Fuel system 20

General description

Engines used for vehicle applications have Bosch fuel injection pumps (A or B). The pumps which are fitted to engine types AB, AD, YB and YD have a boost control (B1).

Engines used for agricultural and industrial applications have CAV fuel injection pumps. Engine types AA, AC, YA and YC have CAV DPA fuel pumps fitted (C). Engine types AB, AD, YB and YD have CAV DPS fuel pumps fitted (D) and these pumps have a boost control (D1).

The boost control is a device which is affected by boost pressure (from the turbocharger) and reduces the maximum fuel delivery at lower engine speeds to match the reduced air supply to the cylinders.

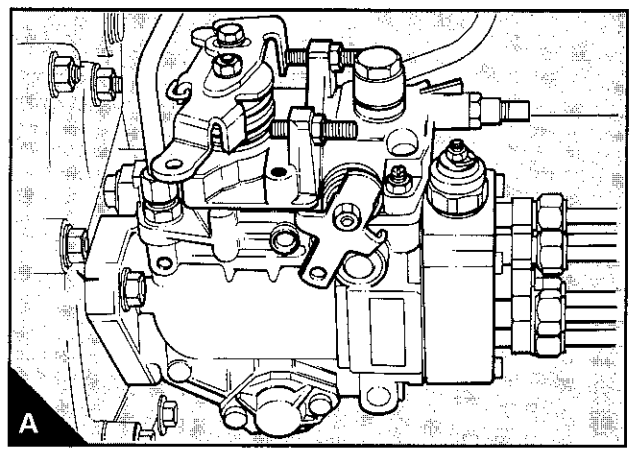
Both the Bosch and CAV fuel injection pumps have mechanical governors to control the engine speed.

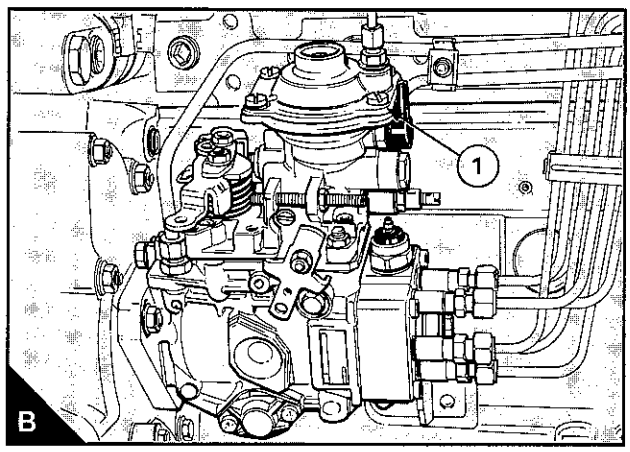
The "low spring" atomisers receive high pressure fuel from the fuel injection pump and inject this fuel into the combustion chamber of the pistons as a very fine spray. The atomisers are set in the factory, but must be checked in accordance with the preventive maintenance schedules. The pressure at which atomisers operate can be adjusted by a change of shims fitted above the spring.

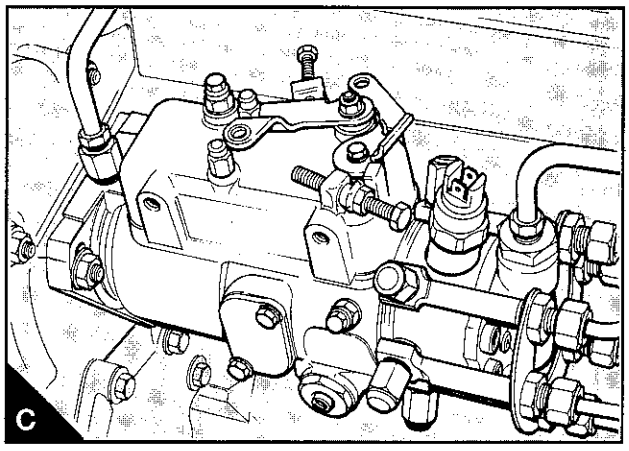
The fuel injection equipment must only be checked and adjusted by personnel who have had the correct training.

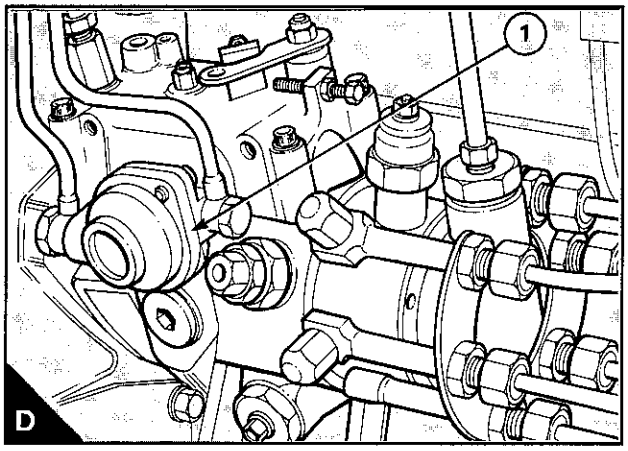
The fuel lift pump is of the diaphragm type and is mechanically driven. It is fitted on the right side of the cylinder block and is driven by an eccentric on the camshaft. The pump is fitted with a priming lever.

