

Index

index continues on next page



Engine Code NF, CIS-E III

- Acceleration enrichment**
 - checking 25.114
- A/C compressor clutch ON/OFF signal**
 - checking 25.88
- Altitude sensor**
 - checking 25.91
- Air flow sensor plate assembly**
 - control plunger, removing/installing 25.96
 - free, play, checking 25.95
 - free play, adjusting 25.97
 - rest position, checking/adjusting 25.93
 - sensor plate/sensor lever, centering 25.94
 - sensor plate lever/control plunger, checking 25.93
 - sensor plate lever, basic adjustment 25.95
 - stop screw sealing ring, replacing 25.96
- Carbon canister shut-off solenoid**
 - checking 25.84
- CIS-E III system**
 - components 25.78
 - component layout 25.77
 - control unit, locations 25.82
- Cold start valve**
 - operation, checking 25.113
 - power, checking 25.111

★ **NEW INFORMATION** since last filming

- Coolant temperature sensor**
 - checking 25.90
- Deceleration fuel shut-off**
 - checking 25.117
- Differential pressure regulator control**
 - checking 25.123
- Engine settings**
 - checking 25.128
 - CO value, adjusting 25.130
 - ignition timing, checking/adjusting 25.134
- Fuel injectors**
 - ★ ■ checking/cleaning 25.122a
- Fuel pressure checking**
 - differential pressure Part I, checking 25.120
 - differential pressure Part II, checking 25.121
 - injector pressure specifications 25.122
 - pressure tester VW 1318, connecting 25.119
 - residual pressure, checking 25.122
 - system pressure 25.119
- Fuel pump relay control**
 - checking 25.87

cardiagn.com

Index

Engine Code NF, CIS-E III

Idle and full throttle switches

- ★ ■ checking/adjusting
(Automatic transm. 097) 25.109a
- full throttle switch, checking 25.108
- idle switch, checking 25.108a
- voltage supply, checking 25.107

Idle stabilization system

- shift mode signal, checking 25.89
- valve power, checking 25.85

Injection quantity

- ★ ■ comparative measurement 25.125

Oxygen sensor

- control system, checking 25.103
- heating, checking 25.104
- removing/installing 25.105

Potentiometer

- adjusting 25.101
- checking 25.98

Rules of cleanliness

- chart 25.83

Safety guidelines

- chart 25.83

Technical data

- chart 25.118

Throttle potentiometer (w/ 097 Auto. transm.)

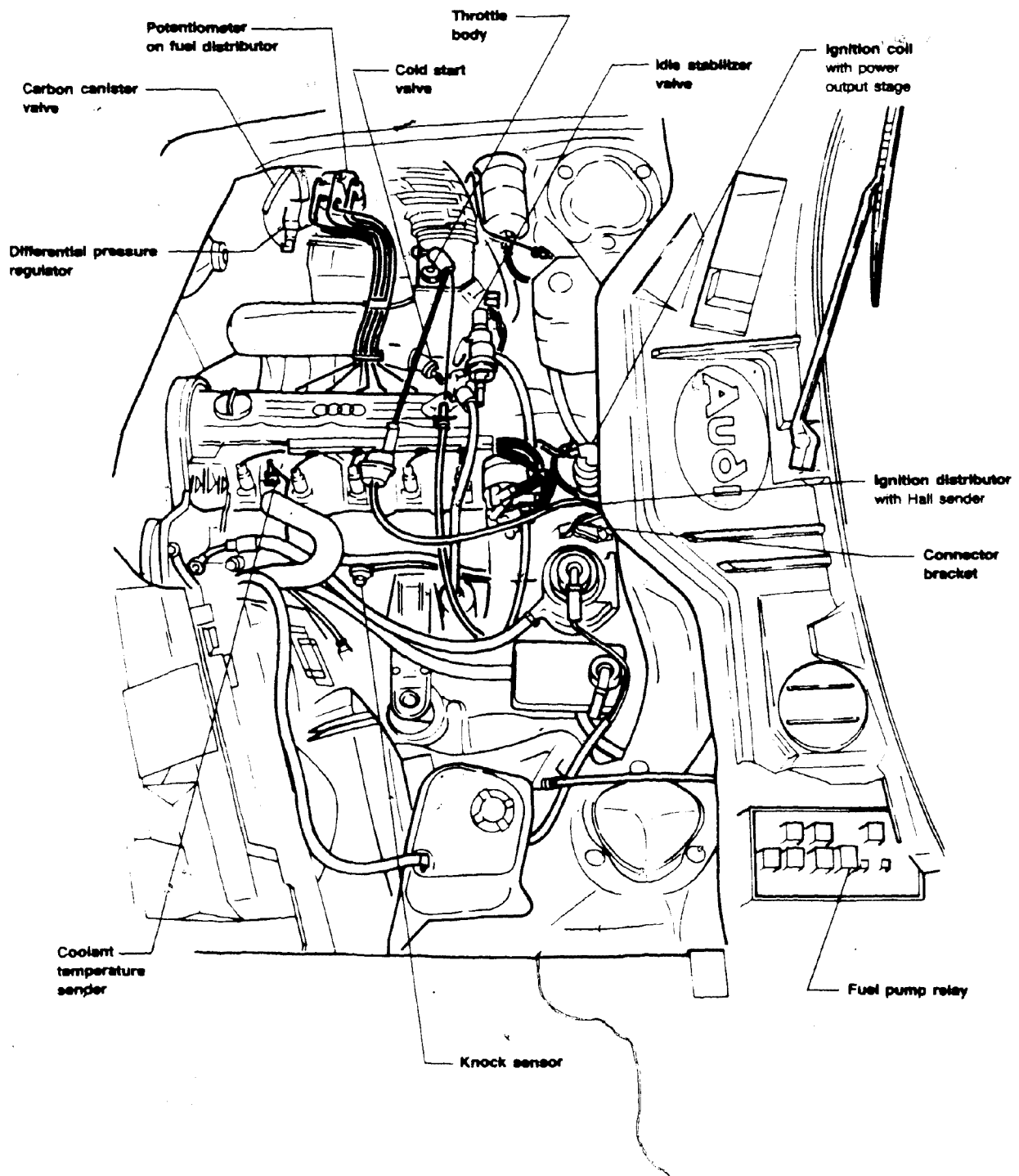
- ★ ■ checking/adjusting 25.102a

Throttle valve

- basic adjustment 25.106
- dashpot, adjusting 25.110

★ **NEW INFORMATION** since last filming

Continuous Injection System

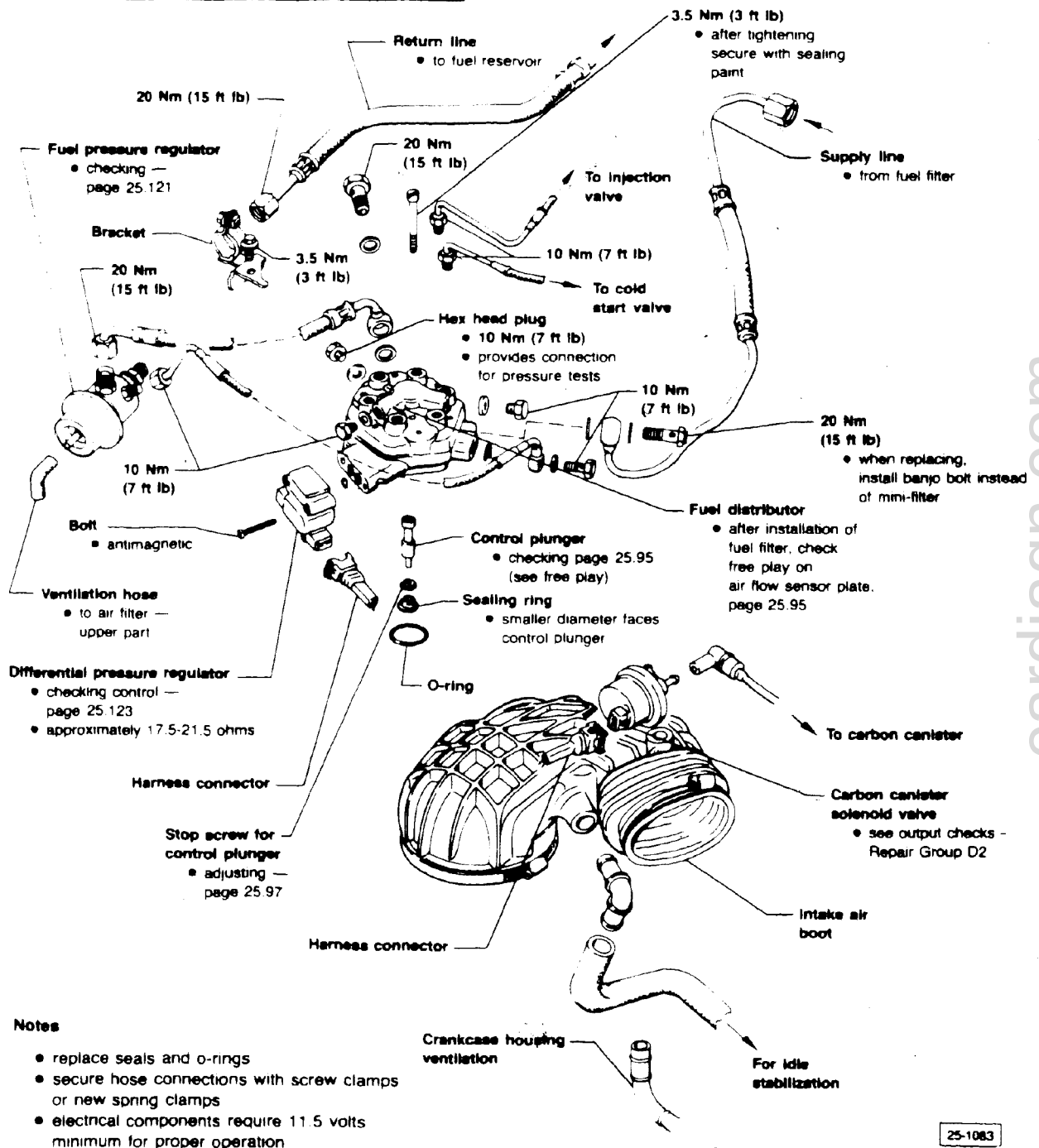


98-906

Continuous Injection System

WARNING

Fire hazard Do not smoke or have anything in area that can ignite fuel

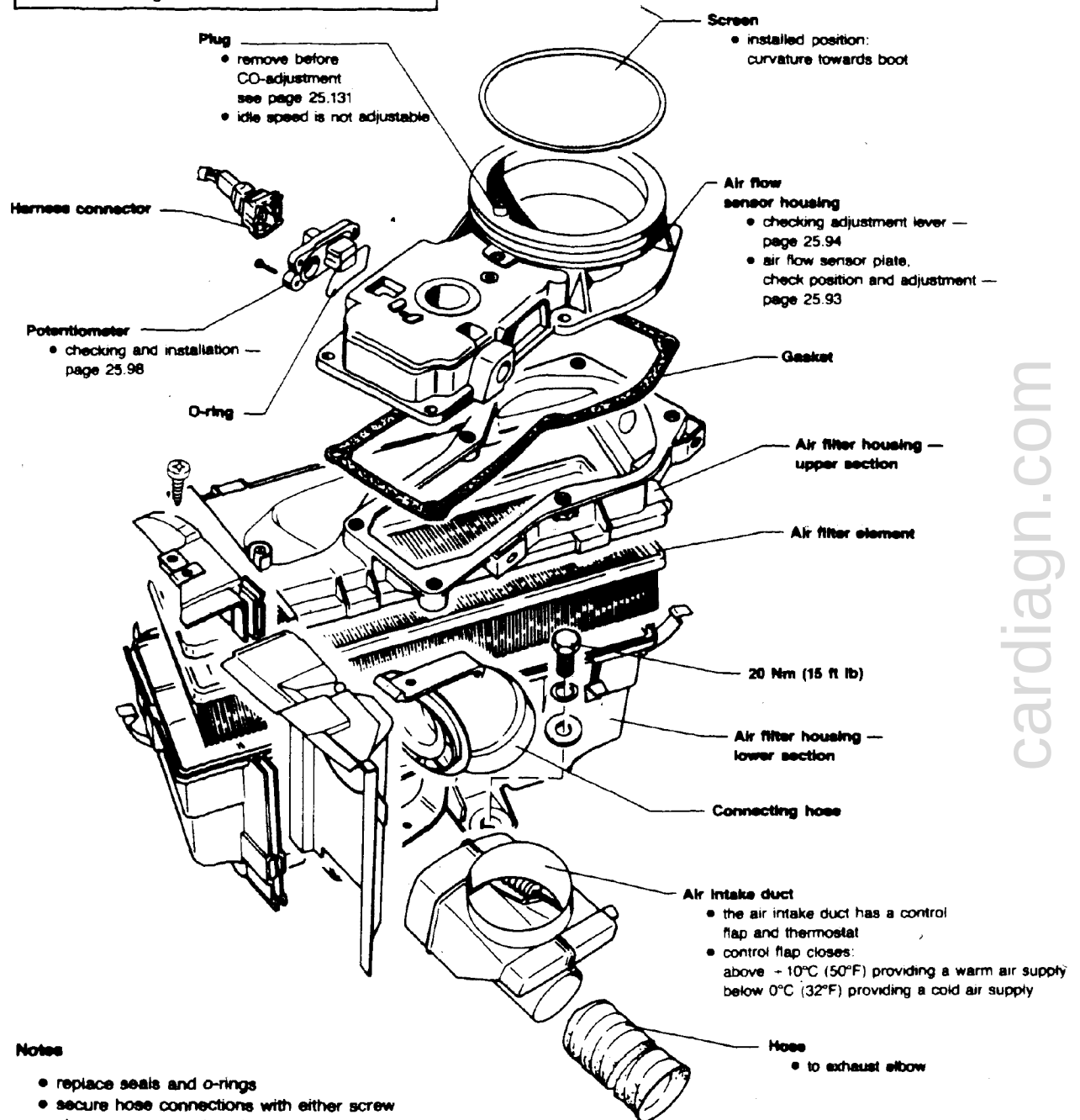


25-1083

Continuous Injection System

WARNING

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

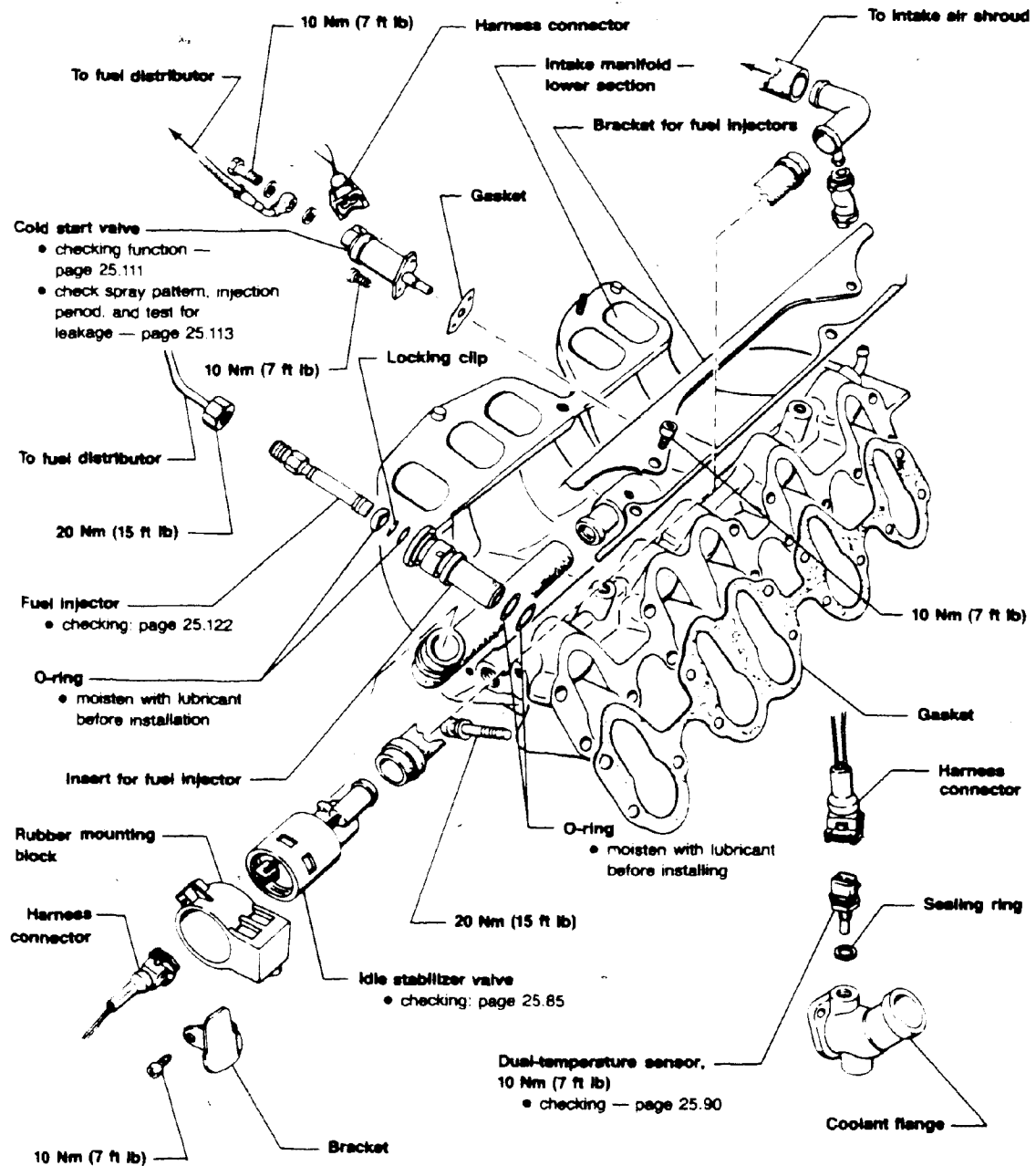


Notes

- replace seals and o-rings
- secure hose connections with either screw clamps or new spring clamps
- electrical components require 11.5 volts minimum for proper operation

