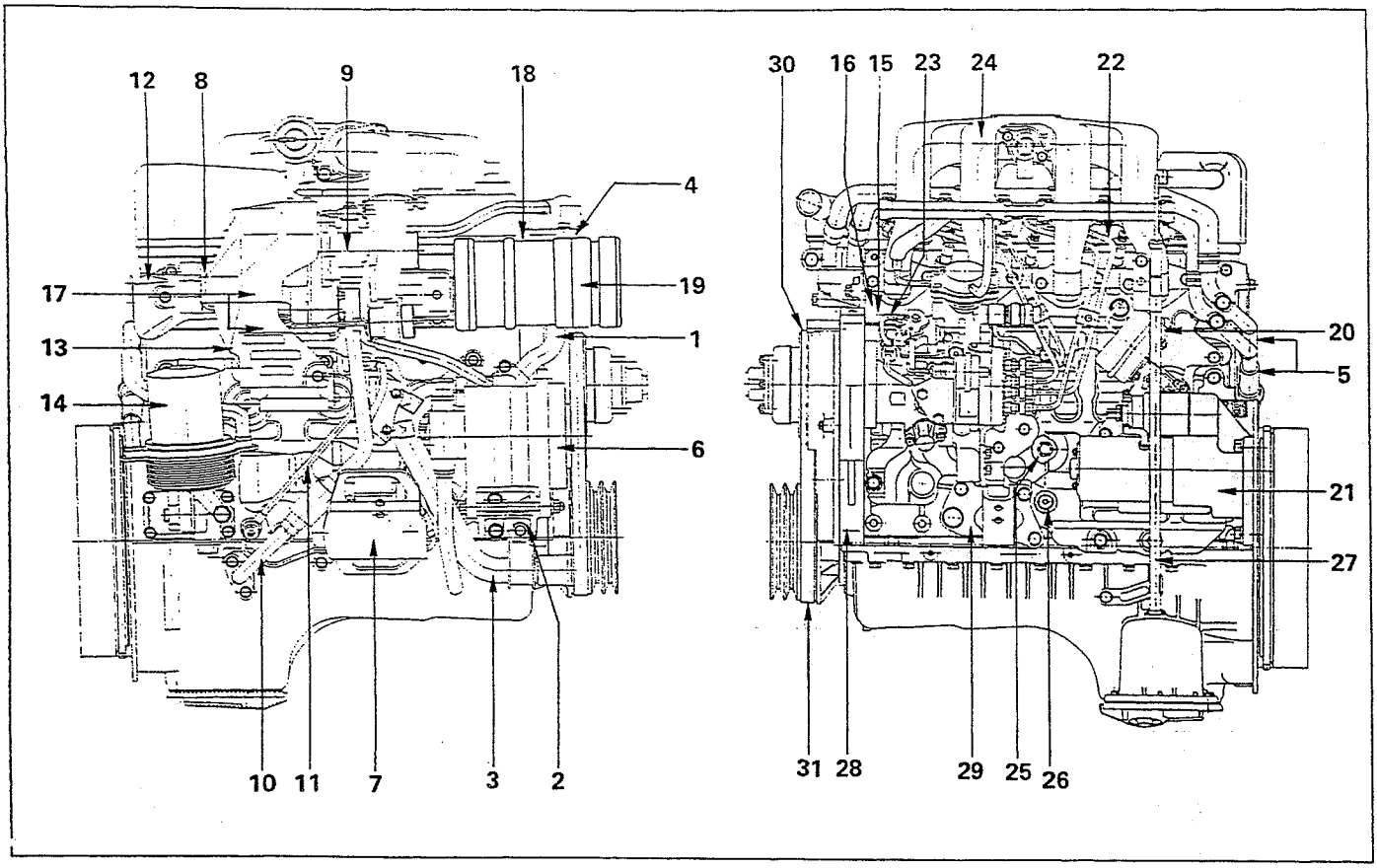
050507A

## EXTERNAL PARTS

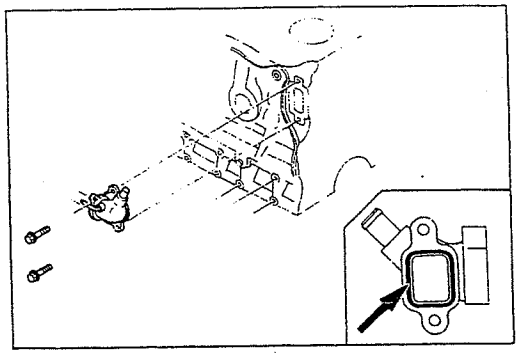
These reassembly steps are based on the 4JB1T engine.




### Reassembly Steps

- ▲ 1. Water inlet suction pipe
- ▲ 2. Alternator bracket
- ▲ 3. Water inlet pipe
- 4. Water by-pass hose
- 5. Heater pipe (Rear side)
- ▲ 6. Alternator and adjusting plate
- ▲ 7. Engine mounting bracket with mounting rubber
- ▲ 8. Exhaust manifold
- ▲ 9. Turbocharger
- ▲ 10. Turbocharger oil return pipe
- ▲ 11. Turbocharger oil feed pipe
- 12. Exhaust manifold heat protector
- ▲ 13. Exhaust adaptor
- ▲ 14. Oil filter with oil cooler
- ▲ 15. Power steering oil pump bracket
- ▲ 16. Power steering oil pump
- 17. Turbocharger heat protector upper and lower
- ▲ 18. Compressor bracket
- ▲ 19. Compressor
- ▲ 20. Exhaust actuator
- ▲ 21. Starter motor
- ▲ 22. Fuel injection pipe with clip
- 23. Fuel leak hose (leak off pipe to injection pump)
- ▲ 24. Upper intake manifold
- 25. Water drain cock
- 26. Oil pressure warning switch and, the nipple
- ▲ 27. Oil level gauge guide tube
- ▲ 28. Stiffener (Housing — cylinder body)
- ▲ 29. Engine mounting bracket with mounting rubber
- ▲ 30. Cooling fan drive belt
- ▲ 31. Cooling fan pulley

## Important Operations



### ▲ Water Inlet Suction Pipe

1) Apply the recommended liquid gasket or its equivalent to the suction pipe at the position shown in the illustration.

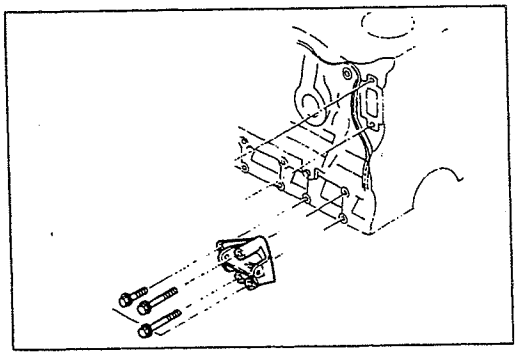
   Do not apply an excessive amount of liquid gasket.

2) Tighten the suction pipe bolts to the specified torque.

| Suction Pipe Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 1.9 ± 0.5 (13.7 ± 3.6/18.62 ± 4.90) | |

### ▲ Heater Pipe (Rear Side)

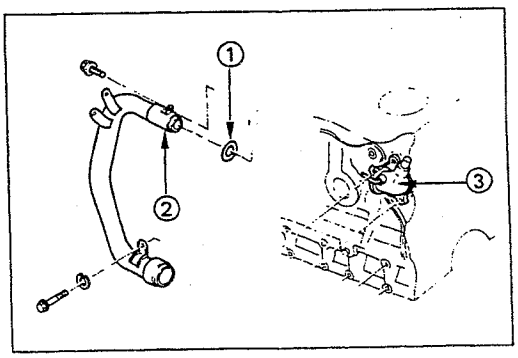
1) Install the heater pipe to the cylinder head.
2) Connect the oil cooler return hose and feed hose to the oil cooler.
3) Connect the water rubber hose to the heater pipe.



### ▲ Alternator Bracket

Install the alternator bracket to the cylinder body and tighten the bracket bolts to the specified torque.

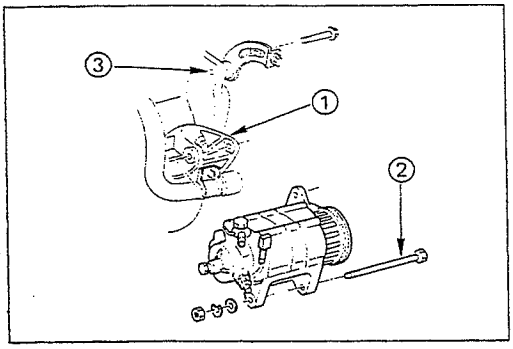
| Bracket Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 4.1 ± 0.6 (29.7 ± 4.3/40.18 ± 5.88) | |




### ▲ Water Inlet Pipe

1) Install the O-ring ① to the inlet pipe O-ring groove ②.
2) Connect the inlet pipe to the suction pipe ③ and tighten the inlet pipe bolts to the specified torque.

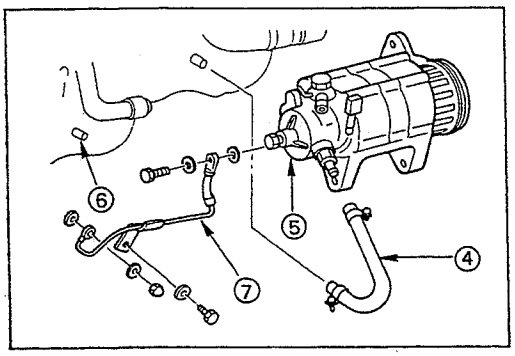
| Inlet Pipe Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 1.9 ± 0.5 (13.7 ± 3.6/18.62 ± 4.90) | |



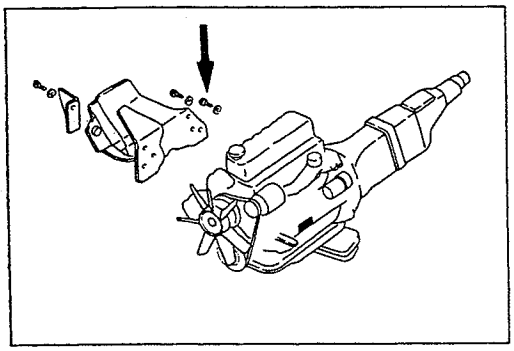

### ▲ Alternator and Adjusting Plate

1) Install the alternator to the bracket ①.
2) Temporarily tighten the alternator bolt ② and adjusting plate bolts ③.

   The bolts will be finally tightened after installation of the cooling fan drive belt.




3) Connect the vacuum pump rubber hose ④ to the vacuum pump ⑤, and the oil pan ⑥.
4) Connect the vacuum oil pipe ⑦ to the vacuum pump, and the cylinder body.

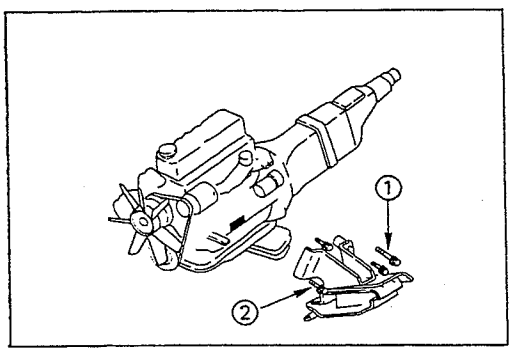


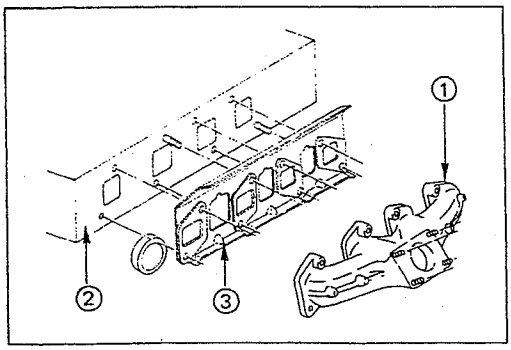
### ▲ Engine Mounting Bracket with Mounting Rubber

Install the engine mounting bracket to the cylinder body and tighten the bracket bolts to the specified torque.

Mounting Bracket Bolt Torque — kg·m(lb.ft/N·m)

| | | |
|---|---|---|
| Right Side | M10×1.25 (9T) | $5.6^{+0.8}_{-0.9}$ ($40.5^{+5.8}_{-6.5}$/$54.88^{+7.84}_{-8.82}$) |
| Left Side | ① M10×1.25 (7T) | 4.1 ± 0.6 (29.7 ± 4.3/40.18 ± 5.88) |
| | ② M14×1.50 (7T) | $11.9^{+2.3}_{-2.4}$ ($86.1^{+16.6}_{-17.4}$/$116.62^{+22.54}_{-23.52}$) |



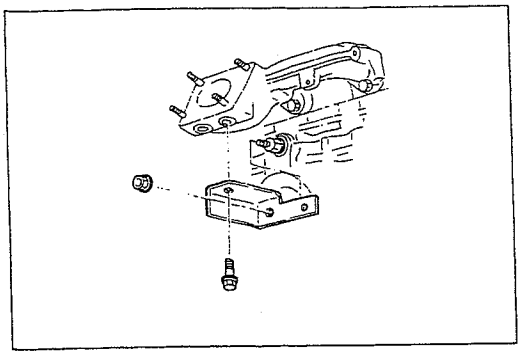




### ▲ Exhaust Manifold

1) Install the exhaust manifold ① to the cylinder head ② with the manifold gasket ③.
2) Tighten the exhaust manifold bolts to the specified torque a little at a time in the order shown in the illustration.

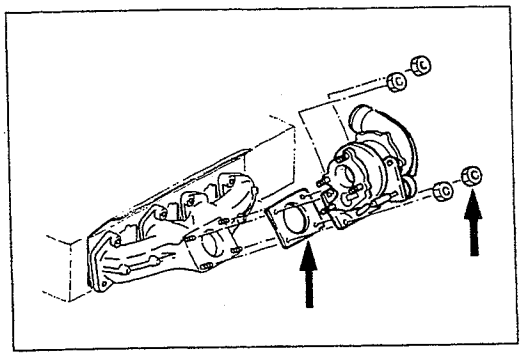
Exhaust Manifold Bolt Torque — kg·m(lb.ft/N·m)

| |
|---|
| 1.9 ± 0.5 (13.7 ± 3.6/18.62 ± 4.90) |



3) Install the exhaust manifold bracket to the manifold and the cylinder body.

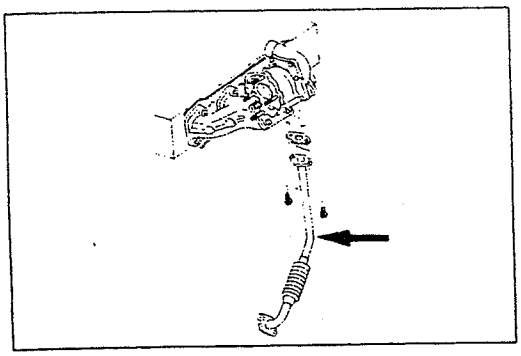
| Manifold Bracket Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 1.9 ± 0.5 (13.7 ± 3.6/18.62 ± 4.90) | |



**▲ Turbocharger**

1) Install the turbocharger and the gasket.
2) Temporarily tighten the turbocharger nuts at this time. They will be fully tightened after the installation of the turbocharger oil pipe.

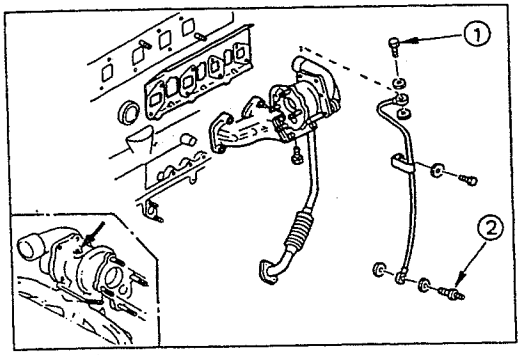
   Always install new nuts and washers.



**▲ Turbocharger Oil Return Pipe**

1) Install the oil return pipe with gasket to the turbocharger.
2) Tighten the turbocharger oil return pipe to the specified torque.

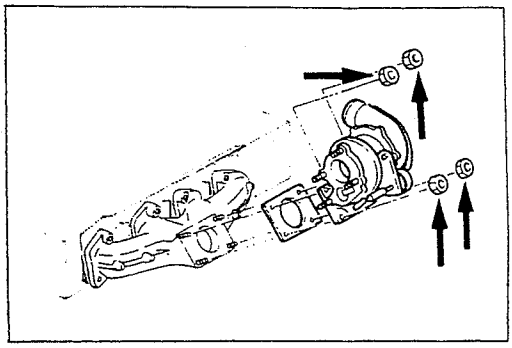
| Turbocharger Oil Return Pipe Torque | kg·m(lb.ft/N·m) |
|---|---|
| 0.8 ± 0.2 (5.8 ± 1.4/7.84 ± 1.96) | |




**▲ Turbocharger Oil Feed Pipe**

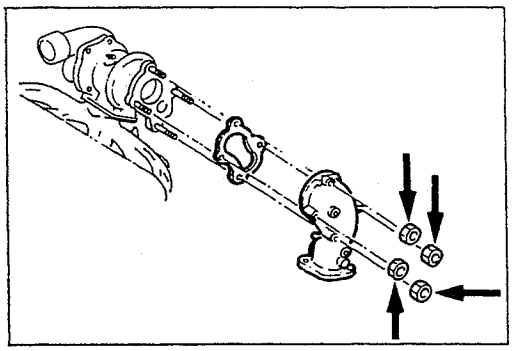
1) Before installing the oil feed pipe, supply 100 — 130 $cm^3$ (6.1 — 7.9 $in^3$) of clean engine oil to the turbocharger center housing through the oil feed opening.
2) Turn the rotating assembly with your hand to throughly lubricate the internal parts.
3) Tighten the oil feed pipe to the specified torque.

| Turbocharger Oil Feed Pipe Joint Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| ① M10 × 1.5 | 2.25 ± 0.25 (16.3 ± 1.8/22.05 ± 2.45) |
| ② M14 × 1.5 | 3.0 ± 0.25 (21.7 ± 1.8/29.40 ± 2.45) |



4) Tighten the turbocharger nuts to the specified torque.

| Turbocharger Nut Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.7 ± 0.5 (19.5 ± 3.6/26.46 ± 4.90) | |



**▲ Exhaust Adapter**

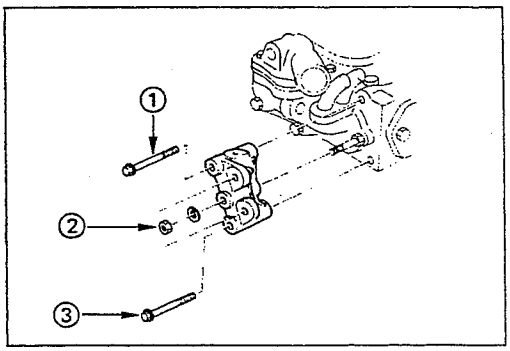
Install the exhaust adapter with gasket and tighten the adapter bolts to the specified torque.

| Adapter Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.7 ± 0.5 (19.5 ± 3.6/26.46 ± 4.90) | |

**▲ Oil Filter and Oil Cooler**

1) Install the O-ring to the oil filter flange groove.
2) Tighten the oil filter and oil cooler to the specified torque.

| Oil Filter Flange Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 1.9 ± 0.5 (13.7 ± 3.6/18.62 ± 4.90) | |

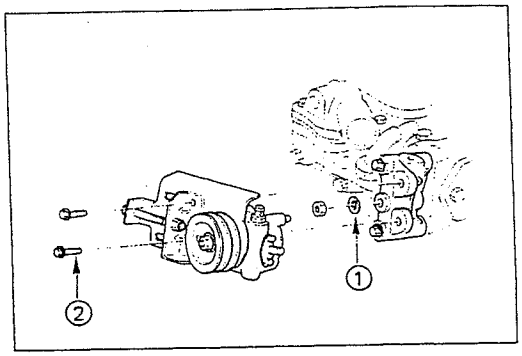



**▲ Power Steering Oil Pump Bracket**

**▲ Power Steering Oil Pump**

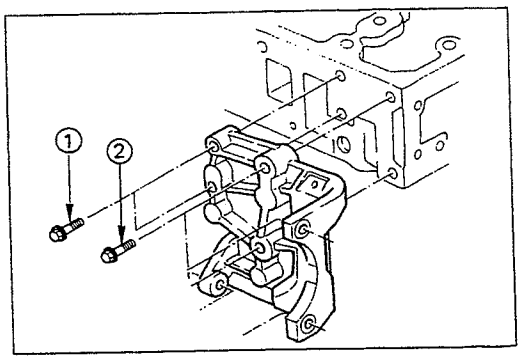
1) Install the oil pump bracket to the cylinder head.
2) Tighten the pump bracket nut and bolts to the specified torque.

| Oil Pump Bracket Nut and Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| ① M10 × 1.25 (7T) | 3.75 ± 0.95 (27.1 ± 6.9/36.75 ± 9.31) |
| ② M 8 × 1.25 (7T) | 1.75 ± 0.55 (12.7 ± 4.0/17.75 ± 5.39) |
| ③ M 8 × 1.25 (4T) | 1.30 ± 0.50 (9.4 ± 3.6/12.74 ± 4.90) |




3) Install the oil pump to the bracket.
4) Temporarily tighten the oil pump nut ① and bolts ②.

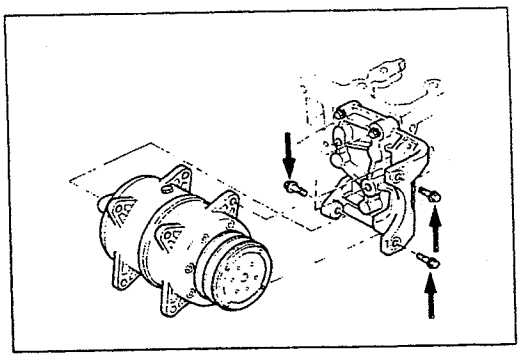
The nut and bolts will be finally tightened after installation of the drive belt.




**▲ Compressor Bracket**

1) Install the compressor bracket to the cylinder head.
2) Tighten the bracket bolts to the specified torque.

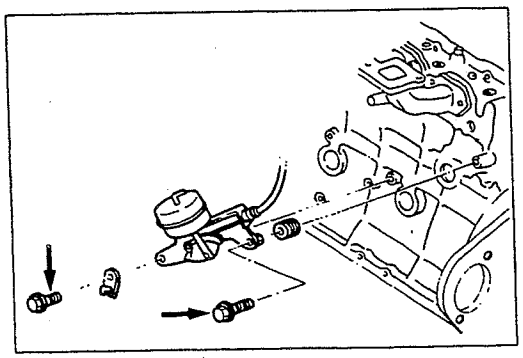
| Bracket Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| ① M 8 × 1.25 | 1.9 ± 0.5 (13.7 ± 3.6/18.62 ± 4.90) |
| ② M10 × 1.25 | 3.8 ± 1.0 (27.5 ± 7.2/37.24 ± 9.80) |



**▲ Compressor**

1) Install the compressor to the compressor bracket.
2) Tighten the compressor bolts to the specified torque.

| Compressor Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 3.8 ± 1.0 (27.5 ± 7.2/37.24 ± 9.80) | |

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**▲ Exhaust Actuator**

1) Install the exhaust actuator to the cylinder body.
2) Tighten the actuator bolts to the specified torque.

| Actuator Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.7 ± 0.5 (19.5 ± 3.6/26.46 ± 4.90) | |

3) Connect the control wire to the actuator.

