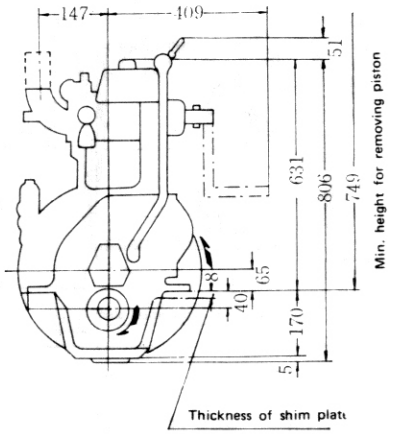
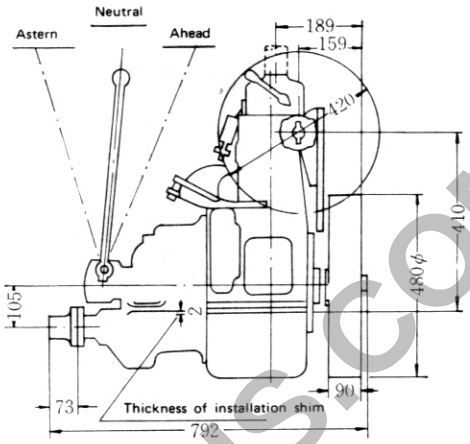
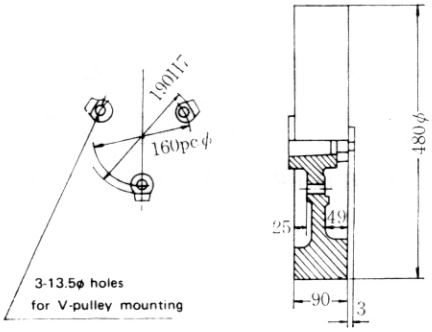
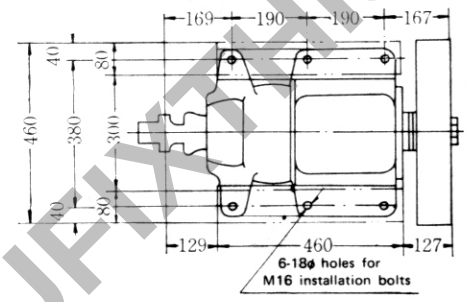
EXTERNAL DIMENSIONS (1SM)



