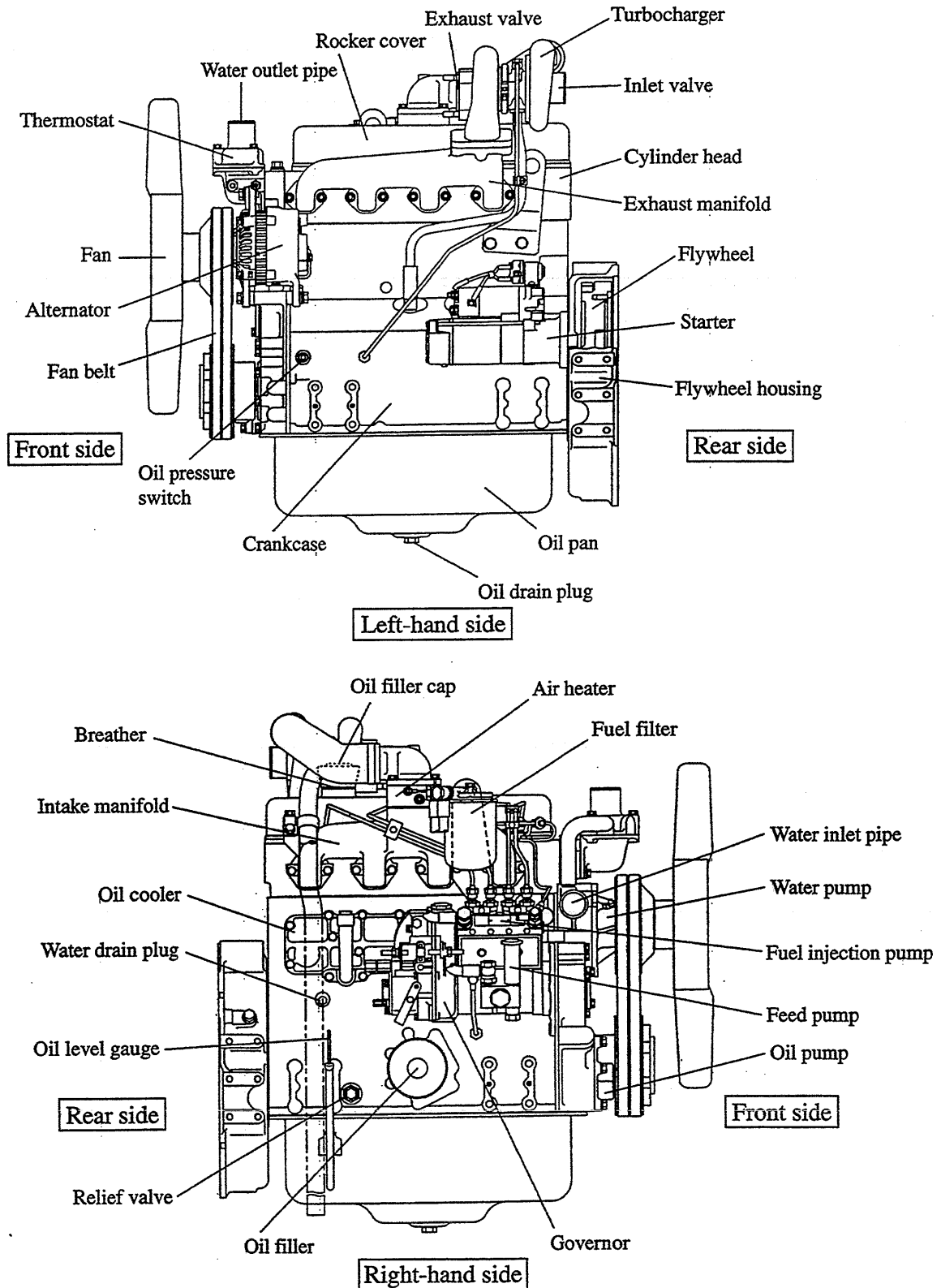


GENERAL INFORMATION

1. GENERAL

1.1 S4K-T diesel engine - External views



**NOTE**

Direction of rotation when viewed from the flywheel side is to the rear left (counterclockwise).

**2. SPECIFICATIONS** [Sections marked with ☆ indicate Mitsubishi Standard specifications (external diagram).]

Model designation			S4K	S4K-T	S6K	S6K-T	
General	Type		Diesel	Diesel engine with turbocharger	Diesel	Diesel engine with turbocharger	
	Cooling system		Watercooled				
	Cycle		4-stroke cycle				
	No. of cylinders – arrangement		4-in line		6-in line		
	Type of combustion chamber		Direct injection				
	Valve mechanism		Overhead				
	Bore × stroke		mm (in.) 102 × 130 (4.02 × 5.12)				
	Piston displacement		liter (cu in.) 4.249 (259.3)		6.373 (388.9)		
	Compression ratio		17:1				
	Fuel (ASTM specification)		Diesel fuel (JIS K2204 Special Grade 2)				
	Firing order		1-3-4-2		1-5-3-6-2-4		
	Direction of rotation		Counterclockwise as viewed from flywheel side				
	Dimensions (☆)	Overall length	mm (in.)	857 (33.74)	873 (34.37)	1143 (45)	1143 (45)
		Overall width	mm (in.)	631 (24.84)	634 (24.96)	634 (24.96)	634 (24.96)
Overall height		mm (in.)	868 (34.17)	929 (36.57)	918 (36.14)	976 (38.43)	
Weight (dry)		kg (lb)	340 (750)	350 (770)	465 (1025)	475 (1047)	
Engine proper	Type of cylinder sleeves		Dry, special cast iron				
	No. of piston rings	Compression ring	2				
		Oil ring	1 (w/spring expander)				
	Valve timing	Inlet valves	Open	10° B.T.D.C.			
			Close	50° A.B.D.C.			
		Exhaust valves	Open	54° B.B.D.C.			
			Close	10° A.T.D.C.			
Starting system		Electric starter					
Starting aid		Air heater					
Inlet/exhaust systems	Air cleaner	Type	Paper element				
	Turbocharger	Type	-	TD06H or TD04H	-	TD06H	
Lubrication system	Type		Pressure feed by oil pump				
	Engine oil	API service classification	CD	CD	CD	CD	
		Refill capacity (incl. filter) liter (U.S. gal)	13 (3.4)		20.5 (5.4)		
	Oil pump	Type	Gear				
		Speed ratio to crankshaft	1.0				
Delivery capacity liter (U.S. gal)/min/rpm		40 (10.57)/2000		66 (17.44)/1800			

