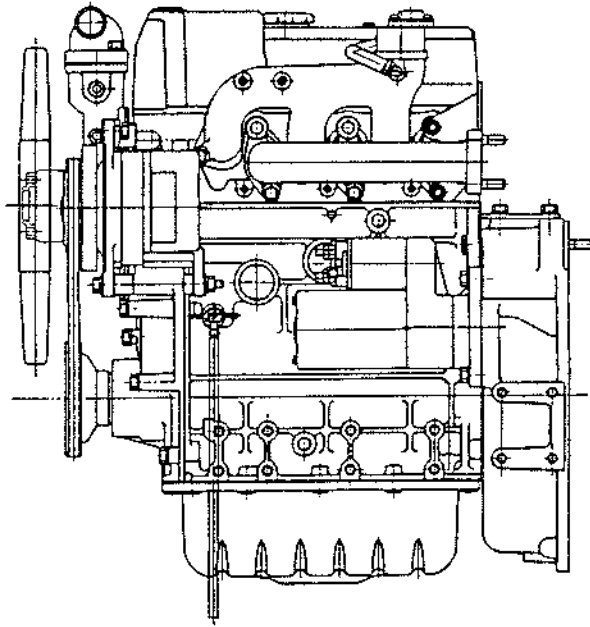


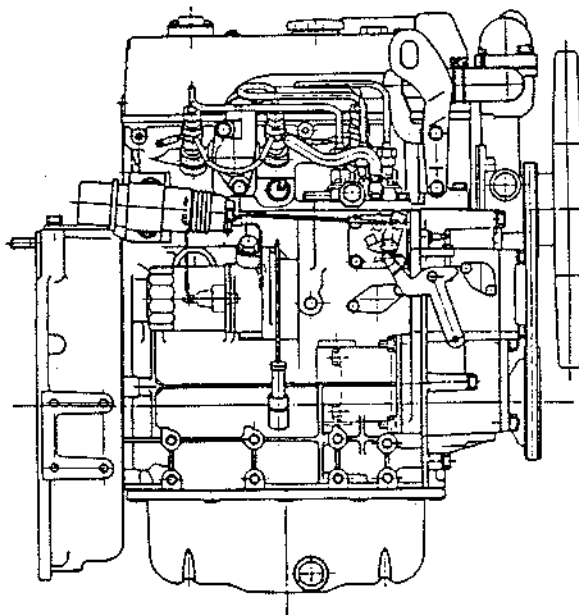
APPEARANCE

1. 3KC1 model

Left side view



Right side view



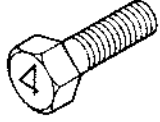
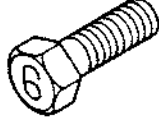
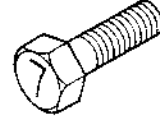
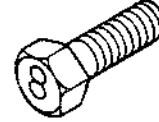
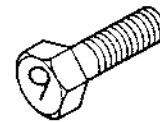
ENGINE/General information

TORQUE SPECIFICATIONS

STANDARD BOLTS

The tightening torque values listed below are applied to the bolts unless otherwise specified.

