Disassembly and Reassembly of Engine

Job No. 01–4

Change: Models 180 c and 190 SL with new engine type designation added.

In the event of repairs normally only those assemblies and engine parts are removed, which have to be repaired or tested. The procedures are therefore subdivided. If an engine has to be completely disassembled, refer to the operations given in sections A to Q.

A. Removal and installation of carburetor or injection system including venturi control unit and control linkage.
B. Removal and installation of intake pipe and exhaust manifold.
C. Removal and installation of cylinder head, valves, camshaft, chain tensioner, sprocket bearing and rocker arm.
D. Removal and installation of generator and starter.
E. Removal and installation of water pump with fan.
F. Removal and installation of distributor with bearings.
G. Removal and installation of drive for oil pump, distributor, injection pump and revolution counter.
H. Removal and installation of fuel feed pump.
I. Removal and installation of oil filter.
K. Removal and installation of oil relief valves crankcase.
L. Removal and installation of oil pan.
M. Removal and installation of oil pump.
N. Removal and installation of counterweight and vibration damper on crankshaft.
O. Removal and installation of crankshaft with counterweight and flywheel.
P. Removal and installation of pistons and connecting rods.
Q. Disassembly and reassembly of crankcase.
R. Removal and installation of front grease seal for crankshaft with engine installed in vehicle.
S. Removal and installation of flywheel.
T. Removal and installation of roller chain with engine in vehicle.

Clean and check all removed parts and assemblies (refer to checking and repair procedures). Small damaged parts such as screws, nuts, washers, lock washers, etc. should be checked for re-use and replaced, if required. They should not be put back when damaged.

Definitely replace: Gaskets, sealing rings, locking plates, cotter pins, etc.

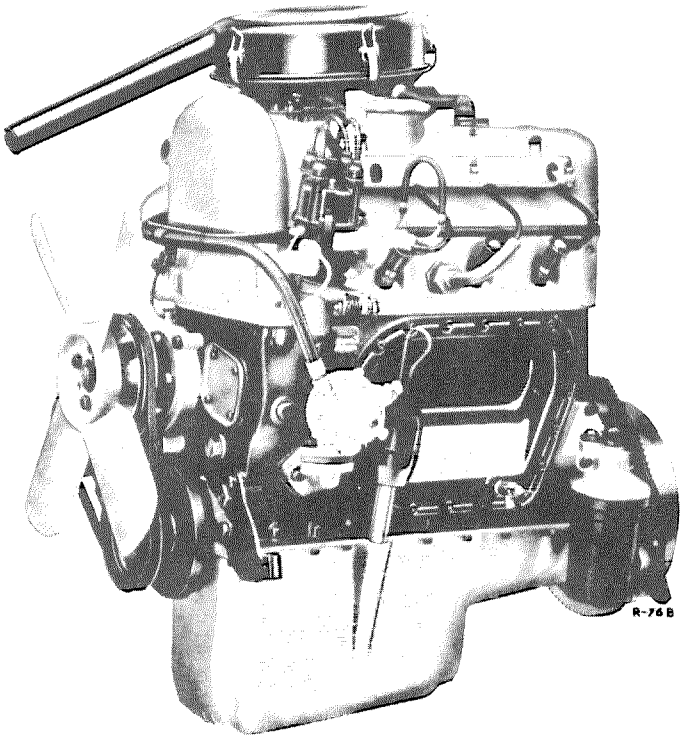
All ground and precision parts, above all the respective bearing surfaces, should be subjected to one more visual inspection prior to installation into engine.

If damaged, bearing surfaces should be refinished now. Also watch out for burrs.

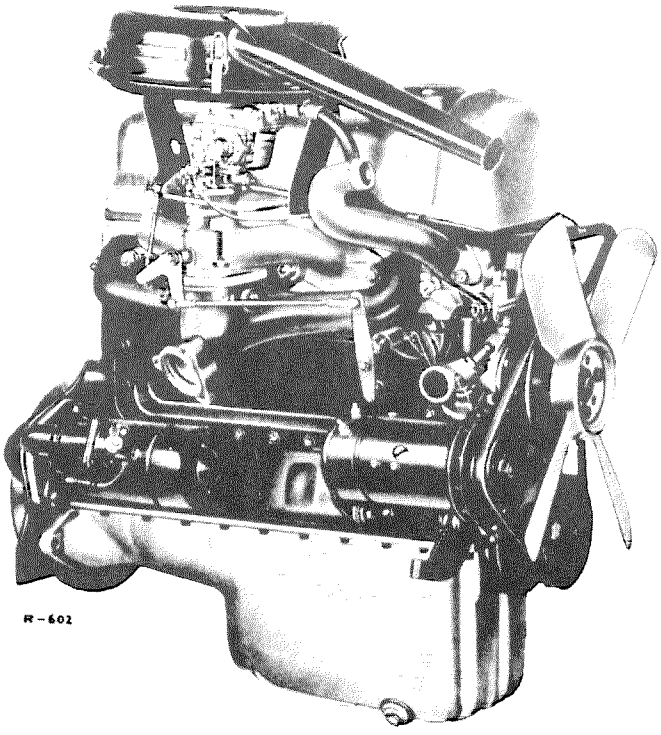
Engine M 121 B IV for Model 180 a

(Type Designation 121.923)

The pictures of the engine model 180 a show the earlier design. On later models the side walls of the cylinder crankcase, for example, have no cylinder cover. For further modifications see Job No. 01–4.
The engine for model **180 b** carries the designation **M 121 B IV–b** (type designation **121.923**).The engine for type **180 c** carries the designation **M 121 B VIII** (type designation **121.927**). Both engines have exactly the same outside appearance as the more recent engine for model 180 a.



Spark Plug Side

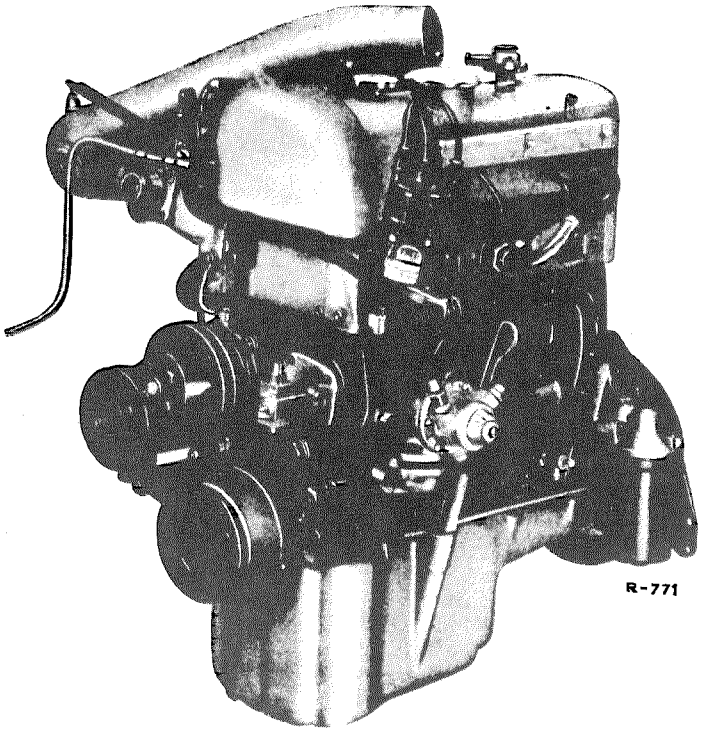


Carburetor Side

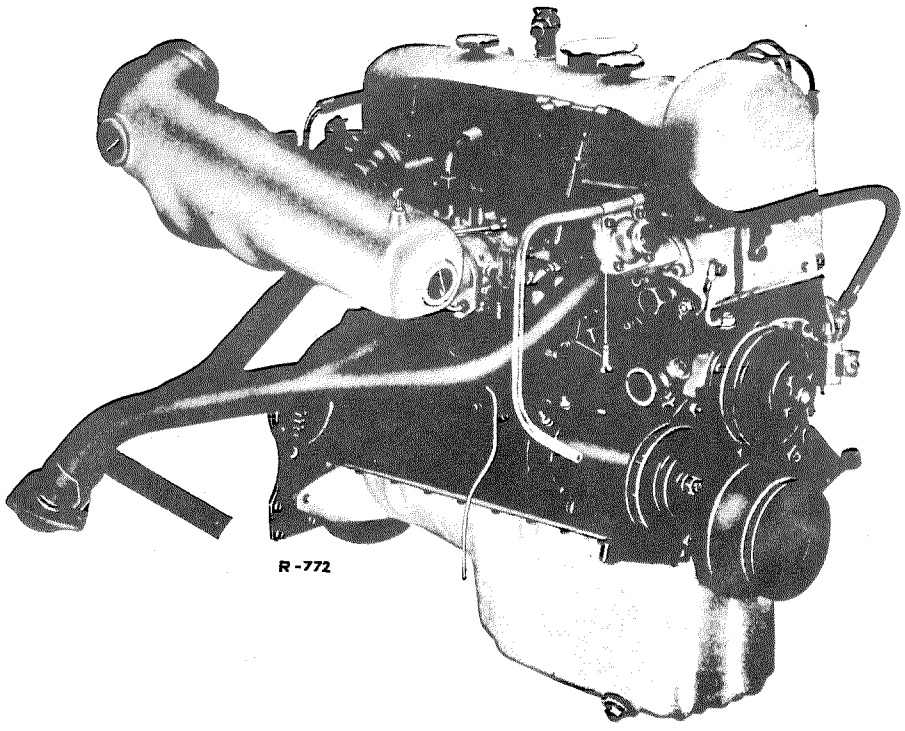
Engine M 121 B II for Model 190 SL

(Type Designation 121.921)

As from further modified valve timing with engine designation **M 121 B IX** and type designation **121.928**



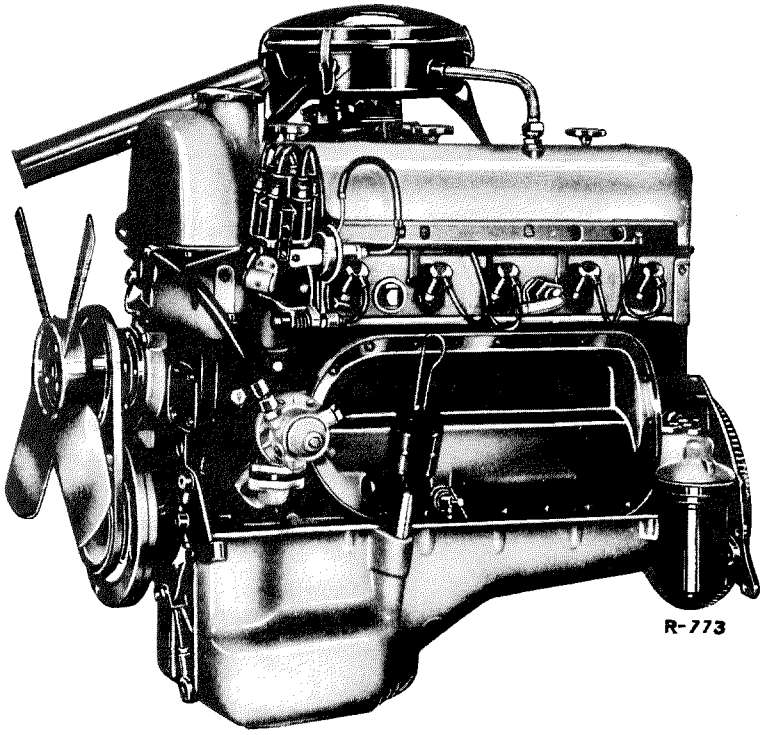
Spark Plug Side



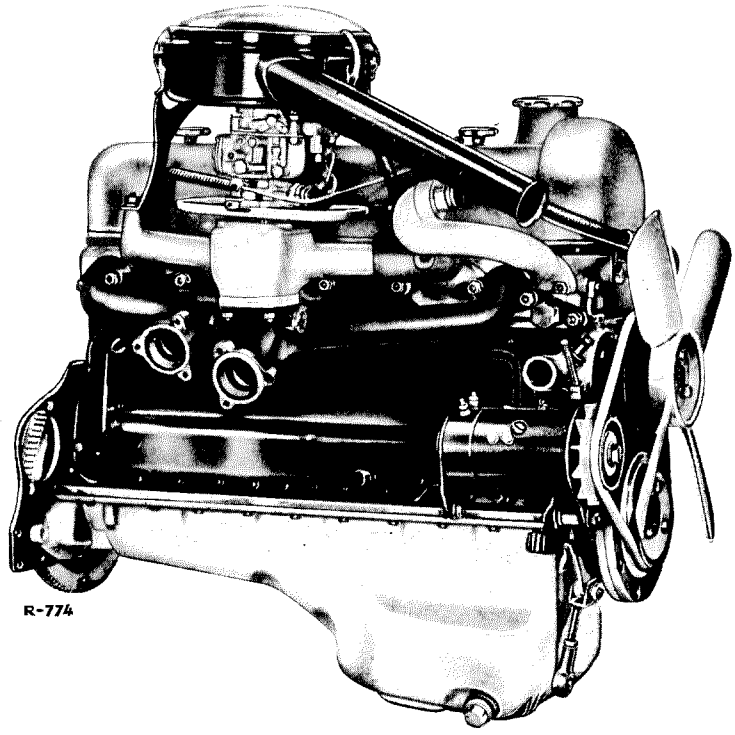
Carburetor Side

Engine M 180 II for Models 220 a and 219

(Type designation 180.921)



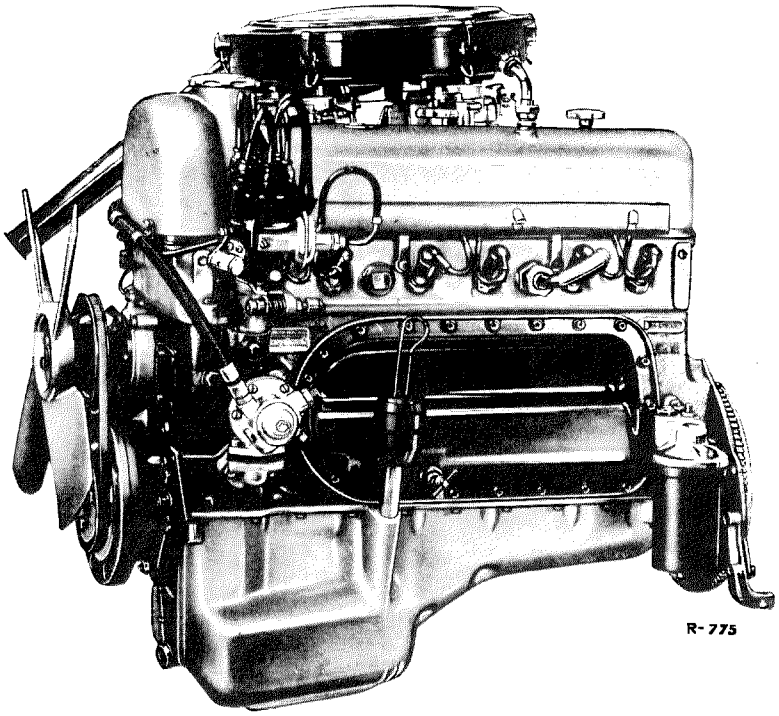
Spark plug side



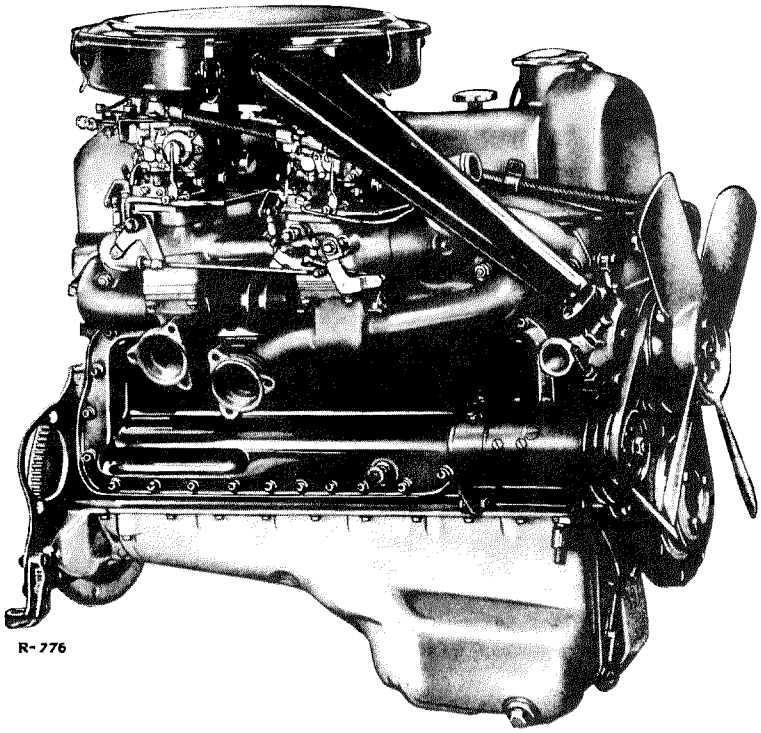
Carburetor side

Engine M 180 III for Model 220 S

(Type designation 180.924)



Spark plug side

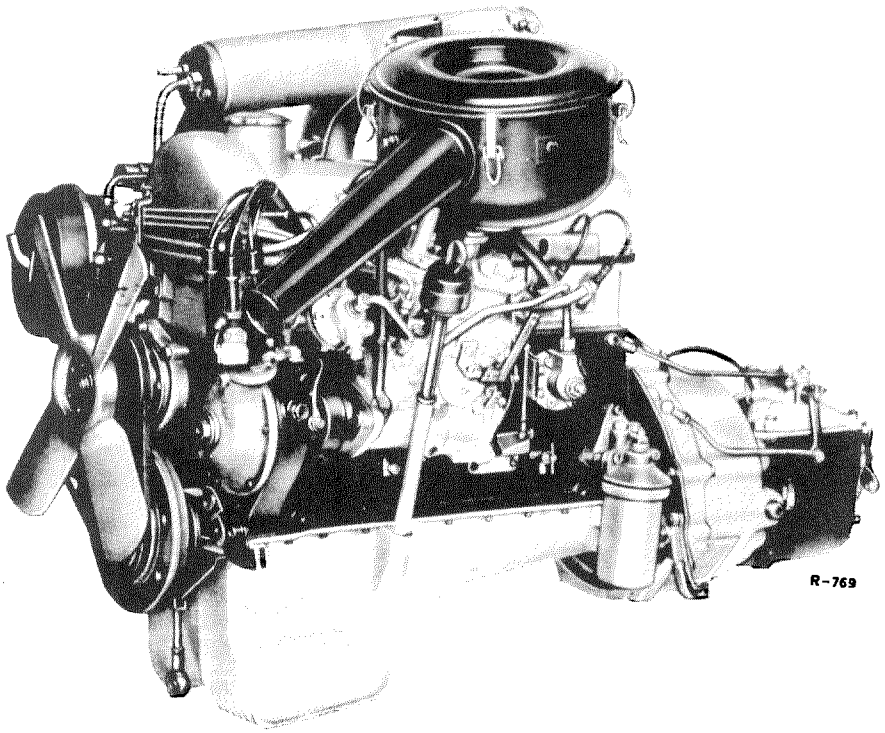


Carburetor side

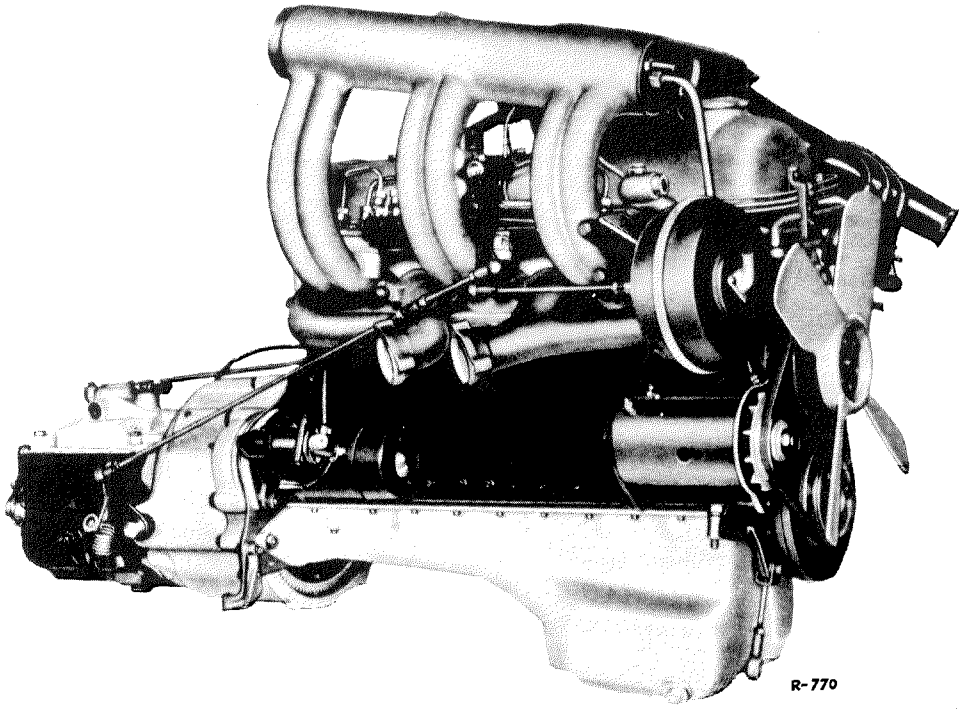
Engine M 127 I for Model 220 SE

for cars with hydraulic automatic clutch

(Type designation 127.980)



Injection pump side



Intake pipe side

A. Removal and Installation of Carburetor or Fuel Injection System including Venturi Control Unit and Control Linkage

I. Removal and Installation of Carburetor on Models 180 a, 180 b, 220 a, 219, and 220 S

For repair procedure see Job Nos. 07-0 and 07-4.

Removal:

1. Loosen the air vent line cap nut on the cylinder head cover and remove the air intake silencer.
   On Models 180 a and 180 b the air intake silencer is screwed to the two brackets; it is advisable to remove it together with the brackets. To do this, unscrew the fixing nuts for the brackets at the intake pipe.
   On Models 219 and 220 a the air intake silencer is fastened to the brackets by means of snap catches. The brackets need not therefore be detached from the intake pipe. On Model 220 S the intake silencer is fastened to the carburetors by means of two pipe clips. In order to remove the air intake silencer, the two clamping screws on the pipe clips must be loosened.

