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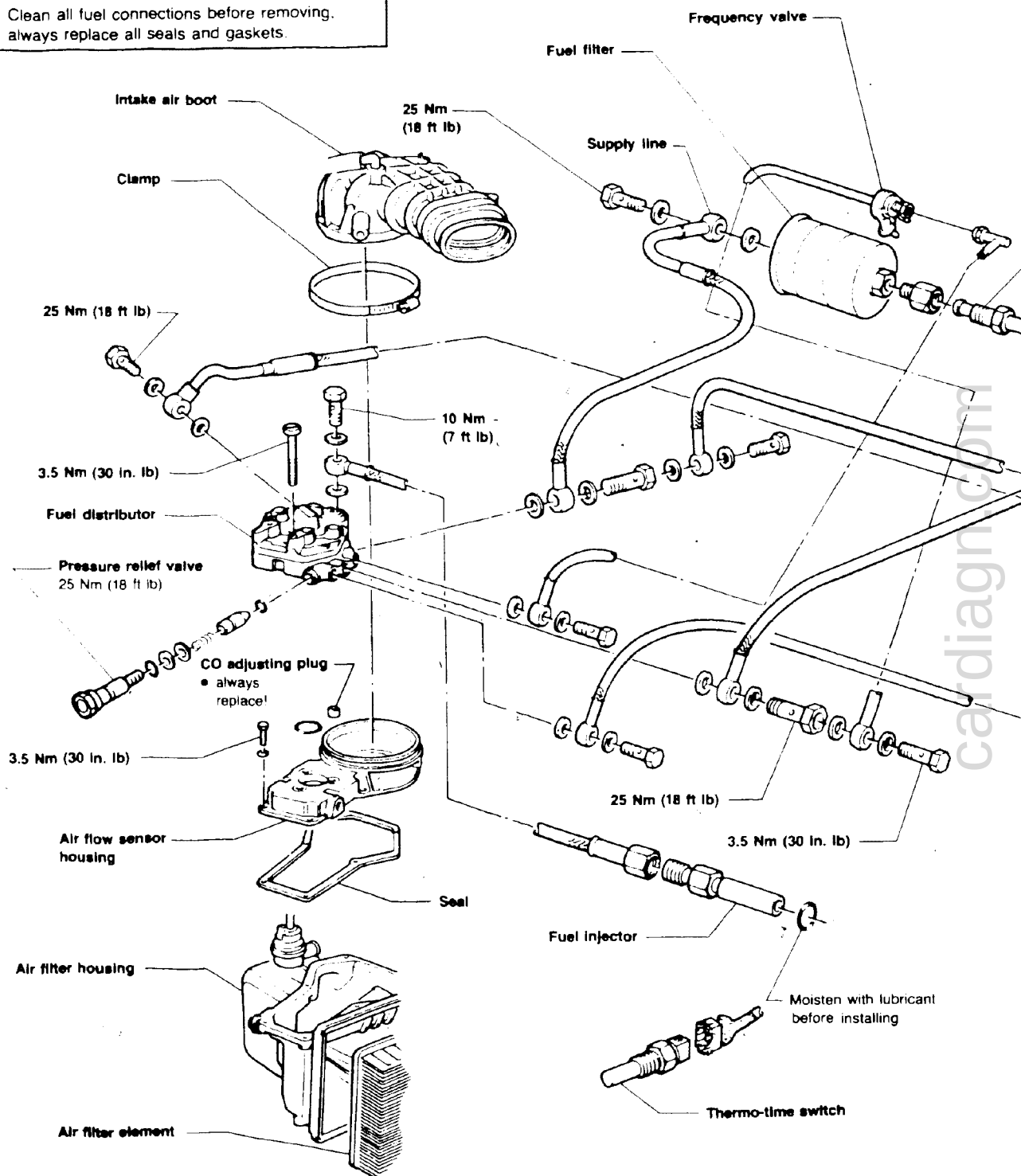
Engine Code MC w/two knock sensors

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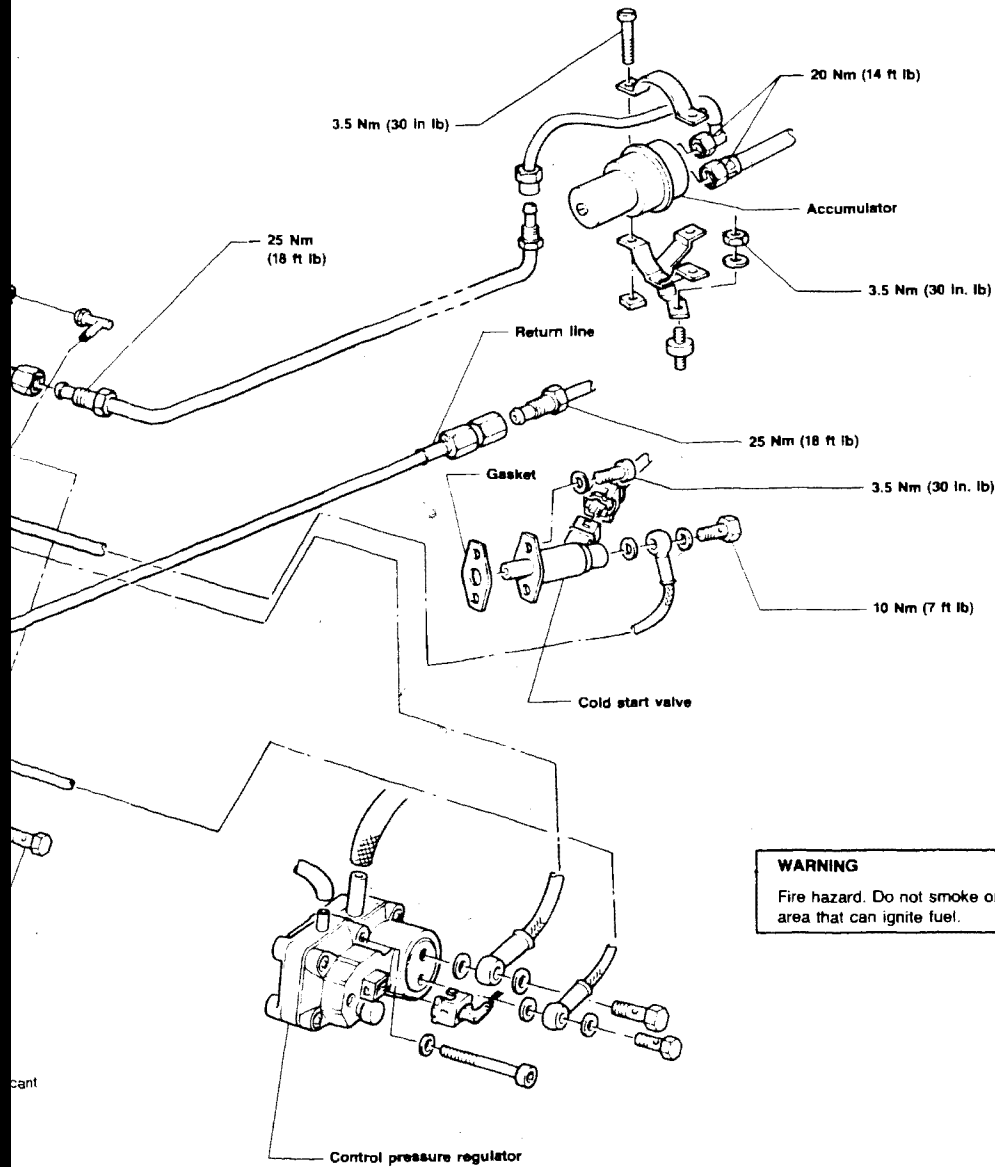
★ **NEW INFORMATION** since last filming

CAUTION

Clean all fuel connections before removing.
always replace all seals and gaskets.



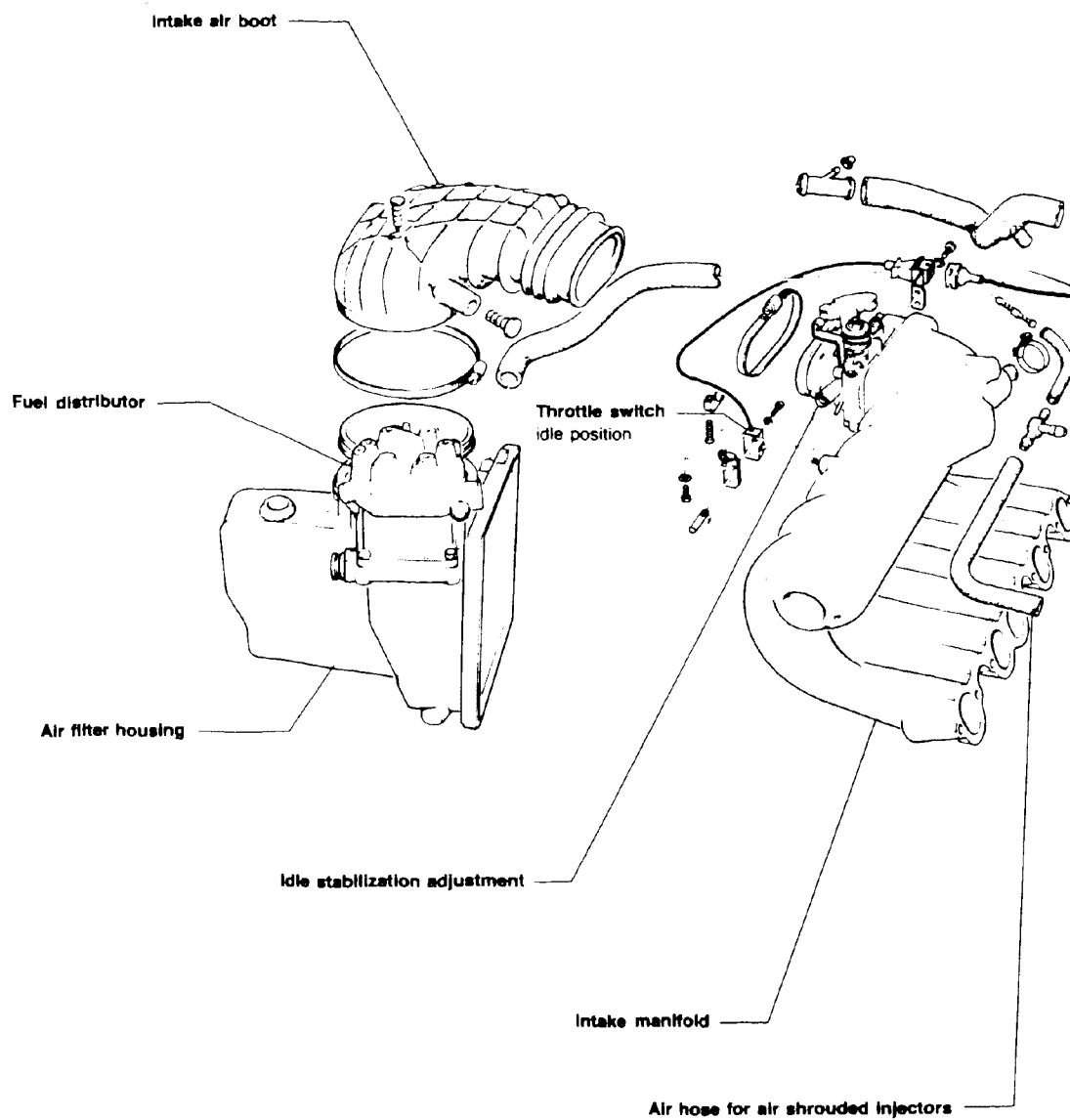
Continuous Injection System

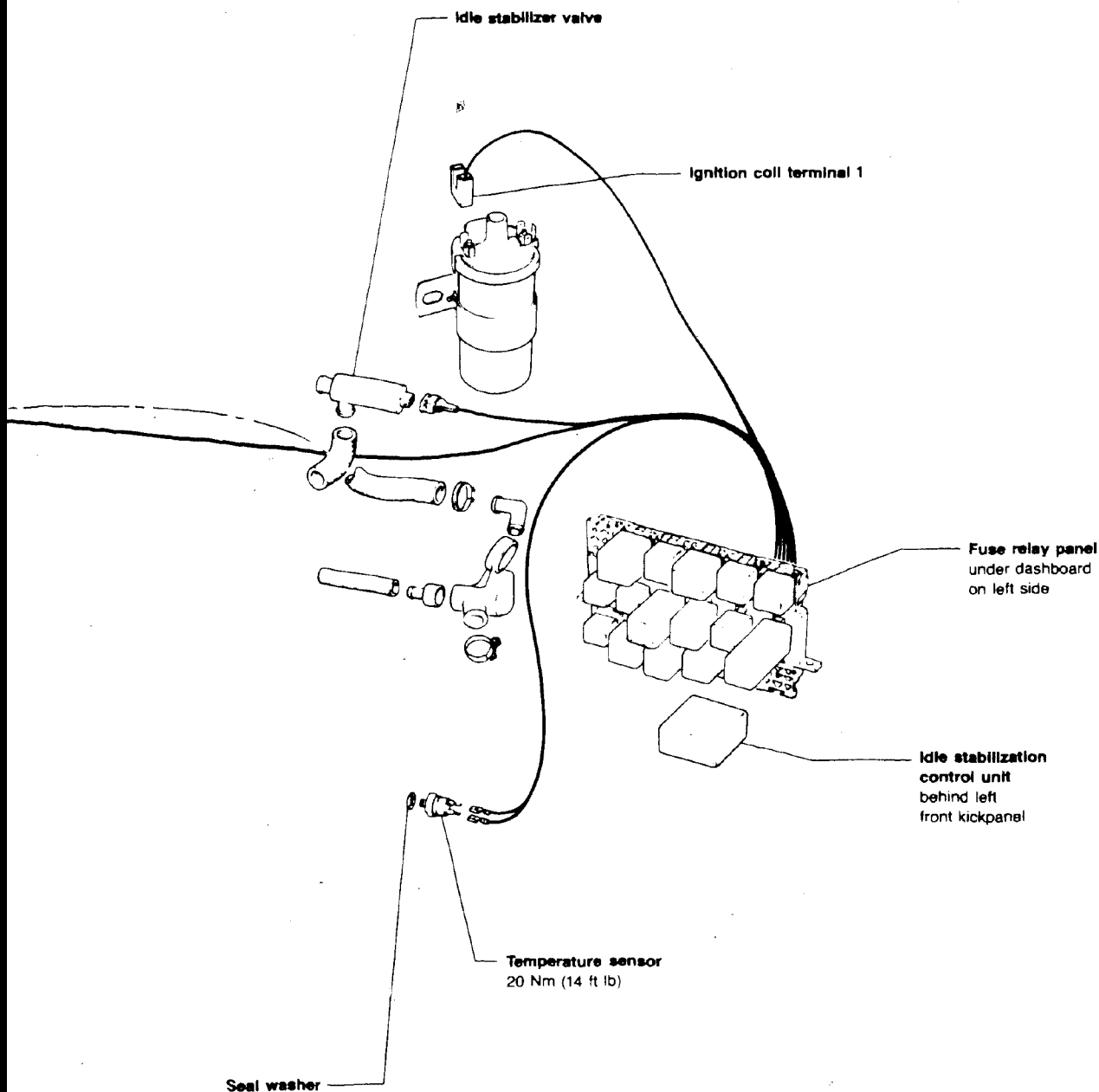


WARNING

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

25-559





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25-532

Deceleration cut-off valve
checking, page 25.28

Intake air boot

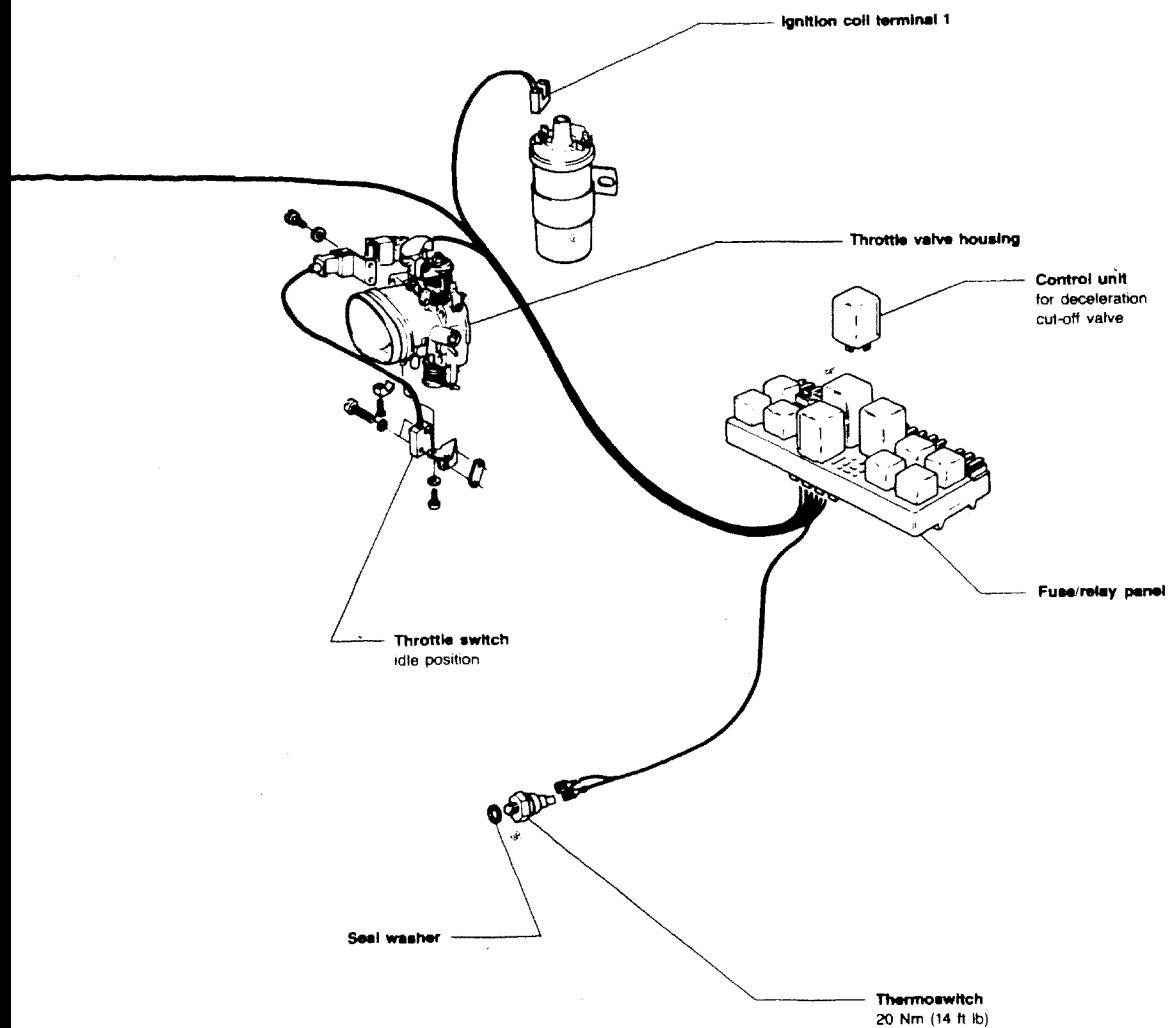
Air flow sensor

Air filter housing

20 Nm (14 ft lb)

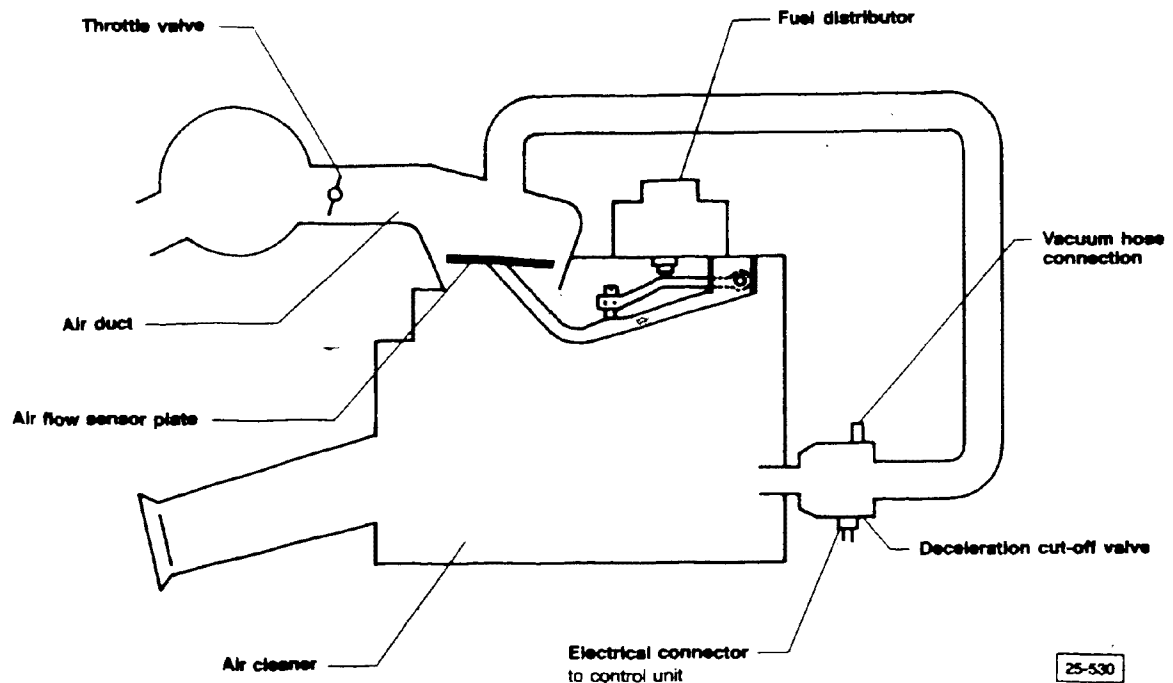
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Continuous Injection System



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Continuous Injection System



Deceleration fuel cut-off, operation (manual transmission)

When vehicle is decelerating no power is required. The fuel being fed to system during this phase is not required and can be saved.

