

14-050 Discription of operation

Model year 1980

A. General Information

In model year 1980 a uniform emission control system is installed for Federal and California versions.

Color Coding of Vacuum Lines

The base of the emission control vacuum lines is transparent (white).

Colored stripes on vacuum lines identify individual functions.

Emission Control System Arrangement

Ignition

Advanced timing

red

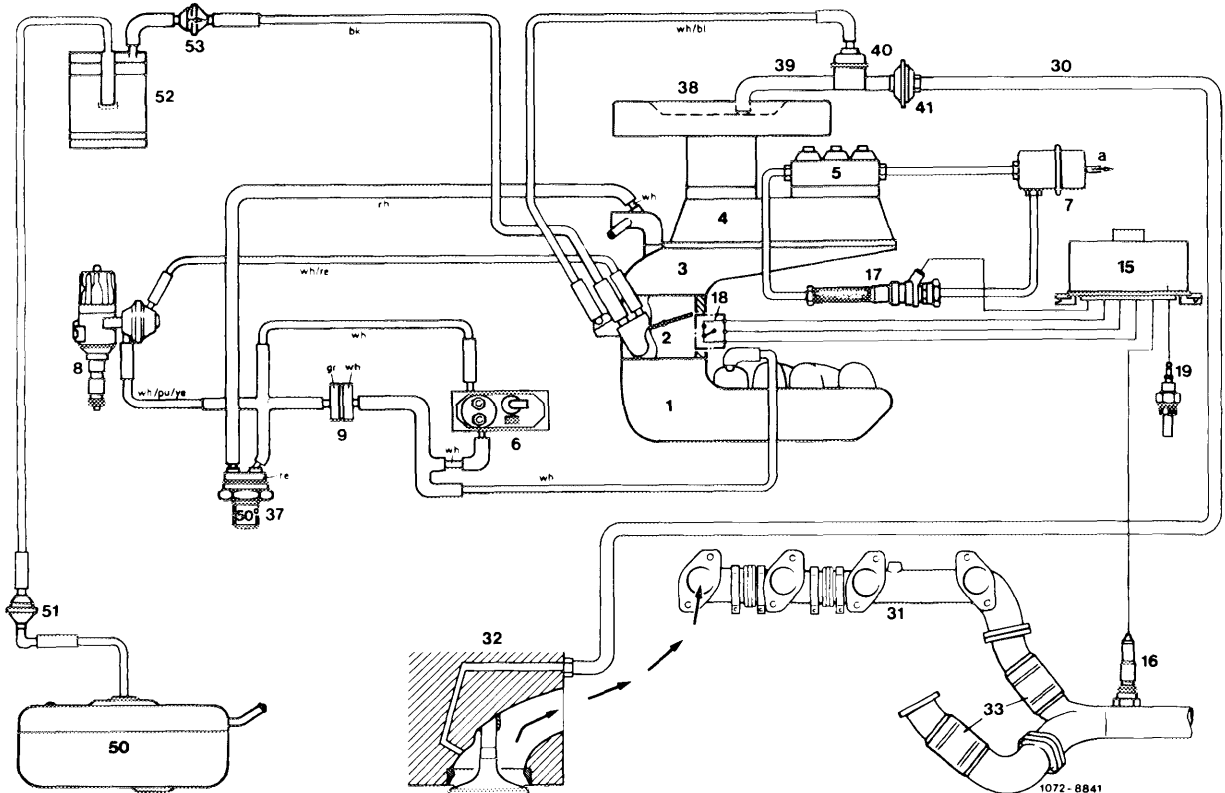
Retarded timing

yellow/purple

Air injection

blue

Functional Schematic, Vacuum Line Diagram



- | | |
|----------------------------------|----------------------------------------|
| 1 Intake manifold | 16 Oxygen sensor |
| 2 Throttle valve housing | 17 Frequency valve |
| 3 Air duct housing | 18 Throttle valve switch |
| 4 Air flow sensor | 19 Temperature switch, oil 16 °C/60 °F |
| 5 Fuel distributor | 30 Air injection line |
| 6 Warm-up enrichment compensator | 31 Exhaust manifold |
| 7 Pressure damper | 32 Cylinder head |
| 8 Ignition distributor | 33 Primary catalyst |
| 9 Restricting orifice | 37 Thermo-vacuum valve 50 °C/122 °F |
| 15 Electronic control unit | 38 Air filter |

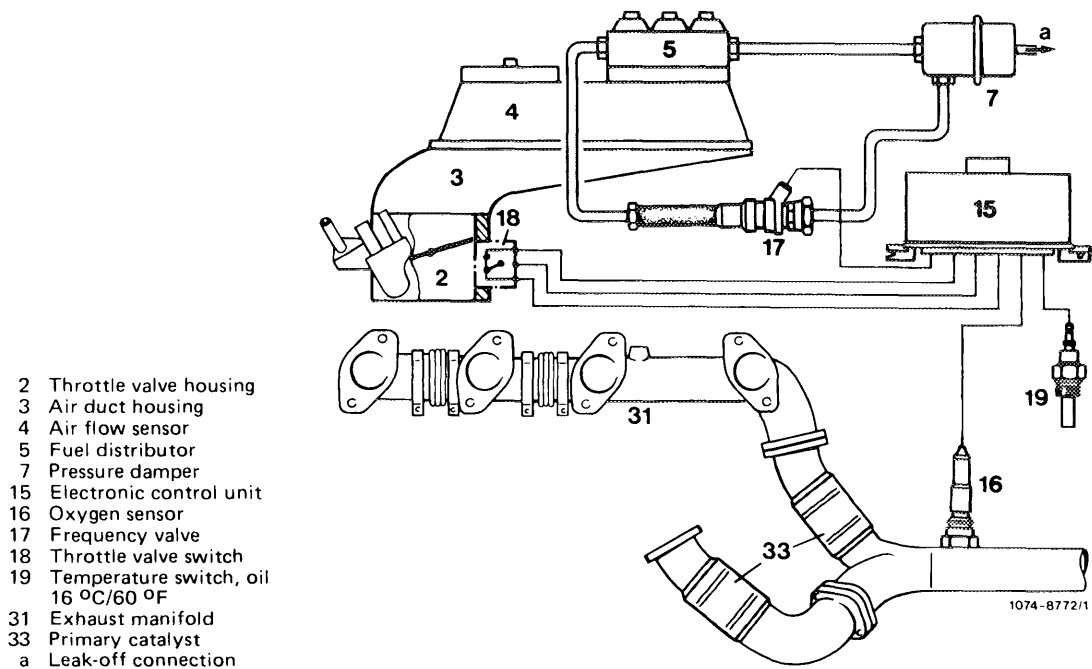
- | |
|------------------------|
| 39 Special shaped hose |
| 40 Air shut-off valve |
| 41 Aspirator valve |
| 50 Fuel tank |
| 51 Vent valve |
| 52 Charcoal canister |
| 53 Purge valve |
| a Leak-off connection |

- | |
|-------------|
| Color code |
| bk = black |
| bl = blue |
| gr = green |
| re = red |
| ye = yellow |
| wh = white |
| pu = purple |

B. Lambda Control ($\lambda = \text{Lambda}$)

In order to comply with stricter emission regulations for internal combustion engines, it is necessary to meter the air-fuel mixture more accurately.

