

2

Specifications

Basic engine data - 2306 engine

Number of cylinders	6
Cylinder arrangement	In line
Cycle	Four stroke
Induction system	Turbocharged
Combustion system	Direct injection
Nominal bore	137 mm (5.394 in)
Nominal stroke	165 mm (6.496 in)
Compression ratio	15.9:1
Cubic capacity	14,6 litres (893 in ³)
Firing order	1, 5, 3, 6, 2, 4
Direction of rotation	Anti-clockwise viewed on flywheel
Lubricating oil capacity:	
Total system	68 litres (120 UK pints)
Sump maximum	60 litres (106 UK pints)
Sump minimum	45 litres (79 UK pints)
Lubricating oil pressure:	
At rated speed	4,5 bar
Typical coolant capacity of engine	20,8 litres (4.6 UK gallons)
Typical coolant capacity of engine and radiator	47 litres (10.3 UK gallons)

Basic engine data - 2806 engine

Number of cylinders	6
Cylinder arrangement	In line
Cycle	Four stroke
Induction system	Turbocharged
Combustion system	Direct injection
Nominal bore	140 mm (5.512 in)
Nominal stroke	171 mm (6.732 in)
Compression ratio	15.9:1
Cubic capacity	15,8 litres (964.18 in ³)
Firing order	1, 5, 3, 6, 2, 4
Direction of rotation	Anti-clockwise viewed on flywheel
Lubricating oil capacity:	
Total system	68 litres (120 UK pints)
Sump maximum	60 litres (106 UK pints)
Sump minimum	45 litres (79 UK pints)
Lubricating oil pressure:	
At rated speed	4,5 bar
Typical coolant capacity of engine	20,8 litres (4.6 UK gallons)
Typical coolant capacity of engine and radiator	50 litres (11 UK gallons)

Rocker cover

To remove and to fit

Operation 3-1

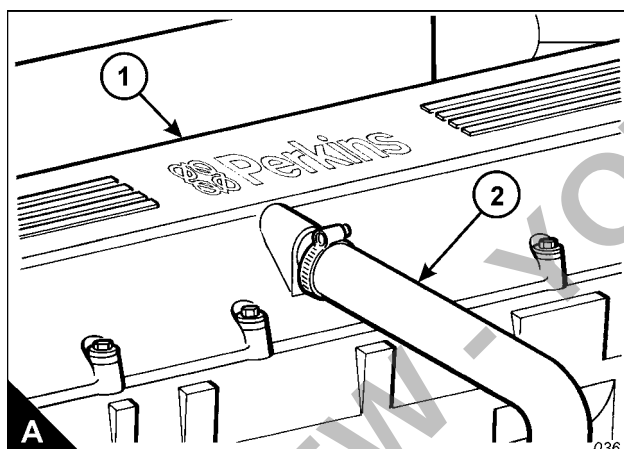
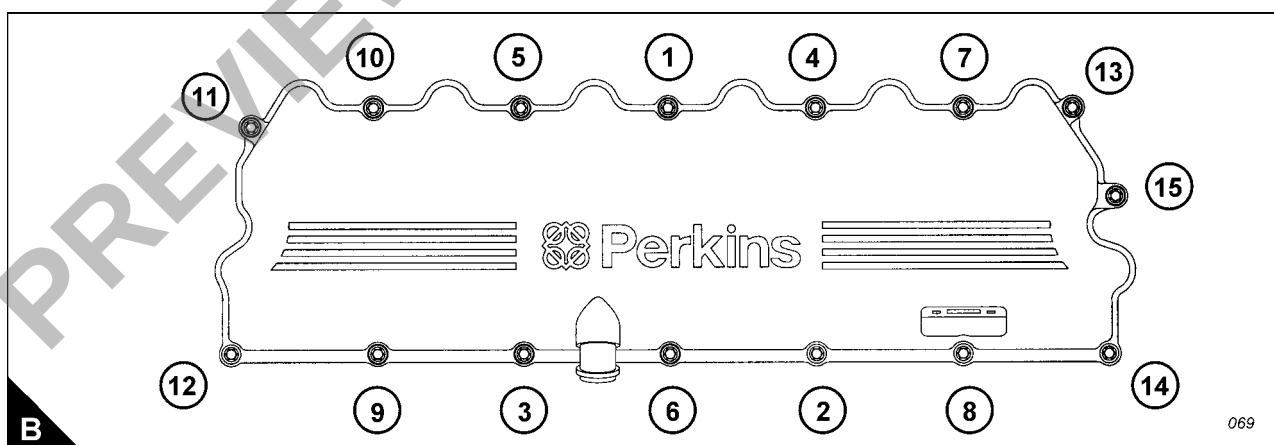
To remove

Warning! The electrical circuit for the fuel injector units operates on 110 volts. Do NOT work on the fuel injector units unless the power supply to the ECM has been disconnected.

