
Lubrication system

19

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General description

For four cylinder engines the lubrication system is as follows:

Pressure lubrication is supplied by a rotor type pump. The pump is driven through an idler gear from the crankshaft gear. If a balancer unit is fitted, the pump is fitted to the balancer frame and is driven by the balancer drive shaft. The lubricating oil from the oil pump passes through a full flow filter to the pressure rail. The filter has a by-pass valve which lets oil pass directly to the pressure rail, if the filter becomes restricted. From the pressure rail, lubricating oil passes to the main bearings of the crankshaft and through passages in the crankshaft to the big end bearings. The pistons and the cylinder bores are lubricated by splash and oil mist.

Lubricating oil for the camshaft journals is supplied from the main bearings and a reduced supply is sent from the centre camshaft journal, through passages in the cylinder block and the cylinder head, to the rocker assembly. Lubricating oil passes through the rocker shaft to the bearings of the rocker levers. The valve stems and valve springs are lubricated by splash and oil mist.

The hub of the idler gear is supplied with lubricating oil from the pressure rail and the timing gears are splash lubricated.

The maximum pressure in the system is controlled by a relief valve. This valve controls the pressure of the oil immediately after it has left the oil pump. If a balancer unit is fitted, the valve is fitted in the frame of the balancer.

On turbocharged engines and certain naturally aspirated engines the lubricating oil passes through an oil cooler before it passes to the oil filter. When cold oil increases the restriction in the cooler, a by-pass valve lets the lubricating oil pass directly to the oil filter.

The turbocharger is lubricated by oil from the pressure rail. The lubricating oil is sent through a passage across the cylinder block to an adaptor fitted to the right side of the engine and then by pipe to the turbocharger. The lubricating oil returns from the turbocharger to the sump.

These engines have piston cooling jets fitted. These jets are connected to the pressure rail and spray lubricating oil inside the piston to keep them cool.

The lubrication circuit of 6 cylinder engines is basically the same as that for 4 cylinder engines except for these differences:

- 1 All turbocharged engines and the majority of naturally aspirated engines have an oil cooler.
- 2 When an oil cooler is fitted, the relief valve is in the circuit between the oil cooler and the oil filter.
- 3 The oil supply for the rocker assembly is from number 2 camshaft journal.

For both 4 and 6 cylinder engines the supply of lubricating oil to the compressor or exhauster is by a pipe connected to the pressure rail.

Filter canister

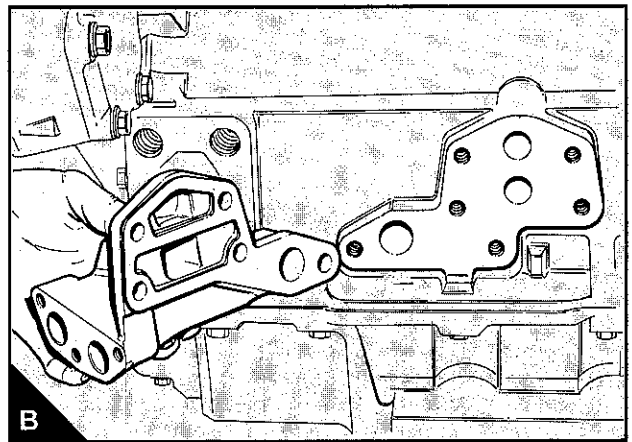
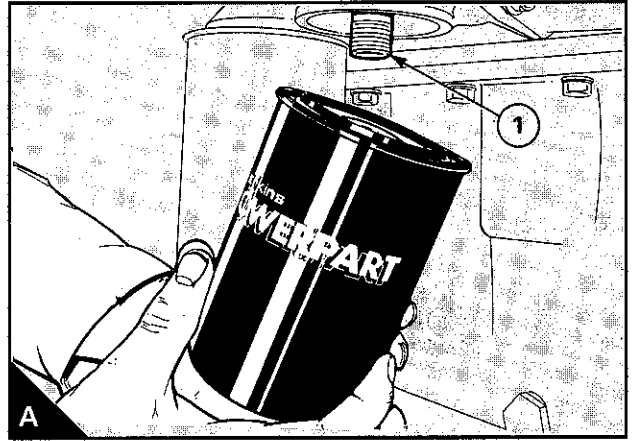
To renew