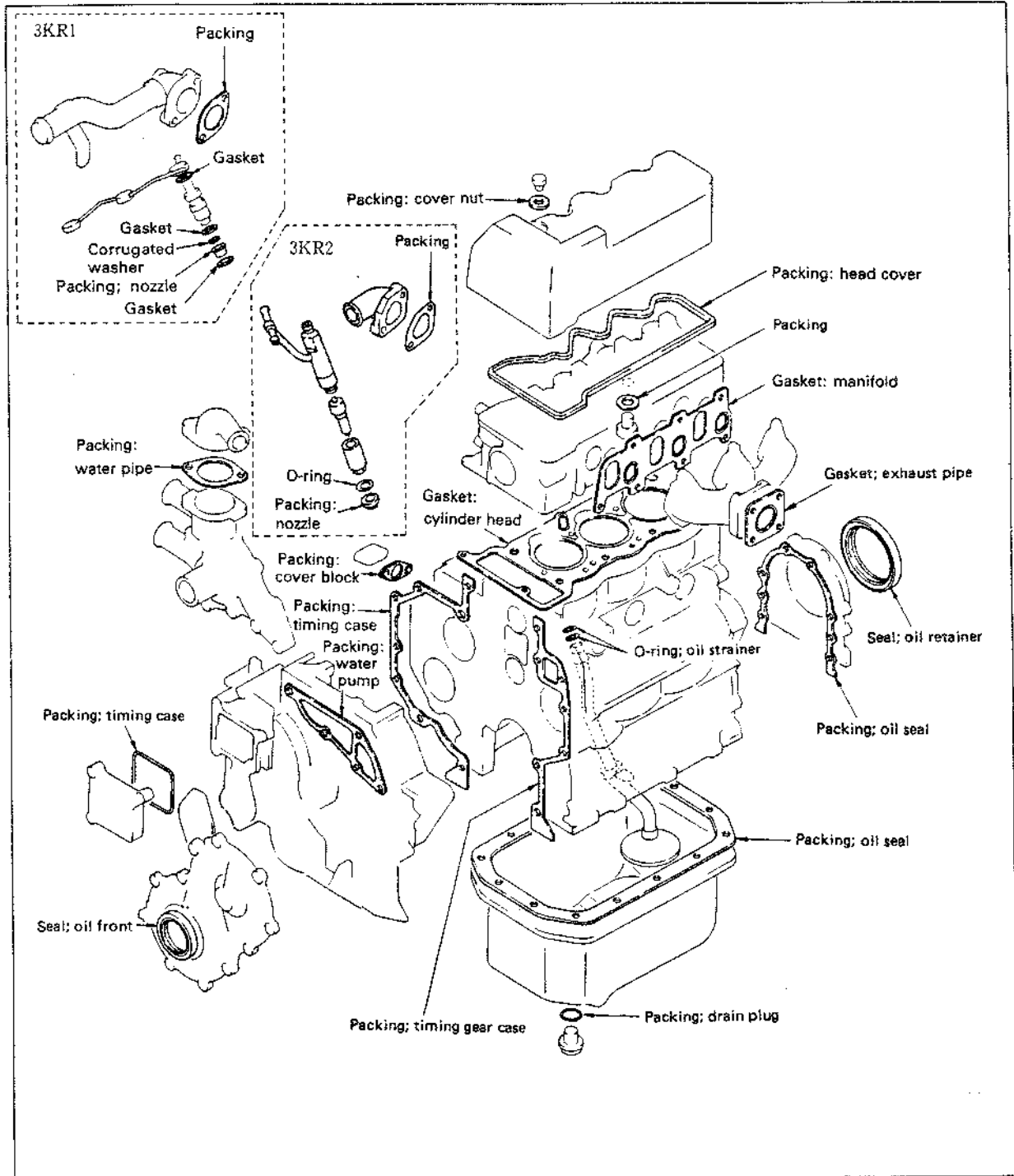
kg·m

| <div style="display: inline-block; vertical-align: middle;">Bolt head marking</div> <div style="display: inline-block; vertical-align: middle; margin-left: 10px;">      </div> <div style="display: inline-block; vertical-align: middle; margin-left: 10px;">Nominal size (Dia.×pitch)</div> | | | | | |
|---|---------------------------------------|---------------------------------------|--|--|--------------------------------------|
| M6×1 | 0.6 ± 0.2 | 0.7 ^{+0.2} _{-0.3} | 0.8 ^{+0.2} _{-0.3} | 0.9 ^{+0.2} _{-0.3} | — |
| M8×1.25 | 1.3 ± 0.5 | 1.6 ^{+0.4} _{-0.6} | 1.8 ^{+0.5} _{-0.6} | 2.1 ^{+0.5} _{-0.7} | 2.4 ± 0.7 |
| M10×1.25 | 2.8 ± 0.7 | 3.3 ^{+0.8} _{-0.9} | 3.8 ^{+0.9} _{-1.0} | 4.3 ± 0.9 | 5.1 ± 1.3 |
| *M10×1.5 | 2.7 ± 0.7 | 3.2 ± 0.8 | 3.7 ± 0.9 | 4.2 ± 1.0 | 4.9 ± 1.2 |
| M12×1.25 | 6.2 ^{+1.3} _{-1.2} | 6.7 ^{+1.4} _{-1.3} | 7.7 ^{+1.6} _{-1.5} | 8.8 ^{+1.8} _{-1.7} | 9.7 ^{+1.9} _{-2.0} |
| *M12×1.75 | 5.8 ± 1.2 | 6.3 ± 1.2 | 7.2 ± 1.4 | 8.2 ± 1.6 | 9.1 ± 1.8 |
| M14×1.5 | 9.7 ⁺² _{-1.9} | 10.4 ⁺² _{-2.1} | 11.9 ^{+2.3} _{-2.4} | 13.6 ^{+2.6} _{-2.8} | 14.5 ± 2.9 |
| *M14×2 | 9.1 ± 1.8 | 9.8 ± 1.9 | 11.2 ± 2.2 | 12.8 ± 2.5 | 13.6 ± 2.7 |
| M16×1.5 | 13.3 ± 2.7 | 15.1 ± 3.1 | 17.3 ± 3.5 | 19.7 ± 4.0 | 20.4 ± 4.1 |
| *M16×2 | 12.7 ± 2.5 | 14.4 ± 2.9 | 16.5 ± 3.3 | 18.8 ± 3.8 | 19.5 ± 3.9 |
| M18×1.5 | 19.2 ± 3.8 | 21.7 ^{+4.4} _{-4.3} | 24.9 ± 5.0 | 28.4 ± 5.7 | 29.3 ± 5.9 |
| *M18×2.5 | 19.2 ± 3.8 | 21.8 ^{+4.4} _{-4.3} | 25.0 ± 5.0 | 18.5 ± 5.7 | 29.4 ^{+5.9} _{-5.8} |
| M20×1.5 | 26.3 ± 5.3 | 30.0 ^{+6.1} ₋₆ | 34.4 ± 6.9 | 39.2 ^{+7.9} _{-7.8} | 40.4 ± 8.1 |
| *M20×2.5 | 24.3 ± 4.9 | 27.8 ^{+5.5} _{-5.6} | 31.8 ± 6.4 | 36.3 ^{+7.2} _{-7.3} | 37.4 ± 7.5 |
| M22×1.5 | 32.0 ^{+10.2} _{-6.4} | 40.4 ± 8.1 | 46.3 ^{+9.2} _{-9.3} | 52.8 ^{+10.5} _{-10.6} | 54.1 ± 10.8 |
| *M22×2.5 | 27.8 ± 5.6 | 37.6 ± 7.5 | 43.1 ± 8.6 | 49.1 ± 9.8 | 50.3 ± 10.1 |
| M24×2 | 45.8 ± 9.2 | 47.9 ^{+15.4} _{-9.6} | 54.9 ^{+17.6} _{-11.0} | 62.6 ^{+20.1} _{-12.6} | 70.6 ± 14.1 |
| *M24×3 | 43.1 ± 8.6 | 45.1 ± 9.0 | 51.7 ± 10.3 | 58.9 ^{+11.8} _{-11.7} | 66.4 ± 13.3 |

*Data is for female screws of soft material such as cast iron.

