2. SPECIFICATIONS

	Engine Model No.	S6E	S6E2
Main	Type	Diesel	

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2. LIST OF TIGHTENING TORQUES

2.1 Tightening Torques for Main Bolts

mm (in)

Part to be tightened	Thread Diameter–Pitch	Width across flats	Tightening torque			Remarks
			kgf•m	lbf•ft	N•m	
Cylinder head bolt	12–1.75	19	12 ±0.5	87±4	118±5	[wet]

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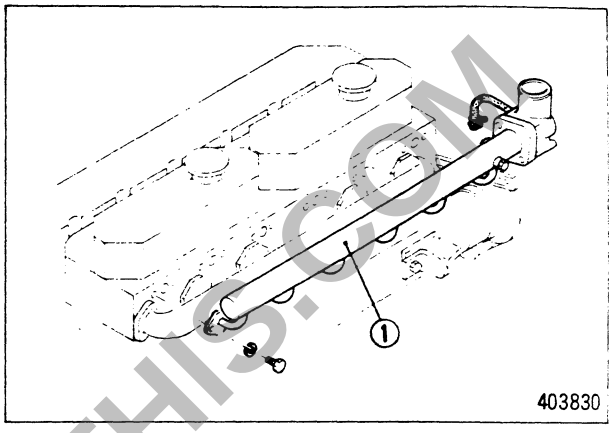
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This section describes the procedures and major points for removing and mounting auxiliary equipment on the assumption that the engine is to be overhauled.

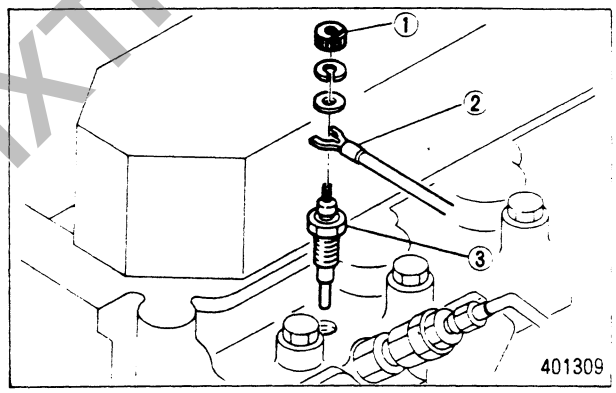
1. REMOVING AUXILIARIES

(1) Removing the Water Outlet Pipe
After removing the water bypass hose, remove pipe-mounting bolts and remove water outlet pipe (1) from the cylinder head.



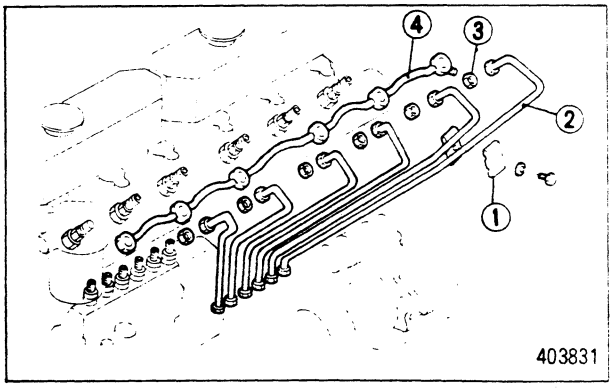
(2) Removing the Glow Plug
Loosen nut (1) and remove wire (2) and glow plug (3).

CAUTION
Be sure to cover the hole from which the glow plug has been removed with tape. Take care to prevent dirt and dust from entering into the head.



(3) Removing the Injection Pipe
(a) Remove pipe clamp (1) and injection pipe (2).
(b) Remove locknut (3) and leak-off pipe (4).

