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FUEL INJECTION PUMP CHANGES - BEGINNING WITH 1972 MODELS

The 2,4 liter engines are equipped with changed injection pumps. The changes consist of a wider contoured cam and modified centrifugal weights and springs.

Pump designation (BOSCH number on data plate):

911 T = 0408 126015

911 E = 0408 126014

911 S = 0408 126013

CHANGES IN THROTTLE VALVE HOUSINGS AND INTAKE MANIFOLDS

Beginning with the 1972 models, throttle valve stops in the throttle valve housing are relocated to the lever side. The new levers require the use of modified protractors, special tool P 228 c.

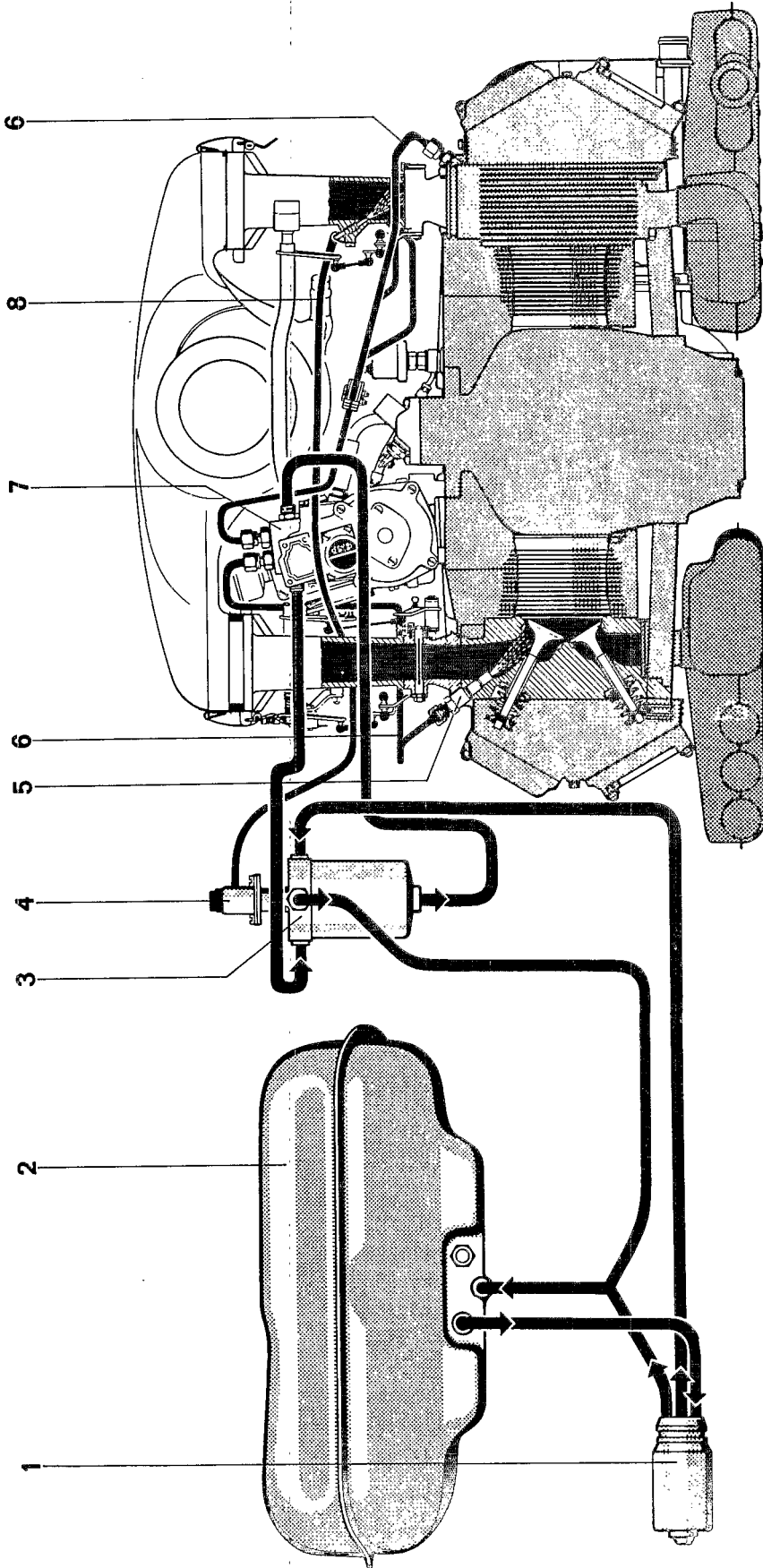
The protractor on the injection pump control lever has not been changed. The correlation checkout procedure remains same (see page SF 22).

The intake velocity stacks are made of plastic. They form a single unit together with the lower air assembly.

COLD START ENRICHMENT SYSTEM CHANGES

Fuel for cold start enrichment now is fed directly into each individual velocity stack. The discharge nozzles are bonded and can not be exchanged.

SCHEMATIC VIEW OF THE PORSCHE FUEL INJECTION SYSTEM



- 1 Fuel pump
2 Fuel tank
3 Fuel filter

- 4 Cold start enrichment solenoid
5 Injection valve(nozzle)
6 Injection line

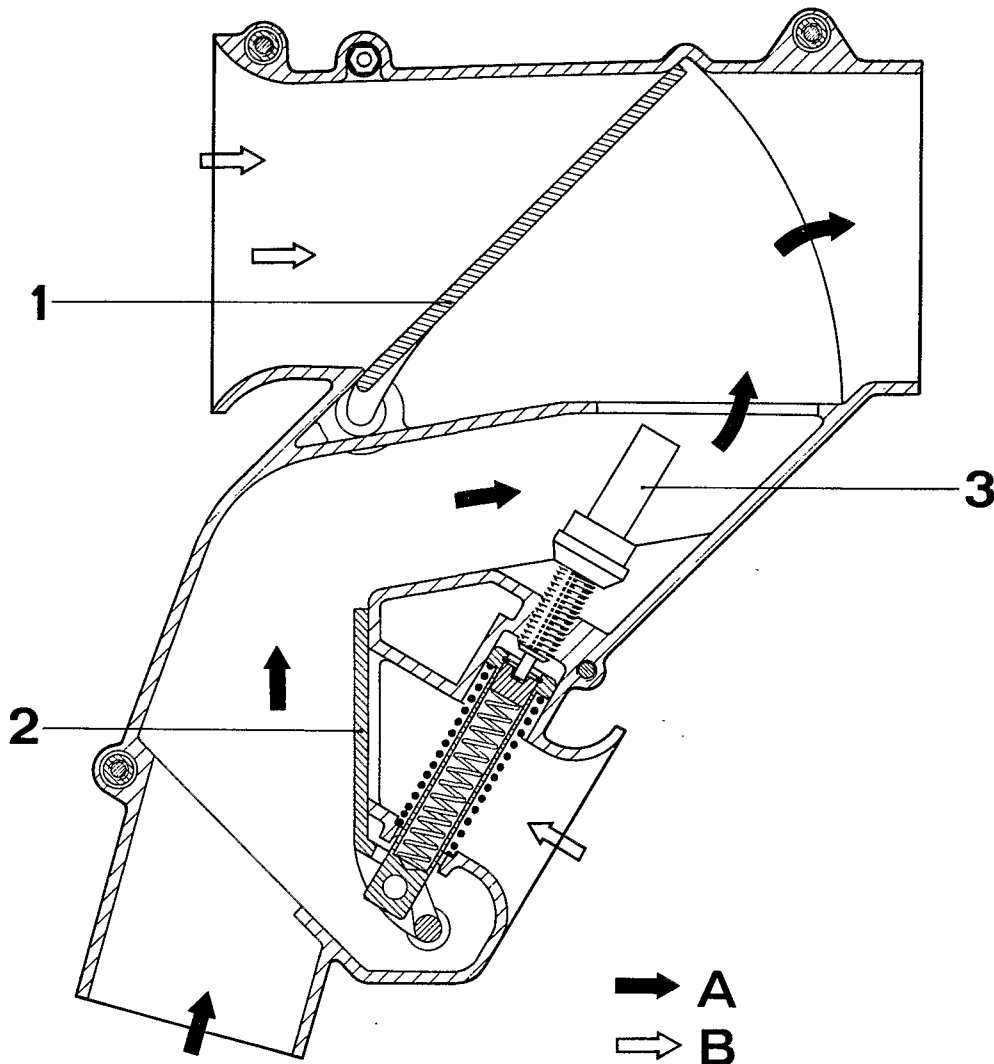
- 7 Injection pump
8 Cold start enrichment hose

INDUCTION AIR PREHEATING - BEGINNING WITH 1972 MODELS

General Information

Beginning with the 1972 models, all 2.4 liter fuel injection engines are equipped with an induction air preheating system.

Induction air preheating provides even induction air temperatures in lower engine speed ranges resulting in improved performance, as well as lower exhaust emission values.



1 = Fresh air flap

2 = Hot air flap

3 = Thermostat

A = Hot air

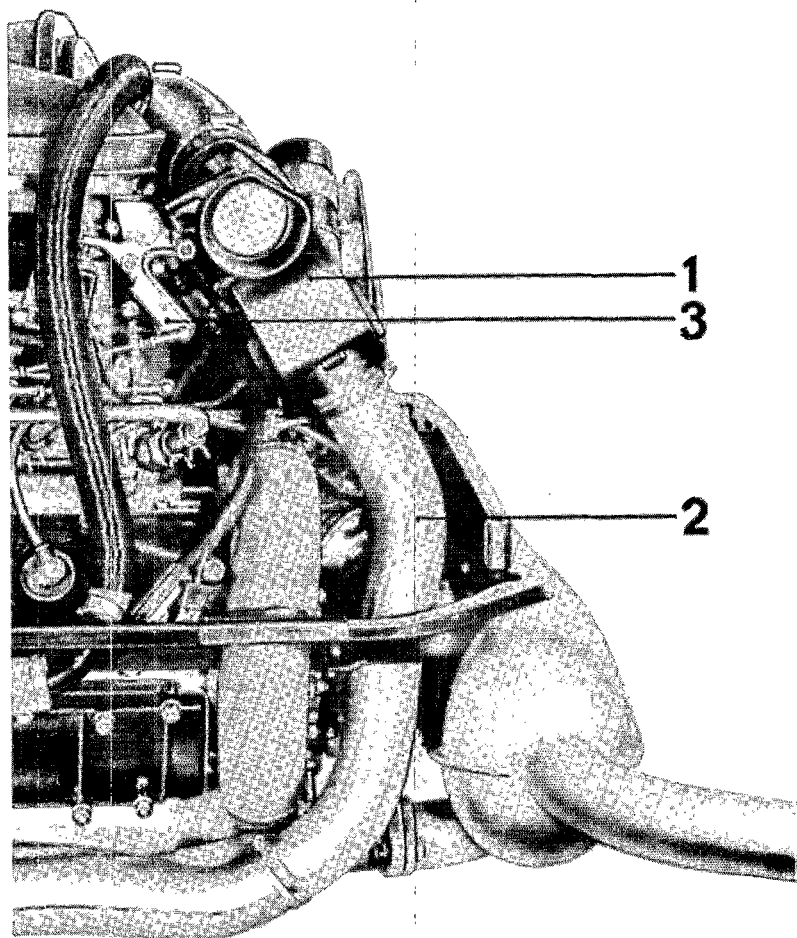
B = Fresh air

Design The induction air preheating system consists of:

1. A regulator housing which is attached to the left velocity stack by three 6 mm bolts. It contains two flaps and a thermostat.

One of the flaps (the fresh air flap) is controlled by the throttle linkage. The other flap (hot air flap) is controlled by the thermostat.

2. A hose which feeds heated air from the left heat exchange.
3. A cam on the left throttle valve lever which controls the fresh air flap.



- 1 Control box
- 2 Hot air supply duct
- 3 Control lever

Function A thermostat-controlled hot air flap maintains induction air temperature at 45°C (112°F). A second flap stops the flow of hot air from throttle valve position of about 20° and engine draws only fresh outside air at wide open throttle.

Engine started, cold (below 45°C (112°F))

Throttle at idle position (fresh air flap closed)

Hot air flap open, engine draws hot air from heat exchanger.

Engine cold (below 45°C (112°F)) - throttle in partial load position

Hot air flap open. It opens according to position of cam. Fresh outside air is added.

Fresh air flap is fully open in full throttle position.

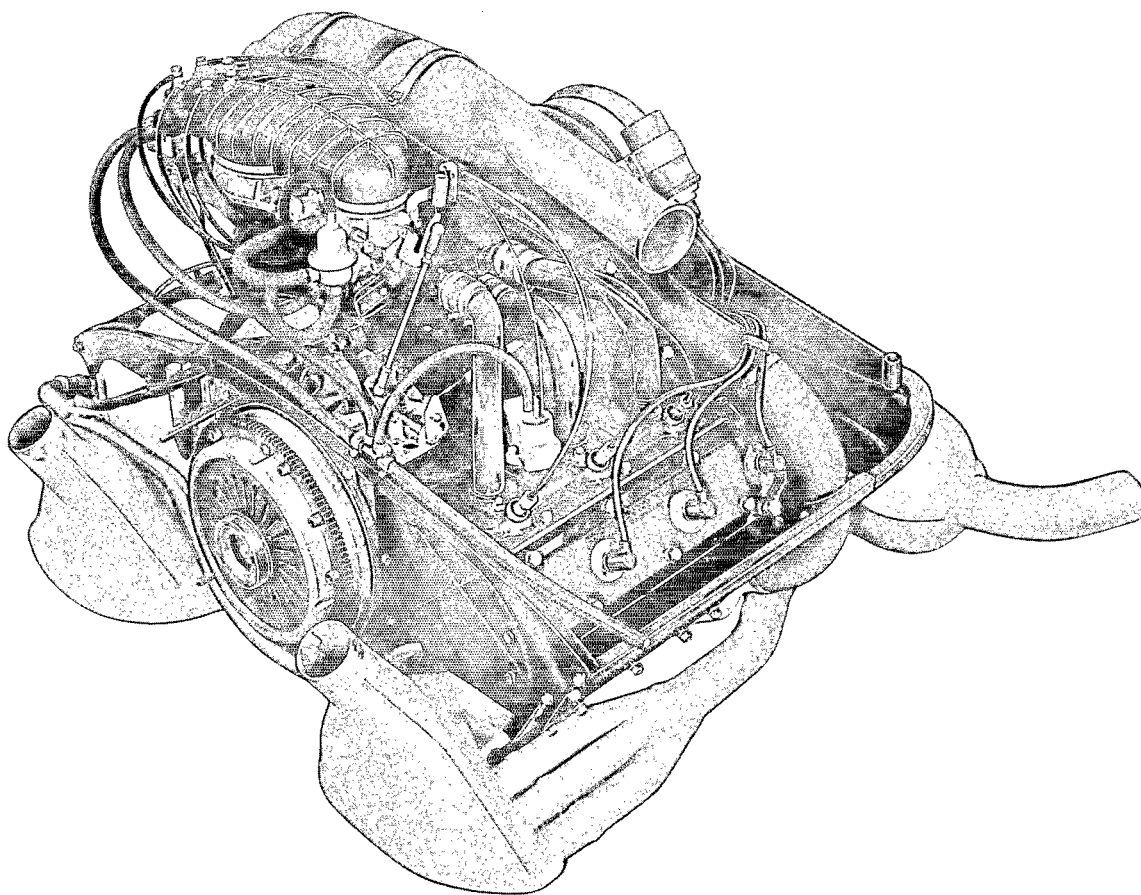
Air temperature rises to 45-50°C (112°F - 122°F)

Thermostat begins to close hot air flap at 45°C (112°F). It is fully closed at 50°C (122°F) and engine draws only fresh outside air.

A bypass duct, closed by the hot air flap when cold, feeds additional air with increasing temperatures.

CONTINUOUS INJECTION SYSTEM (CIS)

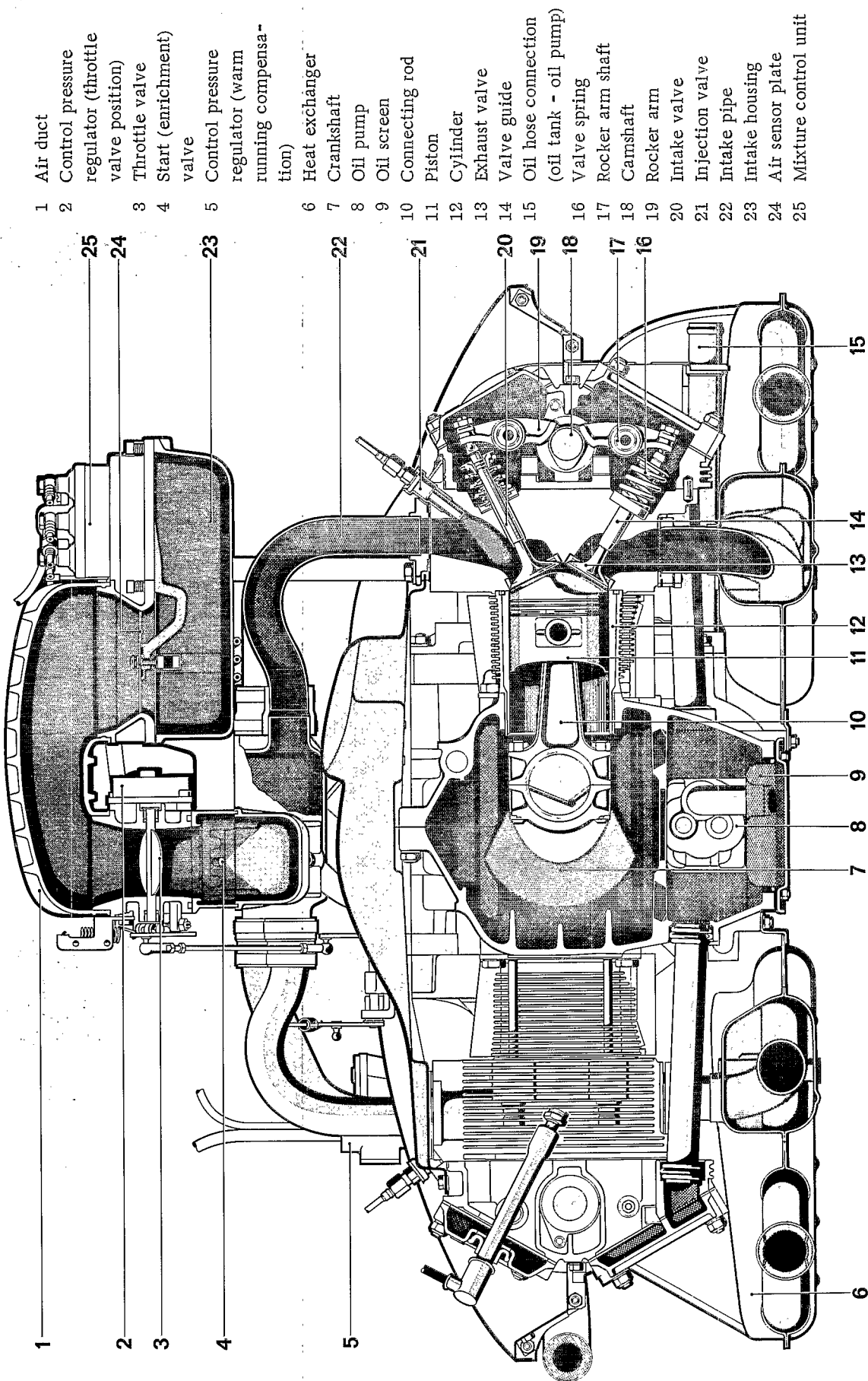
Beginning with the January 1973 production, Type 911 T vehicles are equipped with the continuous injection system (CIS).



The working principle of this system depends on measuring the intake air flow rate to determine the amount of fuel to be injected.

The fuel distributor determines the quantity of fuel to be delivered depending on air flow rate and engine loading conditions.

ENGINE CROSS SECTION



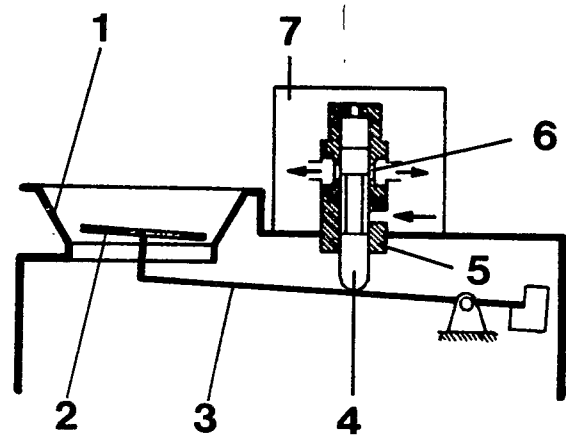
Mixture Control Unit

Air Flow Sensor and Fuel Distributor.

The air flow sensor consists of a venturi and a sensor plate which is attached to a lever.

The volume of intake air passing through the venturi determines the position of the sensor plate.

The control plunger and the slotted metering cylinder are located in the center of the fuel distributor. Machined into the metering cylinder are 6 rectangular slots which act as metering ports. They can be progressively opened by the control plunger.



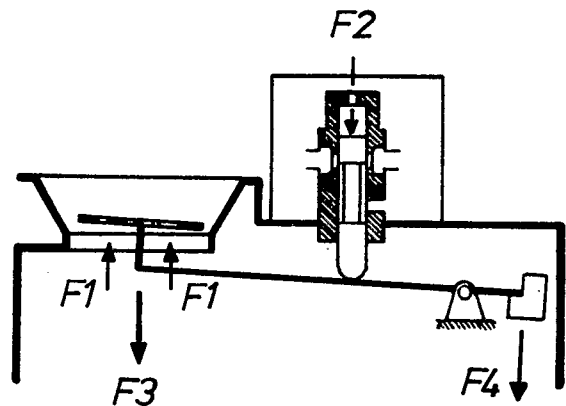
- 1 Venturi
- 2 Sensor plate
- 3 Lever
- 4 Control plunger
- 5 Slotted metering cylinder
- 6 Metering port
- 7 Fuel distributor

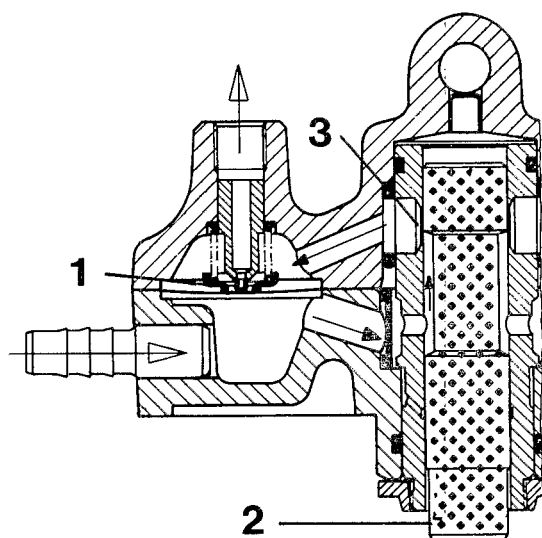
The metering ports open depending on the position of the sensor plate whose movement is transmitted to the control plunger through a lever.

Intake air which passes through the air flow sensor exerts a pneumatic force F_1 on the sensor plate.

The pneumatic force is countered in the fuel distributor by hydraulic force F_2 which is exerted against the control plunger through a port.

The sensor plate will yield until the pneumatic force and hydraulic force equalize.





- 1 Pressure regulating valve
- 2 Control plunger
- 3 Metering port

The hydraulic pressure F2 will remain constant in a warm engine although it can be lowered through the reduction of control pressure, such as during warm-up or due to the given position of the throttle valve.

Weight of the sensor plate and lever F3 is equalized by the counter weight F4.

Each metering port in the fuel distributor is provided with a pressure regulating valve which keeps the pressure drop at the metering port constant (pressure difference = pressure ahead of the metering port less pressure after the metering port) independent of the fuel transfer rate, primary system fuel pressure, and injection valve opening pressure.

The pressure regulating valves are flat seat valves with a steel diaphragm acting as a valve plate.

By maintaining the pressure difference constant, it is possible to control the fuel flow rate by means of the size of the metering port cross-section alone.

The injection valves have no metering function.

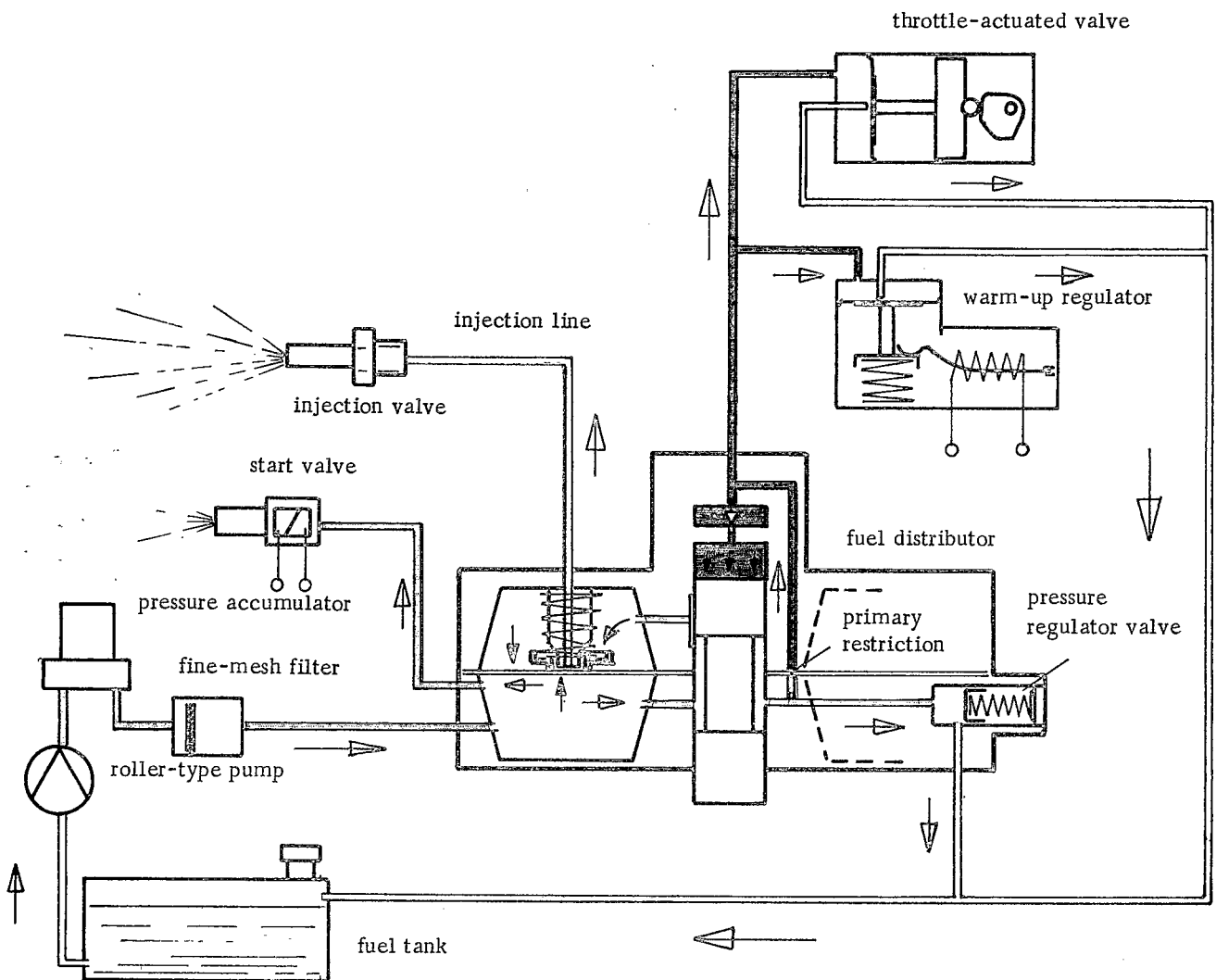
Fuel Flow





The fuel flows from the electric fuel pump through an accumulator and filter to the mixture control unit.

A pressure regulator in the primary system maintains constant pressure in the system.

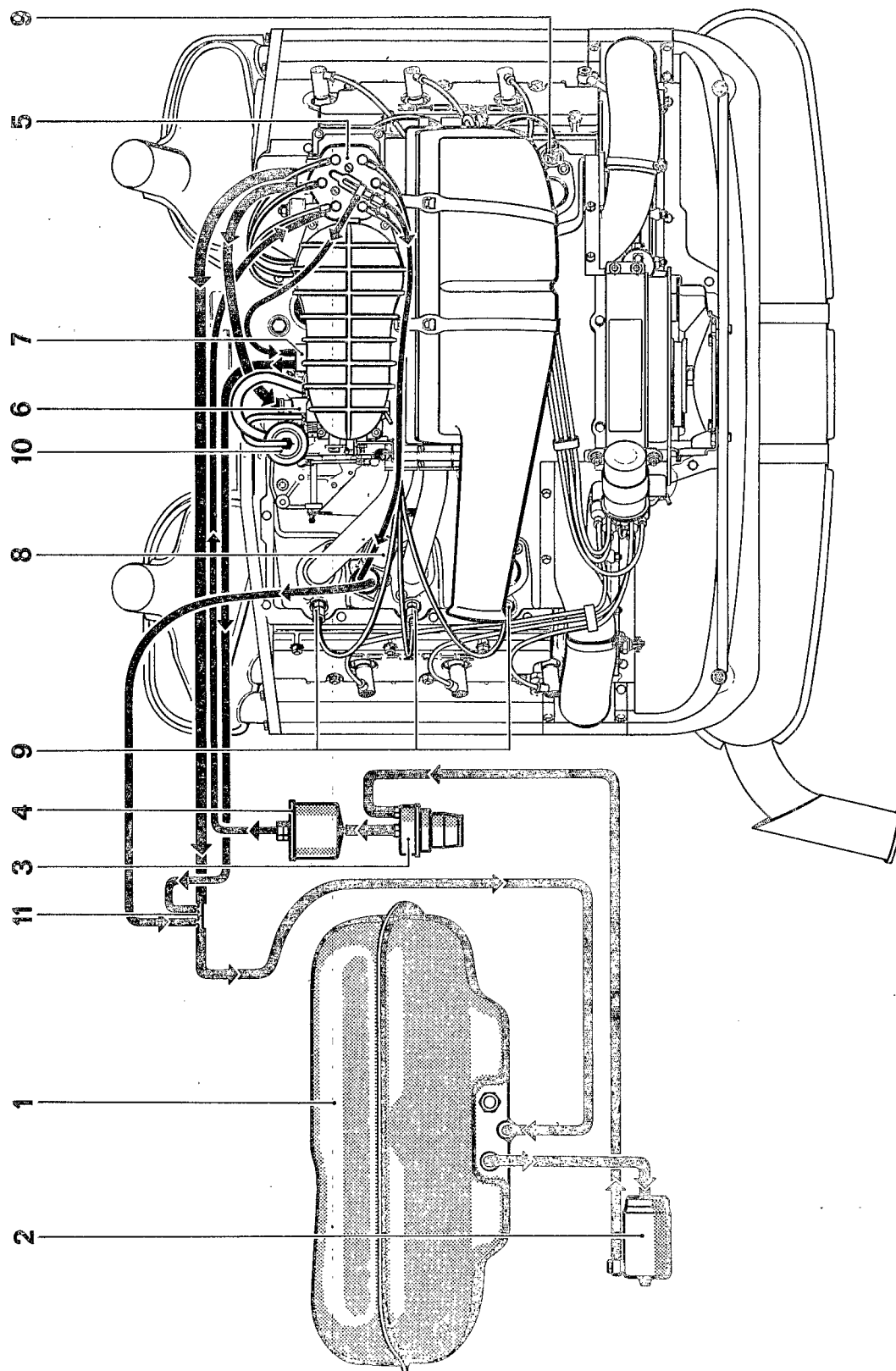
From the mixture control unit, injection lines carry the fuel to the injection valves. In addition, a separate line carries fuel to the start (enrichment) valve.

Control pressure can be varied by two (control) pressure regulators, one according to engine and outside temperatures, the other according to accelerator pedal movement.



-  Primary system fuel pressure
-  Supplied fuel
-  Control pressure
-  Return flow

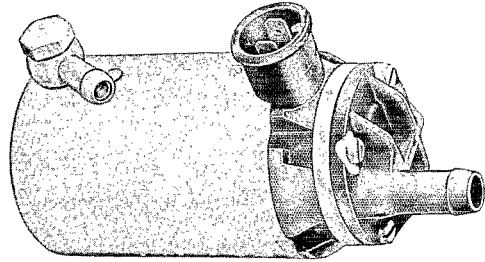
FUEL FLOW SCHEMATIC



- | | | |
|-----------------------------|--|--|
| 1 Fuel tank | 5 Fuel distributor | 8 Control pressure regulator (warm running compensation) |
| 2 Fuel pump | 6 Start (enrichment) valve | 9 Injection valves |
| 3 Fuel pressure accumulator | 7 Control pressure regulator (throttle valve position) | 10 Auxiliary air device |
| 4 Fuel filter | | 11 Fuel return connection |

Electric Fuel Pump

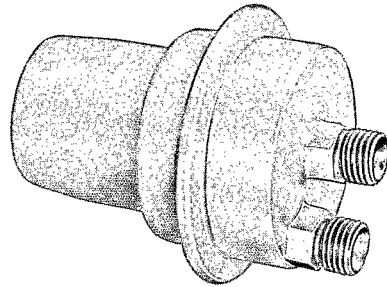
A roller-type fuel pump is utilized.



Fuel Pressure Accumulator

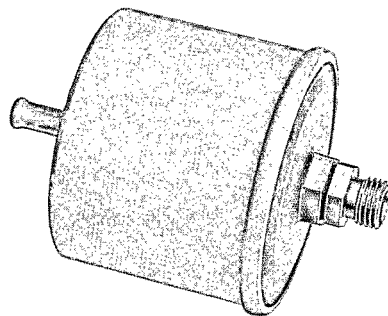
The fuel pressure accumulator is located in the primary circuit directly after the fuel pump. Its function is to delay the initial pressure surge when the pump starts. This delay is necessary to prevent the control plunger from being forced up before sufficient control pressure has been allowed to build up.

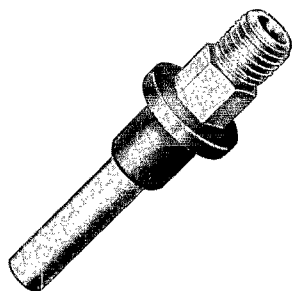
It also serves as a reservoir to keep the system under sufficient pressure for a short period of time when the engine is turned off.



Fuel Filter

An in-line filter with a paper cartridge is utilized.

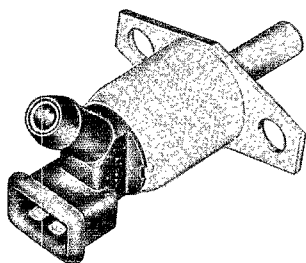




Injection Valves

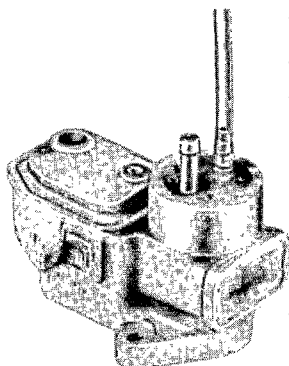
Since the injection process is longer in a continuous injection system, the injection valves had to be designed for a smaller fuel transfer rate.

The injection valve permits fine atomization of fuel when small amounts are transferred. Opening pressure for the injection valves is approx. 3 bar.



Start (Enrichment) Valve

The solenoid-operated start (enrichment) valve discharges supplemental fuel into the intake manifold when the engine is being started.



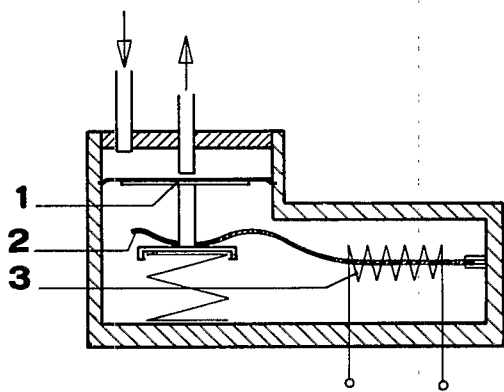
Control Pressure Regulator (Warm Running Compensation)

The control pressure regulator for warm running compensation contains a bimetallic spring acting on a spring-loaded diaphragm.

During engine warm-up, the bimetal spring presses against the valve spring causing the control pressure to drop. This results in a lower hydraulic pressure F2, greater travel of the air flow sensor plate with unchanged amount of intake air, and increased metering port cross-section, making a richer fuel/air mixture.

As the bimetal spring is heated, it gradually relaxes its pressure against the valve spring. Thus the control pressure normalizes again.

Idle speed can be increased during warm-up by opening the throttle manually (hand throttle).



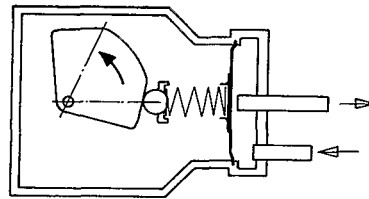
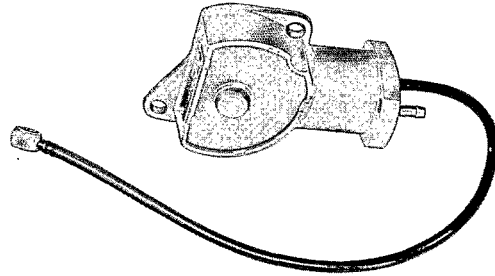
- 1 Pressure regulating valve
- 2 Bimetal spring
- 3 Heater coil

Control Pressure Regulator (Throttle Valve Position)

The control pressure regulator for throttle valve position is basically similar to the regulator for warm running compensation. It is attached to the throttle valve housing.

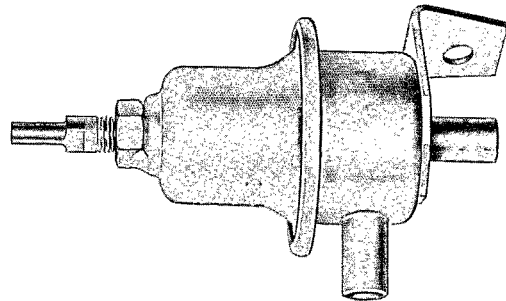
A cam plate is attached to the throttle valve shaft and rides along with it, compressing the regulator spring to a greater or lesser degree.

This changes the control pressure along with changed throttle valve position, adjusting the fuel/air mixture as required.



Auxiliary Air Device

When decelerating from high rpm with throttle closed, considerable vacuum builds up in the intake manifold. The vacuum is channeled to an auxiliary air device. As the device opens, additional air bypasses the throttle creating a combustible mixture.

