

SECTION P

Air Cleaners and Fuel System

AIR CLEANERS

Operating conditions play an important part in deciding how frequently it is necessary to service the air cleaner. If you are working in dusty conditions then the air cleaner should be attended to every day, as indicated under "Preventive Maintenance".

If not already fitted, you should consider the fitting of an 18 in water gauge RESTRICTION INDICATOR in the air trunking between the air cleaner and the engine induction manifold. It indicates by means of a visual signal when the air cleaner element needs servicing. A means of visual signalling for the "Rotopamic" type air cleaner failure is the use of the "DUST SIGHT". A window in this device becomes cloudy when the system has failed, but this type of indicator is usually only used with the two stage extreme heavy duty cleaners.

The type of air cleaner fitted to your vehicle or machine depends upon the manufacturer of your equipment. Usually, guidance for the method of servicing is shown on the body of the air cleaner, but the following advice will also help.

Dry Type Two Stage "Cyclopac" See Fig. P.1

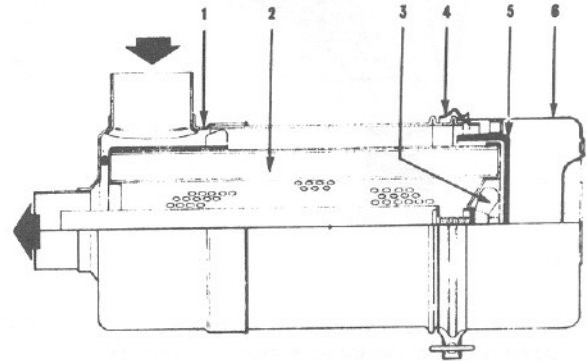
The dust bowl collects the heavier particles which are thrown out by the centrifuge path of the air. This dust enters the bowl by the slot in the baffle plate. The level of dust in the bowl must not be allowed to reach to within half an inch of the slot in the baffle plate.

For cleaning purposes the assembly should be removed from the engine. With horizontal installations the slot in the baffle is located at the top.

Remove the dust bowl by releasing the pinch screwed clamp. Remove the baffle from the interior of the dust cup by lifting it out, which gives access to the dust for removal. The element can be removed by releasing the wing nut.

Renew the element or clean by back flow air pressure no more than 100 lbf/in² or washing in a non foaming detergent as recommended by the air cleaner manufacturers. Allow the element to soak for at least ten minutes and then gently agitate. Rinse the element with clean water and allow to dry. Do not use oven heat.

WARNING: There is a danger that some of the dust remaining in the element after it is washed will be pulled through into the engine if the element is replaced in a wet condition. The reason for this is that the water acts as a carrier for the dust.



P1

1. Body Assembly
2. Element Assembly
3. Nut and Gasket Assembly
4. Clamp Assembly
5. Baffle Skirt
6. Cup Assembly

Inspect the element by placing a bright light in its centre. Any pin holes, thin spots or ruptures render the element unfit for further use. This cleaning procedure reduces the effective life of the element.

With all dry type elements, they should be renewed after six cleanings and at least once a year, whichever occurs first.

Never use petrol (gasoline) for cleaning.

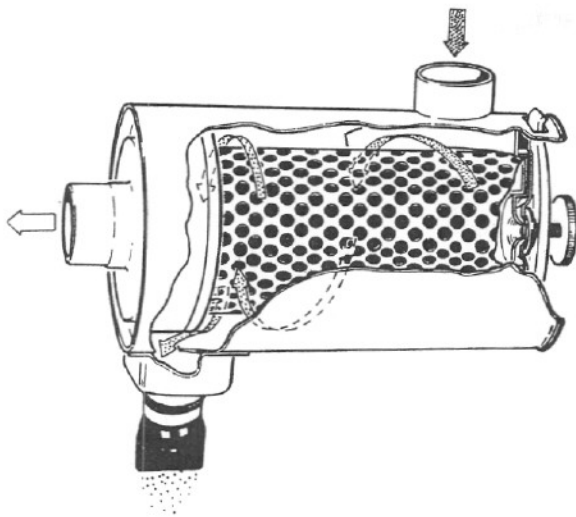
Dry Type Two Stage "Cyclone" See Fig. P.2

The AUTOMATIC DUST EJECTOR should always be kept clean and the lips of the rubber ejector checked to see that they close but do not adhere together.

To service the element, unscrew the clamping screw and remove the element retaining strip. Remove the seal plate (if fitted) and element.

If the element is contaminated by dry dust, clean by carefully tapping by hand or by directing low pressure compressed air on to the clean side of the element. If the element is contaminated by oil or soot, it can be cleaned by washing in a suitable non-foaming detergent. After washing, rinse out thoroughly by directing clean water to clean air side of element and allow to dry — do not oven dry.

AIR CLEANERS AND FUEL SYSTEM—P.2



P2

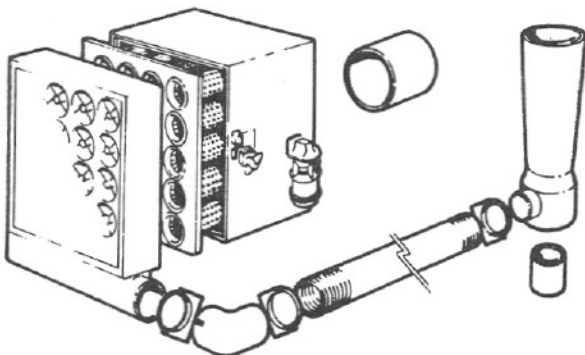
Inspect cleaned element by placing a bright light inside and looking through element. Any thin spots, pin holes or other damage will render the element unfit for further use.

The element should be renewed after six detergent washes or annually, whichever occurs first. Clean the inside of the element body and dry thoroughly. Inspect joints, hoses and clips and renew where necessary. Re-assemble cleaner ensuring that all joints are leak proof.

Extreme Heavy Duty Two Stage, with Multiple Elements "Rotopamic" — See Fig. P.3

The "Rotopamic" type air cleaner may be fitted where the application is designed to work in heavy concentrations of dust and a restriction indicator must be fitted.