2. Unscrew the fuel line and the vacuum line to the distributor, **holding the pipe union at the carburetor steady.**

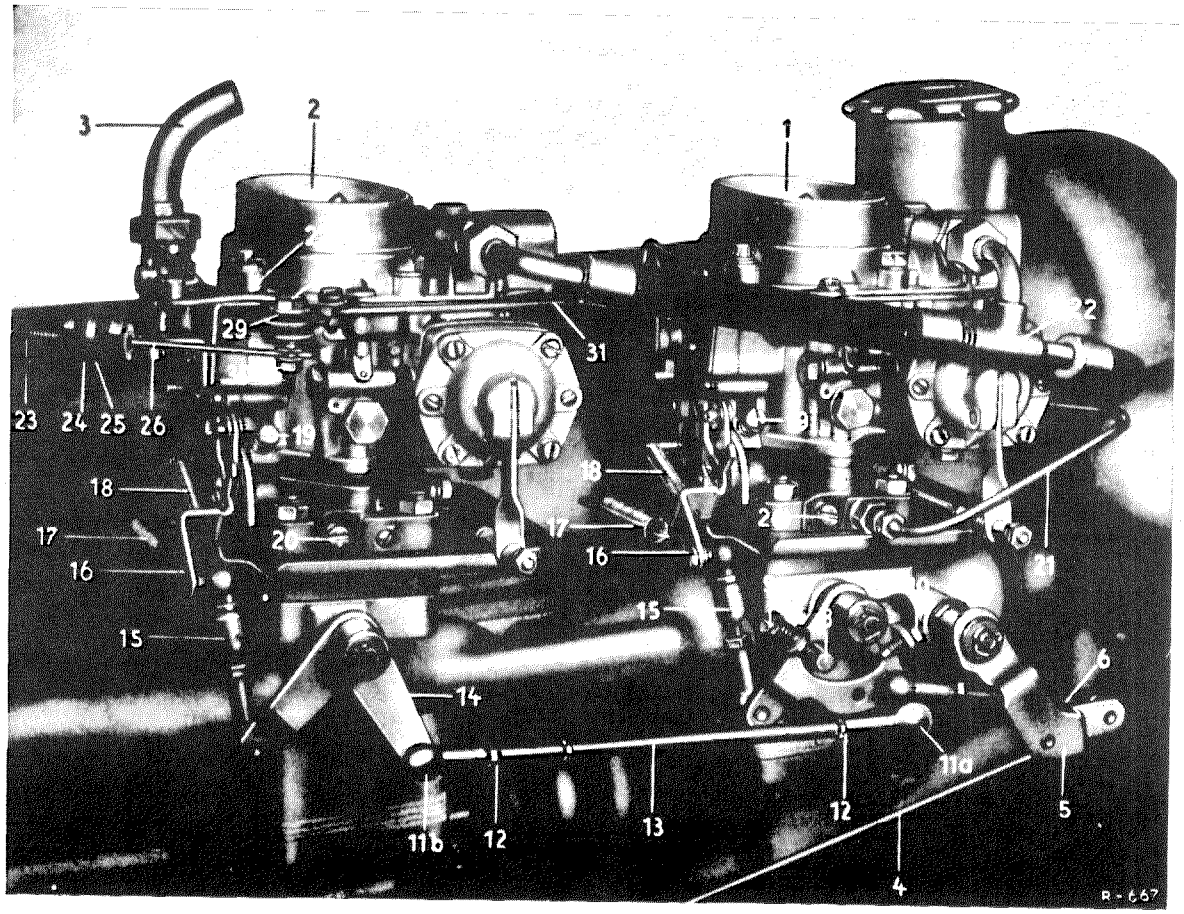


Fig. 01-4/1
Carburetor system for Model 220 S

1 Front carburetor
2 Rear carburetor
3 Vent tube
4 Pull rod
5 Relay lever
6 Push rod
7 Control lever
8 Stop bolt
9 Idle stop screw
10 Aperture limiting screw
11a Ball socket
11b Ball socket
12 Hexagon nut
13 Push rod
14 Angle lever
15 Spring-loaded push rod
16 Throttle valve lever
17 Return spring
18 Tension spring
19 Idle adjustment screw
20 Idle mixture adjustment screw
21 Vacuum line to distributor
22 Fuel line
23 Coil spring
24 Rubber bushing
25 Adjusting nut
26 Spring steel wire
27 Angle lever
28 Clamping screw
29 Rubber bushing
30 Hexagon nut
31 Connecting rod
32 Hexagon screw

3. Detach the carburetor linkage and the return spring at the throttle valve lever.

   On Model 220 S also detach the connecting rod (31) to the start mechanism of the front carburetor (Fig. 01-4/1).

   If the engine is installed in the vehicle, the choke cable must be disconnected on all Models (see Job No. 30-6).

4. Unscrew the carburetor fixing nuts and remove the carburetor, taking care that the lock washers do not fall into the intake pipe.

   Remove the upper insulating flange (on carburetors with grey cast iron flange on Models 219 and 220 a remove the gasket), remove the screening plate and the lower insulating flange from the intake pipe.

   In the case of the carburetor for Model 220 S of Stage 1, the upper insulating flange is provided with an air jet (1), which should be taken out after the flange has ben removed (Fig. 01-4/2).

Installation:

5. Before the carburetor is installed, the insulating flanges, the screening plate, the attaching flange at the carburetor, and the intake pipe must be checked for plane surfaces. Damaged insulating flanges must be replaced. Small rough spots on the attaching flange of the carburetor and on the intake pipe can be removed on a surface plate by means of abrasive cloth.

   The flange surfaces must be absolutely smooth, even and clean in order to ensure that the carburetor connections are leakproof and that the engine cannot take in any excess air. Leaky carburetor flanges are responsible for uneven engine performance. Furthermore, they make it impossible to regulate the idle speed properly.

   This is particularly important on cars of Model 220 a which have a carburetor with a die-cast flange.

   On later cars this carburetor was fitted with a grey cast iron flange, which ensures better dimensional stability. The same carburetor was installed also on Model 219.

Note: When the grey cast iron flange was installed, it was necessary to dispense with the upper insulating flange so as not to change the installation height of the carburetor. By way of compensation, a standard paper gasket, Part No. 180 071 00 80, is installed on these carburetors between the carburetor flange and the screening plate (Fig. 01-4/3).

6. Install the lower insulating flange, and in the case of Models 220 a and 219, the gasket on the intake pipe (Fig. 01-4/3).

   On Model 220 S insert the air jet (1) in the first Stage bore of the upper insulating flange (2) (Fig. 01-4/2).

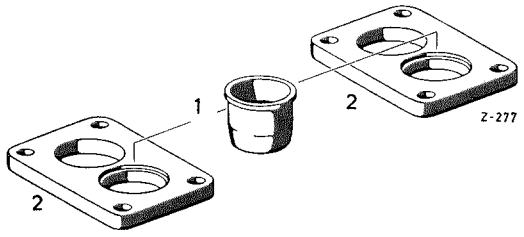


Fig. 01-4/2

1 Air jet
2 Upper insulating flange

   On Models 219 und 220 a mount the insulating flange and the gasket with **sealing compound.** Use only a thin coat of sealing compound.

   On all other carburetors the insulating flanges are mounted without sealing compound.

7. Install the carburetor, put on the spring washers, and tighten the carburetor by means of the hexagon nuts.

   Tighten the nuts evenly in order to prevent distortion of the carburetor flange.

   On Models 220 a and 219 the spacer sleeves (5) must be installed in the bores of the carburetor flange from the throttle valve part (7) before the fixing nuts are screwed on (Fig. 01-4/3).

The purpose of the spacer sleeves is to ensure that the tightening torque is transferred not to the carburetor flange (7), but to the grey cast iron flange (9). For this reason the spacer sleeves must project beyond the carburetor flange by the distance "a" = appr. 0.2 mm (Fig. 01-4/3).

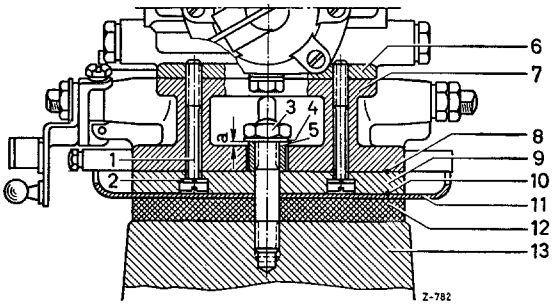


Fig. 01-4/3

a = appr. 0.2 mm

1 Cylinder head screw
2 Spring washer
3 Hexagon nut
4 Lock washer
5 Space sleeve
6 Float chamber
7 Throttle valve part
8 Gasket
9 Grey cast-iron flange
10 Gasket
11 Screening plate
12 Insulating flange
13 Intake pipe

8. Screw on the fuel line and the vacuum line to the distributor, **holding the pipe union** at the carburetor **steady**.

9. Attach the carburetor linkage and the return spring to the throttle valve lever.

   On Model 220 S also attach the connecting rod (3) to the start mechanism of the front carburetor (Fig. 01-4/1).

   When the engine is installed in the vehicle, connect up the choke cable (see Job No. 30-6).

10. Attach the air intake silencer and attach the air vent line from the cylinder head cover to the air intake silencer. In order to attach the air intake silencer on Models 180 a and 180 b, screw the two brackets to the intake pipe, and on Models 219 and 220 a, close the snap catches at the brackets, and on Model 220 S screw down the two clamping screws on the pipe clips.

11. Check the adjustment of the carburetor linkage and adjust the idle (see Job No. 01-3, Section K).

II. Removal and Installation of Carburetor on Model 190 SL

For repair procedure see Job Nos. 07-0 and 07-4.

Removal:

Note: It is advisable to remove the carburetor only together with the intake pipes, since otherwise the upper spring washers (2) may drop into the intake pipe and cause damage when the carburetor is removed or installed (see Fig. 01-4/4).

1. Loosen the clamping screw (1) for the sleeve of the choke control on the air suction tube and the clamping screws (2) for the choke control on the choke valve levers of the two carburetors and pull out the cable (Fig. 01-4/5). Also loosen the clamping screw (4) for the hot-start cable and pull out the cable. Then detach the return spring (3) for the accelerator linkage and the connecting rod (8) at the carburetor control shaft lever.

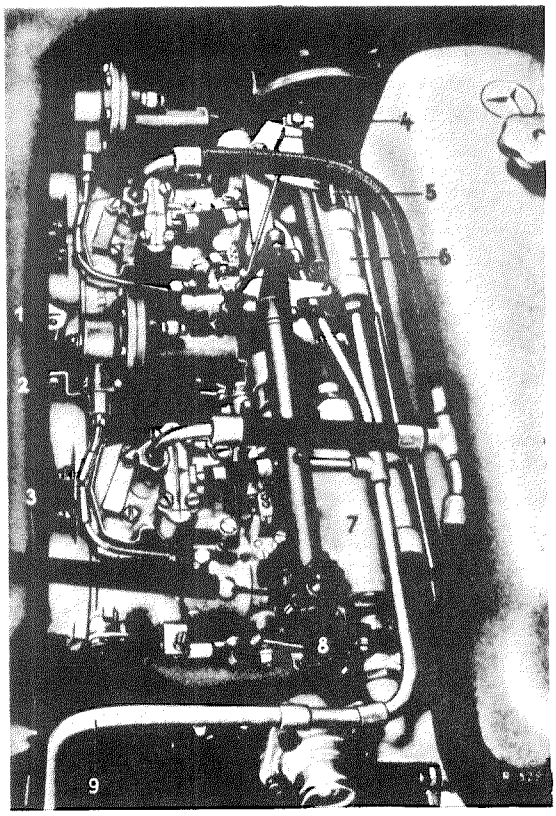


Fig. 01-4/5

Die-cast carburetor

1 Clamping screw for choke control sleeve
2 Clamping screw for choke control on both carburetors
3 Return spring for accelerator linkage
4 Clamping screw for hot-start cable
5 Control valve tube for ATE Power Brake
6 Rear intake pipe
7 Front intake pipe
8 Connecting rod
9 Fuel overflow line

2. Unscrew the strut (4) supporting the carburetor system at the air suction tube (Fig. 01-4/6) and unscrew the hexagon nuts from the air suction tube.

3. Open the snap catches (5) on the air filter, detach the rubber hose (4) from the vent tube of the cylinder head cover, and remove the upper part of the filter (3) together with the air hose (2) and the air suction tube (1) (Fig. 01-4/7). Pay attention to the gaskets between air suction tube and carburetor.

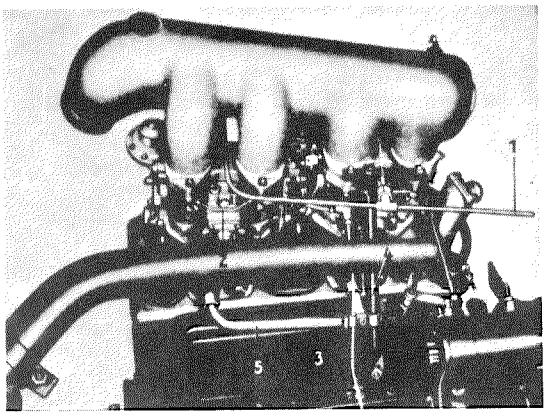


Fig. 01-4/6

Sand-cast carburetor

1 Fuel overflow line
2 Suction line
3 Leak-off pipe
4 Strut for supporting air suction tube
5 Return pipe to water pump

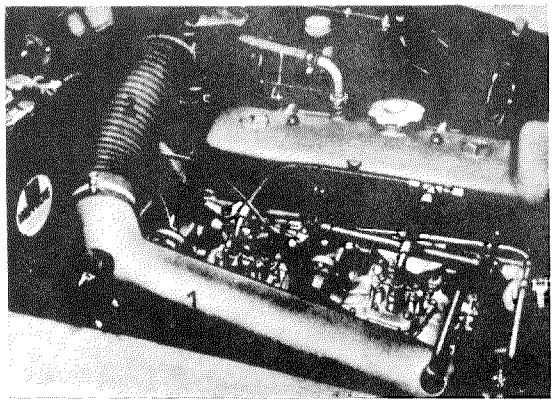


Fig. 01-4/7

Die-cast carburetor

1 Air suction tube
2 Air hose
3 Upper part of filter
4 Rubber hose
5 Snap catches

4. Disconnect the fuel line (4) at the two carburetors, holding the pipe union steady (Fig. 01-4/8). Then detach the hose between the fuel overflow line (3) and the front pipe union (on the bracket of the right radiator support).

Note: The fuel overflow line need not be detached from the carburetor and suction system.

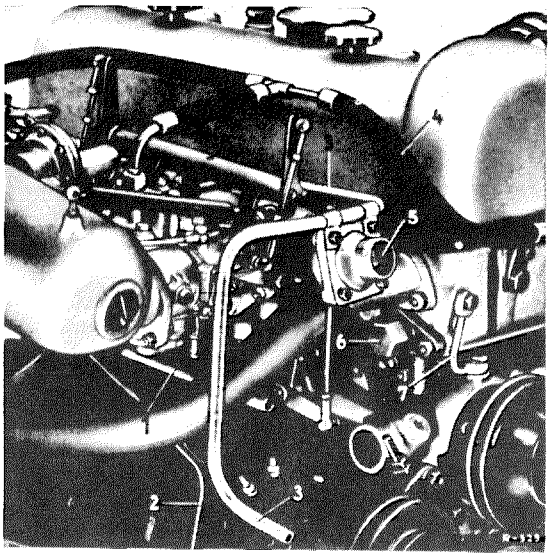


Fig. 01-4/8

Die-cast carburetor

1 Water return pipe
2 Leak-off pipe
3 Fuel overflow line
4 Fuel line
5 Cooling water drain union with cooling water thermostat
6 Chain tightener
7 Air vent line

5. Unscrew the cap nut at the Tee-piece of the leak-off pipe (3) (Fig. 01-4/6). It is not necessary to detach the lower part of the leak-off pipe from the strut supporting the carburetor or the upper part from the carburetors.

6. If the car is provided with an ATE Power Brake, disconnect the vacuum line at the threaded union (5) of the rear intake pipe (Fig. 01-4/5).

7. If the engine is installed in the vehicle, drain off part of the cooling water, collecting the water if additives are present.

8. Detach the water hose from the radiator to the cooling water thermostat (5) and the cooling water return line (1) at the connections of the front and rear intake pipes (Fig. 01-4/8). Unscrew the hexagon nuts on the intake pipes, the exhaust manifold, and the cooling water drain union. Then remove the carburetors together with the intake pipes and the cooling water drain union together with the cooling water thermostat.

9. Detach the fuel overflow line (9) from the two carburetors and the fixing clip on the bearing bracket for the hot-start mechanism (Fig. 01-4/5). Then detach the connecting hose from the cooling water drain union to the front intake pipe and remove the fuel overflow line together with the fuel water drain union and the cooling water thermostat.

10. Disconnect the leak-off pipe (3) at the two carburetors (Fig. 01-4/6).

11. Detach the return spring for the hot-start mechanism. Unscrew the hexagon screws and nuts fastening the carburetors to the intake pipe. Remove the rear carburetor together with the hot-start mechanism and the front carburetor together with the control shaft bearing.

Installation:

12. Before installing the front carburetor, check whether the throttle valve of Stage 1 is absolutely horizontal under full load. If this should not be the case, correct the position of the throttle valve at the full-load stop as far as necessary.

13. Check the rubber flanges (3) and the rubber washers (5) between carburetor and intake pipe to see if they are fit for re-use and, if necessary, replace them (Fig. 01-4/9).

Note: Since the rubber flanges may be squeezed outward when they are compressed, the flanges used on former cars with a bore of 46 mm may project too far into the intake pipe and may cause the throttle valve and vacuum valve to jam. For this reason the bore in the rubber flange was enlarged to 49 mm. For this reason only

rubber flanges with the larger bore should be installed.

14. Attach the carburetors to the intake pipes and evenly tighten the hexagon screws.

    Do not forget the spring washers (2) between carburetor flange and rubber flange (Fig. 01-4/9).

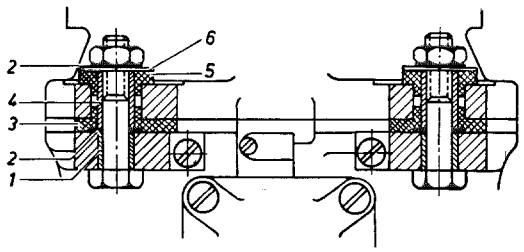


Fig. 01-4/9

1 Sleeve (cast integral)	4 Sleeve
2 Spring washer	5 Rubber washer
3 Rubber flange	6 Washer

Note: If the suction tubes have been disassembled, they must be reassembled again before the carburetors are installed and must be fitted to the cylinder head in order to ensure that the distance between them is correct; only then should the coupling nuts (5) of the compensating line (3) and the hose straps (14) of the connecting hose (12) be tightened (see Fig. 01-4/18).

When installing the carburetors, it is advisable first to attach the rear carburetor together with the hot-start mechanism and then the front carburetor together with the control shaft bearing.

Furthermore, the carburetors should be attached to the intake pipes before these are mounted in order to ensure that the spring washers (2) have not dropped into the intake pipe, since otherwise engine damage may occur (Fig. 01-4/9).

15. Attach the leak-off pipe (3) to the two carburetors (see Fig. 01-4/6).
    Attach the fuel overflow line to the two carburetors and the fixing clip to the bearing bracket of the hot-start mechanism (see Fig. 01-4/5). Attach the connecting hose from the cooling water drain union to the first intake pipe.

16. Check the gaskets of the intake pipes and of the cooling water drain union and, if necessary, replace them.

17. Install the carburetors on the cylinder head together with intake pipes and cooling water drain union and tighten evenly.

    Attach the water hose from the radiator to the cooling water thermostat (5) and the water return pipe (1) (see Fig. 01-4/8) to the various unions below the front and rear intake pipes. Top up the cooling water.

18. If the car is provided with an ATE Power Brake, attach the vacuum line to the threaded union (5) of the rear intake pipe (see Fig. 01-4/5).

19. Screw the cap nut of the lower leak-off pipe (3) to the Tee-piece (see Fig. 01-4/6). Attach the fuel line (4) to the two carburetors, holding the connecting union steady (see Fig. 01-4/8).

    Attach the hose to the front pipe length of the fuel overflow line (3), making sure that the fuel overflow line is not bent when the hose is being installed.

20. Adjust the carburetor linkage (see Job No. 01-3, Section K).

21. Check the gaskets of the air suction tube and, if necessary, replace them. Place the air suction tube (1) on the carburetors and the upper part of the filter (3) together with air hose (2) on the air filter and close the snap catches (5) (see Fig. 01-4/7).

    Screw on the air suction tube. Then attach the rubber hose (4) to the vent tube of the cylinder head cover (see Fig. 01-4/7). Attach the return spring (3) for the accelerator linkage (see Fig. 01-4/5).

22. Screw the strut supporting the carburetors to the air suction tube (Fig. 01-4/10).

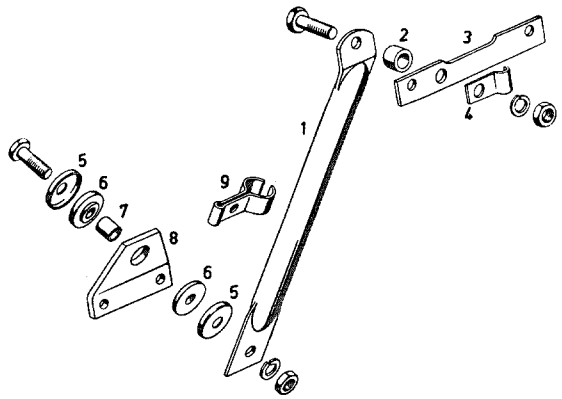


Fig. 01-4/10

1 Strut for supporting air suction tube
2 Spacer tube
3 Holder at air suction tube
4 Pipe clip
5 Cup washer
6 Rubber washer
7 Sleeve
8 Holder at crankcase
9 Pipe clip for fuel leak-off line

Note: The air suction tube upper attachment shown in the above picture 01-4/10 is the first version. In the second version the strut is screwed directly to a fixing eye cast integral with the suction tube. In this version the holder (3), the spacer tube (2), and the pipe clip (4) for the leak-off pipe are no longer required.

23. Insert the choke cable and attach the clamping screw (1) for the sleeve of the choke cable and the clamping screws (2) for the choke cable to the choke valve levers of the two carburetors (see Fig. 01-4/5).

    When doing this, check whether the choke valves are closed when the starter button is pulled out and whether, when the starter button is pushed in, the two valves are horizontal and the levers rest against the lower stop.

24. Insert the hot-start cable and lock the sleeve by means of the clamping screw (4) (see Fig. 01-4/5). Attach the return spring. Then press the angles of the hot-start mechanism against the counterweights until the distance is no more than appr. 2 mm. In this position tighten the clamping screw for the cable.

    Check the hot-start cable for ease of movement, depressing the accelerator as far as it will go. When the cable is released, the hot-start cable must return properly to its initial position. In the released position the angle levers must not rest against the weights of Stage 2.

25. Check the adjustment of the carburetor linkage and adjust the idle (see Job No. 01-3, Section K).

Subsequent installation of die-cast carburetors

In Model 190 SL, up to Engine End No. 55 00708, sand-cast carburetors were installed, and as from Engine End No. 55 00709 die-cast carburetors are installed.

