
Cooling system

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General description

Coolant from the bottom of the radiator passes through the centrifugal water pump which is fitted on the front of the timing case. The pump is gear driven from the gear of the fuel injection pump and assists the flow of the coolant through the system. From the pump, the coolant passes through a passage in the timing case to the front of the cylinder block.

On four cylinder engines the coolant passes through a passage in the left side of the cylinder block to the rear of the cylinder block. Where a lubricating oil cooler is fitted, some of the coolant passes around the element of the cooler and then to the rear of the cylinder block. The coolant then passes around the cylinders and up into the cylinder head. The coolant leaves the cylinder head at the front and passes into the thermostat housing. If the thermostat is closed, the coolant goes directly through a by-pass to the inlet side of the water pump. If the thermostat is open, the thermostat closes the by-pass and the coolant passes to the top of the radiator.

On six cylinder engines the coolant divides as it enters the cylinder block. Most of the coolant passes along the right hand side of the cylinder block and around the outside of the cylinders to the rear of the cylinder block. The remainder of the coolant passes along a passage on the left hand side of the cylinder block to the lubricating oil cooler. The coolant flows around the element of the lubricating oil cooler to the rear of the cylinder block. The coolant then passes to the rear of the cylinder head.

Coolant passes forward through the cylinder head and into the thermostat housing. These engines have two thermostats. If the thermostats are closed, the coolant goes, through a by-pass, directly to the inlet side of the water pump. If the thermostats are open, the coolant passes to the top of the radiator.

Thermostats

To remove and to fit

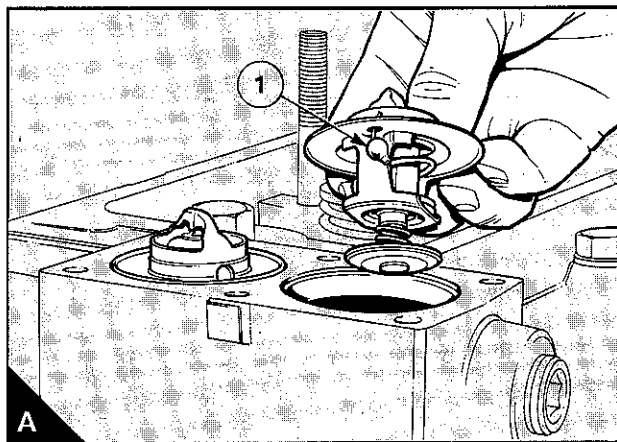
21A-01

To remove

- 1 Drain the cooling system so that the coolant level is below the thermostat position and disconnect the top hose from the water outlet connection.
- 2 Release the setscrews and remove the water outlet connection.
- 3 Remove the thermostat(s) (A).

To fit

- 1 Ensure that the joint faces of the housing and the outlet are clean and that the jiggle pin(s) (A1) in the thermostat(s) is/are free to move.
- 2 Put the new thermostat(s) in position in the housing.
- 3 Fit a new joint and the water outlet connection. Tighten the setscrews.
- 4 Connect the top hose and fill the cooling system.



To test

- 1 Hang the thermostat in a suitable container filled with water.
- 2 Heat the water gradually. Use a thermometer to check the temperature at which the valve starts to open and at which it is fully open. The correct temperatures are given in section 11C.
- 3 If the thermostat does not operate correctly, it must be renewed. Do not try to adjust the settings.

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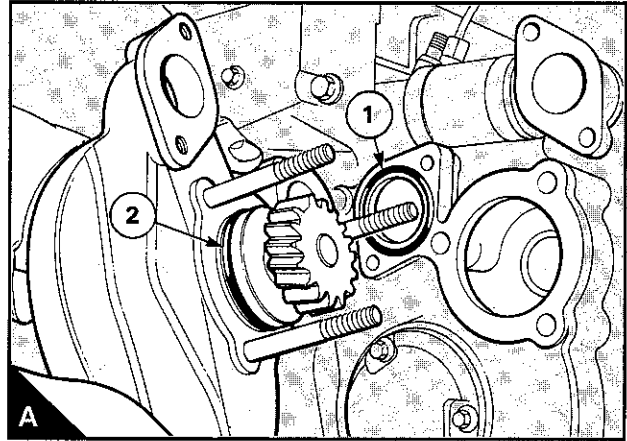
Water pump