Components:

- Switch unit (in main relay plate, socket No. 3)
- Valve for deceleration cut-off (on air cleaner housing, behind fuel distributor)
- Temperature switch (in cylinder head at front left)
- Switch (underneath the throttle valve)

Function:

Fuel cut-off during deceleration takes place when:

- Coolant temperatures above 30°C (86°F)
- Engine speeds above 1200 RPM
- Throttle in idling position

In this operating condition the switch unit controls the deceleration cut-off valve which is then opened by vacuum.

Auxiliary air then bypasses the air flow sensor plate and plate sinks to the rest position.

When engine speed drops below 1200 RPM the switch unit receives a speed signal from terminal 1 of coil. The deceleration cut-off valve closes and allows the sensor plate to rise again.

Rules of cleanliness

CAUTION

First:

- clean connecting points before loosening

When fuel system is open

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

Use clean parts only

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

Safety guidelines for fully electronic ignition system

CAUTION

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

Turn ignition off:

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

Don't forget about the battery:

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

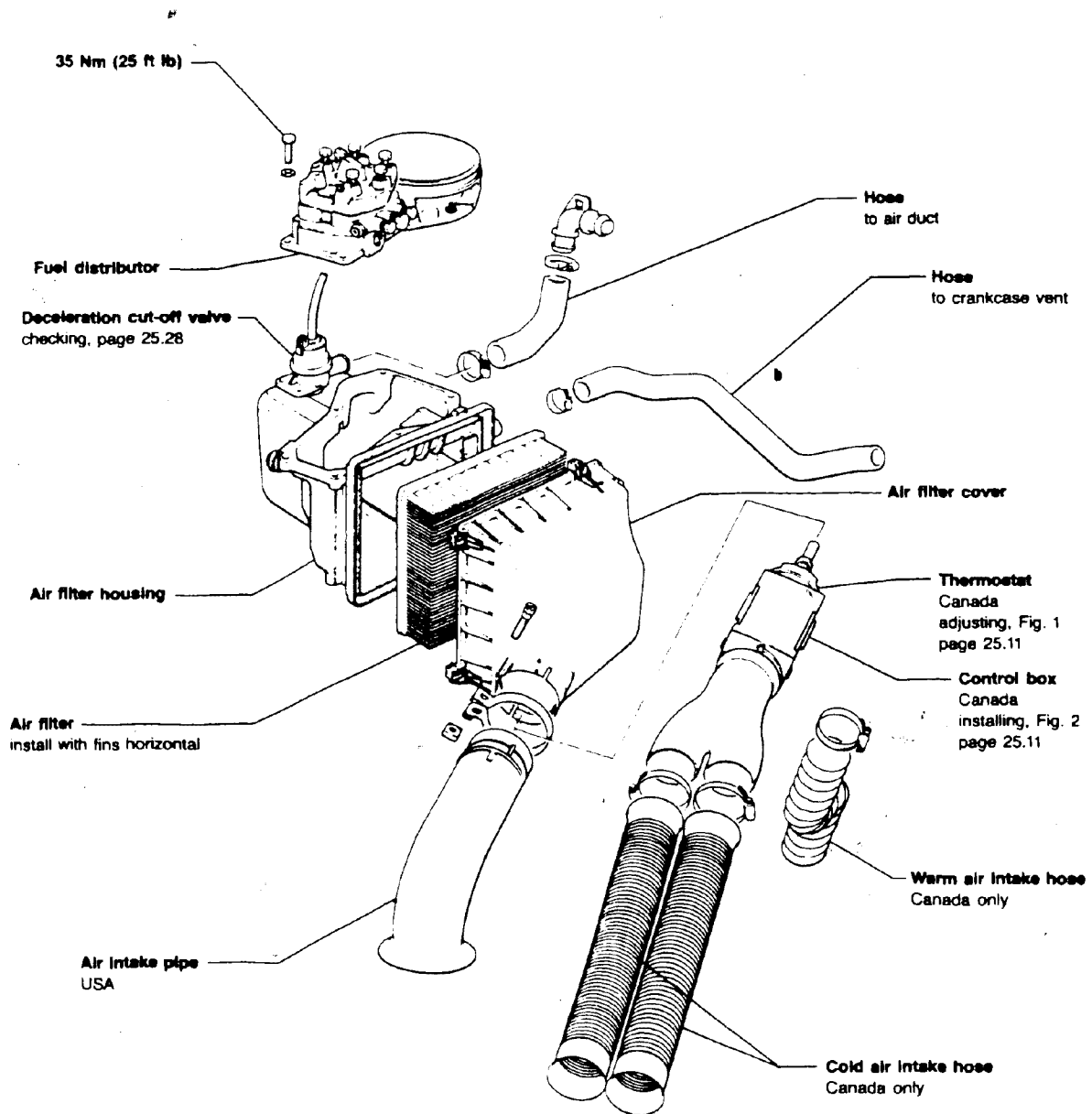
When testing the system:

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

When applying heat:

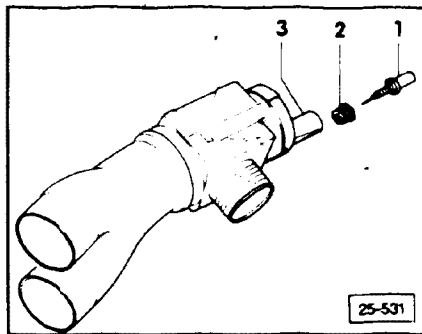
- if components are heated above 80°C (175°F) from paint dryer or steam cleaner, wait for components to cool before starting engine

Continuous Injection System



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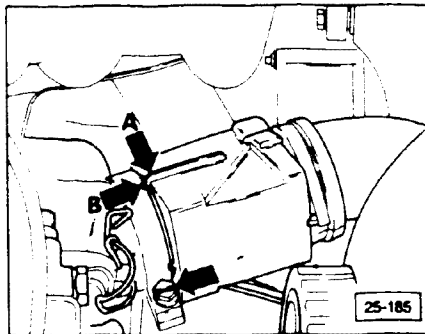
Thermostat, adjusting



► Fig. 1

- install thermostat 1 into adapter 2 with three turns
- install adapter into control box 3
- immerse thermostat for two minutes in lukewarm water 20°C (68°F)
- turn thermostat further in until control flap shuts off cold air flow
- lock thermostat in position with locking compound

Control box, installing



► Fig. 2

- install control box in air filter cover so rib A on control box is in line with groove B on air filter cover (arrows)

Continuous Injection System

Control pressure regulator checking resistance of temperature sensing element	approximately 14-22 ohms		
Control pressure regulator	034 133 403 A		
Control pressure — cold (electrical connector to control pressure regulator disconnected) (vacuum hose remains connected)	work shop temperature		
	20°C (68°F)	25°C (77°F)	30°C (86°F)
	from 1.5 bar (21.8 psi)	1.6 bar (23.2 psi)	1.8 bar (26.1 psi)
	to 1.8 bar (26.1 psi)	2.1 bar (30.5 psi)	2.3 bar (33.4 psi)
tolerance = ± 0.25 bar (3.6 psi)			
Control pressure — warm (engine oil temp. 50°-70°C (122°-158°F))	3.4 bar — 3.8 bar (49.3 psi — 55.1 psi)		
System pressure	5.8 bar — 6.6 bar (84.1 psi — 95.7 psi)		
Shut-off pressure after approximately 5 seconds	3.2 bar (46.4 psi)		
Residual pressure (Leak test) after approximately 10 minutes	3.0 bar (43.5 psi)		
after approximately 20 minutes	2.8 bar (40.6 psi)		
Control unit, part number	035 905 383 T		
Cold start valve — Injection time cold start temperature °C (°F) injection time (seconds)	- 30(- 22), 0(32) +, 20(68), + 35(95) 10 3 1 0		
Fuel injectors injection quantity difference between injectors using tool VW 1348 idle measurement max. ml full throttle measurement max. ml opening pressure bar (psi)	3.0 8.0 4.3-4.6 (62.4-66.7 psi)		
Idle speed check**, RPM manual transmission: automatic transmission:	800 ± 50 720 ± 50		
Duty cycle % checking value: adjusting value:	25-65% 50 ± 8%		
CO content*, vol. %	0.3 to 1.2%		
Octane rating, minimum	95 (unleaded)		

*CO value serves only to verify the duty cycle

**Note adjustment conditions

CAUTION

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

Continuous Injection System

Metal tipped fuel injectors, checking/cleaning

Identifying

- check Part Number stamped on barrel of injector

Note

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

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

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

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

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

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

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

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

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

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

- see section 25.15b "Viton Tipped Injectors, Cleaning and Checking"

Any other Part Number indicates that it is metal tipped.

CAUTION

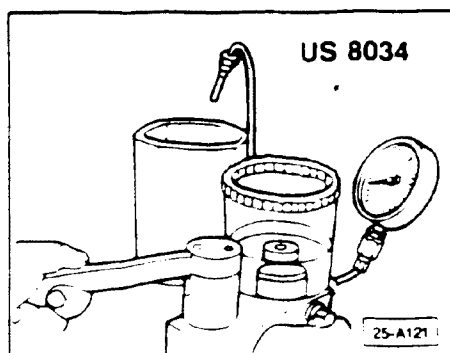
Part Numbers are for reference only.
Always consult with the Parts
Department for the latest information.

Notes regarding metal tipped injectors:

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

Continuous Injection System

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



Note

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

CAUTION

Perform the following checks in sequence.

Corrosion checking

- visually inspect tip of injector

If **YES**

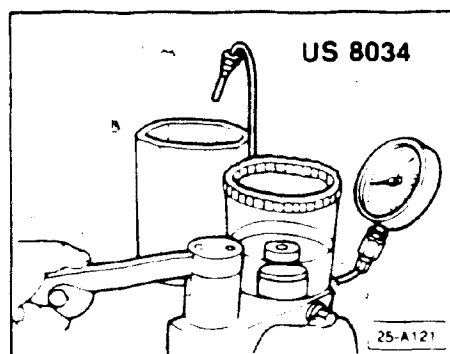
- replace injector

If **NO**

- proceed with following procedures

WARNING

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



Contamination and varnish, checking

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

Engine code MC

Turbo

Metal tipped fuel injectors, checking/cleaning

25.14

Continuous Injection System

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

If NO

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

If still below specification.

- replace injector

If OK

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

Opening pressure, checking

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

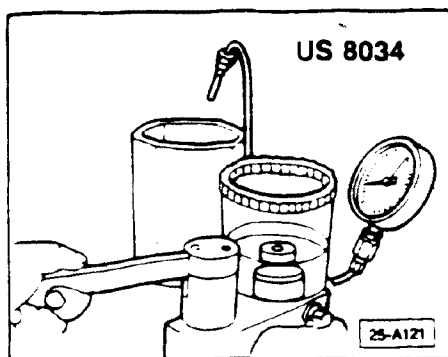
Leak checking

Requirement

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

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

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



Continuous Injection System

Chatter, spray pattern test

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

If droplets form at the injector tip,

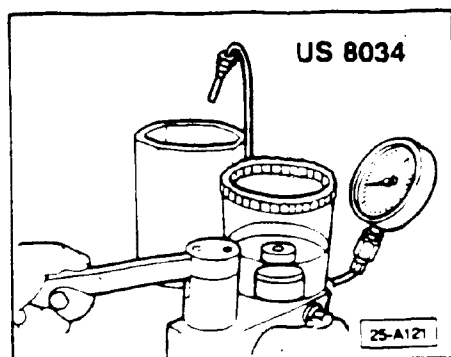
- replace entire set of injectors with Viton tipped

If spray pattern is straight (not conical),

- replace entire set of injectors with Viton tipped

If spray is solid (not atomized),

- replace entire set of injectors with Viton tipped



CAUTION

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

Continuous Injection System

Viton tipped fuel injectors, checking/cleaning

Identifying

- check Part Number stamped on barrel of injector

Note

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

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

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

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

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

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

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

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

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

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

- see section 25.13 "Metal Tipped Injectors, Cleaning and Checking"

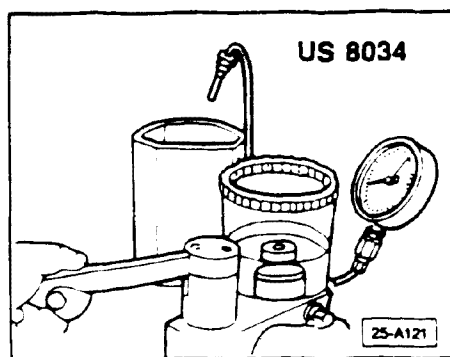
CAUTION

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

Continuous Injection System

Notes regarding Viton tipped injectors:

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



Note

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

CAUTION

Perform the following checks in sequence.

Corrosion checking

- visually inspect tip of injector for rust

If **YES**

- replace injector

If **NO**

- proceed with following procedures

WARNING

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

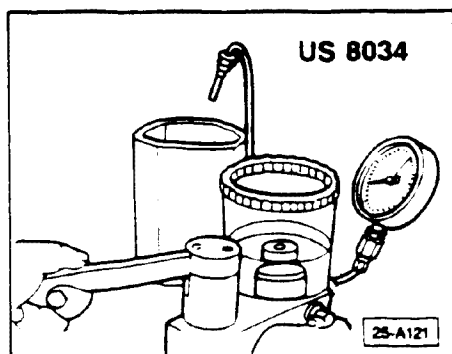
Engine code MC

Turbo

Viton tipped fuel injectors, checking/cleaning

25.15c

Continuous Injection System



Contamination and varnish, checking

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

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

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

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

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

If NO

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

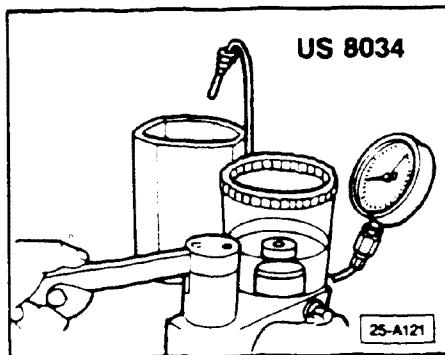
Engine code MC

Turbo

Viton tipped fuel injectors, checking/cleaning

25.15d

Continuous Injection System



If still below specification,

- replace injector

If OK

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

Opening pressure, checking

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

Note

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

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

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

Engine-code MC

Turbo

Viton tipped fuel injectors, checking/cleaning

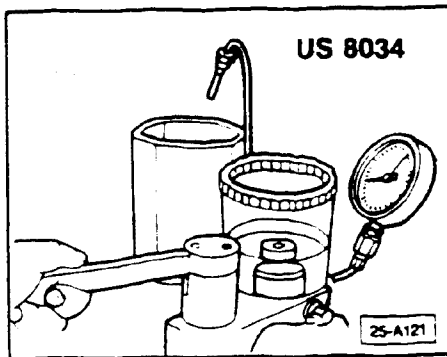
25.15e

Continuous Injection System

Leak checking

Requirement

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



CAUTION

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

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Engine code MC

Turbo

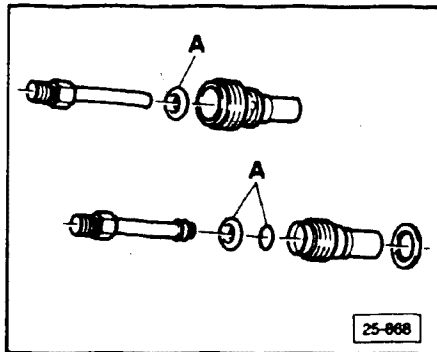
Viton tipped fuel injectors, checking/cleaning

25.15f

Continuous Injection System

Fuel injector inserts, leak checking

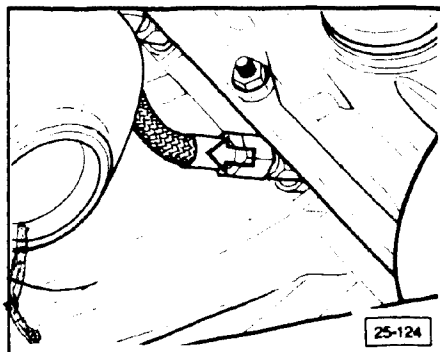
- remove air shrouded injector supply air hose at intake manifold nipple
- remove air distributor for fuel injector air supply
- spray surface of fuel injectors and inserts with non-flammable leak test fluid
- adjust shop air down to 1.0 bar (14.5 psi) gauge pressure
- apply reduced shop air at fuel injector air supply nipple (on intake manifold)
 - **NO** bubbles should appear on sprayed areas



- If bubbles form on the sprayed areas,
- pull fuel injector(s) out of insert and replace O-ring(s) A

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Continuous Injection System

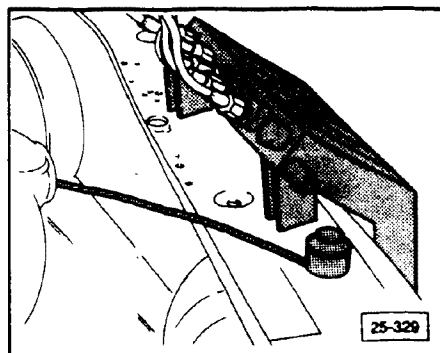


Fuel Injectors, checking

WARNING

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

- pull injectors (in direction of arrow) out of their inserts with fuel lines left attached



- fasten fuel analyzer **US 4480/2** to grille/bumper
- insert fuel injectors into **US 4480/2** analyzer

CAUTION

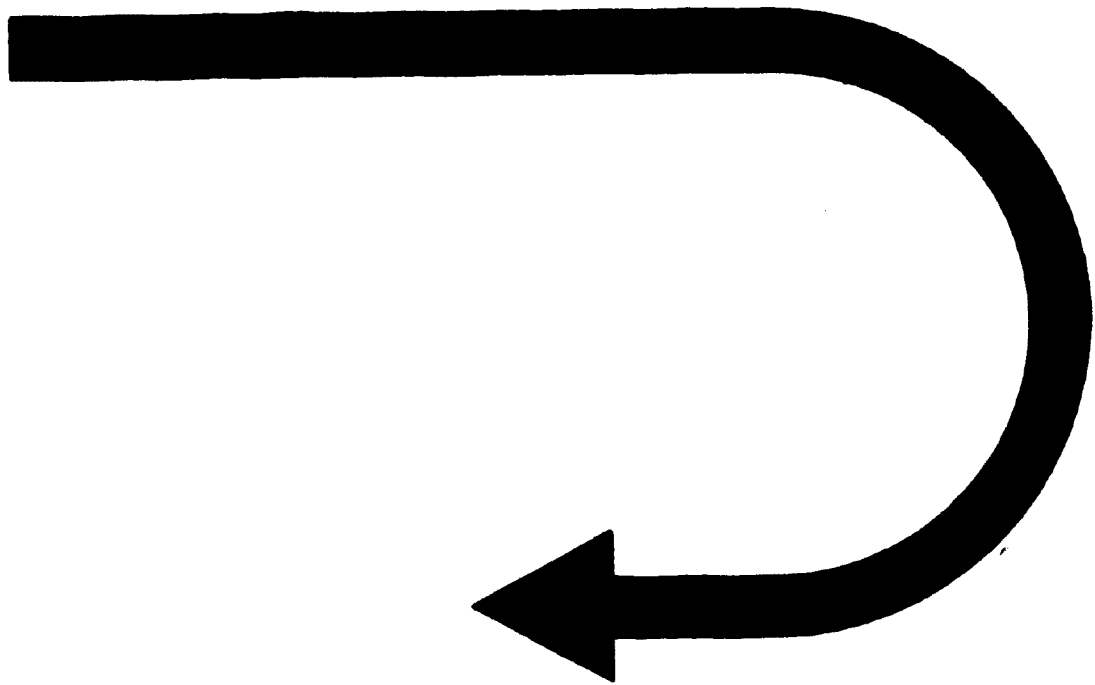
Do **NOT** kink the fuel lines while inserting them into the analyzer. If necessary; loosen fuel lines at fuel distributor, reroute and re-tighten.