- 1 Disconnect the wiring harness at the socket on the rocker cover (A1).
- 2 Disconnect and remove the engine breather pipe (A2).
- 3 Loosen fully the bolts which retain the rocker cover, but do not remove the bolts from the assembly; allow them to be retained by the seal.
- 4 Remove the rocker cover.

To fit

- 1 Inspect the seal of the rocker cover and renew if worn or damaged.
- 2 Fit the rocker cover, complete with seal and bolts. Tighten the bolts to a torque of 20 Nm (15 lbf ft); use the sequence shown (B).
- 3 Fit the engine breather pipe (A2).
- 4 Connect the wiring harness. Ensure that the wiring harness is fully engaged with the connector.



Recommended torque figures

Exceptions to these torque figures are given in the Workshop Manual where necessary.

Before any components are fitted to the engine, ensure that they are in a new or close to new condition. Bolts or threads must not be worn or damaged. Components must be free from rust or other corrosion. Clean with a non-corrosive cleaner if necessary. Do not lubricate the threads of fasteners. Rust preventative which has been applied by the component supplier for shipping and storage is acceptable. Certain components may require an application of a particular lubricant, details are given in the Workshop Manual where relevant.

Standard torque figures for metric fasteners

Metric nuts and bolts	
Thread size metric	Standard torque
M6	12 +/- 3 Nm (9 +/- 2 lbf ft)
M8	28 +/- 7 Nm (21 +/- 5 lbf ft)
M10	55 +/- 10 Nm (41 +/- 7 lbf ft)
M12	100 +/- 20 Nm (75 +/- 15 lbf ft)
M14	160 +/- 30 Nm (120 +/- 22 lbf ft)
M16	240 +/- 40 Nm (175 +/- 30 lbf ft)
M20	460 +/- 60 Nm (340 +/- 44 lbf ft)
M24	800 +/- 100 Nm (590 +/- 75 lbf ft)
M30	1600 +/- 200 Nm (1180 +/- 150 lbf ft)
M36	2700 +/- 300 Nm (2000 +/- 220 lbf ft)

Metric taperlock studs	
Thread size metric	Standard torque
M6	8 +/- 3 Nm (6 +/- 2 lbf ft)
M8	17 +/- 5 Nm (13 +/- 4 lbf ft)
M10	35 +/- 5 Nm (26 +/- 4 lbf ft)
M12	65 +/- 10 Nm (48 +/- 7 lbf ft)
M16	110 +/- 20 Nm (80 +/- 15 lbf ft)
M20	170 +/- 30 Nm (125 +/- 22 lbf ft)
M24	400 +/- 60 Nm (300 +/- 44 lbf ft)
M30	750 +/- 80 Nm (550 +/- 60 lbf ft)
M36	1200 +/- 150 Nm (880 +/- 110 lbf ft)

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Cylinder head

Thickness of cylinder head (new) ... 120,00 +/- 0,15 mm (4.724 +/- 0.006 in)

Minimum thickness for a used cylinder head. ... 119,50 mm (4.705 in)

Flatness of cylinder head: The cylinder head must be flat to within a total of 0,13 mm (0.005 in). Additionally, the cylinder head must be flat within a maximum of 0,03 mm (0.001 in) across any 76,2 mm (3.00 in) span.

