ENGINE BASE

SERVICE MANUAL

MITSUBISHI
S4K,S6K

HYUNDAI

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REFERENCE ONLY
- EXCAVATOR(10TON, -7SERIES)

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

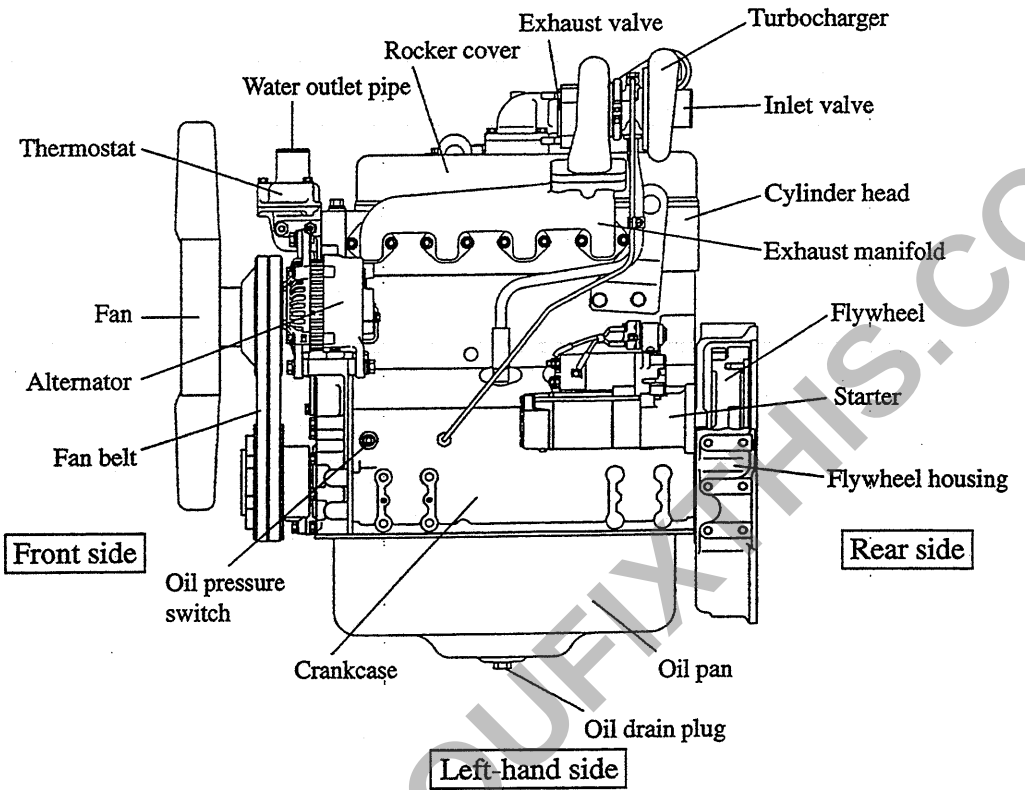
Model designation				S4K	S4K-T	S6K	S6K-T
General	Type			Diesel	Diesel engine with turbocharger	Diesel	Diesel engine with turbocharger
	Cooling system			Watercooled			
	Cycle			4-stroke cycle			
	No. of cylinders – arrangement			4-in line		6-in line	
	Type of combustion chamber			Direct injection			
	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	