If sand-cast carburetors are subsequently replaced by die-cast carburetors, take care to ensure that also the pipe (Part No. 121 070 09 35) of the fuel overflow line at the front part of the air scoop bracket is replaced. In the case of sand-cast carburetors, the pipe has a cross-section of 6 × 0.75 mm, whereas on die-cast carburetors the cross-section is 10 × 1.0 mm. The larger cross-section of the fuel overflow line on die-cast carburetors is necessary, since in addition to the fuel also the total compensating air passes to the carburetors through this line. Therefore the pipe with the smaller cross-section must on no account be used for die-cast carburetors, since otherwise carburetor trouble is bound to occur.

When installing a new or a replacement engine, which are supplied only with die-cast carburetors, in a vehicle which was equipped with sand-cast carburetors, the pipe with the larger cross-section (Part No. 121 070 09 35) must also be used. When installing this, take care to ensure that the fuel overflow line and the pipe are screwed on in the correct position and without forcing, since otherwise speed build-up will be uneven (see Fig. 01-3/15 and No. 3 in Fig. 01-4/8).

The following parts are required when die-cast carburetors are subsequently installed:

Designation	Part No.	Number per car required
Front carburetor	000 071 61 01	1
Rear carburetor	000 071 62 01	1
Bearing bracket for hot-start cable	121 070 02 40	1
Fuel line	121 070 01 32	1
Fuel overflow line	121 070 08 35	1
Fixing clip at bearing bracket for hot-start cable	121 995 00 01	1
Hexagon socket screw	M 5 × 10 DIN 912–8 G	2
Washer	5.3 DIN 433	1
Lock washer	B5 DIN 127	2
Hexagon nut	M5 DIN 934-5 S	2
Fixing clip at cooling water thermostat	121 995 03 35	2
Pipe to overflow line	121 070 09 35	1
Fillister head screw for pipe	AM 4 × 12 DIN 7985–4 S	2
Lock washer	B 4 DIN 127	2
Hexagon nut	M 4 DIN 934–5 S	2
Fuel hose	B 8 × 12 × 40 DIN 73379	2
Hose clip	S 12/9 N 228 a	4
Fuel hose	A 9 × 14 × 70 DIN 73379	1
Air suction tube	121 090 04 29	1
Sealing flange	121 094 01 79	4
Sealing ring for fuel leak-off pipe	A 6 × 10 DIN 7603 Fiber	4
Cheese-head screw	M 6 × 18 DIN 912–8 G	2

III. Removal and Installation of Fuel Injection System, including Venturi Control Unit and Control Linkage on Model 220 SE

a) Injection Pump

Removal:

1. Remove air filter. For this purpose loosen vent line to cylinder head, supplementary air line (2), the connection to the venturi control unit and the fixing screw on supporting rod (19) (Fig. 01–4/11 a).

   Then remove air filter **upward,** because the inlet air thermostat (13) projects into the air filter.
2. Drain part of the cooling water. Unscrew cooling water lines (3) and (14), as well as the supplementary air line (4), the oil line (6) and the fuel lines on the injection pump. Also loosen cable for cold start magnet.
3. Detach push rod on adjustment lever (16), and unscrew guide tube with bracket (18) for oil dipstick.
4. Then unscrew the three fixing nuts and pull injection pump out toward the rear.
5. If an injection pump is replaced pull off drive lug on camshaft and attach to new pump, because spare pumps are delivered without drive lugs.
   Loosening of nut on camshaft requires a hold on drive lug using serrated wrench 621 589 00 08. The drive lug is pulled off with puller 621 589 00 33.

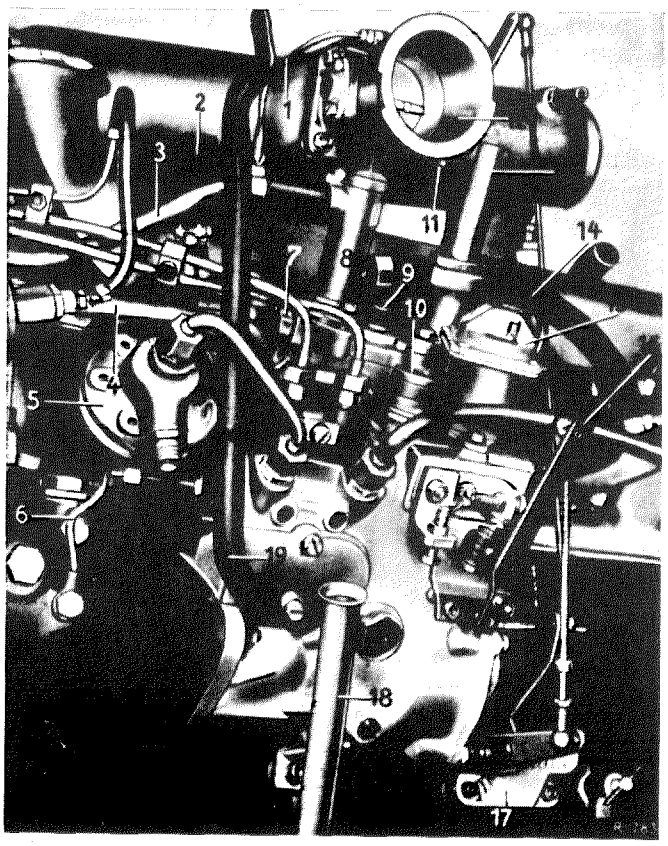


Fig. 01–4/11 a

ZEA Injection Pump

1 Vacuum line to distributor
2 Line for cold-start supplementary air
3 Cooling water line
4 Line for cold-start supplementary air
5 Damper unit
6 Oil line for oil lock
7 Stop bolt for cooling water thermostat
8 Cooling water thermostat
9 Stop screw for inlet air thermostat
10 Air filter for governor housing
11 Idle air throttle
12 Venturi control unit
13 Inlet air thermostat
14 Cooling water line
15 Cold-start magnet
16 Adjustment lever
17 Control lever with bearing block
18 Guide tube for oil dipstick
19 Supporting rod for air filter

Note: On the first version of the drive lug dimension a = 1.5 mm, on the second version = 2.7 mm (Fig. 01–4/11 b). Drive lugs of the 1st version should no longer be installed.

To obtain a good grip for the puller, two adjoining cylinder screws which hold the flange on the injection pump have to be screwed out (refer to Fig. 01–4/11 c). After the drive lug has been pulled, don't forget to screw the two screws down again.

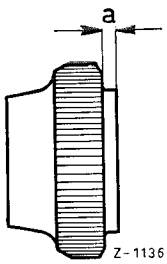


Fig. 01–4/11 b

Installation:

6. The injection pump for Model 220 SE is not set to an end of 60° after TDC in the delivery stroke as for the other gasoline injection engines, it should be set as follows:

   Prior to installing the injection pump the piston of No. 1 cylinder is set to TDC (intersection dead center or ignition dead center) and the camshaft of the injection pump is rotated in such a manner that the marking line on the camshaft is aligned with the mark on the flange of the injection pump (Fig. 01–4/11 c).

   This is the position in which the injection pump is installed. Installation according to instructions will then provide a delivery end of 120° before TDC for the No. 1 cylinder. An extra delivery end checkup by means of container and overflow pipe is not required for injection pump for Model 220 SE. This is why the fastening flange of the pump has no slotted holes for correcting the pump position.

7. Connect all lines and check whether cap nuts have been tightened well.

   Pay special attention to **the check valve for the oil lock. The hollow screw should be tightened well, because otherwise oil may be lost.**

8. Attach push rod on injection pump lever and **check adjustment of control linkage** (refer to Workshop Manual Passenger Car Models starting August 1959, Job No. 00–16).

9. Install air filter, fasten and connect all lines. When installing air filter, make sure that **the rubber grommet is accurately seated in filter bottom** and is not pushed into filter housing.

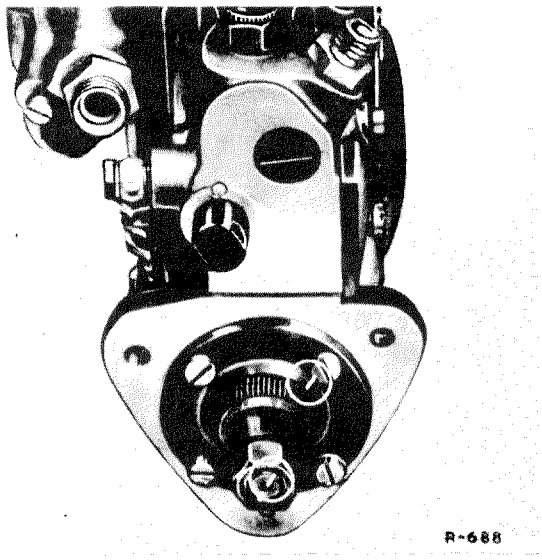


Fig. 01–4/11 c

b) Injection Valves and Fuel Distributor Fittings

The uniform distribution of the fuel to the individual cylinders does not only depend on uniform ejection pressure and flow volume of injection valves, but also from the condition of the pertinent fuel distributor fittings.

Fuel distributor fittings and injection valves are selected during production in such a manner that the injected quantity of the three injection valves which belong to one distributor fitting is of uniform size. The correlated parts are marked with letters and are supplied as a complete distribution group (Fig. 01–4/12 a).

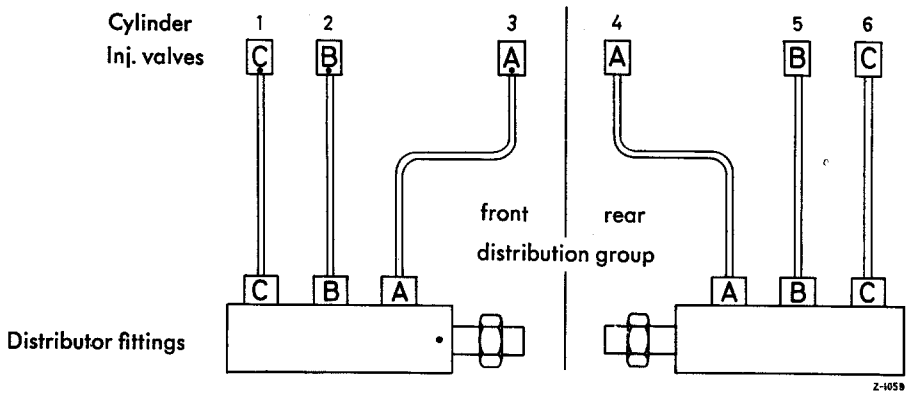


Fig. 01–4/12 a

In addition the front distribution group (fuel distributor fitting and injection valves for cylinders 1–3) is marked during production with a red dot (Fig. 01–4/12 a).

This mark should be heeded during assembly because otherwise nonuniform fuel distribution to the individual cylinders and a correspondingly bad-running engine might result.

When the injection valves and the distributor fittings are disassembled their sequence should be marked, or the two distributing groups should be placed in separate containers to prevent confusion.

Check Injection Valves and Fuel Distributor Fittings

The injection valves should be checked by means of a commercial tester and a pressure gauge with a measuring range of 0–25 kg/cm² and with test oil (OL 61 v 1) to the specified ejection pressure, proper shape of jet and for leaks.

Prior to the test check **whether the tester and the test oil are absolutely clean. The same applies to the filter of the tester,** which should be cleaned, if required. The pressure gauge is disconnected by closing the shutoff valve on the tester. Then the tester is first actuated several times **without** injection valve, to flush any remaining contaminations out of the apparatus. Then the unit **with the injection valve** is actuated several times **quickly and energetically,** to force out any remaining air.

1. Jet Shape – Visual Control of Injection Valves

The observation of the jet shape is effected by pushing the pump lever down quickly several times (2–3 strokes per sec.) with the pressure gauge disengaged. The jet should be uniformly well atomized and should have the shape of a cone-shaped shell.

If the jet drips, and is too wide, with too many strands and not completely compact, the injection valve is not in order.

If after another clearing of the injection valve the test conditions are not met, the injection valve or the complete distribution group, of which the objected injection valve is a part, should be replaced.

2. Check Ejection or Opening Pressure of Injection Valves

Push hand pump lever of switched-on pressure gauge slowly (1 stroke per sec.) down and read ejection pressure on pressure gauge when valve opens or ejection begins.

Caution: With pressure gauge switched-on increase pressure only slowly and above all blow off only slowly, because the pressure gauge might otherwise be damaged.

The opening or ejection pressure of the injection valves should be 13.0 to 15.5 atü. The difference of the ejection pressure within three injection valves (distribution group) belonging to one fuel distributor fitting should not be more than 0.5 atm. to guarantee uniform distribution of the fuel to the individual cylinders.

If there is a larger difference than 0.5 atm. the injection valve or the complete distribution group to which the objected to injection valve belongs should be replaced.

3. Check Injection Valves for Leaks

Push hand pump lever of switched-on pressure gauge slowly down to the point where the indicator stops on the pressure gauge 3 atm. below the previous measured ejection pressure. The injection valve is leakproof if no drop comes out of mouth of injection valve.

If an injection valve leaks the complete distribution group to which the objected to injection valve belongs should be replaced.

4. Measuring for Uniform Distribution of the Fuel of the Distributor Groups

Measuring the delivered quantity of fuel a distribution group for uniform distribution of the fuel may be done on a Bosch pump test stand or as follows:

The distribution group consisting of a distributor fitting and three injection valves about to be checked are connected to a two-plunger pump, exactly as in the vehicle. Only perfectly ejecting injection valves, in which the ejection pressure differs no more than 0.5 atm. from each other, should be used. A measuring glass is set under each injection valve.

The difference (max spread) of the fuel quantity delivered by the injection valves may not be more than 2.5 cc/1000 strokes at idling speed (350 rpm of the injection pump), and at full load (1000 rpm of the injection pump) no more than 3.0 cc/1000 strokes.

The cold-start quantity per injection valve at 40 rpm of the injection pump in a 220 SE should be mean 11 to 13 cc/100 strokes, but definitely not less than 8 cc/100 strokes (with OL 61 v 1). If there are larger differences between idling and full load, or if the fuel quantity is not reached during a cold start, as stated above, the complete distribution group should be replaced.

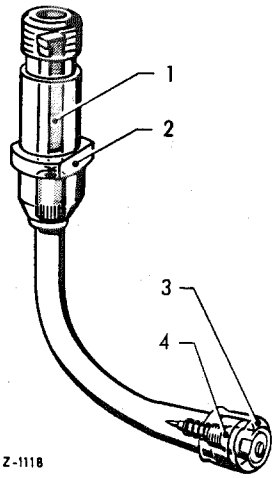


Fig. 01–4/12 b

Injection Valve

1 Filter
2 Connecting socket
3 Sheet metal cap
4 Valve insert

If a distribution group requires replacement, the rejected distribution group can now be completely replaced under part No. 000 078 01 95/80 (Bosch designation EPVT 1 P 12 Z injection valves with screen filter) or under part No. 000 078 00 95/80 (Bosch designation EPVT 1 P 11 Z injection valves with rod-type filter) (Fig. 01–4/12 a), that is, upon returning of a disassembled, complete, correlated distribution group you will receive an overhauled distribution group, in which the 3 injection valves (Fig. 01–4/12 b) have been given new valve inserts (4), the injection valve pipes have been provided with connecting sockets (2), and the respective fuel distributor fitting has been cleaned, and the reconditioned distribution group has been tested for uniform distribution of the fuel.

If no replacement distribution group is available, any Bosch service will replace the valve inserts (4) of the rejected distribution group or the injection valves (Fig. 01–4/12 b), while using the disassembled injection valve pipes and connecting sockets again, and will then re-install the assembly with the respective fuel distributor fitting.

Prior to installing a new distribution group or new injection valves with new valve inserts, the injection valves should be well flushed on a tester (for measuring the ejection pressure), to prevent any sticking of the injection valve needle as the result of resinification after extended storage.

Prior to installing the holders for the injection valves check whether the surface of the holder (10) and the surface on the intake pipe are undamaged. These surfaces must be perfectly level, because otherwise leaks may occur. Be sure to replace the seal between the holder (10) and the intake pipe and to use Teroson sealing compound for installation. When mounting the flange (9), which holds the injection valves in the holder (10), the hexagon nut which holdes the flange (9) and the holder (10) may not be tightened more than 1.5 mkg (Fig. 01–4/12 c).

The cap nuts (6) should be tightened with about 2.5 mkg.

Following installation, the holders (10) of the injection valves should suitably be checked for seal tightness by spraying with gasoline while the engine is running.

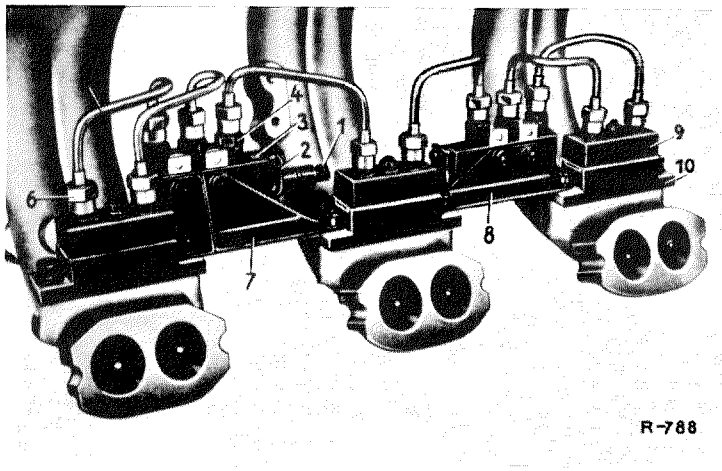


Fig. 01–4/12 c

1 Pressure pipe connection
2 Lock
3 Fuel distributor fitting
4 Pressure pipe connection
5 Injection pipe
6 Cap nut
7 Support for front distributor fitting
8 Support for rear distributor fitting
9 Flange
10 Holder for injection valves

Note: Whenever injection valves made by Bosch are tested or reconditioned, the respective, local Bosch agencies should be consulted, whenever possible.

Fuel Distributor Fittings

Each of the two fuel distributor fittings (3) is screwed to the support (7) or (8) (Fig. 01–4/12 c) by means of two hexagon bolts and one nut and one lock washer each. The supports (7) in turn are attached to the intake pipe together with the holders (10), with the higher support mounted in front and the lower at the rear.

Injection Valves with Holder

After disconnection injection pipes (4) and unscrewing flange (7), the injection valve may be removed from the holder (8) (Fig. 01–4/12 d).

The holders (8) themselves are attached to the intake pipe (Fig. 01–4/12 d) by means of two hexagon socket screws (9) with lock washers and washers (10) and gasket (11).

Note: On the side of the holder (8), to which the support for the fuel distributor fitting is attached does not require washer (10).

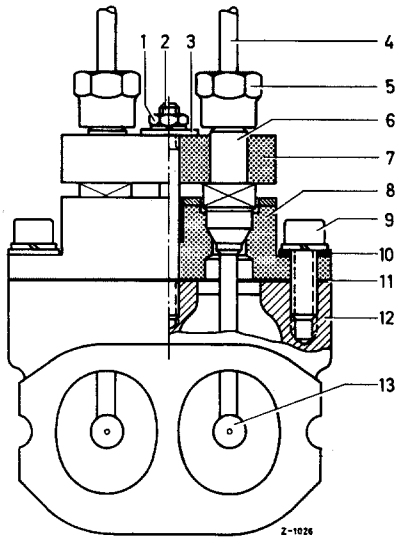


Fig. 01–4/12 d

1 Nut
2 Stud
3 Washer
4 Injection pipe
5 Cap nut
6 Injection valve
7 Flange
8 Holder
9 Hexagon socket screw
10 Washer or support
11 Gasket
12 Intake pipe
13 Locking cap on injection valve

c) Venturi Control Unit

Removal:

1. Remove the air filter. To do this, unscrew the vent line to the cylinder head, the supplementary-air line (2), the connection to the venturi control unit and the fixing screw at the supporting rod (19) (see Fig. 01-4/11a). Then remove the air filter **upward,** since the inlet air thermostat (13) projects into the air filter.

2. Disconnect the vacuum line to the distributor at the venturi control unit, detach the pull rod and the return spring at the throttle valve lever and unscrew the control unit.

Installation:

3. Attach the venturi control unit and the return spring holder to the intake pipe; do not omit the sealing ring. Attach the vacuum line to the distributor and attach the pull rod and the return spring to the throttle valve lever.
4. After installing the venturi control unit, **check the adjustment of the control linkage** (See Workshop Manual Passenger Car Models, starting August 1959, Job No. 00-16).
5. Place the air cleaner in position and attach it. Connect up the supplementary-air line and the air vent line.

d) Control Lever with Bearing Block, and Control Linkage

Control Lever with Bearing Block

The control lever with bearing block is fastened to the crankcase by means of two hexagon socket screws and washers. Both parts, the control lever and the bearing block **must be replaced as a unit,** since the bore for holding the control linkage in the idle position is bored through both parts together.

The "O" rings (2) and the needle bearings (3) can be replaced individually (Fig. 01-4/13).

Before reassembly the needle bearings should be well filled with grease.

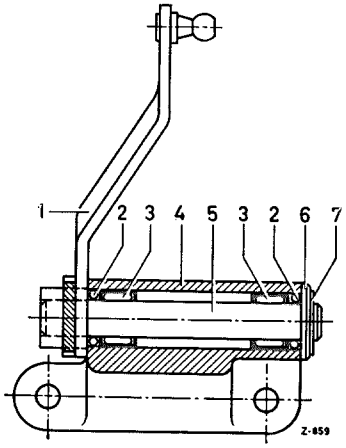


Fig. 01-4/13

1 Control lever
2 "O" ring
3 Needle bearing
4 Bearing block
5 Pivot pin
6 Washer
7 Locking plate

Control Linkage

The ball sockets of the control linkage must not have any play. **Worn ball sockets must always be replaced.** Before installing the control linkage, the ball sockets should be well filled with grease.

After installing the control lever with bearing block and the control linkage, **check the adjustment of the control linkage** (see Workshop Manual Passenger Car Models starting August 1959, Job No. 00-16).

B. Removal and Installation of Intake Pipe and Exhaust Manifold

I. Models 180 a, 180 b, 220 a, 219, 220 S and 220 SE

Repair procedure see Job No. 14-5.

Removal and Installation:

On Models 180 a, 180 b, 220 a, 219, and 220 SE the intake pipe and the exhaust manifold can only be removed together. If the intake pipe has to be replaced, the carburetor must be removed beforehand. In all other cases the intake pipe and the exhaust manifold can be removed with the carburetor screwed to them. However, the air intake silencer with the supports must always be removed. Removal and installation on these Models is essentially the same as on Model 190.

On Models 220 a and 219 the rear exhaust manifold half can be removed separately, and there is no necessity to remove the intake pipe and the front exhaust manifold half as well (Fig. 01-4/15). On Model 220 S, however, the rear exhaust manifold half is screwed to the intake pipe (Fig. 01-4/16).

On Model 220 SE, the intake pipe, the front and the rear exhaust manifold can be removed individually.