Camshaft and bearings

Diameter of camshaft journal (E3) 84,85 +/- 0,02 mm (3.341 +/- 0.001 in)

Exhaust lobe lift.. ... 8,515 mm (0.3352 in)

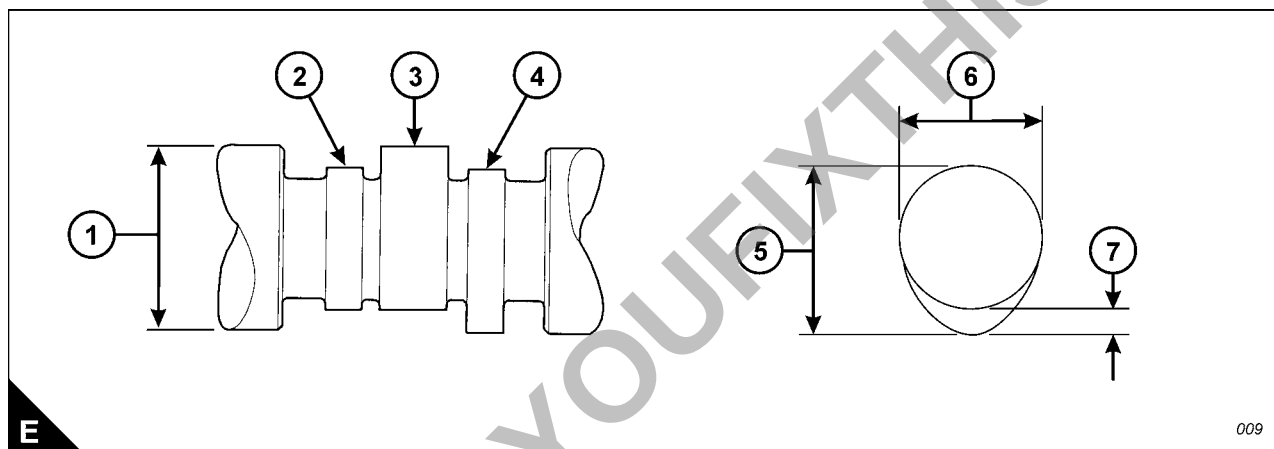
Inlet lobe lift ... 9,431 mm (0.3713 in)

Injector lobe lift... ... 10,451 mm (0.4114 in)

Maximum permissible difference between the actual lobe lift (E7)

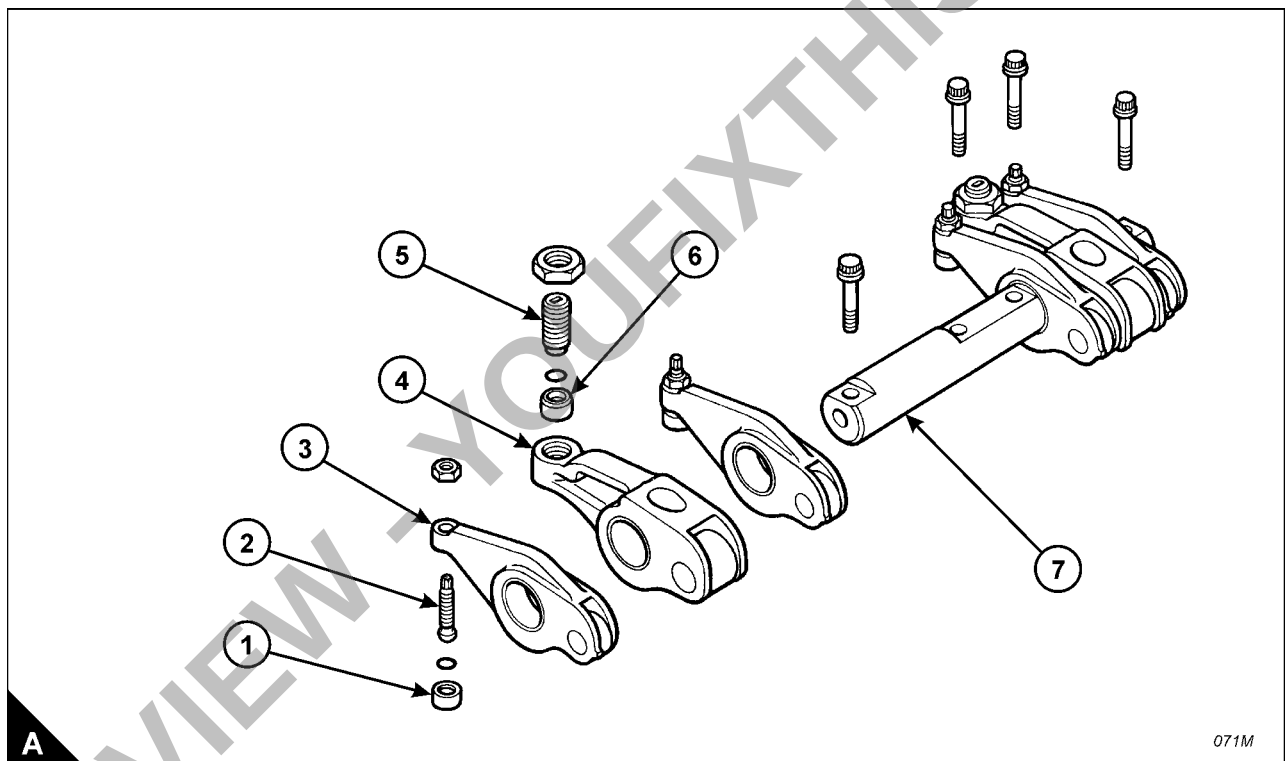
and the specified dimension .. 1,0 mm (0.0394 in)

