

Workshop Manual

928

DR. ING. h. c. F. PORSCHE Aktiengesellschaft

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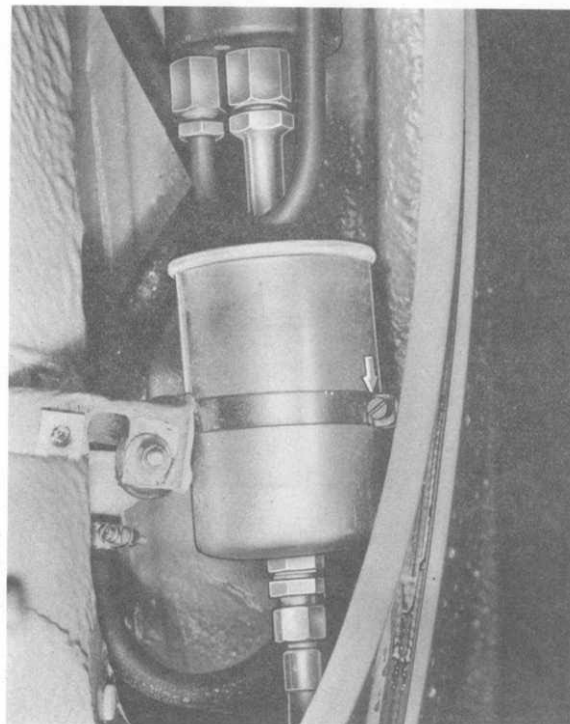
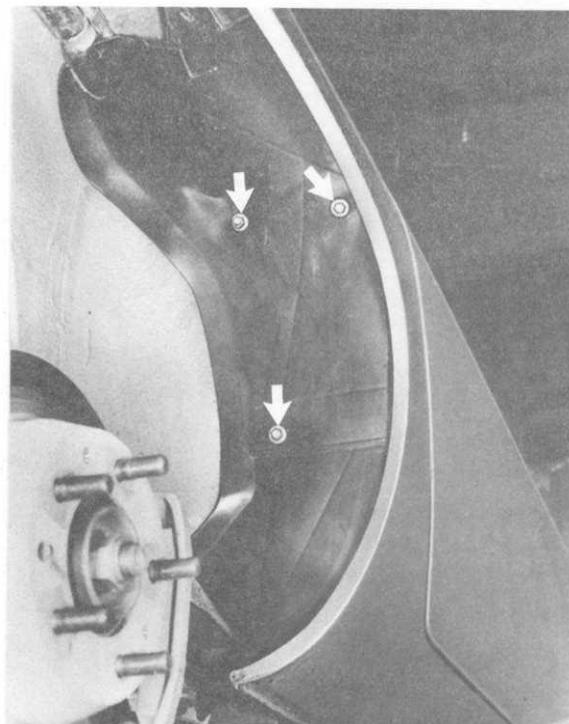
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REPLACING FUEL FILTER - up to 1980 Models

Remarks

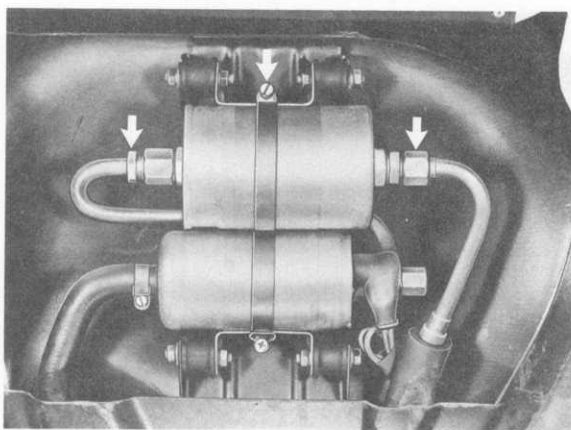
Fuel filter is located in right rear wheel house behind lock pillar.

1. Take off cover.
2. Detach fuel lines, while counterholding. Catch escaping fuel.
3. Loosen clamp and take off fuel filter.
4. Install new filter, noting direction of flow (arrow).
5. Check for leaks.



REPLACING FUEL FILTER - from 1980 Models

1. Disconnect ground wire at battery.
2. Take cover off of fuel tank at bottom.
3. Disconnect fuel lines, not forgetting to counter-hold. Catch escaping fuel.
4. Loosen clamp and take off fuel filter.



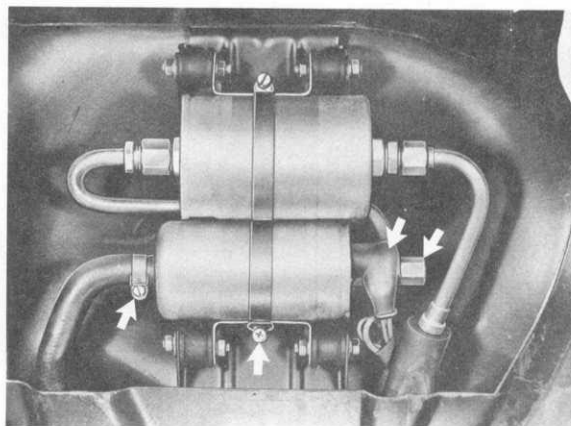
5. Install new filter. Watch direction of flow (arrow faces fuel distributor).
6. Check for leaks.

REMOVING AND INSTALLING FUEL PUMP

Removing

1. Disconnect ground wire at battery.
2. Take cover off of fuel tank at bottom.

3. Pinch intake line with VW 647 clamp and detach hose. Disconnect electric wires, unscrew hollow bolt, loosen fuel pump clamp and take off fuel pump. Catch escaping fuel.



Installing

Use a new seal on the hollow bolt.

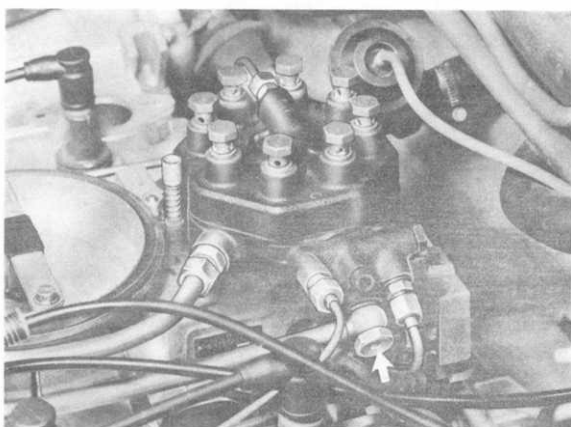
CHECKING DELIVERY RATE OF FUEL PUMP - CONTINUOUS INJECTION SYSTEM

Requirements:

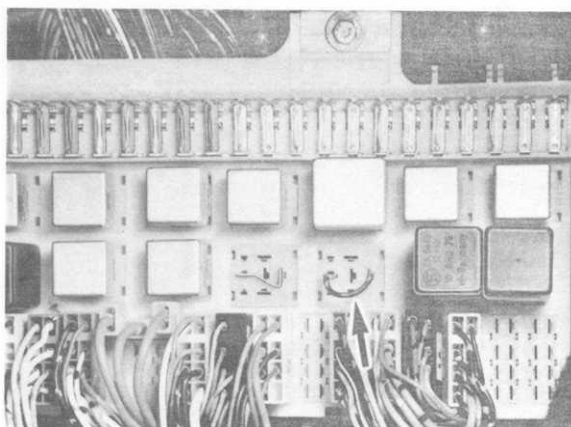
Fuel filter and power supply okay.

1. Take off air cleaner assembly.

2. Remove fuel return line from fuel distributor and connect a suitable test hose in its place (test hose with 12 mm dia. ring connector).



3. Bridge fuel pump relay socket terminals 30 and 87.



4. Hold end of test hose in a measuring glass.

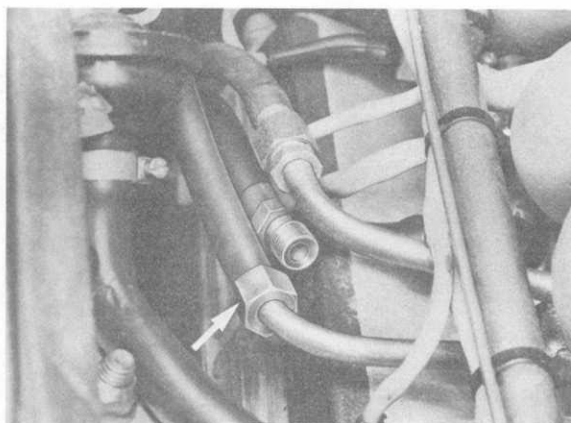
5. Bridge fuel pump circuit for duration of specified measuring time and measure delivery rate.

CHECKING FUEL PUMP DELIVERY - AFC

Requirements:

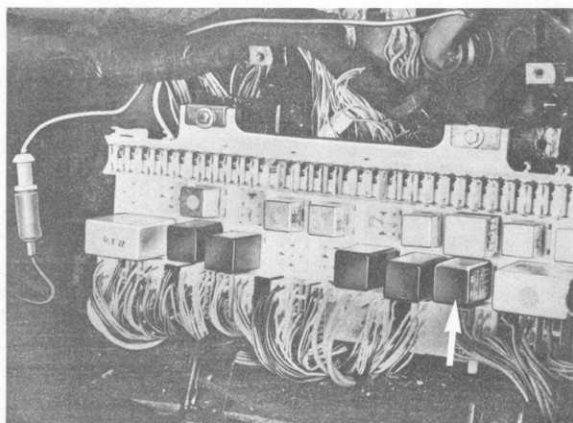
Fuel filter and power supply okay.

1. Disconnect fuel return line in engine compartment.

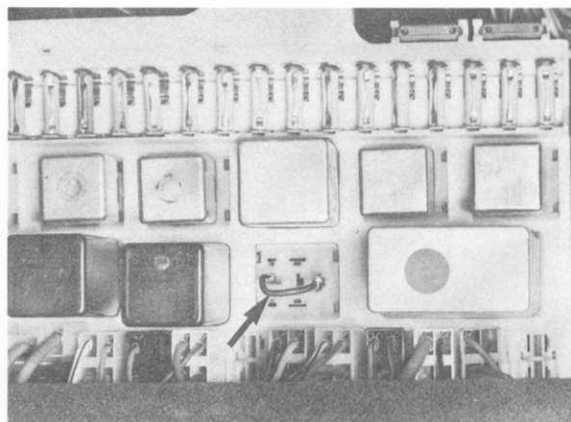


2. Hold end of fuel return hose from pressure regulator in a measuring glass (approx. 1500 cc).

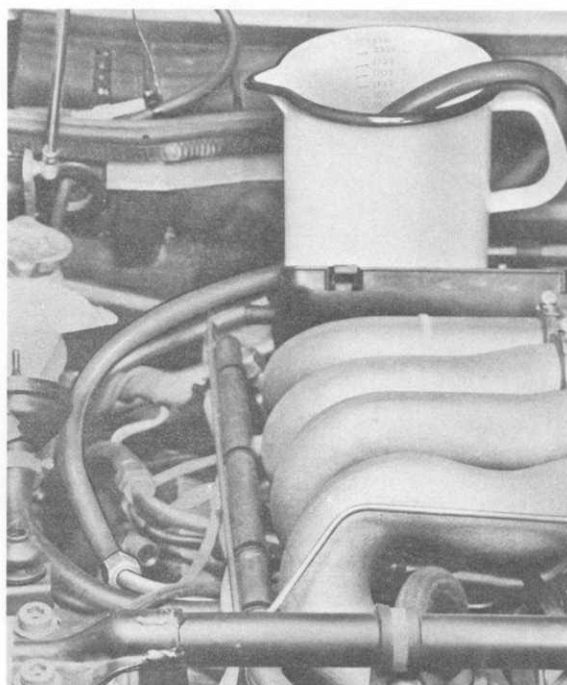
3. Unplug fuel pump relay from central electric board.



4. Bridge terminals 30 and 87 with an extra wire.



5. Let fuel run into measuring glass for 30 seconds. See page 24 - 1 for test values.



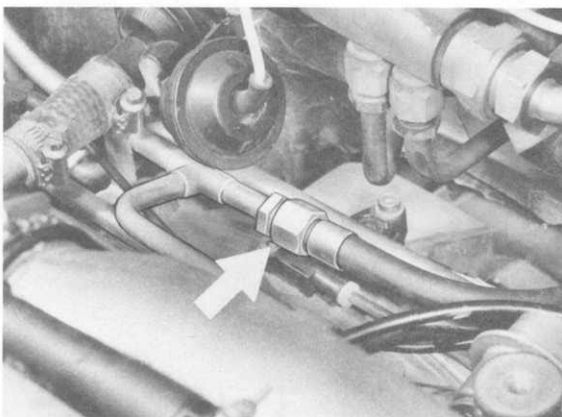
CHECK FUEL PUMP DELIVERY – LH-JETRONIC

Beginning with 1984 Models

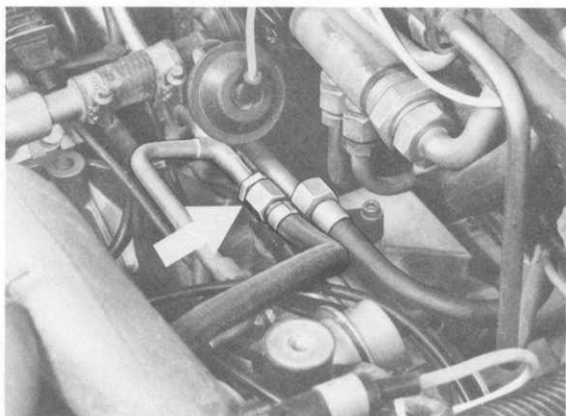
Requirements:

Fuel filter and power supply okay.

1. Disconnect fuel return line in rear of engine compartment while counterholding (essential).

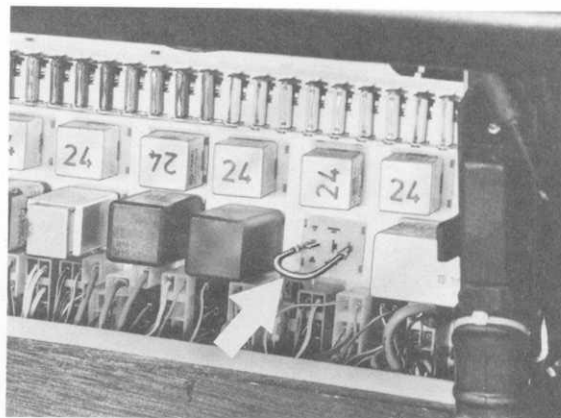


2. Connect a commercially available fuel hose.

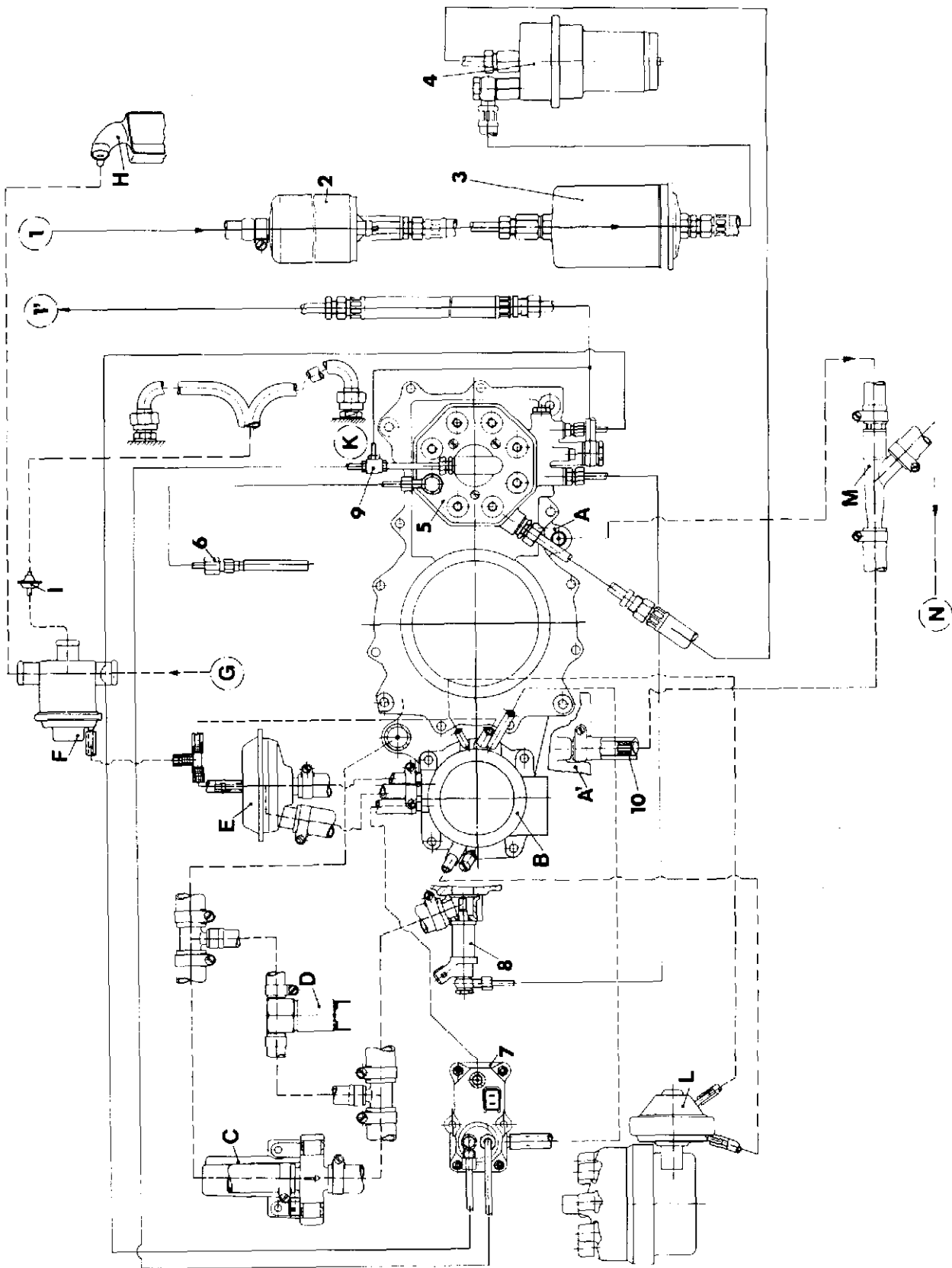


3. Hold end of test hose in a measuring glass (approx. 2000 cc).

4. Pull off fuel pump relay on central electric board and bridge terminals 30 and 87 with an extra wire for 30 seconds.



5. See page 24 - 121 for test values.

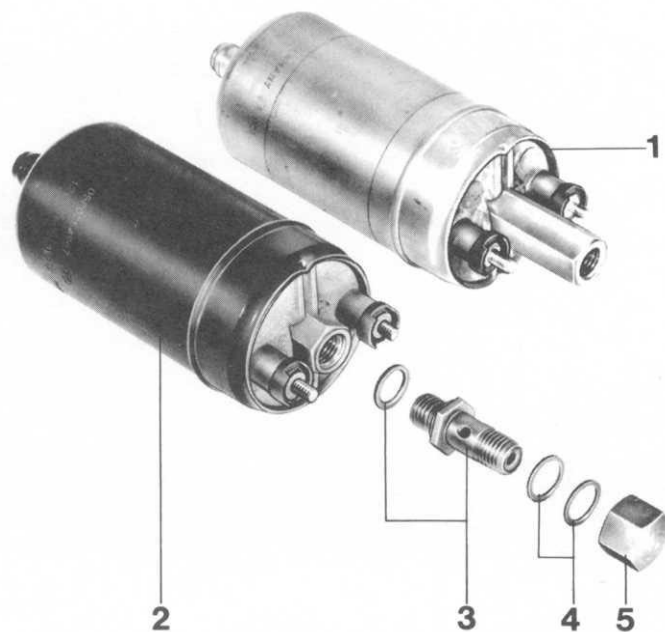


HOSE PLAN FOR K-JETRONIC SYSTEM 928

- | | |
|-----------------------------|------------------------------------|
| 1 - From fuel tank | A - Air guide housing |
| 1' - To fuel tank | A' - Intake distribution housing |
| 2 - Fuel pump | B - Throttle housing |
| 3 - Fuel filter | C - Throttle bypass valve |
| 4 - Fuel pressure reservoir | D - Solenoid valve (only for A/C) |
| 5 - Fuel distributor | E - Booster valve (vacuum control) |
| 6 - Fuel injector(s) | F - Blowoff switching valve |
| 7 - Warm-up control | G - From auxiliary air pump |
| 8 - Cold start valve | H - To air cleaner |
| 9 - Solenoid valve | I - Check valve |
| 10 - Hose orifice | K - To exhaust ports |
| | L - Ignition control |
| | M - Suction ejection pump |
| | N - To brake booster |

— Fuel
 --- Air/vacuum

ARRANGEMENT OF CHECK VALVES ON FUEL PUMPS



No.	Description	Qty.	Removing	Note When: Installing	Special Instructions
1	Fuel pump (long neck version with integrated check valve)	1			
2	Fuel pump (new version since 1981 models)	1			
3	Check valve with seal	1		Always replace seal. Torque: 20 Nm (14 ftlb)	
4	Seal	2		Always replace	
5	Cap nut	1		Torque: 20 Nm (14 ftlb)	

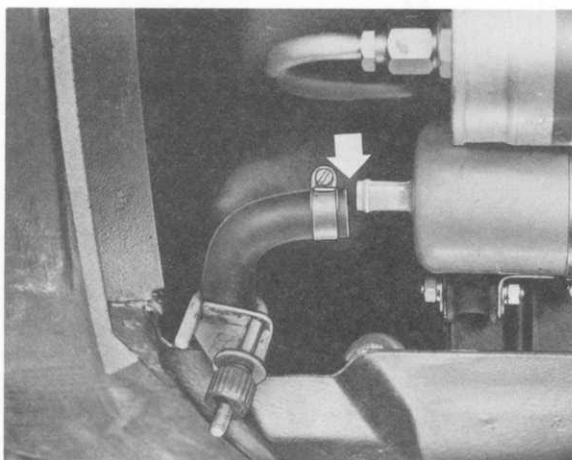
REPLACING CHECK VALVE

Caution!

Conform with safety regulations for working on fuel systems!

Removing

1. Remove fuel tank cover at bottom.
2. Pinch fuel intake hose with a standard hose clamp and detach hose.



3. Disconnect electric wires.
4. Disconnect hose on pressure side of fuel pump by unscrewing cap nut. Catch escaping fuel.
5. Unscrew check valve, while holding on hexagon of fuel pump with a narrow (machined) open-end wrench.

Installing

1. Screw in new check valve with a new seal.
For long neck version fuel pumps the new check valve is installed in addition to the check valve integrated in the pump.

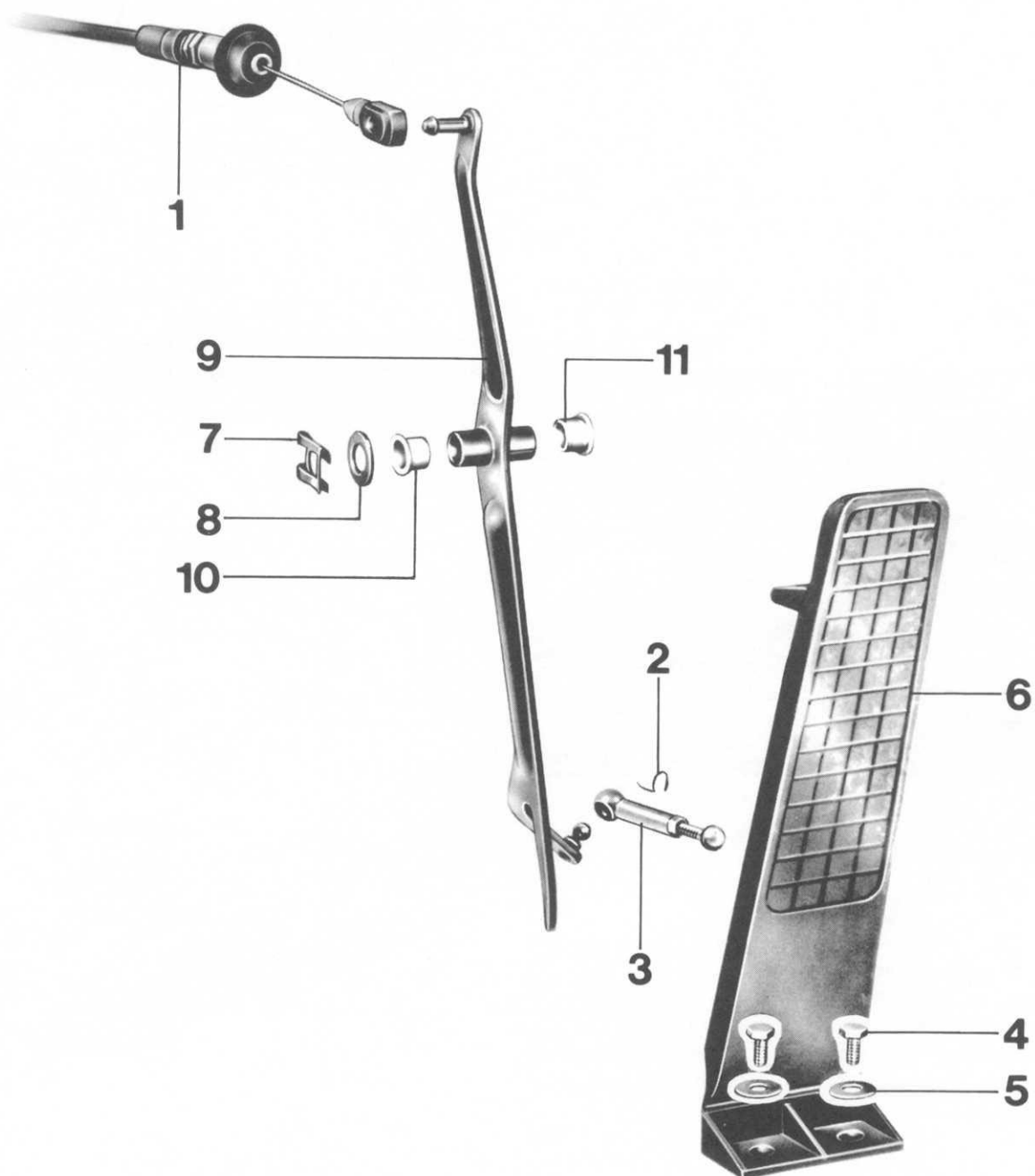
2. Install fuel line with ring adapter and new seals, and secure with cap nut.

Important!

Make sure fuel hose is routed correctly and cannot rub before tightening the cap nut.

3. Remove hose clamp and check for leaks. Install cover again.

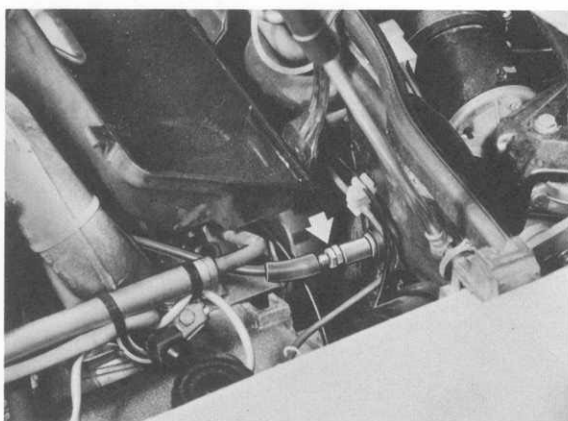
DISASSEMBLING AND ASSEMBLING ACCELERATOR PEDAL



No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Throttle cable	1			
2	Lock	1			
3	Push rod	1		Adjust push rod to 48 ± 1 mm for LHD (between ball head centers) and connect	
4	Bolt	2			
5	Washer	2			
6	Accelerator pedal	1			
7	Lock	1			
8	Washer A 10.5	1			
9	Operating lever	1			
10	Bearing	1		Check, replace if necessary and lubricate with multipurpose grease	
11	Bearing	1			

ADJUSTING FULL LOAD POSITION OF THROTTLE

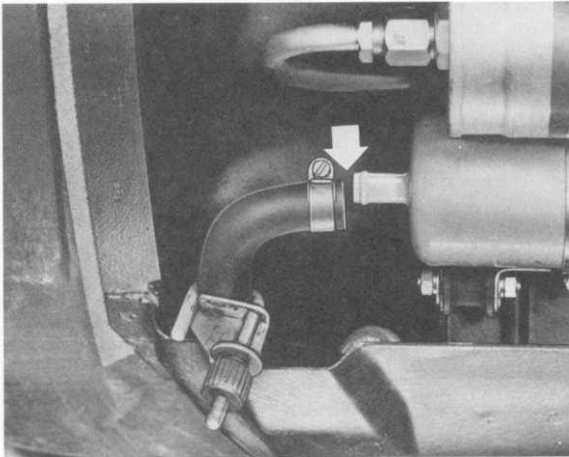
The throttle linkage has to be adjusted so that there is at least 1 mm play on the throttle lever when the accelerator pedal is floored.



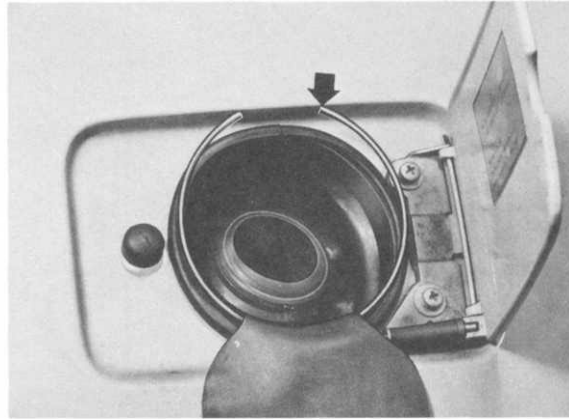
REMOVING AND INSTALLING FUEL TANK

Removing

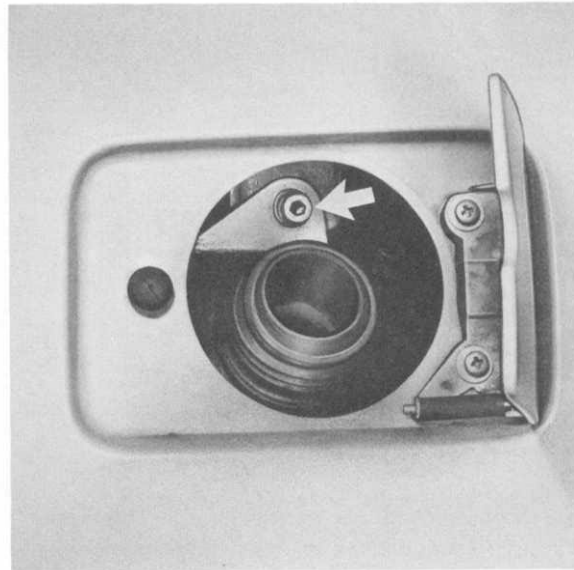
1. Disconnect ground wire at battery.
2. Draw off fuel.
Caution!
Conform with safety regulations for working on fuel systems.
3. Take off bottom tank cover. Pinch fuel intake hose with a standard hose clamp and detach hose on fuel pump.



4. Fold back floor mat. Remove cover on fuel lever transmitter. Disconnect hose and electric wire plug on fuel level transmitter.
5. Unscrew hose clamp and pull off breather hose on fuel expansion tank.
6. Remove retainer with guards and grommet.

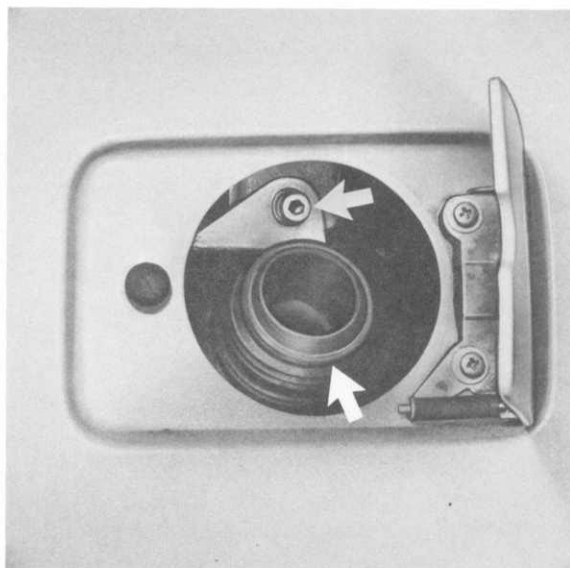


7. Unscrew bolt at upper fuel tank mounting point.



8. Unscrew four mounting points for retaining straps and let complete suspension with fuel pump and fuel filter hang down on one side.

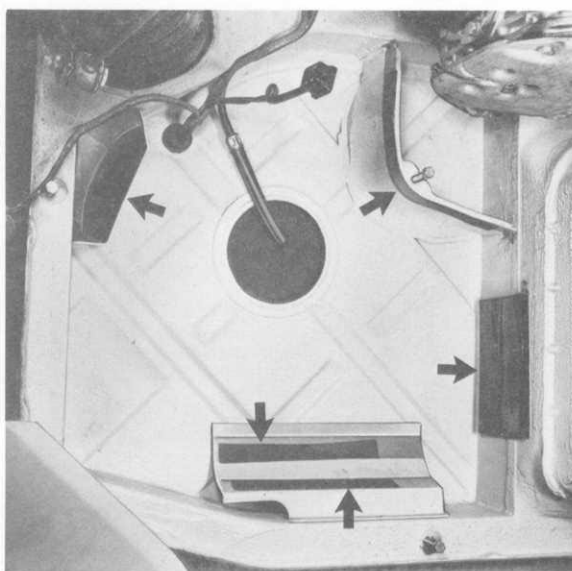
2. Make sure seal fits correctly in tank filler neck.



9. Remove fuel tank from below.

Installing

1. Check suspension points for correct fit before installing fuel tank.



REMOVING AND INSTALLING INITIAL FUEL PUMP IN TANK (JAPAN)

Note

Conform with safety regulations for working on fuel systems!

Removing

1. Disconnect ground wire at battery.
2. Draw off fuel.
3. Remove bottom tank cover. Pinch fuel intake hose with a standard hose clamp.
4. Disconnect 4 mounting points of suspension straps and let complete suspension with fuel pump and fuel filter hang down to one side.



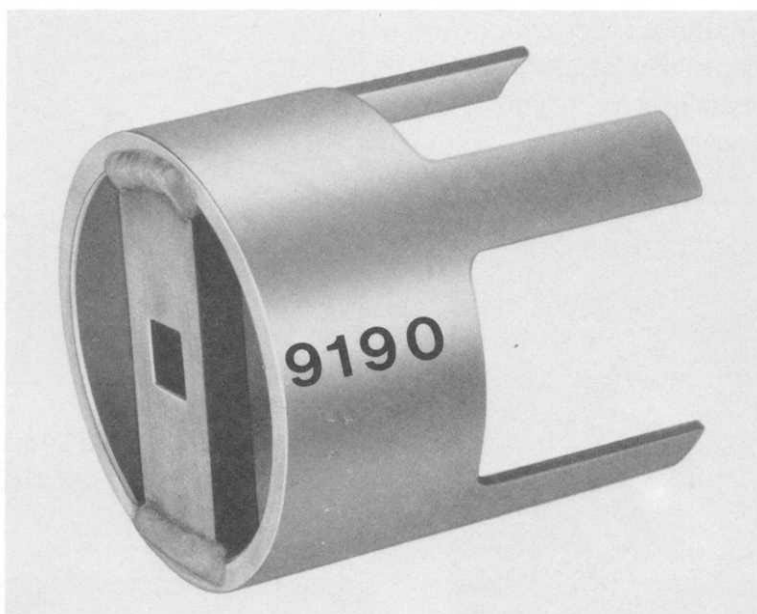
Installing

1. Always use a new gasket.
2. Tightening torque for pump in tank: 25 Nm.

5. Disconnect electric wire plugs, hose clamp and pump in tank, and remove. Catch escaping fuel.

REMOVING AND INSTALLING
FUEL TANK SENSOR

TOOL



No.	Designation	Special tool	Remarks
	Pin wrench	9190	

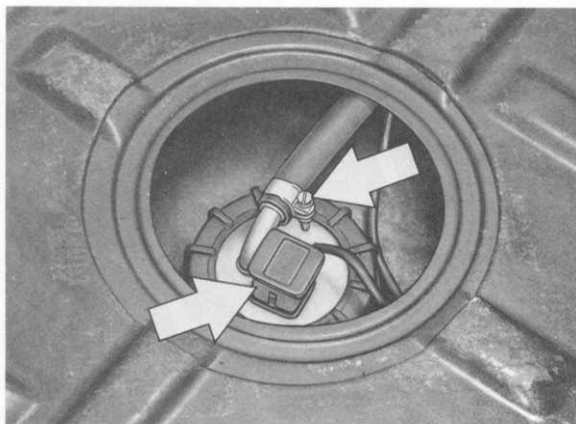
Removing and installing the fuel tank gauge unit

Note

When working on the fuel system, observe relevant safety requirements. Do not remove the gauge unit while the tank is full.

Removal

1. Remove luggage compartment floor covering. Remove cover of fuel tank gauge unit. Undo hose clamp, disconnect fuel return hose and electrical connector.



2. Undo union nut using Special Tool 9190. Take gauge unit complete with gasket.

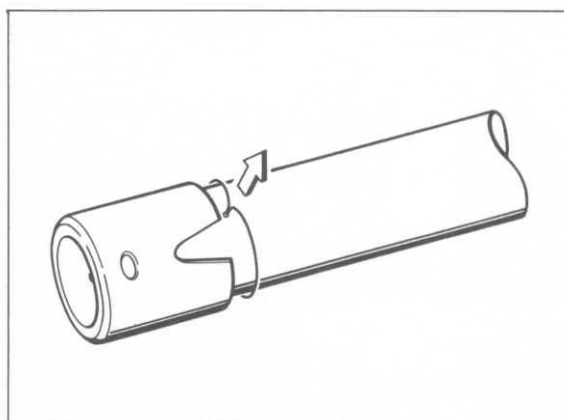
Installation

1. Always use a new gasket. Coat threads and seating area of union nut with Optimoly TA.

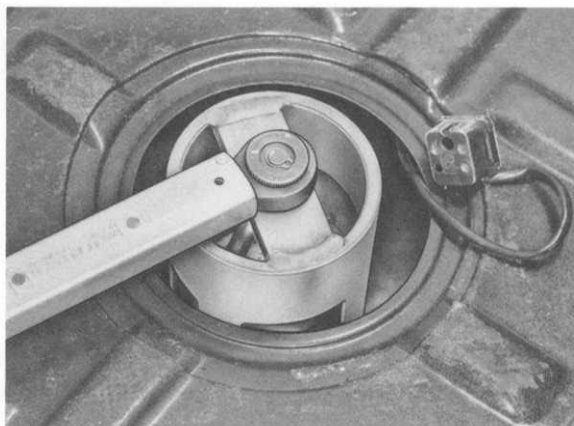
Note

TO facilitate assembly, immerse the union nut into hot water (heated to approx. 60 to 70 deg. C) for approx. 8 minutes.

2. Before fitting a new tank gauge unit, remove the transport protector.



3. Tighten union nut to a torque of 35 ± 5 Nm (26 ± 4 ftlb) using Special Tool 9190.

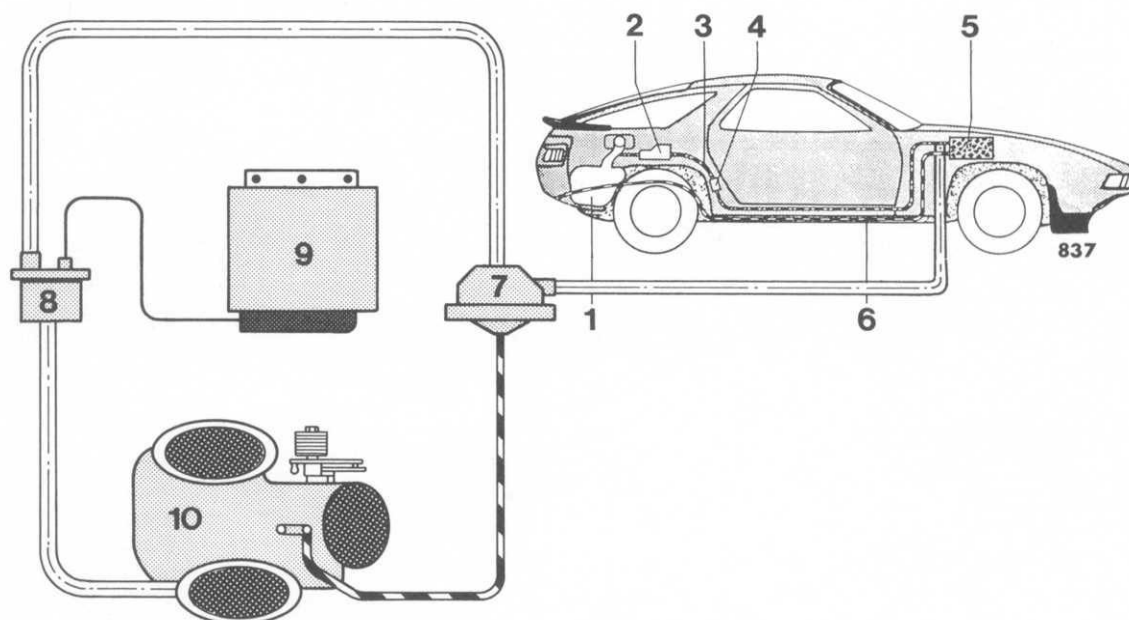


4. When fitting the fuel return hose, make sure the screw of the hose clamp does not contact the union nut or the fuel tank gauge unit.

ACTIVATED CHARCOAL CANNISTER FOR REMOVAL OF TOXIC SUBSTANCES FROM FUEL TANK BREATHER (DIAGRAM)

87 MODELS ONWARD

ENGINE TYPE M28. 41/42



- 1 - Fuel tank
- 2 - Expansion tank
- 3 - Hose
- 4 - Rollover valve
- 5 - Activated charcoal cannister

- 6 - Breather line
- 7 - Diaphragm valve
- 8 - Solenoid valve
- 9 - LH Jetronic control unit
- 10 - Throttle housing

Calibrating the tank sensor system for Model 89 onwards

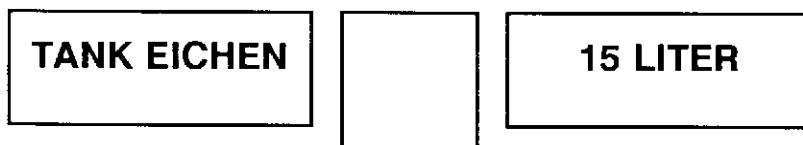
Note

The system must be calibrated if the fuel tanks, tank sensor or backlit instrument cluster have been replaced.

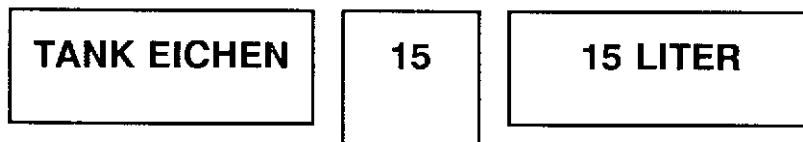
Note

Terminate calibration mode by switching off the ignition or starting the engine.

1. Empty the fuel tank.
2. Fill with exactly 15 l (3.96 gallons) fuel.
3. Wait for at least 1 minute. Vehicle must remain stationary.
4. Pull the operating lever for the backlit instrument cluster, turning the ignition on at the same time. The following response appears in the left and right display boxes*



5. Press the reset button in the center console until 15 appears in the center display box.



The tank sensor system is now calibrated.

***TANK EICHEN = CALIBRATE TANK**

AFC EQUIPMENT TABLE

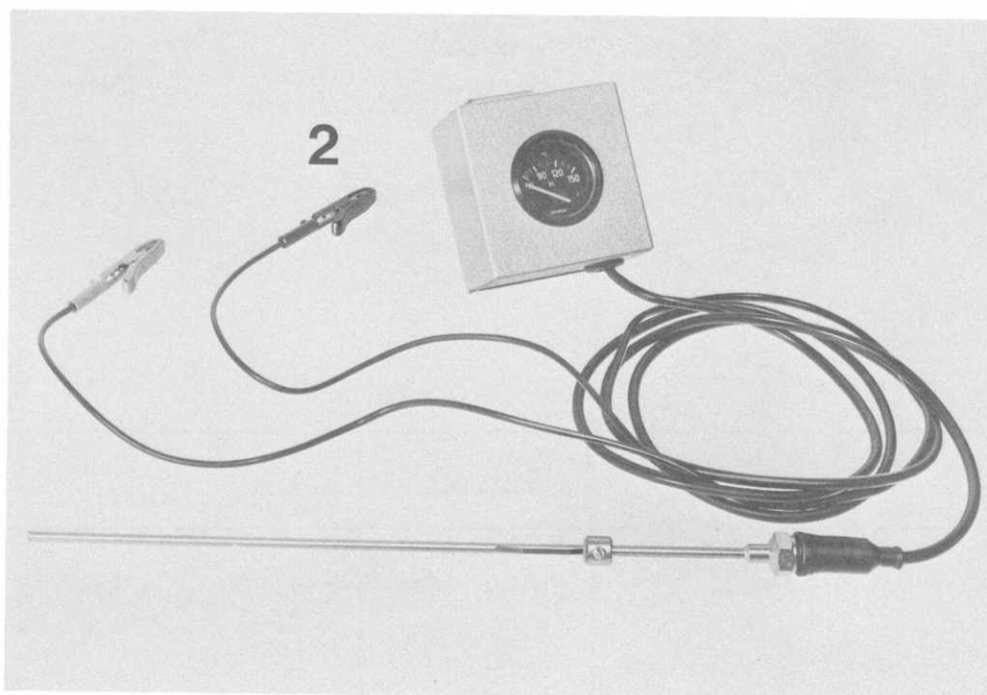
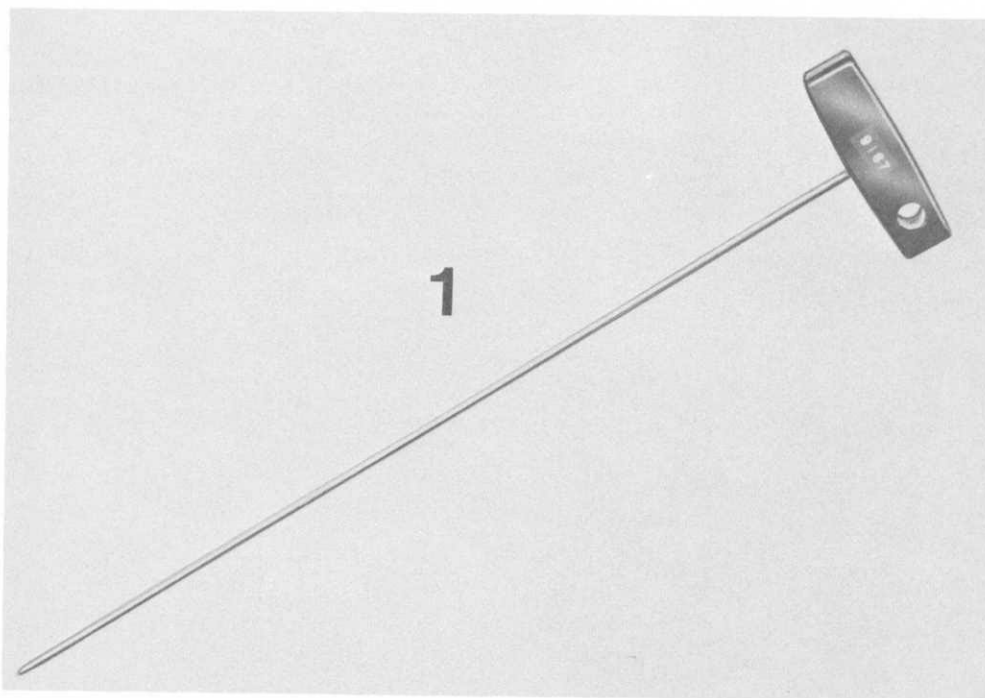
928 with AFC	Control Unit	Air Flow Sensor	Fuel Injector	Temp. Sensor	Oxygen Sensor	Electric Fuel Pump
1980 model	928.618.106.01 Bosch No. 0280.002.101	928.606.121.01 Bosch No. 0280.203.009	928.606.110.01 Bosch No. 0280.150.154	928.606.125.01 Bosch No. 0280.130.023	928.606.123.01 Bosch No. 0258.001.017	928.608.104.01 Bosch No. 0580.464.017
1981 / 1982 models	928.618.106.04 Bosch No. 0280.002.104	928.606.121.02 Bosch No. 0280.203.015	as above	as above	as above	as above
1983 model	as above	as above	as above	as above	928.606.124.01 Bosch No. 0258.003.003	as above
	Press. Damper or Diaphragm Damper	Pressure Regulator	Auxiliary Air Regulator	Cold Start Valve	Temperature Time Switch in Thermostat Housing	Vacuum Control
1980, 1981, 1982 models	928.110.202.00 Bosch No. 0280.161.008	928.110.198.10 Bosch No. 0280.160.215	928.606.102.01 Bosch No. 0280.140.219	911.606.107.01 Bosch No. 0280.170.409	928.605.101.00 Bosch No. 0280.130.214	928.110.173.00 Bosch No. 0280.162.200
1983 model	as above	as above	928.606.102.02 Bosch No. 0280.140.227	as above	as above	928.110.173.01 Bosch No. 0280.160.322

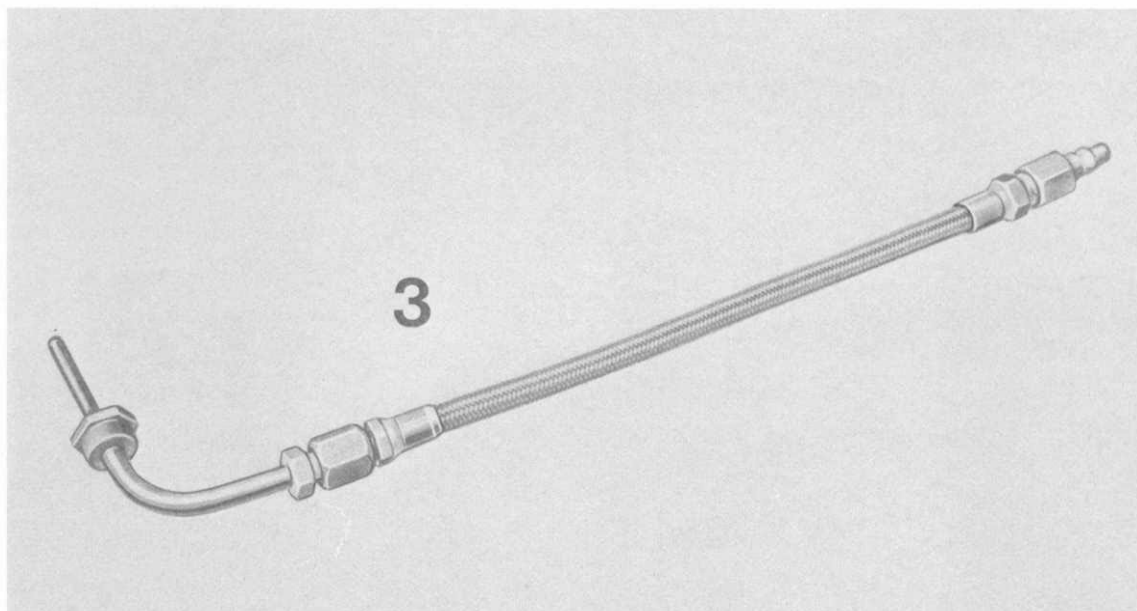
TESTING AND ADJUSTING SPECIFICATIONS FOR AFC
(1980/1981/1982/1983 Models)

Test Point	Specifications	Remarks
Electric fuel pump Delivery rate	at least 1150 cc/30 sec.	
Fuel pressure (engine stopped) Fuel pump bridged Check value for idle	2.5 ± 0.2 bar approx. 2 bar	
Leak test Min. pressure after 20 minutes	1 bar	
Idle adjustments Idle speed CO level	750 ± 50 rpm from Mod. 83 650 ± 50 rpm 0.4 – 0.8 % (measured in front of catalytic converter with oxygen sensor plug disconnected)	

ADJUSTING IDLE - USA AND JAPAN
(from 1980 Models with L-Jetronic)

TOOLS





No.	Description	Special Tool	Remarks
1	Ball screwdriver	9187	or US 8025
2	Oil temperature tester	9122	
3	CO test line	US 8023	

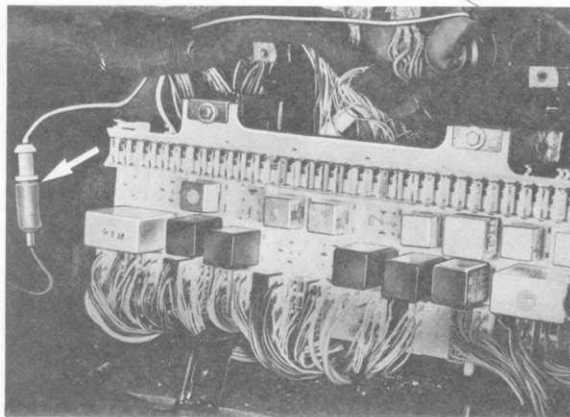
ADJUSTING IDLE - USA and Japan (from 1980 Models with L-Jetronic)

Remarks

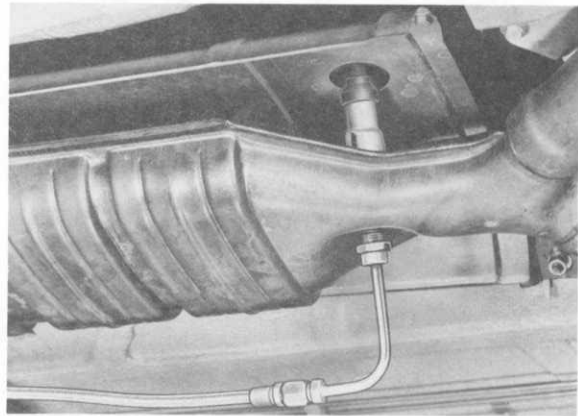
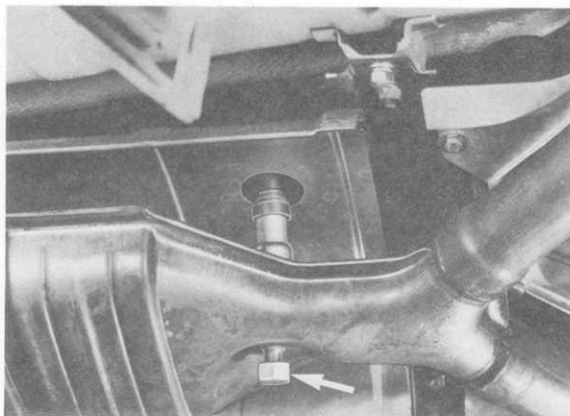
Requirements:

Engine in perfect mechanical condition and ignition timing adjusted correctly.

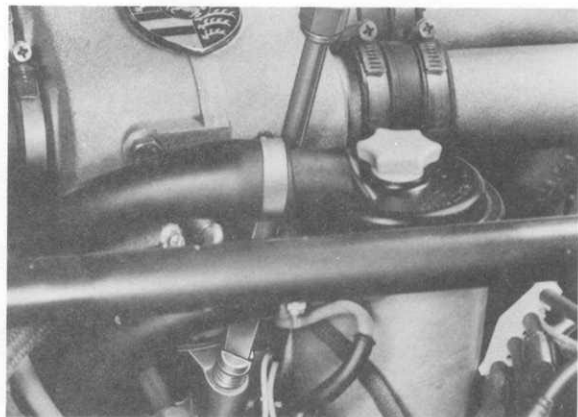
1. Fold up foot support in footwell of passenger's side and disconnect oxygen sensor plug.



2. Connect CO test line US 8023 or SUN 120-239 on test connection of catalytic converter.



3. Run engine to operating temperature (oil temperature approx. 80 °C). Use special tool US 8025.
4. Connect CO tester to supplier's instructions.
5. Turn control screw or bypass screw on throttle housing until specified speed is reached.

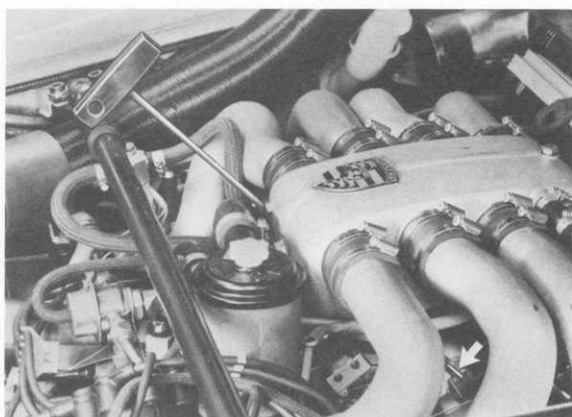
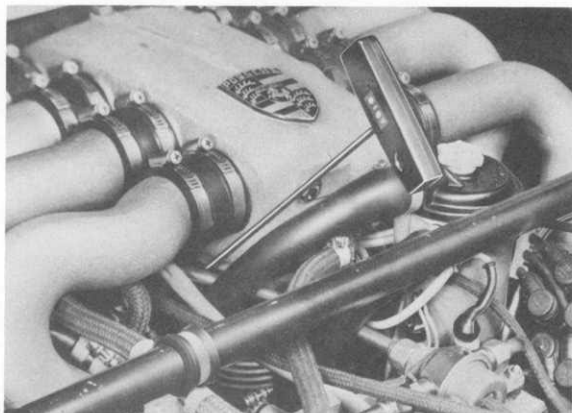


Important

Use separate tachometer of tester or similar.

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.

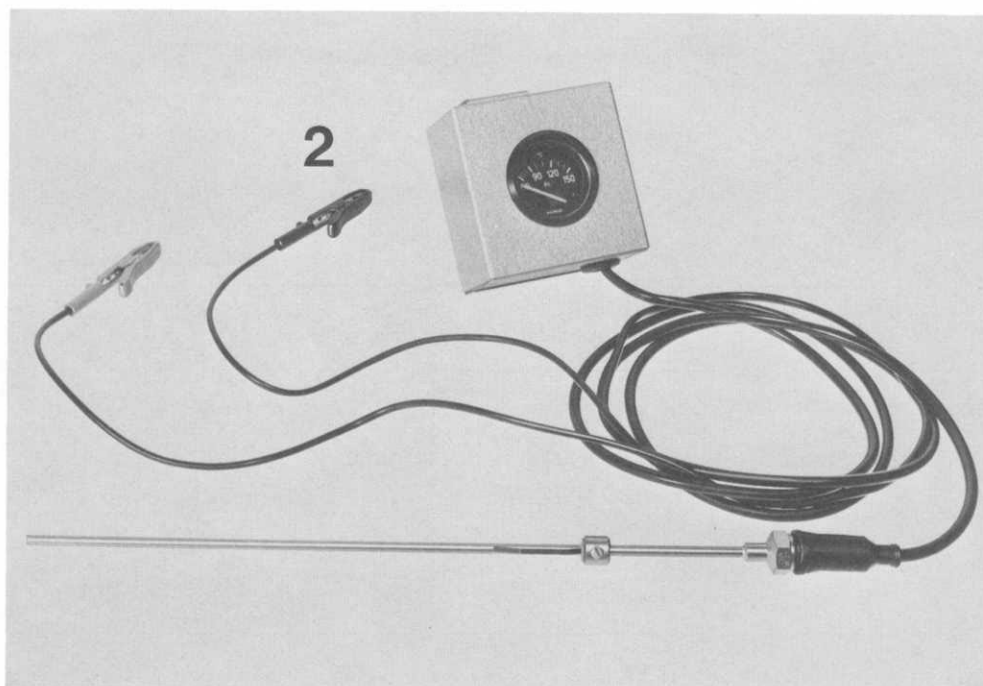
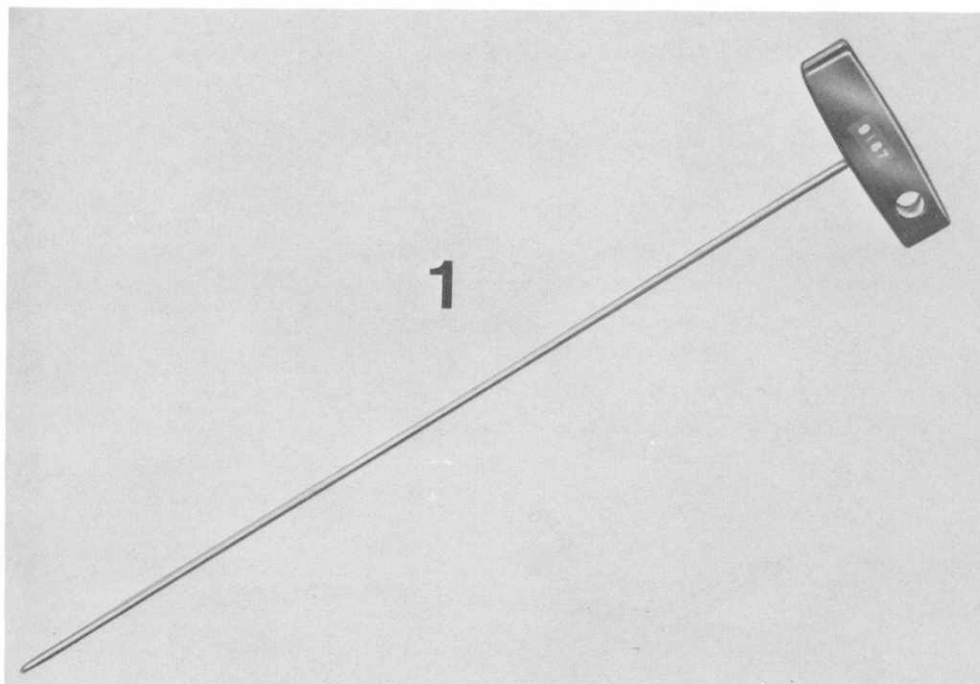
6. Adjust fuel/air mixture. Guide special tool 9187 into adjusting bore of air flow sensor and turn mixture control screw accordingly.

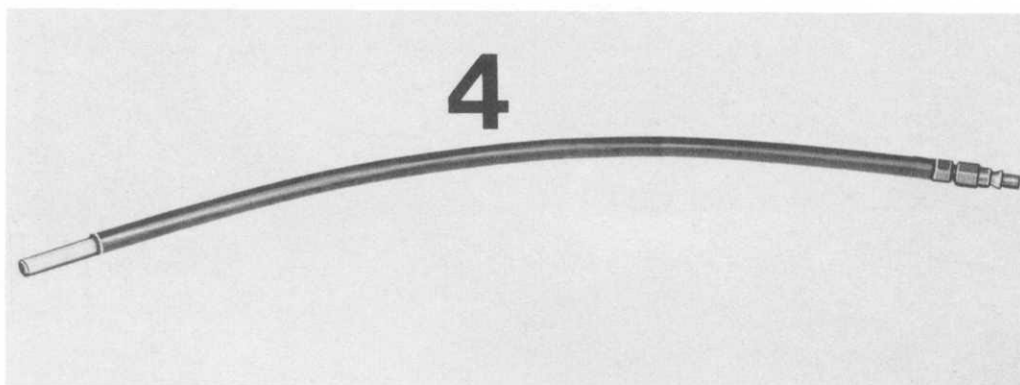
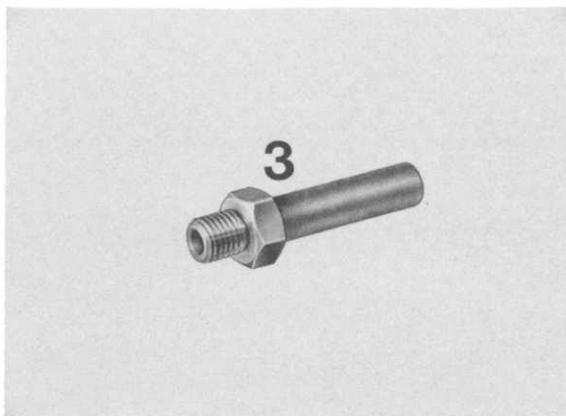


7. Turning clockwise = richer mixture.
Turning anticlockwise = leaner mixture.
8. After finishing adjustment reconnect the oxygen sensor plug.
9. Coat threads of plug for test connection on catalytic converter with Bosch Paste VS 140 16 Ft or Optimoly HT.

ADJUSTING IDLE SPEED AND CO – USA AND JAPAN
(Beginning with 1983 Models – L-Jetronic)

TOOLS





No.	Description	Special Tool	Remarks
1	CO adjusting tool	9187	or US 8025
2	Oil temperature tester	9122	
3	Adapter	US 8040	
4	Exhaust probe	US 4492	

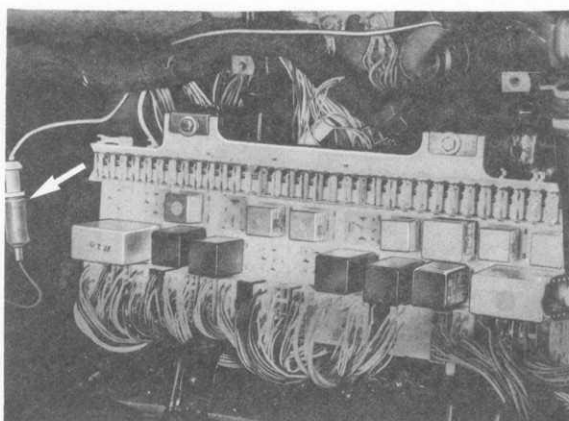
ADJUSTING IDLE SPEED AND CO – USA AND JAPAN (Beginning with 1983 Models – L-Jetronic)

Note:

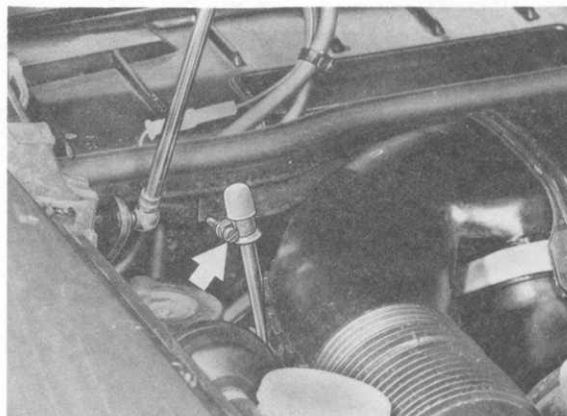
Requirements:

Engine in perfect mechanical condition and ignition timing adjusted correctly.

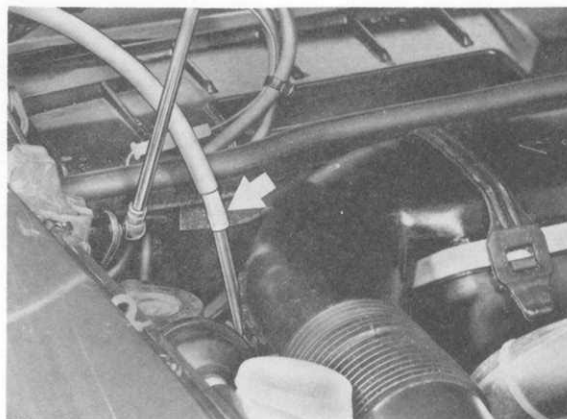
1. Fold up foot support in footwell on passenger's side and disconnect oxygen sensor plug.



2. Take off cover of exhaust source line in engine compartment.

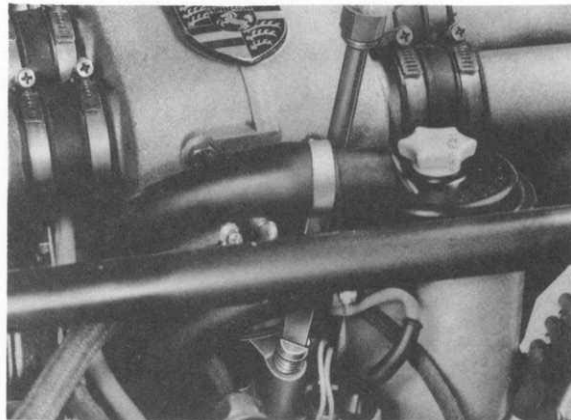
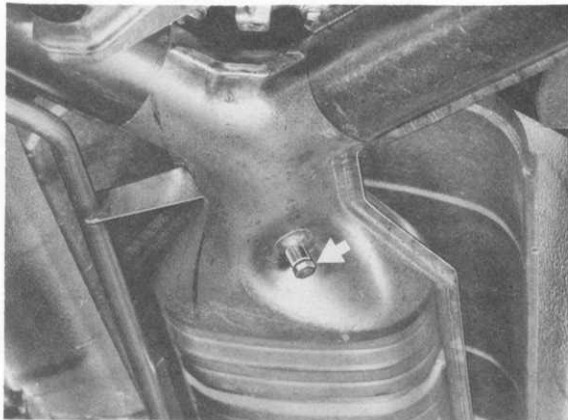


3. Connect exhaust probe US 4492 on exhaust source line.



Note:

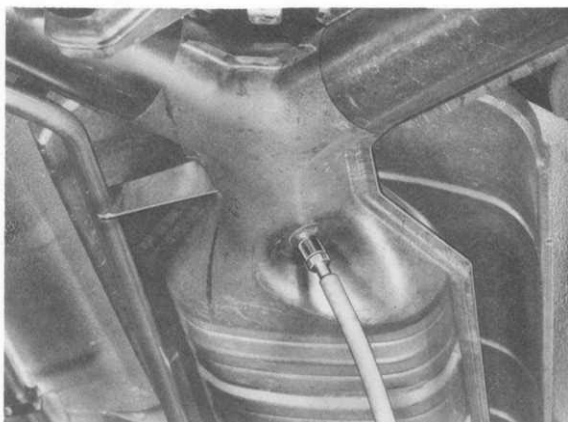
If there is suspicion of erratic engine running or when troubleshooting, it is advantageous to use test connection on the catalytic converter.



Note:

Use separate tachometer from tester or similar.

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.



4. Run engine to operating temperature (oil temperature approx. 80 °C). Use Special Tool US 8025.

5. Connect CO tester to supplier's instructions.

6. Turn control screw or bypass screw on throttle housing until specified speed is reached.

7. Check CO. If CO is not as specified, correct the air flow sensor adjustment.

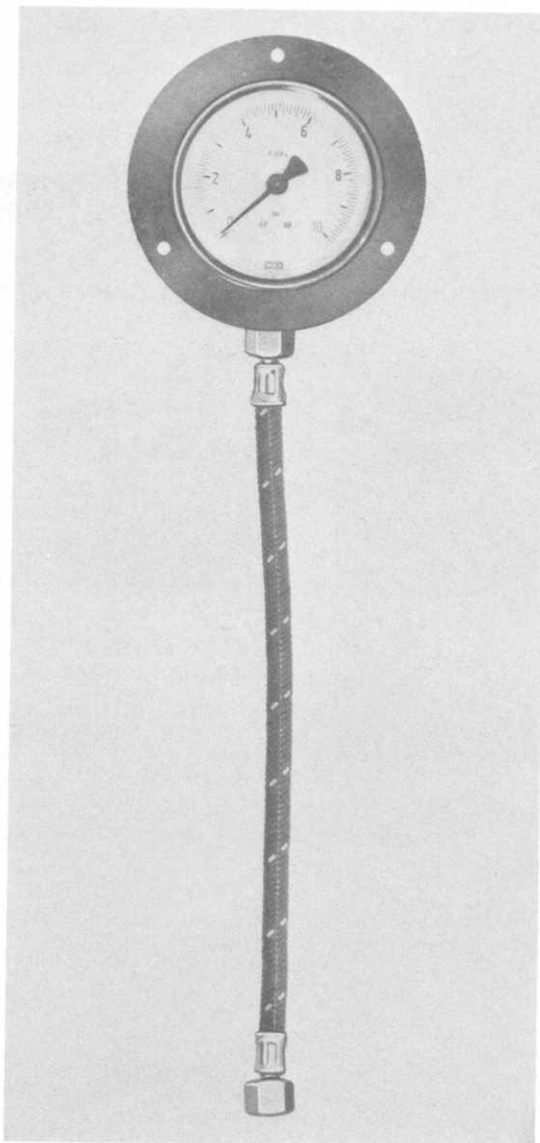
8. Reconnect oxygen sensor plug after finishing adjustments.

9. Coat threads of plug for test connection on catalytic converter with Bosch Paste VS 140 16 Ft or Optimoly HT.

Tightening torque = 15 Nm.