The air cleaner elements are replaceable and no attempt should be made to clean or re-use dirty elements or cartridges.



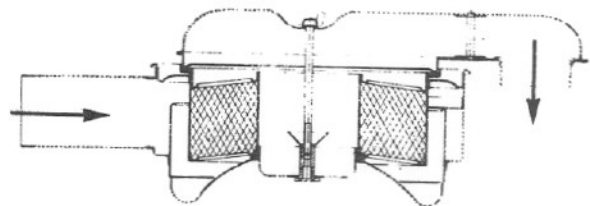
P3

For cartridge replacement, unclamp and remove the moisture eliminator or pre-cleaner panel, pull out the dirty cartridges and insert the new ones. Refit the pre-cleaner.

Never use petrol (gasoline) for cleaning any of the air induction system.

Oil Bath Air Cleaners — See Fig. P.4

To service the oil bath type cleaner, the lid should be removed and the element lifted out. The oil in the container should be drained out and the dirt and sludge thoroughly cleaned out with a proprietary cleaning fluid or Kerosene. Refill the container with clean new engine lubricating oil, grade SAE 40 to the indicated level. The woven filter element should be cleaned in a bath of Kerosene. Do not use petrol (gasoline) as this highly volatile fuel could cause explosive damage within the engine. The indicated filling mark level should never be exceeded, otherwise oil can be drawn up into the engine which could lead to uncontrolled engine speeds, and excessive engine wear.



P4

The heavy duty oil bath air cleaners are usually fitted with a centrifugal pre-cleaner mounted on top of the main cleaner, this should be removed and the air inlet vanes in the bottom plate of the assembly, the ejection slots on the side of the cone and the vanes in the outlet tube, cleaned of dust and dirt. The detachable element is accessible by lowering the oil container which may be attached by clips or a pinch screwed clamp.

Thoroughly clean the container and refill to the indicated level with new engine lubricating oil. The separate element should be cleaned in a Kerosene bath.

The upper element which is permanently attached inside the body should be periodically cleaned by washing in a Kerosene bath. Drain the element thoroughly before reassembly and do not use petrol (gasoline) for cleaning purposes.

FUEL OIL FILTERS

The element in this filter is of the paper type and therefore no attempt should be made to clean it. Its life will be governed by the quality and condition of the fuel passing through it, but under average conditions the element should be renewed in accordance with the recommended Periodical Attentions given on Page C.1. This period would naturally be reduced if it was apparent from the condition of the element if removed and inspected, that conditions warranted it.

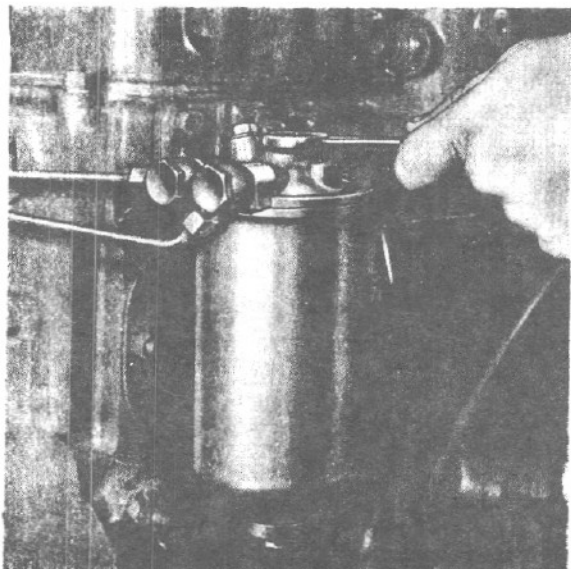
To Renew the Filter Element

1. Unscrew the filter bowl securing bolt in the centre of the headcasting. Refer to Fig. P.5.
2. Lower the filter bowl clear as shown in Fig. P.6 then discard the fuel therein together with the old element.
3. Inspect the sealing rings and replace if damaged in any way.
4. Place the new element in position inside the filter bowl and offer up the bowl firmly and squarely so that the top rim of the filter bowl locates centrally against the sealing ring in the filter head casting.
5. Hold in this position whilst the securing bolt is located and screwed home.

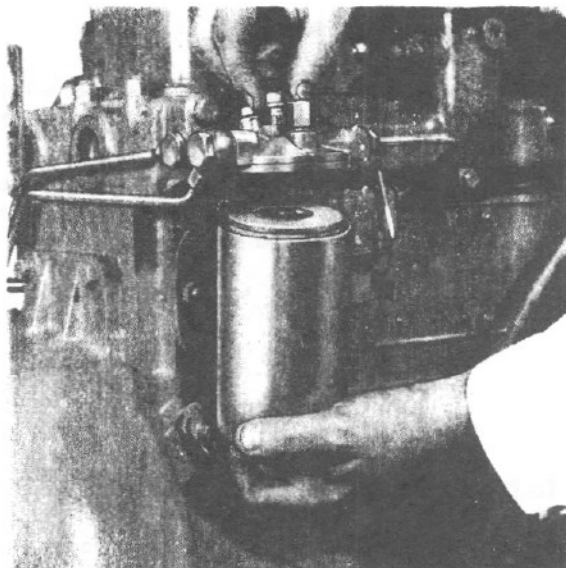
NOTE: If the sealing rings are in good order and the bowl is located correctly, no excessive tightening will be required to obtain a leak proof seal.

6. Prime the fuel system as detailed on Page P.10.

NOTE: Some filter bowls have a drain plug fitted, in this case the relevant manufacturers service literature should be consulted.