To obtain the lobe lift (E7) proceed as follows: Measure the lobe height (E5) and measure the base circle (E6). Subtract the base circle from the lobe height to give the lobe lift.



To assemble

- 1 Install new 'O' ring seals in the buttons (A1).
- 2 Install new 'O' ring seals in the buttons (A6).
- 3 To fit the 'O' ring seals and buttons to the valve rocker levers, proceed as follows:
 - a. Support the valve rocker lever (A3) in a vice which has soft jaws.
 - b. Put the 'O' ring seal and button (A1) on the round end of the adjustment screw (A2).
 - c. Use a soft hammer to seat the button on the adjustment screw.
- 4 To fit the 'O' ring seals and buttons to the unit injector rocker levers, proceed as follows:
 - a. Support the unit injector rocker lever (A4) in a vice which has soft jaws.
 - b. Put the 'O' ring seal and button (A6) over the end of adjustment screw (A5).
 - c. Use a soft hammer to seat the button on the adjustment screw.
- 5 Repeat steps 3 and 4 for the rocker levers which remain.
- 6 Fit the assembled rocker levers to the shafts (A7). Ensure that they are fitted to their original positions.



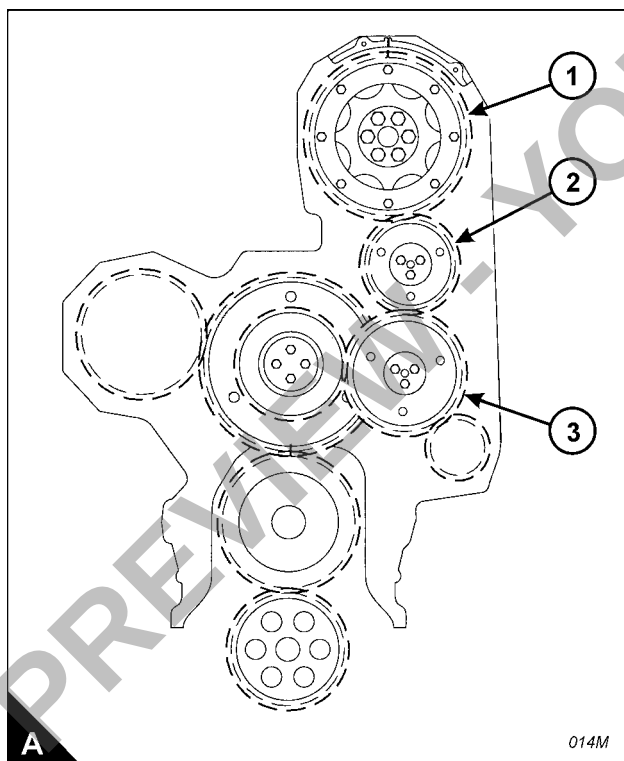
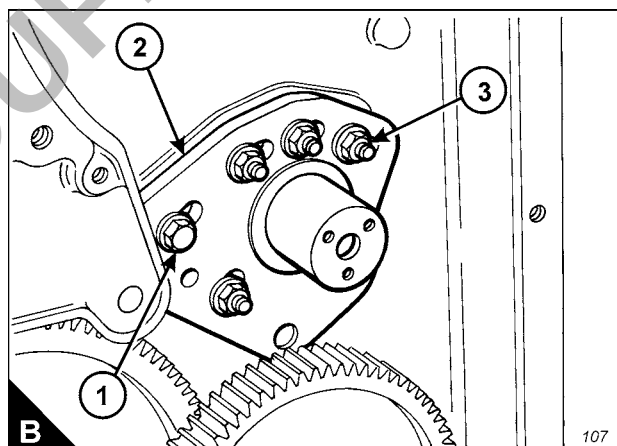
How to set the backlash for the camshaft gear

