YANMAR

OPERATION MANUAL

MARINE PROPULSION ENGINE

6N18(A)L-V

Thank you for purchasing YANMAR product.

Be sure to read this Operation Manual for you to use this product safely and correctly. Even after reading it, carefully keep it, making clear to all personnel concerned where it's kept so that the operator, mechanic or supervisor will have an opportunity to it whenever he wants to read or refer to it.

I.B.C.No. 06-6N18(A)-V-H-22E
2006.03.31R

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For safe use of your engine.

Be sure to abide by ⚠ -marked DANGERs, WARNINGs and CAUTIONs described in this Manual. As far as safety is concerned, they are particularly important parts of instructions.

- The following shows the safety marks used for caution indications in this Operation Manual and safety labels attached to this product and explains their meaning.

⚠ DANGER	It indicates that a danger of possible death or serious injury is very great when the proper precautions is not followed.
⚠ WARNING	It indicates that there is a danger of resulting in death or serious injury when the proper precautions is not followed.
⚠ CAUTION	It indicates that there is the possibility of resulting in injury or serious damage to the engine when an advice on safety handling or the proper precautions is not followed.

- Where the safety labels are posted is shown in page 0 -12.

- The cautions prefixed with the ⚠ mark in this Operation Manual are especially important for safe handing of this product. A failure to observe this caution may incur a deterioration of performances or trouble/accident of this product. Therefore, be sure to observe the items.

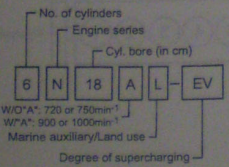
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1. ENGINE DESCRIPTION

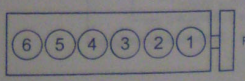
1-1. Engine Specification (1/2)

Model		Unit	6N18L-DV	6N18L-UV	6N18L-SV	our engine 6N18L-EV
Type		---	Vertical, water-cooled, 4-cycle diesel engine			
Combustion chamber		---	Direct injection type			
No. of cylinders		---	6			
Cylinder bore		mm	180			
Stroke		mm	280			
Total cylinder displacement		---	42.75			
Compression ratio		---	16.5			
Rated speed of revolution		min^{-1}(rpm)	720 or 750			
Direction of rotation of crankshaft		---	Counterclockwise as viewed from the flywheel end (XL)			
Operating side		---	On the left as viewed from the flywheel end			
Order of firing		---	1-4-2-6-3-5-1			
Supercharging system		---	Exhaust gas turbine supercharger (turbocharger) with air cooler			
Cooling system		---	Dual fresh water line cooling.			
Lubricating system		---	Forced lubrication (system oil also used as turbocharger lub.oil) (system oil also used as rocker arm lub.oil)			
Lubricating oil sump system		---	Sump incorporated in common bed			
Starting system		---	Air motor starting			
Dimensions	Overall length	mm	2,696			
	Overall width	mm	1,315			
	Overall height	mm	1,935			
Mass (of engine singly)		kg	6,500 (may vary as depending on specification)			

Constitution of Model Designation

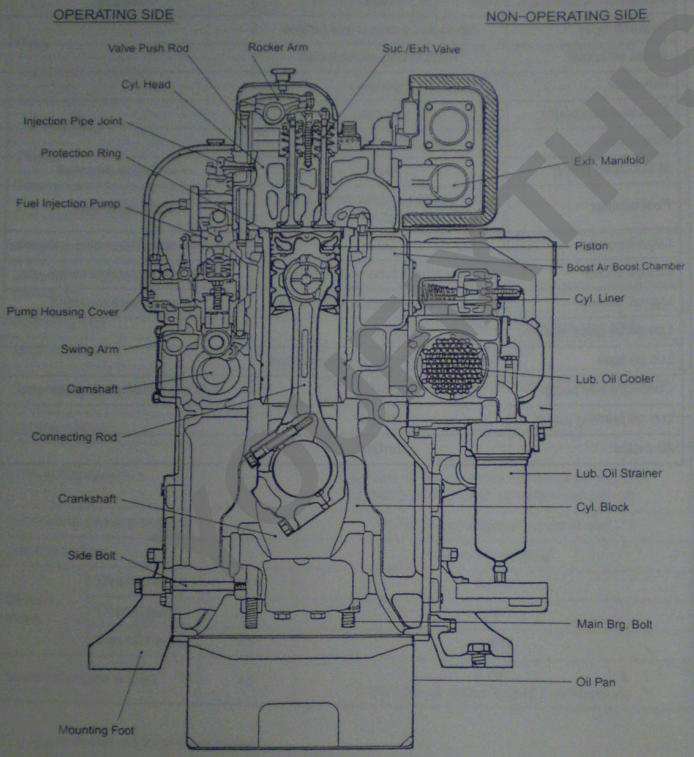


[Configuration of Cylinders]