19A-01

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

- 1 Put a tray under the filter to contain spilt lubricating oil.
- 2 Remove the filter canister with a strap wrench or a similar tool. Ensure that the adaptor (A1) is secure in the filter head and then discard the canister.
- 3 Clean the filter head.
- 4 Add clean engine lubricating oil to the new canister. Give the oil time to fill the canister through the filter element.
- 5 Lubricate the top of the canister seal with clean engine lubricating oil.
- 6 Install the new canister and tighten it by hand only. Do not use a strap wrench.
- 7 After the lubricating oil has been added to the sump, operate the engine and check for leakage from the filter. When the engine has cooled, check the oil level on the dipstick and add oil to the sump, as necessary.

Attention: The canister contains a valve and special tube which ensure that lubricating oil does not drain from the filter. Therefore, ensure that the correct Perkins POWERPART canister is used.

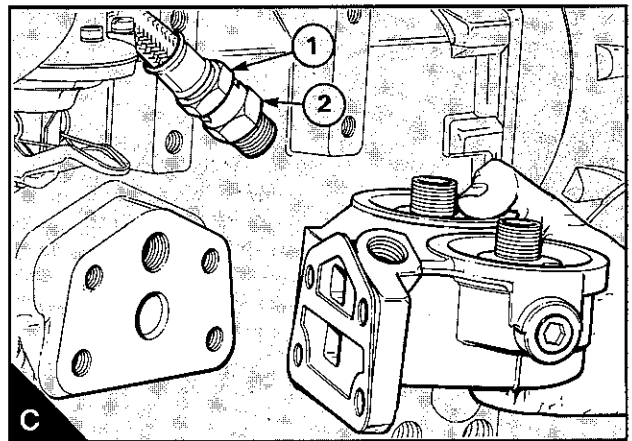


Filter head

To remove and to fit

19A-02

- 1 Put a tray under the filter head to contain spilt lubricating oil.
- 2 Remove the filter canister(s), operation 19A-01.
- 3 If a lubricating oil cooler is fitted, release the setscrews and remove the oil cooler pipes from the filter head. Discard the joint. If the filter head is fitted to the right side of a turbocharged engine, disconnect the oil supply pipe of the turbocharger. Use a spanner on the hexagonal end of the flexible pipe (C1) to hold the pipe while the connection (C2) is released.
- 4 Release the setscrews or nuts and remove the filter head from the cylinder block (B or C). Discard the joint.
- 5 Clean the joint face of the filter head and, if fitted, the flange of the oil cooler pipes. Fit the filter head and a new joint. Tighten the setscrews or nuts. Where necessary, fit the pipes of the oil cooler and a new joint. Tighten the setscrews. Where necessary, connect the oil supply pipe of the turbocharger. Use a spanner on the hexagonal end of the flexible pipe to hold the pipe while the connection is tightened.
- 6 Fit new filter canister(s), operation 19A-01.