Operation 3-11

If the cylinder head or the camshaft is removed, the backlash between the camshaft gear (A1) and the adjustable idler gear (A2) must be checked and, if necessary, adjusted. The backlash between the camshaft gear and the adjustable idler gear, and also between the adjustable idler gear (A2) and the main idler gear (A3), must be $0,25 \pm 0,08$ mm (0.010 ± 0.003 in).

Note: This procedure must be performed before the rocker lever and shaft assemblies are fitted.

- 1 Remove the main idler gear (A3). Hold the camshaft gear stationary and use a dial test indicator (DTI), mounted on the gear case, to check the backlash of the adjustable idler gear.
- 2 Fit the main idler gear (A3), hold the main idler gear stationary and measure the backlash on the adjustable idler gear.
- 3 To adjust the backlash, remove the three bolts and thrust plate which retain the adjustable idler gear (A2) and remove the gear. Loosen the five nuts (B3) and the bolt (B1) which retain the stub axle (B2) and move the stub axle by the relevant amount. Tighten the nuts and bolt to a torque of 47 ± 9 Nm (35 ± 7 lbf ft).
- 4 Fit the idler gear. Retain with the thrust plate and three bolts. Check again the backlash between the adjustable idler gear and the camshaft gear, and also between the adjustable idler gear (A2) and the main idler gear (A3), as given in steps 1 and 2. Repeat the procedure if necessary until the correct backlash settings have been obtained.
- 5 When the correct backlash settings have been obtained, remove the adjustable idler gear and proceed as follows: Remove one of the nuts which retains the idler axle, apply a small amount of Loctite 542 to the threads of the stud, fit the nut and tighten to a torque of 47 ± 9 Nm (35 ± 7 lbf ft). Repeat this procedure for the other four nuts and the bolt; work on one nut or bolt at a time so that the position of the stub axle is not affected.



To fit

Note: Before the new seal and wear sleeve are installed, read carefully the special instruction which is supplied with each seal and wear sleeve.

1 Clean and the wear sleeve inside diameter and crankshaft outside diameter with quick cure primer, CV60892. Apply some retaining compound, CV60893, to the crankshaft outside diameter before the wear sleeve is installed on the crankshaft. Do not allow any quick cure primer or retaining compound to touch the lip of the seal.

2 Use the bolts (C4), GE50009, to install the guide, GE50008, on the crankshaft.

Notes:

- The seal and the wear sleeve must be installed in a dry condition.
- Ensure that the seal is fitted with the part number and the crankshaft rotation arrows toward the outside.

Caution: The front and rear seals and wear sleeves have different spiral grooves. The seal will not function if it is installed at the wrong end of the engine.

3 Fit the wear sleeve and seal (C3) as a unit onto the locator, GE50008.

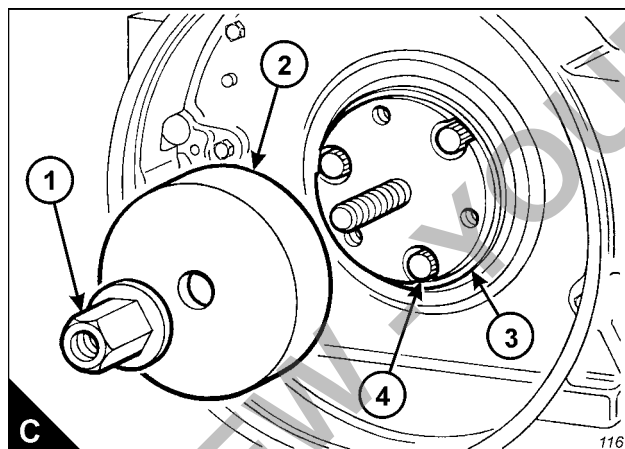
4 Fit the installer (C2), GE50012, onto the locator.

5 Apply clean engine oil to the face of the nut (C1), GE50014, and to its contact area on the installer, GE50012.

6 Fit the nut to the locator and tighten the nut until the inside surface of the installer is in contact with the locator.