**▲ Starter Motor**

Tighten the starter motor bolts to the specified torque.

| Starter Motor Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 7 ± 1 (50.6 ± 7.2/68.60 ± 9.80) | |

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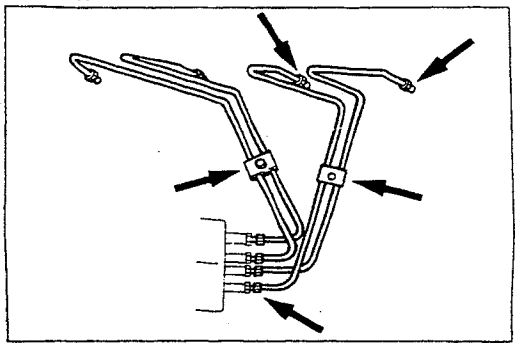


### ▲ Fuel Injection pipe with Clip

1) Temporarily tighten the injection pipe sleeve nut.
2) Set the clip in the prescribed position.

   Illustration ① : For Belt Drive
   Illustration ② : For Gear Drive

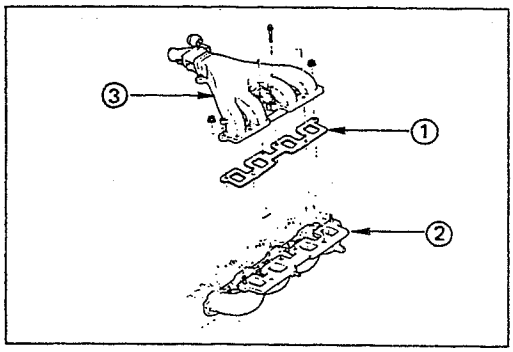
**Note:**

**Make absolutely sure that the clip is correctly positioned.**

**An improperly positioned clip will result in injection pipe breakage and fuel pulsing noise.**

3) Tighten the injection pipe sleeve nut to the specified torque.

| Injection Pipe Sleeve Nut Torque | kg·m(lb.ft/N·m) |
|---|---|
| 3 ± 1 (21.7 ± 7.2/29.40 ± 9.80) | |




### ▲ Upper Intake Manifold (4JB1T)

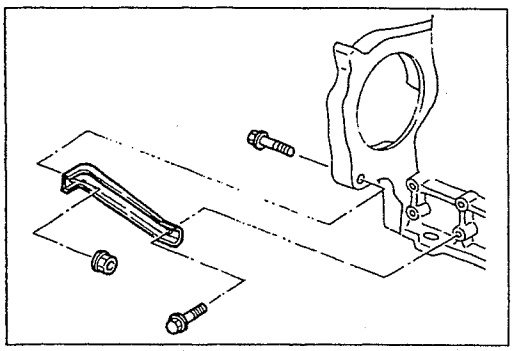
1) Install the manifold gasket ① to the lower intake manifold ②.
2) Connect the intake rubber hose to the turbocharger.
3) Install the upper intake manifold assembly ③ to the lower intake manifold.

   The upper intake manifold assembly consists of the intake pipe "B", the intake throttle assembly, the intake pipe "A", the PCV hose, the intake rubber hose, and the intake duct.
4) Tighten the intake manifold bolts and the flange nuts to the specified torque.

| Intake Manifold Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 1.9 ± 0.5 (17.8 ± 3.6/18.62 ± 4.90) | |

| Intake Manifold Flange Nut Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.4 ± 0.5 (17.8 ± 3.6/23.52 ± 4.90) | |

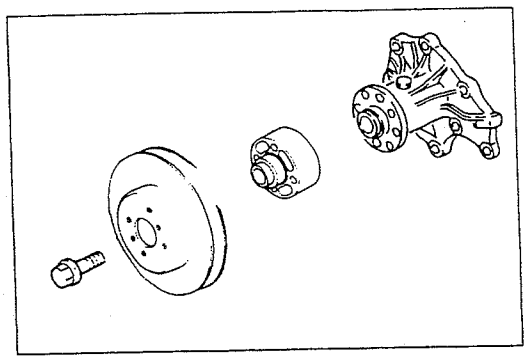
5) Connect the PCV hose to the cylinder head cover.



### ▲ Stiffener

1) Install the stiffener to the cylinder body and timing pulley housing or gear case.
2) Tighten the stiffener bolts to the specified torque.

| Stiffener Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 3.8 ± 1.0 (27.5 ± 7.2/37.24 ± 9.80) | |



▲ **Cooling Fan Pulley**

1) Install the cooling fan pulley to the water pump wiht spacer.
2) Tighten the cooling fan pulley bolts to the specified torque.

| Cooling Fan Pulley Bolt Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.6 ± 0.5 (18.8 ± 3.6/25.48 ± 4.90) | |

0600

# LUBRICATING SYSTEM

060101

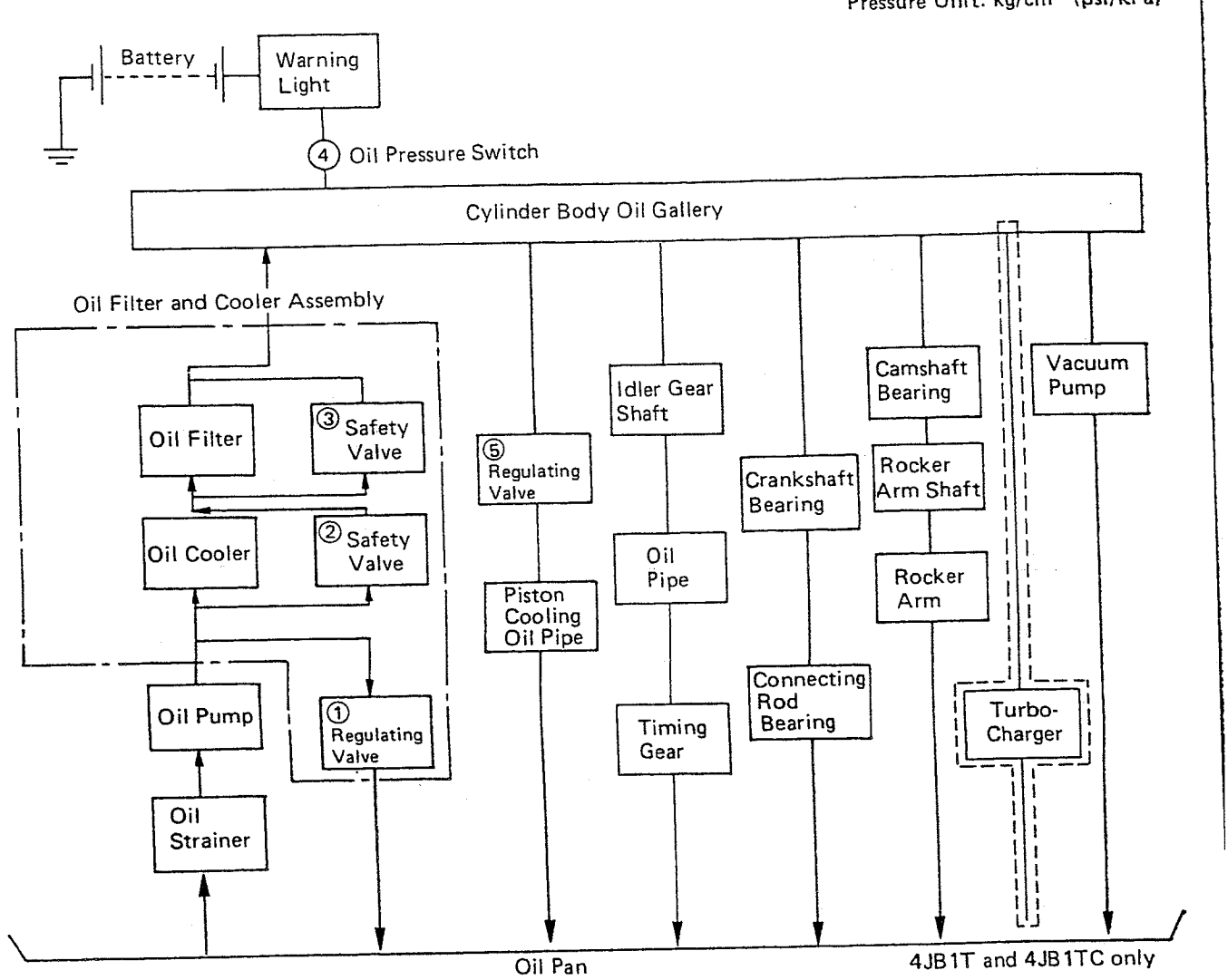
## MAIN DATA AND SPECIFICATIONS

| Engine model | | 4JA1 | 4JB1 | 4JB1T, 4JB1TC |
|---|---|---|---|---|
| Oil pump type | | Gear | Trochoid | Gear |
| Delivery volume | lit(US/UK gal)/min | 19.9 (5.3/4.4) | 13.0 (3.4/2.9) | 19.9 (5.3/4.4) |
| Pump speed | rpm | 1000 | | |
| Delivery pressure | kg/cm²(psi/kPa) | 4 (56.9/392.0) | | |
| Oil temperature | °C(°F) | 48 — 52 (118 — 126) | | |
| Engine oil | | SAE 30 | | |
| Oil pressure switch operating pressure | kg/cm²(psi/kPa) | 0.2 — 0.5 (2.8 — 7.1/19.6 — 49.0) | | |
| Oil filter type | | Full flow with cartridge paper element | | |
| Relief valve opening pressure | kg/cm²(psi/kPa) | 4.3 — 4.7 (61.1 — 66.8/421.4 — 460.6) | | 5.7 — 6.3 (82.5 — 89.5/ 558.6 — 617.4) |
| Safety valve opening pressure | kg/cm²(psi/kPa) | 0.8 — 1.2 (11.38 — 17.07/78.9 — 117.6) | | |
| Oil cooler type | | Water-cooled | | |
| Safety valve opening pressure | kg/cm²(psi/kPa) | 2.3 — 2.7 (32.7 — 38.4/225.4 — 264.6) | | |

0602

# GENERAL DESCRIPTION

## LUBRICATING OIL FLOW



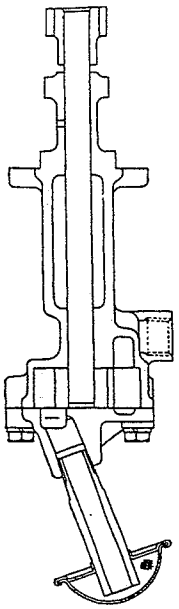
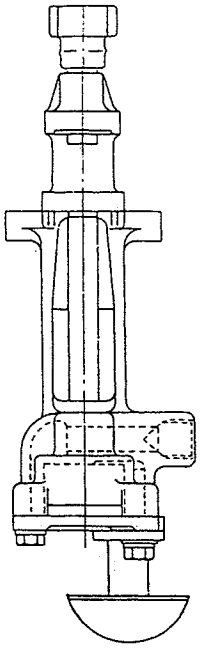
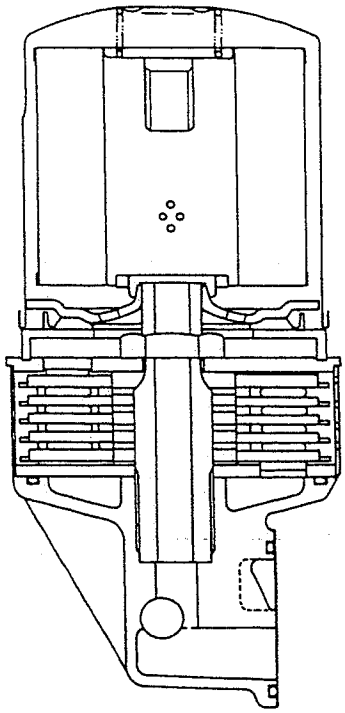

① Oil filter regulating valve opening pressure : 4.3—4.7 (61.1—66.8/421.4—460.6) for 4JA1, 4JB1
5.7—6.3 (82.5—89.5/558.6—617.4) for 4JB1T, 4JB1TC
② Oil filter safety valve opening pressure : 0.8—1.2 (11.38—17.07/78.9—117.6)
③ Oil cooler safety valve opening pressure : 2.3—2.7 (32.7—38.4/225.4—264.6)
④ Oil pressure switch operating pressure : 0.2—0.5 (2.8—7.1/19.6—49.0)
⑤ Oil pressure regulating valve (Except 4JB1) : 2.3—2.7 (32.7—38.4/225.4—264.6)

The 4J Series engine lubricating system is a full flow type.

Lubricating oil is pumped from the oil pump to the cylinder body oil gallery through the oil cooler and the oil filter. It is then delivered to the vital parts of the engine from the cylinder body oil gallery.

Piston cooling oil pipes installed on the cylinder body spray engine oil to the piston inside faces to achieve maximum piston cooling effect.

060202
## OIL PUMP AND OIL FILTER

| TROCHOID TYPE | GEAR TYPE | OIL FILTER WITH BUILT-IN OIL COOLER |
|---|---|---|
|  |  |  |

060202-004

4JB1 engines are equipped with a trochoid-type oil pump.

4JA1, 4JB1T, and 4JB1TC engines are equipped with a gear-type oil pump.

All 4J Series engines are equipped with a single unit oil filter with built-in oil cooler for the most effective engine oil cooling.

Exhaust gas recirculation system (EGR) equipped engines also have a bypass filter.

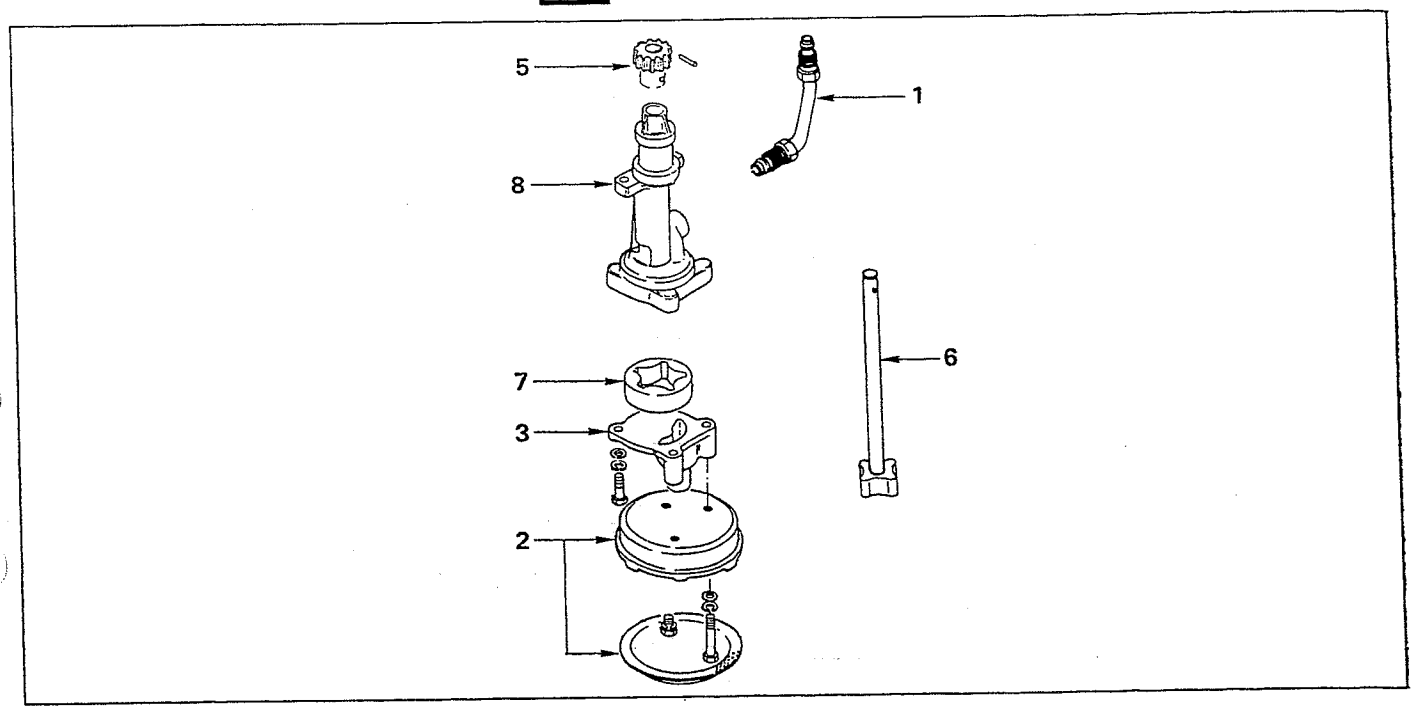
The bypass filter provides longer engine oil life.

060304

# OIL PUMP (TROCHOID TYPE)

06030401A

## DISASSEMBLY



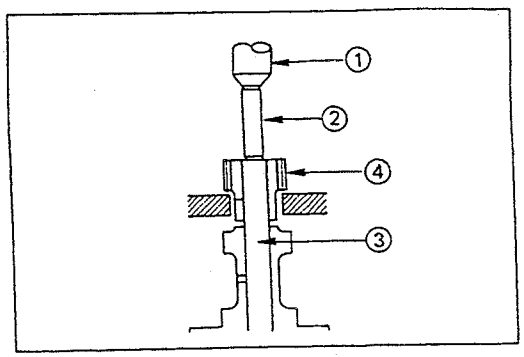

06030401B

### Disassembly Steps

1. Oil pipe
2. Strainer
3. Pump cover
4. Vane
- ▲ 5. Pinion gear
6. Rotor shaft
7. Oil pump body

06030402

### Important Operations




**▲ Pinion Gear**

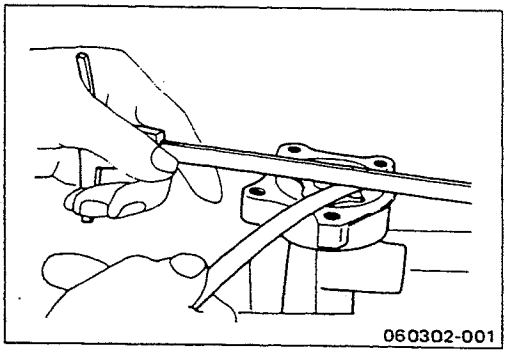
Use a bench press ① with brass bar ② to slowly force the rotor shaft ③ from the pinion gear ④.

060302

# INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

06030201




### Vane, Rotor, and Cover Clearance

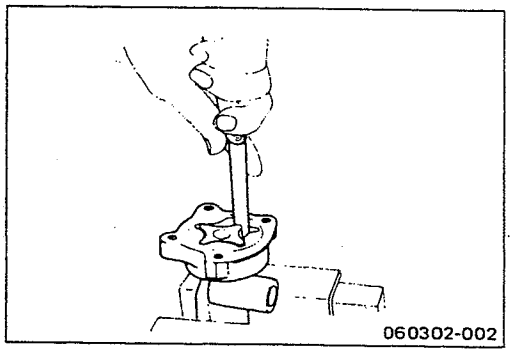
Use a feeler gauge to measure the clearance between the vane, the rotor, and the cover.

If the clearance between the vane, the rotor, and the cover exceeds the specified limit, the rotor set (pin, shaft, rotor, and vane) must be replaced.

Vane, Rotor, and Cover Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.06 (0.0024) | 0.15 (0.0059) |

06030202




### Rotor and Vane Clearance

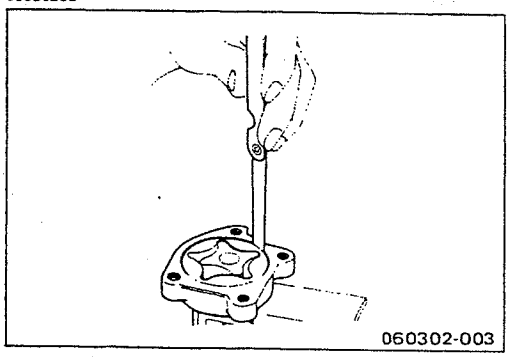
Use a feeler gauge to measure the clearance between the rotor and the vane.

If the clearance between the rotor and the vane exceeds the specified limit, the rotor set (pin, shaft, rotor, and vane) must be replaced.

Rotor and Vane Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.14 (0.0055) or less | 0.20 (0.0079) |

06030203




### Vane and Oil Pump Body Clearance

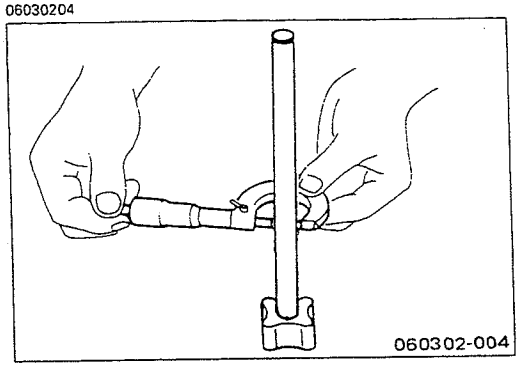
Use a feeler gauge to measure the clearance between the vane and the pump body.

If the clearance between the vane and the pump body exceeds the specified limit, the entire pump assembly must be replaced.

Vane and Pump Body Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.26 (0.0102) | 0.40 (0.016) |

06030204




### Rotor Shaft and Oil Pump Body Clearance

Use a micrometer to measure the rotor shaft outside diameter.

Use an inside dial indicator to measure the pump body inside diameter.

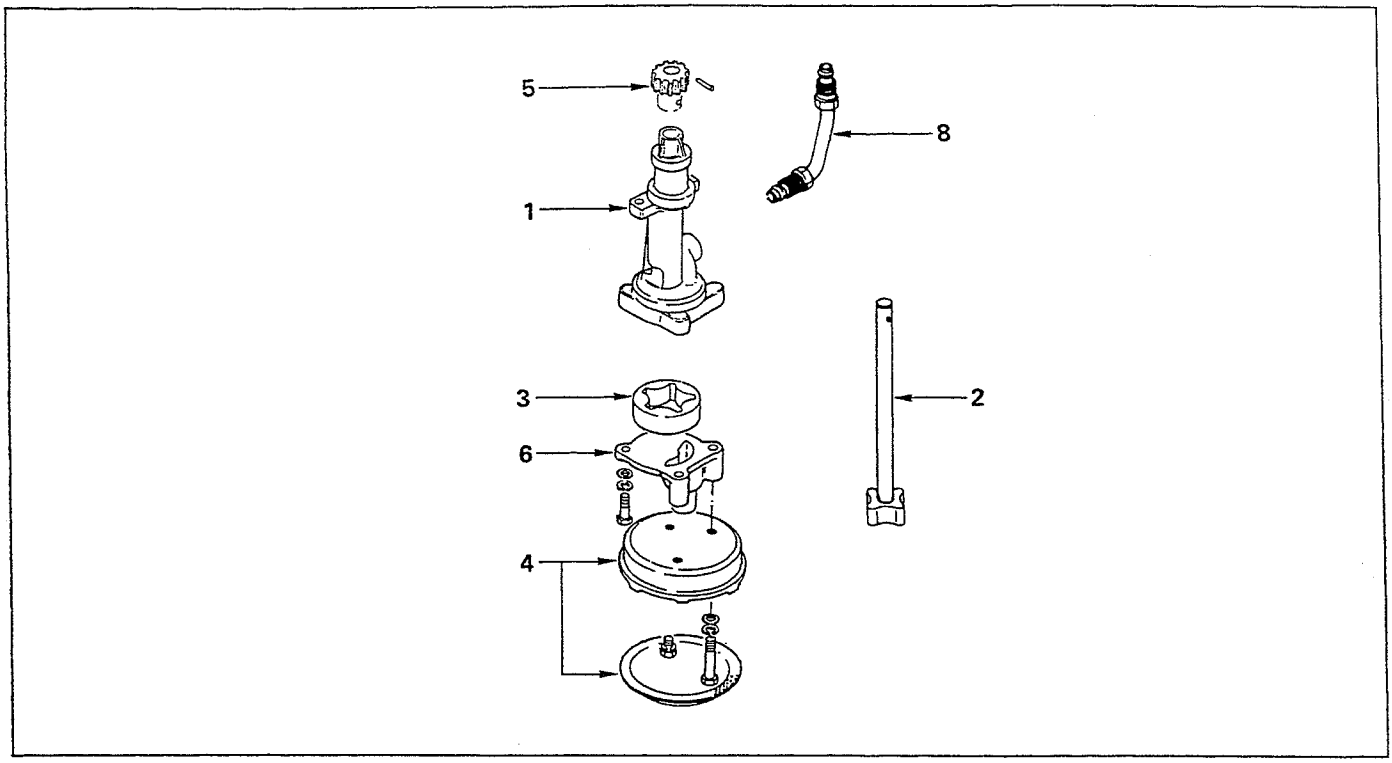
If the clearance between the rotor shaft and the pump body exceeds the specified limit, the entire pump assembly must be replaced.