25-1038

Continuous Injection System



WARNING

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

Notes

- replace seals and o-rings during reassembly
- secure hose connections with either screw clamps or new spring clamps
- electrical components require 11.5 volts minimum for proper operation

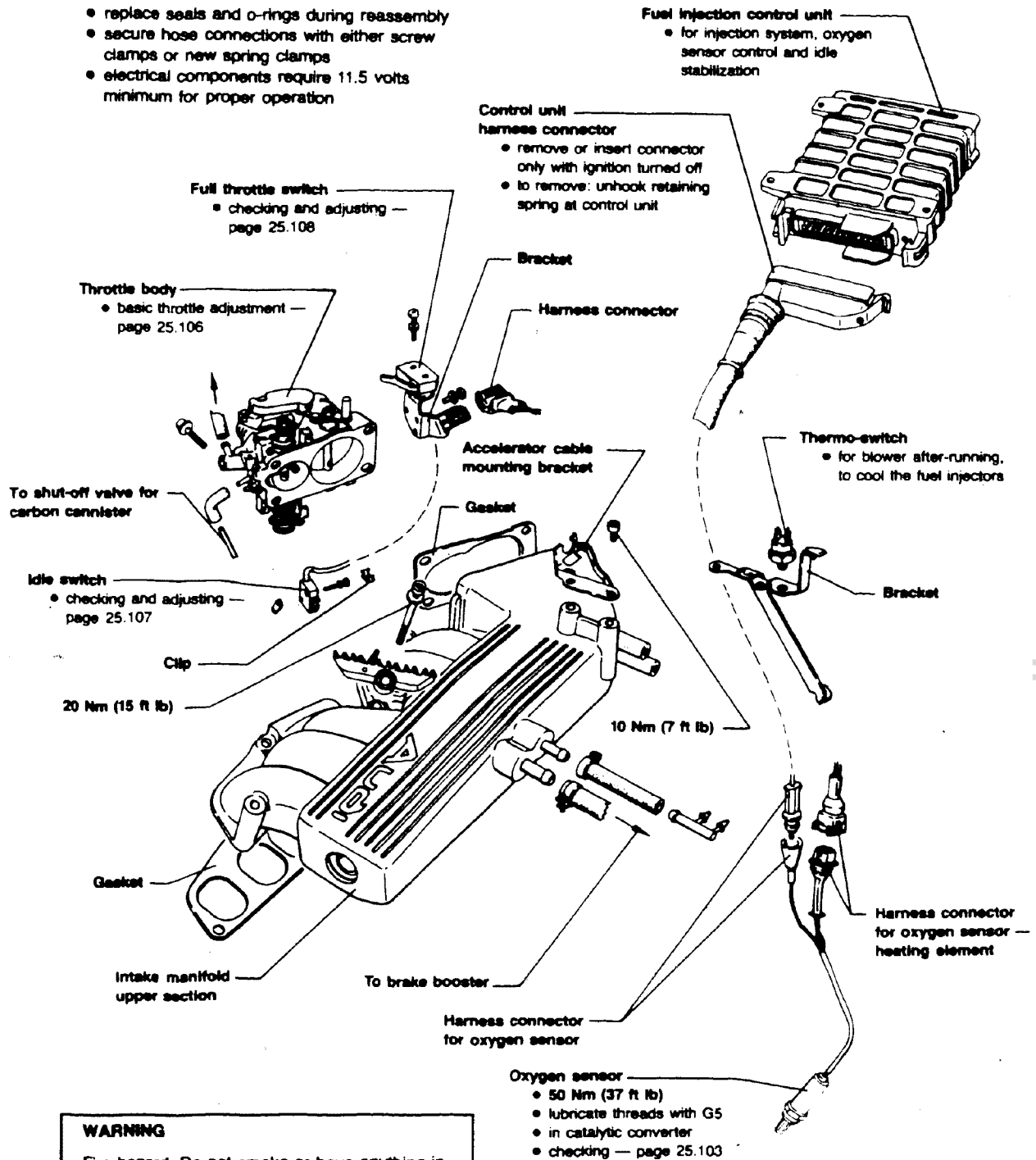
25-1040

B-7

Continuous Injection System

Notes

- replace seals and o-rings during reassembly
- secure hose connections with either screw clamps or new spring clamps
- electrical components require 11.5 volts minimum for proper operation



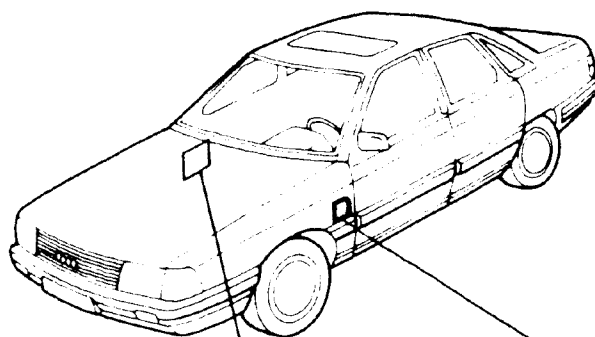
WARNING

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

25-1084

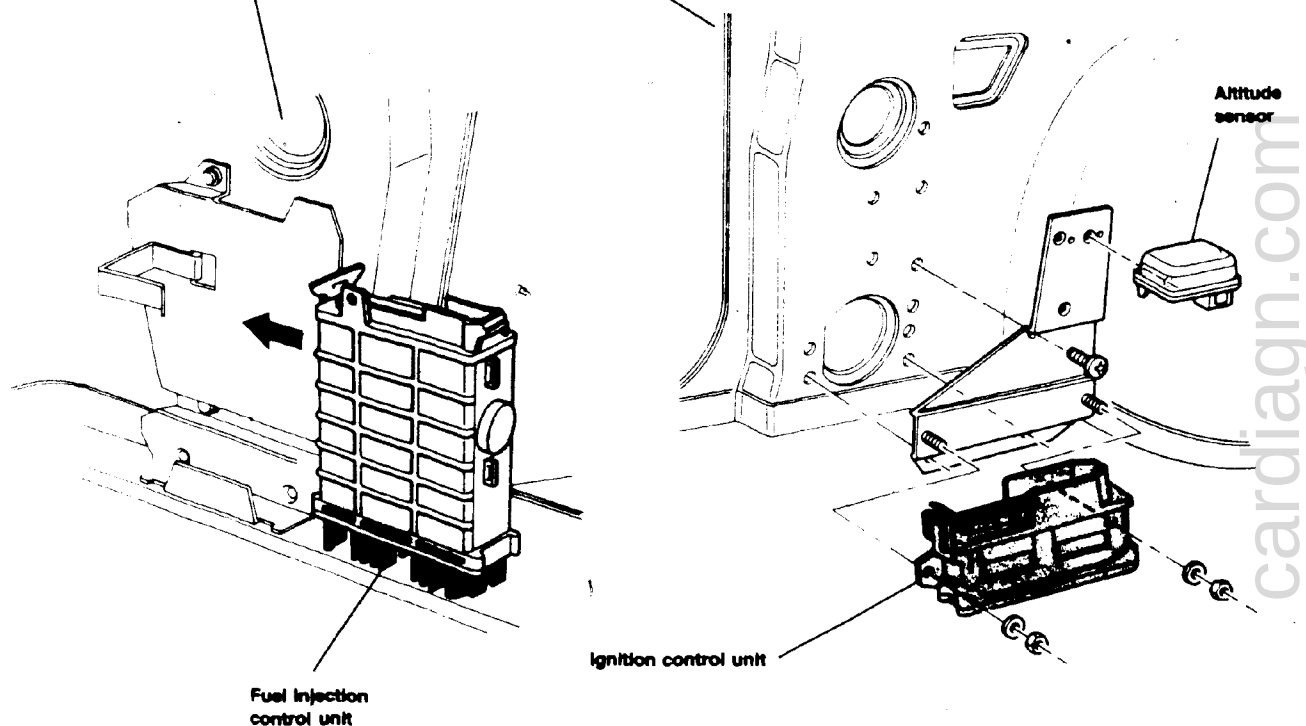
B-6

Continuous Injection System



CAUTION

Please read safety precautions on page 25.83 before working on the electronic ignition system.



Note

The CIS-E III engine control system uses two separate control units, located behind the right and left kick panels. The units are connected together electrically by the vehicle's wire harness.

Each control unit contains its own fault memory. During the self diagnosis display, any information stored in the ignition control unit will be displayed first. When completed, the information from the fuel injection control unit will be displayed.

For additional troubleshooting information see Repair Group D2.

25-A182

Rules of cleanliness

CAUTION

First:

- clean connecting points before loosening

When fuel system is open

- do not use compressed air if you don't need it
- move vehicle only if you must
- if you cannot finish repairs, carefully cover parts with plastic or paper — not with rags

Use clean parts only

- do not unwrap new parts before needed
- only use new parts, not loose or unwrapped parts from tool box
- lay removed parts on clean surface. Cover with plastic or paper — not with rags

Safety guidelines for fully electronic ignition system

CAUTION

Be alert when you work on the engine. High voltage can injure you and damage components.

Turn ignition off:

- when connecting or disconnecting tester leads to ignition system
- when connecting or disconnecting ignition wires
- when washing the engine

Don't forget about the battery:

- do not disconnect battery when engine is running
- for emergency starting use fast charge for 15 seconds only and not more than 16.5 volts
- disconnect battery when using arc, spot, or electrical welding equipment

When testing the system:

- do not apply voltage to control unit to simulate output signals
- when coil wire (terminal 4) is disconnected from distributor, always ground using jumper wire
- with high tension wire disconnected do not crank engine (example: compression test)

When applying heat:

- if components are heated above 80°C (175°F) from paint dryer or steam cleaner, wait for components to cool before starting engine

Carbon canister shut-off solenoid, checking

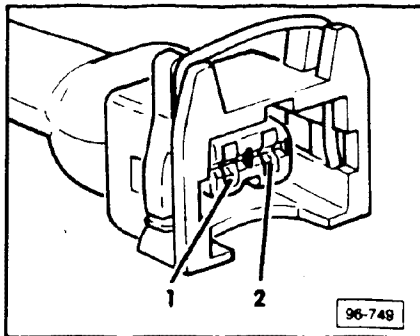
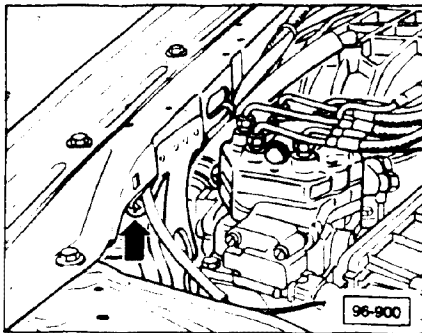
(Fault code 4343)

Check this first:

- ignition switched to **OFF** position
- insert spare fuse in top of fuel pump relay
- turn ignition **ON**, remove fuse after four seconds
- re-insert fuse for four seconds, then remove
- fault indicator light displays **4343** code
- close full throttle switch
- shut-off solenoid clicks **ON** and **OFF** when full throttle switch is closed

If **NO**

- disconnect carbon canister shut-off solenoid harness connector in right wheel house (arrow)



Carbon canister valve, harness connector

- connect LED tester **US 1115** to connector terminals 1 and 2 using jumper wire
- **US 1115** must light up (blink)

If **YES**

- replace carbon canister shut-off solenoid

If **NO**

- connect multimeter **US 1119** between terminal 1 of connector and ground
- approximately 12 volts

If **NO**

- check wiring as follows
- remove fuel injection control unit access cover in right passenger footwell and disconnect control unit harness connector

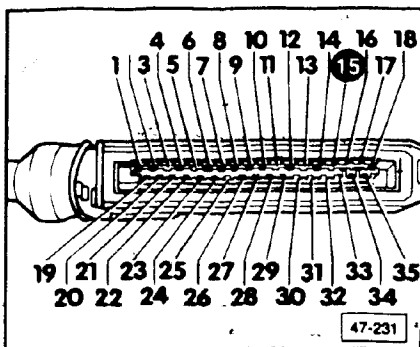
- with multimeter **US 1119**, check resistance between terminal 2 and terminal 15 of fuel injection control unit harness connector (35 pin)
- approximately 0.2 ohms

If **NO**

- repair break in wiring using wiring diagram

If **OK**

- replace fuel injection control unit



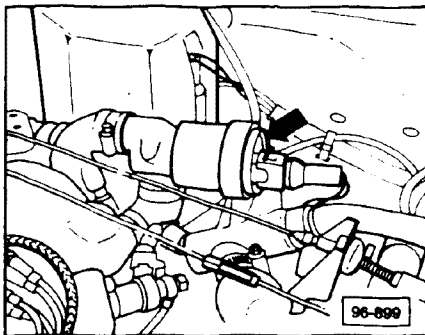
Continuous Injection System

Idle stabilizer valve power, checking

(Fault code 4431)

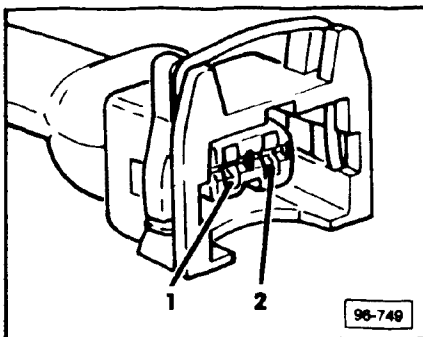
Check this first

- ignition switched to **OFF** position
- insert spare fuse in top of fuel pump relay
- turn ignition **ON**, remove fuse after four seconds
- re-insert fuse for four seconds, then remove
- re-insert fuse for four seconds, then remove
 - fault indicator light displays **4431** code
- close full throttle switch
 - idle stabilizer valve must cycle (click)



If **NO**

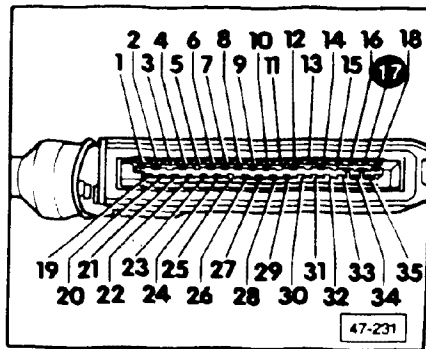
- disconnect harness connector from idle stabilizer valve (**arrow**)



Idle stabilizer valve, harness connector

- connect LED tester **US 1115** to terminals **1** and **2** of harness connector using jumper cable
- after starting the output checks, call up idle stabilizer valve power (code number **4431**) according to the appropriate sequence, see output checks, Repair Group D2
 - **US 1115** LED tester must light up

Continuous Injection System



If **YES**

- replace idle stabilizer valve

If **NO**

- connect multimeter **US 1119** between terminal 2 and engine ground
 - approximately 12 volts

If **NO**

- repair break in wiring using wiring diagram

If **YES**

- switch ignition **OFF**
- remove fuel injection control unit access cover in right passenger footwell and disconnect control unit harness connector

35 pin fuel injection control unit harness connector

- with multimeter **US 1119** check continuity between fuel injection control unit harness connector terminal 17 and idle stabilizer valve harness connector, terminal 1
 - approximately 0.2 ohm

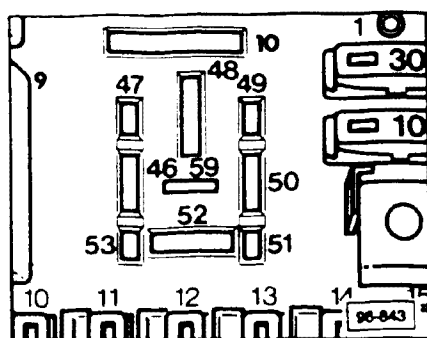
If **NO**

- repair break in wiring using wiring diagram

If **YES**

- replace fuel injection control unit

Continuous Injection System



Fuel pump relay control, checking

- pull fuel pump relay out of relay panel, location 10
- connect multimeter US 1119 between terminals 48 and 50 of relay socket
 - approximately 12 volts
- connect multimeter US 1119 between terminals 46 and 50 of relay socket
- switch ignition **ON**
 - approximately 12 volts

If NO

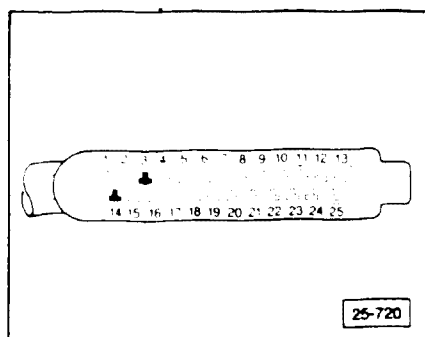
- correct break in wiring according to wiring diagram
- connect multimeter US 1119 between terminals 46 and 47 of relay socket
- operate starter briefly
 - minimum 7 volts

If YES

- replace fuel pump relay

If NO, check wiring as follows:

- remove ignition control until access cover in left footwell, and pull harness connector from control unit
- measure resistance between 25 pin ignition control unit harness connector and relay socket 10 using multimeter US 1119



25 PIN connector	relay socket 10
terminal 3	terminal 49
terminal 14	terminal 47

terminal 3 ↔ terminal 49
terminal 14 ↔ terminal 47

- approximately 0.2 ohms

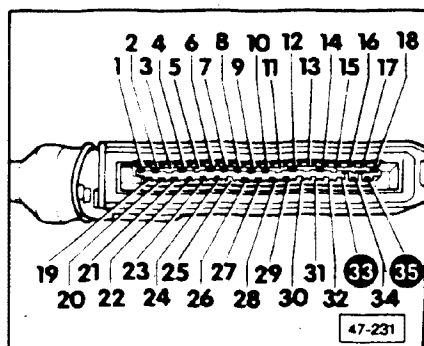
If NO

- repair break in wiring using wiring diagram

If YES

- replace Ignition control unit

Continuous Injection System



Air conditioning compressor clutch, on/off signal, checking

- disconnect 35 pin harness connector from fuel injection control unit
- connect multimeter **US 1119** between terminals **33** and **35** (ground) of harness connector
- with A/C in **OFF** position, switch ignition **ON**
 - 0 volts

