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SERVICE MANUAL

3, 4JH2LE

YANMAR

SERVICE MANUAL

MARINE DIESEL ENGINE

MODEL 3,4JH2LE

MODELS 3,4JH2LE

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CHAPTER 1

GENERAL

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1. Engine Specifications

1-1 3JH Series

Model		3JH2L		3JH2L-T		
Type		Vertical 4-cycle water cooled diesel engine				
Combustion system		Direct injection				
Aspiration		Naturally aspirated		Turbocharged		
Number of cylinders		3				
Bore × stroke		mm		82 × 86		
Displacement		liter		1.363		
Output	Intermittent rating	kW/rpm (hp/rpm)	10.9/1500 (14.8/1500)	12.9/1800 (17.6/1800)	13.3/1500 (18.1/1500)	16.9/1800 (23/1800)
	Continuous rating	kW/rpm (hp/rpm)	9.93/1500 (13.5/1500)	11.8/1800 (16/1800)	12.1/1500 (16.5/1500)	14.7/1800 (20/1800)
Mean effective pressure (cont.)		kgf/cm	5.94	5.87	7.27	7.34
Mean piston speed		m/sec	4.30	5.16	4.30	5.16
Compression ratio			18.1		18.1	
Fire order			1 — 3 — 2 — 1			
Fuel injection pump			Bosh in-line type, YPES-CL H			
Fuel injection timing (FID)		Degree	12° ± 1° bTDC		12° ± 1° bTDC	
Fuel injection pressure		kgf/cm	200 ± 5			
Fuel injection valve			Hole type			
Direction of rotation			Counter-clockwise viewed from flywheel			
Power take-off			At flywheel side			
Cooling system			Fresh water cooling by centrifugal fresh water pump and rubber impeller seawater pump			
Lubrication system			Forced lubrication with trochoid pump			
Starting system	Starting motor		DC 12V, 1.4kW			
	Alternator		12V, 35A (option)			
Speed regulation (Governor regulation)	Instant	%	Less than 10			
	Permanent	%	≤ 6.6	≤ 5	≤ 6.6	≤ 5
	Recovery time	sec	Less than 8			
	Stability	%	≤ ± 0.5			
Dimensions	Overall length	mm	685		698	
	Overall width	mm	507		534	
	Overall height	mm	629		629	
Engine weight (dry)		kg	173		178	
Lube oil capacity, Effect/max.		ℓ	1.8/4.7			
Cooling water capacity (Fresh water)	Water tank	ℓ	4.4			
	Reserve tank	ℓ	0.8			

Chapter 1 General
1. Engine Specifications

SM/3,4JH2LE

1-2 4JH Series

Model		4JH2L-T		4JH2L-HT		
Type		Vertical 4-cycle water cooled diesel engine				
Combustion system		Direct injection				
Aspiration		Turbocharged		Turbocharged & intercooler		
Number of cylinders		4				
Bore × stroke		mm 82 × 86				
Displacement		liter 1.817				
Output	Intermittent rating	kW/rpm (hp/rpm)	18.2/1500 (24.7/1500)	22.4/1800 (30.5/1800)	22.2/1500 (30.2/1500)	28.4/1800 (38.5/1800)
	Continuous rating	kW/rpm (hp/rpm)	16.5/1500 (22.5/1500)	20.2/1800 (27.5/1800)	20.2/1500 (27.5/1500)	25.7/1800 (35/1800)
Mean effective pressure (cont.)		kgf/cm	7.43	7.57	9.58	9.63
Mean piston speed		m/sec	4.30	5.16	4.30	5.16
Compression ratio		18.1		18.1		
Fire order		1 — 3 — 4 — 2 — 1				
Fuel injection pump		Bosh in-line type, YPES-CL H				
Fuel injection timing (FID)		Degree	12° ± 1° bTDC		10° ± 1° bTDC	
Fuel injection pressure		kgf/cm	200 ± 5			
Fuel injection valve		Hole type				
Direction of rotation		Counter-clockwise viewed from flywheel				
Power take-off		At flywheel side				
Cooling system		Fresh water cooling by centrifugal fresh water pump and rubber impeller seawater pump				
Lubrication system		Forced lubrication with trochoid pump				
Starting system	Starting motor	DC 12V , 1.4kW				
	Alternator	12V, 35A (option)				
Speed regulation (Governor regulation)	Instant	%	Less than 10			
	Permanent	%	≦ 6.6	≦ 5	≦ 6.6	≦ 5
	Recovery time	sec	Less than 8			
	Stability	%	≤ ± 0.5			
Dimensions	Overall length	mm	792		792	
	Overall width	mm	534		540	
	Overall height	mm	629		639	
Engine weight (dry)		kg	224		246	
Lube oil capacity, Effect/max.		ℓ	2.3/5.8			
Cooling water capacity (Fresh water)	Water tank	ℓ	6.0			
	Reserve tank	ℓ	0.8			