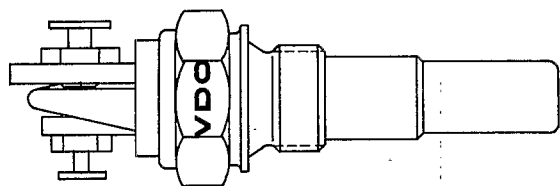


Idle Adjustment

The adjusting method is same as that for carburetors. The idle air mass passes through the air flow sensor where it is measured. The closed throttle is bypassed through a bypass bore.

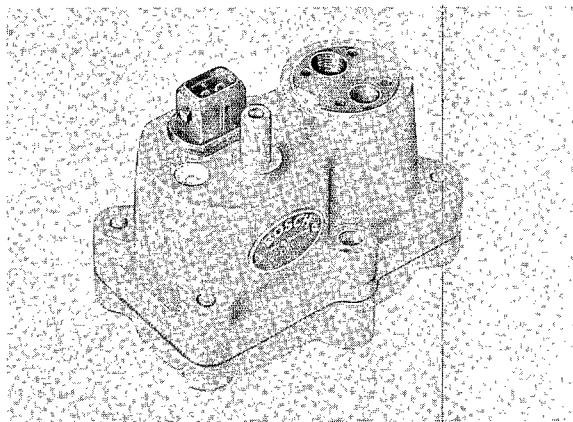
The cross-section of this bore can be changed with the aid of an adjustment screw. A change in cross-section changes the engine speed without affecting the composition of the fuel/air mixture.

The fuel/air mixture can be adjusted within certain limits by means of a mixture adjusting screw to attain the required effect.



Thermoswitch

Beginning with 1974 models, engines equipped with the continuous injection system (K-Jetronic) are furnished with a thermostatic switch which is connected to the cold start enrichment valve. The thermostatic switch is located in the left chain housing cover. A microswitch is connected in series with it. The microswitch is activated by the hand throttle lever when the latter is moved to at least 5° of the throttle valve position. The thermostatic switch is active up to engine temperature of approx. + 45° C (113° F) and prevents the injection of supplemental fuel by the cold start enrichment valve when starting a hot engine.

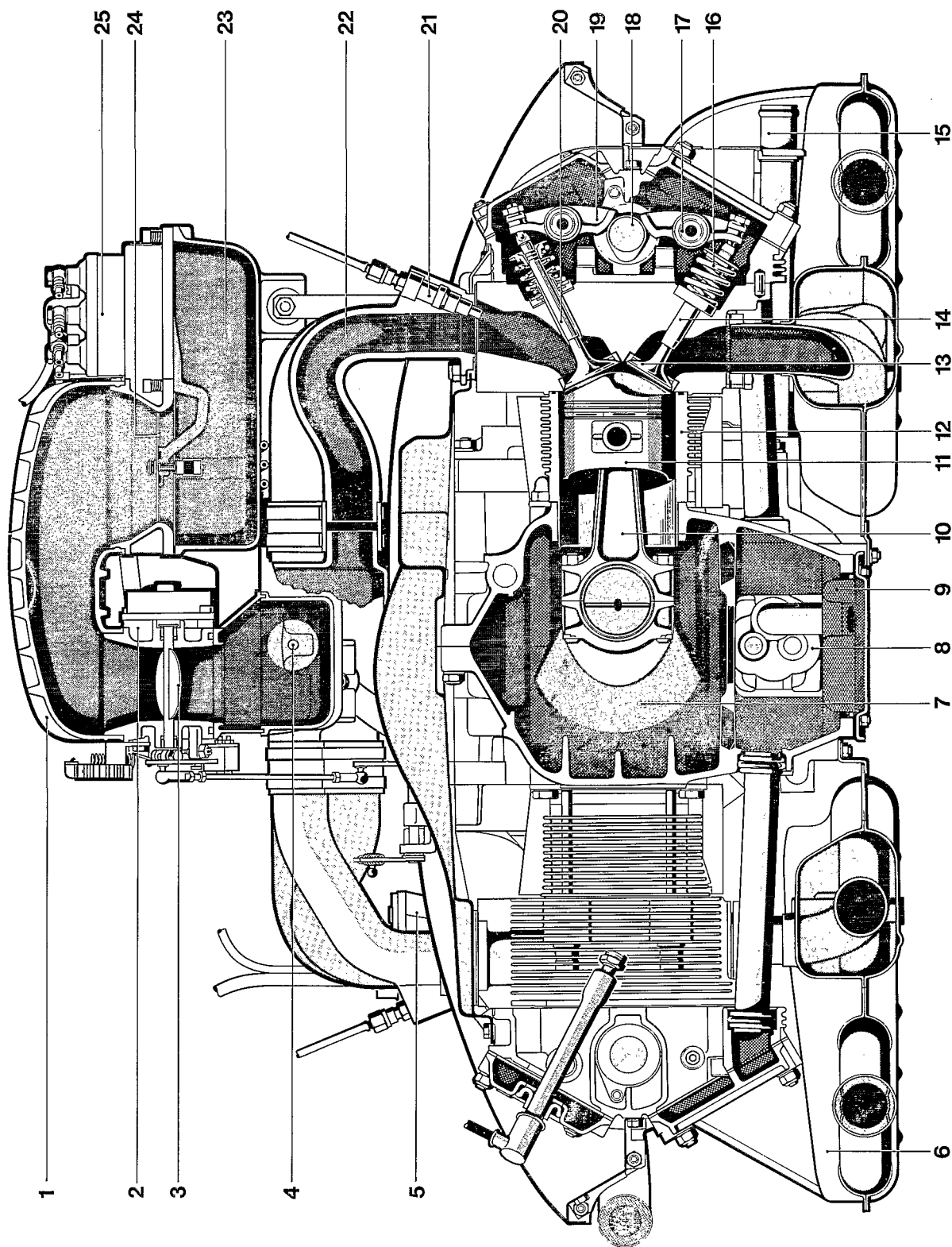


Vacuum controlled warm-up regulator

Control pressure changes of this warm-up regulator are made via intake manifold vacuum.

BEGINNING WITH 1974 MODELS

- 1 Air duct
- 2 Control pressure regulator (throttle valve position)
- 3 Throttle valve
- 4 Cold start enrichment valve
- 5 Control pressure regulator (warm running compensation)
- 6 Heat exchanger
- 7 Crankshaft
- 8 Oil pump
- 9 Oil screen
- 10 Connecting rod
- 11 Piston
- 12 Cylinder
- 13 Exhaust valve
- 14 Valve guide
- 15 Oil hose connection (oil tank - oil pump)
- 16 Valve spring
- 17 Rocker arm shaft
- 18 Camshaft
- 19 Rocker arm
- 20 Intake valve
- 21 Injection valve
- 22 Intake pipe
- 23 Intake housing
- 24 Air sensor plate
- 25 Mixture control unit



CONTINUOUS INJECTION SYSTEM (CIS)

Beginning with 1974 models, Type 911 and 911 S vehicles are equipped with the continuous injection system.

Changes Effective with 1974 Models

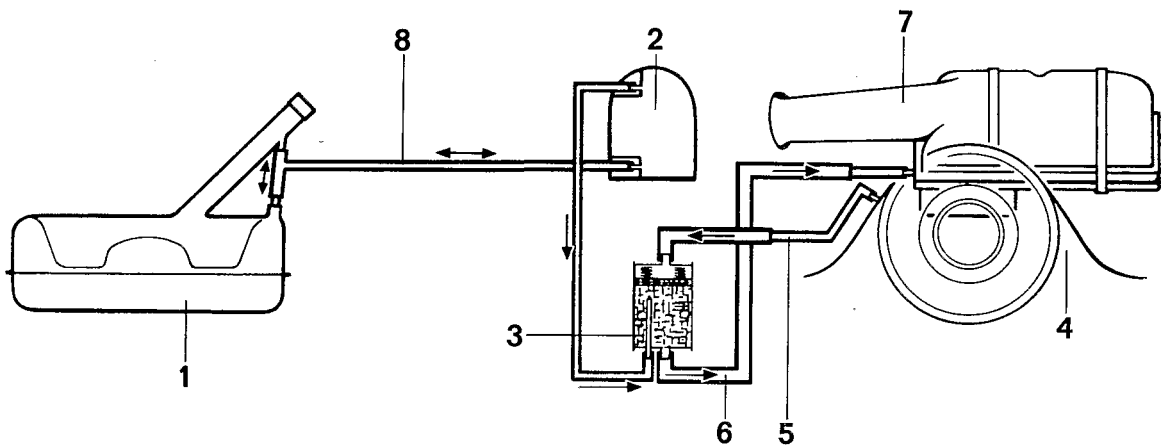
1. Cast intake pipes with mounting hole for injection valves.
2. Repositioning of the injection valves resulted in their being lengthened and injection lines shortened.
3. The diameter of intake pipes at the intake housing has been changed:

Intake pipe for Type 911	=	31 mm dia.
911 S	=	34.5 mm dia.
4. Mixture control unit has been calibrated for 2.7 liter engines.
5. The pneumatic valve has been repositioned and also modified to the vacuum characteristics prevailing in the 2.7 liter CIS engines.
6. The cold start enrichment valve has been moved to the center of the intake housing to effect a better distribution of the fuel to the individual cylinders.
7. A thermoswitch has been mounted on the left chain housing cover to supplement the cold start enrichment valve.

FUEL EVAPORATIVE CONTROL SYSTEM

General

All vehicles are equipped with a sealed fuel tank venting system incorporating an activated charcoal filter. The closed system prevents fuel fumes from entering the atmosphere. The fumes are ducted into the activated charcoal filter with the aid of fresh air supplied by the engine cooling fan, and then to the engine air filter where they mix with the induction air and are burned with it.



- | | |
|--|---|
| 1 Fuel tank | 5 Hose from cooling fan to activated charcoal filter |
| 2 Expansion chamber | 6 Hose from activated charcoal filter to engine air filter |
| 3 Activated charcoal filter | 7 Engine air filter |
| 4 Cooling fan upper shroud with hose connector | 8 Return hose connecting fuel tank with the expansion chamber |

CONTINUOUS INJECTION SYSTEM (CIS)

GENERAL CHECKOUT PROCEDURE

Prerequisite for the CIS checkout is a properly functioning ignition system and proper mechanical condition of the engine.

A complete CIS checkout should be carried out in the below given sequence.

However, specific problems can be analyzed by performing individual tests.

In addition, the following should be noted: Certain tests require that the engine is cold (check control pressure "cold"). For this test, the engine should be out of operation for several hours, or overnight. The checkout should be performed at the same location where the car was parked for several hours. Erroneous test results will be obtained if, for instance, the vehicle should be brought into a heated garage from a cold outside environment.

The remaining tests, with the exception of the idle adjustment, can be performed with the engine warm or cold.

The engine must be at warm operating temperature when idling is adjusted.

All tests, idle adjustment excepted, are accomplished with the engine turned off.

NOTE

Always install new gaskets whenever fuel lines are loosened or detached.

It is important to maintain the highest degree of cleanliness when servicing the CIS.

The outside of the fuel lines must be thoroughly cleaned before they are loosened.

VISUAL INSPECTION

The CIS should be visually inspected prior to the initiation of work.

Visual inspection for leaks:

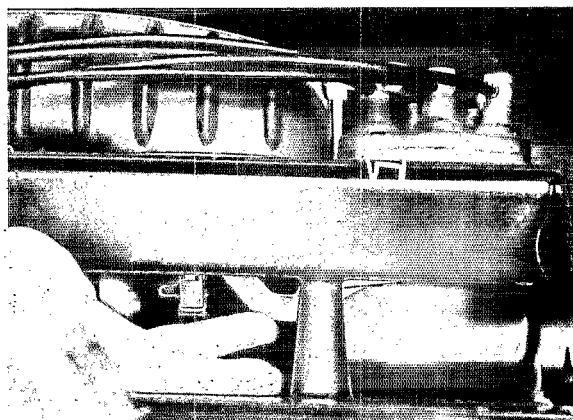
1. Check all fuel line connections for leaks.
2. Check induction system (vacuum system) for leaks between the mixture control unit and engine (air duct between mixture control unit and throttle housing).
3. Check for leaks between intake manifold and start (enrichment) valve (O-ring).
4. Check for leaks between intake manifold and pipes.
Replace porous rubber boots.
5. Check hose connections for leaks at the intake manifold, vacuum hoses at the throttle housing, as well as the auxiliary air device.
6. Check proper seating of rubber covers at the injection valves.
7. Check attachment of intake pipes at cylinder heads.

Checking free movement of lever
in air flow sensor

1. Unhook rubber straps, remove air filter horn and withdraw cartridge.
2. Raise lever of air flow sensor by hand.

An even amount of resistance should be felt throughout the length of movement.

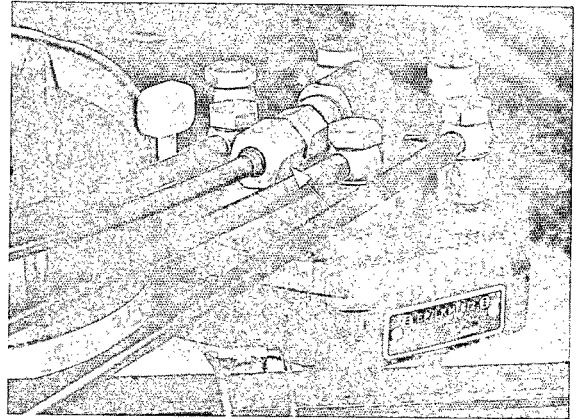
A quick downward movement of the lever will detach it from the sluggish control plunger at which time no resistance should be felt at the lever.



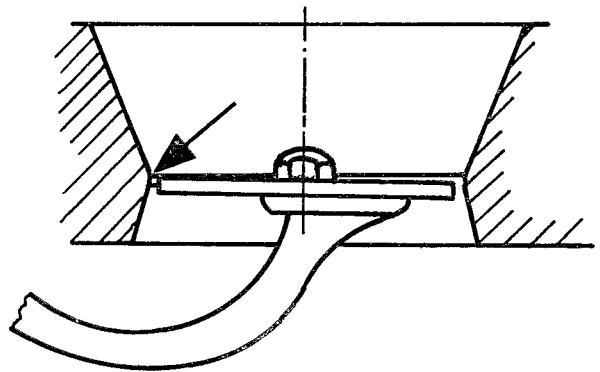
Inspection of the flexible sensor plate stop in the air flow (sensor plate in position of rest)

The fuel system must be depressurized when performing this check.

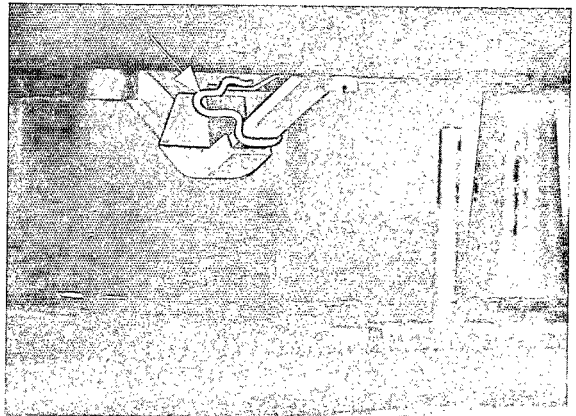
To relieve the remaining pressure, slightly loosen the pressure line connection at the control pressure regulator for warm running compensation. When loosening the line, wrap the connection with a rag to keep fuel from spilling.



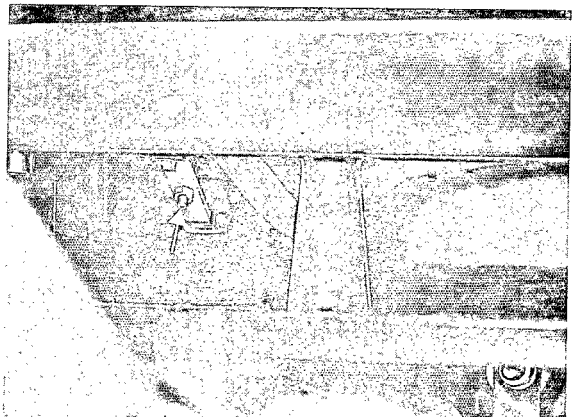
The upper edge of the sensor plate must now be flush with the root of the taper at a point shown in the illustration. A lower positioning of up to 0,5 mm is permissible.



If required, adjustment of the flexible stop can be corrected by bending the wire bow.



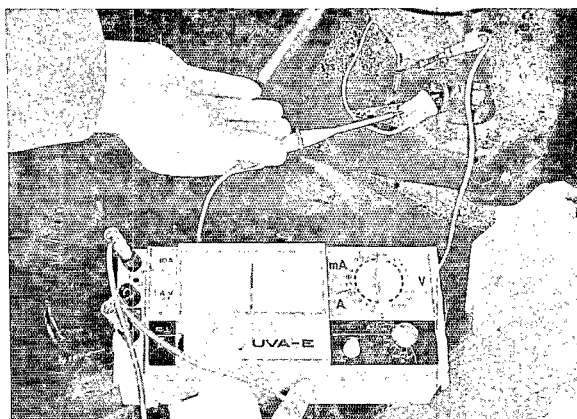
Since April of 1976 the spring-loaded stop of the sensor plate can be corrected with an adjusting screw.



INITIAL CHECKS

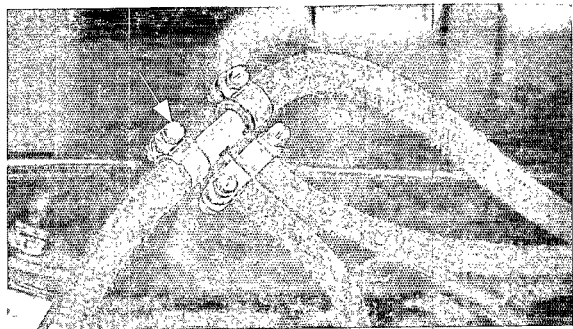
The following tests are component tests. Final evaluation of individual parts is possible only upon completion of pressure checks.

When performing the tests outlined below, remove the middle fuse from the rear fuse box to keep the heater coil in the control pressure regulator for warm running compensation from heating up.



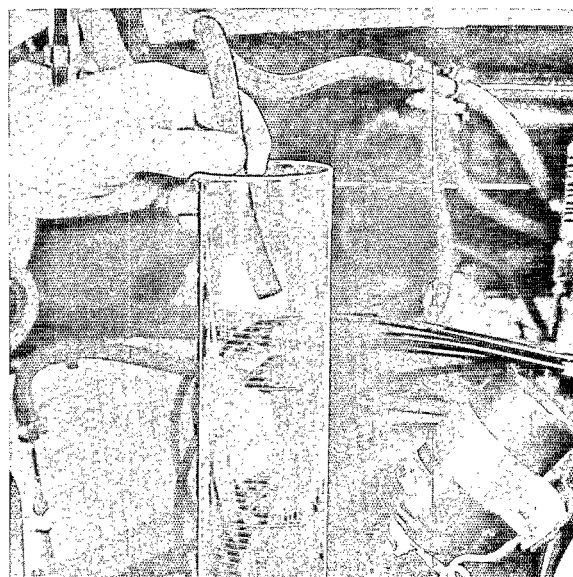
Checking electric fuel pump

1. Minimum voltage at the connecting terminal is 11.5 volts.
2. Current draw when running is 8.5 amps maximum.



3. Check pump delivery rate:

Disconnect fuel return line at the connector. Push a section (about 50 cm long) of normal fuel hose onto the connector and hold in a measuring glass. Switch the ignition on for the duration of the measuring period. See page 1.1 - 1/13 for specifications.

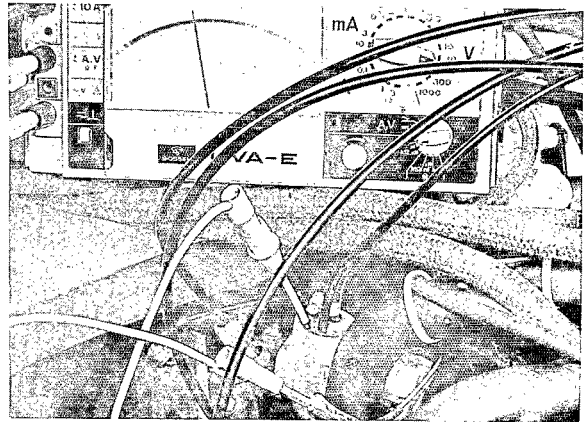


Modifications - 1976 Model

Terminals 30 and 87a of the relay (rear of luggage compartment) must be bridged to check the fuel pump delivery rate, due to a safety switch on the mixture control unit (also refer to page 1.1 - 1/17).

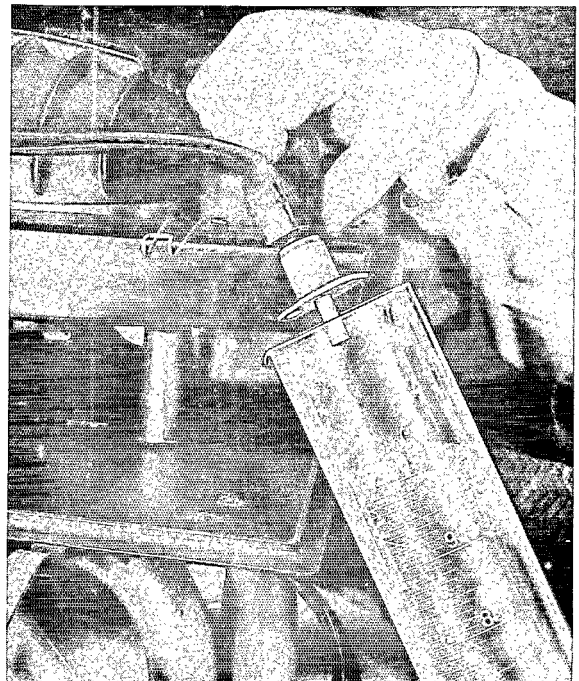
Checking Control Pressure Regulator (Warm Running Compensation)

1. Minimum voltage at the connecting terminal is 11.5 volts.
2. Check heater coil continuity with the aid of a test buzzer or ohmmeter. (Check between wire terminal at the control pressure regulator and the ground.) The connecting wire must be detached from the control pressure regulator. If the circuit is open, the control pressure regulator will have to be replaced.



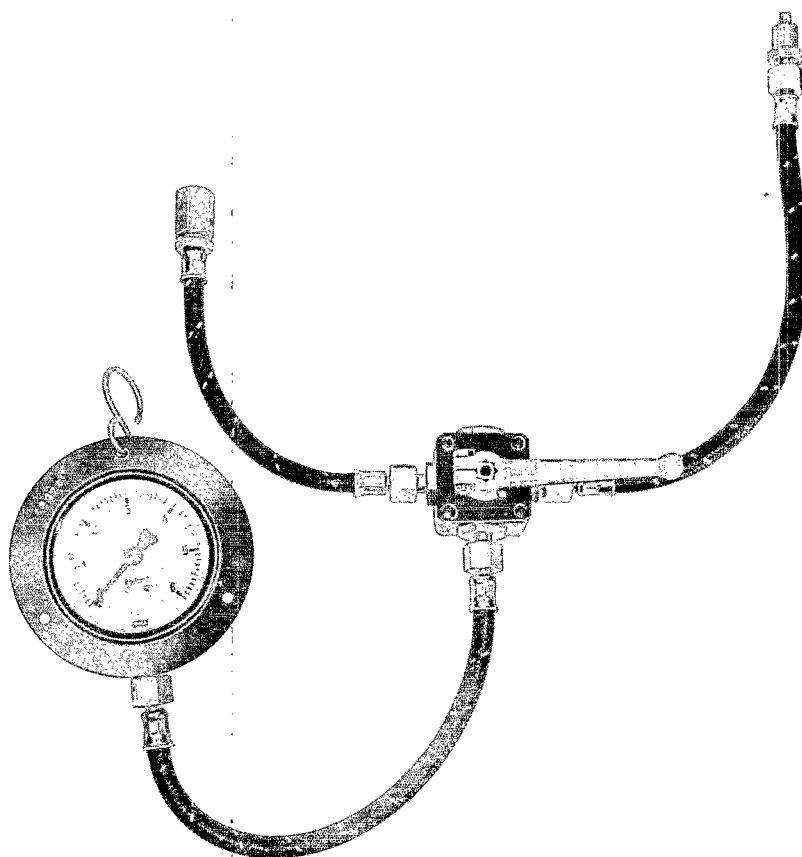
Checking Start (Enrichment) Valve

1. Remove start (enrichment) valve (see page 2.2 - 1/10); the fuel line remains connected.
2. Hold the start (enrichment) valve in a receptacle and connect to battery B+ (upper fuse in rear fuse box in engine compartment, left side) and to ground with a piece of jumper wire. Briefly switch the ignition on. The start (enrichment) valve must spray fuel in an even conical pattern.
3. Remove jumper wire and switch the ignition on. After waiting about 10 seconds, wipe nozzle of start (enrichment) valve dry; no fuel should come out.



PRESSURE TESTS

TOOLS



No.	Description	Special Tool	Remarks
1	Pressure tester	P 378	

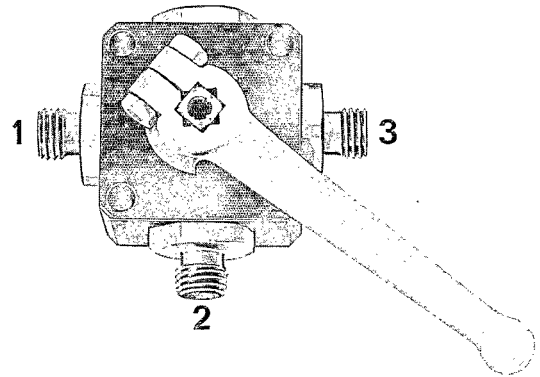
General

The tester should be connected into the control pressure line at the mixture control unit.

The control pressure now is transmitted from the mixture control unit, through the three-way selector valve, to the control pressure regulators for warm running compensation or throttle valve position, respectively.

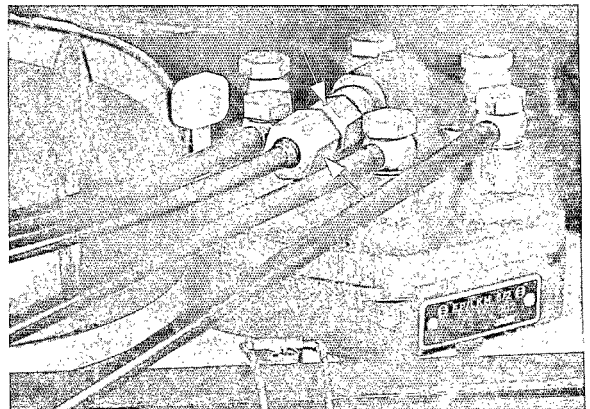
Thus, all pressure tests can be performed without reconnecting the lines.

For better clarity, connecting points and lever positions are referenced in the instructions given below according to numbers shown in the adjacent illustration.

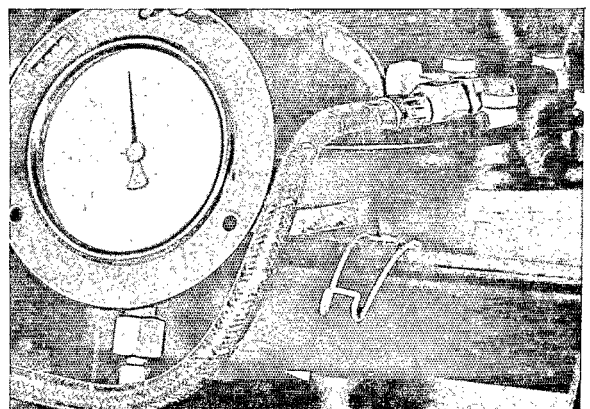


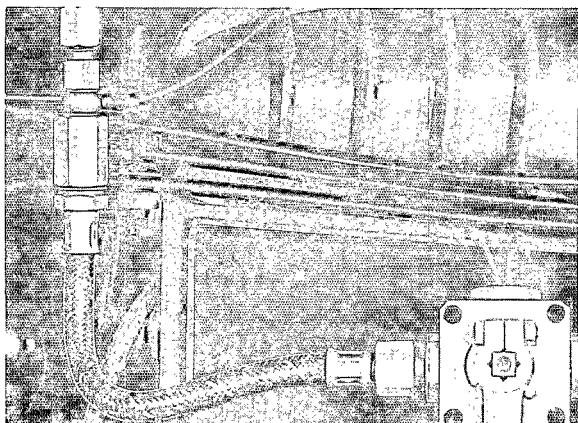
Connecting and Bleeding Pressure Tester

1. Detach pressure lines for control pressure regulators for warm running compensation and throttle valve position.

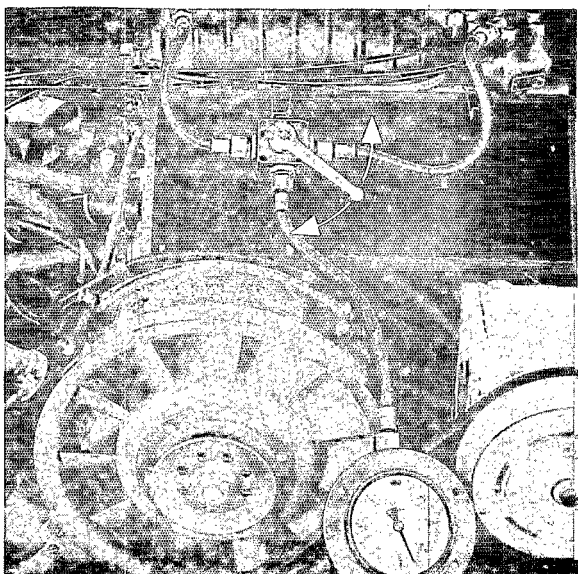


2. Insert a gasket in the special tool connector and screw into the control pressure connection of the mixture control unit in place of the banjo bolt.





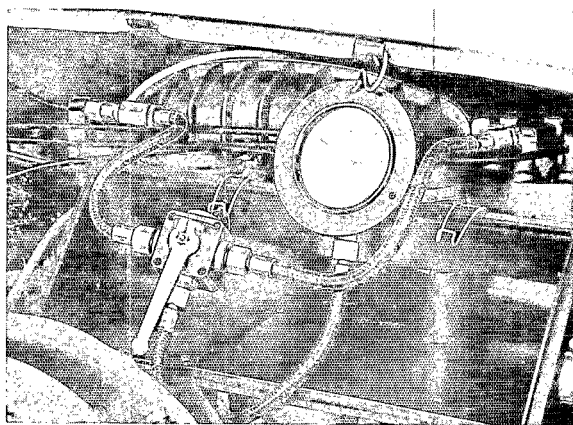
3. Connect pressure lines of control pressure regulators for warm running compensation and throttle valve position to second connector using original banjo bolt and gaskets.



4. Turn selector valve to position \equiv 2. Allow pressure gauge to hang down (hose stretched) and switch the ignition on. Turn lever of three-way selector valve to position \equiv 3 about 5 times at 10-seconds intervals.

Checking "Cold" Control Pressure

This test can be performed on a cold engine only. It must definitely be performed when encountering starting or warm-up problems.



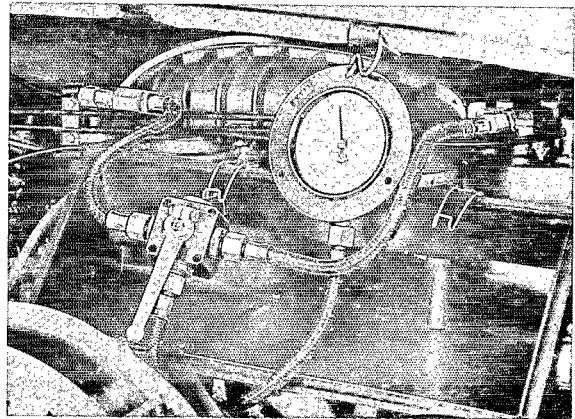
1. Turn selector valve to position \equiv 2. Switch the ignition on.
2. Pressure specifications for the given ambient air temperature are shown in the diagram on page 1.1 - 1/13, Testing and Adjustment Specifications.
3. Excessive deviations from the specified values are caused by a faulty control pressure regulator for warm running compensation which should be replaced in such cases.

Checking "Warm" Control Pressure

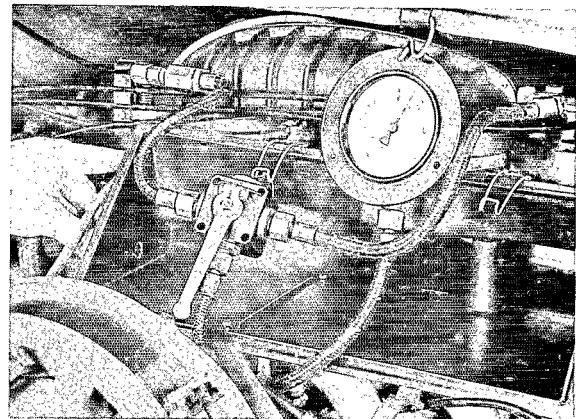
Refer to page 1.1 - 1/15 for engines with vacuum controlled control pressure regulator for warm running compensation.

This test can be performed on a warm or cold engine.

1. Detach connecting wire from control pressure regulator for warm running compensation. Connect the regulator to B+ by means of a jumper wire (fuse box in left side of engine compartment). Switch the ignition on. Make sure that the throttle plate is fully at the idle stop (hand throttle must be fully in).
2. The control pressure will rise slowly and must reach the idle value shown under testing and adjustment specifications, page 1.1 - 1/13.

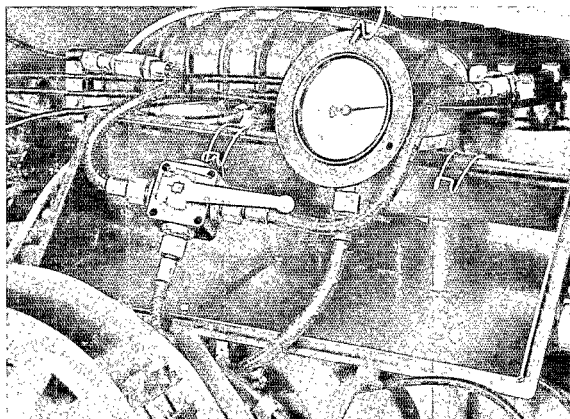


3. Open throttle about halfway by hand. The control pressure should now rise to the specified part-load value.
4. Open throttle fully (full power stop). The control pressure should now drop to the full-power value.



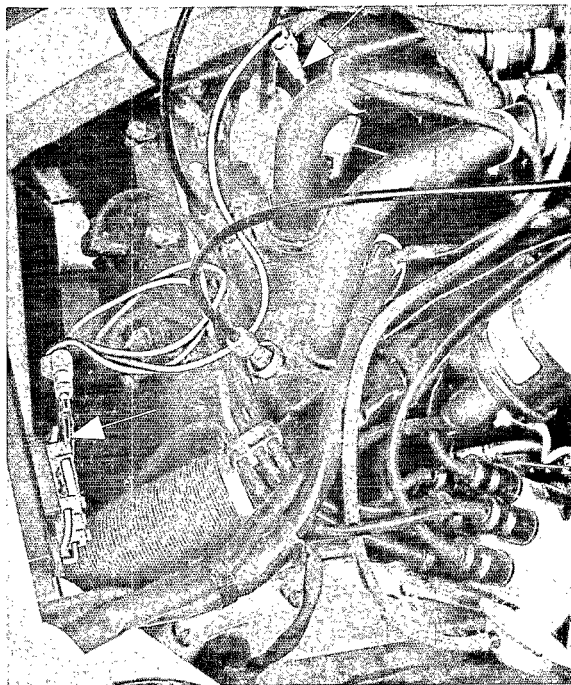
If excessive deviation is encountered, proceed as follows:

- a. Idle value: Idle value can be corrected within certain limits. Refer to instructions for checking or adjusting control pressure regulator for throttle valve position. If the required pressure cannot be obtained, replace control pressure regulator for throttle valve position.
- b. Part-load value: Replace control pressure regulator for warm running compensation.
- c. Full-power value: Replace control pressure regulator for throttle valve position.



Checking System Pressure

1. Turn selector valve to position $\ddot{=}$ 3 and switch the ignition on.
2. The system's pressure must agree with specifications on page 1.1-1/13. If it deviates from specifications, correct position of pressure relief valve in fuel distributor with shims.



Checking for Leakage

1. Detach electrical wire from the control pressure regulator for warm running compensation. Using a jumper wire, connect the control pressure regulator for warm running compensation directly to B+ (fuse box on left side of engine compartment). Turn selector valve to position $\ddot{=}$ 2 and switch the ignition on.

Having attained the "warm" control pressure value (part-load value), switch the ignition off again and observe the pressure drop on pressure gauge (the pressure will drop considerably first). If the pressure continues to drop too rapidly (see testing and adjustment specifications), repeat check in position $\ddot{=}$ 3 of the selector valve to locate the problem. If the same results are obtained, four components can be responsible:

electric fuel pump

Fuel distributor

injection valves

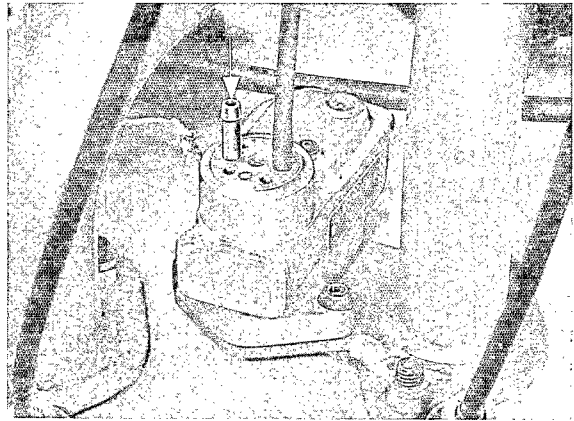
start (enrichment) valve

Injection valves and start valve are judged in separate tests. Replace electric fuel pump and seal of pressure relief valve in fuel distributor one after other and repeat each test.

If leakage does not occur in $\ddot{=}$ 3 position of the selector valve, the problem can be in the control pressure regulators for warm running compensation or throttle valve position.

To locate the problem, switch the ignition on until control pressure has built up, then switch the ignition off again. Detach return hose from the control pressure regulator for warm running compensation. With the remaining pressure being 1.5 to 2.4 bar, no fuel should come out from the return connector of the control pressure regulator for warm running compensation.

If some fuel should be coming out, it would indicate that the control pressure regulator for warm running compensation is leaking and should be replaced in such case.



If the leak is not in the control pressure regulator for warm running compensation, it will be found in the control pressure regulator for throttle valve position, in which case the control pressure regulator for throttle valve position will have to be replaced.

Checking Injection Valves

Injection valves must be removed for testing (see page 2.2 - 1/13).

Testing is accomplished with a Bosch jet tester EFEP 60 H, pressure gauge 0 to 6 bar, caliber 1.0, 100 mm dia., testing agent Ol 61 v 11.