Attention: It is very important that dirt does not enter the fuel system. Before a connection is disconnected, clean thoroughly the area around the connection. After a component has been disconnected, fit a suitable cover to all open connections.









Fuel filter

To remove and to fit — 20A-01

The filter can have one or two elements. When twin elements are fitted, both of the elements must be renewed at the same time.

1 Clean the outside surfaces of the fuel filter assembly. If a drain tap is fitted to the filter bowl, drain the fuel from the filter (A).

2 Hold the bottom cover of the filter element and release the setscrew which is fitted through the filter head above the centre of each element.

3 Lower the bottom cover of the filter (B).

4 Remove the element and discard it.

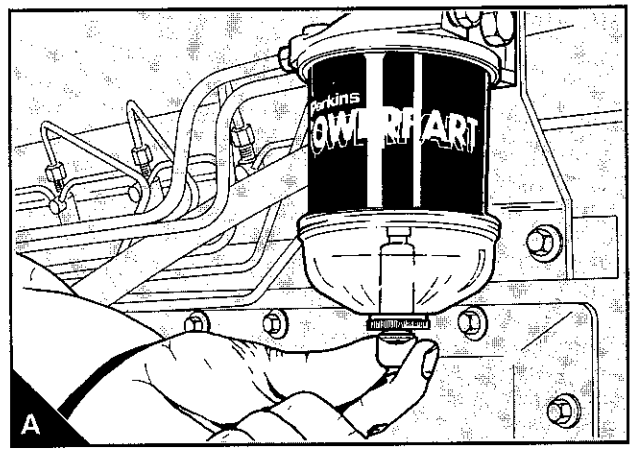
5 Clean the inside surfaces of the top and bottom filter covers.

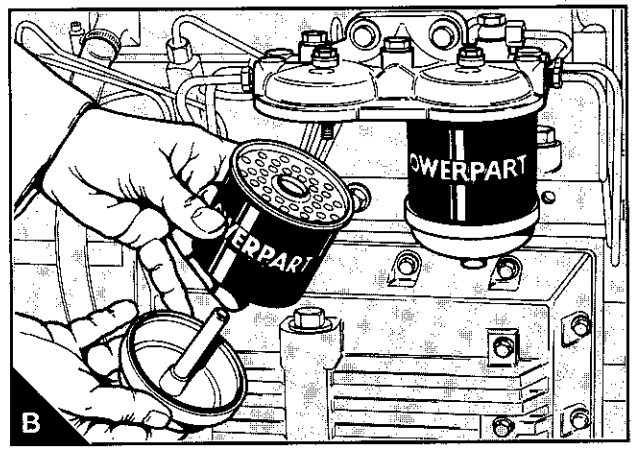
6 Fit the new sealing rings.

7 Put the bottom cover on the bottom of the new element and assemble it squarely to the filter head to ensure that the element is fitted in the centre against the joint in the filter head.

8 Hold the assembly in this position and engage and tighten the setscrew.

9 Eliminate all air from the fuel system, operation 20A-08A or 20A-08B.





Atomisers

Atomiser fault

An atomiser fault can be shown by an engine misfire. In order to find which atomiser is defective, operate the engine at a fast idle speed. Loosen and tighten the union nut of the high pressure fuel pipe at each atomiser. When the union nut of the defective atomiser is loosened, it will have little or no effect on the engine speed.

Do not let the fuel spray on to your skin!

To remove and to fit — 20A-02

1 Remove the fuel leak-off pipe.

2 Release the union nuts of the high-pressure pipes from the atomisers and from the fuel injection pump. Hold the pump outlet with a spanner to prevent movement while the union nut of the high-pressure pipe is released at the pump. Do not bend the pipe. If necessary, remove the pipe clamps.

