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3. CYLINDER BLOCK AND OTHER COMPONENTS (1)

kg·m (ft. lbs.)

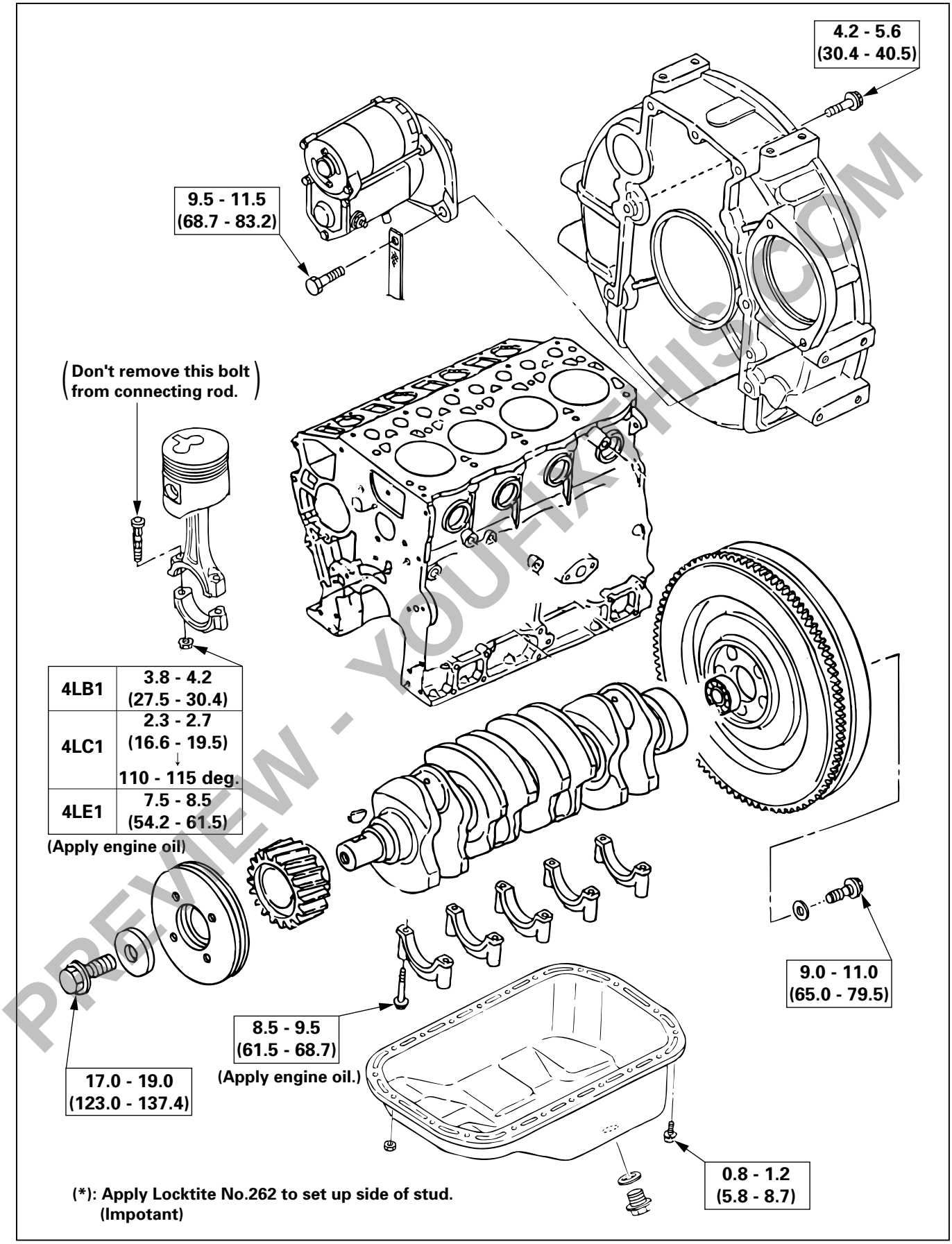


Fig. 15

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TIGHTENING TORQUE SPECIFICATIONS

The tightening torque values given in the table below are applicable to the bolts unless otherwise specified.