DETAIL OF FLYWHEEL

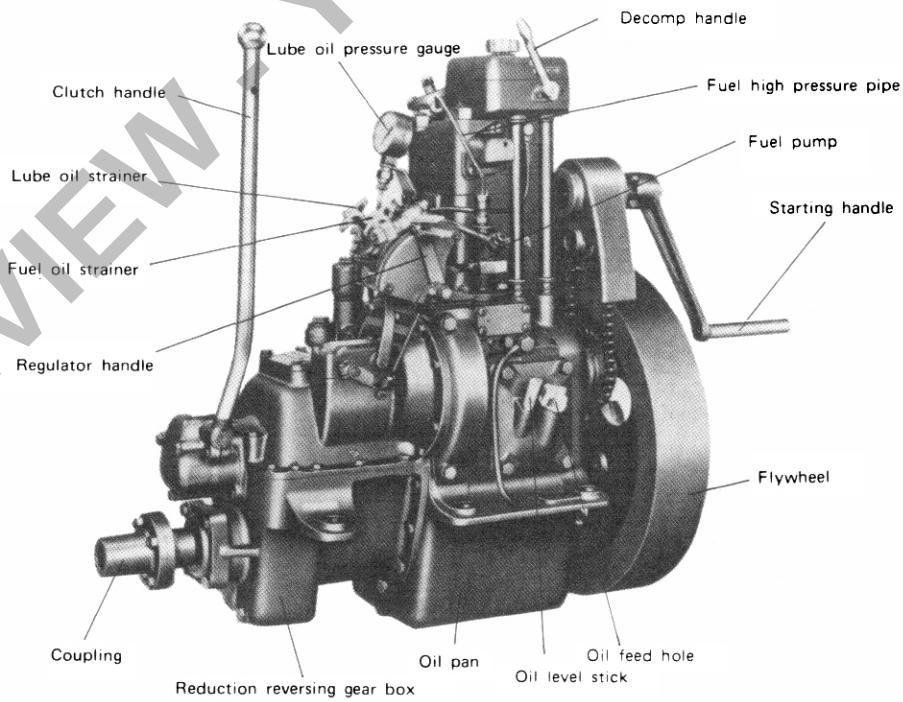






VIEWED FROM BOTTOM OF ENGINE

PARTS LOCATION (1SM)



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1. OUTLINE OF STRUCTURES

No.	Division	Parts	Description		
			1SM	2SM	3SM
1	Engine body	Cyl. block	Monoblock piece for water jacket and crank case		
		Cyl. liner	Separate piece from cylinder, wet-type		
		Main bearing	Metal housing	Lift up from cylinder block	
		Oil sump	Cyl. block unit	Oil pan	
2	Suc. & exh. device & valve meachanism	Cyl. head	Water cooling of cylinder individually		
		Suc. & exh. valves	Mushroom-shape, seat angle of 45°		
		Exh. manifold	Bend-type air cooling insulating material	Exh. manifold type air cooling, w/o insulating material	Exh. manifold type water cooling
		Exh. silencer	Circle shape no-resistance type		
		Air cleaner			
		Valve mechanism	Valve push rod, suspending arm type, suc. & exh. cam w/baffer curve line		
3	Main working section	Crankshaft	Stamp forging		
		Flywheel	Fitted from crankshaft and taper part, w/power take-off pulley		
		Piston	Oval process, anti-abrasive ring set top ring cut.		
		Piston pin	Floating type		
		Piston rings	3 pressure rings and 2 oil scraper rings		
		Connecting rod	I section, stamp forging		
		Crankpin metal	Thick metal	Thin metal	
4	Lub. system	Lub. oil pump	Spur gear type		
		Lub. oil strainer	Full flow type, auto-clean type strainer	Full flow type, auto-clean type strainer	Full flow type, by-pass centrifugal strainer
		Oil level gauge	Plug-in type		
		Lub. oil cooler	Water-cooling single-pipe type	Water-cooling single-pipe type	Water-cooling multi-pipe type
5	Cooling system	Heat exchanger			
		Plunger pump	Single-acting plunger type		
6	Bilge system	Plunger pump	Single-acting plunger type		
7	Fuel system	Fuel injection pump	Bush type, independent cylinder		
		Fuel injectio valve	Pintle valve		
		Fuel strainer	Auto-clean type		
		Fuel tank	Made of steel board		
8	Governor system	Governor	Centrifugal, all-speed type		
9	Starting system	Manual starting			
		Chain starting	Accelerating starting by chain		
		Electric starting		(special order)	(standard equipped)
		Air starting			
10	Reducer & clutch system	Reducer	Spur gear type		
		Reversing clutch	Wet-type, single plate, mechanical	(hydraulic-special order for 2SM)	Wet-type, single plate, hydraulic oil type
11	Remote control system	Governor remote control system	Wire-type remote control		
		Clutch remote control system	Wire-type remote control		
12	Engine bed	Wooden bed, etc.			

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Classification by Usage Condition

(API Service Classification)

Classification		Quality & Application
	Symbol	
Diesel Engine Use	DG	Used under the light-load operational condition of diesel engine. Requirement is small in checking on producing of worn-off particles and abrasion due to designed roles of fuel, lubricating oil and engine itself.
	DM	Used under the severe operational condition of diesel engine when producing of worn-off particles, abrasion, etc. are evident due to sulphur content of fuel used or when residual carbon of lubricating oil affects greatly upon engine design.
	DS	Used under the heavy-load operational condition of diesel engine when the fuel producing worn-off particles to a great extent, or when abrasion of the engine especially designed for high-output, high-load operation, etc. is serious.

