

KOMATSU

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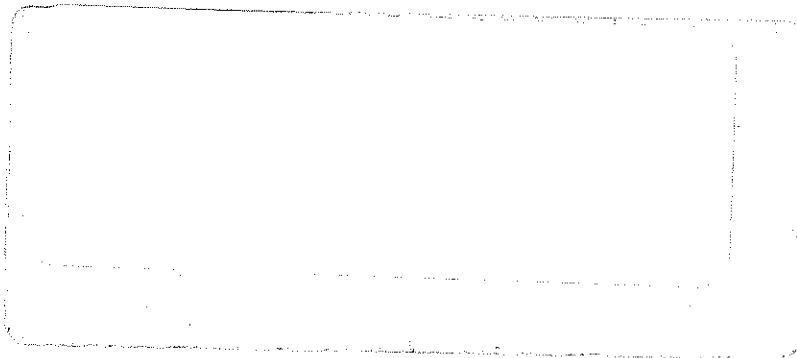
Ord: 0

SM-(S)6D95L-BE2 DIESEL ENGINE

SHOP MANUAL

6D95L/S6D95L-1

DIESEL ENGINE



KOMATSU FORKLIFT

SHOP MANUAL

6D95L/S6D95L-1

DIESEL ENGINE

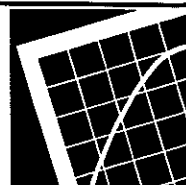
ENGINE MODEL	APPLICABLE MACHINE MODEL
6D95L-1	FD35Z/40Z-4
	FD35/40/45-4
	FD33S/35S/40S/45S-4
	FD35/40/45-5E
	FD35Z/40Z-5
	FD35/40/45-5
	FD50E/60E/70E-5
	FD50/60/70-5
	FD50E/60E/70E-6
	FD50/60/70-6
	SD23/25-3
S6D95L-1	FD60H/70H/80H-5

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ENGINE

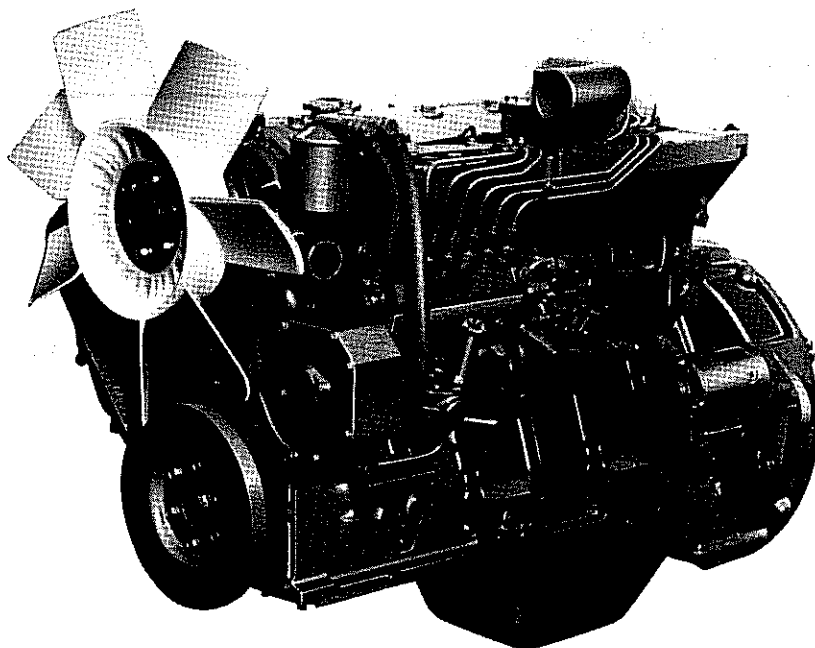
01 GENERAL



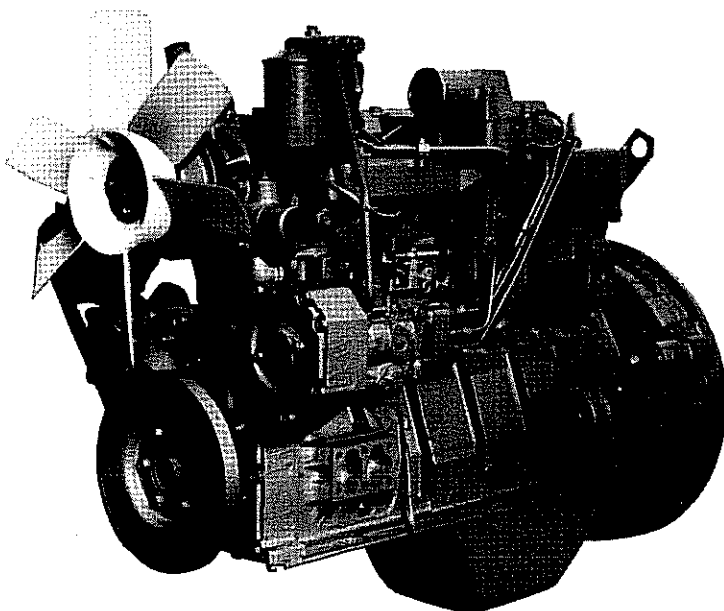
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GENERAL VIEW