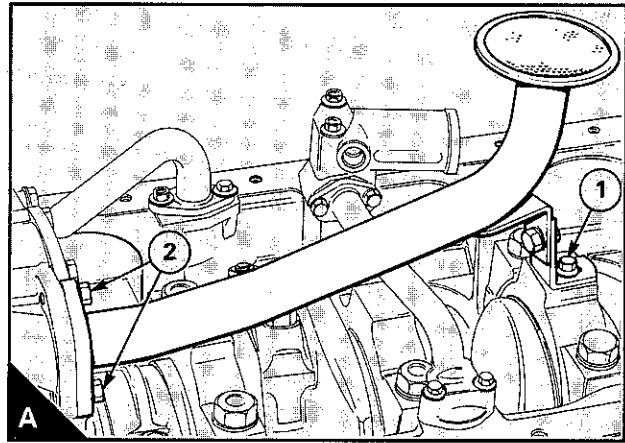
19

Sump

To remove and to fit

19A-03

- 1 Operate the engine until it is warm.
- 2 Stop the engine, remove the sump drain plug and its "O" ring and drain the oil. Where necessary, remove the dipstick and the dipstick tube.
- 3 Provide a support for the sump and remove the setscrews and the two nuts which fasten the sump to the cylinder block and to the timing case. Lower the sump and remove the joint.
- 4 Wash the sump with clean kerosene, ensure all the kerosene is removed. Clean the flange face of the sump and of the cylinder block.
- 5 Fit the sump together with a new joint and ensure the correct location with a setscrew on each side. Fit the remainder of the setscrews and the nuts and tighten all the fasteners to 22 Nm (16 lbf ft) 2,2 kgf m. Fit the drain plug together with a new "O" ring and tighten the plug to 34 Nm (25 lbf ft) 3,5 kgf m. Where necessary, fit the dipstick tube and the dipstick. Fill the sump to the "MAX" level on the dipstick with an approved lubricating oil.



Oil strainer and suction pipe

To remove and to fit

19A-04

The oil strainer is an integral part of the suction pipe. No regular service is necessary but wash the strainer when it is removed. On four cylinder engines which have a balancer fitted, the suction pipe is normally a short pipe which is fastened to the balancer frame and a pipe bracket is not fitted.

- 1 Remove the sump, operation 19A-03.
- 2 Release the setscrew which holds the bracket to the main bearing cap (A1).
- 3 Release the setscrews from the flange of the suction pipe (A2). Remove the suction pipe and strainer. Remove the old joint. Clean the flange face of the oil pump and of the suction pipe.
- 4 Loosely assemble the bracket of the suction pipe to the correct main bearing cap. Fit the suction pipe to the oil pump together with a new joint. Tighten the setscrews. Tighten the setscrew of the suction pipe bracket. If the clamp type bracket, used on some four cylinder engines, has been removed, ensure that the clamp, bracket and pipe are correctly aligned before the setscrews are tightened. Ensure that there is no stress on the suction pipe.
- 5 Fit the sump, operation 19A-03, and fill it with an approved oil to the "MAX" level on the dipstick.

To inspect and to correct

19A-05

- 1 Wash the assembly in kerosene and dry it thoroughly.
- 2 Check the pipe, the strainer and the welded joints for cracks and other damage. Check that the mounting bracket is secure.
- 3 If the damaged component cannot be welded correctly, renew the assembly.

Lubricating oil pump

To remove and to fit

19A-06

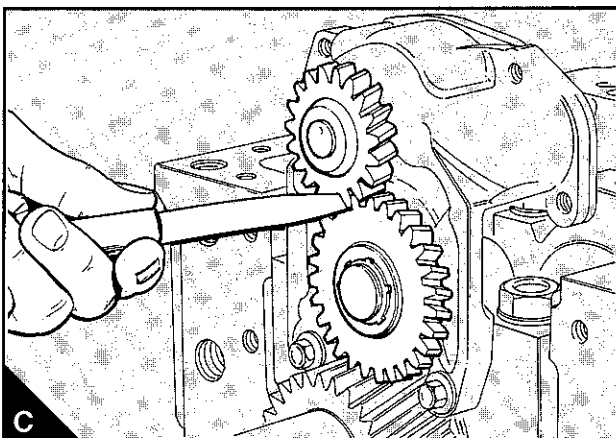
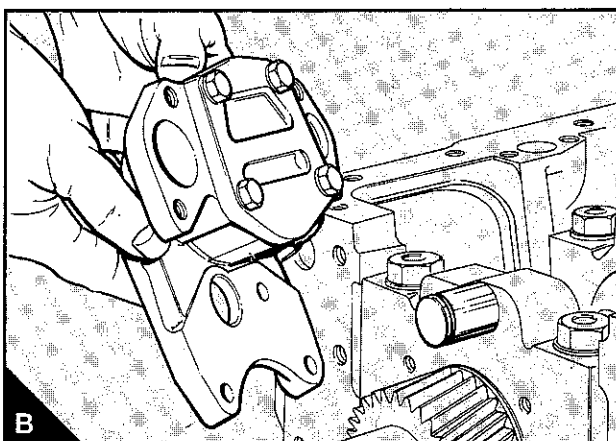
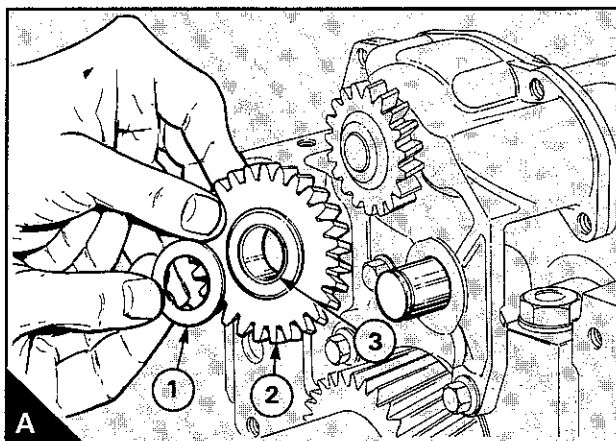
Engine types AA, AB, AC and AD: If a balancer unit is fitted, the oil pump is integral with the balancer unit, see section 14 for removal instructions etc.

