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 access to it whenever he wants to read or refer to it.

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YANMAR Worldwide Service

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ATTACHED
Service Manual for the Engine Air Starters
Yanmar Service Networks

Preface

PREFACE

Thank you for purchasing a YANMAR Diesel Engine.

1. Foreword

This Operation Manual has been prepared for your safe and effective use of the engine. Read through this Operation Manual and fully understand the safety precautions and precautions regarding the operation, checking and servicing before using this engine.

(1) Keep this Operation Manual at a clearly identified place accessible for the operator to refer to it at any time.
(2) The text and illustrations of this Operation Manual may partly disagree with engines of some specifications.
For such engines, refer to the Engine Specification and Final Document we have submitted you separately.
Also note that used parts and the content of this Operation Manual description of this engine are changed without notifying the user beforehand for improving the quality and performances of engine or for safety.
(3) For the following devices, refer to the corresponding operation manuals separately attached.
Turbocharger
Hydraulic governor
Other attachments of special specifications
(4) In this manual, the numerical values are based on the SI system (International System of Units). However, the numerical values based on the conventional unit system are also given in brackets.
(5) Replacement parts should be our genuine parts or specified parts. Order a part to your nearest sales or service agent of Yanmar's parts. When ordering a part, clearly specify the Part Name (part description) and Part No., and the Model and manufacture's Serial No. of the engine.
(6) If you should have lost or damaged this Operation Manual, or if you have any questions and advice, please contact us or your nearest sales or service agent (shown in the service network list "YANMAR Worldwide Service" appended to this manual).
(7) If you transfer this engine, also transfer this Operation Manual, Final Document and Records of Shop Trial with the engine to the next owner.
(8) If you use this engine for an application or under service condition other than those specified, or if you handle it not in accordance with this Operation Manual, an accident or a failure may be caused. Please contact us or your nearest sales or service agent before changing any technical data of the engine or modifying the engine after it has been delivered. Never modify the engine without consulting us.

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.

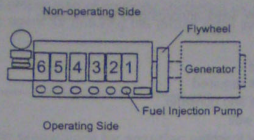
⚠ DANGER	It indicates that a danger of possible death or serious injury is very great when the proper precautions is not followed.
⚠ WARNING	It indicates that there is a danger of resulting in death or serious injury when the proper precautions is not followed.
⚠ CAUTION	It indicates that there is the 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.

2. Term & Symbol Marks

1) The major terms used in this Operation Manual are defined as follows:

Front part of engine:	Part opposite to the flywheel end
Rear part of engine:	Part on the flywheel end
Operating side:	Left side as viewed form the flywheel end (fuel injection pump side)
Non-operating side:	On the right as viewed from the flywheel end (exhaust pipe side)
CW rotation:	Clockwise rotation as viewed from the flywheel end
CCW rotation:	Counterclockwise rotation as viewed from the flywheel end
Cylinder No:	Assigned in the ascending order from the cylinder nearest to the flywheel end



2) The following symbol marks are used in the safety labels shown in this Operation Manual and posted on the engine.

(1) Caution marks and signal words

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.

△ It indicates a handing caution which, if not observed, may incur a deterioration of performance or a trouble/accident of this product.

(2) Symbol marks

(a)Caution marks


Caution on explosion


Caution on rotating part


Caution on fire


Caution on high temperature


Caution on hazardous noise


High pressure air inside

(b)Others


・・Refer to another page, section or chapter of this Operation Manual or other document.

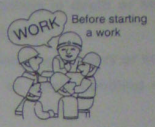
WARNING An accident may occur if the safety rules are not followed.

3. Precautions on Safety

3-1. Basic Precautions

Strict Observance of the Safety Rules

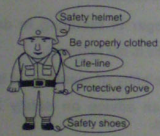
- When running the engine or servicing it for its maintenance, observe the safety rules, precautions on safety and work procedures.
- When carrying out a joint work, work according to the predetermined signs.



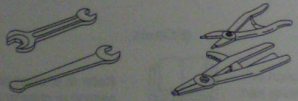
Way of pre-work arrangement

(1) According to kind of work required
(2) Everyone to contemplate and consider
(3) Everyone to understand well
(4) Fix the most suitable way to work

- Wear the proper protective garment. Don't wear oil smudged work clothes because they are prone to catch fire.
- Wear protectors such as helmet, safety goggles, safety shoes, protective mask, protective glove, life-line, etc., depending on the nature of work required.



- When working on the engine, use the specified engine tools. Use jigs or tools suitable for particular work because use of a wrong tool causes an injury.



SAFETY FIRST

(1) Safety has priority over all the works.
(2) Safety is more important than any other duties.
(3) It is needless to say that "Safety First" means that safety has priority over working efficiency.
(4) Safety is the foundation for working efficiency. Safety is never contradictory to working efficiency.

- While at work, do not jump on and off the engine.
- For working, install a work bench fitted to the size of your engine to secure a good footing. Don't work in a dangerous position.

⚠ CAUTION

No Modification, Please.

- When you want to modify your engine, consult us or your nearest sales or service agent in advance. Yanmar can not be responsible for an accident resulting in injury or death or an engine trouble resulted from unauthorized modification.
- Your engine and its safety devices have been sealed for the sake of safety. Don't break or tamper with a seal indiscreetly.
- If a sealing is missing, take a proper step of promptly contacting us or your nearest sales or service agent for ensuring the proper initial setting.



⚠ WARNING **Observe the precautions for ensuring safety.**

Check of Safety Devices

- Check the all the safety devices of your engine have been set normally.
- If a safety device is wrongly used, it leads to a serious accident resulting in injury or death.
- Promptly repair a cover a rotating part, a heat shielding cover for exhaust pipe, a protective cover of the heating region or the like, if found damaged.



- Never run the engine while the cover of a rotating part is removed. Otherwise during operation, your hand, body or clothing may be caught in the rotating part, resulting in your injury.

⚠ CAUTION

Be Cautious of Handling of a High-temperature or High-pressure Spot.

— Take care not to get burnt. —

- During running and immediately after the engine has stopped, the whole engine is heated. Take care not to get burnt.



- When changing cooling water, lubricating oil or filter immediately after the engine has stopped, proceed to work only after the temperature has lowered.
- Do not touch a high-temperature region such as the exhaust pipe or pressure indicator cock of engine with bare hands.
- Do not touch the heater and heated sections of fuel oil system with bare hands.
- Since the pressure indicator becomes hot, be sure to wear gloves when taking reading.
- If you uncap the radiator or fresh water tank, vapor or hot water may blow up, causing you to get burnt.
- Stop the engine and wait until the temperature has dropped. Then, wrap the cap with cloth and slowly loosen it to release the internal pressure. After that, remove the cap.

⚠ DANGER

Be Cautious of Handling of Fuel & Lubricating Oil.



- If fire is brought close to fuel and/or lubricating oil, there is the possibility of catching fire.
  (Particularly the fuel is highly flammable and dangerous.)
- Fire should be strictly prohibited in the engine installed place (engine room).
- Check for leak of fuel oil and lubricating oil. If you find a defective point, repair it and wipe out leaked fuel or lubricating oil.
- Store the fuel oil and lubricating oil at the specified place and do not allow persons other than those concerned to handle them.
- Unnecessary flammables in the engine installed place (engine room) may cause fire. Therefore, store these flammables in another specified place.





Ventilate Well.

- Exhaust gas emitted from an engine is dangerous.
- If Exhaust gas is leading, promptly repair such a leaking point at the exhaust pipe.
- Ventilate well the indoor engine installed place (and/or the engine room.)
- Take care that the room does not fall short of the air (oxygen) because the turbocharger takes in a great volume of air.



- While charging the battery, there is danger of catching fire because hydrogen gas is generated.

Ventilate well to prevent gas intoxication.

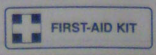


- Inhaling exhaust gas is very dangerous.
- When working indoors, sufficiently ventilate the room.

Installing of a Fire Extinguisher and First-aid Kit

- Install a fire extinguisher against a possible fire, and check how to use it.
- Fix a safekeeping place for a first-aid kit, and install it there.
- Fix the actions to be taken when fire or an accident has occurred.
- Establish a means of reporting to emergency medical institution such as an emergency hospital, and have its telephone number written down.





WARNING Observe the precautions for ensuring safety.

3-2. Precautions on Operation

(1) Prior to Starting of the Engine

Start the Engine after Signaling

- Check if no one is around the engine.
- If someone is found near the engine, give him a sign that the engine will be started. Only then start it.
- Check the holding capacities of fuel, oil, air, etc.
- Be sure to detach the turning device once the engine is started, and keep it at it's fixed housing spot.
- Turn on the power supply of the engine protection device before starting up the engine.
- After the engine has been stopped for a long time or after the engine has been serviced, be sure to start up the engine at the engine side.
- If the rotational speed rises extremely rapidly or if you find an usual sound or fume, immediately set the start/stop lever in the STOP position to stop the engine.

SAFETY FIRST

Check After the Engine Is Started

- Check if pressure values of each instrument/gauge board are normal.
- Check if there are no unusual sound and abnormal heat buildup.
- Check for any leakages of fuel, oil, air, etc., and if a leakage is found, promptly repair.
- Except in case of emergency, apply the load after a warming-up.

(2) During a Run

- Keep watching the pressure and temperature or check for unusual sound and abnormal heat buildup.
- Check whether the engine fully shows its proper performances and record the check results. (Refer to the Records of Shop Trial, then record the check results on the Engine Log.)

WARNING



Take care not to be caught in a rotating part.

- Never allow your hands, body and clothing to make contact or bring close to any rotating part.

CAUTION



Take care not to get burnt.

- During running and immediately after the engine has stopped, the whole engine is heated. Therefore, take care not to get burnt.
- Take care not to allow your hands, body and clothing to make contact with the turbocharger, exhaust manifold, exhaust pipe and/or engine as whole.
- If any abnormality is detected, immediately stop the engine and repair it.

WARNING



Take care not to get hearing loss.

- Put an ear protection in engine-room during running, because can cause hearing loss.

⚠ WARNING **An accident may occur if the safety rules are not followed.**

(3) When Stopping the Engine

- Do not stop the engine simultaneously with load shutoff.
- Except in case of emergency, keep running the engine without load after load shutoff.
- Keep the engine ready for being started up.
- Promptly repair the points that have been troubling during a run.

⚠ DANGER



- Do not open the side cover of crankcase for at least 10 minutes after having stopped the engine. Otherwise, the entry of external air may result in explosion.

⚠ CAUTION



Take care not to get burnt.

- Immediately after the engine has stopped, the whole engine is heated. Therefore, take care not to get burnt.
  Take care not to allow your hands, body and clothing to make contact with the turbo-charger, exhaust manifold, exhaust pipe and engine as a whole.
- If you attempt to drain oil while the engine is still hot, take care not to get burnt with splash of oil.
- If you disassemble the cooling water system while the engine is still hot, vapor or hot water may blow out, causing you to get burnt.
  Wait until the engine becomes cool, then wrap the disassembling part with cloth or the like and slowly loosen it.

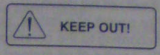
WARNING Observe the precautions for ensuring safety.

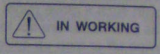
3-3. Precautions on Maintenance

(1) Precautions Prior to Maintenance Servicing

Indication of Warnings in Checking and Servicing

- While checking and/or maintenance servicing the engine, post a notice on a warning indicating board for danger prevention.
- Strive for safety, maintaining a close contact with the respective parties concerned.
- Strive to prevent a danger from emerging, forbidding other than the parties concerned to enter the engine installed place (and/or the engine room), for instance.





Immediately After an Engine Stop

DANGER



- Do not open the side cover of crankcase for at least 10 minutes after having stopped the engine. Otherwise, entry of external air may result in explosion.

CAUTION



Take care not to get burnt.

- Immediately after the engine has stopped, the whole engine is heated. Therefore, take care not to get burnt.
  Take care not to allow your hands, body and clothing to make contact with the turbocharger, exhaust manifold, exhaust pipe and engine as a whole.
- If you attempt to drain oil while the engine is still hot, take care not to get burnt with splash of oil.
- If you disassemble the cooling water system while the engine is still hot, vapor or hot water may blow out, causing you to get burnt.
- Wait until the engine becomes cool, then wrap the disassembling part with cloth or the like and slowly loosen it.

Preparation Prior to Working

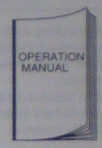
- Since a working area will be stained/smudged, put it in good order.
- Prepare engine jigs and tools ready to use.
- Prepare oil, genuine parts, waste cloth, wire, etc. according to the nature of work to be done.
- Secure a work bench fitted to the height of the engine.

WARNING **An accident may occur if the safety rules are not followed.**

(2) Precautions During Maintenance Servicing

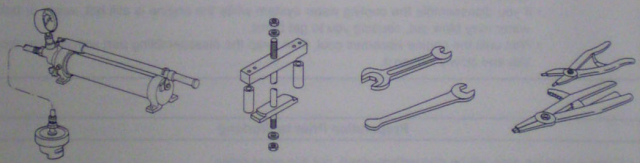
Check in Course of Work

- For a joint work strive for elimination of a possible danger by keeping alert to the surroundings.
- Tie such an accessory detached in work to a stable post or spot so that it will not fall down.
- For a work at a height, put on the safety belt or life-line.
- According to the condition of working, wear protectors.
- Be careful of oil stained or smudged protective glove because working with such a glove might lead to a damage of parts or a personal injury as your hands are apt to slip.
- Wipe off or mop up spilled fuel or oil at once because, if left alone, it is dangerous as it causes a slip.
- Prepare a box to accommodate removed parts in advance so that they will not be lost nor damaged.
- If necessary, provide setting marks before disassembling the engine so that you can reassemble it in the proper reassembling sequence.
- Reassemble the setting marked portions with reference to the setting marks.
- Tighten the bolts and nuts to the specified torque or hydraulic pressure.



Use of the Proper Tools

- Use the specified engine tools to prevent the damage of the respective bolts and nuts of the engine.
- When handling a heavy thing, follow the slinger's instructions.
- In advance of using exclusive tools, check the function of these tools.
- Carefully check for any damages to rubber hose and joints of hydraulic jacks.
- Use the specified lifting gear, hook, rope, etc.; and pay attention to safety when handling a heavy thing particularly.



TOOLS

Precautions in Use of Fire

DANGER



- In such works with welder, electrical tools and grinder, be careful of sparking. Since there is the possibility of catching fire, try not to leave combustibles such as fuel, lubricating oil and used waste cloth in a working area.



WARNING Observe the precautions for ensuring safety.

DANGER

Precautions in Checking the Electrical System



- Shut off the power supply before starting the work. Otherwise, a fire may occur or you may receive electric shock.
- When checking the battery system, be sure to disconnect the earth cable (–) terminal. Otherwise, the negative terminal may be short-circuited by mistake, resulting in fire.
- The strong acid battery electrolyte put on your skin or eyes will cause inflammation. If the battery electrolyte should be put on your skin or eyes, immediately flush it with fresh water, then consult a physician.

Precautions for Using Organic Solvent

- Since an organic solvent is highly volatile, liable to be gasified and absorbed by worker through his breathing as it vaporized, pay close attention to ventilation when handling it.
- Since a highly concentrated organic solvent has the property of dissolving fats and oils and is absorbed by worker through his skins, be careful of handling it.
- When working with such a solvent, be sure to wear rubber gloves.

WEAR PROTECTORS

(3) Precautions at Completion of Maintenance Servicing

Check of Work Finish

- Check if detached parts have been refitted at the specified spots in the total number.
- Check if the damaged parts have been replaced with the good ones.
- Return tools, lifting gear, hook, rope, etc. used to the former safekeeping place.
- Remove fuel and oil from the engine installed place (and/or the engine room).
- Keep the engine installed place (and/or the engine room) in order and tidy so that it will not interfere with daily operation.
- Before starting the engine, check various parts to see if there is no abnormality. Refer back to 3-2. Precautions on Operation, (1) Prior to Starting of the Engine.
- Proceed t a load run, and check that the performance does not differ from that existed prior to the maintenance servicing. Refer back to 3-2. Precautions on Operation, (2) During a Run.
- As soon as a load run is completed, enter records of performance as well as the nature of maintenance servicing in your Engine Log. (Keeping of records and then reporting of work completion)
- Remove such as a standing signboard, and contact the respective parties concerned for reporting the completion of work.

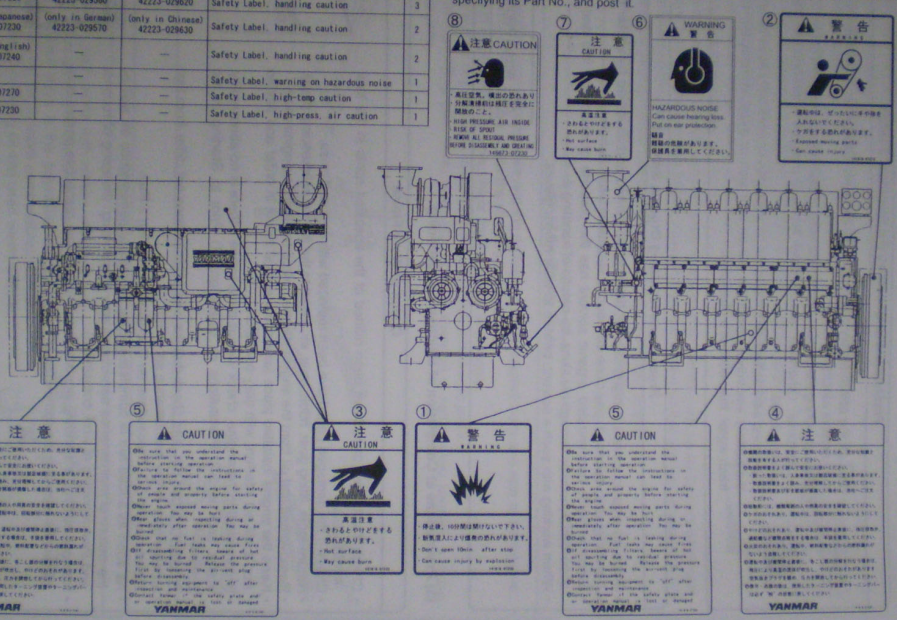




4. List of Safety Labels

- This page shows where safety labels are posted for safely use of this engine. Carefully read the cautions shown on the safety labels to prevent accidents.
- If any safety label is stained, damaged or lost, order it to your nearest Yanmar sales or service agent (shown in the service network list "YANMAR Worldwide Service" appended to this manual) by clearly specifying its Part No., and post it.

	Part No.			Part Description	Q'ty
	Japanese-English	German-English	Chinese-English		
①	141616-07200	42223-029540	42223-029600	Safety Label, warning on blow-by explosion	1
②	141616-07210	42223-029550	42223-029610	Safety Label, warning on rotating part	1
③	141616-07220	42223-029560	42223-029620	Safety Label, handling caution	3
④	(only in Japanese) 141616-07230	(only in German) 42223-029570	(only in Chinese) 42223-029630	Safety Label, handling caution	2
⑤	(only in English) 141616-07240	—	—	Safety Label, handling caution	2
⑥	—	—	—	Safety Label, warning on hazardous noise	1
⑦	141616-07270	—	—	Safety Label, high-temp caution	1
⑧	146673-07230	—	—	Safety Label, high-press. air caution	1



5. Lifting Procedures for Engine

⚠ WARNING

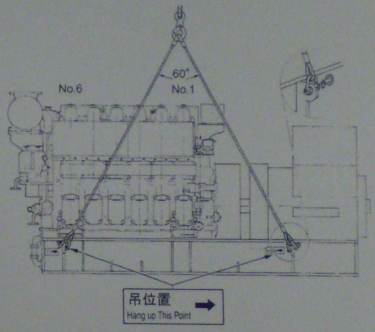
Falling of the engine or generating set during its lifting or carriage is very dangerous if so happened.
In time of a load lifting work, observe the following items in order to prevent an accident:

- Use the lifting wire rope, shackle, etc. that are suitable for lifting weight.
- Choose the wire rope length so that the engine or common bed does not lean to one side during lifting.
- Put a cushioning material such as padding between the wire rope and the engine or driven machine (generator, for instance) which the wire rope comes into contact with otherwise.
- Choose such a cushioning material as will not be damaged not removed during lifting, then attach it not to allow its contacts with the engine or driven machine to be damaged.
- Do not enter an area below the lifting load.

Lifting sling attaching points

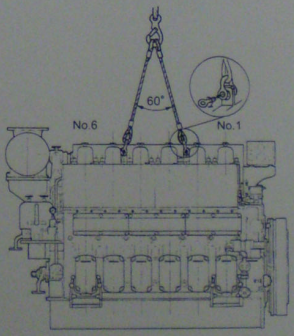
1) Common bed set

The "Hang up This Point" labels have been stuck on the common bed.



2) Engine singly

- ○ Fit the (optionally available) exclusive lifting slings to cylinder head clamping bolts of the No. 2 and No. 5 cylinders close to the center of the engine.
- ○ Haul up the cylinder heads under the specified hydraulic pressure tightened state.
- ○ Keep the lifting angle of the wire rope within 60 degrees.



3) Driven machines (generator, pump, etc.)

- ○ For the wire rope attaching points, refer to the respective Operation Manuals.

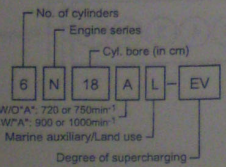
1. Engine Description

1. ENGINE DESCRIPTION

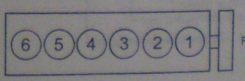
1-1. Engine Specification (1/2)

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



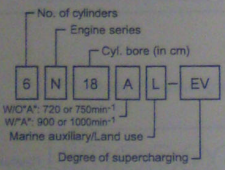
[Configuration of Cylinders]



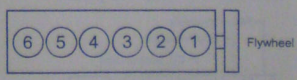
1-1. Engine Specification (2/2)

Model		Unit	6N18AL-HV	6N18AL-DV	6N18AL-UV	6N18AL-SV	6N18AL-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		ℓ	42.75				
Compression ratio		---	16.5				
Rated speed of revolution		min^{-1}(rpm)	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



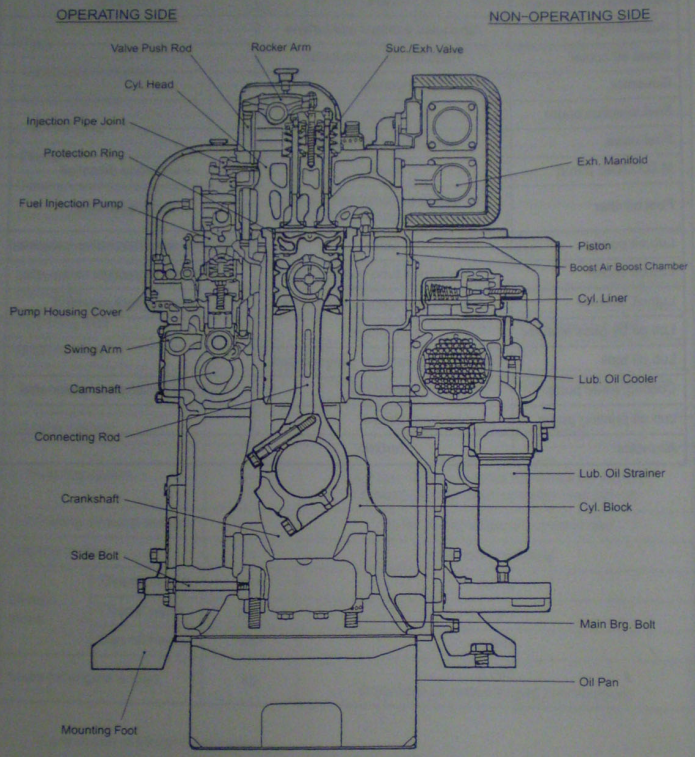
[Configuration of Cylinders]



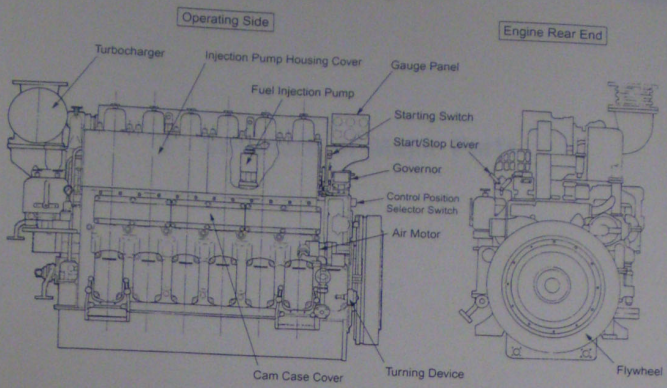
1-2. Types of Accessories & Attachments

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	Duplex, changeover notch wire	Manual back-washing
Lub.oil by-pass strainer	Centrifugal	
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	

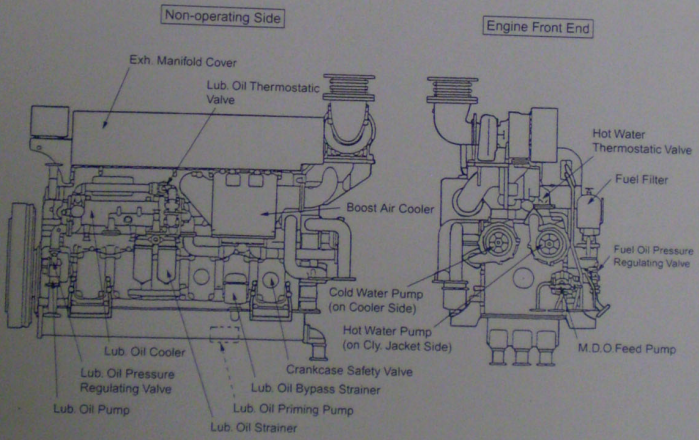
1-3. Sectional View of the Engine



1-4. (1/2) Engine Outline & Device Arrangement



1-4. (2/2)Engine Outline & Device Arrangement



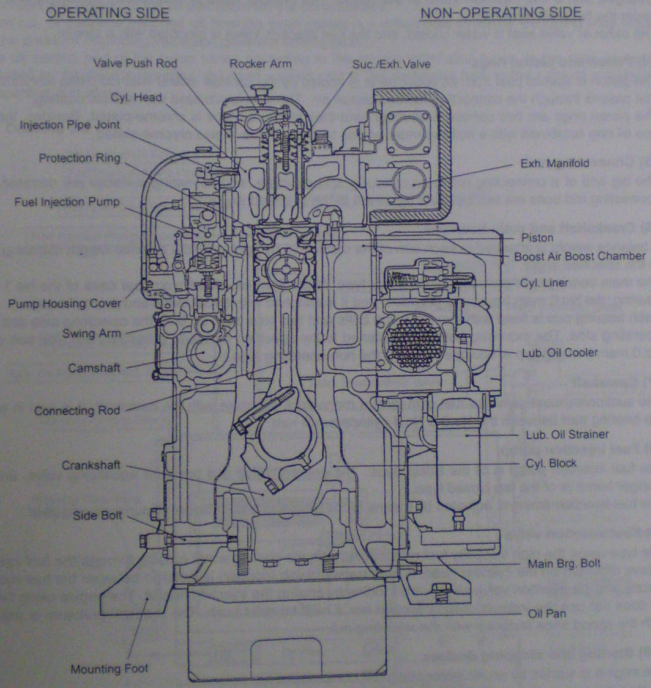
2. Structure of Major Parts

2. STRUCTURE OF MAJOR PARTS

2-1. Outline of Structure

This engine is designed to be a crankcase integrated, suspension metal structure as shown in the below sectional view.
For its installation, there are the fixed supporting to fix it directly on the common bed and the antivibration supporting to fix the mounting foot and generator on the common bed via rubber vibration insulators.

Drawing2-1.



2-2. Structure of Major Parts

1) Cylinder block

Provided with side covers on both the operating side and the non-operating side, the cylinder block is a duplex wall structure made of casting integrating the boost air manifold (boost air chamber), main lubricating oil pipe and main cooling water pipe.

2) Cylinder liner

Made of a special cast iron, the cylinder liner has the special thermal treated surface. The inner face is finished with precision honing. On the upper part of inner diameter of the liner, an anti-polish ring is mounted.

3) Cylinder head

The cylinder head is of the 4-valve type equipped with two suction valves and two exhaust valves and arranged with a fuel injection valve at the center. The cylinder head is clamped by tightening four bolts under the hydraulic pressure.
The exhaust valve seat is water cooled, and the fuel injection valve is mounted with a sleeve.

4) Piston and piston rings

The piston is special cast iron. Its upper parts is cooled by the cocktail shaker method using lubricating oil that passes through the connecting rod and piston pin. The skirt is provided with special coating.
The piston rings are two compression rings, and their sliding surface is chrome-plated. Besides, there is one oil ring combined with a coil expander whose sliding surface is also chrome-plated.

5) Connecting rod

The big end of a connecting rod is an obliquely split structure, and its mating surfaces are serrated. The connecting rod bolts are two tap bolts tightened to the specified angle.

6) Crankshaft and main bearings

A balance weight is attached to each arm of the crankshaft by tightening the balance weight clamping bolts to the specified angle.
The main bearing is of the suspension metal type. At the flywheel-side timing gear case of the No.1 main bearing, the No.0 main bearing is provided, and it is attached with thrust metal and journal metal.
Each bearing cap is fixed with two mounting bolts and two side bolts on both the operating side and non-operating side. The mounting bolts are tightened to the specified hydraulic pressure.(The side bolt of the No.0 main bearing cap is equipped only on the non-operating side.)

7) Camshaft

The suction/exhaust cam and fuel cam form a monoblock structure with the camshaft. It is split in two at the bearing part between the No.3 & No.4 cylinders.

8) Fuel injection pump

The fuel injection pump is of the Bosch type. The delivery valve is a pressure equalizing valve, and the plunger barrel is of the top closed type.
The fuel injection timing is adjusted by means of the adjusting bolt of tappet of pump driving gear.

9) Fuel injection valve

The type using the high viscosity fuel oil is cooled with the cooling water running through the fuel injection sleeve mounted on the cylinder head. A heat transfer bush (copper) is installed between the fuel injection nozzle and the injection valve sleeve, thus indirectly cooling the injection nozzle. The engine using the MD oil does not use the indirect cooling system nor a heat transfer bush. The injection pressure is adjusted with the spring shoe fastened with the adjusting nut.

10) Starting and stopping devices

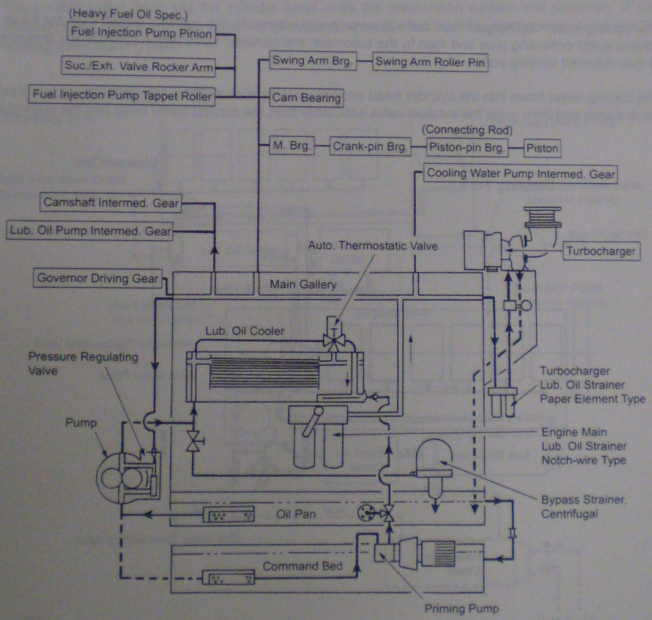
The engine is started by an air motor using the compressed air.
To stop the engine, the start/stop lever is set in the STOP position. To stop the engine by the remote operation, the air piston is actuated to set the rack of fuel injection pump at the non-injection position.
The start/stop lever and turning device are interlocked with the respective switches to prevent starting by erroneous operation.

2-3. Lubricating Oil System

- The lubricating oil pump is a gear pump integrating the pressure regulating valve and safety valve.
- The lubricating oil strainers are a notch-wire type strainer and a centrifugal bypass strainer.
- 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.
- 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.

Drawing 2-2



2-4. Cooling Water Pipe System

2-4-1. Cooling Water Pipe System (both fresh water line of the mixing type)

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.

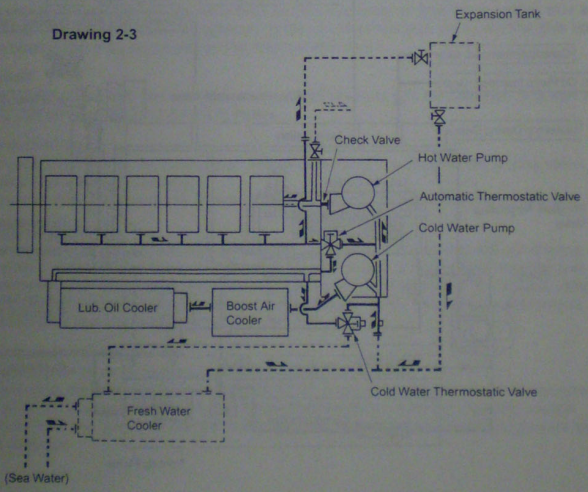
- ○ Both the cold water pump and the hot water pump are centrifugal pumps equipped to the frontal part of the engine. The hot water pump is such a structure to incorporate the check valve directly to the frontal side gear case through the check valve on the delivery side. (The suction parts of both pumps 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 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 pipe.

Drawing 2-3



2-4-2. Cooling Water Pipe System (cold water line sea water spec.)

1) 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 sea water.

- The cooling system is a dual-line system consisting of the cylinder jacket line and cooler line. Sea water lines are equipped with a motor-driven centrifugal pump mounted in the marine as the standard provision.
- The cooling fresh water pump in the cylinder jacket line, the centrifugal pump is driven via an idle gear.

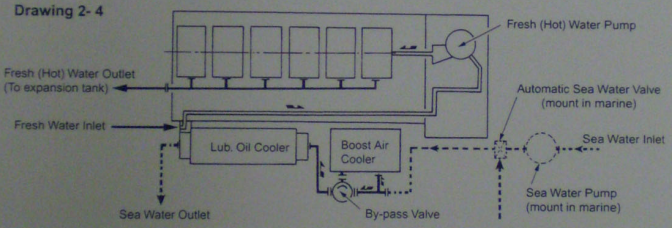
2) The cooling sea water discharged from the cold water pump passes through the boost air cooler and lubricating oil cooler.

3) A bypass valve is provided at the cooling water outlet side of boost air cooler. Opening the bypass valve decreases the amount of cooling water flowing through the boost air cooler and raised the boost air temperature.

4) 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 cooling water expansion tank tank.

5) 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.

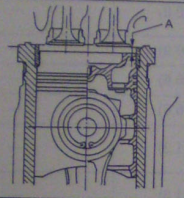
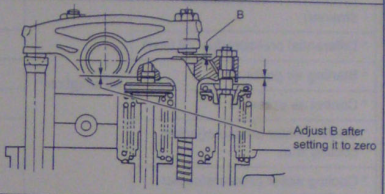
Drawing 2- 4



3. Table of Engine Standard Adjustments

3. TABLE OF ENGINE STANDARD ADJUSTMENTS

3-1. Assembly Adjustment Values

Item			Adjustment Value	Remarks
Timing/Clearance	Piston top clearance(A)	mm	2.0 ± 0.2	
	Suction Valve: Begins to open(before T.D.C.)	deg.	68	
	Suction Valve: Ends closing(after B.D.C)		50	
	Suction Valve: Valve head clearance(B)	mm	0.3	In the cold state
	Exhaust Valve: Begins to open(before B.D.C)	deg.	68	
	Exhaust Valve: Ends closing(after T.D.C)		58	
	Exhaust Valve: Valve head clearance(B)	mm	0.4	In the cold state
				
	Fuel injection pump begins to deliver(before T.D.C)	deg.	★	Refer to Records of Shop Traial.
Injection pressure, fuel injection valve		MPa(kgf/cm²)	34.0 ± 0.5(347 ± 5)	

3-2. Pressure & Temperature Setting Values

Item			Setting Value	Remarks
Pressure	Fuel feed pressure	MPa(kgf/cm²)	0.49 ~ 0.54(5.0 ~ 5.5)	Marine disel oil(M.D.O)
			Refer to Chapter 5,5-1-3	Heavy fuel oil(H.F.O.)
	Maximum combustion pressure(Pmax)		★	Refer to Records of Shop Trial.
	Lub. oil pressure		0.39 ~ 0.44(4.0 ~ 4.5)	Engine inlet(cooler outlet)
			0.25 ~ 0.44(2.5 ~ 4.5)	Turbocharger inlet
	Cooling water pressure(jacket cooling line)		0.15 ~ 0.25/ ※ 0.39 (1.5 ~ 2.5/ ※ 4.0)	Values marked with ※ are permissible cooling water pressure of central cooling system when the pressurized water inlet pressure or tank head pressure are imposed
	Cooling water pressure(cooler cooling line)		0.15 ~ 0.25/ ※ 0.39 (1.5 ~ 2.5/ ※ 4.0)	
	Starting air pressure: Starting air tank		2.94(30)	Lower limit:1.18(12)
	Starting air pressure: After decompression		0.69 ~ 0.98(7 ~ 10)	At the air motor inlet
Temperature	Cooling water engine outlet temperature	K(℃)	358 ± 4(85 ± 4)	
	Cooling water air cooler inlet temperature		Below311(below38)	
	Lub.oil engine inlet temperature(cooler outlet)		323 ~ 338(50 ~ 65)	
	Exhaust temperature(at each cylinder outlet)		★	Refer to Records of Shop Trial.
	Exh.gas turbocharger inlet temp.		★	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.

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.

4. Operation

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.)

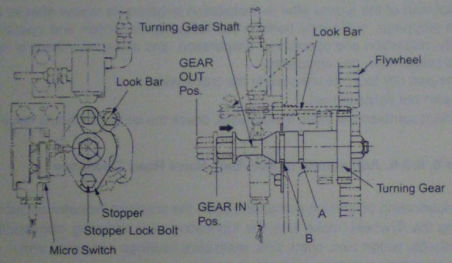
Turn the flywheel by the following procedures:
Turning Gear Device - - - - - - - - Operational spec.

(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

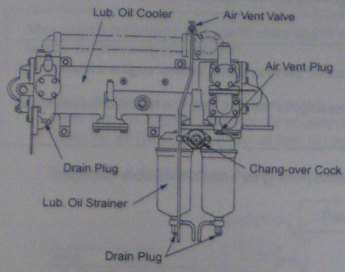
The piping parts of lubricating oil system are banded with yellow coating.

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.

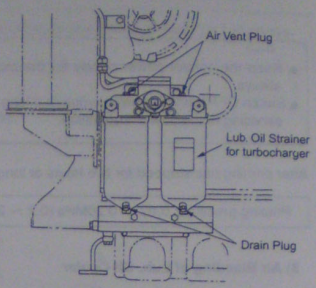
Chapter 3. Table of Engine Standard Adjustment

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

Drawing 4-2. Draining&Air Bleeding Points on Non-operating Side



Drawing 4-2. Draining & Air Bleeding Points

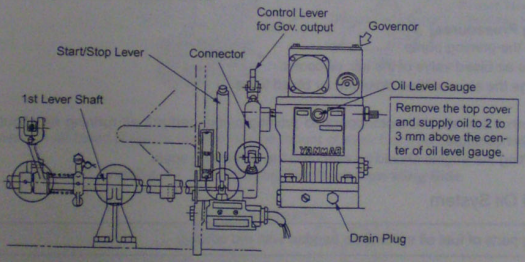


Oil Supplying Points on Operating Side

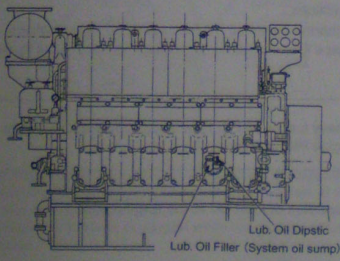
Hand Lubricating Points

Manually lubricate the governor link and control devices (circled portions)

Drawing 4-4. Governor Device



Drawing 4-5. Lub. System Oil



2) Priming of lubricating oil

This engine employs the continuous priming system using a motor-operated pump.

- Keep the control power supply for the motor-operated priming pump of this engine switched ON always.
- Switch OFF the said power supply in a long-term stoppage of the ship and in a rest and maintenance servicing of the power installation.

After priming has stopped for two hours or longer, perform priming for about 20 minutes or longer.

Priming pressure: 0.02 ~ 0.20MPa (0.2 ~ 2.0kgf/cm^2)

3) Air Bleeding of Lub. Oil Cooler

- If any of the following items arises, start the engine after bleeding air from the lub. oil cooler, operate the priming pump.
- After priming has stopped for two hours or longer.
- After disassembling & cleaning the lub. oil strainer.
- After changing the lub. oil or disassembling the piping parts of lubricating oil system.

Air Bleeding Procedures

(1) Operate the priming pump.
(2) Open the air bleed valve of the lub. oil cooler.
(3) Discharge the air, and then close the air bleed valve.

- If you cannot operate the motor-operated priming pump, perform air running for about 3 seconds repeatedly five times.
  After starting the engine should be executed the air venting again.

4-1-2. Fuel Oil System

The piping parts of fuel oil system are banded with red coating.

(1) Drain the fuel oil tank and fuel oil filter.
(2) Supply the fuel oil into the fuel oil tank, and check the fuel oil. Then, open or close each valve according to the operation conditions.
(3) You use an engine of marine diesel oil (M.F.O) start/stop specifications, turn on the heater for the heavy fuel oil (H.F.O.) pipe line, and continue heating the H.F.O. until its viscosity becomes proper.

If you use an engine of heavy fuel oil (H.F.O.) start/stop specifications, make sure the fuel oil temperature (viscosity) at the engine inlet is proper.

Chapter 5, 5-1-3. Properties of Fuel Oil at the Engine Inlet

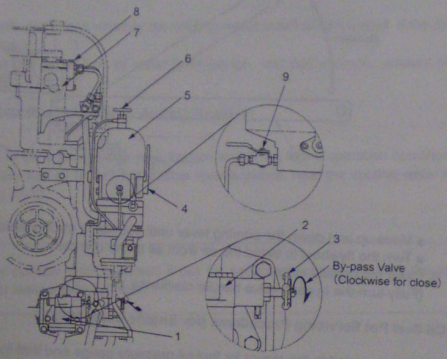
(4) Bleeding air from oil system

After engine installation, long-term stoppage or overhaul of the engine, bleed air from the fuel oil system by the following procedures:

① Open the bypass valve of fuel feed pump.
(Fully turn the bypass valve handle counterclockwise)
② Open the air bleed cock of fuel oil filter to bleed air.

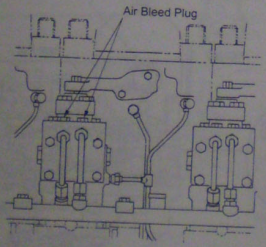
Drawing 4-6 Air Bleeding Points on Frontal Side

Item	Name
1	Fuel Feed Pump
2	Press Regulat. Valve
3	By-pass Handle
4	Chang-over Cock
5	Fuel Filter (NO.2)
6	Air Bleed Cock
7	Fuel Injection Pump
8	Air Bleed Plug
9	Drain Cock



③ Loosen the air bleed plugs on the fuel oil pipe mount of each fuel injection pump to bleed air.

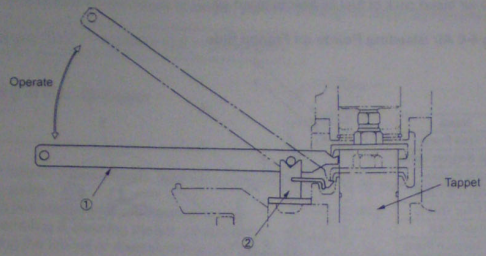
Drawing 4-7 Air Bleeding Points on Operating Side



④ Bleed the air from each fuel injection pump by the following procedures:
- Set the start/stop lever in the RUN position, and push the rack of fuel injection pump to the injection volume increase direction.
- Attach the priming tools to the pump tappet while the plunger of fuel injection pump is at the lowermost position.

No.	Exclusive Tool Description	Part No.
①	Priming lever	146673-92920
②	Lever support	146673-92930

Drawing 4-8 Priming Procedures



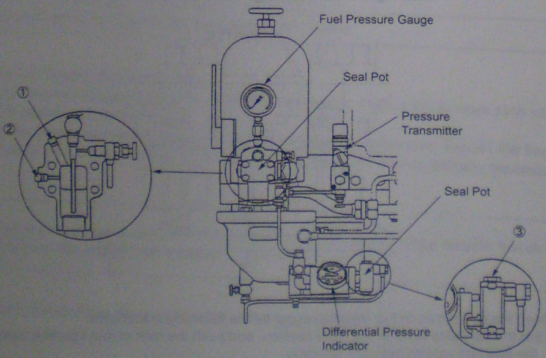
- Move up and down the priming lever until you feel a strong resistance.
- Turn the flywheel to bleed the air from all of the cylinders.

⑤ Close the bypass valve.
(Fully turn the bypass valve handle clockwise.)

Fuel Oil Seal Pot Servicing Procedures (for Engine Using H.F.O.)

Seal pots are equipped to the mount for fuel oil pressure gauge and that for the fuel oil differential pressure indicator (optional) of an engine using the heavy fuel oil (equivalent to 1,500-sec. or higher fuel oil).

Drawing 4-9 Seal Pot Servicing Procedures



(1) Remove the filler plug ① and the air vent plug ② .
(2) Pour ethylene glycol from the filler until it overflow from the air vent plug.
(3) When the seal pot is filled with ethylene glycol, securely tighten the plugs ① & ② .
(4) Remove the plug ③ , and pour ethylene glycol from the filler. When the seal pot is filled with ethylene glycol, tighten the plug.
(5) Periodically (about every two months) loosen the plug ② and plug ③, and check if the fuel oil does not overflow.

4-1-3. Cooling Water System

The piping parts of cooling water system are banded with blue coating.

(1) Inspect the cooling water tank, and check whether the cooling water is not contaminated. If the cooling water is considerably, change it.
(2) Supply the cooling water to the upper limit of water level gauge, and add a proper amount of rust inhibitor.

Chapter 5, 5-3-2. Brands of Rust Inhibitor & Adding Quantity

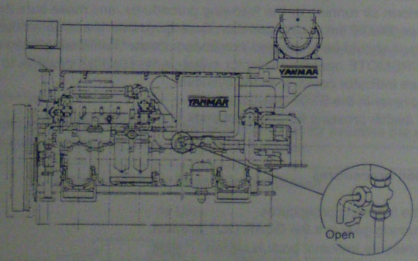
(3) Open and close each valve of the cooling water pipe system according to the operation conditions.
(4) If you use an engine of heavy fuel oil (H.F.O.) start/stop specifications, heat the cooling water in the cylinder jacket side to 65 to 75 ℃ .

When you have replaced the cylinder liner or drawn it out for servicing, remove the cylinder side cover and make sure no water leaks inside cylinder.

4-1-4. Boost Air System

Open the drain cocks of the following points to drain them.

Drawing 4-10 Boost Air System Draining Points on Non-operating Side



4-1-5. Starting Air System

The piping parts of fuel oil system are banded with white coating.

(1) Drain the starting air reservoir.
(2) Make sure that the pneumatic pressure in the air reservoir is high enough to start the engine (2.2 MPa{22kgf/cm^2} or higher).

4-1-6. Control and Protective Devices

(1) Move the start/stop lever from the RUN position to the STOP position and vice versa, and make sure the rack of fuel injection pump, 1st lever shaft of governor link and connector move smoothly.
(2) Check for excessive play of connector pin.
(3) Set the power switch of protective and alarm devices to the ON position.

△

Unless the power switch is set in the ON position, the protective and alarm devices do not actuate.

4-2. Starting

This engine is started by an air motor.
Press the START switch. Then, the pilot air solenoid valve directly attached to the air motor will open on the battery power to start the engine.

! CAUTION

During start operation, do not bring your face close to the air motor. Dust adhered at the exhaust port of air motor may enter your eye, resulting in injury.

△

Before the initial start of the engine after its installation of before its start after its overhaul or long-term stoppage, perform air running by the following procedures, and make sure there is no abnormality. Then, start the engine by the control panel on the engine side. If a large amount of fuel oil, cooling water or lubricating oil should be entrapped in cylinders, "water hammering" may occur.

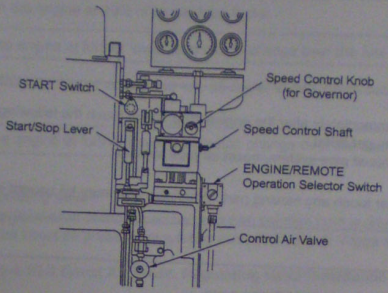
- Set the ENGINE/REMOTE operation selector switch in the ENGINE position.
- Open the pressure indicator cocks of all the cylinders.
- Set the start/stop lever in the STOP position.
- Hold the START switch pressing for 2 to 3 seconds to effect air running.

1) Starting operation procedures

Start the engine by the following procedures.
(1) Make sure the turning gear is it the GEAR OUT position.
(2) Make sure the pressure indicator cock is closed.
(3) Set the ENGINE/REMOTE operation selector switch to the ENGINE or REMOTE position corresponting to the control panel to be selected.

(4) Set the start / stop lever in the RUN position.
(5) Make sure the pointer of speed control shaft of governor indicates the position of ordinary operation (rated speed).
(6) Open the starting air reservoir valve and control air valve.
(7) Hold the START switch pressing for 2 to 3 seconds, and make sure of ignition. Only then release the switch.

Drawing 4-11 Start Operating Procedures



Set it to the position in which the start/stop lever is fixed respectively in notch when you suit the start/stop lever to the position of "RUN" or "STOP".

2) Corrective actions to be taken in starting failure

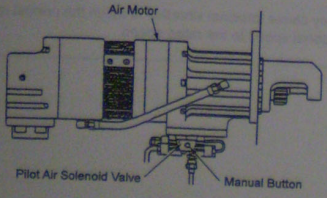
CAUTION

If the engine cannot be properly started, unburnt combustion gas in the flue may be ignited, resulting in explosion. Therefore, perform air running to discharge the gas from the exhaust gas system before attempting to restart the engine.

(1) Make sure the flywheel has completely stopped, and then press the START switch.
(2) If the battery power for the START switch has been exhausted (and in case of emergency), press the manual button of air motor to start the engine.

Use starting control based on the manual button only in emergency because the air motor may rotate excessively as the control module is not in operation in this case.

Drawing 4-12 Air Motor Manual Button



3) Checks to be made immediately after starting

Check the following items. If any abnormality is found, stop the engine and repair it.
(1) Value indicated by the pressure indicator on the gauge panel
(2) Leak from each piping
(3) Unusual sound and abnormal heat generation of each part

4-3. Running

CAUTION

- During a run and immediately after the engine stop, never touch the following parts with bare hands. Otherwise, you may get burnt.
  - •Turbocharger, Exhaust pipe system, boost air pipe system
  - •Flue and funnel
- During a run, never touch any moving part. Otherwise, you may be caught in, resulting in injury.

Keep the control air valve opened during a run.
If you close it, the protective devices cannot actuate.

1) Initial Running-in Operation

To prevent initial abnormal wear of piston rings and cylinder liner, run the engine on marine diesel oil (M.D.O) for the following period:

(1) For 10 to 20 hours after installation.
(2) For 10 to 20 hours after replacement of piston rings, piston or cylinder liner

2) Steady (Routine) Running

(1) Make sure the pressure of lubricating oil, cooling water and fuel oil has reached the specified value.
(2) Run the engine for about 10 minutes at the rated speed without load to warm it up.
(3) If the engine is used to drive a cargo pump or the like, which requires the control on rotation, run the engine at the preset idling speed to warm it up.

The critical speed that may cause torsional vibration is within the normal rotation speed range, quickly avoid it, and set the rotational speed to the rated speed.

(4) If you continue running the engine with a low load for longer than three hours, observe the following load factors, otherwise combustion worsens and fouling of the combustion chamber, exhaust pipe, turbocharger, etc. becomes heavy.

① If fuel oil used is the marine diesel oil (M.D.O), run the engine at 15% or higher load factor.
② If fuel oil used is the heavy fuel oil (H.F.O)
•And if the (optional) boost air temperature controller which heats the boost air in a low load run is equipped, run the engine at 15% or higher load factor.
•But if the cooling water for the boost air cooler and lub. oil cooler is used jointly with the main marine engine, run the engine at 20% or higher load factor.

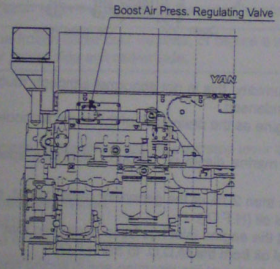
If you want to run the engine at further lower load factor, change over the fuel oil to the M.D.O.

•But if the cooling water for the air cooler and lub. oil cooler is sea water, run the engine at 25% or higher load factor.

If you want to run the engine at further lower load factor, change over the fuel oil to the M.D.O.

(5) Boost air pressure regulating valve
① To evade the surging generation of the supercharger when the high load is driven (vicinity of the load of 100%), it equips the boost air pressure regulating valve (6N18AL-E V-type engine)

Drawing 4-12-2 Boost Air Press. Regulating Valve Installation position



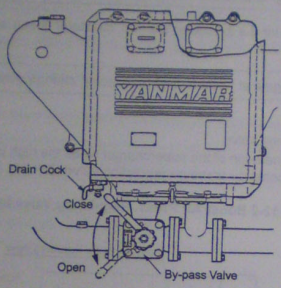
② Adjustment of boost air pressure regulating valve
* Adjust it in the state that opens from the state of all closes 180° (state at shipment).
* Please turn the valve in an open direction and enlarge opening when the supercharger does surging by the change in the room temperature etc.
* Opening of the valve disc opens only to 540° .

Adjustment of Boost air temperature
(in the case of sea water cooling)

① Adjust the boost air temperature to 40 to 60 ℃ , operating the cooling water bypass valve handle of the boost air cooler.

As the bypass valve handle is set in the OPEN side, the cooling water bypassed, and the boost air temperature rises.

Drawing 4-13 Sea Water By-pass Valve (Boost Air Cooler)



② In the case of a high humidity, this is not abnormal although much drain may be produced as the moisture in the air is condensed.
In this case, run the engine as the drain cock of the boost air cooler kept opened.

(6) If you use an engine of marine diesel oil (M.D.O.) start/stop specifications, observe the following items:

- If the load factor is less than 20% of the generator rated output, do not switch the fuel oil from the M.D.O. to the heavy fuel oil (H.F.O.).
- Make sure the H.F.O. at the engine inlet has been heated so that its viscosity becomes proper, and then switch over the fuel oil from the M.D.O. to the H.F.O.
- The load substantially fluctuates at the incoming and outgoing and loading and unloading of vessel. For these operations, we recommend you to run the engine on the M.D.O.

Proper viscosity: 11 to 14 cSt (R.W.No.1 55 ～ 65 sec.)

(7) Measure the running performance once a day and record the measurement data.

Chapter 6, 6-3-1. Measurement of Running Performance

4-4. Stopping

4-4-1. Stopping in Normal Running

Except in case of emergency, stop the engine by the following procedures:

1) Preparation of stopping

(1) If you use an engine of marine diesel oil (M.D.O.) start/stop specifications, switch over the fuel oil from the heavy fuel oil (H.D.O.) to the M.D.O. to prevent the H.F.O. from being stagnant inside the fuel oil pipes, fuel oil filter, fuel injection pumps when stopping the engine.

> As the reference, continue running the engine on the marine diesel oil (M.D.O.) for 20 to 30 minutes before stopping the engine. However, since the required time depends upon the load applied when the fuel oil is switched over and the capacity of pipes in the vessel, consult the dockyard where the engine has been installed.

(2) Shut off the load, and then continue running the engine without load for about 10 minutes.

2) Stopping operation

(1) Set the start/stop lever in the STOP position.

> If you use the engine of the remote start/stop specifications, press the STOP switch.

(2) Run the lubricating oil priming pump
(3) Open the pressure indicator cock, and perform air running to discharge the as from the combustion chambers.
(4) Open or close the valves of each system according to the stopping conditions.

> When the cooling water may be frozen under cold weather, or before a long term stoppage, drain the cooling water from the cylinder jacket side and cooler side.

4-4-2. Emergency Stop

If any of the following problems arises, immediately set the start/stop lever in the STOP position to stop the engine.

(1) Any of the following alarms has been issued.
- Expressive pressure drop of lub. oil
- Expressive temperature rise of lub.oil
- Expressive tempera rise of cooling water
- Overspeed

(2) An unusual sound has been made.
(3) Heat has generated unusually from a part
(4) Smoke is issued from a bearing or any other moving part.
(5) A pipe of fuel oil, lub. oil or cooling water system has been broken.
(6) The supply of cooling water has stopped, and it is impossible to supply it immediately.
(7) A setscrew or bolt of a moving part is loose or broken.
(8) Moisture is mixed in the lubricating oil.
(9) The boost air pressure has dropped, and the exhaust temperature has excessively risen.
(10) The rack of fuel injection pump has stuck.

> △
> If the engine is not stopped by setting the start/stop lever in the STOP position or pressing the STOP switch, close the fuel oil inlet valve.

4-4-3. Disposal After an Emergency Stop

When repairing the engine or investigating the cause of problem, observe the following items:

⚠ WARNING

Do not open the side cover of crankcase for at least 10 minutes after having stopped the engine. Entry of fresh air into the engine may cause ignition of oil mist, resulting in explosion.

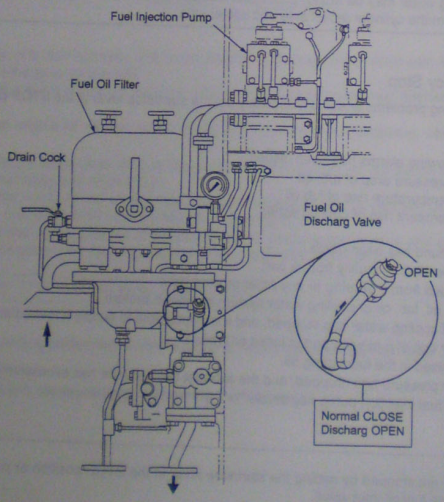
⚠

If you have stopped the engine while it is running on the heavy fuel oil (H.F.O.), immediately discharger the H.F.O. from the fuel oil pipes, fuel oil filter and fuel injection pumps, and displace them with marine diesel oil (M.D.O.).

If the residual H.F.O. is cooled and its viscosity rises, it becomes impossible to restart the engine.

(1) Set the fuel oil changeover valves at the engine inlet and outlet to the marine diesel oil (M.D.O.) position.
(2) Open the bypass valve of fuel feed pump.
(3) Open the drain cock of fuel oil filter and drain valve of fuel oil main pipe.
(4) Turn the flywheel to discharge the H.F.O. from the fuel injection pipes and fuel injection valves. (Set the start/stop lever in the RUN position, and turn the flywheel under the fuel injection status.)

Drawing 4-14 H.F.O. Discharging Points



5. Fuel Oil,Lub.Oil & Cooling Water

5. FUEL OIL, LUB. OIL & COOLING WATER

5-1. Fuel Oil

The properties of fuel oil applicable to this engine are shown in the following table.
The properties of fuel oil are uncertain and broadly ranged; thus they affect such factors as a smooth run of the engine, maintenance interval and service life of parts. Consequently, it might be necessary to change the specifications of engine or add attachment in accordance with the applied fuel oil.

5-1-1. Quantity Criteria of Fuel Oil

Quality Criteria \ Direct burning fuel oil			---	200sec.Oil	1,500sec.Oil	3,500sec.Oil	7,000sec.Oil
Viscosity	at 50 ℃	cSt	3 ~ 8	< 30	< 180	< 380	< 700
	R.W.No.1 at 100℉	sec.	37 ~ 58	< 200	< 1500	< 3500	< 7000
Property critical value	Specific gravity at 15/4 ℃		< 0.86	< 0.991	< 0.991	< 0.991	< 0.991
	Flash point	℃	> 60	> 60	> 60	> 60	> 60
	Residual carbon	mass.%	< 0.7	< 10	< 15	< 18	< 22
	Sulfur content	mass.%	< 1.0	< 3.5	< 5	< 5	< 5
	Ash content	mass.%	---	< 0.10	< 0.10	< 0.15	< 0.20
	Moisture content	vol.%	< 0.1	< 0.5	< 1.0	< 1.0	< 1.0
	Vanadium	ppm	---	< 150	< 300	< 500	< 600
	Sodium	ppm	---	< 30	< 40	< 100	< 200
	Aluminum	ppm	---	< 30	< 30	< 30	< 30
	Diesel index		(Cetane no. of > 45)	> 30	> 25	> 20	> 15

Quality criteria equivalent fuel oil						
ISO	DBMorDMA	RMB10	RME25	RMG35	RMH55
CIMAC	---	CIMAC B10	CIMAC E25	CIMAC G35	CIMAC H55
BSI	---	(M4)	(M6)	(M7)	M9
JIS	M.D.O	I.F.O	H.F.O.(heavy fuel oil)		

Note: M.D.O. = marine diesel oil; I.F.O. = intermediate fuel oil

" Use HFO with the CCAI, (an ignitability index), below 850 as an standard. (However, please note that the said value was estimated from the past operation data and that the value can vary depending on the future fuel oil quality.) The use of HFO with CCAI exceeding 850 will cause faulty combustion and aggravate exhaust color. If such use is inevitable, raise the intake air temperature. This will improve combustion to an extent. However, raise the intake air temperature carefully in relation with the exhaust temperature, since this will affect the exhaust temperature and other engine performance."

What is CCAI?
CCAI stands for **C**alculation **C**arbon **A**romaticity **I**ndex, which shows an ignitability index.
The index, in consideration of the relation between aromatic compound content in fuel oil and the ignitability is used to obtain the aromaticity degree in relation with the fuel oil properties. The larger the CCAI value, the larger the firing delay for inferior ignitability. In this case, the HFO direct starting is not possible or exhaust color is aggravated due to faulty combustion.

5-1-2. Quality Criteria of Blended Fuel Oil

In the case of using a highly viscose fuel oil by blending with marine diesel oil to lower the viscosity of fuel oil, in addition to the case of direct burning of fuel oil set forth above for its pretreatment, apply the blending ratio shown in the following table based on the quality criteria on the blended fuel oil, not based on the viscosity criteria.

When blending fuel oil of different production origins, sludge may be separated out, resulting in clogging of fuel oil filters and sticking of fuel injection pumps and fuel injection valves. Pay your attention to this regard.

Blended fuel oil		200-sec. oil equivalent	1,500-sec. oil equivalent	3,500-sec. oil equivalent
Quality criteria on direct burning equivalent fuel oil	ISO	RMB10	RME25	RMG35
	CIMAC	CIMAC B10	CIMAC E25	CIMAC G35
	BSI	(M4)	(M6)	(M7)
Blending ratio(%)		M.D.O.: H.F.O.(1,500-sec.oil) 60 : 40		
		M.D.O.: H.F.O.(3,500-sec.oil) 70 : 30	M.D.O.: H.F.O.(3,500-sec.oil) 40 : 60	
			M.D.O.: H.F.O.(7,000-sec.oil) 60 : 40	M.D.O.: H.F.O.(7,000-sec.oil) 30 : 70

Note: M.D.O. = marine diesel oil; H.F.O. = heavy fuel oil

Viscosity after blending: **5-1-5. How to Find out the Viscosity of Blended Oil**

5-1-3. Properties of Fuel Oil at the Engine Inlet

Impurities contained in the heavy fuel oil (H.F.O.) may cause fuel injection pumps and fuel injection valves to be damaged, cylinder liners to be excessively worn and exhaust valves and valve seats to be deteriorated. Therefore, raise the cleaning effect of pretreatment system to the maximum extent, and also supply the fuel oil heated to have the proper pressure and viscosity.

△

Residual oil of a catalytic cracking refining device is sometimes used for industrial low-cost, high-viscosity fuel oil. In this residual oil, there remain fine particles of silica and alumina that are catalysts for this device.
A low-cost, high-viscosity fuel oil which uses there bases will cause abnormal wear of piston rings, cylinder lines, fuel injection pumps, fuel injection valves, etc.
Therefore, use a low-cost, high-viscosity fuel oil treated of content less than 0.03 wt. % of ash, minimum of silicon and aluminum and removed of all particles which exceed 3 ~ 5 μ in size, utilizing the F.O. treating apparatus.
Incidentally, the moisture content should be kept at less than 0.2 vol. %.

(1) Recommend properties of heavy fuel oil (H.F.O.) at engine inlet

Moisture content	Less than 0.2 vol.%
Content of solid particles	Less than 20 ppm
Size of FFC catalytic particle	Less than 5 μ

(2) Recommended viscosity and pressure of heavy fuel oil (H.F.O.) at engine inlet

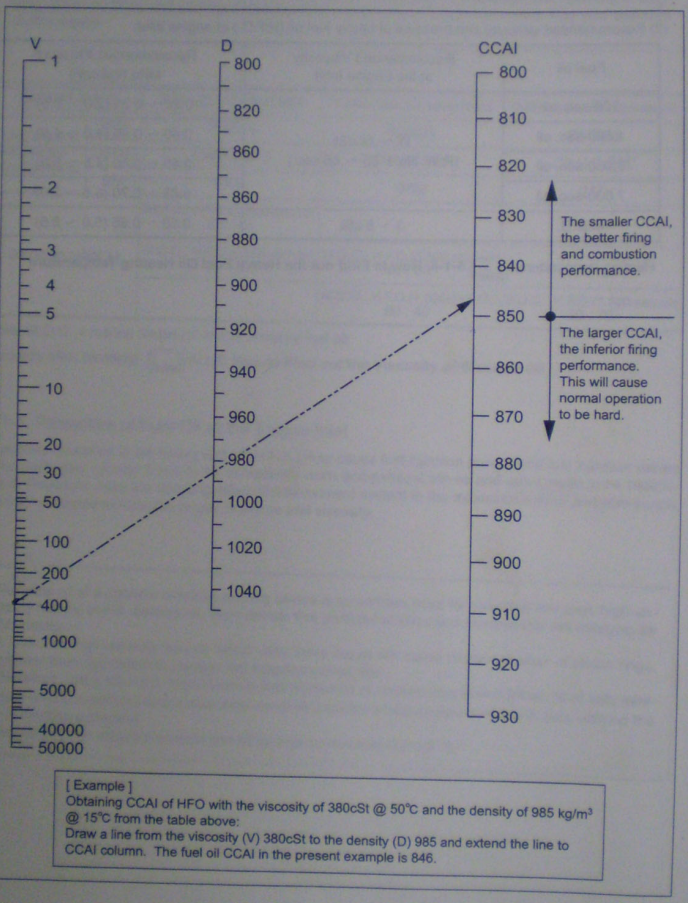
Fuel oil	Recommended Viscosity at the Engine Inlet	Recommended Pressure MPa (kgf/cm^2)
200-sec. oil	11 ~ 14 cSt (R.W. No.1 55 ~ 65 sec.)	0.20 ~ 0.25 (2.0 ~ 2.5)
1,500-sec. oil		0.40 ~ 0.45 (4.0 ~ 4.5)
3,500-sec. oil		0.45 ~ 0.50 (4.5 ~ 5.0)
7,000-sec. oil		0.65 ~ 0.70 (6.5 ~ 7.0)
M.D.O.	3 ~ 8 cSt	0.50 ~ 0.55 (5.0 ~ 5.5)

Heating temperature: **5-1-4. How to Find out the Heavy Fuel Oil Heating Temperature**

Calculation of CCAI

$CCAI = D - 81 - 141 \cdot \log\log (V + 0.85)$

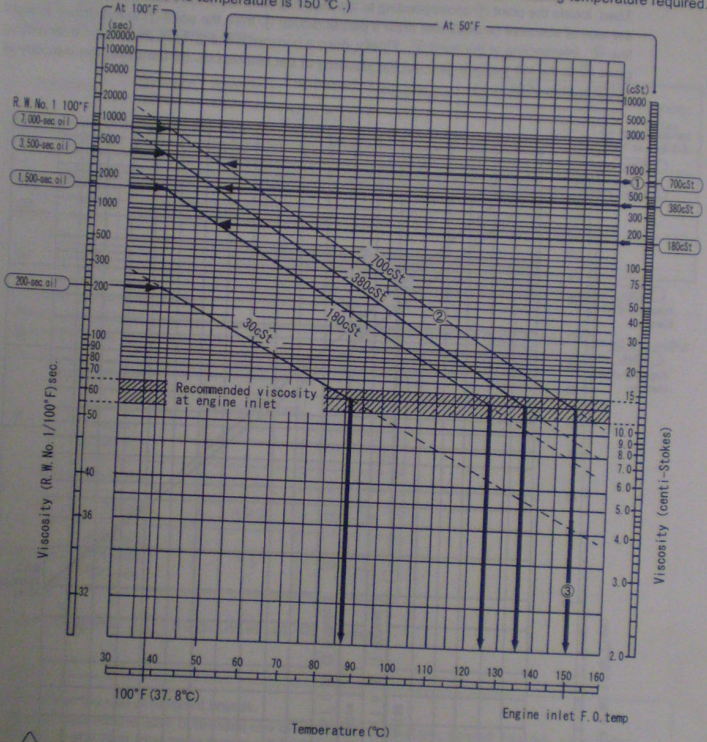
D : Density kg/m³ @ 15℃, V : Viscosity mm²/S @ 50℃



[Example]
Obtaining CCAI of HFO with the viscosity of 380cSt @ 50℃ and the density of 985 kg/m³ @ 15℃ from the table above:
Draw a line from the viscosity (V) 380cSt to the density (D) 985 and extend the line to CCAI column. The fuel oil CCAI in the present example is 846.