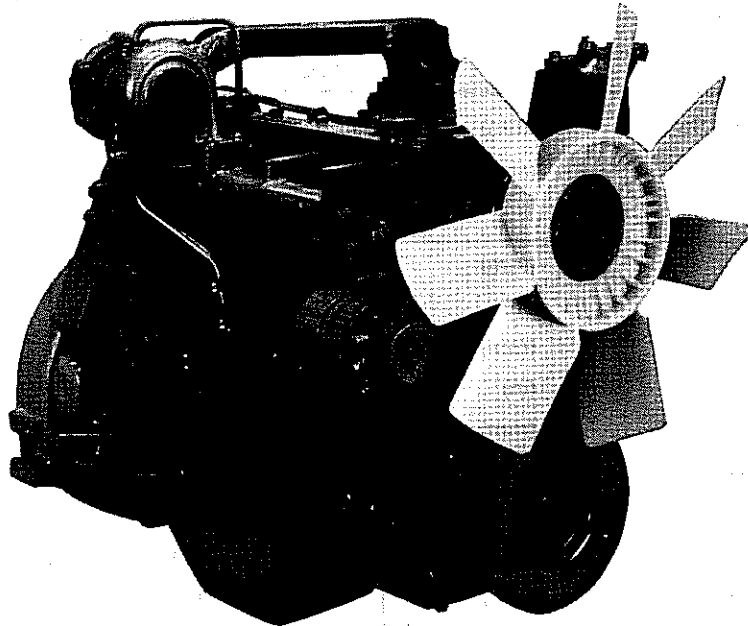
6D95L-1 (with in-line type pump)



6D95L-1 (with distributor type pump)



S6D95L-1 (with distributor type pump)



SPECIFICATIONS

Engine model		6D95L-1 (with in-line type pump)	6D95L-1 (with distributor type pump)
Applicable machine model		FD35Z/40Z-4, FD35/40/45-4 FD33S/35S/40S/45S-4	FD35Z/40Z-4, FD35/40/45-4 FD33S/35S/40S/45S-4 FD35/40/45-5E, SD23/25-3
Number of cylinder — Bore x Stroke	(mm)	6 — 95 x 115	6 — 95 x 115
Total piston displacement	(cm ³)	4,890	4,890
Firing order		1 — 5 — 3 — 6 — 2 — 4	1 — 5 — 3 — 6 — 2 — 4
Dimensions	Overall length	(mm) (in)	986 (38.8)
	Overall width	(mm) (in)	637 (25.1)
	Overall height	(mm)	809
	(Excluding exhaust pipe)	(in)	(31.9)
	Performance	Flywheel horsepower	(HP/rpm)
Maximum torque		(kgm/rpm) (ft · lb/rpm)	28/1,500 (203/1,500)
High idling speed		(rpm)	2,350 ± 50
Low idling speed		(rpm)	700 ± 25
Minimum fuel consumption ratio		(g/HPh)	160
Dry weight	(kg)	370	360
Fuel pump		Bosch type PES-A	Bosch type VE
Governor		Bosch RSV centrifugal, all-speed type	Mechanical all-speed type
Lubricating oil capacity	(ℓ) [gal (us)]	11 [2.9]	11 [2.9]
Coolant capacity	(ℓ) [gal (us)]	7.5 [2.0]	8.5 [2.2]
Alternator		24 V, 15 A	24 V, 15 A
Starting motor (Refer to page 30-51)		24 V, 4.5 kW	24 V, 4.5 kW (2.8 kW)
Battery		12 V, 70 Ah x 2	12 V, 70 Ah x 2
Turbocharger		—	—
Air compressor		—	—
Others		—	—

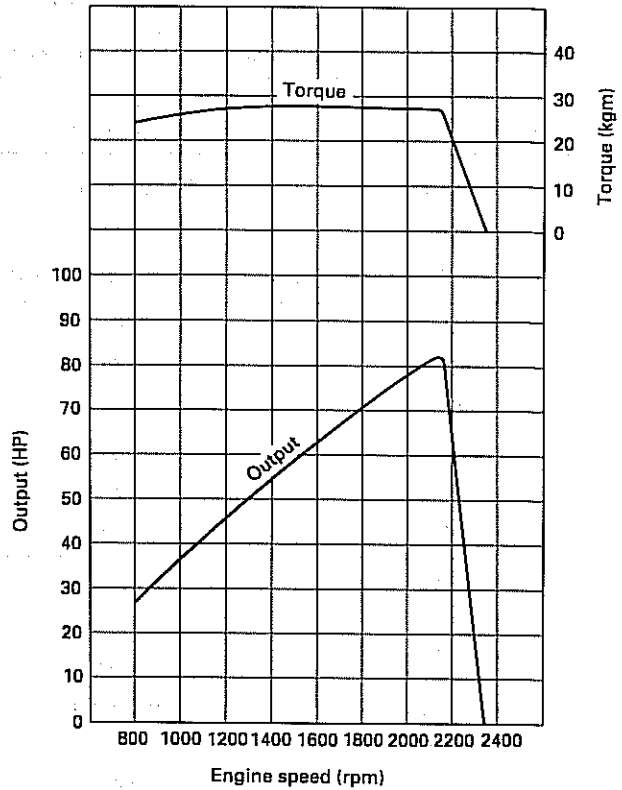
6D95L-1 (with distributor type pump)	6D95L-1 (with distributor type pump),	6D95L-1 (with distributor type pump)		S6D95L-1 (with distributor type pump)
FD35Z/40Z-5 FD35/40/45-5	FD50E/60E/70E-5 FD50E/60E/70E-6	FD50/60/70-5	FD50/60/70-6	FD60H/70H/80H-5
6 – 95 x 115 4,890 1 – 5 – 3 – 6 – 2 – 4	6 – 95 x 115 4,890 1 – 5 – 3 – 6 – 2 – 4	6 – 95 x 115 4,890 1 – 5 – 3 – 6 – 2 – 4		6 – 95 x 115 4,890 1 – 5 – 3 – 6 – 2 – 4
983 (38.7) 627 (24.7) 875 (34.4)	986 (38.8) 586 (23.1) 876 (34.5)	986 (38.8) 586 (23.1) 876 (34.5)		986 (38.8) 586 (23.1) 876 (34.5)
85/2,150 28/1,500 (203/1,500) 2,350 \pm_{-50}^{+25} 700 \pm 25 160	82/2,150 28/1,500 (203/1,500) 2,350 \pm 50 700 \pm 25 160	90/2,250 30/1,500 (217/1,500) 2,500 \pm 50 700 \pm 25 160	95/2,250 32/1,500 (231/1,500) 2,500 \pm 50 700 \pm 25 160	110/2,000 41.5/1,500 (300/1,500) 2,200 \pm 50 700 \pm 25 160
345	360	360		425
Bosch type VE Mechanical all-speed type	Bosch type VE Mechanical all-speed type	Bosch type VE Mechanical all-speed type		Bosch type VE Mechanical all-speed type (Bosch PES-A: Option)
13 [3.4]	11 [2.9]	11 [2.9]		12.5 [3.3]
10 [2.6]	16 [4.2]	16 [4.2]		18 [4.8]
24 V, 25 A 24 V, 4.5 kW 12 V, 70 Ah x 2	24 V, 15 A 24 V, 4.5 kW 12 V, 70 Ah x 2	24 V, 15 A 24 V, 4.5 kW 12 V, 70 Ah x 2		24 V, 15 A 24 V, 4.5 kW (2.8 kW) 12 V, 70 Ah x 2
— — —	— — —	— — —		GARRET T31 — —