STANDARD BOLT

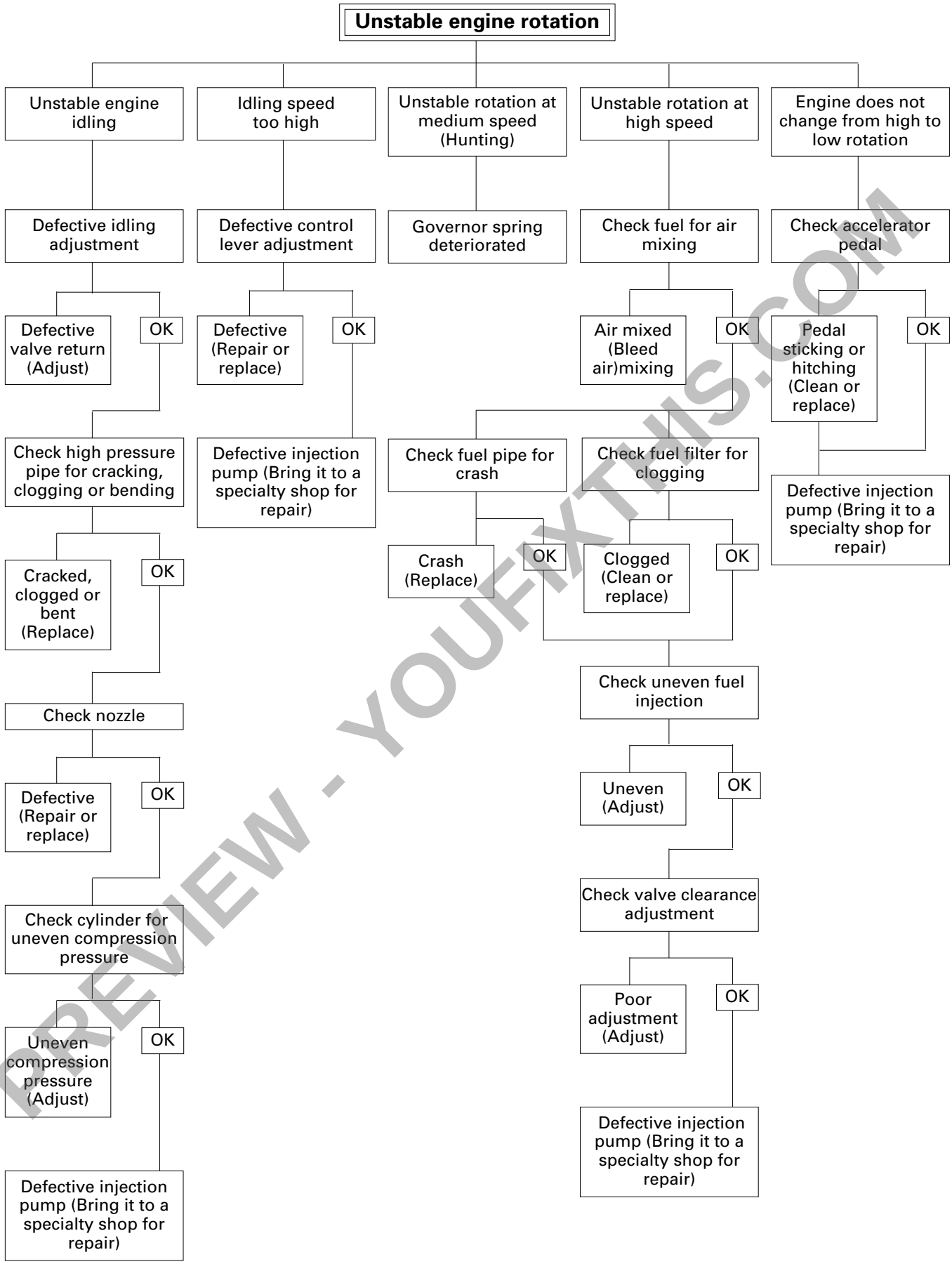
kg·m (lb.ft/N·m)

Strength Class / Bolt Identification / Bolt Diameter × pitch (mm)	4.8 (4T)	(7T)	8.8		9.8 (9T)
			Refined	Non-Refined	
					