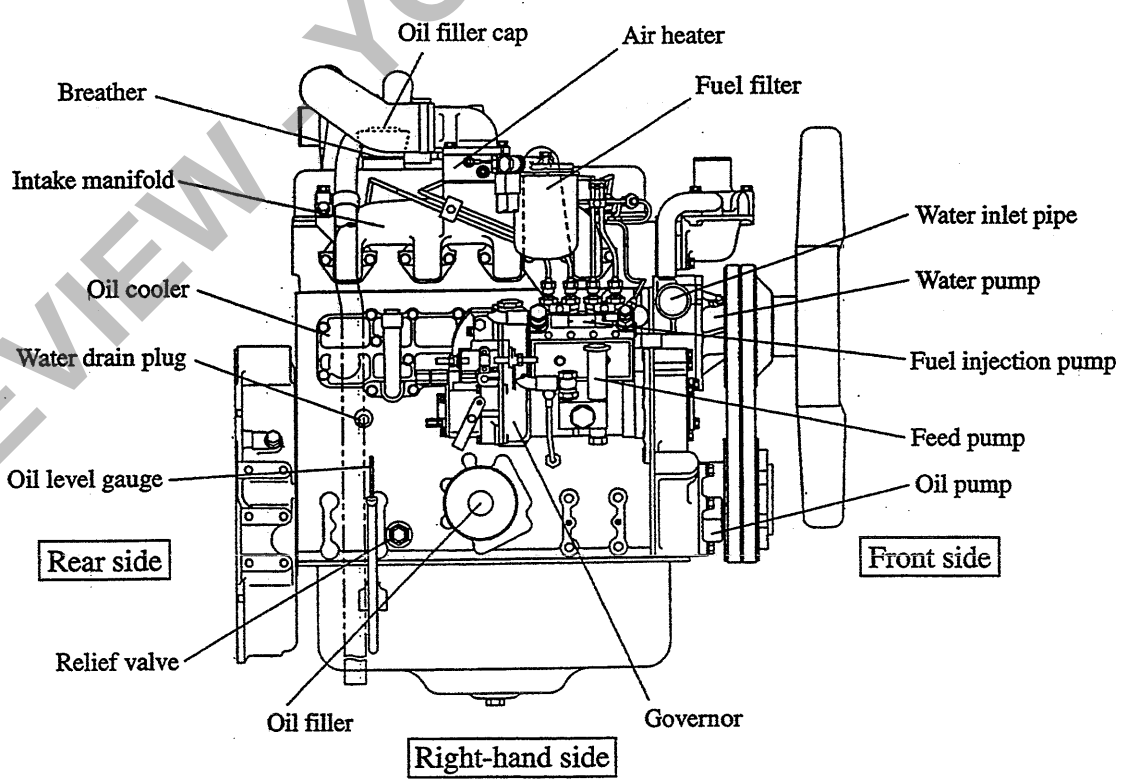
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1. GENERAL

1.1 S4K-T diesel engine - External views



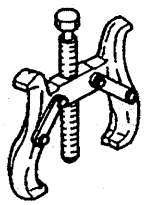
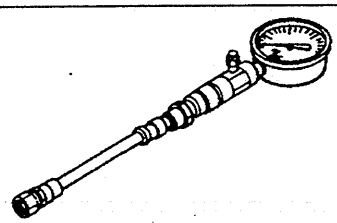
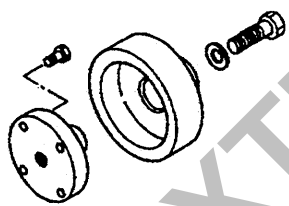
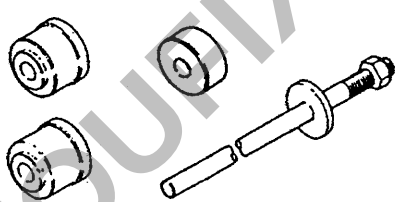
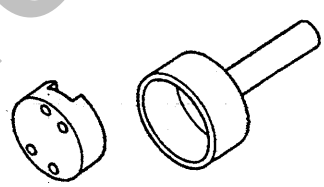


NOTE

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

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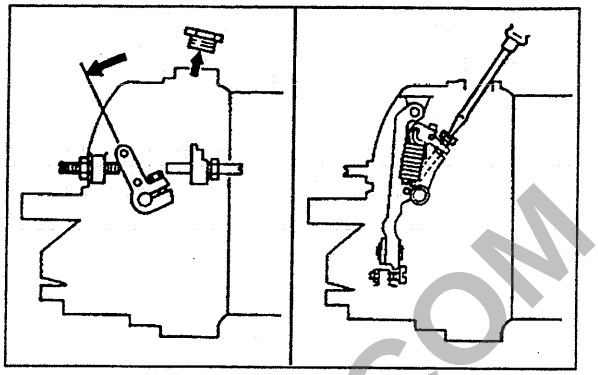
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Tool name	Part No.	Shape	Use
Puller assembly	64309-12900		Crankshaft gear and crankshaft pulley removal
Compression gauge	33391-02100		Compression pressure testing
Rear oil seal installer	34291-00020		Installation of oil seal slinger in rear side of crankshaft
Camshaft pushing installer set	30691-00010		Camshaft bushing removal/installation (S6K/S6K-T only)
Crankshaft sleeve installer	34291-00010		Installation of double-lip oil seal sleeve on crankshaft rear side

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(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) Thightening 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.