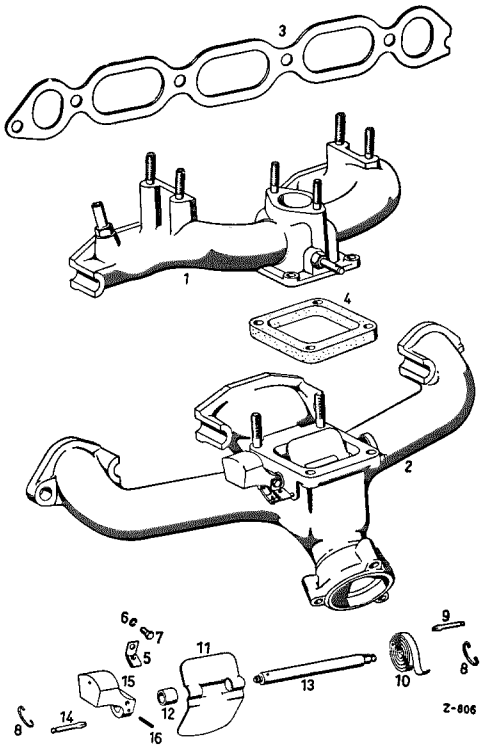


Fig. 01-4/14

Intake pipe and exhaust manifold on Models 180 a and 180 b

1 Intake pipe
2 Exhaust manifold
3 Gasket
4 Insulating flange
5 Damper spring
6 Lock washer
7 Hexagon screw
8 Tension spring
9 Front notched collar pin
10 Heating spiral
11 Heater valve
12 Bushing for heater valve shaft
13 Heater valve shaft
14 Rear notched collar pin
15 Balancing weight for heater valve
16 Dowel pin

Note: On Model 180 a the suction canal in the intake pipe has a diameter of 32 mm, on Model 180 b of 34 mm.

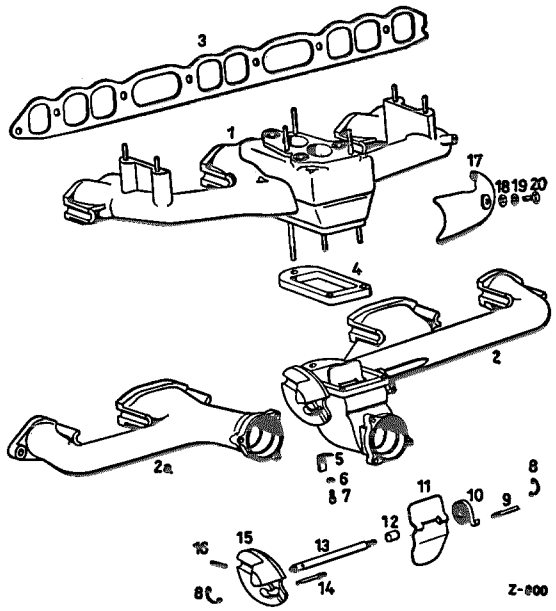


Fig. 01-4/15

Intake pipe and exhaust manifold on Models 220 a and 219

1 Intake pipe
2 Exhaust manifold, front part
2a Exhaust manifold, rear part
3 Gasket
4 Insulating flange
5 Damper spring
6 Lock washer
7 Hexagon socket screw
8 Tension spring
9 Front notched collar pin
10 Heating spiral
11 Heater valve
12 Bushing for heater valve shaft
13 Heater valve shaft
14 Rear notched collar pin
15 Balancing weight for heater valve
16 Dowel pin
17 Screening plate for intake pipe
18 Washer
19 Lock washer
20 Hexagon screw

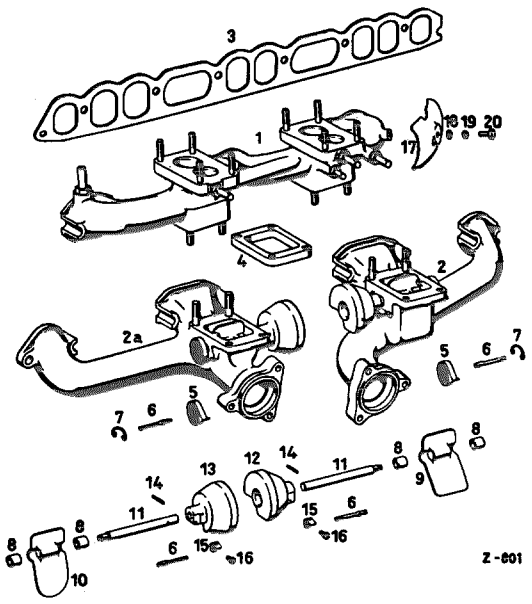


Fig. 01-4/16

Intake pipe and exhaust manifold on Model 220 S

1 Intake pipe
2 Exhaust manifold, front part
2a Exhaust manifold, rear part
3 Gasket
4 Insulating flange
5 Heating spiral
6 Notched collar pin
7 Tension spring
8 Bushing for heater valve shaft
9 Heater valve in exhaust manifold, front part
10 Heater valve in exhaust manifold, rear part
11 Heater valve shaft
12 Balancing weight for heater valve
13 Balancing weight for heater valve
14 Dowel pin
15 Damper spring
16 Fillister head screw
17 Screening plate for intake pipe
18 Washer
19 Lock washer
20 Hexagon screw

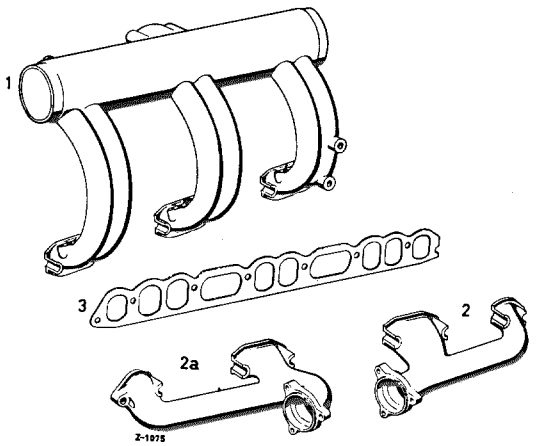


Fig. 01-4/17

Intake pipe and exhaust manifold on Model 220 SE

1 Intake pipe
2 Exhaust manifold, front part
2a Exhaust manifold, rear part
3 Gasket

II. Model 190 SL

Repair procedure see Job No. 14-5.

On Model 190 SL the intake pipes and the exhaust manifold can be removed separately.

a) Intake Pipes

Removal:

1. Remove the carburetors and the intake pipes (see Job No. 01-4, Section A/II, para 1-11).

2. Unscrew the coupling nuts (5) and remove the compensating line (3) together with the clamp rings (4) (see Fig. 01-4/18).

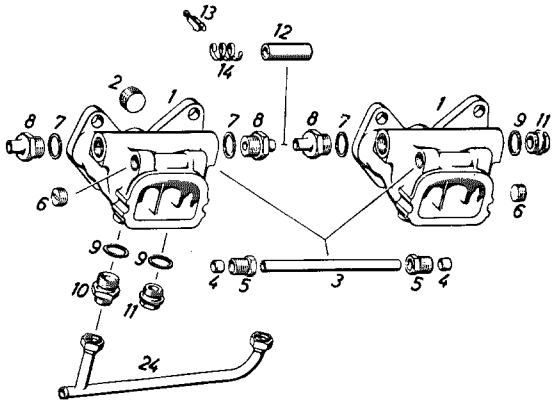


Fig. 01-4/18

1 Intake pipe	9 Sealing ring
2 Screw plug	10 Adapter
3 Compensating line	11 Screw plug
4 Clamp ring	12 Rubber hose
5 Coupling nut	13 Hose clamp
6 Slotted plug	14 Hose strap
7 Sealing ring	24 Return line
8 Threaded union	

3. Loosen the hose clamp (13) and remove the rubber hose (12).

Installation:

4. Check the gasket (3) for the intake pipes and the exhaust manifold (see Fig. 01-4/19). If the gasket is damaged, it must be replaced. To do this, remove the exhaust manifold. Also check the gasket for the cooling water drain union.

5. Connect the two intake pipes by means of the compensating line (3), but only tighten the coupling nuts by hand, since the intake pipes have first to be fitted to the cylinder head in order to ensure that the distance between them is accurate.

6. Press the water hose (12) onto the threaded union (8).

7. Fit the intake pipes to the cylinder head and tighten the hexagon nuts by hand. Now tighten the coupling nuts (5) on the two intake pipes evenly and attach the hose clamps (13).

Note: The compensating line must be leak-proof, since otherwise the idle will become irregular.

The mixture is pre-heated when the intake pipes are connected to the cooling water circulation.

8. Unscrew the hexagon nuts for fastening the intake pipes to the cylinder head again and remove the intake pipes.

9. Screw the intake pipes to the carburetors and install the whole system (see Job No. 01-4, Section A/II, para 12-25).

b) Exhaust Manifold

Removal:

1. Screw out the two hexagon screws (5a) for fastening the holder (10) to the support (8) and unscrew the hexagon screws together with nuts on the three-hole flange (11) (Fig. 01-4/19). Then unscrew the exhaust manifold and remove.

Note: The exhaust attachment shown is for left-hand drive cars. For right-hand drive cars the exhaust is freely suspended.

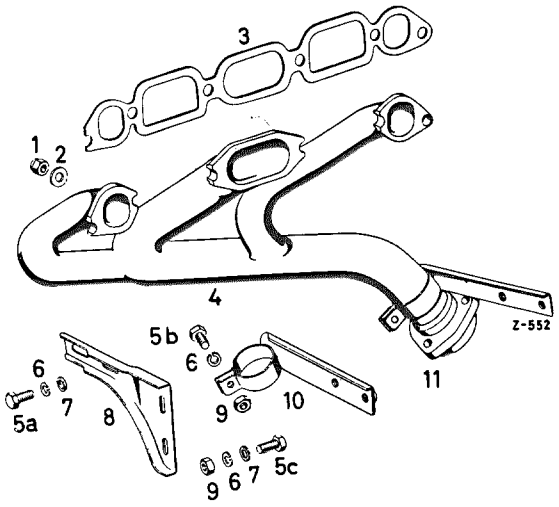


Fig. 01–4/19

1 Hexagon nut
2 Washer
3 Gasket
4 Exhaust manifold
5a Hex screw
5b Hex screw
5c Hex screw
6 Spring washer
7 Washer
8 Support
9 Hex nut
10 Bracket
11 Threehole flange

Installation:

2. Test gasket (3) for intake pipes and exhaust manifold. Damaged gaskets should be replaced. For this purpose, remove intake pipes (Fig. 01–4/19).

3. Hold exhaust manifold to cylinder head and tighten hexagon nuts. Tighten hexagon nuts on screw of three-hole flange (11) and hexagon screw (5 a) which hold bracket (10) to support (8).

C. Removal and Installation of Cylinder Head, Valves, Camshaft, Chain Tensioner, Tension Sprocket Bearing and Rocker Arms

Repair procedures see Job No. 01–5 and 05–5.

Removal and installation of cylinder head, valves, camshaft, chain tensioner, tension sprocket bearing and rocker arms for Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S and 220 SE is substantially similar to Model 190. Deviations are described in section I to III.

Unless the cylinder head requires disassembly for reconditioning, the intake pipe with the carburetor system and the exhaust manifold should suitably remain attached to the cylinder head during removal and installation. This applies particularly to Model 190 SL, because the loosening and re-attachment of these components in built-in condition is difficult.

I. Removal and Installation of Cylinder Head on Model 190 SL

Also refer to Section III.

Removal:

1. Loosen choke cable on air suction tube and on choke valve levers, as well as the hot-start cable on bearing block and angle lever.

Note: With built-in idle cutout valve disconnect cable on rear carburetor.

2. Remove air hose from air intake silencer to air suction tube, and vent tube from cylinder head cover to air intake silencer.

3. With built-in ATE power brake disconnect vacuum line at the threaded union of rear intake pipe.

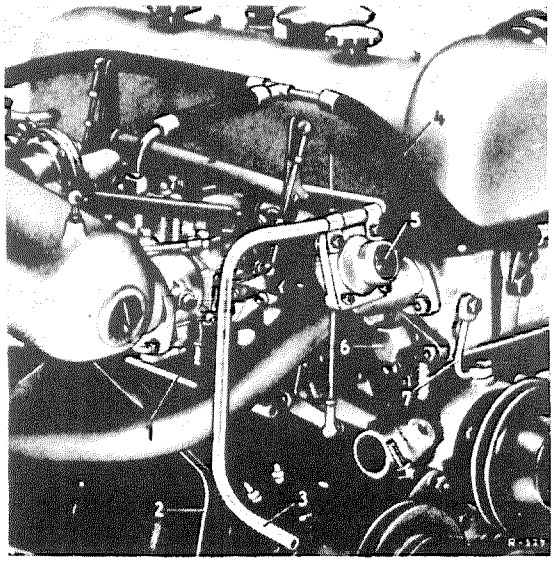


Fig. 01–4/20

Die-Cast Carburetor

1 Water return pipe
2 Leak-off pipe
3 Fuel overflow line
4 Fuel line
5 Cooling water drain union with cool. water thermostat
6 Chain tensioner
7 Air vent line

4. Detach fuel line (4) on both carburetors and on fuel feed pump while supporting pipe union (Fig. 01–4/20). Then loosen clamp which holds fuel line to cylinder head and remove line.

5. Then loosen strut (4) which supports the carburetor system at top of air suction tube (refer to Fig. 01–4/6).

6. Unscrew fuel leak-off pipe (3) on Tee-piece (refer to Fig. 01–4/6).

7. Pull fuel overflow line (3) out of connecting hose to front pipe connection (Fig. 01–4/20).

8. With engine installed drain part of the cooling water, be careful of additives.

9. Loosen water hose from raditor to cooling water thermostat (5) and water return pipe (1) on connecting hose to distributor pipe (Fig. 01–4/20).

10. Unscrew air vent line (7) on water pump and on cylinder head.

11. Unhook accelerator linkage and unscrew exhaust pipe on exhaust manifold.

12. Remove distributor with distributor bearing (refer to Job No. 01–4, Section F). If the distributor bearing is the first version, that is a bearing without fixing eye, there is no need for removal.

13. Unscrew thermostat for cooling water telethermometer from cylinder head and take capillary tube from clamp on ignition cable conduit.

14. Unscrew water pipe bend for heating pipe union on cylinder head.

15. For further disassembly proceed as for Model 190.

Installation:

16. Following the installation of the cylinder head, which is done vice-versa, set ignition (refer to Job No. 01–3, Section E).

17. Warm up engine and tighten cylinder head screws (refer to Section III, (Para i).

Note: On model 190 SL with the new, further modified valve controls (Fig. 01–4/20 a) the valve stem seal and the removal of the rocker arms differ as desribed below. Rocker arms for inlet and outlet valves are of similar design.

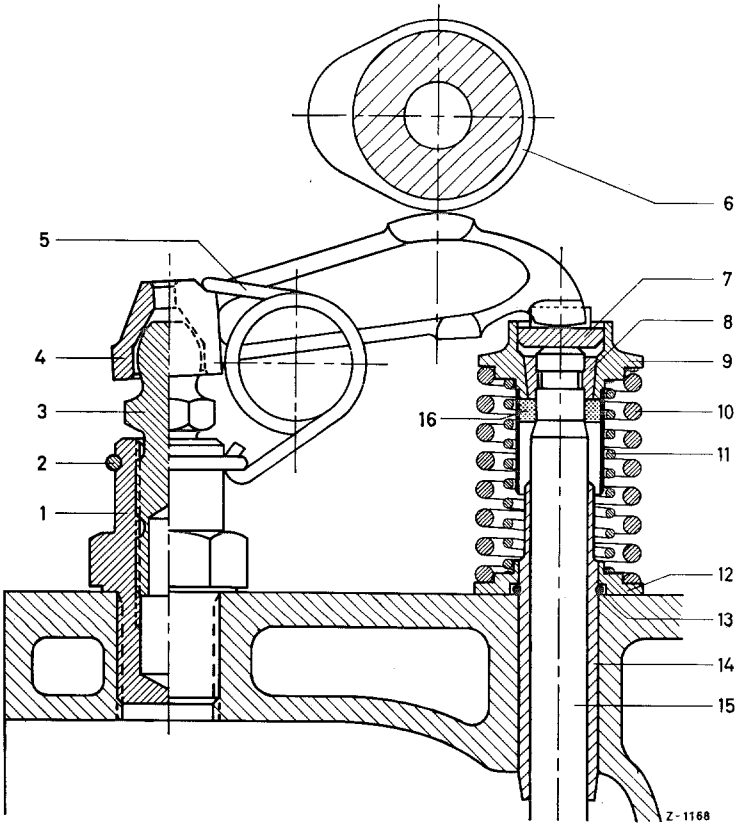


Fig. 01–4/20 a

New, further modified valve controls types 180 c and 190 SL

1 Ball pin socket
2 Annular spring
3 Ball pin top
4 Rocker arm
5 Tension spring
6 Camshaft
7 Thrust plate
8 Valve cone section
9 Valve plate with sealing ring holder
10 Outer valve spring
11 Inner valve spring
12 Thrust plate
13 Snap ring
14 Valve guide
15 Valve
16 Sealing ring

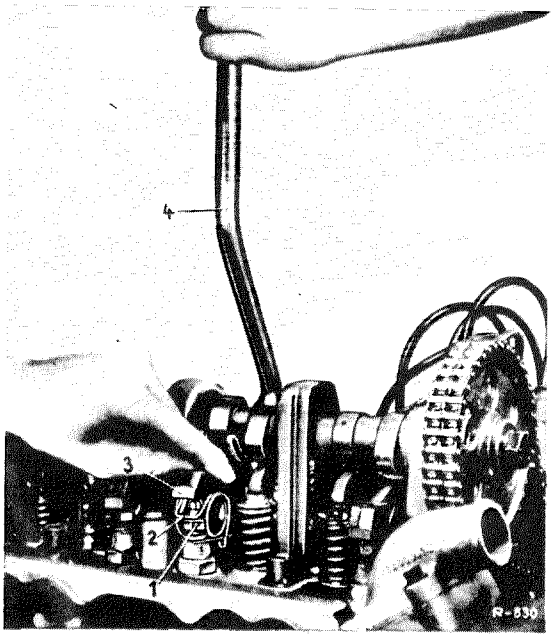


Fig. 01–4/20 b

1 Ball pin top
2 Tension spring
3 Rocker arm
4 Disassembly and assembly tool 111 589 01 61

Disassembly of Rocker Arm:

1. Push tension spring (2) out of notch at top of rocker arm (3) and slide spring over ball socket of rocker arm outwards (refer to Fig. 01–4/20 b).
2. Apply disassembly and assembly tool (4) 111 589 01 61 to camshaft and valve spring plate and force valve downward to relieve rocker arm (3) (Fig. 01–4/20 b).
3. Lift rocker arm (3) from ball pin top (1) and remove (Fig. 01–4/20 b).

Note: Prior to installation check slide surfaces and ball socket of rocker arm. Damaged rocker arms should be replaced.

Installation of Rocker Arms:

4. Apply disassembly and assembly tool 111 589 01 61 to camshaft and to valve spring plate and press valve downward to the point where the rocker arm with its ball socket can be inserted into the ball pin top.
5. Insert rocker arm.
6. Push tension spring across ball socket of rocker arm toward the front until it snaps into the notch of the rocker arm.
7. Check or adjust valve clearance (refer to Job No. 00–3).

Valve Stem Sealing

A sealing ring holder (3) in the shape of a bell enveloping the valve guide is soldered to the valve spring plate (5) at the exhaust valve (8). The rubber sealing ring (4) is inserted into sealing ring holder from below (Fig. 01–4/20 d).

Valve stem sealing at inlet valve (8) is effected by a sealing ring holder (3) by means of a Silicon sealing ring (4). The sealing ring holder is pushed over the valve guide and held in place by the inner valve spring (10) (Fig. 01–4/20 c).

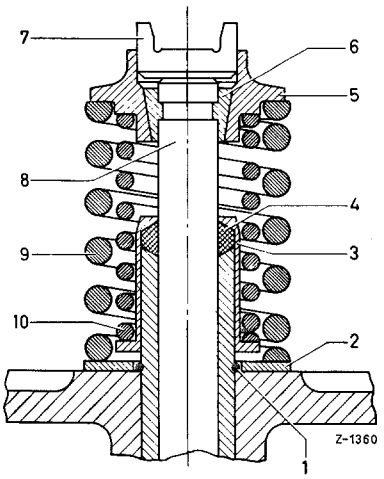


Fig. 01–4/20 c

Inlet Valve

1 Lock washer
2 Washer for valve spring
3 Sealing ring holder
4 Silicon sealing ring
5 Valve spring plate
6 Valve cone section
7 Thrust plate
8 Inlet valve
9 Outer valve spring
10 Inner valve spring

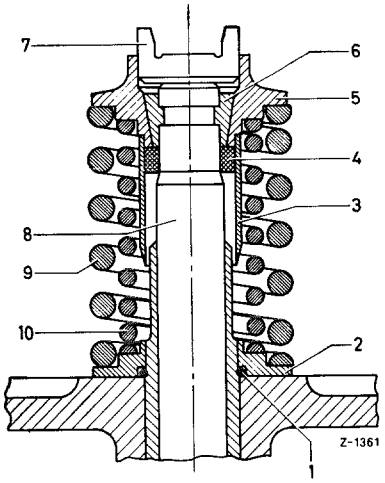


Fig. 01–4/20 d

Exhaust Valve

1 Lock washer
2 Thrust ring
3 Sealing ring holder
4 Sealing ring
5 Valve spring plate
6 Valve cone section
7 Thrust plate
8 Exhaust valve
9 Outer valve spring
10 Inner valve spring

During assembly the following points should be observed

a) Valves should have no burr at the groove for the valve cone sections to eliminate any possibility of damage when the sealing rings are attached.

b) Don't forget washer (2) or thrust ring (2) for spring support (Fig. 01–4/20 c and 01–4/20 d).

c) The sealing ring holder (3) at the inlet valve (8) should slide easily over valve guide, but without play (Fig. 01–4/20 c).

d) The sealing ring holder at the exhaust valve should not cover the valve guide more than 2.5 to 3 mm when the valve is closed.

e) Valve cone section should bear only at top and bottom of stem next to the groove, but not on bottom of groove.

f) The gap between the two valve cone sections should be of similar size on both sides when assembled.

g) During assembly be sure that sealing ring holder (3) does not touch valve spring (10) (Fig. 01–4/20 d).

II. Removal and Installation of Cylinder Head of Model 220 SE

Also refer to Section III.

Removal:

1. Remove air filter. For this purpose loosen vent line to cylinder head, supplementary air line (2), connection to venturi control unit and fixing screw on supporting rod (19) (refer to Fig. 01–4/11 a). Then remove air filter **in upward direction,** since the inlet air thermostat (13) projects into the air filter.

2. Disconnect the vacuum line to the distributor at the venturi control unit, detach the pull rod and the return spring at the throttle valve lever and unscrew the venturi control unit.

3. If the engine is installed in the car, drain off part of the cooling water and collect additives if present.

4. Remove the supplementary-air line, the injection pipes from the injection pump to the fuel distributor fittings, and the cooling water lines for the cooling water thermostat.

5. Further removal procedures are the same as for Model 190.

Installation:

6. Installation of the cylinder head is the reverse of the removal procedure. After installation attach all pipes and lines.

