Volkswagenwerk AG

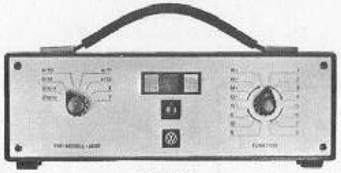
Troubleshooting Guide

for Engines with Electronic Fuel Injection MPC (manifold pressure controlled)

Type 3/all
Type 4/Manual Transmission
Type 4/Automatic Transmission
(up to Oct. 1973)

Contents

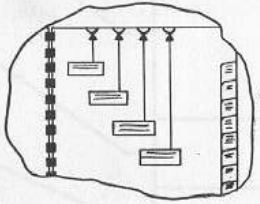
Introduction
Start here



VW 1218
(ASE 000050)

How does this troubleshooting guide work?

Together with the necessary equipment – mainly the VW 1218 tester – this guide should help you to locate trouble in the fuel injection system quickly



Finding your way

Step 1: Verify the complaint. Check the customer complaint to determine if a problem really exists. Road test, and if possible have the customer show you what happens. If the problem exists, note the symptoms.
Step 2: Find symptom on contents page
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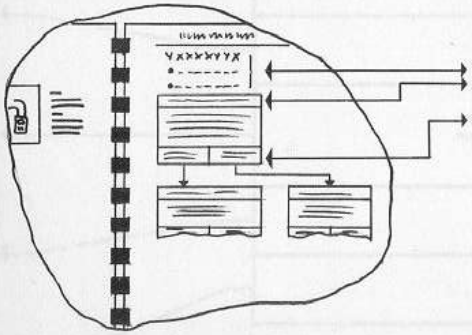

How to check

Step 1: Be sure test conditions check out OK
Step 2: Upper box lists most probable trouble. Start to check here first.
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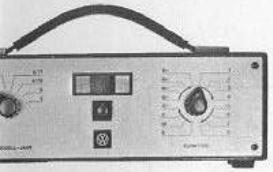
Engine does not start

Cold engine does not start

Hot engine does not start

Engine starts but stops again after a short time



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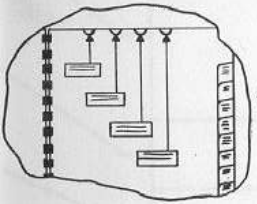

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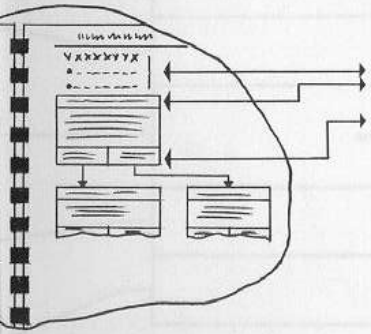

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Starting trouble

Idling trouble

Hesitation trouble

oor output/
op speed too low

Fuel consumption too high

Engine misfiring

CO value too high

Wiring diagram

Engine does not start

Test conditions:
- Correct starting procedure.
- Fuel in tank.
- Starter is turning fast enough (battery voltage).

Faults in ignition system

Check ignition system and eliminate any defects.

Caution
Sparks at the plug connectors do not always indicate that ignition system is in order.

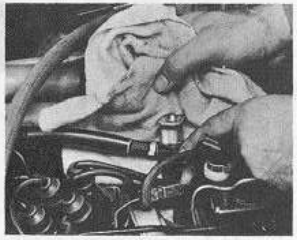
Engine does not start	Engine starts

Note
Following defects may be found despite visible sparking at spark plug connectors:
- Distributor cap (damp, cracked, burnt by tracking)
- Rotor defective
- Loose connections on coil
- Spark plugs or connectors defective
- Ignition timing incorrect (breaker points)
- Ignition cables poorly connected
- Arcing at ignition cables on distributor (through the rubber caps)
- Voltage at terminal 15 on coil too low (minimum = 9 volts)
- Condenser defective

Faults in fuel system

Check pressure in ring main with pressure gauge while starting. Specified pressure: 2.0 kg/cm² (28 psi).

Pressure builds up	No pressure



Check cold start valve for sealing

Note
- Detach cold start valve from intake air distributor but leave it connected to ring main.
- Switch ignition on and off several times and check if fuel is delivered.

Engine floods due to defective cold start device

Possible troubles:
- Cold start valve leaking
- Thermoswitch not switching off at higher temperatures

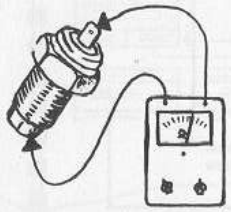
  Wrong combination of thermoswitch and control unit (see list of equipment in workshop manual)

No trouble	Trouble corrected, engine starts

Pump control defective

Switch ignition on several times; pump relay should operate audibly (clicking). Switch off again after about 1 second.

Relay works	Relay does not work



Note
Thermoswitch should not show any continuity above specified cut-in temperature.

Cut-in temperatures are:
- 311 906 161 = −12 to −18°C (10 to 0°F) (Aug. 67 to July 69)
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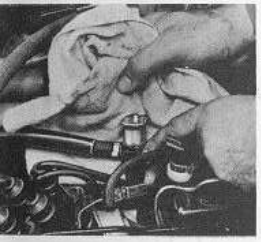

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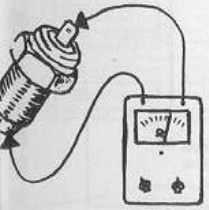

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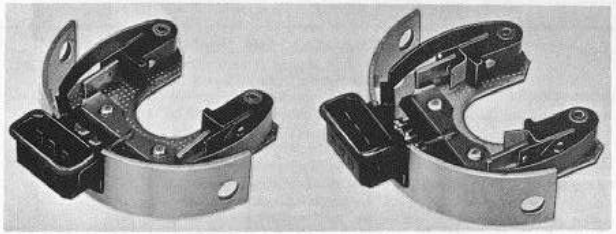


without deflector plate

with deflector plate

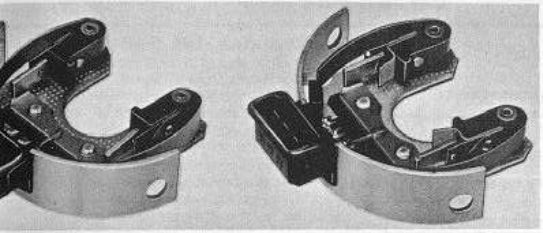
Note
On older vehicles the distributor trigger contacts with oil deflector can be service installed:

Introduced in production: July 1971
- Type 3 from Chassis No. 311 2 252 242
- Type 4 from Chassis No. 411 2 059 500

Engine does not start (cont'd from page 5)

Trouble in electrical part of injection system	
Connect tester VW 1218 and run through test program.	
No trouble	Trouble located and corrected

Clean or replace trigger contacts in distributor.



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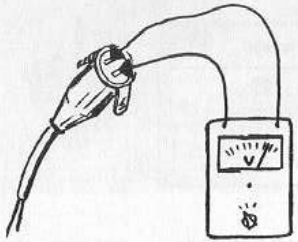
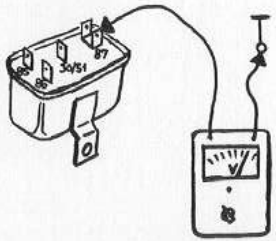




Engine does not start (cont'd from page 5)

No voltage at fuel pump

Switch ignition on several times and check voltage at fuel pump connection

Voltage present	No voltage

Fuel pump defective

Repair pump connection or replace pump

Operate starter

Engine does not start; no pressure in ring main	Engine starts

Fuel line blocked

Possible trouble:

- Fuel filter blocked
- Tank strainer blocked
- Rust in fuel tank

Correct trouble

Pump relay defective

Switch ignition on several times and measure voltage at terminal 87 on relay.

Voltage present	No voltage

Possible trouble:

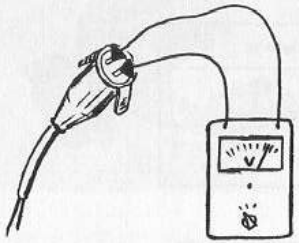
- Wire between terminal 87 of pump relay and pump defective.
- Pump ground wire defective

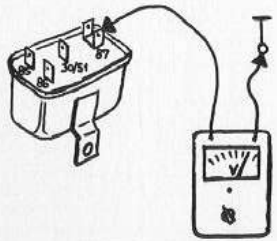
Correct trouble

Possible causes:

- Fuse blown
- Relay defective

Correct trouble





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Possible causes:

- Fuse blown
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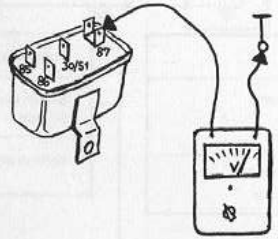
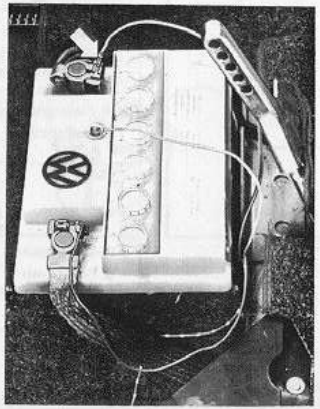
Correct trouble

Note
The voltage supply relay is located as follows:
- Type 3 Sedan: on left under rear seat
- Type 3 Squareback: on left under rear seat
- Type 4 Four door Sedan: on left of engine compartment
- Type 4 Wagon: on control unit





Pump relay not receiving voltage from voltage supply relay

Switch ignition on several times and check that voltage supply relay clicks.

