

## 14-050 Operation

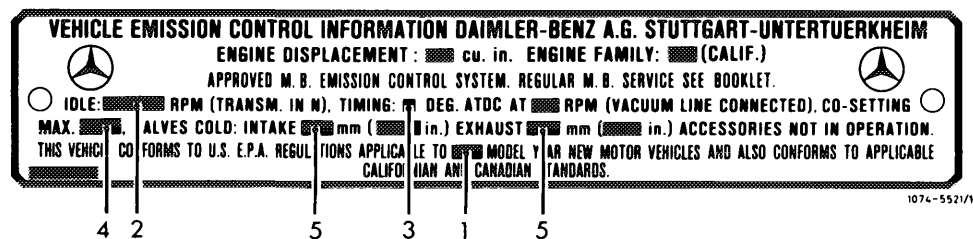
Federal and California version model year 1976

### A. General

#### Information plate

Federal version basic color black.

California version basic color green.



- 1 Model year
- 2 Idle . . . rpm
- 3 Timing at . . . rpm
- 4 Emission value at idle
- 5 Valve clearance

#### Identification of vacuum lines

The basic color of vacuum lines for emission control system is transparent (white).

Additional color stripes are used to facilitate identification of the individual functions.

**Lines originating at a vacuum source** (originating lines) **have only one color stripe.**

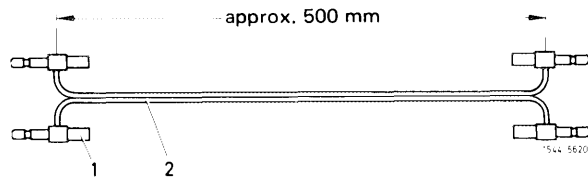
**Lines terminating at a vacuum-operated device** (terminating lines) **have two color stripes.** Purple is always the second color.

Emission control system	Color coding of originating vacuum line	Color coding of terminating vacuum line
<b>Ignition switchover</b>		
Advance	red	red/purple
Retard	yellow	yellow/purple
<b>EGR</b>	brown	brown/purple
<b>Air injection</b>	blue	blue/purple
<b>Fuel evaporation control system</b>		
Purge valve	black	

### Test cable

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To test the individual components of emission control system we recommend a self-made test cable according to illustration.

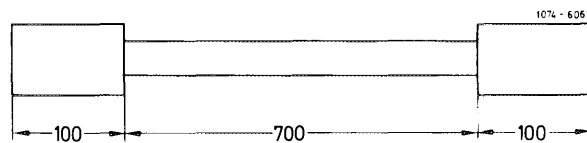


- 1 Coupling part no. 003 545 28 28 (housing omitted)
- 2 Cable 1.5 mm<sup>2</sup>

### Test line

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Make a vacuum line according to illustration to test vacuum switch (56) and EGR valve.



- 700 = 700 mm vacuum line 4 x 1 mm
- 100 = 100 mm hose 8 x 2 mm

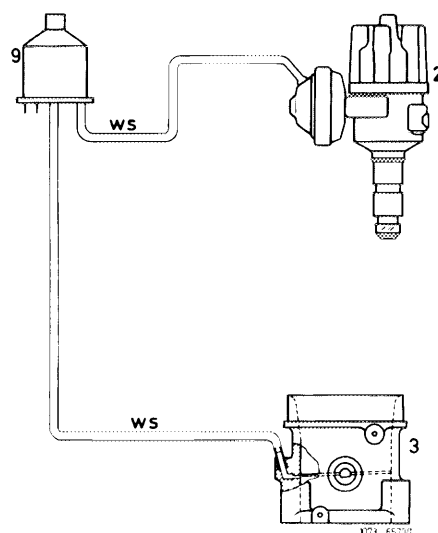
## B. Ignition timing

The ignition timing influences the running characteristics of the engine.

Ignition timing in direction of "retard" results in a higher engine temperature, longer periods of dwell and thereby in a reduction of CH and CO values.