2. Construction

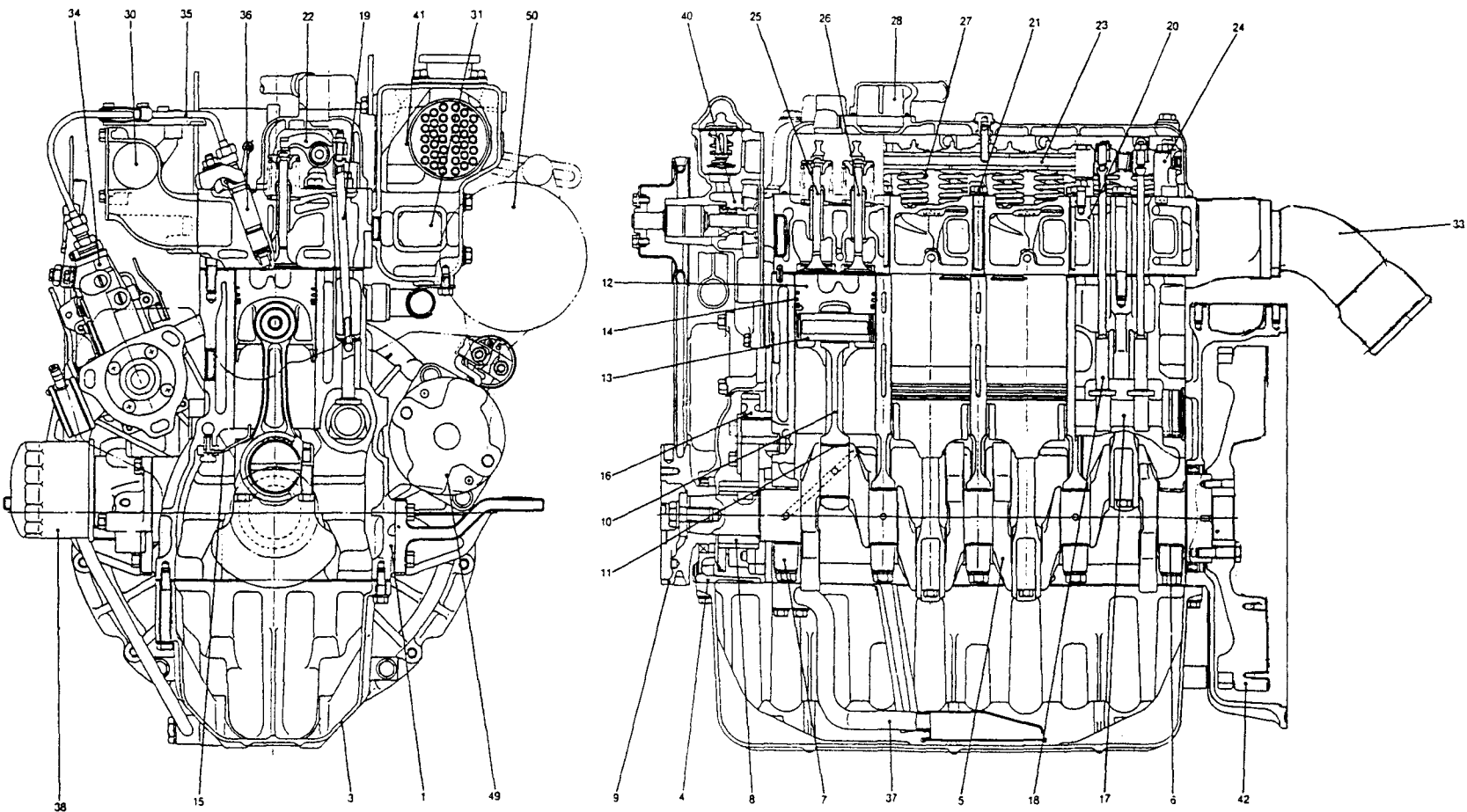
2-1 3JH Series

ENGINE MODEL		3JH2L	3JH2L-T
Group	Part	Construction	
Engine Proper	Cylinder block	Integrally-cast water jacket and crankcase	
	Cylinder liner	Sleeve less	
	Timing gear case	Cast aluminum	
	Oil sump	Steel plate	
	Main bearings	Hanger-type bearings supports	
Intake/Exhaust, Valve Drive	Cylinder head	Integrally-cast type, jet cooling between valves, Intake/exhaust valve seat inserts	
	intake/exhaust valves	Mushroom shaped, seat angle: Intake: 120° Exhaust: 90°	
	Intake manifold	Cast aluminum	
	Exhaust manifold	Water cooled integral with water tank	
	Turbocharger	—	IHI RHB 31 (Water cooled) exhaust gas turbo
	Valve drive	Overhead valve push rod rocker arm system	
	Timing gear	Helical gear	
Main Moving Parts	Crankshaft	Stamped forging	
	Flywheel	Cast iron static balance with ring gear	
	Pistons	Cast aluminum, oval type	
	Piston rings	2 compression rings, 1 oil ring	
	Piston pin	Floating type	
	Connecting rod	Forged steel	
	Crank pin bushings	Aluminum bushings	
Lube Oil System	Lube oil pump	Trochoid type	
	Oil filter	Full flow paper element cartridge type	
	Oil cooler	—	Tube type
	Control valve	Cylindrical type with external adjusting shims	
Cooling Water System	Fresh water pump	V-pulley driven, centrifugal type	
	Sea water pump	V-pulley driven, rubber impeller type	
	Thermostat	Wax pellet type	
	Fresh water cooler	Multi-tube type integral with exhaust manifold	
Fuel Injection Equipment	Fuel injection pump	YANMAR YPES-CL type integral with governor	
	Fuel injection nozzles	Hole type	
	Fuel feed pump	Diaphragm type	
	Fuel filter	Paper element cartridge type	
Governor	Governor	Centrifugal all-speed mechanical type	
Starting Equipment	Electric starter	DC12V, 1.4kW starter motor	
	Generator	12V, 35A with IC regulator(option)	

2-2 4JH Series

ENGINE MODEL		4JH2L-T	4JH2L-HT
Group	Part	Construction	
Engine Proper	Cylinder block	Integrally-cast water jacket and crankcase	
	Cylinder liner	Dry sleeve	
	Timing gear case	Cast aluminum	
	Oil sump	Steel plate	
	Main bearings	Hanger-type bearings supports	
Intake/Exhaust, Valve Drive	Cylinder head	Integrally-cast type, jet cooling between valves, Intake/exhaust valve seat inserts	
	intake/exhaust valves	Mushroom shaped, seat angle: intake: 120° Exhaust: 90°	
	Intake manifold	Aluminum diecast integral	
	Exhaust manifold	Water cooled integral with water tank	
	Aircooler		Plate fin type
	Turbocharger	IHI RHB 31 (Water cooled) exhaust gas turbo	
	Valve drive	Overhead valve push rod rocker arm system	
	Timing gear	Helical gear	
Main Moving Parts	Crankshaft	Stamped forging	
	Flywheel	Cast iron static balance with ring gear	
	Pistons	Cast aluminum, oval type	
	Piston rings	2 compression rings, 1 oil ring	
	Piston pin	Floating type	
	Connecting rod	Forged steel	
	Crank pin bushings	Aluminum bushings	
Lube Oil System	Lube oil pump	Trochoid type	
	Oil filter	Full flow paper element cartridge type	
	Oil cooler	Tube type	Double tube type
	Control valve	Cylindrical type with external adjusting shims	
Cooling Water System	Fresh water pump	V-pulley driven, centrifugal type	
	Sea water pump	V-pulley driven, rubber impeller type	
	Thermostat	Wax pellet type	
	Fresh water cooler	Multi-tube type integral with exhaust manifold	
Fuel Injection Equipment	Fuel injection pump	YANMAR YPES-CL type integral with governor	
	Fuel injection nozzles	Hole type	
	Fuel feed pump	Diaphragm type	
	Fuel filter	Paper element cartridge type	
Governor	Governor	Centrifugal all-speed mechanical type	
Starting Equipment	Electric starter	DC12V, 1.4kW starter motor	
	Generator	12V, 35A with IC regulator(option)	

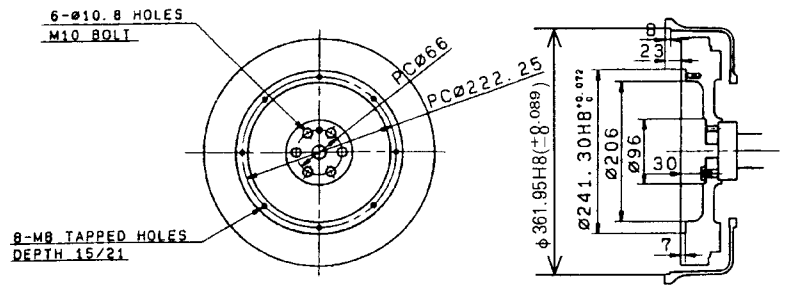
3. Engine Cross Section



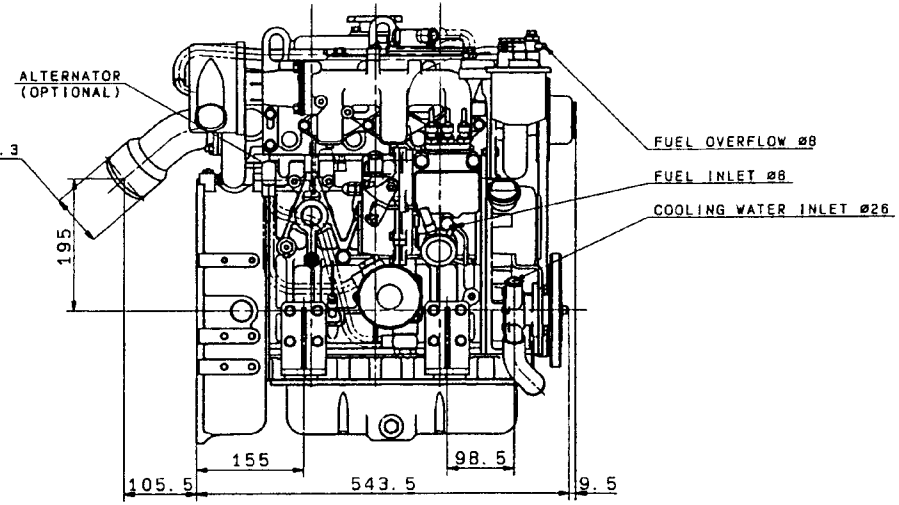
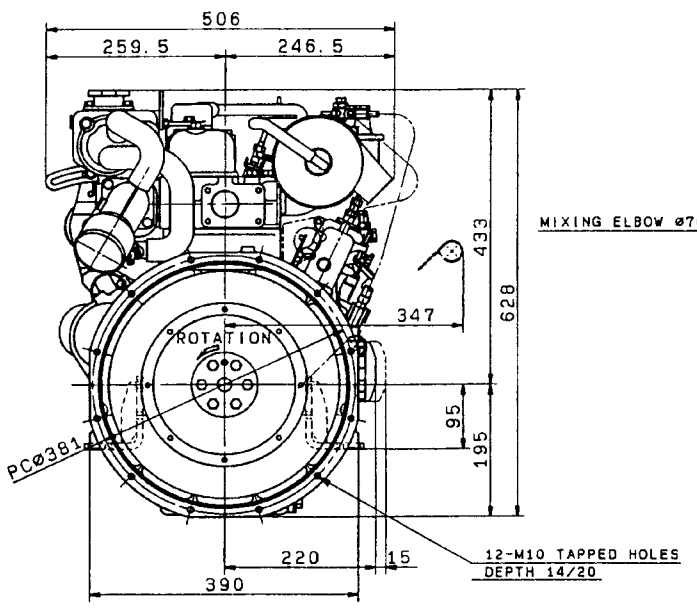
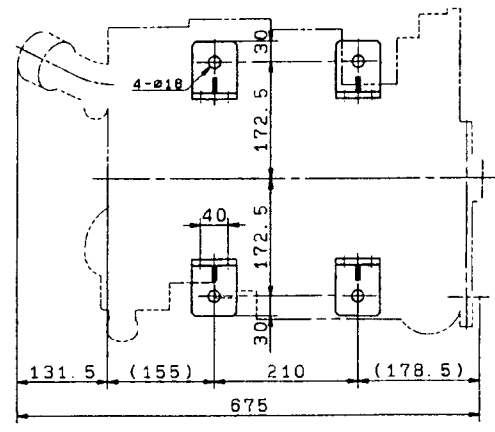
- | | | | | |
|-------------------------|---------------------------|------------------------------------|--------------------------------|--------------------|
| 1. Cylinder block | 11. Crank pin bushing | 21. Cylinder head bolt | 31. Exhaust manifold | 41. Heat exchanger |
| 3. Oil pan | 12. Piston | 22. Valve rocker arm | 33. Mixing elbow | 42. Flywheel |
| 4. Timing gear case | 13. Piston pin | 23. Valve rocker arm shaft | 34. Fuel injection pump | |
| 5. Crankshaft | 14. Piston ring | 24. Valve rocker arm shaft support | 35. Fuel pressure pipe | |
| 6. Main bearing bushing | 15. Piston cooling nozzle | 25. Intake valve | 36. Fuel injection nozzle | |
| 7. Main bearing cap | 16. Idle gear | 26. Exhaust valve | 37. Lubricating oil inlet pipe | |
| 8. Crank gear | 17. Camshaft | 27. Valve spring | 38. Lubricating oil filter | |
| 9. Crankshaft V-pulley | 18. Tapet | 28. Breather | | 49. Starting motor |
| 10. Connecting rod | 19. Push rod | 29. Intake silencer | | 50. Alternator |
| | 20. Cylinder head | 30. Intake manifold | | |
| | | | 40. Cooling water pump | |

