Model Year 1979

AUS

Mercedes-Benz
service

Introduction into service

Daimler-Benz Aktiengesellschaft
Stuttgart-Untertürkheim
Zentralkundendienst

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This introduction covers the vehicle versions for model year 1979.

Model 123.026 (250) is no longer supplied.

Apart from the modifications and revisions described here, the vehicles correspond to those of model year 1978.

Model series 116 is extended by the addition of model 116.036 (450 SEL 6.9).

The essential characteristics of this sedan are the 198 kW (269 HP) engine at 4200/min, as well as the hydropneumatic suspension.

Accessories and equipment of this sedan correspond to model 116.033 (450 SEL).

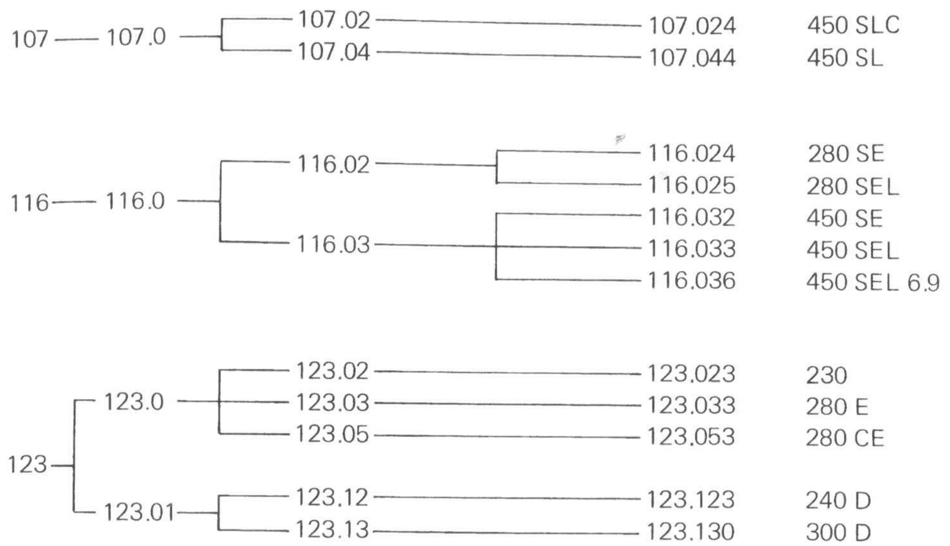
This introduction covers all the characteristics different from those of the 116.033 sedan.

All repair instructions, adjusting values and maintenance jobs are shown in the available technical literature.

Daimler-Benz Aktiengesellschaft
Zentralkundendienst

August 1978

Contents



Sales Designation	Model	Engine	Transmission Manual	Transmission Automatic	Power Steering
240 D	123.123	616.912	716.005 (G 76/18 C)	722.117 (W 4 B 025)	
300 D	123.130	617.912	–	722.118 (W 4 B 025)	
230	123.023	115.954	–	722.119 (W 4 B 025)	765.704 (LS 90)
280 E	123.033	110.984	–	722.112 (W 4 B 025)	
280 CE	123.053	110.984	–	722.112 (W 4 B 025)	
280 SE	116.024	110.985	–	722.112 (W 4 B 025)	
280 SEL	116.025	110.985	–	722.112 (W 4 B 025)	765.702 (LS 90)
450 SE	116.032	117.986	–	722.001 (W 3 B 050)	
450 SEL	116.033	117.986	–	722.001 (W 3 B 050)	
450 SLC	107.024	117.985	–	722.001 (W 3 B 050)	765.701 (LS 90)
450 SL	107.044	117.985	–	722.001 (W 3 B 050)	
450 SEL 6.9	116.036	100.985	–	722.003 (W 3 B 050)	765.703 (LS 90)

An **information plate** for the emission control system in English is attached to the cross member in front of the radiator.

This plate bears the most important engine tuning data. Its basic color is silber with black lettering.

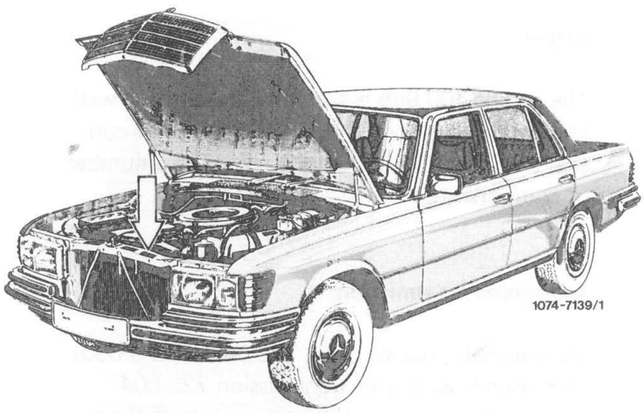


Fig. 1

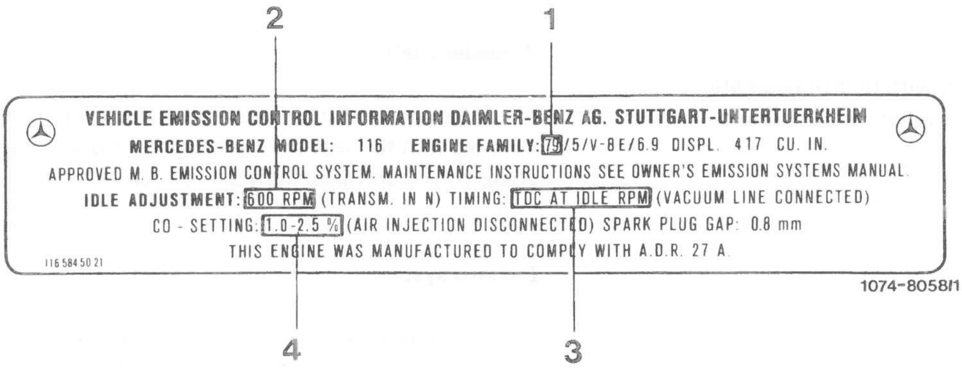


Fig. 2

1 Model year designation
2 Idle speed
3 Ignition timing at idle speed
4 CO level at idle speed

Engine

The engine 100.985 is a modification of the well-known 6.3-liter engine 100.981 and differs considerably from the latter with regard to a number of components.

Automatic transmission

Mechanically, transmission 722.003 (W 3 B 050) corresponds widely to transmission 722.004 (W 3 A 040), but essential components of the power train have been reinforced to match the high engine torque.

Suspension

The vehicle is provided with hydropneumatic suspension, a gas (air) system with hydraulic level control.

Front axle

The front axle corresponds to that of models 116.03, but with two deviations:

1. The steering knuckle strength has been increased.

2. To save space, the upper control arm is made of steel.

Rear axle

The rear axle has a differential with limited slip (positive traction). The ratio is 1:2.65 (number of teeth 45:17).

Propeller shaft

The dimensions of the intermediate shaft tube are 45 x 3.5 mm to meet the high engine torque. The yokes of the universal joint are reinforced.

Exhaust system

Center and resonance damper, as well as the exhaust pipes starting at center damper are made of corrosion-resistant steel. The pipe dia. is 50 mm.

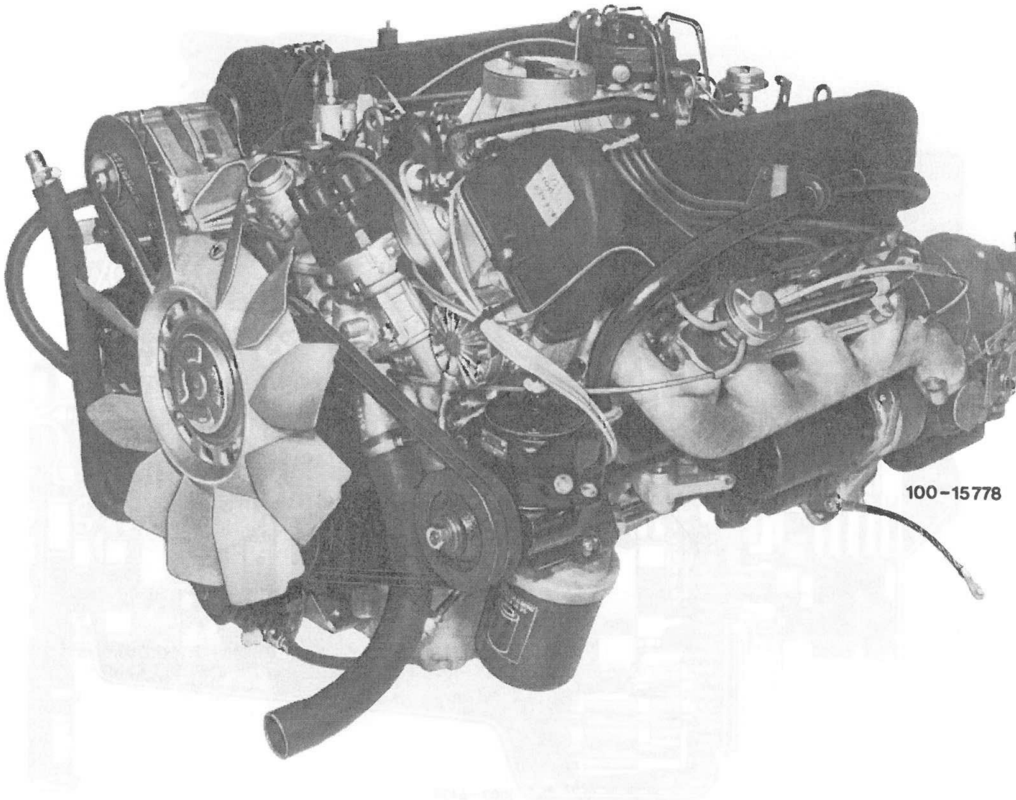


Fig. 3

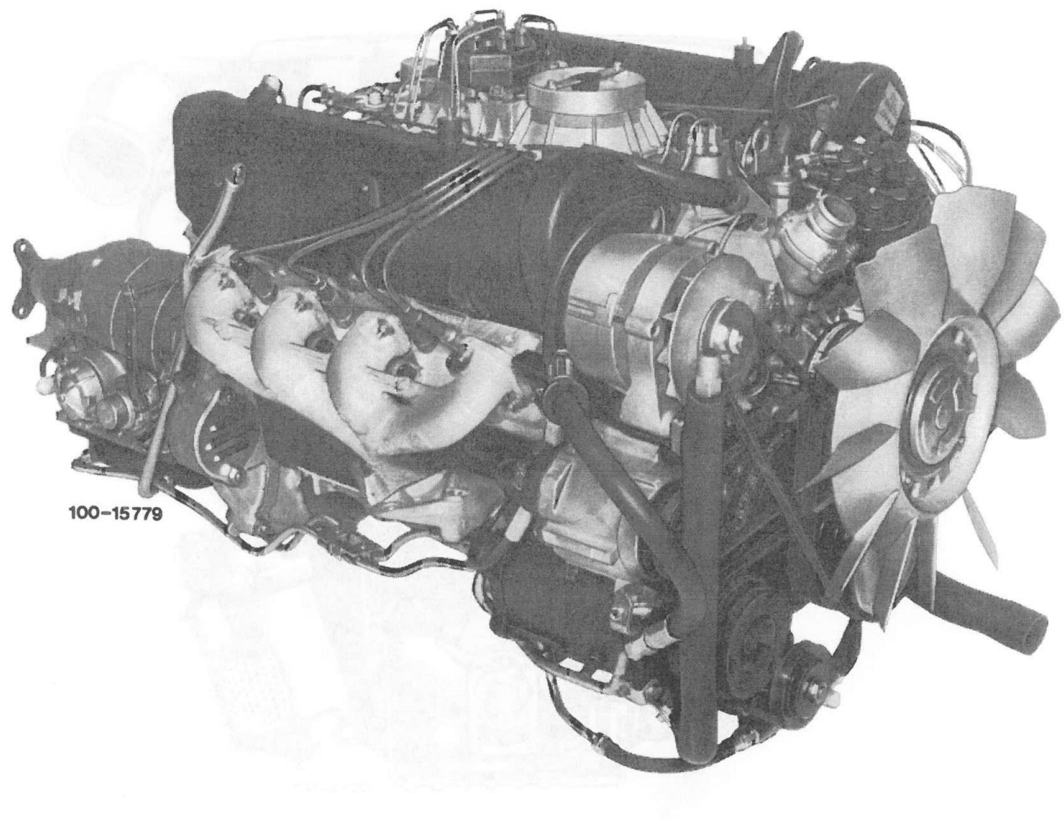


Fig. 4

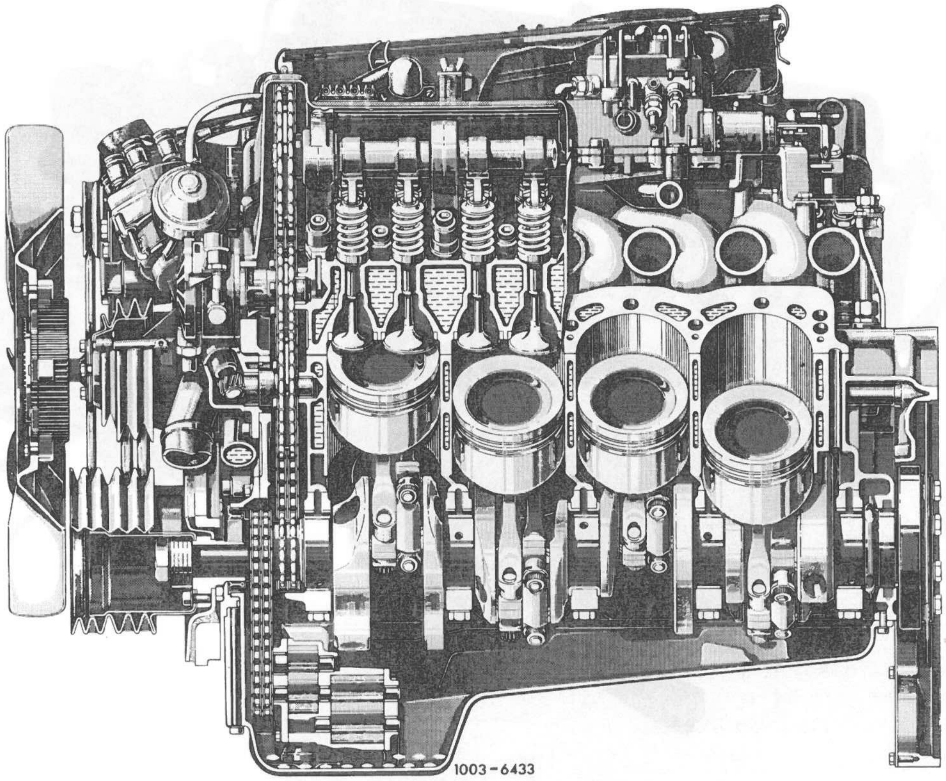


Fig. 5

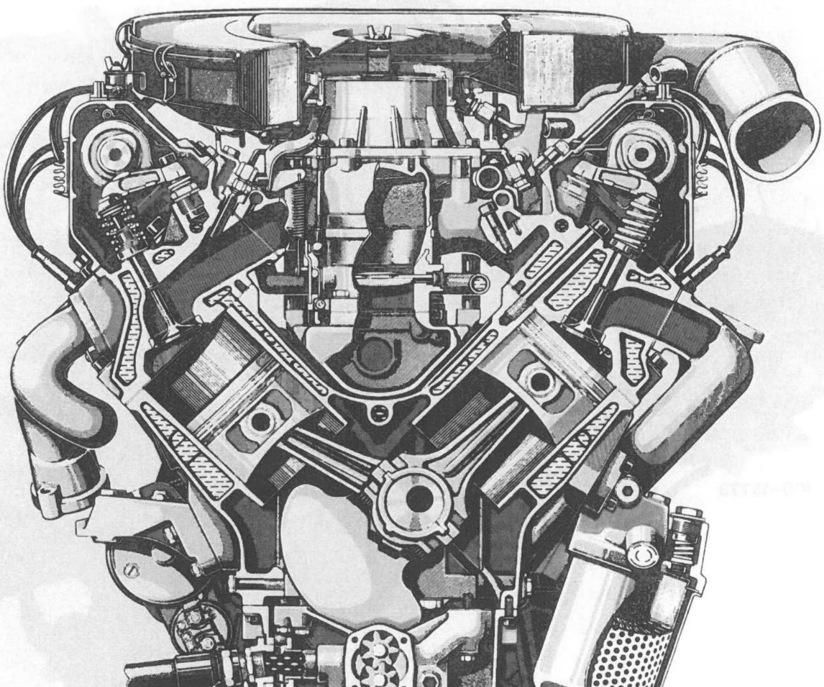


Fig. 6

General Information

Engine 100.985, with 6.9 liters displacement, mechanical gasoline injection system with airflow sensor, breakerless transistorized ignition system, hydraulic valve lifters and dry sump lubrication, is a further development of engine 100.981 (6.3 liters).

Pertinent Data

Model	Engine	Displacement cm^3 (in^3)	Stroke mm (inches)	Bore mm (inches)	Output kW (HP) at 1/min	Torque Nm (kpm) at 1/min
116.036 (450 SEL 6.9)	100.985	6 834 (417)	95 (3.74)	107 (4.21)	198 (269) 4 200	510 (51) 2 800

Crankcase and Oil Pan

Both cylinder banks are arranged in a V-form at an angle of 90° to each other and an offset so that two connecting rods are mounted on one crankshaft journal.

For increased rigidity, the crankcase extends far below the crankshaft center (Fig. 8).

The cylinder bores (107 mm/4.21") are completely surrounded by coolant.

In addition to the four oil return bores of 12 mm (0.47") diam. at the rear end of the crankcase (two per cylinder bank), an additional oil return bore of 15 mm (0.59") is located between cylinders 2 and 3, and 6 a and 7 (Fig. 7).

Of the five crankshaft bearing caps, bearing caps 2,3, and 4 are each fitted into the crankcase at two points and attached by four bolts (Fig. 8). Two of the bolts are screwed in laterally (at right angles).

Bearing caps 1 and 5 also have two fitting points; however, they are attached with only two bolts (Fig. 9).

The third bearing cap holds the thrust bearing.

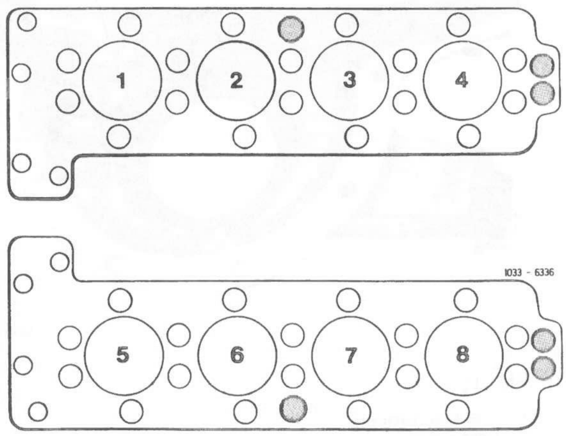


Fig. 7

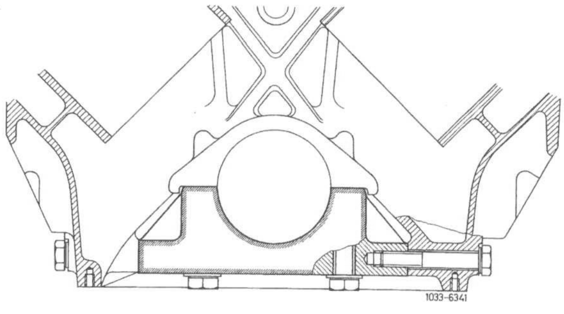


Fig. 8

Bearing caps 2, 3 and 4

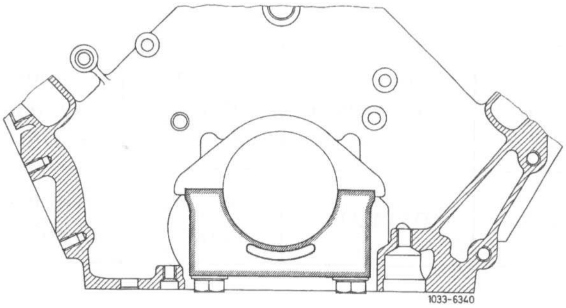


Fig. 9

Bearing caps 1 and 5

The radial sealing ring as well as the chain tensioner (1) with leaf spring (2) for the oil pump chain drive are housed in the front crankcase cover.

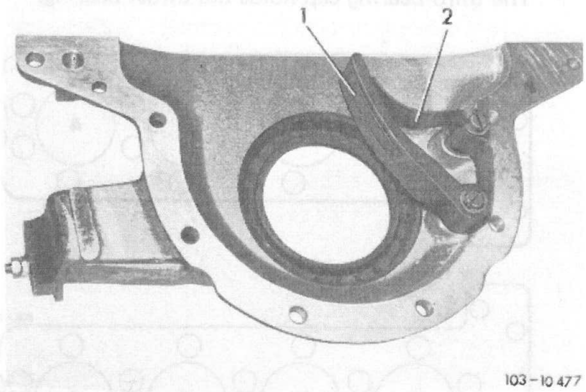


Fig. 10

1 Chain tensioner
2 Leaf spring

In addition, the top-dead-center sensor bracket for the diagnostic test program is cast on the crankcase cover (Fig. 10 and 11).

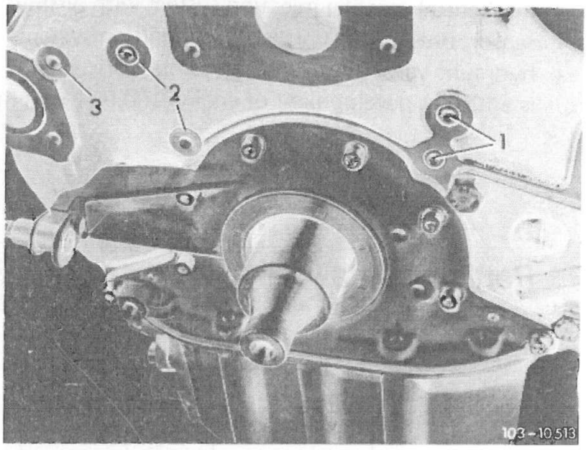


Fig. 11

The radial sealing ring inserted in the rear cover plate and crankcase consists of a rubber strip (2) and a profile strip (1). When installing the radial seal ring the rubber strip must be inserted first and then the profile strip (Fig. 12).

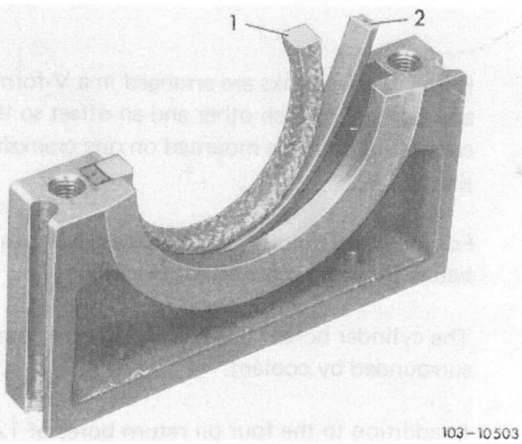
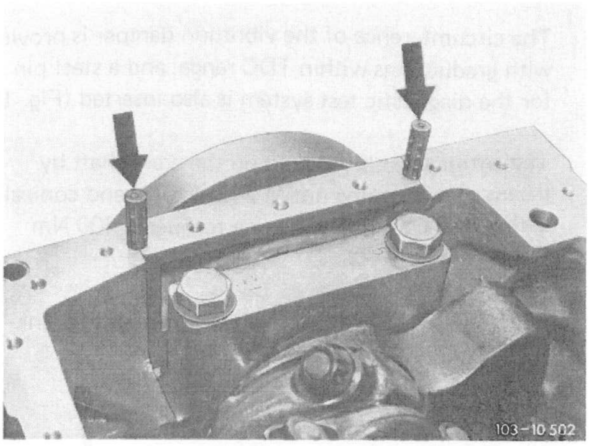


Fig. 12

1 Profile strip (textured-radial sealing ring)
2 Rubber strip



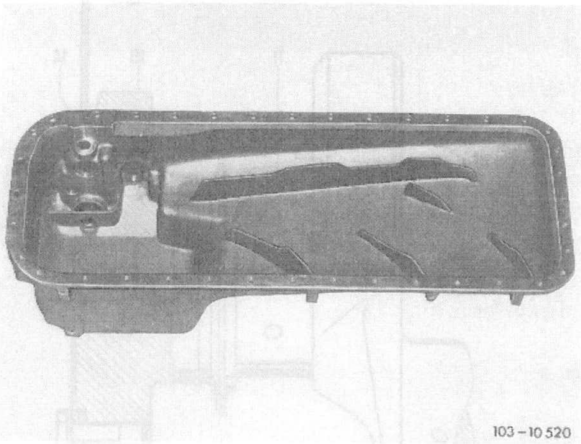


Fig. 14

Rubber coated steel pins are inserted between the cover plate and crankcase to seal the joints (Fig. 13).

The one-piece aluminum oil pan has an oil baffle around the oil drain plug and oil guide fins cast in the flat portion (Fig. 14).

The oil drain plug (4) is located on the right side (in driving direction). The connections for the suction, pressure and venting lines to the oil reservoir are above the drain plug (Fig. 15).

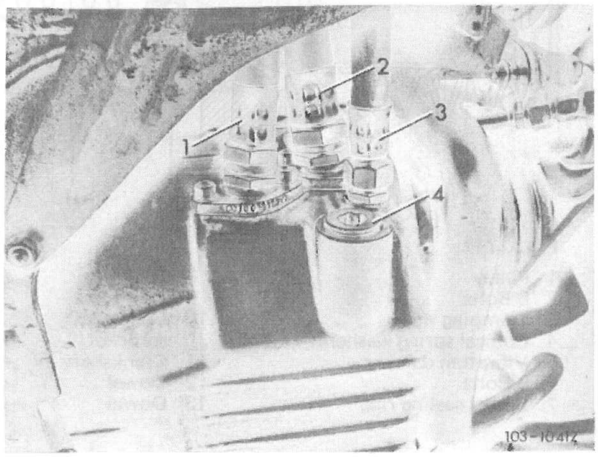


Fig. 15
1 To oil reservoir (return flow pump)
2 To engine oil pump (suction side)
3 Vent line
4 Oil drain plug

Crank Assembly

The crankshaft (with 6 counterweights) has five main bearings (Fig. 16).

A sprocket (10) for two duplex roller chains is installed on the front journal of the crankshaft and located by a flat key (9).

The camshaft, ignition distributor and the hydraulic pump for the hydro-pneumatic suspension are driven off the rear duplex sprocket and duplex chain.

The engine oil pump is driven off the front duplex sprocket.

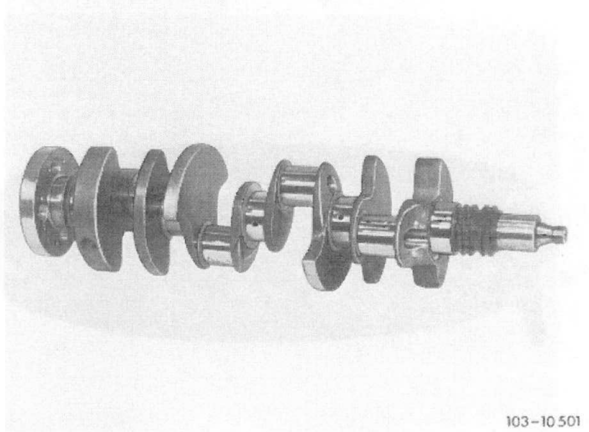


Fig. 16

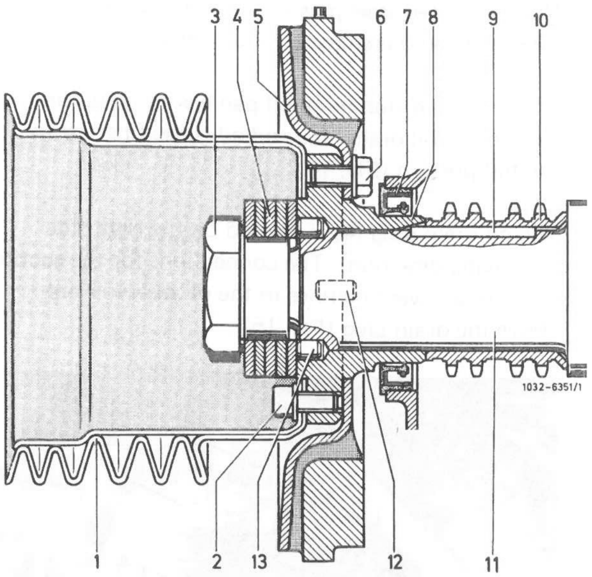


Fig. 17

1	Pulley	8	Hub
2	6 Bolts	9	Key
3	Clamping nut	10	Crankshaft sprocket
4	Conical spring washer	11	Crankshaft
5	Vibration damper	12	Dowel
6	6 Bolts	13	Dowel
7	Radial sealing ring		

A hub (8) in front of the crankshaft duplex sprocket serves to hold the vibration damper (5) and the V-belt pulley (1).

To permit mounting the hub in one position only, a key (9) and two dowel pins serve for locating the assembly on the crankshaft.

The vibration damper is bolted to the hub from the rear, the pulley from the front. In addition, the vibration damper is located on hub (8) by means of a dowel (12).

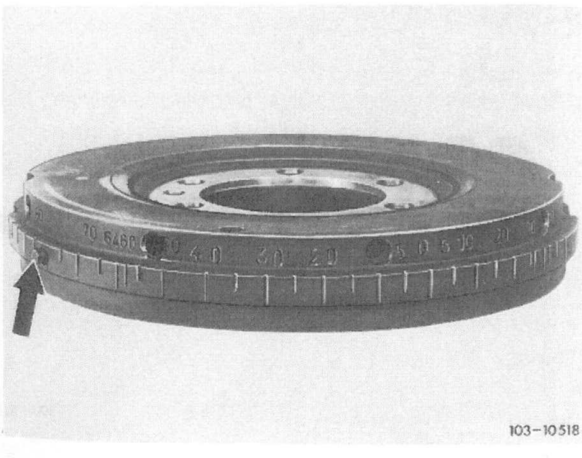


Fig. 18

The circumference of the vibration damper is provided with graduations within TDC range, and a steel pin for the diagnostic test system is also inserted (Fig. 18).

The entire assembly is held on the crankshaft by means of a clamping nut M 24 x 1.5 (3) and conical spring washers (4). Tightening torques is 400 Nm (40 kpm).

Flex plate and spacer washer are attached to crankshaft by means of 8 bolts (Fig. 19).

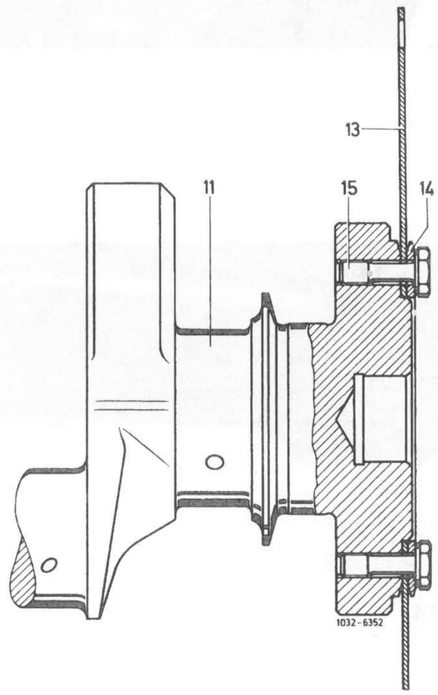


Fig. 19

11	Crankshaft	14	Spacer washer
13	Flex plate	15	8 Stretch bolts

Crankshaft, driven plate, vibration damper and pulley can be exchanged without static balancing in the event of repairs.

The pistons (3 rings) are provided with a recess of 80 mm (3.15") diam., 5.60 mm (0.22") deep in the piston crown (Fig. 20). In addition, the wrist pin bore is offset from center in the direction of the thrust side.

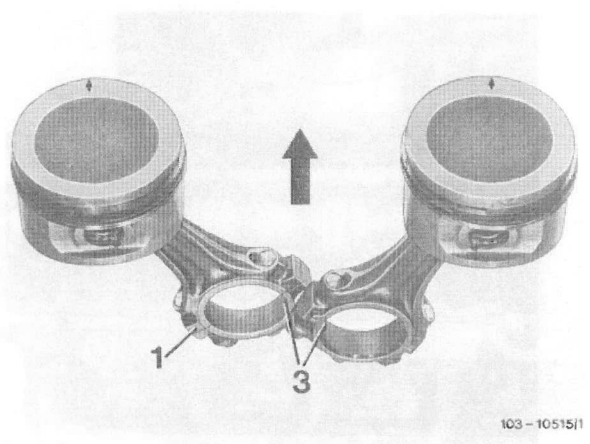


Fig. 20
1 Thrust face
3 Retaining groove for bearing shells

Two connecting rods each are mounted on one crankpin (Fig. 21). During assembly, make sure of installation position. Install connecting rods with narrow faces on large crankshaft bearing facing each other.

Connecting rods are provided with a 5.5 mm (0.22") bore for lubricating the wrist pin (pressure lubrication) (Fig. 22).

The 10 mm (0.40") connecting rod bolts (M 10 x 1 threads) have serrated shanks and are tightened to an initial torque of 4–5 kpm (29–36 ft. lbs.) and an angle of rotation torque of 90° – 100°.

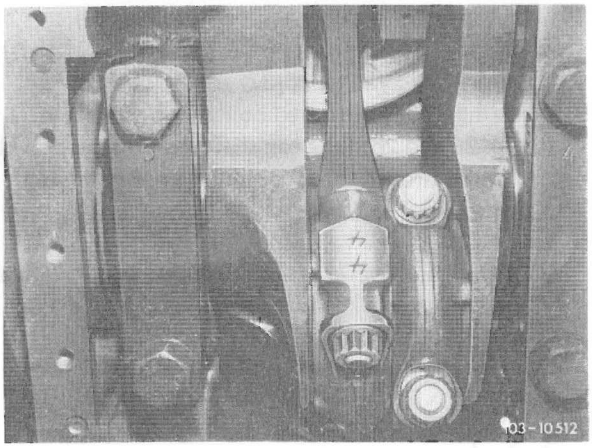


Fig. 21

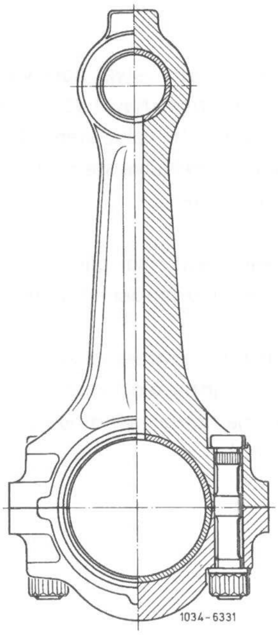


Fig. 22

Cylinder Heads and Timing

The cylinder heads, located on the crankcase by means of two locating sleeves per bank, are attached at the circumference of each cylinder by means of 6 bolts; 18 bolts per cylinder head (Fig. 23).

The installation of a cylinder gasket 1 mm (0.039") thick eliminates retightening the cylinder head bolts after 300–1,000 km (200–600 miles).

The intake and exhaust valves arranged in line and diagonal in relation to cylinder head surface are actuated via rocker arms mounted on hydraulic valve lifters and are actuated by the overhead camshafts (Fig. 24).

The intake and exhaust valve seat rings and valve guides are shrink-fitted into the cylinder heads as before.

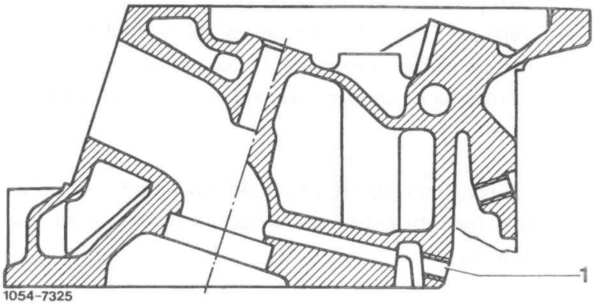


Fig. 23

A bore (1) is provided in the cylinder heads for the air injection.

The intake and exhaust valves have valve seats which are hardened, and the exhaust valves are, in addition, filled with sodium. The valve stem of the intake valves is nitrated. The valve stem of the exhaust valves is chrome-plated.

The exhaust valve seat ring (part no. 100 053 02 32) is made of a specially hardened material.

Each valve has two progressive valve springs (7 and 8), which are more tightly wound at one end. They are installed with the tighter winding pointing toward the Rotocap (10).

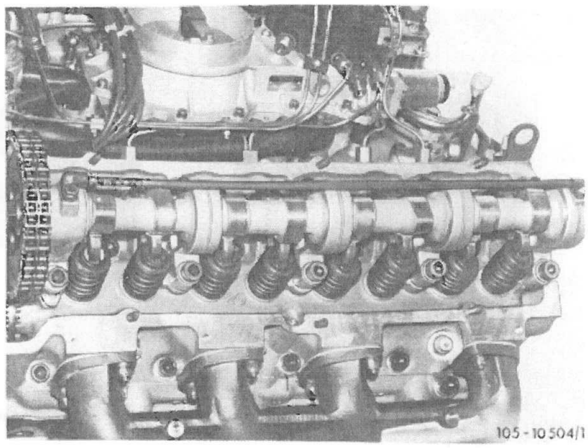


Fig. 25

All valves are provided with a Rotocap (10).

Camshafts (code no. 36/37) are mounted in five bearings. They are bored hollow and tin-plated (Fig. 25 and 26). The camshaft bearings are provided with oil through the longitudinal bore in the camshafts (Fig. 26).

The hydraulic valve lifters are provided with oil via the fifth camshaft bearing and a longitudinal duct in the cylinder head (Fig. 27).

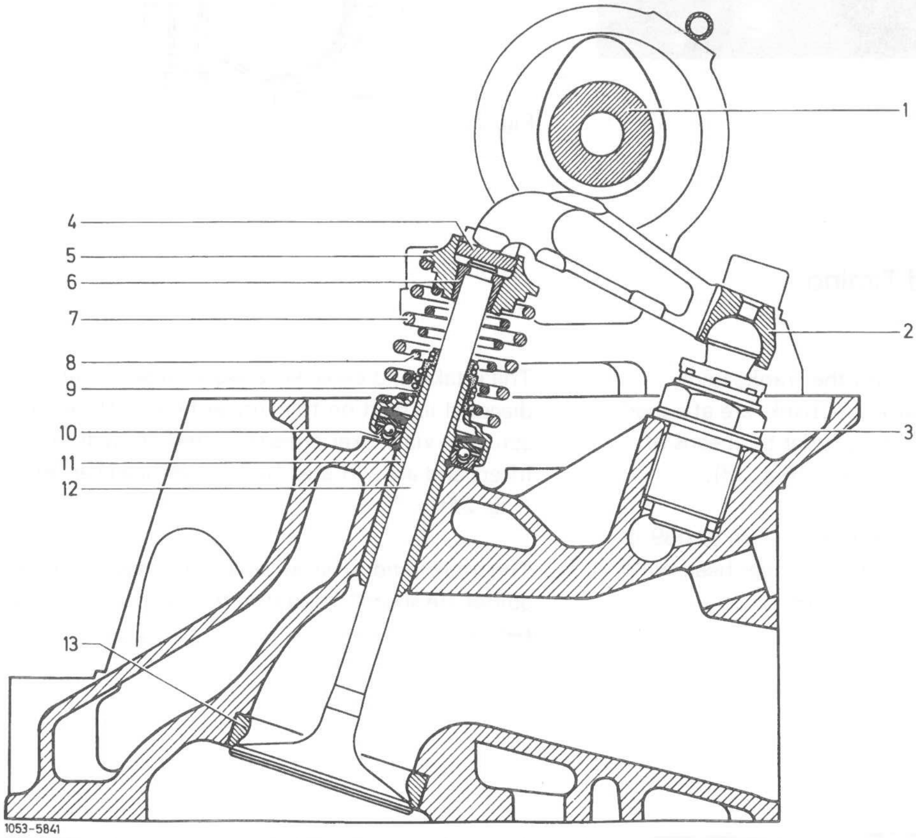


Fig. 24

1 Camshaft
2 Rocker arm
3 Hydraulic valve lifter
4 Thrust piece
5 Valve spring retainer
6 Conical valve key halves
7 Outer valve spring
8 Inner valve spring
9 Valve stem seal
10 Rotocap
11 Valve guide
12 Intake valve
13 Valve seat insert

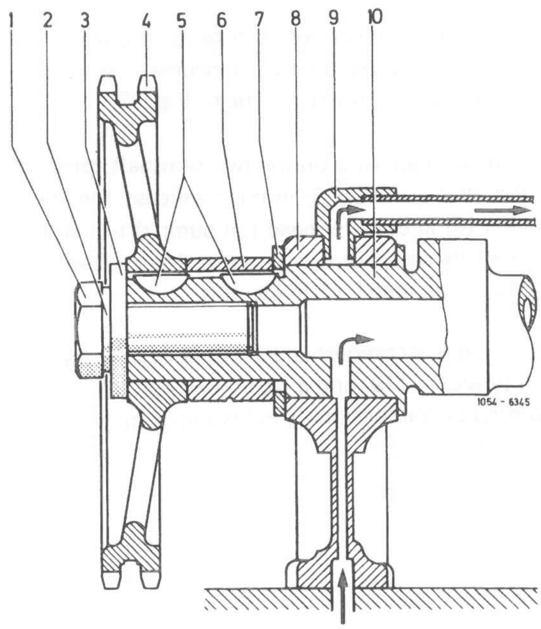


Fig. 26

1 Hex. bolt
2 Lock washer
3 Washer
4 Camshaft sprocket
5 Woodruff key
6 Sleeve
7 Washer
8 Camshaft bearing
9 Oil tube
10 Camshaft

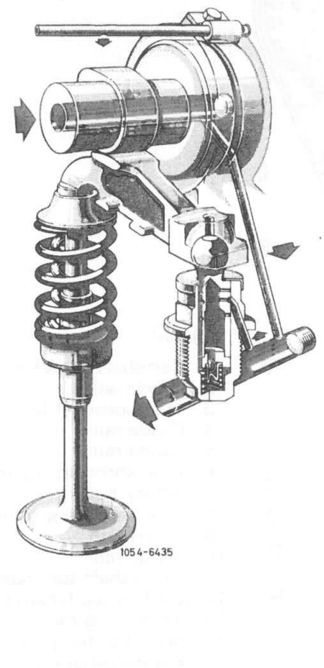


Fig. 27

In addition to the oil return gallery at rear end of cylinder heads, one additional oil return bore each is located on the outside center (Fig. 28).

The cylinder head covers are attached to the cylinder head by means of 7 nuts (Fig. 29).