	 No mark	——			
M 6 × 1.0	0.4～0.8 (2.9～5.8/3.9～7.8)	0.5～1.0 (3.6～7.2/4.9～9.8)			——
M 8 × 1.25	0.8～1.8 (5.8～13.0/7.8～17.7)	1.2～2.3 (8.7～16.6/11.8～22.6)			1.7～3.1 (12.3～22.4/16.7～30.4)
M10 × 1.25	2.1～3.5 (15.2～25.3/20.6～34.3)	2.8～4.7 (20.3～34.0/27.5～46.1)			3.8～6.4 (27.5～46.3/37.3～62.8)
M12 × 1.25	5.0～7.5 (36.2～54.2/49.0～73.6)	6.2～9.3 (44.8～67.3/60.8～91.2)			7.7～11.6 (55.7～83.9/75.5～113.8)
M14 × 1.5	7.8～11.7 (56.4～84.6/78.5～114.7)	9.5～14.2 (68.7～102.7/93.2～139.3)			11.6～17.4 (83.9～125.6/113.8～170.6)
M16 × 1.5	10.6～16.0 (76.7～115.7/103.0～156.9)	13.8～20.8 (99.8～150.4/135.3～204.0)			16.3～24.5 (118.9～177.2/159.9～240.3)
M18 × 1.5	15.4～23.0 (111.1～166.4/151.0～225.6)	19.9～29.9 (143.9～216.3/195.2～391.3)			23.4～35.2 (169.3～254.6/229.5～345.2)
M20 × 1.5	21.0～31.6 (151.9～228.6/205.9～307.9)	27.5～41.3 (198.9～298.7/269.7～405.0)			32.3～48.5 (233.6～350.8/316.8～475.6)
M22 × 1.5	25.6～42.2 (185.2～305.2/251.1～413.8)	37.0～55.5 (267.6～401.4/362.9～544.3)			43.3～64.9 (313.2～469.4/424.6～636.5)
M24 × 2.0	36.6～55.0 (264.7～397.8/358.9～539.4)	43.9～72.5 (317.5～523.9/430.5～711.0)			56.5～84.7 (408.7～612.6/554.1～830.6)
*M10 × 1.5	2.0～3.4 (14.5～24.6/19.6～32.4)	2.8～4.6 (20.3～33.3/27.5～45.1)			3.7～6.1 (26.8～44.1/36.3～59.8)
*M12 × 1.5	4.6～7.0 (33.3～50.6/45.1～68.7)	5.8～8.6 (42.0～62.2/56.9～84.3)			7.3～10.9 (52.8～78.8/71.6～106.9)
*M14 × 2.0	7.3～10.9 (52.8～78.8/71.6～106.9)	9.0～13.4 (65.1～96.9/88.3～131.4)			10.9～16.3 (78.8～118.9/106.9～159.9)
*M16 × 2.0	10.2～15.2 (73.8～110.0/100.0～149.1)	13.2～19.8 (95.5～143.2/129.5～194.2)			15.6～23.4 (112.8～169.3/162.8～229.5)

An asterisk (*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting. Those shown in parentheses in the strength class indicate the classification by the old standard.

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MAIN DATA AND SPECIFICATIONS

1. MODELS 4LB1 AND 4LB1T

Item \ Engine model(s)			4LB1	4LB1T
Type			In-line water cooled 4-cycle type, OHV: diesel engine	
Timing drive system			Gear drive	
Number of piston rings			Compression rings 2, and oil ring 1	
No. of cylinders - bore × stroke mm			4 – 77.4 × 79.7	
Displacement cc (cid)			1499 (92)	
Compression ratio			22 : 1	
Type of combustion chamber			Swirl chamber	
Overall length × width × height mm			* 554 × 436 × 579	554 × 466 × 611
Dry weight kg (lb)			* 130 (287)	137 (302)
Fuel injection timing (BTDC) (when at stop)			* 16°	
Firing order			1 – 3 – 4 – 2	
Fuel			Highspeed diesel fuel (SAE No.2)	
Idling speed r.p.m			* 850	
Compression pressure kg/cm^2 (psi/MPa)			31 (441/3) or more/250 r.p.m.	
Valve clearance (cold) mm (in)		Intake	0.4 (0.0157)	
		Exhaust	0.4 (0.0157)	
Valve operating timing	Intake valve	Open (BTDC)	15°	
		Close (ABDC)	29°	
	Exhaust valve	Open (BBDC)	40°	
		Close (ATDC)	16°	
Injection pump			Bosch type	
Governor			Mechanical type	
Nozzle			Throttle type	
Injection pressure kg/cm^2 (psi/MPa)			* 135 (1920/13.2)	
Oil pump			Trochoid type	
Oil filter			Cartridge type	
Lubricant capacity: In total lit (qts)			* About 7.3 (7.7)	
Generator output (V – A)			* 12 – 20	
Starter output (V – KW)			* 12 – 1.0	

(Note) These specifications may be subject to change without notice.
Figures in the column with an asterisk (*) are different for each machine. Refer to the specifications provided by machine manufacturers.