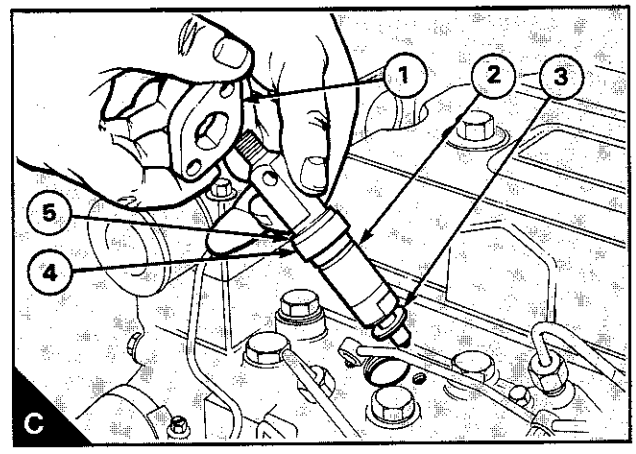
3 Release the setscrews of the atomiser flange and remove the flange (C1), the atomiser (C2) and its seat washer (C3). Remove the dust seal (C4) and the spacer (C5) and fit the spacer and a new dust seal to the new atomiser.

4 Put the new atomiser in position with its spacer, new dust seal and a new seat washer. Fit the flange and engage the flange setscrews. Ensure that the atomiser is not tilted and tighten the setscrews gradually and evenly to 12 Nm (9 lbf ft) 1,2 kgf m.

5 Fit the high-pressure pipes and tighten the union nuts to 18 Nm (13 lbf ft) 1,9 kgf m. Hold the pump outlet with a spanner to prevent movement while the pipe nut is tightened at the pump. If necessary, fit the pipe clamps.

6 Renew the seal washers and fit the leak-off pipe.

7 Operate the engine and check for fuel leakage.



Fuel lift pump

To remove and to fit 20A-03

1 If a heat shield is fitted, remove it. Disconnect the fuel pipes from the fuel lift pump.

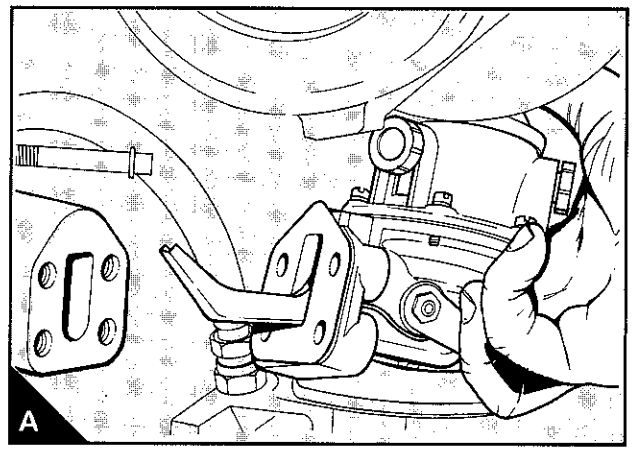
2 Release the setscrews, remove the lockplates and remove the fuel lift pump (A). The lift pump may be difficult to remove from the engine. If this occurs the crankshaft must be rotated until the camshaft eccentric, that operates the lift pump, is in a position which will free the rocker lever of the lift pump.

3 Ensure that the camshaft eccentric is in the minimum lift position before the lift pump is fitted. Clean the joint face of the lift pump and the cylinder block and fit the lift pump together with a new joint. Fit the lockplates and the setscrews and tighten them gradually and evenly to 22 Nm (16 lbf ft) 2,2 kgf m.

4 Connect the fuel pipes and, if necessary, fit the heat shield.

5 Release the vent screw on the fuel filter head and operate the priming lever of the fuel lift pump to eliminate any air between the lift pump and the fuel filter. Operate the lift pump until fuel, free of air, comes from the vent screw. Tighten the vent screw.

6 Operate the engine and check for any fuel or air leakage.



To dismantle and to assemble 20A-04

To dismantle

1 Clean the outside surfaces of the fuel lift pump.

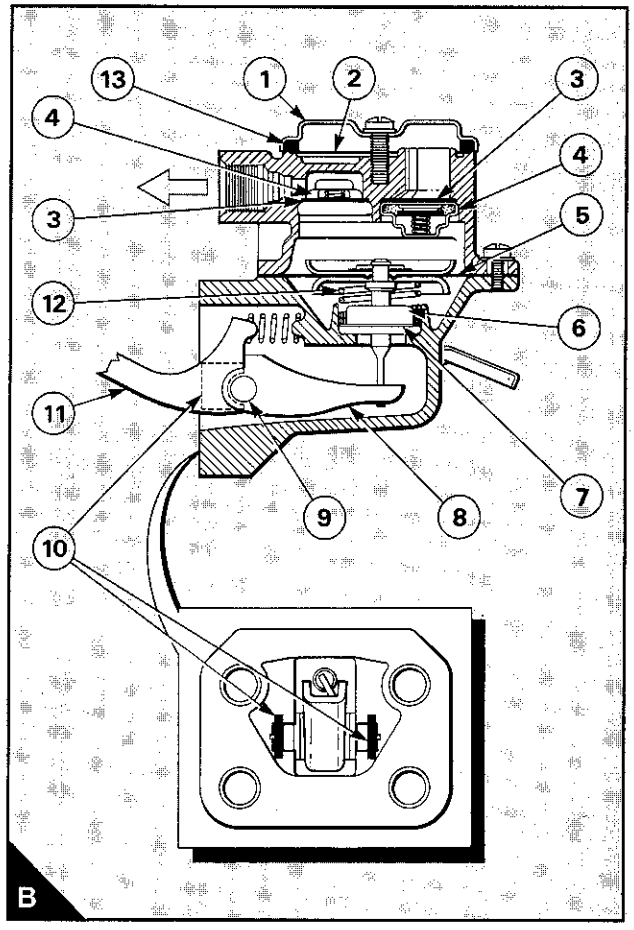
2 Make a mark across the flanges of the two halves of the pump to ensure correct relationship when the pump is assembled.

