

14-050 Operation

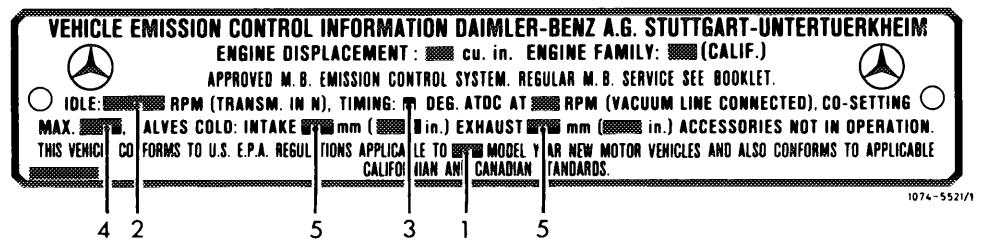
Federal and California version model year 1975

A. General

Information plate

Federal version basic color black

California version basic color green



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

Identification of vacuum lines

Starting model year 1975 a new identification system for all vacuum lines in vehicle has been introduced.

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

To facilitate recognition of the individual functions, additional color stripes will be used similar to the model years before.

Lines originating at a vacuum source (originating lines) have one color stripe only. These lines, to the extent they are part of a switchover valve, are plugged to the center connection of the switchover valve having the same color.

Lines terminating at a vacuum-operated device (terminating lines) have two color stripes. Purple is always the second color. These lines are plugged outside to switchover valves having the same color.

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

Color coding of cable connections

Starting model year 1975 the cable connections of switchover valves are color-coded with tape according to their function (e.g. blue for air injection).

Vacuum switchover valve

For easy identification, the filter caps are color-coded according to valve function.

- Yellow cap — valve for ignition retard
- Blue cap — valve for air injection
- Red cap — valve for ignition advance/EGR

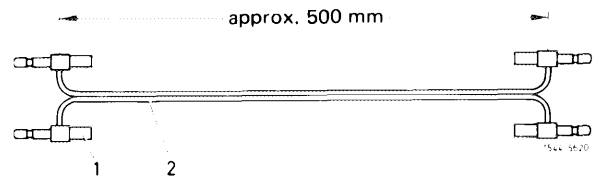
Do not confuse vacuum connections when mounting valves. Always slip vacuum-carrying line (originating line) on center connection. It is unimportant whether this connection is at top or bottom of valve.

Operation	Part. no.	Color	De-energized	Energized
In a de-energized condition, connection B is closed. Vacuum connections A and E are connected to each other. When energized, port E is closed and only connection A is open to atmosphere.	001 540 08 97	yellow		
	001 540 18 97	blue		
	001 540 09 97	red		
Never confuse connections E and A.				

A = Connection to vacuum unit B = Connection to atmosphere E = Connection to vacuum source

Test cable

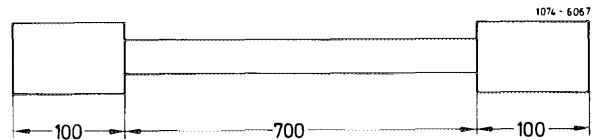
To test the individual components of emission control system use a self-made cable according to drawing.