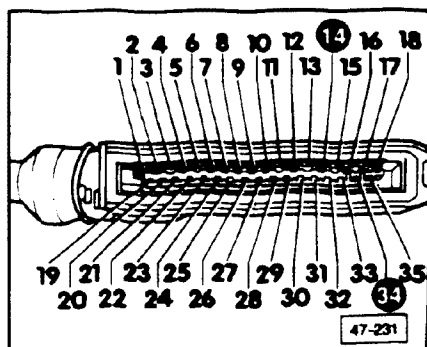
If **NO**

- repair break in wiring using wiring diagram
- with A/C in **AUTO** or **BI-LEVEL** position switch ignition **ON**
 - A/C compressor clutch must become energized
 - approximately 12 volts

If **NO**

- repair break in wiring using wiring diagram

Continuous Injection System



Idle stabilization system, shift mode signal, checking

Vehicles with automatic transmission only

- disconnect 35 pin harness connector from fuel injection control unit
- connect LED tester US 1115 between terminals 14 and 34 of harness connector
- switch ignition ON
- engage selector lever first in Neutral and then in Park
 - LED tester US 1115 must light up
- select any driving gear
 - LED tester US 1115 must not light

If NO

- repair break in wiring according to wiring diagram

Continuous Injection System

Coolant temperature sender, checking

(Fault code 2312)

Check this first:

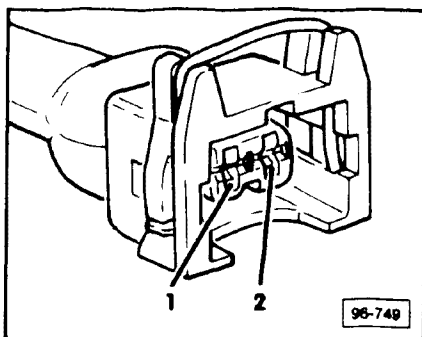
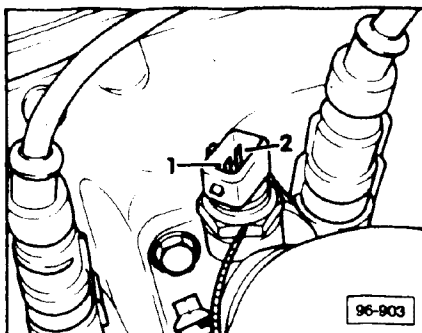
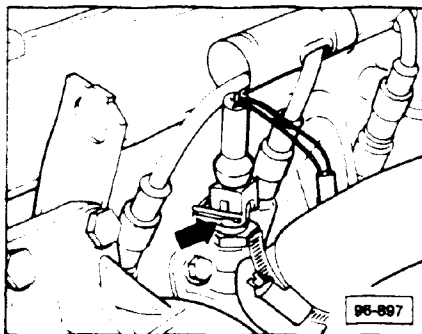
- coolant temperature over 80°C (176°F)

Note

Two temperature senders are installed in the one coolant temperature sender housing. They work independently of each other, one for fuel injection and the other for electronic ignition.

If a defect is found in either temperature sender, the entire coolant temperature sender must be replaced.

The temperature sensor is an NTC (Negative Temperature Coefficient) type, meaning, resistance decreases as engine temperature increases.



- remove harness connector from coolant temperature sender (arrow)

- connect multimeter US 1119 between temperature sender terminal 1 and engine ground, then between terminal 2 and engine ground
 - 200 ohm-2.5 k ohm

- connect multimeter US 1119 between terminals 1 and 2 of the disconnected harness connector, one after the other, with engine ground
- switch ignition ON
 - 4.5-5.5 volts

If NO

- repair break in wiring between control units and harness connectors, using wiring diagram

If specification is **NOT** obtained and no break in wiring is found

- replace respective control unit

Continuous Injection System

Altitude sensor, checking

(Fault code 2223)

Note

The altitude sensor sends a voltage signal based on altitude. A barometric element inside the sensor reacts to changes in air pressure and moves an electrical contact across a resistance track.

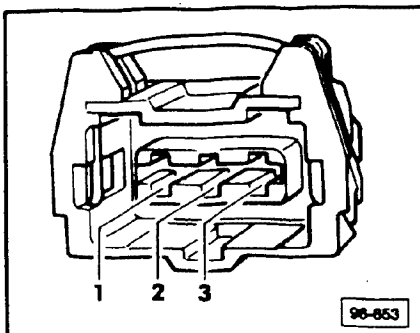
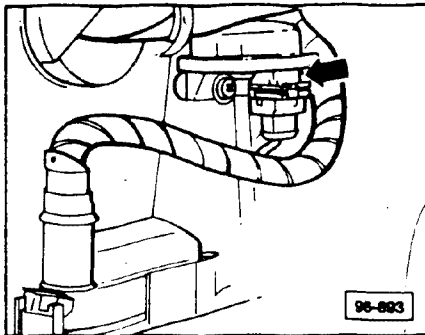
This signal is used by the fuel injection control unit to correct the fuel mixture in relation to altitude or air pressure changes. The ignition control unit also uses this signal to correct the ignition timing during certain engine load ranges at higher altitudes.

- remove kick panel from left driver side footwell
- remove knock sensor ignition control unit and disconnect 25 pin harness connector
- remove harness connector from altitude sensor (arrow)

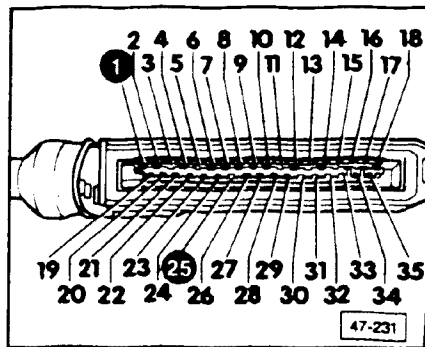
Note

The altitude sensor is attached to the mounting bracket for the ignition control unit behind the left kick panel.

- connect multimeter US 1119 between terminal 1 and engine ground
- switch ignition **ON**
 - approximately 5 volts



Continuous Injection System



If **NO**

- repair break in wiring between fuel injection control unit terminals 1 and 25 using wiring diagram or replace fuel injection control unit
- connect multimeter **US 1119** between terminals 1 and 3 and then between terminals 2 and 3
- switch ignition **ON**
 - 4.5-5 volts

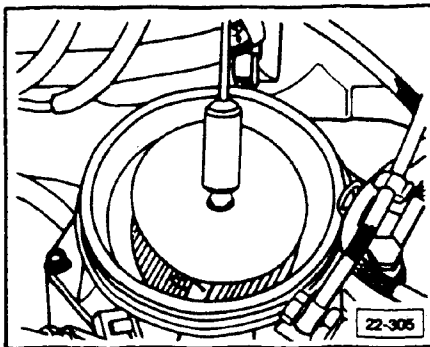
If **NO**

- repair break in wiring according to wiring diagram or replace fuel injection control unit
- check wiring between knock sensor ignition control unit and altitude sensor according to wiring diagram

If all specifications **ARE** obtained

- replace altitude sensor

Continuous Injection System



Air flow sensor plate assembly, checking/adjusting

Sensor plate lever/control plunger, checking

- actuate starter for 10 seconds (with coil wire disconnected and grounded) or activate remote control **US 4480/3** for 10 seconds
- using pliers or a magnet, lift sensor plate through entire range of lever and control plunger travel
 - an even resistance must be felt
- move sensor plate quickly from raised position to rest position
 - **NO** resistance should be felt

If resistance felt

- replace air flow sensor

If sensor plate lever is hard to move upward, but moves freely downward

- control plunger sticking
- fuel distributor must be replaced

Air flow sensor plate rest position

Checking

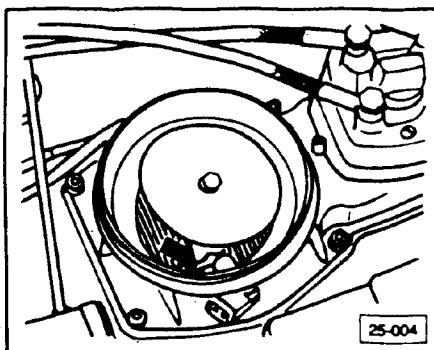
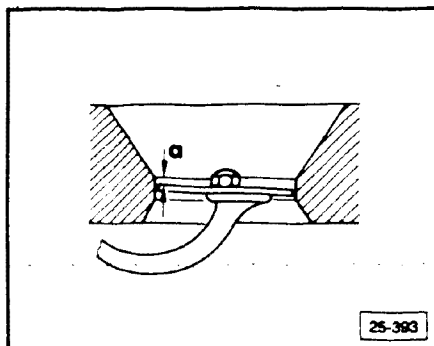
- upper edge of air flow sensor plate must be below lower edge of air cone
 - $a = 1.9$ to 3.0 mm (0.075 to 0.118 in.)

Adjusting

- raise air flow sensor plate
- adjust position of sensor plate by bending wire clip (**arrow**)

Note

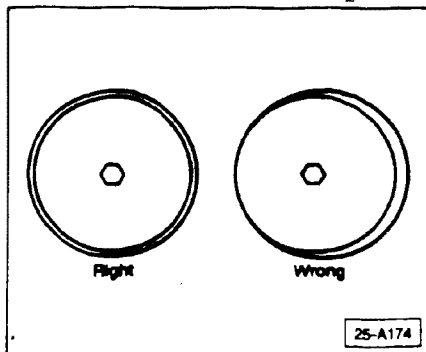
You should try to achieve the smaller setting if at all possible.



CAUTION

Do not scratch venturi of air flow sensor. Do not bend leaf spring.

Continuous Injection System



Sensor plate/sensor lever, centering

Note

Sensor plate must be centered in air cone. Plate edges must not touch sides of air cone or free movement of plate will be restricted.

Sensor plate

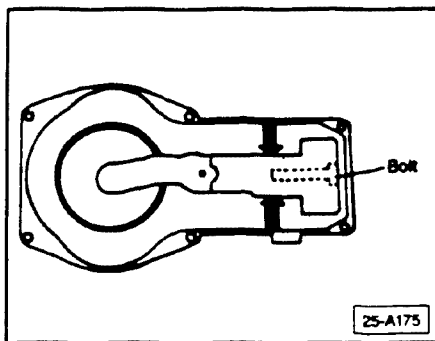
- remove 10 mm adjusting bolt from center of plate
- coat bolt with locking compound
- install bolt finger-tight
- center plate using **US 1109** or by using two 0.1 mm (0.004 in) feeler gauges criss-crossed
- torque adjusting bolt
 - 5-7 Nm (40-60 in lb)

If plate cannot be centered

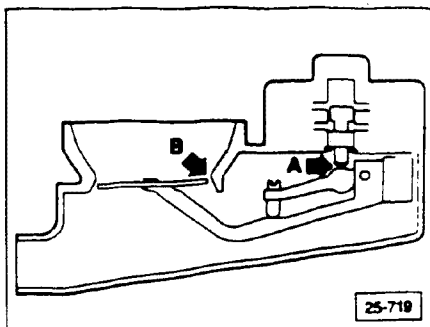
- remove air sensor housing and center sensor lever

Sensor lever

- remove clamping bolt on sensor lever counterweight
- clean bolt of any locking compound or dirt
- coat bolt with locking compound
- install bolt finger-tight
- center lever (**arrows**)
- tighten clamping bolt



Continuous Injection System



Free play, checking

Note

Free play is noted between control plunger and sensor plate lever (arrow A). It is measured on side of air flow sensor facing fuel distributor (arrow B).

Test conditions

- 4-16 mA differential pressure regulator current
- conforms to basic adjustment of sensor plate lever
- actuate starter for 10 seconds (with coil wire disconnected and grounded) or remote control **US 4480/3** for 10 seconds to energize fuel pump
- slightly lift air flow sensor until resistance is felt
 - minimum clearance: 1.0 mm (0.039 in.)
 - maximum clearance: up to venturi cone 3.0 mm (0.118 in.)

If clearance **NOT OK**

- perform sensor plate free play, adjusting with control plunger stop screw, page 25.97

Sensor plate lever, basic adjustment

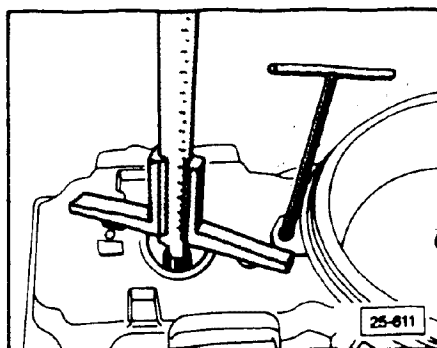
Note

Always perform basic adjustment of lever when replacing fuel distributor or air flow sensor.

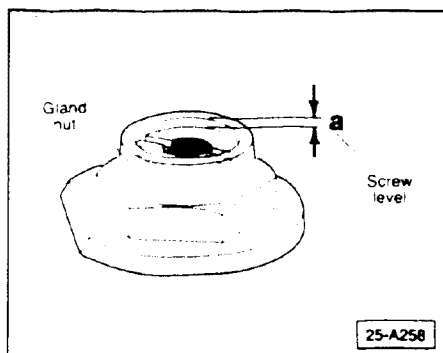
- check distance between contact surfaces for fuel distributor on air flow sensor and roller for sensor plate lever. If necessary, adjust via mixture adjustment screw
 - 18.5 ± 0.1 mm (0.73 ± 0.004 in.)*

Note

*This value loses its validity after adjusting CO content to specification.



Continuous Injection System



CAUTION

Mechanical cleaning of the control plunger is not permitted. If, after cleaning with solvent, the control plunger is scored or sticking, the entire fuel distributor should be replaced.

Control plunger, removing/Installing

- note measurement "a" before removing stop screw
- remove stop screw and detach control plunger
- clean control plunger with gasoline before reinstalling
- check sealing ring of stop screw for damage; if necessary replace (smaller diameter of sealing ring points to control plunger)
- turn stop screw back in to measurement "a"
- check and adjust rest position and clearance of sensor plate

Stop screw sealing ring, replacing

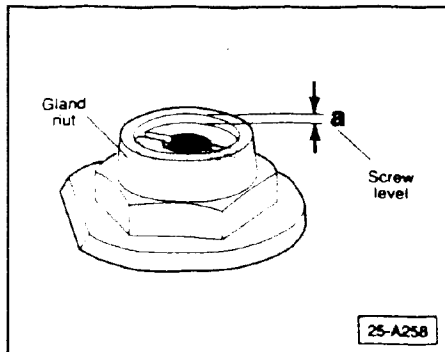
- measure and note dimension "a" prior to removing the stop screw
- remove stop screw with sealing ring

Note

When replacing the stop screw sealing ring, do not pull out or allow the control plunger to fall out. If the control plunger is removed, clean with solvent before reinstalling.

- check sealing ring for damage, if necessary, replace (smaller diameter facing control plunger)
- install stop screw according to previously noted dimension "a"
- check rest position and idle travel of air flow sensor plate

Continuous Injection System



CAUTION

Mechanical cleaning of the control plunger is not permitted. If, after cleaning with gasoline, the control plunger is scored or sticking, the entire fuel distributor should be replaced.

Sensor plate free play adjusting with control plunger stop screw

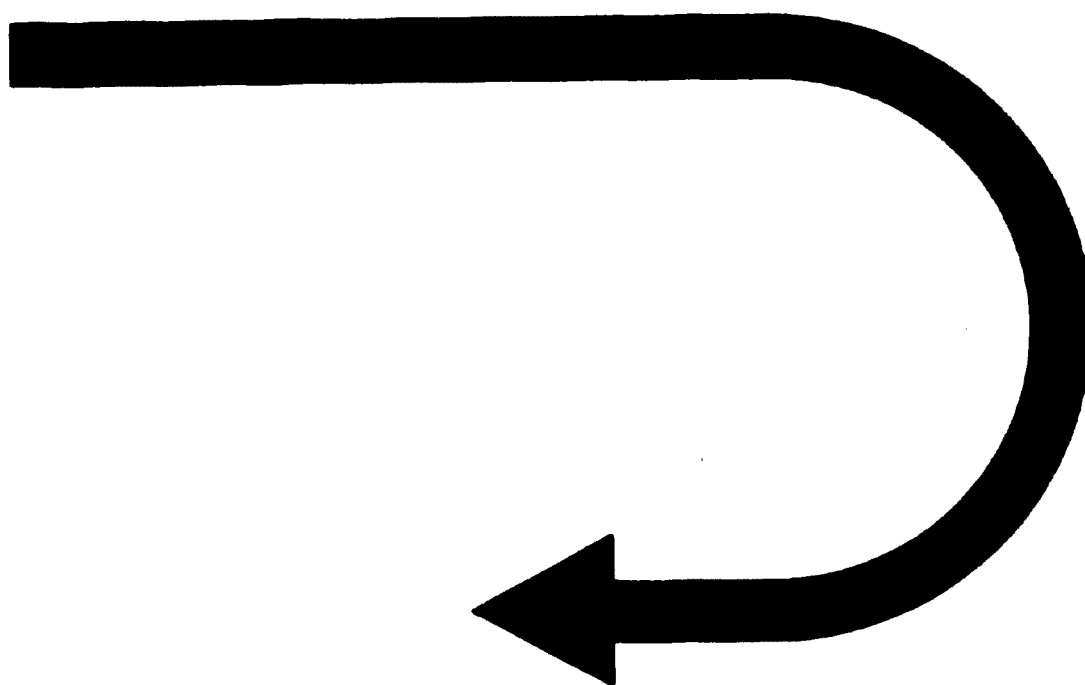
- adjust free play of air flow sensor plate at control plunger stop screw as follows

Varying measurement "a":

(distance "a" = approximately 0.6 mm (0.024 in.) between stop screw and collar of hex nut)

- turn stop screw clockwise — clearance larger
 - turn stop screw counterclockwise — clearance smaller
 - 1/4 turn of stop screw — approximately 1.3 mm/0.05 in. difference on sensor plate
- after adjusting free play, check idle speed, adjust if necessary
 - if idle speed is adjusted, recheck free play, re-adjust free play if necessary

CONTINUED IN THE
BEGINNING OF NEXT ROW



Continuous Injection System

Potentiometer, checking

CAUTION

The potentiometer is to be checked **ONLY** while mounted on the mixture control unit.