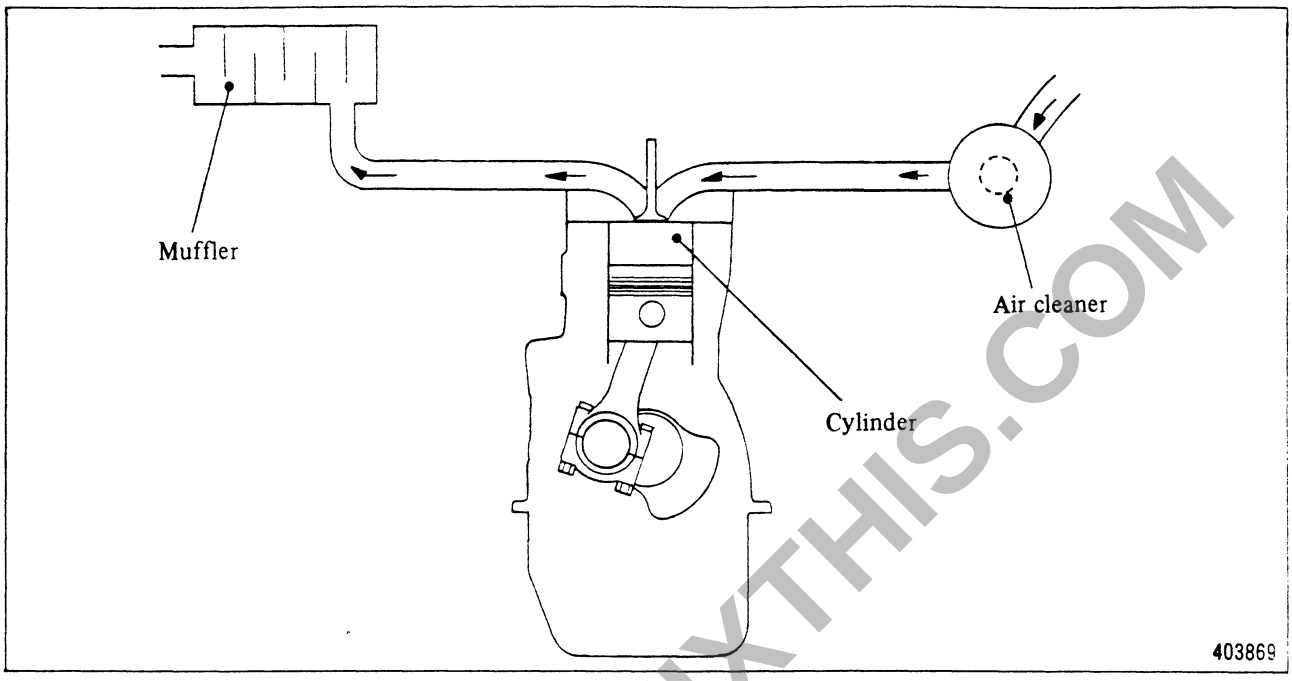
CAUTION
Be sure to cover the connection at which the injection pump is coupled to the injection pipe of the nozzle holder with a rubber cap. Take care to prevent foreign matter from entering into the fuel system.



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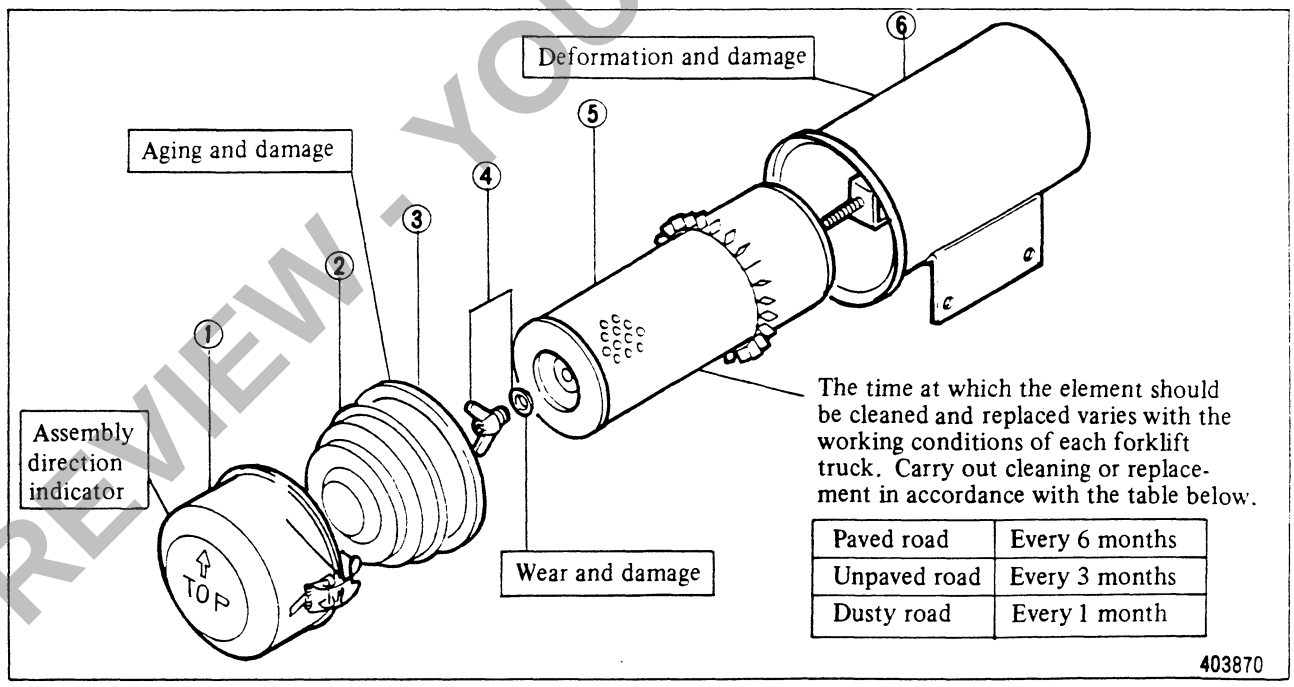
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1. OUTLINE OF INLET AND EXHAUST SYSTEM