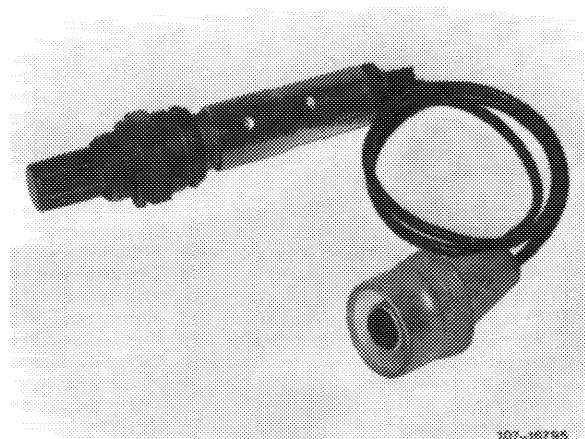
The oxygen sensor control system ensures that a constant air-fuel weight ratio is maintained at approx. 14.5 : 1 ($\lambda = 1$). That means, that an exact proportioning between the injected fuel and the air drawn in can be obtained. This is the ideal mixture ratio, which reduces, in conjunction with the 3-way catalyts, the emissions of HC, CO and NO_x in the exhaust gas to a minimum.



Components of Lambda Control

Oxygen Sensor

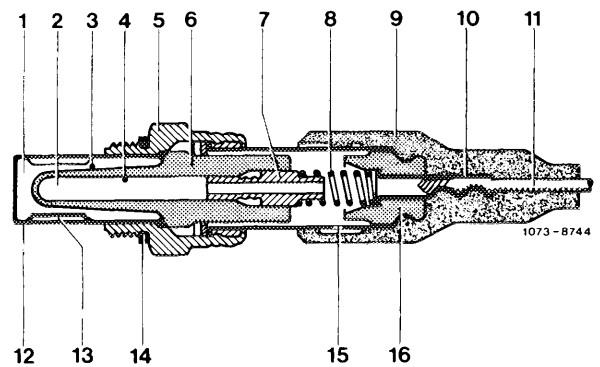
The oxygen sensor is screwed into the front part of the exhaust pipe to measure the oxygen content in the exhaust gases.



Construction

The protective casing (12) protects the probe's ceramic insert (6) against mechanical damage. The outer part of the ceramic insert is in contact with the exhaust gases, the inner side with surrounding air. The ceramic surfaces are coated with a thin layer of permeable platinum. In addition, a porous layer of ceramic was added on the exhaust side, which protects the platinum surface underneath against fouling from combustion materials, ensuring a long life of the oxygen sensor.

- | | |
|----------------------------------|-----------------------------|
| 1 Exhaust gas side | 8 Contact spring |
| 2 Outside air side | 9 Protective boot |
| 3 Outer electro-conductive layer | 10 Crimp connector |
| 4 Inner electro-conductive layer | 11 Connecting leak |
| 5 Probe body with hexagon | 12 Case |
| 6 Probe-ceramic | 13 Exhaust gas intake slots |
| 7 Contact bushing | 14 Seal ring |
| | 15 Fresh air intake slot |
| | 16 Insulator |

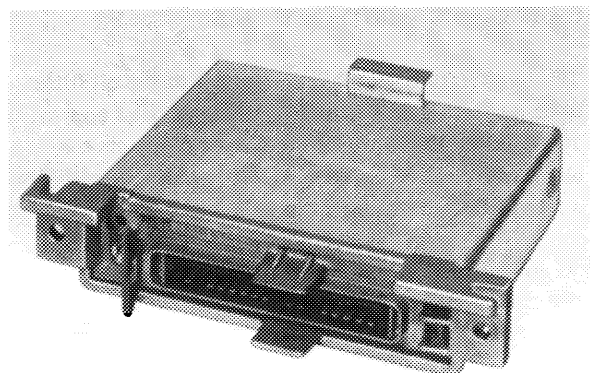


Function

At a temperature of approx. 300 °C/580 °F the ceramic material becomes conductive to the oxygen ions. A different amount of oxygen between either side (exhaust gas side and fresh air side) presents a chemical reaction between the adjoining surfaces and induces an electrical potential. The value of this potential represents the measurement for oxygen differential on both sides of the oxygen sensor. The oxygen sensor is highly sensitive at a range of $\lambda = 1$ (ideal air-fuel ratio) and signals the electronic control unit of this being the desired value.

Electronic Control Unit

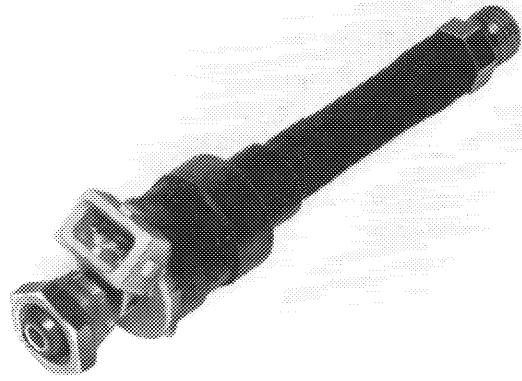
The electronic control unit is located behind the right kick panel. A combination of printed circuits regulates the air-fuel mixture to an ideal value of $\lambda = 1$.



107-16791

Frequency Valve

The frequency valve is attached to the air flow sensor housing. It is connected to a fuel line from the lower chamber of the fuel distributor via the pressure damper to the return line of the warm-up enrichment compensator.



107-18794

Throttle Valve Switch

The throttle valve switch is installed on the throttle valve housing and has two functions: Idle and full throttle contact.

Idle Contact

At idle, the throttle valve switch limits the operating range of the oxygen sensor through the electronic control unit. This will eliminate rpm fluctuation at idle.



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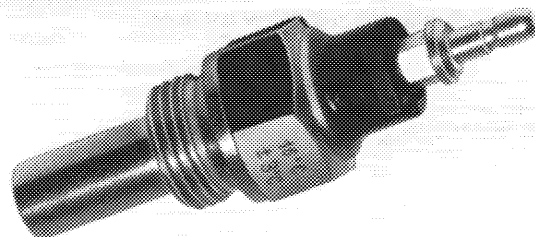
Full Throttle Contact

If the vehicle is driven at full throttle (throttle valve at full throttle stop), the full throttle contact produces in the electronic control unit a fixed 60 to 40 on-off ratio (rich mixture).

Oil Temperature Switch — 16 °C/60 °F

The temperature switch is screwed into the oil filter housing. Below an engine oil temperature of approx. 16 °C/60 °F the temperature switch connects the electronic control unit to ground (—) which produces a fixed 60 to 40 on-off ratio.