7. Attach the venturi control unit and the return spring holder to the intake pipe; do not omit the sealing ring (O-ring). Attach the vacuum line to the distributor and attach the pull rod and the return spring to the throttle valve lever.

8. **Check the adjustment of the control linkage** (see Workshop Manual Passenger Car Models starting August 1959, Job No. 00-16).

9. Install the air filter, fasten it, and connect all lines. When installing the air filter, take care to ensure that the rubber grommet is properly seated in the filter bottom and is not pushed into the filter housing.

10. Top up the cooling water.

11. Set the ignition (see Job No. 01-3, Section E).

12. Warm up the engine and retighten the cylinder head screws (see Section III, para i).

III. Procedure Differences for the Individual Models Concerning Removal and Installation of Cylinder Head, Valves, Camshaft, Chain Tensioner, Tension Sprocket, and Rocker Arms

a) Cylinder Head

1. **Compression Ratio**

When the cylinder head is replaced, pay attention to the stamped or cast-in compression ratio.

In order to exclude confusion between the cylinder heads for the different compression ratios, the compression ratio of the engine has been cast into the left side of the cylinder head above the threaded union for the water pipe connection (Fig. 01-4/21).

On previous cars the compression ratio was stamped into the left rear part of the machined surface (Fig. 01-4/21).

In order to increase engine performance and torque, the compression ratio was increased on Models 219 and 220 S from $\varepsilon = 7.6 : 1$ to $\varepsilon = 8.7 : 1$.

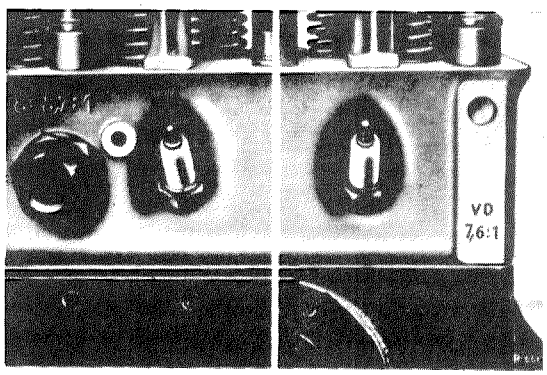


Fig. 01-4/21

Compression ratio on cylinder head

Cast-in on recent cars	Previously stamped

On Model 190 SL the compression ratio was also increased from $\varepsilon = 8.5 : 1$ to $\varepsilon = 8.8 : 1$. When cylinder heads are replaced on Models 220 a, 219, and 220 S, replacement cylinder heads are only supplied for a

compression ratio $\varepsilon = 8.7 : 1$, even if the engine was originally supplied with a cylinder head for a compression ratio $\varepsilon = 7.6 : 1$. We recommend, however, that when the higher compression cylinder head is installed, particularly in cars which are normally driven at high speeds, that the exhaust valves are replaced by sodium-filled exhaust valves as installed originally on Model 220 S and installed as a standard part on Model 219 with a compression ratio $\varepsilon = 8.7 : 1$.

In the same way replacement cylinder heads for Model 180 a are only supplied with a compression ratio $\varepsilon = 7.0 : 1$ and for Model 190 SL with a compression ratio $\varepsilon = 8.8 : 1$.

If pinking occurs during acceleration in the lower speed range when lower octane-number fuel is used in the case of Model 180 a with a compression ratio $\varepsilon = 7.0 : 1$, distributor VJU R 4 BR 28 should be installed. This distributor has a retarded centrifugal governor advance. When distributor VJU R 4 BR 28 is being installed, the ignition should at the same time be retarded to 4° BTDC, since otherwise ignition would be too early in the upper speed range. For countries using fuel of a lower octane rating, Models 220 a, 219, and 220 S have occasionally been supplied with a compression ratio of $\varepsilon = 6.8 : 1$.

The correct compression ratio for countries above 2000 meters altitude is $\varepsilon = 7.5 : 1$ for Models 180 a and 180 b.

2. Cylinder Head Gasket and Water Distributor

The water distributor, which on Models 180 a, 190 SL, 220 a, 219, and 220 S was previously stamped into the crankcase, has for some months now been pressed into the cylinder head. This alteration makes it necessary to use a different cylinder head gasket.

On Models 180 b, 219, and 220 S with a compression ratio of $\varepsilon = 8.7 : 1$ and on Model 220 SE the water distributor was pressed into the cylinder head on all cars.

Note: All replacement cylinder heads are supplied with a pressed-in water distributor system. If such replacement cylinder heads are used on engines on which the water distributor is located in the crankcase, the water distributor in the crankcase must be removed and the correct gasket type must be installed.

Four-cylinder engines

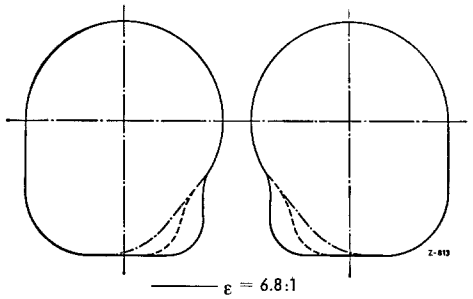


Fig. 01-4/22

Six-cylinder engines

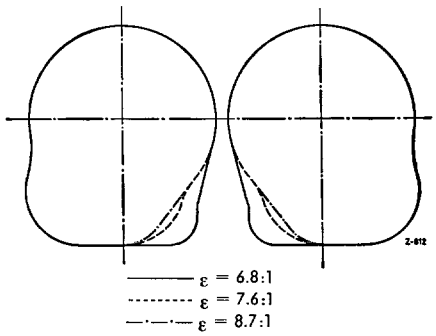


Fig. 01-4/23

It follows that different gaskets must be used for engines with water distributors in the cylinder head as for engines with water distributors in the crankcase.

Before installing the cylinder head gasket, check

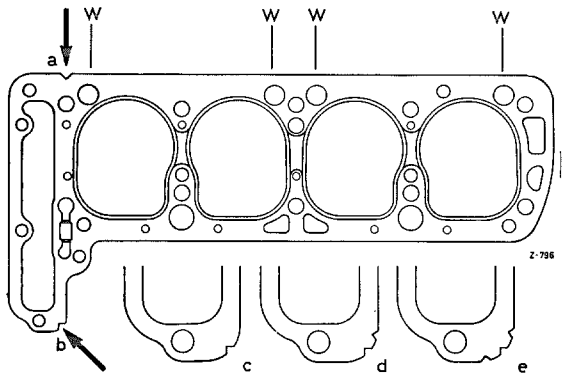
a) the location of the water distributors,
b) the compression ratio of the engine.

The easiest way of checking this is to put the cylinder head gasket on the cylinder head and to check whether the shape of the combustion chamber in the cylinder head and in the gasket correspond (Figs. 01-4/22 and 01-4/23).

Together with the introduction of the higher compression ratio ($\varepsilon = 8.7 : 1$) on Models 219 and 220 S the cylinder head gasket was increased from 1.5 mm to 2 mm (unpressed). On the other hand, the crankcase was made 0.5 mm lower at the separating surface in accordance with the thicker gasket.

On recent cars of Models 220 a, 219, and 220 S of a compression ratio of 6.8 : 1 these 2 mm cylinder head gaskets and the lower crankcases have been installed as standard parts.

Be sure that no thin seal of 1.5 mm thickness is placed into engine having the lower crankcase, because in unfavorable cases the piston may then touch the inlet valve.



For better distinction of cylinder head gaskets – also when installed – the gaskets for the engines with water distributors are marked with notches on the cylinder head, which were first at the front right part, but are now at the left front part (see arrows in Fig. 01–4/24).

Fig. 01–4/24

Marking of Cylinder Head Gasket in a 4-Cylinder Engine

a = 1st version of notch marks
b = 2nd version of notch marks
c = 1 notch as identification mark
d = 2 notches as identification mark
e = 3 notches as identification mark
W = Water holes right

The table below shows the various cylinder head gaskets including the various notch marks.

Cylinder Head Gaskets

Model	Compression Ratio	Part.-No. of Cylinder Head Gaskets for Engines with Water Distributors in		Notch Mark
		Cylinder Crankcase	Cylinder Head	
180 a (190 after SA 10250)	6.8 : 1	121 016 10 20 (Diring)	121 016 19 20 (Goetze) 121 016 22 20 (Diring)	—v—
180 a, 180 b, 180 c, (190, 190 b acc. to SA 10250)	7.0 : 1	The water distributors are pressed into cylinder head from the beginning	121 016 25 20 (Goetze)[2] 121 016 24 20 (Diring)[2]	—v—v—
190, (180 a, 180 b acc. to SA 10331)	7.5 : 1	121 016 09 20 (Diring)	121 016 25 20 (Goetze)[2] 121 016 24 20 (Diring)[2]	—v—v—
190 b, 190 c, 190 SL	8.5 : 1 8.7 : 1 8.8 : 1	121 016 08 20 (Diring)	121 016 26 20 (Goetze)[2] 121 016 23 20 (Diring)[2]	—v—v—v—
220 a and 219 acc. to SA 10037 220 S acc. to SA 10187	6.8 : 1	180 016 15 20	180 016 28 20 (Diring)[2]	—v—
220 a 219, 220 S	7.6 : 1	180 016 16 20 (Diring) optional 180 016 17 20 (Goetze)	In the event of a replacement for Models 220 a, 219, 220 S, only one cyl. head at a compr. ratio of ε = 8.7:1 will be supplied	—
220 a, 219 220 S	8.7 : 1	The water distributors are pressed into cylinder head from beginning	180 016 27 20 (Diring)[2] 180 016 29 20 (Goetze)[2]	—v—v—
220 SE	8.7 : 1		127 016 08 20 (Diring)[2]	—

[1] Only for cylinder head gaskets of engine with water distributors in cylinder head.
[2] With copper-lined water holes.

b) **Valve Guides with Valve Stem Sealing Systems**

Valves stem sealing for Models 180 a, 180 b, 190 b, 190 SL, 220 a, 219 and 220 S at inlet and exhaust valves is according to Fig. 01–4/26 or 01–4/27. However, on Model 220 SE the inlet valve is sealed acc. to Fig. 01–4/25 by means of a silicone ring, and the exhaust valve acc. to. Fig. 01–4/27.

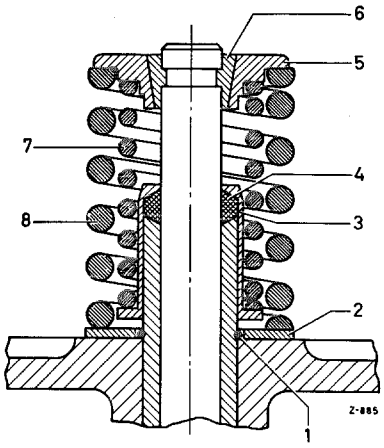


Fig. 01–4/25

Inlet Valve Stem Sealing for Model 220 SE

1 Snap ring
2 Washer
3 Sealing ring retainer
4 Sealing ring
5 Valve spring retainer
6 Valve cone half
7 Inner valve spring
8 Outer valve spring

When installing the thrust collars which serve to hold the valve guides and as a support for the valve springs, attention should be paid to the type of valve guides used. Formerly, only shouldered valve guides were used (Fig. 01–4/26).

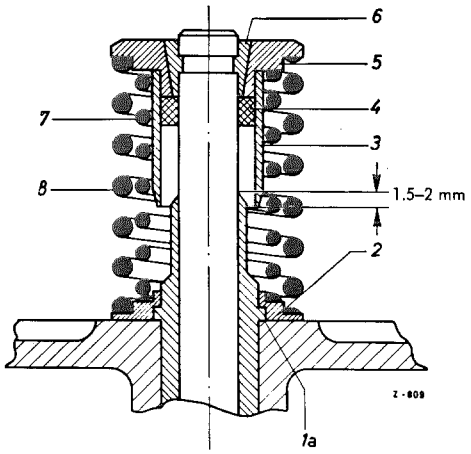


Fig. 01–4/26

1st Version

1a Shoulder on valve guide
2 Thrust collar
3 Sealing ring retainer
4 Sealing ring
5 Valve spring retainer
6 Valve cone half
7 Inner valve spring
8 Outer valve spring

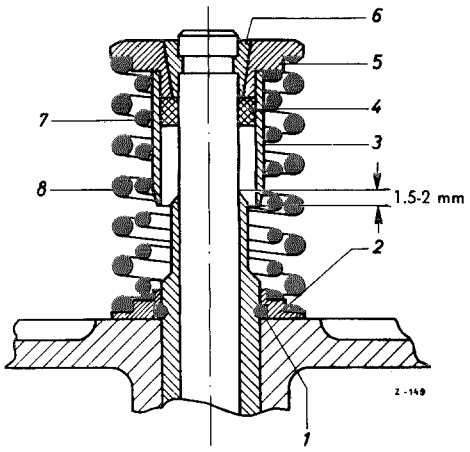


Fig. 01–4/27

2nd Version

1 Snap ring
2 Thrust collar
3 Sealing ring retainer
4 Sealing ring
5 Valve spring retainer
6 Valve cone half
7 Inner valve spring
8 Outer valve spring

Now we are using only valve guides with snap ring (Fig. 01–4/27).

For shouldered valve guides only thrust collars, part No. 121 053 01 62 with the dimension a = 2.2 + 0.2 mm may be used, and for valve guides with snap ring only thrust collars, part No. 121 053 02 62, with the dimensions a = 1.1 + 0.2 mm (Fig. 01–4/28).

In exceptional cases valve guides with snap ring may also use thrust collars of a dimension a = 2.2 + 0.2 mm, but in no case vice-versa.

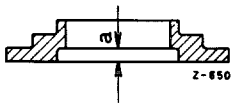


Fig. 01–4/28

a = 2.2 + 0.2 mm for shouldered valve guides
a = 1.1 + 0.2 mm for valve guides with snap ring

Note: More recently valve shaft sealing on Models 190 SL, 190 c and 180 c is from the beginning as shown in Fig. 01–4/20 c and 01–4/20 d.

c) **Valves**

The following engines are provided with sodium-filled exhaust valves as standard parts:

180 b	as from engine end No. 029 282	Part No. 121 053 15 05
180 c	as from 1st engine	Part No. 121 053 15 05
190 b	as from engine end No. 027 409	Part No. 121 053 15 05
190 SL	as from compression 8.8:1	Part No. 121 053 15 05
219	as from compression 8.7:1	Part No. 180 053 11 05
220 S	as from 1st engine	Part No. 180 053 11 05
220 SE	as from 1st engine	Part No. 180 053 11 05
220 SE	Cabriolet A and Coupe A as from 1st engine	Part No. 180 053 15 05

In no case may normal exhaust valves be installed in these engines, since this may lead to burning of the valves.

During subsequent installation of a high-compression cylinder head (ε = 8.7:1) on Models 220 a and 219 the use of sodium-cooled exhaust valves is recommended.

The use of sodium-cooled exhaust valves for these models is a must, if a camshaft with the code. No. 33 has been used (also refer to Section d).

On Models 180 a and 180 b sodium-cooled exhaust valves may be used in the event of repairs up to engine end No. 029 282.

To prevent confusion, the part No. punched into valve stem end should be observed.

Note: When scrapping sodium-cooled exhaust valves observe safety regulations!

Because of a danger of explosion sodium-cooled valves may not be melted down without first removing the sodium charge. It is similary dangerous to forge tools such as punches, screw drivers, chisels, etc. from sodium-cooled valves without previously removing the sodium charge.

Be careful when removing the sodium from valves, because sodium reacts extremely strongly and explosive when in contact with water and aqueous solutions, while in addition the developing inflammable hydrogen gas may start fires.

For removal and installation of valves the valve mounting bridge 180 589 05 63 should be used for 6-cylinder engines, and valve mounting bridge 121 589 01 63 for 4-cylinder engines.

d) **Camshaft**

The valve timing has been changed for engines of Models 190 SL, 220 a, 219 and 220 S (also refer to Job No. 01–3, Section L). To distinguish between the various camshafts they are marked at their rear end face with a number (Fig. 01–4/31).

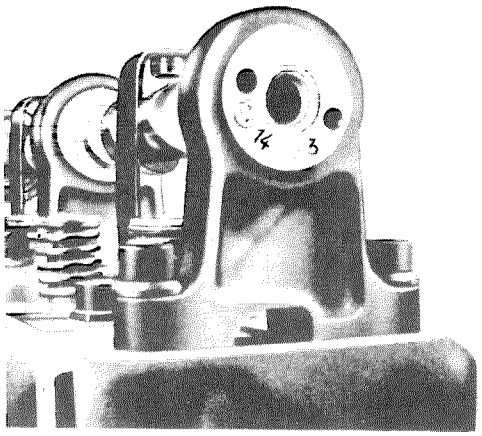


Fig. 01–4/31

Code Numbers of Camshafts

Model	Engine End No.	Code No.
180 a, 180 b 190, 190 b	—	11
180 c, 190 c	—	42
190 SL	up to 55 00183	14
	from 55 00184	15
190 SL	from further modified valve timing	44
220 a	up to 55 04778	14
	from 55 04779	14/1
219	up to 75 04347	14/1
220 S	up to 75 09083	
219	from N 75 04348 Z 75 00002	33
220 S	from N 75 09084 Z 75 00003	
220 SE	—	50

N = Engine with standard clutch.
Z = Engine with hydraulic automatic clutch.

On Model 190 SL the two camshafts having the code numbers of 14 and 15 may not be mixed up. Because of the longer stroke of the inlet valve the camshaft with Code No. 15 may be used only in combination with the cylinder head now used. If the new camshaft (with the Code No. 15) is nevertheless used with an old cylinder head, the supporting surface on the cylinder head for the thrust collars of the valve springs have to be milled down another Millimeter, because otherwise the valve springs may be crushed when the valve block is fully open (Fig. 01–4/32).

For Models 220 a, 219 and 220 S (also at a compression of ε = 7.6:1) only spare camshafts having the Code No. 33 will be supplied.

However, this camshaft may only be used in combination with sodium-cooled exhaust valves.

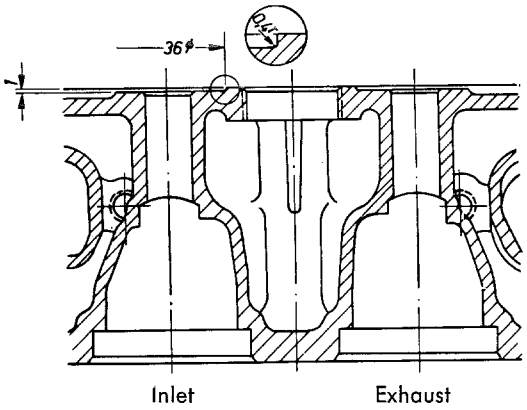


Fig. 01–4/32

e) Chain Tensioner

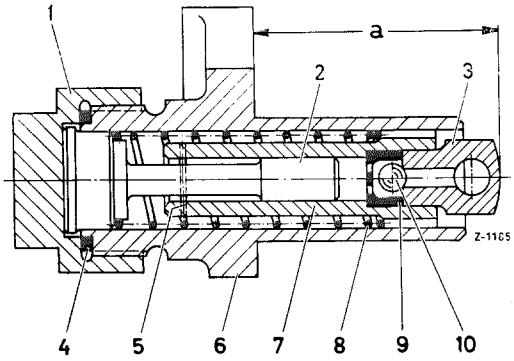


Fig. 01–4/33 a

1st Version

1 Cover cap
2 Pressure pin
3 Head
4 Sealing ring
5 Dowel pin
6 Chain tensioner housing
7 Pressure sleeve
8 Pressure spring
9 Ball retainer
10 Steel ball

A self bleeding chain tensioner has been installed (Fig. 01–4/33 b). This chain tensioner may be used instead of first version acc. to Fig. 01–4/33 a for subsequent installation, also for Model 220 a. Models 180 b, 190 b, 190 SL and 220 SE have the 2nd and 3rd version. Installation and removal is similar to model 190. However, it is emphasized once again that the two fixing nuts should be tightened uniformly and carefully. A new seal should also be used.

Following installation check, whether chain tensioner operates accurately without jamming, because otherwise the chain may run noisy.

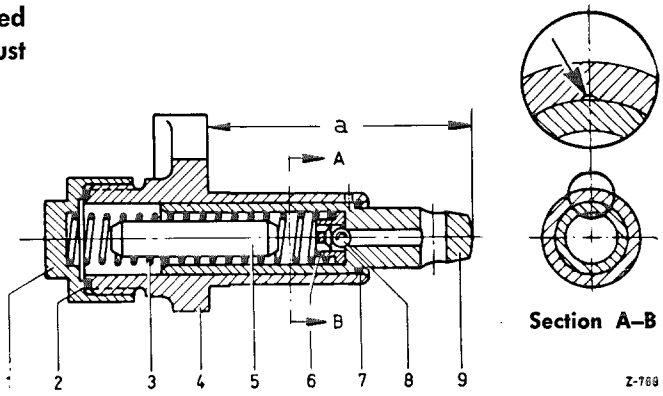


Fig. 01–4/33 b

2nd Version

1 Cap nut
2 Sealing ring
3 Pressure spring
4 Housing
5 Pin
6 Ball retainer
7 Snap ring
8 Ball
9 Pressure pin

Model	Part No.	Dimension "a" with removed chain tensioner
1st Version		
180 a 190 190 SL	121 050 03 11	58
220 a 219 220 S	180 050 03 11	52
2nd Version		
180 a, 180 b 190, 190 b 190 SL	621 050 00 11	58
219 220 S 220 SE	180 050 05 11	52

3rd Version[1]			
Model	Installed as from engine end No.	Part No.	Dimension "a" with removed chain tensioner
180 b	017 323	121 050 04 11	58
190 b	015 336		
190 SL	018 423		
220 SE Ca and CpA	001 059 000 240	180 050 06 11	52
4th Version[2]			
180 c	000 031	121 050 05 11	58
190 c	000 341		
190 SL	000 007		

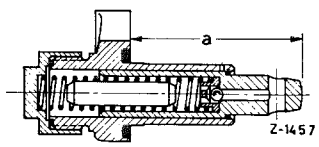


Fig. 01–4/33 c

3rd Version

[1]) The chain tensioner of 3rd design is in its functions similar to the 2nd version. The chain tensioner housing is however provided with an annular groove and a rubber ring is inserted between chain tensioner and cylinder crankcase; the up to now used gasket is therefore omitted (flange gasket).

[2]) The chain tensioner of 4th version (for 4-cyl. engine with improved valve timing) is distinguished from the 3rd version by its stronger pressure spring. This chain tensioner is marked by a red dot on the cap nut.

f) Tension Sprocket Bearing

If a new tension sprocket bearing is installed in Model 190 SL first measure the height "H" of the web of the oil case (Fig. 01-4/33c). The height of the web was changed from 28 mm to 32 mm and later to 36 mm in order to prevent air from being sucked up by the chain tensioner. On various engines this web was subsequently increased in height by adding a rubber gasket.

In order to prevent the tension sprocket bearing from fouling the web, old tension sprocket bearings with the Part No. 180 050 04 10 or 121 050 01 10 must not be installed in engines with a higher web and in engines modified as shown in Fig. 01-4/33 c. The new tension sprocket bearings with the Part No. 121 050 09 10 (Fig. 01-4/33 c) can be used in any engine.