To remove

- 1 Drain the lubricating oil and remove the lubricating oil sump, operation 19A-03.
- 2 Remove the suction pipe and strainer, operation 19A-04.
- 3 Engine types AA, AB, AC and AD: Remove the oil pressure relief valve, operation 19A-09, and the delivery pipe. Engine types YA, YB, YC and YD: Remove the delivery pipe of the oil pump.
- 4 The oil pump is fitted to number 1 main bearing cap. The oil pump can be removed with the main bearing cap, if a suitable spanner is available that will enable the torque to be applied correctly to the setscrews of the main bearing cap when it is fitted. If a suitable spanner is not available, the timing case must be removed, operation 15A-08.
- 5 Release the circlip which retains the idler gear of the oil pump and remove the washer (A1) and the idler gear (A2).
- 6 Release the setscrews and remove the oil pump (B).

To fit

- 1 Fill the oil pump with clean engine lubricating oil. Fit the oil pump to the main bearing cap and tighten the setscrews to 22 Nm (16 lbf ft) 2,2 kgf m.
- 2 Check the idler gear and the bush for wear and other damage. If the gear and/or bush are damaged, they can be renewed as an assembly or the bush can be renewed as a single item. Lubricate the bush (A3) with clean engine lubricating oil and fit the idler gear (A2), the washer (A1) and the circlip. Check that there is a minimum of 0,076 mm (0.003 in) backlash between the oil pump gear and the idler gear (C).
- 3 If number 1 main bearing cap was removed, lubricate the bearing with clean engine lubricating oil and fit the bearing cap. Tighten the setscrews to 265 Nm (196 lbf ft) 27,0 kgf m. If the timing case was removed, fit the timing case, operation 15A-08. Check that there is a minimum of 0,076 mm (0.003 in) backlash between the oil pump idler gear and the crankshaft gear.
- 4 Fit the suction pipe and strainer, operation 19A-04.
- 5 Engine types AA, AB, AC and AD: Fit the delivery pipe and oil pressure relief valve, operation 19A-09. Engine types YA, YB, YC and YD: Fit the delivery pipe and tighten the setscrews. Use new joints.
- 6 Fit the lubricating oil sump, operation 19A-03. Fill the sump to the "MAX" mark on the dipstick with an approved lubricating oil.