To remove and to fit

21A-02

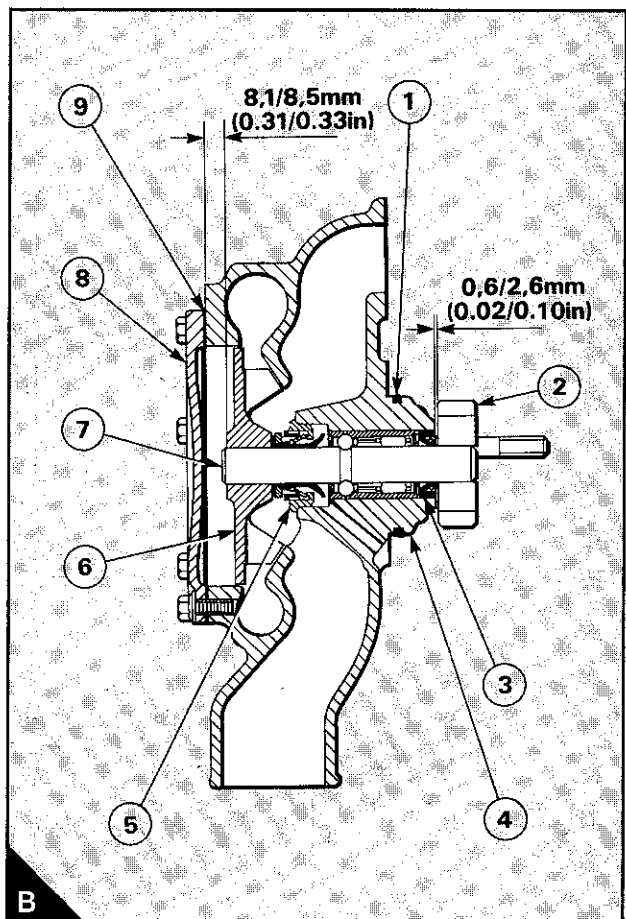
To remove

- 1 Drain the cooling system and disconnect the hose at the inlet connection of the water pump.
- 2 Release the setscrews from the flange of the coolant by-pass.
- 3 Release the three setscrews which retain the water pump to the cover of the timing case - two from the front and one from the rear.
- 4 Release the nuts from the rear face of the timing case, which fasten the pump to the timing case, and remove the water pump (A). Ensure that the "O" ring (A1) on the cover of the timing case is not lost.



To fit

- 1 Check the "O" rings on the pump body (A2) and on the cover of the timing case (A1) for damage. If either of the "O" rings are damaged, they must be renewed. Ensure that all joint faces are clean.
- 2 Check the drive gear of the water pump for wear or other damage. If the gear is damaged, it must be renewed.
- 3 Lightly lubricate the "O" ring on the pump body with clean engine lubricating oil. Fit the pump to the timing case cover with its gear in mesh with the gear of the fuel injection pump. The pump is a tight fit in the cover, but can be pulled into position if the nuts for the pump studs are gradually and evenly tightened. Ensure that the "O" ring in the cover remains in position while the pump is fitted.
- 4 Fit and tighten the three setscrews which retain the pump to cover of the timing case - two from the front and one from the rear.
- 5 Fit a new joint to the flange of the coolant by-pass. Fit the by-pass and tighten the setscrews.
- 6 Connect the hose to the inlet connection of the water pump and fill the cooling system. Operate the engine and check for leakage.



To dismantle and to assemble

21A-03

To dismantle

Special tool:
Gear puller, MS.99

- 1 Remove the three long studs and the "O" ring (B1) from the pump body (B4).
- 2 Remove the front cover (B8) and the joint (B9).
- 3 Remove the gear (B2) with puller.
- 4 Use a suitable lever to remove the oil seal (B3) and discard the seal.
- 5 If necessary, remove the studs from the pump body. With a suitable support under the impeller end of the body, use a suitable adaptor to press out the shaft and bearing assembly (B7), together with the impeller (B6) and the water seal (B5).
- 6 With a suitable support under the impeller, press the shaft out of the impeller. Remove the water seal and discard it.