3 Remove the cover (B1) and the gauze (B2). Release the setscrews and separate the two halves of the pump.

4 Turn the diaphragm assembly (B5) 90° to release the pull rod from the link arm (B8) and remove the diaphragm assembly. Remove the stem seal (B6), the spring seat washer (B7) and the spring (B12) from the pull rod. The diaphragm and pull rod assembly is renewed as an assembly and no service is possible on the diaphragm.

5 The valves (B4) are peened in and can be removed with a suitable lever. Some of the peened metal will have to be removed before the valves can be removed.

6 To remove the link arm: Hold the rocker lever (B11) in a vice and hit the body of the lift pump with a soft face hammer to release the two retainers (B10). Be careful not to damage the joint face of the pump body. Remove the rocker lever, the pin (B9), the link arm and the return spring. Check the components for wear and other damage.



To assemble

1 Thoroughly clean the valve housings. Fit new seat washers (B3) and push the new valves (B4) into position. As the valves are the same, but one valve is fitted in reverse of the other, it is possible to fit the valves upside down. To ensure that the valves are fitted correctly, fit them as shown in B. When the valves are correctly fitted, peen the edge of the valve housings in six places, evenly divided, to keep the valves in position.

2 Fit the rocker lever (B11), pin (B9) and link arm assembly (B8) into the bottom half of the lift pump. Fit the return spring; ensure that the ends of the spring are in their correct location.

3 With a light hammer and a suitable adaptor, fit two new retainers (B10) in their grooves in the casing until they fasten the pin. Peen the open ends of the grooves to fasten the retainers in position.

4 Fit the diaphragm spring (20A.04/B12) into its location under the diaphragm (20A.04/B5) and put the spring seat washer (20A.04/B7) and a new stem seal (20A.04/B6) into position on the pull rod. Ensure that the small diameter at the top of the seal is on the round section of the pull rod.

5 Put the diaphragm assembly in position over the lower half of the body with the blade of the pull rod aligned with the slot in the link arm. Press lightly down on the diaphragm until the notch in the pull rod is in the slot in the link arm and turn the diaphragm 90° in either direction. This action will engage and retain the pull rod in the slot of the link arm.

6 Push the rocker arm towards the pump body until the diaphragm is level with the body flange and fit the top half of the body in position with the marks on the flanges aligned. Keep the pressure on the rocker arm; fit the spring washers and the screws and tighten them evenly.

7 Fit the gauze filter (20A.04/B2) and the cover (20A.04/B1), ensure that the rubber seal (20A.04/B13) is fitted correctly and tighten the screw.

To test **20A-05**

1 Disconnect the fuel outlet pipe from the fuel lift pump. Fit a 0-70 kPa (0-10 lbf/in^2) 0-0,7 kgf/cm^2 pressure gauge to the outlet of the lift pump. Release the connection at the gauge and operate the priming lever of the lift pump to eliminate air from the pipe. When fuel, free of air, flows from the pipe tighten the connection. Ensure that there are no leaks at the connections between the pump and the gauge.

2 Operate the starter motor for 10 seconds and note the maximum pressure indicated on the gauge. If the pressure indicated is less than the test pressure shown in section 11C, repair or renew the pump. Also check the rate at which the pressure reduces to half the maximum pressure obtained. If this is less than 30 seconds, repair or renew the pump.

3 Remove the gauge and connect the outlet pipe to the lift pump. Release the vent screw on the fuel filter head and operate the priming lever until fuel, free of air, flows from the vent screw. Tighten the vent screw.

