

Index

20-valve engine (to 03/90 prod.)

A/C compressor cut-out

- checking 24-160

Air mass sensor

- checking 24-60

Carbon canister solenoid valve

- checking 24-80

Coolant temperature sensor

- checking 24-90

Engine speed sensor

- checking 24-120

Fuel consumption rate indicator

- checking 24-150

Fuel injectors

- checking 24-50

Fuel pressure

- checking 24-40

Fuel pump relay

- checking 24-70

Idle switch

- checking/adjusting 24-110

Idle speed and CO content

- checking/adjusting 24-180

Idle stabilization system

- checking 24-190

MPI (multi-point injection) control unit

- checking 24-200

MPI fuel injection system

- component layout 24-210

Oxygen sensor system

- checking 24-170

Potentiometer

- checking 24-100

Safety precautions

- rules of cleanliness 24-20
- safety measures 24-20

Speed signal (vehicle speed)

- checking 24-140

Tachometer signal

- checking 24-130

Technical data

- fuel pressure
and settings 24-30

CIS-E Motronic (combined fuel and ignition system), repairing

Engine code: 3A

Note

The CIS-E Motronic control unit is equipped with a fault memory system. Before performing repairs, adjustments, or troubleshooting, activate the fault memory system — see Repair Group D2 for additional information.

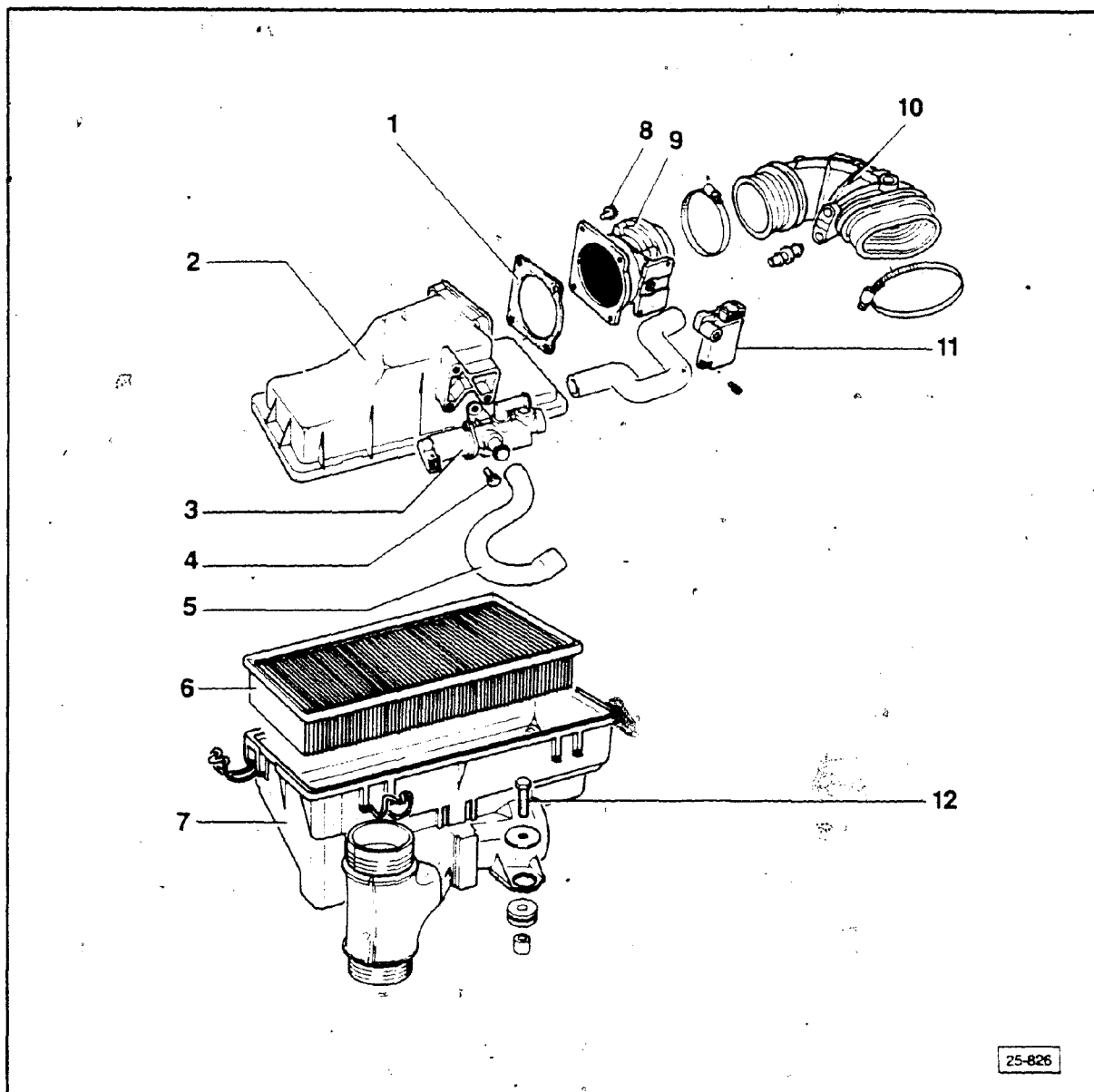
CAUTION

Control limits are sometimes exceeded during checking and adjustment work. These over-limits are recognized as faults by the control unit and stored in the Permanent Fault Memory.

Be sure to erase the Permanent Fault Memory system after all checking and adjustment work has been performed. See Repair Group D2.

Note

The fuel injection part of the CIS-E Motronic is handled in Repair Group 25. Components of the ignition system such as distributor, ignition coil, etc. are found in Group 28.



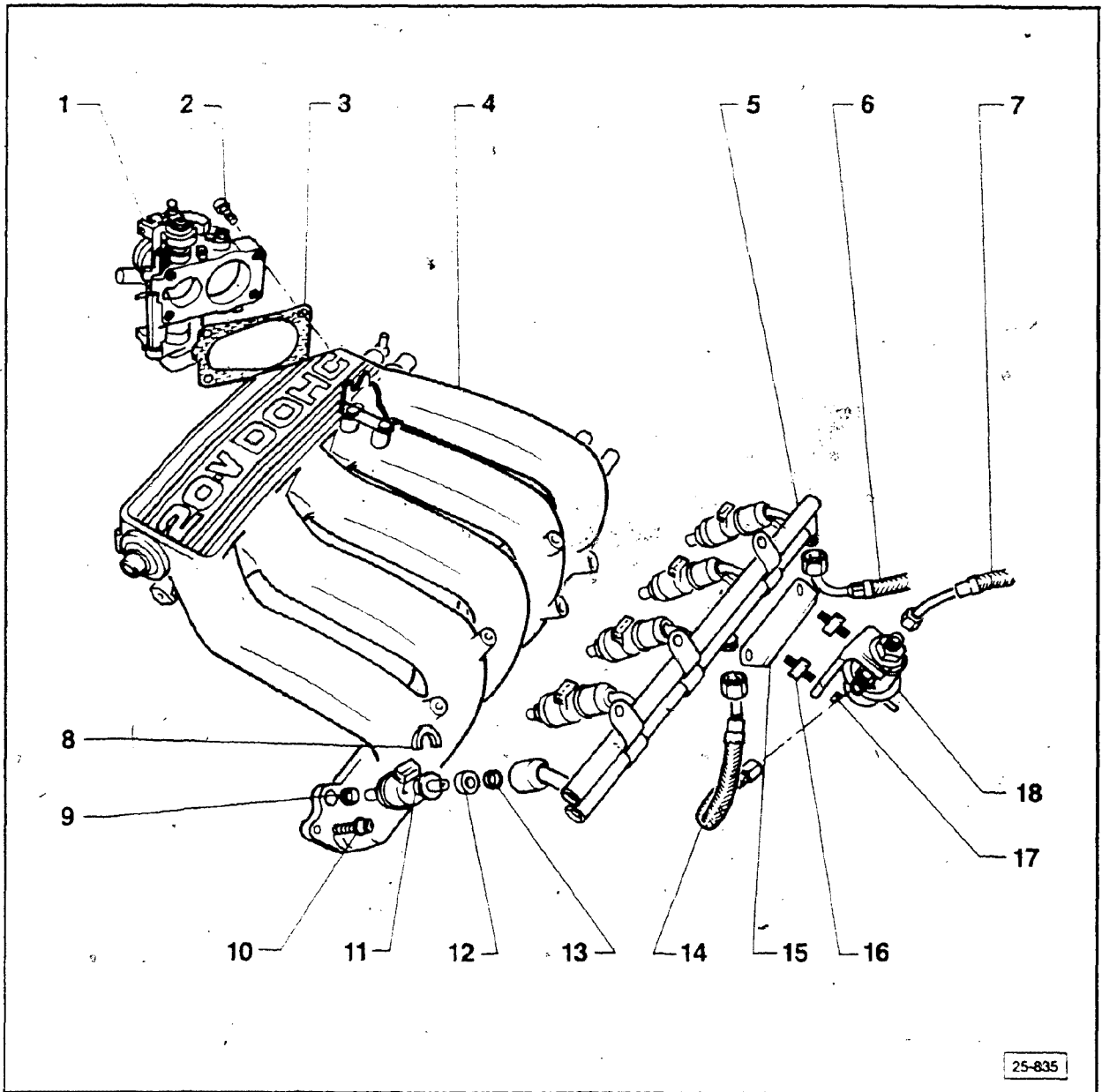
25-826

- 1 — Gasket
- 2 — Air filter housing, upper section
- 3 — Idle stabilizer valve
- 4 — 10 Nm (7 ft lb)
- 5 — Hose
- 6 — Air filter element
- 7 — Air filter housing, lower section
- 8 — 10 Nm (7 ft lb)

- 9 — Air mass sensor housing
- 10 — Intake air boot
- 11 — Air mass sensor
- 12 — 15 Nm (11 ft lb)

Note

Replace gaskets as necessary.



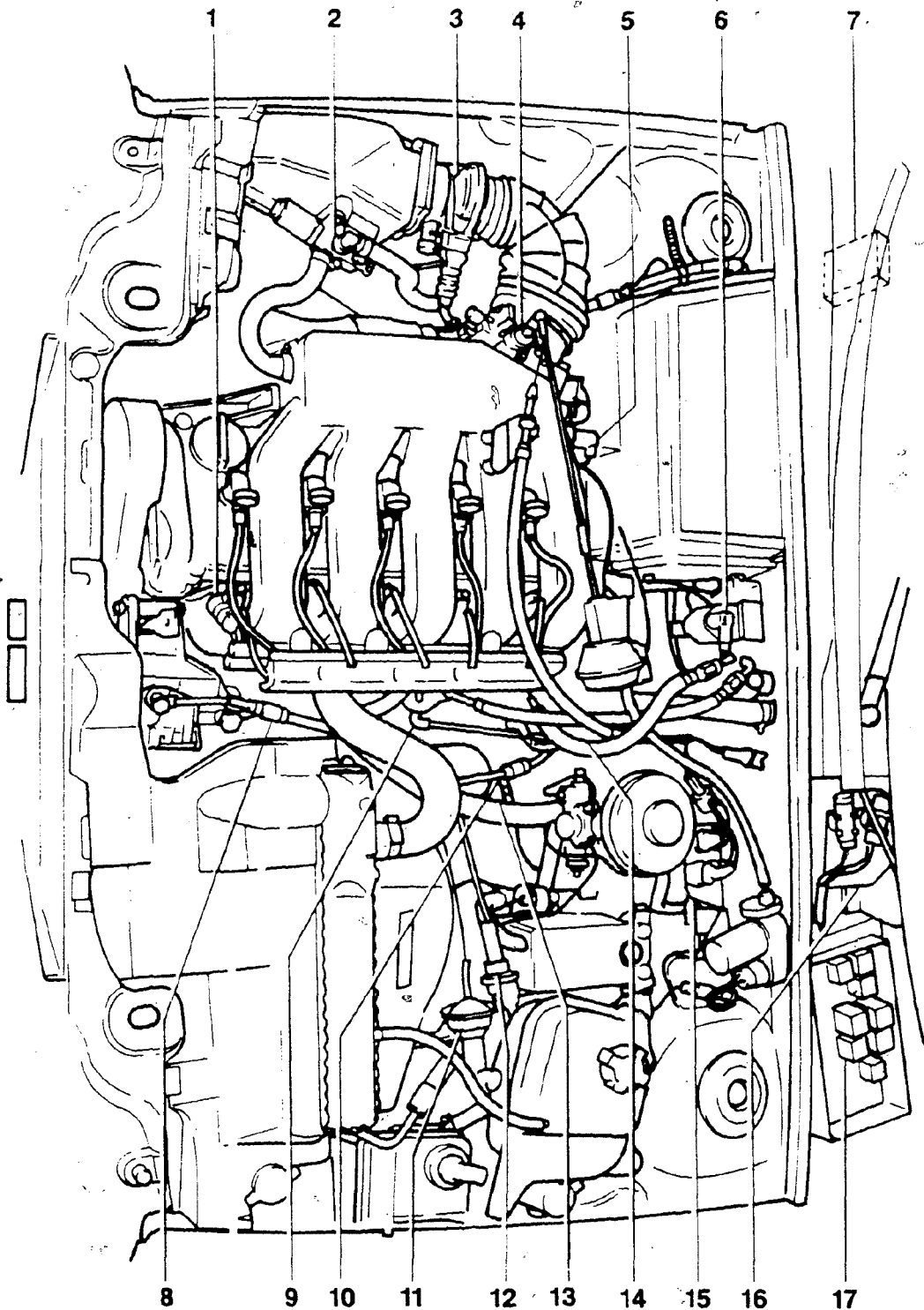
- safety measures, section 24-20
- cleaning, section 24-20
- system pressure testing, section 24-40