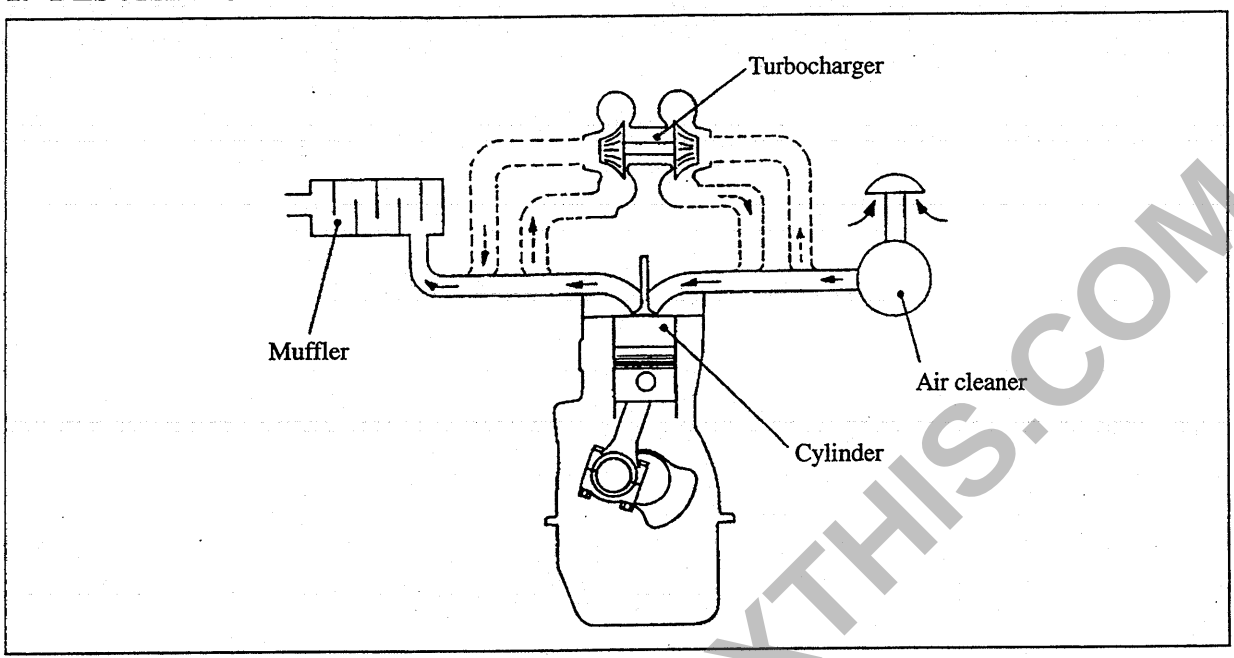
(7) Sealing

Seal each set bolt.