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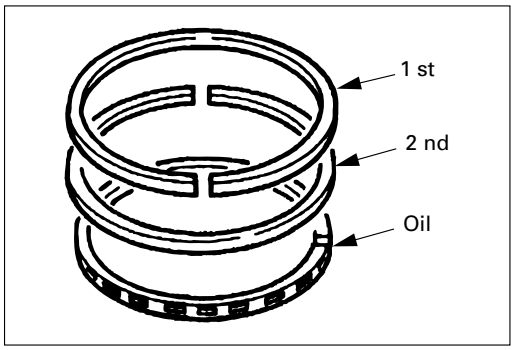


Fig. 134

Position the rings as shown making sure the ring gaps are away from the thrust side.

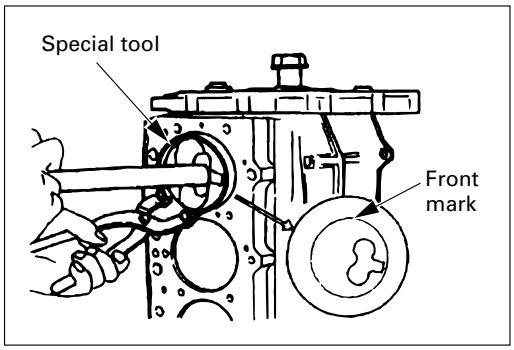


Fig. 135

Piston and Connecting Rod

Lubricate the piston, the piston rings, and the connecting rod bearings with engine oil.

Position the piston front mark towards the front of the engine.

Use the piston ring compressor to compress the piston rings.

Use a hammer grip to push the piston in until it makes contact with the crank pin.

At the same time, rotate the crankshaft until the crankpin reaches its highest point.

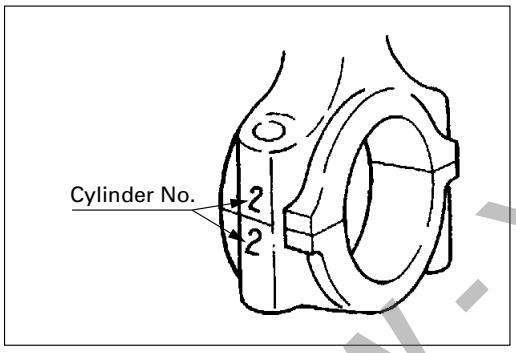


Fig. 136

Set the bearing cap cylinder number marks and the connecting rod cylinder number marks.

The marks must be facing the injection pump side.

kg·m (ft. lbs.)

Tightening torque	4LB1	3.8 – 4.2 (27 – 30)
	4LC1	2.3 – 2.7 (17 – 20) ↓ 100 – 115 deg.
	4LE1	7.5 – 8.5 (54 – 61)

Note:

After installation, confirm that the crankshaft rotates smoothly.

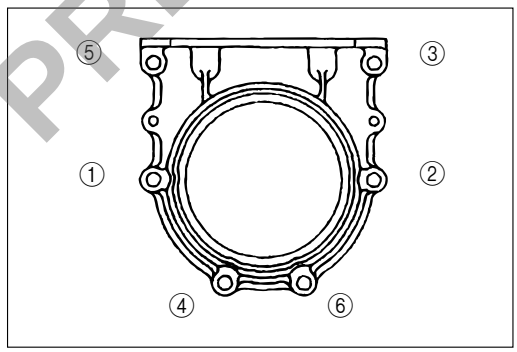


Fig. 137

Installation of retainer

After applying engine oil to the lip of the oil seal, install the retainer. Apply sealant.

Tighten bolts on the retainer to the specified torque in the order as shown in the figure left.

kg·m (ft. lbs.)

Tightening torque	0.8 – 1.2 (6.0 – 9.0)

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LUBRICATING OIL CIRCULATION DIAGRAM