Fuel injection pump

To remove and to fit - Bosch pump 20A-06A

To remove

Special tools:
Gear puller, PD.155B
Adaptors for use with PD.155B, PD.155B-5
Spanner for flange nuts of fuel injection pump, PD.199

1 Remove all the pipes, disconnect the stop control and the control rod of the fuel injection pump. Ensure that a spanner is used to prevent movement of the fuel pump outlets when the nuts of the high-pressure pipes are released.

2 Remove the gear cover from the cover of the timing case. Remove the gear nut and the spring washer.

3 Turn the crankshaft until the keyway in the gear of the fuel pump is in the 1 o'clock position (A).

4 Remove the setscrew and the nut of the support bracket below the fuel pump. Release the flange nuts of the fuel pump. If access to the flange nuts of the fuel pump is restricted by, for example, a compressor, use tool PD.199 to release the flange nuts.

5 Loosen the drive gear of the fuel injection pump with the puller PD.155B and adaptors PD155B-5 (B).

6 Remove the fuel pump; ensure that the key does not fall from the drive shaft.

To fit

1 Turn the drive shaft of the fuel injection pump clockwise to align the key with the 1 o'clock position of the keyway in the drive gear. In this position there will be no spring pressure on the drive shaft. Ensure that the key is correctly fitted and fit the fuel pump to the gear.

2 Align the mark on the flange of the fuel pump with the mark on the rear face of the timing case (C1). Fit the flange nuts of the fuel pump and the setscrew and nut of the support bracket. Ensure that force is not applied to the fuel pump when the support bracket is fitted.

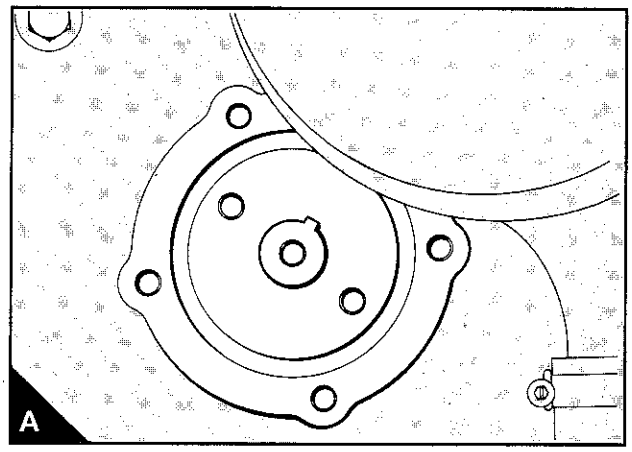
3 Fit the spring washer and nut to the drive shaft of the fuel pump and tighten the nut to 80 Nm (59 lbf ft) 8,2 kgf m. Fit the gear cover to the cover of the timing case. Fit a new joint, if necessary.

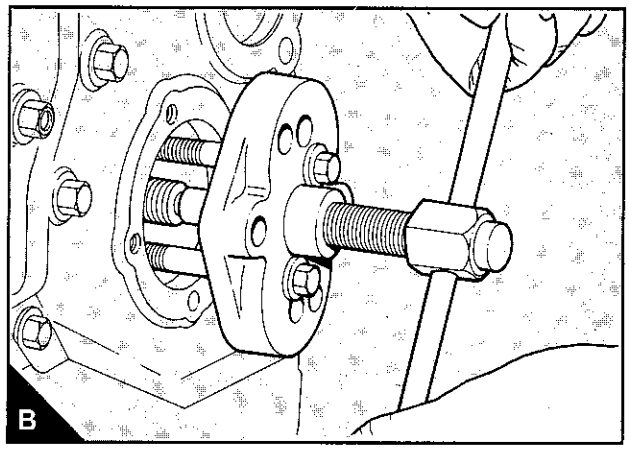
4 Fit all the pipes, connect the stop control and the control rod of the fuel injection pump. Ensure that a spanner is used to prevent movement of the pump outlets when the high-pressure pipes are fitted.

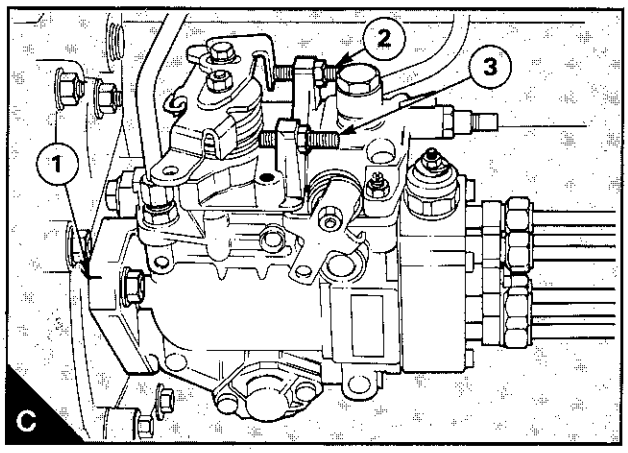
5 Eliminate air from the fuel system, operation 20A-08A.