- remove intake air boot
- remove fuel pump relay from fuse/relay panel
- plug **VW 1348/3** remote control (in **OFF** position) into socket previously occupied by fuel pump relay
- raise air flow sensor plate using magnet or pliers
- activate remote control
 - fuel injectors **MUST** spray in a uniform cone shaped pattern

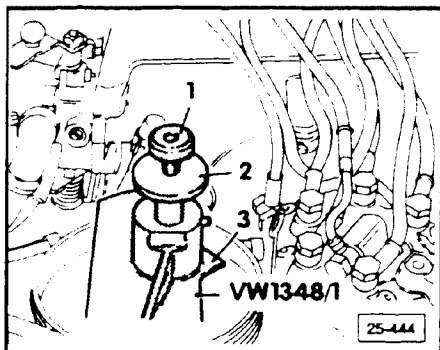
If **NO**

- clean and test injector(s), see page 25.13
- switch **OFF** remote control
- return air flow sensor plate to rest position
- dry off tips of fuel injectors
- switch **ON** remote control
 - fuel injectors must remain dry (**NOT** drip) for 2 minutes
- drain **VW 1348/2** fuel analyzer back into fuel tank

CONTINUED IN THE
BEGINNING OF NEXT ROW



Continuous Injection System



Injection quantity, comparative measurement

WARNING

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

Before installing tool **1348/1**, pull slide **2** out to upper stop. Then place tool centrally on edge of the air flow sensor with edge **3** pointing in the direction of the fuel distributor.

- check air flow sensor plate position, adjust if necessary
- push adjusting slide **2** down onto stop
- turn setting screw **1** clockwise until magnetic tip contacts sensor plate bolt

Idle setting, injection quantity comparison

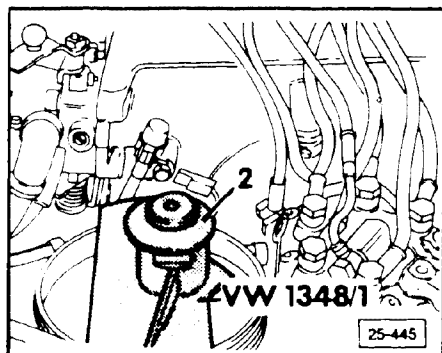
- switch **ON** remote control
- turn adjusting screw **1** counterclockwise until fuel begins to spray from one injector
- switch **OFF** remote control
- empty any fuel in analyzer back into tank (injectors may remain inserted)
- lift adjusting slide **2** to first stop (simulated idle)
- switch **ON** remote control until fuel level on scale of one measuring glass reaches 20 ml
- switch **OFF** remote control
- compare quantities of fuel in analyzer
 - maximum difference in quantity between tubes is 3.0 ml

CAUTION

Analyzer **MUST** be kept level while making quantity comparisons.

If difference **EXCEEDS** 3.0 ml between high and low

- interchange those two injectors and repeat test



Continuous Injection System

Full throttle injection quantity, comparison

WARNING

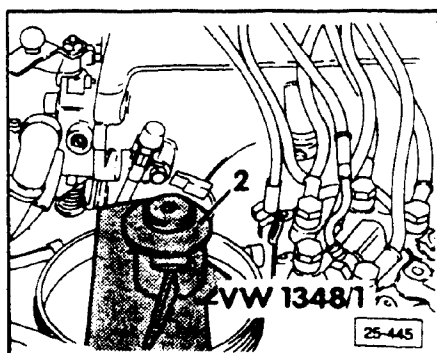
Fire hazard. Do **NOT** smoke or have anything in the area that can ignite fuel.

If difference of injection quantities does **NOT** change

- check for pinched fuel line or defective fuel distributor

If difference of injection quantities **DOES** change after swapping injectors

- replace those fuel injectors
- empty any fuel in analyzer back into tank (injectors may remain inserted)
- lift adjusting slide 2 to last stop (simulated full throttle)
- switch **ON** remote control until fuel level on scale of one measuring glass reaches 80 ml
- switch **OFF** remote control
- compare quantities of fuel in analyzer
 - maximum difference in quantity between tubes is 8.0 ml



CAUTION

Analyzer must be kept level while making quantity comparisons.

If difference **EXCEEDS** 8.0 ml between high and low

- interchange those two injectors and repeat test

If difference of injection quantities does **NOT** change

- check for pinched fuel line or defective fuel distributor

If difference of injection quantities **DOES** change after swapping injectors

- replace those fuel injectors

Control pressure regulator (N 9), checking

Requirement

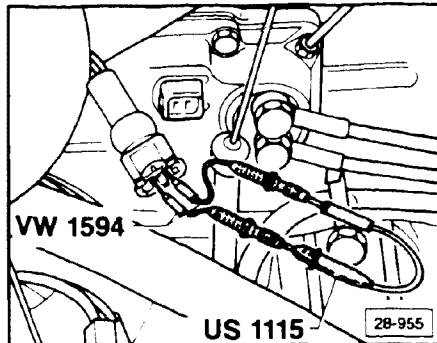
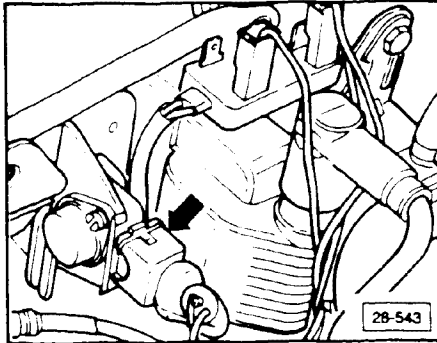
- engine cold, 20 to 30°C (68 to 86°F)

Vehicles without power output stage ignition coil:

- remove high voltage wire from coil and connect to ground using adaptor from **VW 1594** adaptor kit

Vehicles with power output stage ignition coil:

- disconnect harness connector from ignition coil power output stage
- disconnect harness connector from control pressure regulator



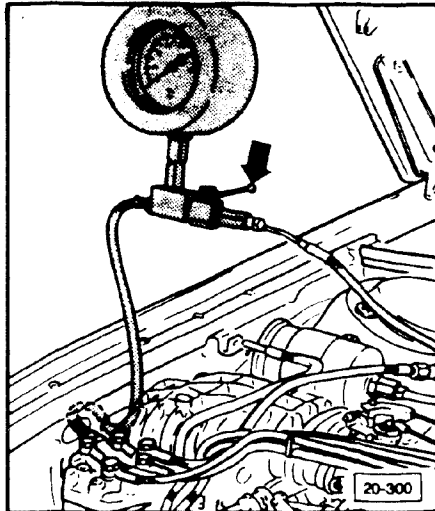
- connect **US 1115** LED tester to harness connector terminals using jumpers from **VW 1594** adaptor kit
- operate starter
 - LED tester must light up

If **NO**

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

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Continuous Injection System



Fuel pressure, checking

Control pressure (cold), checking

WARNING

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

- install pressure gage **VW 1318** in line between control pressure regulator and fuel distributor
- move **VW 1318** pressure gage shut-off valve (**arrow**) to open position
- start engine and take reading after 30 seconds (but not more than one minute)
 - see technical data on page 25.12 for specifications

If correct pressure is **NOT** obtained

- replace control pressure regulator

Control pressure (warm), checking

- re-connect control pressure regulator harness connector
- start engine and let idle until engine oil temperature reaches 50°C (122°F) minimum
- observe pressure on **VW 1318**
 - see technical data on page 25.12 for specifications

If pressure is too **HIGH** possible causes could be:

- defective control pressure regulator
- plugged fuel filter
- (system) pressure regulator/pressure relief valve is defective

If pressure is too **LOW**

- fuel return line could be plugged

Continuous Injection System

System pressure, checking

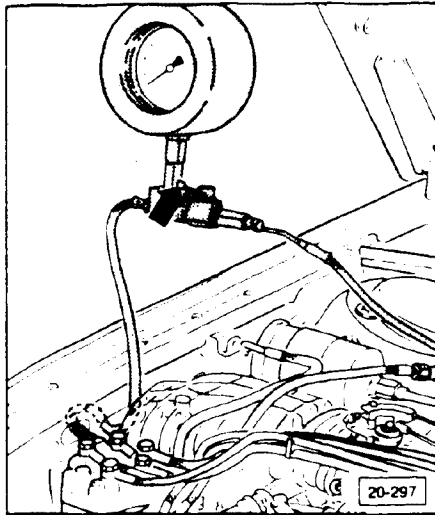
WARNING

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

Requirement

- control pressure regulator harness connector **MUST** be connected

Before checking system pressure check the fuel delivery quantity (see group 20) and the fuel filter.



- place **VW 1318** shut-off valve (arrow) in closed position
- start engine and let idle, observe gauge pressure
 - 5.8 to 6.6 bar (84.1 to 95.7 psi)

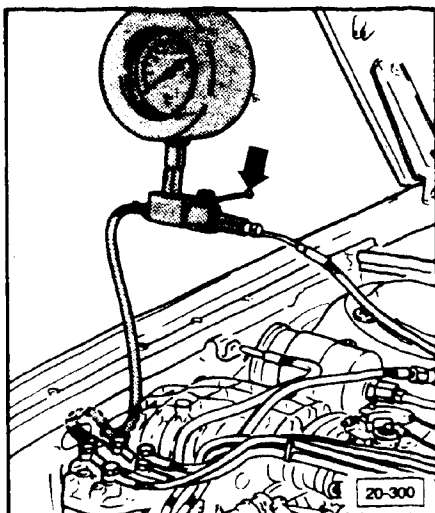
If fuel pressure is too **LOW**, possible causes could be:

- crimped, clogged or leaking fuel lines
- leaking pressure reservoir
- plugged fuel filter
- inadequate fuel pump delivery quantity
- defective or dirty system pressure regulator/pressure release valve
- defective fuel distributor

If fuel pressure is too **HIGH**, possible causes could be:

- clogged or crimped fuel return line
- defective system pressure regulator/pressure release valve

Continuous Injection System



Residual pressure, checking

WARNING

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

Requirements:

- engine oil temperature 50°C (122°F) minimum
- VW 1318 pressure gauge connected

- start engine and let idle
- bleed pressure gauge, by holding gauge down and moving shut-off lever (**arrow**) several times from open to closed position
- place shut-off valve (**arrow**) in **OPEN** position
 - control pressure (warm) must be within specifications (see technical data on page 25.12)

- switch **OFF** ignition
 - after 10 minutes, gauge pressure **MUST** be 3.0 bar (43.5 psi) minimum

If pressure drops very quickly

- check fuel pump check valve (see Group 20)

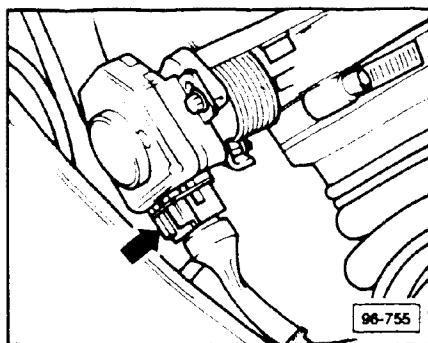
If observed pressure meets specifications;

- extend the test time to 20 minutes
 - after 20 minutes gauge pressure **MUST** be at least 2.8 bar (40.6 psi)

If the pressure is below specification;

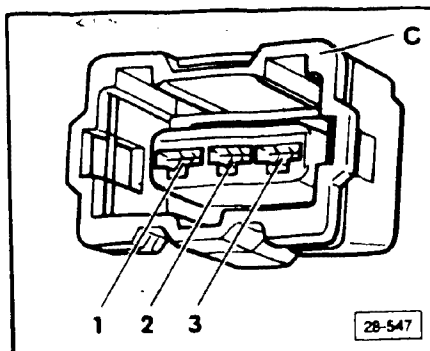
check the following possible causes:

- leaking fuel distributor
- leaking fuel injectors
- leaking cold start valve
- leaking fuel line(s) within the system



Idle and full throttle switches, checking

- disconnect harness connector for throttle switches at throttle body (arrow)

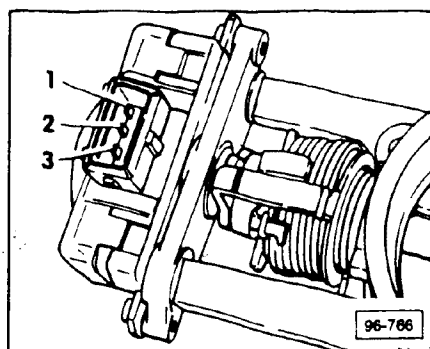


Voltage supply, checking

- connect multimeter US 1119 between terminal 2 of harness connector C and ground
- switch **ON** ignition
 - approximately 12 V
- switch **OFF** ignition

If **NO**

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



Idle switch, checking

- connect multimeter US 1119 between terminals 1 and 2
 - approximately 0 Ω (continuity)
- actuate switch with throttle lever
 - $\infty \Omega$ (open)

If **NO**

- adjust idle switch, see page 25.27
- repeat measurement

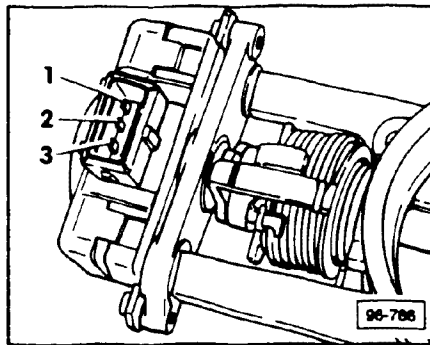
If still **NO**

- replace idle switch and adjust, see page 25.27

If **YES**

- check full throttle switch, page 25.26

Continuous Injection System



Full throttle switch, checking

- connect multimeter US 1119 between terminals 2 and 3
 - $\infty \Omega$ (open)

- actuate switch with throttle lever
 - 0Ω (continuity)

If **NO**

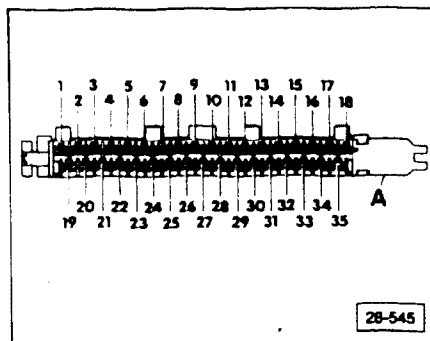
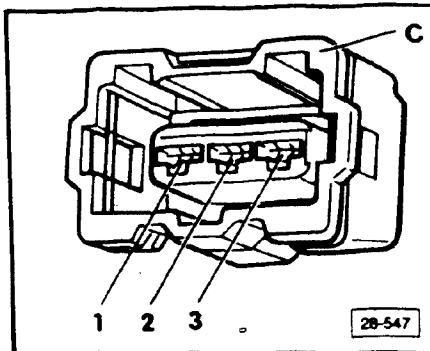
- adjust idle switch, see Repair Group 25
- recheck

If still **NO**

- replace full throttle switch

If **YES**

- check wiring between harness connector C and control unit connector A as follows
- remove control unit cover located in footwell on passenger side of vehicle



- unplug control unit harness connector A
- use multimeter US 1119 to check continuity between terminals of harness connector C and control unit harness connector A:

Harness connector C	Control unit harness connector A
1	20
3	26

- approximately 0Ω (continuity)

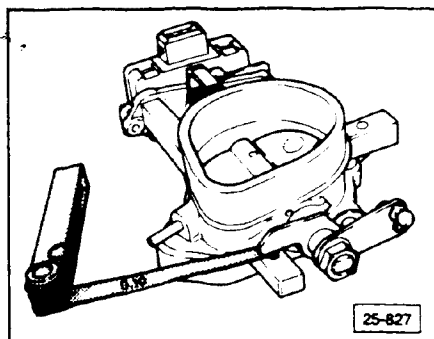
If **NO**

- check for open circuit in wiring between connectors A and C using wiring diagram

If measurements **OK** and system **NOT OK**

- replace control unit

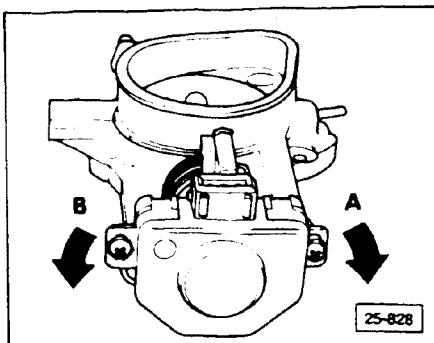
Continuous Injection System



Idle switch, adjusting

You must first remove the throttle valve body to adjust the idle switch.