4. Engine Outline

4-1 3JH2L

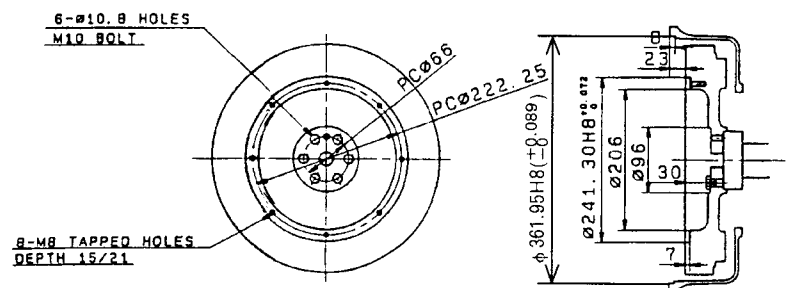


DETAIL OF FLYWHEEL

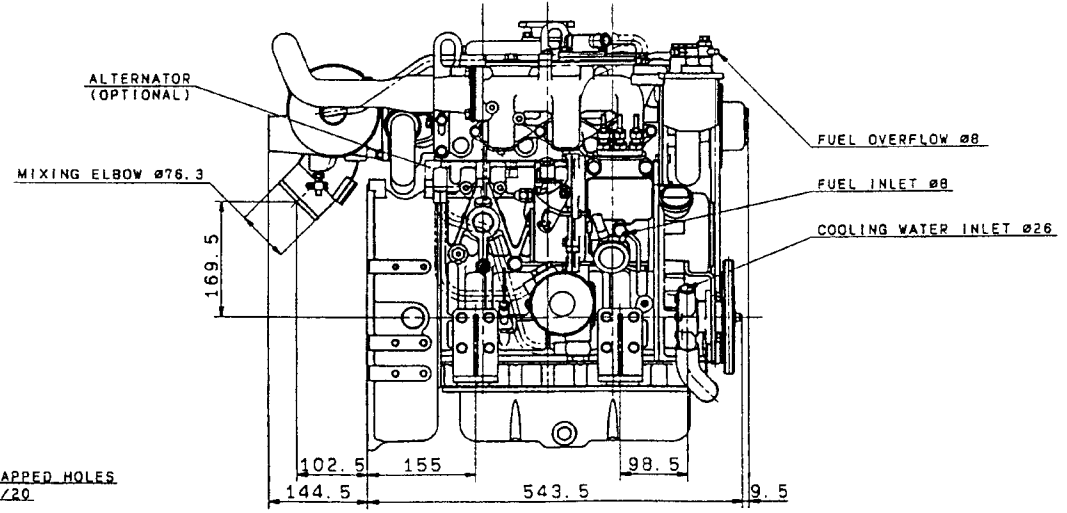
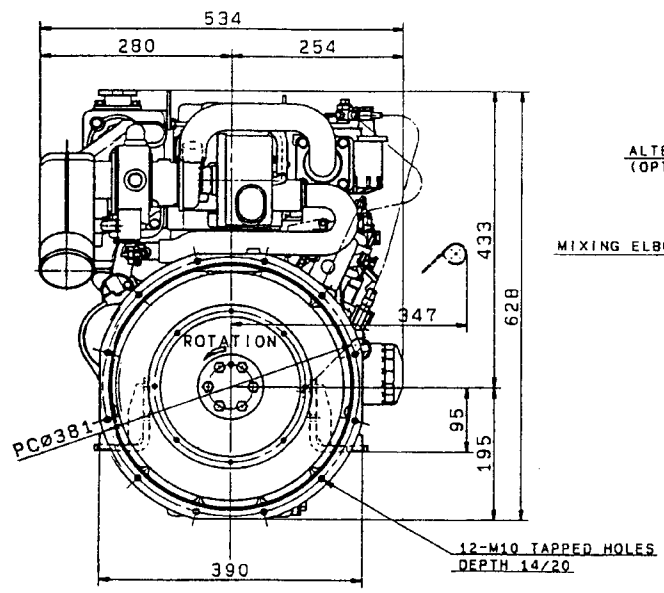
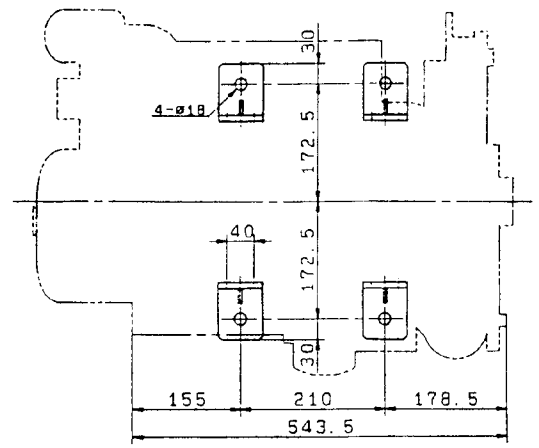


1-6

SPECIFICATIONS			
Model	3JH2L		
Continuous rating output	kw(HP/rpm)	9.93/1500(13.5/1500)	11.8/1800(16/1800)
Intermittent rating output	kw(HP/rpm)	10.9/1500(14.8/1500)	12.9/1800(17.6/1800)
Reduction ratio	—		
Dry weight	kg	Approx. 173	
Direction of crankshaft rotation (Viewed from flywheel side)	Counter-Clockwise		

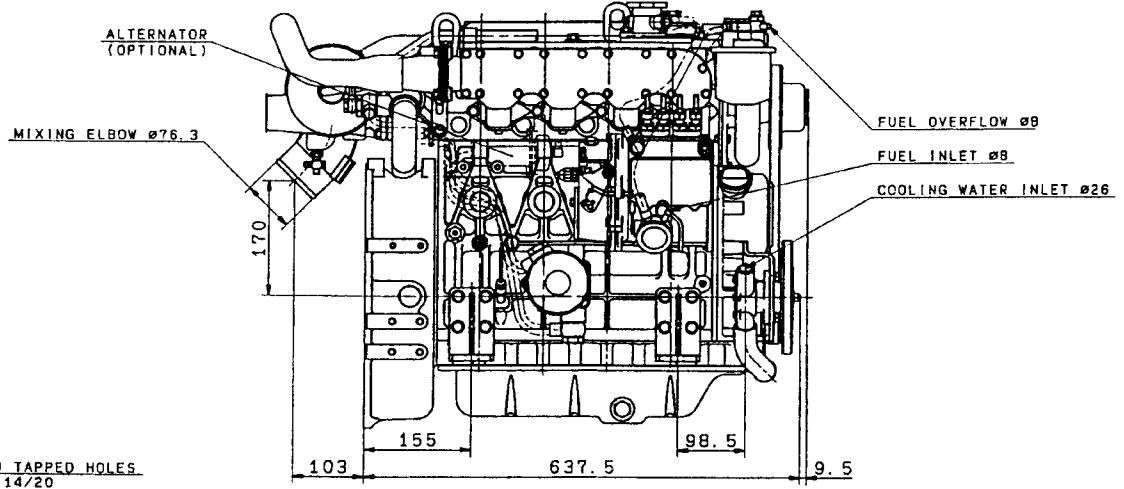
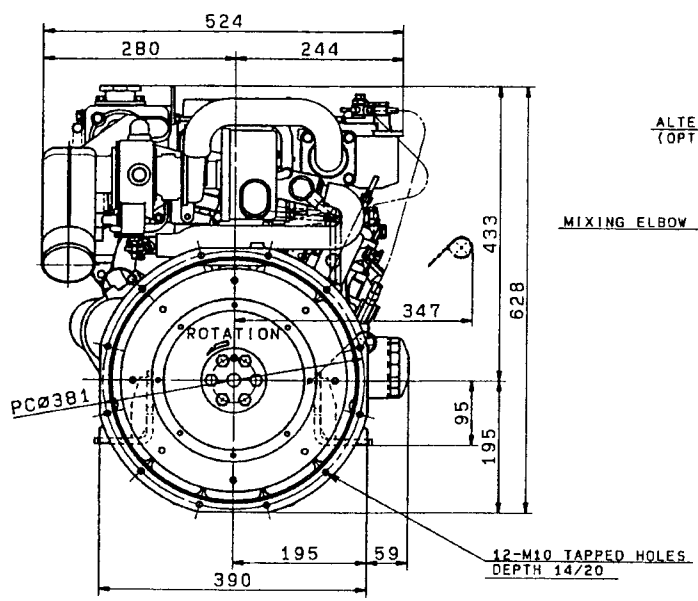
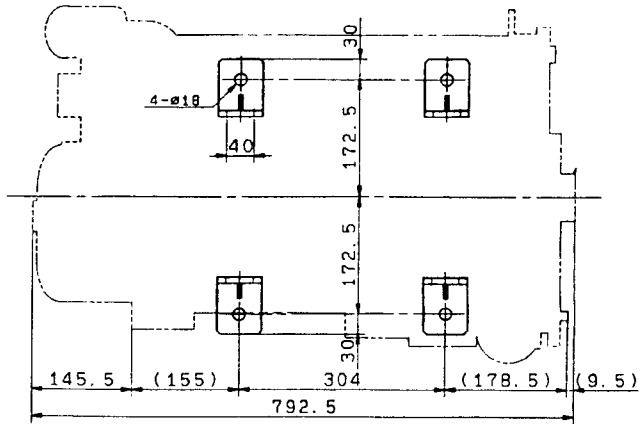
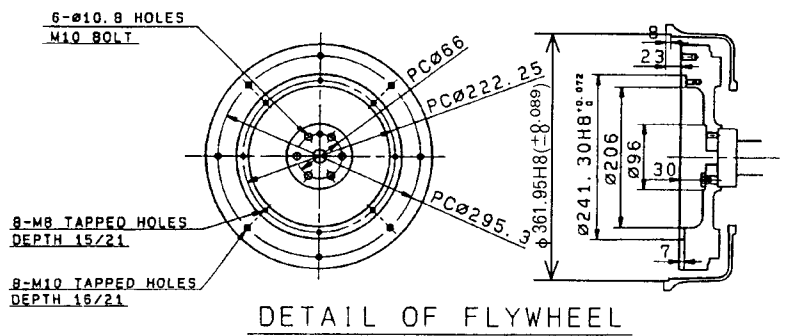