MAINTENANCE STANDARDS

Unit: mm (in.)

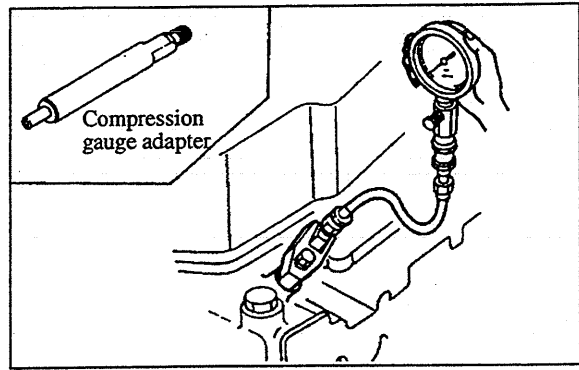
Group	Item	Nominal Size	Assembly Standard (standard clearance)	Repair Limit (clearance)	Service Limit (clearance)	Remarks	
Cylinder head	Valve springs	Free length	56.40 (2.2205)		55.00 (2.1654)		
		Squareness		2°, maximum		Difference in angle between ends with respect to center line	
		Test force/length under test force, kgf(lbf)/N/mm(in.)		22.7 to 25.1 (50.1 to 55.3) [222.6 to 246.1] /44 (1.73)		21.2 (46.7) [208] /44(1.73)	
	Rocker arms	Inside diameter of rocker arm (bushing)	20 (0.79)	20.011 to 20.094 (0.78784 to 0.79110)			
		Diameter of rocker shaft	20 (0.79)	19.984 to 19.966 (0.78677 to 0.78606)			
		Clearance of bushing on shaft	20 (0.79)	(0.027 to 0.128) ((0.00106 to 0.00504))	(0.15) ((0.0059))		
	Valve pushrods	Runout (bend)		0.4 (0.016), maximum			Runout measured with pushrod supported at centerlines of its spherical ends (Dial gauge reading)
Main moving parts	Crankshaft	Runout		0.02 (0.0008), maximum	0.05 (0.0020)		
		Diameter of journal	90 (3.54)	-0.03 (-0.0012) -0.05 (-0.0020)	-0.15 (-0.0059)	-0.90 (-0.0354)	
		Diameter of crankpin	60 (2.36)	-0.035 (-0.00138) -0.055 (-0.00217)		-0.20 (-0.0079)	
		Distance from center of journal to center of crankpin	65 (2.56)	±0.05 (±0.0020)			
		Parallelism between journal and crankpin		Runout: 0.01 (0.0004), maximum			
		Out-of-round of journal and crankpin		0.01 (0.0004), maximum	0.03 (0.0012)		
		Taper of journal and crankpin					
		Fillet radius of journal and crankpin	3R (0.12)	±0.2 (±0.008)			
		End play		(0.100 to 0.264) ((0.00394 to 0.01039))		(0.300) ((0.01181))	If repair limit is reached, replace thrust plates. If it is exceeded, use oversize thrust plates. Oversize thrust plates: +0.015 (+0.0059) +0.30 (+0.0118) +0.45 (+0.0177)

**3. SEALANTS**

Application point	Mating parts	Sealant	How to use
Oil pan gasket	<ul style="list-style-type: none"> <li>• Rear metal cap seat of crankcase</li> <li>• Lower side of front plate</li> </ul>	ThreeBond 1104 (No. 4)	Apply to lower rear end of crankcase and lower side of front plate (metal cap seat).
<ul style="list-style-type: none"> <li>• Water hole sealing cap for crankcase and sealing cap for main oil gallery</li> <li>• Water hole sealing cap for cylinder head</li> </ul>	<ul style="list-style-type: none"> <li>• Crankcase</li> <li>• Cylinder head</li> </ul>	ThreeBond 1307N Hermeseal S-2	Apply to holes before installing plugs.
Screw plug (taper plug) for crankcase main oil gallery	Crankcase	Loctite 271	Apply to threads.
Water bypass hose and pipe	Thermostat cover, elbow and water pump	Loctite 271	Apply to threads.
Rear metal cap side seal of crankcase	Metal cap (rear side seal contact surface)	ThreeBond 1105D (No. 5)	Apply to crankcase before installing rear bearing cap.
Timing gear case gasket	Timing gear case	ThreeBond 1102 (No. 2)	Apply to gasket surface of timing gear case.
Oil pump cover	Timing gear case	ThreeBond 1205	Apply to gasket surface of timing gear case.
Front oil seal sleeve	Crankshaft pulley	ThreeBond 1205	Apply to sleeve mounting surface of crankshaft pulley.

