

Index

4-cylinder

CIS-E Motronic system

- component layout 28-10

Engine settings

- checking/adjusting 28-90

Hall sensor

- checking 28-70

Ignition coil

- checking 28-60

Ignition distributor

- installing 28-80
- rotor, checking 28-40
- trigger wheel, removing/installing 28-50

Ignition system and spark plugs

- technical data 28-20

Ignition wires and connectors

- checking 28-40

System precautions

- rules of cleanliness 28-30

5-cylinder

CIS-E III system

- component layout 28-100

Engine settings

- checking/adjusting 28-180

Hall sensor

- checking 28-160

Ignition coil

- checking 28-170

Ignition distributor

- installing 28-150
- rotor, checking 28-140
- settings 28-110

Ignition wires and connectors

- checking 28-130

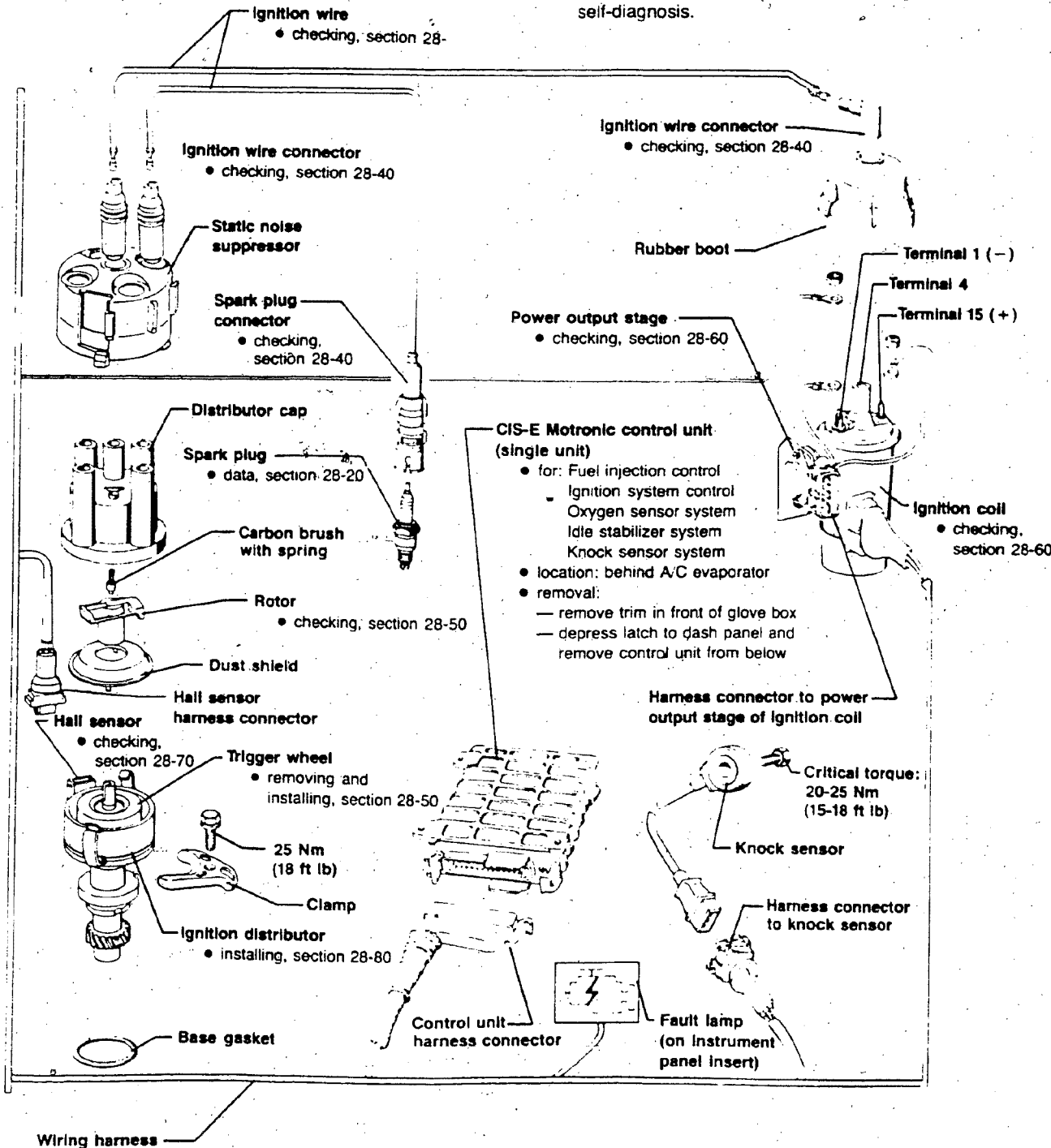
CIS-E Motronic ignition system

Engine code 3A

Note

Only the ignition portion of the CIS-E Motronic system is described in this Repair Group. Fuel injection and electrical testing of the CIS-E Motronic is handled in Repair Group 25.

- Note system precautions section 28-30
- See Repair Group D2 for information regarding self-diagnosis.



Tuneup specifications From 1988

Engine code	3A	
Type fuel/ignition system	CIS-E Motronic	
CIS-E Motronic (combined fuel/ignition)	893 907 404	
Ignition distributor	053 905 205A	
RPM cutoff (upper limit) (via CIS-E Motronic control unit)	6400 ± 100 RPM	
Ignition timing	checking value	4° - 8° Before TDC
	adjusting value	6° ± 1° Before TDC see idle adjustment, Group 25
Firing order	cylinders 1-3-4-2	
Spark plugs	Bosch	W7DTC
	electrode gap	mm (in.)
	tightening torque	Nm (ft lb)
Idle RPM (NOT adjustable, controlled by idle stabilization system)	840 ± 60	
CO-content (measured at CO tap with oxygen sensor connected)	0.3 - 1.2 vol % Adjustment performed via differential pressure regulator control current adjustment.	

CAUTION

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

CAUTION

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

CIS-E Motronic system precautions

CAUTION

Be alert when you work on the engine. High voltage can injure you and damage sensitive 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 and CIS-E Motronic control unit 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
- do not crank engine with high tension wire disconnected and un-grounded (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

When towing:

- vehicles with ignition problems (or where problems may be suspected) must have the power output stage of the ignition coil disconnected

Rules of cleanliness

CAUTION

First:

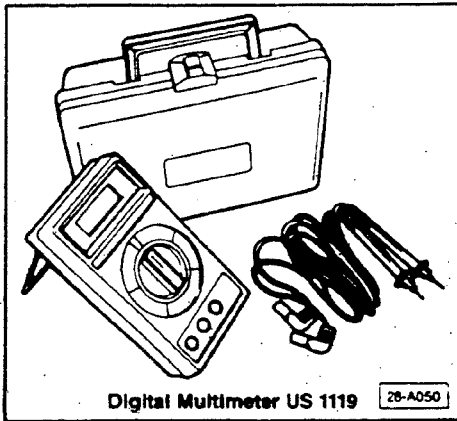
- clean connecting points before loosening

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 repair, carefully cover exposed parts with plastic or paper — not with rags

Use clean parts only

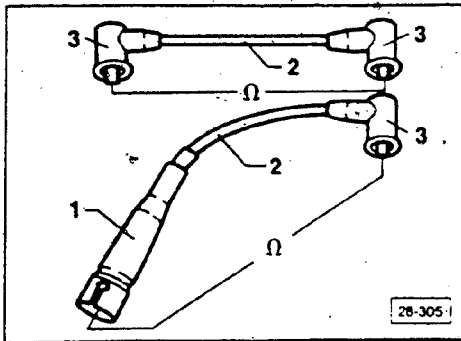
- do not unwrap new parts before needed
- only use new parts, not loose or unwrapped parts from tool box
- lay removed parts on clean surface. Cover with plastic or paper — not with rags



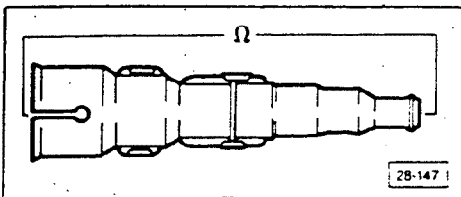
Ignition wires and connectors, checking

Use multimeter US 1119 for the following measurements.

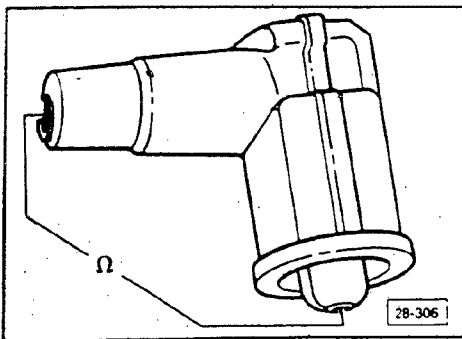
Connect the tester according to the manufacturer's instructions.