DETAIL OF FLYWHEEL



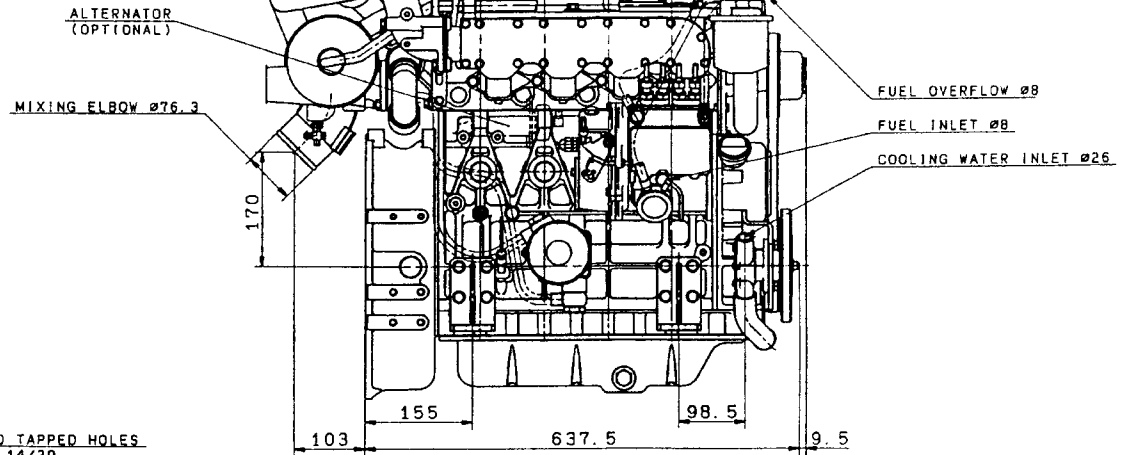
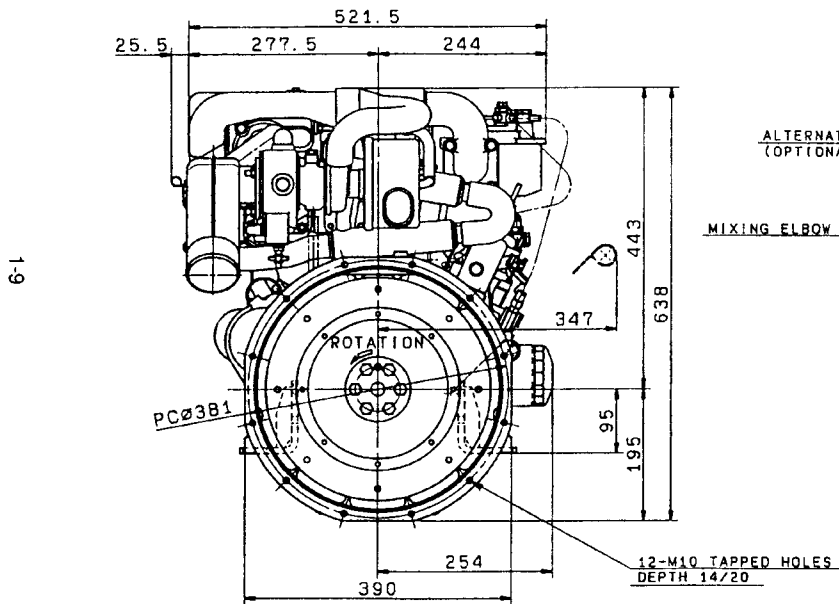
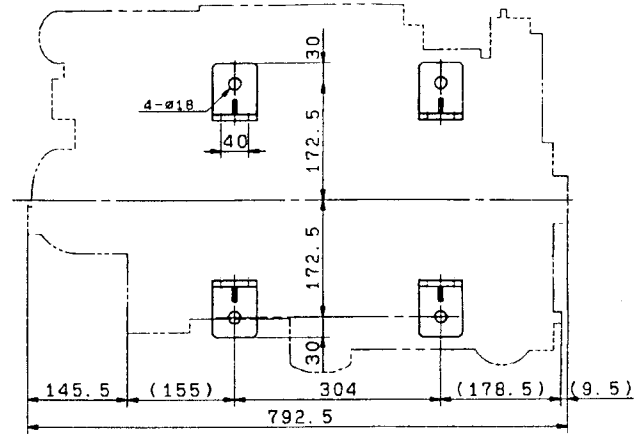
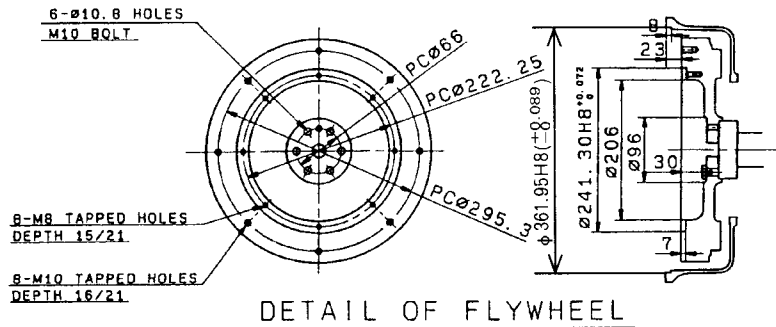
1-7

SPECIFICATIONS			
Model	3JH2L-T		
Continuous rating output	kw(HP/rpm)	12.1/1500(16.5/1500)	14.7/1800(20/1800)
Intermittent rating output	kw(HP/rpm)	13.3/1500(18.1/1500)	16.9/1800(23/1800)
Reduction ratio	—		
Dry weight	kg	Approx. 178	
Direction of crankshaft rotation (Viewed from flywheel side)	Counter-Clockwise		



1-8

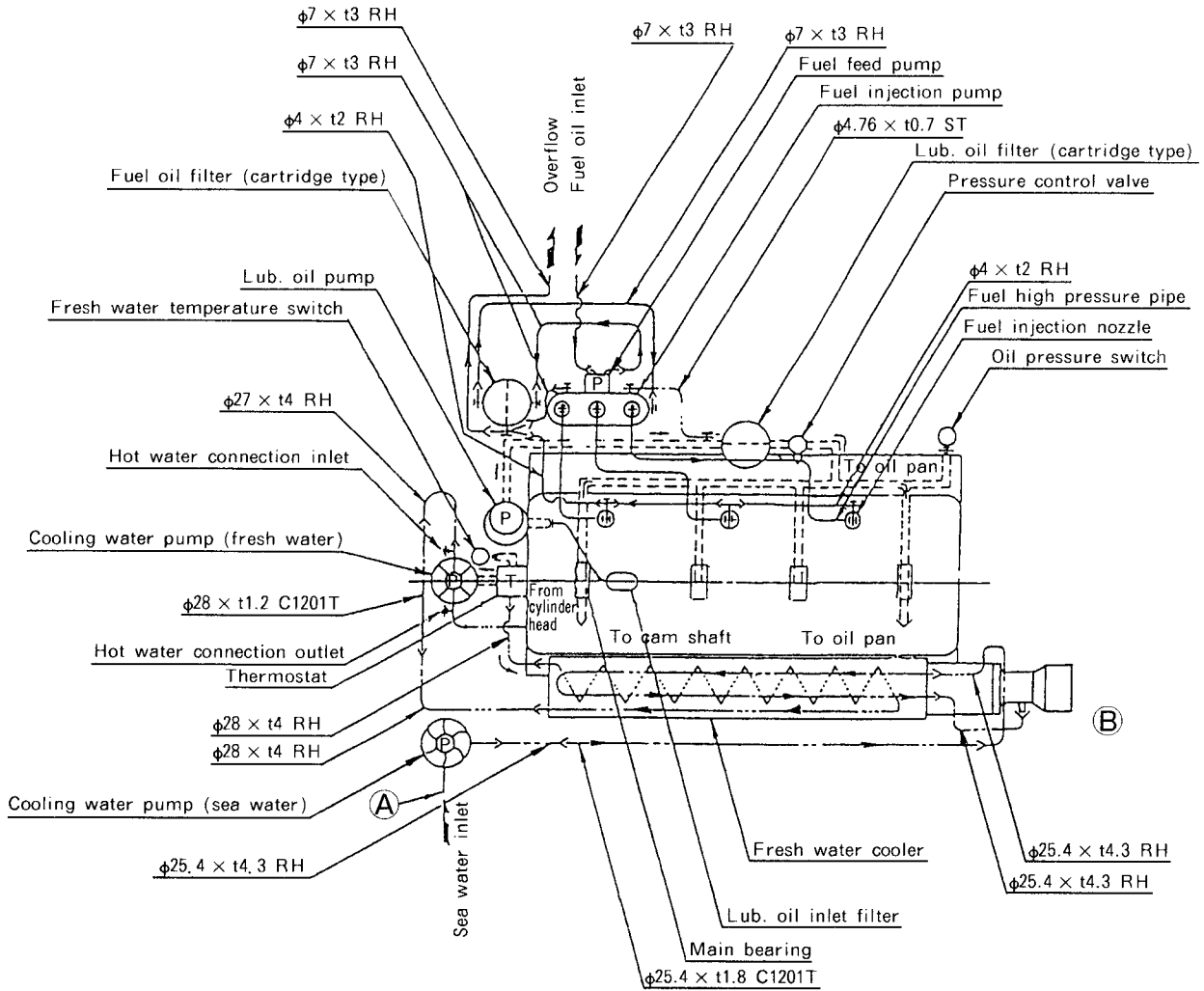
SPECIFICATIONS			
Model		4JH2L-T	
Continuous rating output	kw(HP/rpm)	16.5/1500(22.5/1500)	20.2/1800(27.5/1800)
Intermittent rating output	kw(HP/rpm)	18.2/1500(24.7/1500)	22.4/1800(30.5/1800)
Reduction ratio		—	
Dry weight	kg	Approx. 224	
Direction of crankshaft rotation (Viewed from flywheel side)		Counter-Clockwise	