- 1 Coupling part no. 003 545 28 28 (housing omitted)
- 2 Cable 1.5 mm²

Test line

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

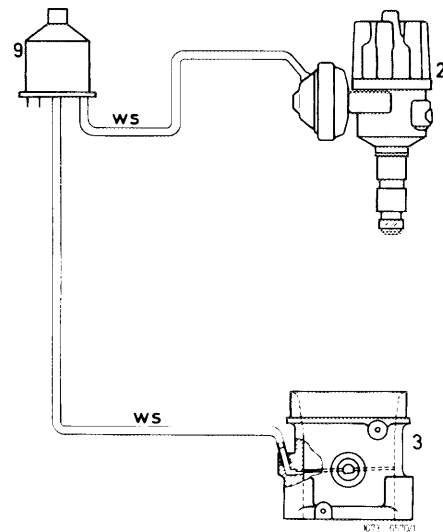
B. Ignition timing

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

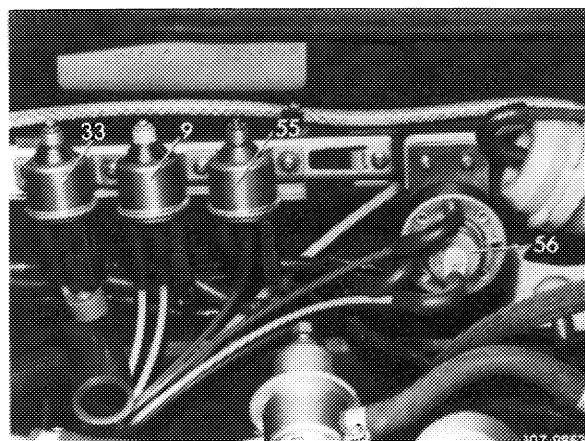
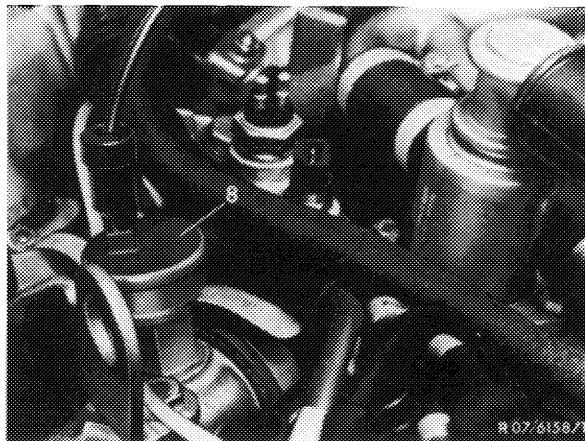


Vacuum adjustment in direction of “retard” becomes effective at the following operating conditions:

- 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.

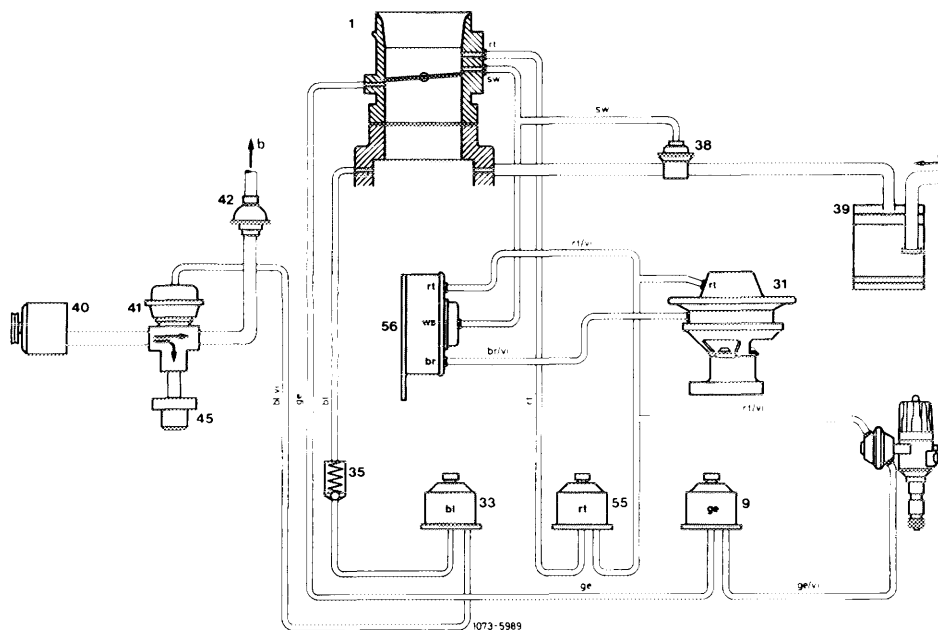


C. EGR (exhaust gas recirculation)

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
- 2 Ignition distributor
- 9 Switchover valve ignition retard
- 31 EGR valve
- 33 Switchover valve air injection
- 35 Check valve
- 38 Purge valve
- 39 Charcoal canister
- 40 Air pump

- 41 Diverter valve
- 42 Check valve air injection
- 45 Air filter for silencing
- 55 Switchover valve EGR/ignition advance
- 56 Vacuum switch