See testing and adjustment specifications for opening pressure.

Tight: At a pressure of 0.5 bar less than opening pressure there must not be any drops falling within 15 sec..

See page 2.1 - 1/5 for testing procedure.

CHECKING AUXILIARY AIR DEVICE

1. Check idle rpm with control pressure regulator for throttle valve position connected (engine warm).

2. Stop engine.

3. Remove filter housing with filter cartridge and duct.



4. Disconnect hose leading to auxiliary air device above throttle valve at throttle valve housing and tightly seal the connector and hose.

5. Install duct.

6. Start engine and check idle rpm.

NOTE

If a change in rpm is noted, the auxiliary air device is leaking. If the valve leaks considerably, it will not be possible to adjust idle speed.

Replace auxiliary air device.

CIS TESTING AND ADJUSTING SPECIFICATIONS (1974/1975 Models)

Test Step	Test Specification	References
Electric fuel pump, fuel delivery	min. 850 cm ³ /30 seconds	Page 1.1 - 1/4
Control pressure "cold" (at corresponding ambient air temperature)		Page 1.1 - 1/8 Page 1.1 - 1/16 a

Diagram for Control Pressure
Regulator

Part No. 911. 110.927.00

(911.606.103.00)

Bosch No. 0438.140.001

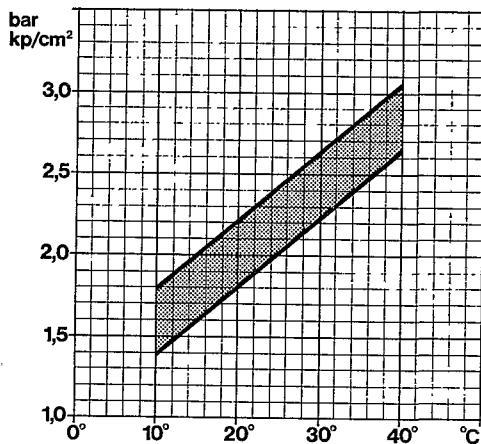


Diagram for Control Pressure
Regulator

Part No. 911.606.103.01

Bosch No. 0438.140.008

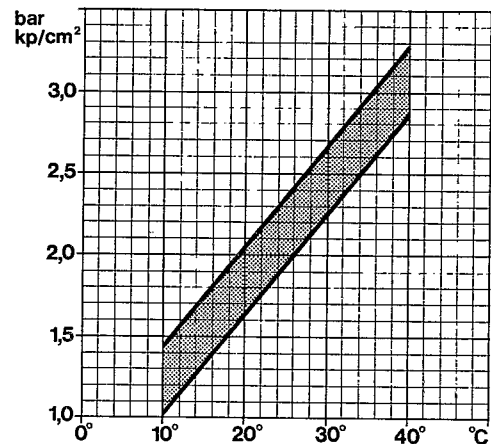


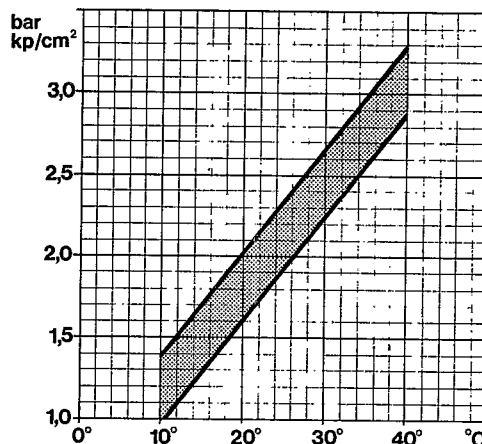
Diagram for Control Pressure Regulator *

Part No. 911.606.105.01

Bosch No. 0438.140.009

Test vacuum: 520 - 546 mbar

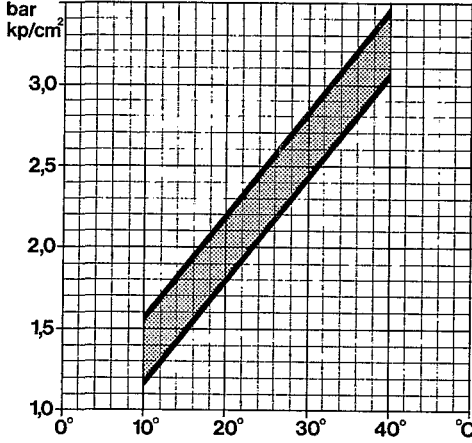
(390 - 410 mmHg)



* only applicable for vacuum controlled control pressure regulator

Test Step	Test Specification	References
Control pressure "warm"		Page 1.1 - 1/9
Throttle position version		
Throttle valve position:		
Idle, test specification	2.8 to 3.0 bar	
adjusting		
specification	2.85 to 2.95 bar	
Partial throttle	3.4 to 3.8 bar	
Full throttle	2.6 to 3.0 bar	
Vacuum controlled version		
Testing at atmospheric pressure (no vacuum)	2.7 to 3.1 bar	
To perform vacuum test, connect vacuum pump to control pressure regulator. Test pressure 520 - 546 mbar (390 - 410 mmHg)	3.4 to 3.8 bar	
System pressure		Page 1.1 - 1/10
Test specification	4.5 to 5.2 bar	
Adjusting specification	4.7 to 4.9 bar	
Leak test (warm engine)		Page 1.1 - 1/10
Min. pressure after 10 minutes	1.3 bar	
20 minutes	1.1 bar	
Fuel injectors opening pressure	2.5 to 3.6 bar	Page 1.1 - 1/11 Page 2.1 - 1/5

CIS TESTING AND ADJUSTING SPECIFICATIONS (1976/1977 Models)

Test Step	Test Specification	References
Electric fuel pump, fuel delivery	min. 850 cm ³ /30 seconds	Page 1.1 - 1/4
Control pressure "cold" (at corresponding ambient air temperature)	<p>Diagram for Control Pressure Regulator Part No. 911.606.105.03 and 911.606.105.04 Bosch No. 0438.140.017 and 0438.140.033 Test vacuum: 520 - 546 mbar (390 - 410 mmHg)</p> 	Page 1.1 - 1/16 a
Control pressure "warm"		Page 1.1 - 1/9
1976 Model		
Testing atmospheric pressure (no vacuum)	2.7 to 3.1 bar	
To perform vacuum test, connect vacuum pump to control pressure regulator. Test pressure 520 - 546 mbar (390 - 410 mmHg)	2.7 to 3.1 bar	
At high idle speed (approx. 1800 rpm)	3.4 to 3.8 bar	

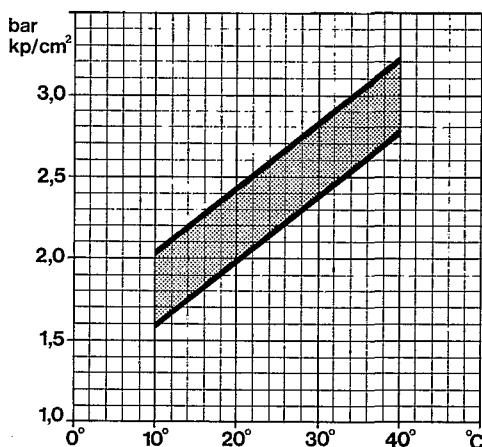
Test Step	Test Specification	References
1977 Model		
Testing at atmospheric pressure (no vacuum)	2.7 to 3.1 bar	
To perform vacuum test, connect vacuum pump to control pressure regulator, Test pressure 520 - 546 mbar (390 - 410 mmHg)	3.4 to 3.8 bar	
System pressure		Page 1.1 - 1/10
Test specification	4.5 to 5.2 bar	
Adjusting specification	4.7 to 4.9 bar	
Leak test (engine warm)		Page 1.1 - 1/10
Min. pressure after 10 min	1.3 bar	
20 min	1.1 bar	
Fuel injectors opening pressure	2.5 to 3.6 bar	Page 1.1 - 1/11 Page 2.1 - 1/5

CIS TESTING AND ADJUSTING SPECIFICATIONS (1978/1979 Models)

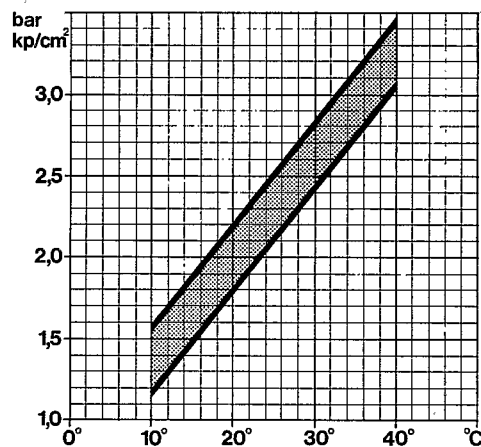
Test Step	Test Specification	References
Electric fuel pump fuel delivery	min. 1000 cm ³ /30 seconds	Page 1.1 - 1/4
Control pressure "cold" (at corresponding ambient air temp.)		Page 1.1 - 1/16 a

Diagram for Control Pressure Regulator

Part No. 911 606 105 05
 Bosch No. 0 438 140 045
 Test vacuum 460 - 600 mbar
 (350 - 450 mmHg)

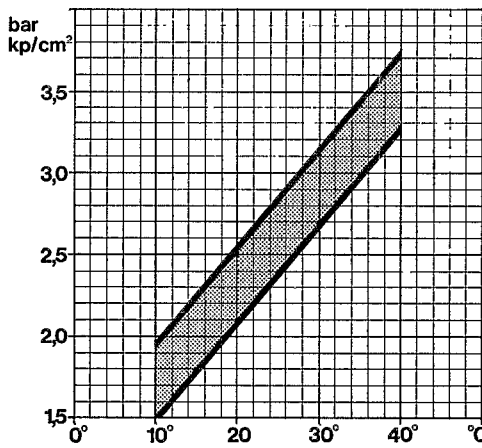
Diagram for Control Pressure Regulator
(from January 1979)

Part No. 911 606 105 06
 Bosch No. 0 438 140 069
 Test vacuum 450 - 550 mbar
 (340 - 420 mmHg)

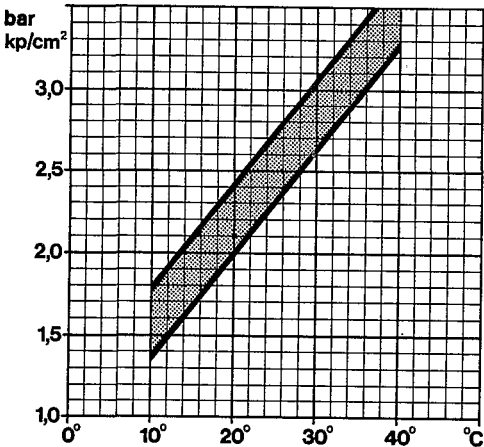


Control pressure "warm"		Page 1.1 - 1/9
Testing at atmospheric pressure (no vacuum)	2.7 to 3.1 bar	
To perform vacuum test, connect vacuum pump to control pressure regulator	3.2 to 3.6 bar	
System pressure		Page 1.1 - 1/10
Test specification	4.5 to 5.2 bar	
Adjusting specification	4.7 to 4.9 bar	
Leak test (warm engine)		Page 1.1 - 1/10
Min. pressure after 10 min.	1.3 bar	
20 min.	1.1 bar	
Fuel injectors		Page 1.1 - 1/11
opening pressure	2.5 to 3.6 bar	Page 2.1 - 1/5

CIS TESTING AND ADJUSTING SPECIFICATIONS
(1980 Model with Oxygen Sensor)

Test Step	Test Specification	References
Electric fuel pump, fuel delivery	min. 1000 cm ³ /30 seconds	Page 1.1 - 1/4
Control pressure "cold" (at corresponding ambient air temperature)	<p>Diagram for Warm-up Regulator Part No. 911.606.105.07 Bosch No. 0438 140 072</p> 	Page 1.1 - 1/8
Control pressure "warm"	3.4 to 3.8 bar	Page 1.1 - 1/9
System pressure Test specification Adjusting specification	<p>4.5 to 5.2 bar 4.7 to 4.9 bar</p>	Page 1.1 - 1/10
Leak test (warm engine) Min. pressure after 10 min. 20 min.	<p>1.3 bar 1.1 bar</p>	Page 1.1 - 1/10
Fuel injectors opening pressure	2.5 to 3.6 bar	<p>Page 1.1 - 1/11 Page 2.1 - 1/5</p>

TESTING AND ADJUSTING VALUES - 911 SC
(1981 Models with Oxygen Sensor Control)

Test Step	Testing/Adjusting Value	Special Instruction
Electric fuel pump Delivery rate	at least 1000 cc/30 sec.	Page 1.1 - 1/4
Control pressure "cold"	<p>Diagram for warm-up control Part No. 911.606.105.08 Bosch No. 0438.140.090</p> 	Page 1.1 - 1/8
Control pressure "warm"	3.4 ... 3.8 bar	Page 1.1 - 1/9
System pressure Test value Adjusting value	<p>4.5 ... 5.2 bar 4.7 ... 4.9 bar</p>	Page 1.1 - 1/10
Leak test (engine warm) Min. Pressure after 10 min. after 20 min.	<p>1.3 bar 1.1 bar</p>	Page 1.1 - 1/10
Fuel injectors Opening pressure	2.5 ... 3.6 bar	<p>Page 1.1 - 1/11 Page 2.1 - 1/5</p>

Test Step	Testing and Adjusting Values		
Idle setting		USA and Canada	California and High Altitude States
	Manual transm. to 1977 models	900 \pm 50	900 \pm 50
	Sportomatic to 1977 models	950 \pm 50	950 \pm 50
Idle speed (rpm)	1977 models	950 \pm 50	1000 \pm 50
	1978/79 models	950 \pm 50	950 \pm 50
	1980 models	900 \pm 50	900 \pm 50
	1981 models	900 \pm 50	900 \pm 50
	1973 models (2.4 ltr.)	1.5 to 2.0	1.5 to 2.0
	1974 models (2.7 ltr.)	1.5 to 2.5	1.5 to 2.5
	1975 models	1.7 to 2.0	1.5 to 2.0
CO content (%)	1976 models	2.0 to 4.0 *	2.0 to 4.0 *
	1977 models	1.5 to 3.0 *	1.5 to 3.0 *
	1978/79 models	1.5 to 3.5 *	1.5 to 3.5 *
	1980 models	0.4 to 0.8 * *	0.4 to 0.8 * *
	1981 models	0.4 to 0.8 * *	0.4 to 0.8 * *

* Air pump disconnected.

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

CHECKING CONTROL PRESSURE OF VACUUM-CONTROLLED CONTROL PRESSURE REGULATOR

Connect and bleed pressure gauge.

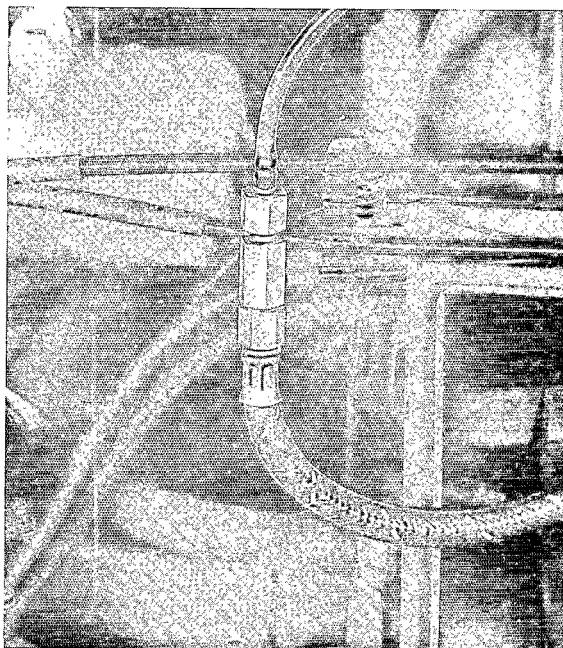
Refer to page 1.1 - 1/7.

Note

Connect pressure line (of control pressure regulator only) to second connector of pressure tester since the throttle valve control pressure regulator has been eliminated.

CHECKING "COLD" CONTROL PRESSURE

Refer to page 1.1 - 1/16 a.



CHECKING "WARM" CONTROL PRESSURE

This test can be done on a cold or warm engine.

1. Remove mounting plate cover in engine compartment.
2. Remove standard relay at center of relay plate.

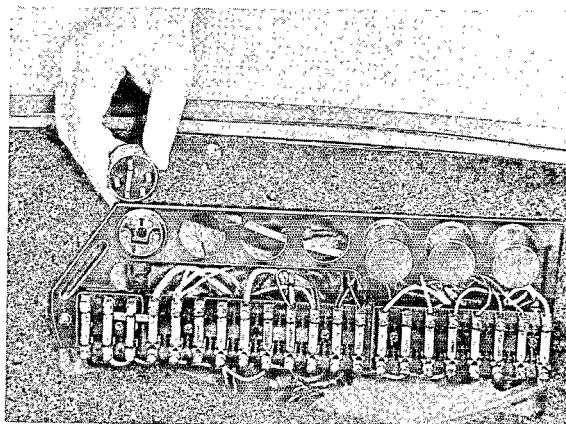
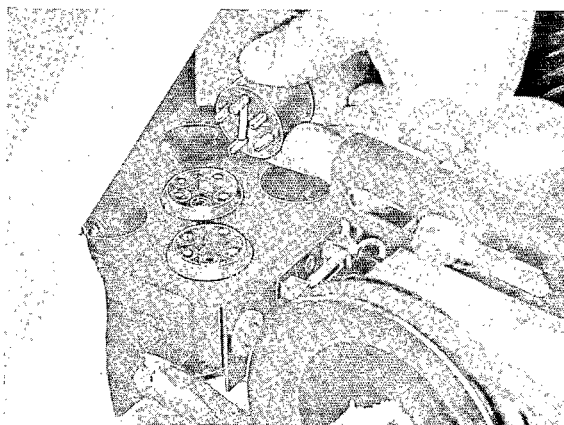
Note

The standard relay for the control pressure regulator of some vehicles is located to the rear, right side of the relay plate - and not as illustrated. Also refer to Group 9, Page 0.1 - 4/3.

CAUTION

With the 1976 Model the relay is in luggage compartment (rear relay as seen in driving direction).

3. Bridge terminals 87 a and 30 of a spare relay.
4. Place this modified relay in relay plate instead of the original relay.



5. Turn on ignition (fuel pump runs).
6. The control pressure rises slowly and must stabilize at 2.9 ± 0.20 bar. The regulating time span varies with the ambient temperature. Replace control pressure regulator (for warm running compensation) if necessary.

CAUTION

Reinstall original relay after testing!

CHECKING "IDLE" CONTROL PRESSURE

Start engine.

Control pressure must be 3.6 ± 0.20 bar at idle speed of 900 ± 50 rpm.

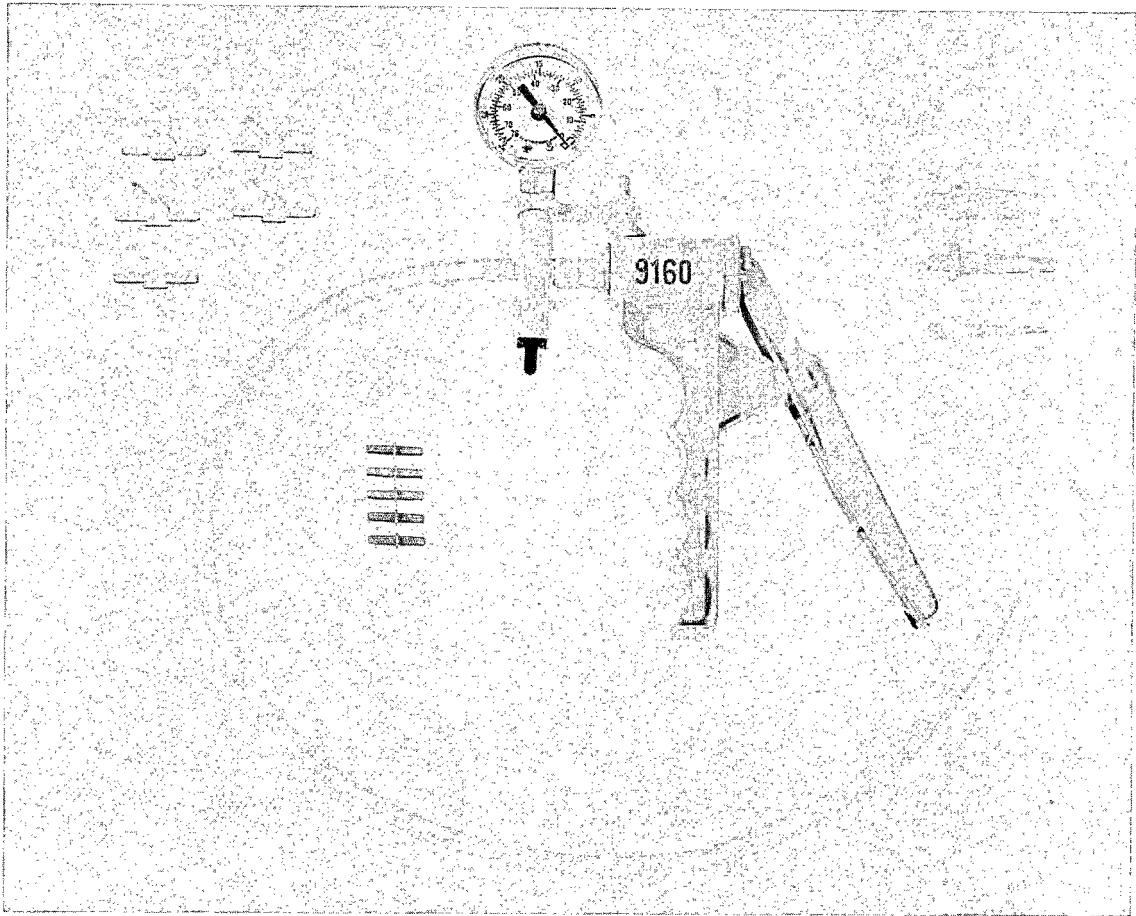
1978 and later models: 3.4 ± 0.20 bar at idle speed of 900 ± 50 rpm.

CAUTION

Position selector valve at 2 for this control pressure test.

CHECKING "COLD" CONTROL PRESSURE
(vacuum controlled (warm-up) control pressure regulator)

TOOLS



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

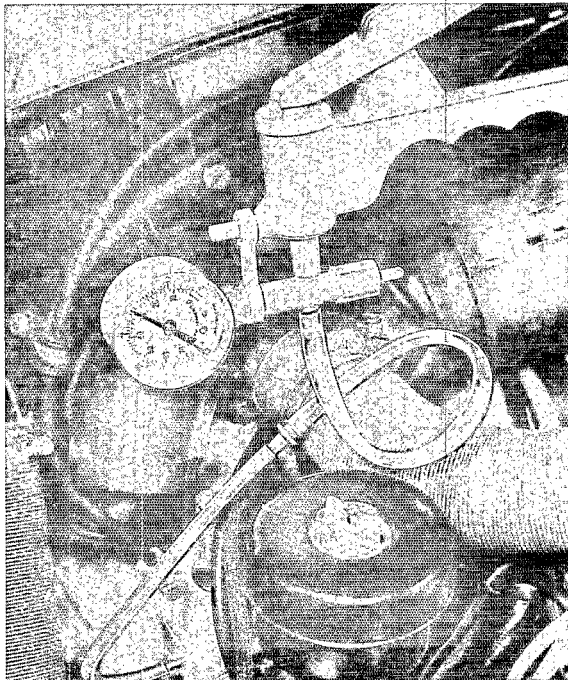
CHECKING "COLD" CONTROL PRESSURE
(vacuum controlled (warm-up) control pressure regulator)

Note

Engine must be absolutely cold.

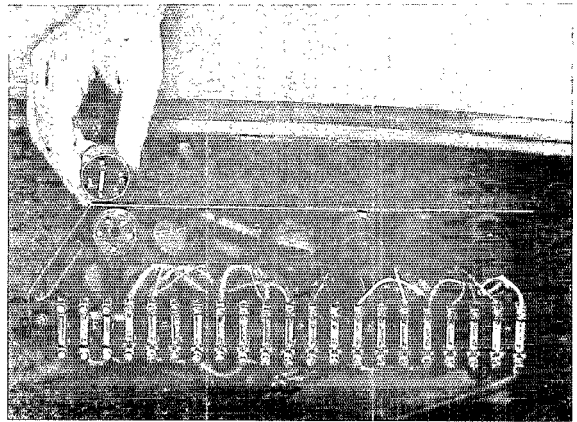
From 1975 models diagram values are only for the vacuum controlled testing method in the case of vacuum controlled (warm-up) control pressure regulator.

1. Connect and bleed pressure tester. Set valve to position 2.
2. Remove hose between heater blower and warm air neck.
3. Pull off vacuum hose from (warm-up) control pressure regulator and connect hose/manual vacuum pump (US 8026) to connection of (warm-up) control pressure regulator.



4. Pull off wire plug from (warm-up) control pressure regulator.

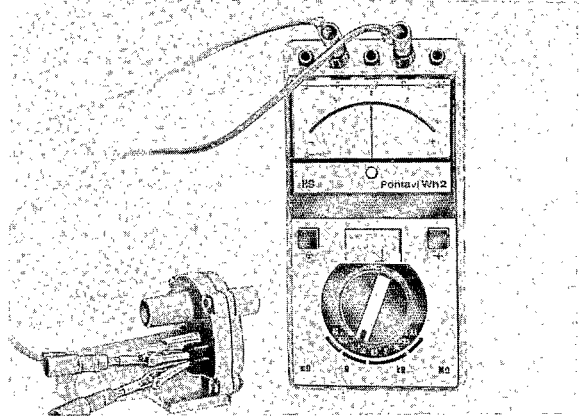
5. Bridge electric safety circuit, by pulling off standard relay in trunk (rear relay looking forward) and replacing with a relay of which terminals 87 a and 30 are bridged or by pulling off wire plugs on air flow sensor.



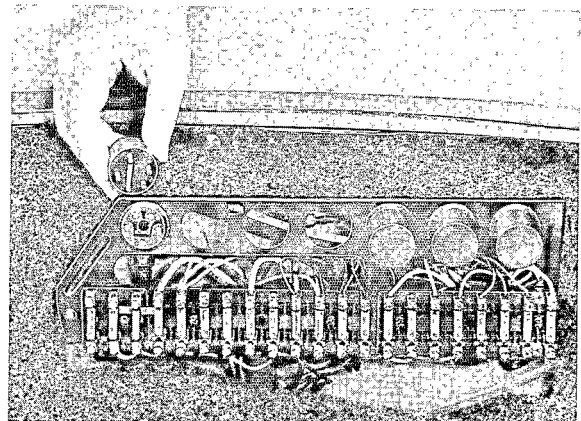
6. Turn on ignition (fuel pump should run).
7. Adjust vacuum to specified value with the manual vacuum pump (9160) - see page 1.1 - 1/13.
8. Refer to diagram below "Testing and Adjusting Specifications" on page 1.1 - 1/13 for specified pressure corresponding with actual outside temperature.

CHECKING AUXILIARY AIR REGULATOR

1. Remove auxiliary air regulator.
2. Connect ohmmeter to both terminals of auxiliary air regulator and check.
Specifications: approx 33 ohm



3. Check power supply of auxiliary air regulator.
 - a) Pull off standard relay in luggage compartment (rear relay as seen in driving direction).
 - b) Bridge terminals 30 and 87a, turn on ignition.
 - c) Connect test lamp to both auxiliary air regulator terminals from which the plugs have been pulled off.



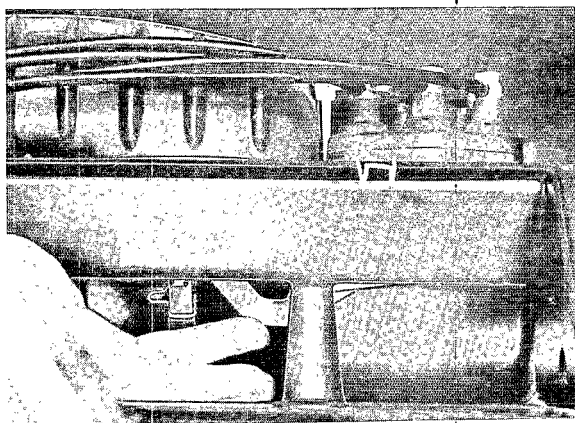
4. Refer to "Troubleshooting Automatic Choke" for other checks.

CHECKING AUXILIARY AIR VALVE

Refer to "Troubleshooting Automatic Choke".

CHECKING OPERATION OF SAFETY SWITCH

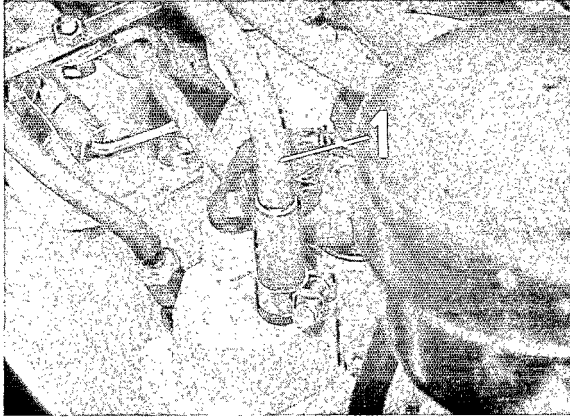
1. Disconnect rubber straps and remove air cleaner cover as well as the air cleaner cartridge.
2. Turn on ignition; fuel pump should not run.



3. Lift sensor plate lever; slightest movement should start fuel pump.

CHECKING THERMOVALVE

1. Detach vacuum hose (1) at warm-up regulator.

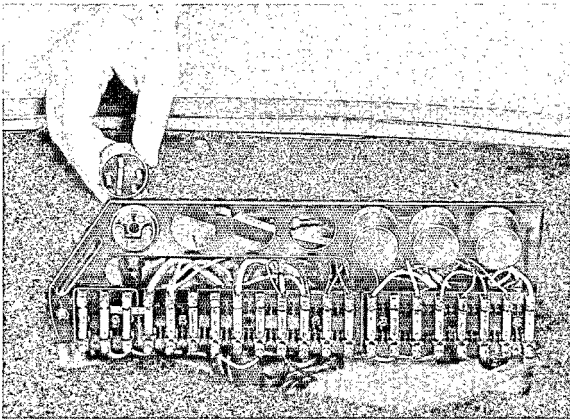


4. Blow into detached vacuum hose (from warm-up regulator) by mouth.

Valve must open after 10 to 30 seconds, if thermovalve's ambient temperature is 20 to 30 °C/68 to 86 °F.

Replace thermovalve, if necessary.

2. Bridge terminals 30 and 87a of fuel pump relay in luggage compartment (rear relay as seen in driving direction).



3. Turn on ignition and stop time until switched in.

CIS PROBLEMS AND REMEDIES

A properly working ignition system and good mechanical condition of the engine are prerequisites for a successful CIS problem diagnosis.

Problem	Cause		Remedy				
	Improper operation	Control pressure "cold" not within tolerances	Control pressure "warm" too high (beyond adjustment)	Control pressure "warm" too low (beyond adjustment)	System pressure not within tolerances	Vacuum system leaking	Visual inspection
Engine does not start or is difficult to start when cold	•	•			•	•	
Engine does not start or is difficult to start when warm	•						
Engine misses when car is driven					•		•
Unsatisfactory engine performance							
Excessive fuel consumption				•			•
Engine backfires into intake pipe							
Engine dieseling							
Rough idle during warmup		•		•		•	•
Rough idle when warm			•	•		•	•
Idle speed cannot be adjusted						•	
CO emissions too low at idle			•			•	
CO emissions too high at idle				•			

[illegible]

TROUBLESHOOTING AUTOMATIC CHOKE - 1976 MODEL

Problem: Speed remains too high at high engine temperatures or no speed increase on cold engine.

Possible Cause: Auxiliary air regulator or auxiliary air valve defective.

Remedy: 1. Disconnect top control line at auxiliary air valve and plug.

Problem corrected: Replace auxiliary air valve.

Problem unchanged: Auxiliary air valve good.

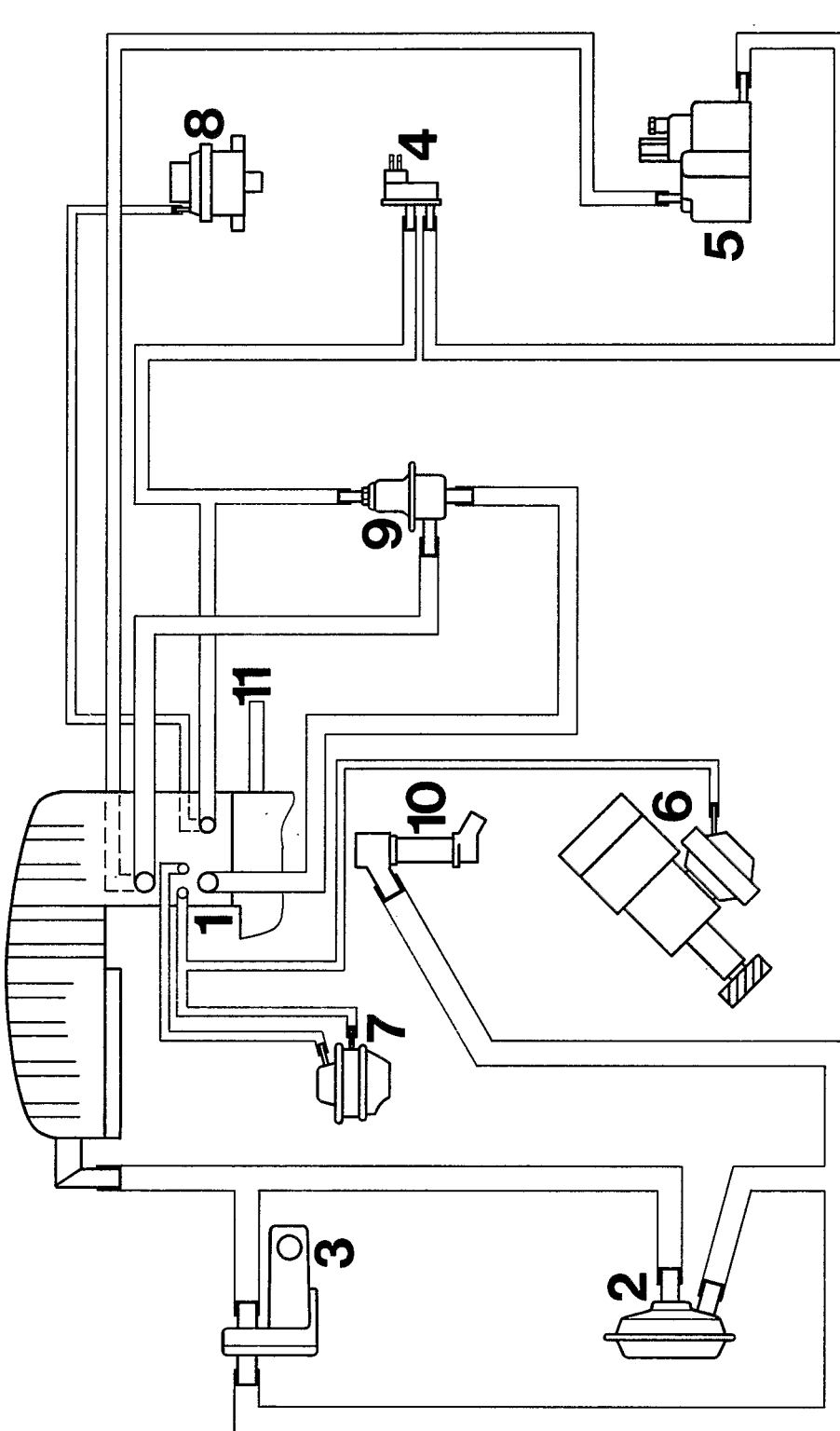
2. Cold engine: If there is no increase in speed, auxiliary air regulator is defective.

Warm engine: Disconnect one hose at auxiliary air regulator and plug both openings.