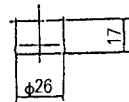
SPECIFICATIONS			
Model	4JH2L-HT		
Continuous rating output	kw(HP/rpm)	20.2/1500(27.5/1500)	25.7/1800(35/1800)
Intermittent rating output	kw(HP/rpm)	22.2/1500(30.2/1500)	28.4/1800(38.5/1800)
Reduction ratio			
Dry weight	kg	Approx. 246	
Direction of crankshaft rotation (Viewed from flywheel side)	Counter-Clockwise		

5. Piping Diagrams

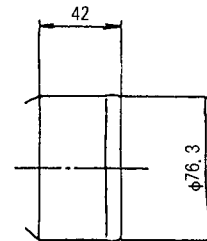
5-1 3JH2L



MARKS OF PIPING	NAME
RH	RUBBER HOSE
STS	CARBON STEEL PIPE
C1201T	COPPER PIPE
⊕	SCREW JOINT
⊕	FLANGE JOINT
⊕	EYE JOINT
⊕	INSERTION JOINT
----	DRILL HOLE
----	COOLING FRESH WATER PIPING
----	COOLING SEA WATER PIPING
----	LUB.OIL PIPING
----	FUEL OIL PIPING

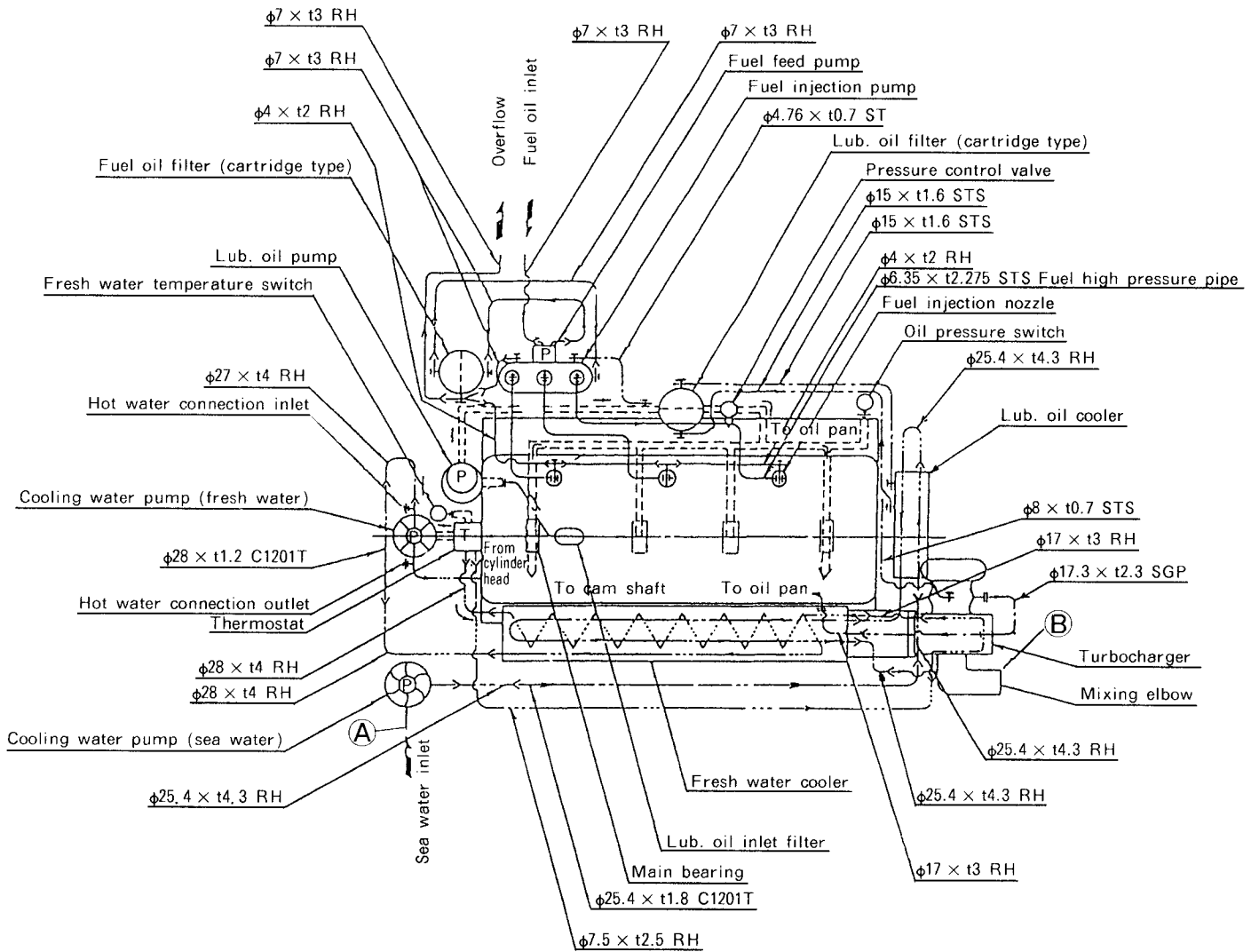


Detail of part (A)

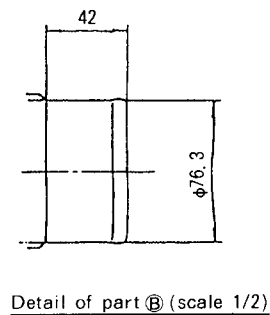
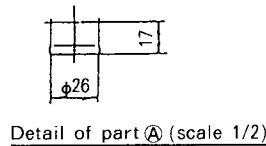


Detail of part (B)