CHECKING FUEL PRESSURE - USA and Japan
(from 1980 Models with L-Jetronic)

TOOLS



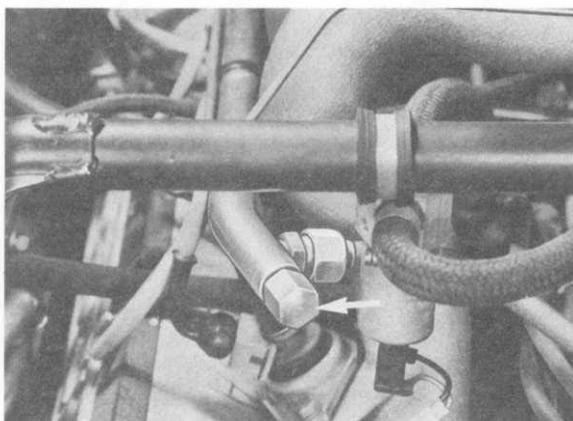
No.	Description	Special Tool	Remarks
1	Pressure gauge with hose from pressure tester	P 378	

CHECKING FUEL PRESSURE - USA and Japan (from 1980 Models with L-Jetronic)

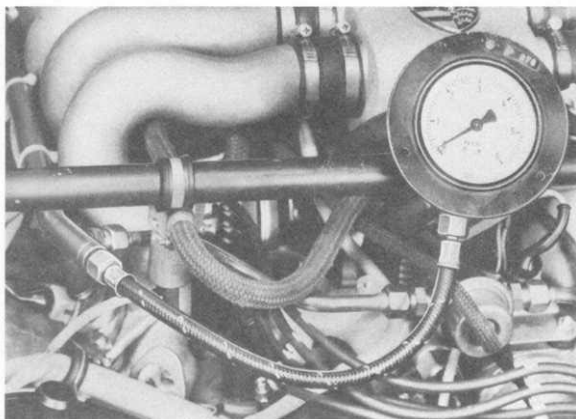
1. Unscrew and remove cap nut from test connection on fuel distribution line.

Note

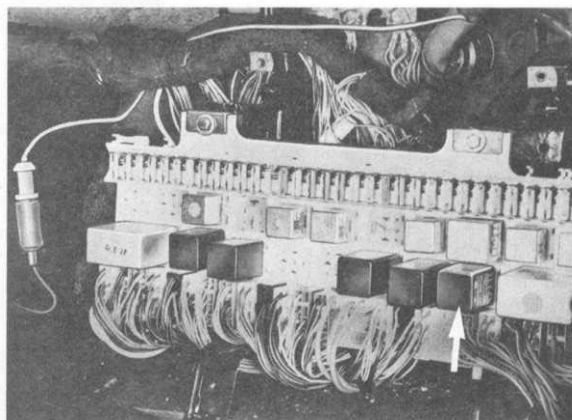
Watch sealing ball when removing cap nut.



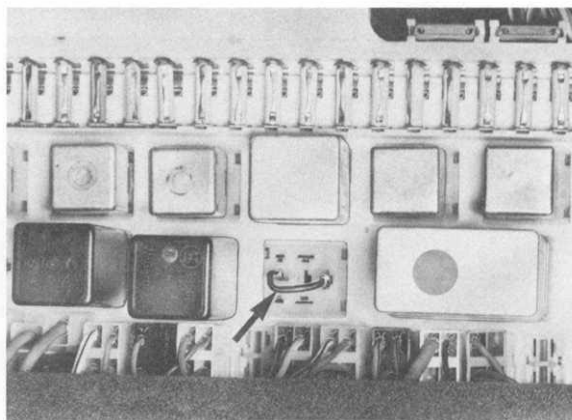
2. Connect pressure gauge with hose from pressure tester P 378 on the test connection.



3. Fold up foot support in footwell of passenger's side and pull fuel pump relay off of central electric board.



4. Bridge terminals 30 and 87 with an extra wire. Fuel pump should now run.



5. See page 24 - 1 for checking values.
6. Torque for cap nut: 22 Nm (2, 2 kpm).

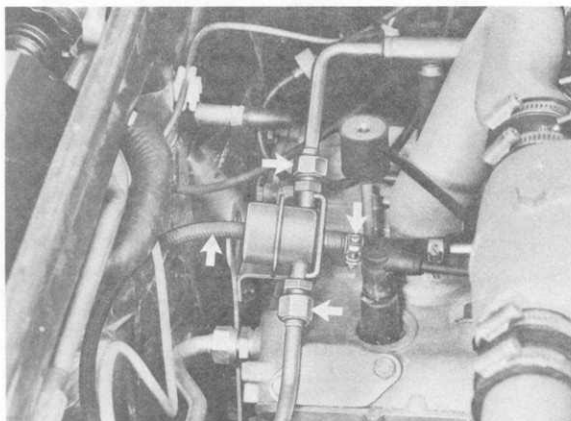
REMOVING AND INSTALLING PRESSURE
REGULATOR

1. Disconnect ground wire at battery.

2. Take off air cleaner assembly.

3. Pull off vacuum hose and disconnect fuel lines, making sure to counterhold.

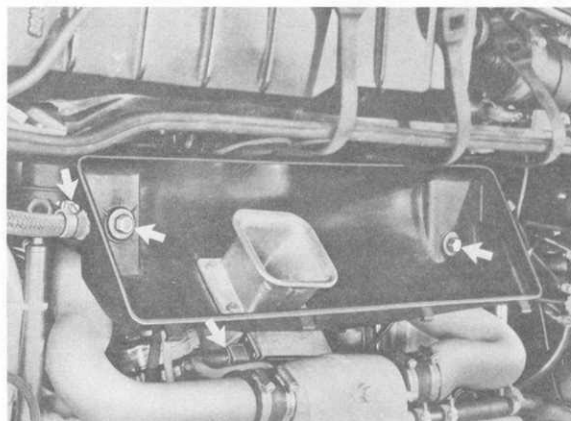
Catch escaping fuel.

REMOVING AND INSTALLING INTAKE
AIR SENSOR

Removing

1. Remove air cleaner upper section and air filter cartridge.

2. Disconnect carbon canister hose and unscrew captive bolts. Pull off multiple pin plug and remove lower section with intake air sensor.



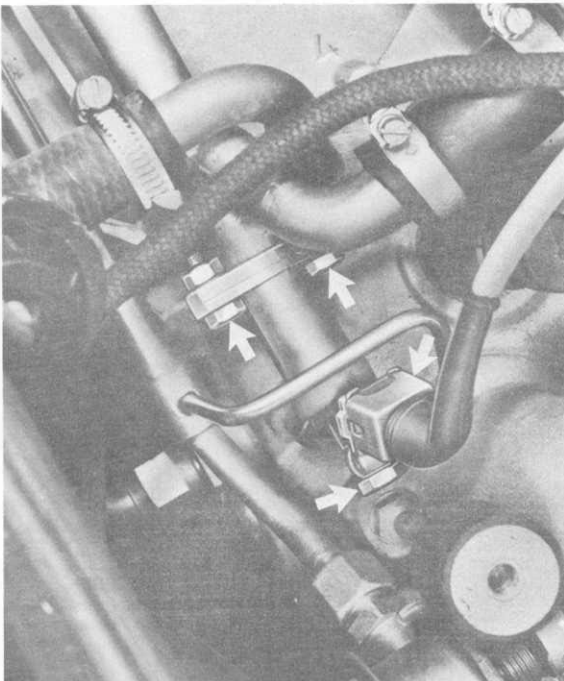
3. Unscrew bolts on intake funnel and take intake air sensor and gasket off of air cleaner lower section.

Installing

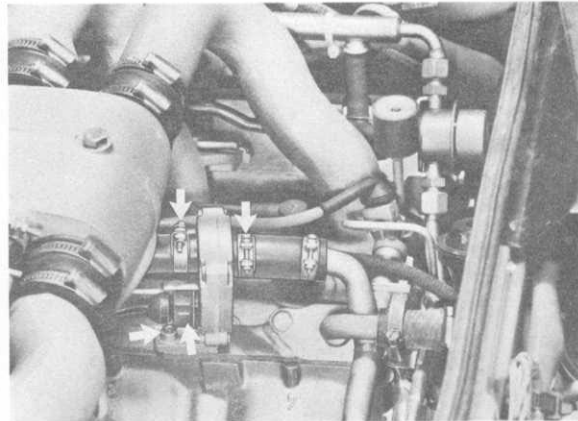
Check seal in air sensor housing and make sure of correct fit.

REMOVING AND INSTALLING COLD
START VALVE

1. Disconnect ground wire at battery.
2. Take off air cleaner assembly.
3. Pull off (blue) wire plug, unscrew fuel line and mounting bolts.

REMOVING AND INSTALLING
AUXILIARY AIR REGULATOR

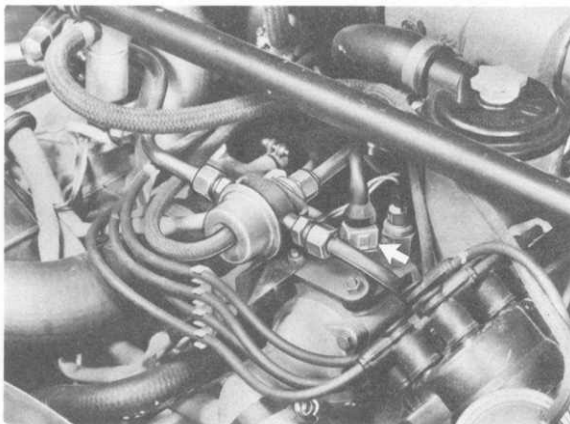
1. Take off air cleaner assembly.
2. Pull off (black) wire plug, loosen hose clamps, unscrew socket head bolts and remove auxiliary air regulator.



REMOVING AND INSTALLING
TEMPERATURE SENSOR II

Removing

Pull off electric plug and unscrew temperature sensor.



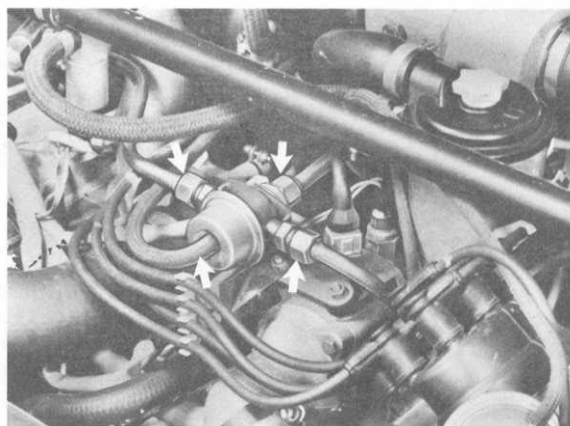
Installing

Use a new seal.

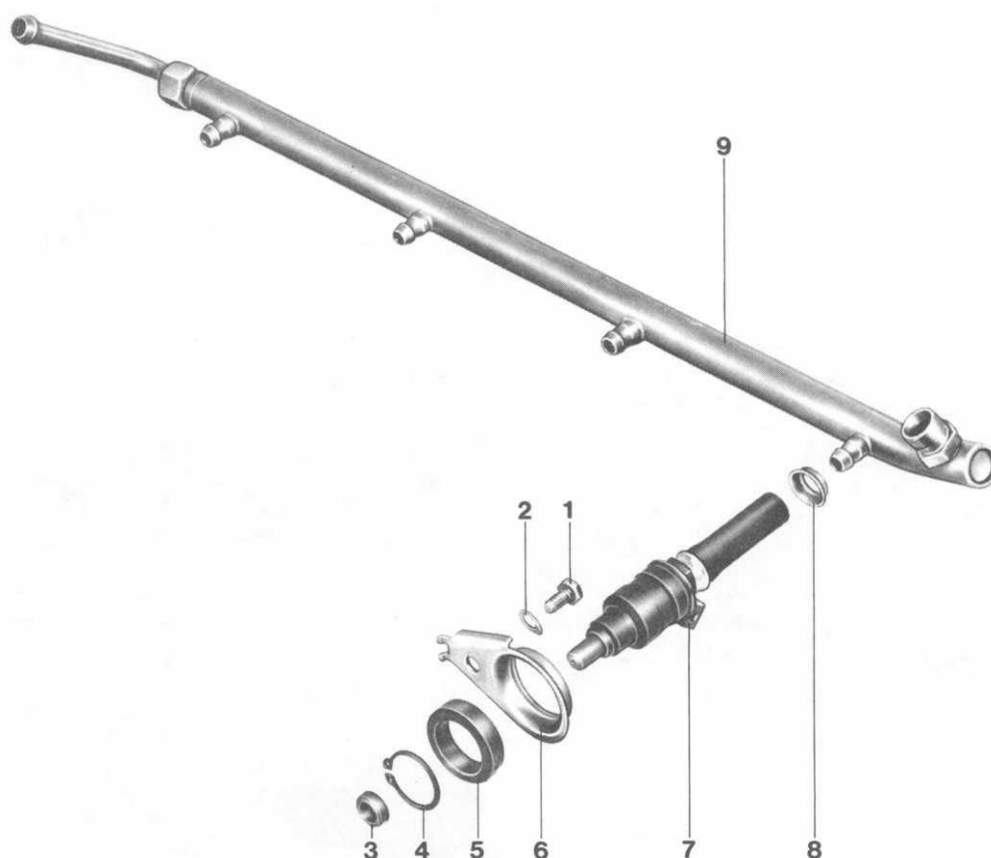
REMOVING AND INSTALLING
PRESSURE DAMPER

1. Disconnect ground wire at battery.

2. Pull off vacuum hose and disconnect fuel lines, not forgetting to counterhold. Catch escaping fuel.



REMOVING AND INSTALLING FUEL INJECTORS



No.	Description	Qty.	Note When		Special Instructions
			Removing	Installing	
1	Bolt	8			
2	Washer	8			
3	Injector bushing, inner	8		Always replace	
4	Circlip	8		Position correctly	
5	Injector bushing, outer	8		Check, replace if necessary	
6	Retaining plate	8		Position correctly in cast boss of intake manifold	
7	Fuel injector	8		Electric connection faces down	See page 24 - 13
8	Hose sleeve	8	Cut open		
9	Fuel distributor line	2			

DISASSEMBLING FUEL INJECTOR

1. Cut open hose sleeve with metal snips.
2. Burn off hose with a soldering iron and pull off.

ASSEMBLING FUEL INJECTOR

1. Clean outside of hose adapter on fuel distribution line.
2. Coat inside of new fuel hose with fuel and push hose sleeve on hose adapter against stop by hand.

Hose sleeve must be a tight fit.

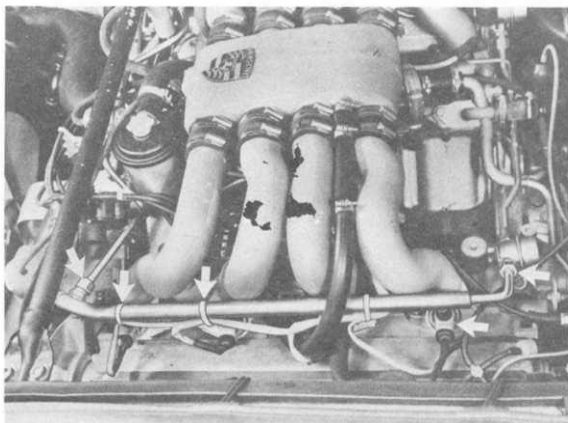
REMOVING AND INSTALLING FUEL INJECTORS

Note

Only four left or right fuel injectors can be removed together.

Cut off wire straps. Pull off wire plugs and disconnect retaining plates of fuel injectors at intake manifolds.

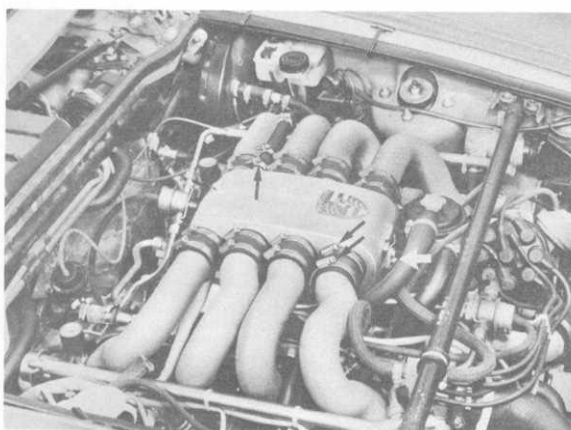
Unscrew fuel lines, remembering to counterhold. Catch escaping fuel. Remove fuel distribution line.



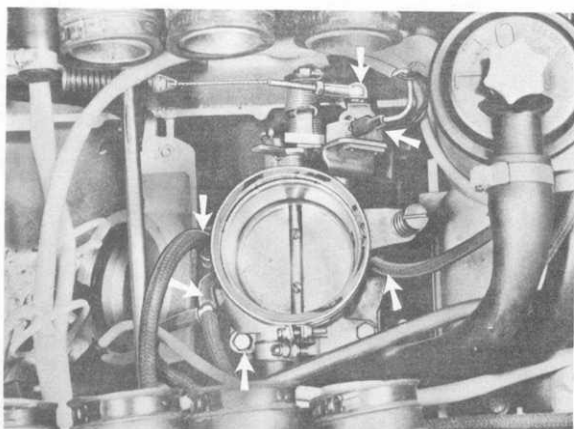
REMOVING AND INSTALLING THROTTLE HOUSING

Removing

1. Take off air cleaner assembly.
2. Disconnect brake booster hose on connecting adapter of intake distributor.
 - a) Disconnect hose from A/C solenoid valve on intake distributor.
 - b) Loosen hose clamps on intake pipes and push back rubber sleeves on intake pipes.



3. Loosen upper hose clamps on connector between intake distributor and throttle housing. Remove intake distributor from above.
4. Pull off hoses and disconnect throttle cable. Pull wires off of microswitches, unscrew mounting bolts and remove throttle housing.

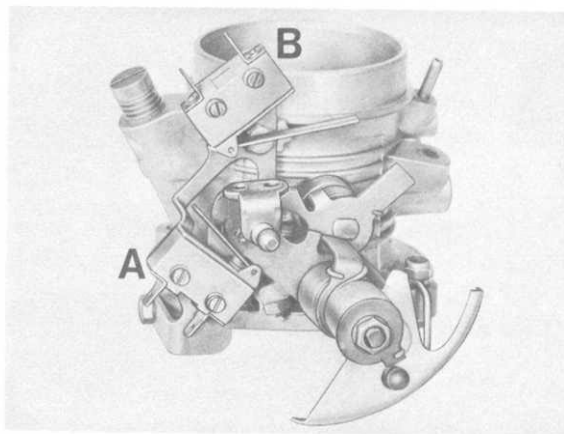


Installing

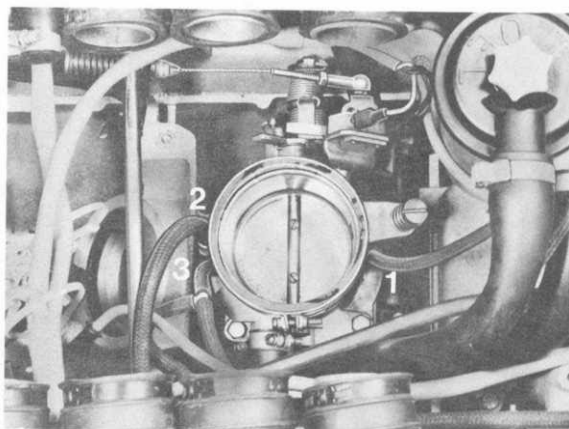
1. Connect wires on microswitches as follows:

Term. 18 black and term. 2 black/white on microswitch A (idle contact).

Term. 18 black and term. 3 white on microswitch B (full throttle contact).

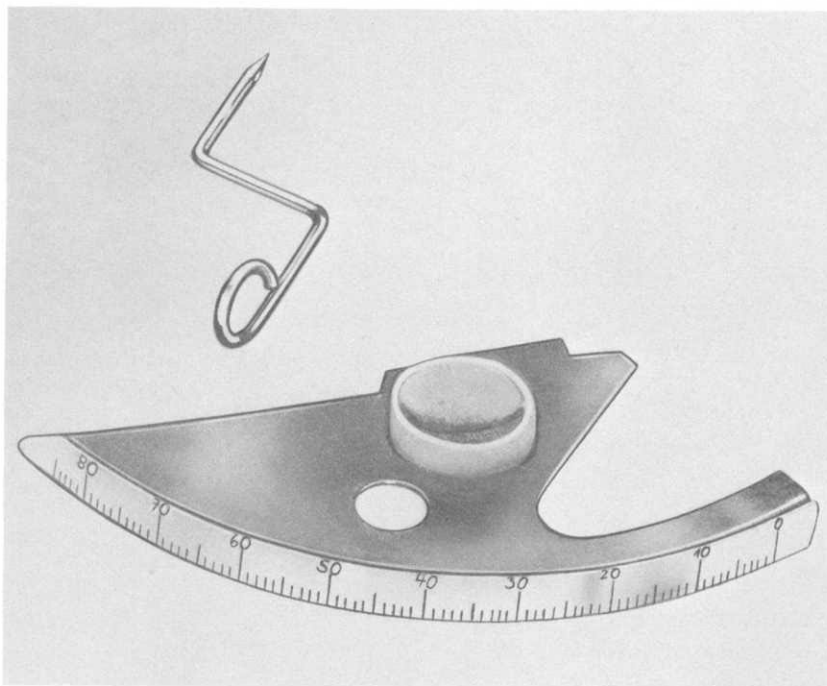


2. Connect vacuum hoses as follows:
 - 1 To distributor (retard).
 - 2 To decel valve/pressure regulator/pressure damper.
 - 3 To distributor (advance)/vacuum check valve (charcoal filter).



CHECKING AND ADJUSTING MICROSWITCHES ON THROTTLE HOUSING

TOOLS

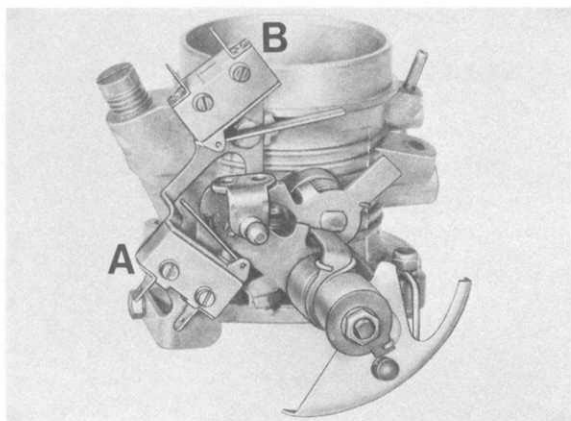


No.	Description	Special Tool	Remarks
1	Degree disc	from P 228 c	
2	Indicator		Made locally

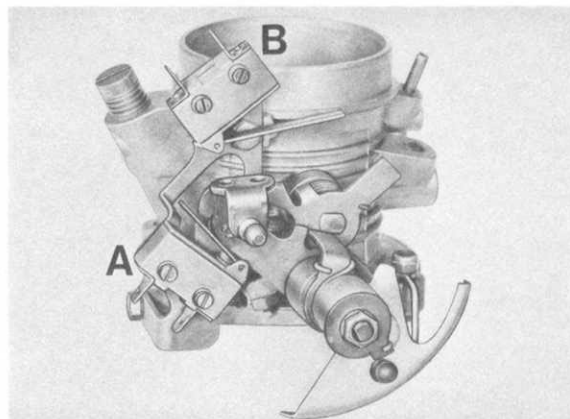
CHECKING AND ADJUSTING MICROSWITCHES ON THROTTLE HOUSING

1. Remove throttle housing.

2. Check microswitch A (idle contact).

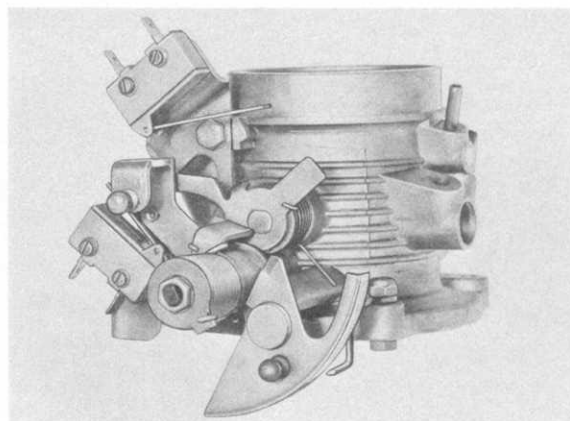


3. Check microswitch B (full throttle contact).



a) Place degree disc of special tool P 228 c on operating lever.

b) Mount and align (locally made) indicator.



c) Operate throttle $30^{\circ} \pm 4^{\circ}$. Microswitch must close; adjust if necessary.

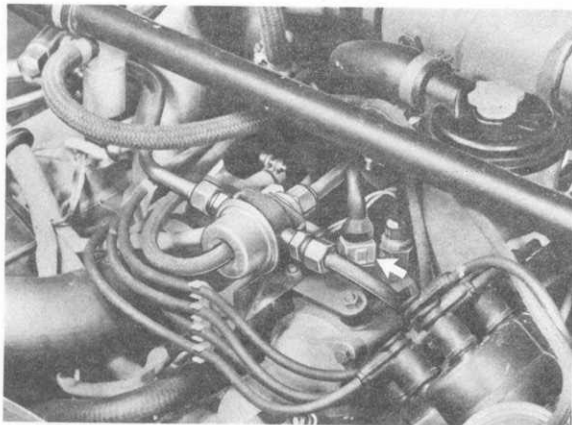
Note

The microswitch will already switch when play in accelerator linkage is eliminated by force on the pedal. The throttle valve should still be closed.

Connect a standard buzzer or ohmmeter on both contacts of microswitch. Power must be flowing through microswitch; adjust if necessary.

CHECKING TEMPERATURE SENSOR II (gray plug)

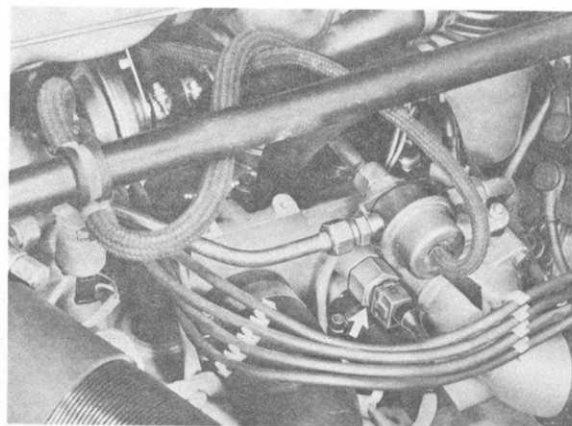
Measure resistance direct off of temperature sensor.



For - 10° C/14° F	7 ... 12 k-ohms
+ 20° C/68° F	2 ... 3 k-ohms
+ 80° C/176° F	250 ... 400 ohms

Replace, if necessary.

CHECKING TEMPERATURE TIME SWITCH (FOR COLD START VALVE) (brown plug)



1. Pull off plug and measure resistance direct off of temperature time switch.

Check by measuring resistance between

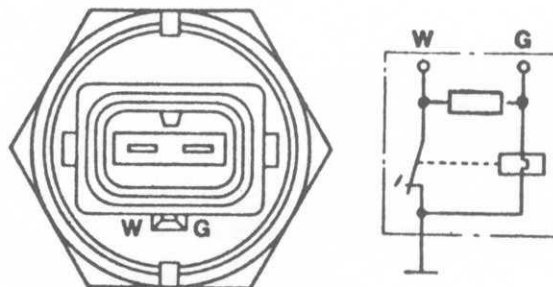
terminal "G" and "ground" (housing):
below + 30° C/86° F: 0 ohms
above + 40° C/104° F: 100 - 160 ohms

terminal "W" and "ground" (housing):
below + 30° C/86° F: 0 ohms
above + 40° C/104° F: 100 - 160 ohms

terminal "G" and terminal "W":
below + 30° C/86° F: 25 - 40 ohms
above + 40° C/104° F: 50 - 80 ohms

Note

Temperatures above + 40° C/104° F and below + 30° C/86° F can be produced with water of pertinent temperature.



CHECKING AUXILIARY AIR REGULATOR

CHECKING COLD START VALVE

1. Connect ohmmeter to both connection of auxiliary air regulator and measure resistance.

Specification: 40 to 75 ohms.

2. Check power supply.

Bridge fuel pump relay socket terminals 30 and 87.
Disconnected plug should have battery voltage.

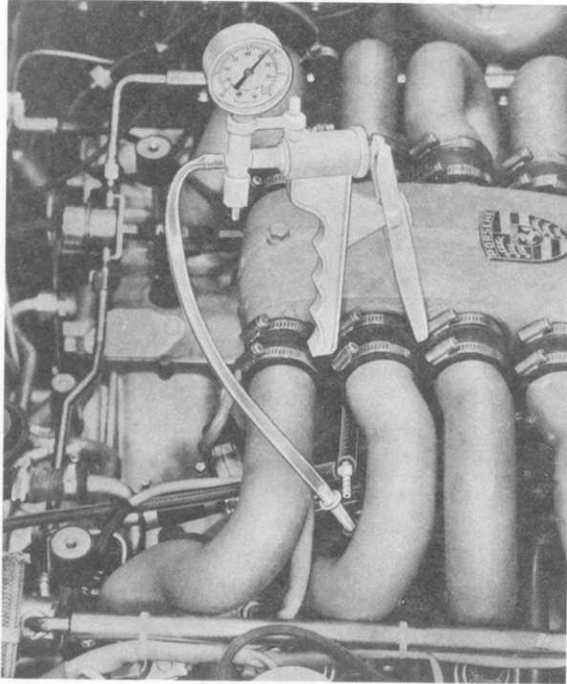
1. Check power supply of cold start valve. Pull off plug for this purpose and connect a test lamp on both contacts of disconnected plug.

Start engine. Test lamp should come on at coolant temperature below $+30^{\circ}\text{C}/86^{\circ}\text{F}$ and not come on above $+40^{\circ}\text{C}/104^{\circ}\text{F}$.

2. Check resistance of cold start valve.
Resistance: approx. 4 ohms.

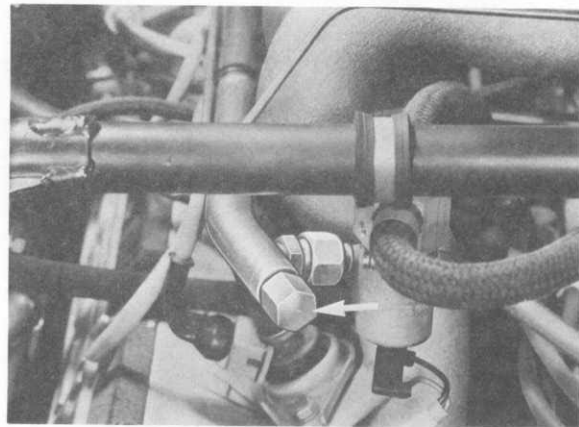
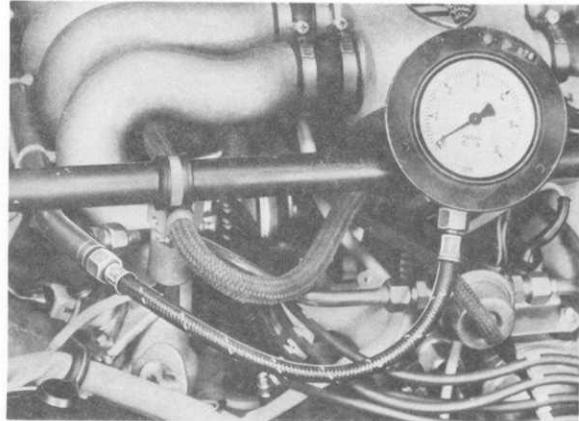
CHECKING VACUUM CONTROL

Run engine at idle speed.
Pull control hose for decel valve off of branch
and connect hand vacuum pump US 8026.
Decel valve will open and idle speed rise when
vacuum is sufficient.

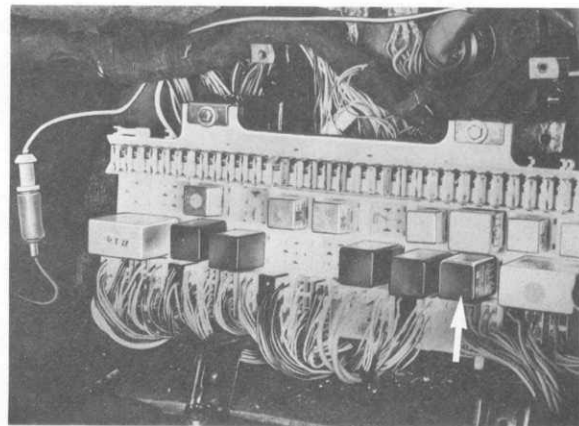


CHECKING PRESSURE REGULATOR

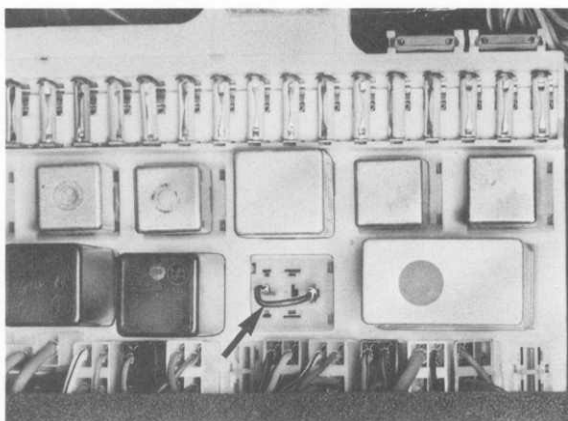
1. Take off air cleaner assembly.
2. Connect pressure gauge with hose from pressure tester P 378 on testing connection.



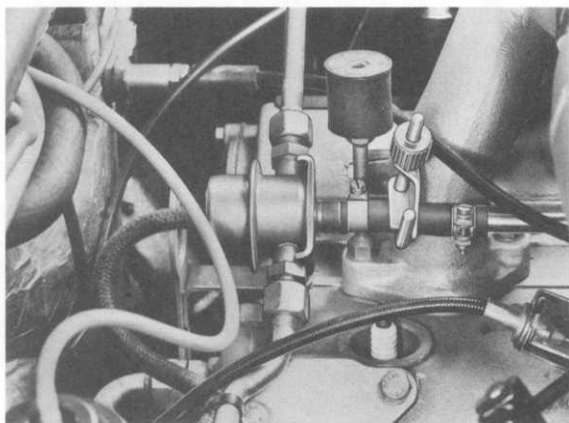
3. Fold up foot support in footwell of passenger's side and pull fuel pump relay off of central fuse/relay plate.



4. Bridge terminals 30 and 87 with an extra wire.
Fuel pump should now run.



5. Shut off return line of one pressure regulator with a standard hose clamp. Fuel pressure should rise only slightly (approx. 0.05 bar).
If pressure rises, return line of opposite pressure regulator is clogged or pressure regulator is defective.
Check second pressure regulator in same manner.



CHECKING AIR FLOW SENSOR

1. Pull off plugs on air flow sensor.
2. Connect ohmmeter on connections 6 and 9.
Specification: 200 – 400 ohms

Connections 6 and 8
Specification: 130 – 260 ohms

Connections 8 and 9
Specification: 70 – 140 ohms

Connections 6 and 7
Specification: 40 – 300 ohms

Connections 7 and 8
Specification: 100 – 500 ohms

Connections 27 and 6
Specification: 2 – 3 k-ohms at 20 °C/68 °F

Note

Beginning with manufacturing date 042 (stamped in housing of air flow sensor).

1. Pull off plugs on air flow sensor.
2. Connect ohmmeter on connections 6 and 9.
Specification: 400 – 800 ohms

Connections 6 and 8
Specification: 160 – 520 ohms

Connections 8 and 9
Specification: 140 – 280 ohms

Connections 6 and 7
Specification: 80 – 600 ohms

Connections 7 and 8
Specification: 200 – 1000 ohms

Connections 27 and 6
Specification: 4 – 6 k-ohms at 20 °C/68 °F

TROUBLESHOOTING AFC

Condition

1. Engine will not start or poor start
2. Engine starts, but stops again
3. Rough engine idling
4. Poor acceleration

Requirements for troubleshooting:
Ignition, electrical system and engine
in perfect mechanical or operating
condition.

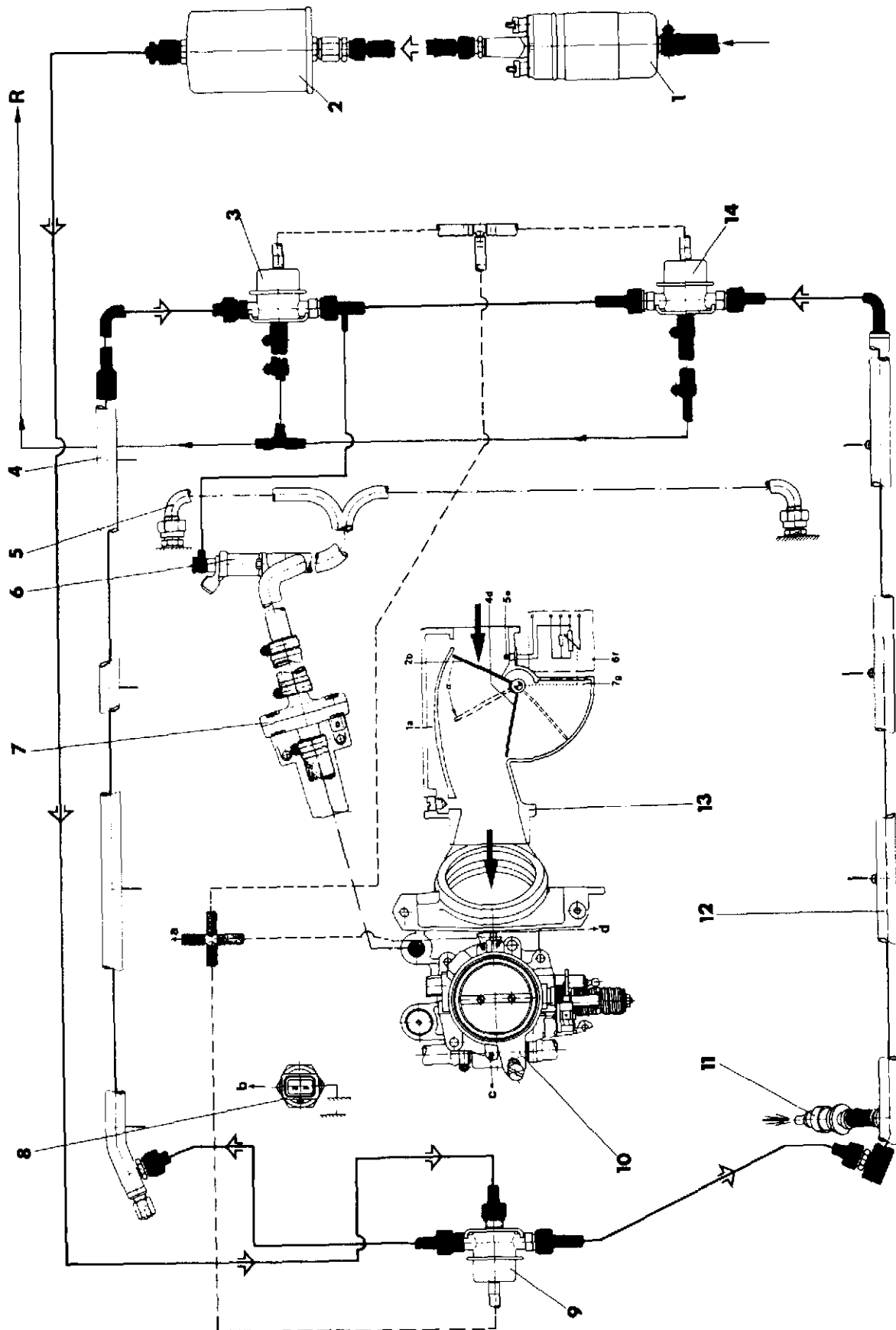
5. Engine misfiring in all load conditions
6. Excessive fuel consumption
7. Max. power output not reached
8. CO level at idle speed too high
9. CO level at idle speed too low

Correction - Testing Instructions

Cause

X	X								AFC relay (XVI) defective.	Check power supply.
X									Fuel pump not running.	Check pump fuse. Voltage at relay and fuel pump?
X									Cold start valve won't open.	Resistance about 4 ohms. Check ejection.
X	X				X				Cold start valve leaks.	Check for leaks in pressure test.
X									Temp. time switch defective.	Check switching point.
X	X								Auxiliary air regulator won't open.	Visual inspection: warm engine - valve closed cold engine - valve opened, electrics okay
X	X				X	X			Intake air sensor defective.	Check movement of sensor plate. Eliminate dirt.
X									Pump relay defective.	Check power supply.
X	X				X				Leak in intake system.	Check intake pipes, bolted equipment and all hose connections for leaks.
X	X				X	X			Fuel injectors defective.	Check injection action by feeling.
X	X				X				Fuel pressure too low or zero.	Check pressure, filter, fuel lines, pressure regulator.
					X				Fuel pressure too high.	Pressure reg./intake pipe conn. hose connected? Fuel return line clogged or pinched? Pressure regulator defective?
X	X				X				Temp. sensor II in engine defective.	Measure resistance.
	X								Throttle won't close.	Service throttle valve. Align accelerator linkage. Then adjust throttle.
					X				Throttle won't open fully.	Adjust accelerator linkage and cable to final stop.
							X		Poor central ground. Loose contacts.	Eliminate faults.
									Wrong plug connections.	
X	X	X	X	X	X	X			Break in wire harness and plugs.	Eliminate break.
	X	X			X				Throttle switch defective.	Check adjustment. Check full throttle and idle contacts.
					X				CO level setting too rich.	Check idle speed and CO level.
								X	CO level setting too lean.	Check idle speed and CO level.
								X	Oxygen sensor defective.	
X	X	X	X	X	X	X			Control unit defective.	

HOSE DIAGRAM FOR AFC



HOSE DIAGRAM FOR AFC

- | | |
|---|--|
| 1 - Fuel pump | 11 - Fuel injector |
| 2 - Fuel filter | 12 - Distributor line for cyl. 5 - 8 |
| 3 - Pressure regulator for cyl. 1 - 4 | 13 - Intake air sensor |
| 4 - Distributor line for cyl. 1 - 4 | 14 - Pressure regulator for cyl. 5 - 8 |
| 5 - Air line (central cold idle system) | R - Return to tank |
| 6 - Cold start valve | a - To vacuum control |
| 7 - Auxiliary air regulator | b - To AFC control unit |
| 8 - Temperature sensor II | c - To distributor (retard) |
| 9 - Pressure damper | d - To distributor (advance) |
| 10 - Throttle housing | |

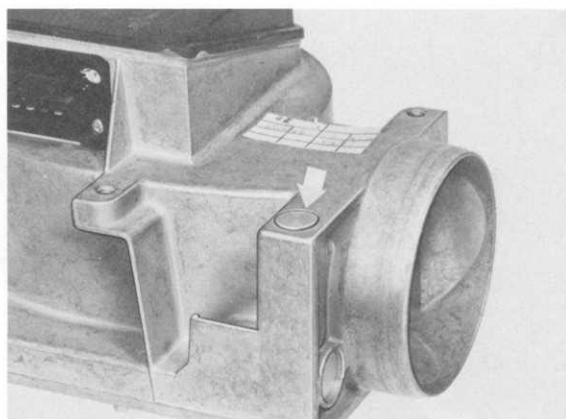
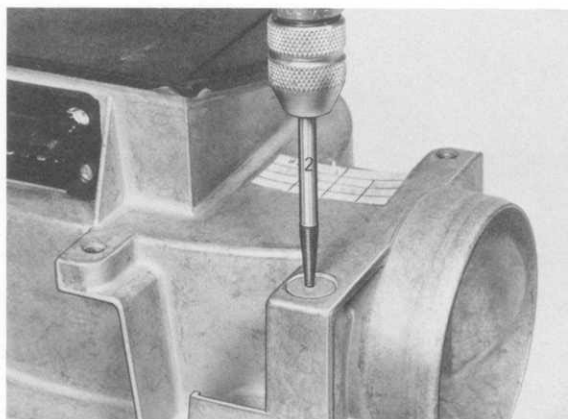
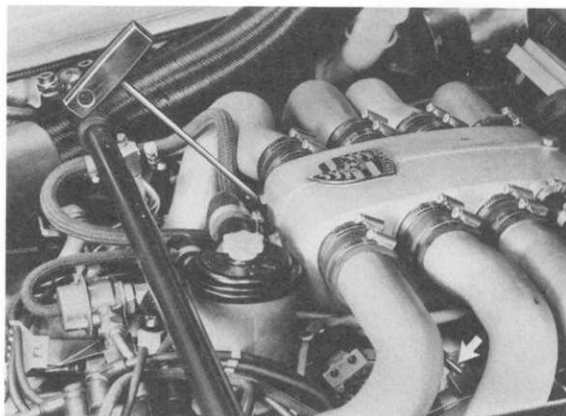
CORRECTING CO LEVEL ON AIR FLOW SENSOR

Note

If CO level is not the specified value, remove plug from hole providing access to the mixture control screw. This requires removal of the air flow sensor.

Removing

1. Remove air flow sensor.
2. Drill hole in plug with a 2 mm dia. drill bit (up to stop on steel insert).
3. Pull out plug with a left-turning drill (no. 2).
3. Close hole providing access to mixture control screw with a new plug after finishing adjustments. Press in plug flush.



Installing

1. Install air flow sensor.
2. Adjust engine idle speed and CO level. Turn mixture control screw accordingly with a screwdriver.
Turning clockwise = richer mixture
Turning anticlockwise = leaner mixture

Note

Never reuse a drilled plug!

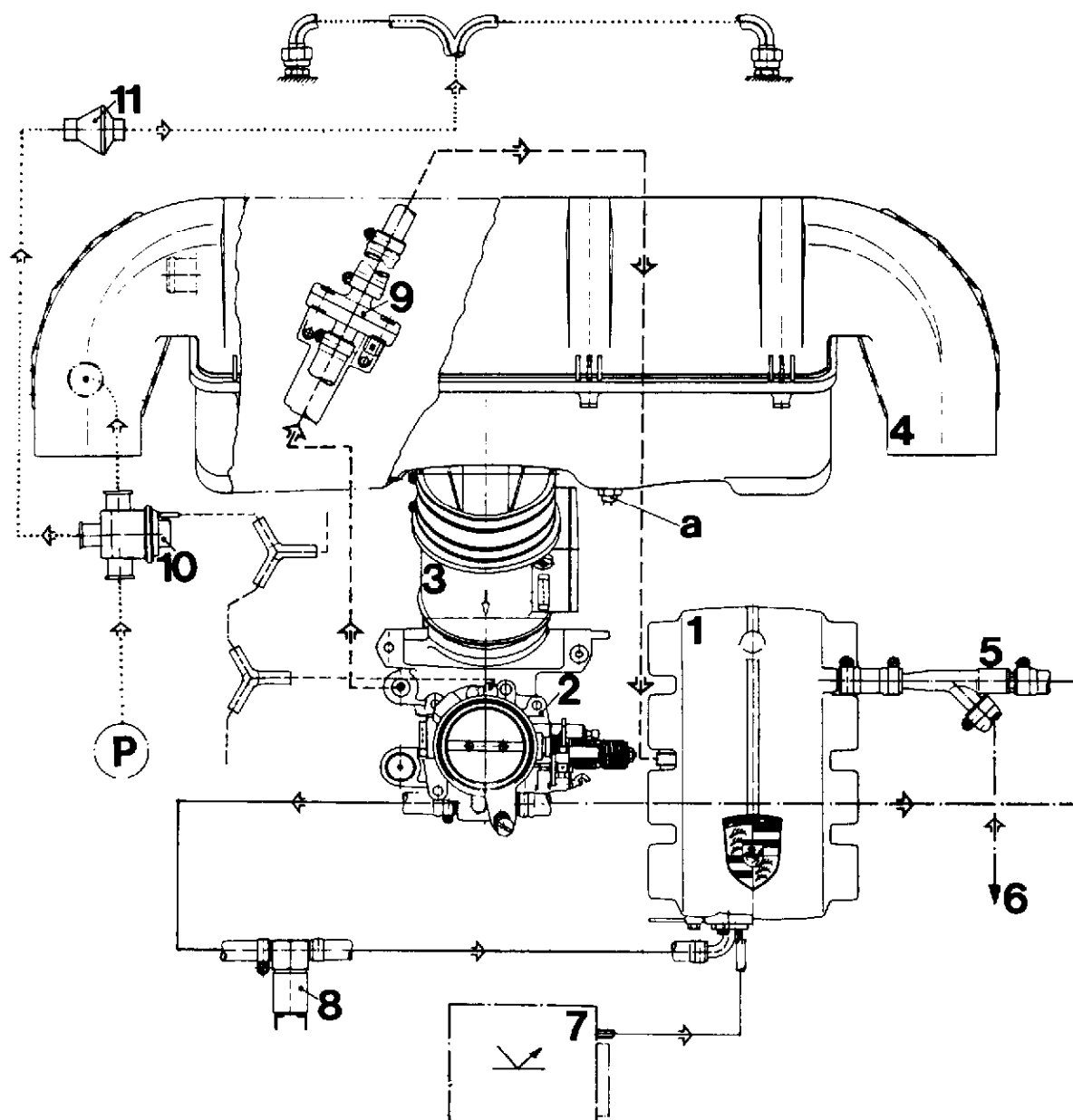
LH-JETRONIC EQUIPMENT TABLE – 928 S / from 1984 Models
Engine Type M 28-21/22

Electric Fuel Pump EKP 4	Fuel Filter	Fuel Pressure Damper	Fuel Pressure Regulator
928.608.104.01 Bosch No. 0580.464.017	928.110.253.00 Purolator No. PFC-6	928.110.202.00 Bosch No. 0280.161.008	928.110.198.01 Bosch No. 0280.160.215

Heated Wire Air Flow Sensor	NTC Temperature Sensor (Double Func.)	Throttle Switch	Auxiliary Air Regulator
928.606.141.00 Bosch No. 0280.214.001	928.606.126.00 Bosch No. 0280.130.032	931.606.119.00 Bosch No. 0280.120.301	928.606.102.00 Bosch No. 0280.140.228

Vacuum Control Switzerland, Sweden, Australia (Manual Transm.)	Electric Air Valve	Electric Fuel Injectors	LH-Jetronic Control Unit
930.110.173.00 Bosch No. 0280.160.302	944.606.215.00 Bosch No. 0280.141.012	928.606.119.00 Bosch No. 0280.150.252	928.618.123.00 Bosch No. 0280.002.501

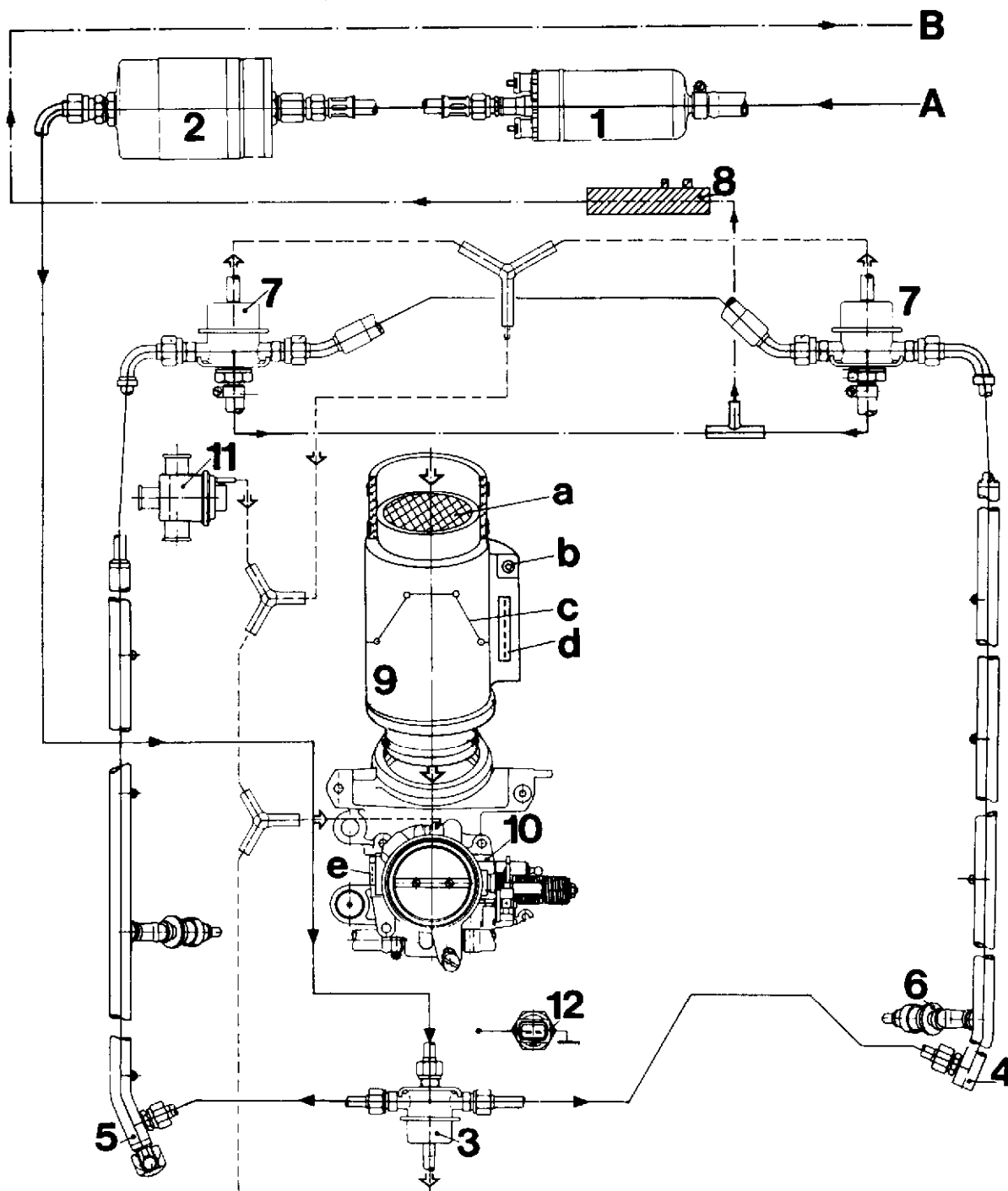
LH-JETRONIC AIR FLOW LAYOUT – 928 S – R. o. W. – 1984 Models
Engine Type 28-21/22



- 1 – Intake air distributor
- 2 – Throttle housing
- 3 – Heated wire air flow sensor
- 4 – Air cleaner
- 5 – Ejector
- 6 – To brake booster
- 7 – Electronic ignition control unit

- 8 – Electric air valve (air conditioner)
- 9 – Auxiliary air regulator
- 10 – Blowoff switching valve
- 11 – Check valve
- a – Temperature sensor I (intake air) for ignition
- P – Auxiliary air pump

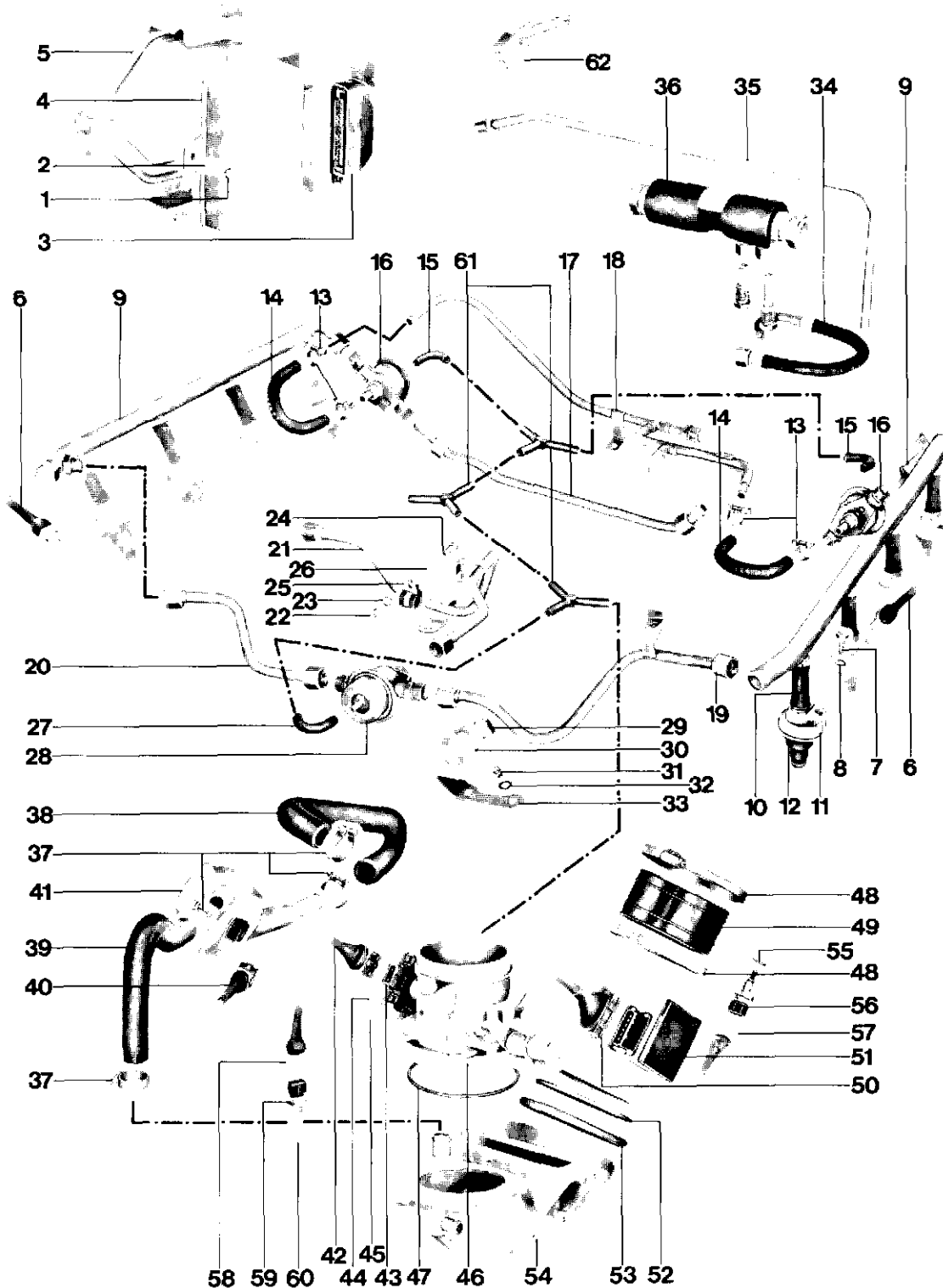
LH-JETRONIC FUEL FLOW LAYOUT – 928 S – R. o. W. – 1984 Models
Engine Type 28-21/22



- | | |
|----------------------|------------------------------|
| 1 – Fuel pump | 6 – Fuel injectors |
| 2 – Fuel filter | 7 – Pressure regulator |
| 3 – Pressure damper | 8 – Fuel cooler |
| 4 – Fuel line | 9 – LH air flow sensor |
| Cyl. 5 – 8 | 10 – Throttle housing |
| 5 – Fuel line | 11 – Blowoff switching valve |
| with test connection | 12 – Temperature sensor II |

A – From fuel tank
(feed)
B – To fuel tank (return)

LH-JETRONIC



No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Bolt	3			
2	Washer	3			
3	Multiple pin plug LH control unit	1		Make sure plug engages securely	
4	LH control unit	1			
5	Control unit holder	1			
6	Plug connector	8			
7	Bolt	8			
8	Washer	8			
9	Distributing injection tube	2			
10	Hose sleeve	8			
11	Thrust plate	8			
12	Fuel injector	8			
13	Hose clamp	4			
14	Hose	2			
15	Elbow hose	2			
16	Pressure regulator	2			
17	Fuel line	1			
18	Fuel line	1			
19	Fuel line	1			
20	Fuel line	1			
21	Fuel line (feed)	1			

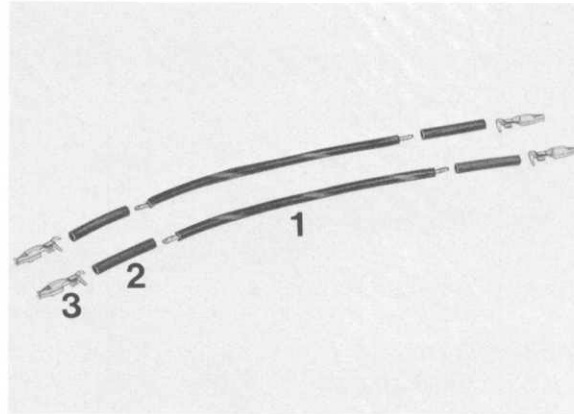
No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
22	Nut	1			
23	Washer	1			
24	Bolt	1			
25	Pipe clamp	1			
26	Holder	1			
27	Elbow hose	1			
28	Pressure damper	1			
29	Nut	1			
30	Washer				
31	Nut	2			
32	Washer	2			
33	Holder	1			
34	Fuel line	1			
35	Fuel line	1			
36	Fuel cooler	1			see page 24 - 126
37	Hose clamp	4			
38	Hose	1			
39	Hose	1			
40	Plug connector	1			
41	Auxiliary air regulator	1			
42	Plug connector	1			
43	Throttle switch	1			
44	Bolt	4			

No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
45	Washer	4			
46	Throttle housing	1			
47	O-ring				
48	Hose clamp	2			
49	Connecting hose	1			
50	Plug connector	1			
51	Air flow sensor	1			
52	O-ring (dust guard)	1			
53	O-ring	1			
54	Air guide housing	1			
55	Seal	1			
56	Temperature sensor I	1			
57	Plug connector	1			
58	Plug connector	1			
59	Temperature sensor	1			
60	Seal	1			
61	Y-adaptor	3			
62	Plug connector for central electric	1			

TESTERS AND TOOLS

- Engine tester with oscilloscope, e. g. 1010/1019, Bosch Mot 300/400
- Multiple tester (internal resistance at least 20 Kohm/V)
- Adapter line (Bosch "L-Jetronic" No. 1684 463 093)
- Pressure gauge with hose from pressure tester P 378
- Two test lines (made locally) for measuring on multiple pin plugs of control units and plug connectors with same type of contact (flat contacts)

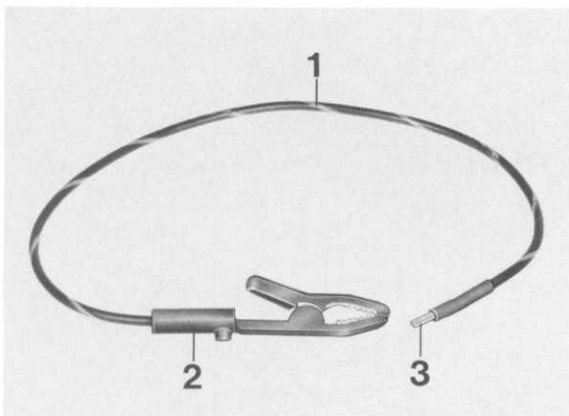
- Two adapters — test lines (made locally)



- 1 — Highly flexible line, approx. 10 cm long

- 2 — Insulating hose

- 3 — Flat contact N 17.182.2

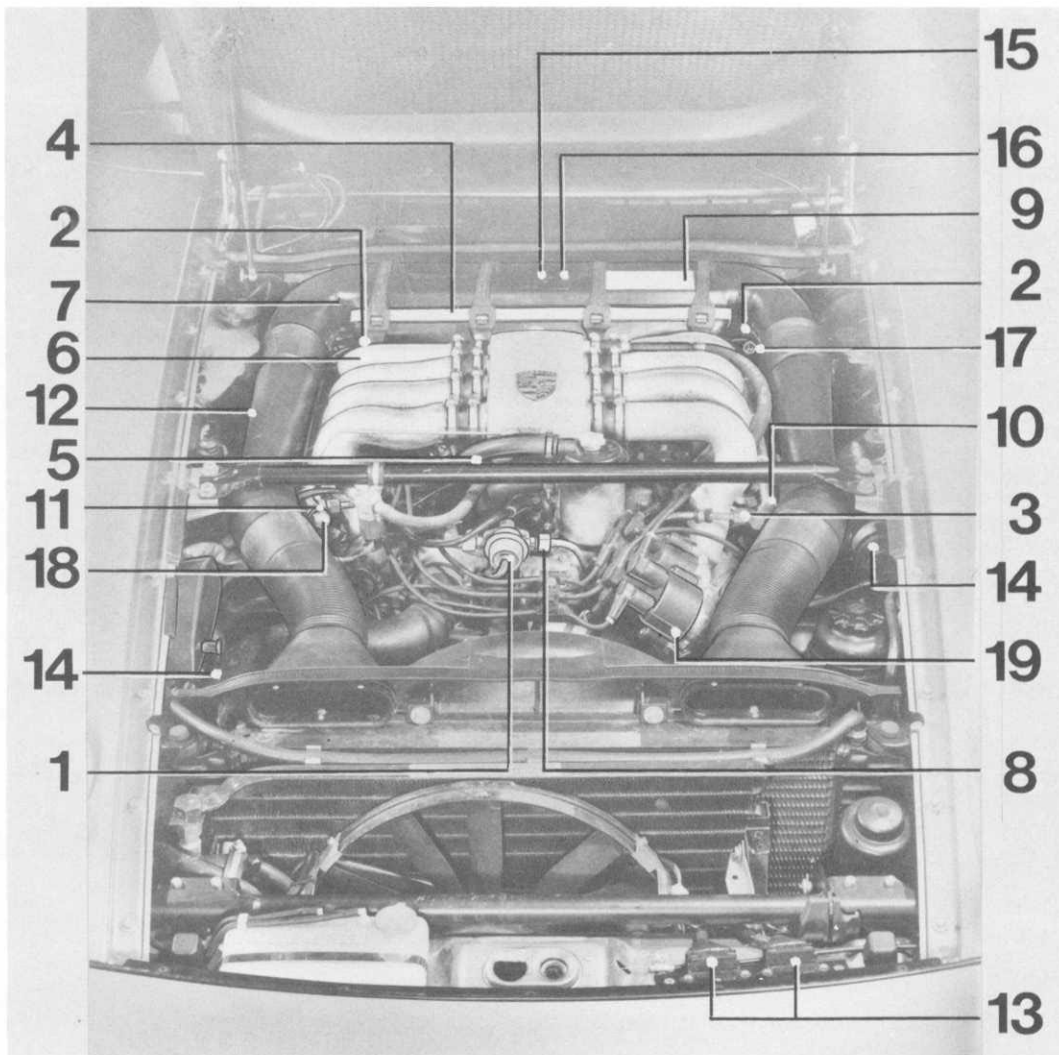


- 1 — Highly flexible line

- 2 — Alligator clips (standard)

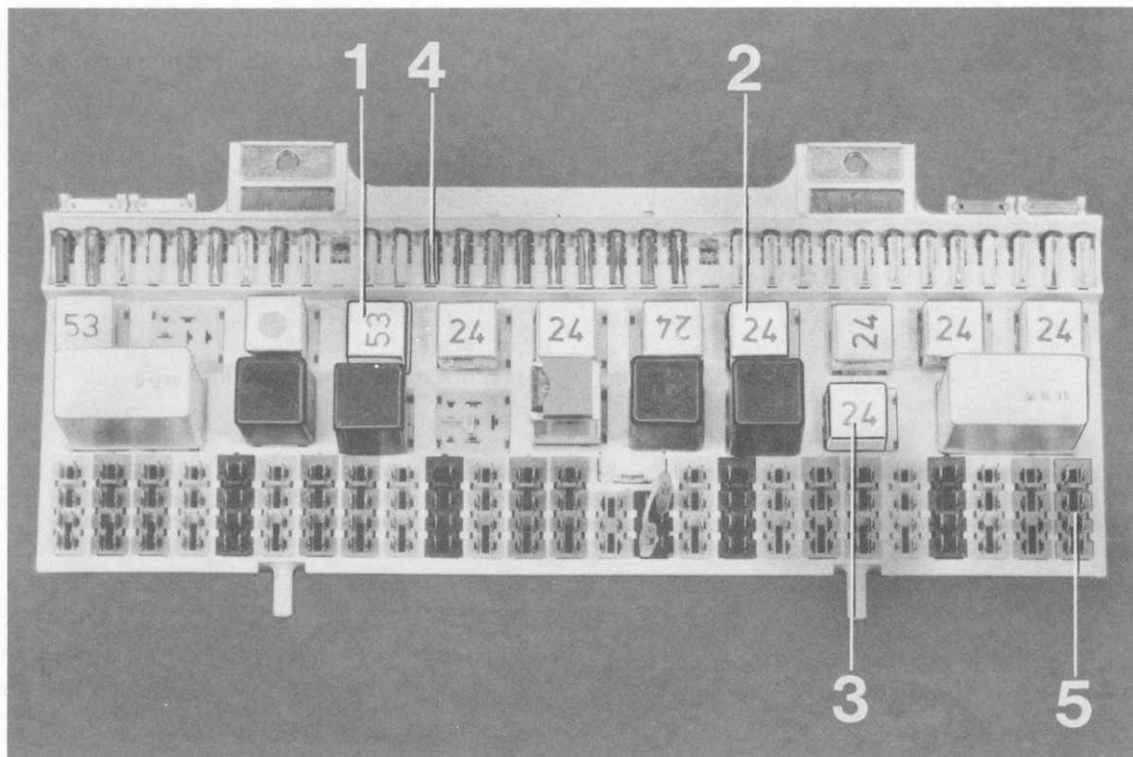
- 3 — Flat male plug 2.8 (N 17.457.2)

LOCATION OF COMPONENTS



- | | |
|---------------------------------|------------------------------------|
| 1 — Pressure damper | 11 — Fuel injectors, right |
| 2 — Pressure regulator (two) | 12 — Blowoff switching valve |
| 3 — Fuel injectors, left | 13 — Ignition control unit |
| 4 — LH air flow sensor | 14 — Ignition coils |
| 5 — Throttle switch | 15 — Speed/reference mark sensors |
| 6 — Auxiliary air regulator | 16 — TDC sensor |
| 7 — Control units (ignition/LH) | 17 — TDC sensor test connection |
| 8 — Temperature sensor II | 18 — Fuel pressure test connection |
| 9 — Temperature sensor I | 19 — Distributor |
| 10 — Fuel line | |

CENTRAL ELECTRIC POWER SUPPLY FOR LH / ELECTRONIC IGNITION



- 1 — Electronic ignition relay VIII (power supply for electronic ignition and LH control units)
- 2 — LH-Jetronic relay XVI (power supply for LH control unit and air flow sensor)
- 3 — Fuel pump relay XVII (power supply for fuel pump, auxiliary air regulator and fuel injectors)
- 4 — Fuse no. 13 = fuel pump, auxiliary air regulator
- 5 — Plug X, red (power supply for electronic ignition/LH)

Testing Conditions	LH-Jetronic Possible Causes of Defects										
Engine in good operating condition	Ground and plug connections	Power supply for control unit and fuel pump	Air flow sensor	Temperature sensor II	Throttle switch	Fuel injectors/injection timing	Auxiliary air regulator	CO and idle speed adjustment	Leaks in intake	Fuel pressure	Alternator/regulator
Battery charged											
Starter turning											
See Test Point											
Engine does not start											
Engine hard to start											
Erratic idling											
Poor pickup											
Misfiring											
High fuel consumption											
Poor power output											
Engine hesitation											
	1	2	3	4	5	6	7	8	9	10	11
Engine does not start	X	X		X		X				X	
Engine hard to start	X			X		X	X		X	X	
Erratic idling			X	X		X		X	X	X	
Poor pickup	X		X	X	X	X		X	X	X	
Misfiring	X		X		X	X			X	X	X
High fuel consumption			X	X	X	X		X		X	
Poor power output	X		X	X	X	X			X	X	
Engine hesitation	X	X	X	X		X	X	X	X	X	X

X = Check with suitable tester

TEST POINT 1

Checking Ground and Plug Connections

See page 28 - 53.

- 1.2 If battery voltage is not displayed, pull off relay XVI and bridge terminals 30 and 78.

Recheck voltage on LH multiple pin plug between terminals 9 and 5.

TEST POINT 2

Power Supply for LH Control Unit and Fuel Pump

1. LH Control Unit

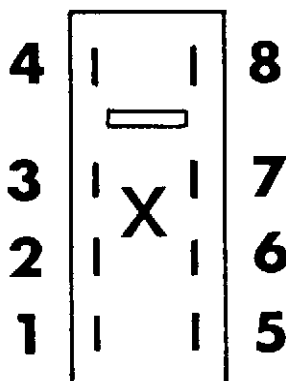
Switch off ignition and pull off multiple pin plug on LH control unit.

1.1 Switch on ignition.

Measure voltage on multiple pin plug between terminals 9 and 5.

Specification: battery voltage.

If value deviates from specification, measure voltage on plug X connected on central electric board between terminal 8 and ground.



Specification: battery voltage

2. Fuel Pump

The fuel pump relay is activated negatively by the LH control unit.

- 2.1 Connect terminal 17 on disconnected LH control unit plug on ground with a piece of wire.

Fuel pump relay should be activated and fuel pump must run.

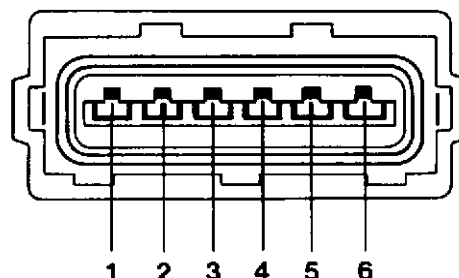
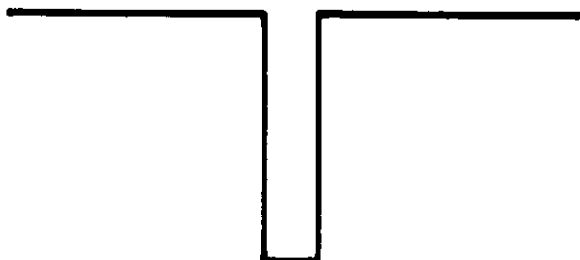
If pump does not run, check fuse no. 13 and relay XVII activation as well as fuel pump relay.