P5



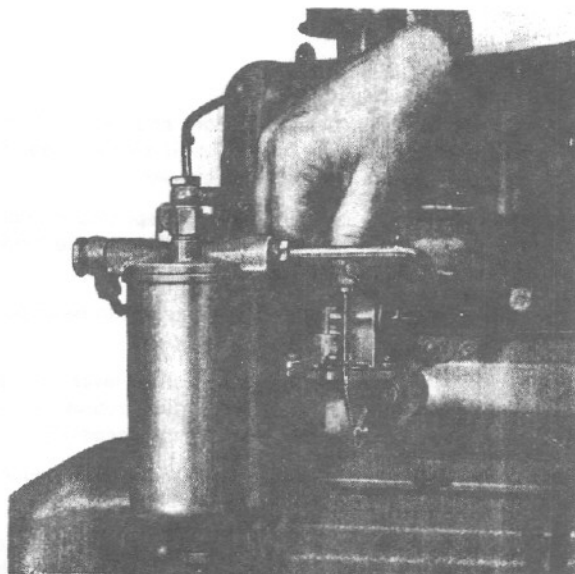
P6

FUEL LIFT PUMP

Testing the Pump in Position

1. Disconnect the outlet pipe (lift pump to filter) leaving a free outlet from the pump.
2. Rotate the engine and note if there is a well defined spurt of fuel from the outlet port once every two engine revolutions.

NOTE: As an alternative the pump may be operated by means of the hand primer as shown in Fig. P.7, which should give the same result every time the priming lever is operated. However should the engine happen to have stopped in such a position that the eccentric operating the lift pump is in the maximum lift position, then it will not be possible to operate the hand primer properly. If such a condition arises the remedy is to rotate the engine one complete revolution.



P7

ports. Seal the ends of the pipes to prevent the entry of foreign matter.

2. Remove the two nuts and washers holding the pump to the tappet inspection cover. Withdraw the pump, distance piece and joints.

To Dismantle the Lift Pump

1. Before dismantling, make a file mark across the two flanges for location purposes when the pump is being re-assembled.
 2. Remove the five cover screws and separate the two main castings, then remove the diaphragm assembly from the lower half by turning the diaphragm through 90° in either direction.
- NOTE: The diaphragm and pull rod assembly is a permanent assembly and no attempt should be made to separate the parts.
3. Remove the retaining clip from one side of the pump body and push out the rocker arm retaining pin. Withdraw the rocker arm, etc., from the body.
 4. Prise out the valves with a screwdriver or other suitable tool.

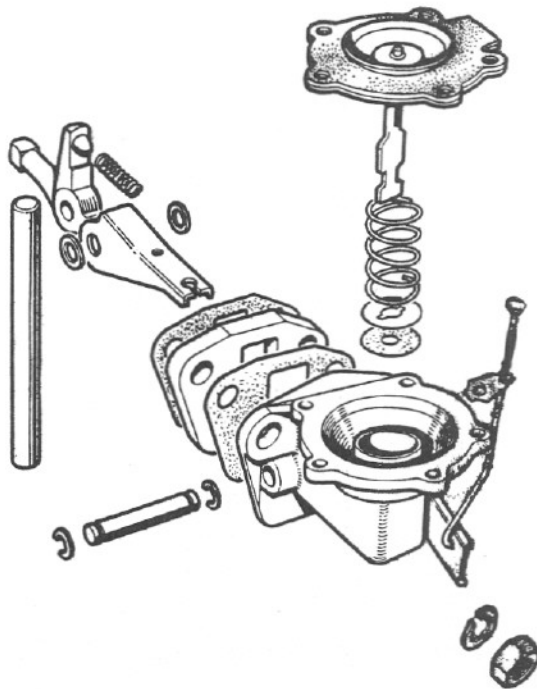
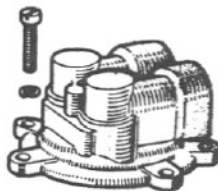
Inspection

1. Check the diaphragm assembly and renew if the material is split or cracked, or if serious wear is apparent in the link engagement slot.
2. The diaphragm spring should be replaced if faulty or corroded. A new spring should have the same colour identification (Refer to Page B.11).
3. Replace the valves unless they appear to be in perfect condition.
4. Examine the rocker arm, operating lever, rocker arm retaining pin and rocker arm return spring for wear. Replace any parts where necessary.
5. Replace all joints, seals and washers as routine procedure.
6. Examine upper and lower castings for wear or distortion. Slight distortion of flanges can be corrected by heating the flange face to remove

sufficient material to provide a sound staking when new valves are fitted.

Clean the valve recesses to allow the new valves to be correctly fitted.

1. Insert a new valve gasket in each valve recess.
2. Place the new valves in the recesses. The valve in the inlet port should be fitted with the spring outwards (i.e., towards the diaphragm flange) and the valve in the outlet port fitted in the reverse position.
3. Press the valves home with a suitable piece of tubing, approximately 9/16 in (14,29 mm) inside diameter and 3/4 in (19,05 mm) outside diameter.



4. Stake the casting in six places (between the original stakings) round each valve, with a suitable punch.

NOTE: Valves fitted to earlier lift pumps were held in position with a retaining plate and two screws. On no account should attempts be made to stake the valves of this earlier type pump.

5. Place the rocker arm retaining pin in the appropriate hole in the lower casting and push through until it protrudes slightly inside.
6. Fit one packing washer and the link into the casting moving the pin in slightly to retain them.
7. Fit the rocker arm and return spring and retain by moving the pin in further, ensuring that the spring seats correctly.
8. Fit the remaining packing washer, then push the rocker arm retaining pin through the link, washer and casting until the ends protrude equally beyond the outside of the casting.
9. Retain by securing with the two clips.
10. Insert the new rubber sealing washer followed by the steel seating washer and diaphragm return spring.
11. Place the diaphragm assembly over the spring with the pull rod downwards, locating the top of the spring in the diaphragm protector washer.
12. Now position the pull rod so that the flat notched blade has one of its thin edges facing the rocker arm. Press downwards on the diaphragm assembly and twist it through 90° in either direction, this action will engage and retain the pull rod in the fork of the link.
13. Operate the rocker arm against the diaphragm spring pressure until the diaphragm is level with the body flange.
14. Place the cover assembly in position and line up the file marks made on the flanges prior to dismantling.
15. Still holding the diaphragm level with the body flanges, fit the five flange securing screws, tighten evenly and securely.

