5-Cylinder w/CIS-E III

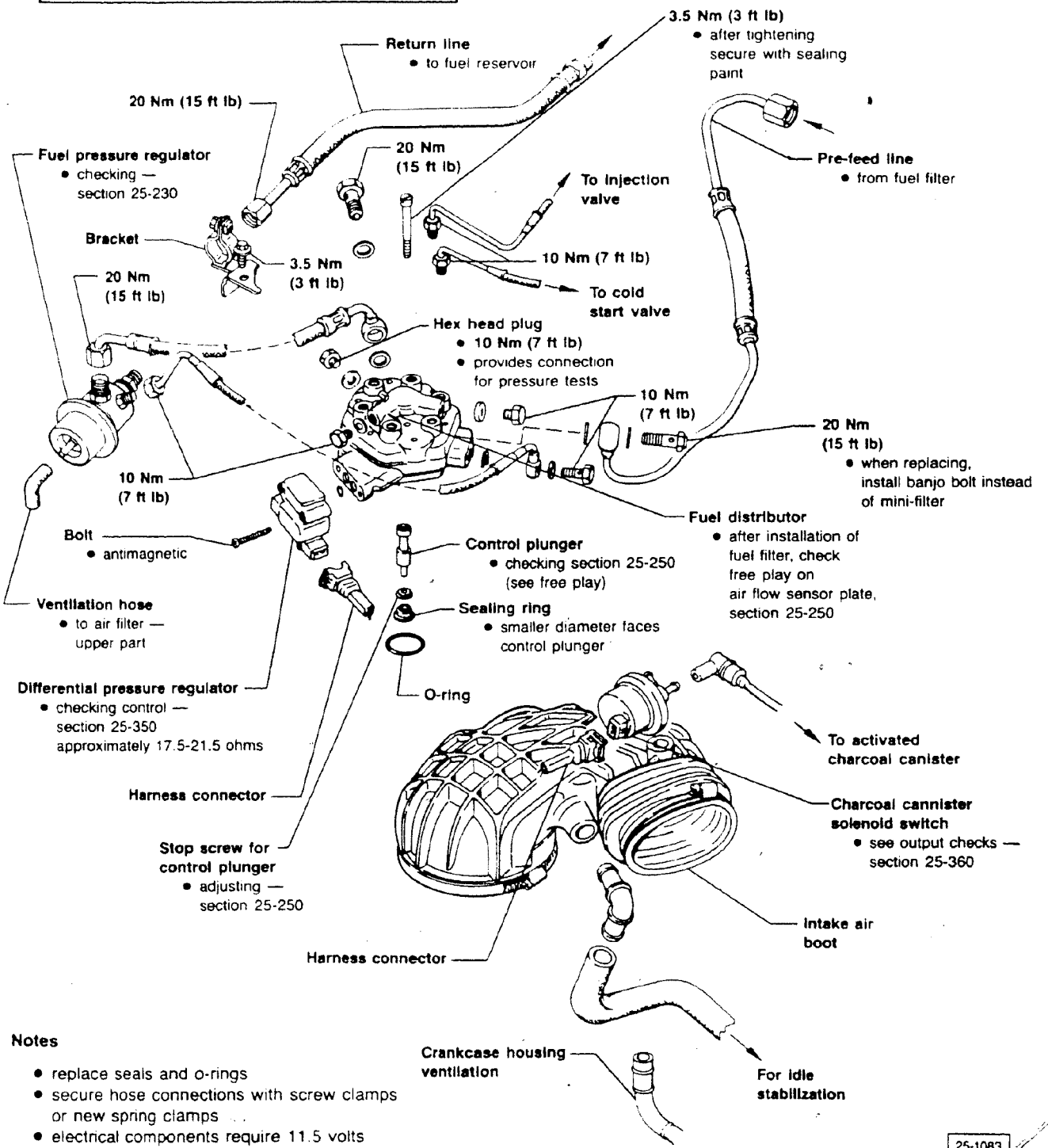
Index

Coupe

★ NEW INFORMATION since last filming

WARNING

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

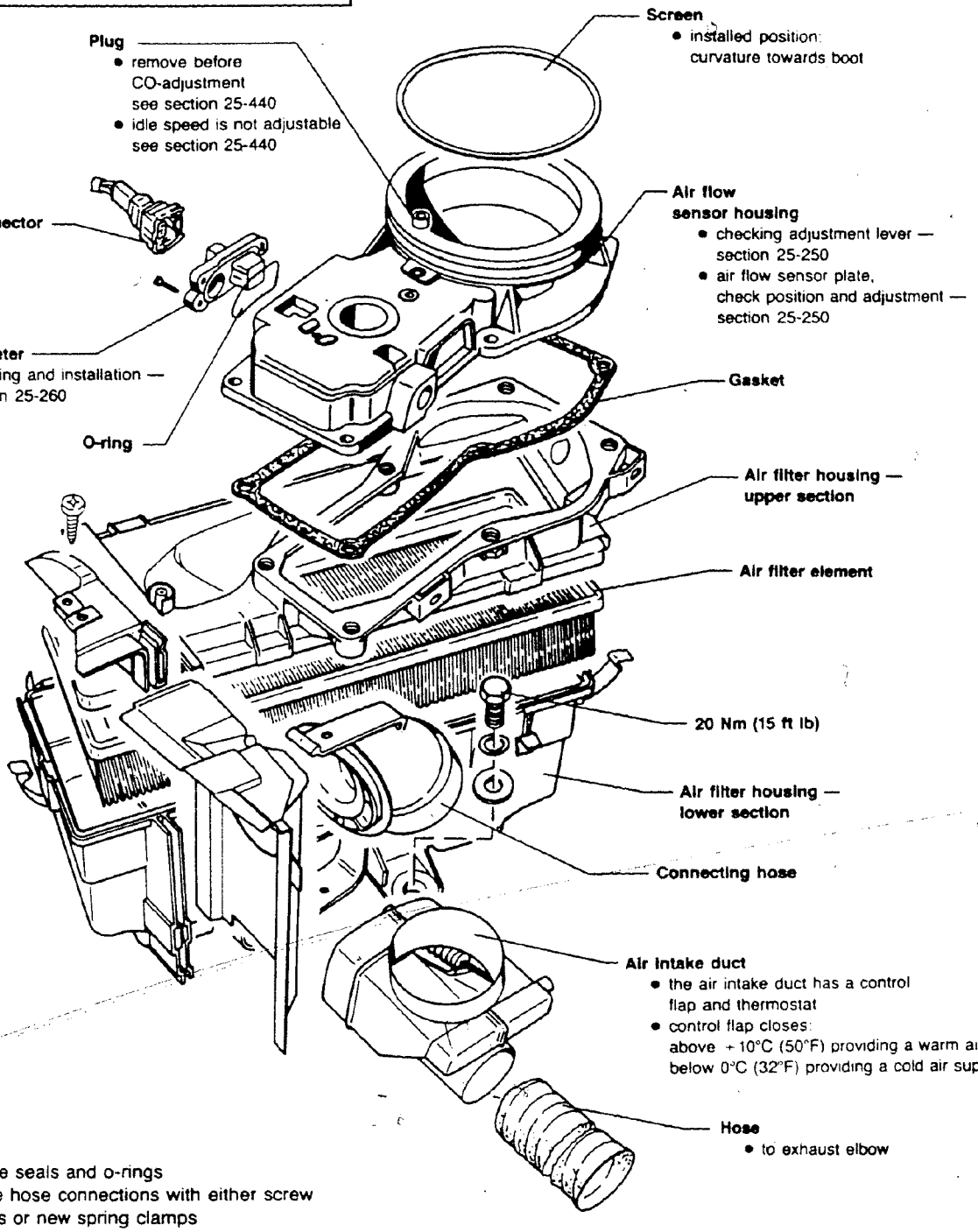


Notes

- replace seals and o-rings
- secure hose connections with 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.



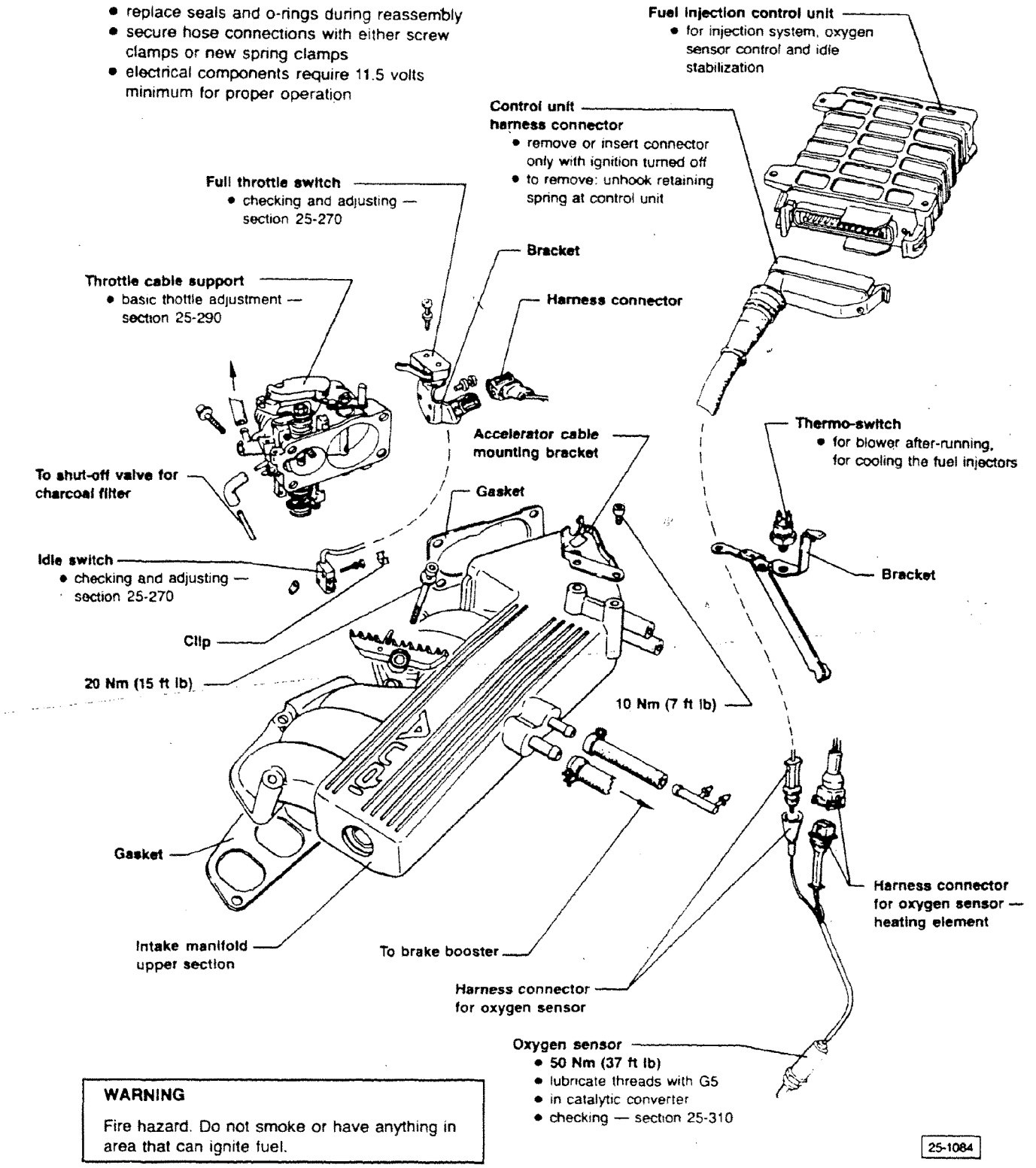
Notes

- 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

Notes

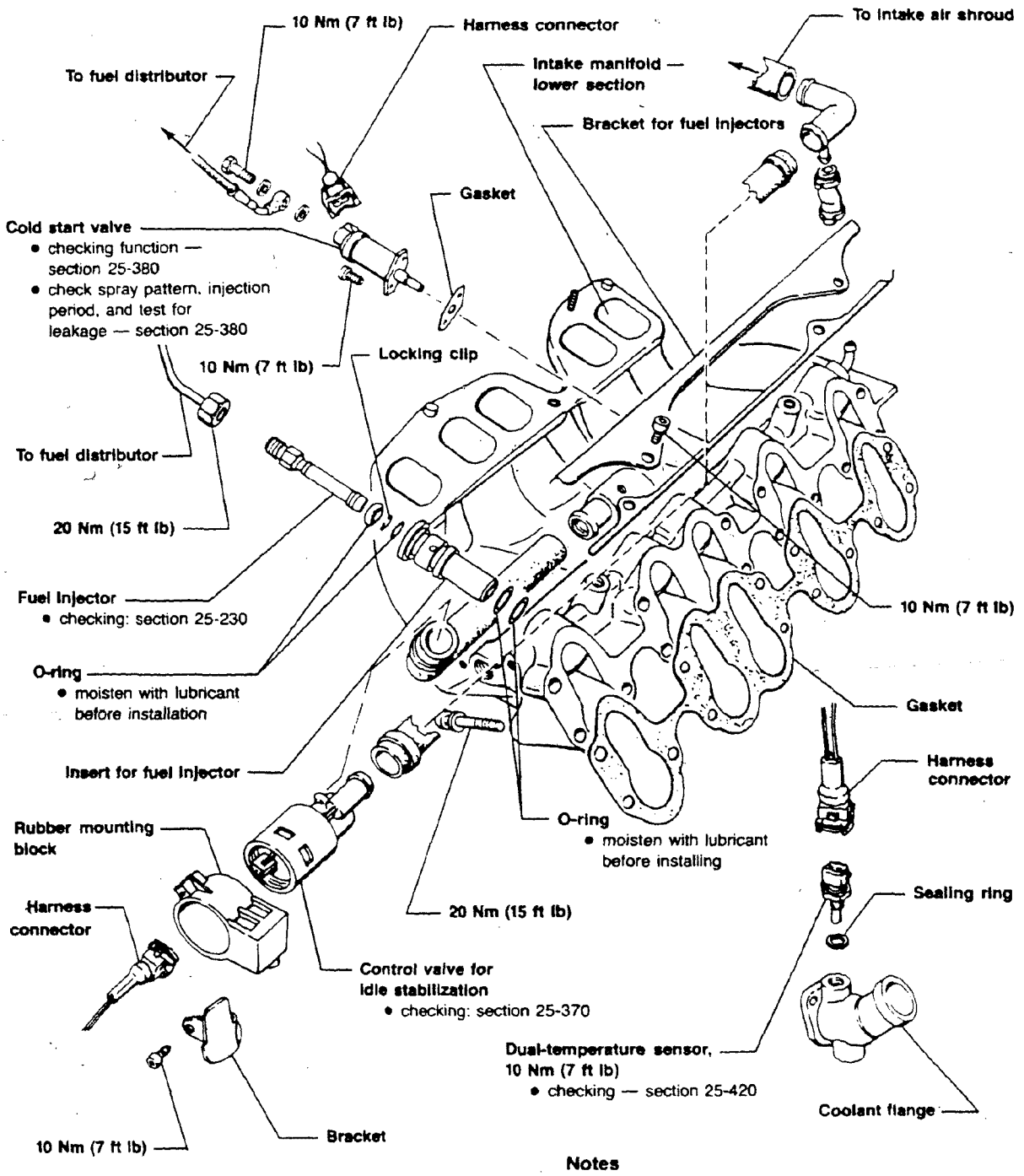
- replace seals and o-rings during reassembly
- secure hose connections with either screw clamps or new spring clamps
- electrical components require 11.5 volts minimum for proper operation



WARNING

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

25-1084



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

System precautions

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

Rules of cleanliness

CAUTION

First:

- clean connecting points before loosening

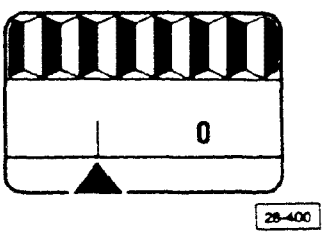
When fuel system is open

- 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

Technical data

Starting 1987 M.Y.		U.S.A.
Engine code		NG
Introduction date		8-87
Fuel injection control unit	49 states**	443 906 264 C
	California**	443 906 264 B
Ignition control unit	49 states**	443 907 397 C
	California**	443 907 397 E
Ignition distributor		034 905 205 H
RPM cutoff (upper limit) (VIA CIS-E III control unit)		6600 ± 100 RPM
Ignition timing	checking value	13-17° Before TDC
	adjusting value	15 ± 1° Before TDC
Timing mark location: ON flywheel		 28-400
Firing order		1-2-4-5-3
Spark plugs	Bosch	W7DTC
	Electrode gap mm (in.)	0.8 ± 0.1 (0.031 ± 0.004)
	Tightening torque Nm (ft lb)	20Nm (15 ft lb)
Idle RPM*	manual transmission RPM	790 ± 70
	automatic transmission RPM	790 ± 70
CO-content (oxygen sensor probe disconnected)	checking value	0.3-3.0 vol. %
	adjusting value	0.6-1.0 vol. %

*Idle speed can **NOT** be adjusted using air screw on throttle body, idle is regulated by CIS-E III control unit
**Do NOT mix California and 49 state control units with one another.