- bl = blue
- br = brown
- ge = yellow
- rt = red
- sw = black
- vi = purple
- ws = white

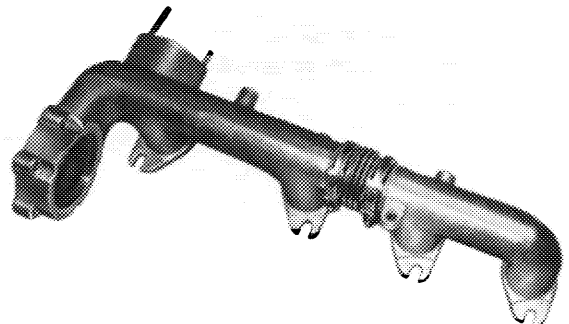
- a Connection tank vent
- b Air injection line to cylinder head

EGR components:

Exhaust manifolds

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

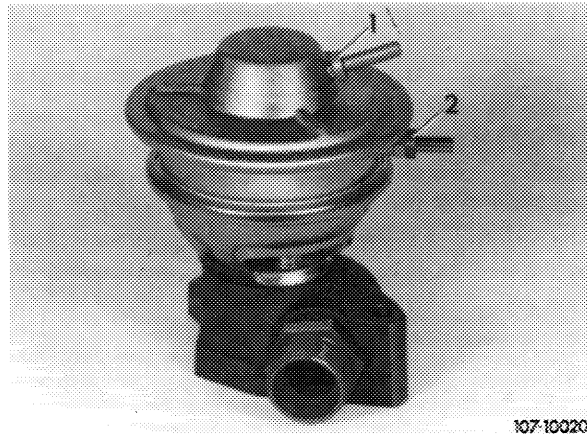
For EGR, a bore as well as a flange for the EGR valve are located at lefthand exhaust manifold.



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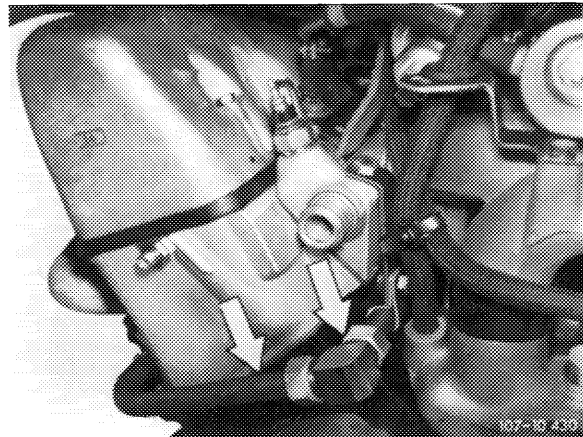
EGR valve

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



EGR line

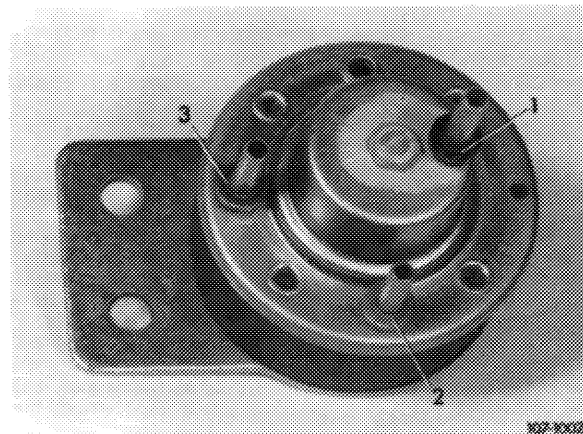
The EGR line runs from EGR valve under exhaust manifold from the rear to intake pipe (arrows).