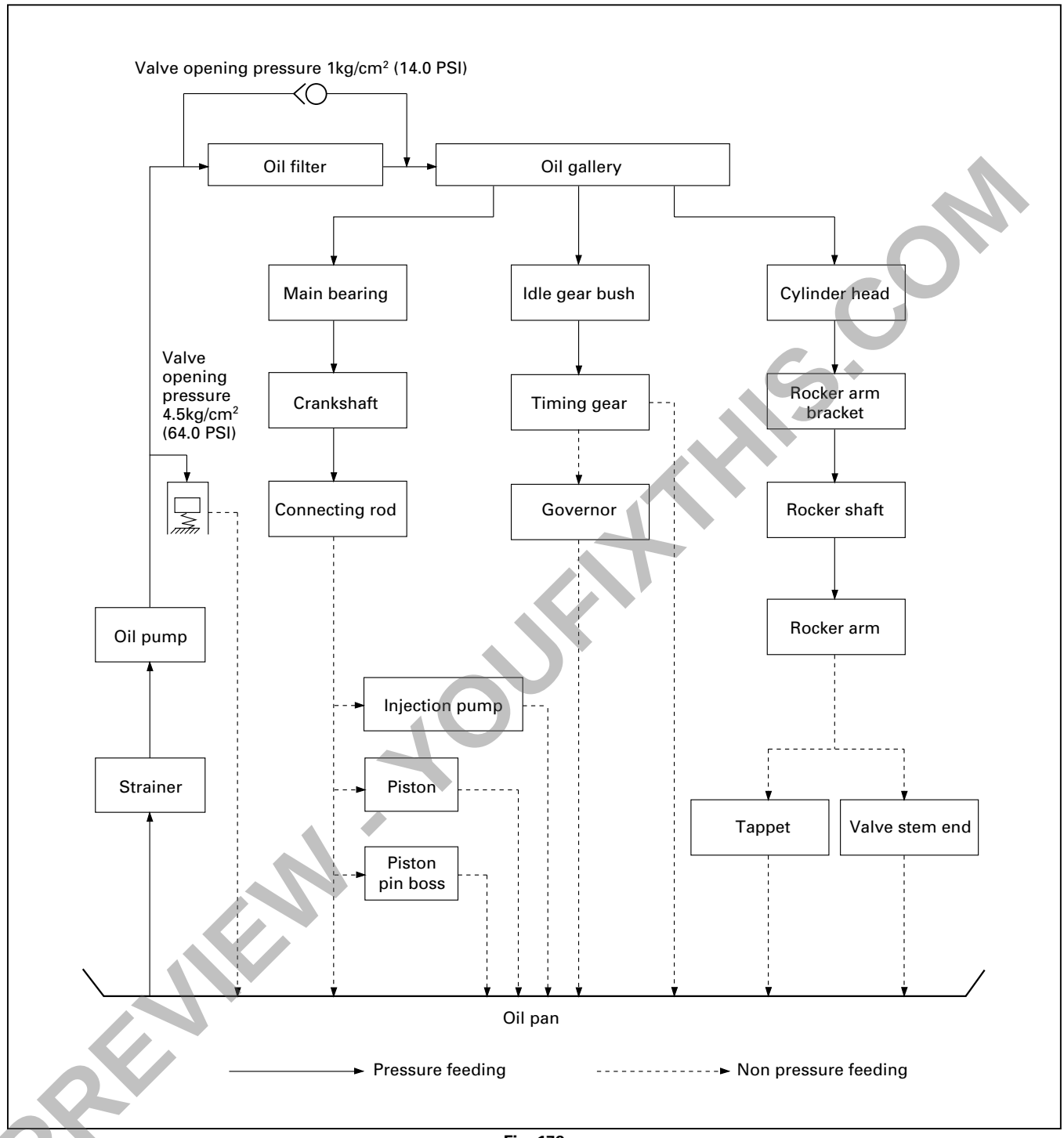


Fig. 179

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Clearance between piston pin and piston pin hole

mm (in.)

	Standard
4LB1, 4LC1, 4LE1	0.002 – 0.012 (0.00008 – 0.00047)

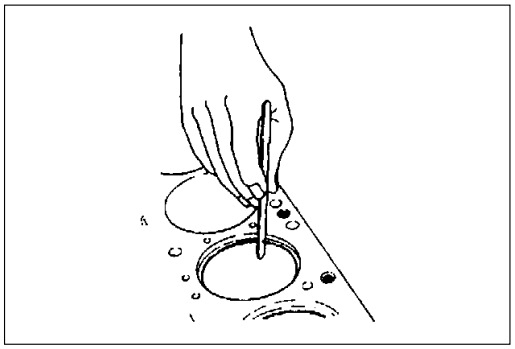


Fig. 101

Piston ring gap

With the ring inserted into the cylinder bore, push it in with the piston head so that it becomes a right angle to the cylinder, and then measure the gap of the piston ring.

If worn beyond the limit, replace the rings.

mm (in.)