3. Checking Control Signal for Electronic Ignition to LH Control Unit

Pull off multiple pin plug on LH control unit; leave plug on electronic ignition control unit.

- 3.1 Connect positive test lead of oscilloscope on terminal 1 and negative test lead on ground.

Oscilloscope should display following control signal.



If no signal is displayed, check power flow from terminal 16 of electronic ignition control unit plug to terminal 1 of LH control unit plug.
If power flow is okay, replace electronic ignition control unit.

Pull off relay XVI for this purpose and bridge terminals 30 and 87.

Specification: battery voltage.

TEST POINT 3

4. Measure resistance for idle mixture position.
Connect ohmmeter on terminals 6 and 3 of air flow sensor.

Specification: 0 . . . 1000 ohms.

LH Air Flow Sensor

1. Take off upper air cleaner housing and filter element.

5. Connect ohmmeter on terminals 5 and 3 of air flow sensor.

Specification: 3.6 . . . 4.1 ohms.

2. Pull lower air cleaner housing and air flow sensor out of air guide housing.

3. Pull off multiple pin plug on air flow sensor.

Measure voltage between terminals 4 and 2 (positive) on disconnected plug.

6. Checking "Free Burning" of Heated Wire

6.1 Visually inspect

- plug connection and contacts,
- wire grid for damage and
- heated wire for breaks.

6.2 Install air flow sensor with lower air cleaner housing.

Coat O-ring in air guide housing with silicone for this purpose.

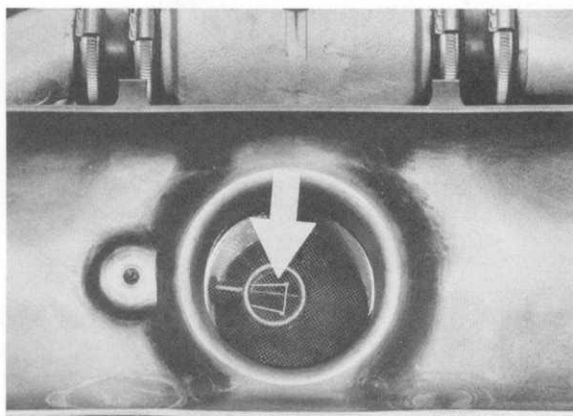
Connect plugs on air flow sensor and temperature sensor.

Push in air flow sensor carefully.

6.3 Do not install filter element and upper air cleaner housing.

Run engine having operating temperature at approx. 2,000 rpm and then switch off ignition.

Observe heated wire with help of a mirror.



Heated wire must glow about 1 second after waiting approx. 4 seconds.

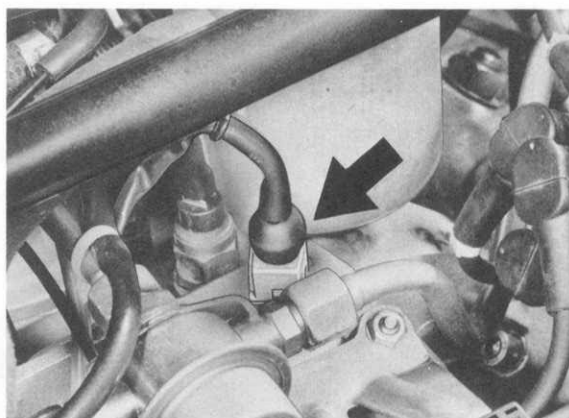
Check activation and wires in case of malfunction.

(LH plug terminal 8 to air flow sensor terminal 1).

TEST POINT 4

Temperature Sensor II (Engine Temperature)

1. Check plug connection on temperature sensor II for tight fit and clean contacts.



2. Connect ohmmeter on terminals 2 and 5 of disconnected LH multiple pin plug.

Specifications:

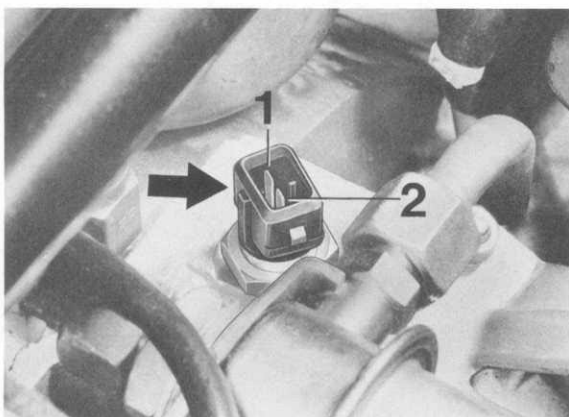
0 °C/	32 °F = 4.4 – 6.8 kΩ
15 to 30 °C/59 to 86 °F	= 1.4 – 3.6 kΩ
40 °C/	104 °F = 0.9 – 1.3 kΩ
60 °C/	140 °F = 480 – 720 Ω
80 °C/	176 °F = 250 – 390 Ω

If specified values are not reached, repeat same tests on the temperature sensor direct.

Note:

Two independent temperature sensors are installed in the temperature sensor housing.

Connect tester on only one contact of the sensor and a second test lead on ground.



1 — Electronic ignition

2 — LH-Jetronic

Temperature sensor II provides the LH control unit with information on the instantaneous engine temperature. It enriches the fuel/air mixture for cold starting and engine warm-up.

In case of interruption (inf. ohms):
excessively rich mixture, engine will not run in warm state and cannot be started.

In case of short circuit (0 ohm):
mixture too lean, no pickup in cold state.

In case of interruption, wires could be bridged for emergency operation of the car.

TEST POINT 5**Throttle Switch.****1. Idle Speed Contact**

Pull off multiple pin plugs on LH and electronic ignition control units.

1.1 Connect ohmmeter between terminals 3 and 5 on LH plug.

Specifications:
throttle closed = 0 ohm
throttle opened = inf. ohms

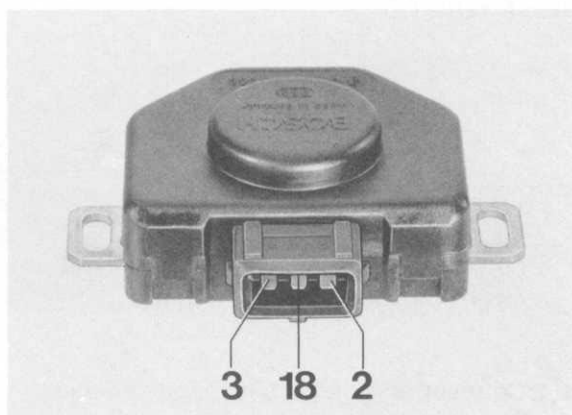
Switching over must take place already with a throttle gap of approx. 1°.

2. Full Load Contact**2.1 Connect ohmmeter between terminals 12 and 5 on LH plug.**

Specifications:
throttle closed = inf. ohms
throttle in full load pos. = 0 ohm

Switching point is after approx. 3/4 throttle travel.

Make tests direct on throttle switch, if switching points are not reached.



2 = Idle speed contact

18 = Ground

3 = Full load contact

Note:

If idle speed switch has a break, there will be no coasting shutoff.

If idle speed switch has a short circuit, there will be a single cutout at high idle speed.

If full load switch has a break, there will be no full load enrichment.

If full load switch has a short circuit, enrichment will be too early and consequently fuel consumption too high.

TEST POINT 6

1. Checking Fuel Injectors

If engine can be operated, pull off plugs on injectors separately.

If fuel injectors are okay, engine speed should drop each time.

If engine cannot be operated, measure voltage on one plug of injectors against ground.

One of both terminals should have battery voltage.

Measure coil resistance of fuel injectors.

Specification: 15 – 17.5 ohms
(+ 15 ... 30 °C/+ 59 ... 86 °F).

2. Checking Injection Timing

Adjust oscilloscope according to instructions supplied with tester.

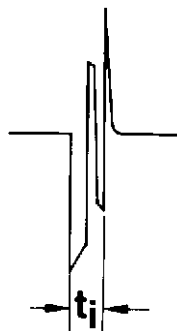
Connect adapter line (Bosch "L-Jetronic" No. 1 684 463 093) between one fuel injector and corresponding plug.

Caution!

Tester leads must not have contact with ground.

Start engine. If injection timing is working correctly, the oscilloscope will display the following oscillographs.

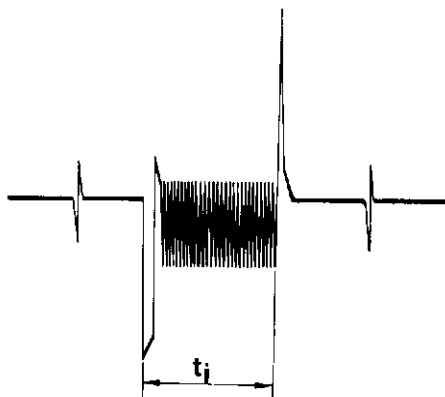
STARTER SPEED



IDLE SPEED



ACCELERATION



DECELERATION



Note :

If engine does not start or the idle speed drops, exchange test connections on adapter line and check tester adjustment.

TEST POINT 7

Auxiliary Air Regulator

1. The auxiliary air regulator will be closed in heated state.
Squeeze air hose tight — engine speed may only drop slightly.

2. Pull off plug on auxiliary air regulator and measure voltage between both terminals.

Specification: battery voltage.

3. Measure resistance on auxiliary air regulator.

Specification: 10 . . . 45 ohms.

TEST POINT 8

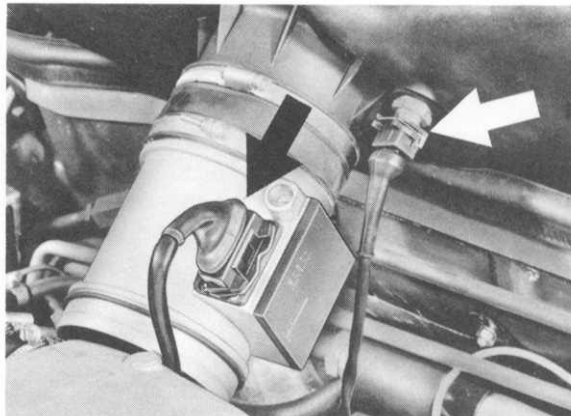
CO and Idle Speed Adjustment

See page 24 - 122.

TEST POINT 9

Leaks in Intake System

1. Remove air intake hoses.
2. Take off upper air cleaner housing and remove hose on blow-off switching valve.
3. Unscrew unlosable hexagon head screws (13 mm wrench size) in lower air cleaner housing and remove lower housing with heated wire air flow sensor. Pull off both multiple pin plugs.



4. Unscrew heated wire air flow sensor on lower air cleaner housing and plug air inlet opening, e. g. with dust cap of original spare part package and heated wire air flow sensor.

TEST POINT 10

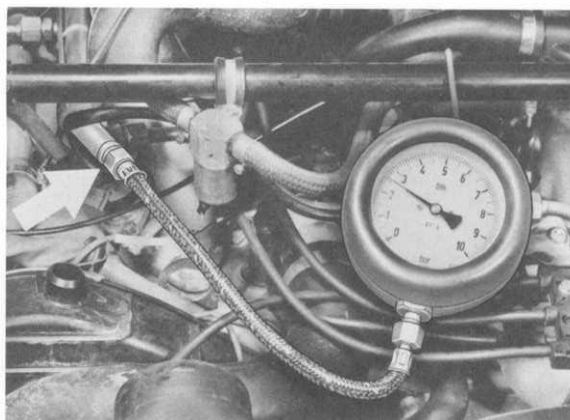
Fuel Pressure

1. Unscrew cap nut on injection line.

Note:

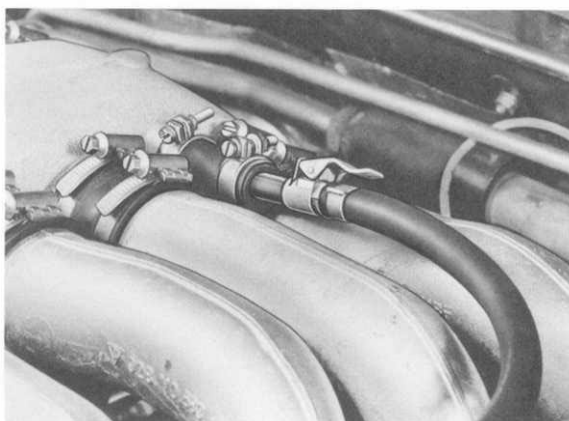
Be careful that sealing ball does not fall out when removing the cap nut.
Catch escaping fuel.

2. Connect pressure tester P 378.



5. Install lower air cleaner housing with air flow sensor.

6. Build up approx. 0.5 bar pressure.



7. Spray leak detecting spray on all connections. Bubbles will be produced at leaking points.

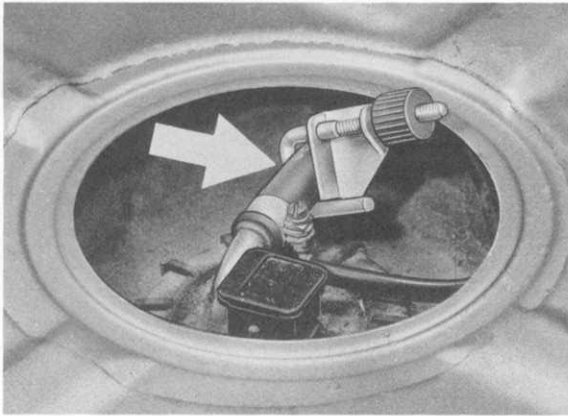
3. Start engine and measure fuel pressure at idle speed.

Specification: approx. 2.0 bar.

Pull off vacuum hose on left pressure regulator.

Specification: 2.3 . . . 2.7 bar.

4. If fuel pressure deviates from specified values, slowly squeeze return line with a clamp applied at rear next to the fuel level transmitter.



If pressure rises to less than 4 bar, check fuel filter or, if necessary, replace fuel pump.

5. If engine cannot be operated, pull off relay XVII and bridge terminals 30 and 87.
Fuel pump must run.

Specification: 2.3 . . . 2.7 bar.

TEST POINT 11

Alternator/Regulator

Peak voltage of the alternator could cause engine misfiring.

1. Remove drive belt and alternator.
2. Start engine. If misfiring is eliminated, check alternator and regulator.

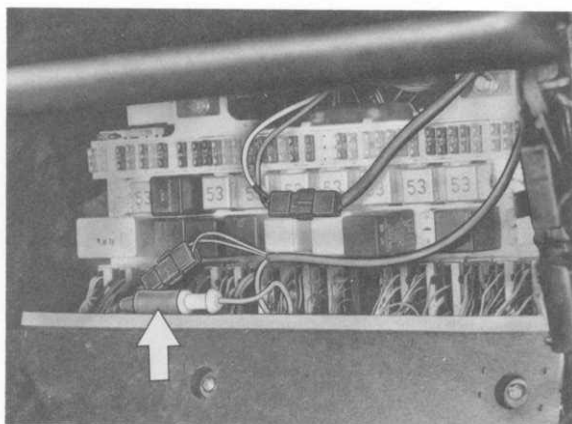
TESTING OXYGEN SENSOR OPERATION, UP TO '86 MODELS

Brief test

Precondition:

- Engine at operating temperature.
- Ideal speed correctly adjusted.
- Exhaust tester connected to extraction point in engine compartment.

1. Disconnect oxygen sensor plug, wait until state of equilibrium is reached and note CO value.



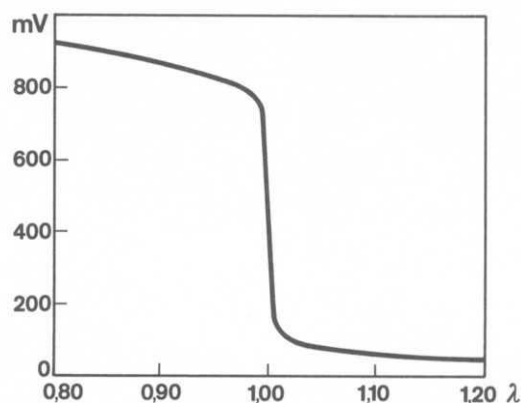
2. Disconnect vacuum line from fuel pressure regulator. The CO reading must show a considerable increase.
3. Reconnect oxygen sensor plug. The CO value must return to the specified $0.6 \pm 0.2\%$.

If CO value does not change, there is a fault in either the oxygen sensor or the LH control unit.

Testing sensor voltage

1. Precondition as for the "brief test"
2. Disconnect oxygen sensor plug.
3. Connect voltmeter to sensor half of plug and earth
4. The voltage must be in the 0.1 V - 1.0 V range (depending on level of oxygen in the exhaust).

Voltage characteristic of oxygen sensor for working temperature of 600°C.



Rich mixture Lean mixture
(air deficiency) (excessive air)

Testing lambda control function

1. Test precondition as for "brief test".
2. Disconnect oxygen sensor plug.
3. With a length of cable, briefly connect cable of control-unit side of plug to ground.

The CO value must increase.

If there is no change in the CO value check connection to LH control unit, if necessary replace control unit.

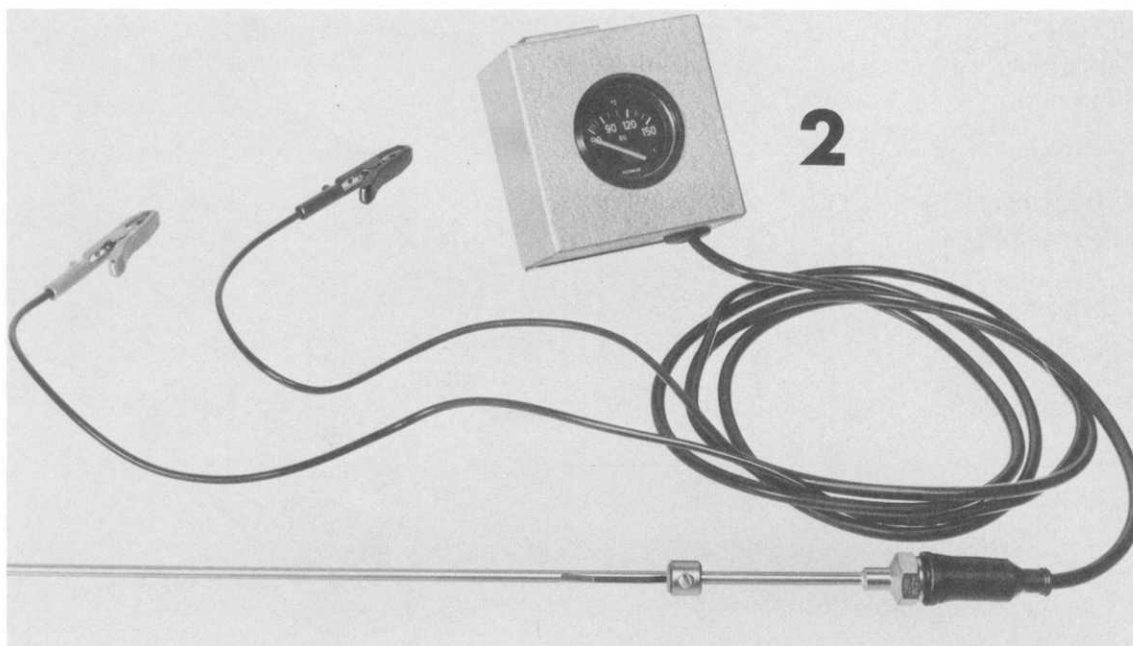
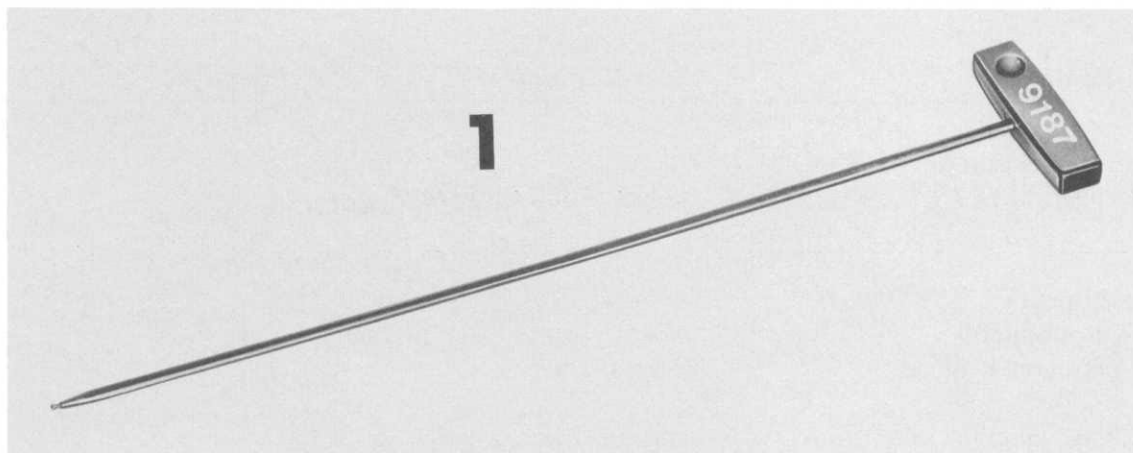
TESTING AND ADJUSTING SPECIFICATIONS FOR LH-JETRONIC – TYPE 928 S Rest of World

Beginning with 1984 Models
Engine Type M 28.21/22

Test Point	Specifications	Remarks
Electric fuel pump Delivery rate	at least 1350 cc/30 sec.	
Fuel pressure (engine stopped) Fuel pump bridged Check value for idle	2.5 ± 0.2 bar approx. 2 bar	
Leak test Min. pressure after 20 minutes	1 bar	
Idle adjustments Idle speed (rpm) CO (%)	700 + 500 0.5 – 1.5 R. o. W. 0.5 – 1.0 Australia, Switzerland, Sweden	

ADJUSTING IDLE SPEED AND CO — beginning with 1984 models
Engine Type M 28.21/22

TOOLS



No.	Description	Special Tool	Remarks
1	CO adjusting tool	9187	
2	Oil temperature tester	9122	

ADJUSTING IDLE SPEED AND CO

Note:

Requirement:

Engine in perfect mechanical condition.

Make adjustments as quickly as possible to avoid excessive heat in intake ports and consequently wrong CO values.

1. Take off right air intake hose.
2. Disconnect auxiliary air pump hose on air pipe and insert a suitable plug in open air pipe (e. g. rubber grommet for doors, Part No. 999.703.163.40).

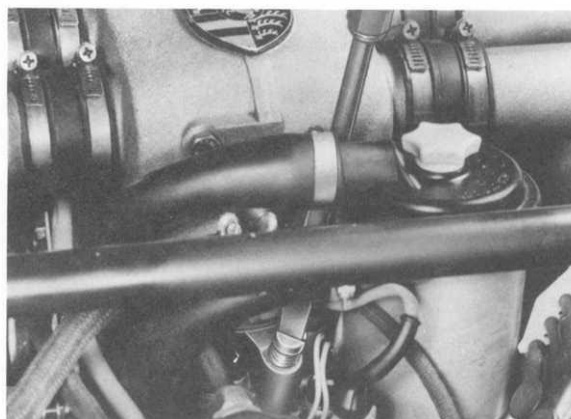


3. Install air intake hose.
4. Run engine to operating temperature (oil temperature approx. 80 to 90 °C/ 176 to 194 °F).
Use Special Tool 9122 to measure oil temperature.

Intake air temperature:
15 to 35 °C/59 to 95 °F.



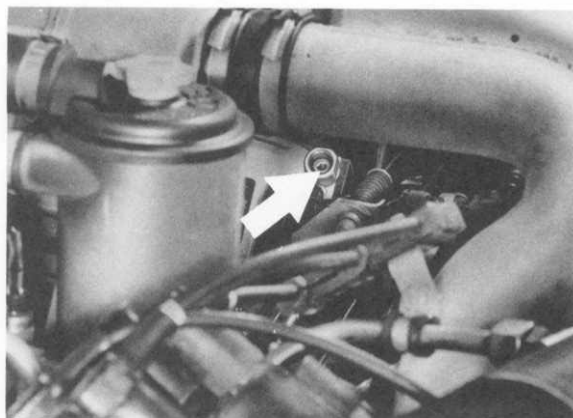
5. Connect CO tester and separate tachometer to supplier's instructions.
6. Turn control screw or bypass screw on throttle housing, until speed of 700 + 50 rpm is reached.



Note:

Use separate tachometer from tester or similar.

7. Adjust fuel/air mixture. Guide Special Tool 9187 into adjusting bore of heated wire air flow sensor and turn idle speed potentiometer accordingly.



Turning clockwise = richer mixture.
Turning counterclockwise = leaner mixture.

CO specifications:

0.5 – 1.5 % R. o. W.

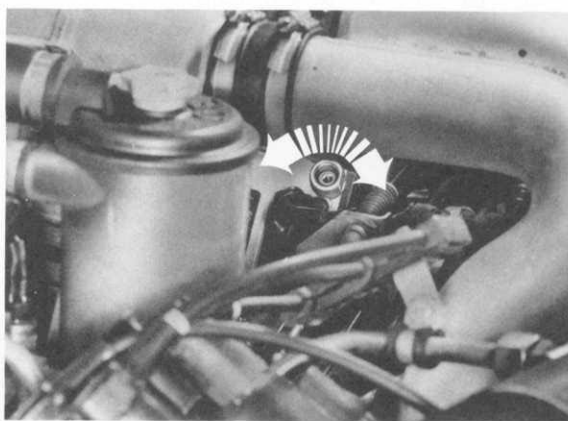
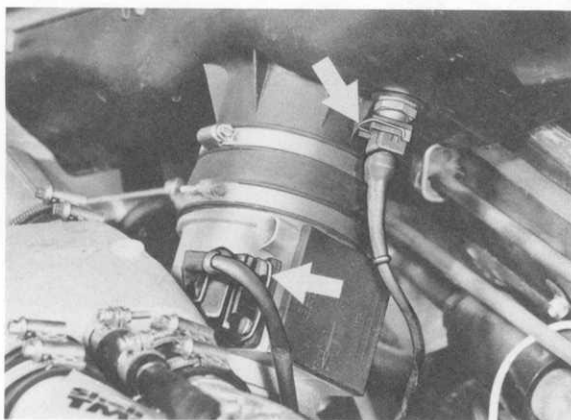
0.5 – 1.0 % Australia,
Switzerland,
Sweden

8. Remove plug in air pipe and reconnect hose.

REMOVING AND INSTALLING HEATED WIRE AIR FLOW SENSOR

Removing

1. Remove air intake hoses.
2. Take off upper air cleaner housing and remove hose on blowoff switching valve.
3. Unscrew unlosable hexagon head screws (13 mm wrench size) in lower air cleaner housing and remove lower housing with heated wire air flow sensor.
4. Pull off both multiple pin plugs.



3. Install and mount lower air cleaner housing and then tighten bottom hose clamp.

5. Loosen bottom hose clamp and take heated wire air flow sensor off of lower air cleaner housing.

Installing

1. Check O-ring in air guide housing for damage and correct fit. Lubricate O-ring with silicone grease, e. g. Bosch Ft 2v2.

REMOVING AND INSTALLING FUEL COOLER

Removing

1. Discharge air conditioner as described in Group 87 of Repair Manual 928.

Note:

Conform with safety precautions for handling refrigerants.

2. Disconnect battery.
3. Take off upper air cleaner housing and filter element.

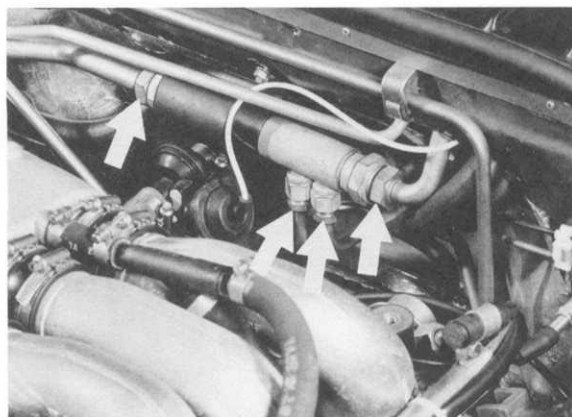
Pull off hose on blowoff switching valve and unscrew unlosable hexagon head screws (13 mm wrench size) in lower air cleaner housing.
4. Pull out lower air cleaner housing with air flow sensor and pull off plugs.

Press bar in direction of arrow while pulling off plugs.



5. Remove fuel cooler.

- a) First unscrew right refrigerant line coupling completely, while holding on hexagon of line.
- b) Unscrew both fuel line connections on fuel cooler, while holding on cooler each time.
- c) Unscrew bracket for fuel cooler.
- d) Unscrew left refrigerant line coupling, while holding on hexagon of line.



Installing

1. Install fuel cooler.

- a) Check that seals on refrigerant line connections are not damaged, replacing if necessary.
- b) First connect left refrigerant line on fuel cooler. Do not tighten coupling fully at this point.

- c) Connect and tighten both fuel lines on fuel cooler, while counterholding.
 - d) Connect right refrigerant line.
 - e) Tighten both refrigerant line couplings on fuel cooler, holding on hexagon each time and being careful that fuel cooler is not turned.
 - f) Install and bolt bracket for fuel cooler.
2. Mount air flow sensor together with lower air cleaner housing, connecting wires on air flow sensor and air cleaner.
- Tighten lower air cleaner housing mounting screws.
- Install filter element and upper air cleaner housing, connecting hose from blowoff switching valve on upper air cleaner housing.
3. Connect battery.
4. Start engine and run approx. 15 seconds while checking fuel line connections on fuel cooler for leaks.
Tighten fuel line connections if necessary.
5. Flush, discharge and charge air conditioner as described in Group 87 of Repair Manual 928.
-

SPECIFICATIONS FOR TESTING AND ADJUSTING LH-JETRONIC TYPE 928 S

85 MODEL ONWARD (32-VALVE ENGINES)

ENGINE TYPE M28. 43/44/45/46

Test	Specification	Remarks
Electric fuel pump delivery rate	min. 1350 cm ³ / 30 s	
Fuel pressure (engine off) fuel pump bridged	2.3.....2.7 bar	
Overpressure at idle speed	approx. 2 bar	
Leak test minimum pressure after 20 minutes	1 bar	
Idle speed adjust- ment Idle speed in rpm l/min	680 $\pm$ 20	
CO-content %	0.6 % $\pm$ 0.2 %	

EQUIPMENT CHART LH - JETRONIC - TYPE 928 S

85 MODELS ONWARD (32-VALVE ENGINES)

ENGINE TYPE M 28. 43/44/45/46

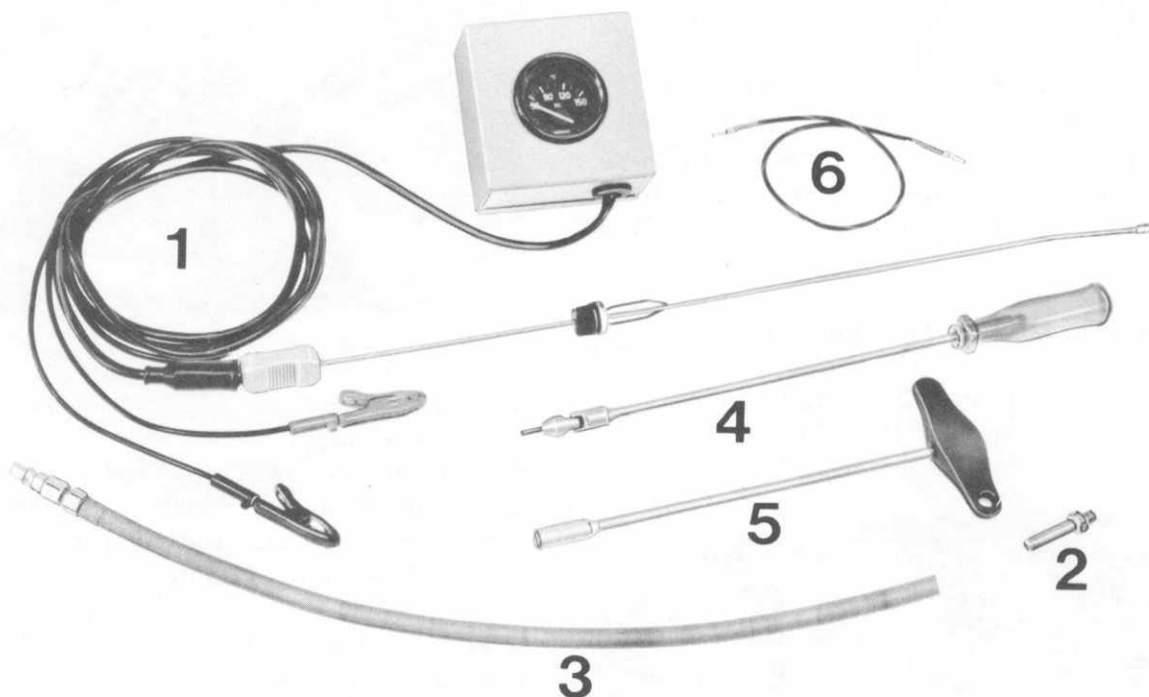
Electric fuel pump	Fuel filter	Fuel pres- sure damper (intake)	Fuel pressure regulator
928.608.104.01 Bosch No. 0580.464.017	928.110.253.00 Purolator No. 506.883.901.5	928.110.202.00 Bosch No. 0280.161.008	928.110.198.01 Bosch No. 0280.160.215

Hot wire air volume meter	NTC Temperature sensor II (dual function)	Throttle switch	Idle adjuster
928.606.141.00 Bosch No. 0280.214.001	928.606.126.00 Bosch No. 0280.130.032	944.606.113.01 Bosch No. 0280.120.308	928.606.161.00 Bosch No. 0280.140.509

Electric injection valves	LH-Jetronic control unit 85 models M28. 43/44	LH-Jetronic control unit 86 models M28. 43/44/45/46
928.606.120.00 Bosch No. 0280.150.706	928.618.123.03 Bosch No. 0280.002.50	928.618.123.04 Bosch No. 0280.002.503

ADJUSTING IDLE (32 VALVE ENGINE)

Tools



No.	Description	Special Tool	Remarks
1	Oil temperature tester with test probe	9122 + 9122/1	or US 8025
2	Adapter	US 8040	
3	Exhaust probe	US 4492	
4	Screwdriver	9230	
5	7 mm hexagon key		e.g. Hazet 428 - 7
6	Lead		Made locally

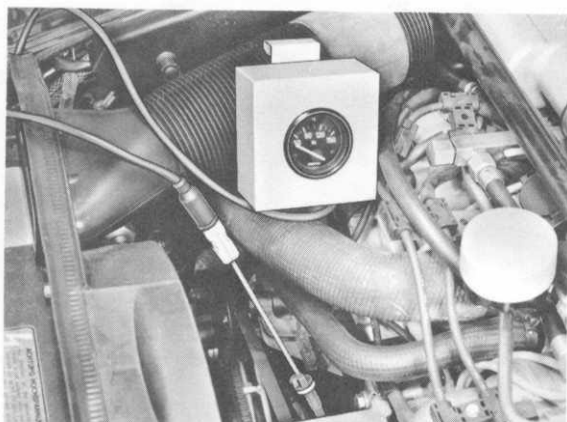
ADJUSTING IDLE (32 VALVE ENGINE)

Note

Adjusting Requirements:

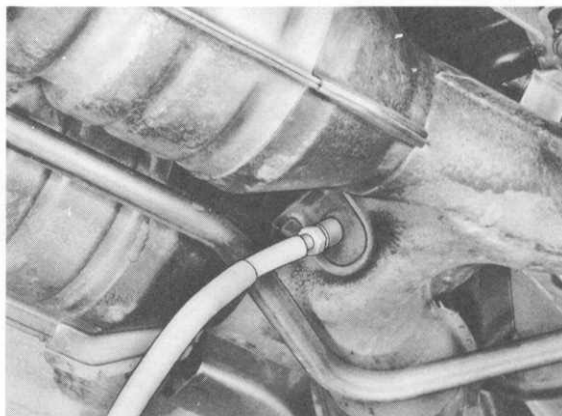
Engine in perfect mechanical condition.
Electric equipment switched off during adjustments. Adjustments made as quickly as possible to prevent heating up the intake ports and consequently causing wrong CO values.

1. Run engine to operating temperature (oil temperature 80 to 90° C). Use Special Tools 9122 + 9122/1 to check oil temperature: 15 to 30° C.



2. Disconnect oxygen sensor plug and connect CO tester according to supplier's instructions.

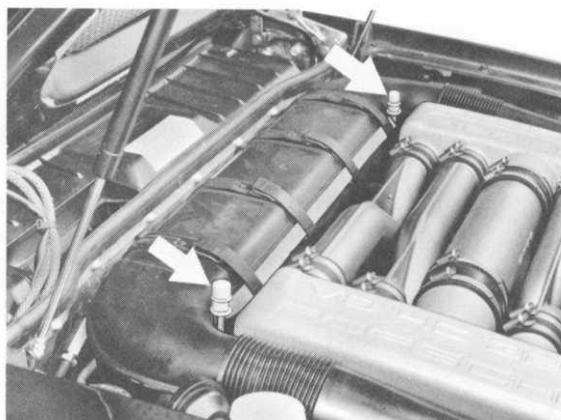
3. Install Special Tool US 4492 on CO testing pipe.



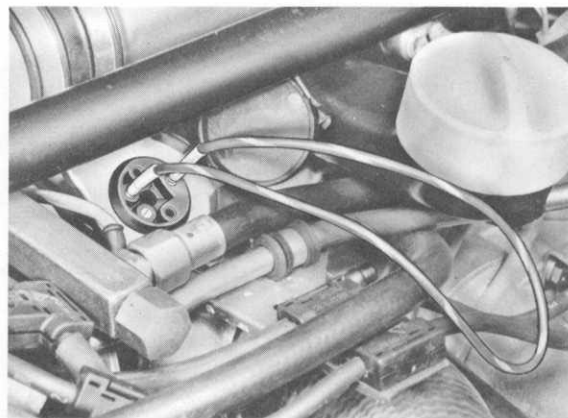
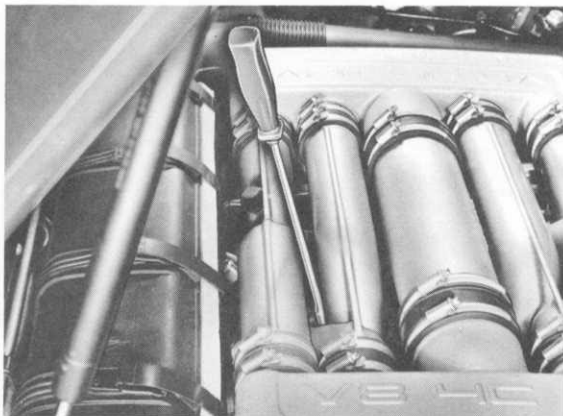
Note

It is recommended to use the test connection in area of air cleaner housing, if there is suspicion of erratic engine running or when troubleshooting.

CO testing pipe for cylinders 1 - 4 is on righthand side, or lefthand side for cylinders 5 - 8.



4. Check CO. If CO level deviates from specified value, correct the adjustment on air volume sensor. Use Special Tool 9230.



CO adjusting value: $0.6 + 0.2 \%$
 Turned clockwise - richer mixture
 Turned anticlockwise - leaner mixture

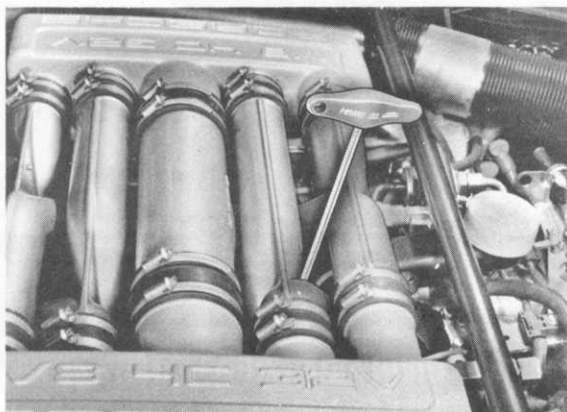
Note

If the CO level has to be corrected on the air volume sensor, remove plug in bore affording access to the idle speed CO adjusting screw after removal of the air volume sensor.



5. Connect oxygen sensor plug and insert plug in CO testing pipe after finishing adjustments.
6. Connect separate tachometer to supplier's instructions.
Idle speed adjusting value: 680 ± 20 rpm.
7. Check and adjust idle speed.
This requires stopping the idle speed charging control.

- a) Connect test jacks B and C with a piece of locally made wire. This stops idle speed charging control.
- b) Check and adjust speed with, for example, VAG Tester 1367.
8. Turn control screw (bypass) on throttle housing with a standard screwdriver, e.g. Hazet 428 - 7, until the specified speed of 680 ± 20 rpm.



9. Restore idle speed charging control after finishing adjustments (remove locally made wire on test jacks).
 10. Recheck adjusted values.
- _____

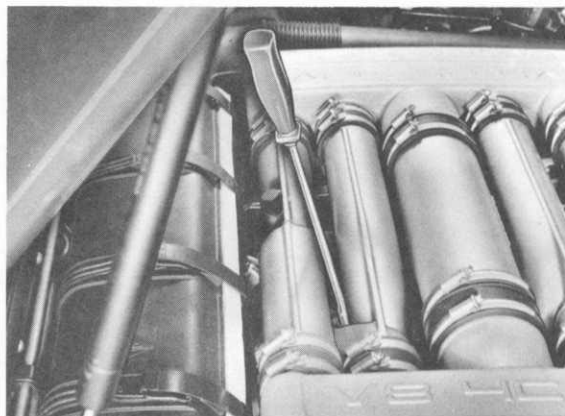
CORRECTING CO ADJUSTMENT ON AIR VOLUME SENSOR (32 VALVE ENGINE)

Note

If CO level deviates from the specified value, remove plug in bore affording access to the CO adjusting screw after removal of the air sensor.

Removing

1. Remove air sensor.
2. Drill hole in plug with a 2 mm dia. drill (up to stop on steel insert).
3. Pull out plug with a lefthand spiral drill (size no. 2).



3. Install a new plug in bore affording access to CO adjusting screw after finishing adjustments. Press in plug flush.

Note

Drilled plugs must never be reused.

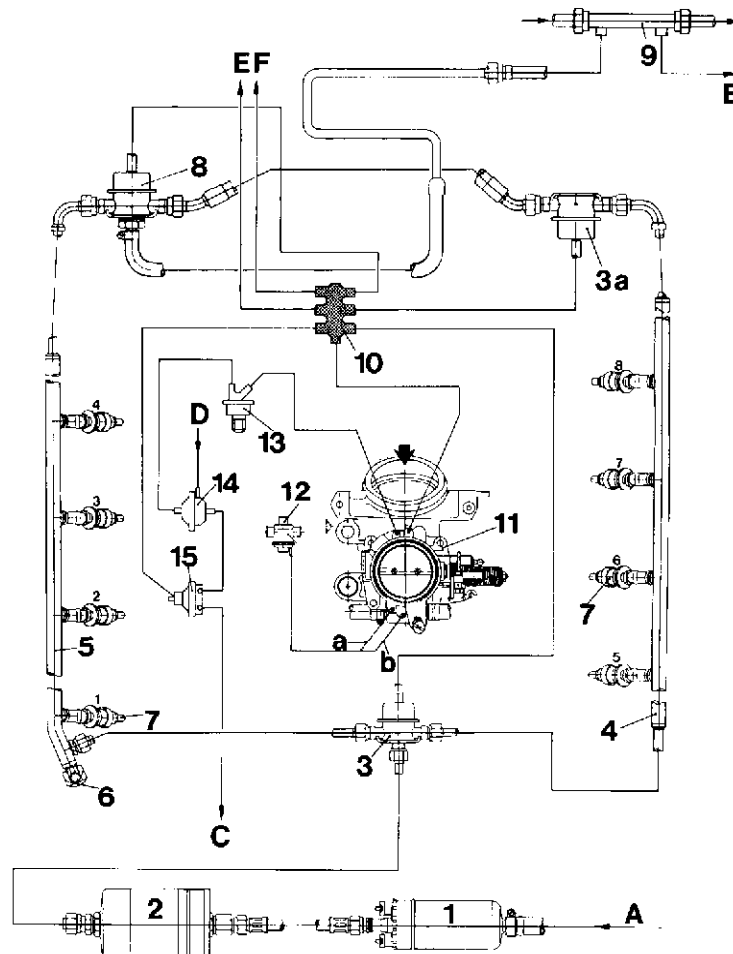
Installing

1. Install air sensor.
2. Adjust CO and engine idle speed. Turn CO adjusting screw accordingly with Special Tool 9230.

Turned clockwise - richer mixture
Turned anticlockwise - leaner mixture

FUEL PATH - LH-JETRONIC 928 S 85 MODELS ONWARD (32-VALVE ENGINES)

ENGINE TYPE M28. 43/44/45/46



a - connection, USA
b - connection, California

A - from fuel tank
B - to fuel tank
C - vent to oil filter neck

D - from activated charcoal cannister

E - to automatic transmission
F - to ECU

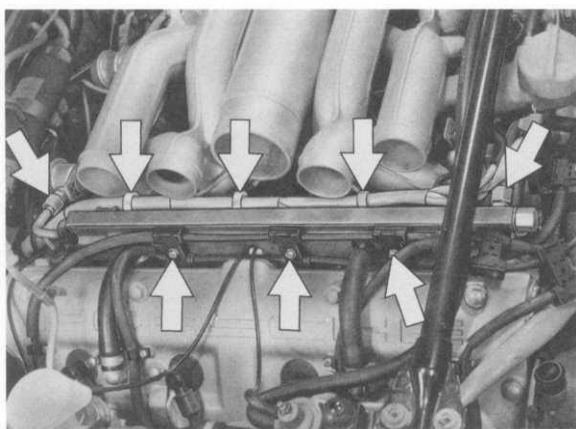
1 - fuel pump
2 - fuel filter
3/3a - pressure damper
4 - left-hand injection line
5 - right-hand injection line
6 - test point
7 - injectors
8 - pressure regulator

9 - fuel cooler
10 - underpressure distributor
11 - throttle valve body
12 - Blow-off valve
13 - Thermo switch
14 - air-bleed valve
15 - diaphragm valve

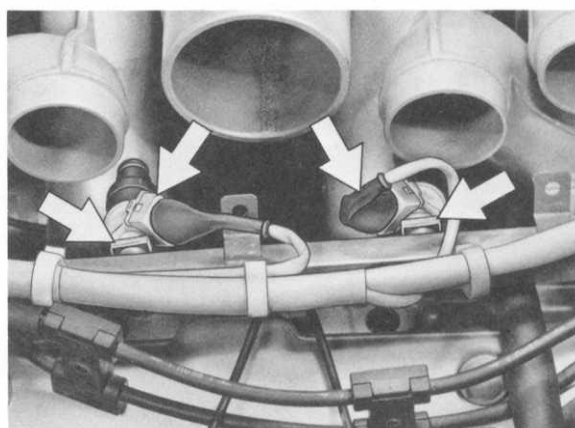
Removing and installing injection valves (32-valve engine)

Removal

1. Remove air intake hoses and air filter system as a unit.
2. Slacken holder of exhaust sampler and hose clamps on intake pipe and lift off intake manifold.
3. Remove both union nuts from fuel-distribution pipe, using a second open-end wrench to counter the nuts. Catch the fuel from the pipe in a suitable container.
4. Remove ignition lead and cable clip from distribution pipe. Disconnect distribution pipe from intake pipes and lift off.



5. Disconnect electrical connections, remove retainers and extract injection valves.



Installation

1. Replace injection valve seals. Apply a thin coat of oil to the housing bore.
2. Visual check to ensure system leak tightness.

Testing and adjustment values for Type 928 S 4 - 928 GT - 928 GTS (5,4l)

As from Model 87

Engine type M 28. 41/42/47/49/50

Test step	Test values		Special notes
Electric fuel pump Delivery quantity	min. 1250 cm ³ /30 s		
Fuel pressure (Engine standstill) Fuel pump relay bypassed	3.8 ± 0.2 bar		
Check value in idling condition	approx. 3.3 bar		
Leak test Minimum pressure after 20 min	3.0 bar		
Idle setting	without catalytic converter	Catalytic converter vehicles	* Idle and CO level adjustment is no longer possible on vehicles fitted with catalytic converter
928 GT Engine Type M28.47 Idle speed, rpm	775 ± 25	775 ± 25	
Idling speed rpm	675 ± 25	675 ± 25	rpm 775 ± 25
CO values %	0.5 - 1.5**	0.4 - 1.2*	* Measured before catalytic converter and Lambda probe connector <u>not</u> disconnected
HC values ppm	≤ 300	≤ 300*	

* Only CO adjustment is possible on vehicles without catalytic converter.

EQUIPMENT CHART - LH - JETRONIC - TYPE 928 S -

'87 MODELS ONWARD

ENGINE TYPE M28. 41/42

Electric fuel pump	Fuel filter	Fuel-line-pressure damper (feed)	Fuel pressure regulator ('87 models)
928.608.104.02 Bosch no. 0580.464.045	928.110.253.00 Purolator no. 506.883.901.5	928.110.202.01 Bosch no. 0280.161.034	928.110.198.02 Bosch no. 0280.160.262

Hot-wire airflow sensor	NTC Temperature sensor II (dual function)	Throttle-valve switch	Idle actuator
928.606.141.00 Bosch no. 0280.214.001	928.606.126.00 Bosch no. 0280.130.032	928.606.157.00 Bosch no. 0280.120.322	928.606.161.01 Bosch no. 0280.140.515

Electric injection valve	LH-Jetronic control unit	Ignition control unit	Knock sensor
928.606.119.02 Bosch no. 0280.150.730	928.618.123.10 Bosch no. 0280.002.504	928.618.124.11 Bosch no. 0227.400.035	911.606.141.00 Bosch no. 0261.231.008

Fuel pressure regulator ('88 models)	LH-Jetronic control unit ('88 models)	Ignition control unit ('88 models)	
928.110.198.03 Bosch no. 0280.160.297	928.618.123.11 Bosch no. 0280.002.504	928.618.124.12 Bosch no. 0227.400.035	

CHECKING IDLE - USA - and cars with catalytic converters

'87 MODELS ONWARD

ENGINE TYPE M28. 41/42

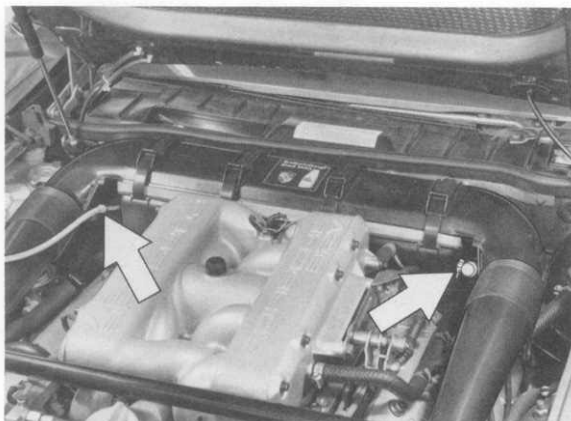
Note:

It is no longer necessary to adjust the idle speed and CO level of USA cars and cars with catalytic converters. Do not disconnect the oxygen sensor plug for the idle speed CO level check.

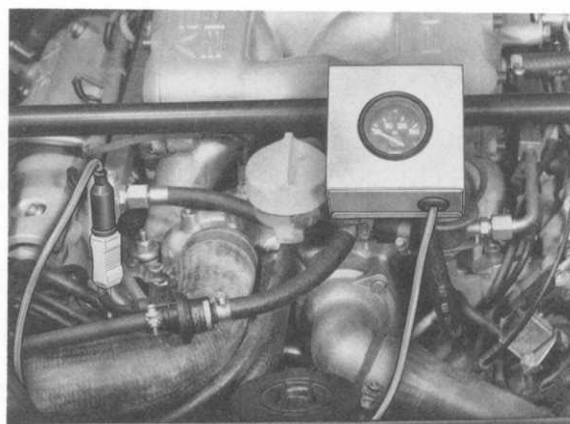
Test requirement:

Engine in perfect mechanical condition. Switch off all consumers during adjustment. Make adjustments as quickly as possible to avoid excessive heat at intake ports which would produce wrong CO values. Intake air temperature 15 - 35°C/59 - 95°F.

1. Push exhaust-gas extraction line over CO-connector of cylinders 1-4 or cylinders 5-8 in engine compartment.



2. Run engine to operating temperature (70 - 90°C oil temperature). Use oil-temperature tester, Special Tools 9122 + 9122/2.



3. Do not disconnect oxygen sensor plug. Connect CO meter and separate rev. counter in accordance with manufacturer's instructions.

Specified CO-level	0.4 - 1.2%
Idle speed	675 $\pm$ 25 rpm

ADJUSTING IDLE WITHOUT CATALYTIC CONVERTER

87 MODELS ONWARD

ENGINE TYPE M28. 41/42

Note :

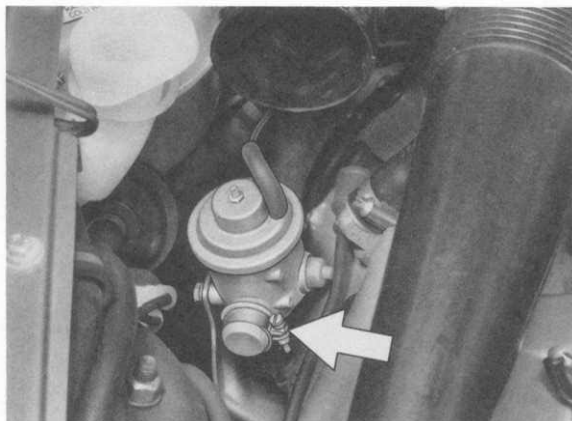
No provision is made for adjusting the idle speed. The adjustment at the throttle nozzle is no longer necessary.

Idle Speed CO -
Level Adjustment

Precondition for adjustment:

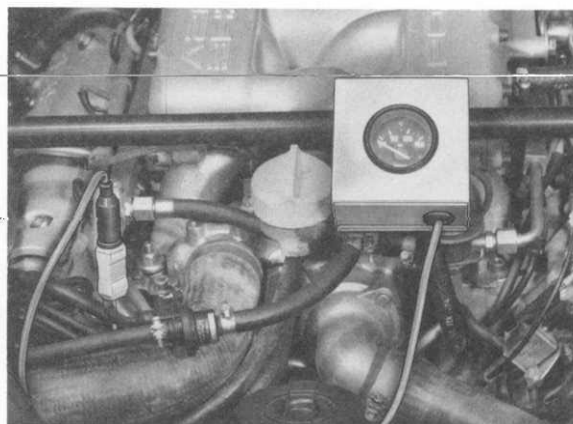
Engine in perfect mechanical order. Switch off all consumers during adjustment. Make adjustments as quickly as possible to avoid excessive heat at intake ports which would result in incorrect CO readings. Intake air temperature 15 - 35°C.

1. Disconnect additional air pump hose at changeover valve and seal changeover valve with a suitable plug.



2. Reconnect air intake hose

3. Run engine to operating temperature (70-90°C oil temperature). Use oil temperature meter, special tool 9122 +9122/2.



4. Check CO-level. If the CO-level is not within specified limits, correct setting of CO-potentiometer. Remove plug covering hole which provides access to CO-adjustment.



Specified CO-value: 0.5 - 1.5%
Turning clockwise = richer mixture
Turning anticlockwise = leaner mixture

5. Insert plug (blue) spare part No.
944 606 935 01 in CO-adjustment
screw aperture.

Recheck idle speed

Connect separate rev. counter in
accordance with manufacturer's
instructions

Idle speed 675 ± 25 rpm

FUEL PATH - LH-JETRONIC 928 S, 87 MODELS ONWARD

ENGINE TYPE M28.41/42

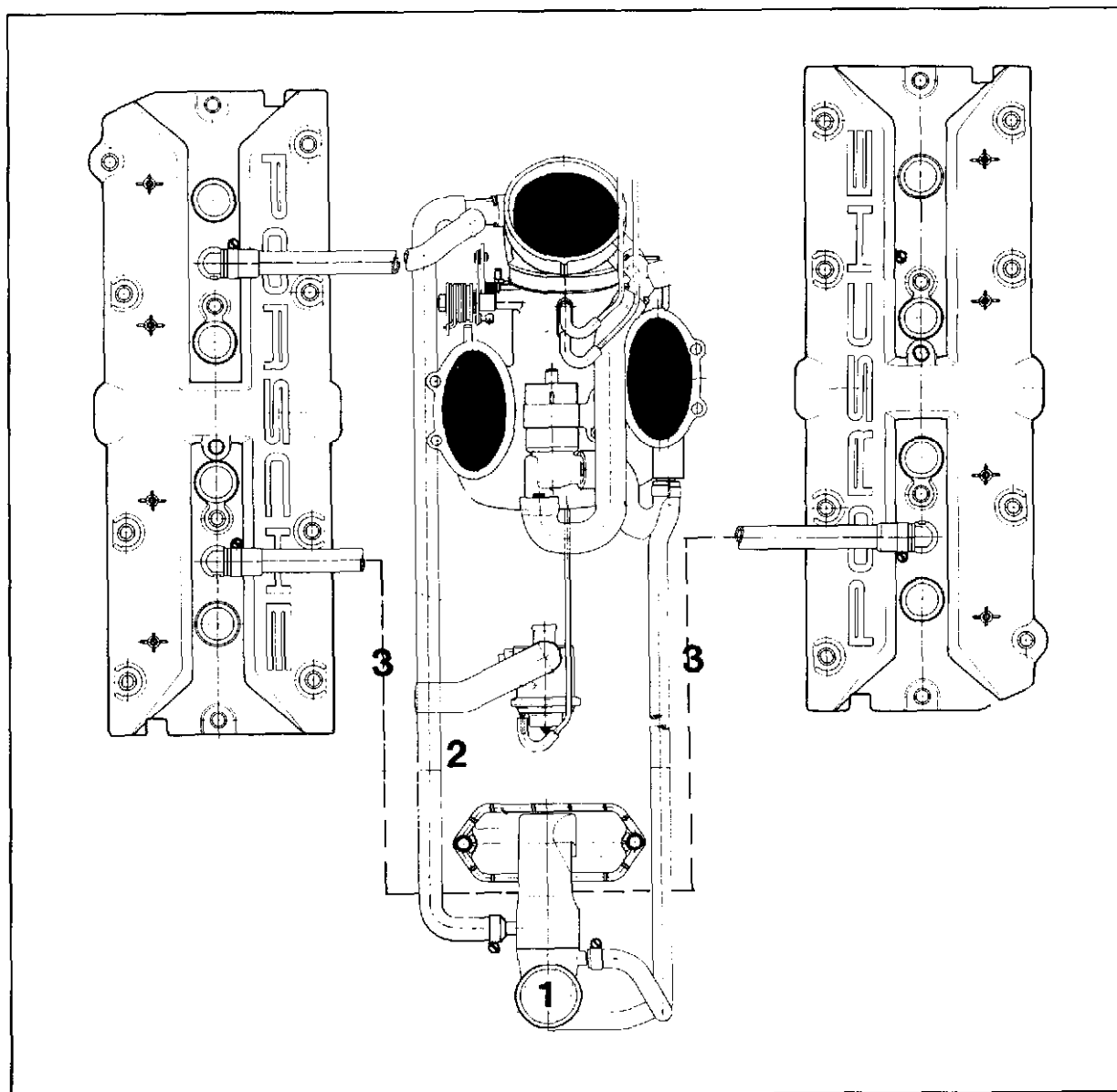
- 1 - Fuel pump
- 2 - Fuel filter
- 3 - Fuel line
- 4 - Distributor-type fuel-injection tubes
- 5 - Injectors

- A - Throttle housing
- B - Idle speed actuator
- C - Intake jet pump
- D - Pressure damper
- E - Pressure regulator
- F - Vacuum valve
- G - Electric tank breather valve
- H - Oil filler neck
- I - Secondary-air valve
- K - Vacuum-operated switch valve (tune-intake flap)
- L - Vacuum unit (tune-intake flap)

- a - from fuel tank
 - b - to fuel tank
 - c - from activated charcoal cannister
 - d - from vacuum reservoir
 - e - to automatic transmission
- _____

Modified breather for crankcase and cylinder heads

Engine Type M 28.49/50



1337-24

1 Oil filler neck: de-icer valve is deleted.

2 Hose connection between oil filler neck and throttle body modified, throttle bore
– Ø 5 mm – for this breather hose is now located in the oil filler neck.

3 Additional breather hose between right-hand and left-hand rocker cover, throttle bores in the
rocker cover for cylinder nos. 1 to 4 are deleted.

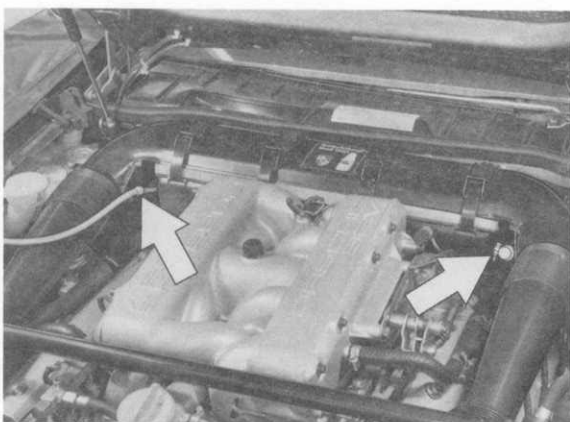
TESTING OXYGEN SENSOR OPERATION, '87 MODELS ONWARD

Testing sensor voltage

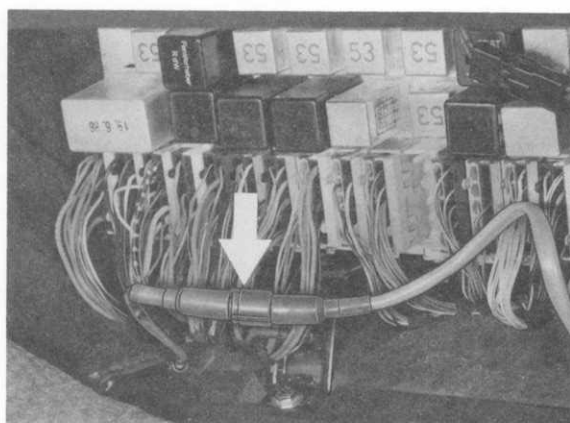
Precondition:

- Engine at operating temperature.

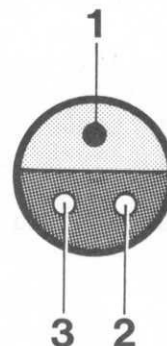
1. Connect exhaust tester to an extraction point in engine compartment.



2. Disconnect oxygen sensor plug.

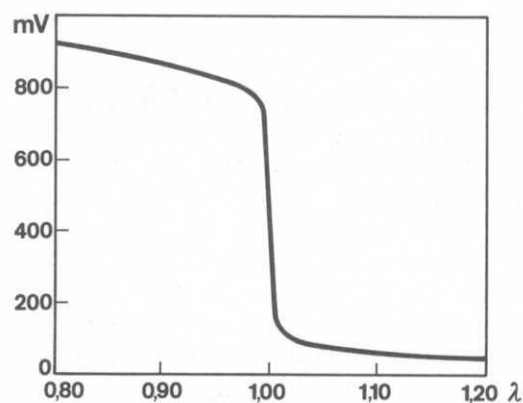


3. Connect voltmeter to terminal 1 (sensor half of plug) and ground.



4. The voltage must be in 0.1 V to 1.0 V range (depending on concentration of oxygen in exhaust)

Voltage characteristic of oxygen sensor for working temperature of 600°C.

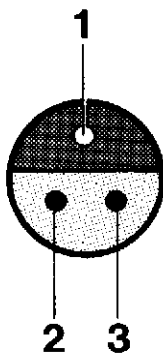


Rich mixture Lean mixture
(air deficiency) (excessive air)

5. Disconnect vacuum line from fuel pressure regulator. The voltage signal must increase.

Testing lambda control function.

1. Precondition as for the "sensor voltage" test.
2. Disconnect oxygen sensor plug.
With length of cable, briefly connect terminal 1 of control-unit side of plug to ground.



The CO reading must increase.

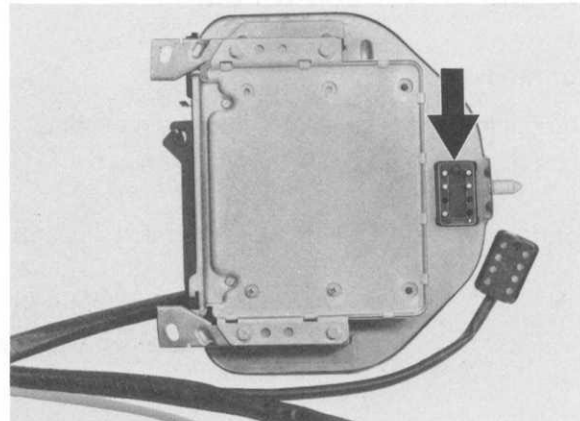
Note:

Do not conduct this test for any longer than required to detect a change in the CO reading of the exhaust tester.

If there is no change in the CO reading, check connection to LH control unit and LH control unit coding (see page 24 - 221), if necessary, replace control unit.

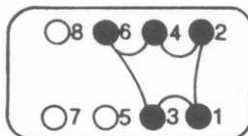
LH 2.3 CONTROL UNIT CODING, 87 MODELS ONWARD

Only one controlled unit is used. The appropriate characteristic can be called up by means of the coding plug on the rear of the control-unit holder.

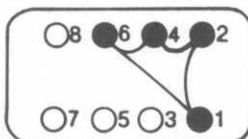


Switching diagram

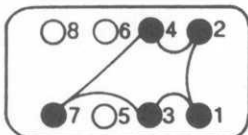
Type



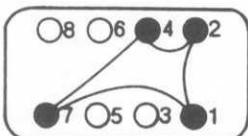
R.o.W. without catalytic converter,
manual transmission



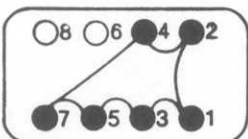
R.o.W. without catalytic converter,
automatic transmission



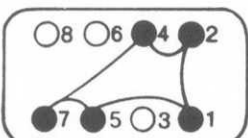
R.o.W. with catalytic converter
and USA,
manual transmission



R.o.W. with catalytic converter
and USA,
automatic transmission



Australia, manual transmission



Australia, automatic transmission

Coding for LH control unit

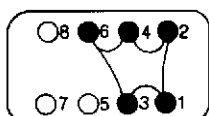
For Model 89 onwards

The coding connector is fitted to the mounting plate for the LH and EZK control units.

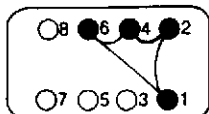
Wiring diagram

Version

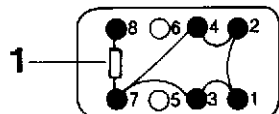
Rest of world without catalytic converter,
manual transmission



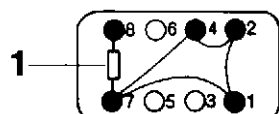
Rest of world without catalytic converter,
automatic transmission



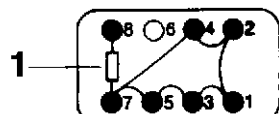
Rest of world, USA with catalytic converter,
manual transmission



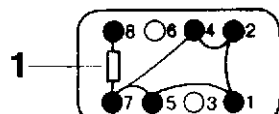
Rest of world, USA with catalytic converter,
automatic transmission



Fuel grade 91 RON, with catalytic converter,
manual transmission



Fuel grade 91 RON, with catalytic converter,
automatic transmission



162 - 24

1 - resistor 150 Ω

REMOVING AND INSTALLING ROTARY IDLE ACTUATOR

'87 MODELS ONWARD

ENGINE TYPE M28. 41/42

Removing:

1. Disconnect battery ground strap behind tool tray.
Place fender and bumper guards in position.

2. Unbolt and remove transverse strut.

Note:

Car must be standing on its wheels, transverse strut is under tension.

3. Remove air intake hoses and air filter as a complete unit.
Disconnect vacuum hose from brake booster and remove.

4. Unbolt bracket for accelerator linkage and TDC sender from intake manifold.

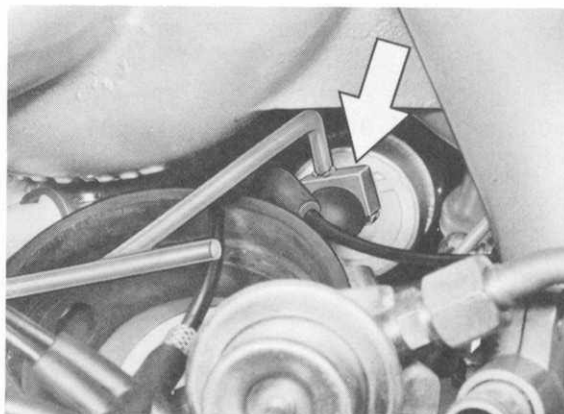
5. Unbolt holder for fuel line and crankcase breather. Remove air-flow sensor.

6. Remove left-hand and right-hand injection-valve covers. Remove both union nuts from fuel-distribution line, counterholding with a second open-ended wrench. Catch any escaping fuel in a suitable container. Disconnect distribution line from intake pipes and lift out.

7. Mark vacuum hoses and disconnect. Break electrical connection between thermostatic switch and intake pipe.

8. Unbolt fuel-line-pressure damper and holder. Disengage throttle valve actuator cable and disconnect plug from throttle valve.

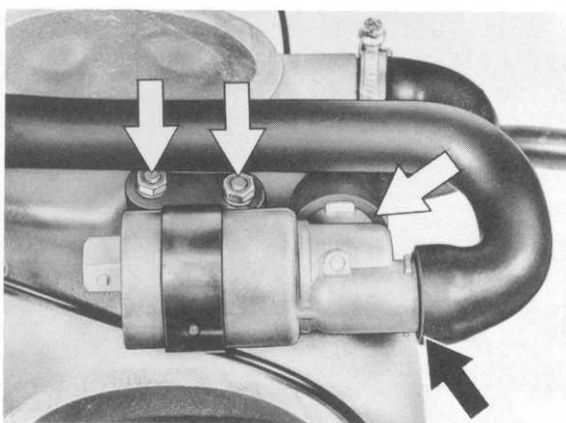
9. Remove air-guide dome from throttle-valve housing. Use Special Tool 9266 to disconnect electrical plug from rotary idle actuator.

Note:

Take care to ensure that the plug gasket remains in the male half once the connection is broken and does not become detached.

10. Unbolt intake manifold from cylinder head and lift slightly. Disconnect all remaining vacuum and crankcase breather hoses and remove intake manifold.

11. Unbolt throttle-valve housing from intake manifold and remove rotary idle actuator.



Installing

1. Always renew gaskets for intake manifold. Take care to ensure that the vacuum hoses and breather hoses are correctly routed.

2. Carry out visual inspection to check for leaks.

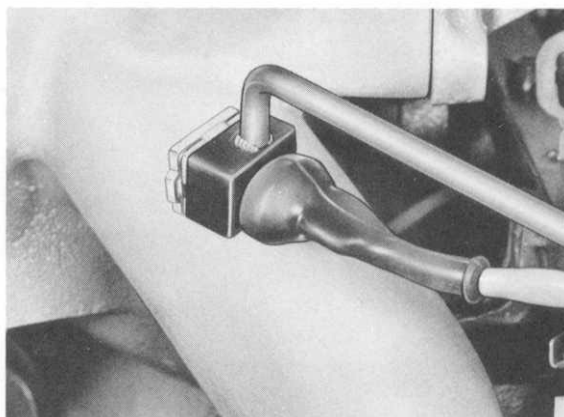
3. Check that vacuum hoses and hose clamps are correctly seated.

Throttle-valve housing to intake manifold attachment, tightening torque 20 Nm (14 ftlb).

Intake manifold to cylinder head attachment, self-locking nuts, tightening torque 15 Nm (11 ftlb).

Note:

Special Tool 9266 can also be used to open other 2-pole connectors.