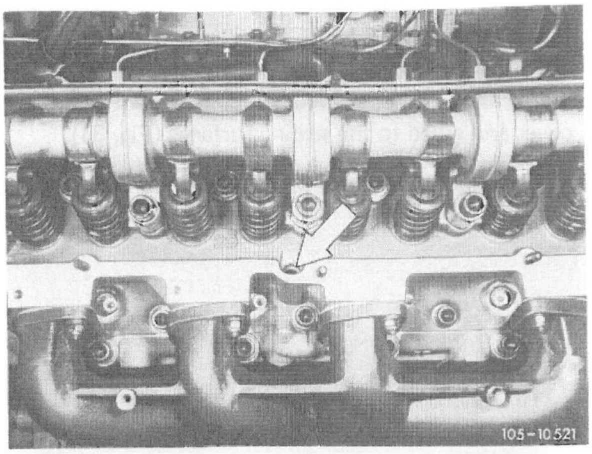


Fig. 28

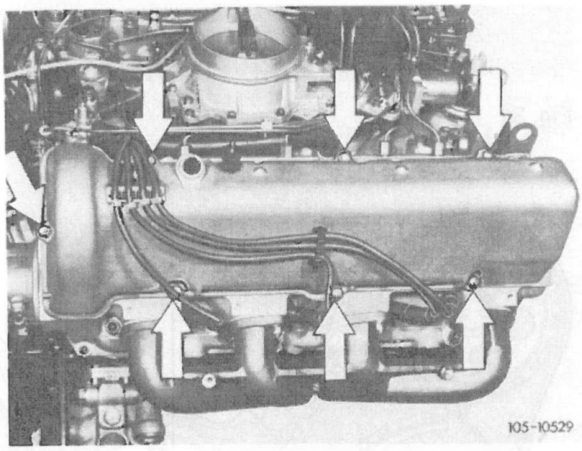


Fig. 29

A flat gasket is used for sealing the cylinder head covers (Fig. 30).

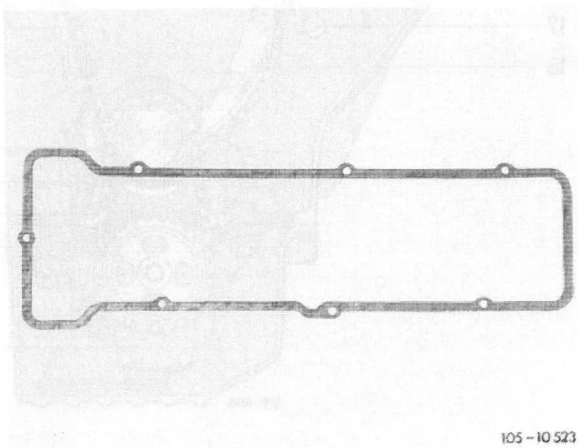


Fig. 30

In addition, the insides of the cylinder head covers are provided with an oil deflector plate for the crankcase breather system, which is riveted into the cover and glued to the sealing surfaces (Fig. 31).

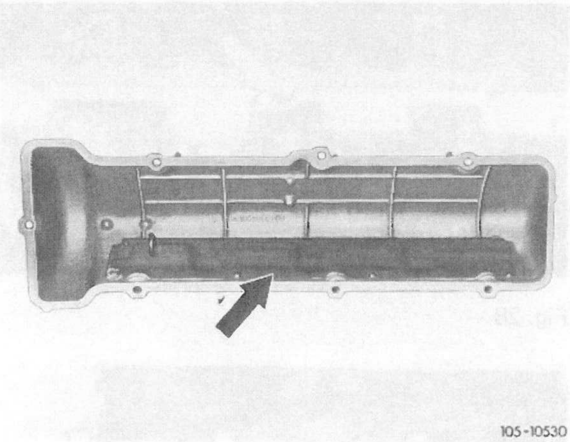


Fig. 31

The camshafts, the ignition distributor and the pressure oil pump for the hydropneumatic suspension are driven via a duplex roller chain (Fig. 32).

The endless chain runs on the two camshaft sprockets (1), the idler sprocket (3) in the crankcase, the idler sprocket (6) in cylinder head (oil pump drive) and the intermediate sprocket (ignition distributor drive). The chain is guided by 5 guide rails.

Tensioning is accomplished by means of a hydraulic chain tensioner (19) and a tensioning rail (18). The mounting of the tensioning rail is similar to that of engine 110.

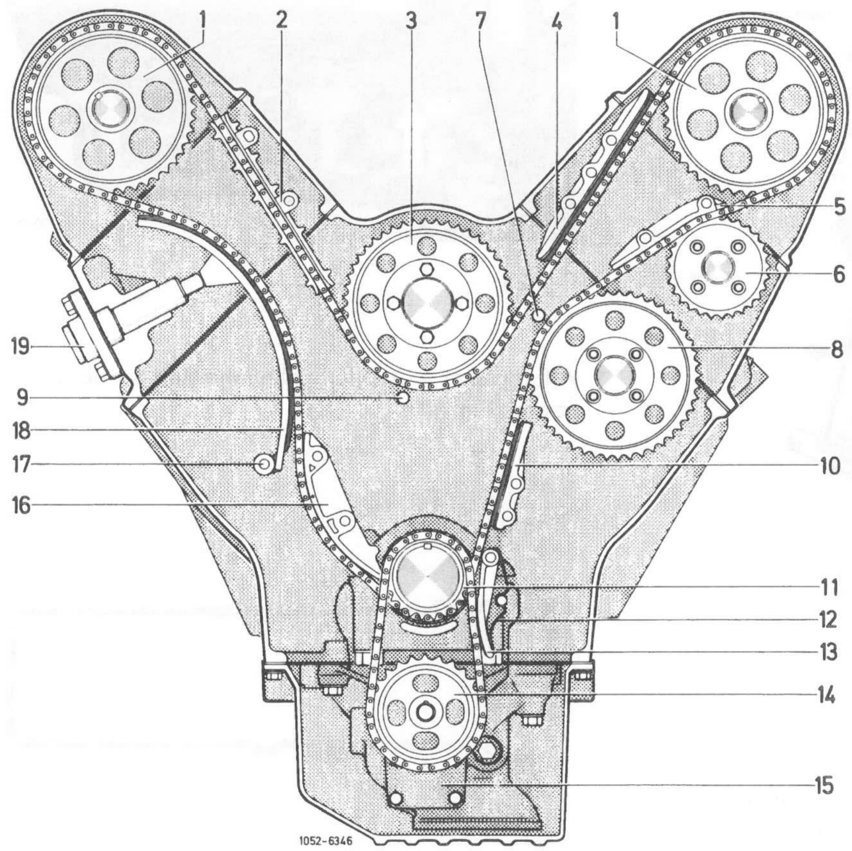


Fig. 32

1 Camshaft sprocket
2 Guide rail
3 Idler sprocket (cylinder crankcase)
4 Guide rail
5 Guide rail
6 Idler sprocket (cylinder head)
7 Safety bolt
8 Intermediate sprocket
9 Safety pin
10 Guide rail
11 Crankshaft sprocket
12 Leaf spring (chain tensioner)
13 Tensioning rail
14 Sprocket (oil pump)
15 Engine oil pump
16 Guide rail
17 Bearing bolt tensioning rail
18 Tensioning rail
19 Chain tensioner

The contact pressure required for tensioning the timing chain comprises the force of the compression spring and the oil pressure present in the chain tensioner. Independent of the engine oil pressure, the oil pressure in the chain tensioner is held approximately constant during all operating conditions by means of a check valve (3) and a pressure limiting valve (10) (Fig. 33).

The chain tensioner housing (7) is provided with detents and the plunger (8) with a detent spring (12). The plunger pin moves forward from detent to detend according to the amount of chain stretch. The return path is limited by the detents. Consequently, the plunger cannot be pushed back when the engine is stopped. Any jumping of a loose timing chain or chain noises when starting the engine are therefore eliminated.

The chain tensioner is attached to a flange (2) which is bolted to the cylinder head (on the right side seen in driving direction).

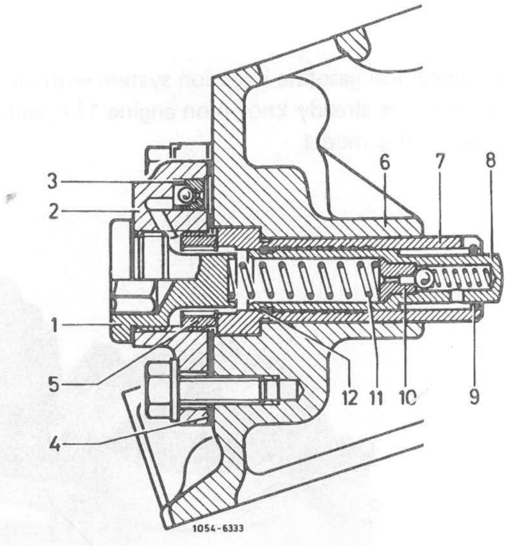


Fig. 33

1 Plug
2 Flange
3 Check valve
4 Gasket
5 Threaded ring
6 Cylinder head
7 Chain tensioner housing
8 Plunger
9 Circlip
10 Pressure limiting valve
11 Compressing spring
12 Detent spring

Hydraulic Valve Lifters

The installation of the hydraulic valve lifters eliminates any adjustment of valve clearance. The hydraulic valve lifters are similar in construction and function to those used on engine 117.

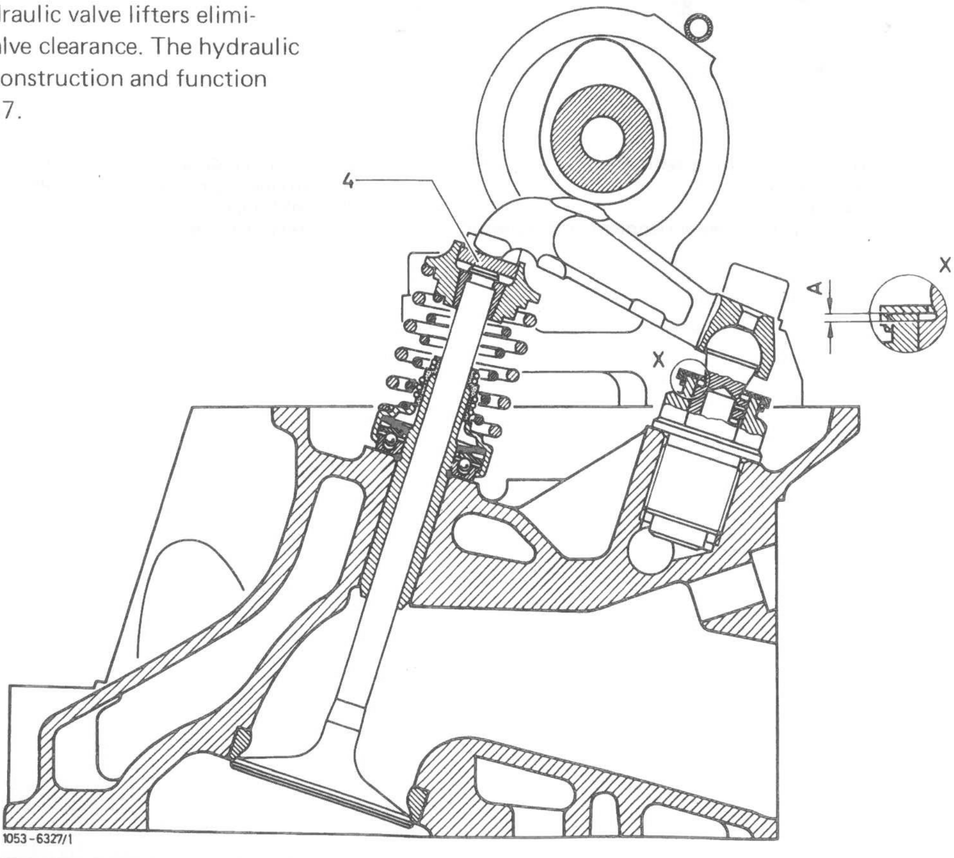


Fig. 34

The mechanical gasoline injection system with air flow sensor, as already known on engine 117, will also be used on this model.

For a description of operation, refer to Model Year 1977, Passenger Cars with Engine 117.

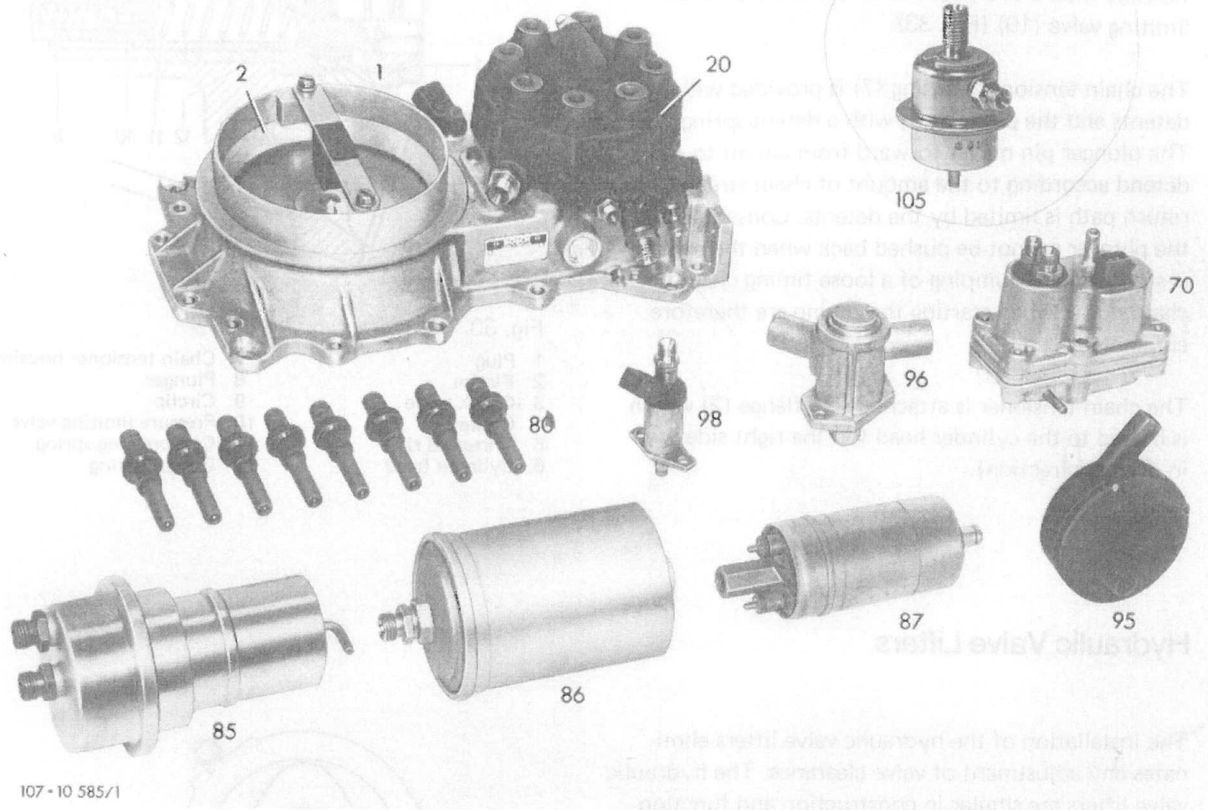


Fig. 35

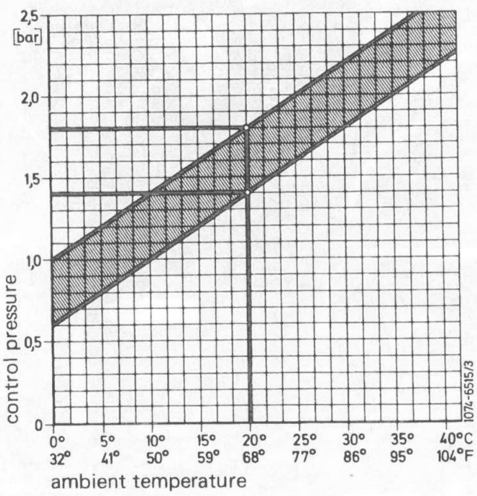
1 Mixture regulator assembly
2 Airflow sensor
20 Fuel distributor
70 Warm-up/full load enrichment compensator
95 Suction damper
96 Auxiliary air valve
98 Cold-start valve
105 Pressure damper
80 Injection nozzles
85 Fuel accumulator
86 Fuel filter
87 Fuel pump

Fuel pressures

Engine	100
Warm-up compensator Bosch No.	0 438 140 060
System pressure engine cold or warm (at idle)	5.2 – 5.8 bar gauge pressure (atü)
Control pressure engine warm (at idle) warm-up compensator cycle completed	3.4 – 3.8 bar gauge pressure (atü) at 530 mbar intake pipe vacuum
Full load enrichment vacuum hose pulled off (at idle)	2.8 – 3.2 bar gauge pressure (atü)
Control pressure engine cold in accordance with ambient temperature	min. 0.5 bar gauge pressure (atü) (refer to diagram)

Example:

Ambient temperature 20 °C–
control pressure 1.4 – 1.8 bar gauge pressure (atü).



Engine 100

Vacuum adjustment in direction of "advance"

The advance unit of the ignition distributor is connected to the vacuum connection of the throttle valve unit which is at atmospheric end when the throttle valve is closed, but interrupted by the 40 °C thermo valve (60). With the throttle valve set and at a coolant temperature above 40 °C the ignition is adjusted in dependence of the vacuum in the direction of "advance" in addition to the centrifugal adjustment. A delay of the vacuum adjustment up to 40 °C coolant temperature results in a shortening of the warming-up phase.

In addition, a delay valve (77) has been installed between the thermo valve (60) and the vacuum unit. When the throttle valve is rapidly opened, the delay valve will dampen the abrupt vacuum increase toward advance unit. As a result, the CH-values of the emissions will be reduced.

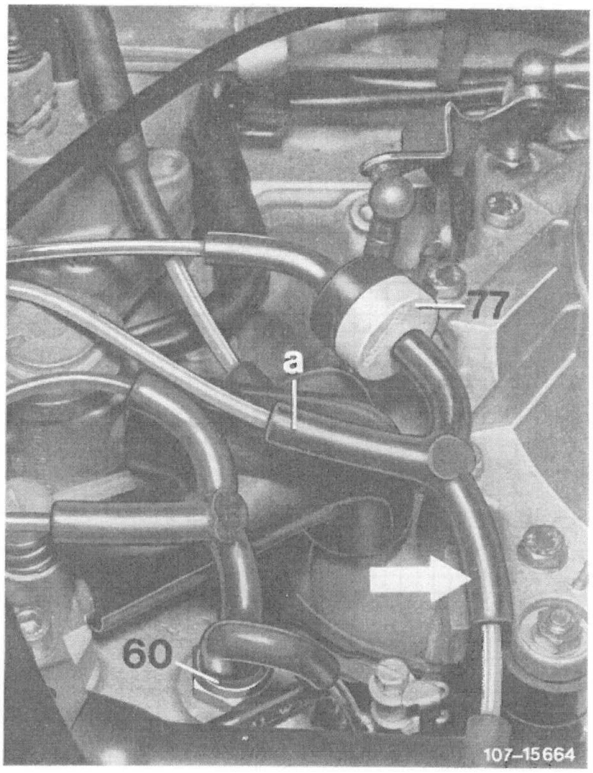


Fig. 36

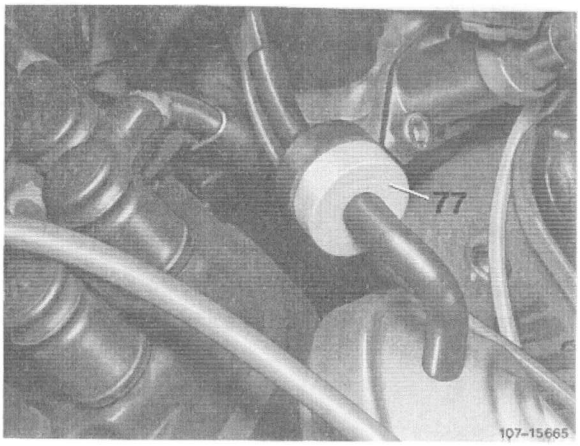


Fig. 37

Spark Plugs

Spark plugs with a thermal value of 125 are installed.

The electrode gap amounts to 0.8 mm (.032").

General Information

Color-coding of vacuum lines

The base color of the vacuum lines for the vacuum control system is opaque (white).

To simplify recognition of the individual functions, additional color-striping is employed.

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 device	Color-coding of originating vacuum lines	Color-coding of terminating vacuum lines
Ignition change-over		
Ignition advance	red	–
Ignition retard	yellow	yellow/purple
Exhaust gas recirculation (EGR)	brown	red/purple
Air injection	blue	blue/purple

Functional Diagram

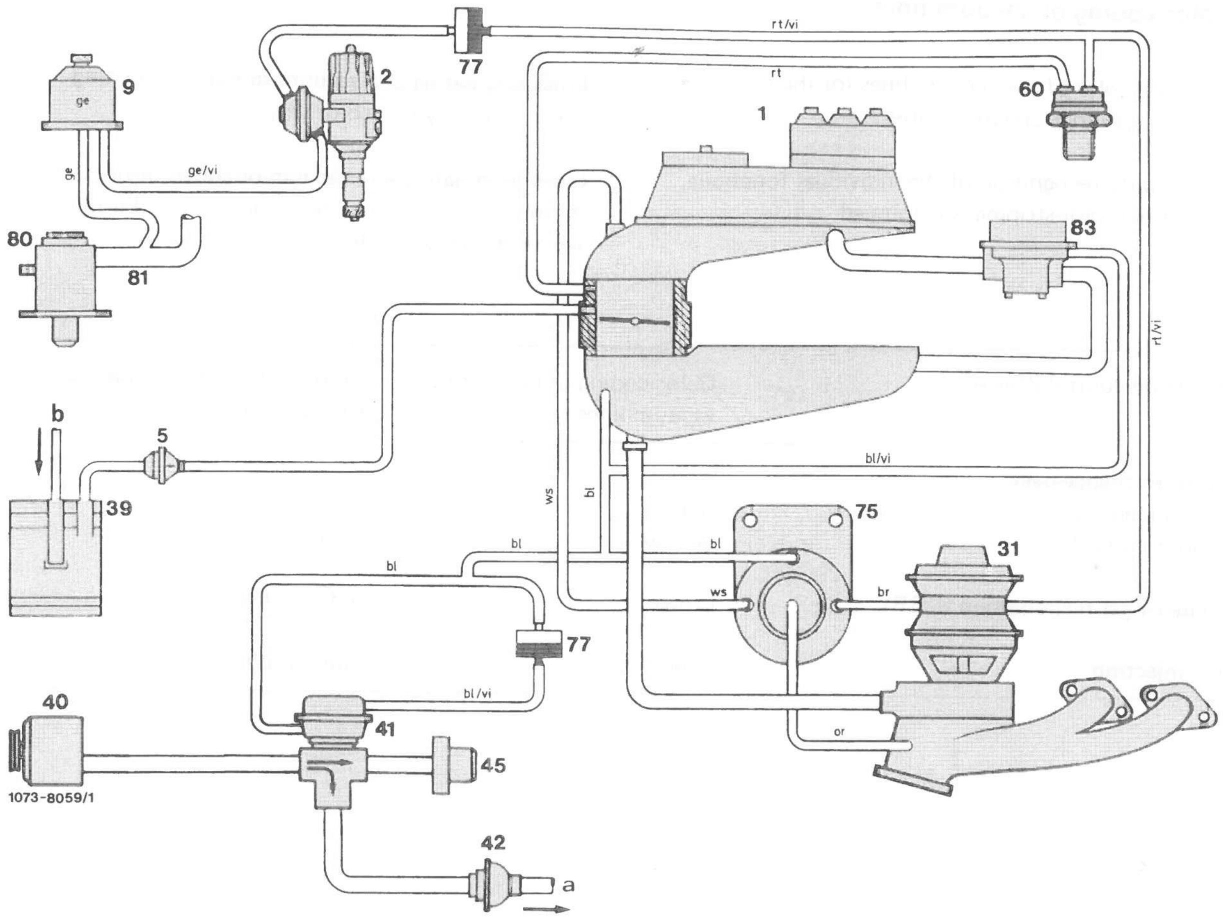


Fig. 38

1	Throttle valve housing and intake manifold	39	Charcoal canister	77	Delay valve	bl	=	blue
2	Distributor	40	Air pump	80	Auxiliary air valve	br	=	brown
5	Purge valve	41	Anti-backfire valve	81	Hose	ge	=	yellow
9	Switch-over valve (on vehicles with air conditioner)	42	Check valve	83	Coasting bypass valve	or	=	orange
31	EGR valve	45	Silencer (air filter for noise suppression)	a	to cylinder head	rt	=	red
		60	Thermo valve, 40 °C	b	from fuel tank	vi	=	purple
		75	Transducer			ws	=	white

Exhaust Gas Recirculation

To reduce nitric oxides in exhaust gases, a portion of these gases is taken back into the intake pipe by means of a valve.

The recirculated portion is limited and is shut off in some driving conditions, so that driving characteristics will not be influenced.

The system consists of the following components:

EGR valve

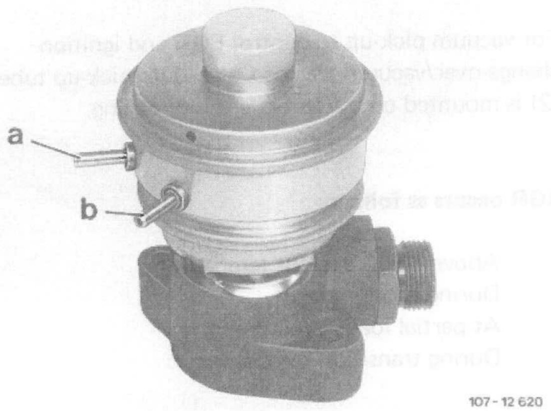


Fig. 39

The EGR valve is contructed as a three-diaphragm valve in order to provide better proportioning of the exhaust gas recirculation.

EGR line

The exhaust gases are routed from the EGR valve around the front of the engine into the intake manifold.

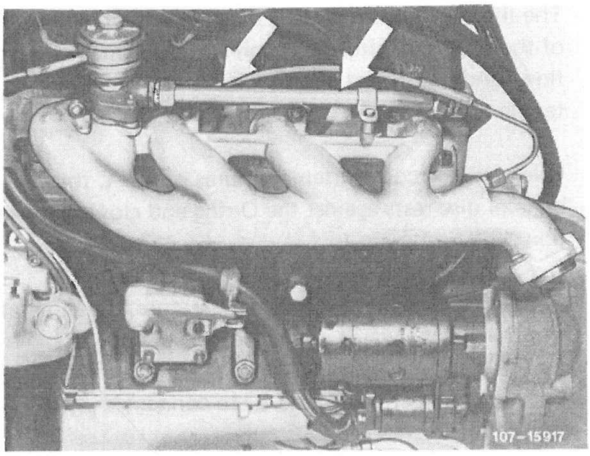


Fig. 40

Exhaust pressure transducer

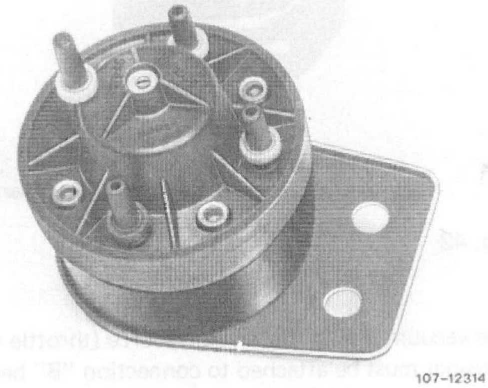


Fig. 41

The exhaust pressure transducer (75) controls the amount of EGR dependent on exhaust back pressure.

Thermo-vacuum valve 40 °C (Color-code black)

The thermo-vacuum valve is located in the portion of the intake manifold through which engine coolant flows and it opens at approx. 40 °C coolant temperature.

Below engine coolant temperatures of 40 °C the bimetal disc rests against the O-ring and closes connection "B".

Above 40 °C engine coolant temperature, the bimetal disc snaps downwards due to heating action.

Vacuum connections A and B are connected with each other.

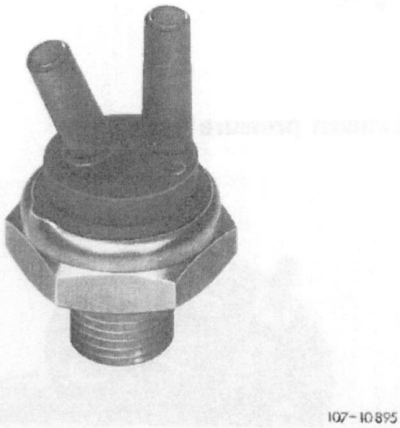


Fig. 42

The vacuum line to the vacuum source (throttle valve housing) must be attached to connection "B" because only in this position can a leak-proof seal between the bimetal disc and the O-ring be accomplished.

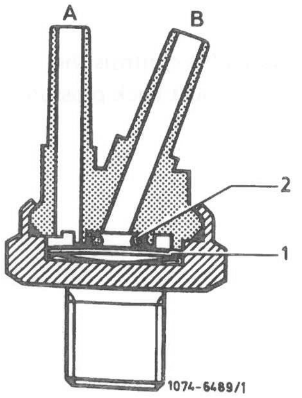


Fig. 43
A To EGR valve
B To throttle valve housing
1 Bimetal disc
2 O-ring

Throttle valve housing

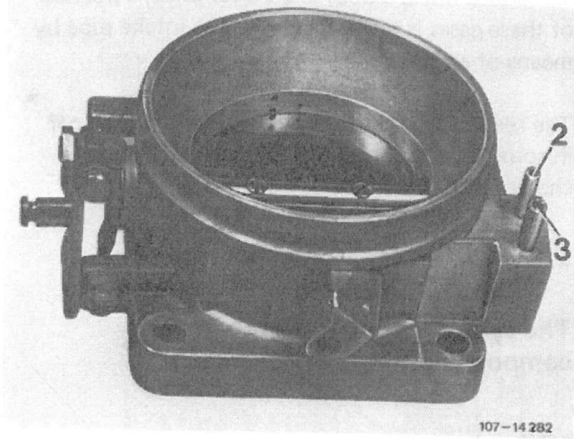


Fig. 44

For vacuum pick-up to control EGR and ignition change-over/vacuum advance, a vacuum pick-up tube (2) is mounted on the throttle valve housing.

EGR occurs as follows:

- Above 40 °C coolant temperature
- During acceleration
- At partial load
- During transition to coasting

Description of Operation

Above an engine coolant temperature of approx. 40 °C in the intake manifold, a portion of exhaust gas from the exhaust manifold is routed to the intake manifold during acceleration, partial throttle operation and transition to coasting.

The amount of EGR is dependent on the position of the throttle valve (vacuum pick-up on throttle valve housing) and the exhaust gas back pressure in the exhaust manifold.

Depending on the position of the throttle valve, the center diaphragm chamber of the EGR valve is actuated to a lesser or greater extent by vacuum via the thermo-vacuum valve 40 °C (60) in the intake manifold.

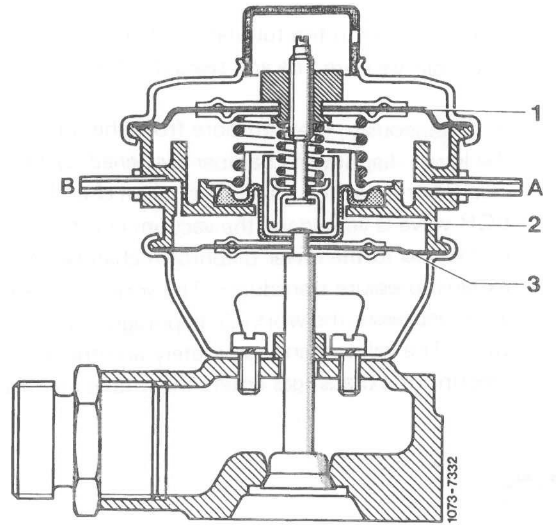


Fig. 45

1 Shut-off diaphragm
2 Long-stroke diaphragm
3 Working diaphragm
A Vacuum line connection to thermo-vacuum valve
B Vacuum line connection to exhaust pressure transducer

In the upper diaphragm, there is always atmospheric pressure present via a vent bore.

Dependent on vacuum, the shut-off diaphragm (1) with connecting pin is moved downward against spring tension and the valve can open.

The opening and closing of the EGR valve is controlled by the exhaust pressure transducer which, depending on exhaust gas back pressure in the exhaust manifold, either vents or evacuates the diaphragm chamber above the working diaphragm (3).

Exhaust pressure transducer

The exhaust pressure transducer (75) is divided into three chambers by two spring-loaded diaphragms; an upper (1) and a lower (2). Both diaphragms are interconnected via a tubular shaft.

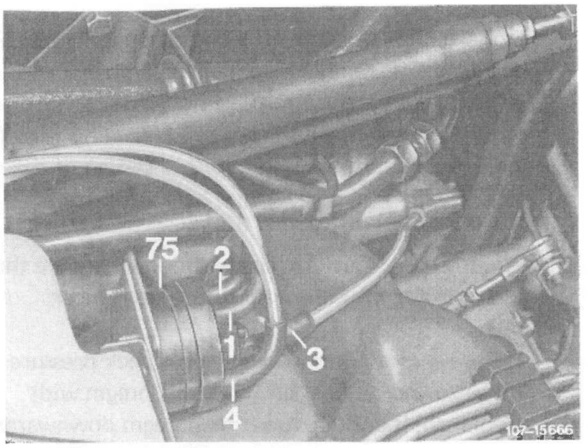


Fig. 46

1 Connection, intake manifold vacuum
2 Connection, vent line
3 Connection, exhaust gas back pressure line
4 Connection, vacuum control line to EGR valve

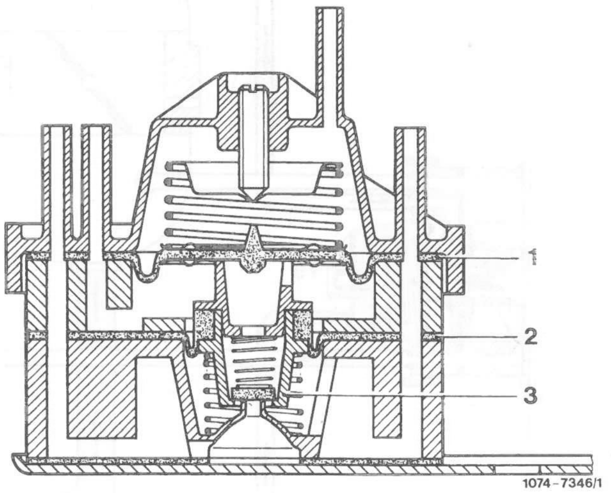


Fig. 47

1 Upper diaphragm
2 Lower diaphragm
3 Tubular shaft

Exhaust back pressure affects the upper diaphragm chamber. The middle diaphragm chamber is continually vented via the air intake housing. The position of the two diaphragms is not influenced by this. The lower diaphragm chamber is either vented or evacuated depending on the exhaust gas back pressure.

Due to the various driving conditions there are three positions for the exhaust pressure transducer:

1. During acceleration, exhaust gas back pressure increases and pushes the upper diaphragm with tubular shaft and the lower diaphragm downwards.

The valve disc in the tubular shaft closes the intake manifold vacuum line and seats itself on the lower

Simultaneously, the vent bore from the middle to the lower diaphragm chamber is opened by the valve disc. Therefore, the lower diaphragm chamber in the EGR valve is vented via the vacuum control line connected to the lower diaphragm chamber of the exhaust pressure transducer. The spring in the EGR valve depresses the working diaphragm including the valve. The valve opens completely and the maximum amount of exhaust gas enters the intake manifold.

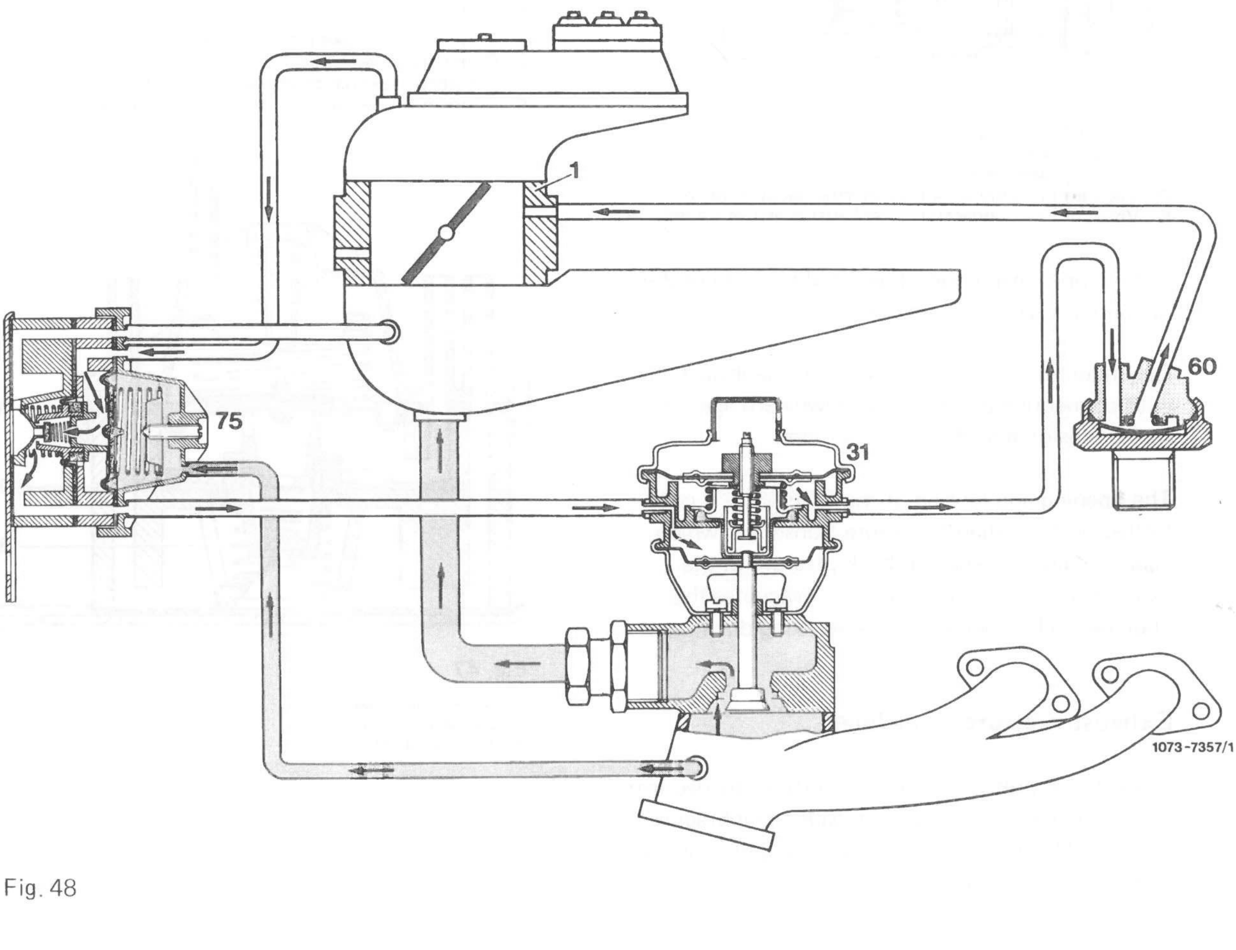


Fig. 48

2. During transition to coasting, the exhaust gas back pressure decreases. The upper diaphragm (1) with the tubular shaft and the lower diaphragm return to their initial position. The valve disc opens the intake manifold vacuum line and seats itself on the lower sheet metal contour of the tubular shaft. This interrupts the venting of the lower diaphragm chamber.

The intake manifold vacuum now present in this diaphragm chamber evacuates also via the vacuum control line, the lower diaphragm chamber in the EGR valve. Depending on the amount of vacuum, the valve is pulled in a closing direction against the spring force. EGR is reduced.

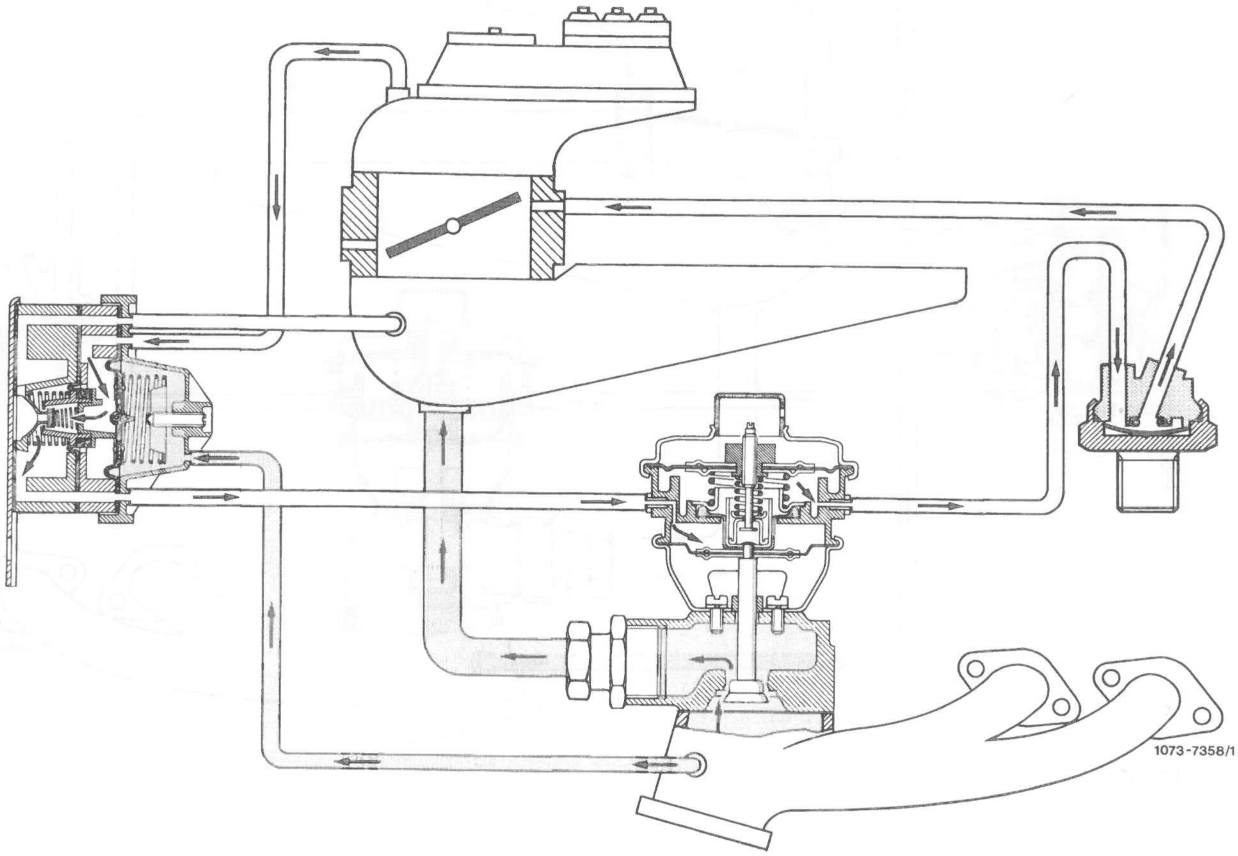


Fig. 49

3. During steady driving operation, there is an equilibrium in the lower and upper diaphragm chambers. The EGR valve remains in its present position and the amount of EGR also remains constant (Fig. 49).

