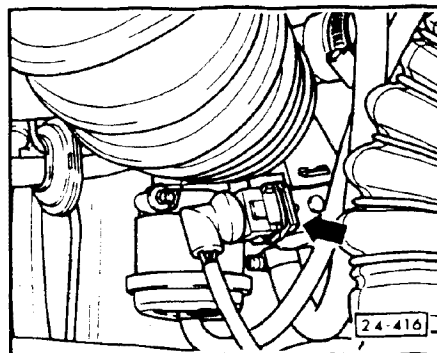
- disconnect frequency valve harness connector (arrow)
- switch multimeter **US 1119 (VAG 1526)** to resistance range



- connect multimeter between frequency valve terminals
 - must be 25 to 35 ohms

If NO

- replace wastegate frequency valve (N 75)

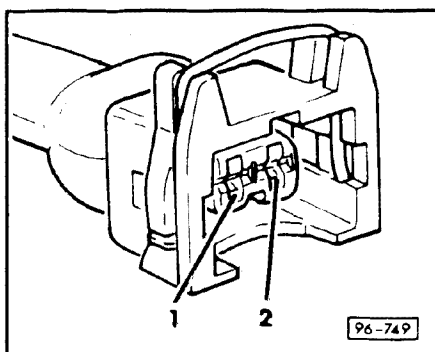


- disconnect frequency valve harness connector (arrow)
- connect **US 1115 (VAG 1527B) LED tester** between terminal 1 of harness connector and ground using **VW 1594** adaptor kit
- operate starter for a few seconds
 - LED tester must light up during cranking

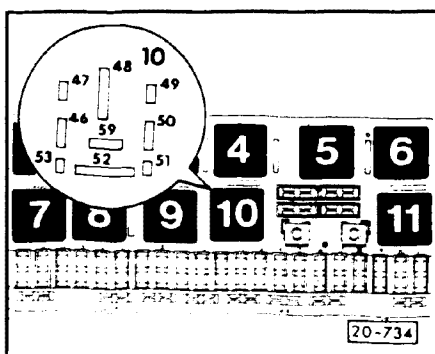
If NO

- check fuses 24 and 28

Fuel Injection, AFC System



- check for continuity between terminal 1 of harness connector and fuse 24, using wiring diagram, replace or repair as necessary



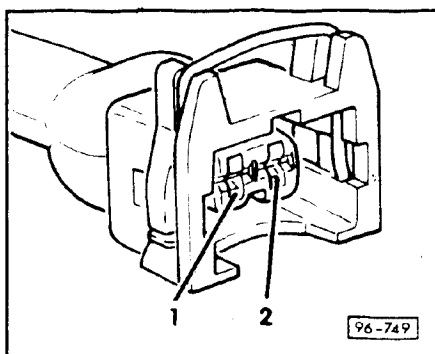
- check for continuity between fuse 24 and terminal 59 of fuel pump relay socket in fuse/relay panel, using wiring diagram, replace or repair as necessary
- check fuel pump relay triggering, see section 24-50
- perform Output checks diagnosis, see Repair Group D2 for additional information
 - LED tester must light up

Note

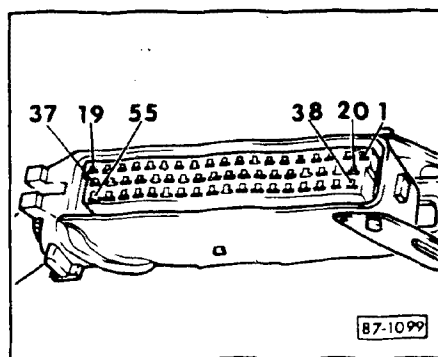
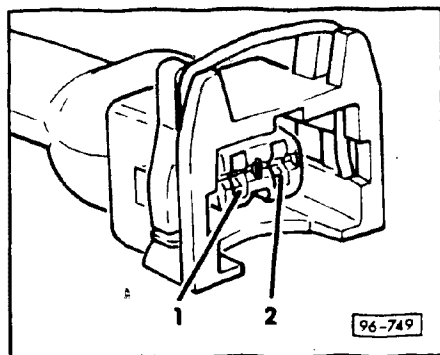
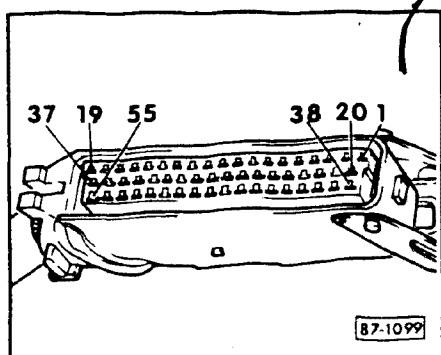
Regardless of which component is being checked by in the output check, terminal 2 of the frequency valve harness connector must display positive voltage.