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1-3. Sectional View of the Engine



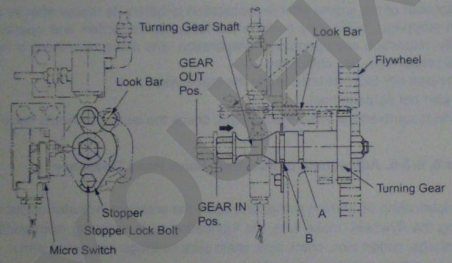
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Turn the flywheel by the following procedures:
Turning Gear Device - - - - - - - - Operational spec.

(1) Remove the lock bar, loosen the stopper lock bolt and slightly move the stopper.
(2) Press the turning gear shaft down to the GEAR IN position.
(3) Fit the stopper into the groove B of the gear shaft, and then tighten the stopper lock bolt.
(4) Attach the socket and ratchet handle for turning to the shaft, and then turn the flywheel.
(5) When the turning operation has completed, return the turning gear shaft to the GEAR OUT position. Then, fit the stopper into the groove A , and tighten the stopper lock bolt.
(6) Attach the lock bar.

△
Unless the turning gear is the GEAR OUT position, the turning gear engagement/disengagement switch actures to disable starting. (optional spec)

Drawing 4-1 Turning gear device (Optional spec.)



4-1-1. Lubricating Oil System

The piping parts of lubricating oil system are banded with yellow coating.

1) Inspection and oil supply of lubricating oil sump
(1) Open the drain valve, cock or plug of the following oil sumps and devices; and check the drain. Supply the lubricating oil to the upper limit of oil level gauge or dipstick in each oil sump;
① Engine oil pan or common bed (lubricating system oil sump)
② Governor oil sump
③ Lubricating oil cooler
④ Lubricating oil strainer
(2) Check the properties of lubricating oil; and if it is considerably contaminated of deteriorated, change it.

Chapter 3. Table of Engine Standard Adjustment

Chapter 5, 5-2-2. Control on Lub. Oil

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3-3. Protective Device Setting Values

Item	Unit	Alarm Setting Value	Emer.Stop Setting Value
Lub.oil engine inlet pressure	MPa(kgf/cm²)	0.34(3.5)	0.29(3.0)
Lub.oil turbocharger inlet pressure		0.25(2.5)	---
Cooling water engine outlet temperature	K(℃)	368(95)	373(100)
Rotational overspeed	min⁻¹(rmp)		115 ~ 120% of the rated speed
* Lub.oil priming pressure	MPa(kgf/cm²)	0.02(0.2)	---
* Differential pressure(lub.oil strainer)		0.09(0.9)	---
* Differential pressure(fuel.oil filter)		0.09(0.9)	---
* Starting air pressure		0.65(6.6)	---
* Control air pressure		0.65(6.6)	---
* Cooling water pressure(jacket cooling line)		0.13(1.3)	---
* Cooling water pressure(cooler cooling line)		0.13(1.3)	---
* Lub.oil engine inlet(cooler outlet) temperature	K(℃)	348(75)	---

As for an asterisk(*), for equipment of each item varies as depended on the specification, refer to the Final Document.

3-4. Holding Volumes of Lubricating Oil and Cooling Water

[Unit: ltr.]

	Item		Holding Volume	Remarks
Lubricating Oil	Engine(incl.inside the cooler, strainer & piping)		35	
	Lub.oil sump(common bed tank)		*	more than 1.0ℓ/ps
	* Governor	Type NZ61, RHD	1.3	
		Type PSG	2.0	
Cooling water	Cylinder jacket(fresh water)		75	
	Cooler		25	

As for an asterisk(*), refer to the Final Document as the volume may vary according to the specification.