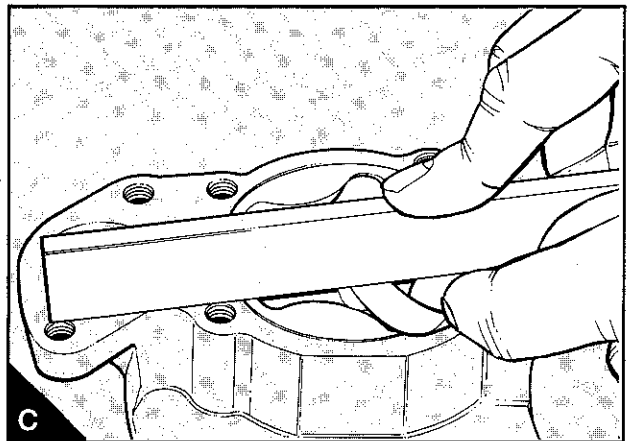
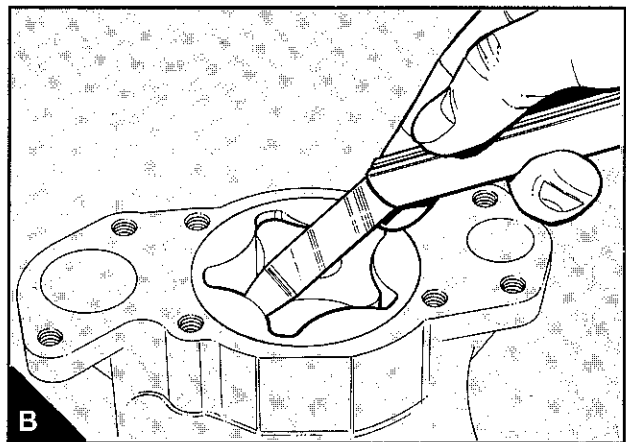
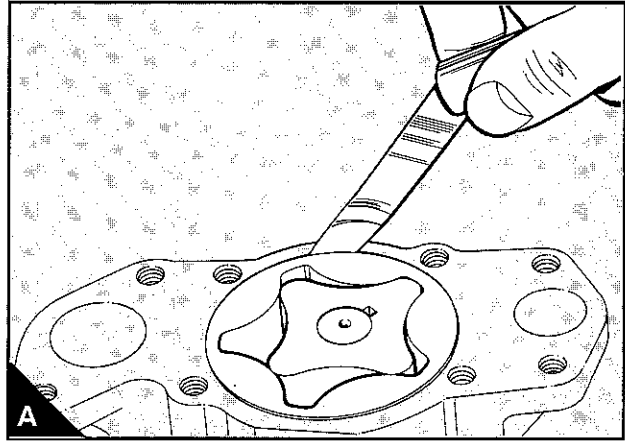


To inspect

19A-07

If any part is worn enough to have an effect on the performance of the oil pump, the complete oil pump must be renewed.

- 1 Release the setscrews and remove the cover of the oil pump. For pumps which are fitted to a balancer unit, remove the single setscrew and the cover.
- 2 Remove the outer rotor and clean thoroughly all the parts. Check for cracks and any other damage.
- 3 Fit the outer rotor and check the outer rotor to body clearance (A).
- 4 Check the inner rotor to outer rotor clearance (B).
- 5 Check the rotor end-float with a straight edge and a feeler gauge (C). For all the above clearances, see section 11C.
- 6 Clean the top face of the oil pump and the bottom face of the cover and fit the cover. Tighten the setscrews to 28 Nm (21 lbf ft) 2,9 kgf m. For pumps which are fitted to a balancer unit, put the cover in position and tighten the single setscrew to 22 Nm (16 lbf ft) 2,2 kgf m.



Relief valve

To remove and to fit

19A-08

Engine types AA, AB, AC, and AD which have a balancer unit fitted: The relief valve is fitted inside the balancer frame and cannot be removed as an assembly.