If NO

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected
- check for continuity between terminal 1 of frequency valve harness connector and terminal 37 of Test box, replace or repair as necessary



Fuel Injection, AFC System



- terminal 37 of Test box corresponds to terminal 37 of control unit harness connector

If wiring OK

- replace control unit
- disconnect **VAG 1598** Test box and adaptor cable
- reconnect control unit to harness connector

- connect LED tester with red wire to terminal 1 and black wire to terminal 2 of wastegate frequency valve harness connector
- perform Output checks diagnosis, see Repair Group D2 for additional information
 - during triggering of the solenoid valve step, LED tester must blink

If LED tester does **NOT** blink or if it lights up continuously

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected

If LED tester lights up continuously

- check for continuity between terminal 2 of frequency valve harness connector and terminal 23 of Test box, replace or repair as necessary
 - terminal 23 of Test box corresponds to terminal 23 of control unit harness connector

If LED tester does **NOT** blink

- check for continuity between terminal 1 of frequency valve harness connector and terminal 23 of Test box, replace or repair as necessary
 - terminal 23 of Test box corresponds to terminal 23 of control unit harness connector

If wiring OK

- replace Motronic control unit

Carbon Canister Frequency Valve (N 80), Checking

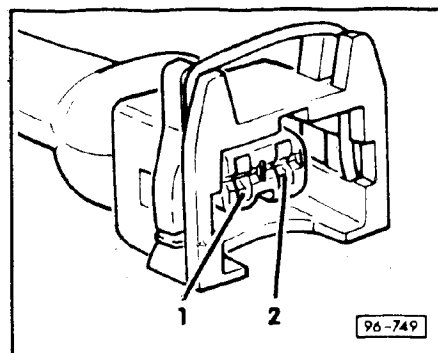
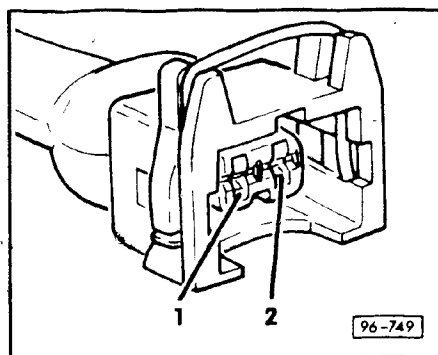
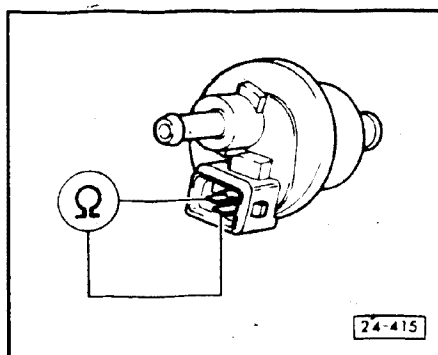
The carbon canister frequency valve is located behind the engine between the cylinder head and the firewall.

Valve resistance, checking

- disconnect frequency valve harness connector
- switch multimeter **US 1119 (VAG 1526)** to 200 ohms range
- connect multimeter between terminals of frequency valve
 - must be 40 to 50 ohms

If NO

- replace carbon canister frequency valve (**N 80**)



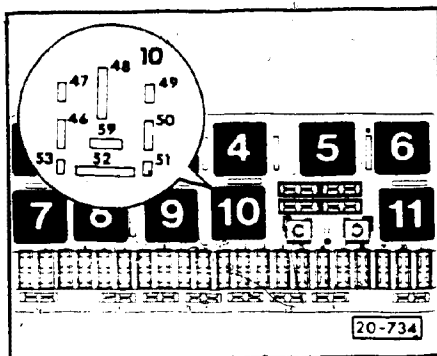
Triggering, checking

- disconnect frequency valve harness connector
- connect LED tester **US 1115 (VAG 1527B)** between terminal 2 of harness connector and ground using **VW 1594** adaptor kit
- operate starter for a few seconds
 - LED tester must light up during cranking

If NO

- check fuses **24** and **28**
- check for continuity between terminal 2 of harness connector and fuse **24** using wiring diagram, replace or repair as necessary

Fuel Injection, AFC System



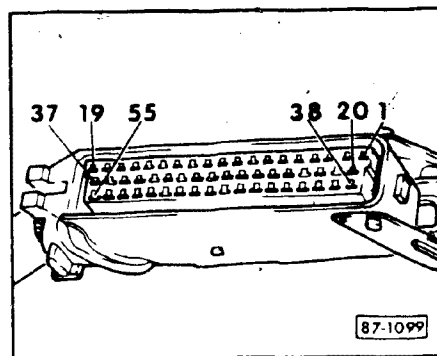
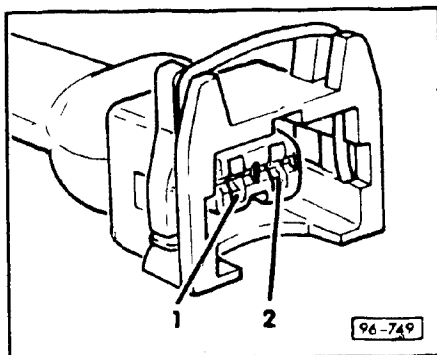
- check for continuity between fuse **24** and terminal **59** of fuel pump relay socket in fuse/relay panel, using wiring diagram, replace or repair as necessary
- check fuel pump relay triggering, see section 24-50
- perform Output checks diagnosis, see Repair Group D2 for additional information
 - LED tester must light up

Note

Regardless of which component is being checked in the output check, terminal 2 of the frequency valve harness connector must display positive voltage.

If NO

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected
- check for continuity between terminal **2** of frequency valve harness connector and terminal **37** of Test box, replace or repair as necessary

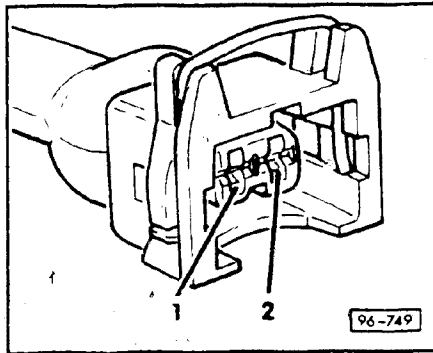


- terminal **37** of Test box corresponds to terminal **37** of control unit harness connector

If wiring OK

- replace Motronic control unit
- disconnect **VAG 1598** Test box and adaptor cable
- reconnect control unit to harness connector