Rotor Shaft and Pump Body Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.05 (0.0020) | 0.15 (0.0059) |

060303A

## REASSEMBLY



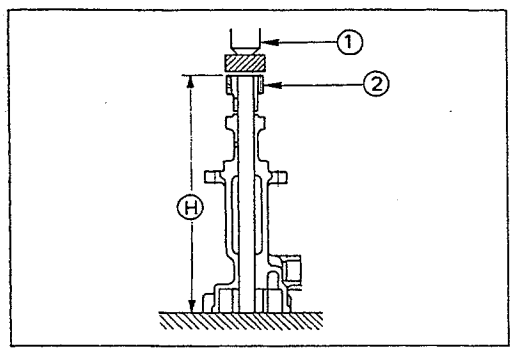

0603030001B

### Reassembly Steps

1. Oil pump body
2. Rotor shaft
3. Vane
4. Pump cover
- ▲ 5. Pinion gear
6. Strainer
7. Oil pipe

06030301

### Important Operations




**▲ Pinion Gear**

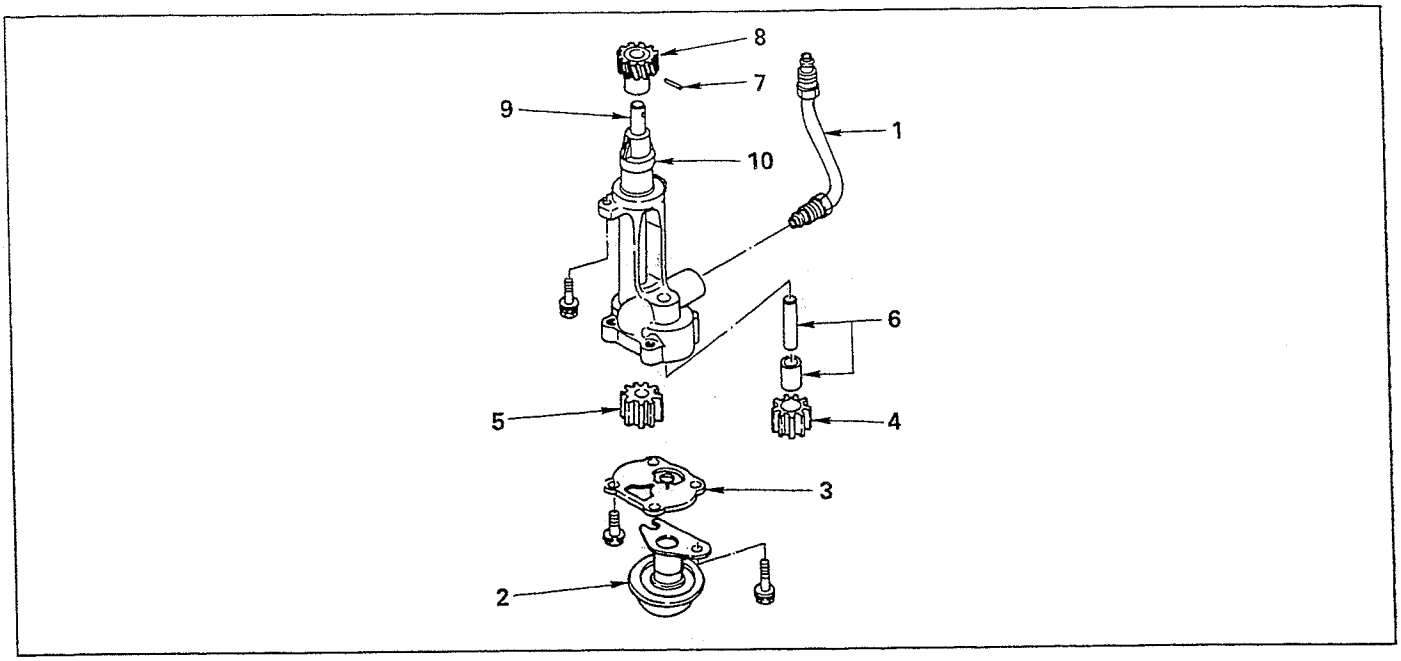
Use a bench press ① to slowly force the pinion gear ② into place.

Note the installation distance Ⓗ between the pinion gear upper face and the oil pump cover fitting face.

| Pinion Gear and Pump Fitting Face Distance Ⓗ | mm(in) |
|---|---|
| 83.5 (3.41) | |

# OIL PUMP (GEAR TYPE)

## DISASSEMBLY



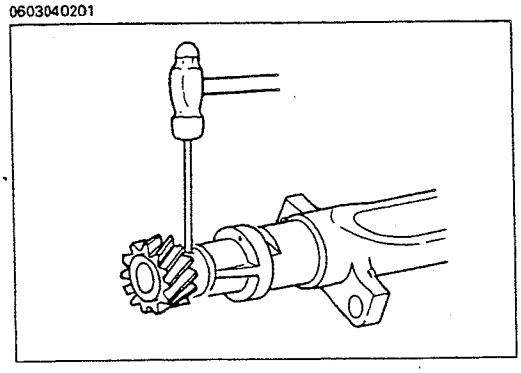

### Disassembly Steps

1. Oil pipe
2. Strainer
3. Pump cover
4. Driven gear with bush
5. Driven gear
6. Driven shaft
- ▲ 7. Pinion pin
- ▲ 8. Pinion gear
9. Drive shaft
10. Oil pump body

06030402

### Important Operations

0603040201



- ▲ **Pinion Pin**
- ▲ **Pinion Gear**

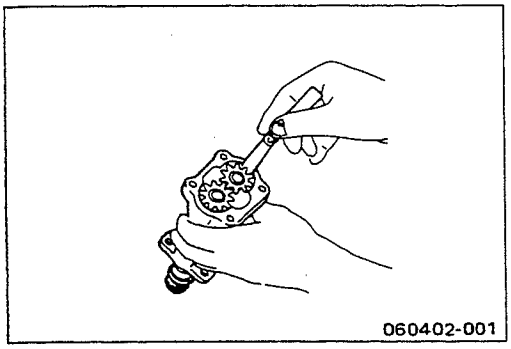
1) File off the caulked end of the pinion stopper pin.
2) Use a hammer and bar to drive the pinion pin free.
3) Remove the pinion.

060402

## INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

06040201




### Gear Teeth and Body Inner Wall Clearance

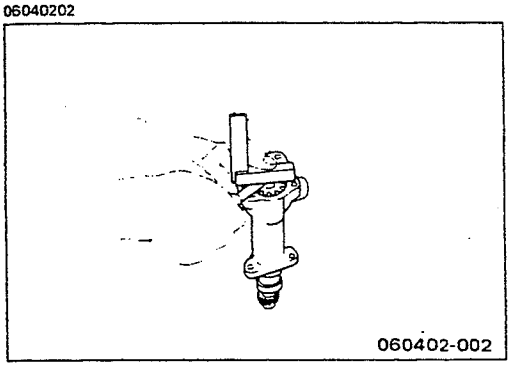
Use a feeler gauge to measure the clearance between the gear teeth and the body inner wall.

If the clearance between the gear teeth and the body inner wall exceeds the specified limit, either the gear or the body must be replaced.

Gear Teeth and Body Inner Wall Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.14 (0.0055) | 0.20 (0.0079) |

06040202




### Gear and Body Clearance

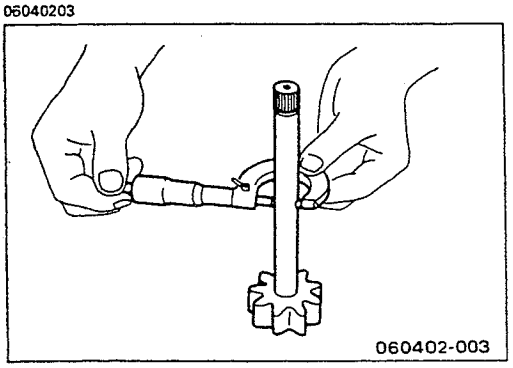
Use a feeler gauge to measure the clearance between the body and the gear.

If the clearance between the gear and the body exceeds the specified limit, the body must be replaced.

Gear and Body Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.06 (0.024) | 0.15 (0.0059) |

06040203




### Drive Shaft and Oil Pump Body Clearance

Use a micrometer to measure the drive shaft outside diameter.

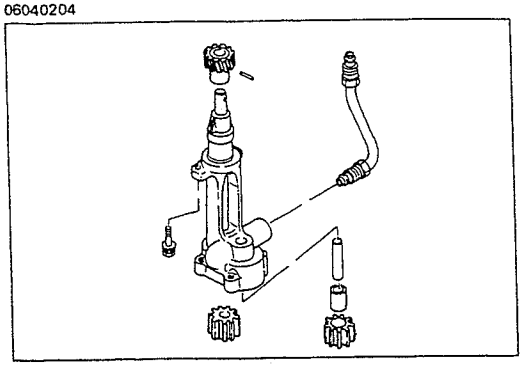
Use an inside dial indicator to measure the pump body inside diameter.

If the clearance between the drive shaft and the oil pump body exceeds the specified limit, the oil pump assembly must be replaced.

Drive Shaft and Oil Pump Body Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.04 (0.0016) | 0.20 (0.0079) |

06040204



### Driven Shaft and Bushing Clearance

Use a micrometer to measure the driven shaft outside diameter.

Use an inside dial indicator to measure the bushing inside diameter.

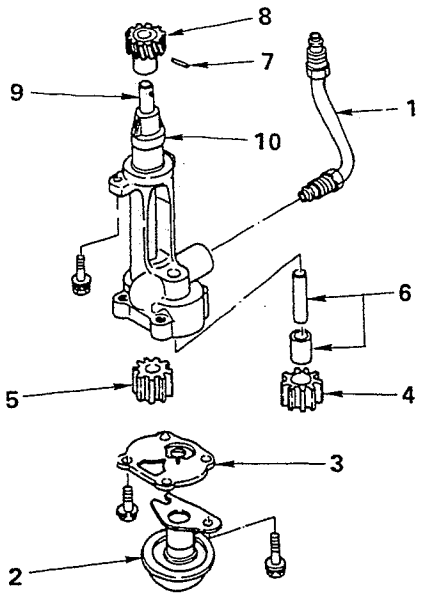
If the clearance between the driven shaft and the bushing exceeds the specified limit, the bushing must be replaced.

Driven Shaft and Bushing Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.05 (0.0020) | 0.15(0.0059) |

060403

## REASSEMBLY



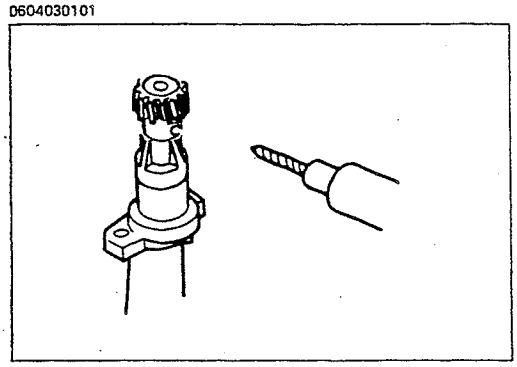

### Reassembly Steps

1. Oil pump body
2. Drive shaft
3. Driven shaft
4. Driven gear
5. Drive gear
6. Pump cover
▲ 7. Pinion gear
▲ 8. Pinion pin
9. Strainer
10. Oil pipe

06040301

### Important Operations

0604030101



▲ **Pinion Gear**

▲ **Pinion Pin**

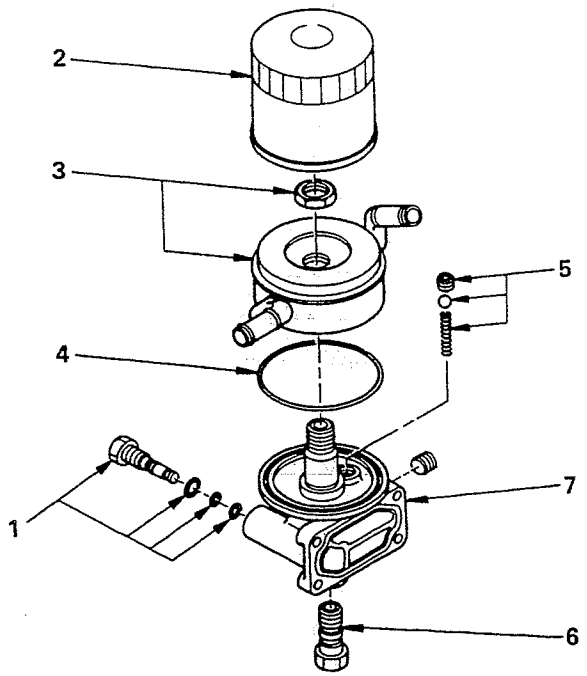
1) Install the new drive shaft to the pump body.
2) Set the pinion gear to the drive shaft.
3) Use a 5 mm (0.20 in) drill to drill a hole through the pinion gear and the drive shaft.
4) Insert the pinion pin into the hole.
5) Caulk the pinion pin.

0605001

# OIL FILTER WITH BUILT-IN OIL COOLER

060501

## DISASSEMBLY




060501-002

### Disassembly Steps

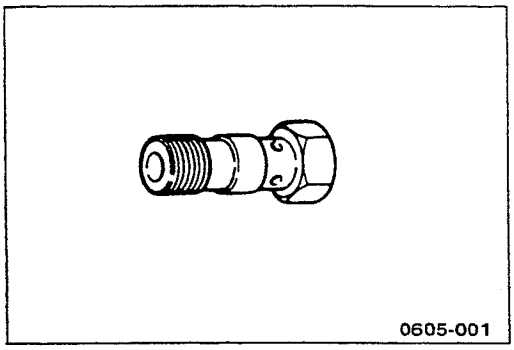
1. Drain plug
2. Cartridge oil filter
3. Oil cooler
4. O-ring
5. Safety valve
6. Relief valve
7. Oil filter body

060502

## INSPECTION AND REPAIR

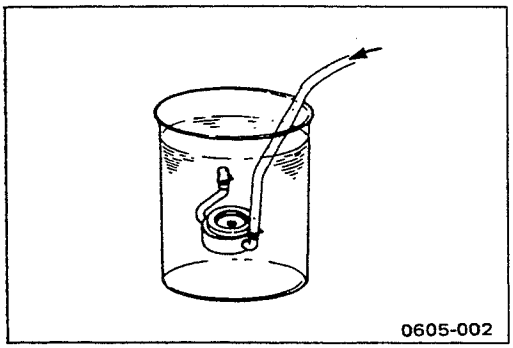
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

06050201



0605-001

06050202



0605-002

### Relief Valve

1. Attach an oil pressure gauge to the oil gallery near the oil filter.
2. Start the engine to check the relief valve opening pressure.

| Relief Valve Opening Pressure | kg/cm $^2$(psi/kPa) |
|---|---|
| 4JA1·4JB1 | 4.3—4.7 (61.1—66.8/421.4—460.6) |
| 4JB1T·4JB1TC | 5.7—6.3 (82.5—89.5/558.6—617.4) |

### Oil Cooler

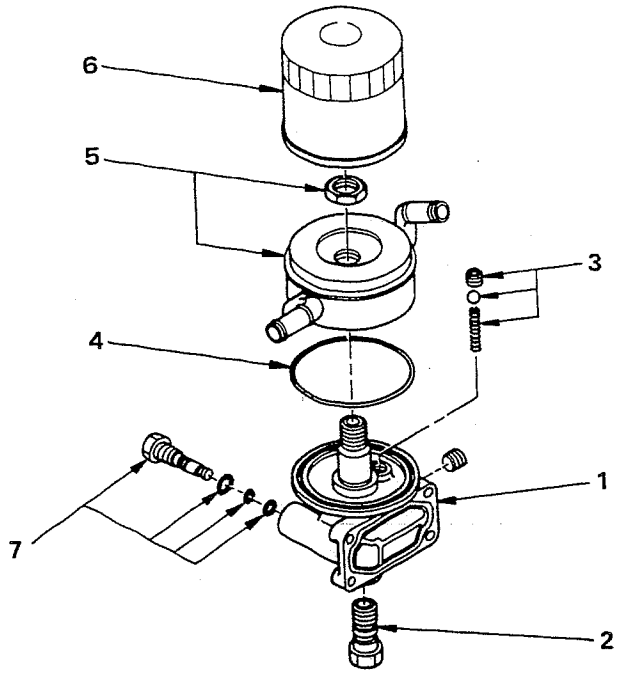
Water Leakage At Water Passage

1. Plug one side of the oil cooler water passage.
2. Submerge the oil cooler in water.
3. Apply compressed air (2 kg/cm$^2$ (28.4 psi/196 kPa)) to the other side of the oil cooler water passage.

   If air bubbles rise to the surface, there is water leakage.

060503

## REASSEMBLY




060503-007

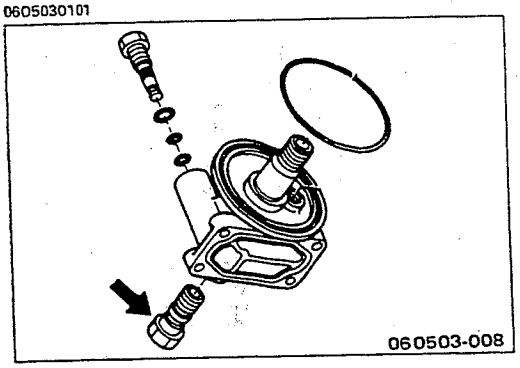
### Reassembly Steps

1. Oil filter body
▲ 2. Relief valve
3. Safety valve
4. O-ring
▲ 5. Oil cooler
▲ 6. Oil filter cartridge
▲ 7. Drain plug

06050301

## Important Operations

0605030101

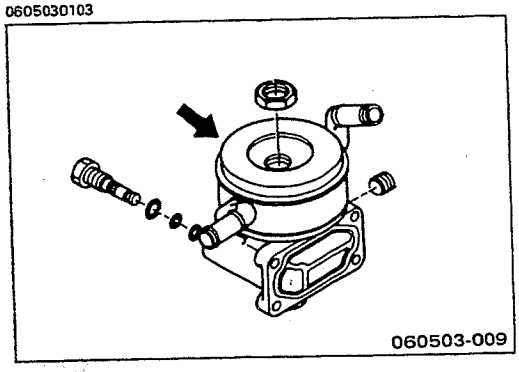



### ▲ Relief Valve

Tighten the relief valve to the specified torque.

| Relief Valve Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.0 ± 0.5 (14.5 ± 3.6/19.60 ± 4.90) | |

0605030103

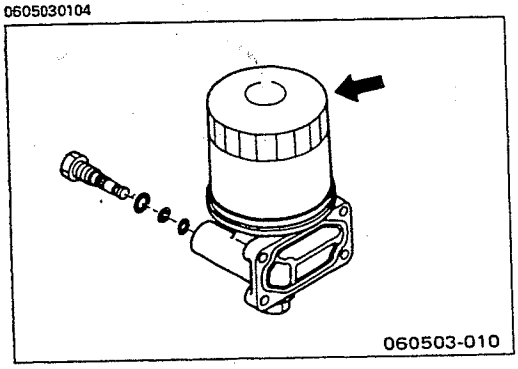



### ▲ Oil Cooler

1) Align the oil filter holes with the body knock pins at installation.
2) Tighten the oil cooler nut to the specified torque.

| Oil Cooler Torque | kg·m(lb.ft/N·m) |
|---|---|
| 3.0 ± 0.5 (21.7 ± 3.6/29.40 ± 4.90) | |

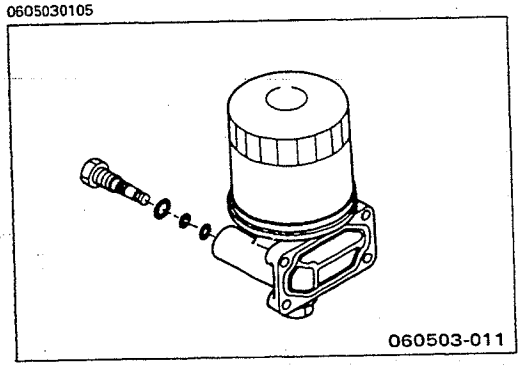
0605030104




### ▲ Oil Filter Cartridge

1) Apply engine oil to the O-ring.
2) Turn in the cartridge oil filter until the filter sealing face makes contact with the O-ring.
3) Turn in the cartridge oil filter an additional 1 and 1/4 turns.