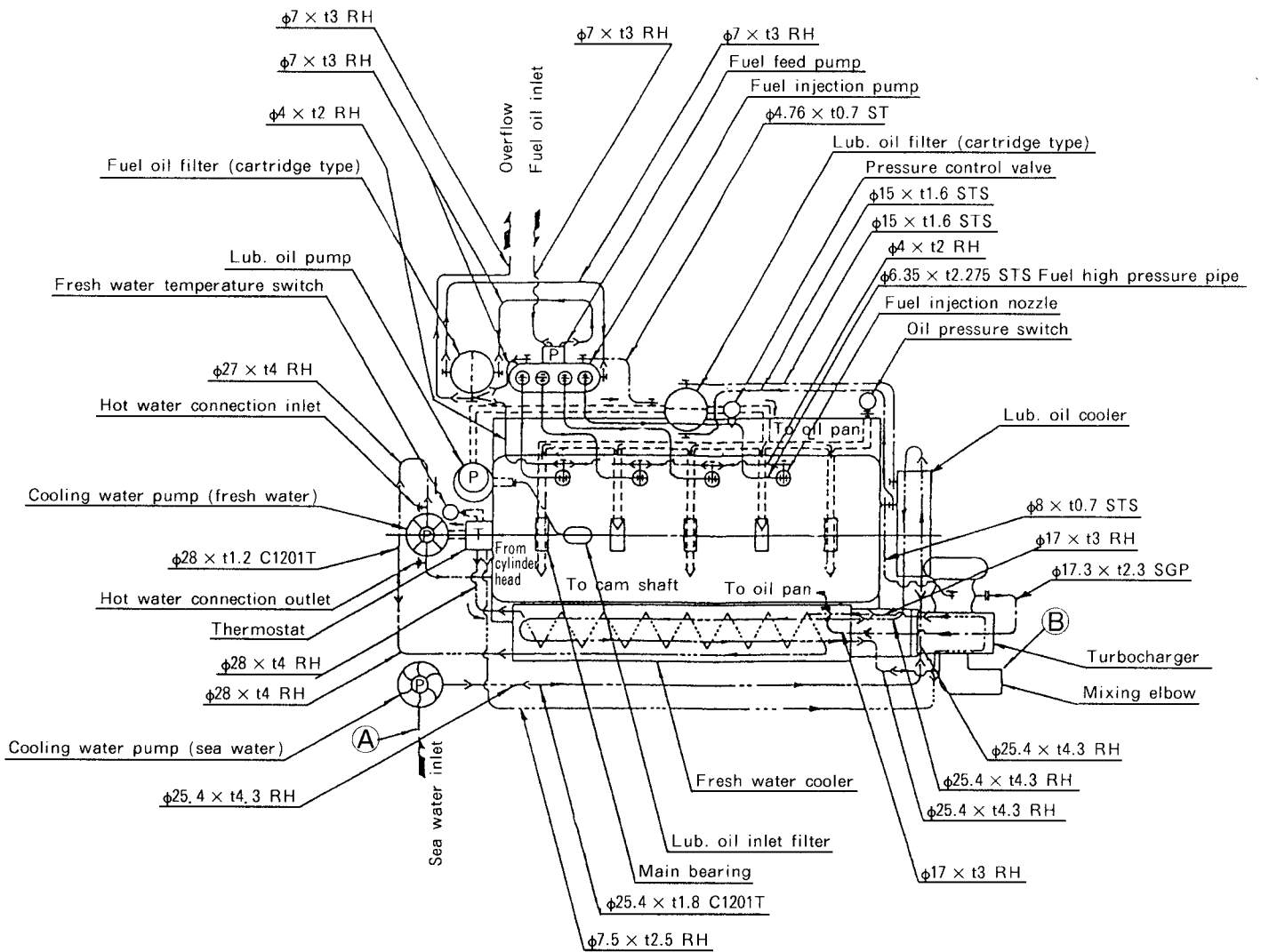
5-2 3JH2L-T



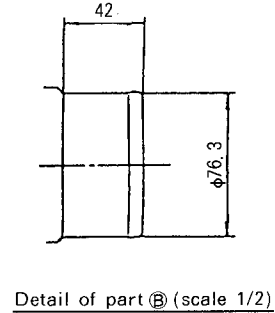
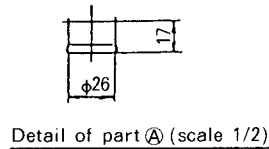
MARKS OF PIPING	NAME
RH	RUBBER HOSE
STS	CARBON STEEL PIPE
C1201T	COPPER PIPE
⊕	SCREW JOINT
⊕	FLANGE JOINT
⊕	EYE JOINT
←	INSERTION JOINT
⋯	DRILL HOLE
---	COOLING FRESH WATER PIPING
---	COOLING SEA WATER PIPING
---	LUB.OIL PIPING
---	FUEL OIL PIPING



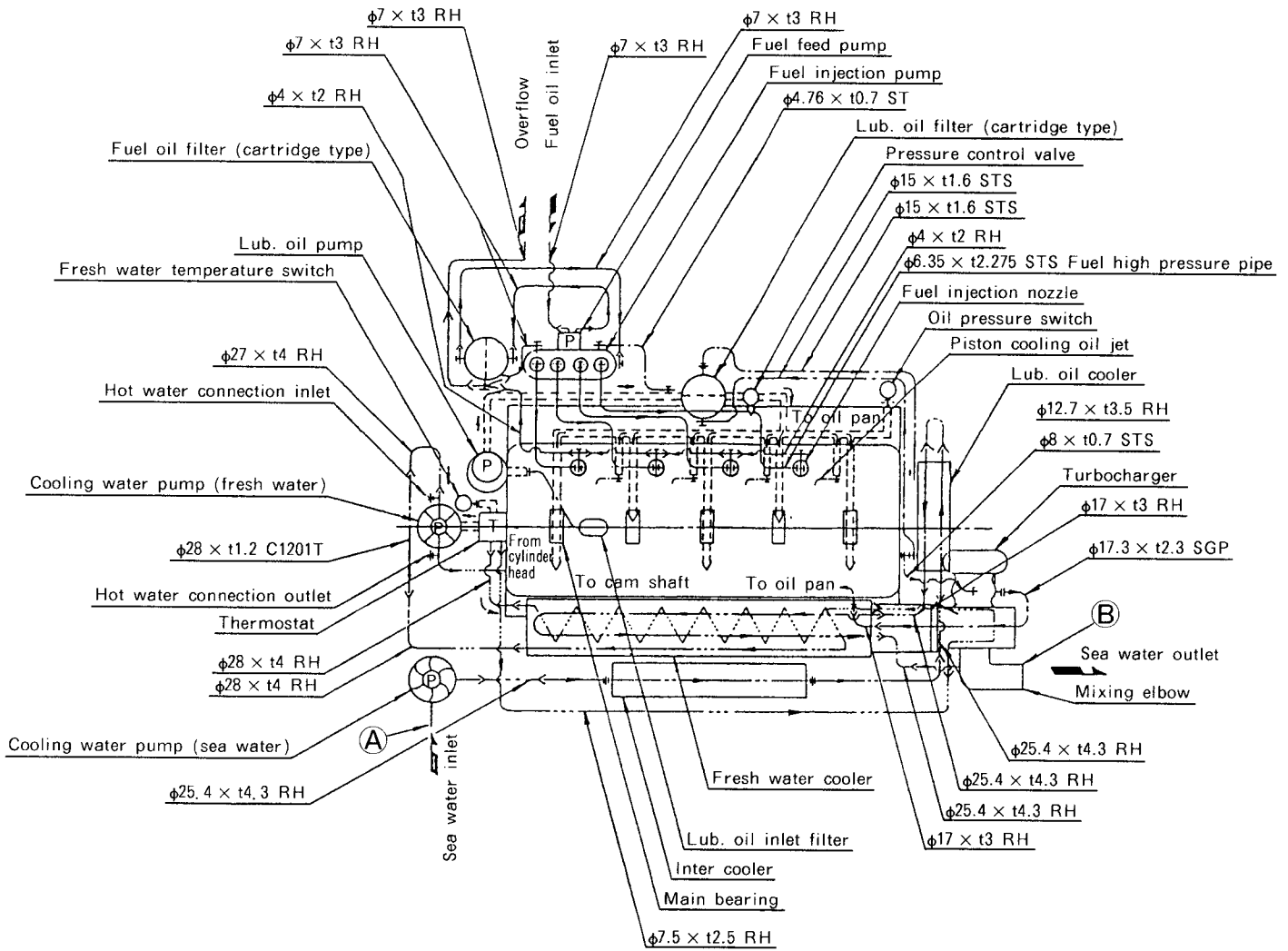
5-3 4JH2L-T



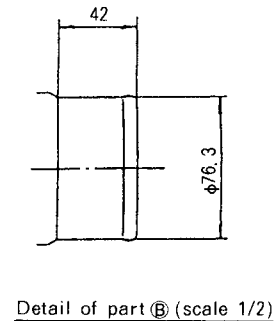
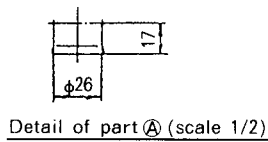
MARKS OF PIPING	NAME
RH	RUBBER HOSE
STS	CARBON STEEL PIPE
C1201T	COPPER PIPE
⊕	SCREW JOINT
⊕	FLANGE JOINT
⊕	EYE JOINT
←	INSERTION JOINT
----	DRILL HOLE
----	COOLING FRESH WATER PIPING
----	COOLING SEA WATER PIPING
----	LUB.OIL PIPING
----	FUEL OIL PIPING