## Function diagram

- 2 Ignition distributor
- 3 Throttle valve housing
- 9 Switchover valve

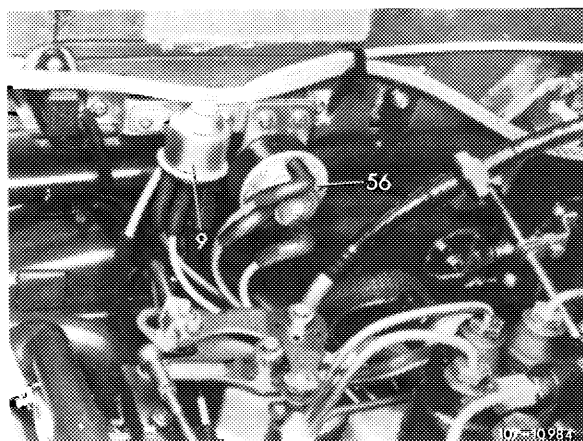
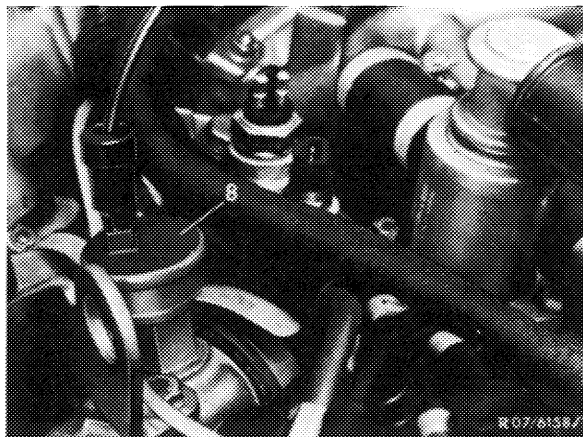


Vacuum adjustment in direction of "retard" becomes effective at the following operating conditions:

- Below 100 °C coolant temperature.
- Engine at idle.
- Engine decelerating (coasting) (throttle valve at idle speed stop).
- Air conditioning system switched off.

Vacuum adjustment in direction of "retard" is switched off and on by means of switchover valve (9), which is contacted by temperature switch 100 °C (8) via relay (19).

Below 100 °C coolant temperature the temperature switch 100 °C (8) is open, the switchover valve (9) is de-energized. The vacuum flows from throttle valve housing (3) via switchover valve (9) to diaphragm of vacuum unit of ignition distributor.

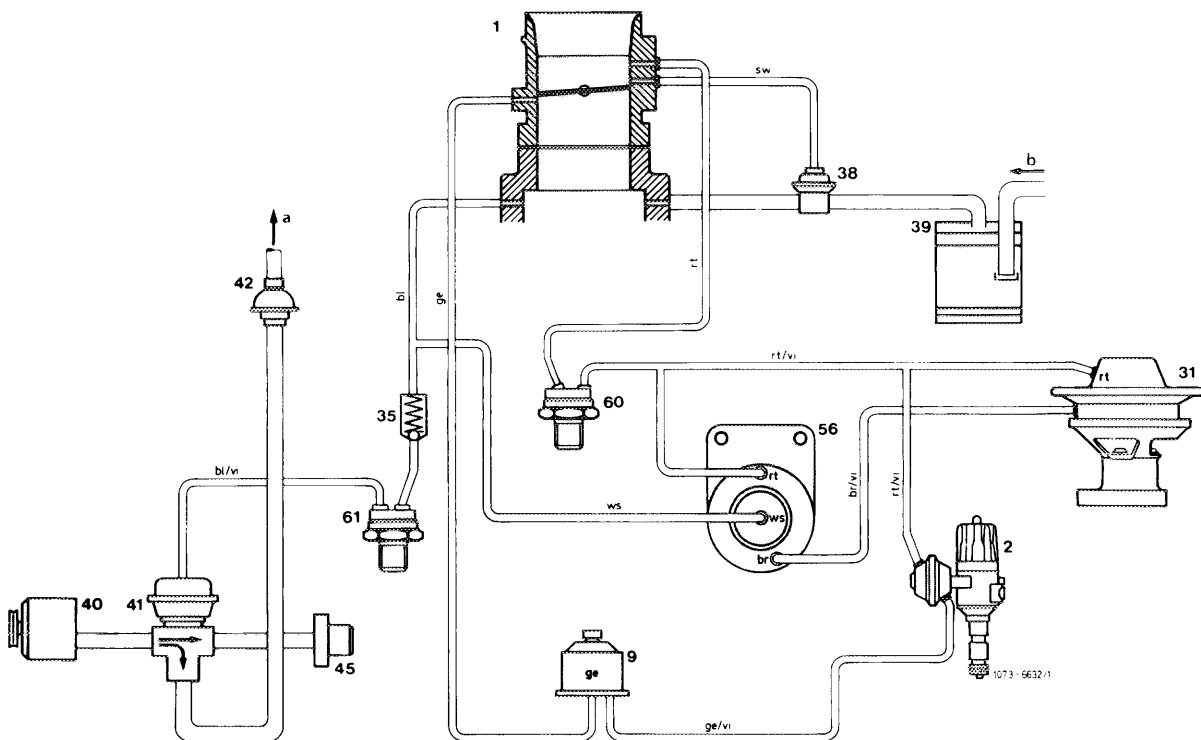


### C. EGR (exhaust gas recirculation)

To reduce nitrogen oxides in exhaust gases, a portion of the gases from the exhaust manifold is returned to the intake pipe.

The quantity of the returned exhaust gas is controlled by the throttle valve position and the intake pipe vacuum.