ENGINE PERFORMANCE CURVE

6D95L-1

(FD35Z/40Z-4, FD35/40/45-4)
 (FD33S/35S/40S/45S-4, FD35/40/45-5E)
 (FD50E/60E/70E-5, FD50E/60E/70E-6, SD23/25-3)

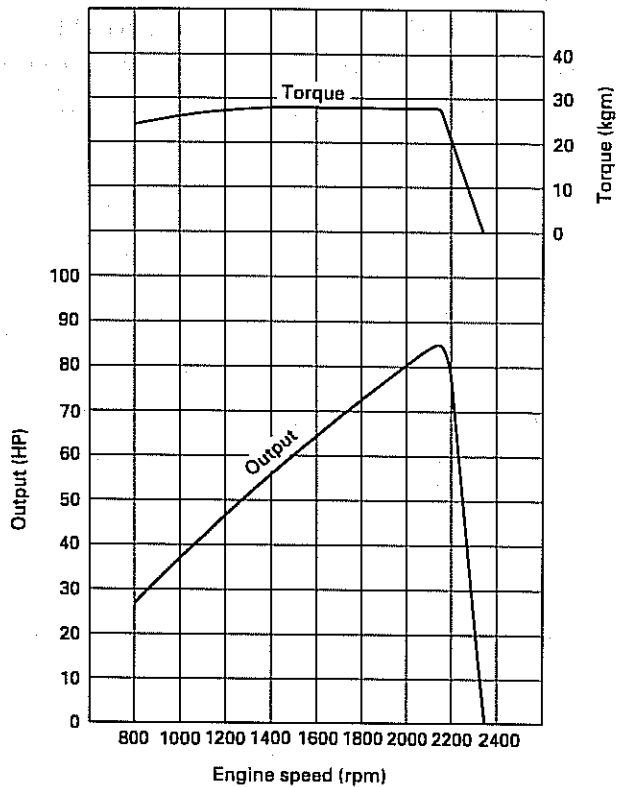
Flywheel horsepower: 82 HP/2,150 rpm
 Maximum torque: 28 kgm/1,500 rpm
 Minimum fuel consumption ratio: 160 g/HPh



6D95L-1

(FD35Z/40Z-5)
 (FD35/40/45-5)

Flywheel horsepower: 85 HP/2,150 rpm
 Maximum torque: 28 kgm/1,500 rpm
 Minimum fuel consumption ratio: 160 g/HPh



6D95L-1

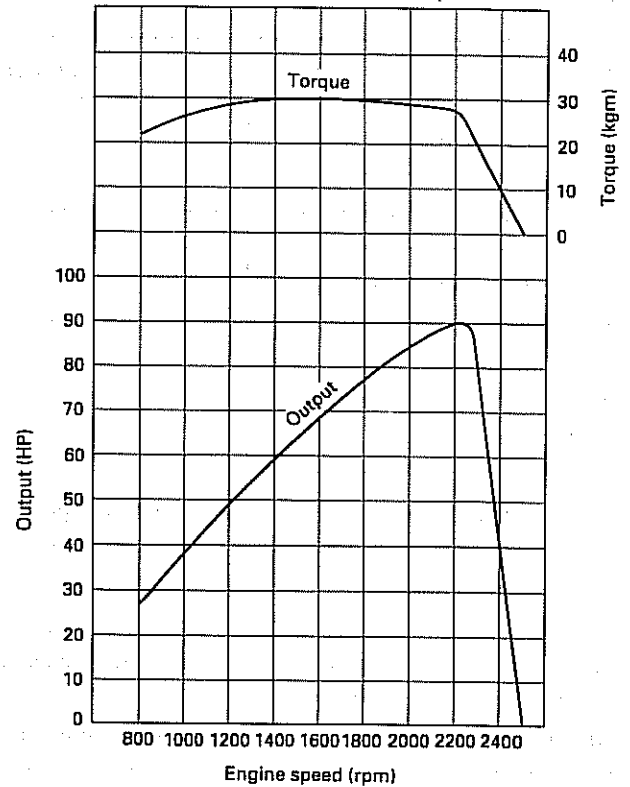
(FD50/60/70-5)