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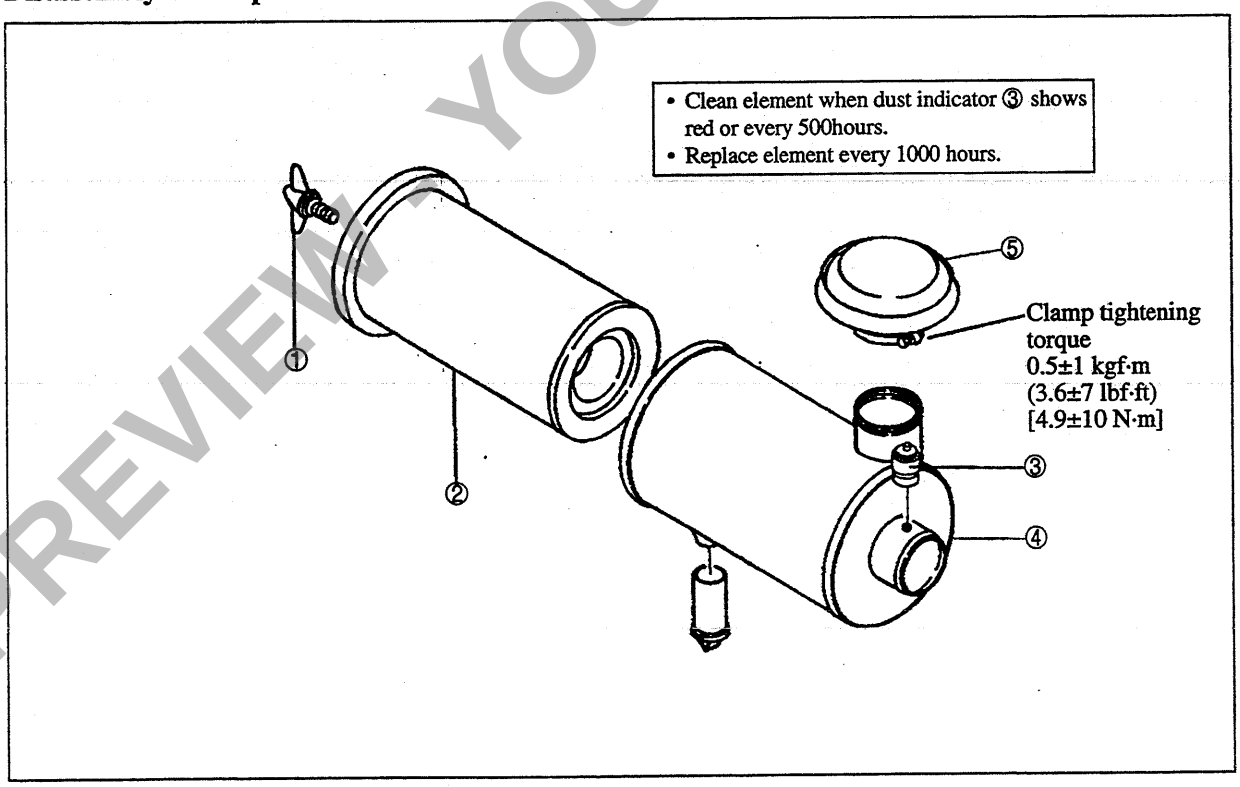
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1. DESCRIPTION



2. PAPER-ELEMENT TYPE AIR CLEANER

Disassembly and inspection



① Wing nut
② Element
③ Dust indicator
④ Air cleaner body
⑤ Air cleaner cap

⚠CAUTION

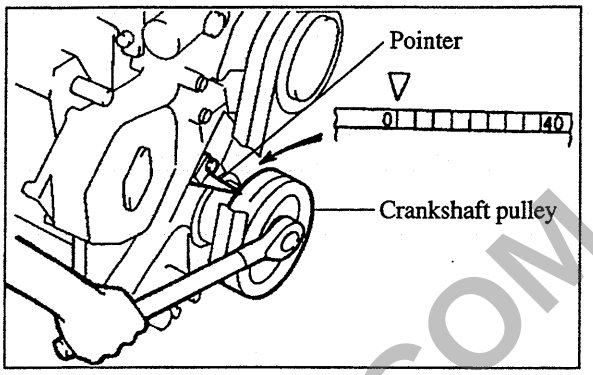
When removing the air cleaner for servicing, be sure to stop the engine and cover the air inlet port to prevent dirt from entering the engine.

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1.3 Fuel injection timing inspection and adjustment

The injection timing for each model of the engine varies according to its output, speed and specification. Be sure to verify the timing by referring to the specifications of each model.