2. PAPER ELEMENT TYPE AIR CLEANER

Disassembly and Inspection



The time at which the element should be cleaned and replaced varies with the working conditions of each forklift truck. Carry out cleaning or replacement in accordance with the table below.

Paved road	Every 6 months
Unpaved road	Every 3 months
Dusty road	Every 1 month

① Dust pan
② Baffle plate
③ Packing
④ Wind nut and seal washer
⑤ Element
⑥ Housing

CAUTION
Do not remove the air cleaner until after stopping the engine. Before starting a service operation, be sure to completely plug the inlet port to keep out foreign matter.

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RANGE OF COVERAGE AND HOW TO USE THIS MANUAL

This manual covers the specifications, service standards and adjustment and other service procedures, such as disassembly, inspection, repair, reassembly of the Mitsubishi Diesel engines mounted on fork lift trucks on a group-by-group basis.

The main contents by group are enumerated in a general table of contents, and each group carries its each table of contents on its cover page.

For operation, periodic inspection and maintenance procedures, see the Instruction Manual; for the procedures for ordering component parts and other replacements, see the Parts Catalog; and for structures and functions, see the relevant training materials.

1. Range of Coverage

(1) Component part names, as used in drawings and in the text, are numbered in the order of disassembly.

(2) The inspections to be conducted during the disassembly are encircled in ☐ on the disassembly drawing.

(3) The service standards to be complied with in the inspection/repairing operations are specified at every relevant section in the text. They are also enumerated in a list in Group No.2.

(4) The sequence in which parts must be reassembled during an assembly operation is in the order of ⑤ → ② → ④ → ③ → ①.

(5) Those precautions which especially relate to safety are marked in the text with the following:

⚠ ..... To prevent human injury

CAUTION ..... To prevent the engine from being damaged and to carry out an operation more efficiently

NOTE ..... To give a complementary explanation

(6) Those tightening torques which relate to a screw with engine oil applied to its threads are marked "WET." The portions not so indicated, therefore, should be remain dry.

2. Terminology

Nominal value ..... indicating the reference nominal size of a part to be measured.

Assembly standard ..... indicating the dimensions or standard performance of an independent part.

Standard clearance ..... indicating a clearance between parts.

Repair limit ..... indicating that a repair is required once the repair limit given as a numerical value has been reached.

Service limit ..... indicating that a part be replaced with a new one once the service limit given as a numerical value has been reached.

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Unit: mm (in)