## 2. MEASURING THE COMPRESSION PRESSURE

- (1) Remove the injection nozzle from a cylinder on which the compression pressure is to be measured.
- (2) Attach the gauge adaptor (36791-00100) to the cylinder, and connect the compression gauge to the adaptor.
- (3) Crank the engine by means of the starter, and read the compression gauge indication when the engine begins to run at the specified speed.
- (4) If the compression pressure is lower than the repair limit, overhaul the engine.



### CAUTION

- a) Be sure to measure the compression on all cylinders. It is not a good practice to measure the compression pressure on two or three cylinders and judge the compression pressure of the remaining cylinders therefrom.
- b) The compression pressure may vary depending on engine rpm. This makes it necessary to check the engine rpm when measuring the compression.

Unit: kgf/cm<sup>2</sup> (psi) [MPa]

Item	Assembly Standard	Repair Limit
Compression	30 (427) [2.9]	27 (384) [2.6]

### NOTE

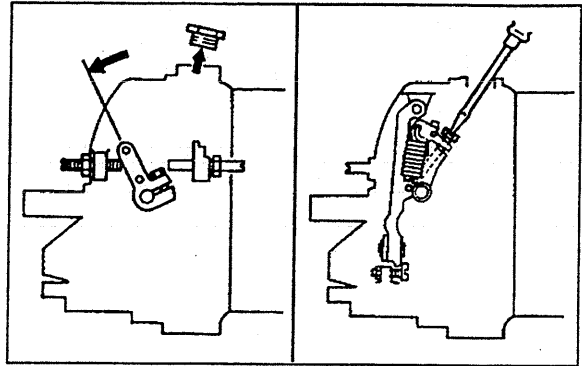
It is important to measure compression pressure regularly to obtain data of the gradual change in compression pressure.

Compression pressure is usually higher when the engine is new and immediately after an overhaul due to tight clearances of piston rings and valve seats, and gradually decreases as the engine breaks in.

## TESTING AND ADJUSTING

### (6) Speed regulation adjustment (governor notch adjustment)

- (a) This adjustment is to be made by turning the adjusting screw for swivel lever to increase or decrease the preload of governor spring.
- (b) To gain access to the adjusting screw, remove the plug at the top of governor housing, and turn the speed control lever all the way to the low idling set bolt: this will turn up the swivel lever, pointing the head of the adjusting screw toward the plug hole. Insert a flat-tip screwdriver through the hole to catch the screw head.
- (c) Tightening the adjusting screw increases the preload of governor spring to narrow the speed regulation; loosening it decreases the governor spring preload to widen the regulation. One notch corresponds to 1/4 turn of adjusting screw and to 3 to 5 rpm change of engine speed.
- (d) Changing the setting of this adjusting screw changes the governor setting (for limiting the maximum engine speed). After making a governor notch adjustment, be sure to readjust the governor setting.
- (e) Tightening the adjusting screw, mentioned above, will increase the maximum speed, and vice versa.



### **CAUTION**

The adjustable range is 20/notch (5 rotations) long. Never loosen the screw by more than 20 notches from the fully tightened position or the control action of the governor will become hazardous.

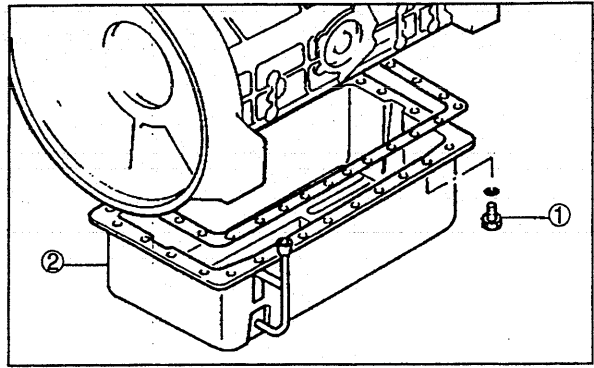
### (7) Sealing

Seal each set bolt.

## ENGINE ACCESSORY REMOVAL AND INSTALLATION

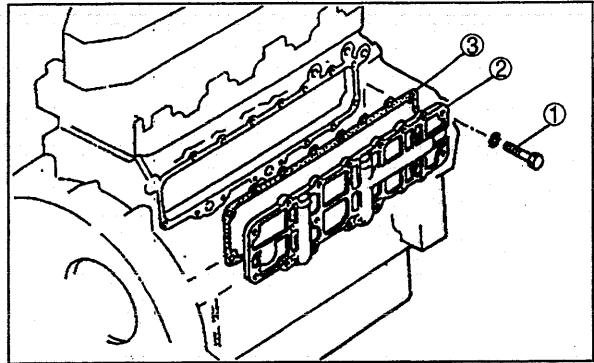
### (15) Removing oil pan

Unscrew bolts ①, and remove oil pan ②.



### (16) Removing oil cooler

Unscrew bolts ①, and remove the oil cooler attached to cover ②. Remove gasket ③.