To Refit the Fuel Lift Pump

1. Fit the distance piece using a joint on either side.
2. Enter the pump operating lever into the recess in the tappet inspection cover as shown on Fig. P.9 and secure with the two nuts and washers.
3. Reconnect the low pressure fuel pipes to the inlet and outlet ports.



P9

FUEL INJECTION PUMP

Description

The fuel injection pump is of the D.P.A. distributor type. It is a precision built unit incorporating a simple hydraulic governor or alternatively one of the mechanical flyweight type depending upon the application to which the engine is fitted.

To Remove the Fuel Injection Pump

1. Remove the four high pressure pipes between the pump and the atomisers and blank off all ports to prevent the ingress of foreign particles.
2. Remove the low pressure fuel pipes from the inlet and outlet connections and blank off all ports.
3. Disconnect the stop and throttle controls and their return springs.
4. Remove the two nuts and the socket headed set-screw which secure the fuel pump to the mounting flange together with their spring and plain washers.
5. Carefully withdraw the fuel pump from its mounting.

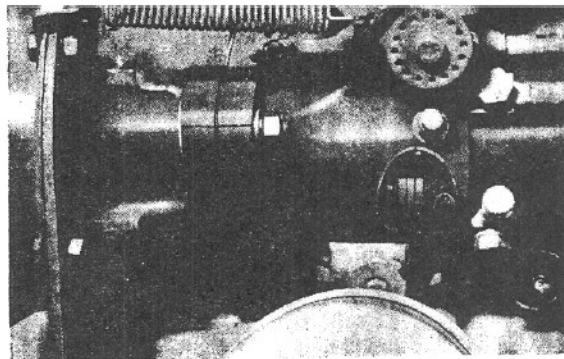
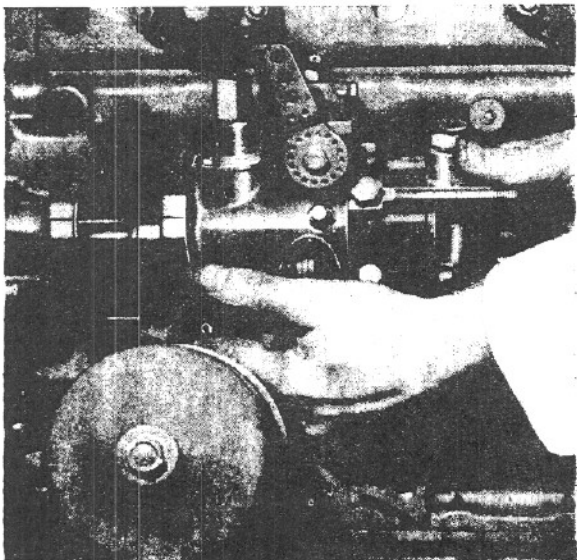
that the master spline on its quill shaft is correctly positioned to engage with the female splines within the fuel pump drive hub.

NOTE: This master spline ensures that the pump will only locate in the drive hub in one position for timing purposes.

3. When the splines are in correct alignment the pump can be pushed in until the mounting flanges meet and the securing nuts and setscrew with their washers can be fitted.
4. Before tightening, align the timing marks scribed on the fuel pump mounting flanges as shown in Fig. P.11. Tighten the setscrew and nuts.
5. Refit the low pressure pipes to the inlet and outlet connections.
6. Refit the high pressure fuel pipes.
7. Reconnect the throttle and stop controls together with their return springs.
8. Prime the fuel system with fuel oil as detailed on Page P.10.
9. Fuel pump timing can be checked as detailed in the following text.

DPA FUEL INJECTION PUMP TIMING

The circlip used as a timing device within the pump is no longer in a pre-set position and before attempting to check fuel injection timing by the drop-valve method, it is necessary to remove the pump from the engine and fix the position of the circlip by connecting No. 1 cylinder outlet connection on the pump to an atomiser tester and pump up to 30 ats (31 kgf/cm² or 440 lbf/in²). Turn the pump by hand in its normal direction until it "locks up". The squared end of the circlip should now be lined up with the relevant letter on the pump rotor. September 1975.



P11

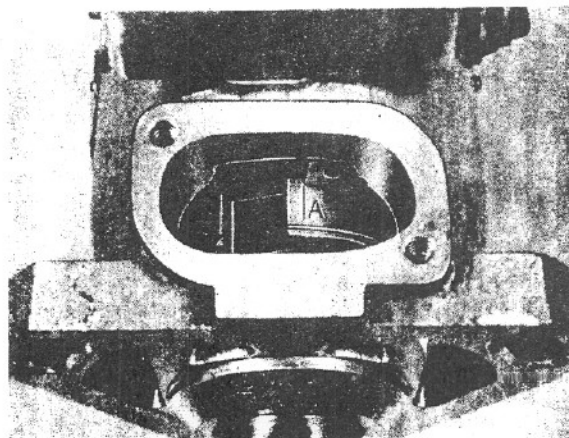
FUEL INJECTION PUMP TIMING

Reference should be made to the details given on Page L.1 covering engine timing. If this timing sequence has been followed regarding the timing gears and the timing marks on the mounting flanges are correctly aligned as shown in Fig. P.11, then the fuel pump timing should be correct.

A further check is possible and utilises the internal timing marks within the pump body. To be able to see these marks necessitates the removal of the inspection cover.

On the fuel pump rotor inside the fuel pump, are a number of scribed lines, each one bearing an individual letter. A timing circlip, one end of which has a straight edge is positioned inside the pump body and is preset so that when the appropriate scribed line on the fuel pump rotor aligns with the straight end of the circlip, it denotes commencement of injection (static timing) see Fig. P.12.

NOTE: On earlier pumps, the timing circlip had a scribed line on one end and on these pumps, the scribed line on the fuel pump rotor should be aligned with the scribed line on the circlip.