#### Function diagram



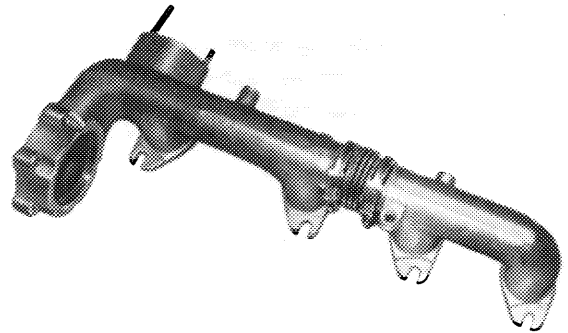
- |                                    |                                       |             |
|------------------------------------|---------------------------------------|-------------|
| 1 Throttle valve housing           | 41 Diverter valve                     | bl = blue   |
| 2 Ignition distributor             | 42 Check valve air injection          | br = brown  |
| 9 Switchover valve ignition retard | 45 Air filter for silencing           | ge = yellow |
| 31 EGR valve                       | 56 Vacuum switch                      | rt = red    |
| 35 Check valve                     | 60 Thermostatic valve 40 °C (black)   | sw = black  |
| 38 Purge valve                     | 61 Thermostatic valve 17 °C (blue)    | vi = purple |
| 39 Charcoal canister               | a Air injection line to cylinder head | ws = white  |
| 40 Air pump                        | b Connection tank vent                |             |

## EGR components:

### Exhaust manifolds

Exhaust manifolds now have one bellows only. A flange is cast-on at the front for assembly of catalyst.

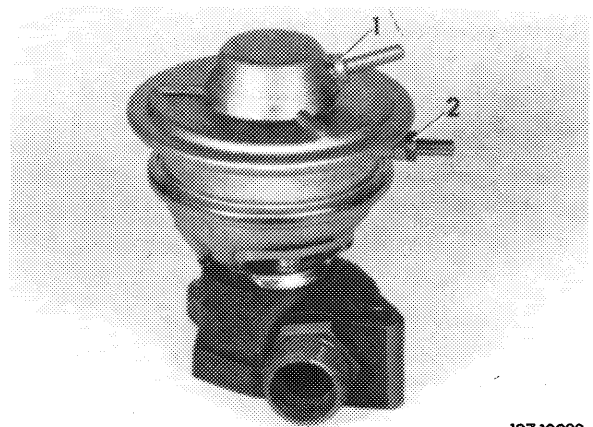
For EGR, a bore as well as a flange for the EGR valve are located at lefthand exhaust manifold.



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### EGR valve

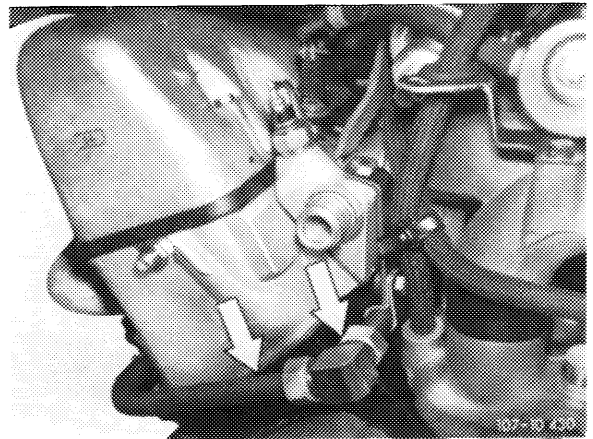
For better adaptation of EGR on engine, the EGR valve is provided with a double diaphragm.



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### EGR line

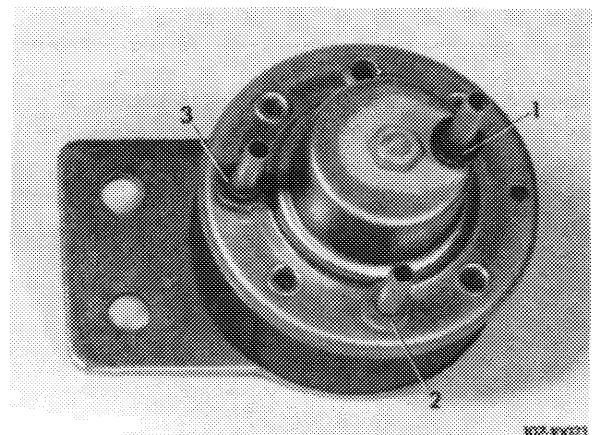
The EGR line runs from EGR valve under exhaust manifold from the rear to intake pipe.



### Vacuum switch

A vacuum switch is installed to control EGR.