- check ignition wires 2 for continuity
- check ignition wires 2:
 - between coil and distributor
 - with radio: **2000 ± 800 ohms**
 - without radio: **0 ohms**
 - between distributor and spark plug
 - with radio: **6000 ± 1400 ohms**
 - without radio: **1000 ± 400 ohms**
 - if not within range go to next check



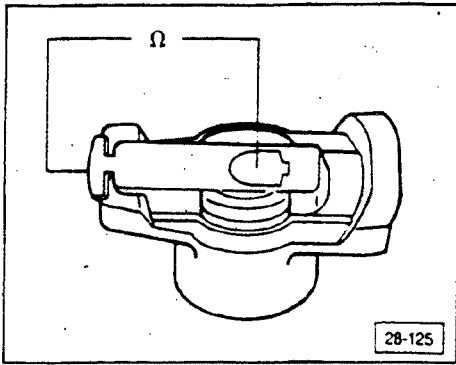
- check spark plug connector 1
 - with radio (suppressed): **5000 ± 1000 ohms**
 - without radio (not suppressed): **1000 ± 400 ohms**



- check connector/suppressor 3
 - resistance: **1000 ± 400 ohms**

If the specified values are **NOT** obtained after performing these checks:

- replace the faulty wire or connector

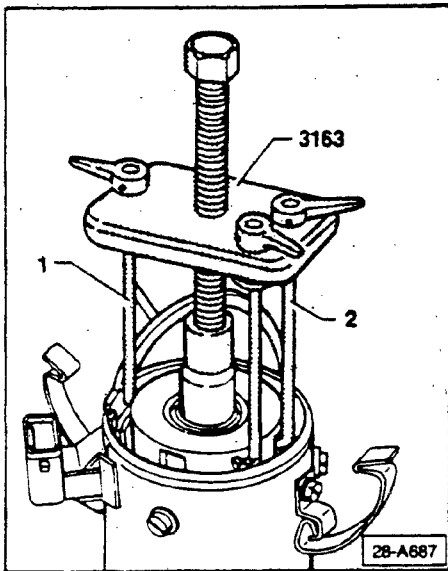


Distributor rotor, checking

- measure electrical resistance of distributor rotor
 - resistance: 1000 ± 400 ohms

Note

Rotor must be marked with R 1 (for Hall generator equipped cars).

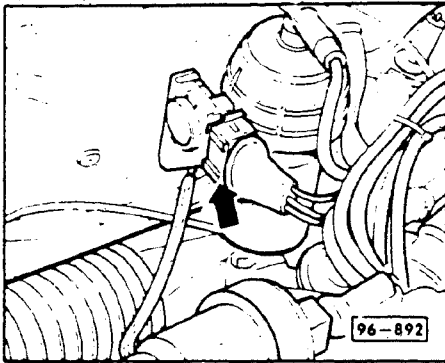


Ignition distributor trigger wheel removing and installing

- remove circlip on top of trigger wheel
- install hooks 1 and 2 as shown
- center 3163 tensioning bolt on top of distributor shaft
- slowly tighten bolt and withdraw trigger wheel

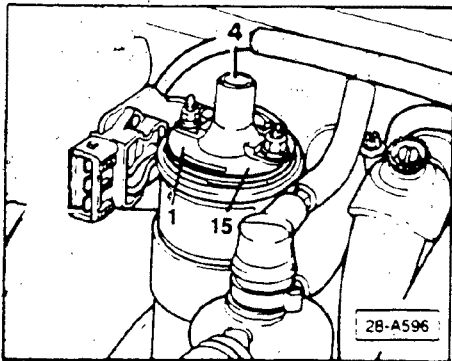
Note

A pin is used to position the trigger wheel, which can become dislodged during removal. Be careful not to drop it into the distributor.



Ignition coil, checking

- check wiring between power stage and ignition coil and ground wire between power stage and engine for corrosion or damage
- disconnect ignition coil power stage (arrow)



Secondary resistance, checking

- connect multimeter US 1119 between terminals 1 and 4
 - 5000 to 9000 ohms

If **NO**

- replace ignition coil

Primary resistance, checking

- connect multimeter US 1119 between terminals 1 and 15 of ignition coil
 - 0.5-1.5 ohms

If **NO**

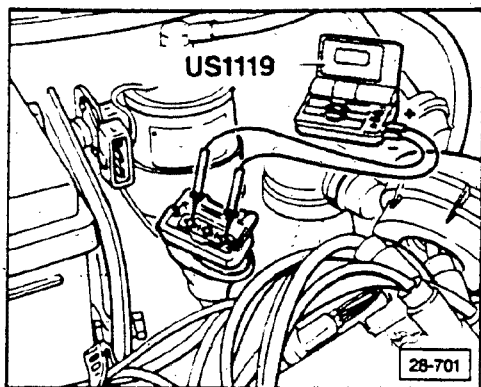
- replace ignition coil

If all specified values are obtained and the engine still does not run (no ignition impulse)

- replace ignition coil complete with power stage

CAUTION

The function of the power stage is **NOT** to be tested.



Ignition coil, power output stage, checking

Requirement:

- ignition coil OK (checking, section 28-60)

Voltage supply, checking

- remove harness connector from power output stage
- switch multimeter **US119** to 20 volt range and connect to terminal 1 and terminal 3 of disconnected harness connector
- switch **ON** ignition
 - approximately battery voltage

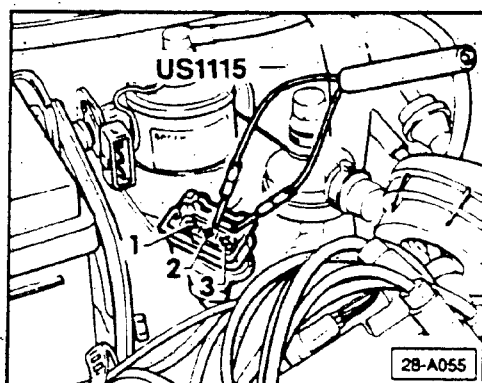
If NO

- repair break in wiring using wiring diagram
- connect LED tester **US1115** to terminals 2 and 3 of harness connector
- activate starter and check for signal from Hall sensor
 - **US1115** must flicker

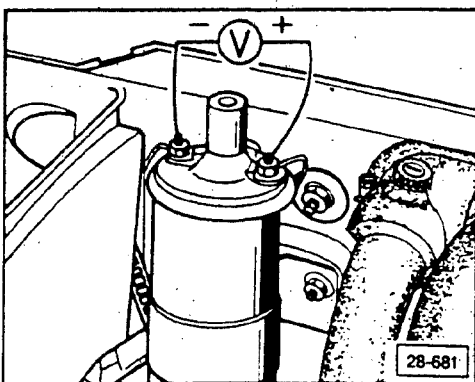
If NO

- check Hall sensor, section 28-70

- shut **OFF** ignition
- reconnect harness connector to power output stage of coil
- remove harness connector from Hall sensor on distributor.



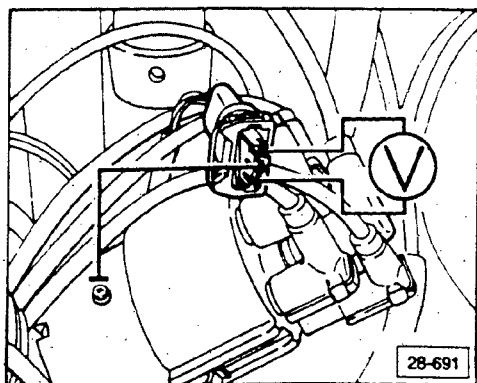
- connect multimeter to terminal 1 (-) and terminal 15 (+) of ignition coil
- switch **ON** ignition

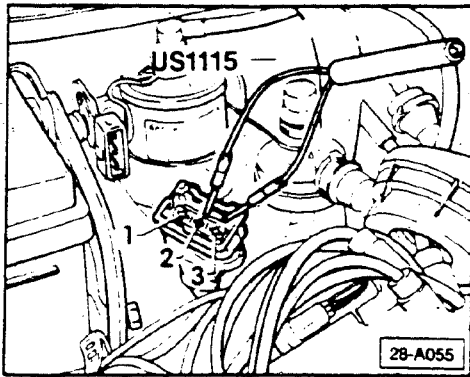


- briefly touch center wire from disconnected Hall sensor harness connector to ground
 - indicated voltage must increase to 2 volts minimum and after 1 to 2 seconds drop to zero volts

If the voltage does **NOT** drop:

- temporarily substitute a new power output stage and check previous step again, also inspect top of coil for leakage
- if necessary replace coil assembly, complete with power output stage





Hall sensor, checking

Note

Checking is necessary only if ignition spark is **NOT** present.