CAUTION

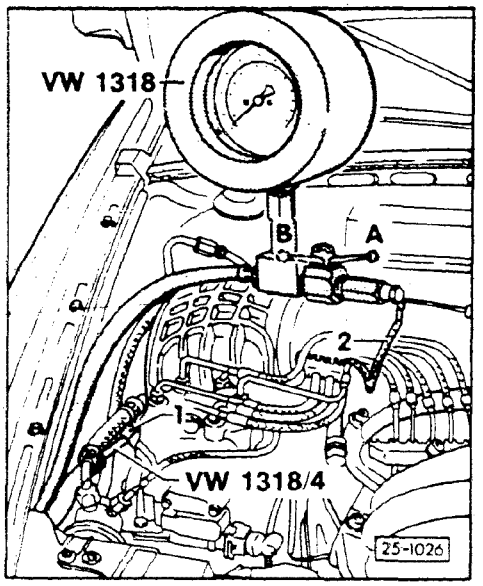
Part numbers are for reference only. Always consult with the Parts Department for the latest information.

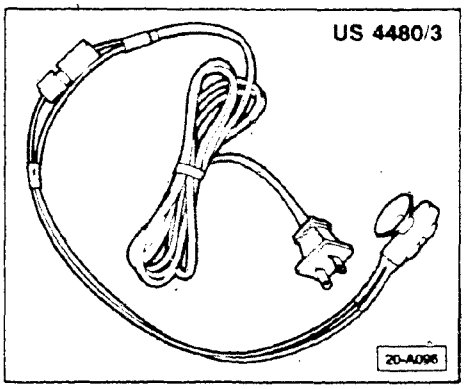
CAUTION

Idle speed, ignition timing and CO are interrelated and must be checked and adjusted together.

Fuel pressure measurement, technical data

Engine code	NG
System pressure with pressure gauge shut-off (in **closed** position) bar (psi)	6.1-6.5 (88.5-94)
Pressure differential 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)
Injection valves	
permissible difference between set of fuel injection valves:	
Idle speed (first stop on tool VW 1348/1) • at 20 ml fuel quantity measured with **US 4480**	maximum 2.5 ml fuel
full throttle (last stop on tool VW 1348/1) • at 80 ml fuel quantity measured with **US 4480**	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





Fuel pressure, checking

Connecting VW 1318 pressure tester

Note

Use all new sealing rings. Observe the safety precautions, section 25-200.

- connect pressure tester **VW 1318** to measuring location 1 on fuel distributor using adaptor **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, checking

- 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.

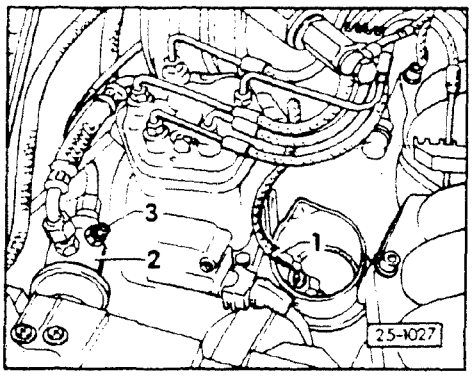
Differential pressure Part I, checking

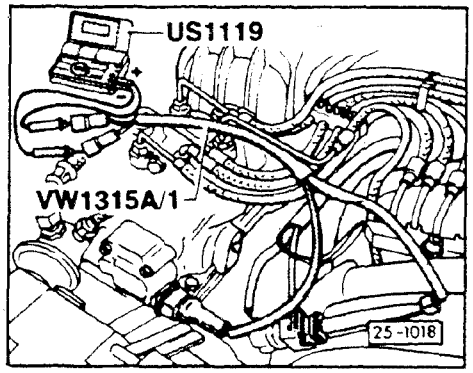
- close valve on **VW 1318** pressure gauge

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**

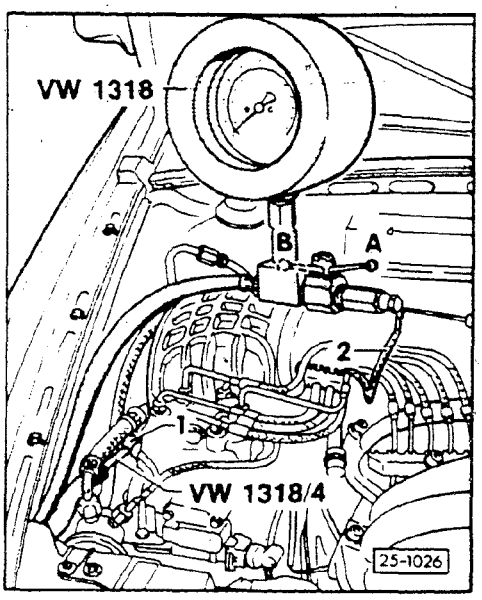
- replace differential pressure regulator
- reconnect fuel line to fuel pressure regulator

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.



Residual pressure, checking

Note

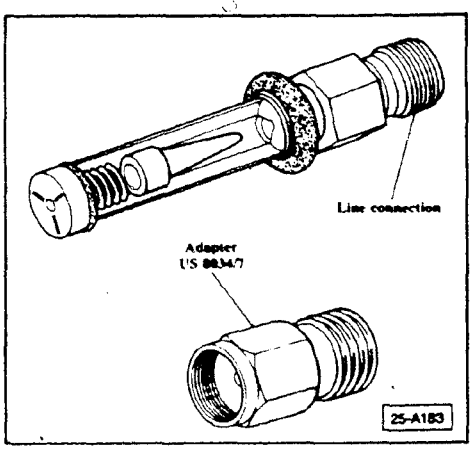
This procedure is required only for hot start problems.

- 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 section 25-250-3
- 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**.

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 25-236 "**Metal Tipped Injectors**, Cleaning and Checking"

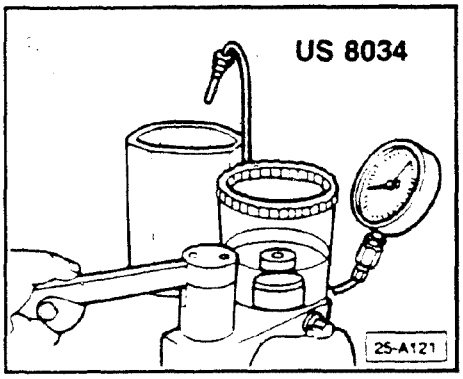
> **CAUTION**
>
> Part Numbers are for reference only. Always consult with the Parts Department for the latest information.

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 tests should not be performed on these injectors because the results cannot be used to determine acceptability

Cleaning/checking



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**

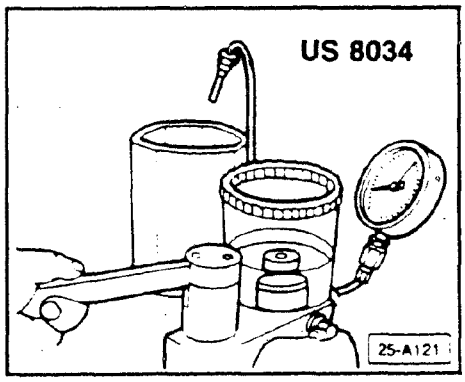
- replace injector

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.

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**

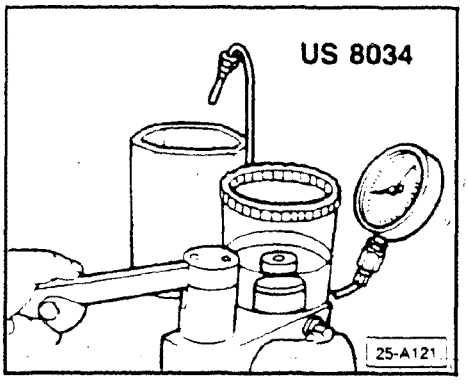
- injector may be contaminated or varnished

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

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.

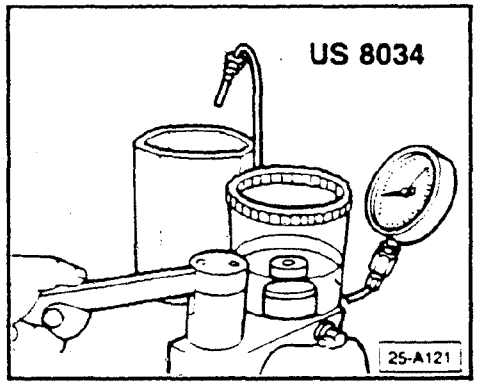
- use following chart (based on length of time injector has been removed from the fuel system) to determine acceptable opening pressures

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

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 the shipping or handling.

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.

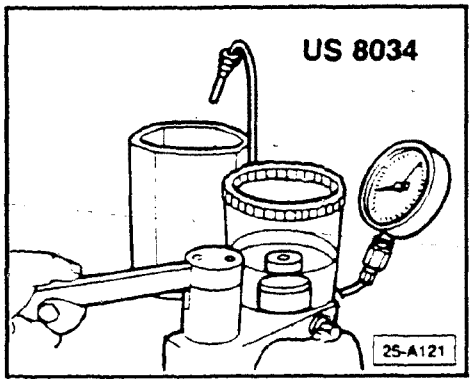
- see section 25-235 "**Viton Tipped Injectors**, Cleaning and Checking"

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

Any other Part Number indicates that it is metal tipped.

Notes regarding metal tipped injectors:

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



Cleaning/checking

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**

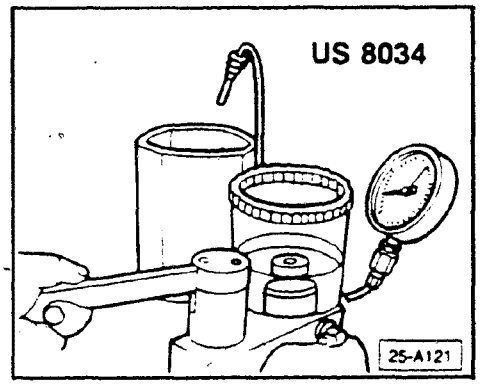
- replace injector

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.

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 tester
- 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 operating tester with 20 to 30 vigorous strokes
- repeat contamination check

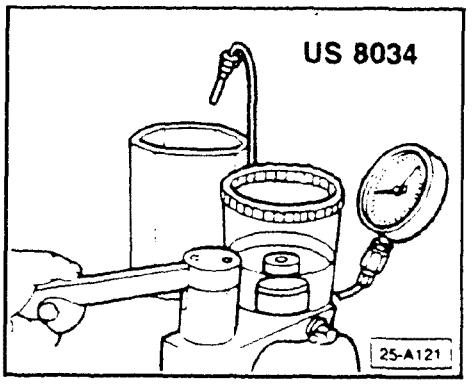
If still below specification,

- 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

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),

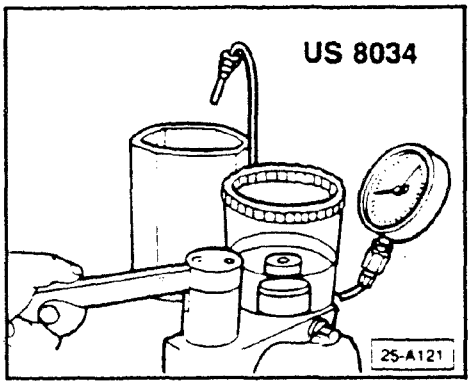
- replace entire set of injectors with Viton tipped

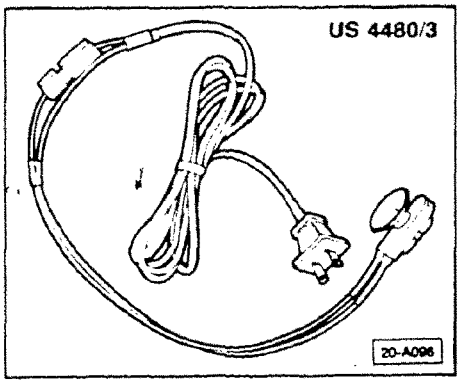
If spray is solid (not atomized),

- 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.





Injection quantity, comparative measurement

Check this first:

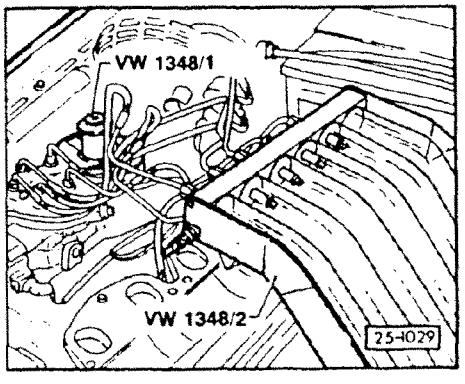
- fuse No. 13 **OK**

- remove fuel pump relay from fuse relay panel (position No. 10)
- connect **US 4480/3** remote control

- remove intake manifold (upper section) see section 25-190-4 (for exploded view)
- remove injector bracket

WARNING

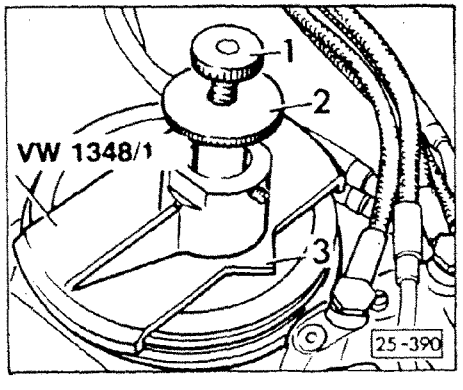
Fire hazard. Do not smoke or have anything in area that can ignite fuel



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

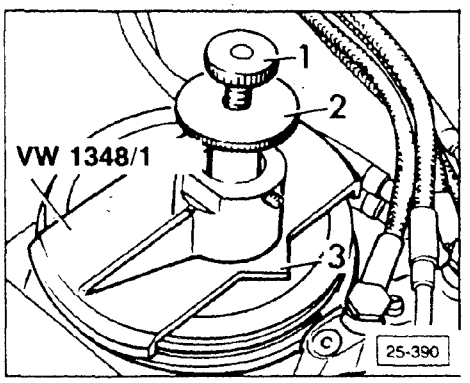
Note

Carefully route the fuel lines to avoid pinching and bending.