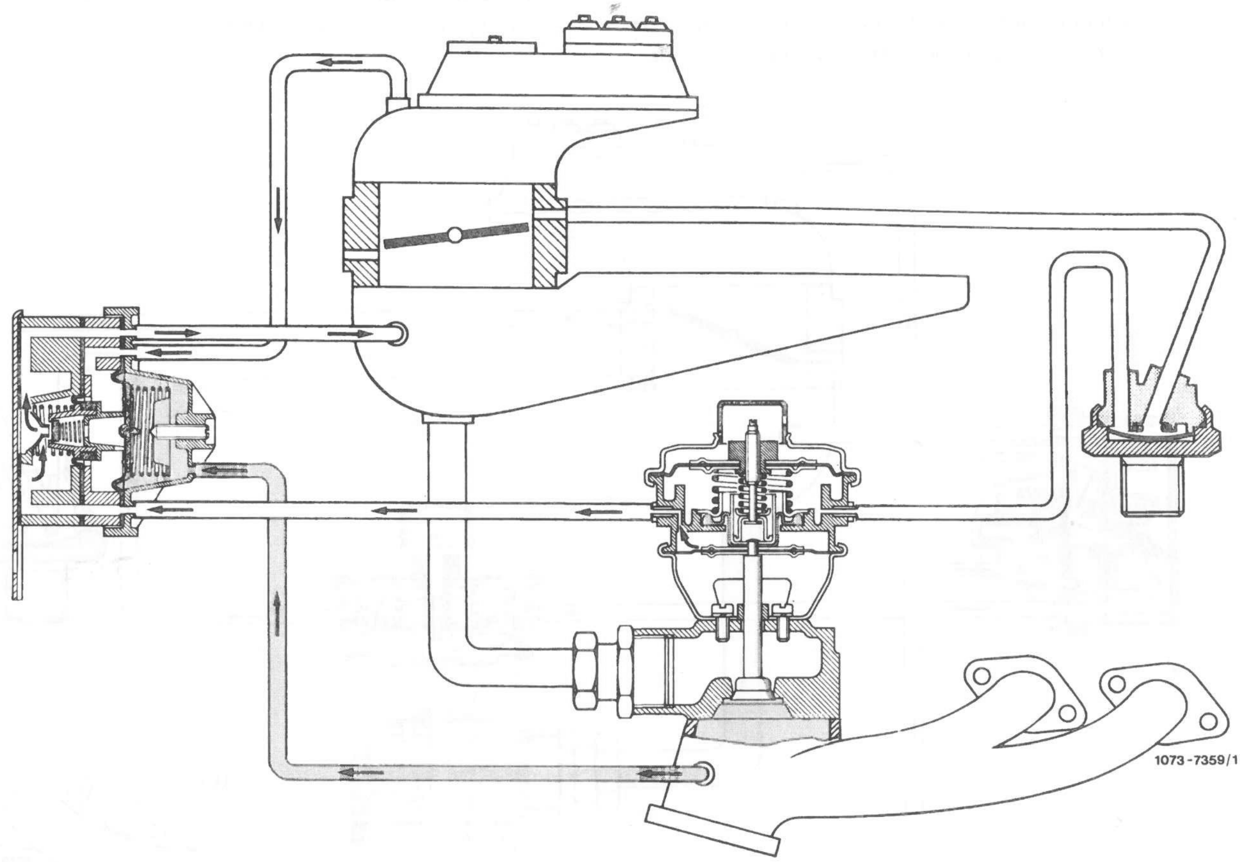


Fig. 50

Air Injection

To reduce completely burned components in exhaust gas, air is injected into the hot zone behind the exhaust valves. Afterburning is controlled by the engine temperature and by vacuum conditions in intake pipe.

To avoid backfiring in exhaust, the air injection is shut off in certain driving ranges.

Afterburning system

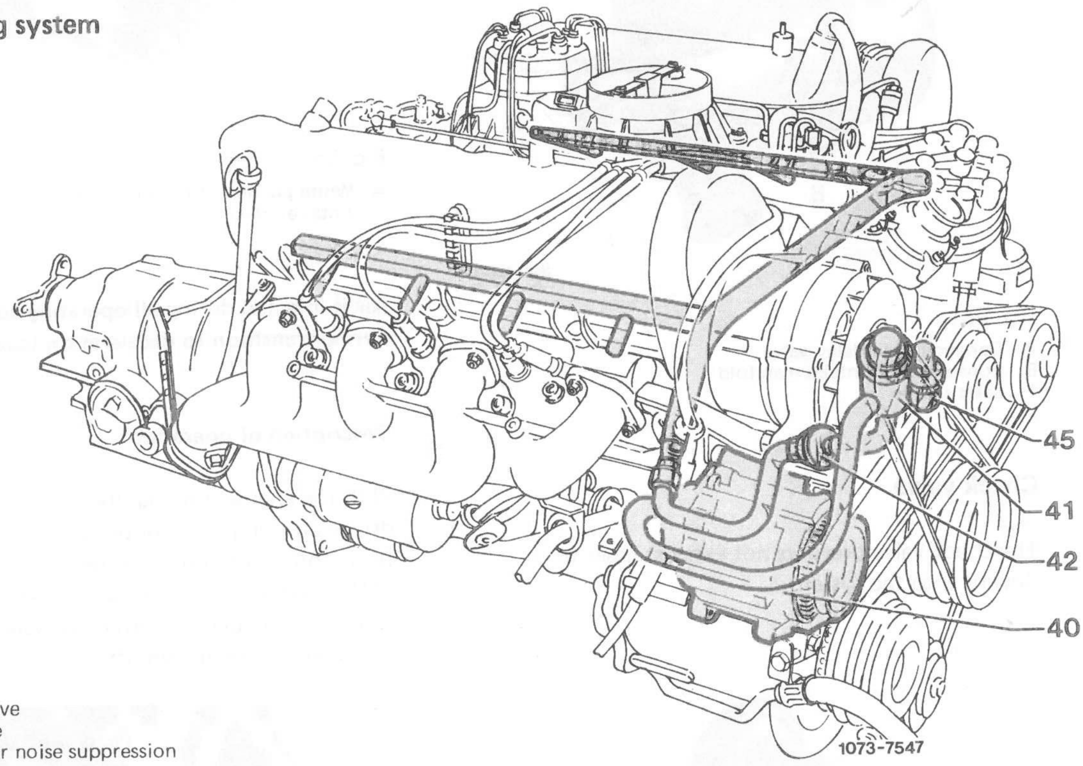


Fig. 51

40 Air pump
41 Diverter valve
42 Check valve
45 Air filter for noise suppression

Afterburning system components

Air pump (Saginaw pump)

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

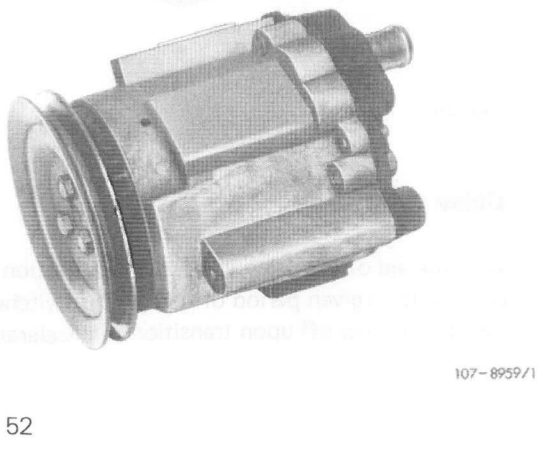


Fig. 52

Anti-backfire valve

The anti-backfire valve controls the air injection/ blow-off at given driving conditions.

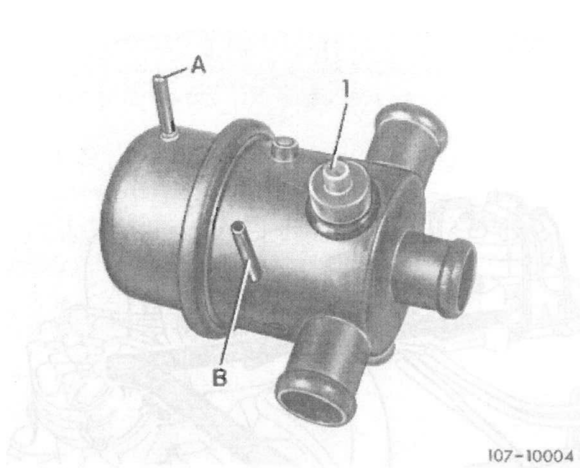


Fig. 53

A Connection to delay valve
B Connection to intake manifold
1 Safety valve

Check valve

The check valve prevents hot exhaust gases from flowing into the system.

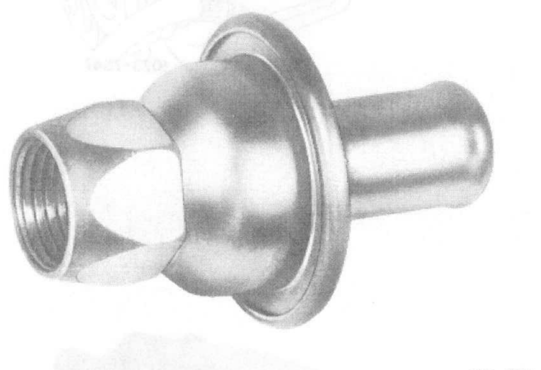


Fig. 54

Delay valve

With the aid of the delay valve, the air injection is delayed for a given period of time and is switched over to air blow-off upon transition to deceleration.

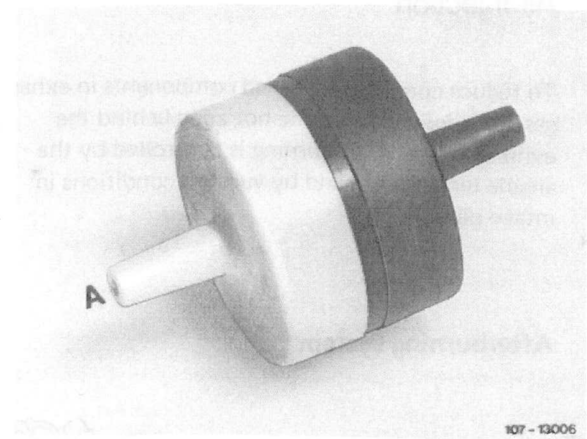


Fig. 55

A White portion of housing – vacuum connection (intake side)

Air is injected during **all operating conditions, except during transition to deceleration (coasting)**

Description of operation

With the engine running, the crankshaft and V-belt driven air pump will continuously deliver air, which flows through a contour hose to antibackfire valve (41). A safety valve integrated in anti-backfire valve will begin to open at a given pressure, so that any excess air can be blown off.

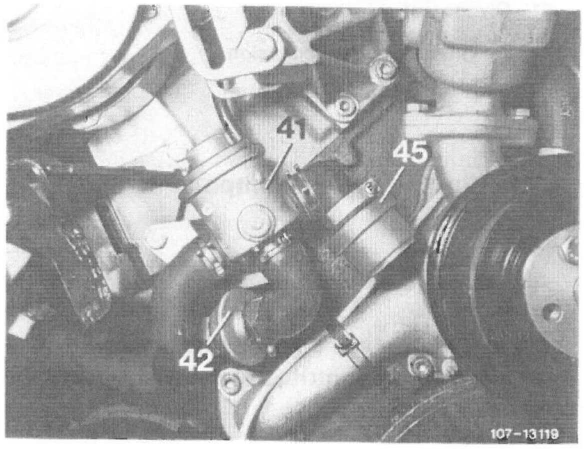


Fig. 56

41 Blowoff valve
42 Check valve
45 Air filter for noise suppression

Two switching functions are integrated in the anti-backfire valve.

1. Air injection

The lower diaphragm chamber (b) of the anti-backfire valve (41) is connected directly to the intake manifold and the upper diaphragm chamber (a) is connected to it via a delay valve (77).

The vacuum pick-up bore is at the intake manifold under the throttle valve.

In the operating modes mentioned, the lower and upper diaphragm chambers are evacuated more or less depending on the throttle valve position. Since there is the same vacuum in both diaphragm chambers, the spring pulls the two-sided diaphragm disc upward, opens the air injection line (c) and closes the blow-off line (d) at the same time.

The injected air passes through a tube to the cylinder head and through cross bores into the exhaust ports.

To prevent hot exhaust gases from entering into the air injection line, a check valve (42) has been installed in the line between the anti-backfire valve and cylinder head.

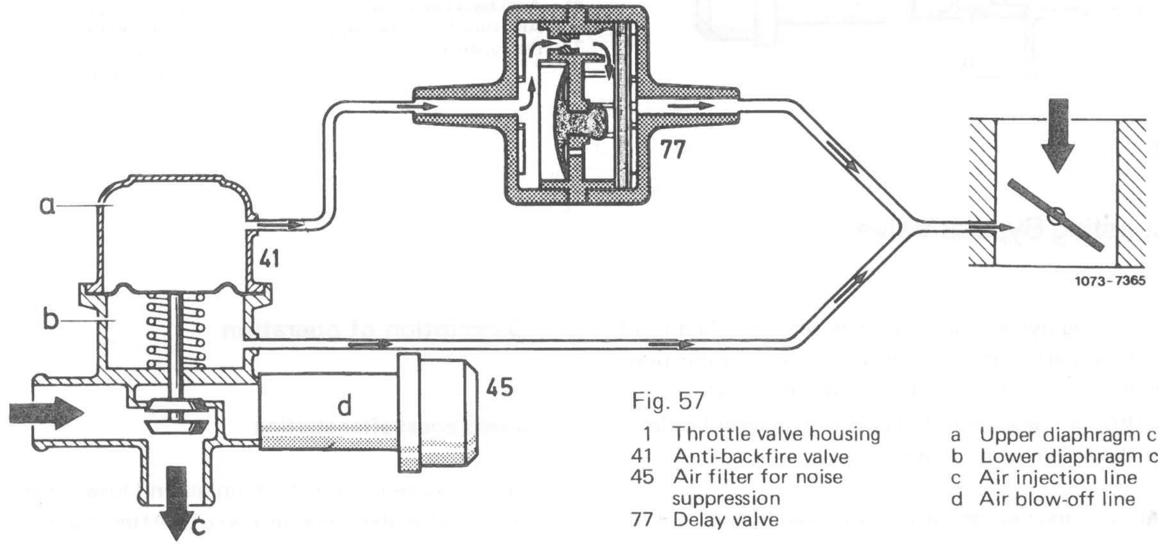


Fig. 57

1 Throttle valve housing
41 Anti-backfire valve
45 Air filter for noise suppression
77 Delay valve

a Upper diaphragm chamber
b Lower diaphragm chamber
c Air injection line
d Air blow-off line

2. Air discharge for transition to deceleration

During the time the throttle valve in housing is closed, vacuum in the lower diaphragm chamber (b) increases very quickly. In the upper diaphragm chamber (a), on the other hand, the vacuum cannot increase so quickly because of the calibrated bore in the delay valve (77). The difference in vacuum effects that the valve head is pulled down against the spring force and the air discharge line is opened.

The delivered air is blown off through the air filter (45). This procedure continues for so long, until the vacuum in both diaphragm chambers is the same. The compensating time depends on the size of the calibrated bore in the delay valve and the volume of the upper diaphragm chamber (a).

This measure will prevent backfiring in the exhaust while in transition to deceleration.

So that the vacuum can be reduced in the upper diaphragm chamber (a) just as quickly as in the lower diaphragm chamber (b) when accelerating, in addition to the calibrated bore (f) the upper diaphragm chamber is vented via a valve plate (e) in the delay valve.

This is necessary, so that when in transition to deceleration the anti-backfire valve can switch to air discharge immediately.

The desired switching would not be possible without this venting, because in this case there would still be high vacuum pressure in the upper diaphragm chamber.

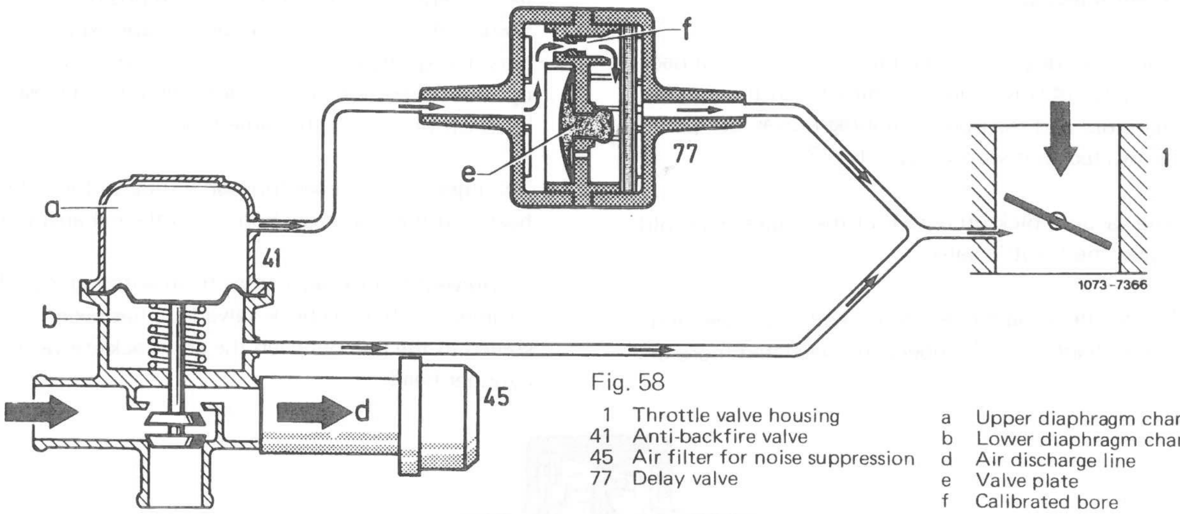


Fig. 58

1 Throttle valve housing
41 Anti-backfire valve
45 Air filter for noise suppression
77 Delay valve

a Upper diaphragm chamber
b Lower diaphragm chamber
d Air discharge line
e Valve plate
f Calibrated bore

Coasting Bypass Valve

A coasting bypass valve (83) has been installed to lift the speed after starting and to improve combustion while coasting. It is located behind the mixture control unit and mounted on the gate lever holder for the accelerator linkage.

The coasting bypass valve is operated by vacuum from the intake and connects the air guide housing with the intake manifold.

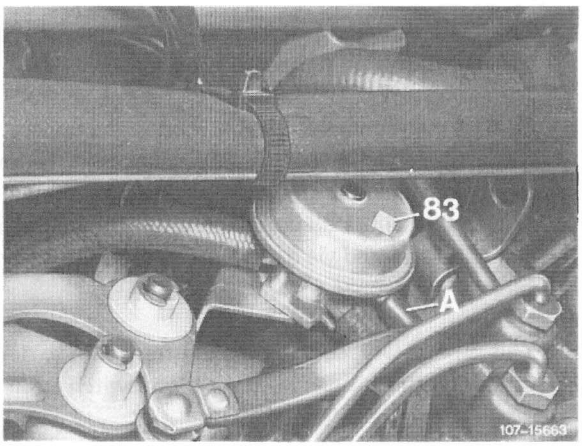


Fig. 59

Description of operation

Speed boost after starting

The pressure is uniform in upper and lower diaphragm chambers with engine turned off. After starting the engine there is high vacuum in lower diaphragm chamber (5) for a short time, which overcomes the force of spring (6). Valve (8) is pressed downward, and the opening for bypass air is open from the air guide housing to the intake manifold.

As soon as the vacuum has been equalized in both diaphragm chambers by way of throttle bore (10), spring (6) presses valve (8) up to close it.

The idle speed is increased briefly by supplying bypass air, which stabilizes idle operation.

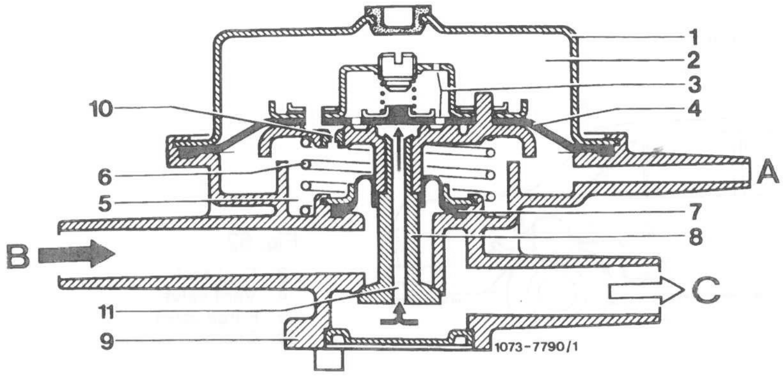


Fig. 60
1 Housing upper section
2 Upper diaphragm chamber
3 Vent bores
4 Diaphragm spring
5 Lower diaphragm chamber
6 Spring
7 Sealing diaphragm
8 Valve
9 Housing lower section
10 Throttle bores
11 Vent bore
A Intake manifold vacuum connection
B Air guide housing connection
C Intake manifold lower section connection

Air feed for coasting

A spring closes valve (8) because of the equalized pressure in upper and lower diaphragm chambers while driving constantly.

While coasting vacuum in the lower diaphragm chamber (5) will rise faster than it can be equalized with the upper diaphragm chamber by way of throttle bore (10). The pressure of the high vacuum overcomes the force of spring (6) and valve (8) is pressed down again. Bypass air can now flow from the air guide housing into the intake manifold.

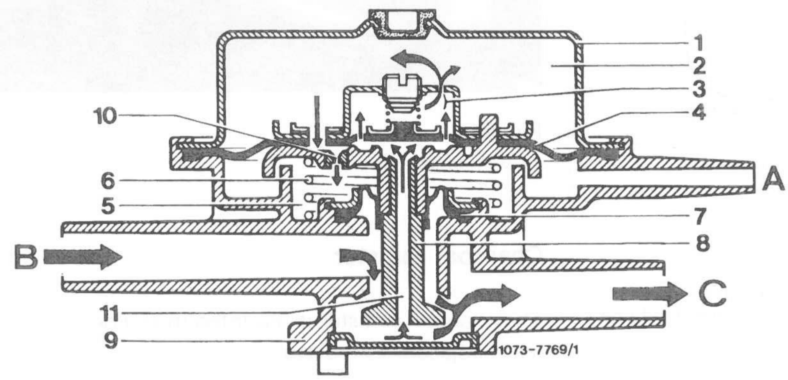


Fig. 61
1 Housing upper section
2 Upper diaphragm chamber
3 Vent bores
4 Diaphragm spring
5 Lower diaphragm chamber
6 Spring
7 Sealing diaphragm
8 Valve
9 Housing lower section
10 Throttle bore
11 Vent bore
A Intake manifold vacuum connection
B Air guide housing connection
C Intake manifold lower section connection

The fuel evaporation control system has been completely revised.

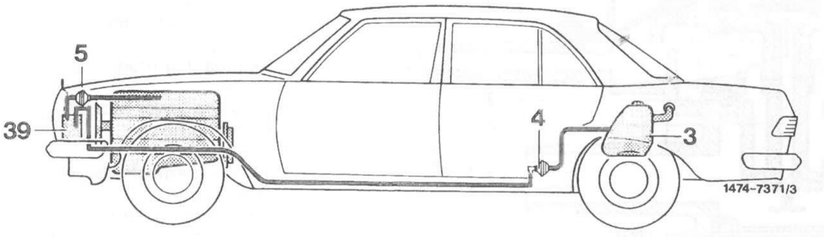


Fig. 62
3 Fuel tank
4 Vent valve
5 Purge valve
39 Charcoal canister

The system consists of the following components:

Fuel tank

The fuel tank with the tube system and expansion tank is identical to the already known version.

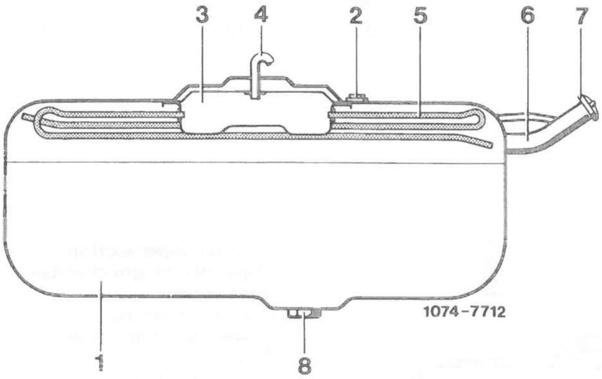


Fig. 63

1 Fuel tank
2 Fuel gauge sending unit
3 Expansion tank
4 Connection, vent valve unit
5 Tube system
6 Filler neck
7 Fuel tank cap
8 Connection, fuel feed line

Note: In Model 107.044 the expansion tank is outside the fuel tank.

Vent valve unit

The fuel tank vent valve unit (4) is mounted underneath the vehicle in the area of the rear footwell and replaces the valve system as known from Model Year 1977.

The vent valve unit consists of a vacuum and pressure relief valve.

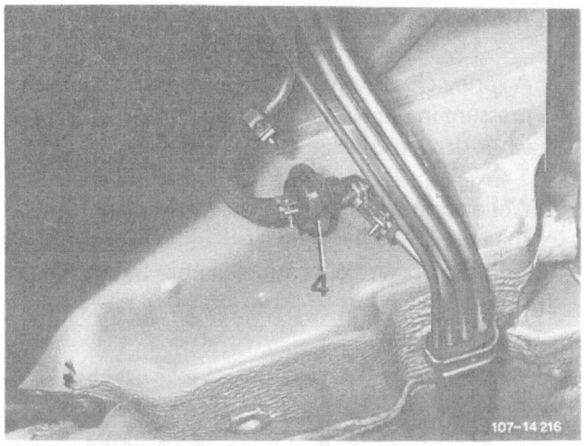


Fig. 64
4 Vent valve unit

Charcoal canister

The charcoal canister is mounted in engine compartment adjacent to radiator.

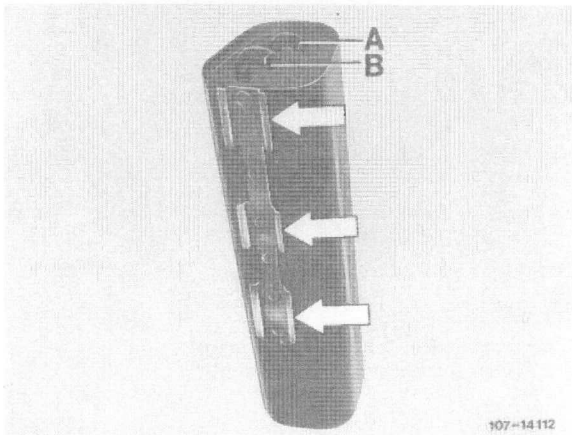


Fig. 65
A Connection, purge line
B Connection, fuel vapors from tank

Purge valve

The purge valve (5) is located in the purge line from the charcoal canister to the throttle valve housing.

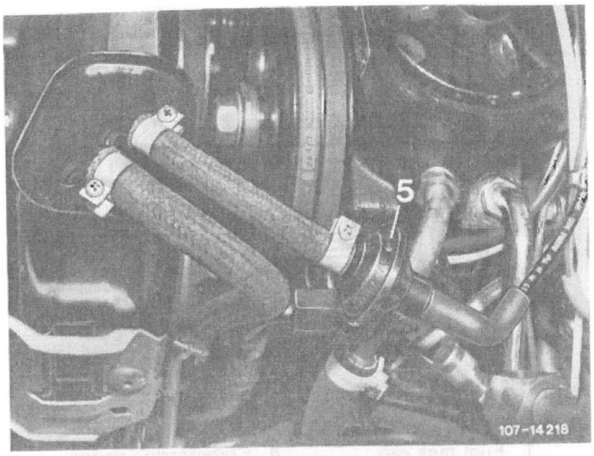


Fig. 66

Throttle valve housing

In comparison to Model Year 1977, the throttle valve housing has been slightly modified. To prevent a mix-up of the vacuum lines, the outside diameter of the vacuum line to the charcoal canister has been increased from 4 to 5 mm. To purge the fuel vapors from the charcoal canister, two purge bores are provided above the throttle valve.

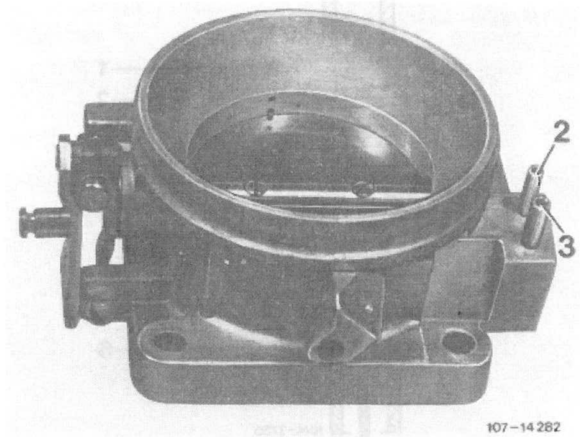


Fig. 67

2 Vacuum connection, ignition advance
3 Vacuum connection, charcoal canister

Fuel tank cap

To avoid excessive pressure in the fuel tank, the fuel tank cap has been modified.

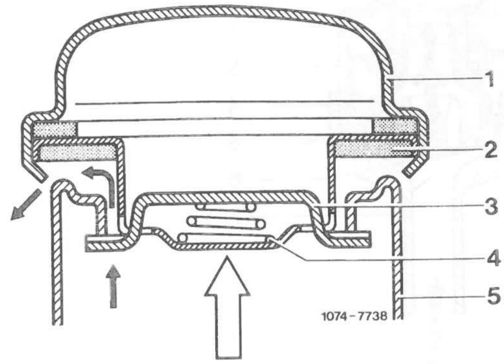


Fig. 68

1 Fuel tank cap
2 Gasket
3 Locking tab
4 Compression spring
5 Filter neck

Description of operation:

Evaporation system

By means of the vent valve unit (4), the pressure in the fuel tank is increased to 30 – 50 mbar.
This ensures that less fuel vapors can escape from the tank.

If a pressure of 30 – 50 mbar is reached in the fuel tank, the pressure relief valve in the vent valve unit (4) opens and permits the fuel vapors to travel to the charcoal canister, where they are stored if the engine is not running.

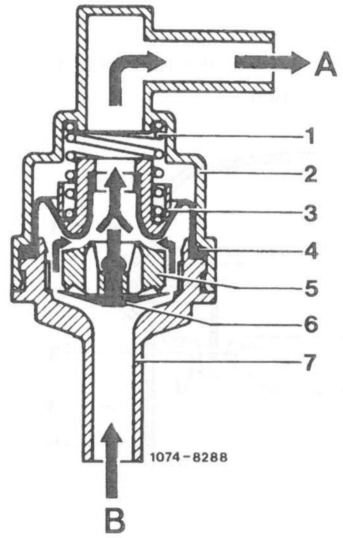


Fig. 69

Vent valve unit, open to charcoal canister

1 Compressing spring
2 Valve housing
3 Spring seat
4 Pressure relief valve
5 Valve disc
6 Vacuum relief valve
7 Connecting fitting
A Connection, charcoal canister
B Connection, fuel tank

When the fuel cools down, the volume is reduced, creating a vacuum in the fuel tank. If the vacuum increases to 1 – 16 mbar, the vacuum relief valve (6) opens allowing air or fuel vapors to flow from the charcoal canister back into the fuel tank thereby reducing the vacuum. If the vacuum in the fuel tank drops below 1 mbar, the vacuum relief valve (6) closes.

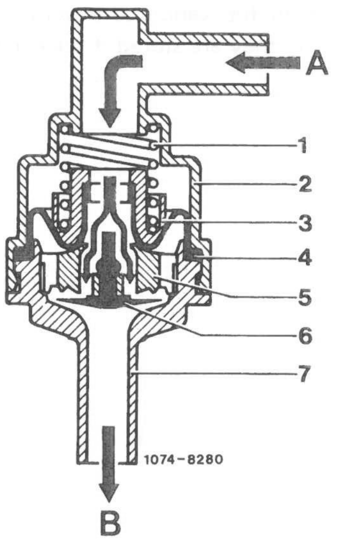


Fig. 70

Vent valve unit, open to fuel tank

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

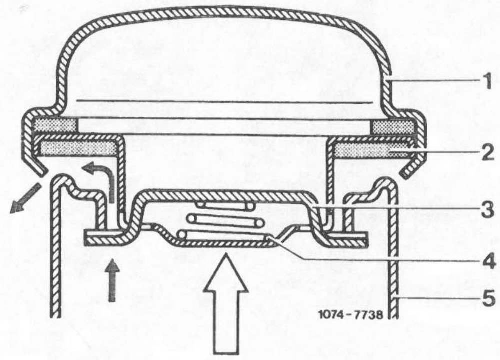


Fig. 71

1 Fuel tank cap
2 Gasket
3 Locking tab
4 Compression spring
5 Filler neck

Purge system

The charcoal canister is connected with the throttle valve housing by a hose in which the purge valve is installed.

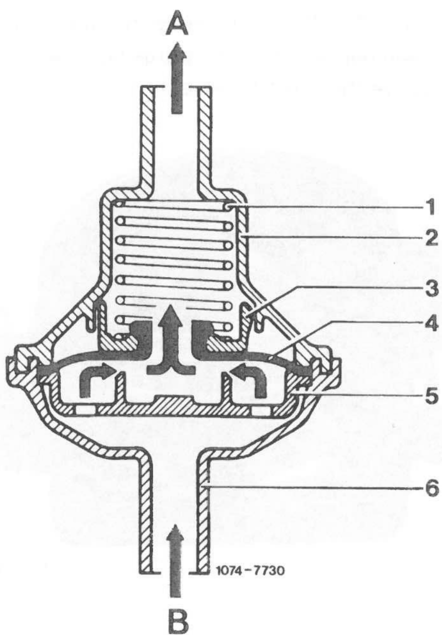


Fig. 72

Purge valve open

1 Compression spring
2 Valve housing
3 Spring seat
4 Pressure relief valve
5 Valve disc
6 Connection fitting
A Connection, throttle valve housing
B Connection, charcoal canister

When the engine is running and the vacuum in the purge line exceds 30 – 50 mbar, the purge valve opens. The fuel vapors stored in the charcoal canister can be drawn into the throttle valve housing depending on the throttle valve position.

As the throttle valve is opened, the two purge bores in the throttle valve housing, which terminate in a common passage, are progressively exposed to the venturi vacuum. This will result in a metered purging in the lower partial load operating range of the engine without influencing the driving characteristics.

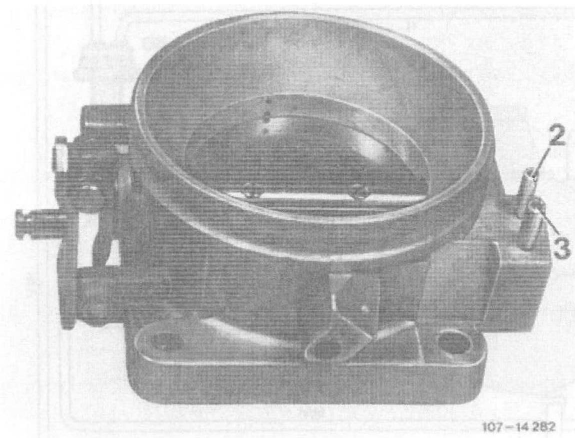


Fig. 73
Throttle valve

At idle and during coasting (throttle valve closed), both purge bores are located on the atmosphere side of the throttle valve. The purge valve is closed and, therefore, no purging of fuel vapors from the charcoal canister takes place.

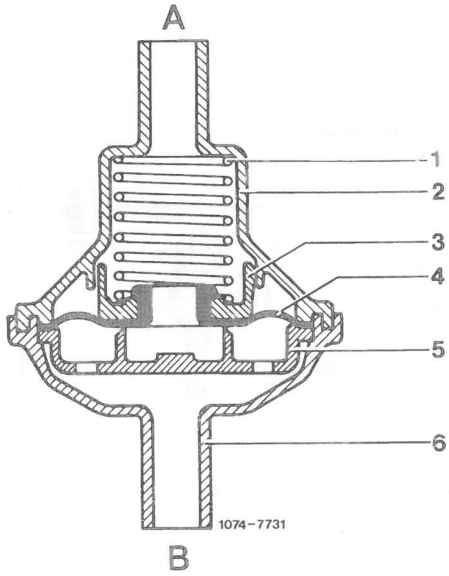


Fig. 74
Purge valve, closed

Complaints such as:	Engine poorly warming up, poor idle speed, does not accept gasoline or splashes during acceleration, requires checking emission control system for correct operation.
Test conditions:	Engine at operating temperature, keep engine running at idle.
Check:	EGR, air injection and fuel evaporation system.

Functional diagram

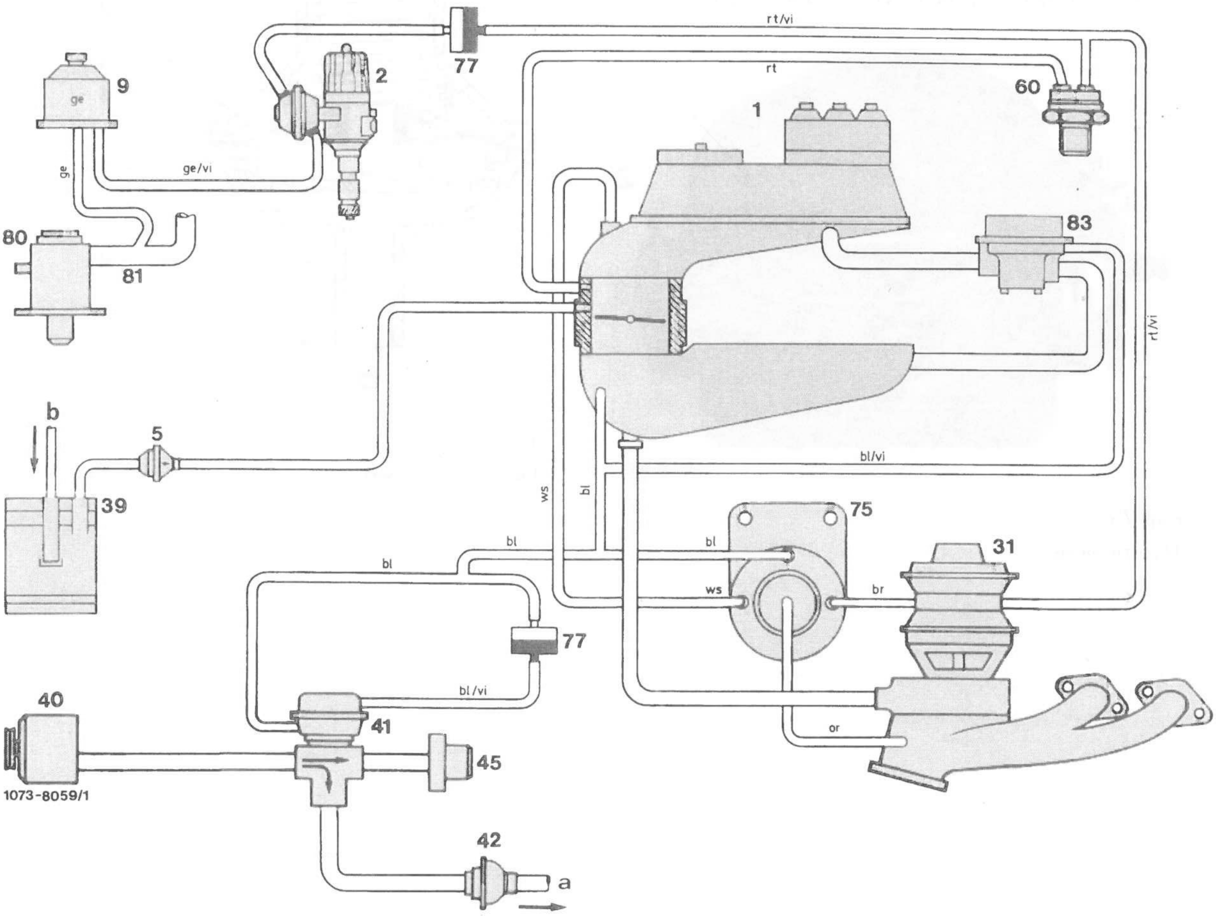


Fig. 75

1 Throttle valve housing and intake pipe
2 Ignition distributor
5 Purge valve
9 Switchover valve (on vehicles with air conditioner)
31 EGR valve
39 Charcoal canister
40 Air pump
41 Anti-backfire valve
42 Check valve
45 Silencer
60 Thermo valve 40 °C
75 Exhaust pressure transducer
77 Delay valve
80 Auxiliary air valve
81 Contour hose
83 Coasting bypass valve
a to cylinder head
b from fuel tank

bl = blue
br = brown
ge = yellow
or = orange
rt = red
vi = violet
ws = white

Checking EGR

Pull off brown vacuum line on EGR valve and slowly increase idle speed.

Engine runs erratically starting at approx. 1200/min or stops.	Engine continues operating poorly.

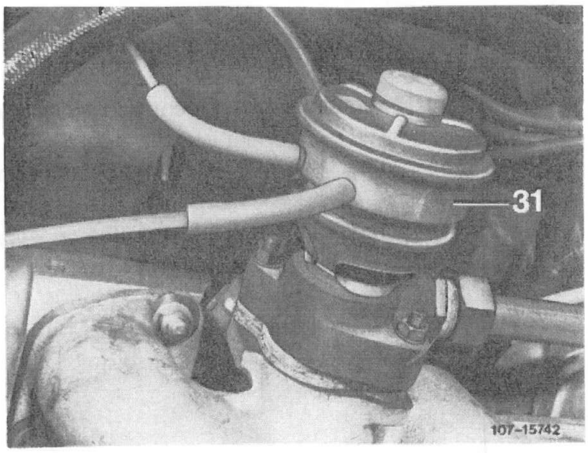


Fig. 76

Check vacuum lines

Check layout of vacuum lines on exhaust pressure transducer and intake pipe.

Make sure that connections on transducer are identified with colored rings and that the attached vacuum lines have the same color.

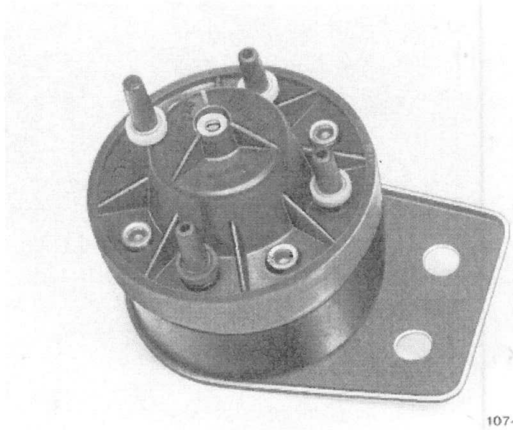


Fig. 77

1 Connection intake pipe vacuum (blue)
2 Connection venting line (white)
3 Connection exhaust gas backpressure line (orange)
4 Connection vacuum control line to EGR valve (brown)

On thermo valve 40 °C (60) the red vacuum line must be plugged to inclined connection and the red/purple vacuum line via the 3-way distributor to the straight connection. Check all connected vacuum lines for leaks and blow out vacuum pickup connections with compressed air.

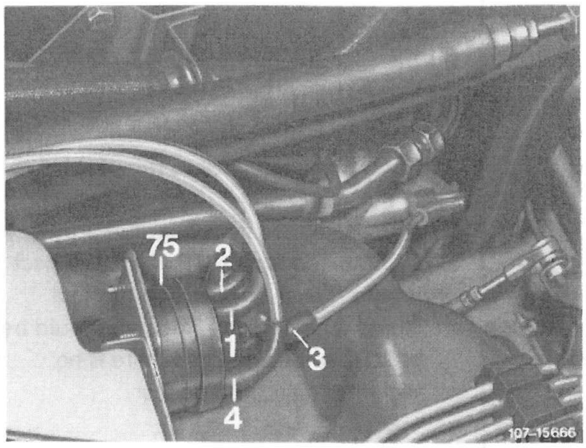


Fig. 78

Check thermo-vacuum valve (60)

The thermo valve is identified by its black plastic component and the legend "50 AA 4" punched into metal component.

Pull off red/purple vacuum line on 3-way distributor, run engine and accelerate.

Vacuum should be feldt at free connection on 3-way-distributor.