Speed too high: auxiliary air valve defective

Speed drops: auxiliary air regulator defective

VACUUM SYSTEM LAYOUT (1978 Models)



- 1 - Throttle housing
- 2 - Auxiliary air valve
- 3 - Auxiliary air regulator

- 4 - Thermo valve
- 5 - Control pressure regulator
- 6 - Distributor

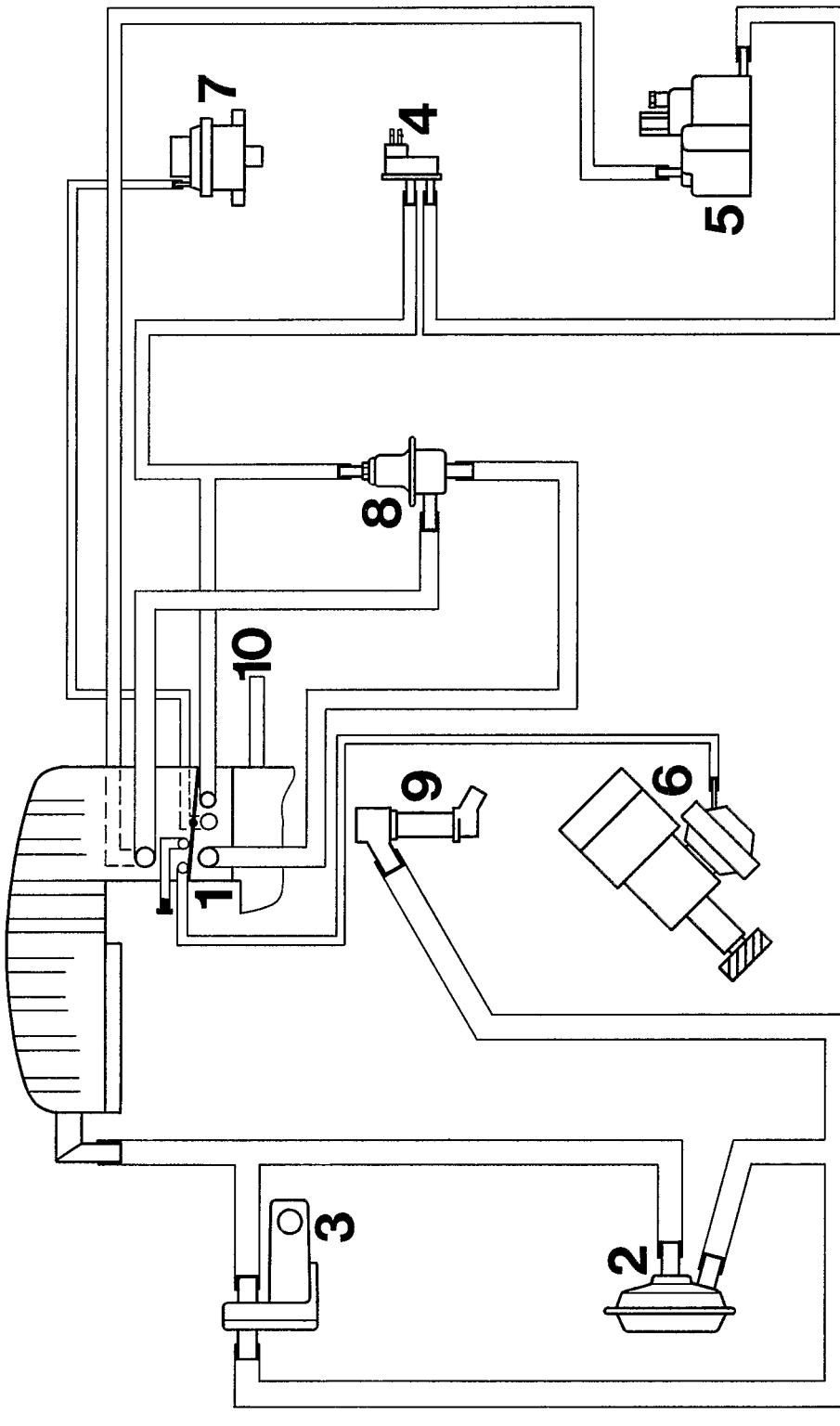
- 7 - EGR valve (only California)
- 8 - Diverter valve

- 9 - Vacuum control

- 10 - Vacuum source for auxiliary air valve and auxiliary air regulator

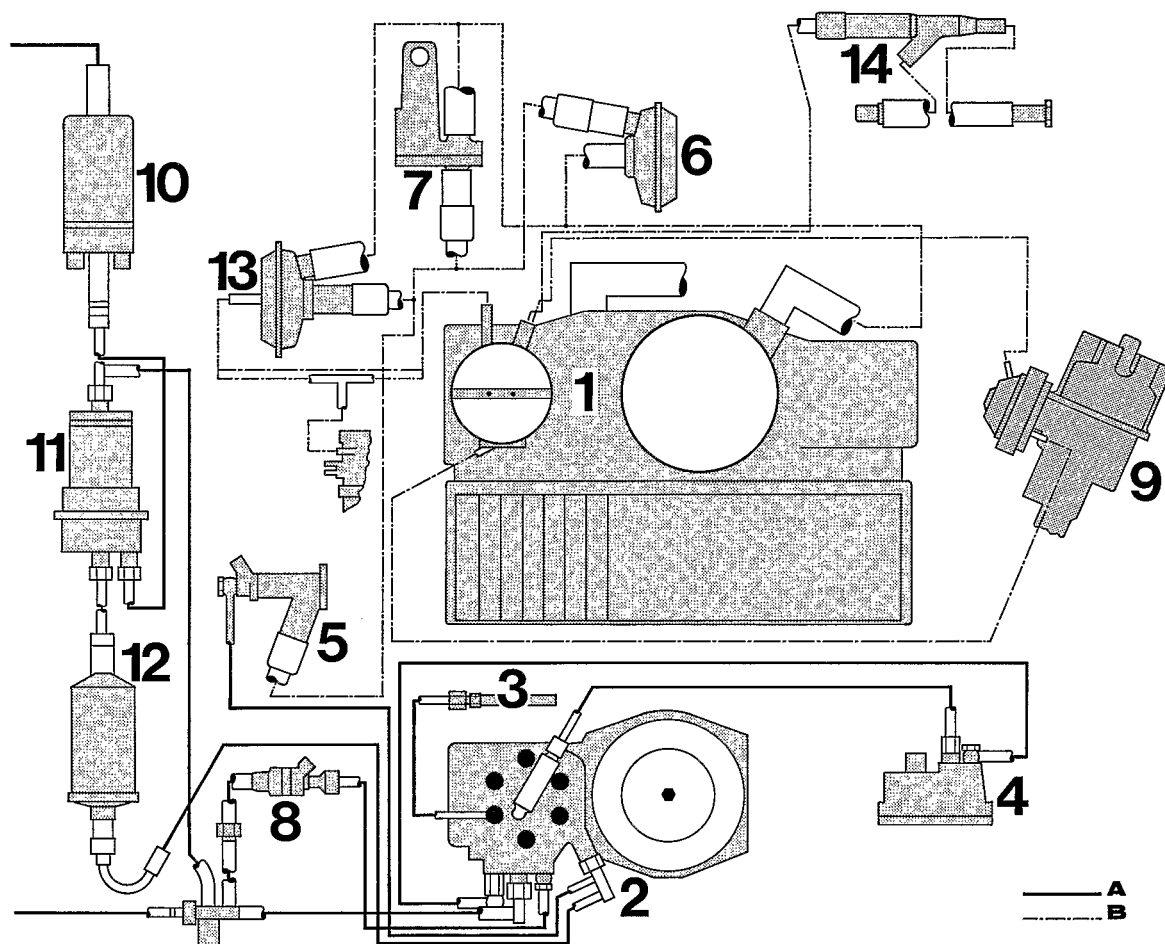
- 11 - Vacuum source for power brakes

VACUUM SYSTEM LAYOUT (from 1979 Model)



- | | |
|--|---|
| 1 - Throttle housing | 6 - Ignition distributor |
| 2 - Auxiliary air valve | 7 - Divertor valve |
| 3 - Auxiliary air regulator | 8 - Deceleration valve |
| 4 - Thermo valve | 9 - Vacuum source for auxiliary air valve and auxiliary air regulator |
| 5 - (Warm-up) control pressure regulator | 10 - Vacuum source for power brake |

LAYOUT OF FUEL AND VACUUM LINES - 911 SC (from 1980 Model)



A - Fuel lines

B - Vacuum lines

1 - Throttle housing

2 - Mixture control unit

3 - Fuel injector

4 - (Warm-up) control pressure regulator

5 - Cold start valve

6 - Auxiliary air valve

7 - Auxiliary air regulator

8 - Frequency valve

9 - Ignition distributor

10 - Fuel pump

11 - Fuel reservoir

12 - Fuel filter

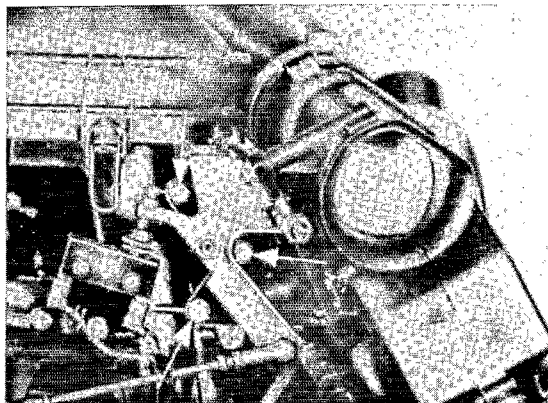
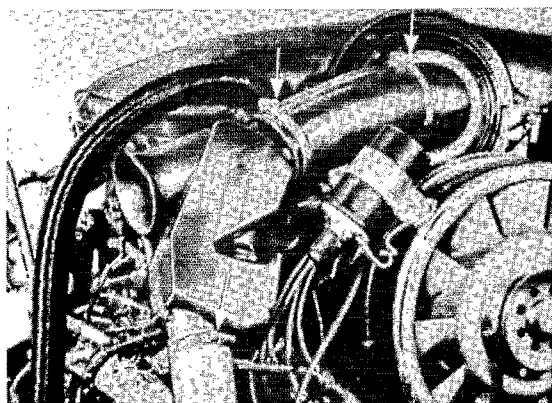
13 - Deceleration valve

14 - Vacuum booster

REMOVING AND INSTALLING REGULATOR HOUSING

Removing

1. Detach hot air hose between left heat exchanger and regulator housing, then remove hose between regulator housing and air cleaner intake.
2. Remove 3 retaining bolts from left velocity stack and remove regulator housing.

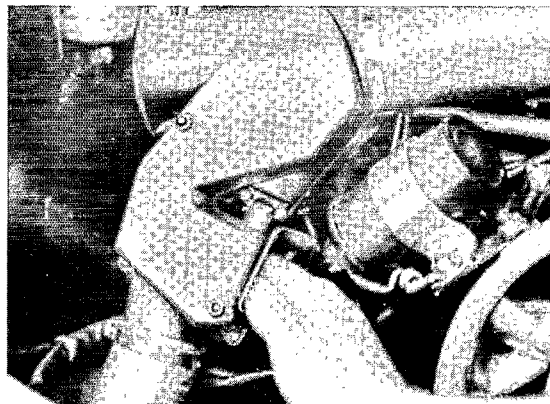


Installing

Adjust fresh air flap (see page 2.1-1/2).

CHECKING OPERATION OF INDUCTION AIR PREHEATING SYSTEM

1. Hot air flap must be open when engine is cold. This can be checked through the bypass hole in the regulator housing. The hot air flap closes the bypass duct and stays in place under spring tension.



2. Warm up engine at about 2500 rpm. The hot air flap must close after about 3-4 minutes. Check flap position through bypass hole.

3. If the hot air flap, which is controlled by a thermostat, does not work, replace the regulator housing.

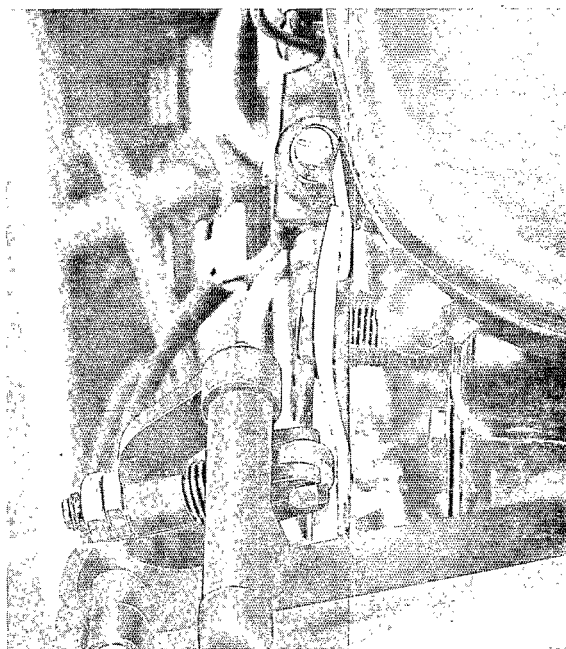
Note: The thermostat in the regulator housing can not be replaced. Replace the entire control box.

ADJUSTING FRESH AIR FLAP

1. Adjust fresh air flap with throttle valve linkage set in idle position.
2. Adjust roller for fresh air flap lever with both nuts so that the roller touches the control lever without play. Lock the nut.

Note:

After adjusting, check that the fresh air flap begins to open with throttle valves set at 20°.



REPLACING FRESH AIR FLAP LEVER

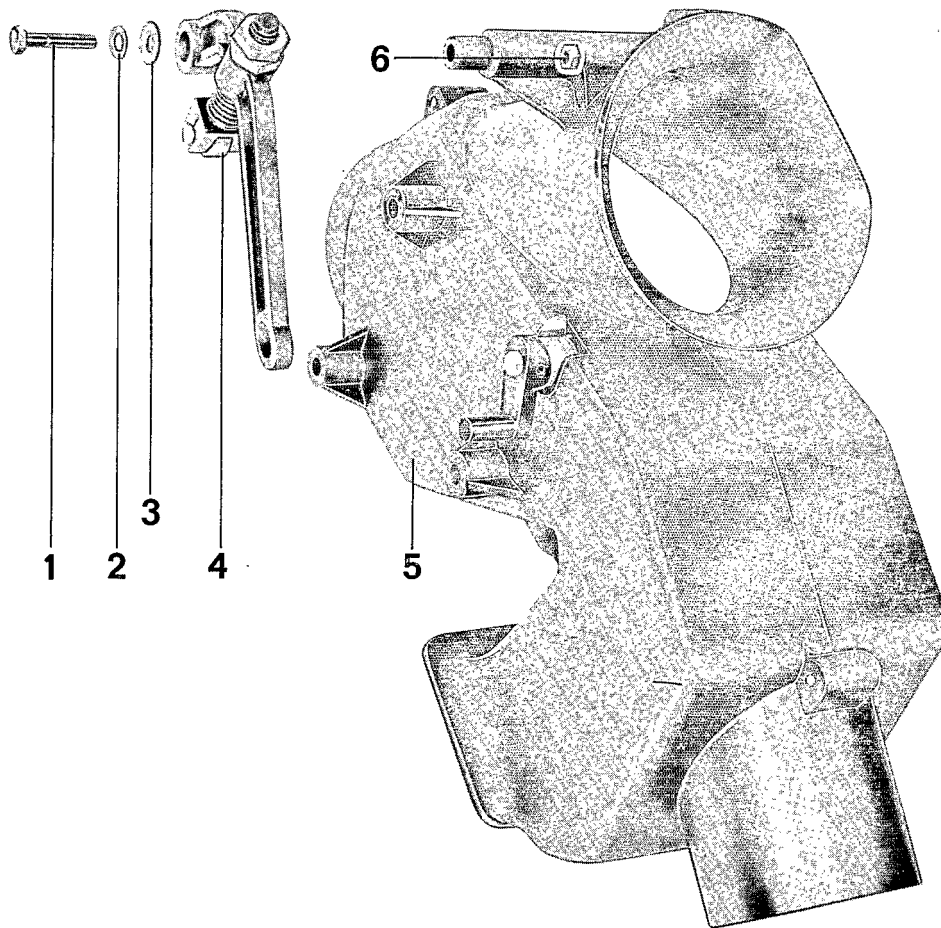
Caution

Prevent nut from falling into regulator housing by holding nut of retaining bolt during removal.

1. Remove bolt and lever.

Note:

Hold lock nut with punch or scriber. The nut can fall into the control box.



1 Nut
2 Spring washer

3 Washer
4 Lever

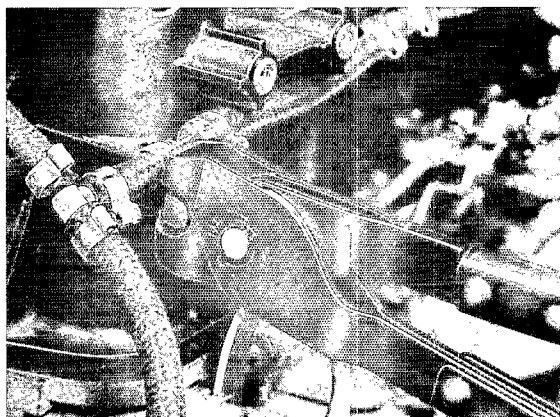
5 Control box
6 Nut

INSTALLING HOSE CLAMPS FOR COLD START ENRICHMENT

Tighten hose clamps with VW special tool
Nr. ASE 000 049.

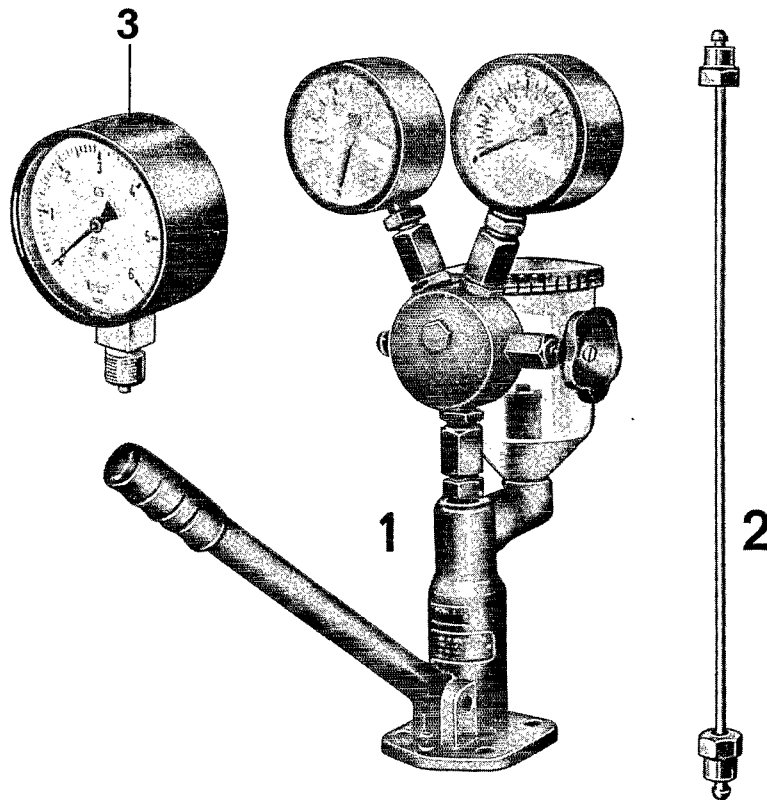
Note:

The hose clamps can be used only once.



FUEL INJECTION

TOOLS



No.	Description	Special Tool	Remarks
1	Injection nozzle tester with two pressure gauges		Use Bosch or similar injection nozzle tester. Pressure gauge range: 0-25 kg/cm ² (0-355 psi)
2	Line with fittings		Use Bosch EF 8040/30 or similar
3	Pressure gauge 0-6 kp/cm ² Kl. 1.0 100 mm dia.		For CIS

CHECKING FUEL INJECTORS

General

Instructions for checking the injectors apply to vehicles equipped with either the mechanical or CIS fuel injection.

The injector tester is used for checking opening pressure, spray pattern, and leakage of injectors.

Fill container of the tester with testing oil and bleed tester prior to testing the injectors. Use only testing oil 01 61 v 11.

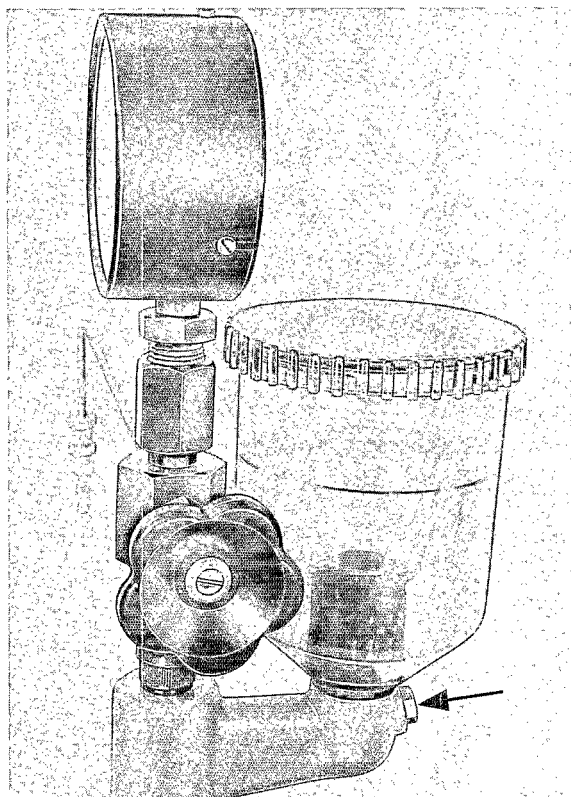
Under no circumstances should gasoline be used.

When testing injectors for the mechanical injection system, use pressure gauge EF 1687 231 000 0 - 25 bar. When testing CIS injectors use pressure gauge with calibrations 0 - 6 bar.

Bleeding the Tester

1. Open bleeder screw.

2. Open pressure gauge valve.

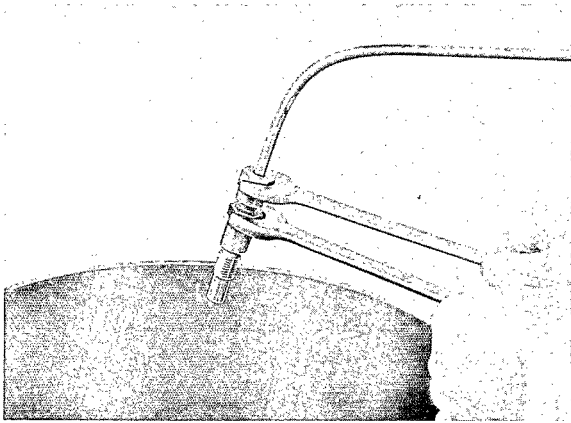


3. Actuate hand lever until testing oil comes out of the bleeder without air bubbles.

4. Tighten bleeder screw.

5. Connect injector to pressure line but do not tighten connection. Actuate hand lever until air bubbles cease to come out at the coupling nut.

6. Tighten injector to pressure line.



Checking Injectors

Note

The injectors of one engine can be replaced separately.

Defective injectors cannot be repaired, but must be replaced.

Checking

Operate hand lever slowly (about 2 sec./stroke) with the pressure gauge shut-off valve open. In this manner a valve leaking because of a large particle of dirt can be recognized (tight spray on valve, pressure built up to max. 1.5 bar).

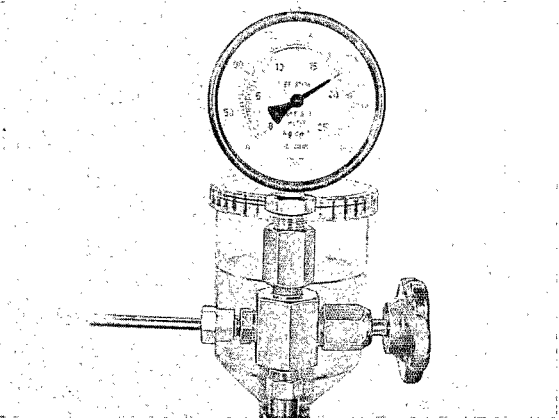
Checking Opening Pressure

1. Flush injector with the pressure gauge shut-off valve closed by moving lever back and forth several times quickly.
2. Open pressure gauge shut-off valve and read opening pressure on pressure gauge while moving lever slowly (about 2 sec./stroke).

The opening pressure is:

- 15 to 18 bar (mechanical injection system)
- 2, 5 to 3, 6 bar (continuous fuel injection)

Replace injector, if opening pressure is outside of these tolerances.



Caution

When pressure gauge shut-off valve is open increase pressure slowly to avoid damaging the pressure gauge.

Checking for Leaks

Mechanical Fuel Injection

1. Open shut-off valve on pressure gauge until the pressure on the pressure gauge has dropped below 15 bar.
2. Operate hand lever slowly until a pressure of 2.0 bar less than the measured opening pressure is reached.

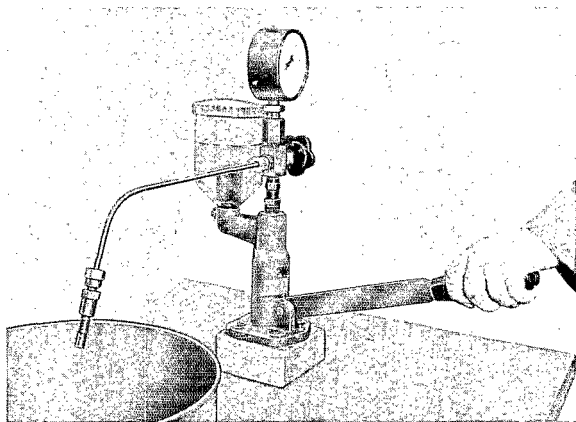
No drops should form on the valve within 15 seconds when the pressure is 2 bar less than the opening pressure.

Continuous Fuel Injection

1. Close pressure gauge shut-off valve and flush injector by operating lever many times.
2. Open shut-off valve and increase pressure slowly to 0.5 bar less than the previously measured opening pressure (but not below 2, 3 bar), and hold.
No drops should form on injector within 15 seconds.

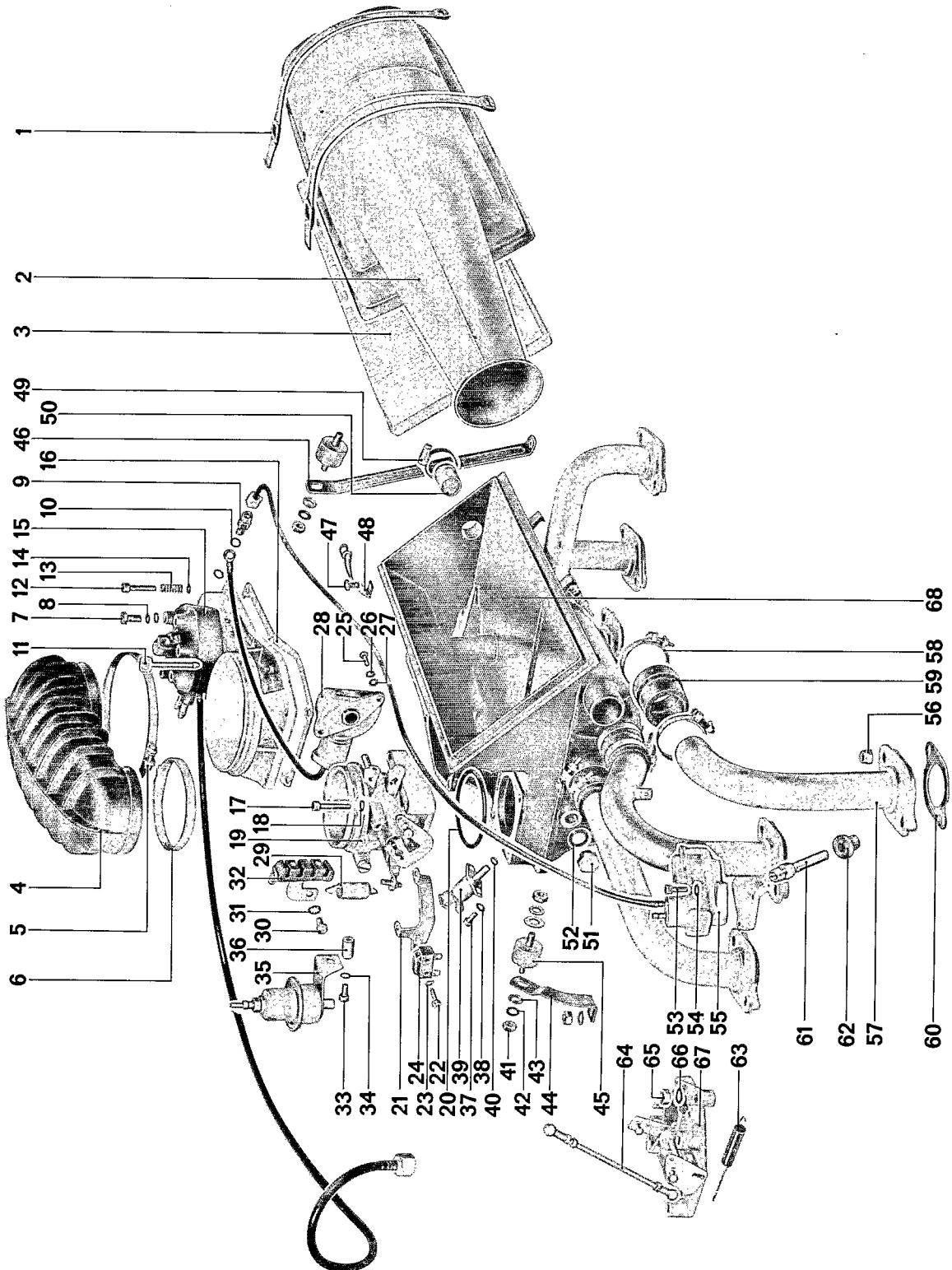
Humming Test/Checking Spray Pattern

1. Close pressure gauge shut-off valve and flush injector by operating lever many times (0.5 sec./stroke).



2. Then reduce lever movement to about 1 sec./stroke. This must cause injector to hum. No drops should form on injector. A tight spray pattern is not allowable. An atomized, one-sided spray pattern of about 35° is permissible.

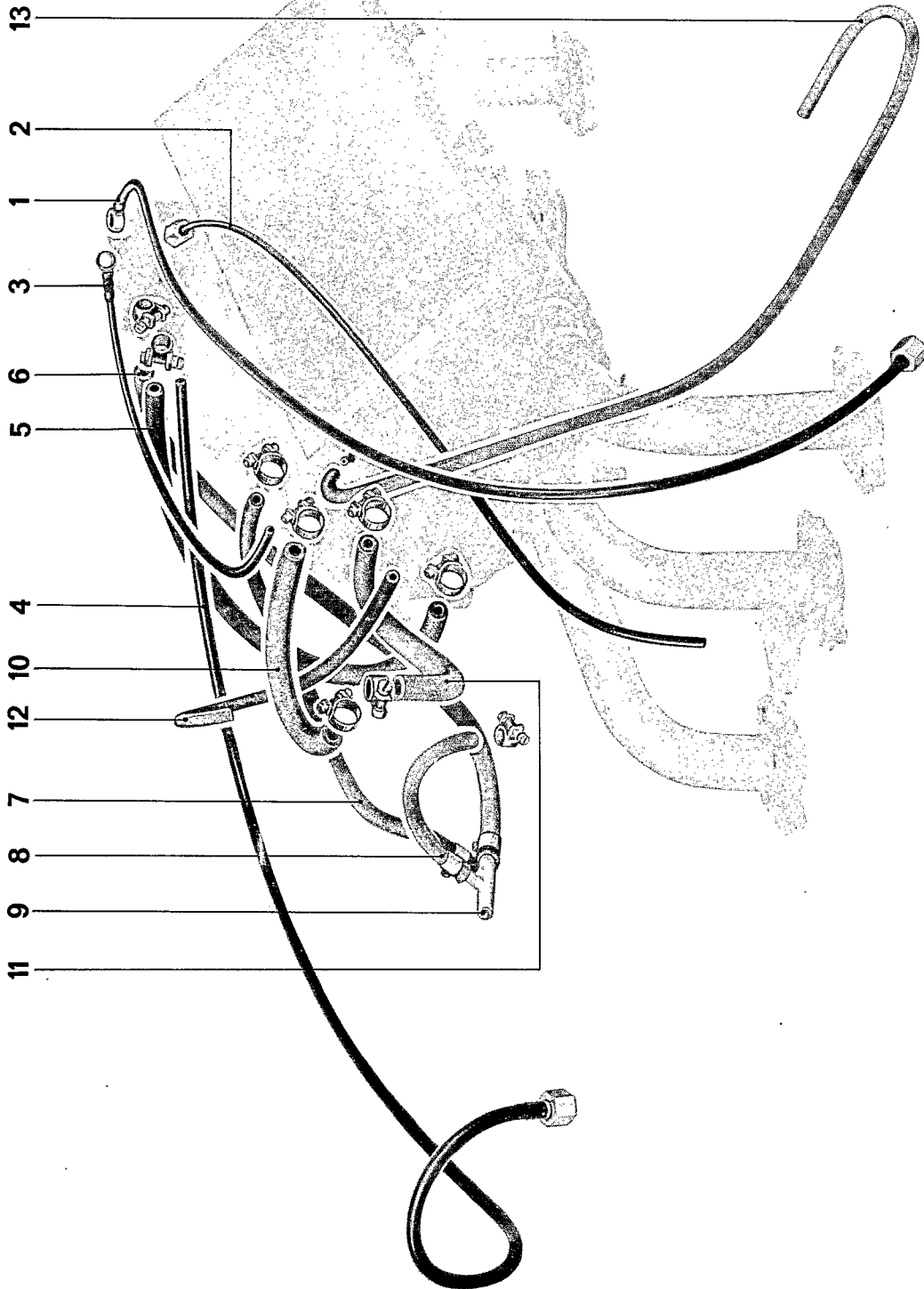
DISASSEMBLING AND REASSEMBLING



No.	Description	Qty	removing	Note when installing	References
1	Rubber strap	2			
2	Intake horn	1			
3	Filter cartridge	1		Replace if necessary	
4	Duct	1			
5	Hose clamp	1			
6	Hose clamp	1			
7	Banjo bolt	6			
8	Gasket	12		Replace	
9	Stud	1			
10	Gasket	2		Replace	
11	Plug	1			
12	Allen bolt	6		Tighten lightly, then loosen by 1 turn	Page 2.2 - 1/7
13	Spring	6			
14	Washer	6			
15	Mixture control unit	1			Page 2.2 - 1/7
16	Gasket	1		Replace	
17	Allen bolt	4			
18	Spring washer	4			
19	Throttle valve housing	1			Page 2.2 - 1/8
20	O-ring	1		Replace	
21	Holder	1			
22	Allen bolt	2			
23	Spring washer	2			
24	Microswitch	1			Page 3.2 - 1/4

No	Description	Qty	Note when		Reference
			removing	installing	
25	Allen bolt	2			Page 2.2 - 1/8
26	Lock washer	2		Replace	
27	Washer	2			
28	Control pressure regula- tor for throttle valve position	1			
29	Spring	1			
30	Bolt	1			
31	Lock washer	1			
32	Terminal block	1			
33	Allen bolt	1			
34	Washer	1			
35	Auxiliary air device	1			Page 2.2 - 1/10
36	Spacer sleeve	1			
37	Allen bolt	2			
38	Spring washer	2			
39	Start (enrichment) valve	1			
40	O-ring	1		Replace	
41	Bolt	4			
42	Spring washer	4			
43	Washer	3			
44	Support	1			
45	Rubber/metal cushion	2			

No	Description	Qty	Note when removing installing	Reference
46	Support	1	Replace	Page 2.2 - 1/9
47	Sheet metal screw	2		
48	Holder	2		
49	Hose clamp	1		
50	Flame trap cartridge	1		
51	Plug	1		
52	Gasket	1		
53	Allen bolt	2		
54	Spring washer	2		
55	Control pressure regulator for warm running compensation	1		
56	Nut	12		
57	Intake pipe	6		
58	Hose clamp	12		
59	Rubber muff	6		
60	Gasket	6		
61	Injection valve	6		Page 2.2 - 1/13
62	Rubber bushing	6		
63	Spring	1		
64	Pull rod	1		
65	Nut	3		
66	Spring washer	3		
67	Bracket	1		
68	Intake manifold	1		



No	Designation	Qty	Note when removing installing	References
1	Injection line	6		
2	Supply line to control pressure regulator for warm running compensation	1		Page 2.2 - 1/15
3	Supply line to control pressure regulator for throttle valve position	1		Page 2.2 - 1/15
4	Supply line from fuel filter to mixture control unit	1	Install in proper position	Page 2.2 - 1/15
5	Supply line to start (enrichment) valve	1		
6	Return line from mixture control unit to fuel tank	1		
7	Return line from control pressure regulator for throttle valve position to fuel tank	1		
8	Return line from control pressure regulator for warm running compensation to fuel tank	1		
9	Connector for return flow hoses	1		
10	Vacuum hose	1		
11	Vacuum hose	1		
12	Vacuum hose	1		
13	Vacuum hose	1		

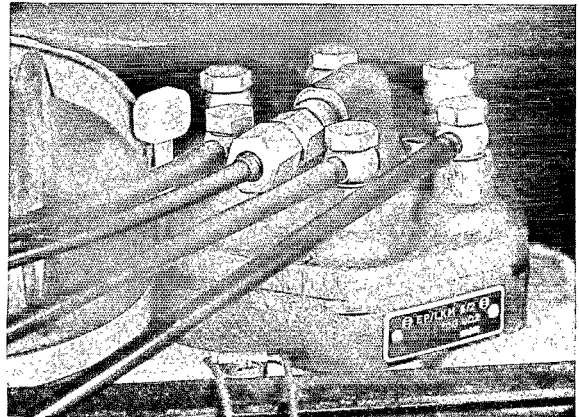
REMOVING AND INSTALLING MIXTURE CONTROL UNIT

Removal

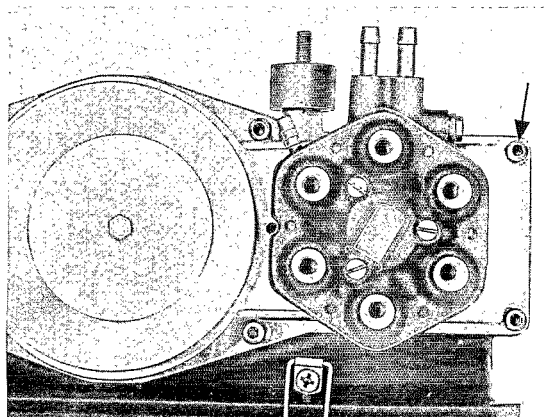
1. Disconnect all fuel lines and hoses from the mixture control unit. Detach fuel supply line from fuel filter.

NOTE

Use rag to prevent fuel spillage.



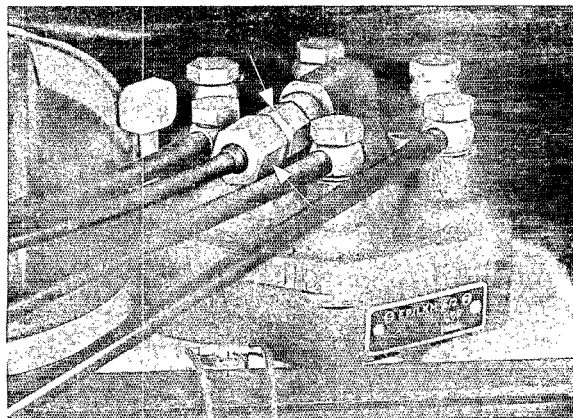
2. Unscrew 6 Allen bolts and remove with spring and plate.
3. Remove mixture control unit together with gasket.



Installation

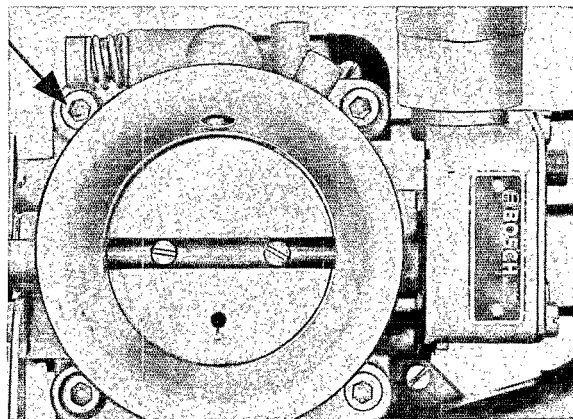
1. Watch proper location of gasket.
2. Tighten Allen bolts to bottom, then back off 1 complete turn.
3. Use new gaskets in fuel line connections.
4. Bleed fuel line system (see page 2.2 - 1/17).

REMOVING AND INSTALLING THROTTLE VALVE HOUSING AND CONTROL PRESSURE REGULATOR (THROTTLE VALVE POSITION)



Removal

1. Disconnect fuel line, which connects mixture control unit with the control pressure regulator for throttle valve position, from the mixture control unit.
2. Disconnect fuel hose from regulator.



3. Remove 4 Allen bolts and withdraw throttle valve housing with control pressure regulator for throttle valve position.
4. Remove 2 Allen bolts and remove regulator from throttle valve housing.

Installation

1. Check proper positioning of the O-ring for the throttle valve housing.
2. Adjust control pressure regulator for throttle valve position (see page 3.2 - 1/5).
3. Bleed fuel line system (see page 2.2 - 1/17).