Vacuum switch

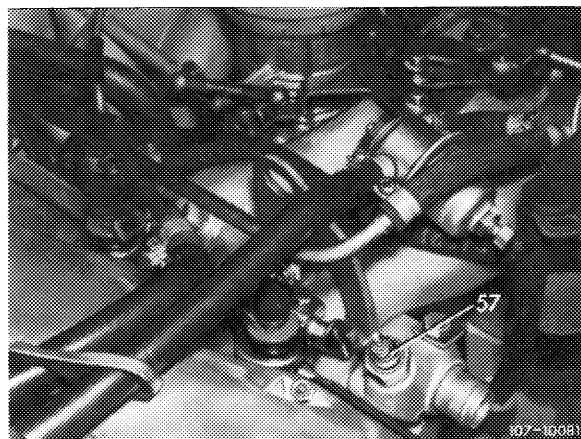
A vacuum switch is installed to control EGR.

- 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



Temperature switch 40 °C (57)

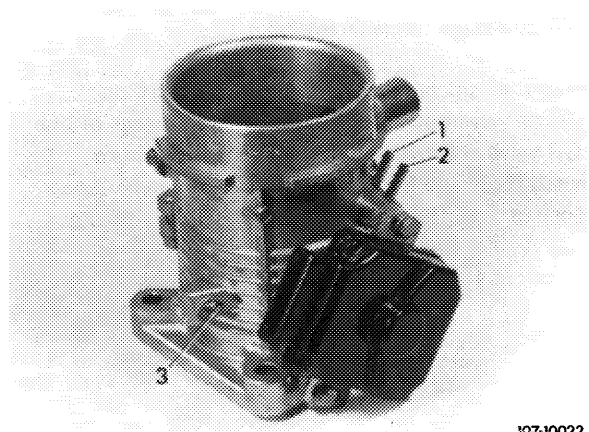
A temperature switch 40 °C is installed for temperature-dependent control of large EGR volumes and ignition advance.



Throttle valve housing

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

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



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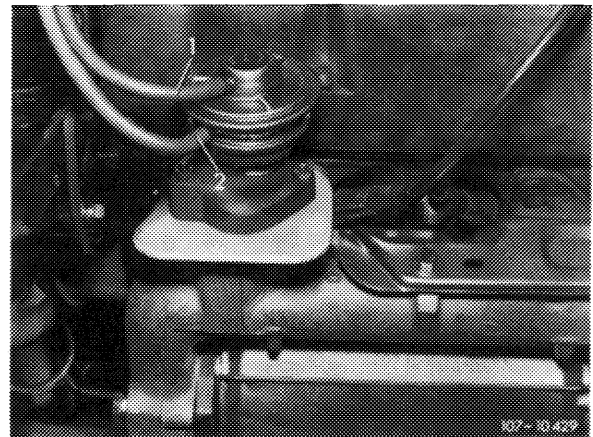
EGR is activated:

- 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).



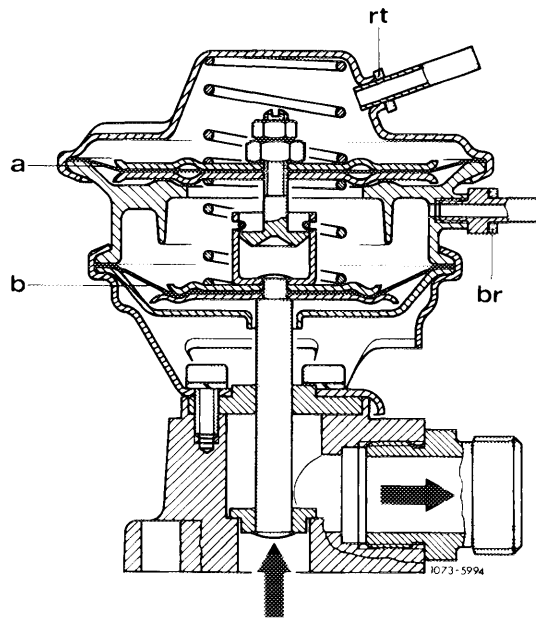
EGR 1st stage (small quantity)

The switchover valve (55) controlled via temperature switch 40 °C and relay (58) is de-energized. The connection from throttle valve housing to EGR valve is established.