To assemble

- 1 Clean thoroughly the inside of the pump body especially the bearing bore and the counterbore for the water seal. Both of these bores and their chamfers must be clean and free of corrosion.
- 2 Apply a thin layer of Loctite 35 to the outer surface of the bearing, but keep the Loctite away from the ends of the bearing. Provide a suitable support under the gear end of the pump body. Put the bearing and shaft assembly (21A.04/B7) in position with the bearing square to the pump body and the shortest end of the shaft in the pump body. Use a press and a suitable adaptor, which will apply the force to the bearing and not to the shaft, to press in the bearing and shaft assembly. Press in the bearing until the end of the bearing is level with the bottom of the counterbore for the water seal. Remove the adaptor and remove all Loctite from the end of the bearing.
- 3 Do not lubricate the water seal (21A.04/B5). It is important that it is not contaminated with oil or grease and, if it is held in the hand, it should be held by the edge of the outside flange. With the widest end of the water seal towards the bearing, push the seal onto the shaft until it is against the chamfer of the counterbore. Ensure that the seal is square with the bore and press the seal into the counterbore, with a suitable adaptor, until the outer flange is in contact with the pump body. The adaptor must apply force only to the outer flange of the seal. With the seal in position, continue to apply force for approximately ten seconds to ensure that the seal remains in position.
- 4 Hold the pump with the gear end of the shaft on a suitable support and, with the use of a suitable distance piece and a flat bar, press the impeller (21A.04/B6) onto the shaft to the dimension indicated in 21A.04/B. Remove the tool and ensure that the shaft is free to rotate. If the original impeller is to be used again, Loctite 35 must be applied to the bore of the impeller and any excess Loctite removed after the impeller has been fitted.
- 5 Turn the pump over and provide a suitable support for the pump body; remove the studs, if necessary. Lightly lubricate the oil seal (21A.04/B3) with clean engine lubricating oil. Put the oil seal into position in the pump body with the flat face of the seal towards the bearing. With a suitable adaptor, press the oil seal into the body until the rear of the seal is level with the end of the pump. When the seal is in position, continue to apply force for approximately ten seconds to ensure that the seal remains in position when the force is released.
- 6 Hold the pump with the impeller end of the shaft on a suitable support. Press the gear (21A.04/B2) onto the shaft to the dimension shown in 21A.04/B. If the original gear is used, Loctite 35 must be applied to the bore of the gear and all excess Loctite removed after the gear has been fitted.
- 7 Fit a new joint (21A.04/B9) and the cover (21A.04/B8) and tighten the fasteners.

Fan

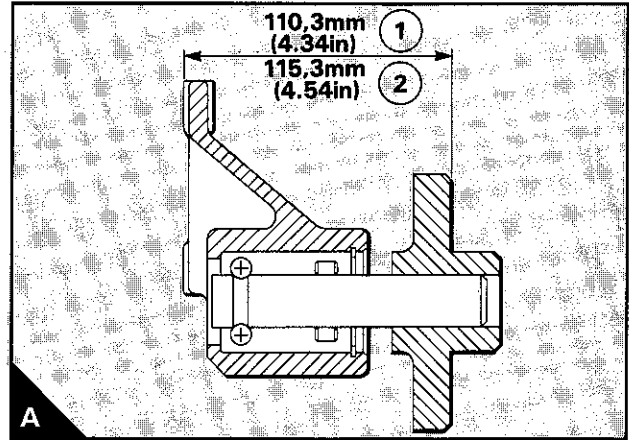
To remove and to fit **21A-04**

To remove

Release the setscrews and remove the fan. If necessary, fit the setscrews to retain the fan extension and the pulley to the hub.

To fit

If necessary, release the setscrews from the hub of the fan drive. Fit the fan and the setscrews and tighten the setscrews to the torque recommended in section 11C.



Fan drive

To remove and to fit **21A-05**

To remove

- 1 Loosen the pivot fasteners of the alternator and the fasteners of the adjustment link. Remove the drive belt(s).
- 2 Release the setscrews and remove the fan. Remove the fan extension, if fitted, and the pulley.
- 3 Check the end-float of the drive shaft. If it is more than 0,25 mm (0.010 in), the assembly must be renewed.
- 4 Release the setscrews and remove the fan drive.

To fit

- 1 Fit the fan drive and tighten the setscrews to 44 Nm (33 lbf ft) 4,5 kgf m.
- 2 Fit the fan, operation 21A-04.
- 3 Fit the belt(s) and adjust the tension, operation 23A-02.

To dismantle and to assemble **21A-06**

To dismantle

- 1 Use a suitable puller to remove the hub from the drive shaft.
- 2 Remove the circlip which retains the bearing.
- 3 Provide a suitable support for the front of the bearing housing. Put a suitable adaptor on the rear of the bearing and press the bearing and shaft assembly out through the front of the bearing housing. Do not apply force to the shaft.

To assemble

- 1 Put the bearing housing on a suitable support with the largest opening towards the top.
- 2 Put the bearing on the housing with the shortest end of the shaft towards the housing. Put a suitable adaptor on the bearing and press the bearing and shaft assembly into the housing. Do not apply force to the shaft.
- 3 Fit the circlip in its groove in the bearing housing.
- 4 With the rear end of the shaft on a suitable support, press on the hub to the relevant dimension shown in A: dimension A1 is for six cylinder engines in vehicle applications; dimension A2 is for all other engines. Ensure that the chamfered edge of the hub flange is towards the front.