<table>
<tr><th>Section</th><th colspan="2">Part</th><th>Nominal value</th><th>Assembly standard [Standard clearance]</th><th>Repair limit [Clearance]</th><th>Service limit [Clearance]</th><th>Remarks</th></tr>
<tr><td rowspan="4">Fuel system</td><td>Governor</td><td colspan="6">Adjustment: VH: adjusting lever angle NP: pump speed (rpm)
RW: rack position [mm (in)]
[S6E]
<table>
<tr><th colspan="3">High speed control</th><th colspan="3">Medium speed control</th><th colspan="3">Low speed control</th></tr>
<tr><th>VH</th><th>NP</th><th>RW</th><th>VH</th><th>NP</th><th>RW</th><th>VH</th><th>NP</th><th>RW</th></tr>
<tr><td rowspan="2">47°±5°</td><td rowspan="2">1200
1240–
1320
1320</td><td rowspan="2">8.2±0.1
(0.377±0.004)
Initially
2.3±1
(0.091±0.039)</td><td rowspan="2">47°±5°</td><td rowspan="2">850
1050</td><td rowspan="2">8.8±0.1
(0.346±0.004)
8.4±0.2
(0.331±0.008)</td><td rowspan="2">21.5°±5°</td><td>350</td><td>2.8±0.5
(0.110±0.020)
(Set lever)</td></tr>
<tr><td>330</td><td>4.8±0.1
(0.189±0.004)
(Set subspring)</td></tr>
</table>
[S6E2]
<table>
<tr><th colspan="3">High speed control</th><th colspan="3">Medium speed control</th><th colspan="3">Low speed control</th></tr>
<tr><th>VH</th><th>NP</th><th>RW</th><th>VH</th><th>NP</th><th>RW</th><th>VH</th><th>NP</th><th>RW</th></tr>
<tr><td rowspan="2">48°±5°</td><td rowspan="2">1200
1220–
1230
1280</td><td rowspan="2">9.2±0.1
(0.362±0.004)
Initially
4.1±1
(0.161±0.039)</td><td rowspan="2">48°±5°</td><td rowspan="2">600
800</td><td rowspan="2">10.1±0.2
(0.398±0.008)
9.7±0.1
(0.381±0.004)</td><td rowspan="2">21.5°±5°</td><td>325</td><td>5.8±0.1
(0.228±0.004)
(Set lever)</td></tr>
<tr><td>375</td><td>4.5±0.1
(0.177±0.004)
(Set subspring)</td></tr>
</table></td></tr>
<tr><td>Injection nozzle</td><td>Valve opening pressure</td><td>120 kgf/cm² (1.707 psi)</td><td>+5–+15 kgf/cm² (+71–213 psi)</td><td></td><td></td><td>Adjust with shim. A 0 mm (0.004 in) shim will cause a change of 10 kgf/cm² (142 psi).</td></tr>
<tr><td></td><td>Injection angle</td><td>0°</td><td></td><td></td><td></td><td>[light oil at about 20°C (68°F)]. After flushing in clean light oil, replace nozzle tip if nozzle remains defective.</td></tr>
<tr><td></td><td>Needle valve seat oil tightness</td><td colspan="3">Apply oil pressure lower by 20 kgf/cm² (284 psi) than valve0opening pressure and keep it for 10 seconds.</td><td></td><td>Flush or replace nozzle tip.</td></tr>
<tr><td rowspan="4">Electrical system</td><td>Starter</td><td>Commutator outside diameter</td><td>φ38.7 (1.52)</td><td></td><td></td><td>37.7 (1.48)</td><td></td></tr>
<tr><td rowspan="2">Brush</td><td>Length</td><td>17 (0.67)</td><td></td><td></td><td>11 (0.43)</td><td></td></tr>
<tr><td>Spring pressure</td><td>3.0 kg (6.6 lb)</td><td></td><td></td><td>1.8 (4.0)</td><td></td></tr>
<tr><td colspan="2">Pinion shaft thrust gap</td><td>0.5 (0.020)</td><td>0 and below unacceptable</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Pinion gap</td><td>0.1–2.5 (0.004–0.098)</td><td></td><td></td><td></td><td></td></tr>
</table>

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3. PERFORMANCE TEST

3.1 Condition in which Engine is Equipped

The performance test is to be conducted while being equipped with the necessary accessories such as a fan, air cleaner and alternator.

3.2 Test Items

(1) Fuel consumption
(2) No-load maximum speed
(3) No-load minimum speed

3.3 Test Procedure

(1) Fuel consumption test
  (a) Measured engine speed
  (b) Fuel injection
  (c) Output
(2) Adjust the governor to set the engine to the no-load maximum speed.
(3) No-load minimum speed test
  (a) Under the no-load condition, operate the levers and fix them to a stable minimum engine speed. Select an engine speed, within the range where the engine will not stop even if slowed down quickly from a high speed.
  (b) No-load minimum speed 650 – 700 rpm

(4) Miscellaneous
Check the engine for possible gas leakage, coolant leakage, abnormal noise, oil leakage and hunting, and make corrections when necessary.