At adequate vacuum, the EGR valve is slightly lifted and a small quantity of the exhaust gases is returned (recirculated) to 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

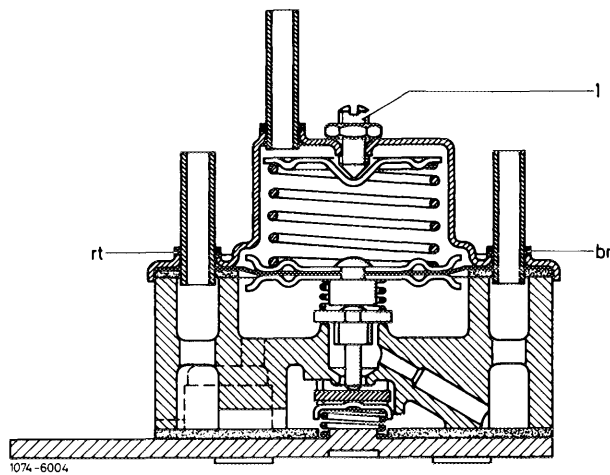
If the vacuum on center connection drops below the preset value, the spring will push the diaphragm downwards.

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.

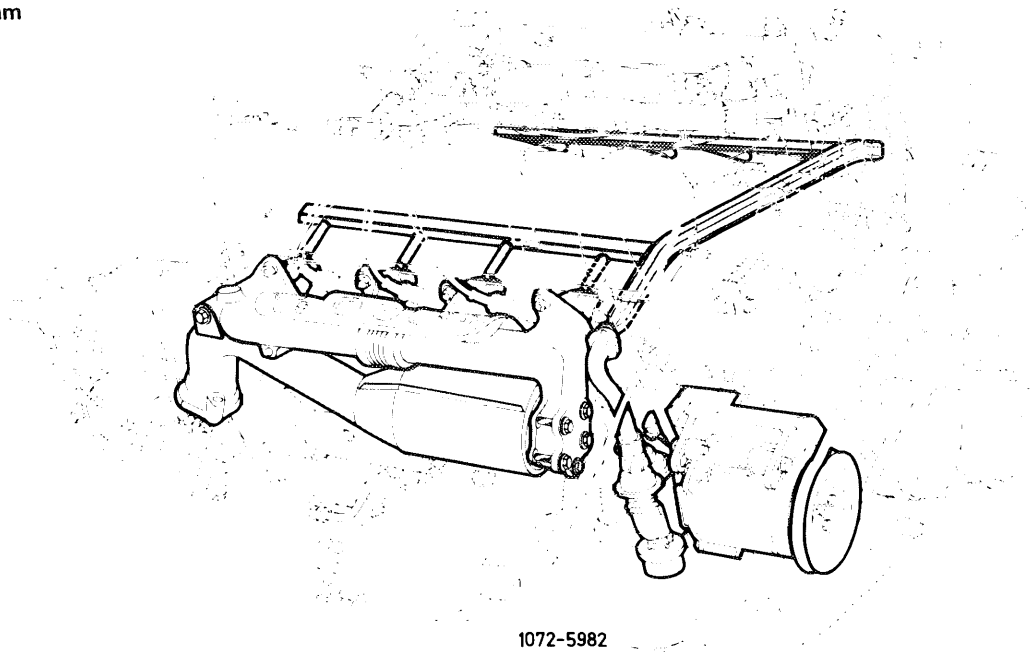


D. Air injection

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

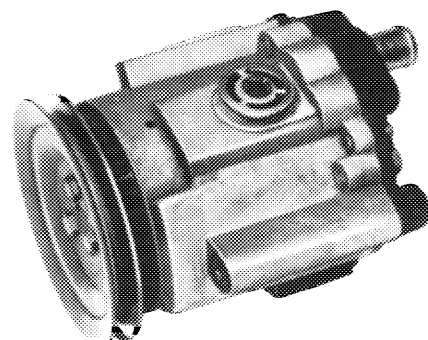


Components of air injection:

Air pump (Saginaw pump)

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

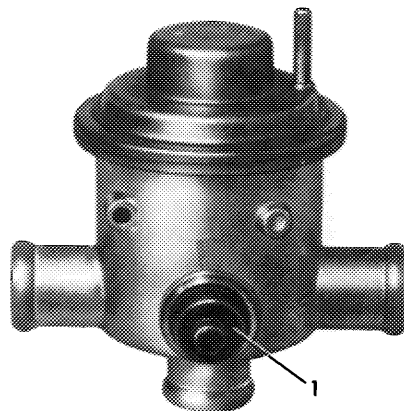
The pump housing is provided with a safety valve which discharges the delivered air at a given overpressure to protect the pump vanes against overloads.