5-1-4. How to Find out the Heavy Fuel Oil Heating Temperature

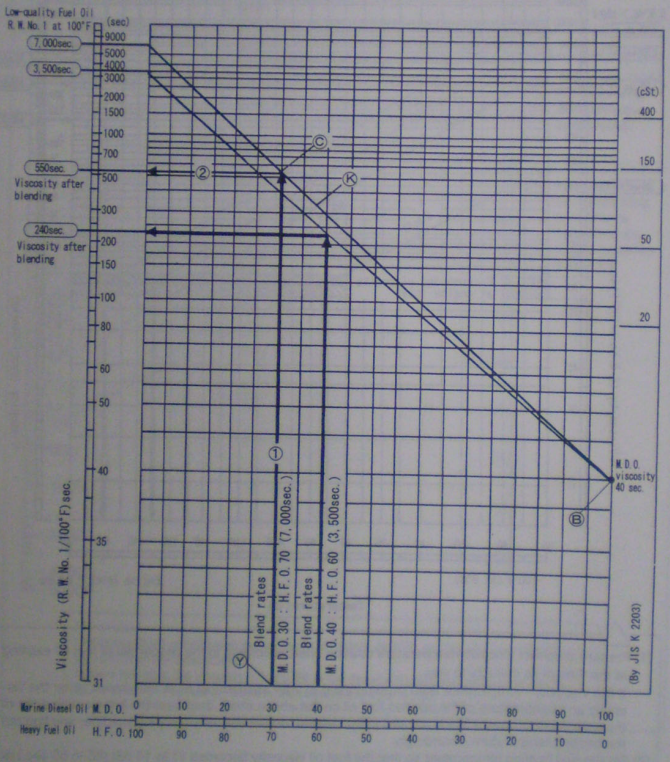
Example: In the case of finding out the heating temperature of 700 cSt (at 50 ℃) fuel oil
Find the intersecting point ① corresponding to viscosity of 700 cSt and temperature of 50 ℃ on a line ② standing for viscosity-temperature relation of 700 cSt (at 50 ℃) fuel oil.
On this line ② , locate a point corresponding to the recommend viscosity at the engine inlet, and then draw a perpendicular ③ from this point to the axis of abscissa (x-axis).
The intersection of this perpendicular with the x-axis indicates the heating temperature required.
(In this case, the temperature is 150 ℃ .)



(1) Prepare a correct viscosity-temperature relation chart according to the properties of fuel oil existing at the time of its delivery to you.
If the viscosity - temperature line corresponding to your applied fuel oil is not shown, enter the viscosity and temperature of the applied fuel oil on the above chart, item from the intersecting point of the entered data draw a line in parallel to the nearest drawn viscosity-temperature line, and find out the heating temperature accordingly.
(2) Set the fuel heating temperature so that the fuel oil viscosity becomes 11 to 14 cSt (55 to 65 sec.) at the engine inlet to allow some temperature drop in the piping system.

5-1-5. How to Find out the Viscosity of Blended Oil

Example: In the case of finding out the viscosity of blending (R.W. No.1 at 100°F) 7,000-sec. heavy fuel oil (H.F.O.) with (R.W. No.1 at 100°F) 40-sec. marine oil (M.D.O.) at the blending ratio of 70:30.
On the left y-axis (axis of ordinate) corresponding to 100 % H.F.O., locate the point Ⓐ corresponding to the viscosity (7,000 sec.) of H.F.O.; on the right y-axis corresponding to 100 % M.D.O., the point Ⓑ corresponding to the viscosity (40 sec.) of M.D.O. Now draw a straight line Ⓚ to link both located points.
Then, locate the point Ⓨ corresponding to the blending ratio of 70 % H.F.O. and 30 % M.D.O. on the axis of abscissa (x-axis), and draw a perpendicular ① from the point Ⓨ to the drawn straight line Ⓚ, intersecting at the point ⓒ. Finally, draw a horizontal line ② from thus found intersecting point ⓒ to the left y-axis to find out the viscosity of the blended oil. (In the case, the viscosity at 100°F is about 550 sec.)



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 ring, seizure and early wear of piston, 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 API Service Grade CE or CD Class.

1) Viscosity
Use an oil shown in the below table.

Application	Viscosity (SAE)	Specific Gravity	Frash point ℃ (Open Type)	Pour Point (℃)	Kinematic Viscosity(cSt)		Viscosity Index
					40 ℃	100 ℃	
● Marine auxiliary engine	30	0.89	> 230	< − 10	105 ~ 125	11 ~ 12.5	96 ~ 110
● Marine auxiliary engine ● Land use engine	40	0.893	> 240	< − 7.5	140 ~ 155	14 ~ 15.5	96 ~ 110

2) Total Base Number (T.B.N.)
Select a lub. oil based on the values given in the following table for the base number against the sulfur content including in the fuel used.

Fuel Oil Used Redwood No.1 Viscosity s(100°F)	Sulfur Content (wt. %)	Total Base Number (T.B.N.) (mgKOH/g)
M.D.O. equivalent	< 1	9 ~ 15
I.F.O. eq. 200-sec.	< 3.5	16 ~ 26
1,500-sec H.F.O. eq. 3,500-sec. 7,000-sec	< 5	30 ~ 42

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, consult your lub. oil supplier.)
(2) 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 carbonate) 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.
- 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.

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	
Flash point(PM method)	℃	> 180			140	
Change in viscosity	cSt(40 ℃)	Within new oil ± 15 %			New oil ± 25 %	
Moisture content	vol.%	< 0.1			0.2	
n-pentane insoluble matter (A method)	mass.%	< 1.5			2.0	
Toluene insoluble matter (A method)	mass.%	< 1.5			2.0	
Difference between n-pentane and toluene insoluble matters	mass.%	—			< 0.5	
Total base number	mgKOH/g	Meas. method / Fuel oil used	HCl method	$HClO_4$ method	HCl 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 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

API Service Grade CE or CD/SAE 30 or 40 Equivalent.

Fuel Oil Spec. Division	Marine diesel oil M.D.O.	Intermediate fuel oil I. F.O.=(R.W. No.1 at 100°F) 200sec. Oil	Heavy fuel oil H.F.O.=(R.W. No.1 at 100°F) 1,500sec./3,500sec./7,000sec.Oil
Total Base Number(T.B.N)	9 ~ 15	16 ~ 25	30 ~ 42
Supplier			
YANMAR	YANMAR MARINE SUPER OIL 40	---	---
IDEMITSU KOSAN	DAPHNE MARINE OIL SX30, SX40	DAPHNE MARINE OIL SW30, SW40 DAPHNE MARINE OIL MV30, MV40	DAPHNE MARINE OIL SW30, SW40 DAPHNE MARINE OIL SH40
CASTROL	MCL 30, 40 CASTROL MHP30, 40 SEAMAX EXTRA30, 40	CASTROL TLX203, 204	CASTROL TLX303, 304 CASTROL TLX403, 404
BRITISH PETROLEUM	BP ENERGOL DS3-153, 154	BP ENERGOL IC-HFX203, 204	BP ENERGOL IC-HFX303, 304
Chevron Tsxaco (FAMM, Caltex)	DELO 1000 MARINE OIL 30, 40 TARO XD12 30, 40 TARO XD16 30, 40	DELO 2000 MARINE OIL 30, 40 TARO 20 DP30, 40	DELO 3000 MARINE OIL 30, 40 DELO 3400 MARINE OIL 30, 40 TARO 30 DP30, 40
COSMO OIL	COSMO MARINE SUPER 30, 40	COSMO MARINE 3025, 4025	COSMO MARINE 3040, 4040
FUJI KOSAN	FUKKOL MARINE 312, 412	FUKKOL MARINE 320, 420	FUKKOL MARINE 330, 430
EXXON MOBIL	MOBIL GARD 312, 412 EXXMAR 12TP30, 40	MOBIL GARD 312, 412 MOBIL GARD 330, 430	MOBIL GARD 330, 430 MOBIL GARD 340, 440 EXXMAR 30 TP30, 40 EXXMAR 40 TP30, 40
KYGNUS OIL	KYGNUS MARINE DX 30, 40	KYGNUS MARINE DX 330, 340	---
JAPAN ENERGY/ELF	JOMO MARINE D-13, D-14 DISOLA M3015, 4015	JOMO MARINE D-23, D-24 AURELIA 3030, 4030	JOMO MARINE D-33, D-34 AURELIA XT 3040, 4040
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 CT 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
NIPPON OIL	MARINE T103, T104	MARINE T203, T204	MARINE T303, T304

5-3. Cooling Water (Engine Jacket Water)

5-3-1. Criteria on Cooling Fresh Water

(1) Use pure water (distilled water) or tap water.
(2) Use the water having the properties shown in the following table.

Recommended Water Quality	
pH 298 K (25 ℃)	6.3 ~ 8.0
Total hardness ($CaCO_3$)	< 100 ppm
Chlorine ion (Cl^-) concentration	< 100 ppm
M alkalinity	30-100 ppm
Ammonium ion (NH_4^+) conc.	< 0.05 ppm
Sulfate ion (SO_4^{--}) concentration	< 100 ppm
Evaporated residue	< 400 ppm

△
Do not use hard water.
If hard water is used, scale adheres to water chambers such as cylinder head and cylinder water jackets and may cause an overheat. Pay your particular attention to this regard.

5-3-2. Selection of and Control on Corrosion Inhibitor

(1) Add a corrosion inhibitor to cooling fresh water because use of fresh water causes a drop in strength of parts and the cooling effect through corrosion of water chamber and adhering of scale.
(2) Select a corrosion inhibitor which does not have an adverse effect on parts of the cooling water system because parts made of cast iron, carbon steel, brass and bronze, are used in the cooling water system of an engine.

△
- In the case where aluminum materials are used in the cooling water system, consult the supplier of corrosion inhibitor because a kind of corrosion inhibitor to be used differs in this case.
- As to the adding quantity of and concentration control on corrosion inhibitor and addition and handling of supplementary adjuster, obey the criteria set by the supplier of corrosion inhibitor.
- In the case where the concentration of corrosion inhibitor could not be controlled, annually change the cooling water by the total volume.

⚠ CAUTION

① Do not dump cooling water to which the corrosion inhibitor was added directly to the ocean or river. Since the method of treating the waste liquor has been provided for in the law, such liquid has to be treated according to instructions given by the supplier of corrosion inhibitor.
② Do not mix different brands of corrosion inhibitor. (In the case where mixing of different brands of corrosion inhibitor is unavoidable, consult the suppliers of corrosion inhibitor.
③ A corrosion inhibitor is chemical for industrial water treatment use; do not use it in the drinking water line.
④ When handling, wear rubber gloves and gauze mask to avoid direct contact with hands or other parts of the body.
⑤ If the chemical accidentally comes in contact with skin, eyes or mouth, wash out thoroughly with fresh water. If the problem persists, consult a doctor.

(3) Recommended brands of corrosion inhibitor

Brands of corrosion inhibitor applicable to the enclosed circuit specification of the cooling water system are shown in the following table.

Brand	Supplier	Brand	Supplier
Royal Caviruston Antirust	Yanmar Sangyo Co., Ltd.	Diesel Guard NB	UNITOR & Taiho Industries Co., Ltd
*YANMAR Royal Freeze			
Polycrin I - 109	Kurita Water Industries Ltd.	Rocor NB Liquid	
Polycrin I - 175		Nalcool 2000	NALCO Japan Co., Ltd.
*Kurilex L - 222		*Nalfleet 9 - 111	
Neos PN - 106S	Neos Co., Ltd.	Nalfleet 9 - 108	
Neos PN - 106		Uniprot PC - 200	Nippon Yuka Kogyo Co., Ltd.
Hi-mol L - 10	Taiho Industries Co., Ltd.	Uniprot PC - 300	
Hi-mol AM - 5		Shadan K	Otsuka Chemical Co., Ltd.
*Olgard C-601	Organo Co., Ltd.	Liquide WT	ASHLAND JAPN CO., Ltd

- In the case where the cooling water system is of the enclosed circuit specification, consult the supplier of corrosion inhibitor because some brands drop in the concentration of corrosion inhibitor early.
- Notice a corrosion inhibitor which doubles as an anti-freeze has a low thermal conductivity and may be overheated during a load running.
- In the case where aluminum materials are in the cooling water system, use a brand of corrosion inhibitor asterisked above.

6. Maintenance Checking

6. MAINTENANCE CHECKING

6-1. Precautions in Maintenance Checking

To use an engine always in good order, checking is necessary periodically for trouble prevention. The period of checking can not be fixed indiscriminately because it is influenced by application of the engine, conditions of use, quality of fuel oil and lub. oil used, and daily handling circumstance.

△

- The following tables of checking show the standard checking frequency. Perform the initial overhaul servicing according to these checking tables. Then, based on the obtained checking (on wear corrosion, accumulation of carbon, accumulation of sludge and others), make the most economical checking schedule suitable for your engine, and conform to the specified schedule from the second checking.
- As for the items whose checking frequency is shown by both the accumulated operation hours and number of days, schedule the checking at the earlier timing.

6-2. Table of Periodical Checking

(1) For marine service engine

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

(2) For land service and/or generator engine

In accordance with the Specifications of Checking & Servicing of Diesel Service Generating Set separately stipulated.

6-3. Routine Maintenance Checking & Adjustment Procedures

6-3-1. Measurement of Running Performance
6-3-2. Measurement of Max. Combustion Pressure (Pmax)
6-3-3. Regulation of Fuel Injection Volume (Rack Scale)
6-3-4. Adjustment of Fuel Injection Timing
6-3-5. Checking of Fuel Injection Valve & Adjustment of Injection Pressure
6-3-6. Adjustment of Suc./Exh. Valve Head Clearance
6-3-7. Adjustment of Lub. Oil Pressure
6-3-8. Adjustment of Lub. Oil Temperature
6-3-9. Adjustment of Fuel. Oil Pressure
6-3-10. Checking of Cyl. Jacket Cooling Water Thermostatic Valve
6-3-11. Cleaning of Lub. Oil Bypass Strainer
6-3-12. Cleaning of Lub. Oil Strainer
6-3-13. Cleaning of Fuel. Oil Filter
6-3-14. Cleaning of Strainer Element
6-3-15. Washing of Turbocharger Blower
6-3-16. Maintenance of Pressure Gauge
6-3-17. Measurement of Crankshaft Deflection
6-3-18. Adjustment of Fuel. Injection Pump Pinion Lubricating Volume (for Engine Using H.F.O.)
6-3-19. Maintenance of Fuel. Oil Seal Pot (for Engine Using H.F.O.)
6-3-20. Checking & Replacement of Anticorrosive Zinc

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.)

Table 6-2. Checking Table for Engine Using Marine Diesel Oil (1/3)

An asterisk (*) given in the following tables refers to the timing of initial check after the initial start or part replacement. Perform the check from the second time and onward at the ordinary frequency.

Div.	Part to Be Checked	Nature of Service	Checking & Servicing Frequency (hrs.)						
			3 mo. or 1,000 ~ 1,500	6 mo. or 2,000 ~ 2,500	1 yr. or 4,000 ~ 5,000	2 ~ 3 yr. or 8,000 ~ 10,000	5 yr. or 16,000 ~ 20,000		
Cylinder head	Fuel injection valve	Drawing-out check & adjustment	1,500 ~ 2,000					1st time:500 ~ 800hrs	
	Cylinder head	Check & adjustment of the valve head clearance	○						
		Check of valve spring			○				
		Check disassembly & check of valve rotator			○				
		Disassembly, check & cleaning				○			
		Grinding of suc./exh. valve seat				○			
		Scale cleaning & hydraulic test of water chamber				○			
		Replacement of stem seal (Suc./Ehx. Valve)				○			
		Check of cyl. head bolt tightening force		*		○			
Major Moving Parts	Piston	Drawing-out, cleaning, checking & measurement of piston				○			
		Check & measurement of piston rings				○			
		Check & measurement of piston pin				○			
	Connecting rod	Check & measurement of piston pin metal				○			
		Check & measurement of crank-pin metal				○			
		Check of connecting rod bolt tightening force				○			
		Change of connecting rod bolts						20,000 hrs.	
	Cyl. liner	Inner dia. checking, cleaning & measurement				○			
		Drawing-out, check & cleaning of water jacket part					○		
	Crankshaft	Measurement of crank pin outer dia. & journal				○			
		Measurement & adjustment of deflection		○					
	Main bearing	Disassembly, metal checking & measurement				○			
		Check on tightening force of main bearing clamping bolts				○			
		Check on tightening force of side bolt				○			
	Camshaft	Check of cam & roller bearing			○				
		Disassembly & check of fuel pump tappet				○			
		Disassembly, check & measurement of swing arm				○			
		Drawing-out of crankshaft & bearing check & measurement					○		
	Timing gear	Check of tooth bearing & backlash				○			
		Disassembly of idle gear & check & measurement of bearing					○		
		Check of idle gear mounted shaft tightening force					○		

Table 6-2. Checking Table for Engine Using Marine Diesel Oil (2/3)

Div.	Part to Be Checked	Nature of Service	Checking Servicing Cycle (hrs.) 3 mo. or 1,000 ~ 1,500	3 mo. or 2,000 ~ 2,500	1 yr. or 4,000 ~ 5,000	2 ~ 3 yr. or 8,000 ~ 10,000	5 yr. or 16,000 ~ 20,000	
Major Moving Parts	Fuel feed pump, lub. oil pump, & cold water pump driving intermediate 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
		Check of deflector & replacement		○				
		Disassembly, cleaning & check			○			
	Fuel feed pump	Disassembly & check			○			
		Replacement of oil seal			○			
	F.O.control & stop air piston	Replacement of o-ring				○		
Lub. Oil System	Lub. oil	Change (depended on results of property analysis)	○					
	Lub. oil cooler	Disassembly, check, cleaning & hydraulic test				○		
	Thermostatic valve	Disassembly, check & cleaning			○			
		Disassembly, check & measurement				○		
	Lub. oil pump	Disassembly & check of pres. reg. valve & safety valve				○		
	Turbocharger lub. oil strainer	Change the element of lub. oil strainer	1,000-2,000					Change the element When the lub. oil pressure dropped by 0.3MPa(3kgf/cm^2)
	Lub.oil priming motor pump	Bearing of motor				○ 1st time	○ 2nd & subsequent	

Table 6-2. Checking Table for Engine Using Marine Diesel Oil (3/3)

Div.	Part to Be Checked	Nature of Service	Checking Servicing Cycle (hrs.)						
			3 mo. or 1,000 ~ 1,500	3 mo. or 2,000 ~ 2,500	1 yr. or 4,000 ~ 5,000	2 ~ 3 yr. or 6,000 ~ 10,000	5 yr. or 10,000 ~ 20,000		
Cooling Water System	Thermostatic valve	Disassembly, check & cleaning		○					
	Cooling water pump	Disassembly, check & measurement			○				
		Replacement of mechanical seal			○				
	Fresh water cooler	Disassembly, check, cleaning & hydraulic test			○				
	Cooling water (Fresh water)	Change (depended on results of property analysis)			○				
	Sea water cooling parts	Check of anticorrosive zinc & replacement (Air cooler & Lub. oil cooler)	○						
Other	Turbocharger	Disassembly & cleaning			○				
	Boost air cooler	Disassembly, check, cleaning & hydraulic test			○				
	Starting air motor	Disassemble and clean the muffler element. (Clean with neutral detergent.)		○					
		Remove the starting motor from the engine and turn the pinion gear manually, check that it turns smoothly and it emits no abnormal sound.		○					
		Disassembly, inspection, cleaning and replacement of grease of moving parts. replacement of o-ring, first reduction gear bearing and special grease inside the reduction gear.				○			
		Disassembly, inspection, cleaning and replacement of grease of moving parts. replacement of o-ring, 1st & 2nd reduction gear bearings and special grease inside the reduction gear.					○		
	Engine tachometer	Calibration of indication			○				
	Alarm switch	Actuation test		○					

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) (1/3)

An asterisk (*) given in the following tables refers to the timing of initial check after the initial start or part replacement. Perform the check from the second time and onward at the ordinary frequency.

Div.	Part to Be Checked	Nature of Service	Checking & Servicing Frequency (hrs.)					
			3 mo. or 1,000 ~ 1,500	6 mo. or 2,000 ~ 2,500	1 yr. or 4,000 ~ 5,000	2 ~ 3 yr. or 6,000 ~ 10,000	5 yr. or 16,000 ~ 20,000	
Cylinder head	Fuel injection valve	Drawing-out check & adjustment	1,500 ~ 2,000					1st time:500~800hrs
	Cylinder head	Check & adjustment of the valve head clearance	○					
		Check of valve spring			○			
		Check disassembly & check of valve rotator			○			
		Disassembly, check & cleaning			○			
		Grinding of suc./ehx. valve seat			○			
		Scale cleaning & hydraulic test of water chamber				○		
		Replacement of stem seal (Suc./Ehx. Valve)				○		
		Check of cyl. head bolt tightening force		*	○			
Major Moving Parts	Piston	Drawing-out, cleaning, checking & measurement of piston				○		
		Check & measurement of piston rings				○		
		Check & measurement of piston pin				○		
	Connecting rod	Check & measurement of piston pin metal				○		
		Check & measurement of crank-pin metal				○		
		Check of connecting rod bolt tightening force				○		
		Change of connecting rod bolts						20,000 hrs.
	Cyl. liner	Inner dia. checking, cleaning & measurement				○		
		Drawing-out, check & cleaning of water jacket part					○	
	Crankshaft	Measurement of crank pin outer dia. & journal				○		
		Measurement & adjustment of deflection		○				
	Main bearing	Disassembly, metal checking & measurement				○		
		Check on tightening force of main bearing clamping bolts				○		
		Check on tightening force of side bolt				○		
	Camshaft	Check of cam & roller bearing			○			
		Disassembly & check of fuel pump tappet				○		
		Disassembly, check & measurement of swing arm				○		
		Drawing-out of crankshaft & bearing check & measurement					○	
	Timing gear	Check of tooth bearing & backlash				○		
		Disassembly of idle gear & check & measurement of bearing					○	
		Check of idle gear mounted shaft tightening force					○	

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) (2/3)

Div	Part to Be Checked	Nature of Service	Checking Servicing Cycle (hrs.)					
			3 mo. or 1,000 ~ 1,500	3 mo. or 2,000 ~ 2,500	1 yr. or 4,000 ~ 5,000	2 ~ 3 yr. or 8,000 ~ 10,000	5 yr. or 16,000 ~ 20,000	
Major Moving Parts	Fuel feed pump, lub. oil pump, & cold water pump driving intermediate 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
		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			○			
	Accumulator	Replacement of Accumulator (for Fuel oil line: F.O. Main pipe & Pressure regulating valve.)					○	optional part
	F.O.control & stop air piston	Replacement of o-ring				○		
Lub. Oil System	Lub. oil	Change (depended on results of property analysis)	○					
	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				○		
	Turbocharger lub. oil strainer	Change the element of lub. oil strainer	1,000-2,000					Change the element When the lub. oil pressure dropped by 0.3MPa(3kgf/cm^2)
	Lub.oil priming motor pump	Bearing of motor				○ 1st time	○ 2nd & subsequent	

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) (3/3)

Div.	Part to Be Checked	Nature of Service	Checking Servicing Cycle (hrs.)						
			3 mo. or 1,000 ~ 1,500	3 mo. or 2,000 ~ 2,500	1 yr. or 4,000 ~ 5,000	2 ~ 3 yr. or 6,000 ~ 10,000	5 yr. or 16,000 ~ 20,000		
Cooling Water System	Thermostatic valve	Disassembly, check & cleaning		○					
	Cooling water pump	Disassembly, check & measurement			○				
		Replacement of mechanical seal			○				
	Fresh water cooler	Disassembly, check, cleaning & hydraulic test			○				
	Cooling water (Fresh water)	Change (depended on results of property analysis)			○				
	Sea water cooling parts	Check of anticorrosive zinc & replacement (Air cooler & Lub. oil cooler)	○						
Other	Turbocharger	Disassembly & cleaning			○				
	Boost air cooler	Disassembly, check, cleaning & hydraulic test			○				
	Starting air motor	Disassemble and clean the muffler element. (Clean with neutral detergent.)						Every 6 months	
		Remove the starting motor from the engine and turn the pinion gear manually, check that it turns smoothly and it emits no abnormal sound.						Every 6 months	
		Disassembly, inspection, cleaning and replacement of grease of moving parts. replacement of o-ring, first reduction gear bearing and special grease inside the reduction gear.				○			
		Disassembly, inspection, cleaning and replacement of grease of moving parts. replacement of o-ring, 1st & 2nd reduction gear bearings and special grease inside the reduction gear.					○		
	Engine tachometer	Calibration of indication			○				
	Alarm switch	Actuation test		○					

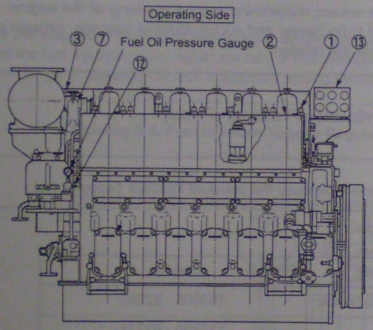
6-3. Routine Maintenance Checking & Adjusting Procedures

6-3-1. Measurement of Running Performance

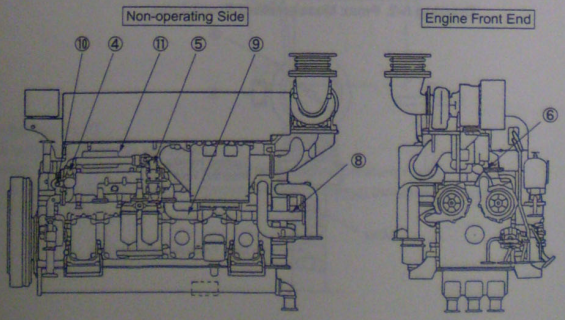
Check and record the following engine performances once a day while the load is stable.

(1) Each cylinder internal max. combustion pressure (Pmax)
(2) Each cylinder outlet exhaust gas temperature
(3) Turbocharger inlet exhaust gas temperature
(4) Lub. oil temperature (at the cooler inlet)
(5) Lub. oil temperature (at the engine inlet)
(6) Cooling water temperature (at the engine inlet)
(7) Cooling water temperature (at the engine outlet)
(8) Cooling water temperature (at the air cooler inlet)
(9) Cooling water temperature (at the air cooler outlet)
(10) Cooling water temperature (at the lub. oil cooler outlet)
(11) Boost air temperature
(12) Engine inlet fuel temperature (for engine using H.F.O.)
(13) Each pressure indicated on the gauge panel
(14) Room temperature

Drawing 6-1 (1/2) Running Performance Confirming Points



Drawing 6-1 (2/2) Running Performance Confirming Points



Compare readings with corresponding valves given in the Records of Shop Trial or the Records of Transfer Trial, and if found to be abnormal, carry out an adjustment or servicing required.

Refer to the following items since the engine performance vary according to the room temperature, water temperature, condiltions of load, etc.

(1) The dispersion of the maximum combustion pressure (Pmax) among cylinders is normal if it is within 0.5Mpa (5kgf/cm^2).

- Pmax may rise considerably as depended on properties of fuel oil. However, in any case, run the engine to keep Pmax below 17.7Mpa (180kgf/cm^2).
- Reflation between the Pmax and the boost air temperature

If the room temperature rises, Pmax falls; conversely, if the room temperature drops, Pmax rises. There is a tendency of Pmax 0.2 MPa (2kgf/cm^2) against the room temperature change 3℃.

(2) Exhaust temperature refers to the corresponding temperature recorded in the Transfer Trial.

- The dispersion of the exhaust temperature among the respective cylinder outlets is normal if it is within 40℃.

Even if this temperature is found not uniform among cylinders, it is unnecessary to force revising this non-uniformity if the fuel injection volume and Pmax are found uniform among cylinders.

- Relation between the room temperature and the exhaust temperature.

The exhaust temperature varies at the rate of about twice the room temperature change. Nevertheless, use the engine within the limit values, maintaining a good servicing of the engine, etc. and reducing the load because fouling of turbocharger and suction/exhaust passage, exhaust pressure, properties of fuel oil, etc. may influence this relation.

6-3-2. Measurement of Max. Combustion Pressure (Pmax)

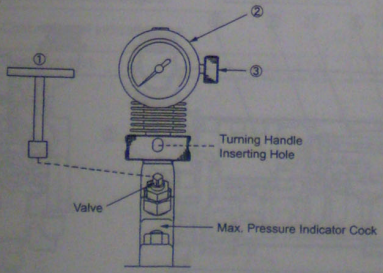
CAUTION

Wear gloves when taking a measurement because the pressure indicator becomes hot.

(1) Prepare the following exclusive tools:

No.	Exclusive Tool Description	Part No.
①	Pressure indicator cock turning handle	153605 - 92360
②	Pressure indicator	137600 - 93751

Drawing 6-2. Pmax Measurement Procedures



(2) Open the valve of pressure indicator cock with use of pressure indicator cock turning handle ① , and lightly race/rev up the engine for two to three times.
(For prevention of dust and foreign matter from intruding into pressure indicator)
(3) Attach the pressure indicator ② , and close its exhaust valve ③ .
(4) Be sure to fully open the valve of pressure indicator cock withe use of turning handle, and close the indicator cock when the pressure becomes the highest.
(5) After reading out the Pmax, open the exhaust valve of pressure indicator.
(6) Detach the pressure indicator when its needle shows 0 MPa (0 kgf/cm^2).

(When the pressure indicator cock is found hard to loosen, use the turning handle.)

△

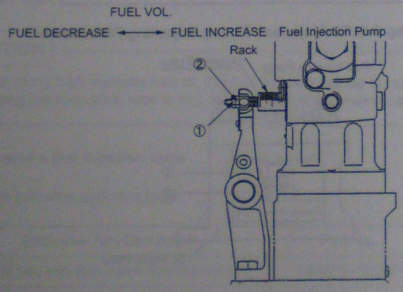
(1) Should the dispersion in Pmax among cylinders exceed 0.5MPa(5kgf/cm^2), adjust it with the injection timing of within 1°.
(2) Should the Pmax exceed its limiting value, adjust the injection timing upon examining the engine performances.

6-3-3. Regulation of Fuel Injection Volume (Rack Scale)

△

(1) Should the dispersion in exhaust temperature among cylinders exceed 40 ℃ under the serviced state of the fuel injection valve, adjust the rack of the corresponding fuel injection pump.
(2) Keep the range of dispersion of rack adjustment among cylinders within one scale graduation.

Drawing 6-3. Fuel Injection Volume Regulating Procedures



(1) Loosen the lock nut ① .
(2) Turn the adjusting screw ② as follows:
Clockwise: To increase the injection volume (exhaust temperature rise)
Counterclockwise: To decrease the injection volume (exhaust temperature drop)
(3) Tighten the lock nut.

6-3-4. Adjustment of Fuel Injection Timing

If it is necessary to adjust the fuel injection timing as based on the data recorded during a load run, stop the engine, and adjust the timing according to the following procedures:

1) Procedures for checking the fuel injection timing

(1) Turn the flywheel to align the marked-off line on the body of fuel injection pump with that on the plunger guide.
(2) The scale graduation pointed out by the flywheel pointer at this time indicates the fuel injection timing. (The flywheel scale within the range of 0° to 30° from the T.D.C. is graduated in 2°, and outside the range, 5°.)

2) Adjustment of the injection timing

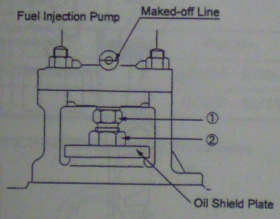
⚠ CAUTION

Do not bring your fingers close to the lock nut nor oil shield plate while turning the flywheel. Otherwise, your fingers may be caught in, resulting in an injury.

(1) Prepare the following exclusive tools:

Exclusive Tool Description	Part No.
Single-ended wrench (M24) for adjusting bolt	138603 - 92510
Double-ended wrench	28110 - 220240
Ratchet handle for turning	147673 - 92851
Socket (M24) for turning	42111 - 001850

Drawing 6-4. Fuel Injection Timing Adjusting Procedures



(2) Turn the flywheel to position the adjusting bolt ① at the lowermost.
(3) Loosen the lock nut ②.
(4) Turn the flywheel in the direction of engine rotation so as to align the flywheel pointer with the injection timing (indicated by the flywheel scale) of a cylinder to be adjusted.

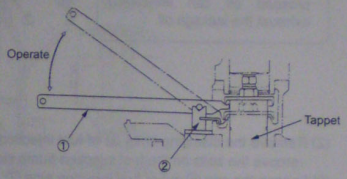
Advance the injection timing:	Pmax rises.
Delay the injection timing:	Pmax drops.

(5) Turn the adjusting bolt to align the marked-off line on the pump body with that on the plunger guide.
(6) Turn the flywheel to position the adjusting bolt at the lowermost.
(7) Tighten the lock nut.
(Have the adjusting bolt fixed with use of a wrench so as not to allow the bolt to turn together when lock nut is tightened.)

After having adjusted the injection timing, turn the flywheel in the direction of engine rotation. When the adjusting bolt has come to its uppermost position, further push up the oil shield plate to make sure there is allowance for the pump stroke. (Use the fuel pump priming tool.)

Drawing 6-5. Fuel Injection Pump Priming Tool

No.	Exclusive Tool Description	Part No.
①	Priming lever	146673 - 92920
②	Lever support	146673 - 92930



6-3-5. Checking of Fuel Injection Valve & Adjustment of Injection Pressure

Improper servicing of fuel injection valve greatly affects the fuel combustion and output. However, it is generally difficult to specify the servicing frequency which depends on such as the fuel oil used and service load. Therefore, determine the proper servicing frequency based on such as changes of exhaust temperature and exhaust color.

CAUTION

In the engine using high viscosity fuel oil, the fuel injection nozzle is indirectly cooled. For servicing and dismantling the fuel valve, refer to Fig. 36-C: Fuel injection maintenance procedure.

1) Drawing-out of a fuel injection valve

(1) Prepare the following exclusive tools:

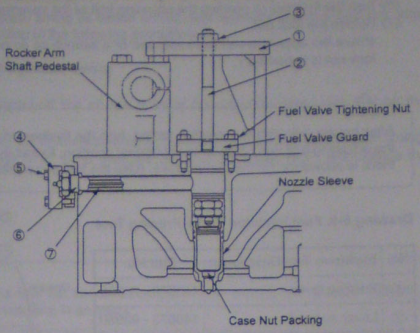
No.	Exclusive Tool Description	Part No.
①	Body of fuel injection valve drawing-out tool	146673 - 92340
②	Drawing-out bolt	146673 - 92330
③	Nut	26732 - 160002
	Hexagonal wrench key (M8)	28150 - 080000
	Hexagonal wrench key (M6)	28150 - 060000

Drawing 6-6. Fuel Injection Valve Drawing-out Procedures

CAUTION

<Prevent leakage oil in the fuel injection valve from dropping in the cylinder liner>

Before the fuel injection valve slips out, remove the bolt (B) (Refer drawing 6-7, p6-15) of pipe coupling. Leakage oil in the fuel injection valve can be exhausted if it does so. Additionally, blowing by compressed air can effectively exhaust the leakage oil.



(2) Remove the clamping bolts ⑤ of fuel injection pipe joint ④ with use of hexagonal wrench key. (Also remove the bolts on the fuel injection pump side.)
(3) Loosen the cap ⑥ nut of fuel injection pipe ⑦, and remove it with the fuel injection pipe.
(4) Remove the fuel valve tightening nut.

Handle the injection pipe with care because oil leakage takes place if the spherical surface on either end of fuel injection pipe is flawed.

(5) Screw the drawing-out bolt ② into the fuel valve guard.
(6) Attach the body of drawing-out tool ①.
(7) Tighten the nut ③ to draw out the fuel valve.
(8) Draw out the case nut packing. (It may be drawn out together with the fuel valve.)

2) Incorporating the valve

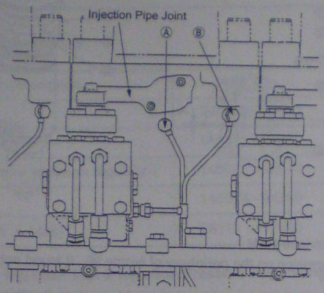
After cleaning, check or replacement of the fuel valve and adjustment of fuel injection pressure is finished, incorporate the fuel valve while observing the following point:

(1) Take care not to damage the tip of nozzle sleeve when clearing the fuel valve mounting hole.
(2) Replace the case nut packing with new one.
(3) First tighten the cap nut ⑥ of fuel injection pipe, and then tighten the fuel valve tightening nut.
(4) Do not make a mistake in the incorporating direction because spherical washers are used to the injection pipe joint clamping bolts on the fuel injection pump side.
(5) Tighten the clamping bolts of fuel injection pipe joint ④ on the cylinder head side and the fuel injection pump side alternately and gradually in two or three times.

3) Leaked oil check

During a run immediately after servicing of a fuel injection valve, check for oil leaked from the overflow pipe.
(A) Leaked oil take-off part of the injection pipe and injection pipe joint
(B) Leaked oil take-off part from the nozzle clearance.

Drawing 6-7. Leaked Oil Take-off Parts



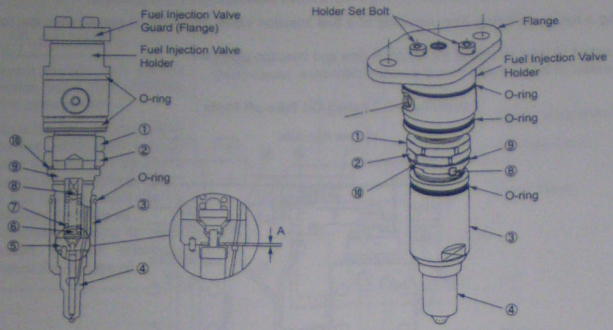
4) Disassembly & cleaning of a fuel injection valve

(1) Prepare the following exclusive tools:

Exclusive Tool Description	Part No.
Socket for case nut	146673 - 92260
Single-ended wrench (M41) for pressure regulation	146673 - 92270
Hexagonal wrench key (M8)	28150 - 080000

(2) Clean carbon adhered to the nozzle exterior, and then disassemble the fuel injection valve. (Removal of carbon is facilitated by soaking the nozzle in the carbon remover or stock solution of cresol.)
(3) First remove the fuel valve guard, and then disassemble the valve sequentially in the ascending order of numbers shown in the drawing below.

Drawing 6-8. Fuel Valve Disassembling Sequence



(4) Check & servicing of various parts

- Check for sulfuric acid corrosion on the periphery of nozzle ④ . If found noticeable corroded, replace the nozzle with a new one.
- If the nozzle valve has stuck of it does not move smoothly, replace it with a new one.
- When the stepped wear "A" of valve stop spacer ⑤ exceeds 0.15mm, replace it with a new one.
- Replace the case nut ③ and O-rings of body of fuel injection valve with the respectively new ones.
- You are recommended to hold spare parts of nozzle, supposing that its average service life is about 2,500 hours.

(5) Reassemble a fuel injection valve in the sequence reverse to disassembly, paying attention to the following paints:

(1) Do not make a mistake in the incorporating direction of the spring seat ⑥ , spring shoe ⑧ and spring shoe guide ⑨ .
(2) Tighten the case nut to the specified torque using an exclusive socket. Excessively tightening it may cause the nozzle to malfunction and the straight pin to be broken.

Chapter9. Table or Tightening Torques of Major Bolts

5) Injection test & injection pressure regulation

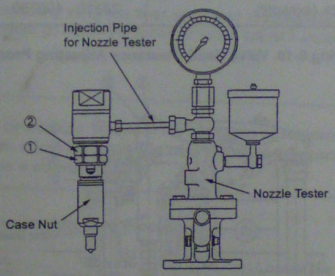
⚠ WARNING

When operating the nozzle tester, be careful not to expose any part of your body to spray from the injection valve.
If exposed, you would be seriously wounded because the injection pressure is very high at 34MPa (347kgr/cm²)

(1) Prepare the following exclusive tools:

Exclusive Tool Description	Part No.
Nozzle tester	737600 - 93110
Injection pipe for nozzle tester	141616 - 93420
Single-ended wrench (M41) for pressure regulation	146673 - 92270
Socket for case nut	146673 - 92260
Double-ended wrench (M41 × M46)	28110 - 410460

Drawing 6-9. Injection Test & Injection Pressure Regulating Procedures



Set the fuel injection valve downwards.

(2) Attach the injection valve to the nozzle tester.
(3) While slowly operating the hand lever of the tester, adjust the screwing-in of the pressure adjusting nut ① to attain the specified injection pressure.
(4) Quickly operate the hand lever of the tester (at rate of two to three strokes per second), and check the state of spray. If the hand lever of the tester is operated slowly at this time, fuel oil runs down after the hand lever is stoked, and you might err in judgment that the nozzle is defective. Thus, pay attention to this regard.
• Replace such a clogged nozzle or nozzle which gives a streaky injection with the new one.
(5) The nozzle can be used continually if the oil tightness of the seat part maintains a pressure 2.0 MPa (20kgf/cm²) lower than the specified injection pressure and allows the fuel oil to such an extent of oozing out from the nozzle tip.

(1) When replacing the nozzle, remove the case the case nut under the loosened state of the pressure adjusting nut. If the case nut is loosened under a high state of the injection pressure, the mating surfaces of nozzle and spacer and the straight pin may be damaged.
(2) Tighten the case nut to the specified torque with use of exclusive socket.

(6) When the injection test and adjustment of injection pressure are finished, tighten the lock nut ② with an exclusive single-ended wrench. (To prevent the adjusting nut ① from being turned together with the lock nut, lock it with a double-ended wrench.)

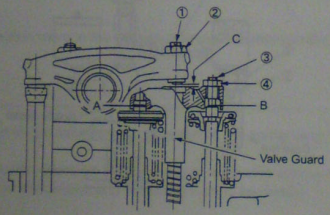
6-3-6. Adjustment of Suc./Exh. Valve Head Clearance

Adjust the suction/exhaust valve head clearance according to the following procedures because the valve mechanism of this engine is so constructed to retain two suction (or exhaust) valves by means of the T-shaped valve guard which will be distorted to cause an abnormal wear to the valve guard guide and/or valve guide unless adjusted to retain two valves simultaneously:

(1) Prepare the following exclusive tools:

Exclusive Tool Description	Part No.
Feeler gauge, 0.3-mm thick (suction)	28312 - 300750
Feeler gauge, 0.4-mm thick (exhaust)	28312 - 400750

Drawing 6-10. Valve Head Clearance Adjusting Procedures



(2) Turn the flywheel to bring the cylinder for which the clearance is to be adjusted to assume the T.D.C. of the compression stroke.

Do not mistake the T.D.C. of overlap for the instructed T.D.C.

(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.

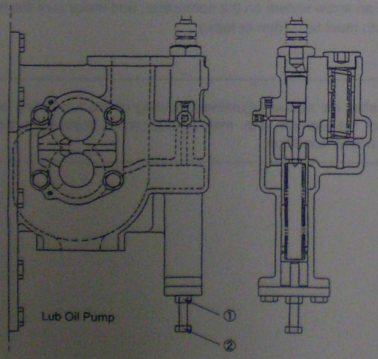
Valve head clearance: **Chapter 3. Table of Engine Standard Adjustments**

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.

Drawing 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.

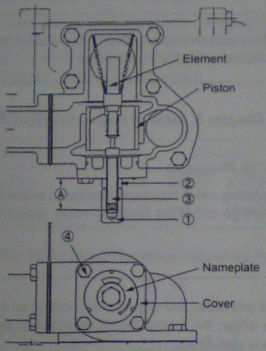
6-3-8. Adjustment of Lub. Oil Temperature

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 tc 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 sea aria, 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 lubricating oil temperature

Drawing 6-12. Lub. Oil Temperature Adjusting Procedures



(1) Remove the cap nut ① , and loosen the lock 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 17mm or less.)

△

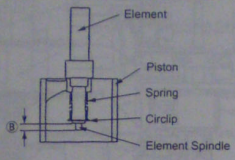
Should the temperature do not drop even after the above adjustment, fouling of the lubricating oil cooler, sticking of a piston of malfunction of the element, etc. may be suspected. Investigate the cause, and restore the engine to the former proper condition.

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 Drawing 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 withe 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.

Drawing 6-13. Element Checking Procedures



Lift of the element spindle (normal part)

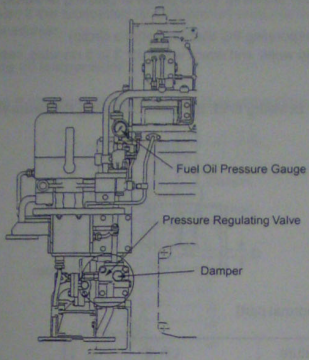
Checking Water Temperature	Lift Ⓑ
Cold water of 30℃or less	5 ± 0.1mm
Warm water of 65℃or more	Greater than 23mm

(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 36mm, and then attach the cover.

6-3-9. Adjustment of Fuel Oil Pressure

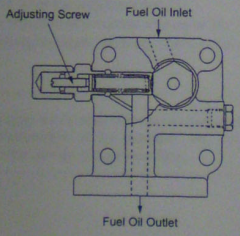
The fuel oil pressure regulating valve is equipped to the end of fuel oil return pipe together with a damper which absorbs the pulsating pressure inside the return pipe.

Drawing 6-14. Pressure Regulating Valve Equipped Point



(1) Before adjusting the fuel oil pressure, first clean the fuel oil filters.
(2) Adjust the fuel oil pressure, taking the tank head pressure into consideration.

Drawing 6-15. Fuel Oil Pressure Adjusting Procedures

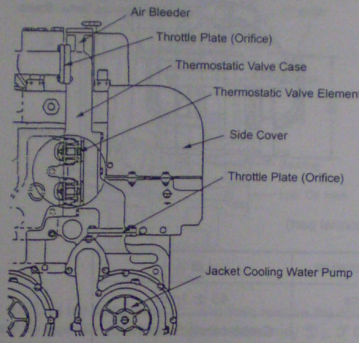


(1) Turn the pressure adjust screw as follows:
Clockwise ... The pressure rise.
Counterclockwise ... The pressure drops.

6-3-10. Checking of Cyl. Jacket Cooling Water Thermostatic Valves

An automatic thermostatic valve has been equipped to cylinder jacket to rise the cylinder jacket cooling water temperature in a short time after the engine is started and to maintain the temperature within the proper range during a run. The cooling water temperature varies with the load conditions and the cooling water (cold fresh water) temperature at the boost air cooler inlet. This automatic thermostatic valve has been set so that the cooling water at the engine outlet becomes 85 ℃ when the cold fresh water temperature is 38 ℃. However, if this cooling water temperature is not within the range from 80 ℃ to 90 ℃ as for your guide, overhaul check the thermostatic valve according to the following procedures:

Drawing 6-16. Thermostatic Valve Removing Procedures



1) Removal of thermostatic valve elements

(1) Close each valve at the inlet and outlet of the cooling water system, and then discharge the cooling water from inside the cylinder jacket.
(2) Remove the air bleeder.
(3) Detach the side cover.
(4) Remove the thermostatic valve case, and take out the elements.

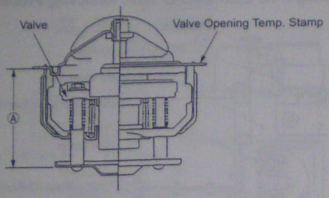
△ Be careful not to drop the thermostatic valve elements.

2) Check of thermostatic valve elements

The thermostatic valve is equipped with two elements of different valve opening temperatures. Check the elements according to the following procedures:

(1) Check for crack of the valve, broken spring and foreign matters caught on the valve seat face.
(2) Soak the elements in cold water and hot water for 2 to 3 minutes, respectively, and measure the valve lift Ⓐ.

Drawing 6-17. Element Checking Procedures



Valve lift of the element (normal part)

Checking Water Temperature	Lift Ⓐ
Cold water of 30℃ or less	45 ± 1mm
Hot water of 95℃ to 100 ℃	Greater than 55 ± 1mm

(3) If the valve lift does not satisfy the values shown in the above table, replace the elements with new one.

3) Incorporation thermostatic valve elements

Incorporation thermostatic valve element in the sequence reverse to removal.

(1) Do not make a mistake in the element incorporating direction.
(2) Do not forget to incorporate throttle plates at thermostatic valve case inlet and outlet sides.

6-3-11. Cleaning of Lub. Oil Bypass strainer

The lubricating oil system is equipped with a centrifugal bypass strainer in addition to a notch-wire oil strainer. During a run, keep open a cock at outlet of lub. oil pump to allow the lubricating oil to flow through the strainer regularly. When any problem has occurred to the bypass strainer, close the cock to stop the oil flow.

CAUTION

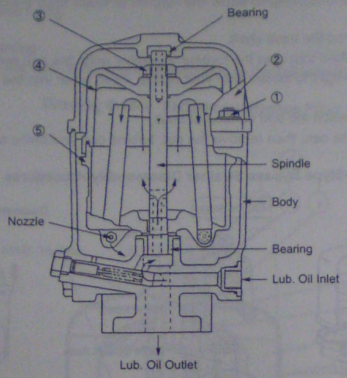
Stop the engine before cleaning the bypass strainer.
If you disassemble the bypass strainer during a run, oil mist may be blown off, causing you to get a burt.

GF-2type Bypass Strainer

1) Disassembly & cleaning

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

Drawing 6-18. GF-2type 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.

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.

ROC-5type Bypass Strainer

1) Disassembly & cleaning

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

(1) Loosen the bell knob 1/4 turns and remove the bell clamp, then remove the bell housing.

(2) Raise up the turbine assembly to allow the lub. oil to drain from inside, then remove the turbine assembly.

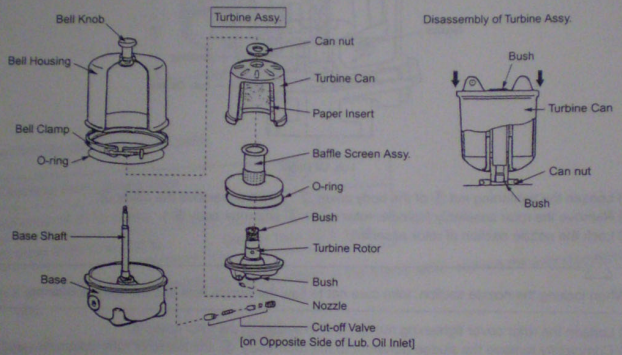
- Take care not to bend the base shaft.

(3) Loosen the can nut, then turn over the turbine assembly withe the can nut loosely attached.

- If the can nut is too tight to loosen with your hands, insert a bar into the hole of can nut and turn the bar.
- Take care not to scratch the end surface of bush.

(4) Press down the turbine can, then remove the nut, turbine can and baffle screen.

Drawing 6-19. ROC-5type Bypass Strainer Disassembly Procedures



2) Checking and servicing

Sludge whose thickness is 15mm or more may cause abnormal vibration. According to the operation conditions, specify the proper servicing interval.

(1) Insert such a narrow and thin tool as a spatula between the inside wall of turbine can and paper insert to remove sludge and paper insert.

(2) Clean the turbine can, baffle screen and turbine rotor.

- Completely remove the sludge. Otherwise, abnormal vibration may be caused.

(3) Check for clogging of nozzle.

(4) Replace the O-ring, gasket and paper insert with new ones, respectively.

3) Reassembly

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

o Tighten the can nut and bell clamp only with your hands and fingers.

o Attach the turbine assembly to the bell shaft, then make sure that it can be smoothly turned.

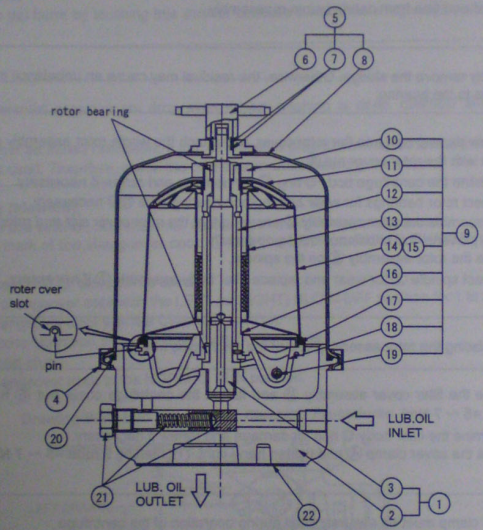
o Tighten the bell clamp, then tighten the can nut 1/4 turns.

FM200 type Bypass Filter

This FM200 centrifugal bypass filter should be cleaned at regular intervals ensuring that the thickness of the dirt deposit inside the rotor does not exceed approximately 35 mm.
The filter assembly is fitted with a cut off valve, which is located in the filter body. This valve is designed to protect the engine by stopping the supply of lube oil to the filter at start-up and during periods when the oil pressure is below the valve rating.

1) Disassembly & cleaning
Disassemble and clean the lube oil bypass filter according to the following procedures:

Drawing 6-18-b FM200 type Bypass Filter



No.	NAME	No.	NAME
1	BODY ASSEMBLY	12	BEARING TUBE
2	BODY	13	STAND TUBE
3	SPINDLE	14	ROTOR COVER
4	COVER CLAMP	15	PAPER INSERT
5	COVER ASSEMBLY	16	CIRCLIP
6	COVER NUT	17	O-RING (ROTOR ASSEMBLY)
7	O-RING	18	ROTOR BODY
8	COVER	19	NOZZLE
9	ROTOR ASSEMBLY	20	O-RING (FILTER BODY)
10	ROTOR COVER NUT	21	CUT OFF VALVE KIT
11	STIFFNENER PLATE	22	FLANGE GASKET

(1) Ensure the engine stopped, and the filter has come to a complete stop before proceeding.
(2) Remove the band clamp ④ ,unscrew the cover nut ⑥ and remove the centrifuge cover assembly ⑤ .
(3) Allow the oil to drain out of the rotor assembly ⑨ . Withdraw the rotor assembly vertically upwards from the spindle.
- At this time, it is noted not to damage an upper and lower rotor bearing.

(4) Secure the rotor assembly ⑨ on the rotor disassembly tool. Unscrew the rotor cover nut ⑩ and separate the rotor cover from the rotor body ⑱ .
(5) Remove the stand-tube ⑬ .
(6) Remove sludge deposits from the inside of the rotor cover ⑭ using a spatula, and remove the paper insert from the rotor cover. Clean the rotor components using a suitable cleaning fluid.

2) Reassembly

(1) Ensure that all rotor components (including the two nozzles located in the rotor body) are thoroughly cleaned and free from debris before reassembly.

△

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

(2) Fit a new paper insert into the rotor cover, and attach the whole rotor assembly component. And then tighten with the rotor cover nut ⑩ .
- Examine the centrifuge body O ring ⑰ for damage and renew if necessary.
- Inspect rotor bearings for wear and replace bearing tube ⑫ if necessary.
- Reassemble the rotor assembly ⑨ ensuring that the rotor cover slot and rotor body pin are aligned. This prevents the unbalance during operation.

(3) Replace the rotor assembly ⑨ on the spindle.
- Inspect spindle ② for wear and replace filter body assembly ① if necessary.

△

After replacing the rotor assembly, check the rotor spins freely.

(4) Replace the filter cover assembly ⑮ and fasten the centrifuge cover nut ⑥ hand tight. (Tightening torque =5 ~ 7 Nm)
- Examine the filter body O ring for damage and renew if necessary.

(5) Replace the cover clamp ④ and tighten hand tight. (Tightening torque =5 ~ 7 Nm)

△

The band clamp must be securely fitted during operation of the centrifuge.

(6) With the centrifuge running, check all joints for leaks.

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

Engine Main Lubricating Oil Strainer

The lubricating oil strainer is of the manual back-washing, duplex changeover type, and its element 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 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 (1kgf/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.

△

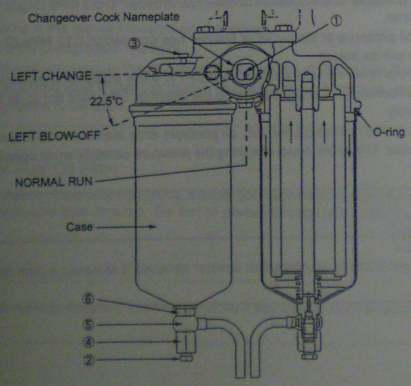
- Should the differential pressure not drop even if back-washing is done, overhaul and clean the strainer.
- Should the strainer be fouled noticeably, a lub. oil pressure drop alarm may be issued when one side of this strainer is used. Therefore, check the oil pressure while cleaning the strainer.

1) Back washing (blow-off)

Wash both sides of this strainer, one 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 on the nameplate.
(2) Loosen the drain plug ② two to three turns.
(3) Carry out the changeover cock with the LEFT (or RIGHT) BLOW-OFF position for 1 to 2 seconds.
(4) Return the changeover cock with the CHANGE position.
(5) Repeat the above operation steps (3) & (4) three or four times.
(6) Tighten the drain plug.
(7) Return the changeover cock to the NORMAL RUN position.

Drawing 6-20. Lub. Oil Strainer Cleaning Procedures



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.

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

3) Incorporation

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

- Do not make a mistake in the element incorporating direction.
- Take care not to permit the O-ring bit in the case.
- 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 be issued.

Turbocharger Lubricating Oil Strainer

The lubricating oil strainer is of the duplex changeover type and its elements are of the paper type. In a normal run, the lubricating oil passes through both sides (both elements) of strainer.
Besides, a pressure switch is provided on the outlet side of strainer to detect clogging of the strainer.

When the lub. oil pressure at the outlet of strainer has dropped to 0.3 MPa (3kgf/cm^2), replace the elements of the strainer.

- When the lub. oil pressure at the outlet of strainer has dropped to 0.25 MPa (2.5kgf/cm^2), the pressure drop alarm will be issued.
  Simultaneously, the relief valve of strainer will open to allow sludge and contaminant in the strainer to flow to the turbocharger, thereby damaging the bearing. Take care not to let the lub. oil pressure to drop excessively.
- If the strainer is fouled noticeably, the lub. oil pressure drop alarm may be issued when one side of this strainer is used. Therefore, keep checking the pressure carefully while operating one side of this strainer.

CAUTION

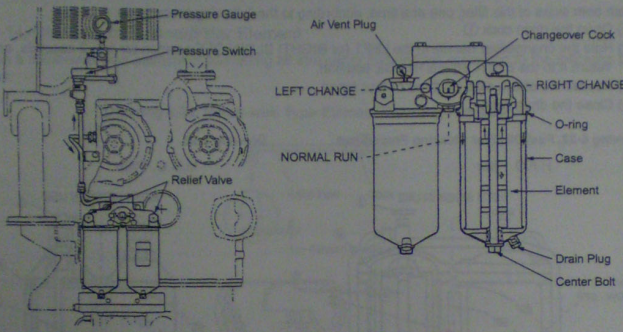
Be careful not to get burnt by touching this strainer because it assumes a high temperature during a run.

1) Disassembly & cleaning

If you disassemble the strainer during a run, disassemble and clean on element then the other sequentially.

(1) Align the red mark of the changeover cock with the LEFT (or RIGHT) CHANGE position.
(2) Loosen the air vent plug.
(3) Remove the drain plug, and discharge the lub. oil from the case.
(4) Loosen the center bolt, and remove the case and element.
(5) Replace the element.

Drawing 6-21.



2) Incorporation

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

- Do not make a mistake in the element incorporating direction.
- Take care not permit the O-ring bite in the case.
- 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 be issue.

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.

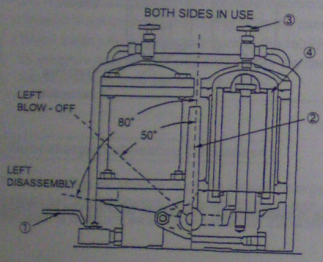
- Should the filter be fouled noticeably, the revolution of the engine may decrease as the fuel oil pressure drops when one side of this filter is used. Therefore, check the fuel oil pressure while cleaning the filter.
- A positioning notch is provided to the changeover handle. In a blow-off or disassembly,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

1) Back-washing (blow-off)

Wash both sides of this filter, one at a time, according to the following procedures:
(1) Open the drain cock ① .
(2) Hold the changeover handle in the LEFT (or RIGHT) BLOW-OFF position for 1 to 2 seconds, and then return it to the BOTH SIDES IN USE position.
(3) Repeat the above step (2) three or four times.
(4) Close the drain cock.

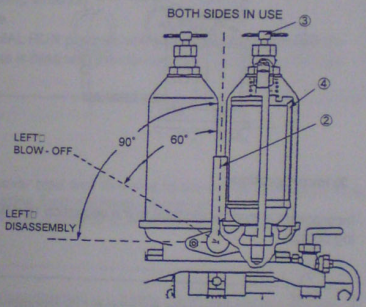
Drawing 6-22. Fuel Oil Filter Cleaning Procedures

H.F.O. Filter



Drawing 6-23.

M.D.O. Filter



2) Disassembly & cleaning

When disassembly this filter during a run, do so one side of the filter at a time according to the following procedures:
(1) Tilt the changeover handle ② to the LEFT (or RIGHT) DISASSEMBLY position.
(2) Open the air vent cock ③ .
(3) Open the drain cock ① to discharge the fuel oil.
(4) Remove the circular nut ⑤ .
(5) Remove the element ④ , and clean it.

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

(6) Clean the inside of the filter body.

3) Incorporation

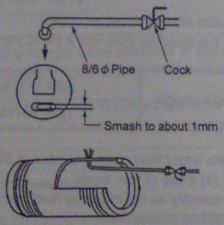
Incorporation a filter element in the sequence reverse to disassembly, paying attention to the following point.

(1) When setting the handle in the BOTH SIDES IN USE position, shift it slowly. If shifted rapidly to the BOTH SIDES IN USE position, the oil pressure may drop before the filter is filled with the fuel oil.
(2) Open the air vent cock to bleed air.

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

Clean a notch-wire type element of lubricating oil strainer or fuel oil filter according to the following procedures:

Drawing 6-24. Notch-wire Type Element Cleaning Procedures



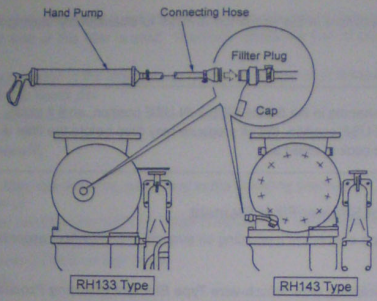
(1) Soak the element in the light oil or cleaning fluid to remove the sludge adherent on the surface with a wire brush.
(2) Prepare a nozzle as shown in the above drawing, and spray the compressed air of 0.3 to 0.5 MPa (3 to 5 kgf/cm^2) from the inside of the element.
(3) Lighting the element form its inside, make sure the dirt and foreign matters have been removed.
(4) Check for flaws, wire breakage, corrosion, etc. on the surface of notch wire.

6-3-15. Washing of Turbocharger Blower

When the blower of turbocharger is fouled, the exhaust temperature may rise, shortening the service life of fuel injection valves and exhaust valves.
Also, the effect of late washing is lower than that of timely washing. Therefore, record the boost air pressure before and after such a washing, and referring to the recorded data, periodically wash the blower.

(1) Wash the blower during a run of abut 75% or more load. After washing it, continue a load run for at lest one hour.
(2) Should the boost air pressure not restored even after washing the blower, overhaul and clean it.
(3) Fresh water alone does not have the effect of cleaning the blower. For washing the blower, use the cleaning fluid (P/#137616-18400).

Drawing 6-25. Turbocharger Blower Washing Procedures



(1) Open the drain cock on the outlet side of boost air cooler.
(2) Suck one washing's usage of the cleaning fluid into a hand pump.

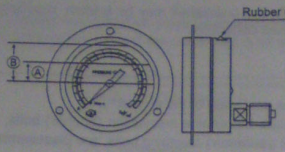
One washing's usage	Type RH133: 0.15 ltr.
	Type RH143: 0.2 ltr.

(3) Connect the land pump with the water filler plug, and pour in the cleaning fluid in 4 to 10 seconds.
(4) Repeat the above steps (2) & (3) three of four times.
(5) Pour fresh water of the same quantity as the cleaning fluid into the washer, and carry out washing with fresh water in the same way above procedures.
(6) After the washing, attach the cap to the water filler plug, and close the drain cock.
(7) If the boost air pressure is not restored, wait next 10 minutes, and then repeat the above washing.

6-3-16. Maintenance of Pressure Gauge

Glycerin aqueous solution is sealed in a pressure gauge equipped on the gauge panel to prevent wear of the gear and link mechanism inside the gauge.
Handle a pressure gauge, observing the following items:
(1) When removing the gauge panel or a pressure gauge for its servicing, have the rubber cap of a pressure gauge faced upward.
(If faced sidelong, the sealing liquid will leak through the ventilating hole in the rubber cap.)
(2) Always maintain the sealing liquid at the specified level.

Drawing 6-26. Level of Pressure Gauge Sealing Liquid



Minimum liquid level Ⓐ = 18mm
Higher Liquid level Ⓑ = 25~26mm

(3) Should the sealing liquid become contaminated or its level drop, detach the rubber cap, and change the sealing liquid or replenish the pressure gauge with its sealing liquid.
(Sealing liquid (P/#42111-002800) is optionally available.
(4) When a pressure gauge is replaced with the new one, use it after cutting off the navel of the rubber cap to open a ventilating hole to the gauge.
(If the gauge is not provided with an opened ventilating hole, the indication becomes be out of order.)

Adjustment of Pressure Take-off Main Valve

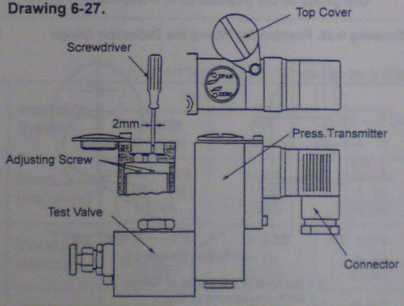
Check and adjust the operating of a needle valve provided at the piping part of a pressure gauge or pressure transmitter in order to prevent the damage or malfunction of the pressure gauge and pressure transmitter that are subject to pulsation.
- Fuel pressure main valve: Open 1/4 turn from the completely closed position.
- Other pressure main valve: Open one turn from the completely closed position.

Adjustment of Remote Indicating Pressure

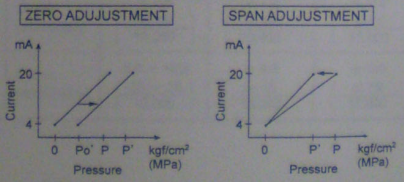
In the case of remote indication of a pressure, a pressure transmitter has been equipped. If the indication on the remote side has to be adjusted, proceed to the adjustment according to the following procedure:

[Adjusting Procedure]
- Detach the top cover from a pressure transmitter.
- Lightly press a small screwdriver (of which head is 2mm in diameter) against the ZERO or SPAN adjust screw, and turn the screw as the need arises.

Drawing 6-27.



- As the screw is turned clockwise, the indicated value varies in the direction of an arrow shown in the following graphs.



6-3-17. Measurement of Crankshaft Deflection

If the crankshaft deflection enlarges excessively, the crankshaft may be broken, resulting in an accident. Consequently, periodically measure the crankshaft deflection.

(1) Measure the crankshaft defection under the cold state of the engine.
(2) When you have removed of further tightened the engine installation (anchor) bolts, common bed clamping bolts or driven machine (such as generator) clamping bolts, are disassembled or retightened, measure the crankshaft deflection.
(3) Move the contactor of deflection gauge, and make sure the needle of dial gauge returns to the original position.

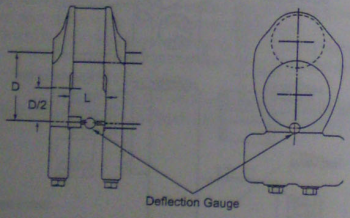
1) Deflection measuring procedures

(1) Prepare the following exclusive tools:

Exclusive Tool Description	Part No.
Deflection gauge	42111 - 000040
Deflection gauge mirror	42111 - 001420
Ratchet handle for turning	147673 - 92851
Socket (M24) for turning	42111 - 001850

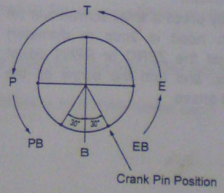
(2) Open the pressure indicator cocks of all cylinders.
(3) Turn the flywheel to bring it to the position EB of 30 degrees after the B.D.C.
(4) Fit the deflection gauge, and set the needle of dial gauge in the zero indication.
(5) Slowly turn the flywheel in the rotational direction of the engine, and take and record readings of the dial gauge at the position E, T, P and PB.

Drawing 6-28. Position for Fitting the Deflection Gauge



D = Diameter of crankshaft of 180mm
L = Width across arms of 98mm

Drawing 6-29. Deflection Measuring Positions



EB : 30° after B.D.C. (measuring reference)
E : 90° before T.D.C.
T : Top Dead Center (T.D.C.)
P : 90° after T.D.C.
PB : 30° before B.D.C

2) Criteria on results of the deflection measurement

The relation between the deflection valve (reading of dial gauge) at each measured position with the reference taken at the position EB and the crankshaft is as shown in the below table.

Drawing 6-30.

Reading of Dial Gauge	+	−
Crankshaft	 (lower spread)	 (lower contract)

(1) Should the deflection increase every time it is periodically measured, this is caused by the wear of the crankshaft and/or main bearings. If the deflection of only a certain cylinder increases suddenly, it is suspectable that the corresponding main bearing metal is abnormally worn. In these cases, check for the pertinent parts.
(2) Since the deflection value measured under the hot state of the engine varies as depending on the temperature existing at the measurement, it cannot be relied on as the reference. However, according to out test results, that deflection is roughly 2/10,000 to 3/10,000 × stroke (lower contract).

3) Allowable value of the deflection

Should the crankshaft deflection exceed the allowable value, correct the deflection by redistributing the installation shims and shaft centers of the engine and driven machine (or outer bearings).

(1) In case of the direct coupling systems Ⓐ , Ⓑ , & Ⓓ , the normal deflection for the No.1 cylinder is lower contract.
(2) In case of the direct coupling systems Ⓒ , adjust the deflection for the No.1 cylinder to lower spread because the temperature rise of engine bearings becomes larger than that of generator bearings during a run and thus the shaft center of crankshaft becomes comparatively higher.

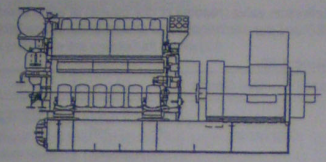
Table: Allowable value of the deflection

[Unit:1/100mm] Note: "S" stands for s stroke

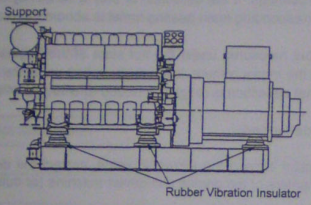
Coupling System	Driven Machine	Installation System	No.1 Cyl.		No.2 ~ 6 Cyl.
			T-PB/EB (direction)	P-E (direction)	
Ⓐ (Direct coupling)	Generator, single-side bearing	Direct (stationary)	-5.6 ~ +2.8 (-2S ~ 1S / 10,000)	± 2.8 (± 1S / 10,000)	± 2.8 (± 1S / 10,000)
Ⓑ (Bell housing coupling)	Generator, single-side bearing	Vibration insulation	-7.5 ~ +2.8 (-2.7S ~ 1S / 10,000)	± 2.8 (± 1S / 10,000)	± 2.8 (± 1S / 10,000)
Ⓒ (Direct coupling)	Generator, both-side bearing	Direct (stationary	± 2.8 (± 1S / 10,000)	± 2.8 (± 1S / 10,000)	± 2.8 (± 1S / 10,000)
Ⓓ (Air clutch & flexible coupling)	Pump & compressor	Direct (stationary)	-5.6 ~ +2.8 (-2S ~ 1S / 10,000)	± 2.8 (± 1S / 10,000)	± 2.8 (± 1S / 10,000)

Drawing 6-31. Driven Machine Direct Coupling Sistem.