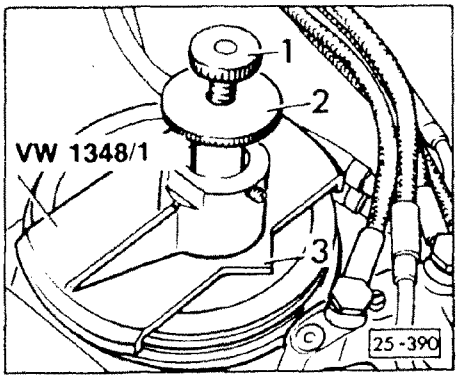
- turn and lift adjusting screw **1** and slide **2** into upper (full throttle) position on **VW 1348/1**
- place **VW 1348/1** centrally on edge of airflow sensor assembly
  - pointer **3** faces to center of fuel distributor

- 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



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



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**

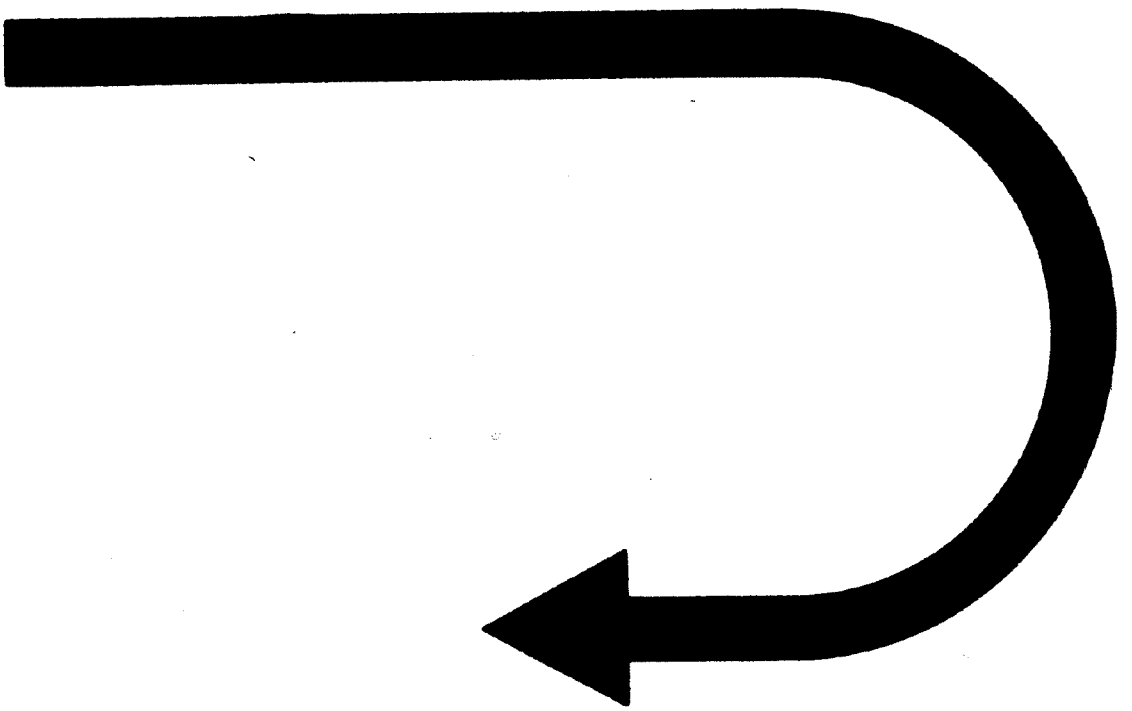
- briefly lift sensor plate up once, fully and repeat test
- compare amount of fuel for all injectors (keep measuring device vertical)
- permissible difference between fuel quantity in all flasks must be not more than **8.0 ml fuel**
  - if fuel in flasks differs between high and low more than 8.0 ml, 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

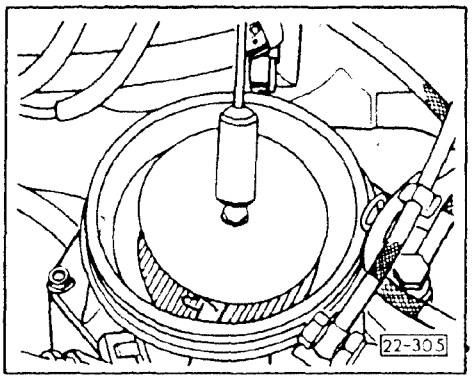
Immediately after measuring, test injectors for leaks:

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

CONTINUED IN THE

BEGINNING OF NEXT ROW





Air flow sensor, 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

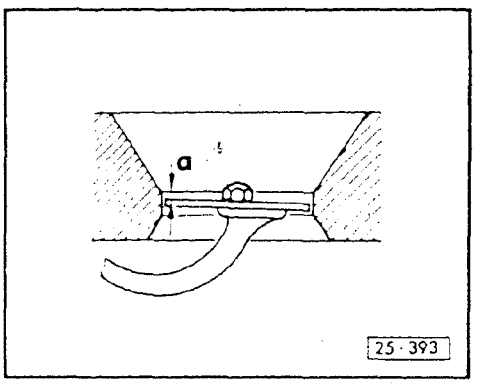
- using pliers or a magnet, lift sensor plate through entire range of lever and control plunger travel
  - an even resistance must be felt

- 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

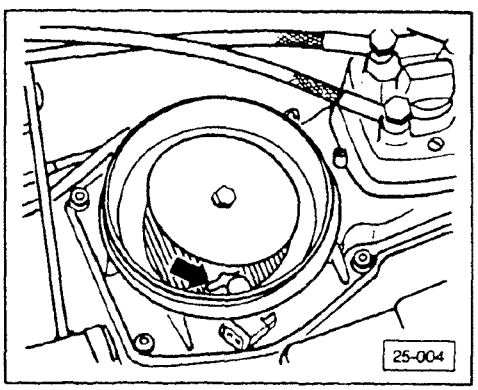


Air flow sensor plate rest position, checking/adjusting

Checking

- upper edge of air flow sensor plate must be below lower edge of air cone
  - a = 1.9 to 3.0 mm (0.875 to 0.118 in)

Adjusting



- raise air flow sensor plate

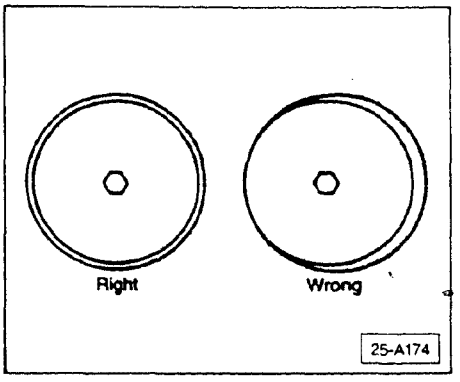
- adjust position of sensor plate by bending wire clip (**arrow**)

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.



Sensor plate/sensor lever, centering

Note

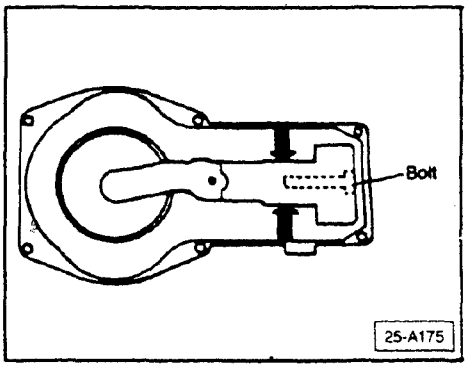
Sensor plate must be centered in air cone. Plate edges must not touch sides of air cone or free movement of plate will be restricted.

Sensor plate, centering

- 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)

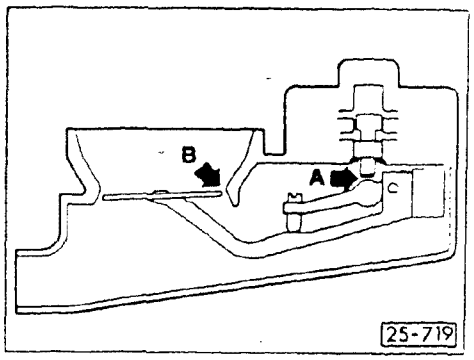
If plate cannot be centered

- remove air sensor housing and center sensor lever



Sensor lever, centering

- 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



Air flow sensor plate 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

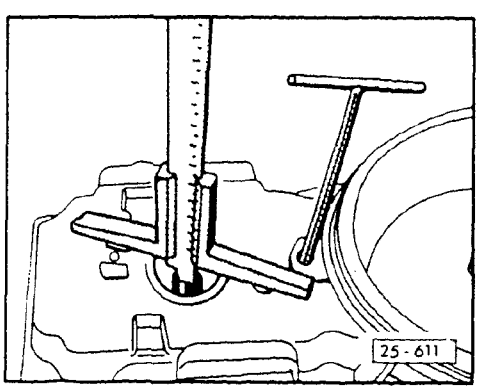
- actuate starter for 10 seconds (with coil wire disconnected and grounded) or remote control **US 4480/3** for 10 seconds to energize fuel pump
- slightly lift air flow sensor until resistance is felt
  - minimum clearance: 1.0 mm (0.039 in)
  - maximum clearance: up to venturi cone 3.0 mm (0.118 in)

If clearance **NOT OK**
- perform sensor plate free play, adjusting with control plunger stop screw, section 25-250-5

Sensor plate lever, basic adjustment

Note

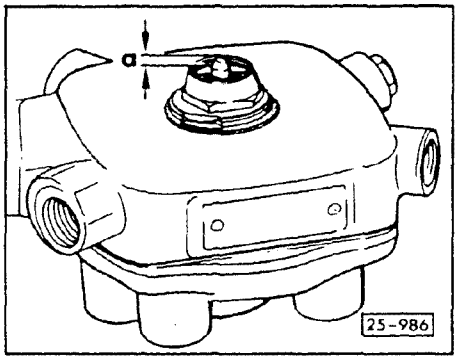
Always perform basic adjustment of lever when replacing fuel distributor or air flow sensor.



- 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.



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

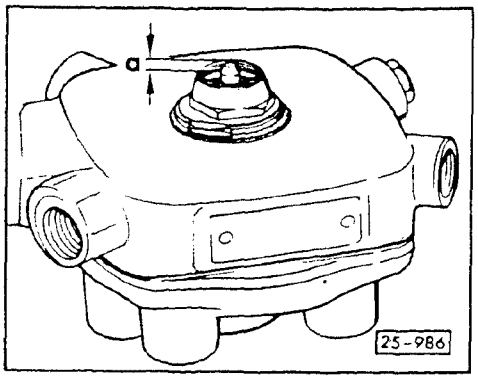
Stop screw sealing ring, replacing

- 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



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

Potentiometer, checking/adjusting

CAUTION

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

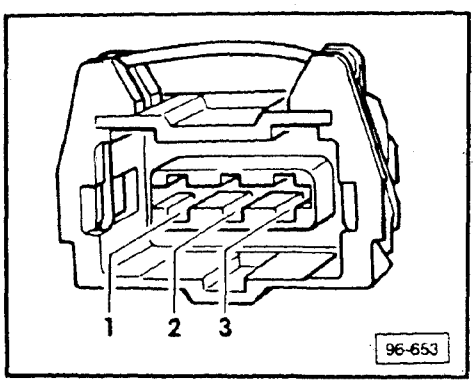
The potentiometer is to be replaced **ONLY** with the airflow sensor as an assembly.

Check the potentiometer if any of the following conditions are observed:

- fault code **2232** is displayed
- idle speed increases
- engine speed fluctuates at idle

Requirements

- engine oil temperature 80°C (176°F) minimum
- fault code display has been initiated
- valve cover gasket is tight and oil dipstick 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 while taking measurements
- ignition timing point and CO content **OK**
- **NO** intake air leaks

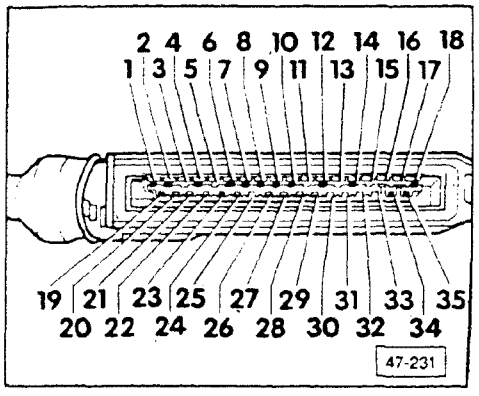


Checking

- disconnect potentiometer harness connector
- switch multimeter **US 1119** to 200 ohm range and connect between terminal **3** and ground
  - 0 to 0.8 ohms

If **NO**

- repair break in wiring between connector and control unit using wiring diagram
- switch multimeter to 20 volt range and connect between terminals **1** and **3**

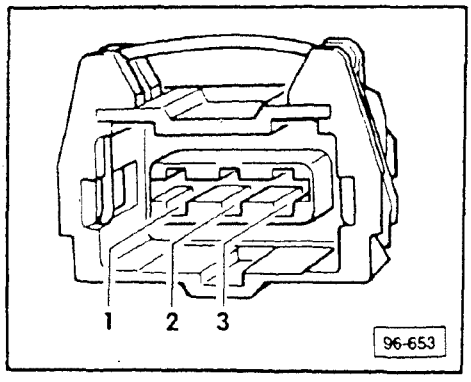


- switch **ON** ignition
  - 4.35 to 5.35 volts (record value)

If **NO**

- check potentiometer wiring as follows:
- switch **OFF** ignition
- remove trim from glove compartment
- push locking knob for control unit and pull out control unit from below

- remove harness connector from fuel injection control unit



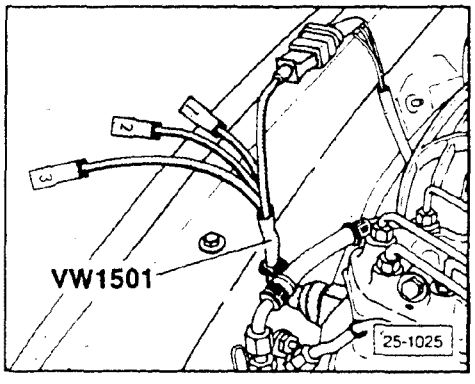
- switch **US 1119** to ohms scale and check continuity between the potentiometer harness connector and fuel injection control unit harness connector as follows:

Potentiometer harness connector terminals	Fuel injection control unit harness connector terminals
1 ⟷	26
2 ⟷	23
• 0.0 to 0.8 ohms	

If **NO**

- check for break in wiring using wiring diagram

If **YES**



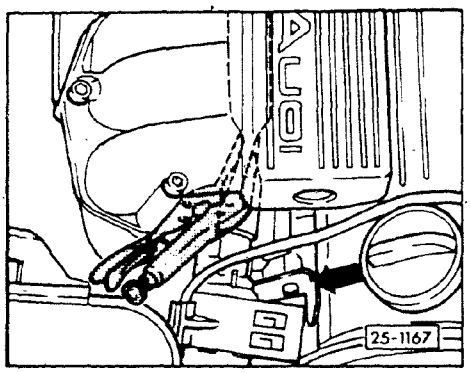
- connect test adapter **VW 1501** between potentiometer and potentiometer harness connector
- switch multimeter to 2 volts range and connect to terminals **2** and **3** of test adapter **VW 1501**
- switch **ON** ignition
  - (with airflow sensor plate in rest position): 0 to 200 mV

- connect engine tester **VW 1367**

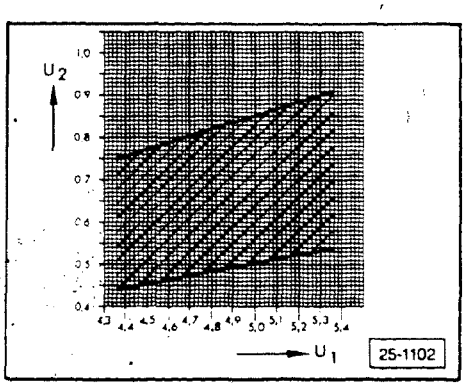
CAUTION:

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 completed)
- start engine and run at idle
- remove harness connector from idle stabilizer
  - engine speed must increase



- remove idle stabilizer valve from mount
- clamp upper hose with pliers until an engine speed of 800 ± 20 RPM along with an ignition angle of 13 to 17° BTDC is displayed on the **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**

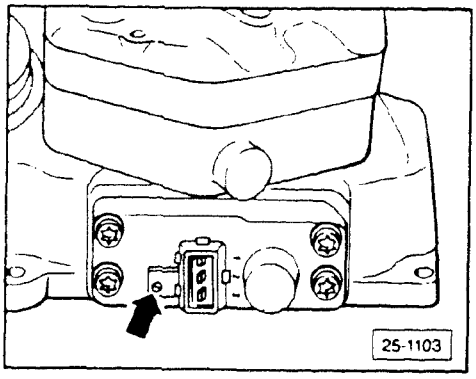
U2 = output voltage of potentiometer between terminals **2** and **3** (measured with engine at idle, 800 ± 20 RPM)

If the U2 measures slightly below the lower tolerance range of 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

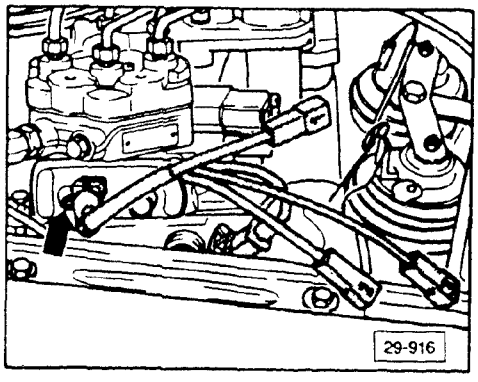
- adjust potentiometer



Potentiometer, adjusting

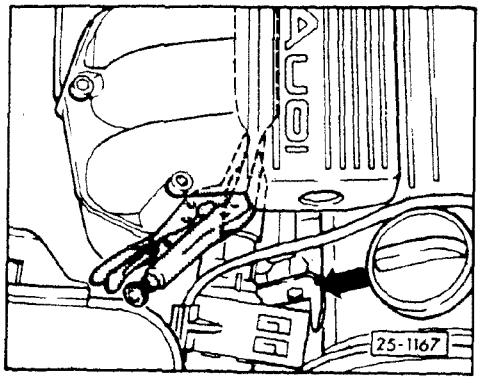
- switch **OFF** ignition
- remove test adapter **VW 1501** from potentiometer
- reconnect idle stabilizer valve harness connector

- carefully remove sealing compound from potentiometer trim screw (**arrow**)