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Diverter valve

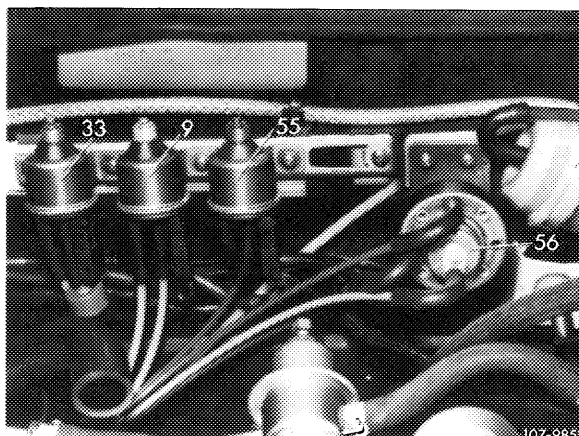
The diverter valve serves the purpose of discharging the delivered air below 17 °C oil temperature by way of an air filter (silencer).



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Switchover valve (33)

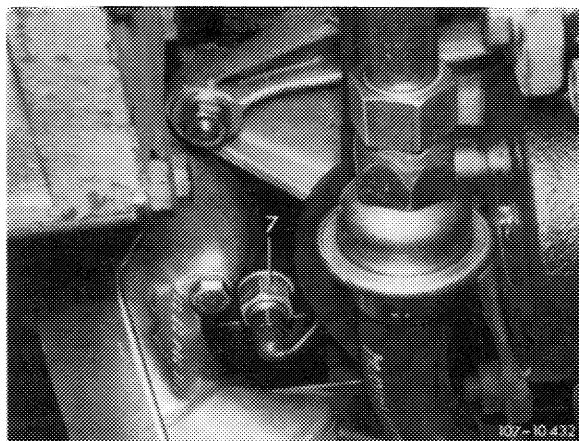
The switchover valve is located in engine compartment at front wall and controls the air injection and the air discharge.



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Temperature switch 17 °C

A temperature switch 17 °C (7) is installed in oil circuit to control air injection and air discharge.



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Check valve (42)

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

Air is injected above 17 °C oil temperature.

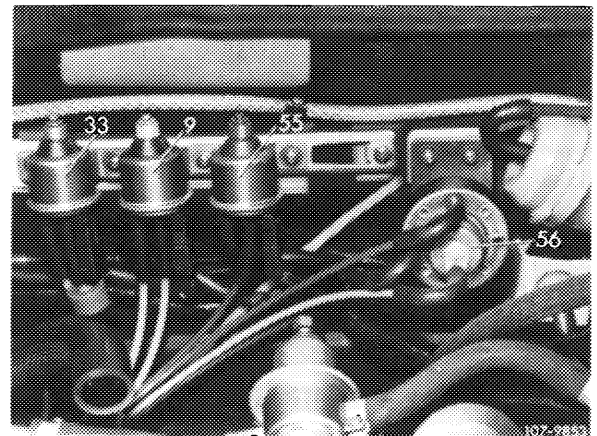
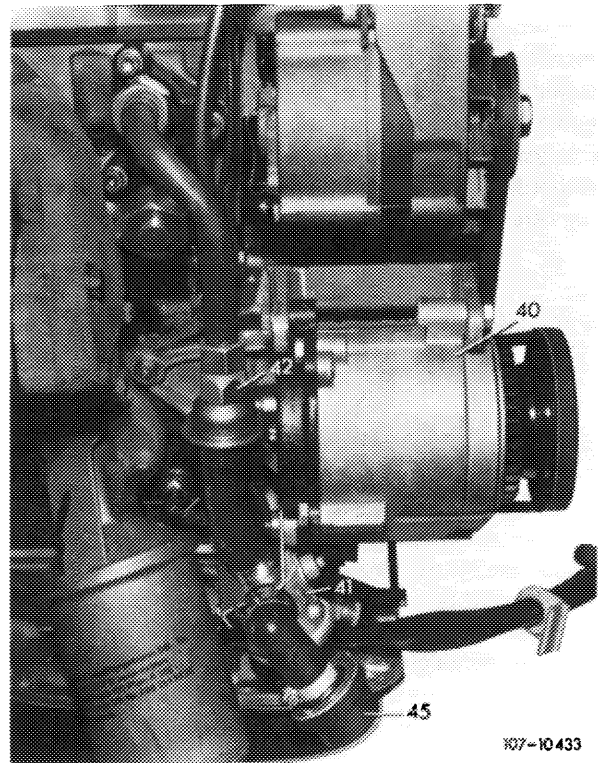
Operation