- insert 0.1 mm (0.004 in.) feeler gage between throttle valve stop and adjusting screw
- loosen throttle switch assembly mounting screws



- turn throttle switch assembly in direction **A** as far as possible, then slowly turn in direction **B** until multimeter indicates 0 ohms (continuity)
- re-tighten mounting screws
- repeat measurement

If resistance value is still **NOT** obtained

- replace idle switch and adjust

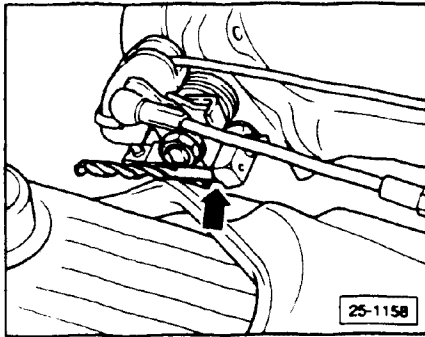
If the resistance value **IS** obtained

- connect multimeter between terminals 2 and 3 of throttle switch
 - infinite ohms (open)
- open throttle valve fully
 - approximately 0 ohms (continuity)

If resistance value is **NOT** obtained

- replace switch for idle and full throttle

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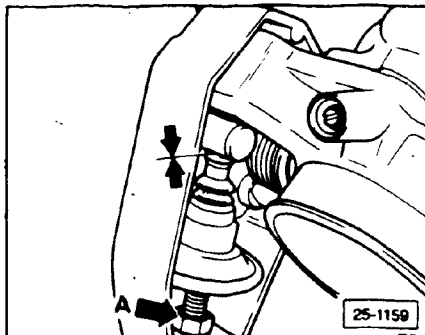


Dashpot (throttle body), checking and adjusting

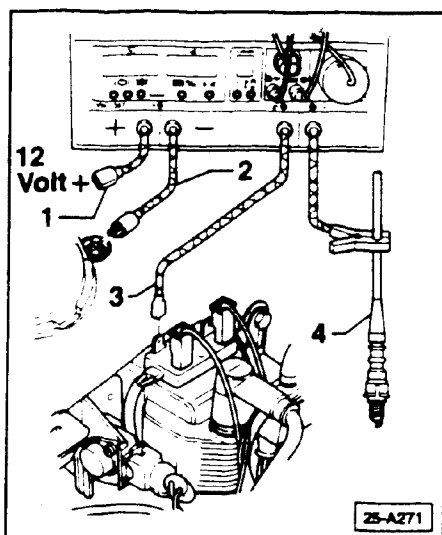
- remove connecting hose between intercooler and throttle body
- open throttle and insert a 5 mm drill between the throttle stop and the throttle lever (arrow)
 - the dashpot must just begin to lift from the roller on the throttle shaft

If NO

- loosen locknut A and rotate the dashpot until it just lifts from the roller
- re-check, re-adjust if necessary
- remove drill and re-install hose



Continuous Injection System

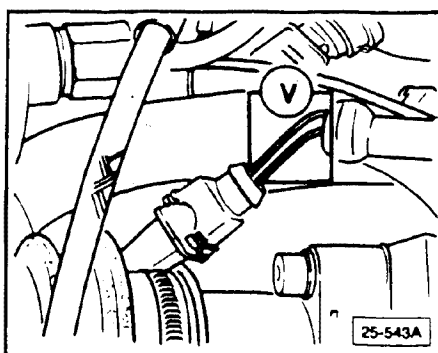


Deceleration fuel cut-off, checking

(manual transmission ONLY)

Check this first:

- engine oil temperature 80°C (176°F) minimum
- connect **VW 1367** engine tester as shown in illustration (to monitor engine speed)



- push back connector boot on cut-off valve
- switch multimeter **US 1119** to 20 volt range and connect to cut-off valve terminals
- start engine and let run at idle
- raise engine speed to 2000 RPM and release throttle allowing it to slam shut
- observe voltage on multimeter **US 1119**
 - approximately battery voltage

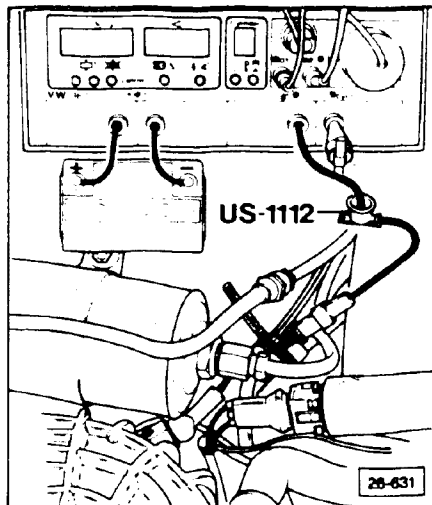
If 0.0 volts

- check idle switch (on throttle valve)
 - below 1200 RPM (in deceleration direction) **MUST** be 0.0 volts

If **NO**

- replace deceleration valve control unit, see illustration on page 25.7

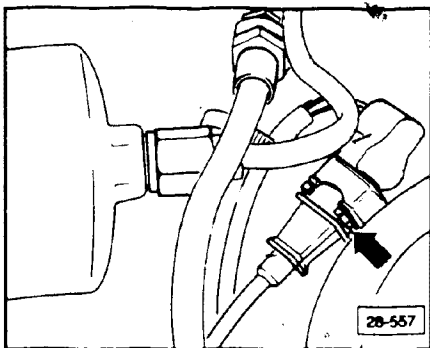
Continuous Injection System



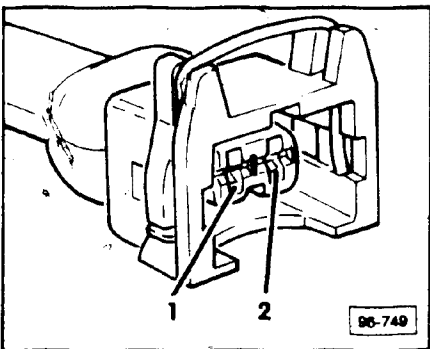
Signal to control unit

Check this first:

- deceleration fuel shut-off **OK**
- connect tester **VW 1367** according to manufacturer's instructions
- using test adaptor **US 1112**, connect green test lead to OXS system test connection
- push % button on **VW 1367**



- unplug harness connector from shut-off valve (**arrow**)
- start engine and run at idle



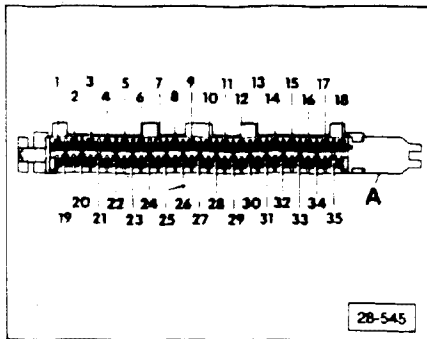
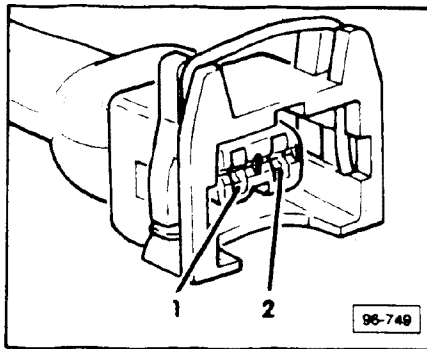
- using jumper cable, connect terminal 2 of open shut-off valve harness connector to ground
 - 40% duty cycle

Duty cycle must read 40% regardless of engine RPM.

If duty cycle reading **NOT OK**

- remove cover of control unit located in front passenger footwell
- unplug control unit connector **A**

Continuous Injection System



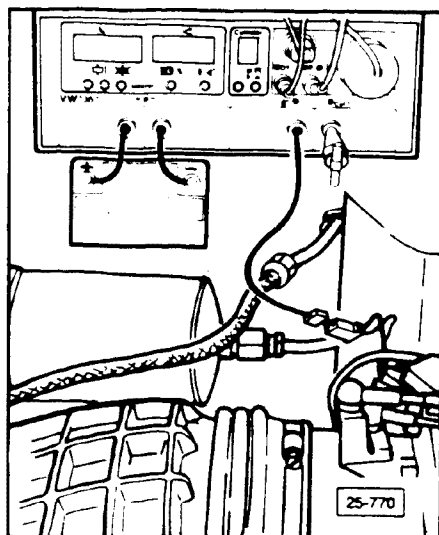
- using multimeter **US 1119**, check for continuity between terminal 2 of shut-off valve connector and terminal 4 of control unit connector **A**
 - 0.2 Ω

If **NO**

- check for open circuit using wiring diagram

If wiring **OK**

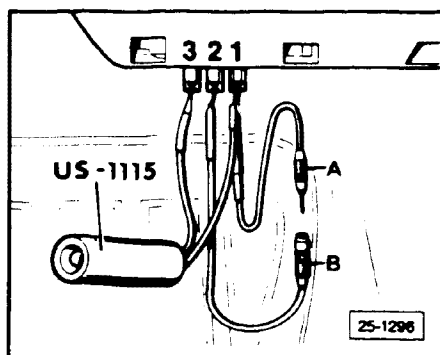
- replace control unit



Oxygen sensor system, checking

Use the **VW 1367** engine tester and **US 1125** adaptor to perform these tests. Let the engine run for approximately five minutes before testing the Oxygen sensor system (OXS).

- connect **VW 1367** to 12 volt supply voltage
- connect green test wire (from 1367) to adaptor **US 1125**
- connect **US 1125** adaptor to (Blue/Black) OXS duty cycle test connector
- depress % button on **VW 1367**



- connect **US 1115** LED tester (using adaptors from **V.A.G. 1594** adaptor kit) between rear terminals of black diagnostic connector 1 and blue diagnostic connector 3
- connect adaptor leads from **V.A.G. 1594** to front terminals of diagnostic connectors 1 and 2
- start engine and let run at idle (oxygen sensor **MUST** be at operating temperature)
- join connector **A** with connector **B**
 - 50% duty cycle (constant), at a speed of 2000 RPM or less

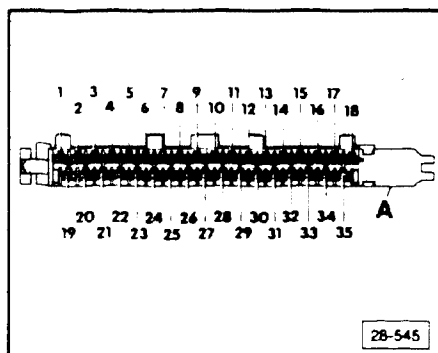
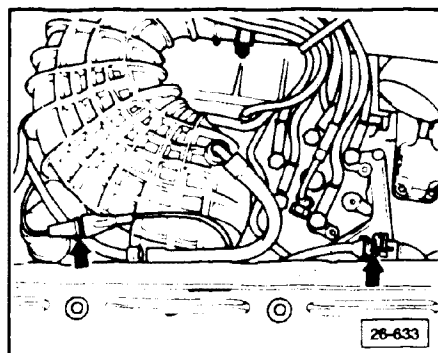
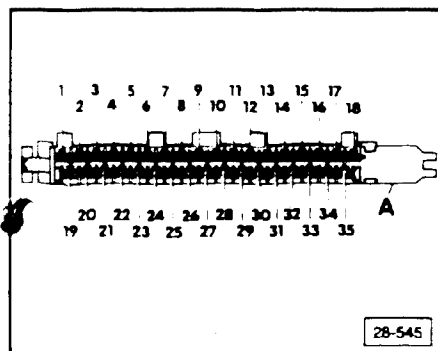
If duty cycle value **IS** obtained

- separate connectors **A** and **B**
- briefly increase engine speed to over 2000 RPM
 - 25% - 65% duty cycle (fluctuating)

If duty cycle value is **NOT** obtained

- check wiring as follows:

Continuous Injection System



- remove engine control unit then disconnect control unit harness connector
- switch multimeter **US 1119** to resistance range
- check continuity between blue/black wire of OXS test connector and terminal **8** of control unit harness connector **A**
 - approximately 0 ohms (continuity)

If continuity **IS** obtained

- replace engine control unit

If continuity is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

Oxygen sensor control, checking

- disconnect oxygen sensor harness connector (next to intake air boot)
- switch multimeter **US 1119** to 2 volt range
- connect mutimeter between OXS harness connector and ground
 - 400 ± 50 mV

If voltage value is **NOT** obtained

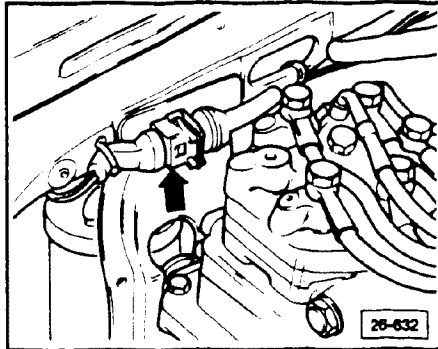
- remove engine control unit then disconnect control unit harness connector
- switch multimeter **US 1119** to resistance range
- check continuity between terminal **30** of engine control unit harness connector and OXS harness connector
 - approximately 0 ohms (continuity)

If continuity **IS** obtained

- replace engine control unit

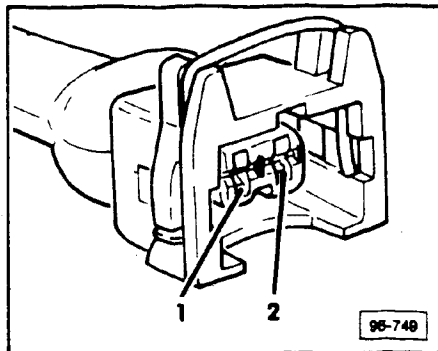
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Continuous Injection System



Oxygen sensor heater, checking

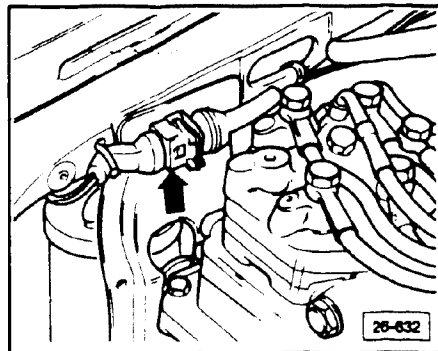
- separate harness connector for oxygen sensor heater (arrow)



- switch multimeter **US 1119** to 20 volt range
- connect multimeter between terminals 1 and 2 of OXS harness connector
- start engine and let run at idle
 - 12 volts minimum

If voltage value is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary



If voltage value **IS** obtained

- connect test adaptor **VW 1315 A/1** between OXS heater connector and OXS heater harness connector (arrow)
- connect ammeter with measuring range of 10 amps to test adaptor **VW 1315 A/1**
- switch **ON** ignition
 - 0.5 to 3.0 amps

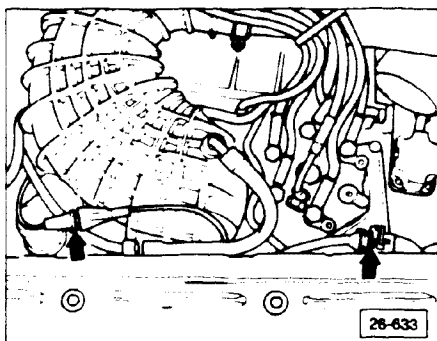
Note

Current is reduced as OXS heating increases.

If amperage value is **NOT** obtained

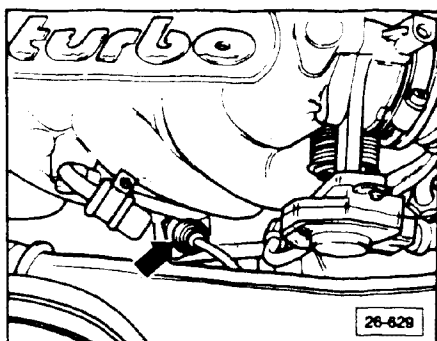
- replace oxygen sensor

Continuous Injection System



Oxygen sensor, removing/installing

- disconnect harness connectors for oxygen sensor and oxygen sensor heater (arrow)

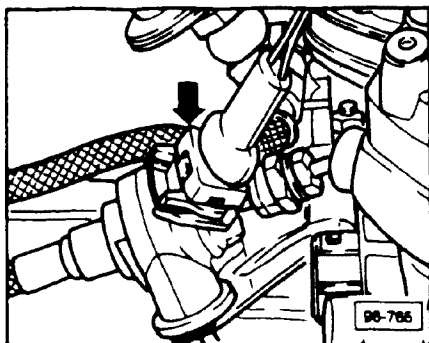


- remove oxygen sensor (arrow)

CAUTION

Oxygen sensor threads are coated with anti-seize compound. Do **NOT** allow compound into the slots at the sensor tip.

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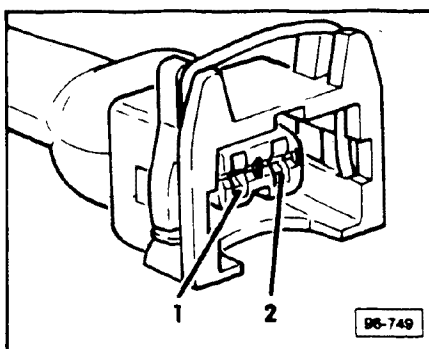


OXS frequency valve, checking

- unplug harness connector (arrow) from OXS frequency valve

Note

Oxygen sensor frequency valve is located in the passenger side front fender cavity.



- using LED tester US 1115, connect red test lead to terminal 1 and black lead to terminal 2 of open OXS frequency valve connector
- initiate output check sequence until code 4441 for OXS frequency valve is displayed, see Repair Group D2 for additional information
 - LED tester must be OFF

If LED is OFF

- replace OXS frequency valve

If LED is ON

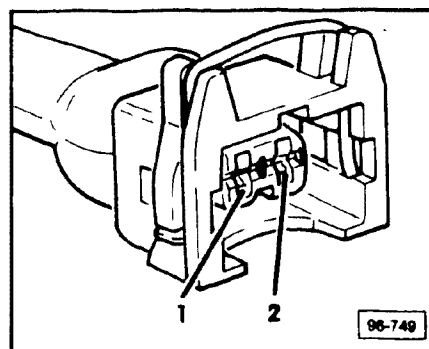
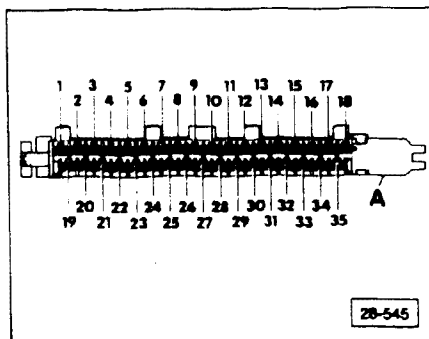
- connect multimeter US 1119 between terminal 1 and ground
 - approximately 12 volts

If NO

- check for open circuit using wiring diagram

If voltage reading OK

- remove control unit access cover located in front passenger footwell
- unplug control unit connector A



- connect multimeter US 1119 between terminal 8 of open control unit connector A and terminal 2 of open OXS frequency valve connector
 - approximately 10 Ω

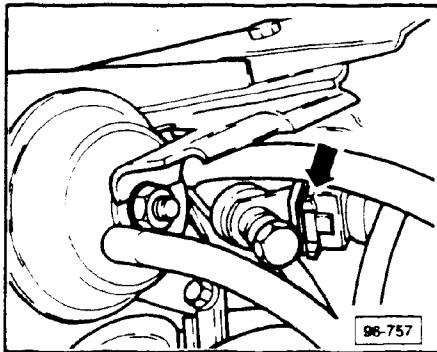
If NO

- check for open circuit in wiring between frequency valve connector and control unit connector using wiring diagram

If YES

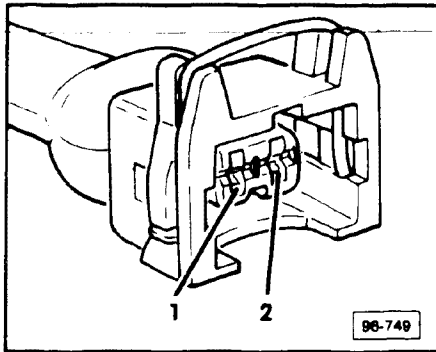
- replace control unit

Continuous Injection System



Cold start valve (control function), checking

- disconnect cold start valve harness connector



- connect **US 1115** LED tester to cold start valve harness connector using **VAG 1594** adaptor kit
- activate fault memory, (see Repair Group D2 for additional information). when code **4443** appears:
 - **US 1115 MUST** flash for approximately 10 seconds

If **US 1115 DOES** flash

- replace cold start valve

If **US 1115** does **NOT** flash

- connect multimeter between terminal 2 of cold start valve harness connector and ground
 - approximately 12 volts

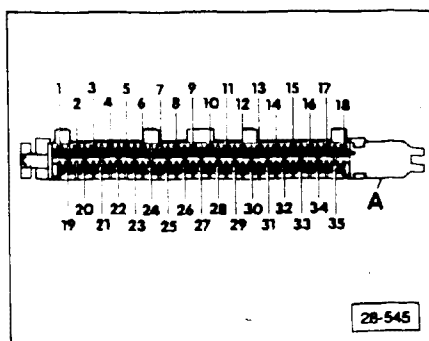
If voltage valve is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

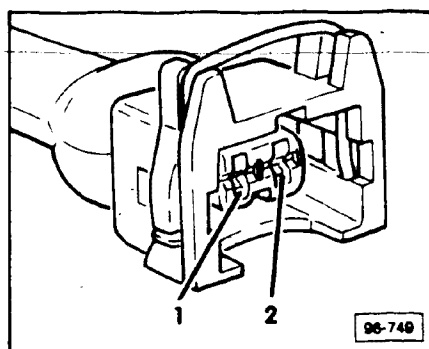
If voltage value **IS** obtained

- check wiring as follows:
- remove engine control unit then disconnect control unit harness connector
- switch multimeter **US 1119** to resistance range

Continuous Injection System



- disconnect control unit harness connector A



- using multimeter US 1119, check for continuity between terminal 2 of cold start valve connector and terminal 1 of control unit harness connector A
 - approximately 0.2 Ω

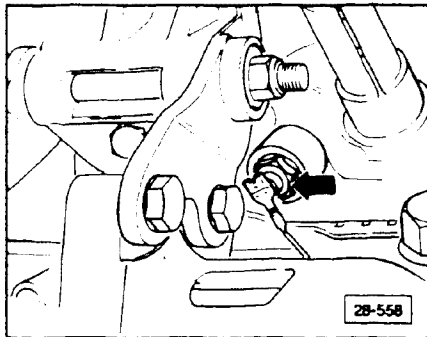
If resistance reading **NOT OK**

- check for open circuit using wiring diagram

If wiring **OK**

- replace control unit

Continuous Injection System



Coolant temperature sensor, checking

Check this first:

- coolant temperature 20°C (68°F) minimum

- remove harness connector from coolant temperature sensor (**arrow**)
- connect multimeter **US 1119** between coolant temperature sensor and ground cable
 - 60-1000 Ω

If **NO**

- replace coolant temperature sensor

If **YES**

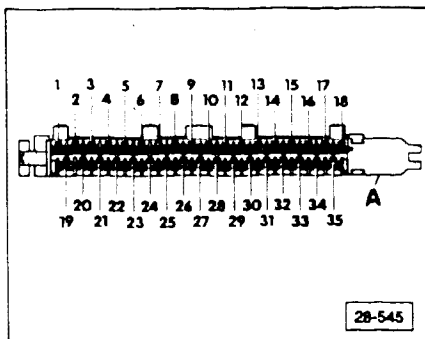
- check sensor wiring
- remove control unit cover located in passenger side footwell and unplug control unit harness connector **A**
- connect multimeter **US 1119** between terminal **10** on control unit connector **A** and disconnected wire from coolant harness temperature sensor
 - approximately 0 Ω (continuity)

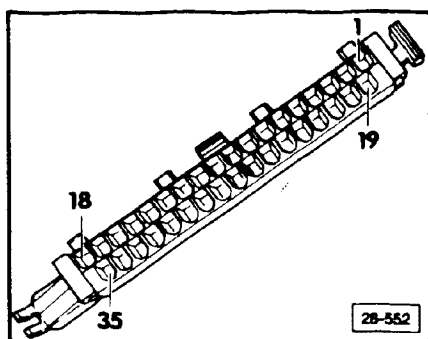
If **YES**

- check for open circuit using wiring diagram

If circuit **OK**

- replace control unit





Boost pressure Indicator, checking

- with control unit connector attached to control unit, connect multimeter **US 1119** to terminal 17 wire of control unit and ground
- run engine at idle
 - 0.25-2.5 volts

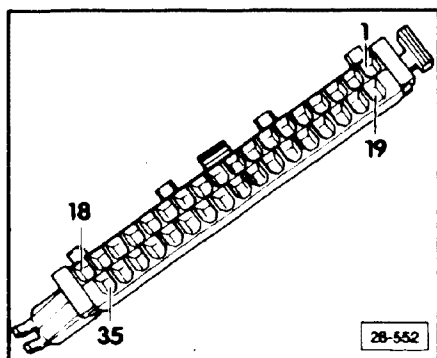
If **NO**

- replace control unit

If voltage reading **OK**, but boost pressure **NOT** indicated on instrument cluster

- check wiring between terminal 17 of control unit and instrument cluster indicator using wiring diagram
- repair as necessary

Continuous Injection System



Tachometer signal, checking

This reading is made with the control unit harness connector installed. Gain access to the terminals by peeling back the rubber insulating boot over the terminals.