Relay works	Relay does not work

Possible trouble
- Wire between voltage supply relay terminal 86 and terminal 15 in fuse box defective
- Ground wire between terminal 85 and body or engine defective.
- Voltage supply relay defective.

Repair wiring or replace voltage supply relay

Faulty contact in voltage supply relay

Check voltage at voltage supply relay terminal 87 and pump relay terminal 86.

Voltage present	No voltage

Possible trouble
- Wire between battery plus and terminal 30/5 of voltage supply relay defective.
- Voltage supply relay defective.

Correct trouble

Pump relay not grounded via wire 19 of control unit

Connect VW 1218 tester and run through test program

Possible trouble
- Wire 18 between control unit and starter terminal 50 defective.
- No continuity at multi-pin connector
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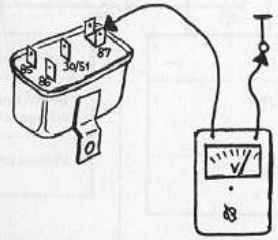

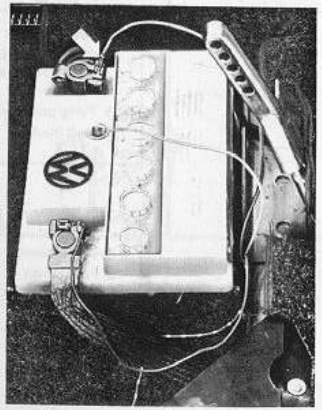

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Correct trouble

Cold engine does not start

Test condition:
- Fuel in tank

Incorrect starting procedure

Try to start engine using correct procedure (in condition complaint was made)

Engine does not start or is difficult to start	Engine starts normally

Advise customer on correct startin procedure

Battery voltage too low

Check state of battery charge: charge if necessary or replace battery
Try to start engine again.

Engine does not start or is difficult to start	Engine starts normally

Voltage at coil terminal 15 too low

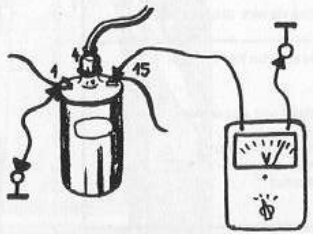
Install additional wire from terminal 1 to ground. Measure voltage at terminal 15 with voltmeter while starter is operating.

Voltage is 9 volts or more	Voltage is less than 9 volts

Possible trouble
- Voltage drop in circuit from battery via light switch, ignition-starter switch to coil terminal 15.
- Poor ground connection between battery and body and between transmission and body.
- Starter current draw too high.

Correct trouble

Starting engine
- Gear shift lever in neutral
- Do **not** press accelerator pedal
  This holds true for a cold engine and an engine at operating temperature no matter what the outside temperature is
- Switch on ignition and start engine
- At outside temperatures below 0°C (32°F) press clutch pedal before starting.



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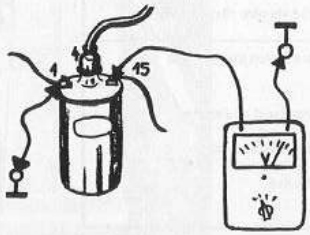

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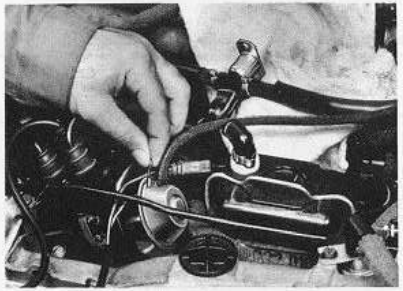


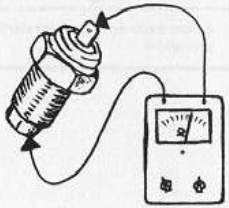
Test instructions:

Cold start valve and wiring:

- Detach cold start valve from intake air distributor but leave it connected to the ring main.
- Pull connector off thermoswitch and connect to ground.
- Pull wire off terminal 1 on coil

Warning
Fire hazard

- Operate starter briefly and check if cold start valve injects fuel (catch fuel with rag).



Thermoswitch can only be tested at very low ambient temperatures or when switch has been cooled down to actuating temperature in a refrigerator.

Actuating temperatures:

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Trouble in cold start device

Possible trouble:

- Cold start valve wire detached from terminal 50 of solenoid.
- Wire detached from thermoswitch.
- Incorrect combination of thermoswitch and control unit. (see list of equipment in workshop manual)
- Cold start valve or thermoswitch defective.

Replace cold start valve or thermoswitch as required.

No trouble	Trouble found and corrected

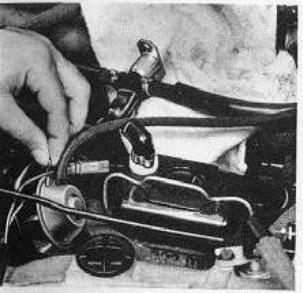
Trouble in electrical part of injection system

Connect VW 1218 tester and run through test program.

Possible trouble:

- Control unit defective
  Temperature sensors I and II defective
- Pressure sensor defective
- Trigger contacts defective

Correct trouble



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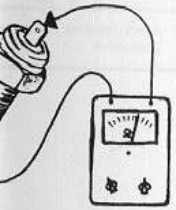

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Correct trouble

Starting engine
- Gear shift lever in neutral
- Do **not** press accelerator pedal
  This holds true for a cold engine and an engine at operating temperature no matter what the outside temperature is
- Switch on ignition and start engine
- At outside temperature below 0 °C (32 °F) press clutch pedal before starting

Test conditions:
- Correct starting procedure being used
- Fuel in tank

Valve clearance incorrect

Adjust valves properly with **engine cold.**
Warm engine up and carry out starting tests.

Engine difficult to start	Engine starts normally

Pressure in ring main too high (mixture too rich)

Check pressure with gauge while operating starter and set to 2 kg/cm² (28 psi) if necessary.
Try to start engine again.

Engine difficult to start	Engine starts normally

Control unit or pressure sensor making mixture too rich

Connect tester 1218 and run through test program.
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Correct trouble and try to start engine.

Engine difficult to start	Engine starts normally

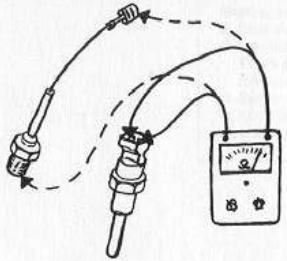
Resistances of temperature sensors I + II too high despite OK indication (mixture too rich).

Remove temperature sensors. Let them cool down to room temperature and measure resistance with ohmmeter:

- Sensor I not more than 300 Ω
- Sensor II not more than 2.5 kΩ

Replace defective sensors and try to start engine again.

Engine difficult to start	Engine starts normally



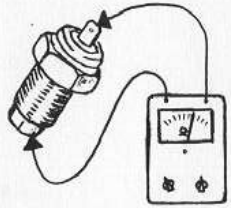
Engine floods due to defective cold start device

Possible trouble:

- Cold start valve leaking
- Thermoswitch does not switch off at higher temperatures

Correct trouble, try to start engine again.

Engine difficult to start	Engine starts normally



Note
The thermoswitch should not show any continuity above the specified switch-on temperature.

Actuating temperatures:

- 311 906 161 = −12 to −18°C (10 to 0°F) (Aug. 67 to July 69)
- 311 906 161A = 0 to + 10°C (32 to 14°F) (Aug. 69 to March 70)
- 311 906 161C = −6 to −14°C (21 to 7°F) (from April 70)
- 311 906 161B = −2 to −8°C (28 to 18°F) (For service installation only up to March 70)

Injectors leaking

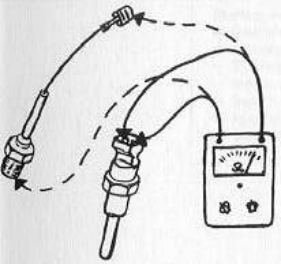
Remove injectors but leave them connected to the ring main.

Switch ignition on and off several times without starting engine

Warning Fire hazard

Have second mechanic check if more than two drops are ejected by each injector per minute.

Replace leaking injectors.