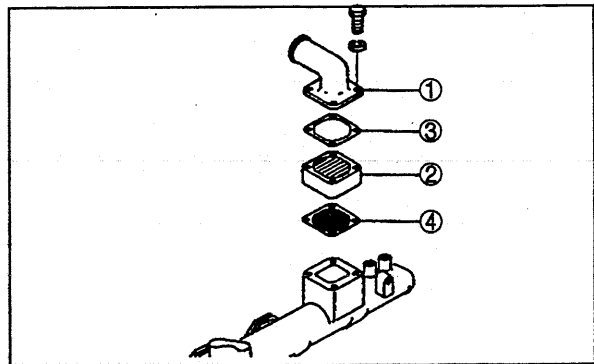


### (17) Removing air heater

Unscrew the bolts securing air inlet elbow ①, and remove the elbow, air heater ② and gaskets ③ ④.

#### NOTE

When installing gaskets ③ and ④, make sure gasket ④ faces the manifold.

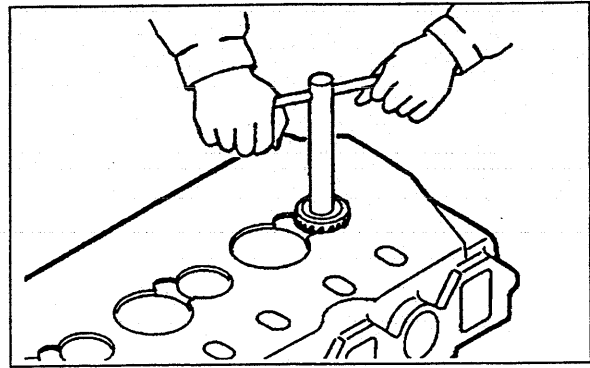


(6) Refacing valve seats

Using a valve seat cutter or a valve seat grinder, cut the valve seat. After cutting, grind the seat with a sandpaper of #400 grade or so inserted between the cutter and valve seat.

**NOTE**

- a) Do not cut or grind the valve seat more than is necessary for refacing.
- b) If the seat width seems to be greater than the service limit when refaced, replace the valve seat.



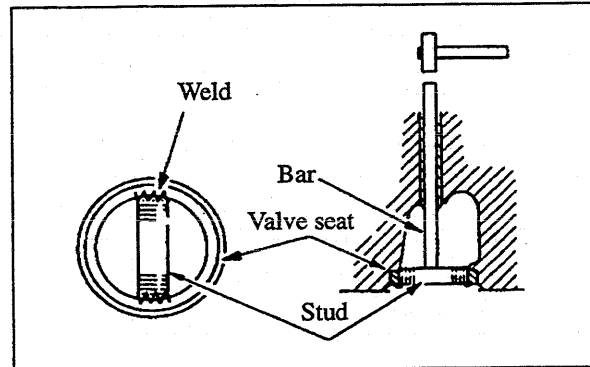
Refacing valve seat

(7) Replacing valve seats

- (a) Weld a stud or bar to the valve seat. Insert a bar through the valve guide from the upper side of the cylinder head to put its end on the stud, as shown in the illustration. Then, drive the seat off the head.

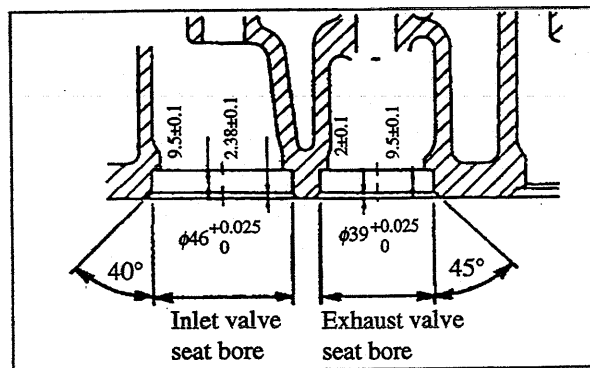
**NOTE**

When welding the stud to the valve seat, avoid contact of any spatter with the machined surface of the cylinder head.



Removing valve seat

- (b) Before installing a replacement valve seat, measure the bores in the cylinder head for the valve seats to make sure they are correct in dimension.



Valve seat bore dimensions



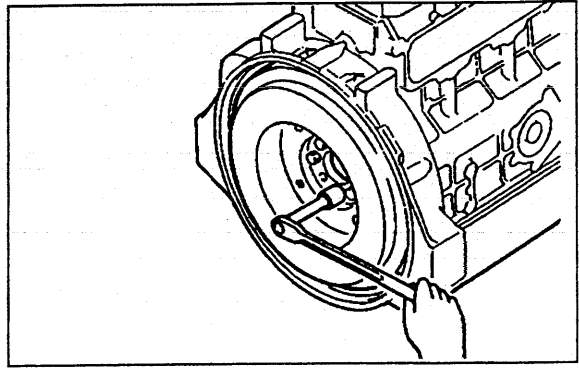
## ENGINE PROPER

### (1) Removing flywheel

- (a) Unscrew the flywheel mounting bolts.
- (b) Screw the jacking bolts (M10 × 1.5 or M16 × 2) into the holes provided in the flywheel uniformly, and remove the flywheel.

**⚠ CAUTION**

When removing the flywheel, be careful not to get injured by the ring gear.