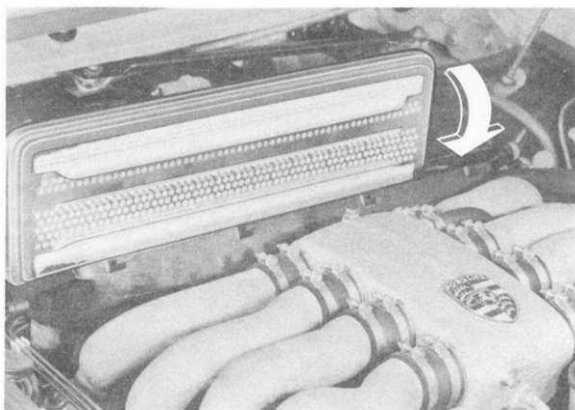


TIGHTENING TORQUE FOR FUEL SYSTEM

Location	Description	Torque Nm (ftlb)	Threads
Insert for fuel injector in cylinder head		15 (11)	M 24 x 1.5
Injection line to fuel distributor	Hollow bolt	11 (8)	M 10 x 1
Injection line to fuel injector	Coupling nut	20 (14)	M 12 x 1.5
Feed line to fuel distributor	Coupling nut	30 (22)	M 16 x 1.5
Feed line to fuel damper	Coupling nut	15 (11)	M 10 x 1
Return line to control pressure regulator to mixture control	Hollow bolt	11 (8)	M 8 x 1
	Coupling nut	15 (11)	M 10 x 1
Feed line to cold start valve to mixture control	Hollow bolt	15 (11)	M 10 x 1.5
	Coupling nut	15 (11)	M 10 x 1
Return line to mixture control	Hollow bolt	15 (11)	M 8 x 1
Feed line to fuel distributor to fuel damper	Coupling nut	20 (14)	M 12 x 1.5
	Coupling nut	20 (14)	M 12 x 1.5
Feed line to fuel damper	Coupling nut	20 (14)	M 12 x 1.5
Return line	Hollow bolt	32 (23)	M 12 x 1.5
Control pressure regulator adapter		15 (11)	M 10 x 1
Distributor injection tube collar nut	Collar nut	22 (16)	M 12 x 1.5
Mixture control to rubber mount	Hexagon nut	6 (4)	M 6

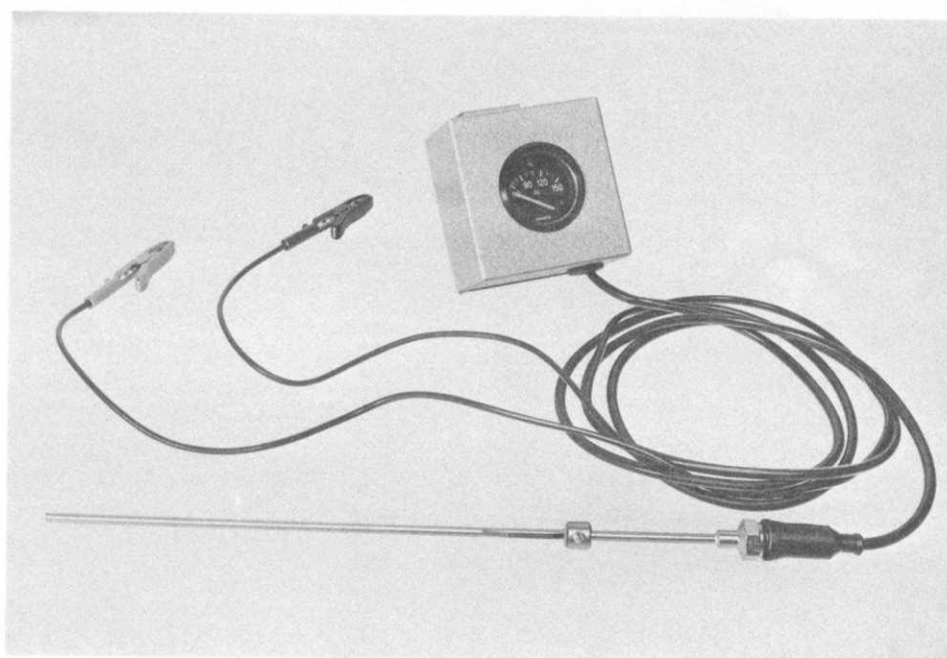
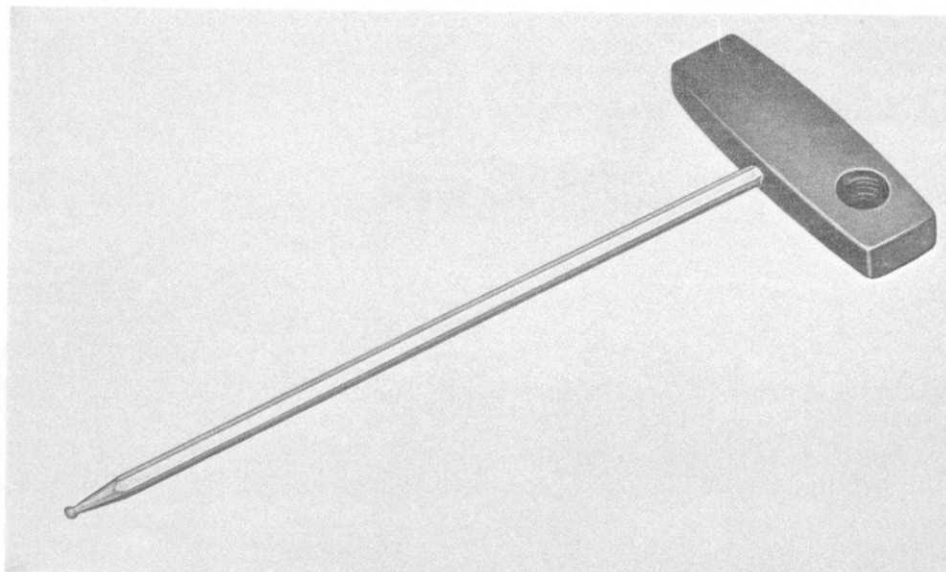
REPLACING AIR CLEANER ELEMENT

1. Detach air intake hoses from air cleaner housing, making sure that each hose is still connected to the camshaft drive belt cover.
2. Release rubber fasteners, take off air cleaner upper section and remove filter element.
3. Make sure that filter element has correct position and fit.



ADJUSTING IDLE AND CO

TOOLS



No.	Description	Special Tool	Remarks
1	Adjusting wrench	9134	
2	Oil temperature tester	9122	or US 8025

ADJUSTING IDLE AND CO

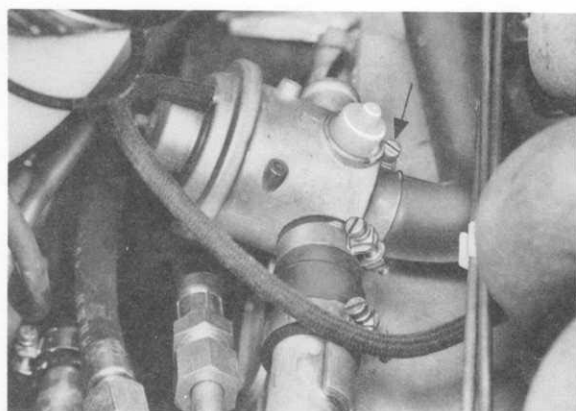
Note

Requirements:

Engine in perfect mechanical condition.
Ignition timing set correctly.

Adjustments must be made as quickly as possible,
to prevent excessive heat in the intake ports.

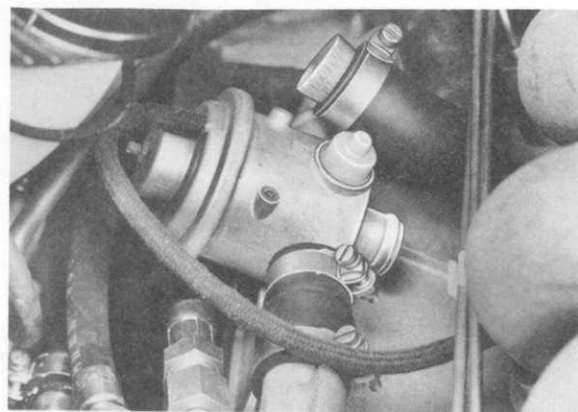
1. Detach right air intake hose.
2. Remove air cleaner upper section.
3. Detach air hose at diverter valve and insert a suitable plug.
4. Install air cleaner upper section and air intake hose.
5. Run engine to operating temperature (80 to 90° C/
176 to 194° F oil temperature).
Use Special Tool 9122 or US 8025.



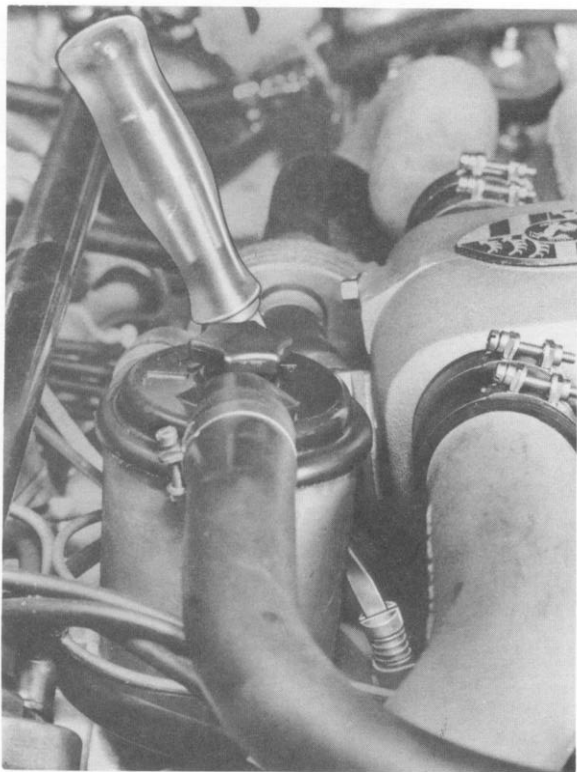
6. Connect CO level tester and separate tachometer
according to instructions of manufacturer.

Note

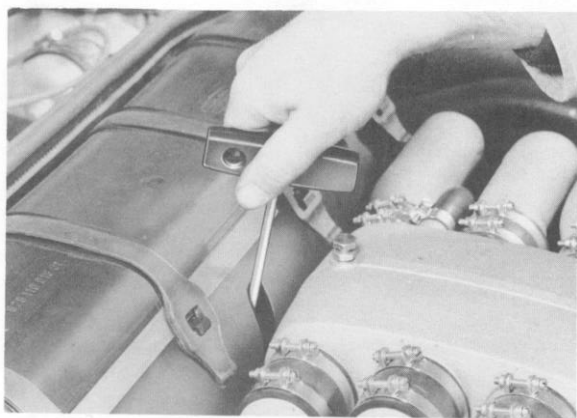
Make adjustments as quickly as possible to avoid
excessive heat in intake ports and consequently
wrong CO values.



7. Adjust control screw on throttle housing until specified speed is reached.



8. Adjust mixture. Insert Special Tool 9134 through funnel-shaped opening into spring-loaded driver in mixture control unit. Press down special tool approx. 18 mm to engage spring-loaded drive in mixture control screw.

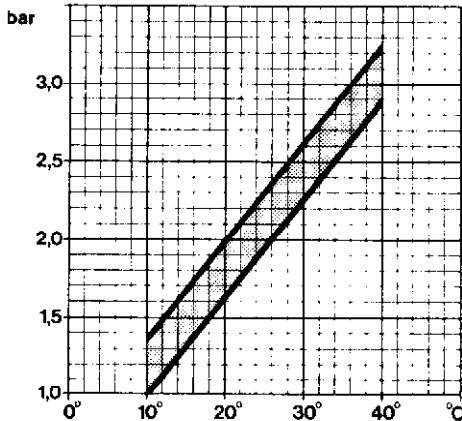


Important

It is essential to conform with the following points.

- a) Always make CO level adjustments from lean to rich. Example: when mixture is too rich, first turn mixture control screw counterclockwise further than necessary and then clockwise to adjust to specifications.
 - b) Just turn control slightly, since the smallest adjustment will change CO level considerably.
9. Turn clockwise for richer
or
counterclockwise for leaner mixture.
 10. Remove special tool.
 11. Accelerate engine briefly.
 12. Wait until CO tester shows exhaust gas concentration at idle speed.
See page 25 - 6 for adjusting data.
If necessary, repeat adjusting procedures.
 13. Recheck idle speed and correct, if necessary.
 14. Remove plug after completion of adjustments.
Attach air hose to diverter valve.

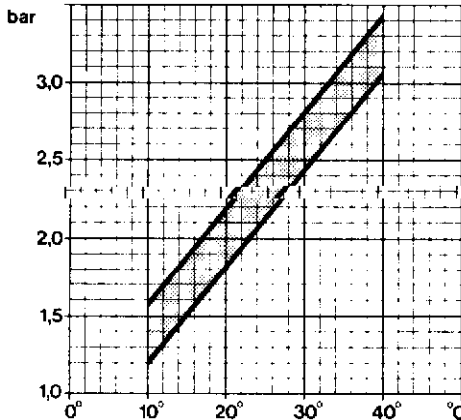
TESTING AND ADJUSTING SPECIFICATIONS FOR CIS (1978/1979 Models Automatics)

Test	Specification	Remarks
Electric fuel pump Delivery rate with 1 fuel pump with 2 fuel pumps	at least 1120 cc/30 sec. at least 1360 cc/30 sec.	
Control pressure "cold" (= ambient temperature)	Diagram for control pressure regulator Part No. 928,606,109,02 Bosch No. 0438,140,053 Test vacuum 460 - 600 mbar (350 - 450 mmHg) 	
Control pressure "warm"		
Test with pressure (without vacuum)	2,8 ... 3,2 bar	
Vacuum pump connected on intake connection of control pressure regulator. With test pressure of 460 - 600 mbar (350 - 450 mmHg)	3,4 ... 3,8 bar	

Test	Specification	Remarks
System pressure Testing value Adjusting value	5.2 ... 5.8 bar 5.3 ... 5.5 bar	
Leak test (engine warm) Min. pressure after 10 minutes 20 minutes 30 minutes	2.0 bar 1.7 bar 1.6 bar	
Fuel injectors Opening pressure	3.0 ... 4.1 bar	

Pressures listed in Test Value Chart in bar.

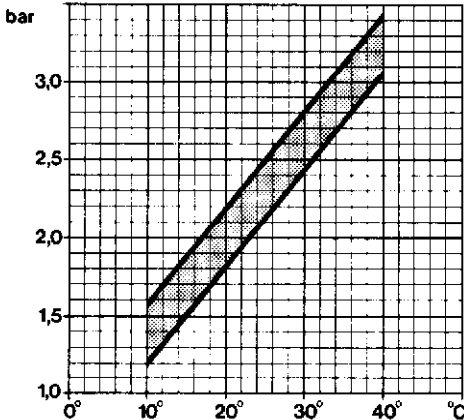
TESTING AND ADJUSTING SPECIFICATIONS FOR AFC (1979 Models - Manuals)

Test	Specification	Remarks
Electric fuel pump Delivery rate with 2 fuel pumps	at least 1360 cc/ 30 seconds	
Control pressure "cold" (= ambient temperature)	Diagram for control pressure regulator Part No. 928.606.109.03 Bosch No. 0438.140.063 Test vacuum 450 - 550 mbar (340 - 420 mmHg) 	
Control pressure "warm"		
Test with pressure (without vacuum)	2,8 ... 3,2 bar	
Connect vacuum pump on intake pressure connection of control pressure regulator. Test pressure 450 - 550 mbar (340 - 420 mmHg)	3,4 ... 3,8 bar	

Test	Specification	Remarks
System pressure Testing value Adjusting value	5,2 ... 5,8 bar 5,3 ... 5,5 bar	
Leak test (engine warm) Min. pressure after 10 minutes 20 minutes 30 minutes	2,0 bar 1,7 bar 1,6 bar	
Fuel injectors Opening pressure	3,0 ... 4,1 bar	

Pressures listed in Test Value Chart in bar.

TESTING AND ADJUSTING SPECIFICATIONS FOR K-JETRONIC
(1979 Models - Manuals - USA and Japan)

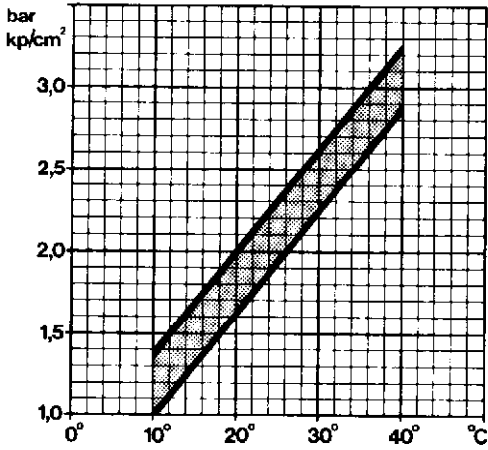
Test Point	Specification	Remarks
Electric fuel pump Delivery rate with 2 fuel pumps	at least 1360 cc/30 seconds	
Control pressure "cold" (= ambient temperature)	Diagram for warm-up control Part No. 928.606.109.03 Bosch No. 0438.140.063 Test vacuum 450 - 550 mbar (340 - 420 mmHg) 	
Control pressure "warm"	Test with pressure (without vacuum) 2.8 ... 3.2 bar Connect vacuum pump for test on intake pressure connection of warm-up control. Test pressure 450 - 550 mbar (340 - 420 mmHg) 3.4 ... 3.8 bar	

Test Point	Specification	Remarks
System pressure Testing value Adjusting value	5.2 ... 5.8 bar 5.3 ... 5.5 bar	
Leak test (engine warm) Min. pressure after 10 minutes 20 minutes 30 minutes	2.0 bar 1.7 bar 1.6 bar	
Fuel injectors Opening pressure	3.0 ... 4.1 bar	

Pressures listed in Test Value Chart in bar.

TESTING AND ADJUSTING SPECIFICATIONS FOR K-JETRONIC (1981/1982 Models)

Engine M 28.09 and M 28.10

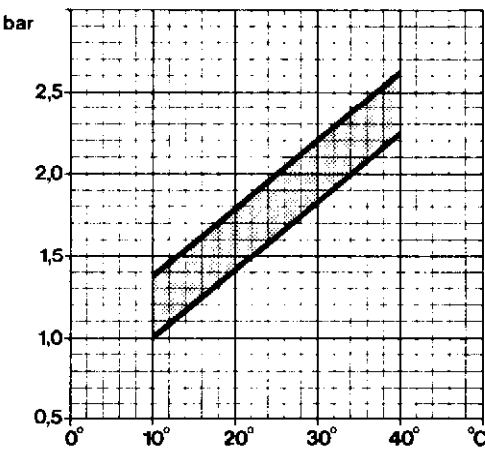
Test Point	Specification	Remarks
Electric fuel pump Delivery rate with 1 fuel pump	at least 1120 cc/30 sec.	
Control pressure "cold" (= ambient temp.)	Diagram for warm-up control Part No. 928.606.109.05 Bosch No. 0438.140.087 Test vacuum 450 - 550 mbar (340 - 420 mmHg) 	
Control pressure "warm"	Test with pressure (without vacuum) 2,8 . . . 3,2 bar Connect vacuum pump for test on intake pressure connection of warm-up control. Test pressure 460 - 600 mbar (350 - 450 mmHg) 3,4 . . . 3,8 bar	

Test Point	Specification	Remarks
System pressure Testing value Adjusting value	5,2 . . . 5,8 bar 5,3 . . . 5,5 bar	
Leak test (engine warm) Min. pressure after 10 minutes 20 minutes 30 minutes	2,7 bar 2,6 bar 2,5 bar	
Fuel injectors Opening pressure	3,0 . . . 4,1 bar	

Pressures listed in Test Value Chart in bar.

TESTING AND ADJUSTING SPECIFICATIONS FOR K-JETRONIC (1981/1982/1983 Models) 928 S

Engine M 28.11 and M 28.12

Test Point	Specification	Special Instructions
Electric fuel pump Delivery rate with 1 fuel pump	at least 1120 cc/30 sec.	
Control pressure "cold" (equal to ambient temperature)	Diagram for warm-up regulator Part No. 928.606.109.04 Bosch No. 0438.140.086 With test vacuum 450 - 550 mbar (340 - 420 mmHg) 	
Control pressure "warm"		
Test with atmospheric pressure (without vacuum)	2,8 . . . 3,2 bar	
Connect vacuum pump to test on intake connection of warm-up regulator. With test pressure 460 - 600 mbar (350 - 450 mmHg)	3,4 . . . 3,8 bar	

Test Point	Specification	Special Instructions
System pressure		
Testing value	5,2 ... 5,8 bar	
Adjusting value	5,3 ... 5,5 bar	
Leak test (engine warm)		
Min. pressure after 10 minutes	2,7 bar	
20 minutes	2,6 bar	
30 minutes	2,5 bar	
Fuel injectors		
Opening pressure	3,0 ... 4,1 bar	

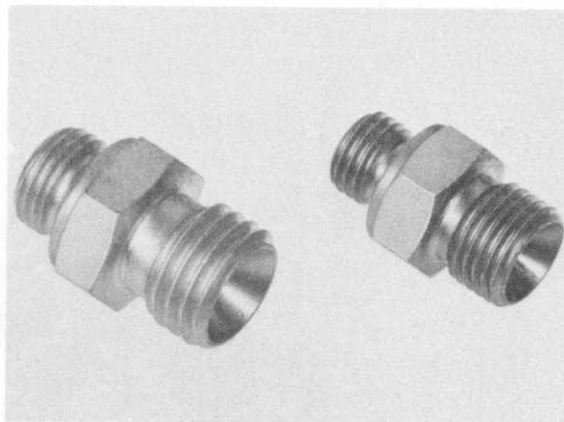
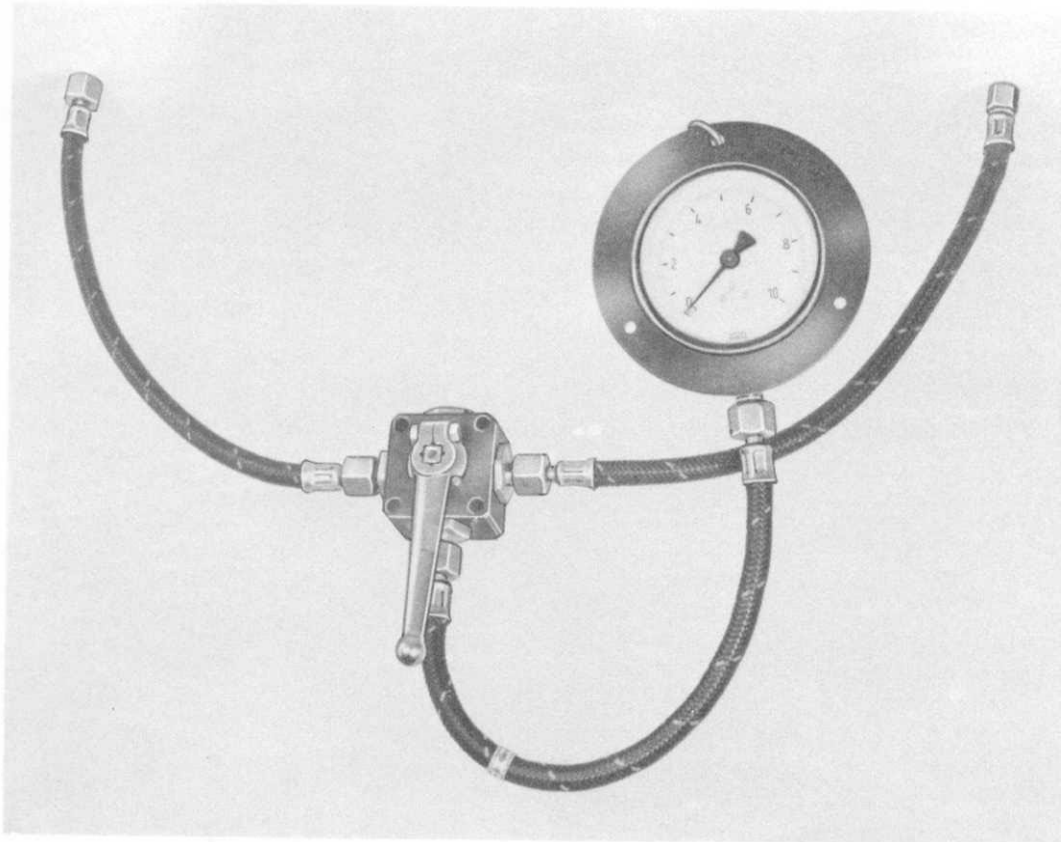
Pressures listed in Test Value Chart in bar.

Test Point	Specification				Special Instructions
		Europe	USA, Japan + Canada	Australia + Sweden	
Idle adjustment					
Idle speed (rpm)	78/79 models	700 + 50	800 ± 50	700 ± 50	
	80/81/82 mod.	700 ± 50	750 ± 50	700 ± 50	
	80/81/82 mod. 928 S	700 + 50	---	700 ± 50	
CO level (%)	78/79 models	2,0 to 3,0 *	2,0 to 4,0 *	2,0 to 3,0 *	
	80/81/82 mod.	1,0 to 2,0 *	0,4 to 0,8 **	1,0 to 2,0 *	
	80/81/82 mod. 928 S	1,5 to 2,5 *	---	1,0 to 2,0 *	

* Air pump disconnected.

** Measured in front of catalytic converter with oxygen sensor plug disconnected.

TOOLS

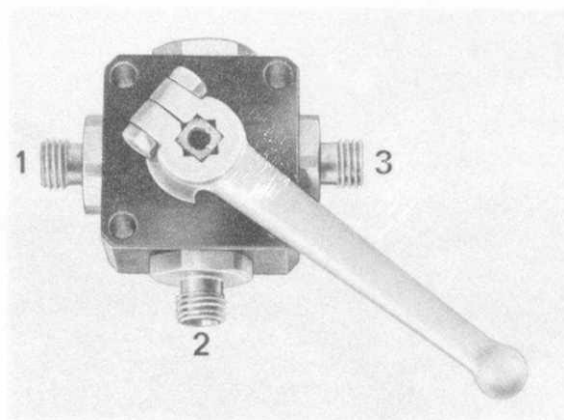


No.	Description	Special Tool	Remarks
1	Pressure gauge	P 378	Used with P 378 a
2	Adapter	9114/1	

PRESSURE TESTS

General

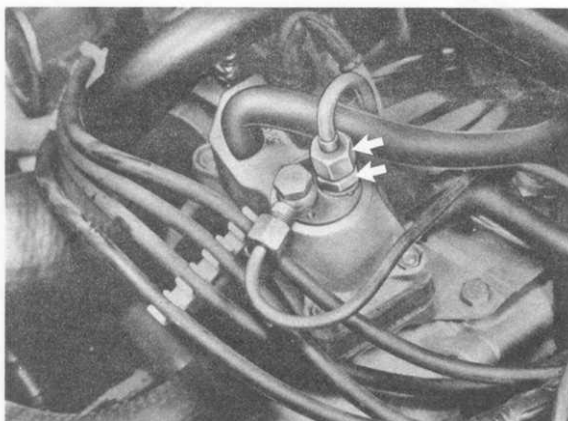
For better understanding the connections and lever positions of the selector valve are numbered in the following descriptions.



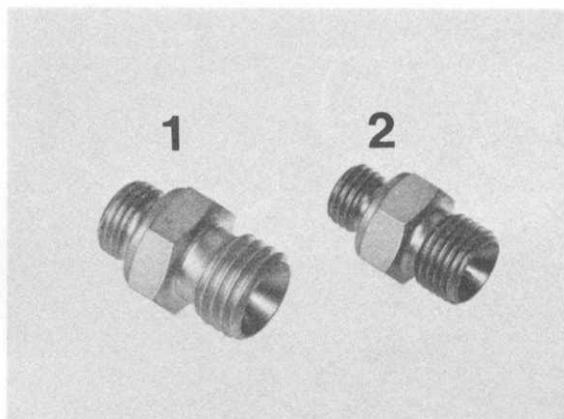
CONNECTING AND BLEEDING PRESSURE GAUGE

Connecting

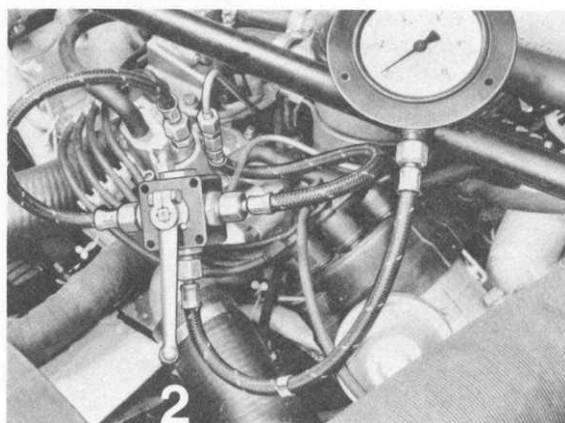
1. Unscrew control pressure line and standard adapter from control pressure regulator.



2. Screw adapter (1) from Special Tool 9114/1 with a seal in control pressure regulator and connect left hose from Special Tool P 378.



3. Connect adapter (2) between detached control pressure line and right hose.



Note

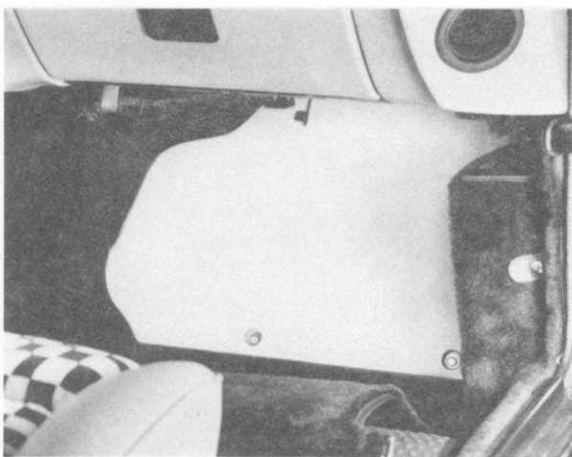
Do not bend control pressure line when connecting.

Bleeding

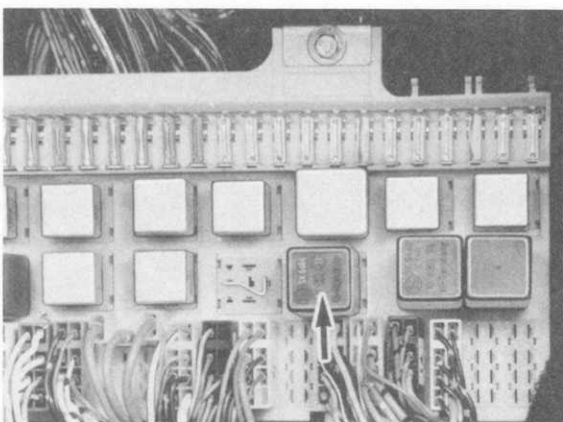
1. Pull off electric plugs from control pressure regulator and auxiliary air regulator, so that parts will not run hot during the following tests.

2. Bridge electric safety circuit.

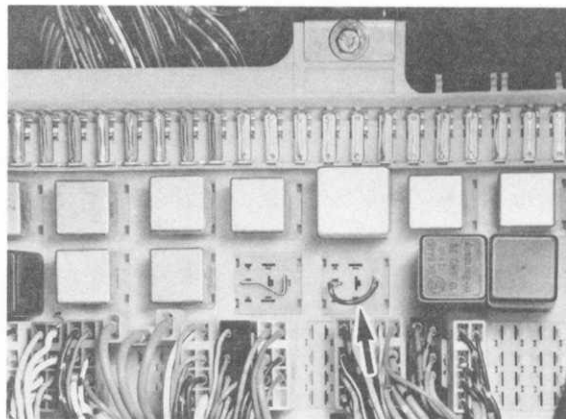
a) Remove cover in footwell on front passenger's side.



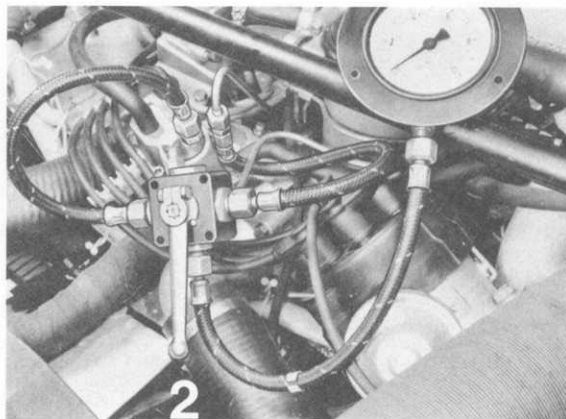
b) Pull off fuel pump relay.



c) Bridge terminals 30 and 87 with a piece of wire. Fuel pump or pumps must now run.



3. Position selector lever at 2. Let pressure gauge hang down (stretched hose). Move selector lever to position 3 about 5 times at intervals of 10 seconds.

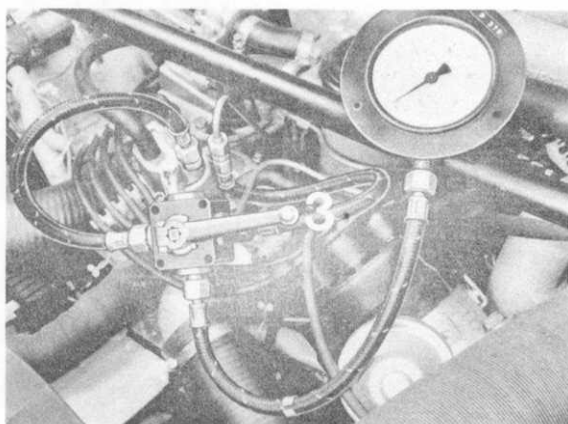


CHECKING SYSTEM PRESSURE

1. Connect and bleed pressure gauge.

2. Bridge terminals 30 and 87.

3. Set selector valve at position 3.



4. System pressure should now agree with specifications.

CHECKING CONTROL PRESSURE "WARM"

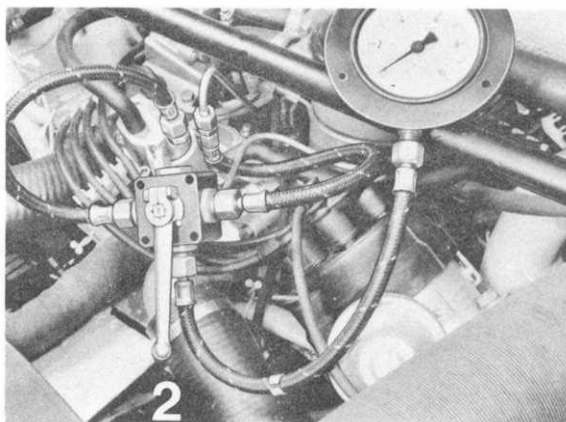
Engine could be cold or warm for this test.

1. Connect and bleed pressure gauge.

2. Electric plug remains connected on control pressure regulator.

3. Bridge terminals 30 and 87.

4. Set selector valve at position 2. Control pressure will now rise slowly and reach the specified value when control pressure regulator has been operated. Operating time will vary depending on ambient temperature.

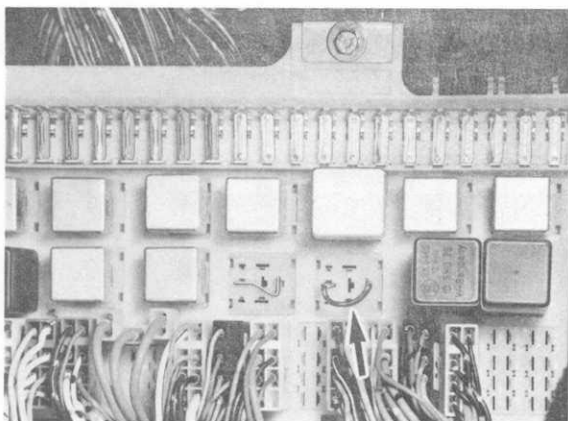


CHECKING ENTIRE FUEL SYSTEM FOR LEAKS

Engine must be warm for this test.

1. Connect and bleed pressure gauge.

2. Bridge terminals 30 and 87.



3. Move selector valve to position 2 and wait until "warm" control pressure is reached.

4. Take off bridge at terminals 30 and 87.

5. Observe pressure drop on pressure gauge and compare it with Testing and Adjusting Data on page 25 - 6.

6. If pressure drop is too fast, repeat test with control pressure circuit broken by moving selector valve to position 3. If results are the same, leak is in system pressure circuit. If results of second test are good, leak is in control pressure circuit.

Possible Leaks in System Pressure Circuit:

1. Check valve in pressure neck of electric fuel pump(s).

2. Cold start valve.

3. O-ring in system pressure regulator.

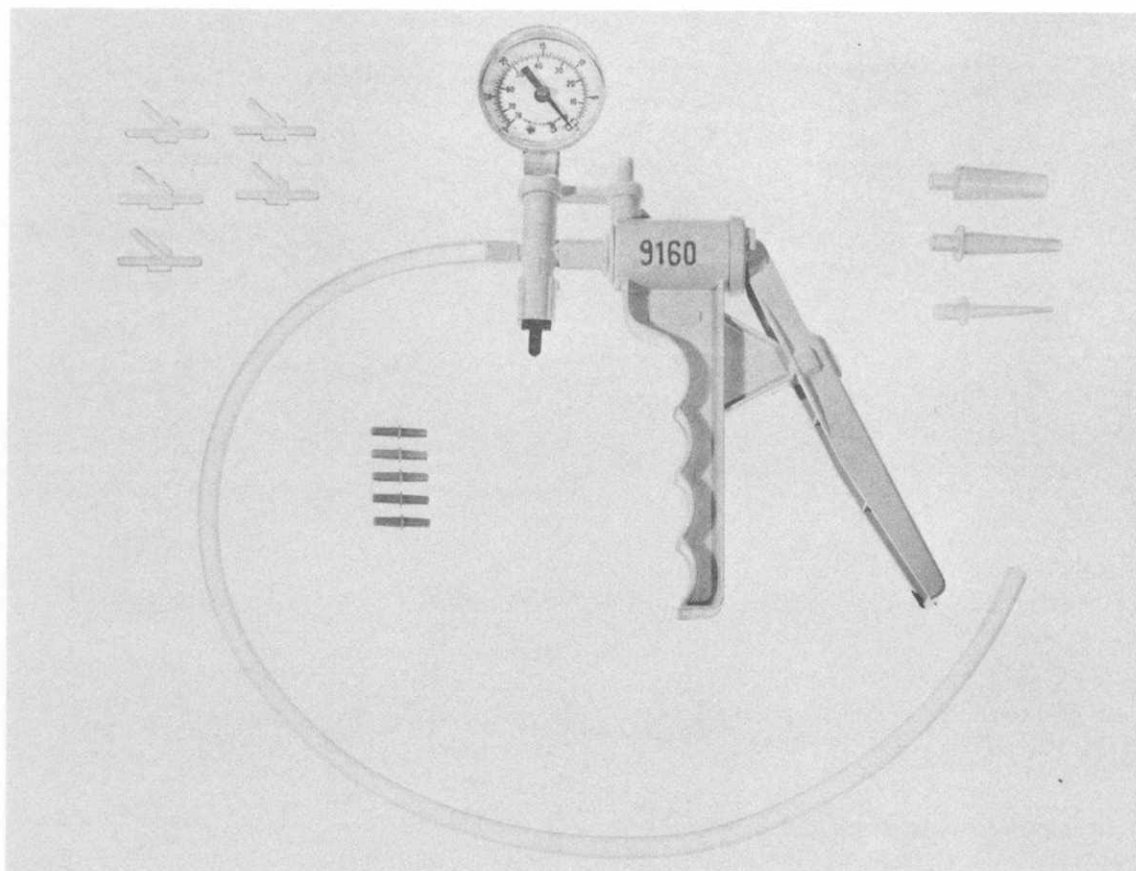
4. Fuel injector(s).

Possible Leaks in Control Pressure Circuit:

Pressure relief/residual pressure valve.

CHECKING CONTROL PRESSURE "COLD"
(Vacuum Controlled Control Pressure Regulator)

TOOLS



No.	Description	Special Tool	Remarks
1	Hand vacuum pump	9160	or US 8026

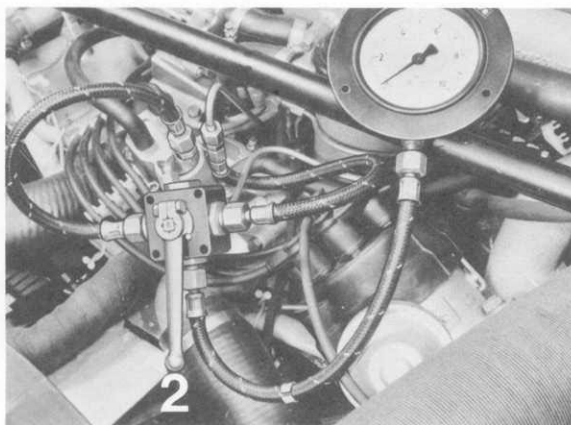
CHECKING CONTROL PRESSURE "COLD"

Note

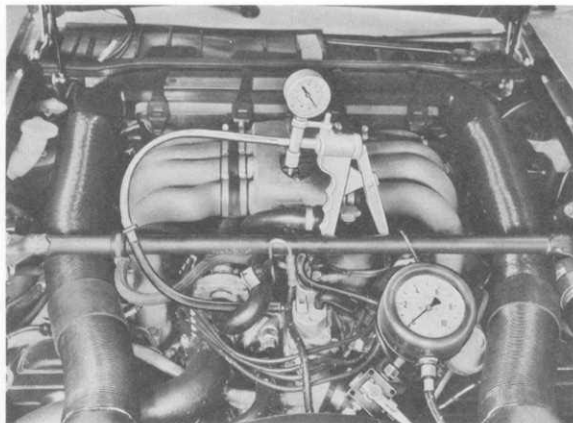
Engine must be cold for this test, which is absolutely essential for cars experiencing starting and/or warming-up problems. Do not use car for several hours, at best overnight.

If the control pressure regulator is vacuum controlled, the charts will only show values for the vacuum test method.

1. Connect and bleed pressure tester P 378. Set switching valve at position 2.

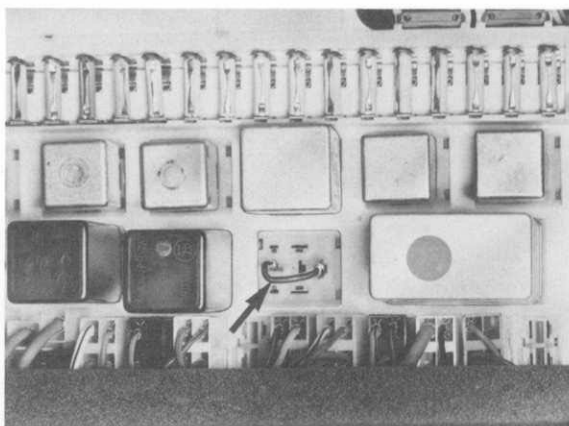


2. Pull vacuum hose off of control pressure regulator and connect extra hose and hand vacuum pump US 8026 to connection of control pressure regulator.



3. Pull wire plugs off of control pressure regulator to prevent overheating.

4. Bridge fuel pump relay socket terminals 30 and 87.



5. Produce specified vacuum with the hand vacuum pump, or adjust (see Testing and Adjusting Specifications).

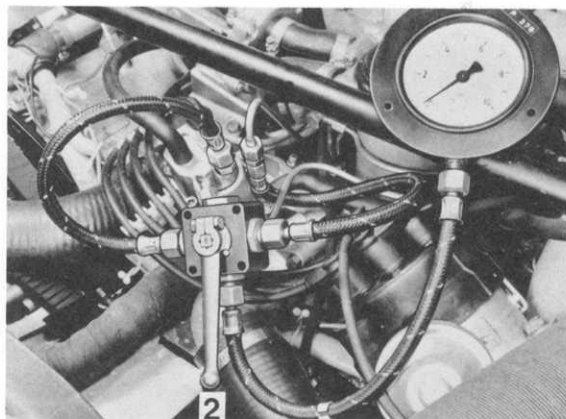
6. Refer to diagram underneath Testing and Adjusting Specifications for nominal pressure agreeing with actual ambient temperature.

CHECKING FUNCTION OF HOT START VALVE (CIS) (to Reduce Control Pressure for Warm Start)

Test Requirement:

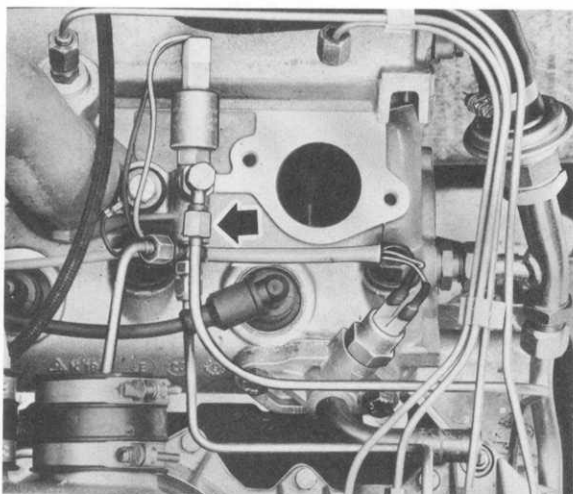
Engine warm, coolant temperature about + 60 °C/
140 °F or warmer.

1. Connect pressure tester and switch to position 2.
2. Operate starter. This opens the hot start valve and drops the control pressure.
Specification: 0.5 – 0.8 bar (note brief delayed action time).
3. If applicable, replace hot start valve or check temperature switch, i. e. temperature switch must have switched to through flow (ground).

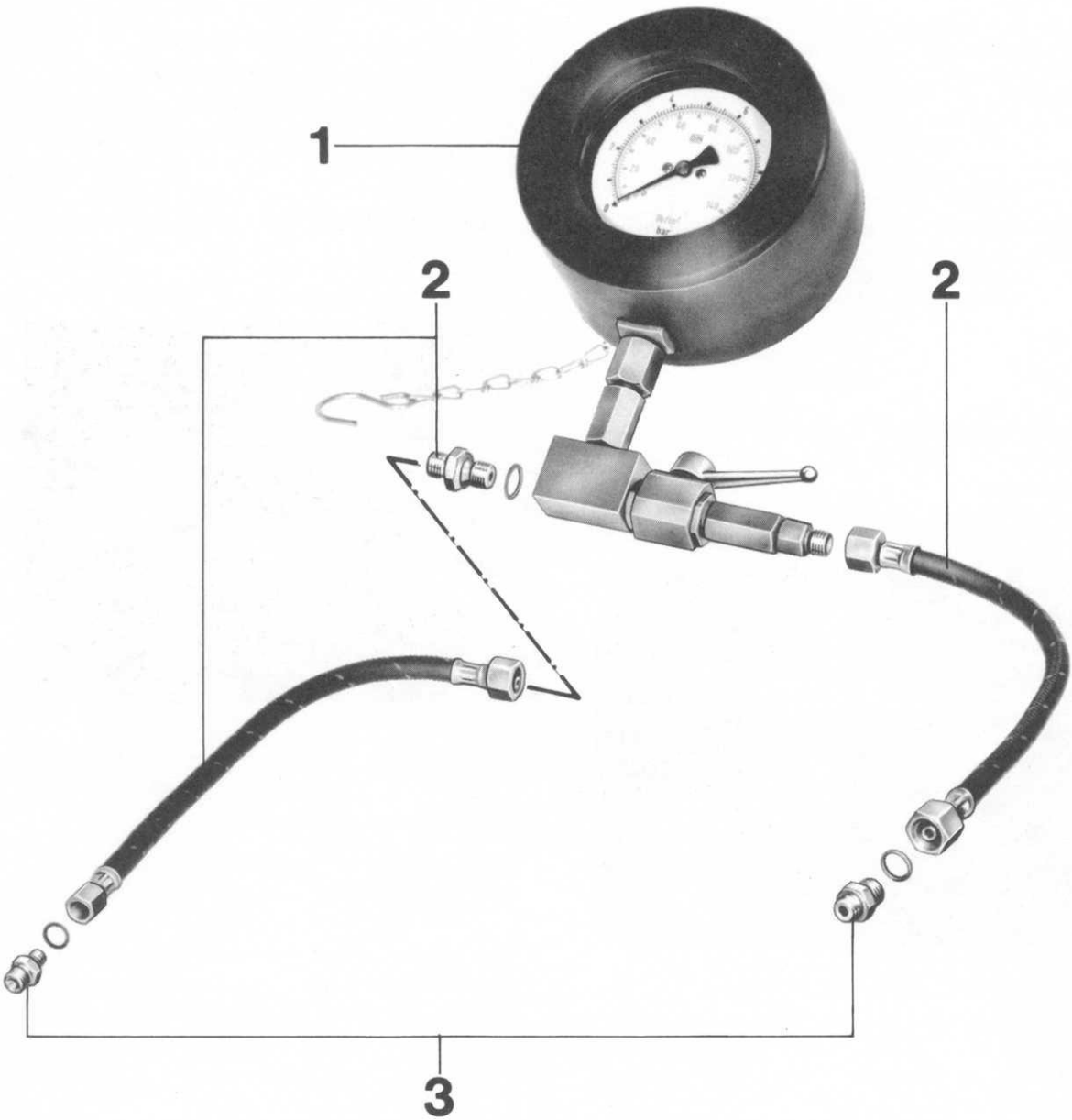


CHECKING HOT START VALVE FOR LEAKS (CIS)

1. Detach and plug fuel return line.
2. Bridge fuel pump relay.
3. Hot start valve must be absolutely tight, i. e. fuel must not escape on fuel return connection.



TOOLS



No.	Description	Special Tool	Remarks
1	Pressure tester	VW 1318	
2	Connectors	P 378 c	
3	Adapter	9114/1	

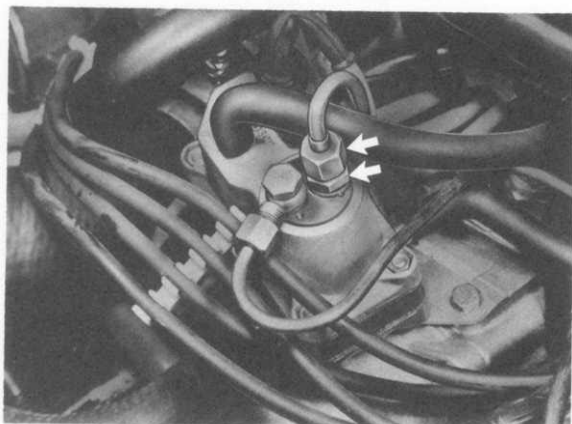
CONNECTING AND BLEEDING PRESSURE TESTER VW 1318

Connecting

Note:

Unscrew tank cap to let pressure escape from fuel tank prior to disconnecting fuel lines.

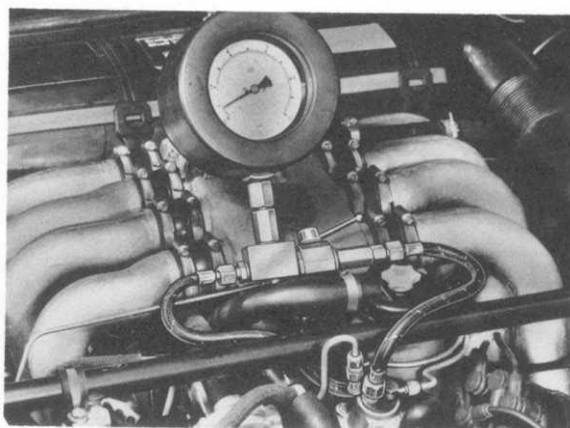
1. Unscrew control pressure line and standard adapters (M 10 x 1 / M 8 x 1) on control pressure regulator.



2. Remove original hose on pressure tester VW 1318 (it is not needed).
3. Screw in adapter of 9114/1 (M 10 x 1 / M 12 x 1.5) with seal on control pressure regulator and connect right test line of P 378 c.

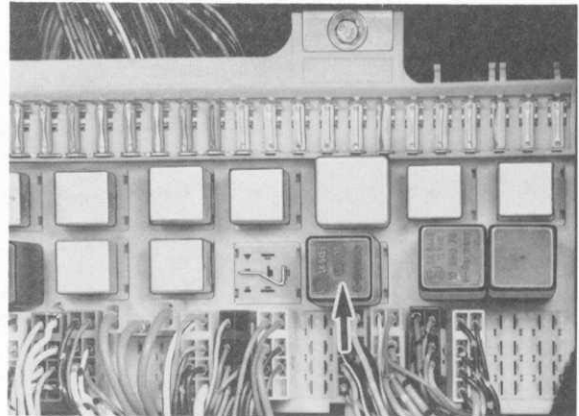
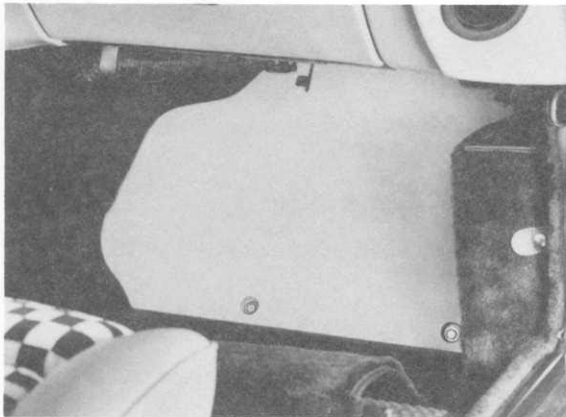
4. Connect adapter of 9114/1 (M 8 x 1 / M 10 x 1) between disconnected control pressure line and left test line of P 378 c.

5. Connect adapter (M 12 x 1.5) and test line on pressure tester.



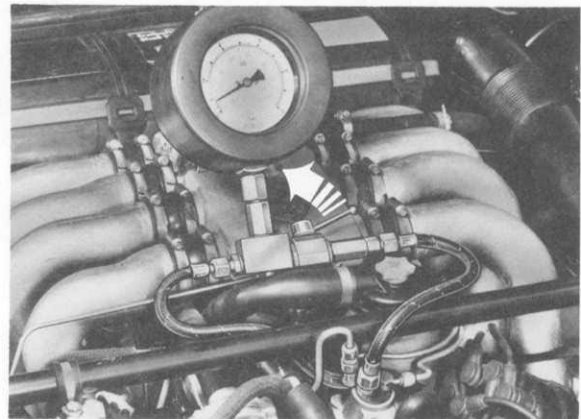
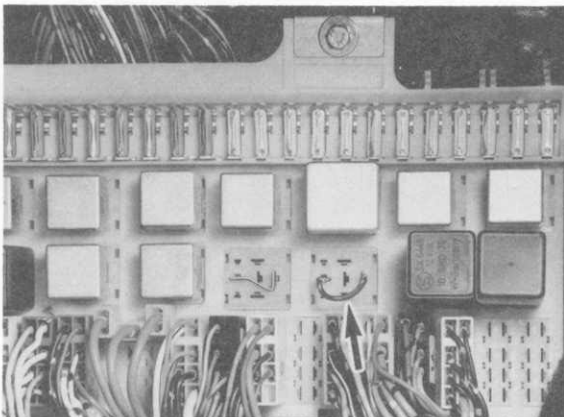
Bleeding

1. Pull off electric wire plugs on control pressure regulator and auxiliary air regulator to prevent heating of parts for the following tests.
2. Bridge electric safety circuit.
 - a) Unscrew and fold up cover in footwell on passenger's side.



b) Pull off fuel pump relay.

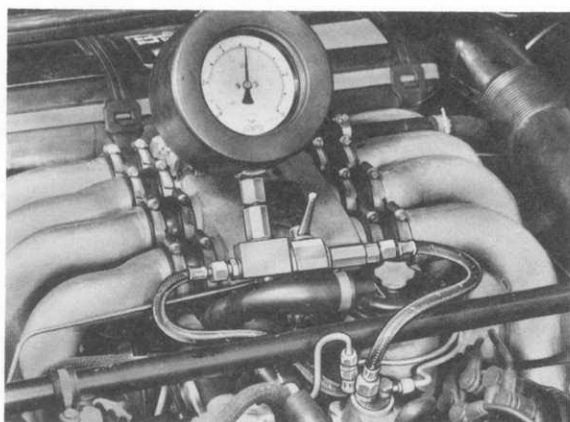
3. Bleed pressure tester. Let pressure gauge hang down. Move lever for switching-over valve between valve opened and valve closed positions in 10 second intervals.



c) Bridge plug connections 30 and 87 with a piece of wire. Fuel pump or fuel pumps should now run.

CHECKING SYSTEM PRESSURE

1. Connect and bleed pressure tester VW 1318.
2. Bridge safety circuit.
3. Set lever to closed valve position.

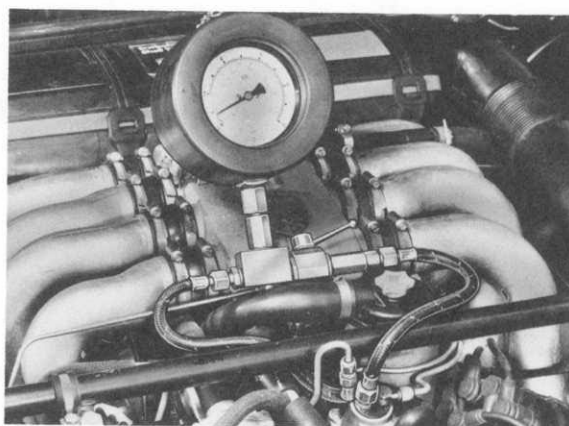


4. System pressure should now agree with specifications.

CHECKING CONTROL PRESSURE "WARM"

Engine could be cold or warm for this test.

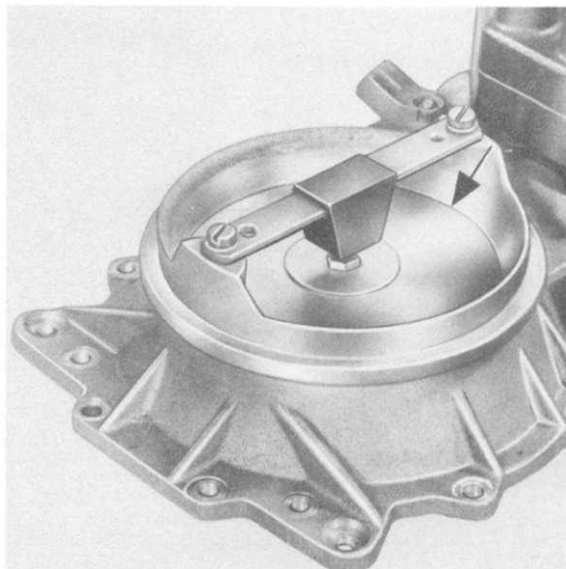
1. Connect and bleed pressure tester VW 1318.
2. Electric wire plug remains connected on control pressure regulator.
3. Bridge safety circuit.
4. Set lever to opened valve position. Control pressure will now rise slowly and reach the specified value when control pressure regulator has been operated. Operating time will vary depending on ambient temperature.



CHECKING AND ADJUSTING REST POSITION OF AIR FLOW SENSOR PLATE

Checking

1. Pull off high tension wire 4 from distributor and operate starter approx. 10 seconds.
2. Upper edge of air flow sensor plate must be flush with beginning of venturi cone or at most a max. of 0.5 mm higher (strive for lowest position).
3. Air flow sensor plate must be horizontal and centered in venturi.

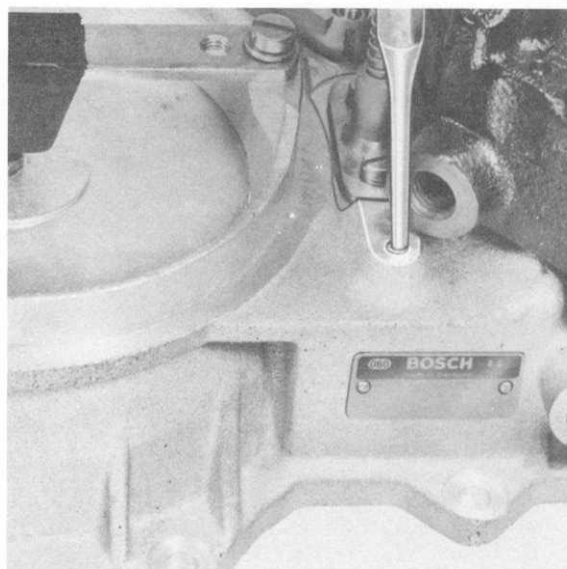


Adjusting

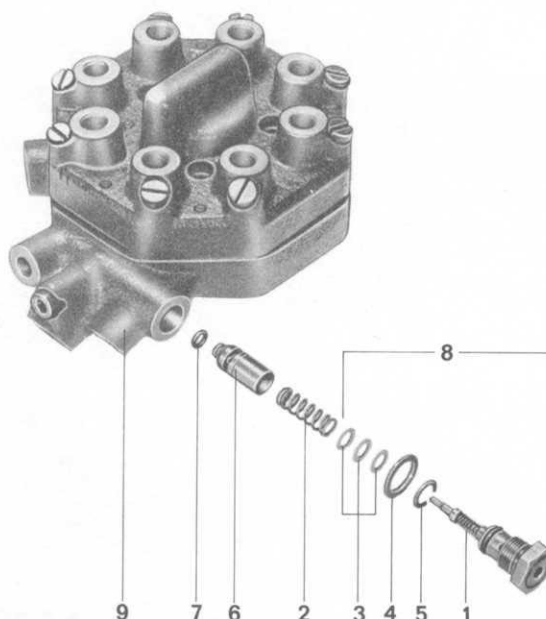
An excessively high air flow sensor plate setting can be corrected by driving down the stop spring guide pin with a drift and light hammer.

Note

Adjust very carefully, so that guide pin is not driven in too deep.
Avoid repeated adjustments in both directions, since this would loosen press fit of pin.



REPLACING PRESSURE RELIEF AND RESIDUAL PRESSURE VALVES

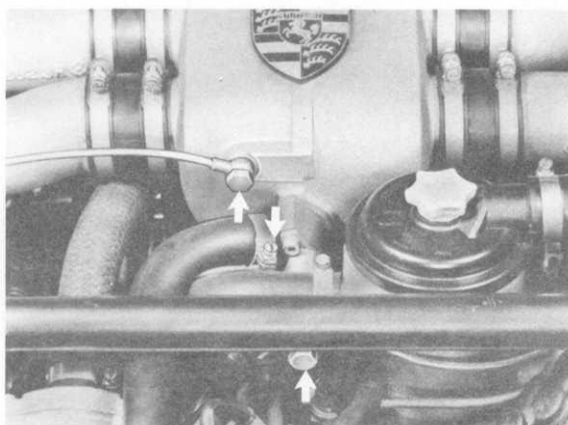


No.	Description	Qty.	Note When		Special Instructions
			Removing	Installing	
1	Adapter with residual pressure valve (assembled unit)	1		Torque 1.3 - 1.5 mkg (9.4 - 10.8 ft lb)	Check system pressure
2	Spring	1			
3	Shim (as req.; 0.1, 0.15, 0.3, 0.4, 0.5 mm thick)	3		Install same as removed (always 3)	
4	Flat seal	1		Replace	
5	O-ring	1		Replace	
6	Pressure relief valve piston	1	Use tapered wooden peg, if necessary	Check, replace fuel distributor if damaged	disassemble
7	O-ring	1		Check, replace if necessary	
8	Part set	1			
9	Fuel distributor	1			

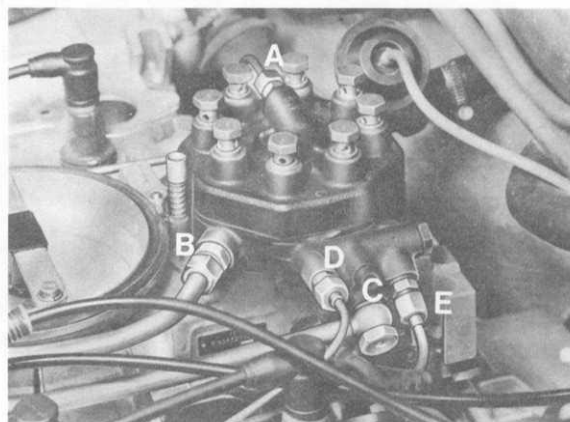
REMOVING AND INSTALLING MIXTURE CONTROL UNIT

Removing

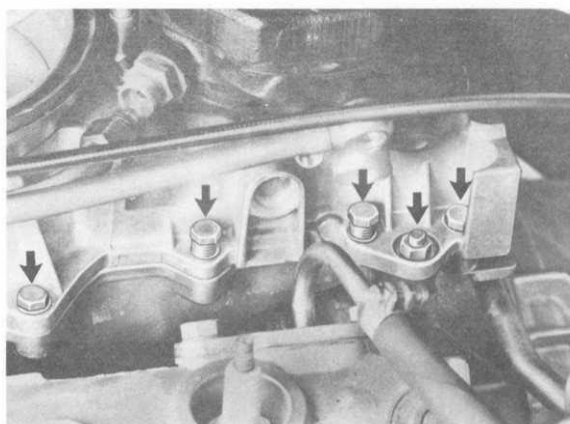
1. Disconnect battery ground wire from spare wheel well.
2. Remove air cleaner assembly.
3. Remove vacuum hose between intake branch and brake booster.
4. Detach and remove all fuel injection lines, counterholding on fuel injectors.
5. Detach and remove hose between auxiliary air regulator and air distributor, fuel supply line on cold start valve and, on cars with an automatic transmission, vacuum line.
7. Detach intake pipes at bottom and remove together with air distributor.
8. Detach fuel lines:
 - A - Control pressure line to control pressure regulator
 - B - Fuel feed
 - C - Fuel return
 - D - Fuel feed/cold start valve
 - E - Fuel return/control pressure regulator



6. Loosen upper hose clamp on connector between air distributor and throttle housing.

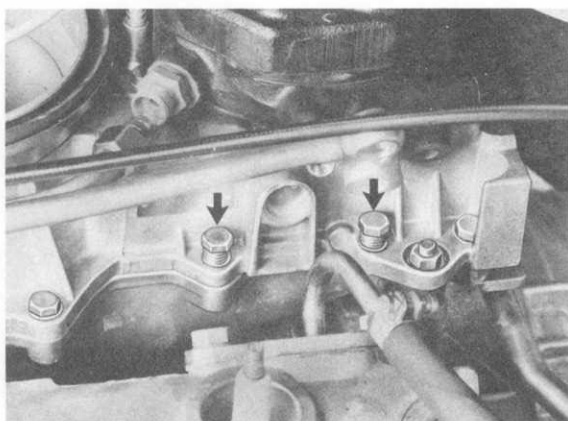


9. Unscrew hexagon head bolts and nuts between air flow sensor and air guide housing, and remove mixture control unit from above.



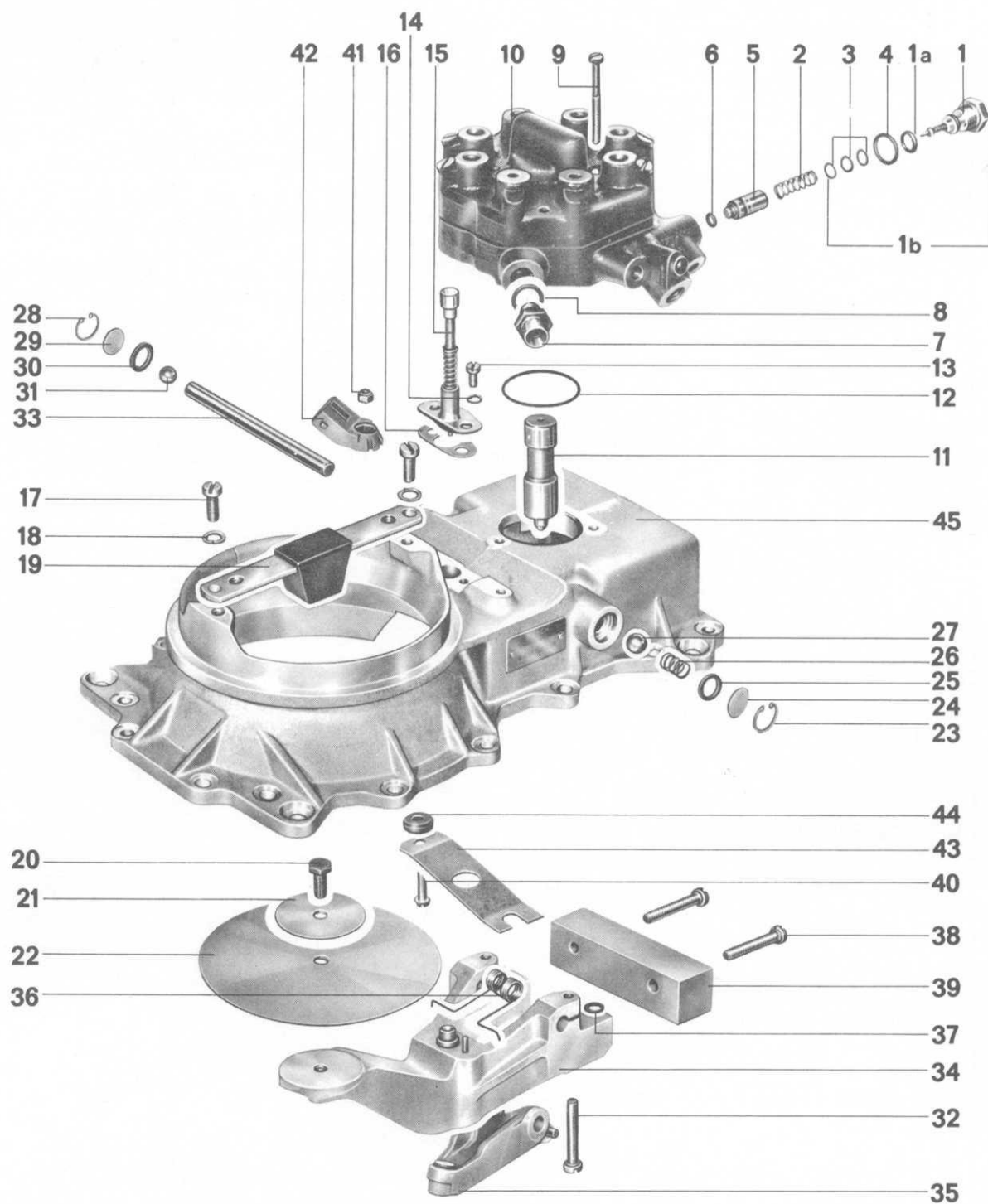
Installing

1. Always use new seals and gaskets.
2. Tighten hex. head bolts on mixture control unit crosswise to 1,0 mkg (7 ft lb).
3. Tighten hex. head bolts with spring (in area of sensor plate lever bearings) to compressed length of spring and then loosen by one turn.



4. Tighten fuel lines and intake pipes to specified torque.

DISASSEMBLING AND ASSEMBLING MIXTURE CONTROL UNIT



No.	Description	Qty.	Note When		Special Instructions
			Removing	Installing	
1	Adapter with residual pressure valve (assembled unit)	1		Torque 1.3 - 1.5 mkg (9.4 - 10.8 ft lb)	Check system pressure
1a	O-ring	1		Replace	
1b	Set of parts	1			
2	Spring	1			
3	Shim(s) as req. (0.1, 0.15, 0.3, 0.4, 0.5 mm thick)	3		Install same shims as removed (always 3)	
4	Flat seal	1		Replace	
5	Pressure relief valve piston	1	Pull out with tapered wooden peg	Check, replace fuel distributor if damaged (close tolerance part)	
6	O-ring	1		Check, replace if necessary	
7	Adapter	1			
8	Seal	1		Replace	
9	Fillister head cap-screw	3		Torque 0.32 - 0.38 mkg (2.3 - 2.7 ft lb)	
10	Fuel distributor	1			
11	Control piston	1	Do not let control piston fall out		
12	Seal	1		Replace	
13	Fillister head cap-screw	2			
14	Copper washers (standard part)	2			
15	Allen key for mixture adjustments	1		Curved side of flange faces fuel distributor	

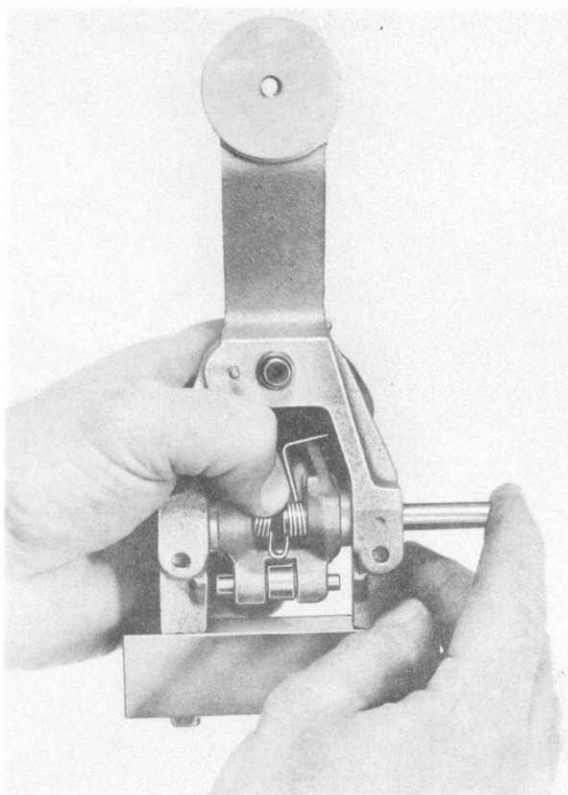
No.	Description	Qty.	Note When		Special Instructions
			Removing	Installing	
16	Gasket	1		Check, replace if necessary	Shown with 90° offset in fig.
17	Fillister head capscrew	2			
18	Lockwasher	2			
19	Stop	1			
20	Hex. head bolt	1		Torque 0.50 - 0.55 mkg (3.4 - 4 ft lb)	
21	Support disc	1			
22	Sensor plate	1		Check, replace if necessary Stamped edge of sensor plate or stamped code (--) faces up	
23	Circlip	1	First take off this circlip	Sharp edge side faces out	
24	End plate	1			
25	Seal	1			
26	Spring	1			
27	Ball	1		Lubricate with silicone grease	
28	Circlip	1		Sharp edge side faces out	
29	End plate	1			
30	Seal	1			
31	Ball	1		Lubricate with silicone grease	
32	Fillister head capscrew	2		Torque 0.47 - 0.53 mkg (3.4 - 3.8 ft lb)	

No.	Description	Qty.	Note When		Special Instructions
			Removing	Installing	
33	Cylindrical pin	1			
34	Adjusting lever	1		Check	
35	Fork lever	1			
36	Spring	1			
37	Spacer	2			
38	Fillister head capscrew	2		Torque 0.47 - 0.53 mkg (3.4 - 3.8 ft lb)	
39	Counterweight	1		Position correctly	
40	Fillister head capscrew	1			
41	Locknut	1			
42	Plug, safety switch	1		Turned toward air venturi by approx. 15°	No electrical function
43	Stop leaf spring	1		Position correctly	
44	Insulator	1			
45	Air flow sensor housing	1		Lubricate bearing bores with silicone grease	

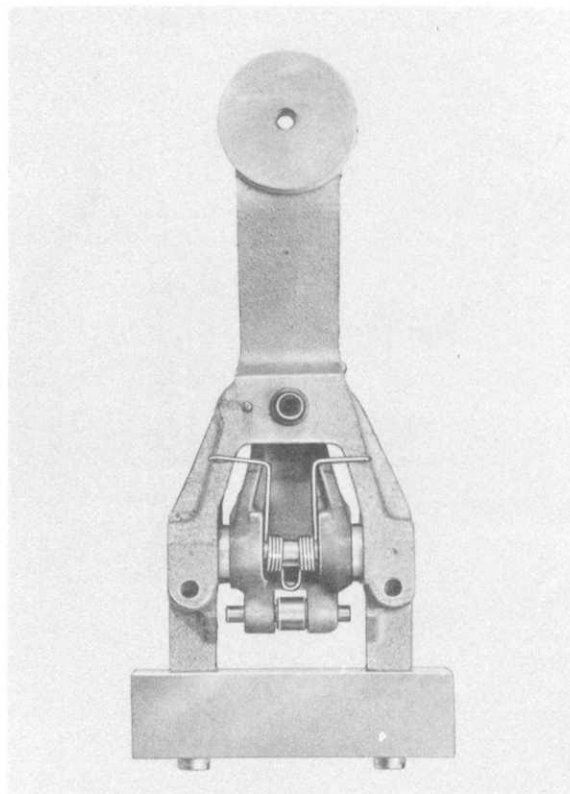
DISASSEMBLING AND ASSEMBLING MIXTURE CONTROL UNIT

1. Pre-assemble adjusting lever, spring and fork lever prior to installation in air flow sensor housing.

2. This requires a suitable cylindrical pin, e.g. pin from adjusting lever of 911 mixture control unit or a standard 8 h 8 x 60 DIN 7 cylindrical pin.
Both ends must be chamfered.