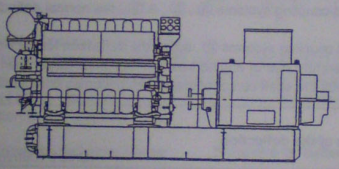
Ⓐ



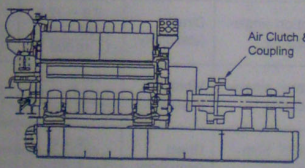
Ⓑ



Ⓒ



Ⓓ

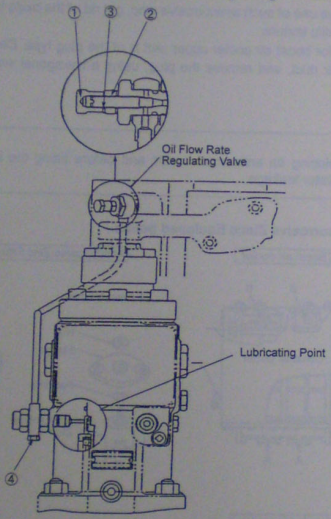


6-3-18. Adjustment of Fuel Injection Pump Pinion Lubricating Volume (for Engine Using H.F.O.)

The pinion sleeve of fuel injection pump of an engine using the heavy fuel (equivalent to 3,500-sec. or 7,000-sec. fuel oil) has been lubricated by lub. oil. Adjust the lubricating volume according to the following procedures:

(1) First run the engine, and then adjust the lubricating volume when the lubricating oil temperature becomes 55 to 65℃.
(2) Adjust the lubricating volume so that the lubrication becomes 1 dropful per 10 to 12 seconds.

Drawing 6-32. Lubricating Volume Adjusting Procedures



(1) Remove the cap nut ① from the lub. oil flow rate regulating valve, and loosen the lock nut ②.
(2) Fully screw in the lub. oil flow rate adjust screw ③.
(3) Remove the plug ④ on the fuel injection pump side to check the lubricating volume.
(4) Gradually loosen (turn counterclockwise) the adjust screw until the lubricating volume becomes as specified.
(5) When the lubricating volume has become as specified, securely tighten the lock nut ②, cap nut ① and plug ④.

6-3-19. Maintenance of Fuel Oil Seal Pot (for Engine Using H.F.O.)

Maintenance servicing of mentioned in Section 4-1-2. (Page4-6)

6-3-20. Check & Replacement of Anticorrosive Zinc

In the case of the fresh & sea water 2-line cooling specification, anticorrosive zincs have been fitted to the boost air cooler, lub. oil cooler. Check them according to the following procedures:

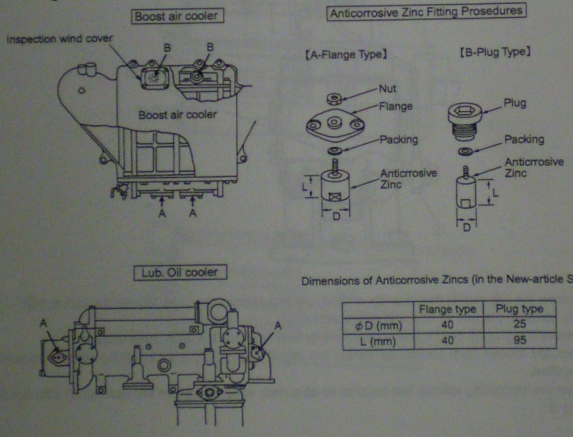
- In the case where such anticorrosive zinc is found consumed more than 70% of the state retained by the new article, replace it with the new one.

	Fitting Area (Q'ty)
Boost air cooler	Cooling water inlet/outlet cover (2) Water return cover (2) ··· plug type
Lub. oil cooler	Inlet side cover (1) Outlet side cover (1)

- In the case of continuous use of such anticorrosive zinc, get rid of the oxide layer from the surface of the zinc to expose the metallic texture.
- The anticorrosive zinc for boost air cooler upper part is of the plug type. Detach the inspection window cover from the boost air duct, and remove the plug, using a hexagonal wrench key (having the width across flats of 17mm).

△ After checking and replacing an anticorrosive zinc and before fitting the inspection window cover, check that there is no water leakage.

Drawing 6-33. Anticorrosive Zincs Equipped points



Dimensions of Anticorrosive Zincs (in the New-article State)

	Flange type	Plug type
φD (mm)	40	25
L (mm)	40	95

7. Maintenance Servicing

7. MAINTENANCE SERVICING

- In advance of maintenance and check of the engine, thoroughly read this Operation Manual to understand the structure of the pertinent part and the nature of work to be performed and to examine sufficiently the work procedures. If you begin the work without examining the work sufficiently, not only the labors will be wasted but also accidents or damages of the engine due to misassembly will be caused.
- If any part is found to be damaged of not durable for further use (reaching its usage limit) as a result of check, be sure to replace it. Besides, considering the schedule for next check, replace any part estimated not to be durable until the next check.
- If it is difficult to take any countermeasure of action on site, or if the necessary spare part is not available, consult us or your nearest sales or service agent (shown in the service network list "YANMAR Worldwide Service" appended to this manual).

7-0. Precautions in Maintenance Servicing

1) Precautions on Safety

To work safely, read the items regarding safety in the following pages:

- **Chapter 0. For Safe Use of Your Engine .... (p.0-2)**
- **Chapter 0, 3. Precautions on Safety (pp.0-4 to 0-13)**

⚠ WARNING

(1) If the engine runs during disassembly or check, you may be caught in it, resulting in a serious accident.

☆ Prior to servicing, return the start/stop lever to the STOP position and surely close the valves of the starting air system to make sure the engine does not turn. Only then, proceed to disassembly or checking work. (Be sure to changeover the control position selector switch to the ENGINE position.)

(2) Before turning the flywheel with the turning device, make sure you do not make a contact withe any rotating part and that rotation of the engine will not endanger you, your coworkers or other persons around the engine. Also be sure to give a sign when turning the flywheel.
For usage of the turning device, refer to the following:

Chapter 7-0. 4) Handling Procedures for Turning Device (p. 7-4)

☆ Prevent the self-rotation of crankshaft with the lock bar of the turning device before disassembling of checking any moving part.

☆ Other than turning the flywheel, return the turning device to the GEAR OUT position.

(3) Be sure to turn off the power switch before handling an electric part. Otherwise, you may receive an electric shock or fire may be caused.

(4) During welding and grinding, sparks may be spread, resulting in fire. Therefore, do not store such combustible materials as the fuel oil, lubricating oil and waste cloth at the working site.

⚠ WARNING

(5) When handling a liquid, strictly observe the following precautions:

☆ Fuel oil and lubricating oil: Flammables	The lighting of fires is strictly prohibited.
☆ Fresh-water rust inhibitor and fresh-water antifreezing fluid: Toxic	Do not drink any of them.
• Battery fluid	When handling the battery fluid, wear rubber gloves and a mask, if possible, and do not allow it to make direct contact with your skin. If it is put o your skin, flush it. Before discharging it, treat it according to the instruction manual of the additive manufacturer.
☆ Mercury (thermometer): Poisonous	Do not drink it. If it is put on your skin, flush it.

⚠ CAUTION

(6) According to the condition of working, wear protectors such as gloves, a helmet, safety shoes and safety goggles.
- ☆ During a run and immediately after the engine has stopped, the whole engine is heated. Before working, wear gloves so as not to get burnt.
- ☆ On the floor of engine room, oil is adherent and slippery. Especially when working at a height such as on the footboard, sufficiently watch your step not to fall from there.

(7) If you disassemble a strainer/filter of piping joint immediately after the engine has stopped, hot oil or water may be spout out due to the residual pressure.
Before disassembling a strainer/filter or removing a piping joint, close all valves for external connection to the CLOSE position, and gradually loosen the air vent plug to release the internal pressure. Then wrap the part with cloth or the like to disassemble or remove it.

(8) Note that spring may spring out when disassembling a valve or device which uses one or more springs.

(9) Do not raise heavy thing forcedly by your hands. Using a chain block, lift it. Also, keep off under the lifted heavy thing.
For the weight of major part, refer to the following:

Chapter 8, 8-2. Principal Part Mass for Disassembly & Servicing

(10) Use the proper tools. Use an exclusive tool upon understanding its function.
- ☆ Carefully check for any damages to rubber hose and joints of hydraulic jacks. The high-pressure oil may spout out from a damaged portion during operation, causing you to get an injury.
For how to use the hydraulic jack, refer to the following:

Chapter 7-0, 5) Handling Procedures for Hydraulic Jack (p. 7-5)

2) Precautions in Dismantling, Servicing & Reassembly

Be sure to observe the following precautions because the performance of the product may be deteriorated or the machine may break down if you neglect any of the following precautions.

(1) Prepare the necessary tools and spare parts in advance.
As for the exclusive tools, use the specified tools; as for the spare parts, use our genuine parts or the parts specified by us.

(2) If any part is found to be damaged or not durable for further use as a result of check, be sure to replace it. Besides, considering the schedule for next check, replace any part estimated not to be durable until the next check.

Chapter 10. Clearances & Wear Limits of Major Parts

(3) During disassembly, cover any exposed opening with tape or clean cloth so as not to allow foreign matters to enter it.
Incidentally, do not forget to remove the covering tape or cloth in reassembly.

(4) When disassembling jointed parts, check whether set marks have been stamped or not, and stamp set marks, if found necessary.

(5) On the major bolts, the cylinder No., bearing No., marking for incorporating position and set mark have been stamped at the time of manufacture. However, they can not serve as reference for tightening indefinitely because the clamping seat may be worn and the bolts may be stretched in their use. Using a set mark only as a guide, be sure to tighten each bolt to the specified torque, specified angle or specified hydraulic pressure.

Chapter 9. Table of Tightening Torques of Major Bolts

Besides, when any of these major bolts has been replaced with a new one, give the same marking as that of the former on to the new one.

(6) Note that bolts and nuts to be used a the high heated area are made of materials differed from those used elsewhere but of the same size. If wrong ones are used in reassembly, they become difficult to be taken out at the next servicing.

(7) When disassembling each section of the engine, carefully check the bolts and nuts that are not exposed during a run. If such a bolt or nut is loose, investigate the cause, take the proper actions, and then tighten it.

3) Precautions at Completion of Maintenance Servicing

⚠ CAUTION

(1) Turning the flywheel and lubricating oil priming, check for abnormalities in various parts of the engine.
(2) Be sure to incorporate the removed covers such as covers for rotating parts, heat shielding covers for exhaust pipe and protective covers for heated region in position.

⚠ WARNING

(3) After having used the turning bar, return it on the set position.
(3)' After having used the turning device, return it to the GEAR OUT state.

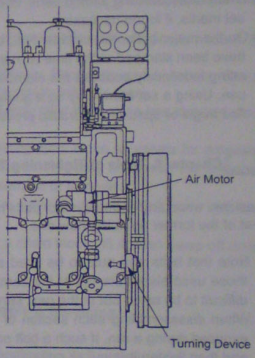
(4) Record the nature of maintenance servicing rendered and replaced parts in the Engine Log.

4) Handling Procedures for Turning Gear Device

(Optional spec.)

The turning device is of the gear intermeshing type and equipped below the air motor on the operating side. When the turning gear is intermeshing, the engagement/disengagement switch is actuated, disabling a start of the engine.

Drawing 7-1. Turning Device Equipped Point



Handle the turning device according to the following procedures:

① Prepare the exclusive tools for turning.

Exclusive Tool Description	Part No.
Ratchet handle	147673 - 92851
Socket (M24)	42111 - 001850

② Detach the lock bar, loosen the two stopper lock bolts, and then take off the stopper from the slot Ⓐ of turning shaft.
③ Push in the shaft to the GEAR IN position.
④ Fit the stopper in the shaft slot Ⓑ, and tighten the two lock bolts.
⑤ Attach the socket for turning and ratchet handle to the shaft, and then turn the flywheel.

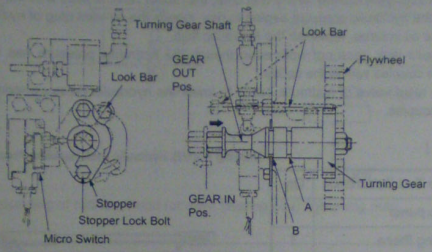
⚠ WARNING

Before disassembling or checking any moving part engage the turning gear with the flywheel and lock it with the lock bar to prevent self-rotation of crankshaft.

The lock bar is used to prevent the crankshaft from turning itself during an overhaul checking work. Set the turning gear in the intermeshing state, lock the turning shaft with the stopper, and then tighten the lock bar.

⑥ After turning work, return the turning gear to the GEAR OUT position, fit the stopper in the slot Ⓐ, and then tighten the lock bolts and lock bar.

Drawing 7-2. Turning Device Handling Procedures



5) Handling Procedures for hydraulic Jack

Use a hydraulic jack in a work of loosening or tightening the cylinder head tightening nuts and main bearing cap tightening nuts.
Furthermore, simultaneously loosen or tighten the four cylinder head tightening per cylinder or two main bearing cap tightening nuts per main bearing.

⚠ CAUTION

If the hydraulic fluid leaks while the hydraulic jack is being used, the fluid may spout under a high pressure, resulting in injury. Therefore, be sure to observe the following precautions:
- Do not use the hydraulic jack with a rubber hose having a flaw or an oil leaking portion.
- Do not put nor drop a heavy thing on any rubber hose.
- Do not grip any rubber hose. Do not bring your face close to the jack or branch during a work.

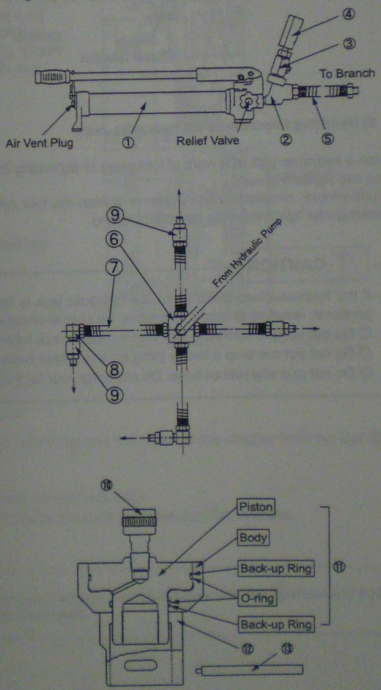
Use the following exclusive tools for loosening and tightening each nut.

[Usage]
(1) When assembling the hydraulic jack, be sure to use the sealing tape at the threaded part so that there will be no leakage.
(2) Connect the hydraulic pump and branch with 3 m long rubber hose.
(3) Connect two 1 m long rubber hoses to the branch.
(4) Use the hydraulic pump placed horizontally.
(5) To operate the hydraulic pump, use it, opening the air valve.
(6) When a hydraulic jack is used for the first time, the rubber hose is filled with the hydraulic fluid. Therefore, when the hydraulic pressure begins to rise, loosen the air vent plug of hydraulic pump, and then checking the oil volume, replenish the hydraulic fluid.
(7) If the hydraulic jack does not work even though the hydraulic pressure has risen to the specified value, loose couples will be the cause.
Loosen the relief valve of hydraulic pump to lower the hydraulic pressure, and then check the connection of couples.

[Common Tools]

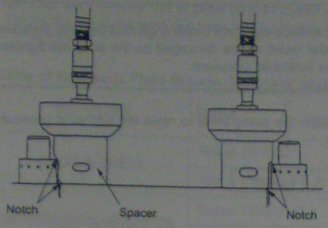
No.	Exclusive Tool Description	Qty.
①	Hydraulic pump	1
②	Connecting Piece	1
③	Gauge damper	1
④	Pressure gauge	1
⑤	Rubber hose, 3 m long	1
⑥	Branch	1
⑦	Rubber hose, 1 m long	4
⑧	Square elbow	2
⑨	Coupler, external threaded	4
⑩	Coupler, internal threaded	4
⑪	Hydraulic jack	4
⑫	Spacer	4
⑬	Handle	1

Drawing 7-3(1/2). Hydraulic Jack Handling Procedures [Common Tools]

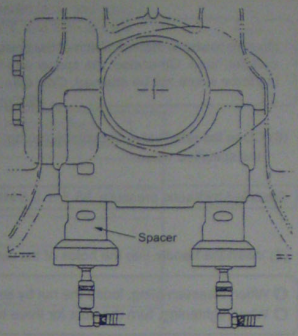


Drawing 7-3 (2/2). Hydraulic Jack Handling Procedures

[Cylinder Head Fitting Procedures]



[Main Bearing Cap Fitting Procedures]



(1) Clean the surrounding of cylinder head (or main bearing cap) tightening nuts.

Tighten the cylinder head (or main bearing cap) tightening nuts to their seating with use of the handle.

(2) Fit the spacer.

△

- When attaching the hydraulic jack to a cylinder head, be sure to check that the notch of the spacer fitting surface does not make a contact with the adjacent cylinder head. Otherwise, the spacer and the cylinder head will be damaged. Only then, raise the hydraulic pressure.
- When attaching the hydraulic jack to a main bearing, direct the handle insertion hole toward the crankshaft.

(3) Attach the hydraulic jack to the cylinder head (or main bearing cap) bolt, and screw in the jack until it adheres to the spacer.

△

Make sure that there is no differences in level between the piston of hydraulic jack and the end surface of body of the jack.

(4) Connect the hydraulic jack, branch and hydraulic pump with rubber hose (couplers).

(5) Loosen the hydraulic jack by one full turn from the state of adhering to the spacer.

Be sure to check that the notch of the spacer fitting surface does not make a contact with the adjacent cylinder head. Otherwise, the spacer and the cylinder head will be damaged as the accurate tightening force would not be attained. Only then, raise the hydraulic pressure.

(6) Close the relief valve of hydraulic pump, and operate the pump lever to raise the hydraulic pressure to the specified value.

Specified hydraulic pressure: 58.8 ± 0.5 MPa (600 ± 5 kgf/cm²)

(7) Insert the handle into the holes of the nut through the hole of spacer, and then turn the nut.

- When disassembling, loose the nut by seven to eight holes.
- When tightening, turn the nuts for three to four holes to the fully seated state.

CAUTION

- If the nut to be removed could not be turned with use of the handle, slowly raise the hydraulic pressure, and then turn the nut.
  The hydraulic pressure should not be raised above 63.7 MPa (650 kgf/cm²).
- When tightening, check if the nut threaded part is not damaged or the couplers are not poorly connected in the case where the number of turns of the nuts is few.

(8) Gradually open the relief valve of hydraulic pump to decrease the hydraulic pressure to the zero.
(9) Screw the hydraulic jack in until it adheres to the spacer, and then discharge the hydraulic fluid from the jack.
(10) Disconnect the rubber hose of hydraulic jack, branch and hydraulic pump.
(11) Remove the hydraulic jack and spacer.

- When disassembling, check if the bolts are not loose after removing the tightening nuts.
- When reassembling, check that set marks of the nuts and bolts are in agreement.

[Maintenance Servicing of Hydraulic Jack]

(1) To prevent rusting, apply the lubricating oil to the hydraulic jack, and store it.
(2) Cap each coupler not to allow foreign matters to enter it, and then store it.
(3) As for oil to be sent out from the hydraulic pump, use hydraulic fluid whose viscosity grade is ISO VG32.

Table of Hydraulic Fluid Brands (Viscosity grade: ISO VG32)

SUPPLIER	Brand [General hydraulic fluid / Wear resistant hydraulic fluid]
SHOWA SHELL	Tellus Oil C32
	Tellus Oil 32
NIPPON MITSUBISHI OIL	Super Hiland 32
	Super Hiland V32
COSMO OIL	Cosmo Epoch ES32
	Cosmo Hydro AW32
JAPAN ENERGY ELF	JOMO Hydrax 32
	JOMO Hydrax ES32
IDEMITSU KOSAN	Daphne Hydraulic Fluid 32
	Daphne Super Hydro 32A
EXXON MOBIL	DTE Oil Light, Unipower 32
	DTE 24 Oil, Unipower SQ32

7-1. Cylinder Head & Its Accessories

Carbon accumulated on the surface of cylinder head exposed to combustion gas hinders combustion and allows scale to adhere on the cooling water passage, reducing the cooling effect.
Besides, the thermal load during running of an engine may cause the head combustion surface to be cracked. Therefore, periodically overhaul and clean the cylinder head. (Simultaneously, also remove and check its accessories.)

7-1-1. Cylinder Head

1) Disassembling preparation

Prepare the following exclusive tools:
(1) Hydraulic pump & hydraulic jack ..... One set

Chapter 7-0, 5) Handling Procedures for Hydraulic Jack (p.7-5)

(2) Cylinder head lifting tool

No.	Exclusive Tool Description	Part No.
①	Lifting tool body	146673 - 92310
②	Cap nut	146673 - 92320
③	Eye nut	26620 - 160002
④	Bolt	26116 - 160452

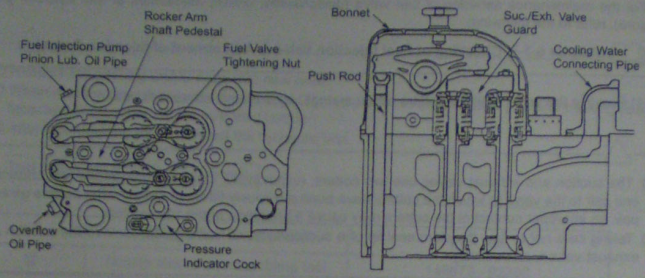
2) Disassembly

Disassemble the cylinder head according to the following procedures:

(1) Close each valve of cooling water inlet and outlet, and drain the cooling water from the cylinder jacket.
(2) Detach the exhaust manifold cover.
Using an eye bolt (P/#26610 - 120002), lift the cylinder head.
(3) Remove the exhaust manifold.
(4) Disconnect the following pipe and accessories from the cylinder head.
Overflow oil pipe, fuel injection pump pinion lub. oil pipe, cooling water connection pipe, pressure indicator cock, fuel injection pipe joint, fuel injection pipe cap nut and fuel injection pipe.
(5) Detach the bonnet, and remove the rocker arm shaft pedestal, suction/exhaust valve guards and push rod.
(6) Remove the fuel valve tightening nut.
(7) Remove the protective cap of a cylinder head bolt.
(8) Using the hydraulic jack, remove the cylinder head tightening nut.

Chapter 7-0, 5 Handling Procedures for Hydraulic Jack (p.7-5)

Drawing 7-4. Cylinder Head Disassembling Procedures

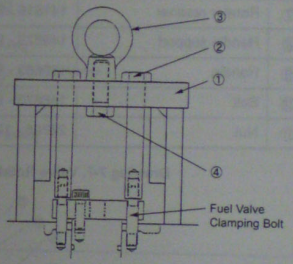


(9) Lock the cylinder head lifting tool onto the fuel valve clamping bolt, and lift the cylinder head straight up.

△

- Lightly tighten the cap nut ② to an extent that the body ① does not become rickety.
- When lifting the cylinder head, be careful not to damage the hydraulic jack fitting threaded part of the cylinder head bolt.

Drawing 7-5. Cylinder Head Lifting Procedures

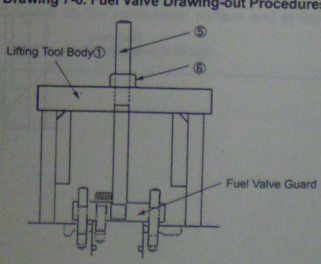


(10) Removal of the fuel valve
Remove the cap nuts ② , eye nut ③ and bolt ④ from the cylinder head lifting tool. Then, attach the fuel valve drawing-out exclusive tool, and draw out the fuel valve.

No.	Exclusive Tool Description	Part No.
⑤	Drawing-out bolt	146673 - 92330
⑥	Nut	26732 - 160002

Drawing 7-6. Fuel Valve Drawing-out Procedures

Attach the lifting tool body ① and drawing-out bolt ⑤ to the fuel valve guard. Tighten the nut ⑥ to draw out the fuel valve guard.



For the maintenance servicing of fuel valve (disassembly, check, adjustment of fuel injection pressure), refer to the following:

Chapter 6-3-5. Checking of Fuel Injection Valve & Adjustment of Injection Pressure

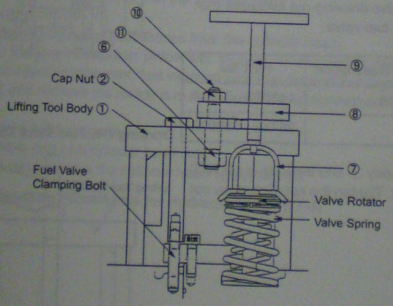
(11) Remove the valve rotators, cotters, valve springs, suction and exhaust valves.

- The suction and exhaust valves use two cotters, respectively. In reassembly, fit the two cotters as one pair to the valve to which the cotters have been previously fitted. (If not used the cotters as each pair, an improper contact at the cotters may cause a breakage to the valves stem.
- Taking care not to flaw the stem seal lip of a suction/exhaust valve guide, remove the suction and exhaust valves, respectively.

Lock the cylinder head lifting tool body ① to the fuel valve clamping bolt with the cap nut ② . Remove a valve rotator with the following exclusive tools.

No.	Exclusive Tool Description	Part No.
⑦	Rotator retainer	141616 - 92330
⑧	Handle support	146673 - 92360
⑨	Handle	139653 - 92340
⑩	Bolt	146673 - 92350
⑪	Nut	26706 - 120002

Drawing 7-7. Valve Rotator Detaching/Attaching Procedures



(12) Disassemble the nozzle sleeve once every four years with use of the exclusive tool, check for corrosion in the water chamber side, and clean it.

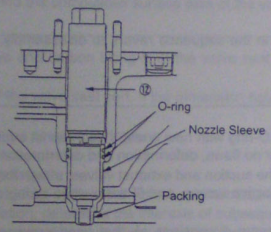
△

- O Replace the packing and O-rings with new ones.
- O When incorporating the nozzle sleeve, apply Protec grease to the threaded part and packing seating face, and tighten them to the specified torque.
- O After incorporating them, conduct the hydraulic test.

Test pressure: 0.7 MPa (7 kgf/cm²)

No.	Exclusive Tool Description	Part No.
⑫	Nozzle sleeve disassembling tool	146673 - 92250

Drawing 7-8. Nozzle Sleeve Disassembling Procedures



3) Checking & servicing of cylinder head

△

- O After having removed the cylinder head, cover the cylinder so as not to allow foreign matters to enter the boost air chamber.
- O Not to damage the threaded part of a cylinder head bolt, cap it with a protective tube.
- O Do not use any gas burner to eliminate carbon adherent on the combustion surface and at the exhaust port.
  The loose exhaust valve seat and a deteriorated O-ring may cause a water leakage.

(1) Check the state of carbon adherent in the combustion chamber and at the suction and exhaust ports (for your reference on determining the intervals for subsequent servicing). After clearing, carefully check for cracks and corrosion.
(2) Check the state of scale in the water jacket part. Depended on the water quality, a lot of scale adheres even in the water jacket part of a fresh-water cooled engine. Therefore, at least once every two years, clean the water jacket part with a descaling agent, etc. (For example, Unicon 146 sold by Yanmar can descale the water jacket part without overhauling the cylinder head while the engine is stopped.)
(3) Especially carefully check for flaws and foreign matters in the socket and spigot part of the cylinder head fitting surface. If this part has been flawed or contaminated by foreign matters, a blow-bye occurs during a run.
(4) Conduct the hydraulic test at least once every two years, and check whether water leaks from the exhaust valve seat mated part.
Also, if the cylinder head is overheated due to a failure of cooling water system, conduct a hydraulic test.

Test pressure: 0.7 MPa (7 kgf/cm²)

4) Reassembly

Reassemble the cylinder head in the sequence revers to disassembly, paying attention to the following points:

- Replace each packing and O-ring with new ones. If you cannot avoid using a packing or an O-ring again, sufficiently check it for no flaws, deformation and deterioration before using it.
- Apply the lubricating oil on the suction and exhaust valves, attach the same cotters as those used in the disassembly to the respective valves, and fit them while taking care not to damage the lip of a valve guide stem seal.
- If a head packing of the same dimensions as that used previously is used, the top clearance becomes the standard value and does not require any particular adjustment.
- Check for no foreign mattes in the suction and exhaust passages of cylinder head, piston upper part and boost air chamber of cylinder, and then incorporate the cylinder head.
- When mounting the cylinder head on the cylinder liner, take care not to flaw the threaded part of a cylinder head bolt.
- Apply the grease or lubricating oil on the hydraulic jack fitting threaded part of the cylinder head bolts to prevent the treaded part from being rusted.
- Apply the lubricating oil to the head tightening nut. After being tightened, cap them with the protective caps.

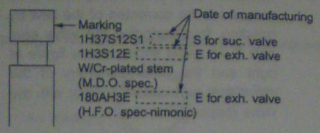
After incorporation of a cylinder head, adjust the suction/exhaust valve head clearance.

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

7-1-2. Suction & Exhaust Valves

Take care not to confuse the suction and exhaust valves as they are of the same shape but made of different materials.

Drawing 7-9. Markings for Suction&Exhaust Valve



1) Checking items

(1) Check for sulfuric acid corrosion and bend of the suction/exhaust valve stem, and measure the dimensions.
If the clearance between the suction/exhaust valve stem and the corresponding valve guide exceeds the usage limit value, replace either the valve or valve guide whichever is worn more than the other.

(2) Check for high-temperature corrosion of the valve poppet.

△ Correct the valve poppet tip part upon careful checking it because if it becomes too thin, it may be chipped and the pieces may enter the combustion chamber and turbocharger, causing a secondary damage. (However, do not grind the combustion surface side of the valve poppet part for this correction.)

(3) Check the state of blow-bye and carbon biting-in at the valve seat part, and according to the state, grind the seat face.

(4) Measure the dimensions of the valve seat part. If the dimension have reached the usage limit values, replace it.

(5) Check for cracks and corrosion of valve springs.

2) Suction/exhaust valve grinding

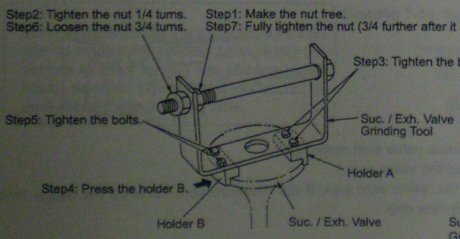
(1) Perform the initial valve grinding earlier than usual as indicated in Chapter 6, Table of Periodical Checking. Judging the situation, determine the intervals of subsequent servicing.

(2) Checking the clearance between the valve guide and stem, replace the pertinent part, and then perform a valve grinding.

Chapter 10. Clearances & Wear Limits of Major Parts

(3) Apply the proper quantity of grinding compound to the valve to be ground, and elaborately grind the valve with the specified grinding tool. Finally grind the valve with oil.

Drawing 7-10(1/2). Suc./Exh. Valve Grinding Procedures

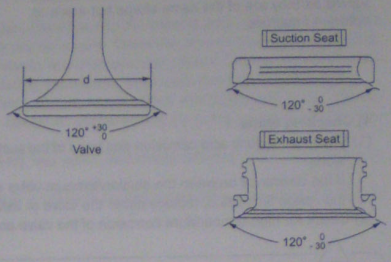


Drawing 7-10(2/2).



(4) If a flaw on the seat face of a suction/exhaust valve is so deep that it is required to be corrected of the flaw by grinding, finish grinding the valve seat part in an angle shown in the figure at right and the outer periphery of the valve seat part makes contact with the valve (poppet).

Drawing 7-11. Angle of Suc./Exh. Valve Seat



7-1-3. Suc./Exh. Valve Seat

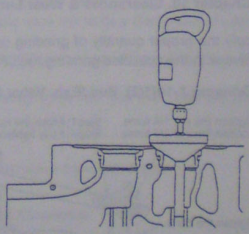
The suction/exhaust valve seat has been shrink fitted to the cylinder head. The exhaust valve seat is of the cooled type.

1) Checking & servicing

Do not use any gas burner to eliminate carbon adherent on the combustion surface and at the exhaust port.
Otherwise, the exhaust valve seat may become loose or the O-rings may be deteriorated, resulting in a water leakage.

(1) Check the state of blow-bye and carbon biting-in of the valve seat part. According to the state, grind the seat face. Since the satellite has been built on the valve seat face, if a flaw on it is so deep, correct it with use of a rough correcting seat cutter (with grinder), and then grind the valve seat part. (The seat cutter is optionally available.)

Drawing 7-12. Valve Seat Correcting Procedures (Rough Finishing)



(2) Check for water leakage at the exhaust valve seat mated part.
(If a water leakage is found, replace the valve seat.)
(3) Measure the contact diameter of the valve seat part. If the measurement exceeds the usage limit value, replace the valve seat with a new one.

2) Replacement of the valve seat

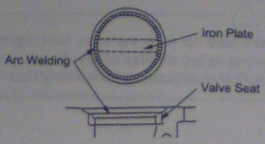
Replace the valve seat according to the following procedures:

(1) Removal of the valve seat

Build up the whole circumference of the valve seat face by arc welding to remove the valve seat.

If the exhaust valve seat is difficult to remove because of the O-rings incorporated in it, further weld an iron plate to the valve seat, and hammer out the valve seat through a round rod driven into the valve guide.

Drawing 7-13. Valve Seat Removing Procedures



(2) Incorporation of the valve seat

① Check for flaws, hit mark and burr on the valve seat inserting hole of a cylinder head and on the outer periphery of the valve seat. If found, correct it.

② Measure diameter of the seat valve and the seat valve inserting hole, and confirm the interference.

[Interference for the Value Seat] (Unit: mm)

Suction valve seat	0.045 ~ 0.095
Exhaust valve seat	0.039 ~ 0.072 (59 ϕ part)
	0.069 ~ 0.102 (67 ϕ part)

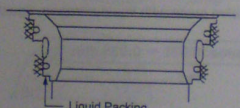
③ Heat the whole cylinder head to 40 to 60 ℃ . The appropriate heating is by steam cleaning.

④ Chill the valve seat with liquid carbon dioxide. If liquid carbon dioxide is not available, soak it in the mixed solution of a small lump (10 kg) of dry ice and alcohol (1.5 lit.) for 1 hour or longer to chill it.

△ Chill the exhaust valve seat with O-rings incorporated to it. Do not use liquid nitrogen. Otherwise, the O-rings will be hardened and broken when the valve seat is inserted in the cylinder head.

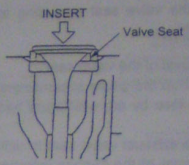
△ Just before inserting the exhaust valve seat into its hole of the cylinder head, apply the seizure inhibitor (spray) and silicone-based liquid packing (Three-Bond 1211 or its equivalent) to the inserting hole.

Drawing 7-14. Exhaust Valve Seat Inserting Procedures



⑤Using the suction valve (or exhaust valve), rapidly insert the valve seat into its hole on the cylinder head.

Drawing 7-15. Valve Seat Inserting Procedures



△ Take care not to tilt the valve seat. Apply a load for one to two minutes on the valve seat to avoid insufficient adhesion to its inserting hole.

△ After having replaced the exhaust valve seat, be sure to conduct the hydraulic test to make sure no water leaks from the mated part.

Test pressure: 0.7 MPa (7 kgf/cm²)

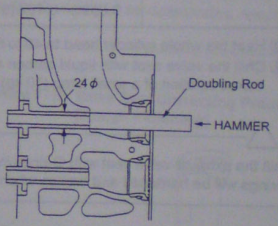
7-1-4. Suc./Exh. Valve Guide

The suction/exhaust valve guide has been shrink fitted and inserted and incorporated with the stem seal.

1) Checking & servicing

(1) Measure the clearance between the suction/exhaust valve guide and the valve stem. If the measurement exceeds the usage limit value, replace the valve guide or valve.
(2) Replace the stem seal at every servicing.

Drawing 7-16. Valve Guide Removing Procedures



2) Removal of the valve guide

Draw out the suction/exhaust valve guide by hammering it from the valve side through a stepped doubling rod.

3) Incorporation of the valve guide

Chill the valve guide with liquid nitrogen, liquid carbon dioxide or the like, and then press fit it.

Interference: 0.001 ~ 0.035 mm

△ When press-fitting the valve guide, hold the flange part of the valve guide.

4) Incorporation of the stem seat

Incorporate the stem seal with use of a jig so as not to damage the stem seal lip.

7-1-5. Suc./Exh. Valve Bridge & Its Guide

The valve bridge guide has been shrink fitted in the cylinder head.
If the engine is used under the condition that there is an excessive clearance between the valve bridge and valve bridge guide, the valve bridge may fall while the suction/exhaust valve is working, causing a malfunction of the valve, uneven wear of the valve guide or damage of suction/exhaust cam.

1) Checking & servicing

If the clearance between the valve bridge and valve bridge guide exceeds the usage limit value, replace either the valve bridge or valve guide whichever is worn more than the other.

2) Replacement of the valve bridge guide

Chill the valve bridge guide with liquid nitrogen or liquid carbon dioxide, and then press fit it into the cylinder head.

7-1-6. Valve Rotator

Improper rotation of the valve rotator will cause carbon to be bitten in the valve seat part, causing blow-bye at the seat part and affecting the service life of the valve and valve seat. Therefore, periodically overhaul and check the valve rotator.

To take out the valve rotator without disassembling the cylinder head, set the piston at the T.D.C. of the compression stroke, and then remove the valve rotator.

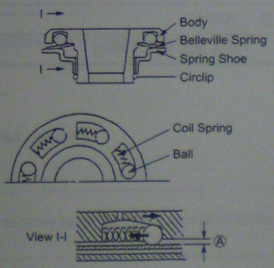
Drawing 7-7. Valve Rotator Detaching/Attaching Procedures (p.7-12)

1) Checking & servicing

Remove the circlip, and check each part. If any of the following defective parts is found, replace it.

① Wear (at the body groove) and corrosion of Belleville spring
② Wear (deformation) and corrosion of ball
③ Wear and breakage of coil spring
④ Wear of the body groove

Drawing 7-17. Valve Rotator



2) Incorporation

① Incorporation the coil springs, balls and Belleville spring in the proper direction.
② After incorporation, make sure of the clearance Ⓐ.

7-2. Piston & Connecting Rod

The frequency of piston drawing-out check varies according to the daily maintenance, especially the lubricating oil control and load (overload and excessively low load). Therefore, the supervisor is required to decide the proper frequency. However, the initial overhaul and check should be performed at the time mentioned in Chapter 6. From then on, decide the subsequent check schedule according to the overhaul checking results, an increase of blow-by and an increase in lubricating oil consumption. When the lubricating oil consumption has become twice the initial value, overhaul and clean the piston, and replace the piston rings.

7-2-1. Piston & Piston Pin

1) Disassembling preparation

Prepare the following exclusive tools:

[For Disassembling the Connecting Rod Bolt]

Exclusive Tool Description	Part No.
Socket wrench for connecting rod bolt	146673 - 92850
Handle	138987 - 92760
Lock nut	239653 - 92770

[For Disassembling the Protection Ring]

No.	Exclusive Tool Description	Part No.
①	Drawing-out plate, protection ring	146673 - 92060
②	Liner drawing-out upper implement	146673 - 92010
③	Spacer	139653 - 92040
	Eye bolt, piston lifting	26610 - 120002

2) Piston drawing-out

CAUTION

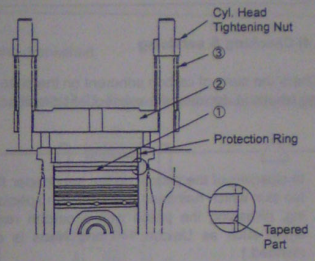
While you are drawing out or incorporating the piston, the crankshaft may turn spontaneously due to the unbalance. This is dangerous. Securely lock the flywheel not to allow the crankshaft to turn. Making sure the crankshaft does not turn spontaneously, proceed to a work.

Chapter 7-0, 4) Handling Procedures for Turning Device (p.7-4)

(1) Set the piston at a position of about 80 to 90° before the T.D.C.
(2) Place the protection ring drawing-out tool ① on the piston.

Place the tool so that its outer taper faces toward the piston and do not allow it to make contact with the cylinder liner.

Drawing 7-18. Protection Ring Drawing-out Procedures



(3) Install the liner drawing-out upper implement ② and spacer ③ in the cylinder block as shown in Drawing 7-18. Afterwards, fix the tools with the cylinder head tightening nut.
(4) Turn the flywheel, and remove the protection ring.
(5) Remove the disassembling tools and protection ring.
(6) Eliminate the carbon from the upper part of cylinder liner.
(7) Set the piston at a position of about 30° after the T.D.C.
(8) Loosen the connecting rod bolts with the specified disassembling tool, and then remove the bolts and metal cap.
(9) Screw the lifting eyebolt into the piston, and lift it by 20 to 30 mm.
(10) Remove the upper metal, and draw out the piston.

Take care to prevent the connecting rod from making a contact with the crankshaft or cylinder liner.

3) Removal of the piston pin & piston rings

(1) Remove the piston pin circlips with use of pliers (P/#28190 - 000130).

CAUTION

Note that the circlip springs out to cause an injury if the tip of pliers come out of the groove of circlip in course of removing the circlip.

(2) Draw out the piston pin while holding the connecting rod.
(3) Make two loops from wire, and then remove a piston ring with them.

CAUTION

Wear gloves because the corners of rings will be sharp edged to cause you an injury after a long time of run.

Be careful not to widen the cut of a ring by more than 40 to 50 mm; otherwise, the ring may be broken.

4) Checking & servicing

Check the state of carbon adherent on the piston and the state of wear various parts. Refer to these checking results in deciding the subsequent check schedule.

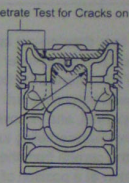
In cleaning of the piston, do not sandpaper the piston skirt which has been provided with special coating. (Washing the piston with a carbon removing agent such as Unicon 146 and Neos is recommended.)

(1) Check the contact of piston skirt and piston hole.
(2) Check the piston by 『Penetrate Test』 for cracks on its top surface and ring groove (outside & inside).
(3) Remove the piston cooling case cover, and check for adherent scale.
(4) Measure the dimensions of various piston parts and of the piston pin.
(5) If possible, replace the piston rings with new ones, considering the time to the next servicing.
(6) If the piston is replaced with the new one, provide the same set mark on the new one as that on the previous one.

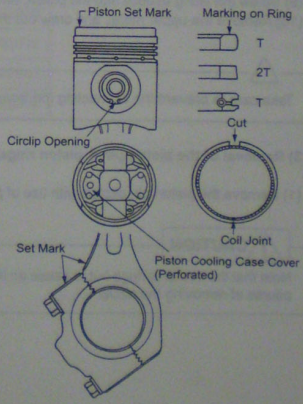
5) Incorporation of the piston

Incorporate the piston in the sequence reverse to drawing-out, paying attention to the following points:
(1) Incorporate the perforated piston cooling case cover on the operating side, apply a proper screw lock agent (Tokyo Three-Bond Screw Lock No.1 or its equivalent) on the bolts, and tighten them to fix the cover.
(2) Incorporate the piston pin circlip with its opening facing straight down.
(3) Incorporate the piston rings with their marked sides facing upward and their cuts shifted 120° from those of adjacent rings.

Drawing 7-19.



Drawing 7-20. Piston Incorporating Procedures



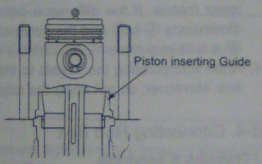
Piston ring groove plating repaired piston.
If the piston top ring groove have been repaired with Cr-plating, do not use the 3-face Cr-plated top ring.

(4) Incorporate the oil ring with its coil joint shifted 180° from its cut.
(5) Incorporate the piston and connecting rod, aligning their set marks with each other.

Do not apply the lubricating oil on the rear of crank-pin metals.

(6) Apply the lubricating oil to the piston, cylinder liner and crankshaft.
(7) Set the piston inserting guide (P/#146673 - 92140), and incorporate the piston.
(While tapping the piston with a resin hammer, drive the piston down.)
(8) Tighten the connecting rod bolts.

Drawing 7-21. Piston Reassembling Procedures



If you have restamped the set mark on a connecting rod bolt, do not mistake the new set mark for the previous set mark.

Chapter 7-2-4. Connecting Rod Bolt (p.7-24)

7-2-2. Connecting Rod

1) Checking & servicing

(1) Check the contact and looseness in fit of piston-pin metals.
(2) Measure the inner diameter of a piston-pin metal. If the measurement exceeds the usage limit value, replace the piston-pin metal. Remove the piston-pin metal either by hammering it out through a doubling metal or by drawing it out with a press so as not to flaw the metal inserting hole.
To incorporate the piston-pin metal, align oil holes and press fit the metal. After having press fitted, measure the inner diameter of the metal.
(3) Check for cracks and wear on the serration mating surface of the connecting rod big end.

If a water hammer has occurred or a heavy burnout of the piston has been detected, measure the bend and inclination of the connecting rod, and dye check for cracks.

Criteria for simple bend check
Draw out the piston-pin metal, detach the oil hole plug on the small end, and try to insert a 10-mm dia. bar or long drill into this plug hole and to turn the bar or drill.
If the connecting rod is bent, the bar or drill cannot be inserted, or it can be inserted but cannot be turned.

7-2-3. Crank Pin Metal

1) Checking & servicing

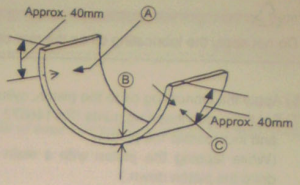
Be sure to replace both the upper and lower crank-pin metals as a pair.

(1) Check the contact on the rear and mating surface of each metal, and also check for cranks, seizure and imbedded foreign matters on the sliding surface of each metal.

(2) Incorporate the crank-pin metals to the connecting rod, and tighten the connecting rod bolts to the specified angle. Then, measure the inner diameter of the metals. If the measurement exceeds the usage limit value, replace the metals.

(3) Measure the thickness of the upper and lower metals. If the difference between the dimensions Ⓐ & Ⓒ and the dimensions Ⓐ & Ⓑ is 0.04 mm or more, replace the metals.

Drawing 7-22. Metal Thickness Measuring Points



(4) When incorporating the metals to the connecting rod, clean them not to allow biting-in of foreign matters. Moreover, do not apply the lubricating oil the rear of the metals.

7-2-4. Connecting Rod Bolt

1) Checking & servicing

(1) Checking for hit mark and plucking on the bearing surface and threaded part of each bolt. If any defect is found, correct it.

(2) When disassembling a connecting rod, be sure to restamp the set mark which has been stamped on each connecting rod bolt just before the shipment from our shop because the tightening torque of the bolt varies as depended on accustoming of the bolt threaded part and bearing surface and the big end serration mated surface.

(3) To prevent the bolts from being broken due to fatigue, replace them about every 20,000 hours even if their appearance is normal.

2) Reassembling procedures

(1) Be sure to incorporate the bolts at the respectively previous positions.
(2) Before tightening the bolts, apply the lubricating oil to the treated part and Protec grease to the bearing surface.
(3) Tighten the upper and lower bolts gradually in the three steps (approx. 40°, 80° and 120°), aligning with the set mark to the point Ⓑ on the connecting rod.

● Keep the deviation between the set mark of the bolt and the set mark of the connecting rod in less than 2 mm in the bolt tightening direction.

3) Bolt set mark stamping procedures

The connecting rod bolts are tightened to the specified angle. On the connecting rod, the marks indicating the specified angle (120°) are stamped (at two points Ⓐ & Ⓑ).

△ Stamp a set mark on each bolt according to the following procedures under the condition that the crank-pin metals are not equipped.

(1) Apply the lubricating oil and Protec grease to each bolt, and screw it to its seating by hand.
(2) Using a torque wrench, tighten the bolt to the seating torque.

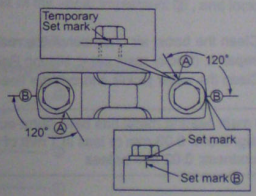
△ After replacing connecting rod bolts or the connecting rod, repeat tightening the bolts by about 90° and loosening them three or four times to make the bolts and the connecting rod accustomed each other.

Seating torque: 49 N·m (5 kgf·m)

(3) Stamp a temporary set mark on the side of the bolt collar, aligning with the set mark at the point Ⓐ on the connecting rod.
(4) Tighten the upper and lower bolts gradually in the three steps (approx. 40°, 80° and 120°), aligning with the set mark to the point Ⓑ on the connecting rod.
(5) Stamp a set mark on the side of the bolt collar, aligning with the set mark at the point Ⓑ on the connecting rod.

After replacing connecting rod bolts and the connecting rod, stamp the same Cylinder No., Bolt No., etc. as those stamped on the previous ones.

Drawing 7-23. Connecting Rod Bolt Marks



7-3. Cylinder Block & Cylinder Liner

7-3-1. Cylinder Block

Excluding some special case such as burnout of the crankshaft, ordinarily removal of the cylinder block is not necessary. When the cylinder head, piston, cylinder liner, etc., are removed, perform the following check and servicing:

1) Checking and servicing

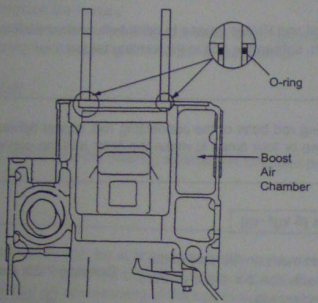
(1) Check for loose cylinder head bolts and main bearing cap clamping bolts.

- When replacing a bolt with damaged thread...
  Apply a seizure inhibitor (Sumitomo Metal Mining's Low Call Spray or its equivalent) to the threaded part on the studded side, and incorporate the new bolt.

  Studding torque: 196^{+49}_{0} N · m (20^{+5}_{0} kgf · m)

- Incorporate the O-ring on the studded side, and apply white paint.

Drawing 7-24. Cylinder Block Checking Points



(2) Clean the boost air chamber. If the rust preventive paint applied on its inner surface has peeled off, repair it. (Epoxy resin paint: Nippon Paint's Hi-Pon 50 or its equivalent)

(3) Clean the water jacket and cylinder liner fitting part, and check for corrosion.

If a main bearing metal has been burnt out, measure the accuracy of main bearing cap hole.
Straightness: 0.03 mm or less in 1 mm of length
Roundness: 0.02 mm or less

7-3-2. Cylinder Liner

- Periodically measure the inner diameter of cylinder liner because the extent of wear of inner surface of cylinder liner varies as depended on the control on lubricating oil used, cooling water temperature and normal load.

Measure the inner diameter of cylinder liner under the condition of being incorporated in the cylinder block and with use of the inner diameter position measuring implement (P/#42111-002930).

- Periodically draw out the cylinder liner, and check for corrosion of cylinder liner because cooling water may cause cavitation at the cylinder liner water jacket and erode from the outer surface of cylinder liner.

1) Disassembling preparation

(1) Prepare the following exclusive tools:

No.	Exclusive Tool Description	Part No.
①	Spacer	139653-92040
②	Liner drawing-out upper implement	146673-92010
③	Bolt	137655-92030
④	Washer	22137-240000
⑤	Nut	26732-240002
⑥	Liner drawing-out lower implement	146663-92020
⑦	Nut	26732-240002
⑧	Lock nut	26772-240002

(2) When drawing out the cylinder liner, cover the crankshaft with a sheet or the like to prevent water and foreign matters from entering the crankcase.

2) Disassembly

Remove the cylinder liner according the following procedures:

(1) Attach the exclusive tools in the ascending order of numerals shown in Drawing 7-25.

> Attach the aforementioned upper implement ② and the lower implement ⑥ so that their respective stepped parts face the inner diameter side of the cylinder liner and the lower implement ⑥ in the direction of the crankshaft.

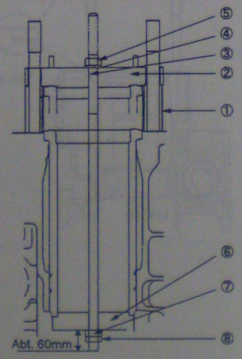
(2) Adjust the length of protrusion from the lower part of the drawing-out bolt ③ to about 60mm, and lock the drawing-out bolt ③ with the lock nut ⑧.

(3) While supporting the cylinder liner to prevent it from making contact with the cylinder, tighten the nut ⑤.

(4) Fit the cylinder liner in the stepped part on the lower side of the upper implement ②, and lock the cylinder liner with the drawing-out tools.

(5) Attach a wire rope to the upper implement ②, and lift the cylinder liner.

Drawing 7-25. Cylinder Liner Drawing-out Procedures



3) Checking & servicing

> Do not use sand paper, wire brush, or the like when cleaning the outer periphery of cylinder liner. Otherwise, the heat-treated layer on the surface is removed to cause rusting or corrosion.

(1) If the measurement on the inner diameter of a cylinder liner exceeds the usage limit value or if the measurement is expected to reach the usage limit value before the next servicing, replace such a cylinder liner.
(2) Check for seizure, streak and corrosion on the sliding surface of cylinder liner.
(3) Dye check the rounded part of collar of cylinder liner for cracks.
(4) Check for corrosion and wear at the part of cylinder liner mated with the cylinder block.

4) Reassembly

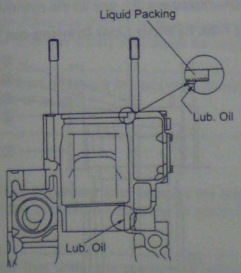
(1) Replace the O-rings of cylinder liner. Apply the lubricating oil or silicone oil to new O-rings, and fit them. Then, eliminate torsion from the O-rings.

> Before incorporating the O-rings, stretch them to check whether a crack has developed or not on their surface due to a change of temperature and humidity, for instance, with time if stored under improper condition.

(2) Just before incorporating the cylinder liner, apply the silicone-based liquid packing (Three-Bond 1211 or its equivalent) to the upper section of cylinder block. Moreover, apply the lubricating oil to the mated part of the cylinder liner and block.
(3) Attach the aforementioned exclusive tools ② thru ⑧ to the cylinder liner. Then, aligning the mark 0 (zero) of the cylinder liner and the punched mark of the cylinder (block), incorporate the cylinder liner into the cylinder, block. (Do not use the spacer ① for this incorporation.)

> After having overhauled and serviced the cylinder liner, check for a water leakage form the O-ring part when filling the water tank with cooling water and when running the engine for testing.

Drawing 7-26. Liquid Packing & Lub. Oil Applying Points

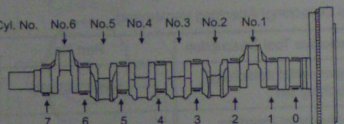


7-4. Main Bearing & Crankshaft

Each throw of the crankshaft is equipped with two balance weights of which shape varies with the service rotatory speed of a machine driven by the engine.
At the timing gear case behind the journal for the No.1 cylinder, another main bearing is mounted, and further at the head, a thrust bearing is incorporated. Thus, this crankshaft is equipped with eight bearings in total.
The main bearing cap is of the suspension metal structure fixed to the cylinder block with two clamping bolts (with the tightening nuts tightened to the specified hydraulic pressure) and two side bolts (tightened to the specified torque).

Side bolts
The side bolts for the datum part (No.0) main bearing cap are equipped only on the non-operating side. To the No.1, 2, 6 & 7 main bearing caps, side bolts of different lengths are provided to clamp also the engine supporting feet.

Drawing 7-27. Main Bearing Numbers



Main brg. cap No.		7	6	5	4	3	2	1	0
Tightening nut stamped No.	On the op. side	71	61	51	41	31	21	11	01
	On the non-op. side	72	62	52	42	32	22	12	02

7-4-1. Main Bearing

Any main bearing cap cannot be taken out through the cylinder side cover. Check or replace a main bearing metal from the operating side according to the following procedures:

1) Disassembling preparation

(1) Prepare the following exclusive tools:

[For the hydraulic pump & hydraulic jack type]

Chapter7-0. 5) Handling Procedures for Hydraulic Jack (p.7-5)

[Main Bearing Cap Drawing-out Implement]

No.	Exclusive Tool Description	Part No.
①	Body	146673-92100
②	Mounting bolt (M10 × 60)	26206-100602
③	Drawing-out bolt	26206-121554
④	Nut	26706-120002

[Main Bearing Cap Holding Implement]

No.	Exclusive Tool Description	Part No.
⑤	Bolt	146673-92120
⑥	Circular nut	146673-92110

[Upper Metal Detaching/ Attaching Implement]

No.	Exclusive Tool Description	Part No.
⑦	Upper metal detaching/ attaching pin	146673-92970
⑧	Upper metal inserting implement	146673-92950

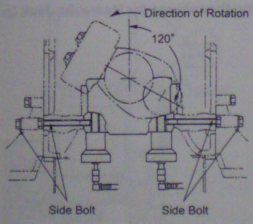
(2) To facilitate the check or replacement work, set the piston adjacent to the main bearing to be disassembled at a position about 120° before the T.D.C.

2) Disassembly

(1) Fit a hydraulic jack, and connect it with a hydraulic pump.

Take out t the rubber hose in a direction to facilitate the work.

Drawing 7-28. Hydraulic Jack Fitting Procedures



Chapter7-0. 5) Handling Procedures for Hydraulic Jack (p.7-5)

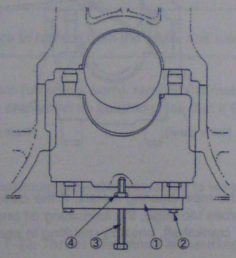
(2) Remove the side bolts from the main bearing to be disassembled.
(3) Loosen the main bearing cap clamping nuts, applying the hydraulic pressure to the hydraulic jack.

If the main bearing cap cannot be drawn out due to its own weight:
- ○ Loosen the side bolts of the adjacent main bearing caps.
- ○ Loosen the main bearing cap tightening nuts two to three turns, and then draw out the main bearing cap using the drawing-out tools.

Lock the drawing-out tool body ① to the main bearing cap bolts with the bolts ② . Then, screw the bolt ③ to the main bearing cap, and turn the nut ④ to draw out the main bearing cap.

(4) Remove the main bearing cap tightening nuts, and attach the main bearing cap holding implement to the main bearing cap clamping bolts.

Drawing 7-29. Main Bearing Cap Drawing-out Procedures

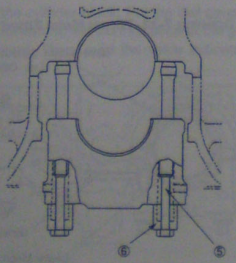


⚠ CAUTION

Do not remove both tightening nuts simultaneously. Otherwise, the main bearing cap may fall, resulting in injury.

Screw each circular nut ⑥ into the corresponding holding bolt ⑤ to lock the holding bolt with the corresponding main bearing cap clamping bolt. Adjust the position of circular nuts to make them hold the main bearing cap.

Drawing 7-30. Main Bearing Cap Holding Procedures



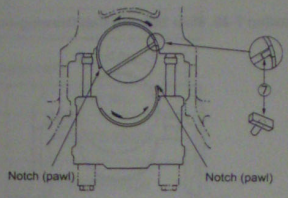
(5) Remove the main bearing lower metal.
(6) Remove the upper metal.

Fit the attaching/ detaching pin ⑦ to the crankshaft oil hole from the no-operating side (so that the head of attaching/detaching pin lies along the outer periphery of crankshaft). Slowly turn the flywheel in the direction of engine rotation, and draw out the upper metal to the operating side.

Disassembly & Reassembly of No.0 bearing cap

Thrust metals are equipped on both the front and the rear of the datum part (No.0) main bearing cap.
- Remove the lub.oil pump and side bolt on the non-operating side first, and then disassemble the No.0 bearing cap in the same way as for the No.1 thru 7 main bearing caps.

Drawing 7-31. Metal Drawing-out Procedures



3) Checking & servicing

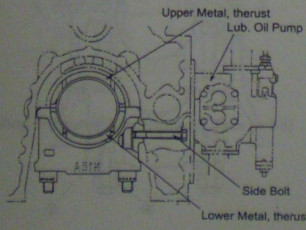
Carefully check and service the main bearing metals. If the clearance between the crankshaft and the main bearing metals becomes too large, the lubricating oil pressure drops to burn out the metals and increase the deflection of crankshaft, possibly resulting in serious accidents such as a breakage of the crankshaft.

(1) Check for hit marks and flaws on the mated and fitted surfaces of main bearing cap with and to the cylinder block.
(2) Check for hit marks on the mating surface and rear of the main bearing metal, and also check for flaws, seizures and imbedded foreign matters on their sliding surface.

△

Do not correct the rear and slicing surface of any main bearing or thrust metal because such a corrective repair changes the clearance between the metal and the crankshaft.

Drawing 7-32. Thrust Metal Fitted State



(3) Check for looseness of main bearing cap clamping bolts.

Studding torque: 196^{+49}_{0} N · m (20^{+5}_{0} kgf · m)

(4) Measure the clearance between the crankshaft and the metal.

① An accurate method of measuring the clearance is to remove the crankshaft and then to measure its outer diameter and the inner diameter of a main bearing cap.
② To obtain the clearance without removing the crankshaft, place and about 0.5-mm dia. lead wire on the sliding surface of main bearing lower metal (along the outer periphery of crankshaft to prevent the lead wire from slipping with grease, etc.), tighten the main bearing cap tightening nuts to the specified hydraulic pressure, take out the lead wire, and then measure its thickness. You can determine the clearance between the crankshaft and metal from this thickness.

(5) If the clearance exceeds the maximum allowable value due to wear of the metal, replace it with the new one.

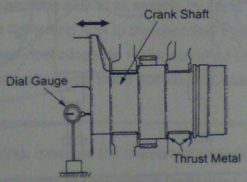
△ When replacing the metal, be sure to replace both the upper and lower metals as a pair.

If the crankshaft is excessively worn (unevenly worn), replace the metals with undersized metals.
Also, it is necessary to rework the crankshaft by polishing it so that it fits with the new undersized metals.

[Thrust metals]

(1) Check for wear and burnout.
(2) If the clearance exceeds the maximum allowable value due to wear, replace both the upper and lower metals as a pair.

Drawing 7-33. Thrust Clearance Measuring Procedures



① Fix the dial gauge stand to the cylinder block. Put the dial gauge in contact with the crankshaft. Then, move the crankshaft forward to set the indication of the gauge to zero.
② Move the crankshaft backward. Then, read the value indicated by the gauge. The indicated value is the thrust clearance.

(3) When incorporating thrust metals, observe the following points:

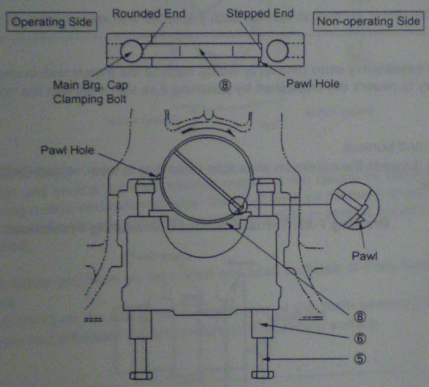
① Incorporate each one of the upper and lower metals of the frontal and rear parts at the respective former point, not mistaking one for other.
② Incorporate the upper metal by mating its printed part with the cylinder block side and sliding it along the crankshaft.
③ Incorporate the lower metal, mating its groove with the crankshaft side.

4) Incorporation of main bearings

Reassemble main bearings in the following sequence:

(1) Turn the flywheel to lower the oil hole in the crankshaft below the center of crankshaft.
(2) Directing the pawl of the upper metal toward the non-operating side, insert the upper metal along the crankshaft.

Drawing 7-34. Upper Metal Incorporating Procedures



Position the upper metal in the forward-backward direction so that its pawl will mate with the pawl hole in the cylinder block.

(3) Attach the upper metal inserting implement ③ to the main bearing cap (from which the lower metal is detached).

Attach the implement, mating its one curved end with the outer periphery of a main bearing cap clamping bolt on the operating side and aligning the other stepped end with the inner periphery (on the pawl hole side) of main bearing cap.

(4) Insert the attaching/ detaching pin ⑦ to the crankshaft oil hole on the non-operating side.

Put the head of metal attaching/ detaching pin along and in close contact with the outer periphery of crankshaft with the proper grease so as not to allow the pin to fall during turning.

(5) Tighten the circular nuts ⑥ of the main bearing cap holding implement until the upper metal inserting implement ⑧ is about to make contact with the rear of the upper metal.

(6) Slowly turn the flywheel in a direction reverse to the direction of engine rotation.

Make sure the side of pawl of the upper metal is in contact with the side of the metal inserting implement. If they are not in contact, the pawl does not fit in the pawl hole.

(7) When the pawl of the metal has been aligned with the pawl hole in the cylinder block, continue turning the flywheel until the metal end aligns with the cylinder block end.

(8) Loosen the circular nuts ⑥ to lower the main bearing cap. Remove the metal attaching/ detaching pin ⑦ and metal inserting implement ⑧ . Then, incorporate the lower metal.

(9) Tighten the circular nuts ⑥ and remove the holding bolts ⑤ . Then, fit main bearing cap tightening nuts.

CAUTION

Fit the tightening nuts one side a time. When a main bearing cap falls under its own weight, there is a fear you might be injured.

(10) Tighten the nuts until the main bearing cap makes a close contact with the cylinder block.

If the side bolts of main bearings adjacent to the main bearing involved in disassembly have been loosened, first tighten the side bolt on the non-operating side, and then the side bolt on the operating side to the specified torque.

(11) Tighten the side bolt on the non-operating side to half of the specified torque. (Have the bolt on the operating side removed in advance.)

(12) Tighten the side bolt on the operating side to its seating by hand.

(13) Tighten the main bearing cap tightening nuts to the specified hydraulic pressure.

(14) Tighten the side bolt on the non-operating side to the specified torque.

(15) Tighten the side bolt on the operating side to the specified torque

After incorporating the main bearing, measure the crankshaft deflection.

Chapter 6, 6-3-17. Measurement of Crankshaft Deflection (p.6-34)

7-4-2. Crankshaft

The crankshaft requires careful checking and measurement because it may be broken or burnt out if you continue running under the following states of crankshaft:

① Uneven wear of crankshaft
② Excessive clearance between the crankshaft and main bearing metal due to wear of crankshaft
③ Running exceeding the allowable value of crankshaft deflection
④ Running at critical region of torsional vibration rotatory speed.

1) Disassembling procedures

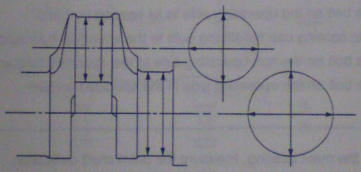
In either case of removing the crankshaft downward by lifting the engine or removing the crankshaft up ward by inverting the engine, fit the rope to the No.2 & 5 crank-pin parts, and remove the crankshaft vertically. (The engine lifting tool is optionally available.)

2) Checking & measurement

(1) Check for flaws, improper contact and abnormal wear of the bearings.
(2) Dye the root rounded part of crank arms.
(3) Check for looseness of balance weight clamping bolts.
(4) Measure the dimensions of bearings and check for uneven wear.
(5) Measurement of crankshaft deflection
For measuring procedures, refer to the following:

Chapter 6, 6-3-17. Measurement of Crankshaft Deflection

Drawing 7-35. Crankshaft Bearing Part Measuring Points



In a burnout of the crankshaft bearing part, not only the correction and replacement o main bearing or thrust metals but also check for hair cracks through measurement of the surface hardness and magnetic flaw detection.

Crank shaft surface hardness	Should be HS 65 ~ 85.
Hair crack	Should not be detected.

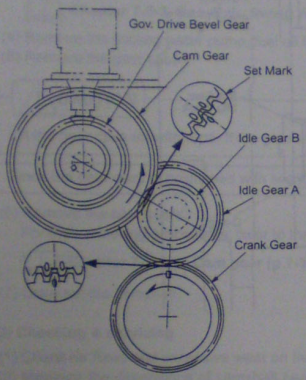
7-5. Timing Gear, Camshaft & Suc./Exh. Swing Arm

7-5-1. Timing Gear

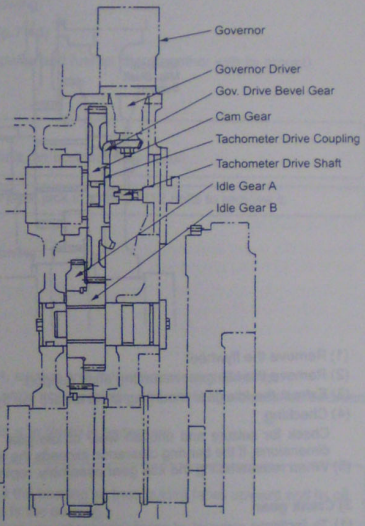
Even under the condition of normal operation, there is a wear of gears. This may cause a pitching wear, plucking and hair cracks on the tooth surface.
Besides, since the wear is related to noise and vibration periodically check the backlash of gears and contact of tooth surface.
When disassembling the timing gears, measure the backlash of gears. If the measurement exceeds the allowable value, replace the pertinent gear of bearing with the new one.

A set mark is stamped on the side of crank gear, idle gear A, idle gear B and cam gear. When assembling the timing gears, set the No.1 (or No.6) cylinder at the B.D.C., and align the set marks.

Drawing 7-36. Timing Gear Set Marks



Drawing 7-37. Cam Gear Disassembling Procedures



1) Cam gear

> The governor drive bevel gear is incorporated to the cam gear, and they are incorporated to the camshaft together with the tachometer drive coupling.

Disassemble (or reassemble) the cam gear according to the following sequence with the cover of timing gear case removed:

(1) Remove the governor and governor driver.
(2) Remove the tachometer drive shaft.
(3) Remove the cam gear clamping bolt and tachometer drive coupling.
(4) Draw out the cam gear toward the flywheel side, and remove the gear through the window of timing gear case.

(5) Cam gear clamping procedures

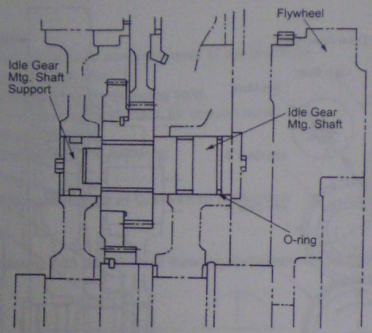
- Mating the number stamped on the head of cam gear clamping bolt with the number stamped on the side of cam gear, incorporate the bolt into the gear.
- When tightening the cam gear clamping bolt, apply the seizure inhibitor (Three-Bond 1910 or its equivalent) on the bearing surface and threaded part of the bolt, and then tighten the bolt to the specified torque.

2) Idle gears

Extract the idle gear mounting shaft toward the flywheel side, and then take the idle gears out from the window of timing gear case.

The idle gears A & B have been shrink fitted.

Drawing 7-38. Idle Gears Disassembling Procedures



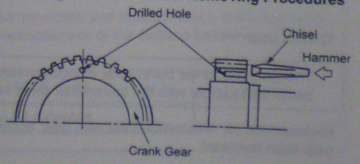
(1) Remove the flywheel.
(2) Remove the idle gear mounting shaft support.
(3) Extract the idle gear mounting shaft toward the flywheel side.
(4) Checking
Check for seizure and uneven wear of idle gear shaft bearing and mounting shaft, and measure the dimensions, If the bearing clearance exceeds the allowable value, replace the bearing or mounting shaft.
(5) When reassembling the idle gear assembly, replace the O-ring of the idle gear mounting shaft.