- remove harness connector from power output stage of ignition coil and connect LED tester **US1115** to terminals 2 and 3
- actuate starter and check signal from Hall sensor
 - **US1115 must flicker**

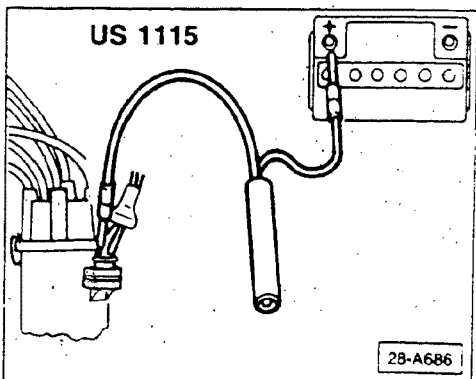
If the **US1115** flickers, Hall sensor is **OK** and test is ended.

If **NO**; continue

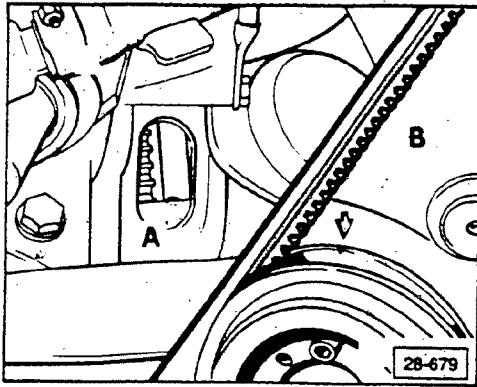
- remove harness connector from Hall sensor on distributor
- switch multimeter **US 1119** to 20 volt range
- connect multimeter to outer connections of harness connector and with ignition switched **ON**, check voltage supply for Hall sensor from CIS-E.Motronic control unit
 - 9 volt minimum
- remove rubber boot from harness connector for Hall sensor and re-connect to Hall sensor connection on distributor
- connect LED tester **US1115** to center wire of harness connector for Hall sensor and to battery plus (+)
- activate starter and check signal from Hall sensor
 - if the light diode flickers, the Hall sensor is **OK**

If **NO**

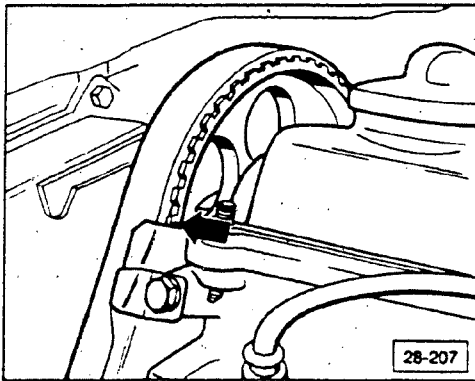
- Hall sensor is defective
- or
- CIS-E Motronic control unit is defective
- replace as necessary



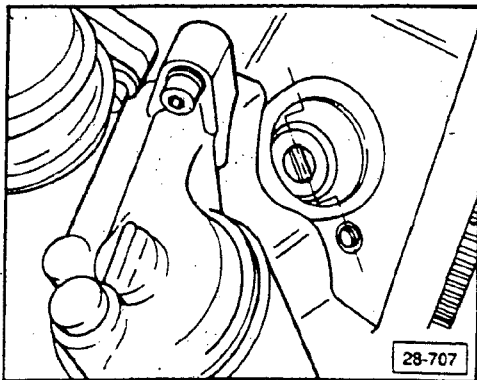
Ignition distributor, installing



- A — with engine installed
- set flywheel to TDC — Cylinder 1
- B — with engine removed
- align marking on vibration damper (pulley) with marking on belt cover



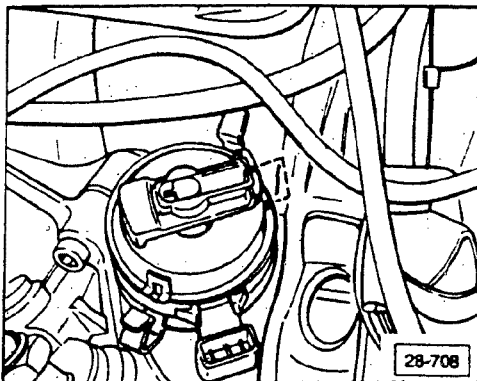
- align marking on camshaft sprocket with cylinder head cover (arrow)



- adjust so the drive lug slot aligns with threaded hole

Note

The distributor clamp bolt head is covered with a “tamper-proof” seal which **must** be replaced if the distributor is loosened for any reason.



- install distributor so that the distributor rotor points to marking for cylinder 1 on distributor housing
- clean distributor cap before installing, check for cracks and carbon tracks due to arcing, replace if necessary
- adjust ignition timing — see section 28-90
- tighten distributor clamp bolt
 - 25 Nm (18 ft lb)
- install new “tamper-proof” seal on distributor clamp bolt

Engine settings

Note

Always activate fault memory before checking engine settings, see Repair Group D2 for additional information.

If **no** faults are stored

- check ignition timing, idle speed (not adjustable) and CO content, using the procedures in this section.

Requirements:

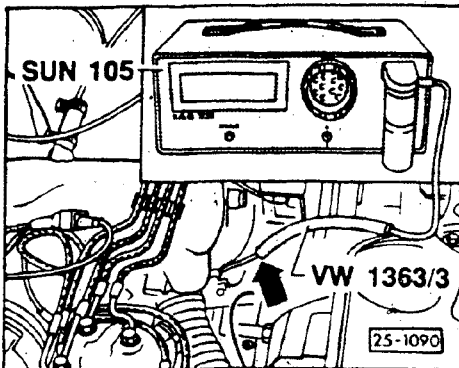
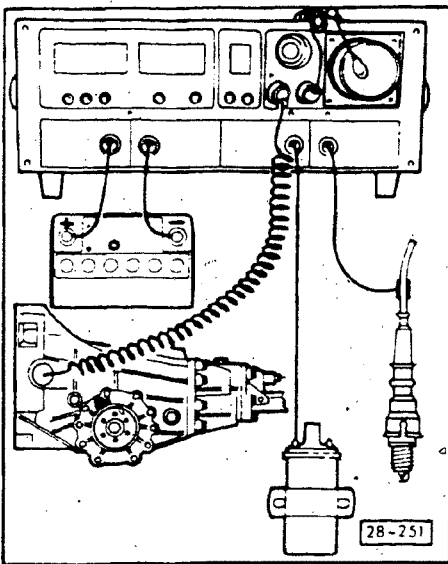
- engine-oil 80°C (176°F) minimum
- all electrical consumers switched **OFF**
- radiator fan must **NOT** be running during checking or adjustments
- A/C switched **OFF**
- disconnect any pressure measuring devices
- if any injection lines were loosened or replaced, raise the engine speed above 3000 RPM several times and let idle for at least two minutes
- exhaust system must not leak
- oxygen sensor control **OK**

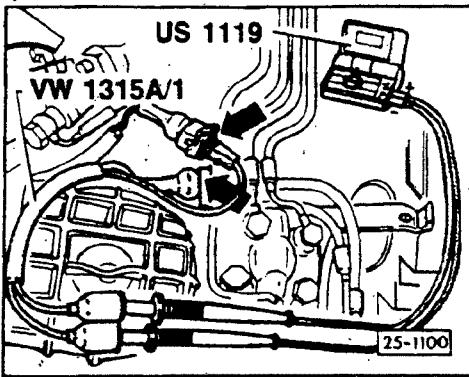
Preparations for checking

- switch **OFF** ignition
- connect engine tester **VW1367** for ignition timing and RPM display
- connect CO tester **SUN 105** (or EPA equivalent) using adapter **VW1363/3** on CO measuring tube

Note

Hose must fit snugly on CO-measuring tube to minimize measurement errors.

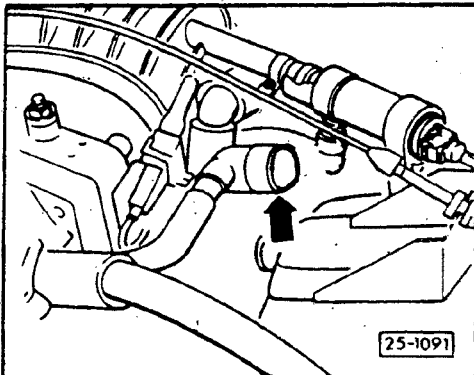




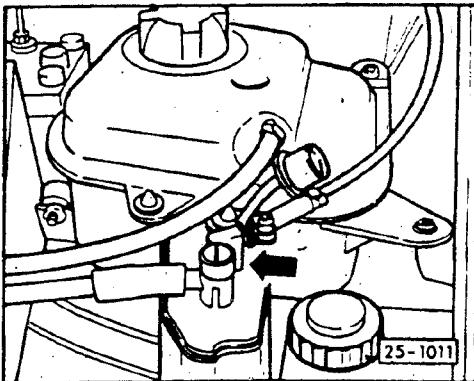
- connect multimeter **US1119** and test adapter **1315A/1** to differential pressure regulator
- switch **ON** ignition
 - control current must indicate positive (–)