- 1 — Throttle body
Potentiometer switch,
checking/adjusting, see section 24-100 •
Idle switch, checking/adjusting, see
section 24-110
- 2 — 20 Nm (15 ft lb)
- 3 — Gasket
- 4 — Intake manifold

- 5 — Fuel rail
- 6 — Fuel supply line
- 7 — Fuel return line (to control pressure
regulator)
- 8 — retaining clip for fuel injector
- 9 — Gasket
- 10 — 20 Nm (15 ft lb)
- 11 — Fuel injector
Checking section 24-50
- 12 — Fuel filter element

Fuel Injection, AFC System

- 13 — Gasket
- 14 — Fuel return line (to fuel tank)
- 15 — Fuel line cover
- 16 — Bushing (rubber bonded)
- 17 — 10 Nm (7 ft lb)
- 18 — Control pressure regulator



28-911

MPI fully-electronic engine management system, component layout

Note safety measures and Rules of Cleanliness section 24-20.

Note

Multimeter **US 1119**, LED tester **US 1115** and the **VW 1594** adaptor kit are required for testing.

- 1 — **Fuel injector**
control, checking, section 24-50
- 2 — **Idle stabilizer valve**
control, checking, section 24-190
- 3 — **Air mass sensor**
checking, section 24-60
- 4 — **Throttle body potentiometer**
checking, section 24-100
- 5 — **Coolant temperature sensor**
checking, section 24-90
- 6 — **Ignition coil with power output stage**
checking, see Repair Group 28
- 7 — **MPI control unit**
supply voltage, checking, section 24-200
coding connector, checking section 24-200
- 8 — **Knock sensor I — 10 Nm (7 ft lb)**
- 9 — **Knock sensor II — 10 Nm (7 ft lb)**
- 10 — **Ignition timing sensor**
checking, see Repair Group 28
- 11 — **Carbon canister shut-off valve**
checking, see Repair Group 20
- 12 — **Carbon canister solenoid valve**
control, checking, section 24-80
- 13 — **Engine speed sensor**
checking, section 24-120
- 14 — **Ignition distributor with Hall Sensor**
basic setting and installation see Repair Group 28
- 15 — **Connector bracket**
- 16 — **Series resistors pack**
checking, section 24-50
- 17 — **Fuel pump relay**
control, checking, section 24-70

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:
 - do **NOT** remove replacement parts from package until time of installation
 - do **NOT** use spare parts that have been 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.

- switch **OFF** the ignition before connecting or disconnecting components or test equipment
- do **NOT** crank engine before high tension wire of ignition distributor (terminal 4) is connected to ground
- 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

Technical data

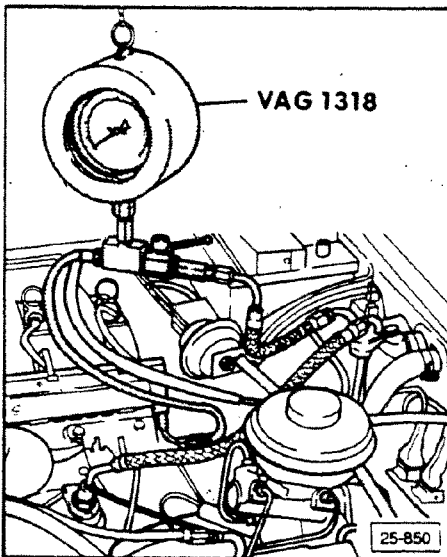
System pressure		3.8 to 4.2 bar (55 to 61 psi)
Residual pressure	minimum after 10 minutes	3.2 bar (46.4 psi)
	minimum after 20 minutes	3.0 bar (43.5 psi)
Fuel injector delivery volume (per 20 seconds)		100 to 120 ml
Idle speed*		800 $\pm$ 50 rpm
CO content*		0.5 to 1.0% volume

CAUTION

Idle speed and CO content are interrelated and **MUST** be checked and adjusted together.

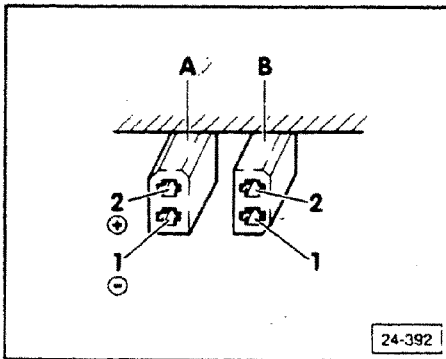
*Requirements

- perform vehicle self diagnosis see Repair Group D2 for additional information.
- engine warm, oil temperature 80°C (176°F) minimum
- throttle valve in idle position
- all electrical consumers switched **OFF**
- pressure gauges **NOT** connected
- radiator fan **NOT** running while taking any readings



Fuel pressure, checking

- connect pressure gauge **VAG 1318** between fuel rail and fuel supply line, with pressure gauge lever in **OPEN** position



System pressure, checking

- bridge diagnostic connector **A** terminal 1 and diagnostic connector **B** terminal 1 using jumper from **VW 1594** adaptor kit

Note

Diagnostic connectors **A** and **B** are located in the recess beneath the shelf in the footwell on the driver's side.

- switch **ON** ignition
- after 4 seconds (minimum) remove jumper from diagnostic connectors
 - must be 3.8 to 4.2 bar (55 to 61 psi)
 - fuel pump **MUST** be running (audible)

CAUTION

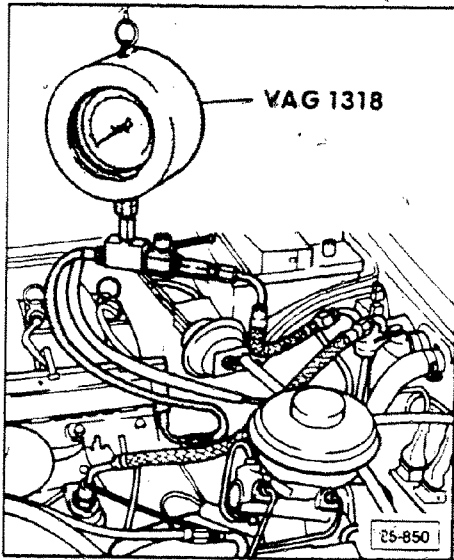
The fuel control pressure regulator is more audible than the fuel pump, do not confuse the two sounds.

If fuel pump is **NOT** running

- check fuel pump relay and controls if necessary, section 24-70

If specified pressure is **NOT** obtained

- replace control pressure regulator on a trial basis and repeat test



If specified value is still **NOT** obtained

- check fuel pump and/or fuel supply line for damage (possibly pinched), repair or replace as necessary

If specified pressure is exceeded

- connect pressure gauge **VAG 1318** between fuel rail and control pressure regulator (substituting short return line)
- repeat pressure check
 - must be 3.8 to 4.2 bar (55 to 61 psi)

If specified pressure is obtained

- replace fuel rail

If measured pressure is below specifications

- replace control pressure regulator

If pressure value exceeds specifications

- check return lines for damage (e.g. pinched areas) replace as necessary

Residual pressure, checking

- switch **OFF** ignition
- observe pressure on gauge; wait 10 minutes and observe gauge pressure again
 - must be 3.4 bar (49.3 psi) minimum

If pressure is below specification

- check fuel lines and connections for leakage; correct as necessary

If **NO** leakage is detected

- replace fuel pump check valve (see Repair Group 20)

Fuel injectors, checking

Note

First perform vehicle self diagnosis as outlined in Repair Group D2.

If as a displayed result of the self diagnosis actuation:

one or several fuel injectors are **NOT** being controlled, perform the following checks

Electrical checking

CAUTION

The fuel injectors are operated via a series resistor network which limits the amount of current to the fuel injectors.

DO NOT try to check the fuel injectors by applying battery voltage.

- remove harness connector from fuel injector to be tested
- switch multimeter **US 1119** to resistance range
- connect multimeter to both terminals of fuel injector
 - must be 1 to 3 ohms

If **NO**

- replace fuel injector

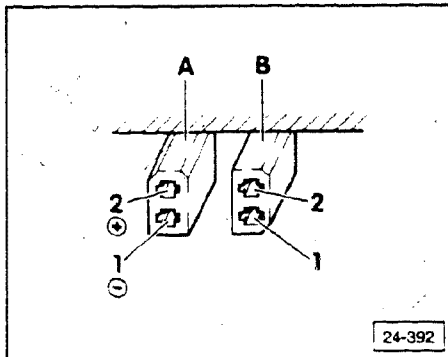
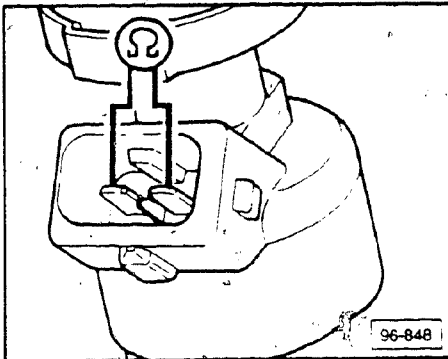
Voltage supply, checking

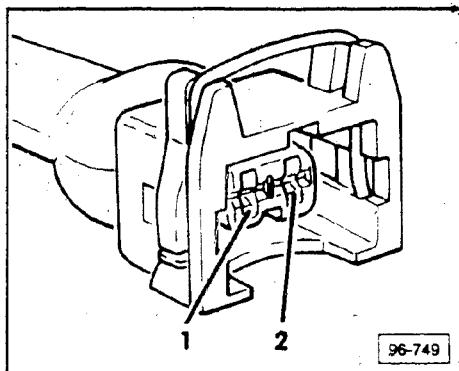
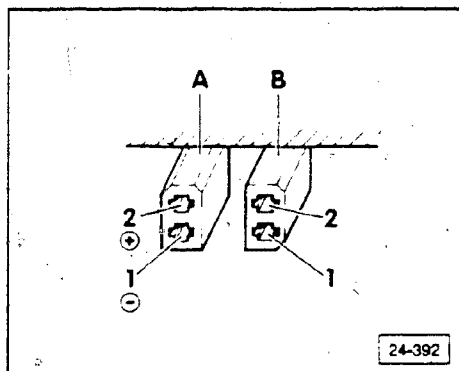
Requirements

- Fuel pump relay **OK**
- Fuel pump relay control function **OK**
- Fuse **13 OK**
- bridge diagnostic connector **A** terminal 1 and diagnostic connector **B** terminal 1 using jumper from **VW 1594** adaptor kit

Note

Diagnostic connectors **A** and **B** are located in the recess beneath the shelf in the footwell on the driver's side.





- switch **ON** ignition
- after 4 seconds (minimum) remove jumper from diagnostic connectors

CAUTION

The fuel injectors are operated via a series resistor network which limits the amount of current to the fuel injectors. **DO NOT** try to check the fuel injectors by applying battery voltage.