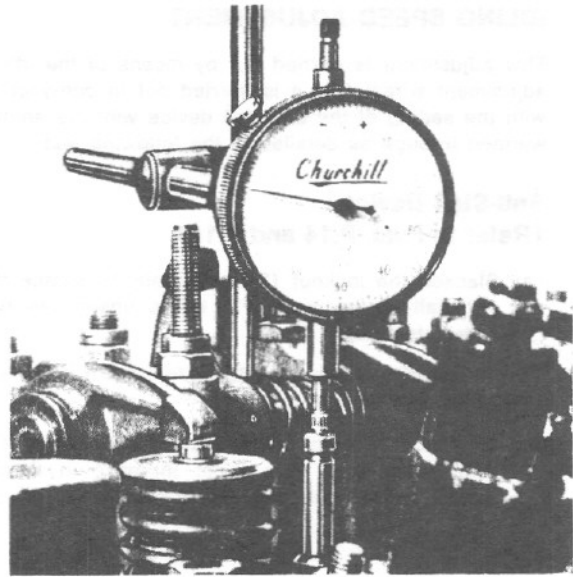
CHECKING FUEL PUMP TIMING

1. Ensure that the fuel pump is correctly fitted with the scribed line on the mounting flange aligning with the adjacent mounting flange on the cylinder block (see Fig. P.11).
2. Position the crankshaft so that No. 1 piston is at T.D.C. on its compression stroke.
3. Remove the cylinder head cover.
4. Slacken the valve adjusting screw on No. 1 exhaust valve sufficiently to allow the rocker lever to be moved to one side and the push rod removed, rotate the rocker lever on the shaft, so that the valve spring cap is accessible for using the valve spring compressor.
5. Remove the collets, spring cap and springs from No. 1 exhaust valve and allow the valve to rest on the top of the piston. A suitable ring should be fitted to the valve stem to prevent the valve falling completely into the cylinder.
6. With the aid of a clock gauge in contact with the end of the valve now resting on No. 1 piston, it will be necessary to position the crankshaft so that the piston will be 0.108 in (2,95 mm) B.T.D.C. this being the equivalent of 18° on the engine fly-wheel. Refer Fig. P.13.

To do this, zero the gauge to piston T.D.C. and then turn the crankshaft in the opposite direction to normal rotation, approximately an eighth of a turn and then forward until the required position is registered on the clock gauge. This enables the backlash in the timing gears to be taken up.

NOTE: The above setting is for 4.108 vehicle engines. For other applications and engines see Page B.12.

7. Remove the inspection plate on the fuel pump enabling the rotor to be seen (Fig. P.12).
8. With No. 1 piston at the static timing point on its compression stroke, the scribed line on the rotor marked 'A' (for hydraulically governed engines) or 'C' (for mechanically governed engines) should align with the straight edge or scribed line on the timing circlip.
9. If the timing is incorrect proceed by either :—
 - (a) making any necessary adjustments by means of the holes in the fuel pump gear, they are slotted enabling the drive shaft to be turned relative to the gear when the securing setscrews are slackened. (Refer to Fig. K.6) or
 - (b) by slackening the two nuts and socket headed setscrew which secure the fuel pump to the mounting flange and turning the pump body in the direction required.
10. When the fuel pump timing has been set, turn the engine against the normal direction of rotation once again to the appropriate piston displacement to check that the squared end of the circlip is now aligned with the line on the rotor.
11. When the fuel pump timing has been correctly set, slowly turn the engine to T.D.C. in the normal direction of rotation, remove the clock gauge and refit the valve springs.
12. Refit the push rod and reset the valve clearance.



P13

Maximum Speed Setting (Refer to Figs. P.14 and P.15)

The maximum speed screw (5) is set and sealed by the manufacturers and must not be altered or tampered with in any way, unless factory authority is first obtained and any adjustments necessary are carried out by experienced personnel. As with all seals on the pump unauthorised removal may render the guarantee void.

The maximum no load speed may vary according to the vehicle or application to which it is fitted, reference may be made to the code number stamped on the fuel pump data plate. The last four numbers in the code indicate the maximum no load engine speed, therefore in the case of the following example it would be 4480 rev/min. Code Example EH39/1200/0/4480.

NOTE: If the fuel pump data plate is damaged or defaced so as to make it impossible to read accurately, or if there is no code stamped on the plate you are advised to contact your nearest C.A.V. Distributor, or alternatively, Service Department, Perkins Engines Ltd., Peterborough, to obtain the required information.

NOTE: The engine must not be allowed to operate at a speed in excess of that specified or severe damage may occur.

AIR CLEANERS AND FUEL SYSTEM—P.8

IDLING SPEED ADJUSTMENT

This adjustment is carried out by means of the idling adjustment screw (4), it is carried out in conjunction with the setting of the anti-stall device with the engine warmed through as detailed in the following text.

Anti-Stall Device

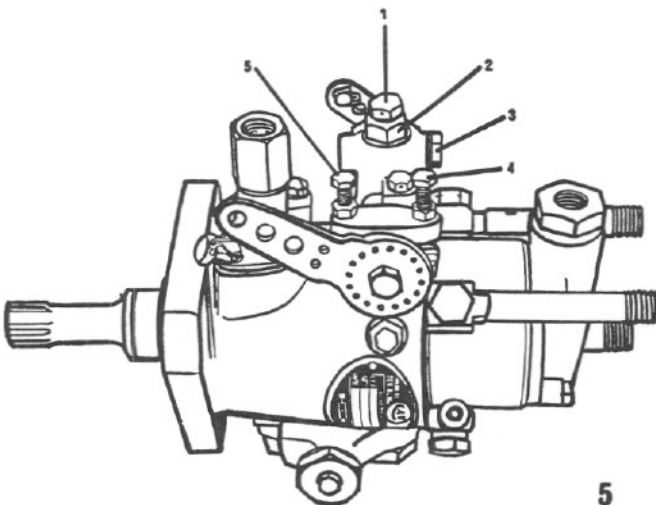
(Refer to Figs. P.14 and P.15)

- (a) Slacken the locknut (2) sufficiently to enable the anti-stall device body (1) to be unscrewed two complete turns.
- (b) Adjust idling speed to 625 rev/min* with the idling adjustment screw (4).
- (c) Now screw down the anti-stall device body (1) until there is a very slight increase in engine speed, bring back half a turn and lock with the lock nut (2).