Flywheel horsepower: 90 HP/2,250 rpm
 Maximum torque: 30 kgm/1,500 rpm
 Minimum fuel consumption ratio: 160 g/HPh

6D95L-1

(FD50/60/70-6)

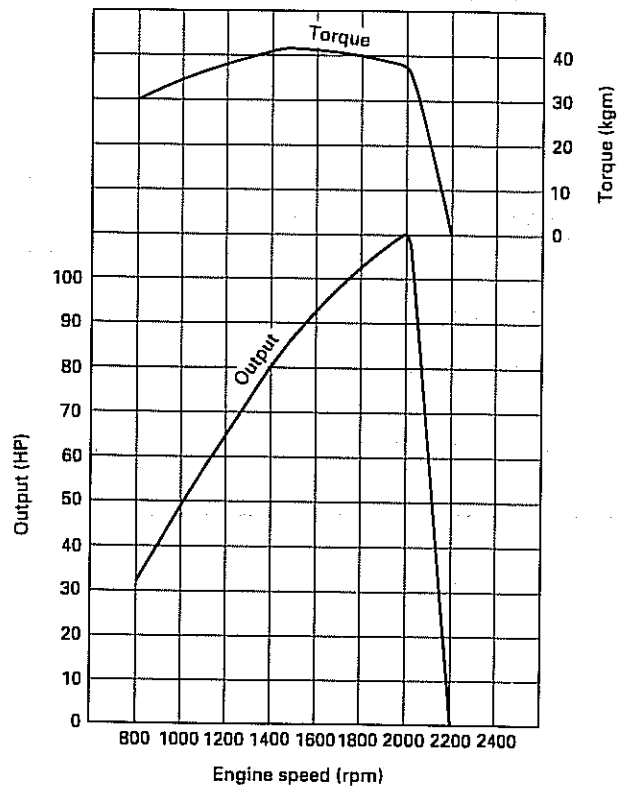
Flywheel horsepower: 95 HP/2,250 rpm
 Maximum torque: 32 kgm/1,500 rpm
 Minimum fuel consumption ratio: 160 g/HPh




S6D95L-1

(FD60H/70H/80H-5)

Flywheel horsepower: 110 HP/2,000 rpm
 Maximum torque: 41.5 kgm/1,500 rpm
 Minimum fuel consumption ratio: 160 g/HPh



WEIGHT TABLE

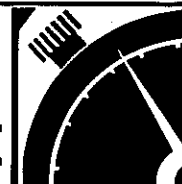
 This weight table is a guide for use when transporting or handling components.

Unit: kg (lb)

No.	Item	Components	6D95L-1	S6D95L-1
1	Turbocharger		—	7.0 (15.4)
2	Cylinder head assembly	Cylinderhead, valve, valve spring	41 (90)	41 (90)
3	Cylinder block assembly	Cylinder block, main bearing cap, cylinder liner	105 (232)	105 (232)
4	Timing gear case		9.8 (22) 9.0(20): FD50(E) — 70(E)	9.0 (20)
5	Oil pan		3.1 (6.8)	3.1 (6.8)
6	Flywheel assembly	Flywheel, ring gear	17 (37)	17 (37)
7	Flywheel housing		20 (44)	35 (77)
8	Crankshaft assembly	Crankshaft, crankshaft gear	36.5 (80)	36.5 (80)
9	Camshaft assembly	Camshaft, camshaft gear thrust plate	8.5 (18.7)	8.5 (18.7)
10	Piston and connecting rod assembly	Piston, piston ring, piston pin, connecting rod	2.1 (4.6)	2.1 (4.6)
11	Oil pump		0.5 (1.1)	0.5 (1.1)
12	Fuel injection pump		13.5 (30) (for in-line type pump)	5.5 (12.1)
			5.5 (12.1) (for distributor type pump)	
13	Water pump		7.3 (16.1)	7.3 (16.1)
14	Alternator		7.8 (17.2) (for 24 V, 25 A type)	4.0 (8.8) (24 V, 15 A type)
			4.0 (8.8) (for 24 V, 15 A type)	
15	Starting motor		8.5 (18.7) (for 24 V, 4.5 kW type)	6.8 (15) (24 V, 2.8 kW)
			6.8 (15) (for 24 V, 2.8 kW type)	

ENGINE

10 INSPECTION AND MAINTENANCE



INSPECTION AND MAINTENANCE

1. Proper selection of fuel
and lubricants 10- 2
2. Fuel filter 10- 3
3. Fan belt tension 10- 3
4. Cylinder head mounting bolt 10- 4
5. Valve clearance adjustment 10- 5
6. Injection timing 10- 6
7. Engine compression measuring 10-11
8. Engine oil pressure measuring 10-11

INSPECTION AND MAINTENANCE

1. PROPER SELECTION OF FUEL AND LUBRICANTS

RESERVOIR	KIND OF FLUID	ATMOSPHERIC TEMPERATURE				
		14 -10	32 0	50 10	68 20	86°F 30°C
Engine oil pan	Engine oil	SAE 30-CD				
		SAE 10W-CD				
		SAE 10W-30-CD				
TORQFLOW transmission case	Engine oil	SAE 10W-CD				
		SAE 5W-CD				
Differential case	Gear oil	SAE 90				
		SAE 80				
Hydraulic tank	Engine oil	SAE 10W				
Fuel tank	※ Diesel fuel					
Brake fluid reservoir	Brake fluid	SAE 1703e				
Clutch fluid reservoir	Brake fluid	SAE 1703e				
Grease		NLGI No.2				
Coolant	Soft water	—				