If **NO**

- reverse the test probes



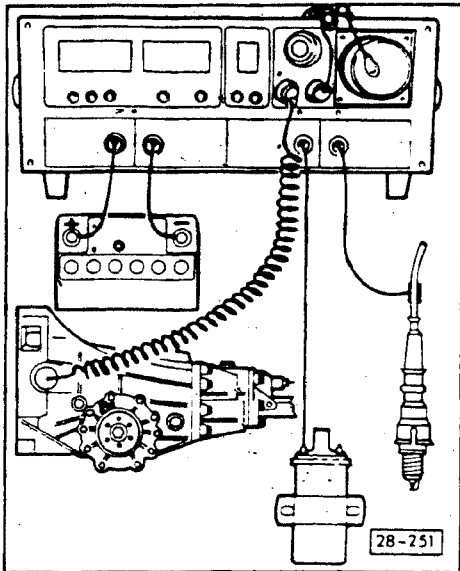
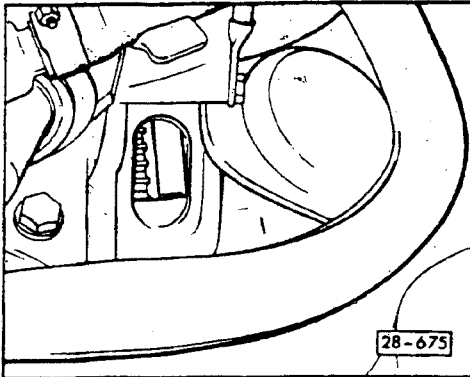
- remove crankcase housing breather hose from cylinder head cover and vent it to atmosphere
- remove crankcase housing breather hose from breather housing (cylinder block), and vent to atmosphere



- remove sealing cap (**shaded**) from charcoal canister

CAUTION

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



Ignition timing, checking and adjusting

- start engine and let idle
- check ignition timing, timing point will be displayed directly on engine tester VW1367 or use strobe light method

Ignition timing mark (on flywheel) for use with stroboscope method of checking

- checking value: 4° to 8° Before TDC
- adjusting value: $6^{\circ} \pm 1^{\circ}$ Before TDC

- adjust if necessary

Note

To loosen the distributor, remove the tamper proof seal (cap) covering the distributor clamp bolt. When you have finished making adjustments and have re-torqued the bolt (18 ft lb), install a new seal.

Idle speed checking, NOT adjustable

Read idle RPM directly on VW1367

- start engine and let idle
 - engine speed must be 780-900 RPM

If NO

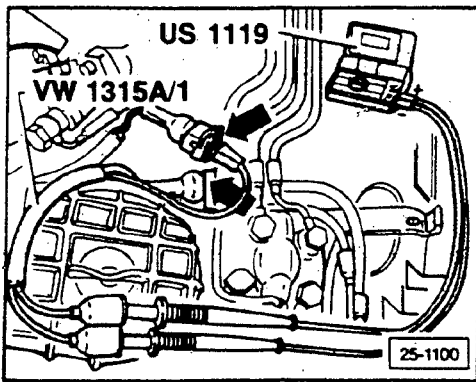
- check intake air system for leaks
- check airflow sensor potentiometer, adjust if necessary

- switch **ON** A/C

- idle speed must increase by approximately 70 RPM

If NO

- perform electrical check, see Repair Group 25 page 25.112



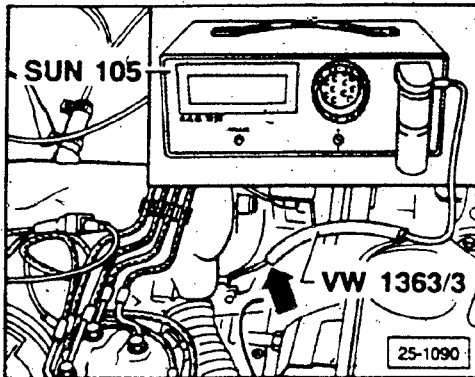
CO, checking and adjusting

(primary check)

- check the CO content by reading mA output on **US1119** multimeter
 - 0 to 5 mA (**must fluctuate**)

If **NO**, or does **NOT** fluctuate

- check the oxygen sensor control system, page 25.86 (group 25)



(secondary check)

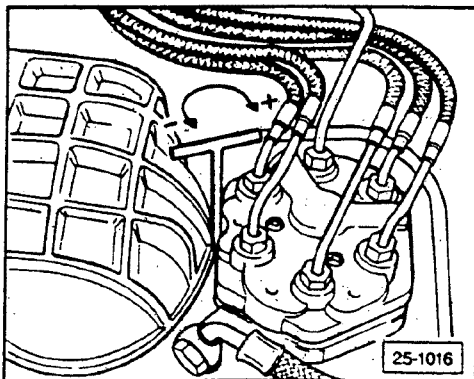
- read CO content directly on **SUN 105** (or EPA equivalent)
 - 0.2 to 1.2% by volume

If flash codes **2343** or **2344** were stored or the CO content is outside of the tolerance range; adjust CO content as follows:

- switch **OFF** ignition
- remove rubber boot from mixture control unit
- **lightly** center punch mixture adjusting screw plug
- drill 2.5 mm (3/32 in) hole in center of plug approximately 3.5 to 4.0 mm (9/64 to 5/32 in) deep
- screw in 3 mm (1/8 in) sheet metal screw

CAUTION

Do not press down on the adjustment wrench during adjustment, do not accelerate the engine with the adjustment tool in place. Remove the tool after each adjustment and briefly accelerate the engine before reading the CO value.

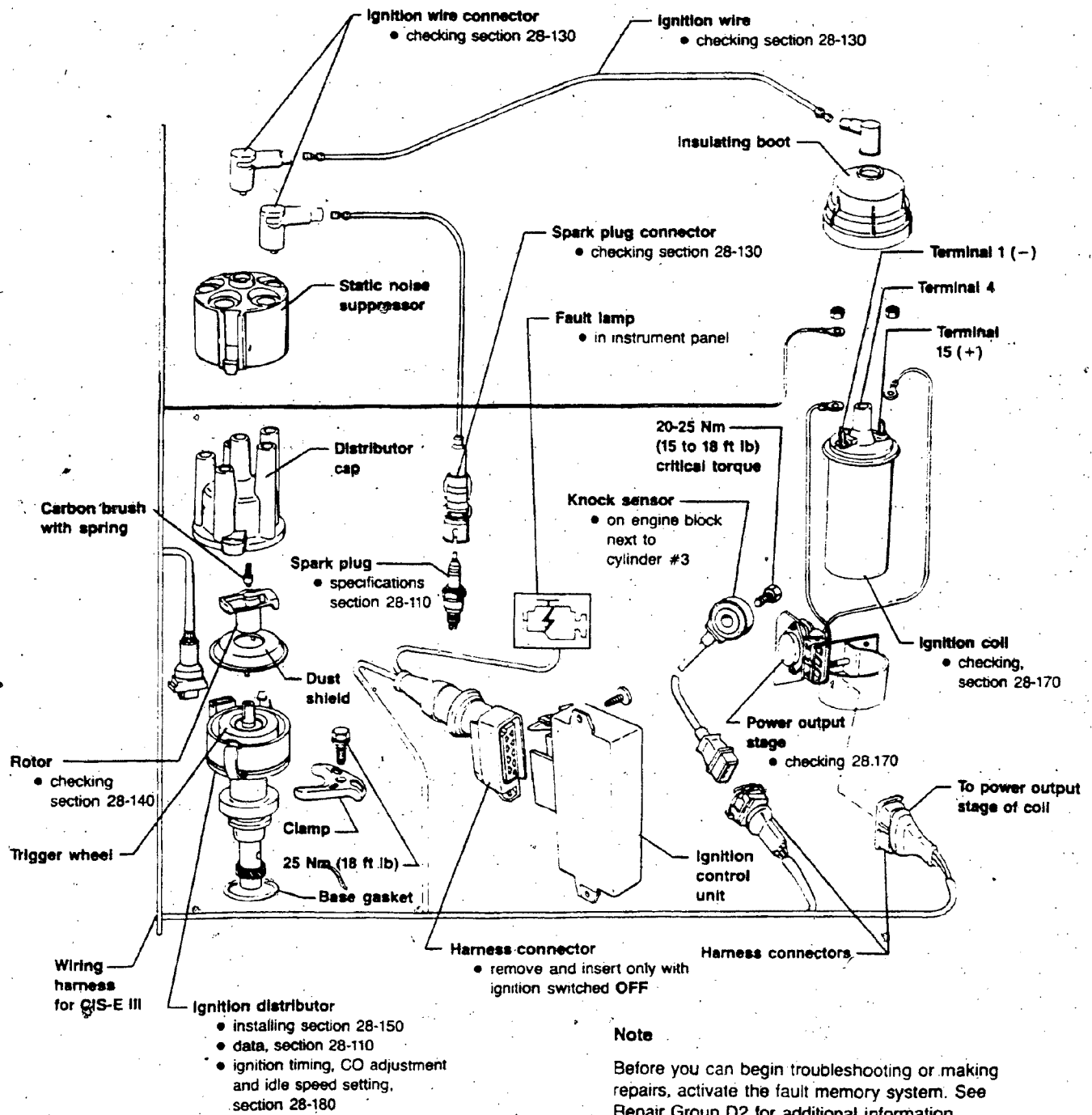


- remove plug/screw, using pliers
- reinstall rubber boot
- start engine, repeat primary and secondary CO checks, adjust as follows
 - turning clockwise: CO increases
 - turning counterclockwise: CO decreases
- when primary and secondary CO adjustment specifications have been obtained, install new plug in CO adjustment hole

Engine code letters NG

Note

Check the ignition timing if you replace the control unit, adjust the timing if necessary.