3) Crank gear

(1) To facilitate removal of crank gear, drill a hole below the bottom land of the gear, and drive a chisel into this hole. This will loosen fitting, and thus the gear can be easily removed.

Take care not to damage the positioning knock pin.

Drawing 7-39. Crank Gear Removing Procedures



(2) Before incorporating the crank gear, put it in the oil bath, and hear the bath to about 150 to 190 ℃ , leave the gear in the bath for about 60 minutes, and then take it out of the bath. After that, quickly insert the crank gear to the crankshaft.
Refrain from heating the crank gear with a burner or the like, otherwise the temperature will rise excessively to change the structure of the material and to decrease its strength. Instead, use of an oil bath is recommended for this purpose.

7-5-2. Camshaft

The fuel cam and suction and exhaust cams form a monoblock structure with the camshaft. The camshaft is split in two at the bearing part between the No.3 & No.4 cylinders and coupled by reamer bolts.
If the engine installation site does not have space enough to extract the camshaft in one piece, split it, and then draw out two parts from the engine.
Draw out the camshaft toward the front side (the side opposite to the flywheel).

1) Disassembly

Disassemble the camshaft according to the following procedures:

(1) Remove the bonnet, and then rocker arm shaft pedestal and push rod.
(2) Disconnect the fuel injection pipe joint, and then remove the fuel injection pump and fuel injection pump driver.
(3) Remove the suc./exh. swing arm.
For their removing procedures, refer to the following:

Chapter 7-5-3. Suc./Exh. Swing Arm (p.7-40)

(4) Remove the cooling water pump, fuel oil feed pump and fuel oil filter (together with its mount).
(5) Remove the gear case.

CAUTION

Lift the gear case up with rope. If the gear case falls, an accident may occur.

Since the gear case is positioned with two knock pins, jack it up with M12 bolts to remove it.

(6) Remove the cam gears.
For their removing procedures, refer to the following:

Chapter 7-5-1, 1) Cam gear (p.7-37)

(7) Draw out the camshaft.

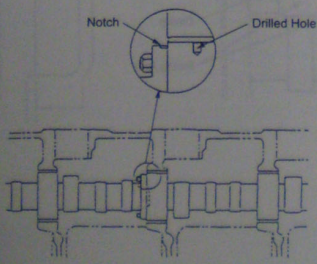
2) Checking & servicing

(1) Check for flaws and excessive wear on the fuel, suction and exhaust cams and bearings.
(2) Measure the dimensions of camshaft bearing parts and bearings, and check the clearance between each bearing and the shaft.
(3) To replace a camshaft bearing by press fitting it, a jig (jack) is necessary.

△

When incorporating a bearing to the camshaft, put the bearing so that its joint faces upward and its oil hole is mated with oil hole of camshaft, and press fit the bearing.

Drawing 7-40. Camshaft Coupling Part



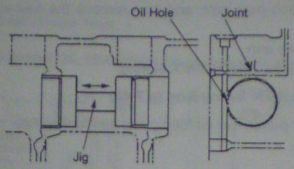
3) Reassembly

Reassemble the camshaft in the sequence reverse to that of disassembly, paying attention to the following points:

(1) Make the camshaft coupling surfaces free from adherent foreign matters and lubricating oil. Then, align the notch with the drilled hole to reassemble the camshaft.

(2) Tighten U-nuts of the coupling part only after applying the seizure inhibitor (Three-Bond 1910 or its equivalent) to their threaded part and bearing surface.

Drawing 7-41. Camshaft Bearing Press-fitting Procedures



7-5-3. Suc./Exh. Swing Arm

The valve mechanism forcedly lubricates the roller pins by the swing arm system.

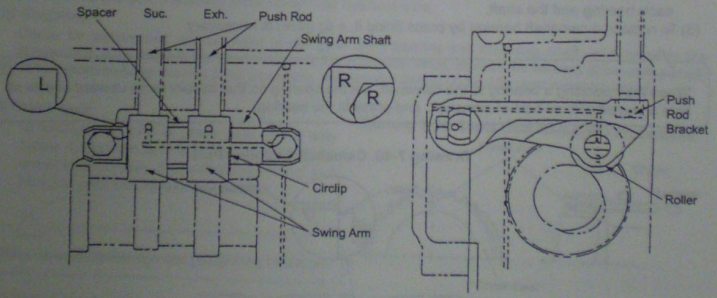
1) Disassembly

Remove the rocker arm shaft pedestal and push rods, and disassemble the swing arm assembly according to the following procedures:

(1) Remove the cover of cam case. Loosen the swing arm shaft clamping bolts, and remove the arm shaft and arm together as a set.

(2) Remove the circlips form the arm shaft with use of circlip pliers (P/#28190-000020), and then remove the swing arms and spacers.

Drawing 7-42. Swing Arm Disassembling Procedures



2) Checking & servicing

(1) Check if the roller rotates unsmoothly (is catching) and for flaws on the outer periphery and one-sided contact of roller.(If any defect is detected, replace the swing arm with the new one by assembly.)

(2) Check for jolting of a push rod. Measure the dimensions of the arm shaft and arm shaft bearing, and if a measurement exceeds the usage limit value, replace the shaft or the arm.

3) Reassembly

Reassemble the suc./exh. swing arm assembly in the sequence reverse to disassembly.

(1) Check for deformation or missing of collar of swing arm shaft clamping bolt holes.

(2) Incorporate the swing arm shaft so that its set mark "R" is positioned on the right side. Screw the clamping bolts with the set mark "R" on the right side and with the set marl "L" on the left side.

△

Do not make a mistake in this incorporation. If not incorporated properly, the lubricating oil passage is shut, resulting in burnout of the arm shaft and roller pins.

(3) After having incorporated the rocker arm shaft pedestal, adjust the suc./exh. valve head clearance. For the adjustment procedures, refer to the following:

Chapter 6, 6-3-6. Adjustment of Suc./Exh. Valve head clearance

7-6. Fuel Injection Pump & Pump Driver

7-6-1. Fuel Injection Pump

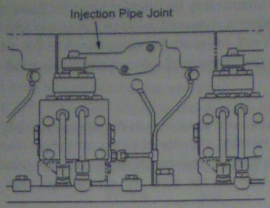
Pay full attention to handling of the fuel injection pump in its disassembly & reassembly since it has been made precisely and even minute foreign matters and hit mark may cause it to be burnt out or its malfuncion.

1) Disassembly

(1) Prepare the following exclusive tools:

Exclusive Tool Description		Part No.
Socket wrench for pump mounting	On the flywheel side	146673-92550
	On the anti-flywheel side	146673-92570
Hexagonal wrench key (8 mm)		28150-080000
Hexagonal wrench key (6 mm)		28150-060000

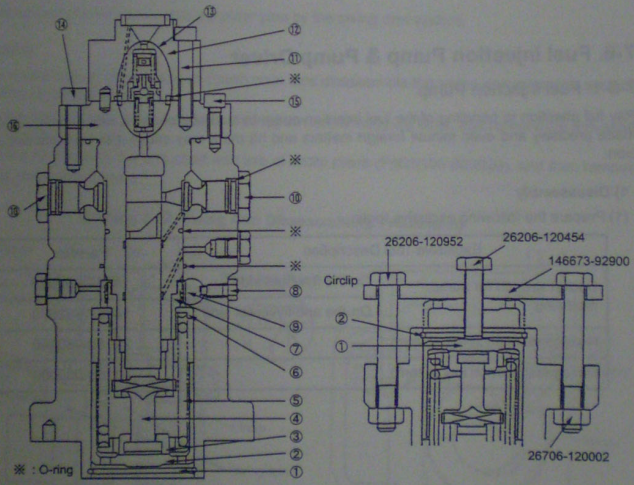
Drawing 7-43. Fuel Injection Pump Removing Procedures



(2) Next, remove the fuel injection pump in the following sequence:
Remove the fuel injection pipe joint, overflow oil pipe, fuel oil inlet pipe, fuel oil outlet pipe, and pinion lub. oil pipe (H.F.O. specification only).
(3) Using the exclusive socket wrenched, loosen the fuel injection pump tightening nuts to remove the pump.
(4) Disassemble the fuel injection pump, paying attention to following points:

- ○ Be sure to handle the plunger ④ and barrel ⑯ as a pair.
- ○ When removing the pressure equalizing valve body ⑫ , take care not to lose any parts of pressure equalizing valve ⑬ .

Drawing 7-44. Fuel Injection Pump Disassembling Procedures



Disassemble the fuel injection pump in the ascending sequence of numbers shown in Drawing 7-44. Invert the pump, and remove the circlip ① with use of the pertinent exclusive tool. Then, remove the parts ② thru ⑦ .

⚠ CAUTION

When taking off the circlip ① from the groove, wrap it with cloth or the like to prevent the circlip from springing off to inflict you an injury.

2) Checking & servicing of fuel injection pump

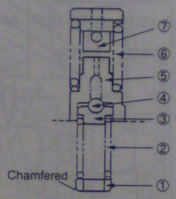
Wash each part cleanly, and take care not to allow it to be rusted.

(1) Check if the spring of pressure equalizing valve ⑬ is not broken.
(2) Check if the mating surfaces of pressure equalizing valve body ⑫ and barrel ⑯ are free from blow-by of fuel.
(3) Check for flaws or sludge stuck on the outer periphery of plunger ④ .
(4) Clean the oil hole of barrel and pinion lub. oil hole of the pump body.
(5) If the tip part of deflector ⑩ is dented by corrosion, replace it.
(6) Replace each O-ring with the new one.

3) Reassembly

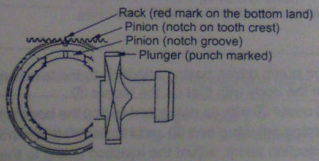
Reassemble the fuel injection pump in the sequence reverse to disassembly, paying attention to the following points:

Drawing 7-45. Pressure Equalizing Valve Parts Incorporating Sequence



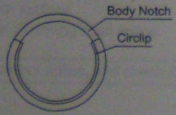
(1) After having incorporated each O-ring, make sure it is not warped.
(2) Apply the lubricating oil to the barrel, and incorporate it to the body.
(3) Incorporate the parts of pressure equalizing valve ⑬ in the ascending sequence of numbers shown in Drawing 7-45.
(4) Tighten the barrel clamping bolt and pressure equalizing valve body clamping bolt ⑪ evenly in three steps to the specified torque.
(5) Align the set marks of rack ⑨ , pinion ⑦ and plunger ④ .

Drawing 7-46. Set Marks of Racks, Pinion & Plunger



(6) When incorporating the circlip ① , push in the plunger guide ② while checking the move of rack ⑨ not to allow the pinion ⑦ to be damaged by the collar of plunger ④ .
(7) Align the opening of circlip with the notch of the body.

Drawing 7-47. Circlip Incorporating Procedures



(8) After reassembling the fuel injection pump, makes sure the rack moves smoothly.

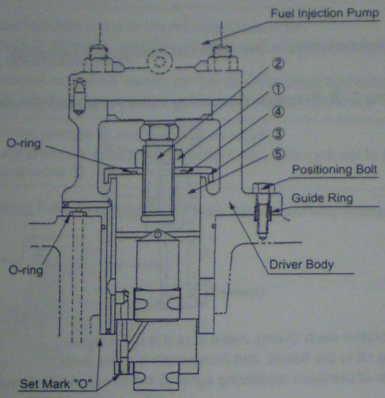
7-6-2. Fuel Injection Pump Driver

The fuel injection pump driver adopts the tappet roller system that forcedly lubricates the roller pin. Besides, on the body of the pump, the oil hole for lubricating the outer periphery of the roller is provided.

1) Disassembly

Remove the fuel injection pump and then the positioning bolt. After that, remove the driver form the cylinder, and disassemble it in the ascending sequence of numbers shown in Drawing 7-48.

Drawing 7-48. Pump Driver Disassembling Sequence



2) Checking & servicing

(1) Check for one-sided contact and flaws on the outer periphery of roller.
(2) Check if the roller rotates smoothly.
(3) Blow the air into the oil hole in the body to check for clogging.
(4) Replace the O-rings shown in Drawing 7-48. with new ones.

3) Reassembly

Reassemble the fuel injection pump driver, paying attention to the following points:
(1) Align the set mark "O" on the body with that on the tappet ⑤ .
(2) Incorporate the oil shield cover ③ with its notch part facing the operating side.
(3) Fully screw in injection timing adjusting bolt ② , and incorporate it in position.
(4) After mounting the fuel injection pump, adjust the injection timing to the specified timing.
For the injection timing adjusting procedures, refer to the following:

Chapter 6, 6-3-4. Adjustment of Fuel Injection Timing (p.6-12)

7-7. Governor & Governor Gear

7-7-1. Governor

The engines can be equipped with one of the three types of hydraulic governors depending on their specifications. For each governor, refer to its operation manual provided separately.

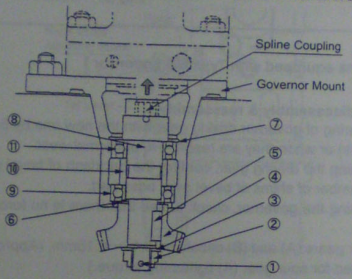
△

○ Before removing the governor, record the speed regulation and status of each adjusting point.
○ When removing the governor, do not give an impact to the gear shaft, terminal shaft, speed control shaft, etc.

7-7-2. Governor Gear

The governor gear is drive via the bevel gear on the camshaft gear side. The governor is driven by the governor gear via a spline coupling.

Drawing 7-49A. Type NZ (or RHD) Governor Driver



1) Disassembly

Either of two types of governor gears is applicable to the governor used.

△

When removing the governor, take it out vertically, paying attention not to flaw the driving shaft spline.

[In the case of an engine equipped with Type RHD governor]
(1) Disassemble the governor gear in the ascending sequence of numbers shown in Drawing 7-49A.

○ Loosen the gear tightening nut ② , and remove the parts ③ thru ⑥ to the gear side.
○ Remove the circlip ⑦ with use of circlip pliers. Remove the spline coupling to the governor side.
(The bearings ⑨ & ⑪ are press-fitted to the driving shaft ⑧ .)

2) Checking & servicing
(1) Check the contact of bevel gear tooth surface.
(2) Check the contact and stepped wear of driving shaft spline.

Fit the driving shaft spline with the governor spline, and check if jolting is not excessive.

(3) Replace the ball bearings every 8,000 to 10,000 hours even if their appearance is free from abnormality.

When incorporating the ball bearings ⑨ & ⑪ to the driving shaft, press fit them, applying the load to the inner race of the bearings.

3) Reassembly

Reassemble the governor gear in the sequence reverse to disassembly.

(1) Mount the governor gear, and check the backlash of the bevel gear.

To adjust the backlash, remove the bevel gear ④ from the driving shaft, and adjust the thickness of adjusting shim ⑥ .

When mounting the governor, let its spline fit with the governor gear spline under the governor own weight.

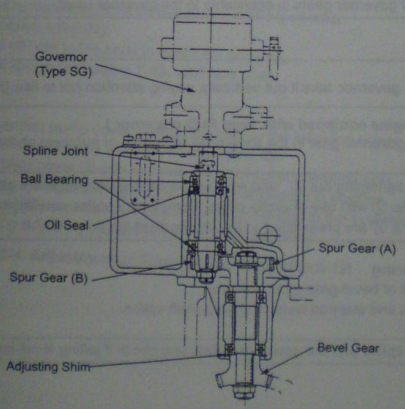
[In the case of an engine equipped with Type SG governor]

Governor driving gear

Item of importance for disassembly & reassembly

(1) Replace the ball bearing of governor driving gear with the new one by 6,000 ~ 8,000 hours of operation (about two years) or when they are resulted in abnormal wear.
(2) At the time of attaching the driving gear, confirm the backlash of bevel gear, and adjust the backlash by regulating the number of shims of bevel gear boss part.
(3) At the time of attaching the governor, check to see that there is no forcing to fitting of governor shaft and spline coupling.
(4) The backlash of spur gears (A) and (B) should be 0.1 ~ 0.15mm. (Approximately 98 ~ 118N-m (10 ~ 12kgf/m) is suggested for spur gear (A) tightening torque.)
(5) Pay attention to the direction of oil seal. (The correct direction is that the oil seal faces downward.)

Drawing 7-49B. Type SG Governor Driver

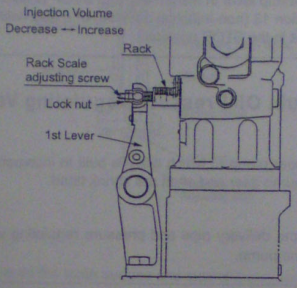


7-7-3. Coupling Adjustment of Governor

Improper coupling of the governor and fuel injection pump may adversely affect the performances of governor, disable the engine from stopping and cause the rotational speed to rise excessively. After having serviced or replaced the fuel injection pump and/or governor, adjust this coupling according to the following sequence.

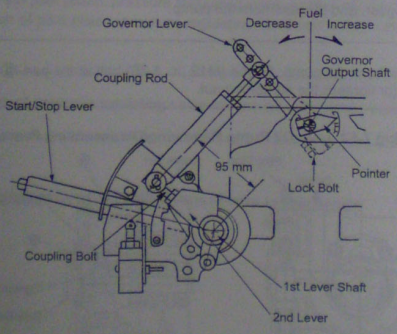
(1) Check if the clearance between the coupling rod and the connecting pin on both ends od coupling rod is not excessive.
(2) Set the start/stop lever in the STOP position.
(3) Make the rack scales of fuel injection pumps of all cylinders set to the same position within the range of graduation 9 to 10.
(At this time, also make sure the first lever moves smoothly.)

Drawing 7-50. Fuel Injection Pump Rack Adjusting Procedures



1) If the Type NZ (or RHD) governor is equipped

Drawing 7-51. Type NZ (or RHD) Governor Connecting Procedures



(4) Adjust the screwing-in of the 2nd lever coupling bolt so that the distance between the center of the 1st lever shaft and the center of the coupling rod becomes about 95mm.
(5) Connect the coupling rod to the 2nd lever coupling bolt.
(6) Insert a blade screwdriver into the governor output shaft end, fully turn the shaft in the fuel DECREASE direction so as to set the pointer at the FUEL "0" indication.
(7) Incorporate the governor lever to the governor output shaft. (Loosen the governor lever lock bolt in advance.)
(8) Connect the coupling rod to the governor lever. (The governor lever has four holes. Connect the coupling rod with the same hole as connected before disassembly.)
(9) Insert a blade screwdriver into the governor output shaft end, set the pointer to the FUEL "1" indication, and tighten the governor lever lock bolt.

① Check that both ends of coupling rod are not twisted.
② Alternately setting the star/stop lever in the START and STOP positions, and make sure each rack scale is set at the graduation 13 (non-injection position) of a less (within the range of graduation 9 to 10) while the lever is set in the STOP position.

7-8. Lub. Oil Pump, Lub. Oil Pressure Regulating Valve & Lub. Oil Cooler

7-8-1. Lub. Oil Pump

The lubricating oil pump is a gear pump of which body is built in incorporates with a pressure regulating valve and a safety valve. The pump gear and shaft are shrink fitted.

1) Disassembly

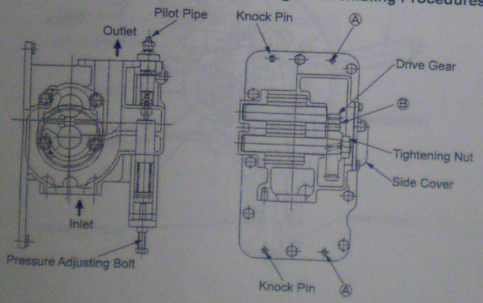
(1) Disconnect the suction pipe, delivery pipe and pressure regulating valve pilot pipe from the lub. oil pump, and then remove the pump.

The pump is positioned with knock pins. Remove the pump by fitting the pump mounting bolts to the respective disassembling threaded holes Ⓐ and jacking up the pump.

(2) Disassembly of lubricating oil pump
remove the pump drive gear, and disassemble the pump.

Detach the side cover from the pump. Fit the (M12 × 1.75) bolt at the part Ⓑ of the driving gear to lock it. Then, loosen (or tighten) the tightening nut.

Drawing 7-52. Lub. Oil Pump Removing/Disasembling Procedures

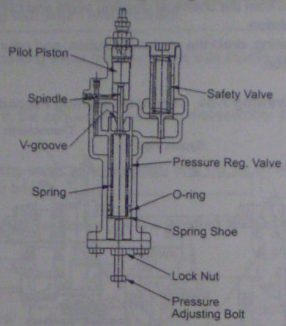


(3) Disassembly of the lub. oil pressure regulating valve & safety valve

CAUTION

Be careful of a spring which springs out from the safety valve and/of pressure regulating valve in disassembly to inflict you an injury.
Disassemble the pressure regulating valve after loosening the pressure adjusting bolt.

Drawing 7-53. Pressure Regulating Valve & Safety Valve



2) Checking & servicing

[Pump body & pump gear]

(1) Check for flaws and seizure on the tooth surface and side of the pump gear.
(2) Check for flaws and seizure on the pump gear shaft and gear shaft bearing.
(3) Measure the clearance between the pump gear and the pump body at the bearing part. If the measurement exceeds the allowable value, replace either part whichever is worn more than the other.

[Pressure regulating valve & safety valve]

(1) Check for flaws on the pilot piston, pressure regulating valve, safety valve and valve springs.
(2) Check the operation of pilot piston, pressure regulating valve and safety valve, and make sure they operate properly.

Directing the V-groove of pressure regulating valve toward the pilot piston, incorporate the pressure regulating valve.

3) Reassembly

Reassemble the lubricating oil pump in the sequence reverse to disassembly.

7-8-2. Lub. Oil Cooler

The lub. oil cooler is of the multi tubular type, and chemical cleaning seats that enable cleaning of the oil cooler without removing it are equipped on the lubricating oil passage side.

1) Chemical cleaning procedures

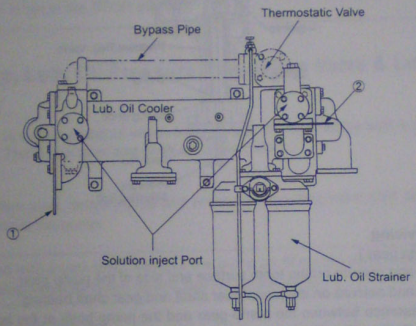
The hose, pump and the like required for chemical cleaning are not included in the standard provision of this engine.

(1) Drain the lubricating oil from the oil cooler, rearrange the respective baffle plates ① , ② & ③ at the oil cooler inlet and outlet.

(2) Remove the round covers from the chemical cleaning seats and connect a hose with each seat. Then, circulate the cleaning solution.

(3) After having finished cleaning, drain the cleaning solution, and return the baffle plates and round covers to their former condition.

Drawing 7-54. Chemical Cleaning Procedures



To prevent the cleaning solution from being mixed into the lubricating oil, be sure to treat the oil cooler after chemical cleaning.

2) Disassembly

Drain the lubricating oil from the lub. oil cooler, fix the cooler body with rope, and remove it from the engine.

(1) Remove the lub.oil strainer.

(2) Remove the caps from the cooling water inlet and outlet.

(3) Remove the lub. oil thermostatic valve.

(4) Remove the cooling water pipe assembly.

3) Checking & servicing

(1) For checking and servicing of lub. oil strainer and lub. oil thermostatic valve, refer to the followings:

Lub. oil strainer: Chapter 6, 6-3-12 (p.6-27)
Thermostatic valve: Chapter 6, 6-3-8 (p.6-20)

(2) Clean the pipe on the cooling water side and lubricating oil side of cooling water pipe assembly.

- Descale the pipe on the cooling water side with a long-handle brush.
- For the pipe on the lubricating oil side, cleaning combining washing with such a sludge cleaning agent as Neos and cleaning with steam is appropriate.

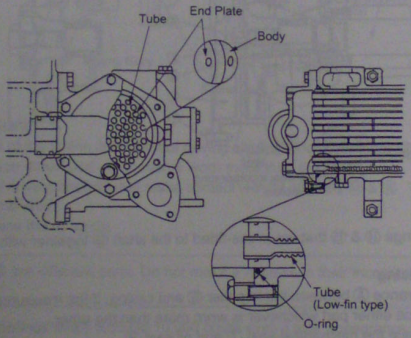
(3) Replace the O-rings at the cooling water inlet and outlet side covers with new ones.

4) Reassembly

Reassemble the lub.oil cooler in the sequence reverse to disassembly, paying attention to the following points:

(1) Align the set marks of cooling water pipe assembly and lub. oil cooler body when incorporating the pipe assembly to the cooler body.

Drawing 7-55. Set Marks (on The Cooling Water Outlet Side)



7-9. Cooling Water Pump

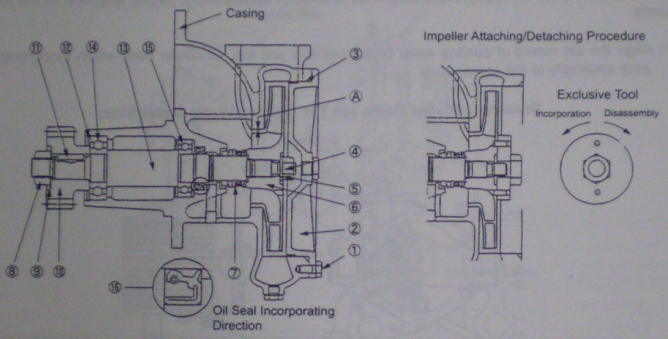
The cooling water pump is a centrifugal pump. The only difference between the high-temperature water side and the low temperature water side is the direction of cooling water inlet and outlet. The impeller is incorporated to the shaft by screw tightening.

> Note that the thread of impeller and that of impeller tightening nut are reverse handed. When disassembling/reassembling the cooling water pump, be careful of the loosening/tightening direction.

1) Disassembly

Disassemble the pump in the ascending sequence of numbers shown in Drawing 7-56. Remove the impeller ⑥ with use of the specified exclusive tool (P/#146673-92750).

Drawing 7-56. Cooling Water Pump



Remove the ball bearings ⑭ & ⑮ that are press-fitted to the shaft ⑬ together with the shaft.

2) Checking & servicing

(1) Measure the clearance Ⓐ between the impeller ⑥ and casing. If the measurement exceeds the allowable value, replace either part whichever is worn more than the other.

(2) If necessary, replace the mechanical seal ⑦ and oil seal ⑯.

> Do not make a mistake in the incorporating direction.

(3) Replace the ball bearings every 8,000 to 10,000 hours even if their appearance is free from abnormality.

> When press-fitting a bearing to the shaft, apply the load on the inner race of the bearing.

3) Reassembly

Reassemble the cooling water pump in the sequence reverse to disassembly, paying attention to the following points:

(1) When incorporating the shaft, be careful not to flaw the lip of oil seal.

(2) Tighten the impeller ⑥ and impeller tightening nut ④ to the specified torque.

7-10. Fuel Oil Feed Pump

The fuel oil feed pump is a gear pump. The pump gear on the driving shaft side are coupled to the shaft through a spline.

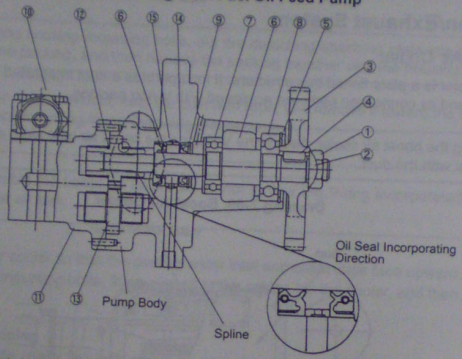
1) Disassembly

Disassemble the pump in the ascending sequence of numbers shown in Drawing 7-57.

(1) Remove the ball bearings ⑦ & ⑧ that are press-fitted to the driving shaft ⑥ together with the shaft.

(2) When replacing the oil seal, detach the circlip ⑨ , and draw out the seal toward the driving gear ④ side.

Drawing 7-57. Fuel Oil Feed Pump



2) Checking & servicing

(1) Check the contact of the spline fitting part of driving shaft ⑥ and pump gear ⑫ . If the clearance (play) is too large, replace either part whichever is worn more than the other.

(2) Check the parts of driving shaft ⑥ that make contact with its oil seals ⑭ & ⑯ . Then, if the wear is substantial, replace the shaft.

(3) If necessary, replace the oil seals.

> The oil seals ⑭ & ⑯ are different parts. Do not make a mistake in their incorporating position and direction.

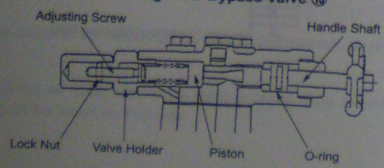
(4) Replace the ball bearings every 8,000 to 10,000 hours even if their appearance is free from abnormality.

> When press-fitting the ball bearing to the shaft, apply the load on the inner race of the bearing.

(5) The bypass valve ⑩ functions also as a safety valve of fuel oil feed pump. During operation, keep the bypass valve closed.

- ○ Remove the plug and check the operation of piston.
- ○ If the fuel leaks from the handle shaft part, replace the O-ring.

Drawing 7-58. Bypass Valve ⑩



3) Reassembly

reassemble the fuel oil feed pump in the sequence reverse to disassembly, pay attention to the following points:

(1) When incorporating the shaft, be careful not to flaw the lip of oil lip seals.

(2) Apply a thin and uniform film of liquid packing (Three-Bond TB 1201 or its equivalent) on the mating surfaces of pump cover ⑪ and pump body.
(The thickness of the packing after clamping must be 0.02mm or less.)

(3) Align the hole of spacer ⑮ for oil seal with the over flow oil take-off hole of the body.

(4) Replace the bend washer ② with the new one every time the fuel oil feed pump is disassembled.

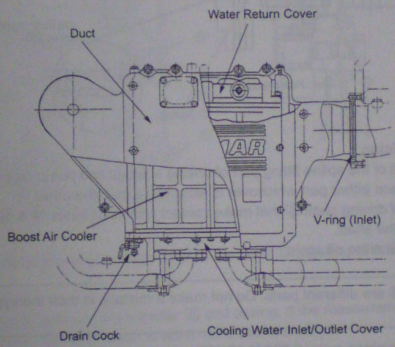
7-11. Suction/Exhaust System

7-11-1. Boost Air Cooler

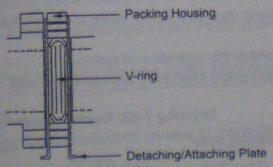
The boost air cooler is a plate finned box structure. It incorporates a duct integrated with the boost air inlet and outlet pipe, and its connection parts are equipped with V-ring packing.

When servicing the boost air cooler, detach the V-ring on the boost air inlet side, and then remove the cooler together with the duct.

Drawing 7-59. Boost Air Cooler



Drawing 7-60. Boost Air Inlet Side V-ring Removing Procedures



1) Disassembly

Disassemble the boost air cooler, removing its parts according to the following sequence:

(1) Prepare the following exclusive tools:

Exclusive Tool Description	Part No.
Packing (V-ring) detaching/attaching tool	146673-92800
Eyebolt (M12)	26610-12000

(2) Remove the boost air cooler thermal insulating plate, thermometer, cooling water pipe and so forth.

(3) Remove the V-ring on the boost air inlet side.

> Loosen the packing housing mounting bolts, put the detaching/attaching plate into both sides of the housing to hold the packing, and then remove the packing together with the housing.

(4) Fit an eyebolt on the top of duct, hold the duct with rope, and remove it toward the non-operating side.

(5) Remove the duct according to the following procedures:

> △ Carefully disassemble the boost air cooler so as not to flaw the V-ring incorporated part, otherwise this causes a boost air leak.

① Invert the boost air cooler so that the cooling water inlet and outlet caps face upward.

② Unscrew the duct mounting bolts, fit an eyebolt to the cooler, life the cooler, and then remove the duct from the cooler.

2) Checking & servicing

(1) Clean the air side (plate fin) with steam or soak it in the cleaning fluid, blow the compressed air against, it, and finally wash it in water.

> The appropriate cleaning fluid is the following products or their equivalents.
> Neos Co.,Ltd: Neos One-1
> Kurita Water Industries Ltd.: Emocon 1E55

(2) Remove the water return cover on the cooling water side. Then, clean the cooler interior, brushing with a long-handle brush.

(3) Check the coating on the inner surface of the duct and inner surface of the cooler side plate. If the coating has peeled off, repair it with the following paint.

> ○ Inner surface of duct (heat-resistant silicone paint)
> Oshima Kogyo: Pirojin IN Color G2 or its equivalent
> ○ Inner surface of cooler side plate (silicone epoxy pain)
> Oshima Kogyo: Silicone Epoxy ING #2

(4) Check for clogging of a drain hole.

(5) Replace the packings with new ones.

3) Reassembly

Reassemble the boost air cooler in the sequence reverse to disassembly, paying attention to the following points.

(1) Fit the V-ring on the boost air outlet side to the cylinder block. After mounting the boost air cooler, incorporate the V-ring on the boost air inlet side.

7-11-2. Exhaust Manifold

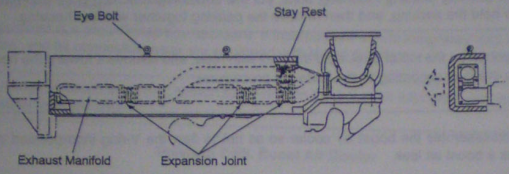
1) Disassembly

CAUTION

Lifting the exhaust manifold cover with use of a lifting use of a lifting eyebolt (P/#26610-100002) and a chain block or the like, remove the cover.

Disassemble the exhaust manifold while checking whether the steady rest and the clamping bolts are not loose.

Drawing 7-61. Exhaust Manifold & Expansion Joint



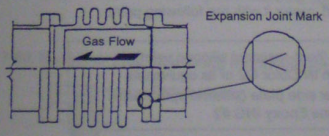
Be careful not to confuse stainless steel bolts and nuts of exhaust manifold, expansion joint and steady rest with those made of other material for clamping these parts.

2) Reassembly

(1) Apply the seizure inhibitor to each bolt or nut, and then tighten it.
(2) Checking the mark stamped on the flange of the expansion joint, fit it in the proper incorporating direction according to the mark.

If the expansion joint is fitted in the reverse direction, carbon is entrapped in the clearance, causing the expansion joint to be broken in a shorter period.

Drawing 7-62. Exhaust Expansion Joint



7-11-3. Turbocharger

For disassembling and servicing of the turbocharger, refer to the operation manual separately provided for it.

The turbocharger mount is provided with the boost air and lubricating oil passages. After having removed the turbocharger, cover the ports of boost air and lubricating oil passages to prevent foreign matters from entering the turbocharger.

7-12. Air Motor

Refer to the attached Service Manual for Engine Air Starters (Model 45M).
Restrict disassembly and repairs of the air motor to disassembly, checking and the following parts replacement of the air inlet housing and the spool valve.

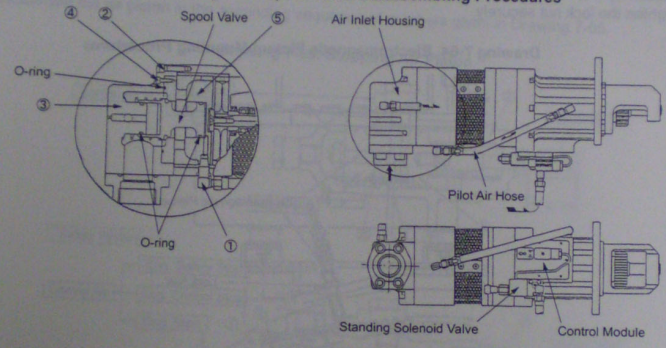
- O-rings of the spool valve and the air inlet housing
- Starting solenoid valve
- Control module
- Pilot air hose

1) Disassembly (of the spool valve)

After removing the air motor, disassemble it in the ascending sequence of numbers given in Drawing 7-64.

When unscrewing a bolt ④ used to fasten the nozzle valve seat ⑤ to the inlet housing, be careful so that the spool valve does not spring out.

Drawing 7-63. Spool Valve Disassembling Procedures



2) Maintenance checking

(1) Check the sliding surface and the seat face of the spool valve if they are not flawed not the foreign matter has not been bittern in.
(2) Check the nozzle/valve seat if the seat face and nozzle part are not damaged.
(3) Replace the O-rings with the new ones.

3) Reassembly

Reassemble the air motor in the sequence reverse to disassembly, paying attention to the following points:

(1) Apply grease to the sliding surface of the spool valve.
(2) Use sealing tape at the threaded part of the elbow ① of pilot air hose to that the air does not leak from this part.
(3) Tighten each bolt with the following torques:
- 5 bolts for nozzle/valve seat: 7.2 N-m (0.7 kgf-m)
- 4 bolts for air inlet housing: 19.2 N-m (2 kgf-m)
- 4 bolts for air inlet pipe: 94.9 N-m (9.7 kgf-m)
- 3 bolts for air motor: 136 N-m (13.9 kgf-m)

7-13. Electromagnetic Pickup

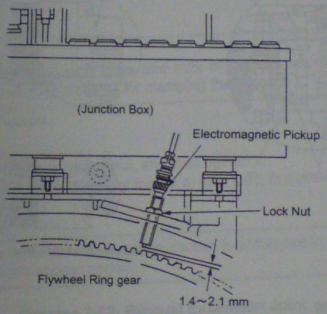
This pickup is a sensor to detect the rotational speed of the engine and is mounted near the outer periphery of the flywheel ring gear.

1) Adjustment on the mounting dimensions
When the pickup is replaced or removed, be sure to adjust the clearance.

If the adjustment on the clearance is found poor, the rotational speed may not be detected, and the (overspeed) protective device may not actuate.

- Adjust the screwing-in of the pickup so that the clearance between the pickup tip and the outer periphery of the ring gear becomes 1.4 to 2.1 mm.
  (Screw in the pickup so that its tip contacts the outer periphery of the flywheel ring gear, and then loosen by 1 to 1.5 turn.)
- Tighten the lock nut securely.

Drawing 7-64. Electromagnetic Pickup Mounting Procedures



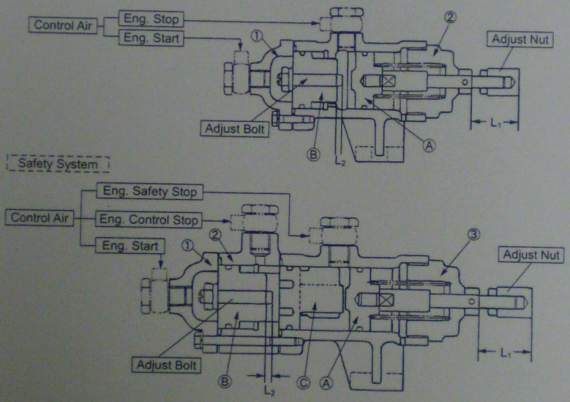
7-14. Stopping Air Piston

This piston purports to stop the engine when the protective device actuates and in case of remote stopping, and to control fuel injection volume when engine is started up.
Ⓐ, Ⓒ : stopping (to stop supply of fuel oil) air piston.
Ⓑ : fuel injection volume controling air piston.

Do not disassemble adjustment nut and adjust bolt in the case where parts replacement is not needed.
The stroke of the piston has been properly adjusted prior to shipment from out factory, do not readjust it.
When parts replacement is needed, do so with attention paid to the following:
Measure the dimension L1, L2 when disassembly is needed, and set it in the same dimension as the measured L1, L2 when reassembling this air piston.

1) Disassembly
Disassemble the air piston in the ascending sequence of numbers given in Drawing 7-65.

Drawing 7-65. Stopping Air Piston



2) Reassembly
Reassemble the air piston in the sequence reverse to disassembly.
- Incorporate the piston, applying lubricating oil or lithium series grease to its sliding part.
- Replace the O-ring with the new one.

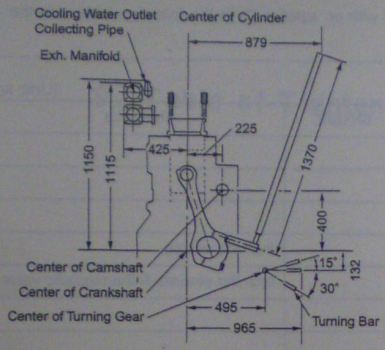
Conduct such a performance test once in every three months.
- Send the control air into the each air pistons, and confirm the movement of the sopping air piston adjust nut

8. Principal Dimensions & Part Mass for Disassembly & Servicing

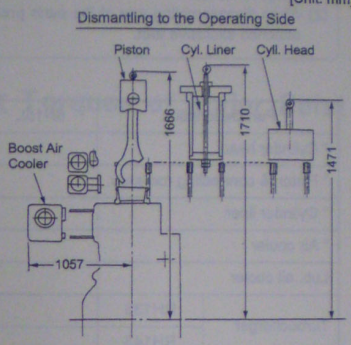
8. PRINCIPAL DIMENSIONS & PART MASS FOR DISASSEMBLY & SERVICING

Drawing 8-1. Principal Dimensions for Disassembly & Servicing

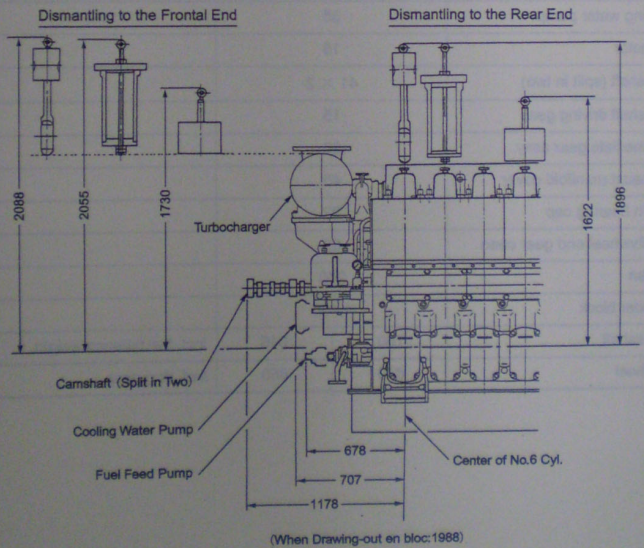
[Unit: mm]



Dismantling to the Frontal End



Dismantling to the Rear End



(When Drawing-out en bloc:1988)

8-1. Principal Part Mass for Disassembly & Servicing

⚠ CAUTION

(1) When hoisting a part, use rope and lifting gear and hook that can withstand the can withstand the weight of the part.
(2) When disassembling any of the parts prefixed with an asterisk (*) in the following table, use the attached exclusive tool.

[Unit: kg]

Part Description		6N18L	6N18AL	Remarks
* Cylinder head		105		
* Piston & connecting rod assy.		42		
* Cylinder liner		40		
* Air cooler		300		Incl. the casing
Lub. oil cooler		162		Incl. the strainer & thermostatic valve
Turbocharger	RH133	63		
	RH143	145		
Fuel feed pump		16		
Lub. oil pump		30		
Cooling water pump		35		
Air motor		18		
Camshaft (split in two)		41 × 2		
Camshaft driving gear		15		
Intermediate gear assy.		20		
* Exhaust manifold cover		45		
* Main bearing cap		22		
Anti-flywheel end gear case		62		
Oil pan		200		
Cylinder block		1,496		
Crankshaft		760	846	Incl. the balance weight
Flywheel		870	650	Incl. ring gear

9. Table of Tightening Torques of Major Bolst

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}	

9-3. Other Major Bolts (Torque Tightening)

(1) Before tightening a flywheel clamping bot or fuel injection valve nozzle sleeve, apply Protec gease on its thread and bearing surface.
(2) Before tightening a camshaft coupling nut, apply seizure inhibitor (Three-Bond 1910 or its equivalent) on its thread and bearing surface.
(3) The parts prefixed with an asterisk (*) in the following table are provided with an exclusive tool, respectivery.
(4) Be sure to tighten a part with a torque wrench to the specified torque.

Part Description	Screw Dia. × Pitch	Face-to-Face Width of Bolt/Nut (mm)	Tightening Torque		Remarks
			N-m	(kgf-m)	
Indicator cock tightening nut	M12 × 1.75	19	59 ~ 69	6 ~ 7	
Rocker arm shaft stand clamping bolt	M16 × 1.5	24	186 ~ 206	19 ~ 21	
* Fuel injection valve nozzle sleeve	M22 × 1.5	2 grooves	157 ~ 167	16 ~ 17	Engine Using MDO
	M30 × 1.5		245 ~ 265	25 ~ 26	Engine Using HFO
Fuel injection valve guard tightening nut	M10 × 1.5	17	39 ~ 44	4 ~ 4.5	
* Fuel injection valve case nut	M28 × 1.5	27	167 ~ 176	17 ~ 18	
* Fuel injection valve injection pressure regulating lock nut	M33 × 1.5	41	47 ~ 51	4.8 ~ 5.2	
* Fuel injection pipe joint bolt (on cyl. head side)	M8 × 1.25	6 (hex. socket)	20	2	
* Fuel injection pipe joint bolt (on pump side)	M10 × 1.5	8 (hex. socket)	69	7	
* Fuel injection pump tightening nut	M12 × 1.75	19	74 ~ 83	7.5 ~ 8.5	
Fuel injection pump equalizing valve body clamping bolt	M10 × 1.5	8 (hex. socket)	54 ~ 59	5.5 ~ 6.0	
Fuel injection pump barrel retaining bolt	M10 × 1.5	8 (hex. socket)	54 ~ 59	5.5 ~ 6.0	
Fuel injection pump protector	M20 × 1.5	32	49 ~ 59	5.0 ~ 6.0	
Fuel injection timing adjust bolt lock nut	M22 × 1.5	30	196 ~ 245	20 ~ 25	
Camshaft coupling nut	M12 × 1.25	17	88 ~ 98	9 ~ 10	U-nut
Cam gear clamping bolt	M14 × 1.5	19	137 ~ 157	14 ~ 16	Tightening together with tachometer driving disk
Idle gear shaft clamping bolt	M16 × 1.5	24	118 ~ 127	12 ~ 14	
Idle gear retainer clamping bolt	M12 × 1.75	19	59 ~ 69	6 ~ 7	
Cooling water pump impeller tightening nut	M16 × 1.5	24	64 ~ 74	6.5 ~ 7.5	Left hand screw
* Cooling water pump impeller	M22 × 2.5	round socket 4 points	137 ~ 157	14 ~ 16	Left hand screw
Cooling water pump driving gear tightening nut	M24 × 2.0	36	235 ~ 255	24 ~ 26	
Cooling water pump idle gear shaft clamping bolt	M16 × 1.5	24	118 ~ 137	12 ~ 14	
Main bearing cap side bolt	M22 × 1.5	32	343 ~ 382	35 ~ 39	
Flywheel clamping bolt	M20 × 1.5	24	510 ~ 569	52 ~ 58	
Exhaust manifold clamping bolt	M12 × 1.75	19	59 ~ 69	6 ~ 7	
Exhaust expansion joint clamping bolt	M12 × 1.75	19	59 ~ 69	6 ~ 7	
Lub.oil pump driving gear tightening nut	M24 × 2.0	36	157 ~ 177	16 ~ 18	
Swing arm shaft clamping bolt	M16 × 1.5	24	118 ~ 137	12 ~ 14	

9-4. General Bolts

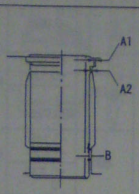
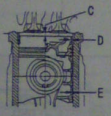
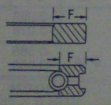
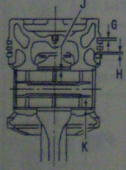
(1) Tighten any bolts other than the major ones according to the following table.
(2) Tighten a part whose clamping section is made of aluminum, tighten it to 80% of the torque shown in the following table.
(3) The following table is applicable only to the bolts whose Part No. (an 11-digit numeral) shown in the attached Parts List consists of 2 at its first place and 2, 5 or 6 at its fifth place.

Screw Dia. × Pitch (mm)	Face-to-Face Width of Bolt/Nut (mm)	Tightening Torque	
		N-m	(kgf-m)
M6 × 1.0	10	10 ~ 12	(1.0 ~ 1.2)
M8 × 1.25	13	24 ~ 27	(2.4 ~ 2.8)
M10 × 1.5	17	44 ~ 54	(4.5 ~ 5.5)
M12 × 1.75	19	78 ~ 98	(8 ~ 10)
M14 × 1.5	22	123 ~ 152	(12.5 ~ 15.5)
M16 × 1.5	24	206 ~ 245	(21 ~ 25)
M16 × 2.0	24	206 ~ 245	(21 ~ 25)

10. Clearances & Wear Limits of Major Parts

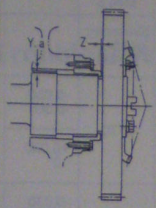
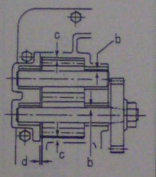
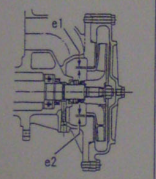
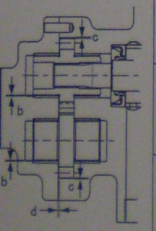
10. CLEARANCES & WEAR LIMITS OF MAJOR PARTS

(Unit in mm)

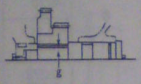
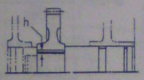
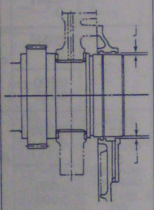
	Item	Sketch	Dimension		St'd Clearance Assembling Time	Max. Allowance Clearance	Usage Limit of Parts
			Normal	Tolerance			
Cylinder & cylinder liner	Inner dia. of cylinder upper part		φ246	+0.029 0	A1=0.075 ~ 0.139	A1=0.25	+0.1
	Outer dia. of cylinder liner upper part			-0.075 0.110			-0.2
	Inner dia. 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.

(Unit in mm)

	Item	Sketch	Dimension		St'd Clearance Assembling Time	Max. Allowance Clearance	Usage Limit of Parts
			Normal	Tolerance			
Crankshaft	Outer dia. of camshaft datum part		φ120	-0.072 -0.107	Y=0.072 ~ 0.197	Y=0.3	-0.17
	Inner dia. of camshaft datum part bearing			+0.090 0			+0.17
	Thrust clearance of camshaft datum part		6	-0.15 -0.20	Z=0.200 ~ 0.310	Z=0.5	—
	Width of camshaft thrust collar housing			+0.11 +0.05			—
	Outer dia. of camshaft intermediate part		φ120	-0.072 -0.107	a=0.072 ~ 0.197	a=0.3	-0.17
	Inner dia. of camshaft intermediate part bearing			+0.095 0			+0.17
Lub. oil pump	Outer dia. of lub. oil pump shaft		φ30	-0.040 -0.053	b=0.040 ~ 0.074	b=0.2	—
	Inner dia. of lub. oil pump shaft bush			+0.021 0			+0.15
	Clearance betw. pump case & gear		φ72	+0.046 0	c=0.200 ~ 0.296	c=0.3	—
	Outer dia. of gear			-0.200 -0.250			—
	Width of pump case		6N18L 77 6N18AL 66 bell mounting coupling spec	+0.046 0	d=0.060 ~ 0.136	d=0.18	—
	Width of pump gear		6N18L 72	-0.060 -0.090			—
Cooling water pump	Outer dia. of cooling water pump impeller boss		φ94	-0.13 -0.18	e1&e2 =0.78 ~ 0.87	e1&e2 =1.60	-0.6
	Inner dia. of casing			+0.69 0.65			+1.0
Fuel Oil Feed Pump	Outer dia. of fuel oil feed pump shaft		φ25	-0.020 -0.041	b=0.020 ~ 0.062	b=0.2	-0.1
	Inner dia. of fuel oil feed pump shaft bush			+0.021 0			+0.1
	Inner dia. of pump case		φ48	+0.025 0	c=0.080 ~ 0.130	—	—
	Outer dia. of pump gear			-0.080 -0.105			—
	Width of pump case		12	+0.018 0	d=0.1 ~ 0.2 (Liquid packing ≦ 0.02)	—	—
	Width of pump gear			-0.016 -0.034			—

(Unit in mm)

	Item	Sketch	Dimension		St'd Clearance Assembling Time	Max. Allowance Clearance	Usage Limit of Parts
			Normal	Tolerance			
Transmission gear	Gear backlash		(Tuning gear & pump drive gear) M=4.5	—	f=0.15 ~ 0.25	f=0.5	—
			(Governor gear) M=3.0	—	f=0.12 ~ 0.20	f=0.3	—
	Outer dia. of cam driving intermediate gear shaft		ϕ70	-0.030 -0.060	g=0.030 ~ 0.090	g=0.2	-0.17
	Inner dia. of the above's bush			+0.030 0			+0.14
	Outer dia. of pump driving intermediate gear shaft		ϕ70	-0.030 -0.060	h=0.030 ~ 0.090	g=0.2	-0.17
	Inner dia. of the above's bush			+0.030 0			+0.14
Oil shield, flywheel side	Outer dia. of crankshaft		ϕ220	0 -0.046	j=0.030 ~ 0.446	—	—
	Inner dia. of oil shield			+0.400 +0.300			—

11. Troubleshooting & Countermeasures

11. TROUBLESHOOTING & COUNTERMEASURES

The causes of abnormalities and troubles are diverse, and they break out from compsite factors. Catching a change in running performance and referring to the record of maintenance and servicing date and the history of part replacement, locate the cause early and take the proper countermeasures.

11-1. Starting Failure
1) Flywheel not turned.
2) Flywheel turned, but ignition not taken place.
11-2. Rotational Speed Dropped Spontaneously.
11-3. Output of Each Cylinder not in Unifomity. (Dispersion of the maximum combustion pressure and exhaust temperature is large among cylinders.)
11-4. Bad Color of Exhaust Gas
11-5. Lub. Oil Pressure Dropped below the Specified Pressure
11-6. Unusual Sounds Heard (Knocking Occurred) During Operation
11-7. Cooling Water Temperature Too High
11-8. Exhaust Temperatures of All the Cylinders Too High
11-9. Engine Stopped Suddenly

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.	

11-2. Rotational Speed Dropped Spontaneously

Cause	Countermeasure	
(1) Clogging of fuel oil filter	Clean the filter.	
(2) Seizure of moving part (piston, main bearing or turbocharger)	Check and repair the pertinent moving part, of replace it.	
(3) Air mixed in fuel oil pipe system	Check and repair the fuel oil pipe system, then bleed air.	
(4) Moisture content in fuel oil	Drain the filter, tank, etc.	
(5) Defect of fuel injection pump	Check and repair the pump, or replace it.	
(6) Defect of fuel injection valve	Check and adjust the valve, or replace it.	
(7) Malfunction of governor	Check and adjust the governor, or replace it.	

11-3. Output of Each Cylinder not in Uniformity. (Dispersion of the maximum combustion pressure and exhaust temperature is large among cylinders.)

Cause	Countermeasure	
(1) Air mixed in fuel oil pipe system	Check and repair the fuel oil pipe system, then bleed air.	
(2) Moisture content in fuel oil	Drain the filter, tank, etc.	
(3) Fuel injection volume not in uniformity among cylinders		
1.Nonuniform position of fuel injection pump racks	Check the position of fuel injection pump racks, then adjust it.	
2.Sticking or wear of fuel injection pump plunger	Check and repair the plunger, or replace it.	
3.Defect of fuel injection valve	Check and repair the valve, or replace it.	
4.Looseness or damage of fuel injection pipe	Check and repair the pipe, or replace it.	
5.Sticking of suction / exhaust valve or damage of suction / exhaust valve seat	Check and repair the pertinent valve or valve seat, or replace it.	
6.Damage of fuel cam, or damage of suction / exhaust cam	Check the fuel cam or suction / exhaust cam, then repair it, of replace it.	

11-4. Bad Color of Exhaust Gas

Cause	Countermeasure	
(1) Improper injection timing	Check and adjust the timing.	
(2) Defect of fuel injection valve (fuel injection pressure drop, sticking of nozzle)	Check the valve, then regulate the pressure, or replace it.	
(3) Defect of fuel injection pump	Check the pump, then repair it, or replace the pertinent valve sect.	
(4) Improper adjustment of suction / exhaust valve head clearance or damage of suction / exhaust valve seat	Adjust or correct the clearance, or replace the pertinent valve sect.	
(5) Sticking of suction / exhaust valve	Overhaul the suction / exhaust valve, and then correct it.	
(6) Damage of suction / exhaust cam	Replace the camshaft.	
(7) Defect of turbocharger		
1.Clogging of filter	Wash the filter.	
2.Fouling of the blower side or turbine side	Overhaul and wash the turbocharger / blower.	
(8) Fouling of boost air cooler (too high temperature of boost air)	Overhaul and clean the air cooler.	
(9) Shortage of fuel oil	Use a high-quality fuel oil.	
(10) Overload	Reduce the load.	

11-5. Lub. Oil Pressure Dropped below the Specified Pressure.

Cause	Countermeasure	
(1) Looseness of lub. oil pipe and cylinder block oil hole plug	Check and repair the lub. oil pipe and each oil hole plug.	
(2) Clogging of lub. oil strainer	Overhaul and clean the strainer.	
(3) Excessive clearance of crankshaft bearing	Check the clearance, then replace the metal.	
(4) Sticking of lub. oil pressure regulating valve or loose adjusting bolt	Check the valve and bolt, then repair or adjust the pertinent part.	
(5) Sticking of lub. oil safety valve	Check the valve and bolt, then repair it.	
(6) Too high temperature of lub. oil		
1.Shortage of cooling water volume	Check the cooling water pump.	
2.Fouling of lub. oil cooler	Check the cooler, then over haul and clean it.	
3.Excessive blow-bye (gas leak) into the crank-case	Check the piston rings and cylinder liner.	
4.Sticking of piston of lub. oil thermostatic valve or defect of its element	Check the piston and element, then repair or replace the pertinent part.	
(7) Air sucked in lub. oil pump (shortage of lub. oil volume)	Replenish the lub. oil.	

11-6. Unusual Sounds Heads (Knocking Occurred) During Operation

Cause	Countermeasure	
(1) Excessive clearance of bearing of crankshaft of camshaft	Check the clearance, then replace the pertinent bearing.	
(2) Loose bolts		
1.Connecting rod bolts	Check the connecting rod and bolts, then retighten the bolts or replace them.	
2.Flywheel clamping bolts	Check the bolts, then retighten them, or replace them.	
(3) Improper adjustment of suction / exhaust valve head clearance or loose bolt	Check the clearance and bolt, then adjust the clearance.	
(4) Improper adjustment of fuel injection timing	Check the timing, then adjust it.	
(5) Fuel injection volume excessive		
1.Malfunction of fuel injection pump	Check and repair the pump, or replace it.	
2.Defect of fuel injection valve	Check and repair the valve, then adjust it.	
(6) Increase of gear backlash or wear of gear bear-ing	Check and adjust the gear or its bear-ing, or replace it.	

11-7. Cooling Water Temperature Too High

Cause	Countermeasure	
(1) Shortage of cooling water volume	Check and repair the cooling water pump.	
(2) Sticking or defect of cooling water thermostatic valve	Check or replace the thermostatic valve.	

11-8. Exhaust Temperatures of All the Cylinders Too High

Cause	Countermeasure	
(1) Boost air temperature too high		
1.Boost air cooler cooling water temperature too high	Check the cooling water system, and lower the cooling water temperature to the specified range.	
2.Shortage of boost air cooler cooling water volume	Check and repair the cooling water pump.	
3.Fouling of boost air cooler (cooling water side & air side)	Overhaul and wash the cooler.	
4.Engine room internal temperature too high	Check and service the engine room ventilation equipment.	
(2) Boost air pressure too high		
1.Clogging of turbocharger filter	Wash the filter.	
2.Clogging of boost air cooler (air side)	Overhaul and wash the cooler.	
3.Fouling of turbocharger (turbine side & blower side) or its damage	Wash the blower side or overhaul and wash the turbocharger, or replace it.	
4.Rise of back pressure at exhaust port	Check and clean the exhaust manifold and exhaust pipe.	
5.Engine room put under a negative pressure	Check and service the engine room ventilation equipment.	
(3) Unsuitable properties of fuel oil	Judging from the property analysis results, change the fuel oil if necessary.	
(4) Overload	Reduce the load.	

11-9. Engine Stopped Suddenly

Cause	Countermeasure	
(1) Protective device switched on		
1.Overspeed	Check the switch, then repair the defective part. If necessary, replace the pertinent part.	
2.Lub. oil pressure drop		
3.Temperature rise of cooling water excessive		
(2) Governor or governor gear	Check the governor and governor gear, then repair or replace the pertinent part.	
(3) Fuel tank empty	Replenish the fuel oil.	
(4) Air mixed in fuel oil system	Bleed air from the filter and oil pipe.	
(5) Clogging of fuel oil filter	Overhaul and clean the filter.	
(6) Seizure of interlocking part (piston, main bearing, crank-pin bearing, timing gear, etc.)	Check and repair the pertinent part, or replace it.	

Parts List & Attached Figs.

Parts List & Attached Figs.

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 34	燃料噴射ポンプ仕組	Fig 34	FUEL INJECTION PUMP ASS'Y,
付図 35	燃料噴射ポンプ駆動装置	Fig 35	FUEL INJECTION PUMP DRIVING DEVICE
付図36-1	燃料噴射弁仕組（A重油仕様）	Fig36-1	FUEL INJECTION VALVE ASS'Y, marie diesel oil spec.
付図36-2	燃料噴射弁仕組（低質油仕様）【間接冷却ノズル】	Fig36-2	FUEL INJECTION VALVE ASS'Y, heavy fuel oil spec. of Indirect-cooling type
付図36-3	燃料噴射弁メンテナンスサービス要領（間接冷却ノズル）	Fig36-3	MAINTENANCE SERVICE PROCEDURE OF FUEL INJECTION VALVE, Indirect-cooling type
付図 37	燃料噴射管仕組	Fig 37	FUEL INJECTION PIPE ASS'Y
付図38-1	燃料フィードポンプ仕組（A重油仕様）	Fig38-1	FUEL FEED PUMP ASS'Y, marine diesel oil spec.
付図38-2	燃料フィードポンプ仕組（C重油仕様）	Fig38-2	FUEL FEED PUMP ASS'Y, heavy fuel oil spec.
付図 39	燃料圧力調整弁仕組	Fig 39	FUEL PRESSURE REGULATING VALVE ASS'Y,
付図 40	燃料バイパス弁仕組（C重油仕様）	Fig 40	FUEL BY-PASS VALVE ASS'Y, heavy fuel oil spec.
付図41-1	燃料第1こし器仕組（25A/40A）	Fig41-1	FUEL OIL FIRST FILTER ASS'Y, (25A/40A)
付図41-2	燃料第1こし器仕組（50A）	Fig41-2	FUEL OIL FIRST FILTER ASS'Y, (50A)
付図42-1	燃料第2こし器仕組（A重油仕様）	Fig42-1	FUEL OIL SECOND FILTER ASS'Y, marine diesel oil psec.

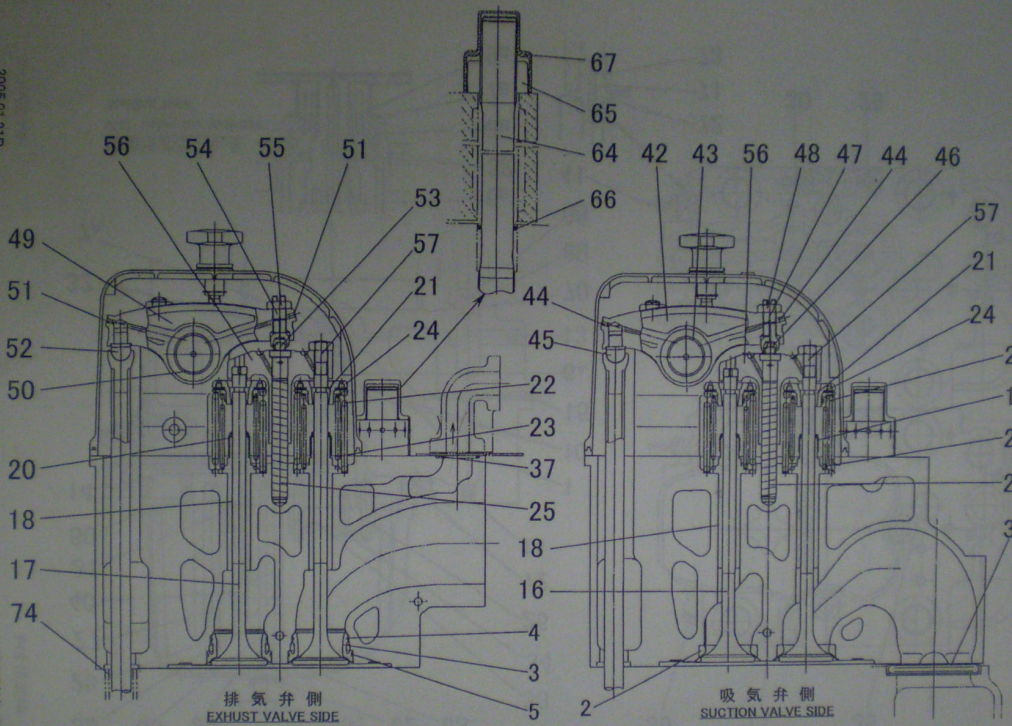
付図42-2	燃料第2こし器仕組 (C重油仕様)	Fig42-2	FUEL OIL SECOND FILTER ASS'Y, heavy fuel oil spec.
付図43-1	燃料第2こし器取付台 および シールポット(C重油仕様)	Fig43-1	FUEL FILTER BRACKET & SEAL POT, heavy fuel oil spec.
付図43-2	アキュムレータ (C重油仕様)	Fig43-2	ACCUMULATOR, heavy fuel oil spec.
付図44-1	燃料油管装置 (A重油仕様)	Fig44-1	FUEL OIL PIPE SYSTEM, marine diesel oil spec.
付図44-2	燃料油管装置 (C重油仕様)	Fig44-2	FUEL OIL PIPE SYSTEM, heavy fuel oil spec.
付図 45	燃料油管被覆 (C重油仕様)	Fig 45	FUEL OIL PIPE LAGGING, heavy fuel oil spec.
付図 46	燃料噴射管漏油スイッチ仕組	Fig 46	FUEL OIL LEAK-OUT SWITCH ASS'Y, fuel injection pipe
付図 47	調速装置および操縦装置	Fig 47	GOVERNOR LINKAGE & CONTROL DEVICE,
付図48-1	ガバナ駆動装置 (NZ61型)	Fig48-1	GOVERNOR DRIVING DEVICE, NZ61 type
付図48-2	ガバナ駆動装置および連結桿仕組 (PSG型)	Fig48-2	GOVERNOR DRIVING DEVICE & LINK ASS'Y, PSG TYPE
付図48-3	ガバナ駆動装置および連結桿仕組 (UG-8型)	Fig48-3	GOVERNOR DRIVING DEVICE & LINK ASS'Y, UG-8 TYPE
付図 49	始動スイッチおよび操作場所切換 スイッチ	Fig 49	STARTING SWITCH & TRANSFER SWITCH
付図 50	操作空気管装置 (燃料流量制御)	Fig 50	OPERATION AIR PIPE SYSTEM, fuel oil control
付図 51	空気ピストン(燃料流量制御用)	Fig 51	AIR PISTON, fuel flow control
付図52-1	スターティングモータ (始動空気)	Fig52-1	STARTING MOTOR, air starting
付図52-2	スターティングモータ作動図	Fig52-2	STARTING MOTOR DRAWING OF ACTION
付図 53	始動空気管装置 (非嵌体直結仕様)	Fig 53	STARTING AIR PIPE SYSTEM, direct coupling spec.
付図 54	始動空気減圧弁仕組	Fig 54	PRESSURE REDUCING VALVE ASS'Y, starting air
付図 55	始動空気安全弁仕組	Fig 55	SAFETY VALVE ASS'Y, starting air
付図 56	計器板仕組	Fig 56	GAUGE BOARD ASS'Y
付図 57	圧力検出器および管路	Fig 57	PRESSURE SENSORS & PIPE LINE
付図 58	給気圧力調整装置(6N18AL-EV形)	Fig 58	BOOST AIR PRESSURE REGULATING DEVICE (6N18AL-EV Type)

付図1.　シリンダヘッド仕組

Fig.1　CYLINDER HEAD ASS'Y

付図1. シリンダヘッド仕組 (2/8)

Fig.1 CYLINDER HEAD ASSY



付図1. シリンダヘッド仕組

(3/6)

Fig.1 CYLINDER HEAD ASS'Y

A 仕様：燃料 A 重油 / A Spec.: A-Heavy Fuel Oil (M.D.O).

B 仕様：燃料 低質油 (1500秒油) / B Spec.: Low Quality Fuel Oil (1500Sec. Oil).

C 仕様：燃料 低質油 (3500秒油) / C Spec.: Low Quality Fuel Oil (3500Sec. Oil).