NOTE: *Symbols operated in above table have the following meanings.*

	Symbol	Meaning
First Letter	M	Motor
Second Letter	M	Moderate
	S	Severe
	G	General

Engine oil has been refined and blended with addition of such necessary additives as oxidation inhibiter, corrosion inhibiter, rust preventive, dispersant, etc.

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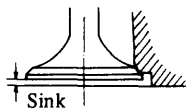
	Treatment	Instruction to engine operator	Reason
Service after used	Drain cooling water.	After using the engine, drain cooling water by opening the cocks of cooling water pump and exhaust manifold. Complete drainage is obtained by turning the flywheel. In cold season, tighten the Kingstone cock.	In cold weather, frozen water in the cylinder may damage the cylinder.
	Clean the engine.	While the engine is still warm, clean dust and dirt completely.	For better maintenance of engine.
Storing engine	Change lub. oil.	Change lub. oil and allow to turn a few times.	For next use. Treatment for rust-proof.
	Keep the outer parts away from corrosion and dust.	Wipe dust and dirt away. Apply oil to the following parts: 1. Link part of fuel pump. 2. Pinion shaft of cell motor. 3. Moving part of remove control device, shaft part of handles. Cover the engine with vinyle, paper, or cloth for dust-proof.	
	Occasionally turn the engine.	Turn the engine by hand once a month.	For rust-proof of metal, piston, liner rings.
	Store battery.	Disconnect the wire. Store in dry place. Charge once a month.	

3-2. Time of Periodical Checking

A periodical checking is necessary to keep the engine in good conditions at all times. The frequency of periodical checking may vary depending upon the purpose of using the engine, conditions of use, quality of oils to be used, and methods of handling the engine, and it is difficult to generalize on the frequency of periodical checking and servicing. Therefore, general explanations will be given here. The relationship between the detail of checks and time is as follows:

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Name of Parts					Nominal size	Difference in size	Standard Clearance of Ass'y	Maximun Allowable Clearance	Limit of Use	Measures to be taken
Crank shaft	Crank pin		Outer dia. of crank pin		70φ	−0.040 −0.055	0.04 ~ 0.094	0.15	0.7	When uneven wear of pin reaches over 0.06mm, regrind the pin and use undersized metal. (size: −0.25, −0.5)
			Inner dia. of bearing							
	Journal	Dia.	Outer dia. of journal		70φ	−0.040 −0.055	0.040 ~ 0.093	0.15		When uneven wear of pin reaches over 0.06mm, regrind the pin and use undersized metal. (size: −0.25, −0.5)
			Dia. of bearing			+0.038 +0.018				
		Side clearance	1SM	Breadth of journal	110	−0.054	0.15 ~ 0.30	0.3	0.5	When the metal is worn out beyond limit of use, use oversized metal 0.1, 0.2.
				Standard brea of bearing						
			2, 3SM	Breadth of journal	50	+0.025 0	0.09 ~ 0.14	0.3	0.5	When the metal is worn out beyond limit of use, use oversized metal 0.2, 0.4.
				Std. breadth of bearing						
Cam shaft	Dia.	Outer dia. of journal part			—	—	—	—	—	—
		Inner dia. of bearing				—			—	—
	Breadth	Standard breadth of journal			—	—	—	—	—	—
		Standard breadth of bearing				—			—	—
	Height of cam				39.5	±0.01		—	−0.5	Change
Suction & exh. valves	Clearance between valve rod & valve guide	Suc.	Valve rod outer dia.		10φ	−0.043 −0.060	0.043 ~ 0.075	0.25	−0.15	Change valve or valve guide
			Valve guide inner dia.			+0.015 0				
		Exh.	Valve rod outer dia.		10φ	−0.043 −0.060	0.043 ~ 0.075	0.20	−0.15	
			Valve guide inner dia.			+0.015 0				
	Valve seat	Angle			90°	—	—	—	—	—
		Breadth			—	—	2.83	—	—	—
		Sink			0.5				1.5	Change valve seat (exhaust side)
	Top Clearance	Suction valve			—	—	0.15		0.10~ 0.20	—
		Exhaust valve			—		0.15		0.10~ 0.20	—

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7-2. Servicing and Repairing of Major Parts

As the engine is operated for a long time, the operation may be interferred by such factors as wear of parts and others. The followings are major repairing and servicing procedures.