(d) Accelerate the engine to maximum no load rev/min and immediately return to idling. Should the period of return from maximum rev/min to idling exceed three seconds the device has been screwed in too far.

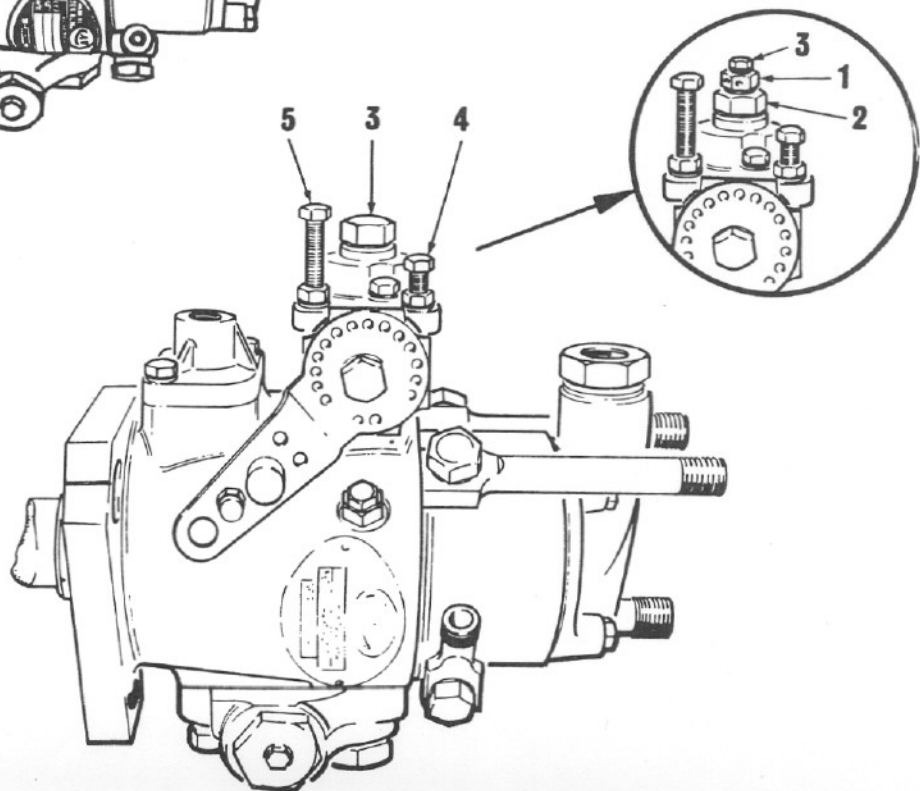
However should stalling occur, then the device has not been screwed in far enough. Therefore the necessary adjustment should be made to suit whichever is the case.

*This idling speed may vary according to application, refer to relevant manufacturers service literature or to Perkins Engines Limited, Peterborough if in doubt.



P14
Earlier Fuel Pump

1. Anti-stall device body
2. Anti-stall device body locknut
3. Air vent screw
4. Idling adjustment screw
5. Maximum Speed Screw



P15
Later Fuel Pump

When replacing atomisers in the cylinder head, it is essential that a new, correct type copper washer is fitted between the nozzle body and cylinder head. The first symptoms of atomiser trouble usually come under one or more of the following headings:—

1. Misfiring.
2. Knocking in one (or more) cylinders.
3. Engine overheating.
4. Loss of power.
5. Smoky exhaust (black).
6. Increased fuel consumption.

Testing for Faulty Atomiser

If an atomiser is suspected of being faulty, try this method to isolate it.

Slacken the union nut at the atomiser end of the high pressure fuel pipe. If each atomiser is isolated in turn in this way, (with the engine running at approximately 1,000 rev/min) tightening each union nut firmly before proceeding to the next, then the faulty atomiser, when isolated in this manner, will have little or no effect on the running.

Warning

Great care should be taken to prevent the hands or face from getting into contact with the spray, as the working pressure will cause the oil to penetrate the skin with ease.

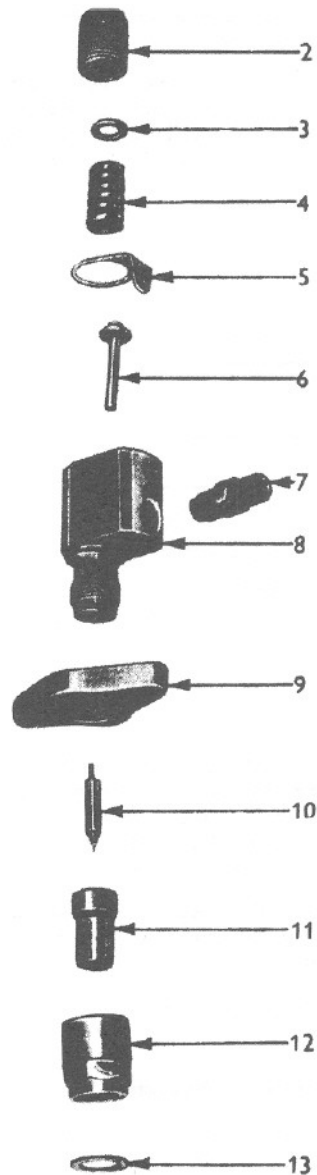
Atomiser Pressures

Details of holders and nozzle types together with pressure settings are given on Page B.12.

NO ATTEMPT SHOULD BE MADE TO ADJUST THE INJECTION PRESSURE WITHOUT AN ATOMISER TESTING PUMP OF THE TYPE ILLUSTRATED. IT IS QUITE IMPOSSIBLE TO ADJUST THE SETTING OF ATOMISERS WITH ANY DEGREE OF ACCURACY WITHOUT PROPER EQUIPMENT.