0605030105




### ▲ Drain Plug

Tighten the drain plug to the specified torque.

| Drain Plug Torque | kg·m(lb.ft/N·m) |
|---|---|
| 2.0 ± 0.5 (14.5 ± 3.6/19.60 ± 4.90) | |

0700

# COOLING SYSTEM

0701

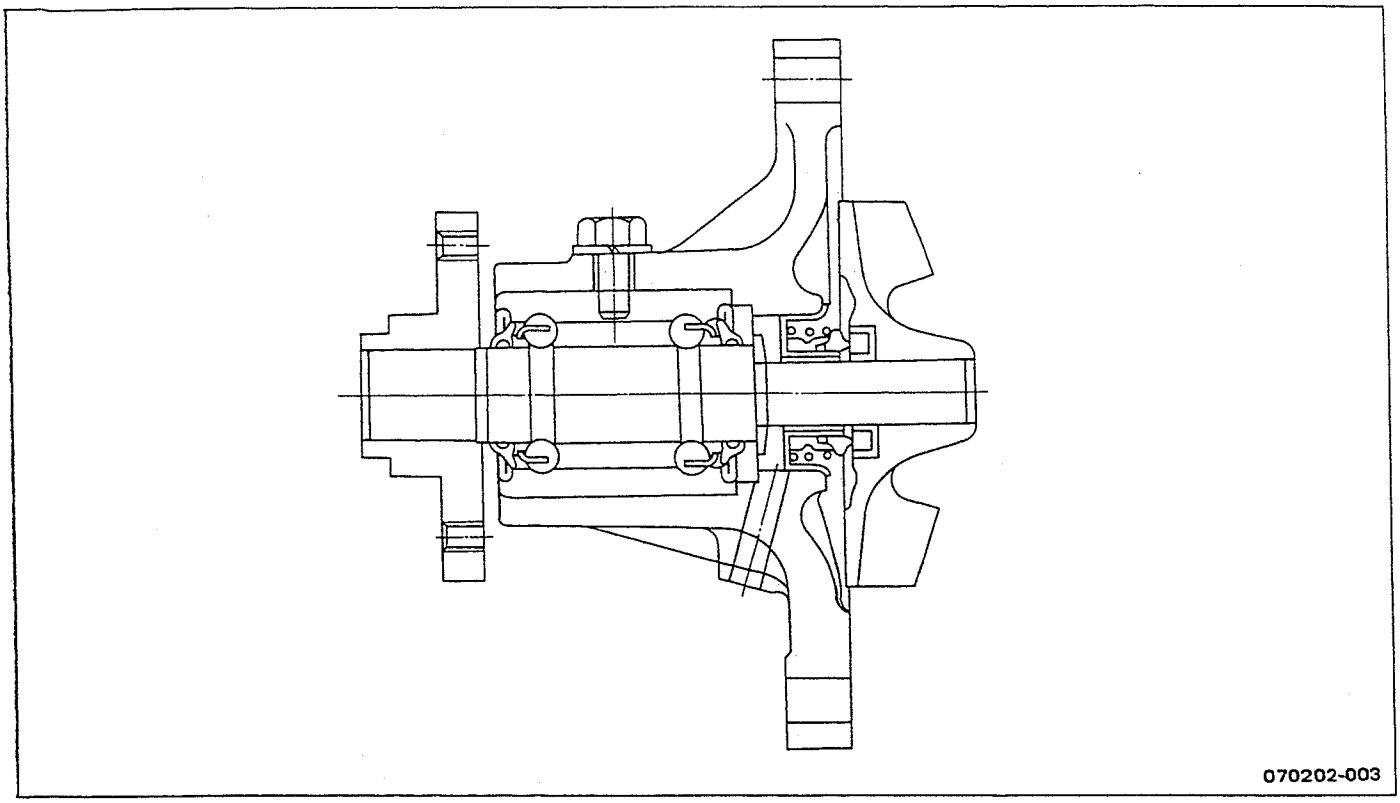
## MAIN DATA AND SPECIFICATIONS

| Item | Description | |
|---|---|---|
| Water pump type | Centrifugal | |
| Pump to crankshaft speed ratio (To 1) | 1.1 | |
| *Delivery volume lit(US/UK gal)/min | 100 (26.3/22.2) | |
| Pump bearing type | Double row shaft | |
| Thermostat type | Wax pellet with jiggle valve | |
| Valve initial opening temperature °C(°F) | 82 (180) | Primary: 85 (185)<br>Secondary: 88 (190) |
| Valve full opening temperature °C(°F) | 95 (203) | 100 (212) |
| Valve lift at fully open position mm(in) | 8 (0.31) | 10 (0.39) |
| Thermovalve | | |
| Valve initial opening temperature °C(°F) | 75 (167) | |
| Valve full opening temperature °C(°F) | 90 (194) | |
| Valve lift at fully open position mm(in) | 4.5 (0.18 or more) | |

*Pump speed at 3,000 rpm and water temperature at 30°C (86°F)

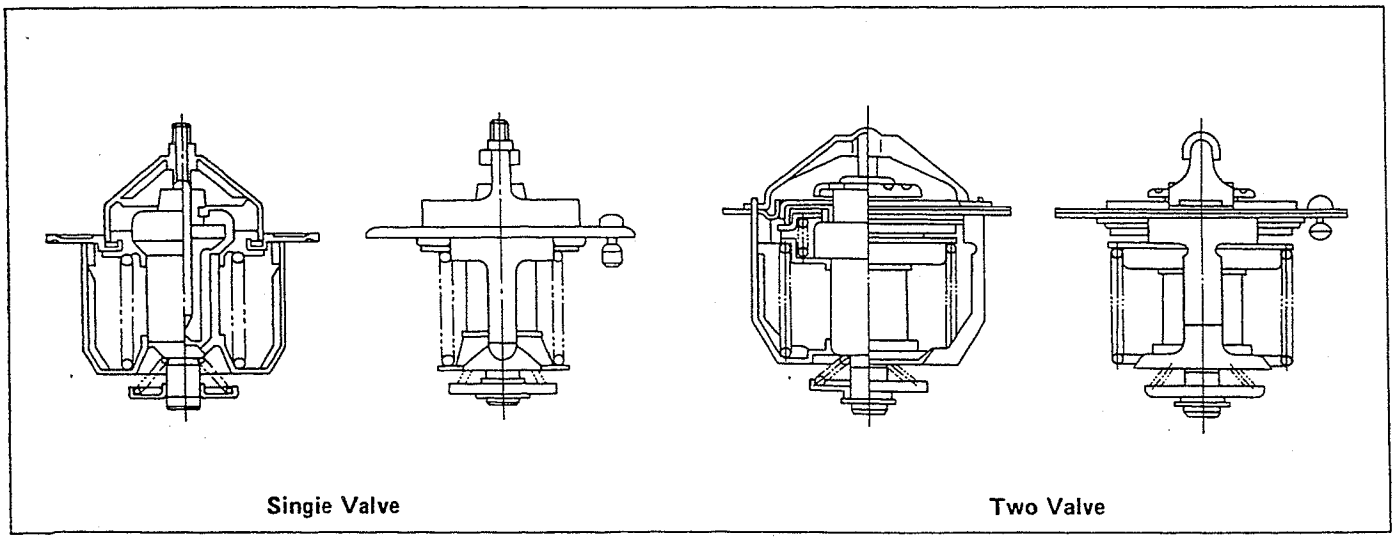
070202A

## WATER PUMP




070202B

## THERMOSTAT




A centrifugal type water pump forcefully circulates the coolant through the cooling system.

A wax pellet type thermostat is used.

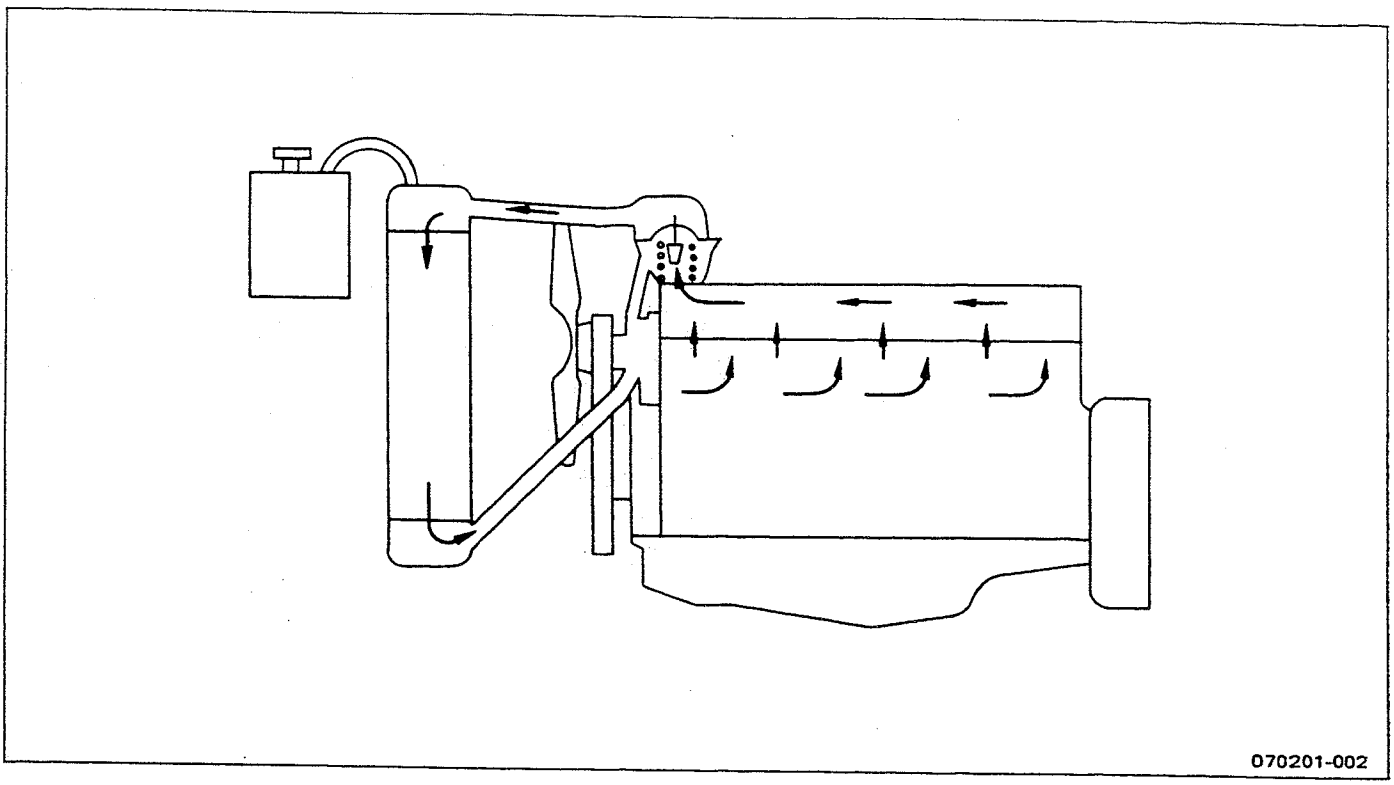
The jiggle valve accelerates engine warmup.

0702

# GENERAL DESCRIPTION

070201

## COOLANT FLOW



070201-002

The engine cooling system consists of the radiator, the water pump, the cooling fan, and the thermostat.

Either a single valve type or a two-valve type thermostat is used. Installation depends upon engine and vehicle model.

To quickly increase cold engine coolant temperature for smooth engine operation, the coolant is circulated by the water pump and thermostat through the by-pass hose and back to the cylinder body. The coolant does not circulate through the radiator.

When the coolant temperature reaches the 82 — 85°C (180 — 185°F) range, the thermostat will begin to open and a gradually increasing amount of coolant will circulate through the radiator.

The thermostat will be fully open when the coolant temperature reaches the 95 — 100°C (203 — 212°F). All of the coolant is now circulating through the radiator for effective engine cooling.

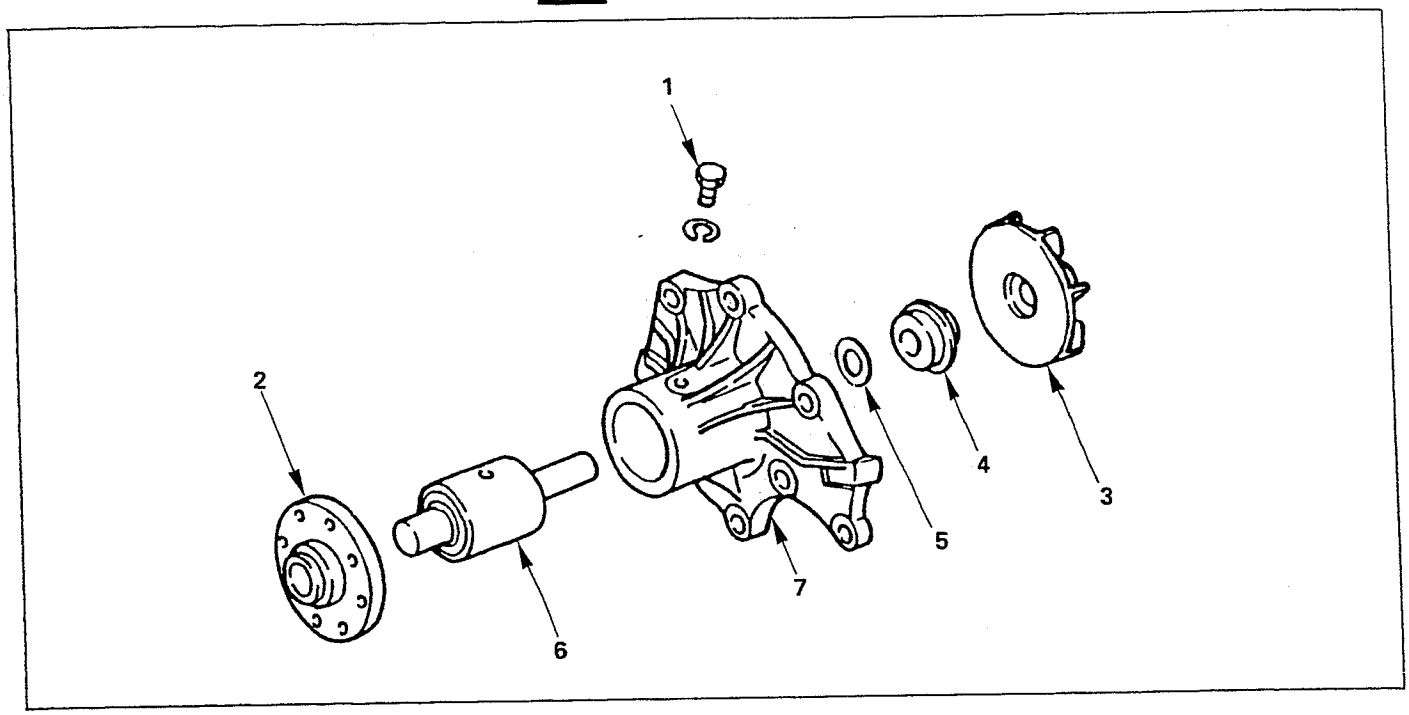
The Quick-Warming-Up System (QWS) is available as an option.

0703

# WATER PUMP

070301

## DISASSEMBLY



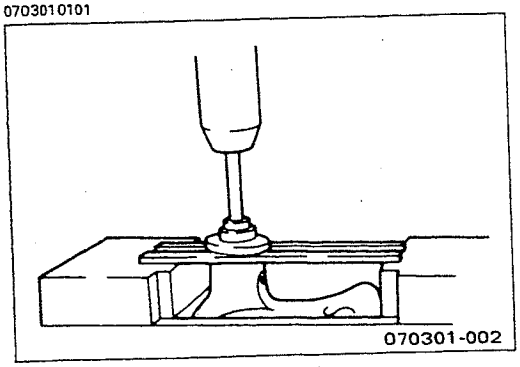

### Disassembly Steps

1. Set screw
▲ 2. Cooling fan center
▲ 3. Impeller
▲ 4. Seal unit
5. Thrower
6. Bearing unit
7. Water pump body

07030101

### Important Operations

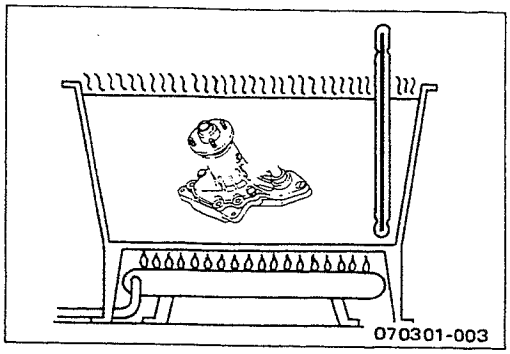
0703010101




**▲ Cooling Fan Center**

Remove the fan center with a bench press and a bar.

0703010102A



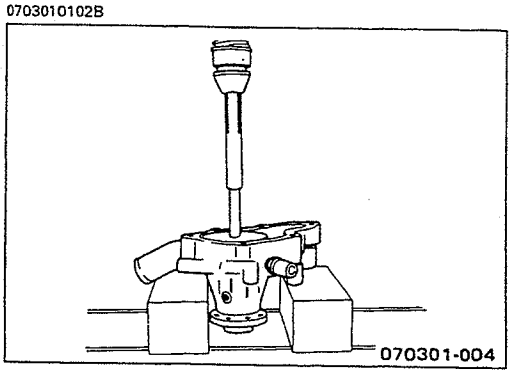

▲ **Impeller (Aluminum Body Only)**

▲ **Seal Unit**

▲ **Bearing Unit**

1) Heat the pump body in hot water (80 — 90°C/176 — 194°F).

0703010102B




2) Remove the impeller, the seal unit, and the bearing unit, and the bearing unit with a bench press and bar.

**Note:**

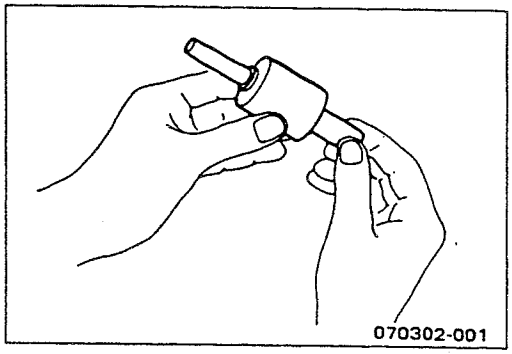
**Do not drive out the impeller with a hammer. Damage to the impeller will result.**

070302

## INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

07030201

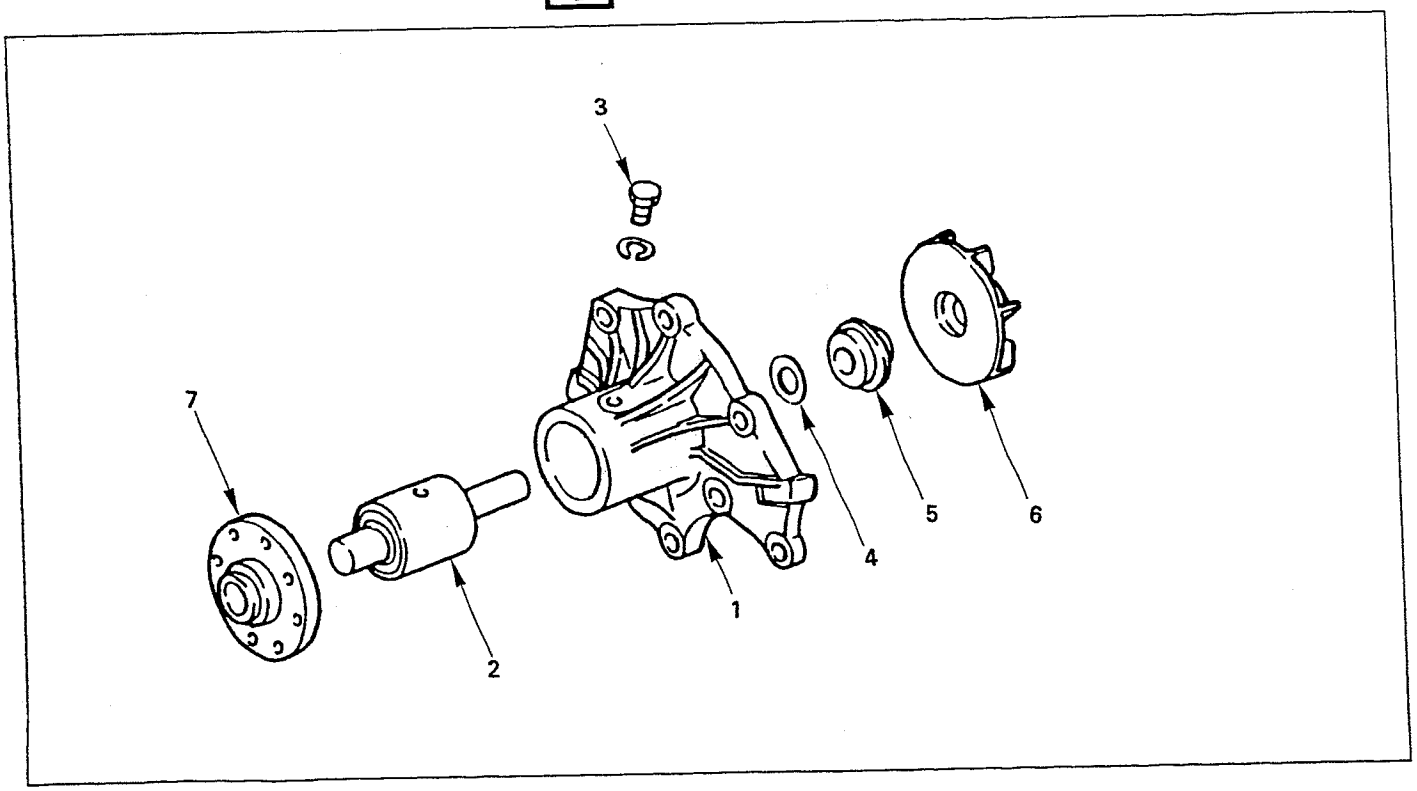



**Bearing Unit**

Check the bearing for abnormal noise, binding, and other abnormal conditions.

0703030001

## REASSEMBLY



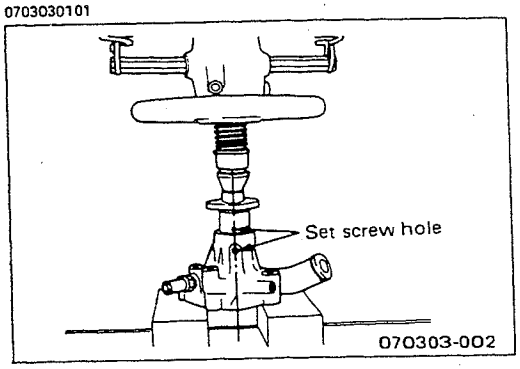

**Reassembly Steps**

1. Water pump body
▲ 2. Bearing unit
▲ 3. Set screw
4. Thrower
▲ 5. Seal unit
▲ 6. Impeller
▲ 7. Cooling fan center

07030301

### Important Operations

0703030101

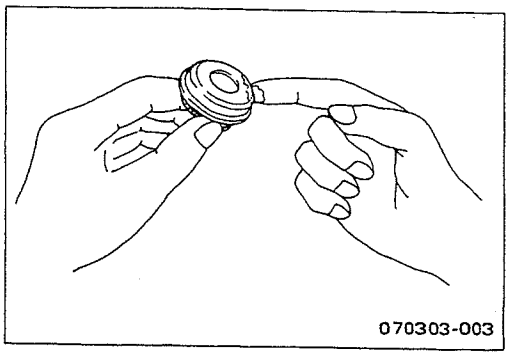



▲ **Bearing Unit**

▲ **Set Screw**

1) Align the bearing set screw hole with the pump body set screw hole.
2) Press the bearing unit into place.
3) Secure the bearing with the set screw.

0703030102A

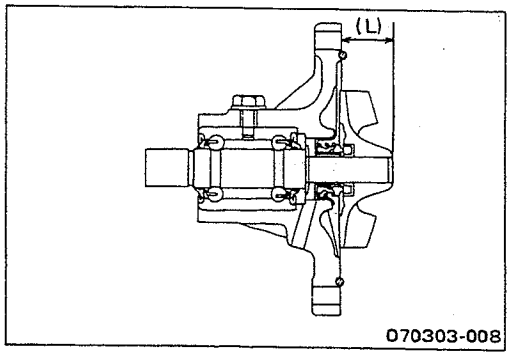



▲ Seal Unit

▲ Impeller

1) Apply a thin coat of liquid gasket to the seal unit outer periphery.
2) Install the seal unit.