ENGINE/General information

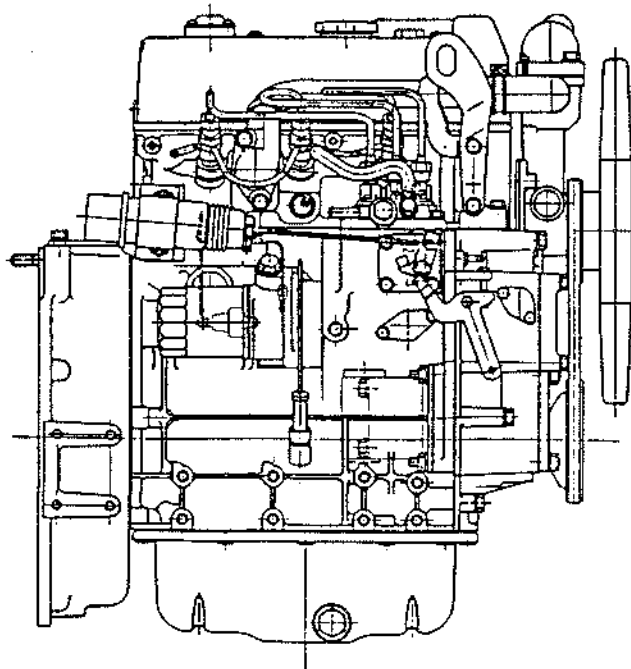
2. 3KR1, 3KR2 models



ENGINE

GENERAL VIEW OF ENGINE

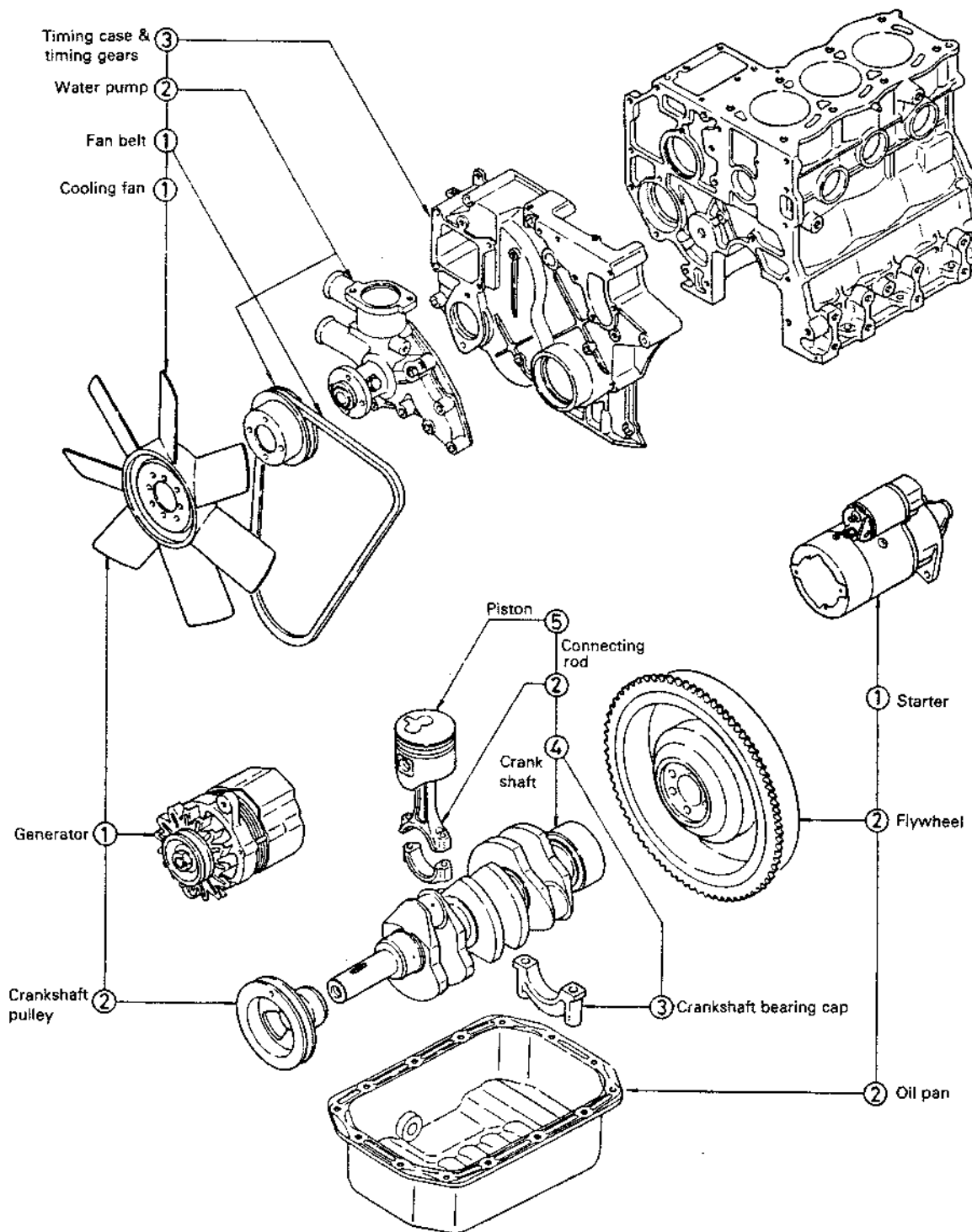
3KC1 model



ENGINE/Engine

DISASSEMBLY STEPS (2)