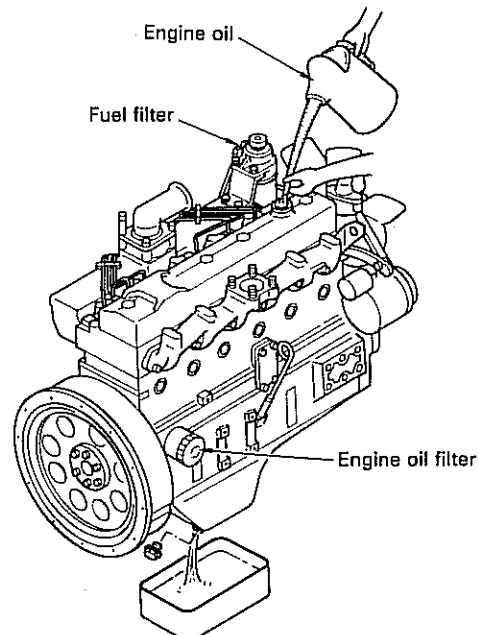
※ Do not use diesel fuel mixed with kerosene for the diesel engine.
 Figures in parenthesis shows oil refill quantity.

NOTE:

- SAE numbers give to engine oil should be selected according to atmospheric temperature.
- As for engine oil used in engine oil pan, use SAE 10W oil when the temperature at the time of engine start-up is below 0°C, even if the atmospheric temperature in daytime is expected to rise to 10°C or more.
- If any engine oil of API service class CC is to be used instead of class CD engine oil, the frequency of oil change must be doubled.

- ★ When adding engine oil, do not let the oil overflow from the filler port.
 Always remove the dipstick and add the specified amount of oil.

For details of the replacement interval for the oil and oil filter, and details of the method for checking the oil level, see the Operation & Maintenance Manual.

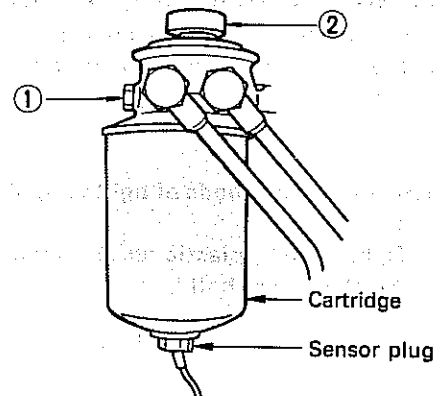


2. FUEL FILTER

For details of the replacement interval for the fuel filter, and details of the method for replacement for the fuel filter, see the Operation & Maintenance Manual.

Air bleeding

Loosen plug (1), and move knob (2) up and down until no more bubbles come out. Then, tighten plug (1).

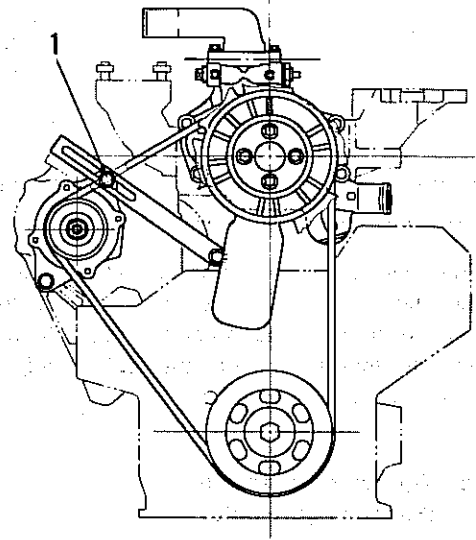


3. FAN BELT TENSION


Check the amount the fan belt deflects when pushed with a force of 6 kg at a point midway between the fan pulley and the alternator pulley.

Adjustment

- 1) Loosen mounting bolt of alternator pulley and belt tension adjustment bolt (1).
- 2) Using a bar, raise alternator and adjust fan belt tension. Tighten adjustment bolt (1), then tighten mounting bolt.



4. CYLINDER HEAD MOUNTING BOLT

 Cylinder head mounting bolt
(Coat bolt threads and washers with molybdenum disulphide)

There are two methods of tightening the head bolts.

1) **Tightening by plastic turning angle**
(See the figure bolt.)


 Cylinder head mounting bolt

Unit: kgm (ft · lb), deg.

Order	Target	Range
1st step	7 (51)	6 – 8 (43 – 58)
2nd step	11 (80)	10.5 – 11.5 (76 – 83)
3rd step	90°	90° – 120°

* The cylinder head mounting bolt may be reused five times. Make a punch mark on the bolt head each time the bolts are used. If there are already five marks on the bolt head, replace with new bolts.

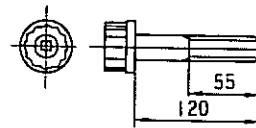
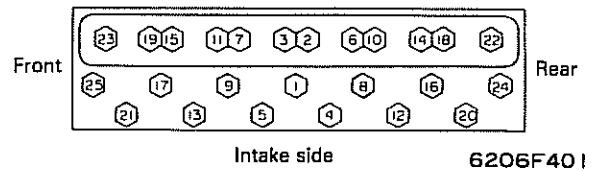
2) **Tightening by torque**
(See the figure bolt.)