(5) Correcting the Engine Output
The output of a diesel engine depend upon the atmosphere, atmospheric temperature and humidity. It is necessary, therefore, to adjust the output according to the standard atmospheric conditions [atmosphere 760 mmHg (29.9 in Hg), room temperature 20°C (68°F) and partial pressure of steam in the atmosphere 11.4 mmHg (0.449 in Hg)].
Correct the measured axial output and torque by multiplying them by a correcting coefficient obtained from the expression given below.

$$K = \frac{760-11.4}{H-H^w}\sqrt{\frac{273+t}{293}}$$

where, H: measured atmosphere (mmHg)
H^w: partial pressure of steam in the atmosphere (mmHg)
t: room temperature (°C)

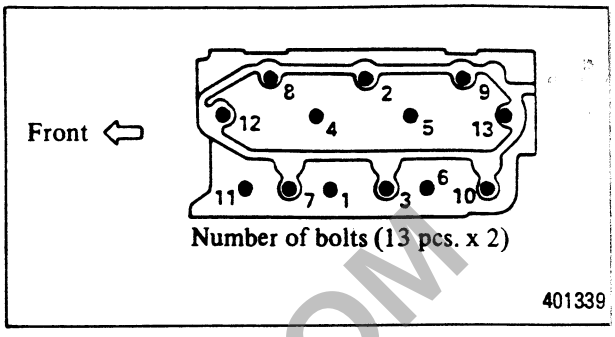
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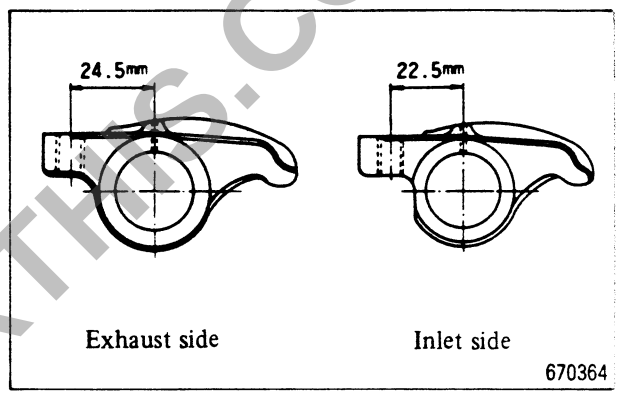
(c) Uniformly tighten the cylinder head bolts to the specified torque in the order illustrated.

Unit: kgf.m(lbf.ft) [N.m]

Tightening torque	12 ± 0.5 (87 ± 4) [118 ± 5]

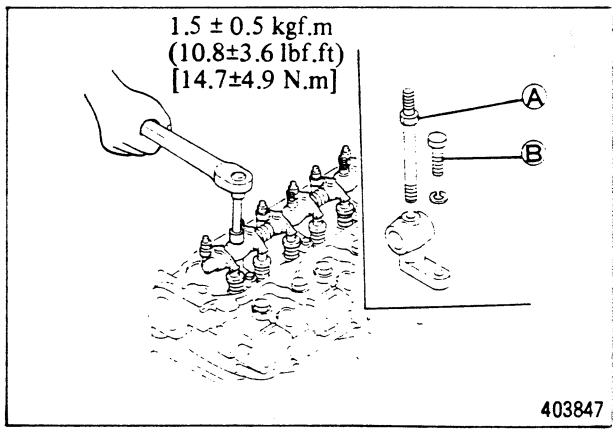


(4) Assembling the Rocker Shaft Assembly
The shapes and dimensions of rocker arms differ between the inlet and exhaust sides. Take care not to mistake them upon assembly. After completion of the assembly, make certain that rocker arms move with ease.



(5) Mounting the Rocker Shaft Assembly
To tighten the rocker shaft bracket clamping bolts, follow the procedure for removing the bracket in reverse. In other words, tighten long bolt (A) first and then short bolt (B).

(6) Adjusting the Valve Clearance
For the adjustment procedure, see Section 1.1, Group No. 5.