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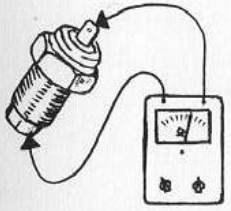

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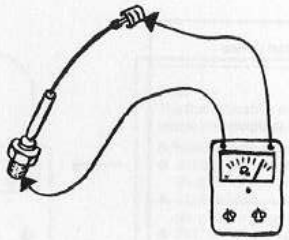


Trouble in electrical part of injection system

Connect tester VW 1218 and run through test program

Possible trouble:

- Control unit defective
- Temperature sensor II (cylinder head) defective
- Pressure sensor defective

No trouble	Trouble corrected

Temperature sensor II defective despite OK indication

Remove sensor, let it cool down to room temperature and measure resistance with an ohmmeter.

Specified value: 1.5 to 2.5 kΩ

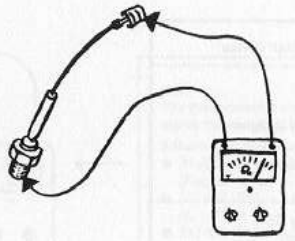
Resistance clearly too high	Resistance OK

Auxiliary air regulator defective

Check air flow through regulator with engine cold

If there is no flow or a restricted flow, replace auxiliary air regulator

Replace temperature sensor II



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Replace temperature sensor II

Rough idle during warm-up

Test conditions:
- Valve clearance and ignition timing correct (very important).
- Idling speed of warm engine within specified tolerances.
- Let engine cool down to ambient temperature before starting test.

Idle enrichment inadequate during the warm-up phase

Start engine.
When auxiliary air regulator has closed (after 3-4 minutes), measure idle variation.

Variation more than 100 rpm	Variation less than 100 rpm

Type 3 → This variation is permissible and requires no repair work

Type 4 →

Idling CO potentiometer setting too lean

Turn potentiometer slowly clockwise until idle is normal (Variation less than 100 rpm)

Idle OK	Idle still varying

Idle OK → Check that CO is not too high when engine is warm (50–70°C/122–158°F)
If the CO is considerably above the permissible maximum, look for fault in "CO value too high" section of guide

Idle still varying → Idle contact in throttle valve switch not in order

Possible trouble:
- Throttle valve switch incorrectly adjusted
- Wire 17 between throttle valve switch and control unit defective
- Throttle valve switch defective

Rough idle during warm-up

Test conditions:
- Valve clearance and ignition timing correct (very important).
- Idling speed of warm engine within specified tolerances.
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Variation more than 100 rpm	Variation less than 100 rpm

Type 4

Idling CO potentiometer setting too lean

Turn potentiometer slowly clockwise until idle is normal (Variation less than 100 rpm)

Idle OK	Idle still varying

Check that CO is not too high when engine is warm (50–70°C/122–158°F)
If the CO is considerably above the permissible maximum, look for fault in "CO value too high" section of guide

Type 3

This variation is permissible and requires no repair work

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Possible trouble:
- Throttle valve switch incorrectly adjusted
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Test conditions:
- Valve clearance and ignition timing correct (very important).
- Idling speed of warm engine within specified tolerances.
- Let engine cool down to ambient temperature before starting test.

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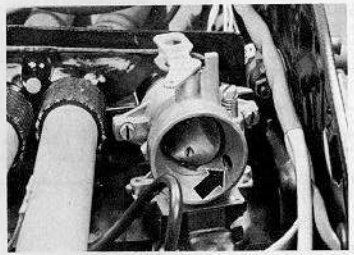


Hunting at idle at all temperatures

Note
This point concerns only vehicles with deceleration fuel cutoff
- Type 3 up to Chassis No. 311 2 500 000
- Type 4 up to Chassis No. 411 2 100 000

Test condition:
- Engine warm (50–70°C/122–158°F)
- Engine running at idle

Leakage in intake manifold

Pull auxiliary air regulator hose off at intake elbow and close it with the thumb.

Idle steady	Engine continues to hunt

Auxiliary air regulator not closing

Type 3 / Automatic Type 4:	Type 3 / Manual:
Run engine and check if there is voltage at the connection on auxiliary air regulator.	Replace mechanical regulator

Voltage present	No voltage

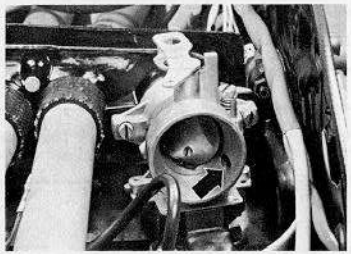
Replace regulator

Check wire to terminal 87 on pump relay and repair.

Pull intake elbow off throttle valve support, close off by-pass drilling with thumb and listen for sucking noises.

Possible causes for leaks:
- Hoses between intake manifolds and intake air distributor
- Intake manifold gaskets
- Rubber mountings for injectors
- Vacuum hoses

Eliminate all leaks found



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Idle steady	Engine continues to hunt

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- Hoses between intake manifolds and intake air distributor
- Intake manifold gaskets
- Rubber mountings for injectors
- Vacuum hoses

Eliminate all leaks found

Check wire to terminal 87 on pump relay and repair.

Hot engine stalls at idle

Test condition
- Engine cold

Valve clearance incorrect

Check clearance and – if necessary – set exactly (very important).
Warm up engine and check if it will idle properly

Engine stalls	Engine idles properly

Trouble in electrical part of injection system

Connect tester 1218 and run through the guide

Possible trouble:
- Throttle valve switch incorrectly adjusted
- Control unit defective
- Pressure sensor defective (too lean)

Correct trouble

Test condition
- Engine cold

Valve clearance incorrect

Check clearance and – if necessary – set exactly (very important).
Warm up engine and check if it will idle properly

Engine stalls	Engine idles properly

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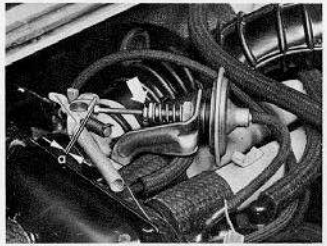


Idling speed regulator
(only Type 4/Automatic Transm.)

Note

Engine oil temperature must be 50–70°C (122–158°F).

Regulator must be adjusted with engine running.

Adjustment

1 – Set idle to 850–900 rpm.

2 – Apply parking brake and select driving range.

In this condition idle should be approximately 600–700 rpm. Play at "a" should be 0.5–1.0 mm (0.02–0.04 in.)

3 – Adjust play as required on M 5 screw (arrow).

Uneven idle in driving range (Automatic Type 4)

Test conditions:
- No variation in idle with lever at "N"
- Idle speed with engine warm 850–900 rpm

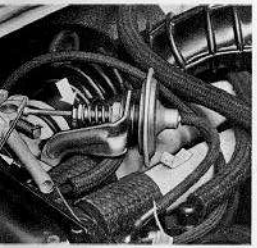
Idling speed regulator incorrectly adjusted

Check adjustment and correct if necessary

Idle still uneven	Idle OK

Install regulator with softer spring.

Production: From Engine No. W 0105 249



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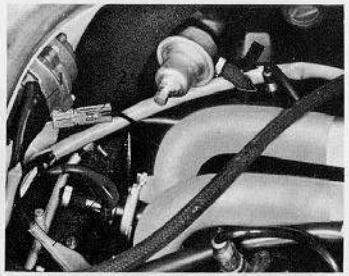


1 – Pressure sensor connector
2 – Connector for temperature sensor II
3 – Connectors for injectors.

Note
The area near the plug connector for No. 3 cylinder on the Type 4/Wagon is particularly critical.

Repair instructions:

a – Pull wires off pressure sensor, temperature sensor II (cylinder head) and injectors for cylinders 3 and 4

b – Route wiring behind fuel line on pressure regulator (see illustration).

c – Connect wires again.

Idle irregular (like misfiring)

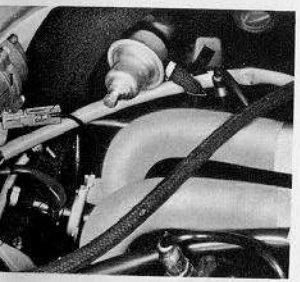
Test conditions:
- Engine warm (50°–70°C/122–158°F)
- Engine running at idling speed

Inductance from ignition system	
Check if the injection system wiring is coming into contact with the high tension ignition cables (see instructions on left) Route wiring so that it is as far as possible from ignition cables	
Idle still irregular	Idle OK

Trouble occurs only when heater is switched on	
Switch heater off and watch idle	
Idle still irregular	Idle OK when heater is switched off

Inductance from some other source
Possible trouble: ● Powerful radio station in immediate vicinity ● Two-way radio on vehicle near engine
No remedy normally required

Trouble in heater electrical system
Possible cause: ● Defective condenser in combustion air blower Replace combustion air blower.