The subsequent increase of the web height is described in detail in Workshop Manual Model 190 (see Job No. 05-5, Section F).

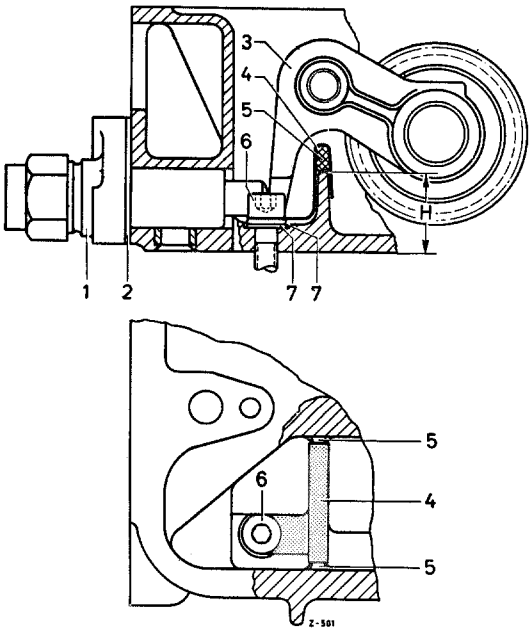


Fig. 01-4/33 c

1 Chain tensioner
2 Gasket
3 Tension Sprocket Bearing 121 050 09 10
4 Insert Plate 121 016 00 41
5 Rubber Gasket 121 987 00 46
6 Hexagon socket screw M 8 × 22 DIN 912-8 G
7 Washer 8.4 DIN 433

g) Chain Guides

On Model 220 SE the arrangement has been modified by adding a guide sprocket in the cylinder head; as a consequence, the chain guide is now fastened to a bracket screwed to the cylinder head. (Fig. 01-4/34).

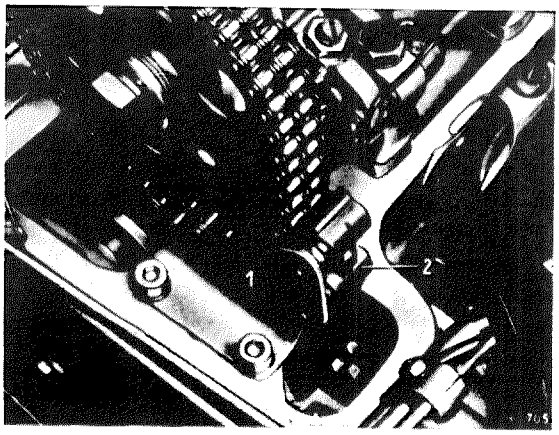


Fig. 01-4/34

1 Bracket 2 Chain guide

h) Rocker Arm Blocks and Rocker Arms

On earlier models sheet-metal spring clamps were used to secure the rocker arms (Fig. 01-4/35).

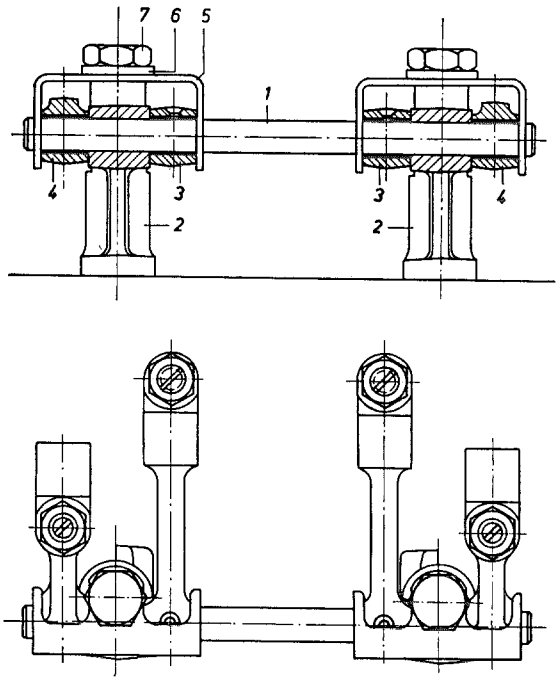


Fig. 01-4/35

1 Rocker arm shaft
2 Rocker arm block
3 Rocker arm for inlet valve
4 Rocker arm for exhaust valve
5 Spring clamp
6 Washer
7 Stretch screw

These sheet-metal clamps have now been replaced by spring clamps of spring steel wire (Fig. 01-4/36). At the same time, the

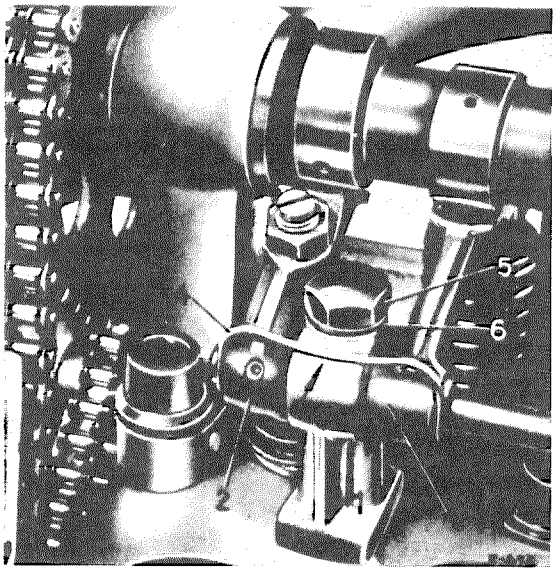


Fig. 01-4/36

1 Rocker arm block
2 Rocker arm for exhaust valve
3 Rocker arm for inlet valve
4 Spring clamp
5 Stretch screw
6 Washer

rocker arm blocks were provided with a notch in which the clamp springs engage (Figs. 01-4/36 and 01-4/37).

When repairs are being carried out, it is advisable to replace the sheet-metal spring clamps by spring clamps of spring steel wire with the Part No. 180 055 00 93. If the old rocker arm blocks are not being replaced, they must be provided with a notch to secure the spring clamp as shown in Fig. 01-4/37. The notch must correspond exactly to the dimensions given above in order to ensure that the clamp is tensioned sufficiently and engages securely.

Note: On Models 220 S and 220 SE the length of the rocker arm shafts is 153 mm for the 1st version and 159 mm for the 2nd version. The projecting ends of the 2nd version shafts prevent the spring clamps from jumping off the rocker arm shafts at high engine speeds. If complaints are received, the 1st version can without any modification be replaced by the 2nd version (Part No. 180 055 08 05) on Models 219, 220 S, and 220 SE.

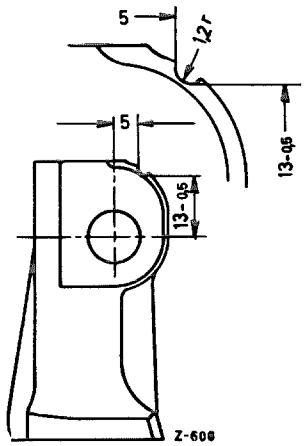


Fig. 01-4/37

i) Tightening of Cylinder Head Screws

The cylinder head screws must be tightened in stages and in the sequence shown in Figs. 01-4/38 and 01-4/39.

1st tightening	4 mkg
2nd tightening	6 mkg
3rd tightening	8 mkg
4th tightening (check tightening)	8 mkg
5th tightening with engine hot	9 mkg

Tightening Sequence for 4-Cylinder Engines

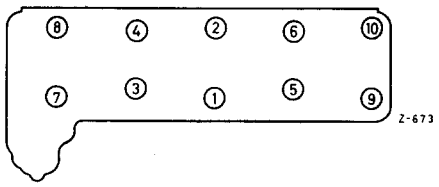


Fig. 01-4/38

Tightening Sequence for 6-Cylinder Engines

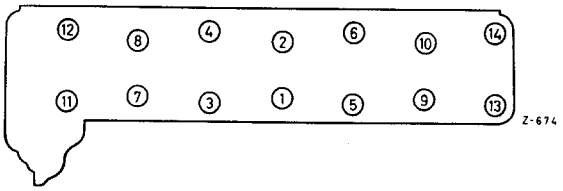


Fig. 01-4/39

The four hexagon socket screws M 8 at the front of the cylinder head should be tightened by hand.

After tightening the cylinder head screws check whether the camshaft can be turned easily by hand.

For the final tightening of the cylinder head screws on the warm engine proceed as follows:

Warm up the engine under slight load until the cooling water temperature reaches 80° C. Run the engine for another 5 minutes at this cooling water temperature and then tighten the cylinder head screws **to 9 mkg** in the sequence indicated above.

After a road test or after a mileage of no more than 20 km check the tightening torque of the cylinder head screws (9 mkg.) Do not force the engine during the road test.

After the road test also check all unions for leakage and all screws for tightness and, if necessary, retighten.

Finally check the tappet clearance once more with the **engine cold.**

After the car has run a further 500 km carry out a third check on the tightening torque of the cylinder head screws with the engine at normal running temperature; the tightening torque must be **9 mkg.**

D. Removal and Installation of Generator and Starter

a) Removal and Installation of Generator, see Job No. 15–11.

b) Removal and Installation of Starter, see Job No. 15–0.

E. Removal and Installation of Water Pump with Fan

Repair procedures see Job No. 20–5.

On Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE, with the exception of the pump on Model 190 SL, the removal and installation procedures are the same as for Model 190.

The usual by-pass line (8) (Fig. 01–4/40) is not installed in Model 190 SL, since the line heating the intake pipe also serves as a by-pass line. The threaded union (10) in the water pump housing has been replaced by a screw plug (Fig. 01–4/41). Furthermore, the hub pressed onto the water pump shaft and to which the pulley and the fan are fixed has four threaded bores, whereas on all other models pulley and fan are fastened with only three screws.

The water pumps of Models 180 a, 180 b, 190, 220 a, 219, 220 S, and 220 SE with the same capacity are interchangeable, whereas the pulleys vary in size (see table).

Pulley for Water Pumps

Model	180 a, 180 b, 190, 190 b, 220 S	190 SL	220 a, 219, 220 SE
External diameter of pulley	138	125	149

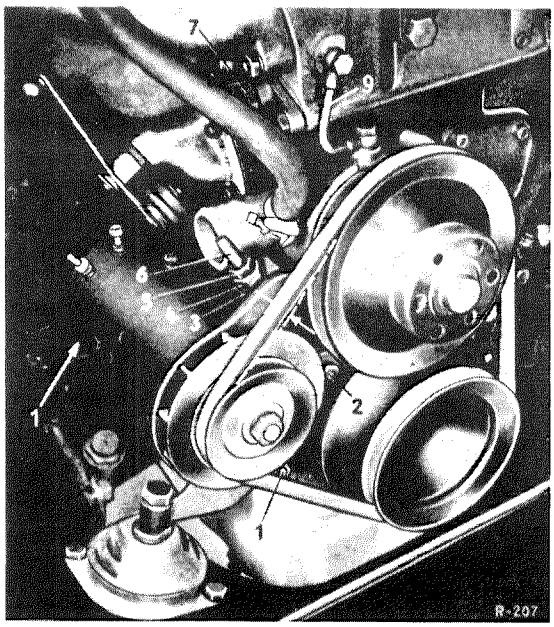


Fig. 01-4/40

1 Generator mounting
2 Tensioning screw (6) mounting
3 Clamping piece
4 Tensioning nut
5 Hexagon nut
6 Tensioning screw
7 Chain tensioner
8 By-pass line
9 Air vent line

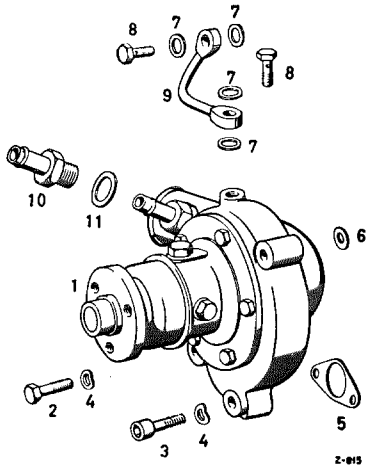


Fig. 01–4/41

1 Waterpump
2 Hexagon screw
3 Hexagon socket screw
4 Spring washer
5 Gasket
6 Sealing ring
7 Sealing ring
8 Hollow screw
9 Compensating line
10 Threaded union
11 Sealing ring

On Models 220 a, 219, 220 S, and 220 SE the fixing screw (3) is a hexagon socket screw (Fig. 01-4/41). This screw can only be removed and installed through the vibration damper. To do this turn the crankshaft until one of the six bores in the vibration damper is accurately aligned with the screw.

When installing the water pump do not forget the sealing ring (6) under the top fixing lug. On no account should a standard washer be used, since when the water pump fixing screws are tightened the sealing ring (6) must be compressed to the same degree as the gasket (5) in order to achieve a proper tight seal between the water pump and the crankcase.

Water Pump with Higher Capacity

In recent cars of Models 180 a, 190 SL, 219, and 220 S water pumps with a capacity of 4 kg/sec are installed (previous capacity 3.25 kg/sec). Models 180 b and 220 SE have all been provided with this high capacity water pump. The new water pump has a larger impeller and as a consequence also a larger water pump housing; see also Job No. 20-5. The high capacity water pump can be installed subsequently in older engines of the above-mentioned models and also in Model 220 a. In future, only high capacity pumps will be supplied as replacement parts.

In the case of the high capacity water pump a distinction must de made between the intermediate version and the final version. The intermediate version water pump has no connecting branch for the by-pass line on the inlet branch for the cooling water, whereas the final version water pumps are fitted with such a connecting branch.

The installation of an intermediate version water pump therefore requires a distributor pipe for cooling water return flow, heating, and by-pass line, whereas for the installation of the final version and the lower capacity water pump only a distributor pipe for cooling water return flow and heating is required.

When subsequently installing the water pump in Model 220 a up to engine end no. 55 09040 use a pulley Part No. 180 205 07 10 with 3 hexagon screws M 8×18 DIN 933–8 G and 3 spring washers B 8 DIN 137, since up to this engine number the pulley is cast integral with the hub. When installing the high capacity water pump subsequently, make sure that there is sufficient space between the recess on the crankcase and the modified water pump housing (Fig. 01-4/42). If necessary, increase the recess (b) by milling down the crankcase.

In addition, on Models 220 a, 219, and 220 S the eye (a) for the front stud bolt on the cylinder head must de milled down to ensure that the water pump does not touch the cylinder head (Fig 01-4/42).

The previous air vent line from the water pump to the cylinder head can no longer be used for the new water pump. Models 180 a and 190 SL require an air vent line Part No. 121 200 02 58 and Models 220 a, 219, and 220 S require an air vent line Part No. 180 200 02 58.

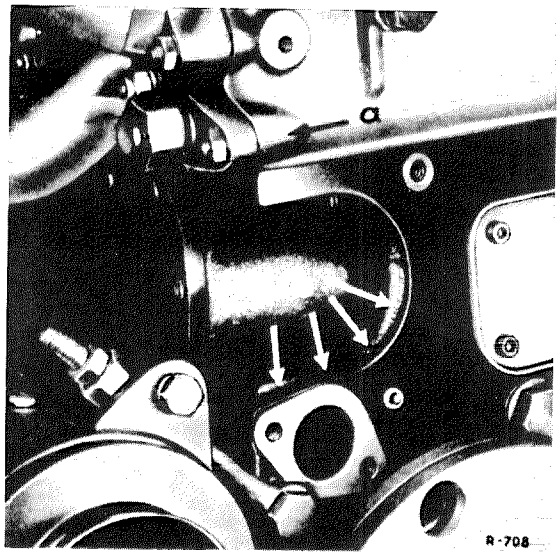


Fig. 01–4/42

F. Removal and Installation of Distributor with Bearing

Repair procedures see Job No. 15–23.

a) Distributor

The removal and installation procedures for the distributor on Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE are the same as described for Model 190.

In addition to the details given in the Workshop Manual for Model 190 the following points are of importance:

Before installing the distributor check whether the piston of the 1st cylinder is at ignition dead center and whether the distributor rotor arm points to the timing mark for the 1st cylinder on the distributor housing (Fig. 01–4/44).

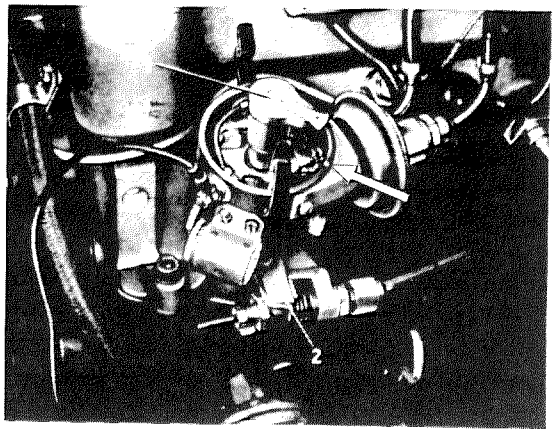


Fig. 01–4/44

1 Distributor rotor arm
2 Timing lever

If the helical gear has been removed, note the following points when re-installing it:

The groove in the helical gear and the two driving jaws of the distributor shaft are offset from the center by a = 0.8 mm (Fig. 01-4/45). When installing the helical gear make sure that the offset part of the groove is on the correct side, i. e. the wider segment must point toward the crankcase. Since groove and jaws are only slightly offset, the distributor can be forced into position if the helical gear has been installed the wrong way round, i. e. displaced by 180°. However, an incorrectly installed helical gear will make the distributor housing wobble and may cause scoring of the distributor drive.

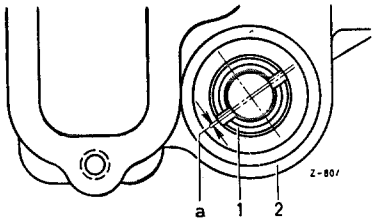


Fig. 01–4/45

a = 0.8 mm
1 Helical gear
2 Crankcase

On recent models the distributor is connected to the cylinder head by a ground lead (1) (Fig. 01–4/46).

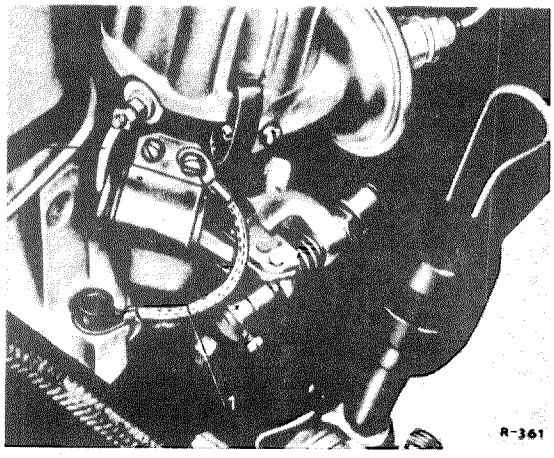


Fig. 01–4/46

1 Ground lead
2 Cable

Because of faulty ground connection between distributor and engine block, engines without ground lead may be subject to ignition failure at high engine speeds. In such cases, and when distributor bearings are replaced, we recommend the installation of this ground lead Part No. 121 150 02 32. The ground lead is fastened to the distributor by the right condenser screw; on Model 220 SE by the screw for the vacuum box; the ground lead is attached to the engine by the cylinder head screw on the sprocket housing.

b) Distributor Bearing

With the exception of Model 220 SE the procedures for removing and installing the distributor bearing on Models 180 a, 180 b, 190 SL, 220 a, 219, and 220SE are basically the same as described for Model 190. The deviations from the standard procedure result from the fact that in the course of time the distributor bearing and the timing device for the distributor have undergone a number of modifications.

The 1st version of the distributor bearing is shown in Fig. 01–4/47. Later, the distributor bearings were provided with a fixing lug (3) with which the bearing was fastened to the cylinder head by means of the hexagon socket screw (1) (Fig.01–4/49); the stud screw (4) was no longer fitted (Fig. 01–4/47). Later, the octane number compensator on the instrument panel was dispensed with and the distributor bearing was modified to enable the distributor to be adjusted directly on the bearing by means of the adjusting screw(13) (Fig. 01–4/50).

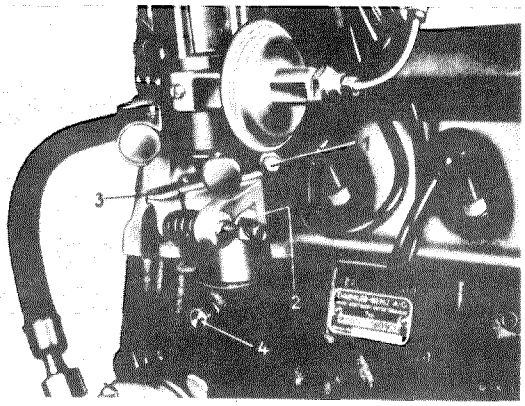


Fig. 01–4/47

1st Version distributor bearing
for octane number compensator

1 Clamping screw for clamping timing lever to distributor
2 Stud screw for securing distributor to distributor bearing
3 Timing lever at distributor bearing
4 Stud screw for fixing distributor bearing in crankcase

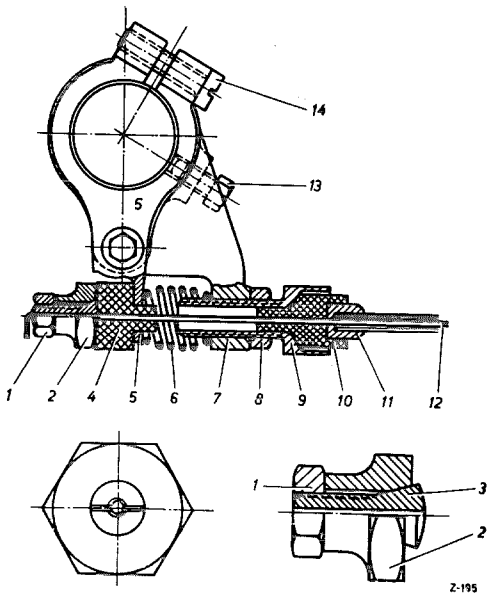


Fig. 01–4/48

1st Version distributor bearing
for octane number compensator

1 Hexagon nut
2 Clamping chuck
3 Collet
4 Damping rubber
5 Timing lever
6 Pressure spring
7 Distributor bearing
8 Hexagon nut
9 Adjusting screw
10 Rubber sleeve
11 Sleeve
12 Coil spring
13 Hexagon screw for fixing distributor
14 Clamping screw

When installing a distributor bearing with the fixing lug (3) cast integral, please note that the hexagon socket screw (1) is 45 mm long, whereas on distributor bearings of the 1st Version (without fixing lug) the hexagon socket screw was only 20 mm long (Fig. 01–4/49).