- connect **US 1115** LED tester between terminal **7** and terminal **18** (ground)
- start engine and let run at idle
 - **US 1115 MUST** light up (flash)

If **US 1115** does **NOT** light up (flash)

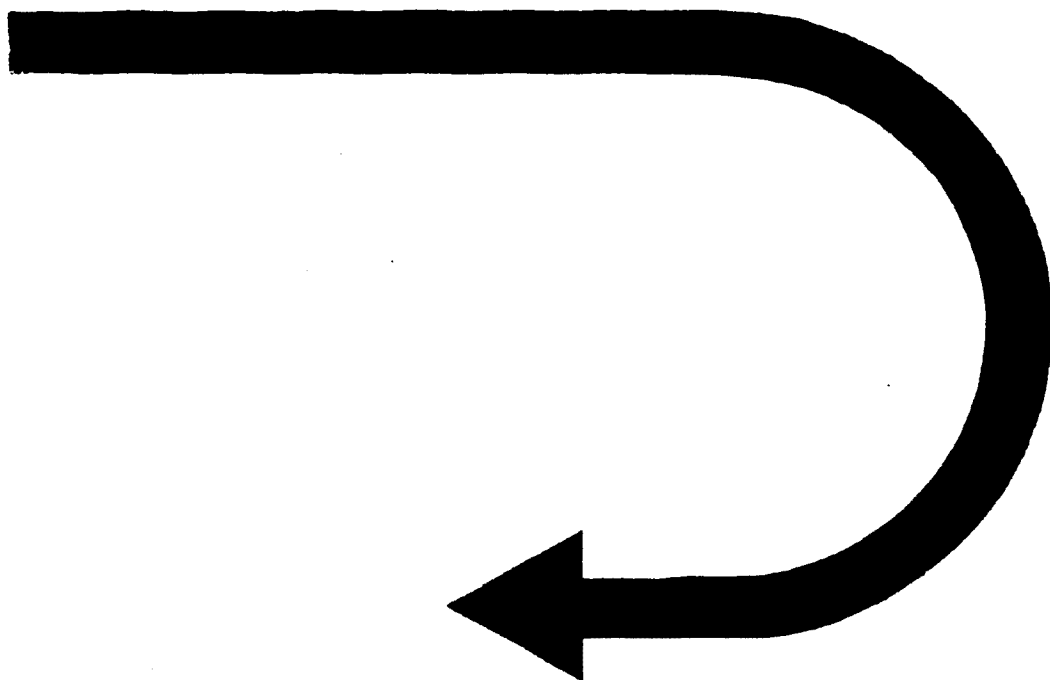
- replace engine control unit

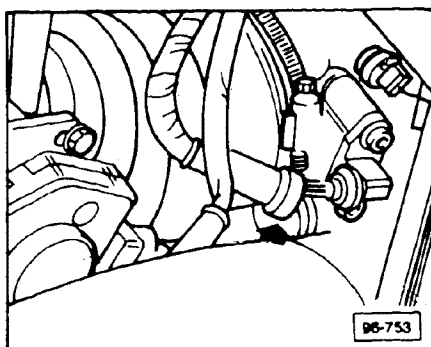
If **US 1115 DOES** light up (flashes), but vehicle tachometer does **NOT** indicate engine speed

- check wiring between terminal **7** of engine control unit harness connector and vehicle tachometer using wiring diagram

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CONTINUED IN THE
BEGINNING OF NEXT ROW





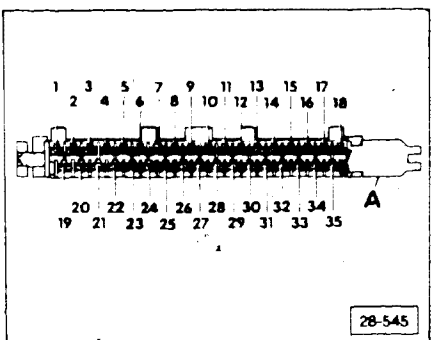
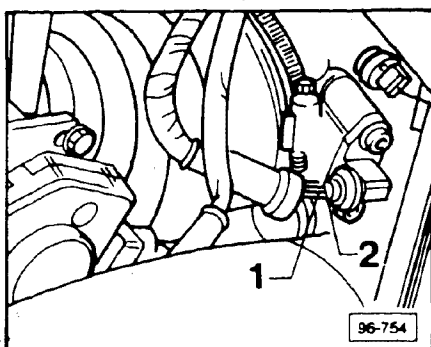
Intake air temperature sensor, checking

The intake air temperature sensor is located in the inter cooler outlet.

- without unplugging connector, slide back protective boot (**arrow**) and connect multimeter **US 1119** between terminals of intake air temperature sensor
 - 400-700 Ω

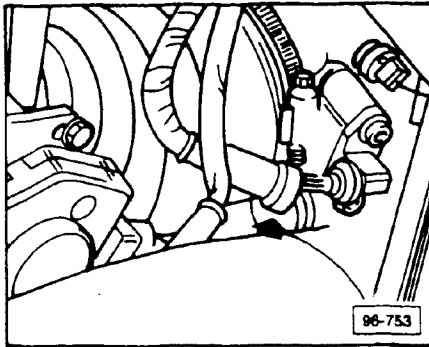
If YES

- check wiring between sensor and control unit as follows
- remove control unit cover panel located on passenger side footwell
- unplug control unit harness connector
- connect multimeter **US 1119** between terminal **23** of control unit harness connector and terminals **1** and **2** of air temperature sensor
 - either 0.0 ohms
or
400-700 ohms



- connect multimeter **US 1119** between terminal **24** of control unit connector and terminal **1** of air temperature sensor
 - from 400-700 ohms
- connect multimeter **US 1119** between terminal **24** of control unit connector and terminal **2** of air temperature sensor
 - approximately 0.0 ohms (continuity)

Continuous Injection System



If **NO**

- cut wires at intake air temperature sensor terminals (**arrow**) and check as follows
- connect multimeter **US 1119** between open terminals 1 and 2 of intake air temperature sensor
 - from 400-700 ohms

If **NO**

- replace sensor

Intake air temperature sensor must always be re-soldered when wires have been cut to insure that proper electrical characteristics are maintained.

If sensor **OK**

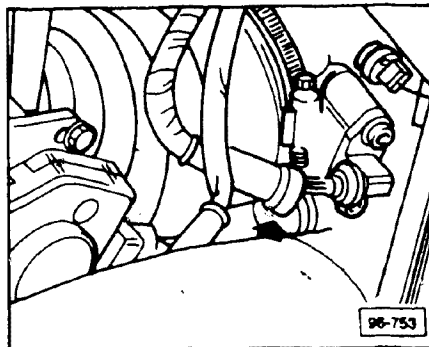
- check for short circuit in wiring between control unit and air temperature sensor

If wiring **OK**

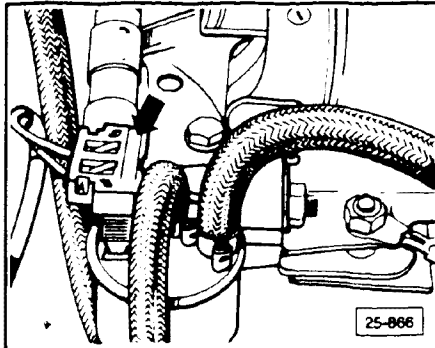
- replace control unit
- repeat test

Removing/Installing

- push back protective boot on intake air temperature sensor (**arrow**)
- cut off wires at sensor
- remove sensor
- remove protective boot and install new sensor
- fit rubber insulator and protective boot over wiring
- fit terminal lugs on bared wires and solder to sensor terminals
- push rubber insulator over soldered joints
- push protective boot onto sensor

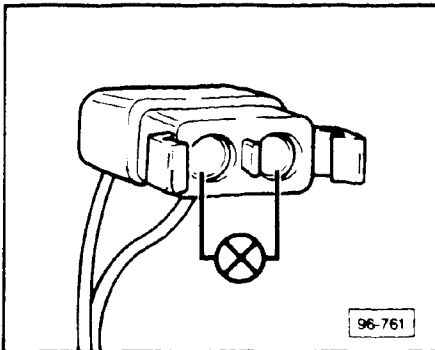


Continuous Injection System



Wastegate frequency valve (control function), checking

- disconnect wastegate frequency valve harness connector (arrow)



- connect **US 1115** LED tester to wastegate frequency valve harness connector using **VAG 1594** adaptor kit

- activate fault memory (see Repair Group D2 for additional information), when code **4442** appears:

- **US 1115** LED tester **MUST** flash

If **US 1115** **DOES** flash

- replace wastegate frequency valve

If **US 1115** does **NOT** flash

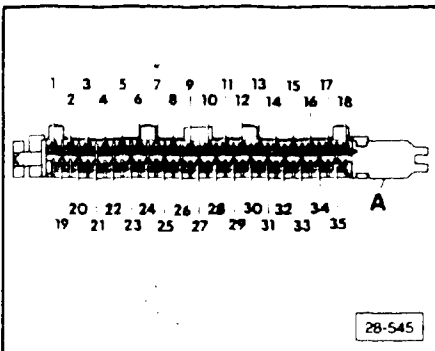
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between blue/black wire of wastegate frequency valve harness connector and ground
- approximately 12 volts

If voltage value is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

If voltage value **IS** obtained

- check wiring as follows:
- remove engine control unit then disconnect control unit harness connector
- switch multimeter **US 1119** to resistance range



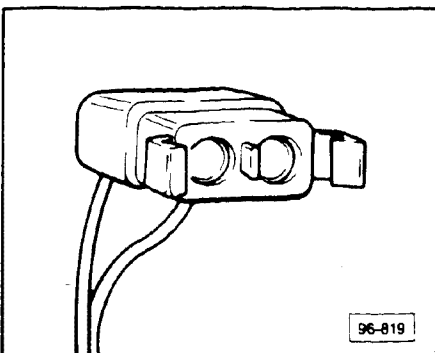
- check continuity between terminal **19** of control unit harness connector **A** and gray/yellow wire of wastegate frequency valve harness connector
- approximately 0.2 ohms (continuity)

If continuity is **NOT** obtained

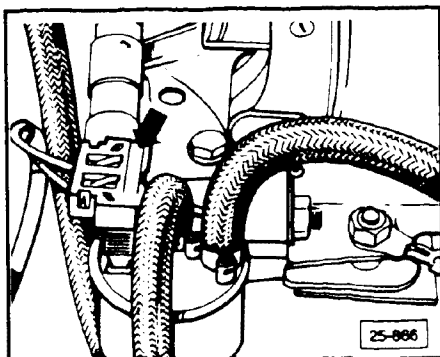
- check wiring using wiring diagram, make repairs as necessary

If continuity **IS** obtained

- replace engine control unit



Continuous Injection System



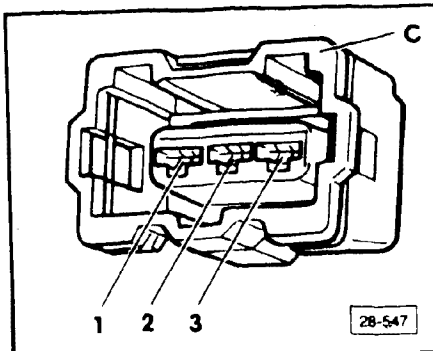
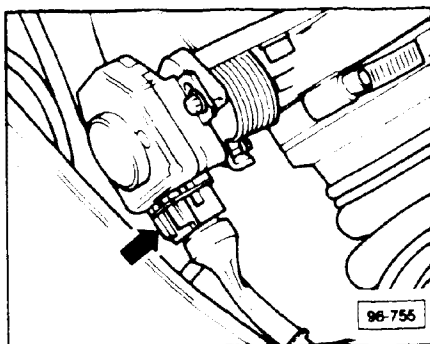
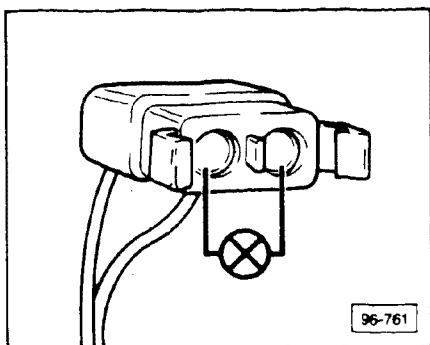
Temperature safety switch, checking

Check this first:

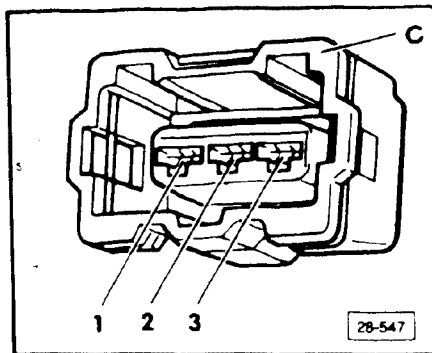
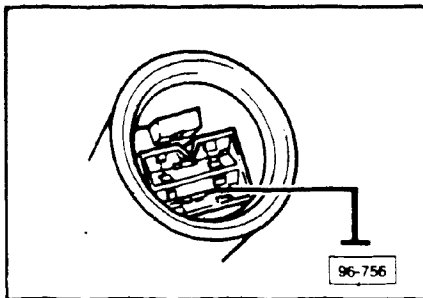
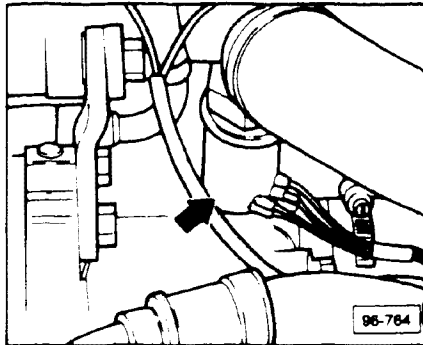
- wastegate frequency valve **MUST** click **ON** during output diagnosis

If **YES**

- disconnect harness connector from wastegate frequency valve (arrow)
- using LED tester **US 1115**, connect red test lead to blue/black wire terminal and black test lead to green/yellow wire terminal
- run engine at idle
- unplug harness connector at throttle switch (arrow)
- using jumper wire, bridge terminals 2 and 3 of open throttle switch harness connector **C** (short circuit)
 - LED tester must go **ON** for approximately two seconds (or at least flicker)



Continuous Injection System



If **NO**

- replace thermoswitch

If **YES**, check thermoswitch as follows:

- remove jumper bridge between terminals 2 and 3 of wastegate frequency valve harness connector
- remove harness connector (arrow) from thermoswitch

- connect terminal of harness connector (as shown) to ground using jumper wire

- connect terminal of harness connector (as shown) to ground using jumper wire

- bridge terminals 2 and 3 of throttle switch harness connector C
 - LED tester must **NOT** go **ON** or flicker

If LED goes **ON**

- check wiring between thermoswitch and control unit using wiring diagram

Note

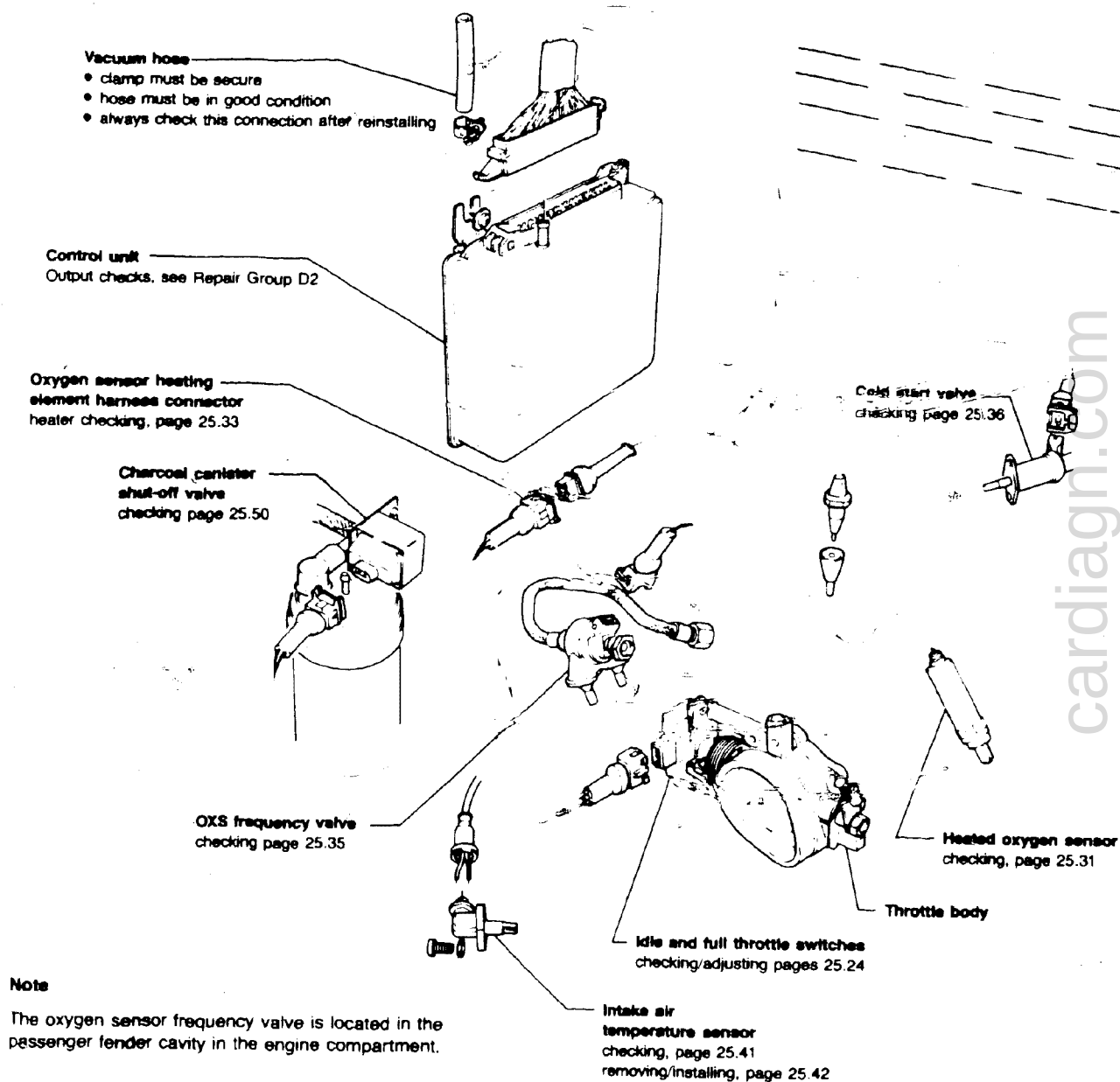
Boost pressure from the turbocharger is electronically controlled. A specified manifold pressure map is programmed into the control unit. The control unit operates the wastegate frequency valve.