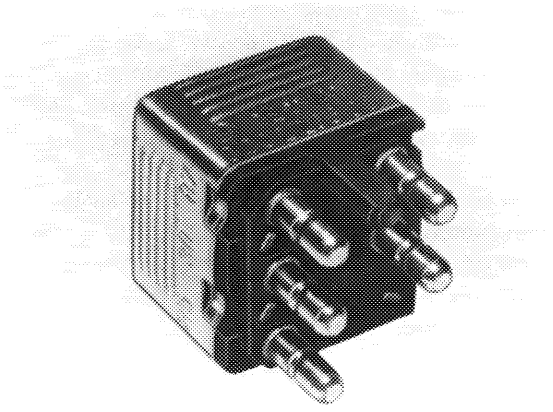
At approx. 16 °C/60 °F the oil temperature switch opens and the electronic control unit resumes its normal cycling.



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Voltage Supply Relay

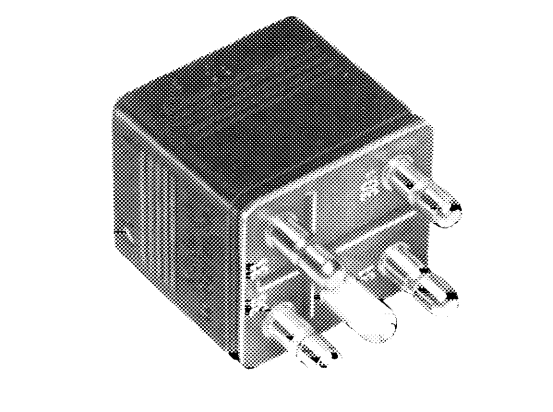
The Lambda system receives voltage from the voltage supply relay located behind the glove box.



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Excess Voltage Protection Unit

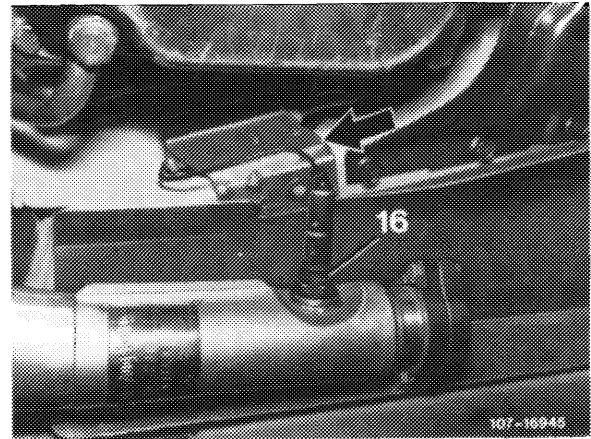
To prevent damage to components of the Lambda system in the event of overloading the vehicle's electrical system (fast charging of battery, loose battery connection), an excess voltage protection unit is connected ahead of the voltage supply relay.



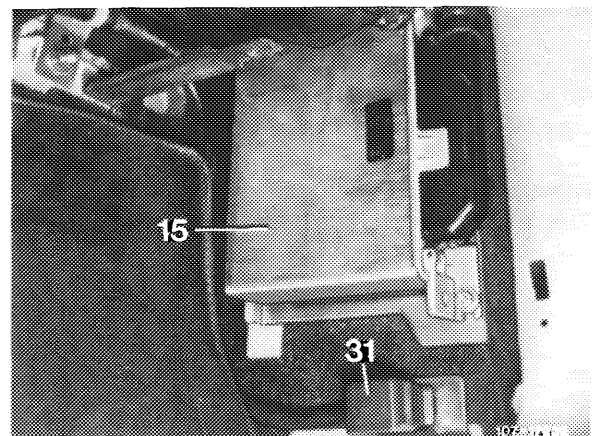
154-17174

Description of Operation

At an operating temperature of 300 °C/580 °F the oxygen sensor (16), which is screwed into the front exhaust pipe, builds up an electrical potential according to the amount of oxygen received through the exhaust gases, and signals the electronic control unit if the mixture is richer or leaner than the ideal mixture of $\text{Lambda} = 1$.

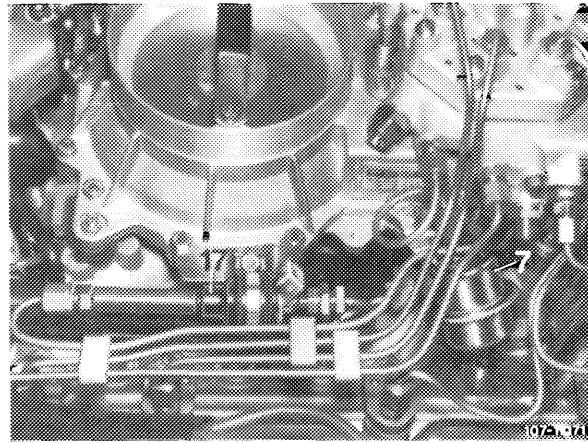


The electronic control unit (15) conveys signals received from the oxygen sensor, as electrical impulses to the frequency valve (17).



The frequency valve is a solenoid valve which, depending on the received electrical impulses varies the differential pressure at the metering slots and thereby the amount of injected fuel (On-Off ratio) (see 07.3, Fuel Distributor).

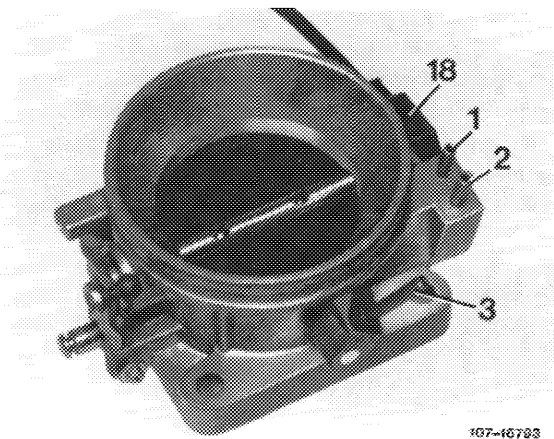
While driving with full throttle or below an engine oil temperature of 16 °C/60 °F, the Lambda control is cancelled, and the electronic control unit cycles the frequency valve at a constant 60 % open and 40 % closed ratio.



These two operating conditions are controlled by the throttle valve switch (18) or by the oil temperature switch (19).

At 30.000 miles an indicator light on the instrument panel lights up to indicate that the oxygen sensor must be replaced.

Beyond that, it is suggested to replace the oxygen sensor every 30.000 miles.