Atomiser Identification

Atomisers can be identified by code letters stamped on a tab washer fitted under the spring cap nut (see Fig. P.16) or alternatively, the code is stamped on the atomiser body. Details of codings can be found on



P16

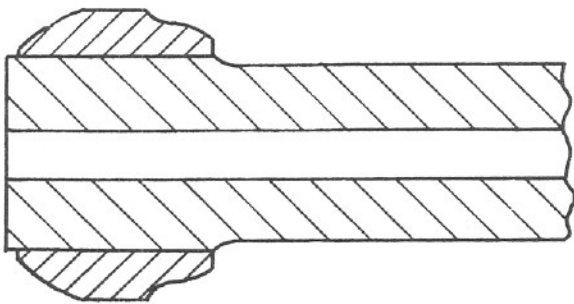
1. Capnut
2. Spring cap
3. Shim washer
4. Nozzle spring
5. Identification tab washer
6. Spindle
7. Fuel inlet union
8. Nozzle holder body
9. Securing flange
10. Nozzle needle
11. Nozzle body
12. Nozzle capnut

AIR CLEANERS AND FUEL SYSTEM—P.10

Fuel Pipes (High Pressure)

When replacing the fuel pipes it should be noted that no two pipes are the same, each is formed to suit an individual atomiser position. This is important when ordering a replacement pipe, as each one has a different part number.

For standardisation purposes, high pressure fuel pipes assemblies are now supplied with olives fitted as shown in Fig. P.17. The earlier type pipe assemblies with olives fitted in the reversed position are still satisfactory.



P17

The pipes should be clean, (wash in clean fuel oil and blow through the fine bore with compressed air if there is any doubt), the olives at each end should not be split or unduly compressed, otherwise leakage will result and a new pipe will be needed.

Ensure when fitting, that the pipe fits squarely at both ends and that the union nuts are tightened firmly but not over-tightened.

When changing an atomiser always remove the pipe completely.

Priming the Fuel System

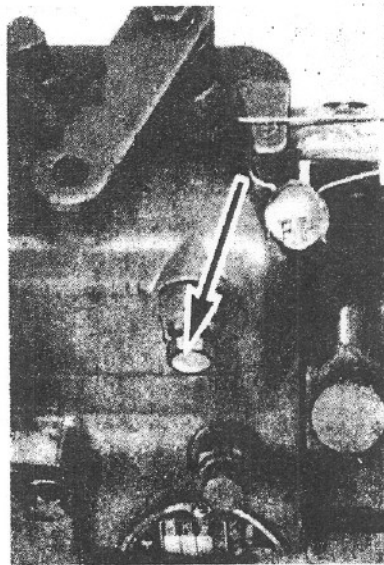
The air must be vented from the fuel system whenever any part of the system between the fuel tank and injection pump has been disconnected for any reason, or when the system has been emptied of fuel.

No attempt must be made to start the engine until the injection pump has been filled and primed as serious damage can be caused to the pump due to lack of lubrication.

The method of priming detailed below, ensures that only fuel which has passed through the paper filter element can reach the interior of the pump.

1. Slacken the air vent valve on the top of the control gear housing on hydraulically governed pumps (refer Fig. P.15) or on the front of the governor housing on mechanically governed pumps (refer Fig. P.18).
2. Slacken the vent valve fitted on one of the two hydraulic head locking screws (Refer to Fig. P.19).

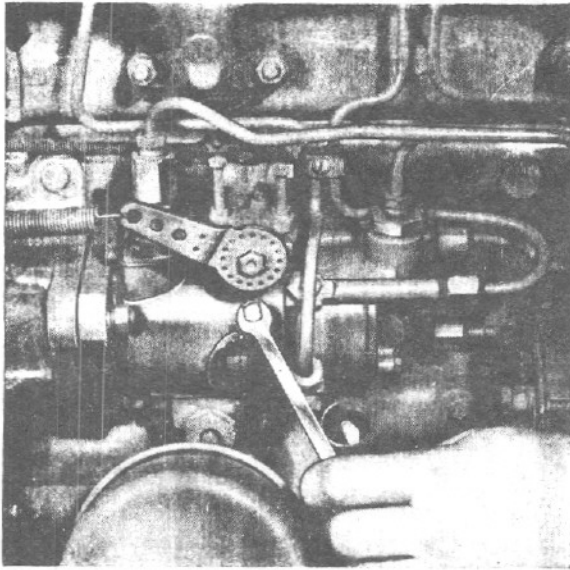
3. Slacken the vent screw on the top of the fuel filter (Refer to Fig. P.20).
4. Operate the priming lever on the fuel feed pump (Refer to Fig. P.7) and when fuel, free from air bubbles, issues from each venting point tighten the screws in the following order:—
 1. Filter cover vent screw.
 2. Head locking screw vent valve.
 3. Governor cover vent valve.
5. Slacken the pipe union nut at the pump inlet, operate the priming lever and retighten when fuel oil, free from air bubbles issues from around the threads.
6. Slacken the unions at the atomiser ends of two of the high pressure pipes.
7. Set the accelerator at the fully open position and ensure that the "stop" control is in the "run" position.
8. Turn the engine until fuel oil, free from air bubbles, issues from both fuel pipes.
9. Tighten the unions on both fuel pipes, and the engine is ready for starting.



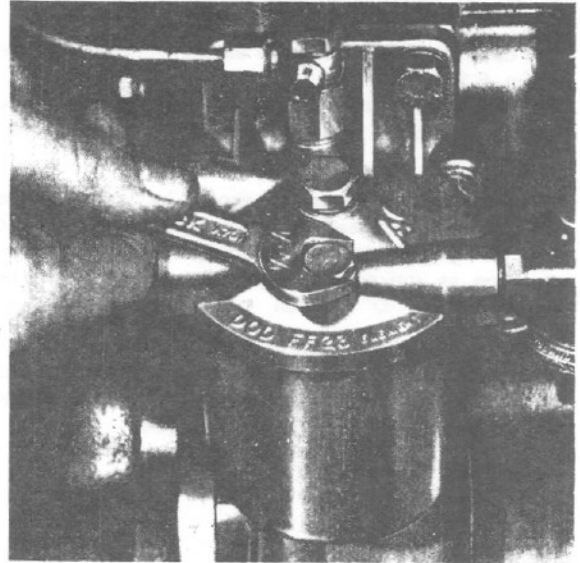
P.18

Priming Procedure after Changing a Filter Element

1. With the vent screw on the filter cover removed, and the union at the filter end of the return pipe (filter to tank) slackened, operate the feed pump priming lever until oil, free from air bubbles, issues from the filter cover vent.
2. Replace the vent plug, and continue to operate the priming lever until oil, free from air bubbles, issues from around the threads of the return pipe union.
3. Tighten the return pipe union.
4. Slacken the union at the filter end of the filter to injection pump feed pipe, and operate the priming lever until oil, free from air bubbles, issues from around the union threads.
5. Tighten the feed pipe union. The pump and filter are now filled and primed and ready for further service.