- remove harness connector from fuel injector to be tested
- switch multimeter **US 1119** to 20 volt range
- connect multimeter to terminal 2 and ground
 - must be approximately 12 volts

If **YES**

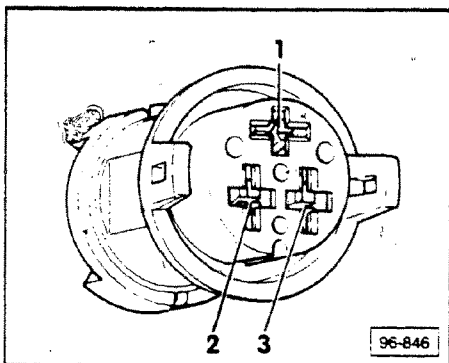
- check fuel injector control page 24-50-4

If **NO**

- check series resistors page 24-50-3

If series resistors are **OK**

- using wiring diagram check wiring from fuel injector harness connector (including terminals) to the series resistors module and from series resistors module via fuse **13** to fuel pump relay
- eliminate any shorts or opens as necessary



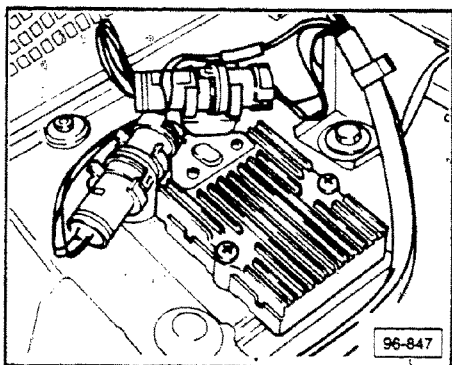
Resistor pack connectors, terminal identification

Gray connector:

terminal 1: voltage supply from fuse 13
terminal 2: to fuel injector cylinder 1
terminal 3: to fuel injector cylinder 2

Brown connector:

terminal 1: to fuel injector cylinder 3
terminal 2: to fuel injector cylinder 4
terminal 3: to fuel injector cylinder 5

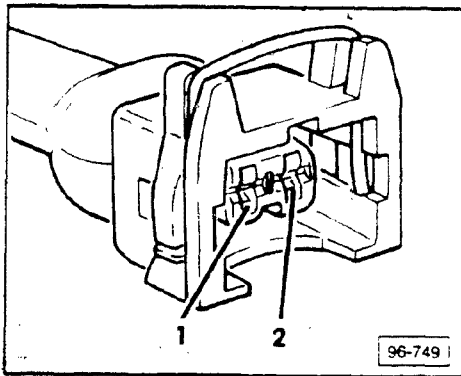


Resistor pack, checking

- disconnect gray and brown connectors from series resistors module
- switch multimeter **US 1119** to resistance range
- connect multimeter in sequence between the white wire and each of the remaining 5 black wires
 - must be 5.0 to 7.0 ohms for the entire set of readings

If **NO**

- replace resistor pack

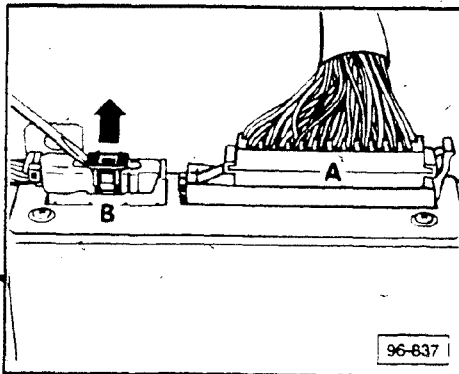


Control, checking

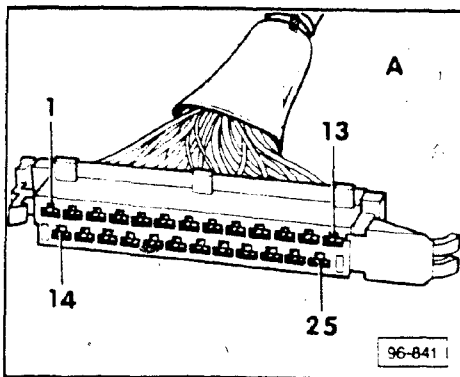
- remove harness connector from fuel injector to be tested
- connect **US 1115** LED tester between terminal 1 of harness connector and battery positive using **VW 1594** adaptor kit
- momentarily activate starter
 - LED tester must flash

If **NO**, check for open circuit as follows

- expose MPI control unit by removing foot well cover beneath glove box



- remove control unit harness connector **A**
- disconnect fuel injector harness connector from fuel injector to be tested



- switch multimeter **US 1119** to resistance range
- check continuity between wires in control unit harness connector **A** and terminal 1 of fuel injector harness connector being checked as follows

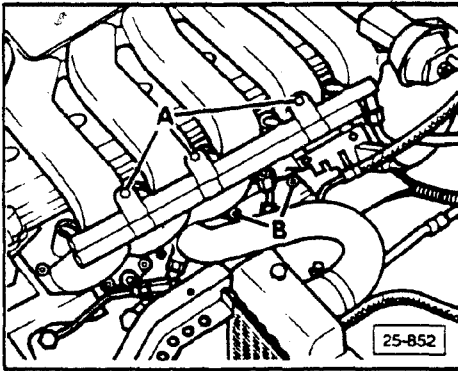
Connector A terminal #	Fuel injector harness connector for cylinder #
3	←→ Cyl. 1
4	←→ Cyl. 2
5	←→ Cyl. 3
16	←→ Cyl. 4
17	←→ Cyl. 5

If continuity is **NOT** obtained

- eliminate open circuit in wiring using wiring diagram

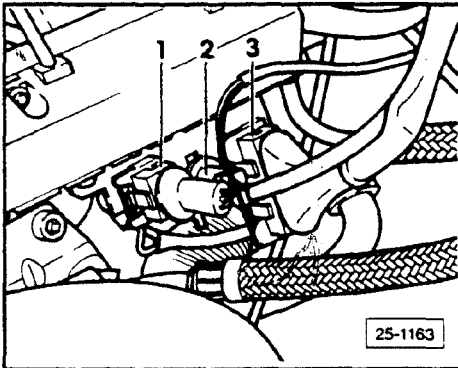
If continuity **IS** obtained

- replace MPI control unit

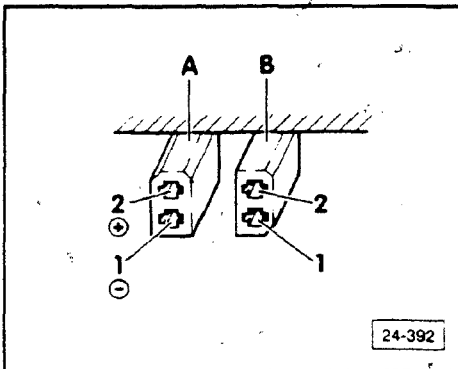


Injection quantity, comparative measurement

- remove fuel rail assembly (mounting bolts **A**) complete with injectors but do **NOT** disconnect fuel lines
- remove pressure regulator with bracket from manifold (mounting bolts **B**)
- remove hose clamp on rear of intake manifold and (if installed) bracket for cruise control vacuum reservoir



- disconnect harness connectors 1, 2 and 3 on intake manifold
- disconnect coil wire from distributor cap and connect to ground using adaptor from **VW 1594** kit
- expose fuel injector connector terminals by pushing back rubber boots on fuel injector harness connectors while leaving connected
- insert fuel injectors into **VAG 1602** analyzer (for volume measurement)



- bridge diagnostic connector **A** terminal 1 and diagnostic connector **B** terminal 1 using jumper from **VW 1594** adaptor kit

Note

Diagnostic connectors **A** and **B** are located in the recess beneath the shelf in the footwell on the driver's side.

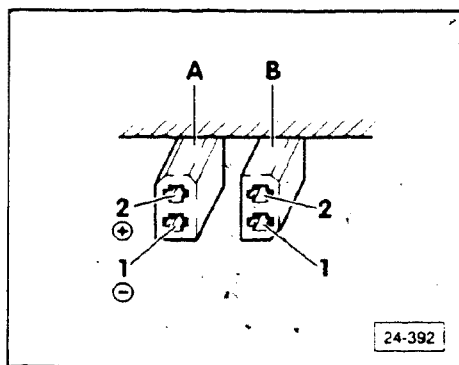
- switch **ON** ignition
- after 4 seconds (minimum) remove jumper from diagnostic connectors
- visually inspect tip of fuel injectors for leakage

Note

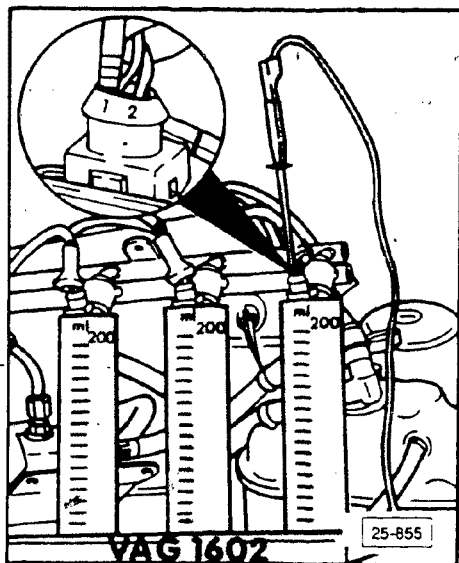
When the fuel pump is running, only 1 to 2 drops per minute (per valve) are permitted to leak.

If leakage is greater

- switch **OFF** ignition
- replace defective fuel injector



- bridge diagnostic connector **A** terminal 1 and diagnostic connector **B** terminal 1 using jumper from **VAG 1594** adaptor kit
- switch **ON** ignition
- after 4 seconds (minimum) remove jumper from diagnostic connectors



- connect brown wire of exposed fuel injector harness connector to ground using jumper from **VW 1594** adaptor kit

Note

This step is performed for each fuel injector in sequence for a duration of 20 seconds per injector.

- after 20 seconds must be 100 to 120 ml of fuel in **VAG 1602**

If fuel quantity for one or more injectors is above or below specification

- replace defective fuel injector(s)

If quantity of all 5 injectors is above or below specification

- check system pressure, section 24-40

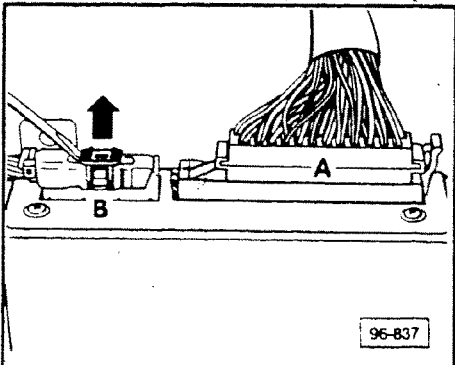
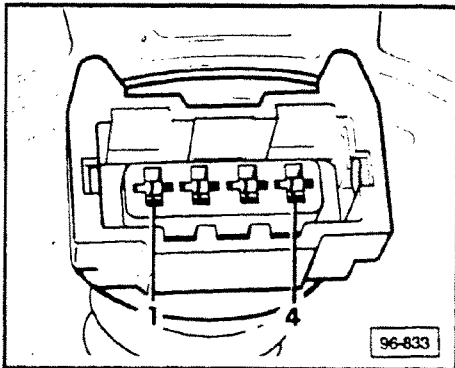
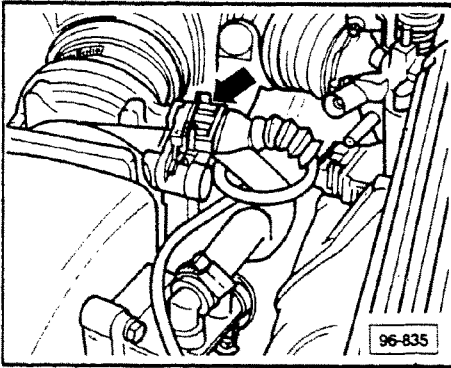
Air mass sensor, checking

Requirement

- fuse 27 is OK

Supply voltage, checking:

- remove air mass sensor harness connector (arrow)



- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminal 3 and engine ground
- switch **ON** ignition
 - approximately 12 Volts