C. Air injection

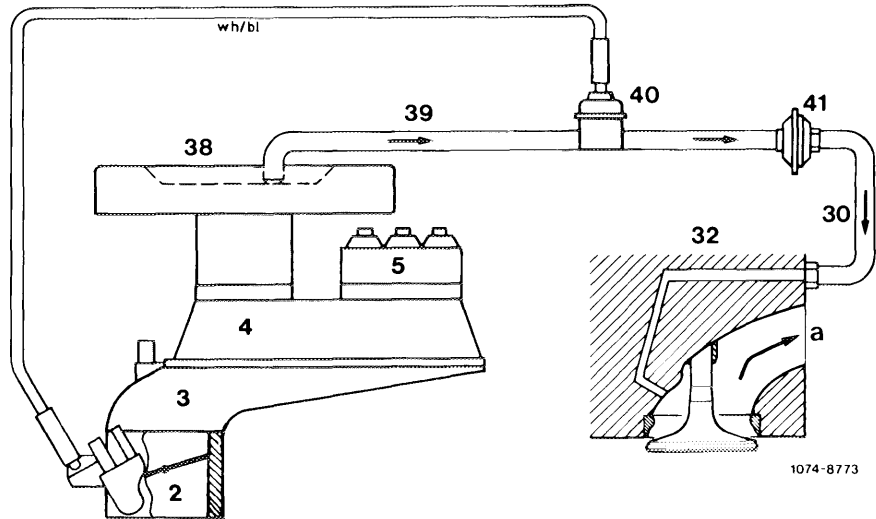
To achieve a smooth idle air is injected into the hot zone behind the exhaust valves at all temperatures.

Subsequently the oxygen sensor detects a lean mixture, and the air-fuel ratio is slightly enriched by the electronic control unit.

Operational Schematic

- 2 Throttle valve housing
- 3 Air duct housing
- 4 Air flow sensor
- 5 Fuel distributor
- 30 Air injection line
- 32 Cylinder head
- 38 Air cleaner
- 39 Special shaped hose
- 40 Air shut-off valve
- 41 Aspirator valve
- a to exhaust manifold

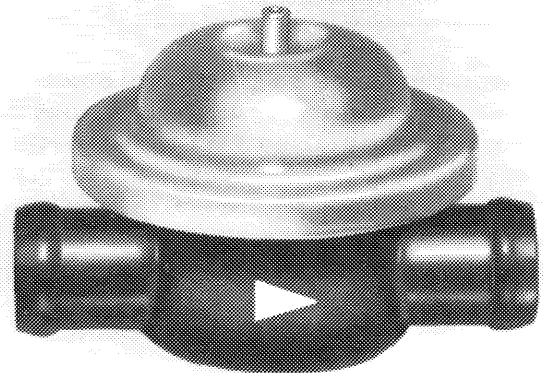
Color code
bl = blue
wh = white



Components of Air Injection System

Air Shut-Off Valve

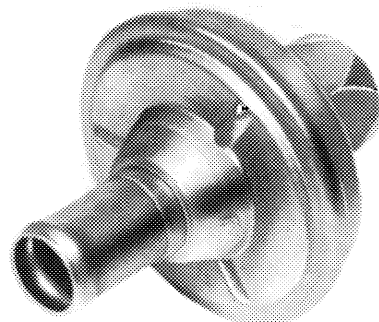
The vacuum governed air shut-off valve is located in the special shaped hose between the air filter and the aspirator valve, and controls the air injection in dependence of vacuum.



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Aspirator Valve

The aspirator valve is installed into the air injection line leading to the cylinder head. Its function is air injection and preventing the hot exhaust gases from flowing back to the air filter.

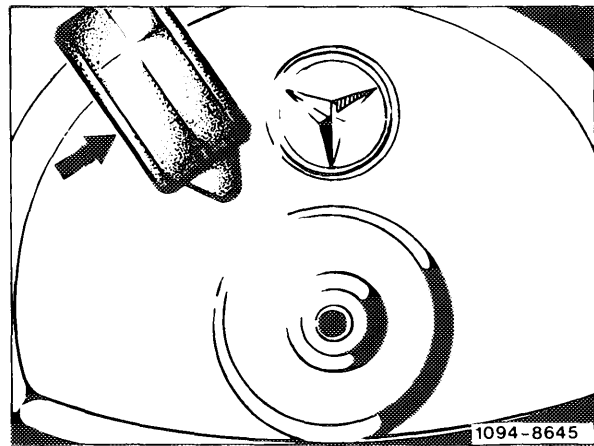


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Air Filter

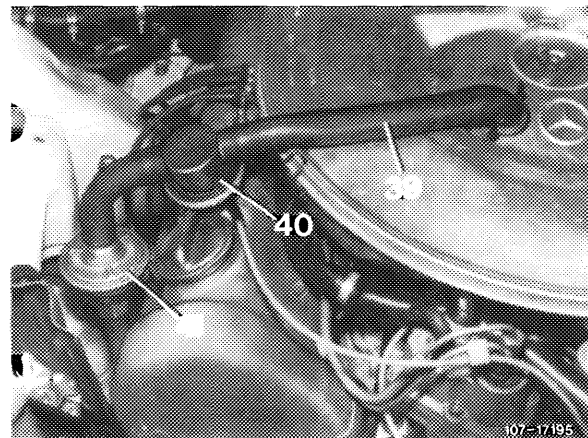
The cover of the air filter is provided with a connection for air injection.

The special shaped hose (arrow) is connected on the air filter cover and draws air from the clean air side of the air filter.



Special Shaped Hoses, Air Injection Lines and Air Passages

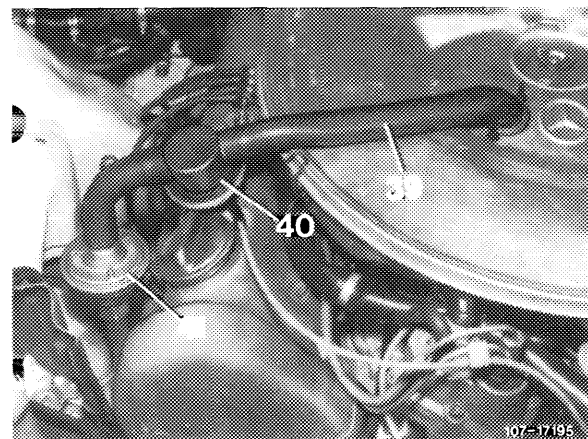
The air is drawn from the air filter via the special shaped hoses, and transferred via injection lines and air passages through the injection ports behind the exhaust valves.



Description of Operation

With the engine running and throttle valve closed (idle position), the intake manifold vacuum causes the air shut-off valve (40) to open. The aspirator valve (41) draws air from the filtered air side of the air filter past its heat resistant diaphragm. The vacuum pulsations that are created behind the exhaust valves and in the exhaust manifold, open the aspirator's diaphragm. If the pressure is positive, it closes the diaphragm and prevents gases from flowing into the air cleaner.

The oxygen contained in the air is combined with hot exhaust gas and is conducted through the primary catalyst to the oxygen sensor. The sensor senses a lean mixture and transmits appropriate signals to the control unit so that the idle mixture will be slightly enriched. This serves to achieve stable running at idle.