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Idle too high

Test conditions:
- Engine warm (50–70°C/122–158° F)
- Tachometer connected
- Engine running at idle

Throttle valve not closing

Press throttle valve with thumb to see if it is fully closed and watch idle

Idle does not drop	Idle drops

Throttle valve sticking

Possible trouble:
- Throttle controls stiff (accelerator cable or pedal)
- Throttle shaft stiff in operation
- Throttle valve switch incorrectly adjusted
- Throttle valve switch base plate bent

Correct trouble

Adjusting screw out of adjustment

Adjust idle by turning screw

Idle cannot be set properly	Idle can be adjusted

Auxiliary air regulator not closing

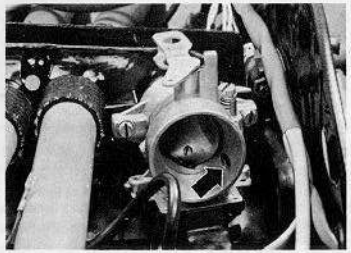
Pull regulator hose off at intake elbow and seal with thumb.

Idle does not drop	Idle drops

Pull intake elbow off throttle valve connection. Close idling by-pass drilling with thumb and listen for suction noises.

Possible sources of leakage:
- Hoses between intake pipes and intake air distributor
- Intake pipe gaskets on cylinder head
- Rubber mountings for injectors
- Vacuum hoses
- Crankcase ventilation valve or hose to intake air distributor defective

Eliminate any leaks.



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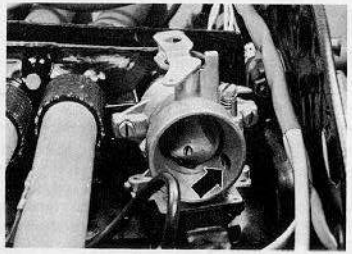
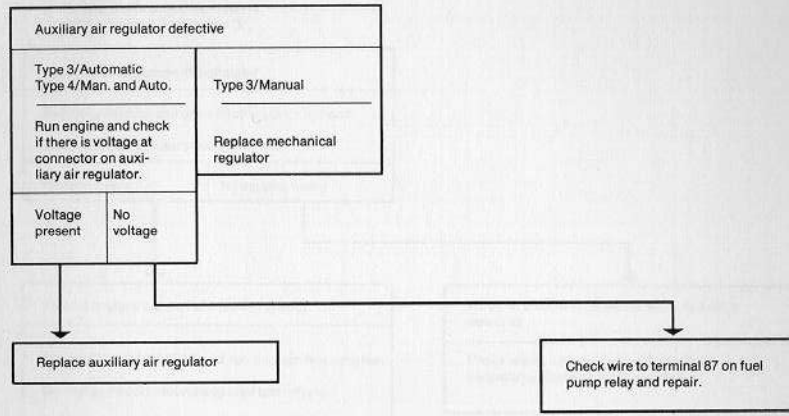


Idle too high (cont'd from page 35)



Idle too high (cont'd from page 35)

Auxiliary air regulator defective

Type 3/Automatic Type 4/Man. and Auto.	Type 3/Manual
Run engine and check if there is voltage at connector on auxiliary air regulator.	Replace mechanical regulator
Voltage present	No voltage

Voltage present → Replace auxiliary air regulator

No voltage → Check wire to terminal 87 on fuel pump relay and repair.

Hesitation trouble

Test condition:
- Vehicle reaches maximum speed (otherwise see "Poor output")

Acceleration enrichment ineffective	
Switch ignition on and open throttle slowly by hand. Listen whether injectors click (20 times)	
Clicking heard	No clicking heard

Trouble in electrical part of injection system	
Connect tester VW 1218 and run through test program Correct any trouble found and road test vehicle	
Progression still not satisfactory	Performance on road test OK

Mechanical trouble in pressure sensor	
Check by using a new pressure sensor and road test vehicle again.	
Progression still not satisfactory	Performance on road test OK

Wires on throttle valve switch faulty or switch defective
Check wiring connections and repair as necessary, otherwise replace switch.

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→ Clicking heard:

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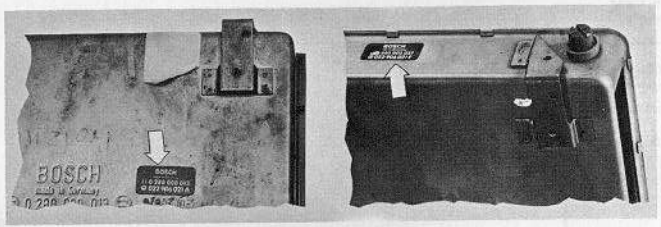


Hesitation trouble (cont'd from page 39)

Incorrect matching of control unit and temperature sensor (mixture too weak)

Check matching
The service temperature sensors I (311 906 081 B) and II (022 906 041 A) must not be installed in vehicles which have control units with yellow, brown or black stickers

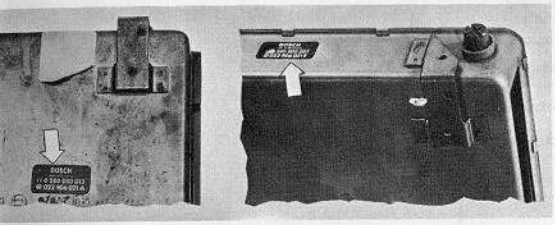
Parts match	Parts do not match

Defect in ignition system

Possible trouble:
- Contact breaker
- Ignition timing
- Spark advance settings
- Spark plug gaps

Correct trouble

Install correct temperature sensor as shown in list of equipment in workshop manual.



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Road testing instructions:

- Increase tire pressures to 3 psi above normal tire pressure
- Engine and transmission must be warm
- Level, dry asphalt road surface
- Normal wind conditions
- Take average readings from one run in each direction
- Check maximum speed where legally permitted on a measured test stretch (1 mile) with a stop watch
- Find actual speed from table below and compare with speedometer to find variation

Speed table
– for 1 mile stretch

Seconds	mph
58	62
55	65
52	69
48	75
45	80
43	85
40	90
38	95
36	100

Possible trouble in ignition system:

- Distributor cap (damp, cracked, burnt by tracking)
- Rotor defective
- Ignition timing incorrect (breaker points)
- Condenser defective
- Loose connections on coil
- Ignition cables poorly connected
- Spark plugs or connectors defective
- Centrifugal spark control defective
- Arcing at ignition cables on distributor (through protective caps)

Poor output / top speed too low

Test conditions:

- Speedometer reading normal (see instructions on left)
- Tire size and type equivalent to standard
- Wheels turning freely (brakes, bearings)

Faulty engine adjustment

Procedure:

- Check valve clearance with engine cold and adjust if necessary
- Check accelerator cable adjustment. (Throttle must be fully open with pedal at full throttle).
- On Type 4 up to model year 71; Check that crankcase ventilation control flap moves freely.
- Check ignition timing and adjust if necessary.

No trouble	Trouble corrected

Troubles in ignition system

Check ignition system and eliminate any faults found.

Caution
Visible sparks do not always prove that the ignition system is in order (see remarks on left).

No trouble	Trouble corrected

Road test

Output poor	Output O.K.

Road test

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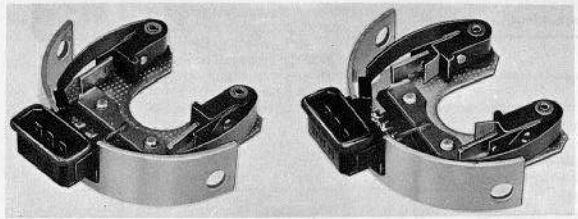
- Rotor defective
- Ignition timing incorrect (breaker points)
- Condenser defective
- Loose connections on coil
- Ignition cables poorly connected
- Spark plugs or connectors defective
- Centrifugal spark control defective
- Arcing at ignition cables on distributor (through protective caps)



without deflector plate

with deflector plate

Note
On older vehicles the distributor trigger contacts with oil deflector can be service installed.

Introduced in production: July 1971

- Type 3 from Chassis No. 311 2 252 242
- Type 4 from Chassis No. 411 2 059 500

Poor output / Top speed too low (cont'd from page 43)

Engine compression low

Check compression

Compression O.K.	Compression poor

Repair engine

Trouble in electrical part of injection system

Connect tester VW 1218 and run through test program

Correct trouble

No trouble	Trouble corrected

Road test

Output poor	Output O.K.

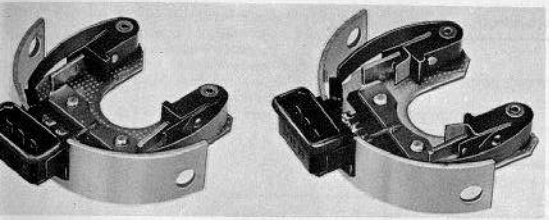
Triggers contacts or injectors dirty

Check contacts and injectors (visually) and clean if necessary

Trigger contacts were clean	Trigger contacts were oily/dirty

Road test

Output poor	Output O.K.



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with deflector plate

Note
On older vehicles the distributor trigger contacts with oil deflector can be service installed.