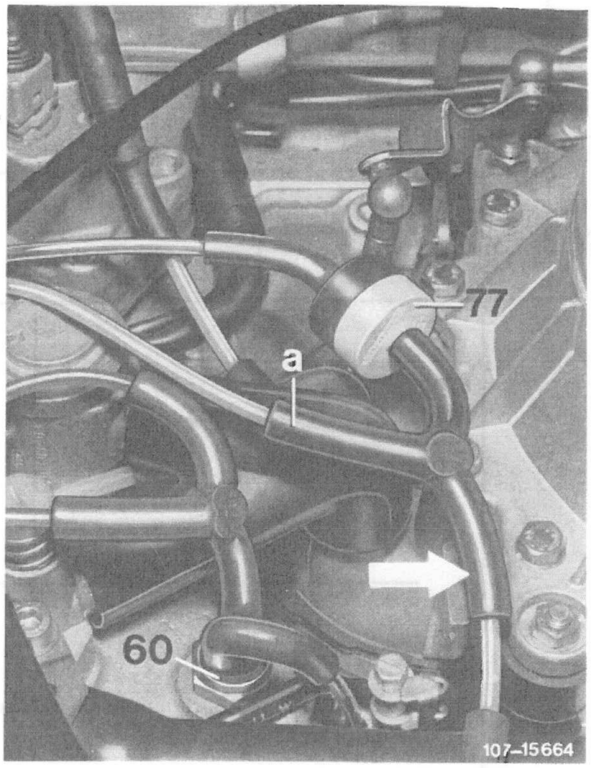


Fig. 79

Check exhaust pressure transducer (75)

Run engine at idle speed. Pull brown vacuum line from EGR valve. Connect vacuum gauge or keep vacuum line closed with a finger. Vacuum should be present at idle speed. If there is no vacuum, replace transducer.

1 Connection intake pipe vacuum
2 Connection vent line
3 Connection exhaust backpressure
4 Connection vacuum control line to EGR valve

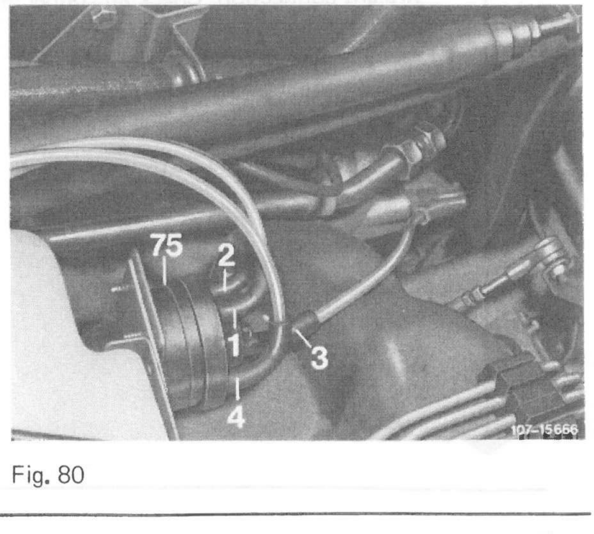


Fig. 80

Check EGR valve (31)

Run engine at idle speed. Pull off both vacuum lines on EGR valve. Plug brown vacuum line to connection for red/purple vacuum line. Engine should run erratically or stop.

If there is no change in operation of engine, replace EGR valve.

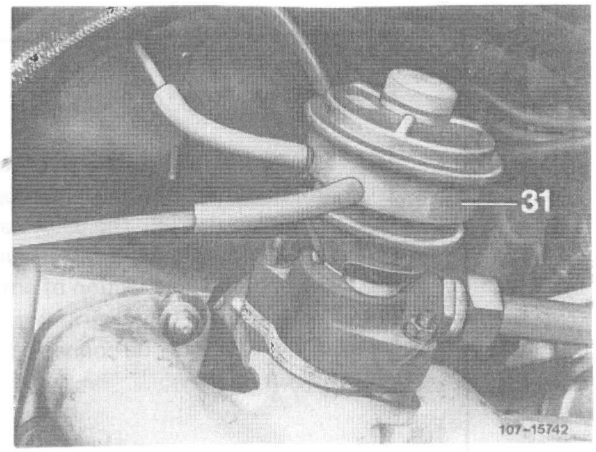


Fig. 81

Checking air injection

Connect CO-measuring instrument. Pull vacuum line from 3-way distributor (arrow).

Emission value increasing.	Emission value not increasing.

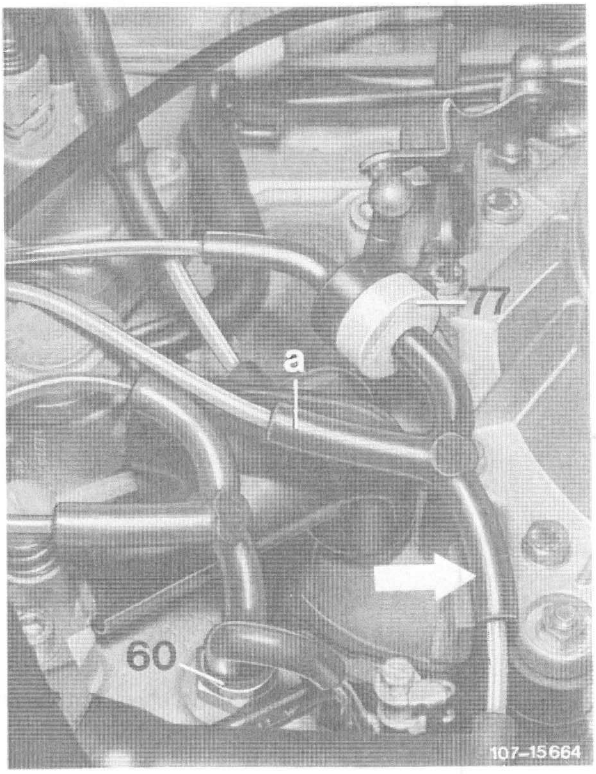


Fig. 82

Check vacuum lines

The blue vacuum line to anti-backfire valve (lower connection) must be plugged to 3-way distributor (a). The delay valve (77) is inserted into blue/purple vacuum line between upper connection of anti-backfire valve (41) and 3-way distributor. The 3-way distributor must be connected to white housing cover.

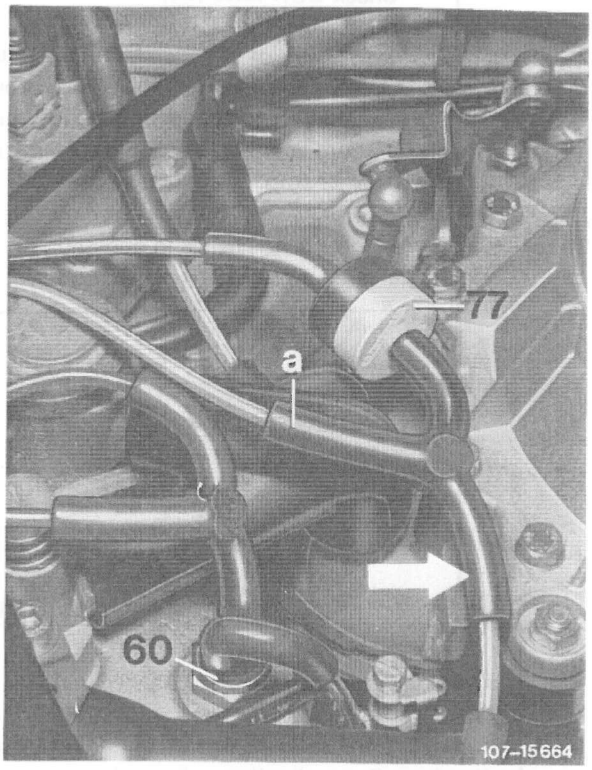


Fig. 83

Check vacuum on anti-backfire valve

Pull vacuum line from 3-way distributor (arrow). Connect vacuum gauge or keep vacuum line closed with finger. Vacuum should be present at idle speed. If there is no vacuum, check vacuum line for leaks and blow compressed air through vacuum pickup connection on intake pipe.

If vacuum is present, check anti-backfire valve (41).

Pull vacuum line from black housing section of delay valve (77). Air should come at air filter (45) of anti-backfire valve. If no air comes out, check air pump. For this purpose, pull hose from air pump to anti-backfire valve.

If air comes out, replace anti-backfire valve.

If no air comes out, check tension of air pump V-belt or replace air pump.

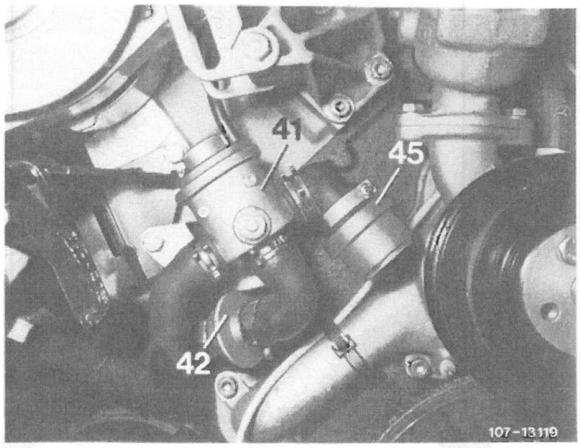


Fig. 84

Reattach blue/purple vacuum line to delay valve (77). After approx. 3–5 sec. no air should come out at air filter (45) of anti-backfire valve.

If air comes out, check delay valve (77).

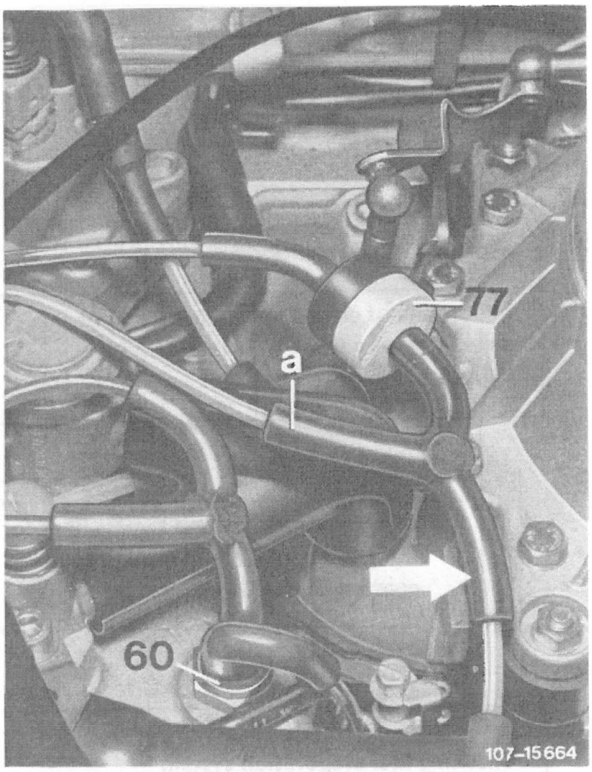


Fig. 85

Checking air injection

Accelerate engine for a short moment to full throttle.

Air flow should be heard for approx. 3–5 sec. at air filter (45).	If air flow is not heard.

Replace delay valve (77).

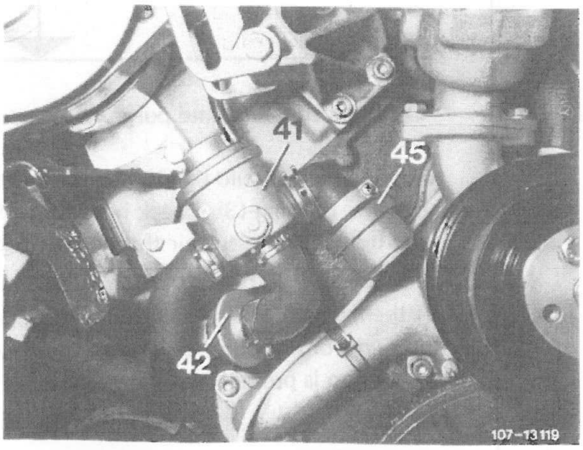


Fig. 86

Check speed increase upon starting and air supply during deceleration

Pull off vacuum hose on connection (A) of coasting bypass valve (83) and plug-on after a short period of retention.

Idle speeed of engine increasing for a short period.	Idle speed not increasing.

Check vacuum line and bypass lines for leaks. If all lines are in order, replace coasting bypass valve.

Checking fuel evaporation system

On charcoal canister, pull off black plastic line (suction line) to throttle valve housing and keep closed with finger or connect vacuum gauge.
Slowly increase engine speed to above approx. 2000/min.

No vacuum at idle. Increasing vacuum at increasing speed.	No increasing vacuum at increasing speed.

Check suction hose and purge valve

Suction hose should be plugged on throttle valve housing (3). Check hose for leaks and blow compressed air through connection on throttle valve housing.

If there ist still no vacuum, pull off suction hose in front of purge valve and repeat test. If vacuum is present, replace purge valve (5).

End of test

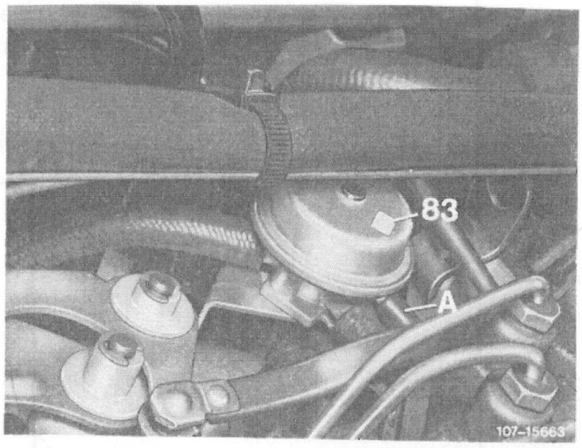


Fig. 87

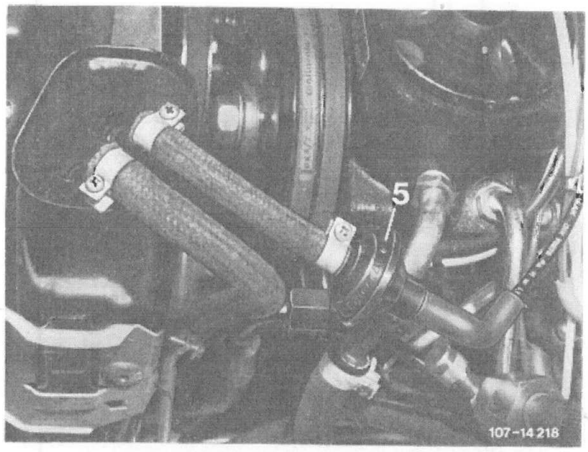


Fig. 88

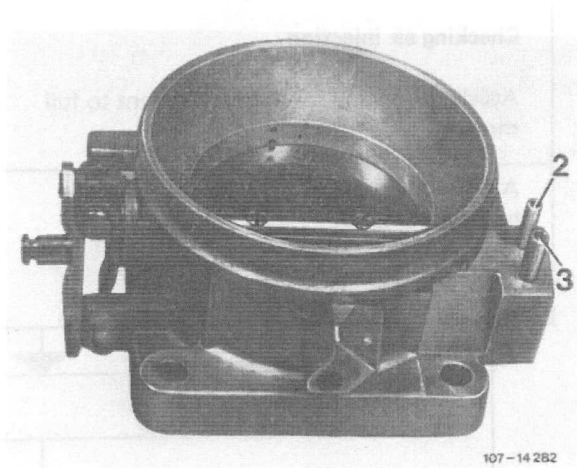


Fig. 89

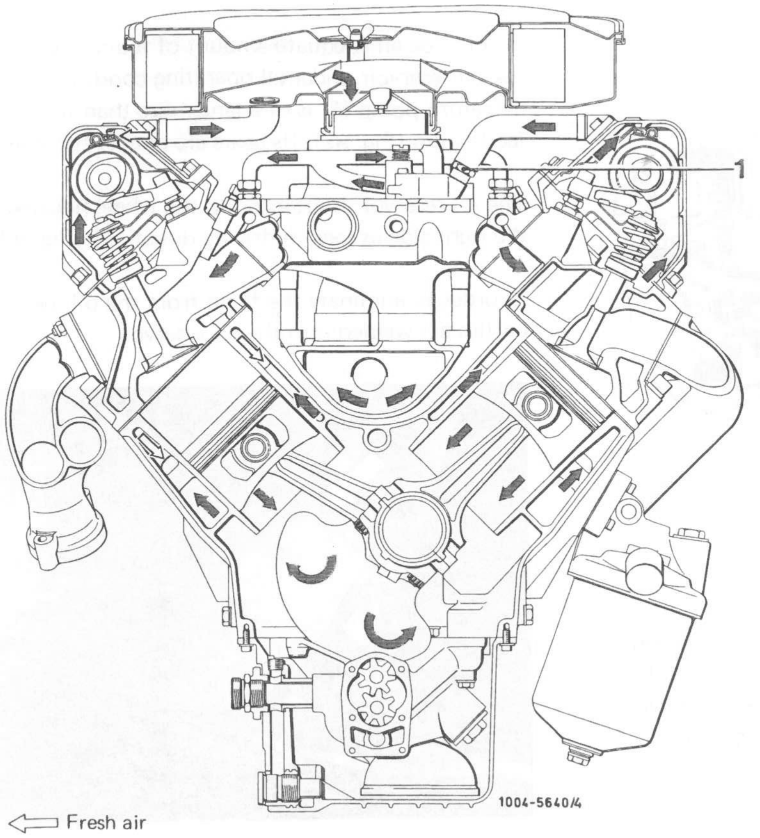


Fig. 90
1 Orifice

The engine has a closed crankcase breathing system requiring no servicing. The engine blow-by gases and cylinder crankcase vapors will flow through the connection in the left cylinder head cover (in driving direction) toward the idle air distributor. The idle air distributor is provided with a breather orifice of 2 mm (0.08") diam. (1).

From the orifice, the blow-by gases and the crankcase vapors flow together with the idle air through a distributing pipe to the two idle air ducts (one duct per cylinder row) which are cast into the intake manifold. From here they are directly routed into the intake manifolds and then into the combustion chambers.

From the breather connection of the right cylinder head cover, the breather line leads directly to the clean air side in the air filter housing.

In the lower and medium load range, the intake manifold vacuum is transmitted through left bank breather line into the cylinder crankcase and this supplies the engine with fresh air via the right cylinder bank. This means clean air will be drawn in from the air filter via the breather line.

Breathing will occur also here in the upper driving range. The blow-by gases and the crankcase vapors will flow to the air filter and into intake manifolds and combustion chambers via throttle valve housing.

To prevent freezing of the condensate in the orifice when outside temperatures are low, the idle speed air distributor is heated by the cooling water.

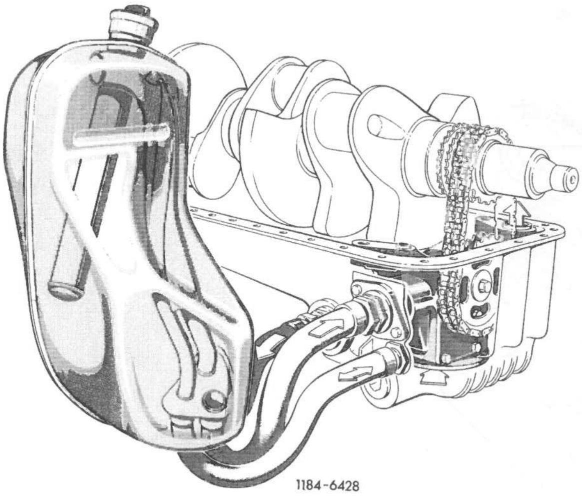


Fig. 91

This engine is provided with a dry sump lubrication. The gear type oil pump consists of an oil feed and oil return pump, which is attached to the crankcase and is driven by a duplex roller chain (Fig. 92).

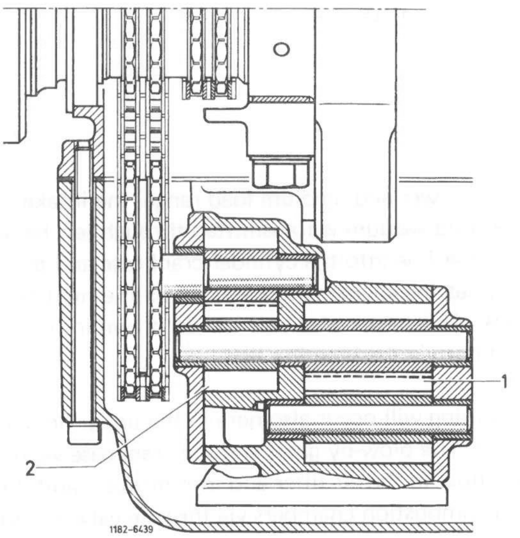


Fig. 92

1 Oil return pump
2 Engine oil feed pump

The sprocket is located on the drive shaft of the oil feed pump, which in turn is driving the oil return pump via the idler gear shaft of the oil feed pump. The return pump will suck the oil coming from the engine out of the oil sump and will pump the oil to the oil reservoir via an oil hose (Fig. 91).

To provide an adequate amount of foam-free oil in the oil reservoir under all operating conditions, the oil return pump (1) is of a larger size than the oil feed pump (Fig. 92). Its gears are almost twice as wide.

The oil reservoir is attached to the wheel housing (on the right side as seen in driving direction) (Fig. 93).

In order to eliminate the foam from the oil, perforated baffles are welded into the oil reservoir.

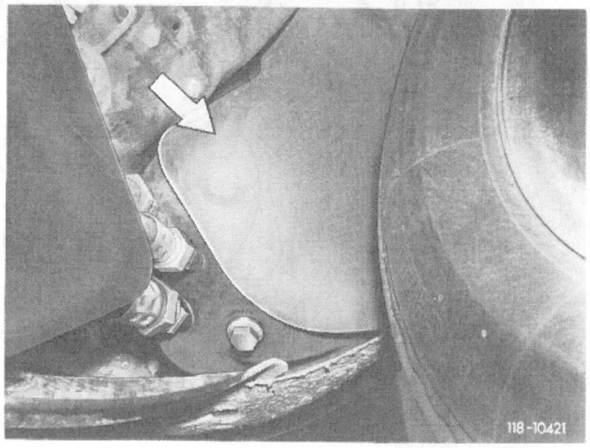


Fig. 93

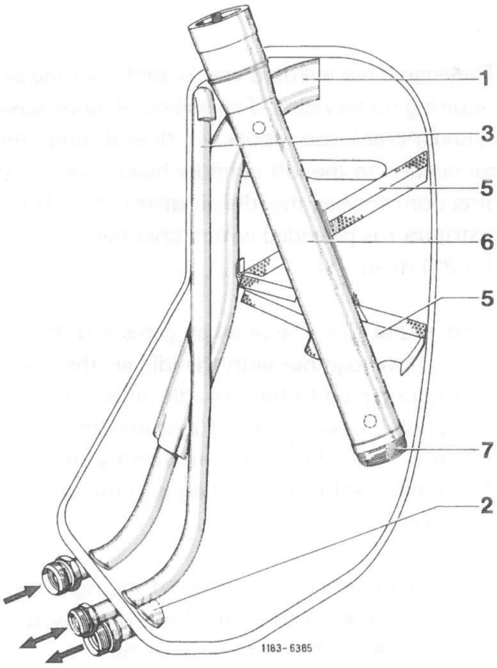


Fig. 94

1 From oil return pump
2 Toward pressure oil pump (suction end)
3 Breather line
5 Perforated baffles
6 Filler tube
7 Strainer

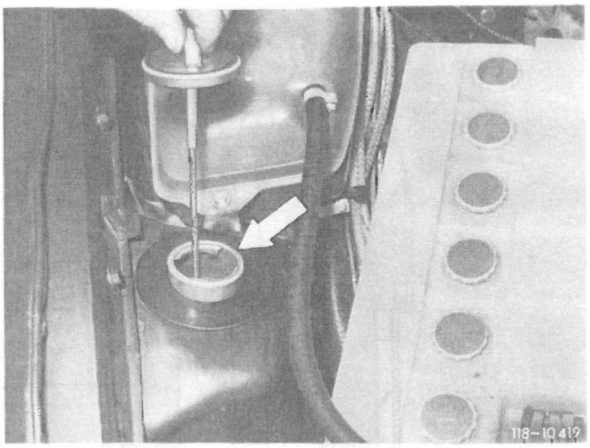


Fig. 95

The oil dipstick is attached to the filler cap of the oil supply tank (Fig. 95).

To prevent foreign matter from entering the oil tank from the outside, a strainer (7) is soldered to the end of the filler pipe (6) (Fig. 94).

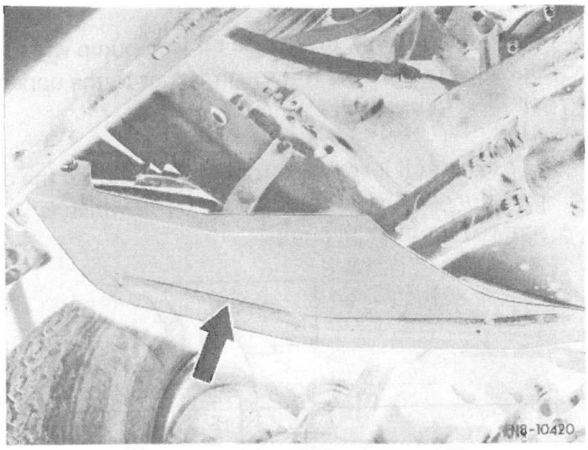


Fig. 96

The oil tank is vented by means of a pipe and hose line (3) in the direction of the oil pan (Fig. 94).

As a protection against flying stones and the like, the connecting hoses between the oil tank and the oil pan are covered by a shield (Fig. 96).

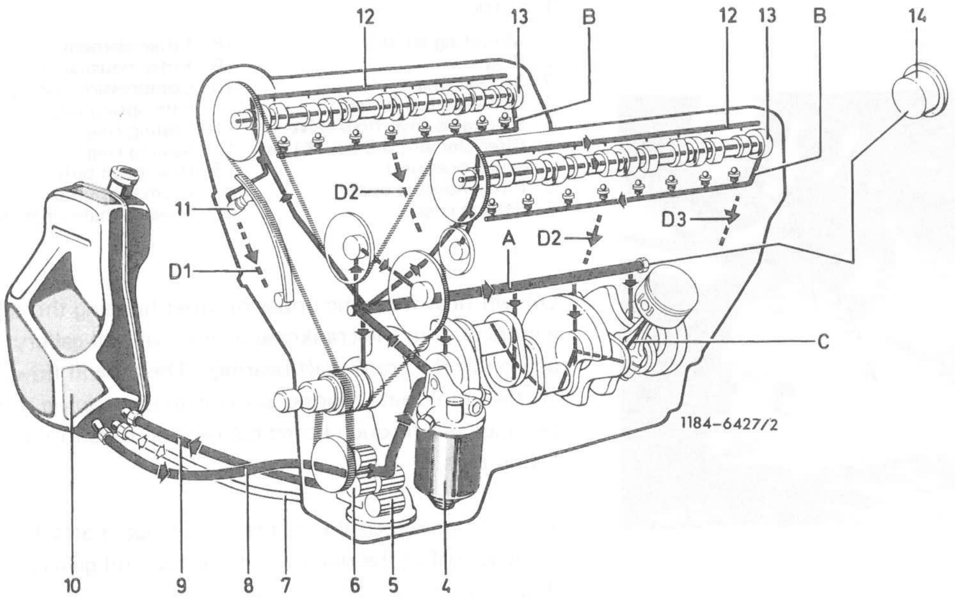


Fig. 97

Oil circulation diagram

- 4 Oil filter
- 5 Oil return pump
- 6 Engine oil feed pump
- 7 Breather line
- 8 From oil reservoir to engine oil feed pump
- 9 From oil return pump to oil reservoir
- 10 Oil reservoir
- 11 Hydraulic chain tensioner
- 12 Oil tube for cam lubrication
- 13 Camshaft, hollow for lubrication
- 15 Oil pressure gauge
- A Oil gallery
- B Bore for hydraulic valve lifters
- C Wrist pin lubrication
- D1 Oil return, timing chain case
- D2 Oil return bore between cylinders 2 and 3, and between 6 and 7
- D3 Oil return bore, rear

From the oil tank, the engine oil feed pump will draw the oil, forcing it through a duct to the upper oil filter housing.

The excess oil is returned to the dry sump via the oil pressure relief valve (2) (8 bar/116 psi) which is screwed into the oil pump.

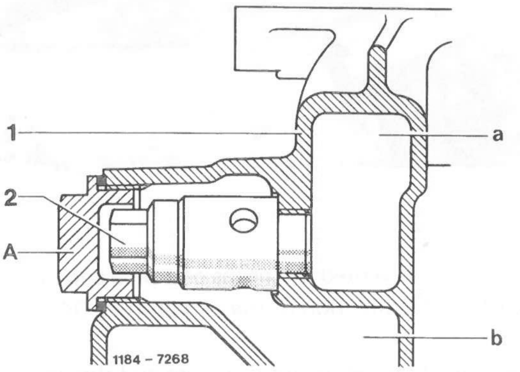


Fig. 98

A Plug
a Pressure side
b Suction side
1 Oil pump housing
2 Oil pressure relief valve

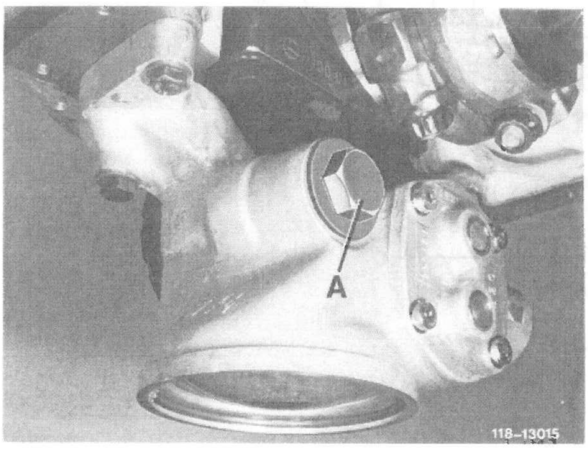


Fig. 99

A Plug (Oil pressure relief valve)

All the oil will pass through the full-flow filter element inserted in the oil filter bottom (Fig. 100).

A relief valve in the upper filter housing will open when the differential pressure between contaminated and clean side of the filter exceeds 3.5 bar (51 psi) gauge pressure. This will occur when the filter element is badly contaminated. The unfiltered oil will then flow directly to the engine.

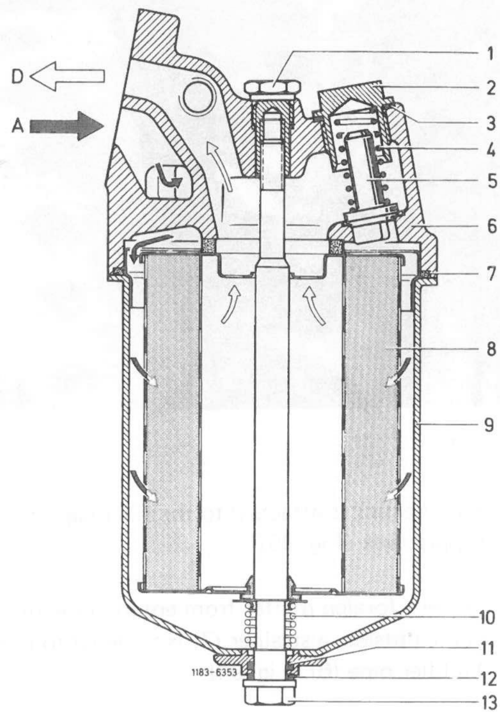


Fig. 100

1 Mounting screw
2 Plug
3 Sealing ring
4 Compression spring
5 Star valve (overflow valve, filter element 3.5 bar (51 psi) gauge pressure)
6 Filter housing upper
7 Sealing ring
8 Filter element
9 Filter housing, lower
10 Compression spring with spring retainer
11 Sealing ring
12 Sealing ring
13 Hex. head bolt
A From oil pump
D Toward main oil gallery

Oil will flow from the upper oil filter housing through a cross duct in the crankcase to the main oil gallery and on to the crankshaft bearings. The oil will flow via the crankshaft bearing journals to connecting rod bearings and through bored connection rods to the piston pins.

The bore, to which the oil pressure gauge is attached, branches off at the rear end of the main oil gallery (Fig. 101).

One bore each at front end of main oil gallery leads to the cylinder heads and a third bore leads via the bearing bushing of the guide wheel shaft to the rear bearing bushing of the intermediate sprocket shaft.

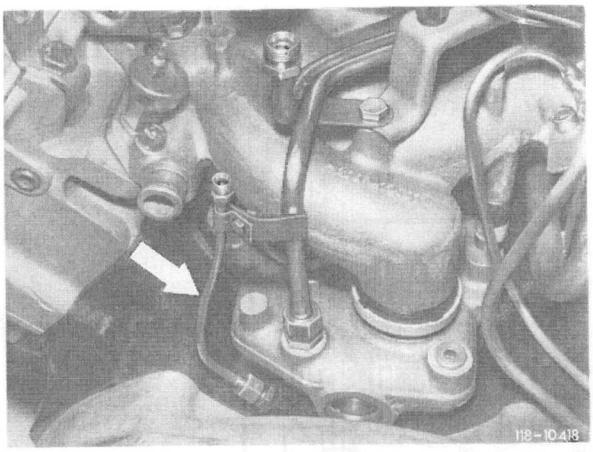


Fig. 101

The ignition distributor drive is supplied with oil through the bored intermediate sprocket shaft.

The oil arriving at the cylinder heads flows into a cross duct. From the cross duct, a bore leads to the first camshaft bearing. The oil flows through an annular groove in the first camshaft bearing, a bore in camshaft bearing journal and the hollow camshaft to the remaining 4 camshaft bearings. (Fig. 102).

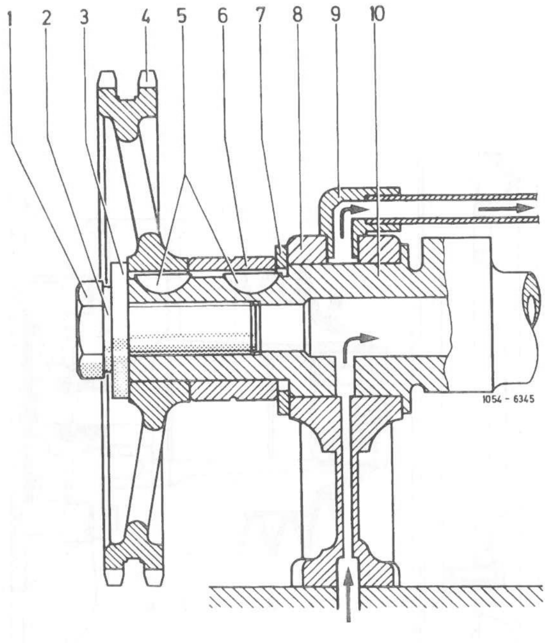


Fig. 102

1 Hex. bolt
2 Lock washer
3 Washer
4 Camshaft sprocket
5 Woodruff keys
6 Sleeve
7 Washer
8 Camshaft bearing
9 Oil tube
10 Camshaft

The cams of the camshaft are supplied with oil via the oil tubes bolted to the first camshaft bearings (Fig. 102).

The hydraulic valve lifters are supplied with oil via the fifth camshaft bearing and a longitudinal duct into the cylinder heads (Fig. 103).

From the cross duct in the right-hand cylinder head (in driving direction), a bore leads toward the chain tensioner and on the left-hand cylinder head toward rear bearing bushing of idler sprocket shaft (hydraulic pump drive for hydropneumatic suspension).

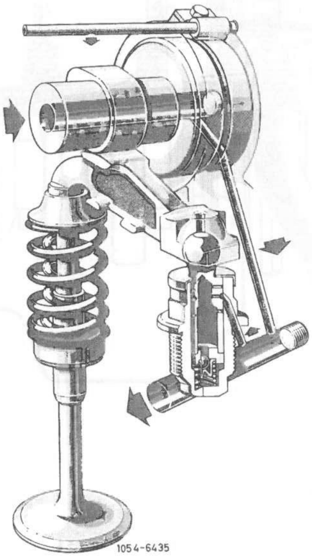


Fig. 103

The oil returns via the timing chain case, two bores each at the rear end of the cylinder heads and one bore each in cylinder head center.

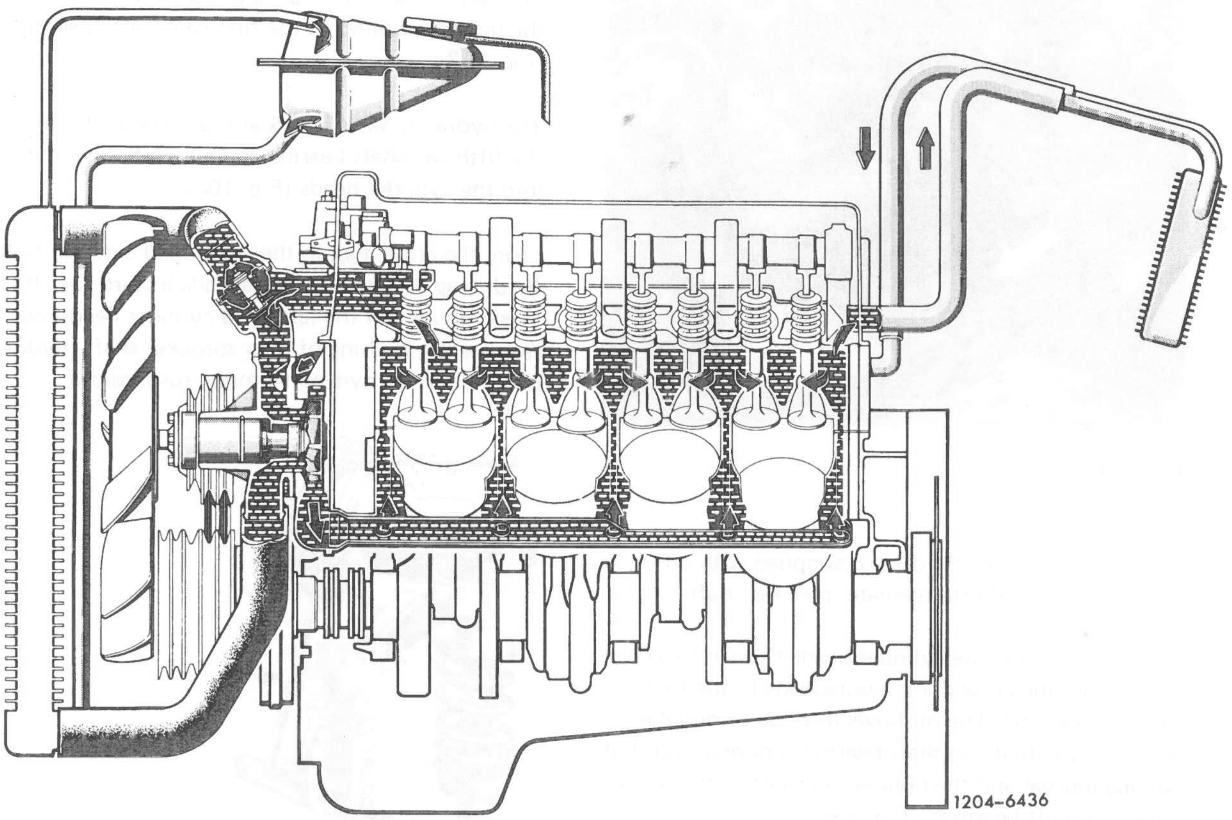


Fig. 104
Cooling circuit diagram

The water pump consists of the impeller (4) and the bearing housing (3) and is bolted to the crankcase. The flange of the water pump carries a 3-groove pulley (2) and a centrifugally controlled visco fan clutch with an 11-blade fan (Fig. 105).

The coolant supplied by the water pump is uniformly distributed by means of two distributing passages in the crankcase (Fig. 106).

After flowing through the cylinder heads, the coolant emerges again at the front at the intake manifold and flows through the thermostat housing (Fig. 107).

With the thermostat closed (warming-up period), the flow toward the radiator is closed. The coolant from the crankcase and the cylinder heads flows directly toward the water pump and from there back to the crankcase. Dependent on engine load and the ambient temperature, the water (within control range of thermostat) flows to a greater or lesser extent through the radiator.

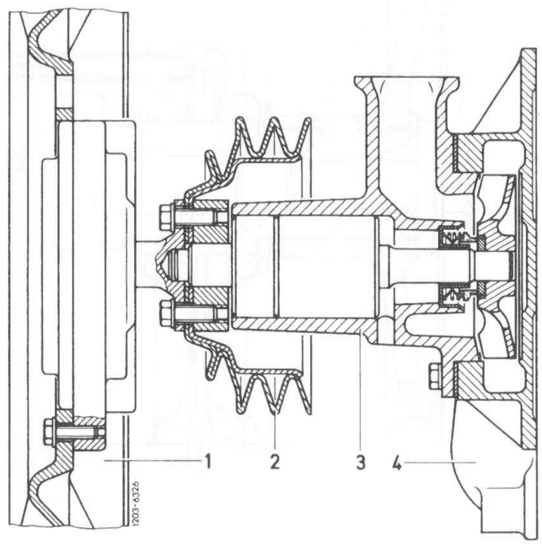


Fig. 105
1 Fan clutch with fan
2 Pulley
3 Bearing housing
4 Impeller

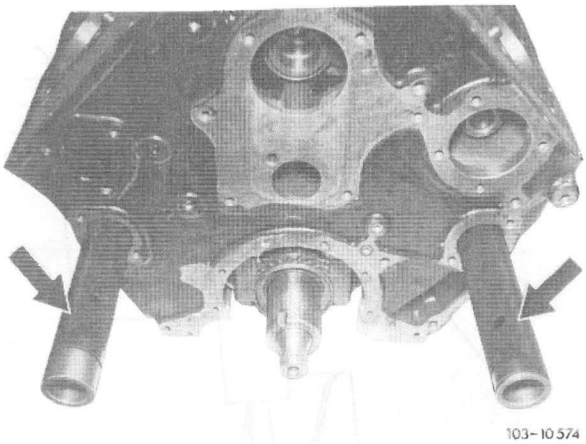


Fig. 106

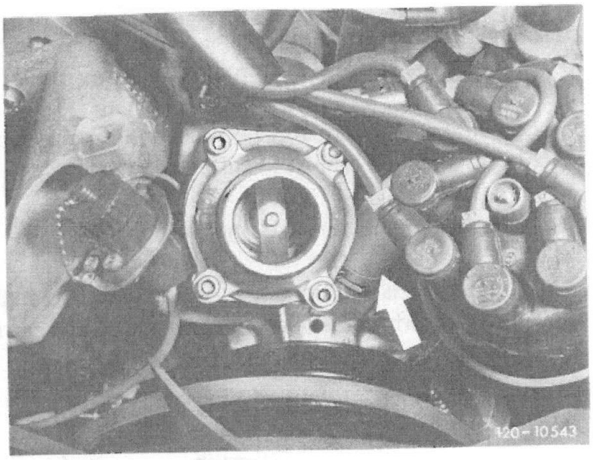


Fig. 107

The thermostat begins to open at 87 °C, the control travel is 8 mm (0.32"). Under full load operation or high ambient temperatures, the direct flow to the water pump is closed, All coolant will then flow through the radiator.

The pressurized cooling system, in combination with an antifreeze protection down to – 30 °C increases the boiling point of the coolant to approx. 125 °C. The red mark on the engine coolant thermometer begins at 122 °C. If the coolant is replaced by water with anti-corrosion oil added, the boiling point is reduced to approx. 118 °C and the danger zone (water ejection) begins prior to the white 120 °C mark.

The vehicle heating system is connected to the engine coolant circuit (supply at intake manifold rear, arrow in Fig. 108; return flow toward water pump housing via piping Fig. 107 and 108).