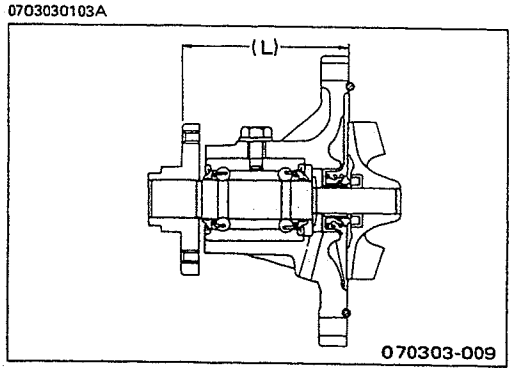
0703030102018




3) Use a bench press to slowly force the impeller into place until the impeller installed distance from the water pump body face is equal to the specified value.

| Impeller Projection (L) (Reference) | mm(in) |
|---|---|
| 2.4 (0.94) | |

0703030103A

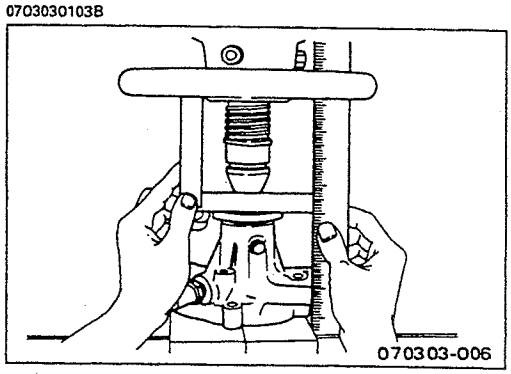



▲ Cooling Fan Center

Measure the distance between the cooling fan fitting face and the rear cover fitting face.

| Cooling Fan Center Distance (L) | mm(in) |
|---|---|
| 79.2—79.8 (3.12—3.14) | |

0703030103B




**Notes:**

1. **The fan center and the impeller are installed to the water pump shaft with a press.**

   **Never attempt to remove and reinstall the fan center and the impeller a second time. Replace the entire water pump assembly.**

   **Removing and reinstalling the fan center and the impeller a second time may result in the breakdown of the water pump during engine operation and subsequent serious overheating problems.**
2. **The water pump assembly must be replaced whenever the fan center and impeller pressure force falls below 200 kg. (441 lb/1,960 N)**
3. **Do not attempt to strike the bearing into position with a hammer or similar object. Damage to the bearing will result.**

0800

# FUEL SYSTEM

0801D1

## MAIN DATA AND SPECIFICATIONS

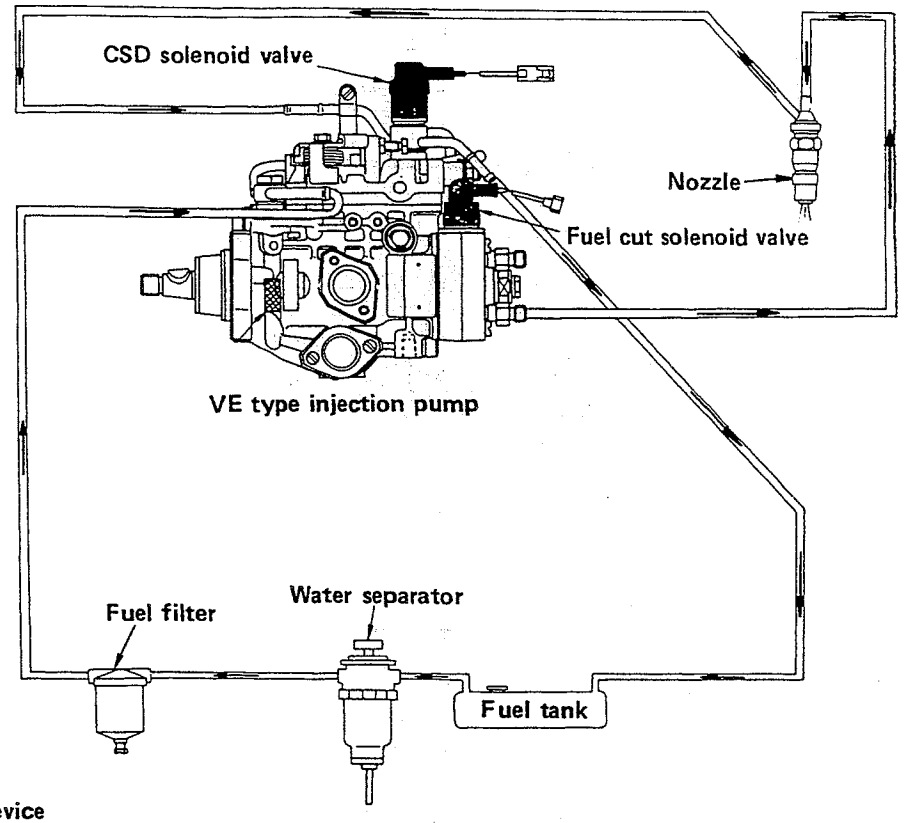
| Item | | 4JA1, 4JB1, 4JB1T (For General Export) | 4JB1T (For Europe) | 4JB1TC (For Europe) |
|---|---|---|---|---|
| Injection pump type | | Bosch Distributor | | |
| Plunger outside diameter | mm(in) | 11 (0.43) | | |
| Plunger lift | mm(in) | 2.2 (0.09) | | |
| Governor type | | Mechanical variable (Half all speed) | | |
| Timer type | | Oil pressure | | |
| Fuel feed pump type | | Vane with input shaft | | |
| Injection nozzle type | | Hole type | | |
| Number of injection nozzle orifices | | 4 | | |
| Injection nozzle orifices inside diameter | mm(in) | 1 (0.04) | | |
| Injection nozzle opening Pressure (Design value) | $kg/cm^2$(psi/kPa) | 185 (2,631/18,143) | Two spring type | |
| | First: | | 170 (2,417/16,671) | |
| | Second: | | 210 (2,986/20,593) | 195 (1,773/19,124) |
| Main fuel filter type | | Cartridge paper element and water separator | | |

0802

# GENERAL DESCRIPTION

080201

## FUEL FLOW




CSD: Cold Start Device

080201-002

The fuel system consists of the fuel tank, the water separator, the fuel filter, the injection pump, and the injection nozzle.

The fuel from the fuel tank passes through the water separator and the fuel filter where water particles and other foreign material are removed from the fuel.

Fuel, fed by the injection pump plunger, is delivered to the injection nozzle in the measured volume at the optimum timing for efficient engine operation.

The CSD solenoid valve controls the injection pump internal pressure.

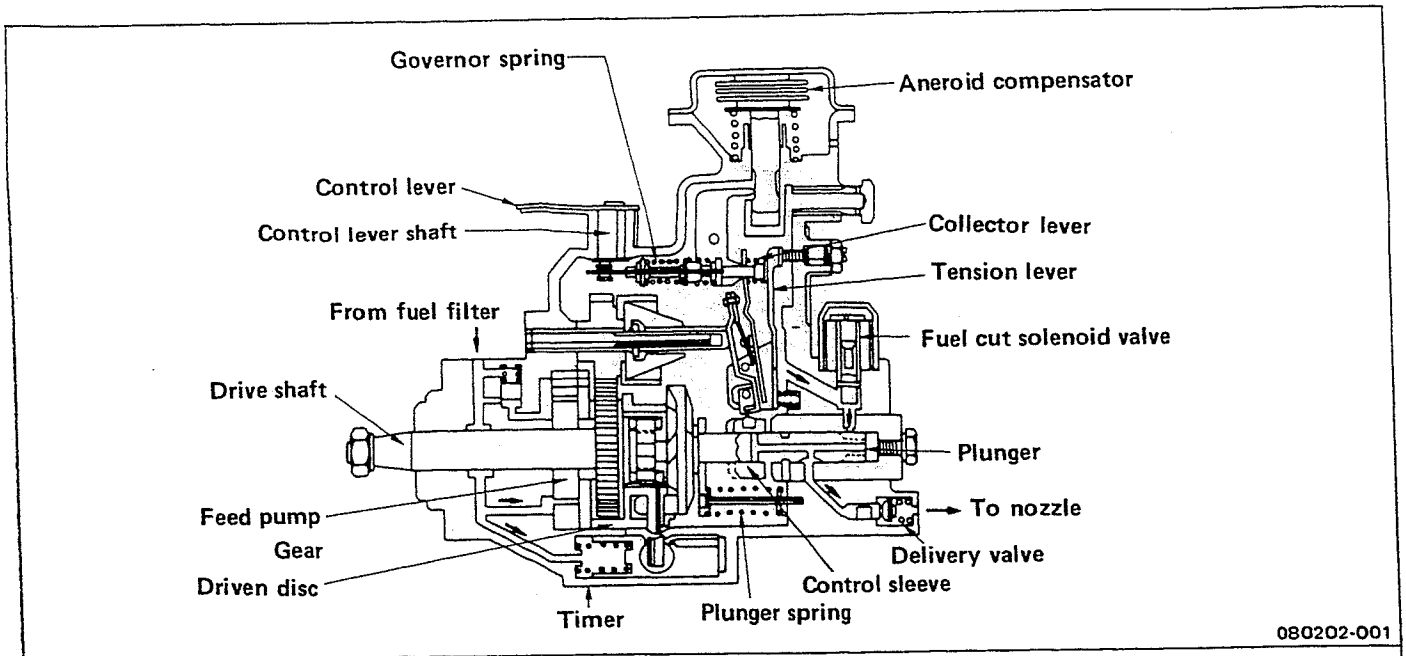
As the pressure rises, fuel injection timing is advanced.

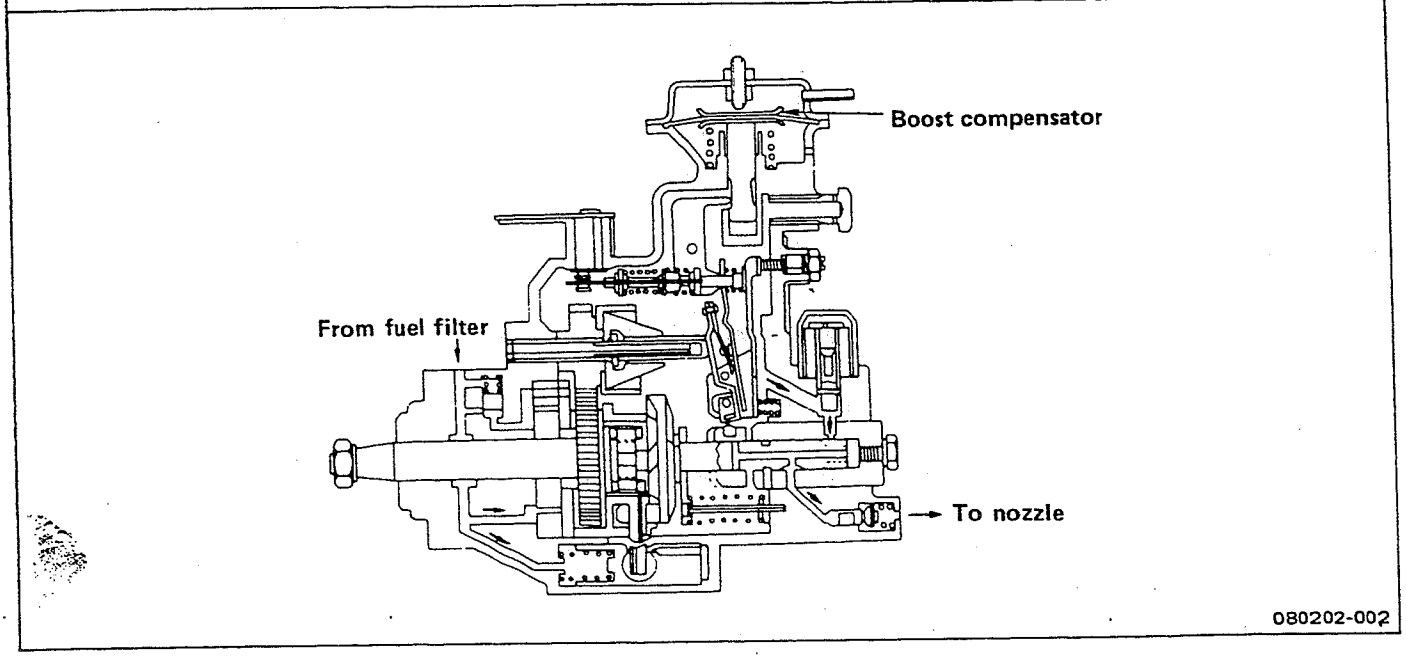
The CSD solenoid valve is also called a "solenoid timer."

CSD solenoid valves are installed on engines equipped with cold weather starting systems.

080202

## INJECTION PUMP




A Bosch Distributor Type Injection Pump is used. A single reciprocating/revolving plunger delivers the fuel uniformly to the injection nozzles, regardless of the number of cylinders.

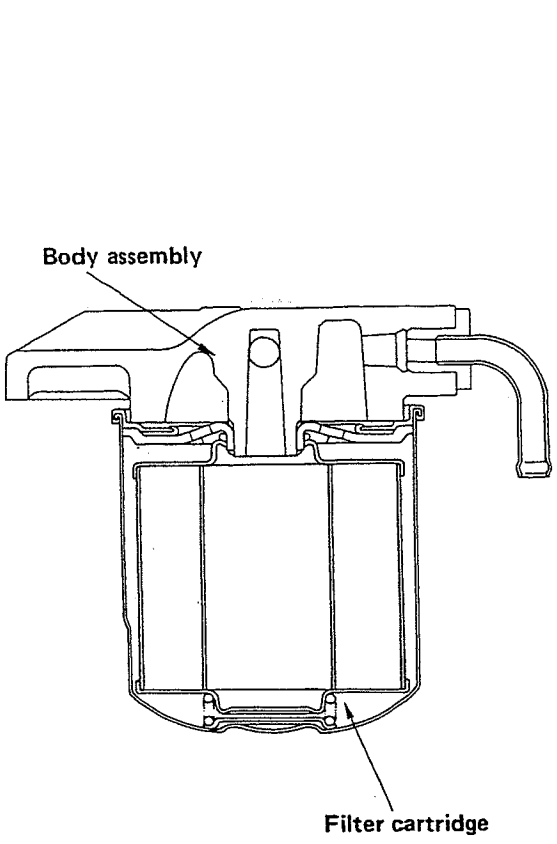
The governor, the injection timer, and the feed pump are all contained in the injection pump housing. The injection pump is compact, light weight, and provides reliable high-speed operation.

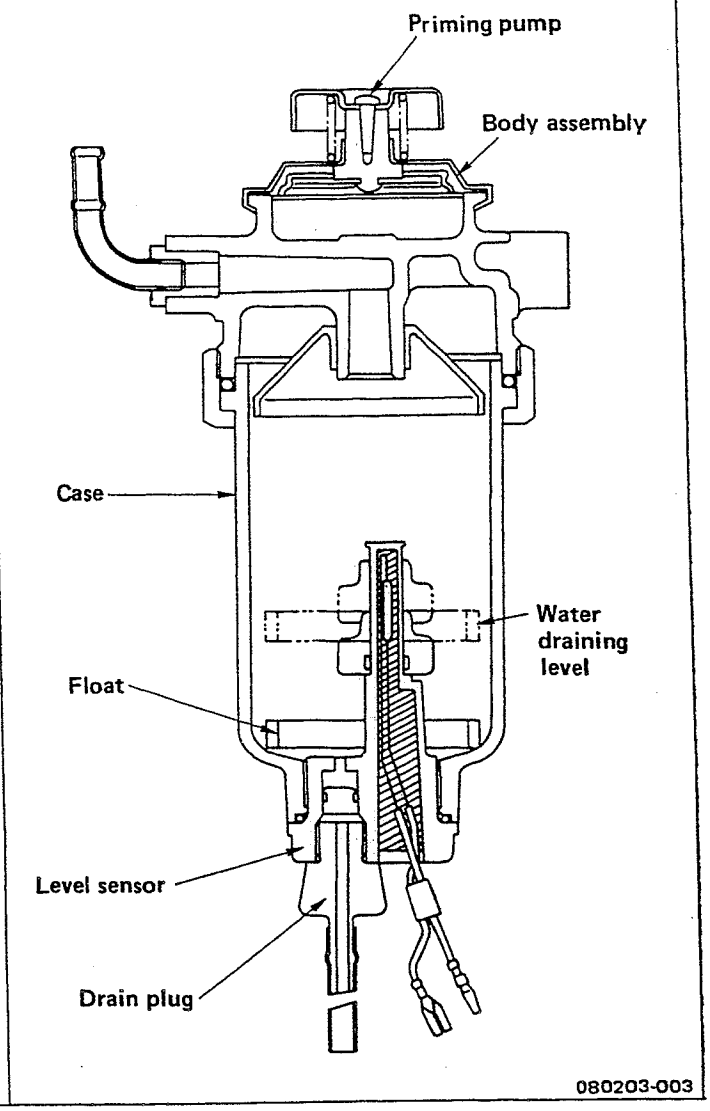
An aneroid compensator is available as an option for vehicles to be operated at high altitudes. It adjusts the fuel and air mixing ratio.

A boost compensator is installed on turbocharger equipped vehicles.

080203

## FUEL FILTER AND WATER SEPARATOR




A cartridge type fuel filter and a water separator are used along with the VE type injection pump.

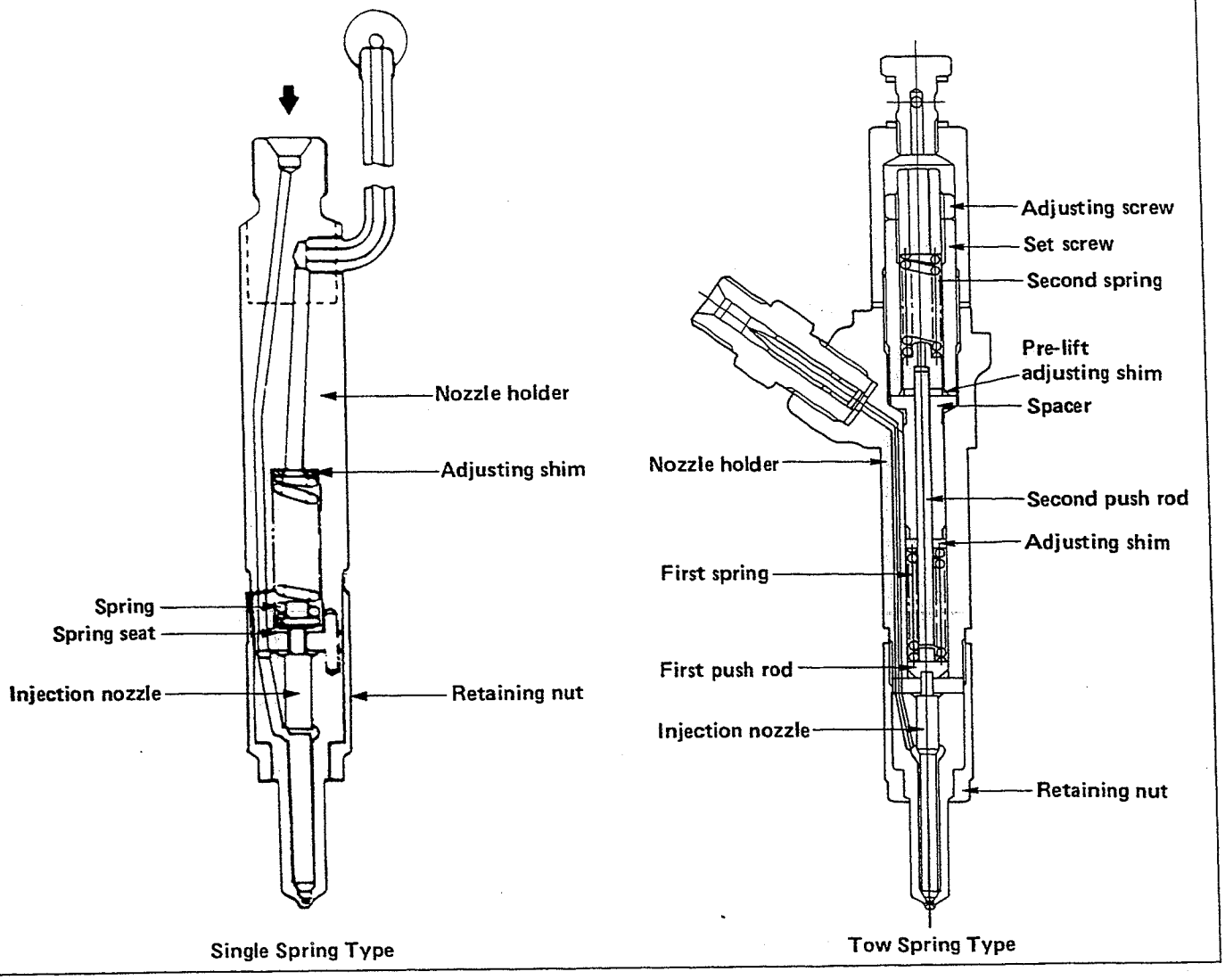
As the inside of the injection pump is lubricated by the fuel which it is pumping, the fuel must be perfectly clean. The fuel filter and the water separator remove water particles and other foreign material from the fuel before it reaches the injection pump.

The water separator has an internal float. When the float reaches the specified level, a warning light comes on to remind you to drain the water from the water separator.

A diaphragm type priming pump is installed at the top of the water separator. It is used during the water draining and the air bleeding procedures.

08020501

## INJECTION NOZZLE




4J Series diesel engines are equipped with one of three types of injection nozzles, depending on engine and vehicle model.

The injection nozzle sprays pressureized fuel from the injection pump through the injection nozzle orifices and into the combustion chamber.

4J Series engines without turbocharger use a single spring hole type injection nozzle.

Turbocharged 4J series engines without an exhaust gas recirculation (EGR) system use a two spring hole type injection nozzle.

Turbocharged 4J series engines with the exhaust gas recirculation (EGR) system use a special two spring hole type injection nozzle.

Injection nozzle configurations for EGR equipped and EGR non-equipped engines are different. The nozzles are not interchangeable.

Two spring type injection nozzles have two independent springs and push rods.

First nozzle opening pressure is controlled by the first spring.

Second nozzle opening pressure must be adjusted with the adjusting screw when the injection nozzle is reassembled after major servicing.

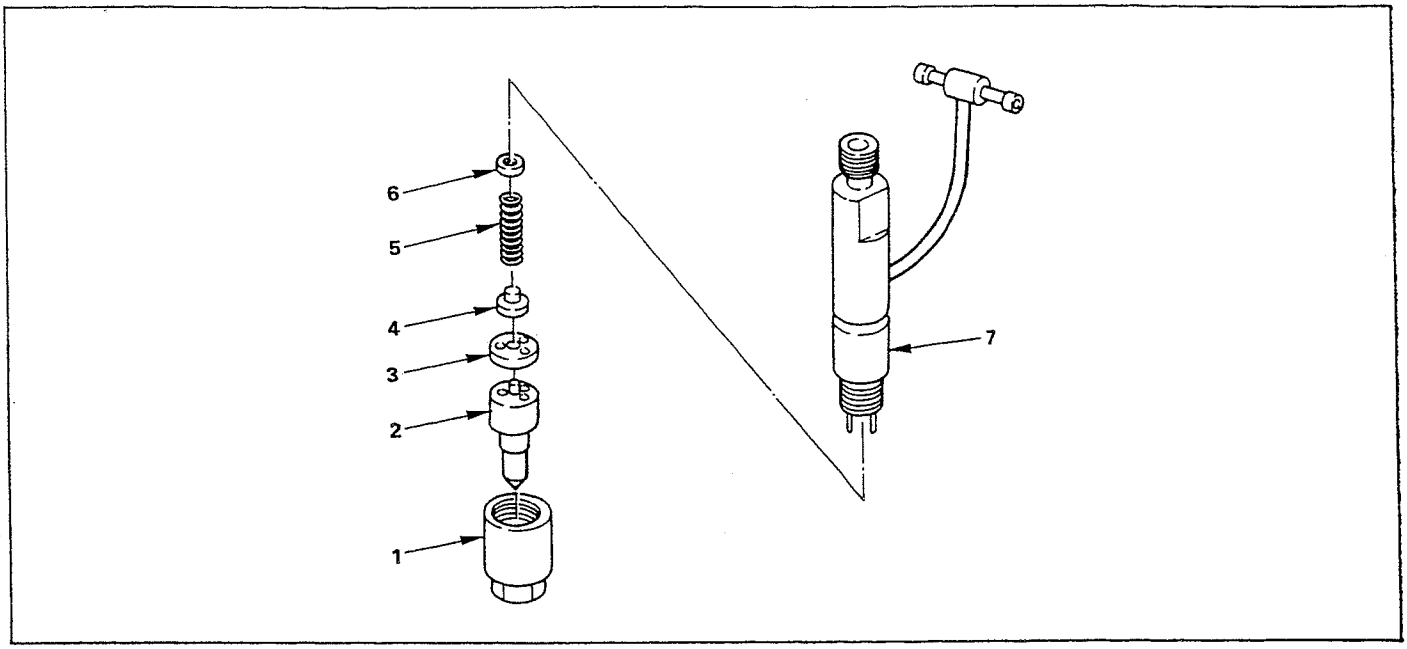
Do not loosen the adjusting screw, lock nut, and set screw during ordeinary servicing.