Introduced in production: July 1971
- Type 3 from Chassis No. 311 2252 242
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Poor output / Top speed too low (cont'd from page 43)

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Check compression

Compression O.K.	Compression poor

Repair engine

Trouble in electrical part of injection system

Connect tester VW 1218 and run through test program

Correct trouble

No trouble	Trouble corrected

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Check contacts and injectors (visually) and clean if necessary

Trigger contacts were clean	Trigger contacts were oily/dirty

Road test

Output poor	Output O.K.

Poor output / top speed too low (cont'd from page 45)

Fuel pressure in ring main too low at full throttle

Measure pressure with gauge:
at idle and
at full throttle (on test stand or on road test with extended gauge connections)

Pressure at idle at full throttle approx. 2 kg/cm² (28 psi)	Pressure drops noticeably at full throttle	Pressure at idle and full throttle the same but too low

Wheel toe badly out of adjustment causing increased roll resistance

Check front and rear wheel toe and adjust if necessary

Toe OK	Toe not OK Adjust toe

Transmission or final drive binding

Defect is usually accompanied by excessive noise (droning, grinding etc.) and/or by excessive heat development.

Not enough fuel delivered

Possible causes:
- Fuel filter blocked
- Strainer in tank blocked
- Rust in fuel tank
- Pump not delivering sufficient fuel

Correct trouble

Pressure regulator incorrectly adjusted

Adjust pressure to 2 kg/cm² (28 psi)

Note
Abnormal tire wear can indicate wrong toe adjustment

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at idle and
at full throttle (on test stand or on road test with extended gauge connections)

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- Rust in fuel tank
- Pump not delivering sufficient fuel

Correct trouble

Pressure regulator incorrectly adjusted

Adjust pressure to 2 kg/cm² (28 psi)

Note
Abnormal tire wear can indicate wrong toe adjustment

Road testing instructions:

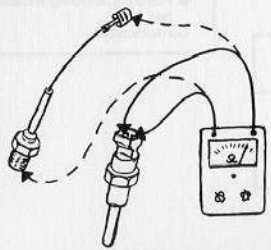
- Where possible customer should be present during road test
- Plan test route to include mixed driving and traffic conditions (equal parts of city traffic, open road and expressway)
- Do **not** switch heater on during the test
- Measure consumption with a fuel consumption tester or by filling fuel tank exactly before and after test
- Approximate consumption figures for mixed traffic at an ambient temperature above 0°C (32° F) are:

  Type 3 / Manual approx.
  18.7 mpg/US or 23 mpg/Imp.
  Type 3 / Automatic approx.
  17.6 mpg/US or 21.5 mpg/Imp.

  Type 4 / Manual approx.
  17 mpg/US or 20 mpg/Imp.
  Type 4 / Automatic approx.
  16.2 mpg/US or 19.9 mpg/Imp.

Caution

- These figures are only for comparison with figure obtained during road test under given driving and traffic conditions. They are not to be used for comparison with consumption figures given by customer.
- When vehicle is driven short distances in rush hours conditions, consumption can go up to 20 liters for 100 km (11.3 mpg /US or 13.4 mpg/Imp. for 60 miles)
- When discussing fuel consumption, remember that the heater (Type 4) also uses from 0.5 to 3 liters per 100 km (1 to 6 pts/US per 60 miles or 0.8 to 4.6 pts/Imp per 60 miles)



Fuel consumption too high

Test condition:

- Standard tire size and type
- Wheels turning freely (brakes, wheel bearings)
- Ignition timing correct
- Road test has shown clearly that fuel consumption is too high (see remarks on left)

Trouble in electrical part of injection system

Connect tester VW 1218 and run through test program

No trouble	Trouble corrected

Resistances of temperature sensors too high despite OK indication (mixture too rich)

Remove temperature sensors I and II and measure resistances with ohmmeter at room temperature

- Sensor I not more than 300 Ω
- Sensor II not more than 2.5 kΩ

Resistance not too high	Resistance too high

Replace defective temperature sensor

Pressure in ring main too high

Measure pressure with gauge

Specified figure 2 kg/cm² (28 psi)

Pressure OK	Pressure well above 2 kg/cm² (28 psi)

Fuel consumption too high

Test condition:
- Standard tire size and type
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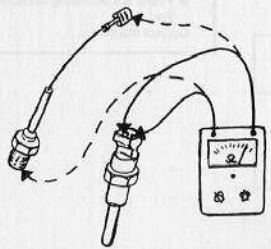
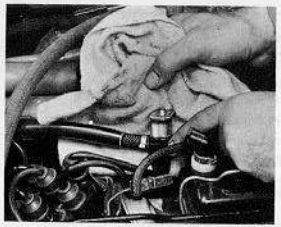




Note
- Detach cold start valve from intake air distributor but leave it connected to the ring main.
- Switch ignition on and off several times and check if fuel is delivered.

Fuel consumption too high (cont'd from page 49)

Cold start valve leaking	
Check cold start valve for leakage	
No trouble	Trouble corrected

Thermostat for cooling air regulation incorrectly adjusted or defective	
Check thermostat and adjustment of cooling air regulation.	
No trouble	Trouble corrected

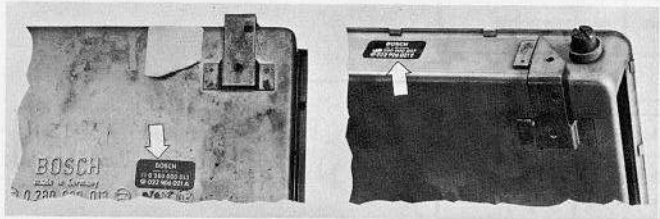
Intake valves leaking despite correct adjustment	
Check compression	
Compression OK	Compression poor

Repair engine

Only Type 3 with pressure switch (up to July 69)

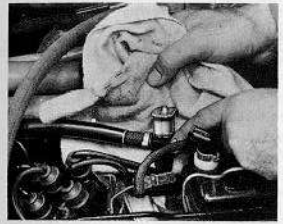
Pressure switch not opening	
Run engine, pull connector off pressure switch and check switch for continuity.	
No continuity	Switch has continuity

Replace switch



Note
Vehicles with control units which do not have a yellow, brown or black sticker that is:
- Type 3 up to Chassis No. 311 2090 091
- Type 4 up to Chassis No. 411 2018 712

can be equipped with temperature sensors 311 906 181 B (for Type 3) and 022 906 041 A (for Type 4) if measures above do not fix the problem



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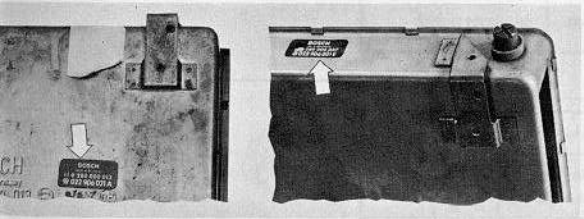

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Fuel consumption too high (cont'd from page 49)

Pressure regulator incorrectly adjusted	
Reduce pressure in ring main to 2 kg/cm² (28 psi)	
Pressure cannot be reduced	Pressure can be reduced

Possible trouble:

- Return line between pressure regulator and tank kinked or blocked
- Pressure regulator defective

Correct trouble

Pressure regulator incorrectly adjusted	
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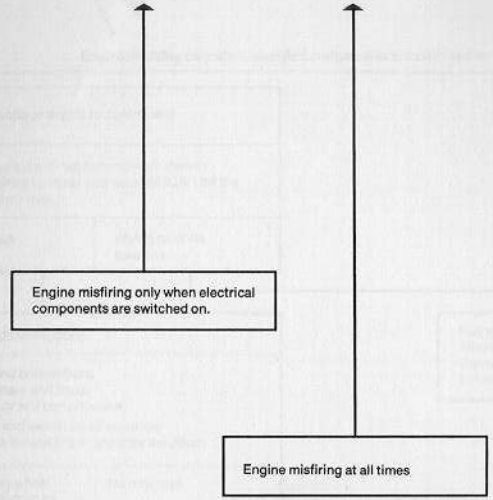
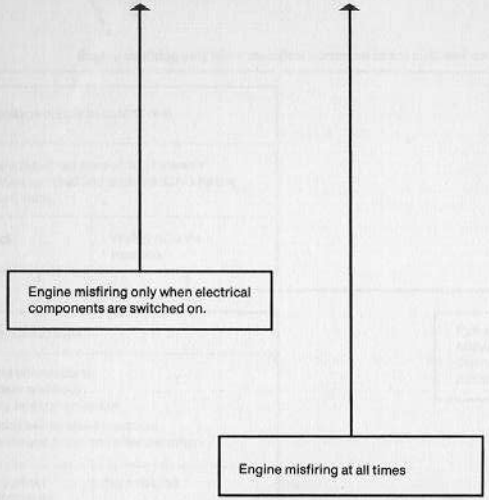
Correct trouble


Engine misfiring only when electrical components are switched on.
Engine misfiring at all times


Engine misfiring only when electrical components are switched on.
Engine misfiring at all times

Engine misfiring only when electrical components are switched on

Trouble in voltage supply to control unit

Check if there is a direct connection between battery positive terminal and terminal 30/51 on the voltage supply relay.