Fuel Injection, AFC System



- connect LED tester with red wire to terminal 1 and black wire to terminal 2 of frequency valve harness connector
- perform Output checks diagnosis. see Repair Group D2 for additional information
 - during output check step when frequency valve is being triggered: LED tester must blink

If LED tester does **NOT** blink or if it lights up continuously

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected

If LED tester lights up continuously

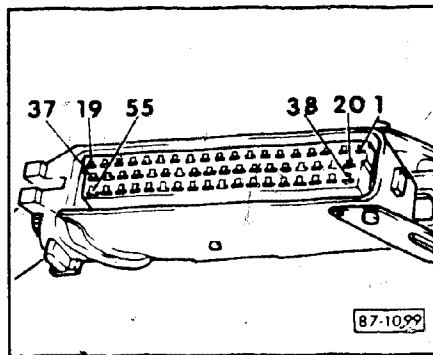
- check for continuity between terminal 1 of frequency valve harness connector and terminal 5 of Test box, replace or repair as necessary
 - terminal 5 of Test box corresponds to terminal 5 of control unit harness connector

If LED tester does **NOT** blink

- check for continuity between terminal 1 of frequency valve harness connector and terminal 5 of Test box, replace or repair as necessary
 - terminal 5 of Test box corresponds to terminal 5 of control unit harness connector

If wiring **OK**

- replace Motronic control unit



Idle Switch, Checking/Adjusting

Note

The idle switch is located in the throttle potentiometer.

Idle switch, checking

- disconnect throttle switch harness connector
- switch multimeter **US 1119 (VAG 1526)** to resistance range
- connect multimeter between terminals **4** and **6** using **VW 1594** adaptor kit
 - must be approximately 0 ohms (continuity)
- open throttle slightly
 - must be infinite ohms (open)

If either value **NOT** obtained

- adjust idle switch (this section)
- repeat check

If resistance values still **NOT** obtained

- replace throttle potentiometer

Idle switch, adjusting

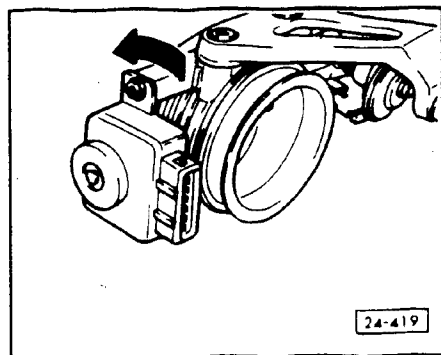
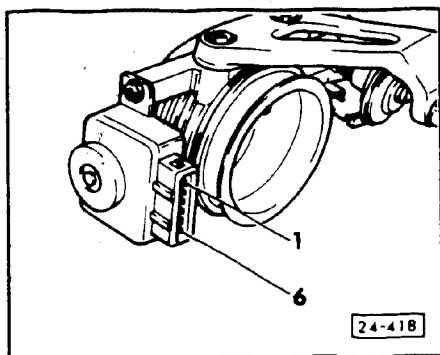
- loosen upper and lower throttle potentiometer mounting screws

To gain better access to upper mounting screw

- remove idle stabilizer valve connector hose
- turn throttle potentiometer in direction of arrow until stop is felt
 - do **NOT** move throttle while rotating throttle potentiometer
- tighten throttle potentiometer mounting screws
- recheck idle switch per checking procedure

Idle switch wiring, checking

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected



Throttle potentiometer, checking/adjusting

See exploded view, section 24-10 for installation location.

Voltage supply, checking

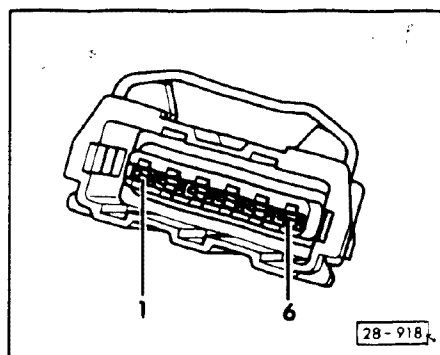
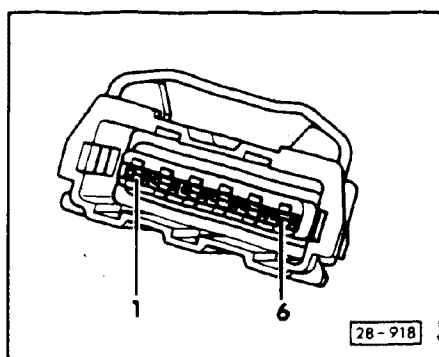
- disconnect throttle potentiometer harness connector
- switch **ON** ignition
- switch multimeter **US 1119 (VAG 1526)** to 20 Volt range
- connect multimeter between terminals 1 and 2
 - must be 4.5 to 5.5 Volts
- connect multimeter between terminals 1 and 3
 - must be 4.5 to 5.5 Volts

If Voltages **OK**

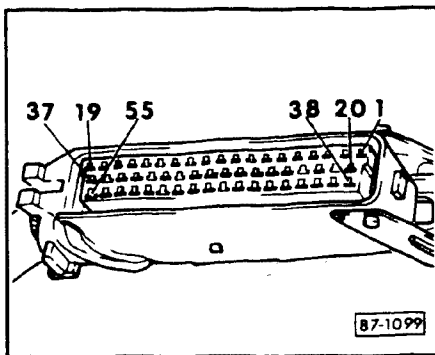
- perform resistance check (this section)

If Voltage **NOT OK**

- switch ignition **OFF**
- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected
 - disconnect throttle potentiometer harness connector
- check for continuity and/or short circuit between following wires, using wiring diagram, repair or replace as necessary



Fuel Injection, AFC System



Harness connector terminal #	Test box terminal #
1	12
2	30
3	53

CAUTION

If the throttle potentiometer connector requires replacement terminals, **ONLY** use gold plated terminal.