- 1 Connection in center with white ring: throttle valve housing/purge valve
- 2 Connection with red ring: ignition advance/EGR valve 1st stage
- 3 Connection with brown ring: EGR valve 2nd stage

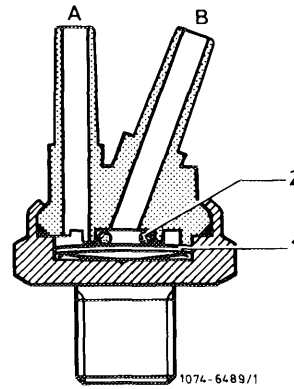


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### Therموالve 40 °C (color code black)

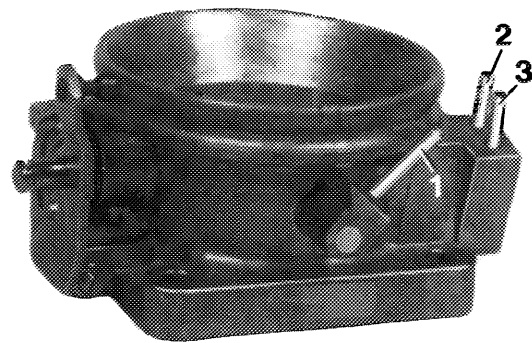
The therموالve (60) is screwed into portion of intake pipe included in coolant flow and **opens** at approx. 40 °C coolant temperature. Below 40 °C coolant temperature the bimetallic plate rests against O-ring and closes connection "B".

Above 40 °C coolant temperature the bimetallic plate snaps downward when heated. Both connections are connected to each other.



### Throttle valve housing

The throttle valve housing is provided with three vacuum connections to control the individual units.



- 1 Vacuum connection ignition "retard"
- 2 Vacuum connection with red ring: EGR 1st stage/ ignition "advance"
- 3 Vacuum connection with black ring: vacuum switch/ purge valve

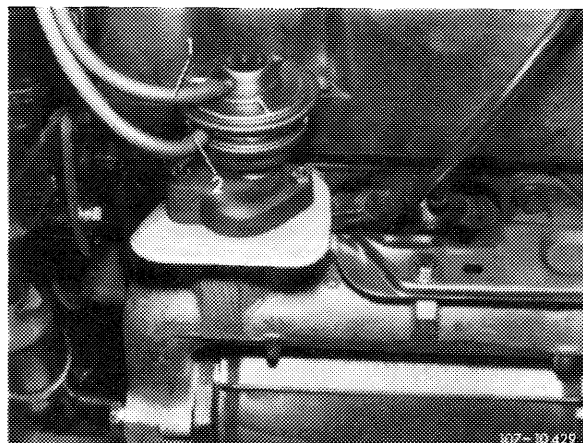
EGR is activated:

- Above 40 °C coolant temperature.
- During acceleration.
- During partial load operation.
- During transition to deceleration (coasting).

### Operation

Above 40 °C in the driving ranges named above, a part of the exhaust gases is returned from exhaust manifold to intake pipe.

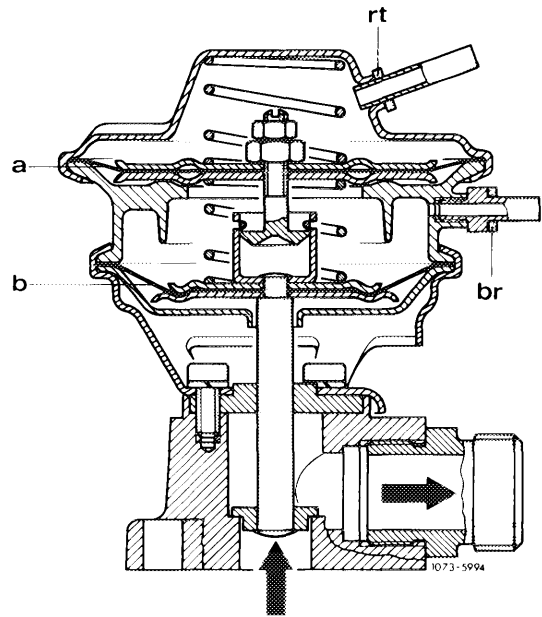
EGR is effected in two stages, the volume (quantity) of the returned exhaust gases depends on position of throttle valve (vacuum tapped at throttle valve housing).



### EGR 1st stage (small quantity)

While driving at coolant temperatures above approx. 40 °C.

The thermovalve (60) is open and the connection from throttle valve housing to EGR valve is established. Valve will lift off with adequate vacuum and exhaust gases are drawn into intake pipe.



### EGR 2nd stage (large quantity)

When the vehicle is accelerated, the vacuum on throttle valve housing drops and the 2nd stage of the EGR valve is activated with vacuum via vacuum switch (56). The EGR valve can fully open in dependence of the intake pipe vacuum.