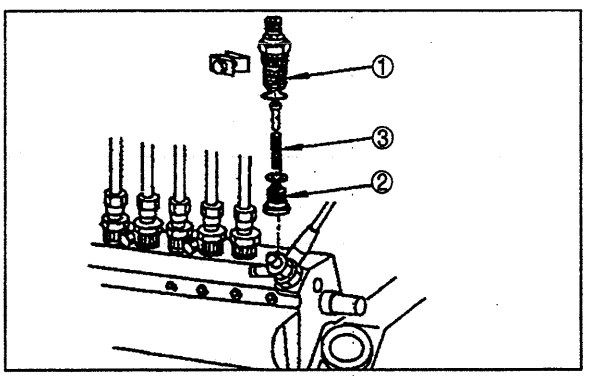
(1) Bringing No. 1 piston to top dead center on compression stroke

(a) Put socket (58309-73100) to the crankshaft pulley, and turn the crankshaft in normal direction (clockwise as viewed from the front side of the engine).

(b) Stop cranking the engine when the timing mark "0" on the crankshaft pulley is aligned with the pointer.

(c) Move the inlet and exhaust valve rocker arms for the No. 1 cylinder up and down to make sure that they are not being pushed up by their pushrods. Now the inlet and exhaust valves should have a clearance to be checked.

(2) Inspecting fuel injection timing



(a) Remove the delivery valve holder from No. 1 pumping element of injection pump. Take delivery valve, spring and stopper out of the holder, and restore the holder to the pump.

(b) Attach a spare injection pipe to No. 1 pumping element, with its free end held downward to that you can see fuel flow from that end.

(c) Turn the crankshaft to bring No. 1 piston to about 60° position before top dead center on compression stroke.

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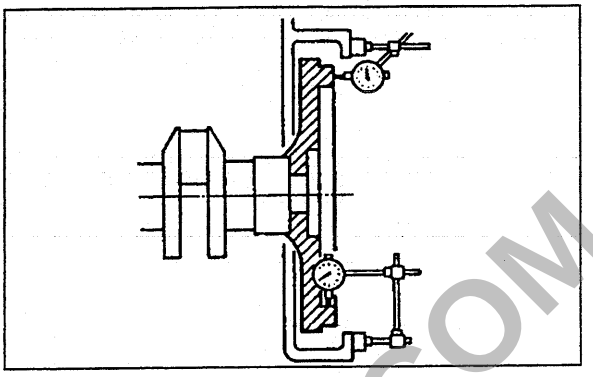
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(2) Measuring face runout of flywheel

With the flywheel installed on the engine, measure its face runout. If the runout exceeds the Assembly standard, check for improper installation or foreign matter lodged in the mounting face.

Unit: mm (in.)

Item	Assembly Standard	Service Limit
Face runout of flywheel	0.15 (0.0059) maximum	0.50 (0.020)



Measuring flywheel face runout

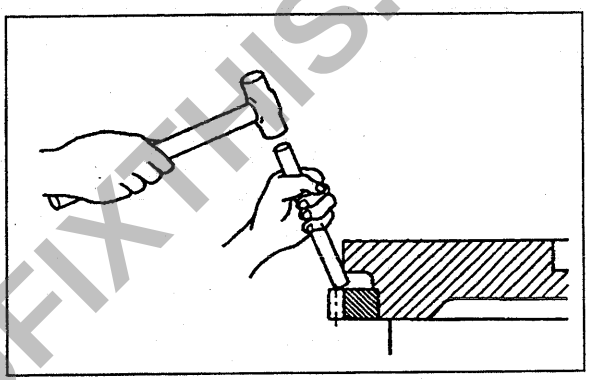
(3) Replacing ring gear

Check the ring gear teeth for wear or other defects, and replace the gear if defective. To remove, proceed as follows:

(Removal)

(a) Heat the ring gear uniformly with an acetylene torch.

(b) Using a bar, give light hammer blows to the periphery of ring gear.



Replacing ring gear

(Installation)

Heat a replacement ring gear up to about 150°C (212°F) in a piston heater, and press the gear onto the flywheel with its unchamfered teeth foremost.

