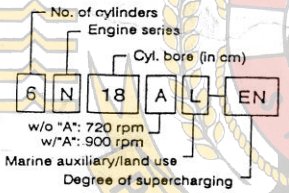
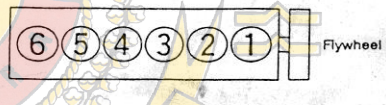
Marine Auxiliary Engine/Land Engine

Model		Unit	6N18AL-DN	6N18AL-UN	6N18AL-SN	6N18AL-EN
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			15.0			
Rated speed of revolution		rpm (min^{-1})	900 or 1,000			
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



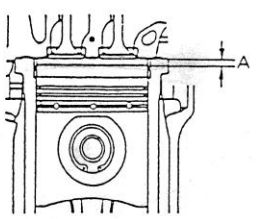
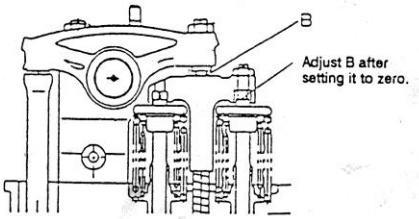
[Configuration of Cylinders]



1-2. Types of Accessories & Attachments

Accessory/Attachment	Type	Remarks
Supercharger	Air-cooled exhaust gas turbine	
Boost air cooler	Plate finned multitubular	
Governor	Hydraulic	
Fuel injection pump	Bosch	
Fuel valve	Non-cooled perforated	
M.D.O. feed pump	Gear	For marine diesel oil
Fuel oil filter	Heat-insulating, manual back-washing, duplex, changeover notch wire	For engine inlet
Lub. oil pump	Gear	Pressure regulating valve integrated
Lub. oil cooler	Low finned tube multitubular	w/automatic temperature control valve
Lub. oil strainer	Manual back-washing, duplex, changeover notch wire	
Lub. oil tank	Tank incorporated in common bed	
Cooling water pump	Centrifugal	Cylinder jacket side, cooler side
Lub. oil priming pump	Screw	
Air motor	Turbine	

3. TABLE OF ENGINE STANDARD ADJUSTMENTS

	Item			Adjustment Value	Remarks
Timing/Clearance	Piston top Clearance (A)		mm	11.5±0.2	
	Suction Valve	Begins to open (before T.D.C.)	deg.	68	
		Ends closing (after B.D.C.)	deg.	43	
		Valve head clearance (B)	mm	0.3	In the cold state
	Exhaust Valve	Begins to open (before B.D.C.)	deg.	63	
		Ends closing (after T.D.C.)	deg.	58	
		Valve head clearance (B)	mm	0.4	In the cold state
					
	Fuel injection pump begins to deliver (before T.C.C.)		deg.	★	Refer to Records of Shop Trial.
Pressure	Injection pressure, fuel injection valve		MPa (kgf/cm²)	34.0 (350)	
	Fuel feed pressure		MPa (kgf/cm²)	0.49~0.54 (5.0~5.5)	Marine diesel oil (M.D.O.)
				Chapter 5, 5-1-3	Heavy fuel oil (H.F.O.)
	Cylinder internal maximum combustion pressure (Pmax)		MPa (kgf/cm²)	★	Refer to Records of Shop Trial.
	Lub. oil pressure		MPa (kgf/cm²)	0.39~0.44 (4.0~4.5)	Engine inlet (cooler outlet)
				0.2~0.49 (2.0~5.0)	Turbocharger inlet
	Cooling water pressure (jacket cooling line)		MPa (kgf/cm²)	0.15~0.25 (1.5~2.5)	
	Cooling water pressure (cooler cooling line)		MPa (kgf/cm²)	0.15~0.25 (1.5~2.5)	
	Starting air pressure	Starting air tank	MPa (kgf/cm²)	2.94 (30)	Lower limit: 1.18 (12)
		After decompression		0.69~0.98 (7~10)	Indicated value on the gauge panee.
Temperature	Cooling water engine outlet temperature		°C	Below 358 (below 85)	
	Cooling water air cooler inlet temperature		°C	Below 311 (below 38)	
	Lub. oil engine inlet (cooler outlet) temperature		°C	323~338 (50~65)	
	Exhaust temperature (at each cylinder outlet)		°C	★	Refer to Records of Shop Trial.
	Exh. gas turbocharger inlet temp.		°C	★	Refer to Records of Shop Trial.

Note: For a star (★) given above, refer to the Records of Shop Trial and enter the obtained value here because it varies according to the engine specification and output.