		Standard	Limit
1st compression ring		0.2 – 0.35 (0.0079 – 0.0138)	1.5 (0.0590)
2nd compression ring	4LB1 4LC1	0.2 – 0.4 (0.0079 – 0.0157)	
	4LE1	0.35 – 0.5 (0.0138 – 0.0197)	
Oil ring		0.2 – 0.4 (0.0079 – 0.0157)	1.0 (0.03937)

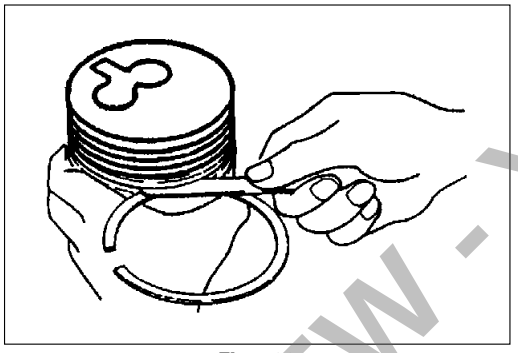


Fig. 102

Clearance between piston ring groove and ring

Measure clearance at several places on the circumference.

If worn beyond the limit, replace the rings or piston.

4LB1 mm (in.)

	Standard	Limit
1st compression ring	0.065 – 0.100 (0.0026 – 0.0039)	0.2 (0.0078)
2nd compression ring	0.03 – 0.070 (0.0012 – 0.0027)	0.15 (0.0059)
Oil ring	0.02 – 0.06 (0.0008 – 0.0024)	

4LB1T, 4LC1 mm (in.)

	Standard	Limit
1st compression ring	0.075 – 0.110 (0.0029 – 0.0043)	0.2 0.0078)
2nd compression ring	0.030 – 0.070 (0.0011 – 0.0027)	0.15 (0.0059)
Oil ring	0.020 – 0.060 (0.0007 – 0.0024)	

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MAINTENANCE

1. VALVE CLEARANCE AND ADJUSTMENT

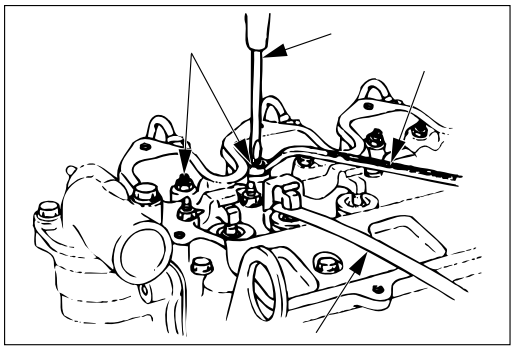


Fig. 21

Note:
The cylinder head bolts were previously tightened with the "Angular Tightening Method". Therefore, it is not necessary to retighten the cylinder head bolts before adjusting the valve clearance.

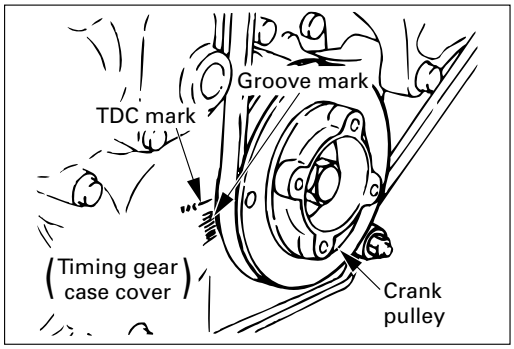


Fig. 22

1. Bring the piston in either the No. 1 cylinder or the No. 3 cylinder to Top Dead Center on the compression stroke by turning the crankshaft until the TDC mark on the front cover aligns with the groove mark on the crankshaft pulley.
2. Check to see if there is play in the No. 1 intake and exhaust valve rocker arms.

   If the No. 1 cylinder intake and exhaust valve rocker arms have play, the No. 1 piston is at TDC on the compression stroke.

   If the No. 1 cylinder intake and exhaust valve rocker arms are depressed, the No. 4 piston is at TDC on the compression stroke.

   Adjust the circle or double circle marked valves as shown in Fig. 24, while the No. 1 or the No.4 cylinder is at TDC on compression stroke.

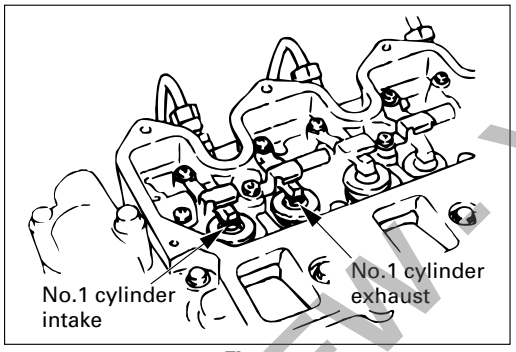


Fig. 23

mm (in.)