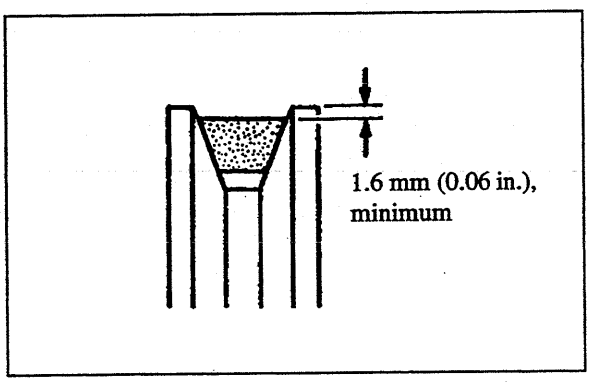
Crankshaft pulley

Inspecting V-belt groove

Check the groove for wear. Wrap a new belt around the pulley, pressing it in the groove as far as it goes, and see if the top surface of the belt is above the top of the pulley.

If the top surface of the belt is uniformly above the top of the pulley all the way around, it is not necessary to replace the pulley.

If the top surface of the belt sinks into the groove more than 1.6 mm (0.06 in.), replace the pulley.



Inspecting V-belt groove in crankshaft pulley

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2.2 Standard bolts

Thread diameter mm	Tightening torque					
	4T			7T		
	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	4±1	0.4±0.1	2.95±0.74	9±1	0.9±0.1	59.74±0.74
M8	11±1.5	1.15±0.15	8.11±1.11	18±3	1.85±0.35	13.28±2.21
M10	21±3	2.15±0.35	15.44±2.21	35±6	3.6±0.6	25.81±4.43
M12	35±6	3.6±0.6	25.81±4.43	64±10	6.5±1	47.2±7.38

2.3 Standard stud bolts

Thread diameter mm	Embedding torque					
	When embedding in aluminum			When embedding in iron		
	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M8	7.4±1	0.75±0.1	5.46±0.74	13±1	1.3±0.1	9.59±0.74
M10	14±1	1.4±0.1	10.33±0.74	24±2	2.4±0.2	17.7±1.48

2.4 Standard plugs

Thread diameter mm	Tightening torque					
	When installing in aluminum			When installing in iron		
	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
NPTF 1/16	6.4±1.5	0.65±0.15	4.72±1.11	10±2	1.0±0.2	0.74±0.15
PT 1/8	10±2	1.0±0.2	7.38±1.48	18±3	1.85±0.35	1.364±2.12
PT 1/4, NPTF 1/4	25±5	2.5±0.5	18.44±3.69	39±5	4.0±0.5	28.76±3.69
PT 3/8	—	—	—	64±10	6.5±1	47.2±7.38

NOTE: (a) The indicated tightening torque values are for standard bolts and nuts.
(b) The indicated values are tightening torque for bolts with spring washers.
(c) The indicated values are standard tightening torque, with an allowed range of ±10%.
(d) Use the indicated tightening torque, unless otherwise specified.
(e) Do not apply oil on bolt threads (dry).

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1.4 No-load minimum (low idle) speed and no-load maximum speed setting inspection and adjustment

⚠CAUTION

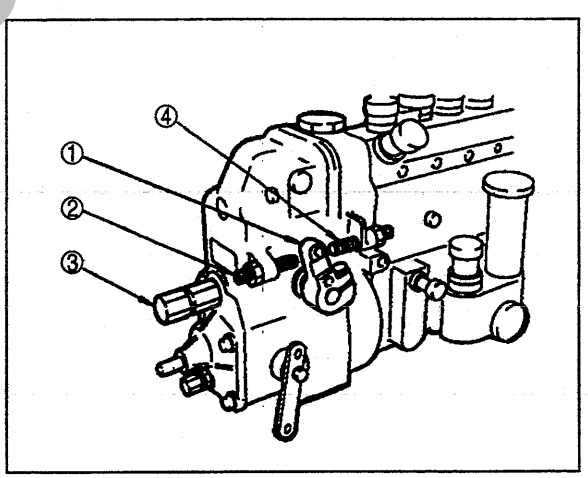
a) The no-load minimum (low idle) speed and no-load maximum speed are set for each engine on the test bench at the factory. The set bolts are sealed. Inspection and adjustment of these speeds are to be made at the Mitsubishi-authorized service shop only.

b) After adjusting the governor by breaking the seals, be sure to re-seal all stoppers, making them appear as if they were sealed at the factory.

c) Whether the stopper seals are intact or not has important bearing on the validity of claims under warranty.

d) When inspecting and adjusting these speeds, be on the standby to operate the engine stop lever manually in the event of engine overrun.