 Cylinder head mounting bolt

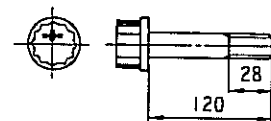
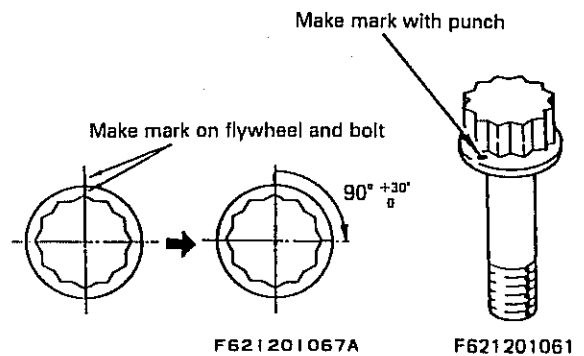
Unit: kgm (ft · lb)

Order	Target	Range
1st step	8 (58)	7 – 9 (51 – 65)
2nd step	12 (87)	11 – 13 (80 – 94)
3rd step	15 (109)	14.5 – 15.5 (105 – 112)

Tightening order of cylinder head mounting bolt



For tightening by plastic turning angle bolts

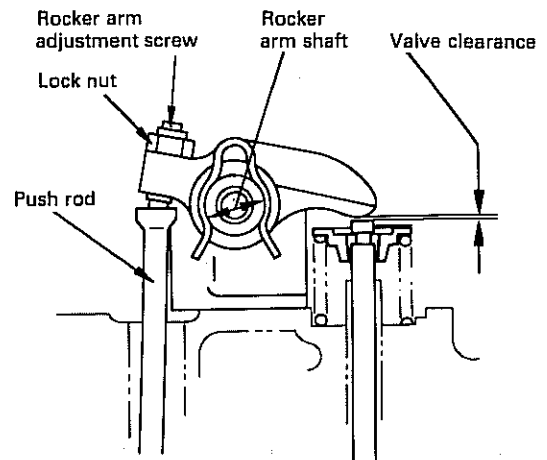
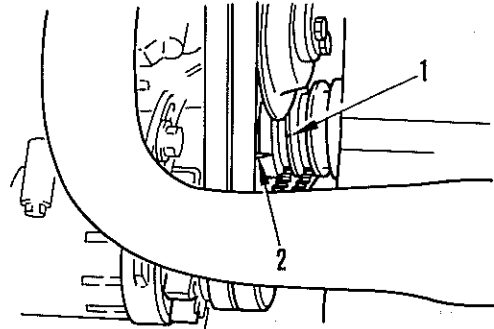


For tightening by torque bolts

5. VALVE CLEARANCE ADJUSTMENT

Warm and cold mm (in)	
IN	0.35 (0.0138)
EX	0.50 (0.0197)

- 1) Rotate the crankshaft in the normal direction to align pointer (2) on the gear case cover with the 1.6 TOP mark on crankshaft pulley (1). When the begin to open, No.1 cylinder is in compression T.D.C.
- 2) When No.1 cylinder is at compression T.D.C., adjust the valve marked ●. Then rotate the crankshaft 360° in the normal direction, and adjust the valves marked ○.



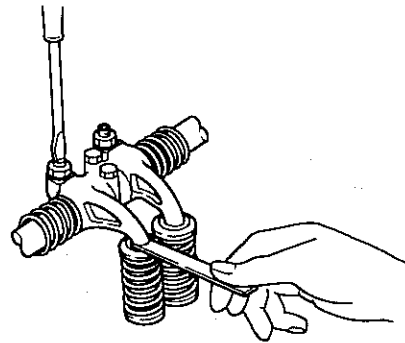
★ Valve arrangement chart

Cylinder No.	1	2	3	4	5	6
Intake valve	●	○	●	○	●	○
Exhaust valve	○	●	○	●	○	●

Lock nut	$4.5 \pm 0.5 \text{ kgm}$ $33 \pm 4 \text{ ft} \cdot \text{lb}$ $44 \pm 5 \text{ Nm}$
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- 3) After adjusting No. 1 cylinder at compression top dead center, it is also possible to turn the crankshaft 120° each time and adjust the valve clearance of each cylinder according to the firing order.
- ★ Firing order: 1 - 5 - 3 - 6 - 2 - 4
 - ★ After tightening the locknut, check the clearance again.



6. INJECTION TIMING

There are two types of injection pump: the distributor type and the in-line type. The method for testing and adjusting is different for each type.

FOR DISTRIBUTOR TYPE INJECTION PUMP

There are two methods for checking and adjusting the fuel injection timing of an injection pump.

- The "MATCH MARK ALIGNMENT" method, which is used when the injection pump is installed to the original engine and the pump is not being repaired.
- The "MEASURING DEVICE" method, which is used when a repaired or replaced injection pump is installed to the engine.

★ Before inspecting and adjusting the fuel injection timing, bring the No. 1 cylinder piston to the top dead center (T.D.C.) of the compression stroke, refer to VALVE CLEARANCE ADJUSTMENT section.