If voltage value is **NOT** obtained

- check wiring using wiring diagram
- connect multimeter between terminals 3 and 2
 - approximately 12 volts

connect multimeter between terminals 2 and 4

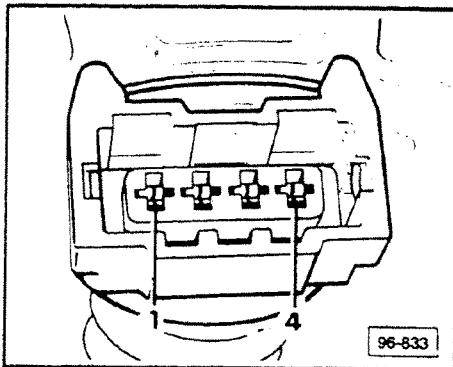
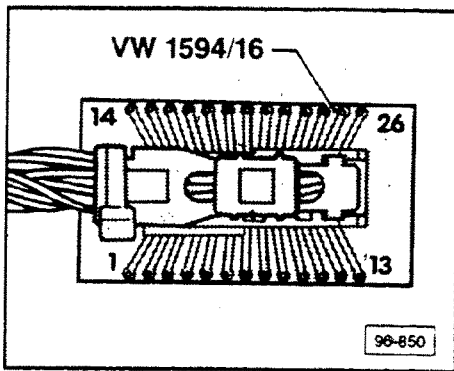
- approximately 8 Volts

If voltage values **ARE** obtained

- check function of air mass sensor, page 24-60-3

If one of the voltage values is **NOT** obtained

- check wiring between (yellow) control unit harness connector **B** and 4-pin connector of air mass sensor
- remove foot-well cover under glove compartment
- pry open secondary lock (black) and remove control unit harness connector **B**



- connect measuring adaptor **VW 1594/16** to control unit harness connector **B**
- switch multimeter **US 1119** to resistance range
- check continuity between adaptor and 4-pin connector

Connector, 4-pin	Measuring adaptor
1	3
2	6
2	16
4	4

- approximately 0 ohms (continuity)

If continuity (for all 4 measurements) is **NOT** obtained

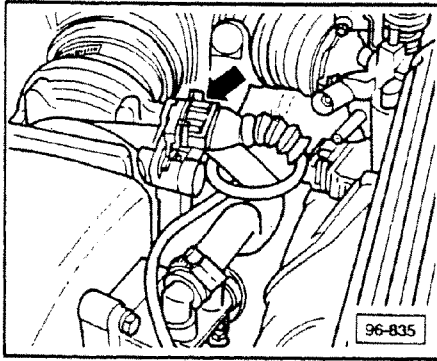
- check wiring using wiring diagram, repair as necessary

If continuity **IS** obtained for all 4 measurements

- check air mass sensor

Note

The connector cavities are correspondingly numbered on the rear side of the connector (under the protective cap).



Function, checking

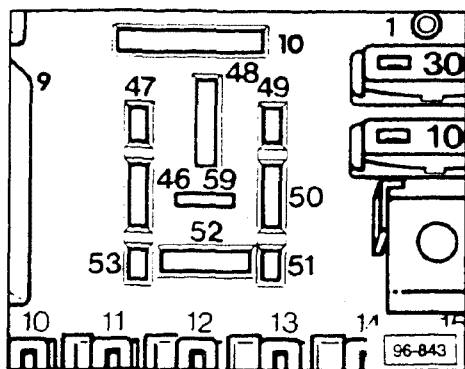
- push back protective cap (leaving air mass sensor connected)
- switch **ON** ignition
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminals 2 and 4
 - approximately 1.0 to 7.5 volts

If voltage value is **NOT** obtained

- replace air mass sensor potentiometer
- connect multimeter between terminals 1 and 2
- switch **ON** ignition
 - 0.3 to 1.1 volts
- start engine, switch **OFF** all electrical consumers (radiator cooling fan must **NOT** be running during measurements)
- continuously vary engine speed between idle and 4000 RPM
 - voltage must vary between 1.5 and 3.4 volts, depending on RPM

If voltage values are **NOT** obtained

- replace air mass sensor



Fuel pump relay, checking

Control, Checking

- remove fuel pump relay from fuse relay panel, cavity 10
- switch **ON** ignition
- switch **US 1119** multimeter to 20 volt range
- connect multimeter between terminal **46** and ground then terminal **48** and ground
 - each must be approximately 12 volts

If voltage value is **NOT** obtained

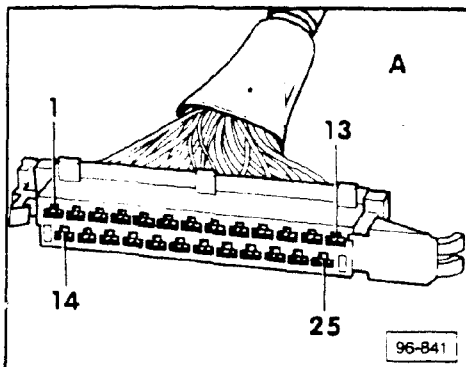
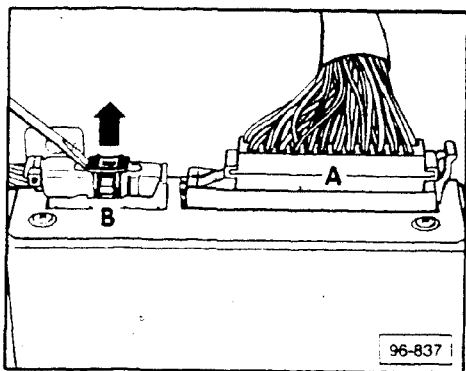
- eliminate open circuit in wiring using wiring diagram
- switch **OFF** ignition
- connect **US 1115** LED tester between terminals **46** and **47**
- switch **ON** ignition
 - LED tester must light up for approximately 1 second

If **YES**

- replace fuel pump relay

If **NO**, check wiring as follows

- expose MPI control unit by removing foot well cover beneath glove box
- remove control unit harness connector **A**
- switch multimeter **US 1119** to resistance range



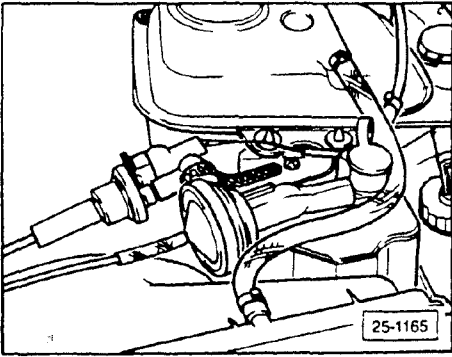
- check continuity between terminal **7** of control unit harness connector **A** and terminal **47** of relay cavity **10** on fuse relay panel
 - must be 0.0 to 0.8 ohms (continuity)

If continuity is **NOT** obtained from **BOTH** measurements

- eliminate open circuit in wiring using wiring diagram

If continuity **IS** obtained from **BOTH** measurements

- replace MPI control unit



Carbon canister solenoid valve, checking

- perform vehicle self diagnosis and call up code **4343** for carbon canister solenoid valve, see Repair Group D2 for additional information
 - solenoid **MUST** click **ON** and **OFF** when full throttle switch is closed

If **NO**

- disconnect harness connector from solenoid valve

- connect **US 1115** LED tester to terminals **1** and **2** of harness connector using **VW 1594** adaptor kit
 - LED tester must flash

If **YES**

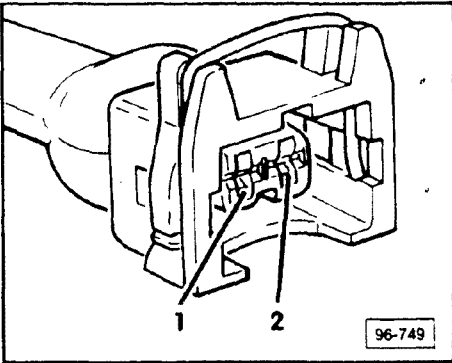
- replace solenoid valve

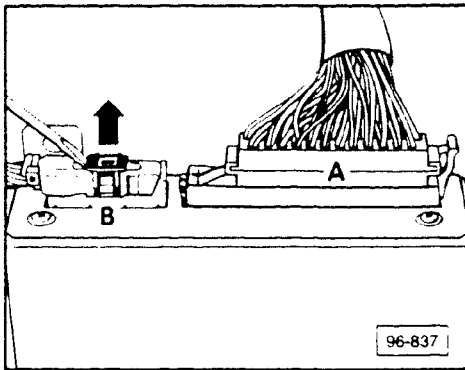
If **NO**

- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminal **1** of harness connector and ground
 - must be approximately 12 volts

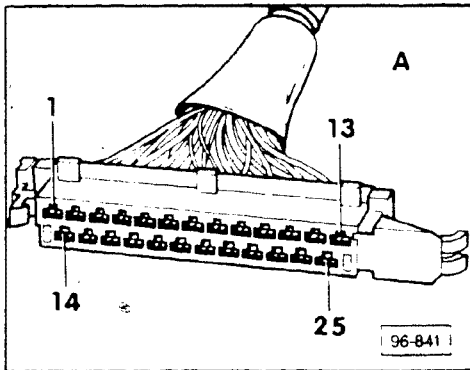
If **NO**

- eliminate open circuit in wiring using wiring diagram





- If voltage **IS** obtained perform following check
- expose MPI control unit by removing footwell cover beneath glove box
 - remove control unit harness connector **A**
 - switch multimeter **US 1119** to resistance range



- check continuity between terminal **20** of control unit harness connector **A** and terminal **2** of carbon canister solenoid valve harness connector

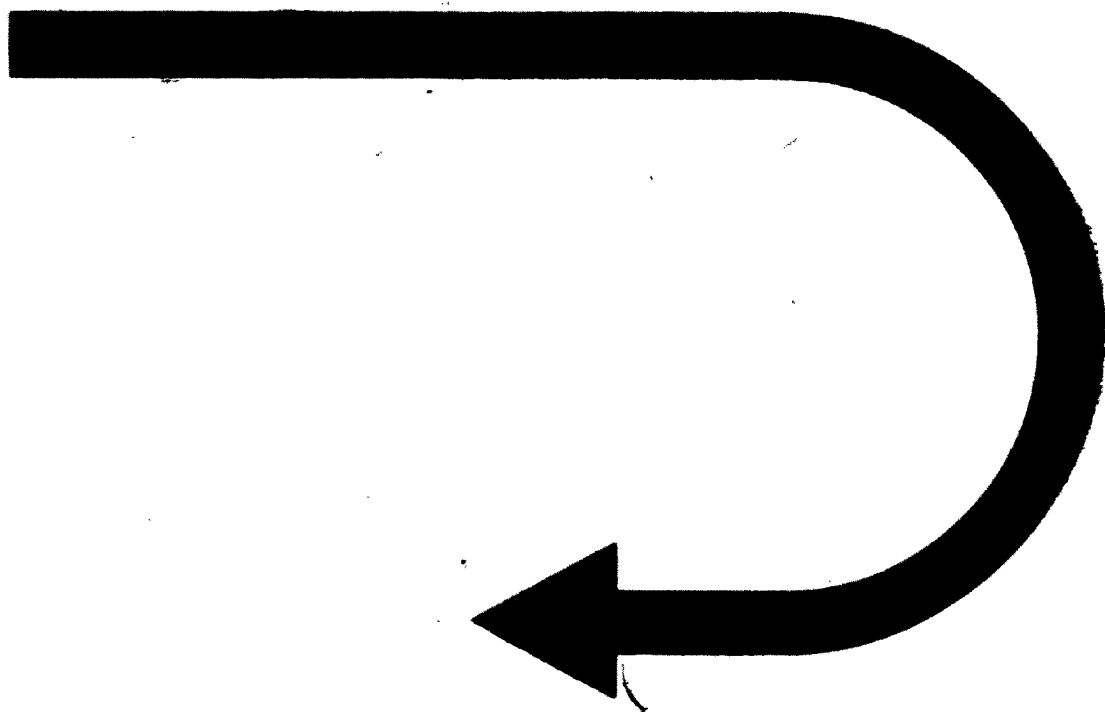
If continuity is **NOT** obtained

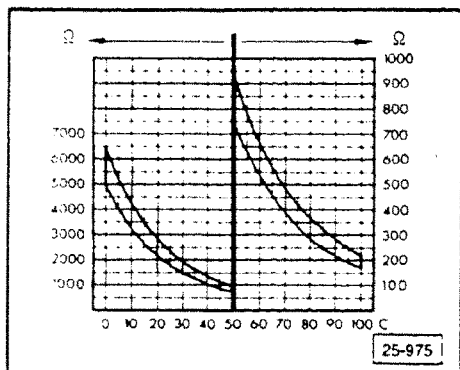
- eliminate open circuit in wiring using wiring diagram

If continuity **IS** obtained

- replace MPI control unit

CONTINUED IN THE
BEGINNING OF NEXT ROW





Coolant temperature sensor, checking

Requirements

- coolant temperature 20°C (68°F) minimum
- remove harness connector from coolant temperature sensor
- switch multimeter **US 1119** to resistance range
- connect multimeter between the two coolant temperature sensor terminals and compare resistance (Ω) reading with chart

Note

Coolant temperature sensor on rear of cylinder head is an NTC type (negative temperature coefficient), resistance decreases as engine temperature increases.