3KC1 model



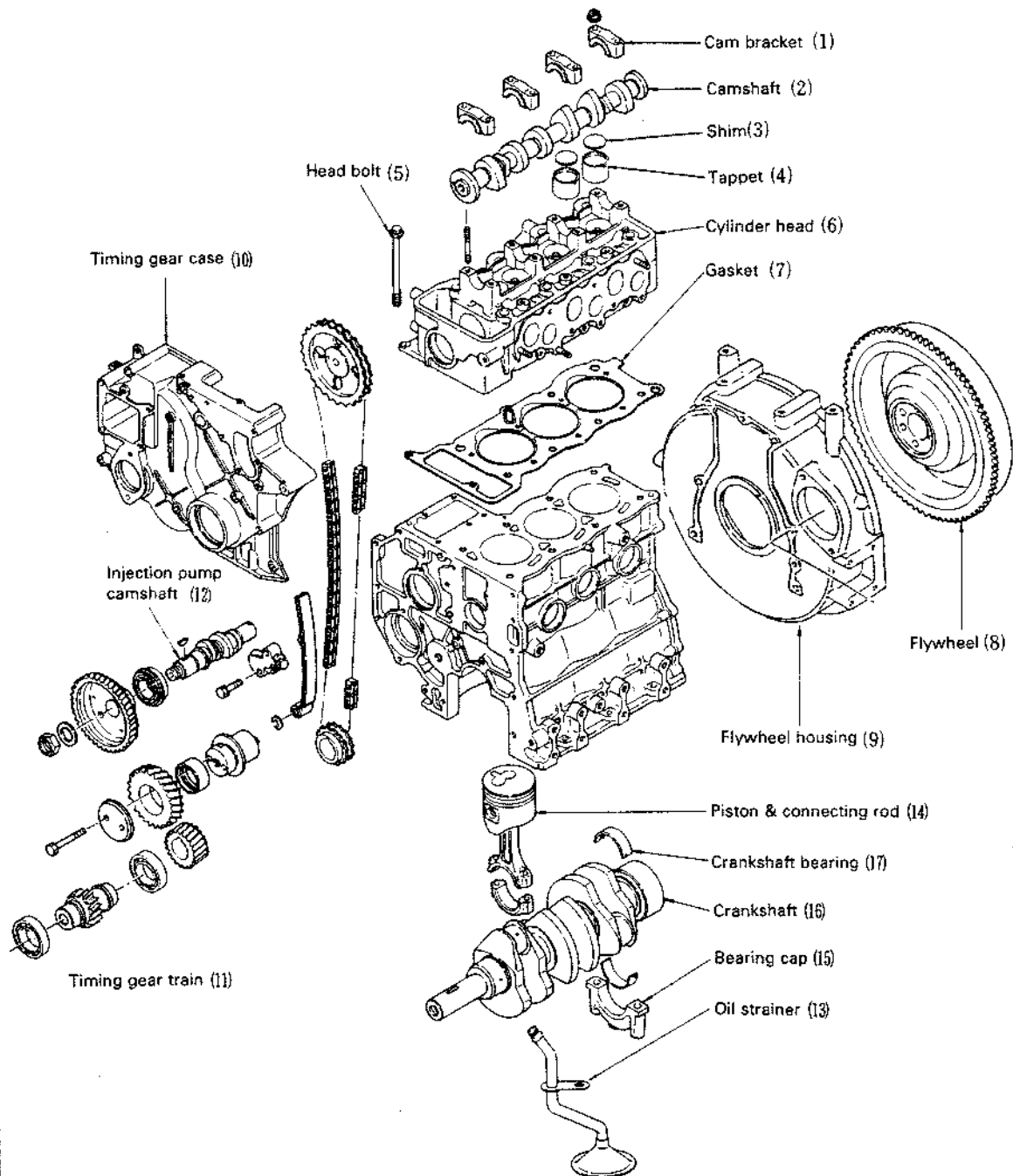
The encircled numbers indicate disassembly steps.

ENGINE/Engine



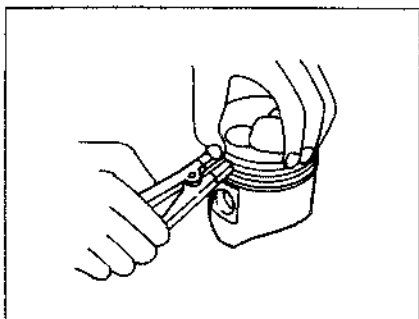
INTERNAL PARTS

3KC1 model



The numbers in () indicate disassembly steps.

ENGINE/Engine

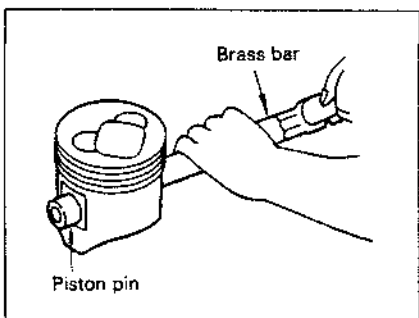


Piston ring

Special tool: Piston ring remover



1 - 85221 - 029 - 0



Piston pin

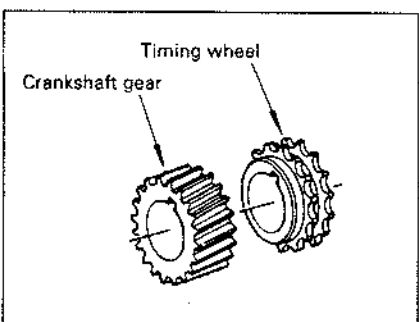
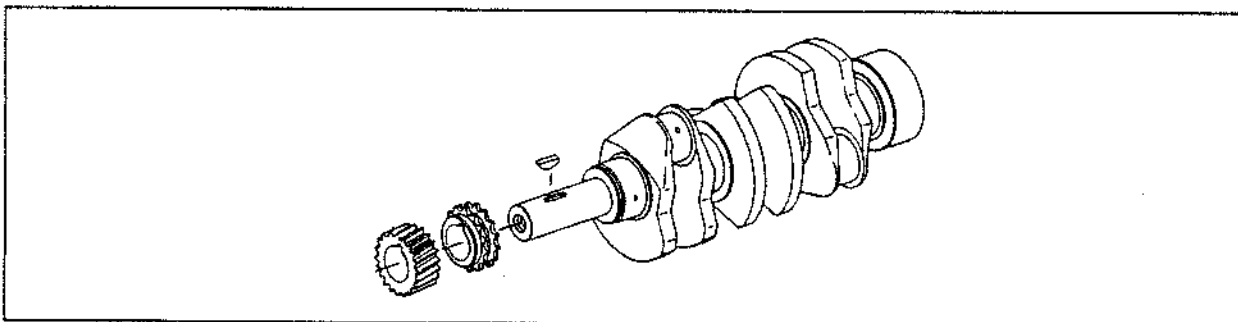
Remove a piston pin by hitting lightly a brass bar on the pin with a hammer.

Note:

Sort pistons, piston pins and connecting rods by cylinder.

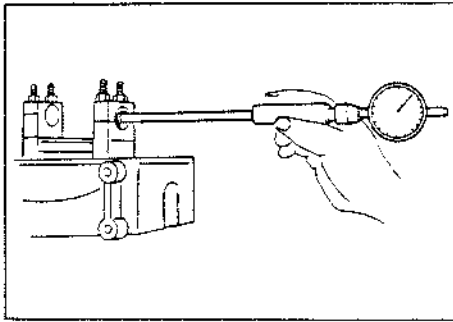


CRANKSHAFT



Remove the crankshaft gear and timing wheel.