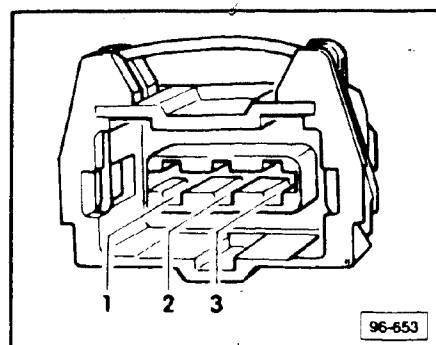
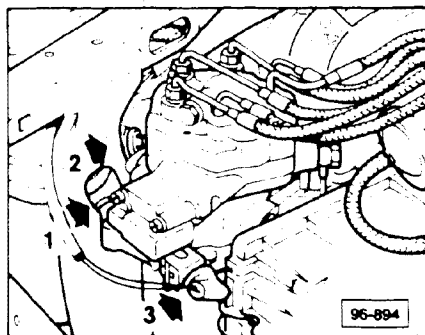
The potentiometer is to be replaced **WITH** the air flow sensor as an assembly **ONLY**.

Check the potentiometer if **ANY** of the following conditions are observed

- fault code **2 2 3 2** is displayed
- idle speed increases
- engine speed fluctuates at idle

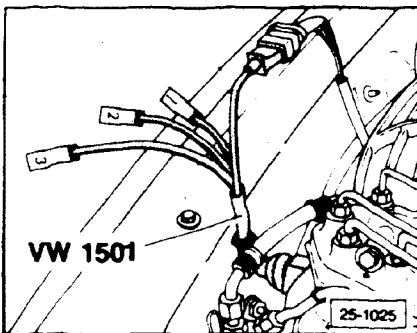
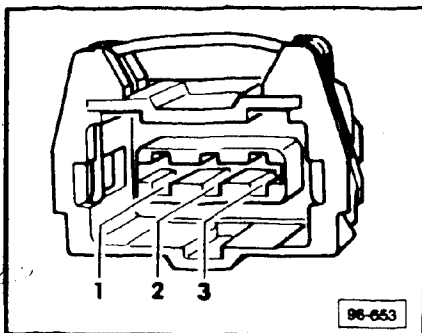
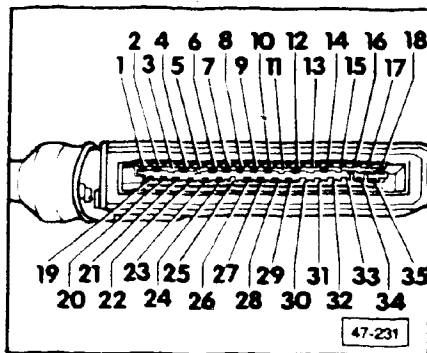
Check these first

- engine oil temperature 80°C (176°F) minimum
- fault code display has been activated (see Repair Group D2)
- valve cover gasket is tight and oil dip stick is inserted completely
- all electrical consumers switched **OFF**
- A/C switched **OFF**
- use multimeter **US 1119** and connector test kit **VW 1594** to perform all measurements
- radiator fan must **NOT** be running during measurements
- ignition timing point and CO content **OK**
- **NO** intake air leaks



- remove air duct to oil cooler
- remove bolt securing lower air filter housing to lower bracket (from below)
- disengage upper air filter housing (1) (from above) by lifting assembly out of slot
- push mixture control assembly (with air filter) toward engine and disconnect harness connector 2 from potentiometer
- switch multimeter to 200 Ohm range and connect between terminal 3 of harness connector and ground
 - 0 - 0.8 Ohm

Continuous Injection System



If NO

- repair break in wiring between connector and control unit using wiring diagram
- switch multimeter to 20 volts DC range and connect between terminals 1 and 3 of harness connector
- switch ignition **ON**
- measure potentiometer supply voltage (called U1), record measurement
 - 4.35-5.35 volts

If NO

- check wiring between potentiometer harness connector and fuel injection control unit harness connector as follows
- switch ignition **OFF**
- remove fuel injection control unit access cover in right passenger side footwell
- remove harness connector from fuel injection control unit

- check resistance between potentiometer harness connector and control unit harness connector

Potentiometer connector	Control unit connector
1	26
2	23

- 0 - 0.8 Ohm

If NO

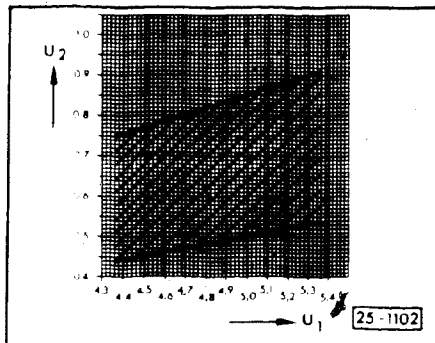
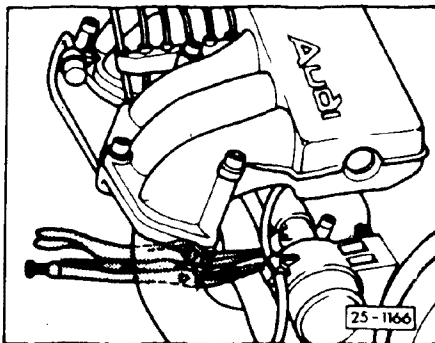
- check for break in wiring using wiring diagram
- connect test adapter **VW 1501** between potentiometer and potentiometer harness connector
- switch multimeter **US 1119** to 2 volts DC range and connect to terminals 2 and 3 of test adapter **VW 1501**
- switch ignition **ON** (with air flow sensor plate in rest position)
 - 0 - 200 mV
- switch ignition **OFF**

Continuous Injection System

- connect engine tester **VW 1367**

CAUTION

Make sure that the **VW 1367** Top Dead Center pickup is fully inserted into the transmission housing.



- insert spare fuse into top of fuel pump relay (do **NOT** remove until test is complete)
 - start engine and run at idle
 - remove harness connector from idle stabilizer valve
 - engine speed **MUST** increase
 - partially clamp one of the two hoses with pliers (as shown) until an engine speed of 800 ± 20 RPM along with an ignition angle of $13-17^\circ$ before Top Dead Center is displayed on **VW 1367**
 - read output voltage **U2** of potentiometer and record, then compare to **U1** voltage on diagram (which was recorded earlier)
- U1** = supply voltage of potentiometer between terminals 1 and 3
- U2** = output voltage of potentiometer between terminals 2 and 3 (measured with engine at idle, 800 ± 20 RPM)

Example: **U1** = 4.82 volts
U2 = 0.72 volts

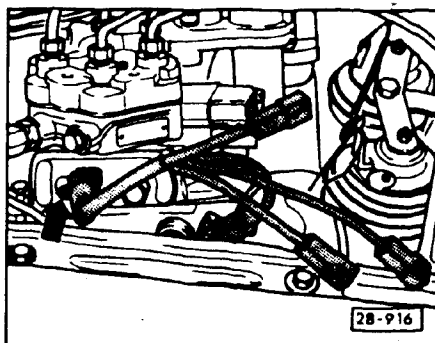
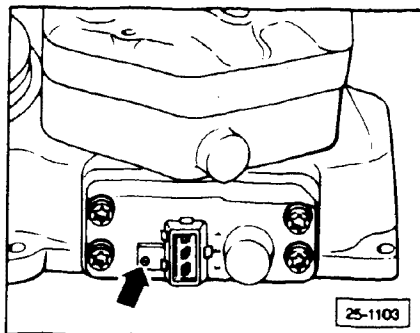
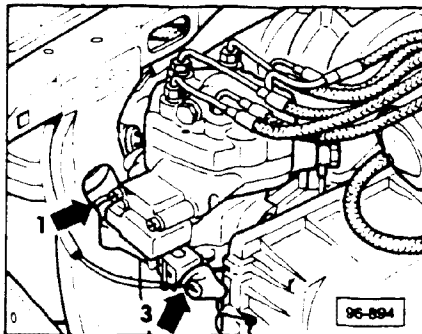
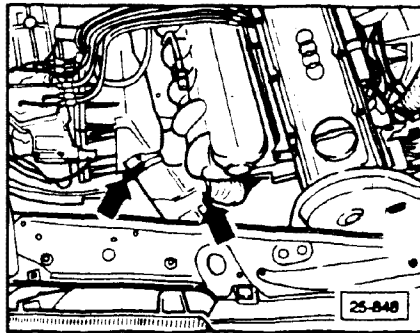
Results fall within the window outlined on the graph

If the **U2** voltage measures slightly below the lower tolerance range on the graph

- check intake air boot, crankcase ventilation hoses, carbon canister hoses, and vacuum lines for leaks
- after eliminating leaks, repeat test

If **NO** leaks are found

- adjust potentiometer (see page 25.101)

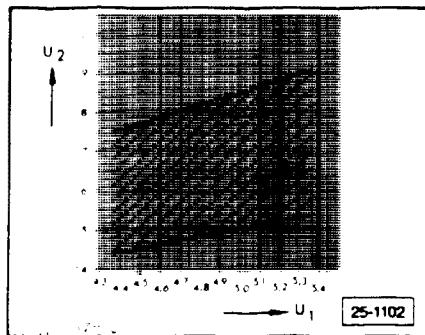
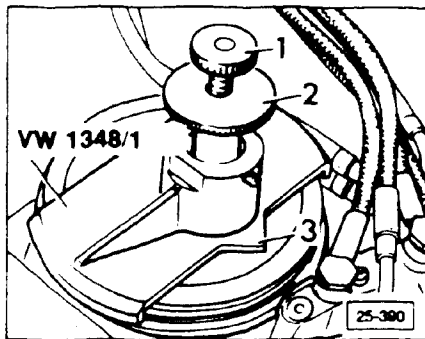


Potentiometer, adjusting

Check these first:

- checking procedure page 25.98 **MUST** be performed first
- ignition switched **OFF**
- remove fuse 13
- remove intake hose for warm air on the preheater control unit (**arrows**)
- remove preheater control unit with intake hose for cold air
- remove intake air boot
- remove fuel line from fuel filter to fuel distributor at fuel filter
- remove air duct to oil cooler
- remove bolt securing lower air filter housing to lower bracket from below
- remove harness connector 3 from differential pressure regulator
- disengage upper air filter housing fastener 1 from above by lifting assembly out of slot (1)
- push mixture control assembly toward engine and raise to allow access to the potentiometer trim screw
- carefully remove sealing compound from potentiometer trim screw (**arrow**)
- connect test adapter **VW 1501** between potentiometer and potentiometer harness connector (**arrow**)
- switch multimeter to 2 volts DC range and connect between terminals 2 and 3 of test adapter
- switch ignition **ON**

Continuous Injection System



- install tool **VW 1348/1** on top of airflow sensor

Note

Before installing tool, pull slide 2 out to upper stop. Then place tool centrally on edge of the air flow sensor with edge 3 pointing in the direction of the fuel distributor.

- push slide 2 down to stop
- rotate screw 1 until base of magnet contacts the sensor plate mounting screw (with sensor plate in rest position)
- turn **VW 1348/1** adjuster screw 1 until voltage displayed on multimeter is same as voltage **U2** (which was obtained during checking procedure on page 25.100)
- connect multimeter to terminals 1 and 3 of test adapter

- adjust potentiometer trim screw until voltage displayed on multimeter falls within tolerance shown on graph

If an acceptable value **CANNOT** be obtained by adjusting the potentiometer trim screw

- remove fuel distributor from air flow sensor assembly
- replace air flow sensor assembly including potentiometer

Note

NO potentiometer adjustment is necessary if the air flow sensor assembly is replaced.

If acceptable values **ARE** obtained according to graph

- re-install mixture control assembly and re-check the potentiometer as shown on page 25.100

If OK

- apply sealing paint to potentiometer trim screw

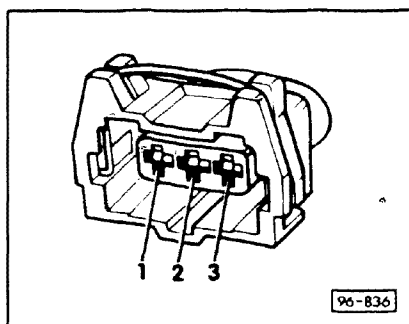
For vehicles with **California** control unit **ONLY**

- erase fault memory (see Repair Group D2)

Throttle valve potentiometer (G 69), checking/adjusting

For vehicles with "097 Automatic
transmission"

- located on underside of throttle body
- the idle (F 60) and full throttle switches (F 81) are part of the throttle valve potentiometer (G 69) assembly
- the throttle valve potentiometer (G 69) becomes adjusted when the idle switch is adjusted
- the full throttle switch (F 81) becomes adjusted when the idle switch is adjusted
- only perform the following procedure if the corresponding fault is indicated during 097 Automatic transmission Self-diagnosis
- always return the automatic transmission control unit (J 217) to its basic setting after completing fuel system repairs or adjustments, see Repair Group D3 for additional information



Voltage supply, checking

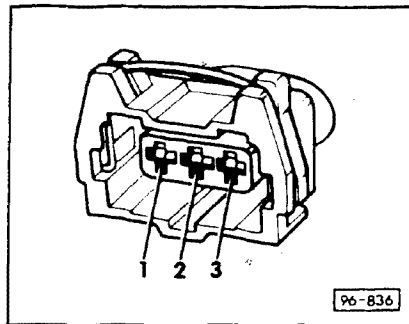
- switch off ignition
- disconnect potentiometer harness connector
- switch **Fluke 83** multimeter to 20 Volt range
- connect multimeter between terminal 1 and ground
- switch **ON** ignition
 - must be between 4.5 and 5.5 Volts
- connect multimeter between terminals 1 and 2 and then between terminals 1 and 3
 - must be between 4.5 and 5.5 Volts

If all voltage readings are obtained,

- measure potentiometer resistance, see procedure and specifications later in this section

If one or more voltage readings are not obtained,

- switch **OFF** ignition
- check wiring for open or short circuit between potentiometer harness connector and control unit (J 217) harness connector using wiring diagram
- repair or replace as necessary



Potentiometer harness connector terminal assignments	Corresponding terminals in control unit harness connector
1 — positive	10
2 — ground	29
3 — signal	9

CAUTION

Only use gold plated terminals when repairing the potentiometer harness connector.

If wiring OK,

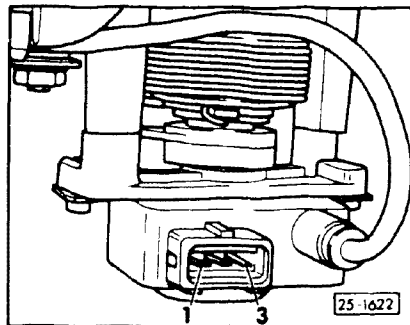
- replace automatic transmission control unit (J 217)

If all voltage readings are obtained, check potentiometer resistance as follows:

- switch **Fluke 83** multimeter to resistance range
 - connect multimeter between terminals 1 and 2
 - must be between 1500 and 2600 Ohms
 - connect multimeter between terminals 2 and 3
 - resistance (in idle position) must be between 750 and 1300 Ohms
 - slowly open throttle to wide open position
 - resistance must increase to a maximum of 3600 Ohms

If any of the resistance measurements are not obtained,

- replace throttle potentiometer (G 69)

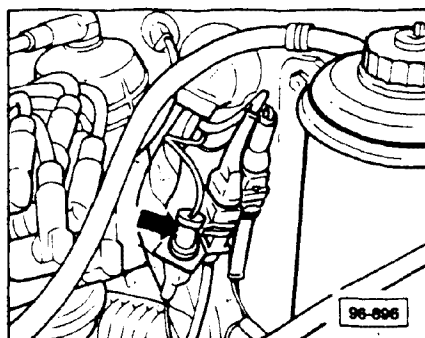
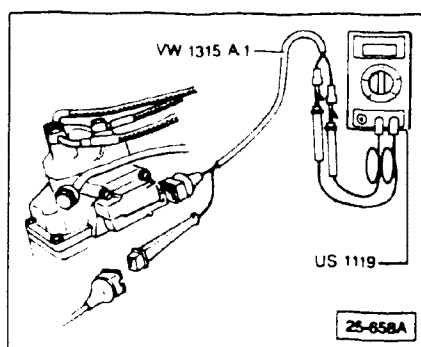


With 097 automatic trans.