7 Remove all of the tools from the crankshaft.

8 Fit the flywheel, Operation 13-1.



Electronic control module

To remove and to fit

Operation 8-1

To remove

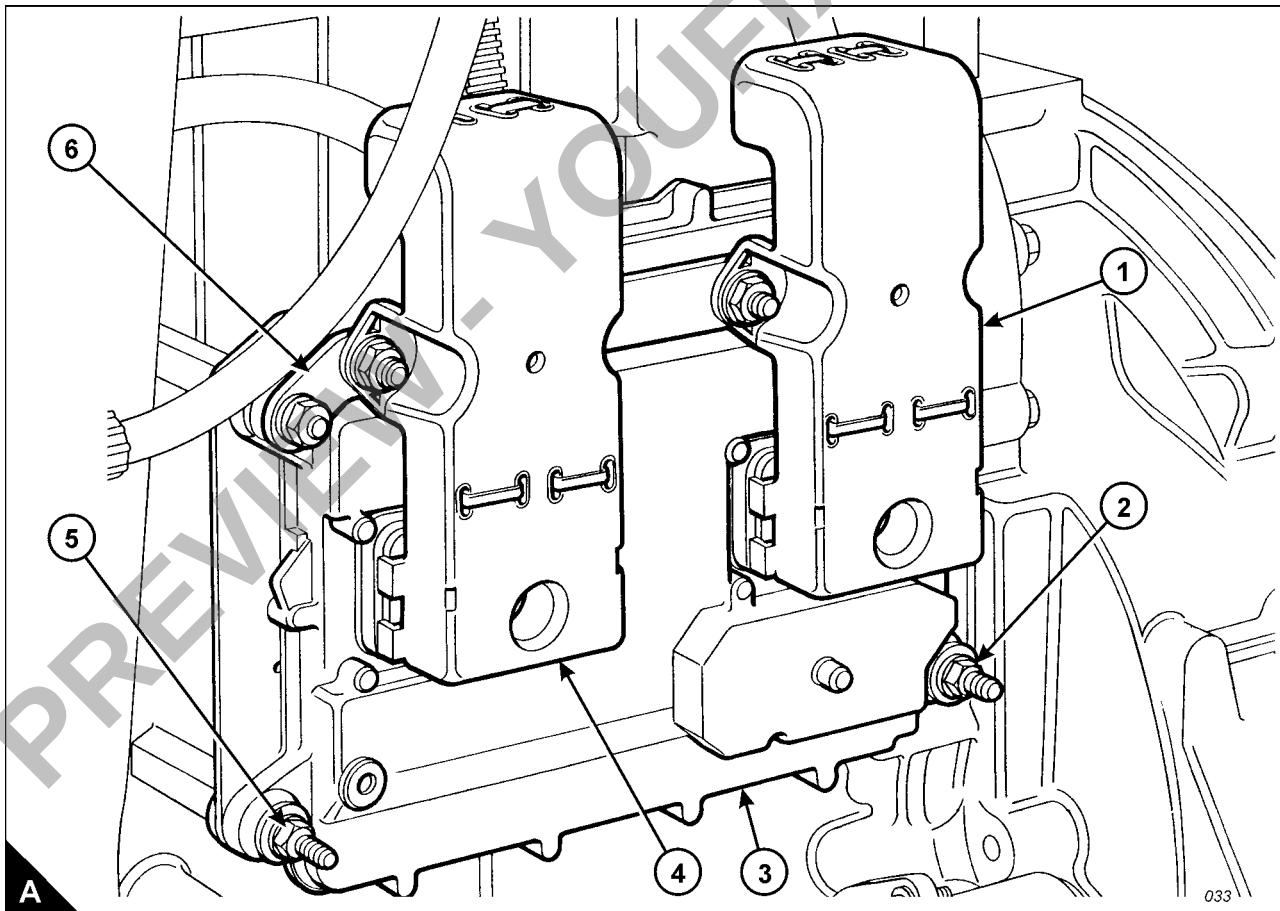
- 1 Switch off the engine and disconnect the electrical power supply.
- 2 Loosen fully the Allen screws from the J1 and J2 connectors (A1 and A4).
- 3 Remove the two nuts which retain the bar (A6) and the control module (A3), release the ground strap and withdraw the bar and connectors from the control module.
- 4 Support the control module, remove the two remaining nuts (A2 and A5) and remove the electronic control module from the engine.