ENGINE/Engine



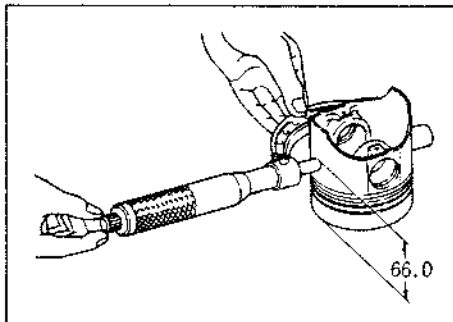
Clearance between cam journal and cam bracket

(mm)

| Standard | Limit | Repair method |
|--------------|--------------|-----------------------------------|
| 0.04 — 0.082 | 0.12 or more | Replace camshaft or cylinder head |



PISTON, PISTON PIN AND PISTON RING



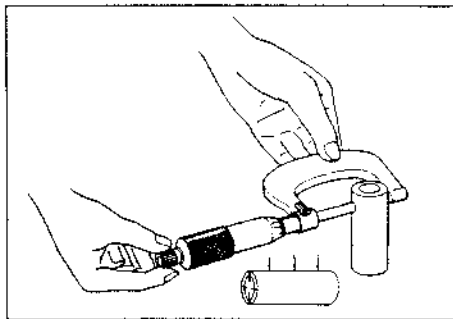
Clearance between piston and cylinder bore

- (1) Measure piston at 66.0 mm from top in right angle direction to the piston pin (in the unit of 1/1,000 mm).

(mm)

| | |
|----------------------------------|---------------|
| Clearance against large diameter | 0.032 — 0.050 |
|----------------------------------|---------------|

- (2) There are two kinds of oversize (0.25, 0.50) allowable for piston.



Wear of piston pin (outside diameter)

(mm)

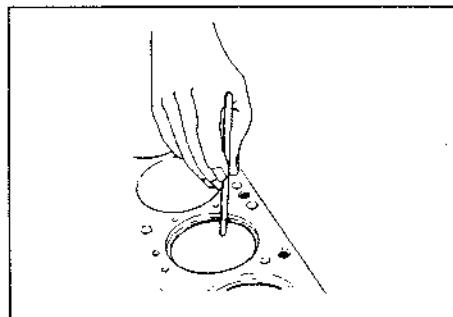
| | Nominal | Limit | Repair method |
|------|-----------|--------------|-------------------------|
| 3KC1 | 21 ϕ | — | Replace if disassembled |
| 3KR1 | 25 ϕ | 24.97 ϕ | Replace |
| 3KR2 | | | |



Clearance between piston pin and piston

(mm)

| | |
|------------|-------------|
| 3KC1 | 0.016~0.020 |
| 3KR1, 3KR2 | 0.002~0.012 |



Piston ring gap

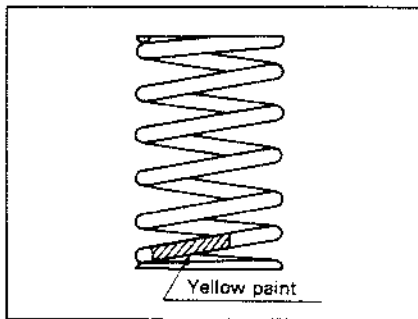
- Insert the ring into a cylinder bore and push it with piston head so that it is right angle to the cylinder.

(mm)

| | Standard | Limit | Repair method |
|-------------------------------|-----------|-------|---------------|
| 1st and 2nd compression rings | 0.2 — 0.4 | 2.0 | Replace |
| Oil ring | 0.2 — 0.4 | 1.0 | |

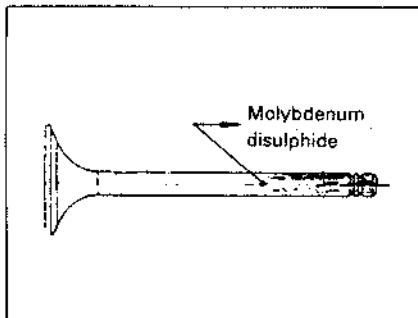


ENGINE/Engine



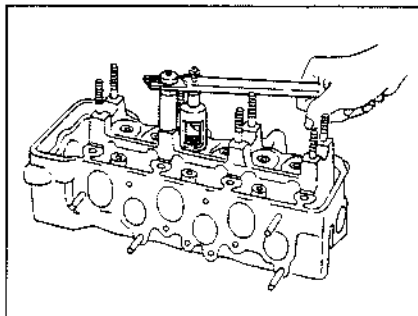
Spring seat, spring

Install the spring with smaller pitch (yellow paint side) faced down.



Valve

- (1) Apply a mixture of oil and molybdenum disulfide to the valve stem.
Engine oil : Molybdenum = 1 : 1
- (2) After installing the valve, prevent the valve from dropping off and form being damaged.

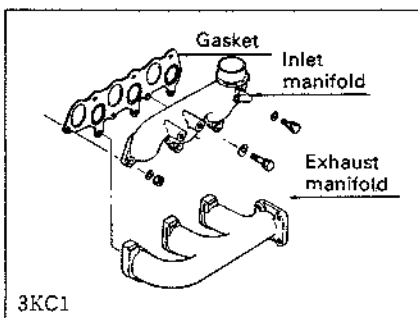


Split collar

Special tool: 5 - 8840 - 9001 - 0



Insert the collar by compressing a spring with the replacer.