- connect **VAG 1598/5** adaptor cable to Motronic control unit
- switch **ON** ignition
- connect multimeter between Test box terminals **12** and **30** then between terminals **12** and **53**
 - must be 4.5 to 5.5 Volts for each measurement

If either Voltage value **NOT** obtained

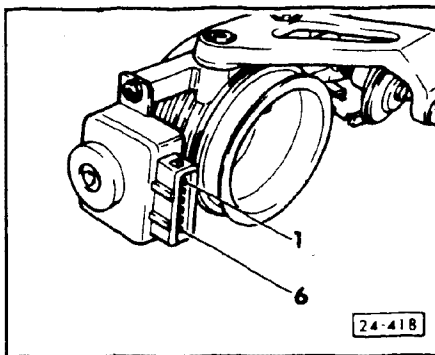
- replace Motronic control unit

Throttle potentiometer (G 69), resistance checking

- switch multimeter **US 1119 (VAG 1526)** to resistance range
- connect **US 1119** to terminals 1 and 2 of throttle potentiometer
 - resistance must be between 1500 and 2600 ohms
- connect multimeter between terminals 2 and 3
 - resistance must be between 750 and 1300 ohms
- slowly open throttle from closed to full open while observing multimeter
 - resistance must increase to a maximum of 3600 ohms

If **ANY** of these resistance values is **NOT** obtained

- replace throttle potentiometer (G 69)



Throttle potentiometer (G 69), adjusting

Note

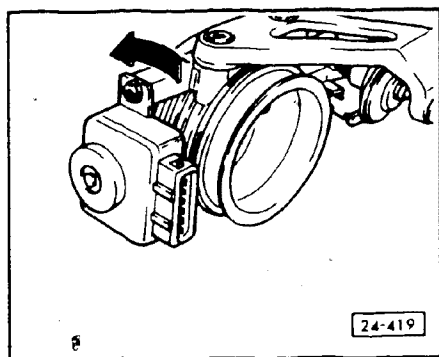
The throttle potentiometer is also adjusted when the idle switch is adjusted.

- loosen upper and lower throttle potentiometer mounting screws

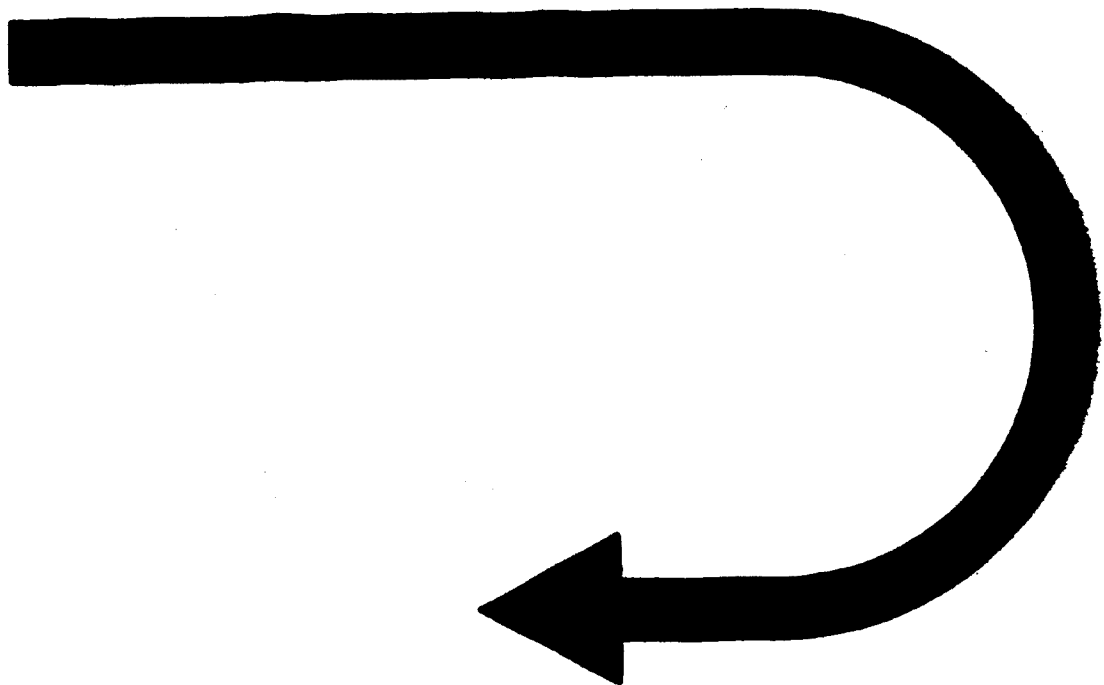
Note

To gain better access to the upper mounting screw, remove the idle stabilizer valve connector hose.

- turn throttle potentiometer in direction of arrow until stop is felt
 - do **NOT** move throttle while rotating throttle potentiometer
- tighten potentiometer
- recheck idle switch per checking procedure, see section 24-120



CONTINUED IN THE
BEGINNING OF NEXT ROW



Altitude Sensor (F 96), Checking

The altitude sensor is located in the drivers side footwell under the A pillar trim.