Engine code NF

Throttle valve potentiometer,
checking/adjusting

25-102 b



Oxygen sensor control system, checking

(Fault code 2341)

Check these first:

- engine oil temperature: minimum 80°C (176°F)
- differential pressure regulator OK

- connect multimeter **US 1119** to differential pressure regulator, using adapter **VW 1315 A1**

- run engine at idle

- disconnect oxygen sensor connector, (arrow) single connector with green wire
- connect green oxygen sensor wire to ground using jumper wire
 - after approximately 15 seconds, differential pressure regulator current must increase to approximately 10mA

If **NO**

- check wiring between fuel injection control unit and oxygen sensor connector (using wiring diagram)

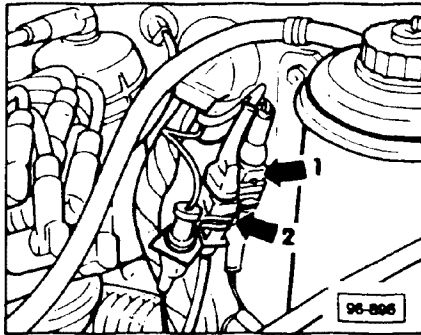
If **NO** break in wiring is found

- replace fuel injection control unit
- reconnect oxygen sensor green wire
- start engine
- raise engine speed briefly to 3000 RPM (to warm oxygen sensor)
 - differential pressure regulator current must return to original mA value, then it **must** fluctuate

If **NO**

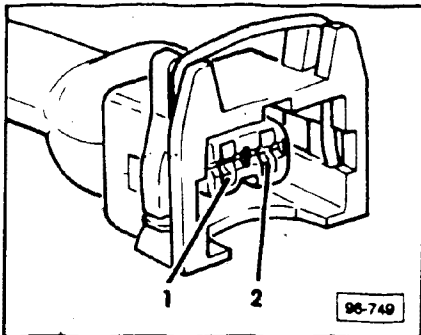
- replace oxygen sensor

Continuous Injection System



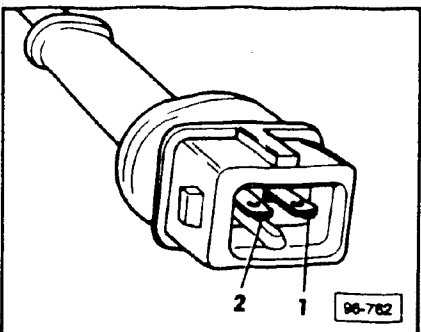
Oxygen sensor heating, checking

- disconnect oxygen sensor heating element connector 2 from harness connector 1



Harness connector

- connect multimeter US 1119 between harness connector terminals 1 and 2
- switch ignition **ON**
 - approximately 12 volts
- If **NO**
 - repair break in wiring using wiring diagram



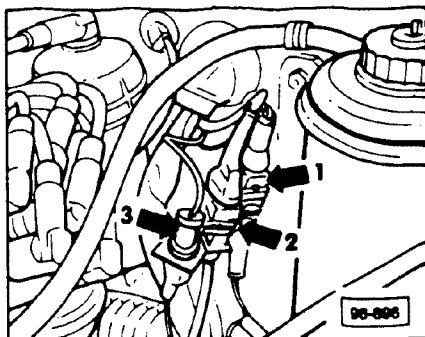
If **YES**

- connect multimeter US 1119 between terminals 1 and 2 of oxygen sensor heating element connector
 - 3 to 15 ohms

If **NO**

- replace oxygen sensor

Continuous Injection System

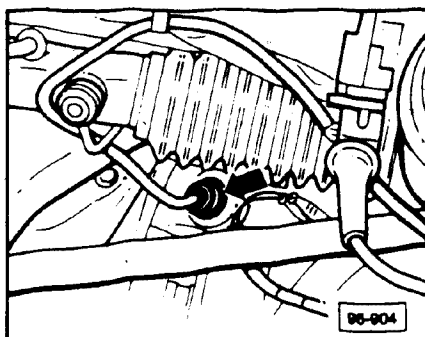


Oxygen sensor, removing and installing

Note

The oxygen sensor replacement interval is 60,000 miles. An OXS mileage counter is not used.

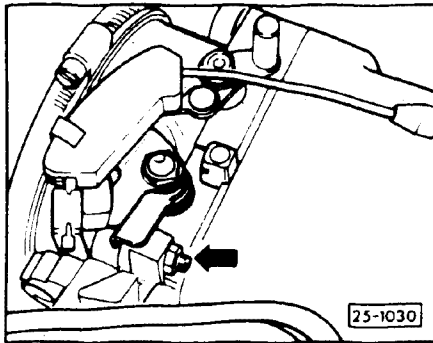
- disconnect oxygen sensor lead 1
- disconnect oxygen sensor heater connector 2 from harness connector 3
- unscrew oxygen sensor (arrow) from exhaust (just ahead of catalyst)
- installation is reverse of removal procedure



CAUTION

Oxygen sensor threads must be coated with anti-seize compound before installing. If the sensor has not already been coated in production, carefully apply a coating to the threads taking extreme care not to allow anti-seize into the sensor slots.

Continuous Injection System



Throttle valve basic adjustment

Note

Stop screw is set at factory and **should not be moved**. If screw position has been altered, check basic adjustment as follows:

- turn throttle stop screw counterclockwise until gap occurs between stop and screw
- turn screw (**arrow**) in until it touches stop

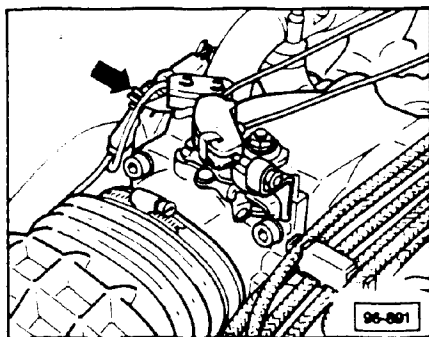
Note

In order to determine the exact stop point of the screw, place a thin piece of cellophane between the screw and the stop. Determine the stop point by tugging at the cellophane and turning the screw at the same time.

- turn screw clockwise additional 1/2 turn
- check throttle switch adjustment

cardiagn.com

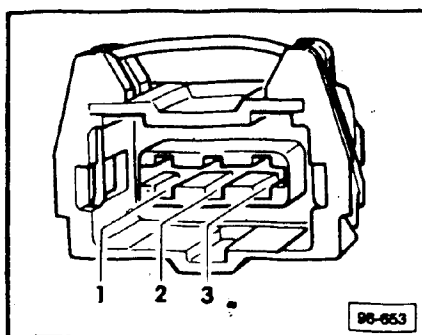
Continuous Injection System



Idle and full throttle switches, checking

Voltage supply for idle and full throttle switches, checking

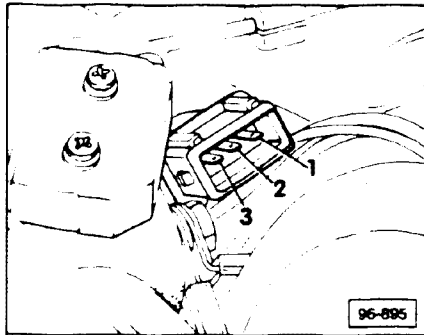
- remove harness connector to idle and full throttle switches on throttle body (arrow)



- connect multimeter **US 1119** between terminal 2 of disconnected throttle switch connector and engine ground
- switch ignition **ON**
 - approximately 12 volts
- If **NO**
 - repair break in wiring according to wiring diagram

cardiagn.com

Continuous Injection System



Full throttle switch, checking

(Fault code 2123)

- connect multimeter **US 1119** between terminals **2** and **3** of throttle switch connector
 - ∞ ohm
- operate switch using throttle valve lever
 - approximately 0 ohms

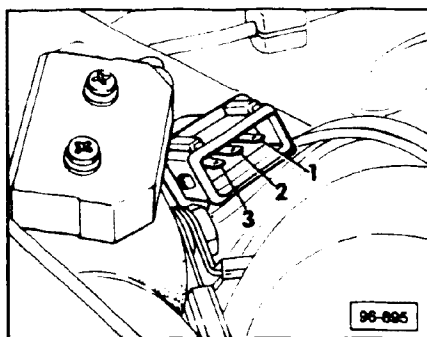
If **NO**

- replace and adjust full throttle switch

If specification **IS** obtained, check wiring between throttle switch connector and fuel injection control unit connectors as follows:

- remove control unit access covers in footwells, driver side left and passenger side right, and pull harness connectors off of Ignition and Fuel injection control units, respectively

Continuous Injection System



Idle switch, checking

(Fault code 2121)

- connect multimeter US 1119 between terminal 1 and terminal 2 (with throttle fully closed)
 - 0 ohms
- move throttle valve 0.5 to 0.7 mm (0.020 to 0.028 in.)

Note

This measurement is made with a feeler gauge between the throttle valve stop and the adjustment screw.

- resistance should change from 0 ohms (with throttle closed) to ∞ ohms as throttle gap increases beyond 0.5 mm (0.020 in.)

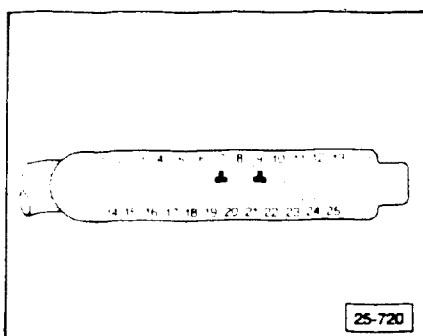
If NO

- adjust idle switch

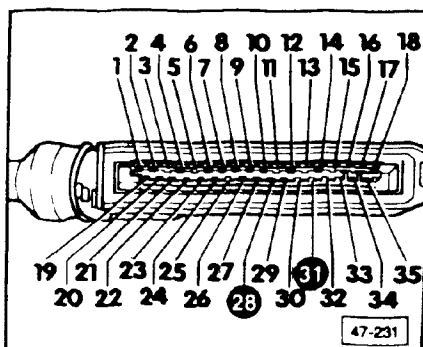
If YES

- check full throttle switch

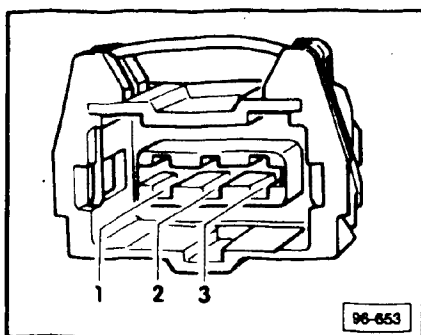
Continuous Injection System



25 pin harness connector, Ignition control unit

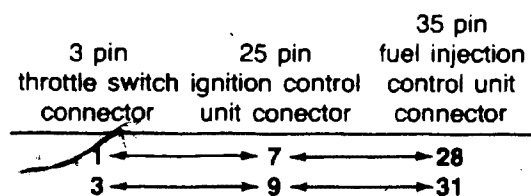


35 pin harness connector, Fuel Injection control unit



3 pin throttle switch, harness connector

- using multimeter check continuity between throttle switch connector (3 pin) and control unit connectors



- approximately 0.2 ohm (continuity)

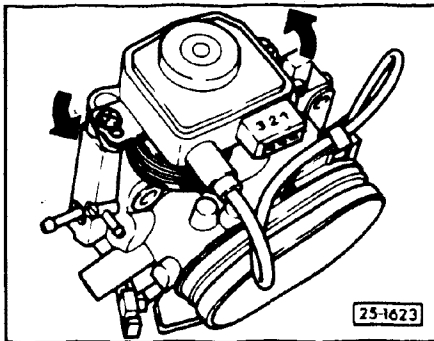
If **NO**

- repair break in wiring using wiring diagram

Idle (F 60) and full throttle switches (F 81), checking/adjusting

For vehicles with "097 Automatic transmission"

- located on underside of throttle body
 - the idle (F 60) and full throttle switches (F 81) are part of the throttle valve potentiometer (G 69) assembly
 - the throttle valve potentiometer (G 69) becomes adjusted when the idle switch is adjusted
 - the full throttle switch (F 81) becomes adjusted when the idle switch is adjusted
 - always return the automatic transmission control unit (J 217) to its basic setting after completing fuel system repairs or adjustments, see Repair Group D3 for additional information
-
- remove throttle valve assembly
 - loosen the two throttle potentiometer screws
-
- turn throttle valve potentiometer in direction of arrow until stop is felt
 - throttle valve (throttle linkage) must not be moved
 - tighten mounting screws in this position
 - reinstall throttle valve assembly and adjust accelerator cable, see Repair Group 20 for additional information
 - check idle switch again



Continuous Injection System

Throttle body dashpot, adjusting

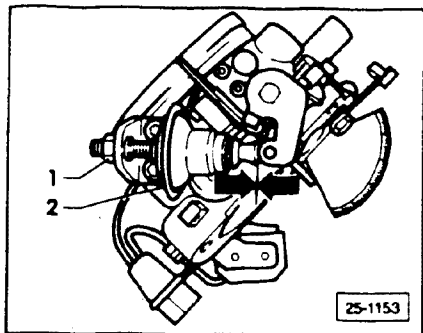
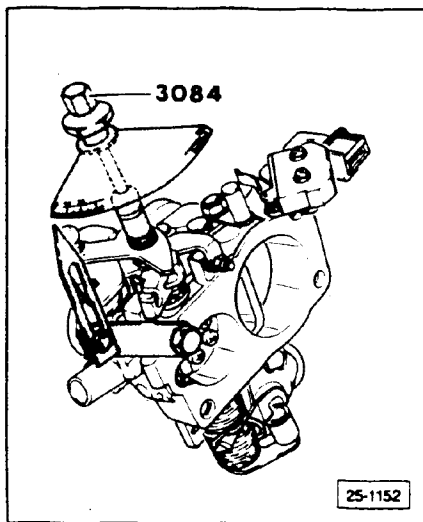
Note

To adjust the dashpot the throttle body must first be removed.

- fasten pointer for protractor **3084** to throttle body (using a spare nut and bolt)
- thread protractor onto throttle shaft, if necessary remove throttle shaft nut
- zero the pointer/protractor
- open throttle 12 to 14 degrees
 - if properly adjusted: the dashpot roller, at this point of throttle travel, should just begin to lose contact with the dashpot plunger

If NO

- loosen sealed lock nut **1** and turn dashpot **2** until a piece of thin paper can be slid between the roller and the dashpot plunger (arrows) without binding
- re-tighten lock nut
- recheck adjustment, re-adjust if necessary



Continuous Injection System

Cold start valve power, checking

(Fault code 4443)

Check this first:

- ignition switched to **OFF** position
- insert spare fuse in top of fuel pump relay
- turn ignition **ON**, remove fuse after four seconds
- re-insert fuse for four seconds, then remove
- re-insert fuse for four seconds, then remove
- re-insert fuse for four seconds, then remove
 - fault indicator light displays **4443** code
- close full throttle switch
 - cold start valve clicks **ON** and **OFF** (for a maximum of ten seconds) when full throttle switch is closed

If **NO**

- proceed as follows

- disconnect cold start valve connector (arrow)
- connect **US 1115** LED tester between terminals 1 and 2 of cold start valve harness connector
 - **US 1115** should light up

If **YES**

- replace cold start valve

If **NO**

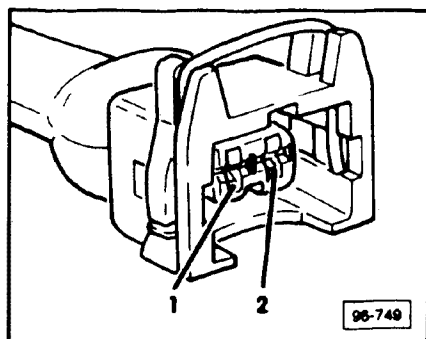
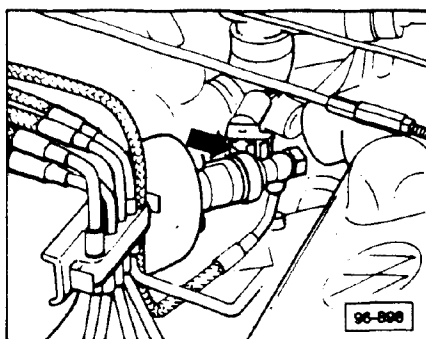
- connect multimeter **US 1119** between connector terminal 1 and ground
 - approximately 12 volts

If **NO**

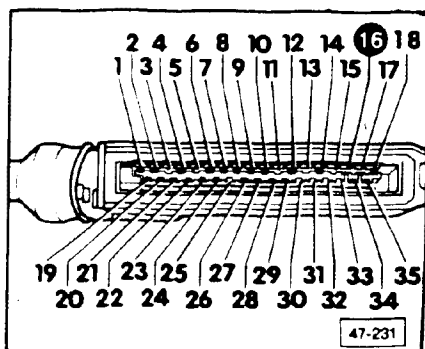
- repair break in wiring, using wiring diagram

If **YES**

- remove fuel injection control unit cover in right passenger footwell and disconnect control unit harness connector



Continuous Injection System



- connect multimeter **US 1119** between terminal 2 of cold start valve harness connector and terminal 16 of fuel injection control unit harness connector
 - approximately 0.2 ohm

If **NO**

- repair break in wiring, using wiring diagram

If **YES**

- replace fuel injection control unit

cardiagn.com

Continuous Injection System

Cold start valve operation, checking

(Fault code 4443)

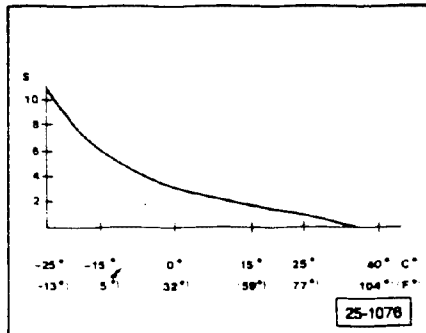
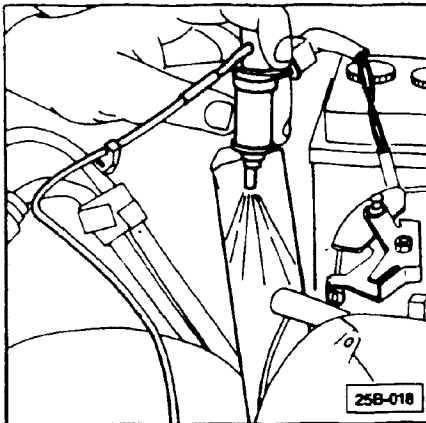
Check this first:

- engine coolant temperature maximum 30°C (86°F)

Note

If engine temperature exceeds 30°C (86°F), disconnect the coolant temperature sensor connector and re-connect it to a substitute sensor (which has been cooled down and jumper wire grounded).