Holding Volumes of Lubricating Oil and Cooling Water

Item				Holding Volume	Remarks
Lubricating Oil	Engine (incl. inside the cooler, strainer & piping)		ltr.	35	
	Lub. oil sump		ltr.	900	★
	Governor	Type NZ61	ltr.	1.3	
		Type PSG	ltr.	2.0	
		Type RHD	ltr.	1.3	
Cooling Water	Cylinder jacket		ltr.	75	
	Cooler		ltr.	25	

As for a star (★), refer to the Final Document as the volume may vary according to the specification.

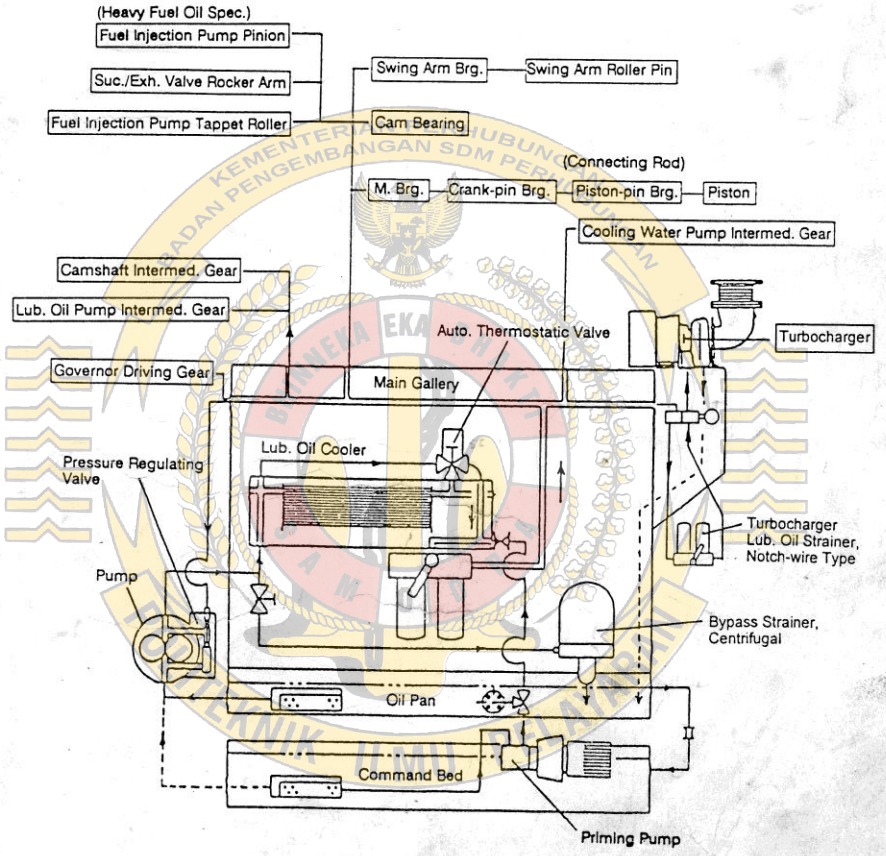
2-3. Lubricating Oil System

- O The lubricating oil pump is a gear pump integrating the pressure regulating valve and safety valve.
- O The lubricating oil strainers are a notch-wire type strainer and a centrifugal bypass strainer.
- O The lubricating oil cooler is a unit structure of the multi-tubular type fitted with an automatic thermostatic valve and a notch-wire type strainer.
- O The priming pump is a motored screw pump and is mounted on the common bed. The delivery pipe is connected with the inlet side of the notch-wire type strainer.

The lubricating oil discharged from the pump is regulated of its pressure to the specified value by the pressure regulating valve. Then, the lub. oil passes through the cooler and strainer and then enters the main gallery of the cylinder block. The lubricating oil line is branched at the main gallery. The oil passes through each part and returns to the oil pan and then the common bed.

Each lub. oil passage franched off from the main gallery is a drilled hole structure, excluding lines leading to the pressure regulating valve and governor driving gear.

The oil suction part of the pump varies according to the engine installation types. In the case an engine installed by the fixed supporting, the fixed suction part is the command bed; in the case of antivibration supporting, it is oil pan.