Voltage supply, checking

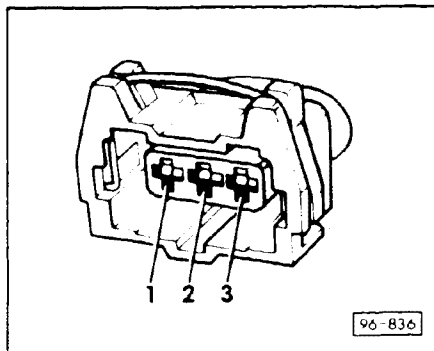
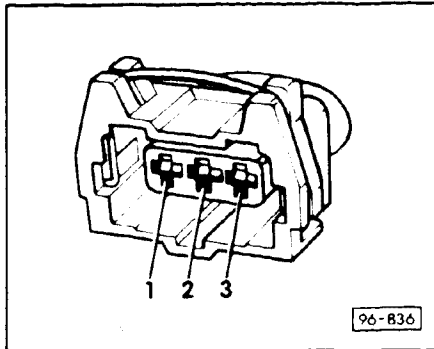
- disconnect altitude sensor harness connector
- switch multimeter **US 1119 (VAG 1526)** to 20 Volt range
- connect multimeter between terminals 1 and 3
 - must be 4.5 to 5.5 Volts
- connect multimeter between terminals 2 and 3
 - must be 4.5 to 5.5 Volts

If **BOTH** measurements **NOT** obtained

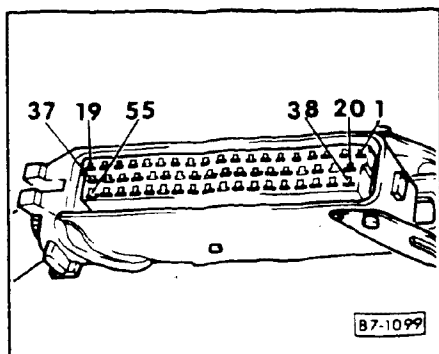
- replace altitude sensor (**F 96**)

If **ONE** measurement **NOT** obtained

- switch ignition **OFF**
- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected
- check for continuity and/or short circuit between following wires, using wiring diagram, repair or replace as necessary



Fuel Injection, AFC System



Cylinder #	Test box terminal #
1	46
2	12
3	30

- connect **VAG 1598/5** adaptor cable to CIS-E Motronic control unit
 - switch **ON** ignition
- connect multimeter between Test box terminals **12** and **30**
 - must be 4.5 to 5.5 Volts
- connect multimeter between Test box terminals **46** and **30**
 - must be 4.5 to 5.5 Volts

If either measurement **NOT** obtained

- replace Motronic control unit

Altitude signal, checking

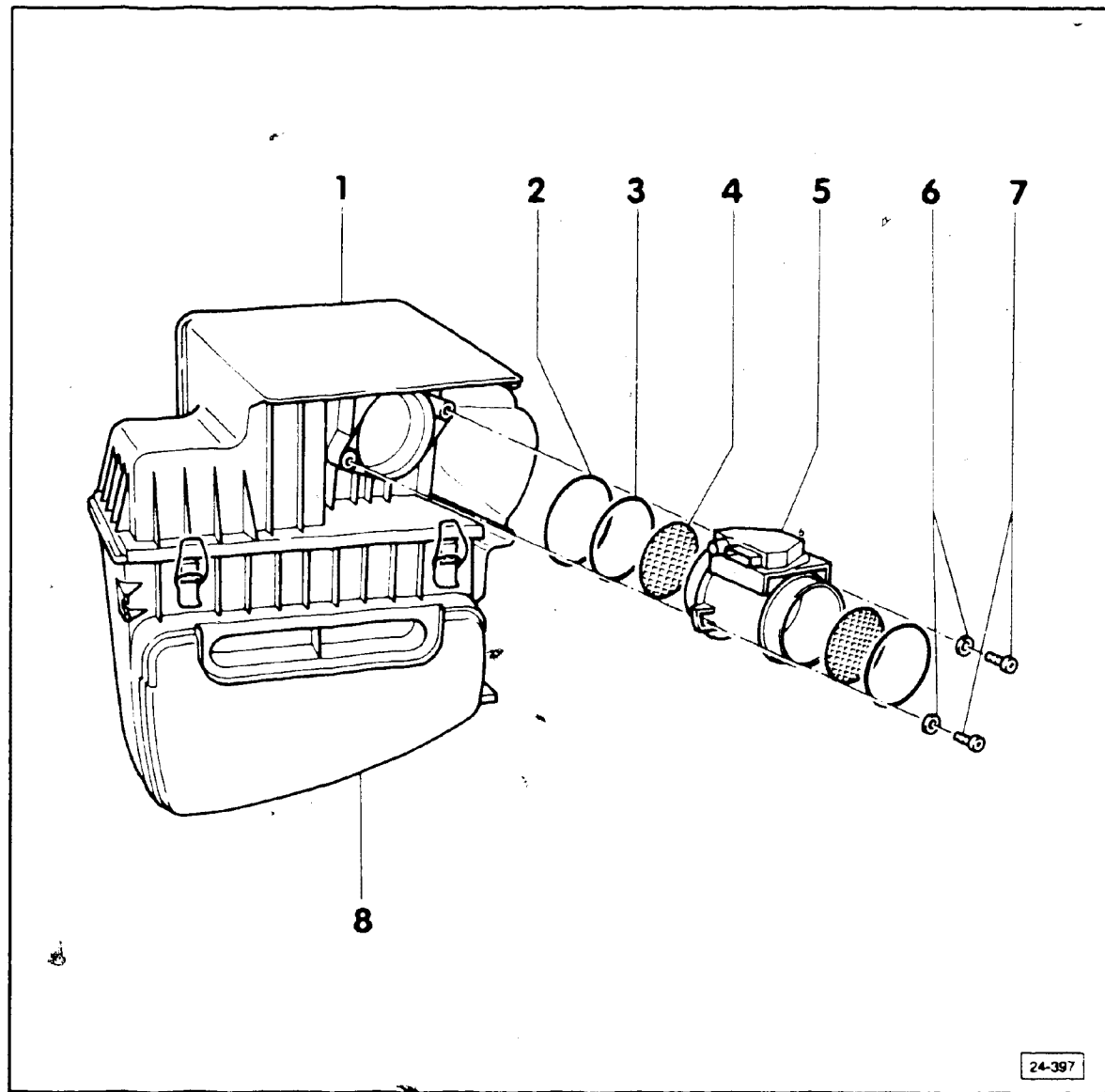
- connect **VAG 1598** Test box to Motronic control unit using **VAG 1598/5** adaptor cable
- re-connect altitude sensor harness connector
- switch **ON** ignition
- connect multimeter between Test box terminals **30** and **46**
 - voltage must lie between 0.5 and 4.0 Volts without consideration of altitude.