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Table 6-1. Table of Routine Maintenance checking

Checking Area		Nature of Work		
		Daily	Weekly	Monthly (or 300-500hrs.)
Starting air tank		Pressure check	Draining	
Governor gear		Gov. oil volume check		Checking & lubrication of linkage system
Fuel Oil System	Fuel feed pump	Check on leak from oil seal		
	Fuel oil filter	Draining	Back-washing (blow-off)	Overhaul cleaning
	Fuel injection Pump			Check on rack scale position
				*Check on pinion lubricating Volume
	Injection timing adjust bolt			Check on looseness of lock nuts
Lub. Oil System	Common bed (or oil pan)	Oil volume check	Lub. oil cleaning The batch cleaning by the purifier	Lub. oil property analysis
	Lub. oil strainer	Draining	Back-washing (blow-off) * (2 ~ 3 days)	Overhaul cleaning * (10 ~ 15 days)
	Lub. oil bypass strainer	—	Overhaul cleaning	
Cooling water pump		Check on leak from mechanical seal		
Turbocharger			Prefilter washing	
			Blower washing	
Starting air motor				Check that electrical wiring is fastend firmly.
				Check that no air leaks from the air pipe and the joint.
Instrument	Each pressure gauge	Check on defective indication		
	Each thermometer	Check on defective indication		
Engine appearance		Check on looseness of bolts & nuts Check on leaks of various parts (cooling water, fuel oil, lub. oil, boost air & exhaust gas)		
Each pipe system		Leak check		

Note: An asterisk (*) refers to only for engine using heavy fuel oil (H.F.O.)

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9. TABLE OF TIGHTENING TORQUES OF MAJOR BOLTS

⚠ WARNING

Tighten the major bolts by the specified procedures.
If tightened improperly, a personal injury or damage of device may be caused. Be cautious.

(1) Unless otherwise specified,apply lub.oil on the thread and bearing surface, and then tightening a bolt or nut.
(2) On the parts prefixed with a star (★) in the following tables, a match mark is stamped. However, when tightening any of these parts, do not refer to the macth mark but tighten it to the specified torque, specified tightening angle or specified hydraulic pressure.

9-1. Hydraulic Peressure Clamping Bolt

Part Description	Screw Dia × Pitch	Face-to-Face Width of Bolt/Nut (mm)	Specific Hydraulic Pressure MPa (kgf/cm²)	Remarks
★ Cylinder head tightening nut	M33 × 2.0	Round	58.8 ± 0.5(600 ± 5)	
★ Main bearing cap tightening nut	M33 × 2.0	Round	58.8 ± 0.5(600 ± 5)	

9-2. Angle Clamping Bolts

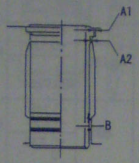
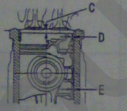
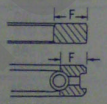
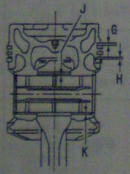
(1) Before tightening a connecting rod bolt, apply the Protec grease on its bearing surface and lub.oil on its thread.
(2) Tighten a bolt to the seating tightening torque, then tighten it to the specified angle.

Part Description	Screw Dia. × Pitch	Face-to-Face Width of Bolt/Nut (mm)	Seating Tightening Torque N-m (kgf-m)	Specified Tightening Angle (deg.)	Remarks
★ Connection rod bolt	M25 × 1.5	32	49(5)	120^{+3}_{0}	
Balance weight clamping bolt	M24 × 2.0	32	49(5)	80^{+3}_{0}	

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10. CLEARANCES & WEAR LIMITS OF MAJOR PARTS

(Unit in mm)