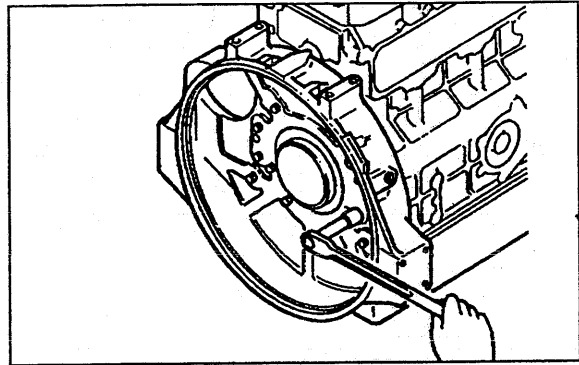


### (2) Removing flywheel housing

Unscrew the housing mounting bolts, and remove the housing.

**⚠ CAUTION**

Oil seals cannot be reused. Be sure to install new oil seals during reassembly.

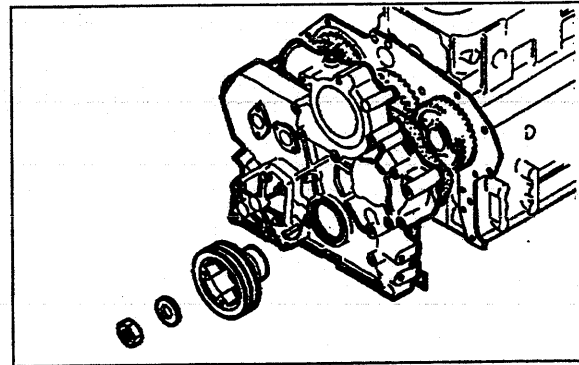


### (3) Removing timing gear case assembly

Remove the crankshaft pulley and timing gear case assembly.

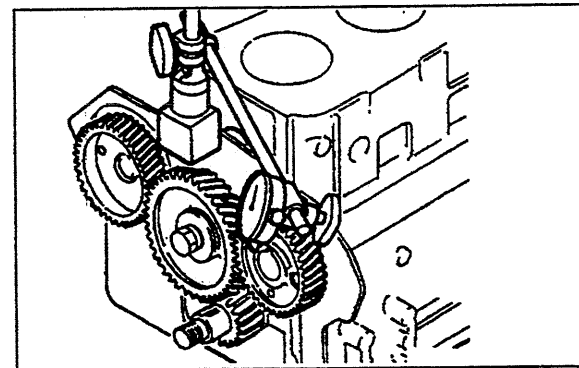
**⚠ CAUTION**

Take care not to damage the oil pump idler gear and crankshaft gear.



### (4) Measuring backlash and end play

Measure the backlash and end play on each gear to obtain the data for parts replacement. (Refer to 2.2, Group No. 7.)



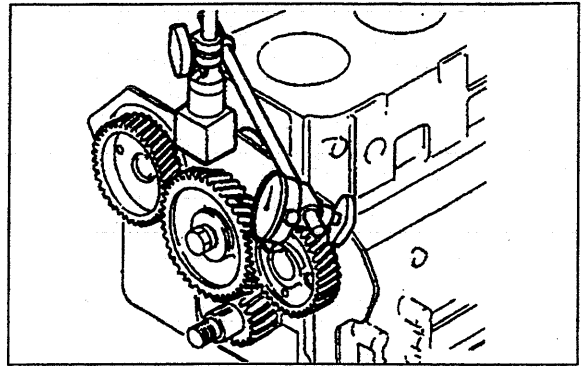
## ENGINE PROPER

### Inspecting and adjusting timing gears after installation

After installing the timing gears, be sure to inspect and adjust them as follows:

#### (Inspecting timing gear backlash and end play)

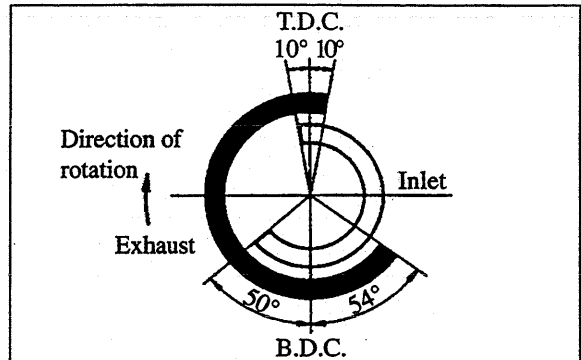
After installing the timing gears, inspect the backlash between the gears in mesh and the end play of each gear. (Refer to 2.2, Group No. 7.)



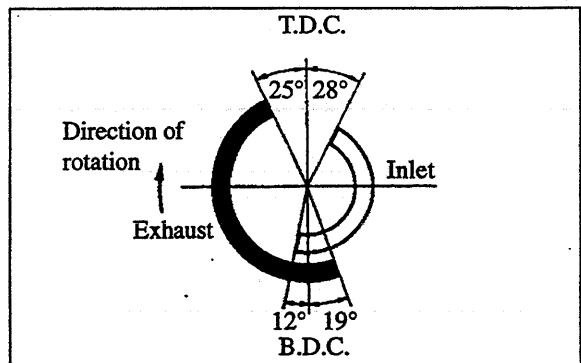
#### (Inspecting valve timing)

It is not necessary to inspect the valve timing, provided that all matching marks on the timing gears are aligned. Inspect the timing for verification as follows:

- (a) Using a flat plate with thickness of 3 mm, adjust the valve clearances of the inlet and exhaust valves for cylinder No. 1.
- (b) Insert a 0.05-mm feeler gauge between the top of the valve cap and the rocker arm, and slowly turn the crankshaft.
- (c) Find a position where the feeler gauge is firmly gripped (valve opening position) and a position where the gauge becomes loose (valve closing position).
- (d) Check to make sure these positions correspond to the angular positions shown in the valve timing diagram (with 3 mm clearance on valve side).