Note

The voltage decreases as altitude increases, at altitudes below 2000 M (6561 ft) the voltage must not be below 1.5 Volts.

If voltage is outside of specification

- replace altitude sensor (**F 96**)



1 — Air filter housing, upper section

2 — Seal
install seal in air filter housing

3 — Circlip

4 — Screen

5 — Air mass sensor (G 70)
Checking, section 24-160

6 — Washer

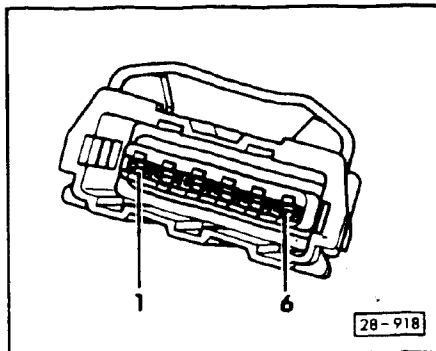
7 — 10 Nm (7 ft lb)

8 — Air filter housing, lower section

Air mass sensor (G 70), checking

CAUTION

Do not touch the hot wire of the air mass sensor.



- remove harness connector from air mass sensor
- connect **US 1115 (VAG 1527B)** LED tester between terminal 1 of harness connector and jumpstart post (battery +)
 - LED tester must light

If NO

- determine break in wiring using wiring diagram, replace or repair as necessary
- connect **US 1115 (VAG 1527B)** LED tester between terminal 5 of air mass sensor harness connector and ground
 - LED tester must light up

If NO

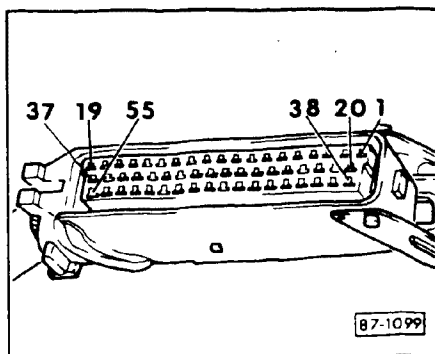
- connect **VAG 1598** Test box to Motronic control unit using adaptor cable **VAG 1598/5**
- connect **US 1115 (VAG 1527B)** LED tester between Test box terminals 19 (ground) and 37
- switch **ON** ignition
 - LED tester must light up

If LED tester lights up

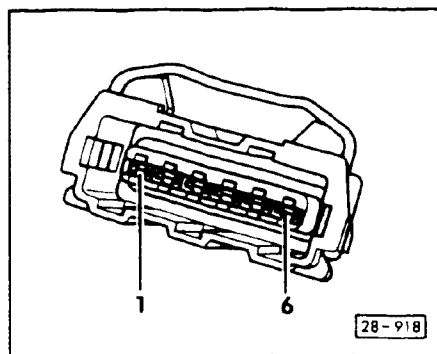
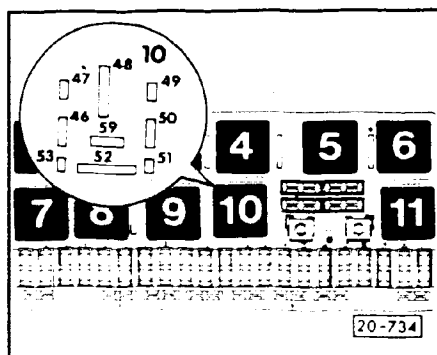
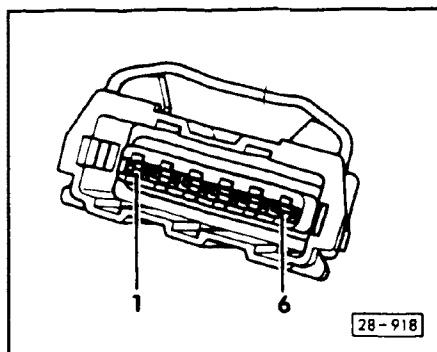
- determine break in wiring between terminal 37 of control unit harness connector and terminal 5 of air mass sensor harness connect or using wiring diagram, replace or repair as necessary

If LED tester does **NOT** light up

- replace Motronic control unit



Fuel Injection, AFC System



- connect LED tester between terminal 5 of air mass sensor and ground
- switch **ON** ignition
- operate starter for a few seconds
 - LED tester must light up while ignition is switched **ON** and during crank

If LED tester goes out when starter is operated

- check fuse **28**
- check for continuity between terminal 5 of air mass sensor and fuse **28** using wiring diagram
- check for continuity between fuse **28** and fuel pump relay terminal **59** using wiring diagram
- check fuel pump relay and if necessary, fuel pump relay triggering, see section 24-50

Sensor wiring, checking

- connect **VAG 1598** Test box to Motronic control unit harness connector using adaptor cable **VAG 1598/5**
 - control unit is not connected
- disconnect air mass sensor harness connector
- check for continuity or short circuit between following terminals, using wiring diagram, repair or replace as necessary

Air mass sensor terminal #	Test box terminal #
2	26
3	7
4	25

CAUTION

If the air mass sensor connector requires replacement terminals, **ONLY** use gold plated terminals.