The oil temperature switch 17 °C (7) in engine block is open. The blue switchover valve (33) is de-energized. The intake pipe vacuum can act on diaphragm of diverter valve (41) via blue switchover valve (33).

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).

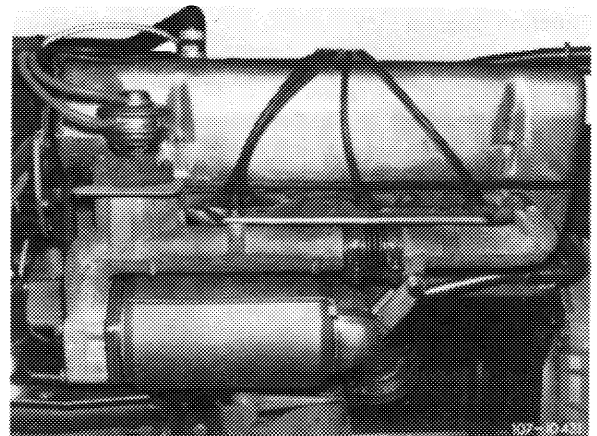
The oxygen in the air encounters the hot exhaust gases and reacts in catalyst. At coolant temperatures below approx. 17 °C the delivered air is discharged into the atmosphere via an air filter for silencing.

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



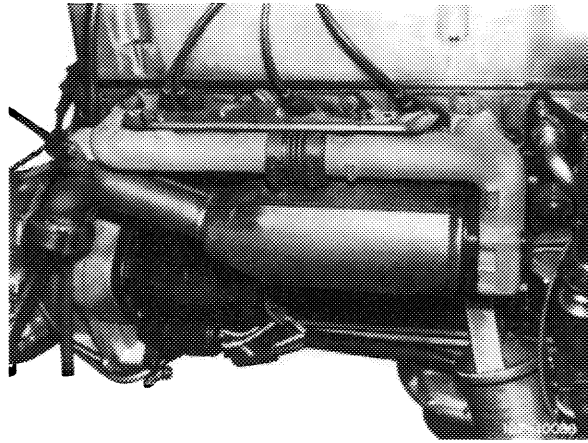
E. Catalyst

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

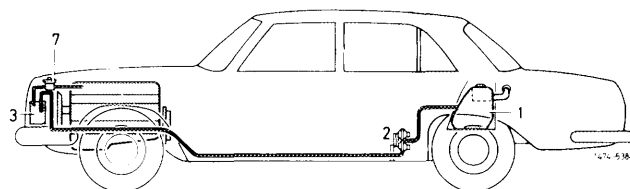
To maintain function of catalyst, the engine should be operated with lead-free fuel only. Since lead-free fuel is available outside the USA only in limited quantities, these vehicles (outside the USA) are operated with fuel containing lead. When these vehicles are imported into the USA, new catalysts 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