**Valve timing diagram**  
(with 0.25 mm clearance on valve side)



**Valve timing diagram**  
(with 3 mm clearance on valve side)

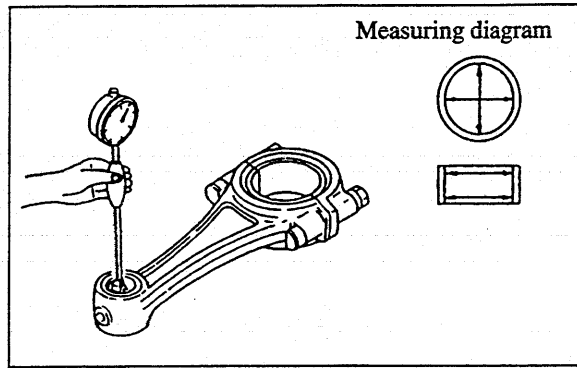
ENGINE PROPER

(2) Checking clearance between connecting rod bushing and piston pin

Measure the inside diameter of the connecting rod bushing bore and the diameter of the piston pin, as shown in the illustration, to check the clearance. If the clearance exceeds the service limit, replace the parts.

Unit: mm (in.)

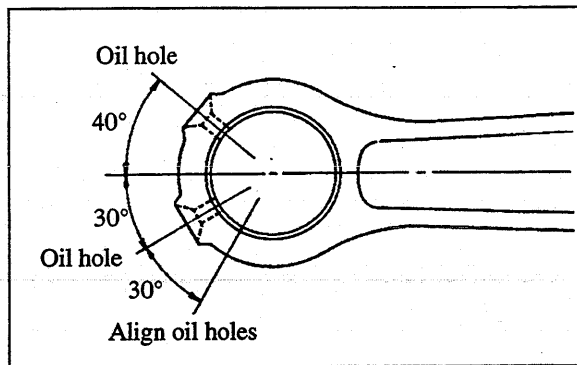
Item	Nominal Size	Assembly Standard	Service Limit
Inside diameter of bushing	34 (1.34)	34.020 to 34.045 (1.33937 to 1.34035)	
Clearance between bushing and piston pin		0.023 to 0.054 (0.00091 to 0.00213)	0.080 (0.00315)



Measuring connecting rod bushing

(3) Replacing connecting rod bushings

- (a) Use a connecting rod bushing puller (MH061296) to replace the connecting rod bushings.
- (b) When installing a new bushing, align the oil holes in the bushing and connecting rod. Position the ends of the bushing at the location shown in the illustration.
- (c) After installing the bushing, insert the piston pin into position and make sure it rotates smoothly.



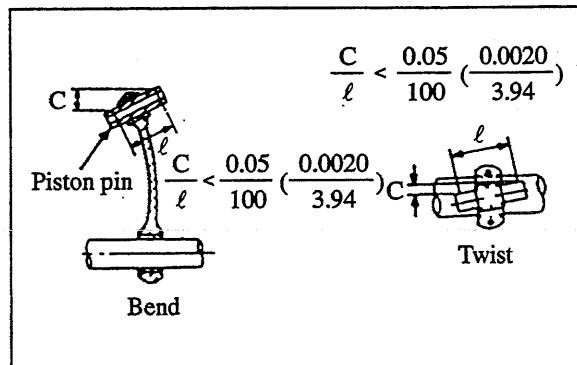
Installing connecting rod bushing

(4) Inspecting connecting rods for bend and twist

- (a) Measure "C" and "l" to check the rod for twist and/or bend. If "C" exceeds 0.05 mm (0.0020 in.) per 100 mm (3.94 in.) of "l," straighten the rod with a press.

Unit: mm (in.)

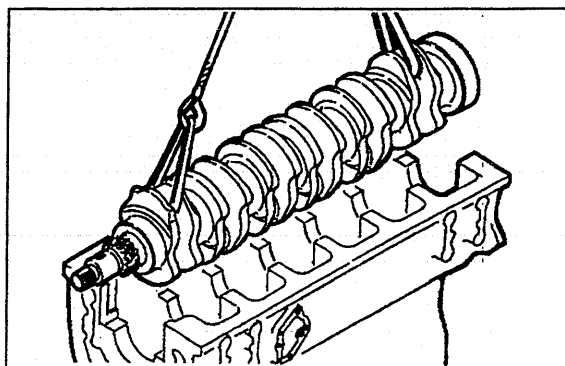
Item	Assembly Standard	Repair Limit
Twist or bend of connecting rod	0.05/100 (0.0020/3.94), maximum	0.15/100 (0.0059/3.94)



Checking connecting rod

## (2) Installing crankshaft

- (a) Wash the crankshaft with cleaning solvent, and dry it by directing pressure air.
- (b) Hold the crankshaft in horizontal position, and carefully put it on the crankcase.
- (c) Apply a thin coat of engine oil to the journals of crankshaft.