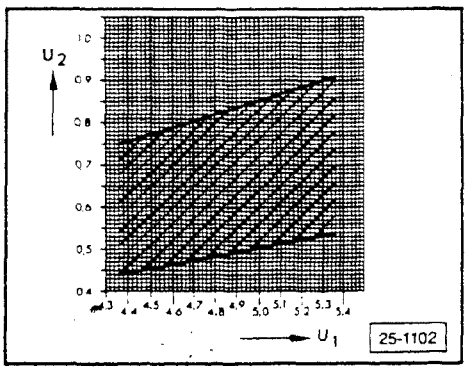


- reconnect test adapter **VW 1501** between potentiometer (**arrow**) and potentiometer harness connector
- switch multimeter to 2 volts scale and connect to terminals **2** and **3** of test adapter **VW 1501**

- start engine and run at idle
- remove harness connector from idle stabilizer valve



- clamp upper hose with pliers until an engine speed of 800 ± 20 RPM is indicated on **VW 1367**, secure pliers at this setting



- adjust potentiometer trim screw until voltage value (U2) falls within the outlined area of the 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

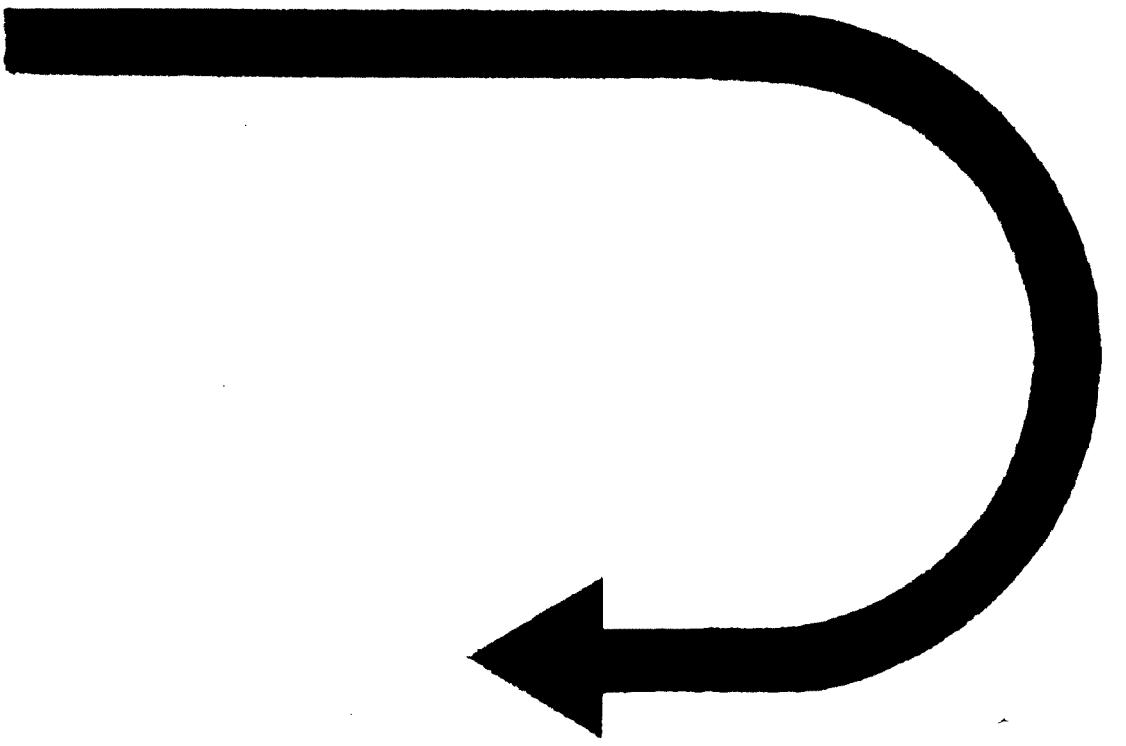
NO potentiometer adjustment is necessary if the air flow sensor assembly is replaced.

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

- apply sealing paint to potentiometer trim screw

CONTINUED IN THE

BEGINNING OF NEXT ROW

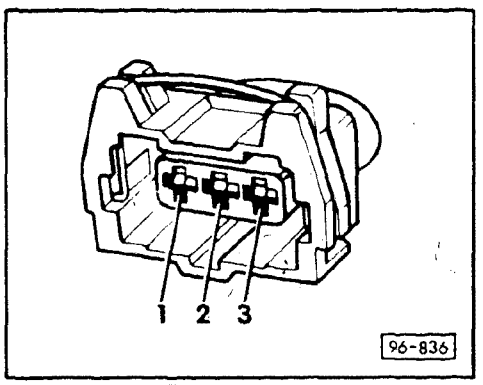


Throttle valve potentiometer (G 69), checking/adjusting

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

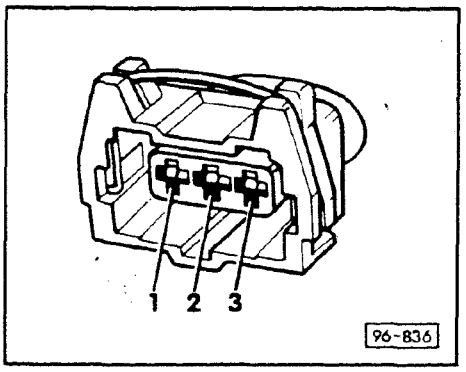
If all voltage readings are obtained,

- 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

I-2



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.

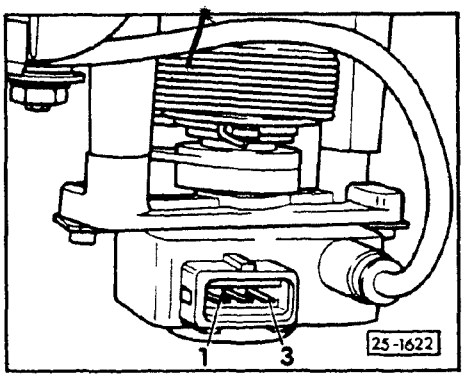
If wiring **OK**

- replace automatic transmission control unit (**J 217**)

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

Resistance Checking

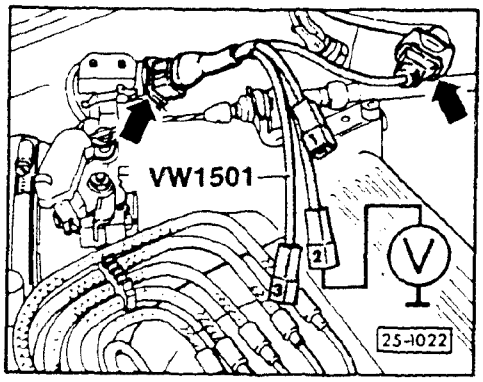
- switch **Fluke 83** multimeter to resistance range



- 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**)



Idle and full throttle switches, checking/adjusting

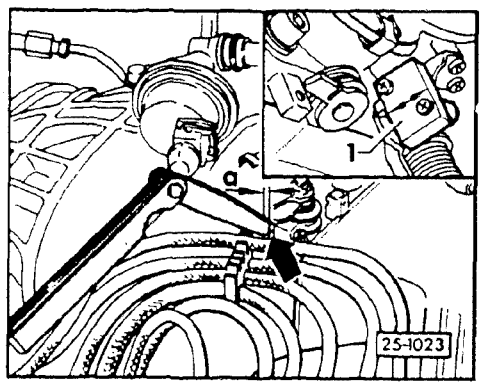
Voltage supply for idle and full throttle switch, checking

- remove harness connector to idle and full throttle switch on throttle body (**arrow**) and connect test adaptor **VW 1501** between throttle switch and harness connector
- connect multimeter **US 1119** between terminal **2** of **VW 1501** adaptor and engine ground
- switch ignition **ON**
  - approximately 12 volts

If **NO**
- repair break in wiring according to wiring diagram

Idle switch, checking (Fault code 2121)

- connect multimeter **US 1119** between terminal **1** of **VW 1501** and ground
  - approximately battery voltage
- switch **US 1119** multimeter to ohms range
- move throttle valve 0.5 to 0.7 mm (0.020 to 0.028 in)



Note

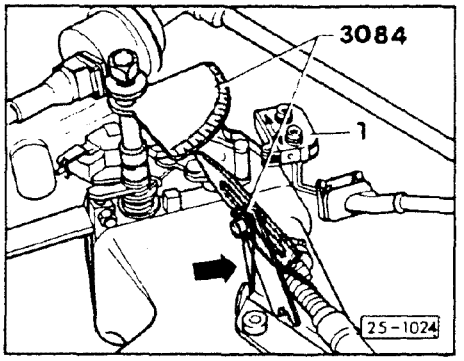
This measurement is made with a feeler gauge between the throttle valve stop and the adjustment screw.

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

Adjusting

If **NO**
- adjust idle switch (gap "**a**")
  - specification:
    .15 to .5 mm (0.006 to 0.020 in)

If **YES**
- check full throttle switch

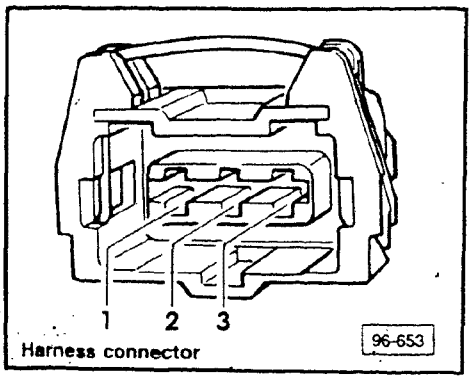


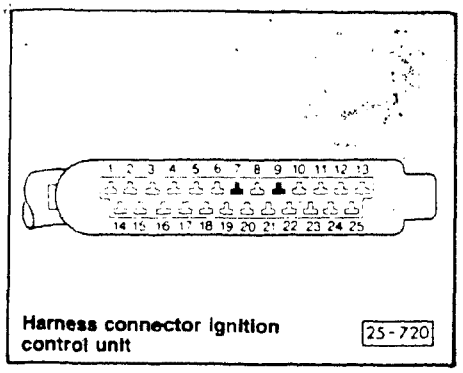
Full throttle switch, checking (Fault code 2123)

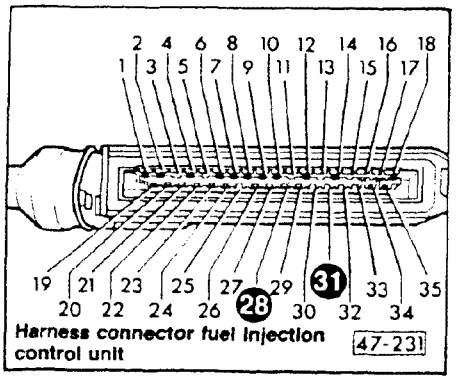
- connect multimeter **US 1119** between terminal **3** of throttle switch and ground
  - approximately battery voltage
- fasten pointer for protractor **3084** to adjuster for accelerator cable (using a rubber band, see **arrow**)
- screw **3084** protractor **3084** onto throttle shaft (unscrew nut on throttle shaft if necessary)
- push throttle lever to full open (at stop limit) and zero pointer + disc
- close throttle to approximately 30°, then slowly move toward full throttle position until full throttle switch engages (zero ohms indicated)
  - 10 ± 4° before contacting full throttle limit stop

If **NO**

- replace and adjust full throttle switch







If **YES**

- check wiring between throttle switch harness connector and fuel injection control unit harness connector as follows:
- remove harness connector from fuel injection control unit
- pull out electronic ignition control unit
- using multimeter check continuity between throttle switch harness connector and control unit harness connector terminals as follows:

throttle switch harness connector	ignition control unit harness connector
1	7
3	9

- approximately 0.2 ohm

throttle switch harness connector	*fuel injection* control unit harness connector
1	28
3	31

- approximately 0.2 ohm

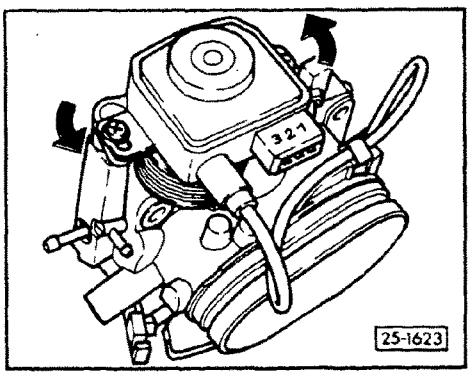
If **NO**

- repair break in wiring using wiring diagram

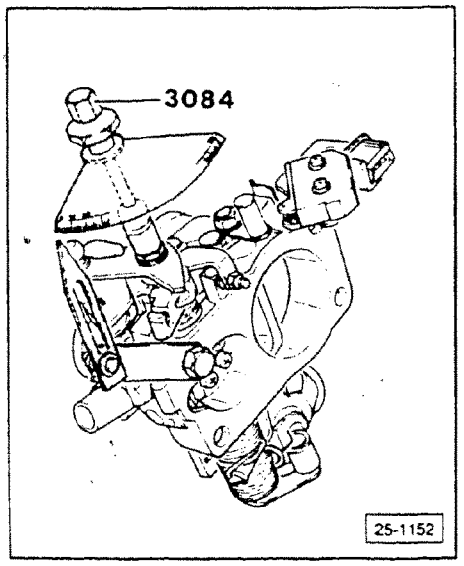
Idle (F 60) and full throttle switches (F 81), checking/adjusting

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



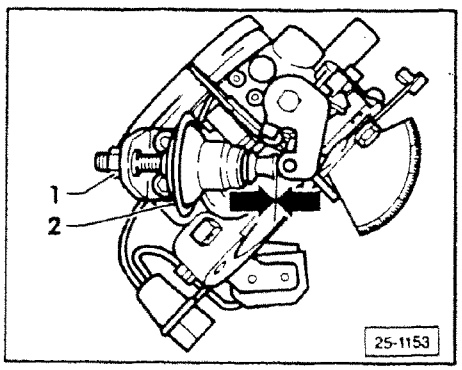
Throttle body dashpot, adjusting

Note

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

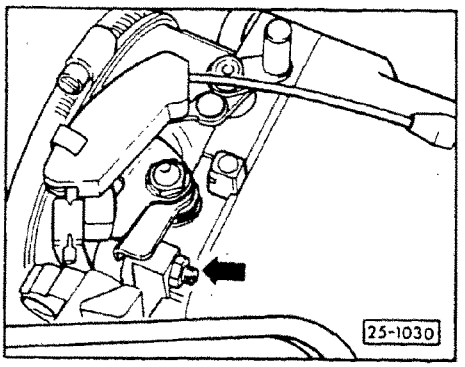
- fasten pointer for protractor **3084** to throttle body (using a spare nut and bolt)
- thread protractor onto throttle shaft, if necessary remove throttle shaft nut
- zero the pointer/protractor

- 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 locknut
- recheck, adjustment, re-adjust if necessary



Throttle valve, basic adjustment

Note

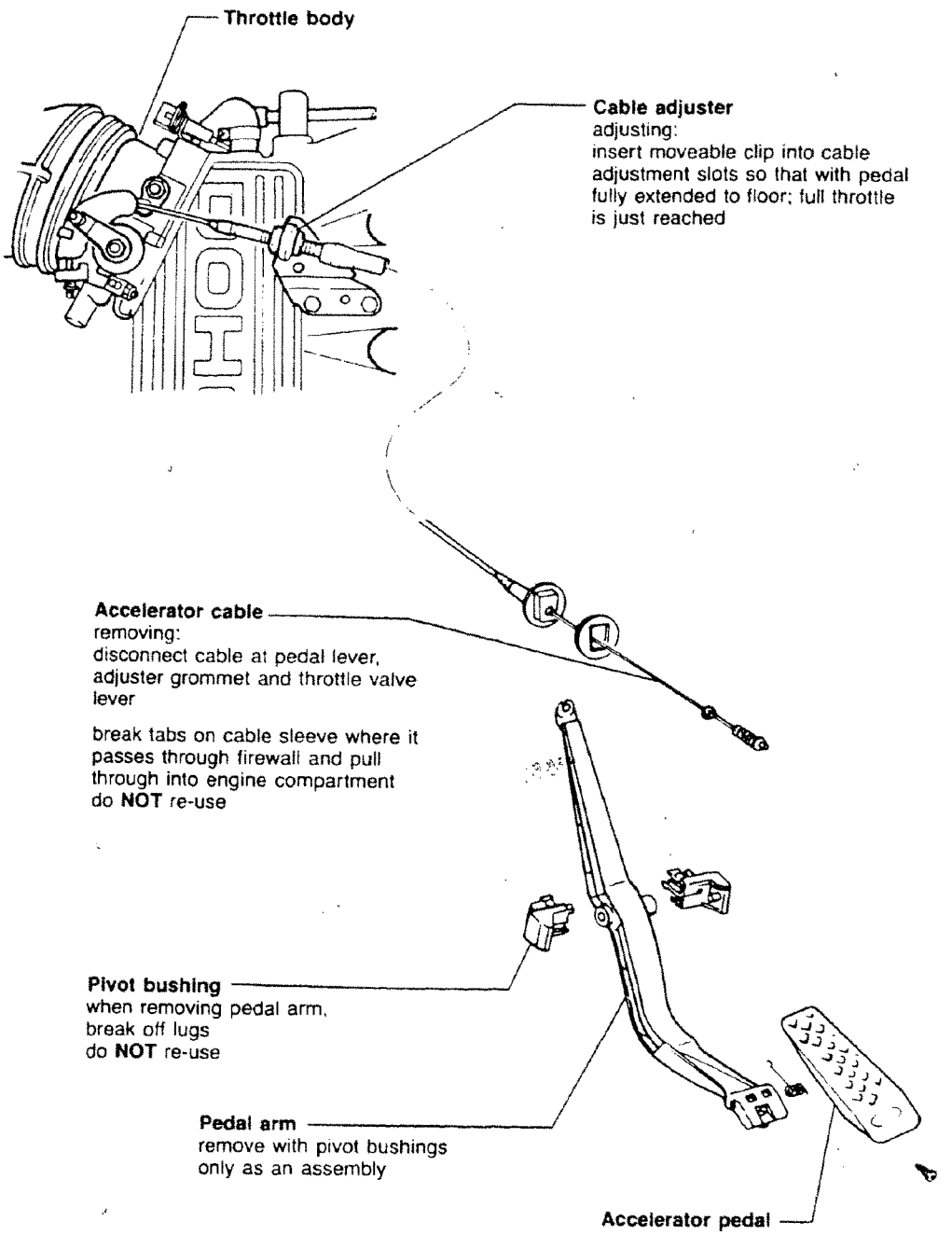
Stop screw is set at factory and **should not be moved**. If screw position has been altered, check basic adjustment as follows:

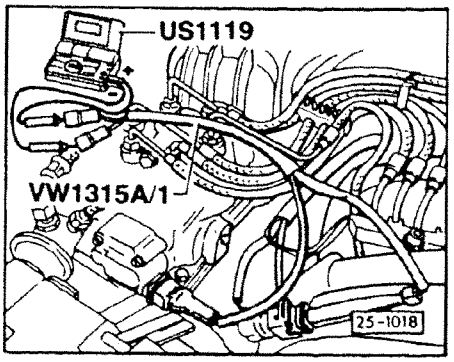
- turn throttle stop screw counterclockwise until gap occurs between stop and screw
- turn screw (**arrow**) in until it touches stop

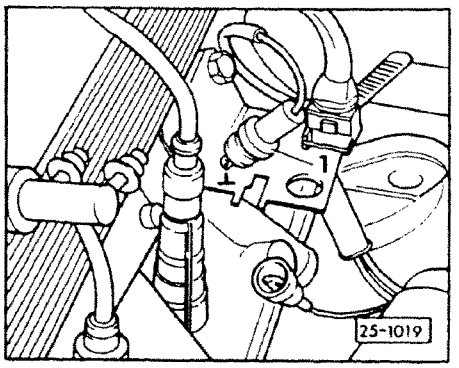
Note

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


Throttle body
Cable adjuster
adjusting:
insert moveable clip into cable adjustment slots so that with pedal fully extended to floor; full throttle is just reached
Accelerator cable
removing:
disconnect cable at pedal lever, adjuster grommet and throttle valve lever
break tabs on cable sleeve where it passes through firewall and pull through into engine compartment
do NOT re-use
Pivot bushing
when removing pedal arm, break off lugs
do NOT re-use
Pedal arm
remove with pivot bushings only as an assembly
Accelerator pedal
20-664





Oxygen sensor, checking (Fault code 2341)

Control system, checking

Check these first:

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

▶ ■ connect multimeter **US 1119** to differential pressure regulator, using adaptor **VW 1315 A/1**
■ run engine at idle

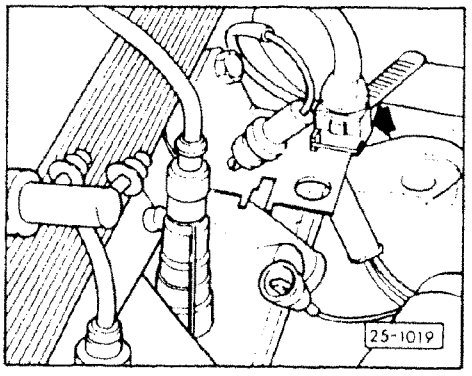
▶ ■ disconnect oxygen sensor connector, (single connector with green wire)
■ touch green oxygen sensor wire (1) to ground
- after approximately 15 seconds, differential pressure regulator current must increase to approximately 10mA

If **NO**
■ check wiring between fuel injection control unit and oxygen sensor harness connector (using wiring diagram)

If **NO** break in wiring is found
■ replace fuel injection control unit

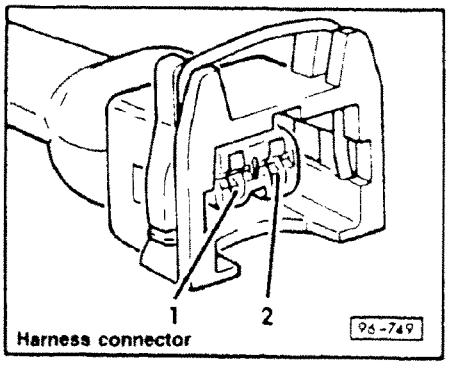
■ reconnect oxygen sensor green wire
■ start engine
■ raise engine speed briefly to 3000 RPM (to warm oxygen sensor)
- differential pressure regulator current must return to original mA value, then it **must** fluctuate

If **NO**
■ replace oxygen sensor



Oxygen sensor heating, checking

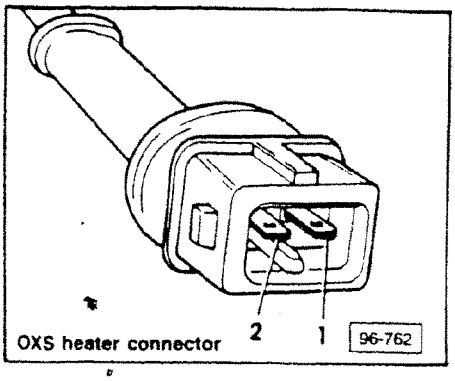
- disconnect oxygen sensor heating element connector from harness connector (**arrow**)



- connect multimeter **US 1119** between harness connector terminals **1** and **2**
- switch ignition **ON**
  - approximately 12 volts

If **NO**

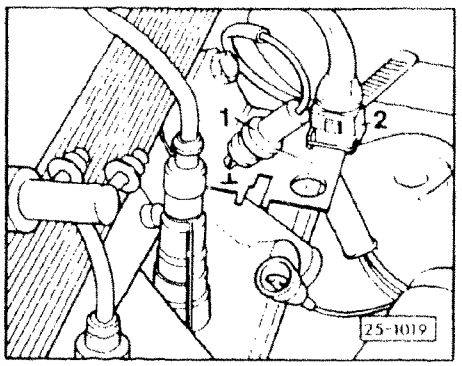
- repair break in wiring using wiring diagram



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

If **NO**

- replace oxygen sensor

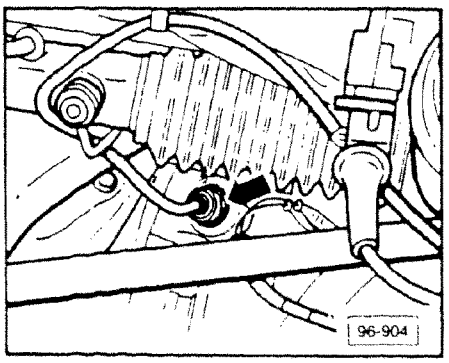


Oxygen sensor, removing and installing

Note

Replace the oxygen sensor at 60,000 miles
An OXS mileage counter is not used.

- disconnect oxygen sensor lead (**1**)
- disconnect oxygen sensor heater connector (**2**) from harness connector



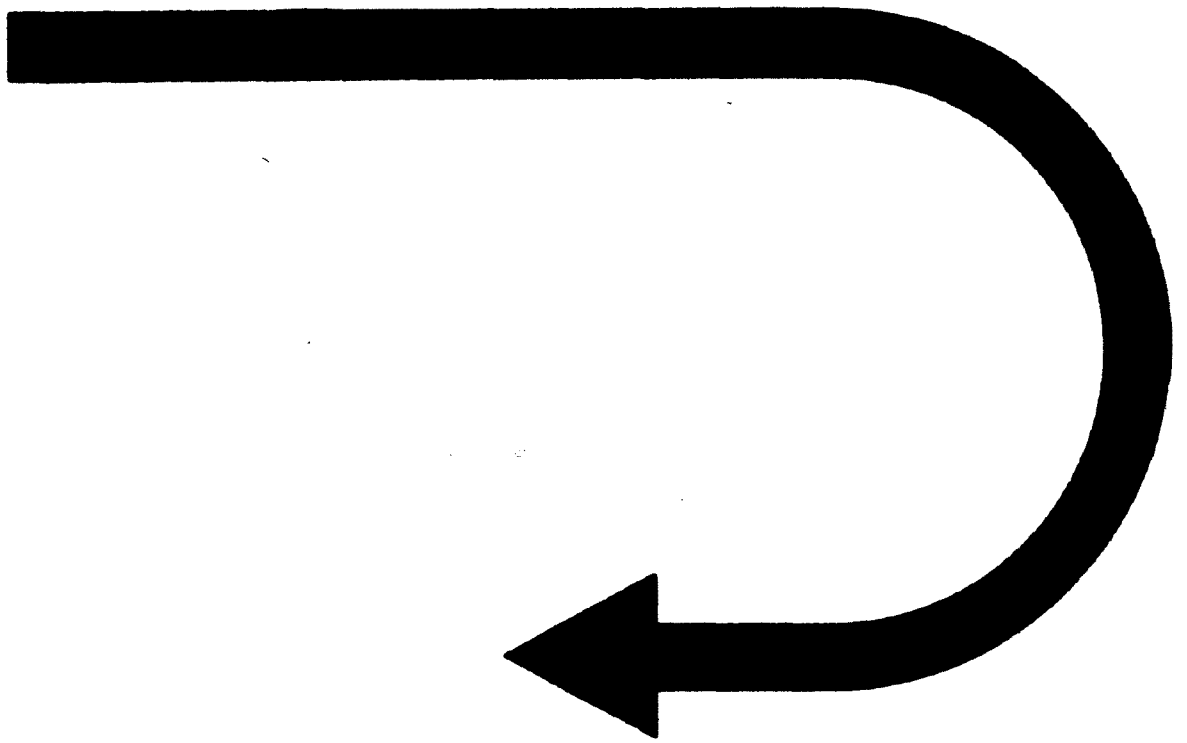
- unscrew oxygen sensor (**arrow**) from exhaust (just ahead of catalyst)
- installation is reverse of removal procedure

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.

CONTINUED IN THE

BEGINNING OF NEXT ROW



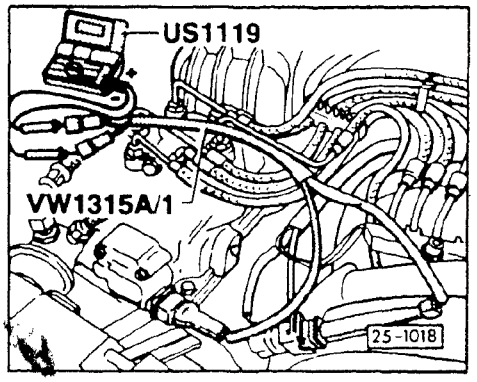
Acceleration enrichment, checking

Check these first:

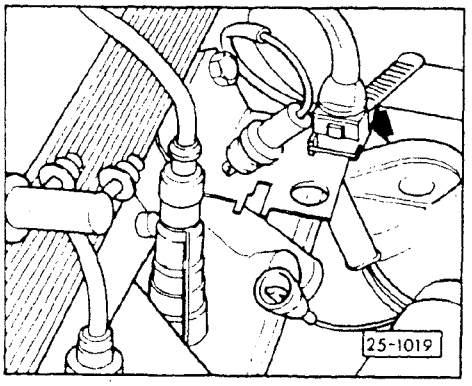
- Engine temperature maximum 30°C (86°F)
- Differential pressure regulator **OK**

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 has been grounded with a jumper wire.



▶ ■ connect multimeter **US 1119** to differential pressure regulator, using adaptor **VW 1315 A/1**



▶ ■ disconnect oxygen sensor harness connector **1**
■ run engine at idle
- 1 to 3mA

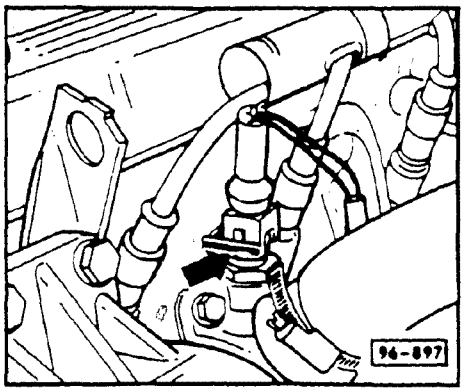
If **NO**
■ check coolant temperature sensor, section 25-420

- depress accelerator pedal briefly
  - differential pressure regulator current must increase to a minimum of 6mA

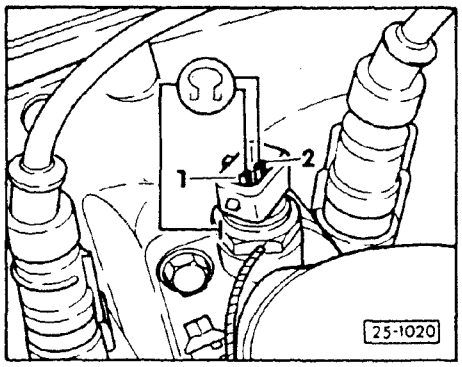
Note

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 minimum 6mA is **NOT** obtained
- shut off engine

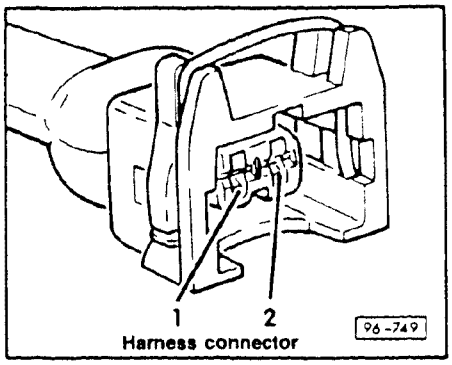


- disconnect coolant temperature sensor harness connector (**arrow**)



- 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 you measure 1 k Ohm or less at a coolant temperature of approximately 30°C (86°F):
- replace coolant temperature sensor
- repeat check



Harness connector

If **OK**

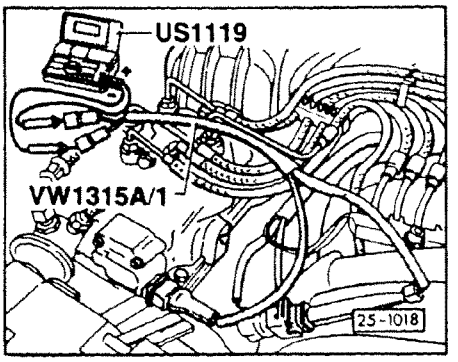
- remove harness connector from coolant temperature sender
- connect multimeter **US 1119** between terminal **1** of the harness connector and engine ground
- switch ignition **ON**
  - 4.5-5.5 volts
- repeat between terminal **2** and engine ground
  - 4.5-5.5 volts

If these voltages are **NOT** obtained

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

If voltages are **NOT** obtained and no break in wiring is found

- replace respective control unit



Deceleration fuel shutoff, checking

Check these first:

- Differential pressure regulator **OK** see output tests section 25-350
- Engine oil temperature minimum 80°C (176°F)

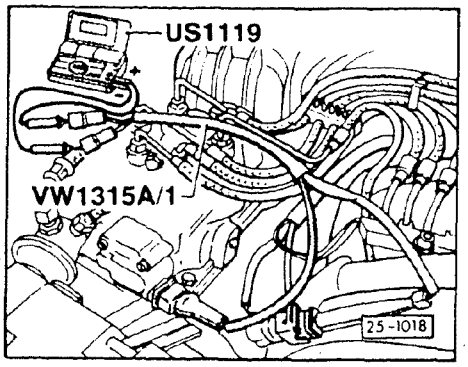
- connect multimeter **US 1119** to differential pressure regulator using test adaptor **VW 1315 A/1**
- run engine at idle
- raise engine speed to over 3000 RPM
- snap throttle shut
  - 1 second after closing throttle, differential pressure regulator current must decrease to −50 to −60mA

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

If **NO**

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

Troubleshooting CIS-E III, output checks

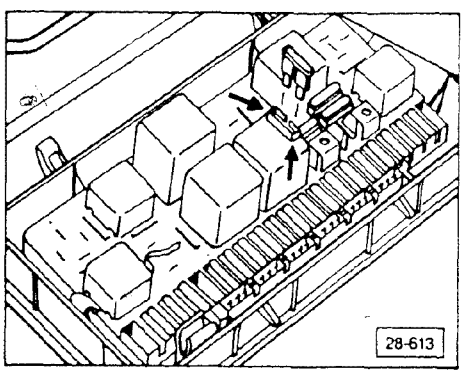


Note

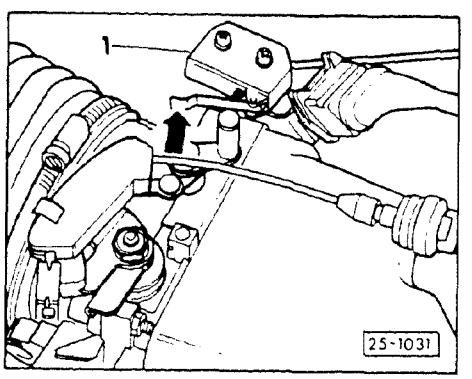
The following procedures describe output check activation for 1987 and 1988 vehicles using the fuel pump relay. For later models, see the **VAG 1551** procedures outlined in repair Group D2.