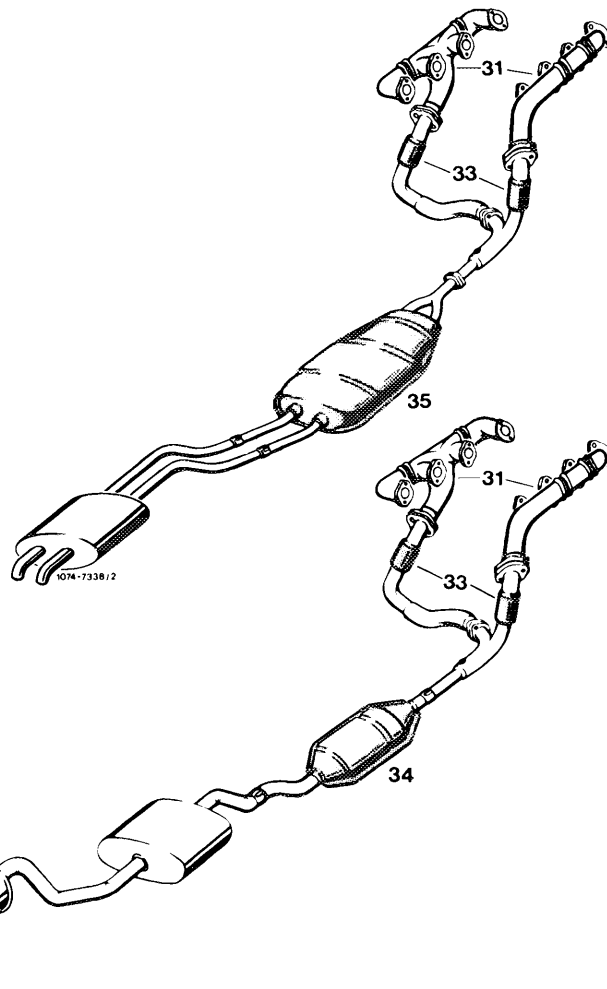
D. Catalytic Converter

The catalysts are designed as three-way catalytic converters and are located in the exhaust system in front of the mufflers. By using this configuration, the toxic components CO (carbon monoxide), HC (hydrocarbons) and NO_x (nitric oxides) can be proportionately reduced to a minimal amount in connection with the use of the oxygen sensor (at $\lambda = 1$).

We differentiate between primary and underfloor catalyst. Chassis type 107 has a catalyst-muffler combination.

Chassis Type 107

- 31 Exhaust manifold
- 33 Primary catalyst
- 35 Catalyst-muffler combination

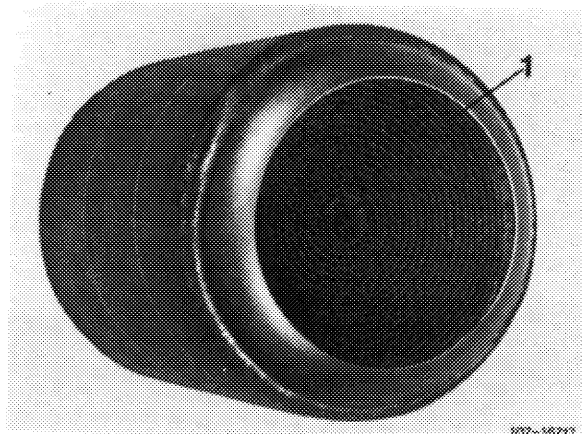


Chassis Type 116

- 31 Exhaust manifold
- 33 Primary catalyst
- 34 Underfloor catalyst

Primary Catalyst

This catalyst consists of a monolith, a honeycomb-shaped structure of steel and is pressed into the exhaust pipe and welded to it.



Primary Catalyst

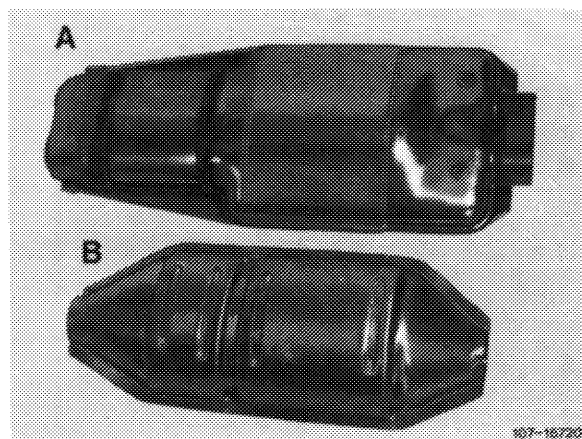
- 1 Monolith (steel structure)

Underfloor Catalyst and Catalyst-Muffler Combination

The catalysts consist of a monolith (3), a honeycomb-structure of ceramic material which is elastically mounted in a wire mesh structure (2).

The precious metal coating on the monolith accelerates the reduction and/or oxidation of toxic materials.

- A Catalyst-muffler combination, Chassis type 107
- B Underfloor catalyst, Chassis type 116



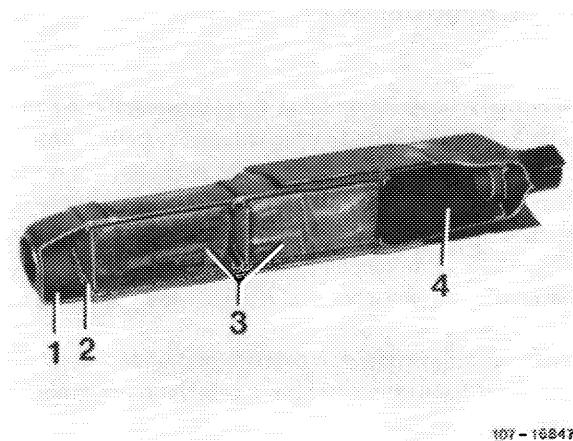
Run engine **only** on unleaded gasoline to keep catalysts operational.

Avoid overheating of catalysts.

Extended overheating of catalysts will result in damage, which means that the monoliths may melt.

Model 107

- | | |
|-------------|------------|
| 1 Housing | 3 Monolith |
| 2 Wire mesh | 4 Muffler |



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Catalysts may overheat for the following reasons:

a) Lack of engine maintenance.

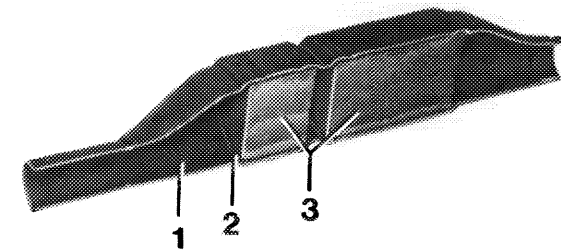
Spark plugs in proper condition are important for life of catalysts.

b) Due to irregular firing, the fuel-air mixture becomes too rich.

c) Emission control system has been tampered with.