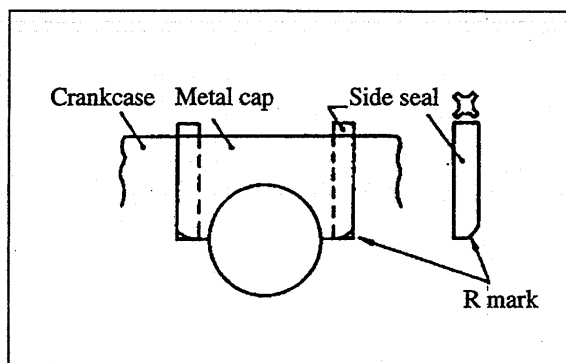


## (3) Installing main metal caps

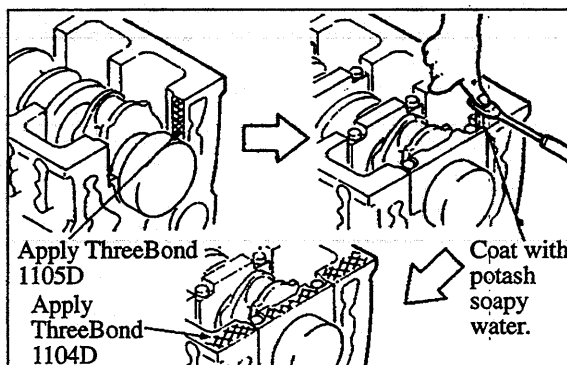
- (a) Apply engine oil to each lower shell, and fit it to the metal cap.
- (b) Apply ThreeBond 1105D to the mating faces of front cap, rear caps and crankcase before installing the caps.

**NOTE**

Do not apply ThreeBond 1105D to any surface other than those mating faces of the caps and crankcase.



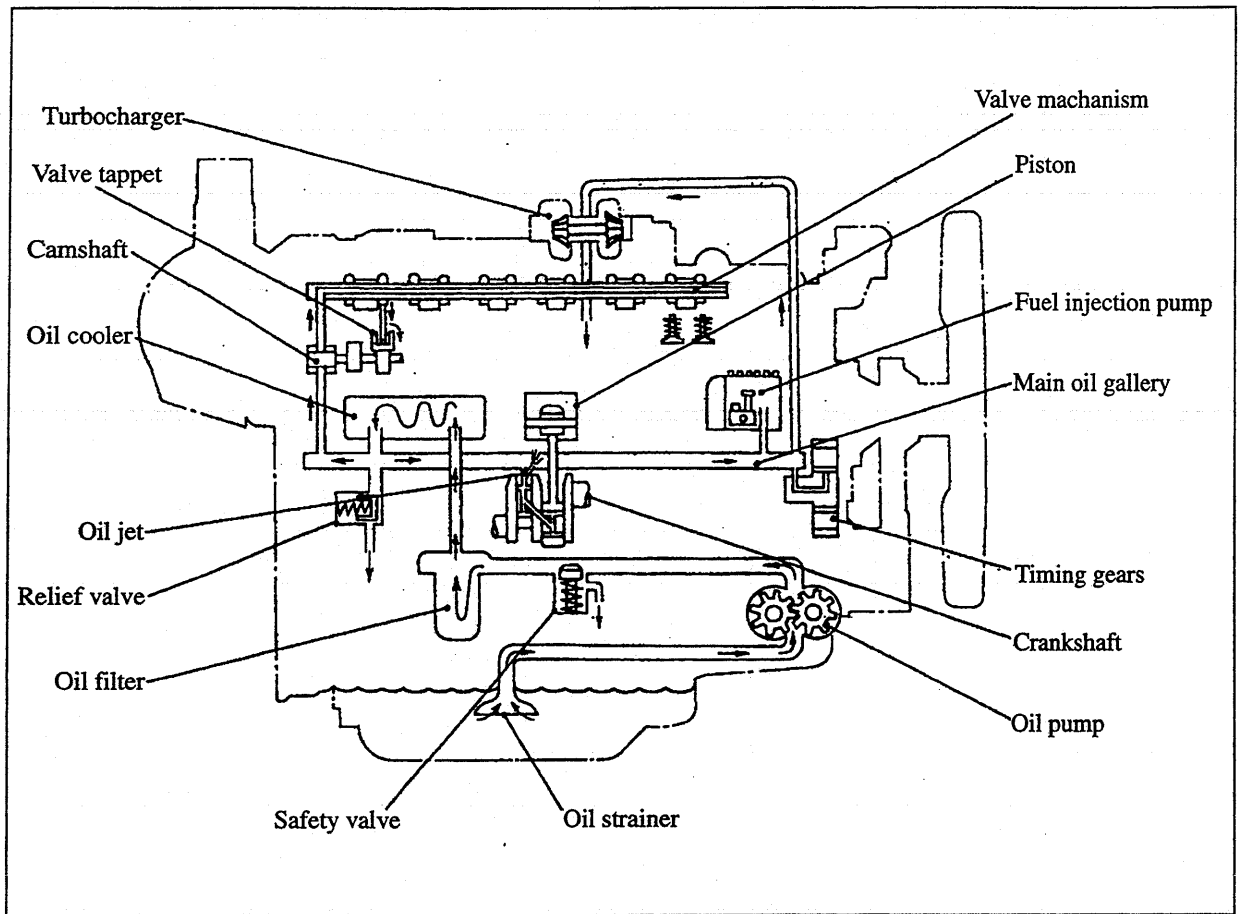
- (c) Install the metal caps to the crankcase, making sure that they are flush with the crankcase walls on the front and rear sides.
- (d) Coat the side seals with potash soapy water, and insert them into the grooves in each metal cap. Using the face of a screwdriver, push in the seals, bringing their rounded corners on the outer side and taking care not to twist the seals.
- (e) Apply ThreeBond 1104 (grey in color) to the side seal joint.