To fit

- 1 Fit the electronic control module. Retain with four nuts, ensure that the ground strap is fitted correctly.

Note: To avoid damage to the components, use the Allen screws to pull the mating parts of the connectors (A1 and A4) and control module (A3) together. Ensure that the connectors are aligned correctly and are fitted to the correct positions before the Allen screws are tightened.

- 2 Fit the connectors (A1 and A4) and retain with Allen screws. Tighten the screws to a torque of 3 Nm (2.2 lbf ft). Do NOT overtighten the screws.
- 3 Connect the electrical power supply.



Drive for the fuel transfer pump

To remove and to fit

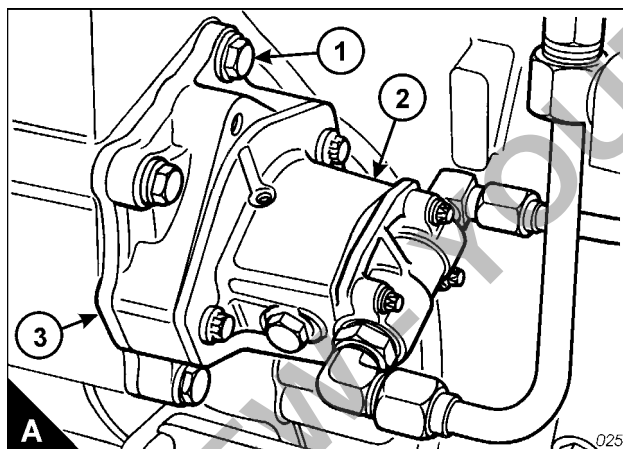
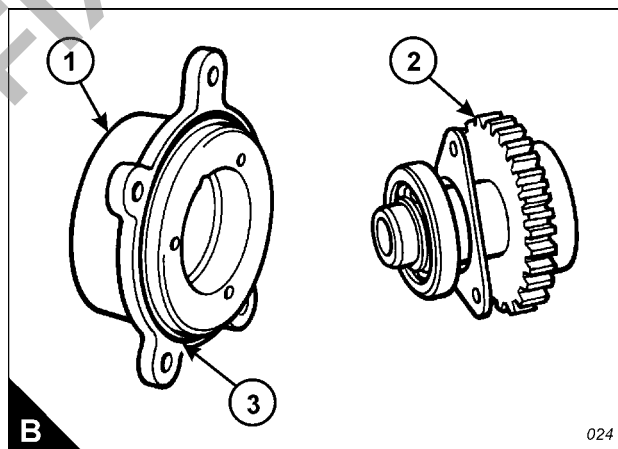
Operation 11-4

To remove

- 1 Remove the fuel transfer pump (A2), Operation 11-2.
- 2 Remove four bolts and washers (A1) and withdraw the assembly of the pump drive and housing (A3) from the gear case.
- 3 Remove the three bolts from the housing (B1) and remove the assembly of the bearings and gear (B2) from the housing.
- 4 Remove the 'O' ring seal (B3) from the housing.
- 5 Inspect all components, renew any which are worn or damaged.

To fit

- 1 Fit the assembly of the bearings and gear (B2) into the pump drive housing (B1).
- 2 Retain the gear and bearings in the housing with the three bolts.
- 3 Fit a new 'O' ring seal (B3) to the housing.
- 4 Insert carefully the assembly of the pump drive and pump drive housing into the gear case. Retain with four bolts and washers.
- 5 Fit the fuel transfer pump, Operation 11-2.



Notes:

- The coolant pump seal can be renewed without removal of the coolant pump from the engine.
- Intermittent leakage of a small amount of coolant from the hole in the coolant pump housing is not an indication of a coolant pump seal failure. This is required to provide lubrication for the seal. Renew the coolant pump seal only if a large amount of leakage or a constant flow of coolant is observed draining from the coolant pump housing.
- Service exchange coolant pumps can be obtained from your Perkins dealer.

To dismantle

1 Remove the bolt (A15) and washer (A14). Use a suitable puller to remove the impeller (A11) from the shaft (A16). Ensure that the impeller does not become damaged during this operation.