- disconnect coil wire 4 from ignition distributor cap and connect to ground with jumper wire
- remove cold start valve and point nozzle into suitable container (leave electrical connector and fuel line connected)



WARNING

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

- crank engine with starter for 10 seconds
 - cold start valve should spray fuel for period shown on graph

Example:

At 25°C (77°F) fuel should spray for approximately one second.

- wipe off nozzle with clean rag
- check valve for leaks
 - after one minute, valve should be dry and free of fuel

If valve is wet or leaking

- replace cold start valve
- repeat check

Continuous Injection System

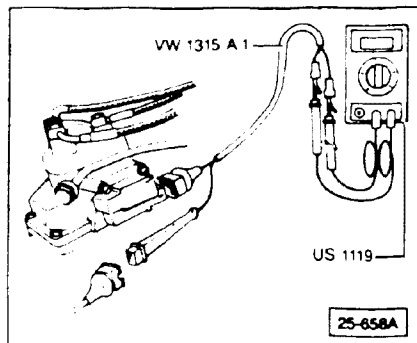
Acceleration enrichment, checking

Check these first:

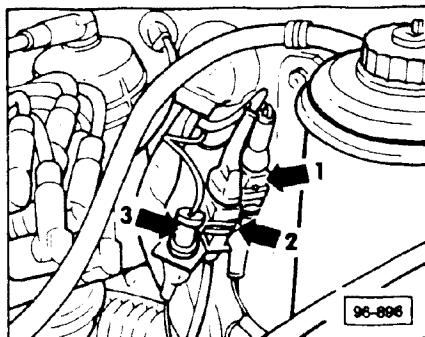
- engine temperature maximum 30°C (86°F)
- differential pressure regulator **OK**

Note

To perform this check the control unit is looking for a temperature signal, lower than 30°C (86°F). If the engine is warmer than 30°C (86°F), disconnect the temperature sensor and substitute a cooled down sensor which is grounded with a jumper wire.



- connect multimeter **US 1119** to differential pressure regulator, using adapter **VW 1315 A/1**



- disconnect oxygen sensor harness connector (**arrow**)
- run engine at idle
 - 1 to 3mA

If NO

- check coolant temperature sensor (see page 25.90)
- depress accelerator pedal briefly
 - differential pressure regulator current must increase to a minimum of 6mA

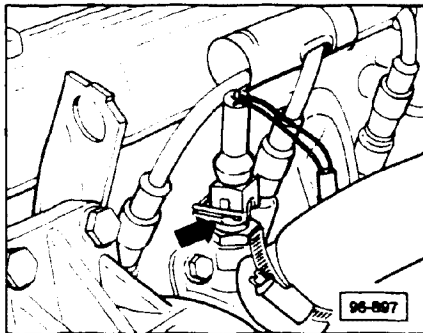
Note

As RPM increases, differential pressure regulator current must also increase. If this current increases only when RPMs drop, check the operation of the air flow sensor potentiometer.

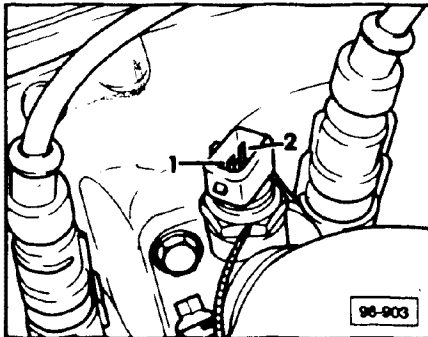
If NO

- shut off engine

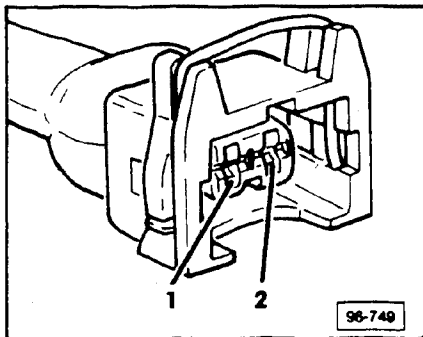
Continuous Injection System



- disconnect coolant temperature sensor harness connector (arrow)



- connect multimeter **US 1119** between sensor terminal 1 and engine ground, take reading
- repeat between sensor terminal 2 and engine ground, take reading
 - greater than 1 k ohm



If a specification greater than 1 k ohm is **NOT** obtained [at a coolant temperature of approximately 30°C (86°F)]

- replace coolant temperature sensor
- repeat check

If **YES**

- remove harness connector from coolant temperature sender
- connect multimeter **US 1119** between terminal 1 of the harness connector and engine ground
- switch ignition **ON**
 - 4.5-5.5 volts
- repeat between terminal 2 and engine ground (specification: same)

If this, or one of the other specifications is **NOT** obtained

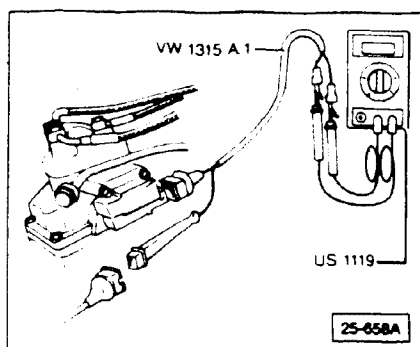
- repair break in wiring between the control units and the connectors, using the wiring diagram

THIS FRAME INTENTIONALLY LEFT

BLANK

cardiagn.com

Continuous Injection System



Deceleration fuel shutoff, checking

Check these first:

- differential pressure regulator **OK** (see output tests page 25.123)
 - engine oil temperature minimum 80°C (176°F)
- connect multimeter **US 1119** to differential pressure regulator using test adapter **VW 1315 A/1**
 - run engine at idle
 - raise engine speed to over 3000 RPM
 - snap throttle shut
 - 1 second after closing throttle, differential pressure regulator current must decrease to - 50 to - 60mA

At an engine speed of about 1200 RPM differential pressure regulator current rises back to about zero mA (nominal)

If specification is **NOT** obtained

- adjust idle switch or repair break in wiring according to wiring diagram

Continuous Injection System

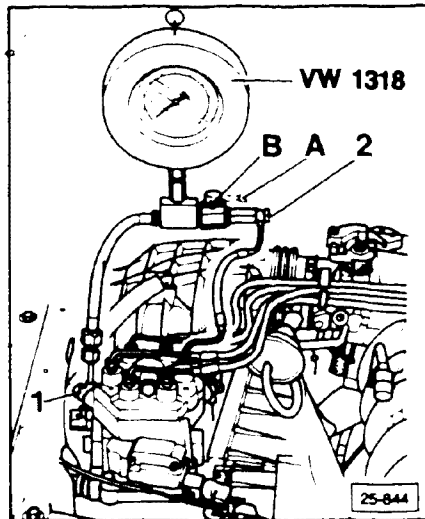
Fuel pressure, technical data

Engine code	NF
System pressure* bar (psi)	6.1-6.5 (88.5-94)
Differential pressure I and II**	
I (differential pressure regulator disconnected)	approximately 0.3-0.5 bar (4.3 to 7.3 psi) less than system pressure
II (differential pressure regulator connected with ignition turned ON)	approximately 1.2 to 1.5 bar (17.4 to 21.8 psi) less than system pressure
Shut-off pressure	
after 5 seconds maximum bar (psi)	3.7 (53.7)
Residual pressure*	
after approximately 10 minutes minimum bar (psi)	3.5 (51)
after approximately 20 minutes minimum bar (psi)	3.4 (49)
Fuel injectors	
permissible difference between set of fuel injection valves:	
Idle speed (first stop of VW 1348/1)	
• at 20 ml fuel quantity measured with US 4480 analyzer	maximum 2.5 ml fuel
full throttle (last stop of VW 1348/1)	
• at 80 ml fuel quantity measured with US 4480 analyzer	maximum 8.0 ml fuel
opening pressure bar (psi)	4.3-4.6 (62-67)
Differential pressure regulator resistance	approximately: 17.5-21.5 ohms

*With pressure gauge shutoff in **OPEN** position

With pressure gauge shutoff in **CLOSED position

Continuous Injection System



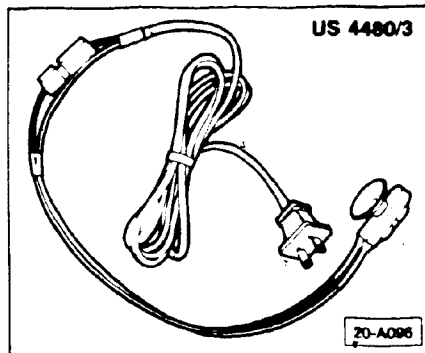
Fuel pressure, checking

Pressure tester VW 1318, connecting

Note

Use all new sealing rings. Observe the rules of cleanliness on page 25.83.

- remove air duct to oil cooler
- unscrew lower air filter housing from bracket
- push fuel distributor out of bracket and push towards engine
- connect pressure tester **VW 1318** to measuring location **1** on fuel distributor using adapter **VW 1318/4**
- connect bolt and line **2** from cold start valve to pressure tester
- turn pressure tester valve to closed position:
 - A** — open
 - B** — closed



System pressure

- remove harness connector from differential pressure regulator
- remove fuel pump relay and jump socket with remote control **US 4480/3**
- open valve on **VW 1318** pressure tester
- switch **ON US 4480/3** remote control and read system pressure on gauge
 - 6.1 to 6.5 bar (88.5 to 94.3 psi)

Note

System pressure is **NOT** adjustable.

Continuous Injection System

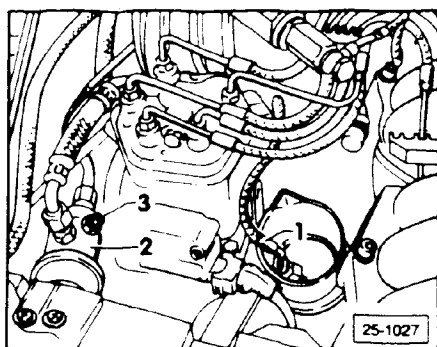
Differential pressure Part I, checking

- close valve on **VW 1318** pressure gauge

Note

Harness connector to differential pressure gauge remains disconnected.

- switch **ON US 4480/3** remote control
- read differential pressure on gauge
 - 0.3 to 0.5 bar (4.3 to 7.3 psi)
less than system pressure



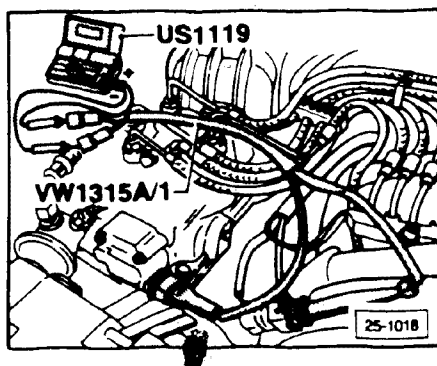
If differential pressure specification not obtained:

- disconnect small diameter fuel line (1) from fuel pressure regulator (2) and place open end in a beaker
- plug opening (3) on fuel pressure regulator
- switch **ON US 4480/3** remote control for one minute and measure amount of fuel
 - 130 to 150 cc

If NO

- replace differential pressure regulator
- reconnect fuel line to fuel pressure regulator

Continuous Injection System



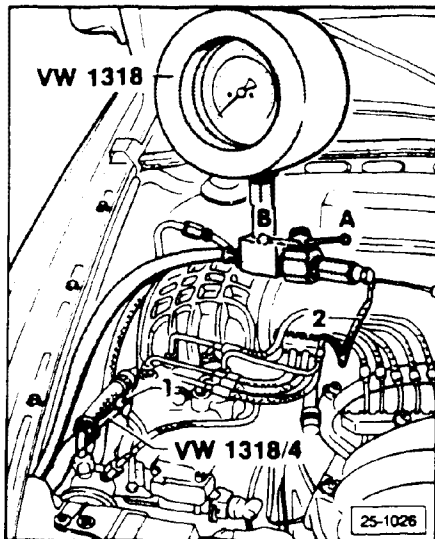
Differential pressure Part II, checking

- close valve on **VW 1318** pressure gauge
- switch **ON** **US 4480/3** remote control
- connect **US 1119** multimeter to differential pressure regulator using adaptor **VW 1315 A/1**
- switch meter to 200 mA DC scale
- switch **ON** ignition
- read regulator current and differential pressure
 - 100 mA
 - differential pressure should be 1.2 to 1.5 bar (17.4 to 21.8 psi) less than system pressure

Note

The fuel injection control unit will generate a fixed current of 100 mA to the differential pressure regulator whenever the ignition is switched **ON** and the engine is stationary.

Continuous Injection System



Residual pressure, checking

Note

This procedure is required only for hot start problems.

- switch **ON** **US 4480/3** remote control for approximately five seconds
- observe pressure drop on **VW 1318**, minimum pressure should be
 - 3.5 bar (51 psi) after 10 minutes
 - 3.4 bar (49 psi) after 20 minutes

If the pressure drop is greater

- check fuel pump check valve (see group 20)
- check air flow sensor plate free play page 25.95
- check sealing rings in fuel distributor, replace if necessary

If these checks don't reveal problem

- replace fuel pressure regulator

Fuel Injectors and Injector lines

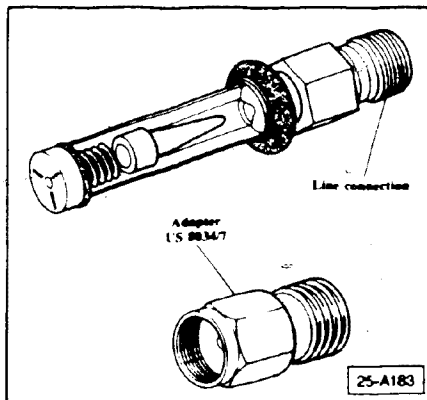
Note

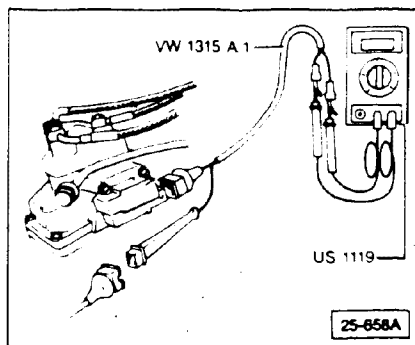
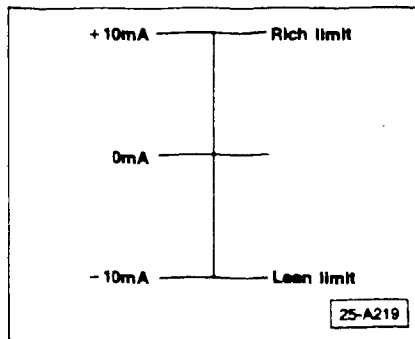
The opening pressure for CIS-E III fuel injectors is higher than CIS-E injectors to allow a higher residual pressure.

- specification: 4.3-4.6 bar (62-67 psi)

Note

The CIS-E III fuel injectors use a finer thread for the fuel line connection than CIS-E injectors. You will need special adaptor **US 8034/7** to use pressure test stand **US 8034**.





Differential pressure regulator control, checking

(Fault code 4341)

Note

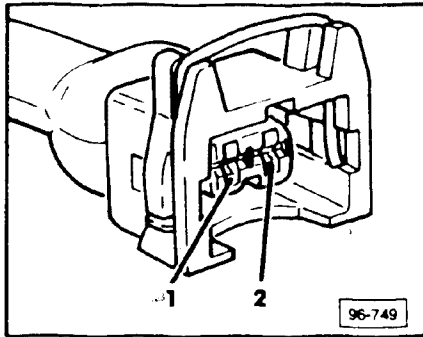
The regulator and its operation is the same as used on CIS-E fuel injection. The operating range during closed loop (oxygen sensor regulation) is different. The operating range is +10mA to -10mA. The nominal CO adjusting point is 0mA. This insures better engine operation if an electrical failure should occur, by providing a fuel mixture which is in the range of the nominal setting.

- ignition in OFF position
- connect **US 1119** multimeter to differential pressure regulator with adapter **VW 1315 A/1**. Set meter to 200mA DC scale
- insert spare fuse in top of fuel pump relay
- turn ignition on, remove fuse after 4 seconds
 - indicator light displays **4341**
- close full throttle switch
 - differential pressure regulator current switches to 10mA (is 100mA with full throttle switch open)

If **NO**

- continue checking on Page 25.124

Continuous Injection System



Note

The following check to be performed after check on page 25.123 has been performed.