2-4. Cooling Water Pipe System

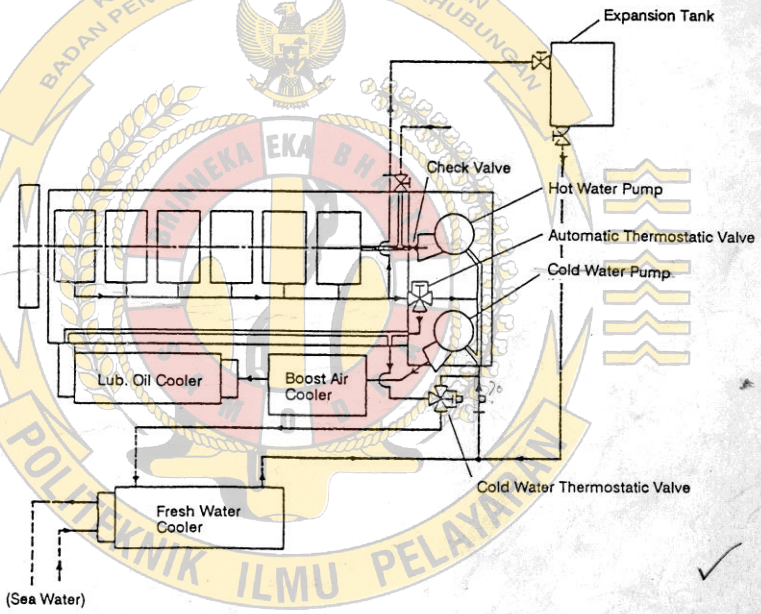
The cooling system of this engine is to cool the engine (cylinder liner and cylinder head) with hot fresh water and the lubricating oil cooler and boost air cooler with cold fresh water. This cooling system is called the dual fresh water line cooling system of the mixing type.

- Both the cold water pump and the hot water pump are centrifugal pumps equipped to the frontal part of the engine. The hot water pump is such a structure to incorporate the check valve directly to the frontal side gear case through the check valve on the delivery side. (The suction parts of both pumps are caupled in the gear case.)
- The temperature of hot water is controlled by the pellet type automatic thermostatic valve.
- The temperature of cold water is controlled by a thermostatic valve equipped on the fresh water cooler side.

The cooling water discharged from the cold water pump passes through the boost air cooler and lubricating oil cooler, and then returns to the fresh water cooler side. However, a part of the cooling water passes through the cooling water passage in the cylinder block and flows into the cold water pump suction side through the automatic thermostatic valve.

The cooling water discharged from the hot water pump returns to the cylinder jacket, cylinder head and cooling water collecting pipe and then to the automatic thermostatic valve which controls the temperature of thus returned cooling water.

The cooling water flown into the cylinder head cools the combustion surface and periphery of fuel injection valve sleeve and then cools the exhaust valve seat. After that, the cooling water flows into the cooling water cooling pipe.



5-2. Lubricating Oil

Selection of the proper lubricating oil is important for a diesel engine. In case of using an inappropriate lub. oil, sticking of piston rings, seizure and early wear of pistons, cylinder liners and bearings, etc. will occur. Consequently, discreetly select the lubricating oil to be used.

5-2-1. Choosing the Lub. Oil

Depending on properties of fuel oil and conditions of usage of the engine, lub. oil to be selected varies. Choose lub. oil based on the values given in the following table for the base number against the sulfur content included in the fuel oil used.

Fuel Oil Used		Flash Point (°C) (Open type)	Pour Point (°C)	Viscosity Index	Total Base Number (T.B.N.) (mgKOH/g)	API Service Grade
Kind	Sulfur Div.					
M.D.O. equivalent	< 1	> 230	< −10	> 96	9~15	CD Grade
200-sec. I.F.O. eq.	< 3.5	> 230	< −10	> 96	16~26	CD Grade
1,500-sec. 3,500-sec. 7,000-sec. H.F.O. eq.	< 5	> 230	< −10	> 96	30~42	CD Grade

Lub. oil to be applied: 5-2-3. List of Lub. Oil Brands

(1) Avoid blended use of different brands.
(In the unavoidable case of blended use of different brands of lub. oil, consult your lub. oil supplier.)

(2) Lub. oil having the alkalinity value matching that of the heavy fuel oil can be used even from the beginning of the M.D.O. burning period with no adverse effects if you wish to begin using heavy fuel oil within the first 300 hours of operation following the initial running-in on M.D.O.
If the engine is to be operated for a prolonged period of time (300 hours or longer) only on M.D.O., use lub. oil having the alkalinity value of 9~15.
If lub. oil of a high total base number (T.B.N.) is used when using fuel oil of a low sulfur content, additive (calcium corbonate) of lub. oil sticks to the high-temperature area together with carbon residue and causes adverse effects as mentioned below: For that reason, use the proper lub. oil.

① Accumulation of the aforementioned deposits on the combustion chamber hinders sliding of piston rings and may cause scuffing to the rings, cylinder liners, etc. Besides, they may cause bite-in and blow-bye if intruded into exhaust valves.

② Accumulation of the aforementioned deposits on the turbocharger nozzle narrows its opening and may cause surging.