Do one after the other:

- connect multimeter **US 1119** to differential pressure regulator harness using adaptor **VW 1315 A/1**
- set meter to 200mA scale



- insert spare fuse in top of fuel pump relay (**arrows**)
- turn ignition **ON**, remove fuse after four seconds
  - fault indicator light will display **4341**

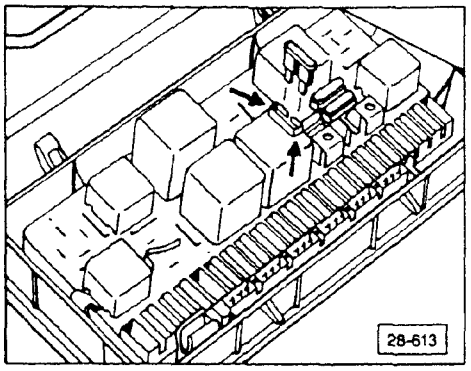


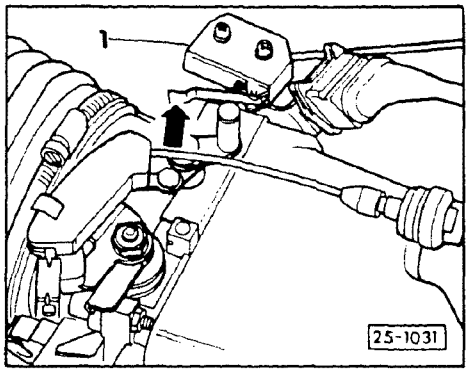
Differential pressure regulator check (code 4341)

- close full throttle switch (**arrow**)
  - *differential pressure regulator current* switches to 10mA (should be approximately 100mA with full throttle switch in open position)

If approximately 10mA is **NOT** obtained
- check differential pressure regulator

For detailed check, see section 25-350





Output checks

Carbon canister shutoff solenoid, check (output code 4343)

- re-insert spare fuse in top of fuel pump relay for four seconds (**arrows**), then remove
  - fault indicator light will display **4343**
- close full throttle switch
  - shutoff solenoid clicks on and off when full throttle switch is closed

For detailed check, see section 25-360

Idle stabilizer valve, check (output code 4431)

- re-insert spare fuse in top of fuel pump relay for four seconds (**arrows**), then remove
  - fault indicator light will display **4431**
- close full throttle switch (**arrow**)
  - idle stabilizer valve must cycle when full throttle switch is closed

For detailed check, see section 25-370

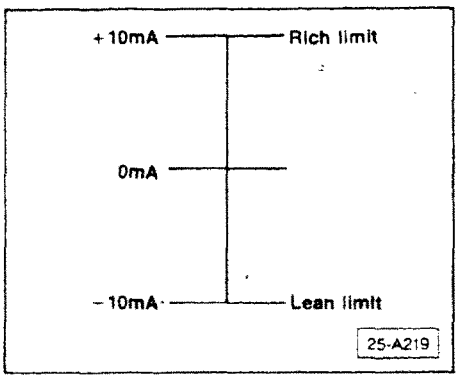
Cold start valve, check (output code 4443)

- re-insert spare fuse in top of fuel pump relay for four seconds (**arrows**), then remove
  - fault indicator light will display **4443**
- close full throttle switch
  - cold start valve clicks **ON** and **OFF** for a maximum of 10 seconds when full throttle switch is closed

For detailed check, see section 25-380

Note

If you find a problem with any of these components, first check the component for continuity using **US 1119** multimeter.



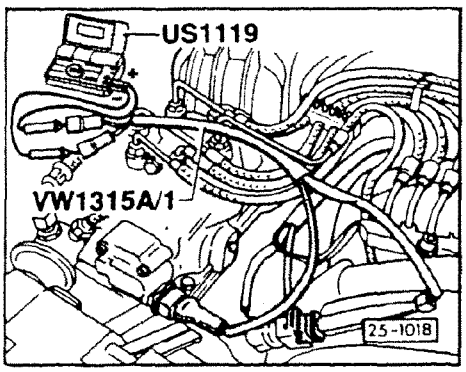
Differential pressure regulator control, checking (output code 4341)

Note

The following procedures describe output check activation for 1987 and 1988 vehicles using the fuel pump relay. For later models, see the **VAG 1551** *procedures outlined in repair Group D2.*

▶ **Note**

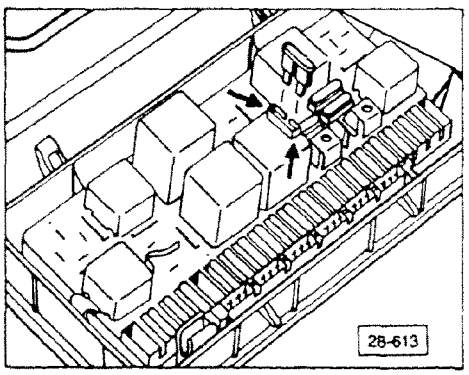
The operating range is +10mA to −10mA. The nominal CO adjusting point is 0mA. This insures better engine operation if an electrical failure should occur, by providing a fuel mixture which is in the range of the nominal setting.



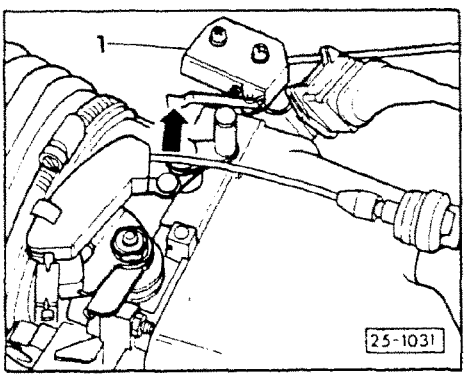
Check this first:

- ignition in **OFF** position

▶ ■ connect **US 1119** multimeter to differential pressure regulator with adaptor **VW 1315 A/1**. Set meter to 200mA DC scale

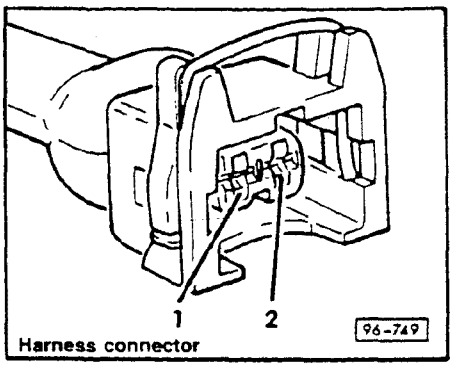


▶ ■ insert spare fuse in top of fuel pump relay (**arrows**)
■ turn ignition **ON**, remove fuse after 4 seconds
- indicator light displays **4341**

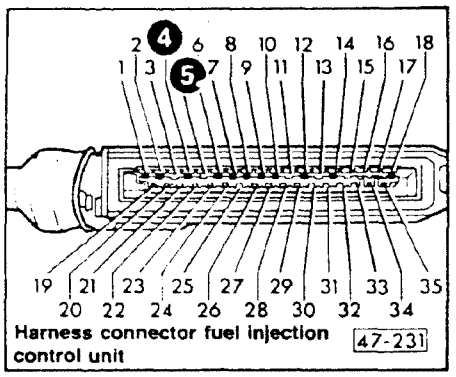


▶ ■ close full throttle switch (**arrow**)
- differential pressure regulator current switches to 10mA (is 100mA with full throttle switch open)

If **NO**
■ continue checking on Page 25.19



Harness connector



Harness connector fuel injection control unit

This check to be performed after check on previous page

- 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 **YES**
- replace differential pressure regulator

If **NO**
- disconnect fuel injection control unit harness connector
- with multimeter **US 1119**, check continuity between fuel injection control unit harness connector and differential pressure regulator harness connector

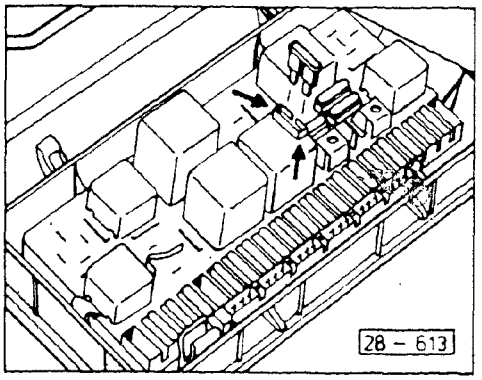
35 PIN connector		2 PIN connector
terminal **4**	⟷	terminal **1**
terminal **5**	⟷	terminal **2**

  - approximately 0.2 ohm

If **NO**
- repair break in wiring using wiring diagram

If **YES**
- replace fuel injection control unit

Carbon canister shut-off solenoid, output check (Output code 4343)



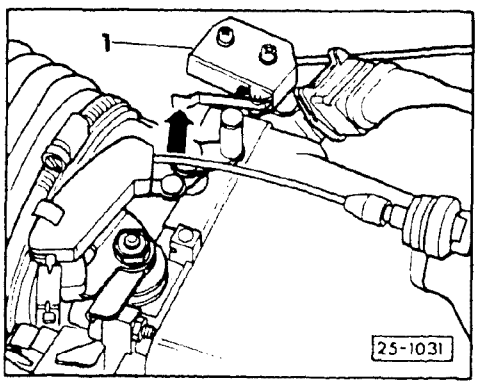
Note

The following procedures describe output check activation for 1987 and 1988 vehicles using the fuel pump relay. For later models, see the **VAG 1551** *procedures outlined in repair Group D2.*

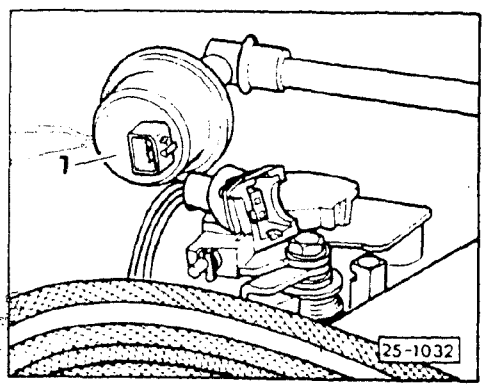
Check this first:

- Ignition switched to **OFF** position

▶ ■ *insert spare fuse in top of fuel pump relay* **(arrows)**
■ turn ignition **ON**, remove fuse after four seconds
■ re-insert fuse for four seconds, then remove
- fault indicator light displays **4343** code

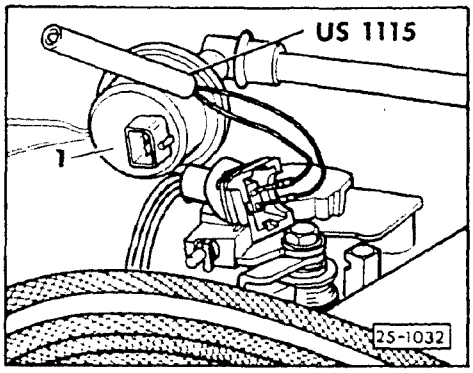


▶ ■ close full throttle switch **(arrow)**
- shut-off solenoid clicks **ON** and **OFF** when full throttle switch is closed



If **NO**

▶ ■ proceed as follows
■ disconnect carbon canister shut-off solenoid harness connector **(1)**

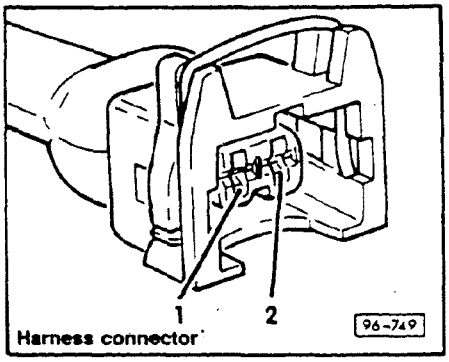


- connect LED tester **US 1115** to harness connector terminals **1** and **2** using jumper wire
  - **US 1115** must light up (blink)

If **YES**
- replace carbon canister shut-off solenoid

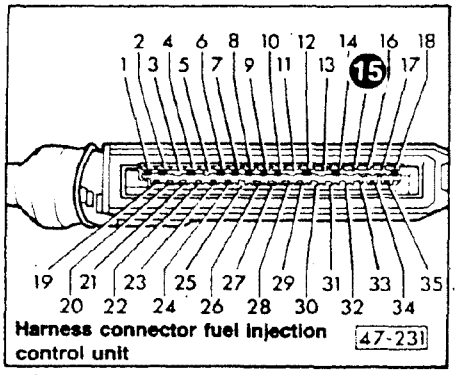
If **NO**
- connect multimeter US 1119 between terminal **1** of connector and ground
  - approximately 12 volts

If **NO**
- check wiring as follows



Harness connector

- disconnect harness connector from fuel injection control unit



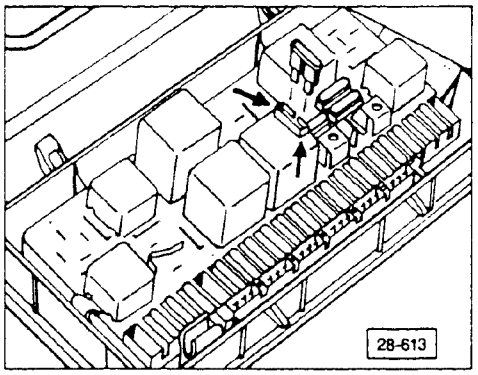
Harness connector fuel injection control unit

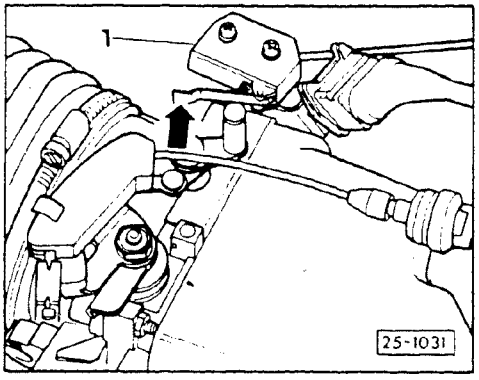
- with multimeter **US 1119**, check resistance between terminal **2** of the solenoid harness connector and terminal **15** of fuel injection control unit harness connector (35 pin)
  - approximately 0.2 ohm

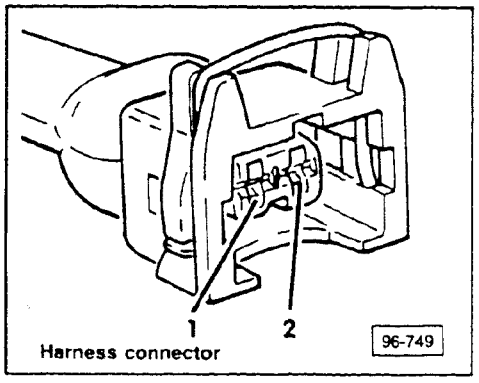
If **NO**
- repair break in wiring using wiring diagram

If **YES**
- replace fuel injection control unit

Idle stabilizer valve power, checking (Output code 4431)







Note

The following procedures describe output check activation for 1987 and 1988 vehicles using the fuel pump relay. For later models, see the **VAG 1551** procedures outlined in repair Group D2.