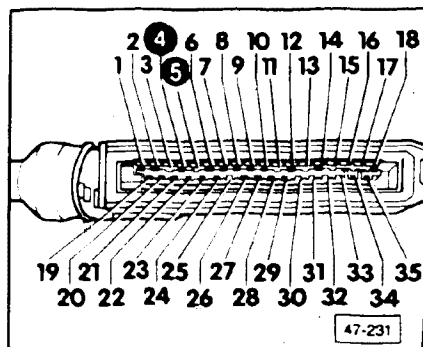
- disconnect harness connector from differential pressure regulator
- connect multimeter US 1119 between terminal 2 of harness connector and engine ground
- switch ignition **ON**
 - approximately 4.5-5 volts
- connect multimeter US 1119 between terminals 1 and 2
 - approximately 4.5-5 volts

If OK

- replace differential pressure regulator

If NO

- remove fuel injection control unit access cover in right passenger footwell and disconnect harness connector from control unit



- with multimeter US 1119, check continuity between fuel injection control unit harness connector and differential pressure regulator harness connector

35 PIN connector	2 PIN connector
---------------------	--------------------

terminal 4	→	terminal 1
terminal 5	→	terminal 2

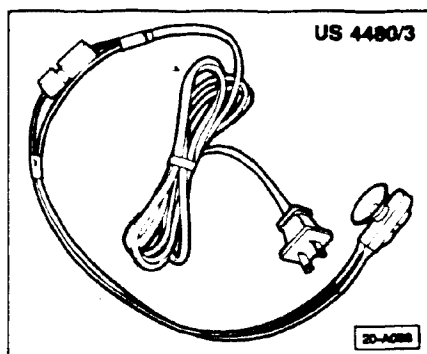
- approximately 0.2 ohm

If NO

- repair break in wiring using wiring diagram

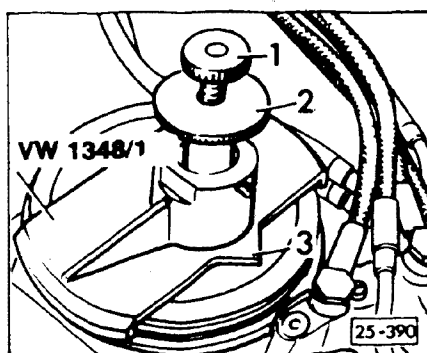
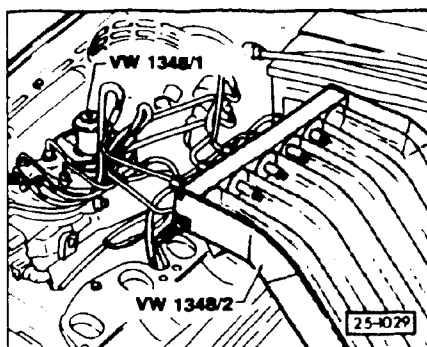
If OK

- replace fuel injection control unit



WARNING

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



Injection quantity, comparative measurement

Check this first:

- fuse No. 13 OK
- remove fuel pump relay from fuse relay panel (position No. 10)
- connect **US 4480/3** remote control
- remove intake manifold (upper section) see page 25.80 (for exploded view)
- remove injector bracket

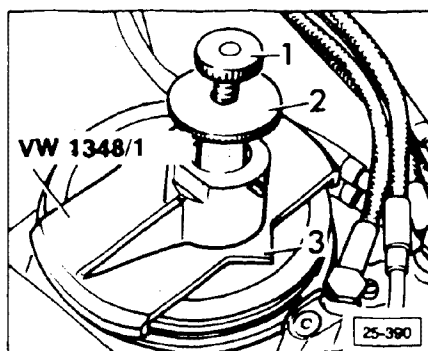
- remove fuel injectors from seats and insert into openings of fuel analyzer **VW 1348/2B**

Note

Carefully route the fuel lines to avoid pinching and bending.

- turn and lift adjusting screw 1 and slide 2 into upper (full throttle) position on **VW 1348/1**
- place **VW 1348/1** centrally on edge of airflow sensor assembly
 - pointer 3 faces to center of fuel distributor
- push adjusting slide 2 down onto stop
- turn setting screw 1 clockwise until magnetic end contacts airflow sensor plate retaining bolt
- switch **ON US 4480/3** remote control
- turn adjusting screw 1 counterclockwise until beginning of fuel injection is seen at one injector
- switch **OFF US 4480/3** remote control and empty **US 4480** analyzer into vehicle fuel tank

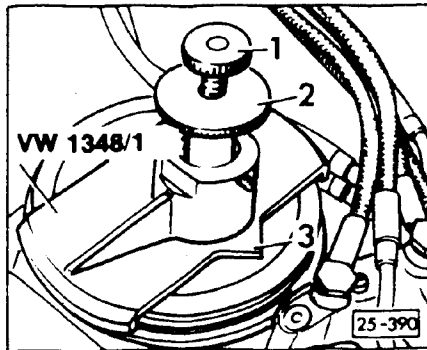
Continuous Injection System



Idle speed fuel injection quantity, measuring

- lift adjusting slide 2 to first stop (simulated idle)
- switch **ON US 4480/3** remote control until fuel level on scale of **one** measuring glass reaches **20 ml fuel**
- note injector spray pattern
 - must be even and cone shaped
 - all injectors should have same spray pattern
- if not, briefly lift sensor plate up once, fully, and repeat test
- compare amount of fuel for all injectors (keep measuring device vertical)
- permissible difference between fuel quantity in all flasks must be not more than:
 - **maximum 3.0 ml fuel**
 - if fuel in flasks differs between high and low more than 3.0 ml, interchange both injectors and repeat test
 - if difference of injected fuel did not change with interchanged injectors, check if fuel line is pinched or fuel distributor is defective
 - if difference of injected fuel has changed with interchanged injectors, replace injectors

Continuous Injection System



Full throttle fuel injection quantity, measuring

- empty measuring device **US 4480**. Reinstall injectors in measuring device
- lift adjusting slide **2** to last stop (simulated full throttle)
- switch **ON US 4480/3** remote control until fuel level on scale of one measuring glass reaches **80 ml fuel**
- note injector spray pattern
 - must be even and cone shaped
 - all injectors should have same spray pattern

If **NO**

- briefly lift sensor plate up once, fully and repeat test
- compare amount of fuel for all injectors (keep measuring device vertical)
- permissible difference between fuel quantity in all flasks must be not more than **8.0 ml fuel**
 - if fuel in flasks differs between high and low more than 8.0 ml, interchange both injectors and repeat test
 - if difference of injected fuel did not change with interchanged injectors, check if fuel line is pinched or fuel distributor is defective
 - if difference of injected fuel has changed with interchanged injectors, replace injectors

Immediately after measuring, test injectors for leaks:

- set sensor plate in rest position
- switch **ON US 4480/3** remote control for about **2 minutes**
 - injectors must not drip

Continuous Injection System

Metal tipped fuel injectors, checking/cleaning

Identifying

- check Part Number stamped on barrel of injector

Note

Two types of fuel injectors are used in these vehicles; Viton tipped, and metal tipped (non-Viton). Viton tipped injectors will have one of the following Bosch Part Numbers stamped on the body of the injector:

0-437-502-043 High pressure concept, fine thread (replacement)

(Audi Replacement,

Part Number: **035 133 551F**)

0-437-502-044 High pressure concept, fine thread (OEM)

(Audi Replacement,

Part Number: **(035 133 551F)**)

0-437-502-045 Low pressure, coarse thread (replacement)

(Audi Replacement,

Part Number: **(026 133 551)**)

0-437-502-046 Low pressure, coarse thread (OEM)

(Audi Replacement,

Part Number: **(026 133 551)**)

If one of the above Part Numbers is **NOT** found,

- see section 25.127e "Viton Tipped Injectors, Cleaning and Checking"

Any other Part Number indicates that it is metal tipped.

CAUTION

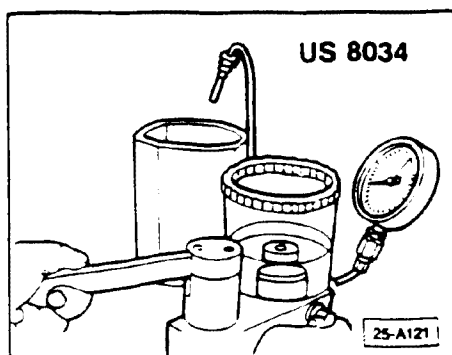
Part Numbers are for reference only.
Always consult with the Parts
Department for the latest information.

Notes regarding metal tipped injectors:

- metal tipped injectors are no longer available as spare parts, replacements will be Viton tipped

Continuous Injection System

- if one or more metal tipped injectors has to be replaced the entire set must be replaced
- Viton and metal tipped injectors must not be used together



Note

Poor injector performance can often be corrected by flushing and testing the injector using the **US 8034** injector tester.

CAUTION

Perform the following checks in sequence.

Corrosion checking

- visually inspect tip of injector

If **YES**

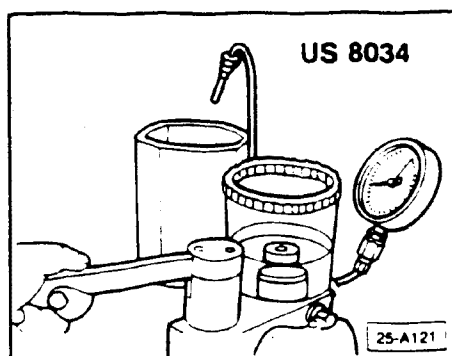
- replace injector

If **NO**

- proceed with following procedures

WARNING

Fluid used in tester (Shell mineral spirits 135) is flammable. Do not smoke or have anything in area that can ignite fuel.



Contamination and varnish, checking

- open **US 8034** pressure valve fully by turning counterclockwise
- loosely connect injector to tester via union nut
- bleed air from pressure line by operating lever several times, allowing tester fluid to escape through nut
 - use a suitable container under injector to catch overspray
- tighten union nut
- slowly operate hand lever
 - approx. 2 strokes per second
- if pressure does not build up, injector has leakage (e.g. foreign object(s) lodged between seat). If this is the case, proceed to bleeding of injector and repeat contamination test

Continuous Injection System

- if after bleeding, pressure is restored:
return to this point and continue with sequence
- observe pressure on gauge
 - minimum opening pressure must be 1.5 to 2.0 bar

If NO

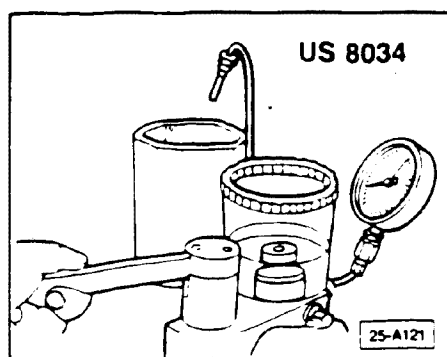
- injector may be contaminated or varnished
- close valve on **US 8034**
- flush injector by operating tester with 20 to 30 vigorous strokes
- repeat contamination check

If still below specification,

- replace injector

If OK

- bleed injector by rapidly operating tester 20 to 30 strokes
 - injector is bled when sound of escaping fluid stabilizes



Opening pressure, checking

- open valve on **US 8034**
- slowly operate hand lever
 - approx. 2 strokes per second
- observe pressure on gauge
 - opening pressure must be 3.0 to 4.1 bar (low pressure), 4.3 to 4.6 bar (high pressure concept)

Leak checking

Requirement

- Hand valve on **US 8034** must be open
- using the previously established opening pressure as a reference; slowly increase the pressure to 0.5 bar below that value

For example: If opening pressure was 4.0 bar; the leak checking pressure must be 3.5 bar.

- a droplet may form at the tip of the injector within 15 seconds, however; if the droplet falls off the injector must be replaced

Continuous Injection System

Chatter, spray pattern test

- close hand valve fully by turning clockwise
- flush injector by operating lever several times
 - approx. 2 strokes per second
- reduce the rate to 1 stroke per second
 - injector must chatter
- observe spray pattern
 - must be conical and well atomized, a one sided spray pattern within a spray angle of 35° is acceptable

If droplets form at the injector tip.

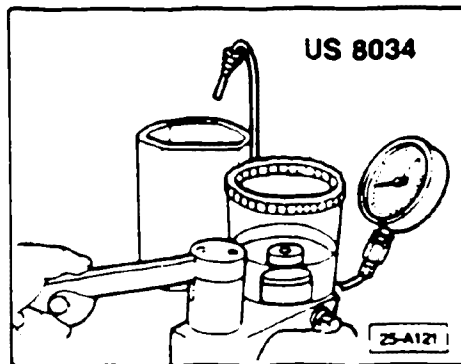
- replace entire set of injectors with Viton tipped

If spray pattern is straight (not conical).

- replace entire set of injectors with Viton tipped

If spray is solid (not atomized).

- replace entire set of injectors with Viton tipped



CAUTION

Always flush new injectors before installing, using the **US 8034** Tester, to remove any foreign material that might have entered the injector during shipping or handling.

Engine code NF

CIS-E III

Metal tipped fuel injectors, checking/cleaning

25.127d

Continuous Injection System

Viton tipped fuel injectors, checking/cleaning

Identifying

- check Part Number stamped on barrel of injector

Note

Two types of fuel injectors are used in these vehicles: Viton tipped, and metal tipped (non-Viton). Viton tipped injectors will have one of the following Bosch Part Numbers stamped on the body of the injector:

0-437-502-043 High pressure concept, fine thread (replacement)

(Audi Replacement,
Part Number: **035 133 551F**)

0-437-502-044 High pressure concept, fine thread (OEM)

(Audi Replacement,
Part Number: **035 133 551F**)

0-437-502-045 Low pressure, coarse thread (replacement)

(Audi Replacement,
Part Number: **026 133 551**)

0-437-502-046 Low pressure, coarse thread (OEM)

(Audi Replacement,
Part Number: **026 133 551**)

If one of the above Part Numbers is **NOT** found

- see section 25.127a "Metal Tipped Injectors, Cleaning and Checking"

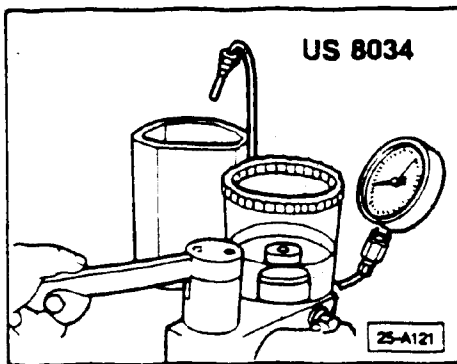
CAUTION

Part Numbers are for reference only.
Always consult with the Parts
Department for the latest information.

Continuous Injection System

Notes regarding Viton tipped injectors:

- they are available in high and low pressure versions, fine and coarse threads
- they can be used as a replacement for metal tipped injectors but only in complete sets
- the fuel absorption characteristics of Viton require different testing considerations than metal tipped injectors
- spray pattern and chatter test should not be performed on these injectors because the results cannot be used to determine acceptability



Note

Poor injector performance can often be corrected by flushing and testing the injector using the **US 8034** injector tester.

CAUTION

Perform the following checks in sequence.

Corrosion checking

- visually inspect tip of injector for rust

If **YES**

- replace injector

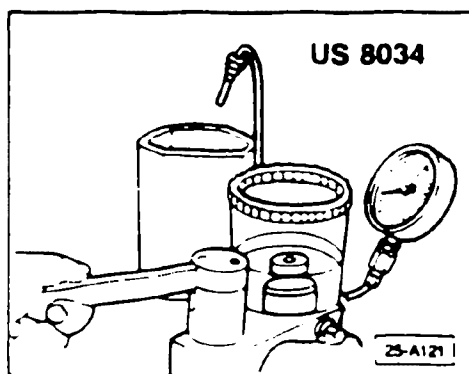
If **NO**

- proceed with following procedures

WARNING

Fluid used in tester (Shell mineral spirits 135) is flammable. Do not smoke or have anything in area that can ignite fuel.

Continuous Injection System



Contamination and varnish, checking

- open **US 8034** pressure valve fully by turning counterclockwise
- loosely connect injector to tester via union nut
- bleed air from pressure line by operating lever several times, allowing tester fluid to escape through nut
 - use a suitable container under injector to catch overspray
- tighten union nut
- slowly operate hand lever
 - approx. 2 strokes per second
- if pressure does not build up, injector has leakage (e.g. foreign object(s) lodged between seat). If this is the case, proceed to bleeding of injector and repeat contamination test
- if after bleeding, pressure is restored: return to this point and continue with sequence
- observe pressure on gauge
 - depending on Part Number of injector, minimum opening pressure must be:

0-437-502-043 3.2 bar
(Audi Replacement,
Part Number: **035 133 551F**)

0-437-502-044 3.2 bar
(Audi Replacement,
Part Number: **035 133 551F**)

0-437-502-045 2.5 bar
(Audi Replacement,
Part Number: **026 133 551**)

0-437-502-046 2.5 bar
(Audi Replacement,
Part Number: **026 133 551**)

If **NO**

- injector may be contaminated or varnished
- close valve on **US 8034**
- flush injector by operating tester with 20 to 30 vigorous strokes
- open valve on **US 8034**
- recheck opening pressure

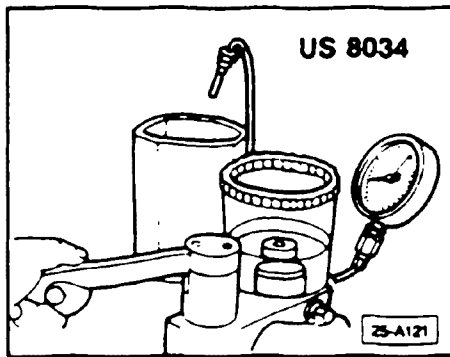
Engine code **NF**

CIS-E III

Viton tipped fuel injectors, checking/cleaning

25.127g

Continuous Injection System



If still below specification,

- replace injector

If OK

- close valve on **US 8034**
- **bleed** injector by rapidly operating tester 20 to 30 strokes
 - injector is bled when sound of escaping fluid stabilizes



Opening pressure, checking

- open valve on **US 8034**
- slowly operate hand lever
 - approx. 2 strokes per second
- observe pressure on gauge

Note

Opening pressure for a Viton tipped injector will vary depending upon how long the Viton has been out of contact with gasoline.