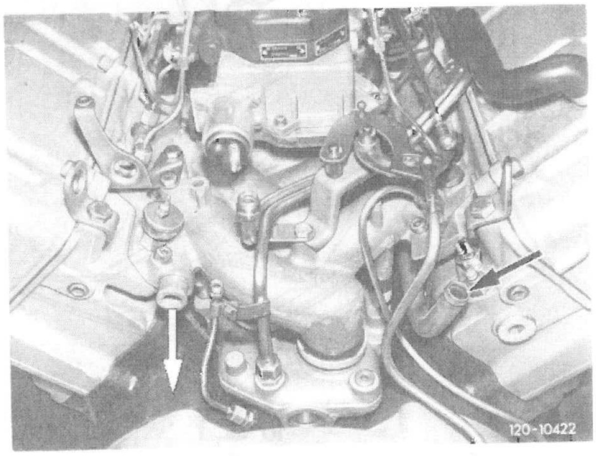


Fig. 108

The bolts for attaching engine carrier to the engine mounts are screwed in from below (arrow in Fig. 109).

Shielding plates are attached above the engine mounts as a protection against the effects of heat.

The rear engine mount cannot be adjusted.

This engine is additionally provided with two engine shock absorbers installed between the engine carrier and the frame cross member (Fig. 110).

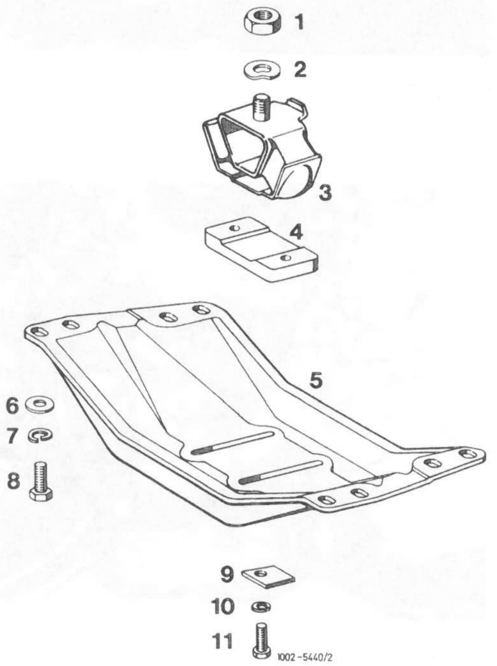


Fig. 109

1 Nut M 12 x 1.5	7 Lock washer
2 Spring washer	8 Bolt
3 Engine mount	9 Washer
4 Washer	10 Lock washer
5 Engine carrier	11 Bolt
6 Washer	

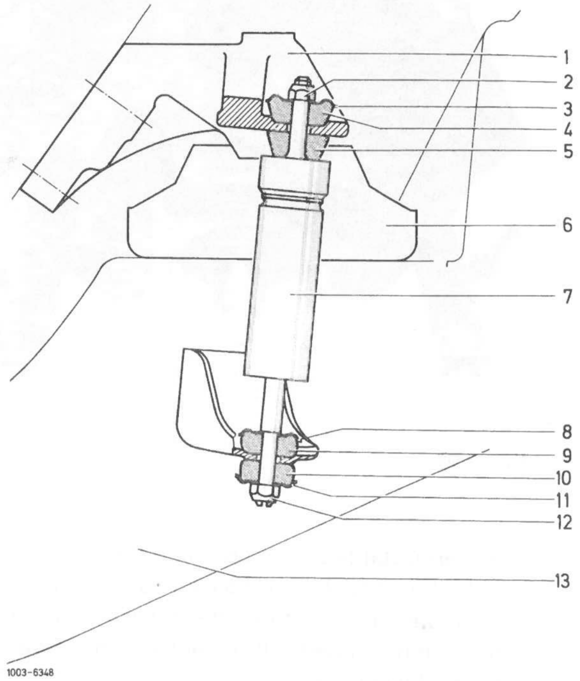


Fig. 110

1 Engine carrier	8 Conical spring washer
2 Nut	9 Rubber buffer
3 Conical spring washer	10 Rubber buffer
4 Rubber buffer	11 Conical spring washer
5 Rubber buffer	12 Nut
6 Engine mount	13 Front axle cross member
7 Engine shock absorber	

Testing and Adjusting Jobs

Take testing and adjusting jobs from available data. Note that the Australia version corresponds to USA version.

Model 116.036 (450 SEL 6.9) is available with automatic transmission only. Transmission 722.003 (W 3 B 050) is installed, the main components of the transmission train have been reinforced due to the high engine torque.

The two disc clutches K1 and K2 are each provided with 6 internal friction plates. The two planetary gear sets are provided with 6 plantetary gears each, with the ring gear diameter remaining the same.

The brake band B 1 is a single band 50 mm (1.97") wide with a double piston, while the brake bands B 2 and B 3 are double-loop bands.

The brake band piston covers are designed as insert which extend beyond the transmission housing (Fig. 111 and 112).

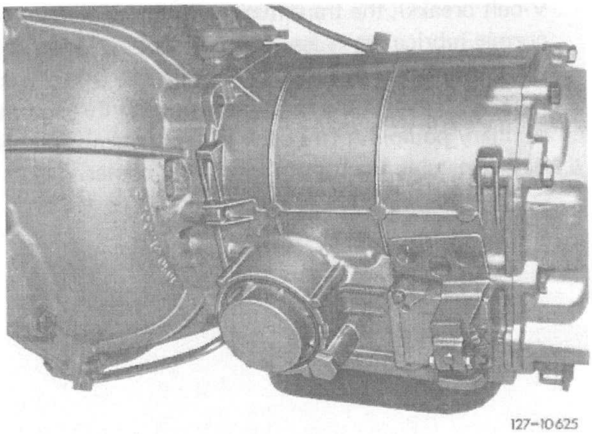


Fig. 111

As a result, the brake band pistons B 2 and B 3 are given more piston travel for the double-loop brake bands, while the supplementary piston is housed in the cover for the brake band piston B 1.

The thrust pin (2) on brake band piston B 2 (1) is movable in its mounting while a plastic filler ring (7) is additionally installed between piston and cover to fill the space around the bypass valve (3), so that the brake band will grip faster (Fig. 113).

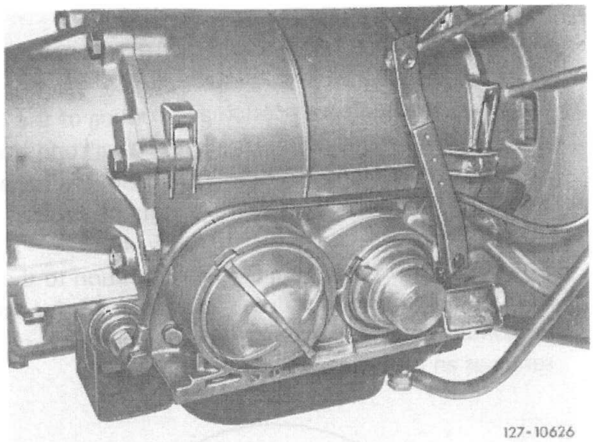


Fig. 112

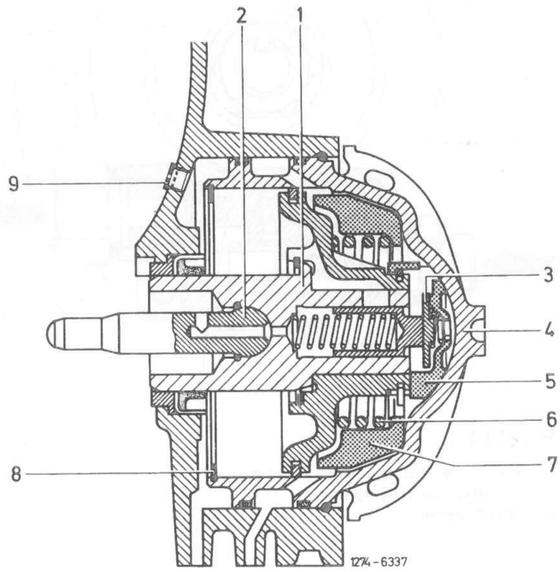


Fig. 113

Brake band piston B 2

1 Brake band piston
2 Pressure pin
3 Bypass valve
4 Cover for brake band piston
5 Plastic cap
6 Compression spring
7 Filler ring
8 Lock ring
9 Insert with orifice

Note: On model 116.036 (450 SEL 6.9) the modulating pressure must be measured at a speed of at least 85 km/h.

The parking lock pawl as well as the parking lock wheel were also reinforced.

Auxiliary pump for automatic transmission

To ensure adequate lubrication and cooling of the automatic transmission under all operating conditions an auxiliary oil pump has been installed in the transmission fluid circuit to the transmission oil cooler.

The auxiliary pump is similar in construction to the primary oil pump and is driven off the V-belt for the air conditioning compressor. Simultaneously, it serves as an idler pulley for the compressor.

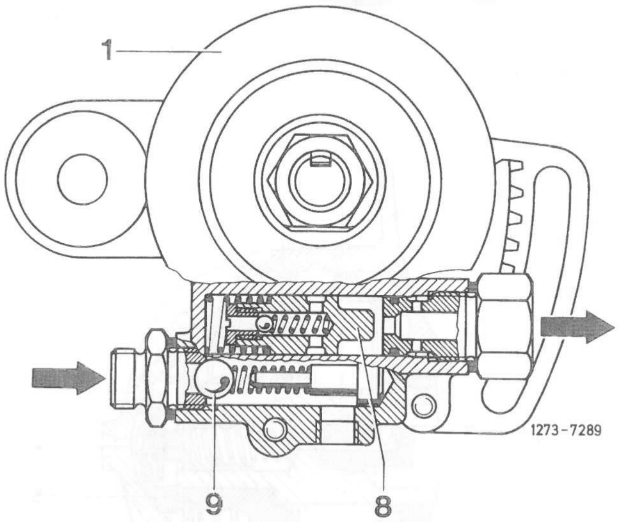


Fig. 114
1 Auxiliary transmission fluid pump
8 Volume control valve
9 Check valve

Operation

The auxiliary pump (1) draws the transmission fluid via line (2) directly from the transmission pan and delivers it through the pressure hose (3) to the transmission fluid cooler, from where it is routed back to the transmission via a return line (5).

The check valve (6) prevents the transmission fluid from flowing directly into the transmission via line (7).

The purpose of the volume control valve (8) in the pump is to have a nearly constant amount of transmission fluid flow through the transmission fluid cooler regardless of engine rpm.

If the auxiliary pump should fail (for example, if the V-belt breaks), the transmission fluid is routed via the normal lubricating pressure circuit through line (7) to the transmission fluid cooler. In this case, the check valve (9) prevents the fluid from flowing through the auxiliary pump directly back to the transmission pan, thus bypassing the transmission fluid cooler.

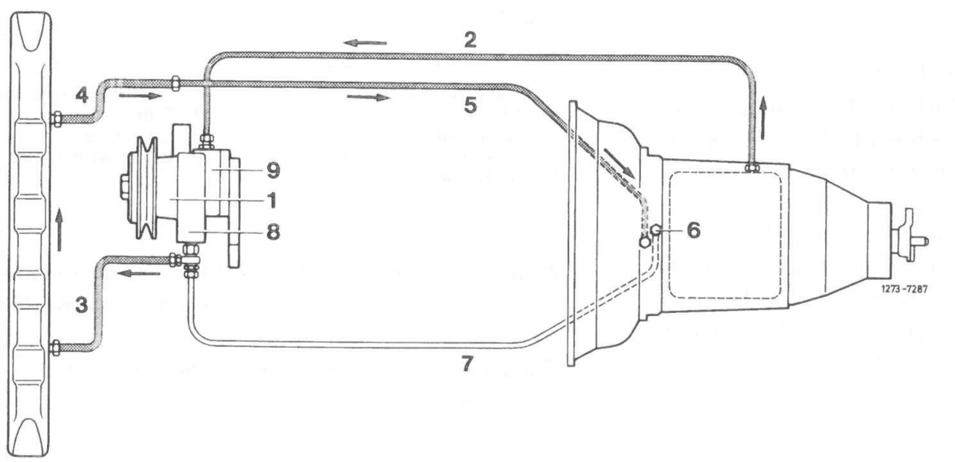


Fig. 115
1 Auxiliary transmission fluid pump
2 Suction line
3 Pressure hose
4 Pressure hose
5 Return line
6 Check valve
7 Bypass line
8 Volume control valve
9 Check valve

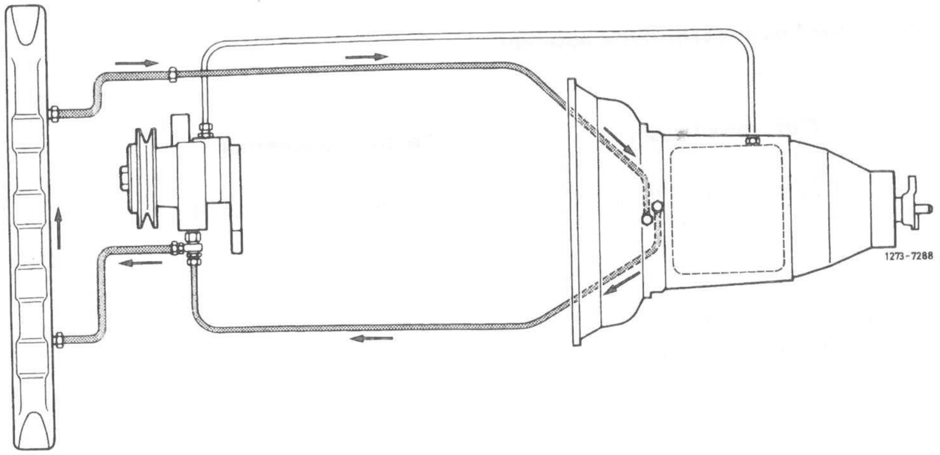


Fig. 116

Note:
The check valve (6) is a transmission component and is supplied with it. If the transmissions is removed, line (7) must be unscrewed from the ring coupling (10).

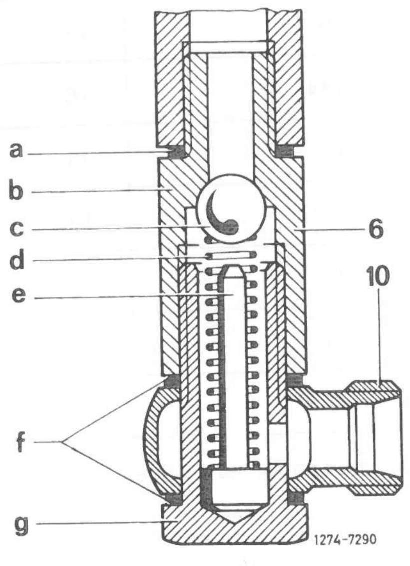


Fig. 117

6 Check valve
10 Ring coupling
a Gasket
b Threaded piece
c Ball valve
d Compression spring
e Spring guide
f Gaskets
g Hollow screw

Note:
On the automatic transmissions the working pressure is adjusted to the engine torque by the intake manifold vacuum and the **control** pressure.

Therefore it is particularly important that not only the modulating pressure be adjusted correctly but also the control pressured rod.

A disconnected or incorrectly adjusted control pressure rod can cause damage to the transmission.

Correlation: Transmission-shift valve housing centrifugal governor

Transmission	**Shift valve housing**	**Centrifugal governor**
Part no. 116 270 21 01	Part no. 116 270 60 07	Part no. 100 270 02 74

Attention!
When exchanging transmission, also rinse supplementary oil pump together with additional oil cooler lines.

Shift Points

Selector lever position	Accelerator position	Shift sequence	▲ km/h	▼ km/h
"D"	Idle	1–2–1	30	13
		2–3–2	47	34
	Full throttle	1–2–1	79	13
		2–3–2	144	76
	Kick-down	1–2–1	79	73
		2–3–2	144	127
"S"	Idle	1–2–1	36	23
	Full throttle	1–2–1	86	33
	Kick-down	1–2–1	86	78

Symbols: ▲ = Upshift
▼ = Downshift

Note: All speeds given are approximate values.

Nominal pressures

Hydraulic pressures in bar gauge pressure

		Modulating pressure	Working pressure
Position	"D"	3.1[1]) / 4.9[2])	10.7 ± 0.4[2])
	"S"	–	6.9 ± 0.3[1])
	"R"		18[2]) and above
Governor pressure		20 km/h	0.6 ± 0.1
		40 km/h	0.9 ± 0.1
		60 km/h	1.4 ± 0.1
		90 km/h	2.4 ± 0.1
		120 km/h	3.1 ± 0.2[3])

[1]) Measured at 85 km/h with vacuum line connected at full throttle.
[2]) Measured stationary with disconnected vacuum line and at full throttle, **not kickdown** (stalling speed).
[3]) Measured at 65 km/h at full throttle

Attention!
Due to generation of considerable heat, hold stalling speed **max. 5 seconds**, while braking vehicle well with parking brake and service brake.

A. General

The hydropneumatic suspension is a gas pressure suspension system with hydraulic level control. The vehicle load is supported by four **suspension elements,** which are simultaneously serving as shock absorbers. The suspension elements comprise one gas pressure shock (13, 20, 30 and 31) each and one pressure reservoir (11, 12, 28 and 29), wich are connected to each other by means of a hose line (Fig. 118 and 119). The vehicle load is hydraulically transmitted to the pressure reservoirs by way of the gas pressure shocks. Suspension is effected by the compression and decompression of the gas cushion in the pressure reservoirs.

To regulate the vehicle level, the oil volume in the gas pressure shocks is increased or reduced by means of a **pressure oil system.** The pressure oil system comprises the pressure oil pump (1), the pressure regulator (3a), the central pressure reservoir (4) and the oil reservoir (2). The pressure regulator (3a) and the adjusting switch (3b) of the control device are combined into one valve unit (Fig. 119).

The central pressure reservoir supplies the system when the engine is stopped.

The control device controls the oil volume by means of one level controller (6 and 24) each at front and rear axle and by the adjusting screw (3b) of the valve unit. The following adjustments of the system can be made by means of the adjusting switch:

N = Normal Level
(Switch pushed-in or control disc at front stop)

S = Locking Position
(Switch engaged in center position or control disc pulled in 1st detent)

H = Higher Level
(Switch completely pulled or control disc pulled in 2nd detent)

M = Assembly Position
Suspension system up to level controllers pressureless (control disc pulled against rear stop with pull knob released).

Operation

The pressure oil pump driven by the engine delivers oil from oil reservoir to central reservoir via pressure regulator of valve unit.

When the max. oil pressure in central reservoir is attained, the pressure regulator of the valve unit will reverse the oil flow. The oil now delivered can flow back into oil reservoir.

If the pressure in the central reservoir drops to minimum pressure as the result of consumption (lowering on level controller) the pressure regulator will reverse and oil will be pumped into reservoir until the max. pressure is again attained.

The pressure oil in central reservoir is connected to the adjusting switch of the valve unit and to the level controllers by means of pertinent lines.

If the vehicle level drops under the influence of a load, the level controller will open the passage to the suspension elements. The oil flowing into the suspension elements will lift the vehicle until the normal level is attained and the level controller has again closed the connection. If the vehicle load is relaxed, the level controller will permit oil to flow from suspension elements until the vehicle is back to its normal level. The oil flowing out of the suspension elements is returned to the oil reservoir through a filter.

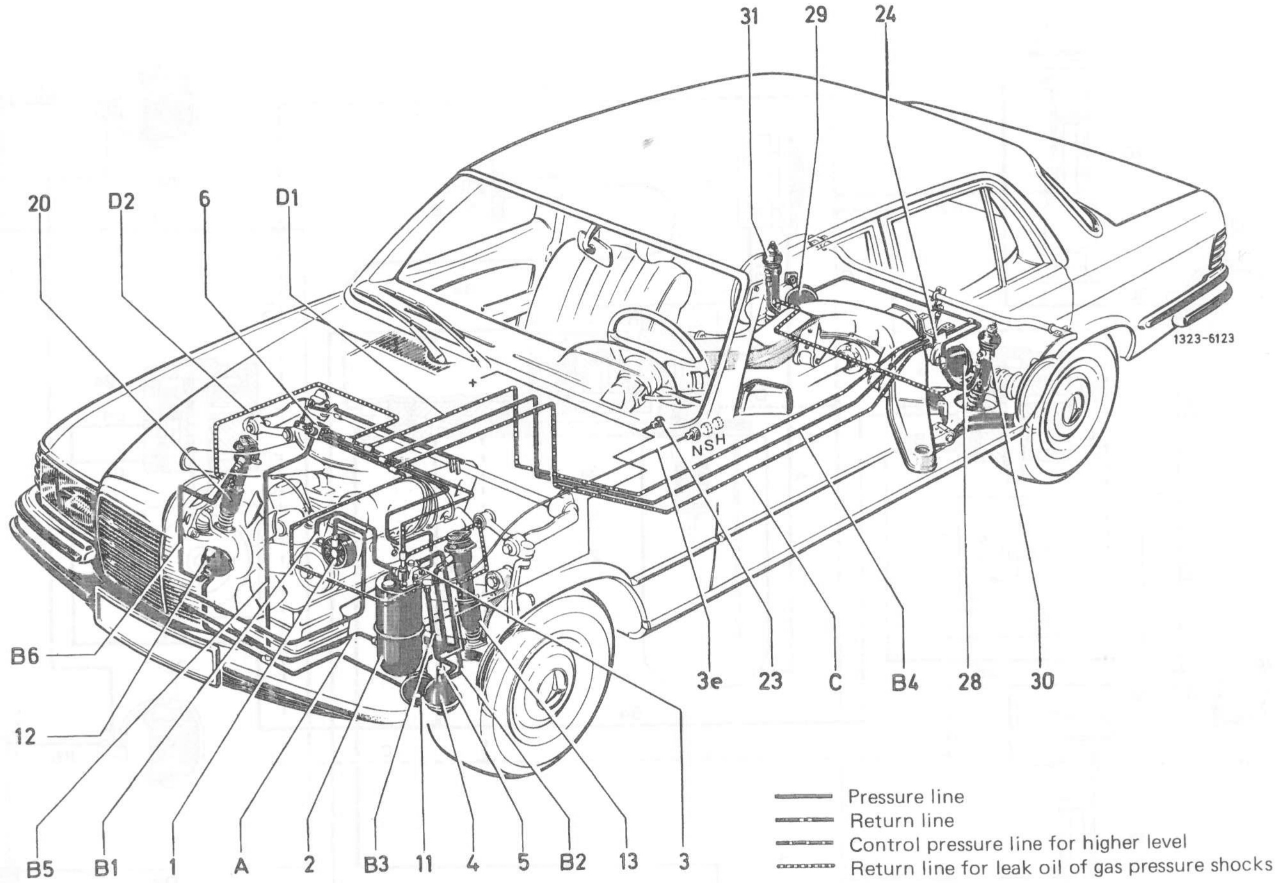


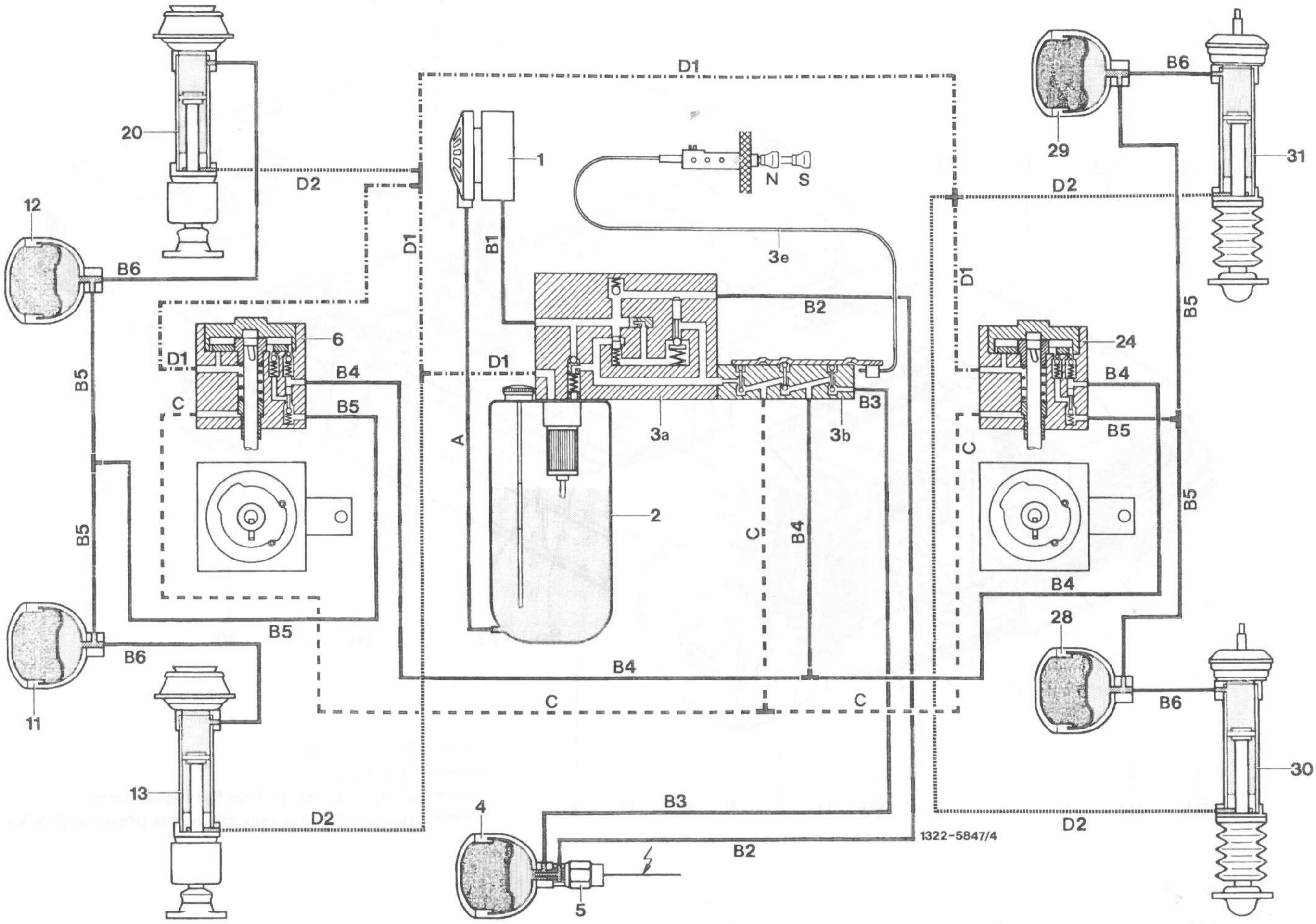
Fig. 118

Diagrammatic view of hydropneumatic suspension

Legend for Fig. 118 and 119

- 1 Pressure oil pump
- 2 Oil reservoir
- 3 Valve unit (pressure regulator and adjusting switch)
- 3a Pressure regulator of valve unit
- 3b Adjusting switch of valve unit
- 3e Pull knob for adjusting switch of valve unit
- 4 Central reservoir
- 5 Electric pressure switch for warning light
- 6 Level controller for front axle
- 11 Pressure reservoir for front axle left
- 12 Pressure reservoir for front axle right
- 13 Gas pressure shock for front axle left
- 20 Gas pressure shock for front axle right
- 23 Warning light
- 24 Level controller for rear axle
- 28 Pressure reservoir for rear axle left
- 29 Pressure reservoir for rear axle right
- 30 Gas pressure shock for rear axle left
- 31 Gas pressure shock for rear axle right

- A Suction line oil reservoir – pressure oil pump
- B1 Pressure line pressure oil pump – pressure regulator of valve unit
- B2 Pressure line pressure regulator of valve unit – central reservoir
- B3 Pressure line central reservoir – adjusting switch of valve unit
- B4 Pressure line adjusting switch of valve unit – level controller on front and rear axle
- B5 Pressure line level controller – pressure reservoir
- B6 Pressure line pressure reservoir – gas pressure shocks
- C Control pressure line for "higher level" adjusting switch – level regulator
- D1 Return line level regulator – pressure regulator
- D2 Return line for leak oil of gas pressure shocks


D1
D2
1
N S
3e
B1
D1
B2
6
D1
D1
B4
C
B5
3a
3b
B3
A
2
C
B4
B5
B6
12
20
B5
B5
B6
11
13
D2
B4
C
C
4
B3
B2
5
1322-5847/4
B6
29
31
D2
D1
B5
24
B4
B5
C
B5
B4
28
B6
30
D2

B. Suspension Elements

The **pressure reservoirs** for front axle are located at the left and right on front end, those of the rear axle at the left and right on frame floor (Fig. 120, 121 and 122). The respective gas and oil pressure chambers are separated by a diaphragm.

The pressure reservoirs of an axle are connected to each other and to the respective level controller by a pressure line (B5). Each pressure reservoir is additionally connected with its oil pressure chamber to the associated gas pressure shock.

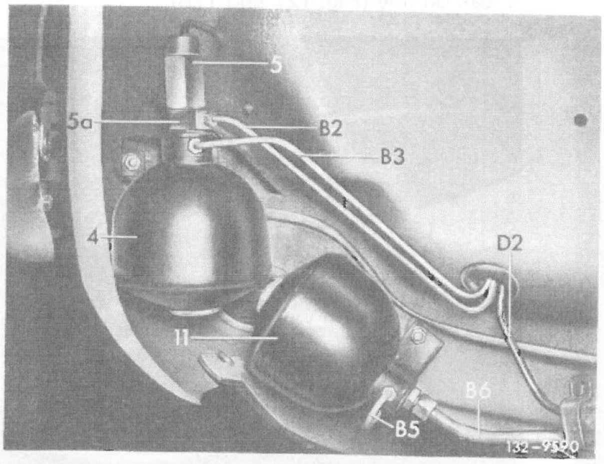


Fig. 120

Pressure reservoir for front axle left front in wheel house

4 Central reservoir
5 Electric pressure switch for warning light
5a Ring fitting
11 Pressure reservoir for front axle left
B2 Pressure line pressure regulator of valve unit – central reservoir
B3 Pressure line central reservoir – adjusting switch of valve unit
B5 Pressure line level controller – pressure reservoir
B6 Pressure line pressure reservoir – gas pressure shock
D2 Return line for leak oil of gas pressure shocks

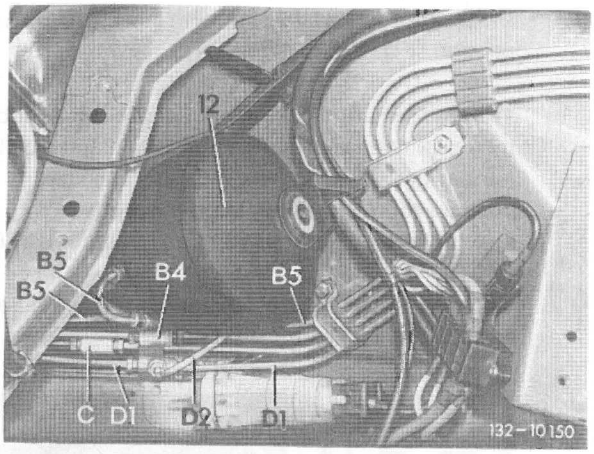


Fig. 121

Pressure reservoir for front axle right front in engine compartment

12 Pressure reservoir for front axle right
B4 Pressure line adjusting switch – level controller
B5 Pressure line level controller – pressure reservoir
D1 Return line level controller – pressure regulator
D2 Return line for leak oil of gas pressure shocks
C Control pressure line for "higher level" adjusting switch – level controller

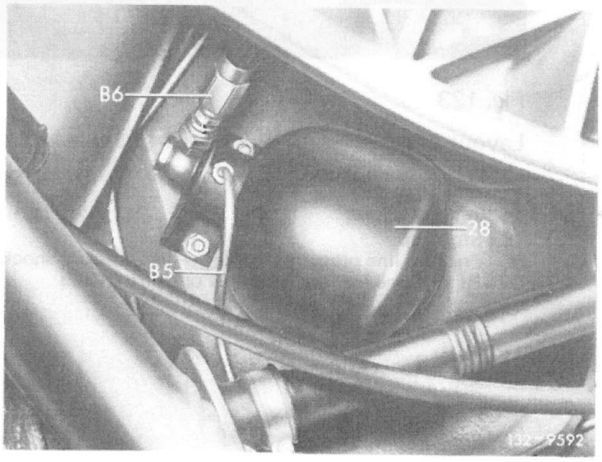


Fig. 122

Pressure reservoir for rear axle

28 Pressure reservoir
B5 Pressure line level controller – pressure reservoir
B6 Pressure line pressure reservoir – gas pressure shock

The **gas pressure shocks** are located at the front and rear axle approximately in the same position as the shock absorbers on vehicles with steel spring suspension (Fig. 123 to 126).

The gas pressure shocks are provided with a rubber mount at their upper suspension point and a ball joint at the lower suspension point. Each gas pressure shock ist connected to respective pressure reservoir by means of a pressure line (B6).

Gas pressure shocks are designed to restrict deflection at front and rear axle.

Rebound at the front axle is restricted by the additional rubber springs (stop buffers) located at the front shock absorber between the housing and the ball joint, and at the rear axle similar to vehicles with steel spring suspension.

The damper function corresponds to that of a single tube gas pressure shock absorber.

The gas pressure shock is sealed at the piston rod by means of a high-pressure and a low-pressure gasket. A ring duct between these two gaskets is connected to the return line toward the valve unit by means of a leak oil line (Fig. 127 and 128).

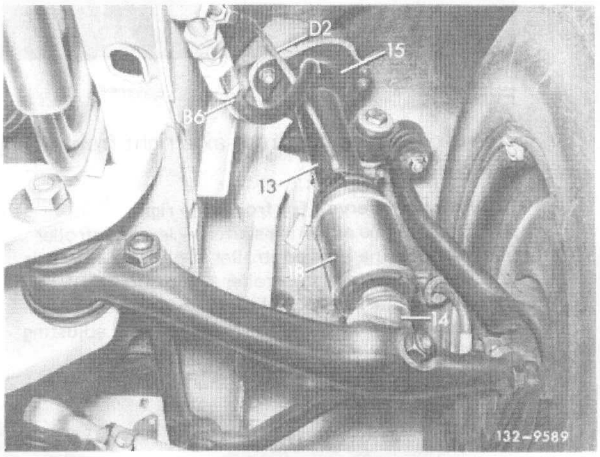


Fig. 123

Layout of gas pressure shock for front axle left

13 Gas pressure shock
14 Ball joint
15 Rubber mount
18 Stop cup
B6 Pressure line pressure reservoir — gas pressure shock
D2 Return line for leak oil of gas pressure shocks

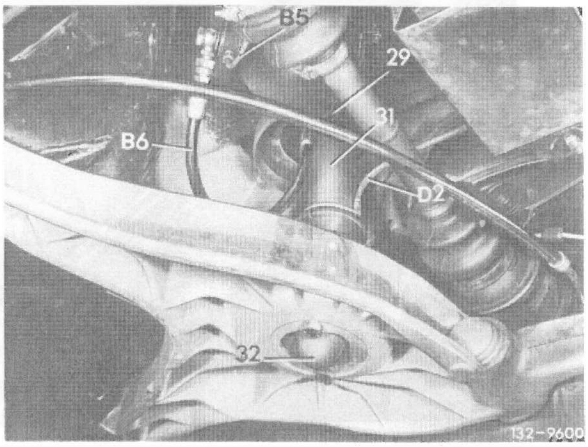


Fig. 124

Layout of gas pressure shock for rear axle right

29 Pressure reservoir
31 Gas pressure shock
32 Ball joint
B5 Pressure line level controller — pressure reservoir
B6 Pressure line pressure reservoir — gas pressure shock
D2 Return line for leak oil of gas pressure shocks

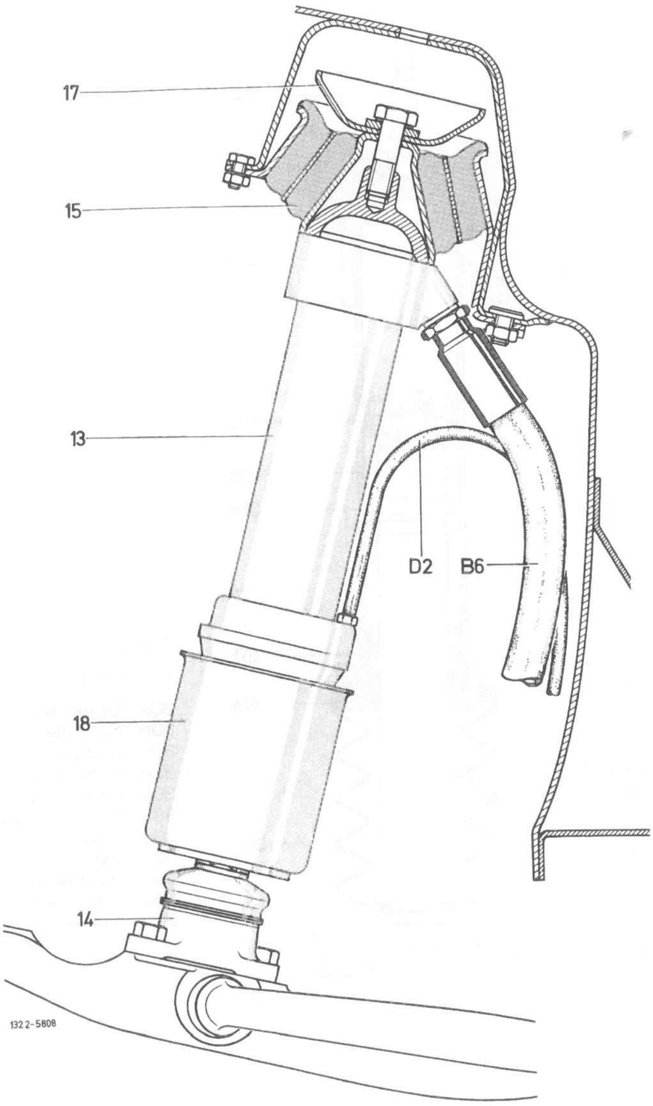


Fig. 125

Layout of gas pressure shock for front axle

13 Gas pressure shock
14 Ball joint
15 Rubber mount
17 Deflection stop
18 Stop cup
B6 Pressure line pressure reservoir – gas pressure shock (drawn offset by 90°)
D2 Return line for leak oil of gas pressure shocks (drawn offset by 90°)

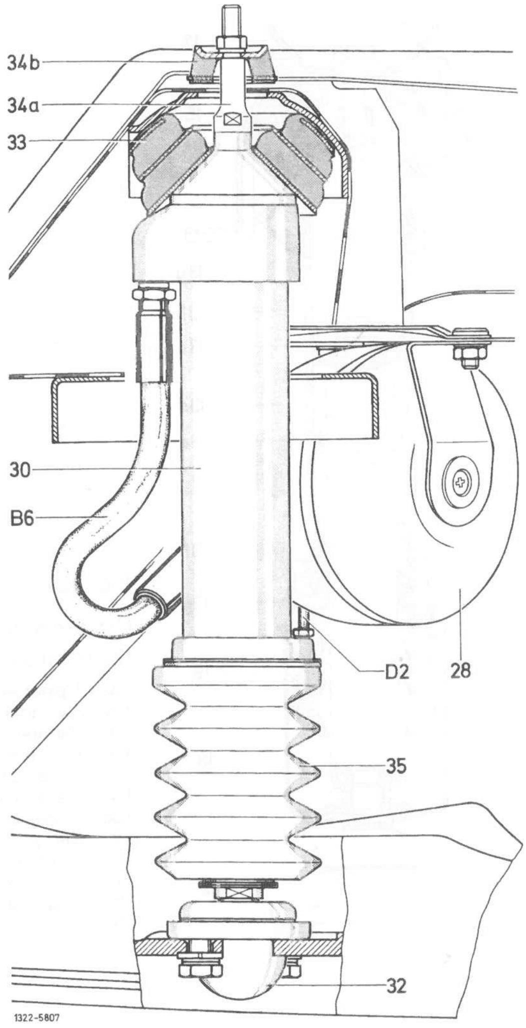


Fig. 126

Layout of gas pressure shock for rear axle

28 Pressure reservoir
30 Gas pressure shock
32 Ball joint
33 Rubber mount
34a Screw bolt
34b Rubber mount
35 Sleeve
B6 Pressure line pressure reservoir – gas pressure shock
D2 Return line for leak oil of gas pressure shocks

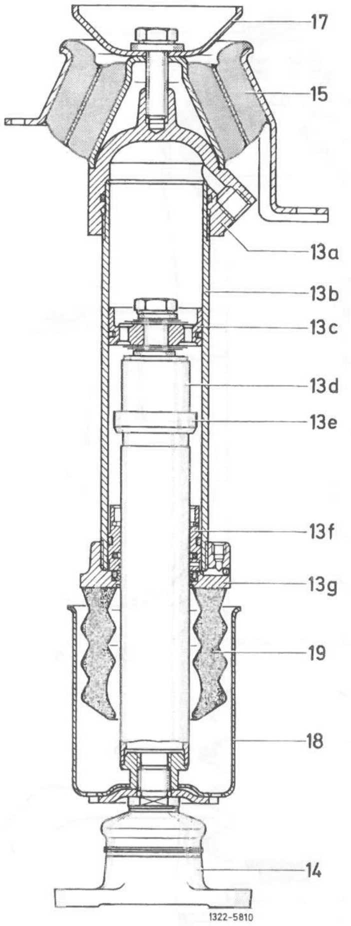


Fig. 127

Gas pressure shock for front axle

13a Upper end cover
13b Cylinder
13c Damper piston
13d Piston rod
13e Collar of piston rod
13f Piston rod guide
13g Lower end cover
14 Ball joint
15 Rubber mount
17 Rebound stop
18 Stop cup
19 Stop buffer

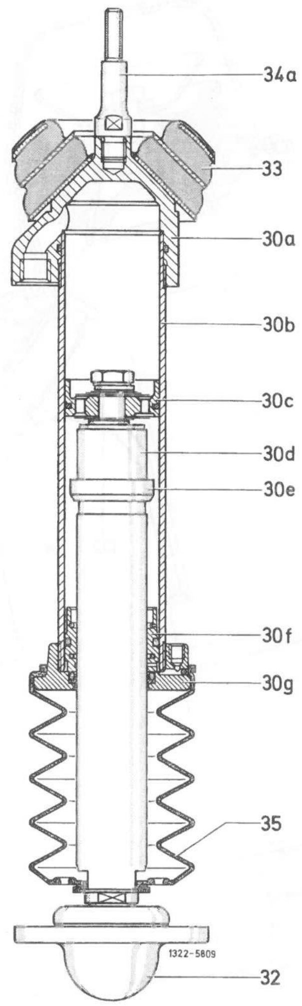


Fig. 128

Gas pressure shock for rear axle

30a Upper end cover
30b Cylinder
30c Damper piston
30d Piston rod
30e Collar of piston rod
30f Piston rod guide
30g Lower end cover
32 Ball joint
33 Rubber mount
34a Screw bolt
35 Sleeve

Operation

Deflection is effected by compression or decompression of gas volume in pressure reservoir. The vehicle load is transmitted to the pressure reservoirs by the oil (Fig. 129).

During deflection, the oil displaced by the piston rod in the gas pressure shock is forced into oil chamber of pressure reservoir through the pressure line, so that the gas volume in the pressure reservoir will become smaller and the gas pressure will become higher.

During rebound, the gas cushion can expand and the gas pressure will become smaller.

If the level controllers are changed by the adjusting switch to "higher level", **more** oil will be forced into gas pressure shocks via the pressure reservoir. The gas pressure in the pressure reservoirs will remain the same as in the "normal level" position. An increase of the gas pressure will occur only when the vehicle is under load.