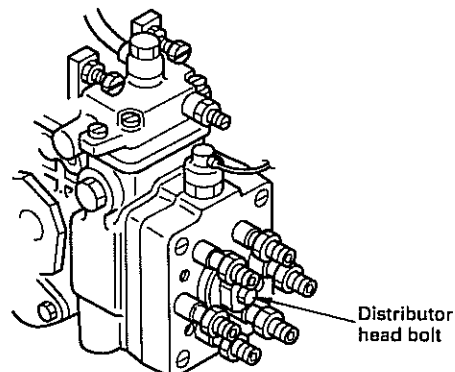
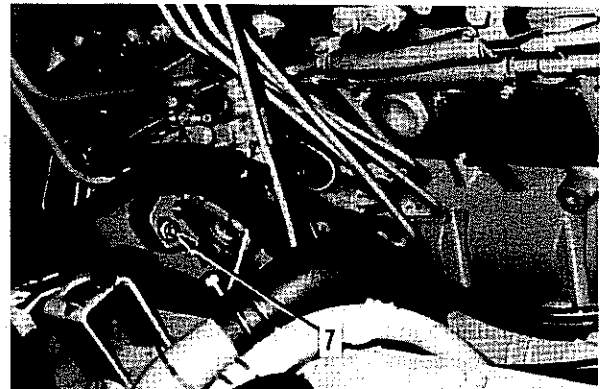
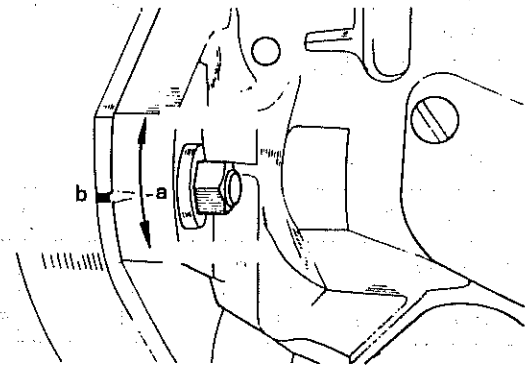
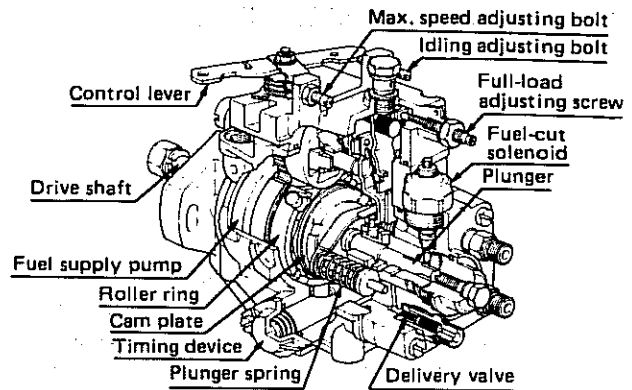
MATCH MARK ALIGNMENT method

1. Check that line **a** on the injection pump and line **b** on the timing gear case are aligned.
 - ★ If the lines are not aligned, loosen nut (7), move the injection pump to align the lines, then tighten the bolt.

MEASURING DEVICE method

Adjust so that the camlift of the injection pump comes to attain the specified value when the No. 1 cylinder is set to compression T.D.C. position.

1. Set No. 1 cylinder at the compression T.D.C. position. Then rotate the crankshaft 25° to 30° in the reverse direction from the compression T.D.C. position.
(The plunger of injection pump should be set to B.D.C. position.)
2. Remove the distributor head bolt from the injection pump.

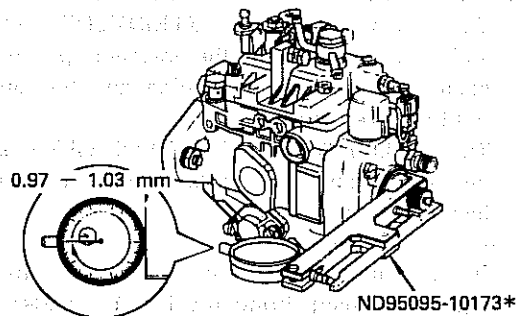
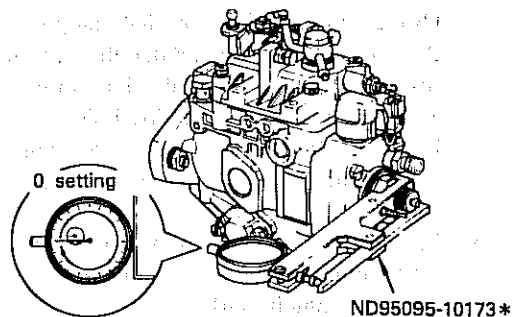


3. Set the dial gauge to the plunger stroke measure (ND95095-10173*), and then fit to the pump.
 - ★ Check that the stylus end of plunger stroke measure contacts the plunger head.
4. Set the dial gauge pointer to 0. In this case, by rotating the crankshaft clockwise/counterclockwise a little, check that the pointer is steady at 0.
5. Rotating the crankshaft in the normal direction. Take the reading of the dial gauge indication when the V-groove of crank pulley matches the pointer. (Compression T.D.C.)

Standard value	0.97 – 1.03 mm (0.038 – 0.041 in)
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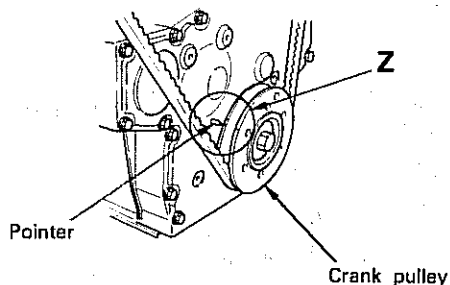
The gauge reading, ± 0.03 mm (0.001 in) is equivalent to $\pm 0.5^\circ$ fuel injection timing.

- ★ The crankshaft should be rotated in the normal direction (clockwise looking from front) without fail.

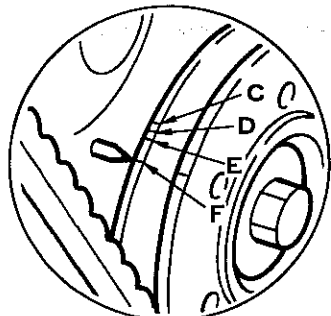


*: Following tools are also available

- ND95095-10172
- ND95095-10171
- ND95095-10170
- ND95904-51260



Detail Z



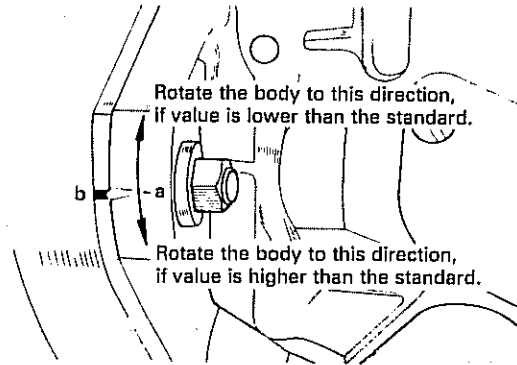
- ★ The groove of the crankshaft pulley which is aligned with the pointer differs according to the engine model. Refer to the value for TESTING AND ADJUSTING DATA table in TESTING AND ADJUSTING chapter.