### Vacuum switch

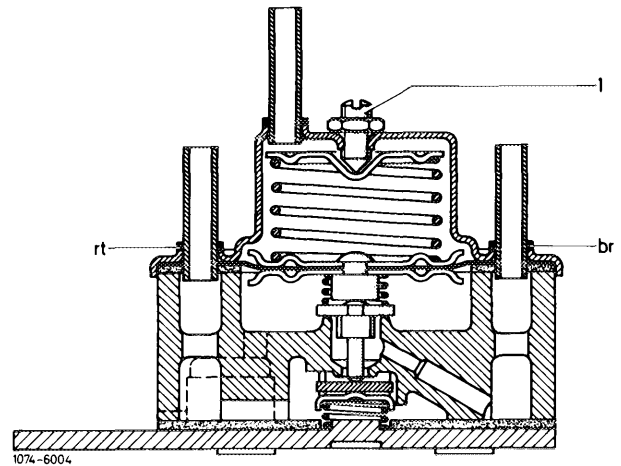
If the vacuum on center connection drops below the preset value, the spring will push the diaphragm downwards.

The upper plate valve (1) is closed, the lower valve is opened and connections red and brown are connected to each other.

If the vacuum on center connection exceeds the preset value, the diaphragm is pushed upwards by the atmospheric pressure against bottom face.

The lower plate valve is closed and the upper valve is opened. The red connection is sealed, the brown connection is positively vented.

**Note:** Positive venting is effected via bottom face of large diaphragm, from there via a filter from outside.

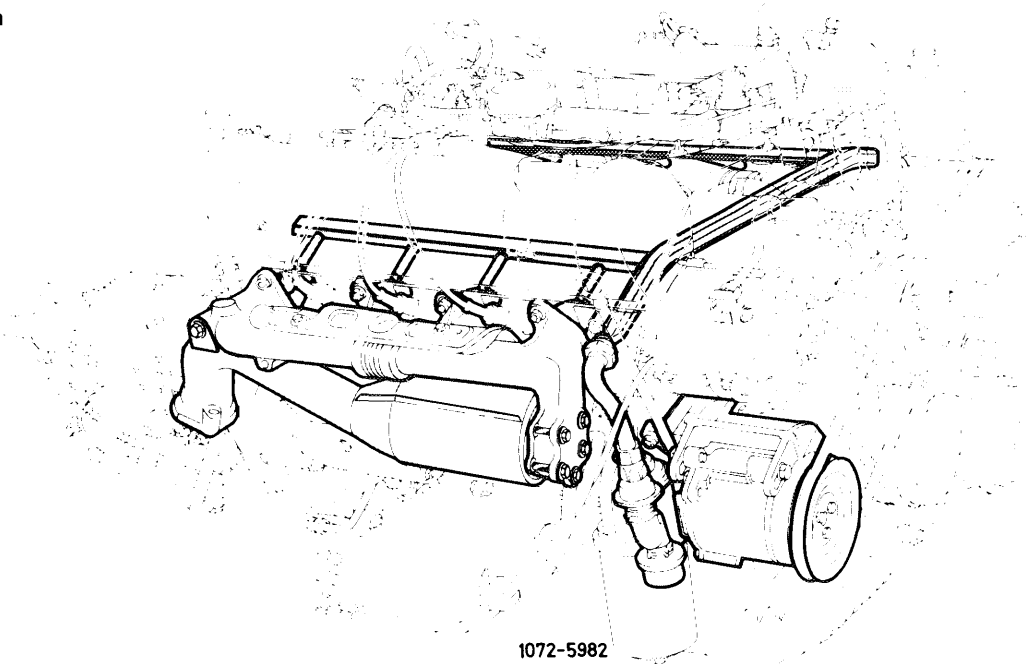


## D. Air injection

To reduce the incompletely burnt components in exhaust gas, air is injected into hot zone behind exhaust valves.

To prevent backfiring in exhaust, the air injection is controlled via switchover valve (33) and diverter valve (41).

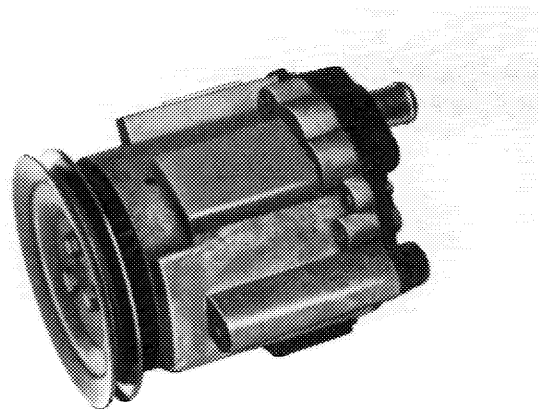
### Function diagram



### Components of air injection:

#### Air pump (Saginaw pump)

The air pump is an impeller pump with a maintenance-free centrifugal filter which cleans the drawn-in air.



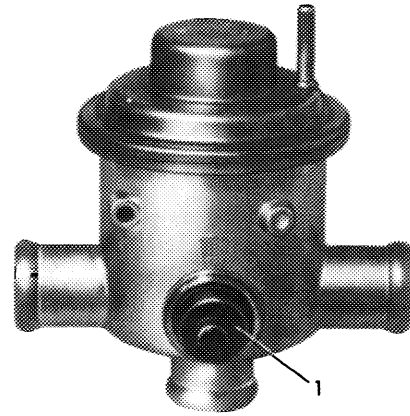
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### Diverter valve

The diverter valve serves the purpose of discharging the delivered air below 17 °C coolant temperature by way of a separate air filter for silencing.