Lubricating oil cooler

To remove and to fit -
engine types AB and AD

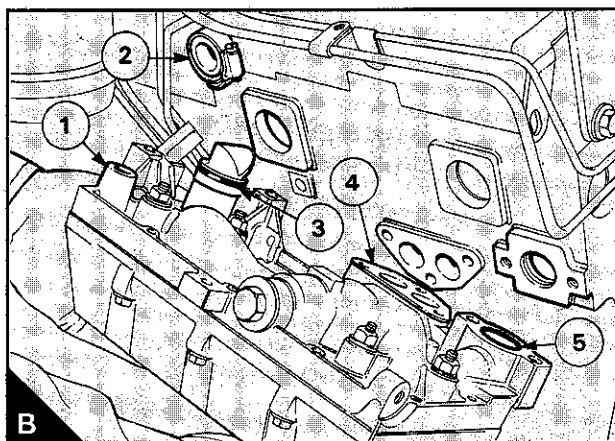
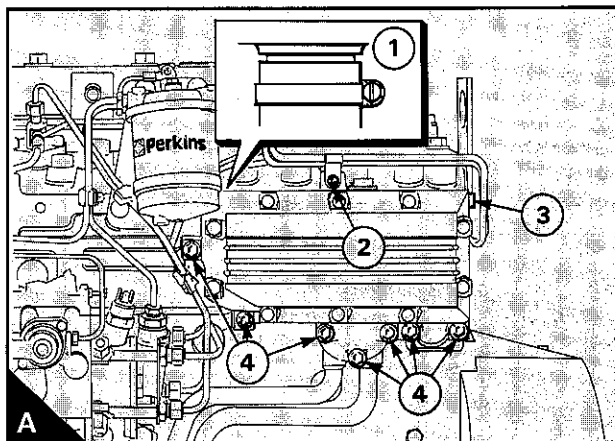
21A-07A

To remove

- 1 Drain the cooling system.
- 2 Release the support bracket at the cooler (A3).
- 3 Release the setscrew and nut (A2) which fasten the low-pressure fuel pipes to the top of the cooler.
- 4 Release the hose clip at the top rear of the cooler (A1).
- 5 Release the six setscrews (A4) which are fitted below the cover and the setscrew (A4) to the left of the cover. Remove the cooler.

To fit

- 1 Renew the "O" rings on the inlet connection for the coolant (B3) and the outlet flange for the coolant (B5). Ensure that the joint faces are clean. Renew the joint (A4) for the oil pipe flange.
- 2 Lightly lubricate the bore of the vent connection (B2) and the "O" ring on the coolant inlet connection with engine lubricating oil.
- 3 Loosely fit the hose clip to the vent connection.
- 4 Fit the cooler to the engine with the vent (B1) fitted correctly in its connection. Tighten the setscrews and the hose clip of the vent connection.
- 5 Fit and tighten the setscrew of the support bracket.
- 6 Fit the setscrew and nut which fasten the low-pressure fuel pipes to the top of the oil cooler.
- 7 Fill the coolant system.
- 8 Operate the engine and check for leakage of coolant or oil.



To remove and to fit -
engine types YA, YB, YC and YD

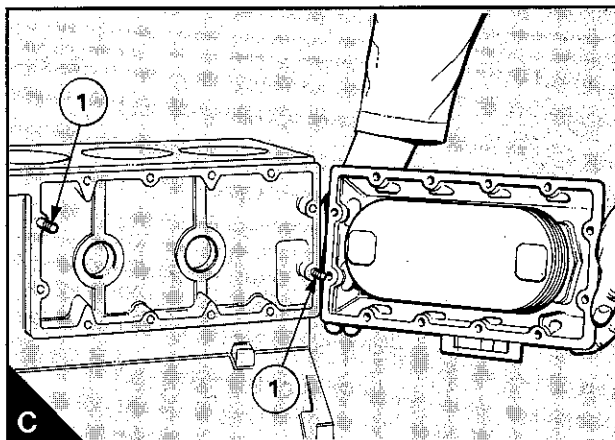
21A-07B

To remove

- 1 Drain the cooling system.
- 2 Disconnect the lubricating oil pipes at the flange on the cooler cover.
- 3 Release the setscrews and nuts of the cover of the oil cooler and remove the cover together with the element (C).