Groove	Pattern A	Pattern B
C	BTDC 16°	BTDC 10°
D	BTDC 14°	BTDC 8°
E	BTDC 12°	BTDC 6°

Groove F: Compression T.D.C. position

6. Adjustment of fuel injection timing

- ① Unless the reading of dial gauge is within the standard value, adjust the fuel injection timing by rotating the injection pump body.
 - ② Tighten the pump mounting bolt.
 - ③ Remove the plunger stroke measure (STT), and then fit the distributor head bolt to there.
- ★ The copper washer of the distributor head bolt should be replaced with a new one.
- ④ Stamp a match mark.

**FOR IN-LINE TYPE INJECTION PUMP**

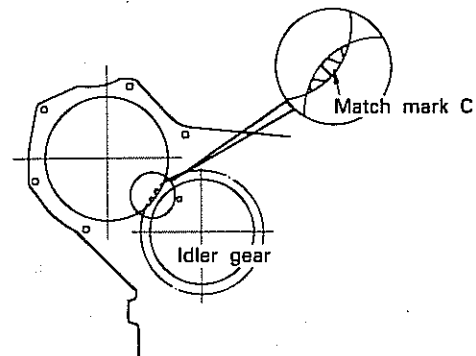
There are two methods for checking and adjusting the fuel injection timing of an injection pump.

- The "MATCH MARK ALIGNMENT" method, which is used when the injection pump is installed to the original engine and the pump is not being repaired.
- The "DELIVERY VALVE" method, which is used when a repaired or replaced injection pump is installed to the engine.

★ Before inspecting and adjusting the fuel injection timing, bring the No. 1 cylinder piston to the top dead center (T.D.C.) of the compression stroke, refer to VALVE CLEARANCE ADJUSTMENT section.

MATCH MARK ALIGNMENT method

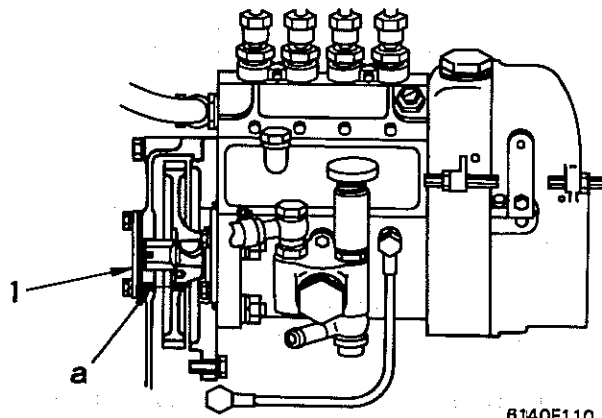
1. Assemble the injection pump, injection pump holder, and drive gear.
2. Set the No. 1 cylinder piston to the compression top dead center.
When aligning the line on the crankshaft pulley (1T or 1.4T, 1.6T) and the pointer, match mark C can be seen at the tip of the idler gear tooth.
If line C cannot be seen, rotate the crankshaft one more turn.



(View from flywheel side)

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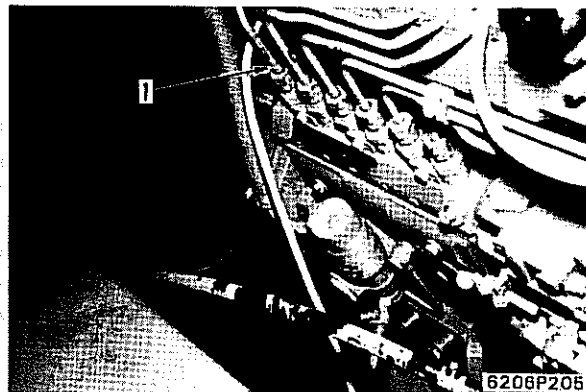
3. Remove cover (1) from the injection pump.
4. Install the injection pump to the engine with the injection pump holder and drive gear as one unit.
When doing this, insert a pin ($\phi 4 - 4.5$, length: 80 mm) through the hole in portion (a) of the front gear cover to align the hole in the drive gear.
5. After installing, check that the pin is straight. Check that there is no misalignment between the hole in the injection pump holder and the mounting hole of the front gear cover, and that there is no problem inserting the bolt.
6. If the position is misaligned, repeat the procedure again from Step 4.
7. After tightening the bolts, check that the lines on the injection pump, injection pump holder, and front plate are aligned.



6140F110

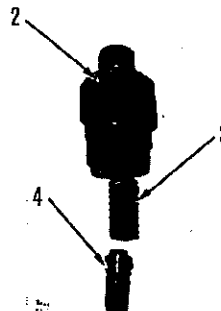
DELIVERY VALVE method

- Except for injection pumps with a stepped lead plunger
1. Disconnect fuel injection tube (1) of No. 1 cylinder.



6206P205

2. Remove delivery valve holder (2).
3. Take out spring (3) and delivery valve (4), then install the delivery valve holder again.
4. Place the fuel control lever at the FULL position, then rotate the crankshaft slowly in the counterclockwise direction while operating the priming pump, and stop at the point where the fuel stops flowing from the delivery valve holder.



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