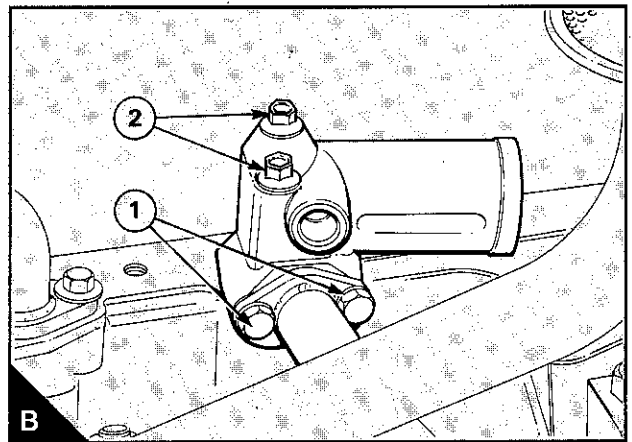
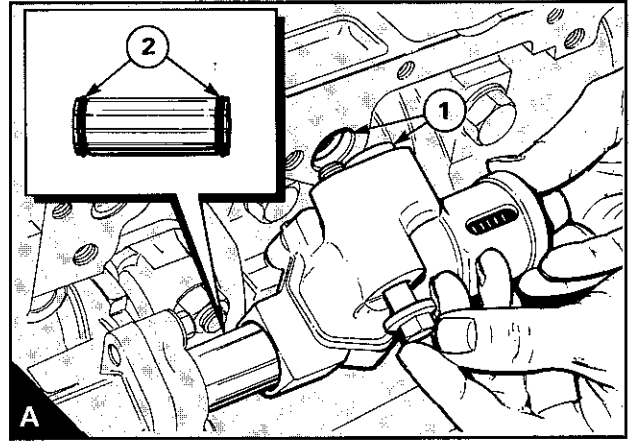
1 Drain the lubricating oil and remove the sump, operation 19A-03.

2 Engine types AA, AB, AD and AD: Release the setscrew and turn the relief valve to withdraw the thimble from the cylinder block (A1). Pull the relief valve from the delivery pipe and pull the delivery pipe from the oil pump.

Renew the "O" rings (A2). Lightly lubricate the "O" rings with clean engine lubricating oil and push the delivery pipe into the oil pump. Push the relief valve onto the delivery pipe and fit the relief valve to the cylinder block; ensure that the thimble is correctly fitted and tighten the setscrew.

3 Engine types YA, YB, YC and YD: Remove the setscrews which fasten the cross flow pipe to the relief valve (B1). Remove the flange joint. Release the two setscrews (B2) which fasten the relief valve to the cylinder block and remove the valve.

Ensure that the faces of the cross flow pipe and the relief valve are clean. Put the valve in position, complete with a new flange joint. Engage the four setscrews and tighten the flange setscrews and then the valve setscrews.



To dismantle and to assemble

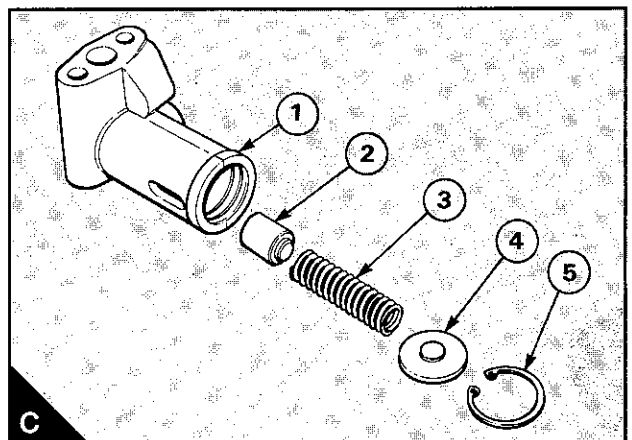
19A-09

If necessary, the relief valve can be dismantled and assembled while it is fitted to the engine.

1 Apply pressure to the end plate (C4 or D4) of the spring assembly; release the circlip (C5) or remove the pin (D5) and carefully release the pressure to remove the end plate and the spring (C3 or D3) from the valve body. Remove the plunger (C2 or D2) from the bore of the body (C1 or D1).

2 Ensure that all the components are cleaned and then lubricated lightly with clean engine lubricating oil.

3 Fit the plunger into the bore with its hollow end to the inside. Fit the spring and the end cap into the bore with the ends of the spring fitted around the bosses of the plunger and the end plate. Apply pressure to the end plate and fit the circlip into its groove or fit the pin into the holes in the balancer frame.



To inspect

19A-10

Do not try to change the operation pressure of the relief valve by a method other than the installation of new components.

1 Check the spring for wear and other damage and, if possible, check the load necessary to compress the spring to its fitted length, see section 11C.

2 Check the plunger for wear and other damage and ensure that it slides easily in the bore of the relief valve.

3 Check the body and the end plate for wear and other damage.

4 Renew worn or damaged components.