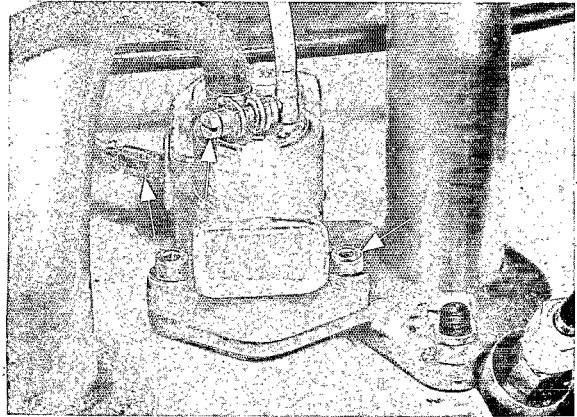
REMOVING AND INSTALLING CONTROL PRESSURE REGULATOR (WARM RUNNING COMPENSATION)

1. Disconnect ground strap from both batteries.

2. Detach electrical connections.

3. Disconnect fuel hose.

4. Remove Allen bolts.

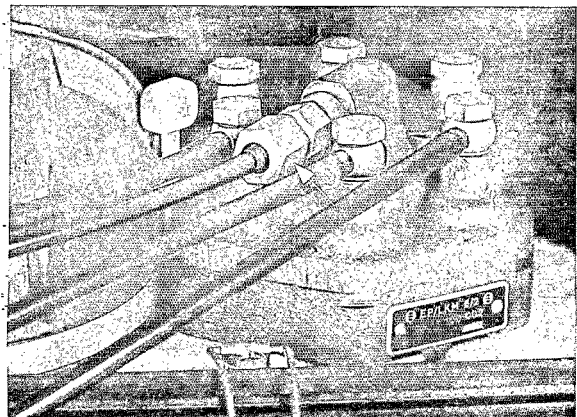


5. Remove fuel line which connects mixture control unit with the control pressure regulator for warm running compensation from the mixture control unit.

NOTE

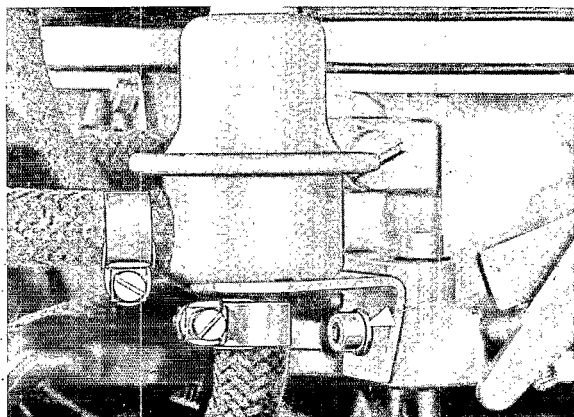
Use rag to prevent fuel spillage.

6. Bleed fuel line system (see page 2.2 - 1/17).



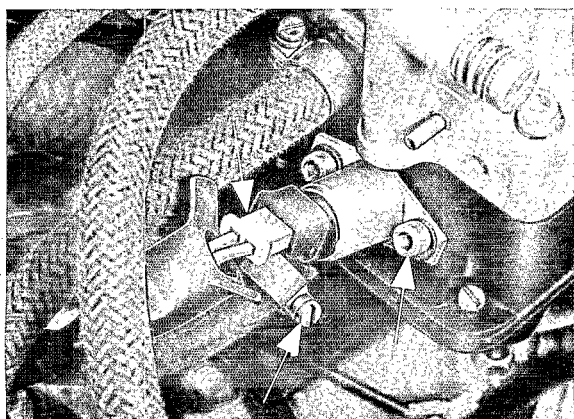
REMOVING AND INSTALLING START (ENRICHMENT) VALVE

Removal



1. Disconnect ground strap from both batteries.

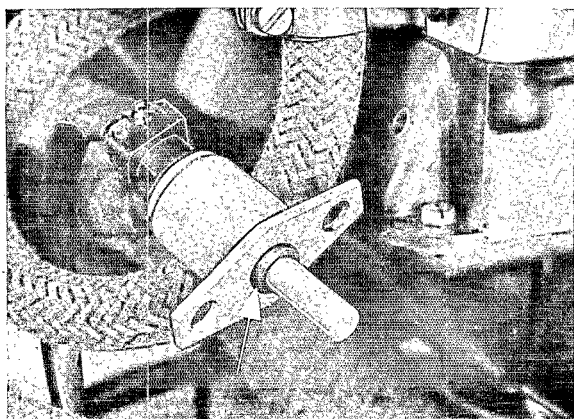
2. Remove auxiliary air device from throttle valve housing.



3. Detach twin electrical connector from the start (enrichment) valve.

4. Remove Allen bolts.

5. Loosen hose clamp and detach fuel line.



Installation

Be sure O-ring is positioned properly.

NOTE

Electrical connector must point upward.

Bleed fuel line system (see page 2.2 - 1/17).

REMOVING AND INSTALLING FUEL FILTER

1. Disconnect ground strap from both batteries.

2. Remove fuel line coupling nut.

NOTE

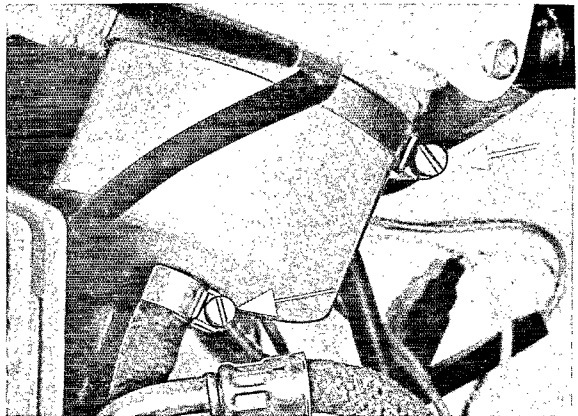
Use rag to prevent fuel spillage.

3. Remove retaining clamp and hose clamp and remove filter.

NOTE

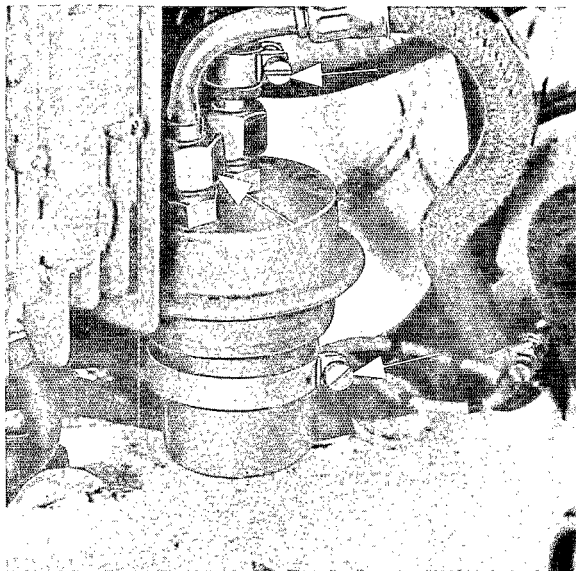
Use an appropriate vessel to collect fuel which may be running out.

4. Do not overtighten the retaining strap since this could deform the filter assembly.



5. Check all connections for leaks.
6. Bleed fuel line system (see page 2.2 - 1/17).

REMOVING AND INSTALLING FUEL PRESSURE ACCUMULATOR



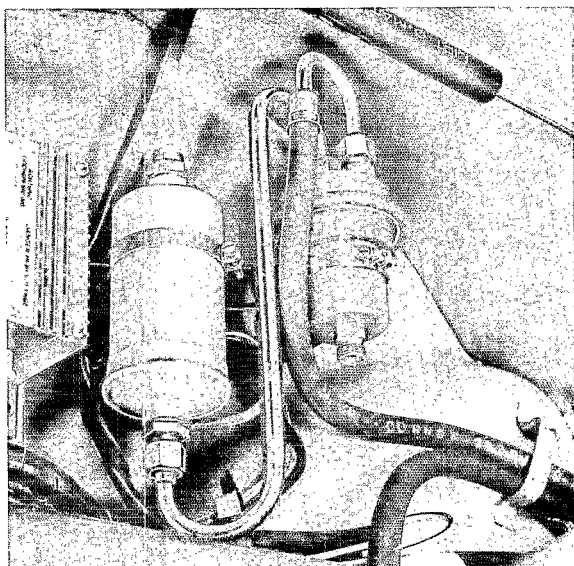
1. Unscrew coupling nut from fuel supply line at the fuel pressure accumulator.

NOTE

Use rags to prevent fuel spillage.

2. Remove attaching clamp.
3. Loosen hose clamp, withdraw fuel pressure accumulator and plug fuel hose with an appropriate plug.
4. Check all connections for leaks.

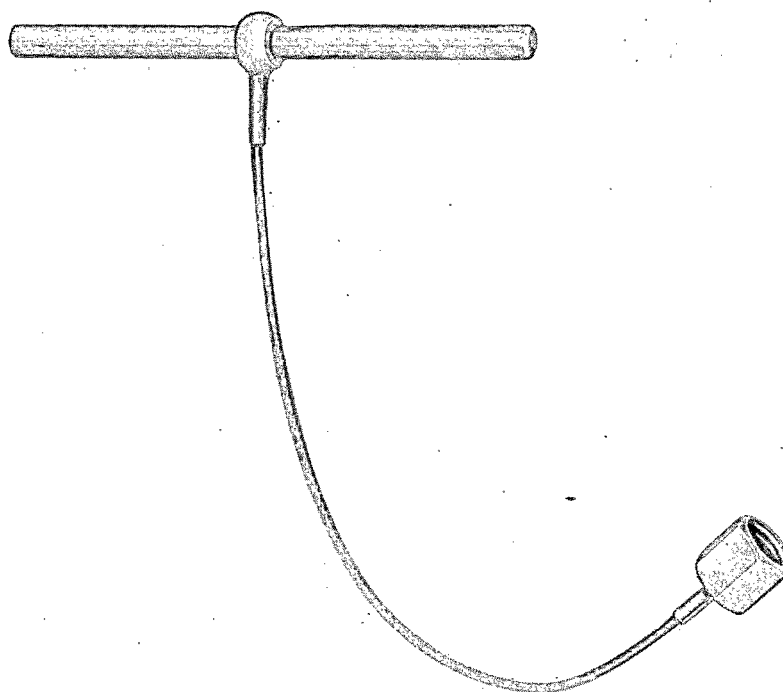
Arrangement from 1977 Models



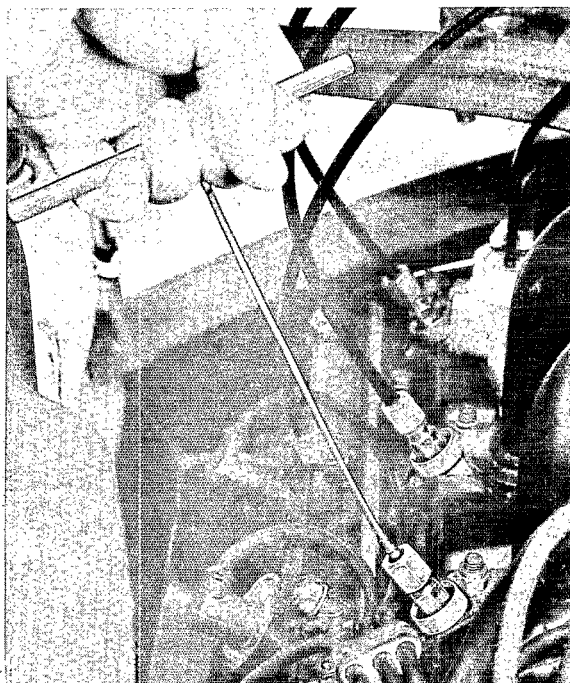
5. Bleed fuel line system (see page 2.2 - 1/17).

REMOVING AND INSTALLING INJECTION VALVES

TOOLS

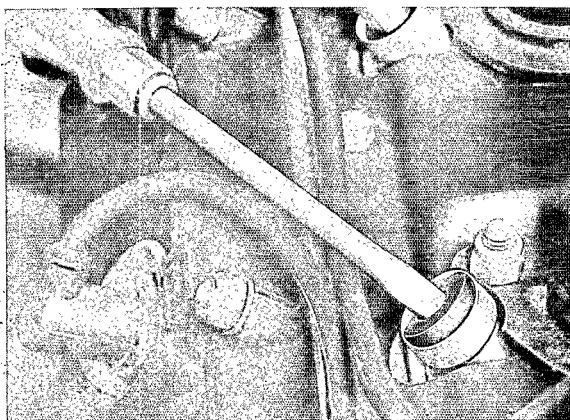


No	Description	Special Tool	Remarks
1	Remover	P 384	



Removal

1. Unscrew coupling nut from the injection line at the injection valve.
2. Install special tool P 384 and pull injection valve out.



3. If rubber bushing remains in the support sleeve, take the bushing out with a screwdriver.

NOTE

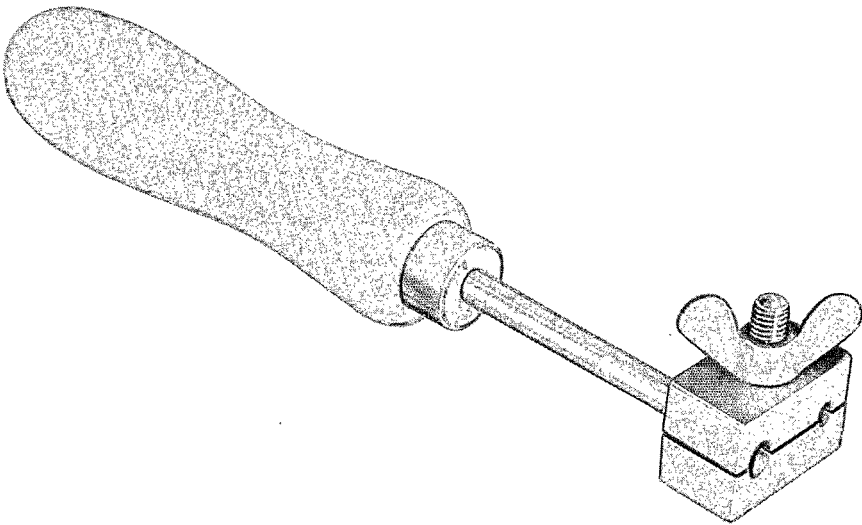
Avoid damaging the supporting sleeve.

Installation

1. Inspect rubber bushing, replace if necessary.
2. Use a drop of engine oil when installing the bushing.
3. Press injection valve firmly into the supporting sleeve to stop.
The rubber bushing must be seated below the bulge in the supporting sleeve.
4. Check fuel lines for leaks.
5. Bleed fuel line system (see page 2.2 - 1/17).

REPLACING PLASTIC FUEL LINES

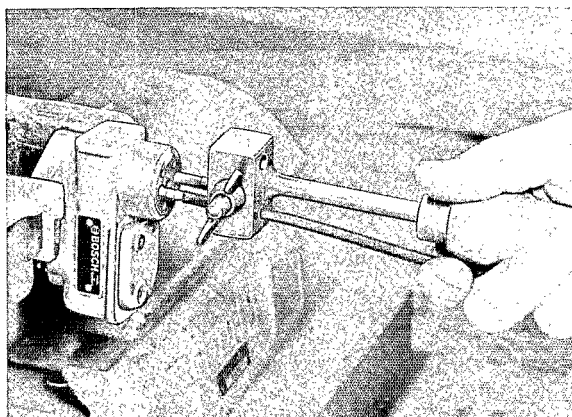
TOOLS



No	Description	Special Tools	Remarks
1	Installer	P 385	

The mixture control unit, control pressure regulator for throttle valve position and control pressure regulator for warm running compensation replacements are furnished with plastic fuel lines attached. Defective plastic fuel lines can be replaced individually.

1. Using a soldering iron, heat defective fuel line in the connector area and pull the line off.



2. Mount replacement part in a vise with soft jaw protectors.
3. Mount fuel line in special tool P 385, allowing push-on section to protrude from the tool.
4. Push dry fuel line onto the connector.

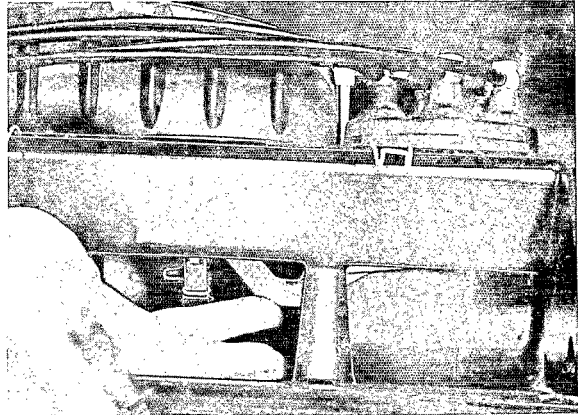
NOTE

Make sure that line is properly positioned.

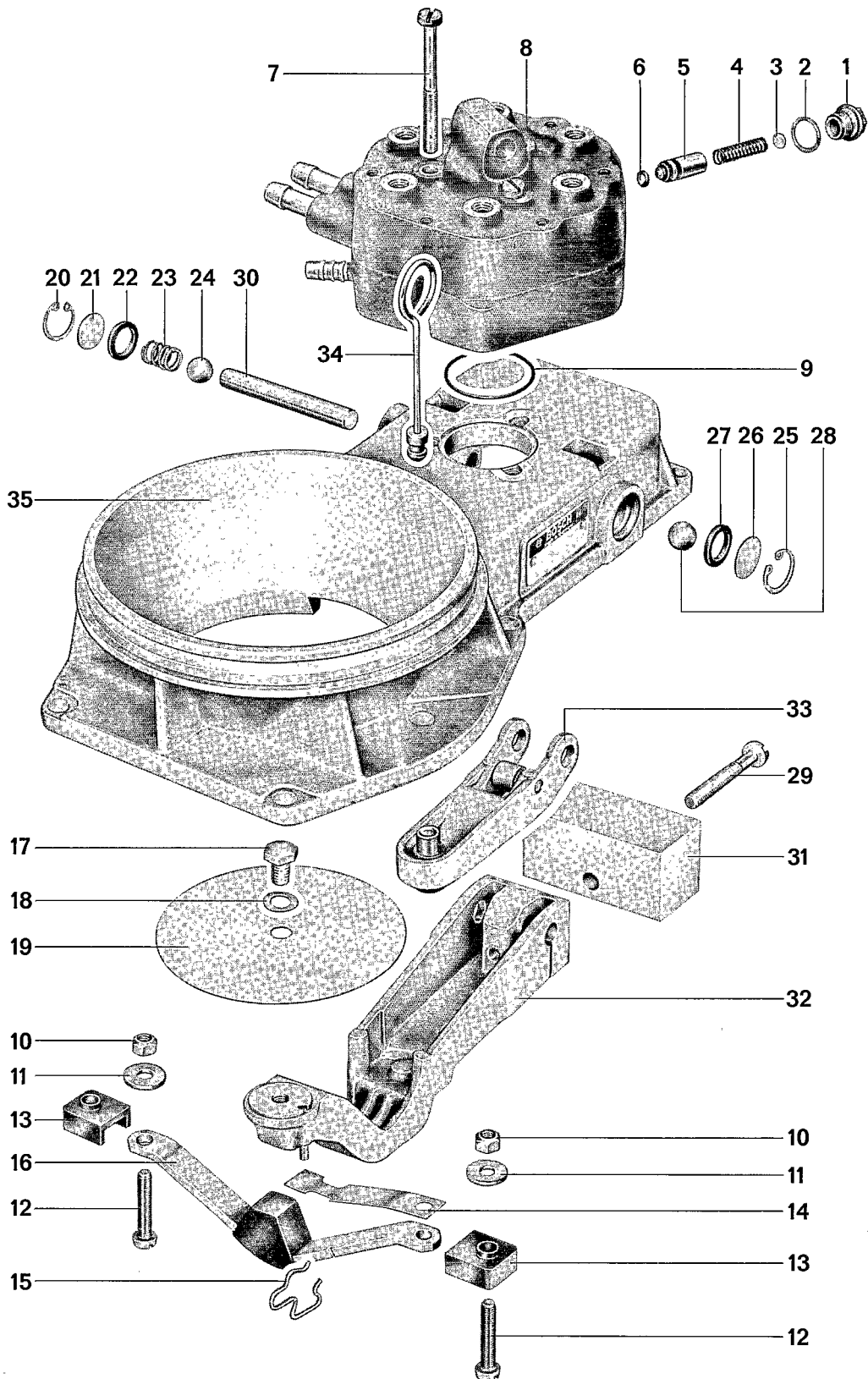
BLEEDING FUEL LINE SYSTEM

The fuel injection system must be bled (prior to starting) whenever a fuel line system component has been replaced.

1. Remove intake horn with filter cartridge.
2. Switch the ignition on.
3. Press diaphragm up by hand to stop (for 1 second to a maximum of 5 seconds) until the fuel lines are filled and the injection valves spray fuel audibly.



DISMANTLING AND ASSEMBLING MIXTURE CONTROL UNIT

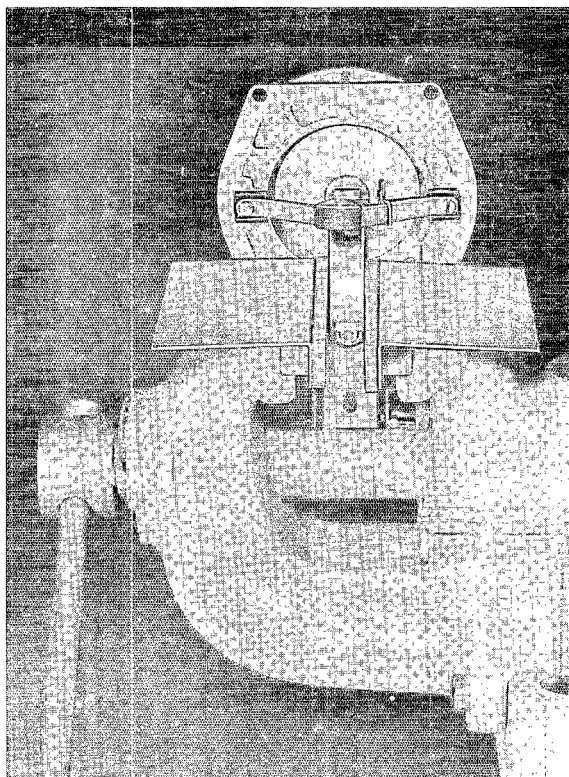


No.	Description	Qty.	Note during:		remarks
			removal	installation	
1	Plug	1		Torque to 1.3 to 1.5 mkg	
2	Seal A 10 x 13.51	1		Replace	
3	Shim	1			2.2 - 2/8
4	Spring	1			
5	Piston	1	Use conical wood peg to drive out	Replace fuel distributor if damaged	
6	Seal	1			
7	Capscrew M 5 x 50	3		Torque to 32 - 38 cmkg	
8	Fuel distributor	1	Don't let control plunger fall out		do not dismantle
9	Seal	1		Replace	
10	Nut	2			
11	Washer	2			
12	Capscrew	2		Torque to 47 - 53 cmkg	
13	Insulator	2			
14	Spring	1		Replace if necessary; install correctly	
15	Clip	1		Replace if necessary; install correctly	
16	Stop	1		Install correctly	
17	Hex head screw	1		Torque to 50 - 55 cmkg and apply liquid thread locking compound	
18	Washer	1			
19	Sensor plate	1		Check, replace if necessary	2.2 - 2/4

No.	Description	Qty.	Note during:		remarks
			removal	installation	
20	Circlip	1	First remove this circlip	Install with sharp edge facing outward	
21	Cover	1			
22	Seal	1		Replace	
23	Spring	1			
24	Ball	1		Coat with silicone grease	
25	Circlip	1		First install this circlip with sharp edge facing outward	
26	Cover	1			
27	Seal	1		Replace	
28	Ball	1		Coat with silicone grease	
29	Capscrew	1		Torque to 47 - 53 cmkp an apply liquid thread locking compound	
30	Pin	1		Check, replace if necessary	
31	Counterweight	1			
32	Operating lever	1		Check	2.2 - 2/6
33	Follower	1		Check if bearing play is too large, needle bearing is damaged, mixture control screw is damaged or rusted, replace parts if necessary	2.2 - 2/7
34	Plug	1			
35	Air flow sensor hsg.	1		Coat bearing bores with silicone grease	

INSTRUCTIONS FOR DISMANTLING AND ASSEMBLING MIXTURE CONTROL UNIT

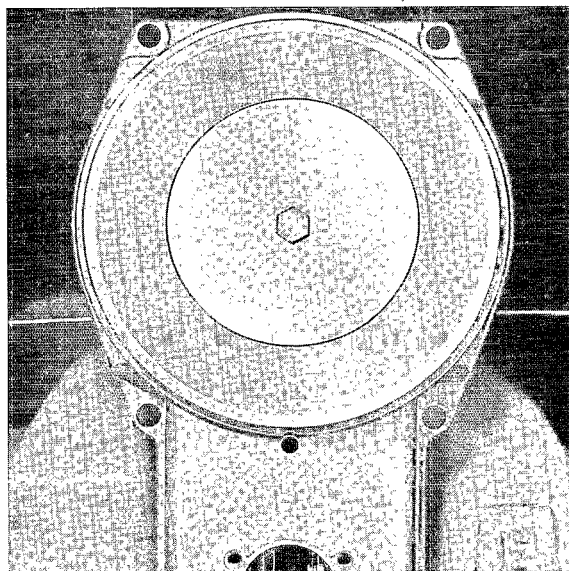
REMOVING AND INSTALLING SENSOR PLATE



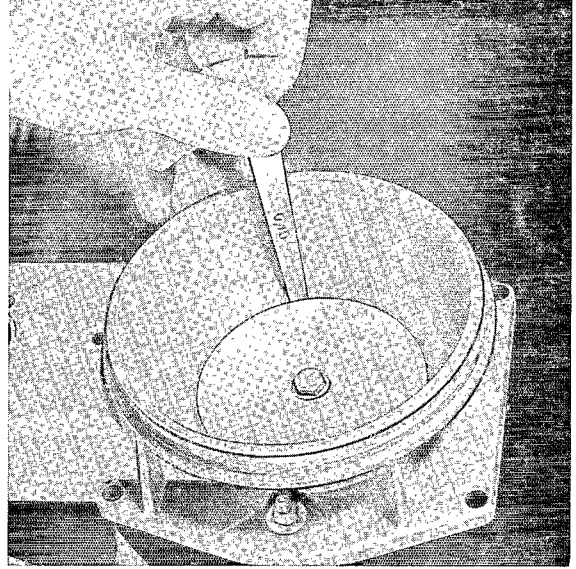
Removing

1. Remove fuel distributor.
2. Clamp mixture control unit vertically in vise with plastic guards on jaws. Clamp mixture control unit at bend in narrow section of operating lever.
3. Loosen sensor plate mounting screw and remove sensor plate.

Installing



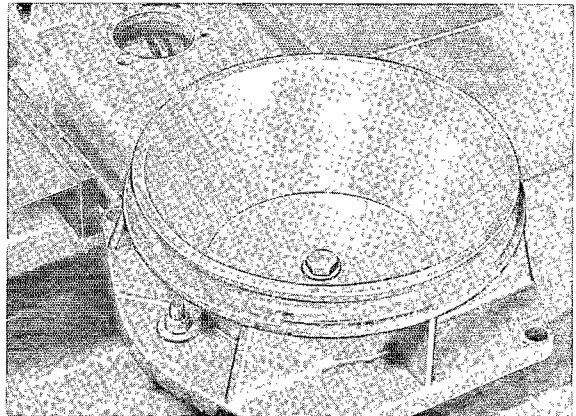
1. Clamp mixture control unit horizontally. Coat sensor plate mounting screw with "Loctite" or "Omnifit". Place new or old sensor plate in center of operating lever and slightly tighten screw by hand.
2. Measure gap between sensor plate and air venturi. A visible gap of about 0.10 mm should be seen all around the sensor plate.



CAUTION

This test requires that the sensor plate be set at the correct height (rest position). The upper edge of the sensor plate must be flush with the lower edge of venturi.

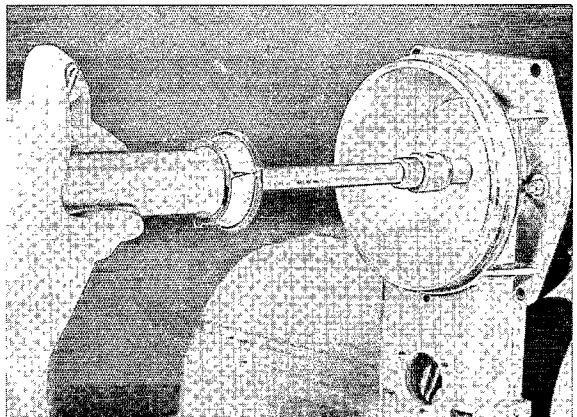
The height position can be corrected by bending the wire clip (refer to page 1.1 - 1/3).



3. Clamp mixture control unit vertically in vise with plastic guards an jaws. Clamp mixture unit at bend in narrow section of operating lever (housing must be able to be moved toward vise).

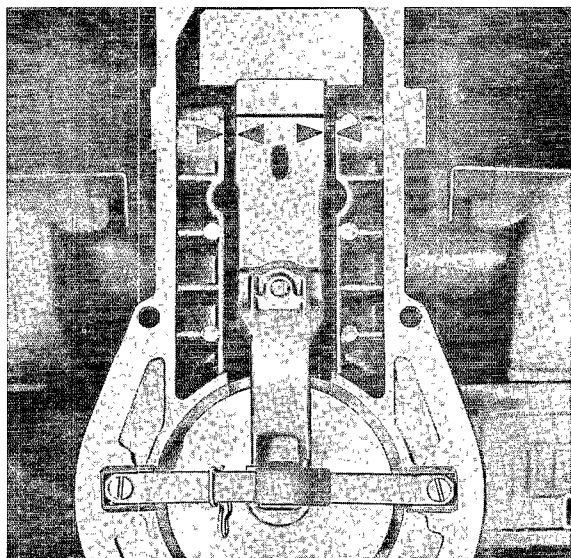
Torque hex head screw to 50 - 55 cmkp.

4. Recheck sensor plate adjustment.

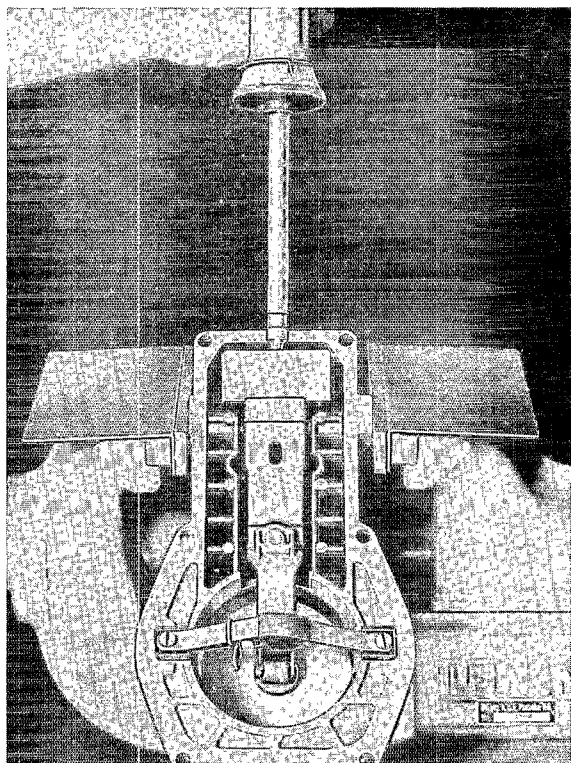


LOCATING OPERATING LEVER WITH FOLLOWER IN AIR FLOW SENSOR HOUSING

1. Apply "Loctite" or "Omnifit" to counterweight mounting screw and tighten screw slightly.



2. Adjust operating lever in air flow sensor housing.



3. Tighten mounting screw to 47 - 53 cmkp.

BASIC ADJUSTMENT OF MIXTURE CONTROL SCREW AFTER REPLACEMENT OF OPERATING LEVER

Caution

This test requires that the sensor plate be positioned correctly (rest position).

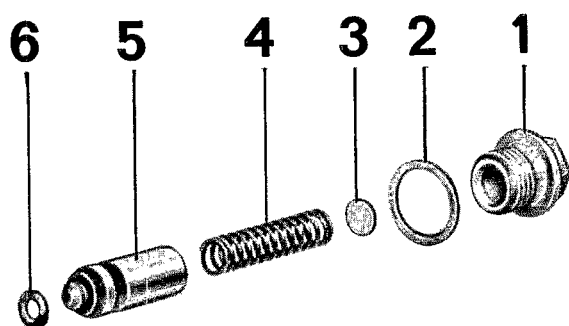
Caution

Never apply downward pressure to adjusting wrench during adjustments, since this could change the injection timing.

1. Install mixture control unit.
2. Bleed fuel lines. (Disconnect injectors and hold in a container. Move sensor plate by hand many times).
3. Use adjusting wrench P 377 to initially turn the mixture control screw counterclockwise about 1 - 2 turns.
4. Turn on ignition, pull plugs off safety switch on air flow sensor or fuel pump relay.
5. Turn mixture control screw clockwise until the injectors just barely eject. From this point turn the mixture control screw back, i.e. counterclockwise, by one half turn.
6. Run engine to operating temperature (oil temperature 80° to 90° C) and adjust idle speed and CO level to their final specified values.

Install injectors.

REPLACING PISTON SEAL OF FUEL DISTRIBUTOR PRESSURE RELIEF VALVE

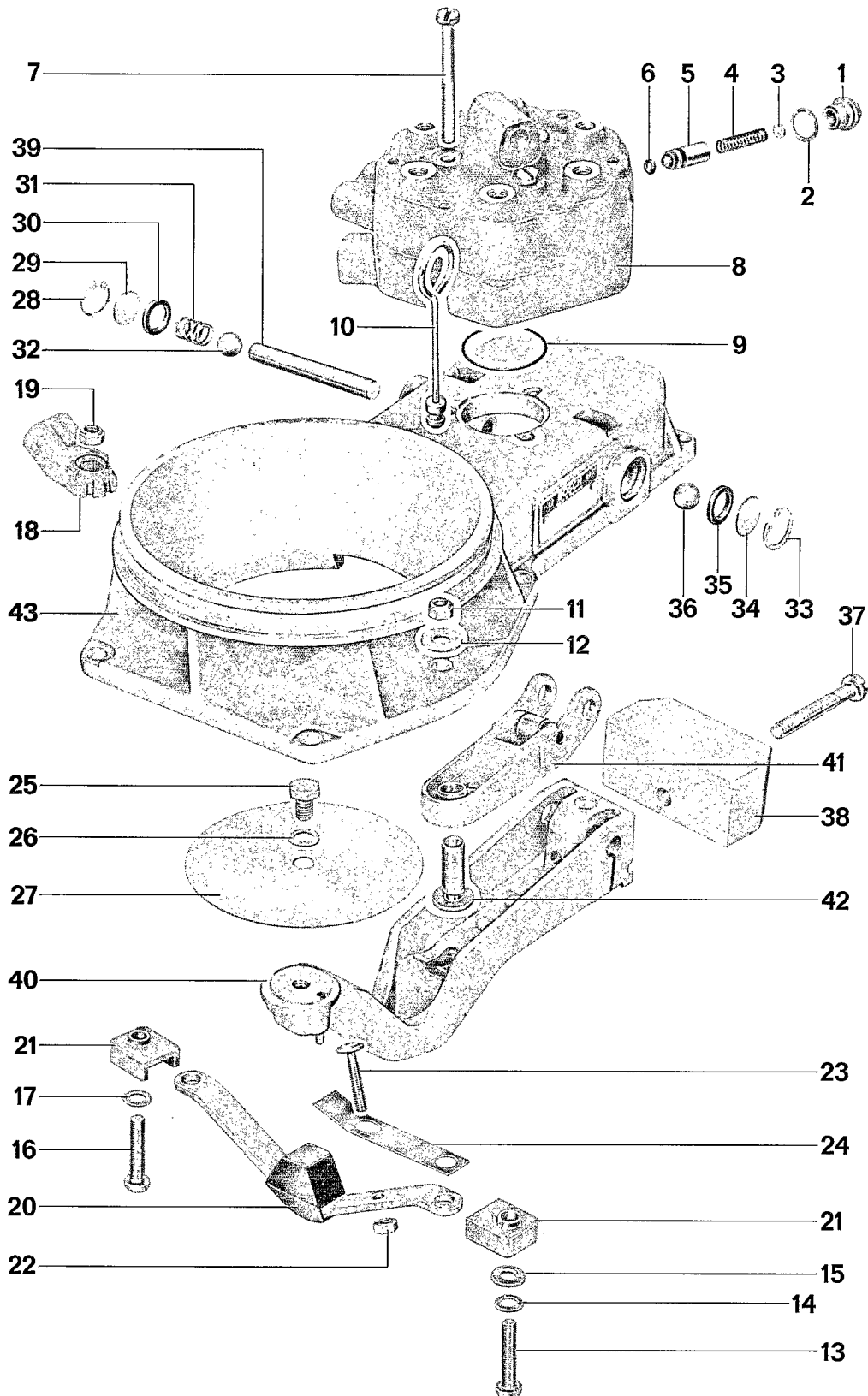


1. Plug
2. Seal
3. Shim
4. Spring
5. Piston
6. Seal

1. Clean fuel thoroughly.
2. Remove plug, being careful of shim in plug.
3. Remove spring and piston (if necessary, use conical wood peg).
4. Replace seal on conical section of piston, being careful not to damage new seal and piston.
5. Install plug with shim (as found while removing) and new seal. Torque screw to 1.3 - 1.5 mkp.
6. Check pressure of system (refer to page 1.1 - 1/10), correcting with shims if necessary.