Check this first:

- Ignition switched to **OFF** position

▶
- insert spare fuse in top of fuel pump relay (**arrows**)
- 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 (**arrow**)
  - idle stabilizer valve must cycle (click)

If **NO**
- disconnect harness connector from idle stabilizer valve

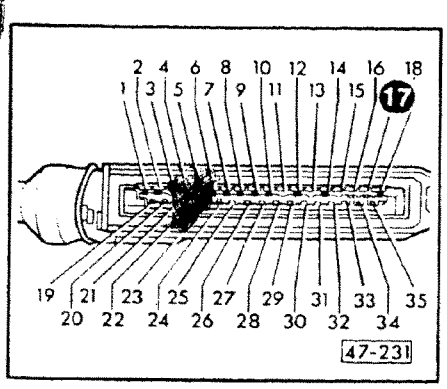
▶
- connect LED tester **US 1115** to terminals **1** and **2** of harness connector
- go step by step through the "output" tests until **4431** is displayed
  - **US 1115** LED tester must blink **ON** and **OFF**

If **YES**
- replace idle stabilizer valve

If **NO**
- connect multimeter **US 1119** between terminal **2** of harness connector and engine ground
  - approximately 12 volts

If **NO**
- repair break in wiring using wiring diagram

If **YES**
- switch ignition **OFF**

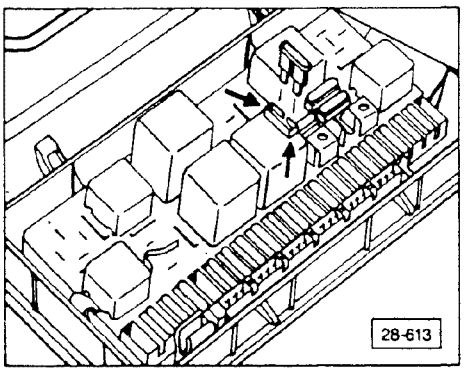


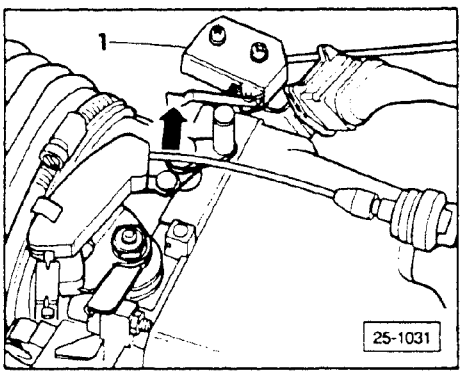
- disconnect harness connector from fuel injection control unit
- with multimeter **US 1119**, check continuity between fuel injection control unit harness connector terminal **17** and idle stabilizer valve harness connector, terminal **1**
  - approximately 0.2 ohm (continuity)

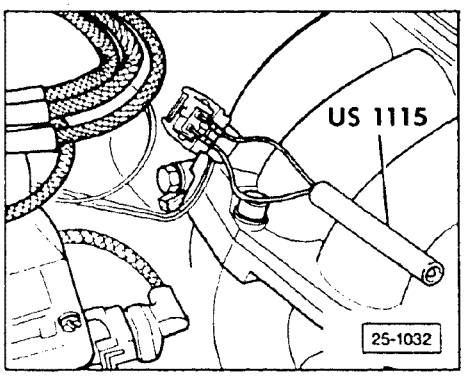
If **NO**
- repair break in wiring using wiring diagram

If **YES**
- replace fuel injection control unit

Cold start valve power, output check (Output code 4443)







Note

The following procedures describe output check activation for 1987 and 1988 vehicles using the fuel pump relay. For later models, see the **VAG 1551** procedures outlined in repair Group D2.

Power supply, checking

Requirement:

- ignition switched to **OFF** position

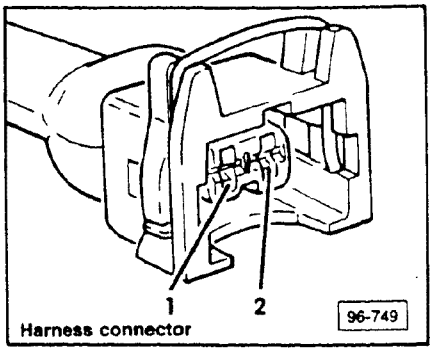
▶ ■ insert spare fuse in top of fuel pump relay (**arrows**)
■ turn ignition **ON**, remove fuse after four seconds
■ re-insert fuse for four seconds, then remove
■ re-insert fuse for four seconds, then remove
■ re-insert fuse for four seconds, then remove
- fault indicator light displays **4443** code

▶ ■ close full throttle switch (**arrow**)
- cold start valve clicks **ON** and **OFF** (for a maximum of ten seconds) when full throttle switch is closed

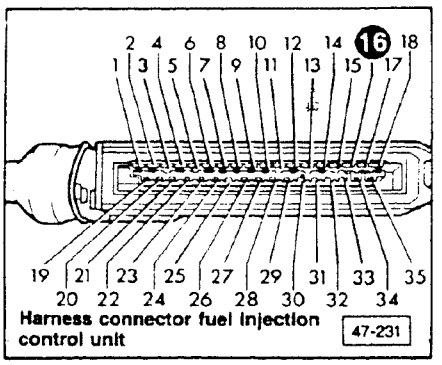
If **NO**

■ disconnect cold start valve harness connector

▶ ■ connect **US 1115 LED** tester between terminals **1** and **2** of cold start valve harness connector
- **US 1115** should light up



Harness connector



Harness connector fuel injection control unit

If **YES**
- replace cold start valve

If **NO**
- connect multimeter **US 1119** between cold start valve harness connector terminal **1** and ground
  - approximately 12 volts

If **NO**
- repair break in wiring, using wiring diagram

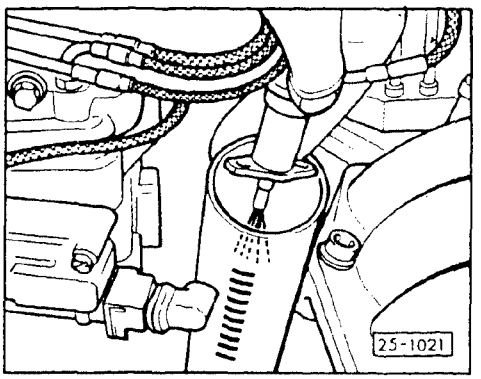
If **YES**
- disconnect harness connector from fuel injection control unit
- connect multimeter **US 1119** between terminal **2** of cold start valve harness connector and terminal **16** of fuel injection control unit harness connector
  - approximately 0.2 ohm (continuity)

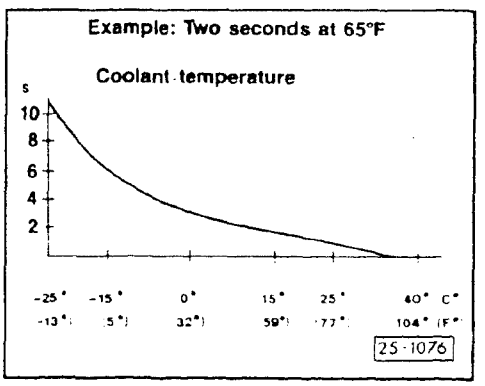
If **NO**
- repair break in wiring, using wiring diagram

If **YES**
- replace fuel injection control unit

WARNING

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





Functional check requirement

- 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).

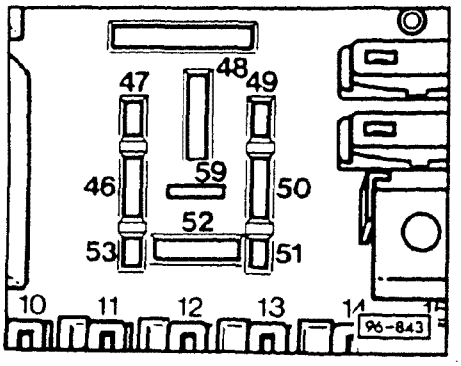
- disconnect coil wire 4 from ignition distributor cap and connect to ground with jumper wire

- remove cold start valve and point nozzle into suitable container (leave electrical connector and fuel line connected)

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

- 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



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

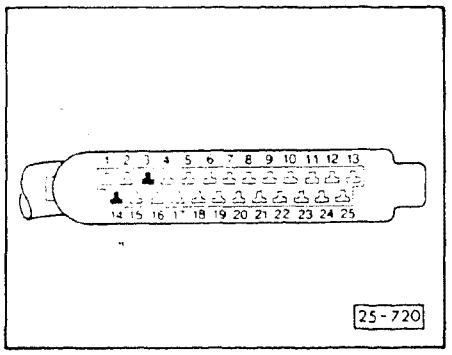
If 7 volts minimum is **NOT** obtained, check wiring as follows:
- partially withdraw electronic ignition control unit and pull harness connector from control unit
- measure continuity between ignition control unit harness connector and relay socket **10** using multimeter **US 1119**

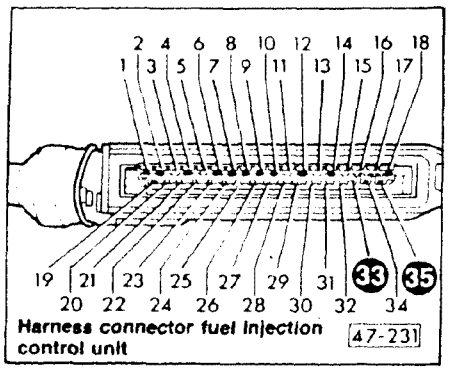
ignition control unit harness connector	relay socket **10**
terminal **3**	terminal **49**
terminal **14**	terminal **47**

  - approximately 0.2 ohm

If **NO**
- repair break in wiring using wiring diagram

If **YES**
- replace knock sensor ignition control unit





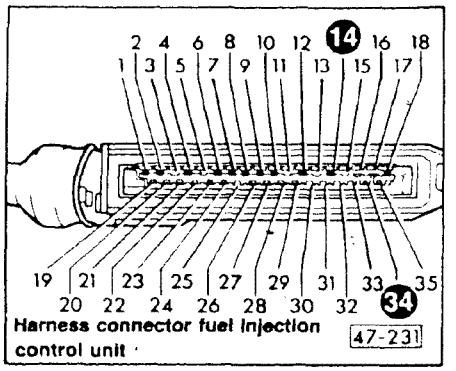
Harness connector fuel injection control unit

Air conditioning compressor clutch, on/off signal, checking

- disconnect fuel injection control unit harness connector from fuel injection control unit
- connect multimeter **US 1119** between terminals **33** and **35** (ground)
- 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 specification is **NOT** obtained
- repair break in wiring using wiring diagram



Harness connector fuel injection control unit

Idle stabilization system, shift mode signal, checking

- disconnect fuel injection control unit harness connector from fuel injection control unit
- connect LED tester **US 1115** between terminals **14** and **34**
- switch ignition **ON**

Vehicles with automatic transmission only

- 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

Vehicles with manual transmission only

- shift into any gear
  - **LED** tester **US 1115** must light up

If **NO**

- repair break in wiring according to wiring diagram

Coolant temperature sender, checking (Fault code 2312)

Check this first:

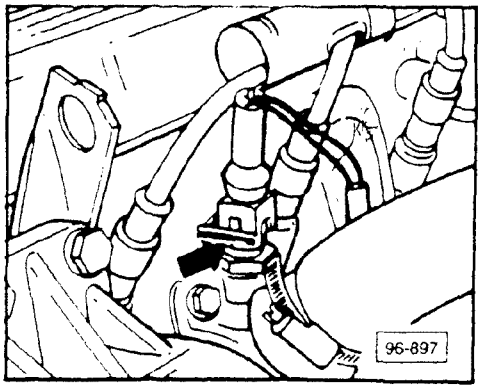
- coolant temperature over 20°C (176°F)

Note

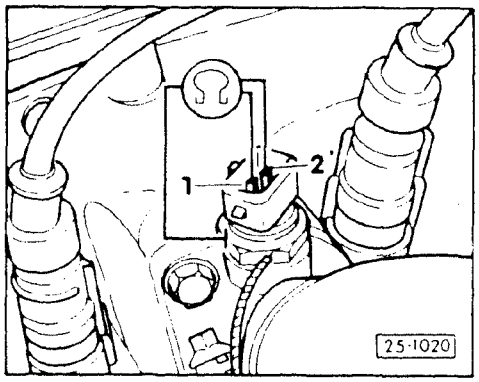
Two temperature senders are installed in the coolant temperature sender housing. Both work independently, one for fuel injection and the other for electronic ignition.

If one temperature sender is bad, the entire temperature sender must be replaced.

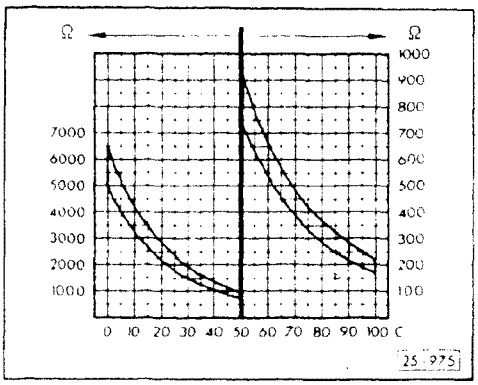
The temperature sensor is an NTC (Negative Temperature Coefficient) type, meaning, resistance decreases as engine temperature increases.



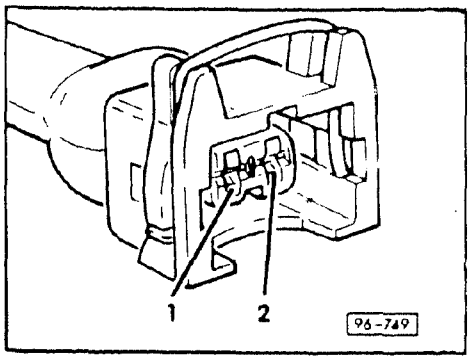
▶ ■ remove harness connector from coolant temperature sender (**arrow**)



▶ ■ connect multimeter **US 1119** between temperature sender terminal **1** and engine ground, then between terminal **2** and engine ground



▶ • see appropriate value on chart



- connect multimeter **US 1119** between harness connector terminal **1** and ground then between terminal **2** and ground
- switch ignition **ON**
  - 4.5-5.5 volts

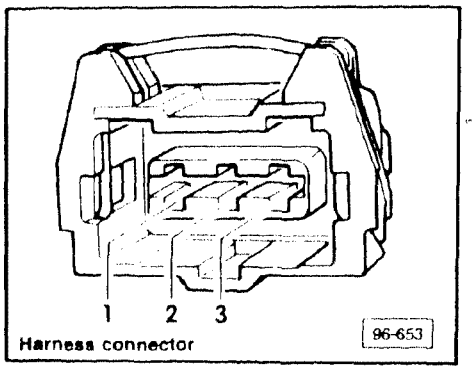
If **NO**

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

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

- replace respective control unit

Altitude sensor, voltage supply checking (Fault code 2223)

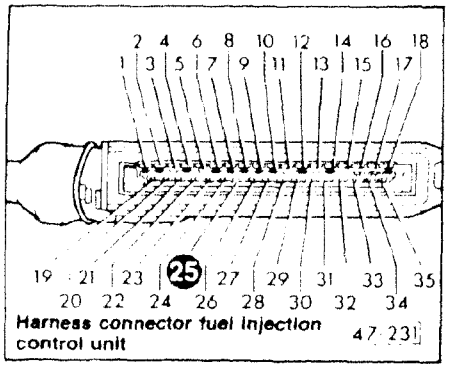


Note

Altitude sensor function cannot be tested, however, it is possible to check the voltage supply to the sensor.

The sensor is located in the A-pillar above the ignition control unit.