Sensor function, checking

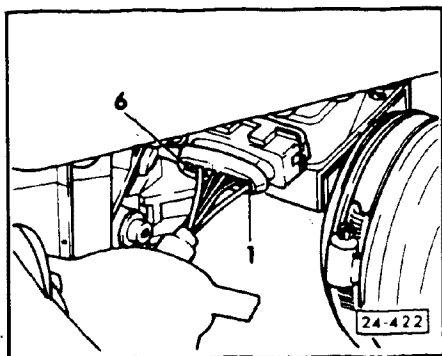
- disconnect air mass sensor harness connector
- switch multimeter **US 1119 (VAG 1526)** to 200 Ohm range
- connect multimeter between terminals 1 and 2 of air mass sensor
 - note displayed resistance value
- disconnect measuring leads from air mass sensor and short the leads to one another
 - resistance reading must be same as previous measurement

Note

The ground bridges in the air mass sensor are being measured. The measured value corresponds to the internal resistance of the measuring leads.

If difference is greater than 0.1 Ohm

- replace air mass sensor
- re-connect air mass sensor harness connector



- peel back rubber boot on back of harness connector to expose terminals
- switch multimeter **US 1119 (VAG 1526)** to 20 Volt range
- connect multimeter between (exposed but connected) terminals 1 and 3
- switch **ON** ignition
 - must be 1.2 to 1.5 Volts
- start engine and let idle
 - must be approximately 2.5 Volts
- briefly raise engine speed
 - voltage must increase to approximately 3 to 5 Volts

If the specified Voltages are **NOT** obtained

- replace air mass sensor

Sensor burn off, checking

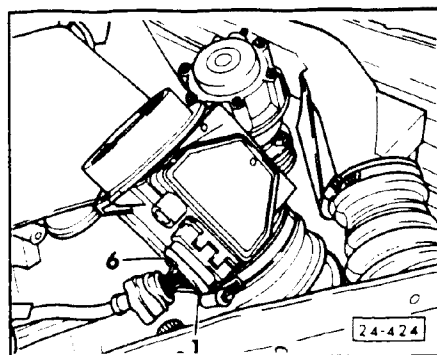
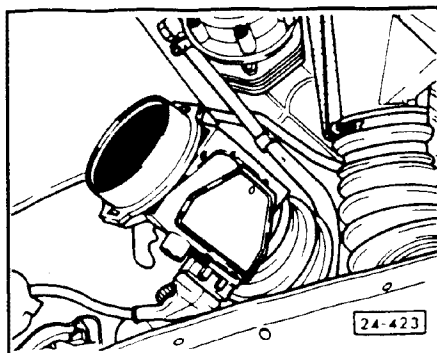
Note

The burn off process occurs about three seconds after the engine has been shut off and lasts for approximately one second. Burn-off assures that the sensor surface is clean which is essential for accuracy

Fuel Injection, AFC System

Burn-off occurs **ONLY** if the following criteria are met:

- Coolant temperature is above 60°C (140°F)
 - Engine speed has been above 2000 rpm for at least 3 seconds
 - Sensor wiring **OK**
 - Fuse **28 OK**
- remove air mass sensor from air filter box and pull out far enough so that element can be observed during burn-off
 - sensor remains connected, intake hose is closed)
 - start engine and increase speed above 2000 rpm for at least 3 seconds
 - switch **OFF** ignition
 - sensor element must glow momentarily



If **NO**

- peel back rubber boot on back of sensor harness connector to expose terminals
 - sensor remains connected

- connect **US 1115 (VAG 1527B)** LED tester red wire to terminal 4 and black wire to terminal 1
- start engine and increase speed above 2000 rpm for at least 3 seconds
- switch **OFF** ignition
 - during burn-off LED tester must light up momentarily

If **YES**

- replace air mass sensor

If **NO**

- connect **VAG 1598** Test box to Motronic control unit using **VAG 1598/5** adaptor cable
- connect LED tester between terminal **26** (ground) and terminal **25**
- start engine and increase speed above 2000 rpm for at least 3 seconds

Fuel Injection, AFC System

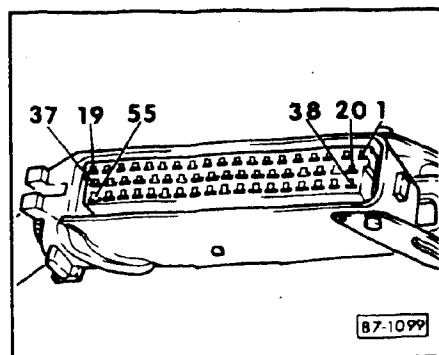
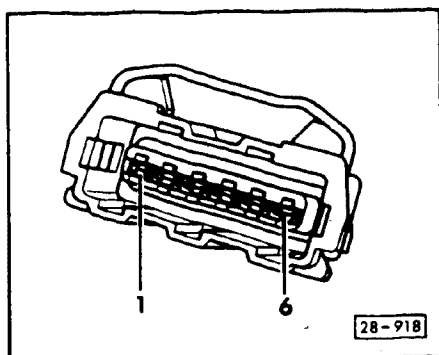
- switch **OFF** ignition
 - during burn-off LED tester must light up momentarily