To fit

- 1 If the studs (C1) have been removed and are to be fitted again, clean the threads in the cylinder block and on the studs. Apply a suitable sealant before the studs are fitted to the cylinder block.
- 2 Fit the oil cooler and a new joint to the cylinder block and tighten the setscrews and nuts to 22 Nm (16 lbf ft) 2,2 kgf m.
- 3 Fit a new joint and connect the lubricating oil pipes to the flange on the cover and tighten the setscrews.
- 4 Fill the cooling system.
- 5 Operate the engine and check for oil or coolant leakage.



To dismantle and to assemble -
engine types AB and AD

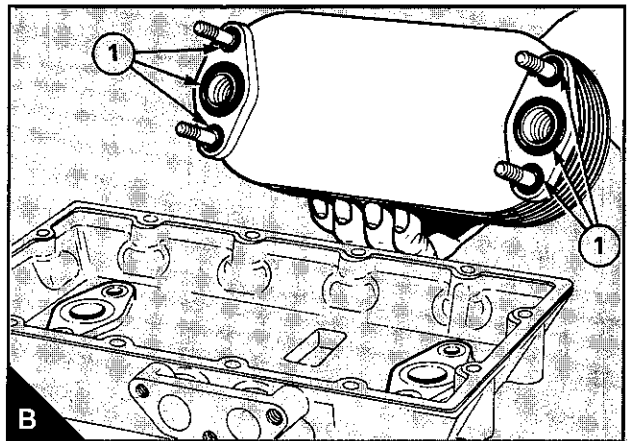
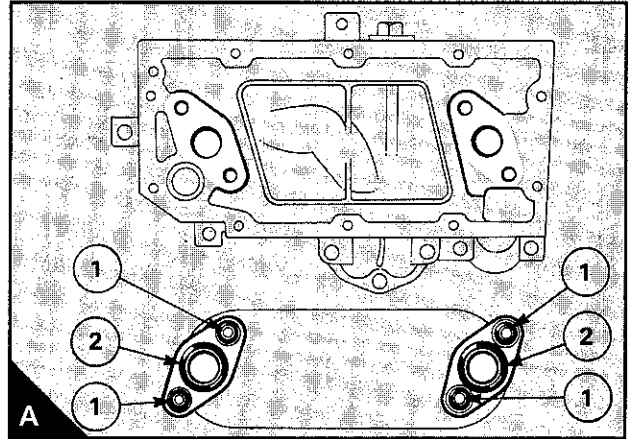
21A-08A

To dismantle

- 1 Remove the oil cooler from the cylinder block, operation 21A-07A.
- 2 Release the setscrews and remove the cover.
- 3 Release the self-locking nuts at the back of the oil cooler and remove the cooler element.
- 4 Clean the element and check for cracks. If a solution is used to clean the outside of the element, ensure that this does not enter the element. Check that there is nothing to restrict the flow of lubricating oil through the element of the oil cooler. If the inside of the element needs to be cleaned, use a solvent which is suitable for copper. Dry the element with low pressure air and then flush it with clean engine lubricating oil.

To assemble

- 1 Renew the "O" rings (A1 and A2) on the flanges of the element and the self-locking nuts for the studs.
- 2 Fit the element to the backplate and tighten the self-locking nuts to 22 Nm (16 lbf ft) 2,2 kgf m.
- 3 Fit the cover and a new joint to the cooler backplate and tighten the setscrews to 11 Nm (8 lbf ft) 1,1 kgf m.



To dismantle and to assemble -
engine types YA, YB, YC and YD

21A-08B

To dismantle

- 1 Remove the oil cooler, operation 21A-07B.
- 2 Release the nuts on the front of the cover and remove the element of the oil cooler (B).
- 3 Clean the element and check for cracks. If a solution is used to clean the outside of the element, ensure that this does not enter the element. Check that there is nothing to restrict the flow of lubricating oil through the element of the oil cooler. If the inside of the element needs to be cleaned, use a solvent which is suitable for copper. Dry the element with low pressure air and then flush it with clean engine lubricating oil.

To assemble

- 1 Renew the "O" rings (B1) on the flanges of the element.
- 2 Fit the element of the oil cooler to the cover and tighten the nuts to 22 Nm (16 lbf ft) 2,2 kgf m.

Cooler by-pass valve

To remove and to fit

21A-09

- 1 Release the hexagonal cap and remove the by-pass valve (A).
- 2 Check the valve spring and the seat for damage and renew the complete assembly, as necessary.
- 3 Renew the aluminium washer (A1). Fit the by-pass valve into the oil cooler and tighten the cap to 50 Nm (37 lbf ft) 5,1 kgf m.