Example:

approximately 2400 ohms (@ 20°C (68°F) coolant temperature, approximately 310 to 320 ohms (@ 80°C (176°F) coolant temperature.

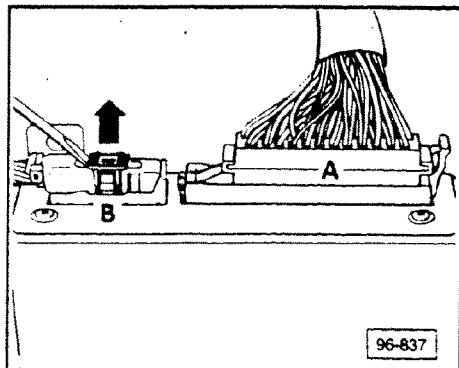
If resistance values are **NOT** obtained

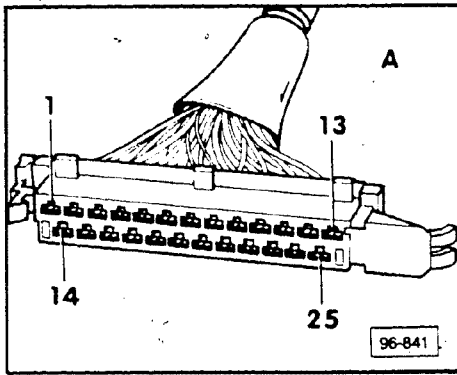
- replace coolant temperature sensor

If the specified values **ARE** obtained

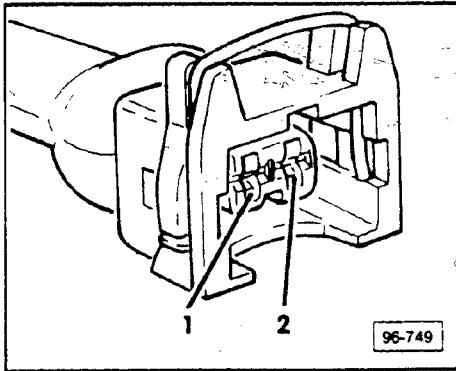
- check wiring from sensor to MPI control unit as follows

- remove foot-well cover under glove compartment
- remove control unit harness connector **A**





- check continuity between control unit harness connector A and 2-pin harness connector of coolant temperature sensor



2-pin connector Connector A on control unit

1	←	→	11
2	←	→	15

- approximately 0 ohms (continuity)

If resistance values are **NOT** obtained

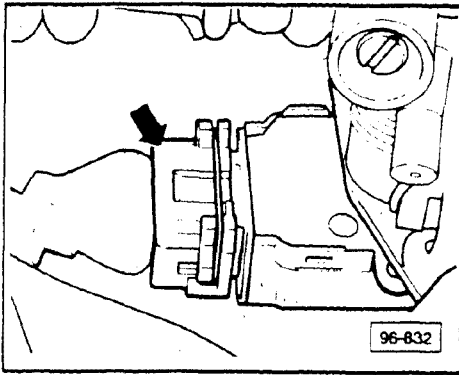
- repeat continuity test reversing test leads at two-pin connector

If resistance values are still **NOT** obtained

- check wiring using wiring diagram

If resistance values **ARE** obtained

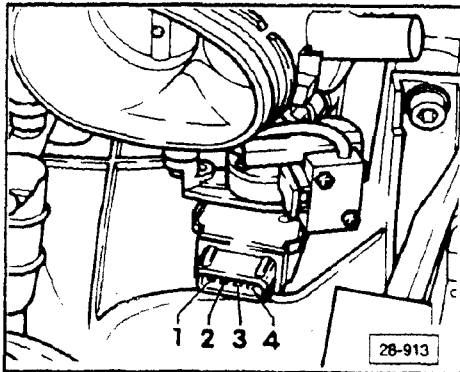
- replace MPI control unit



Potentiometer, checking

Supply voltage, checking

- remove throttle potentiometer harness connector (**arrow**)
- switch ignition **ON**
- switch multimeter **US 1119** to 20 volt range



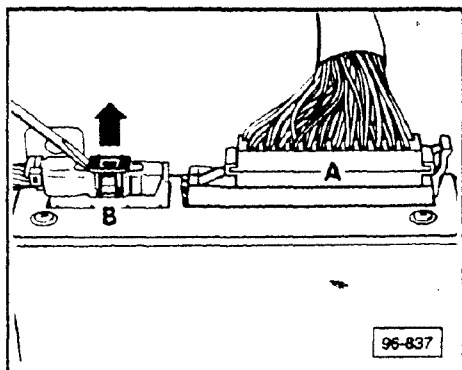
- connect multimeter between terminals **2** and **4** then terminals **3** and **4**
 - approximately 5 volts for each reading

If one of the voltages is **NOT** obtained

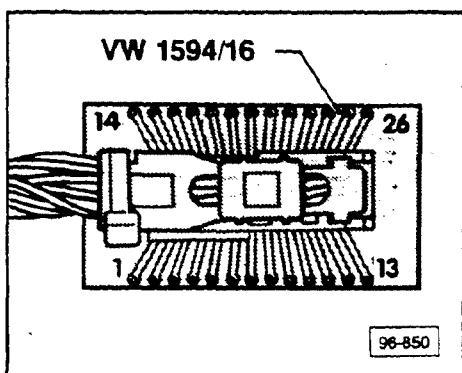
- check wiring between (yellow) control unit connector **B** and 4-pin connector

If both voltage readings **ARE** obtained

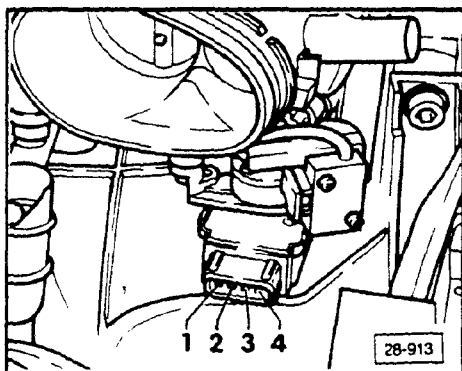
- check throttle potentiometer and idle switch



- remove foot-well cover under glove compartment
- pry open secondary lock (black) of control unit harness connector **B** and remove



- connect measuring adaptor **VW 1594/16** to harness connector **B**



- check continuity between measuring adaptor and 4-pin connector

4 pin connector	VW 1594/16 Measuring adaptor
2	21
3	10
4	9

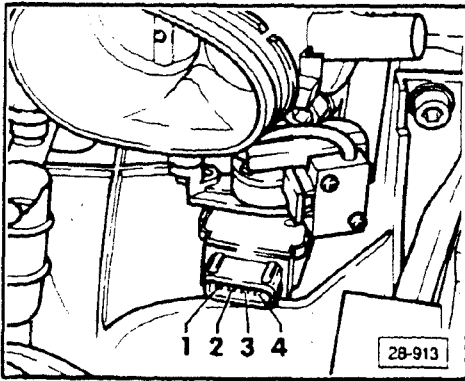
- approximately 0 ohms (continuity)

If continuity is **NOT** obtained

- check wiring according to wiring diagram

If continuity **IS** obtained

- replace MPI control unit

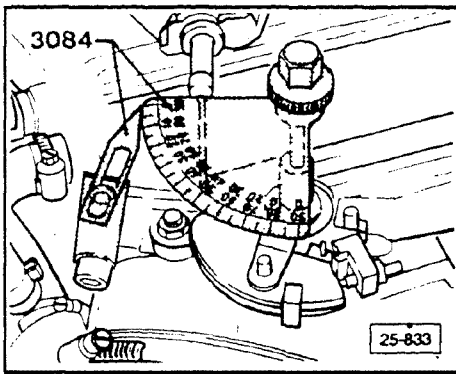


Electrical checking

- remove harness connector from throttle potentiometer
- remove intake air boot
- switch multimeter **US 1119** to resistance range
- connect multimeter between terminals 1 and 3
 - 3000 to 6500 ohms
- connect multimeter between terminals 2 and 3
 - 3000 to 6000 ohms
- fully open throttle lever
 - 0 to 600 ohms

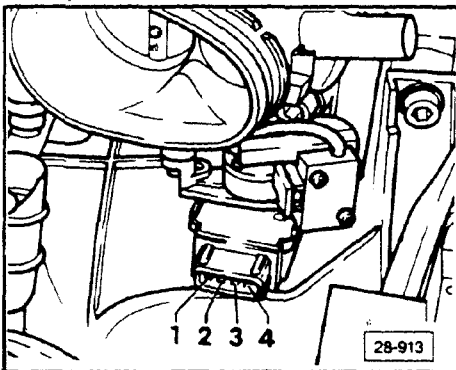
If any of the resistance values are **NOT** obtained

- replace potentiometer



Switch, checking

- attach **3084** protractor pointer to throttle body
- install protractor **3084** onto throttle shaft
- switch multimeter **US 1119** to resistance range



- connect multimeter between terminals **3** and **4** of throttle switch
- "zero" protractor and pointer
- open throttle approximately 20°, then close slowly
 - switching point (continuity): 1.5-2.5°

If continuity is **NOT** obtained

- adjust potentiometer switch

If still **NOT OK**

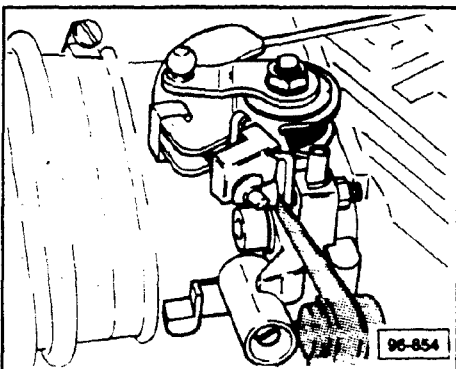
- replace potentiometer switch

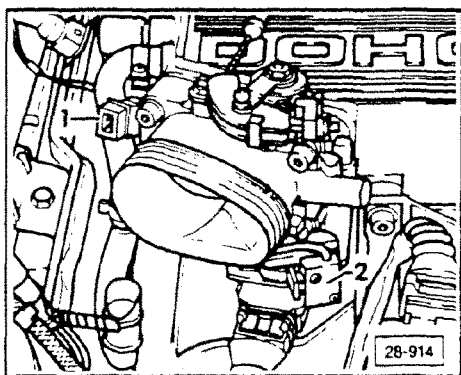
Note

The throttle body must first be removed to adjust or replace the potentiometer switch.