5-4 4JH2L-HT

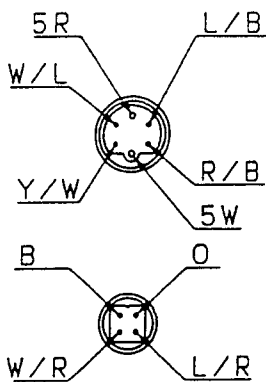
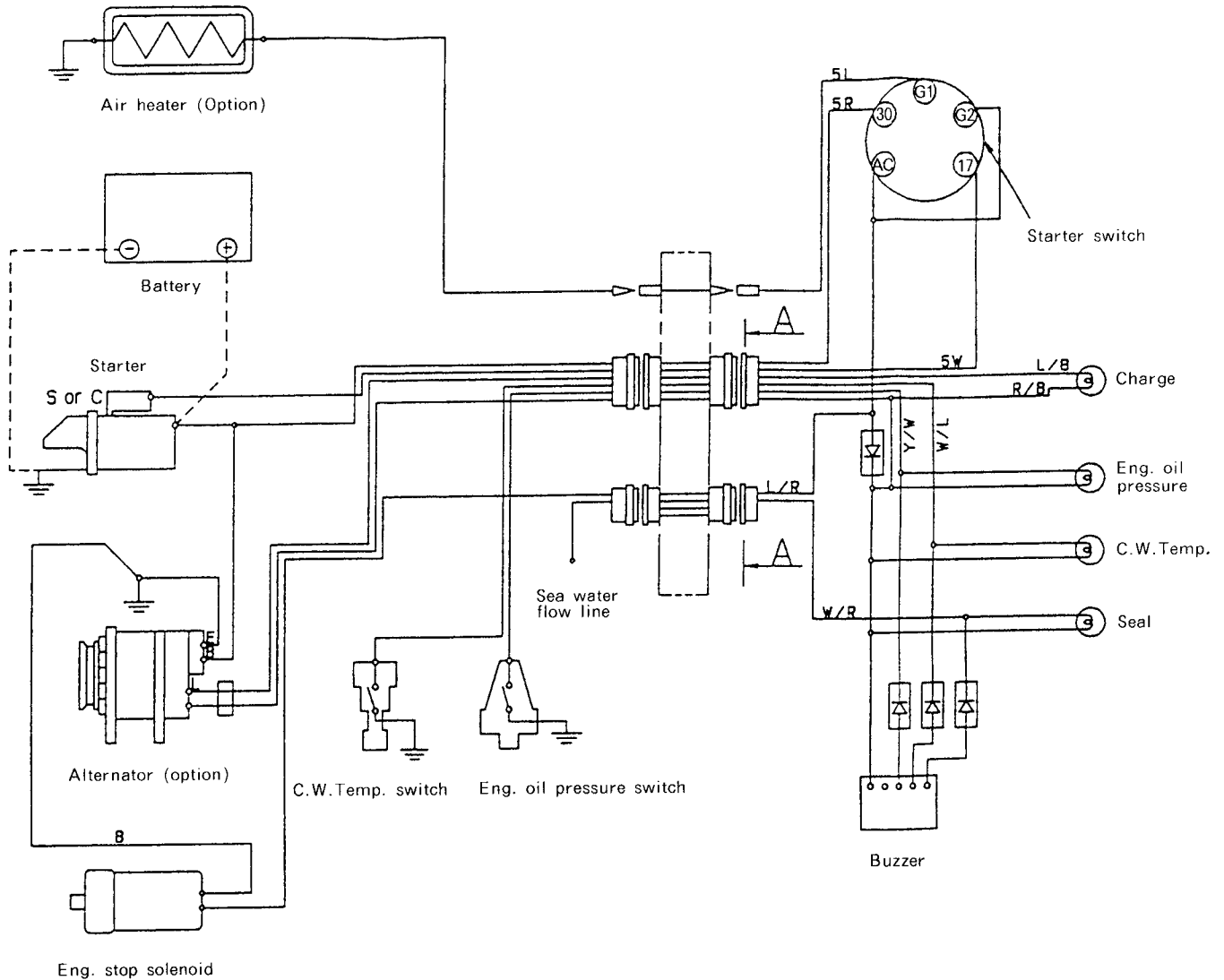


MARKS OF PIPING	NAME
RH	RUBBER HOSE
SGP STS	STEEL PIPE
C1201T	COPPER PIPE
⊕	(UNION) SCREW JOINT
⊕	FLANGE JOINT
⊕	EYE JOINT
←	INSERTION JOINT
----	DRILL HOLE
----	COOLING FRESH WATER PIPING
----	COOLING SEA WATER PIPING
----	LUB.OIL PIPING
----	FUEL OIL PIPING



6. Wiring Diagram

Model : 3JH2L, 4JH2L



Detail of coupler
(Viewed from A-A)

Starter switch

	30	AC	17	G1	G2
GLOW	○	○	○	○	○
OFF	○	○	○	○	○
ON	○	○	○	○	○
START	○	○	○	○	○

Color coding	
R	Red
B	Black
W	White
Y	Yellow
L	Blue
O	Orange

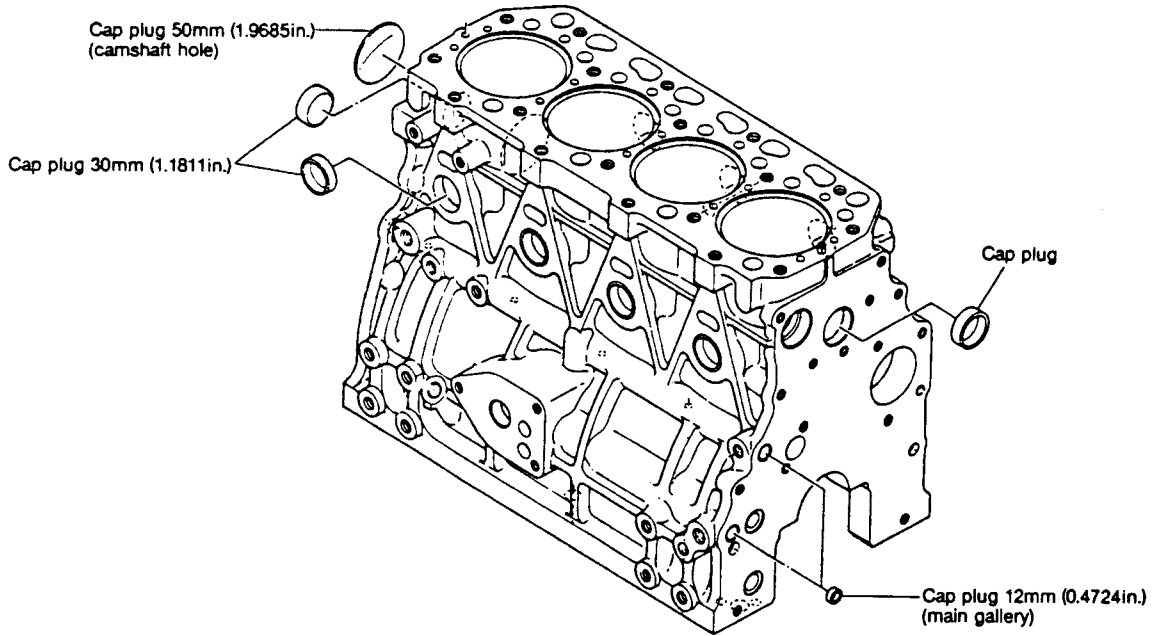
CHAPTER 2

BASIC ENGINE

1. Cylinder Block	2-1
2. Cylinder Head	2-4
3. Piston and Piston Pins.....	2-11
4. Connecting Rod	2-15
5. Crankshaft and Main Bearing	2-18
6. Camshaft and Tappets	2-21
7. Timing Gear.....	2-24
8. Flywheel and Housing	2-26

1. Cylinder Block

The cylinder block is thin-skinned, (low-weight), short skirt type rationally placed ribs. The side walls are wave shaped to maximize rigidity for strength and low noise.



1-1 Inspection of parts

Make a visual inspection to check for cracks on engines that have frozen up, overturned or otherwise been subjected to undue stress. Perform a color check on any portions that appear to be cracked, and replace the cylinder block if the crack is not repairable.

1-2 Cleaning of oil holes

Clean all oil holes, making sure that none are clogged up and the blind plugs do not come off.

Color check kit
Part code No.97550-004560

	Quantity
Penetrant	1
Developer	2
Cleaner	3

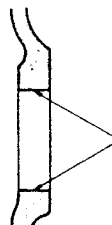


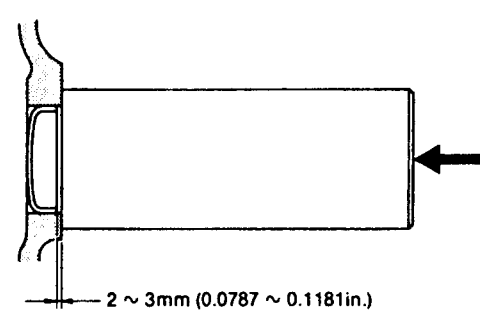
1-3 Color check procedure

- (1) Clean the area to be inspected.
- (2) Color check kit
The color check test kit consists of an aerosol cleaner, penetrant and developer.
- (3) Clean the area to be inspected with the cleaner.
Either spray the cleaner on directly and wipe, or wipe the area with a cloth moistened with cleaner.
- (4) Spray on red penetrant
After cleaning, spray on the red penetrant and allow 5 - 10 minutes for penetration. Spray on more red penetrant if it dries before it has been able to penetrate.
- (5) Spray on developer
Remove any residual penetrant on the surface after the penetrant has penetrated, and spray on the developer. If there are any cracks in the surface, red dots or a red line will appear several minutes after the developer dries. Hold the developer 300 - 400mm (11.8110 - 15.7480in.) away from the area being inspected when spraying, making sure to coat the surface uniformly.
- (6) Clean the surface with the cleaner.

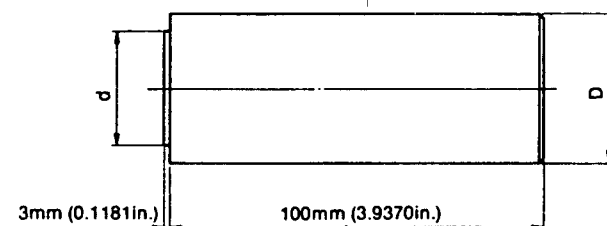
NOTE: Without fail, read the instructions for the color check kit before use.