DISASSEMBLING AND ASSEMBLING MIXTURE CONTROL UNIT

- MODIFICATIONS from April, 1976 -



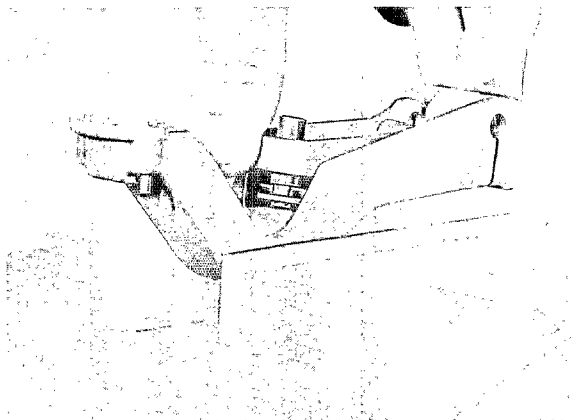
No.	Description	Qty.	Note when removing	installing	Remarks
1	Plug	1		Torque to 13-15 Nm (1.3-1.5 kpm)	
2	Seal	1		Replace	
3	Shim 0.1 mm thick 0.5 mm thick	X			Quantity as required
4	Spring	1			
5	Piston	1	Pull out with tapered wood dowel	Check, replace entire distributor if damaged (fitted part)	
6	O-ring	1	Be careful not to damage piston	Replace	
7	Fillister head cap screw	3		Torque to 3.5 Nm (0.35 kpm)	
8	Fuel distributor	1	Be careful not to let control piston fall out	Check control piston, clean with gasoline, install with chamfer facing down.	Never disassemble
9	Seal	1		Replace	
10	Plug	1			
11	Nut	1			
12	Washer	1			
13	Fillister head cap screw	1		Torque to 4.7-5.3 Nm (0.47-0.53 kpm)	
14	Washer	1			
15	Insulator	1			
16	Fillister head cap screw	1		Torque to 4.7-5.3 Nm (0.47-0.53 kpm)	
17	Washer	1			
18	Plug connector	1		Install in correct position	

No.	Description	Qty.	Note when		Remarks
			removing	installing	
19	Nut	1			
20	Stop bracket	1			
21	Plastic insulator	2			
22	Nut	1			
23	Adjusting screw	1			
24	Leaf spring	1			
25	Bolt	1		Torque to 5.0-5.5 Nm (0.50-0.55 kpm) and apply liquid locking agent	
26	Spring washer	1			
27	Sensor plate	1		Check, replace if necessary	
28	Circlip	1		Sharp side faces out	
29	End plate	1			
30	Seal	1			
31	Spring	1			
32	Ball	1		Lubricate with (Bosch Ft 2 v 2) silicone grease	
33	Circlip	1			
34	End plate	1			
35	Seal	1			
36	Ball	1			
37	Fillister head cap screw	1		Torque to 4.7-5.3 Nm (0.47-0.53 kpm) and apply liquid locking agent	
38	Counterweight	1			

No.	Description	Qty.	Note when removing installing	Remarks
39	Pivot pin	1		
40	Operating lever	1		
41	Adjusting lever	1	Check whether bearing play is excessive or needle bearing is dam- aged, replace if neces- sary	
42	Mixture control screw	1		
43	Air flow sensor housing	1	Lubricate bearing bores with (Bosch Ft 2 v 2) silicone grease	

DISASSEMBLING AND ASSEMBLING INSTRUCTIONS

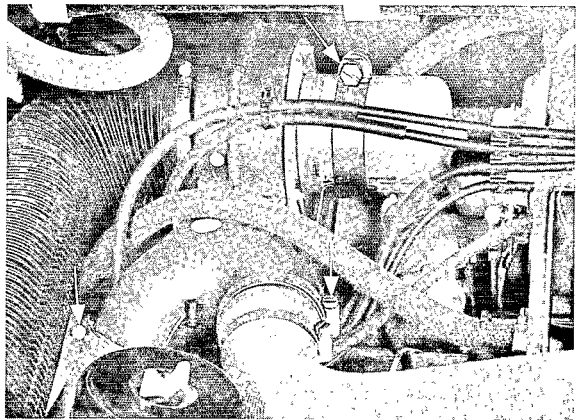
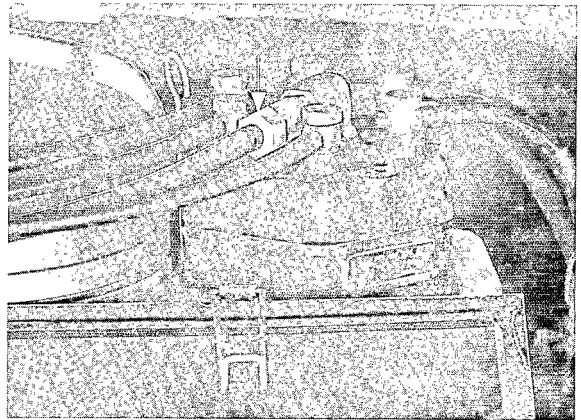
Engage adjusting lever in spring holder by applying sufficient pressure.



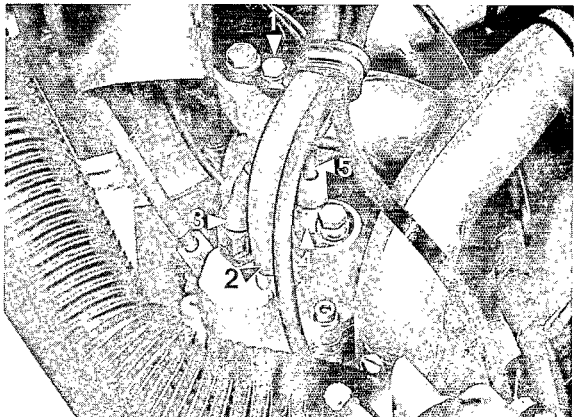
REMOVING AND INSTALLING VACUUM CONTROLLED WARM-UP REGULATOR

Removing

1. Disconnect battery.
2. Disconnect warm intake air connection.
3. Release fuel system pressure by loosening the warm-up regulator pressure line connection at the mixture control unit. Wrap a rag around this connection when loosening to catch escaping fuel. Retighten lines afterwards.
4. Remove air pump air filter.
5. Remove left and right heater hoses, loosen clamp at heater blower and swing heater blower upward.

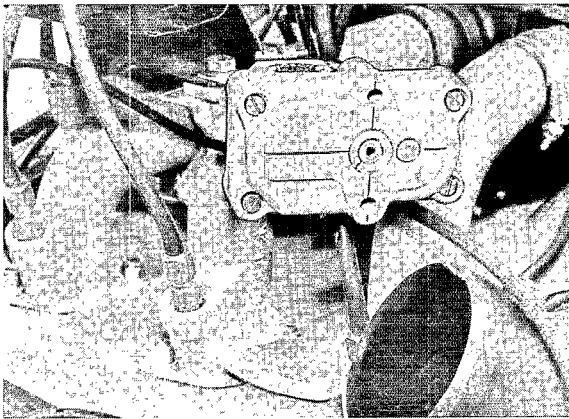


6. Loosen and remove clamp holding hoses and lines (1), vacuum hose clamp (2), plug connector (3), fuel return line (4) and fuel feed line (5).
7. Loosen two socket head capscrews and remove warm-up regulator.



Installing

Torque fuel return line hollow bolt to 1.1 mkp.

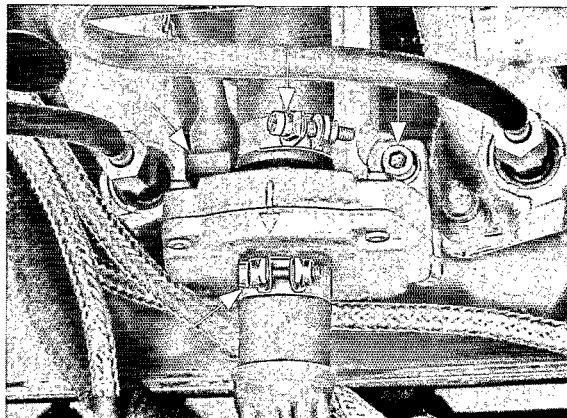


Note

The bottom of the warm-up regulator and the holding plate must be clean to assure proper ventilation for the warm-up regulator.

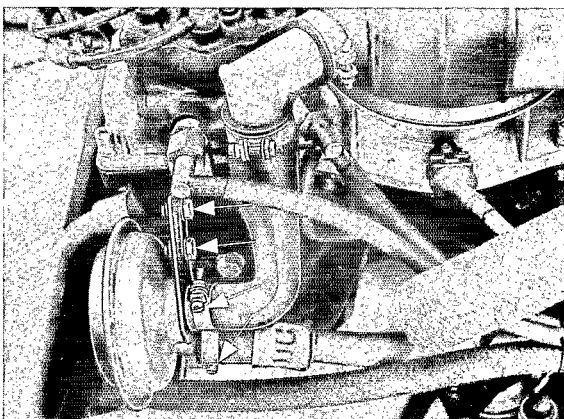
REMOVING AND INSTALLING AUXILIARY AIR REGULATOR

1. Pull wire plugs off of auxiliary air regulator.
2. Loosen hose clamps.
3. Loosen socket head cap screws and remove auxiliary air regulator.



REMOVING AND INSTALLING AUXILIARY AIR VALVE

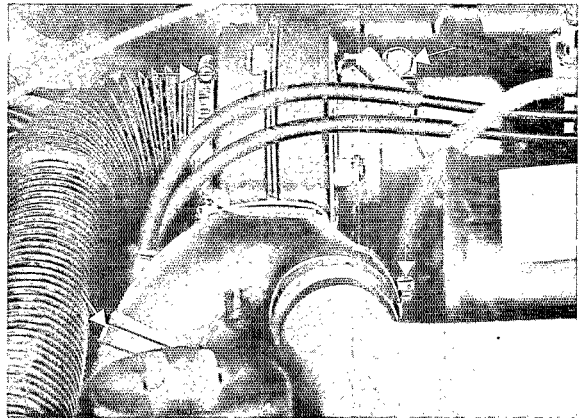
1. Loosen hose clamps and pull hoses off of auxiliary air valve.
2. Loosen mounting screws and remove valve.



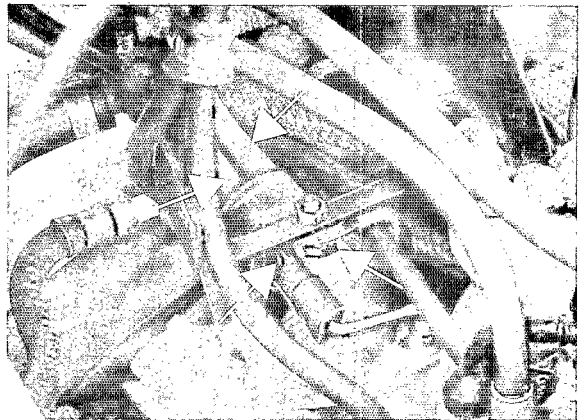
REMOVING AND INSTALLING THERMOVALVE

Removing

1. Remove formed hose, left heater hose and right heater hose. Disconnect electric wires, loosen clamp and remove heater blower.

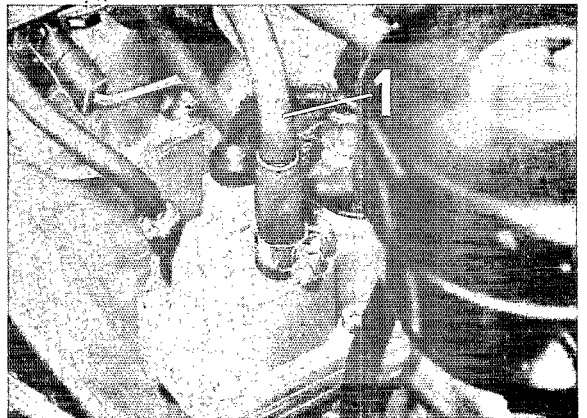
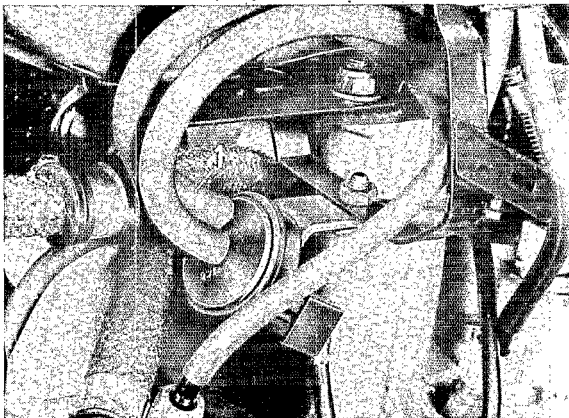


2. Disconnect electric plug at thermostatic valve. Detach hoses, unscrew bolt and remove thermostatic valve.



Installing

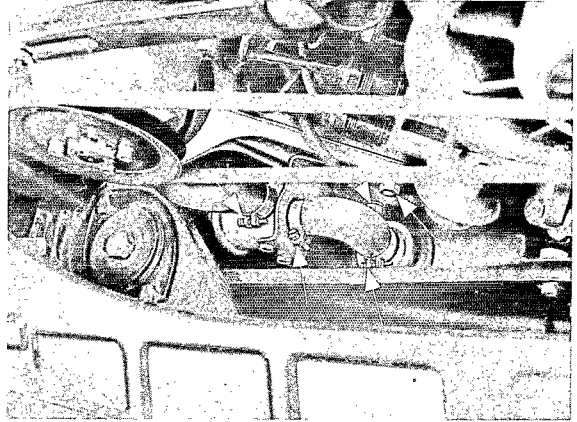
Connect vacuum hoses properly. Outer connection on thermostatic valve (1) to control pressure regulator connection (1), see photos below.



REMOVING AND INSTALLING DIVERTER VALVE

1. Loosen hose clamps and detach hose between diverter valve and check valve as well as hose between diverter valve and air pump.

2. Loosen nuts on air pump carrier and remove diverter valve with holder, pulling off vacuum hose at same time.

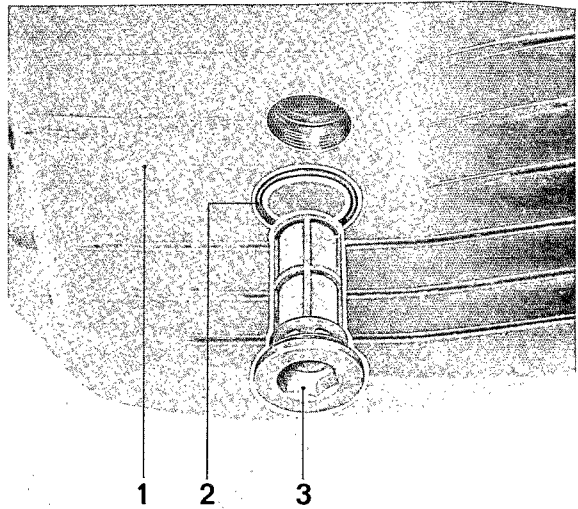


CLEANING FUEL TANK PLUG WITH BUILT-IN CIS FILTER

Fuel supply problems can be traced, among other things, to a dirty filter in the fuel tank plug.

Use new rubber gasket during reassembly.

Tank plug tightening torque is 0.8 - 0.9 mkp.



1. Fuel tank
2. Rubber gasket
3. Tank plug with filter

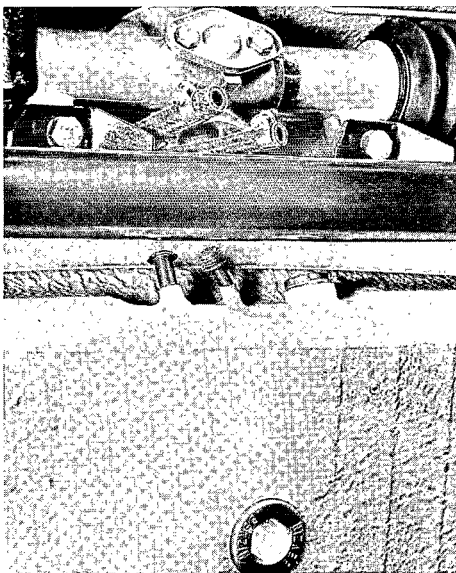
REMOVING AND INSTALLING FUEL TANK (80 Liter Steel Tank from 1974 Models)

Removing

1. Take off bottom guard.
2. Open plug and drain fuel. Then detach fuel lines at tank

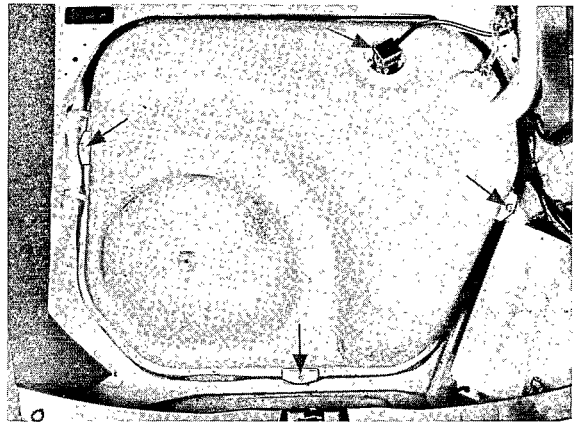
Note

Observe safety regulations when draining fuel.



3. Pull off tank vent hose and fuel gauge wire plug (first unscrew cover on top of plug).
4. Remove holders for fuel tank. If necessary, loosen battery and push battery away.
5. Loosen hose clamp on connecting hose between filler neck and tank.

6. Pull off connecting hose and remove fuel tank from above.



Installing

From 1980 models the tank vent neck as a 14 mm diameter (1974 to 1979 models: 9 mm diameter). After depletion of tanks with 9 mm neck, only new tanks with 14 mm neck will be available from parts. An adapter will be required between the connector (Y-piece) and tank when installing this tank in cars prior to 1980 model.

1. Paste new tank seal on tank. Install tank.
2. Clean filter screen on fuel drain plug. Use a new round cord seal and tighten drain plug to specified torque (see page 2.3 - 1/2).

Make sure hoses are connected correctly and tight.

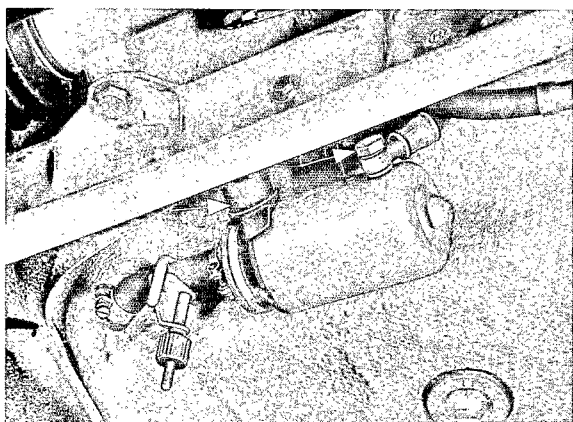
REMOVING AND INSTALLING FUEL PUMP - 1976 MODEL

Removing

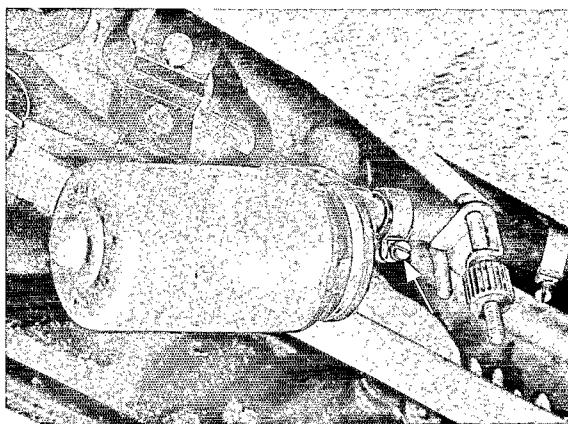
1. Remove guard.
2. Loosen strap and pull fuel pump down a little.



3. Clamp intake fuel hose shut with a pinch clamp. Pull off wire connectors, remove pressure fuel hose and catch escaping fuel.



4. Loosen intake fuel hose clamp and remove fuel pump.



Installing

1. Install pressure fuel hose hollow bolt with new seals. Torque to 16 - 23 Nm/1.6 - 2.3 mkp.

Note

Hollow bolt seals have different thicknesses and must be installed correctly. Place thicker seal between coupling and pump body; thinner seal between coupling and head of hollow bolt.

2. Install wire connectors on to appropriate terminals.

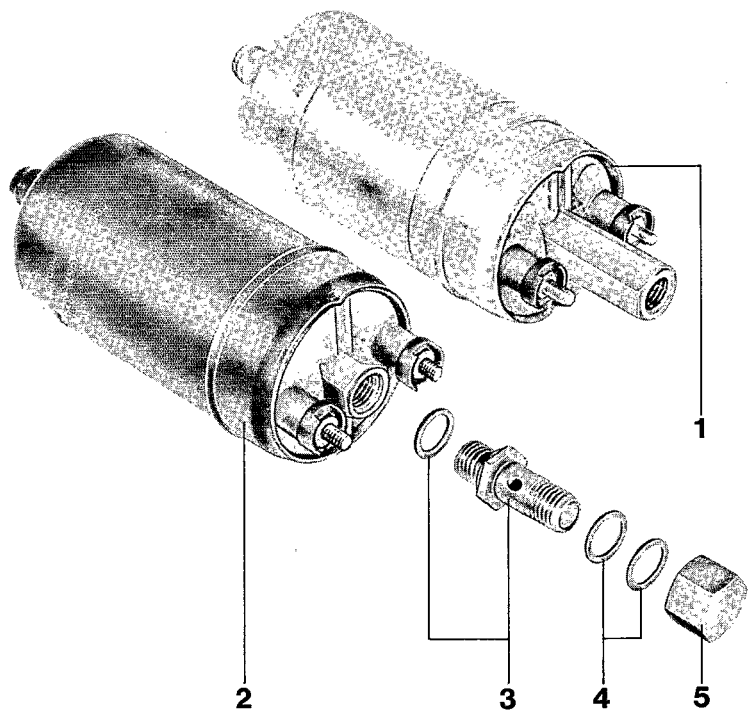
3. Pull cover over wire connectors and position rubber ring for installation.

Note

To prevent corrosion, make sure that cover fits properly.

4. Slide intake fuel hose on pump nipple and secure with hose clamp.
 5. Remove pinch clamp from intake fuel hose.
 6. Position fuel pump for installation (top electrical terminal inclined back about 35°) and secure with strap.
 7. Check hose connections for leaks.
 8. Install guard.
-

LAYOUT DRAWING OF CHECK VALVES ON FUEL PUMPS

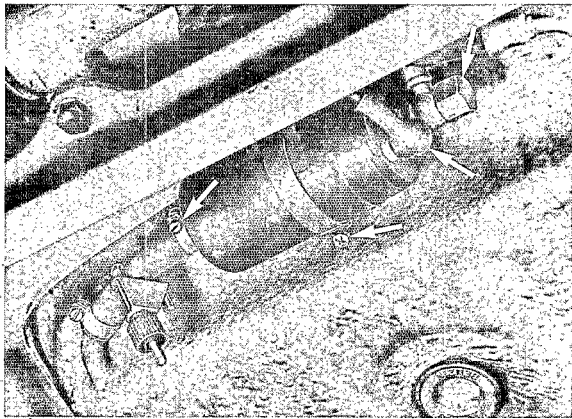


No.	Description	Qty.	Note When:		Special Instructions
			Removing	Installing	
1	Fuel pump (long neck version with integrated check valve)	1			
2	Fuel pump	1			
3	Check valve with seal	1		Always replace seal; tightening torque: 20 Nm	
4	Seal	2		Always replace	
5	Cap nut	1		Tightening torque: 20 Nm	

REPLACING CHECK VALVE

Important: Observe safety pre-cautions for work on fuel systems!

1. Remove bottom guard.
2. Pinch fuel feed hose with a shut-off device and remove pressure hose end by unscrewing cap nut on fuel pump. Catch escaping fuel.



3. Screw in new check valve with a new seal. For long neck version fuel pumps this new check valve is installed in addition to the check valve integrated in the pump.
4. Install fuel line and new seals, and secure with cap nut.

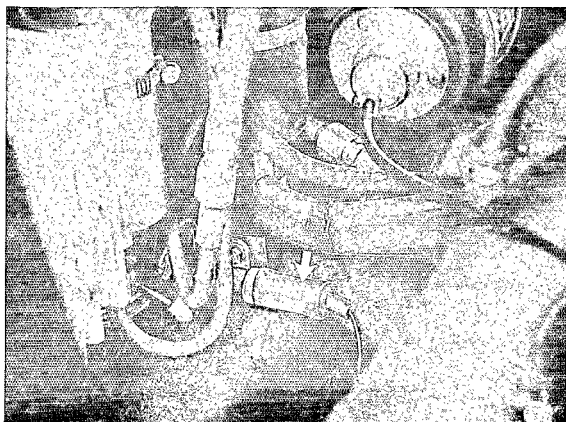
Important: Make sure fuel hose is routed correctly and cannot rub before tightening cap nut.

5. Remove shut-off device and check for leaks. Install bottom guard again.

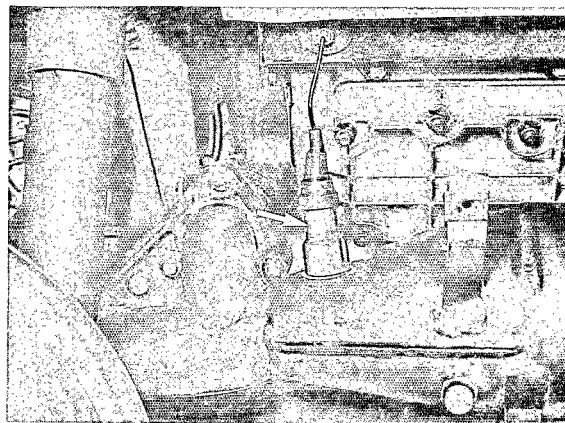
REMOVING AND INSTALLING OXYGEN SENSOR

Removing

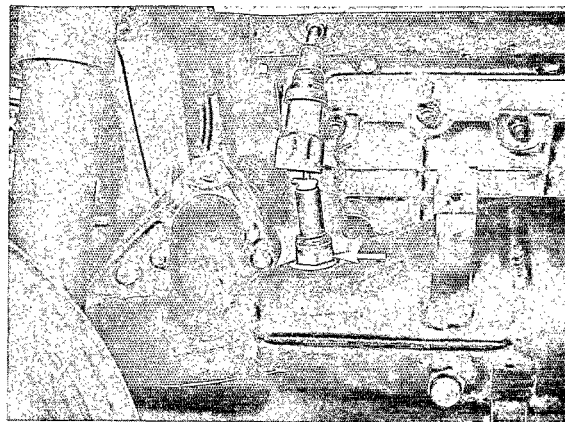
1. Disconnect plug for oxygen sensor on left side of engine compartment. Push wire grommet and plug through engine panel downward.



5. Pull off safety plug on oxygen sensor.



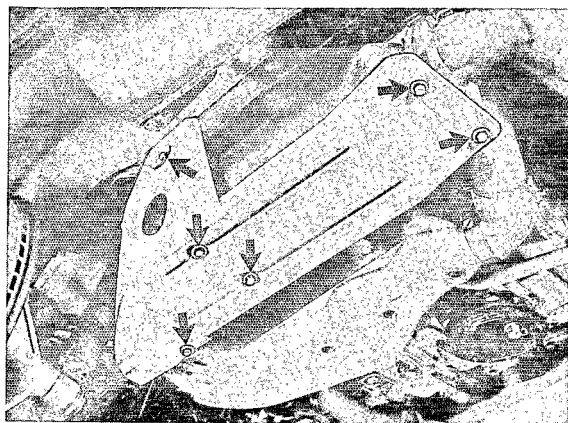
6. Remove oxygen sensor.



2. Lift car.

3. Take off left rear wheel.

4. Remove shield.



Installing

1. Coat threads of oxygen sensor with Bosch paste
VW 140 16 Ft.

Note

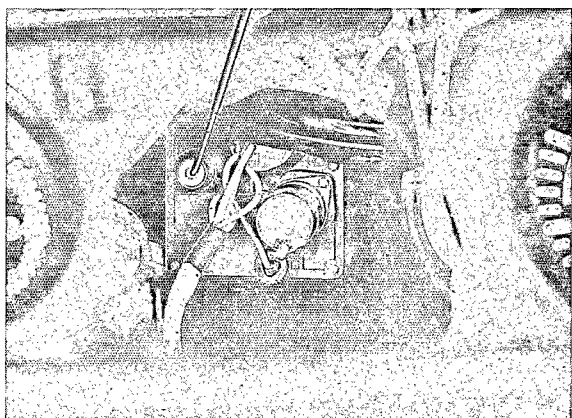
Never allow assembly paste to get into slot of sensor.

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

RESETTING COUNTER

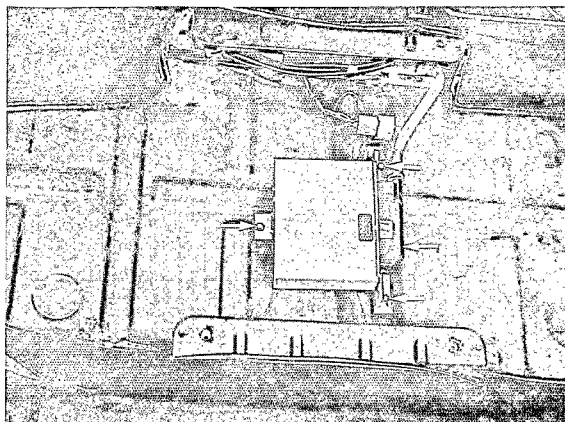
A counter is installed behind the fresh air blower to monitor the operation time. It will turn on the oxygen sensor indicator lamp after car has been driven 30,000 miles. The counter must be reset to zero each time the oxygen sensor is replaced.

1. Disconnect battery ground.
2. Remove speedometer.
3. Press in reset button on counter against stop with an approx. 3 mm thick piece of wire. Counter will return to zero position and oxygen sensor indicator light resumes its normal function.



REMOVING AND INSTALLING OXYGEN SENSOR CONTROL UNIT

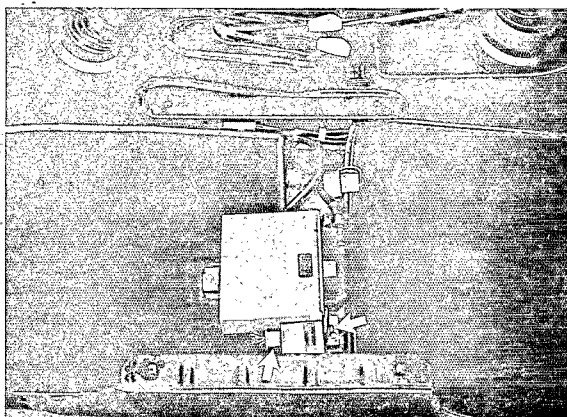
1. Remove right seat after loosening front and rear screws on seat rails.



2. Loosen screws on control unit. Pull off plug and remove control unit.

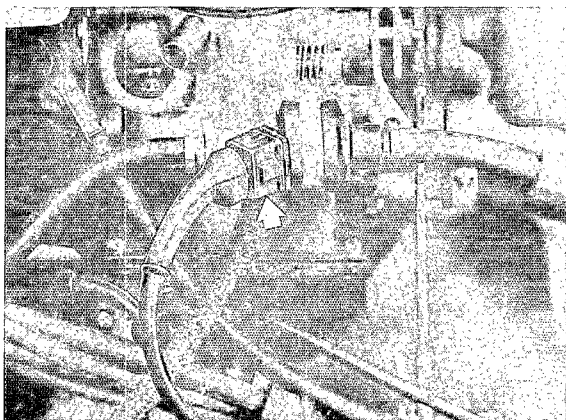
REMOVING AND INSTALLING CONTROL UNIT FOR ACCELERATION ENRICHMENT OF OXYGEN SENSOR CONTROL

1. Remove right seat.
2. Pull off plugs, unscrew bolt and remove control unit.



CHECKING FREQUENCY VALVE FOR OXYGEN SENSOR

1. Pull off wire plug.

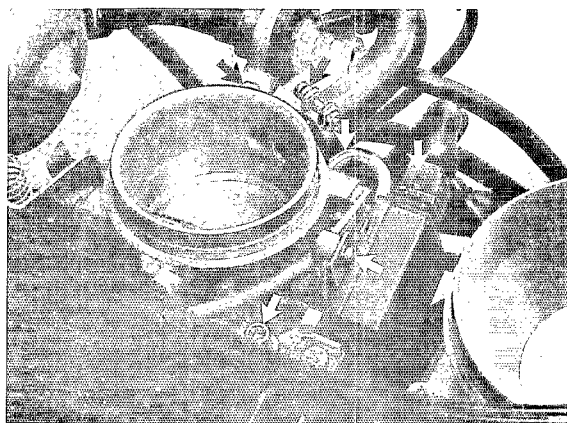


2. Connect ohmmeter on frequency valve.
Coil resistance: 2 to 3 ohms.
 3. If necessary, replace frequency valve.
-

REMOVING AND INSTALLING THROTTLE VALVE SWITCH

Removing

1. Remove air cleaner and cowl.
2. Disconnect holder for frequency valve, vacuum hoses for distributor, hose to vacuum booster and wire plug on throttle valve switch. Remove 4 socket head screws and remove throttle housing.



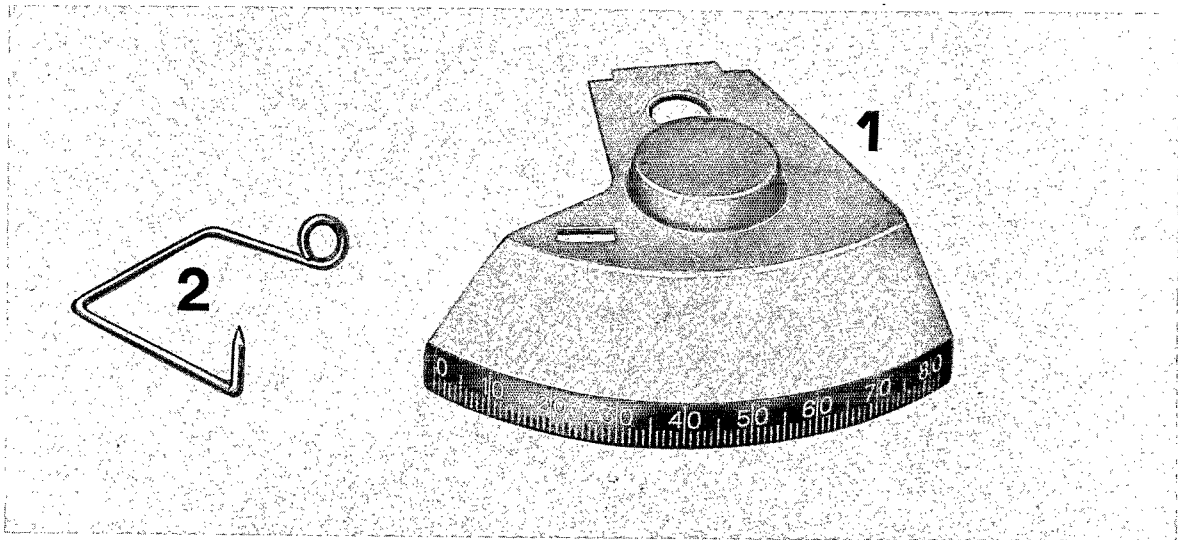
3. Remove mounting screws and remove switch.

Installing

Make sure O-ring is positioned properly on throttle housing.

CHECKING AND ADJUSTING THROTTLE VALVE SWITCH

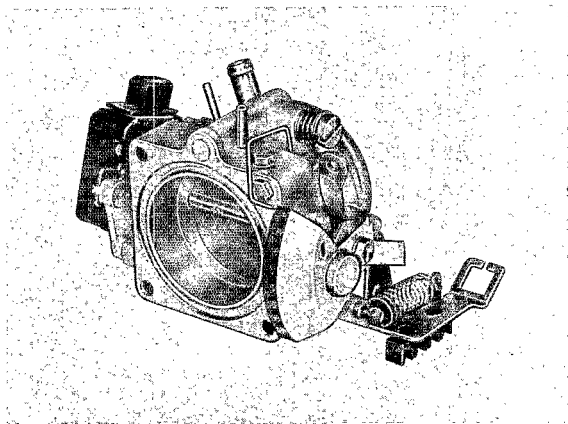
TOOLS



No.	Description	Special Tool	Remarks
1	Dial scale	from P 228 b	
2	Pointer	from P 228 b	

CHECKING AND ADJUSTING THROTTLE VALVE SWITCH

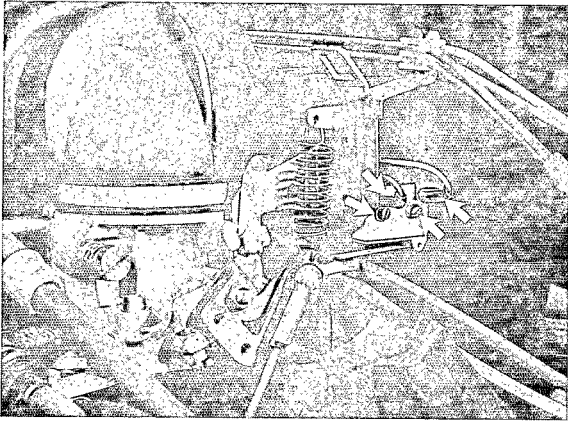
1. Remove throttle housing.
2. Mount dial scale from Special Tool P 228 b on throttle valve shaft.



3. Set pointer (from Special Tool P 228 b) to 0°.
 4. Connect standard buzzer or continuity tester to terminals 18 and 2 (idle contact) of throttle valve switch.
 5. Operate throttle valve. Switching point should be between 2 and 3°. Adjust if necessary.
 6. Check full throttle contact. Connect tester on terminals 18 and 3 of throttle valve switch. The contact must be made between 30 and 35°. The full throttle contact is mounted with the idle contact on a base plate and therefore it cannot be adjusted separately.
-

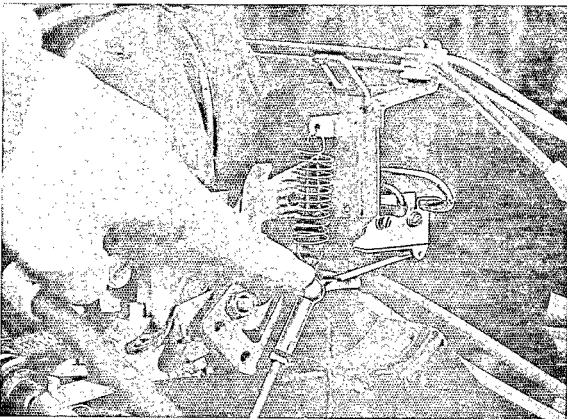
REMOVING AND INSTALLING MICROSWITCH FOR ACCELERATION ENRICHMENT OF OXYGEN SENSOR CONTROL (from 1981 Models)

Pull off plugs and unscrew bolts.