Intake and Exhaust Valve Clearance (cold)	0.40 ± 0.05 (0.015 ± 0.002)

Cylinder No.	1		2		3		4	
Valve arrangement	I	E	I	E	I	E	I	E
No. 1 cylinder TDC for compression	○	○	○			○		
No. 4 cylinder TDC for compression				◎	◎		◎	◎

I ; Intake E ; Exhaust

Fig. 24

3. Loosen each valve clearance adjusting screw as shown in the illustration.
4. Insert a 0.40 mm (0.015 in) feeler gauge between the rocker arm and the valve stem end.
5. Turn the valve clearance adjusting screw until a slight drag can be belt on the feeler gauge.
6. Tighten the lock nut securely.
7. Rotate the crankshaft 360°.

   Realign the crankshaft pulley.
8. Adjust the clearances for the remaining valves as shown in the illustration.

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SECTION 1

GENERAL INFORMATION

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Timing Gear

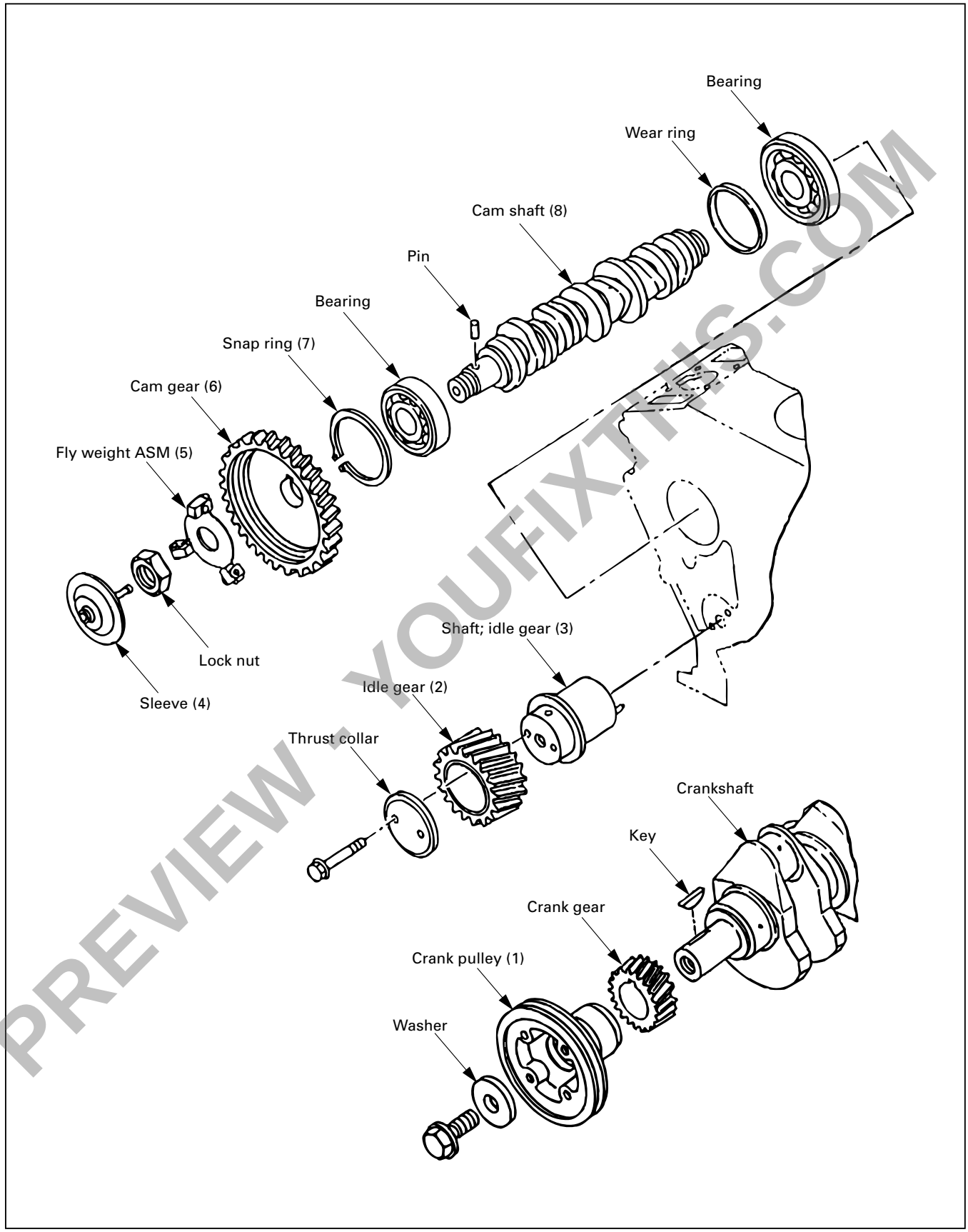


Fig. 52

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4. EXTERNAL PARTS (Right-hand Side)