Model 116

- | | |
|-------------|------------|
| 1 Housing | 3 Monolith |
| 2 Wire mesh | |



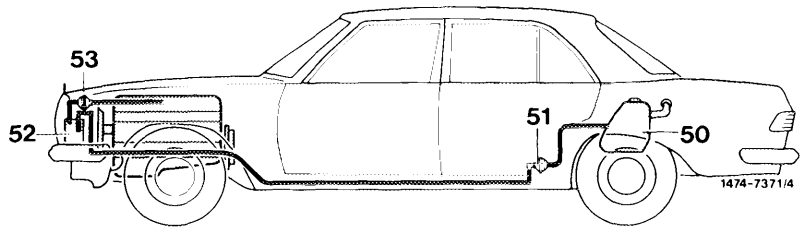
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E. Fuel evaporation control system

A fuel evaporation control system has been installed to improve emissions which are not directly connected to engine combustion.

Function diagram

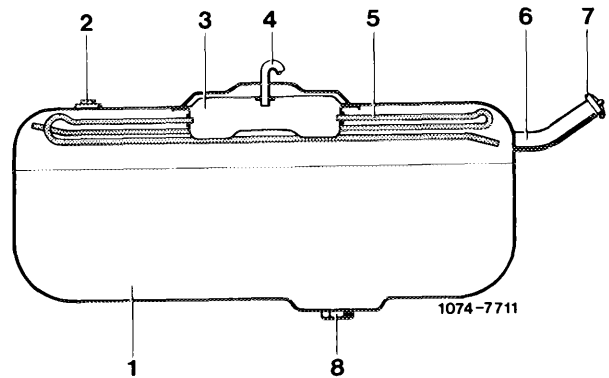
- 50 Fuel tank
- 51 Vent valve unit
- 52 Charcoal canister
- 53 Purge valve



Components of fuel evaporation control system

Fuel tank

A collecting tray inside fuel tank is connected to the pipe system. The connection to vent valve unit enters the collecting tray.



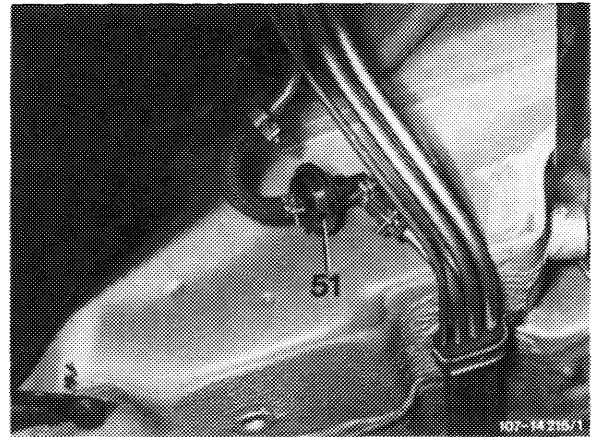
- | | |
|------------------------------|-----------------------------|
| 1 Fuel tank | 5 Pipe system |
| 2 Immersion tube transmitter | 6 Filler neck |
| 3 Expansion tank | 7 Tank cap |
| 4 Connection vent valve unit | 8 Connection fuel feed line |

Vent valve unit

The vent valve unit (51) is mounted underneath vehicle at level of rear legroom.

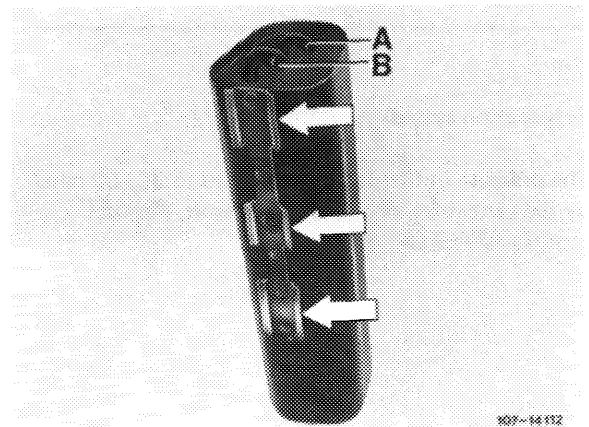
The unit comprises a negative vent valve (pressure relief valve) and a positive vent valve (vacuum relief valve).

Note: The vent valve unit is optionally available in two versions which are, however, identical with regard to operation and effect.



Charcoal canister

The fuel evaporation vapors from fuel tank are stored in charcoal canister and are drawn off again while driving.

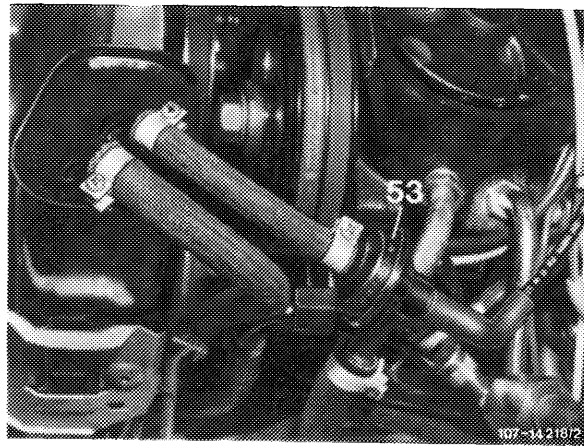


- A Draw-off connection
- B Tank vent connection

Purge valve

The purge valve (53) is located in purge line from charcoal canister to throttle valve housing.

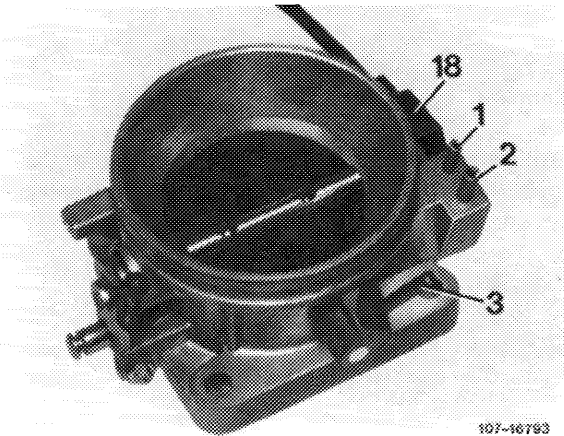
Note: The purge valve is optionally available in two versions which, however, are identical with regard to operation and effect.



Throttle valve housing

Connection (2) on throttle valve housing serves for drawing evaporation vapors from charcoal canister.

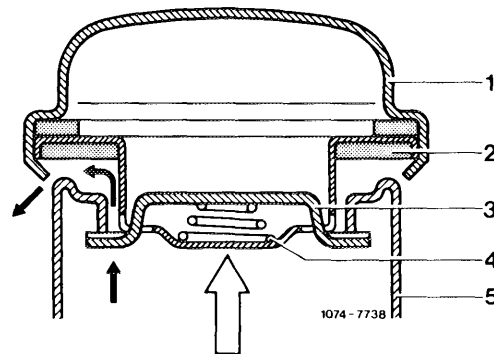
The throttle valve switch (18) is installed to regulate lambda control (idle and full throttle stop).



- 1 Connection vacuum advance
- 2 Draw-off connection charcoal canister
- 3 Connection air shutoff valve
- 18 Throttle valve switch

Fuel tank closing cap

To prevent increased overpressure in fuel tank, the fuel tank cap has been modified starting model year 1978.