Note

Before you can begin troubleshooting or making repairs, activate the fault memory system. See Repair Group D2 for additional information.

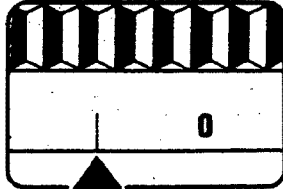
28-705

5-cylinder

System components

28-100-1

Tuneup specifications From 1988 m.y.

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

*Idle speed can NOT be adjusted using air screw on throttle body, idle is regulated by CIS-E III idle stabilization system.

**Do not mix 49 states control units with California control units or vice versa.

CAUTION

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

CAUTION

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

CIS-E III system precautions

CAUTION

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

Turn ignition off:

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

Don't forget about the battery:

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

When testing the system:

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

When applying heat:

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

Rules of cleanliness

CAUTION

First:

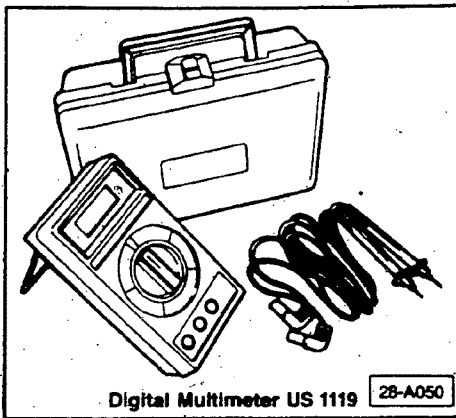
- clean connecting points before loosening

When fuel system is open

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

Use clean parts only

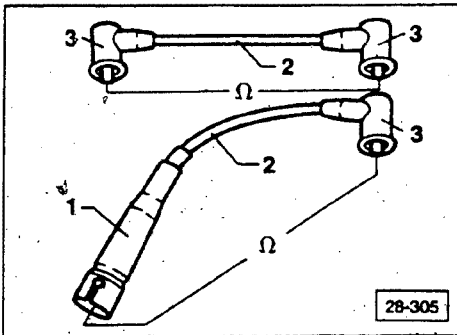
- do not unwrap new parts before needed
- only use new parts, not loose or unwrapped parts from tool box
- lay removed parts on clean surface. Cover with plastic or paper — not with rags



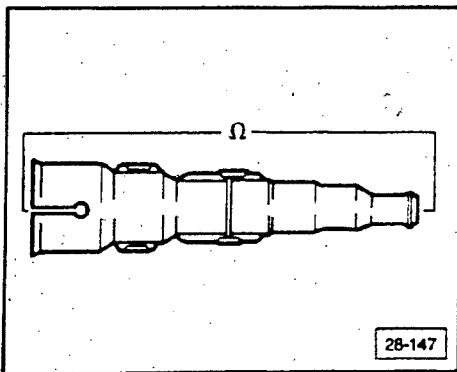
Ignition wires and connectors, checking

Use multimeter **US 1119** for the following measurements.

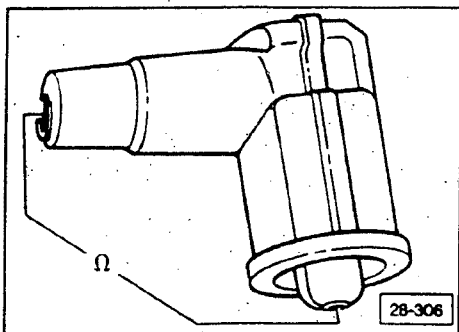
Connect the tester according to the manufacturer's instructions.



- check ignition wires 2 for continuity
- check ignition wires 2:
 - between coil and distributor
with radio: **2000 ± 800 ohms**
without radio: **0 ohms**
 - between distributor and spark plug
with radio: **6000 ± 1400 ohms**
without radio: **1000 ± 400 ohms**
 - if not within range go to next check



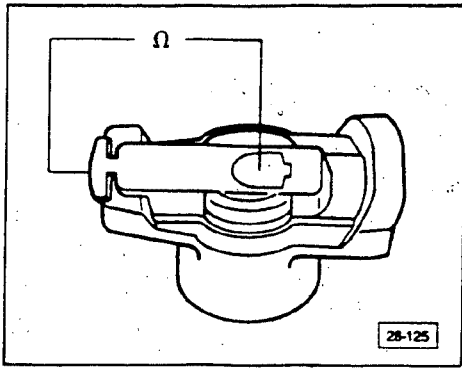
- check spark plug connector 1
 - with radio (suppressed):
5000 ± 1000 ohms
 - without radio (not suppressed):
1000 ± 400 ohms



- check connector/suppressor 3
 - resistance: **1000 ± 400 ohms**

If the specified values are **NOT** obtained after performing these checks:

- replace the faulty wire or connector



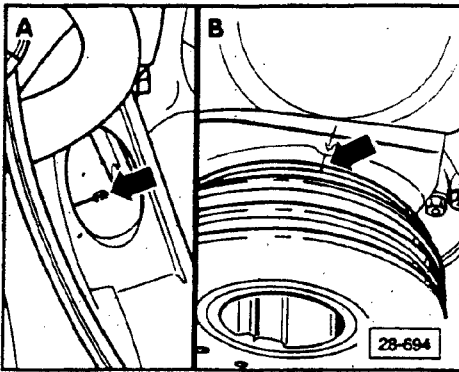
Distributor rotor, checking

- measure electrical resistance of distributor rotor
 - resistance: 1000 ± 400 ohms

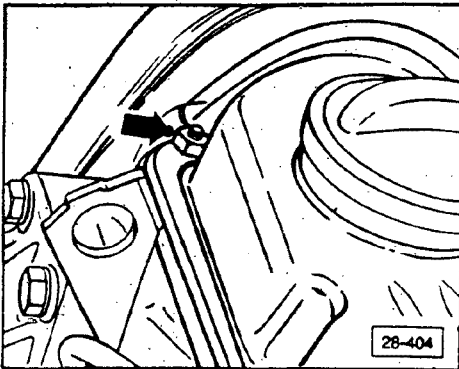
Note

Rotor must be marked with R 1 (for Hall generator equipped cars).

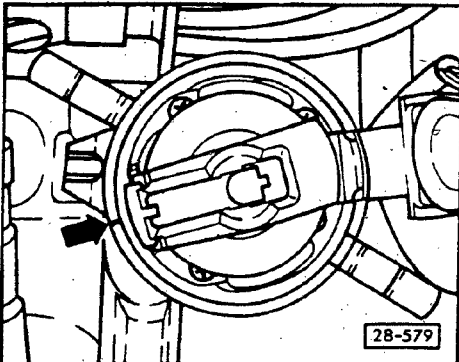
Ignition distributor, installing



- A — engine installed
 - set flywheel to TDC — cylinder 1 (arrow)
- B — engine removed
 - marking on vibration damper (pulley) must align with marking on belt cover (arrow)



- marking on camshaft sprocket must align with cylinder head cover (arrow)

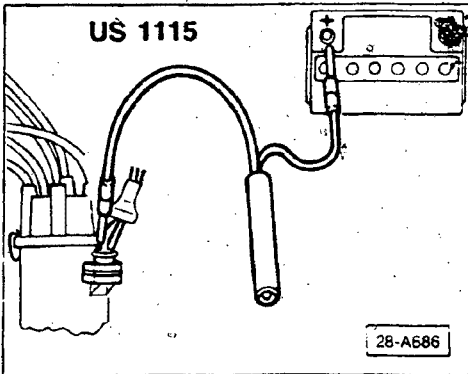
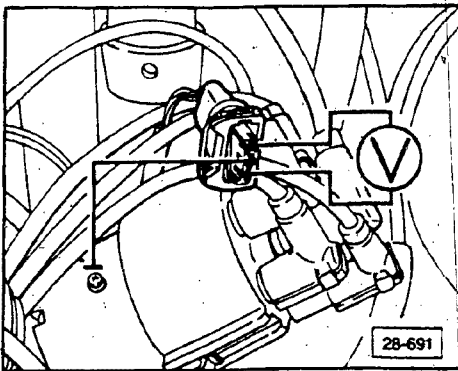
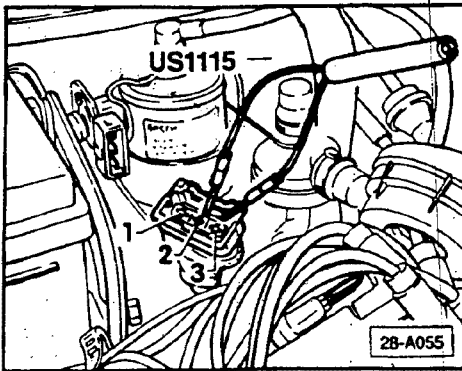


- install distributor so that the distributor rotor points to marking for cylinder 1 on distributor housing (arrow)
- clean distributor cap before installing
- check cap for cracks, carbon tracks due to arcing, replace if necessary

CAUTION

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

- adjust ignition timing, section 28-180



Hall sensor, checking

Note

Checking is necessary only if ignition spark is **NOT** present.