(1) General Cautions

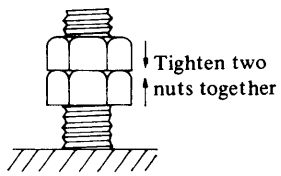
Pay attention to the following cautions for maintenance and cleaning of engine:

1) Carefully observe the parts prior to repairing or cleaning for carbon deposit and contact. This practice will be very helpful for maintenance of engine.
2) Be careful not to scratch the parts when removing the carbon deposit.
3) Avoid using a wire brush or sandpaper for cleaning the precision parts, such as the contact or fitting surface.
4) Use a clean washing oil. Light oil is recommended.
5) Thoroughly clean the outside of engine block and the inside of crankcase at the time of disassembly. Also clean those parts and places which are difficult to clean after assembly.
6) Clean any rusty part with a fine sandpaper and apply oil afterward.
7) Remove scratches or burr on parts. It is not necessary to completely remove large ones but it is desirable to make the surface smooth.
8) If the metal fittings are accidentally hit with each other carefully make the surface smooth.

(2) Tightening of Cylinder Head

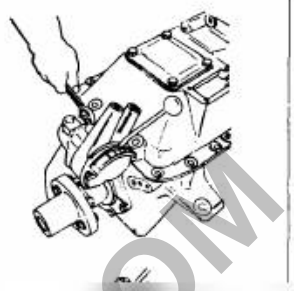
The cylinder head bolts are subjected to a large impact created at the time of explosion, which should therefore be tightened firmly, otherwise gas or water leakage may occur. If the stud bolts are loose, it is necessary to tighten them by using double nuts before fitting the cylinder head.

1) Tightening of Stud Bolts with Double Nuts

Procedure	Instruction	Tool Used	Figure
1. Screw in two nuts onto the bolt.	Put two nuts onto screw part opposite.		
2. Fix the nuts on the bolt.	Using 2 spanners prevent the inner nut from moving and tighten the outer nut firmly.		
3. Set the stud bolt.	Apply the spanner to the outer nut, then tighten the stud bolt.		
4. Loosen the nuts from the bolt.	Lock the inner nut with spanner, preventing it from moving, and loosen the outer nuts, thus loosening both nuts.		

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	Part Name	Piece	Order and Caution	Tool Used	Figure
	Switch valve ass'y Packing Hex. bolt M10 X 25	1 1 4	Attach the switch valve ass'y.	Spanner (17)	

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(3) Adjustment of Fuel Injection Pressure

The injection pressure of the fuel injection valve has a great influence over the combustion at explosion. If the pressure is inappropriate, it will cause not only decreased horsepower, difficult starting, uneven revolution or other improper operation but also sticking or early wear of nozzle and carbon deposite inside the combustion chamber and other troubles.

Adjust the pressure by using a nozzle tester so that the injection pressure becomes 160 kg/cm^2.

If the fuel is not injected properly even after completion of the adjustment, perform fitting for the nozzle (needle valve) or change it with new one.

Procedure	Instruction	Tool Used	Figure
Preparation 1. Remove the high pressure fuel pipe.		Spanner (19)	
2. Detach the fuel injection valve ass'y.	Remove the fuel valve holder and detach the fuel injection valve ass'y.	Spanner (17)	
3. Attach the nozzle tester to the delivery valve and discharge air.	1) Attach the tester as shown in the figure. 2) Set the regulator handle at operation position. 3) Operate the priming lever until fuel comes out from the tester high pressure pipe.	Spanner (17)	