	Item	Sketch	Dimension		Std Clearance Assembling Time	Max. Allowance Clearance	Usage Limit of Parts
			Normal	Tolerance			
Cylinder & cylinder liner	Inner dia. of cylinder upper part		φ246	+0.029 0	A1=0.075 ~ 0.139	A1=0.25	+0.1
	Outer dia. of cylinder liner upper part			-0.075 0.110			-0.2
	Inner dia. of cylinder lower part		φ222	+0.029 0	A2=0.020 ~ 0.094	A2=0.2	+0.13
	Outer dia. of cylinder liner lower part			-0.020 0.065			-0.13
	Inner dia. of cylinder lower part		φ218	+0.029 0	B=0.015 ~ 0.088	B=0.2	+0.13
	Outer dia. of cylinder liner lower part			-0.015 0.059			-0.13
	Top clearance		2.0	± 0.20	C=1.8 ~ 2.2	C=2.5	—
	Inner dia. of protection ring		φ178	± 0.05	D=0.905 ~ 1.045	—	+0.8
	Outer dia. of piston head		φ177.025	± 0.02			—
	Inner dia. of cylinder liner		φ180	+0.030 0	E=0.093 ~ 0.153	E=0.3	+0.4 deflection wear of 0.2
	Outer dia. of piston skirt part		φ179.892	± 0.015			-0.2
Piston piston pin & rings	Radial thick. of piston rings, No.1 ~ No.2		F=6.5	± 0.15	—	—	★
	Radial thick. of oil ring		F=5.0	± 0.25	—	—	4.7
	Width of piston ring, No.1		4.5	-0.065 -0.085	No.1 G=0.110 ~ 0.155	No.1 G=0.4	-0.2
	Width of piston ring groove, No.1			+0.070 +0.045			+0.3
	Width of piston ring, No.2		4.0	-0.010 -0.030	No.2 G=0.055 ~ 0.100	No.2 G=0.4	-0.2
	Width of piston ring groove, No.2			+0.070 +0.045			+0.3
	Width of oil ring		6.0	-0.010 -0.030	H=0.030 ~ 0.065	H=0.4	-0.2
	Width of oil ring groove			+0.035 +0.020			+0.3
	Inner dia. of piston pin metal		φ75	+0.100 +0.080	J=0.080 ~ 0.113	J=0.25	+0.17
	Outer dia. of piston pin			0 -0.013			-0.05
	Inner dia. of piston pin hole			+0.045 +0.030	K=0.030 ~ 0.058	K=0.15	+0.15
	Outer dia. of piston pin			0 -0.013			-0.15

★ : The 1st ring is to be replaced with the new one when its plated layer is worn out and base metal begins to be exposed; the 2nd ring, when the taper face is gone.

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11-1. Starting Failure

1) Flywheel not turned

Cause	Countermeasure	
(1) Starting air pressure insufficient	Fill the starting air tank with air.	
(2) Engagement / disengagement switch actuated (Turning gear set at the intermeshing position)	Disengage the turning gear.	
(3) Malfunction of air motor		
1.Voltage drop of air motor battery	Charge the battery.	
2.Malfunction of air motor pilot solenoid valve	Press the manual starting push button to start the engine.	
(4) Engagement / disengagement switch actuated. (Start / stop lever set in the STOP position)	Set the start / stop lever at the RUN position.	
(5) Too high viscosity of lubricating oil	Warm up the engine or change the current lub. oil with a low-viscosity one.	
(6) Seizure of moving part		
1.Seizure of piston and cylinder liner	Check and repair the piston and cylinder liner, or replace them.	
2.Seizure of main bearing and / or camshaft bearing	Check and repair the pertinent main bearing or camshaft or camshaft bearing, or replace it.	

2) Flywheel turned, but ignition not taken place

Cause	Countermeasure	
(1) Fuel oil not sent under pressure to fuel injection pump		
1.Fuel tank empty	Supply the fuel to the fuel tank.	
2.Clogging of fuel oil pipe (improper opening and closing of each valve)	Check the opening and closing status of each valve.	
3.Clogging of fuel oil filter	Clean the filter.	
4.Failure of fuel feed pump	Check and repair the pump.	
5.Air entry through each joint	Check and repair each joint, then bleed air.	
(2) Malfunction of sopping air piston	Check and repair the air piston.	
(3) Defect of fuel injection pump		
1.Sticking of plunger and plunger guide	Check and repair the plunger or plunger guide, or replace it.	
2.Wear or seizure of plunger guide	Replace the plunger.	
3.Improper assembling (deviation of match marks)	Overhaul and check the pump.	
(4) Defect of fuel injection valve		
1.Sticking or seizure of needle.	Check and repair the needle, or replace it.	
2.Breakage of nozzle spring	Replace the nozzle spring.	
3.Fuel injection pressure dropped	Regulate the pressure.	
4.Oil leakage from nozzle excessive	Check and clean the mating surfaces of nozzle and body, or replace the nozzle.	
5.Breakage or improper clamping of high-pressure fuel pipe	Replace the high-pressure fuel pipe, or correct clamping.	
(5) Malfunction of governor (loose governor link and worn spline	Check and repair the governor, or replace it.	
(6) Poor airtightness of suction / exhaust valve		
1.No clearance at head of suction / exhaust valve	Adjust the valve head clearance.	
2.Sticking of suction / exhaust valve	Grind or replace the valve.	
3.Damage of seat of suction / exhaust valve	Grind or replace the valve seat.	
(7) Too low cetane number of fuel	Use a high- quality fuel oil.	