Switch, adjusting

- remove throttle body
- switch multimeter **US 1119** to resistance range
- connect multimeter between terminals **3** and **4** of potentiometer switch
- loosen throttle switch mounting screws
- position switch in slots so that it opens straight when inserting 0.75 mm (0.030 in.) feeler gage between set screw and stop
 - feeler gage inserted: Infinite ohms (open)
 - feeler gage removed: 0 ohms (continuity)
- tighten mounting screws and re-check adjustment





Idle switch, checking and adjusting

Checking

- remove idle switch harness connector (on throttle)
- switch multimeter **US 1119** to resistance range
- connect multimeter between terminals of switch 1
 - throttle closed: approximately 0 ohms
 - throttle open: Infinite ohms

If resistance values are **NOT** obtained

- check wiring

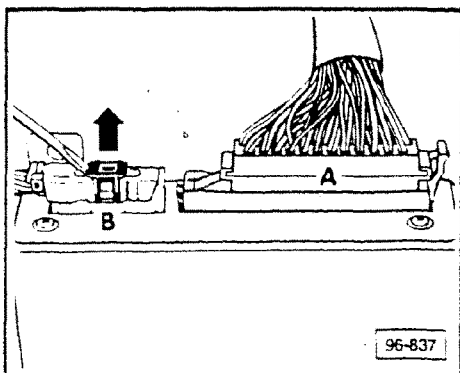
If wiring **OK**

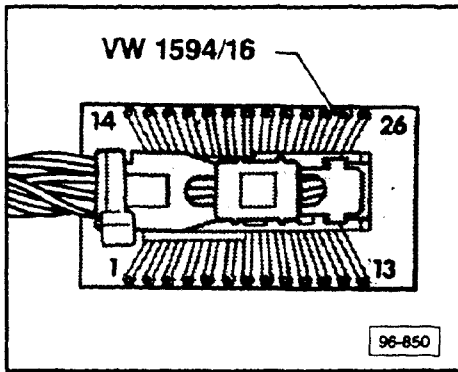
- adjust or replace throttle switch

Wiring to control unit, checking

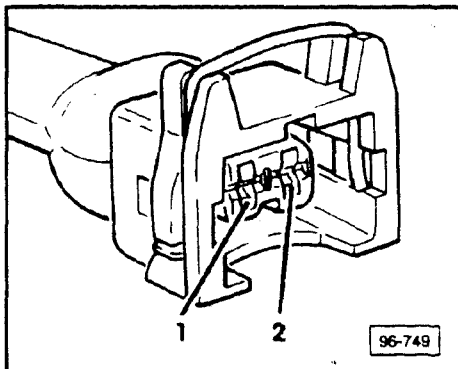
- remove idle switch harness connector (on throttle)
- remove foot-well cover under glove compartment
- pry open secondary lock (black) of control unit harness connector **B** and remove

more





- connect measuring adaptor VW 1594/16 to harness connector B



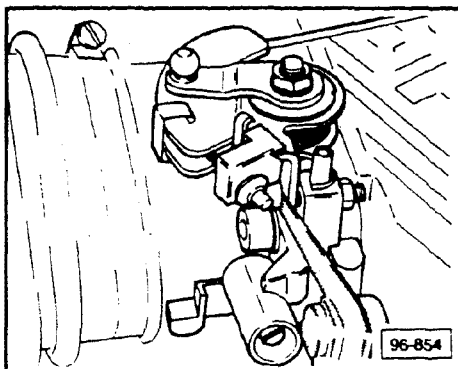
- check continuity with multimeter

Connector B on control unit		Harness Connector for idle switch
21	←————→	2
22	←————→	1

- must not be greater than 1 ohm

If continuity is **NOT** obtained

- check wiring using wiring diagram, repair as necessary



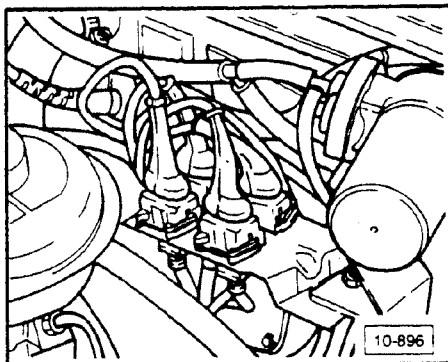
Adjusting

- connect multimeter and protractor assembly as described on page 24-100-4
- open throttle slightly and insert a 0.5 mm (0.020 in.) feeler gage between stop and lever
- close throttle
 - Infinite ohms (open)
- remove feeler gage
 - 0 ohms (continuity)
- carefully re-insert feeler gage between stop, but do **NOT** open throttle any more than necessary to insert feeler gage
 - Infinite ohms (open)

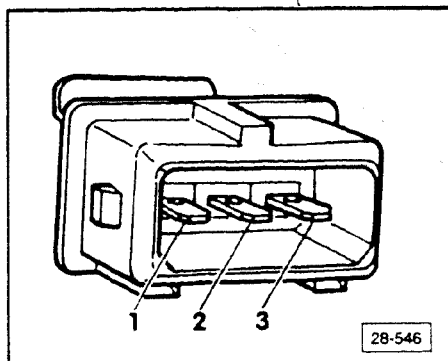
If resistance value is **NOT** obtained

- adjust idle switch
- loosen idle switch mounting screws and position switch in slots so that idle switch opens straight when inserting the 0.4 mm (0.016 in.) feeler gage between set screw and stop
- tighten mounting screws

Engine-speed sensor, checking



- separate gray connector (left side engine compartment near plenum) and remove from bracket (sensor side of cable color marked)
- switch multimeter **US 1119** to resistance range



- connect multimeter between terminals 1 and 2 of speed sensor connector
 - approximately 1000 ohms

If **NO**

- replace engine speed sensor

If **YES**

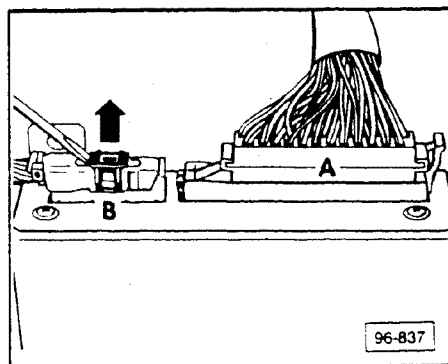
- connect multimeter first between terminals 1 and 3 then between 2 and 3
 - Infinite ohms (open)

If **NO**

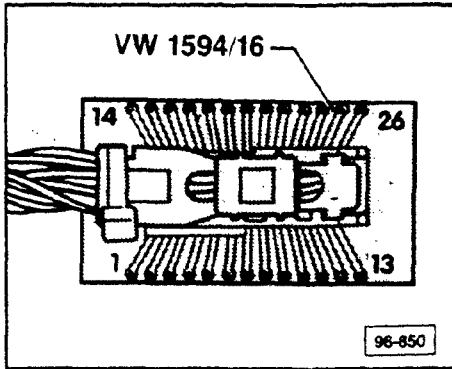
- replace engine speed sensor

If **YES**

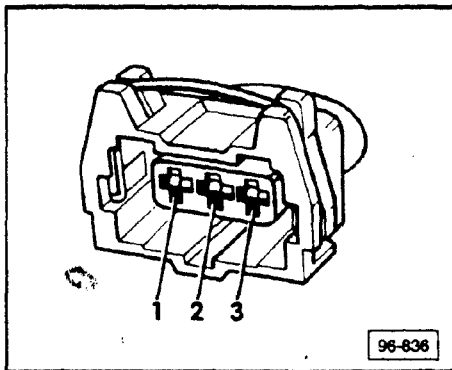
- check wiring between sensor harness connector and control unit harness connector **B** as follows
- remove foot-well cover under glove compartment



- pry open secondary lock (black) of control unit harness connector **B** and remove



- connect measuring adaptor VW 1594/16 to control unit harness connector **B**
- switch multimeter US 1119 to resistance range



- check continuity between sensor connector and measuring adaptor

Sensor connector Measuring adaptor

1	←————→	13
2	←————→	25
3	←————→	25

● approximately 0 ohms

If resistance values are **NOT** obtained

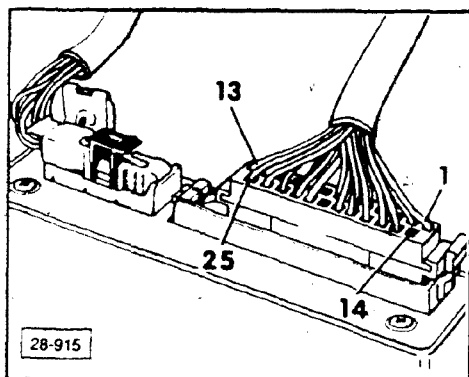
- check wiring using wiring diagram

If resistance values **ARE** obtained

- check teeth on flywheel ring gear for damage

If there is **NO** damage

- replace MPI control unit



Tachometer signal, checking

- connect **VAG 1367** engine tester to measure RPM
- remove foot-well cover under glove compartment
- switch multimeter **US 1119** to **20 Volts AC** range
- connect multimeter between terminals **1** and **10**
- start engine and let run at idle
 - approximately **4.0 to 10.0 volts AC**

If voltage value is **NOT** obtained

- remove instrument cluster and remove (yellow) **26** pin harness connector
- start engine and let run at idle
 - **1 to 2 volts AC**

If voltage value is **NOT** obtained

- replace MPI control unit

If voltage value **IS** obtained but vehicle tachometer does not indicate same RPM as **VAG 1367**

- check wiring from terminal **10** of harness connector **A** on MPI control unit to tachometer (in instrument cluster) using wiring diagram

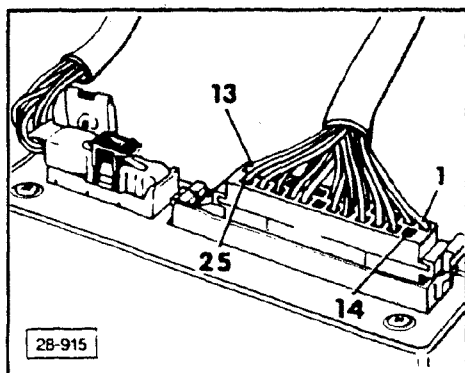
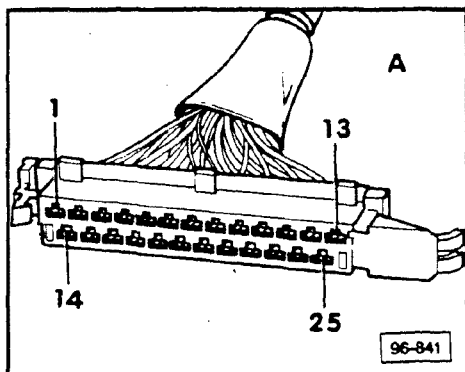
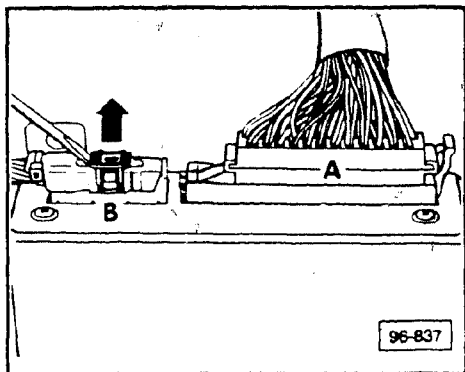
If wiring **OK**

- continue troubleshooting instrument cluster see Repair Group 90 for additional information

Speed signal, checking

Requirement

- fuse 27 OK
- remove foot-well cover under glove compartment
- remove harness connector A



- connector **US 1115** LED tester between terminals 14 and 25 using **VW 1594** adaptor kit
- raise front/left part of vehicle, until wheel is lifted off ground
- switch **ON** ignition
 - **US 1115** must light up at about half brightness
- turn left front wheel slowly by hand
 - **US 1115** must flash (become brighter)

If **US 1115** does **NOT** light up or flash

- check wiring of terminal 14 to instrument cluster using wiring diagram

If wiring **OK**

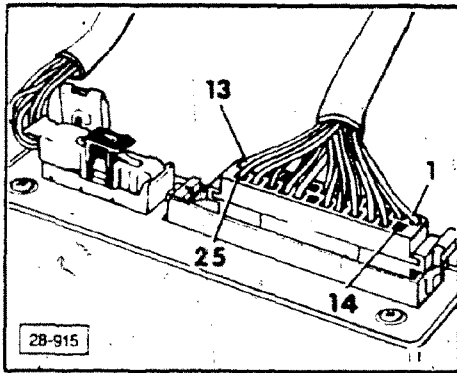
- continue checking using: troubleshooting guide "speed signal, checking" and wiring diagrams

If **US 1115** lights up and flashes

- switch **OFF** ignition and re-connect control unit harness connector **A**
- connect **US 1115** between terminals 14 and 25
- switch **ON** ignition
 - diode testing lamp must light up at about half brightness
- turn left front wheel slowly by hand
 - **US 1115** must flash (become brighter)

If **US 1115** does **NOT** light up or flash

- although no fault was apparent with connector **A** removed while checking
- replace MPI control unit



Fuel consumption rate indicator (On Board Computer), checking

- remove foot-well cover under glove compartment
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminals **1** and **23**
- start engine and let run while continuously changing engine speed between 1000 and 4000 RPM
 - approximately 0.3 to 0.8 volts (corresponding to RPM)

If voltage value is **NOT** obtained

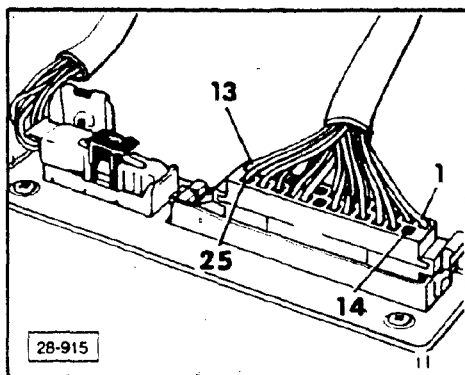
- remove instrument cluster
- remove black 10-pin connector for on-board computer
- start engine and let run at idle
 - approximately 0.1 to 0.3 volts

If voltage value is **NOT** obtained

- check wiring between terminal **23** of connector **A** and on-board computer

If voltage value is still **NOT** obtained

- replace MPI control unit



A/C compressor cut-out, checking

Requirement

- A/C system OK

Remove foot-well cover under glove compartment.