To prevent engine damage from overboost, the system will not operate when:

- engine temperature exceeds 119°C (247°F)
- a fault develops in manifold pressure sensor circuit
- a specified boost value has not been reached within 3 seconds of system operation
- ignition timing is being retarded the maximum amount (7.8) due to engine knock (detonation)

WARNING

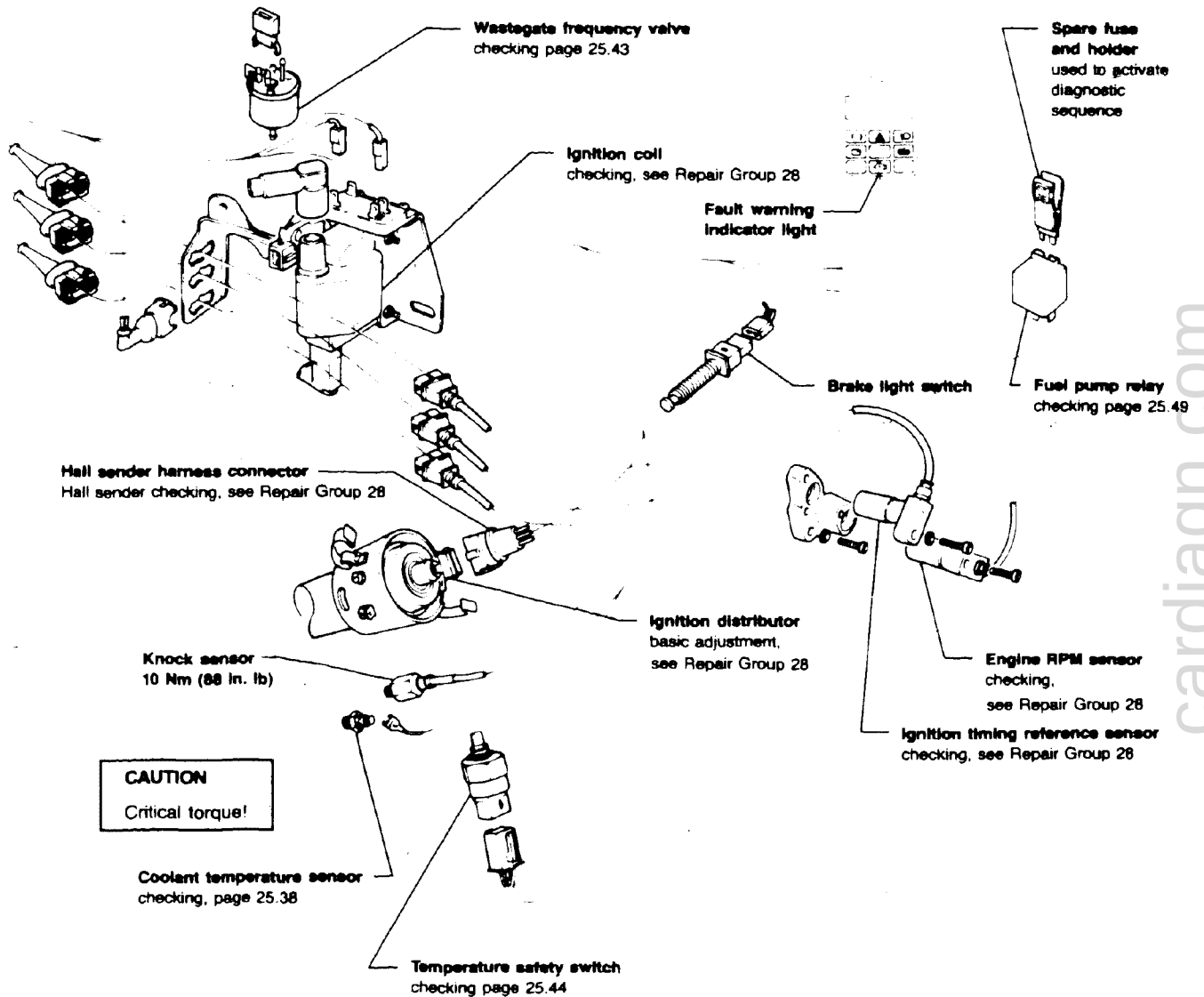
Fire hazard. Do NOT smoke or have anything in area that can ignite fuel.



Continuous Injection System

CAUTION

Please read safety guidelines on page 25.48 before working on electronic ignition.



28-575

Continuous Injection System

Rules of cleanliness

CAUTION

First:

- clean connecting points before loosening

When fuel system is open

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

Use clean parts only

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

Safety guidelines for fully electronic ignition system

CAUTION

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

Turn ignition off:

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

Don't forget about the battery:

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

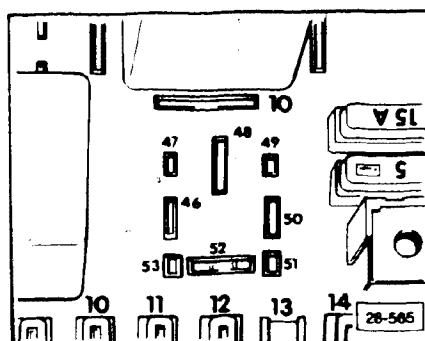
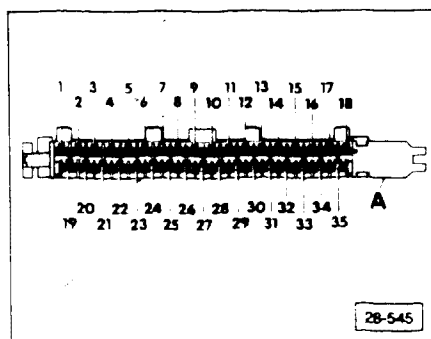
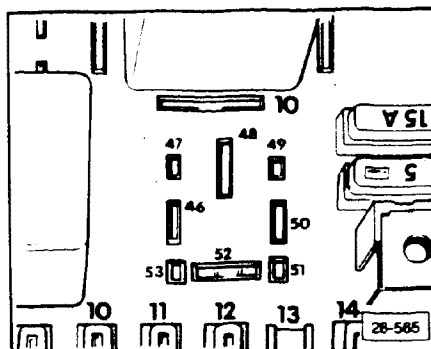
When testing the system:

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

When applying heat:

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

Continuous Injection System



Control unit output signals, checking

Fuel pump relay signal

- pull fuel pump relay from relay panel, location number 10
- connect multimeter US 1119 between terminals 46 and 50, then terminals 48 and 50, with ignition switched ON
 - approximately 12 volts

If NO

- check for open circuit using wiring diagram
- connect multimeter US 1119 between terminals 46 and 47
- briefly actuate starter
 - approximately 9.5 volts

If YES

- replace fuel pump relay

If NO

- check circuits as follows
- remove control unit access cover located in footwell on passenger side of vehicle
- disconnect control unit harness connector
- using multimeter US 1119, check for continuity between following terminals

Connector A	Relay location 10
21	47
31	49

- approximately 0.2 Ω

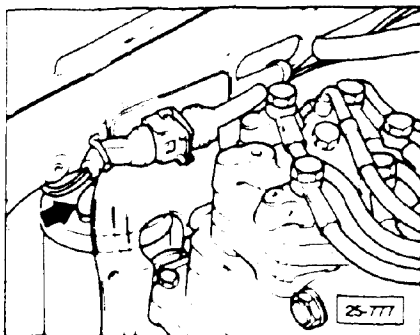
If NO

- check for open circuit using wiring diagram

If YES

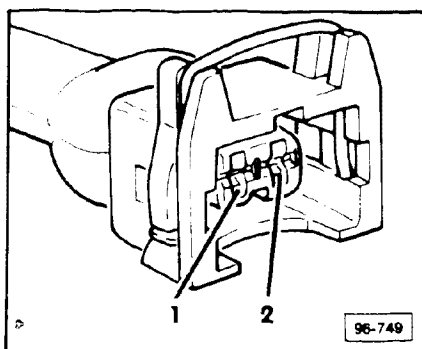
- replace control unit

Continuous Injection System



Carbon canister shut-off valve, checking

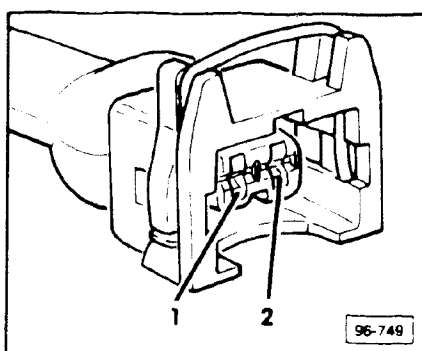
- disconnect harness connector (arrow) from carbon canister shut-off valve, located in fender cavity near fuel distributor



- using LED test **US 1115**, connect red test lead to terminal 1 and black lead to terminal 2 of open harness connector
- activate output check sequence until code **4343** for carbon canister shut-off valve is displayed, see Repair Group D2 for additional information
 - **US 1115** must be **ON**

If LED is **ON**

- replace carbon canister shut-off valve



If LED is **NOT ON**

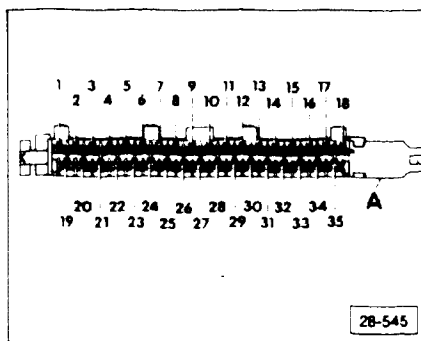
- connect multimeter **US 1119** between terminal 1 of harness connector and ground
 - approximately 12 volts

If **NO**

- check for open circuit using wiring diagram

If **YES**

- remove access cover for control unit located in front passenger side footwell
- disconnect control unit harness connector **A**



- using multimeter **US 1119**, check resistance between terminal 2 of shut-off valve harness connector and terminal 3 of control unit harness connector **A**
 - 0.2 Ω

If **NO**

- check for open circuit using wiring diagram

If wiring **OK**

- replace control unit

Continuous Injection System

Engine settings, checking/adjusting

Preparation for checking/adjusting

CAUTION

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

Requirements

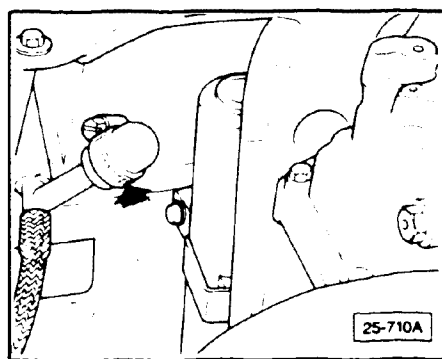
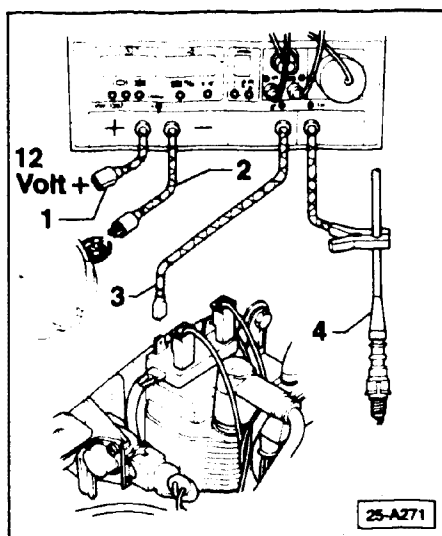
- engine oil temperature 80°C (176°F) minimum
- throttle valve in idle position
- throttle valve switch **OK**
- coolant thermo-switch **OK**
- all electrical consumers switched **OFF**
- A/C switched **OFF**
- there should **NOT** be any pressure measuring devices connected to the fuel system

If injector lines were disconnected or replaced:

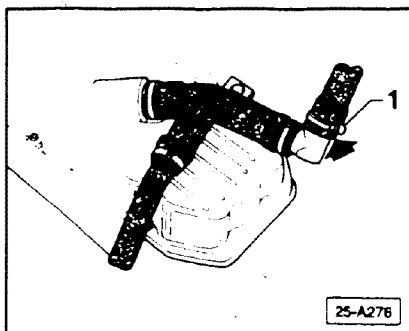
- run engine speed to approximately 3000 RPM several times and then let idle for at least two minutes prior to checking
- position **VW 1367** engine tester on top of plenum
- connect red wire 1 to coil junction block
- connect black test wire 2 to ground
- connect green test wire 3 to terminal 1 of coil junction block
- connect inductive pickup 4 to cylinder 1 spark plug wire

TDC sensor (magnetic pickup) for the **VW 1367** is **NOT** connected.

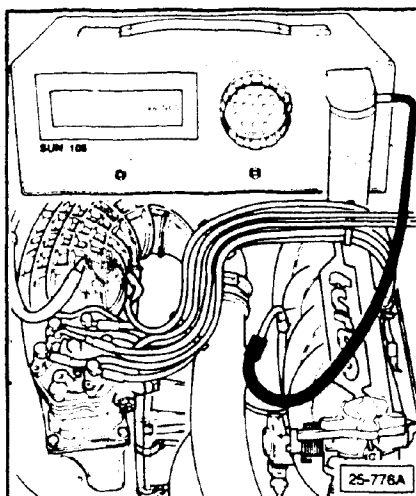
- remove clamp and cap (arrow) from carbon canister tee



Continuous Injection System

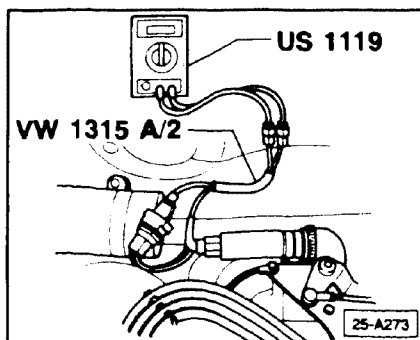


- remove clamp 1 from breather hose and remove hose from fitting
- plug open end of breather hose with cap previously removed from carbon canister tee



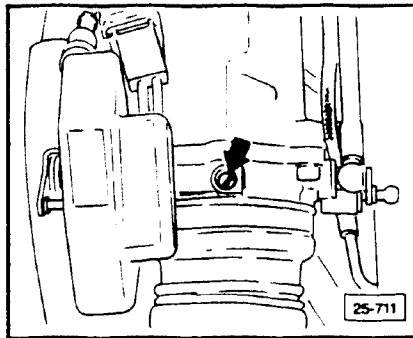
- pull cap off CO tap tube and connect hose from **SUN 105** CO tester

Hose **MUST** fit securely over CO tap tube so there is **NO** exhaust leakage.



- disconnect idle stabilizer valve harness connector and insert test adaptor **VW 1315 A/2** between idle stabilizer valve and harness connector
- switch multimeter **US 1119** to 2 amp range and connect to leads of **VW 1315 A/2** test adaptor

Continuous Injection System



Idle speed, checking/adjusting

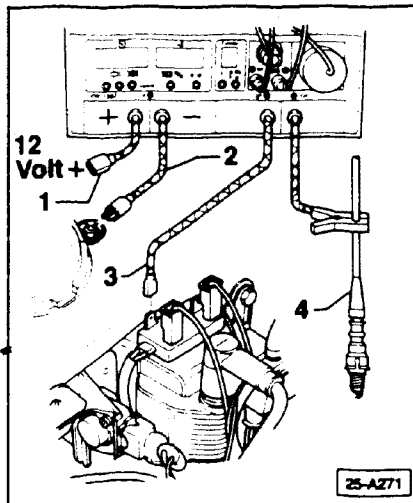
- start engine and let idle
 - 800 ± 50 RPM (manual transmission)
 - 720 ± 50 RPM (automatic transmission)

If NO

- adjust idle speed RPM's by turning idle adjustment screw (arrow)
- disconnect green wire from terminal 1 of ignition coil junction block
 - this activates the idle stabilizer preset value
- observe mA reading on US 1119
 - 430 ± 20 mA

If NO

- check idle stabilization system (see page 25.57)
- reconnect green wire to terminal 1 of ignition coil junction block
 - $430 \text{ mA} \pm 20$ fluctuating
 - idle speed should remain within specifications

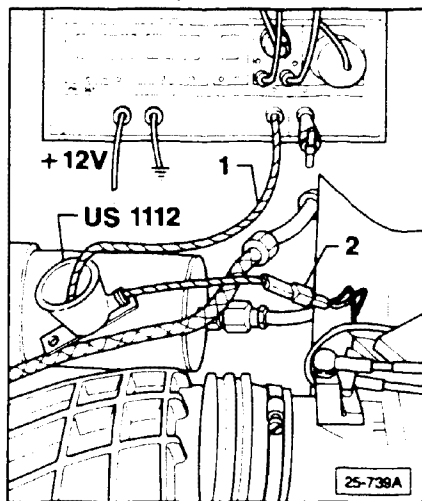


CO value (OXS duty cycle), checking

VW 1367 hookup changes:

- remove inductive pickup from cylinder 1 spark plug wire
- remove green wire 3 from coil junction block and connect to test adaptor US 1112

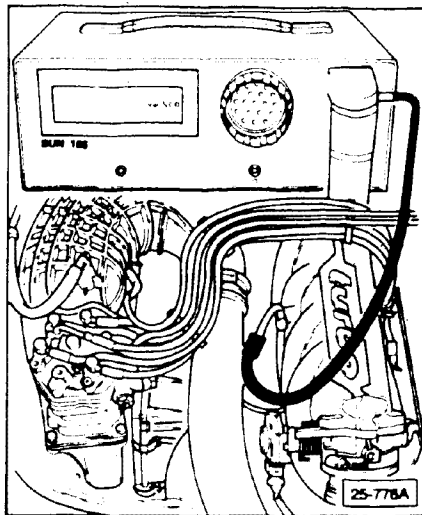
Continuous Injection System



- connect test adaptor **US 1112** to test connector **2**
- depress % button on **VW 1367**
- select 4 cylinder range on **VW 1367**
- start engine and allow to idle

Note

Ignore RPM display on **VW 1367**.



- observe OXS duty cycle
 - 25 to 65% and **fluctuating**
- observe CO content on **SUN 105**
 - 0.3% to 1.2% volume (with oxygen sensor connected)

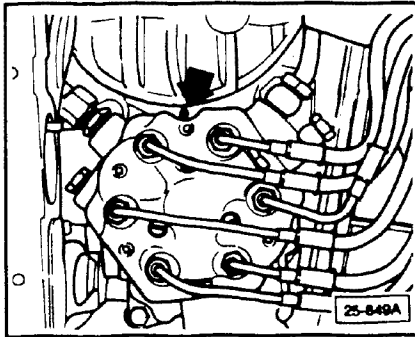
If NO

- adjust CO

If CO content is greater than 1.2% volume **BUT** duty cycle is between 25% and 65%, check the following:

- ignition system **NOT OK**, check and repair as necessary
- leaking exhaust system, seal or replace as necessary
- fuel distributor defective, check and repair as necessary

Continuous Injection System



CO value (OXS duty cycle), adjusting

- switch ignition **OFF**
- remove intake air boot from air flow sensor
- **lightly** center punch CO adjustment plug on top of air flow sensor housing (arrow)

CAUTION

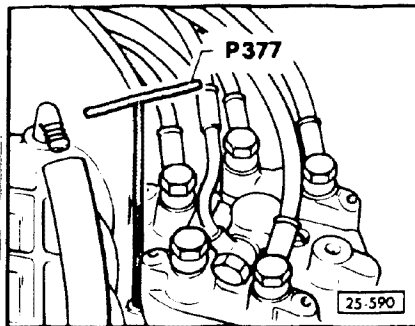
Do **NOT** hit CO plug with force. Do **NOT** drive CO plug through air flow sensor housing.

- drill 2.5 mm (3/32 in.) hole in center of plug approximately 3.5 to 4.0 mm deep (9.64 to 5/32 in.)