6 Operate the engine and check for leakage. With the engine at the normal temperature of operation, check that the idle speed is correct, operation 20A-07A.

7 If a new fuel injection pump has been fitted, check the maximum no load speed, operation 20A-07A.







To remove and to fit - CAV pump 20A-06B

To remove

Special tools:

Gear puller, PD.155B
Adaptors for use with PD.155B, PD.155B-5
Spanner for flange nuts of fuel injection pump, PD.199

1 Remove all the pipes, disconnect the stop control and the control rod of the fuel injection pump.

2 Remove the gear cover from the cover of the timing case. Remove the gear nut and the spring washer.

3 Turn the crankshaft to ensure that the keyway in the drive gear of the fuel pump is at or is near to the top.

4 Remove the setscrew and the nut of the support bracket below the fuel pump. Release the flange nuts of the fuel pump. If access to the flange nuts of the fuel pump is restricted by, for example, a compressor, use tool PD.199 to release the flange nuts.

5 Loosen the drive gear of the fuel injection pump with the puller PD.155B and the adaptors PD.155B-5 (20A.06/B).

6 Remove the fuel pump; ensure that the key does not fall from the drive shaft.

To fit

1 Turn the drive shaft of the fuel injection pump to align the key with the keyway in the drive gear. Ensure that the key is correctly fitted and fit the fuel pump to the gear.

2 Align the mark on the flange of the fuel pump with the mark on the rear face of the timing case (A1). Fit the flange nuts of the fuel pump and the setscrew and the nut of the support bracket. Ensure that force is not applied to the fuel pump when the support bracket is fitted.

3 Fit the spring washer and the nut to the drive shaft of the fuel pump and tighten the nut to 80 Nm (59 lbf ft) 8,2 kgf m. Fit the gear cover to the cover of the timing case together with a new joint.

4 Fit all the pipes. Connect the stop control and the control rod of the fuel pump.

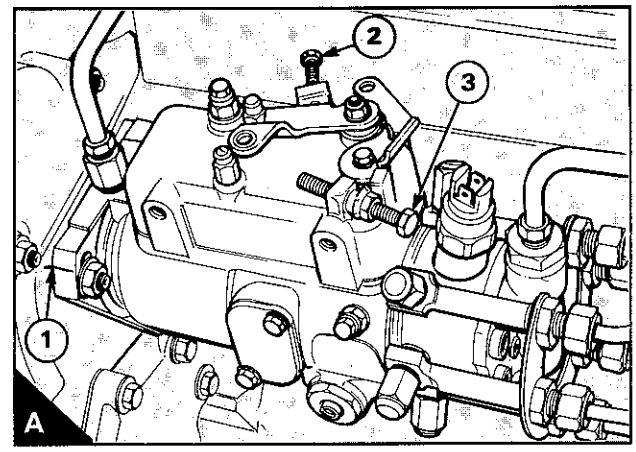
5 Eliminate air from the fuel system, operation 20A-08B.

6 Operate the engine and check for leakage. With the engine at the normal temperature of operation, check that the idle speed is correct, operation 20A-07B.

7 If a new fuel pump has been fitted, check the maximum no load speed, operation 20A-07B.

To adjust - Bosch pump 20A-07A

1 Operate the engine until it reaches its normal temperature of operation and check the idle speed. If necessary, adjustment can be made by the inner adjustment screw (20A.06/C2). Release the locknut and turn the screw clockwise to increase the speed, or counter-clockwise to decrease the speed. When the speed is correct, tighten the locknut. The setting of the idle speed can change for different applications. The correct speed will normally be given in the manufacturer's handbook for the application. If it is not given, apply to your nearest Perkins distributor or to Technical Services Department, Perkins Engines, Peterborough, England.



2 With the engine at its normal temperature of operation, check the maximum no load speed. The maximum no load speed is indicated by the last section of the setting code for the fuel injection pump. The setting code can be found on the data plate on the side of the fuel pump. A typical setting code is 2643J000CK/1/2960. In this example, the maximum no load speed is 2960 rev/min. If necessary, this speed can be adjusted by the outer adjustment screw (20A.06/C3). Release the locknut and turn the screw counter-clockwise to increase the speed or clockwise to decrease the speed. When the speed is correct, tighten the locknut and seal the screw. The person who fits the pump must ensure that the adjustment screw is suitably sealed against interference after it has been set initially.
The adjustment screw on original fuel pumps is set and sealed by the manufacturer. The setting must not be changed as this could affect the engine warranty.