5-2-2. Control on Lub. Oil

⚠ CAUTION

① In case of handling the lubricating oil inside the engine immediately after an engine stop, be careful not to get burnt.

② Should there be a possibility of lubricating oil to get in your eyes or to stick to your skin during handling of lubricating oil, wear protectors such as safety goggles and rubber gloves.

③ If lubricating oil get in your eyes or stick to your skin, it might cause inflammation. In such case, flush an affected region with clean water, and then consult a physician, if necessary.

④ Method of disposing waste oil has been provided for in the law. Dispose of waste oil properly according to the pertinent law. In case you don't know what to do, inquire of your supplier of lubricationg oil about this matter, and dispose of waste oil accordingly.

1) Control Criteria

Conduct the property analysis of lub. oil used every 500 hours of engine run, and change or make up the lub. oil as guided by control criteria set forth in the following table.

Item	Unit	Control Criteria			Critical Value of Usage	
Frash point (PM method)	°C	> 180			140	
Change in viscosity	cSt (40 °C)	Within new oil ±15%			New oil ±25%	
Moisture content	vol. %	< 0.1			0.3	
n-pentane insoluble matter (A method)	wt. %	< 1.5			2.0	
Benzol insoluble matter (A method)	wt. %	< 2.0			2.0	
Difference between n-pentane and benzol insoluble matters	wt. %	< 0.5				
Total base number	mg/KOHg	Meas. method / Fuel oil used	$HClO_3$ method	$HClO_4$ method	$HClO_3$ method	$HClO_4$ method
		M.D.O.	3.0	6.0	1.0	4.0
		200-sec. oil	5.0	10.0	3.0	7.0
		1,500-sec. oil	12.0	18.0	10.0	15.0
		3,500-sec. oil				
		7,000-sec. oil	12.0	18.0	10.0	15.0

2) Oil Change Criteria

Since oil change criteria vary as depended on conditions of use of the engine, an instance of the criteria may be set forth as follows although they could not be fixed uniformly on base of the time used alone.

(1) Ask your lub. oil supplier to analyze the lub. oil being used and thus to determine whether the oil can be further used continually or not.

Sample 500 cc of lub. oil at least from the drain plug of lub. oil strainer immediately after stopping the engine for asking the analysis of lub. oil.

(2) Procuring a spot test kit to learn the remaining total base number, degree of contamination, cleanness dispersing qualities of lub. oil used, etc. as a simple way of criteria, make the most of using such a spot test kit.

(3) Should either of the aforementioned criteria be not possible, change the entire volume of lub. oil with the new one at about 1,500 running hours in the case of constantly holding the oil volume of 1 ltr./PS by replenishing with the new oil.

5-2-3. List of Lub. Oil Brands

Fuel Oil Spec. Division / A.P.I. Service Grade / Supplier	M.D.O.	I.F.O.= (R.W. No. 1 at 100 °F) 200-sec. Oil	H.F.O.= (R.W. No. 1 at 100 °F) 1,500-sec./3,500-sec./7,000-sec. Oil
	Class CD	Class CD	Class CD
IDEMITSU KOSAN	DAPHNE MARINE OIL SX30, 40	DAPHNE MARINE OIL SW30, 40 DAPHNE MARINE OIL MV30, 40	DAPHNE MARINE OIL SP30, 40 DAPHNE MARINE OIL MV30, 40
NIPPON OIL	SUPER MDL UX30, 40	SUPER MDL MX30, 40	SUPER MDL SX30,40 , TX40
CASTROL	CASTROL MLC30, 40	CASTROL 215MXD、220MXD CASTROL TLX 303, 304	CASTROL TLX 303, 304 CASTROL TLX 403, 404
CALTEX	RPM DELO 1000 MARINE OIL 30, 40	RPM DELO 2000 MARINE OIL 30, 40	RPM DELO 3000 MARINE OIL 30, 40
GULF	GULF VERITAS DPO30, 40	GULF VERITAS SELECT 30, 40	GULF VERITAS SELECT 30, 40
COSMO OIL	COSMO MARINE SUPER 30, 40	COSMO MARINE 3025, 4025	COSMO MARINE 3040, 4040
TEXACO	TARO XD 30, 40	TARO DP30, 40	TARO DP30, 40
FUJI KOSAN	FUKKOL MARINE 312, 412	FUKKOL MARINE 320, 420	FUKKOL MARINE 330, 430
BRITISH PETROLEUM	BP ENERGOL DS3-153, 154	BP ENERGOL IC-HFX 303, 304	BP ENERGOL IC-HFX 303, 304 BP ENERGOL IC-HFX 403, 404
ESSO	STAMARINE 30, 40 EXXMAR 12TP30, 40	EXXMAR 24TP30, 40	EXXMAR 30TP30, 40
JAPAN ENERGY ELF	JOMO MARINE D-13, 14 DISOLA M3015, 4015	JOMO MARINE D-23, 24 AURELIA 3030, 4030	JOMO MARINE D-33, 34 AURELIA XT 3040, 4040
MITSUBISHI	DIAMOND NEW HIGH SUPER MARINE 30, 40 DIAMOND MARINE T103, 104	DIAMOND MARINE T203 (A), 204 (A)	DIAMOND MARINE T303 (A), 304 (A)
CHEVRON	DELO 1000 MARINE OIL 30, 40	DELO 2000 MARINE OIL 30, 40	DELO 3000 MARINE OIL 30, 40
SHELL	GADINIA OIL 30, 40 RIMULA Z OIL 30, 40 RIMULA OIL 30, 40	RIMULA OIL 30, 40 RIMULA FB OIL 30, 40	ARGINA T OIL 30, 40 ARGINA X OIL 30, 40
MOBIL	POWER GARD 32, 42 MOBIL GARD 312, 412	MOBIL POWER GARD 2030, 2040	MOBIL GARD 330,430 MOBIL GARD 340 440
GENERAL SEKIYU	GEMICO MARINE DX-103, 104	GEMICO MARINE DX203, 204	GEMICO MARINE SD303, 304 GEMICO MARINE SD403, 404