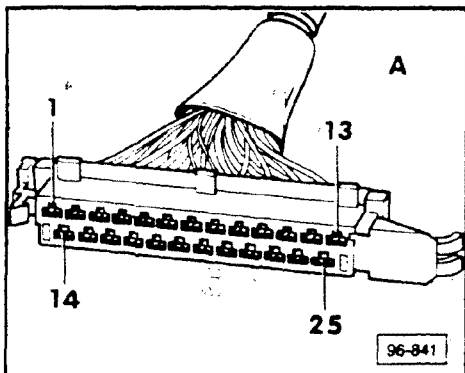
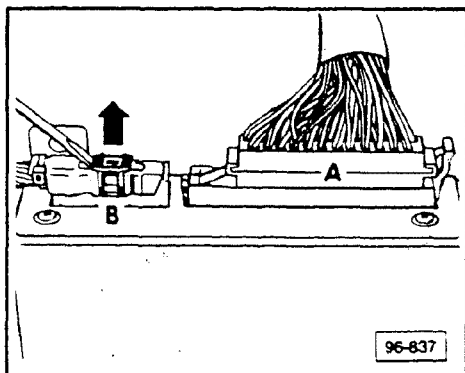
- connect multimeter between terminals 1 and 24 of MPI control unit harness connector
- switch **ON** ignition
- switch **ON** climate control (operating mode AUTO)
 - after approximately 6 seconds voltage must rise from zero to 10-12 volts
- quickly depress accelerator pedal fully and hold down
 - voltage must decrease for about 12 seconds to 0. . . 1 volts and then rise again to 10. . . 12 volts

Note

If accelerator pedal was released sooner, the time period of the voltage drop is reduced to a minimum 3 seconds.

If voltage values are **NOT** obtained

- switch **OFF** ignition
- remove connector **A** from MPI control unit

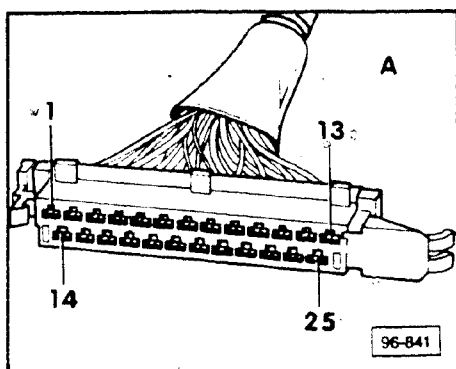


- check continuity of wiring (bridge) from terminal 8 to terminal 24 using multimeter and wiring diagram
- eliminate any open circuits, if necessary

- ensure that correct MPI control unit and compressor clutch control relay are installed

Note

The compressor clutch control relay is in the (left) auxiliary relay panel under the instrument panel, see groups for wiring diagrams, troubleshooting electrical system and installation locations.



- switch multimeter **US 1119** to 200 mA range and connect between terminals 1 and 24
- switch **ON** ignition
- switch **ON** climate control (operating mode AUTO)
 - approximately 30 to 35 mA

If current value is **NOT** obtained

- check wiring from terminal 24 to compressor clutch control relay for continuity or short-circuit using wiring diagram

Note

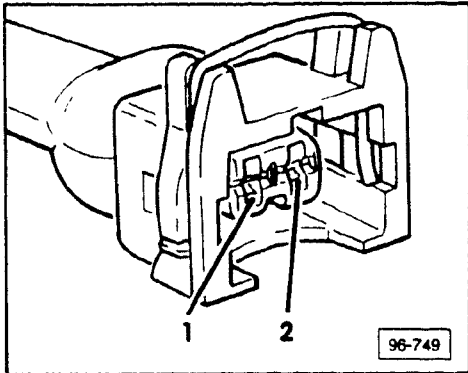
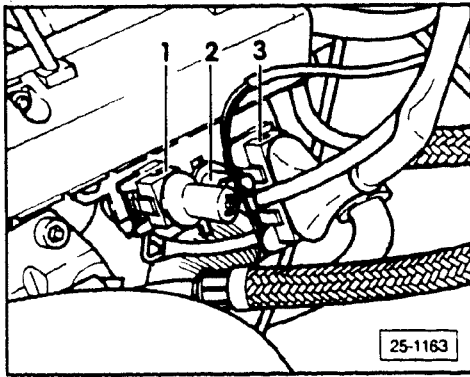
If there is a positive (+) short-circuit, it would damage the MPI control unit.

If wiring **OK**

- replace compressor clutch control relay

If current value **IS** obtained when checking with harness connector **A** removed **BUT** the specified values are **NOT** obtained with harness connector **A** connected

- replace MPI control unit



Oxygen sensor system, checking

Oxygen sensor heating, checking

- disconnect harness connector 1 for Oxygen sensor heating (next to intake manifold)
- switch multimeter **US 1119** to 20 volt range

- connect multimeter between terminals 1 and 2 of harness connector
- start engine and allow to idle
 - must be approximately 12 volts
- switch **OFF** ignition

If voltage value **NOT** obtained

- check fuse 28 and if necessary eliminate open circuit using wiring diagram

If voltage value **IS** obtained

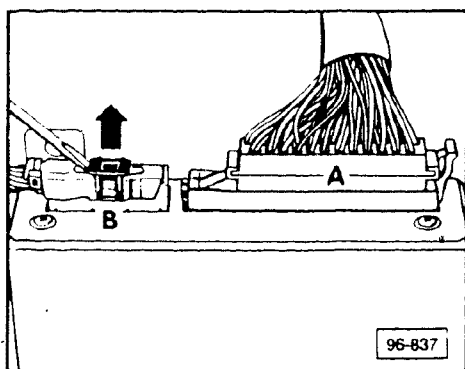
- connect test adaptor **VW 1315A/1** between OXS heater harness connector 1 and heater connector
- connect an ammeter, with a range of zero to 10 amps, to test adaptor **VW 1315A/1**
- switch **ON** ignition
 - must be 0.5 to 3.0 amps (current decreases as sensor heats up)

If amperage value is **NOT** obtained

- replace Oxygen sensor

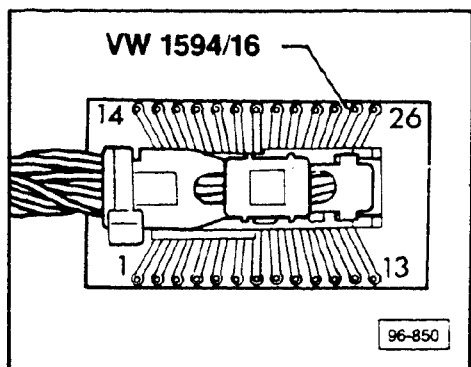
Oxygen sensor control, checking

- disconnect harness connector 2 for Oxygen sensor signal (next to intake manifold)
- switch multimeter **US 1119** to 2 volt range
- connect multimeter between harness connector and ground
- switch **ON** ignition
 - must be 400 ± 50 mV



If **NO**

- expose MPI control unit by removing footwell cover beneath glove box
- pry open secondary lock (black) of control unit harness connector **B** and remove



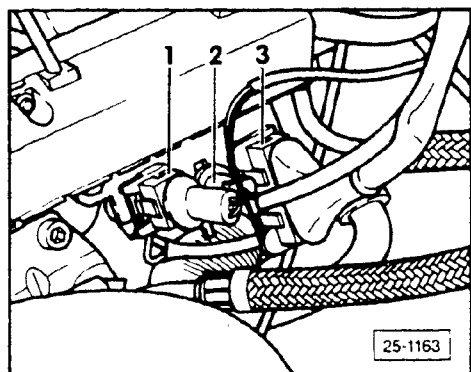
- attach harness connector **B** to test adaptor **VW 1594/16**
- switch multimeter **US 1119** to resistance range
- check continuity between terminal 7 of test adaptor **VW 1594/16** and OXS signal wire (harness side) in engine compartment

If continuity **IS** obtained

- replace MPI control unit

If continuity is **NOT** obtained

- check wiring for open circuit using wiring diagram and repair as necessary



Oxygen sensor, removing/installing

- disconnect Oxygen sensor harness connectors 1 and 2 (next to intake manifold)
- unscrew Oxygen sensor (at base of exhaust manifold)

CAUTION

Oxygen sensor threads **MUST** be coated with an anti-sieze compound before installing. If the sensor has not already been coated in production, carefully apply a coating to the sensors' threads taking extreme care **NOT** to allow anti-sieze compound into the sensor slots.

- when installing Oxygen sensor
 - torque to 50 Nm (37 ft lb)

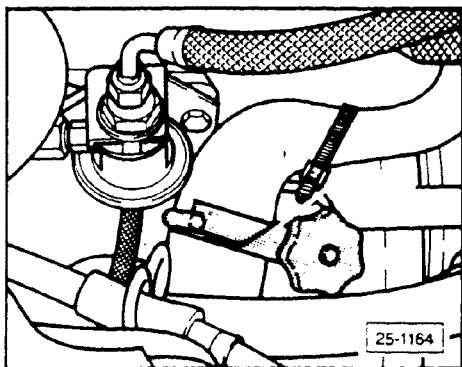
Idle speed and CO content, checking/adjusting

CAUTION

Idle speed and CO content are inter-related and **MUST** be checked and adjusted together.

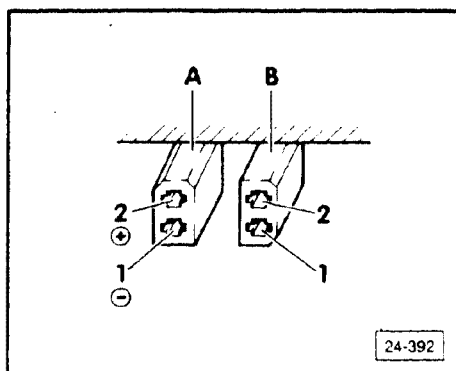
CAUTION

VAG 1367 TDC sensor **MUST** be fully inserted into transmission housing.



Requirements

- perform vehicle self diagnosis, see Repair Group D2 for additional information
- engine warm, oil temperature 80°C (176°F) minimum
- throttle valve against stop
- all electrical consumers switched **OFF**
- pressure gauges **NOT** connected
- radiator fan **NOT** running while taking any readings
- **VAG 1367** connected
- clamp crankcase ventilation hose together (behind fuel pressure regulator)
- remove oil dipstick and cover tube with a lint free rag (to prevent oil spray)
- remove cap from CO tap tube
- connect **Sun EPA 105** CO tester to CO tap tube
- start engine and allow to idle

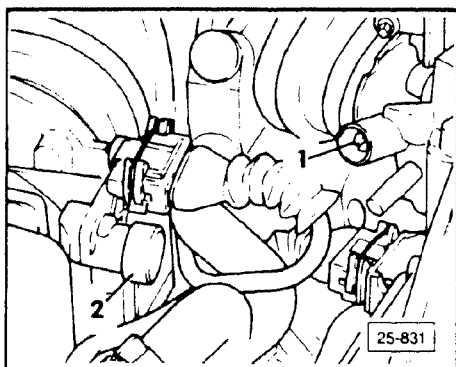


- bridge diagnostic connector **A** terminal 1 and diagnostic connector **B** terminal 1 using jumper from **VAG 1594** adaptor kit

Note

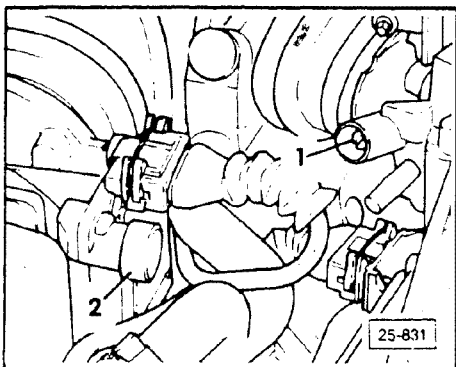
Diagnostic connectors **A** and **B** are located in the recess beneath the shelf in the footwell on the driver's side.