The diverter valve is provided with a safety valve (1) which discharges the delivered air at a given overpressure to protect the pump vanes against overload.

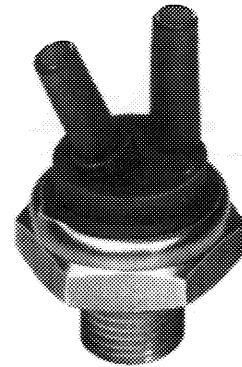


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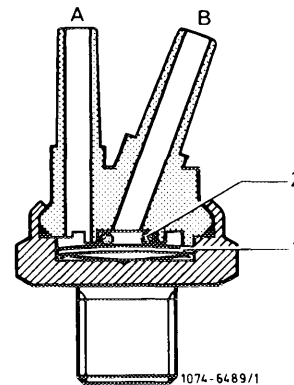
### Therموالve 17 °C (color code blue)

The therموالve (61) is screwed into coolant-controlled portion of intake pipe and **opens** at approx. 17 °C coolant temperature. Below 17 °C coolant temperature the bimetallic plate rests against O-ring and closes connection "B".

Above 17 °C coolant temperature the bimetallic plate snaps downward when heated. Both connections are connected to each other.



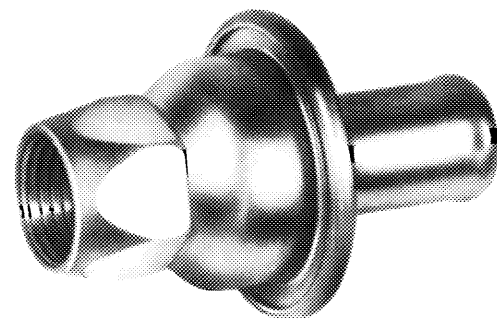
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### Check valve (42)

The check valve prevents the inflow of hot exhaust gases into air line.



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## Operation

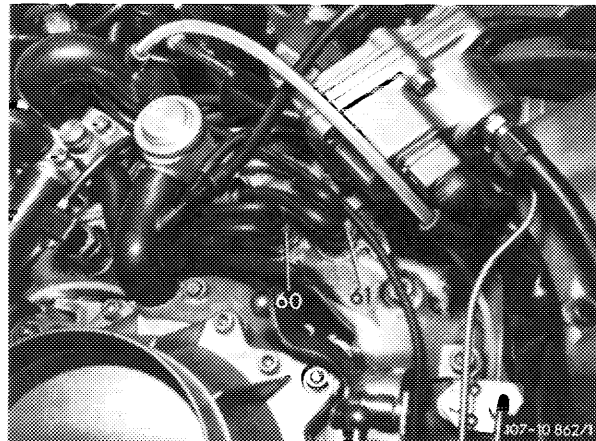
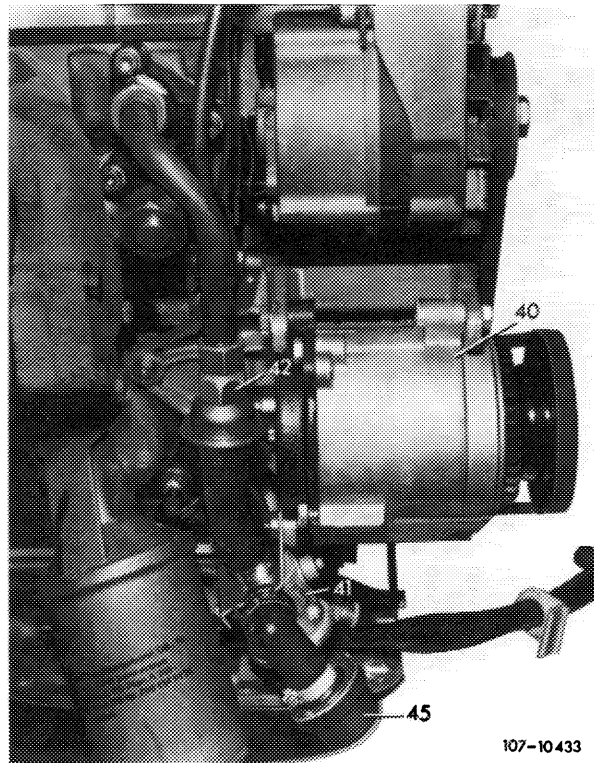
Starting at a coolant temperature of approx. 17 °C in cylinder head, air is injected into exhaust ports of cylinder head at idle, during deceleration (coasting) and when operating under partial load.