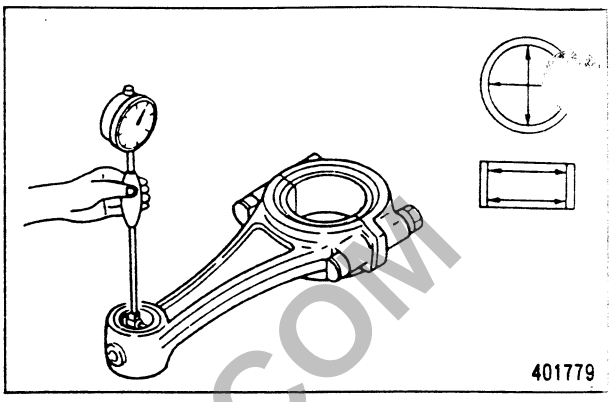
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(2) Measuring the Clearance between the Connecting Rod Bushing and Piston Pin
Measure both connecting rod bushing bore and piston pin outer diameter. If the bore or outer diameter exceeds the repair limit, replace the bushing or piston pin.

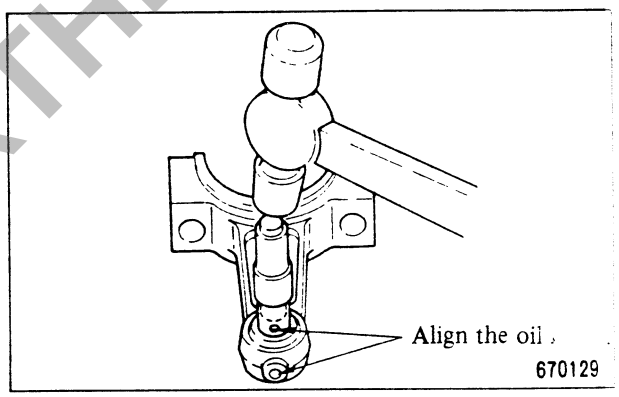
Unit: mm (in)

	Assembly standard	Repair limit
Bushing bore	28.045–28.020 (1.1041–1.1031)	
Clearance between bushing and piston pin	0.020–0.051 (0.00079–0.0020)	0.080 (0.0031)



Measuring the bore of the connecting rod bushing

(3) Replacing the Connecting Rod Bushing
(a) To replace the connecting rod bushing, use a puller as shown in the drawing.
(b) Align the bushing oil hole with that of the connecting rod.
(c) Press-fit the bushing on the side where the connecting rod is chamfered at the end.
(d) After press-fitting the bushing, insert the piston and make certain that it can slide easily and without any play.

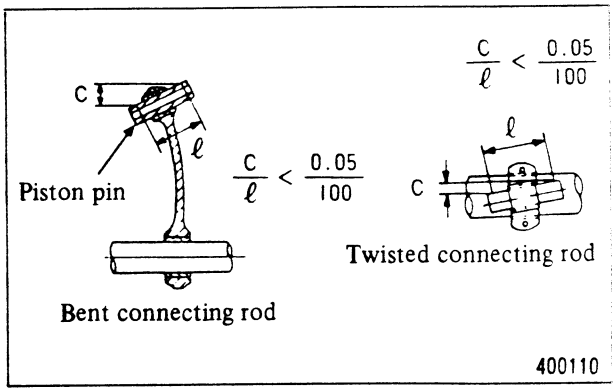


Replacing the bushing of the connecting rod

(4) Checking the Connecting Rod for Bends and Twists
(a) To make the check, measure value C and ℓ as shown. Then, use a press to correct the connecting rod so that C will equal 0.05 mm (0.002 in) per 100 mm (3.94 in) in ℓ.

Unit: mm (in)

	Assembly standard	Service limit
Bends and twists of connecting rod	0.05/100 max.	0.15 (0.0059)