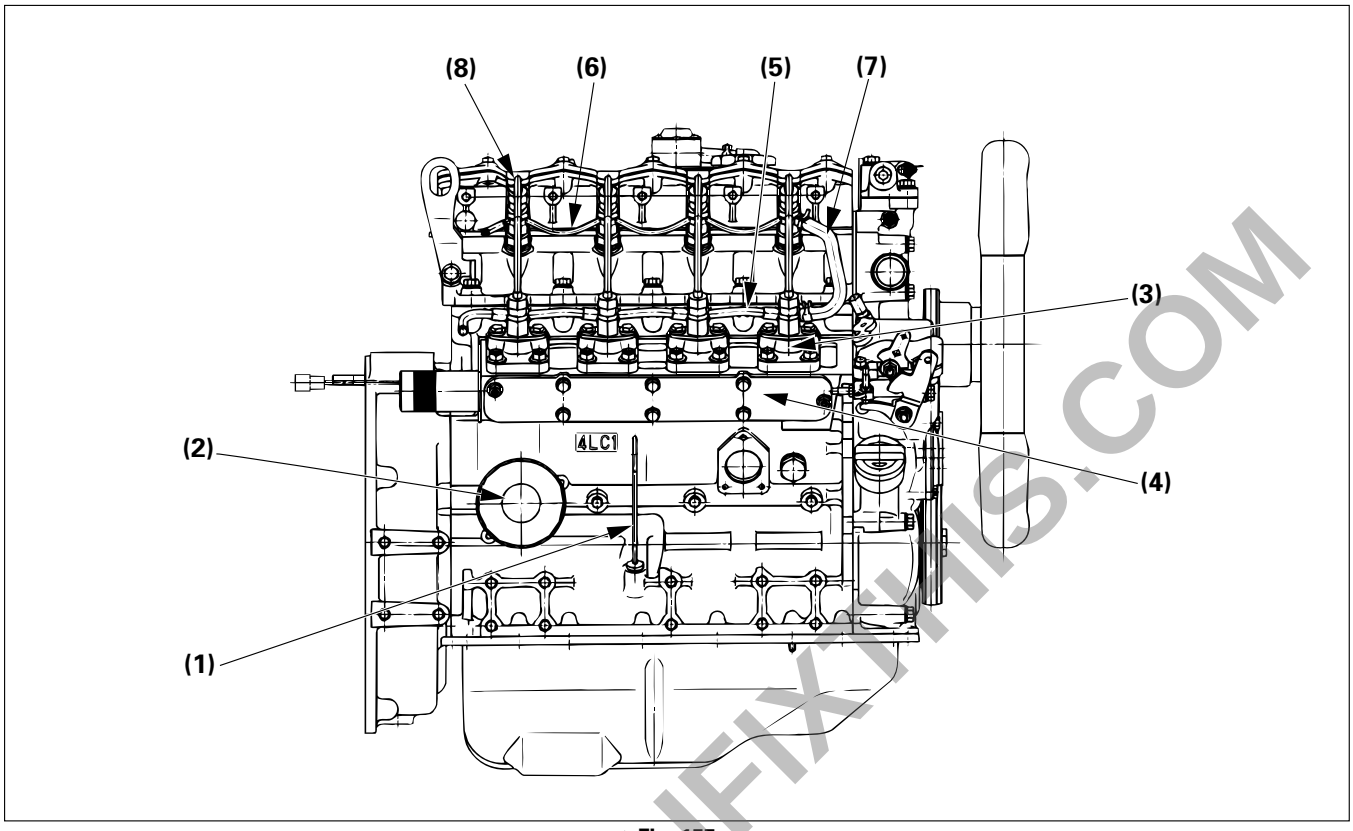


Fig. 157

(1) Dipstick
(2) Oil Filter
(3) Injection Pump
(4) Injection Pump Housing Cover
(5) Fuel Pipe
(6) Leak Off Pipe
(7) Fuel Hose
(8) Injection Pipe

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