1-4 Replacement of cap plugs

Step No.	Description	Procedure	Tool or material used
1.	Clean and remove grease from the hole into which the cap plug is to be driven. (Remove scale and sealing material previously applied.)	 <p>Remove foreign materials with a screw driver or saw blade.</p>	<ul style="list-style-type: none"> ● Screw driver or saw blade ● Thinner
2.	Remove grease from the cap plug.	Visually check the nick around the plug.	<ul style="list-style-type: none"> ● Thinner
3.	Apply Three bond No. 4 to the seat surface where the plug is to be driven in.	Apply over the whole outside of the plug.	<ul style="list-style-type: none"> ● Three bond No. 4
4.	Insert the plug into the hole.	Insert the plug so that it sits correctly.	
5.	Place a driving tool on the cap plug and drive it in using a hammer.	Drive in the plug parallel to the seating surface.	<ul style="list-style-type: none"> ● Driving tool ● Hammer



2 ~ 3mm (0.0787 ~ 0.1181in.)



3mm (0.1181in.) 100mm (3.9370in.)

Plug dia.	d	D
φ 12	φ 11.9–12.0 (φ 0.4685–0.4724)	φ 20 (φ 0.7874)
φ 30	φ 29.9–30.0 (φ 1.1770–1.8110)	φ 40 (φ 1.5748)

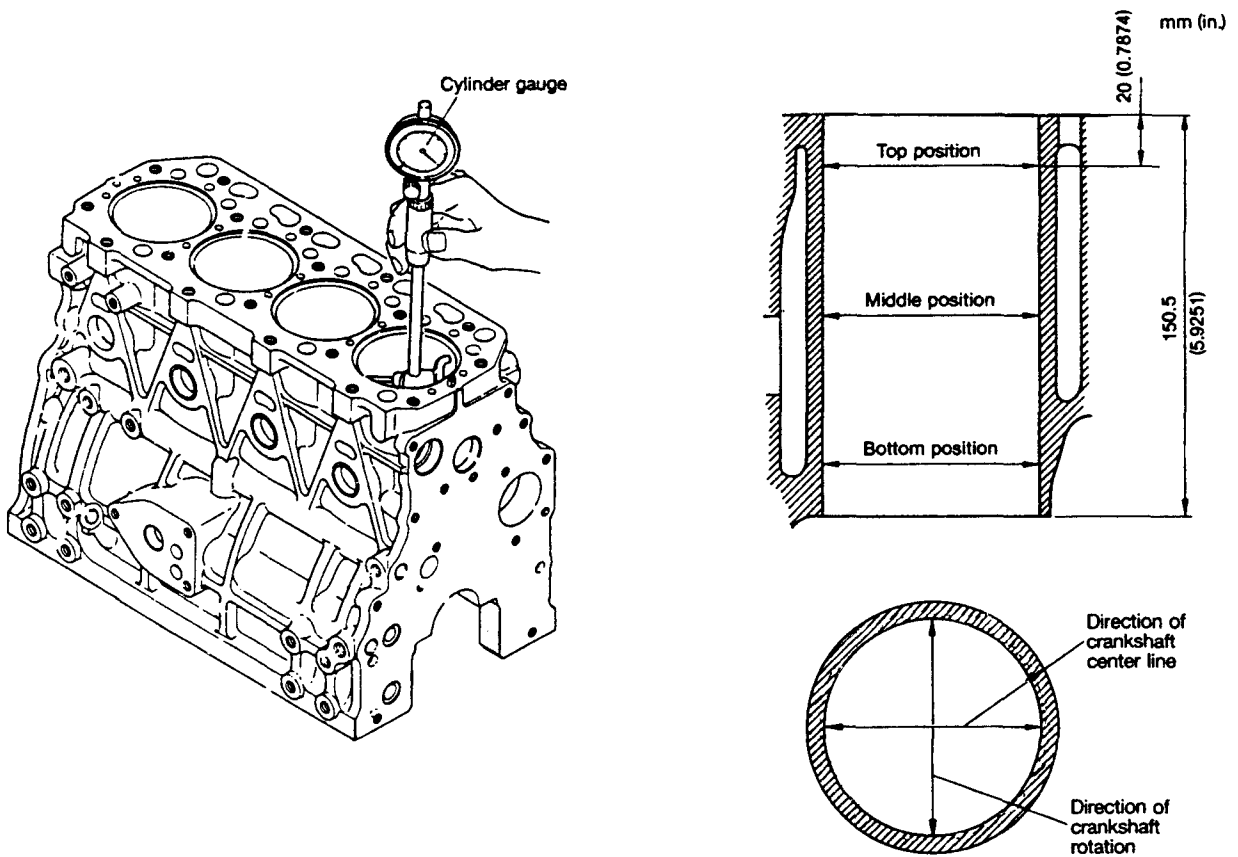
mm(in.)

* Using the special tool, drive the cap plug to a depth where the edge of the plug is 2 mm (0.0787 in.) below the cylinder surface.

1-5 Cylinder bore measurement

Measure the bore diameter with a cylinder gauge at the positions shown in the figure.

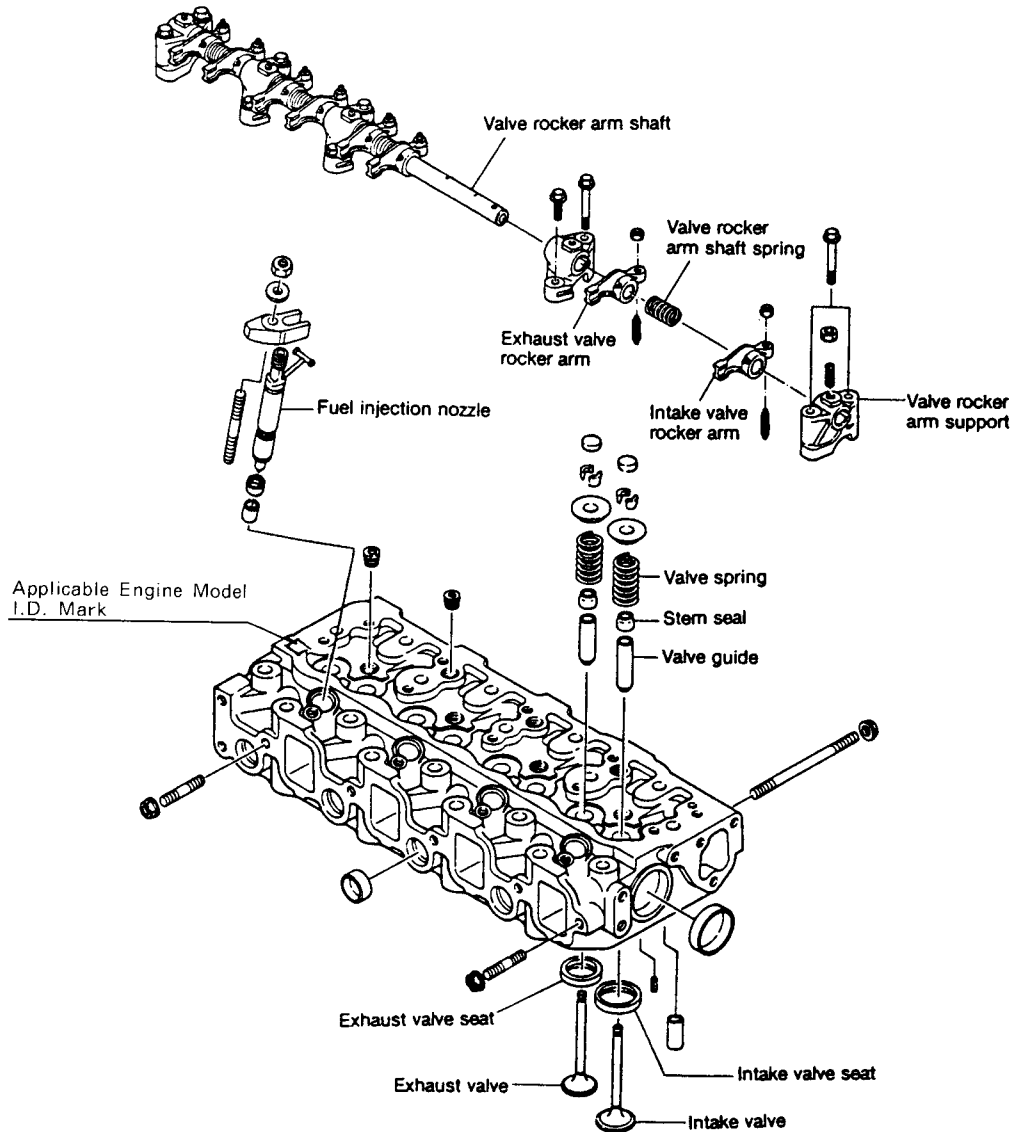
Replace the cylinder bore when the measured value exceeds the wear limit. Measurement must be done at least at 3 positions as shown in the figure, namely, top, middle and bottom positions in both directions along the crankshaft rotation and crankshaft center lines.



	mm (in.)	
	Standard	Wear limit
Cylinder bore dia.	$\phi 82.00 - 82.03$ (3.2283 - 3.2295)	$\phi 82.06$ (3.2307)
Cylinder roundness	0 - 0.01 (0 - 0.0004)	0.02 (0.0008)

2. Cylinder Head

The cylinder head is of 4-cylinder integral construction, mounted with 18 bolts. Special alloy stellite with superior resistance to heat and wear is fitted on the seats, and the area between the valves is cooled by a water jet.



Engine Model	I.D. mark
3JH2L	SH
3JH2L-T	SH
4JH2L-T	SL
4JH2L-HT	SL



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