0803

# INJECTION NOZZLE

0803010001A

## DISASSEMBLY



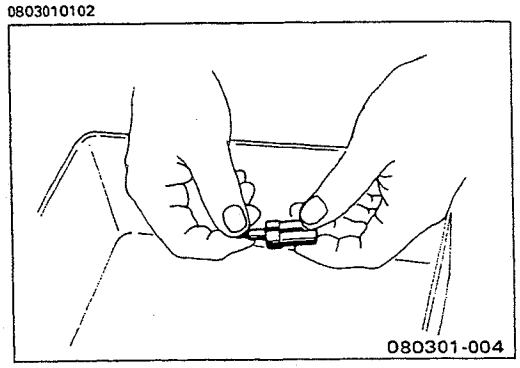

### Disassembly Steps

1. Retaining nut
▲ 2. Injection nozzle
3. Spacer
4. Spring seat
5. Spring
6. Adjusting shim
7. Nozzle holder

08030101

### Important Operations

0803010102




**▲ Injection Nozzle**

1) Remove the nozzle assemblies from the nozzle holders.

   Tag the nozzle assemblies and the nozzle holders to ensure that they are reinstalled in their original positions.

   The nozzle assembly and nozzle holder combinations must not be interchanged.

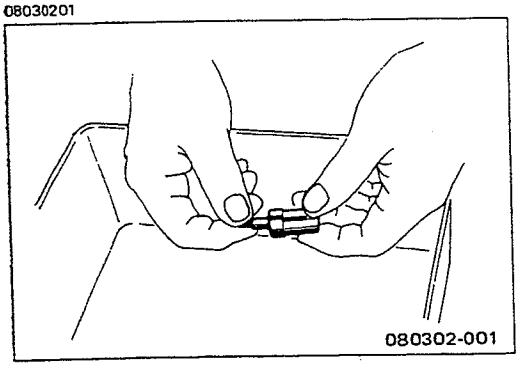
2) Immerse the injection nozzles in a tool tray filled with clean diesel oil to protect them from dust.

0B0302

## INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

08030201

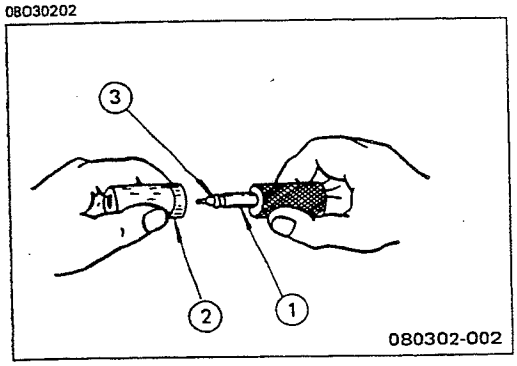



### Injection Nozzle Needle Inspection

1. Remove the nozzle needle from the nozzle body.
2. Carefully wash the nozzle needle and the nozzle body in clean diesel fuel.
3. Check that the nozzle needle moves smoothly inside the injection nozzle body.

   If the nozzle needle does not move smoothly, it must be repaired (See "Nozzle Lapping Procedure" below).

08030202




### Nozzle Lapping Procedure

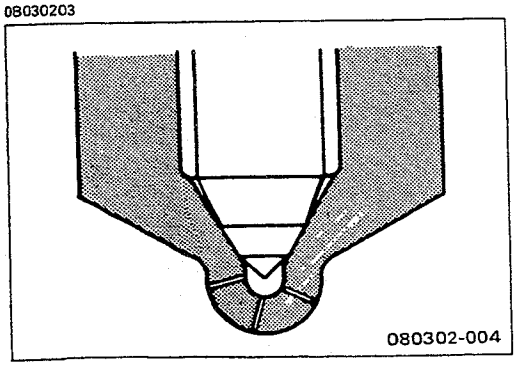
1. Lap the nozzle needle ① and the nozzle body ② by applying a compound of oxidized chrome and animal oil.

**Note:**

**Do not apply an excessive amount of the oxidized chrome and animal oil compound to the injection needle valve seat area.**

2. Carefully wash the needle valve and the nozzle body in clean diesel fuel after lapping.

08030203



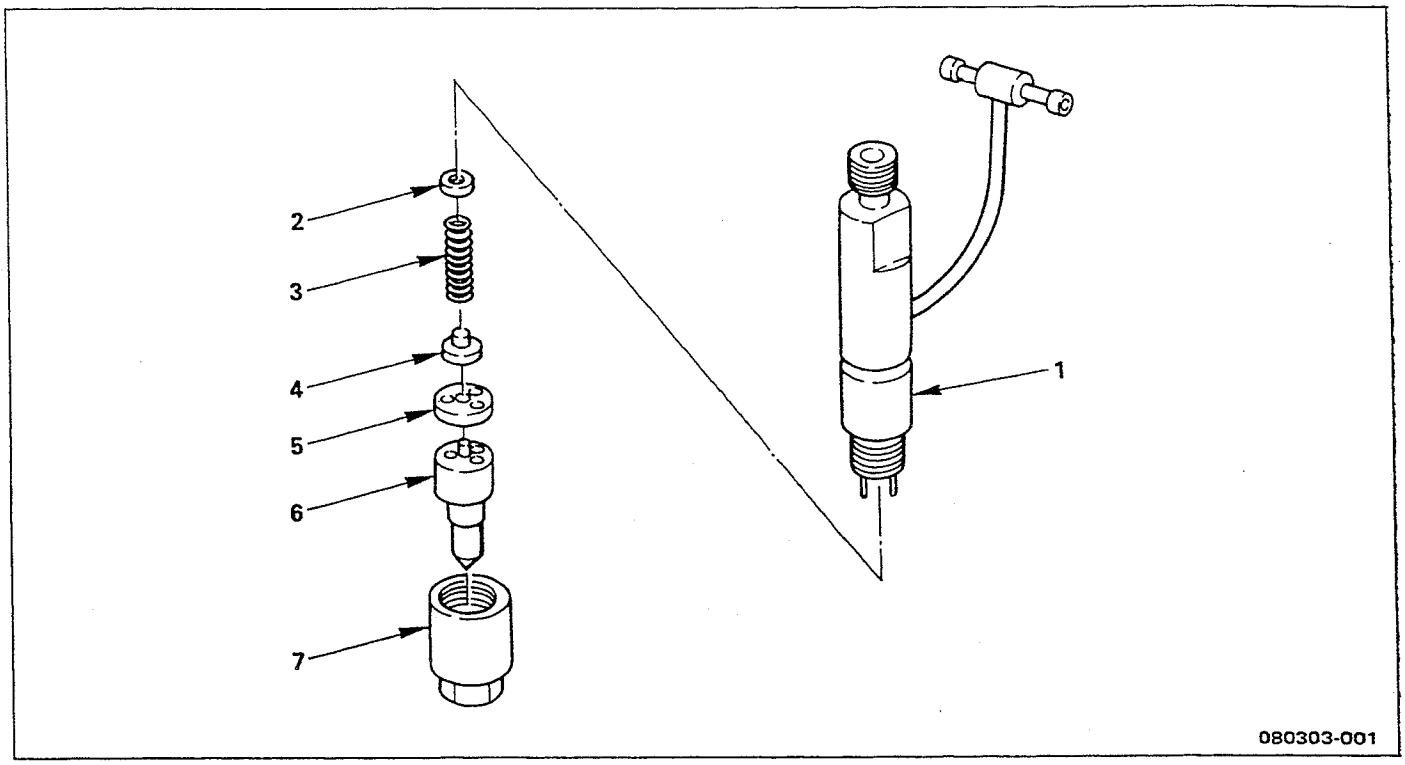

### Nozzle Body and Needle Valve Inspection

Check the nozzle body and the needle valve for damage and deformation.

The nozzle and body assembly must be replaced if either of these two conditions are discovered during inspection.

08030301

## REASSEMBLY



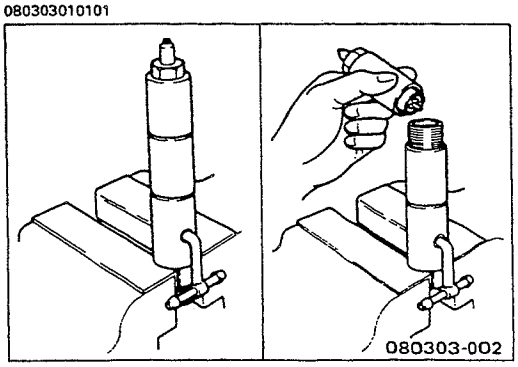

### Reassembly Steps

1. Nozzle holder
2. Adjusting shim
3. Spring
4. Spring seat
5. Spacer
6. Injection nozzle
▲ 7. Retaining nut

0803030101

### Important Operations

080303010101

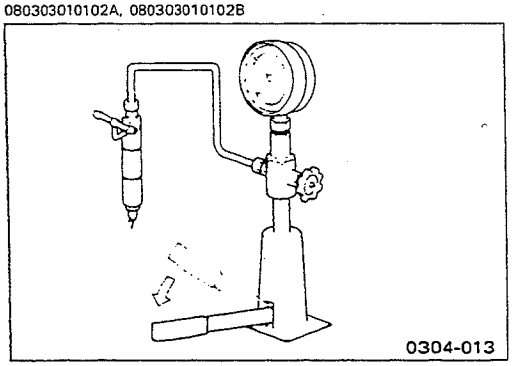



**▲ Retaining Nut**

Tighten the retaining nut to the specified torque.

| Retaining Nut Torque | kg·m(lb.ft/N·m) |
|---|---|
| 4.5 ± 0.5 (32.5 ± 3.6/44.10 ± 4.90) | |

080303010102A, 080303010102B




### Injection Nozzle Adjustment

1) Attach the injection nozzle holder to the injection nozzle tester.
2) Apply pressure to the nozzle tester to check that the injection nozzle opens at the specified pressure.

   If the injection nozzle does not open at the specified pressure, install or remove the appropriate number of ajusting shims to adjust it.

| Adjusting Shim Availability | mm(in) |
|---|---|
| Range | 0.50 — 1.50 (0.02 — 0.06) |
| Increment | 0.025 (0.001) |
| Total No. of Shims | 41 |

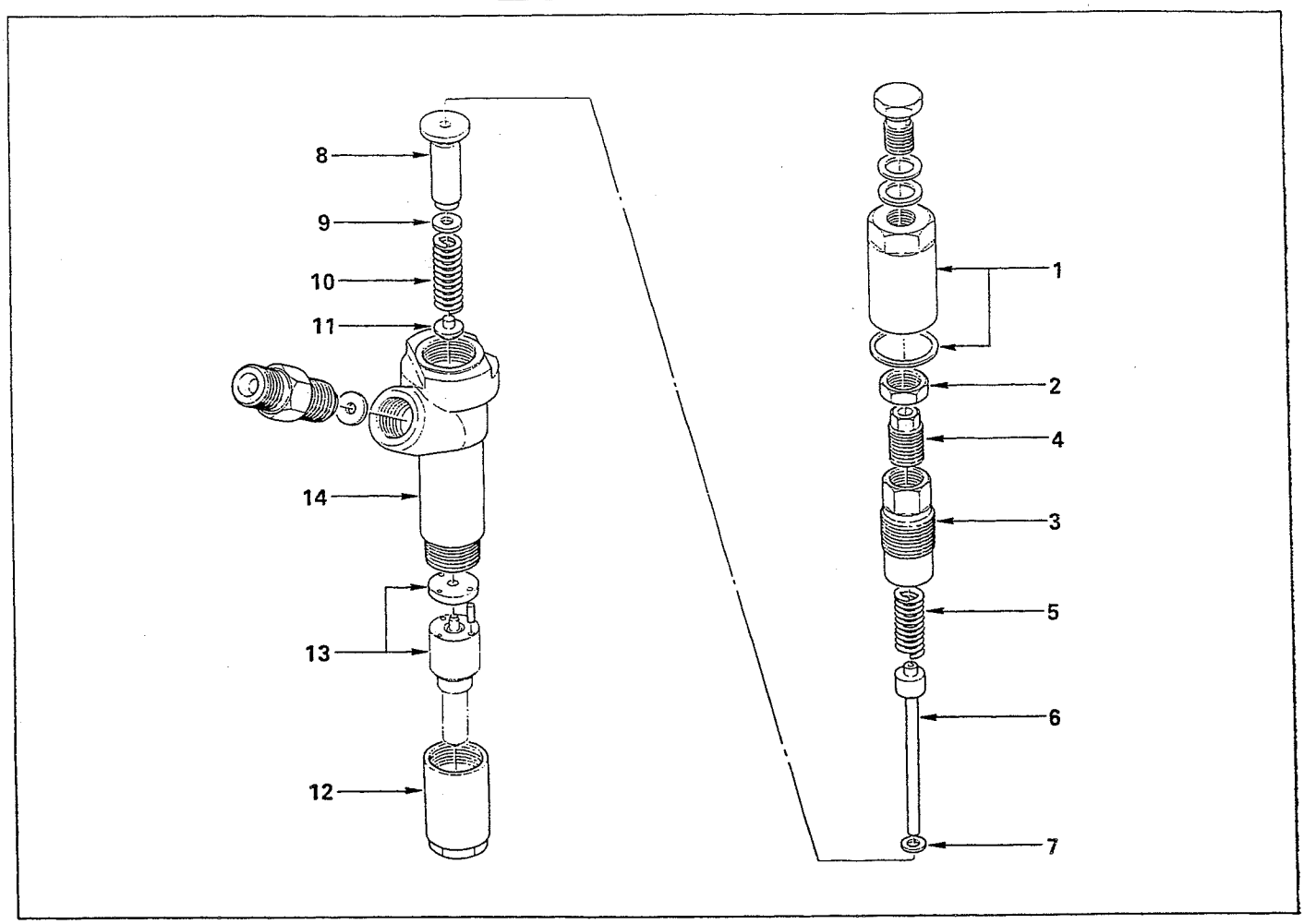
Removing or installing one shim will increase or decrease the nozzle opening pressure approximately 3.77 kg/cm$^3$ (53.6 psi/369.46 kPa).

**WARNING:**

**TEST FLUID FROM THE INJECTION NOZZLE WILL SPRAY OUT UNDER GREAT PRESSURE. IT CAN EASILY PUNCTURE A PERSON'S SKIN. KEEP YOUR HANDS AWAY FROM THE INJECTION NOZZLE TESTER AT ALL TIMES.**

# INJECTION NOZZLE (TWO-SPRING TYPE)

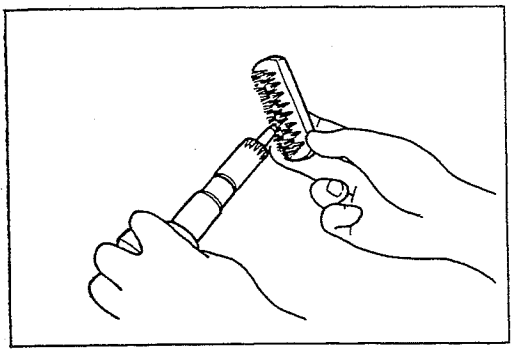
## DISASSEMBLY




### Disassembly Steps

- ▲ 1. Cap nut and gasket
- ▲ 2. Lock nut
- ▲ 3. Set screw
- ▲ 4. Adjusting screw
- ▲ 5. Second spring
- ▲ 6. Second push rod
- ▲ 7. Pre-lift adjusting shim
- ▲ 8. Spacer
- ▲ 9. Adjusting shim
- ▲ 10. First spring
- ▲ 11. First push rod
- ▲ 12. Retaining nut
- ▲ 13. Injection nozzle
- ▲ 14. Injection nozzle holder

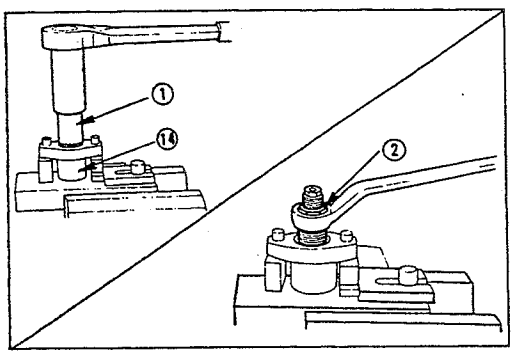
## Important Operations



### Injection Nozzle and Injection Nozzle Holder Assembly Cleaning

Clean the injection nozzle and the injector nozzle assembly before beginning the disassembly procedure.

1) Remove any carbon adhering to the injection nozzle tip.
2) Dip the nozzle holder assembly in a suitable cleaner to clean it.

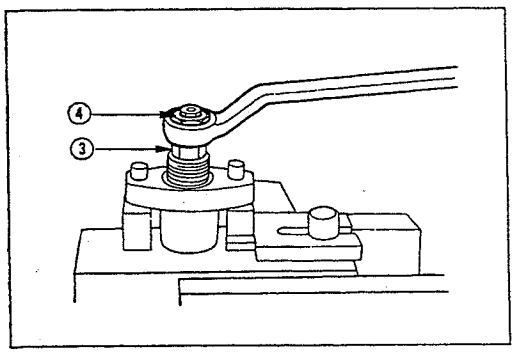



**▲ Cap Nut and Gasket**

**▲ Lock Nut**

1) Clamp the injection nozzle and injection nozzle holder assembly in a vise.

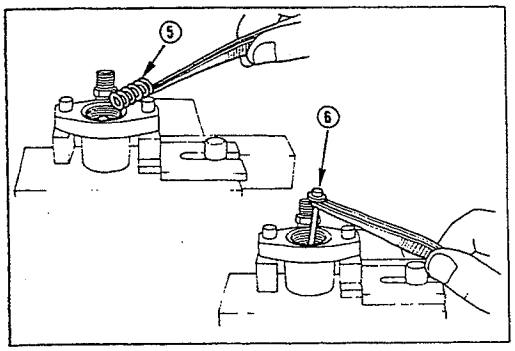
   The cap nut and gasket must be facing up.
2) Remove the cap nut and gasket ①, the lock nut ② from the injection nozzle holder ⑭.




**▲ Set Screw**

**▲ Adjusting Screw**

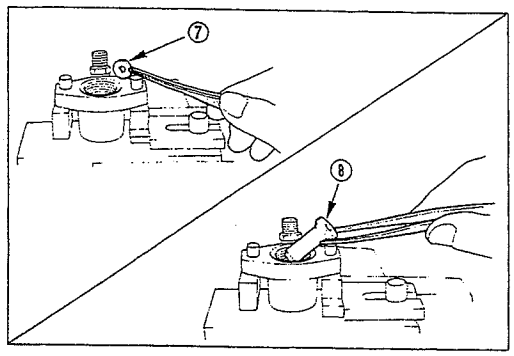
Remove the set screw ③, and the adjusting screw ④ from the injection nozzle holder.




**▲ Second Spring**

**▲ Second Push Rod**

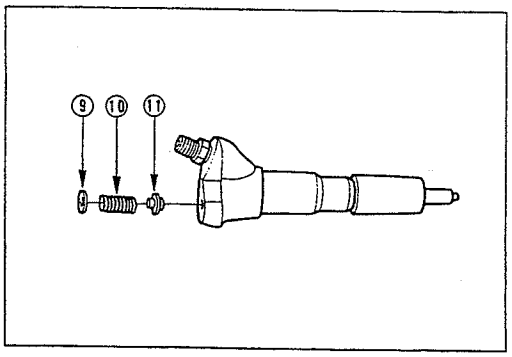
Remove the second spring ⑤, and the second push rod ⑥ from the injection nozzle holder.




▲ **Pre-Lift Adjusting Shim**

▲ **Spacer**

Remove the pre-lift adjusting shim ⑦, and the spacer ⑧ from the injection nozzle holder.

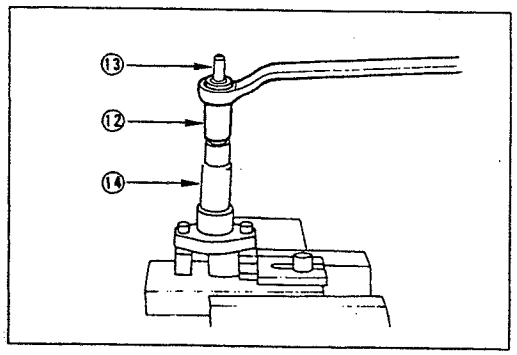



▲ **Adjusting Shim**

▲ **First Spring**

▲ **First Push Rod**

1) Remove the injection nozzle holder assembly from the vise.
2) Remove the adjusting shim ⑨, the first spring ⑩, and the first push rod ⑪ from the injection nozzle and injection nozzle holder.




▲ **Retaining Nut**

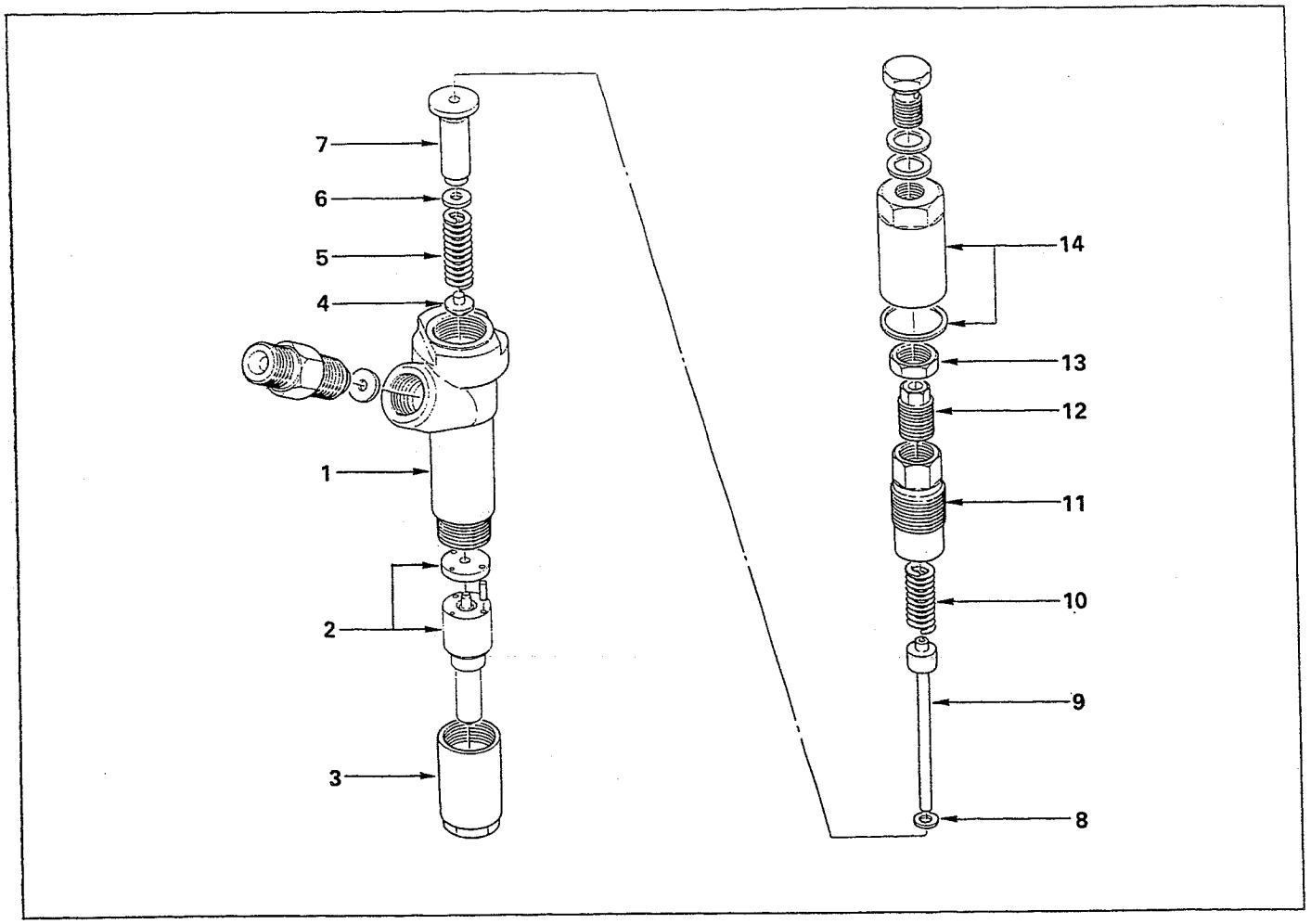
▲ **Injection Nozzle**

▲ **Injection Nozzle Holder**

1) Clamp the injection nozzle and injection nozzle assembly in a vise.