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部品表

お願い

この部品表は取扱説明書の付図を兼ねて編集してありますが、予告なしに部品番号を変更する事があります。このため、部品が必要な場合は御手数ですが、部品名称・部品番号・機関名称（形式）および機関製造番号を明記のうえ最寄りのヤンマー部品販売店へ御注文下さい。

部品注文時に必要な記載項目

機関名称（形式）1	6N18AL-DV
機関製造番号	3701FSF
部品名称	ピストン仕組
部品番号	746674-22011
必要な数量	1 set

PARTSLIST

Request

Though this Parts List has been edited to serve also as the appended figures of the pertinent. Opefation Manual, any Part No. thereof is subject to a chamge without notice. Consequently, when you ate in need of a particular Part, kindly place your order of that Partwuth your nearest YANMAR Parts Selling Agent, writing clearly Model and Mfg. No. of your engine together with Part Name and Part No. of the Part in demand.

Example of item & indication necessary at the time of ordering Yanmar engine parts.

Engine Model	6N18AL-DV
Engine Mfg. No.	3701FSF
Part Name	Piston Ass'y
Part No.	746674-22011
Q'ty Req'd	1 set

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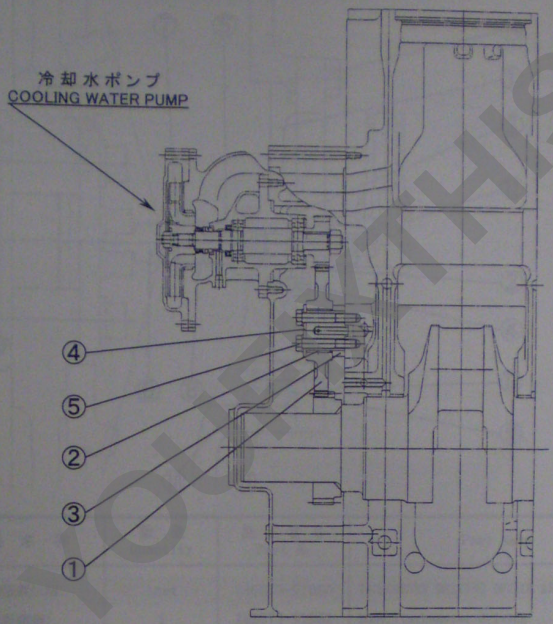
付図1.　シリンダヘッド仕組

Fig.1　CYLINDER HEAD ASS'Y

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付図12. 冷却水ポンプ駆動中間歯車仕組 (1/1)

Fig.12 COOLING WATER PUMP DRIVING IDLE GEAR ASS'Y

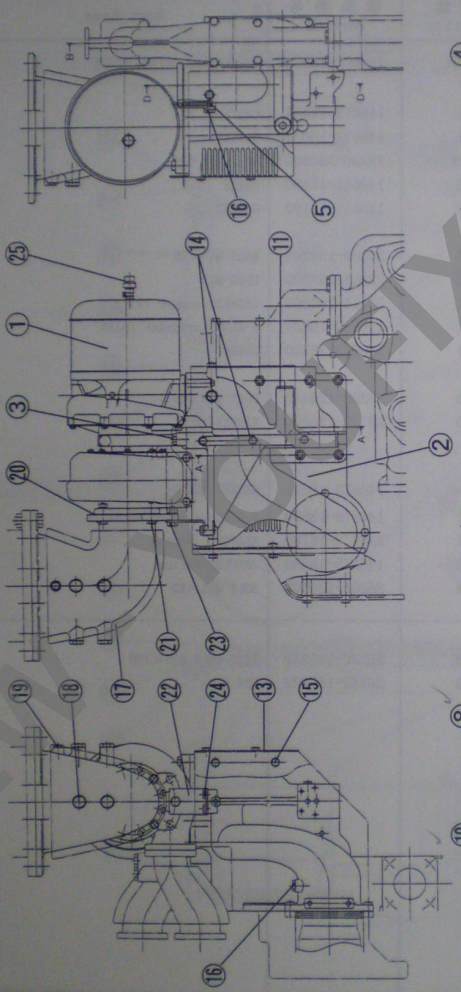


Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	中間歯車仕組 (冷却水ポンプ駆動)	1set	746673-14320	IDLE GEAR ASS'Y, cooling water pump driving
	中間歯車仕組 (冷却水ポンプ駆動)	1s	146673-14630	IDLE GEAR ASS'Y, cooling water pump driving
1	中間歯車	(1)	146673-14640	IDLE GEAR
2	ブッシュ	(1)	141616-14620	BUSH
3	取付台	1	146673-14701	MOUNT, gear
4	押え板 (中間歯車)	1	146673-14711	PLATE, idle gear
5	ボルト M16×100	4	26152-161002	BOLT M16×100
	座金 16	4	22137-160000	WASHER 16