The oxygen in the air encounters the hot exhaust gases and reacts in catalyst. At coolant temperatures below approx. 17 °C the delivered air is discharged into the atmosphere via an air filter for silencing.

Air injection and air discharge is controlled via diverter valve (41).

The thermovalve (61) is open. The intake pipe vacuum can act on diaphragm of diverter valve (41) via thermovalve (61).

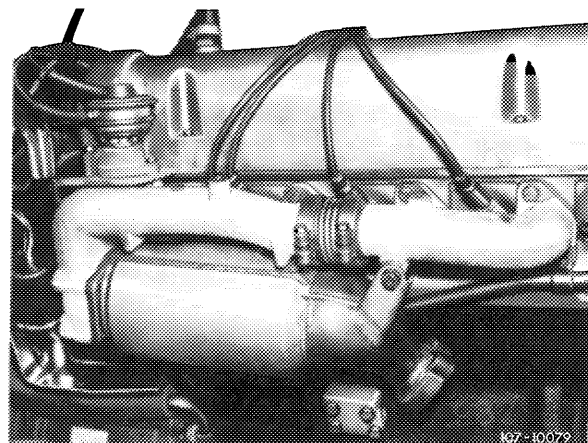
The connection for air discharge is closed and the air delivered by the air pump (40) is discharged into exhaust ports of cylinder heads via check valve (42).



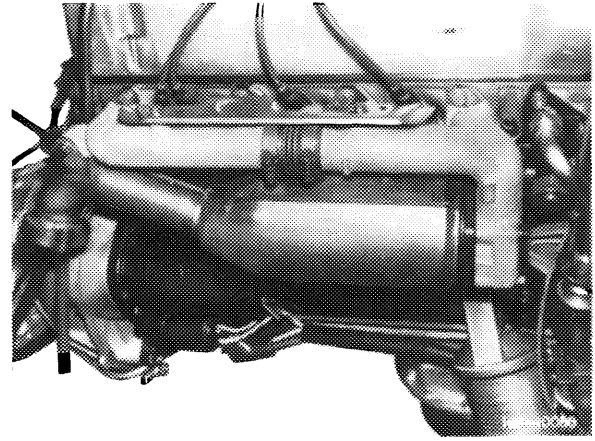
## E. Catalyst

The exhaust gases at each engine side are routed through a catalyst.

Lefthand engine side



The catalyst comprises two elastically suspended monoliths inside a wire netting, a honeycomb-shaped cylindrical body made of a ceramic material. The noble metal evaporated on the monoliths, the actual catalyst, accelerates the oxidation of CO and hydrocarbons with the addition of fresh air at pertinent temperature.



Righthand engine side

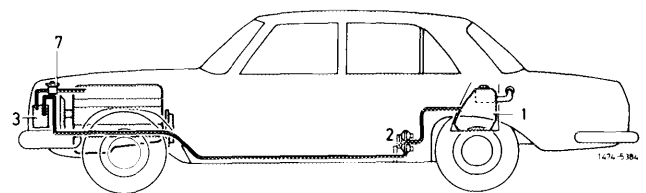
To maintain function of catalyst, the engine should be operated with lead-free fuel only. Since lead-free fuel is available outside the USA only in limited quantities, these vehicles (outside the USA) are operated with fuel containing lead. When these vehicles are imported into the USA, new catalysts are installed and the fuel system is flushed. To show that these jobs have been completed, the yellow exhaust gas information plate is exchanged for the black information plate valid in the USA.

## F. Fuel evaporation control system

A fuel evaporation system has been installed to improve emission characteristics which have nothing to do with engine combustion.

### Function diagram

- 1 Fuel tank with expansion tank
- 2 Valve system
- 3 Charcoal canister
- 7 Purge valve