- remove harness connector from altitude sensor
- connect multimeter **US 1119** between harness connector terminal **1** and engine ground
- switch ignition **ON**
  - approximately 5 volts



If **NO**

- repair break in wiring between terminal **1** of altitude sensor harness connector and terminal **25** of fuel injection control unit harness control
- connect multimeter **US 1119** between terminals **1** and **3** of altitude sensor harness connector and then between terminals **2** and **3**
- switch ignition **ON**
  - 4.5-5 volts

If **NO**

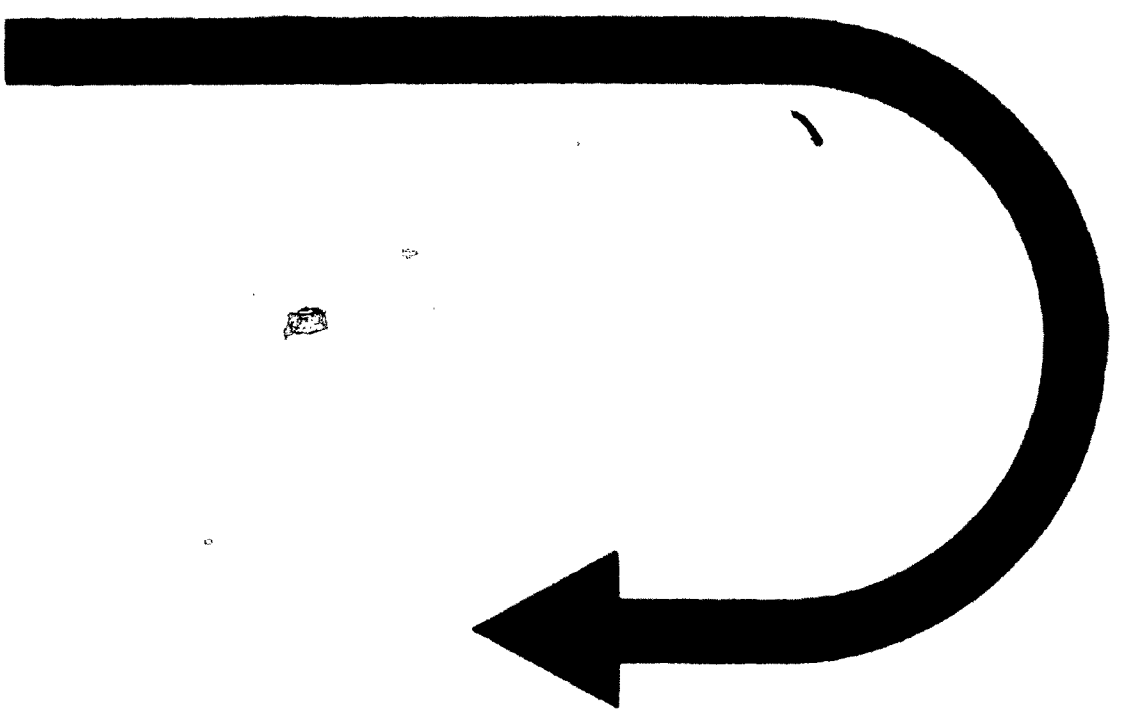
- repair break in wiring according to wiring diagram or replace fuel injection control unit
- check wiring between ignition control unit and altitude sensor according to wiring diagram

If all measurements **ARE** obtained

- replace altitude sensor

CONTINUED IN THE

BEGINNING OF NEXT ROW



CAUTION

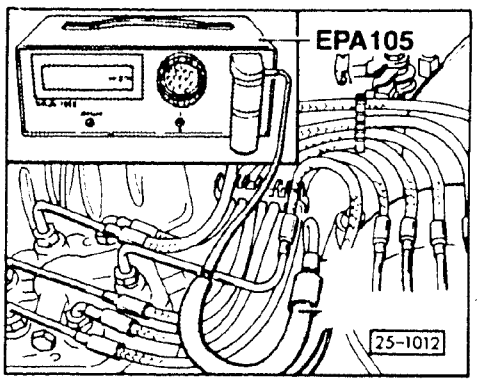
Idle speed, ignition timing and CO are inter-related and **MUST** be checked and adjusted **TOGETHER**.

Engine settings, checking

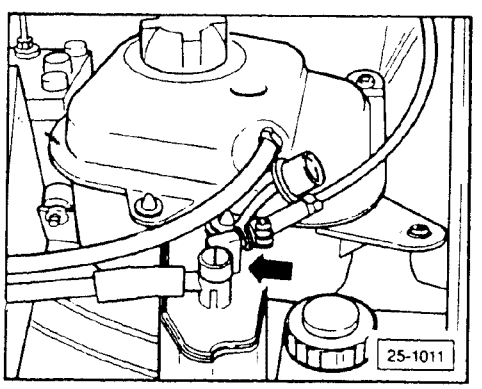
Preparations for checking/adjusting

Requirements

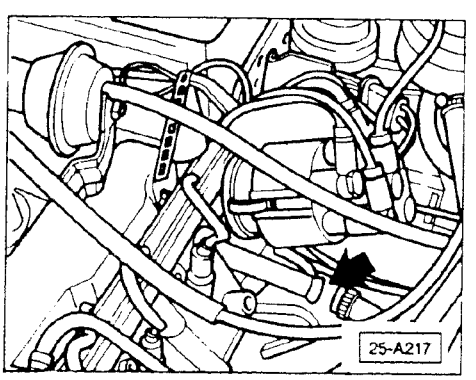
- engine oil temperature minimum 80°C (176°F)
- all electrical consumers switched **OFF**
- radiator cooling fan must **NOT** be running while checking or adjusting
- oxygen sensor connected
- A/C switched **OFF**
- no pressure measuring devices connected
- exhaust system must be tight and free of leaks
- OXS system **OK**



- remove cap from exhaust probe
- connect hose from exhaust gas analyzer (Sun 105 or EPA equivalent) to CO measuring tap (**arrow**)



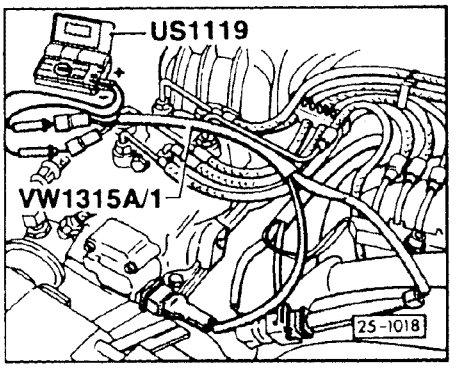
- remove cap (**shaded**) from carbon canister (**arrow**)



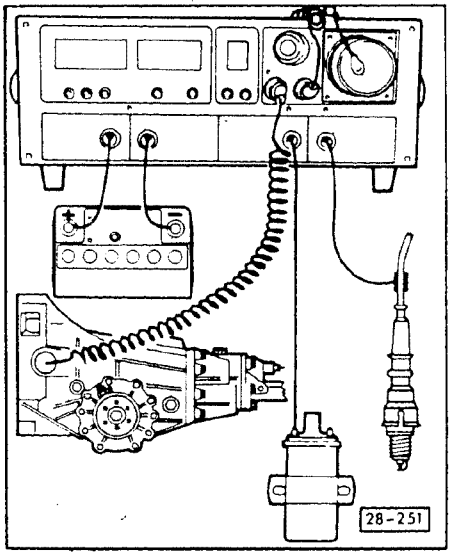
- remove crankcase breather connection at steel pipe
- plug opening of steel pipe (**arrow**)

Note

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



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

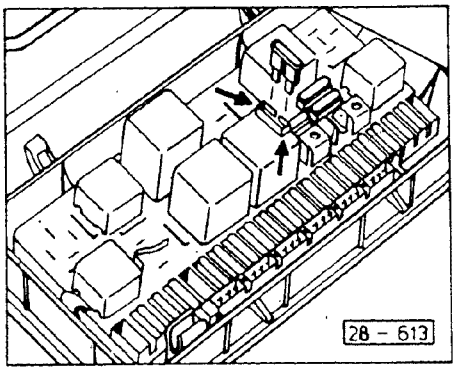


- connect **VW 1367** engine tester to check ignition timing and idle speed
- start engine and run to normal operating temperature (radiator fan must come on at least once)

Note

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

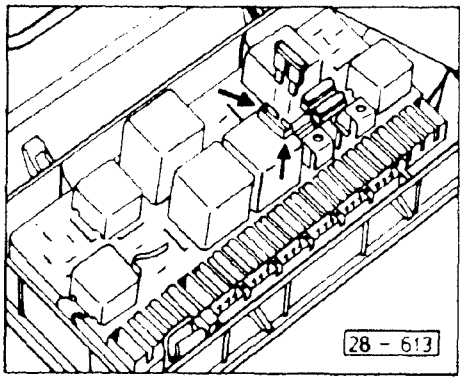
Settings, checking



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

If **NO**

- adjust ignition timing to: 15° ± 1° Before TDC
  For details see Repair Group 28

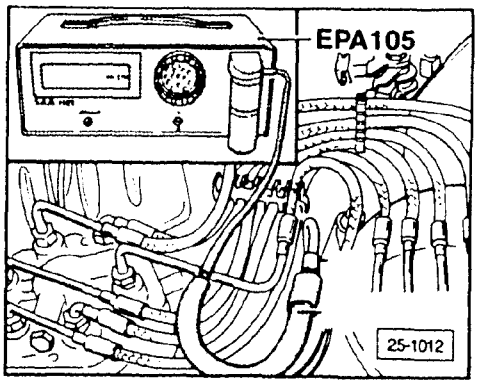


- remove fuse from fuel pump relay and briefly raise engine speed above 2500 RPM to cancel fault display
- check idle speed
  - 790 ± 70 RPM

Note

The idle speed is **NOT** adjustable (idle speed control is obtained through the idle stabilization system). The idle air bypass screw should be turned in fully against its seat.

- if idle speed is out of this range, check for an engine problem such as vacuum leaks, etc.



- check differential pressure regulator current with oxygen sensor **connected**
  - 0 ± 1 mA

If **NO**

- adjust to −1 to +1mA

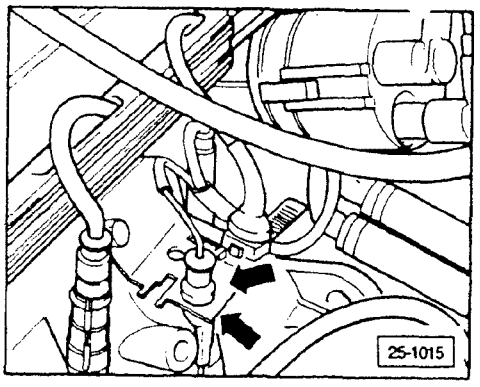
- check CO%
  - 0.3% to 1.2%

Note

Vehicles with air conditioning only:
If the idle speed should drop severely when the air conditioner is switched **ON**, check the idle stabilization system, section 25-370

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, section 25-440
  - checking value: 0.3-3.0 vol. %
    adjustment value: 0.6-1.0 vol. %

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 rubber boot from mixture control unit
- **LIGHTLY** 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

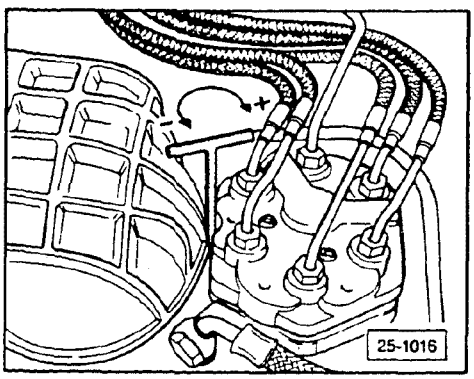
CAUTION

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

- screw in 3 mm (1/8 in) sheet metal screw
- remove plug/screw, using pliers
- reinstall rubber boot
- start engine and run at idle

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.



- adjust CO by turning mixture adjusting screw using tool **P377**
  - counter-clockwise: CO value decreases clockwise: CO value increases

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. With long distance drives, the amount of fuel in the oil will be reduced and the CO value will normalize again. A short term solution would be an oil change.

After adjusting, the specified value must fluctuate with the oxygen sensor connected.

If **NO**

- check the oxygen sensor, section 25-310

CAUTION

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

Engine settings, checking

Preparations for checking/adjusting

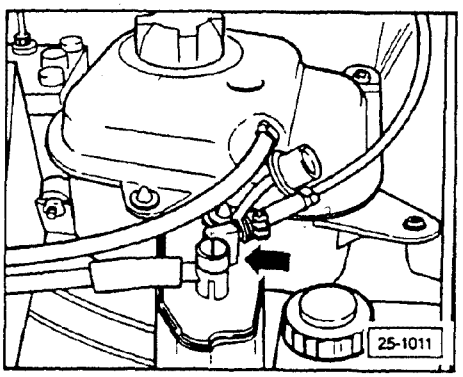
Note

Until 2-88 the throttle bypass screw was installed in a fully seated position and then sealed with safety paint.

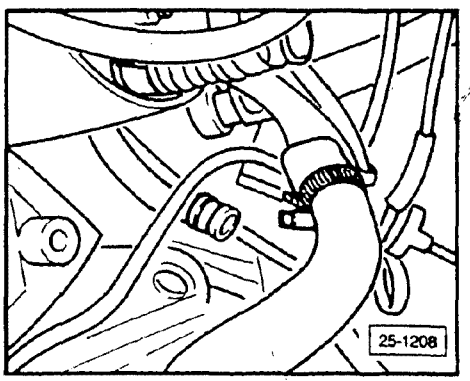
Beginning 3-88 the throttle bypass screw is no longer installed.

Check these first:

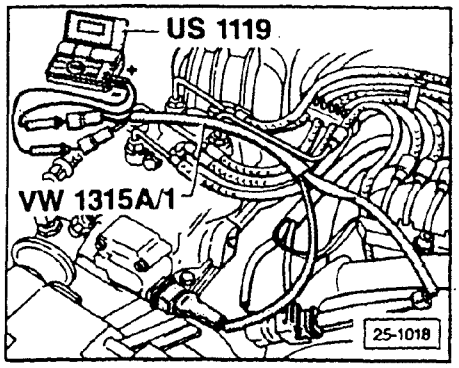
- engine oil temperature 80°C (176°F) minimum
- all electrical consumers switched **OFF**
- radiator fan must **NOT** be running during checking or adjusting
- A/C switched **OFF**
- do **NOT** have any pressure measuring devices connected
- if injection lines were loosened or replaced, raise engine to 3000 RPM's several times then let idle for at least two minutes before making adjustments
- exhaust system **MUST** be tight and free of leakage
- oxygen sensor control system **OK**
- ignition timing adjustment **OK**



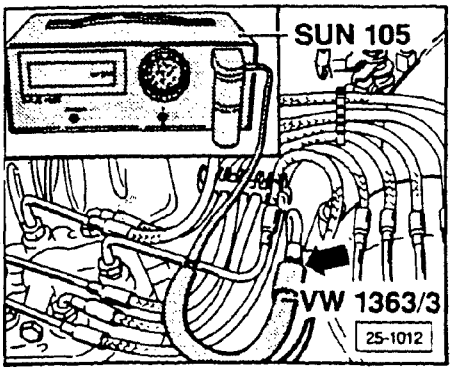
■ remove cap from carbon canister (**arrow**)



■ remove crankcase housing ventilation hose
■ install plug in metal tube



- remove harness connector from differential pressure regulator
- connect test adaptor **VW 1315 A/1 between** differential pressure regulator and its harness connector
- switch multimeter **US 1119** to 200 mA range



- remove cap from CO tap tube
- connect **SUN 105** CO tester according to manufacturer's instructions

Note

Hose must fit securely over the CO tap tube (**arrow**), so there is no exhaust leakage.

- start engine and let idle

Note

The following procedure tests the function of the deceleration fuel shut off and the idle switch.

- briefly raise engine speed to approximately 4000 RPM
- snap throttle shut
  - multimeter **MUST** indicate negative 50-60 mA for a short time

If reading indicates positive 50-60 mA:
- reverse meter connections

If **NO** value is indicated
- check idle switch
  see section 25-270

Workshops over 1000 meters (3280 feet) of elevation: see page 25.63a

Workshops between sea level and 1000 meters (between 0 and 3280 feet) of elevation:

- checking: 0 ± 3 mA

Co value as indicated on the **SUN 105** CO tester must be
- 0.3 to 1.2 volume %

If **NO**

- turn **OFF** ignition
- remove intake air boot from mixture control unit
- **LIGHTLY** 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.)

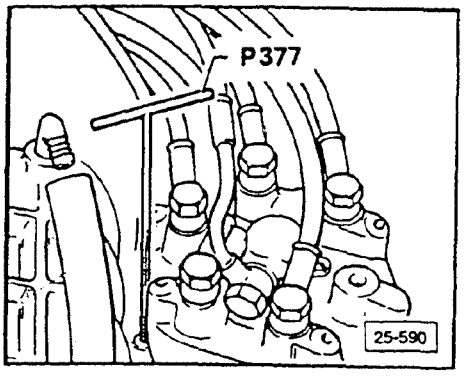
CAUTION

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

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

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.



- adjust CO by turning mixture adjusting screw with tool **P377**
  - adjusting value: 0 ± 1 mA

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
- **LIGHTLY** 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.)

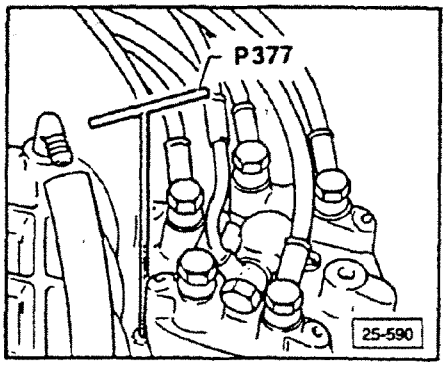
CAUTION

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

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**).