   The retaining nut must be facing up.
2) Remove the retaining nut ⑫ from the injection nozzle holder.
3) Remove the injection nozzle ⑬ from the injection nozzle holder ⑭.

## REASSEMBLY




### Reassembly Steps

- ▲ 1. Injection nozzle holder
- ▲ 2. Injection nozzle
- ▲ 3. Retaining nut
- ▲ 4. First push rod
- ▲ 5. First spring
- ▲ 6. Adjusting shim
- ▲ 7. Spacer
- ▲ 8. Pre-lift adjusting shim
- ▲ 9. Second push rod
- ▲ 10. Second spring
- ▲ 11. Set screw
- ▲ 12. Adjusting screw
- ▲ 13. Lock nut
- ▲ 14. Cap nut and gasket

## Important Operations

The two-spring type injection nozzle assembly procedure is the reverse of the disassembly procedure.

Carefully follow the instructions to assemble and adjust the two-spring type injection nozzle.

Remember that the injection nozzle used with an EGR equipped engine is different from the injection nozzle used with an engine not equipped with an EGR system.

The two injection nozzle types are not interchangeable.

Be absolutely sure that you are installing the correct injection nozzle.

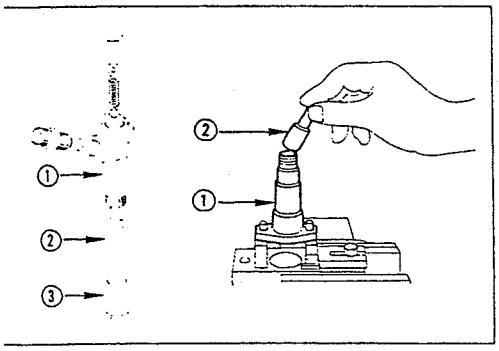
## INJECTION NOZZLE ADJUSTMENT

Injection nozzle adjustment must be performed during the assembly procedure.

Special measuring instruments and procedures are required to make the complicated and delicate adjustments. Carefully follow the instructions to adjust the injection nozzle.

Note the following:

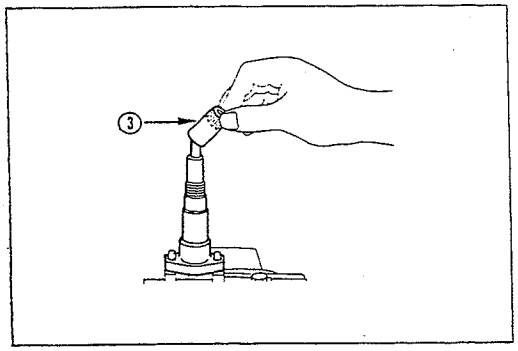
* Assemble the injection nozzle near the nozzle tester. This will save time and effort when making adjustments.
* The pre-lift measurement and adjustment must be made in increments of 0.01 mm (0.0004 in).
* Each injection nozzle part must be carefully washed in diesel oil and wiped free of all foreign material before assembly.




## INJECTION NOZZLE REASSEMBLY AND ADJUSTMENT PROCEDURE

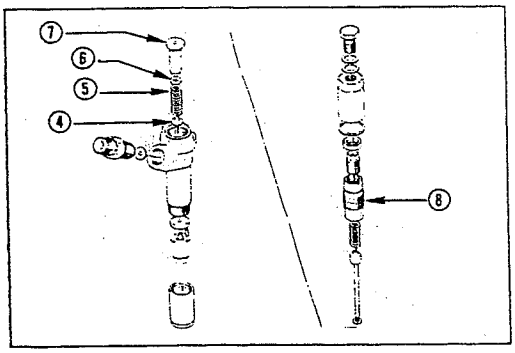
### First Nozzle Opening Pressure Adjustment

1. Clamp the injection nozzle holder ① in a vise.
   The nozzle holder cap must be facing down.
2. Align the injection nozzle ② knock pin with the nozzle holder knock pin hole.
   Install the injection nozzle to the nozzle holder.

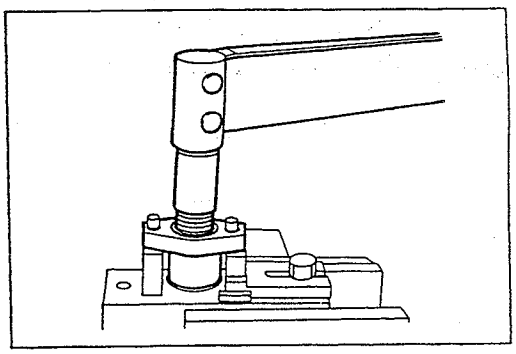



3. Install the retaining nut ③ to the nozzle holder.
4. Use a socket wrench to tighten the retaining nut to the specified torque.

| Retaining Nut Torque | kg·m(lb.ft/N·m) |
|---|---|
| 3.5 ± 0.5 (25.3 ± 3.6/34.30 ± 4.90) | |



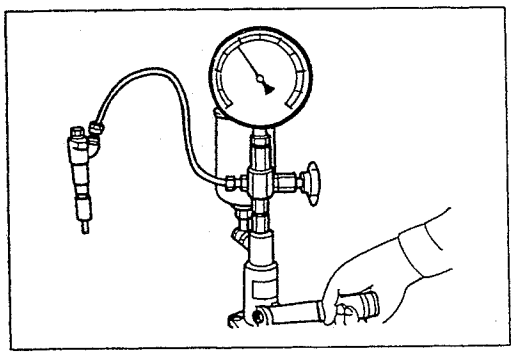

5. Reverse the position of the nozzle holder in the vise.
   The nozzle holder cap will now be facing up.
6. Install the first push rod ④, the first spring ⑤, the adjusting shim ⑥, and the spacer ⑦ to the nozzle holder.
7. Install the set screw ⑧ to the nozzle holder.



8. Use a socket wrench to tighten the set screw to the specified torque.

| Set Screw Torque | kg·m(lb.ft/N·m) |
|---|---|
| 3.75 ± 0.25 (27.1 ± 1.8/36.75 ± 2.45) | |

9. Remove the nozzle holder from the vise.



10. Attach the nozzle holder to the injection nozzle tester.
11. Apply pressure to the nozzle tester.

The injection nozzle should open within the specified opening pressure range.

| First Injection Nozzle Opening Pressure (Service Value) | kg/cm² (psi/kPa) |
|---|---|
| 4JB1T, 4JB1TC | 180 ± 5 (2,560 ± 71/17,653 ± 490) |

If the injection nozzle does not open within the specified range, the nozzle opening pressure must be adjusted.

Each shim thickness must be measured with a micrometer.

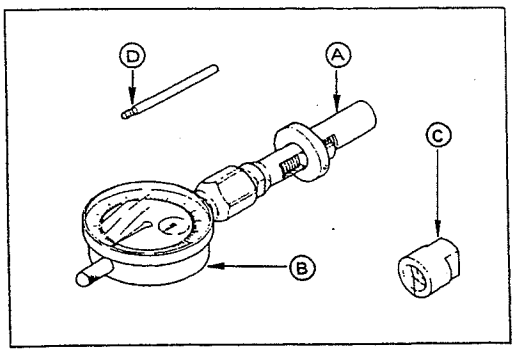
Adjust the opening pressure by installing shims of different thickness.

Installing a one-step larger or smaller shim will increase or decrease the nozzle opening pressure approximately 1.5 kg/cm² (21.3 psi/147 kPa).

| Adjusting Shim Availability | mm(in) |
|---|---|
| Range | 1.00 — 1.75 (0.04 — 0.07) |
| Increment | 0.01 (0.0004) |
| Maximum Number of Shims | 76 |

**WARNING:**

**TEST FLUID FROM THE INJECTION NOZZLE WILL SPRAY OUT UNDER GREAT PRESSURE. IT CAN EASILY PUNCTURE A PERSON'S SKIN. KEEP YOUR HANDS AWAY FROM THE INJECTION NOZZLE TESTER AT ALL TIMES.**



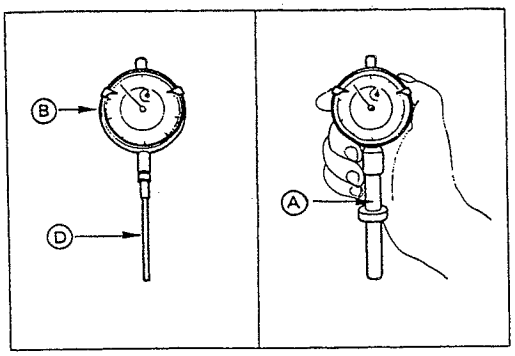

### Pre-Lift Adjusting Shim Selection

The pre-lift adjusting shim selection must be done directly after "First Nozzle Opening Pressure Adjustment."

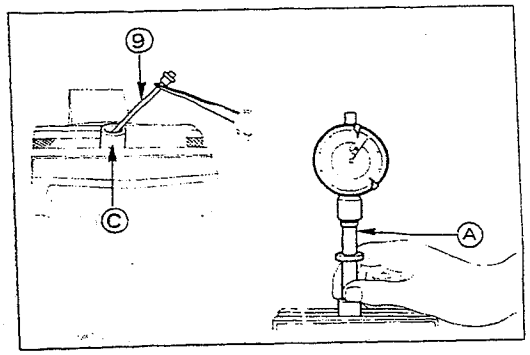
The following special tools are required for pre-lift adjustment shim selection.

Adjusting Device Kit: 5-8840-2138-0

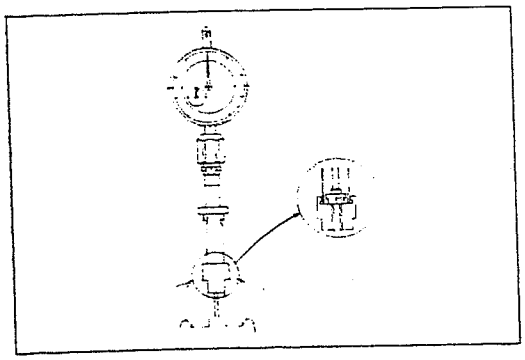
- (A) Adjusting Device : 5-8840-2139-0
- (B) Dial Indicator : 5-8840-2140-0
- (C) Base : 5-8840-2141-0
- (D) Pin : 5-8840-2142-0



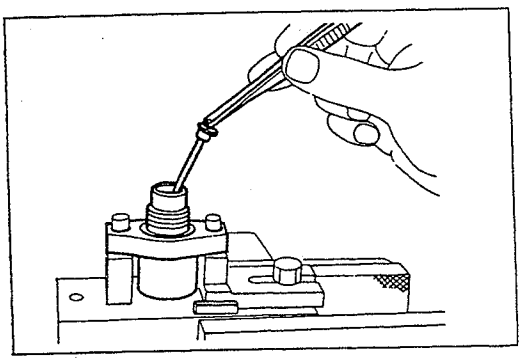

1. Insert the 60.4 mm (2.38 in) pin (D) to the dial indicator (B).
2. Set the dial indicator to the adjusting device (A).




3. Clamp the base Ⓒ in a vise.
4. Insert the second push rod ⑨ into the base.
5. Set the adjusting device Ⓐ to the base.

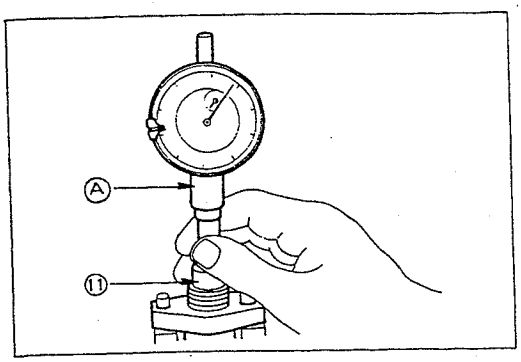


6. Hold the adjusting device down.
   Set the dial indicator to "0".
   Do this several times to be sure that the dial indicator is set correctly.
   Handle the adjusting device Ⓐ very carefully so as not to disturb the dial indicator setting.

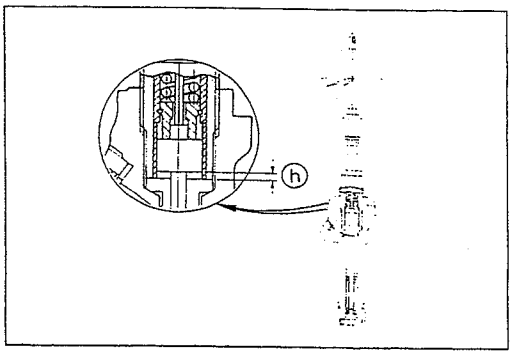


7. Clamp the nozzle holder in a vise and loosen the set screw.
   The nozzle holder cap nut must be facing up.
8. Insert the second push rod to the nozzle holder.
   Do not install the second spring and the pre-lift adjusting shim at this time.
9. Reinstall the set screw and tighten it to the specified torque.

| Set Screw Torque | kg·m(lb.ft/N·m) |
|---|---|
| | 3.75 ± 0.25 (27.1 ± 1.8/36.75 ± 2.45) |

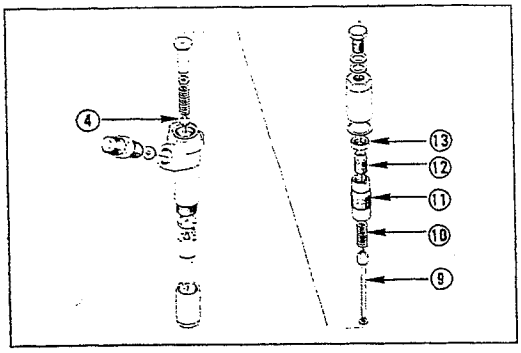



10. Carefully insert the adjusting device Ⓐ to the set screw ⑪.
11. Tighten the adjusting device at the intermediate position.
    Check that the dial indicator moves smoothly.




12. Push the adjusting device down.
    Note the pre-lift measurement ⓗ.
    Measurement must be in increments of 0.01 mm (0.004 in).
13. Select the appropriate pre-lift adjusting shim.
    $t = l + h$
    t: Shim thickness (Measured value)
    l: Pre-lift (Specified value)
    h: (h) measurement (Step 12)
    T: Actual selected shim thickness
    ($T = t \pm 0.015$ mm (0.0006 in))

    Example:
    If the ⓗ measurement is 0.98 mm (0.039 in) .....
    t = 0.10mm + 0.98mm = 1.08mm
    (t = 0.040in + 0.039in = 0.079in)
    T = 1.080mm ± 0.015mm = 1.065mm — 1.095mm
    (T = 0.079in ± 0.006in = 0.073in — 0.085in)
    A 1.08 mm (0.043 in) shim would be used.
14. Set the selected pre-lift adjustment shim aside.
    Do not install the shim at this time.
15. Remove the adjusting device from the nozzle holder.




### Second Nozzle Opening Pressure Adjustment

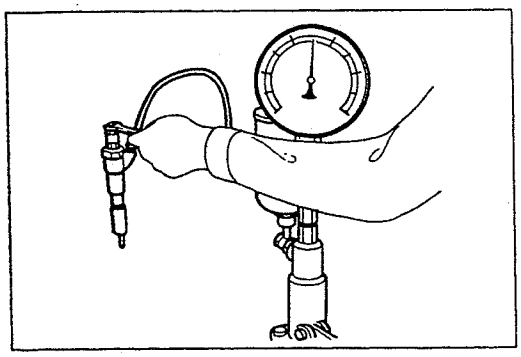
The second nozzle opening pressure adjustment must be done directly after "Pre-Lift Adjusting Shim Selection."

Second nozzle opening pressure cannot be adjusted after reassembly of the injection nozzle.

1. Install the second spring ⑩, the set screw ⑪, the adjusting screw ⑫, and the lock nut ⑬ to the nozzle holder.

   The first push rod ④ must be making contact with the second push rod ⑨.

   Do not install the pre-lift adjusting shim at this time.



2. Attach the nozzle holder to the injection nozzle tester.
3. Apply pressure to the nozzle tester.

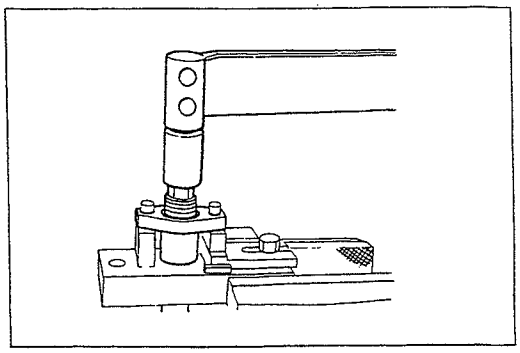
The injection nozzle should open within the specified opening pressure range.

Second Injection Nozzle Opening Pressure (Service Value) kg/cm $^2$ (psi/kPa)

| | |
|---|---|
| 4JB1T | 274.5 ± 3.5 (3,903 ± 50/26,920 ± 343) |
| 4JB1TC (WITHOUT EGR) | 274.5 ± 3.5 (3,903 ± 50/26,920 ± 343) |
| 4JB1TC (WITH EGR) | 224 ± 3.0 (3,185 ± 43/21,968 ± 294) |

If the nozzle opening pressure is outside the specified range, adjust it with the adjusting screw.

Temporarily tighten the lock nut.

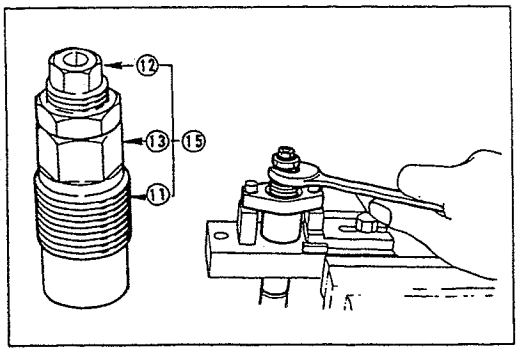


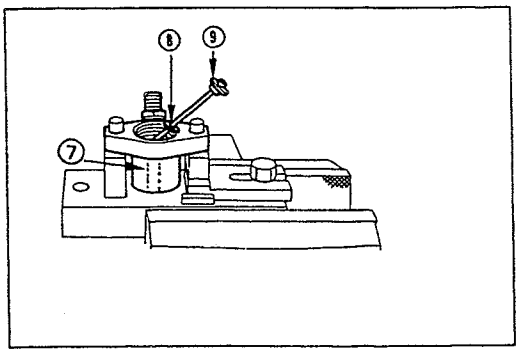
4. Remove the injection nozzle holder from the nozzle tester.
5. Clamp the nozzle holder in a vise.
6. Tighten the lock nut to the specified torque.

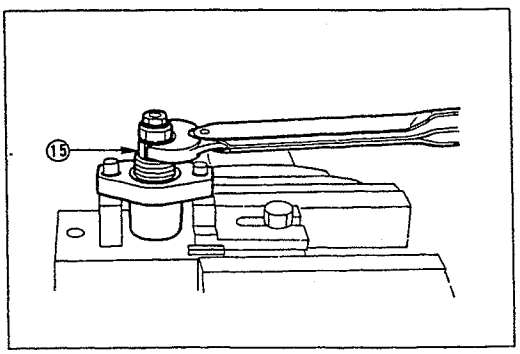
| Lock Nut Torque | kg ·m(lb.ft/N·m) |
|---|---|
| 2.25 ± 0.25 (16.3 ± 1.8/22.05 ± 2.45) | |

7. Recheck the injection nozzle opening pressure (Step 2 and 3).

   Nozzle opening pressure may change after the lock nut is tightened.




**Pre-Lift Adjusting Shim Installation**

Pre-lift adjusting shim installation must be done directly after "Second Nozzle Opening Pressure Adjustment."

1. Clamp the injection nozzle holder in a vise.
2. Remove the set screw assembly ⑮ (the adjusting screw ⑫, the lock nut ⑬, and the set screw ⑪ as a unit.

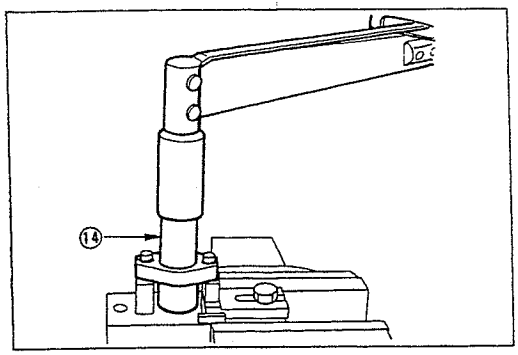
   Do not remove or loosen the lock nut separately from the set screw. The adjusted second nozzle opening pressure will be affected.
3. Remove the second push rod ⑨ from the nozzle holder.
4. Install the pre-lift adjusting shim ⑧ selected earlier to the nozzle holder.

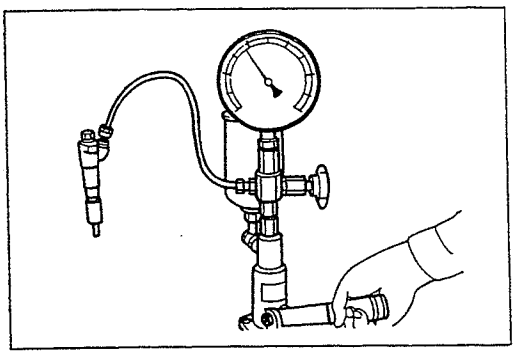
   Be sure that the shim is clean and free of all foreign material.
5. Install the second push rod to the nozzle holder.

   The shim must be installed between the spacer ⑦ and the second push rod.
6. Install the set screw assembly ⑮ to the nozzle holder.