P19



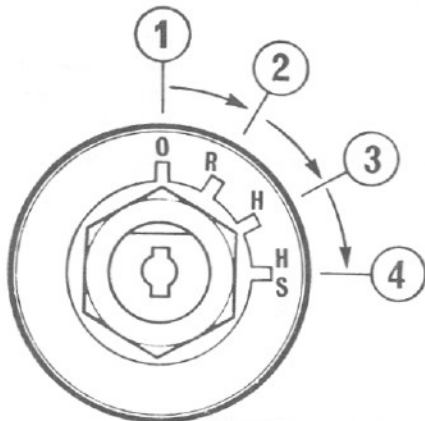
P20

Starting the Engine

If the weather is warm or the engine has only been stopped for a little while, place the accelerator in the fully open position and engage the starter motor by turning the starter switch in a clockwise direction to the "HS" position (See Fig. P.21).

If the battery is well up, enough to turn the starter motor quickly, the engine should start.

Always be sure that the starter pinion and flywheel have stopped revolving before re-engaging the starter, otherwise the ring or pinion may be damaged.



P21

1. Off Position
2. Run Position
3. Heat Position
4. Heat and Start Position

To Operate the Starting Aid

In cold weather the procedure for the use of this equipment is as follows:—

Ensure that the engine stop control is in the "run" position.

Turn on the fuel supply tap of the starting aid reservoir, where fitted.

Turn start switch in direction to "H" position for fifteen to twenty seconds.

With accelerator in the fully open position, turn the switch a further clockwise movement to the "HS" position thereby engaging the starter motor.

If the engine does not start after fifteen seconds, return switch to "H" position for ten seconds and then re-engage starter motor.

As soon as the engine starts, the switch should be returned to the "R" position, and the tap on the starting reservoir, when fitted, turned off.

NOTE: The above procedure is not necessary when the engine is hot. To re-start, turn the switch in a clockwise direction to the "HS" position which will engage the starter motor.

AIR CLEANERS AND FUEL SYSTEM—P.12

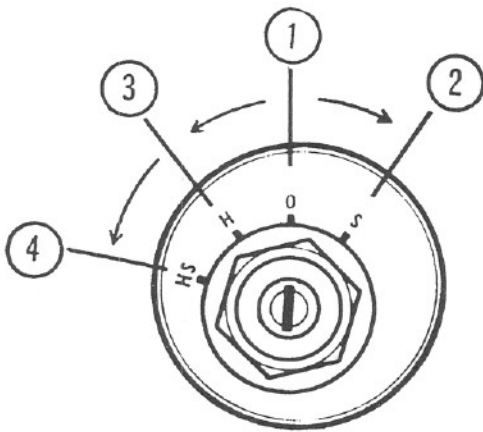
Earlier Heat Start Switch

The cold start switch fitted to earlier engines is shown in Fig. P.22.

With this switch, starting a warm engine is effected by turning the switch in a clockwise direction to the "S" position.

In cold weather, the switch should be turned to the "H" position for fifteen to twenty seconds and then to the "HS" position in order to engage the starter motor. As soon as the engine starts, the switch should be returned to the "O" position.

Where this type of switch is used, it was customary to have a separate switch for the electrical circuits and this should be turned on before starting the engine and turned off after stopping the engine.



P22

1. Off Position
2. Start Position
3. Heat Position
4. Heat and Start Position

Alternative Method

With some engines, a different starter switch is provided and the cold start aid is operated by means of a separate push button switch.

The cold starting procedure is the same i.e.

Switch on by turning the starter switch in a clockwise direction to the first position.

Press the heater button for fifteen to twenty seconds and then, with the heater button still pressed, turn the starter switch in a further clockwise direction to engage the starter motor. As soon as the engine starts, release switch and heater button.

Points to Note

Ensure that the electrical connection to the starting aid is correctly made.

Always ensure that the reservoir feeding fuel to the starting aid is fully primed and is not leaking. With some later engines, this fuel reservoir has been deleted, the cold start aid being fed direct from the fuel filter through a non-return valve.

Extended use of the cold starting equipment above the time periods already stated should be avoided, otherwise the starting aid in the induction manifold may be damaged also continuous flaming will starve the engine of oxygen.

In the event of difficult starting, check that fuel is reaching the starting aid in the induction manifold by unscrewing the inlet fuel connection. If fuel is reaching it satisfactorily, then it may be that the starting aid itself is not working correctly. This can be checked by removing the air cleaner and watching the starting aid whilst the equipment is used. When the starting switch is turned to the "heat" position, the element should become red hot, and upon engagement of the starter motor ignition of the fuel should take place.

4.108, 4.107 and 4.99 engines are fitted with efficient starting equipment and no responsibility can be accepted for any damage caused by unauthorised starting aids.

Stopping the Engine

A spring loaded stop control is located near the normal engine controls and functions by cutting off the fuel at the fuel injection pump.

To operate, pull the knob and hold in this position until the engine ceases to rotate. Ensure that the control returns to the "run" position, otherwise difficulty may be experienced in re-starting the engine.

Return latest cold start switch to the "O" position.

Running In Procedure

To ensure the future efficiency and life of the engine, careful treatment during the early life should be exercised.

To obtain the best results of your new or replacement engine, it should be operated within reasonable limits and not at maximum engine speed for the first 500 miles (800 km) or 12 hours.