Item	部品名称	数量 Quantity A	B	C	部品番号 Part No.	Part Name
	シリンダヘッド仕組	6set			746674-11121	CYLINDER HEAD Ass'y
	シリンダヘッド仕組		6set		746674-11104	CYLINDER HEAD Ass'y (1500Sec. Oil)
	シリンダヘッド仕組			6set	746674-11114	CYLINDER HEAD Ass'y (3500Sec. Oil)
1	シリンダヘッド	6			146673-11050	CYLINDER HEAD
	シリンダヘッド		6	6	146673-11031	CYLINDER HEAD
2	バルブシート (吸気弁)	12	12	12	146673-11701	VALVE SEAT, suction valve
3	バルブシート (排気弁)	12	12	12	146673-11090	VALVE SEAT, exhaust valve
4	Oリング (排気ﾊﾞﾙﾌﾞｼｰﾄ)	12	12	12	146603-11810	O-RING, exhaust valve seat
5	Oリング (排気ﾊﾞﾙﾌﾞｼｰﾄ)	12	12	12	146673-11810	O-RING, exhaust valve seat
6A	ノズルスリーブ (燃料弁)	6			146673-11860	NOZZLE SLEEVE, fuel oil Valve
7A	パッキン (ﾉｽﾞﾙｽﾘｰﾌﾞ)	6			146673-11870	GASKET, nozzle sleeve
10	Oリング (4D) G40	12			24326-000400	O-RING (4D) G40
6B	ノズルスリーブ (燃料弁)		6	6	146673-11611	NOZZLE SLEEVE, fuel oil Valve
7B	パッキン (ﾉｽﾞﾙｽﾘｰﾌﾞ)		6	6	147643-11870	GASKET, nozzle sleeve
8B	押え輪 (テフロンリング)		6	6	146673-11800	RETAINER, teflon ring
9B	テーパブッシュ (銅)		6	6	146673-11622	TAPER BUSH, copper
10	Oリング (4D) G40		12	12	24326-000400	O-RING (4D) G40
11	プラグ (シリンダヘッド)	48	48	48	146673-11950	PLUG, cylinder head
	パッキン (プラグ)	48	48	48	146673-11960	GASKET, plug
12	ねじプラグ PT1	18	18	18	23876-100000	PLUG PT1
13	ねじプラグ PT3/8	24	24	24	23876-030000	PLUG PT3/8
14	ねじプラグ PT1/4	30	30	30	23876-020000	PLUG PT1/4
15	プラグ PT1/8	42	42	42	23876-010000	PLUG PT1/8
16	吸気弁 120	12	12	12	146673-11720	SUCTION VALVE 120
17	排気弁 (Crメッキ)	12	12		146673-11110	EXHAUST VALVE, Cr plating
	排気弁 (ナイモニック)			12	146673-11170	EXHAUST VALVE, Nimonic
18	バルブガイド	24	24	24	141616-11171	VALVE GUIDE
19	バルブステムシール (吸気)	12	12	12	146673-11650	VALVE STEM SEAL, suction
20	バルブステムシール (排気)	12	12	12	141616-11751	VALVE STEM SEAL, exhaust
21	コッタ	24	24	24	27310-140000	COTTER

付図1. シリンダヘッド仕組
Fig.1 CYLINDER HEAD ASS'Y

Item	部品名称	数量 Quantity A	B	C	部品番号 Part No.	Part Name
22	弁ばね（外）	24	24	24	145610-11121	VALVE SPRING, outside
23	弁ばね（内）	24	24	24	145610-11131	VALVE SPRING, inside
24	バルブローテータ仕組	24	24	24	付図 2 参照 Refer to Fig.2	VALVE ROTATOR ASS'Y
25	ブリッジガイド	12	12	12	146673-11550	BRIDGE GUIDE
26	植込みボルト（燃料噴射弁）	12	12	12	133670-54310	STUD BOLT, fuel injection valve
	ナット M10	12	12	12	26706-100002	NUT M10
27	植込みボルト（弁腕台軸）	6	6	6	146673-11370	STUD BOLT, rocker arm shaft support
28	ナット M16	6	6	6	26732-160002	NUT M16
29	植込みボルト M12×65	6	6	6	26216-120652	STUD BOLT M12×65
	ナット M12	6	6	6	26706-120002	NUT M12
30	植込みボルト	6	6	6	146673-15300	STUD BOLT
	ナット M10	6	6	6	26706-100002	NUT M10
31	接続ピン	6	6	6	146673-11750	PIN
32	パッキン（燃料噴射弁）	6	6	6	137600-53091	GASKET, fuel injection valve
33	押え板（燃料噴射弁）	6	6	6	146673-11880	FIXING PLATE, fuel injection valve
34	六角穴ボルト M10×30	12	12	12	26450-100302	HEXAGON SOCKET HEAD BOLT M10×30
35	六角プラグ G1/2	6	6	6	23894-040002	HEXAGON PLUG G1/2
	銅パッキン 21×1	6	6	6	23414-210000	GASKET, Copper 21×1
36	六角プラグ M12	6	6	6	23887-120002	HEXAGON PLUG M12
	銅パッキン 12×1	6	6	6	23414-120000	GASKET, Copper 12×1
37	Oリング（4D）G40	6	6	6	24326-000400	O-RING (4D) G40
38	パッキン（シリンダ出口）	6	6	6	146673-11602	GASKET, cylinder outlet
	弁腕軸台仕組	6set	6set	6set		SHAFT SUPPORT ASS'Y, valve rocker arm
39	取付台（弁腕）	6	6	6	146673-11260	SHAFT SUPPORT, rocker arm
40	軸仕組（弁腕）	6s	6s	6s	146673-11270	SHAFT ASS'Y, rocker arm
	軸（弁腕）	(6)	(6)	(6)	146673-11250	SHAFT, rocker arm
	打込みプラグ 6×8	(6)	(6)	(6)	27225-060080	DRIVING PLUG 6×8
41	軸用C形止め輪 36	12	12	12	22242-000360	RETAINING RING, C type 36
	吸気弁腕仕組	6s	6s	6s	146673-11400	ROCKER ARM ASS'Y, suction valve
42	吸気弁腕	(6)	(6)	(6)	146673-11200	ROCKER ARM, suction valve

付図1. シリンダヘッド仕組
Fig.1 CYLINDER HEAD ASS'Y

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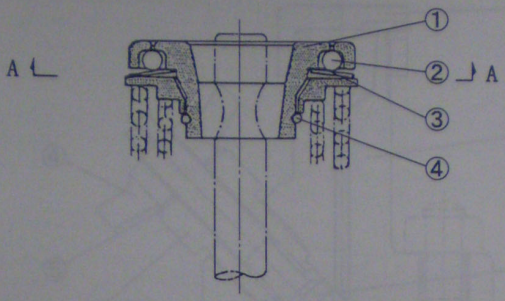
Item	部品名称	数量 Quantity A	B	C	部品番号 Part No.	Part Name
43	ブッシュ	(6)	(6)	(6)	146673-11420	BUSH
44	打込みプラグ 4×6	(12)	(12)	(12)	27225-040060	DRIVING PLUG 4×6
45	当金	(6)	(6)	(6)	139653-11390	CONTACT PIECE
46	弁腕当金	(6)	(6)	(6)	137676-11351	CONTACT PIECE, rocker arm
47	弁腕調整ねじ	(6)	(6)	(6)	146673-11230	ADJUSTING SCREW, valve rocker arm
48	止めナット M14	(6)	(6)	(6)	26692-140002	LOCK NUT M14
	排気弁腕仕組	6s	6s	6s		ROCKER ARM ASS'Y, exhaust valve
49	排気弁腕	(6)	(6)	(6)	146673-11210	ROCKER ARM, exhaust valve
50	ブッシュ	(6)	(6)	(6)	146673-11420	BUSH
51	打込みプラグ 4×6	(12)	(12)	(12)	27225-040060	DRIVING PLUG 4×6
52	当金	(6)	(6)	(6)	139653-11390	CONTACT PIECE
53	弁腕当金	(6)	(6)	(6)	137676-11351	CONTACT PIECE, rocker arm
54	弁腕調整ねじ	(6)	(6)	(6)	146673-11230	ADJUSTING SCREW, valve rocker arm
55	止めナット M14	(6)	(6)	(6)	26692-140002	LOCK NUT M14
	バルブブリッジ仕組	12set	12set	12set	146673-11520	VALVE BRIDGI ASS'Y
56	バルブブリッジ仕組	12s	12s	12s	146673-11510	VALVE BRIDGI ASS'Y
	バルブブリッジ	(12)	(12)	(12)	146673-11500	VALVE BRIDGI
	当金	(12)	(12)	(12)	139653-11530	CONTACT PIECE
	当金	(12)	(12)	(12)	139653-11540	CONTACT PIECE
57	調整ねじ	12	12	12	139653-11580	ADJUSTING SCREW
	止めナット M14	12	12	12	26692-140002	LOCK NUT M14
58	ボルト（弁腕軸台）	6	6	6	146673-11360	BOLT
	ボンネット仕組	6set	6set	6set	746673-11150	BONNET ASS'Y
	ボンネット仕組	6s	6s	6s	146673-11290	BONNET ASS'Y
59	ボンネット	(6)	(6)	(6)	146673-11300	BONNET
60	パッキン	(6)	(6)	(6)	146673-11280	GASKET
61	つかみ	6	6	6	153605-11431	KNOB
62	座金 20	6	6	6	22137-200000	WASHER 20
	シールワッシャ 20	6	6	6	22190-200003	SEAL WASHER 20
63	軸用C形止め輪 20	6	6	6	22242-000200	RETAINING RING, C type 20

付図1. シリンダヘッド仕組
Fig.1 CYLINDER HEAD ASS'Y

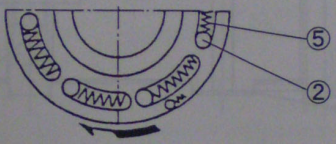
Item	部品名称	数量 Quantity A	B	C	部品番号 Part No.	Part Name
	シリンダヘッドボルトおよびナット仕組	6set	6set	6set		CYLINDER HEAD & NUT ASS'Y
64	シリンダヘッドボルト	24	24	24	146673-01200	STUD BOLY, cylinder head
65	ナット（ヘッドボルト）	24	24	24	146673-01212	NUT, cylinder head bolt
66	Oリング（1A）P28	24	24	24	24311-000280	O-RING (1A) P28
67	保護筒	24	24	24	146673-01280	PROTECTOR
68	冷却水連絡管（φ14）	12	12	12	147676-01410	CONNECTING PIPE, cooling water (φ14)
	冷却水連絡管（φ7.5）	12	12	12	146676-01440	CONNECTING PIPE, cooling water (φ7.5)
69	Oリング（4A）P21	24	24	24	24316-000210	O-RING (4A) P21
70	Oリング（4A）P24	24	24	24	24316-000240	O-RING (4A) P24
71	弁腕注油連絡管	6	6	6	146673-01720	CONNECTING PIPE, valve rocker arm oil
72	Oリング	6	6	6	152633-01810	O-RING
73	Oリング（1A）P9	6	6	6	24311-000090	O-RING (1A) P9
74	ドライブッシュ 31×15	12	12	12	24550-031150	DRY BUSH 31×15
	Oリング（4D）P35	12	12	12	24316-000350	O-RING (4D) P35

付図2. バルブローテータ仕組 (1/1)

Fig.2 VALVE ROTATOR ASS'Y



A-A 断面図
SECTION A-A

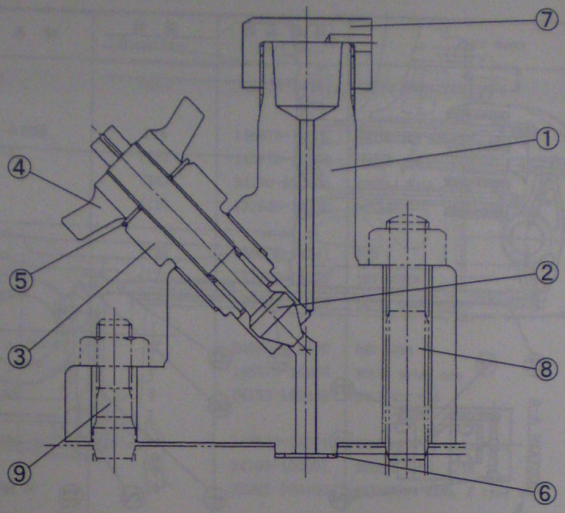


回転方向
DIRECTION OF ROTATION

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	バルブローテータ仕組	24set	27320-140560	VALVE ROTATOR ASS'Y
1	本体	24	————	BOODY
2	鋼球	168	27326-140560	STEEL BALL
3	皿ばね	24	27323-140560	CUP SPRING
4	止め輪	24	27324-140560	RETAINING RING
5	コイルばね	168	27325-140560	HELICAL SPRING

付図3. 指圧採取弁仕組 (1/1)

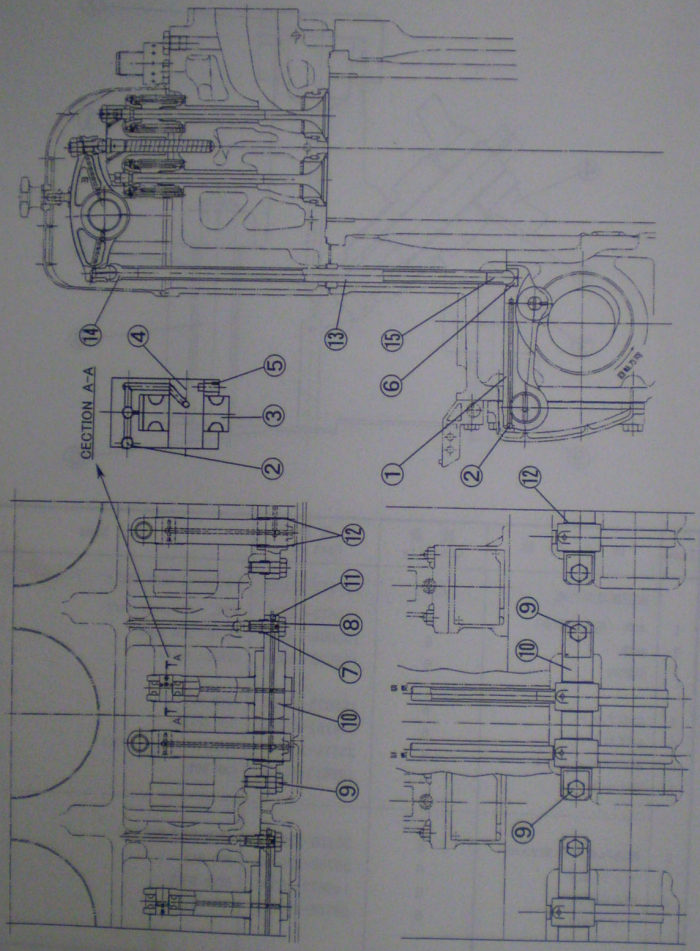
Fig.3 INDICATOR COCK ASS'Y



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	指圧採取弁仕組	6set	746673-15102	INDICATOR COCK ASS'Y
1	本体（指圧採取弁）	6	146673-15291	BODY, indicator cock
2	弁棒	6	153605-15310	VALVE, rod type
3	弁案内	6	153623-15320	GUIDE, valve
4	止めナット	6	153623-15250	LOCK NUT
5	皿ばね	6	194151-47760	CUP SPRING
6	銅パッキン 12×1	6	23414-120000	GASKET, copper 12×1
7	袋ナット	6	138613-15170	CAP NUT
8	植込みボルト M12×65	6	26216-120652	STUD BOLT M12×65
	ナット M12	6	26706-120002	NUT M12
9	植込みボルト	6	146673-15300	STUD BOLT
	ナット M10	6	26706-100002	NUT M10

付図4. 動弁装置 (1/2)

Fig.4 VALVE MECHANISM



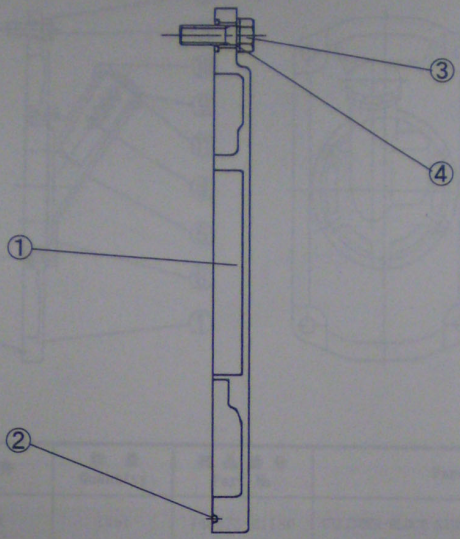
付図4. 動弁装置 (2/2)

Fig.4 VALVE MECHANISM

Item	部品名称	数量 Quantity.	部品番号 Part No.	Part Name
	動弁装置仕組	6set	746673-14201	VALVE MECHANISM ASS'Y
	スイングアーム仕組	12s	146673-14301	SWING ARM ASS'Y
1	スイングアーム	(12)	146673-14260	SWING ARM
2	鋼球 1/4	(24)	24190-080001	STEEL1 BALL 1/4
3	ローラ	(12)	137600-14220	ROLLER
4	ピン	(12)	146673-14241	PIN
5	止めねじ M6×8	(12)	137600-14270	SET SCREW
6	タペットシート	(12)	139653-14210	SEAT, push rod
7	ドライブッシュ 18×12	12	24550-018120	DRY BUSH
8	ボルト (スイングアーム)	6	146673-14250	BOLT, swing arm
9	ボルト M16×45	6	26152-160452	BOLT M16×45
10	スイングアームシャフト	6s	147673-14271	SHAFT ASS'Y, swing arm
11	鋼球 5/16	(6)	24190-100001	STEEL1 BALL 5/16
12	軸用C形止め輪 40	24	22242-000400	RETAINING RING, C type 40
	プッシュロット仕組	12s	146673-14550	PUSH ROD ASS'Y
13	プッシュロット	(12)	146673-14400	PUSH ROD
14	シート (上)	(12)	139653-14410	SEAT, upper
15	シート (下)	(12)	139653-14420	SEAT, lower

付図5-1. シリンダ側ふた仕組 (1/1)

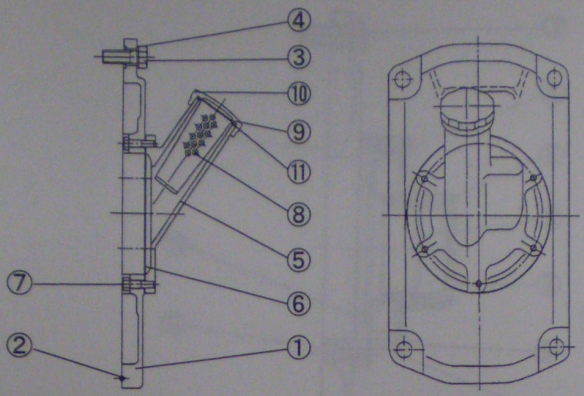
Fig.5-1 CYLINDER-BLOCK SIDE COVER ASS'Y



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	シリンダ側ふた仕組	12set	746673-01150	CYLINDER-BLOCK SIDE COVER ASS'Y
	側ふた仕組	12s	146673-01380	SIDE COVER ASS'Y
1	シリンダ側ふた	(12)	146673-01400	CYLINDER SIDE COVER
2	パッキン	(12)	146673-01411	GASKET
3	ボルト M16×35	48	26152-160352	BOLT M16×40
4	座金 16	48	22137-160000	WASHER 16

付図5-2. シリンダ側ふた仕組（給油口付）

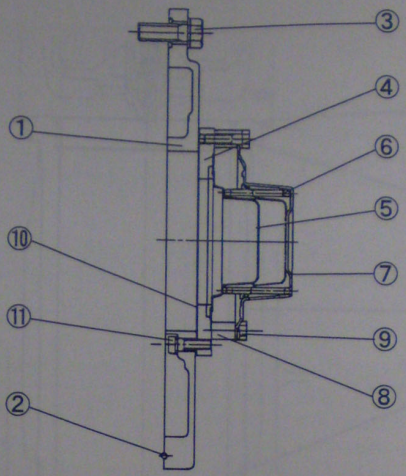
Fig.5-2 CYLINDER-BLOCK SIDE COVER ASS'Y, with lub. oil filler



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	シリンダ側ふた仕組（給油口付）	1set	746673-01180	CYLINDER-BLOCK SIDE COVER ASS'Y, with lub. oil filler
	側ふた仕組	1s	146673-01390	SIDE COVER ASS'Y
1	シリンダ側ふた	(1)	146673-01430	CYLINDER SIDE COVER
2	パッキン	(1)	146673-01411	GASKET
3	ボルト M16×35	4	26152-160352	BOLT M16×35
4	座金 16	4	22137-160000	WASHER 16
5	給油口本体	1	153605-09410	BODY, oil filler
6	パッキン	1	142613-03541	GASKET
7	六角穴付ボルト M8×25	6	26450-080252	HEXAGON SOCKET HEAD BOLT M8×25
	銅パッキン 8×1	6	23414-080000	GASKET, copper 8×1
8	こし網	1	132310-03080	FILTER
9	パッキン（上）	1	137900-09420	GASKE, upper
10	給油口ふた	1	138613-09410	CAP, oil filler
11	パッキン（下）	1	137900-09430	GASKE, lower

付図5-3. 安全弁付シリンダ側ふた仕組

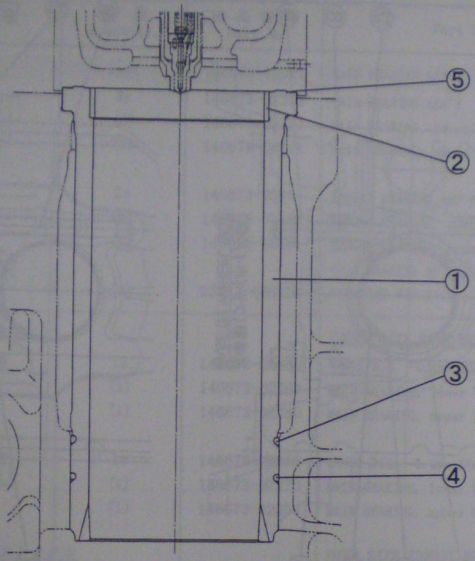
Fig.5-3 CYLINDER-BLOCK SIDE COVER ASS'Y, with safety valve



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	シリンダ側ふた仕組	2set	746673-03020	CYLINDER-BLOCK SIDE COVER ASS'Y
	側ふた仕組	2s	146673-01390	SIDE COVER ASS'Y
1	シリンダ側ふた	(2)	146673-01430	CYLINDER SIDE COVER
2	パッキン	(2)	146673-01411	GASKET
3	ボルト M16×35	8	26152-160352	BOLT M16×40
	座金 16	8	22137-160000	WASHER 16
	安全弁仕組	2s	153623-03750	SAFETY VALVE ASS'Y
4	弁座	(2)	153623-03500	VALVE SEAT
5	安全弁	(2)	153623-03530	SAFETY VALVE
6	弁ばね	(2)	138613-03550	VALVE SPRING
7	カバー	(2)	153623-03540	COVER
8	スペーサ	(12)	153623-03550	DISTANCE PIECE
9	ボルト M8×30	(12)	26206-080302	BOLT M8×30
	ばね座金 8	(12)	22212-080000	SORING WASHER 8
10	パッキン (安全弁)	2	142613-03541	GASKET, safety valve
11	六角穴付ボルト M8×25	12	26450-080252	HEXAGON SOCKET HEAD BOLT M8×25
	銅パッキン 8×1	12	23414-080000	GASKET, copper 8×1

付図6. シリンダライナ仕組 (1/1)

Fig.6 CYLINDER LINER ASS'Y

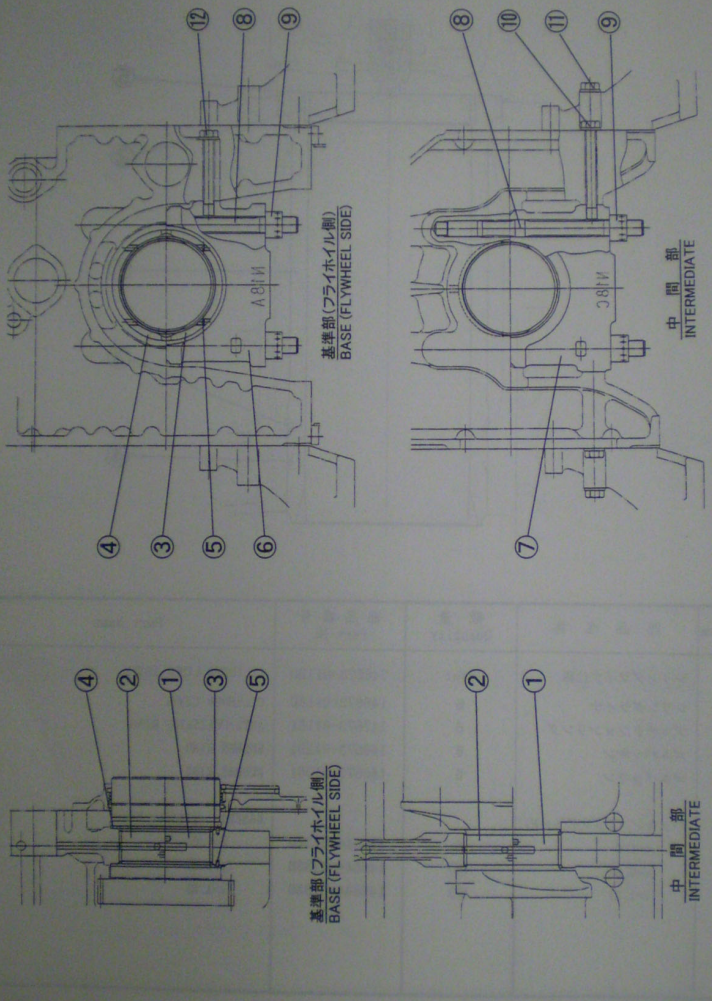


Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	シリンダライナ仕組	6set	746673-01120	CYLINDER LINER ASS'Y
1	シリンダライナ	6	146673-01150	CYLINDER LINER
2	プロテクションリング	6	147673-01131	ANTI-POLISHING RING
3	ゴムパッキン	6	146673-01291	RUBBER RING
4	ゴムパッキン	6	146673-01301	RUBBER RING
5	パッキン (シリンダヘッド)			GASKET, cylinder head
	t=1.0	6	146644-01340	t=1.0
	(t=0.8)	(6)	146644-01330	(t=0.8)
	(t=1.2)	(6)	146644-01350	(t=1.2)

付図7. 主軸受仕組

Fig.7 MAIN BEARING ASS'Y

(1/2)



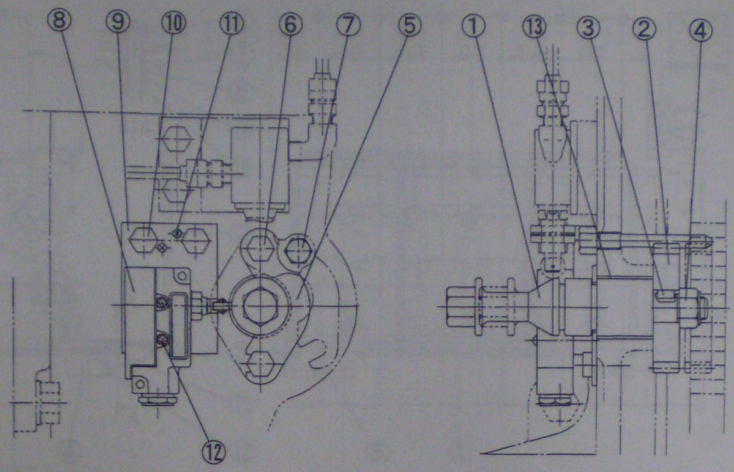
付図7. 主軸受仕組 (2/2)

Fig.7 MAIN BEARING ASS'Y

Item	部品名称	数量 Quantity.	部品番号 Part No.	Part Name
	主軸受仕組	1set	746673-02011	MAIN BEARING ASS'Y
	主軸受仕組	8s	146673-02351	MAIN BEARING ASS'Y
1	主軸受（下）	(8)	146673-02101	MAIN BEARING, lower
2	主軸受（上）	(8)	146673-02111	MAIN BEARING, upper
	スラストメタル仕組	2s	146673-02371	THRUST BEARING ASS'Y
3	スラストメタル（下）	(2)	146673-02151	THRUST BEARING, lower
4	スラストメタル（上）	(2)	146673-02161	THRUST BEARING, upper
	(3,4 メタル厚さ5.0mm)			(3,4 BEARING of THICKNESS 5.0mm)
5	平行ピン 6×12	(4)	22312-060120	STRAIGHT PIN 6×12
	アンダーサイズ主軸受			UNDER SIZE MAIN BEARING
	内径-0.4mmメタル仕組	1s	146673-02340	INNER DIA. -0.4mm BEARING ASS'Y
1	主軸受（下）US 0.4	(1)	146673-02250	MAIN BEARING, lower US 0.4
2	主軸受（上）US 0.4	(1)	146673-02260	MAIN BEARING, upper US 0.4
	内径-0.8mmメタル仕組	1s	146673-02330	INNER DIA. -0.4mm BEARING ASS'Y
1	主軸受（下）US 0.8	(1)	146673-02270	MAIN BEARING, lower US 0.4
2	主軸受（上）US 0.8	(1)	146673-02280	MAIN BEARING, upper US 0.4
	オーバサイズ スラストメタル			OVER SIZE THRUST BEARING
	幅+0.4mmメタル仕組	2s	146673-02381	WIDTH of +0.4mm BEARING ASS'Y
3	スラストメタル（下）OS 0.4	(2)	146673-02171	THRUST BEARING, lower OS 0.4
4	スラストメタル（上）OS 0.4	(2)	146673-02181	THRUST BEARING, upper OS 0.4
	(3,4 メタル厚さ5.2mm)			(3,4 BEARING of THICKNESS 5.2mm)
	幅+0.6mmメタル仕組	2s	146673-02391	WIDTH of +0.6mm BEARING ASS'Y
3	スラストメタル（下）OS 0.6	(2)	146673-02191	THRUST BEARING, lower OS 0.6
4	スラストメタル（上）OS 0.6	(2)	146673-02201	THRUST BEARING, upper OS 0.6
	(3,4 メタル厚さ5.3mm)			(3,4 BEARING of THICKNESS 5.3mm)
6	メタルキャップ（基準）	1	————	MAIN BEARING CAP, base
7	メタルキャップ（中間）	7	————	MAIN BEARING CAP, intermediate
8	ボルト（メタルキャップ）	16	146673-02070	BOLT, main bearing cap
9	ナット（ヘッド/キャップ）	16	146673-01212	NUT, head/cap
10	サイドボルトA	6	146673-02080	SIDE BOLT A
11	サイドボルトB	8	146673-02090	SIDE BOLT B
12	サイドボルト（基準キャップ）	1	146673-02060	SIDE BOLT, base cap

付図8. ターニング装置 (1/1)

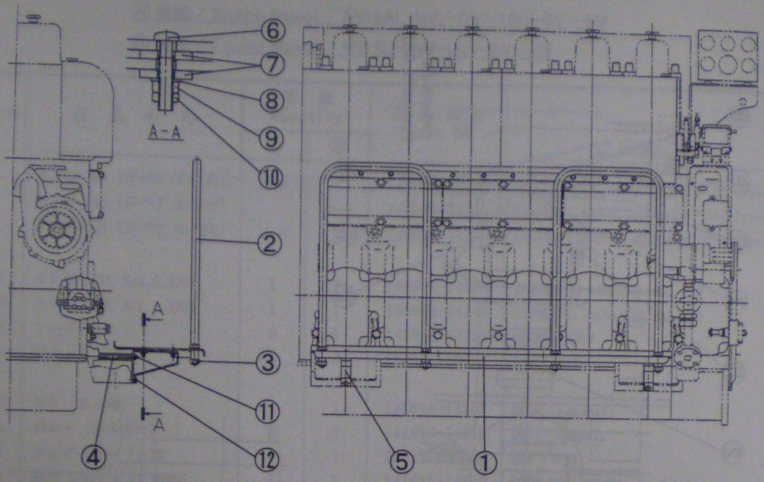
Fig.8 TURNING DEVICE



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	ターニング装置仕組	1set	746673-08100	TURNING DEVICE ASS'Y
1	シャフト (F/W ﾀｰﾆﾝｸﾞ)	1	146673-08300	SHAFT, F/W turning
2	ギヤ (F/W ﾀｰﾆﾝｸﾞ)	1	146673-08310	GEAR, F/W turning
3	フエザーキー 5×12	1	22512-050120	KEY 5×12
4	Uナット M16	1	26356-160002	U-NUT M16
5	ストッパー (F/W ﾀｰﾆﾝｸﾞ)	1	146673-08320	STOPPER, F/W turning
6	ボルト M10×12	2	26206-100122	BOLT M10×12
7	ロックバー	1	146673-08330	LOCK BAR
	ターニング脱確認用スイッチ仕組	1set	746673-74110	OFF-CONFIRMATION SWITCH ASS'Y, turning
8	マイクロスイッチ	1	46130-000110	MICRO SWITCH
9	取付台 (ﾏｲｸﾛｽｲｯﾁ)	1	146673-73161	MOUNT, micro switch
10	ボルト M10×30	2	26206-100302	BOLT M10×30
11	平行ピン 6×12	2	22312-060120	STRAIGHT PIN 6×12
12	なべ小ねじ	2	26557-040402	CROSS-RECESSED HEAD MACHINE SCREW
13	ドライブッシュ 40×40	1	24550-040400	DRY BUSH 40×40

付図9. 踏板仕組 (1/1)

Fig.9 PLATFORM ASS'Y

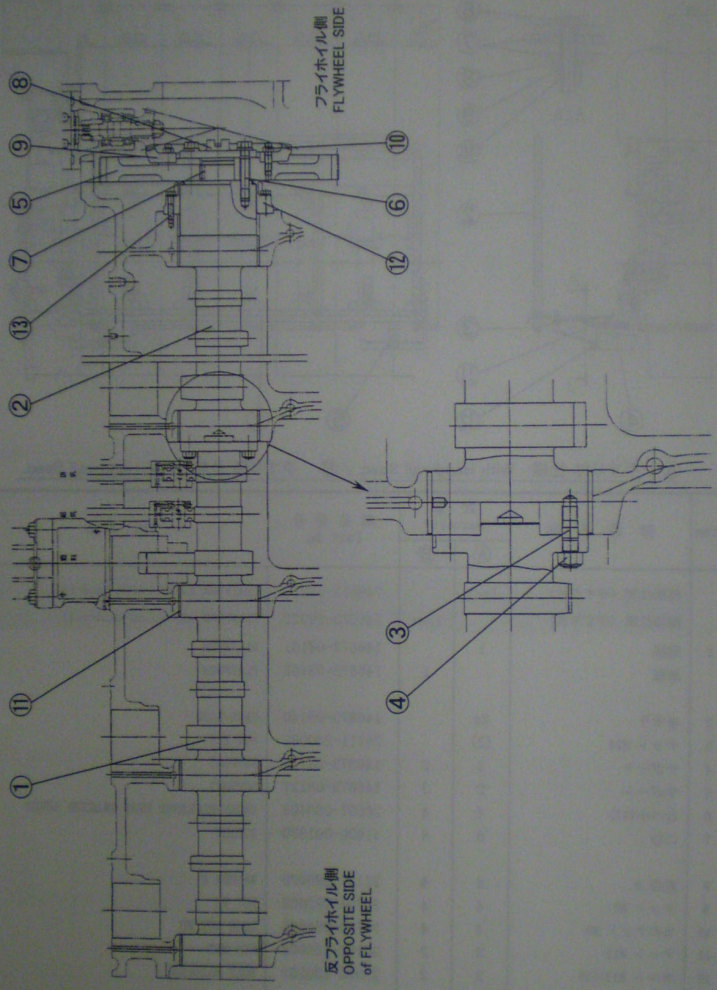


Ⓐ：手すり付 仕様 With Hand-rail Spec. / Ⓑ：手すり無 仕様 No Hand-rail Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	踏板仕組（手すり付）	1set		746673-08211	PLATFORM ASS'Y, with hand-rail
	踏板仕組（手すり無）		1set	746673-08022	PLATFORM ASS'Y, no hand-rail
1	踏板	1		146673-08131	PLATFORM
	踏板		1	146673-08102	PLATFORM
2	手すり	2s		146673-08140	HAND-RAIL
3	ナット M24	(2)		26711-240002	NUT M24
4	サポート	2	2	146673-08110	SUPPORT
5	サポート	2	2	146673-08121	SUPPORT
6	なべ小ねじ	4	4	26557-080402	CROSS-RECESSED HEAD MASHINE SCREW
7	ごむ	8	8	41400-001370	RUBBER
8	座金 8	4	4	22137-080000	WASHER 8
9	ナット M8	4	4	26706-080002	NUT M8
10	止めナット M8	4	4	26796-080002	LOCK NUT M8
11	ナット M12	2	2	26706-120002	NUT M12
12	ボルト M12×25	2	2	26206-120252	BOLT M12×25

付図10. カム軸およびカム軸受仕組 (1/2)

Fig.10 CAMSHAFT & BUSH ASS'Y



付図10. カム軸およびカム軸受仕組

Fig.10 CAMSHAFT & BUSH ASS'Y

Ⓐ 機種 / Engine Model.: 6N18AL-HV/-DV/-UV/-SV/-EV

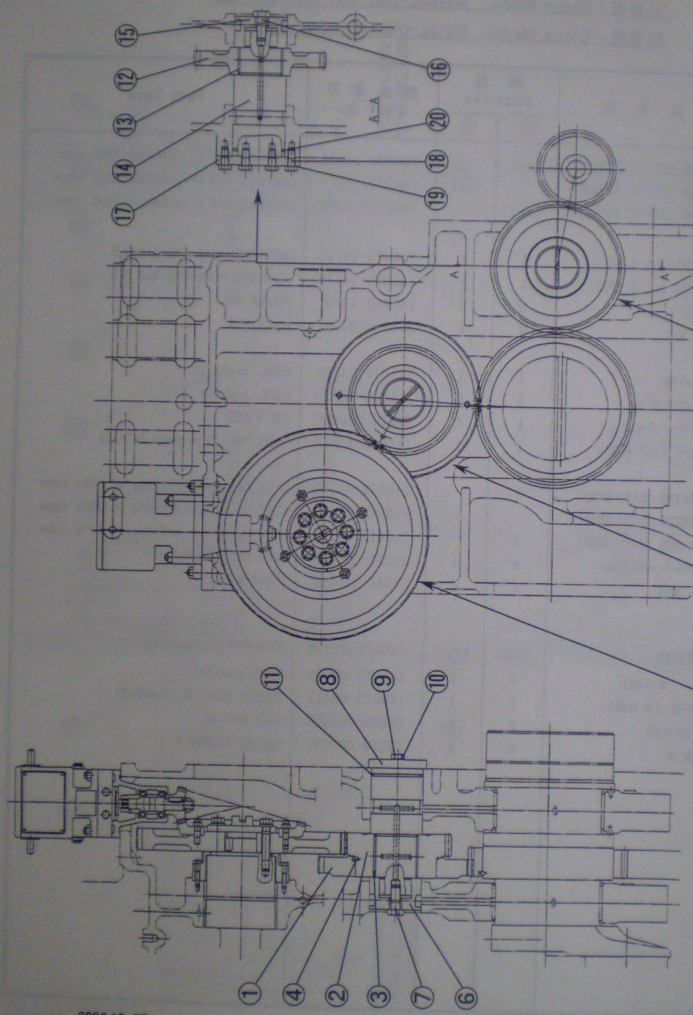
Ⓑ 機種 / Engine Model.: 6N18L-DV/-UV/-SV/-EV

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	カム軸仕組（ガバナ NZ61型）	1set		746674-14100	CAMSHAFT ASS'Y, governor NZ61 type
	カム軸仕組（ガバナ NZ61型）		1set	746674-14110	CAMSHAFT ASS'Y, governor NZ62 type
	カム軸仕組（ガバナ UG-8型）	1set		746674-14120	CAMSHAFT ASS'Y, governor UG-8 type
1	カム軸（CYL No.4,5,6用）	1	1	146674-14130	CAMSHAFT, with CYL No.4,5,6
2	カム軸（CYL No.1,2,3用）	1	1	146674-14140	CAMSHAFT, with CYL No.1,2,3
3	リーマボルト	8	8	141616-14730	REAMER BOLT
4	Uナット M12	8	8	26356-120002	U-NUT M12
5	ギヤ（カム軸）	1	1	141616-14101	GEAR, camshaft
6	ボルト（カムギヤ）	8	8	141616-14810	BOLT, camgear
7	フェザーキー 7×22	1	1	22512-070220	KEY 7×22
8	継手（フィードポンプ駆動）	1	1	141616-14802	COUPLING, feed pump driving
9	ギヤ（NZ61型 ガバナ駆動）	1		146673-14170	GEAR, governor driving of NZ61 type
	ギヤ（NZ61型 ガバナ駆動）		1	146673-14180	GEAR, governor driving of NZ61 type
	ギヤ（UG-8型 ガバナ駆動）	1		147673-17170	GEAR, governor driving of UG-8 type
10	植込みボルト M10×30	4	4	26212-100302	STUD BOLT M10×30
	Uナット M10	4	4	26346-100002	U-NUT M10
	カム軸受仕組	1set	1set	746673-02200	BUSH ASS'Y, camshaft
11	ブッシュ（カム軸）	7	7	146673-02420	BUSH, camshaft
12	スラスト受（カム軸）	1	1	146673-02411	THRUST BEARING, camshaft
13	ボルト M8×40	6	6	26206-080402	BOLT M8×40
	ばね座金 8	6	6	22212-080000	SPRING WASHER 8

付図11. カム軸および潤滑油ポンプ駆動中間歯車仕組

Fig.11 CAMSHAFT & LUB. OIL PUMP DRIVING IDLE GEAR ASS'Y

(1/2)



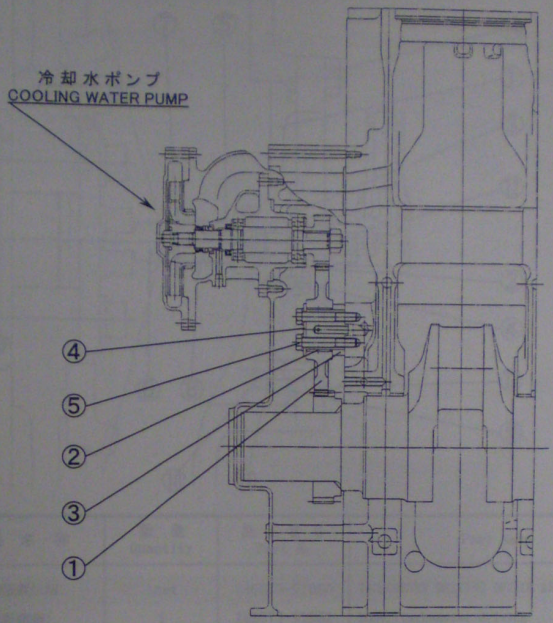
付図 11. カム軸および潤滑油ポンプ駆動中間歯車仕組 (2/2)

Fig.11 CAMSHAFT & LUB. OIL 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（カム軸駆動）	1set	746673-14300	IDLE GEAR ASS'Y, camshaft driving
	中間歯車仕組（カム軸駆動）	1s	146673-14500	IDLE GEAR ASS'Y, camshaft driving
1	中間歯車A	(1)	146673-14510	IDLE GEAR A
2	中間歯車B	(1)	146673-14520	IDLE GEAR B
3	ブッシュ	(1)	146673-14580	BUSH
4	平行ピン 6×6	(1)	22312-060060	STRAIGHT PIN 6×6
5	取付台	1	146673-14530	MOUNT, gear
6	押え（中間ギヤ）	1	146673-14540	SUPPORT, idle gear
7	ボルト M16×40	1	26152-160402	BOLT M16×40
8	押え板（中間サポート））	1	146673-14662	PLATE, idle support
9	ボルト M12×25	2	26206-120252	BOLT M12×25
	ボルト M12×20	2	26206-120202	BOLT M12×20
10	皿ばね座金 H12	4	194151-47760	CONED DISC WASHER H12
11	Oリング（1A）G85	1	24321-000850	O-RING (1A) G85
	中間歯車仕組（潤滑油ポンプ駆動）	1set	746673-14311	IDLE GEAR ASS'Y, lub. Oil pump driving
	中間歯車仕組（潤滑油ポンプ駆動）	1s	146673-14602	IDLE GEAR ASS'Y, lub. Oil pump driving
12	中間歯車	(1)	146673-14612	IDLE GEAR
13	ブッシュ	(1)	141616-14620	BUSH
14	取付台	1	146673-14650	MOUNT, gear
15	押え（中間ギヤ）	1	146673-14540	SUPPORT, idle gear
16	ボルト M16×40	1	26152-160402	BOLT M16×40
17	押え板（中間サポート））	1	146673-14662	PLATE, idle support
18	ボルト M12×25	2	26206-120252	BOLT M12×25
	ボルト M12×20	2	26206-120202	BOLT M12×20
19	皿ばね座金 H12	4	194151-47760	CONED DISC WASHER H12
20	Oリング（1A）G85	1	24321-000850	O-RING (1A) G85

付図12. 冷却水ポンプ駆動中間歯車仕組

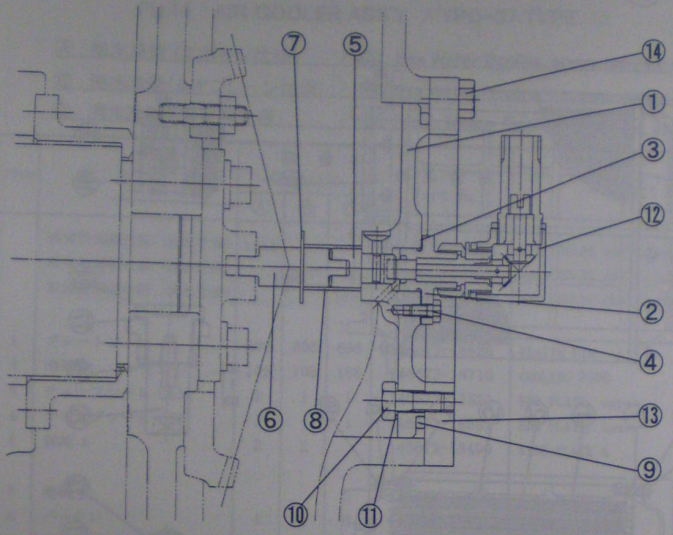
Fig.12 COOLING WATER PUMP DRIVING IDLE GEAR ASS'Y



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	中間歯車仕組	1set	746673-14320	IDLE GEAR ASS'Y,
	(冷却水ポンプ駆動)			cooling water pump driving
	中間歯車仕組	1s	146673-14630	IDLE GEAR ASS'Y,
	(冷却水ポンプ駆動)			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

付図13. 回転計駆動装置仕組 (1/1)

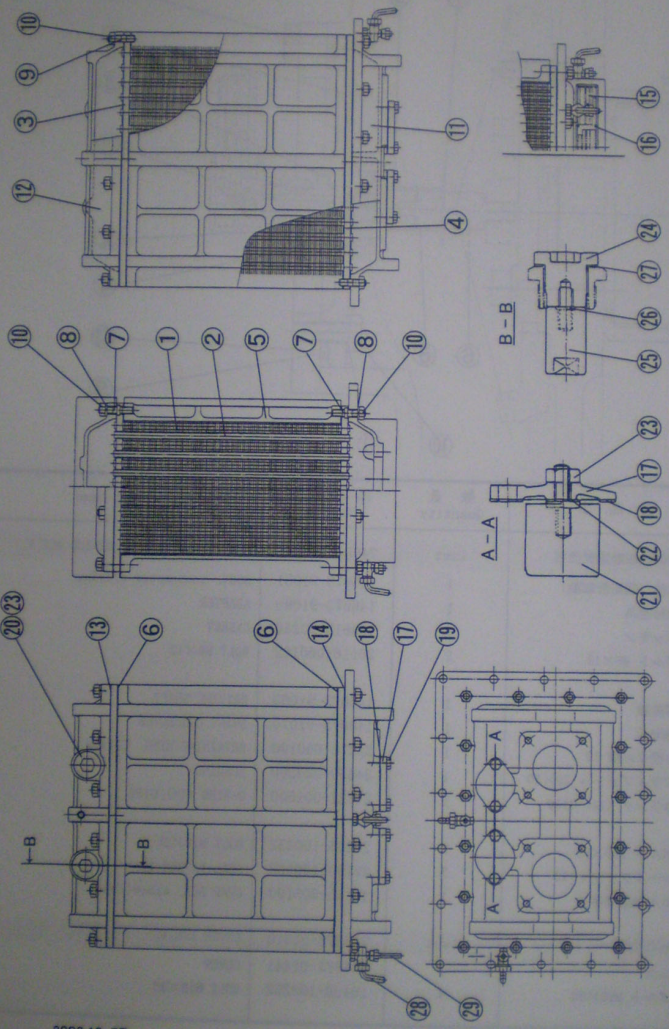
Fig.13 TACHOMETER DRIVING DEVICE ASS'Y



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	回転計駆動装置仕組	1set	746673-91050	TACHOMETER DRIVING DEVICE ASS'Y,
1	本体（回転計駆動）	1	146673-91051	BODY, tachometer driving
2	取付金具	1	146673-91090	ADAPTER
3	パッキン	1	138613-52240	GASKET
4	ボルト M6×12	2	26116-060122	BOLT M6×12
5	駆動軸	1	146673-91060	DRIVING SHAFT
6	軸継手	1	146673-91070	SHAFT CONNECTOR
7	E型止め輪 19	1	22272-000190	RETAINING RING, E type
8	ドライブブッシュ 20×30	1	24550-020300	BUSHING
9	Oリング (1A) G150	1	24321-001500	O-RING (1A) G150
10	ボルト M10×25	3	26206-100252	BOLT M10×25
11	シールワッシャ 10	3	22190-100003	SEAL WASHER 10
12	エルボ型継手	1	46150-005190	GEAR BOX, elbow type
	ふた仕組	1set	746673-01310	COVER ASS'Y,
13	ふた	1	146673-01441	COVER
14	ボルト M16×35	4	26152-160352	BOLT M16×35

付図14. 給気冷却器仕組 / YPC-37型 (1/3)

Fig.14 AIR COOLER ASS'Y / YPC-37 TYPE



付図 14. 給気冷却器仕組 / YPC-37型

(2/3)

Fig.14 AIR COOLER ASS'Y / YPC-37 TYPE

Ⓐ：海水冷却（エポキシ仕様） / Ⓐ：Sea Water Cooling, epoxy painting spec.

Ⓑ：海水冷却(ネオプレーン仕様) / Ⓑ：Sea Water Cooling, neoprne coting spec.

Ⓒ：清水冷却（無塗装仕様） / Ⓒ：Fresh Water Cooling, Spec. no painting spec.

Item	部品名称	数量 Quantity			部品番号 Part No.	Part Name
		Ⓐ	Ⓑ	Ⓒ		
	給気冷却器仕組（海水仕様）	1set			746673-18310	AIR COOLER ASS'Y, sea water spec.
	給気冷却器仕組（海水仕様）		1set		746673-18320	AIR COOLER ASS'Y, sea water spec.
	給気冷却器仕組（清水仕様）			1set	746673-18300	AIR COOLER ASS'Y, fresh water spec.
1	プレートフィン	696	696	696	146673-18620	PLAITE FIN
2	冷却管	105	105	105	146673-18710	COOLING PIPE
3	チューブシート（上）	1	1	1	146673-18521	END PLATE, upper
4	チューブシート（下）	1	1	1	146673-18531	END PLATE, lower
5	側板 A	2	2		146673-18490	SIDE PLATE A
5	側板 A			2	146673-18500	SIDE PLATE A
6	パッキン	4	4	4	146673-18740	GASKET
7	カラーボルト	24	24	24	146674-18720	COLLAR BOLT
8	ばね座金 12	24	24	24	22212-120000	SPRING WASHER 12
9	植込みボルト M12×30	8	8	8	26212-120302	STUD BOLT M12×30
10	ナット M12	32	32	32	26706-120002	MUT M12
11	ヘッダ（冷却水出入口）	1			146673-18660	HEADER, inlet/outlet of cooling water
	ヘッダ（冷却水出入口）		1		146673-18670	HEADER, inlet/outlet of cooling water
	ヘッダ（冷却水出入口）			1	146673-18650	HEADER, inlet/outlet of cooling water
12	ヘッダ（冷却水返し）	1			146673-18590	HEADER, return side of cooling water
	ヘッダ（冷却水返し）		1		146673-18600	HEADER, return side of cooling water
	ヘッダ（冷却水返し）			1	146673-18680	HEADER, return side of cooling water
13	パッキン（ヘッダ）	1	1	1	146673-18750	GASKET, header
14	パッキン（冷却水出入口）	1	1	1	146674-18760	GASKET, inlet/outlet of cooling water
15	銘板	1	1	1	146673-18951	NAME PLATE
16	バーカスクリュウリベット	4	4	4	137900-91451	RIVET
17	ふた			2	137800-33390	COVER
18	パッキン			2	137800-33380	
19	ボルト M10×22			4	26206-100222	BOLT M10×22
20	ねじプラグ R1/4			2	23877-020000	PLUG, screw R1/4

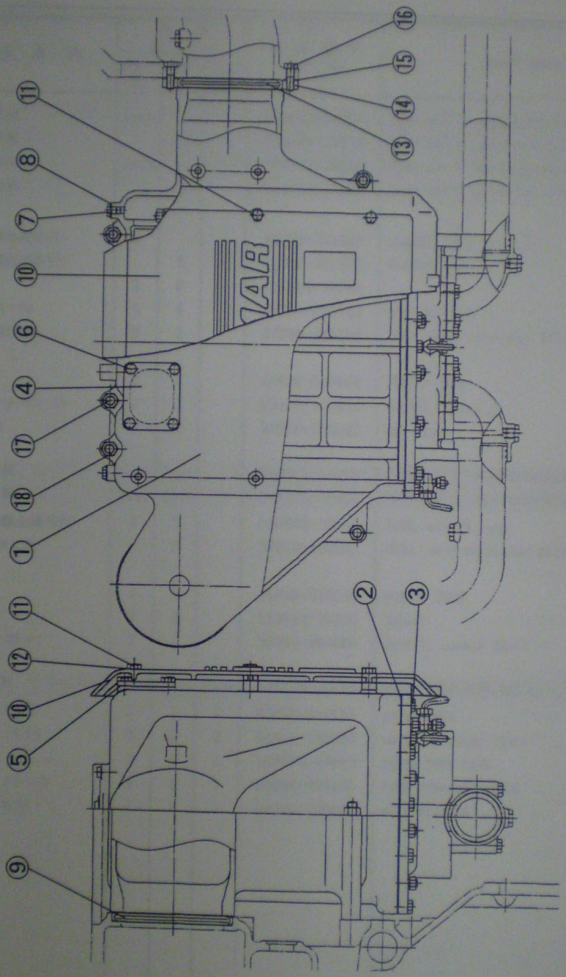
付図 14. 給気冷却器仕組 / YPC-37型

Fig.14 AIR COOLER ASS'Y / YPC-37 TYPE

Item	部品名称	数量 Quantity Ⓐ	Ⓑ	Ⓒ	部品番号 Part No.	Part Name
	防食亜鉛仕組	1set			746673-18260	ZINC ASS'Y, anti-corrosion
	防食亜鉛仕組		1set		746673-18270	ZINC ASS'Y, anti-corrosion
	保護純鉄仕組	1set			746673-18280	IRON ASS'Y, anti-corrosion
	保護純鉄仕組		1set		746673-18290	IRON ASS'Y, anti-corrosion
17	ふた (保護金属取付)	2			41632-004480	FLANGE, zinc
	ふた (保護金属取付)		2		41632-001260	FLANGE, zinc
18	パッキン	2	2		137800-33380	
19	ボルト M10×22	4	4		26206-100222	BOLT M10×22
21	防食亜鉛 40×40	2	2		27200-400400	ZINC, anti-corrosion 40×40
21	保護純鉄	2	2		41609-000960	PURITY IRON
22	ナイロンパッキン 10	2	2		23418-100000	GASKET, nylon 10
23	ナット M10	2	2		26706-100002	NUT M10
	防食亜鉛仕組	1set	1set		746673-18450	ZINC ASS'Y, anti-corrosion
	保護純鉄仕組	1set	1set		746673-18460	IRON ASS'Y, anti-corrosion
24	プラグ (保護金属取付)	2	2		146683-18730	PLUG, zinc & iron
25	防食亜鉛 25×95	2	2		27210-250950	ZINC, anti-corrosion 25×95
25	保護純鉄	2	2		41649-013310	PURITY IRON
26	パッキン	2	2		123210-09310	GASKET
27	銅パッキン 28×1	2	2		23414-280000	GASKET, copper 28×1
	水抜き管仕組	1set	1set	1set	746673-49490	WATER VENT PIPE ASS'Y
28	アスタップコック	1	1	1	23637-040022	ASTAP COCK
	銅パッキン 13×1	2	2	2	23414-130000	GASKET, copper 13×1
29	水抜き管	1	1	1	146673-49880	WATER VENT PIPE
	管止め金具 A6×12	1	1	1	23297-060121	PIPE SUPPORT A6×12
	ボルト M12×16	1	1	1	26206-120162	BOLT M12×16

付図15. 給気冷却器ケーシング仕組 (1/2)

Fig.15 AIR COOLER CASING ASS'Y



付図 15. 給気冷却器ケーシング仕組

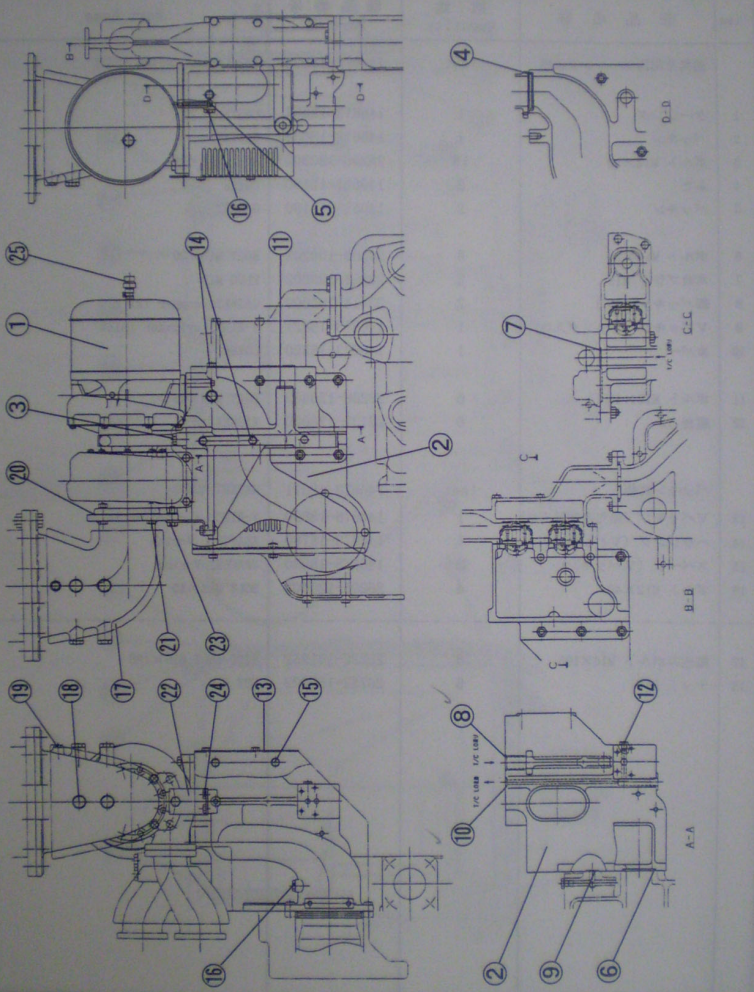
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Fig.15 AIR COOLER CASING ASS'Y

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	給気冷却器ケーシング仕組	1set	746673-18392	AIR COOLER CASING ASS'Y
1	ケーシング	1	146673-18553	CASING
2	パッキン	1	146673-18630	GASKET
3	ボルト M12×30	18	26206-120302	BOLT M12×30
4	ふた	2	146613-12150	COVER
5	パッキン	2	140623-12190	GASKET
6	ボルト M10×20	8	26206-100202	BOLT M10×20
7	六角プラグ M12	2	23887-120002	PLUG M12
8	銅パッキン 12×1	2	23414-120000	GASKET, copper 12×1
9	Vパッキン（シリンダ入口）	1	146673-18821	V-RING, cylinder inlet
10	カバー	1	146673-18320	COVER
11	ボルト M12×45	6	26206-120452	BOLT M12×45
12	座金 12	6	22137-120000	WASHER 12
	パッキン仕組	1set	746673-18371	GASKET ASS'Y
13	Vパッキン（給気冷却器入口）	1	146678-18890	V-RING, air cooler inlet
14	ハウジング（Vパッキン）	1	146673-18780	ADAPTER, V-ring
15	スペーサ（Vパッキン）	2	146678-18880	SPACER, V-ring
16	ボルト M12×40	4	26206-120402	BOLT M12×40
17	植込みボルト M16×195	6	26232-161952	STUD BOLT M16×195
18	ナット M16	6	26732-160002	NUT M16

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



付図16-1. 過給機および排気出口管仕組（RH133-Y型装備）

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

Ⓐ 仕様：燃料 A 重油 / Ⓐ Spec.: Fuel Oil M.D.O.

Ⓑ 仕様：燃料 低質油 / Ⓑ Spec.: Fuel Oil H.F.O.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	過給機 RH133-Y 型仕組				TURBO-CHARGER RH133-Y TYPE ASS'Y
	6N18L-DV/-UV 型機関用	1set		746672-18082	FOR 6N18L-DV/-UV TYPE ENGINE
1	RH133-Y 型過給機	1s		146672-18162	RH133-Y TYPE TURBO-CHARGER
	6N18L-DV/-UV 型機関用		1set	746672-18092	FOR 6N18L-DV/-UV TYPE ENGINE
1	RH133-Y 型過給機		1s	146672-18182	RH133-Y TYPE TURBO-CHARGER
	6N18L-SV 型機関用	1set		746673-18082	FOR 6N18L-SV TYPE ENGINE
1	RH133-Y 型過給機	1s		146673-18162	RH133-Y TYPE TURBO-CHARGER
	6N18L-SV 型機関用		1set	746673-18092	FOR 6N18L-SV TYPE ENGINE
1	RH133-Y 型過給機		1s	146673-18182	RH133-Y TYPE TURBO-CHARGER
	6N18L-EV 型機関用	1set		746674-18082	FOR 6N18L-EV TYPE ENGINE
1	RH133-Y 型過給機	1s		146674-18162	RH133-Y TYPE TURBO-CHARGER
	6N18L-EV 型機関用		1set	746674-18092	FOR 6N18L-EV TYPE ENGINE
1	RH133-Y 型過給機		1s	146674-18182	RH133-Y TYPE TURBO-CHARGER
	6N18AL-HV/-DV 型機関用	1set		746675-18082	FOR 6N18L-HV/-DV TYPE ENGINE
1	RH133-Y 型過給機	1s		146675-18162	RH133-Y TYPE TURBO-CHARGER
	6N18AL-HV/-DV 型機関用		1set	746675-18092	FOR 6N18AL-HV/-DV TYPE ENGINE
1	RH133-Y 型過給機		1s	146675-18182	RH133-Y TYPE TURBO-CHARGER
	6N18AL-UV 型機関用	1set		746676-18082	FOR 6N18AL-UV TYPE ENGINE
1	RH133-Y 型過給機	1s		146676-18162	RH133-Y TYPE TURBO-CHARGER
	6N18AL-UV 型機関用		1set	746676-18092	FOR 6N18AL-UV TYPE ENGINE
1	RH133-Y 型過給機		1s	146676-18182	RH133-Y TYPE TURBO-CHARGER
	6N18AL-SV 型機関用	1set		746678-18082	FOR 6N18AL-SV TYPE ENGINE
1	RH133-Y 型過給機	1s		146678-18162	RH133-Y TYPE TURBO-CHARGER
	6N18AL-SV 型機関用		1set	746677-18092	FOR 6N18AL-SV TYPE ENGINE
1	RH133-Y 型過給機		1s	146677-18182	RH133-Y TYPE TURBO-CHARGER

付図16-1. 過給機および排気出口管仕組（RH133-Y型装備）

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

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
2	取付台（過給機）	1	1	146672-18054	BRACKET, turbo-charger
3	ボルト M16×45	2	2	26152-160452	BOLT M16×45
4	Vパッキン	1	1	146678-18900	V-RING
5	リーマボルト	1	1	146672-18242	REAMER BOLT
6	Oリング（4D）P75	1	1	24316-000750	O-RING (4D) P75
7	Oリング（4D）P44	1	1	24316-000440	O-RING (4D) P44
8	Oリング（4D）P35	1	1	24316-000350	O-RING (4D) P35
9	Oリング（4D）P24	1	1	24316-000240	O-RING (4D) P24
10	Oリング（4D）P20	1	1	24316-000200	O-RING (4D) P20
11	プラグ M33	1	1	152623-11960	PLUG M33
	パッキン	1	1	127610-11760	GASKET
12	六角プラグ M14	1	1	23887-140002	PLUG M14
	銅パッキン 14×1	1	1	23414-140000	GASKET, copper 14×1
13	カバー（過給機取付台）	1	1	146672-18312	COVER, turbo-charger bracket
14	ボルト M12×20	3	3	26206-120202	BOLT M12×20
15	ボルト M12×30	2	2	26206-120302	BOLT M12×30
	ナット M12	2	2	26706-120002	NUT M12
	座金 12	2	2	22137-120000	WASHER 12
16	六角プラグ G3/8	2	2	23897-030002	PLUG G3/8
	銅パッキン 17×1	2	2	23414-170000	GASKET, copper 17×1

Ⓐ：250A 仕様, 250A Spec. / Ⓑ：300A 仕様, 300A Spec.

	排気出口管仕組（250A）	1set		746672-18141	EXHAUST OUTLET PIPE ASS'Y, 250A
	排気出口管仕組（300A）		1set	746672-18150	EXHAUST OUTLET PIPE ASS'Y, 300A
17	排気出口連絡管（250A）	1s		146672-18762	EXHAUST OUTLET PIPE, 250A
	排気出口連絡管（300A）		1s	146672-18950	EXHAUST OUTLET PIPE, 300A
18	六角プラグ G1/2	2	4	23894-040002	PLUG G1/2
	銅パッキン 21×1	2	4	23414-210000	GASKET, copper 21×1
19	六角プラグ M14	1	1	23884-140002	PLUG M14
	銅パッキン 14×1	1	1	23414-140000	GASKET, copper 14×1

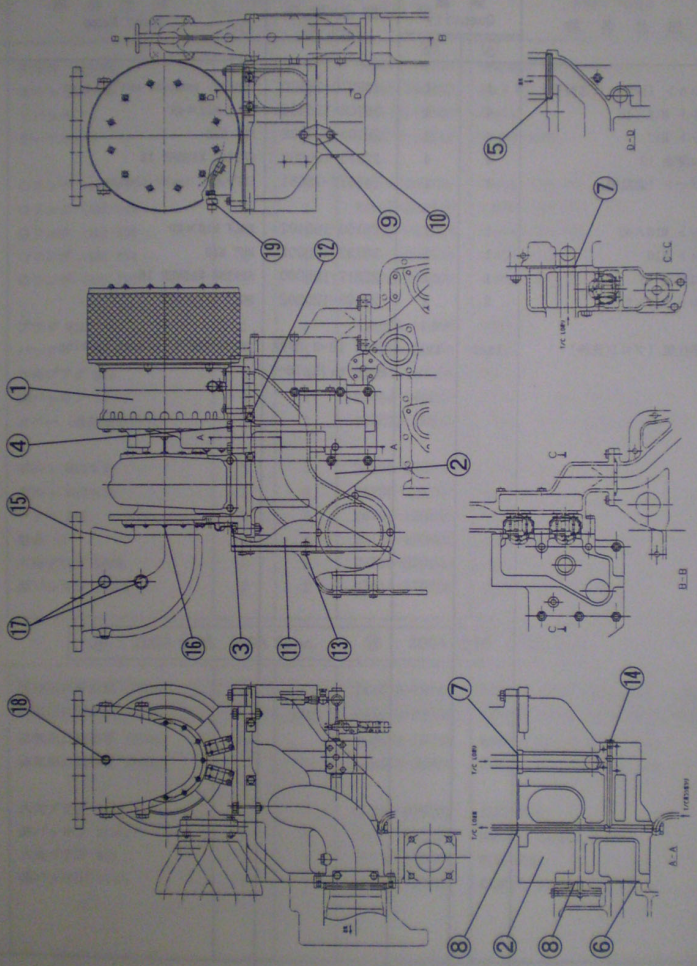
付図16-1. 過給機および排気出口管仕組（RH133-Y型装備）

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

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
20	パッキン（排気出口連絡管）	1	1	133670-18420	GASKET, exhaust outlet pipe
21	ボルト M12×45	4	4	26203-120452	BOLT M12×45
	ナット M12	4	4	26703-120002	NUT M12
	ばね座金 12	4	4	22213-120000	SPRING WASHER 12
22	サポート（過給機）	1	1	146672-18061	SUPPORT, turbo-charger
23	ボルト M16×40	1	1	26156-160402	BOLT M16×40
	ナット M16	1	1	26732-160002	NUT M16
	ばね座金 16	1	1	22217-160000	SPRING WASHER 16
24	ボルト M12×20	2	2	26203-120202	BOLT M12×20
25	継手仕組（ブロワ洗浄）	1set	1set	付図 16-3 参照 Refer to Fig.16-3	JOINT ASS'Y, blower washing

付図16-2. 過給機および排気出口管仕組 (RH143-Y型装備) (1/3)

Fig.16-2 TURBO-CHARGER & EXHAUST GAS OUTLET PIPE ASS'Y equipped with RH143-Y type



付図16-2. 過給機および排気出口管仕組（RH143-Y型装備）

Fig.16-2 TURBO-CHARGER & EXHAUST GAS OUTLET PIPE ASS'Y, equipped with RH143-Y type

Ⓐ 仕様：燃料 A 重油 / Ⓐ Spec.: Fuel Oil M.D.O.