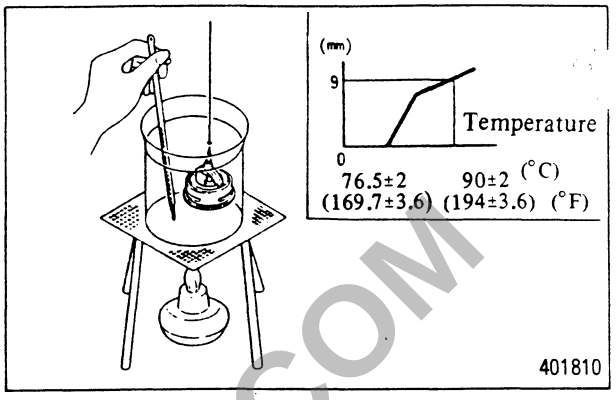


Checking the connecting rod for bends and twist

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3. THERMOSTAT



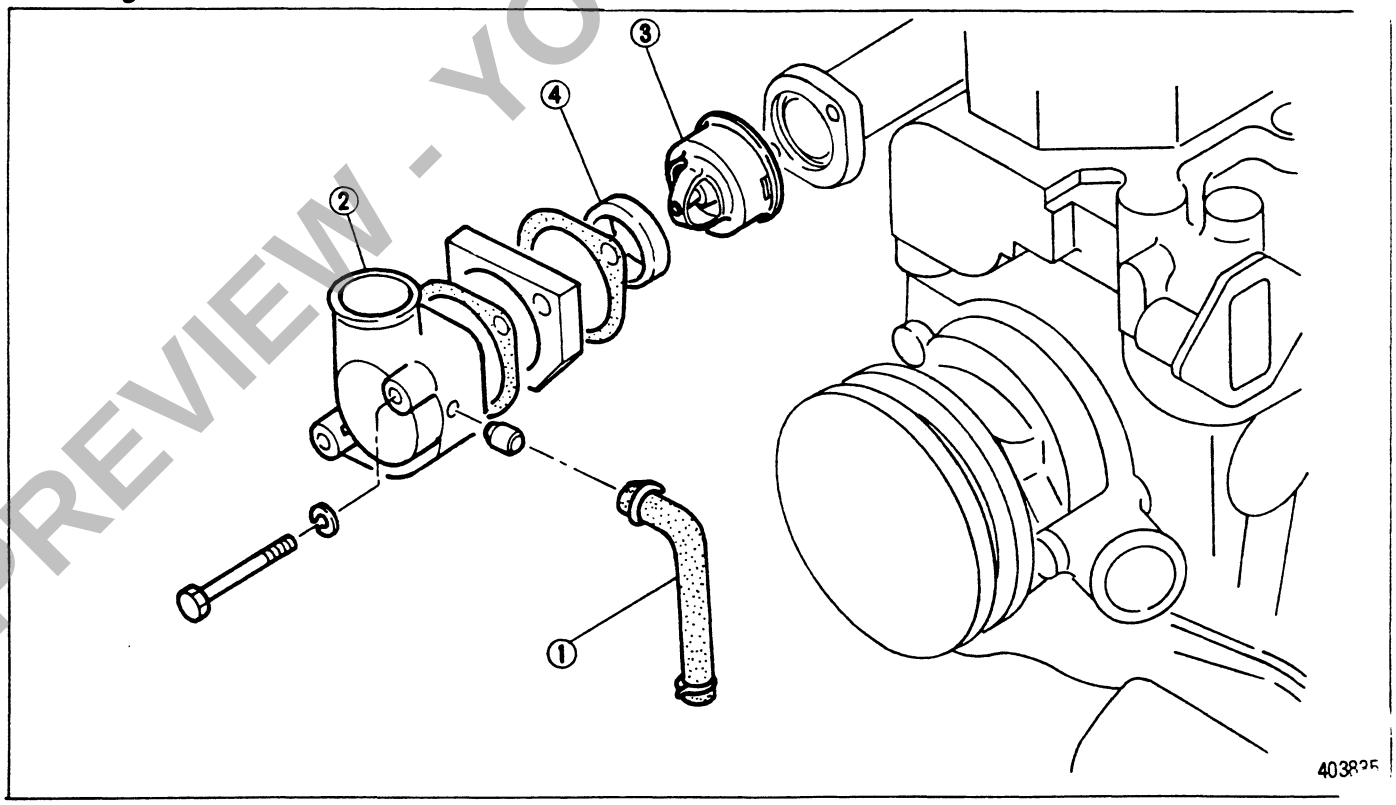
Inspection

To conduct a performance test on the thermostat, immerse it in water. While measuring the water temperature with a temperature gauge, heat the water. Measure the temperatures at which the valve starts to open and has fully opened. If the temperatures are significantly different from the standards, replace the thermostat with a new one.

	Assembly standard
Temperature at which valve starts to open	76.5 ± 2°C (169.7 ± 3.6°F)
Temperature at which valve has fully ppened	90 ± 2°C (194 ± 3.6°F)
Valve stroke	9 mm (0.4 in)

CAUTION
(a) Stir with a stick so that the warm water in the vessel will have a uniform temperature.
(b) Assemble the thermostat so that its vent hole will be directed upwards.