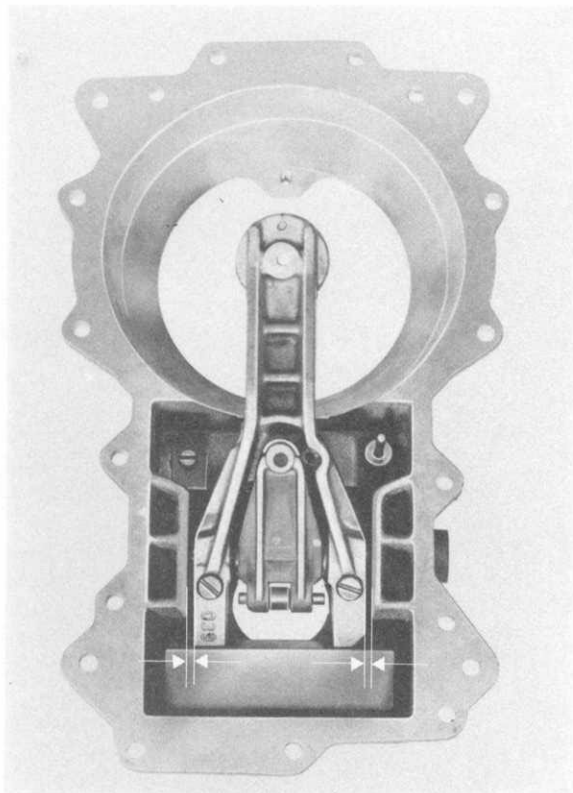


3. Make sure that springs fit properly.

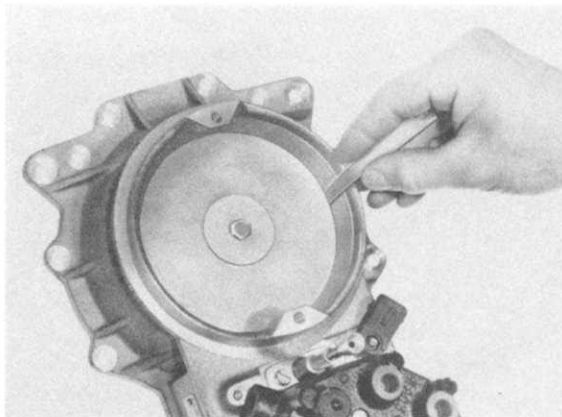


4. Guide preassembled parts into air flow sensor housing and carefully push out pin used for assembling with the original pin.

5. Center adjusting lever in air flow sensor housing and tighten mounting bolts.

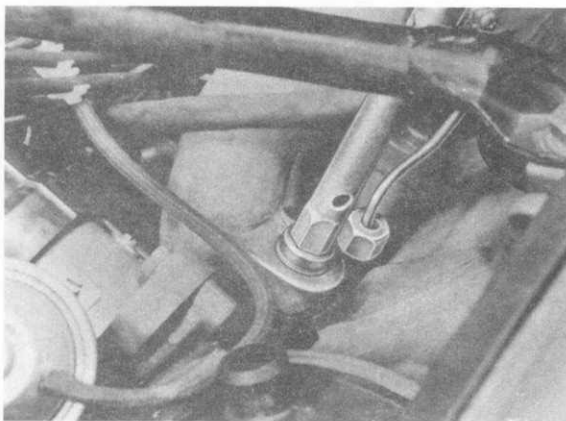


6. Center gap between sensor plate and venturi. The gap must be uniform, and can be checked with a 0.10 mm feeler gauge blade. This requires that the sensor plate be adjusted to correct height (rest position).



REMOVING AND INSTALLING FUEL INJECTORS

1. Unscrew coupling nut of fuel injection line, counterholding on fuel injector.
2. Unscrew fuel injector with a deep socket.

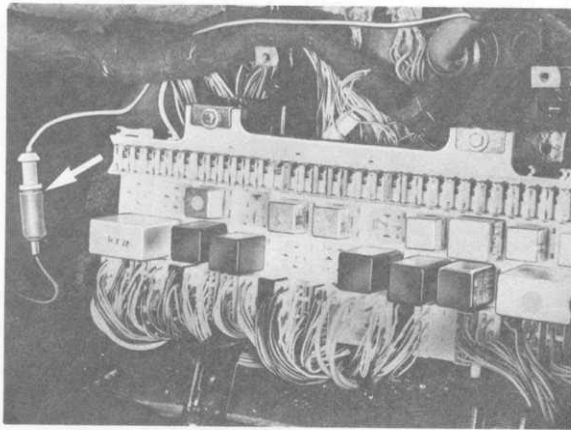


REMOVING AND INSTALLING OXYGEN SENSOR

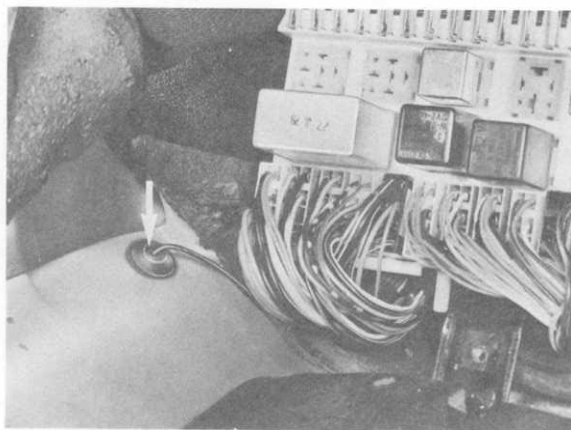
Removing

1. Remove lower section of foot support on passenger's side.

2. Disconnect oxygen sensor plug.



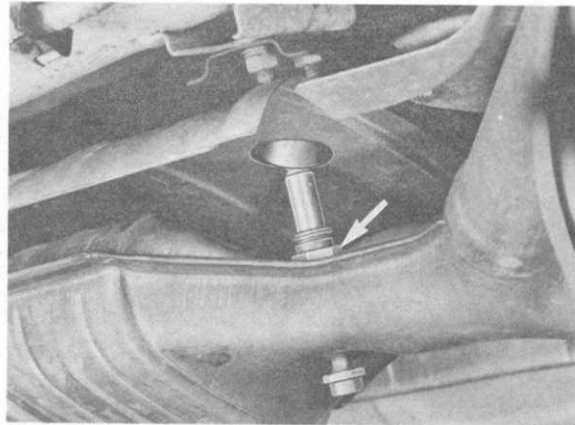
3. Push wire grommet and plug down through the floor board.



4. Lift car.

5. Pull off safety plug on oxygen sensor.

6. Unscrew oxygen sensor.



Installing

1. Coat threads of oxygen sensor with Bosch Paste VS 140 16 Ft or Optimoly HT.

Note

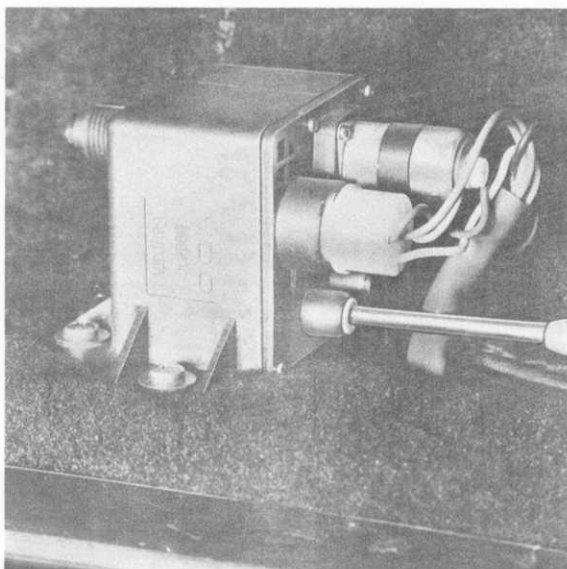
Be careful to keep paste out of slots in sensor.

2. Tighten sensor to specified torque.
Reference value: 50 - 60 Nm (36 - 43 ft lb)

RESETTING ELAPSED MILEAGE SWITCH

An elapsed mileage switch is mounted to the right of the passenger's seat to monitor the time of operation. It will turn on an indicator lamp for the oxygen sensor after the car has been driven 30,000 miles. The elapsed mileage switch must be reset to zero each time the oxygen sensor is replaced.

1. Loosen knurled head screw and remove cover for elapsed mileage switch.
2. Push in reset button on elapsed mileage switch against stop with a suitable tool. The elapsed mileage switch will return to zero and the oxygen sensor indicator light will again operate normally.

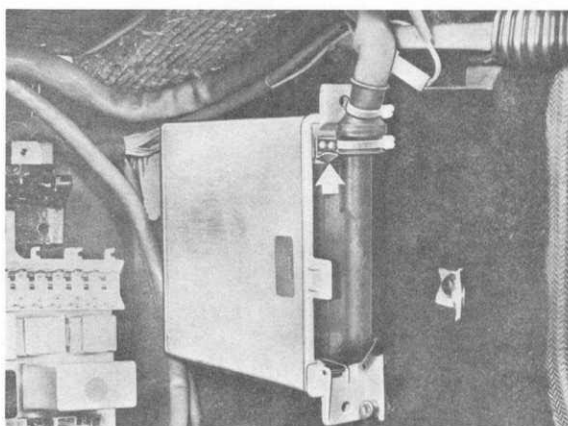


REMOVING AND INSTALLING CONTROL UNIT FOR AFC FUEL INJECTION AND OXYGEN SENSOR

This control unit is mounted on right wheel housing in passenger's footwell.

Removing

1. Push up plug clip to unlock the plug.



2. Loosen three mounting screws and remove control unit.

Installing

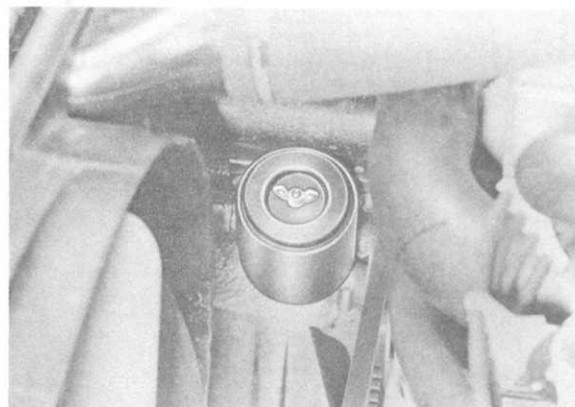
Make sure plug fits properly and can be felt to engage.

REPLACING FILTER ELEMENT OF AIR PUMP

Note

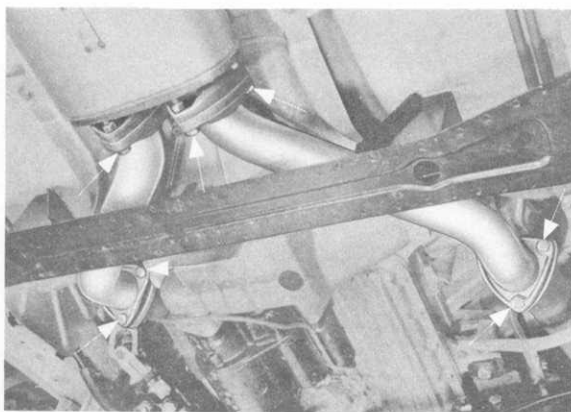
Filter housing is mounted on wheel housing in front righthand side of engine compartment.

Loosen winged nut, remove filter cover and take out filter element.

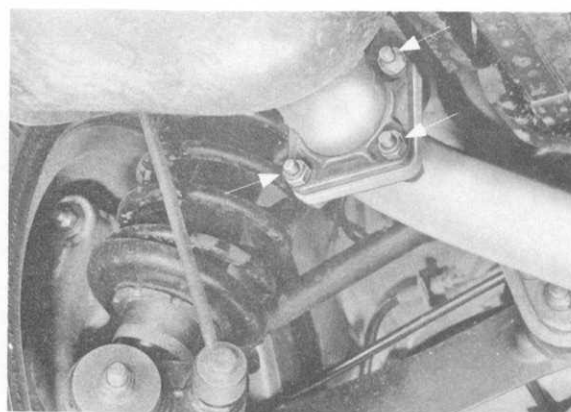


CHECKING TIGHTNESS OF EXHAUST FLANGES

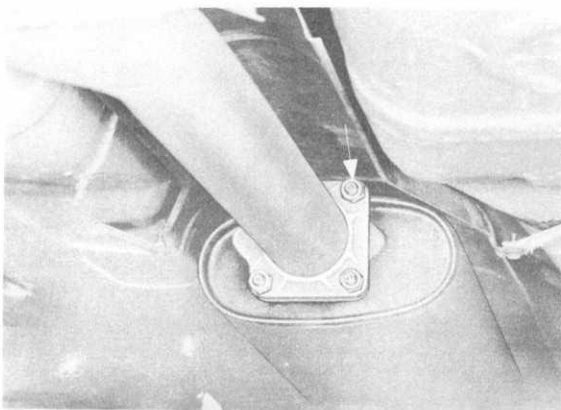
1. Check bolts between exhaust manifold pipes and catalytic converter.



3. Check bolts at main muffler inlet.



2. Check bolts at intermediate muffler outlet.



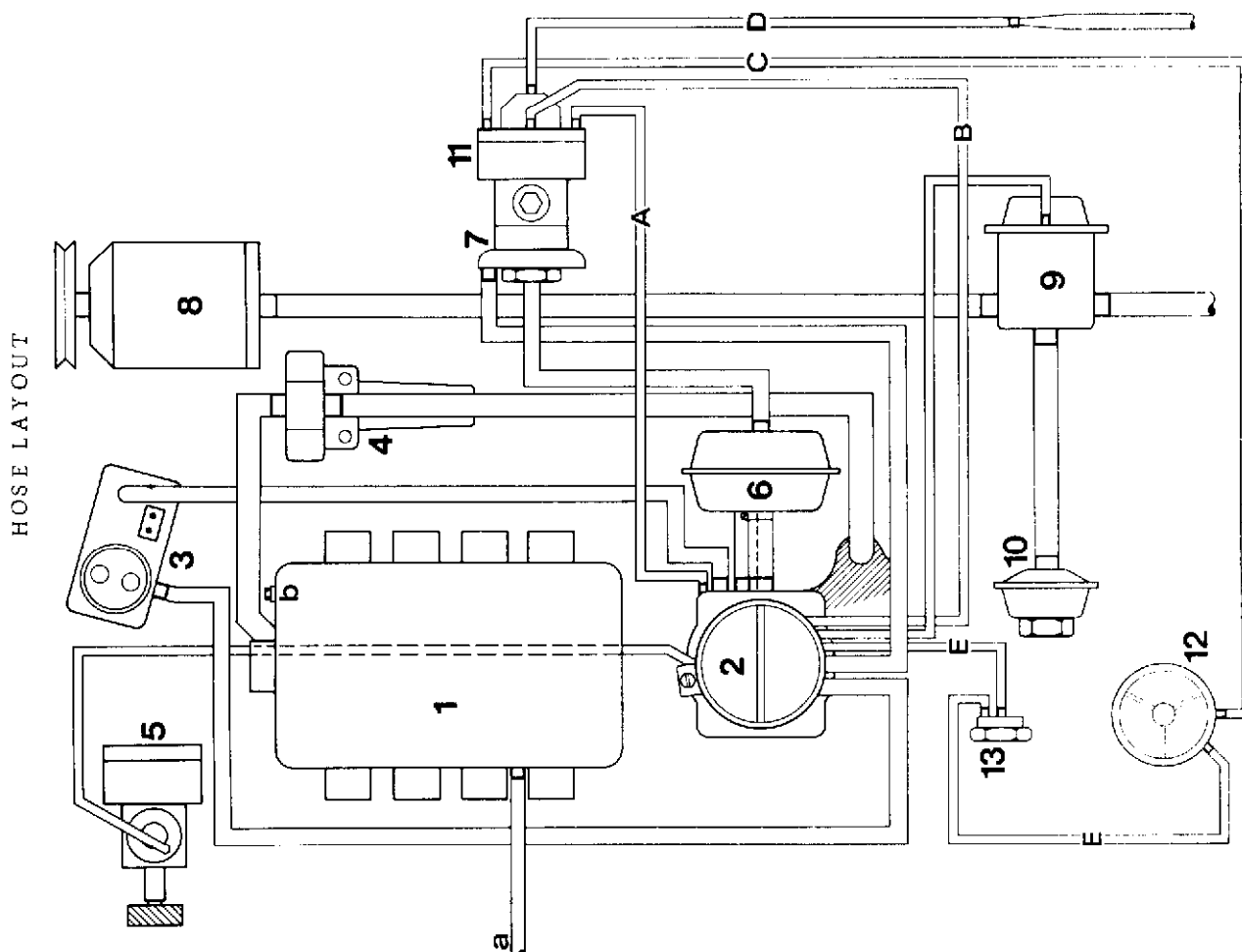
Tightening torque for bolts and nuts:

M 8	2,0 + 0,2 mkg (14 + 1,4 ft lb)
M 10	4,0 + 0,5 mkg (29 + 3,6 ft lb)

- 1 - Air distributor
- a - Vacuum source for brake booster
- b - Vacuum source for automatic transmission
- 2 - Throttle valve housing
- 3 - Control pressure regulator
- 4 - Auxiliary air regulator
- 5 - Ignition distributor
- 6 - Deceleration valve
- 7 - Barometric cell
- 8 - Air pump
- 9 - Diverter valve
- 10 - Check valve
- 11 - Pressure transducer
- 12 - EGR valve
- 13 - Thermo valve

Hose Colors:

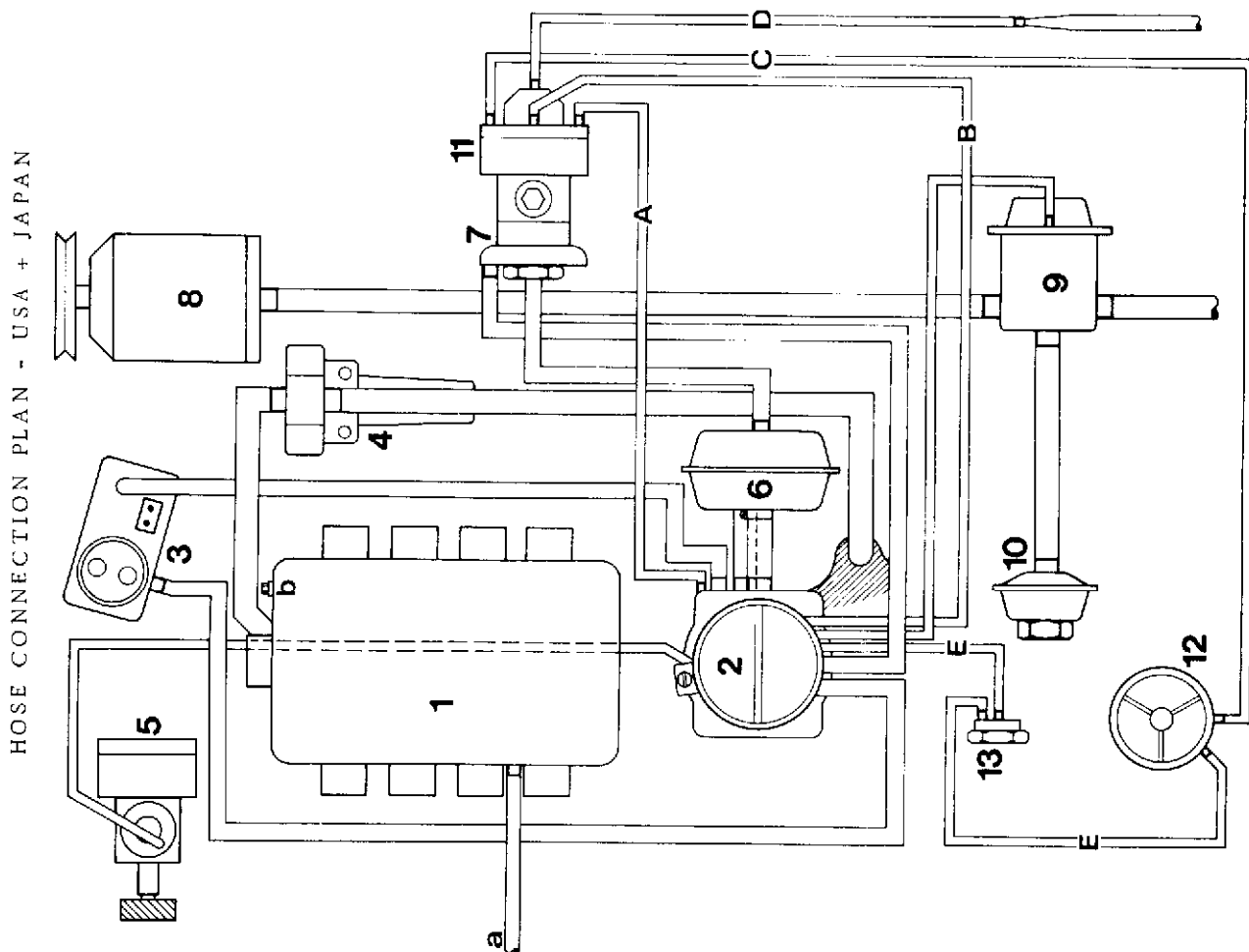
- A - white
- B - blue
- C - light brown
- D - orange
- E - red



- 1 - Intake branch
- a - Vacuum source for brake booster
- b - Vacuum source for automatic transmission
- 2 - Throttle housing
- 3 - Warm-up control
- 4 - Throttle bypass valve
- 5 - Distributor
- 6 - Vacuum control
- 7 - Vacuum box
- 8 - Air pump
- 9 - Blowoff switching valve
- 10 - Check valve
- 11 - Pressure converter
- 12 - EGR valve
- 13 - Thermo valve

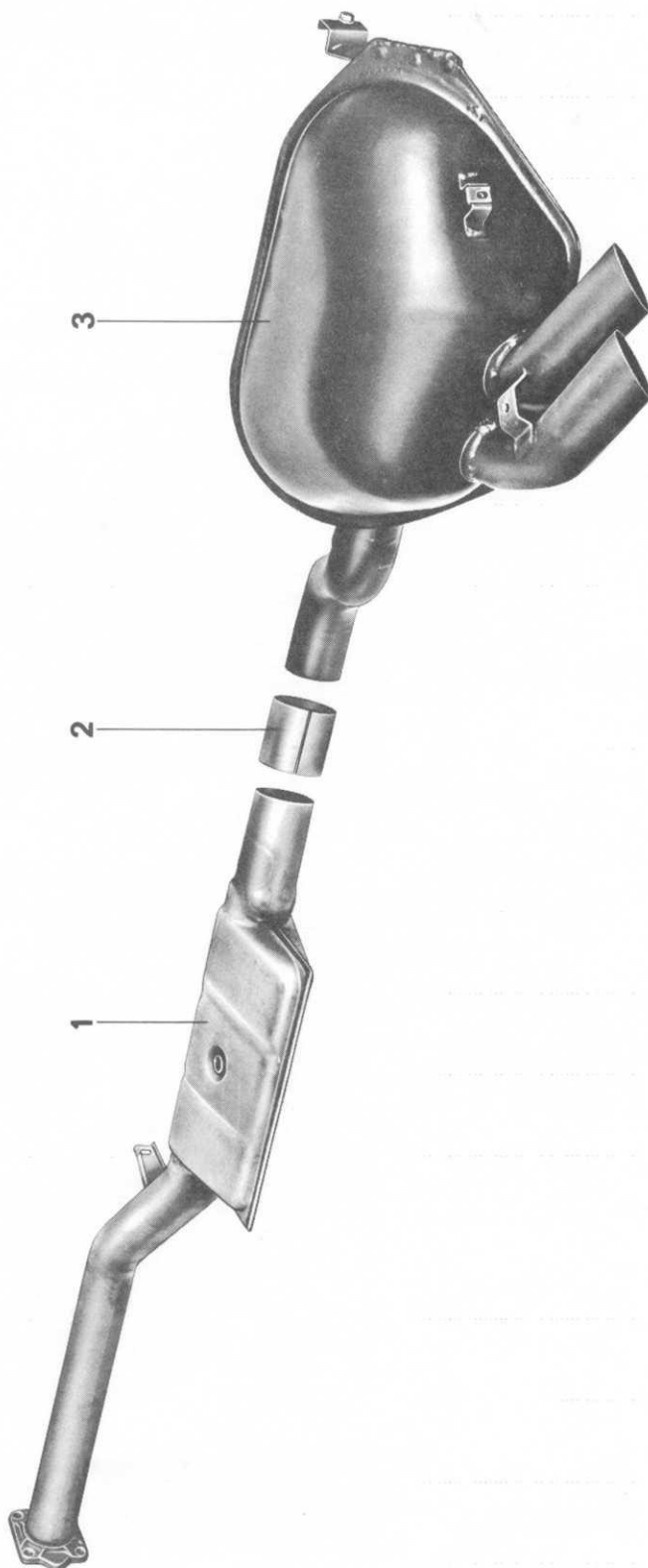
Hose Line Colors:

- A - white
- B - blue
- C - light brown
- D - orange
- E - red



REPLACING INTERMEDIATE AND/OR FINAL MUFFLERS

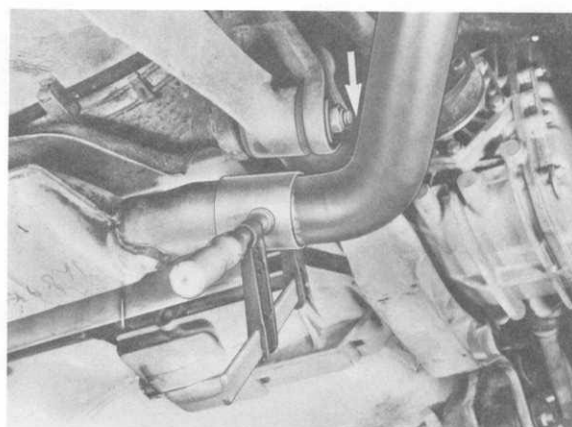
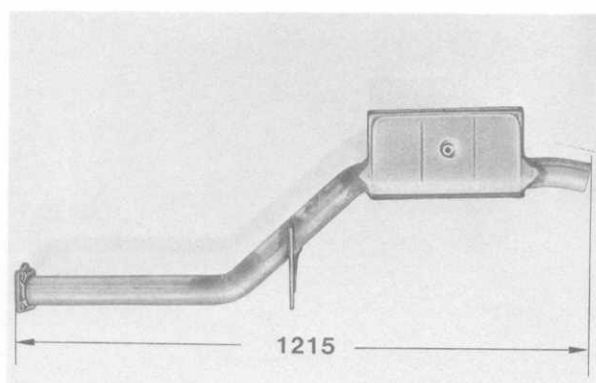
Single Pipe System



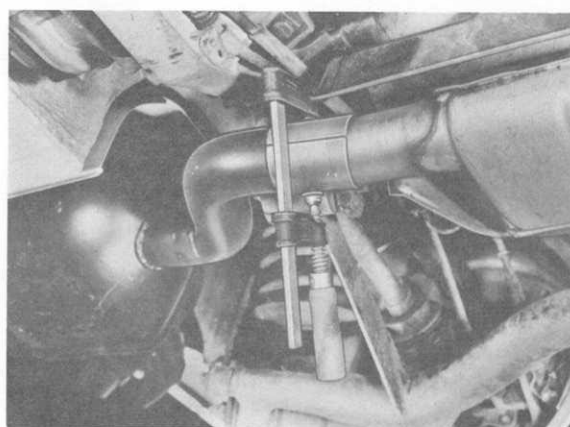
No.	Description	Qty.	Note When		Special Instructions
			Removing	Installing	
1	Intermediate muffler	1			
2	Sleeve	1			
3	Final muffler	1			

PROCEDURES

1. Unscrew bolts at flange of primary/intermediate mufflers and at rear. Remove exhaust assembly. Mark mating points and saw off exhaust pipe (see figure).
Dimensions in mm.



2. Install new parts on car, using old mounting parts when possible.
3. Align exhaust assembly with the connecting sleeve to remove stress, whereby distance between bolt on rear axle beam and exhaust pipe must be about 15 mm. Clamp sleeve at several points to keep in correct position.



4. Remove assembly and weld sleeve all around. Inert gas welding should be preferred.
5. Use new mounting nuts for final installation.

REPLACING CENTER AND/OR FINAL MUFFLERS

Twin Pipe System - Type 928 S

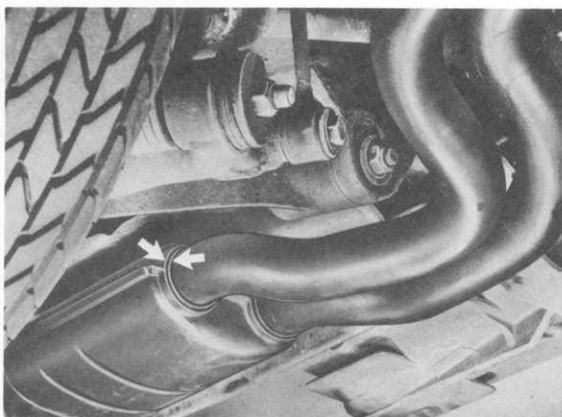


No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Intermediate muffler	1			
2	Final muffler	1			

PROCEDURES

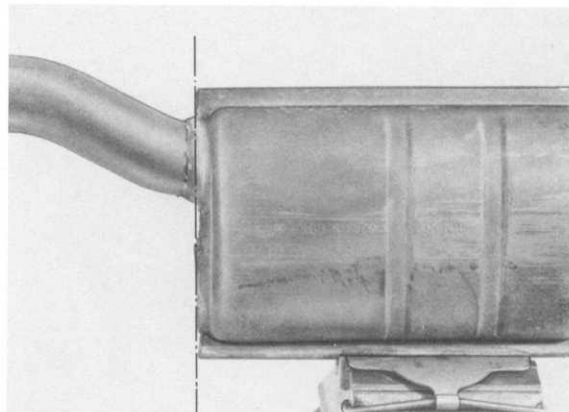
Replacing Intermediate Muffler and Final Muffler Together

1. Remove final muffler with intermediate muffler, heating front connecting pipe with a welder if necessary.
2. Mark off distance of about 10 mm on end of final muffler pipe to have minimum insertion depth of 10 mm.
Install final and intermediate mufflers, and align to remove stress. Tack weld connecting pipe at several points to hold in installed position.
3. Remove assembly and weld connecting pipe as well as intermediate muffler sleeve all around. Inert gas welding should be preferred.

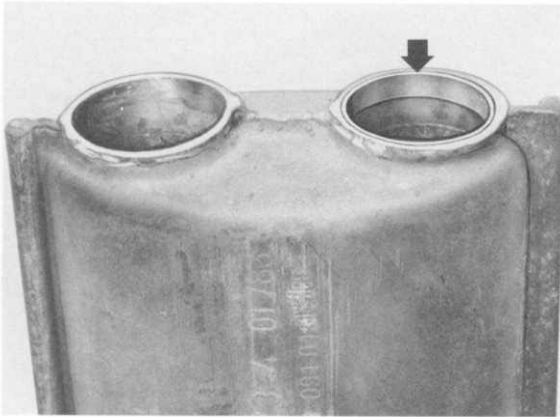


Replacing Final Muffler

1. Remove final muffler with intermediate muffler, heating front connecting pipe with a welder if necessary.
2. Cut through center of welding seam between final muffler and intermediate muffler with a saw or similar tool.



3. Remove remaining pieces of pipe from the intermediate muffler, grinding and/or filing off mating surfaces until pieces of pipe can be removed. Then remove rest of welding seam on inside.

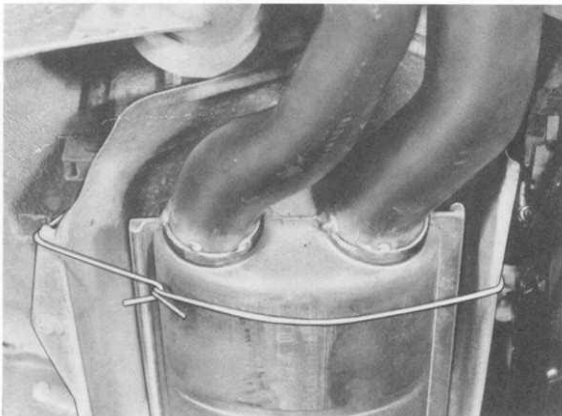


6. Remove assembly and weld connecting pipe as well as intermediate muffler sleeve all around. Inert gas welding should be preferred.

4. Remove protective paint on ends of pipes on new final muffler in area of welding.

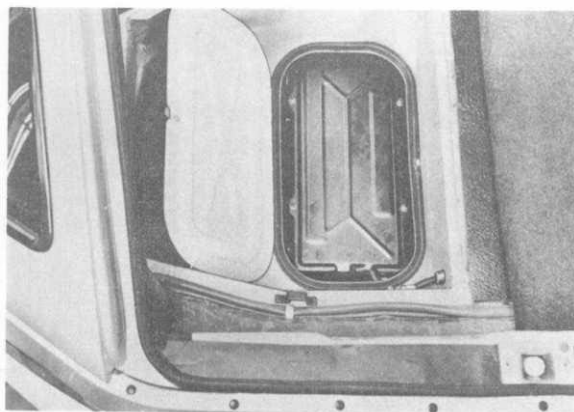
5. Mark off distance of about 10 mm on end of final muffler pipe to have minimum insertion depth of 10 mm.

Install final and intermediate mufflers, and align to remove stress. Tack weld connecting pipe at several points to hold in installed position.

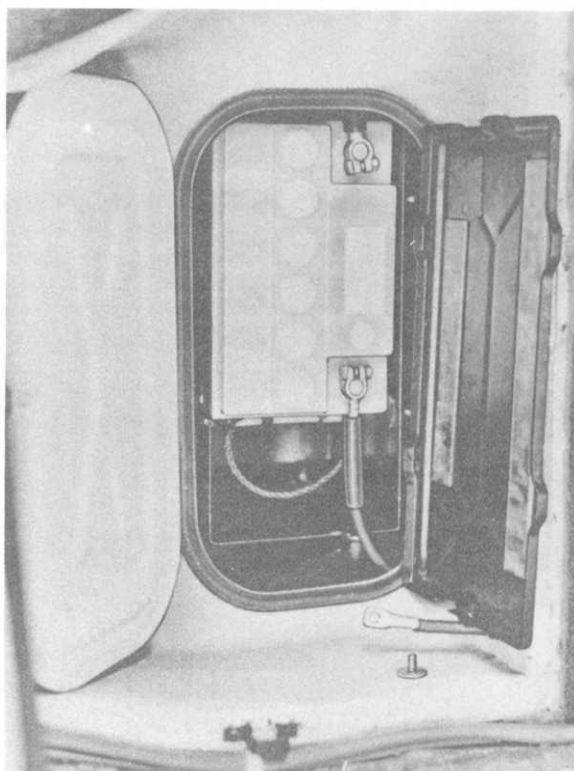


CHECKING BATTERY

1. Lift luggage compartment trim on left-hand side, remove cover plate, take out spare wheel and open battery box lid.



2. Disconnect battery ground wire at body. Unscrew and remove battery cover.



3. Measure specific gravity of each cell.

Specific Gravity	Battery Condition	Remarks
approx. 1.28	Fully charged	
approx. 1.20	Half charged	Recharge, if 1. car is not used for a long time, 2. temperatures are below + 10° C/50° F or 3. specific gravity will not rise in spite of driving long distances (check alternator, regulator, belts).
approx. 1.10	Weak	Recharge immediately

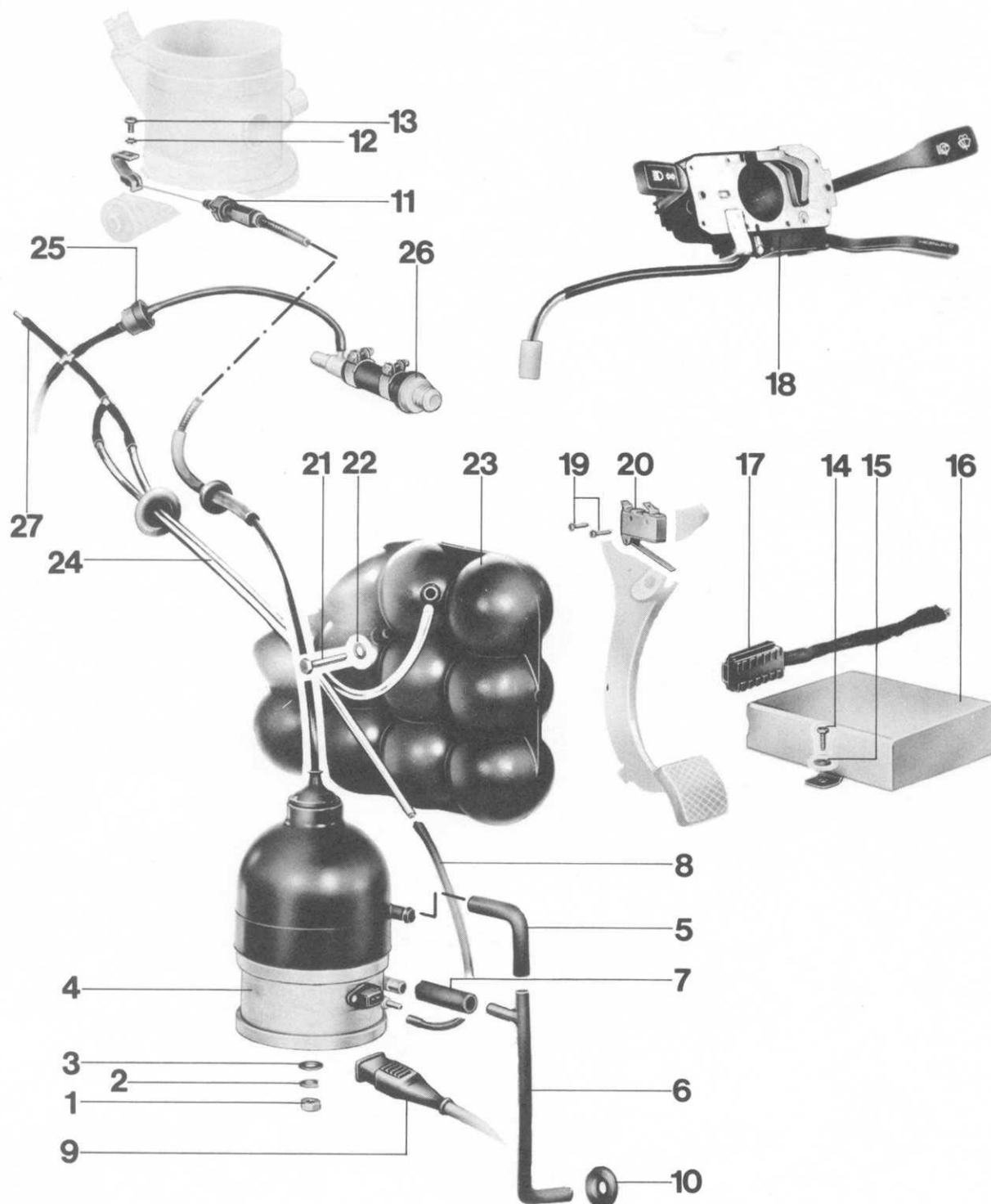
4. Checking the specific gravity will not only supply information on charge condition of battery, but also any possible defects.

- a - Specific Gravity of one cell much lower than that of other cells: short circuit in weak cell, battery defective.
- b - Specific Gravity of two neighboring cells much lower than that of other cells: leak between both weak cells, battery defective.
- c - Specific Gravity correct in all cells, but battery voltage drops excessively under load: poor soldered connection between cells, battery defective.

5. If necessary, add distilled water to correct level.

AUTOMATIC CRUISE CONTROL
(TEMPOSTAT)

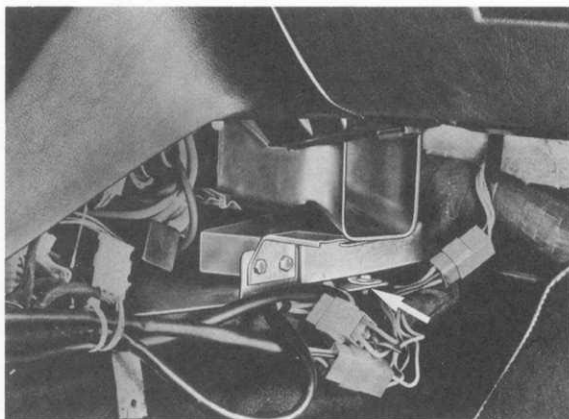
AUTOMATIC CRUISE CONTROL (TEMPOSTAT)



No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Nut	1			
2	Lock washer	1			
3	Washer	1			
4	Vacuum servo	1			
5	Shaped hose	1			
6	Pipe	1			
7	Hose	1			
8	Vacuum hose	1			
9	Plug	1			
10	Grommet	1			
11	Cable	1			
12	Lock washer	2			
13	Bolt	2			
14	Bolt	2			
15	Washer	2			
16	Tempostat control	1			
17	Plug	1			
18	Steering column switch	1			
19	Screw	2			
20	Clutch pedal switch	1			
21	Bolt	1			
22	Washer	1			
23	Vacuum reservoir	1			
24	Vacuum line	2			
25	Check valve	1			
26	Brake booster conn.	1			
27	Testing connection	1			

REMOVING AND INSTALLING TEMPOSTAT CONTROL

1. Remove tray underneath glove box.
2. Unscrew side trim panels on center console.
3. Unscrew control mounting bolts. Remove control on side of passenger's footwell and pull off multiple pin plug.

**REMOVING AND INSTALLING TEMPOSTAT SWITCH (STEERING COLUMN SWITCH)**

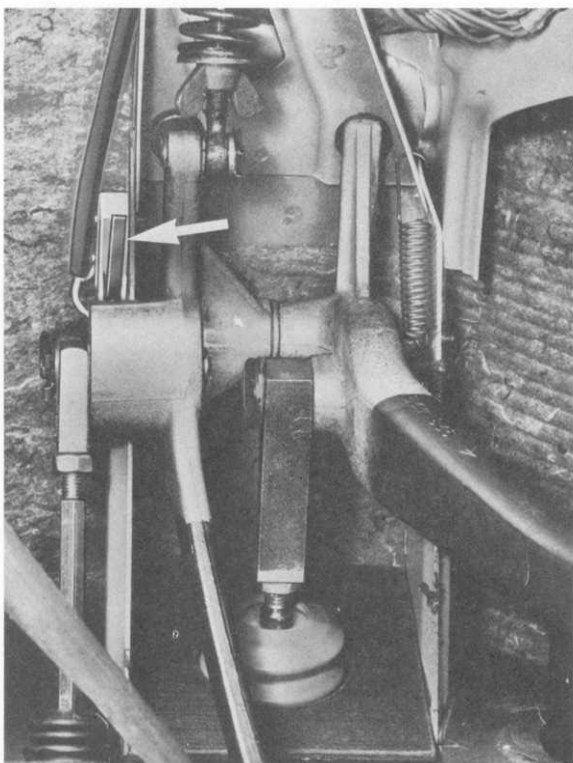
Removal and installation are described on page 94 - 4 of this repair manual.

REMOVING AND INSTALLING CLUTCH PEDAL SWITCH

Note

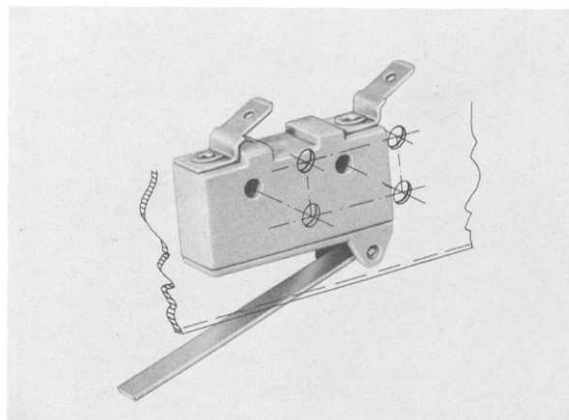
Cars with an automatic transmission will have bridged wires instead of the switch.

1. Unscrew mounting bolts.
2. Pull off wire plugs.



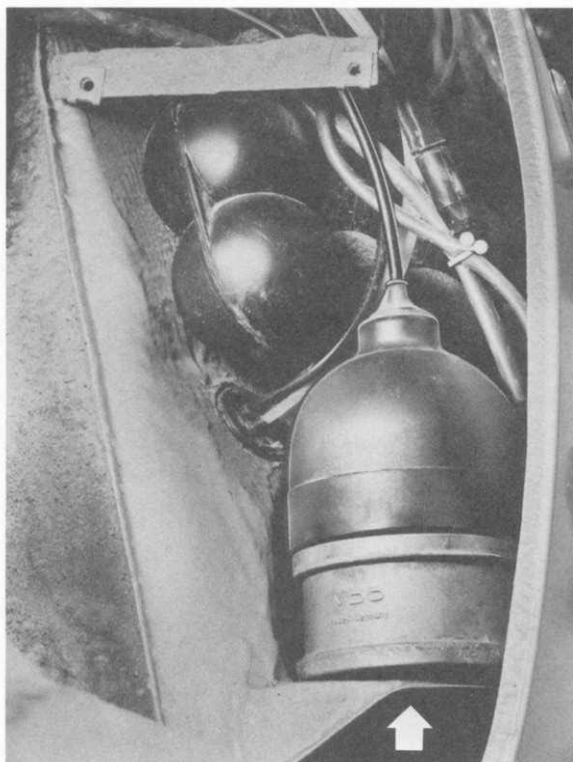
Note

Two mounting planes are provided to adjust the switch. The switch must have switched completely (contacts made) when clutch pedal is in off position.

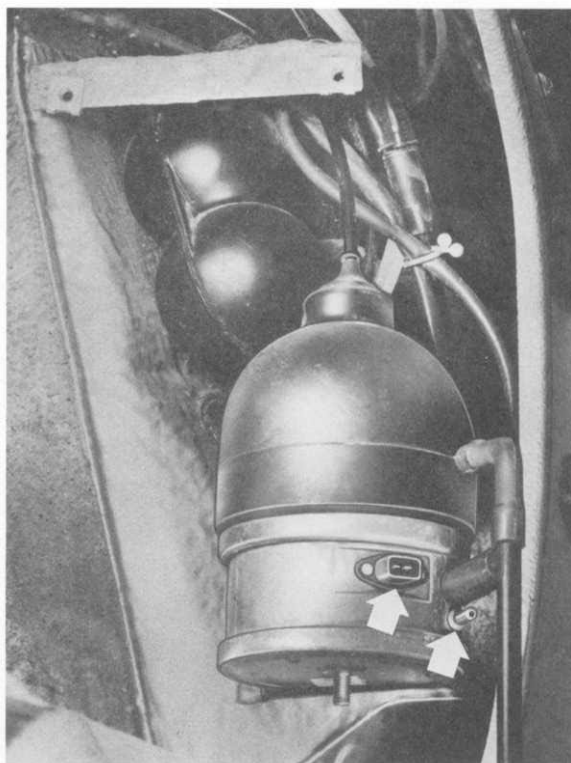


REMOVING AND INSTALLING VACUUM SERVO

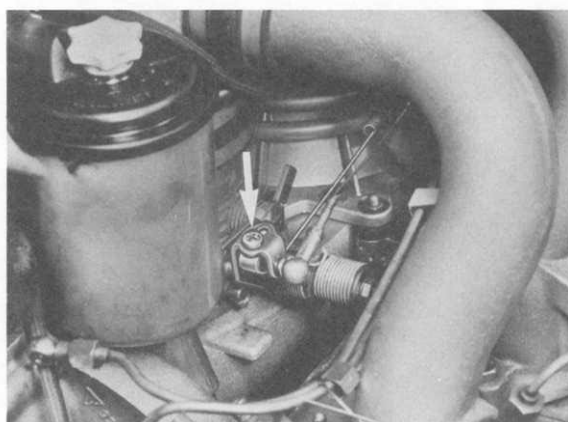
1. Unscrew trim at rear in left front wheel house.
2. Unscrew mounting nut underneath the vacuum servo holder.



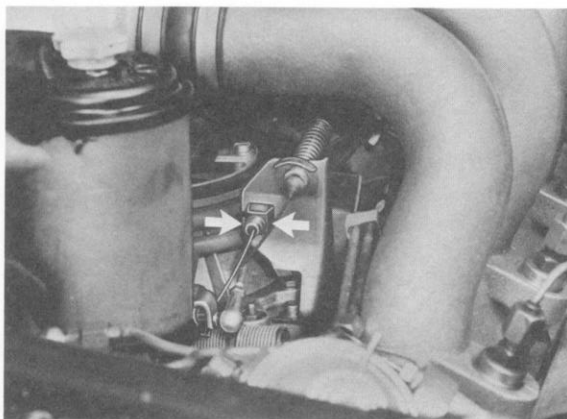
3. Pull vent tube underneath the vacuum servo out of the grommet. Turn vacuum servo so that connections face forward and pull off lines.



4. Remove entire air cleaner.
5. Unscrew cable on throttle.

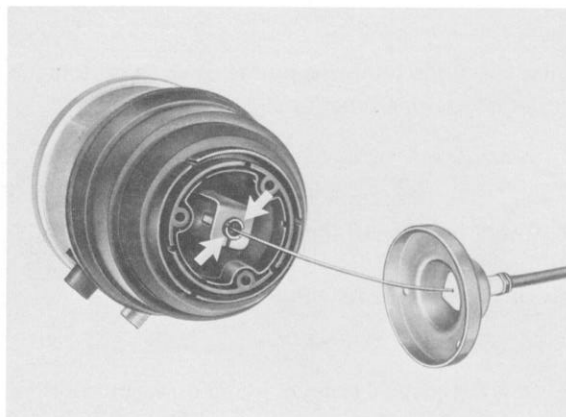


6. Compress catches on adjusting screw and push out of holder.

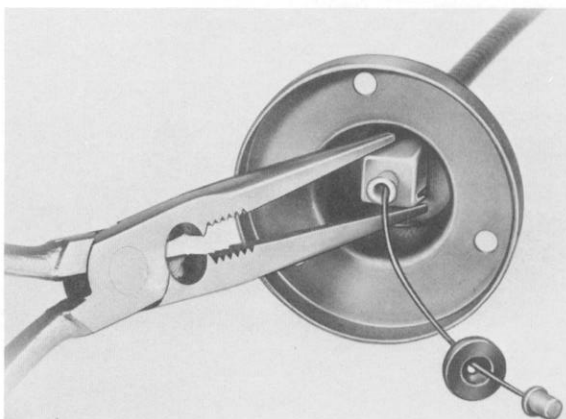


7. Pull cable with grommet into left wheel house.

2. Unscrew cap. Compress clip, push in and disconnect cable.

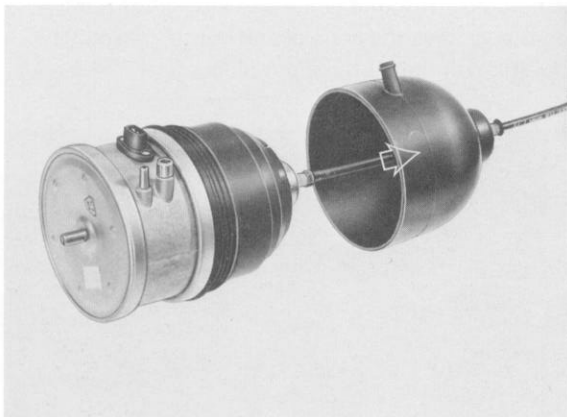


3. Press clip out of cap and take cap off of cable.



REMOVING AND INSTALLING CABLE ON VACUUM SERVO

1. Pry cover off of vacuum servo.



Note

Make sure cable is installed without sharp bends. Cable should have approx. 1 mm play on throttle mounting point. Under no circumstances should the cable be tight when the engine is stopped.

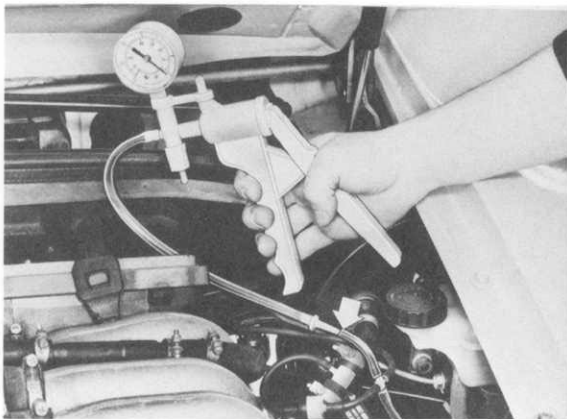
TROUBLESHOOTING AUTOMATIC CRUISE CONTROL (TEMPOSTAT)

First check the following points when the automatic cruise control malfunctions.

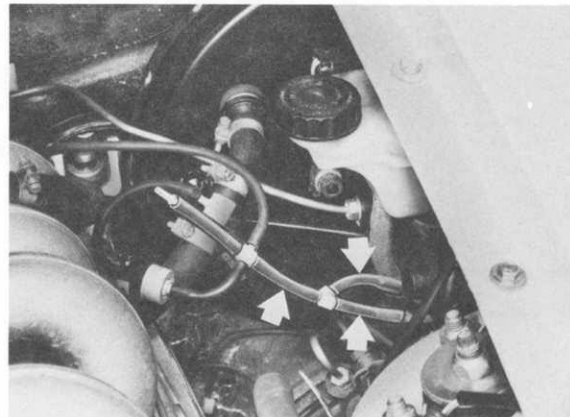
1. Check fuse no. 10 (no. 7 beginning with 1981 models).

This fuse is also for the stop lights.

2. Connect manual vacuum pump on vacuum system and check for leaks.



3. Visually inspect vacuum hoses for bends or twisting.



4. Check that electric connection on vacuum servo fits tight.

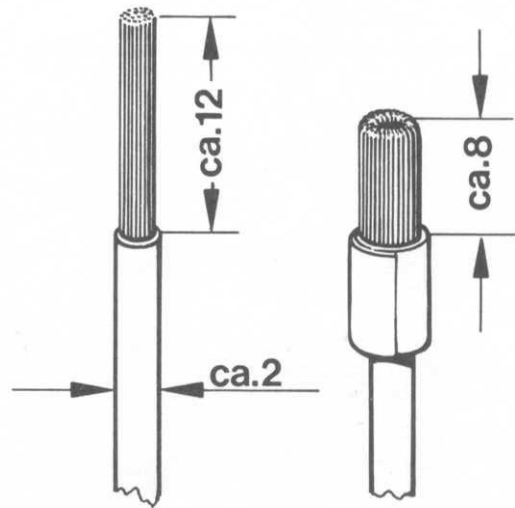
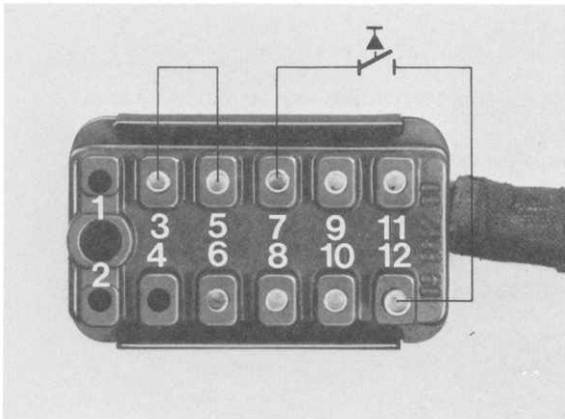
5. Check function of microswitch on clutch pedal. Switch must have switched fully, i. e. contact made, when clutch pedal is in off position (switching heard when operating clutch).

If no defect is found while checking all of these points, remove the control and continue troubleshooting on the multiple pin plug.



CHECKING VACUUM SERVO

1. Bridge term. 3 and term. 5 on multiple pin plug of removed control.
2. Connect any push button switch on terminals 7 and 12.



The length of the wires for the push button switch should be about 2 meters, in order to be able to watch the throttle while operating the switch.

3. Turn on ignition and press push button switch with engine stopped. The vacuum servo should move the throttle uniformly to full load position. This requires vacuum.

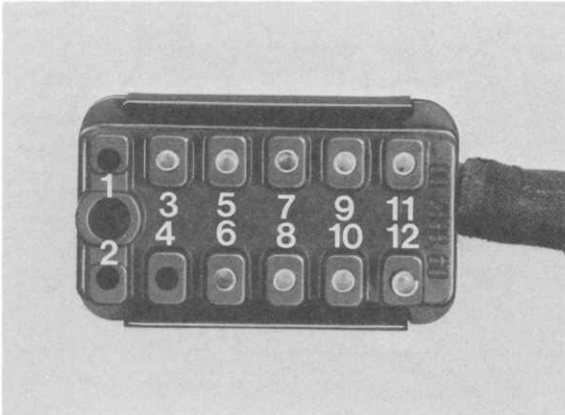
Note

To avoid damaging the female plugs in the multiple pin plug, suitable plugs or the wires described below must be used.

Remove insulation on wires with an insulating diameter of approx. 2 mm, bend back separate wires all around and wrap insulating tape around ends of wires.

CHECKING MULTIPLE PIN PLUG OF CONTROL WITH A VOLTMETER OR TEST LAMP

1. Turn on ignition.
Connect tester between terminals 5 and 12 (ground).



There should be battery voltage at terminal 5.

2. Connect tester between terminals 6 and 12.
There should be battery voltage when operating the brake.

3. Connect tester between terminals 8 and 12.

Display = battery voltage.

Pull back lever on tempostat switch (cancel).

Display = 0 volt.

4. Connect tester between terminals 9 and 12.

Display = 0 volt.

Push lever on tempostat switch forward (set).

Display = battery voltage.

5. Connect tester between terminals 10 and 12.

Display = 0 volt.

Push down lever on tempostat switch (repeat).

Display = battery voltage.

CHECKING MULTIPLE PIN PLUG OF CONTROL WITH AN OHMMETER AND IGNITION TURNED OFF

1. Check ground on plug.
Display between terminal 12 and car ground should be 0 ohm.
2. Connect ohmmeter between terminals 3 and 7.
Display = approx. 14 ohms (resistance value of vacuum servo).
Display should move to infinite ohms (switch interrupted).
3. Connect ohmmeter between terminals 11 and 12 (speed sensor).
Push car slowly or turn one rear wheel and hold the other rear wheel. Display of meter should alternate between 0 and infinite ohms.

Replace the control, if no defects are found in the tests.

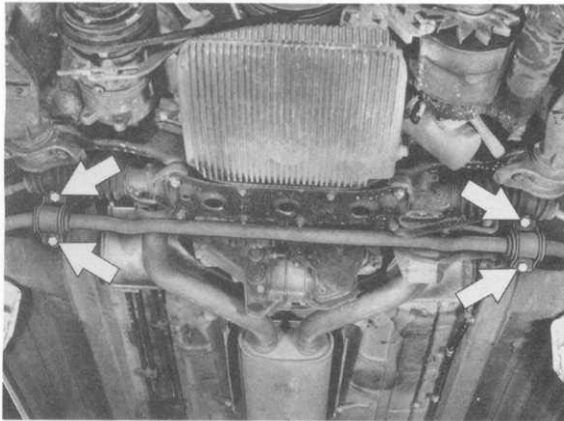
REMOVING AND INSTALLING STARTER

6.Remove mounting bolts.

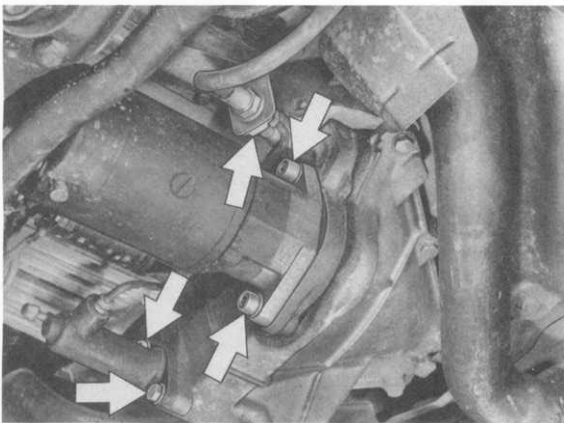
1.Disconnect battery.

2.Disconnect all cables to starter.

3.Detach stabilizer.



4.Remove clip from clutch-hose bracket.



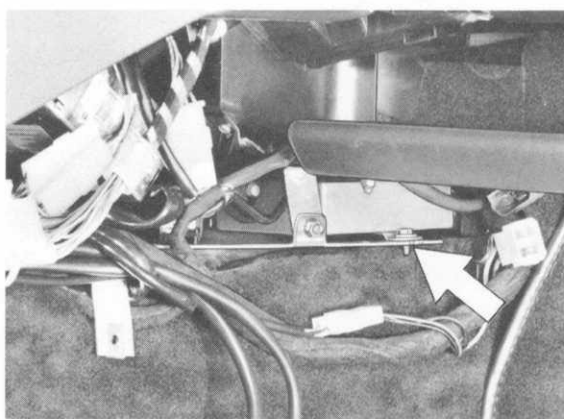
5.Unbolt clutch actuating cylinder.

ELECTRICALLY CONTROLLED TEMPOSTAT, '88 MODELS ONWARD

As of model year '88, the 928 models are fitted with an electrically controlled tempostat.

REMOVING AND INSTALLING TEMPOSTAT CONTROL UNIT

1. Detach right-hand side panel from center console.
2. Remove mounting bolt.



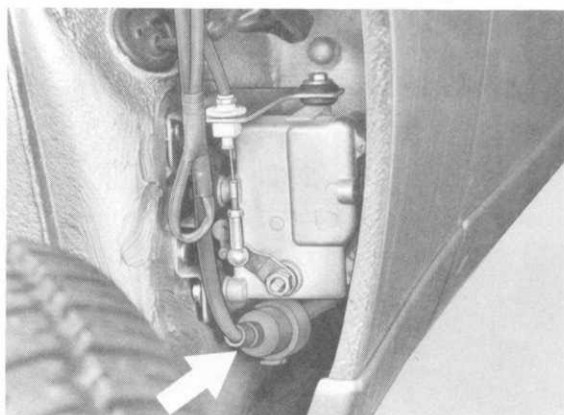
3. Remove control unit.
4. Disconnect plug.

REMOVING AND INSTALLING STEERING COLUMN SWITCH

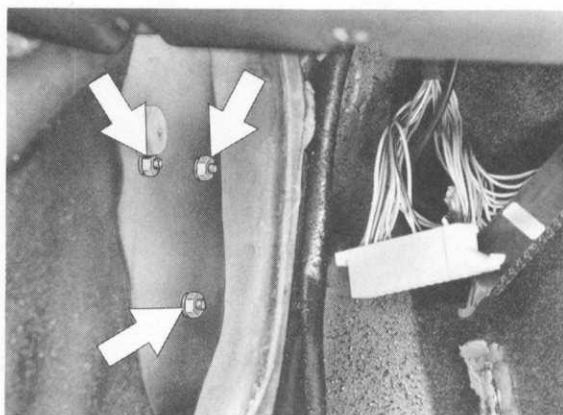
Removal and installation are described on page 94 - 4 of the Repair Manual.

REMOVING AND INSTALLING ACTUATOR

1. Remove front left-hand wheel-arch inner panel.
2. Open multi-pin plug holder and disconnect plug.



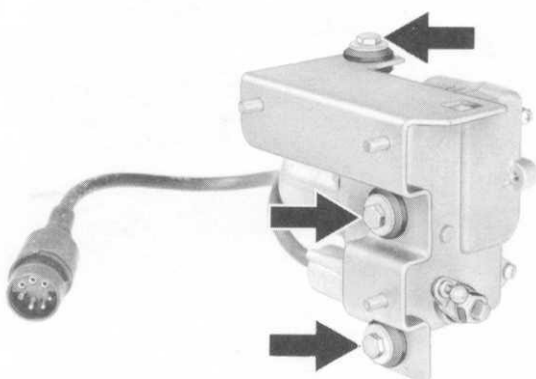
3. Disengage cable.
4. Press retainers together and push Bowden cable up out of holder.
5. Remove footrest in driver's side footwell.
6. Remove carpet and insulator from wheel-arch sidewall far enough to gain access to 3 mounting nuts.



7.Remove mounting nuts.

8.Remove actuator complete with holder.

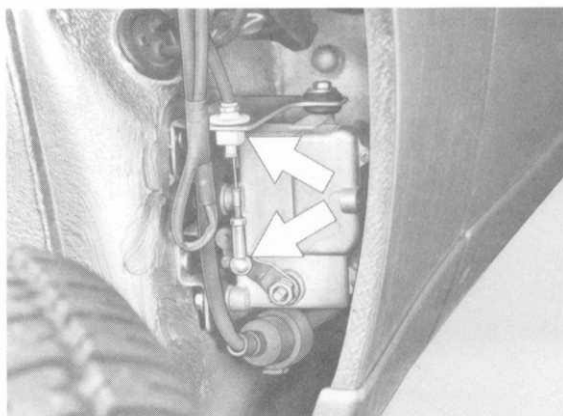
9.Unscrew attachment bolts.



REMOVING AND INSTALLING BOWDEN CABLE

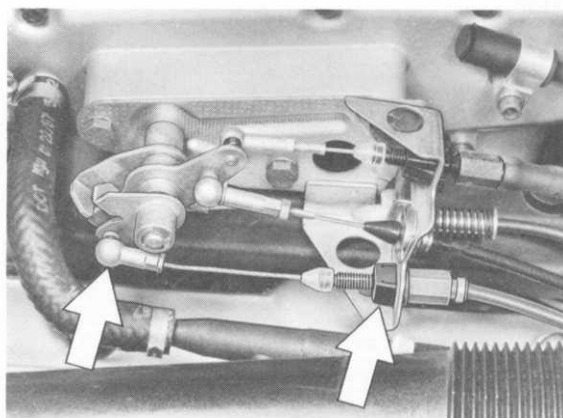
1.Remove front left-hand wheel-arch inner panel.

2.Disengage cable.



3.Press retainers together and push Bowden cable up out of holder.

4.Disengage Bowden cable from reversing lever.



5. Press retainers of setscrew together and push back out of holder.
6. Push Bowden cable and rubber grommet through wheel-arch wall.

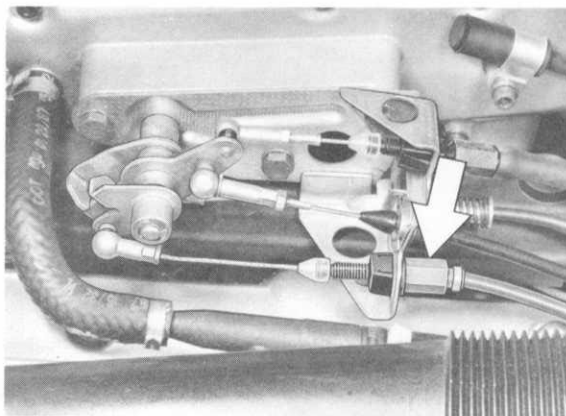
Note:

When installing the Bowden cable, check to ensure that it is routed free of kinks.

Adjusting Bowden Cable

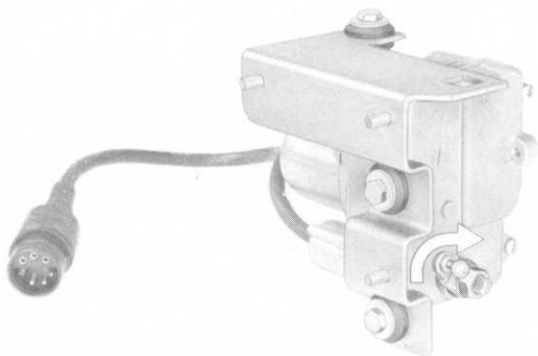
1. Turn adjusting lever on actuator clockwise as far as it will go.

2. Turn setscrew to adjust Bowden cable so that there is play of 1 - 2 mm at reversing lever.



REMOVING AND INSTALLING CLUTCH
PEDAL SWITCH

See page 27 - 7.



TROUBLESHOOTING, TEMPOSTAT

If faults arise in the automatic speed control system, begin by checking the following points.

1. Check cable for damage and maladjustment.
2. Fuse no.4 on the central electrics unit.
3. Operation of stoplights.
4. Operation of clutch pedal switch.
In its normal position, the switch must be closed. A jumper must be installed in place of the clutch pedal switch in cars with automatic transmission.

If these checks do not reveal any fault, continue by testing the multi-pin plug of the control unit.

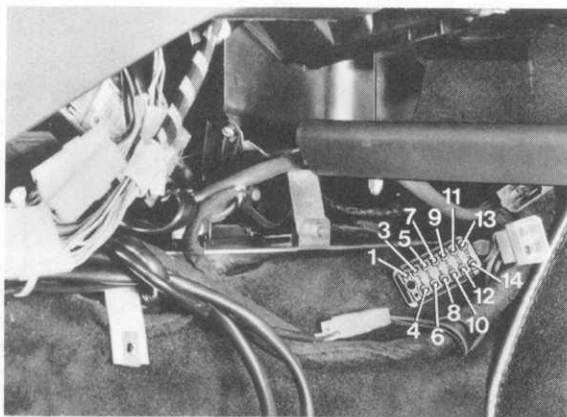
TEMPOSTAT CONTROL UNIT PIN ASSIGNMENT

- 1 - Ter.X
 - 2 - Not occupied
 - 3 - Switch "off"
 - 4 - Switch "set/accelerate"
 - 5 - Clutch actuator
 - 6 - Switch "resume"
 - 7 - Actuator, engine plus
 - 8 - Stoplight/clutch actuator
 - 9 - Clutch, potentiometer plus
 - 10 - Actuator, engine minus
 - 11 - Engine-speed signal
 - 12 - Ter.31/actuator potentiometer minus
 - 13 - Actuator potentiometer sliding contact
 - 14 - Clutch pedal switch, jumper to ter.31 if car has automatic transmission
- _____

TESTING MULTI-PIN PLUG OF TEMPOSTAT CONTROL UNIT

Note:

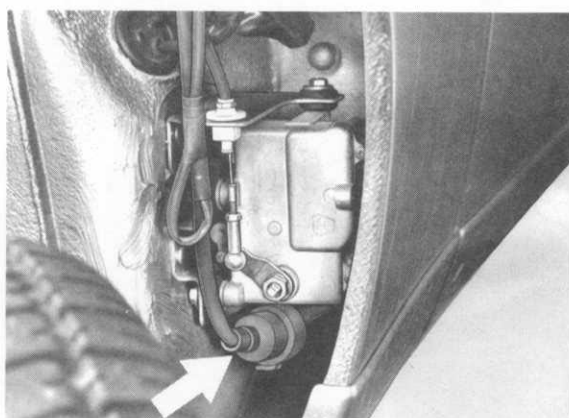
Use a voltmeter or ohmmeter to carry out tests on disconnected plug receptacle.