Inlet manifold

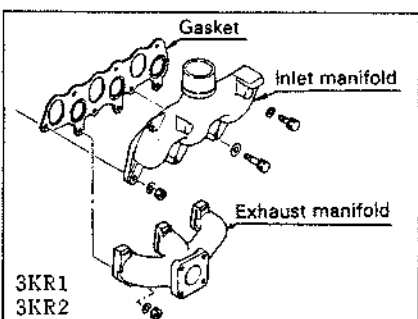
Exhaust manifold

Gasket

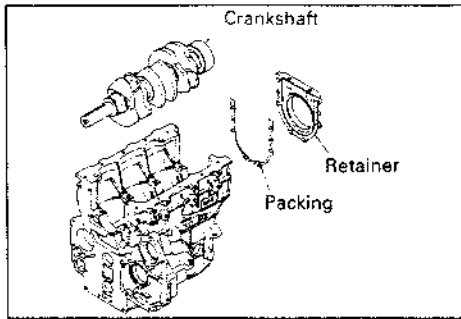


(kg·m)

| Torque | 1.5 - 2.5 |
|--------|-----------|
|--------|-----------|



ENGINE/Engine



Installation of retainer

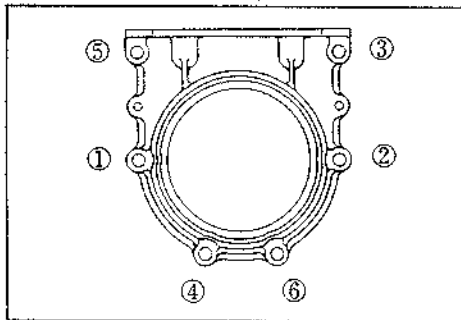
Apply engine oil to the oil seal lip and install it. Take care not to attach dust on the big end of crankshaft.



Install the retainer, and cut off protruded packing.



Special tool: 5 - 8840 - 9004 - 0
5 - 8840 - 0007 - 0

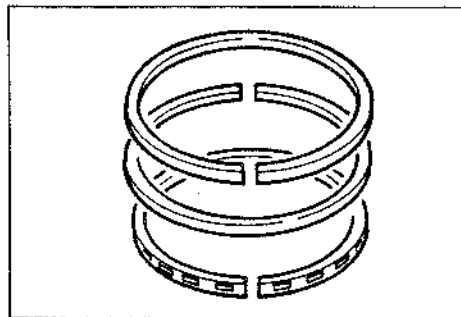


Tighten bolts on the retainer to the following torque in the order shown to the left.



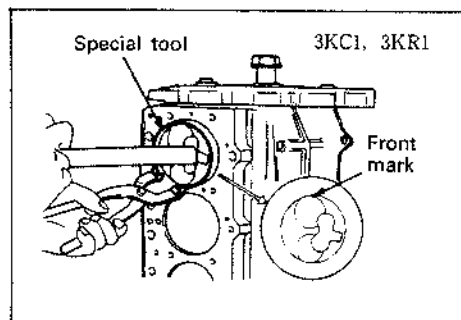
(kg·m)

| Torque | 1.5 - 2.5 |
|--------|-----------|
|--------|-----------|



Piston and connecting rod

Set piston rings as shown to the left before inserting them in the cylinder.

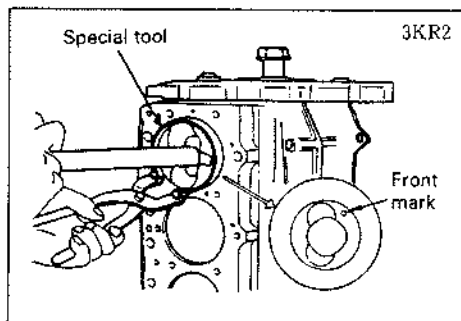


Special tool: Setting tool

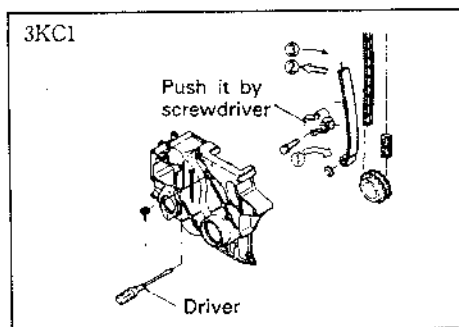
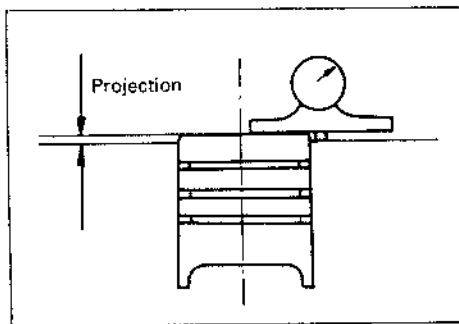
Push in the piston rings with its front mark faced front side (apply engine oil to cylinder and piston).



Special tool: 5 - 8840 - 9018 - 0



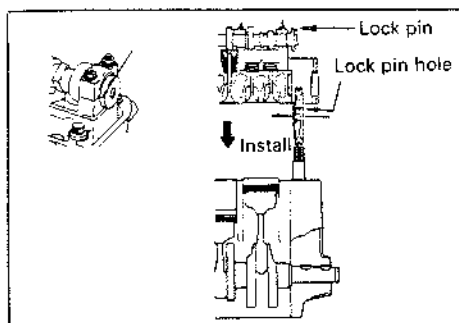
ENGINE/Engine



Reset of the tensioner ratchet (3KC1)

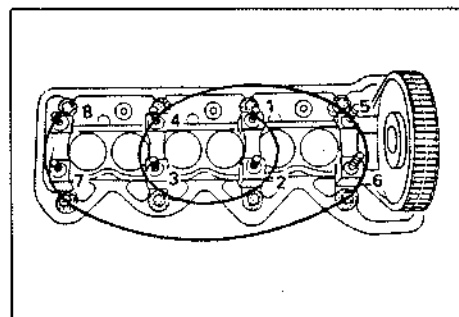
Before commencing with the installation of the cam wheel, reset the tensioner ratchet. (Release a tightening tension of the chain)

- (1) Put the screwdriver through the plug mounting hole of the timing case and push the lever of the tensioner in the arrow direction 「⇒」.
- (2) Push the lever of the tensioner in the arrow direction 「⇐」.
- (3) Take off the screwdriver, and move the lever of the tensioner in the arrow direction 「→」 gradually, then the tensioner ratchet will be locked automatically.



Cylinder head

- (1) Avoid interference between cylinder head and extruded parts such as cam wheel and injection pump. Do not damage gasket.
- (2) Tighten temporarily the bolts with a lock pin on the camshaft aligned with lock pin hole.