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Table 6-1. Table of Routine Maintenance Checking

Checking Area		Nature of Work		
		Daily	Weekly	Monthly (or 300~500 hrs.)
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 property analysis
	Lub. oil strainer	Draining	Back-washing (blow-off) * (2~3 days)	Overhaul cleaning * (10~15 days)
	Lub. oil bypass strainer		Overhaul cleaning	
	* Turbocharger lub. oil strainer		Back-washing (blow-off)	Overhaul cleaning
Cooling water pump		Check on leak from mechanical seal		
Turbocharger			Prefilter washing	
			Blower washing	
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.)

Table 6-2. Checking Table for Engine Using Marine Diesel Oil (2/2)

Div.	Part to Be Checked	Nature of Service	Checking Servicing Cycle (hrs.)						
			3 mo. or 1,000~1,500	6 mo. or 2,000~3,000	1 yr. or 4,000~6,000	2 yrs. or 8,000~12,000	4 yrs. or 16,000~24,000		
Major Moving Parts	Fuel feed pump, lub. oil pump, & cold water pump driving intermed. gear	Check of tooth bearing & backlash				O			
		Disassembly, check & measurement of bearing				O			
		Check of gear mounted shaft tightening force				O			
Gov. Gear	Governor	Change of hydraulic fluid	*	O					
		★Disassembly & check			O				
	Governor driving gear	Disassembly & check of tooth bearing & bearing				O			
Fuel Oil System	Fuel injection pump	Check of injection timing		O				1st time: 300~500 hrs.	
		Check of deflector & replacement		O					
		Disassembly, cleaning & check			O				
	Fuel feed pump	Disassembly & check			O				
		Replacement of oil seal			O				
	Lub. oil	Change (depended on results of property analysis)	O						
Lub. Oil System	Lub. oil cooler	Disassembly, check, cleaning & hydraulic test				O			
	Thermostatic valve	Disassembly, check & cleaning			O				
	Lub. oil pump	Disassembly, check & measurement				O			
		Disassembly & check of pres. reg. valve & safety valve				O			
Cooling Water System	Thermostatic valve	Disassembly, check & cleaning		O					
	Cooling water pump	Disassembly, check & measurement			O				
		Replacement of mechanical seal			O				
	Turbocharger	Disassembly & cleaning			O				
	Boost air cooler	Disassembly, check, cleaning & hydraulic test			O				
	Air motor	Grease lubrication of pinion gear.			O				
Others	Engine tachometer	Calibration of indication			O				
	Alarm switch	Actuation test		O					

Table 6-3. Checking Table for Engine Using Heavy Fuel Oil (R.W. No. 1 at 100 °F 1,500~7,000-sec. Equivalent Fuel Oil) (2/2)