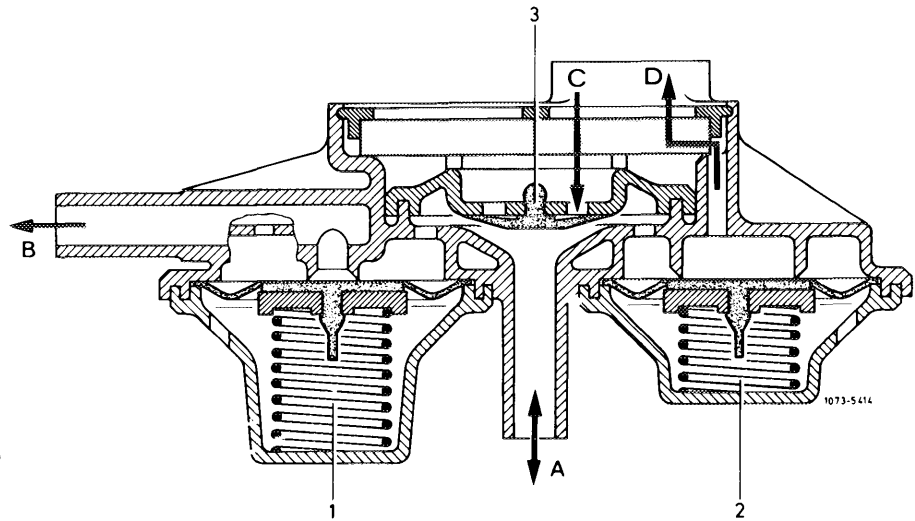
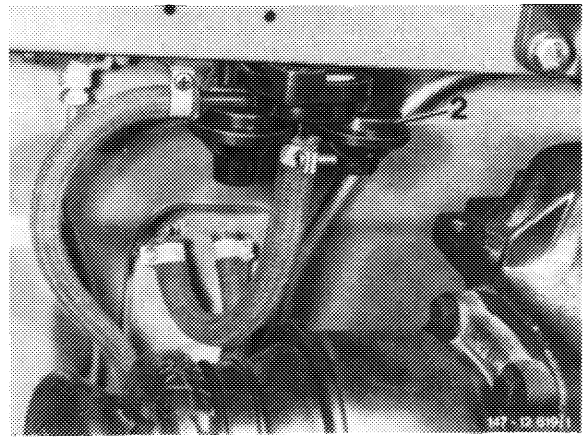
The valve system is mounted under vehicle at level of rear legroom. The system comprises three valves:

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.

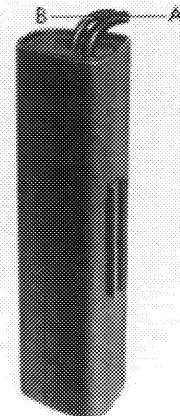
The **positive vent valve** opens in the event of a vacuum caused when the fuel tank is cooling down.



- 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.

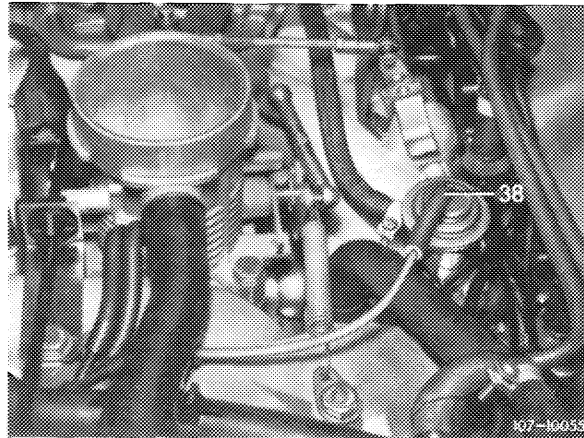


- A Connection tank vent
- B Connection purge valve

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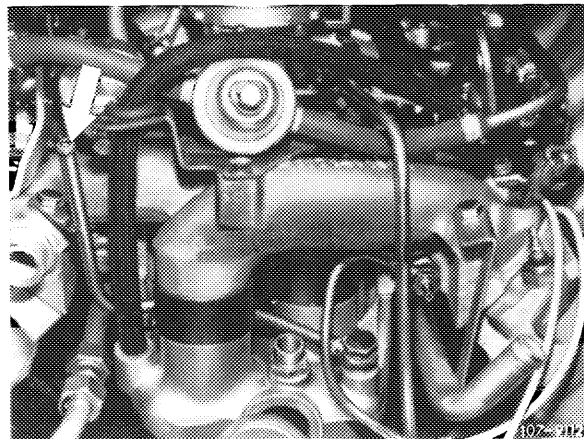
Purge valve

The purge valve (38) 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

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.