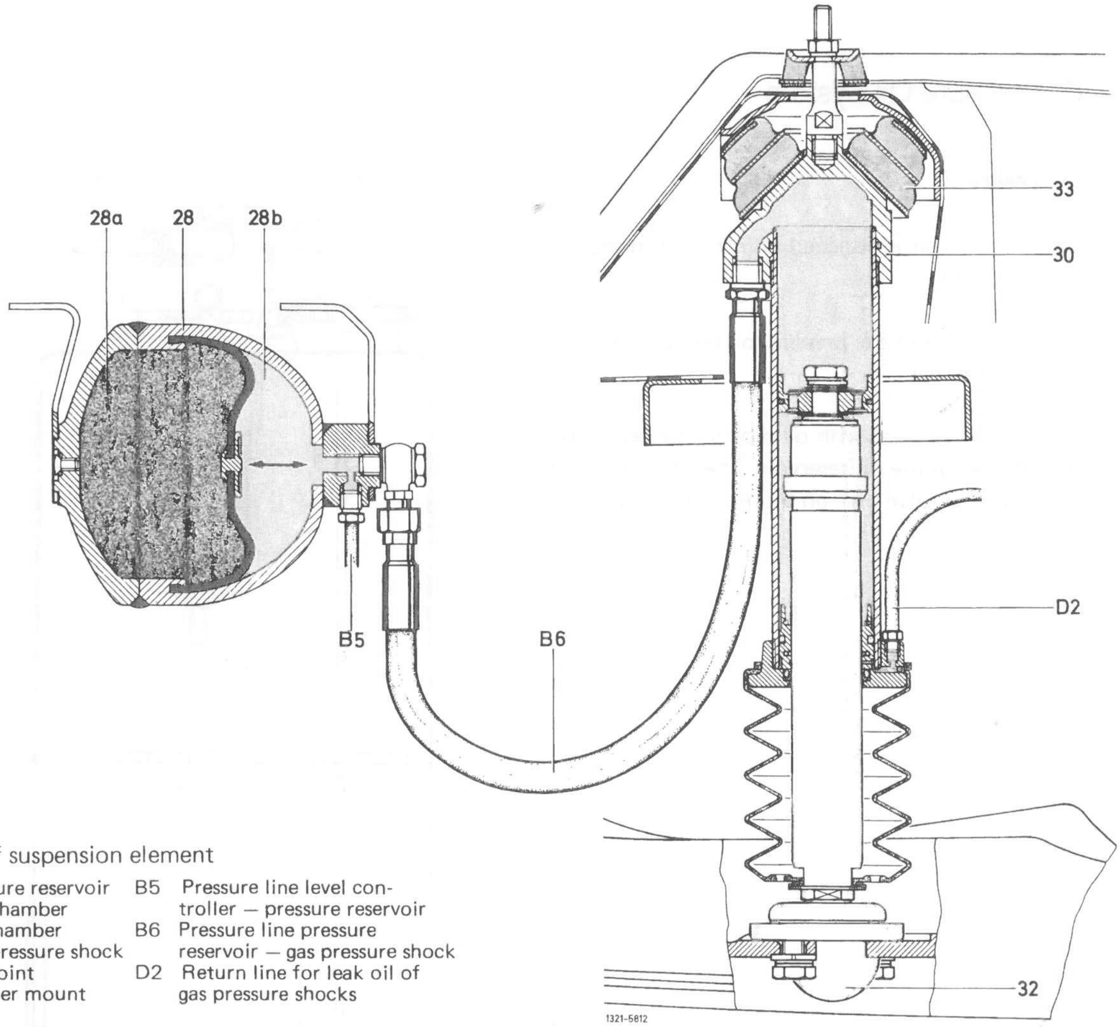


Fig. 129

Layout of suspension element

28	Pressure reservoir	B5	Pressure line level controller – pressure reservoir
28a	Gas chamber	B6	Pressure line pressure reservoir – gas pressure shock
28b	Oil chamber	D2	Return line for leak oil of gas pressure shocks
30	Gas pressure shock		
32	Ball joint		
33	Rubber mount		

The rebound stop in the gas pressure shocks is hydraulically dampened. During rebound, the collar of the piston rod enters the cylindrical portion of the guide ring. The oil between the collar of the piston rod and the cylindrical portion of the guide ring can escape only slowly and the collar of the piston rod can therefore also settle only slowly on inner face of guide ring. To permit easy retraction of gas pressure shock from the stop position into its normal position, a ring valve inside on cylinder releases four bores during deflection, through which oil can flow in (Fig. 130).

The purpose of the gas pressure shock, in combination with the pressure reservoir, to act as a shock absorber is atteined by the piston which is mounted on the piston rod together with the respective bores and valve plates.

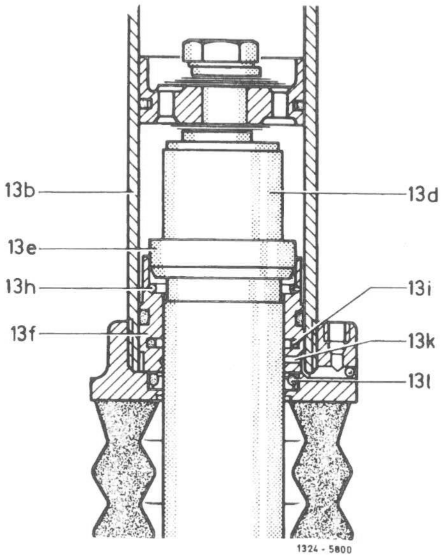


Fig. 130

Gas pressure shock

13b	Cylinder	13h	Ring valve
13d	Piston rod	13i	High-pressure gasket
13e	Collar of piston rod	13k	Ring duct
13f	Guide ring	13l	Low-pressure gasket

C. Pressure Oil System

Oil reservoir

The oil reservoir is attached at front left in engine compartment.

It is connected to the pressure oil pump by means of a suction line.

A closing cover (2a) with oil dipstick serves to check the oil level in the oil reservoir. The oil is returned by means of the valve unit on oil reservoir (Fig. 131).

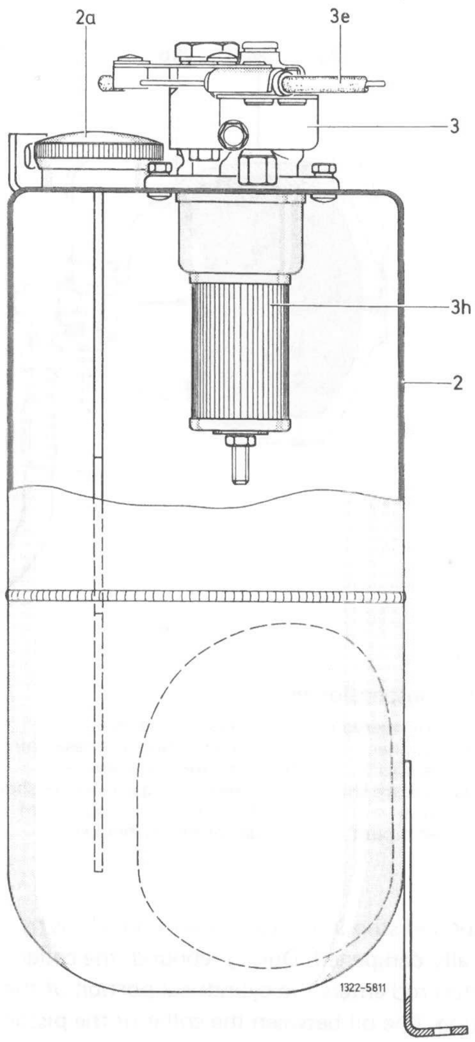


Fig. 131

2 Oil reservoir
2a Closing cover with oil dipstick
3 Valve unit (pressure regulator and adjusting switch)
3e Pull knob for adjusting switch
3h Oil filter

Pressure oil pump

The pressure oil pump is designed as a radial piston pump, with four pistons arranged radially in relation to eccentric shaft. The pump is similar to the pressure oil pump of the type already used on vehicles with level control on rear axle (Fig. 132).

The pressure oil pump is flanged at the front of left-hand cylinder head (Fig. 133). It is driven by the intermediate sprocket of the timing chain by means of a pertinent driver (Fig. 134).

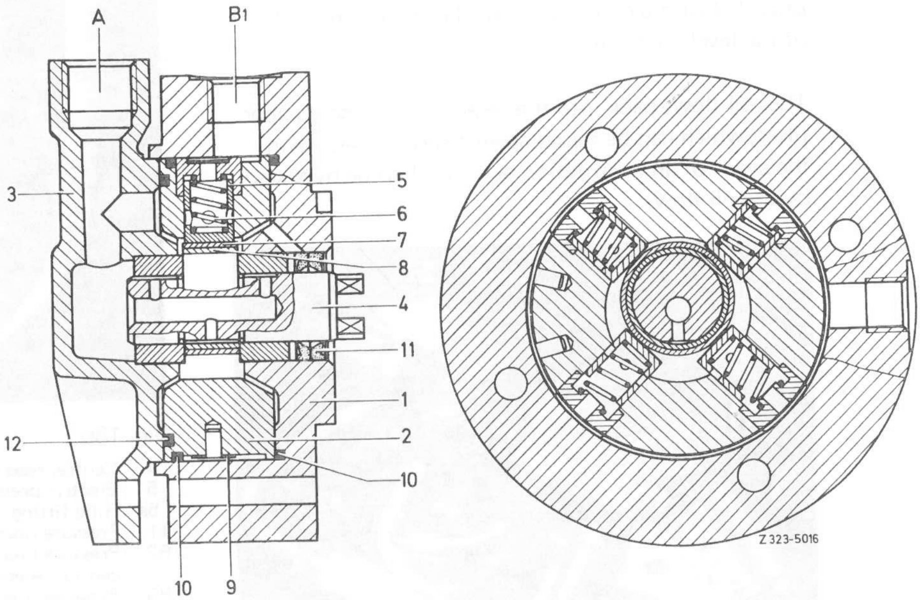


Fig. 132

1 Housing
2 Center piece
3 Bearing cover
4 Eccentric shaft
5 Piston
6 Compression spring
7 Outer race
8 Inner race
9 Reaction sealing strip
10 O-ring
11 Radial sealings rings
12 O-ring
A Suction line oil supply tank – pressure oil pump
B1 Pressure line pressure oil pump – pressure regulator of valve unit

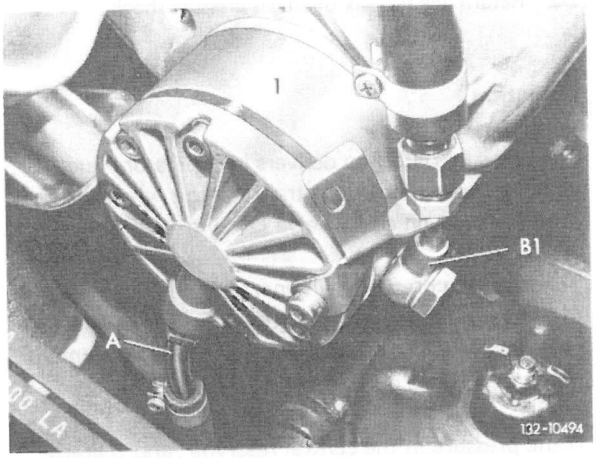


Fig. 133

1 Pressure oil pump
A Suction line oil supply tank – pressure oil pump
B1 Pressure line pressure oil pump – pressure regulator of valve unit

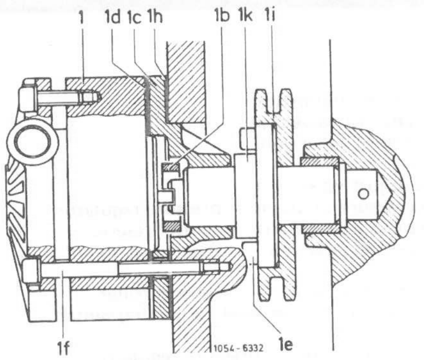


Fig. 134

1 Pressure oil pump
1b Driver
1c Intermediate flange
1d Gasket
1e Hex. socket screw with special head
1f Hex. socket screw
1h Gasket
1i Guide wheel
1k Shaft

Pressure regulator

The pressure regulator and the adjusting switch are combined into one valve unit mounted on oil reservoir (Fig. 135). The pressure regulator is connected to the pressure oil pump and the central reservoir by one pressure line (B1 and B2) each. In addition, it is provided with a connection for the return line (D1) of the level controller.

The oil flows back into the reservoir through a paper filter, which can be raised against spring pressure in the event of an obstruction and can then be bypassed by the oil flow.

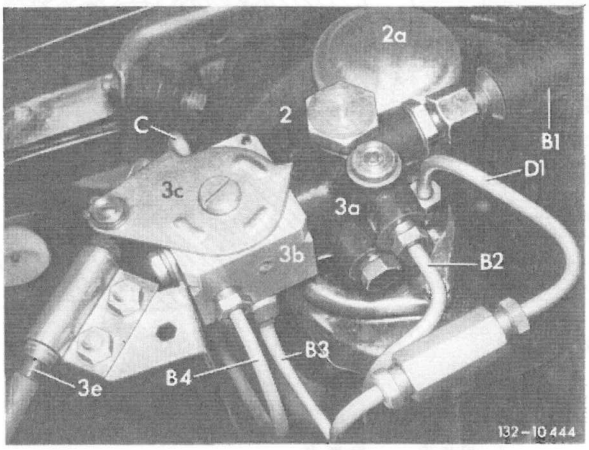


Fig. 135

2 Oil reservoir
2a Closing cover with oil dipstick
3a Pressure regulator of valve unit
3b Adjusting switch of valve unit
3c Control disc
3e Pull knob for adjusting switch
B1 Pressure line pressure oil pump – pressure regulator
B2 Pressure line pressure regulator – central reservoir
B3 Pressure line central reservoir – adjusting switch of valve unit
B4 Pressure line adjusting switch – level controller
C Control pressure line "higher level" adjusting switch – level controller
C1 Return line level controller – pressure regulator

Central reservoir

The central reservoir is located at front left in wheel house (Fig. 136) and comprises a gas pressure and an oil pressure chamber separated by a diaphragm. The oil pressure chamber is connected by means of two pressure lines to its inlet connection (B2) on pressure regulator and to its outlet connection (B3) on adjusting switch.

An electric pressure switch (5) will cause the warning light in instrument cluster to light up when a given minimum pressure is attained.

The central reservoir serves the purpose of supplying both level controllers with pressure oil independent of pressure oil pump. With the engine stopped, the volume changes in the pressure reservoir caused by temperature fluctuations will be balanced.

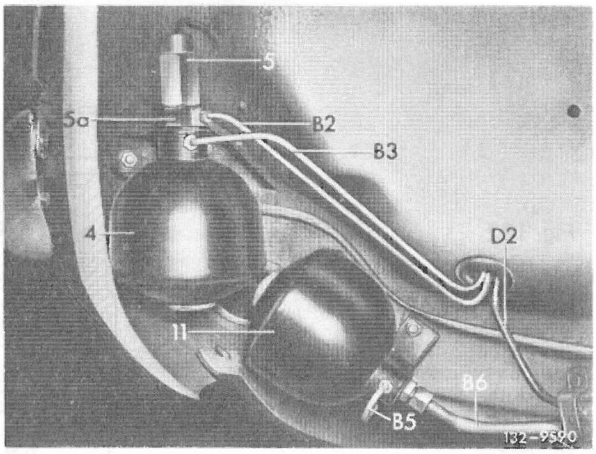


Fig. 136

4 Central reservoir
5 Electric pressure switch for warning light
5a Ring fitting
11 Pressure reservoir
B2 Pressure line pressure regulator of valve unit – central reservoir
B3 Pressure line central reservoir – adjusting switch of valve unit
B5 Pressure line level controller – pressure reservoir
B6 Pressure line pressure reservoir – gas pressure shock
D2 Return line for leak oil of gas pressure shock

Operation

The pressure oil pump delivers into pressure duct (3), which is connected to central reservoir, via pressure duct (1) through check valve (2) (Fig. 137).

The resulting pressure will energize the control piston (4) and simultaneously the control valve (5) and the return valve (6) in control duct (7) via filter element (3g) and throttle bore of throttle screw (3f).

If the pressure in the central reservoir, and thereby the pressure against the control piston, increases above the cutout pressure, the control piston, whose bottom end is connected to the return duct (8) and therefore pressureless, will open the control valve. Opening of the control valve permits the pressure in the control duct to be quickly evacuated via the return duct, since less oil will be able to flow off through throttle bore than through the control valve to the return duct.

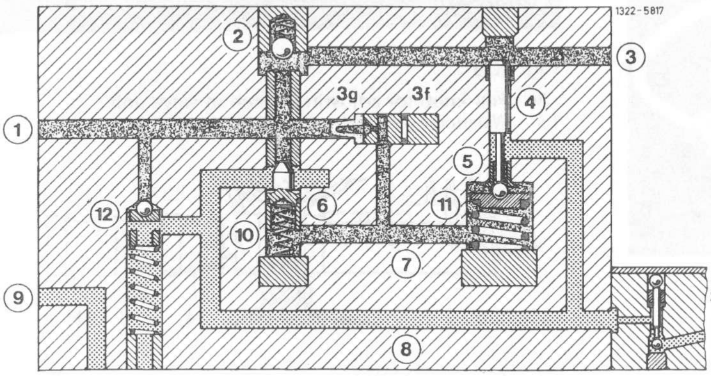
At the bottom end of the return valve only spring (10) is now active, while the upper end is under the oil pressure generated by the pressure oil pump. As a result, the return valve will be opened and the pressure in the pressure duct (1) will be reduced.

Since the pressure in the central reservoir is now higher than in the pressure duct (1), the check valve will close. The pressure oil pump will now deliver into oil reservoir at the pressure required to overcome the spring of the return valve.

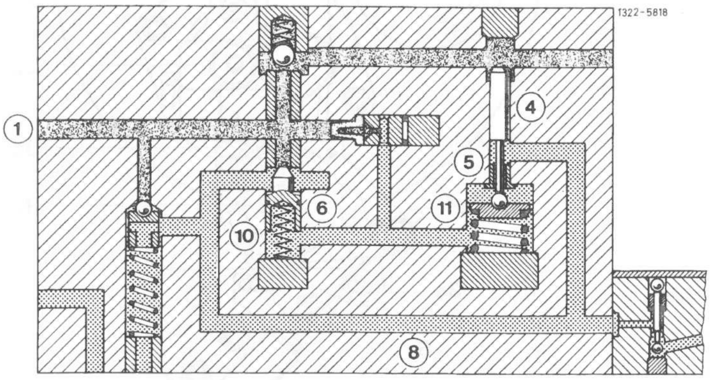
If pressure oil required by the level controllers causes the pressure in the central reservoir to drop below the level of the cut-in pressure, the control valve is closed by its spring (11).

The throttle bore now serves to establish the same pressure in control duct which is effective in duct (1). As a result, spring (10) will now be able to close the return valve. Since the surface of the bottom of the return valve is larger than the surface of the sealing seat, it is now assured that the valve will remain closed at all pressures.

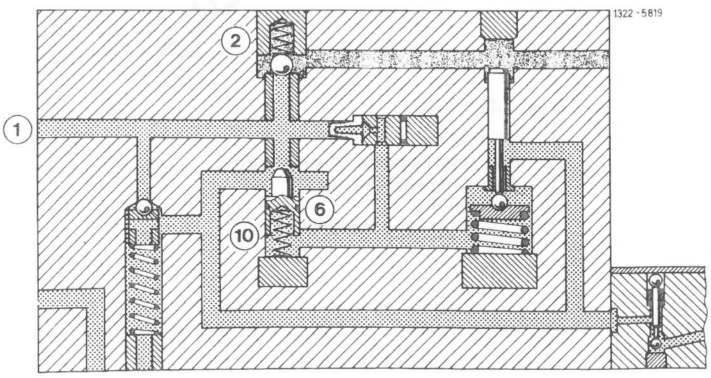
To protect the system, a pressure relief valve (12) is installed between the pressure duct (1) and the return duct (8), so that the oil can flow back into the oil reservoir when the pressure is too high.



Fill central reservoir up to cutout pressure



Cutout pressure attained



Delivery in oil reservoir

Fig. 137
Sectional view of pressure regulator

1 Pressure duct of connection of pressure line B1 from pressure oil pump
2 Check valve
3 Pressure duct for connection of pressure line B2 to central reservoir
3b Adjusting switch
3f Throttle screw
3g Filter element for throttle screw
4 Regulating piston
5 Control valve
6 Return valve
7 Control duct
8 Return duct in pressure regulator
9 Return duct for connection of return line D1
10 Spring of return valve
11 Spring of control valve
12 Pressure relief valve

D. Control Device

Adjusting switch

The adjusting switch (3b) is flanged to pressure regulator (Fig. 21). The adjusting switch and the pressure regulator are connected to each other by the return duct (19) (Fig. 142).

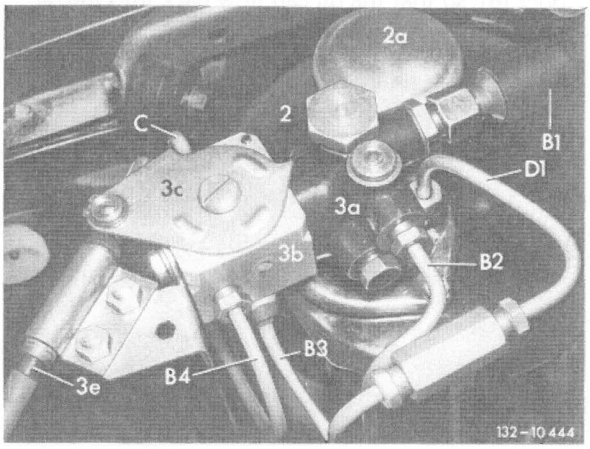


Fig. 138
2 Oil reservoir
2a Closing cover with oil dipstick
3a Pressure regulator of valve unit
3b Adjusting switch of valve unit
3c Control disc
3e Pull knob for adjusting switch
B1 Pressure line pressure oil pump – pressure regulator
B2 Pressure line pressure regulator – central reservoir
B3 Pressure line central reservoir – adjusting switch of valve unit
B4 Pressure line adjusting switch – level controller
C Control pressure line for "higher level" adjusting switch – level controller
D1 Return line level controller – pressure regulator

A pull switch on instrument panel permits attaining the following positions (Fig. 139 and 140):

N = **Normal level**
(switch pushed in)

S = **Locking position**
(switch engaged in center position)

H = **Higher level**
(switch completely pulled)

In position "H" and "S", the warning light (23) (red, with vehicle symbol) at right in instrument cluster will light up (Fig. 139).

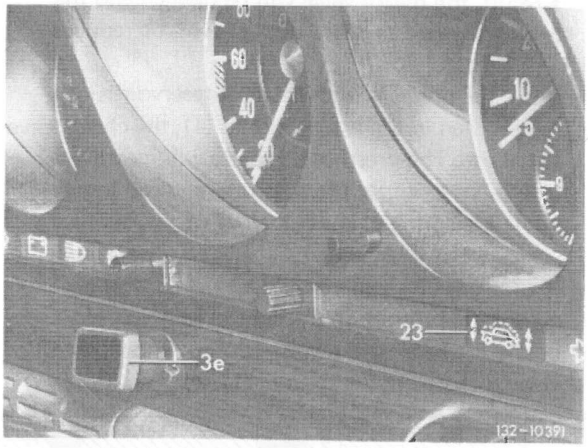


Fig. 139
3e Pull knob for adjusting switch of valve unit
13 Warning light (red, with vehicle symbol)

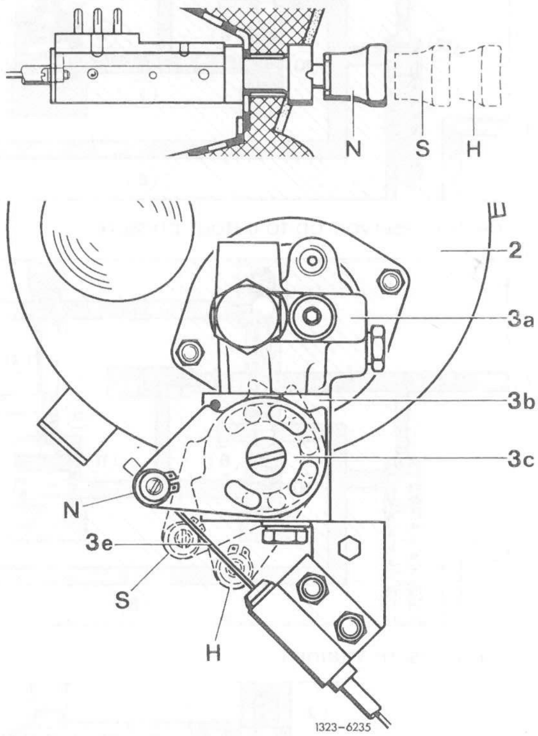


Fig. 140
2 Oil reservoir
3a Pressure regulator of valve unit
3b Adjusting switch of valve unit
3c Control disc
3e Pull knob for adjusting switch

Position

M = "Assembly position" is required for the workshop only. In assembly position, the suspension system is pressureless up to level controllers (control disc pulled back against stop with pull knob released) (Fig. 141).

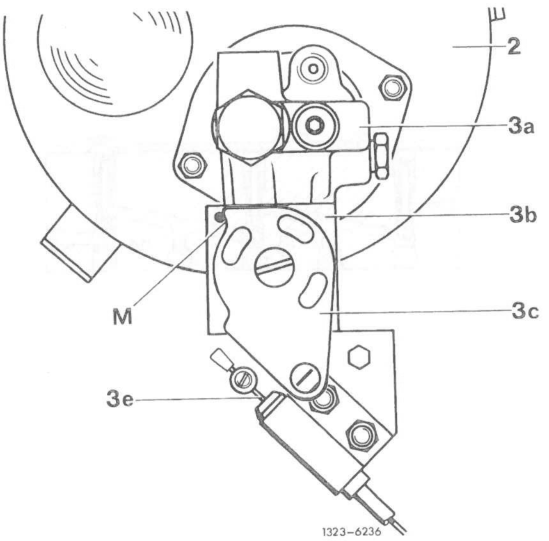


Fig. 141
2 Oil reservoir
3a Pressure regulator of valve unit
3b Adjusting switch of valve unit
3c Control disc
3e Pull knob for adjusting switch

The adjusting switch has three control valves connected in series, whose positions can be adjusted by means of a control disc. The valves are ball valves, but the balls are not forced against their seats by means of springs, but by hydraulic pressure.

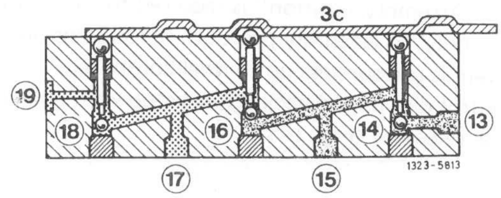
To obtain the pressure required for forcing the balls against their seats when the pressureless system is put into operation, the return duct is designed as a throttle.

The pressure line of the central reservoir is connected prior to the control valve (14), the pressure line for the level controller on front and rear axle in front of control valve (16), and the pressure line for adjusting the "higher level" position in the level controllers in front of control valve (18). In addition, the return duct (19) runs from this valve to the pressure regulator (Fig. 142).

Sectional Views of Adjusting Switch

Position N = Normal Level

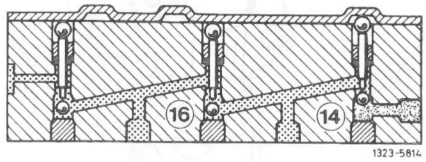
Control valves (14) and (18) are open. Valve (16) remains closed. In this position, the level controllers are connected to the central reservoir via pressure line (B4).



Position S = Locking Position

Control valves (16) and (18) are open, control valve (14) is closed.

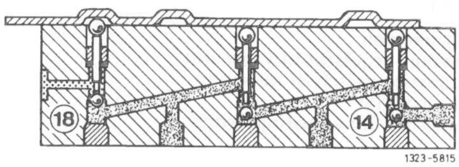
The pressure line (B4) adjusting switch – level controller is pressureless. In the level controllers, the check valve is now closed by the pressure in the pressure reservoirs, so that no more pressure can escape from suspension elements.



Position H = Higher Level

Control valves (14) and (16) are open, control valve (18) is closed.

By actuating this position, the control shaft in level controller is displaced via the control pressure line (C) for higher level by means of the pressure in the central reservoir.



Position M = Assembly

This position can be adjusted only after releasing the pull knob on the control disc (Fig. 141). All three control valves are open, the check valve will be actuated in level controllers similar to position S = "Locking position". In addition, the central reservoir is connected to the return duct (19), so that in this position the pressure lines from and to the central reservoir (B2) and (B3), as well as the pressure line to the level controllers (B4) and the control pressure line for "Higher level" (C) will be pressureless.

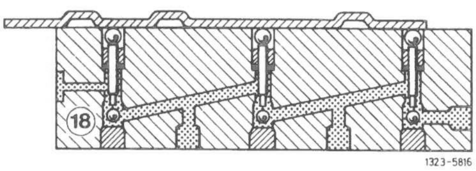


Fig. 142

13 Connection for pressure line (B3) from central reservoir
14 Control valve
15 Connection for pressure line (B4) to level controllers
16 Control valve
17 Connection for control pressure line (C) "Higher level" to level controllers
18 Control valve
19 Return duct

Level controller

The level controller for the front axle is located in engine compartment (Fig. 143). It is actuated via connecting shaft (9) by torsion bar (Fig. 144).

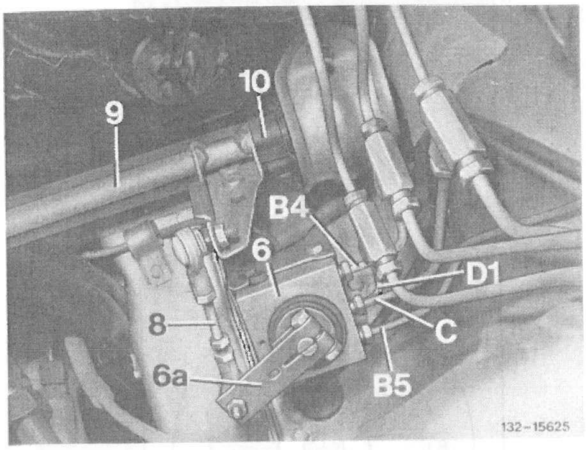


Fig. 143

6 Level controller for front axle
6a Lever for level controller
8 Connecting rod
9 Connecting shaft
10 Torsion bar
B4 Pressure line adjusting switch of valve unit–level controller
B5 Pressure line level controller – pressure reservoir
C Control pressure line for "higher level" adjusting switch – level controller
D1 Return line level controller – pressure regulator

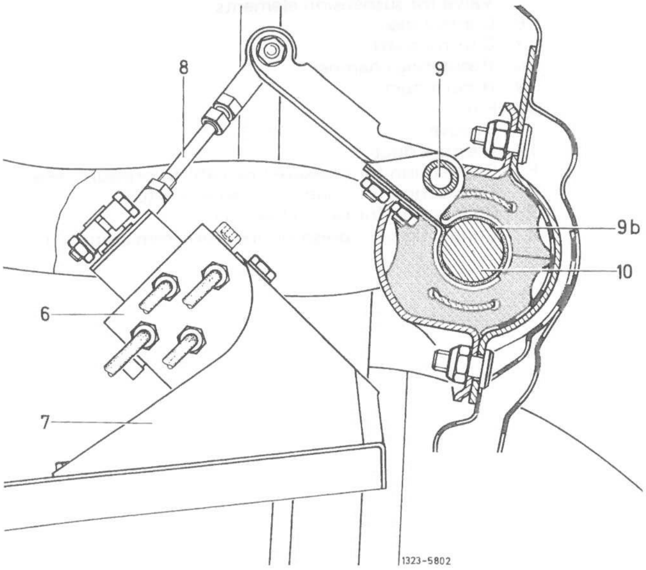


Fig. 144

6 Level controller for front axle
7 Bracket for level controller
8 Connecting rod
9 Connecting shaft
9b Plastic shim
10 Torsion bar

The level controller for the rear axle is attached to frame floor (Fig. 145). It is actuated via the connecting rod and the lever on the torsion bar (Fig. 146).

Level controllers have one connection, each for the pressure line (B4) from adjusting switch; the pressure line (B5) toward pressure reservoirs, the control pressure line (C) and the return line (D1) toward valve unit (Fig. 145).

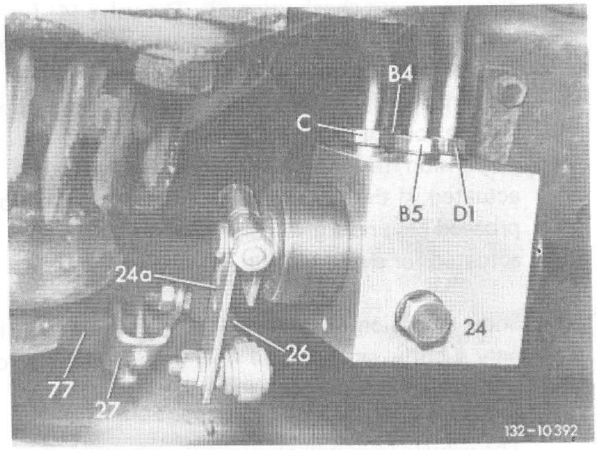


Fig. 145

24 Level controller for rear axle
24a Lever for level controller
26 Connecting rod
27 Level on torsion bar
77 Torsion bar
B4 Pressure line adjusting switch of valve unit – level controller
B5 Pressure line level controller – pressure reservoir
C Control pressure line for "higher level" adjusting switch – level controller
D1 Return line level controller – pressure regulator

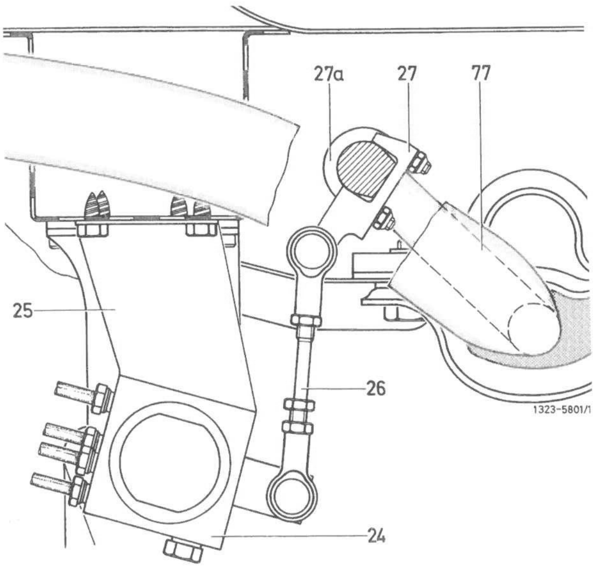


Fig. 146

24 Level controller for rear axle
25 Bracket for level controller
26 Connecting rod
27 Lever on torsion bar
27a Fastener
77 Torsion bar of rear axle

Operation

Level controller: **Center position**

Adjusting switch: **Normal level**

The pressure of the central reservoir prevailing in pressure duct (1) acts against control piston (2) and thereby opens check valve (3). The valve (4) for the pressure duct from central reservoir and the valve (5) for the pressure duct of the suspension elements remain closed. On the basis of the idle travel provided for the control disc (6) the vhicle can complete suspension movements without the valves being actuated. If the suspension movements (deflections) proceed beyond a given distance, the valves are actuated for short periods.

Short actuation of valves will change the vehicle level only slightly, since the oil flow in the level controller is throttled on purpose.

The vehicle level will always adjust itself to the preset value (position of control and semitrailing arms).

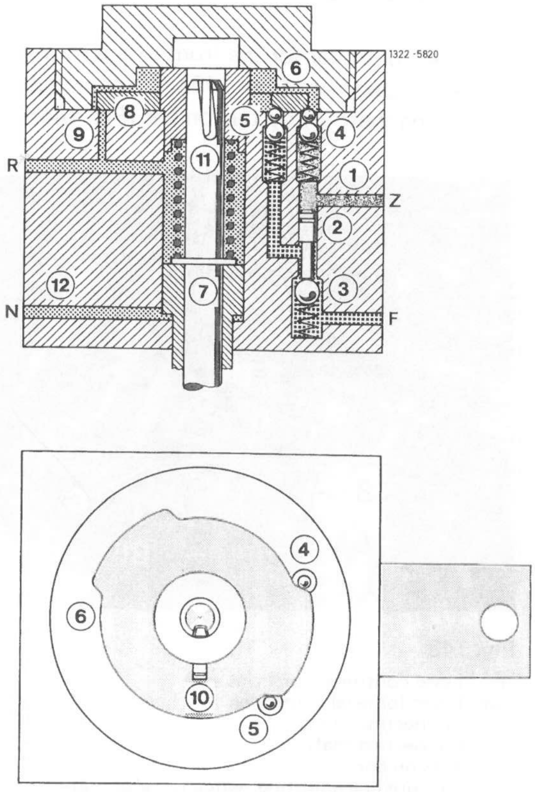


Fig. 147

1 Pressure duct
2 Control piston
3 Check valve
4 Valve for pressure duct from adjusting switch
5 Valve for suspension elements
6 Control disc
7 Control shaft
8 Regulating chamber
9 Return duct
10 Pin
11 Groove
12 Pressure duct
F Connection for pressure line (B5) to pressure reservoirs
N Connection for control pressure line (C)
R Connection for return line (D1)
Z Connection for pressure line (B4) from adjusting switch

Level controller: **Filling**

Adjusting switch: **Normal level**

If the vehicle level drops under load, the control shaft (7) together with the control disc (6) will be rotated by means of the torsion bar and the connecting linkage. The control disc will open the intake valve (4) against the deflection and hydraulic pressure of the central reservoir. The oil in the pressure duct can flow into the suspension elements via the control chamber (8) and valve (5) opened by the hydraulic pressure. This will raise the vehicle until the control disc again releases valve (4). The suspension pressure and the hydraulic pressure in the central reservoir will close this valve.

The return duct remains closed during this procedure. The normal level is again attained.

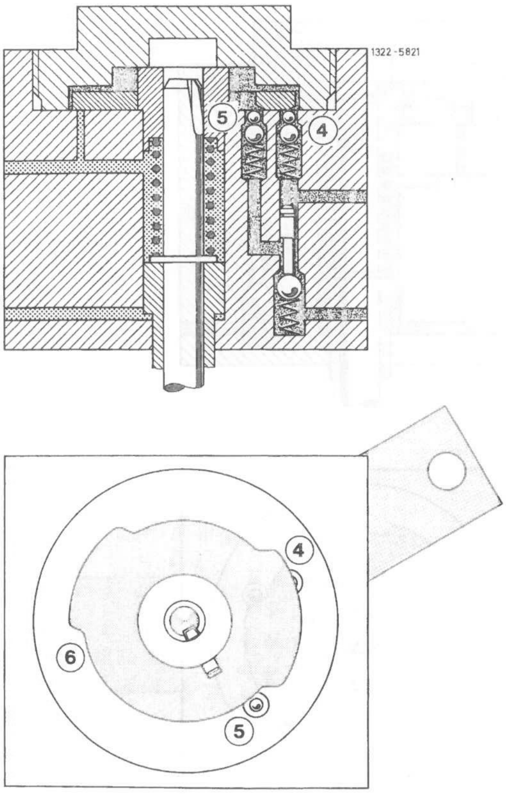


Fig. 148

4 Valve for pressure duct from adjusting switch
5 Valve for suspension elements
6 Control disc

Level controller: **Discharge**

Adjusting switch: **Normal level**

The higher pressure in suspension elements with vehicle under load will first raise the vehicle during discharge, which will turn the control disc via the torsion bar and the connecting linkage and will open the return duct and the valve for the suspension elements. Now, the oil can flow out of suspension elements until the normal level is again attained. The control disc will again release the valve for the suspension elements.

The spring pressure and the hydraulic pressure of the suspension elements will close the valve (5).

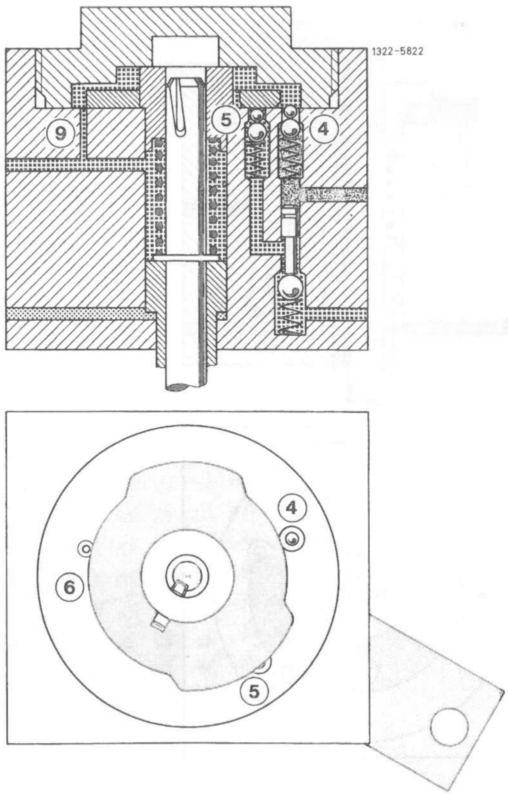


Fig. 149

4 Valve for pressure duct from adjusting switch
5 Valve for suspension elements
6 Control disc
7 Return duct

Level controller: **Center position with higher level**

Adjusting switch: **Higher level**

When the higher level is switched on at adjusting switch, the pressure duct in level controller is connected to central reservoir. The pressure of the central reservoir will displace the control shaft (7) against spring force in longitudinal direction. Since the control disc (6) is actuated by the control shaft by means of a pin (10) which runs in a groove (11) diagonally machined into control shaft, the control disc will rotate in relation to control shaft. As a result, the "filling" position will be adjusted until the higher vehicle level is attained. The control range and the positions "filling" and "discharge" are in this position the same as in the position "normal level", though now the torsion bar and the control disc are displaced in relation to each other.

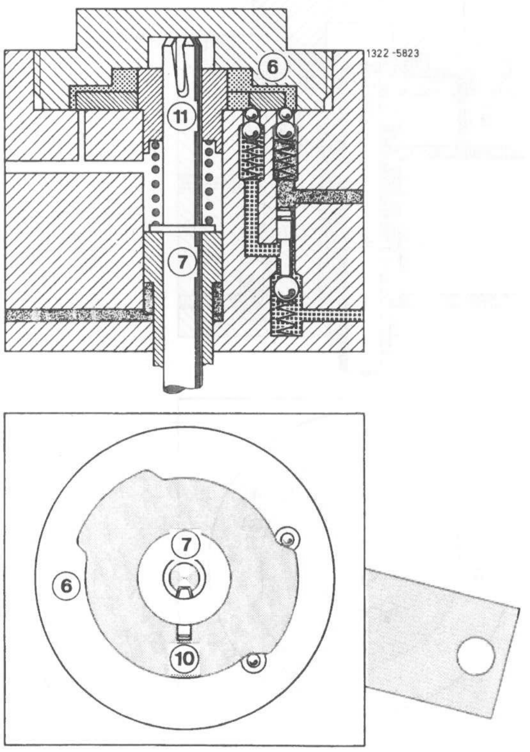


Fig. 150

6 Control disc
7 Control shaft
10 Pin
11 Groove

Level controller: **Locking position**

Adjusting switch: **Locking position**

In "locking position" of the adjusting switch, the pressure line to the level controllers becomes pressureless. As a result, the control piston (2) can no longer keep the check valve (3) open, so that the suspension pressure and the hydraulic pressure in the suspension elements will close the check valve. The functions "filling", "discharge" and "higher level" of the level controller are now no longer in force, since no additional oil can flow into control area. This position must be switched on when changing wheels, for towing and when transporting the vehicle, so that no pressure can escape from suspension elements.