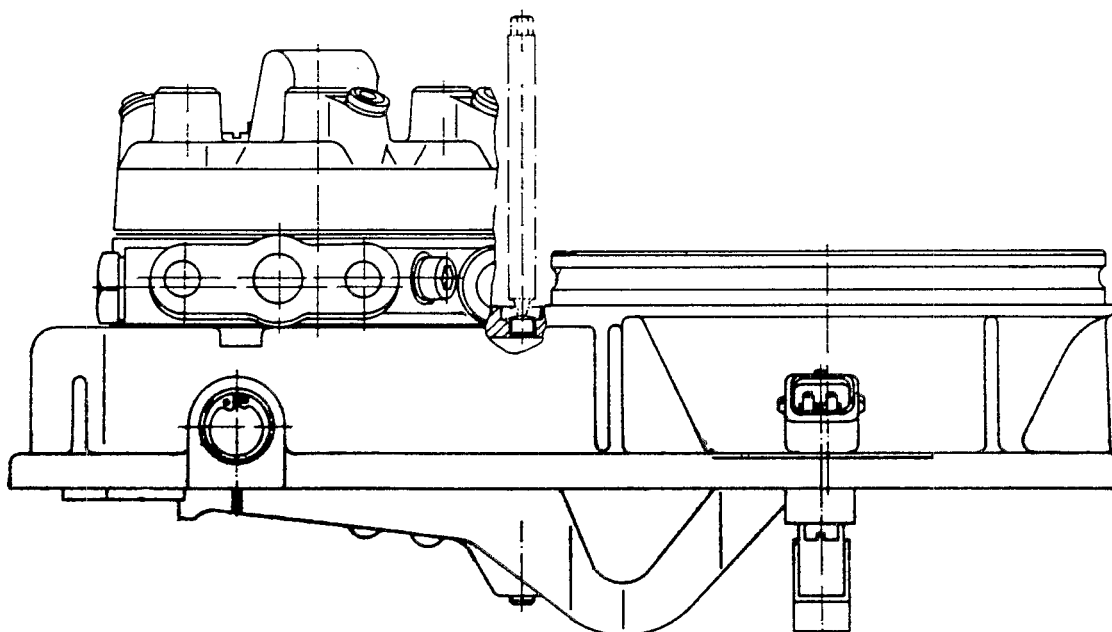
CHECKING AND ADJUSTING MICROSWITCH FOR ACCELERATION ENRICHMENT (from 1981 Models)

1. Connect standard buzzer on both contacts of microswitch (buzzer buzzes).
2. Operate throttle lever by hand. Microswitch should function before the throttle opens (buzzer not buzzing). Adjust if necessary.



CORRECTING CO LEVEL SETTING ON MIXTURE CONTROL UNIT - (from 1981 Models) WITH SHEAR-OFF SCREW

1. Remove entire mixture control unit.
2. Unscrew fuel distributor on air flow sensor.
3. Drill threaded part of shear-off screw with a 2 mm/5/64 in. dia. drill bit (approx. 3.5 mm/9/64 in. deep).
4. Unscrew rest of shear-off screw with a suitable screw extractor.
5. Install mixture control unit.
6. After correction of CO level setting install a new shear-off screw in access bore and tighten until screw shears off.



ADJUSTING FUEL INJECTION PUMP WITH EMISSION TESTER

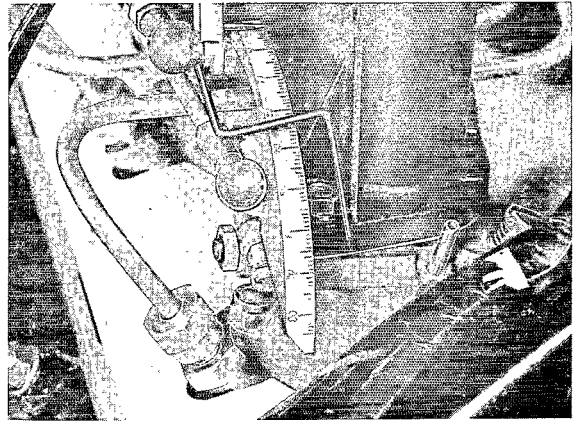
Special Tools

P 228 c Protractors

1. Bring engine to operating temperature (about 80°C/175°F).
2. Connect emission tester according to the manufacturer's instructions.
3. Attach protractor, special tool P 228 c, to the right throttle valve housing (if equipped with air conditioner, attach to left throttle valve housing). Adjust pointer to 0°.

Note

Hand throttle lever must be all the way off.



4. Using hand throttle or locally manufactured tool, open throttle 9°; actuate gas pedal a few times to take strain off linkage.

5. Determine exhaust emission by road test or dynamometer test. Under partial load the 2400 rpm with a 9° throttle opening the exhaust emissions (CO%) should be:

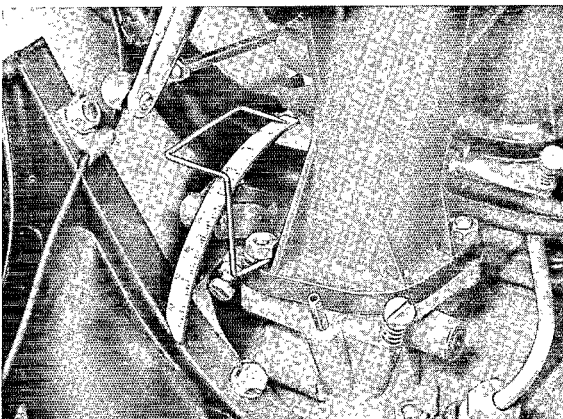
911 T	1.5 - 2.0 % CO
911 E and S	2.0 - 2.5 % CO (Europe 2.0-3.0)
Carrera 2.7	2.5 - 3.0 % CO

For typical road test see page SF 35.

Adjustment instructions for injection pump are shown on page SF 36.

Note

The intake air preheating system eliminates the necessity for monitoring intake air temperature.

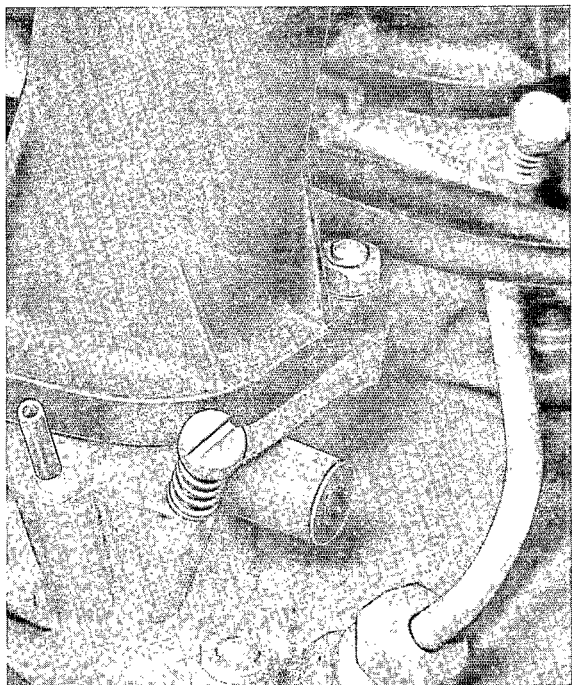


ADJUSTING ENGINE IDLE

Special Tools

P 230 c Socket (9 mm)

1. Bring engine to operating temperature.
2. Check idle speed. If idle speed is too high or low, readjust air correction screws on throttle valve housings as needed. Turning screws in, lowers idle. Turning out, increases idle. Check air flow of individual cylinders at 1600-2000 rpm synchronometer, special tool P 235. See page SF 40 for adjusting instructions.



Note

If resetting the air correction screws shows no reaction on the synchronometer, then the idle passages in the throttle valve housings are carboned up and must be cleaned.

3. Connect emission tester and check CO emissions. If CO value is not within the prescribed limit, shut off engine and readjust idle speed injection quantity on pump.

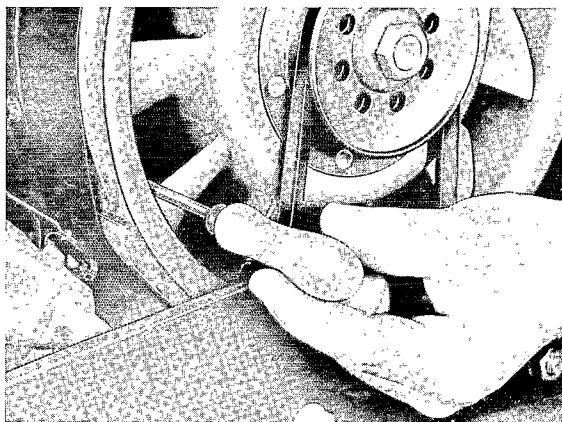
Caution

Do not start engine while adjusting idle speed injection quantity.

4. The idle adjusting screw can be reached with special tool P 230 c through a hole which is covered by a plastic cap in the cooling air upper shroud.

5. Remove cap.

6. Depress the spring-loaded idle adjusting screw with special tool P 230 c until you can feel it engage with the slot of the centrifugal governor.



CO emissions

USA	=	2 - 3 %
Europa	=	2,5 - 3,5 %
Carrera 2, 7	=	2 - 3 %



lean



rich

8. Idle speed can change after CO emissions have been adjusted at idle speed (900 ± 50 rpm).

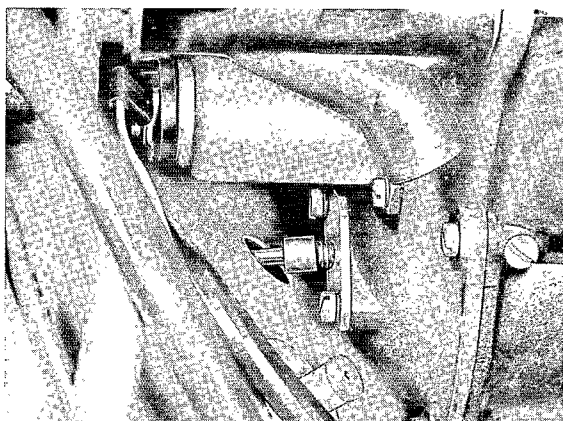
9. Adjust idle speed by turning the air correction screws. Recheck with synchrometer.

Note

Adjustments at idle speed and under partial load should be made as quick as possible so that the velocity stack area does not heat up. Drive the car a short distance or run engine slightly faster (about 3000 rpm) before making another CO test on road or dynamometer. This will cool off the velocity stack area.

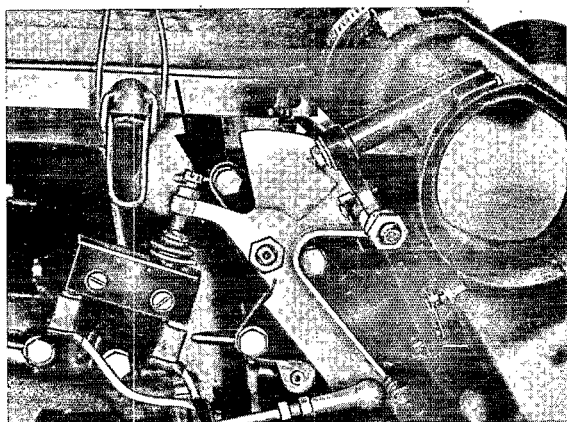
7. Turn adjusting screw counter-clockwise for a leaner mixture and clockwise for a richer mixture.

Do not adjust by more than 1 notch at a time. A maximum of three notches is allowed to either the right or left of the basic adjustment.



ADJUSTING MICRO SWITCH - BEGINNING WITH 1972 MODELS -

1. Loosen lock nut and back off adjusting screw until the micro switch is not closed in idle position.



2. Turn the adjusting screw from this position until the micro switch closes (listen for click sound).

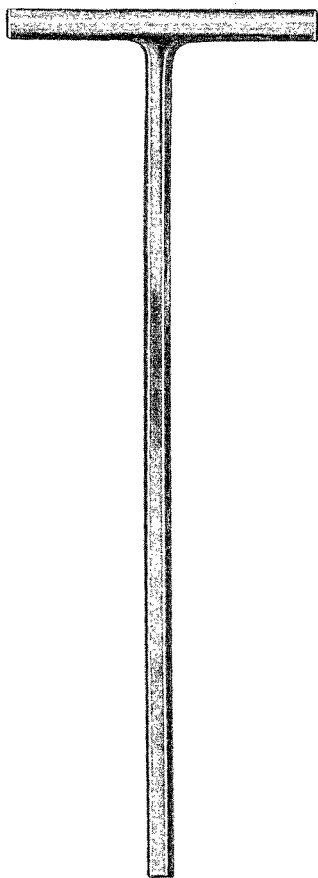
3. Turn adjusting screw 1/4 turn farther in. Tighten lock nut.

Note

The micro switch must be readjusted whenever the throttle valve linkage or injection pump linkage has been reset.

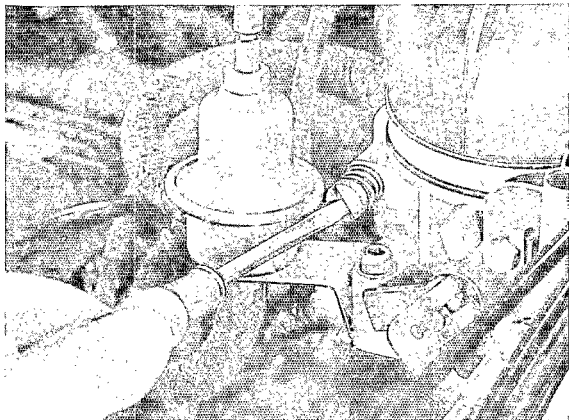
IDLE ADJUSTMENT

TOOLS



No.	Description	Special Tool	Remarks
1	Adjusting wrench	P 377	

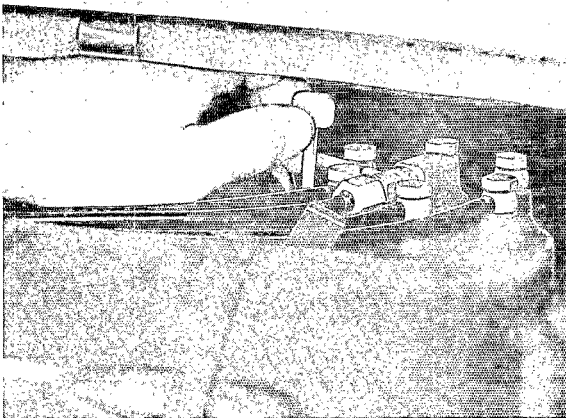
1. Run engine to operating temperature (approx. 80°C).
2. Make sure that hand throttle lever is pushed down to stop.
3. Connect CO-tester according to the manufacturer's instructions.
4. Turn adjusting screw, or bypass screw, resp. at the throttle housing until the specified engine speed has been attained. See page 1.1 - 1/14 e. for specifications.



Note

Use an independent tachometer, such as that from the tester or similar.

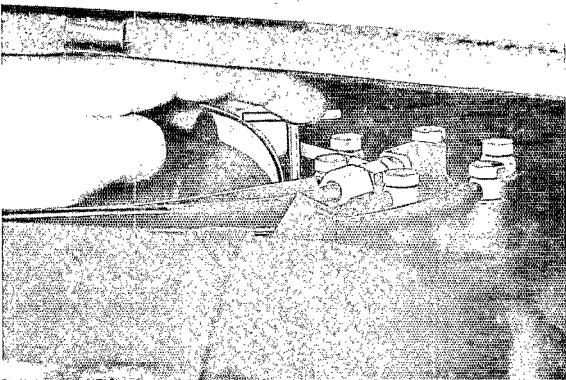
5. Remove plug from mixture control unit between fuel distributor and venturi.
6. Insert adjusting wrench P 377.
7. Turning the wrench clockwise makes the mixture richer, and turning it counter-clockwise makes the mixture leaner.



Note

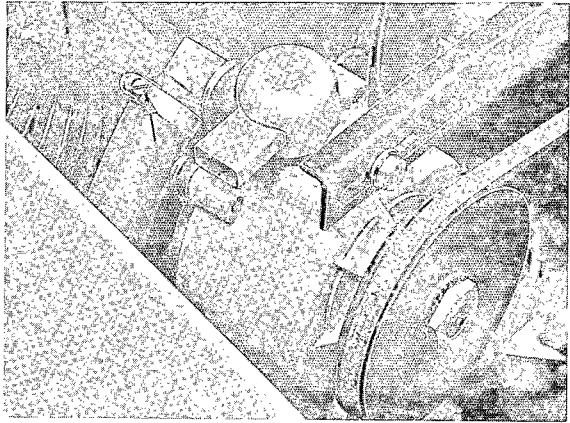
The following points must be definitely noted:

- a) Always adjust CO from lean to rich.
Example: If mixture is too rich, first turn idle control screw counterclockwise further than necessary and then clockwise to specified position.
- b) Turn the adjusting screw very little because small adjustments result in considerable CO emission changes.
- c) The maximum permissible change at the mixture adjusting screw is one-half turn.



- d) The air pump of engines with air injection must be disconnected to adjust CO.

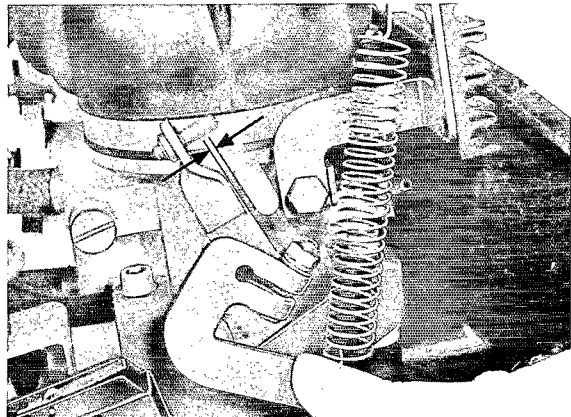
Disconnect pressure hose at pump and plug hose.



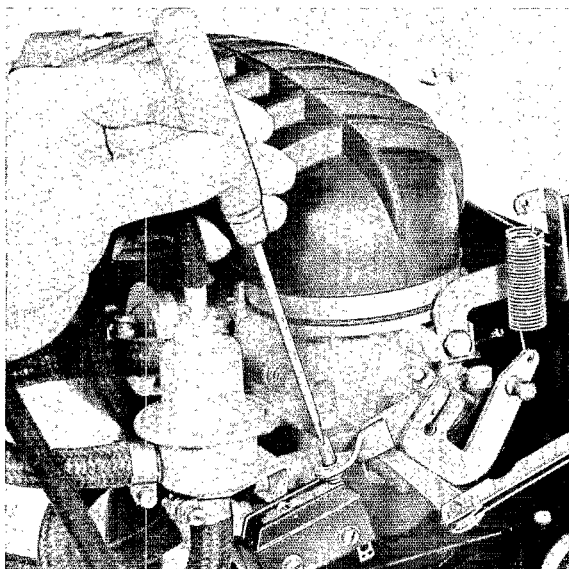
8. Take the wrench out.
9. Accelerate engine briefly.
10. Wait until the CO-tester has stabilized for idle speed reading.
Se page 1.1 - 1/14 e for specifications.
If necessary, repeat the procedure.
11. Recheck idle speed and correct, if necessary.
12. Replace plug upon completion of the adjusting procedure.

ADJUSTING FULL POWER POSITION OF THROTTLE

Throttle linkage must be so adjusted that there is at least 1 mm clearance at the throttle valve lever when the accelerator pedal is in the fully depressed position.



ADJUSTING MICROSWITCH



1. Disconnect electrical connections from microswitch.
2. Connect a standard buzzer to both contacts of the microswitch.
3. Prop up throttle. Place a 2 mm feeler gauge between idle stop screw and throttle valve lever.

Note

This distance must be measured exactly, sliding the feeler gauge in horizontally.

4. Turn adjusting screw at the throttle valve lever to a point beyond the switch-off position of the microswitch (buzzer is off).
5. Turn adjusting screw back to the switch-on position (buzzer is on).
6. Close throttle valve and check if the microswitch arm still has enough travel clearance in this position (at least 0.5 mm).

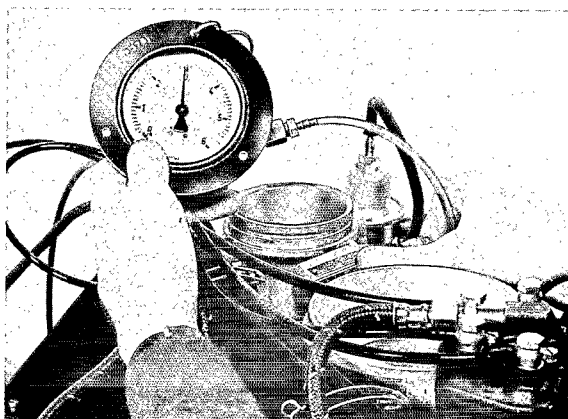
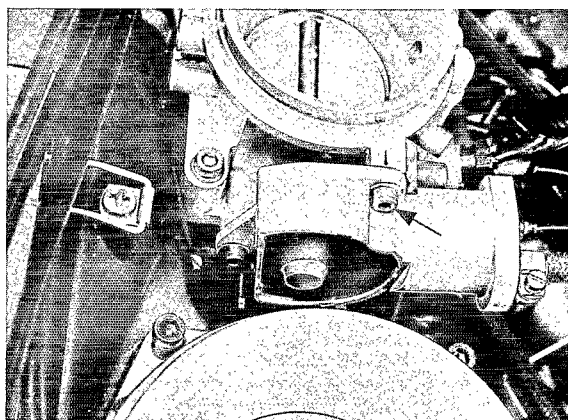
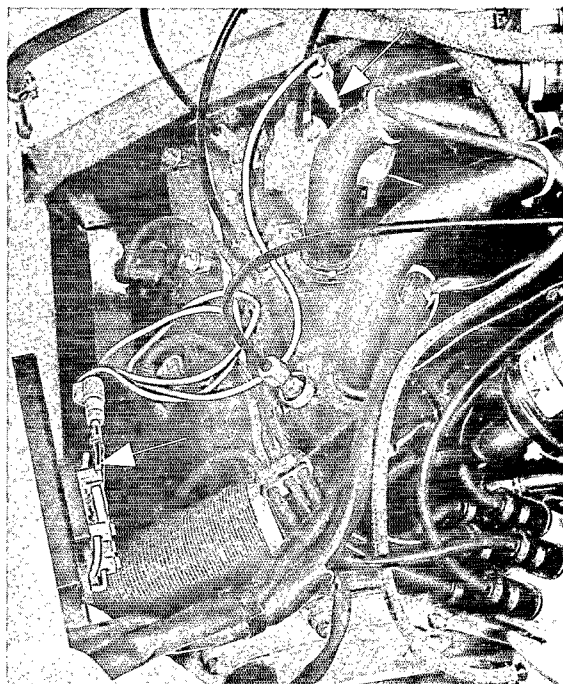
Note

Once the engine is installed in the car and hand throttle is adjusted, check if the microswitch is in the "on" position (buzzer on) with hand throttle fully on.

If necessary, check hand throttle adjustment.

CHECKING AND ADJUSTING CONTROL PRESSURE REGULATOR FOR THROTTLE VALVE POSITION

1. Connect and bleed P 378 pressure tester and switch valve to position \approx 2.
2. Detach electrical wire from control pressure regulator for warm running compensation. Using a jumper wire, connect control pressure regulator for warm running compensation directly to B+ (fuse box on left side of engine compartment). Switch ignition on. Make sure that throttle is fully closed (hand throttle must be pushed back all the way).
3. The control pressure will rise slowly and must reach the idle value shown under testing and adjustment specifications, page 1.1 - 1/13.
4. If the indicated value deviates, turn control pressure regulator for throttle valve position in the oval slots until the specified value is reached.
Control pressure regulator for throttle valve position in direction of vehicle travel = higher pressure.
Control pressure regulator for throttle valve position against the direction of vehicle travel = lower pressure.
5. If the specified pressure cannot be attained in this way, replace the control pressure regulator for throttle valve position.

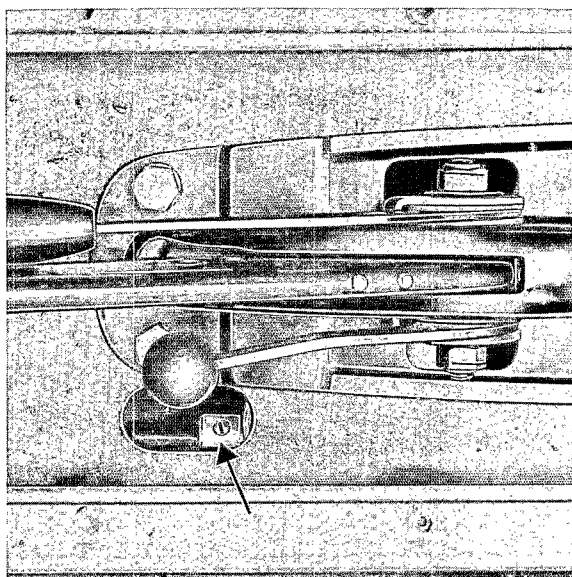


ADJUSTING HAND THROTTLE

1. Fold center tunnel cover forward at parking brake support.
2. When the engine is warm (80°C) and hand throttle completely pulled up, engine should be running at about 3500 - 3800 rpm.

NOTE

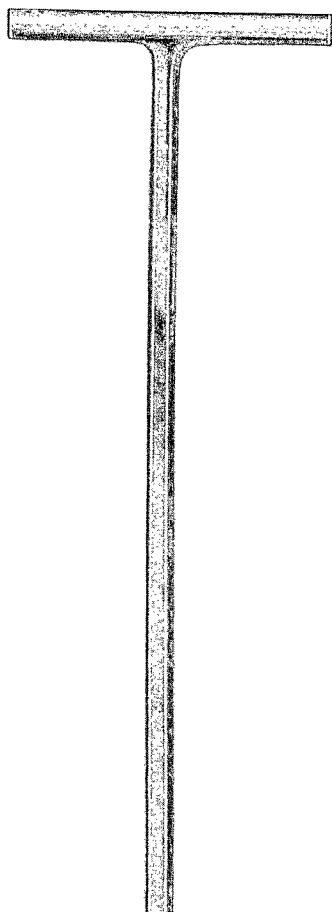
Take care not to overspeed the engine.



3. The hand throttle can be adjusted by repositioning the clamping piece on the throttle control rod in the center tunnel.

ADJUSTING IDLE, 911 SC - 1978 MODELS

TOOLS



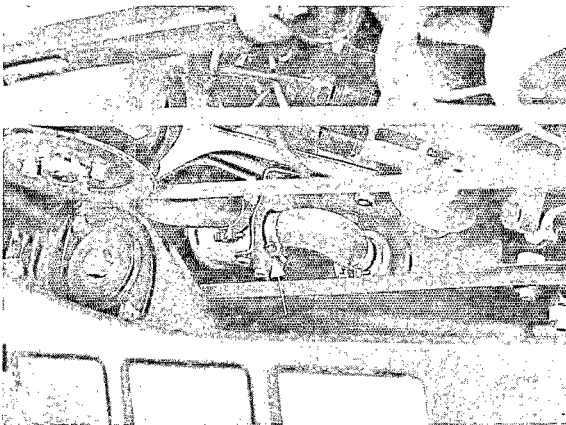
No.	Description	Special Tool	Note
1	Adjusting wrench	P 377	

Adjusting

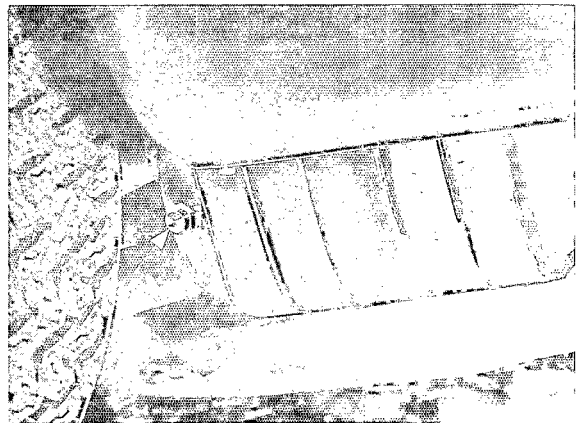
Note

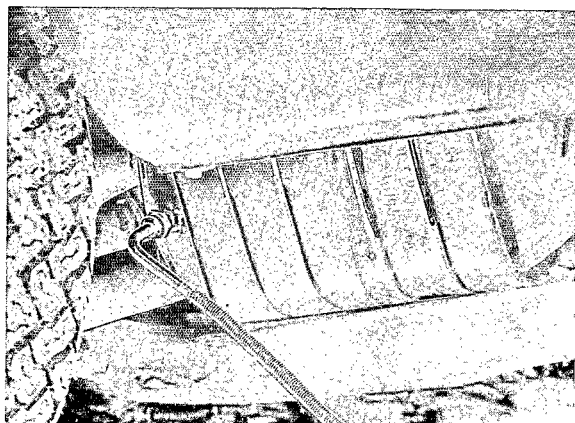
Before starting with the idle adjustments, make sure that oil tank cap fits properly and its seal is in good condition. Leaks at oil tank cap would result in incorrect readings.

1. Run engine to operating temperature (approx. $80^{\circ}\text{C}/176^{\circ}\text{F}$).
2. Connect CO tester according to instructions of the manufacturer.
3. Detach air hose at diverter valve (arrow) and insert an appropriate plug into hose.



4. Connect exhaust gas source line to test connection of catalytic converter.

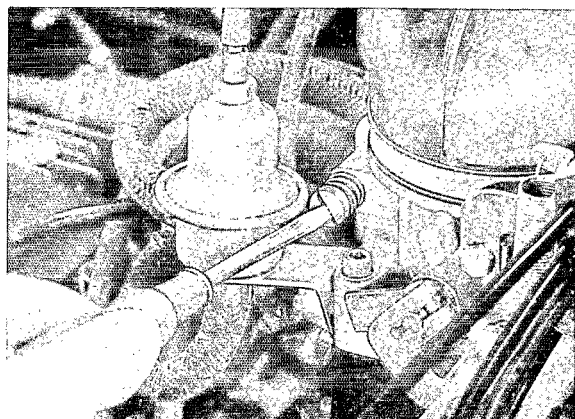




5. Turn idle speed screw or bypass screw on throttle housing, until specified speed is reached.
Test specifications, see page 1.1 - 1/14 e.

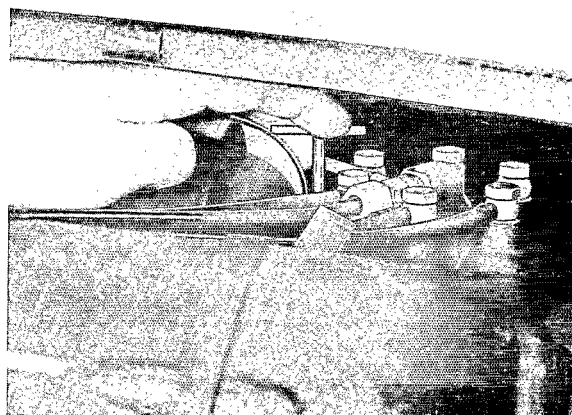
Note

Use separate tachometer of tester or similar instrument.



6. Remove plug in mixture control unit, between fuel distributor and air venturi.

7. Guide in adjusting wrench P 377.



8. Turning clockwise = rich mixture
Turning counterclockwise = lean mixture

Note

- a) Always adjust CO level from lean to rich.
Example: When adjustment is too rich, first turn idle speed screw counterclockwise further than necessary and then clockwise to basic setting.
 - b) Do not apply pressure on adjusting wrench during adjustments (engine would die).
 - c) Turn idle speed screw very little because even small adjustments result in considerable CO emission changes.
9. Remove wrench.
10. Race engine briefly.

11. Wait until CO tester shows exhaust concentration at idle speed.

Test specifications, see page 1.1 - 1/14 e.

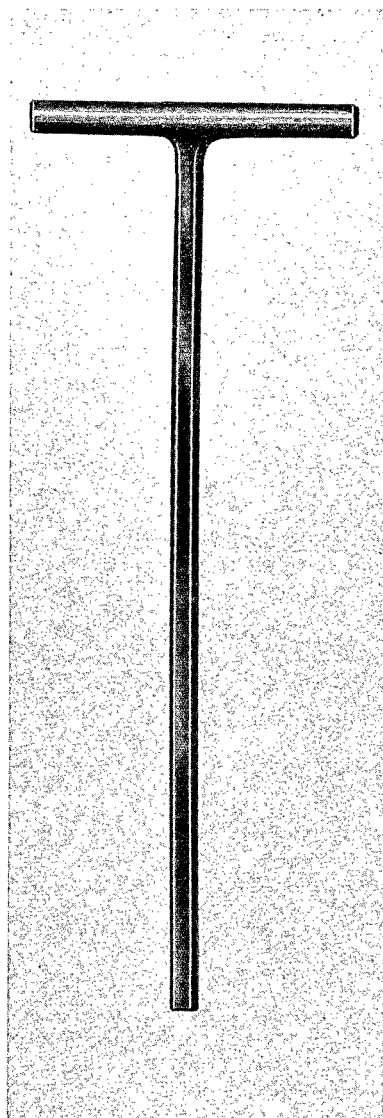
If necessary, repeat adjusting procedure.

12. Recheck idle speed and correct, if necessary.

13. After completion of adjustments, insert plug in mixture control unit and attach air injection hose.

ADJUSTING IDLE SPEED 911 SC - 1980 model

TOOLS



No.	Description	Special Tool	Remarks
1	Adjusting wrench	P 377	

Adjusting

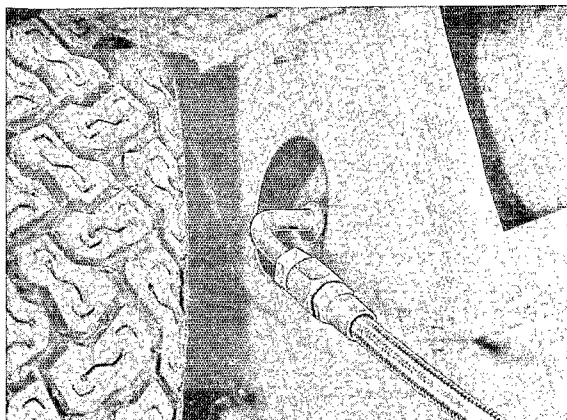
Note

Make sure that oil tank cap and seal fit properly prior to adjustment of the idle speed. Leaks at oil tank cap would cause incorrect measurement.

Requirements:

Engine in perfect mechanical condition and ignition timing adjusted correctly.

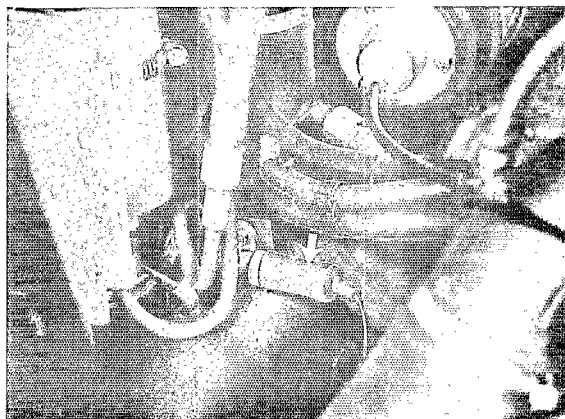
1. Connect exhaust pickup line on test connection of catalytic converter.



2. Run engine to operating temperature (oil temperature about 90° C. oil temperature gauge on upper end of range surrounded in white).

3. Connect CO tester according to instructions supplied with equipment.

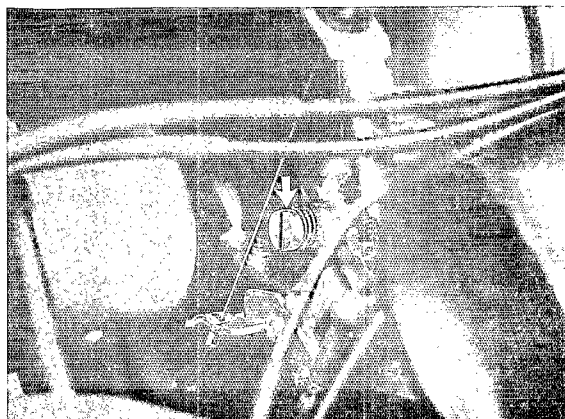
4. Disconnect plug for oxygen sensor in engine compartment on left side.



5. Turn control screw or bypass screw on throttle housing until specified speed is reached. Adjusting values on page 1.1 - 1/13.

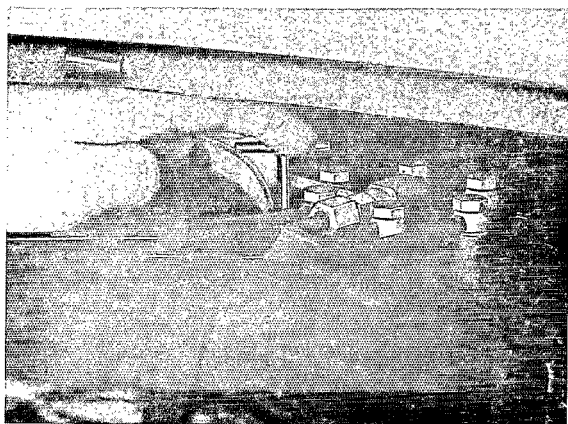
Note

Use separate tachometer from tester or similar.



6. Remove plug in mixture control unit, between fuel distributor and venturi.

7. Insert adjusting tool P 377.



8. Turn clockwise = richer mixture.
Turn counterclockwise = leaner mixture.

10. Accelerate engine briefly.

11. Wait until CO tester shows CO concentration at idle speed. See page 1.1 - 1/14 f for adjusting values. If necessary, repeat adjusting procedures.

12. Recheck idle speed and correct, if necessary.

13. After completion of adjustments insert plug in mixture control unit and connect electric plug for oxygen sensor.

14. Coat threads of cap nut for testing connection on catalytic converter with Bosch assembly paste VS 140 16 Ft.

Note

Always conform with the following points.

a) Always adjust CO level from lean to rich.
Example: If mixture is too rich first turn idle control screw counterclockwise further than necessary and then clockwise to specification.

b) No force should be exerted on adjusting tool during adjustments (engine would die).

c) Turn control screw only minimal amount, since even a slight turn will change the CO level considerably.

9. Remove adjusting tool.

ADJUSTING IDLE 911 SC - (from 1981 Models)

Adjusting

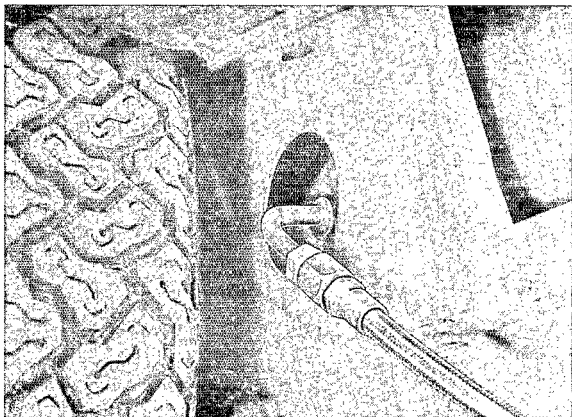
Note

Make sure oil tank cap and seal fit properly before adjusting idle. Leaks through oil tank cap would cause incorrect readings.

Adjusting requirement:

Engine in perfect working condition and ignition timing set correctly.

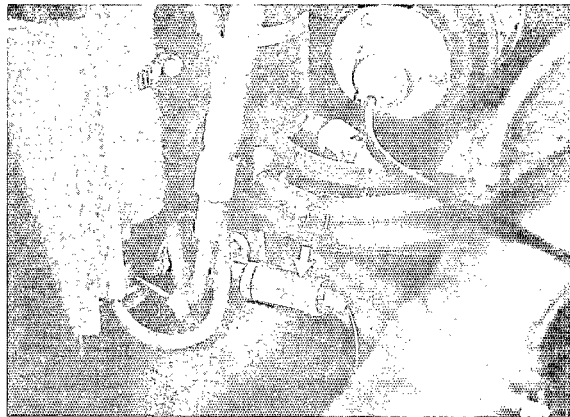
1. Connect exhaust gas tap on test connection of catalytic converter.