Div.	Part to Be Checked	Nature of Service	Checking Servicing Cycle (hrs.)						
			3 mo. or 1,000~1,500	6 mo. or 2,000~3,000	1 yr. or 4,000~6,000	2 yrs. or 8,000~12,000	4 yrs. or 16,000~24,000		
Major Moving Parts	Fuel feed pump, lub. oil pump, & cold water pump driving intermed. gear	Check of tooth bearing & backlash				○			
		Disassembly, check & measurement of bearing				○			
		Check of gear mounted shaft tightening force				○			
Gov. Gear	Governor	Change of hydraulic fluid	*	○					
		★Disassembly & check			○				
	Governor driving gear	Disassembly & check of tooth bearing & bearing				○			
Fuel Oil System	Fuel injection pump	Check of injection timing		○				1st time: 300~500 hrs.	
		Check of deflector & replacement		○					
		Disassembly, cleaning & check			○				
	Fuel feed pump	Disassembly & check			○				
		Replacement of oil seal			○				
	Pressure gauge seal pot	Check on filling of ethylene glycol	○						
		Change of ethylene glycol			○				
	Lub. oil	Change (depended on results of property analysis)	○						
Lub. Oil System	Lub. oil cooler	Disassembly, check, cleaning & hydraulic test				○			
	Thermostatic valve	Disassembly, check & cleaning				○			
	Lub. oil pump	Disassembly, check & measurement				○			
		Disassembly & check of pres. reg. valve & safety valve				○			
Cooling Water System	Thermostatic valve	Disassembly, check & cleaning		○					
	Cooling water pump	Disassembly, check & measurement			○				
		Replacement of mechanical seal			○				
	Turbocharger	Disassembly & cleaning			○				
	Boost air cooler	Disassembly, check, cleaning & hydraulic test			○				
	Air motor	Grease lubrication of pinion gear.			○				
Others	Engine tachometer	Calibration of indication			○				
	Alarm switch	Actuation test		○					

(3) Loosen the lock nuts ② & ④, and then loosen the rocker arm adjusting screw ① and valve guard adjusting screw ③.

(4) Press down the center of the valve guard from above (so that the clearance Ⓐ becomes zero under this condition). Gradually tighten the valve guard adjusting screw ③ so that the clearance Ⓑ becomes zero. After the adjustment, lock the adjusting screw ③ not to turn, and securely tighten the lock nut ④.

(5) Put a feeler gauge into a clearance Ⓒ between the rocker arm adjusting screw ① and the valve guard, and gradually tighten the rocker arm adjusting screw ① until the clearance becomes narrow enough to permit the feeler gauge to be smoothly drawn out. Then, lock the adjusting screw ①, and tighten the lock nut ②.

(6) After having securely tightened the lock nut ②, check that the feeler gauge can be smoothly drawn out.

The valve head clearance of a suction valve and that of an exhaust valve are different. Be careful not to mistake the clearance of one valve for that of the other.

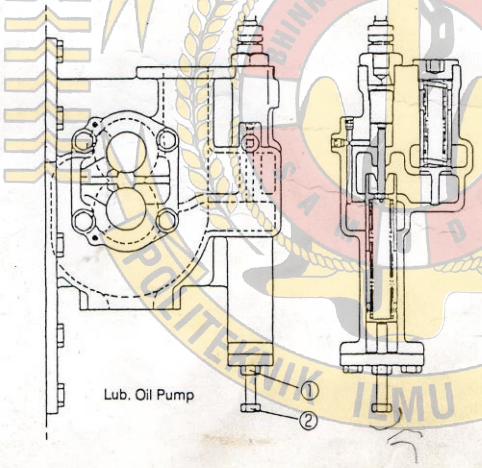
Valve head clearance: Chapter 3. Table of Engine Standard Adjustments

6-3-7. Adjustment of Lub. Oil Pressure

The lubricating oil pressure regulating valve has been integrated in the lubricating oil pump.
Should the lubricating oil pressure go out of the specified value, adjust it according to the following procedures:

(1) Before adjusting the lub. oil pressure, first clean the lubricating oil strainers.
(2) Run the engine, and then adjust the lubricating oil pressure to the specified value only after the lubricating oil temperature is stabilized.

Fig. 6-11. Lub. Oil Pressure Adjusting Procedure



(1) Loosen the lock nut ①.

(2) Adjust the screwing-in of the adjusting bolt ② to regulate the pressure.
Clockwise ... The pressure rises.
Counterclockwise ... The pressure drops.

(3) Securely tighten the lock nut.

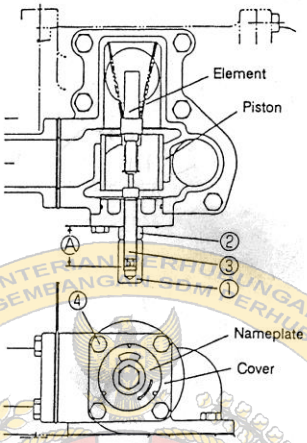
6-3-8. Adjustment of Lub. Oil Temperature

An automatic thermostatic valve has been equipped to the lubricating oil cooler to rise the lubricating oil temperature in a short time after the engine is started and to maintain the temperature in the proper range during a run. The lubricating oil temperature varies with a change of the cooling water temperature in each season and in each sea area, a fluctuation in the cooling water flow rate, fouling of the lubricating oil cooler, etc.