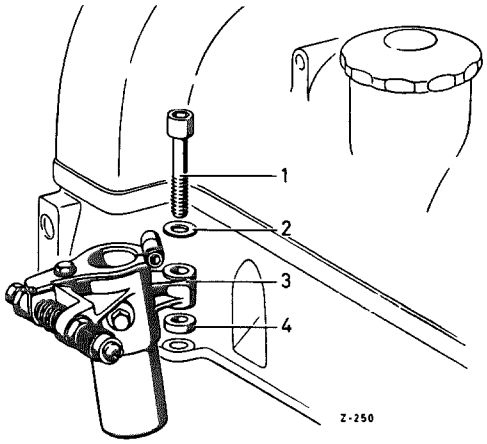


Fig. 01–4/49

2nd Version distributor bearing for octane number compensator

1 Hexagon socket screw (45 mm long)
2 Washer
3 Fixing lug on distributor bearing
4 Spacer ring

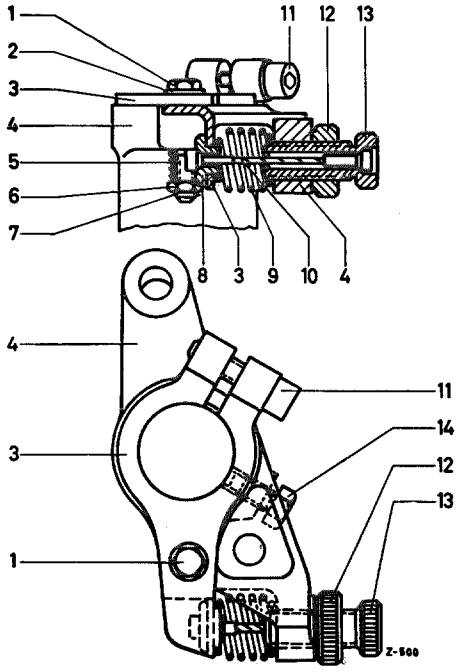


Fig. 01–4/50

3rd Version distributor bearing with adjusting screw

1 Hexagon screw
2 Washer
3. Timing lever
4 Distributor bearing
5 Spring
6 Hexagon nut
7 Cotter pin
8 Washer
9 Pressure spring
10 Cable with 2 nipples
11 Clamping screw
12 Milled nut
13 Adjusting screw
14 Hexagon screw for fixing distributor

On recent models the adjusting screw and control cable on the distributor bearing have been replaced by a hand lever (2) with eccentric disk (Figs. 01–4/51 a and 01–4/51 b). In addition, the stud screw (14) which projects into the circular groove in the distributor collar, is no longer fitted (Fg. 01–4/50).

On Model 220 SE the distributor bearing also serves as a cover plate and is screwed to the end face of the crankcase (Fig. 01–4/51 b).

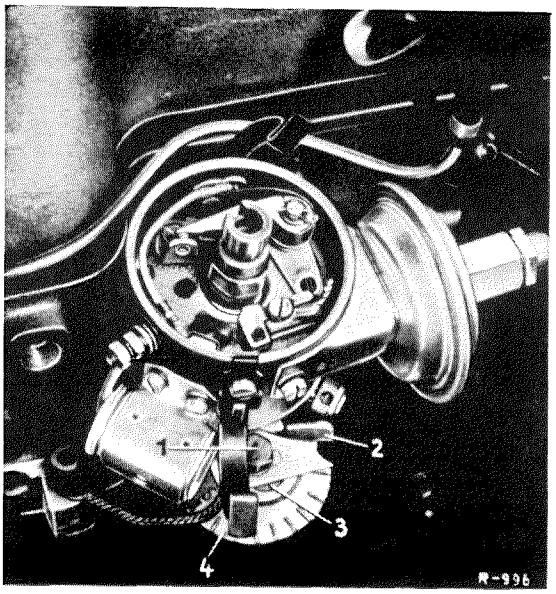


Fig. 01–4/51 a

4th Version distributor bearing with hand lever and eccentric disk

1 Hexagon screw with spring washer
2 Hand lever with eccentric disk
3 Timing lever
4 Distributor bearing

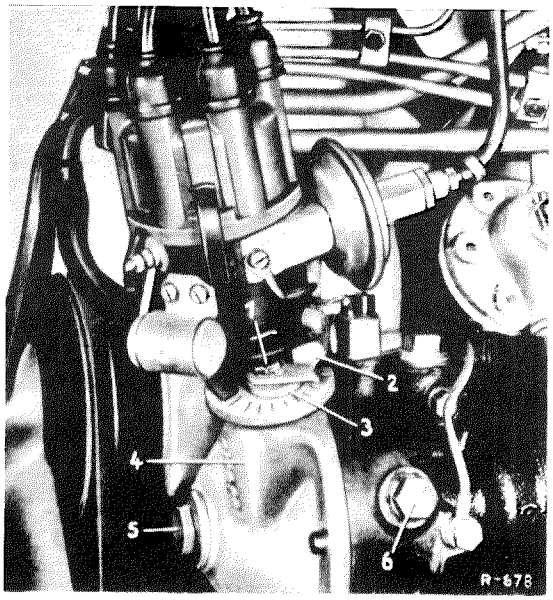


Fig. 01–4/51 b

4th Version distributor bearing photographed on Model 220 S

1 Hexagon screw with spring washer
2 Hand lever with eccentric disk
3 Timing lever
4 Distributor bearing
5 Screw plug
6 Lock screw for chain drive

When the hand lever (2) is turned, the timing lever (3) is moved via the eccentric disk and automatically moves the distributor. To provide a means of checking the ignition adjustment, these distributor bearings have a graduated scale. Movement of the hand lever by one graduation results in a change of the ignition setting by 2° on the crankshaft.

To adjust the hand lever (2) loosen the hexagon screw (1) and then tighten it again.

Note: In future, only distributor bearings with hand lever and eccentric disk will be supplied as replacement parts. If such a bearing is installed in a car which has an octane number compensator remove the control cable.

The following table shows which distributor bearing types are installed as standard parts in the various models.

180 a	180 b	190 SL	220 a	219	220 S	220 SE	Distributor bearing type
		+	+	+	+		1. with octane number compensator as shown in Figs. 01-4/47 and 01-4/48
		+		+	+		2. with octane number compensator and fixing lug as shown in Fig. 01-4/49
+		+		+	+		3. with fixing lug, adjusting screw, and cable as shown in Fig. 01-4/50
+	+	+		+	+	+ [1]	4. with fixing lug, hand lever and eccentric disk as shown in Figs. 01-4/51 a and 51 b

[1]) On Model 220 SE the distributor bearing serves at the same time as a cover plate (Fig. 01-4/51 b).

G. Removal and Installation of Oil Pump Drive, Distributor Drive, Injection Pump Drive, and Revolution Counter Drive

Repair procedures see Job No. 18-1.

I. Models 180 a, 180 b, 220 a, 219 and 220 S

Removal and installation procedures for the oil pump and the distributor drive are the same as described for Model 190.

On Model 180 a the idling gear on older cars was designed for the single roller chain; on recent cars the idling gear is the same as for Model 190, since Model 180 a is now also provided with a twin roller chain.

II. Model 190 SL

Removal and installation procedures for the oil pump and distributor drive are basically the same as described for Model 190.

On Model 190 SL the idling gear shaft (10), via the driving screw (5), also drives the angle drive for the revolution counter (15). The idling gear (8) has a shoulder on the end face which carries the centering disk (7) for the driving screw (5) (Fig. 01-4/52). On no account should an idling gear without shoulder be installed in Model 190 SL.

In place of the cover plate, the flange bushing (1) with the angle drive for the revolution counter (15) is screwed to the crankcase (Fig. 01-4/52). See also Fig. 01-4/53, Nos. (5) and (4).

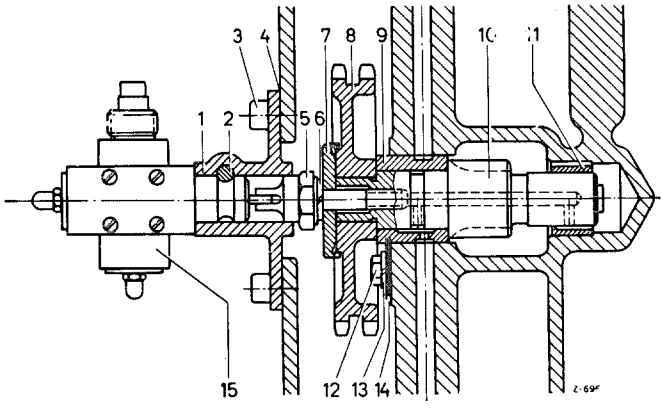


Fig. 01-4/52

1 Flange bushing
2 Hexagon screw
3 Hexagon socket screw
4 Gasket
5 Driving screw
6 Spring washer
7 Centering disk
8 Idling gear
9 Front bearing bushing
10 Idling gear shaft
11 Rear bearing bushing
12 Hexagon screw
13 Lock washer
14 Locking plate for front bearing bushing
15 Angle drive for revolution counter

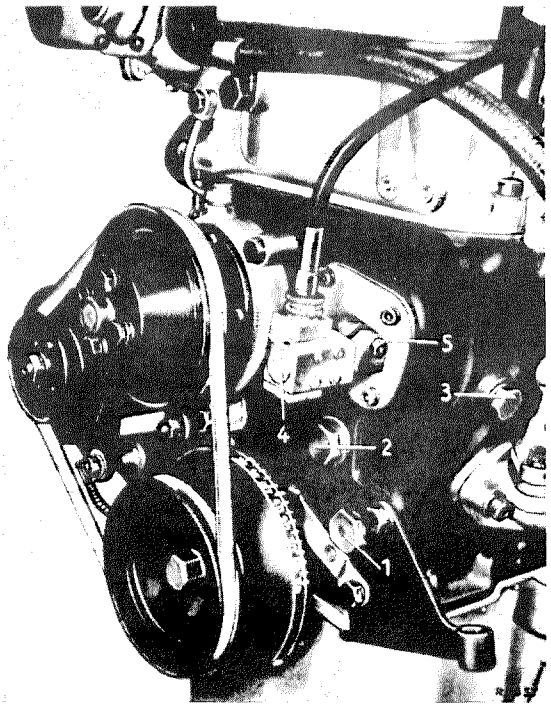


Fig. 01-4/53

1 Screw plug with pivot pin for chain guide
2 Screw plug for oil relief valve
3 Lock screw for chain drive
4 Angle drive for revolution counter
5 Flange bushing

III. Model 220 SE

On Model 220 SE the idling gear shaft drives not only the oil pump and the distributor but also the injection pump. The whole drive arrangement is shown in Fig. 01-4/54. The removal and installation procedures are as follows:

Removal:

1. Remove the injection pump, the venturi control unit, and the distributor. Unscrew the cylinder head cover and move the piston for the 1st cylinder to ignition TDC.

2. Unscrew the six hexagon socket screws on the distributor bearing (8), remove the bearing and pull out the helical gear (9) for the distributor drive (Fig. 01-4/54).

3. Unscrew the hexagon nut (21) at the front of the idling gear shaft (10) and remove the lock washer (22), the washer (23), the drive sleeve (18), the Woodruff key and the spacer sleeve (19).

4. Back off the screw plug (33) on the oil pump drive approximately 2 turns, unscrew the hexagon screw (35) and pry out the pressure piece (36) upward by inserting a screw driver between the screw plug (33) and the cover disk (32). Then pull out the helical gear (39).

5. Unscrew the screw plug (33) completely from the pressure piece (36) and remove the cover disk (32) and the rubber ring (34).

6. Unscrew the chain guide in the cylinder head, the hexagon screw on the camshaft sprocket and the chain tensioner. Then pull off the camshaft sprocket by means of Puller 187 589 01 33, paying attention to the compensating washer between camshaft and camshaft sprocket.

7. Unscrew the locking screw for the chain drive and tap out the idling gear shaft toward the back, removing the idling gear at the same time.

8. If the front and rear bearing bushings (11) and (12) and the bearing assembly (38) with the bearing bushing (40) have to be removed, remove the bearing bushings for the idling gear shaft by means of Puller 186 589 09 33 or tap them out with a suitable drift; after having removed the oil pan tap out the bearing assembly with the bushing for the helical gear from below with a suitable drift.

Checking:

9. Check the parts for wear, in particular the contact surface of the idling gear and of the front bearing bushing.

   The end play between the idling gear and the bearing bushing should be 0.05–0.12 mm. If the play exceeds 0.20 mm replace the worn parts. When replacing the idling gear, install one with a hardened check plate. The check plate turns with the idling gear, they are connected by a heavy dowel pin.

Installation:

10. Use a suitable drift to drive in the bearing bushings or the bearing assembly if previously removed, install the idling gear shaft from the rear, push on the idling gear and install the roller chain making sure that the Woodruff key is properly seated.

Note: On Model 220 SE the front bearing bushing has oil grooves on both end faces, whereas on other models the front bearing bushing has oil grooves only on the rear end face.

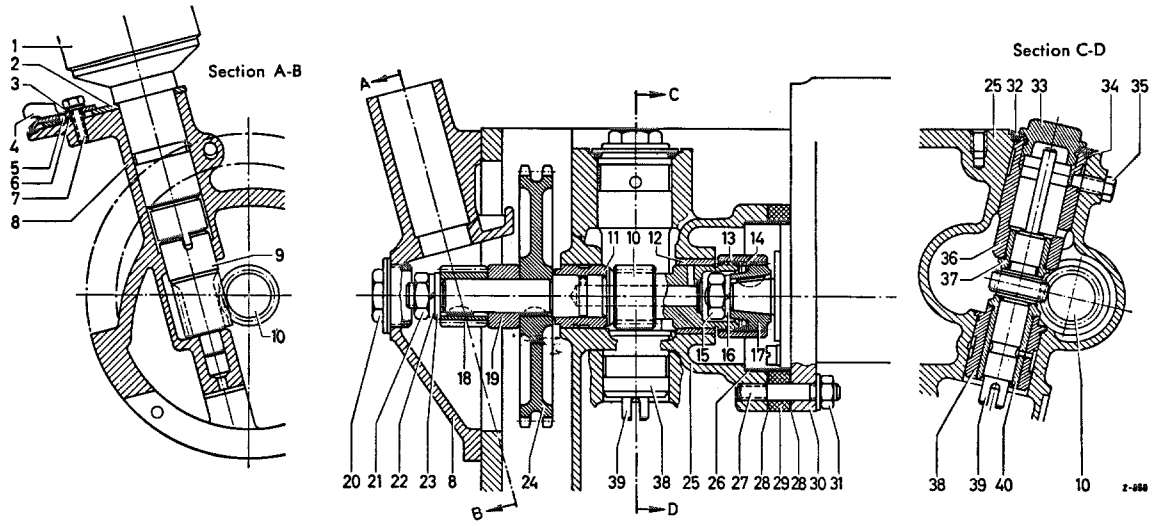


Fig. 01-4/54

1 Distributor
2 Timing lever
3 Spring washer
4 Hand lever
5 Cylindrical pin
6 Eccentric disk
7 Hexagon screw
8 Distributor bearing
9 Helical gear
10 Idling gear shaft
11 Bearing bushing, front
12 Bearing bushing, rear
13 Coupling sleeve
14 Snap ring
15 Hexagon nut
16 Lock washer
17 Follower
18 Drive sleeve
19 Spacer sleeve
20 Screw plug and seal
21 Hexagon nut
22 Lock washer
23 Washer
24 Idling gear
25 Crankcase
26 Bearing sleeve
27 Stud bolt
28 Sealing flange
29 Insulating flange
30 Injection pump
31 Hexagon nut and washer
32 Cover disk
33 Screw plug
34 Rubber ring
35 Hexagon screw
36 Pressure piece
37 Bearing bushing
38 Bearing assembly
39 Helical gear
40 Bearing bushing

11. Install the spacer sleeve (19), the drive sleeve (18), the washer (23), the lock washer (22) and screw on the hexagon nut (21), making sure that the Woodruff key for the drive sleeve is properly seated.

    Then tighten the hexagon nut (21), holding the idling gear shaft steady by inserting Serrated Wrench 621 589 00 08 in the serrations for the coupling sleeve (13).

    Check the end play of the idling gear shaft (0.05–0.12 mm).

12. Screw the distributor bearing (8) to the crankcase. Use a new gasket!

13. Check whether the piston for the 1st cylinder is at TDC. Then install the camshaft sprocket together with the chain, paying attention to the timing mark on the compensating disk and on the front camshaft bearing.

14. Install the chain tensioner and bleed it. Screw on the chain guide in the cylinder head.

15. Put on the cylinder head cover and screw it down, making sure that the rubber seal is properly seated.

16. Insert the helical gear (39) for the oil pump drive and the pressure piece (36). Tighten the stud screw (35) to secure the pressure piece. Check the end play by touch, pulling at the pin of the helical gear; the end play should be 0.1–0.8 mm.

17. Fit the rubber ring (34) and the cover disk (32) and screw in the screw plug (33).

18. Install the distributor and set the ignition.

19. Screw the locking screw for the chain drive and the screw plug (20) into the bearing of the distributor. Use new sealing rings.

20. Install the venturi control unit and the injection pump. Do not forget to check the adjustment of the control linkage (see Workshop Manual Passenger Car Models as from August 1959, Job No. 00-16).

H. Removal and Installation of Fuel Feed Pump

I. Models 180 a, 180 b, 190 SL, 220 a, 219, and 220 S

Repair procedures see Job No. 09-5, Section B.

Removal and installation procedures for the fuel feed pump are the same as described for Model 190.

Subsequent Installation of a Dust-Proof Fuel Feed Pump

as an optional extra according to

SA 10 271 in Models 180 a and 180 b

SA 10 181 in Models 220 a, 219

SA 10 148 in Model 220 S

For countries with dusty and sandy terrain, a fuel pump with two dust filters in the lower part of the case is available in place of the normal fuel pump with a ventilation bore. The dust-proof pump Part No. 000 091 53 01 can be installed in place of the standard pump without further modification.

II. Model 220 SE

Model 220 SE has an electrically driven fuel feed pump which is installed in front of the left spare wheel trough (see Workshop Manual Passenger Car Models as from August 1959, Job Nos. 00-15 and 07-10).

I. Removal and Installation of Oil Filter

Cleaning and testing procedures see Job No. 18-5, Section E.

The removal and installation procedures for Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE are the same as described for Model 190. There are, however, differences in the shape and in the angle of inclination of the connecting flange which are important when the filter is being replaced.

Model 190 SL with three-point engine suspension has an oil filter case upper part Part No. 121 184 00 08 with an inclination of 7° 30'. The same model with four-point engine suspension has an oil filter case upper part Part No. 121 184 01 08 with an inclination of 13° 30'. As a result, the filter head is closer to the oil pan and cannot foul the support arm of the sub-frame for the rear engine mounting.

Never install an oil filter case upper part (Part No. 121 184 00 08) with an inclination of 7° 30' on Models with four-point engine suspension.

On Models 220 a, 219 and 220 S the 1st version connecting flange and also the gasket between the crankcase and the oil filter case have a different shape. The upper part of the case in 4-cylinder engines differs from that in 6-cylinder engines.

For rationalisation purposes the same oil filter case upper part that is used in Models 180 a, 190, and 190 SL is installed in Models 219 and 220 S with a crankcase whose left side wall is closed (without cylinder cover) and on all cars of Models 180 b and 220 SE.

On recent 4-cylinder engines for Models 180 a, 190, and 190 SL and all engines for Model 180 b oil filters are used which have only one fine filter element, whereas Models 219, 220 S, and 220 SE have oil filters with a strainer element and a fine filter element.

K. Removal and Installation of Oil Relief Valve in Crankcase

Cleaning and checking procedures see Job No. 18-5, Section C.

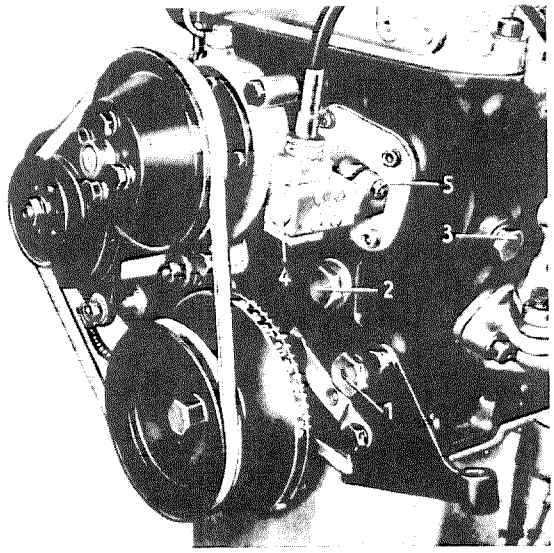


Fig. 01-4/55

Position of oil relief valve on 4-cylinder engines and 6-cylinder engines with closed left side wall

1 Screw plug with pivot pin for chain guide
2 Screw plug for oil relief valve
3 Locking screw for chain drive
4 Angle drive for revolution counter
5 Flange bushing

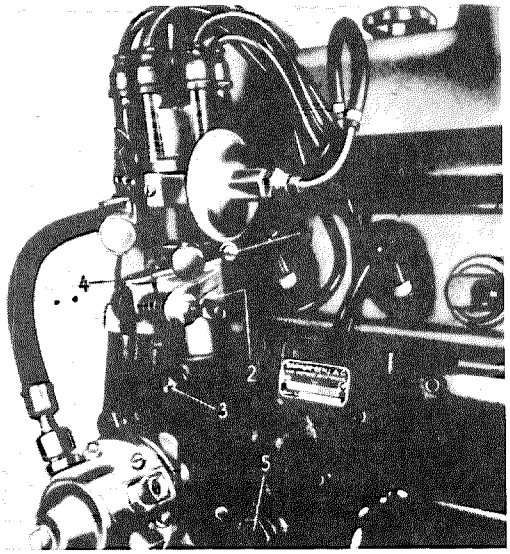


Fig 01-4/56

Position of oil relief valve on 6-cylinder engines with cylinder cover on the left side

1 Cheese-head screw for timing lever
2 Stud screw for distributor
3 Stud screw for distributor bearing
4 Timing lever
5 Oil relief valve

On Models 180 a, 180 b, 190 SL, 220 SE, and on Models 219 and 220 S with a crankcase with closed left side wall (without cylinder cover) the oil relief valve is on the end face of the crankcase and is covered by the screw plug (2) (Fig. 01-4/55).

On Models 220 a, 219, and 220 S whose crankcase has a cylinder cover on the left side, the oil relief valve (5) is screwed into the side of the crankcase without a screw plug (Fig. 01-4/56).

On all models the removal and installation procedures for the oil relief valve are the same as described for Model 190.

Always use a new sealing ring when installing the oil relief valve or the screw plug. The oil relief valve at the end face of the crankcase is installed without a sealing ring.

When the engine has run warm, the oil relief valve or the screw plug must be checked for mechanical tightness and must be retightened, if necessary.

L. Removal and Installation of Oil Pan

I. Models 180 a, 180 b, and 190 SL

Removal and installation procedures for the oilpan are exactly the same as described for Model 190.

II. Models 220 a, 219, and 220 S with Split Oil Pan

Removal:

1. Drain off the oil, remove the tie-rod and the steering shock absorber.

2. Unscrew the front engine brace (judder brace) from the oil pan and the front axle support (only if installed).

3. Unscrew the front part of the oil pan and remove it.

4. If the oil pan is removed only in order to remove the oil pump or to check the connecting rod bearings, the rear part of the oil pan need not be unscrewed (Fig. 01-4/57). If complete removal is necessary, first unscrew the cover plate for the clutch housing, then unscrew the two M 10 fixing screws fixing the clutch housing to the oil pan as well as the two long and two short fixing screws on the oil pan rear part and remove the oil pan.