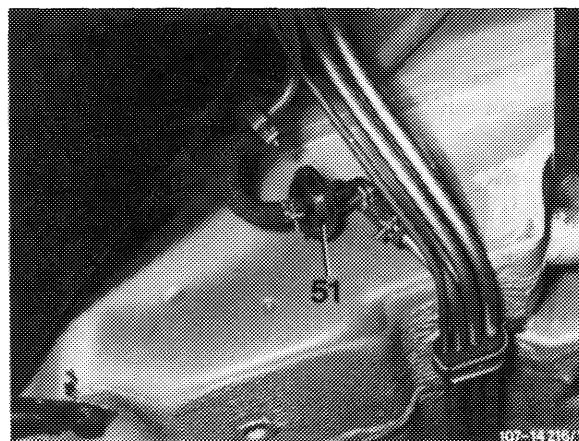


- 1 Closing cap
- 2 Gasket
- 3 Clamp
- 4 Compression spring
- 5 Filler neck

Operation

Evaporation system

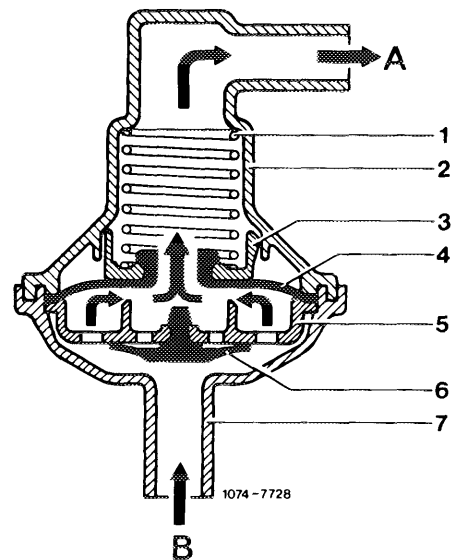
The pressure in fuel tank is increased to 30–50 mbar by the vent valve unit (51). As a result, less fuel vapors can escape from fuel tank.



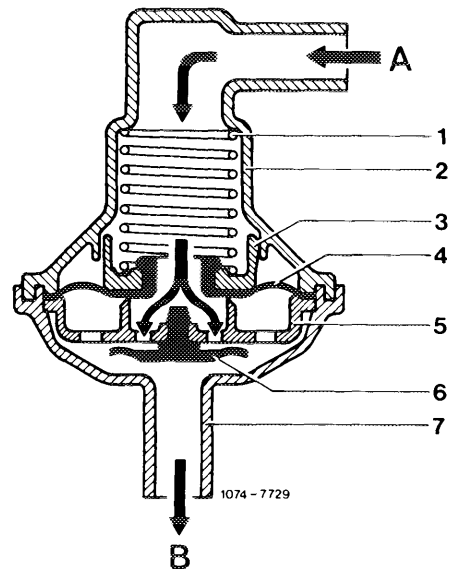
As soon as the pressure in fuel tank reaches 30–50 mbar, the negative vent valve (4) opens allowing the fuel vapors to flow to the charcoal canister where they are stored if the engine is not running.

Vent valve unit open to charcoal canister

- 1 Compression spring
- 2 Valve housing
- 3 Spring retainer
- 4 Negative vent valve (pressure relief valve)
- 5 Valve disc
- 6 Positive vent valve (vacuum relief valve)
- 7 Connection
- A Connection charcoal canister
- B Connection fuel tank



When the fuel cools down, the smaller volume is compensated by the intake of air or fuel evaporation vapors from charcoal canister via positive vent valve (6) starting at a vacuum of 1–16 mbar. If the vacuum in fuel tank drops below 1 mbar, the positive vent valve (6) will close.



Vent valve unit open to fuel tank

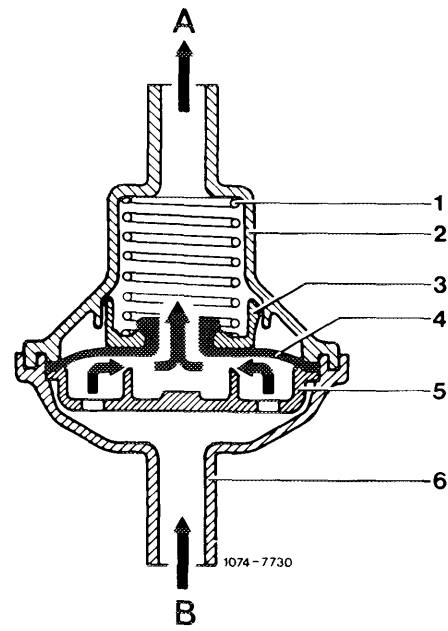
If the pressure in the fuel tank increases to above 0.1–0.3 bar due to a malfunction in the fuel evaporation system, the fuel vapors escape via fuel tank cap.

Purge system

The charcoal canister is connected to the throttle valve housing by means of a line in which the purge valve is installed.

When the engine is running and the vacuum in the purge line exceeds 30–50 mbar, the purge valve will open. The fuel vapors stored in charcoal canister can be drawn off depending on throttle valve position.

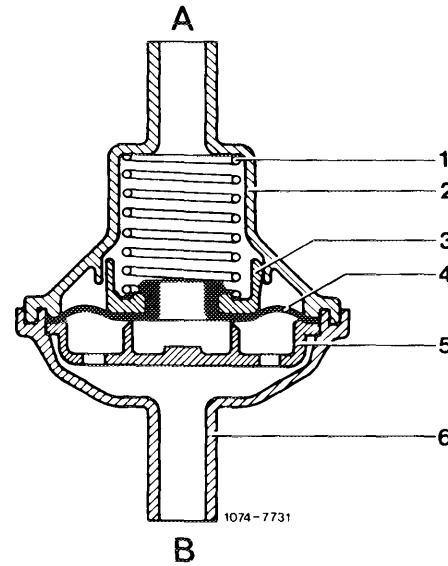
When the throttle valve opens, the two purge bores in throttle valve housing, which are entering a common duct, are both passed over one after the other. As a result, purging in lower partial range begins in dosages which are not influencing the driving characteristics.



Purge valve (open)

- | | |
|-----------------------------------------------|-------------------------------------|
| 1 Compression spring | 5 Valve disc |
| 2 Valve housing | 6 Connection |
| 3 Spring retainer | A Connection throttle valve housing |
| 4 Negative vent valve (pressure relief valve) | B Connection charcoal canister |

At idle and during deceleration (throttle valve closed) the two purge bores are at atmospheric side of throttle valve. There is no purging of charcoal canister.