To adjust - CAV pump 20A-07B

1 Operate the engine until it reaches its normal temperature of operation and check the idle speed. If necessary, adjustment can be made by the inner adjustment screw (A2). Release the locknut and turn the screw clockwise to increase the speed or counter-clockwise to decrease the speed. When the speed is correct, tighten the locknut. The setting of the idle speed can change for different applications. The correct speed will normally be given in the manufacturer's handbook for the application. If it is not given, apply to your nearest Perkins distributor or to Technical Services Department, Perkins Engines, Peterborough, England.

2 With the engine at its normal temperature of operation, check the maximum no load speed. The maximum no load speed is indicated by the last part of the setting code for the fuel injection pump. The setting code can be found on the data plate on the side of the fuel pump. A typical setting code is 2643M000AK/1/2860. In this example, the maximum no load speed is 2860 rev/min. If necessary, this speed can be adjusted by the outer adjustment screw (A3). Release the locknut and turn the screw counter-clockwise to increase, or clockwise to decrease, the speed. When the speed is correct, tighten the locknut and seal the screw. The person who fits the pump must ensure that the adjustment screw is suitably sealed against interference after it has been set initially.
The adjustment screw on original fuel pumps is set and sealed by the manufacturer. The setting must not be changed as this could affect the engine warranty.

To eliminate air from the fuel system - Bosch pump 20A-08A

If air enters the fuel system, it must be eliminated from the system before the engine can be started.
Air can enter the system if:

- The fuel tank is drained during normal operation.
- The low-pressure fuel pipes are disconnected.
- A part of the low-pressure fuel system leaks during engine operation.

In order to remove air from the fuel system, proceed as follows:

1 Loosen the vent plug (A1) on top of the twin element fuel filter (A) by two or three turns. If a single element filter is used, loosen the banjo connection bolt (B1) which is fitted on the top of the filter (B).

2 Operate the priming lever on the fuel lift pump (C) until fuel, free of air, comes from the filter vent point. Tighten the vent plug or the banjo connection bolt. If the drive cam of the fuel lift pump is at the point of maximum cam lift, it will not be possible to operate the priming lever. In this situation, the crankshaft must be turned one revolution.

3 Ensure that the manual stop is in the "run" position. If an electrical stop control is used, turn the key of the start switch to the "R" position.

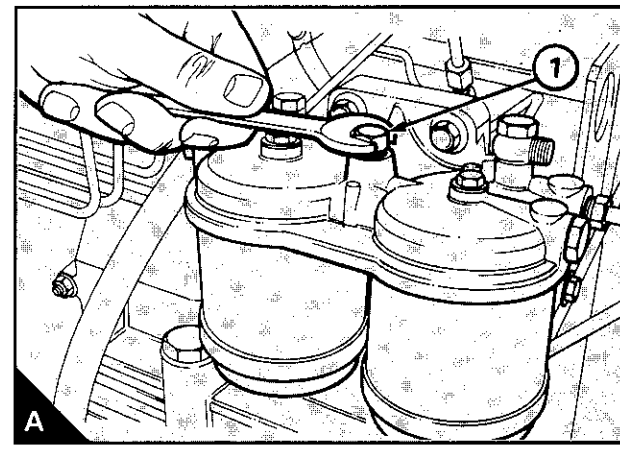
4 Loosen the union nut of the fuel inlet pipe (D1). Operate the priming lever of the fuel lift pump until fuel, free of air, comes from the loose connection. Tighten the union nut.

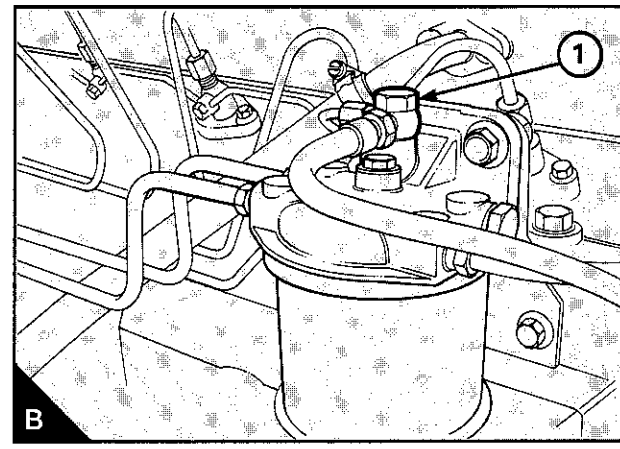
5 Loosen the union nut (20A.09/A1) at the fuelled starting aid, if one is fitted, and operate the priming lever of the fuel lift pump until fuel, free of air, comes from the connection. Tighten the union nut at the starting aid.