   Take care not to disturb the lock nut.
7. Tighten the set screw assembly to the specified torque.

| Set Screw Torque | kg ·m(lb.ft/N·m) |
|---|---|
| 3.75 ± 0.25 (27.1 ± 1.8/36.75 ± 2.45) | |



**Final Inspection**

1. Install the cap nut ⑭ with gasket to the set screw assembly.
2. Tighten the cap nut to the specified torque.

| Cap Nut Torque | kg ·m(lb.ft/N ·m) |
|---|---|
| 3.25 ± 0.25 (23.5 ± 1.8/31.85 ± 2.45) | |

3. Remove the nozzle holder from the vise.
4. Attach the two-spring nozzle holder to the injection nozzle tester.
5. Check the first injection nozzle opening pressure and spray condition.

It is not possible to check the second injection nozzle opening pressure at this time. Check only the first injection nozzle opening pressure.

Check for abnormal noise and leakage.

If any abnormal conditions are discovered during inspection, the injection nozzle assembly must be readjusted or replaced.

0804

# INJECTION PUMP DATA

08040101

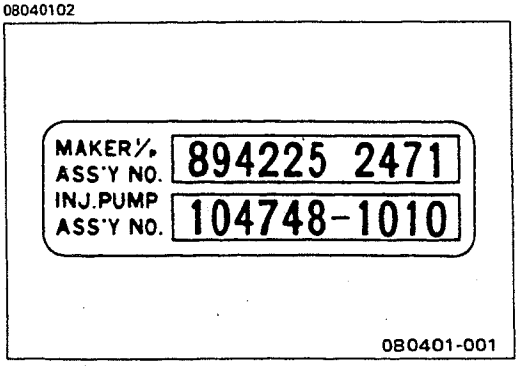
## 4JA1/4JB1/4JB1T/4JB1TC INJECTION VOLUME ADJUSTMENT

0804010202

## TEST CONDITION

| Item | | Condition |
|---|---|---|
| Injection Nozzle | | DKKC Part No.: 105780-0000<br>Bosch Type No: DN12SD12T |
| Injection holder | | DKKC Part No.: 105780-2080<br>Bosch Type No: EF8511/9 |
| Injection nozzle opening pressure | kg/cm²(psi/kPa) | 150 (2,133/14,700) |
| Injection line dimensions | mm(in) | |
| Inside diameter | | 2.0 (0.079) |
| Outside diameter | | 6.0 (0.236) |
| Length | | 840 (33.1) |
| Fuel delivery pressure | kg/cm²(psi/kPa) | 0.2 (2.84/19.6) |
| Test fuel | | SAE Standard Test Diesel Fuel (SAE967D)<br>ISO Standard Test Diesel Fuel (ISO4113) |
| Test fuel temperature | °C(°F) | 45 — 50 (113 — 122) |
| Identification numbers | | 104741-1313 104741-1401 104741-1740<br>104741-1322 104741-1410 104741-1741<br>104741-1332 104741-1421 104741-1750<br>104741-1342 104741-1430 104741-1751<br>104741-1370 104741-1480 104741-6352 |

08040102




## IDENTIFICATION PLATE AND NUMBER

Use the data following the injection pump identification number to adjust the injection volume.

## INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM

## Identification Numbers: 104741-1332

## Test Fuel: Standard Diesel Fuel SAE J967D or ISO 4113

| 1. Item | | Pump speed (rpm) | Settings | | Charge air Press (mmHg) | Delivery difference (cc) |
|---|---|---|---|---|---|---|
| 1.1 | Timing device travel | 1600 | 4.8 — 5.2 | mm | | |
| 1.2 | Supply pump pressure | 1600 | 5.3 — 5.7 | kg/cm² | | |
| 1.3 | Full load delivery without charge-air pressure | 1000 | 41.3 — 42.4 | cc/1000st | | 3.5 |
| 1.4 | Idle speed regulation | 385 | 5.7 - 9.7 | cc/1000st | | 2.0 |
| 1.5 | Start | 100 | Above 65.0 | cc/1000st | | |
| 1.6 | Full-load speed regulation | 2250 | 13.1 — 19.1 | cc/1000st | | 4.5 |
| 1.7 | Aneroid compensator adjustment | 1000 | Decrease 6.3 — 8.8 | cc/1000st | −161 ~ −167 | |

| 2. Test Specifications | | | | | |
|---|---|---|---|---|---|
| 2.1 Timing device | rpm<br>mm | 1200<br>1.4 — 2.2 | 1600<br>4.7 — 5.3 | 2000<br>7.4 — 8.2 | |
| 2.2 Supply pump | rpm<br>kg/cm² | 500<br>Above 1.1 | 1200<br>4.0 — 4.6 | 1600<br>5.3 — 5.7 | 2000<br>6.5 — 7.1 |
| 2.3 Overflow delivery | rpm<br>cc/10s | 1600<br>50.0 — 93.0 | | | |

2.4 Fuel delivery

| Speed control lever | Pump speed (rpm) | Fuel delivery (cc/1000st) | Charge air press (mmHg) |
|---|---|---|---|
| End stop | 1000<br>700<br>500<br>1600<br>2000<br>2250<br>2350<br>1000 | 40.8 — 42.9<br>32.6 — 38.6<br>30.3 — 38.3<br>43.1 — 49.1<br>38.0 — 44.1<br>12.6 — 19.6<br>Below 12.0<br>Decrease 5.6 — 9.5 | −161 ~ −167 |
| Switch-off | 385 | 0 | |
| Idle stop | 300<br>385<br>450 | 9.5 — 15.5<br>5.7 — 9.7<br>Below 5.0 | |
| Partial load | | | |
| 2.5 Solenoid | Maximum cut-in voltage (V)<br>Test voltage (V) | 8<br>12 — 14 | |

| 3. Dimensions (For assembly and adjustment) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Designation | | | | | | |
| Identification numbers | K (mm) | KF (mm) | MS (mm) | α (deg) | A (mm) | β (deg) | B (mm) |
| 104741-1332 | 2.7 — 2.9 | 4.9 — 5.1 | 0.9 — 1.1 | 14 — 22 | 11.3 — 14.8 | 32 — 42 | 10.1 — 13.6 |

## INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM

**Identification Numbers: 104741-1342**

**Test Fuel: Standard Diesel Fuel SAE J967D or ISO 4113**

| 1. | Item | Pump speed (rpm) | Settings | | Charge air press (mmHg) | Delivery difference (cc) |
|---|---|---|---|---|---|---|
| 1.1 | Timing device travel | 1600 | 4.8 — 5.2 | mm | | |
| 1.2 | Supply pump pressure | 1600 | 5.3 — 5.7 | kg/cm² | | |
| 1.3 | Full load delivery without charge-air pressure | 1000 | 41.3 — 42.4 | cc/1000st | | 3.5 |
| 1.4 | Idle speed regulation | 385 | 5.7 - 9.7 | cc/1000st | | 2.0 |
| 1.5 | Start | | Above 65.0 | cc/1000st | | |
| 1.6 | Full-load speed regulation | 2250 | 13.1 — 19.1 | cc/1000st | | 4.5 |
| 1.7 | Aneroid compensator adjustment | 1000 | Decrease 6.3 — 8.8 | cc/1000st | | |

| 2. | Test Specifications | | Solenoid timer ON | OFF | | |
|---|---|---|---|---|---|---|
| 2.1 | Timing device | rpm<br>mm | 1200<br>1.4 — 2.2 | 1600<br>4.7 — 5.3 | 2000<br>7.4 — 8.2 | |
| 2.2 | Supply pump | rpm<br>kg/cm² | 500<br>Above 1.1 | 1200<br>4.0 — 4.6 | 1600<br>5.3 — 5.7 | 2000<br>6.5 — 7.1 |
| 2.3 | Overflow delivery | rpm<br>cc/10s | 1600<br>50.0 — 93.0 | | | |

2.4 Fuel delivery

| Speed control lever | Pump speed (rpm) | Fuel delivery (cc/1000st) | Charge air press (mmHg) |
|---|---|---|---|
| End stop | 1000<br>700<br>500<br>1600<br>2000<br>2250<br>2350<br>1000 | 40.8 — 42.9<br>32.6 — 38.6<br>30.3 — 38.3<br>43.1 — 49.1<br>38.0 — 44.1<br>12.6 — 19.6<br>Below 12.0<br>Decrease 5.6 — 9.5 | −161 ~ −167 |
| Switch-off | 385 | 0 | |
| Idle stop | 300<br>385<br>450 | 9.5 — 15.5<br>5.7 — 9.7<br>Below 5.0 | |
| Partial load | | | |
| 2.5 Solenoid | Maximum cut-in voltage (V)<br>Test voltage (V) | 8<br>12 — 14 | |

| 3. Dimensions (For assembly and adjustment) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Designation | | | | | | |
| Identification numbers | K (mm) | KF (mm) | MS (mm) | α (deg) | A (mm) | β (deg) | B (mm) |
| 104741-1342 | 2.7 — 2.9 | 4.9 — 5.1 | 0.9 — 1.1 | 14 — 22 | 11.3 — 14.8 | 32 — 42 | 10.1 — 13.6 |

## INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM

## Identification Numbers: 104741-1741, 104741-1751

## Test Fuel: Standard Diesel Fuel SAE J967D or ISO 4113

| 1. Item | | Pump speed (rpm) | Settings | | Charge air press (mmHg) | Delivery difference (cc) |
|---|---|---|---|---|---|---|
| 1.1 | Timing device travel | 1700 | 5.0 — 5.4 | mm | 590 — 610 | |
| 1.2 | Supply pump pressure | 1700 | 5.2 — 5.6 | kg/cm² | 590 — 610 | |
| 1.3 | Full load delivery without charge-air pressure | *1250 (Full)<br>900 (BCS) | 63.2 — 64.2<br>50.9 — 51.9 | cc/1000st | 590 — 610<br>340 — 360 | 3.5<br>4.5 |
| 1.4 | Idle speed regulation | 385 | 3.1 - 7.1 | cc/1000st | 0 | 2.0 |
| 1.5 | Start | 100 | 60 — 100 | cc/1000st | 0 | |
| 1.6 | Full-load speed regulation | 2300 | 19.3 — 25.4 | cc/1000st | 590 — 610 | 4.5 |
| 1.7 | | | | cc/1000st | | |

| 2. Test Specifications | | Solenoid timer | | | | |
|---|---|---|---|---|---|---|
| | | ON | OFF | | | |
| 2.1 Timing device (590 — 610 mmHg) | rpm<br>mm | 550<br>Above 0.5 | | 1450<br>2.1 — 2.9 | 1700<br>4.9 — 5.5 | 1850<br>5.8 — 6.5 |
| 2.2 Supply pump (590 — 610 mmHg) | rpm<br>kg/cm² | 500<br>4.0 — 6.0 | 500<br>Above 0.8 | 1450<br>4.3 — 4.9 | 1700<br>5.2 — 5.6 | 1850<br>5.8 — 6.2 |
| 2.3 Overflow delivery (590 — 610 mmHg) | rpm<br>cc/10s | | | 1700<br>73 — 150 | | |

2.4 Fuel delivery

| Speed control lever | Pump speed (rpm) | Fuel delivery (cc/1000st) | Charge air press (mmHg) |
|---|---|---|---|
| End stop | 1250(Full)<br>600<br>750<br>900(BCS)<br>1800<br>2300<br>2500 | 62.7 — 64.7<br>33.1 — 41.1<br>38.7 — 42.7<br>50.4 — 52.4<br>54.6 — 61.6<br>18.8 — 25.8<br>Below 5.0 | 590 — 610<br>90 — 110<br>170 — 190<br>340 — 360<br>590 — 610<br>590 — 610<br>590 — 610 |
| Switch-off | 385 | 0 | |
| Idle stop | 385<br>500<br>If there is no designation in the specification for the solenoid timers "ON—OFF" position, then the position should regarded as "OFF". | 3.1 — 7.1<br>Below 3.0 | Observations:<br>• Comform the end of the BCS stroke at the point".<br>• Attach the timer's measuring device at the low pressure side. |
| Partial load | | | |
| 2.5 Solenoid | Maximum cut-in voltage (V)<br>Test voltage (V) | 8<br>12 — 14 | |

| 3. Dimensions (For assembly and adjustment) | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Designation | | | | | | |
| Identification numbers | K (mm) | KF (mm) | MS (mm) | α (deg) | A (mm) | β (deg) | B (mm) |
| 104741-1741<br>104741-1751 | 2.7 — 2.9 | 5.7 — 5.9 | 0.8 — 1.0 | 14 — 22 | 11.3 — 14.7 | 32 — 42 | 10.1 — 13.6 |

## INJECTION VOLUME AND GOVERNOR PERFORMANCE DIAGRAM

### Identification Numbers: 104741-6352

### Test Fuel: Standard Diesel Fuel SAE J967D or ISO 4113

| 1. | Item | Pump speed (rpm) | Settings | | Charge air press (mmHg) | Delivery difference (cc) |
|---|---|---|---|---|---|---|
| 1.1 | Timing device travel | 1500 | 4.9 — 5.3 | mm | 590 — 610 | |
| 1.2 | Supply pump pressure | 1500 | 4.7 — 5.1 | kg/cm² | 590 — 610 | |
| 1.3 | Full load delivery without charge-air pressure | 1250 | 68.1 — 69.1 | cc/1000st | 590 — 610 | 3.5 |
| | | 800 | 47.7 — 48.7 | cc/1000st | 295 — 315 | 4.5 |
| 1.4 | Idle speed regulation | 385 | 6.1 — 10.1 | cc/1000st | 0 | 2.0 |
| 1.5 | Start | 100 | 80 — 90 | cc/1000st | 0 | |
| 1.6 | Full-load speed regulation | 2300 | 16.6 — 22.6 | cc/1000st | 590 — 610 | 4.5 |

| 2. | Test Specifications | Solenoid timer ON | | OFF | | |
|---|---|---|---|---|---|---|
| 2.1 | Timing device (590 — 610 mmHg) | rpm<br>mm | | 1500<br>4.9 — 5.3 | 1700<br>6.7 — 7.5 | 1900<br>8.3 — 9.0 |
| 2.2 | Supply pump (590 — 610 mmHg) | rpm<br>kg/cm² | | 1500<br>4.7 — 5.1 | | 1900<br>5.8 — 6.4 |
| 2.3 | Overflow delivery (590 — 610 mmHg) | rpm<br>cc/10s | 1500<br>57 — 100 | 1500<br>65 — 108 | | |
| 2.4 | Fuel delivery | | | | | |

| Speed control lever | Pump speed (rpm) | Fuel delivery (cc/1000st) | Charge air press (mmHg) |
|---|---|---|---|
| Max. speed | 1250<br>1250<br>400<br>600<br>800<br>1900<br>2300<br>2400 | 47.6 — 54.6<br>67.6 — 69.6<br>36.5 — 47.5<br>34.7 — 40.7<br>47.2 — 49.2<br>66.5 — 75.5<br>16.1 — 23.1<br>Below 12.0 | 0<br>590 — 610<br>0<br>130 — 150<br>295 — 315<br>590 — 610<br>590 — 610<br>590 — 610 |
| Switch-off | 385 | 0 | 0 |
| Idle stop | 385<br>500 | 6.1 — 10.1<br>Below 3.0 | 0 |
| Partial load | | | |
| 2.5 Solenoid | Maximum cut-in voltage (V)<br>Test voltage (V) | 8<br>12 — 14 | |

| 3. | Dimensions (For assembly and adjustment) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Designation | | | | | | | |
| Identification numbers | K (mm) | KF (mm) | MS (mm) | BCS (mm) | α (deg) | A (mm) | β (deg) | B (mm) |
| 104741-6352 | 2.7 — 2.9 | 5.4 — 5.6 | 0.9 — 1.1 | 3.8 — 4.0 | 20 — 28 | — | 43 — 53 | — |

0900

# TURBOCHARGER

0901

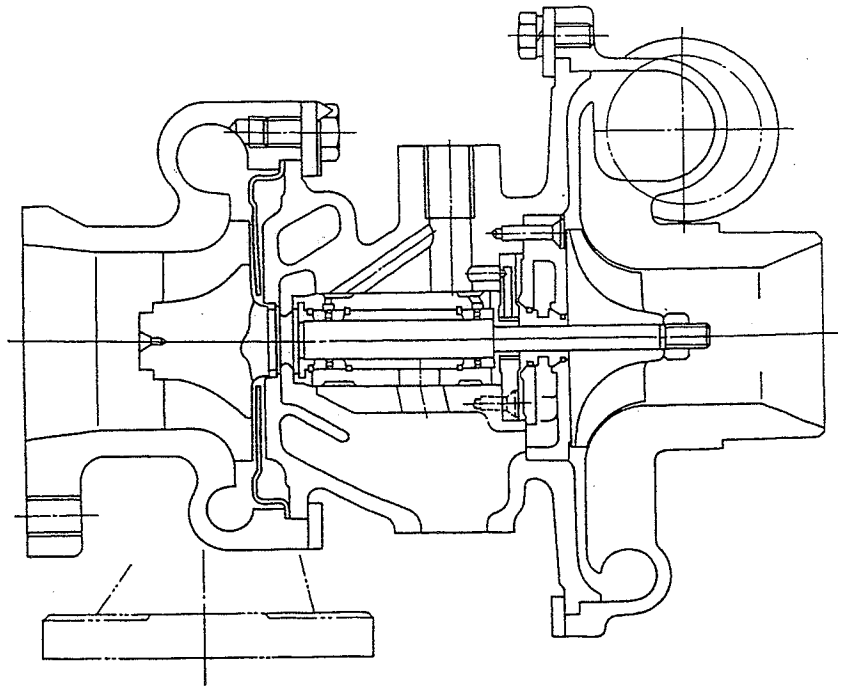
## MAIN DATA AND SPECIFICATIONS

| Item | —'88 4JB1T Engine | 4JB1TC and '89— 4JB1T |
|---|---|---|
| Model | IHI RHB52 | |
| Turbine type | Radial-inflow | |
| Compressor type | Radial-outflow | |
| Maximum permissible speed rpm | 172,000 | |
| Wastegate opening pressure mmHg(inHg) | 600 (23.62) | 660 (25.98) |
| Weight kg(lb) | 4.6 (10.1) | |

IHI : Ishikawajima-Harima Heavy Industries., Ltd.

0902A

# GENERAL DESCRIPTION



090201B

The turbocharger internal mechanism consists of the turbine wheel, the compressor wheel, and the radial bearings. These parts are supported by the bearing housing.

The turbocharger external mechanism consists of the compressor housing air intake port and the turbine housing air exhaust port.

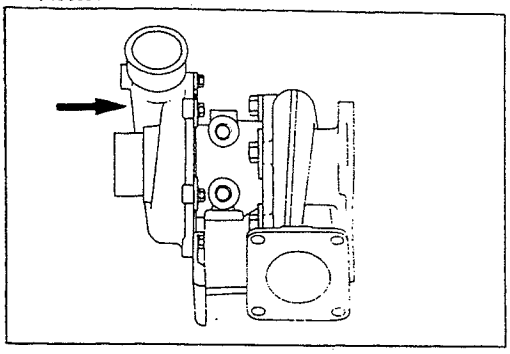
The turbocharger increases air intake efficiency. This results in increased engine power, reduced fuel consumption, and minimal engine noise.

The turbocharger operates at very high speeds and temperatures. Part materials have been carefully selected and machined to extremely high precision.

Turbocharger servicing requires great care and expertise.

If reduced performance is noted, check the engine for damage or wear. If there is no apparent engine damage or wear, trouble with the turbocharger is indicated.

0903, 090301A



## IDENTIFICATION OF UNIT

The turbocharger nameplate gives the date of manufacture and other important information required to identify the unit when service inquiries are made.

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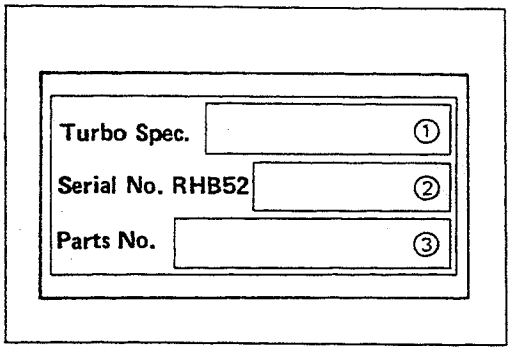


The turbocharger nameplate has the following information stamped on it.

① Turbo Specification Number, Production Year and Month

② Production Date, Daily Serial Number

③ ISUZU Parts Number

0904

# INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

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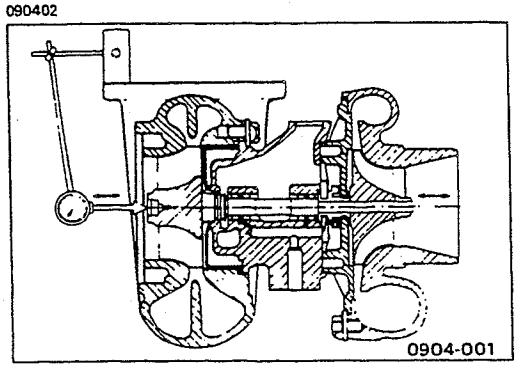
Contact the "ISUZU MOTORS LIMITED" Dealer service department for major reqairs and maintenance.

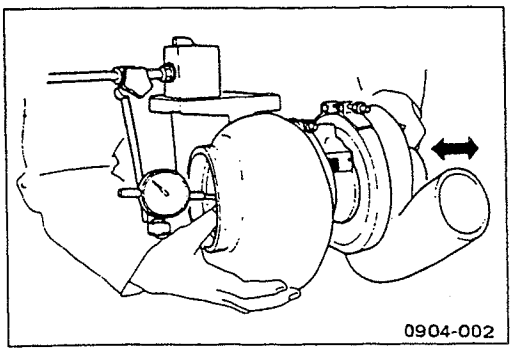
090401B

Important wheel shaft end play and bearing clearance standards and limits are included below for your reference.

090402



0904-001



0904-002

## Wheel Shaft End Play

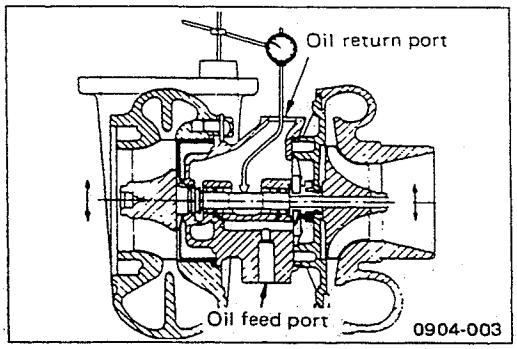
Use a dial indicator to measure the wheel shaft end play.

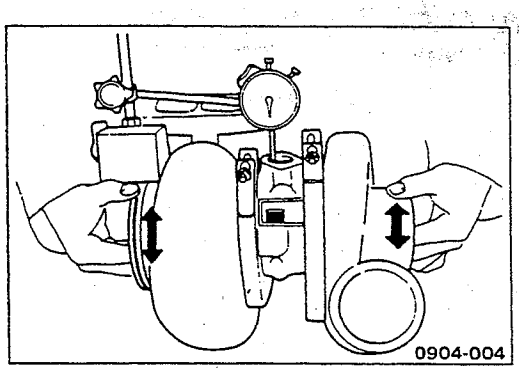
Apply a force of 1.2 kg (2.6 lb/11.76N) alternately to the compressor wheel end and the turbine wheel end.

Wheel Shaft End Play mm(in)

| Standard | Limit |
|---|---|
| 0.03—0.06 (0.0012—0.0024) | 0.09 (0.0035) |

090403




**Wheel Shaft and Bearing Clearance**

Use a dial indicator to measure the wheel shaft and bearing clearance.

Wheel Shaft and Bearing Clearance mm(in)

| Standard | Limit |
|---|---|
| 0.056—0.127 (0.002—0.005) | 0.127 (0.005) |