CAUTION

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

- screw 3 mm (1/8 in.) sheet metal screw into drilled hole
- remove plug/screw using pliers
- reinstall intake air boot



- start engine and allow to idle
- using tee wrench **P377**, adjust duty cycle by means of the CO adjusting screw
 - adjusting specification:
50% $\pm$ 8% **FLUCTUATING**

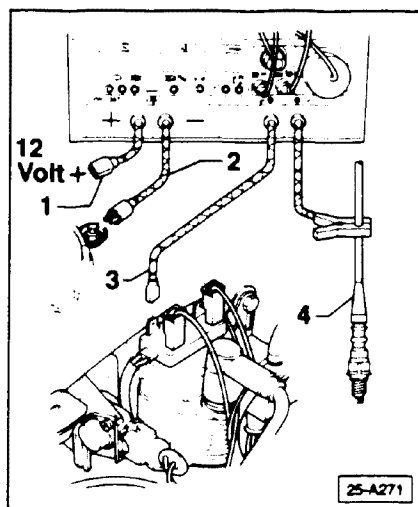
By turning the CO adjustment screw: -

- clockwise (richer) — duty cycle decreases
- counterclockwise (leaner) — increases it

CAUTION

Do **NOT** push the adjustment wrench downward during adjustment, nor should you accelerate the engine with the tool in place. Remove the tool after each adjustment and then briefly accelerate the engine before reading the CO value.

Continuous Injection System



- connect green test wire 3 to terminal 1 of coil junction block
- connect inductive pickup 4 to cylinder 1 spark plug wire
- start engine and allow to idle, recheck idle RPM value
 - 800 ± 50 RPM (manual transmission)
 - 720 ± 50 RPM (automatic transmission)
- adjust if necessary

CAUTION

If the idle speed requires readjustment then the OXS duty cycle must also be readjusted.

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

A short term solution would be an oil change.

- turn engine **OFF**
- disconnect **VW 1367** connections
- reconnect idle stabilizer valve
- reinstall CO tap tube cap
- reinstall cap on carbon canister tee, and tighten
- install new CO adjustment access plug

Continuous Injection System

Idle stabilization system, checking

Note

For idle stabilization control unit location see exploded view on page 25.5.

Requirements:

- engine oil temperature 80°C (176°F) minimum
- throttle valve in idle position
- throttle switch **OK**
- thermoswitch and/or temperature sensor **OK**
- all electrical consumers switched **OFF**
- A/C switch **OFF**
- pressure measuring equipment **NOT** connected
- radiator fan must **NOT** be running during measurements

Note

If fuel injection lines were loosened or replaced, raise engine speed to 3000 RPM several times, then let idle for at least 2 minutes before performing checks.

- disconnect idle stabilizer valve harness connector and insert test adaptor **VW 1315A/2** between idle stabilizer valve and harness connector
- switch multimeter **US 1119** to mA range and connect to leads of test adaptor **VW 1315A/2**
- connect engine tester **VW 1367** according to manufacturer's instructions
- switch ignition **ON**
 - 550 ± 25 mA

If 430 mA is measured

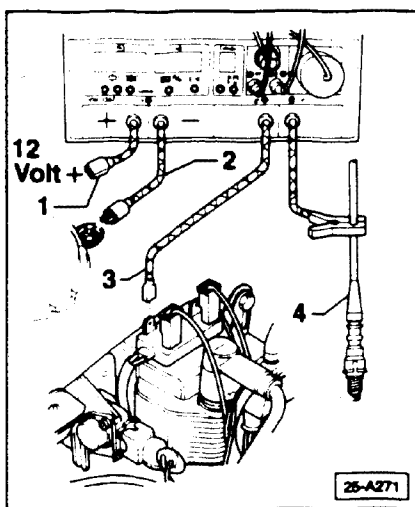
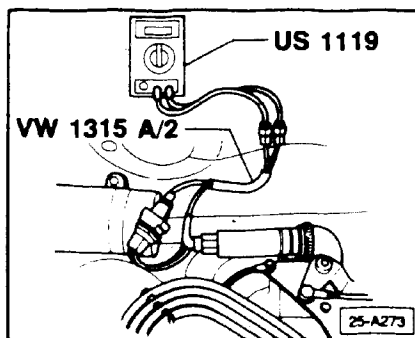
- check for open circuit between control unit and terminal 1 of ignition coil according to wiring diagram

If 0 mA is measured

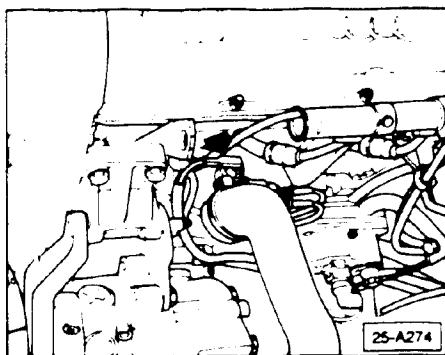
- a. check for open circuit between control unit and temperature sensor or a defective temperature sensor (checking, see page 25.38)
 - b. check for open or short circuit in wiring between control unit and idle stabilizer valve, or a defective idle stabilizer valve
 - c. control unit defective
- switch ignition **OFF**

CAUTION

Always switch **OFF** the ignition while making or breaking electrical connections to the Idle Stabilization System.



Continuous Injection System



Temperature sensor, checking

- disconnect temperature sensor harness connector from temperature sensor (**arrow**)
- connect multimeter **US 1119** between temperature sensor terminal and ground
- measure resistance for the appropriate engine oil temperature:
 - at -20°C (-4°F) approximately $6000\ \Omega$
 - at $+20^{\circ}\text{C}$ (68°F) approximately $1000\ \Omega$
 - at 80°C (176°F) approximately $130\ \Omega$

If an acceptable value is **NOT** obtained

- replace temperature sensor

If an acceptable value **IS** obtained:

- check for open circuit using wiring diagram

If **ALL** open circuits have been checked by using wiring diagram

or

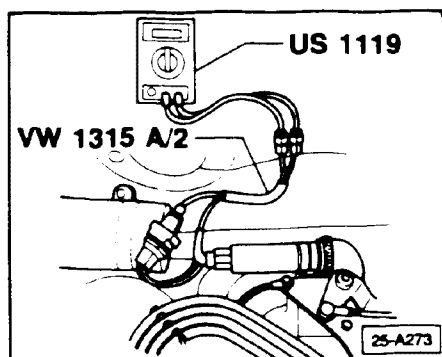
If **NO** open circuits were found

- replace control unit
- start engine and let run at idle
 - $430 \pm 20\ \text{mA}$

If amperage falls within this range, idle speed should be

- manual transmission: $800 \pm 50\ \text{RPM}$
- automatic transmission: $720 \pm 50\ \text{RPM}$

Continuous Injection System



CAUTION

Always switch **OFF** the ignition while making or breaking electrical connections to the Idle Stabilization System.

A/C load compensation, checking

- disconnect idle stabilizer valve harness connector and insert test adaptor VW 1315 A/2 between idle stabilizer valve and harness connector
- switch multimeter US 1119 to 2 amp range and connect to leads of VW 1315 A/2 test adaptor
- start engine and run at idle
- raise speed to 2000 RPM and hold this speed
- note current value (mA)
- switch A/C **ON**
 - with the compressor running and a constant engine speed of 2000 RPM, the noted value must increase abruptly by approximately 80 mA

If the value does **NOT** increase

- check for open circuit between control unit and A/C compressor using wiring diagram

cardiagn.com

Continuous Injection System

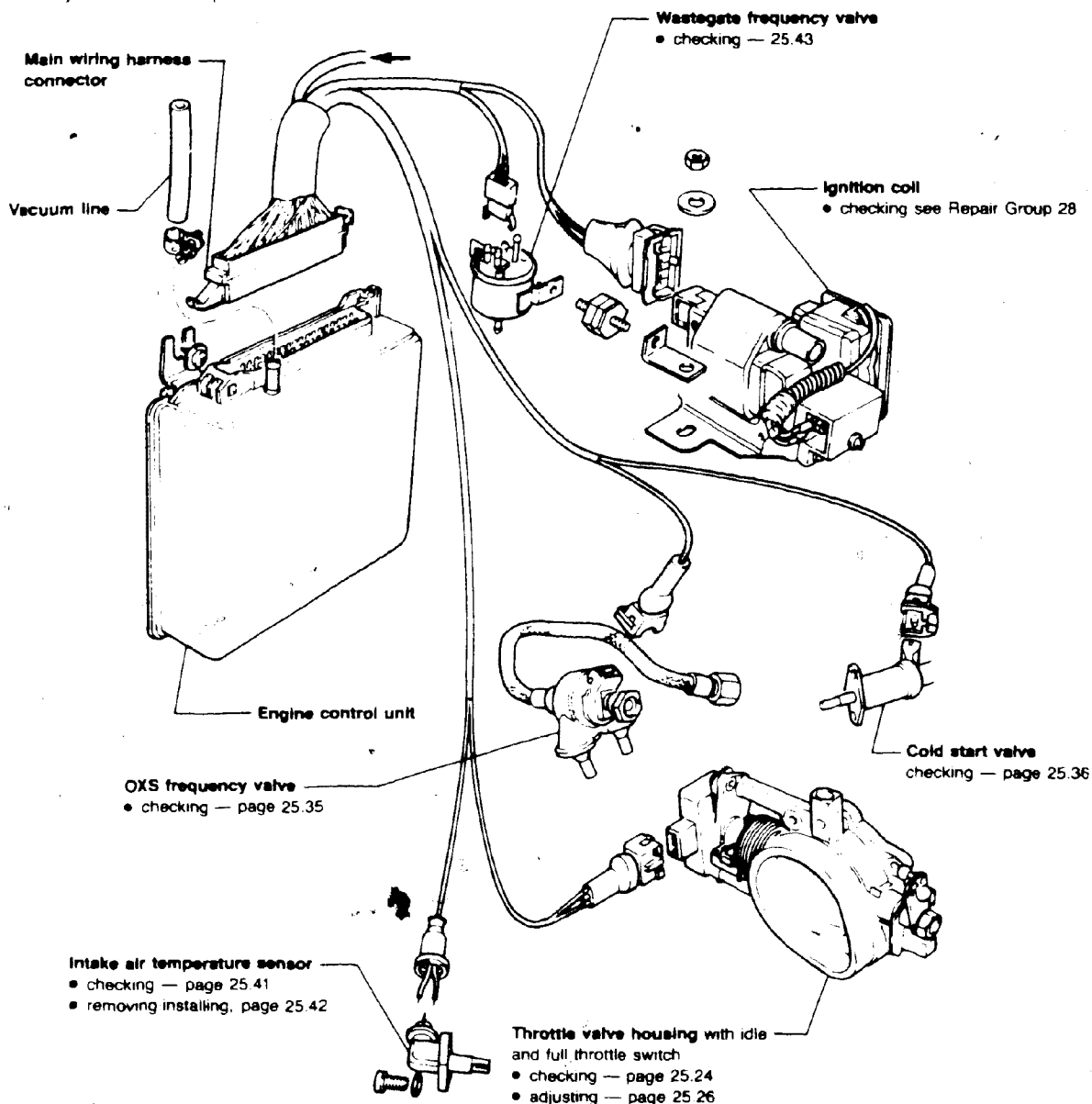
Note

The engine control unit is equipped with a fault memory. Faults must be called up from the fault memory **BEFORE** initiating repairs and/or troubleshooting, see fault memory activation, Repair Group D2.

- observe **Safety Guidelines** page 25.62
- perform all tests and measurements using the US 1119 multimeter and US 1115 LED tester in conjunction with adaptor set VW 1594

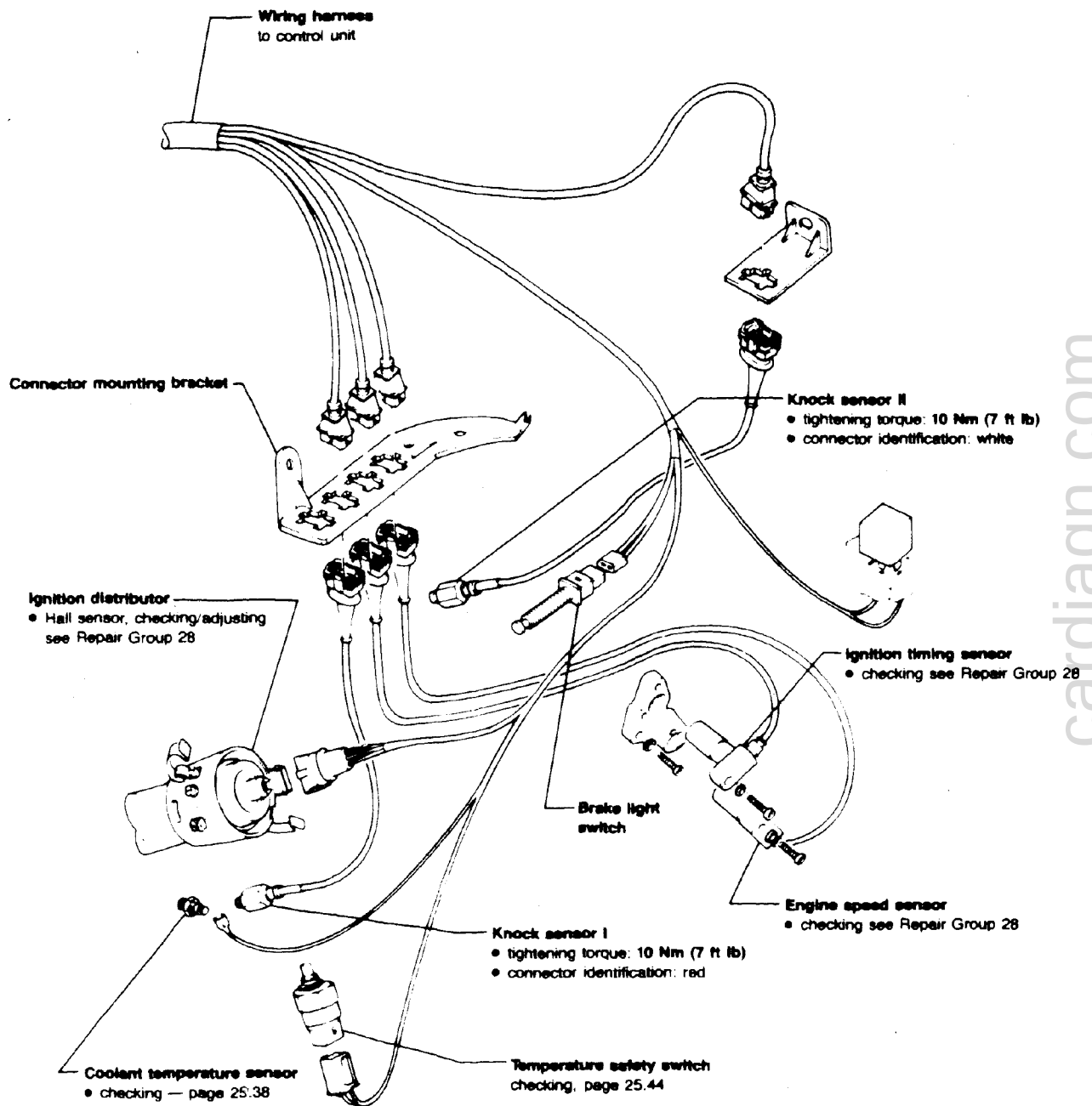
WARNING

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



28-903

Continuous Injection System



28-945

Rules of cleanliness

CAUTION

First:

- clean connecting points before loosening

When fuel system is open

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

Use clean parts only

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

Safety guidelines for fully electronic ignition system

CAUTION

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

Turn ignition off:

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

Don't forget about the battery:

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

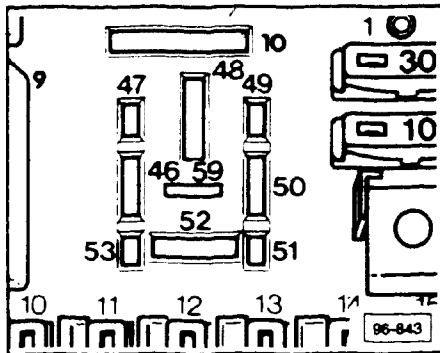
When testing the system:

- 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

Continuous Injection System



Fuel pump relay (control function), checking

- pull fuel pump relay out of fuse/relay panel, relay location 10
- switch multimeter **US 1119** to 20 volt range
- connect multimeter between relay socket terminals **46** and **50**, then **48** and **50**
- switch **ON** ignition
 - approximately 12 volts

If voltage values are **NOT** obtained

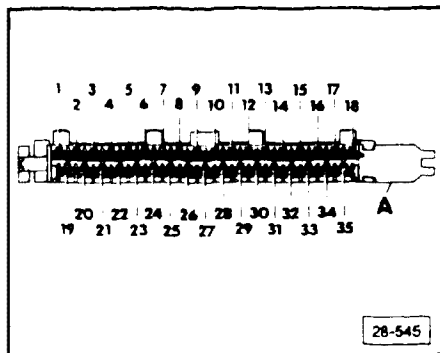
- check wiring using wiring diagram, make repairs as necessary
- connect multimeter between terminals **46** and **47** of fuse relay socket
- briefly actuate starter
 - approximately 9.5 volts

If voltage value **IS** obtained

- replace fuse pump relay

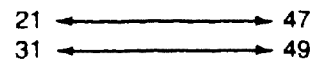
If voltage value is **NOT** obtained

- check wiring as follows:
- remove engine control unit then remove control unit harness connector

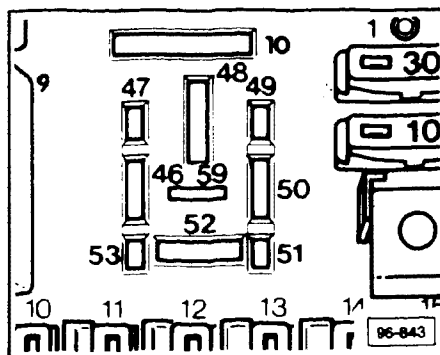


- switch multimeter **US 1119** to resistance range
- check continuity between control unit harness connector **A** and relay socket **10** terminals as follows:

Connector **A** Relay socket **10** terminals



- approximately 0.2 ohms (continuity)



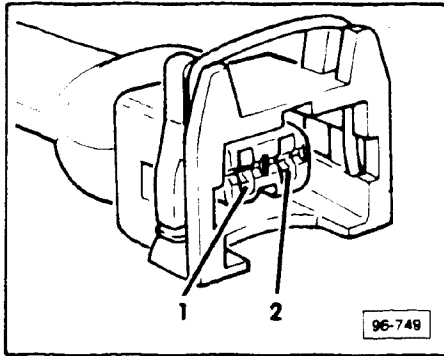
If continuity is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

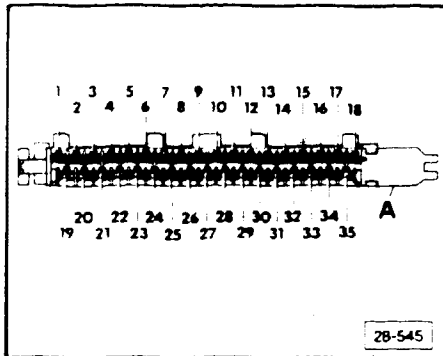
If continuity **IS** obtained

- replace engine control unit

Continuous Injection System



- check continuity between terminal 1 of cold start valve harness connector . . .