Wiring direct	Wiring runs via fuse box

Pull wire to voltage supply relay off at fuse box. Connect it directly to battery positive terminal

Poor ground connections

Check ground connections
between battery and body,
between body and transmission

Run engine and switch on all electrical components several times one after the other.

Misfiring only when heater is switched on	No misfiring

Trouble in electrical part of heater

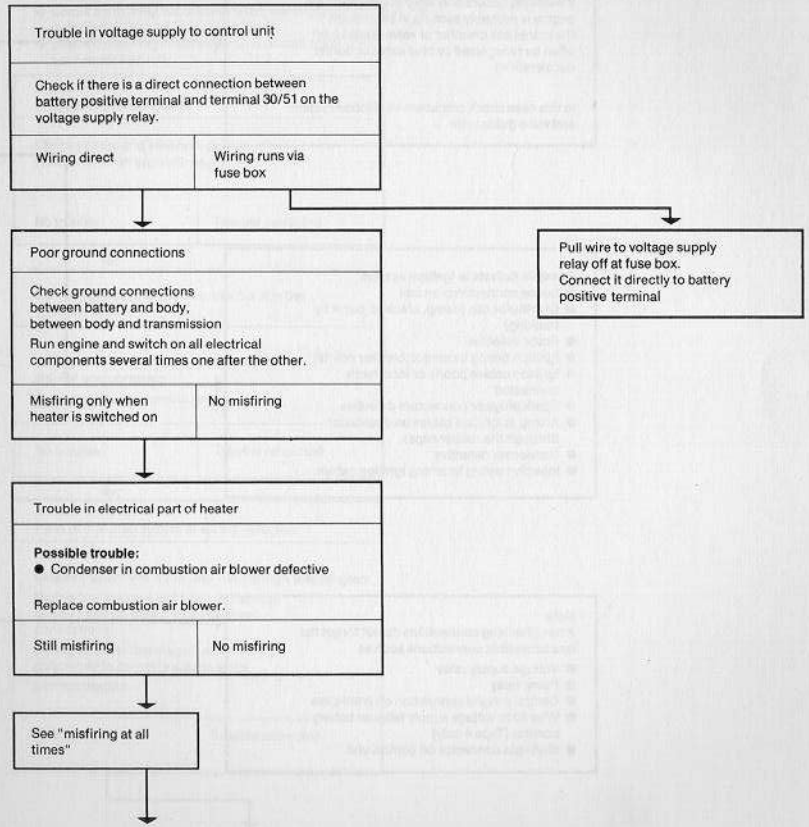
Possible trouble:
- Condenser in combustion air blower defective

Replace combustion air blower.

Still misfiring	No misfiring

See "misfiring at all times"

Engine misfiring only when electrical components are switched on



Engine misfiring at all the times

Test condition:
- Check if misfiring occurs only when electrical components are switched on and off. If so, see page 57.
- Check if misfiring occurs only after deceleration. If so, see remarks on left.

Note
If misfiring occurs only after deceleration the engine is probably sucking in oil through the crankcase breather or valve guides (can often be recognized by blue exhaust during deceleration).

In this case check crankcase ventilation system and valve guide wear.

Trouble in ignition system

Check system and eliminate defects (see remarks on opposite page).

No trouble	Trouble corrected

Possible defects in ignition system
- Loose connections on coil
- Distributor cap (damp, cracked, burnt by tracking)
- Rotor defective
- Ignition timing incorrect (breaker points)
- Ignition cables poorly or incorrectly connected
- Spark plugs or connectors defective
- Arcing at ignition cables on distributor (through the rubber caps)
- Condenser defective
- Injection wiring touching ignition cables

Faulty terminal or ground connections in the injection system

Check all connections systematically for tight fit and corrosion.
(see remarks on opposite page).

No trouble	Trouble corrected

Note
When checking connections do not forget the less accessible connections such as
- Voltage supply relay
- Pump relay
- Central ground connection on crankcase
- Wire 30 to voltage supply relay on battery positive (Type 4 only)
- Multi-pin connector on control unit

Parts of injection system or wiring defective

Connect tester VW 1218 and run through test program
During test stages 4 to 11, tap the control unit by hand (to detect loose soldered connections)
During all other test stages, move wiring concerned to detect breaks in wires
Correct trouble

No trouble	Trouble corrected

Test condition:
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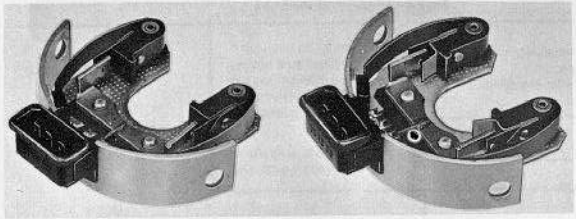


without deflector plate

with deflector plate

Note
On older vehicles distributor trigger contacts with oil deflector can be service installed.

Introduced in production: July 1971
- Type 3 from Chassis No. 311 2252 242
- Type 4 from Chassis No. 411 2059 500

Engine misfiring at all times (cont'd from page 59)

Trigger contacts oiled up/dirty

Check contacts and clean if necessary.

Contacts were clean	Contacts were oiled up/dirty

Generator/alternator or regulator defective

Road test vehicle with V belt removed.

Still misfiring	Not misfiring

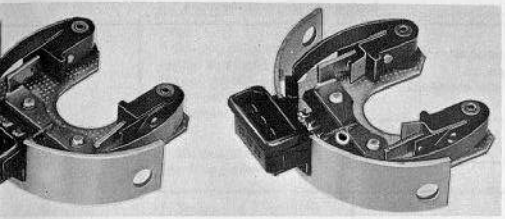
Fuel supply inadequate

Possible trouble:
- Fuel filter blocked
- Tank strainer blocked
- Rust in fuel tank
- Injectors blocked

Correct trouble

Try a different regulator, install belt again and road test vehicle.

If fault still exists:
Repair or replace generator/ alternator



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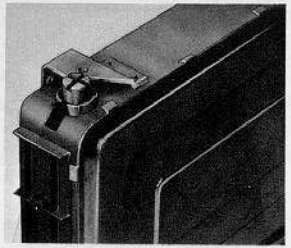
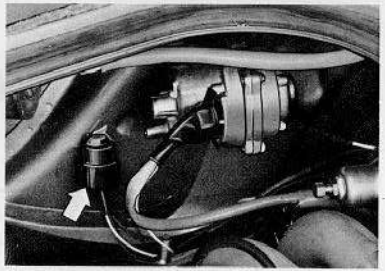




Note
The service installation of a potentiometer (311 906 019) will not eliminate the fault "CO value too high". This is intended only to improve mixture enrichment (Service remedy for hunting at idling speed).

CO value too high

Test conditions:
- Valve clearance and ignition timing correct (very important)
- Engine temperature between 50 and 70°C (122–158° F)

Idling CO potentiometer (if installed) incorrectly adjusted

Adjust CO with potentiometer (on control unit or – if subsequently installed – in engine compartment; see arrow in illustrations)

CO remains too high	CO can be adjusted

Pressure in ring main too high

Check pressure with gauge.
Specified figure: 2 kg/cm² (28 psi)

Pressure is correct	Pressure well above 2 kg/cm² (28 psi)

Trouble in electrical part of injection system

Connect tester VW 1218 and run through test program

No trouble	Trouble corrected

Only Type 3 with pressure switch (up to July 69)

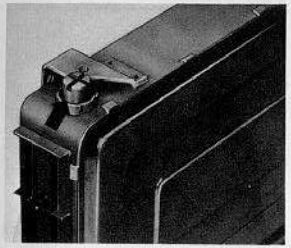
Pressure regulator incorrectly adjusted

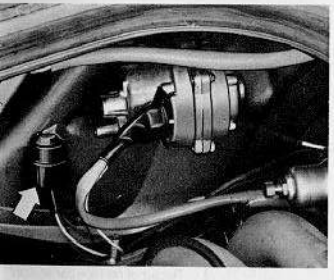
Set pressure to 2 kg/cm² (28 psi)

Pressure cannot be adjusted	Pressure can be adjusted

Possible trouble:
- Return line between pressure regulator and tank kinked or blocked
- Pressure regulator defective

Repair as necessary





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Set pressure to 2 kg/cm² (28 psi)

Pressure cannot be adjusted	Pressure can be adjusted

Possible trouble:
- Return line between pressure regulator and tank kinked or blocked
- Pressure regulator defective

Repair as necessary

CO value too high (cont'd from page 63)

Mechanical trouble in pressure switch

Run engine, pull connector off pressure switch and see if CO is reduced

CO not reduced	CO reduced

CO reduced → Check vacuum pipe to pressure switch or replace pressure switch

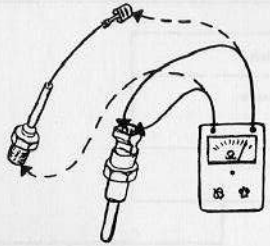
CO not reduced →

Mechanical trouble in pressure switch

Run engine, pull connector off pressure switch and see if CO is reduced

CO not reduced	CO reduced

Check vacuum pipe to pressure switch or replace pressure switch



CO value too high (cont'd from pages 63 and 65)

Resistances of temperature sensors too high despite OK indication (mixture too rich)

Remove sensors I and II and measure resistance with an ohmmeter at room temperature (about 20 °C/68 °F)
- Sensor I not more than 300 Ω
- Sensor II not more than 2.5 kΩ

Resistances correct

Resistances too high → Replace defective temperature sens

Injectors or cold start valve leaking

Check for leaks with injectors and cold start valve connected to ring main.
Switch ignition on and off several times.