If **NO**

- replace Motronic control unit

If **YES**

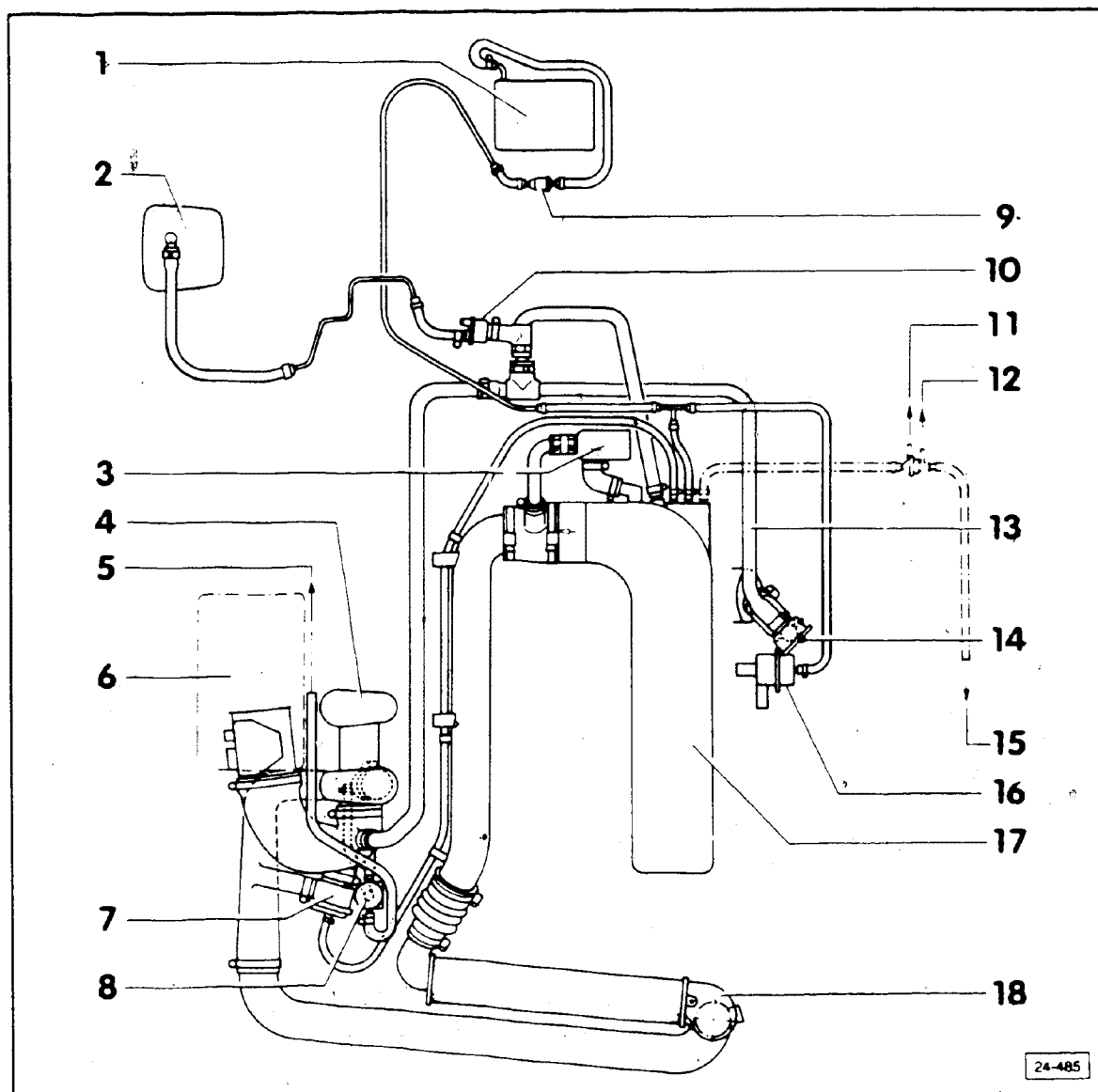
- check for continuity between terminal 4 of air mass sensor harness connector and Test box terminal 25, replace or repair as necessary



- terminal 25 of Test box corresponds with terminal 25 of control unit harness connector

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Fuel Injection, AFC System



- 1 — Motronic control unit
located behind A pillar trim in passenger
side footwell
- 2 — Carbon canister
- 3 — Idle stabilizer valve (N 71)
- 4 — Turbocharger
- 5 — Control pressure connection from wastegate
frequency valve to wastegate
- 6 — Air filter housing
- 7 — By-pass valve

Note

The by-pass valve operates during idle and deceleration when the throttle valve is closed (high vacuum condition). The valve, which opens at high vacuum, allows air to circulate without increasing boost pressure. This feature improves acceleration response and reduces turbo-lag by allowing the turbine to freely rotate until the throttle is opened again.

• Checking, see Repair Group 21

Fuel Injection, AFC System

- 8 — Wastegate frequency valve (N 75)
- 9 — Condenser
- 10 — Carbon canister frequency valve (N 80)
- 11 — Differential lock connection
- 12 — A/C connection
- 13 — Crankcase breather
- 14 — Pressure regulator valve for crankcase breather
- 15 — Vacuum reservoir connection
- 16 — Pressure regulator
- 17 — Intake manifold
- 18 — Intercooler

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This is what's new:

Since the last filming of this fiche, we added or changed:

The fuel injector checking and cleaning procedures in Repair Group 25 have been completely revised.

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