**NOTE**

The metal caps have metal numbers stamped on them. Install the caps in that order from the front side of the engine.

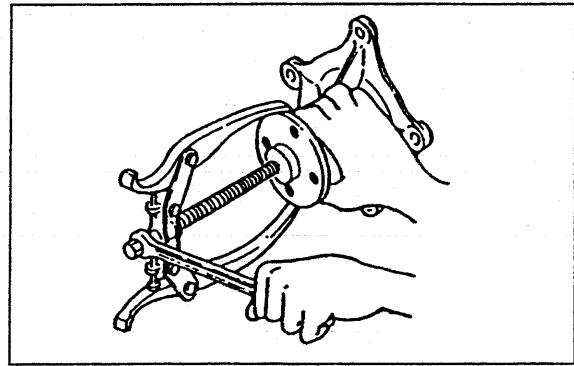
LUBRICATION SYSTEM

1. DESCRIPTION



(1) Removing flange

Using a puller, remove the flange.

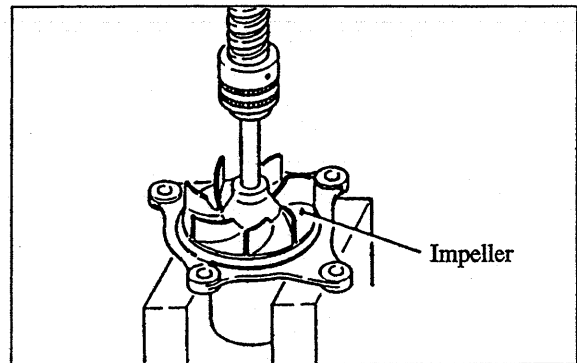


(2) Removing impeller and shaft

- (a) Remove the snap ring.
- (b) Using a press, remove the shaft complete with the bearings. Remove the impeller.

**NOTE**

If the case is heated up to 80°C (176°F), the parts can be removed easily.



**2.2 Inspection**

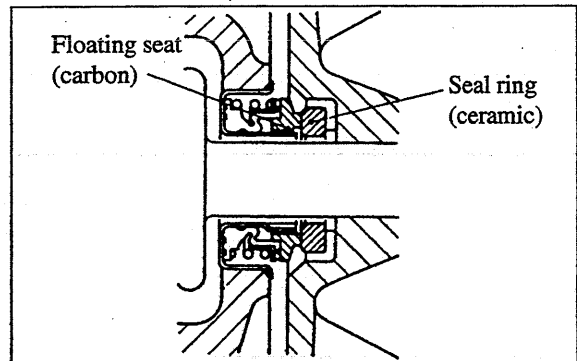
Unit seal

Checking for water leakage

Check the unit seal for condition. Replace the seal if any sign of leakage is noted during operation.

Unit: mm (in.)

Item	Assembly Standard	Service limit
Carbon protrusion	1.5 (0.059)	0
Free-state height	21.8 ± 1 (0.858 ± 0.04)	



**ELECTRICAL SYSTEM**

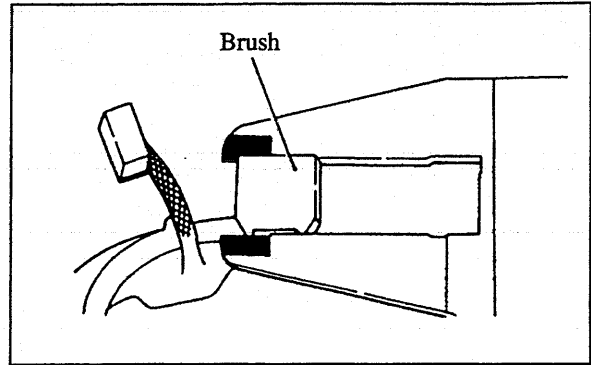
**(3) Brushed and holders**

**(a) Wear of brushes**

Measure the brush length and, if it is less than the Service limit, replace the brushes. If the brushes are unevenly worn or rough, recondition them with a sandpaper of #300 to #500.

Unit: mm (in.)

Item	Assembly standard	Service limit
Length of brush	18 (0.71)	11 (0.43)

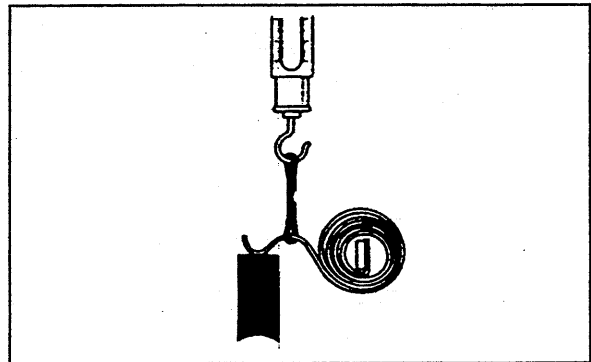


**(b) Brush spring tension**

Test the spring tension (test force) using a new brush. In this test, read the load at the moment that the spring moves off the brush. If the tension is below the Service limit, replace the spring.

Unit: kgf (lbf) [N]

Item	Assembly standard	Service limit
Pressure of brush spring	3.0 to 4.0 (6.6 to ) [29 to 39]	1.4 (3.1) [13.7]



**(c) Testing brush holders for insulation**

If there is continuity between the positive (+) brush holder and negative (-) holder plate, replace the brush holder assembly.