- use following chart (based on length of time injector has been removed from the fuel system) to determine acceptable opening pressures

Bosch Part number:	If less than 3 hours	from 3 to 24 hours	Greater than 24 hours
0-437-502-043 (Audi Replacement, Part Number: 035 133 551F)	3.9 bar	3.8 bar	3.6 bar
0-437-502-044 (Audi Replacement, Part Number: 035 133 551F)	3.9 bar	3.8 bar	3.6 bar
0-437-502-045 (Audi Replacement, Part Number: 026 133 551)	3.0 bar	2.9 bar	2.7 bar
0-437-502-046 (Audi Replacement, Part Number: 026 133 551)	3.0 bar	2.9 bar	2.7 bar

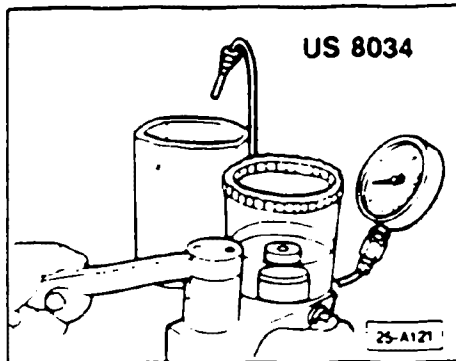
Engine code NF

CIS-E III

Viton tipped fuel injectors, checking/cleaning

25.127h

Continuous Injection System



Leak checking

Requirement

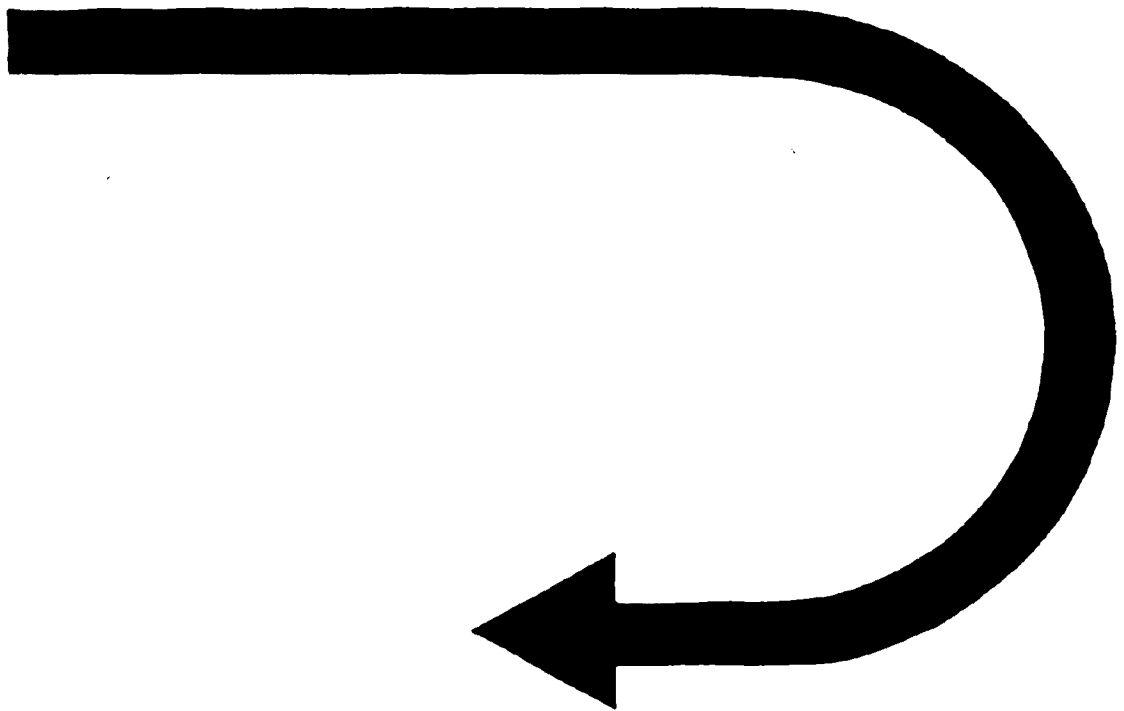
- hand valve on **US 8034** must be open
- using the previously established opening pressure as a reference: slowly increase the pressure to **0.3** bar below that value
- a droplet may form at the tip of the injector within 120 seconds, however, if the droplet falls off the injector must be replaced

CAUTION

Always flush new injectors before installing, using the **US 8034** Tester, to remove any foreign material that might have entered the injector during shipping or handling.

cardiagn.com

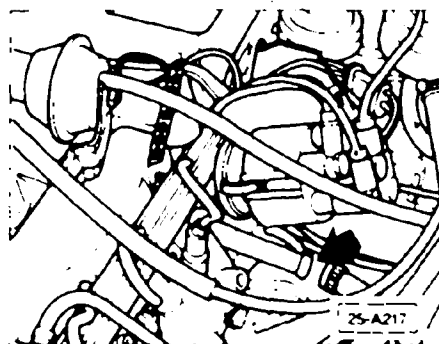
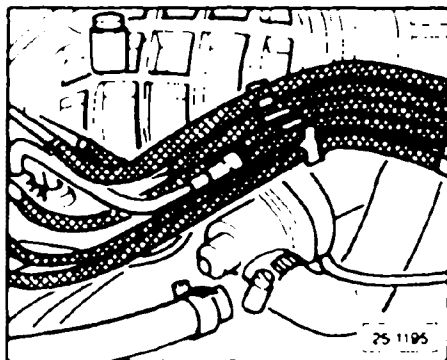
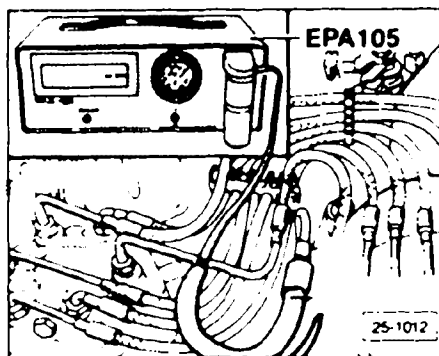
CONTINUED IN THE
BEGINNING OF NEXT ROW



Continuous Injection System

CAUTION

Idle speed, ignition timing and CO are inter-related and **MUST** be checked and adjusted **TOGETHER**.



Engine settings, checking

Check these first:

- engine oil temperature 80°C (176°F) minimum
- all electrical consumers switched **OFF**
- radiator cooling fan must **NOT** be running while checking or adjusting
- oxygen sensor connected
- A.C. switched **OFF**
- no pressure measuring devices connected
- exhaust system must be leak-tight
- OXS system **OK**
- remove cap from exhaust probe
- connect hose from exhaust gas analyzer (Sun 105 or EPA equivalent) to CO measuring tap (**arrow**)
- remove carbon canister hose from frequency valve at intake air boot (**arrow**)

Note

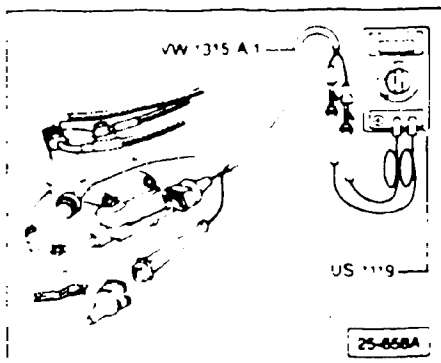
Leave valve open to allow fresh air into the restrictor

- remove crankcase breather connection at steel pipe
- plug opening of steel pipe (**arrow**)

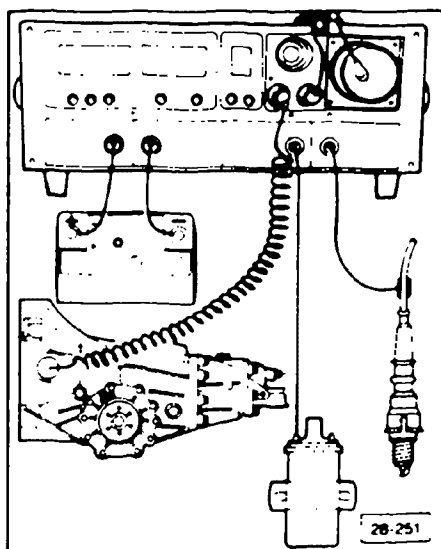
Note

Crankcase vapors must vent to atmosphere during checking or adjusting procedure.

Continuous Injection System



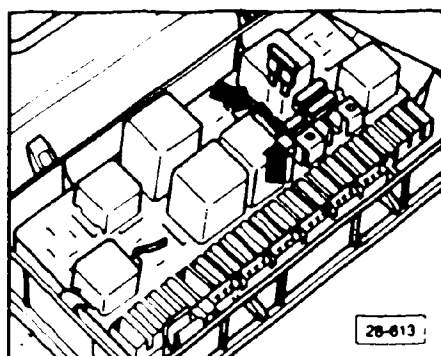
- connect multimeter **US 1119** or equivalent to differential pressure regulator with adaptor **VW 1315 A/1**
- set scale to 200 mA DC



- connect **VW 1367** engine tester to check ignition timing and idle speed
- start engine and run to normal operating temperature (radiator fan must come on at least once)

Note

If you loosen or replace the injector lines, run the engine to about 3000 RPM for several minutes to bleed injectors and lines.



- insert fuse in top of fuel pump relay (**arrow**)
 - indicator light must come on. This indicates that after four seconds, ignition timing is stabilized for testing purposes.

Note

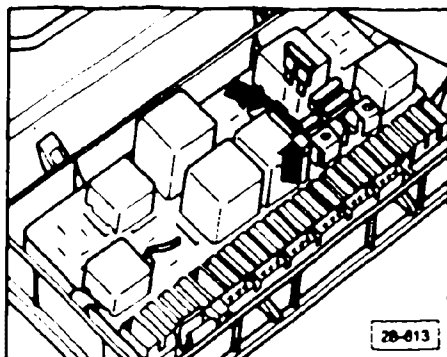
If **VAG 1551** diagnostic connectors are installed in vehicle, use procedure on page 25.134.

- check ignition timing
 - 13° to 17° Before TDC

If NO

- adjust ignition timing to: 15° ± 1° Before TDC (See Group 28 for additional information)

Continuous Injection System



- remove fuse from fuel pump relay and briefly raise engine speed above 2500 RPM to cancel fault display
- check idle speed
 - 720 ± 70 RPM

CAUTION

The idle speed is **NOT** adjustable.

If NO

- check for an engine problem such as vacuum leaks, etc. Fix as necessary
- check differential pressure regulator current with oxygen sensor **connected**
 - 0 ± 1 mA, adjust if necessary
- check CO%
 - 0.3-1.2%

If OK

- disconnect testers and reconnect engine hoses

If NOT OK

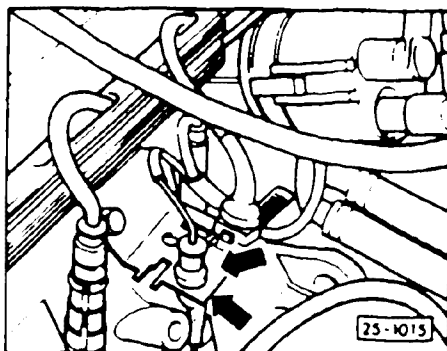
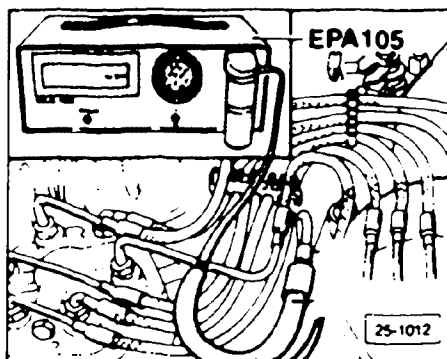
- adjust CO as follows:

CO value, adjusting

For altitudes greater than 1000 meters (3280 ft) see page 25.132.

Note

If injection lines were disengaged or replaced, the engine speed must be raised to 3000 RPM several times then left idling for at least 2 minutes before adjustment. The idle speed is automatically regulated by the idle stabilization valve.

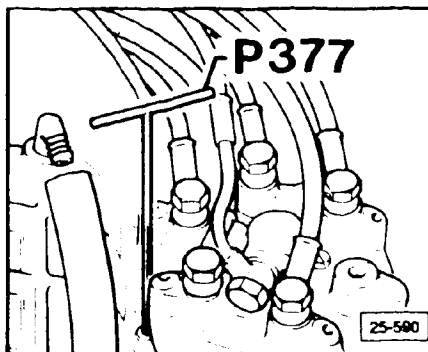


- disconnect oxygen sensor harness connector (arrows)
- check CO-value, if necessary adjust with CO-adjustment screw (page 25.131)
 - checking value: 0.3-3.0% vol.
 - adjustment value: 0.6-1.0% vol.

Continuous Injection System

CAUTION

Clean up any metal shavings.
Apply grease to drill bit to
catch loose shavings.



CAUTION

When adjusting do **NOT** push
adjustment wrench down or
accelerate engine with
adjusting tool in place. Remove
the tool after each adjustment
and briefly accelerate engine
before reading CO value.

Note

If the CO value is less than 0.3 or more than 3.0% volume when the oxygen sensor is disconnected; adjust the CO as follows:

- switch ignition **OFF**
- remove intake air boot
- center punch mixture adjusting screw plug
- drill 2.5 mm (3/32 in.) hole in center of plug approximately 3.5 to 4.0 mm (9/64 to 5/32 in.) deep
- screw in 3 mm (1/8 in.) sheet metal screw
- remove plug/screw, using pliers
- reinstall intake air boot
- start engine and run at idle
- adjust CO value by turning mixture adjusting screw using tool **P377**

- counter-clockwise: CO value increases
- clockwise: CO value decreases
- checking value: 0.3 - 3.0% vol.
- adjusting value: 0.6 - 1.0% vol.

Note

After adjusting, the hoses for the crankcase must be reconnected. If the control current and the CO content change, this is not due to an improper adjustment, but rather to oil dilution caused by short distance driving. Long distance driving reduces the amount of fuel in the oil causing CO value to normalize again. A short term solution would be an oil change.

After adjusting, the specified control current mA value must fluctuate (with the oxygen sensor connected).

If **NO**

- check the oxygen sensor

Continuous Injection System

Workshops above 1000 meters (3280 feet) of elevation:

- disconnect oxygen sensor harness connector (green wire)
- let engine idle
 - record mA value of differential pressure regulator current

Note

The value obtained with the oxygen sensor disconnected is the altitude correction factor.

- reconnect oxygen sensor harness connector (green wire)
 - note mA value and compare with the value obtained with the sensor disconnected

If the difference between readings is more than ± 3 mA, adjust as follows:

- turn **OFF** ignition
- remove intake air boot from mixture control unit
- center punch mixture adjusting screw plug
- drill 2.5 mm (3/32 in.) hole in center of plug to a depth of 3.5 to 4.0 mm (9/64 to 5/32 in.)

CAUTION

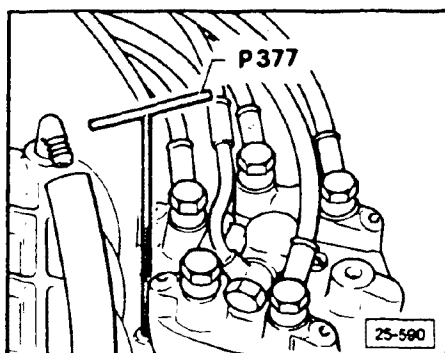
Clean up any metal shavings. Apply grease to drill bit to catch any shavings.

- screw in 3 mm dia. (1/8 in.) sheet metal screw
- remove plug with screw, using pliers
- start engine and run at idle

Continuous Injection System

CAUTION

When adjusting do **NOT** push adjustment wrench down or accelerate engine with adjusting tool in place. Remove tool after each adjustment and briefly accelerate engine before reading the CO value.

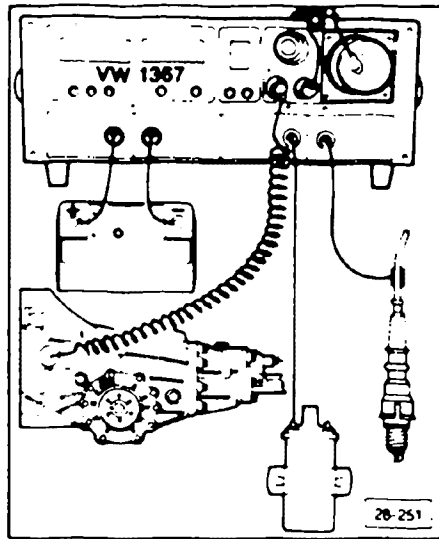


- ensure that oxygen sensor has been re-connected and that mA current is fluctuating slightly
- adjust CO by turning mixture adjusting screw with tool **P377**
 - adjusting value: ± 1 mA of reading taken while oxygen sensor was disconnected

Example:

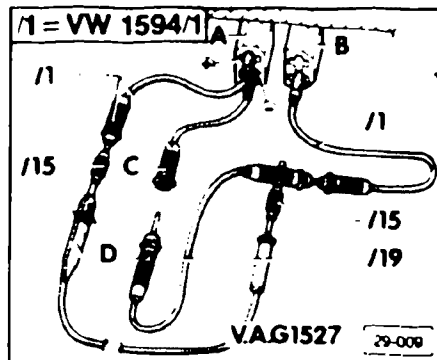
If the reading with the oxygen sensor disconnected was 4 mA and the reading with the oxygen sensor connected was 0 mA the difference would be 4 thus requiring an adjustment.

You would then make an adjustment of 4 ± 1 mA (**WITH** the oxygen sensor **CONNECTED**)



CAUTION

Make sure that the **VW 1367** TDC pickup is fully seated into the transmission housing recess.



Ignition timing, checking/adjusting

Vehicles with VAG 1551 diagnostic connectors

Checking

Check these first:

- engine oil temperature 80°C (176°F) minimum
- throttle in idle position
- A.C switched **OFF**

- connect **VW 1367** engine tester according to manufacturer's instructions

- start engine and let idle

Note

The ignition timing point is displayed directly on the **VW 1367** engine tester. Checking ignition timing using a strobe is **NOT** necessary.

- jumper terminal **C** (ground) with terminal **D** until ignition timing checking/adjusting is completed
 - checking: 13 to 17° Before TDC
 - adjusting: 15 ± 1° Before TDC

Note

A constant ignition timing point is available from the ignition control unit 4 seconds after terminal **C** is jumpered to terminal **D**.

Adjusting

- loosen distributor clamp bolt
- rotate distributor until specification is obtained
- remove jumper between terminals **C** and **D**
- briefly increase engine speed above 2500 RPM
- let engine idle
 - ignition timing must fluctuate between 7° and 20° Before TDC
- if necessary, adjust idle and CO-content



Microfilm Service Information System

Quality Control Test Pattern

ORIGINAL 9-28-81
REVISED 11-17-81

POINT SIZE

LINE WIDTH