Ⓑ 仕様：燃料 低質油 / Ⓑ Spec.: Fuel Oil H.F.O.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	過給機 RH143-Y 型仕組				TURBO-CHARGER RH143-Y TYPE ASS'Y
	6N18AL-EV 型機関用	1set		746678-18011	FOR 6N18L-EV TYPE ENGINE
1	RH143-Y 型過給機	1s		146678-18171	RH143-Y TYPE TURBO-CHARGER
	6N18AL-EV 型機関用		1set	746678-18091	FOR 6N18L-EV TYPE ENGINE
1	RH143-Y 型過給機		1s	146678-18181	RH143-Y TYPE TURBO-CHARGER
2	取付台（過給機）	1	1	146678-18051	BRACKET, turbo-charger
3	ボルト M16×70	2	2	26152-160702	BOLT M16×70
	ナット M16	2	2	26732-160002	NUT M16
	ばね座金 16	2	2	22212-160000	SPRING WASHER 16
4	ボルト M16×55	3	3	26152-160552	BOLT M16×55
	ばね座金 16	3	3	22212-160000	SPRING WASHER 16
5	Vパッキン	1	1	146673-18261	V-RING
6	Oリング（4D）P75	1	1	24316-000750	O-RING (4D) P75
7	Oリング（4D）P44	2	2	24316-000440	O-RING (4D) P44
8	Oリング（4D）P24	2	2	24316-000240	O-RING (4D) P24
9	小判フランジ 34	1	1	23221-340001	PIPE FLANGE, oval shape 34
	小判パッキン 36×1.5	1	1	23428-360000	GASKET, oval shape 36×1.5
10	ボルト M12×25	2	2	26206-120252	BOLT M12×25
11	カバー（過給機取付台）	1	1	146678-18310	COVER, turbo-charger bracket
12	ボルト M12×20	4	4	26206-120202	BOLT M12×20
13	ボルト M12×30	2	2	26206-120302	BOLT M12×30
	ナット M12	2	2	26706-120002	NUT M12
	座金 12	2	2	22137-120000	WASHER 12
14	六角プラグ M14	1	1	23887-140002	PLUG M14
	銅パッキン 14×1	1	1	23414-140000	GASKET, copper 14×1

付図16-2. 過給機および排気出口管仕組（RH143-Y型装備）

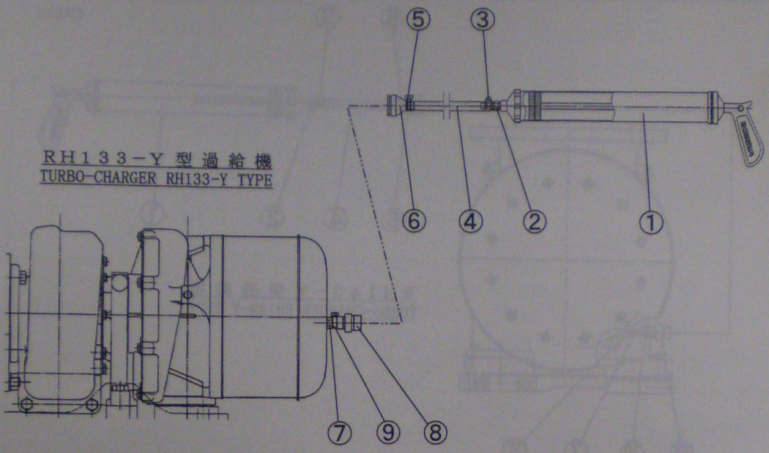
Fig.16-2 TURBO-CHARGER & EXHAUST GAS OUTLET PIPE ASS'Y, equipped with RH143-Y type

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	Ⓐ：250A 仕様, 250A Spec. / Ⓑ：300A 仕様, 300A Spec.				
	排気出口管仕組（250A）	1set		746673-18120	EXHAUST OUTLET PIPE ASS'Y, 250A
	排気出口管仕組（300A）		1set	746673-18131	EXHAUST OUTLET PIPE ASS'Y, 300A
15	排気出口連絡管（250A）	1s		146673-18760	EXHAUST OUTLET PIPE, 250A
	排気出口連絡管（300A）		1s	146673-18851	EXHAUST OUTLET PIPE, 300A
16	ナット M8	12	12	26703-080002	NUT M8
	ばね座金 8	12	12	22213-080000	SPRING WASHER 8
17	六角プラグ G1/2	4	4	23894-040002	PLUG G1/2
	銅パッキン 21×1	4	4	23414-210000	GASKET, copper 21×1
18	六角プラグ M14	1	1	23884-140002	PLUG M14
	銅パッキン 14×1	1	1	23414-140000	GASKET, copper 14×1
19	継手仕組（ブロワ洗浄）	1set	1set	付図 16-4 参照 Refer to Fig.16-4	JOINT ASS'Y, blower washing

付図16-3. 過給機ブロワ洗浄装置 (RH133-Y型)

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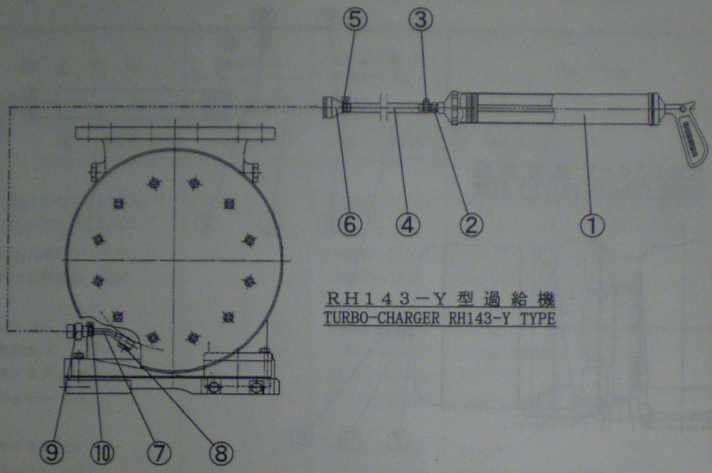
Fig.16-3 TURBO-CHARGER BLOWER WASHER, RH133-Y type



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	ブロワ洗浄装置仕組	1s	153602-92900	BLOWER WASHING EQUPMENT ASS'Y
1	シリンジ本体	(1)	153602-92910	BODY
2	ホースニップル	(1)	153602-92920	HOSE NIPPLE
3	ホースクリップ	(1)	23000-016000	HOSE CLIP
4	ビニール管	(1)	23091-090650	PLASTIC PIPE
5	ホースバンド 18	(1)	23010-018000	HOSE BAND 18
6	ソケット	(1)	153602-92930	SOCKET
	ブロワ洗浄金具仕組	1set	746672-18450	CONNECTOR ASS'Y, blower washing
7	継手 (ブロワ洗浄)	1	146672-18480	CONNECTOR, blower washing
	銅パッキン 8×1	1	23414-080000	GASKET, copper 8×1
8	プラグ	1	153602-92950	PLUG
9	ホースバンド 18	1	23010-018000	HOSE BAND 18

付図16-4. 過給機ブロワ洗浄装置 (RH143-Y型)

Fig.16-4 TURBO-CHARGER BLOWER WASHER, RH143-Y type

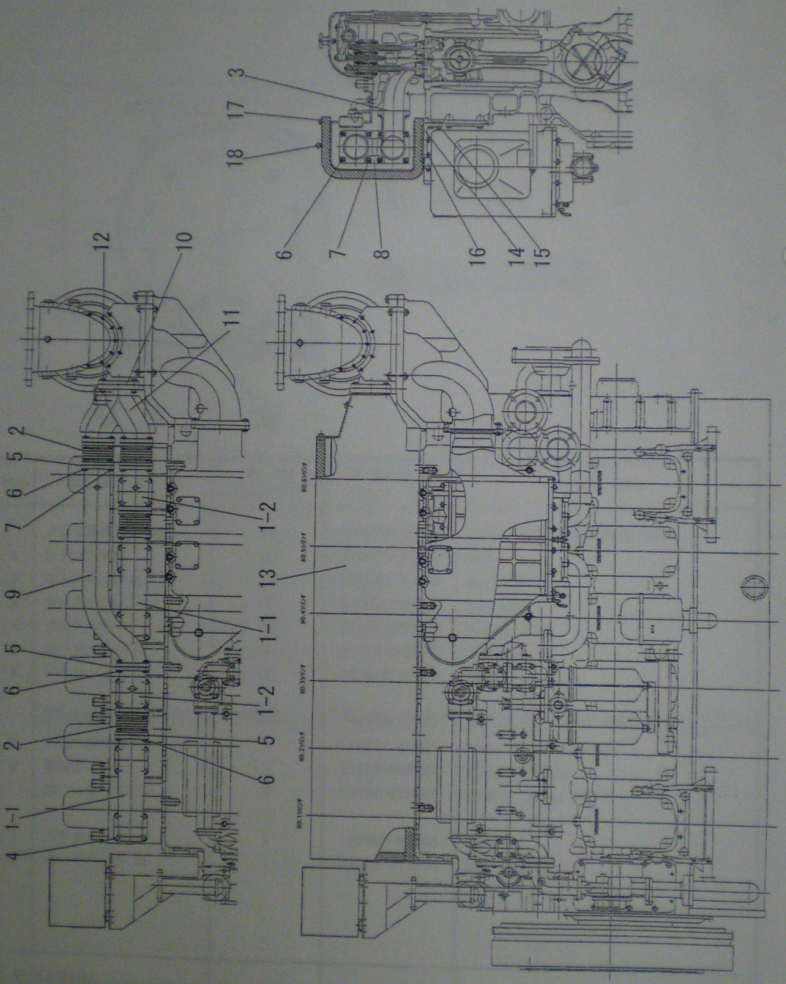


RH143-Y型過給機
TURBO-CHARGER RH143-Y TYPE

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	ブロワ洗浄装置仕組	1s	153602-92900	BLOWER WASHING EQUPMENT ASS'Y
1	シリンジ本体	(1)	153602-92910	BODY
2	ホースニップル	(1)	153602-92920	HOSE NIPPLE
3	ホースクリップ	(1)	23000-016000	HOSE CLIP
4	ビニール管	(1)	23091-090650	PLASTIC PIPE
5	ホースバンド 18	(1)	23010-018000	HOSE BAND 18
6	ソケット	(1)	153602-92930	SOCKET
	ブロワ洗浄管仕組	1set	746673-18420	PIPE ASS'Y, blower washing
7	ブロワ洗浄管	1	146673-18440	PIPE, blower washing
8	管継手ボルト	1	43524-000050	PIPE JOINT BOLT
	銅パッキン 17×1	2	23414-170000	GASKET, copper 17×1
9	プラグ	1	153602-92950	PLUG
10	ホースバンド 18	1	23010-018000	HOSE BAND 18

付図17. 排気マニホールド仕組

Fig.17 EXHAUST MANIFOLD ASS'Y



付図17. 排気マニホールド仕組

(2/3)

Fig.17 EXHAUST MANIFOLD ASS'Y

A仕様：機関形式 6N18(A)L-HV/-DV/-UV/-SV / 6N18L-EV
A Spec.: Engine Model 6N18(A)L-HV/-DV/-UV/-SV / 6N18L-EV

B仕様：機関形式 6N18AL-EV / B Spec.: Engine Model 6N18AL-EV

Item	部品名称	数量 Quantity A	数量 Quantity B	部品番号 Part No.	Part Name
	排気マニホールド仕組	1set	1set	746673-13013	EXHAUST MANIFOLD ASS'Y
1-1	排気マニホールド1.2,4.5	2	2	146673-13510	EXHAUST MANIFOLD 1.2, 4.5
1-2	排気マニホールド 3.6	2	2	146673-13520	EXHAUST MANIFOLD 3, 6
2	伸縮継手（排気）	4	4	147673-13900	FLEXIBLE JOINT (EXH.)
3	パッキン（ヘッド出口）	6	6	146673-13210	GASKET, cylinder head outlet
4	ボルト M12×35	24	24	26203-120302	BOLT M12×35
	座金 12	24	24	22133-120000	WASHER 12
5	ガスケット	9	9	147673-13250	GASKET
6	ボルト M12×45	32	32	147673-13400	BOLT M12×45
	ナット M12	32	32	26703-120002	NUT M12
7	ボルト M12×50	4	4	45521-013670	BOLT M12×50
	ナット M12	4	4	26703-120002	NUT M12
8	サポート（排気連絡管）	6	6	147673-13230	SUPPORT, exhaust pipe
9	排気連絡管	1	1	146673-13120	EXHAUST PIPE
	排気連絡管仕組	1set		746672-13102	EXHAUST PIPE ASS'Y
	排気連絡管仕組		1set	746673-13101	EXHAUST PIPE ASS'Y
10	排気連絡管	1		146672-13140	EXHAUST PIPE
	排気連絡管		1	146673-13140	EXHAUST PIPE
11	ガスケット（過給機入口）	1		146672-13401	GASKET, turbo-charger inlet
	ガスケット（過給機入口）		1	159615-13201	GASKET, turbo-charger inlet
12	ボルト M12×50	4		45521-013670	BOLT M12×50
	ナット M12	4		26703-120002	NUT M12
12	ボルト M16×55		4	147673-13410	BOLT M16×55
	ナット M16		4	26713-160002	NUT M16

付図17. 排気マニホールド仕組

3/3

Fig.17 EXHAUST MANIFOLD ASS'Y

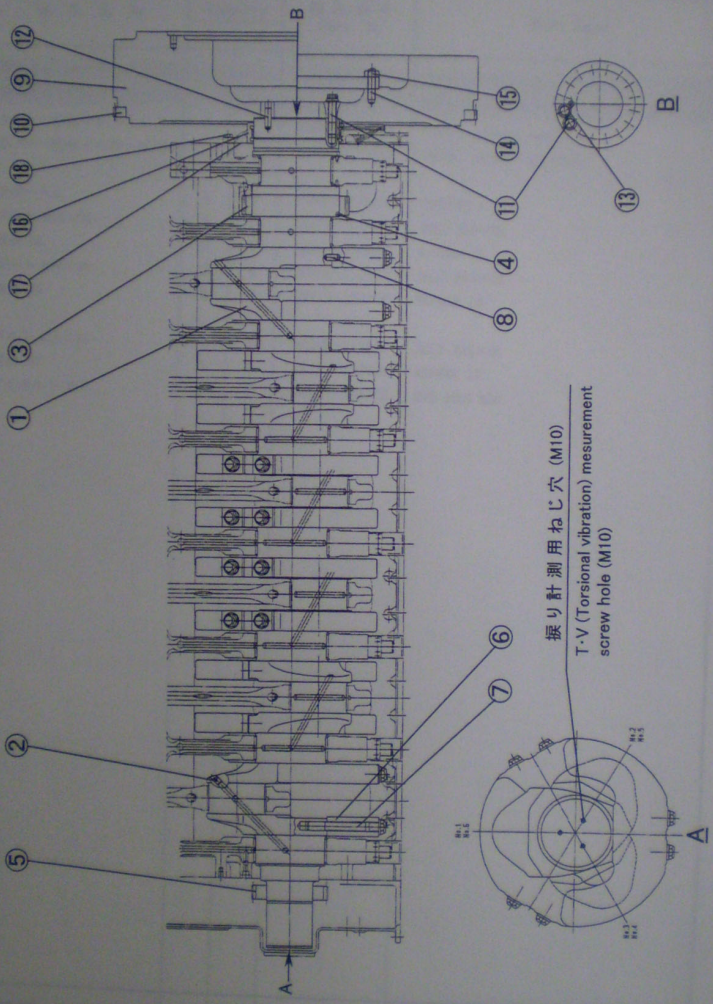
Item	部品名称	数量 Quantity A	数量 Quantity B	部品番号 Part No.	Part Name
	排気マニホールドカバー仕組	1set		146673-13210	EXHAUST MANIFOLD COVER ASS'Y
	排気マニホールドカバー仕組		1set	146683-13210	EXHAUST MANIFOLD COVER ASS'Y
13	カバー（排気マニホールド）	1		146673-13291	COVER, exhaust manifold
	カバー（排気マニホールド）		1	146683-13310	COVER, exhaust manifold
14	サポートA	4	4	146673-13351	SUPPORT A
15	ボルト M12×25	8	8	26206-120252	BOLT M12×25
	座金 12	8	8	22137-120000	WASHER 12
16	ボルト M10×20	8	8	26206-100202	BOLT M10×20
	座金 10	8	8	22137-100000	WASHER 10
17	ボルト M12×50	4	4	26206-120502	BOLT M12×50
	座金 12	4	4	22137-120000	WASHER 12
18	アイボルト M10	2	2	26610-100002	EYE BOLT M10

付図18-1. クランク軸およびフライホイル仕組

（非胴体直結，片側軸受仕様）

1/3

Fig.18-1 CRANKSHAFT & FLYWHEEL ASS'Y, direct coupling & single side bearing spec.



付図18-1. クランク軸およびフライホイル仕組 (2/3)

（非胴体直結、片側軸受仕様）

Fig.18-1 CRANKSHAFT & FLYWHEEL ASS'Y,

direct coupling & single side bearing spec.

A 仕様：振り計測用ねじ穴無 / A Spec. : Shaft end : Rude of T·V mesurement screw hole

B 仕様：振り計測用ねじ穴有 / B Spec. : Shaft end : Screw hole dress of T·V mesurement

Item	部品名称	数量 Quantity A	数量 Quantity B	部品番号 Part No.	Part Name
	クランク軸仕組	1set		746673-21010	CRANKSHAFT ASS'Y
	〃		1set	746673-21020	〃
1	クランク軸	1		146673-21010	CRANKSHAFT
	クランク軸		1	146673-21040	CRANKSHAFT
2	六角穴付止めねじ	6	6	142613-21050	HEXAGON SOCKET HEAD SET SCREW
3	ギヤ（ホイル側）	1	1	146673-21200	GEAR, flywheel side
4	平行ピン 6×6	1	1	22312-060060	STRAIGHT PIN 6×6
5	ギヤ（反ホイル側）	1	1	146673-21211	GEAR, anti flywheel side
	バランスウェイト仕組				BALANCE WEIGHT ASS'Y
	6N18L-DV/-UV/-SV/-EV 用	12set	12set	746673-21161	FOR 6N18L-DV/-UV/-SV/-EV TYPE
6	バランスウェイト	12	12	146673-21111	BALANCE WEIGHT
7	ボルト（バランスウェイト）	24	24	146673-21132	BOLT, balance weight
8	平行ピン 16×30	12	12	22312-160300	STRAIGHT PIN 16×30
	6N18AL-HV/-DV/-UV/-SV -EV 用	12set	12set	746676-21150	FOR 6N18AL-HV/-DV/-UV/-SV/-EV TYPE
6	バランスウェイト	12	12	146676-21100	BALANCE WEIGHT
7	ボルト（バランスウェイト）	24	24	146673-21132	BOLT, balance weight
8	平行ピン 16×30	12	12	22312-160300	STRAIGHT PIN 16×30
	フライホイル仕組				FLYWHEEL ASS'Y
	6N18L-DV/-UV/-SV/-EV 用	1set	1set	746673-21121	FOR 6N18L-DV/-UV/-SV/-EV TYPE
9	フライホイル（1050×220）	1	1	146673-21392	FLYWHEEL (1050×220)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト（フライホイル）	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	縛り線 1.2	1	1	22451-120000	WIRE 1.2

付図18-1. クランク軸およびフライホイル仕組 (3/3)

（非胴体直結、片側軸受仕様）

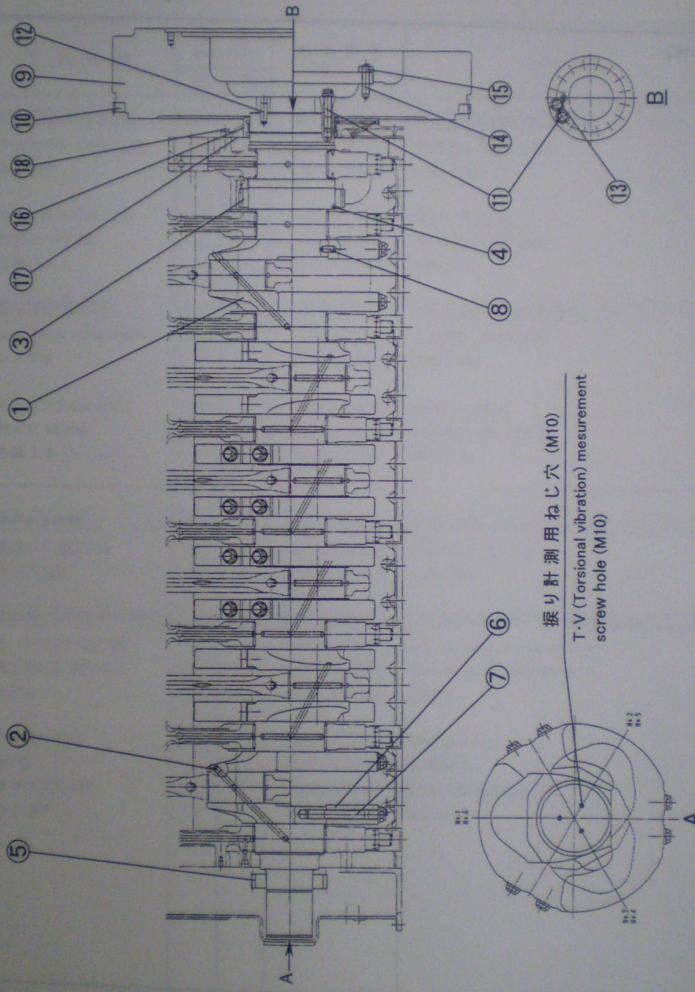
Fig.18-1 CRANKSHAFT & FLYWHEEL ASS'Y, direct coupling & single side bearing spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	6N18AL-HV/-DV/-UV 用	1set	1set	746673-21131	FOR 6N18AL-HV/-DV/-UV TYPE
9	フライホイル (944×182)	1	1	146673-21371	FLYWHEEL (944×182)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト (フライホイル)	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	縛り線 1.2	1	1	22451-120000	WIRE 1.2
	6N18AL-SV/-EV 用	1set	1set	746673-21141	FOR 6N18AL-SV/-EV TYPE
9	フライホイル (944×205)	1	1	146673-21381	FLYWHEEL (944×205)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト (フライホイル)	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	縛り線 1.2	1	1	22451-120000	WIRE 1.2
	直結ボルト仕組	20set	20set	746673-21220	BOLT ASS'Y, direct coupling
14	植込ボルト M20×65	20	20	26232-200652	STUD BOLT M20×65
15	Uナット M20	20	20	26356-200002	U-NUT M20
	ふた仕組 (フライホイル側)	1set	1set	746673-01190	OIL SLINGER ASS'Y, flywheel side
16	ふた (フライホイル側)	1s	1s	146673-01570	OIL SLINGER, flywheel side
	平先止めねじ M10×10	(1)	(1)	26911-100102	SLOTTED SET SCREW M10×10
17	パッキン	1	1	146673-01560	GASKET
18	ボルト M12×30	17	17	26206-120302	BOLT M12×30
	座金 12	17	17	22137-120000	WASHER 12
	平行ピン M10×28	2	2	22340-100282	STRAIGHT PIN M10×28
	ナット M10	2	2	26706-100002	NUT M10

付図18-2. クランク軸およびフライホイル仕組

（非胴体直結，両側軸受仕様） 1/3

Fig.18-2 CRANKSHAFT & FLYWHEEL ASS'Y, direct coupling & both side bearing spec.



付図18-2. クランク軸およびフライホイル仕組 (2/3)
（非胴体直結、両側軸受仕様）

Fig.18-2 CRANKSHAFT & FLYWHEEL ASS'Y, direct coupling & both side bearing spec.

Ⓐ 仕様：振り計測用ねじ穴無 / Ⓐ Spec.: Shaft end; Rude of T·V mesurement screw hole

Ⓑ 仕様：振り計測用ねじ穴有 / Ⓑ Spec.: Shaft end; Screw hole dress of T·V mesurement

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	クランク軸仕組	1set		746673-21010	CRANKSHAFT ASS'Y
	〃		1set	746673-21020	〃
1	クランク軸	1		146673-21010	CRANKSHAFT
	クランク軸		1	146673-21040	CRANKSHAFT
2	六角穴付止めねじ	6	6	142613-21050	HEXAGON SOCKET HEAD SET SCREW
3	ギヤ（ホイル側）	1	1	146673-21200	GEAR, flywheel side
4	平行ピン 6×6	1	1	22312-060060	STRAIGHT PIN 6×6
5	ギヤ（反ホイル側）	1	1	146673-21211	GEAR, anti flywheel side
	バランスウェイト仕組	12set	12set	746673-21170	BALANCE WEIGHT ASS'Y
6	バランスウェイト	12	12	146673-21120	BALANCE WEIGHT
7	ボルト（バランスウェイト）	24	24	146673-21132	BOLT, balance weight
8	平行ピン 16×30	12	12	22312-160300	STRAIGHT PIN 16×30
	フライホイル仕組				FLYWHEEL ASS'Y
	6N18L-DV/-UV/-SV/-EV 用	1set	1set	746673-21121	FOR 6N18L-DV/-UV/-SV/-EV TYPE
9	フライホイル（1050×220）	1	1	146673-21392	FLYWHEEL (1050×220)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト（フライホイル）	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	綴り線 1.2	1	1	22451-120000	WIRE 1.2
	6N18AL-HV/-DV/-UV 用	1set	1set	746673-21131	FOR 6N18AL-HV/-DV/-UV TYPE
9	フライホイル（944×182）	1	1	146673-21371	FLYWHEEL (944×182)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト（フライホイル）	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	綴り線 1.2	1	1	22451-120000	WIRE 1.2

付図18-2. クランク軸およびフライホイル仕組
（非胴体直結、両側軸受仕様）

Fig.18-2 CRANKSHAFT & FLYWHEEL ASS'Y, direct coupling & both side bearing spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	6N18AL-SV/-EV 用	1set	1set	746673-21141	FOR 6N18AL-SV/-EV TYPE
9	フライホイル (944×205)	1	1	146673-21381	FLYWHEEL (944×205)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト（フライホイル）	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	縛り線 1.2	1	1	22451-120000	WIRE 1.2
	直結ボルト仕組	20set	20set	746673-21220	BOLT ASS'Y, direct coupling
14	植込ボルト M20×65	20	20	26232-200652	STUD BOLT M20×65
15	Uナット M20	20	20	26356-200002	U-NUT M20
	ふた仕組（フライホイル側）	1set	1set	746673-01190	OIL SLINGER ASS'Y, flywheel side
16	ふた（フライホイル側）	1s	1s	146673-01570	OIL SLINGER, flywheel side
	平先止めねじ M10×10	(1)	(1)	26911-100102	SLOTTED SET SCREW M10×10
17	パッキン	1	1	146673-01560	GASKET
18	ボルト M12×30	17	17	26206-120302	BOLT M12×30
	座金 12	17	17	22137-120000	WASHER 12
	平行ピン M10×28	2	2	22340-100282	STRAIGHT PIN M10×28
	ナット M10	2	2	26706-100002	NUT M10

付図18-3. クランク軸およびフライホイル仕組（胴体直結仕様）(1/3)

Fig.18-3 CRANKSHAFT & FLYWHEEL ASS'Y, bell mounting spec.

付図18-3. クランク軸およびフライホイル仕組（胴体直結仕様） (2/3)

Fig.18-3 CRANKSHAFT & FLYWHEEL ASS'Y, bell mounting spec.

Ⓐ 仕様：振り計測用ねじ穴無 / Ⓐ Spec. : Shaft end : Rude of T·V mesurement screw hole

Ⓑ 仕様：振り計測用ねじ穴有 / Ⓑ Spec. : Shaft end : Screw hole dress of T·V mesurement

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	クランク軸仕組	1set		746673-21010	CRANKSHAFT ASS'Y
	〃		1set	746673-21020	〃
1	クランク軸	1		146673-21010	CRANKSHAFT
	クランク軸		1	146673-21040	CRANKSHAFT
2	六角穴付止めねじ	6	6	142613-21050	HEXAGON SOCKET HEAD SET SCREW
3	ギヤ（ホイル側）	1	1	146673-21200	GEAR, flywheel side
4	平行ピン 6×6	1	1	22312-060060	STRAIGHT PIN 6×6
5	ギヤ（反ホイル側）	1	1	146673-21211	GEAR, anti flywheel side
	バランスウェイト仕組				BALANCE WEIGHT ASS'Y
	6N18L-DV/-UV/-SV/-EV 用	12set	12set	746673-21161	FOR 6N18L-DV/-UV/-SV/-EV TYPE
6	バランスウェイト	12	12	146673-21111	BALANCE WEIGHT
7	ボルト（バランスウェイト）	24	24	146673-21132	BOLT, balance weight
8	平行ピン 16×30	12	12	22312-160300	STRAIGHT PIN 16×30
	6N18AL-HV/-DV/-UV/-SV -EV 用	12set	12set	746676-21150	FOR 6N18AL-HV/-DV/-UV/-SV/-EV TYPE
6	バランスウェイト	12	12	146676-21100	BALANCE WEIGHT
7	ボルト（バランスウェイト）	24	24	146673-21132	BOLT, balance weight
8	平行ピン 16×30	12	12	22312-160300	STRAIGHT PIN 16×30
	フライホイル仕組				FLYWHEEL ASS'Y
	6N18L-DV/-UV/-SV/-EV 用	1set	1set	746673-21101	FOR 6N18L-DV/-UV/-SV/-EV TYPE
9	フライホイル（944×240）	1	1	146673-21340	FLYWHEEL (944×240)
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト（フライホイル）	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	縛り線 1.2	1	1	22451-120000	WIRE 1.2
	6N18AL-HV/-DV/-UV/-SV -EV 用	1set	1set	746676-21111	FOR 6N18AL-HV/-DV/-UV/-SV/-EV TYPE
9	フライホイル（944×235）	1	1	146673-21360	FLYWHEEL (944×235)

付図18-3. クランク軸およびフライホイル仕組（胴体直結仕様） (3/3)

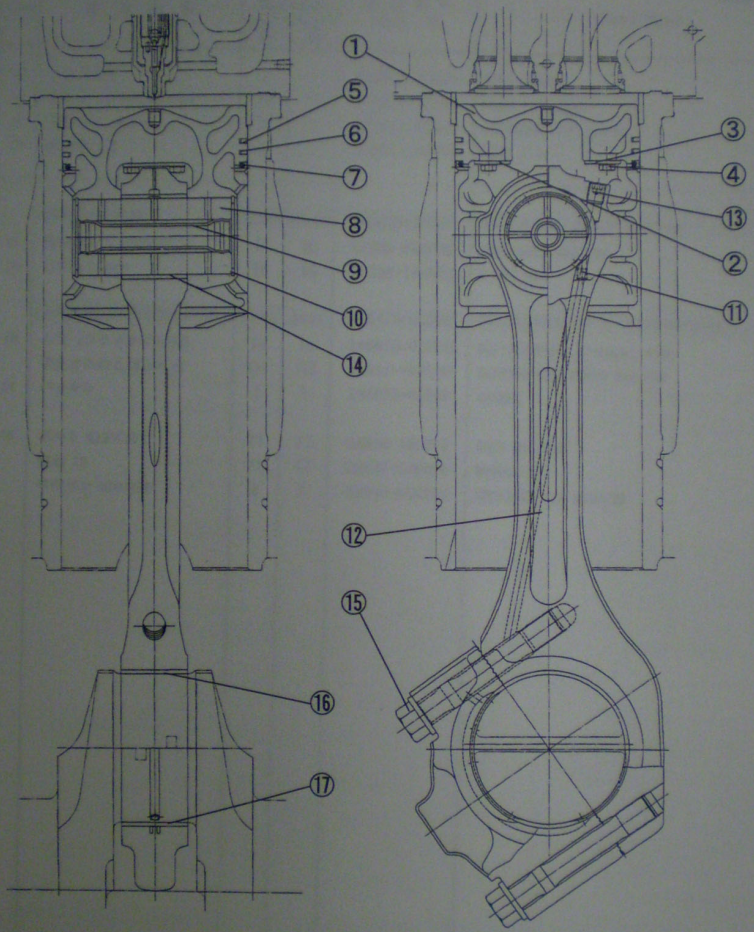
Fig.18-3 CRANKSHAFT & FLYWHEEL ASS'Y, bell mounting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
10	リングギヤ	1	1	146673-21600	RING GEAR
11	ボルト（フライホイル）	16	16	152673-21500	BOLT, flywheel
12	平行ピン 16×50	1	1	22312-160500	STRAIGHT PIN 16×50
13	縛り線 1.2	1	1	22451-120000	WIRE 1.2
	直結ボルト仕組	12set	12set	746673-21200	BOLT ASS'Y, direct coupling
14	植込ボルト M16×60	16	16	26232-160602	STUD BOLT M16×60
15	Uナット M16	16	16	26356-160002	U-NUT M16
	ふた仕組（フライホイル側）	1set	1set	746673-01200	OIL SLINGER ASS'Y, flywheel side
16	ふた（フライホイル側）	1s	1s	146673-01570	OIL SLINGER, flywheel side
	平先止めねじ M10×10	(1)	(1)	26911-100102	SLOTTED SET SCREW M10×10
17	パッキン	1	1	146673-01560	GASKET
18	ボルト M12×30	17	17	26206-120302	BOLT M12×30
	座金 12	17	17	22137-120000	WASHER 12
	平行ピン M10×28	2	2	22340-100282	STRAIGHT PIN M10×28

付図19. ピストンおよび連接棒仕組

(1/3)

Fig.19 PISTON & CONNECTING ROD ASS'Y



反フライホイル側 OPPOSITE SIDE of FLYWEEL

フライホイル側 FLYWEEL SIDE

操縦側 OPERATING SIDE

非操縦側 ANTI-OPERATING SIDE

付図19. ピストンおよび連接棒仕組 (2/3)

Fig.19 PISTON & CONNECTING ROD ASS'Y

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	ピストン仕組	6set	746674-22011	PISTON ASS'Y
	ピストン仕組	6s	146674-22450	PISTON ASS'Y
1	ピストン	(6)	146674-22060	PISTON
2	ふた（冷却室/穴無）	(6)	146603-22850	COVER, cooling chamber / blind
3	ふた（冷却室/φ12穴）	(6)	146673-22850	COVER, cooling chamber / hole φ12
4	ボルト M8×12	(24)	26206-080122	BOLT M8×12
	ねじ用皿ばね	(24)	138613-23290	CUP WASHER
5	ピストンリング（No.1）（3面メッキ）	6	146673-22130	COMPRESSION RING, No.1 (3-face CR-plated)
6	ピストンリング（No.2）	6	146673-22140	COMPRESSION RING, No.2
7	オイルリング仕組	6s	146673-22180	OIL RING ASS'Y
	オイルリング（No.3）	(6)	146673-22160	OIL RING, No.3
	コイルエキスパンダ	(6)	146673-22170	COIL EXPANDER
	ピストンピン仕組	6s	146673-22310	PISTON PIN ASS'Y
8	ピストンピン	(6)	146673-22300	PISTON PIN
9	油止め管	(6)	146673-22320	TUBE, oil gallery
10	穴用C型止め輪 75	12	22252-000750	RETAINING RING, C type 75
11	平先止めねじ M10×12	6	26911-100122	SLOTTED SET SCREW M10×12
	【備考】 再生ピストンの場合			【Remark】 In the case of piston ring groove plating repaired piston
5	ピストンリング（No.1）（1面メッキ）	6	146674-22110	COMPRESSION RING, No.1 (1-face CR-plated)
	『注意』 ピストントップリング溝をクロームメッキで再生している場合は、3面クロームメッキリングを使用しないで下さい。			『CAUTION』 If the piston top ring groove have been repaired with Cr-plating. DO NOT USE THE 3-FACE-CR-PLATED TOP RING.

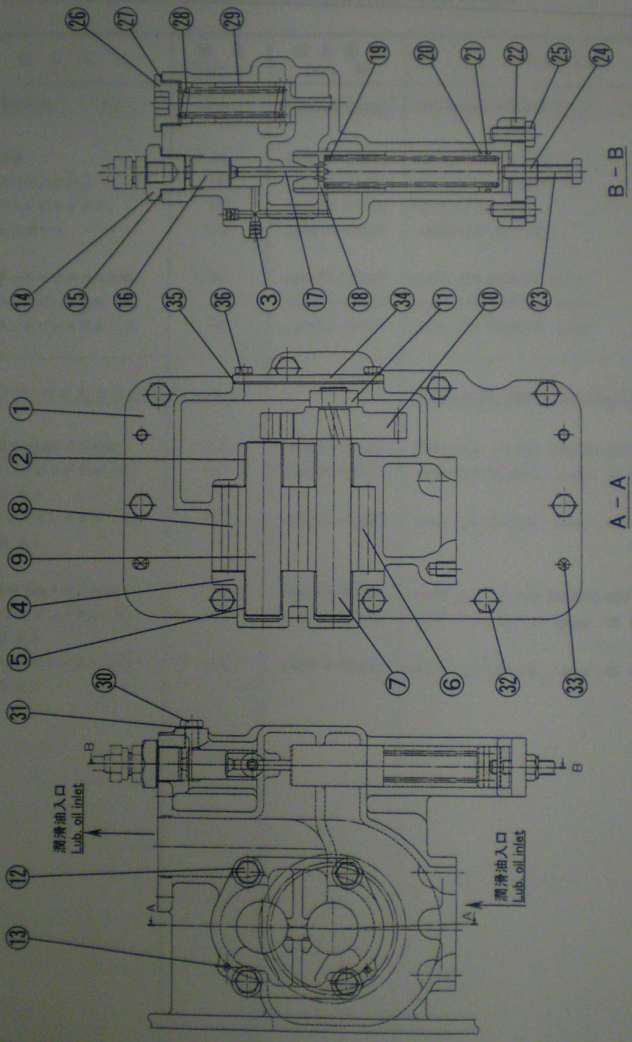
付図19. ピストンおよび連接棒仕組 (3/3)

Fig.19 PISTON & CONNECTING ROD ASS'Y

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	連接棒仕組	6set	746673-23021	CONNECTING ROD ASS'Y
12	連接棒	6s	146673-23021	CONNECTING ROD ASS'Y
13	六角穴付止めねじ	(6)	142613-21050	HEADLESS SET SCREW
14	ピストンピンメタル	(6)	146673-23120	PISTON PIN BUSH
15	ロッドボルト	(12)	146673-23220	CONNECTING ROD BOLT
	クランクピンメタル仕組	6s	146673-23380	CRANK PIN BEARING ASS'Y
16	クランクピンメタル (上)	(6)	146673-23360	CRANK PIN BEARING, upper
17	クランクピンメタル (下)	(6)	146673-23370	CRANK PIN BEARING, lower
	アンダーサイズ クランクピンメタル			UNDER SIZE CRANK PIN BEARING
	内径-0.4mmメタル仕組	1s	146673-23460	INNER DIA. -0.4mm BEARING ASS'Y
16	クランクピンメタル (上) US 0.4	(1)	146673-23420	CRANK PIN BEARING, upper US 0.4
17	クランクピンメタル (下) US 0.4	(1)	146673-23430	CRANK PIN BEARING, lower US 0.4
	内径-0.8mmメタル仕組	1s	146673-23470	INNER DIA. -0.8mm BEARING ASS'Y
16	クランクピンメタル (上) US 0.8	(1)	146673-23440	CRANK PIN BEARING, upper US 0.8
17	クランクピンメタル (下) US 0.8	(1)	146673-23450	CRANK PIN BEARING, lower US 0.8

付図20. 潤滑油ポンプ仕組

Fig.20 LUBRICATING OIL PUMP ASS'Y



付図20. 潤滑油ポンプ仕組

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Fig.20 LUBRICATING OIL PUMP ASS'Y

項目 Item		適用機種 Engine Model	仕様 Spec.
Ⓐ	舶用補機 Auxiliary Eng.	6N18AL-HV/-DV/-UV/-SV/-EV	
	陸用機関 Land Eng.	6N18AL-DV/-UV/-SV/-EV	
Ⓑ	舶用補機関 Auxiliary Engine	6N18L-DV/-UV/-SV/-EV	胴体直結機関 Bell Mounting Eng.
Ⓒ	舶用補機 Auxiliary Eng. 陸用機関 Land Eng.		非胴体直結機関 Direcy Coupling Eng.

Item	部品名称	数量 Quantity Ⓐ	Ⓑ	Ⓒ	部品番号 Part No.	Part Name
	潤滑油ポンプ仕組	1set			746673-32010	LUBRICATION OIL PUMP ASS'Y
	潤滑油ポンプ仕組		1set		746673-32020	LUBRICATION OIL PUMP ASS'Y
	潤滑油ポンプ仕組			1set	746673-32040	LUBRICATION OIL PUMP ASS'Y
	潤滑油ポンプ仕組	1set			746673-32100	LUBRICATION OIL PUMP ASS'Y
	潤滑油ポンプ仕組		1set		746673-32110	LUBRICATION OIL PUMP ASS'Y
	潤滑油ポンプ仕組			1set	746673-32150	LUBRICATION OIL PUMP ASS'Y
	ポンプ本体仕組	1s			146673-32010	PUMP BODY ASS'Y
	ポンプ本体仕組		1s		146673-32250	PUMP BODY ASS'Y
	ポンプ本体仕組			1s	146673-32460	PUMP BODY ASS'Y
1	ポンプ本体	(1)			146673-32021	PUMP BODY
	ポンプ本体		(1)		146673-32050	PUMP BODY
	ポンプ本体			(1)	146673-32450	PUMP BODY
2	ブッシュ	(2)	(2)	(2)	146673-32130	BUSH
3	プラグ PT1/8	(2)	(2)	(2)	23871-010000	PLUG PT1/8
	ふた仕組（ポンプ本体）	1s	1s	1s	146673-32070	COVER ASS'Y, pump body
4	ふた（ポンプ本体）	(1)	(1)	(1)	146673-32081	COVER, pump body
5	ブッシュ	(2)	(2)	(2)	146673-32130	BUSH
	ポンプギヤ仕組（駆動）	1s			146673-32101	PUMP GEAR ASS'Y, driving
	ポンプギヤ仕組（駆動）		1s		146673-32150	PUMP GEAR ASS'Y, driving
	ポンプギヤ仕組（駆動）			1s	146673-32400	PUMP GEAR ASS'Y, driving
6	ギヤ（内部）	(1)			133814-32110	GEAR, inside
	ギヤ（内部）		(1)		146673-32110	GEAR, inside
	ギヤ（内部）			(1)	146673-32410	GEAR, inside
7	軸（駆動）	(1)	(1)		146673-32121	SHAFT, driving
	軸（駆動）			(1)	146673-32420	SHAFT, driving

付図20. 潤滑油ポンプ仕組

Fig.20 LUBRICATING OIL PUMP ASS'Y

Item	部品名称	数量 Quantity Ⓐ	Ⓑ	Ⓒ	部品番号 Part No.	Part Name
	ポンプギヤ仕組（被動）	1s			146673-32190	PUMP GEAR ASS'Y, driving
	ポンプギヤ仕組（被動）		1s		146673-32180	PUMP GEAR ASS'Y, driving
	ポンプギヤ仕組（被動）			1s	146673-32440	PUMP GEAR ASS'Y, driving
8	ギヤ（内部）	(1)			133814-32110	GEAR, inside
	ギヤ（内部）		(1)		146673-32110	GEAR, inside
	ギヤ（内部）				146673-32410	GEAR, inside
9	軸（被動）	(1)	(1)		146673-32170	SHAFT, driving
	軸（被動）			(1)	146673-32430	SHAFT, driving
10	ギヤ（潤滑油ポンプ）	1			146673-32201	GEAR, pump driving
	ギヤ（潤滑油ポンプ）		1	1	146673-32210	GEAR, pump driving
11	止めナット M24	1	1	1	26772-240002	LOCK NUT M24
12	ボルト M12×30	4	4	4	26206-120302	BOLT M12×30
13	平行ピン 6×8	2	2	2	22312-060180	STRAIGHT PIN 6×8
14	ソケット M30-M18	1	1	1	146673-34080	SOCKET M30-M18
15	銅パッキン 30×1	1	1	1	23414-300000	GASKET, copper 30×1
16	圧力調整弁	1	1	1	146673-34030	PRESSURE CONTROL VALVE
17	平行ピン 8×70	1	1	1	22312-080700	STRAIGHT PIN 8×70
18	圧力調整弁	1	1	1	146673-34021	PRESSURE CONTROL VALVE
19	ばね	1	1	1	146673-34071	SPRING
20	ばね受	1	1	1	146673-34050	SPRING RETAINER
21	Oリング（1A）P29	1	1	1	24311-000290	O-RING (1A) P29
22	小判フランジ	1	1	1	146673-34060	FLANGE, oval type
23	ボルト M12×60	1	1	1	26206-120602	BOLT M12×60
24	ナット M12	1	1	1	26706-120002	NUT M12
25	ボルト M12×30	2	2	2	26206-120302	BOLT M12×30
26	六角穴付プラグ	1	1	1	136600-11722	HEXAGON SOCKET HEAD PLUG
27	パッキン	1	1	1	138613-71100	GASKET
28	ばね	1	1	1	133870-34030	SPRING
29	安全弁	1	1	1	147673-34060	PRESSURE CONTROL VALVE
30	六角プラグ M12	1	1	1	23887-120002	PLUG M12
31	銅パッキン 12×1	1	1	1	23414-120000	GASKET, copper 12×1

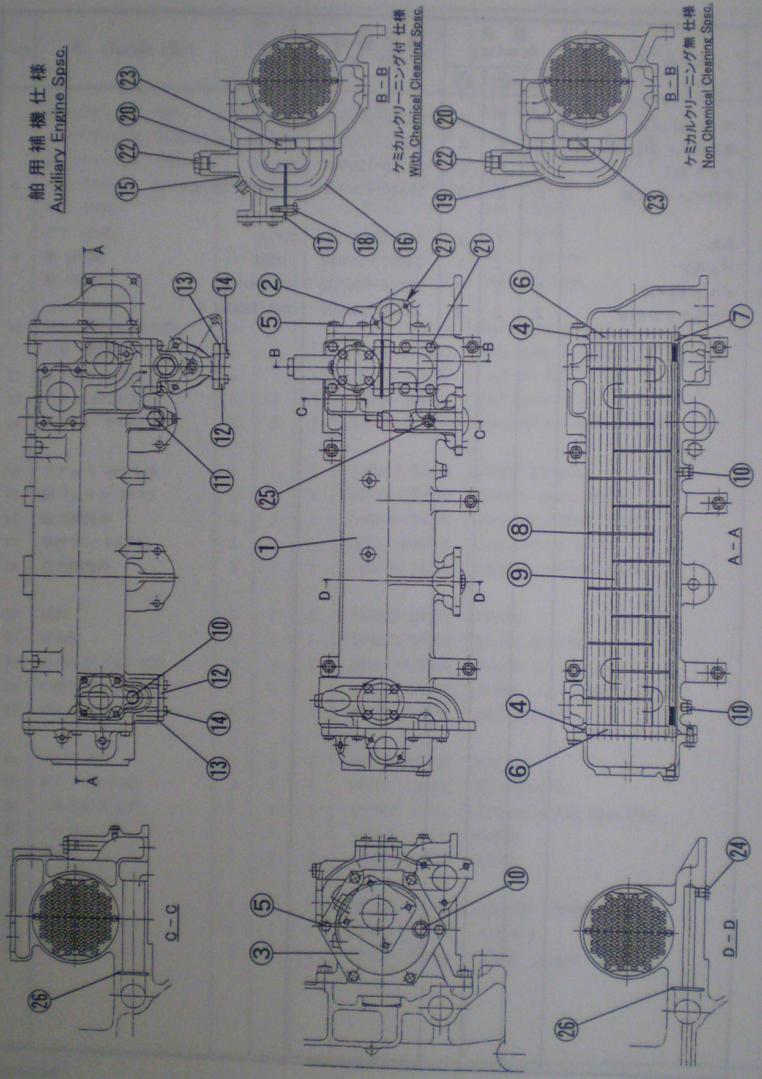
付図20. 潤滑油ポンプ仕組

Fig.20 LUBRICATING OIL PUMP ASS'Y

Item	部品名称	数量 Quantity Ⓐ	Ⓑ	Ⓒ	部品番号 Part No.	Part Name
32	ボルト M12×30	7	7	7	26206-120302	BOLT M12×30
	植込ボルト M12×30	2	2	2	26216-120302	STUD BOLT M12×30
	ナット M12	2	2	2	26706-120002	NUT M12
33	平行ピン M10×25	2	2	2	22340-100252	STRAIGHT PIN M10×25
34	ふた	1	1	1	146673-32030	COVER
35	パッキン	1	1	1	146673-32040	GASKET
36	ボルト M8×20	2	2	2	26206-080202	BOLT M8×20
	シールワッシャ 8	2	2	2	22190-080003	SEAL WASHER 8

付図21-1. 潤滑油冷却器仕組（海水仕様）

Fig.21-1 LUBRICATING OIL COOLER ASS'Y, sea water spec.



付図21-1. 潤滑油冷却器仕組（海水仕様）

(2/3)

Fig.21-1 LUBRICATING OIL COOLER ASS'Y, sea water spec.

舶用補機仕様 / Auxiliary Engine Spec.

Ⓐ：ケミカルクリーニング付 仕様 / With Chemical Cleaning Spec.

Ⓑ：ケミカルクリーニング無 仕様 / Non Chemical Cleaning Spec.

Item	部品名称	数量 Quantity Ⓐ		Ⓑ		部品番号 Part No.	Part Name
	潤滑油冷却器仕組						LUB. OIL COOLER ASS'Y
	1) エポキシ仕様	1s				746673-33122	1) EPOXY PAINTING SPEC.
	2) ネオプレン仕様		1s			746673-33130	2) NEOPRENE COATING SPEC.
	3) エポキシ仕様			1s		746676-33122	3) EPOXY PAINTING SPEC.
	4) ネオプレン仕様				1s	746676-33130	4) NEOPRENE COATING SPEC.
1	オイルクーラ胴	1	1	1	1	146673-33012	OIL COOLER BODY
2	側ふた（潤滑油クーラ入口）						HEADER, inlet side
	1) エポキシ仕様	1		1		146683-33170	1) EPOXY PAINTING SPEC.
	2) ネオプレン仕様		1		1	146672-33160	2) NEOPRENE COATING SPEC.
3	側ふた（潤滑油クーラ出口）						HEADER, outlet side
	1) エポキシ仕様	1		1		146674-33170	1) EPOXY PAINTING SPEC.
	2) ネオプレン仕様		1		1	146672-33170	2) NEOPRENE COATING SPEC.
4	Oリング (1A) P180	2	2	2	2	24311-001800	O-RING (1A) P180
5	ボルト M12×30	12	12	12	12	26206-120302	BOLT M12×30
	冷却管仕組	1s	1s	1s	1s	146683-33240	COOLING PIPE ASS'Y
6	チューブシート	(2)	(2)	(2)	(2)	146673-33200	END PLATE B, cooling pipe
7	冷却管	(95)	(95)	(95)	(95)	146683-33230	COOLING PIPE
8	ソラセ板	(13)	(13)	(13)	(13)	146673-33320	BAFFLE PLATE
9	隔板	(28)	(28)	(28)	(28)	146673-33330	DISTANCE PLATE (A), baffle plate
10	六角プラグ G3/8	4	4	4	4	23894-030002	HEXAGON PLUG G3/8
	胴パッキン 17×1	4	4	4	4	23414-170000	GASKET, copper 17×1
11	六角プラグ G1/2	1	1	1	1	23897-040002	HEXAGON PLUG G1/2
	胴パッキン 21×1	1	1	1	1	23414-210000	GASKET, copper 21×1
12	丸フランジ 25	2	2	1	1	23211-025000	FLANGE, round 25
13	丸パッキン 25×1.5	2	2	1	1	23438-025000	GASKET, round 25×1.5
14	ボルト M10×25	8	8	4	4	26206-100252	BOLT M10×25
15	ベンドA (クーラ出口)	1	1			146673-33450	BEND A, cooler outlet
16	ベンドB (クーラ出口)	1	1			146673-33460	BEND B, cooler outlet
17	めがねフランジ	1	1			146673-39430	FLANGE, spectacle
	パッキン	2	2			152673-39160	GASKET
18	ボルト M12×35	3	3			26206-120352	BOLT M12×35

付図21-1. 潤滑油冷却器仕組（海水仕様）

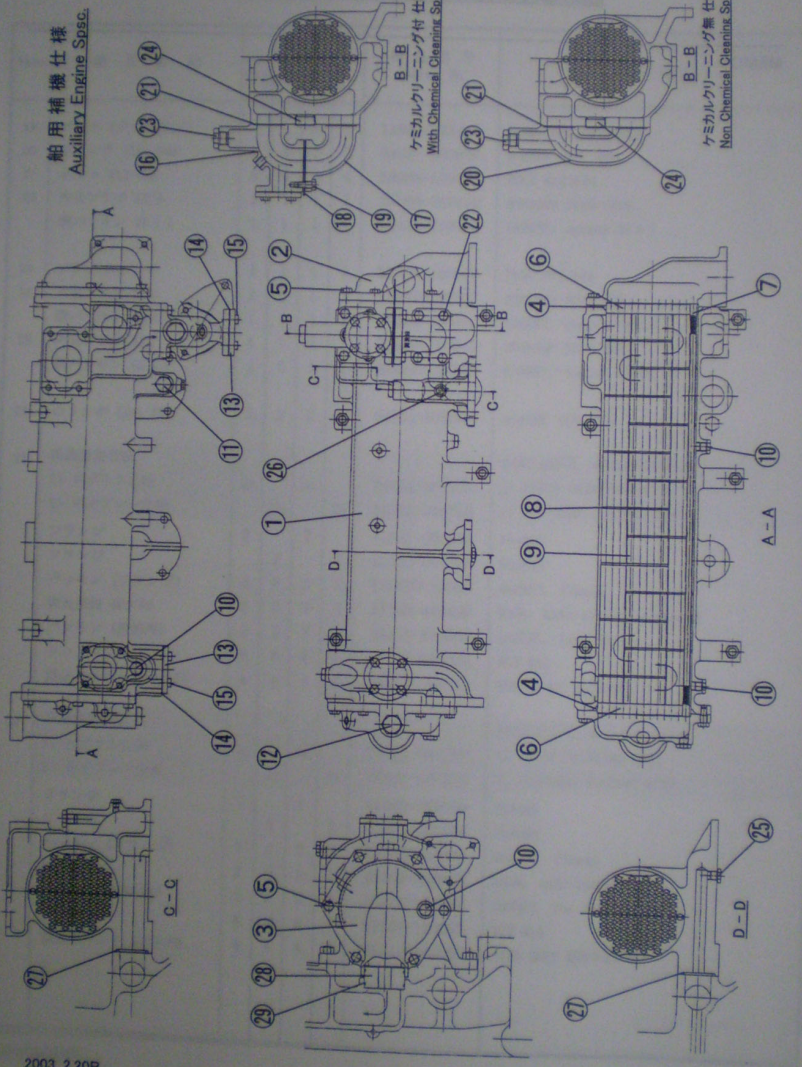
Fig.21-1 LUBRICATING OIL COOLER ASS'Y, sea water spec.

船用補機仕様 / Auxiliary Engine Spec.

Item	部品名称	数量 Quantity Ⓐ		Ⓑ		部品番号 Part No.	Part Name
19	ベンド（クーラ出口）			1	1	146674-33450	BEND, cooler outlet
20	Oリング（1A）G60	2	2	2	2	24321-000600	O-RING (1A) G60
21	ボルト M12×30	8	8	4	4	26206-120302	BOLT M12×30
22	六角プラグ G3/4	1	1	1	1	23894-060002	HEXAGON PLUG G3/4
	胴パッキン 27×1	1	1	1	1	23414-270000	GASKET, copper 27×1
23	プラグ PT1-1/4	1	1	1	1	23875-120000	PLUG PT1-1/4
24	六角プラグ M18	1	1	1	1	23887-180002	HEXAGON PLUG M18
	胴パッキン 18×1	1	1	1	1	23414-180000	GASKET, copper 18×1
25	六角プラグ M12	1	1	1	1	23887-120002	HEXAGON PLUG M12
	胴パッキン 12×1	1	1	1	1	23414-120000	GASKET, copper 12×1
26	Oリング（1A）P55	2	2	2	2	24311-000550	O-RING (1A) P55
27	保護亜鉛仕組						ZINC ASS'Y, anti-corrosion
	1）エポキシ仕様	2s		2s		T936A-0013C0	1) EPOXY PAINTING SPEC.
	2）ネオプレン仕様		2s		2s	T000A-0092E0	2) NEOPRENE COATING SPEC.
	フランジ	2		2		41632-004480	FLANGE
	フランジ		2		2	41632-001260	FLANGE
	パッキン（フランジ）	2	2	2	2	137800-33380	GASKET, flange
	防食亜鉛 40×40	2	2	2	2	27200-400400	ZINC, anti-corrosion 40×40
	パッキン（亜鉛用）	2	2	2	2	23418-100000	GASKET, for zinc
	ナット M10	6	6	6	6	26706-120002	NUT M10
	植込みボルト M10×25	4	4	4	4	26212-100252	STUD BOLT M10×25
27	保護純鉄仕組						IRON ASS'Y, anti-corrosion
	1）エポキシ仕様	2s		2s		T936A-0013D0	1) EPOXY PAINTING SPEC.
	2）ネオプレン仕様		2s		2s	T000A-0092F0	2) NEOPRENE COATING SPEC.
	フランジ	2		2		41632-004480	FLANGE
	フランジ		2		2	41632-001260	FLANGE
	パッキン（フランジ）	2	2	2	2	137800-33380	GASKET, flange
	防食純鉄	2	2	2	2	41609-000960	IRON, anti-corrosion
	パッキン（純鉄用）	2	2	2	2	23418-100000	GASKET, for iron
	ナット M10	6	6	6	6	26706-120002	NUT M10
	植込みボルト M10×25	4	4	4	4	26212-100252	STUD BOLT M10×25

付図21-2. 潤滑油冷却器仕組（清水仕様）

Fig.21-2 LUBRICATING OIL COOLER ASS'Y, fresh water spec.



付図21-2. 潤滑油冷却器仕組（清水仕様）

(2/3)

Fig.21-2 LUBRICATING OIL COOLER ASS'Y, fresh water spec.

船用補機仕様 / Auxiliary Engine Spec.

Ⓐ：ケミカルクリーニング付 仕様 / With Chemical Cleaning Spec.

Ⓑ：ケミカルクリーニング無 仕様 / Non Chemical Cleaning Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油冷却器仕組	1set		746673-33103	LUB. OIL COOLER ASS'Y
	潤滑油冷却器仕組		1set	746676-33102	LUB. OIL COOLER ASS'Y
1	オイルクーラ胴	1	1	146673-33012	OIL COOLER BODY
2	側ふた（潤滑油クーラ入口）	1	1	146673-33160	HEADER, inlet side
3	側ふた（潤滑油クーラ出口）	1	1	146673-33170	HEADER, outlet side
4	Oリング (1A) P180	2	2	24311-001800	O-RING (1A) P180
5	ボルト M12×30	12	12	26206-120302	BOLT M12×30
	冷却管仕組	1s	1s	146683-33190	COOLING PIPE ASS'Y
6	チューブシート	(2)	(2)	146673-33200	END PLATE B, cooling pipe
7	冷却管	(95)	(95)	146673-33230	COOLING PIPE
8	ソラセ板	(13)	(13)	146673-33320	BAFFLE PLATE
9	隔板	(28)	(28)	146673-33330	DISTANCE PLATE (A), baffle plate
10	六角プラグ G3/8	4	4	23894-030002	HEXAGON PLUG G3/8
	胴パッキン 17×1	4	4	23414-170000	GASKET, copper 17×1
11	六角プラグ G1/2	1	1	23897-040002	HEXAGON PLUG G1/2
	胴パッキン 21×1	1	1	23414-210000	GASKET, copper 21×1
12	六角プラグ G3/4	1	1	23894-060002	HEXAGON PLUG G3/4
	胴パッキン 27×1	1	1	23414-270000	GASKET, copper 27×1
13	丸フランジ 25	2	1	23211-025000	FLANGE, round 25
14	丸パッキン 25×1.5	2	1	23438-025000	GASKET, round 25×1.5
15	ボルト M10×25	8	4	26206-100252	BOLT M10×25
16	ベンド A （クーラ出口）	1		146673-33450	BEND A, cooler outlet
17	ベンド B （クーラ出口）	1		146673-33460	BEND B, cooler outlet
18	めがねフランジ	1		146673-39430	FLANGE, spectacle
	パッキン	2		152673-39160	GASKET
19	ボルト M12×35	3		26206-120352	BOLT M12×35
20	ベンド（クーラ出口）		1	146674-33450	BEND, cooler outlet

付図21-2. 潤滑油冷却器仕組（清水仕様）

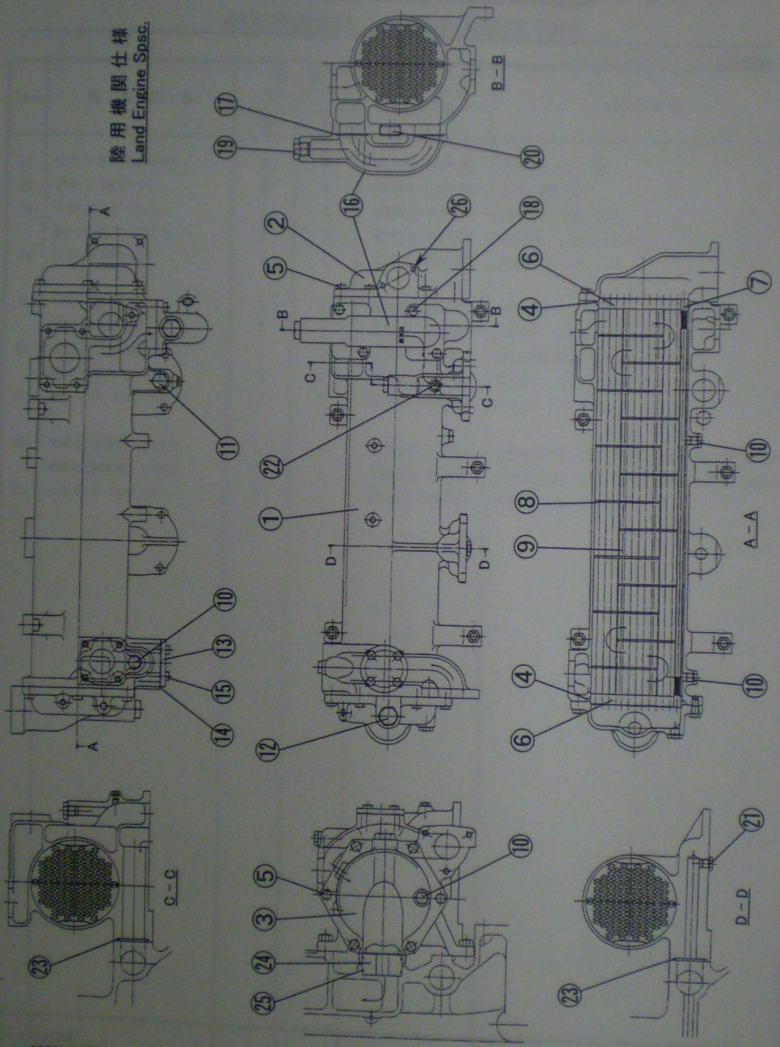
Fig.21-2 LUBRICATING OIL COOLER ASS'Y, fresh water spec.

舶用補機仕様 / Auxiliary Engine Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
21	Oリング (1A) G60	2	2	24321-000600	O-RING (1A) G60
22	ボルト M12×30	8	4	26206-120302	BOLT M12×30
23	六角プラグ G3/4	1	1	23894-060002	HEXAGON PLUG G3/4
	胴パッキン 27×1	1	1	23414-270000	GASKET, copper 27×1
24	プラグ PT1-1/4	1	1	23875-120000	PLUG PT1-1/4
25	六角プラグ M18	1	1	23887-180002	HEXAGON PLUG M18
	胴パッキン 18×1	1	1	23414-180000	GASKET, copper 18×1
26	六角プラグ M12	1	1	23887-120002	HEXAGON PLUG M12
	胴パッキン 12×1	1	1	23414-120000	GASKET, copper 12×1
27	Oリング (1A) P55	2	2	24311-000550	O-RING (1A) P55
28	冷却水連絡管 φ25用	1	1	146673-33350	CONNECTING PIPE φ25, for cooling water
	冷却水連絡管 φ65用	1	1	146673-33380	CONNECTING PIPE φ65, for cooling water
29	Oリング (1A) G75	2	2	24321-000750	O-RING (1A) G75

付図21-3. 潤滑油冷却器仕組（I系統冷却仕様）

Fig.21-3 LUBRICATING OIL COOLER ASS'Y, cooling of I line system



付図21-3. 潤滑油冷却器仕組（Ⅰ系統冷却仕様）

Fig.21-3 LUBRICATING OIL COOLER ASS'Y, cooling of Ⅰ line system

陸用機関仕様 / Land Engine Spec.

Ⓐ ：冷却管標準(材質:C6872T)仕様 / Cooling Pipe Standard (Material : C6872T) Spec.

Ⓑ ：冷却管特殊(材質:C1220T)仕様 / Cooling Pipe Special (Material : C1220T) Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油冷却器仕組	1set		746676-33080	LUB. OIL COOLER ASS'Y
	潤滑油冷却器仕組		1set	746676-33090	LUB. OIL COOLER ASS'Y
1	オイルクーラ胴	1	1	146673-33012	OIL COOLER BODY
2	側ふた（潤滑油クーラ入口）	1	1	146683-33160	HEADER, inlet side
3	側ふた（潤滑油クーラ出口）	1	1	146673-33170	HEADER, outlet side
4	Oリング（1A）P180	2	2	24311-001800	O-RING (1A) P180
5	ボルト M12×30	12	12	26206-120302	BOLT M12×30
	冷却管仕組	1s		146683-33240	COOLING PIPE ASS'Y
	冷却管仕組		1s	146673-33190	COOLING PIPE ASS'Y
6	チューブシート	(2)	(2)	146673-33200	END PLATE B, cooling pipe
7	冷却管	(95)		146683-33230	COOLING PIPE
	冷却管		(95)	146673-33230	COOLING PIPE
8	ソラセ板	(13)	(13)	146673-33320	BAFFLE PLATE
9	隔板	(28)	(28)	146673-33330	DISTANCE PLATE (A), baffle plate
10	六角プラグ G3/8	4	4	23894-030002	HEXAGON PLUG G3/8
	胴パッキン 17×1	4	4	23414-170000	GASKET, copper 17×1
11	六角プラグ G1/2	1	1	23897-040002	HEXAGON PLUG G1/2
	胴パッキン 21×1	1	1	23414-210000	GASKET, copper 21×1
12	六角プラグ G3/4	1	1	23894-060002	HEXAGON PLUG G3/4
	胴パッキン 27×1	1	1	23414-270000	GASKET, copper 27×1
13	丸フランジ 25	1	1	23211-025000	FLANGE, round 25
14	丸パッキン 25×1.5	1	1	23438-025000	GASKET, round 25×1.5
15	ボルト M10×25	4	4	26206-100252	BOLT M10×25
16	ベンド（クーラ出口）	1	1	146674-33450	BEND, cooler outlet
17	Oリング（1A）G60	2	2	24321-000600	O-RING (1A) G60
18	ボルト M12×30	4	4	26206-120302	BOLT M12×30
19	六角プラグ G3/4	1	1	23894-060002	HEXAGON PLUG G3/4
	胴パッキン 27×1	1	1	23414-270000	GASKET, copper 27×1

付図21-3. 潤滑油冷却器仕組（I系統冷却仕様）

Fig.21-3 LUBRICATING OIL COOLER ASS'Y, cooling of I line system

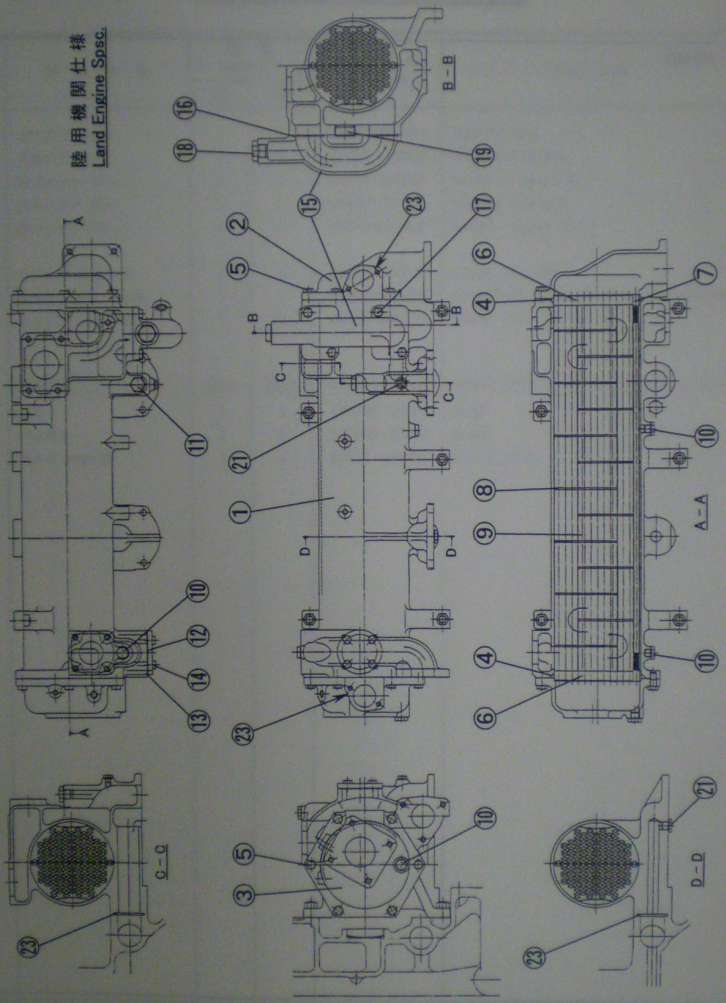
陸用機関仕様 / Land Engine Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
20	プラグ PT1-1/4	1	1	23875-120000	PLUG PT1-1/4
21	六角プラグ M18	1	1	23887-180002	HEXAGON PLUG M18
	銅パッキン 18×1	1	1	23414-180000	GASKET, copper 18×1
22	六角プラグ M12	1	1	23887-120002	HEXAGON PLUG M12
	銅パッキン 12×1	1	1	23414-120000	GASKET, copper 12×1
23	Oリング (1A) P55	2	2	24311-000550	O-RING (1A) P55
24	冷却水連絡管 φ65用	1	1	146673-33380	CONNECTING PIPE φ65, for cooling water
25	Oリング (1A) G75	2	2	24321-000750	O-RING (1A) G75
	ふた仕組	2set	2set	739653-33140	COVER ASS'Y
26	ふた	2	2	137800-33390	COVER
	パッキン	2	2	137800-33380	GASKET
	ボルト M10×25	4	4	26206-100252	BOLT M10×25

付図21-4. 潤滑油冷却器仕組（Ⅱ系統冷却仕様）

Fig.21-4 LUBRICATING OIL COOLER ASS'Y, cooling of Ⅱ line system

陸用機関仕様
Land Engine Spec.



付図21-4. 潤滑油冷却器仕組（Ⅱ系統冷却仕様）

Fig.21-4 LUBRICATING OIL COOLER ASS'Y, cooling of Ⅱ line system

陸用機関仕様 / Land Engine Spec.

Ⓐ ：冷却管標準(材質:C6872T)仕様 / Cooling Pipe Standard (Material : C6872T) Spec.