1. Turn ignition key to position X.
2. Connect voltmeter to ter.1 (plus) and ter.12 (minus).
Reading: battery voltage
3. Connect voltmeter to ter.3 and ter.12
Reading: battery voltage
Push operating switch toward "off".
Reading: 0 volts
4. Connect voltmeter to ter.4 and ter.12
Reading: 0 volts
Press operating switch toward "set/accelerate".
Reading: battery voltage
5. Connect voltmeter to ter.6 and ter.12
Reading: 0 volts
Press operating switch toward "resume".
Reading: battery voltage
6. Connect voltmeter to ter.8 and ter.12
Reading: 0 volts
Press brake pedal.
Reading: battery voltage
7. Connect voltmeter to ter.1 and ter.14
Reading: battery voltage
Press clutch.
Reading: 0 volts
8. Connect ohmmeter to ter.11 and ter.12
Push car slowly.
The reading on the gage must alternate between 0 ohm and ∞ ohm.
9. Connect ohmmeter to ter.5 and ter.8
Reading: approx. 30 - 40 ohm
10. Connect ohmmeter to ter.7 and ter.10
Reading: approx 2 - 6 ohm
11. Connect ohmmeter to ter.9 and ter.12
Reading: 2 - 4 kohm
12. Connect ohmmeter to ter.12 and ter.13
Reading: 2 - 4 kohm

Note:

If the readings stated in steps 9 through 12 are not reached, test the actuator half of the plug in the same way.



13. Connect ohmmeter to ter.1 and ter.7

Reading: 2 - 6 ohm

14. Connect ohmmeter to ter.5 and ter.6

Reading: 30 - 40 ohm

15. Connect ohmmeter to ter.2 and ter.4

Reading: 2 - 4 kohm

16. Connect ohmmeter to ter.2 and ter.3

Reading: 2 - 4 kohm

If these tests do not reveal a fault, replace the control unit.

Alternator, removing and installing as from Model 85

Removing

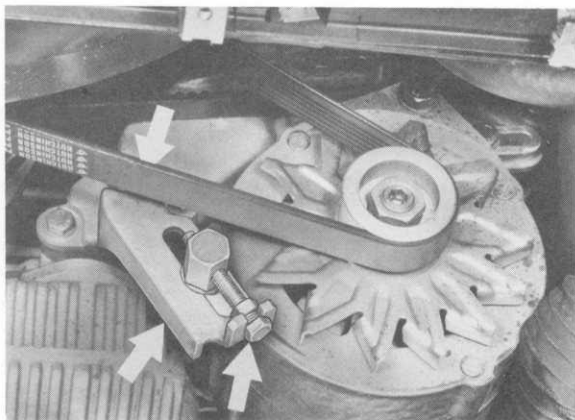
1. Disconnect the battery ground connection behind the tool panel.
2. Lift the vehicle and remove the sump guard.
3. Pull off the ventilation hose for the alternator.
4. Undo both nuts and the alternator adjustment screw. Loosen the bracket on the console, swivel the alternator inwards and remove the poly-rib drive belt.

Installing

Check and adjust the poly-rib drive tension for the alternator, see Page 13 - 18 b.

Tightening torque of the fastening screws

M 10 = 45 Nm.



11571

5. Disconnect the electrical connectors from the oil pressure sensor.
6. Undo the alternator's fastening screw and pull out forwards. Remove the alternator downwards.
7. Remove the air box and detach electrical connections.

IGNITION COMPONENTS

Ignition Coil

Type/Model	Version	Remarks
928	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors (0.4 and 0.6 ohms)

Distributor

Type/Model	Version	Remarks
928	928 602 032 01 Bosch No. 0 237 401 006	Centrifugal advance and vacuum retard control See note on next page!

Spark Plugs

Type/Model	Version	Remarks
928	Bosch W 145 T 30 Beru 145/14/3 A	0.7 + 0.1 mm plug gap

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. 0 227 100 008	Transistor ignition

Note

The fuel pump relay is designed to turn off the fuel pumps when engine reaches a speed of approx. 6300 rpm. This type of speed control is required, since ignition failure could destroy the catalytic converter required for emission control.

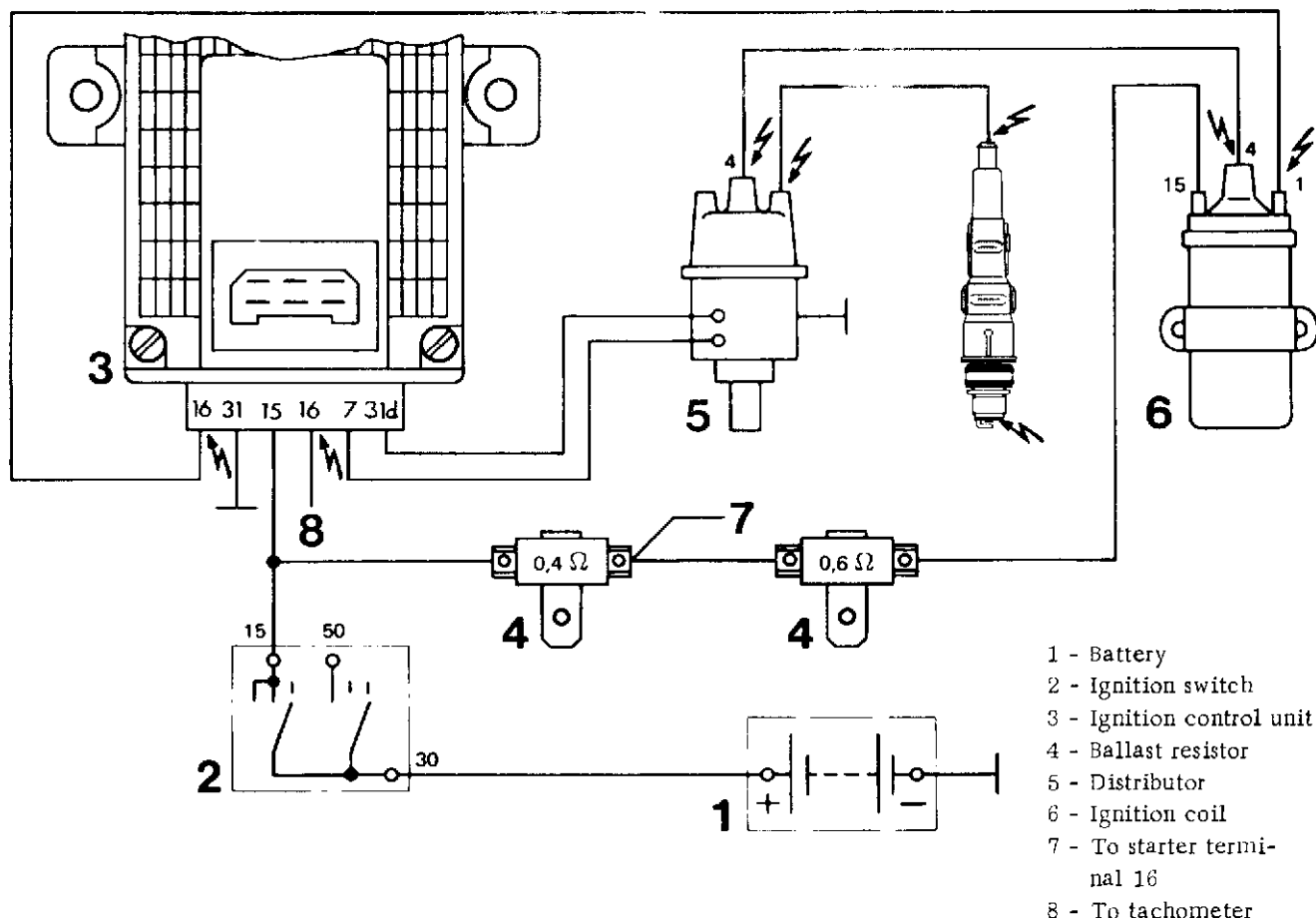
CAUTIONS WHEN REPAIRING ELECTRONIC IGNITION SYSTEMS

The 928 is equipped with an electronic ignition system. The ignition output of this transistorized ignition coil ignition system is so high, that with the engine running there could be dangerous current in the system. Consequently, any work on the ignition system requires that the ignition be turned off or battery ground cable disconnected. Such jobs would include the following.

1. Connecting engine testing equipment (timing light, tachometer, ignition oscilloscope etc.).
2. Replacement of ignition system parts (spark plugs, ignition coil, distributor, ignition cables etc.).

If testing the ignition system or making engine adjustments requires turning on the ignition, dangerous voltage will be on the primary and secondary side of the entire system. Thus the danger is not only present at the individual parts of the ignition system (for example, distributor, ignition coil, ignition control unit, ignition cables etc.), but even on the line leading from the ignition control unit to the tachometer, the plug connections and any testing equipment connected.

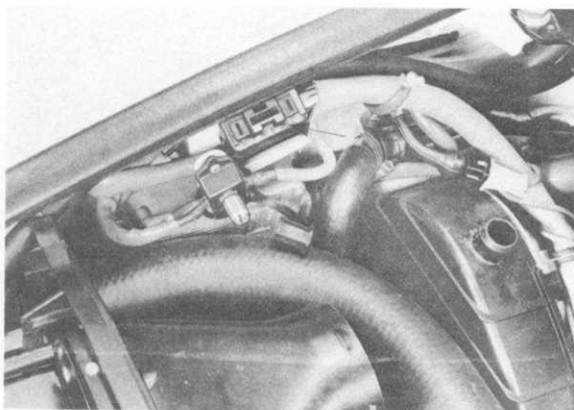
The dangerous points are marked with high tension arrows in the layout plan below.



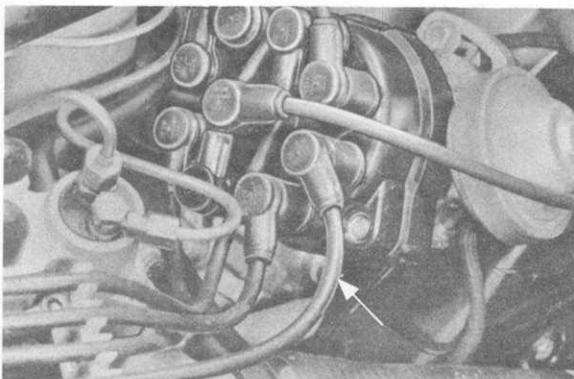
ADJUSTING IGNITION TIMING

1. Run engine to operating temperature (oil temperature about 80 to 90° C/176 to 194° F).

2. Connect engine tester or timing light and tachometer. A positive terminal for connection of testing equipment is located above ignition control unit in engine compartment.



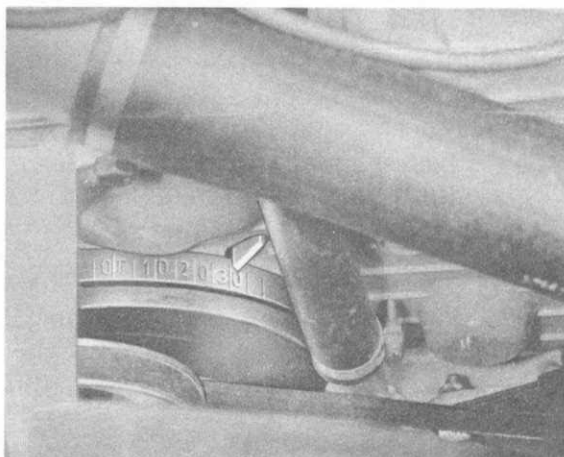
Timing light is connected to ignition cable of cylinder number 1.



Unlike capacitor discharge ignition systems, testing equipment (e.g. tachometer) can be connected to ignition coil terminals 1 and 15 of transistorized ignition coil systems.

3. Detach both vacuum hoses at distributor.

4. Adjust ignition timing to 31° before TDC at engine speed of 3000 rpm. Loosen and turn distributor to change ignition timing.



5. Run engine at 5000 rpm, at which speed ignition timing must not exceed 36°.

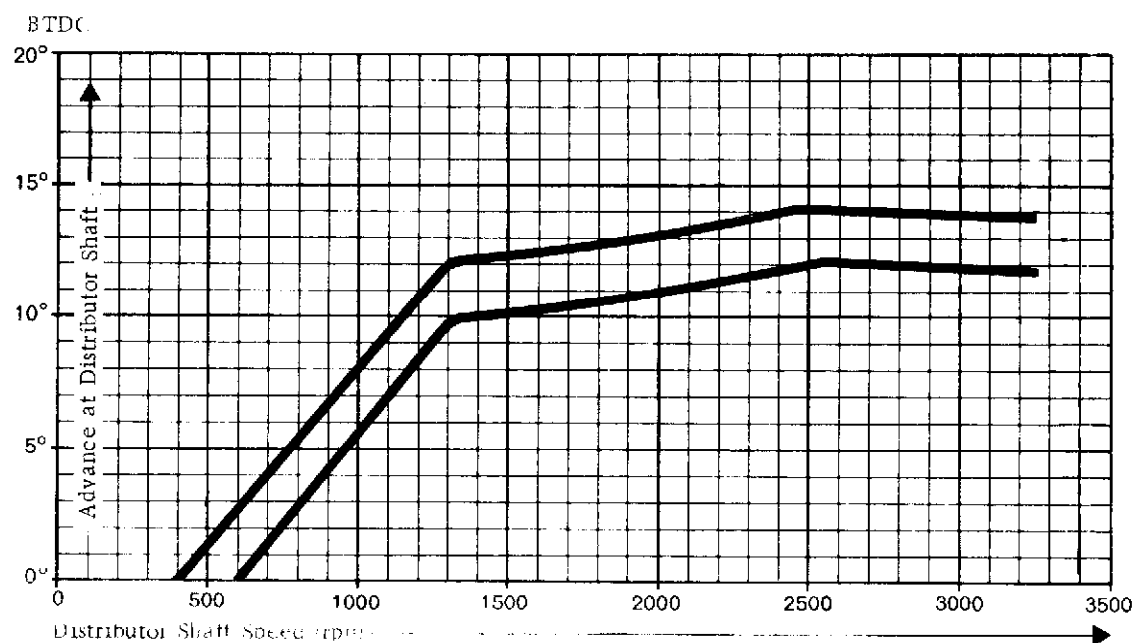
6. Attach vacuum hoses. Ignition timing must be $0 \pm 4^\circ$ when engine runs at idle speed (800 ± 50 rpm).

Remove distributor and check it in a distributor test bench, if specifications in points 5 and 6 cannot be held.

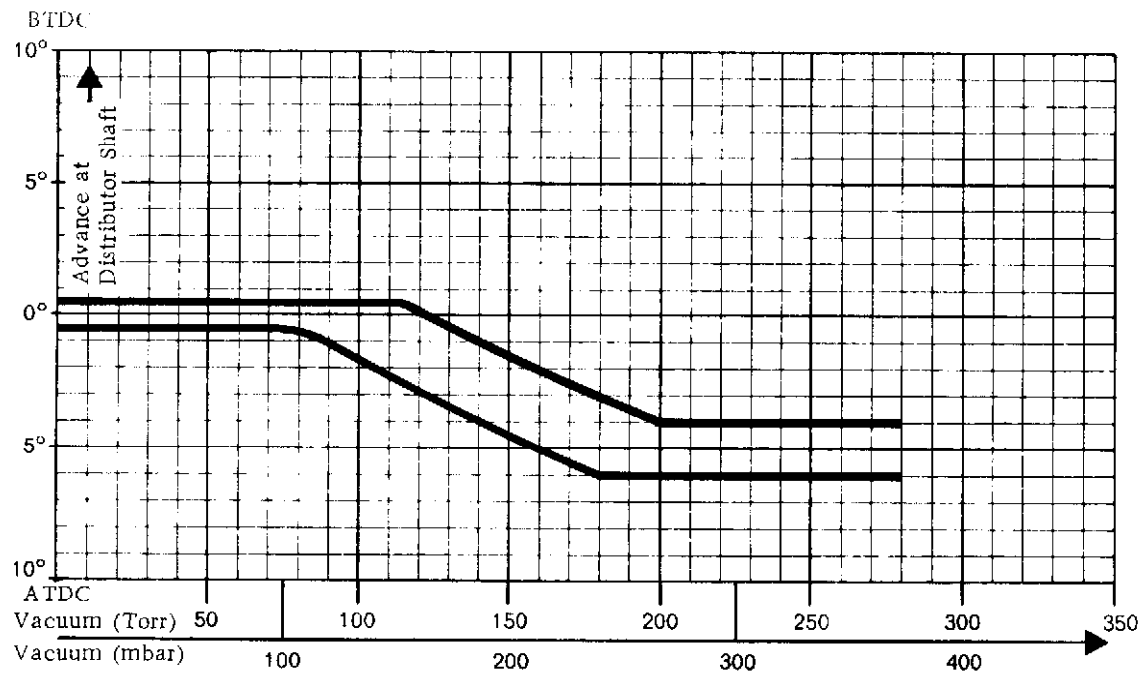
Note

1. Ignition must be off when connecting tester to ignition coil.
2. The dwell angle is not adjustable and does not need to be checked.

CENTRIFUGAL ADVANCE CURVE FOR DISTRIBUTOR

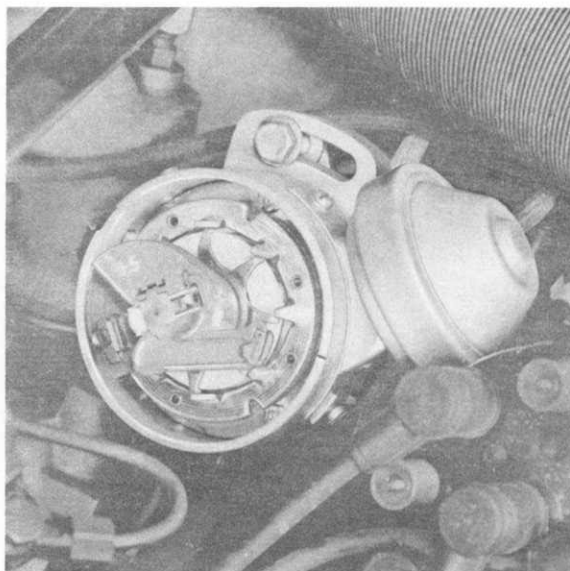


VACUUM RETARD CURVE FOR DISTRIBUTOR



REMOVING AND INSTALLING DISTRIBUTOR

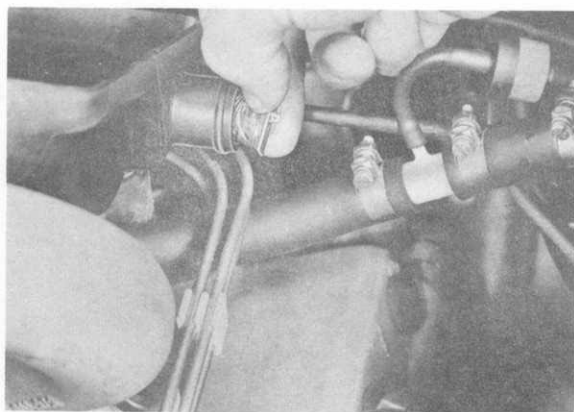
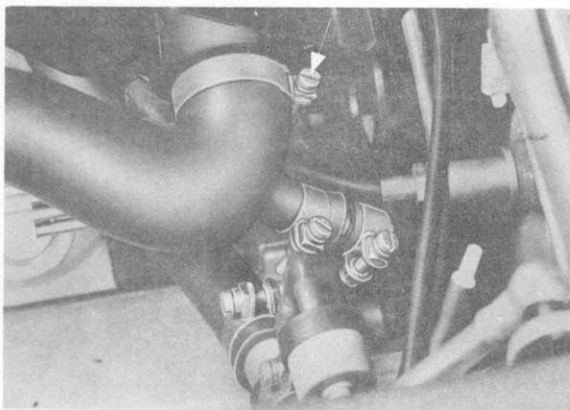
1. Set cylinder 1 at TDC.



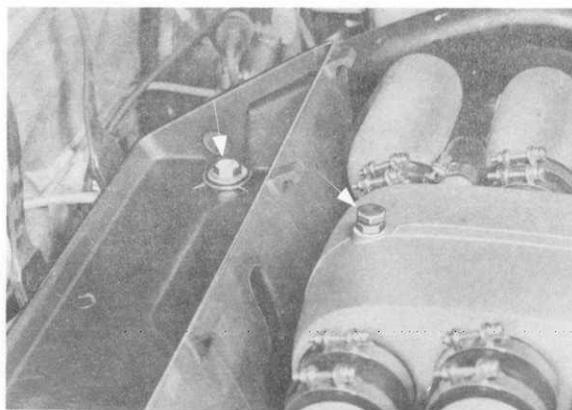
2. Remove distributor cap, rotor and dust cap.
Detach vacuum hoses and wires.
3. Unscrew mounting bolt and remove distributor.
4. When installing the distributor rotor make sure that it faces the cylinder 1 mark on distributor housing.
5. Adjust ignition timing.

REPLACING SPARK PLUGS

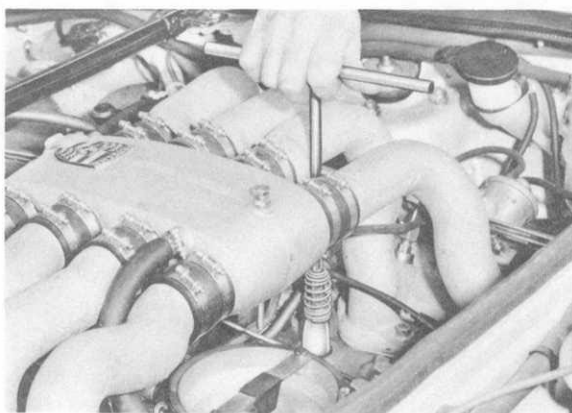
1. Detach both air intake hoses.
2. Disconnect rubber straps at air cleaner lower section and take out filter element.
3. Loosen and detach vent hose, and pull out flame trap.



4. Loosen and pull out air cleaner lower section clamping bolt in intake branch. Loosen air cleaner lower section bolts and remove air cleaner lower section to the right.



5. Unscrew spark plugs with a standard socket.



Installation Instructions

1. Apply a light coat of Molykote HTP white paste to plug threads.
2. Tightening torque: 25 to 30 Nm (18 to 22 ft lb)

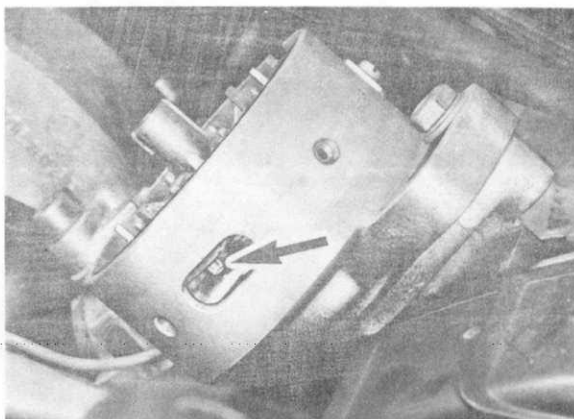
REMOVING AND INSTALLING VACUUM UNIT ON DISTRIBUTOR

1. Remove distributor cap, rotor and dust cover.
Pull off hoses from vacuum unit.

2. Unscrew screws.

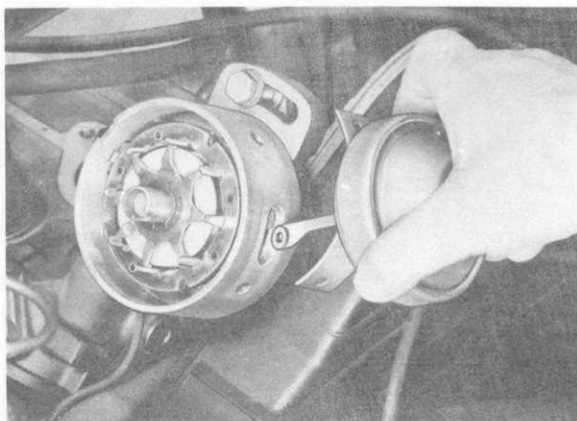


4. When installing, engage hole of pull rod in pin on stator of transmitter.



This can be done more easily by turning stator against left stop and holding in this position.

3. Press up and remove vacuum unit.



Note

The soft iron teeth of the transmitter must not be bent, regardless of circumstances.

TROUBLESHOOTING ELECTRONIC IGNITION SYSTEM (BOSCH TRANSISTORIZED IGNITION SYSTEM)

Testing Prerequisites:

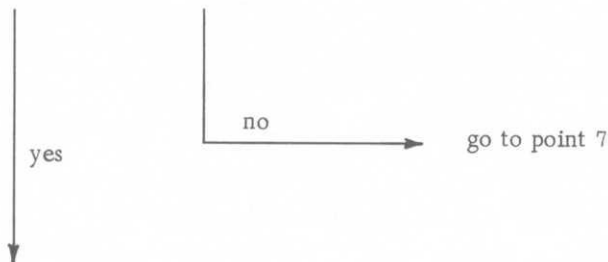
Battery fully charged, fuel in tank, engine or ambient temperature between 0 and + 40 °C/ 32 and 104 °F (temperature has considerable influence on test values).

Note especially information concerning dangers of electronic ignition systems (see page 28 - 3).

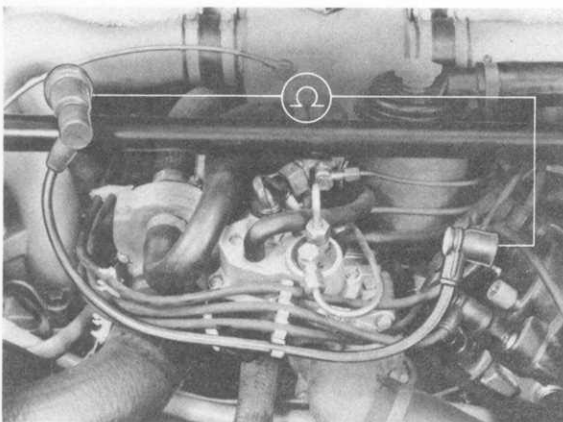
Starter turns, engine will not start or does not develop sufficient power.

1. Connect spark gap tester to ignition coil terminal 4 and set length at 12 mm. Start engine.

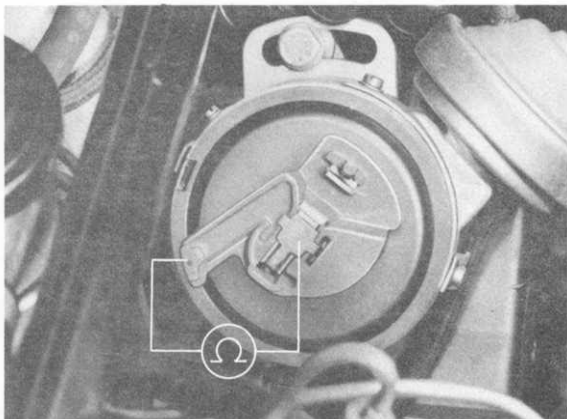
12 mm spark gap present?



2. Check distributor cap, distributor rotor, ignition cables and spark plugs.



Resistance of ignition line including plug: 2.5 k Ohms.



Resistance of distributor rotor: 5 k Ohms.

Spark at spark plug?

yes

no

→ repair secondary side

3. Check ignition timing.

Timing correct?

yes

no

→ adjust timing

4. Check fuel system.

Engine receiving sufficient fuel?

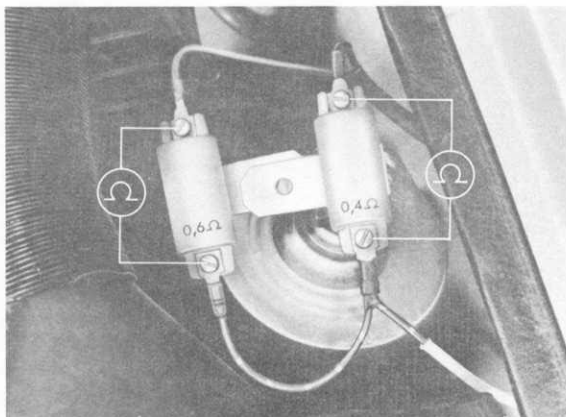
yes

no

→ repair fuel system

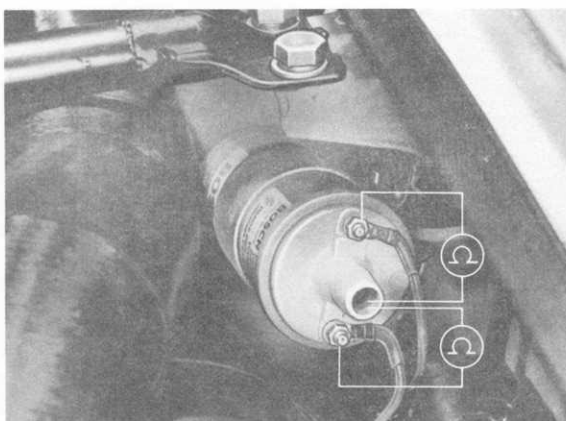
yes

5. Check resistors and ignition coil.



0.4 ohm resistor: 0.35 ... 0.45 ohm

0.6 ohm resistor: 0.55 ... 0.65 ohm



Ignition coil primary (term. 1 and 15):
0.33 ... 0.46 ohm

Ignition coil secondary (term. 1 and 4):
7 ... 12 k Ohms

Resistances value correct?

yes

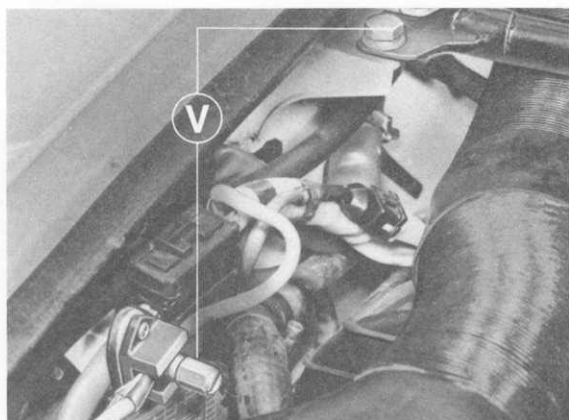
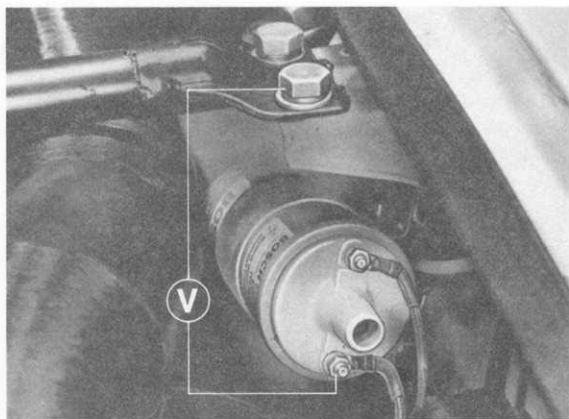
no

replace resistor or ignition coil

yes

6. Measure voltage of ignition coil terminal 15 against ground.

Turn on ignition.



Voltage at term. 15: at least 3 V at battery voltage of at least 11 volts (measure at same time).

Voltage correct?

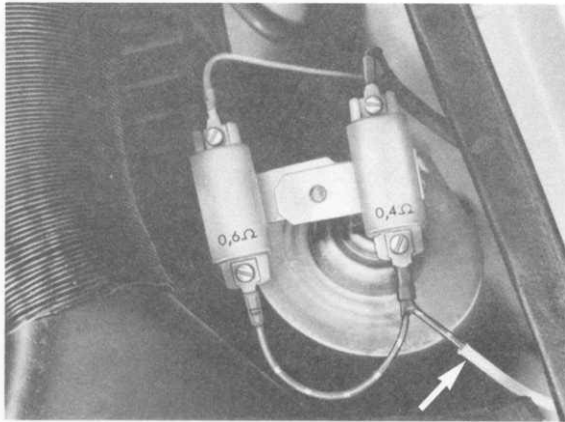
yes

go to point 11.

no

Check voltage drop at wires and connections on ignition switch, resistors, ignition coil and control unit, and eliminate voltage drop.

7. Check starting voltage.



Disconnect line leading to starter term. 15a at 0.4 ohm resistor and connect voltmeter. Operate starter. Measured voltage must be same as battery voltage (measured at same time).

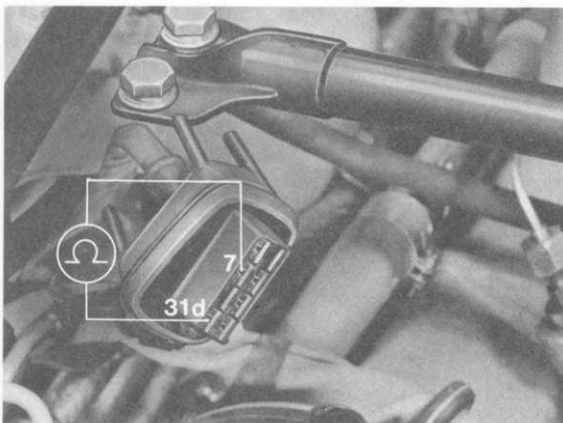
Starting voltage good?

yes

no

Eliminate break in supply line or contact 15a in starter relay.

8. Measure sensor resistance including sensor line at disconnected ignition control unit plug between terminals 7 and 31 d.



Measured value between 485 and 700 ohms?

yes

no

Pull off sensor lines from distributor and repeat test on sensor system.

Resistance between 485 and 700 ohms?

yes

no

Replace sensor line.

Replace distributor.

9. Check sensor coil with sensor line for ground, between terminal 7 and ground; and terminal 31 d and ground.

Infinite resistance?

yes

no

Pull off sensor line from distributor and repeat test on sensor system.

Infinite resistance?

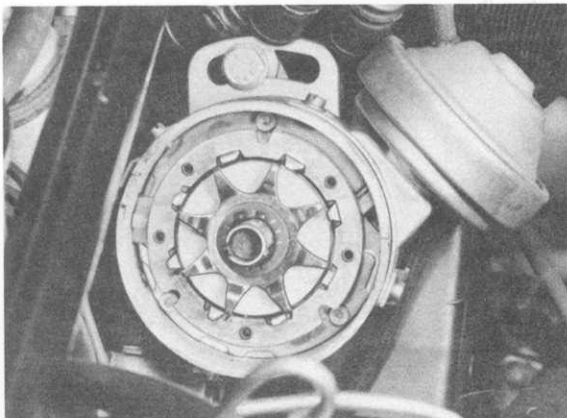
yes

no

Replace sensor line.

Replace distributor.

10. Check sensor system for mechanical damage. Visual inspection: gap between rotor and stator?



Sensor system good?

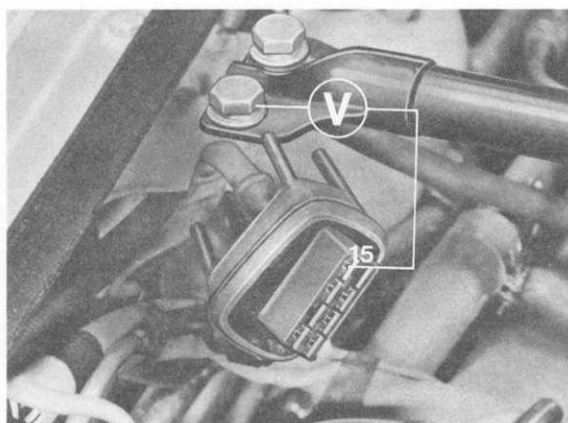
yes

no

Replace distributor.

go to point 5.

11. Check voltage at ignition control unit plug terminal 15 against ground. Voltage must be same as battery voltage.



Voltage correct?

yes

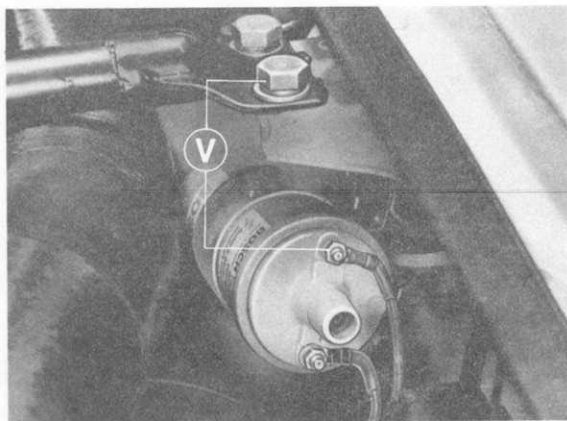
no

Check voltage drop in line from ignition switch to control unit, and eliminate voltage drop.

yes

12. Check voltage at ignition coil terminal 1 against ground.

Voltage at term. 1: max. 2 V.



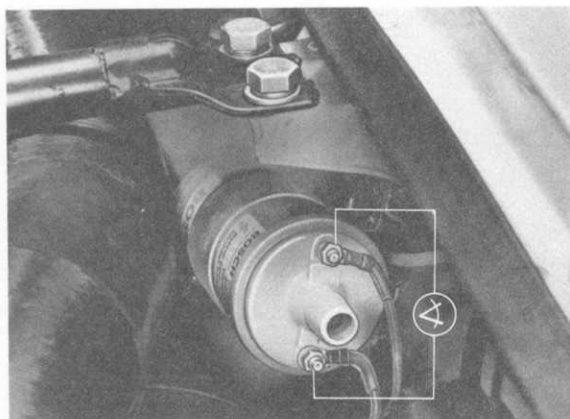
Voltage correct?

yes

no

Replace control unit.

13. Check dwell angle (short test on warm engine).

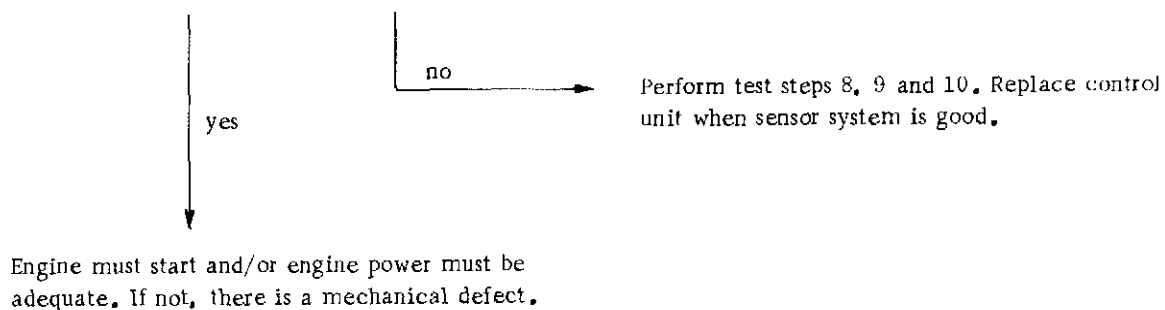


Dwell angle 25 ... 39° at 1500 $\pm$ 50 rpm
Dwell angle 33 ... 40° at 5000 $\pm$ 50 rpm

Dwell angle correct?

yes

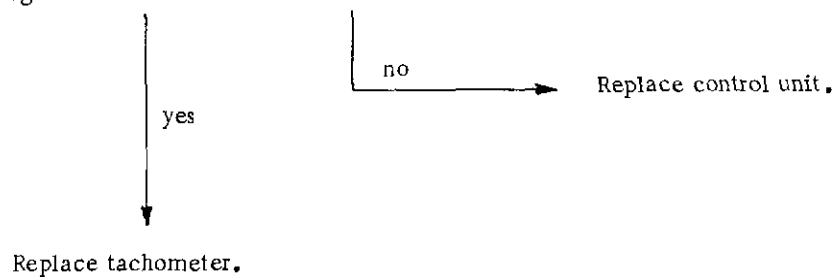
no



14. Ignition failure:

Disconnect tachometer (12-pin plug on instrument cluster, right, or plug G on central fuse/relay panel.

Ignition failure eliminated?



IGNITION COMPONENTS - 1980 Models

Ignition Coil

Type/Model	Version	Remarks
928	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928	928 602 032 03 Bosch No. 0 237 405 010	Centrifugal and vacuum advance and retard control Distributor rotor without rev. limiter.

Spark Plugs

Type/Model	Version	Remarks
928	Bosch WR 8 DS Beru RS 35	0.7 + 0.1 mm (0.028 + 0.004 in.)

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. A 227 010 123	Transistor coil ignition

Note

The vacuum control range of the distributor is changed from 140 - 240 mbar to 360 - 470 mbar beginning with 1981 models.

Part No. for distributor is 928.602.032.04 (Bosch No. 0237 405 020).

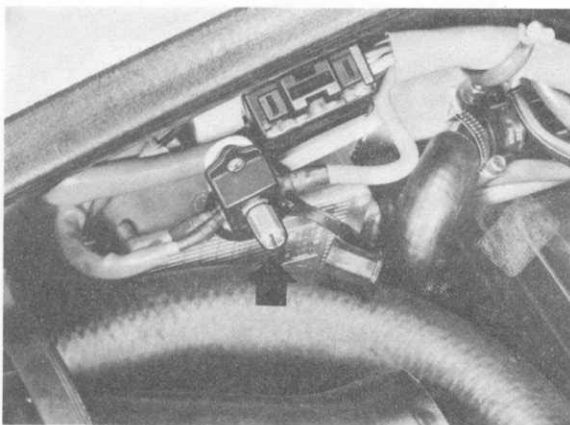
IGNITION ADJUSTING AND TESTING VALUES

Type	928 M 28/13/14
Ignition timing (without vacuum)	23° BTDC at 3000 rpm
Advance installed	yes
Retard installed	yes
Idle speed (rpm)	750 ± 50
Centrifugal advance (without vacuum)	8 to 10° BTDC at idle speed 29 to 34° BTDC at 6000 rpm
Vacuum advance (at idle speed) degrees of "advance" adjustment	Vacuum hose of conn. 2 on conn. 1 8 to 12°
Speed increase	turned back below 1000 rpm
Vacuum retard degrees of retard adjustment (at idle speed) "retard"	Vacuum hose (connection 2) connected 4 to 8° refer Porsche to their publication 4592, 21(928 Service Information) page 73. Ignition timing specs. do not agree!

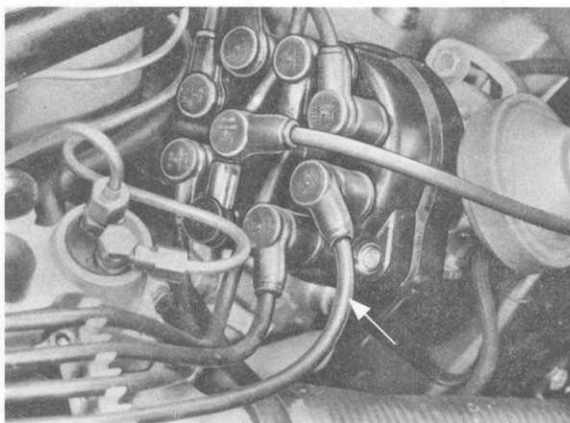
ADJUSTING IGNITION TIMING - From 1980 Models

1. Run engine to operating temperature (oil temperature about 80 to 90°C/176 to 194°F).

2. Connect engine tester. A positive terminal for connection of testing equipment is located in engine compartment.

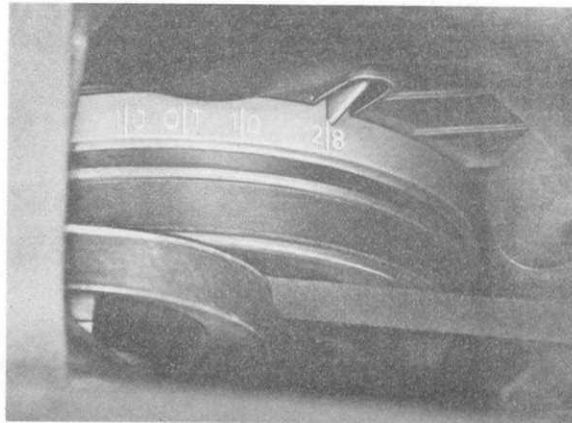


3. Connect timing light to ignition cable of cylinder 1.



4. Pull off both vacuum hoses at distributor.

5. Adjust ignition timing to 23° before TDC at an engine speed of 3000 RPM.



Loosen and turn distributor to change ignition timing.

6. Attach vacuum hoses again.

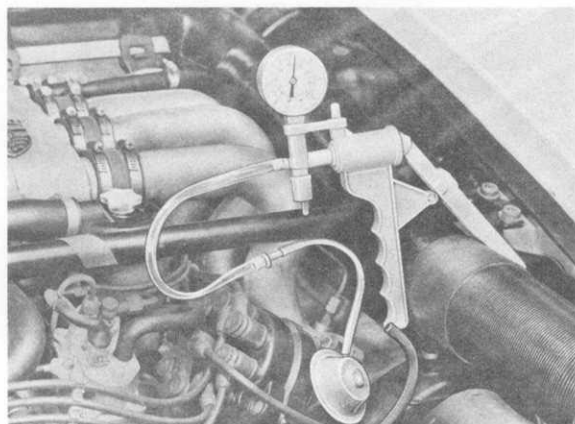
CHECKING IGNITION TIMING - From 1980 Models

Requirements:

Ignition timing adjustment is correct.

1. Check centrifugal advance (see table).

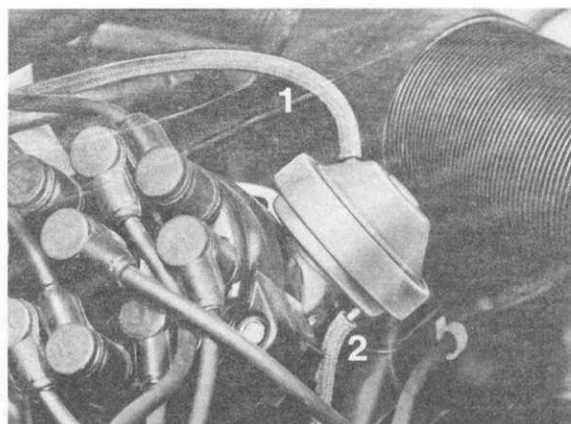
2. Check vacuum unit (see table)



Idle speed vacuum available at connection 2 can be used to check ignition advance.

This requires connecting the vacuum hose from retard unit to the advance unit.

Vacuum connections



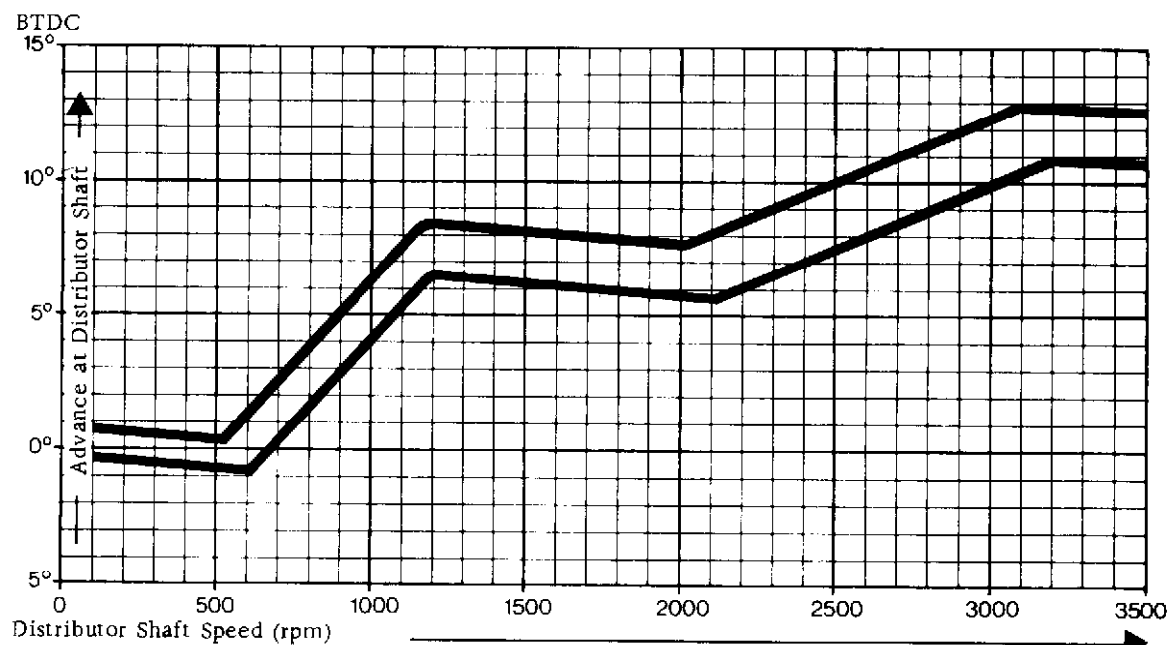
- 1 - Advance
- 2 - Retard

Note

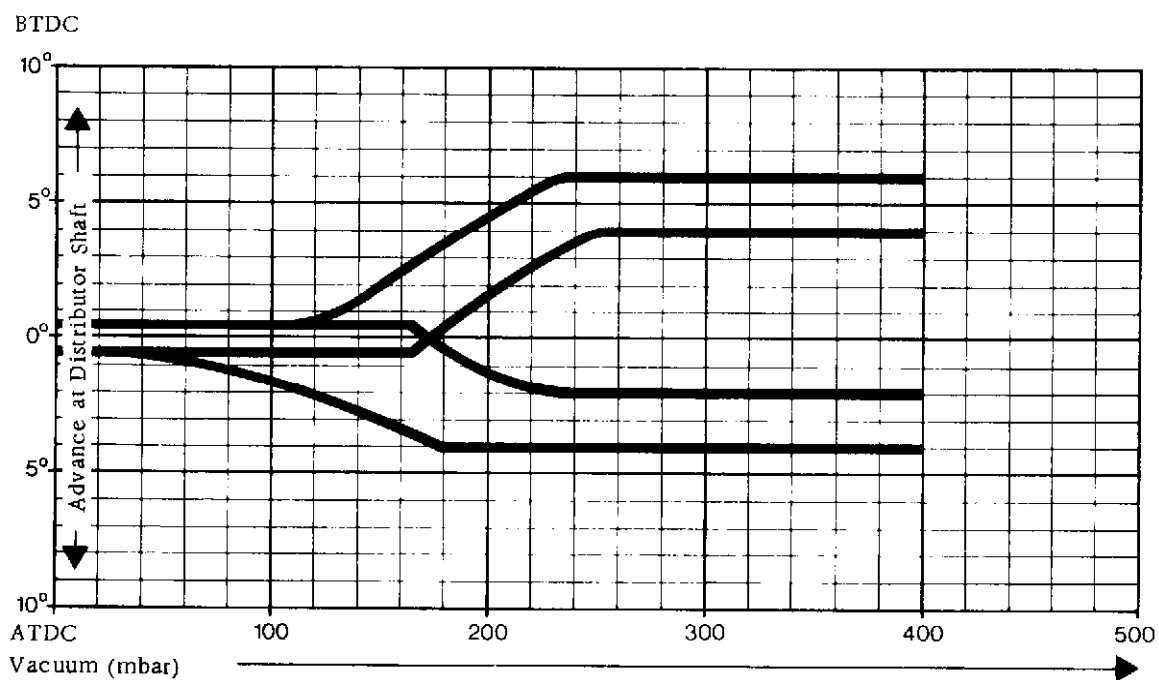
After completion of tests reconnect vacuum hoses.

If specified testing values can't be reached, remove distributor for inspection on a test bench.

CENTRIFUGAL ADVANCE CURVE TYPE 928 - from 1980 Models

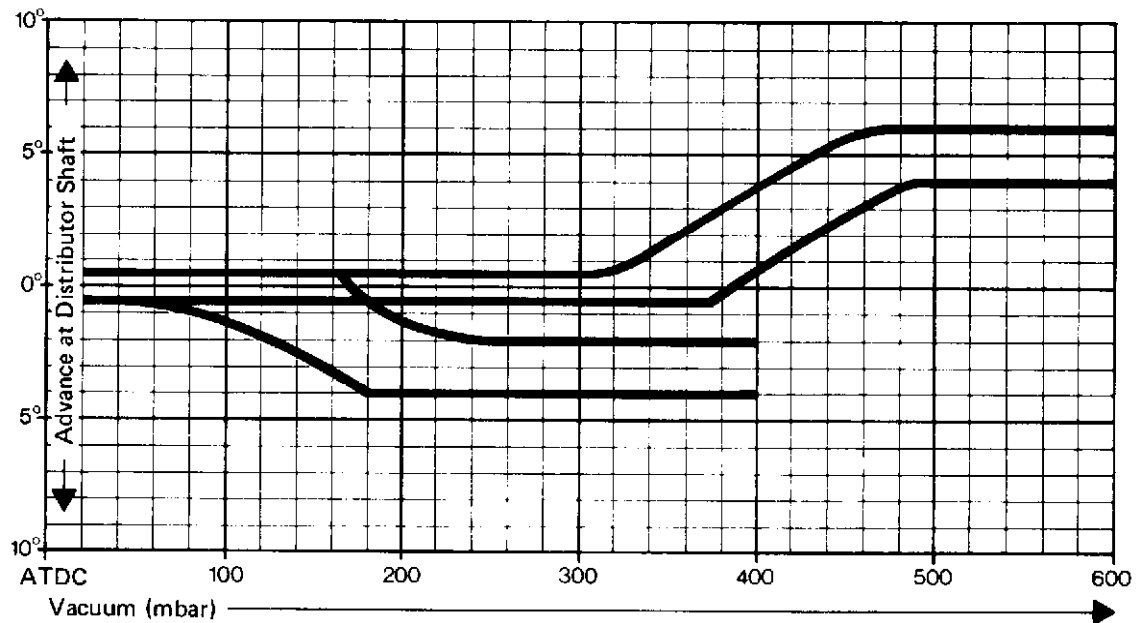


VACUUM ADVANCE CURVE TYPE 928 - from 1980 Models



VACUUM ADVANCE CURVE TYPE 928 - from 1981 Models

BTDC



IGNITION COMPONENTS — 1983 Models

Ignition Coil

Type/Model	Version	Remarks
928 S	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928 S	928 602 032 06 Bosch No. 0 237 401 018	Centrifugal and vacuum advance control. Distributor rotor without speed governor.

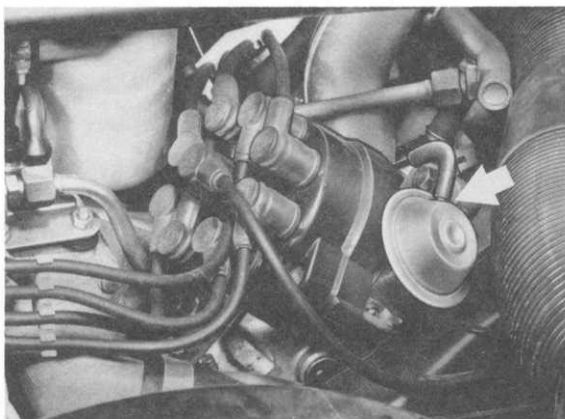
Spark Plugs

Type/Model	Version	Remarks
928 S	Bosch WR 8 DS Beru RS 35	0.7 + 0.1 mm

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. A 227 010 123	Transistor coil ignition

The distributor for USA/Canada models has a vacuum unit for advance control beginning with 1983 models.



IGNITION ADJUSTING AND TESTING VALUE BEGINNING WITH 1983 MODELS

Ignition timing (without vacuum)	20° BTDC at 3000 rpm
Idle speed	650 ± 50 rpm
Centrifugal control (without vacuum)	4 to 8° BTDC at idle speed; 24 to 28° BTDC at 5000 rpm
Vacuum control (at idle speed) "Advance"	Produce approx. 400 mbar with manual vacuum pump 13 to 17°

THE USA PAGES 28 - 31 TO 28 - 34 HAVE BEEN LEFT BLANK.

IGNITION COMPONENTS – 1983 MODELS

Ignition Coil

Type/Model	Version	Remarks
928 S	928 602 503 00 Bosch No. 0 221 122 001	With two ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928 S	928 602 033 00 Bosch No. 0 237 404 013	Centrifugal and vacuum advance and retard control. Distributor rotor with speed governor for 6500 – 260 rpm
928 S USA/Japan	928 602 032 06 Bosch No. 0 237 401 018	Centrifugal and vacuum advance control. Distributor rotor without speed governor.

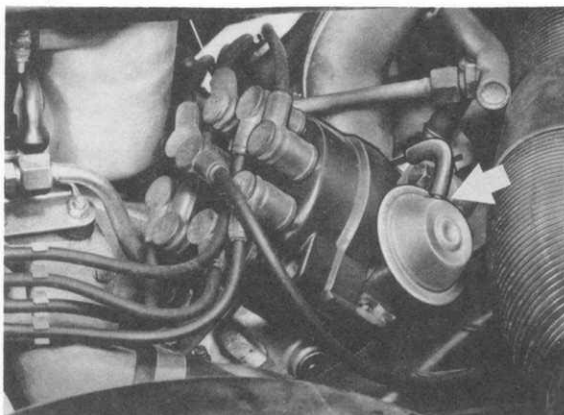
Spark Plugs

Type/Model	Version	Remarks
928 S	Bosch W 7 D (175 T 30) Beru 14 - 7 D (175/14/3A)	0.7 + 0.1 mm
928 S USA/Japan	Bosch WR 8 DS Beru RS 35	0.7 + 0.1 mm

Control Unit

Type/Model	Version	Remarks
928	928 602 702 02 Bosch No. A 227 010 123	Transistor coil ignition

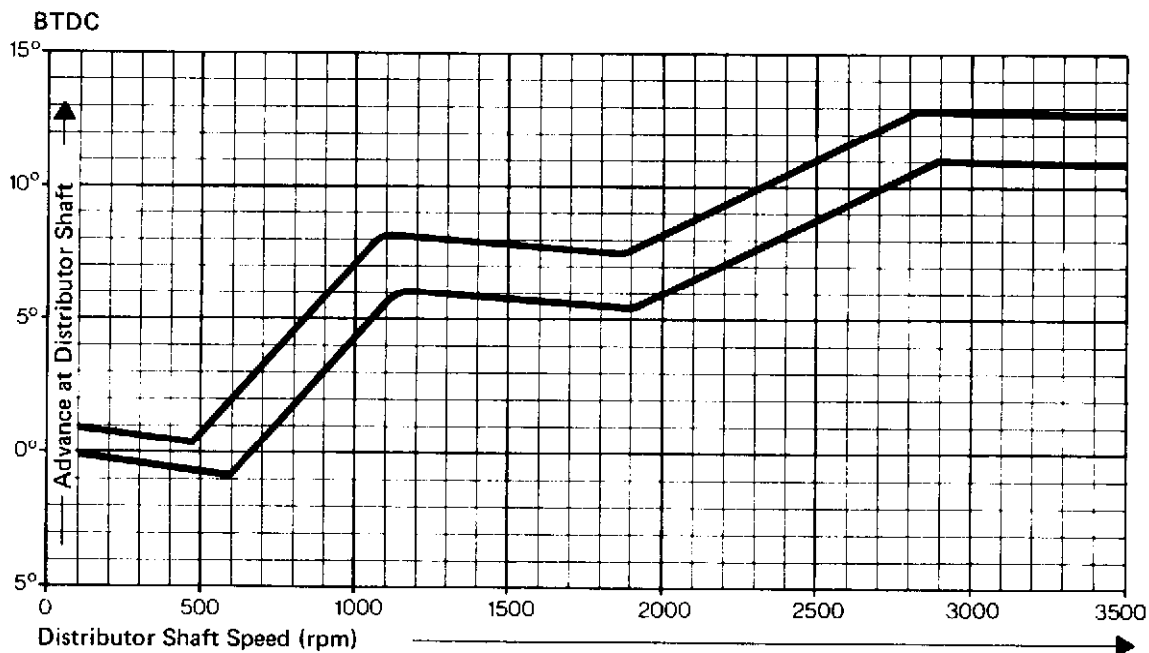
The distributor for USA/Canada/Japan models has a vacuum box for advance control beginning with 1983 model.



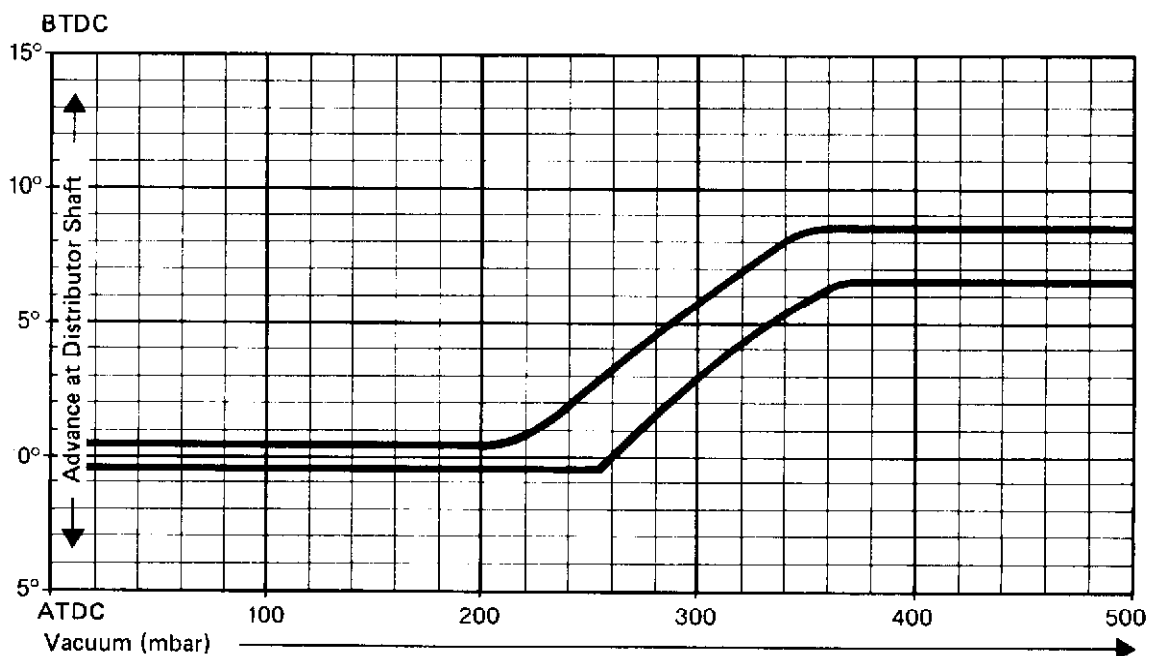
IGNITION ADJUSTING AND TESTING VALUE – USA/CANADA/JAPAN
BEGINNING WITH 1983 MODELS

Ignition timing (without vacuum)	20° BTDC at 3000 rpm
Idle speed	650 ± 50 rpm
Centrifugal control (without vacuum)	4 to 8° BTDC at idle speed 24 to 28° BTDC at 5000 rpm
Vacuum control (at idle speed)	Produce approx. 400 mbar with manual vacuum pump
"Advance"	13 to 17°

CENTRIFUGAL ADVANCE CURVE TYPE 928 S - from 1983 Models
(USA, Canada, Japan)



VACUUM ADVANCE CURVE TYPE 928 S - from 1983 Models
(USA, Canada, Japan)



EQUIPMENT TABLE – BEGINNING WITH 1984 MODELS

Ignition Coil

Type/Model	Version	Remarks
928 S	944 602 115 00 Bosch No. 0 221 118 322	Two ignition coils without ballast resistors
928 S USA/Japan	928 602 503 00 Bosch No. 0 221 122 001	With ballast resistors 0.4 ohm and 0.6 ohm

Distributor

Type/Model	Version	Remarks
928 S	928 602 011 02	Double distributor (2 x 4 cylinders) with mutual drive shaft Only high voltage distribution
928 S USA/Japan	928 602 032 07 Bosch No. 0 237 401 019	Centrifugal and vacuum advance control Distributor rotor without speed governor

Spark Plugs

Type/Model	Version	Remarks
928 S	Bosch W 7 D Beru 14 - 7 DU	0.7 + 0.1 mm plug gap 0.7 mm plug gap
928 S USA/Japan	Bosch WR 8 DS Beru RS 35	0.7 mm plug gap

Steuergerät

Type/Modell	Version	Remarks
928 S FRG, R.o.W. Australia New Zealand Switzerland Sweden Hong Kong	928.618.123.00 spare part: 928.618.123.02	LH-Jetronic control unit
928 S FRG, R.o.W. Australia New Zealand Switzerland Sweden Hongkong	928.618.124.00 spare part: 928.618.124.03 928.618.124.02 spare part: 928.618.124.04	EZF-control unit
928 S USA Japan	928.618.106.04 928.618.106.01	L-Jetronic control unit

Control unit (Final stage)

Type/Model	Version	Remarks
928 S	928.602.706.01	Transistor ignition (2 pieces)
928 S USA/Japan	928.602.702.02	Transistor ignition

CAUTIONS WHEN REPAIRING ELECTRONIC IGNITION SYSTEMS

Modern engines requiring more from ignition systems and the objective of low (or no) maintenance have led to the application of electronic ignition systems in standard production some time ago. Normally the ignition output of an electronic system will be higher than that of a conventional system, whereby even greater ignition output is feasible. Consequently electronic ignition systems are in an output range, where touching current carrying parts or terminals on both primary and secondary sides could be dangerous.

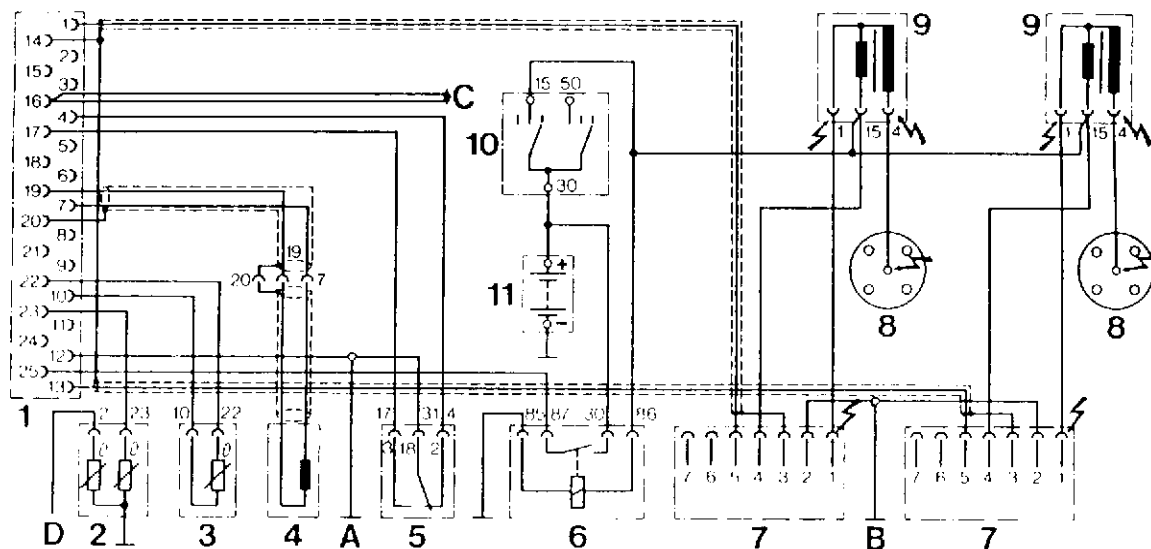
In conjunction with this matter we must point out to you that there must be conformance with pertinent legislation of your country when repairing and testing ignition systems.

Always turn off the ignition or disconnect the battery when working on the ignition system. Such jobs include the following.

- Connecting engine testing equipment (timing light, dwell angle/speed tester, ignition oscilloscope, etc.)
- Replacement of ignition system parts (spark plugs, ignition coils, distributor, ignition cables, etc.)

If testing the ignition system or making engine adjustments requires turning on the ignition, the mentioned dangerous voltage will be in the entire system.

Thus the danger is not only present at the individual parts of the ignition system (for example, distributor, ignition coil, control unit, ignition cables, etc.), but even on the wire harness (as for example, tachometer connection, diagnosis plug), plug connections and any testing equipment connected.



⚡ – Dangerous voltage points (400 V – 25 kV)

2. Wiring Diagram

- 1 – Electronic ignition control unit
- 2 – Engine temperature sensor (double NTC)
- 3 – Intake air temperature sensor
- 4 – Speed and reference mark sensors
- 5 – Throttle switch
- 6 – Power supply relay
- 7 – Final stages
- 8 – Distributor
- 9 – Ignition coils
- 10 – Ignition switch
- 11 – Battery

- A – Ground – control unit (right valve cover below blowoff switching valve)
- B – Ground – final stages (near right ignition coil – looking forward)
- C – Activation – LH-Jetronic
- D – To LH-Jetronic

No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Plug for electronic ign. control unit	1			
2	Elbow hose	1			
3	Bolt	4			
4	Washer	4			
5	Control unit	1			
6	Bracket for control units	1			
7	Bolt	1			
8	Washer	1			
9	Speed/reference mark sensor	1			
10 } 11 }	Plug for speed/reference mark sensor	1			
12	Bracket	1			
13	Bolt	1			
14	Washer	1			
15	TDC sensor	1			
16	Bolt	1			
17	Washer	1			
18	Mounting clamp	1			
19	Test connection for TDC sensor	1			

No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
20	Flywheel	1			
21	Cover	1			
22	Plug	2			
23	Bolt	2			
24	Washer	2			
25	Ignition control unit	2			
26	Cooling plate	1			
27	Plug — ignition cable	10			
28	Distributor cap	2			
29	Hex. head screw	1			
30	Washer	1			
31	Holder	1			
32	Cable holder	1			
33	Distributor	1			
34	Socket head screw	2			
35	Distributor rotor	2			
36	Dust cap	2			
37	Seal	1			

No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
38	Protective cap	2			
39	Hex. head screw	1			
40	Washer	1			
41	Holder, left	1			
42	Hex. head screw	1			
43	Washer	1			
44	Holder, right	1			
45	Hexagon nut	1			
46	Bolt	1			
47	Ignition coil	2			
48	Spark plug connector	8			
49	Spark plug	8			
50	Hex. head screw	5			
51	Washer	5			
52 } 53 }	Holder for ignition cables	5			
54	Holder	1			
55	Holder	1			
56	Plug	1			
57	Temperature sensor II	1			
58	Seal	1			
59	Plug	1			
60	Throttle switch	1			
61	Throttle housing	1			

IMPORTANT CAR INFORMATION

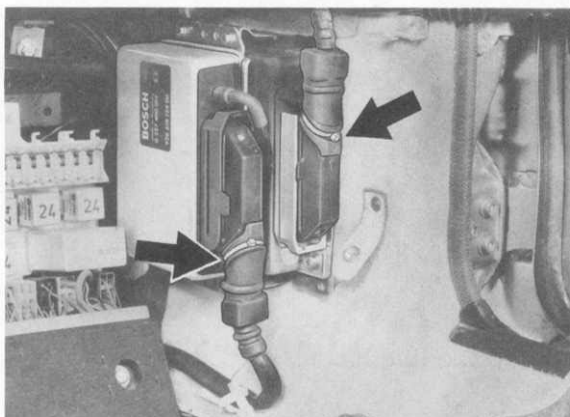
Conformance with following safety measures is necessary to avoid damage on the electronic ignition system.

1. Never start engine without a firmly connected battery.
2. Mixing up power supply connections, e.g. wrong connection of battery, could lead to destruction of the control units.
3. Never disconnect battery while engine is running.
4. Never use a boost battery charger to start the engine. Only use a second 12 V battery for outside starting help.
5. Disconnect battery from car network before boost charging.
6. Only measure resistance values after turning off ignition or disconnecting battery.
7. Pull off both control unit plugs or make a firm connection between ignition coil term. 4 and ground with a piece of wire before checking the compression (dangerous high voltage, insulation damage on ignition coil, high voltage distributor, ignition cables, etc.). Piece of wire must be interference suppressed with a shielding sleeve of at least 2 k-ohms.
8. Never replace specified ignition coil with a different ignition coil.
9. Never connect a shielded capacitor on ignition coil terminals 1 and 15.
10. Ignition coil terminal 1 must not be used for ground connection when installing a burglar alarm system (ignition coil would be destroyed with the "ignition on").
11. Never connect battery positive (+) or a test lamp on ignition coil terminal 1.
12. Never disconnect ignition lead between ignition coil terminal 4 and high voltage distributor terminal 4 while engine is running.
13. To avoid destruction of the ignition control unit, secondary side of ignition system must be shielded with at least 4 k-ohms, whereby the original distributor rotor with a 1 k-ohm shielded resistor must be installed (do not use a 5 k-ohm distributor rotor even for radio and communication equipment suppression).

REMOVING AND INSTALLING ELECTRONIC IGNITION CONTROL UNIT

Removing

1. Turn off ignition.
2. Fold back mat in passenger's footwell and open cover for central electric board.
3. Disengage lock on control unit by pressing toward housing and pull off multiple-pin plug.
Take off vacuum connection.