The automatic thermostatic valve has been set so that the lubricating oil temperature at the engine inlet becomes 50 to 65°C. However, if the lubricating oil temperature exceeds this range, adjust and check it according to the following procedures:

1) Adjustment of lubricationg oil temperature

Fig. 6-12. Lub. Oil Temperature Adjusting Procedures



(1) Remove the cap nut ①, and loosen the lock nut ②.
(2) Check the projecting dimension Ⓐ of the adjusting bolt ③.
(3) Screw the adjusting bolt in the direction of an arrow shown on the nameplate, and make sure the temperature drops. (The bolt screwing-in depth must be 17 mm or less.)

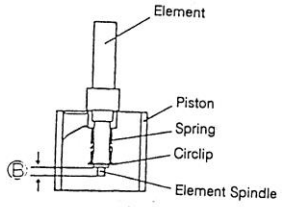
Should the temperature do not drop even after the above adjustment, fouling of the lubricating oil cooler, sticking of a piston or malfunction of the element, etc. may be suspected. Investigate the cause, and restore the engine to the former proper condition.

2) Check of automatic thermostatic valve

Stop the engine, discharge the lubricating oil from the lubricating oil cooler, and then check the automatic thermostatic valve according to the following procedures:

(1) Loosen the bolt ④ shown in Fig. 6-12, and then detach the cover.
(2) Check if the piston moves smoothly. (If the piston is catching or stuck, restore it to the proper condition.)
(3) Take out the piston (incorporating the element with a circlip.)
(4) Soak the element in cold water and warm water for 3 to 5 minutes, respectively, and measure the lift Ⓑ of element spindle.

Fig. 6-13. Element Checking Procedures



Lift of the element spindle (normal part)

Checking Water Temperature	Lift Ⓑ
Cold water of 30°C or less	5±0.1 mm
Warm water of 65°C or more	Greater than 23 mm

(5) If the lift of element spindle does not satisfy the values shown in the above table, replace the element with the new one.
(6) Adjust the projecting dimension Ⓐ of the adjusting bolt ③ to 36 mm, and then attach the cover.

2) Reassembly

Reassemble the lub. oil bypass strainer in the sequence reverse to disassembly, paying attention to the following points.

(1) Check for clogging of the nozzle and damage of the nozzle hole before incorporating the rotor cover.
(2) Incorporate the body cover after incorporating the rotor assembly into the body and making sure it rotates smoothly.

6-3-12. Cleaning of Lub. Oil Strainer

The lubricating oil strainer is of the manual back-washing, duplex changeover type, and its elements are of the notch-wire type. In a normal run, the lubricating oil passes through both sides (both elements) of the strainer.
Besides, a differential pressure indicator which detects senses the oil pressure at the inlet and outlet of the strainer has been fitted to the lubricating oil cooler so as to detect clogging of the strainer.

When the difference between the oil pressures at the inlet and outlet of the strainer reaches 0.09 MPa (1 kgf/cm^2), the differential pressure alarm is issued.

CAUTION

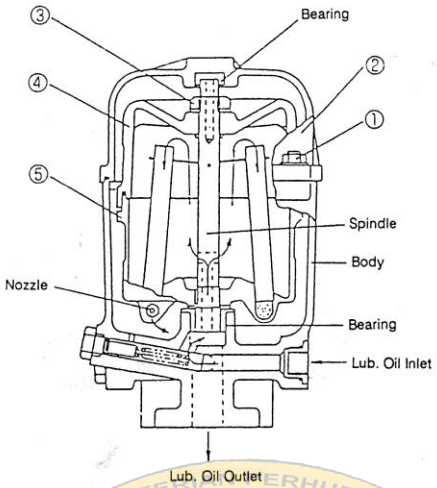
Be careful not to get burnt by touching this strainer because it assumes a high temperature during a run.

(1) Should the differential pressure not drop even if back-washing is done, overhaul and clean the strainer.
(2) Should the strainer be fouled noticeably, a lub. oil pressure drop alarm may be issued when one side of this strainer is used. Therefore, check the oil pressure while cleaning the strainer.

1) Disassembly & cleaning

Disassemble and clean the lub. oil bypass strainer according to the following procedures:

Fig. 6-18. Bypass Strainer Disassembling Procedures



(1) Loosen the tightening nut ① of the body cover ②, and then remove the cover ②.
(2) Remove the rotor assembly (spindle, rotor cover ④ and rotor body ⑤).
(3) Lock the nozzle section of rotor assembly.