2. Run engine to operating temperature (oil temperature about 90° C/194° F; oil temperature gauge needle at upper end of field outlined in white).

3. Connect CO tester according to instructions supplied with equipment.

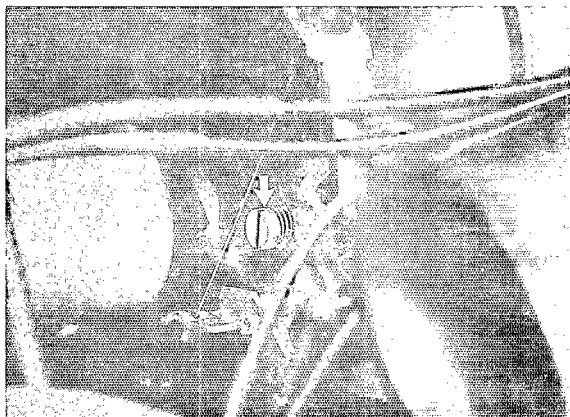
4. Disconnect oxygen sensor plug in engine compartment on left side.



5. Turn control screw or bypass screw on throttle housing until specified engine speed is reached. See page 1.1 - 1/14 f for adjusting value.

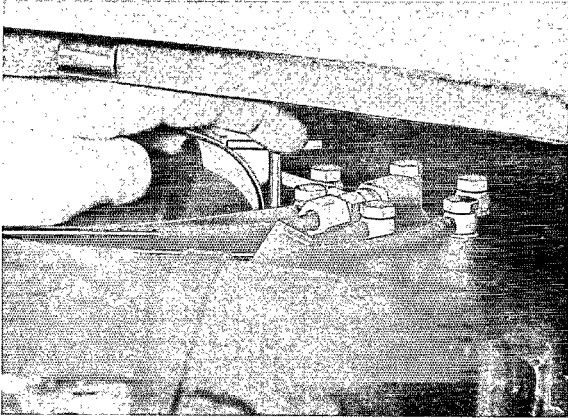
Note

Use separate tachometer of tester or similar.



6. Check CO level. If CO level does not correspond with specified value, remove mixture control unit and remove threaded part of shear-off screw in access bore for mixture control screw (see page 2.5 - 1/8).

7. Guide in Special Tool P 377.



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

Note

The following points are important.

- a) Always adjust CO level from lean to rich.
Example: If mixture is too rich, first turn idle control screw counterclockwise further than necessary and then clockwise to specified value.
 - b) Never exert force on special tool during adjustments (engine dies).
 - c) Turn control screw only very slightly, since even a slight turn will change CO content in exhaust gas considerably.
9. Remove special tool.

10. Accelerate engine briefly.

11. Wait until CO tester shows exhaust gas concentration at idle speed.
See page 1.1 - 1/14 f for adjusting value.
Repeat adjusting procedure, if necessary.

12. Recheck idle speed and, if necessary, correct.

13. After finishing adjustments screw a new shear-off screw in access bore and tighten until screw shears off. Reconnect oxygen sensor plug.

14. Coat threads of cap nut for test connection on catalytic converter with Bosch VS 140 16 Ft or Optimoly HT grease.

Getriebe
Transmission
Boîte de Vitesses
Cambio

3

3

3

3

3

3

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3

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Transmission, 4 and 5 Speeds

Sportomatic

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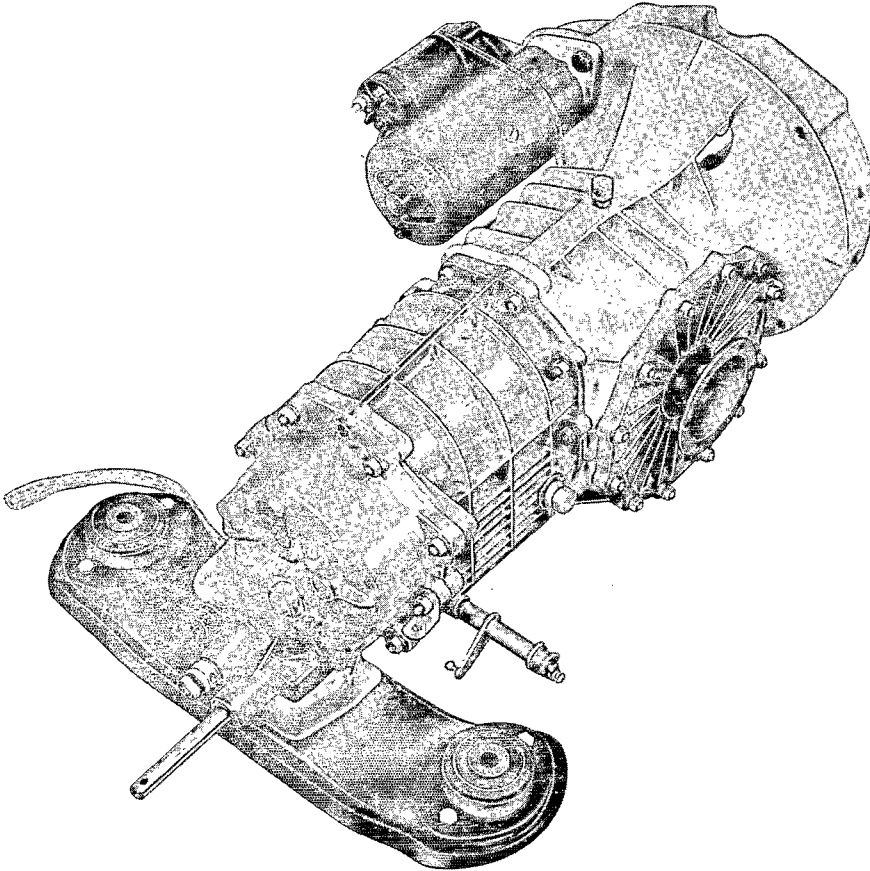
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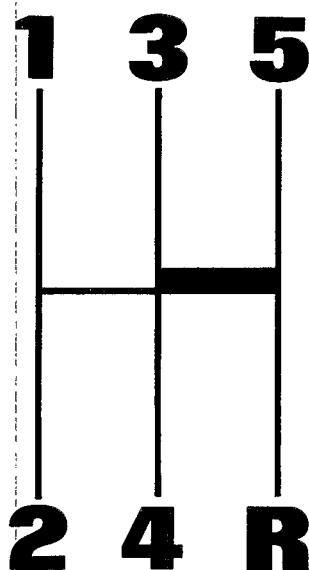
FOUR AND FIVE SPEED TRANSMISSION (TYPE 915)



Beginning with 1972 models, all Type 911 vehicles are equipped with the new, reinforced 4-speed transmission. The 5-speed transmission is optional.

DESIGN AND FUNCTION

The five forward speeds and reverse are arranged in a double "H" shift pattern.



1st speed: left forward

2nd speed: left back

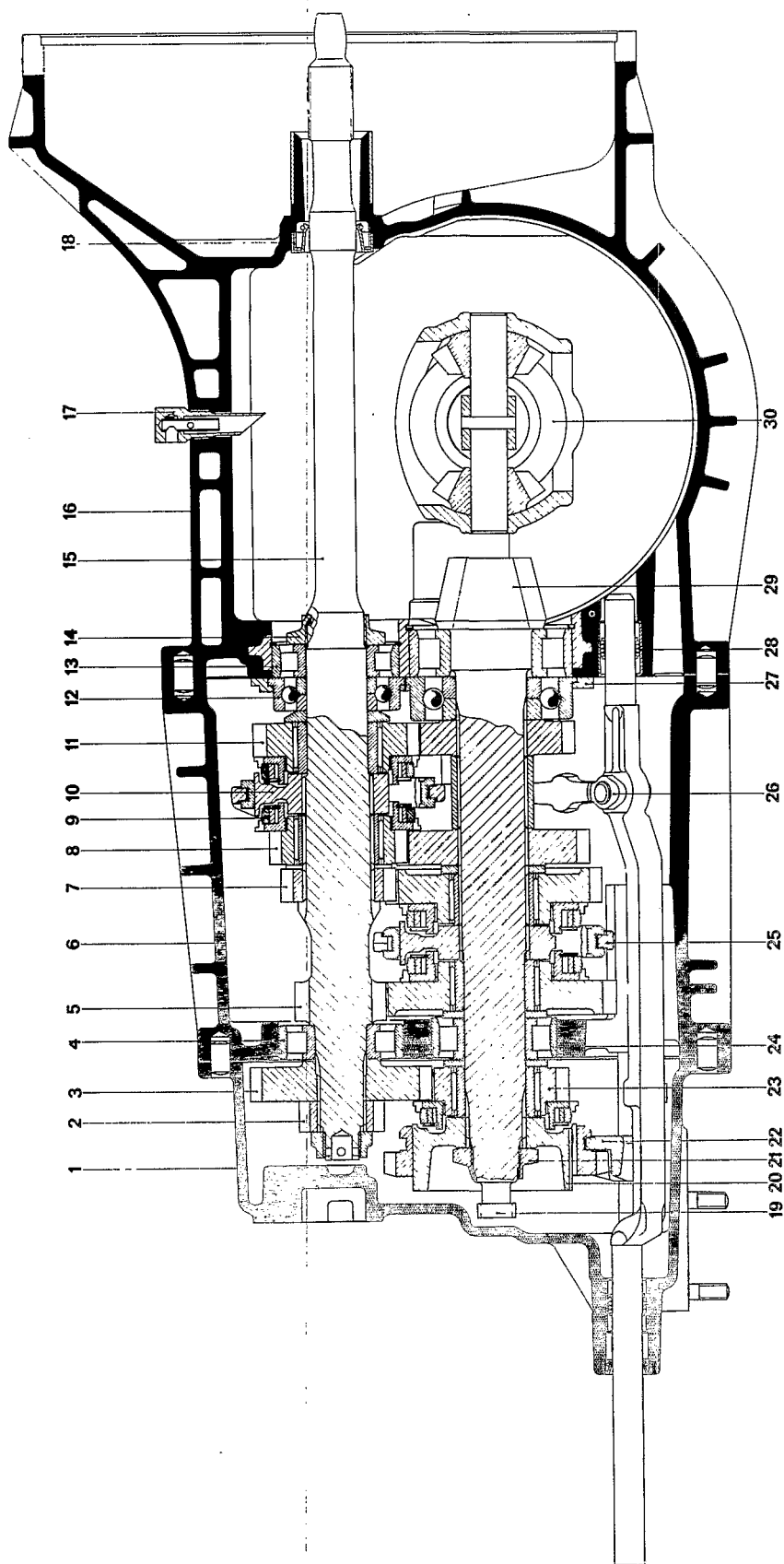
3rd speed: straight forward

4th speed: straight back

5th speed: press right overcoming spring detent, then straight forward

Reverse: press right overcoming spring detent, then straight back

Clutch pedal must be fully depressed and selected gear fully engaged.



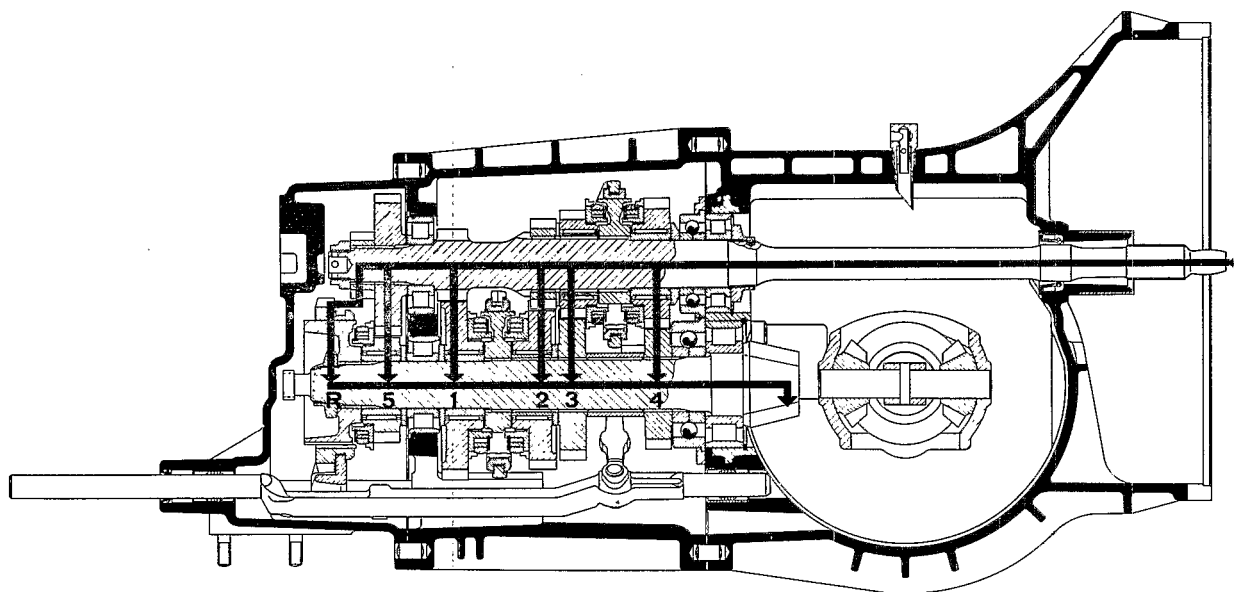
- | | |
|--------------------------------|---|
| 1 - Transmission front cover | 16 - Transmission housing |
| 2 - Reverse, Gear I | 17 - Breather |
| 3 - 5th speed, Gear I, fixed | 18 - Seal |
| 4 - Roller bearing | 19 - Speedometer drive, Gear I |
| 5 - 1st speed, Gear I, fixed | 20 - Spider, 5th and reverse speeds |
| 6 - Gear housing | 21 - Flange nut |
| 7 - 2nd speed, Gear I, fixed | 22 - Shift fork, 5th and reverse speeds |
| 8 - 3rd speed, Gear I, free | 23 - 5th speed, Gear II, free |
| 9 - Synchronizing ring | 24 - Roller bearing |
| 10 - Spider (Synchro hub) | 25 - Shift fork, 1st and 2nd speeds |
| 11 - 4th speed, Gear I, free | 26 - Selector shaft |
| 12 - Pinion shaft ball bearing | 27 - Bearing retaining plate |
| 13 - Roller bearing | 28 - Ball sleeve |
| 14 - Flange nut | 29 - Pinion shaft |
| 15 - Input shaft | 30 - Differential |

POWER FLOW

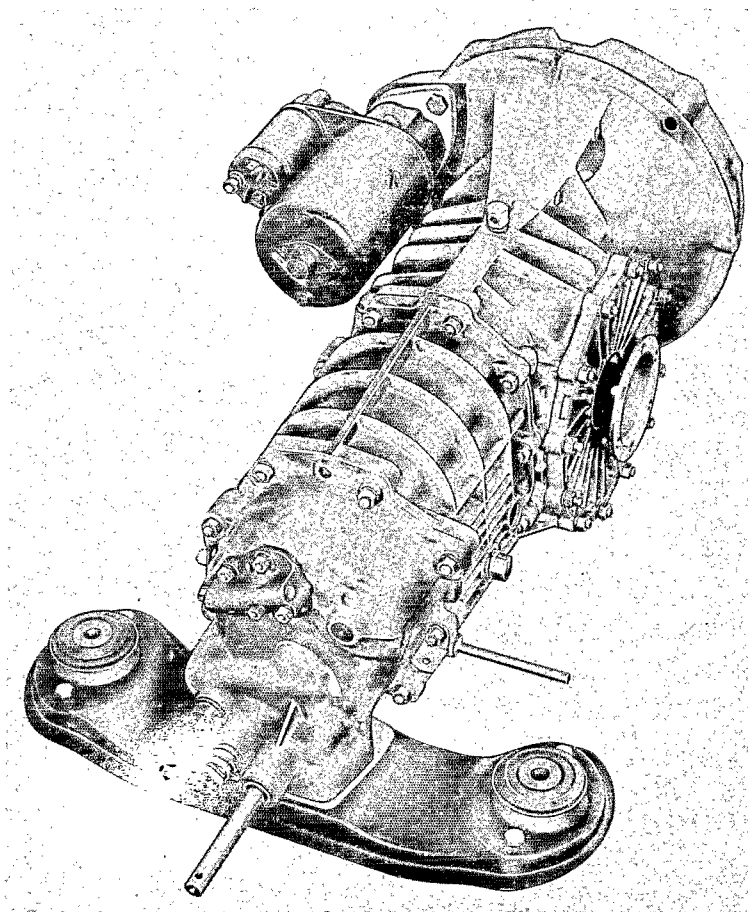
In all gears, power flow is from the input shaft to the pinion shaft through the respectively engaged gear pair. The engaging and synchronizing parts for 1st, 2nd, and 5th gears are on the pinion shaft, and those for the 3rd and 4th gear are on the input shaft.

Torque transfer occurs only through the respective gear pair. Engagement of the 1st, 2nd, and 5th gears is made by repositioning the shifting sleeve or sliding gear located on the pinion shaft, and that of 3rd and 4th gears by one located on the input shaft.

Power flow in reverse gear is from the input shaft through the reverse idler gear, the sliding gear, to the pinion shaft.



TYPE 915 TRANSMISSION WITH OIL PUMP



Carrera 2.7 vehicles are equipped with Type 915/08 and 915/18 transmissions.

These transmissions are identical in design and servicing to transmissions used in 1972 models. However, due to the increased power and torque of the 2.7 liter engines, they are equipped with an oil pump lubrication system.

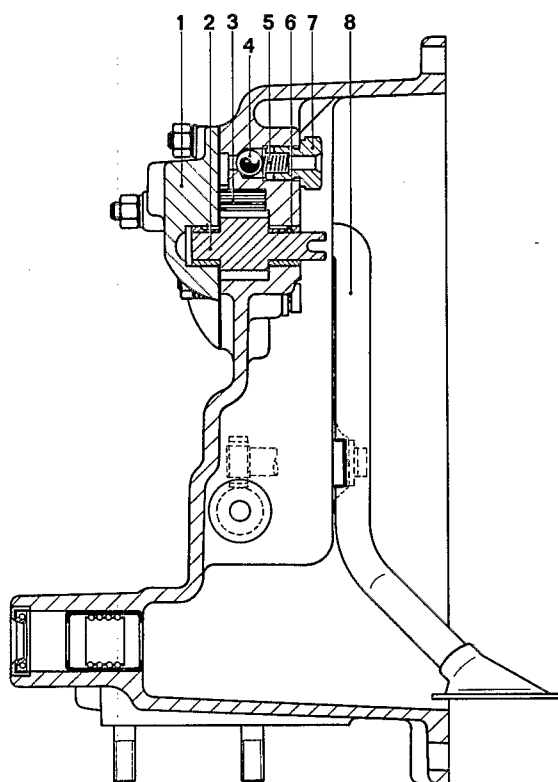
DESCRIPTION OF THE OIL PUMP LUBRICATION SYSTEM

When the car is started, the input shaft sets the oil pump in motion. The pump draws oil from the transmission oil sump through a pickup tube and forces it through the passages in the pump cover and into the pressure lines.

Pressure created by the oil pump forces the transmission oil to pass through discharge nozzles which direct the oil spray to the lubrication points. Oil not used for lubrication cools the working parts and drains back into the transmission oil sump.

A pressure relief valve opens at a pressure of about 3, 4 atmospheres if a malfunction should occur in the oil supply system, such as a plugged pressure line. The oil then drains into the transmission oil sump.

The constant circulation of the transmission oil and spraying of the bearings and gears results in improved cooling and lubrication.

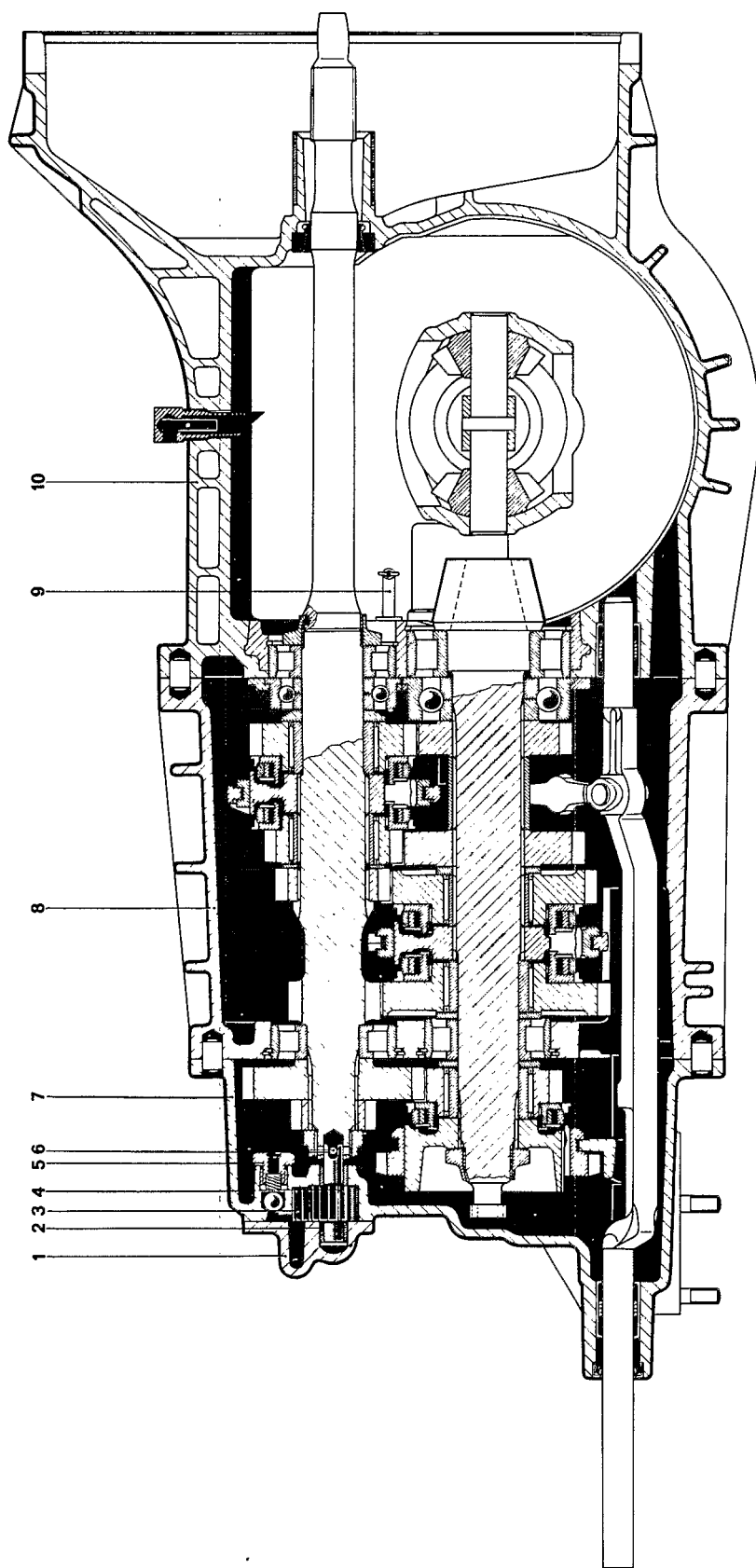


- 1 - Oil pump cover
- 2 - Oil pump gear I
- 3 - Oil pump II
- 4 - Ball for pressure relief valve

- 5 - Spring for pressure relief valve
- 6 - Bushing
- 7 - Plug for pressure relief valve
- 8 - Pickup tube

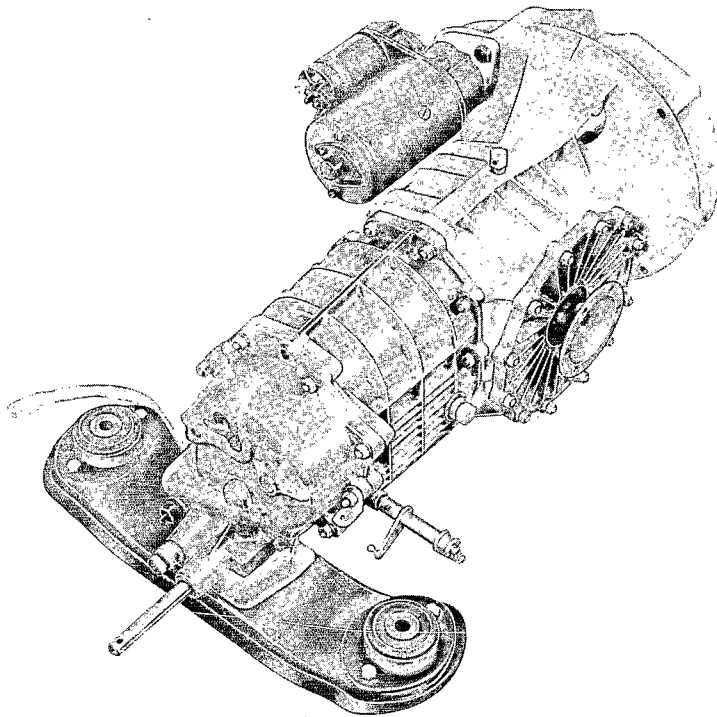
GENERAL INSTRUCTIONS FOR DISASSEMBLING AND REASSEMBLING OF TRANSMISSION WITH OIL PUMP

1. Disassembly and reassembly of a transmission with oil pump is the same as that of a unit without the pump because the pressure line connections are of the slip-on type.
2. Oil the O-rings lightly when installing the pickup tube and pressure lines since otherwise damage may occur.
3. The gear housing should be assembled with the pressure line bolted in place. The pressure line must pass through the hole in shift fork for 3rd and 4th speed.
4. When installing the transmission front cover make sure that the coupling pin in the input shaft engages the coupling slot in oil pump gear I. If necessary, turn the input shaft slightly and push cover into place.
5. Work procedures differing from those applicable to transmissions in 1972 models, such as disassembly and reassembly of the oil pump, are described on pages that follow.



-
- 1 - Oil pump cover
 - 2 - Bushing
 - 3 - Oil pump gear II
 - 4 - Oil pump gear I
 - 5 - Plug for pressure relief valve
 - 6 - Oil pump coupling pin
 - 7 - Transmission front cover
 - 8 - Gear housing
 - 9 - Pressure line
 - 10 - Differential housing

TYPE 915 TRANSMISSION (1974 MODEL)



The following transmission versions are installed from 1974 models on:

4-speed transmission, 915/16 = S

5-speed transmission, 915/06 = SW

S = standard equipment

SW = special order

These transmission versions differ from those used in 1973 models only in the aspect of gear ratios (see Technical Data, page 0.2 - 1/11).

Manual transmission 915 (1975 Models)

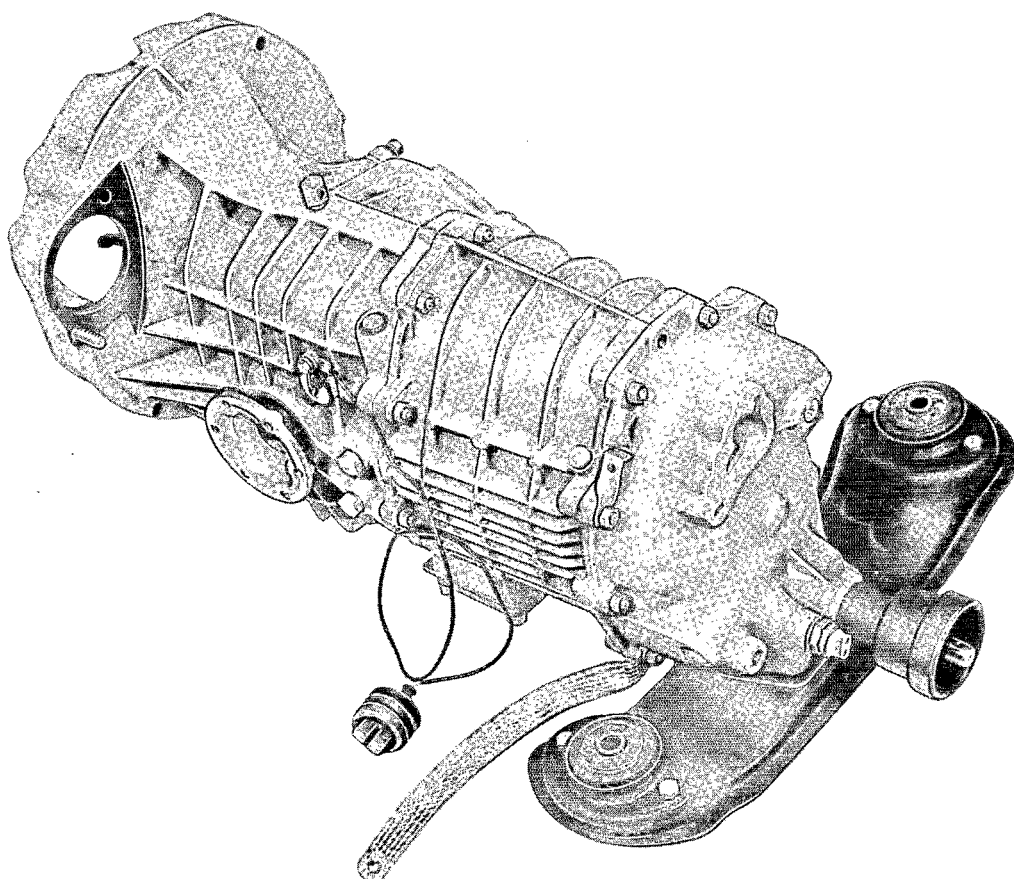
The following transmissions are installed.

Transmission Type	No. of Gears	Application
915/40	5	911 S, Carrera
915/45	4	911 S, Carrera

All transmission types are based on those of 1974 models and only differ slightly from each other.

The 3rd and 4th or 4th and 5th gears as well as the rear axle ratios have been changed on the types 915/45 and 915/40 (refer to technical data on page 0.2 - 1/15). The shift and guide sleeves have also been reinforced, and the clutch release lever modified.

MANUAL TRANSMISSION 915 (1976 MODEL)



The following transmission is available for the 1976 Model.

5-speed transmission 915/44

This transmission model differs from the 1975 model by a new guide tube for the clutch release bearing, an easy to remove drive shaft seal and an electronic speedometer transmitter.

MANUAL TRANSMISSION 915 (1976 MODEL)

The following transmission is available for the 1976 Model.

Transmission	No. of Speeds	For Model
915/44	5	911 S

MANUAL TRANSMISSION 915 (1977 Model)

For 1977 Models the following transmission type is installed.

5-speed transmission 915/61 with auxiliary clutch spring

This transmission differs from the 1976 Model with modified synchronizers for 1st and 2nd gears, an asymmetric tooth profile of the clutch body for 1st gear and a modified operating and guide sleeve for 1st/2nd gear.

MANUAL TRANSMISSION 915 (1978/79 Models)

For the 1978/79 models the

5-speed transmission 915/61

has a silumin case and a modified clutch release lever.

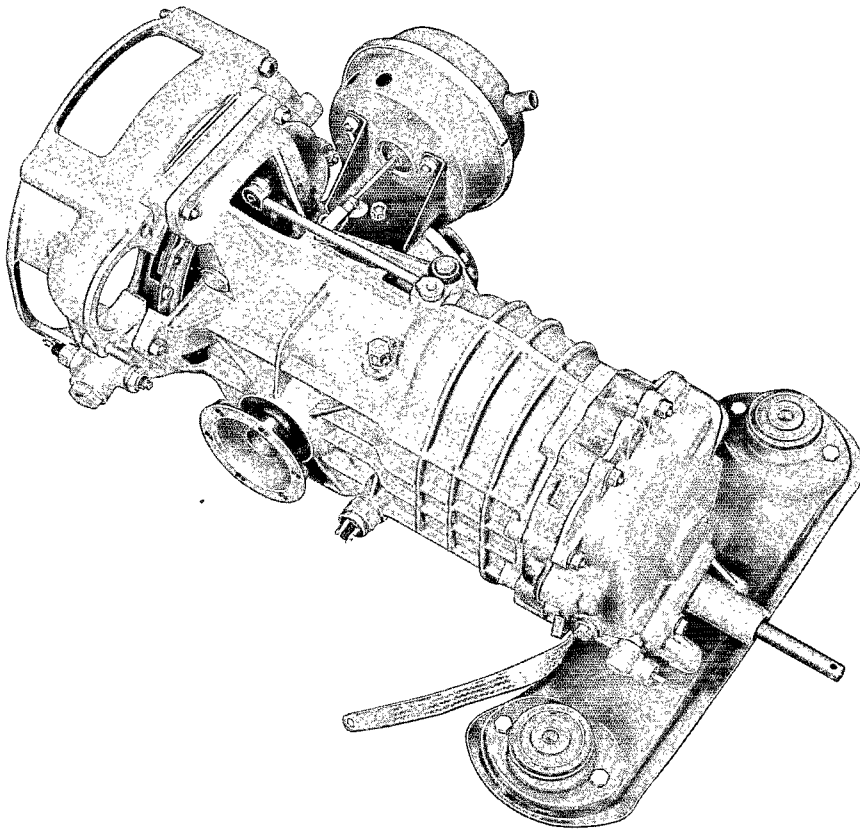
MANUAL TRANSMISSION 915 (1980/81 Models)

The following transmission type is installed in the 1980/81 models:

5-speed transmission 915/63

This transmission differs from those in 1978/1979 models only in the modified 2nd gear ratio.

SPORTOMATIC 925

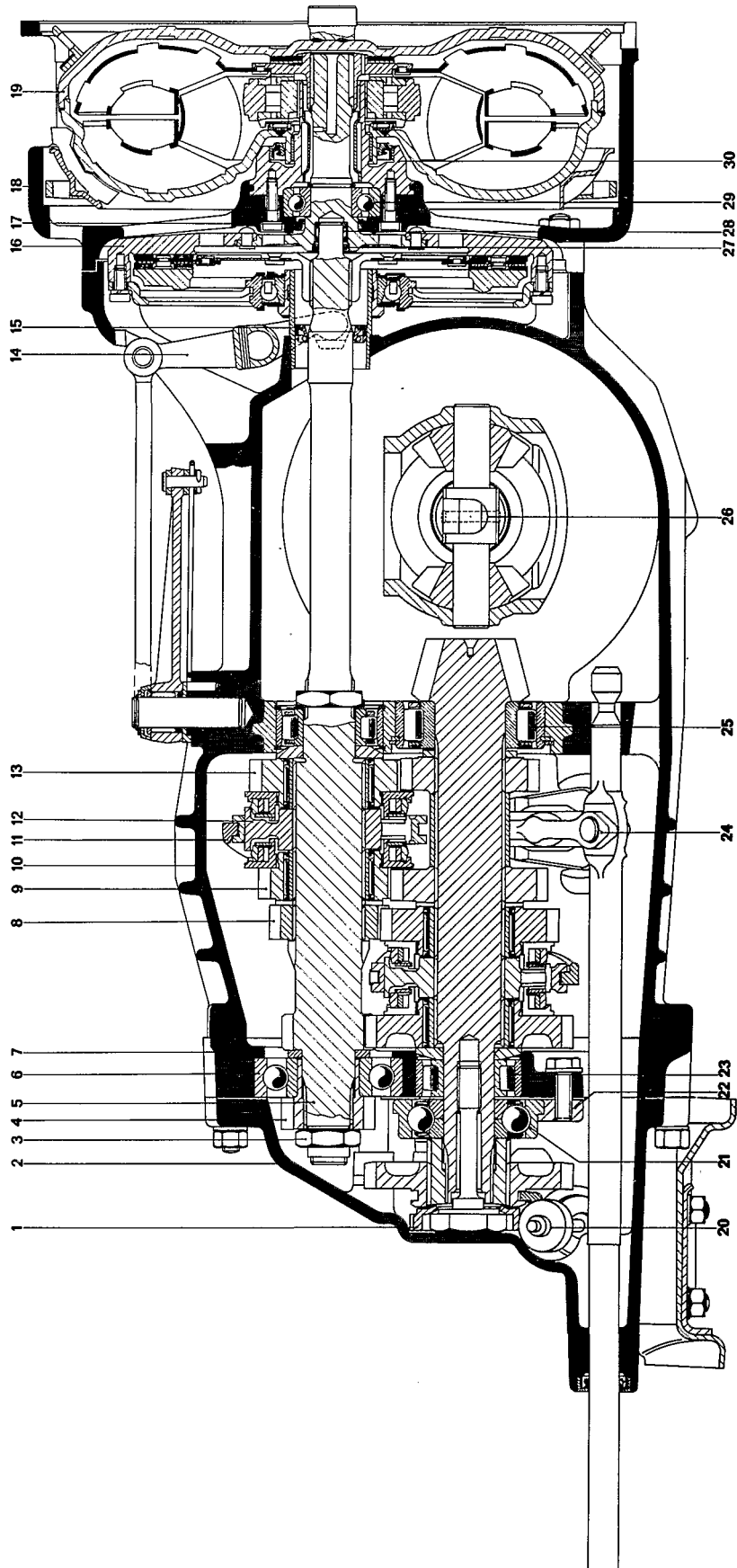


Beginning with Sept. 24, 1971 production, the Sportomatic transmission for 911 vehicles have been modified. The modified transmission have the following designations:

911 T and E	925/ 00
911 S	925/ 01.

Repair procedures for these transmission differ only slightly for those contained in the 911 Workshop Manual, Volume I which applied to models thru 1971.

Only those repair procedures and service information which differ are included in this volume of the workshop manual.



- | | | | |
|------|--------------------------------|------|------------------------------|
| 1 - | Speedometer drive | 16 - | Clutch plate / turbine shaft |
| 2 - | Front cover | 17 - | Oil seal |
| 3 - | Flange nut | 18 - | Torque converter housing |
| 4 - | Gear I, reverse gear | 19 - | Torque converter |
| 5 - | Input shaft | 20 - | Speedometer gear shaft |
| 6 - | Ball bearing race | 21 - | Four point ball bearing |
| 7 - | Intermediate plate | 22 - | Clamping plate |
| 8 - | Gear I, 2nd gear | 23 - | Roller bearing |
| 9 - | Gear I, 3rd gear | 24 - | Selector shaft |
| 10 - | Transmission housing | 25 - | Roller bearing |
| 11 - | Shift fork, 3rd and 4th gear | 26 - | Anchor block |
| 12 - | Shift sleeve, 3rd and 4th gear | 27 - | Oil seal |
| 13 - | Gear I, 4th gear | 28 - | Needle bearing sleeve |
| 14 - | Throwout fork | 29 - | Ball bearing |
| 15 - | Oil seal | 30 - | Stator support |