Ⓑ ：冷却管特殊(材質:C1220T)仕様 / Cooling Pipe Special (Material : C1220T) Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油冷却器仕組	1set		746683-33111	LUB. OIL COOLER ASS'Y
	潤滑油冷却器仕組		1set	746683-33121	LUB. OIL COOLER ASS'Y
1	オイルクーラ胴	1	1	146673-33012	OIL COOLER BODY
2	側ふた（潤滑油クーラ入口）	1	1	146683-33160	HEADER, inlet side
3	側ふた（潤滑油クーラ出口）	1	1	146674-33160	HEADER, outlet side
4	Oリング（1A）P180	2	2	24311-001800	O-RING (1A) P180
5	ボルト M12×30	12	12	26206-120302	BOLT M12×30
	冷却管仕組	1s		146683-33240	COOLING PIPE ASS'Y
	冷却管仕組		1s	146673-33190	COOLING PIPE ASS'Y
6	チューブシート	(2)	(2)	146673-33200	END PLATE B, cooling pipe
7	冷却管	(95)		146683-33230	COOLING PIPE
	冷却管		(95)	146673-33230	COOLING PIPE
8	ソラセ板	(13)	(13)	146673-33320	BAFFLE PLATE
9	隔板	(28)	(28)	146673-33330	DISTANCE PLATE (A), baffle plate
10	六角プラグ G3/8	4	4	23894-030002	HEXAGON PLUG G3/8
	胴パッキン 17×1	4	4	23414-170000	GASKET, copper 17×1
11	六角プラグ G1/2	1	1	23897-040002	HEXAGON PLUG G1/2
	胴パッキン 21×1	1	1	23414-210000	GASKET, copper 21×1
12	丸フランジ 25	1	1	23211-025000	FLANGE, round 25
13	丸パッキン 25×1.5	1	1	23438-025000	GASKET, round 25×1.5
14	ボルト M10×25	4	4	26206-100252	BOLT M10×25
15	ベンド（クーラ出口）	1	1	146674-33450	BEND, cooler outlet
16	Oリング（1A）G60	2	2	24321-000600	O-RING (1A) G60
17	ボルト M12×30	4	4	26206-120302	BOLT M12×30
18	六角プラグ G3/4	1	1	23894-060002	HEXAGON PLUG G3/4
	胴パッキン 27×1	1	1	23414-270000	GASKET, copper 27×1
19	プラグ PT1-1/4	1	1	23875-120000	PLUG PT1-1/4
20	六角プラグ M18	1	1	23887-180002	HEXAGON PLUG M18
	胴パッキン 18×1	1	1	23414-180000	GASKET, copper 18×1

付図21-4. 潤滑油冷却器仕組（Ⅱ系統冷却仕様）

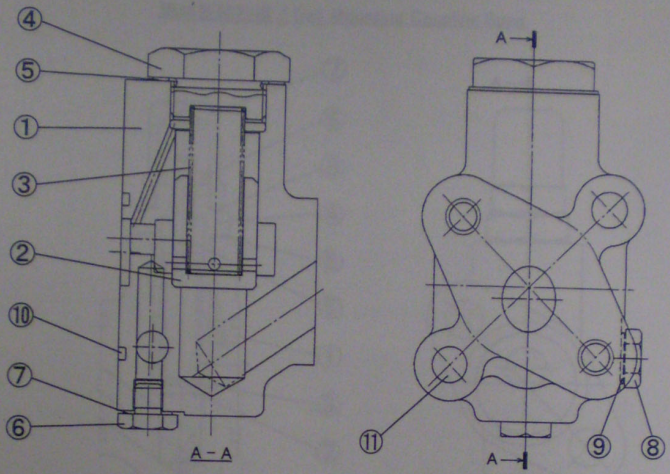
Fig.21-4 LUBRICATING OIL COOLER ASS'Y, cooling of Ⅱ line system

陸用機関仕様 / Land Engine Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
21	六角プラグ M12	1	1	23887-120002	HEXAGON PLUG M12
	銅パッキン 12×1	1	1	23414-120000	GASKET, copper 12×1
22	Oリング (1A) P55	2	2	24311-000550	O-RING (1A) P55
	ふた仕組	2set	2set	739653-33140	COVER ASS'Y
26	ふた	2	2	137800-33390	COVER
	パッキン	2	2	137800-33380	GASKET
	ボルト M10×25	4	4	26206-100252	BOLT M10×25

付図22-1. 潤滑油調圧弁仕組（低圧型プライミングライン） 1/1

Fig.22-1 LUBRICATING OIL PRESSURE REGULATING VALVE ASS'Y, priming line of low pressure type

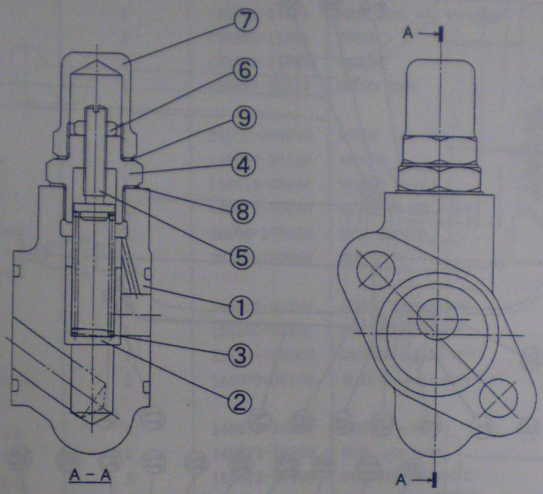


Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油調圧弁仕組	1set	746673-34171	OIL PRESSURE REGULATING VALVE ASS'Y
1	本体（調圧弁）	1	146673-34152	BODY, pressure regulating valve
2	調圧弁	1	146673-34180	PRESSURE REGULATING VALVE
3	弁ばね	1	146673-34540	SPRING, valve
4	ばね押え	1	146673-34160	RETAINER, spring
5	銅パッキン 33×1	1	23414-330000	GASKET, copper 33×1
6	六角プラグ G1/8	1	23897-010002	HEXAGON PLUG G1/8
7	銅パッキン 10×1	1	23414-100000	GASKET, copper 10×1
8	六角プラグ M12	1	23887-120002	HEXAGON PLUG M12
9	銅パッキン 12×1	1	23414-120000	GASKET, copper 12×1
10	Oリング（1A）G50	1	24321-000500	O-RING (1A) G50
11	ボルト M10×75	2	26206-100752	BOLT M10×75

付図22-2. 潤滑油調圧弁仕組（高圧型プライミングライン）

Fig.22-2 LUBRICATING OIL PRESSURE REGULATING VALVE ASS'Y, priming line of high pressure type

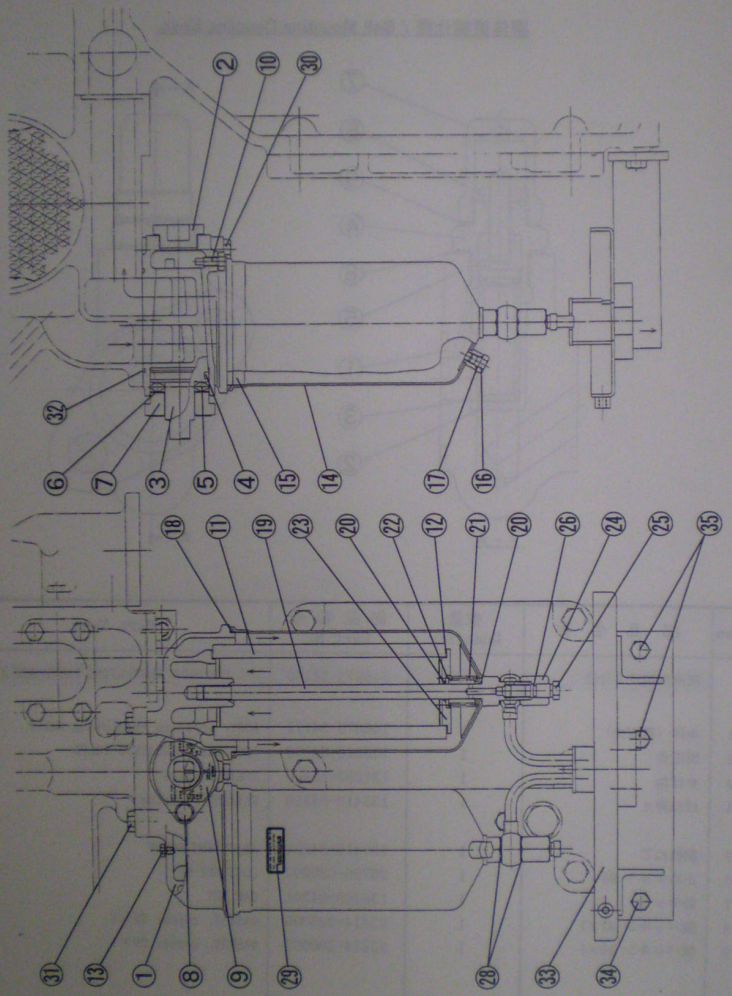
胴体直結仕様 / Bell Mounting Coupling Spec.



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油調圧弁仕組	1set	746673-34160	OIL PRESSURE REGULATING VALVE ASS'Y
1	本体（調圧弁）	1	146673-34171	BODY, pressure regulating valve
2	調圧弁	1	135310-34030	PRESSURE REGULATING VALVE
3	弁ばね	1	137603-52860	SPRING, valve
4	ばね押え	1	135410-84310	RETAINER, spring
5	調整ねじ	1	135410-84281	ADJUSTING SCREW
6	止めナット M8	1	26796-080002	LOCK NUT M8
7	袋ナット	1	135410-84301	CAP NUT
8	銅パッキン 22×1	1	23414-220000	GASKET, copper 22×1
9	銅パッキン 20×1	1	23414-200000	GASKET, copper 20×1

付図23-1. 潤滑油こし器仕組（ノッチワイヤ式） (1/3)

Fig.23-1 LBURICATION OIL STRAINER, notich-wire type



付図23-1. 潤滑油こし器仕組（ノッチワイヤ型）

Fig.23-1 LUBRICATING OIL STRAINER ASS'Y, notich-wire type

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油こし器仕組 (EF50)	1set	746673-35122	LUB. OIL STRAINER ASS'Y (EF50)
1	潤滑油こし器本体	1	146673-35011	BODY, lub. oil strainer
2	ふた	1	139653-11641	COVER
	パッキン	1	138613-11660	PACKING
3	切換コック	1	146673-35251	SWITCH COCK
4	Oリング (1A) P53	1	24311-000530	O-RING (1A) P53
5	パッキン	1	148616-35130	PACKING
6	ワッシャ	1	148616-35140	WASHER
7	パッキン押え	1	146673-35440	GLAND, flange type
8	ボルト M10×35	2	26206-100352	BOLT M10×35
	座金 10	2	22137-100000	WASHER 10
9	銘板（切換コック）	1	146673-35280	LABEL, switch cock
10	止めボルト M10	1	125600-02451	BOLT, stopper M10
	銅パッキン 10×1	1	23414-100000	GASKET, copper 10×1
11	エレメント（ノッチワイヤ）	2	146673-35150	ELEMENT. noti-wire
12	パッキン（エレメント）	4	146673-35160	GASKET, element
13	空気抜きプラグ	2	146673-35790	PLUG, air vent
	シールワッシャ 8×1.2	2	153672-59900	SEAL WASHER 8×1.2
	潤滑油こし器ケース仕組	2s	148616-35600	LUB. OIL STRAINER CASE ASS'Y
14	ケース	(2)	148616-35530	CASING
15	アダプタ	(2)	148616-35550	ADAPTER
16	ドレンプラグ M10	(2)	148616-35580	PLUG, drain M10
17	Oリング（ドレンプラグ）	(2)	148616-35590	O-RING, drain plug
18	Oリング（ボディ）	2	148616-35220	O-RING, body
19	センターボルト	2	146673-35561	CENTER BOLT
20	Oリング	4	148616-35570	O-RING
21	ばね	2	137600-71030	SPRING
22	座金 16	2	22137-160000	WASHER 16
23	押え（エレメント）	2	146673-35170	HOLDER, element
24	キャップナット	2	146673-35260	SLEEVE NUT
25	弁棒	2	146673-35270	VALVE, rod type
26	Oリング (1A) P11	2	24311-000110	O-RING (1A) P11
27	ドレン抜き管	2	146673-35291	DRAIN PIPE

付図23-1. 潤滑油こし器仕組（ノッチワイヤ型）

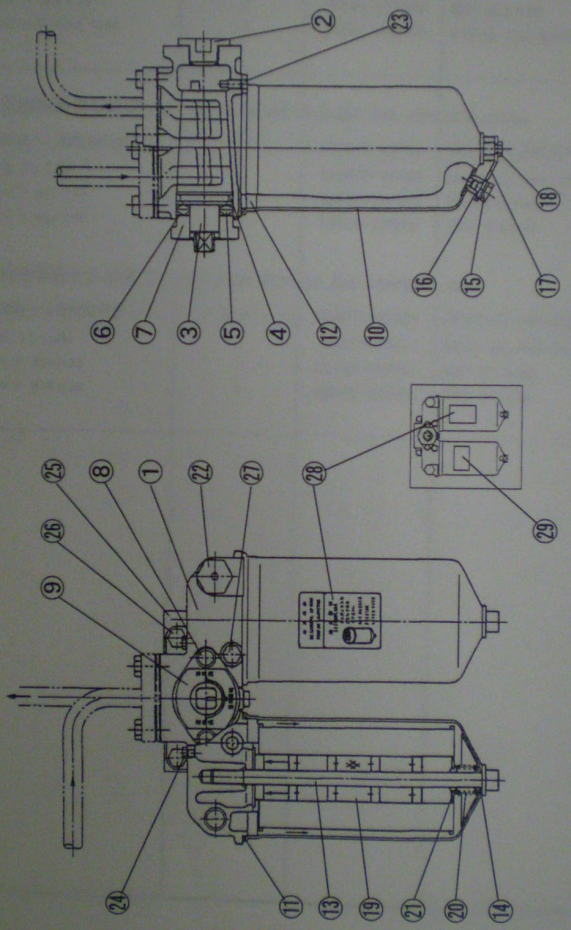
Fig.23-1 LUBRICATING OIL STRAINER ASS'Y, notich-wire type

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
28	銅パッキン 20×1	4	23414-200000	GASKET, copper 20×1
29	こし器銘板	1	146673-35710	NAME PLATE, strainer
30	ボルト M12×100	2	26206-121002	BOLT M12×100
31	ボルト M12×30	2	26206-120302	BOLT M12×30
32	Oリング (1A) G105	2	24321-001050	O-RING (1A) G105
	前部駆動なし仕様 / Front side non-driving for separate spec.			
	潤滑油こし器受皿仕組	1set	746673-35351	DRAIN OIL PAN ASS'Y, strainer
33	受皿（こし器）	1	146673-35403	DRAIN OIL PAN, strainer
34	ボルト M12×20	1	26206-120202	BOLT M12×20
35	ボルト M12×20	2	26206-120202	BOLT M12×20
	前部駆動あり仕様 / Front side driving for separate spec.			
	潤滑油こし器受皿仕組	1set	746673-35360	DRAIN OIL PAN ASS'Y, strainer
33	受皿（こし器）	1	146673-35411	DRAIN OIL PAN, strainer
34	ボルト M16×25	1	26152-160252	BOLT M16×25
35	ボルト M12×20	4	26206-120202	BOLT M12×20

付図23-2. 過給機用潤滑油こし器仕組（濾紙式） (1/3)

Fig.23-2 LBURICATION OIL STRAINER ASS'Y, paper element type for turbo-charger

【前部駆動なし仕様 : Front side non-driving for separate spec.】



付図23-2. 過給機用潤滑油こし器仕組（濾紙式）

(2/3)

Fig.23-2 LUBRICATING OIL STRAINER ASS'Y paper element type for turbo-charger

【前部駆動なし仕様 : Front side non-driving for separate spec.】

Ⓐ : 標準仕様 / Standard spec.　　Ⓑ : GL 仕様 / GL spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油こし器仕組（過給機用）	1set		746678-35152	LUB. OIL STRAINER ASS'Y,
			1set	746678-35162	for turbo-sharger
	潤滑油こし器仕組（過給機用）	1set		752628-35012	LUB. OIL STRAINER ASS'Y,
			1set	746678-35011	for turbo-sharger
	潤滑油こし器本体仕組	1s	1s	152623-35113	BODY ASS'Y, lub. oil strainer
1	潤滑油こし器本体	(1)	(1)	152623-35103	BODY, lub. oil strainer
2	ふた	(1)	(1)	139653-11641	COVER
	パッキン	(1)	(1)	138613-11660	PACKING
3	切換コック	1	1	152623-35400	SWITCH COCK
4	Oリング (4D) P53	1	1	24316-000530	O-RING (4D) P53
5	パッキン	1	1	148616-35130	PACKING
6	座金	1	1	148616-35140	WASHER
7	パッキン押え	1	1	146673-35440	GLAND, flange type
8	ボルト M10×35	2	2	26206-100352	BOLT M10×35
	座金 10	2	2	22137-100000	WASHER 10
9	銘板（切換コック）	1	1	148616-35260	LABEL, switch cock
	エレメント仕組（濾紙）	2s		133654-35420	ELEMENT ASS'Y, paper
	エレメント仕組（濾紙,GL）		2s	146678-35420	ELEMENT ASS'Y, paper GL
10	ケース	(2)	(2)	148616-35530	CASE
11	Oリング	(2)	(2)	152679-35220	O-RING
12	アダプタ	(2)	(2)	148616-35550	
13	センタボルト	(2)	(2)	152623-35560	CENTER BOLT
14	Oリング（センタボルト）	(2)	(2)	152679-35570	O-RING, center bolt
15	ドレンプラグ M10	(2)		148616-35580	DRAIN PULG M10
	ドレンプラグ		(2)	146678-35840	DRAIN PULG
16	Oリング (4D) P10	(2)	(2)	24326-000100	O-RING (4D) P10
17	キャップ (GL)		(2)	146678-35830	CAP (GL)
18	ボルト M10×10		(2)	26206-100102	BOLT M12×150

付図23-2. 過給機用潤滑油こし器仕組 (濾紙式)

Fig.23-2 LUBRICATING OIL STRAINER ASS'Y

paper element type for turbo-charger

【前部駆動なし仕様 : Front side non-driving for separate spec.】

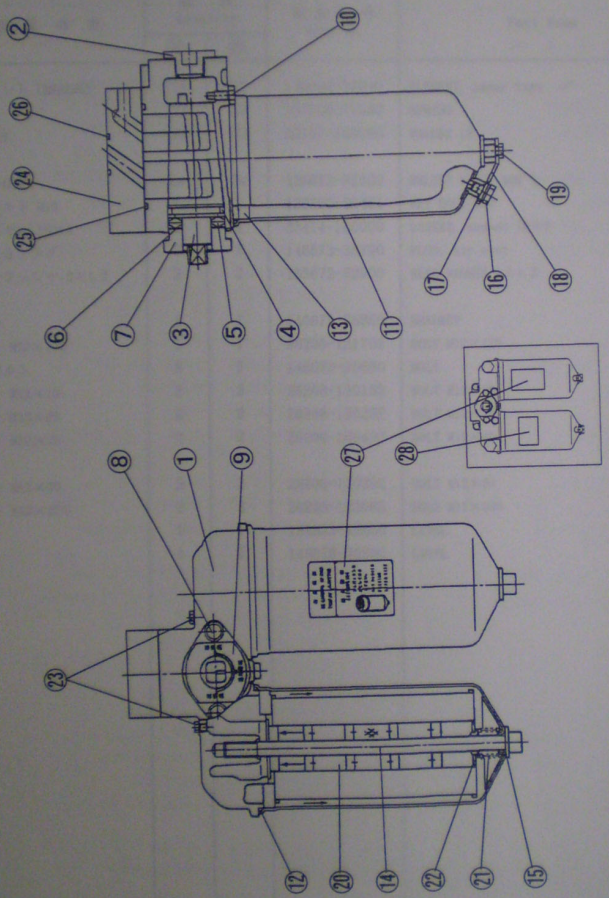
Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
19	エレメント (濾紙式)	(2)	(2)	133654-35540	ELEMENT, paper type
20	ばね	(2)	(2)	137600-71030	SPRING
21	座金 16	(2)	(2)	22137-160000	WASHER 16
22	逃し弁仕組	2s	2s	125613-35300	RELIEF VALVE ASS'Y
23	止めボルト M10	1	1	125600-02451	SET BOLT M10
	銅パッキン 10×1	1	1	23414-100000	GASKET, copper 10×1
24	空気抜きプラグ	2	2	146673-35790	PLUG, air vent
	シールワッシャ 8×1.2	2	2	153672-59900	SEAL WASHER 8×1.2
25	取付台	1	1	146678-35850	BRACKET
	ボルト M12×170	1	1	26206-121702	BOLT M12×170
	間座ボルト	2	2	146673-35880	BOLT
	ボルト M12×16	2	2	26206-120162	BOLT M12×16
	ボルト M12×25	2	2	26206-120252	BOLT M12×25
	ボルト M12×40	2	2	26206-120402	BOLT M12×40
26	ボルト M12×30	2	2	26206-120302	BOLT M12×30
27	ボルト M12×200	2	2	26206-122002	BOLT M12×200
28	銘板	1	1	152623-35450	LEVEL
29	銘板	1	1	146678-35800	LEVEL

付図23-3. 過給機用潤滑油こし器仕組（濾紙式）

(1/3)

Fig.23-3 LBURICATION OIL STRAINER ASS'Y, paper element type for turbo-charger

【前部駆動あり仕様 : Front side driving for separate spec.】



付図23-3. 過給機用潤滑油こし器仕組（濾紙式）

(2/3)

Fig.23-3 LUBRICATING OIL STRAINER ASS'Y

paper element type for turbo-charger

【前部駆動あり仕様 : Front side driving for separate spec.】

Ⓐ : 標準仕様 / Standard spec.　　Ⓑ : GL 仕様 / GL spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油こし器仕組（過給機用）	1set	1set	746683-35151 746683-35161	LUB. OIL STRAINER ASS'Y, for turbo-sharger
1	潤滑油こし器本体	1	1	146673-35011	BODY, lub. oil strainer
2	ふた	1	1	139653-11641	COVER
	パッキン	1	1	138613-11660	PACKING
3	切換コック	1	1	152623-35400	SWITCH COCK
4	Oリング (4D) P53	1	1	24316-000530	O-RING (4D) P53
5	パッキン	1	1	148616-35130	PACKING
6	座金	1	1	148616-35140	WASHER
7	パッキン押え	1	1	146673-35440	GLAND, flange type
8	ボルト M10×35	2	2	26206-100352	BOLT M10×35
	座金 10	2	2	22137-100000	WASHER 10
9	銘板（切換コック）	1	1	148616-35260	LABEL, switch cock
10	止めボルト M10	1	1	125600-02451	SET BOLT M10
	銅パッキン 10×1	1	1	23414-100000	GASKET, copper 10×1
	エレメント仕組（濾紙）	2s		133654-35420	ELEMENT ASS'Y, paper
	エレメント仕組（濾紙,GL）		2s	146678-35420	ELEMENT ASS'Y, paper GL
11	ケース	(2)	(2)	148616-35530	CASE
12	Oリング	(2)	(2)	152679-35220	O-RING
13	アダプタ	(2)	(2)	148616-35550	
14	センタボルト	(2)	(2)	152623-35560	CENTER BOLT
15	Oリング（センタボルト）	(2)	(2)	152679-35570	O-RING, center bolt
16	ドレンプラグ M10	(2)		148616-35580	DRAIN PULG M10
	ドレンプラグ		(2)	146678-35840	DRAIN PULG
17	Oリング (4D) P10	(2)	(2)	24326-000100	O-RING (4D) P10
18	キャップ (GL)		(2)	146678-35830	CAP (GL)
19	ボルト M10×10		(2)	26206-100102	BOLT M12×150
20	エレメント（濾紙式）	(2)	(2)	133654-35540	ELEMENT, paper type

付図23-3. 過給機用潤滑油こし器仕組 (濾紙式)

Fig.23-3 LUBRICATING OIL STRAINER ASS'Y

paper element type for turbo-charger

【前部駆動あり仕様 : Front side driving for separate spec.】

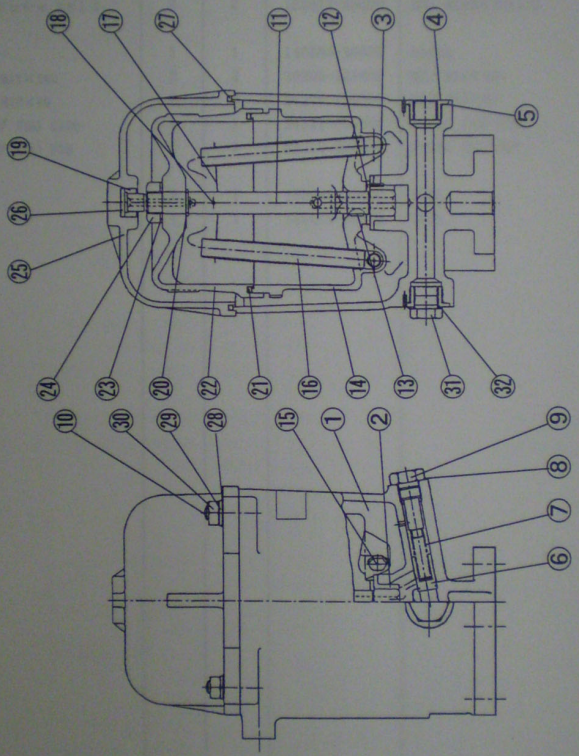
Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
21	ばね	2	2	137600-71030	SPRING
22	座金 16	2	2	22137-160000	WASHER 16
23	空気抜きプラグ	2	2	146673-35790	PLUG, air vent
	シールワッシャ 8×1.2	2	2	153672-59900	SEAL WASHER 8×1.2
24	間座	1	1	146683-35010	SPACER
	ボルト M12×160	2	2	26206-121602	BOLT M12×160
	ボルト M12×90	2	2	26206-120902	BOLT M12×90
25	Oリング (1A) G105	1	1	24321-001050	O-RING (1A) G105
26	Oリング (1A) P35	1	1	24311-000350	O-RING (1A) P35
27	銘板	1	1	152623-35450	LEVEL
28	銘板	1	1	146678-35800	LEVEL

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付図24-1. 潤滑油バイパスこし器仕組 / GF2型（遠心式） (1/2)

Fig.24-1 LBURICATING OIL BY-PASS STRAINER / GF2 TYPE, centrifugal type

A 重油仕様 / Marine diesel oil spec.



付図24-1. 潤滑油バイパスこし器仕組 / GF2型（遠心式）

Fig.24-1 LUBRICATING OIL BY-PASS STRAINER / GF2 TYPE, centrifugal type

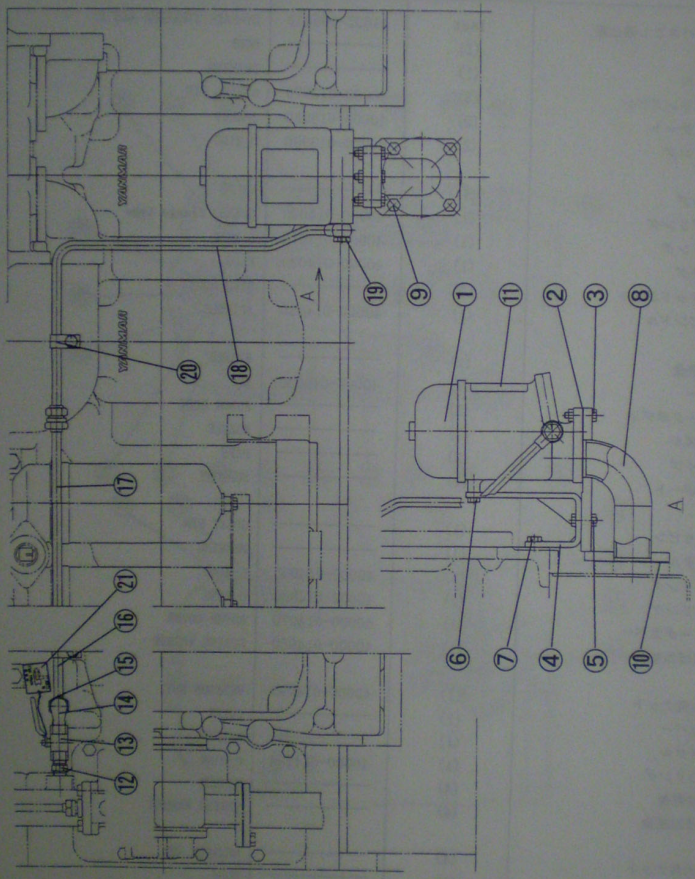
A重油仕様 / Marine diesel oil spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	バイパスこし器仕組	1set	41632-005440	BY-PASS STRAINER ASS'Y,
1	本体	(1)	————	BODY
2	メタル	(1)	————	BEARING
3	スプリングピン	(3)	40000-013970	SPRING PIN
4	インサート	(2)	40000-013980	INSERT
5	Oリング	(2)	40000-013990	O-RING
6	バルブ	(1)	————	VALVE
7	スプリング	(1)	40000-014000	GLAND, flange type
8	Oリング	(1)	40000-014010	O-RING
9	プラグ	(1)	40000-014020	PLUG
10	スタッドボルト	(4)	————	STUD BOLT
11	スピンドル	(1)	40000-014030	SPINDLE
12	平座金	(1)	————	WASHER
13	キー	(1)	40000-014040	KEY
14	ロータボディ	(1)	————	ROTOR BODY
15	ノズル	(2)	————	NOZZLE
16	パイプ	(2)	————	PIPE
17	サポート	(1)	————	SUPPORT
18	割りピン	(1)	————	SPLIT PIN
19	メタル	(1)	————	BEARING
20	Cリング	(1)	40000-014050	C-RING
21	Oリング	(1)	40000-014060	O-RING
22	ロータカバー	(1)	40000-014070	ROTOR COVER
23	皿ばね座金	(1)	40000-014080	SPRING WASHER
24	六角ナット	(1)	40000-014090	HEXAGON NUT
25	カバー	(1)	————	COVER
26	メタル	(1)	————	BEARING
27	Oリング	(1)	40000-014100	O-RING
28	平座金	(4)	————	WASHER
29	ばね座金	(4)	————	SPRING WASHER
30	六角ナット	(4)	————	HEXAGON NUT
31	プラグ	(1)	————	PLUG
32	ガスケットワッシャ	(1)	————	GASKET WASHER

付図24-2. 潤滑油バイパスこし器装置 / GF2型（遠心式） (1/2)

Fig.24-2 LBURICATING OIL BY-PASS STRAINER SYSTEM / GF2 TYPE, centrifugal type

非胴体直結仕様 / Direct coupling spec.



付図24-2. 潤滑油バイパスこし器装置 / GF2型（遠心式） (2/2)

Fig.24-2 LUBRICATING OIL BY-PASS STRAINER SYSTEM / GF2 TYPE, centrifugal type

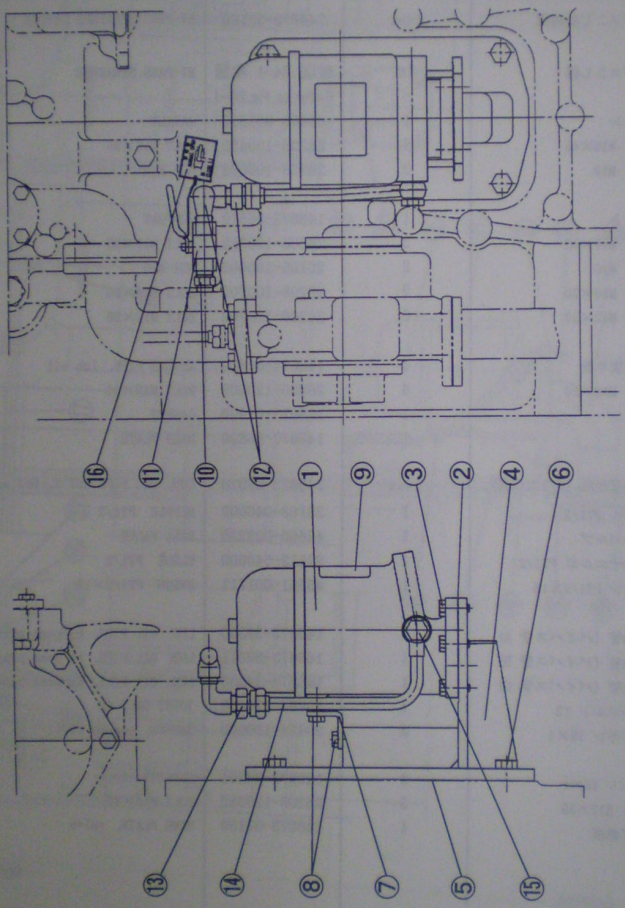
非胴体直結仕様 / Direct coupling spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	バイパスこし器装置	1set	746673-35160	BY-PASS STRAINER SYSTEM
1	バイパスこし器	1s	付図 24-1 参照 Refer to Fig.24-1	BY-PASS STRAINER
2	パッキン	1	43400-001310	GASKET
3	ボルト M10×45	5	26206-100452	BOLT M10×45
	ナット M10	5	26706-100002	NUT M10
4	サポート	1	146673-35510	SUPPORT
5	ボルト M10×35	2	26206-100352	BOLT M10×35
	ナット M10	2	26706-100002	NUT M10
6	ボルト M10×20	2	26206-100202	BOLT M10×20
7	ボルト M12×20	2	26206-120202	BOLT M12×20
8	潤滑油戻り管	1	146674-01670	RETURN PIPE, lub oil
9	ボルト M12×30	4	26206-120302	BOLT M12×30
10	パッキン	1	138673-01990	GASKET
11	銘板	1	146673-35830	NAME PLATE
	潤滑油管仕組（GF2こし器）	1set	746673-39370	LUB. OIL PIPE ASS'Y, GF2 strainer
12	ニップル PT1/2	1	23163-040000	NIPPLE PT1/2
13	ボールバルブ	1	43600-023230	BALL VALVE
14	めすおすエルボ PT1/2	1	23112-040000	ELBOE PT1/2
15	ユニオン PT1/2×15	1	43551-001711	UNION PT1/2×15
16	潤滑油管（バイパス管 A）	1	146673-39300	LUB. OIL PIPE, by-pass pipe A
17	潤滑油管（バイパス管 B）	1	146673-39311	LUB. OIL PIPE, by-pass pipe B
18	潤滑油管（バイパス管 C）	1	146673-39330	LUB. OIL PIPE, by-pass pipe C
19	管継手ボルト 12	1	23857-120000	JOINT BOLT 12
	銅パッキン 18×1	2	23414-180000	GASKET, copper 18×1
20	サポート 15×1	6	146673-39201	SUPPORT 15×1
	ボルト M12×35	3	26206-120352	BOLT M12×35
21	バルブ銘板	1	146673-07150	NAME PLATE, valve

付図24-3. 潤滑油バイパスこし器装置 / GF2型（遠心式） (1/2)

Fig.24-3 LBURICATING OIL BY-PASS STRAINER SYSTEM / GF2 TYPE, centrifugal type

胴体直結仕様 / Bell Mounting Coupling Spec.



付図24-3. 潤滑油バイパスこし器装置 / GF2型（遠心式） (2/2)

Fig.24-3 LUBRICATING OIL BY-PASS STRAINER SYSTEM / GF2 TYPE, centrifugal type

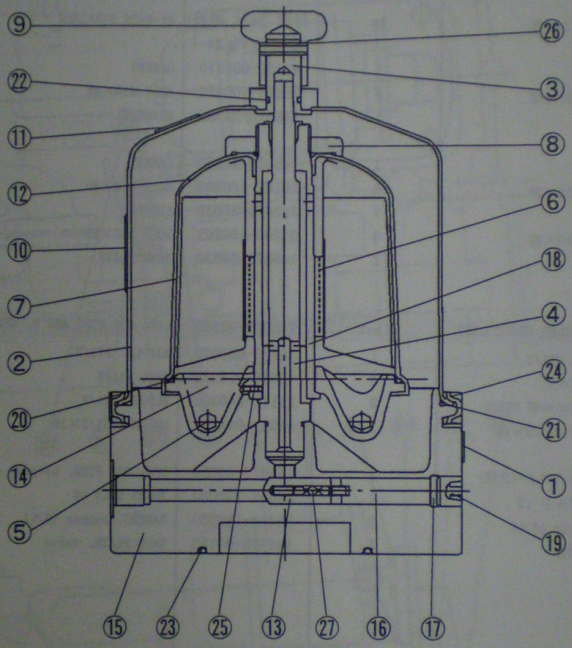
胴体直結仕様 / Bell Mounting Coupling Spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	バイパスこし器仕組	1set	746673-35170	BY-PASS STRAINER ASS'Y,
1	バイパスこし器	1s	付図 24-1 参照 Refer to Fig.24-1	BY-PASS STRAINER
2	パッキン	1	43400-001310	GASKET
3	ボルト M10×45	5	26206-100452	BOLT M10×45
4	取付台	1	146673-35360	BRACKET
5	パッキン	1	146673-01470	GASKET
6	ボルト M16×30	4	26152-160302	BOLT M16×30
7	サポート	1	147673-35520	SUPPORT
8	ボルト M10×20	4	26206-100202	BOLT M10×20
9	銘板	1	146673-35830	NAME PLATE
	潤滑油管仕組（GF2こし器）	1set	746683-39380	LUB. OIL PIPE ASS'Y, GF2 strainer
10	ニップル PT1/2	1	23163-040000	NIPPLE PT1/2
11	ボールバルブ	1	43600-023230	BALL VALVE
12	めすおすエルボ PT1/2	2	23112-040000	ELBOE PT1/2
13	ユニオン PT1/2×15	1	43551-001711	UNION PT1/2×15
14	潤滑油管（バイパス管）	1	146673-39850	LUB. OIL PIPE, by-pass pipe
15	管継手ボルト 12	1	23857-120000	JOINT BOLT 12
	銅パッキン 18×1	2	23414-180000	GASKET, copper 18×1
16	バルブ銘板	1	146673-07150	NAME PLATE, valve

付図25-1. 潤滑油バイパスこし器仕組 / ROC5型（遠心式） (1/2)

Fig.25-1 LUBRICATING OIL BY-PASS STRAINER / ROC5 TYPE, centrifugal type

C 重 油 仕 様 / Heavy fuel oil spec.



付図25-1. 潤滑油バイパスこし器仕組 / ROC5型（遠心式）

(2/2)

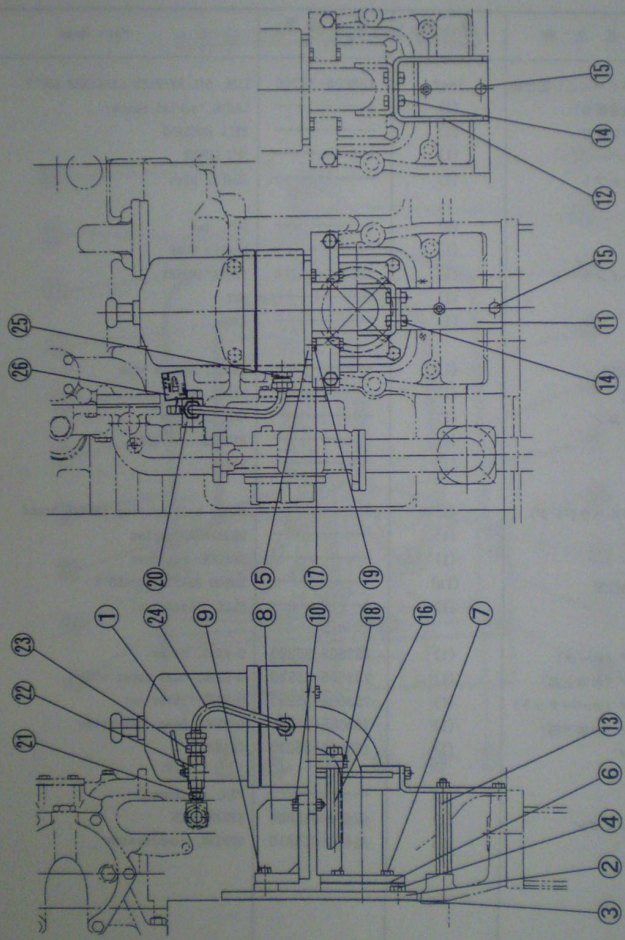
Fig.25-1 LUBRICATING OIL BY-PASS STRAINER / ROC5 TYPE, centrifugal type

C 重油仕様 / Heavy fuel oil spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油バイパスこし器仕組	1set	153605-35200	LUB. OIL BY-PASS STRAINER ASS'Y
1	銘板（製造番号）	(1)	———	LABEL, serial number
2	ベルハウジング	(1)	———	BELL HOUSING
3	ナットカバー	(1)	———	NUT COVER
4	ベースシャフト	(1)	———	SHAFT, base
5	ノズル	(2)	———	NUT, Jet
6	隔管	(1)	———	BAFFLE TUBE
7	ペーパーインサート	(1)	753605-35210	PAPER INSERT
8	ナット	(1)	———	NUT
9	つまみ	(1)	———	KNOB
10	銘板（形式）	(1)	———	LABEL, name & type
11	安全銘板	(1)	———	LABEL, warning
12	タービンカン	(1)	———	CAN, turbine
13	遮断弁	(1)	———	PISTON, cut-off
14	ロータ	(1)	———	ROTOR
15	本体（ベルハウジング）	(1)	———	BASE, bell housing YANMAR brand
16	ばね押え	(1)	———	RETAINER, spring
17	スペーサ	(1)	———	SPACER, retainer
18	ロータ軸仕組	(1s)	———	ROTOR SHAFT SUB-ASS'Y
19	プラグ	(1)	———	PLUG, flush seal
20	Oリング（ロータ）	(1)	753605-35220	O-RING, rotor
21	Oリング（本体上部）	(1)	753605-35230	O-RING, base upper side
22	Oリング（カバーナット）	(1)	753605-35250	O-RING, cover nut
23	Oリング（本体下部）	(1)	753605-35260	O-RING, base lower side
24	クランプ	(1)	153605-35210	CLAMP
25	ピン	(1)	———	PIN, alignment
26	スプリングピン	(1)	42430-015800	SPRING PIN
27	ばね	(1)	42430-015810	SPRING, compression

付図25-2. 潤滑油バイパスこし器装置 / ROC5型（遠心式） (1/3)

Fig.25-2 LBURICATING OIL BY-PASS STRAINER SYSTEM / ROC5 TYPE, centrifugal type



付図25-2. 潤滑油バイパスこし器装置 / ROC5型（遠心式）

(2/3)

Fig.25-2 LUBRICATING OIL BY-PASS STRAINER SYSTEM / ROC5 TYPE, centrifugal type

Ⓐ：非胴体直結仕様 / Ⓐ : Direct Coupling Spec.

Ⓑ：胴体直結仕様 / Ⓑ : Bell Mounting Coupling Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油バイパスこし器装置 (ROC-5型 遠心式)	1set	1set	746673-35180 746673-35140	LUB. OIL BY-PASS STRAINER SYSTEM (ROC-5 Type Centrifugal Type)
1	潤滑油バイパスこし器	1s	1s	付図 25-1 参照 Refer to Fig.25-1	LUB. OIL BY-PASS STRAINER
2	側ふた	1	1	146678-35990	SIDE COVER
3	パッキン	1	1	146673-01470	GASKET
4	ボルト M16×30	4	4	26152-160302	BOLT M16×30
5	取付台	1	1	146678-35981	MOUNT
6	パッキン 丸65×1.5	1	1	23438-065000	GASKET, round 65×1.5
7	ボルト M12×25	4	4	26206-120252	BOLT M12×25
8	サポート A	1	1	146678-35971	SUPPORT A
9	ボルト M12×30	2	2	26206-120302	BOLT M12×30
10	ボルト M12×45	2	2	26206-120452	BOLT M12×45
	ナット M12	2	2	26706-120002	NUT M12
11	サポート B	1		146678-35960	SUPPORT B
12	サポート B		1	146678-35950	SUPPORT B
13	サポート	1	1	146673-08110	SUPPORT
	ナット M12	1	1	26706-120002	NUT M12
14	ボルト M12×30	2	2	26206-120302	BOLT M12×30
	ナット M12	2	2	26706-120002	NUT M12
15	ボルト M12×25	1	1	26206-120252	BOLT M12×25
16	サポート C	2	2	146678-35930	SUPPORT C
	ボルト M16×45	2	2	26152-160452	BOLT M16×45
17	サポート D	2	2	146678-35940	SUPPORT D
18	ボルト M12×85	2	2	26206-120852	BOLT M12×85
19	ボルト M12×35	2	2	26206-120352	BOLT M12×35

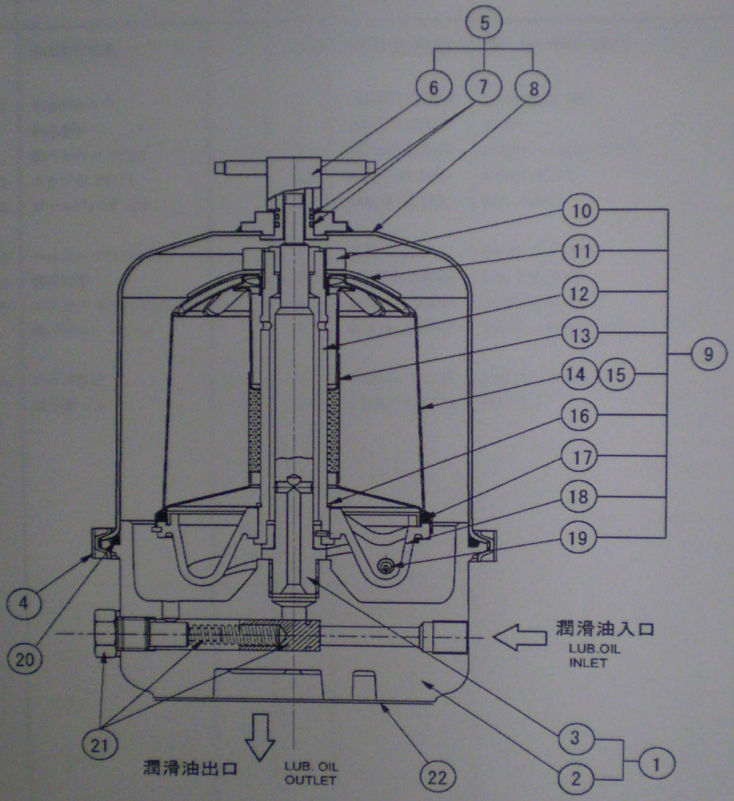
付図25-2. 潤滑油バイパスこし器装置 / ROC5型（遠心式）

Fig.25-2 LUBRICATING OIL BY-PASS STRAINER SYSTEM / ROC5 TYPE, centrifugal type

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油管仕組		1set	746673-39361	LUB. OIL PIPE ASS'Y
20	管継手ボルト		1	146678-39960	PIPE JOINT BOLT
	特殊継手		1	146678-39970	JOINT
	銅パッキン 21×1		2	23414-210000	GASKET, copper 21×1
21	ニップル PT1/2		1	23163-040000	NIPPLE PT1/2
22	ボールバルブ 1/2		1	43600-023230	BALL VALVE
23	ユニオン PT1/2×15		1	43551-001711	UNION PT1/2×15
24	潤滑油管		1	146678-39980	LUB. OIL PIPE
25	ユニオン M25×PF1/2		1	43551-000201	UNION M25×PF1/2
	銅パッキン 21×1		2	23414-210000	GASKET, copper 21×1
26	バルブ銘板		1	146673-07150	NAME PLATE, valve
	綴り線 0.6		1	22451-060000	WIRE 0.6

付図25-3. 潤滑油バイパスこし器仕組 / FM200型（遠心式） 1/2

Fig.25-3 LUBRICATING OIL BY-PASS STRAINER / FM200 TYPE, (centrifugal type)



付図25-3. 潤滑油バイパスこし器仕組 / FM200型（遠心式）

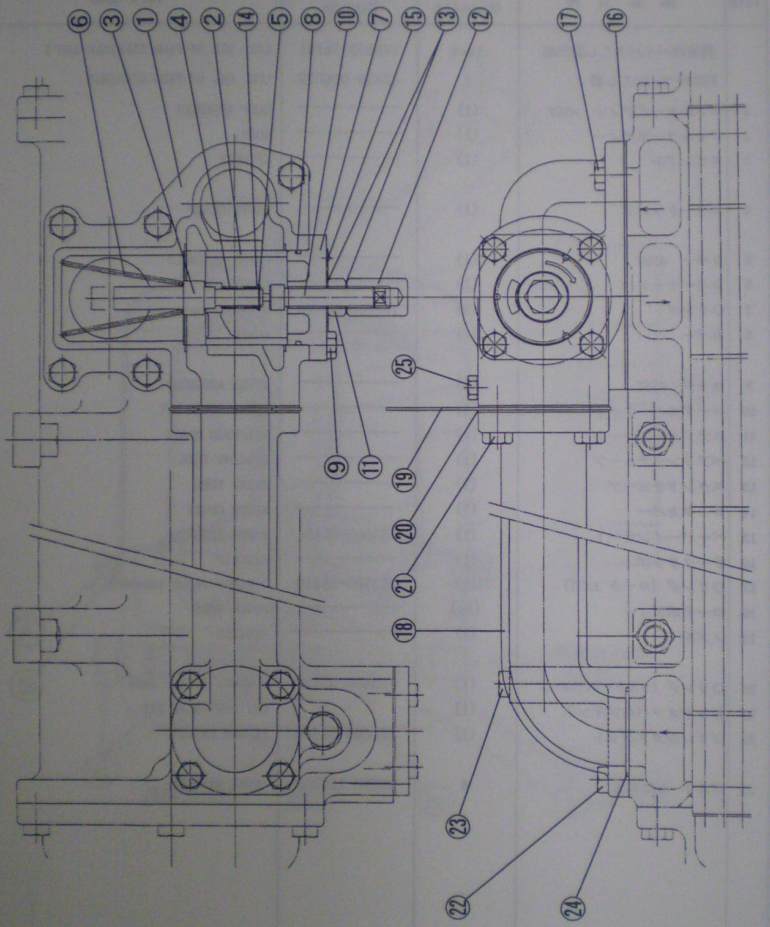
Fig.25-3 LUBRICATING OIL BY-PASS STRAINER / FM200 TYPE, centrifugal type

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油バイパスこし器仕組	1set	746673-35191	LUB. OIL BY-PASS STRAINER ASS'Y
	FM200-21 LOこし器	1	42430-006072	LUB. OIL BY-PASS STRAINER
1	フィルターボディー ASSY	(1)	————	BODY ASSEMBLY
2	フィルターボディー	(1)	————	BODY
3	スピンドル	(1)	————	SPINDLE
4	カバークランプ	(1)	————	CAOVE CLAMP
5	カバー ASSY	(1)	————	COVER ASSEMBLY
6	カバーナット	(1)	————	COVER NUT
7	Oリング	(2)	753605-35420	O-RING, cover nut
8	カバー	(1)	————	COVER
9	ロータ ASSY	(1)	————	ROTER ASSEMBLY
10	ロータカバーナット	(1)	————	ROTER COVER NUT
11	ステフナープレート	(1)	————	STIFFNER PLATE
12	ベアリングチューブ	(1)	————	BERAING TUBE
13	スタンドチューブ	(1)	————	STAND TUBE
14	ロータカバー	(1)	————	ROTOR COVER
15	ペーパーインサート	(1)	753605-35451	PAPER INSERT
16	サークリップ	(1)	————	CIRCLIP
17	Oリング（ロータ ASSY）	(1)	753605-35410	O-RING, rotor assembly
18	ロータボディー	(1s)	————	ROTOR BODY
19	ノズル	(1)	————	BNOZZLE
20	Oリング（フルターボディー）	(1)	753605-35430	O-RING, filter body
21	カットオフバルブキット	(1)		CUT OFF VALVE KIT
22	フランジガスケット	(1)	753605-35440	FLANGE GASKET
23	ボルト M12×35	4	26206-120352	BOLT M12×35

付図26. 潤滑油サーモスタット仕組

(1/2)

Fig.26 LBURICATING OIL THERMOSTAT ASS'Y



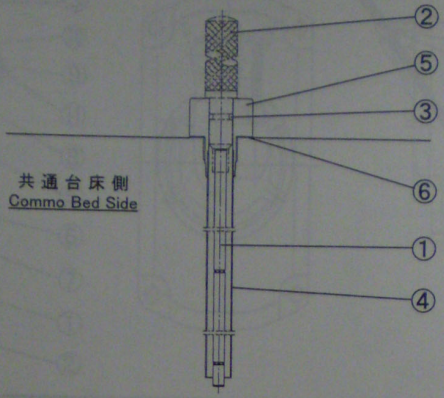
付図26. 潤滑油サーモスタット仕組

Fig.26 LUBRICATING OIL THERMOSTAT ASS'Y

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油サーモスタット仕組	1set	746673-38011	LUBRICATING OIL THERMOSTAT ASS'Y,
1	本体（サーモスタット）	1	146673-38101	BODY, thermostat
2	ピストン	1	141616-38110	PISTON
3	エレメント	1	141616-38210	ELEMENT
4	ばね	1	141616-38140	SPRING
5	E型止め輪	1	22272-000100	RETAINING RING, E type
6	円錐ばね	1	141616-38150	CONICAL SPRING
7	ふた	1	141616-38120	COVER
8	Oリング（1A）G65	1	24321-000650	O-RING (1A) G65
9	ボルト M10×25	4	26206-100252	BOLT M10×25
10	調整ボルト	1	141616-38130	ADJUSTING BOLT
11	止めナット M16	1	26772-160002	LOCK NUT M16
12	袋ナット	1	139653-34090	CAP NUT
13	銅パッキン 16×1	2	23414-160000	GASKET, copper 16×1
14	間座	1	137600-64260	WASHER
15	銘板（サーモスタット）	1	141616-38260	LABEL, thermostat
	リベット	3	137900-91451	RIVET
16	パッキン	1	146673-38110	GASKET
17	ボルト M12×30	5	26206-120302	BOLT M12×30
18	潤滑油クーラバイパス管	1	146673-38500	BY-PASS PIPE, lub. oil cooler
19	めがねフランジ 40	1	43330-002530	FLANGE, spectacle type
20	パッキン	2	43400-004000	GASKET
21	ボルト M12×35	4	26206-120352	BOLT M12×35
22	ボルト M12×30	2	26206-120302	BOLT M12×30
23	ボルト M12×100	2	26206-121002	BOLT M12×100
24	Oリング（1A）G60	1	24321-000600	O-RING (1A) G60
25	六角プラグ M12	1	23887-120002	PLUG M12
	銅パッキン 12×1	2	23414-120000	GASKET, copper 12×1

付図27-1. 検油棒仕組

Fig.27-1 DIP STICK ASS'Y



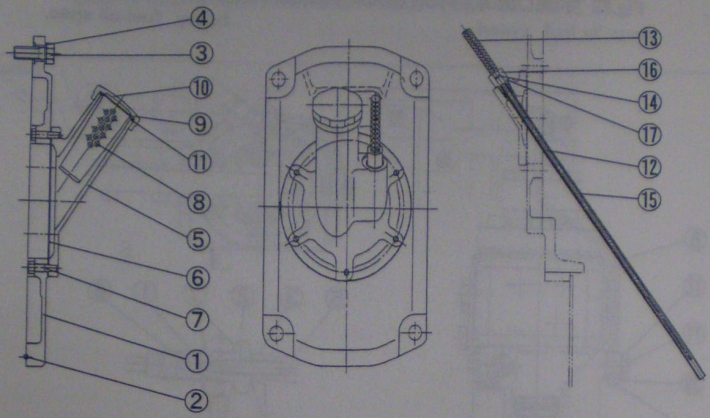
Ⓐ : 非胴体直結仕様 / Ⓐ : Direct Coupling Spec.

Ⓑ : 胴体直結仕様 / Ⓑ : Bell Mounting Coupling Spec.

Item	部品名称	数量 Quantity		部品番号 Part No.	Part Name
		Ⓐ	Ⓑ		
	検油棒仕組	1set		T466K-0035B2	DIP STICK ASS'Y
	検油棒仕組		1set	T466K-0035A1	DIP STICK ASS'Y
	検油棒仕組	1s		41632-010200	DIP STICK ASS'Y
	検油棒仕組		1s	41632-009090	DIP STICK ASS'Y
1	検油棒	(1)		41632-01020A	DIP STICK
	検油棒		(1)	41632-00909A	DIP STICK
2	つかみ	(1)	(1)	41632-500500	GRIP
3	Oリング (1A) P7	1	1	24311-000070	O-RING (1A) P7
	保護筒仕組	1s	1s	41632-500430	PROTECTION COVER ASS'Y
4	保護筒	(1)	(1)	41632-001790	PROTECTION COVER
5	保護筒押え	(1)	(1)	41632-500510	HOLDER
6	銅パッキン 18×1	1	1	23414-180000	GASKET, copper 18×1

付図27-2. 検油棒および補油口仕組（胴体直結仕様）

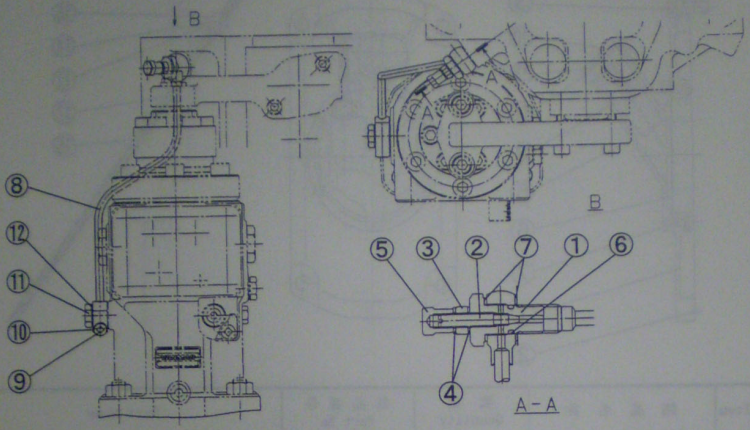
Fig.27-2 DIP STICK & OIL FILLER ASS'Y, bell mounting coupling spec.



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	シリンダ側ふた仕組（給油口、検油棒付）	1set	746673-01170	CYLINDER-BLOCK SIDE COVER ASS'Y, with lub. oil filler & dip stick
	側ふた仕組	1s	146673-01390	SIDE COVER ASS'Y
1	シリンダ側ふた	(1)	146673-01430	CYLINDER SIDE COVER
2	パッキン	(1)	146673-01411	GASKET
3	ボルト M16×35	4	26152-160352	BOLT M16×35
4	座金 16	4	22137-160000	WASHER 16
5	給油口本体	1	153605-09401	BODY, oil filler
6	パッキン	1	142613-03541	GASKET
7	六角穴付ボルト M8×25	6	26450-080252	HEXAGON SOCKET HEAD BOLT M8×25
	銅パッキン 8×1	6	23414-080000	GASKET, copper 8×1
8	こし網	1	132310-03080	FILTER
9	パッキン（上）	1	137900-09420	GASKE, upper
10	給油口ふた	1	138613-09410	CAP, oil filler
11	パッキン（下）	1	137900-09430	GASKE, lower
	検油棒仕組	1set	746673-34150	DIP STICK ASS'Y
	検油棒仕組	1s	153605-34850	DIP STICK ASS'Y
12	検油棒	(1)	153605-3485A	DIP STICK
13	つかみ	(1)	41632-500500	GRIP
14	Oリング（1A）P7	1	24311-000070	O-RING (1A) P7
	保護筒仕組	1s	41632-500480	PROTECTION COVER ASS'Y
15	保護筒	(1)	41632-001840	PROTECTION COVER
16	保護筒押え	(1)	41632-500510	HOLDER
17	銅パッキン 18×1	1	23414-180000	GASKET, copper 18×1

付図28. 燃料噴射ポンプ ピニオン注油管(C重油仕様) (1/1)

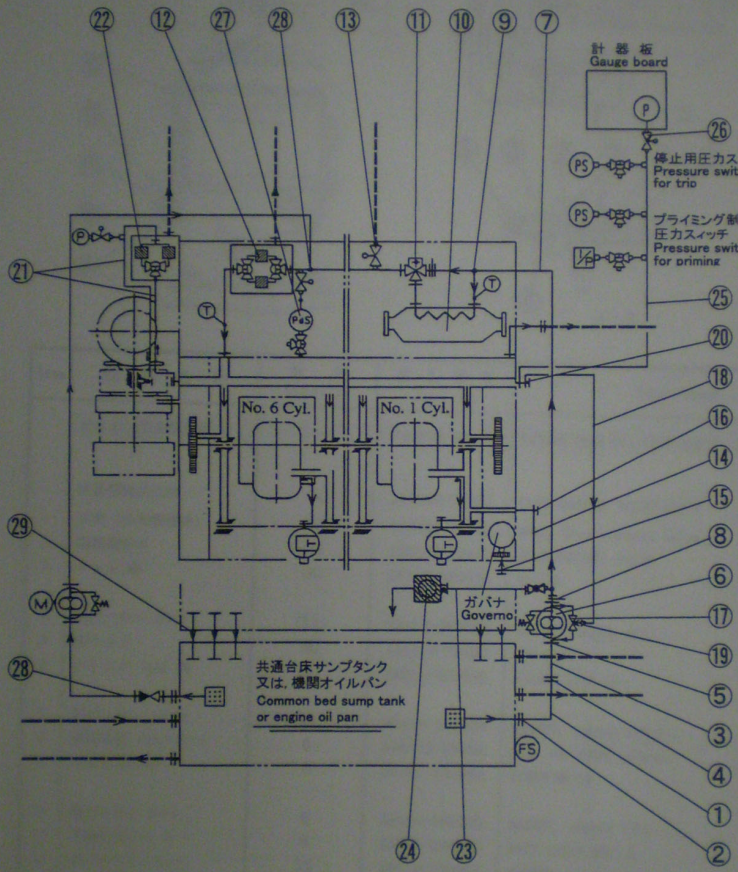
Fig.28 FUEL INJECTION PUMP PINION FEED OIL PIPE, heavy fuel oil spec.



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	ピニオン注油管仕組	6set	746673-39352	PINION FEED OIL PIPE ASS'Y
	油量調整弁仕組	6s	147643-39621	FLOW CONTROL VALVE ASS'Y
1	本体(油量調整弁)	(6)	147643-39600	BODY, flow control valve
2	油量調整弁	(6)	125310-39411	FLOW CONTROL VALVE
3	ナット M6	(6)	26716-060002	NUT M&
4	銅パッキン 6×1	(12)	23414-060000	GASKET, copper 6×1
5	袋ナット	(6)	125310-39420	CAP NUT
6	Oリング (1A) P9	(6)	24311-000090	O-RING (1A) P9
7	銅パッキン 12×1	12	23414-120000	GASKET, copper 12×1
8	潤滑油管 (ピニオン)	6	146673-39795	LUB. OIL PIPE, pinion
9	小ねじ M6×8	6	26557-060082	SCREW M6×8
10	銅パッキン 6×1	6	23414-060000	GASKET, copper 6×1
11	管継手ボルト 6	6	23857-060000	PIPE JOINT BOLT 6
12	銅パッキン 12×1	12	23414-120000	GASKET, copper 12×1

付図29-1. 潤滑油管装置 (1/4)

Fig.29-1 LUBRICATING OIL PIPE SYSTEM



付図29-1. 潤滑油管装置

Fig.29-1 LUBRICATING OIL PIPE SYSTEM

Ⓐ：非胴体直結仕様 / Ⓐ：Direct Coupling Spec.

Ⓑ：胴体直結仕様 / Ⓑ：Bell Mounting Coupling Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油管仕組	1set		746673-39131	LUBRICATING OIL PIPE ASS'Y,
	（潤滑油ポンプ入口）		1set	746673-39140	lubricating oil pump inlet
1	潤滑油管 B	1		146673-39080	LUBRICATING OIL PIPE B,
	（共通台床～ポンプ）				common bed ～ pump
	潤滑油管		1	146673-39100	LUBRICATING OIL PIPE,
	（オイルパン～ポンプ）				oil pan ～ pump
2	パッキン	1		23438-065000	GASKET
	ボルト M12×30	4		26206-120302	BOLT M12×30
	角フランジ		1	146673-39120	FLANGE, quadrate
	パッキン		1	138673-01990	GASKET
	Oリング (1A) P60		1	24311-000600	O-RING (1A) P60
	ボルト M12×55		4	26206-120552	BOLT M12×55
	ナット M12		4	26706-120002	NUT M12
3	潤滑油管 A	1		146673-39072	LUBRICATING OIL PIPE A,
	（共通台床～ポンプ）				common bed ～ pump
4	パッキン	1		43400-003170	GASKET
	ボルト M12×45	4		26206-120452	BOLT M12×45
	ナット M12	4		26706-120002	NUT M12
5	パッキン	1	1	152673-39160	GASKET
	ボルト M12×25	3	3	26206-120252	BOLT M12×25
6	潤滑油ポンプ仕組	1set	1set	付図 20 参照 Refer to Fig.20	LUBRICATING OIL PUMP ASS'Y
	潤滑油管仕組	1set	1set	746673-39150	LUBRICATING OIL PIPE ASS'Y,
	（潤滑油ポンプ～冷却器）				lubricating oil pump ～ cooler
7	ベンド（冷却器入口）	1	1	146673-39411	BEND, cooler inlet
	六角プラグ G1/2	1	1	23897-040002	PLUG G1/2
	銅パッキン 21×1	1	1	23414-210000	GASKET, copper 21×1

付図29-1. 潤滑油管装置

Fig.29-1 LUBRICATING OIL PIPE SYSTEM

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
8	めがねフランジ	1	1	146673-39430	SPECTACLE FLANGE
	パッキン	2	2	152673-39160	GASKET
	ボルト M12×35	1	1	26206-120352	BOLT M12×35
	ボルト M12×40	2	2	26206-120402	BOLT M12×40
9	Oリング (1A) G60	1	1	24321-000600	O-RING (1A) G60
	ボルト M12×30	4	4	26206-120302	BOLT M12×30
10	潤滑油冷却器仕組	1set	1set	付図 21 参照 Refer to Fig.21	LUBRICATING OIL COOLER ASS'Y
11	潤滑油サーモスタット仕組	1set	1set	付図 26 参照 Refer to Fig.26	LUBRICATING OIL THERMOSTAT ASS'Y
12	潤滑油こし器仕組	1set	1set	付図 23-1 参照 Refer to Fig.23-1	LUBRICATING OIL STRAINER ASS'Y
13	空気抜き管仕組 (潤滑油冷却器)	1set	1set	付図 29-5 参照 Refer to Fig.29-5	AIR VENT PIPE ASS'Y, lubricating oil cooler
	潤滑油管仕組 (ガバナ)				LUBRICATING OIL PIPE ASS'Y, governor
	NZ61型ガバナ用	1set	1set	746673-39310	FOR NZ61 TYPE GOVERNOR
	PSG型ガバナ用	1set	1set	746673-39320	FOR PSG TYPE GOVERNOR
14	潤滑油管 (NZ61型ガバナ)	1	1	146673-39370	LUBRICATING OIL PIPE, NZ61 type governer
	潤滑油管 (PSG型ガバナ)	1	1	146676-39370	LUBRICATING OIL PIPE, PSG type governer
15	管継手ボルト	1	1	101147-59810	PIPE JOINT BOLT
	銅パッキン 8×1	2	2	23414-080000	GASKET, copper 8×1
16	管継手ボルト 6	1	1	23857-060000	PIPE JOINT BOLT 6
	銅パッキン 12×1	2	2	23414-120000	GASKET, copper 12×1
17	潤滑油圧力調整弁仕組	1set	1set	付図 20 参照 Refer to Fig.20	LUBRICATING OIL PRESSURE VALVE ASS'Y
	潤滑油管仕組 (圧力調整弁～潤滑油冷却器)	1set	1set	746673-39410	LUBRICATING OIL PIPE ASS'Y, pressure valve ～ lubricating oil cooler
18	潤滑油管 (圧力調整弁～主管)	1	1	146673-39351	LUBRICATING OIL PIPE, pressure valve ～ main pipe
	サポート 12×1	2	2	151605-39540	SUPPORT 12×1
	ボルト M12×40	1	1	26206-120402	BOLT M12×40

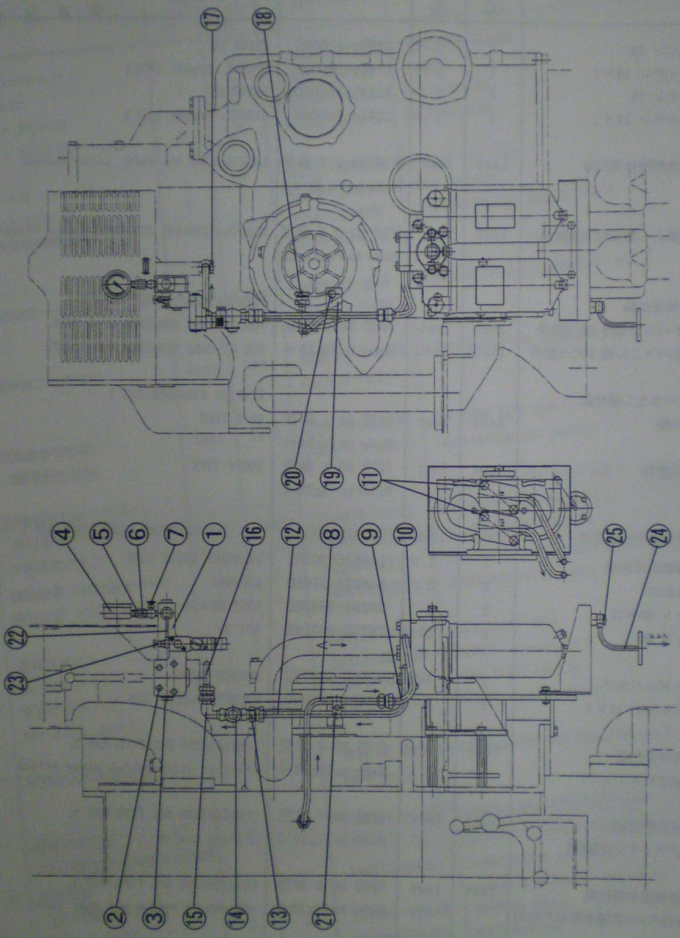
付図29-1. 潤滑油管装置

Fig.29-1 LUBRICATING OIL PIPE SYSTEM

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
19	ユニオン 12	1	1	23831-120000	UNION 12
	銅パッキン 18×1	1	1	23414-180000	GASKET, copper 18×1
20	ユニオン 15	1	1	23831-150000	UNION 15
	銅パッキン 20×1	1	1	23414-200000	GASKET, copper 20×1
21	過給機潤滑油管仕組	1set	1set	付図 29-2,3 参照 Refer to Fig.29-2,3	LUBRICATING OIL PIPE, turbo-charger
22	潤滑油こし器仕組（過給機）	1set	1set	付図 23-2,3 参照 Refer to Fig.23-2,3	LUBRICATING OIL STRAINER, turbo-charger
23	潤滑油管仕組				LUBRICATING OIL PIPE ASS'Y
	バイパスこし器 GF-2型用	1set	1set	付図 29-4 参照	FOR BY-PASS STRAINER GF-2 TYPE
	バイパスこし器 ROC-5型用	1set	1set	Refer to Fig.29-4	FOR BY-PASS STRAINER ROC-5 TYPE
24	バイパスこし器仕組				BY-PASS STRAINER ASS'Y
	GF-2型	1set	1set	付図 24-1 参照 Refer to Fig.24-1	GF-2 TYPE
	ROC-5型用	1set	1set	付図 25-1 参照 Refer to Fig.25-1	ROC-5 TYPE
	潤滑油圧力計管仕組	1set	1set	746673-39391	LUB. OIL PRESSURE GAUGE PIPE ASS'Y
25	潤滑油圧力計管	1	1	146676-39381	PRESSURE GAUGE PIPE
	振れ止め	2	2	146673-91950	SUPPORT
	ボルト M8×20	2	2	26206-080202	BOLT M8×20
	ナット M8	2	2	26706-080002	NUT M8
26	ニードルバルブ	1	1	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	2	2	23414-120000	GASKET, copper 12×1
27	潤滑油管仕組	1set	1set	付図 29-6 参照	LUBRICATING OIL PIPE ASS'Y,
	（差圧計スイッチ）			Refer to Fig.29-6	pressure differential gauge switch
28	潤滑油管仕組	1set	1set	付図 29-7 参照	LUBRICATING OIL PIPE ASS'Y,
	（プライミング装置）			Refer to Fig.29-7	priming system
29	潤滑油戻り管仕組	1set	1set	付図 29-8 参照	LUBRICATING OIL PIPE ASS'Y,
	（ｵｲﾙﾊﾟﾝ～共通台床ｻﾝﾌﾟﾀﾝｸ）			Refer to Fig.29-8	oil pan ～ common bed sump tank

付図29-2. 過給機用潤滑油管装置（前部駆動なし仕様） (1/3)

Fig.29-2 LBURICATING OIL PIPE SYSTEM, turbo-charger
(front side non-driving for separate spec.)