No leaks found

Leaks found and eliminated

Inlet valves leaking despite correct adjustment

Check compression

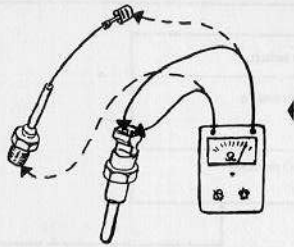
Compression OK

Compression poor → Repair engine

CO influenced excessively by crankcase breather

Possible causes:
- Too much oil in engine
- Oil dilution by fuel
- Pistons, rings and cylinders worn

Repair as necessary



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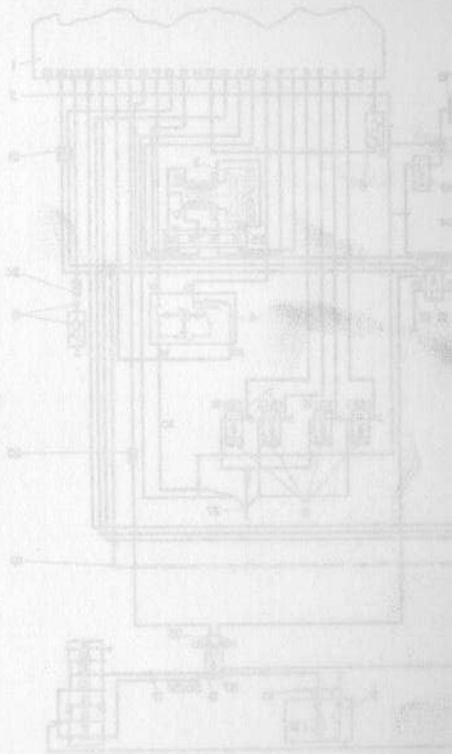
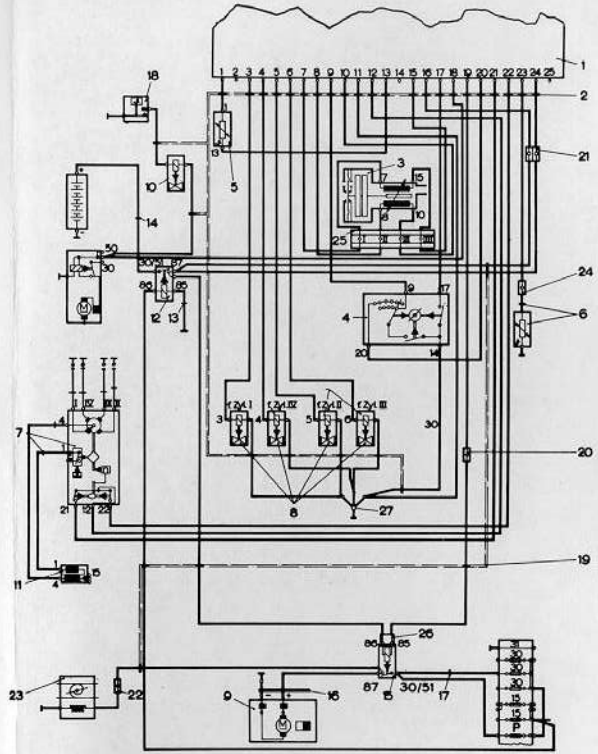
- Pistons, rings and cylinders worn

Repair as necessary



Type 3 up to July 1971

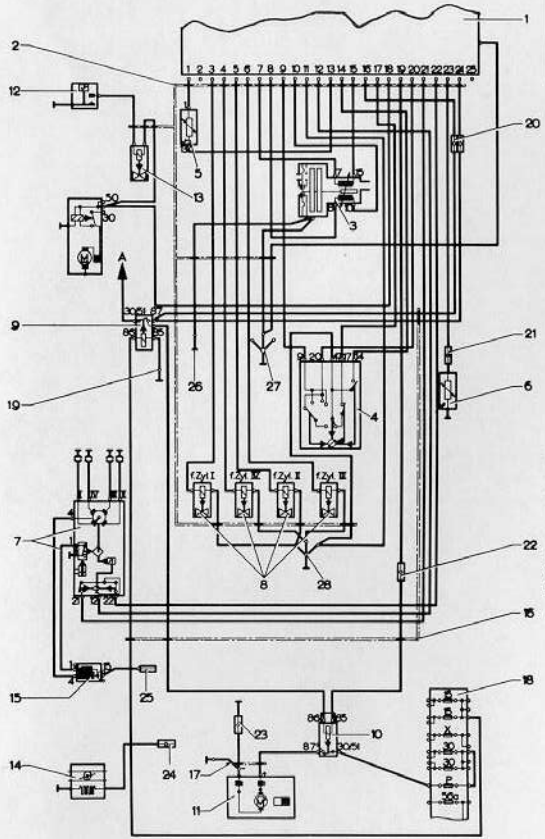


Caution

Before starting to work on any part of electrical system disconnect battery ground strap

1 - Control unit
2 - Wiring harness – electronics
3 - Pressure sensor with full load diaphragm
4 - Throttle valve switch with acceleration enrichment
5 - Temperature sensor in intake air distributor
6 - Temperature sensor on cylinder head
7 - Ignition distributor with trigger contacts
8 - Injectors
9 - Fuel pump
10 - Cold starting valve
11 - Ignition coil
12 - Voltage supply relay
13 - Wiring for voltage supply relay
14 - Wiring, battery – voltage supply relay
15 - Fuel pump relay
16 - Wiring harness – fuel pump
17 - Wiring between fuse box and pump relay
18 - Thermo switch for cold starting device
19 - Wires of main wiring harness
20 - } Wire connector–single
22 - }
24 - }
21 - Wire connector – double
23 - Auxiliary air regulator
25 - 4 point connector with intermediate cable
26 - Plug housing for pump relay
27 - Ground connection on the engine housing

Type 3 from August 1971

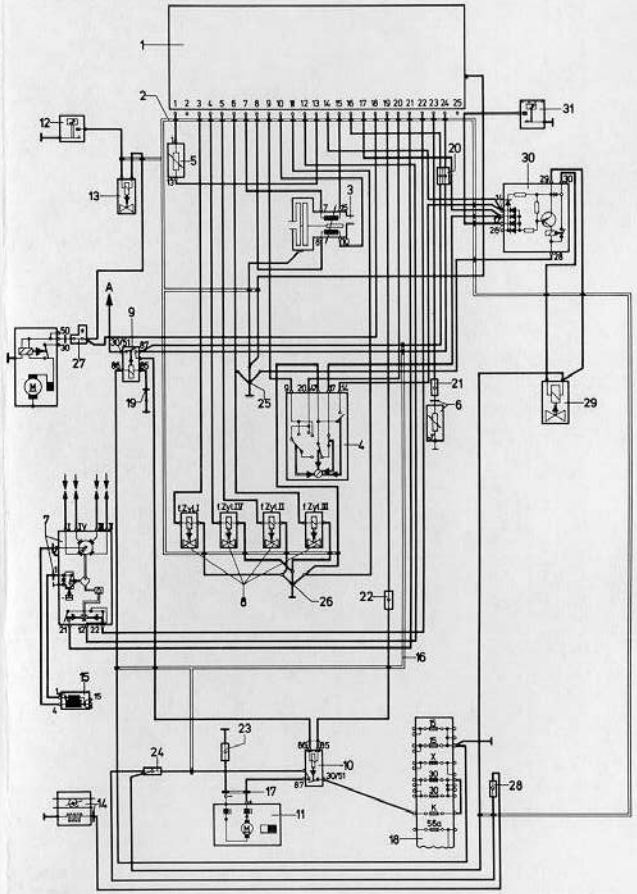


Caution

Before starting to work on any part of electrical system disconnect battery ground strap