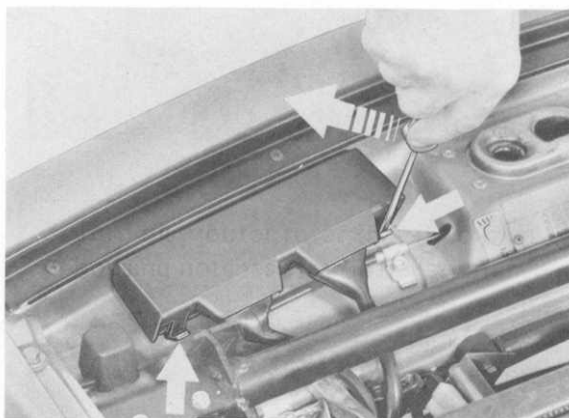


4. Unscrew mounting bolts.

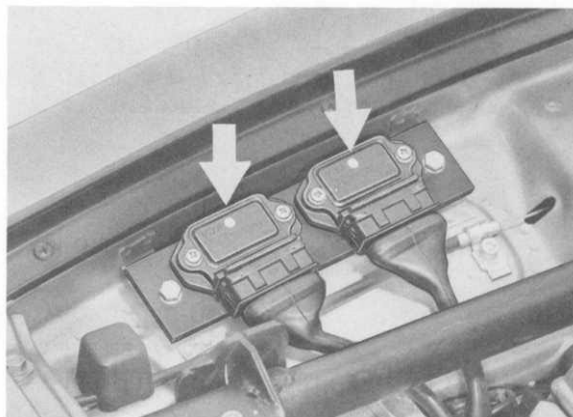
REMOVING AND INSTALLING TRANSISTORIZED IGNITION CONTROL UNIT

Removing

1. Take off left front cover by disengaging locks on both sides with a screwdriver and taking off cover from above.



2. Pull off multiple-pin plug on ignition control unit and unscrew mounting bolts.



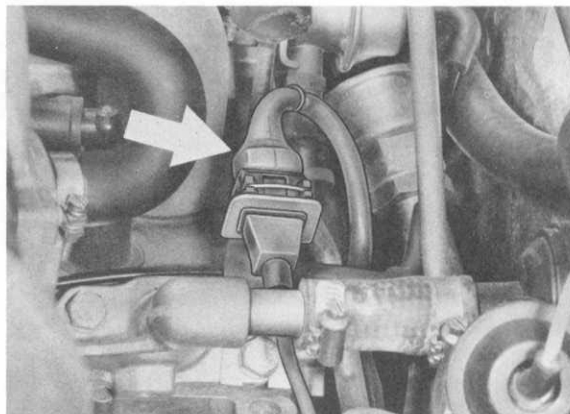
Note:

Baseplate must be coated with a heat-conducting paste prior to installation of the ignition control unit.

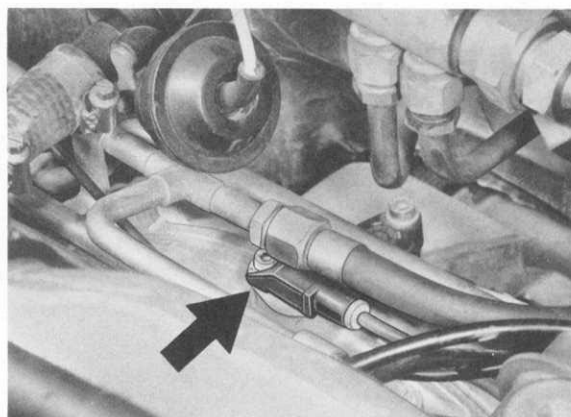


Use a suitable item (e. g. screwdriver, wood match, etc.) to apply coat of heat-conducting paste.

Heat-conducting paste: Bosch No. 5942 860 003.



3. Remove screw. Pull out sensor while turning back and forth at same time.



REMOVING AND INSTALLING SPEED/ REFERENCE MARK SENSOR

Removing

1. Remove air cleaner.
2. Disconnect plug.

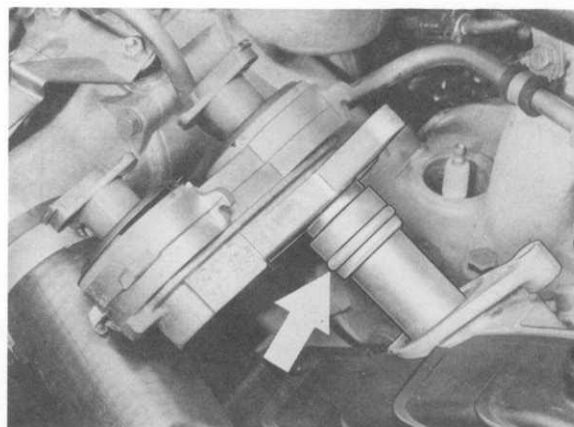
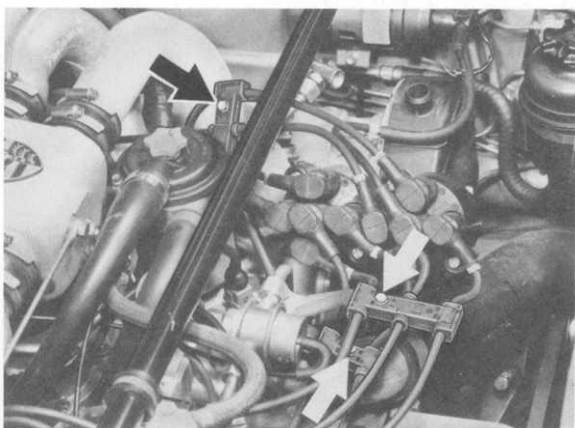
Note:

- Sensor distance cannot be adjusted.
The sensor distance of 0.8 mm + tolerance is given by design.
- Make sure that no metal parts are sticking on the sensor before installing.
- Mounting screw tightening torque = 8 Nm (6 ftlb).

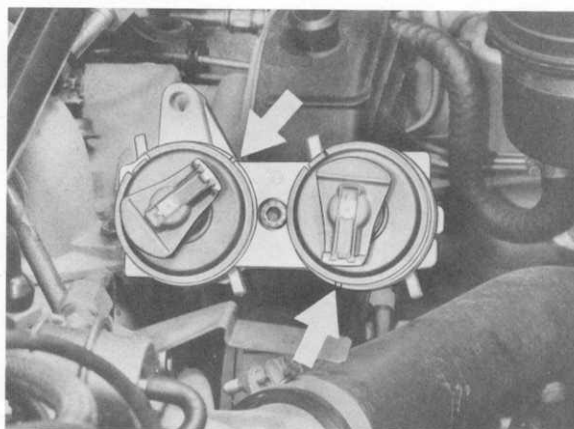
REMOVING AND INSTALLING DISTRIBUTOR

Removing

1. Set cylinder 1 at TDC.
2. Take ignition cables out of holders.



3. Turn distributor rotor that it points to housing notches after installation.



3. Unscrew and remove distributor caps.
4. Unscrew distributor and pull out of engine block.

Installing

1. Set cylinder 1 at TDC.
2. Check seal on distributor, replacing if necessary.

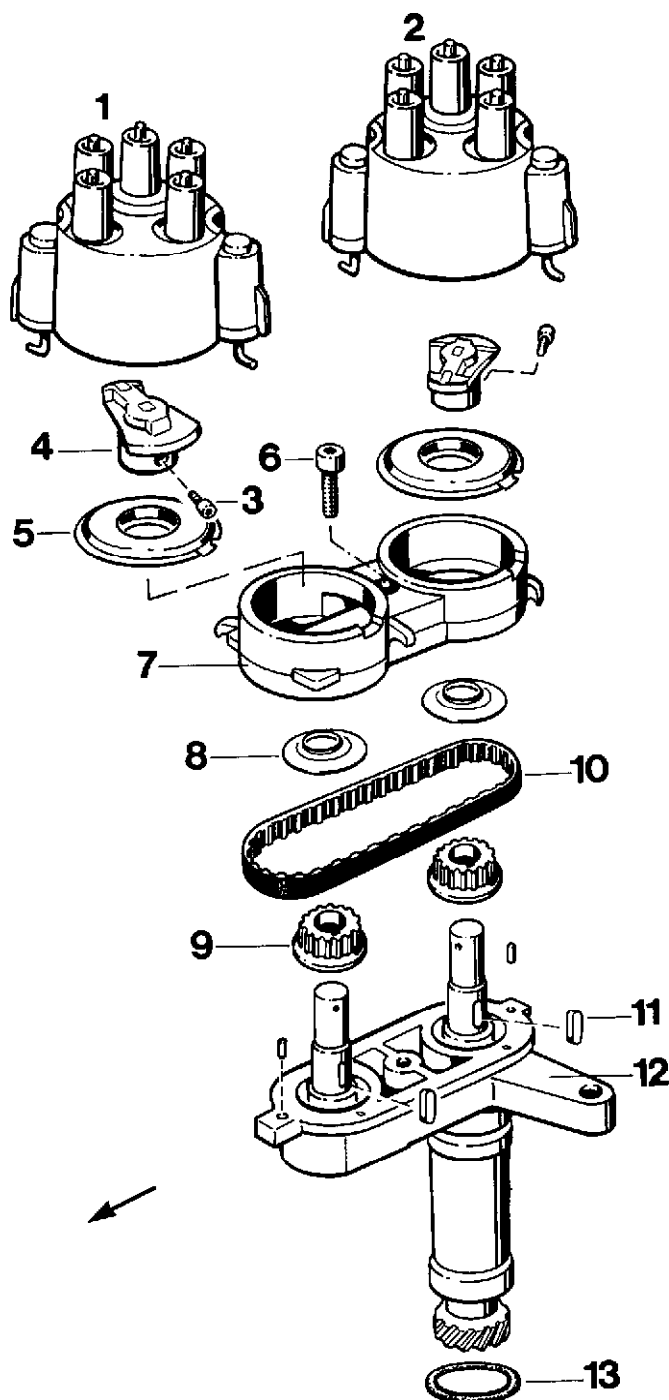
Note:

A basic ignition timing adjustment is not necessary.
Distributor only has the task of distributing high voltage.

Dismantling and assembling distributor

As of MY '84

Engine Type M 28.21/22

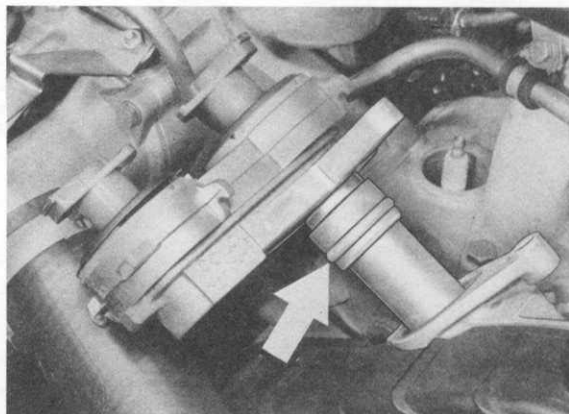
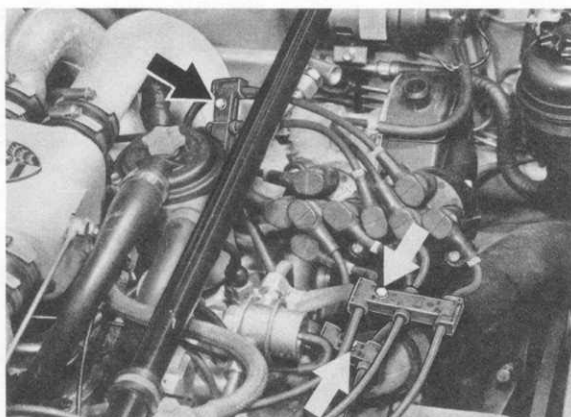


1155-28

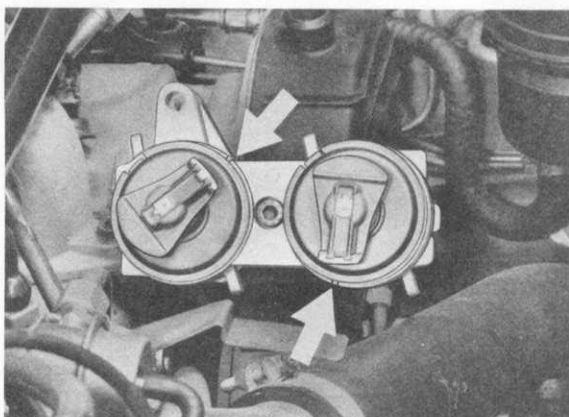
REMOVING AND INSTALLING DISTRIBUTOR

Removing

1. Set cylinder 1 at TDC.
2. Take ignition cables out of holders.



3. Turn distributor rotor that it points to housing notches after installation.



3. Unscrew and remove distributor caps.
4. Unscrew distributor and pull out of engine block.

Installing

1. Set cylinder 1 at TDC.
2. Check seal on distributor, replacing if necessary.

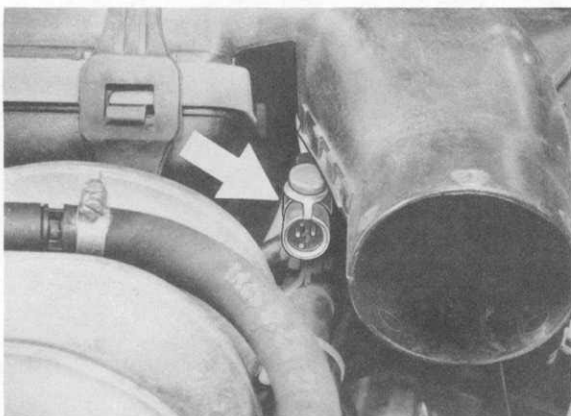
Note:

A basic ignition timing adjustment is not necessary.
Distributor only has the task of distributing high voltage.

REMOVING AND INSTALLING TDC SENSOR

Removing

1. Remove air cleaner.
2. Detach test connection.



3. Unscrew TDC sensor and pull it out of housing.



EXTRA

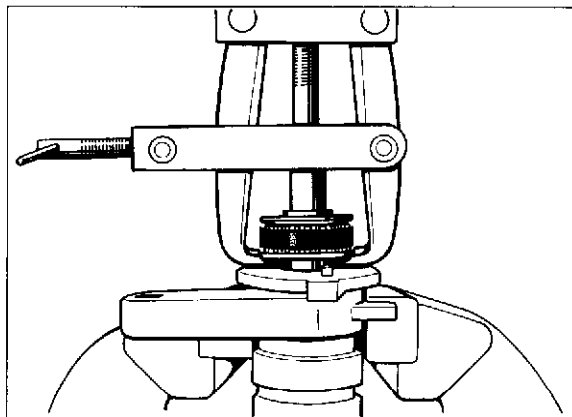
NOT IN LATEST
MANUALS

No.	Designation	Qty.	Note:	
			Removal	Installation
1	Distributor cap cyl. 1-7-6-4	1		
2	Distributor cap cyl. 2-5-8-3	1		
3	Pan head screw M 4 x 6	2		Must always be replaced
4	Distributor rotor	2		
5	Protective cap	2		Make sure it is seated correctly in distributor housing cutout
6	Pan head screw M 8 x 25	1		
7	Housing upper section	1		
8	Flange washer	2	Pull off along with pulley	Must always be replaced, install in correct position
9	Pulley	2	Pull off	
10	Toothed belt *	1	Pull off flange washer and pulley prior to removal	Do not twist, handle with care observe basic setting of distributor shafts
11	Woodruff key	2		
12	Housing lower section	1		
13	Seal	1		Replace

* Toothed belt Part No. 928 602 541 00

Assembly notes

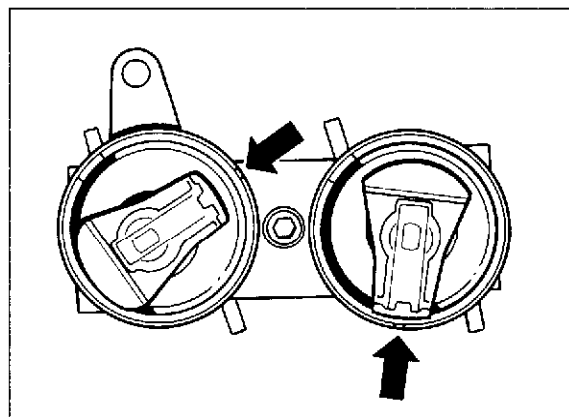
Dismantling



1156-28

Pull off pulley along with flange washer, e.g. with two-way bearing puller CORA No. 47-100

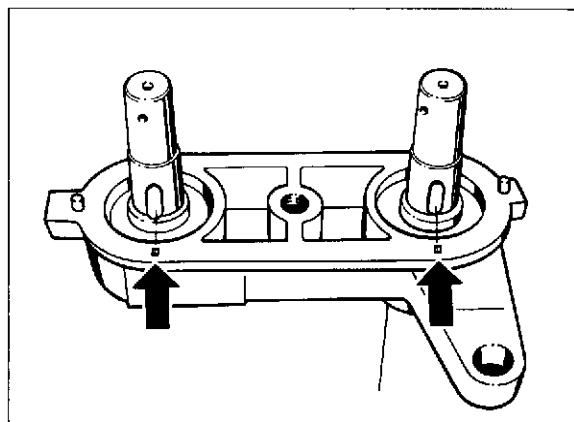
Supplier: Messrs. Albert Schrem
Postfach 1504
D-7928 Giengen 1



1157-28

After assembly, the distributor rotors must point towards the housing notches. Set engine to cylinder no. 1 firing TDC and install distributor in this position.

Assembly



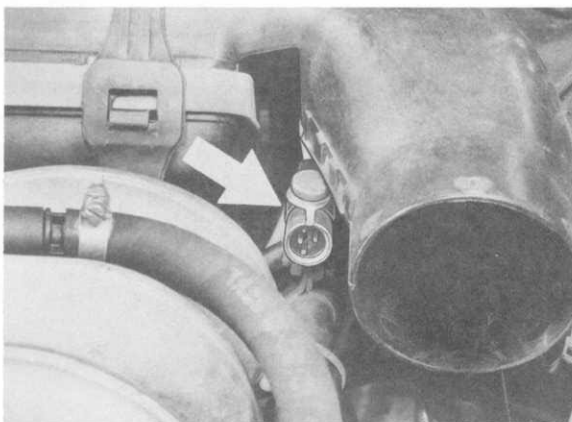
1158-28

Set up distributor shafts in basic position.
Fit pulley and toothed belt.

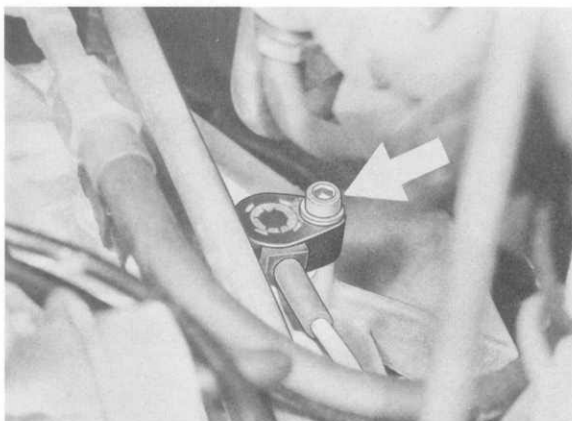
Removing and installing TDC sender

Removal

1. Remove air cleaner assembly.
2. Undo test connection.



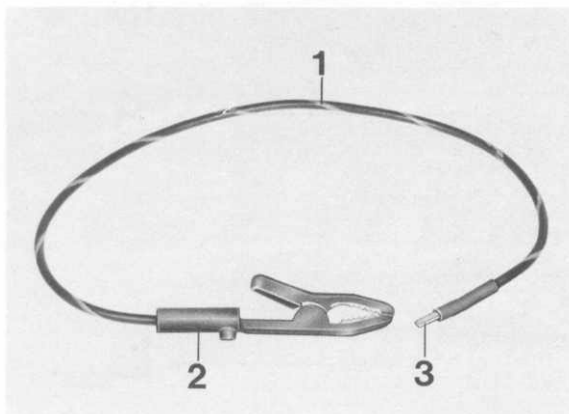
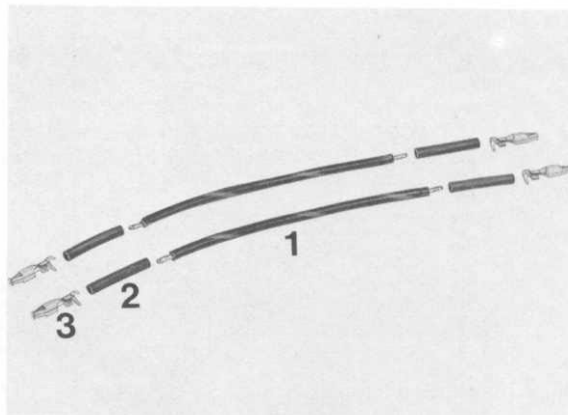
3. Unscrew TDC sender and pull out of housing.



TROUBLESHOOTING ELECTRONIC IGNITION SYSTEM

TESTERS AND TOOLS

- Engine tester with oscilloscope, for example: 1010/1019, Bosch Mot 300/400.
- Multi-tester (internal resistance at least 20 k-ohms/V).
- Two test leads (made locally) for tests on multiple-pin plugs of control units and plug connections with same contact version (flat contacts).

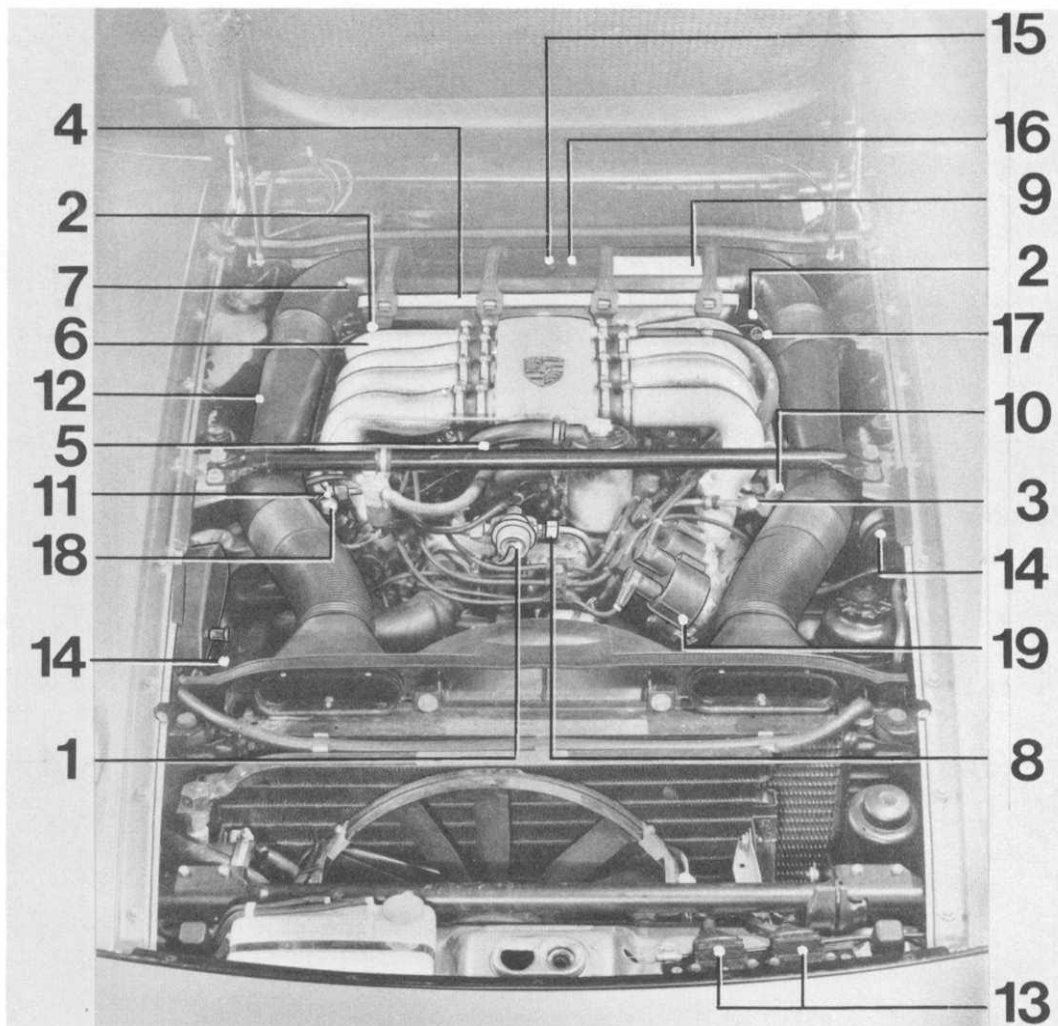


- 1 — Highly flexible lead, approx. 10 cm long
- 2 — Insulating hose
- 3 — Flat contact N 17.182.2

- 1 — Highly flexible lead
- 2 — Alligator clips (standard)
- 3 — Flat male plug 2.8 (N 17.457.2)

- Two adapter test leads (made locally).

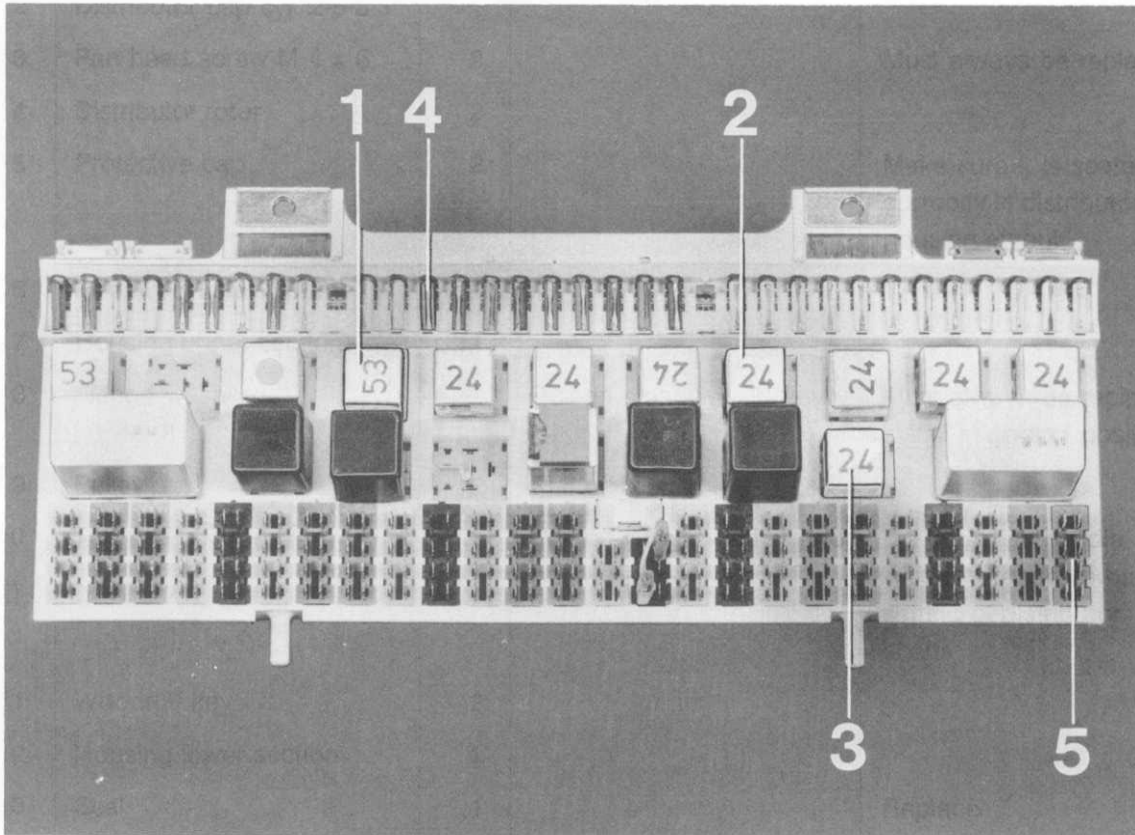
LOCATION OF COMPONENTS



- 1 — Pressure damper
- 2 — Pressure regulator (two)
- 3 — Fuel injectors, left
- 4 — LH intake air sensor
- 5 — Throttle switch
- 6 — Auxiliary air regulator
- 7 — Control units
(electronic ignition/LH injection)
- 8 — Temperature sensor II
- 9 — Temperature sensor I
- 10 — Fuel line

- 11 — Fuel injectors, right
- 12 — Blowoff switching valve
- 13 — Ignition control unit
- 14 — Ignition controls
- 15 — Speed/reference mark sensor
- 16 — TDC sensor
- 17 — Test connection — TDC sensor
- 18 — Test connection — fuel
pressure
- 19 — Distributor

CENTRAL ELECTRIC POWER SUPPLY FOR LH FUEL INJECTION AND ELECTRONIC IGNITION SYSTEM



- 1 = Electronic ignition relay VIII
(power supply for electronic ignition and LH control units)
- 2 = LH-Jetronic relay XVI
(power supply for LH control unit and intake air sensor)
- 3 = Fuel pump relay XVII
(power supply for fuel pump, auxiliary air regulator and fuel injectors)
- 4 = Fuse no. 13 =
fuel pump, auxiliary air regulator
- 5 = Red plug X
(power supply for electronic ignition and LH fuel injection)

TESTING CONDITONS	POSSIBLE CAUSES OF DEFECTS									
Engine in perfect mechanical condition. Battery charged. Starter turning.	Ground and plug connections	Control unit power supply	Speed/reference mark sensor	Load sensor	Temperature sensor I	Temperature sensor II	Throttle switch	Ignition system	Octane loop	Alternator/regulator
See Test Point	1	2	3	4	5	6	7	8	9	10
Engine does not start	X	X	X			X		X		
Engine hard to start	X		X			X		X		
Erratic idling						X		X		
Poor engine pickup	X		X			X	X	X		
Engine misfiring	X	X	X				X	X		X
High fuel consumption				X		X	X	X		
Poor engine output	X		X	X	X	X	X	X	X	
Engine hesitation	X	X	X	X		X	X	X		X
Engine knocks when accelerating				X	X			X		

X = Check with suitable tester

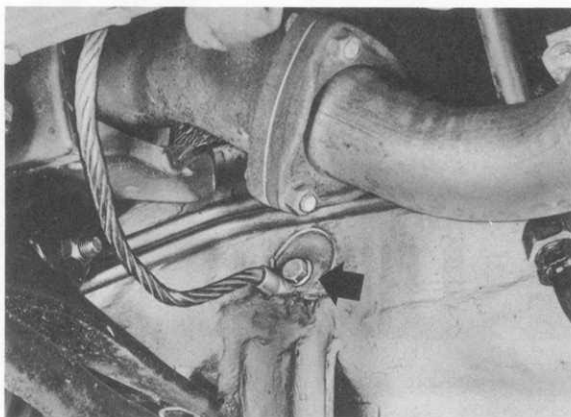
TEST POINT 1

Checking Ground and
Plug Connections

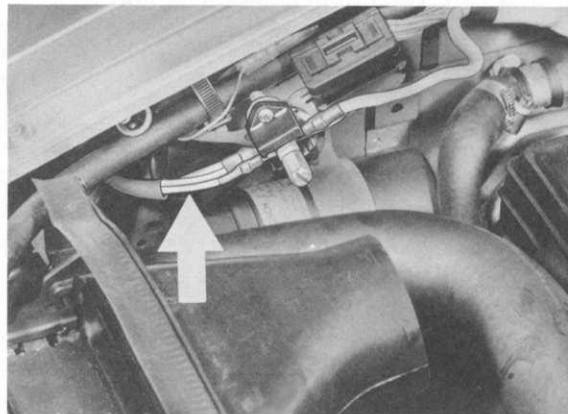
Note:

Go through test points in given sequence, especially if the complaint concerns no or poor engine running.

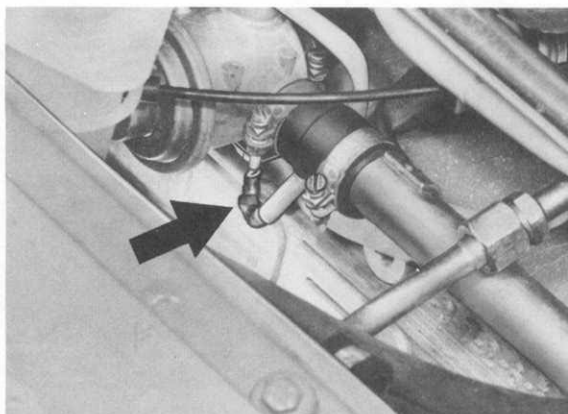
1. Ground connection between engine and body at bottom right.



- 1.1 Ground connection of ignition control units next to right ignition coil.



- 1.2 Output ground connection on camshaft housing near blowoff switching valve.

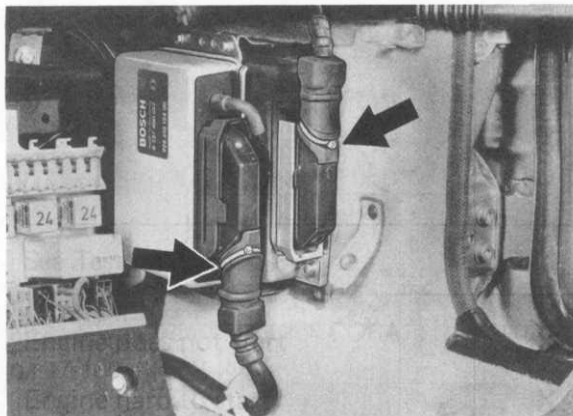


- 1.3 Electronic ground connection on camshaft housing near cylinder 2.

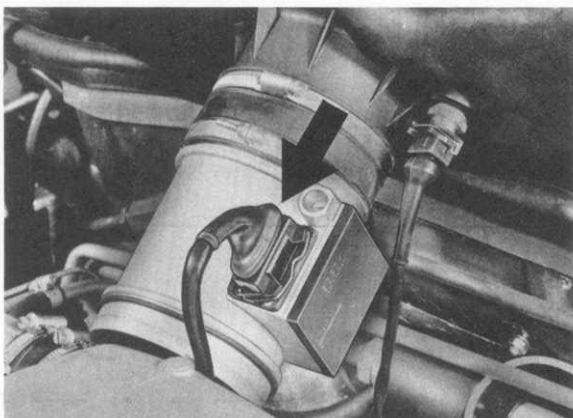


2. Check following plug connections for tight fit, bent plug receptacles and corrosion thoroughly.

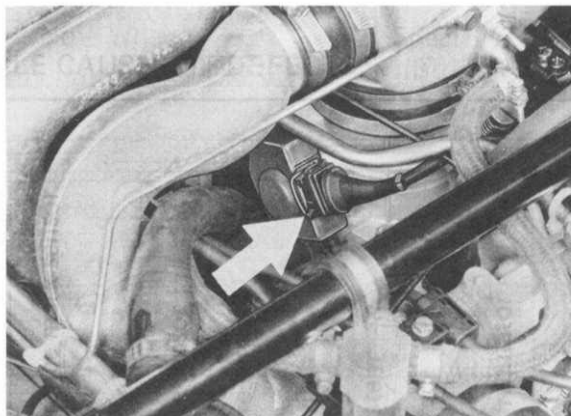
- 2.1 Plug connection of electronic ignition control unit. To remove, push back lock and swing out plug.



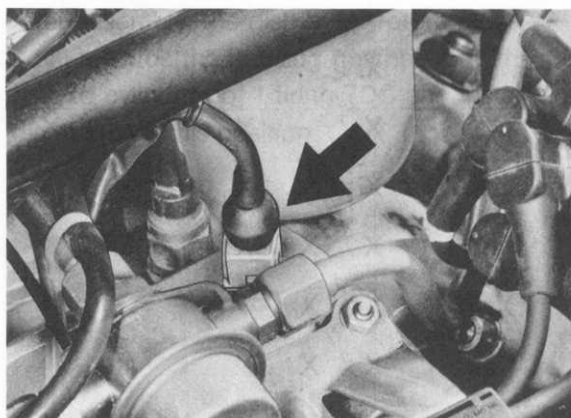
- 2.2 Plug connection on intake air sensor.



- 2.3 Plug connection on throttle switch.



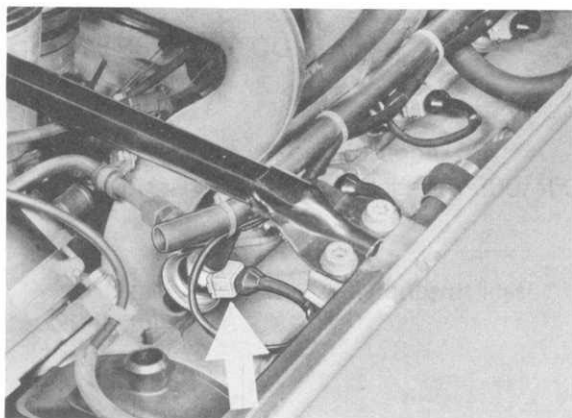
- 2.4 Plug connection on temperature sensor II (engine temperature).



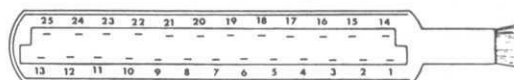
- 2.5 Plug connection on temperature sensor I (intake air temperature).



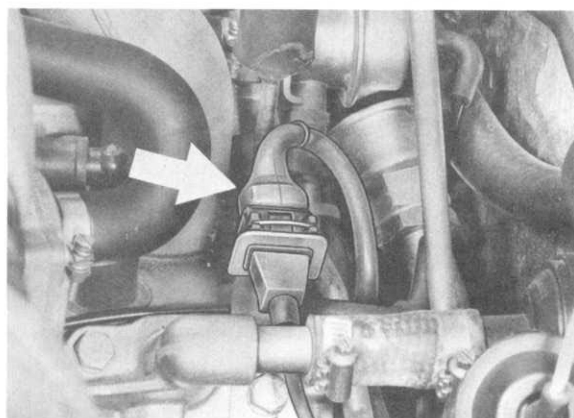
2.6 Plug connections on fuel injectors.



2. Turn on ignition. Measure voltage between terminals 25 and 12.



2.7 Plug connections on speed and reference mark sensors.



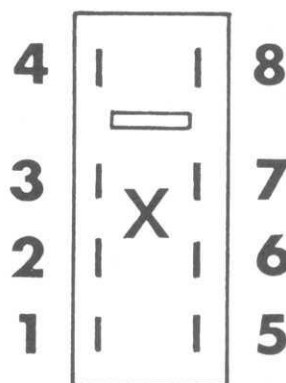
(Only connect tester with help of test leads.)

Specification: battery voltage.

If value deviates, measure voltage on connected plug X of central electric board between terminal 3 and ground.

TEST POINT 2

Power Supply for Electronic Ignition Control Unit



1. Turn off ignition and pull off multiple-pin plug on electronic ignition control unit.

Specification: battery voltage.

If battery voltage is not displayed, pull off relay VIII and bridge terminals 30 and 87.

Repeat voltage test on multiple-pin plug terminals 25 and 12 of electronic ignition control unit.

If there is now battery voltage, replace electronic ignition relay VIII.

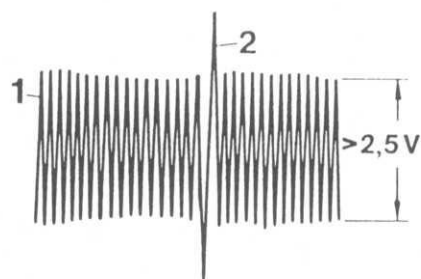
1. Turn off ignition and pull off multiple-pin plug on electronic ignition control unit.

2. Connect positive tester lead on terminal 7 with help of locally made test lead and negative tester lead on terminal 19 of electronic ignition plug. Turn engine with the starter.

TEST POINT 3

Speed —

Reference Mark Sensor



1 = Speed signal

2 = Reference mark signal

Note:

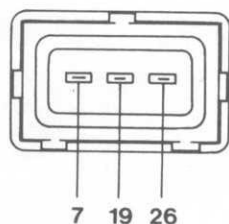
This test can only be made with help of an oscilloscope.

Adjust workshop oscilloscope to supplier's instructions.

Sine oscillations of at least 2.5 V (speed signal) and oscillation with definitely higher amplitude (reference mark signal) must be displayed on the screen.

If the amplitude of the speed signal is less than 2.5 V or no signal is displayed, check connections and test the sensor.

Measure internal resistance of terminal 7 against terminal 19 on the electronic ignition plug or on the speed/reference mark sensor plug connection.



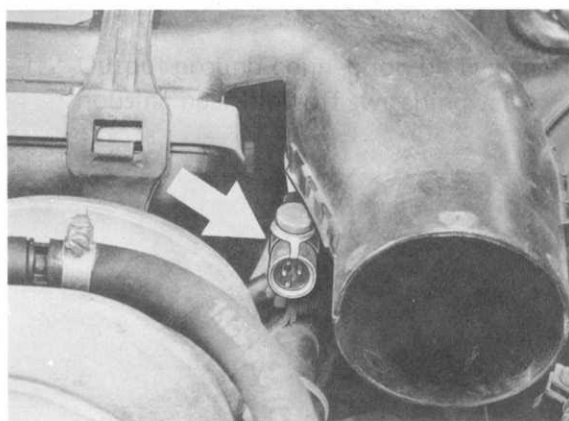
Specification: 0.6 to 1.6 k-ohms.

If necessary,
replace speed/reference mark sensor.

TEST POINT 4

Pressure Sensor
(Integrated in Electronic
Ignition Control Unit)

Connect adjustable ignition timing light or engine tester with TDC sensor system on engine.

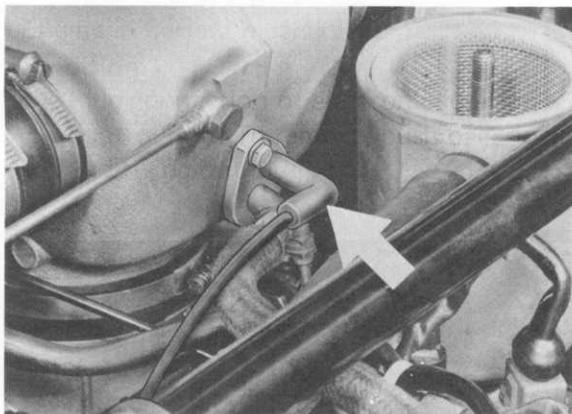


Note:

Tester must be set to "4 cylinders".

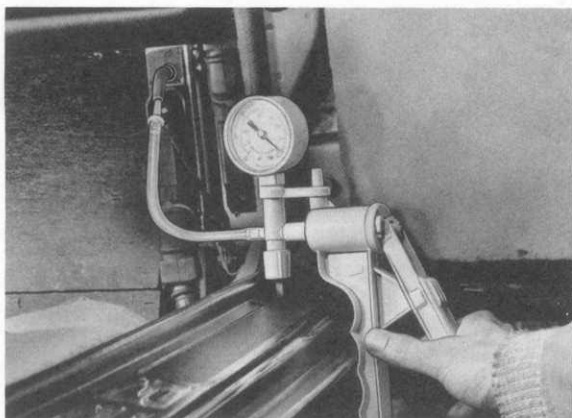
1. Accelerate engine in stopped car to 4,000 rpm.
Ignition timing angle should be $40 \pm 3^\circ$.

2. Detach vacuum connection on intake distributor.



This should reduce ignition timing to $20 \pm 3^\circ$.

3. If $40 \pm 3^\circ$ ignition timing angle is not reached, supply approx. 500 mbar vacuum direct on control unit with help of a manual pump.



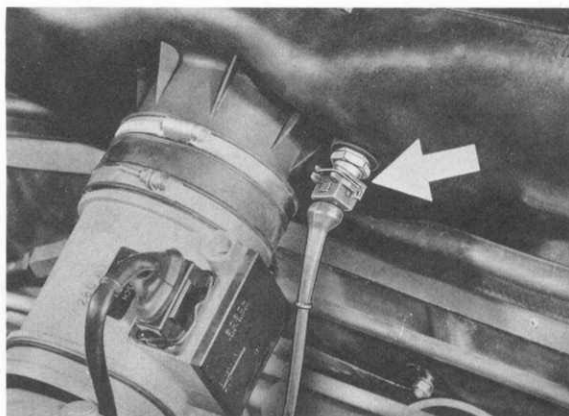
If specified ignition timing is still not reached, replace electronic ignition control unit.

If ignition timing is correct after supplying vacuum to the control unit, check vacuum hose between electronic ignition control unit and intake air distributor for leaks.

TEST POINT 5

Temperature Sensor I (Intake Air Temperature)

1. Check plug connection on temperature sensor I underneath the air cleaner housing for tight fit and clean contacts.



2. Connect ohmmeter between terminals 10 and 22 on disconnected plug of electronic ignition control unit.

Specifications:

0 °C/	32 °F = 4.4 to 6.8 kΩ
15 to 30 °C/59 to 86 °F	= 1.4 to 3.6 kΩ
40 °C/	104 °F = 0.9 to 1.3 kΩ

If specified values are not reached, make same tests on temperature sensor itself and, if necessary, replace temperature sensor.

Note:

Breaks and short circuits will reduce the ignition timing by 3° on crankshaft. Intake air temperature greater than 50 °C/122 °F, closed full load contact and intake vacuum greater than 650 mbar will also reduce the ignition timing by 3° on crankshaft.

2. Connect ohmmeter between terminals 23 and 12 of disconnected electronic ignition control unit plug.

Specifications:

0 °C/	32 °F =	4.4 to 6.8 kΩ
15 to 30 °C/59 to 86 °F =	1.4 to 3.6 kΩ	
40 °C/	104 °F =	0.9 to 1.3 kΩ
60 °C/	140 °F =	480 to 720 Ω
80 °C/	176 °F =	250 to 390 Ω

If specified values are not reached, make same tests on temperature sensor itself.

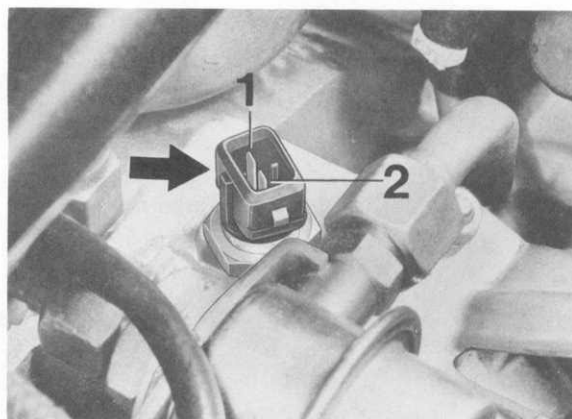
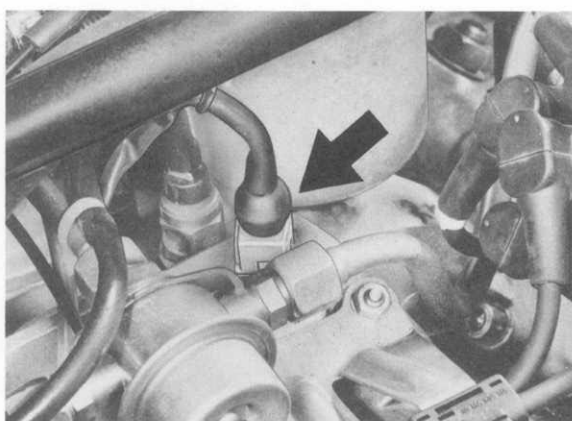
Note:

Two independent temperature sensors are located in the temperature sensor housing. Connect tester on only one contact of sensor and a second test lead on ground.

TEST POINT 6

Temperature Sensor II (Engine Temperature)

1. Check plug connection on temperature sensor II for tight fit and clean contacts.



- 1 – Electronic ignition
- 2 – LH fuel injection

Temperature sensor II advances ignition timing for better engine pickup in partial load range with a cold engine.

TEST POINT 7

If switching points are not correct, make tests direct on throttle switch.

Throttle Switch

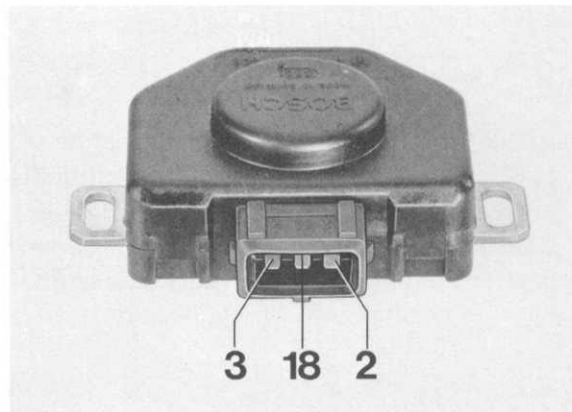
1. Idle Speed Contact:

Turn off ignition and pull off multiple-pin plugs on electronic ignition and LH fuel injection control units.

- 1.1 Connect ohmmeter on electronic ignition plug between terminals 4 and 12.

Throttle closed = 0 ohm
Throttle opened = inf. ohms

Switching over must take place already with a throttle gap of approx. 1°.



2 — Idle speed contact
18 — Ground
3 — Full load contact

Adjusting Throttle Switch

2. Full Load Contact:

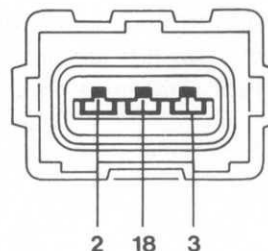
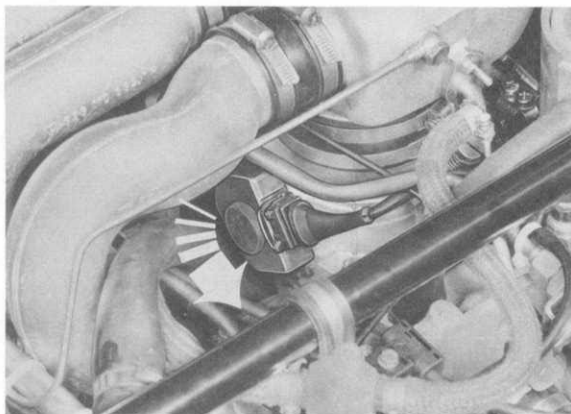
- 2.1 Connect ohmmeter on electronic ignition plug between terminals 17 and 12.

Throttle closed = inf. ohms
Throttle in full load pos. = 0 ohm

Switching point is after approx. 2/3 of throttle travel.

1. Unscrew mounting bolts on throttle switch.

2. Turn switch counterclockwise until inner stop is noticed (idle speed contact closed). Throttle, however, must not also be turned.
Full load contact is adjusted simultaneously and cannot be adjusted separately.



3. Tighten bolts.
Throttle must have firm contact on stop screw.

This should retard the ignition timing by approx. 10° .

Checking Throttle Switch with Engine Running

3. Connect idle speed contact terminal 2 with ground. Engine should begin to surge, i. e. injection signal will be cut off above approx. 1250 rpm (coasting shutoff).

1. Pull off plug on throttle switch at idle speed.

Ignition timing must be advanced by approx. 10° .

TEST POINT 8

2. Accelerate engine to approx. 2,000 rpm. Connect full load contact terminal 3 and ground terminal 18 on plug with a piece of wire.

Ignition System

The ignition system is divided into two ignition circuits.

Left ignition circuit: cylinders 1-7-6-4

Right ignition circuit: cylinders 2-5-8-3

Firing order: 1-3-7-2-6-5-4-8

1. Adjust secondary display on ignition oscilloscope.

Connect terminals 1 and 15 on left or right ignition coil, inductive clip on left or right ignition coil terminal 4 and trigger clip on cylinder 1 for left ignition circuit and cylinder 2 for right ignition circuit.



Note :

If an error is displayed for all cylinders, it will be in the primary or secondary circuit between the ignition coil and distributor rotor.

If the error is on only one cylinder, it will be after the distributor rotor.

2. Check distributor caps for damage, dirt and traces of burning.

Resistance value: 1 k-ohm.

Holding hooks must engage firmly when installing.

3. Check distributor rotor.

Shielded resistance: 1 k-ohm.

Check visually for damage and tight fit.

4. Check spark plug connectors and lines for damage and traces of burning.

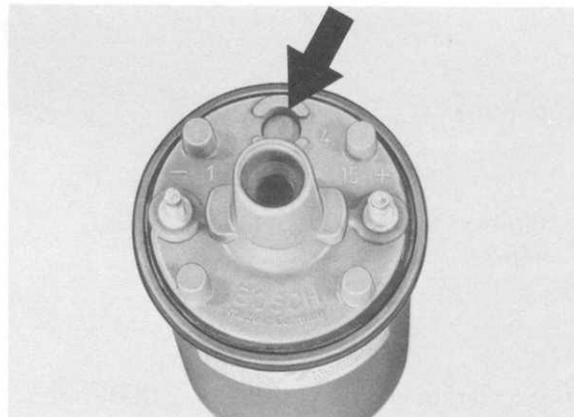
Shielded resistance: 3 k-ohms.

5. Check ignition coils.

Primary resistance of term. 1 versus term. 15: 0.4 to 0.7 ohm.

Secondary resistance of term. 1 versus term. 4: 5 to 8.7 k-ohms.

Check that plugs are not missing.



If plugs are missing or casting compound has run out, replace ignition coil and ignition control unit.

Note :

Avoid an ignition test via the spark gap by pulling off the spark plug connectors. There would be danger of destroying the ignition coil and control unit.

6. Check ignition timing at idle speed and with engine having operating temperature.

Ignition timing at 700 + 50 rpm:
 $10 \pm 3^\circ$ before TDC.

Ignition timing can be measured with a timing light or engine tester with TDC sensor.

7. Activation of high voltage side.

Procedures for checking whether there is an ignition triggering signal from the electronic ignition control unit to the ignition control unit:

- 7.1 Disconnect two-pin plug above central electric board.



- 7.2 Connect plug sections (plug pins) with a suitable piece of wire and turn on ignition.

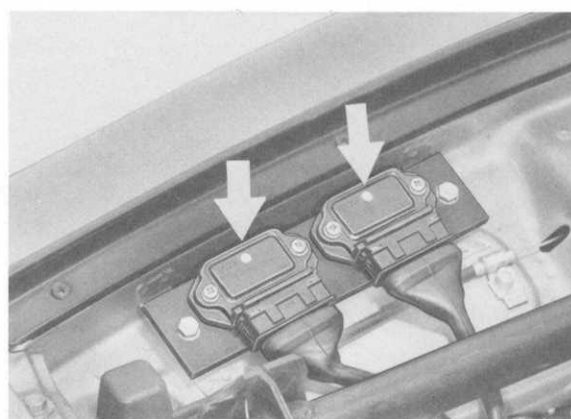
White line = left ignition circuit.
 Green line = right ignition circuit.

If piece of wire is touched on positive (term. 30, fuses 14 – 23), an ignition spark must be triggered on pertinent side of ignition line terminal 4.

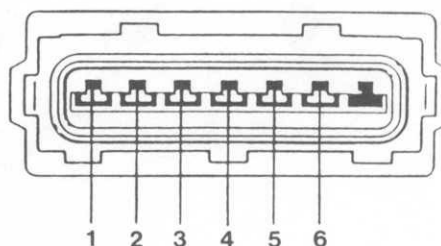
For this purpose apply a booster gap with a 5 k-ohm sleeve-type suppressor on pertinent distributor terminal 4.

8. Check control signal for ignition control units.

- 8.1 Pull off multiple-pin plugs on ignition control units.

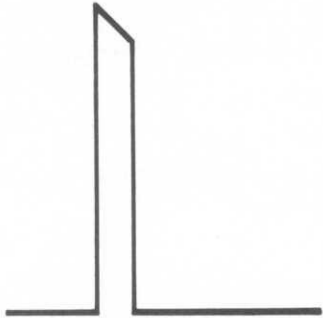


- 8.2 Connect oscilloscope with positive tester lead on terminal 5 and negative tester lead on terminal 2 of ignition control unit plug.



Make test on both multiple-pin plugs.

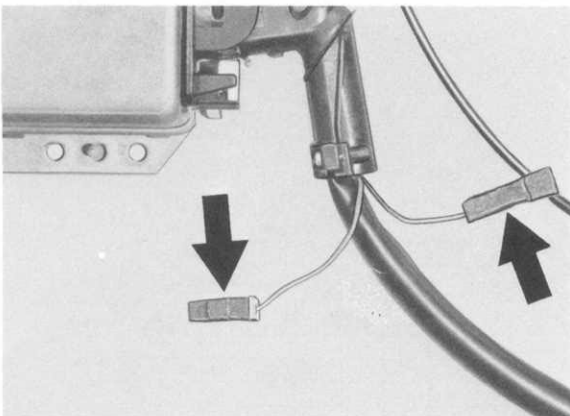
- 8.3 Oscilloscope must display a control signal on each of both multiple-pin plugs.



TEST POINT 9

Octane Loop

An additional single-pin plug is located on the bottom of the multiple-pin plug for the electronic ignition control unit.



With this plug connected the ignition timing will be retarded approx. 3° at full load and high partial load.
(Provision for adaptation to poor grade gasoline.)

TEST POINT 10

Alternator, Regulator

Peak voltage of the alternator could cause engine misfiring.

1. Take off flat drive belt on alternator.
2. Start engine.
If misfiring has been eliminated, check alternator and regulator.

EQUIPMENT SURVEY - 1985 (32 VALVE ENGINE)

ENGINE TYPE M 28.43 / 44

Ignition Coil

Type/Model	Version	Remarks
928 S USA	944 602 115 00 Bosch No. 0221 118 322	2 ignition coils without ballast resistors

Distributor (Cap)

Type/Model	Version	Remarks
928 S USA	928 602 211 01 Bosch No. 1 235 522 395	Only high voltage distribution

Spark Plugs

Type/Model	Version	Remarks
928 S USA	WR 7 DC	Electrode gap: 0.7 + 0.1 mm

Control unit

Type / Model	Version	Remarks
928 S USA	928.618.124.05	EZF ignition
928 S USA	Mod. '85 928.618.123.03 Mod. '86 928.618.123.04 Spare part: 928.618.123.04	LH-Jetronic control unit

Final stage control unit

Type / Model	Version	Remarks
928 S USA	928.602.706.01	Transistor ignition control unit (two)

Equipment table**Engine type M 28.45/46****Control units**

Type / Model	Version	Remarks
928 S Australia M 298/M299	928.618.124.06	EZF control unit
	928.618.123.04	LH Jetronic control unit

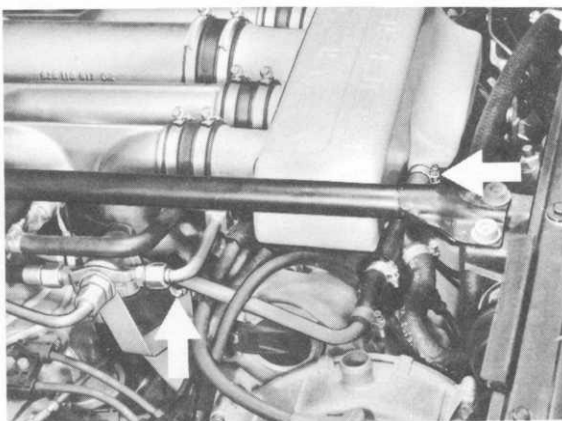
Engine type M 28.41/42**Control units**

Type / Model	Version	Remarks
928 S 4 MY '87	928.618.124.10 928.618.124.11	EZK control unit
	928.618.124.11	Spare part
	928.618.123.10	LH Jetronic control unit
928 S4 MY '88	928.618.124.12 928.618.124.14	EZK control unit
	928.618.124.15	Spare part
	928.618.123.11	LH Jetronic control unit

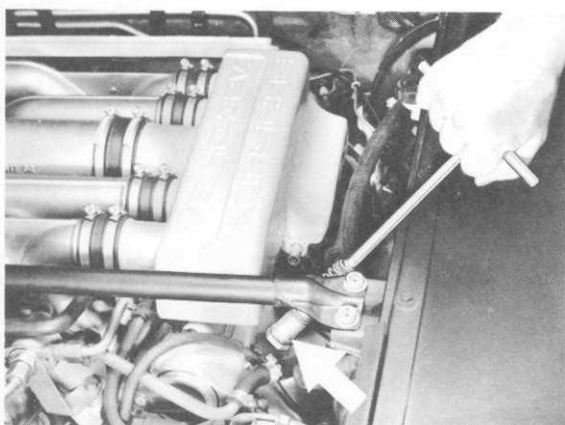
Type / Model	Version	Remarks
928 S4 as of MY '89	928.618.124.15	EZK control unit
	928.618.123.13	LH Jetronic control unit
928 S4 Mod. '91	928.618.123.25	LH Jetronic control unit

REPLACING SPARK PLUGS (32 VALVE ENGINE)

1. Unscrew suction pump on left side of intake air distributor and clamp on vacuum hose.



2. Unscrew spark plug with a standard wrench (car tool set has a special spark plug wrench).

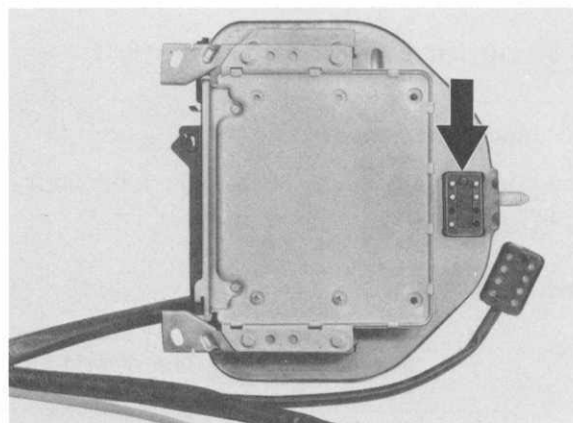


3. Lubricate spark plug threads with a light coat of grease, e.g. white Molykote HTP Paste.

Tightening torque: 30 Nm.

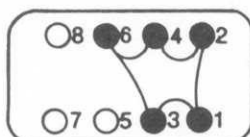
EIK CONTROL UNIT CODING, '87 MODELS ONWARD

Only one control unit is used.
The appropriate characteristic can
be called up by means of a coding
plug on the rear of the control-unit
holder.

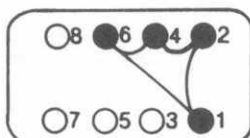


Switching diagram

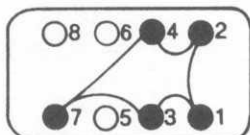
Type



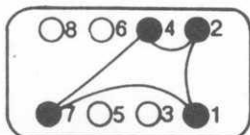
R.o.W. without catalytic converter
manual transmission



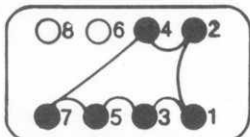
R.o.W. without catalytic converter
automatic transmission



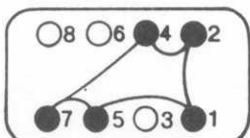
R.o.W. with catalytic converter
and USA
manual transmission



R.o.W. with catalytic converter
and USA
automatic transmission



Australia, manual transmission



Australia, automatic transmission

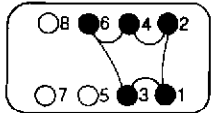
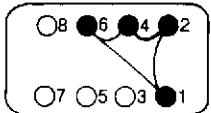
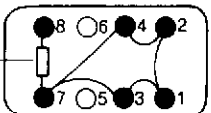
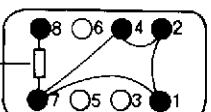
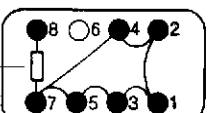
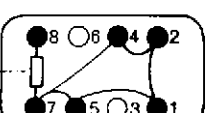
Coding for EZK control unit

For Model 89 onwards

The coding connector is fitted to the mounting plate for the LH and EZK control units.

Wiring diagram

Version

	Rest of world without catalytic converter, manual transmission
	Rest of world without catalytic converter, automatic transmission
	Rest of world, USA with catalytic converter, manual transmission
	Rest of world, USA with catalytic converter, automatic transmission
	Fuel grade 91 RON, with catalytic converter, manual transmission
	Fuel grade 91 RON, with catalytic converter, automatic transmission

162 - 24

1 - resistor 150 Ω

Checking the transmission protection switch (automatic transmission)

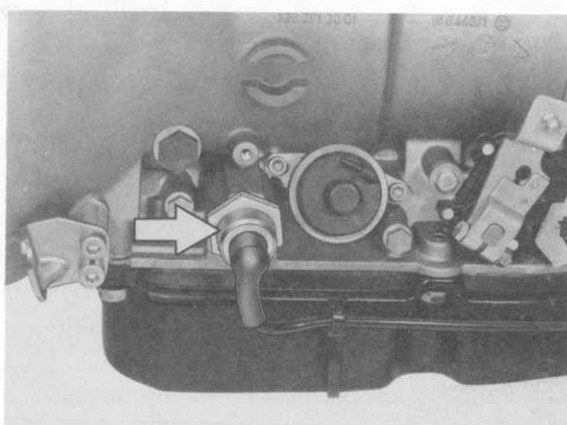
From Model 87 onwards, transmission number

16 H 00 564 USA

16 H 10 447 Rest of world

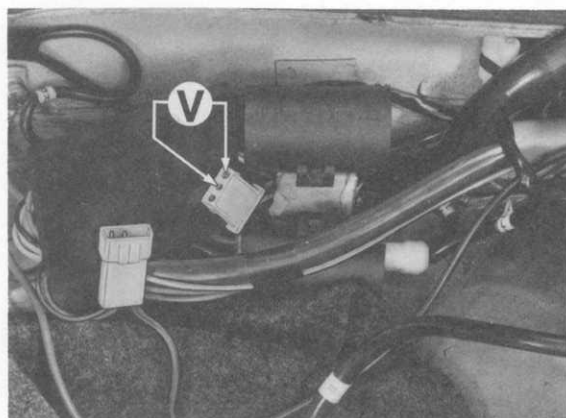
Note

The transmission protection switch is located on the left-hand side of the transmission, viewed from the driving seat.



86/433

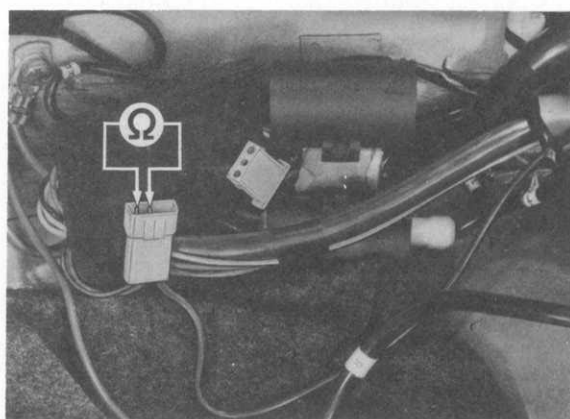
1. Separate the 3-pole connector in the spare-wheel well.
2. Connect voltmeter sleeves to terminals 1 and 2.



3. Switch on ignition.

Display: approx. 5 V

4. Connect ohmmeter plugs to terminals 1 and 2.



87/476

Note

The switch is checked with the engine running. Apply the handbrake and press the footbrake. Observe safety regulations.

Display in positions P and N:

∞ Ohm (switch open)

Display in position D:

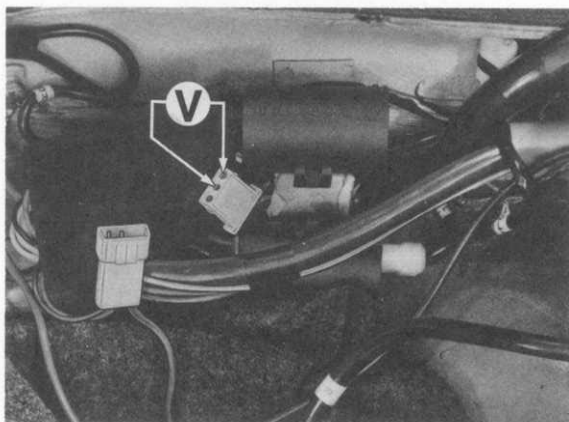
< 1 Ohm (switch closed).

If these values are not indicated, measure at the switch directly, replace if necessary.

Check up to transmission number:
16 H 00 563 USA
16 H 10 446 Rest of world

It is only possible to check the transmission protection switch in these vehicles if the vehicle is in motion.

1. Separate the 3-pole connector in the spare-wheel well.
2. Connect voltmeter sleeves to terminals 1 and 2.

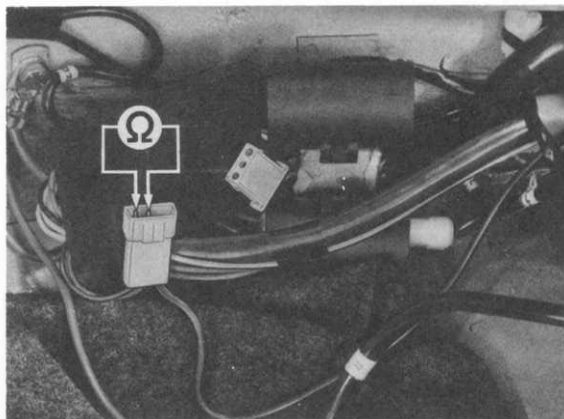


87/476

3. Switch on ignition.

Display: approx. 5 V

4. Connect ohmmeter plugs to terminals 1 and 2.



87/476

The transmission protection switch must close while changing from first to second gear (Display < 1 Ohm) and open when changing from second to third gear (Display ∞ Ohm).

The transmission protection switch must also close when changing down from third to second gear and open when changing down from second to first gear

Equipment table**As from Model 88 CLUB-SPORT-VERSION****Engine type M 28.41 CLUB SPORT****Control units**

Type / Model	Version	Remarks
928 S 4 Club Sport as from Mod. '89	928.618.124.13 928.618.124.16	EZK-control unit Cut-off speed at 6775 1/min
928 S 4 Club Sport as from Mod. '89	928.618.123.12 928.618.123.14	LH-Jetronic control unit

Equipment Table / Type 928 GT - 928 GTS (5,4 l)

As of MY 89 928 GT

Motortyp M 28.47

Steuergeräte und Zündkerzen

Type / Model	Version	Remarks
928 GT	928.618.124.22	EZK control unit cutoff speed 6800 rpm
928 GT Mod. '91	928.618.123.14 928.618.123.26	LH-Jetronic
928 GT	WR 7 DC WR 7 DP	0,7 ± 0,1 mm

As of MY '92 928 GTS (5,4 l)

Engine Type M 28.49/50

Control units and spark plugs

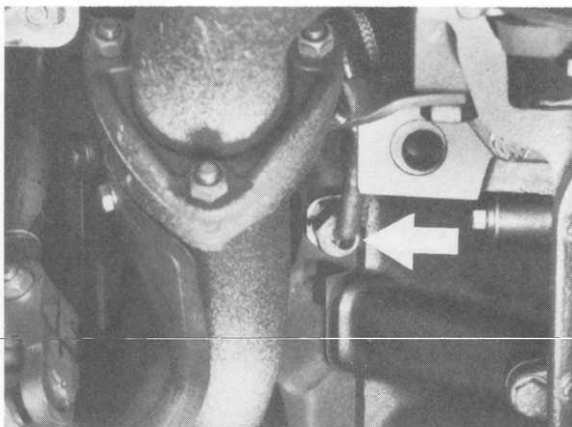
Type / Model	Version	Remarks
928 GTS	928.618.124.30	EZK control unit cutoff speed 6600 rpm
928 GTS	928.618.123.30	LH-Jetronic
928 GTS	WR 7 DTC	3 ground electrodes 0,8 ± 0,1 mm

Ignition circuit temperature sensor, removing and installing

From Model 89
Engine type M 28. 41/42 onwards

Removing

1. Remove air-filter housing complete. Unclip the temperature sensor connector on the cylinder head and separate.
2. Remove rear engine guard. Remove temperature sensor with standard tool, e.g. Hazet 4550-1.



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Installing

1. Join connection from above and clip in.
2. Apply a film of Molykote HTP white paste to the thread of the union nut

Tightening torques:

Union in cylinder head **20 Nm (15 ft. lb.)**
Union nut for temperature sensor **10 Nm (7.5 ft. lb.)**.

Note

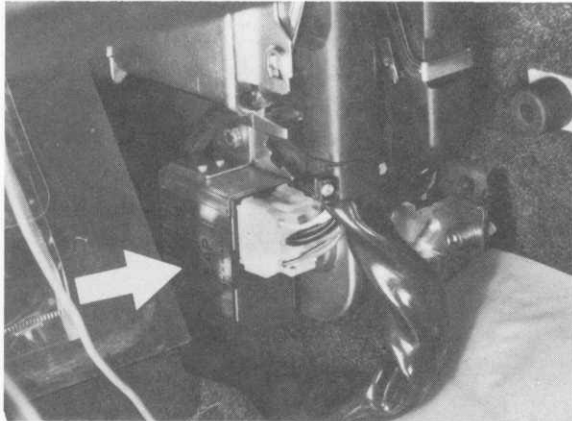
Make sure that the tip of the sensor is not bent when removing or installing the temperature sensor.

Checking the ignition circuit monitoring relay

Note

The ignition circuit monitoring relay is fitted to the mounting plate for the LH and EZK control units.

6. The resistance between E1 and E2 is approx. 5 - 10 Ω (measured at the disconnected relay socket).



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Signals at the ignition circuit monitoring relay

1. Terminal 31 - ground
2. Ground must be present at terminal AL when the ignition is switched off.
3. Battery voltage must be present at terminals 87, 15, A1 and A2 when the ignition is switched on.
4. Battery voltage must be present at terminals 61 and AL when the engine is running.
5. A voltage value of approx. 2.7 V must be present at both terminals E1 and E2 when the ignition is switched on.