For inspection and adjustment, warm up the engine thoroughly until the coolant and oil temperatures are above 70°C (158°F).



(1) Starting engine

(a) Move speed control lever to the high speed position and turn the starter switch to START position to crank the engine.

(b) The engine will fire up at a speed of approximately 150 rpm. When the engine fires, hold the engine speed between 800 and 1000 rpm by operating the speed control lever.

(c) When the engine runs with a steady speed, move the speed control lever back to the low idle speed position.

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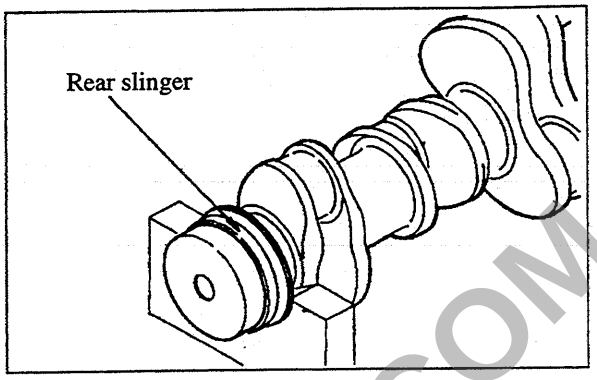
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(8) Replacing rear oil seal on crankshaft rear side

If oil leaks from the oil seal, replace the oil seal and slinger with replacement parts.
(Removal of rear oil seal)
Use a puller to remove the slinger.

⚠CAUTION

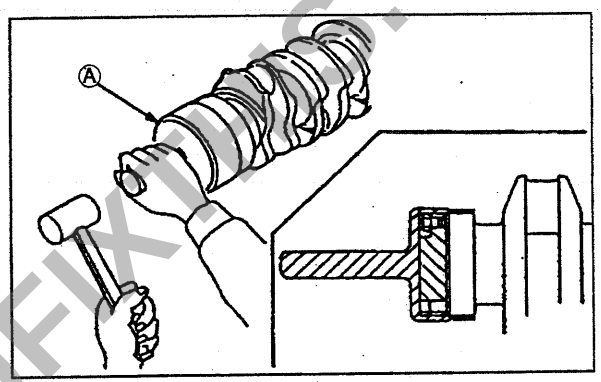
Be careful not to damage the crankshaft when removing the rear oil seal.



Removing rear slinger

(Double-lip rear oil seal)

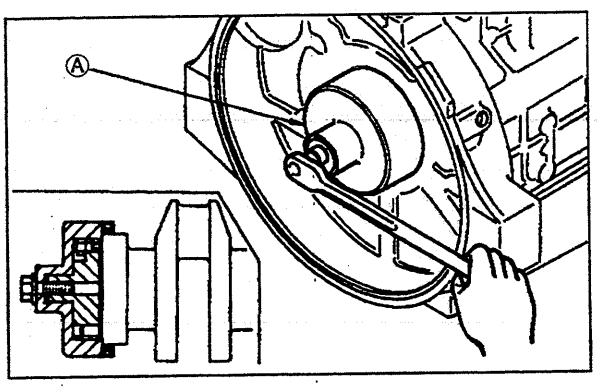
When oil leaks from the double-lip rear oil seal, replace with a sleeved oil seal supplied as a replacement part.
To install the sleeve, apply ThreeBond 1205 to the inner surface of the sleeve, and use crankshaft sleeve installer Ⓐ (34291-00010) and a hammer to fit into place.



Installation of oil seal sleeve

(Installation of slinger)

Install the oil seal on the slinger. Apply oil to the inside surface of the slinger, and apply ThreeBond 1212 to the mounting surface. Use special oil seal installer Ⓐ (34291-00020) to install the oil seal and slinger.



Installing oil seal and slinger

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