- remove harness connector from output stage of the ignition coil and connect LED tester **US 1115** to terminals 2 and 3
- actuate starter and check signal from Hall sensor

If the **US 1115** fluctuates, Hall sensor is **OK** and test is ended.

If **NO**; continue

- remove harness connector from Hall sensor on distributor
- switch multimeter **US 1119** to 20 volt range
- connect multimeter to outer connections of harness connector and with ignition switched **ON**, check voltage supply for Hall sensor from ignition control unit
 - 9 volt minimum
- remove rubber boot from harness connector for Hall sensor and re-connect to Hall sensor connection on distributor
- connect LED tester **US 1115** to center wire of harness connector for Hall sensor and to ground (-)
- activate starter and check signal from Hall sensor
 - if the light diode flickers, the Hall sensor is **OK**

If **NO**

- Hall sensor is defective
- or
- ignition control unit is defective
- replace as necessary

Ignition coil, checking

Power output stage, voltage supply checking

Requirement:

- ignition coil OK

- remove harness connector from power output stage
- switch multimeter **US 1119** to 20 volt range and connect to terminal 1 and terminal 3 of disconnected harness connector
- switch **ON** ignition
 - approximately battery voltage

If **NO**

- repair break in wiring using wiring diagram
- connect LED tester **US 1115** to terminals 2 and 3 of harness connector
- activate starter and check for signal from Hall sensor
 - **US 1115** must flicker

If **NO**

- check Hall sensor, section 28-160

Triggering, checking

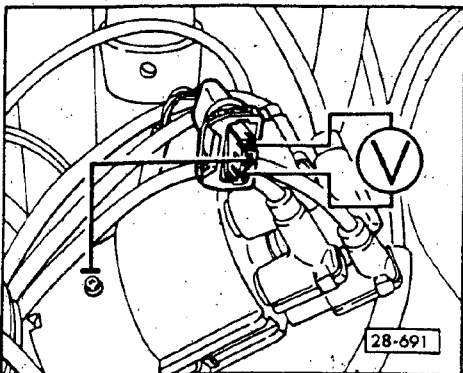
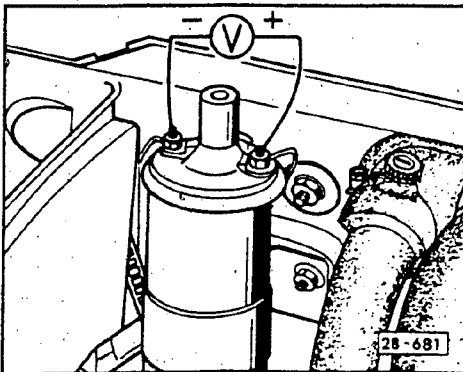
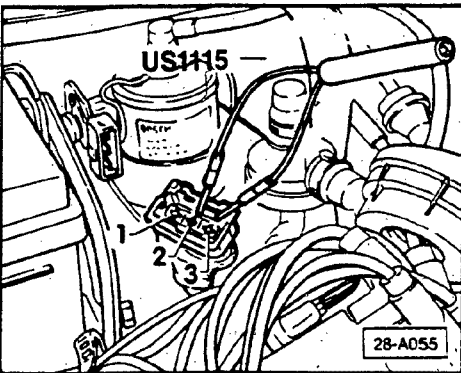
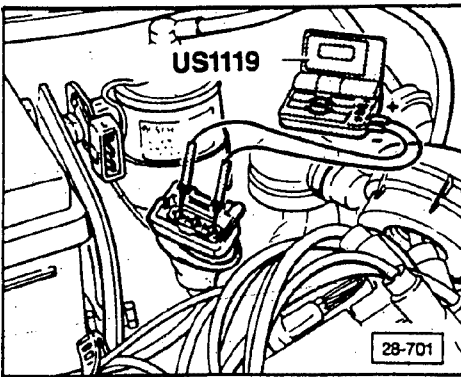
- switch **OFF** ignition
- reconnect harness connector to power output stage of coil
- remove harness connector from Hall sensor on distributor

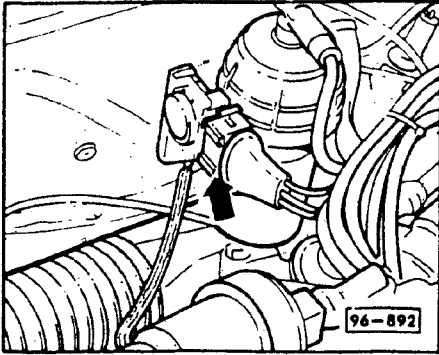
- connect multimeter to terminal 1 (-) and terminal 15 (+) of ignition coil
- switch **ON** ignition

- briefly touch center wire from disconnected Hall sensor harness connector to ground
 - indicated voltage must increase to 2 volts minimum and after 1 to 2 seconds drop to zero volts

If the voltage does **NOT** drop:

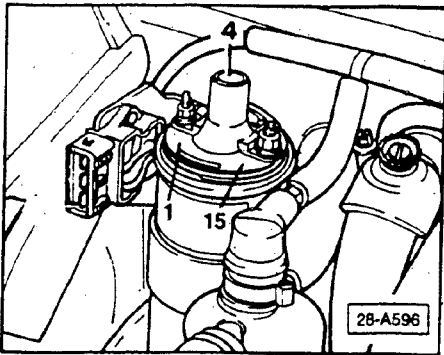
- temporarily substitute a new power output stage and check previous step again, also inspect top of coil for leakage
- if necessary replace coil assembly complete with power output stage





Ignition coil, checking

- check wiring between power output stage and ignition coil and ground wire between power stage and engine for corrosion or damage
- disconnect ignition coil power stage (arrow)



Secondary resistance, checking

- connect multimeter US 1119 between terminals 1 and 4
 - 5-9 K Ω

If NO

- replace ignition coil.

Primary resistance, checking

- connect multimeter US 1119 between terminals 1 and 15 of ignition coil
 - 0.5-1.5 ohm

If NO

- replace ignition coil

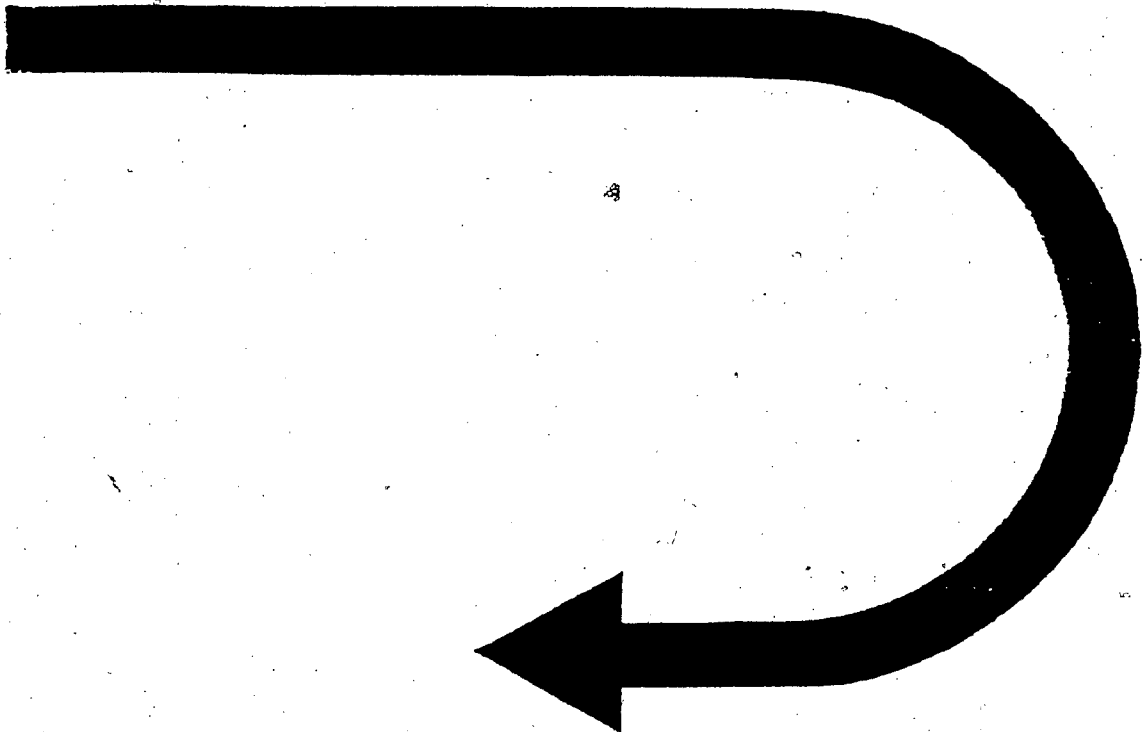
If all specified values are obtained and the engine still does not run (no ignition impulse)

- replace ignition coil complete with power output stage

CAUTION

The function of the power output stage is NOT to be tested.