Mounting and Removal



① Bypass hose ② Elbow ③ Thermostat ④ Gasket

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5.3 Inspection

(1) Checking the Pump Housing

(a) Check the pump housing for possible cracks, damage to threads, etc. If the pump housing is abnormal, replace it.

(b) Inspect the contact surface of the pump housing and cylinder shell. If there are scratches or other defects, use a facing cutter to correct them or replace the pump housing and/or cylinder shell.

(2) Checking the Pump Element

(a) Measure the plunger collar. If the measurement exceeds the service limit, replace the plunger.

(b) Check the sliding surfaces of the plunger and cylinder for damage, seizure and wear. If defects are found, replace the plunger and cylinder as a set.
If a replacement is made, replace all the cylinders.

(c) To determine whether the plunger is acceptable or not, follow the procedure given below.
After flushing the plunger with fresh light oil, incline it approximately 60° and pull out the plunger 15 – 20 mm (0.59 – 0.79 in). When the plunger is released, it should fall smoothly into place in the cylinder without being caught due to its dead weight.
This inspection should be repeated several times while turning the plunger. Make certain that the plunger falls smoothly into the cylinder at all places.
Also check the plunger on the wrapping surface. If it is worn seriously on the top surface or around the control group and if it is losing luster on the wrapping surface and/or has suffered corrosive wear, replace the pump element.

Unit: mm (in)

	Assembly standard	Service limit
Plunger collar width	$7^{0}_{-0.05}$ ($0.3^{0}_{-0.002}$)	6.95 (0.274)



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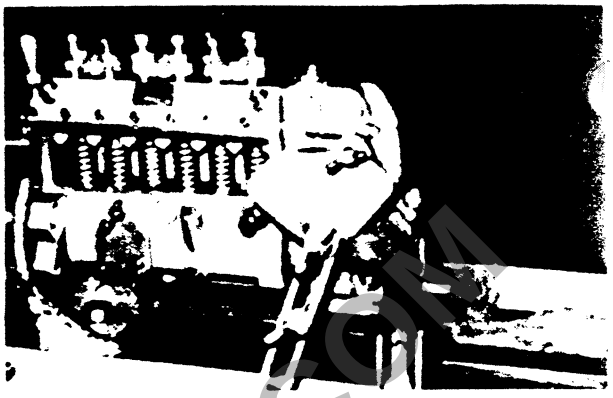
(2) S6E2

(a) Preparing

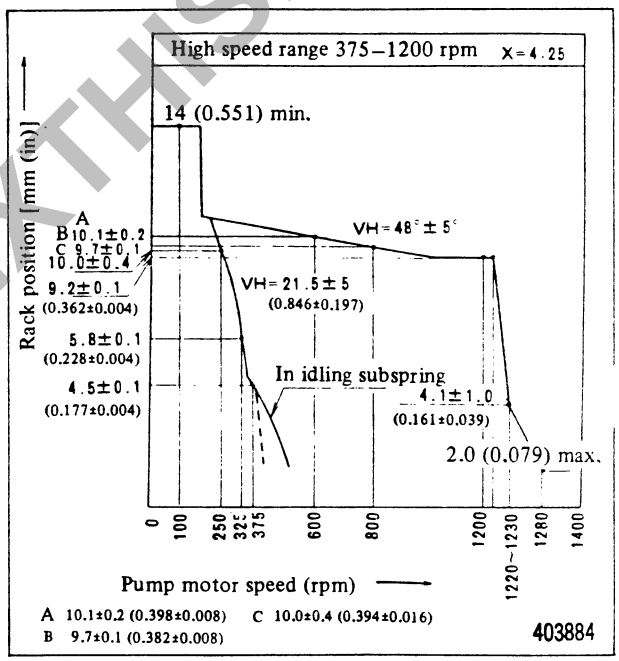
1) See "Adjusting the injection pump" (a).

2) Mount an angle division plate as a device to fix the adjusting lever.

NOTE: For adjusting lever angles specified in the Adjustment Standard Table, an angle of at least 40° will be available if the lever is in the maximum speed stopper position, based on the vertical position taken for 40° in the angle division plate.



Mounting the angle division plate



NOTE: 1. The vertical is to be reckoned as 40° for adjusting the lever angles.

2. Checking the performance of the stopper lever:
With the adjusting lever is the full position, run the pump at 1,200 rpm and actuate the stop lever. The rack should be positioned at 0 mm (0 in).

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