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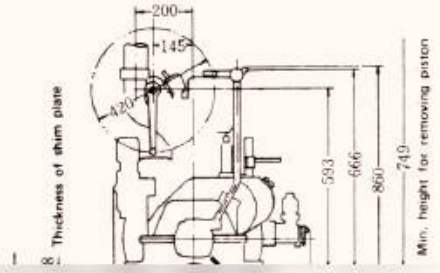
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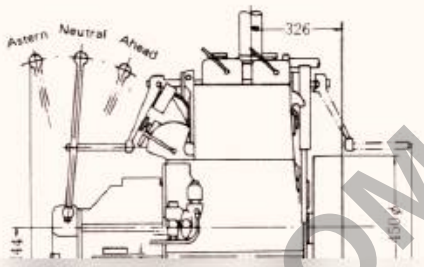
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EXTERNAL DIMENSIONS (2SM)

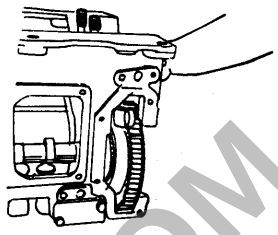
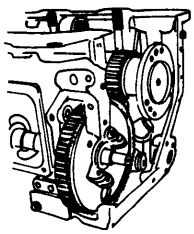
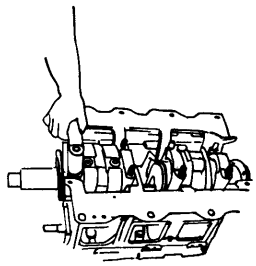
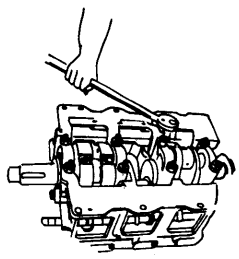




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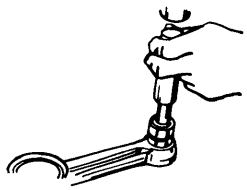
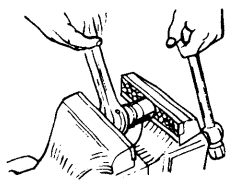
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	Part Name	Piece	Order and Caution	Tool Used	Figure
	Camshaft ass'y	1	Apply oil to camshaft metal.	Camshaft inserting tool	
	Water pump connecting rod	1	Insert the set of the tachometer driving gear, camshaft gear, water pump connecting rod with camshaft inserting tool.		
	Camshaft gear	1	(Note) *The boss part of tachometer driving gear should be on the flywheel side.*		
	Tachometer driving gear	1	(Note) *Pay attention not to damage the metal when camshaft is inserted.* Revolution should be lightly carried out.		
2.	Crank Shaft				
	Main bearing metal (upper)	4	Set the main bearing metals (upper) and apply some oil.		
	Crank shaft ass'y	1	Assemble the crank shaft ass'y and crank shaft gear, match the setting mark (0–0), and then insert the crank shaft, ass'y. Apply some grease and insert the thrust metals.		
	Crank shaft gear	1			
	Thrust metal (upper)	2			
	Main bearing holder (flywheel side)	1	Assemble main bearing holder by fixing thrust metal (lower) and main bearing metal (upper)		
	Main bearing holder (intermediate part)	2			
	Main bearing holder (gear side)	1			
	Thrust metal (upper)	1			
	Main bearing metal (lower)	4			
	Main bearing holder	8	After temporarily tighten the main bearing holder nuts evenly, tighten firmly and alternately not to allow uneven tightening.	Torque wrench Pliers	

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3) Replacement of Small End Bush of Connecting Rod

	Procedure and Caution	Tool Used	Figure
1	1) Place the small end part of connecting rod on repairing table (vise stand) so that the bush is easily removed.		
	2) Take out the small end bush by tapping with small end bush removing tool.	Small end bush removing tool	
2	1) Prepare new small end bush.		
	2) Fit the bush, matching the oil hole of new small end bush with the oil hole of small end part of connecting rod.		
	3) Insert the new small end bush by using the small end bush inserting tool. (Note) *Instead of tapping with a hammer, it is better to press the bush in by a vise or press.*	Small end bush inserting tool	
	4) Insert the piston pin into small end bush, and check if it slides lightly.		

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