## Components of fuel evaporation control system:

### Valve system

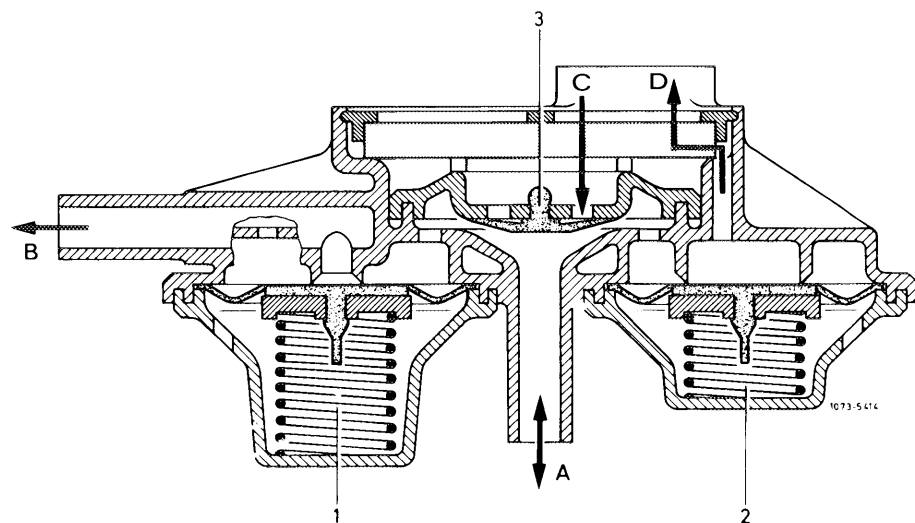
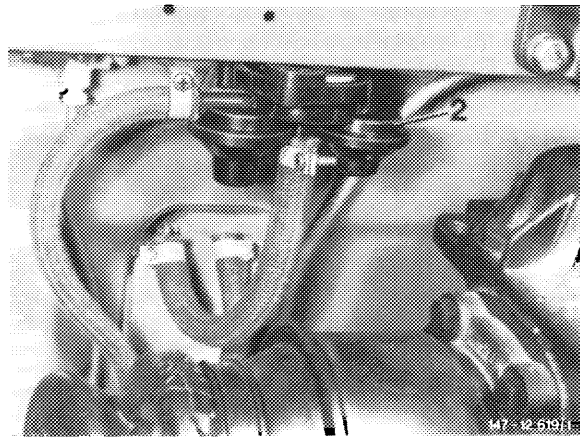
The valve system is mounted under vehicle at level of rear legroom. The system comprises three valves:

1. Negative vent valve
2. Pressure relief valve
3. Positive vent valve

The **negative vent valve** opens at a slight overpressure. The evaporation vapors will flow through negative vent valve (1) (direction B) into a line to charcoal canister.

The **pressure relief valve** is a safety valve and opens in the event of an overpressure in fuel evaporation system. The fuel vapors are vented directly into the open air.

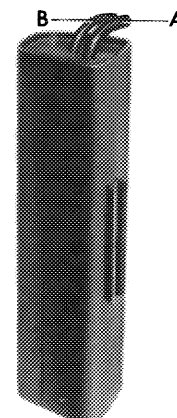
The **positive vent valve** opens in the event of a vacuum caused when the fuel tank is cooling down.



- 1 Negative vent valve
- 2 Pressure relief valve
- 3 Positive vent valve
- A To valve/to expansion tank
- B To charcoal canister
- C Fresh air input
- D Output pressure relief valve

### Charcoal canister

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

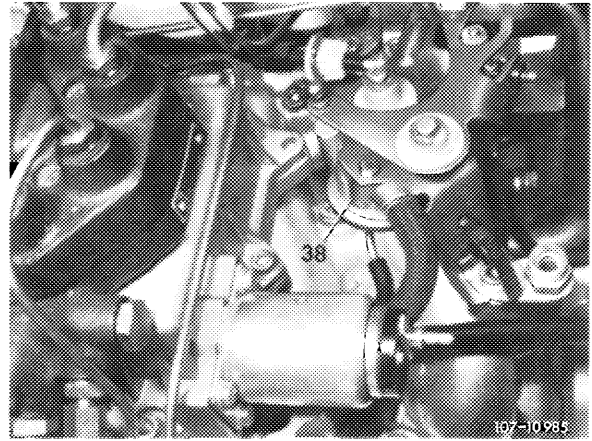


- A Connection tank vent
- B Connection purge valve

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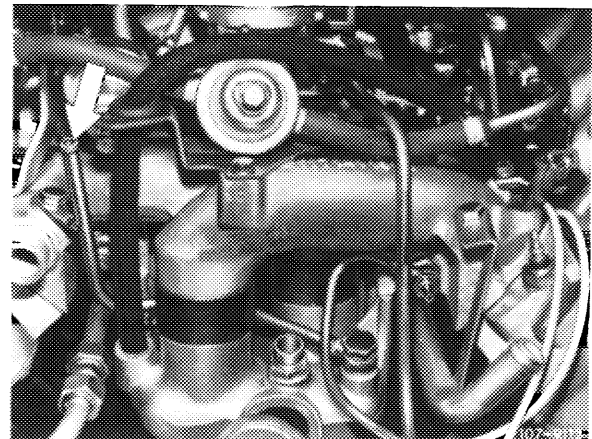
### Purge valve

The purge valve is controlled by the vacuum of the throttle valve. When the diaphragm is activated with a vacuum, the valve opens and the fuel evaporation vapors can be drawn from charcoal canister.



### Intake pipe connection

The intake pipe is provided with a connection (arrow) to draw the fuel evaporation vapors from charcoal canister.



### Operation

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The fuel evaporation vapors from fuel tank are stored in charcoal canister when the engine is stopped, and they are drawn from charcoal canister when the engine is running in dependence of the intake pipe vacuum.

When the throttle valve is opened, the diaphragm of the purge valve is activated with a vacuum and the valve is opened.

The intake pipe vacuum draws the stored vapors from charcoal canister.