Troubleshooting

Relay output	Effect	Cause	Possible test
E1	Injection circuit I switched off	Short circuit to + U _B	Measure voltage Display: Battery voltage
	Injection circuit I switched off	Short circuit to ground	Measure resistance to ground Display: 0 Ω
	Injection circuit II switched off	Discontinuity	Measure resistance between E1 and E2
E2	Injection circuit I switched off	Short circuit to + U _B	Measure voltage Display: Battery voltage.
	Injection circuit I switched off	Short circuit to ground	Measure resistance to ground Display: 0 Ω
	Injection circuit II switched off	Discontinuity	Measure resistance between E1 and E2
AL	Fault code 1132 or 1232	Short circuit to + U _B	Measure voltage Display: Battery voltage
		Shortcircuit to ground	Measure resistance to ground Display: 0 Ω
		Discontinuity	Measure resistance between terminal AL and pin 28 LH control unit
61	Fault code 1132 or 1232	Voltage at terminal 61 less than 3.5 V	Measure voltage Display: Battery voltage with engine running

Injection circuit I switched off red LED illuminated in relay housing

Injection circuit II switched off green LED illuminated in relay housing

LH-EZK-Diagnosis / Troubleshooting



928 S4
928 GT



Dr. Ing. h.c. F. Porsche Aktiengesellschaft

Test point	Description	Page
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	Important vehicle information, Groups 24/28	3
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	LH Fuel Injection System	
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2	Idle speed contact	11
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5	Air mass sensor	15
6	Idle speed control activation.....	16
7	Oxygen regulation control, rich.....	17
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12	No power supply	20
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Precautions

The greater demands placed on ignition systems by modern engines and the desire for freedom from routine maintenance led some time ago to the introduction of electronic ignition systems on production cars. Normally speaking, the ignition power from electronic systems (of almost all makes) is greater than that of conventional systems, and further power increases can be expected in the future. This places electronic ignition systems in a power range where touching live parts or terminals (either the primary or secondary circuits) could lead to a fatal accident.

In this connection you are reminded that German VDE regulations, and in particular VDE 0104 of July 1967 (or the equivalent national regulations) must be complied with whenever work on or inspection of the ignition system takes place. The ignition must always be switched off (ignition or power source) before work on the ignition system is started. Such work includes:

- Connecting engine testers, for example timing light, dwell angle/speed tester, oscilloscope etc.
- Replacement of ignition system components, for example spark plugs, coils, distributors, ignition leads etc.

The above-mentioned dangerous voltages will be present in the entire system should it be necessary to switch on the ignition for ignition system testing or engine adjustments.

In other words, there is not only danger from the individual components of the ignition system (for example distributor, coil, control unit, wiring or associated components) but also at wiring harnesses, plug connections and testers.

Important vehicle information

- Always turn off the ignition or disconnect the battery for resistance tests (if this is not done, the measuring instrument may be damaged beyond repair).
- Always disconnect both speed sensor plugs for compression tests. (If this is not done, dangerously high voltages and insulation damage at the coil, high-tension distributor and ignition leads could result.)
- The specified coil (refer to order number) must not be replaced by a different coil.
- Never connect an interference suppression capacitor to coil terminals 1 and 15.
- Never connect coil terminal 1 to ground for the burglar alarm. This could damage the coil and the control unit beyond repair.
- Never connect battery + or a test lamp to coil terminal 1, or the control unit will be damaged beyond repair.
- Never disconnect the ignition lead from coil terminal 4 to high-tension distributor terminal 4 while the engine is running.
- There must be no electrical flashover from coil terminal 4 to coil terminals 1 and 15, or the control unit could be damaged beyond repair.
- To avoid destruction of the control unit, the secondary circuit of the ignition system must be suppressed with at least 4 k Ω ; the original distributor rotor with 1 k Ω suppressor resistor must be installed (do not use a 5 k Ω - distributor rotor even if radio and telephone interference suppression are necessary).
- Disconnect EZK/LH control units and ignition output stage plugs only after turning off the ignition.
- Flashovers or insulation breakdowns in the high-tension distributor cap area (poor insulation) could destroy the control unit.
- Never disconnect the battery when the engine is running.
- Incorrect battery polarity could damage the ignition output stage, coil and LH-EZK control unit beyond repair.
- External engine starting at more than 16 V or with a rapid battery charger is forbidden.
- Always comply with accident prevention regulations when working on the fuel system.

Equipment required for LH/EZK testing:

- Diagnostic tester 9288 (9268) with connecting leads
 - 1 oscilloscope approved by Porsche
 - 1 digital-display multimeter, internal resistance at least 10 M Ω
 - 1 Bosch L-Jetronic test lead, Bosch No. 1684 463 093 (check lead for correct polarity at plugs).
 - 2 control-unit plug test leads (to be made up in your own workshop) with two No. 17.457.2 tab connectors, to avoid damage to the contacts in the control-unit plug during testing.
 - 2 adapter test leads, consisting of: 4 N 017.483.1 plug connectors with 2 leads approx. 150 mm long, soldered.
 - 1 3-pin test lead (e.g. VW VAG 1501).
 - 2 control-unit plug test leads (to be made up in your own workshop) equipped with 4 N 17.457.2 tab connectors.
 - The test leads must always be used for testing.
- All sensor and ignition timing signals on Porsche automobiles can be checked with the engine testers recommended by Porsche.
Since each tester manufacturer issues different instructions for connection to the vehicle, these instructions should always be followed carefully to ensure correct tester connection.

The following sensor signals can be checked with the oscilloscope:

- Engine speed sensor signal / reference mark signal
- t_i signals
- Idle speed control activation
- Hall sensor signal
- Ignition trigger signal to ignition output stage
- Fuel tank venting activation signal
- Resonance flap activation signal

as well as:

- Reed switch signal (speedometer)
- ABS wheel sensor signals

Control units

The LH and EZK control units were given diagnostic capability at the end of the 1988 model year (see 1988 Model Information, Fuel and Ignition System - Diagnosis).

Starting with the 1988 model year, self-diagnosis with a fault memory is integrated into the two fuel injection and ignition control units. This makes it possible to identify and store certain malfunctions of the fuel injection and ignition system and of the knock regulating system.

To make sure that faults identified and stored in this way are not erased when the ignition is turned off, a permanent + signal is supplied to both control units.

Important:

If the control unit plugs or the battery are disconnected, the fault memory will be erased.

Diagnostic tester:

To call up the contents of the fault memory on 1988 model cars a new diagnostic tester (special tool number 9268) was developed. It is connected to an existing plug connection on the control unit mounting plate.

For diagnostic work on cars from the 1989 model year on, a 19-pin plug-in connection under the booster cover is connected to the new 9288 system tester or the 9268 flashing code tester (using an intermediate adapter lead).

Note:

The test point concerned is supplemented by the equivalent flashing fault code on the 9268 tester.

Example:

Test point 2 = idle speed contact (1_12)

2nd digit display:

"1" = fault present, or

"2" = no fault present.

From tester module version 2.0 on, actual engine data can be read out from the EZK/control unit with system tester 9288.

This LH/EZK diagnosis/troubleshooting plan is based on the contents of the fault memory.

Paths not included in the self-diagnosis can be diagnosed by conventional means (test points 12 - 22 on LH, 12 - 16 on EZK)

Preconditions for troubleshooting are that the person performing the tests

- is familiar with the location of components and the functions of and technical inter-relationships between the systems to be tested (model information)
- can read and evaluate Porsche wiring diagrams
- knows the functions of electrical circuits and relays
- can use testing equipment such as oscilloscopes, voltmeters, ohmmeters and ammeters and knows how to evaluate their readings.

Important:

A fault indication on the display (fault list in the case of the flashing code) **does not always** indicate that the component in question is defective. It can also suggest a fault in the corresponding control unit or the connecting leads (paths) between the component and the control unit.

No troubleshooting involving disconnecting plugs etc. is to be performed with the engine running before the fault memory has been read out, or this in turn may be stored as a fault in the memory.

Note on the 9288 system tester

If the tester display shows

Fault not present, this may mean:

- Fault is no longer present at the time of testing (loose contact)
Remedy: visual inspection of the path, erasure of the fault memory and a repeat test drive.
- The conditions in which the fault is being tested for do not correspond to those under which the fault originally occurred.
Remedy: conform with conditions displayed on the tester.

Signal not plausible:

The signal from the monitored component is not within the tolerance range of the specified control-unit value

In contrast to LH cars up to and including the 1986 model year, on which the injection valves, oxygen sensor and rotary actuator were activated from fuel pump relay XX, the power supply to the injector valves, idle speed control, fuel tank venting valve, encoding element and resonance flap switching valve from the 1987 model year on were supplied in addition from LH-Jetronic relay XXv, which previously had a burn-off function only. This change was necessary to permit self-diagnosis from the 1988 model year on.

From the 1990 model year on, the connections to the central electrics and the installed direction of the control unit plugs have been altered.

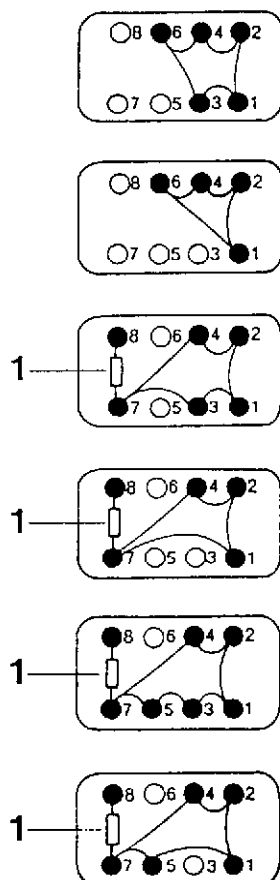
The relay designation from the 1990 model year on is shown in brackets and the wiring entry into the plug as a broken line.

	up to 90	from 90	Power supply for:
Fuel pump relay	XX	XXVI	Fuel pump λ -sensor
EZK relay	XVI	XXII	LH control unit EZK control unit
LH-Jetronic relay	XXV	XXV	

LH-Jetronic, EZK Ignition system

Control unit codes

Circuit diagram



Version for

ECE,
manual gearbox,
no catalytic converter

ECE,
automatic transmission,
no catalytic converter

Worldwide
automatic transmission,
with catalytic converter

Worldwide,
automatic transmission,
with catalytic converter

Fuel grade
91 octane (RM), with
catalytic converter,
manual gearbox

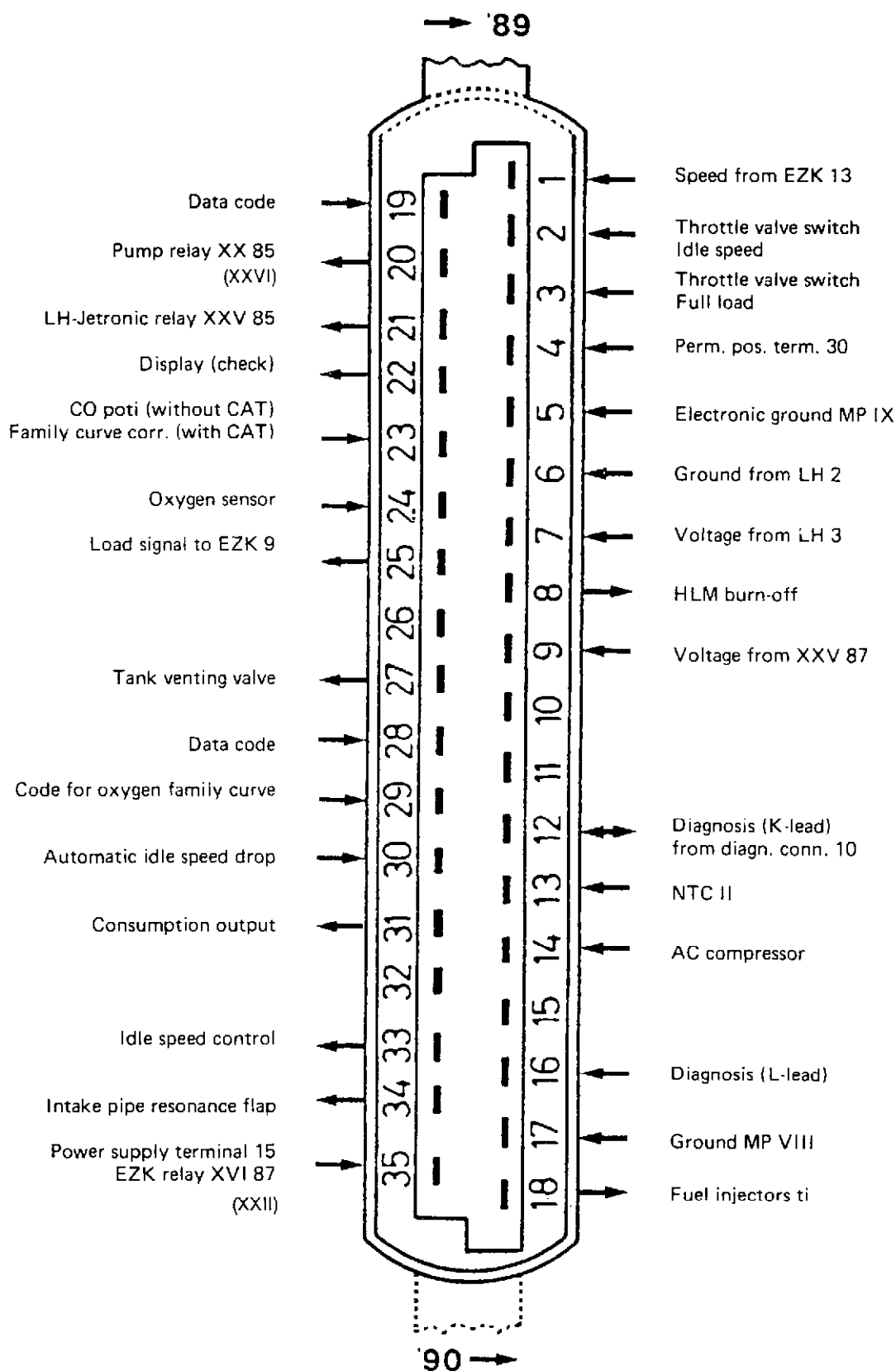
Fuel grade
91 octane (RM), with
catalytic converter,
automatic transmission

1 - Resistance 150 Ω

Engine mechanically OK Battery charged Starter motor cranks the engine	Test point	Engine will not start	Engine hard to start	Irregular idling	Poor pick-up	Misfiring	High fuel consumption	Low power output	Engine hesitation	Poor hot starting	Diagnosis not possible	Fault code 1_	Tester	Plug, Control unit	Terms in bold type = Fault memory display or fault path
	1	x	x			x			x		x	11	V	35 → 17 9 → 17	Supply voltage
	2						x		x			12 15	Ω	2 → 17	Idle speed contact
	3			x			x	x	x			13	Ω	13 → 17	Full load contact
	4	x	x	x	x	x	x	x	x	x		14	Ω	13 → 17	Engine temperature sensor II
	5			x	x	x	x	x	x			21			Air mass sensor
	6		x	x					x	x		22	≅		Idle speed control activation
	7			x	x		x	x	x			23	V		Oxygen regulation stop, rich
	8			x	x			x	x			24	V		Oxygen regulation stop, lean
	9											25	V/Ω		Oxygen sensor, open circuit
	10		x	x	x	x		x		x		31			Injection circuit shut down
	11	x									x	41			Control unit faulty

Fault memory, LH control unit, 928 S4/GT

Power supply	Oxygen sensor control - rich
Idle contact Open circuit short	Oxygen sensor control - lean
Full load contact	Oxygen sensor open circuit
Engine temperature sensor 2	Injector circuit switched off
Idle contact open circuit	Ignition circuit monitoring relay
Hot wire air mass sensor housing	Control unit faulty
Idle stabilizer control	



Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 1 Power supply voltage too high / too low LH control unit Fault code 1_11	If the power supply drops below 10 V or rises above 16 V, this is stored in the fault memory. Check voltage at regulator; check plug connection and terminals for firm contact and freedom from corrosion.

Test point 2

Idle speed contact (Ω)
Short to ground
Fault code 1_12

Check by means of circuit input test with 9288 system tester, or 9268 tester

Select the test step and depress the accelerator pedal.

9288 display: Idle speed contact closed

Idle speed contact open

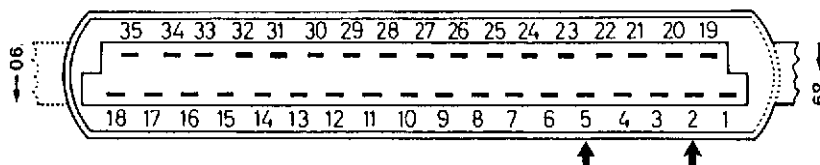
9268 display: 1332 (idle speed contact closed)

0000 (idle speed contact open).

No display:

Disconnect plugs from EZK and LH control unit.

Connect ohmmeter between terminals 2 and 5, using test leads.



Display:

Throttle valve closed

$< 10 \Omega$

Throttle valve opening angle

$> 1^\circ = \infty \Omega$

The idle speed contact must open immediately.

Open circuit: Ignition timing at idle speed approx. 20° CS (crankshaft rotation).

No fuel cutoff when coasting, higher idle speed.

Short circuit: Fuel cutoff as engine runs up, once after every engine start. Ignition timing approx. 10° retarded.

Fault, Fault Code	Possible Causes, Elimination, Remarks
	If the idle speed contact values are not obtained in this test, repeat it directly at the throttle valve switch: disconnect the plug from the throttle valve switch. Connect an ohmmeter between terminals 1 and 2 of the throttle valve switch, using test leads. Display: Throttle valve closed $< 10 \Omega$ Throttle valve opening angle $> 1^\circ = \infty \Omega$
Idle speed contact (Ω) Open circuit Fault code 1_15	Test procedure same as for short to ground. (From 1991 models on, fault is memorized.) Check that setting is correct and adjust if necessary. Cause may be incorrectly set throttle valve switch or accelerator cable, for example.



Fault, Fault Code

Possible Causes, Elimination, Remarks

Test point 3

Full load contact Ω

Fault code 1_13

Check by means of circuit input test with a 9288 system tester or 9268 tester

Select test step and operate the accelerator pedal.

9288 display: Full load contact open

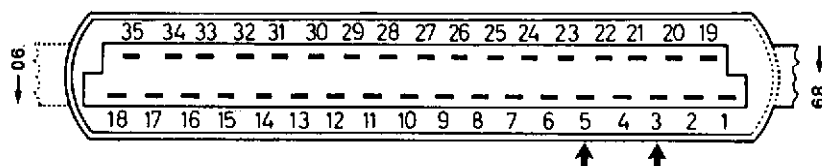
Full load contact closed.

9268 display: 1333 (full load contact open)

0000 (full load contact closed).

No display:

After disconnecting the EZK and LH control unit plugs, connect the ohmmeter to terminals 3 and 5 by means of the test leads.



Display:

Throttle valve closed

 $\infty \Omega$ Throttle valve after opening by
approx. two-thirds of its travel< 10 Ω

If the full load contact values are not reached in this test, it should be repeated directly at the throttle valve switch:

Disconnect plug at throttle valve switch. Connect ohmmeter between terminals 3 and 2 of the throttle valve switch by means of the test leads.

Display:

throttle valve closed

 $\infty \Omega$

Throttle valve open

< 10 Ω 

Note:

If the full load contact fails the control unit generates a load threshold by way of the air mass sensor. Values below this load are the same as if the switch were open, values above it the same as if the switch were closed.

Fault, Fault Code

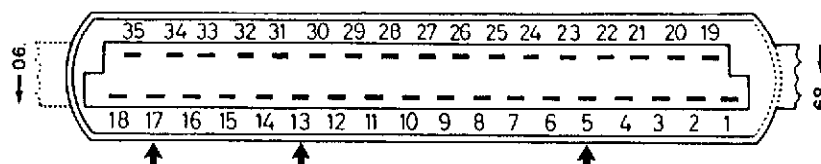
Possible Causes, Elimination, Remarks

Test point 4

Engine temperature
sensor II Ω

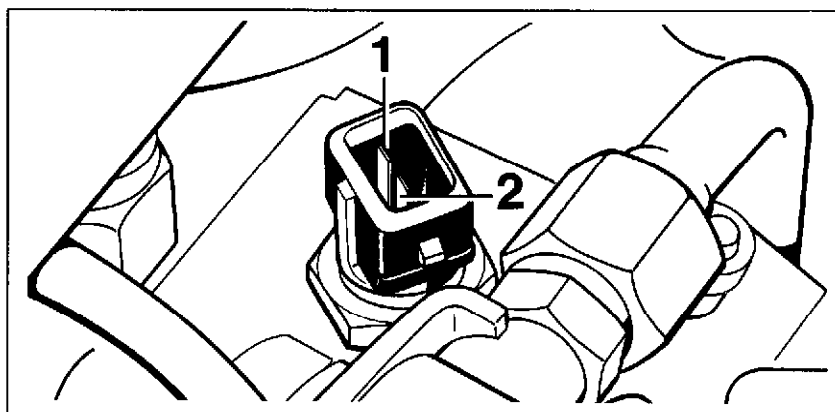
Fault code 1_14

Disconnect the LH control unit plug.
Connect the ohmmeter to terminals 13 and 5 or 17 of the LH control unit plug using the test leads.

**Display: resistance**

Test values at:	0°C	=	4.4 - 6.8 k Ω
	15 - 30°C	=	1.4 - 3.6 k Ω
	40°C	=	1 - 1.3 k Ω
	80°C	=	250 - 290 Ω
	100°C	=	100 - 210 Ω

If the values are not reached, check directly at the engine temperature sensor. Do not connect both contact tabs to the ohmmeter, but check each contact tab separately against ground (there are 2 independent temperature sensors).



1 - EZK
2 - LH

Note: temperature sensor II supplies the cylinder head temperature to the control unit. It is responsible for mixture enrichment during cold starts and when the engine is warming up.

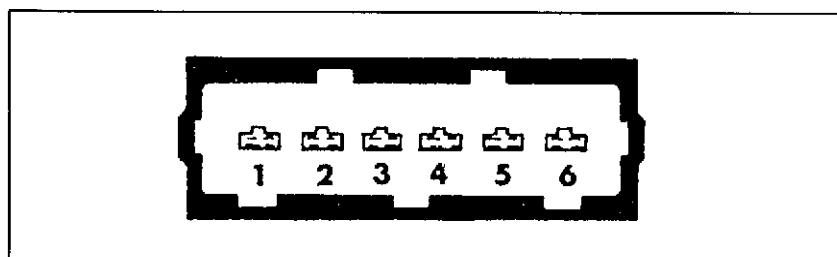
Fault, Fault Code	Possible Causes, Elimination, Remarks	
	Break ($\infty \Omega$):	The LH control unit reverts to a fixed, previously stored program. If the engine is warm, there is no mixture enrichment. If the engine is cold, however, this causes starting problems (since there is no cold-start enrichment).
	Short circuit (0Ω):	When the engine is cold it does not respond to the throttle being opened; the mixture is too weak and the engine stalls. No effect at regular operating temperature.

Test point 5**Air mass sensor**

Fault code 1_21

a) Power supply (V)

Disconnect the plug at the air mass sensor and connect the voltmeter to plug terminals 2 and 4 using the test leads.



Use the test leads to connect terminals 17 and 21 on the LH control unit plug after it has been disconnected.

Display: battery voltage

No display:

Remove LH relay XXV and bridge terminals 87 and 30 at the relay base. Display on voltmeter connected to air mass sensor plug:

battery voltage.

If there is a battery voltage display, check the LH relay and its activation.

If there is no display, check leads and plug connections according to wiring diagram.

b) Checking resistance of hot wire circuit at the air mass sensor (Ω)

Disconnect the plug connection at the air mass sensor. Connect terminals 3 and 5 at the air mass sensor with the ohmmeter.

Display: 3.6 - 4.1 Ω

Fault, Fault Code	Possible Causes, Elimination, Remarks
	c) Checking the hot wire signal (V) Connect the plug to the air mass sensor. Take out LH relay XXV entfernen and bridge terminals 87 and 30 at the base of the relay. Connect terminals 6 and 7 at the LH control unit plug with a voltmeter. Display: $\approx 1.6 \text{ V}$ Blow on the hot wire in the air mass sensor and watch the voltmeter. The voltage reading must change. ($\approx 1.6 - 5 \text{ V}$) d) Checking the hot wire burn-off circuit (visual check) Run the engine with the air mass sensor installed and connected. When an engine temperature of $> 60^\circ\text{C}$ is reached, raise engine speed above 2000 min^{-1} and then stop the engine by switching off the ignition. After a delay of approx. 4 seconds, the hot wire must glow for approx. 1 s (burn-off function). e) Emergency operating program The emergency operating program stored in the LH control unit is activated if the air mass sensor fails, so that the car can be driven to the nearest authorized repair shop. With engine warm and at engine speeds $< 2000 \text{ min}^{-1} \approx 3.5 \text{ ms ti}$ With engine warm and at engine speeds $> 2000 \text{ min}^{-1} \approx 6.3 \text{ ms ti}$ (ti = injection time)

Test point 6
Idle speed control (V)
Fault code 1_22

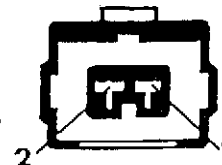
Call up actuator activation menu point

If no pulse is audible, check:

Power supply

Connect voltmeter to terminal 2 of disconnected idle speed actuator plug and ground with the test leads. Switch on the ignition.
Display: battery voltage.
No display:

Check power supply according to wiring diagram.



Fault, Fault Code

Possible Causes, Elimination, Remarks

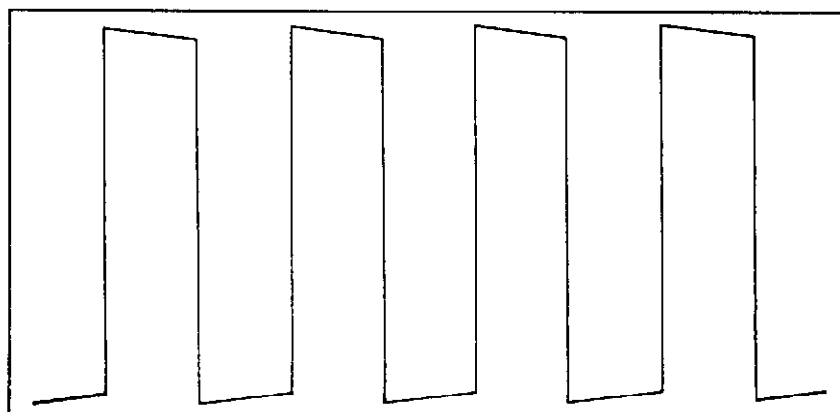
Checking the control signal

Insert 2-pin DME test lead (Bosch No. 1 684 463 093) between rotary actuator and plug connection.

Connect engine tester as stated in manufacturer's instructions, and adjust.

Make sure that there is no contact between the lead connectors and ground on the vehicle (risk of short circuit).

With the engine running, the following display must be seen:



Frequency approx. 100 Hz.

If there is no audible pulse in spite of the power supply and the signal being present, renew the idle speed control.

Test point 7

**Oxygen regulation
Control (rich)**

Fault code 1_23

Mixture preparation problems are preventing the oxygen regulator from operating within its control range. It therefore moves back to its stop.

Test 1: With the engine running and a CO tester connected, note the CO content (between 0.4-1.2 %)

Too lean: check intake system (test point 19)

Fault, Fault Code**Possible Causes, Elimination, Remarks****Test point 8****Oxygen regulator
Control (lean)**

Fault code 1_24

Mixture preparation problems are preventing the oxygen regulator from operating within its control range. It therefore moves back to its stop.

Test 1: With the engine running and a CO tester connected, note the CO content (between 0.4-1.2 %)

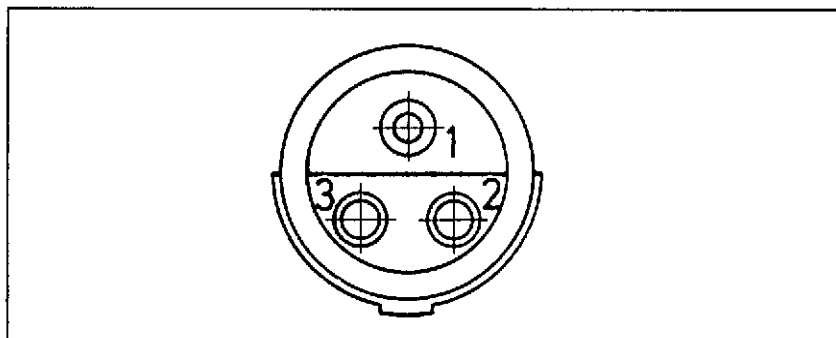
Too rich: Check fuel pressure (test point 17)
Check injector valves for leaks

Test point 9**Oxygen sensor
Open circuit**

Fault code 1_25

a) Checking sensor signal (V)

Disconnect the oxygen sensor plug close to the central electrics. Connect voltmeter at the sensor end to the single plug pin and ground.

**Test connection**

1 = Sensor voltage
2, 3 = Sensor heating

Start the engine and warm it up so that the oxygen sensor can reach its regular operating temperature. When the mixture is richened (for example when the accelerator pedal is pressed down), the voltage signal displayed must go up.

Display on voltmeter: 0.1 - 1 V

b) Checking the control unit

Raise engine to operating temperature. Connect the exhaust tester to the exhaust test tube. Disconnect the oxygen sensor and connect the plug sleeve to ground on the control-unit side. Watch the exhaust tester:

Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 10 Injection circuit shut down Fault code 1_31	The CO content must go up. Important: Continue this test only until a change is noted in the CO content at the CO tester. If the control unit does not process the ground signal, check its coding (see testing plan page D24/28-8) before replacing it. The ignition circuit monitoring relay is mounted on the retaining plate for the LH and EZK control units. If an ignition circuit fails, the power supply to the injector valves is interrupted. At the same time one of the two colored LEDs integrated into the relay lights up. Injection circuit I shut down - red LED lights up. Injection circuit I shut down - green LED lights up. For troubleshooting, see 928 Repair Manual volume I-A, pages 28-77
Test point 11 Defective control unit Fault code 1_41	Renew control unit

Fault, Fault Code	Possible Causes, Elimination, Remarks
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Test point 12

No power supply
to LH control unit (V)

**a) Permanent positive
supply (B +)**

Connect voltmeter to
terminals 17 and 4 of LH
control unit plug with a test
lead.

Display: battery voltage

Checking current path
according to wiring
diagram.

**b) Power supply through
LH relay XXV**

At the LH control unit,
connect a voltmeter to
terminals 17 and 9, and run
to terminal 21 (ground on
body) using test leads. The
LH relay must be energized.

Display: battery voltage

No display:

Check relay Relais XXV and
current path according to
wiring diagram.

Test point 13: Ground connections / Plug connections**Ground connections**

- Engine ground, between engine and right side of body under engine.
- Ground for ignition output stages above the right ignition coil.
- Ground for control units under the fuel pressure regulator and the fuel pressure vaporizer.

Are the ground connections tight and free from corrosion?

Loosen the ground points, clean them and tighten them again as specified.

Note:

Never start the engine when the body-engine ground lead is not connected. This will destroy the control unit immediately.

Plug connections

Are all plug connections correctly wired up and not loose or corroded? Separate the plug connections. Neither the pins nor the sleeves of the plug connections must be bent or corroded.

- At the central electrics, the relays for the fuel pump, EZK and LH and plug W.
- At the EZK and LH control units, the 35-pin plug in each case.
- Plug connection for activating the ignition output stages (green/white lead). Above the central electrics
- At the air mass sensor, a 6-pin plug (only 5 contacts are occupied in the plug housing).
- At temperature sensor, II a 2-pin plug.
- At the engine speed reference mark sensor, a 3-pin plug (behind the air mass sensor).
- At each of the 8 injector valves a 2-pin plug (first remove the ring pipe cover).
- Knock sensor plug connections. Front sensor: plug connection at the front left, below the fuel ring pipe.
- Rear sensor: plug connection above the right fuel ring pipe at the rear.
- Hall sensor plug connection. Behind the housing for the camshaft drive gear, cylinder bank 1-4.
- Plug connection for solenoid valve to operate resonance flap (at toothed belt cover for cylinder bank 5-8).
- Plug connection, fuel tank venting solenoid (at toothed belt cover for cylinder bank 1-4, below the water hose).
- Plug connections for the output stages (on the cover, left cross-wall).

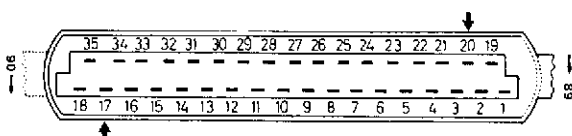
Test point 14: Fuel pump voltage (V)

Fuel pump relay XX (XXVI) is activated by the LH control unit against ground. To check fuel pump activation, connect terminals 200 and 17 at the LH control unit plug with the test leads and switch on the ignition. The relay will be energized and the pump will run.

If the pump does not run:

Check fuse No. 42 (38). If the fuse is in good working order, remove the fuel pump relay and connect terminals 87 and 30 at the base of the relay. The fuel pump must then run.

If the pump runs, check the relay or activation circuit. If the pump does not run, examine the pipes and connections leading to the pump and the pump itself.

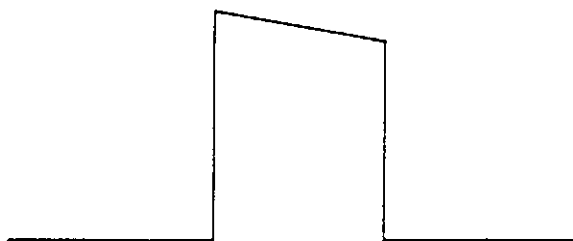


Test point 15: Engine speed signal from EZK

Important: the EZK control unit plug must be attached and the LH control unit plug detached.

At the LH control unit plug, connect terminals 17 and 1 with the engine tester leads, using the test leads.

Adjust the oscilloscope as stated by its manufacturer. Start the engine with the starter motor. A control signal must be visible on the oscilloscope.



Test point 16: Injector valves Control system (V/Ω)

If the engine can be run, pull off the injector valve plugs one after the other. If the injector valve is in good working order and combustion in that cylinder is correct, engine speed will fall. If the engine cannot be run, check:

a) Power supply

Pull off injection valve plug (to do this, first remove the cover over the ring pipe). Remove LH relay XXV and bridge terminals 87 and 30 at the relay base. Connect voltmeter to the valve plug contacts and ground, using the test leads.

Display: battery voltage

If no battery voltage is displayed, check the current flow path according to the wiring diagram.

b) Check injection valve coil resistances

Pull off the valve plugs. Use an ohmmeter at the injection valve connection contacts to measure the coil resistance.

Test value: approx. 16 Ω

c) Injection output stage

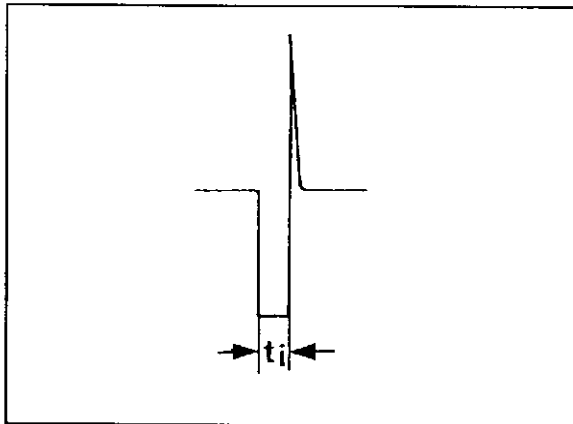
Adjust the oscilloscope in accordance with the manufacturer's instructions. Connect a Bosch test lead (1 684 463 093) between one injection valve and plug. Connect the tester lead to the test lead in accordance with the manufacturer's instructions.

Important:

Tester leads must not have any contact with ground.

Start the engine. If the injection output stage is working correctly and the tester connections are correct, the following displays must appear:

Starter speed



Note

If the engine does not start or if idle speed drops, interchange the tester connections at the test lead and check the tester setting.

Test point 17: Fuel pressure

The fuel collection pipe has a test connection at the front right. Unscrew the cap nut of the test connection.

Warning: the ball seal inside could fall out.

Connect a P 378 or VW 1318 pressure gauge to the test connection. Start the engine and run at idle speed with vacuum at the pressure regulator.

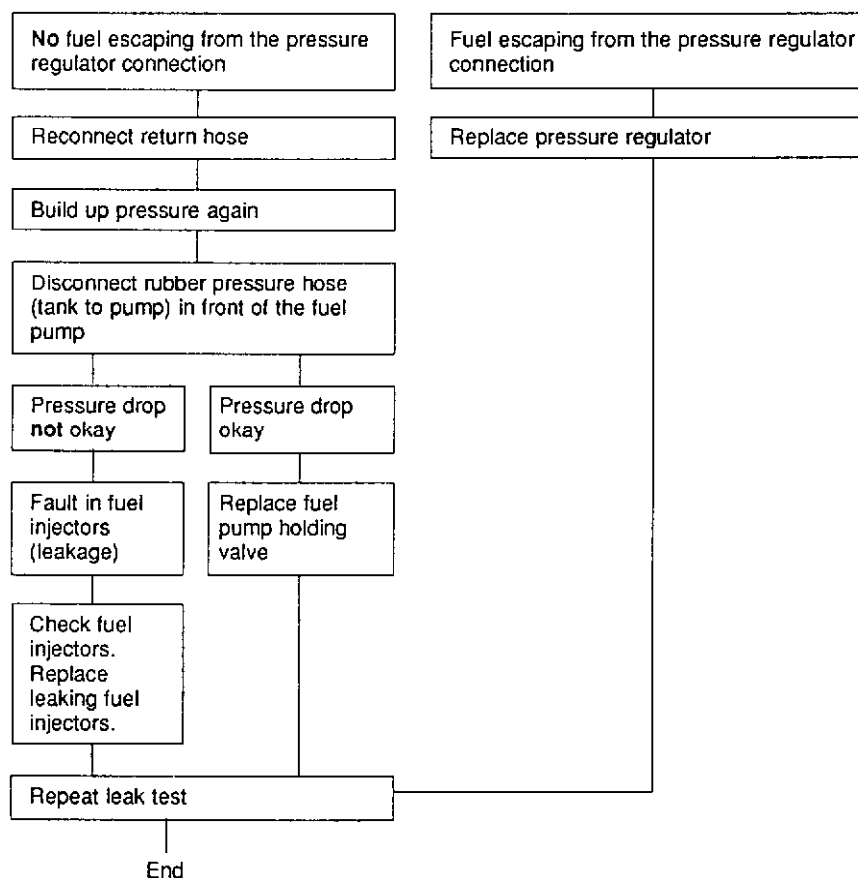
Test pressure 3.3 ± 0.2 bar**If there are hot starting problems:**

Check with the engine stopped and the fuel pump running, without vacuum at the pressure regulator (to do this, remove the relay and bridge terminals 87 and 30):

Test pressure 3.8 ± 0.2 bar

- Switch off the fuel pump. Read off the pressure value at the test pressure gauge (nominal value 3.8 ± 0.2 bar).
- Maximum permissible pressure drop with engine warm: **0.5 bar in 30 minutes.**
- If pressure drops below the specified value, proceed as follows:

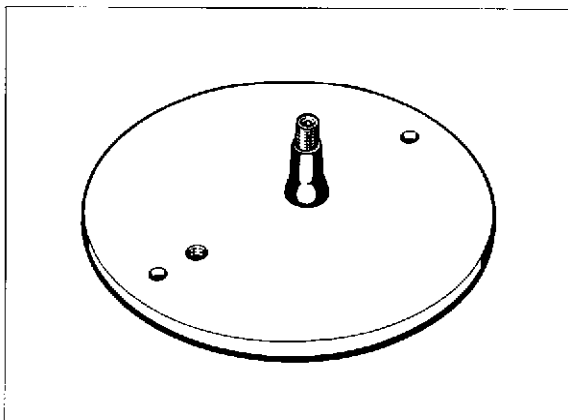
Build up pressure again by switching the fuel pump on briefly. Remove the return pipe at the pressure regulator (the fuel pump must not be switched on).



Test point 18: Intake system leaks

Check all connections after the air mass sensor for tightness and freedom from leaks.

Attach special tool 9264/1 to the air mass sensor with M 4 x 45 mm bolts and build up a pressure of 0.3 bar. If there are any leaks, pressure will drop in the intake system or air will be heard escaping..



551-24

Note

On cars with oxygen regulator, flashing fault code 1_23 (oxygen regulator at rich stop) appears if there are severe leaks in the intake system (for example the intake pipe gasket).

Test point 19: Resonance flap

In certain engine speed ranges and at not less than one-third of full engine load, the resonance flap in the intake system is opened by vacuum. It is also opened whenever the engine is started (provided that vacuum is present in the reservoir).

a) Checking function of flap

Remove the resonance flap shaft cover (rubber cover) attached above the intake pipe cluster. Using a felt marker or similar, mark a central line on the surface of the flap shaft (this makes it easier to detect opening movement).

Start the engine: **the flap will open and close again as the engine is started.**

When the engine is running, depress the accelerator pedal to the full throttle position suddenly: **the flap will open and close.**

(However, this does not happen unless the engine is running at more than 3500 rpm and at not less than one-third of its full load.)

b) Checking operation of resonance flap without running the engine: vacuum side

Detach the vacuum supply pipe from the vacuum reservoir at the solenoid valve. Check vacuum with a vacuum tester
≈ 0.6 bar.

After this, build up a vacuum of approx. 0.4 bar at the pipe to the diaphragm valve (below the intake air pipe cluster = **the resonance flap will open.**

If the flap does not open:
check diaphragm valve and supply pipe.

c) Power supply (V)

Use the test leads to bridge terminals 17 and 21 at the LH control unit plug. Use other test leads to connect terminal 34 of the control unit plug to ground = **the resonance flap will open.**

If the flap does not open:

At the LH control unit plug, connect terminals 17 and 21 with the test leads. Separate the plug connection at the solenoid valve. Connect voltmeter to plug socket (2) and ground.

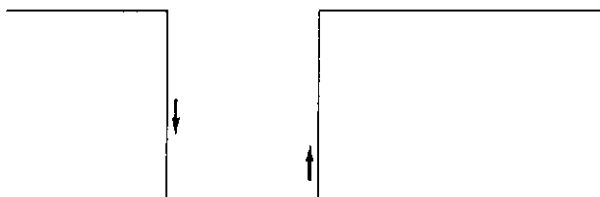
Display: battery voltage

No display:

Check power supply to solenoid valve by way of LH relay XXV according to the wiring diagram. Check that there is no break in the circuit from LH control unit terminal 34 to the solenoid.

d) Checking the control signal with the oscilloscope

Attach the LH control unit plug. Disconnect the plug at the solenoid valve. Connect the engine tester with the test leads to the sleeve side of the solenoid valve plug in accordance with the manufacturer's instructions, and adjust (bei Bosch MOT 300/400, but select screen range of 20 V). While starting the engine and if the throttle is opened suddenly when it is running, the following picture must be visible on the tester:



Test point 20: Fuel tank venting (V)

When the engine is at regular operating temperature and the throttle valve is opened (idle speed contact), the solenoid valve is activated by the LH control unit with an intermittent signal to ground. The greater the airflow at the air mass sensor, the longer the solenoid valve remains open.

a) Checking solenoid valve activation

Connect terminals 17 and 21 with test leads at the LH control unit plug. Use another test lead to connect terminal 27 to ground (on body): the solenoid valve is energized.

If the valve does not open:

Check power supply and continuity of circuit from terminal 27 to solenoid valve according to the wiring diagram.

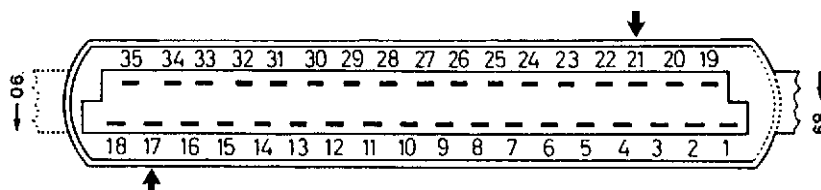
b) Checking power supply (V)

At the control unit plug, connect terminals 17 and 21 with the test leads. Disconnect the solenoid valve plug and connect the voltmeter between the plug connection and ground with the aid of test leads.

Display: battery voltage

No display:

Check power supply through LH relay according to wiring diagram.

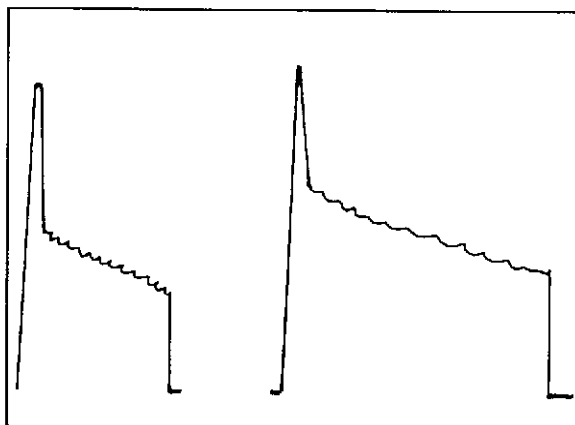


c) Checking control signal with oscilloscope

Connect DME test lead (Bosch No. 1 684 463 093) between solenoid valve and plug connection. Connect the engine tester in accordance with the manufacturer's instructions and adjust it.

Start the engine and open the throttle slightly (the idle speed contact must open, engine temperature must be $> 60^{\circ}\text{C}$). The following display is then obtained:

Fuel tank venting



As air flow increases, the signal broadens.

Test point 21: Alternator, regulator

Engine misfiring may be caused by alternator voltage peaks.

Remove the drive belt from the alternator and start the engine.

If this eliminates the fault, check the alternator and regulator.

Test point 22: Leads K and L

The diagnostic connection between the LH control unit and the diagnosis testers is by way of the two leads K and L. If no diagnosis is possible, the following tests must be carried out:

1. Continuity test (refer to wiring diagram)

Lead L: Pin 7 (19-pole diagnostic socket)
- Pin 16 (LH plug)

Lead K: Pin 8 (19-pole diagnostic socket)
- Pin 12 (LH plug)

2. Ground short test (refer to wiring diagram)

Lead L: With the ignition switched on, the voltage at Pin 7 (19-pole diagnostic socket) must be $> 8\text{ V}$ betragen.

Lead K: With the ignition switched on, the voltage at Pin 8 (19-pole diagnostic socket) must be $> 8\text{ V}$ betragen.

Possible fault causes:

- Ground short or break in wiring or at plug connections.
- Faulty control unit connected to these leads (this may be any control unit with diagnostic capability and must not necessarily be the LH control unit).

Checking: disconnect plugs in succession at the control units with diagnostic capability until the voltage $> 8\text{ V}$. Renew the control unit which is causing the fault.

- Tester faulty.
- No power supply at the diagnostic plug.
- No ground at the diagnostic plug.

Notes on idle speed and CO testing at idle speed:**a) Idle speed**

The 928 S4 is equipped with an adaptive idle-speed cylinder filling control. This makes it unnecessary to adjust the idle speed of any version. On cars with adaptive idle-speed cylinder filling control, system adaptation must only be carried out after disconnecting the LH control unit from the permanent positive supply and after each inspection.

Idle speed control value with engine at regular operating temperature: GT $775 \pm 25/\text{min}$
S4 $675 \pm 25/\text{min}$

b) Idle speed CO value on cars without catalytic converter

The CO level is still adjusted at the CO adjusting screw on the potentiometer. The following preconditions must be observed:

Engine at regular operating temperature

- Engine in good working order mechanically and ignition system OK
- All electrical consumers switched off
- Exhaust emission tester at operating temperature, calibrated and correctly adjusted.

Check-Engine Lamp

(Malfunction Indicator Light M.I.L.)

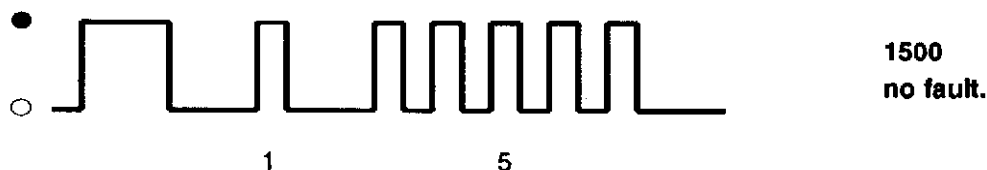
As from model year '91, Californian legislation prescribes a warning lamp which lights up if a part relevant to the exhaust gas fails.

As a function check of the warning lamp, it lights up when the ignition is switched on and goes out once the engine is running when this is started without depressing the accelerator.

The warning lamp has a flashing code to indicate a defective fault path.

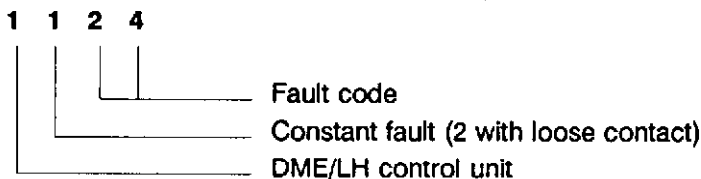
To trigger off the flashing code, fully depress the accelerator pedal with the engine off and the ignition on for 3 seconds until the Malfunction Indicator Lamp flashes. Then remove foot from accelerator.

If no fault is recorded, i.e. no warning came from the indicator light, there appears the flashing code



● = Lamp on ○ = Lamp off

If the warning light did indicate a warning, i.e. there is a fault, there appears a flashing code, e.g.



The flashing code is listed in the Diagnosing/Troubleshooting plan on page D 24/28-7.

The fault can also be read direct using System Tester 9288. After a repair the fault memory must be erased using the System Tester.

Test point	Title	Page
EZK ignition system		
	Effect of faults (checklist)	3
	Fault memory	4
	Connections to plugs, EZK control unit	4
1	Idle speed contact	5
2	Full load contact	6
3	Engine temperature sensor II	7
4	Idle and full load contact	7
5	Load signal	7
6	Transmission protection switch	7
7	Knock sensor I	8
8	Knock sensor II	9
9	Control unit (knock sensor)	9
10	Hall signal	9
11	Control unit faulty	10
12	Permanent power supply	10
13	Engine speed/reference mark transmitter	11
14	Ignition circuit monitoring	12
15	Ignition system - output stages	12
16	Leads K and L	15

Printed in Germany – XXV, 1990

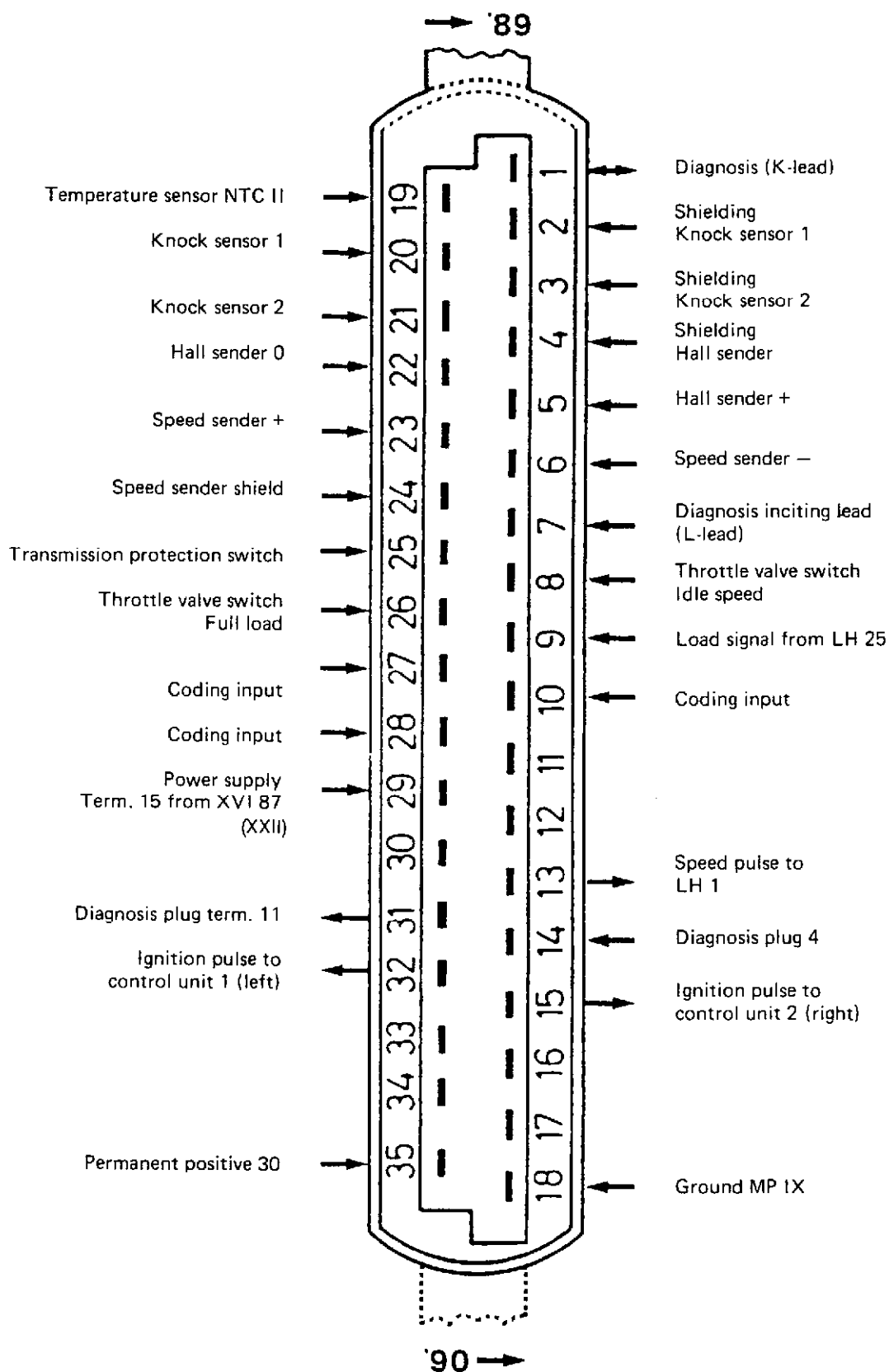
X						X	12	Power supply	V	35 → 18 29 → 18
							13	Engine speed reference mark sensor	≡	23 → 6
	X	X	X	X	X	X	14	Ignition circuit monitoring		
	X	X	X	X	X	X	15	Ignition system output stages	≡	
X							16	Leads K and L	Ω	

V = Voltmeter Ω = Ohmmeter ≡ = Oscilloscope

See inner page for plug terminal assignments on EZK control unit

Fault memory, EZK control unit, 928 S4/GT

Idle contact	Knock sensor 2
Full load contact	Control unit faulty
Engine temperature sensor 2	Hall signal
Idle or full load contact	Control unit faulty
Load sig. LH term. 25 to EZK term. 9	
Transmission safety switch	
Knock sensor 1	



Fault, Fault Code

Possible Causes, Elimination, Remarks

Test point 1

Idle speed contact Ω

Ground short

Break

Fault code 2_12

Check with circuit input test, using 9288 system tester or 9268 tester

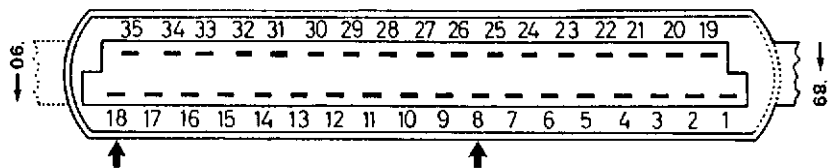
Select the test step and depress the accelerator pedal.
9288 display: Idle speed contact closed
Idle speed contact open

9268 display: 1332 (idle speed contact closed)
0000 (idle speed contact open).

If the display does not change,

disconnect the plugs from the EZK and LH control units.

Using test leads, connect ohmmeter between terminals 8 and 18.



Display:

Throttle valve closed

$< 10 \Omega$

Throttle valve opening angle

$> 1^\circ = \infty \Omega$

If the idle speed contact values are not reached during this test, it must be repeated directly at the throttle valve switch:

Pull off plug at throttle valve switch. Connect ohmmeter between terminals 2 and 3 of the throttle valve switch, using test leads.

Display:

Throttle valve closed $< 10 \Omega$

Throttle valve opening angle $> 1^\circ = \infty \Omega$



Check that setting is correct and adjust if necessary.

Possible cause: incorrectly adjusted throttle valve switch or accelerator cable.

Fault, Fault Code**Possible Causes, Elimination, Remarks****Test point 2****Full load contact (Ω)****Ground short**

Fault code 2_13

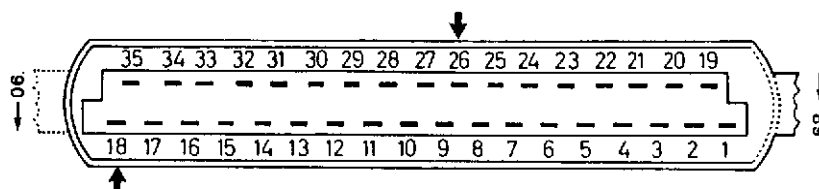
Check by means of circuit input test with 9288 system tester or 9268 tester

Select the test step and depress the accelerator pedal.

9288 display: Full load contact open
Full load contact closed.9268 display: 1333 (full load contact open)
0000 (full load contact closed).

No display:

Disconnect the plug from the EZK and LH control unit and connect the ohmmeter with terminals 18 and 26, using test leads.



Display:

Throttle valve closed $\infty \Omega$ Throttle valve open $< 10 \Omega$

If the full load contact values are not reached during this test, repeat the test directly at the throttle valve switch:

Disconnect the plug at the throttle valve switch. Connect the ohmmeter between terminals 1 and 2 of the throttle valve switch, using test leads.

Display:

Throttle valve closed $\infty \Omega$ Throttle valve open $< 10 \Omega$ 

Fault, Fault Code

Possible Causes, Elimination, Remarks

Test point 3**Temperature sensor II Ω**

Fault code 2_14

Disconnect the EZK control unit plug.

At the EZK control unit plug, connect terminals 19 and 18 with the ohmmeter.

Test values at:	0°C	=	4.4 - 6.8 k Ω
	15 - 30°C	=	1.4 - 3.6 k Ω
	40°C	=	1 - 1.3 k Ω
	80°C	=	250 - 390 Ω
	100°C	=	160 - 210 Ω

If these values are not reached, test at the sensor in the thermostat housing. However, do not connect both contact tabs with the ohmmeter but test each plug contact at the temperature sensor separately against ground (there are two independent temperature sensors).

Test point 4**Idle or full load contact**

Fault code 2_15

To identify a ground short.

Test as stated in test point 1 or 2 (EZK test plan)

Test point 5**Load signal**

Fault code 2_21

From LH control unit terminal 25 a lead runs to EZK control unit terminal 9 and transmits a signal representing actual load.

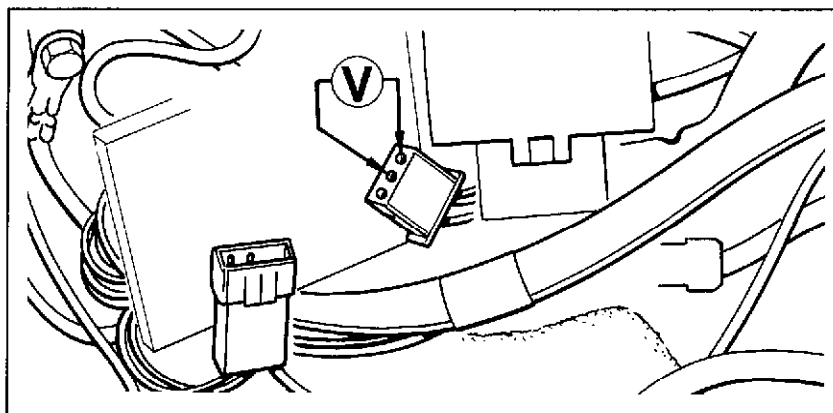
If a fault occurs here, check the wiring and the plug contacts. If the load signal is not present at the EZK control unit, the ignition is retarded in the part-load operating range by up to 25° CS (full load mapped zone, as protective circuit). Renew the control unit if necessary.

Test point 6**Transmission protection switch****(automatic transmission only)**

Fault code 2_26

To protect the transmission shift elements, the ignition is retarded during transmission shifts.

If a fault is indicated here, connect the voltmeter to the socket sleeve side of terminals 1 and 2 at the 3-pin plug in the trunk well.

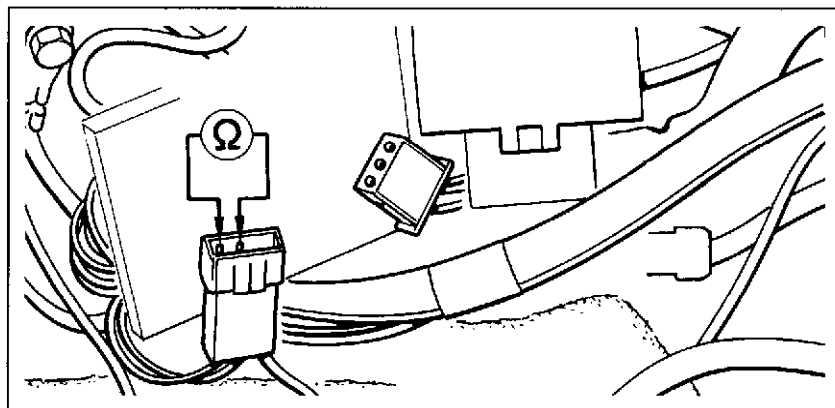


Fault, Fault Code**Possible Causes, Elimination, Remarks**

Switch on the ignition.

Display: approx. 5 V

Connect the ohmmeter to terminals 1 and 2 on the plug side

**Note**

The switch is checked with the engine running. Apply the handbrake and operate the foot brake. Comply with relevant safety regulations.

Display in position P or N:

∞ Ohm (switch open)

Display in position D:

< 1 Ohm (switch closed).

If these values are not reached, measure directly at the switch or renew.

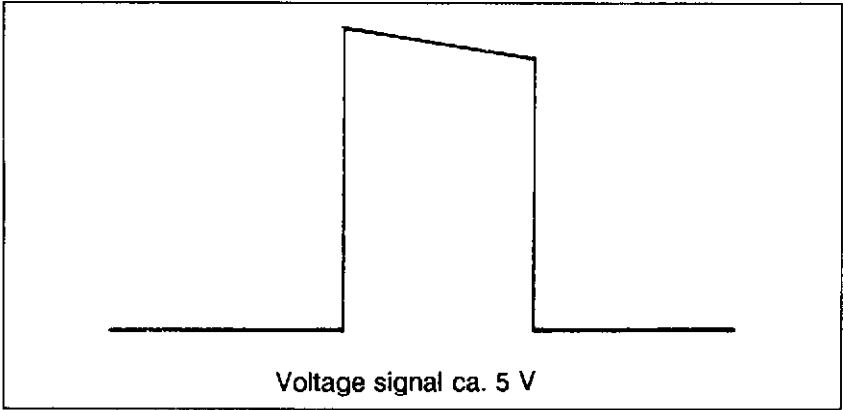
Test point 7**Knock sensor I**

Fault code 2_31

Knock sensor I: sensor signal is not plausible. Check:

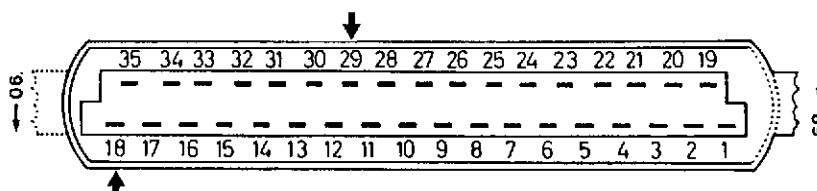
- Knock sensor mounting (note tightening torque and type of screw)
- Wiring and plug connections according to wiring diagram
Reconnect the sensors to eliminate contact resistance.
- Is any coolant or other fluid present at the knock sensors?
- Renew knock sensor

If the knock sensor is faulty, the ignition will be retarded (safety circuit).

Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 8 Knock sensor II Fault code 2_32	Knock sensor II: sensor signal not plausible. Check: - Knock sensor mounting (note tightening torque and type of screw) - Wiring and plug connections according to wiring diagram Reconnect the sensors to eliminate contact resistance. - Is any coolant or other fluid present at the knock sensors? - Renew knock sensor If the knock sensor is faulty, the ignition will be retarded (safety circuit).
Test point 9 Control unit (knock sensor) Fault code 2_33	This fault causes the ignition to be retarded by 6°. Renew the control unit.
Test point 10 Hall signal Fault code 2_34	To check the Hall signal, disconnect the plug connections at cylinder head 1-4 behind the camshaft drive gear, and insert a 3-pole adapter lead (VW 1501) into the signal lead. Connect oscilloscope + and - test leads to terminals 1 and 2 of the adapter lead. Start the engine. If the Hall transmitter is in good working order, the following signal must appear on the screen: 

If the EZK control unit identifies the absence of the Hall signal, the ignition is retarded.

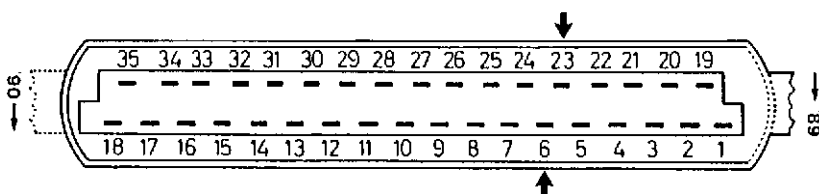
Fault, Fault Code	Possible Causes, Elimination, Remarks
Test point 11 Control unit faulty Fault code 2_33	If this fault occurs, renew control unit
Test point 12 Permanent power supply EZK control unit (V)	a) Permanent positive (B +) If B + is not present the fault memory is erased Test procedure: At the control unit plug, connect the voltmeter with terminals 18 (-) and 35 (+) by means of the test leads. Display : battery voltage No display: check according to wiring diagram b) Power supply through EZK relay At the control unit plug, connect the voltmeter by means of the test leads to terminals 18 (-) and 29 (+). Switch on the ignition. Display: battery voltage No display: check according to wiring diagram



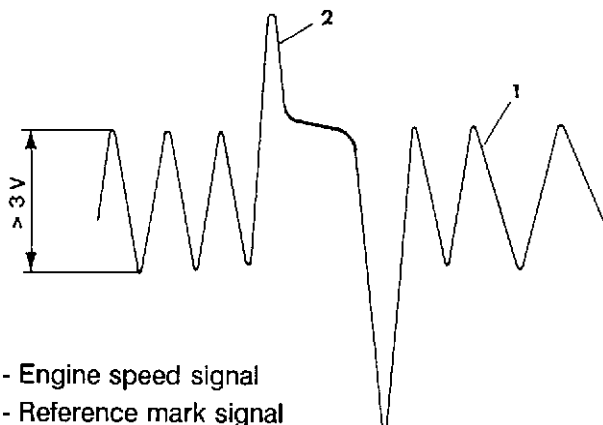
Test point 13: Engine speed / reference mark sensor

This test can only be performed with an oscilloscope. Connect up and adjust the workshop oscilloscope in accordance with the manufacturer's instructions.

Using test leads, connect the positive tester lead to control unit plug terminal 23, and the negative tester lead to control unit plug terminal 6.



Crank the engine with the starter motor. The screen must display sine waves of at least 3 V (engine speed impulses), and these must include a higher amplitude peak (reference mark).

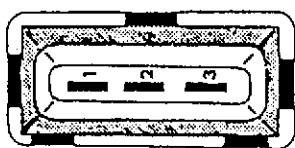


- 1 - Engine speed signal
- 2 - Reference mark signal

If the voltage signal is too low ($< 3\text{ V}$), dirt may have affected the distance between the sensor and the gear ring.

No display:

Disconnect the engine speed sensor plug connection at the plug strip in the engine compartment. Using test leads, connect the lead from the tester to the center and outer plug contact (terminals 1 and 2, pin side). Start the engine. The sine wave pattern must be displayed on the screen.



Engine speed sensor plug

Note

If connection 3 is grounded, the image must not change.

If it changes, check sensor for continuity, correct gap and freedom from dirt.

Test point 14: ignition circuit monitoring (refer to test point 10, LH test plan)

If the exhaust gas temperature changes, for instance on account of misfiring, the faulty injection circuit is shut down. The engine then runs on 4 cylinders.

An ignition circuit monitoring relay at the LH/EZK control unit controls this protective device. 2 light-emitting diodes on the relay housing show which injection circuit has been shut down. For repairs, refer to 928 Repair Procedures, volume I-A, page 28-77.

Test point 15: Ignition system - output stages

Checking ignition timing

At idle speed	675 ± 25 1/min	10° bTDC $\pm 2^\circ$
928 GT	775 ± 25 1/min	10° bTDC $\pm 2^\circ$

To display a secondary image at the oscilloscope, the engine tester must be switched to 4 cylinders, since the car's ignition system is divided into 2 separate ignition circuits.

Firing order: 1-3-7-2-6-5-4-8

Ignition circuit I:

High-tension distributor on exhaust camshaft for cylinders 1-4:

1-7-6-4

Ignition circuit II:

High-tension distributor on exhaust camshaft for cylinders 5-8:

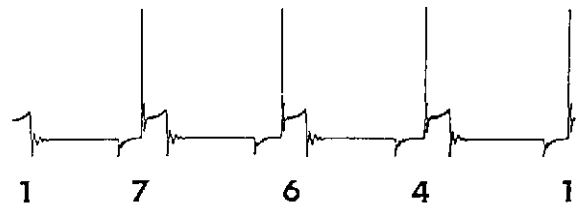
5-8-3-2

The high-tension power supply for **ignition circuit I** comes from the coil installed at the front right, the high-tension power supply for **ignition circuit II** comes from the coil installed at the front left.

a) Connecting the engine tester

Connect and adjust the engine tester in accordance with the manufacturer's instructions (note that the 4-cylinder measuring range must be selected).

To display the ignition pattern for ignition circuit I (right side), connect the tester to the ignition lead for cylinder 1 and the front right coil.



Cylinders:

To display the ignition pattern for ignition circuit II (left side), connect the tester to the ignition lead for cylinder 5 and the front left coil.



Cylinders:

Note:

If a fault is indicated for all cylinders, it must be in the primary or secondary current circuit from the coil to the distributor rotor.

If the fault is indicated for one cylinder only, it must be located after the distributor rotor.

b) Resistances at coil, high-tension distributor and spark plug caps

Coil (Ω/V):

Primary resistance	
Terminals 1 + 15	0.4 - 0.7 Ω
Secondary resistance	
Terminals 1 + 4	5 - 8.7 k Ω
Voltage at terminal 15 with engine running	> 10 V

High-tension distributor (Ω):

Distributor rotor	
Suppression resistor	1 k Ω
Inspect for damage, tracking or oxidation.	

Spark plug caps (Ω)

Suppression resistor 3 k Ω
Inspect for damage, tracking or oxidation.

c) Activating the high-tension side

To speed up troubleshooting in the ignition system, the ignition trigger signal can be simulated. To do this, disconnect the 2-pin connector (arrow) above the ZEL (green/white lead).

Connect plug pins with test leads.

Connect oscilloscope tester lead terminal 4 to ignition lead terminal 4.

Switch on the ignition. If 12 V is applied at intervals to one of the two plug pins with the test lead, a high-tension peak should be visible each time on the oscilloscope screen (ignition trigger).

- If no signal is visible, check:
- Power supply to output stage and coil.
- Ground point for output stages (under right-hand coil).
- Plug connections at output stages, coils and high-tension distributor.
- The high-tension components (e.g. coil, ignition leads, spark plug caps ...)
- Wiring continuity from control unit plug to output stage (green lead: ignition lead I, white lead: ignition lead II).

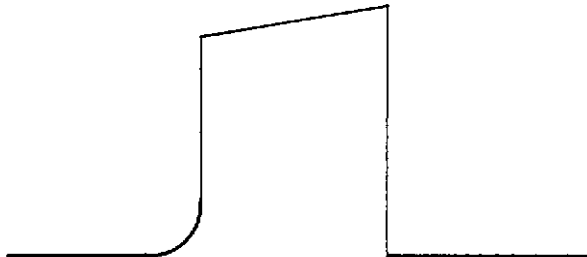
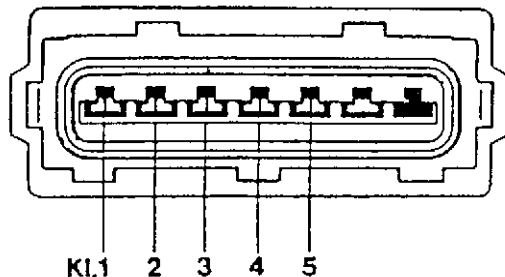
d) Check output stage control signal

Check at **both** (disconnected) output stage plugs.

Connect the positive tester lead to terminal 5 and the negative tester lead to terminal 2 of the disconnected output stage plug.

Crank the engine with the starter motor.

The oscilloscope must display a control signal for each output stage plug.



Test point 16: leads K and L

The diagnostic connection between the EZK control unit and the diagnosis tester is by way of the two leads K and L. If diagnosis is not possible, perform the following checks:

1. Continuity test (refer to wiring diagram)

Lead L: Pin 7 (19-pole diagnosis socket)
- Pin 7 (EZK plug)

Lead K: Pin 8 (19-pole diagnosis socket)
- Pin 1 (EZK plug)

2. Ground short test (refer to wiring diagram)

Lead L: The voltage at Pin 7 (19-pole diagnosis socket) must be $> 8\text{ V}$ with the ignition switched on.

Lead K: The voltage at Pin 8 (19-pole diagnosis socket) must be $> 8\text{ V}$ with the Ignition switched on.

Possible causes of faults:

- Short to ground or break in wiring or plug connections.
- A faulty control unit connected to these lines (it may be any control unit with diagnosis capability, not necessarily the EZK control unit).
- Checking: disconnect plugs successively at the control units with diagnosis capability until the voltage becomes $> 8\text{ V}$. Renew the control unit which is causing the fault.
- Faulty tester.
- No power supply at diagnostic plug.
No ground at diagnostic plug.