2 Remove the spring and seal (A13) from the shaft.

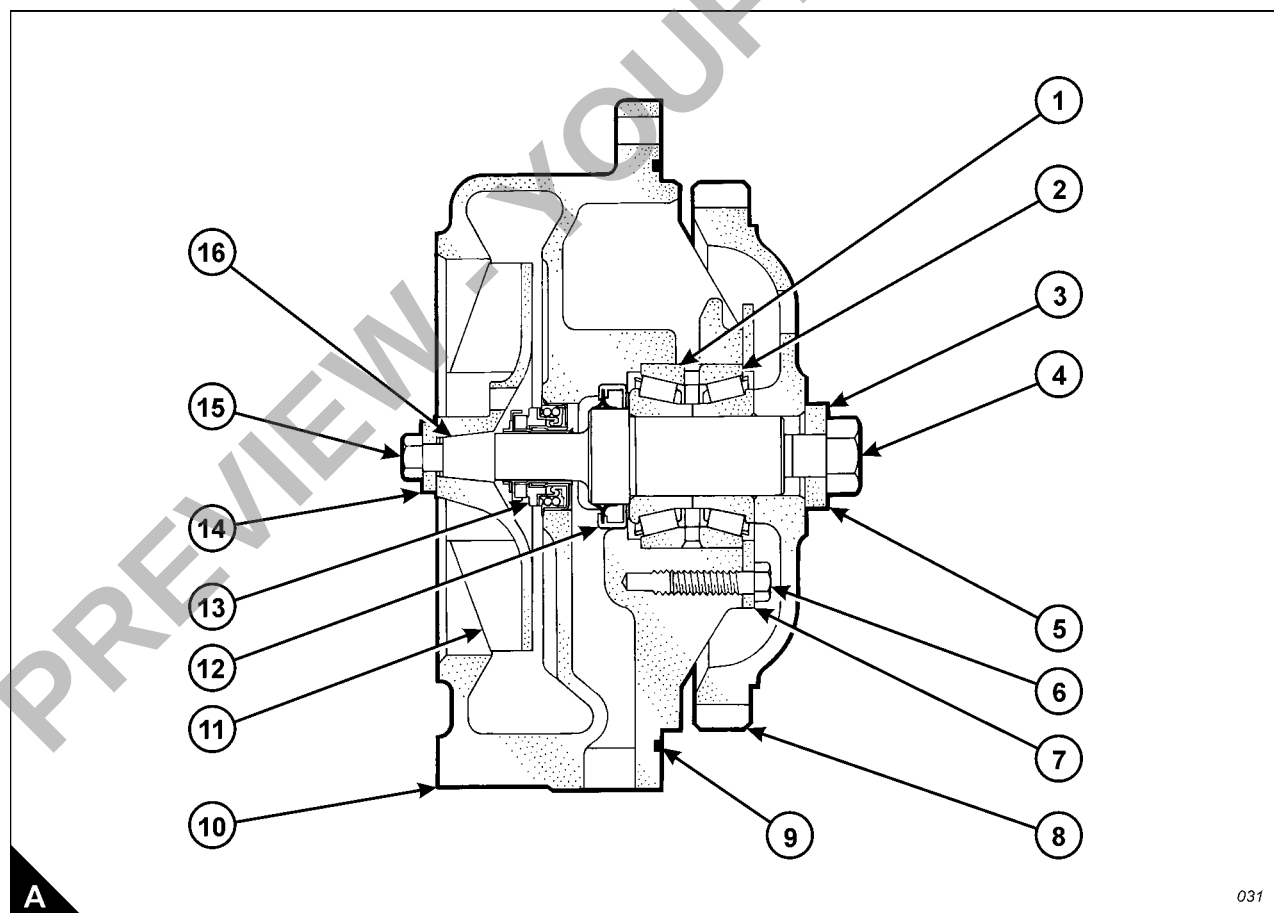
Note: The coolant pumps of certain engines may not have a spring fitted at this position.

3 Remove the four bolts (A6) from the retainer (A7) and remove the 'O' ring seal (A9) from the housing (A10).

4 Remove the gear and shaft assembly (A8). Remove the bolt (A4) and retainers (A3 and A7) from the shaft assembly.

5 Use a press to remove the shaft (A16) from the gear. Remove the bearing (A1), the spacer if fitted, and second bearing (A12) from the shaft.

6 Remove the lip-type seal (A12) from the housing.



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