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付図16-1. 過給機および排気出口管仕組 (RH133-Y型装備) (1/4)

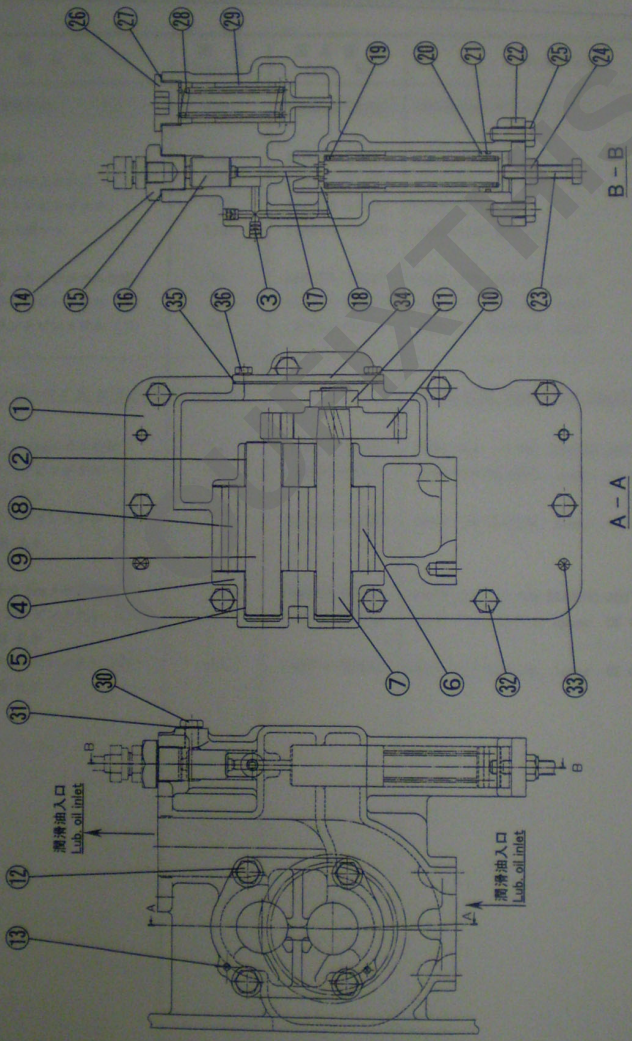
Fig.16-1 TURBO-CHARGER & EXHAUST GAS OUTLET PIPE ASS'Y equipped with RH133-Y type



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付図20. 潤滑油ポンプ仕組

Fig.20 LUBRICATING OIL PUMP ASS'Y



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4. OPERATION

CAUTION

During operation, the diesel engine runs at a high speed. Also, some parts of the engine are hot, and the compressed air and such pressurized fluids as oil and water are flowing inside it. Therefore, thoroughly read the safety precautions before operation, maintenance and inspection to handle the engine properly not to cause any accidents.

Chapter0, Section 3. Precautions on Safety

4-1. Operational Preparation

Before the initial start of the engine after its installation or before its restart after its overhaul servicing or a long-term stoppage, sufficiently perform the following inspection and operation preparation in addition to daily inspection and operational preparation, and make sure there is no abnormality and the operational preparation has completed.

(1) Make sure no part nor tool has been left in the crankcase.
(2) Check for a part not tightened yet.
(3) If you have disassembled the valve mechanism, check the suction/exhaust valve head clearance.

Chapter 6, 6-3-6. Adjustment of Suc./Exh. Valve Head Clearance

(4) Operate the lubricating oil priming pump, and open the pressure indicator cocks of all the cylinders. While turning the flywheel, make sure the lubricating oil is dropping from each part of the valve rocker arm shafts, piston pins, crank pins, main sure bearings and swing arms.
(5) Bleed the air from the lubricating oil strainer.
(6) Bleed the air from the fuel oil filter and inlet pipe of fuel injection pump.
(7) Manually lubricate the governor linkage, and make sure it moves smoothly.

[Procedures for turning the flywheel]

WARNING

Be careful not to allow your body to make contact with a moving part while turning the flywheel. (Never put you hand into the crankcase.)

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