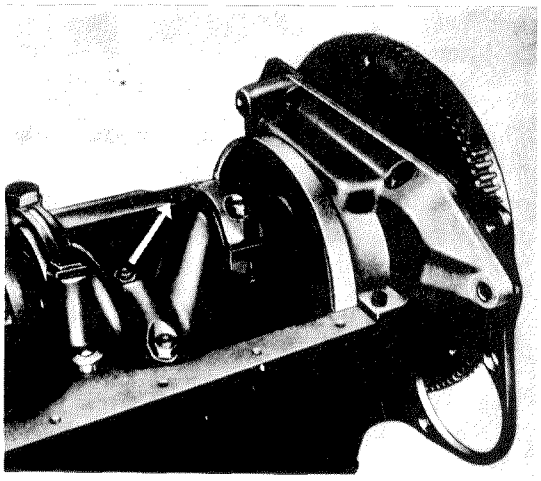


Fig. 01-4/57

Installation:

5. Check the fabric sealing ring in the oil pan rear part which serves to seal the crankshaft and, if necessary, replace it. Carefully press the sealing ring into the sealing ring retainer by means of a hammer handle and cut the ends off so that the ring projects appr. 0.2 mm at the separating surface. This is necessary in order to achieve sufficient contact pressure at the joints. Oil the fabric sealing ring, coat the separating surface of the oil pan rear part with sealing compound and screw it on.

6. Fit the rubber sealing ring for sealing the front and rear parts of the oil pan in the groove and lightly glue it in place in such a way that the ends project 1–2 mm and that the distance from the separating surface is the same on both sides. Apply sealing compound to the separating surface of the oil pan and also to the sealing surface for the front sealing ring, put on the oil pan and tighten the screws.

7. Fix the front engine brace (judder brace) to the front axle support and to the oil pan. If necessary, adjust the connecting rod to its correct length (see Job No. 22-2).

8. Screw on the cover plate for the clutch housing, screw in the two M 10 fixing screws and insert the oil dipstick.

9. Install the tie-rod and the steering shock absorber and top up the engine oil.

III. Models 219, 220 S, and 220 SE with One-Piece Oil Pan

On Model 219 as from Engine End No. 7501549 and on Model 220 S as from Engine End No. 7503461 the split oil pan was replaced by a one-piece oil pan. This one-piece oil pan cannot be removed with the engine installed in the vehicle. When the engine is removed, the removal and installation procedures for the oil pan are the same as described for Model 190.

Note: On Models 220 a, 219, and 220 S the split oil pan can be subsequently replaced by the one-piece oil pan without any modification.

With the introduction of the crankcase with closed left side wall (without cylinder cover) the front left hexagon socket screw for fastening the oil pan to the crankcase was moved outward 35 mm. This oil pan cannot be installed in engines of previous design.

M. Removal and Installation of Oil Pump

Repair procedures see Job No. 18-5, Section B.

Note: In the case of engines with a one-piece oil pan, the oil pump cannot be removed with the engine installed in the vehicle.

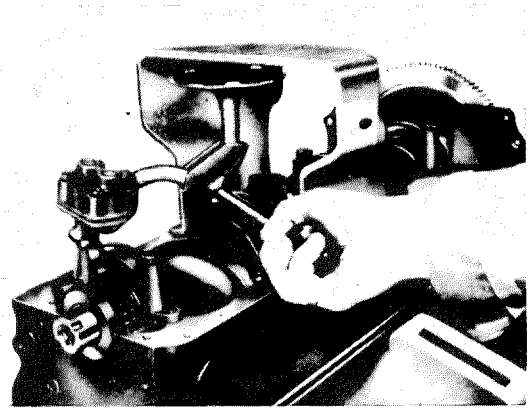


Fig. 01-4/58

I. Models 180 a, 180 b, and 190 SL

Removal and installation procedures for the oil pump are the same as described for Model 190.

II. Models 220 a, 219, 220 S, and 220 SE

The removal and installation procedures for the oil pump are basically the same as described for Model 190, but the oil pump suction pipe is fastened with a bracket to the second crankshaft bearing cap. Since, furthermore, the suction pipe is screwed to the oil pump housing and is not cast integral with it, care must be taken to ensure that the suction strainer is parallel to the bottom of the oil pan when the pump is being installed. If this is not the case, the suction pipe must be turned (Fig. 01-4/58).

N. Removal and Installation of Counterweight and Vibration Damper on Crankshaft

Repair procedures for the vibration damper see Job No. 03–5, Section I.

I. Counterweight on Models 180 a, 180 b, and 190 SL

On Models 180 a, 180 b, and 190 SL a counterweight is mounted on the front crankshaft end as in the case of Model 190 (Fig. 01–4/59). Removal and installation procedures are the same as for Model 190.

On recent cars of Models 190 and 190 SL the counterweight with long hub has been replaced by a counterweight with a short hub and a spacer ring. As a result, the crankshaft is no longer sealed at the front by the hub of the counterweight, but by the spacer ring which has been installed in all cars of Models 180 a and 180 b and in all 6-cylinder engines (see Fig. 01–4/60).

The advantage of this modification is that when the sealing surface is worn only the spacer ring has to be replaced and not the whole counterweight.

The spacer ring Part No. 121 031 00 51 can also be installed subsequently; in this case, the counterweight with long hub Part No. 121 031 01 07 must be replaced by a counterweight with short hub Part No. 121 031 03 07.

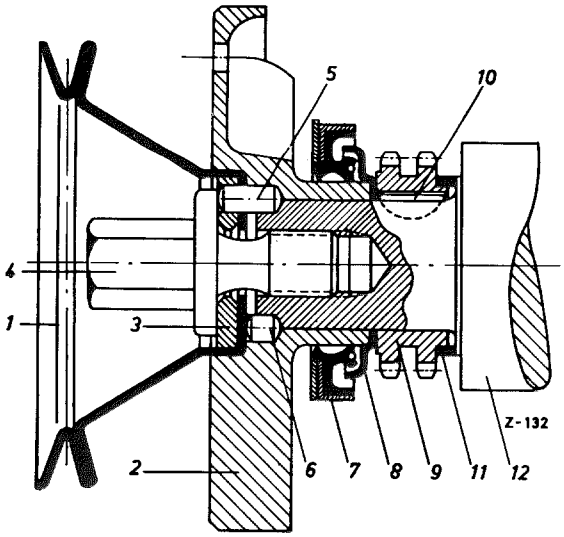


Fig. 01–4/59

1 Pulley
2 Counterweight
3 Washer
4 Shoulder screw
5 Dowel pin
6 Dowel pin
7 Oil seal
8 Oil thrower
9 Crankshaft sprocket
10 Woodruff key
11 Compensating ring
12 Crankshaft

II. Counterweight and Vibration Damper on Models 220 a, 219, 220 S, and 220 SE

On Models 220 a, 219, 220 S, and 220 SE a vibration damper is installed between the counterweight (2) and the pulley (8) Fig. 01–4/60).

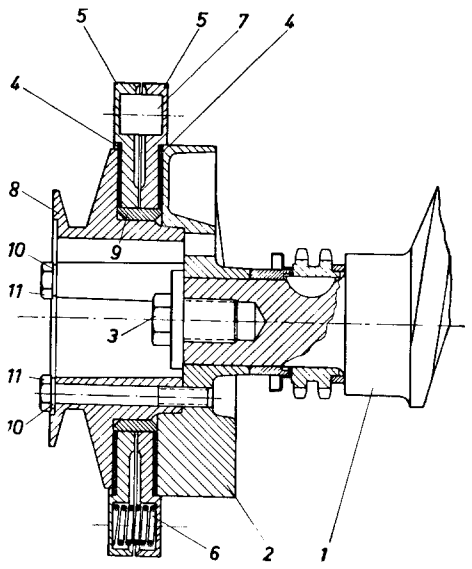


Fig. 01–4/60

1 Crankshaft
2 Counterweight
3 Shoulder screw
4 Contact disk
5 Flywheel ring
6 Pressure spring
7 Shear block
8 Pulley
9 Contact ring on pulley
10 Spring washer
11 Hexagon screw

Removal:

1. If the vibration damper and the counterweight are removed with the engine in the vehicle, the radiator must be removed beforehand (see Job No. 50–1).

2. Unscrew the fan, release the tension of the fan belt at the belt tensioner and remove the belt.

3. Fit the two Clamps 187 589 04 31 over the flywheel rings and slightly compress the vibration damper (Fig. 01–4/61).

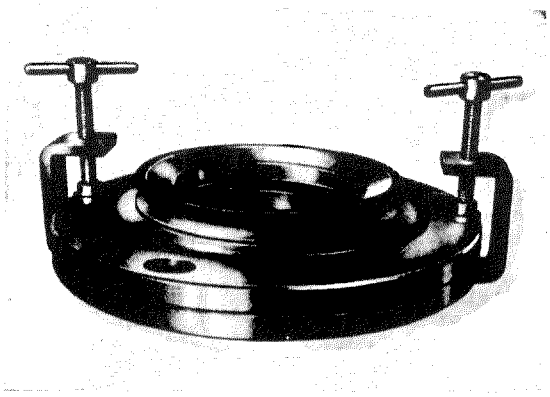


Fig. 01–4/61

4. Detach the connecting rod of the front engine brace, if installed. Then detach the front engine support at the rubber mountings and lift the engine at the front until the lower edge of the vibration damper is above the upper edge of the front axle support.

5. Unscrew the hexagon screws (11) for fastening the pulley and take of the pulley together with the vibration damper (Fig. 01–4/60).

6. Unscrew the wing nuts of both clamps evenly and disassemble the vibration damper. Check all parts and, if necessary, repair or replace them.

7. Unscrew the shoulder screw (3) which fixes the counterweight to the crankshaft, and pull the counterweight of the crankshaft, using Puller 000 589 17 33.

Note: If the counterweight has to be replaced, **remove the crankshaft and rebalance it together with the new counterweight and the flywheel** (see Job No. 03–5, Section G).

Installation:

8. Fit the counterweight (2) to the crankshaft extension pin and turn it until the bores for the dowel pins are lined up.

   Attention! The bores are slightly offset with respect to each other in order to prevent the counterweight from being installed incorrectly.

   Then drive in the two dowel pins. They must be seated firmly in the bores; if that is not the case, the bores must be bored and reamed to a diameter of 9.930–9.966 mm (10 ⌀ X9) with a maximum depth of 9 mm; use thicker dowel pins 10 h 8 × 8 DIN 7 (9.978–10.000 mm ⌀) (Fig. 01-4/62).

   Now firmly tighten the counterweight (2) on the crankshaft by means of the shoulder screw (3).

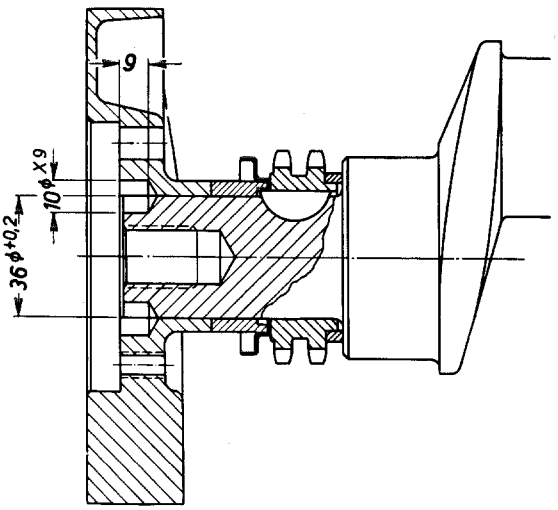


Fig. 01–4/62

9. Assemble vibration damper. Insert the 8 pressure springs and 2 shear rubbers into flywheel and clamp uniformly by means of the two clamps 187 589 04 31 (Fig. 01–4/61).

10. Place outer contact disk (4), the compressed flywheel rings (5) and the inner contact disk (4) onto contact ring (9) of the pulley and attach by means of hexagon screws (11) to counterweight. Use spring washers with hexagon screws. Then remove the two clamps from vibration damper.

11. Lower engine, attach front engine supports to rubber mountings and fasten connecting rod of engine brace. Attach fan belt and tighten, then mount fan.

12. Install radiator and top up with cooling water (refer to Job No. 50–1).

O. Removal and Installation of Crankshaft with Counterweight and Flywheel

Repair procedures see Job No. 03–5, Sections A, B and G.

Removal and installation of the crankshaft for models 180 a, 180 b, 180 c, 190 SL, 220 a, 219, 220 S, 220 SE is the same as for model 190, except that the front seal of the crankshaft is no longer, as before, on the hub of the counterweight, but on a specially attached spacer ring (refer to Section N, page 01–4/47).

In addition, model 190 SL is provided as from engine. end No. 65 00 795 with a flywheel having a larger attaching flange. The bolt hole circle has been enlarged from 56 ± 0.2 mm to 78 ± 0.1 mm. For replacements, only crankshafts of the 2nd version with the matching flywheel will be available.

Instead of the former thrust washers fixing the crankshaft in axial direction, which are in part still used today, all our engines will in future be provided with a fitted bearing and collar in the cylinder crankcase (upper bearing shell section), and in some cases also in the crankshaft bearing cap (lower bearing shell section). (For details refer to Job No. 03–5, Section B.)

The bolts for the crankshaft bearing cap are now for all types uniformly assembled with spring washers B 12 DIN 137. For engines, where the second crankshaft bearing cap is used to attach the bracket for the oil pump, these bolts are assembled without spring washers.

P. Removal and Installation of Piston and Connecting Rods

Removal and Installation of pistons and connecting rods on models 180 a, 180b, 190 SL, 220 a, 219, 220 S and 220 SE is exactly the same as for model 190. In these models the pistons may be removed in upward direction.

In all models, with the exception of models 180 a and 180 b, pistons with extended skirt will be used (Fig. 01–4/63).

The piston for model 220 SE has a piston pin bore of 24 mm dia. as compared with the piston for models 220 a, 219 and 220 S, which have a 22 mm dia. Since the reinforcement of the connecting rods at the piston boss of models 219 and 220 S the external dia. of the bushing is now also 27 mm, similar to model 220 SE, instead of 25 mm as before. The internal dia. of the bushing of models 219 and 220 S has remained the same.

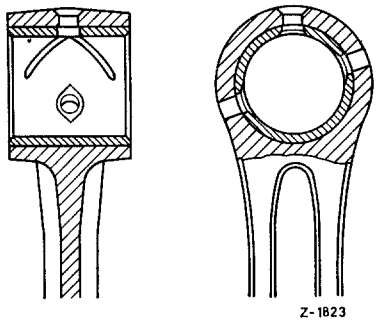


Fig. 01–4/63 a

Small End with Oil Holes

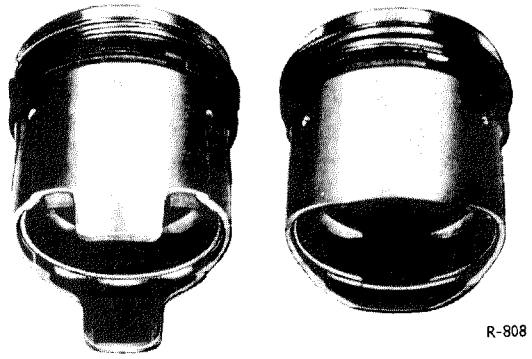


Fig. 01–4/63

Piston Shapes

Models 180 c, 190, 190 b, 190 SL, 220 a, 219, 220 S and 220 SE — Models 180 a, 180 b

For connecting rods and pistons of models 180 c (from the beginning) and 190 SL the distance from the center bearing hole has been changed from 154 mm to 149 mm, the distance from center piston pin hole to piston head from 43 mm to 48 mm, and the diameter of the piston pin from 25 mm to 26 mm. The pressure oil hole to piston pin has been eliminated. Instead, the piston head is provided with three holes through which the splashed oil reaches the piston pins.

Connecting rods and pistons are installed in such a manner that the lower oil hole "a" at the connecting rod boss, or the holding lugs of the bearing shells, respectively, point towards the left, and the arrow on the piston head in the direction of driving.

Q. Disassembly and Reassembly of Crankcase

Disassembly and reassembly of cylinder crankcase for models 180 a, 190 SL, 220 a, 219, 220 S and 220 SE is substantially the same, since the various crankcases vary but slightly in construction.

On models 180 a and 190 SL fastening the right-hand cylinder cover holds simultaneously also the bearing block for the carburetor linkage relay lever, on type 190 SL in addition the bracket for the air suction pipe support. When mounting the cylinder cover watch out for proper length of bolts. The long M 6 × 18 screws are meant to attach the brackets.

For some time now, Models 180 a and 190 SL have been fitted with a crankcase on which both the left and the right side wall are closed; the cylinder covers which were previously used are no longer fitted.

The bearing bracket for the relay lever of the carburetor linkage in Model 180 a and the bracket for the air suction pipe support on Model 190 SL which were previously fastened to the crankcase together with the cylinder cover are now screwed directly to the crankcase.

The crankcase has 3 threaded holes M 6 and 1 threaded hole M 8 for this purpose.

On Models 180 a and 180 b the bearing bracket is fixed with 3 hexagon screws M 6×15 and the threaded bore M 8 is closed by a 10 mm hexagon screw with sealing ring.

On Model 190 SL the bearing bolt is screwed into the M 8 bore together with a sealing ring. The two front threaded bores M 6 are closed with two 10 mm hexagon screws with sealing rings. The third rear threaded bore M 6 remains open.

Liberally coat the threads of the screws and the surfaces of the sealing rings with sealing compound in order to ensure proper sealing of the water jacket space.

The closed crankcase was first used on

Model 180 a as from Engine End No. 85 07471
Model 190 as from Engine End No. 85 09140
Model 190 SL as from Engine End No. 85 01732

All cars of Model 180 b have the crankcase with closed side walls.

On Models 219 and 220 S a crankcase has been used for some time now, on which the left side is closed and is consequently no longer fitted with a cylinder cover.

This crankcase was first used on

Model 219 with standard clutch
as from Engine End No. N 85 00360

Model 219 with hydraulic automatic clutch
as from Engine End No. Z 85 00121

Model 220 S with standard clutch
as from Engine End No. N 85 00647

Model 220 S with hydraulic automatic clutch
as from Engine End No. Z 85 00283

All cars of Model 220 SE have a crankcase with the left side wall closed.

On Models 180 a, 190 SL, 220 a, 219, and 220 S the partition plate between crankcase and clutch housing has been reinforced from 5 mm to 6 mm in order to improve the centering of the clutch.

Note: All cars of Models 180 b and 220 SE have the 6 mm partition plate.

On Models 180 a, 190 SL, 219, 220 S, and 220 SE the length of the dowel pins top left in the crankcase for centering the partition plate and the clutch housing and the dowel pin top right in the crankcase for centering the partition plate were increased in diameter from 8 to 12 mm. All cars of Model 180 b have these thicker dowel pins. When installing a replacement engine or a new partition plate or a new clutch housing, it may be necessary to use shouldered dowel pins. For details see the tables below.

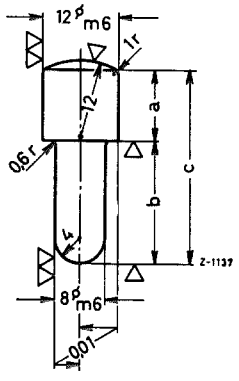


Fig. 01–4/64

$8 \phi\ m\,6 = 8\ ^{+\ 0.006}_{+\ 0.015}$

$12 \phi\ m\,6 = 12\ ^{+\ 0.007}_{+\ 0.018}$

Dowel Pin Crankcase – Partition Plate – Clutch Housing

Diameter of bore in			Part No.	Dimension		
Crankcase	Partition plate	Clutch housing		b	a	c
8	8	8	186 991 07 01	—	—	26
8	8	12	180 991 01 62	14	16	30
8	12	12	[1]	11	19	30
12	8	8	180 991 03 62	19	11	30
12	12	8	180 991 02 02	13	17	30
12	12	12	180 991 00 60	—	—	34

[1] If a partition plate and a clutch housing with 12 mm dowel pin bores is installed, a dowel pin must be made as shown in Fig. 01-4/64. Dowel Pin 180 991 02 62 can be used in an emergency.

Dowel Pin Crankcase – Partition Plate

Diameter of bore in		Part No.	Dimension		
Crankcase	Partition plate		a	b	c
8	8	186 991 08 01	—	—	16
8	12	180 991 04 62	11	11	22
12	8	180 991 04 62	11	11	22
12	12	180 991 01 60	—	—	20

R. Removal and Installation of Front Grease Seal for Crankshaft with Engine Installed in Vehicle

On Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE the removal and installation procedures for the front grease seal for the crankshaft are the same as described for Model 190. If the grease seal is being replaced, always check the spacer ring, or in older engines of Models 190 and 190 SL the hub of the counterweight to see whether the sealing surface for the grease seal is badly worn (see Figs. 01–4/59 and 01–4/60). If the sealing surface is badly worn the parts must be replaced.

S. Removal and Installation of Flywheel

Repair procedures see Job No. 03–5, Sections E to H.
On Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE the removal and installation procedures for the flywheel are the same as described for Model 190. The following points deserve attention:

On Models 190 SL, 219, and 220 S a spacer sleeve was installed on some cars between crankshaft and annular grooved bearing. On the present crankshafts the bore is not so deep and consequently the spacer sleeve is no longer necessary.

On Model 190 SL a flywheel with a larger attaching flange was installed as from Engine End No. 65 00795. The bolt hole circle was increased from 56 ± 0.2 mm to 78 ± 0.1 mm.

On Models 219 and 220 S with hydraulic automatic clutch the annular grooved bearing has been replaced by a centering ring for the journal of the clutch end plate in the crankshaft. On recent cars the centering ring is no longer fitted and the journal has been correspondingly increased in diameter.

On Models 219 and 220 S the flywheel has been changed and is now of the same design as on Models 180 a, 180 b, and 190 SL. The new flywheel can only be installed subsequently if the clutch (without drive plate) is replaced.

The flywheel fixing screws (stretch screws) are tightened with a torque of 6–6.5 mkg in the case of 4-cylinder engines and of 4–4.5 mkg in the case of 6–cylinder engines. The screws are not locked.

T. Removal and Installation of Roller Chain with Engine Installed in Vehicle

For Models 180 a, 180 b, 190 SL, 220 a, 219, 220 S, and 220 SE the removal and installation procedures for the roller chain are the same as described for Model 190.

If repair should be necessary, a chain with a jointing link (spare link) can be installed as a substitute for the endless chain. This enables the chain to be replaced without disassembling the engine.

When the engine is being overhauled, however, an endless chain should always be fitted if the chain has to be replaced.

On earlier cars of Model 180 a, a single roller chain was fitted. Later, as from Engine End No. 85 10924, this was replaced by a twin roller chain of the type used in the other models.