- check idle speed
 - must be 800 ± 50 RPM



If **NO**

- adjust idle speed to specification using adjustment screw 1

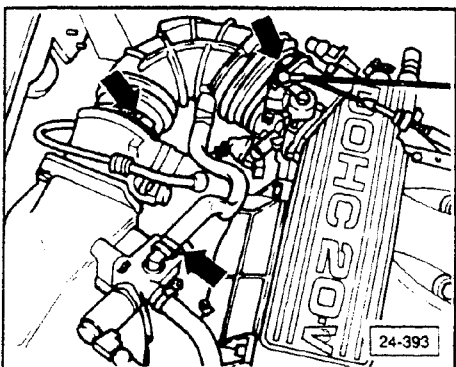


CO content, checking

- with engine at idle observe CO content on **Sun EPA 105** CO tester
 - must be 0.5 to 1.0 volume %

If **NO**

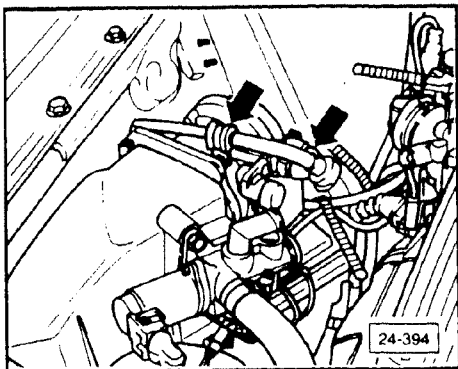
- adjust CO content using CO adjustment screw 2 as follows
- switch **OFF** ignition



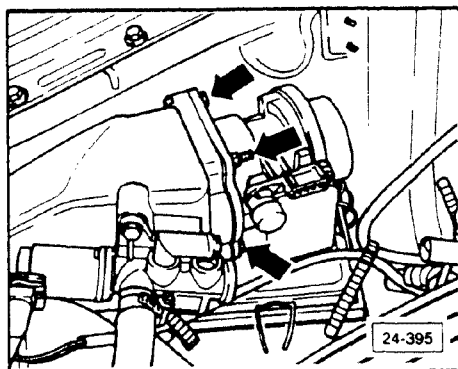
- loosen clamps on intake air boot (upper arrows)
- remove intake air boot

Note

When re-installing, be sure that the intake air boot fully seats onto the flange recesses before tightening the clamps.



- remove cable clamp (**left arrow**) and disconnect harness connector from air mass sensor (**right arrow**)



- remove 4 mounting bolts from air mass sensor (**arrows**)
 - installing torque: 10 Nm (7 ft lb)
- remove plug covering CO adjustment screw as follows
 - **VERY LIGHTLY** center punch plug
 - drill using 2.5 mm (3/32 in) drill bit
 - thread in a 3 mm self tapping screw
 - remove plug by pulling on the screw with pliers
- re-install air mass meter

CO content, adjusting

- start engine and let idle
- observe CO content on **Sun EPA 105 CO** tester
 - must be 0.5 to 1.0 volume %

If **NO**

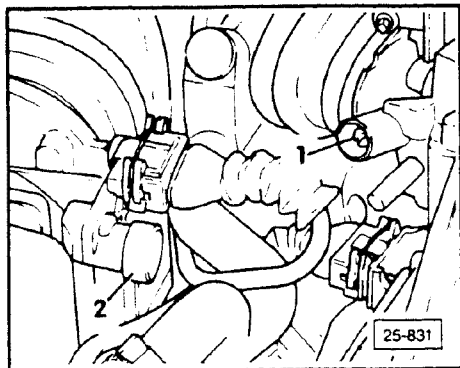
- rotate adjustment screw **2** as necessary to obtain specified value
 - Clockwise rotation: CO content increases
 - Counter-clockwise: CO content decreases
- after adjusting CO content, check idle speed, correct if necessary
- after idle speed and CO content have been adjusted, disconnect jumper from diagnostic connectors
- briefly raise engine speed above 2000 RPM then let idle
 - idle speed and CO content **MUST** meet specifications

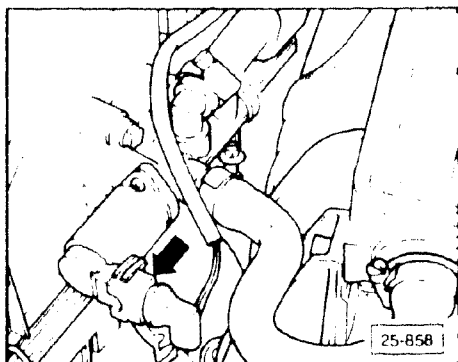
If values deviate from specifications

- perform vehicle self-diagnosis again

If **OK**

- disconnect test equipment
- install new plug over CO adjustment screw



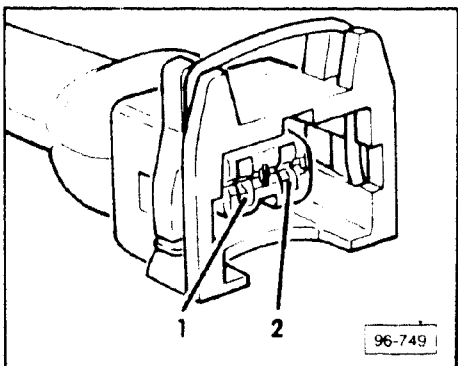


Idle Stabilization system, checking

- perform vehicle self diagnosis and call up idle stabilizer valve, code **4431**, see Repair Group D2 for additional information
 - stabilizer valve must click

If **NO**

- disconnect idle stabilizer valve harness connector (**arrow**)



- connect **US 1115** LED tester between terminals 1 and 2 of idle stabilizer valve harness connector
 - LED tester must flash

If **YES**

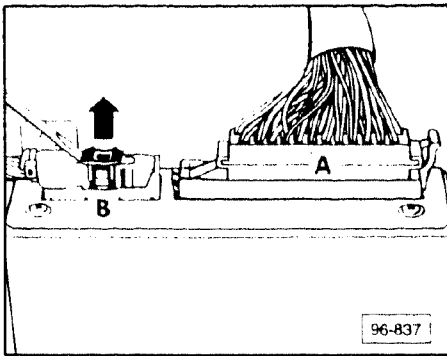
- replace idle stabilizer valve

If **NO**

- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminal 1 and ground
 - must be approximately 12 volts

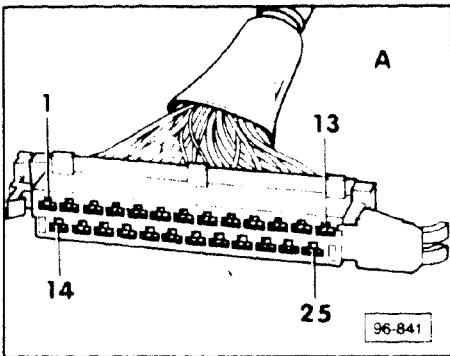
If **NO**

- check fuse **28**, if necessary eliminate open circuit in wiring using wiring diagram



If voltage value **IS** obtained

- switch **OFF** ignition
- remove footwell cover below glove box
- disconnect MPI control unit harness connector **A**
- switch multimeter **US 1119** to resistance range



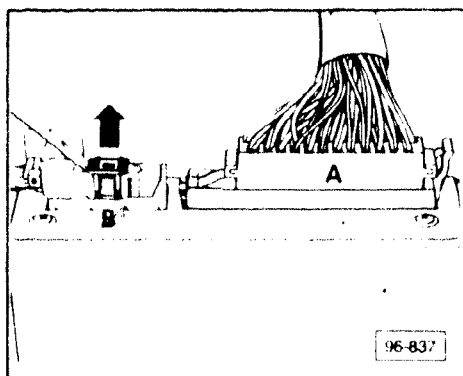
- check for continuity between terminal **19** of connector **A** and terminal **2** of idle stabilizer valve harness connector

If continuity is **NOT** obtained

- eliminate open circuit in wiring using wiring diagram

If continuity **IS** obtained

- replace MPI control unit



MPI control unit, checking

Voltage supply, checking

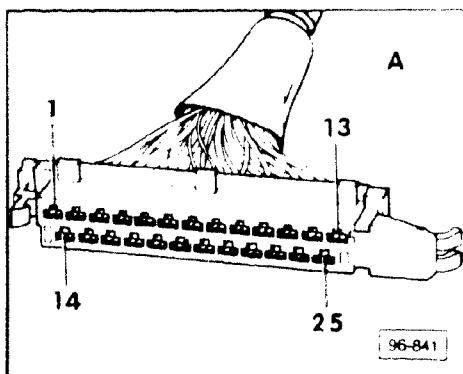
- remove foot-well cover under glove compartment
- remove harness connector **A**
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminals **18** and **21**
- switch **ON** ignition
 - approximately 12 volts

If voltage value is **NOT** obtained

- check wiring using wiring diagram
- connect multimeter between terminals **25** and **1**, then **25** and **2**, then **25** and **13** of harness connector **A**
 - approximately 12 volts

If voltage value is **NOT** obtained

- check wiring using wiring diagram



Coding connector, checking (California vehicles ONLY)

Note

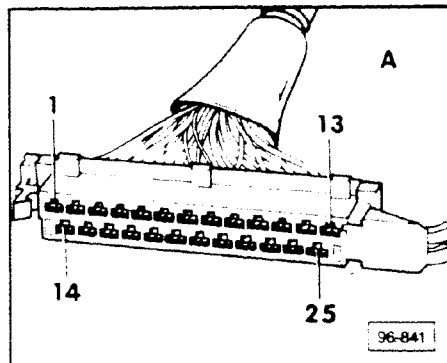
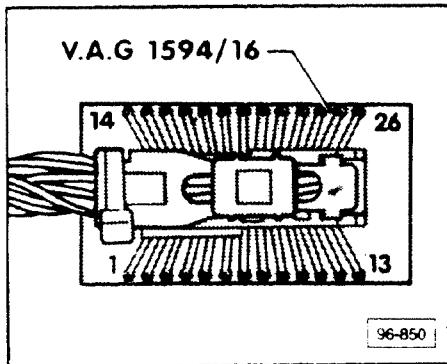
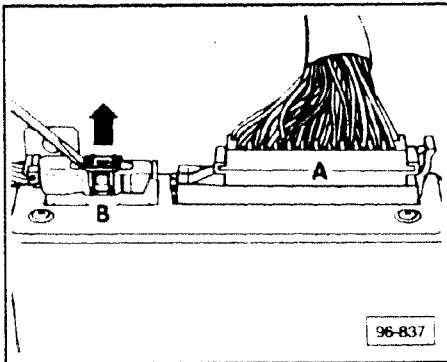
The 6-pin coding connector is located in the passenger side foot-well under A pillar kick panel.

Requirement

- MPI control unit supply voltage **OK**
- remove passenger side kick panel (A-pillar)
- remove coding connector mating piece
- connect multimeter **US 1119** between both terminals of coding connector
- switch **ON** ignition
 - approximately 5 volts

If voltage value is **NOT** obtained

- switch **OFF** ignition
- remove foot-well cover under glove compartment
- remove harness connector **A** from control unit
- open connector **B** secondary lock (black) and remove connector
- connect measuring adapter **VW 1594/16** to connector **B**
- switch multimeter **US 1119** to resistance range
- check continuity between terminal 3 of coding connector and terminal 5 of measuring adapter



- check continuity between terminal 5 of the coding connector and terminal 13 of harness connector **A**

If there are **NO** open circuits and voltage value was **NOT** obtained

- replace MPI control unit
- check continuity between terminals 3 and 5 in wiring bridge in mating piece of coding connector