CONTINUED IN THE
BEGINNING OF NEXT ROW



CAUTION

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

Engine settings, checking

Preparations for checking/adjusting

Requirements:

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

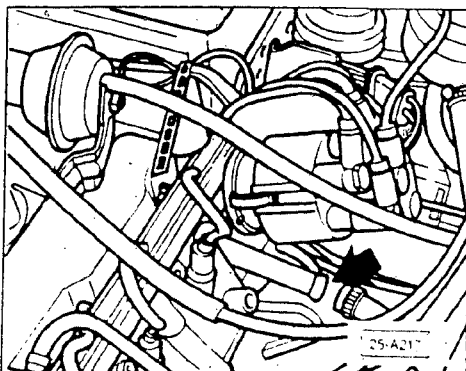
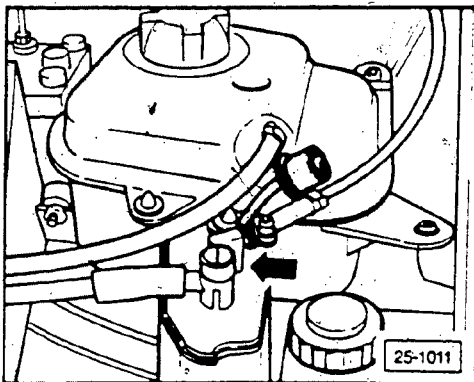
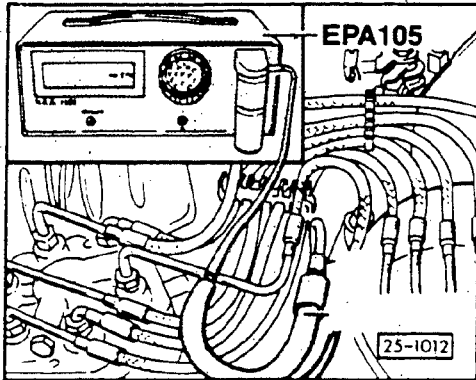
- remove cap from exhaust probe
- connect hose from exhaust gas analyzer (Sun 105 or EPA equivalent) to CO measuring tap (**arrow**)

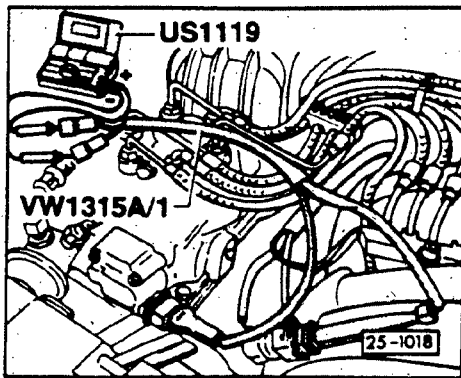
- remove cap (shaded) from carbon canister (**arrow**)

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

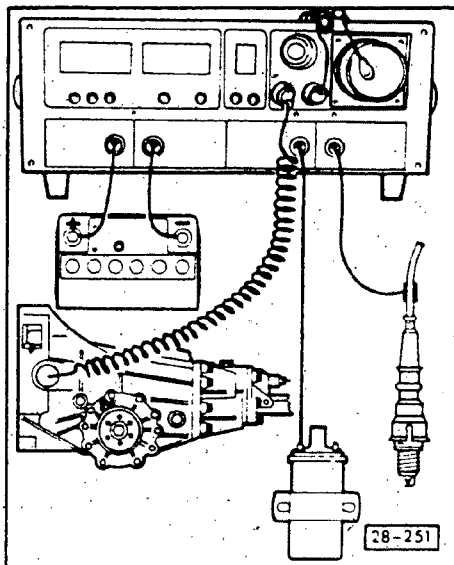
Note

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





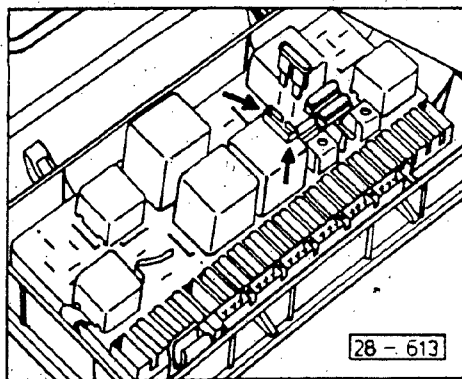
- connect multimeter **US 1119** or equivalent to differential pressure regulator with adaptor **VW 1315 A/1**
- set scale to 200 mA DC



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

Note

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

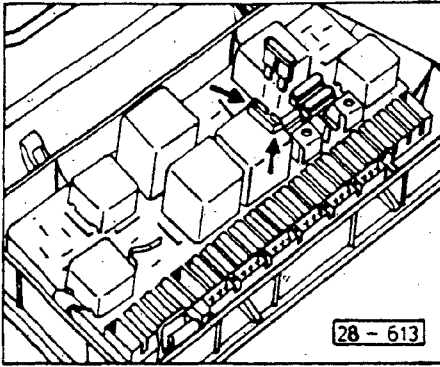


Engine settings, checking

- insert fuse in top of fuel pump relay (**arrow**)
 - indicator light must come on. This indicates that after four seconds, ignition timing is stabilized for testing purposes
- check ignition timing
 - 13° to 17° Before TDC

If NO

- adjust ignition timing to: 15° ± 1° Before TDC (see page 28-180-9)

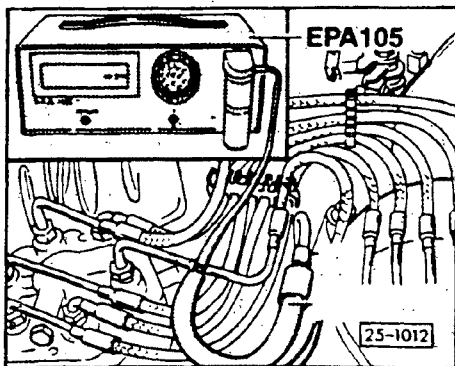


- remove fuse from fuel pump relay and briefly raise engine speed above 2500 RPM to cancel fault display
- check idle speed
 - 790 ± 70 RPM

Note

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

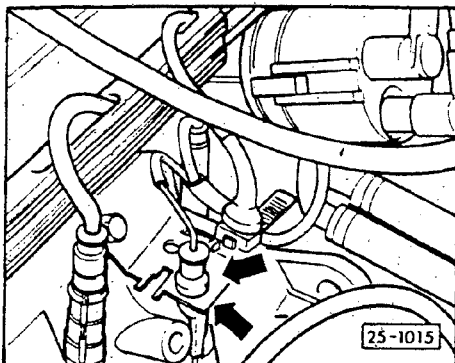
- if idle speed is out of this range, check for an engine problem such as vacuum leaks, etc.
- check differential pressure regulator current with oxygen sensor **connected**
 - 0 ± 1 mA, adjust if necessary



- check CO%
 - 0.3% to 1.2%

Note

Vehicles with air conditioning only:
If the idle speed should drop severely when the air conditioner is switched **ON**, check the idle stabilization system (Group 25). If injection lines were disengaged or replaced, the engine speed must be raised to 3000 RPM several times then left idling for at least 2 minutes before adjustment. The idle speed is automatically regulated by the idle stabilization valve.