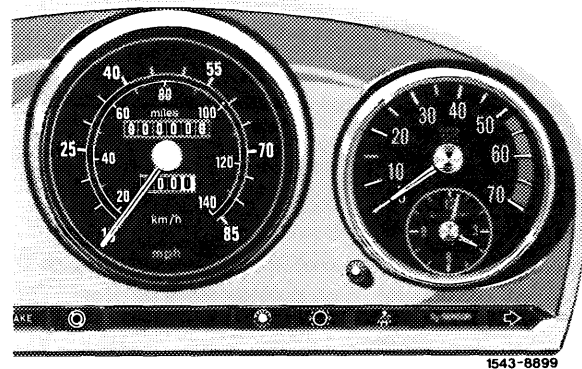


Purge valve (closed)

F. Oxygen sensor renewal indicator

Pertinent legislation specifies that the oxygen sensor must be renewed once after 30 000 miles. This is indicated by an "oxygen sensor" indicator lamp (arrow) in instrument cluster lighting up.

The oxygen sensor is renewed in the USA only.

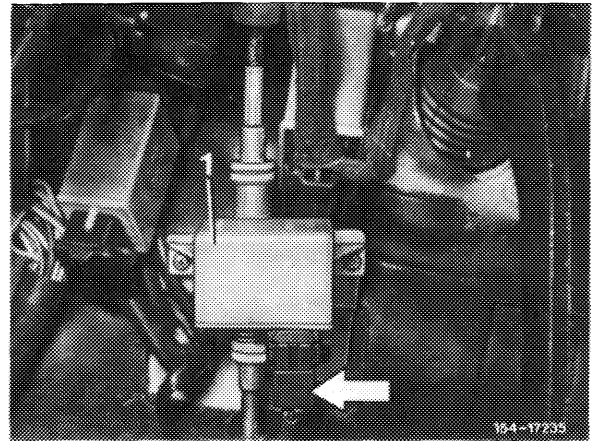


The mileage indicator is attached under instrument panel and is driven by tachometer shaft. When the respective number of miles is attained, a contact will close and the "oxygen sensor" indicator lamp will light up.

After replacing the oxygen sensor, the indicator lamp is made inoperative by pulling-off plug (arrow) on mileage counter.

Note: Prior to installing oxygen sensor, coat its threads with hot lubricating paste 000 989 88 51.

The tightening torque of oxygen sensor is 50–60 Nm.



G. Hints for troubleshooting lambda control

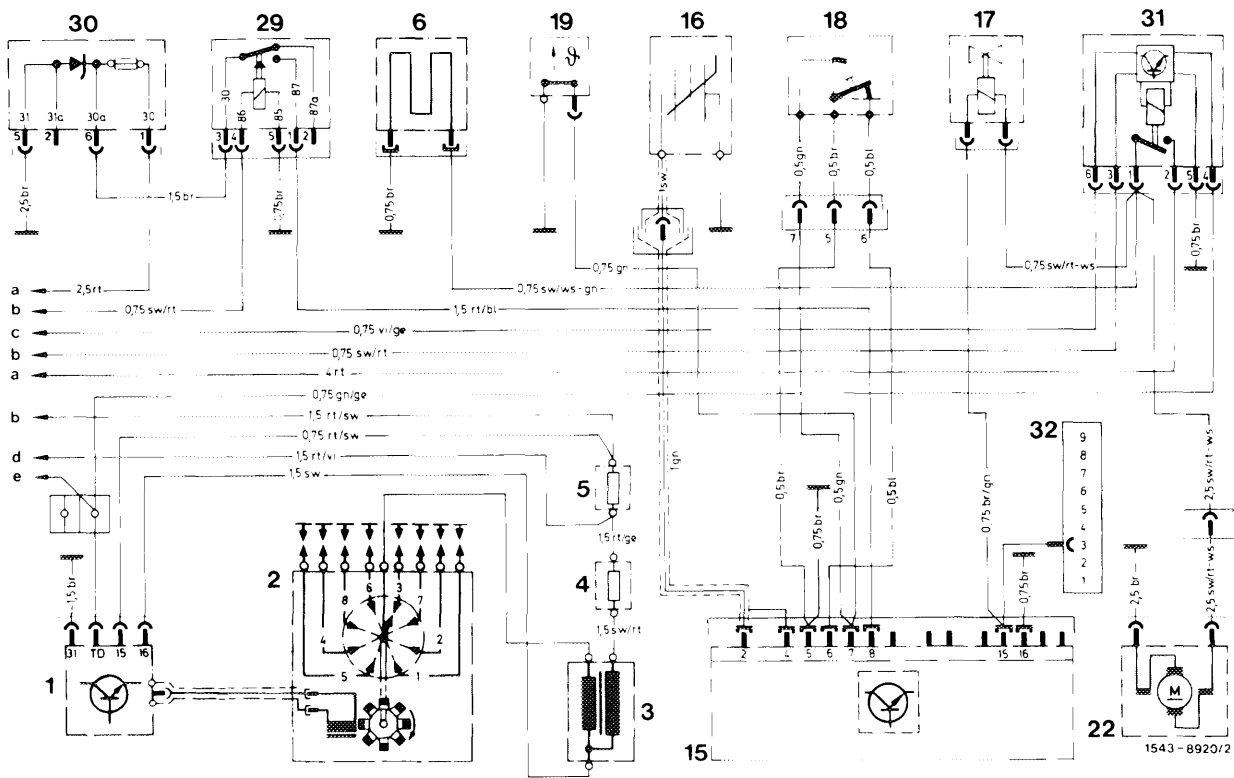
For complaints such as:

Poor warm-up characteristics of engine, hunting at idle, not accepting gas or splashing during acceleration, proceed as follows:

- 1 Check frequency valve while running engine at operating temperature and at idle, place hand on output end (fuel hose) of frequency valve to check for noticeable operation. If frequency valve is not operating, perform test program (14–100).
- 2 Check on/off ratio and regulate, if required (07.3–105).
- 3 Check adjustment of throttle valve switch and correct, if required (07.3–170).
- 4 Check acceleration enrichment of warm-up compensator (07.3–175).
- 5 Check fuel pressures and firing point and correct, if required (07.3–120 or 15–500).
- 6 Check engine for mechanical condition and eliminate faults, if required.

There should be no more faults after these complaints have been remedied.

H. Electric wiring diagram lambda control



- | | | | | | |
|----|----------------------------------------|----|--------------------------------|---|--------------------------------------------|
| 1 | Transistorized ignition switching unit | 17 | Frequency valve | a | Cable connector, terminal 30 |
| 2 | Ignition distributor | 18 | Throttle valve switch | b | Fusebox, terminal 15 |
| 3 | Ignition coil | 19 | Temperature switch 16 °C/61 °F | c | Relay air-conditioning/starter terminal 87 |
| 4 | Pre-resistance 0.6 Ω | 22 | Fuel delivery pump | d | Starter terminal 16 |
| 5 | Pre-resistance 0.4 Ω | 29 | Relay voltage supply | e | Diagnosis socket, jack 1 |
| 6 | Warm-up compensator | 30 | Overtoltage protection | | |
| 15 | Lambda control unit | 31 | Fuel pump relay (electronic) | | |
| 16 | Oxygen sensor | 32 | Diagnosis socket | | |