- and terminal 1 of control unit harness connector **A**
 - approximately 0.2 ohms (continuity)

If resistance value is **NOT** obtained

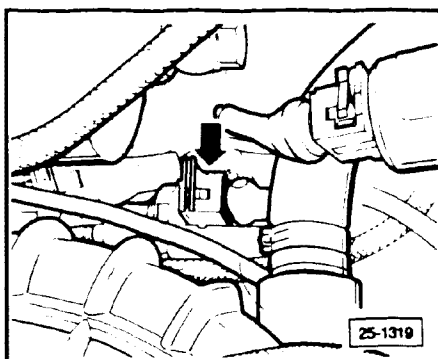
- check wiring using wiring diagram, make repairs as necessary

If resistance value **IS** obtained

- replace engine control unit

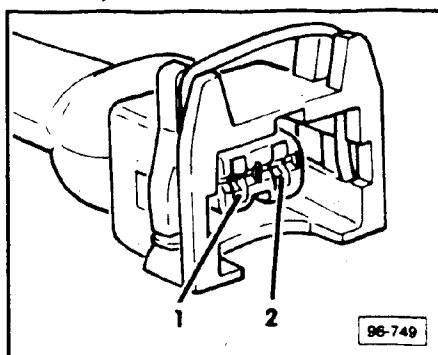
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Continuous Injection System



Carbon canister shut-off valve (control function), checking

- disconnect shut-off valve harness connector



- connect **US 1115** LED tester to shut-off valve harness connector using **VAG 1594** adaptor kit
- initiate fault code system, (see Repair Group D2 for additional information), when code **4343** appears:
 - **US 1115 MUST** flash for approximately 10 seconds

If **US 1115 DOES** flash

- replace shut-off valve

If **US 1115** does **NOT** flash

- connect multimeter between terminal 1 of shut-off valve harness connector and ground
 - approximately 12 volts

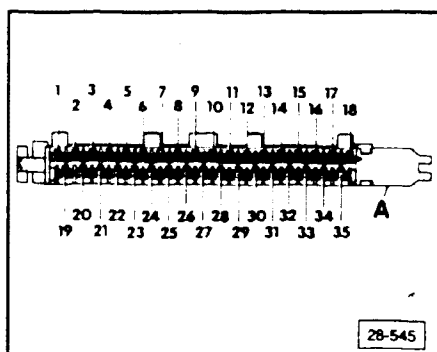
If voltage value is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

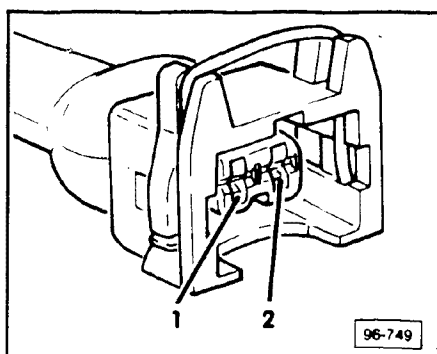
If voltage value **IS** obtained

- check wiring as follows:
 - remove engine control unit then disconnect control unit harness connector

Continuous Ignition System

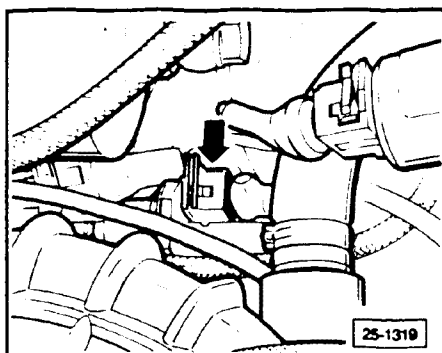


- switch multimeter **US 1119** to resistance range
- check continuity between terminal **3** of control unit harness connector **A** . . .



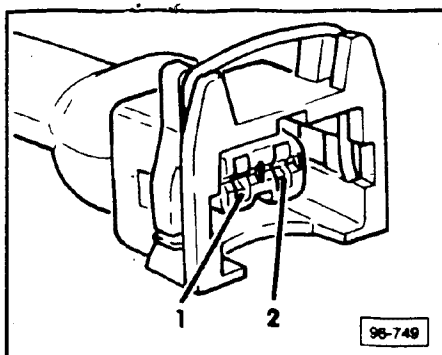
- and terminal **2** of shut-off valve harness connector
 - approximately 0.2 ohms (continuity)
- If continuity is **NOT** obtained
 - check wiring using wiring diagram, make repairs as necessary
- If continuity **IS** obtained
 - replace engine control unit

Continuous Ignition System



Carbon canister frequency valve (control function), checking

- disconnect frequency valve harness connector (arrow)



- connect **US 1115** LED tester to shut-off valve harness connector using **VW 1594** adaptor kit
- initiate fault code system, (see Repair Group D2 for additional information), when code **4331** appears:
 - **US 1115 MUST** flash for approximately 10 seconds

If **US 1115 DOES** flash

- replace shut-off valve

If **US 1115** does **NOT** flash

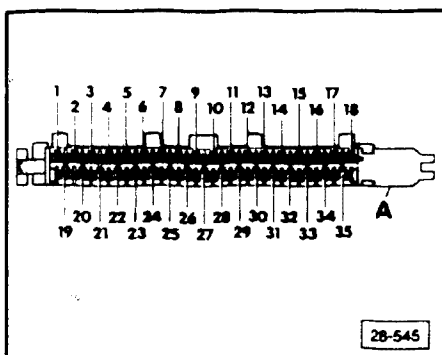
- connect multimeter between terminal 1 of shut-off valve harness connector and ground
 - approximately 12 volts

If voltage value is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

If voltage value **IS** obtained

- check wiring as follows:
- remove engine control unit then disconnect control unit harness connector



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

- check continuity between terminal 23 of control unit harness connector **A** . . .

and terminal 2 of shut-off valve harness connector

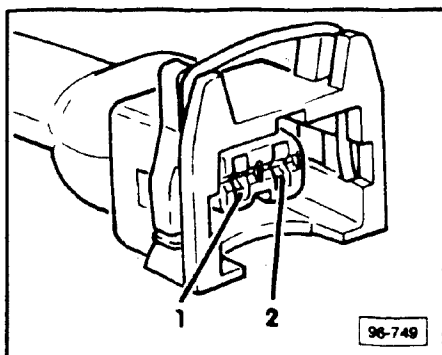
- approximately 0.2 ohms (continuity)

If continuity is **NOT** obtained

- check wiring using wiring diagram, make repairs as necessary

If continuity **IS** obtained

- replace engine control unit



Continuous Injection System

Engine settings, checking and adjusting

Preparation for checking/adjusting

CAUTION

Idle speed and CO content must be checked and adjusted together. CO measurement is performed to verify duty cycle.

Requirements

- engine oil temperature 80°C (176°F) minimum
- throttle valve in idle position
- throttle valve switch **OK**
- all electrical consumers switched **OFF**
- radiator fan must **NOT** be running during checking or adjusting measurements
- A/C switched **OFF**
- do **NOT** have any fuel 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

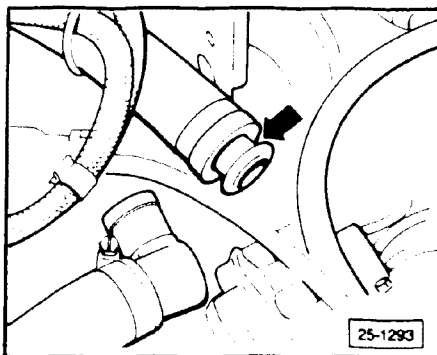
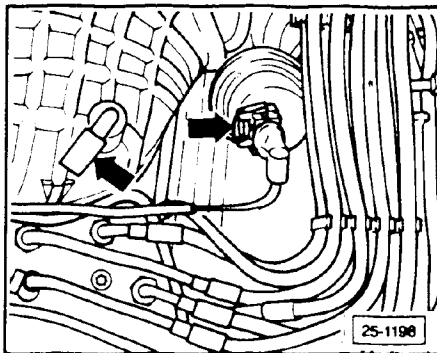
- disconnect harness connectors from both carbon canister solenoid valves

Only the carbon canister frequency valve (**right arrow**) is shown in the illustration. The shut-off valve is behind the intake boot near the fuel filter.

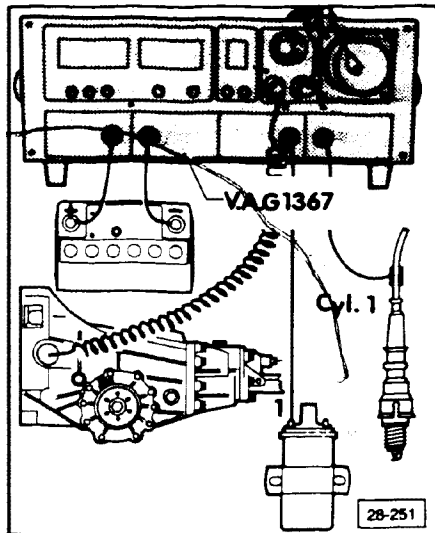
- remove cap (**left arrow**) from elbow on top of intake air boot

Elbow, which contains a calibrated orifice, **must** remain in intake air boot.

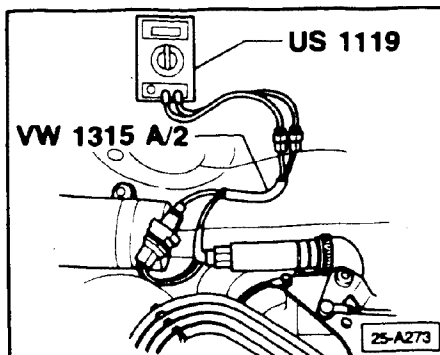
- remove crankcase ventilation hose between intake air boot and valve cover
- plug hose using cap (**arrow**) from CO tap tube



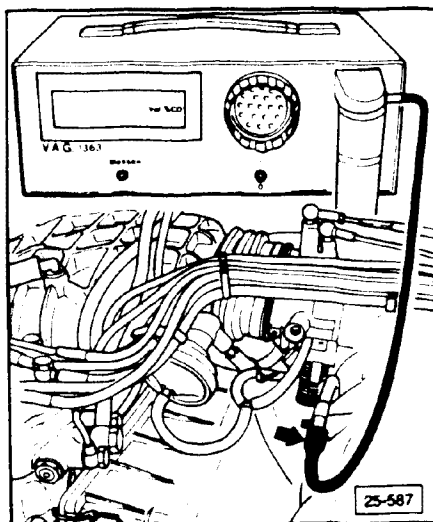
Continuous Injection System



- remove ignition coil cover
- connect **VW 1367** engine tester to terminals 1 and 15
- connect **VW 1367** engine tester according to manufacturer's instructions



- connect test adaptor **VW 1315 A/2** between idle stabilizer valve and its harness connector
- switch multimeter **US 1119** to 2 amp range
- connect multimeter to **VW 1315/A2** test adaptor



- connect **SUN 105** (or EPA equivalent) CO tester to CO tap tube (arrow)

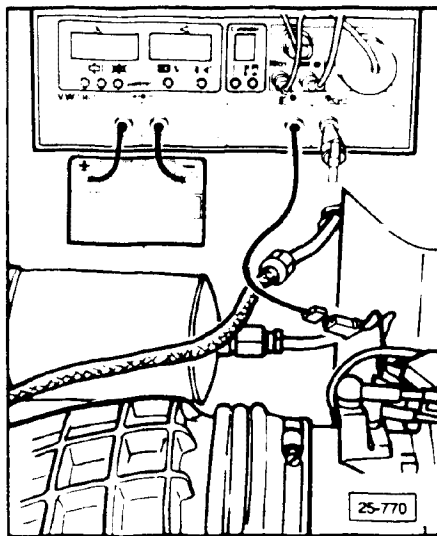
Note

Hose must fit tightly over the CO tap tube, so that no exhaust leak can develop.

Continuous Injection System

Idle speed, checking/adjusting

- start engine and let run at idle
 - 430 mA
- If mA value is **NOT** obtained
- adjust using idle adjusting screw after adjusting idle stabilization (mA), resulting idle speed must be:
 - 720 ± 50 RPM
- If RPM value is **NOT** obtained
- check idle stabilization, see page 25.73



CO value (OXS duty cycle), checking

- disconnect **VW 1367** cable from terminal 1 of ignition coil and connect to blue/white cable of Oxygen sensor test connector
- disconnect **VW 1367** inductive pickup from cylinder 1
- remove TDC sensor from transmission housing
- depress dwell angle % button on **VW 1367**
- start engine and let run at idle
 - dwell 25% to 65% and fluctuating

Note

Ignore the RPM display on the **VW 1367**.

- observe CO value on EPA 105
 - 0.3 to 1.2% volume (with oxygen sensor connected)

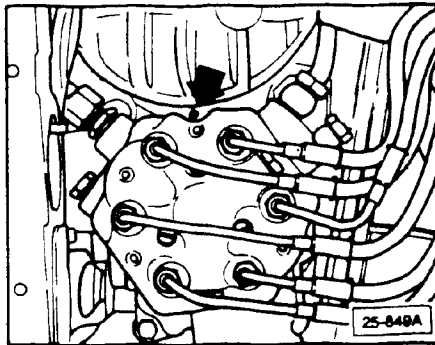
If the CO-content is more than 1.2% volume with a duty cycle of 25% to 65%, check the following possibilities:

- ignition system **NOT OK**, check and repair as necessary
- leaky exhaust system, seal or replace components as necessary
- fuel distributor defective: unequal injection volumes at idle, check and replace/repair as necessary

If the duty cycle is **less** than 25% or **greater** than 65%:

- adjust using CO adjusting screw

Continuous Injection System



CO value (OXS duty cycle), adjusting

- turn **OFF** ignition
- remove intake air boot from mixture control unit
- **lightly** center punch CO adjusting plug (arrow)
- 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.)

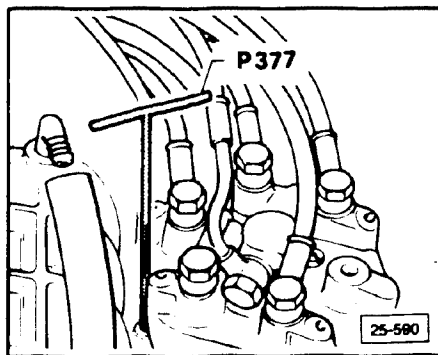
CAUTION

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

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

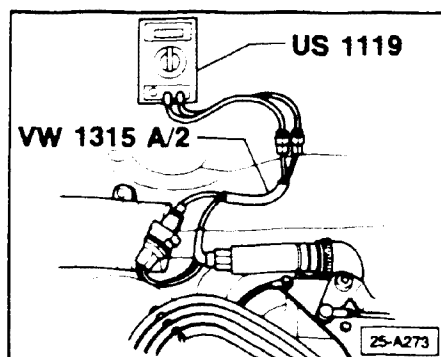
CAUTION

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**
 - 50% $\pm$ 8% and fluctuating
 - clockwise = lower duty cycle
 - counterclockwise = greater duty cycle
- after adjusting duty cycle, check idle speed and adjust if necessary
- switch **OFF** ignition

Continuous Injection System



- remove test adaptor **VW 1315 A/2**
- reconnect idle stabilizer valve harness connector
- disconnect **SUN 105** CO analyzer and reinsert cap on CO tap tube
- reinsert crankcase ventilation hose on cylinder head cover
- disconnect **VW 1367** engine tester
- reconnect harness connectors for carbon canister solenoid valves
- reinstall cap on elbow on top of intake air boot
- install new CO adjustment access plug

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

A short term solution would be an oil change.

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Continuous Injection System

Idle stabilization system, checking

Note

For idle stabilization system control unit location, see exploded view on page 25.5.

Requirements

- engine speed (RPM) display **OK** (vehicle tachometer)
- battery voltage 11 volts **minimum**
- engine oil temperature 80°C (176°F) **minimum**
- radiator fan **MUST** run at least once before the test
- throttle valve in idle position
- all electrical consumers turned **OFF** (radiator fan must not run during checking or adjusting)
- A/C **OK**
- A/C switched **OFF**
- fuel pressure measuring devices **NOT** connected

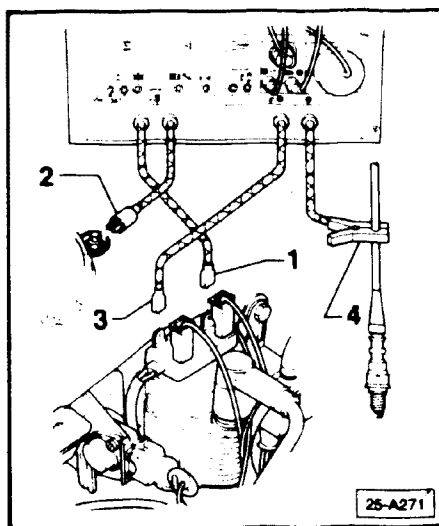
Multimeter **US 1119**, the **US 1115** LED tester and connector adaptor set **VW 1594** are required for testing.

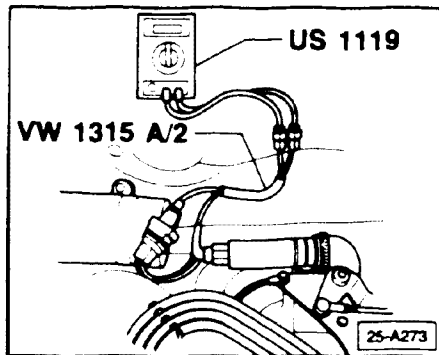
CAUTION

The **US 1115** must be connected before switching **ON** the ignition, because the circuit between the idle stabilizer valve and the control unit must **NOT** be interrupted while the ignition is turned **ON**.

If fuel-injection lines were loosened or changed:

- raise engine speed to 3000 RPM before checking engine and let run at idle for at least 2 minutes
- switch **OFF** ignition
- connect **VW 1367** engine tester for idle speed measurement





- connect **VW 1315 A/2** test adaptor to idle stabilizer valve
- switch multimeter **US 1119** to 2 amp range
- connect multimeter to **VW 1315 A/2** test adaptor using **VW 1594** adaptor set
- switch **ON** ignition
 - 440-500 mA

If mA value **IS** obtained

- start engine and let run at idle

If 0 mA is displayed

- switch **OFF** ignition and turn **ON** again after about 5 seconds

If 0 mA is displayed again

- remove harness connector from idle stabilizer valve
- measure resistance between terminals of idle stabilizer valve
 - 3-8 ohms

If resistance value is **NOT** obtained

- replace idle stabilizer valve

If resistance value **IS** obtained

- check wiring between idle stabilizer valve harness connector and idle stabilizer control unit using wiring diagram, make repairs as necessary

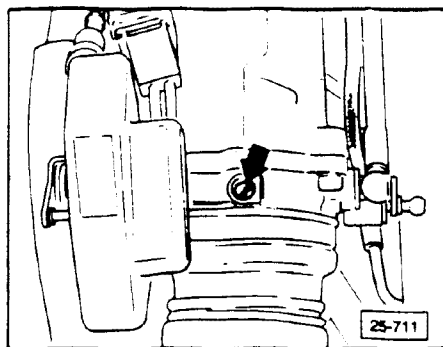
If **NO** open circuits are found

- check function of idle stabilization control unit

If all specified values in the test steps are **OK**

- replace idle stabilizer control unit and repeat test, for location see page 25.5
- start engine and let run at idle
 - 430 ± 10 mA (fluctuating) at an idle speed 720 ± 20 RPM

Continuous Injection System



If a constant value of 470 mA is displayed
■ turn idle adjusting screw (arrow) in both directions

If the mA value does **NOT** change when the idle adjusting screw is turned

■ perform test steps 4 and 5, page 25.76

If results in test step 5 are **OK**

■ replace idle stabilization control unit and repeat test

If the mA value **CHANGES** by turning the idle adjusting screw

■ adjust control current by turning the idle adjusting screw again
• 430 + 10 mA

■ check idle speed, adjust if necessary
• 720 + 20 RPM

Idle stabilization system, troubleshooting:

• see chart on next page

If idle speed is irregular

■ check idle stabilization system, see page 25.73

If idle speed is greater than 1000 RPM

■ check idle switch, see page 25.24 or function of idle stabilization control unit see Repair Group D2 for additional information

If idle speed is greater than 840 RPM with the air conditioner turned **OFF**

■ check control function of idle stabilization control unit see Group D2 for additional information

Continuous Injection System

Idle stabilization system, Troubleshooting chart

Test step	Terminals on relay socket	Function to be checked	Test conditions	Specified values
Switch US 1119 to 20 volt DC measuring range				
1	4 + 5	terminal 15 — supply voltage	• switch ON ignition	approximately battery voltage
2	8 + 5	idle switch closed	• ignition switched ON • throttle valve in idle position	approximately battery voltage
3	8 + 5	idle switch open	• ignition switched ON • activate idle switch by means of throttle valve lever or accelerator pedal (open)	0 volts
4	17 + 5	engine speed signal from control unit	• start engine	US-1115 MUST flash
5	7 + 5	speedometer sender	• switch ON ignition	US 1115 MUST light up
6	13 + 5	temperature sensor	• none	engine cold: approximately 20°C (68°F) approximately 800-1000 ohm engine oil temperature: approximately 80°C (176°F) 70-150 ohm
7	11 + 4	idle stabilizer valve	• idle stabilizer valve connected	approximately 3-8 ohm
8	6 + 5	positive	• ignition switched ON • A/C ON • operating mode AUTO • blower HI • temperature HI	approximately battery voltage
If the specified values are NOT obtained, check connectors and wiring to components using wiring diagram. If no interruptions or short circuits are found, replace the appropriate component and repeat test. If all specified values are obtained in spite of a disturbance, replace idle stabilization control unit.				