When locking the nozzle section, take care not to flaw the nozzle hole and the spindle bearing.

(4) Loosen the rotor cover tightening nut ③, and then detach the rotor cover ④.
(5) Completely remove the sludge adherent to the rotor body ⑤ and inside of rotor cover ④, and then wash them.

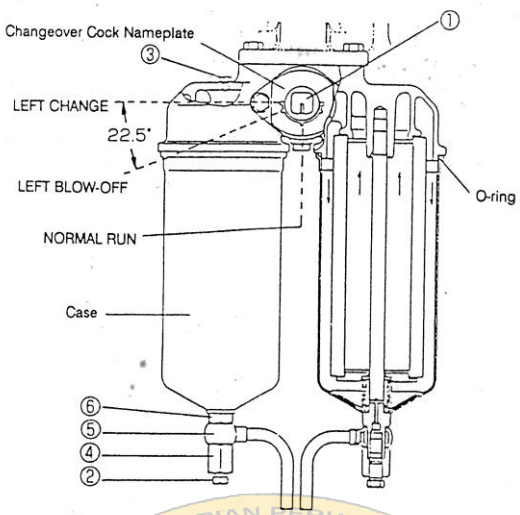
Completely remove the sludge. Otherwise, the residual sludge may cause an unbalance in rotation, resulting in a damage to the bearing.

(6) Check for flaws of the bearings of body and body cover.

1) Back washing (blow-off)

Wash both sides of this strainer, one at a time, according to the following procedures:

Fig. 6-19. Lub. Oil Strainer Cleaning Procedures



(1) Align the red mark of the changeover cock ① with the LEFT (or RIGHT) BLOW-OFF position on the nameplate.
(2) Loosen the drain plug ② two to three turns, and carry out a blow-off for 1 to 2 seconds. Then, tighten the drain plug.
(3) Return the changeover cock to the NORMAL RUN position.
(4) Repeat the above operation steps (1) & (2) three or four times.

2) Disassembly & cleaning

When disassembling this strainer during a run, do so one side of the strainer at a time according to the following procedures:

(1) Align the red mark of the changeover cock ① with the LEFT (or RIGHT) CHANGE position.
(2) Loosen the drain plug ②.
(3) Loosen the air vent plug ③.
(4) Discharge the lubricating oil in the case, loosen the nut ④, and then detach the blow-off pipe ⑤.
(5) Loosen the center bolt ⑥, and remove the case and element.
(6) Clean the removed element.

6-3-14. Cleaning of Strainer/Filter Element

3) Incorporation

Incorporate a strainer element in the sequence reverse to disassembly, paying attention to the following points.

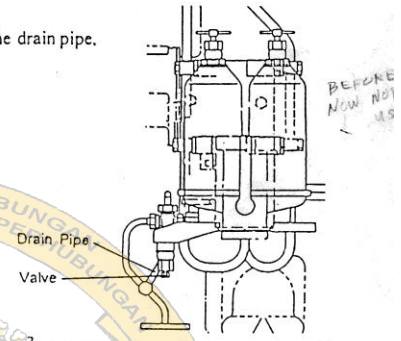
(1) Do not make a mistake in the element incorporating direction.
(2) Take care not to permit the O-ring bit in the case.
(3) When setting the changeover cock in the NORMAL RUN position, shift it slowly. If shifted rapidly, the oil pressure may temporarily drop before the case is filled with the lubricating oil, causing the lubricating oil pressure drop alarm to issue.

Turbocharger Lubricating Oil Strainer

- A turbocharger lubricating oil strainer of the same type as fuel oil (marine diesel oil) filter has been equipped.
- For its usage, disassembly and cleaning procedures, refer to

6-3-13. Cleaning of Fuel Oil Filter

- When back washing (blow-off), close the valve of the drain pipe.



- As the pressure of turbocharger lub. oil becomes 0.3 MPa (3 kgf/cm^2), a pressure drop alarm comes to work.

6-3-13. Cleaning of Fuel Oil Filter

The fuel oil filter equipped is of the heat-insulating, manual back-washing, duplex changeover type, and its elements are of the notch-wire type. In a run, the fuel oil passes through both sides (both elements) of this filter.

CAUTION

Be careful not to get burnt by touching this filter because it assumes a high temperature during a run on H.F.O.

(1) Should the filter be fouled noticeably, the RPM of the engine may decrease as the fuel oil pressure drops when one side of this filter is used. Therefore, check the fuel oil pressure while cleaning the filter.
(2) A positioning notch is provided to the changeover handle. In a blow-off or disassembly, tilt the handle to align the notch with the knock pin.