A Semi-tighten bolts (3 — 5 kg·m) in the order shown to left, then tighten again to the specified torque.



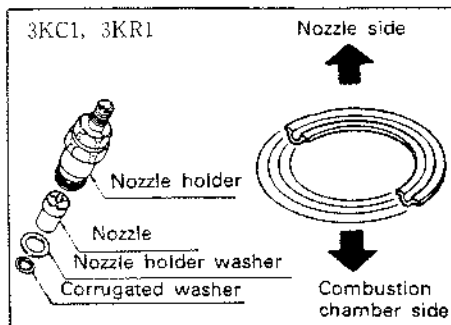
(kg·m)

| | | New | Reuse |
|--------|------|-----------|-----------|
| Torque | 3KC1 | 9.5~10.5 | 11.0~12.0 |
| | 3KR1 | 11.5~13.5 | 13.0~15.0 |
| | 3KR2 | | |



Apply engine oil to the threads.

ENGINE/Engine



Corrugated washer
Nozzle holder washer
Nozzle holder

3KC1, 3KR1

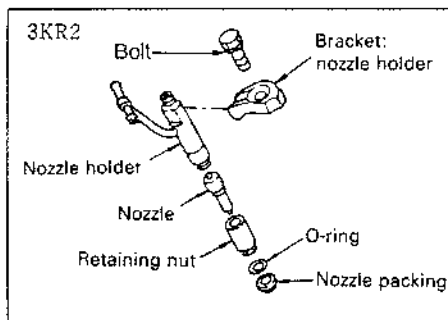


(kg·m)

| | |
|--------|---------|
| Torque | 4.5–5.5 |
|--------|---------|

Note 1: Do not allow dust and foreign matter to attach to the nozzle tip or do not damage it.

Note 2: Take care of the installation direction of corrugated washer.



Nozzle holder 3KR2

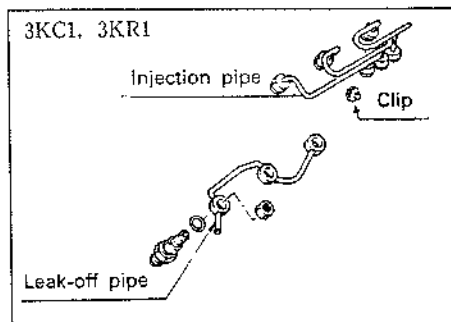
(kg·m)



| | |
|-------------------------------|-----------|
| Clamp bolt; bracket Torque | 3.3 – 4.3 |
|-------------------------------|-----------|

Note:

Do not allow dust and foreign matter to attached to the nozzle tip or do not damage it.



Injection pipe

Leak-off pipe



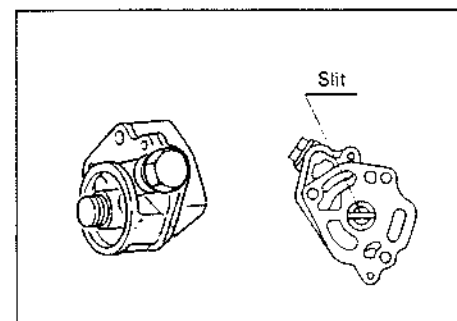
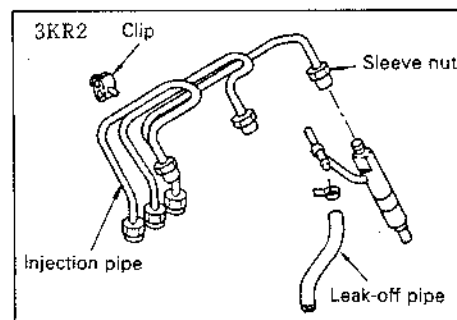
Clip

(kg·m)

| | |
|----------------------|-----------|
| Sleeve nut Torque | 3.0 – 3.5 |
|----------------------|-----------|

Note 1: Avoid interference between injection pipes.

Note 2: Do not settle the clip at the radius portion of pipe.



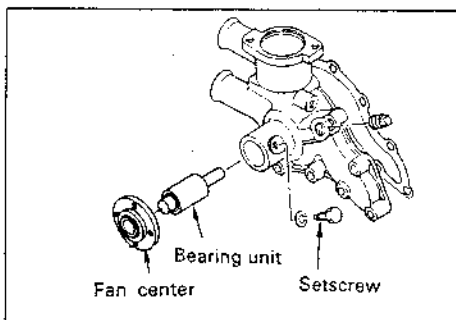
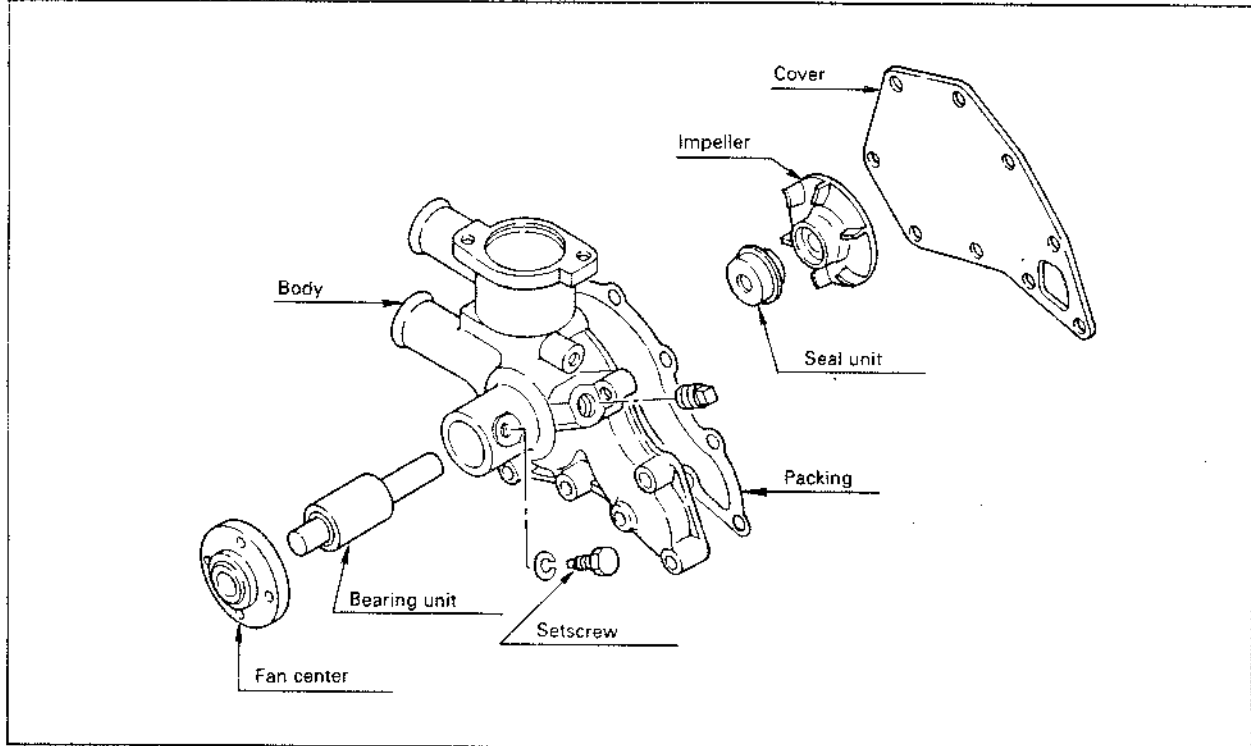
Oil pump