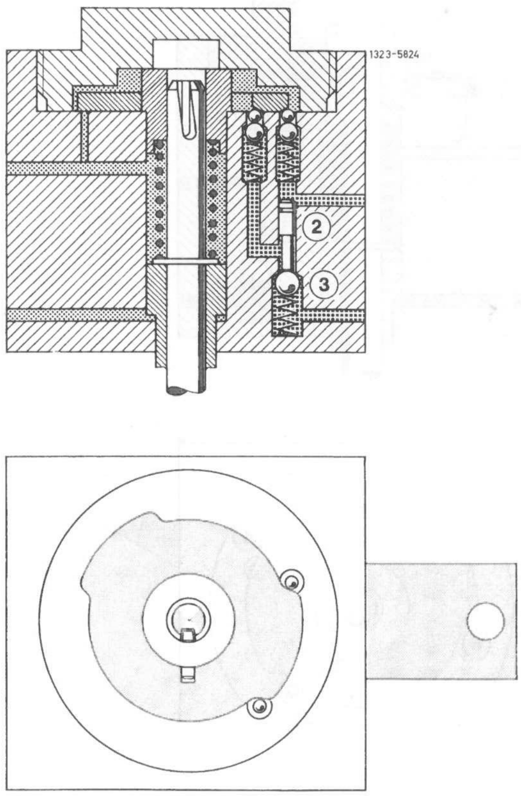


Fig. 151

2 Control piston
3 Check valve

Level controller: **Locking position**

Adjusting switch: **Normal or higher level**

If the pressure in the central reservoir drops below the pressure prevailing in the suspension elements due to a defect in the pressure oil system, the control piston can no longer keep the check valve open. The locking position will be the automatic result.

Similar to the locking position of the adjusting switch, the functions of "filling", "discharge" and "higher level" can no longer be met, since no more oil can flow into control chamber.

Since the pressure oil can flow off slowly into oil reservoir via the return line for the leak oil, the vehicle can still be driven for a short distance. The vehicle will then be exclusively supported by the supplementary rubber springs.

Notes Concerning Test Jobs

All repair and test jobs are described in microfiche Hydropneumatic Suspension Group 32, Model 116.036.

Notes Concerning Maintenance Jobs

All the maintenance jobs not shown here should be taken from available maintenance literature.

If the central reservoir cannot be filled, evacuate pressure from suspension elements by carefully opening bleeder.

The pressure in suspension elements can also be included whenever during inspection jobs and with the engine running the level controllers are in "filling" position with the connecting rod unhooked. In such a case, the suspension elements are filled up to cut-out pressure of pressure regulator. The pressure can then be reduced through bleeders only. For this purpose, attach a hose prior to release and hold hose into a vessel.

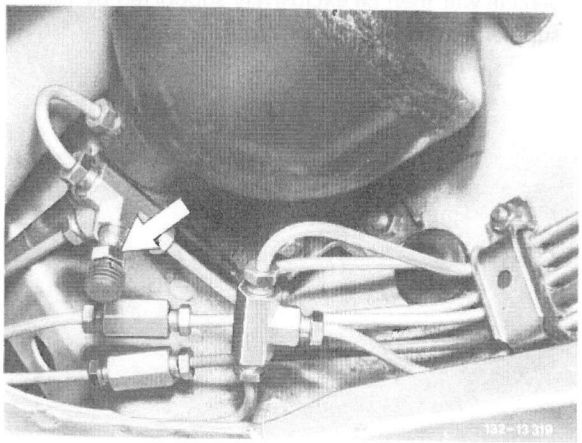


Fig. 152

Bleeder for suspension elements on front axle

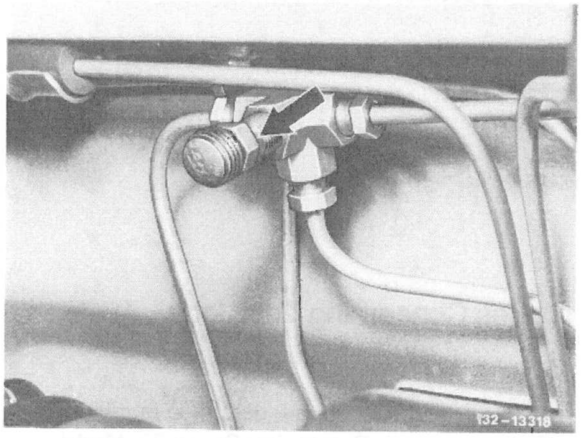


Fig. 153

Bleeder for suspension elements on rear axle

Maintenance Jobs

020 **Check rubber sleeves of ball joints on tube shocks**
Every 15000 km

086 **Check systems for leaks and condition**
1st and 2nd service
then every 15000 km

139 **Check and correct fluid level**
1st and 2nd service
then every 15000 km

628 **Check pressure reservoir and central reservoir for gas filling pressure**
Every 45000 km

Scope: Refer to maintenance manual

Front axle corresponds to version for remaining models 116, but with the following exceptions:

Compared with normal version, steering knuckle strength is higher.

Steering knuckle left part No.	116 330 20 20
Steering knuckle right part No.	116 330 21 20

For reasons of space, only the steel version with two-piece rubber mounts of the upper control arm may be installed. In contrast to optional assembly of control arms made of steel and light alloy for remaining models 116.

Maintenance Job every 45 000 km

631 Renew grease charge of front wheel bearing, check tapered roller bearing.

Scope: Refer to maintenance manual

To meet the higher front axle load, power steering 765.703 is provided with 8 mm dia. reaction pistons to prevent steering forces from becoming too high. The steering is identified with code No. "8" on closing cover for steering valve.

The pressure relief valve of the power steering pump opens at 90 bar gauge pressure. The opening pressure is punched into information plate of power steering pump (arrow, Fig. 154).

Fig. 154

The steering linkage and the steering arms have been changed. When installing track rods, make sure that the ball joint which is screwed into track rod tube with the longer threaded journal is attached to pitman arm or intermediate steering arm.

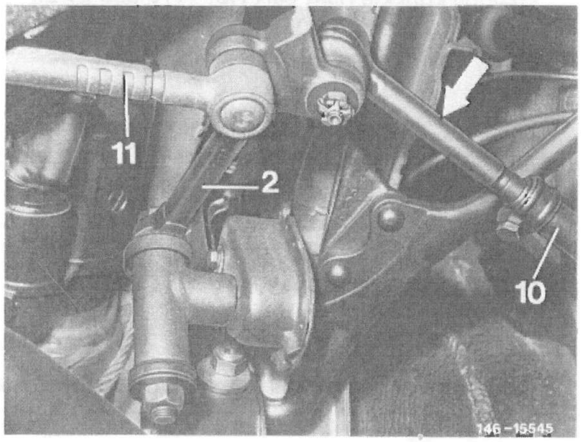


Fig. 155

Spare parts

Designation	Part No.	Code No.
Power steering	116 460 13 01	8
Pitman arm	116 463 13 01	1613
Intermediate steering gear arm	116 463 12 10	1612
Steering knuckle arm left	116 332 18 20	1618
Steering knuckle arm right	116 332 19 20	1619
Track rod	123 330 07 03	–
Drag link	116 460 07 05	
Power steering pump (optional)	116 460 29 80	
	116 460 30 80	

This model is provided with cruise control as standard equipment. Functional description and repair instructions are in repair instructions for speed control system.

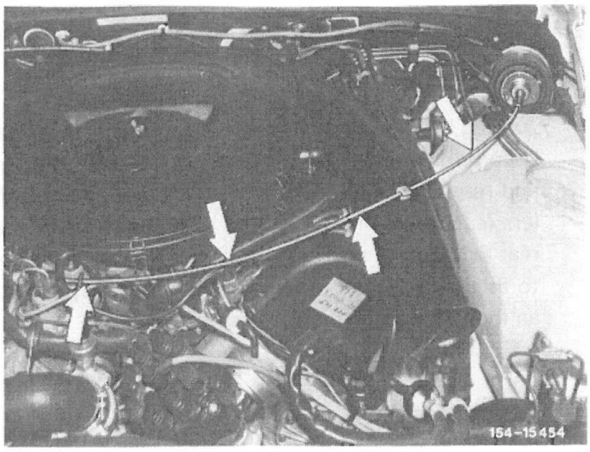


Fig. 156
Layout control unit (regulator) with cable control

Instructions for Aiming Headlights

Aiming headlights requires that the vehicle level has been uniformly set by the level controllers on front and rear axle. Varying response of the level controllers (e. g. on front axle due to load condition or on rear axle due to no-load condition or vice versa) due to the idle travel of the level controllers may result in an incorrect adjustment of headlights.

Adjustment

1 Move cable control for adjusting switch of valve unit into position N = "Normal Level" (switch on instrument panel completely pushed down).

2 To fill central reservoir run engine at approx. 2000/min (normal filling time of empty central reservoir up to cutout pressure approx. 30 s).

3 Move adjusting switch of valve unit into position H "Higher Level" (switch completely pulled out). After approx. 10 seconds set again to position N = "Normal Level".

4 Adjust (aim) headlights.

Attention!
Do not change load or no-load condition of vehicle after moving adjusting switch from position "H" to position "N", as well as during actual adjustment of headlights!

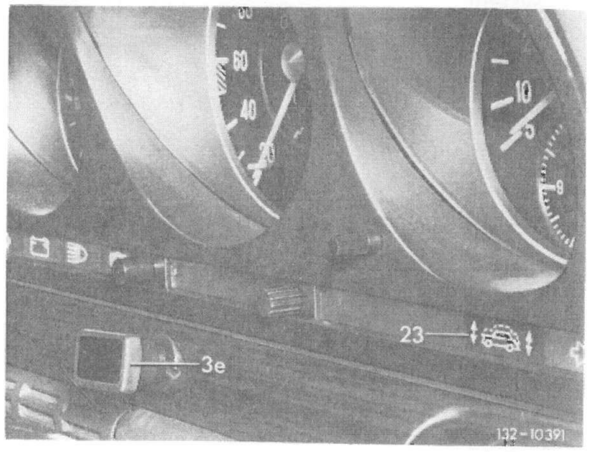


Fig. 157

3e Cable control for adjusting switch of valve unit
23 Warning lamp (red, with vehicle symbol)

Positions of adjusting switch:

N = Normal level
Switch completely pushed down

S = Locking position
Switch locked in center position

H = Higher level
Switch fully pulled

Removal and Installation of refrigerant compressor

Data

Power input	204 W
Fan speed at 12 V	2500/min
Refrigerant R 12	refer to Specifications for Service Products page 361
Filling capacity	1.2 kg

Oil type

Cold-flowing oil	for approved cold-flowing oils refer to Specifications for Service Products page 362

Oil capacity in liters

New refrigerant compressor	approx. 0.3
Removed refrigerant compressor, air conditioner flushed with R 11	0.3
Removed refrigerant compressor, air conditioner not flushed	0.25

Tightening torques			Nm	(kpm)
Pipe line (3) to pipe line (24)	with	Cu-seal	60±5	(6.0±0.5)
	without	Cu-seal	70±6	(7.0±0.5)
Pressure hose (18) to silencer (6)	with	Cu-seal	45±5	(4.5±0.5)
	without	Cu-seal	55±5	(5.5±0.5)
Pipe line (3) to refrigerant compressor (1)			17	(1.7)

Special tool

Pressure plate	109 589 00 25 00

Note

The refrigerant compressor can be removed and installed only together with carrier. If the compressor is removed because of leaks on compressor or on system, correct oil level in compressor by refilling, but add only max 0.25 liter of fresh cold-flowing oil.

When the refrigerant compressor is replaced, drain all the cold-flowing oil from new refrigerant compressor. Then fill-in max. 0.25 liter of cold-flowing oil. If system is flushed with refrigerant R 11, fill 0.3 liter of refrigerant oil into refrigerant compressor.

When loosening or tightening hose or pipe connections, be sure to apply counterhold with a second open end wrench.

Removal

1 Cover front fender.

2 Drain air-conditioning system.

3 Remove battery and pull positive (plus) line with clip from holder.

4 Remove battery frame.

5 Unscrew shielding plate from righthand engine mount.

6 Loosen belt tensioning roller (15) by slackening tensioning screw and remove V-belt (16) from refrigerant compressor and tensioning roller (Fig. 160).

7 Unscrew protective shield for oil hoses.

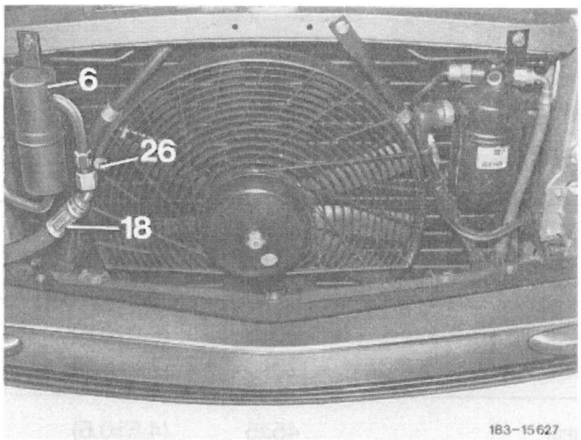


Fig. 158

Service valve (pressure end)

6 Silencer
18 Pipe line with hose line
26 Service valve (pressure end)

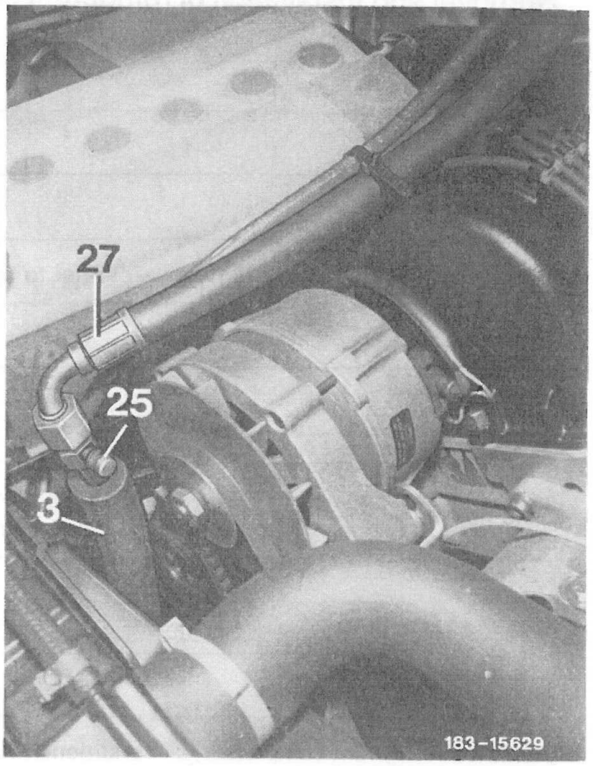


Fig. 159

Service valve (suction end)

3 Pipe line
25 Service valve (suction end)
27 Hose line from evaporator to compressor

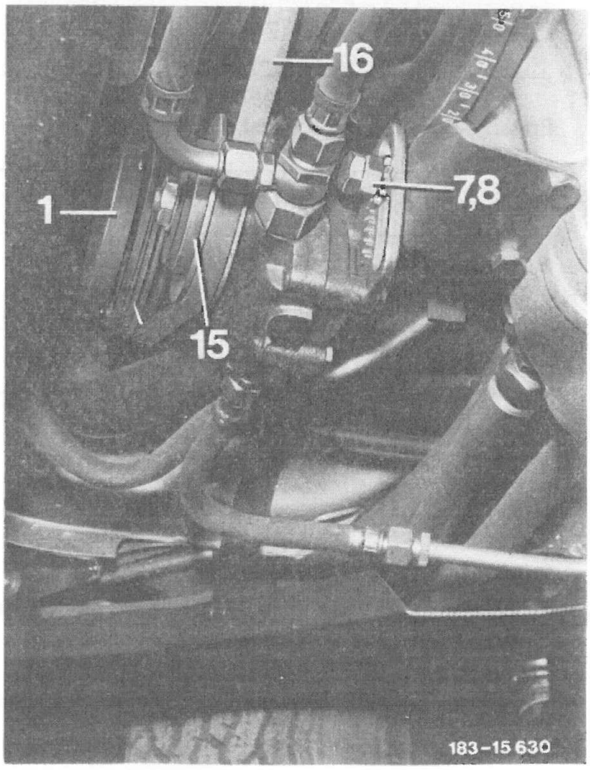


Fig. 160

1 Refrigerant
7 Screw
8 Washer
15 Belt tensioning roller
16 V-belt

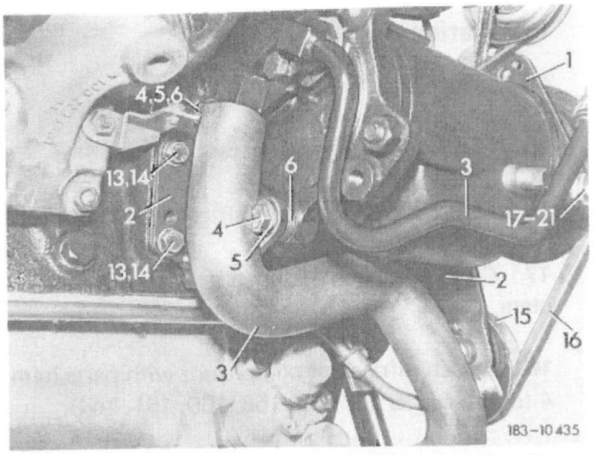


Fig. 161

1 Refrigerant compressor
2 Carrier
3 Pipe line
4 Screw
5 Washer
6 Spacing ring
13 Screw
14 Washer
15 Belt tensioning roller
16 V-belt
17 Holder
18 Screw
19 Washer
20 Screw
21 Washer

8 Unscrew pipe lines (3) rear on refrigerant compressor from holder (17) and from hose line (27) (Fig. 158, 161, 164), as well as hose line (18) on silencer (6).

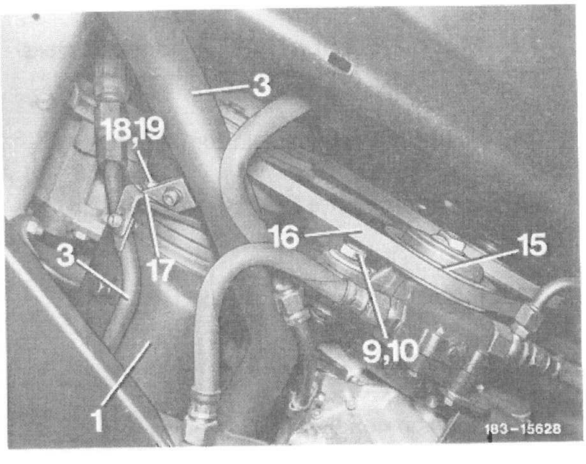


Fig. 162

1 Refrigerant compressor
3 Pipe line
9 Screw
10 Washer
15 Belt tensioning roller
16 V-belt
17 Holder
18 Screw
19 Washer

9 Unscrew screw (9) (Fig. 162).

10 Unscrew screws (11 to 13) for carrier (2) on crankase (Fig. 161, 164, 165).

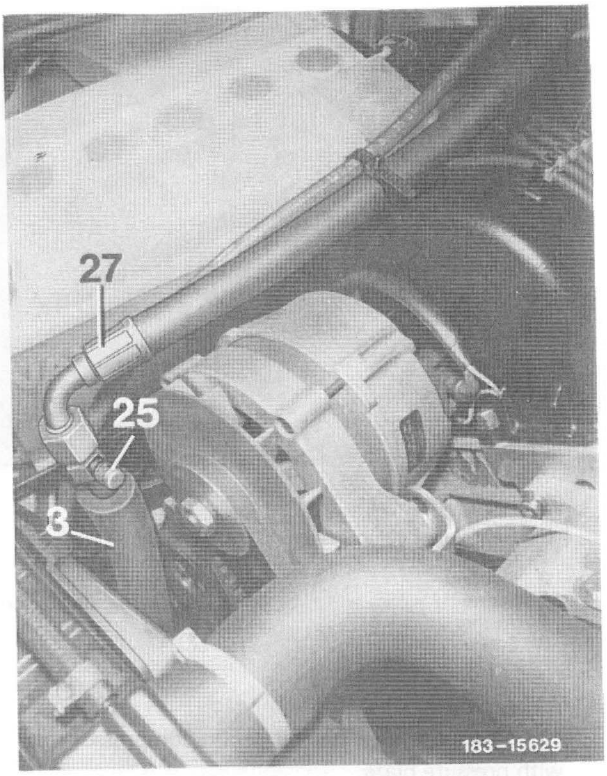


Fig. 163
Service valve (suction end)

3 Pipe line
25 Service valve (suction end)
27 Hose line from evaporator to compressor

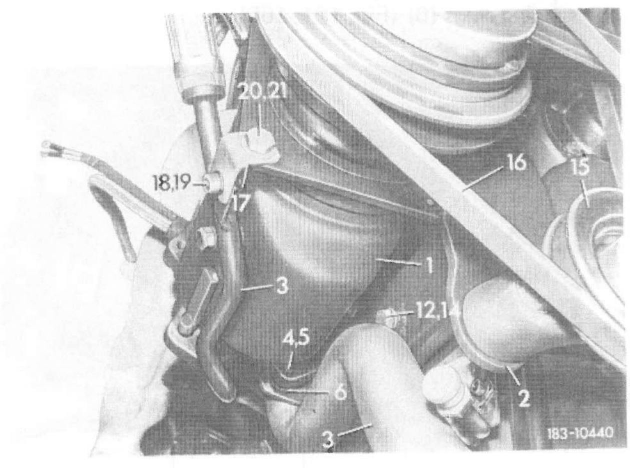


Fig. 164

1 Refrigerant compressor
2 Carrier
3 Pipe line
4 Screw
5 Washer
6 Spacing ring
12 Screw
14 Washer
15 Belt tensioning roller
16 V-belt
17 Holder
18 Screw
19 Washer
20 Screw
21 Washer

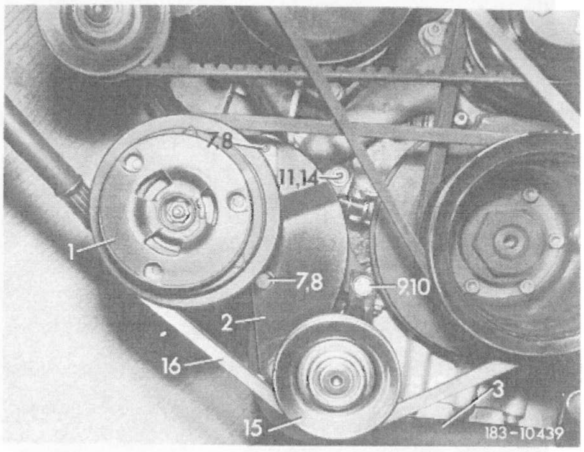


Fig. 165

1 Refrigerant compressor	10 Washer
2 Carrier	11 Screw
3 Pipe line	14 Washer
7 Screw	15 Belt tensioning roller
8 Washer	16 V-belt
9 Screw	

11 Close openings on refrigerant compressor rear with pressure plate.

12 Remove refrigerant compressor with carrier in forward and downward direction.

13 Unscrew screws (4 and 7) and remove refrigerant compressor from carrier, while paying attention to spacing rings (6) (Fig. 161, 166).

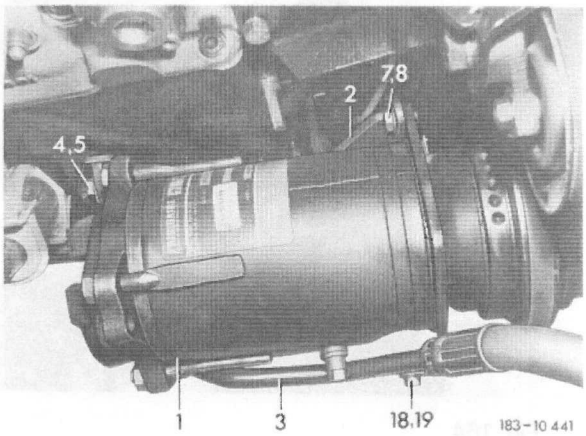


Fig. 166

1 Refrigerant compressor	7 Screw
2 Carrier	8 Washer
3 Pipe line	18 Screw
4 Screw	19 Washer
5 Washer	

Installation

14 Install pipe lines (3).

15 Check oil level in refrigerant compressor.

16 Check sealing rings on refrigerant compressor.

17 Close refrigerant compressor with pressure plate.

18 Attach refrigerant compressor with parts item 4 to 8 to carrier (2) (Fig. 158, 160, 161, 164).

19 Attach refrigerant compressor with carrier by means of parts item 11 to 14 to crankase, but do not yet tighten (Fig. 161, 166).

20 Attach pipe lines (3) on refrigerant compressor to hose line (27) as well as on silencer (6), but do not yet tighten.

21 Tighten screws (9, 11, 12 and 13).

22 Tighten pipe lines and hose lines (3).

23 Mount V-belt (16) and adjust V-belt tension with tensioning screws (7).

24 Check layout of oil line for automatic transmission in range of refrigerant compressor.

25 Mount protective shield for oil hoses.

26 Screw protective shield to righthand engine mount.

27 Install battery frame and battery.

28 Evacuate air-conditioning system.

29 Refill air-conditioning system.

30 Check air-conditioning system for function.

Warm-up Compensator Engine 110

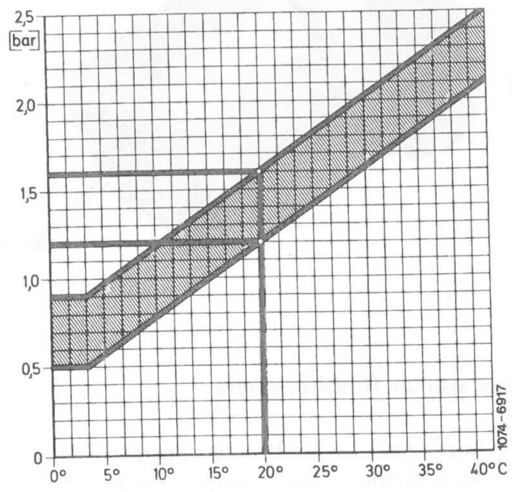
Characteristic of warm-up compensator has been changed.

Fuel pressures

Engine	110
Warm-up compensator Bosch No.	0 438 140 056
System pressure engine cold or warm (at idle)	5.2–5.8 bar gauge pressure (atü)
Control pressure engine warm (at idle) warm-up compensator cycle completed	3.4–3.8 bar gauge pressure (atü) at 530 mbar intake pipe vacuum
Full load enrichment vacuum hose pulled off (at idle)	2.8–3.2 bar gauge pressure (atü)
Control pressure engine cold according to ambient temperature	min. 0.5 bar gauge pressure (atü) (refer to diagram)

Example

Ambient temperature 20 °C
control pressure 1.2–1.6 bar
gauge pressure (atü).



Spark Plugs

Installed spark plugs have a thermal value of 125.

The electrode gap amounts to 0.8 mm (0.032").

The Stromberg carburetor has been modified as follows:

- Supporting ring for air piston diaphragm.
- New starter (choke) cover.
- Protective bushing for actuating lever of bimetallic spring.

Testing and adjusting jobs are the same as for Model Year 1978.

Supporting ring for air piston diaphragm

The supporting ring (arrow) is installed between air piston and diaphragm. The ring prevents damage to diaphragm by tickler when air piston is lifted. (Refer to installation instructions).

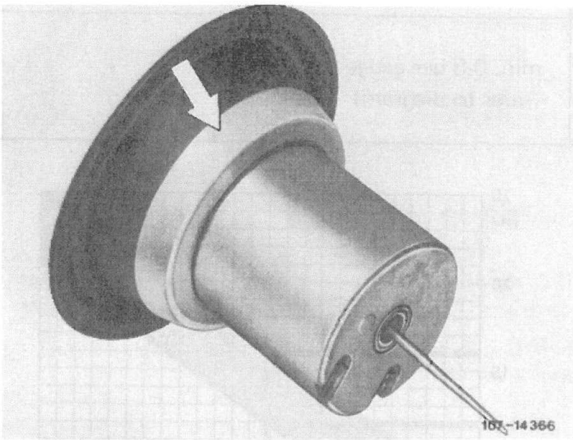


Fig. 167

New starter (choke) cover

The heat resistance has been dropped to 7 Ohms (formerly 8 Ohms). Heating up of the bimetallic spring and movement in relation to actuaring lever of bimetallic spring increased. Simultaneously, the starter (choke) shutoff point came sooner.

Identification: Starter (choke) cover code number **"200"** (arrow).

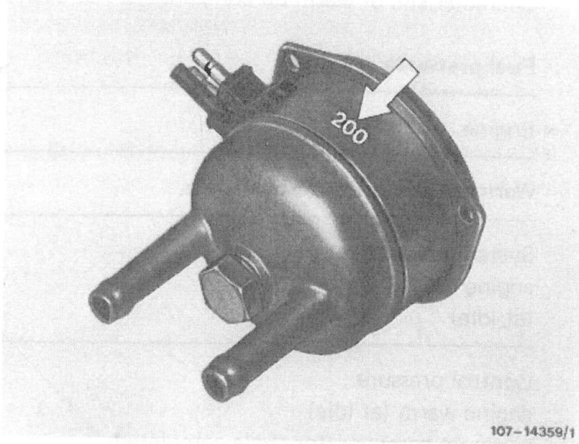


Fig. 168

Protective bushing for actuating lever of bimetallic spring

The protective bushing (171) mounted on actuating lever prevents wear on lever.

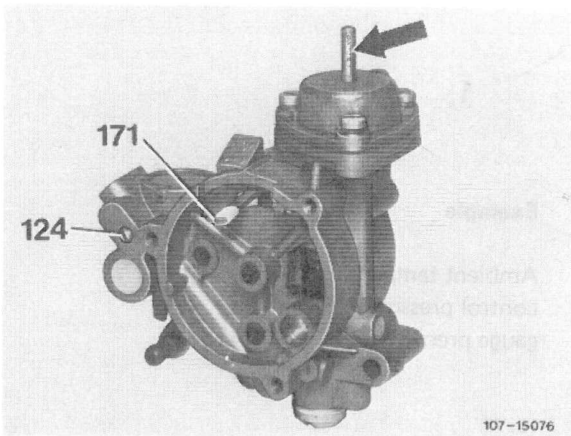


Fig. 169

Intake pipe (ring jacket)

The new intake pipe (B) is partially provided with double walls (ring jacket). With the engine cold and the heater flap closed, the intake pipe in this range is surrounded by hot exhaust gases (Fig. 170).

This will result in an intensive heating of the intake pipe which in turn will improve engine operation.

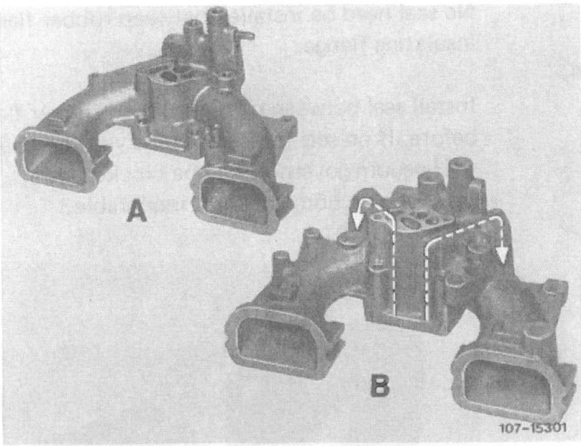


Fig. 170

A Former intake pipe
B modified intake pipe
Arrow direction of flow – exhaust gas

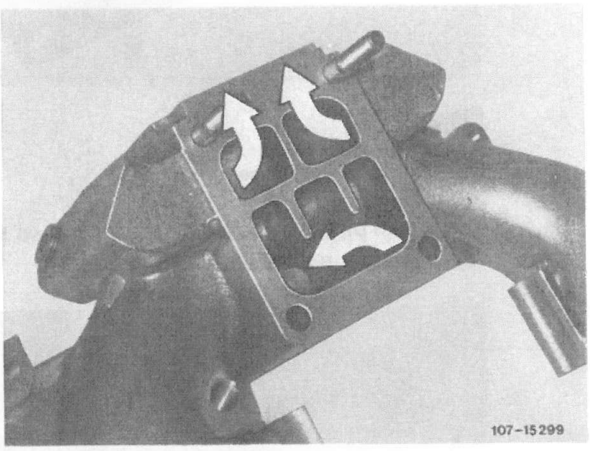


Fig. 171

Arrows Flow channels for exhaust gas

Rubber flange for suspending carburetor

The design of the rubber flange has been modified, it ist now vulcanized all-around. This will provide advantages with regard to vibrations as well as longer life. (Refer to installtion instructions, page 93).

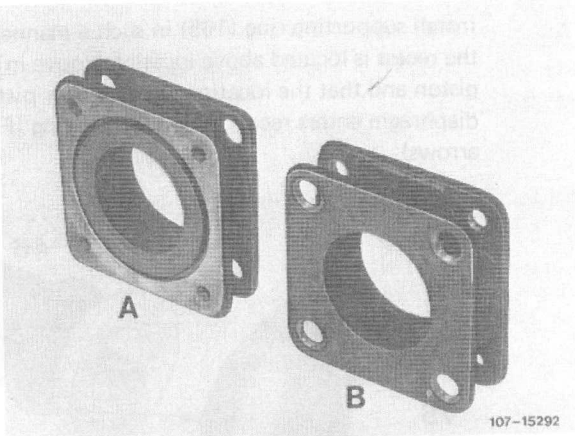


Fig. 172

A former rubber flange
B modified rubber flange

Heater flap spring

The heater flap spring on exhaust manifold has been reinforced (arrows). Its restoring force is now higher so that the heater flap will securely close when the engine is cold.

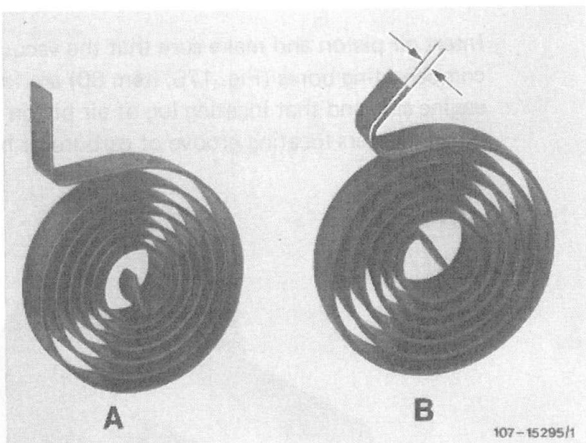


Fig. 173

A modified heater flap spring
B former heater flap spring

Installation Instructions

Installing supporting ring for air piston diaphragm

Observe the following:

Install supporting ring (165) in such a manner that the recess is located above locating groove in air piston and that the locating lug of the air piston diaphragm enters recess of supporting ring (Fig. 174, arrows).

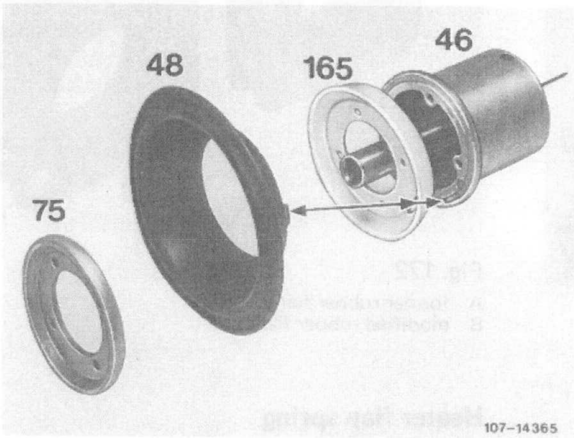


Fig. 174

46 Air piston
48 Air piston diaphragm
75 Holding ring
165 Supporting ring

Insert air piston and make sure that the vacuum compensating bores (Fig. 175, item 80) are facing engine side and that locating lug of air piston diaphragm enters locating groove of carburetor housing.

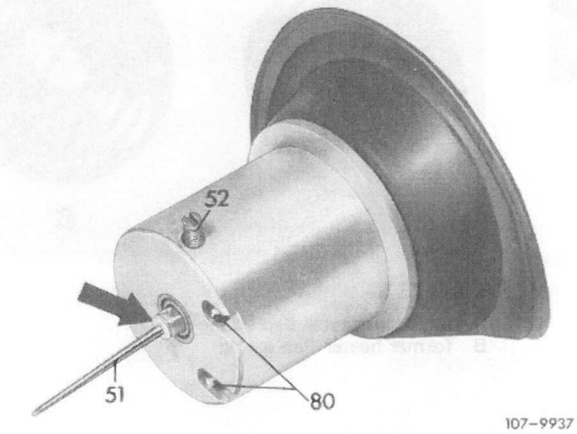


Fig. 175

Exchanging rubber flange for carburetor suspension

When the new rubber flange (B) vulcanized all-around is installed, observe the following:

No seal need be installed between rubber flange and insulating flange.

Install seal between carburetor and rubber flange as before. If no seal is installed, the vacuum channel for the vacuum governor may be blocked, which will make the vacuum governor inoperable.

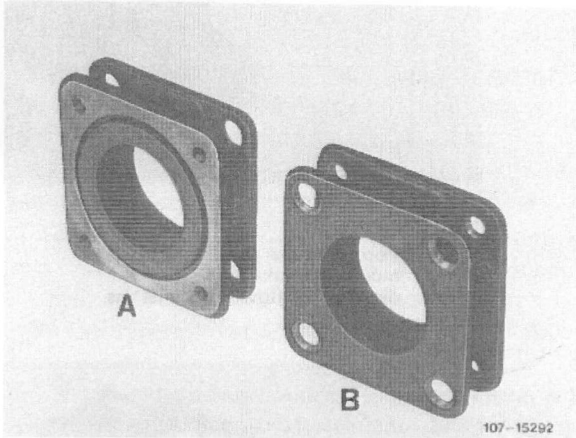


Fig. 176

A former rubber flange
B modified rubber flange

The intake pipe is attached by means of two lugs which engage in air filter housing recesses.

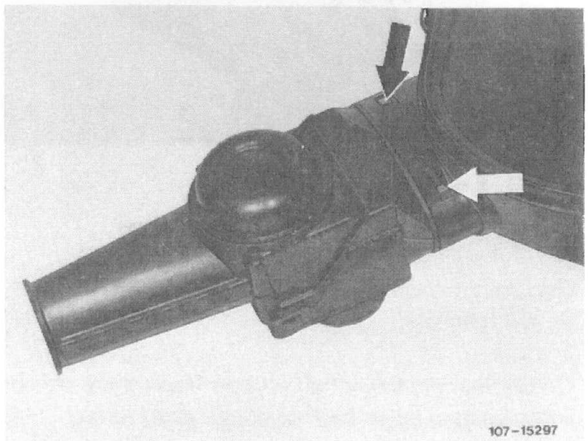


Fig. 177

Arrows fastening lugs

Cylinder Crankcase

For reasons of standardization the cylinder dia. has been reduced from 91 mm to 90.9 mm. This corresponds to a change of displacement from 2404 cc to 2399 cc.

The oil return bore in cylinder crankcase (arrow) has been increased from 12 mm dia. to 14 mm dia. and displaced further toward the rear by approx. 2 mm.

In this cylinder crankcase, pistons of 91 mm dia. cannot be installed.

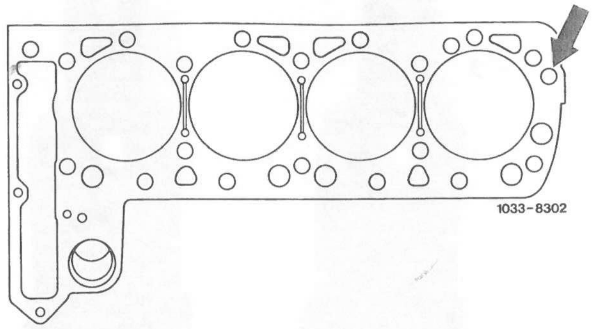


Fig. 178

Piston

For better distribution or swirling of fuel-air mixture in combustion chamber the piston crown ist provided with a star-shaped combustion chamber cavity (B). In addition, the piston has a smaller diameter (90.9 mm). The star-shaped recesses are in uniform alignment with combustion bores in prechamber (B, Fig. 179).

Do not install piston with reduced diameter and former round combustion chamber cavity (B) in this engine.

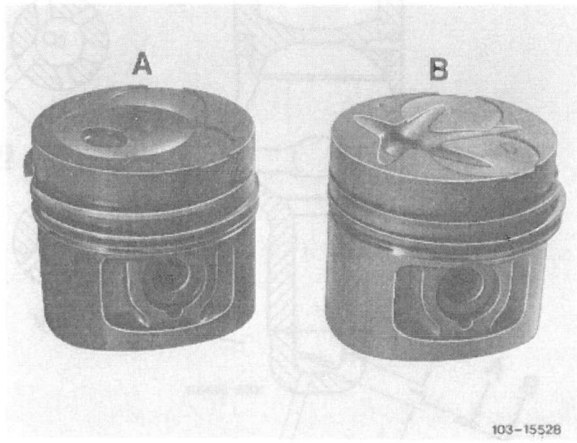


Fig. 179

A Former piston version
B Present piston version

Prechambers

Only minor changes with regard to output were made on prechambers:

On prechamber lower half (burner neck) there are not 5 combustion bores (burner bores) as on former prechamber, but 6 such bores with varying diameter at varying levels and angle positions (Fig. 180 and 181).

One of the burner bores is in prechamber bottom. The spherical shape of prechamber bottom provides for uniform wall thickness in range of burner bores.

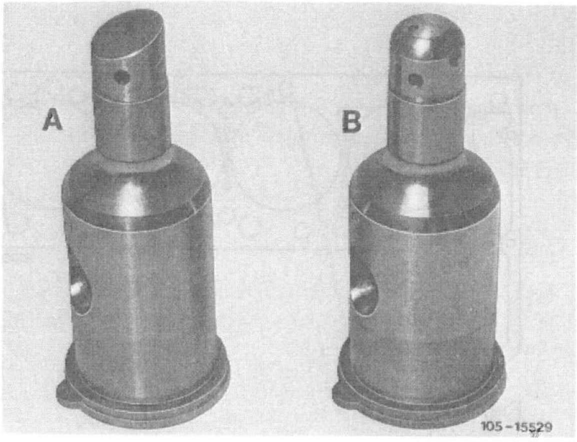


Fig. 180

A Former prechamber
B Present prechamber

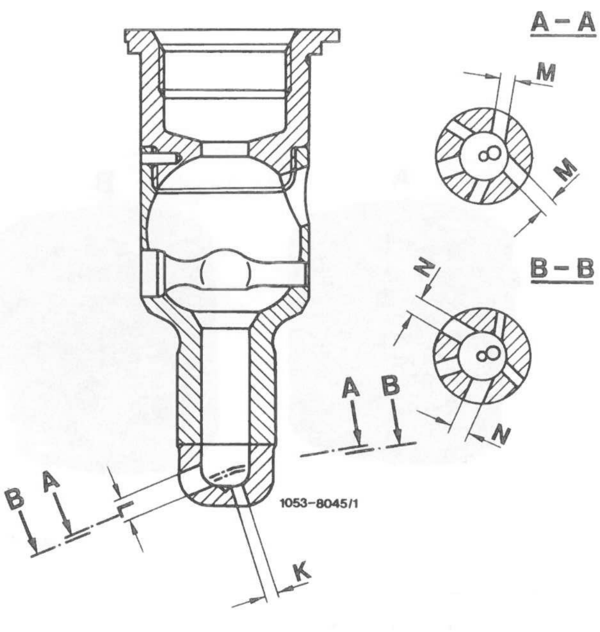


Fig. 181

K Burner bore 2 mm dia.
L Burner bore 3.5 mm dia.
M Burner bore 2.5 mm dia.
N Burner bore 3.2 mm dia.