1 - Control unit
2 - Wiring harness – electronics
3 - Pressure sensor
4 - Throttle valve switch
5 - Temperature sensor I in intake air distributor
6 - Temperature sensor II on cylinder head
7 - Ignition distributor with trigger contacts
8 - Injectors
9 - Voltage supply relay
10 - Fuel pump relay
11 - Fuel pump
12 - Thermo switch
13 - Cold starting valve
14 - Auxiliary air regulator
15 - Ignition coil
16 - Wiring of main harness
17 - Wiring harness for fuel pump
18 - Fuse box
19 - Wiring for voltage supply relay
20 - Wire connector, double
21 - Wire connector, single
22 - Wire connector, single
23 - Wire connector, single
24 - Wire connector, single
25 - Wire connector, single
26 - Ground cable pressure sensor
27 - Ground connection
28 - Ground connection on engine housing
A - To battery, positive (+) terminal

Type 3 from August 1972



Caution

Before starting to work on any part of electrical system disconnect battery ground strap

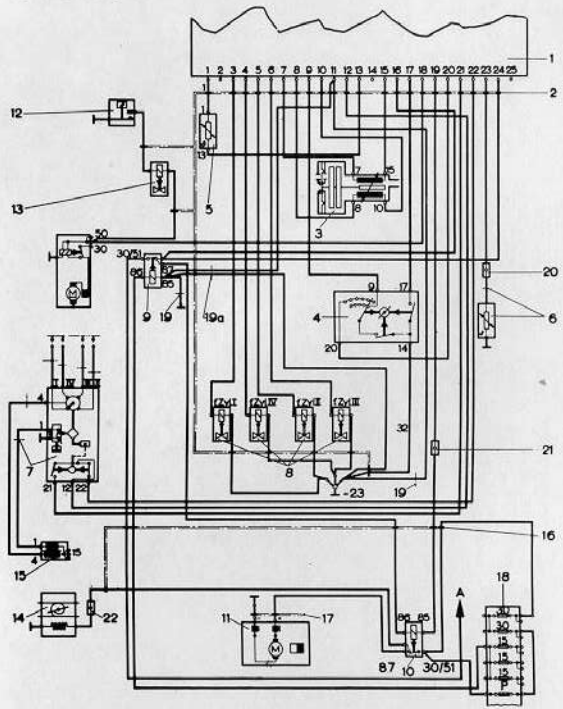
1 - Control unit
2 - Wiring harness – electronics
3 - Pressure sensor
4 - Throttle valve switch
5 - Temperature sensor I in intake air distributor
6 - Temperature sensor II on cylinder head
7 - Ignition distributor with trigger contacts
8 - Injectors
9 - Voltage supply relay
10 - Fuel pump relay
11 - Fuel pump
12 - Thermo switch
13 - Cold starting valve
14 - Auxiliary air regulator
15 - Ignition coil
16 - Wiring of main harness
17 - Wiring harness – fuel pump
18 - Fuse box
19 - Wiring for voltage supply relay
20 - Wire connector – double
21 - }
22 - } Wire connector – single
23 - }
24 - }
25 - Ground connection
26 - Ground connection, engine housing
27 - Wire connector – multiple
28 - Wire connector – single
29 - Valve for exhaust gas recirculation
30 - Relay for exhaust gas recirculation
31 - Thermo switch

A - To battery positive (+) terminal

Type 4 up to July 1971

Caution

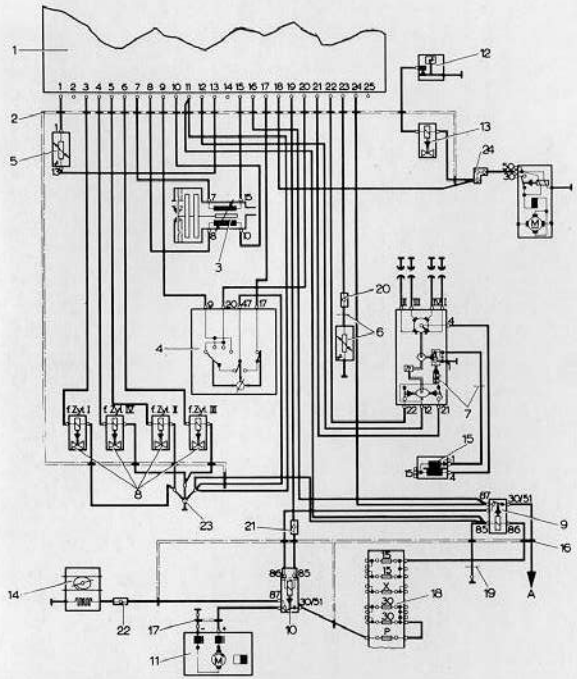
Before starting to work on any part of electrical system disconnect battery ground strap



1 - Control unit
2 - Wiring harness – electronics
3 - Pressure sensor
4 - Throttle valve switch with acceleration enrichment
5 - Temperature sensor I on intake air distributor
6 - Temperature sensor II on cylinder head
7 - Ignition distributor with impulse trigger contacts
8 - Injectors
9 - Voltage supply relay
10 - Fuel pump relay
11 - Fuel pump
12 - Thermo switch for cold starting device
13 - Cold starting valve (on intake air distributor)
14 - Auxiliary air valve
15 - Ignition coil
16 - Wiring of main harness
17 - Wiring harness – fuel pump
18 - Fuse box
19 - Ground connection, Sedan
19a- Ground connection, Wagon
20 - } Wire connector – single
21 - } Wire connector – single
22 - } Wire connector – single
23– Ground connection on the engine housing

A - to battery positive (+) terminal

Type 4 from August 1971
(see additional diagram on next page)



Caution

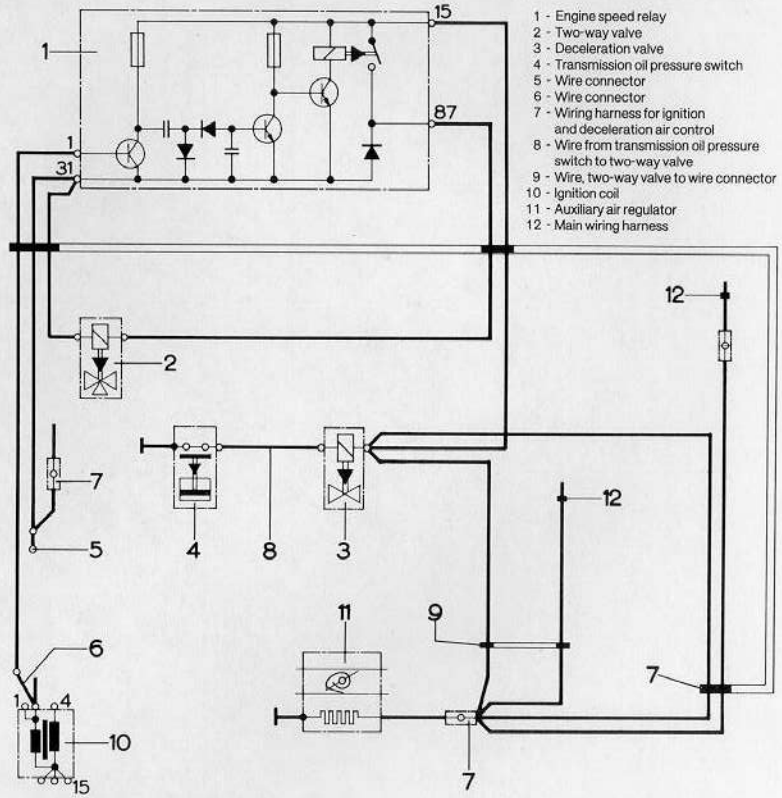
Before starting to work on any part of electrical system disconnect battery ground strap

1 - Control unit
2 - Wiring harness – electronics
3 - Pressure sensor
4 - Throttle valve switch
5 - Temperature sensor I in intake air distributor
6 - Temperature sensor II on cylinder head
7 - Ignition distributor with trigger contacts
8 - Injectors
9 - Voltage supply relay
10 - Fuel pump relay
11 - Fuel pump
12 - Thermo switch
13 - Cold starting valve
14 - Auxiliary air regulator
15 - Ignition coil
16 - Wires of the main wiring harness
17 - Wiring harness – fuel pump
18 - Fuse box
19 - Wiring harness – voltage supply relay
20 - } Wire connector – single
21 - } Wire connector – single
22 - } Wire connector – single
23 - Ground connection
24 - Wire distributor

A - to battery positive (+) terminal

Type 4 from August 1971 (additional wiring diagram)
(see also diagram on preceding page)

Caution
Before starting to work on any part of electrical system disconnect battery ground strap



1 - Engine speed relay
2 - Two-way valve
3 - Deceleration valve
4 - Transmission oil pressure switch
5 - Wire connector
6 - Wire connector
7 - Wiring harness for ignition and deceleration air control
8 - Wire from transmission oil pressure switch to two-way valve
9 - Wire, two-way valve to wire connector
10 - Ignition coil
11 - Auxiliary air regulator
12 - Main wiring harness