Install the oil pump with its slit aligned with a slit on the rear end of camshaft of injection pump.

WATER PUMP



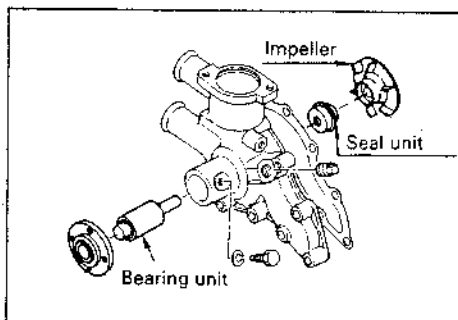
DISASSEMBLY



Fan center



Loosen a setscrew.



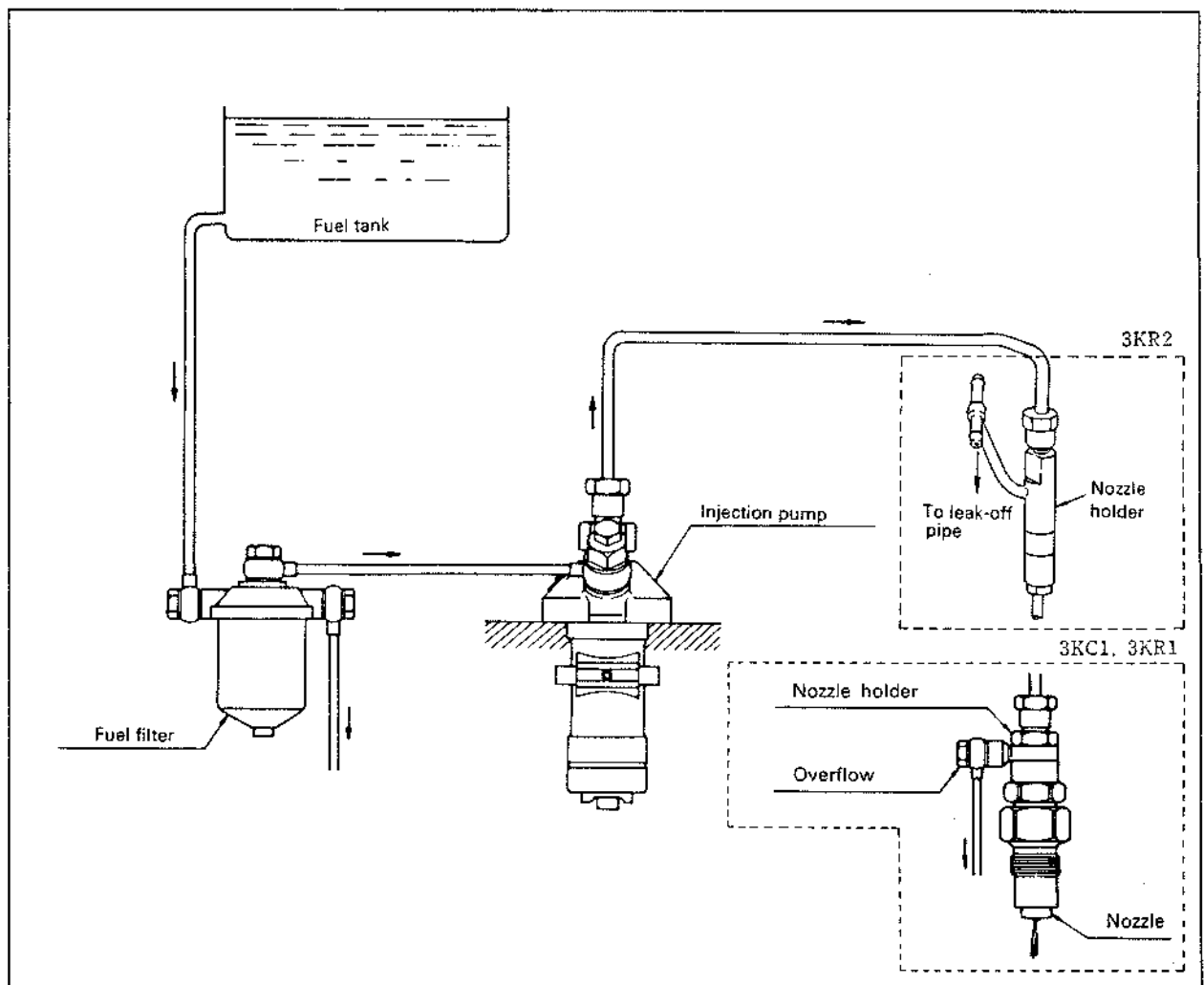
Impeller

Seal unit

Bearing unit

FUEL SYSTEM

FUEL FLOW DIAGRAM



ENGINE/Troubleshooting