In installed condition, the prechamber is identified by the code numer "616 01" punched into collar.

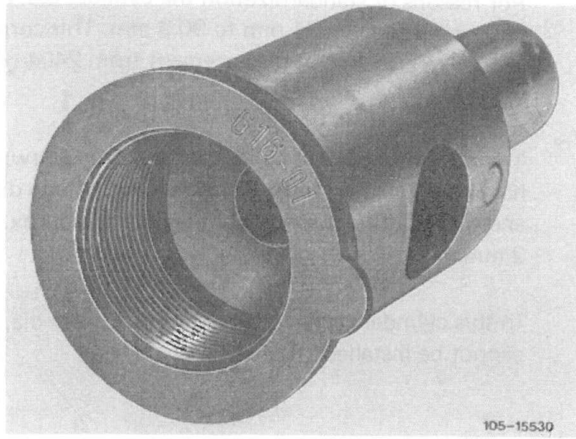


Fig. 182

Do not install former prechamber (A, Fig. 180) in this engine, since it would knock against piston crown.

Camshaft and Rocker Arm

The improved cylinder charge required for increased output, has been attained by increasing the valve stroke. For this purpose, the intake and exhaust cams on camshaft have been changed both in height and shape.

Since the change results in higer loads on camshaft, a different composition and pairing of materials between camshaft and rocker arm has been applied.

The camshaft (code number 10) is a chilled die casting and the pertinent rocker arms are provided with a brazed-on hard metal coating as a sliding surface.

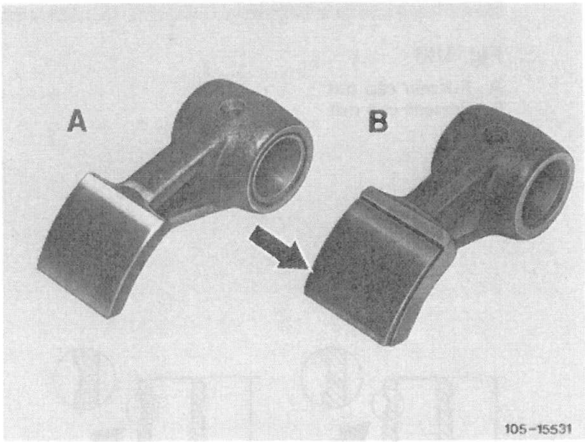


Fig. 183

A Former rocker arm version
B Present rocker arm version

The camshaft timing is shown in section "Testing and Adjusting Values".

The valve clearance remains the same.

To use camshaft with the higher cams, the bearing dia. (D) at camshaft bearings 2 and 3 had to be increased by 2.5 mm.

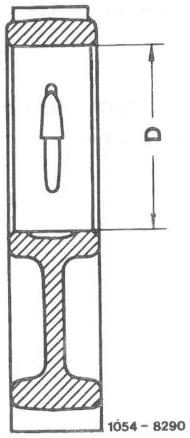


Fig. 184

D 49 mm dia. (formerly 46.5 mm dia.)

Accordingly, bearing journals 2 and 3 of camshaft were also given a diameter larger by 2.5 mm (D).

Camshaft bearings 2 and 3 were additionally reinforced.

The 1st camshaft bearing and the 1st camshaft bearing journal have not been changed.

In the event of repairs, do not install the former camshaft and rocker arm (A, Fig. 183) in this engine.

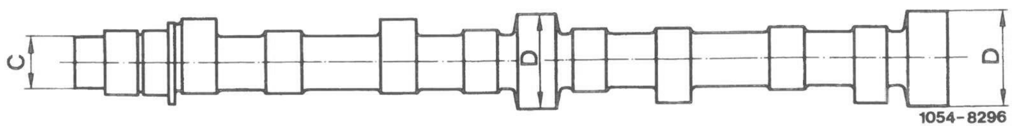


Fig. 185

C 35 mm dia.
D 49 mm dia. (formerly 46.5 mm dia.)

Cap Nuts

Cap nuts were reinforced in upper range and are plated with hard chromium.

These cap nuts can also be installed in former engine types.

On the other hand, the former cap nuts may not be used for the new, more powerful engine.

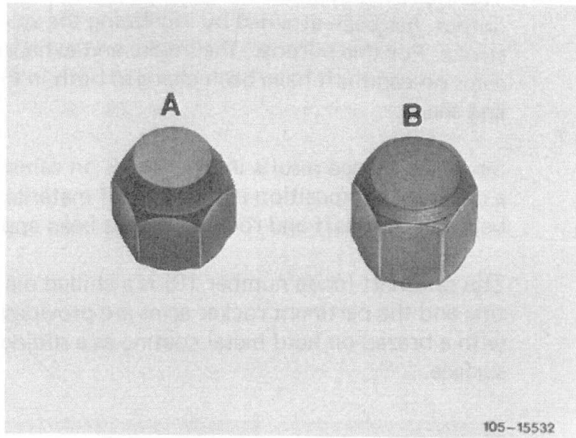


Fig. 186
A Former cap nut
B Present cap nut

Valve Guides

The larger valve stroke required shortening of valve guides by 1 mm.

Simulateneously, the groove (arrow) for the valve stem seal has been given another shape. The distance between the cylinder head parting surface and the bottom edge of the valve guide has not been changed (refer to Job No. 05.4-135).

Do not install former valve guides in this engine.

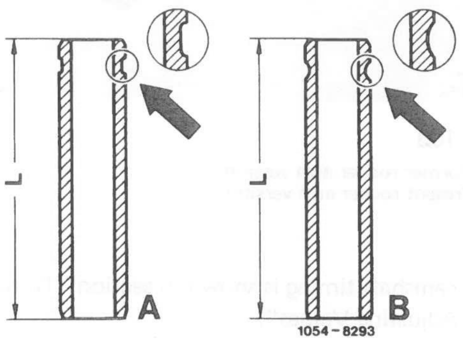


Fig. 187

A Former valve guides
Intake L = 61.00 mm
Exhaust L = 49.50 mm

B Present valve guides
Intake L = 60.00 mm
Exhaust L = 48.50 mm

Valve Stem Seals

The sealing lip on valve stem seals has been moved further down. This change prevents the holding groove on valve stem from diving under sealing lip when the valve is opened and will keep oil out of combustion chamber. The new valve stem seal is shorter and has a different shape.

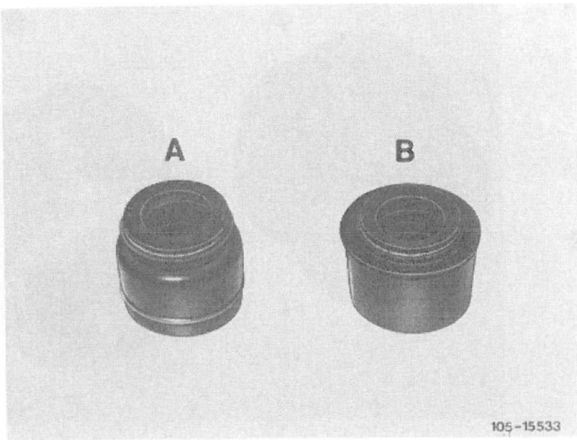


Fig. 188
A Former valve stem seal
B Present valve stem seal

In the event of repairs, do not install the former valve stem seal in this engine. Due to the changed shape, use new mandrel, part No. 617 589 00 43 00 for positioning valve stem seal.

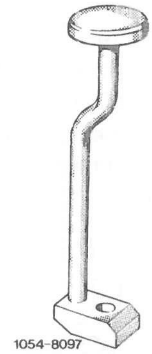


Fig. 189

Cylinder Head Gasket

The oil return hole (arrow) on cylinder head gasket has been enlarged from 13 mm dia. to 14 mm dia. and the gasket edge has been widened at this point.

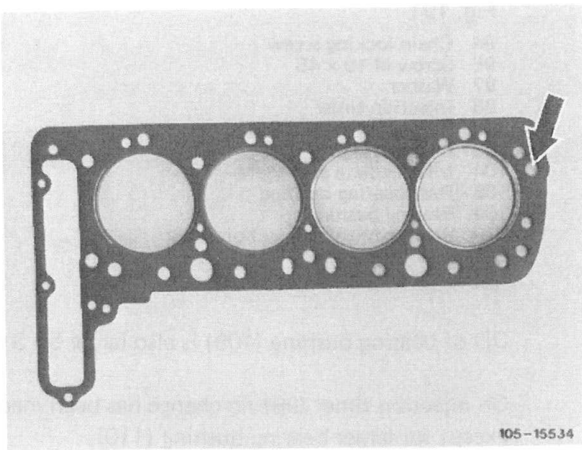


Fig. 190

Intermediate Gear Shaft and Injection Timer

The attachment of the injection timer on the intermediate gear shaft and the oil supply of the injection pump required a new intermediate gear shaft (104) and changes on bearing bushings (102, 105 and 109).

The injection timer (98) is attached to intermediate gear shaft by means of a screw M 10 x 45 (95) (Tightening torque 40 Nm (4 kpm). Using screw (95) required increasing the OD of intermediate gear shaft (104) and ID of bearing bushings (102 and 109) by 1.3 or 2.0 mm.

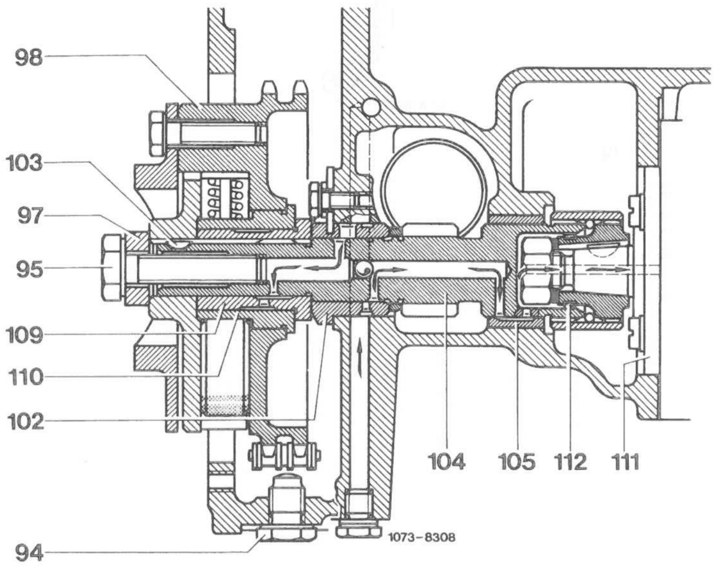


Fig. 191

94 Chain locking screw
95 Screw M 10 x 45
97 Washer
98 Injection timer
102 Front bearing bushing
103 Woodruff key
104 Intermediate gear shaft
105 Rear bearing bushing
109 Bearing bushing
110 Bearing bushing injection timer
111 Injection pump
112 O-ring

OD of bearing bushing (109) is also larger by 3 mm.

On injection timer (98) no change has been made except for larger bearing bushing (110).

Mistakes are therefore impossible.

The injection pump is provided with the oil required for lubrication via intermediate gear shaft. For this purpose, an additional oil bore (Fig. 192 and 193) has been made in bearing bushing (102) and in intermediate gear shaft (104).

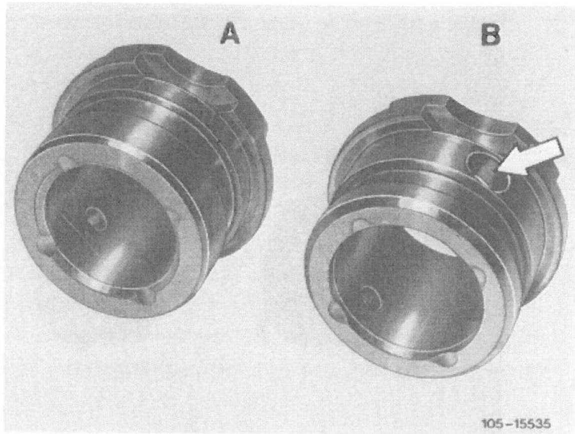


Fig. 192

A Former front bearing bushing
B Present front bearing bushing

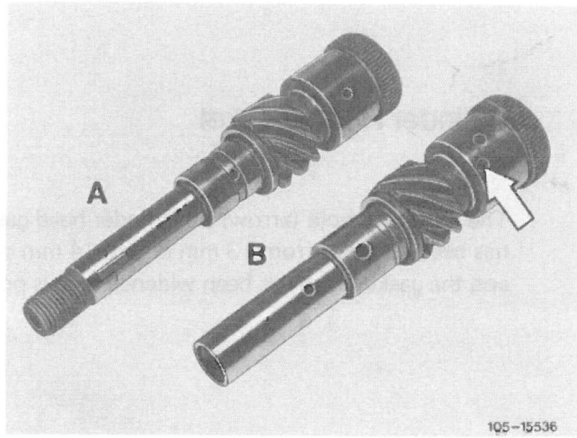


Fig. 193

A Former intermediate gear shaft
B Present intermediate gear shaft

In addition, the bearing bushing (105) has been provided with an oil groove (arrow).

Do not install former parts in this engine.

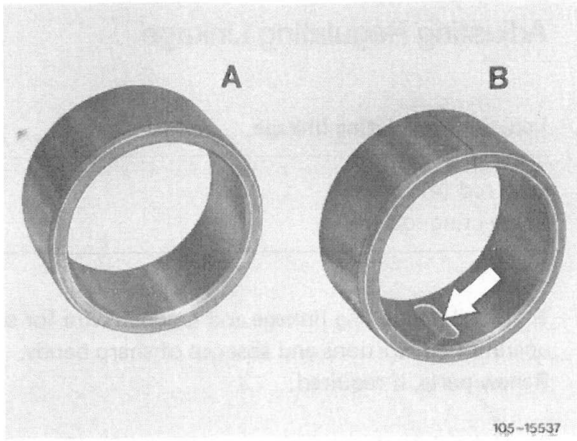


Fig. 194

A Former rear bearing bushing
B Present rear bearing bushing

Adjusting Regulating Linkage

Length of regulating linkage

Push rod (4)	180 mm
Connecting rod (6)	148 mm

1 Check regulating linkage and bowden wire for easy operation, distortions and absence of sharp bends. Renew parts, if required.

2 Unhook both regulating rods (4 and 6). (Fig. 195).

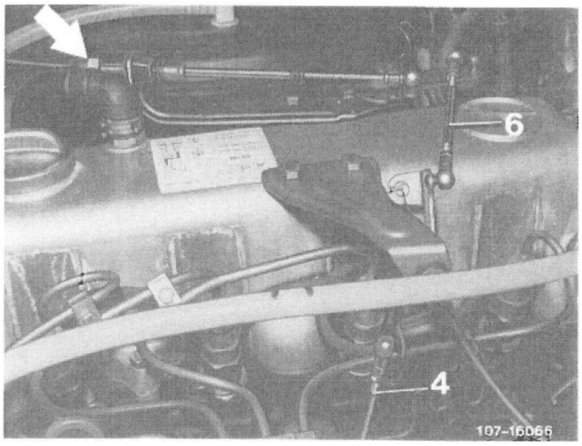


Fig. 195
4 Push rod
6 Connecting rod

3 Check whether regulating lever (1) of injection pump rests against idle speed stop inside injection pump (Fig. 196).

4 Adjust push rod (4 and 6) to specified length measured from center to center of ball socket and join (Fig. 195).

5 Check full throttle stop. With the engine stopped, step down on accelerator pedal from inside vehicle to full throttle stop or with automatic transmission down to stop on kickdown switch. Accelerator pedal and regulating lever (1) should rest against full throttle stop (2). If required, adjust by means of adjusting screw (arrow) bowden wire in such a manner that the regulating lever (1) rests against full throttle stop (2) (fig. 195 and 196).

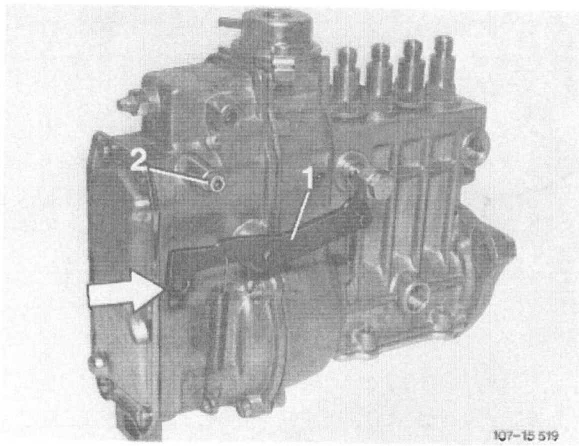


Fig. 196
1 Regulating lever
2 Full throttle stop

6 Adjust control pressure rod.

The control pressure rod is attached to bore (arrow) of regulating lever (1) on injection pump (Fig. 196).

Loosen fastening screw (1) on control pressure rod (3). Apply full throttle at guide lever on cylinder head cover. Regulating lever should rest against full throttle stop on injection pump and the control pressure rod against full throttle stop of automatic transmission. Tighten fastening screw (1) again.

Note: Compression spring (2) will pull automatic transmission also to full throttle (Fig. 199).

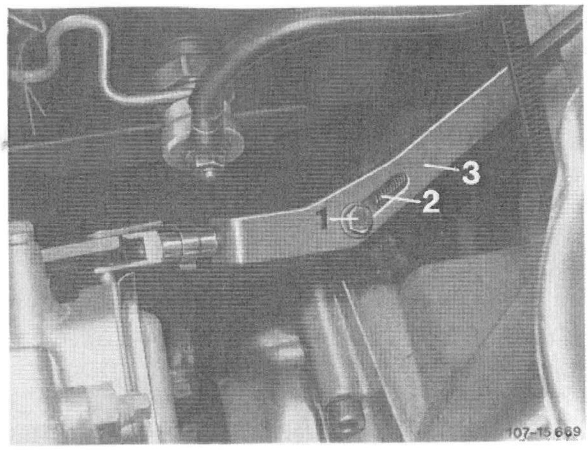


Fig. 199

1 Fastening screw
2 Compression spring (covered)
3 Control pressure rod

Air-oil Cooler

The air-oil cooler is no longer installed on vehicles without air-conditioning system.

Oil Filter

On vehicles without air-conditioning system the oil filter of engine 615 is installed (no connections for air-oil cooler).

Radiator

The elimination of the air-oil cooler provides vehicles without air-conditioning system with a radiator of increased block depth (cooling surface) and a fan cover modified accordingly.

Heating Water Feed Hose

The longitudinal regulating shaft required a different shape of the heating water feed hose (arrow).

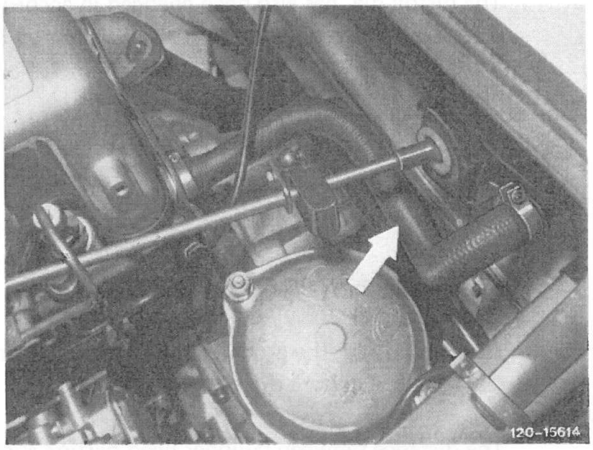


Fig. 200

Cylinder Crankcase

To avoid exceeding a displacement of 3000 cc, the cylinder diameter has been reduced from 91 mm to 90.9 mm.

This corresponds to a displacement of 2998 cc. Pistons of 91 mm dia. cannot be installed in this crankcase.

Piston

The piston dia. has also been changed in accordance with the smaller cylinder bore dia.

These pistons are not interchangeable with former piston version.

Valve Guides

Valve guides have been shortened by 1 mm.

Simultaneously, the groove (arrow) for valve stem seal has been given a different shape.

The distance between cylinder head parting surface and bottom edge of valve guide has not been changed (refer to job No. 05.4–135).

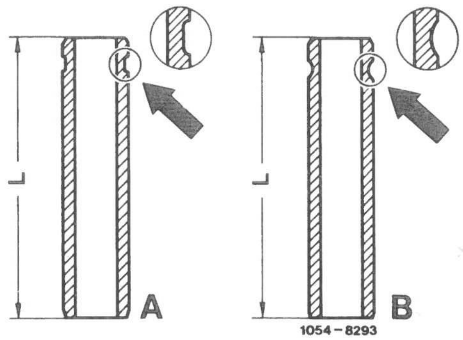


Fig. 201

A Former valve guides
Intake L = 61 mm
Exhaust L = 49.5 mm

B Present valve guides
Intake L = 60 mm
Exhaust L = 48.5 mm

Expansion Tank

The stepped tandem-main cylinder is provided with a modified expansion tank with now 2 contact elements.

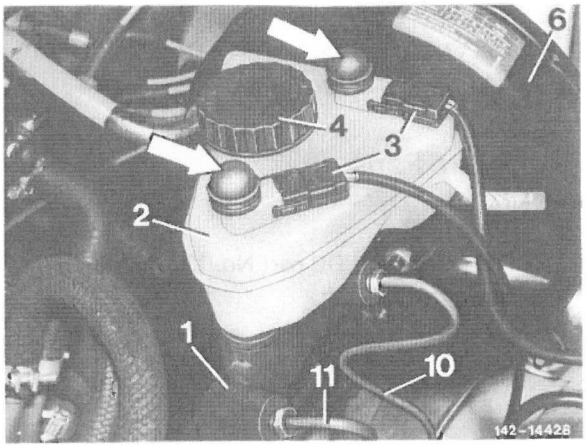


Fig. 202

Brake Unit Models 123 only

Instead of the 9" brake booster these models are now provided with a 10" booster. This will increase the boost factor from approx. 3 to approx. 3.8.

Steering arms are provided with stop lugs which serve as an additional stop in addition to inside stops of power steering.

Spare Parts

Pitman arm RL DB part No. 123 463 56 01 (code No. 2356).

Intermediate steering arm RL DB part No 123 463 32 10 (code No. 2333).

On all vehicles with gasoline engines the following components are modified as of now:

Vent Valve

The vent valve known from Model Year 1978. (Fig. 203), is replaced by vent valve (Fig. 204). Function and operation are the same.

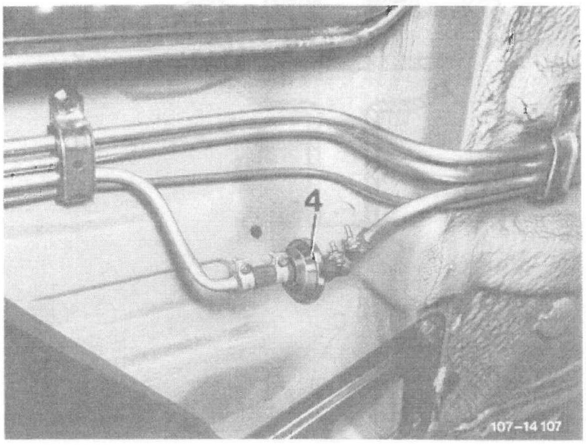


Fig. 203

Old vent valve

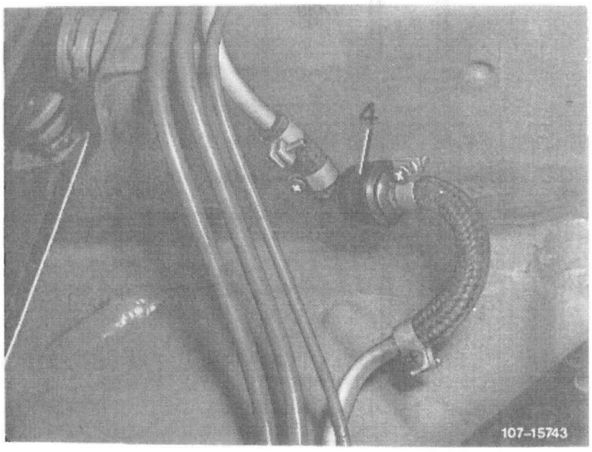


Fig. 204

New vent valve

Purge Valve

In addition to the known purge valve (Fig. 205) a new purge valve (Fig. 206) has been additionally released. Function and operation are the same and the valves are therefore interchangeable.

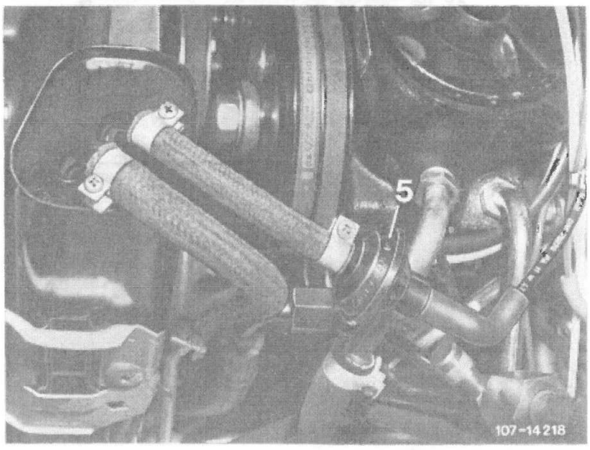


Fig. 205

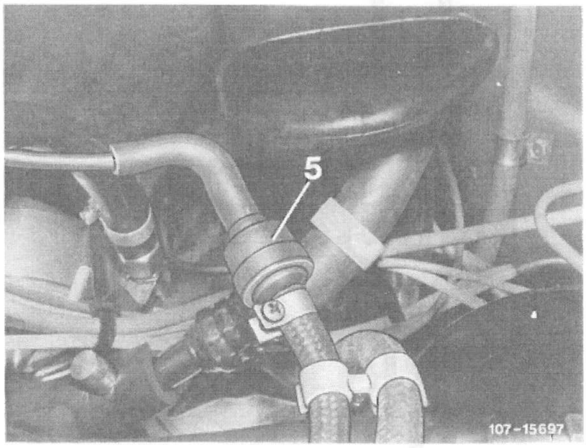


Fig. 206

Purge valve

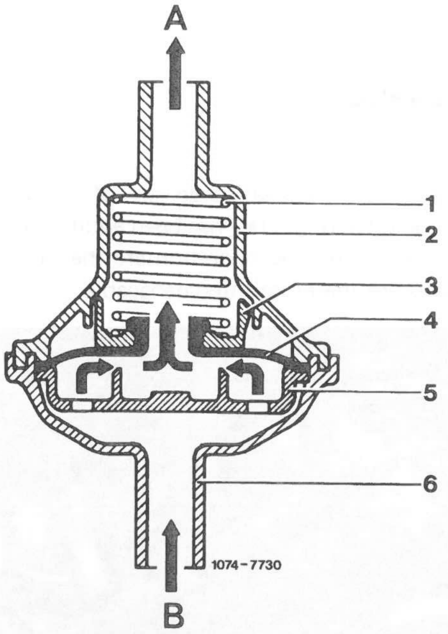


Fig. 207

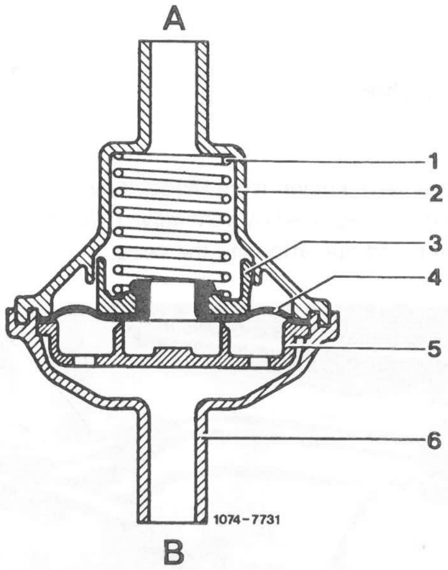


Fig. 209

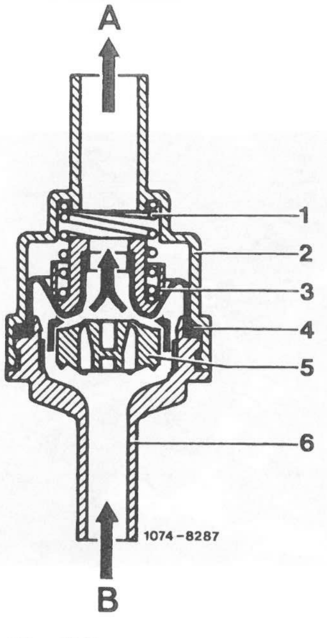


Fig. 208

Purge valve opened

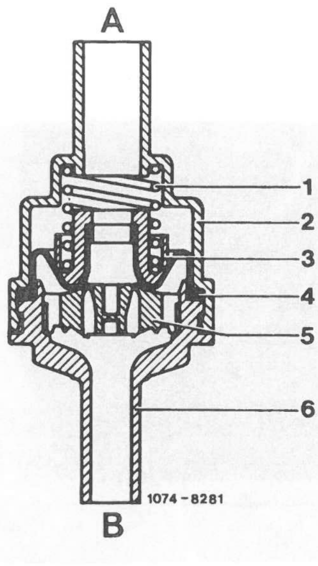


Fig. 210

Purge valve closed

1 Compression spring
2 Valve housing
3 Spring retainer
4 Negative venting valve
5 Valve plate
6 Connection
A Connection throttle valve housing
B Connection charcoal canister

All maintenance jobs not listed here remain unchanged and can be looked up in the existing "Maintenance Manual".

020 Hydropneumatic Suspension – Check Rubber Sleeves of Ball Joints on Tube Shocks

Model 116.036

First and second service, then every 15000 km

See Maintenance Manual for work procedure

086 Hydropneumatic Suspension – Check Systems for Leaks and Condition

Model 116.036

First and second service, then every 15000 km

See Maintenance Manual for work procedure

139 Hydropneumatic Suspension – Check and Correct Fluid Level

Model 116.036

First and second service, then every 15000 km

See Maintenance Manual for work procedure

628 Hydropneumatic Suspension – Check Pressure Reservoir and Central Reservoir for Gas Filling Pressure

Model 116.036

Every 45000 km

See Maintenance Manual for work procedure

631 Renew Grease Charge of Front Wheel Bearing, Check Tapered Roller Bearing

Every 45000 km

Model 116.036

See Maintenance Manual for work procedure

756 Retension V-Belts

First service

Engine 100.985

See Maintenance Manual for work procedure

797 Checking and Adjusting Idle Speed Adjuster

2nd service and then every 15 000 km

Engine 616.912

Turn knob on instrument panel completely to the right. Bowden wire should rest free of tension against plastic clip (arrow). Adjust with adjusting screw (2), if required.

With the engine stopped, accelerate by means of accelerator pedal while simultaneously turning knob for idle speed adjuster counterclockwise.

Keep engine running. Speed should now amount to 1000–1100/min. Adjust with adjusting screw (2), if required.

Attention!
When the speed is set higher, the idle speed control range will be abandoned. As a result, the engine speed can now increase up to max. speed (under no-load conditions).

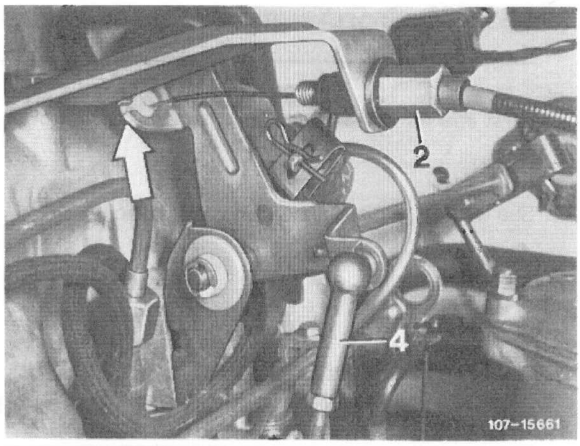


Fig. 211

798 Checking and Readjusting Idle Speed

2nd service and then every 15 000 km

Engine 616.912

Test values

Idle speed	750/min (by ear)

Run engine to 60–80 °C engine oil temperature.

Turn knob for idle speed adjuster on instrument panel completely clockwise.

Unhook push rod (arrow) and adjust idle speed by ear to n = 750/min by means of idle speed adjusting screw (4) after loosening counter nut (3).

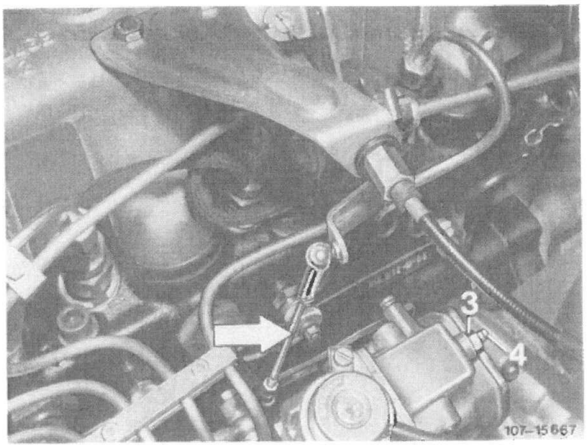


Fig. 212

798 Check Idle Speed with CO-Tester and Adjust

First and second service, then every 15000km

Engine 100.985

For checking or adjusting idle speed and idle speed emission value the air injection must be switched off. Pull vacuum hose (arrow) from 3-way distributor and close connection.

See Maintenance Manual for work procedure engine 117.

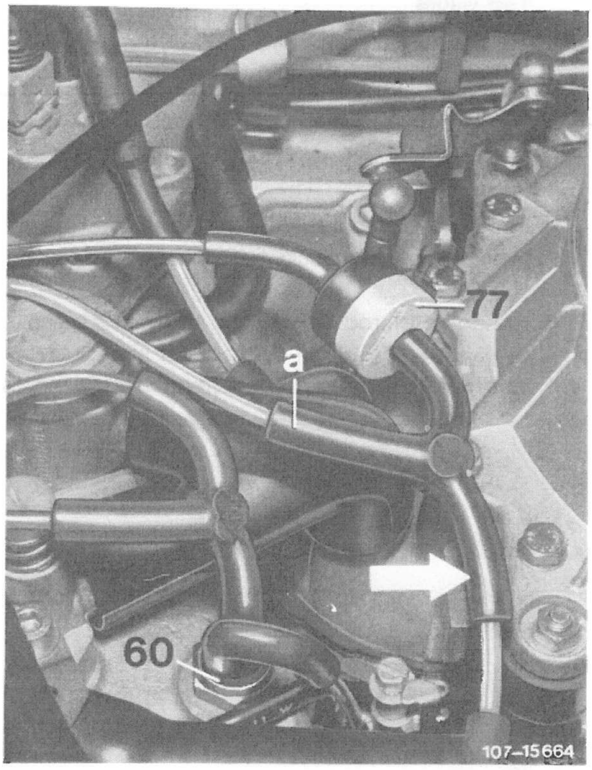


Fig. 213

Connection to anti-backfire valve (arrow)

Engine

Model		123.123	123.130
Engine		616.912	617.912
Operation		four-stroke diesel MB prechamber method	
No. of cylinders		4	5
Cylinder arrangement		upright in line	
Bore/stroke	mm	90.90/92.4	
Total displacement eff.	cm^3	2399	2998
Compression ratio	ϵ	21 : 1	
Firing order		1–3–4–2	1–2–4–5–3
Max. speed without load or cycle completed	1/min	5300	5100
Engine power DIN[1])	kw (HP) at 1/min	53(72)/4400	59 (80)/4000
Torque max. DIN	Nm (mkp) at 1/min	137 (14)/2400	172 (17.5)/2400
Crankshaft bearing		5	6
Valve arrangement		overhead	
Camshaft arrangement		overhead	
Oil cooling		air-oil cooler with thermostatic feed control	
Cooling		water circulated by pump, thermostat with bypass disc, plastic fan (on engine 617.912 viscofan coupling, light metal fan) finned tube radiator	
Lubrication		oil pressure circulation lubrication by means of gear pump	
Oil filter		combination main and bypass filter	
Air filter		dry air filter with paper cartridge	

1) The stated power in kW (HP) is effectively available at vehicle clutch, since all auxiliary requirements have already been deducted.

Model	123.123	123.130
Engine	616.912	617.912

Driving performance with manual transmission

With rear axle ratio of		i =	3.69	3.46
Max. speed in individual gears	1st	km/h	39	38
	2nd	km/h	63	64
	3rd	km/h	103	104
	4th approx.	km/h	143	148
Climbing ability	1st gear slip limit	%	41	41
	2nd	%	22	23
	3rd	%	12	13
	4th	%	7.5	8.5
Acceleration shifting through gears 0–100 km/h Load: 2 persons		s ± 7 %[1])	22.0	19.9
Engine speed at 100 km/h in 4th gear		1/min	3195	2995

Driving performance with automatic transmission

With rear axle ratio of		i =	3.69	3.46
Max. speed in individual gears	1st	km/h	34	36
	2nd	km/h	63	64
	3rd	km/h	103	104
	4th approx.	km/h	138	143
Climbing ability	1st gear slip limit	%	42	41
	2nd	%	36	41
	3rd	%	14	17
	4th	%	7	9
Acceleration shifting through gears 0–100 km/h Load: 2 persons		s ± 7 %[1])	24.7	20.8
Engine speed at 100 km/h in 4th gear		1/min	3280	3090

Consumption data and operating conditions

Fuel consumption during average inter-city driving		l/100 km[2])	8–11	8–13
Fuel consumption according to DIN 70030[3])		l/100 km	9.5	10.8
Engine oil consumption		l/100 km	max. 0.25	
Coolant	coolant temperature up to max.	approx. °C	126	
	within control range of thermostat	approx. °C	80–95	
Fuel			Diesel	

[1]) The range "± 7 %" comprises not only the dispersions as a result of the permissible output tolerance, but also the possibility of permissible deviations caused by the tires.
[2]) On vehicles with automatic transmission the fuel consumption is slightly higher.
[3]) Determinded at 3/4 of max. speed, max. 110 km/h adding 10 %.

Engine

Engine		100.985
Operation		4-stroke Otto, mechanical gasoline injection with metered air volume
Number of cylinders		8
Cylinder arrangement		V-shape 90°
Bore/stroke	mm	107/95
Total displacement, eff.	cm^3	6,834
Compression ratio	ϵ	8 : 1
Firing order		1–5–4–8–6–3–7–2
Max. speed	1/min	5,300
Engine power DIN[1])	kw (HP) at 1/min	198 (26.9)/4200
Torque max. DIN	Nm (mkp) at 1/min	510 (52)/2800
Crankshaft bearings		5 multi-component plain bearings with steel-backed shells
Valve layout		overhead
Camshaft layout		1 overhead camshaft for each cylinder row
Oil cooling		Air-oil cooler
Cooling		water circulated by pump, thermostat with bypass disc, viscofan coupling, light metal fan, finned tube radiator
Lubrication		oil pressure circulation lubrication by means of gear pump
Oil filter		Main flow filter with paper cartridge
Air filter		dry air filter with paper cartridge

[1]) The stated power in kW (HP) is effectively available at vehicle clutch, since all auxilliary requirements have already been deducted.

Model 116.036 (450 SEL 6.9)
Technical Data

Dimensions

Vehicle	Length	mm	5,060
	Width	mm	1,879
	Height (ready-to-drive)	mm	1,410 + 40 (by raising level)
Wheel base		mm	2,960
Track width	front	mm	1,521
	rear	mm	1,505
Wheel lock	inside	approx. degrees	42
	outside	approx. degrees	32.5
Turning circle min. dia		m	12.06

Weights

Vehicle deadweight acc. to DIN 70 020 ready-to-drive, with full fuel tank, spare wheel and tools		kg	1,955
Perm. total weight		kg	2,410
Perm. axle load	front/rear	kg	1,220/1,190

Electrical System

Battery	Voltage Capacity	V Ah	12 88
Starter	Bosch		GB 12 V 1.5 HP
Alternator	Bosch Capacity max.	 W	N 1 – 14 V 75 A 20 1,050

Filling capacities

Fuel tank/reserve		fuel	approx. l	96/13
Engine	initial capacity	engine oil	approx. l	12
	during oil and filter change	engine oil	approx. l	11
	Total capacity in dry sump oil tank	engine oil max./min.	l	12/10
	oil filter	engine oil	l	1.5
Cooling system with heater		coolant	approx. l	16
Water pump				maintenance-free
Brake system and clutch actuation		brake fluid	approx. l	0.5
Automatic transmission		automatic transmission fluid (ATF)	approx. l	8.9 initial capacity 7.9 oil change
Rear axle hypoid gear oil SAE 90			approx. l	1.3
Power steering		ATF or manual transmission oil	approx. l	1.4

Driving performance with automatic transmission

With rear axle ratio of		i =	2.65
Max. speed in individual gears	1st	km/h	105
	2nd	km/h	170
	3rd approx.	km/h	220
Climbing ability	1st gear slip limit	%	40
	2nd	%	40
	3rd	%	17
Acceleration shifting through gears 0 – 100 km/h Load: 2 persons		s ± 7 %[1])	7.4
Engine speed at 100 km/h in 3rd gear		1/min	2,250

Consumption data and operating conditions

Fuel consumption during average inter-city driving		l/100 km[2])	15 – 26
Fuel consumption according to DIN 70 030[3])		l/100 km	17.0
Engine oil consumption		l/100 km	max. 0.25
Coolant	coolant temperature up to max.	approx. °C	126
	within control range of thermostat	approx. °C	85 – 100
Fuel			Super (Premium)
Octan rating	min. RON		91
	min. MON		81

[1]) The range "± 7 %" comprises not only the dispersions as a result of the permissible engine output tolerance, but also the possibility of permissible deviations caused by the tires.
[2]) On vehicles with automatic transmission the fuel consumption is slightly higher.
[3]) Determined at 3/4 of max. speed, max. 110 km/h adding 10 %.

Engine 616.912

Group 05 **Minimum set B**

Part No. 617 589 00 43 00

Mandrel for pressing-on valve stem seal

Supplier 10


11004–8190

Group 07 **Minimum set C**

Part No. 617 589 00 09 00

Socket notched

17 x 20, 1/2" square

Supplier 10

Engine 100

Dwell angle (timing angle)

The installation of breakerless ignition cancels	checking of dwell angle during service jobs

Adjustment of firing point

Engine	Bosch ignition distributor designation	**Adjusting value** of firing point with vacuum	**Test values** of ignition timing without vacuum at			Vacuum adjustment in direction of		**Adjustment value** of ignition distributor
		at idle	1500/min	3000/min or 3500/min	4500/min	"retard" at idle	"advance" at 4500/min (total)	
100	0 237 405 002	**TDC**	9–16°	27–33° **3500/min**	–	6–10°	8–12°	7° before TDC

Spark plugs

100		Designation	MB part No.
Make	Bosch	W 125 T 30–W9D	002 159 25 03
	Beru	125/14/3A–14-9D	002 159 26 03
	Champion	N 12 Y	002 159 30 03
Electrode gap		0.8 mm	

Idle speed and idle speed emissions-adjusting values

Engine	Idle speed	Emission values at idle % CO
100	600	1.0–2.5 without air injection

Engine 616

Timing at 2 mm valve lift

Camshaft code number [1])	Intake valve opens after TDC	Closes after BDC	Exhaust valve opens before BDC	closes before TDC
10	11°	17°	25°	14°

[1]) Camshaft code number is punched into rear end of camshaft.