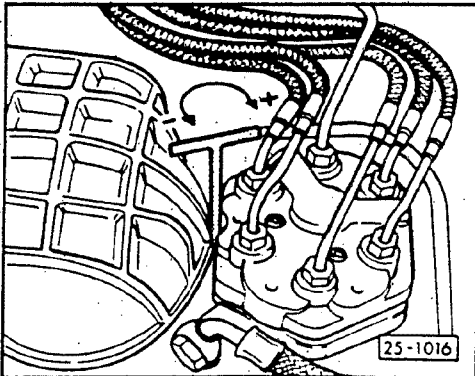
- disconnect oxygen sensor harness² connector (arrows)
- check CO-value, if necessary adjust with CO-adjustment screw (Page 25.61)
 - checking value: 0.3-3.0 vol. %
 - adjustment value: 0.6-1.0 vol. %

CAUTION

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

CAUTION

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



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

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

Note

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

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

If **NO**

- check the oxygen sensor (Group 25)

Idle and CO content, checking and adjusting

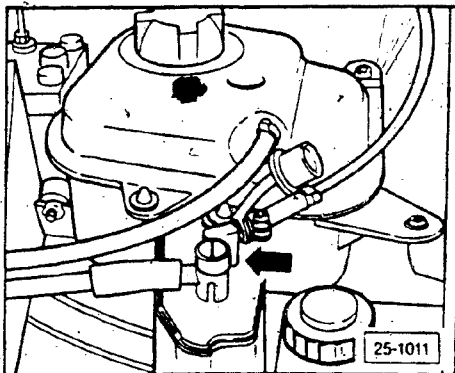
Note

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

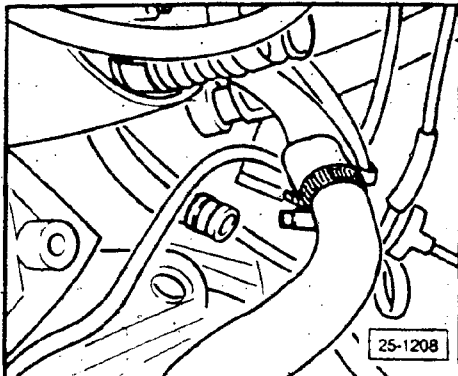
Beginning 3-88 the throttle bypass screw was no longer installed.

Check these first:

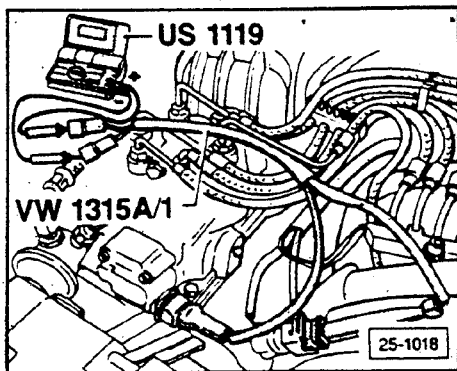
- engine oil temperature 80°C (176°F) minimum
- all electrical consumers switched **OFF**
- radiator fan must **NOT** be running during checking or adjusting
- A/C switched **OFF**
- do **NOT** have any pressure measuring devices connected
- if injection lines were loosened or replaced, raise engine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



- remove cap from carbon canister (arrow)



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



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

- remove cap from CO tap tube
- connect **SUN 105** CO tester according to manufacturers instructions

Note

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

- start engine and let idle

Note

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

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

If reading indicates positive 50-60 mA:

- reverse meter connections

If **NO** value is indicated

- check idle switch see Repair Group 25

Workshops over 1000 meters (3280 feet) of elevation: see section 28-180-7

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

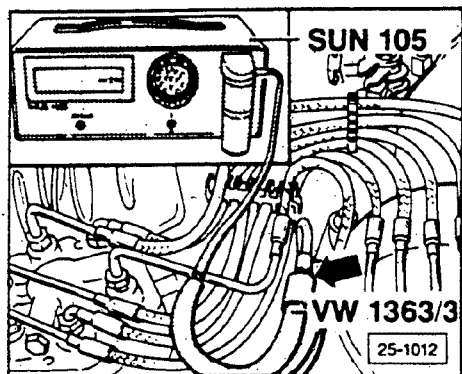
- checking: 0 = 3 mA

CO value as indicated on the **SUN 105** CO tester must be

- 0.3 or 1.2 volume %

If **NO**

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



- **lightly** center punch mixture adjusting screw plug
- drill 2.5 mm (3/32 in.) hole in center of plug to a depth of 3.5 to 4.0 mm (9/64 to 5/32 in.)

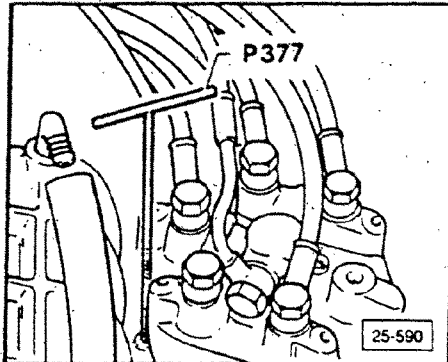
CAUTION

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

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

CAUTION

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



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

Workshops above 1000 meters (3280 feet) of elevation:

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

Note

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

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

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

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

CAUTION

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

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

CAUTION

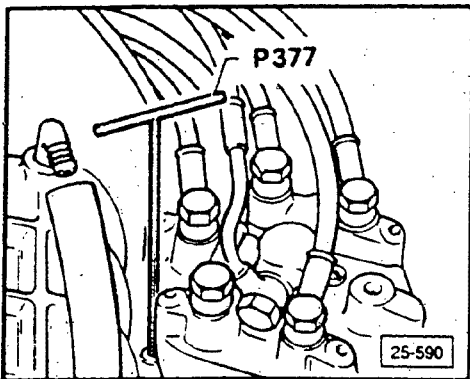
When adjusting do **NOT** push adjustment wrench down or accelerate engine with adjusting tool in place. Remove tool after each adjustment and briefly accelerate engine before reading the CO value.

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

Example:

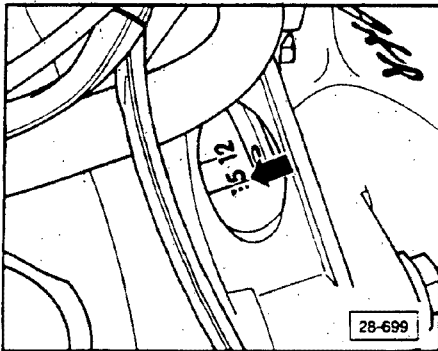
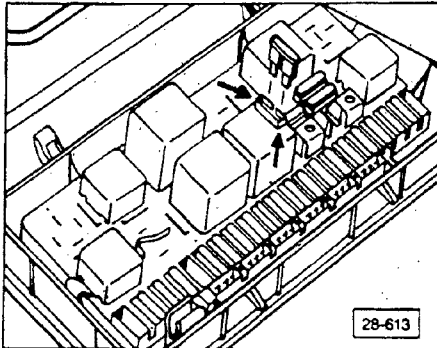
If the reading with the oxygen sensor disconnected was 4 mA and the reading with the oxygen sensor connected was 0 mA the difference would be 4 thus requiring an adjustment.

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



CAUTION

These are the detailed instructions for adjusting the ignition timing. They are not meant to be performed separately from idle and CO adjustments. (See engine settings).



Ignition timing, adjusting (1987, 1988)

Check these first:

- engine oil temperature at least 80°C (176°F)
- A/C switched OFF
- knock sensor OK (no fault code displayed)
- connect engine tester VW 1367 for timing point and RPM display
- start engine and let idle
- insert fuse in fuel pump relay (arrows)
- after at least 4 seconds check timing

Checking with TDC — sensor:

Ignition timing point is displayed numerically on the VW 1367

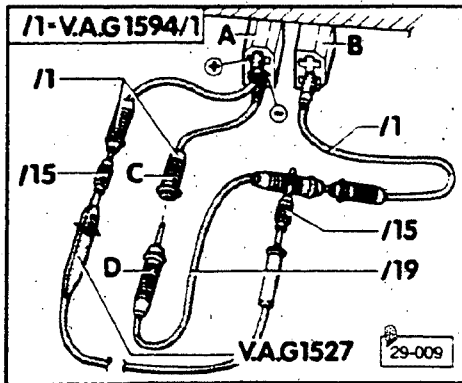
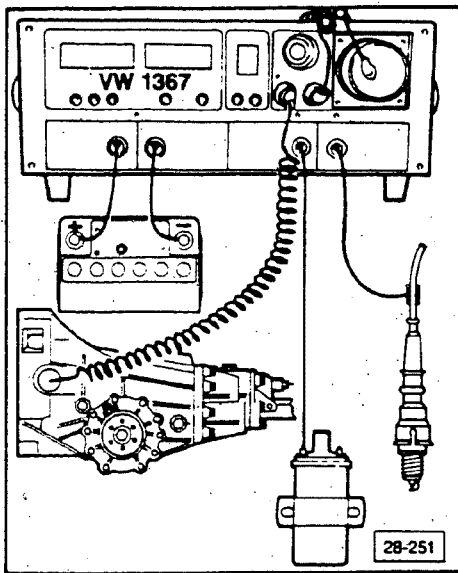
- checking value: 13 to 17° Before TDC

Checking with strobe light:

Ignition timing mark on flywheel (15°) flashes

If NO

- loosen distributor clamp
- adjust ignition timing by turning the distributor
 - adjustment value: 15 ± 1° Before TDC
- remove fuse from fuel pump relay and increase engine speed to briefly exceed 2500/RPM
- let engine idle. Ignition timing point must fluctuate between approximately 7° and 20°
- adjust idle speed if necessary (page 28-180-3)
- tighten distributor clamp bolt
 - 25 Nm (18 ft lb)



Ignition timing, checking (1989)

Check these first:

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

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

CAUTION

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

- start engine and let idle

Note

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

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

Note

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

Ignition timing, adjusting

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