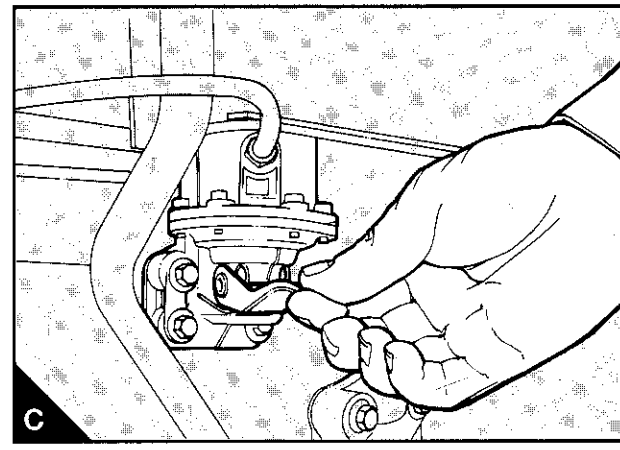
6 Loosen the high-pressure pipe connections (20A.09/B1) at two of the atomisers.

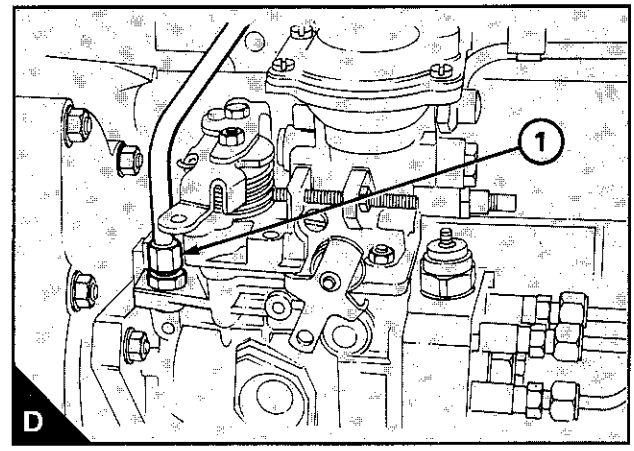
7 Ensure that the manual stop control, if one is fitted, is in the 'run' position. Operate the starter motor until fuel, free from air, comes from the pipe connections.

8 The engine is now ready to start.
If the engine runs correctly for a short time and then stops or runs roughly, check for air in the fuel system. If there is air in the fuel system, there is probably a leakage in the suction or low-pressure system.









To eliminate air from the fuel system - CAV pump **20A-08B**

If air enters the fuel system, it must be eliminated from the system before the engine can be started.
Air can enter the system if:

- The fuel tank is drained during normal operation.
- The low-pressure fuel pipes are disconnected.
- A part of the low-pressure fuel system leaks during engine operation.

In order to remove air from the fuel system, proceed as follows:

1 Loosen the vent plug on top of the twin element fuel filter (20A.08/A1) by two or three turns. If a single element filter is used, loosen the banjo connection bolt which is fitted on the top of the filter (20A.08/B1).

2 Operate the priming lever on the fuel lift pump (20A.08/C) until fuel, free of air, comes from the filter vent point. Tighten the vent plug or the banjo connection bolt. If the drive cam of the fuel lift pump is at the point of maximum cam lift, it will not be possible to operate the priming lever. In this situation, the crankshaft must be turned one revolution.

3 Ensure that the manual stop is in the "run position. If an electrical stop control is used, turn the key of the start switch to the "R" position.

4 CAV DPA fuel injection pump: Loosen the vent screw (C1) on the lock screw of the hydraulic head and loosen the vent screw (C2) on the top of the governor housing.
Operate the priming lever of the fuel lift pump until fuel, free of air, comes from the vent point in the lock screw of the hydraulic head. Tighten the vent screw. Continue to operate the priming lever on the fuel lift pump until fuel, free of air, comes from the vent point on the governor housing. Tighten the vent screw.
CAV DPS fuel injection pump: Loosen the vent screw (D1) on the top of the governor housing.
Operate the priming lever of the fuel lift pump until fuel, free of air, comes from the vent point. Tighten the vent screw.

5 Loosen the union nut (A1) at the fuelled starting aid, if one if fitted, and operate the priming lever of the fuel lift pump until fuel, free of air, comes from the connection. Tighten the union nut at the starting aid.

6 Loosen the high-pressure pipe connections (B1) at two of the atomisers.

7 Ensure that the manual stop control, if one is fitted, is in the "run" position. Operate the starter motor until fuel, free from air, comes from the pipe connections.

8 The engine is now ready to start.
If the engine runs correctly for a short time and then stops or runs roughly, check for air in the fuel system. If there is air in the fuel system, there is probably a leakage in the suction or low-pressure system.