付図29-2. 過給機用潤滑油管装置（前部駆動なし仕様） (2/3)

Fig.29-2 LUBRICATING OIL PIPE SYSTEM, turbo-charger (front side non-driving for separate spec.)

Ⓐ : RH133-Y type, 6N18(A)L-DV/-UV/-SV/ 6N18AL-HV engine .spec.

Ⓑ : RH143-Y type, 6N18AL-EV engine spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油管仕組				LUBRICATING OIL PIPE ASS'Y,
	（過給機RH133-Y型装備）	1set		746678-39240	RH133-Y type turbo-charger
	（過給機RH143-Y型装備）		1set	746678-39300	RH143-Y type turbo-charger
1	潤滑油連絡継手	1	1	146676-39553	LUB. OIL PATHWAY
	パッキン	1	1	146673-35611	GASKET
2	ボルト M8×50	4	4	26206-080502	BOLT M8×50
3	六角プラグ M16	2	2	23887-160002	PLUG M16
	銅パッキン 16×1	2	2	23414-160000	GASKET, copper 16×1
4	圧力計	1	1	146673-91444	PRESSURE GAUGE
5	接続金具	1	1	139653-91170	CONNECTOR
6	パッキン T=1.0	1	1	43400-005640	GASKET T=1.0
7	緩圧バルブ	1	1	146673-59940	NEEDLE VALVE
8	潤滑油管 A	1	1	146678-39610	LUBRICATING OIL PIPE A
9	潤滑油管 B	1	1	146678-39620	LUBRICATING OIL PIPE B
10	パッキン	2	2	153803-39140	GASKET
11	ボルト M12×40	4	4	26206-120402	BOLT M12×40
12	潤滑油管 C	1		146678-39640	LUBRICATING OIL PIPE C
	潤滑油管 C		1	146678-39850	LUBRICATING OIL PIPE C
	潤滑油管 D 仕組	1s		146678-39810	LUBRICATING OIL PIPE D ASS'Y
	潤滑油管 D 仕組		1s	146678-39820	LUBRICATING OIL PIPE D ASS'Y
13	ユニオン PT1/2×15	(2)	(2)	43551-001711	UNION PT1/2×15
14	スイング逆止弁	(1)	(1)	138623-39200	CHECK VALVE, swing
15	おすめすエルボ PF1/2	(1)	(1)	23112-040000	ELBOW PF1/2
16	潤滑油管 D	(1)		146678-39650	LUBRICATING OIL PIPE D
	潤滑油管 D		(1)	146678-39860	LUBRICATING OIL PIPE D
17	管継手ボルト 15	1	1	23857-150000	PIPE JOINT BOLT 15
	銅パッキン 20×1	2	2	23414-200000	GASKET, copper 20×1
18	ユニオン 15	1	1	23831-150000	UNION 15
	銅パッキン 20×1	1	1	23414-200000	GASKET, copper 20×1

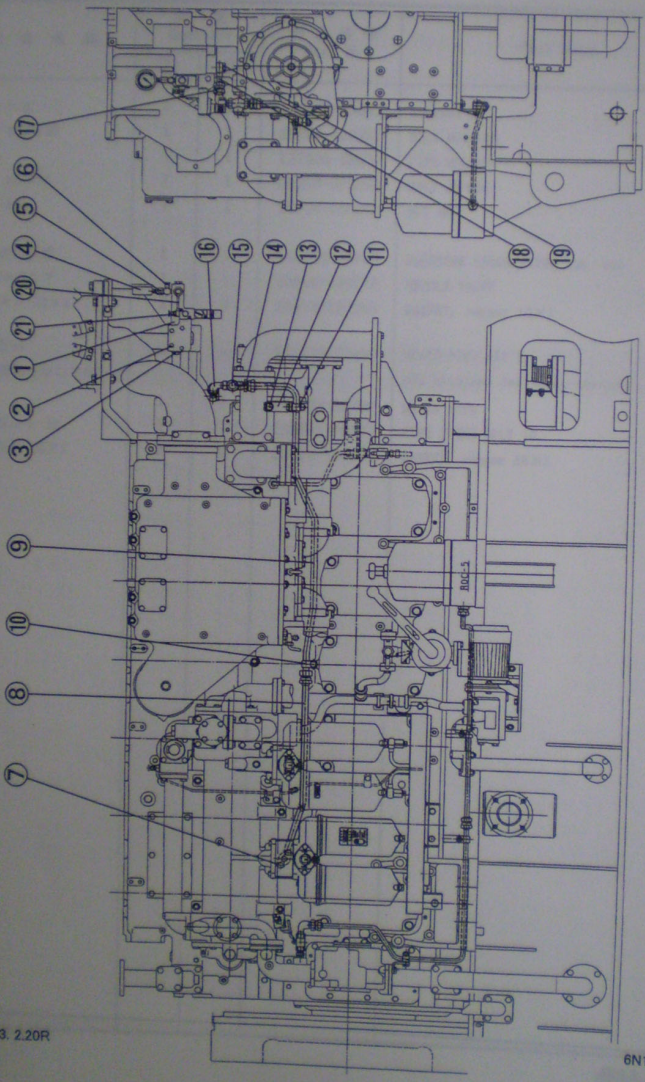
付図29-2. 過給機用潤滑油管装置（前部駆動なし仕様） (3/3)

Fig.29-2 LUBRICATING OIL PIPE SYSTEM, turbo-charger (front side non-driving for separate spec.)

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
19	サポート A	1	1	146676-39651	SUPPORT A
20	ボルト M12×35	1	1	26206-120352	BOLT M12×35
21	管押え	1	1	137606-59450	PIPE HOLDER
	ボルト M8×35	1	1	26206-080352	BOLT M8×35
	ナット M8	1	1	26706-080002	NUT M8
22	潤滑油圧力計管	1	1	146676-39700	PRESSURE GAUGE PIPE, lub. oil
23	ニードルバルブ	1	1	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	2	2	23414-120000	GASKET, copper 12×1
	漏油管仕組 (過給機潤滑油こし器)	1set	1set	746678-39490	DRAIN PIPE ASS'Y, oil strainer for turbo-charger
24	漏油管	1	1	146678-39700	DRAIN PIPE
25	管継手ボルト 10	1	1	23857-100000	PIPE JPINT BPLT 10
	銅パッキン 16×1	2	2	23414-160000	GASKET, copper 16×1

付図29-3. 過給機用潤滑油管装置（前部駆動あり仕様） 1/3

Fig.29-3 LBURICATING OIL PIPE SYSTEM, turbo-charger
(front side driving for separate spec.)



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付図29-3. 過給機用潤滑油管装置（前部駆動あり仕様） (2/3)

Fig.29-3 LUBRICATING OIL PIPE SYSTEM, turbo-charger (front side driving for separate spec.)

Ⓐ : RH133-Y type, 6N18(A)L-DV/-UV/-SV/ 6N18AL-HV engine spec.

Ⓑ : RH143-Y type, 6N18AL-EV engine spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油管仕組				LUBRICATING OIL PIPE ASS'Y,
	（過給機RH133-Y型装備）	1set		746683-39311	RH133-Y type turbo-charger
	（過給機RH143-Y型装備）		1set	746683-39301	RH143-Y type turbo-charger
1	潤滑油連絡継手	1	1	146676-39553	LUB. OIL PATHWAY
	パッキン	1	1	146673-35611	GASKET
2	ボルト M8×50	4	4	26206-080502	BOLT M8×50
3	六角プラグ M16	2	2	23887-160002	PLUG M16
	銅パッキン 16×1	2	2	23414-160000	GASKET, copper 16×1
4	圧力計	1	1	146673-91444	PRESSURE GAUGE
5	接続金具	1	1	139653-91170	CONNECTOR
	パッキン T=1.0	1	1	43400-005640	GASKET T=1.0
6	緩圧バルブ	1	1	146673-59940	NEEDLE VALVE
7	Oリング (1A) P28	1	1	24311-000280	O-RING (1A) P28
	ボルト M10×22	2	2	26206-100222	BOLT M10×22
8	潤滑油管 A	1	1	146683-39501	LUBRICATING OIL PIPE A
9	潤滑油管 B	1		146683-39581	LUBRICATING OIL PIPE B
	潤滑油管 B		1	146683-39511	LUBRICATING OIL PIPE B
10	サポート 20×1	2	2	146683-39271	SUPPORT 20×1
	ボルト M12×45	1	1	26206-120452	BOLT M12×45
11	サポート 20×1	2	2	146683-39271	SUPPORT 20×1
	ボルト M12×55	1	1	26206-120552	BOLT M12×55
	ナット M12	1	1	26706-120002	NUT M12
	座金 12	1	1	22137-120000	WASHER 12
12	サポート 20×1	1	1	146683-39521	SUPPORT 20×1
13	ボルト M16×50	1	1	26152-160502	BOLT M16×50
	座金 16	1	1	22137-160000	WASHER 16

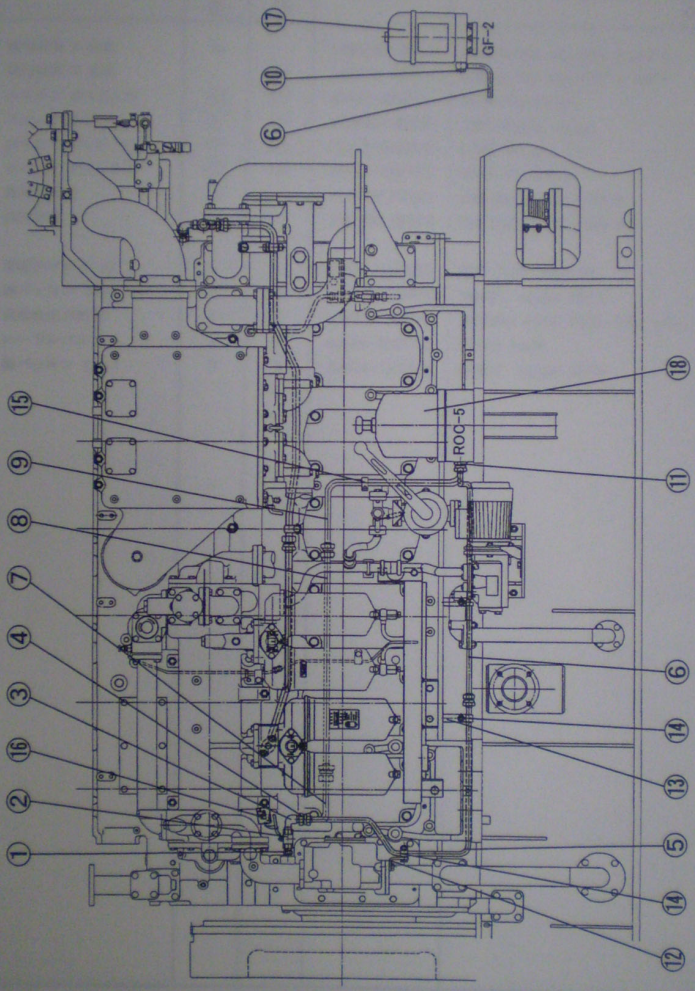
付図29-3. 過給機用潤滑油管装置（前部駆動あり仕様） (3/3)

Fig.29-3 LUBRICATING OIL PIPE SYSTEM, turbo-charger (front side driving for separate spec.)

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	潤滑油管 D 仕組	1s		146678-39880	LUBRICATING OIL PIPE D ASS'Y
	潤滑油管 D 仕組		1s	146678-39870	LUBRICATING OIL PIPE D ASS'Y
14	ユニオン PT1/2×20	(1)	(1)	43551-000301	UNION PT1/2×20
15	スイング逆止弁	(1)	(1)	138623-39200	CHECK VALVE, swing
16	おすめすエルボ PF1/2	(1)	(1)	23112-040000	ELBOW PF1/2
17	ユニオン PT1/2×15	(1)	(1)	43551-001711	UNION PT1/2×15
18	潤滑油管 D	(1)		146678-39650	LUBRICATING OIL PIPE D
	潤滑油管 D		(1)	146678-39860	LUBRICATING OIL PIPE D
19	管継手ボルト 15	1	1	23857-150000	PIPE JOINT BOLT 15
	銅パッキン 20×1	2	2	23414-200000	GASKET, copper 20×1
20	潤滑油圧力計管	1	1	146676-39700	PRESSURE GAUGE PIPE, lub. oil
21	ニードルバルブ	1	1	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	2	2	23414-120000	GASKET, copper 12×1

付図29-4. バイパスこし器用潤滑油管装置 (1/3)

Fig.29-4 LBURICATING OIL PIPE SYSTEM, by-pass strainer



付図29-4. バイパスこし器用潤滑油管装置

Fig.29-4 LUBRICATING OIL PIPE SYSTEM, by-pass strainer

Ⓐ：GF-2 型 Ⓐ：GF-2 type,	A 重 油 Marine diesel oil,	前部駆動あり仕様 Front side driving for separate spec.
Ⓑ：ROC-5 型 Ⓑ：ROC-5 type,	低 質 油 Heavy fuel oil,	前部駆動あり仕様 Front side driving for separate spec.
Ⓒ：ROC-5 型 Ⓒ：ROC-5 type,	低 質 油 Heavy fuel oil,	前部駆動なし仕様 Front side non-driving for separate spec.

Item	部 品 名 称	数 量 Quantity Ⓐ	Ⓑ	Ⓒ	部品番号 Part No.	Part Name
	潤滑油管仕組					LUBRICATING OIL PIPE ASS'Y,
	(こし器 GF-2型装備)	1set			746674-39351	GF-2 type by-pass strainer
	(こし器ROC-5型装備)		1set		746674-39360	ROC-5 type by-pass strainer
	(こし器ROC-5型装備)			1set	746678-39320	ROC-5 type by-pass strainer
1	ニップル PT1/2	1	1	1	23163-040000	NIPPLE PT1/2
2	ボールバルブ 1/2	1	1	1	43600-023230	BALL VALVE 1/2
3	おすめすエルボ PT1/2	1	1	1	23112-040000	ELBOW PT1/2
4	ユニオン PT1/2×15	1	1	1	43551-001711	UNION PT1/2×15
5	潤滑油管 A	1	1		146674-39551	LUBRICATING OIL PIPE A
6	潤滑油管 B	1			146674-39560	LUBRICATING OIL PIPE B
	潤滑油管 B		1		146674-39570	LUBRICATING OIL PIPE B
7	潤滑油管 A			1	146673-39300	LUBRICATING OIL PIPE A
8	潤滑油管 B			1	146673-39311	LUBRICATING OIL PIPE B
9	潤滑油管 (ROC-5入口)			1	146673-39200	LUBRICATING OIL PIPE, ROC-5 inlet
10	管継手ボルト 12	1			23857-120000	PIPE JOINT BOLT 12
	銅パッキン 18×1	2			23414-180000	GASKET, copper 18×1
11	ユニオン M25×PF1/2		1	1	43551-000201	UNION M25×PF1/2
	銅パッキン 21×1		1	1	23414-210000	GASKET, copper 21×1
12	サポート	1	1		146674-39540	SUPPORT
	ボルト M12×30	1	1		26206-120302	BOLT M12×30
13	サポート	2	2		146678-39771	SUPPORT
	ボルト M12×35	2	2		26206-120352	BOLT M12×35

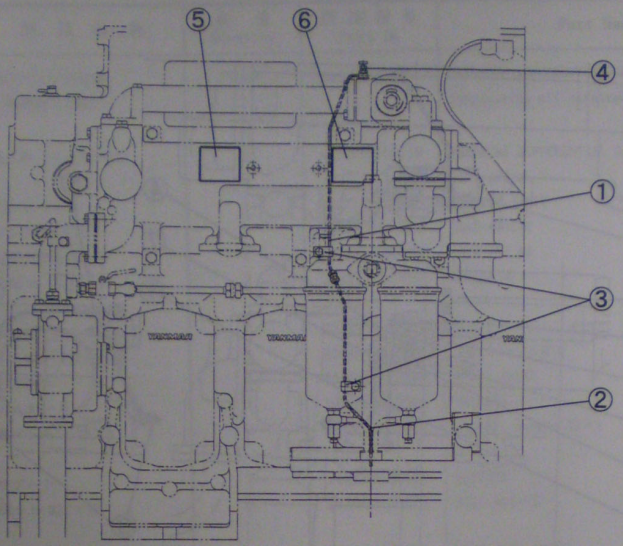
付図29-4. バイパスこし器用潤滑油管装置

Fig.29-4 LUBRICATING OIL PIPE SYSTEM, by-pass strainer

Item	部品名称	数量 Quantity Ⓐ	Ⓑ	Ⓒ	部品番号 Part No.	Part Name
14	サポート 15×1	6	6		146673-39201	SUPPORT 20×1
	ボルト M12×45	3	3		26206-120452	BOLT M12×45
	ナット M12	3	3		26706-120002	NUT M12
15	サポート 15×1			6	146673-39201	SUPPORT 20×1
	ボルト M12×35			3	26206-120352	BOLT M12×35
16	バルブ銘板	1	1	1	146673-07150	NAME PLATE, valve
17	GF-2型バイパスこし器	1s			付図 24-1 参照 Refer to Fig.24-1	GF-2 type by-pass strainer
18	ROC-5型バイパスこし器		1s	1s	付図 25-1 参照 Refer to Fig.25-1	ROC-5 type by-pass strainer

付図29-5. 空気抜き管（潤滑油冷却器）

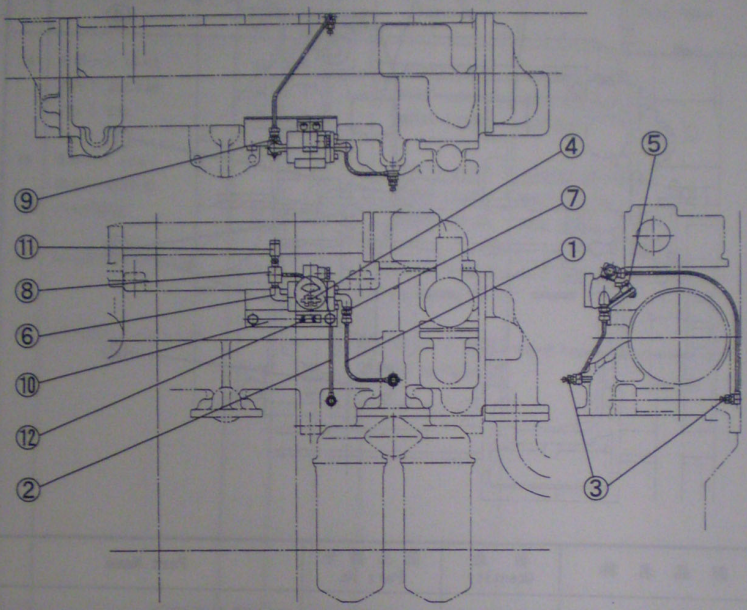
Fig.29-5 AIR VENT PIPE, lubricating oil cooler



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	空気抜き管仕組 （潤滑油冷却器）	1set	746676-39401	AIR VENT PIPE ASS'Y, lubricating oil cooler
1	空気抜き管 A （潤滑油冷却器）	1	146673-39930	AIR VENT PIPE A, lubricating oil cooler
2	空気抜き管 B （潤滑油冷却器）	1	146673-39940	AIR VENT PIPE B, lubricating oil cooler
3	サポート 4×1	4	153605-49920	SUPPORT 4×1
	ボルト M12×35	2	26206-120352	BOLT M12×35
4	ニードルバルブ	1	43600-037560	NEEDLE VALVE
	銅パッキン 12×1	2	23414-120000	GASKET, copper 12×1
5	注意銘板（和文）	1	146673-33701	CAUTION PLATE, japanese
6	注意銘板（英文）	1	146673-33711	CAUTION PLATE, english

付図29-6. 潤滑油管装置（差圧計スイッチ） (1/2)

Fig.29-6 LUBRICATING OIL PIPE SYSTEM, lub. oil pressure differential gauge switch



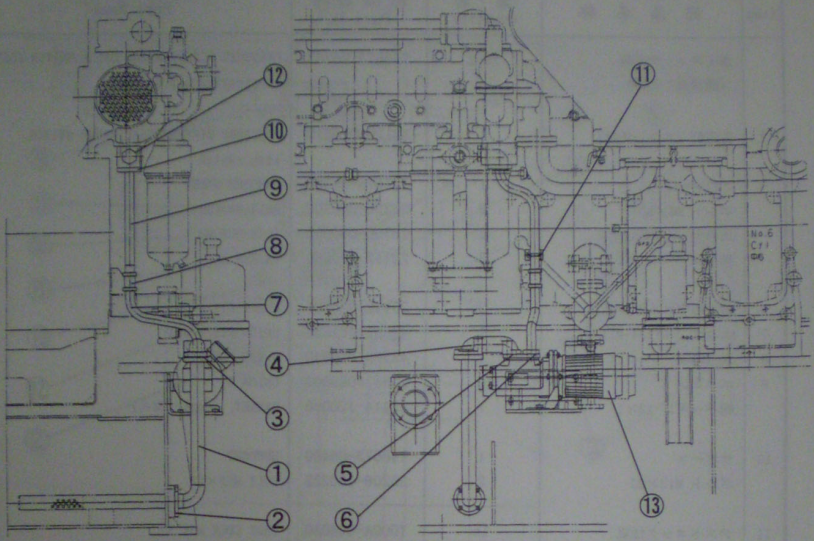
Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油管仕組（差圧計スイッチ）	1set	746673-39444	LUBRICATIIN OIL PIPE ASS'Y, pressure differential gauge swatch
1	潤滑油管（こし器入口）	1	146673-39394	LUBRICATIIN OIL PIPE, strainer inlet
2	潤滑油管（こし器出口）	1	146673-39403	LUBRICATIIN OIL PIPE, strainer outlet
3	ニードルバルブ	2	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	4	23414-120000	GASKET, copper 12×1

付図29-6. 潤滑油管装置（差圧計スイッチ）
Fig.29-6 LUBRICATING OIL PIPE SYSTEM, lub. oil pressure differential gauge switch

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	差圧スイッチ仕組（潤滑油こし器）	1set	746673-86353	PRESSURE DIFFERENTIAL GAUGE SWITCH ASS'Y, lubricating oil strainer
4	差圧計（スイッチ付）	1	42130-015210	PRESSURE DIFFERENTIAL GAUGE SWITCH, with switch
5	ごむシート	1	147673-39920	RUBBEER SHEET
	ボルト M8×30	2	26206-080302	BOLT M8×30
	止めナット M8	2	26796-080002	LOCK NUT M8
	座金 8	2	22117-080000	WASHER 8
6	おすめすエルボ PT1/4	2	23112-020007	ELBOW PT1/4
7	ユニオン PT1/4-M14	1	43551-001541	UNION PT1/4-M14
8	三方継手	1	43580-015940	3-WAY JOINT
9	ユニオン 6	1	23831-060000	UNION 6
	銅パッキン 12×1	1	23414-120000	GASKET, copper 12×1
10	サポート	1	146673-86450	SUPPORT
	ボルト M12×22	2	26206-120222	BOLT M12×22
11	テストコック仕組	1s	T000A-0040A0	TEST COCK ASS'Y
	ニードルバルブ	(1)	43600-006951	NEEDLE VALVE
	ソケット M14-PF1/4	(1)	43570-006151	SOCKET M14-PF1/4
	ナイロンパッキン 10	(1)	23418-100000	GASKET, nylon 10
	六角プラグ G1/4	(1)	23894-020002	PLUG G1/4
	銅パッキン 13×1	(1)	23414-130000	GASKET, copper 13×1
12	スイッチ銘板	1	42221-014580	NAME PLATE, switch

付図29-7. 潤滑油管(プライミング装置) (1/2)

Fig.29-7 LUBRICATING OIL PIIPE, priming system



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油管仕組 (プライミング装置)	1set	746673-39462	LUBRICATING OIL PIPE ASS'Y, priming system
1	潤滑油管 (共通台床～ﾌﾟﾗｲﾐﾝｸﾞﾎﾟﾝﾌﾟ)	1	43711-087780	LUBRICATING OIL PIPE, common bed ～ priming pump
2	パッキン	1	23438-025000	GASKET
	ボルト M10×30	4	26206-100302	BOLT M10×30
3	角フランジ 44.2	1	43331-00 0 050	FLANGE, square 44.2
	パッキン	1	141616-39220	GASKET
	ボルト M12×45	2	26206-120452	BOLT M12×45
	ボルト M12×80	2	26206-120802	BOLT M12×80
	ナット M12	4	26706-120002	NUT M12

付図29-7. 潤滑油管(プライミング装置) (2/2)

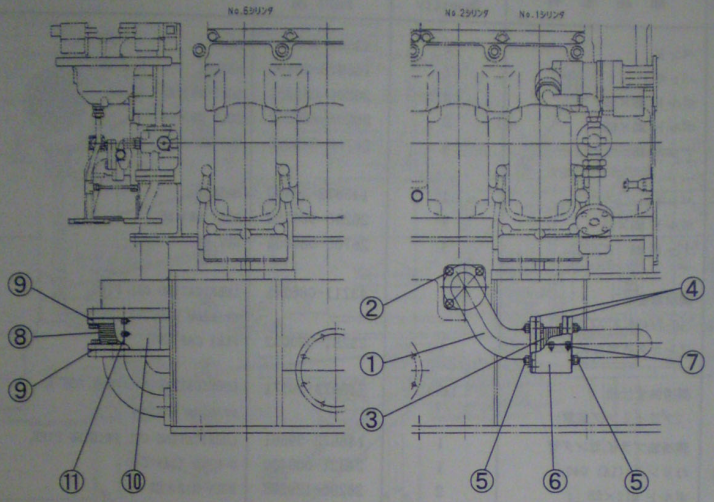
Fig.29-7 LUBRICATING OIL PIIPE, priming system

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
4	ベンド	1	43560-009250	BEND
5	パッキン	1	146673-39490	GASKET
	ボルト M8×35	2	26206-080352	BOLT M8×35
	ボルト M8×65	2	26206-080652	BOLT M8×65
	ナット M8	4	26706-080002	NUT M8
6	パッキン	1	146673-39490	GASKET
	ボルト M8×35	4	26206-080352	BOLT M8×35
	ナット M8	4	26706-080002	NUT M8
7	潤滑油管 (ﾌﾟﾗｲﾐﾝｸﾞﾎﾟﾝﾌﾟ出口)	1	43711-086291	LUBRICATING OIL PIPE, priming pump outlet
8	フレックスカップ 20S	1	23281-020032	FLEX CAP 20S
	潤滑油管仕組 (プライミング装置)	1set	746673-39171	LUBRICATING OIL PIPE ASS'Y, priming system
9	潤滑油プライミング管	1	146673-39661	LUBRICATING OIL PRIMING PIPE,
10	Oリング (1A) G40	1	24321-000400	O-RING (1A) G40
	ボルト M12×25	2	26206-120252	BOLT M12×25
11	サポート	1	146673-39621	SUPPORT
	ボルト M12×20	1	26206-120202	BOLT M12×20
	振れ止め	1	153605-59400	SUPPORT
	ボルト M10×35	1	26206-100352	BOLT M10×35
12	潤滑油調圧弁仕組	1set	付図 22-1 参照 Refer to Fig.22-1	LUBRICATING OIL PRESSURE REGULATING VALVE ASS'Y
13	潤滑油プライミングポンプ	(交換用部品)		LUBRICATING OIL PRIMING PUMP
	モータ用ベアリング	(Parts for exchange)		BEARING FOR MOTOR
	ABB社製モータ用	1	24107-062030	at Motor maker by ABB company
	〃	1	24107-062020	〃
	シーメンス社製モータ用	1	24105-062020	at Motor maker by SIEMENS company
	〃	1	24107-062020	〃

付図29-8. 潤滑油戻り管

(1/2)

Fig.29-8 LUBRICATING OIL RETURN PIIPE



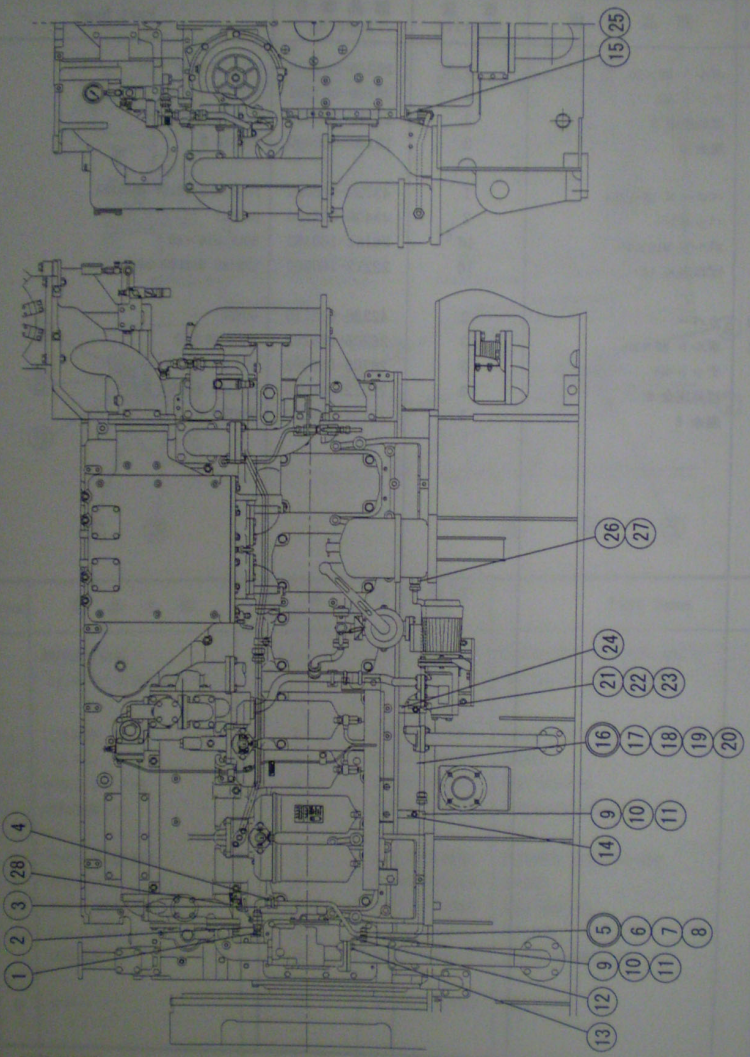
Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	潤滑油管仕組 (オイルパン～共通台床タンク)	1set	746673-39113	LUBRICATING OIL PIPE ASS'Y, oil pan ～ common bed
1	二方継手	1	43570-020951	2-WAY JOINT
2	パッキン	1	23438-080000	GASKET
	ボルト M16×45	4	26152-160452	BOLT M16×45
	ばね座金 16	4	22212-160000	SPRING WASHER 16
3	ベローズ 5K-80A	1	43720-016080	FLEXIBLE JOINT 5K-80A
4	パッキン	2	43400-005110	GASKET
5	ボルト M16×55	8	26152-160552	BOLT M16×55
	ナット M16	8	26732-160002	NUT M16
	ばね座金 16	8	22212-160000	SPRING WASHER 16
6	カバー	2	42326-012730	COVER

Fig.29-8 LUBRICATING OIL RETURN PIIPE

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
7	ボルト M8×20	3	26206-080202	BOLT M8×20
	ナット M8	3	26706-080002	NUT M8
	ばね座金 8	3	22212-080000	SPRING WASHER 8
	座金 8	3	22137-080000	WASHER 8
8	ベローズ 5K-125A	1	43720-016090	FLEXIBLE JOINT 5K-125A
9	パッキン	2	43400-006100	GASKET
	ボルト M16×45	16	26152-160452	BOLT M16×45
	ばね座金 16	16	22212-160000	SPRING WASHER 16
10	カバー	2	42326-012750	COVER
11	ボルト M8×20	3	26206-080202	BOLT M8×20
	ナット M8	3	26706-080002	NUT M8
	ばね座金 8	3	22212-080000	SPRING WASHER 8
	座金 8	3	22137-080000	WASHER 8

付図29-9. バイパスこし器(FM200)用潤滑油管装置(1/2)

Fig. 29-9. LUBRICATING OIL PIPE SYSTEM, by-passstrainer (FM200)



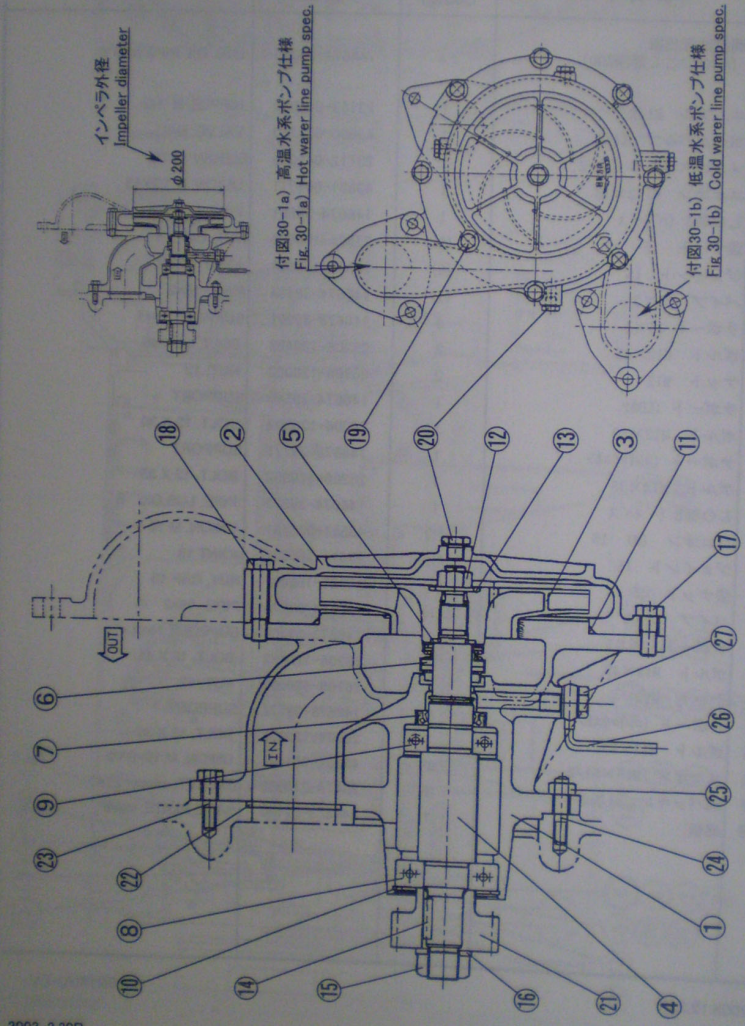
付図29-9. バイパスこし器(FM200)用潤滑油管装置 (2/2)

Fig.29-9. LUBRICATING OIL PIPE SYSTEM, by-pass strainer (FM200)

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
▽	潤滑油管仕組 (ﾊﾞｲﾊﾟｽこし器FM200)	1 s	746674-39360	LUB. OIL PIPE ASS'Y
1	ニップル R1/2	1	23163-040000	NIPPLE R 1/2
2	ボールバルブ (1/2	1	43600-023230	VALVE, BALL
3	メスオスエルボ R1/2	1	23112-040000	ELBOW R 1/2
4	ユニオン R1/2×15	1	43551-001711	UNION, R 1/2X15
5	ＬＯ管A (ﾊﾞｲﾊﾟｽ	1	146674-39551	PIPE, LUB.OIL A
6	袋ナット 15	(2)	23821-150001	NUT, CAP 15
7	ジョイント 15	(2)	23311-150001	JOINT 15
8	パイプ 15×2	(1)	146674-3955A	PIPE 15×2
9	サポート 15×1	4	146673-39201	SUPPORT 15×1
10	ボルト M12×45	2	26206-120452	BOLT, 12 X 45
11	ナット M12	2	26706-120002	NUT, 12
12	サポート (LOｶﾝ	1	146674-39540	SUPPORT
13	ボルト M12×30	1	26206-120302	BOLT, 12 X 30
14	サポート (ｺｼｷｮｳﾕｶﾝ	1	146678-39771	SUPPORT
15	ボルト M12×35	1	26206-120352	BOLT, 12 X 35
16	ＬＯ管B (ﾊﾞｲﾊﾟｽ	1	146674-39570	PIPE, LUB.OIL B
17	ユニオン (M) 15	(1)	43551-001481	UNION, M 15
18	ジョイント 15	(1)	23311-150001	JOINT 15
19	袋ナット 15	(1)	23821-150001	NUT, CAP 15
20	パイプ 15×2	(1)	146674-3957A	PIPE 15×2
21	サポート 15×1	2	146673-39201	SUPPORT 15×1
22	ボルト M12×45	1	26206-120452	BOLT, 12 X 45
23	ナット M12	1	26706-120002	NUT, 12
24	サポート (ｺｼｷｮｳﾕｶﾝ	1	146678-39771	SUPPORT
25	ボルト M12×35	1	26206-120352	BOLT, 12 X 35
26	ユニオン M15×G1/2	1	43551-001481	UNION, M 15×G1/2
27	銅パッキン 21×1	1	23414-210000	GASKET, copper 21×1
28	銘板	1	146673-07150	NAME PLATE, valve

付図30-1. 冷却水ポンプ仕組（標準仕様） (5)

Fig.30-1 COOLING WATER PUMP ASS'Y, standard spec.



付図30-1a). 冷却水ポンプ仕組 / 標準型（高温水系ポンプ）

Fig.30-1a) COOLING WATER PUMP ASS'Y / STNDARD TYPE, hot water line pump

A：720,750min-1(rpm)仕様/720,750min-1(rpm) spec.

B：900,1000min-1(rpm)仕様/900,1000min-1(rpm) spec.

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
	冷却水ポンプ仕組				COOLING WATER PUMP ASS'Y
	720,750min-1 (rpm) 仕様	1set		746673-42111	720,750min-1 (rpm) SPEC.
	900,1000min-1(rpm) 仕様		1set	746676-42111	900,1000min-1 (rpm) SPEC.
	冷却水ポンプ仕組	1set	1set	746676-42011	COOLING WATER PUMP ASS'Y
1	取付台	(1)	(1)	146673-42230	BODY
2	ケーシング	(1)	(1)	146673-42240	CASING
3	インペラ	(1)	(1)	146673-42221	IMPELLER
4	シャフト	(1)	(1)	146673-42210	SHAFT
5	カラー	(1)	(1)	147673-42260	COLLAR
6	メカニカルシール	(1)	(1)	147673-42490	MECHANICAL SEAL
7	オイルシール TC355511	(1)	(1)	24421-355511	OIL SEAL TC355511
8	玉軸受 6307	(1)	(1)	24101-063074	BALL BEARING 6307
9	玉軸受 6207RS	(1)	(1)	24102-062074	BALL BEARING 6207RS
10	C形止め輪 80	(1)	(1)	22252-000800	RETAINING RING, C type 80
11	Oリング	(1)	(1)	136600-42040	O-RING
12	ナット M16（左ねじ）	(1)	(1)	146673-42200	NUT M16, counter clockwise screw
13	座金 16	(1)	(1)	22133-160000	WASHER 16
14	フェザーキー 7×32	(1)	(1)	22512-070320	KEY 7×32
15	ナット M24	(1)	(1)	26732-240002	NUT M24
16	座金 24	(1)	(1)	22137-240000	WASHER 24
17	ボルト M12×30	(4)	(4)	26116-120302	BOLT M12×30
18	ボルト M12×55	(3)	(3)	26116-120552	BOLT M12×55
19	ボルト M12×85	(1)	(1)	26116-120852	BOLT M12×85
20	六角プラグ G1/2	(5)	(5)	23897-020002	PLUG G1/2
	銅パッキン 13×1	(5)	(5)	23414-130000	GASKET, copper 13×1

付図30-1a). 冷却水ポンプ仕組 / 標準型（高温水系ポンプ）

Fig.30-1a) COOLING WATER PUMP ASS'Y / STNDARD TYPE, hot water line pump

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
21	歯車				GEAR
	720, 750min-1 (rpm) 仕様	1		146644-42460	720, 750min-1 (rpm) SPEC.
	900, 1000min-1(rpm) 仕様		1	146673-42400	900, 1000min-1 (rpm) SPEC.
22	Oリング P75	1	1	24316-000750	O-RING P75
23	ボルト M12×30	5	5	26206-120302	BOLT M12×30
24	植込みボルト M12×30	2	2	26216-120302	STUD BOLT M12×30
25	ナット M12	2	2	26706-120002	NUT M12
26	漏れ検出管	1	1	146673-42481	DRAIN CHECK PIPE
27	管継手ボルト 8	1	1	23854-080000	PIPE JOINT BOLT 8
	銅パッキン 14×1	2	2	23414-140000	GASKET, copper 14×1

付図30-1b). 冷却水ポンプ仕組 / 標準型（低温水系ポンプ）

Fig.30-1b) COOLING WATER PUMP ASS'Y / STNDARD TYPE, cold water line pump

A：720,750min-1(rpm)仕様/720,750min-1(rpm) spec.
B：900,1000min-1(rpm)仕様/900,1000min-1(rpm) spec.

Item	部品名称	数量 Quantily		部品番号 Part No.	Part Name
		A	B		
	冷却水ポンプ仕組				COOLING WATER PUMP ASS'Y
	720,750min-1 (rpm) 仕様	1set		746673-42121	720,750min-1(rpm) SPEC.
	900,1000min-1(rpm) 仕様		1set	746676-42121	900,1000min-1(rpm) SPEC.
	冷却水ポンプ仕組	1set	1set	746676-42021	COOLING WATER PUMP ASS'Y
1	取付台	(1)	(1)	146673-42230	BODY
2	ケーシング	(1)	(1)	146673-42240	CASING
3	インペラ	(1)	(1)	146673-42221	IMPELLER
4	シャフト	(1)	(1)	146673-42210	SHAFT
5	カラー	(1)	(1)	147673-42260	COLLAR
6	メカニカルシール	(1)	(1)	147673-42490	MECHANICAL SEAL
7	オイルシール TC355511	(1)	(1)	24421-355511	OIL SEAL TC355511
8	玉軸受 6307	(1)	(1)	24101-063074	BALL BEARING 6307
9	玉軸受 6207RS	(1)	(1)	24102-062074	BALL BEARING 6207RS
10	C形止め輪 80	(1)	(1)	22252-000800	RETAINING RING, C type 80
11	Oリング	(1)	(1)	136600-42040	O-RING
12	ナット M16（左ねじ）	(1)	(1)	146673-42200	NUT M16, counter clockwise screw
13	座金 16	(1)	(1)	22133-160000	WASHER 16
14	フェザーキー 7×32	(1)	(1)	22512-070320	KEY 7×32
15	ナット M24	(1)	(1)	26732-240002	NUT M24
16	座金 24	(1)	(1)	22137-240000	WASHER 24
17	ボルト M12×30	(4)	(4)	26116-120302	BOLT M12×30
18	ボルト M12×55	(3)	(3)	26116-120552	BOLT M12×55
19	ボルト M12×85	(1)	(1)	26116-120852	BOLT M12×85
20	六角プラグ G1/2	(5)	(5)	23897-020002	PLUG G1/2
	銅パッキン 13×1	(5)	(5)	23414-130000	GASKET, copper 13×1

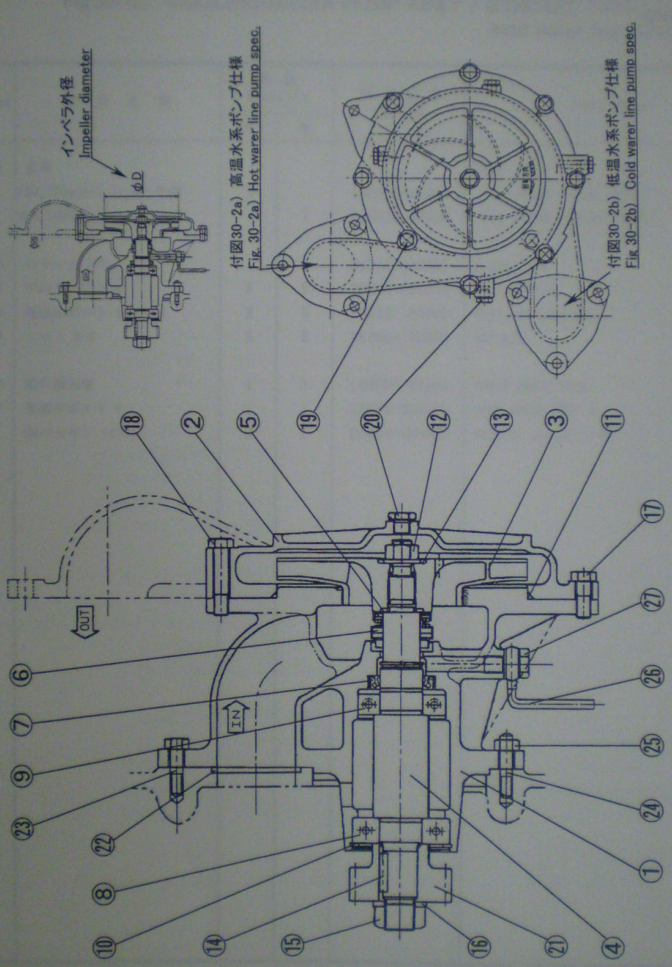
付図30-1b). 冷却水ポンプ仕組 / 標準型（低温水系ポンプ）

Fig.30-1b) COOLING WATER PUMP ASS'Y / STNDARD TYPE, cold water line pump

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
21	歯車				GEAR
	720, 750min-1 (rpm) 仕様	1		146644-42460	720, 750min-1(rpm) SPEC.
	900, 1000min-1(rpm) 仕様		1	146673-42400	900, 1000min-1(rpm) SPEC.
22	Oリング P75	1	1	24316-000750	O-RING P75
23	ボルト M12×30	5	5	26206-120302	BOLT M12×30
24	植込みボルト M12×30	2	2	26216-120302	STUD BOLT M12×30
25	ナット M12	2	2	26706-120002	NUT M12
26	漏れ検出管	1	1	146673-42481	DRAIN CHECK PIPE
27	管継手ボルト 8	1	1	23854-080000	PIPE JOINT BOLT 8
	銅パッキン 14×1	2	2	23414-140000	GASKET, copper 14×1

付図30-2. 冷却水ポンプ仕組（特注仕様） (1/5)

Fig.30-2 COOLING WATER PUMP ASS'Y, option spec.



付図30-2a). 冷却水ポンプ仕組 / 特注型（高温水系ポンプ）

Fig.30-2a) COOLING WATER PUMP ASS'Y / OPTION TYPE, hot water line pump

A:720、750min-1(rpm)／720、750min-1(rpm)spec

B:900、1000min-1(rpm)／900、1000min-1(rpm)spec

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
	冷却水ポンプ仕組				COOLING WATER PUMP ASS'Y
	720, 750・$^{-1}$(rpm) 仕様	1set		746674-42110	720, 750・$^{-1}$(rpm) SPEC.
	900, 1000・$^{-1}$(rpm) 仕様		1set	746678-42110	900, 1000・$^{-1}$(rpm) SPEC.
	冷却水ポンプ仕組	1set		746674-42010	COOLING WATER PUMP ASS'Y
	冷却水ポンプ仕組		1set	746678-42010	COOLING WATER PUMP ASS'Y
1	取付台	(1)	(1)	146673-42230	BODY
2	ケーシング	(1)	(1)	146673-42240	CASING
3	インペラ				IMPELLER
	外径(φD) =φ175	(1)		146673-42450	diameter(φD) =φ175
	外径(φD) =φ160		(1)	147673-42820	diameter(φD) =φ160
4	シャフト	(1)	(1)	146673-42210	SHAFT
5	カラー	(1)	(1)	147673-42260	COLLAR
6	メカニカルシール	(1)	(1)	147673-42490	MECHANICAL SEAL
7	オイルシール TC355511	(1)	(1)	24421-355511	OIL SEAL TC355511
8	玉軸受 6307	(1)	(1)	24101-063074	BALL BEARING 6307
9	玉軸受 6207RS	(1)	(1)	24102-062074	BALL BEARING 6207RS
10	C形止め輪 80	(1)	(1)	22252-000800	RETAINING RING, C type 80
11	Oリング	(1)	(1)	136600-42040	O-RING
12	ナット M16 (左ねじ)	(1)	(1)	146673-42200	NUT M16, counter clockwise screw
13	座金 16	(1)	(1)	22133-160000	WASHER 16
14	フェザーキー 7×32	(1)	(1)	22512-070320	KEY 7×32
15	ナット M24	(1)	(1)	26732-240002	NUT M24
16	座金 24	(1)	(1)	22137-240000	WASHER 24
17	ボルト M12×30	(4)	(4)	26116-120302	BOLT M12×30
18	ボルト M12×55	(3)	(3)	26116-120552	BOLT M12×55
19	ボルト M12×85	(1)	(1)	26116-120852	BOLT M12×85
20	六角プラグ G1/2	(5)	(5)	23897-020002	PLUG G1/2
	銅パッキン 13×1	(5)	(5)	23414-130000	GASKET, copper 13×1

付図30-2a). 冷却水ポンプ仕組 / 特注型（高温水系ポンプ）

Fig.30-2a) COOLING WATER PUMP ASS'Y / OPTION TYPE, hot water line pump

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
21	歯車				GEAR
	720, 750 • $^{-1}$ (rpm) 仕様	1		146644-42460	720, 750 • $^{-1}$ (rpm) SPEC.
	900, 1000 • $^{-1}$ (rpm) 仕様		1	146673-42400	900, 1000 • $^{-1}$ (rpm) SPEC.
22	Oリング P75	1	1	24316-000750	O-RING P75
23	ボルト M12×30	5	5	26206-120302	BOLT M12×30
24	植込みボルト M12×30	2	2	26216-120302	STUD BOLT M12×30
25	ナット M12	2	2	26706-120002	NUT M12
26	漏れ検出管	1	1	146673-42481	DRAIN CHECK PIPE
27	管継手ボルト 8	1	1	23854-080000	PIPE JOINT BOLT 8
	銅パッキン 14×1	2	2	23414-140000	GASKET, copper 14×1

付図30-2b). 冷却水ポンプ仕組 / 特注型（低温水系ポンプ）

Fig.30-2b) COOLING WATER PUMP ASS'Y / OPTION TYPE, cold water line pump

A：720、750min-1(rpm)仕様／720、750min-1(rpm) spec

B：900、1000min-1(rpm)仕様／900、1000min-1(rpm) spec

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
	冷却水ポンプ仕組				COOLING WATER PUMP ASS'Y
	720, 750 • $^{-1}$(rpm) 仕様	1set		746674-42120	720, 750 • $^{-1}$(rpm) SPEC.
	900, 1000 • $^{-1}$(rpm) 仕様		1set	746678-42120	900, 1000 • $^{-1}$(rpm) SPEC.
	冷却水ポンプ仕組	1set		746674-42020	COOLING WATER PUMP ASS'Y
	冷却水ポンプ仕組		1set	746678-42020	COOLING WATER PUMP ASS'Y
1	取付台	(1)	(1)	146673-42230	BODY
2	ケーシング	(1)	(1)	146673-42240	CASING
3	インペラ				IMPELLER
	外径(φD) =φ175	(1)		146673-42450	diameter(φD) =φ175
	外径(φD) =φ160		(1)	147673-42820	diameter(φD) =φ160
4	シャフト	(1)	(1)	146673-42210	SHAFT
5	カラー	(1)	(1)	147673-42260	COLLAR
6	メカニカルシール	(1)	(1)	147673-42490	MECHANICAL SEAL
7	オイルシール TC355511	(1)	(1)	24421-355511	OIL SEAL TC355511
8	玉軸受 6307	(1)	(1)	24101-063074	BALL BEARING 6307
9	玉軸受 6207RS	(1)	(1)	24102-062074	BALL BEARING 6207RS
10	C形止め輪 80	(1)	(1)	22252-000800	RETAINING RING, C type 80
11	Oリング	(1)	(1)	136600-42040	O-RING
12	ナット M16 (左ねじ)	(1)	(1)	146673-42200	NUT M16, counter clockwise screw
13	座金 16	(1)	(1)	22133-160000	WASHER 16
14	フェザーキー 7×32	(1)	(1)	22512-070320	KEY 7×32
15	ナット M24	(1)	(1)	26732-240002	NUT M24
16	座金 24	(1)	(1)	22137-240000	WASHER 24
17	ボルト M12×30	(4)	(4)	26116-120302	BOLT M12×30
18	ボルト M12×55	(3)	(3)	26116-120552	BOLT M12×55
19	ボルト M12×85	(1)	(1)	26116-120852	BOLT M12×85
20	六角プラグ G1/2	(5)	(5)	23897-020002	PLUG G1/2
	銅パッキン 13×1	(5)	(5)	23414-130000	GASKET, copper 13×1

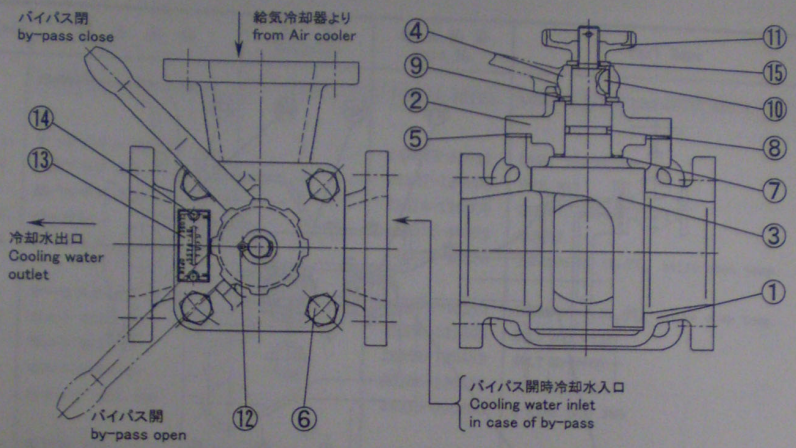
付図30-2b). 冷却水ポンプ仕組 / 特注型（低温水系ポンプ）

Fig.30-2b) COOLING WATER PUMP ASS'Y / OPTION TYPE, cold water line pump

Item	部品名称	数量 Quantily A	数量 Quantily B	部品番号 Part No.	Part Name
21	歯車				GEAR
	720, 750 • -1 (rpm) 仕様	1		146644-42460	720, 750 • -1 (rpm) SPEC.
	900, 1000 • -1 (rpm) 仕様		1	146673-42400	900, 1000 • -1 (rpm) SPEC.
22	Oリング P75	1	1	24316-000750	O-RING P75
23	ボルト M12×30	5	5	26206-120302	BOLT M12×30
24	植込みボルト M12×30	2	2	26216-120302	STUD BOLT M12×30
25	ナット M12	2	2	26706-120002	NUT M12
26	漏れ検出管	1	1	146673-42481	DRAIN CHECK PIPE
27	管継手ボルト 8	1	1	23854-080000	PIPE JOINT BOLT 8
	銅パッキン 14×1	2	2	23414-140000	GASKET, copper 14×1

付図31. 給気冷却器冷却水バイパス弁仕組

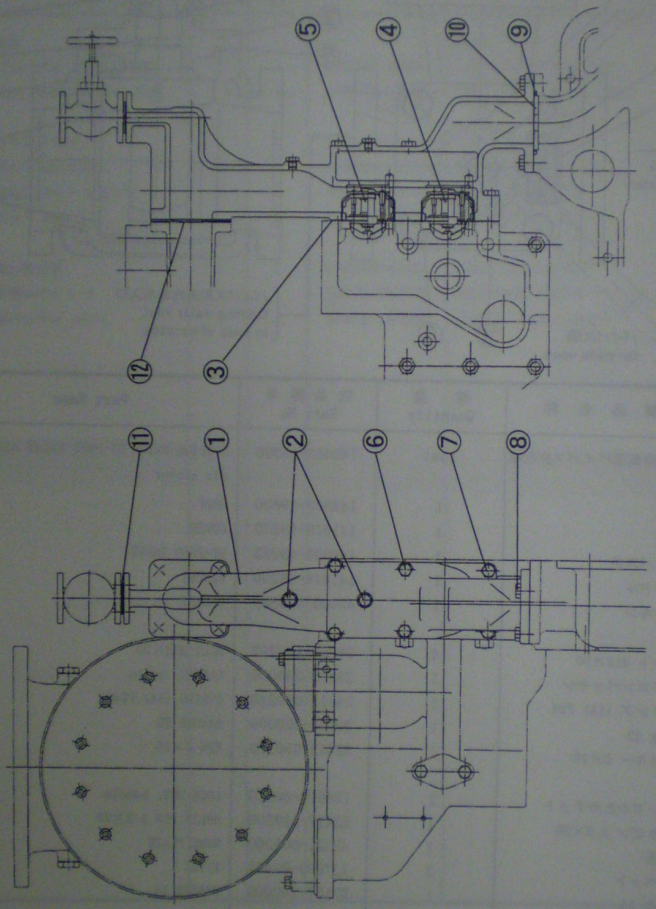
Fig.31 COOLING WATER BY-PASS VALVE ASS'Y, air cooler



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	給気冷却器バイパス弁仕組	1set	746683-49390	COOLING WATER BY-PASS VALVE ASS'Y, air cooler
1	本体	1	146683-49600	BODY
2	ふた	1	141616-49270	COVER
3	バイパス弁	1	146603-49283	BY-PASS VALVE
4	ハンドル	1	141616-49280	HANDLE
5	パッキン	1	43400-000880	GASKET
6	ボルト M12×30	4	26206-120302	BOLT M12×30
7	ナイロンパッキン	1	23418-330000	GASKET, nylon
8	Oリング (1A) P24	1	24311-000240	O-RING (1A) P24
9	座金 22	1	22137-220000	WASHER 22
10	半月キー 5×16	1	22522-050160	KEY 5×16
11	ハンドル止めナット	1	136610-66410	LOCK NUT, handle
12	割りピン 3.2×20	1	22417-320200	SPLIT PIN 3.2×20
13	銘板	1	42221-005260	NAME PLATE
14	リベット	2	137900-91451	RIVET
15	座金 14	1	22137-140000	WASHER 14
	パッキン	1	138673-01990	GASKET
	ボルト M12×30	4	26206-120302	BOLT M12×30

付図32. 冷却水サーモスタット仕組 (1/2)

Fig.32 COOLING WATER THERMOSTAT ASS'Y



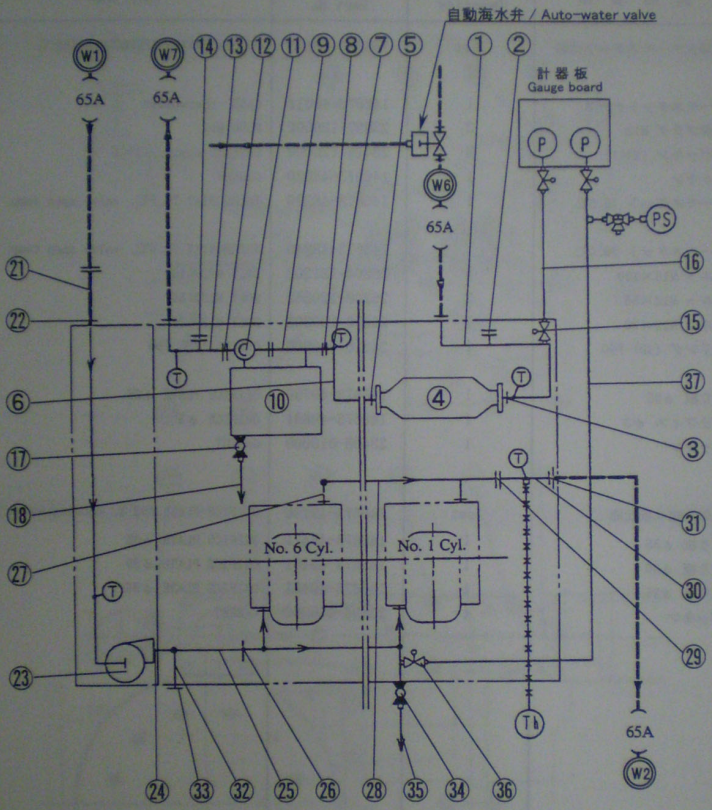
付図32. 冷却水サーモスタット仕組

Fig.32 COOLING WATERL THERMOSTAT ASS'Y

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	冷却水サーモスタット仕組	1set	746673-48103	COOLING WATER THERMOSTAT ASS'Y,
1	サーモスタットケース	1	146673-48011	CASE, thermostat
2	六角プラグ M12	2	23887-120002	PLUG M12
	銅パッキン 12×1	2	23414-120000	GASKET, copper 12×1
3	パッキン	1	146673-48020	GASKET
4	サーモスタット 76.5℃	1	146673-48230	THERMOSTAT 76.5℃, valve open temp.
5	サーモスタット 79.0℃	1	146673-48240	THERMOSTAT 79.0℃, valve open temp.
6	ボルト M12×130	4	26206-121302	BOLT M12×130
7	ボルト M12×55	2	26206-120552	BOLT M12×55
8	ボルト M12×30	4	26206-120302	BOLT M12×30
9	Oリング (4D) P90	1	24316-000900	O-RING (4D) P90
10	絞り板 φ25	1	146673-49750	ORIFICE PLATE φ25
11	オリフィス φ3	1	146673-49891	ORIFICE φ3
	パッキン	1	23438-015000	GASKET
	冷却水絞り板仕組	1set	746673-49190	ORIFICE PLATE ASS'Y, cooling water
12	絞り板 φ35	1	146673-49471	ORIFICE PLATE φ35
	絞り板 φ30	1	146673-49461	ORIFICE PLATE φ30
	絞り板 φ25	1	146673-49451	ORIFICE PLATE φ25
	パッキン	1	23438-065000	GASKET

付図33-1. 冷却水管装置（低温水系：海水ポンプ船体付仕様） 1/6

Fig.33-1 COOLING WATER PIPE SYSTEM,
cold water line : sea water pump hull fitting spec.



W1	：高温水系清水入口 / Hot water line for Fresh water inlet
W2	：高温水系清水出口 / Hot water line for Fresh water outlet
W6	：低温水系海水入口 / Cold water line for Sea water inlet
W7	：低温水系海水出口 / Cold water line for Sea water outlet

付図33-1. 冷却水管装置 (低温水系：海水ポンプ船体付仕様)

Fig.33-1 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Ⓐ : 低温水管 亜鉛メッキ仕様 / Ⓐ : Cold water pipe Zn plating Spec.
Ⓑ : 低温水管 ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様 / Ⓑ : Cold water pipe Polyethylen lining Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	低温水系冷却水管装置				COLD WATER PIPE LINE SYSTEM
	冷却水入口管仕組				COOLING WATER INLET PIPE ASS'Y,
	亜鉛メッキ仕様	1set		746676-49410	ZN PLATING SPEC.
	ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様		1set	746677-49410	POLYETHYLENE LINING SPEC.
1	冷却水入口管 (亜鉛メッキ仕様)	1		146676-49640	COOLING WATER INLET PIPE, zn plating spec.
	六角プラグ G3/4	1		23894-060002	HEXAGON PLUG G3/4
	銅パッキン 27×1	1		23414-270000	GASKET, Copper 27×1
1	冷却水入口管 (ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様)		1	146677-49640	COOLING WATER INLET PIPE, polyethylene lining spec.
2	ふた (25A) 亜鉛メッキ仕様	1		43310-006580	COVER (25A), zn plating spec.
	ふた (25A) エポキシ仕様		1	43310-006600	COVER (26A), epoxy painting spec.
	丸パッキン 25×1.5	1	1	23438-025000	GASKET, round 25×1.5
	ボルト M10×35	4	4	26206-100352	BOLT M10×35
	ナット M10	4	4	26706-100002	NUT M10
3	パッキン	1	1	138673-01990	GASKET
	ボルト M12×30	4	4	26206-120302	BOLT M12×30
4	潤滑油冷却器仕組	1set	1set	付図 21-1 参照 Refer to Fig.21-1	LUBRICATING OIL COOLER ASS'Y
	冷却水管仕組 (潤滑油冷却器～給気冷却器)				COOLING WATER INLET PIPE ASS'Y, lub. oil cooler ～ air cooler
	亜鉛メッキ仕様	1set		746676-49310	ZN PLATING SPEC.
	ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様		1set	746677-49310	POLYETHYLENE LINING SPEC.
5	パッキン	1	1	138673-01990	GASKET
	ボルト M12×35	4	4	26206-120352	BOLT M12×35

付図33-1. 冷却水管装置 (低温水系：海水ポンプ船体付仕様) (3/6)

Fig.33-1 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
6	冷却水入口管 (亜鉛メッキ仕様)	1		146676-49620	COOLING WATER INLET PIPE, zn plating spec.
	冷却水入口管 (ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様)		1	146677-49620	COOLING WATER INLET PIPE, polyethylene lining spec.
7	六角プラグ G3/8	1		23894-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1		23414-170000	GASKET, Copper 17×1
	座 (温度計取付用)		1	147644-49970	FLANGE, for thermometer fitting
	ボルト M5×16		4	26116-050162	BOLT M5×16
8	パッキン	1	1	138673-01990	GASKET
	ボルト M12×30	2	2	26206-120302	BOLT M12×30
	ボルト M12×35	2	2	26206-120352	BOLT M12×35
9	冷却水管仕組 (給気冷却器バイパス)	1set	1set	付図 33-6 参照 Refer to Fig.33-6	COOLING WATER PIPE ASS'Y, air cooler by-pass
10	給気冷却器仕組	1set	1set	付図 14 参照 Refer to Fig.14	AIR COOLER ASS'Y,
11	冷却水バイパス弁仕組 (給気冷却器)	1set	1set	付図 31 参照 Refer to Fig.31	COOLING WATER BY=PASS VALVE ASS'Y. air cooler
	冷却水出口管仕組				COOLING WATER OUTLET PIPE ASS'Y,
	亜鉛メッキ仕様	1set		746676-49301	ZN PLATING SPEC.
	ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様		1set	746677-49301	POLYETHYLENE LINING SPEC.
12	パッキン	1	1	138673-01990	GASKET
	ボルト M12×45	4	4	26206-120452	BOLT M12×45
	ナット M12	4	4	26706-120002	NUT M12
13	冷却水入口管 (亜鉛メッキ仕様)	1		146676-49611	COOLING WATER INLET PIPE, zn plating spec.
	六角プラグ G3/8	1		23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1		23414-170000	GASKET, Copper 17×1
	六角プラグ G3/4	1		23897-060002	HEXAGON PLUG G3/4
	銅パッキン 27×1	1		23414-270000	GASKET, Copper 27×1

付図33-1. 冷却水管装置（低温水系：海水ポンプ船体付仕様）

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Fig.33-1 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
13	冷却水入口管		1	146677-49611	COOLING WATER INLET PIPE,
	(ﾎﾟﾘｴﾁﾚﾝﾗｲﾆﾝｸﾞ仕様)				polyethylene lining spec.
	座（温度計取付用）		1	147644-49970	FLANGE, for thermometer fitting
	ボルト M5×16		4	26116-050162	BOLT M5×16
	サポート	1	1	146676-49630	SUPPORT
	ボルト M12×20	2	2	26206-120202	BOLT M12×20
14	ふた（25A）亜鉛メッキ仕様	1		43310-006580	COVER (25A), zn plating spec.
	ふた（25A）エポキシ仕様		1	43310-006600	COVER (26A), epoxy painting spec.
	丸パッキン 25×1.5	1	1	23438-025000	GASKET, round 25×1.5
	ボルト M10×35	4	4	26206-100352	BOLT M10×35
	ナット M10	4	4	26706-100002	NUT M10
	冷却水圧力計管仕組	1set	1set	746673-49262	COOLING WATER PRESSURE GAUGE PIPE ASS'Y,
15	ソケット M12-G1/8	1	1	43570-019170	SOCKET
	銅パッキン 12×1	1	1	23414-120000	GASKET, Copper 12×1
	ニードルバルブ	1	1	43600-006951	NEEDLE VALVE
	ナイロンパッキン 10	1	1	23418-100000	GASKET, nylon 10
16	圧力計管	1	1	146673-49242	PRESSURE GAUGE PIPE
	ジョイント 6	1	1	43530-001770	JOINT 6
	袋ナット 6	1	1	23824-060001	CAP NUT 6
	給気冷却器水抜き管仕組	1set	1set	746673-49480	AIR COOLER DRAIN PIIPE ASS'Y,
17	アスタップコック	1	1	23637-040022	ASTAP COCK
	銅パッキン 13×1	1	1	23414-130000	GASKET, Copper 13×1
18	給気冷却器水抜き管	1	1	146673-49872	AIR COOLER DRAIN PIIPE
	管止め金具 A6×12	2	2	23297-060121	PIPE SUPPORT A6×12
	ボルト M12×16	1	1	26206-120162	BOLT M12×16
	高温水系冷却水管装置				HOT WATER PIPE LINE SYSTEM
	冷却水入口管仕組（高温水ポンプ入口）	1set	1set	746676-49400	COOLING WATER INLET PIPE ASS'Y, hot water pump inlet
21	冷却水入口管	1	1	146676-49800	COOLING WATER INLET PIPE

付図33-1. 冷却水管装置 (低温水系：海水ポンプ船体付仕様)

Fig.33-1 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
22	パッキン	1	1	138613-49220	GASKET
	ボルト M16×40	4	4	26152-160402	BOLT M16×40
23	高温水ポンプ仕組	1set	1set	付図 30-1 参照 Refer to Fig.30-1	HOT WATER PUMP ASS'Y
	冷却水出口管仕組 (高温水ポンプ出口)	1set	1set	746673-49160	COOLING WATER OUTLET PIPE ASS'Y, hot water pump outlet
24	Oリング (4D) G90	1	1	24326-000900	O-RING (4D) G90
	ボルト M12×30	3	3	26206-120302	BOLT M12×30
25	冷却水連絡管	1	1	146676-49550	COOLING WATER CONNECTOR
26	Oリング (4D) G80	1	1	24326-000800	O-RING (4D) G80
	冷却水集合管仕組	1set	1set	746673-49110	COOLING WATER CONCENTRATOR ASS'Y,
27	冷却水連絡管 (ヘッド出口)	6	6	146673-49361	COOLING WATER CONNECTOR, head outlet
	パッキン 36×1.5	12	12	23428-360000	GASKET 36×1.5
	ボルト M12×30	12	12	26206-120302	BOLT M12×30
	遮熱カバー	6	6	146673-13331	COVER, heat off
28	冷却水集合管 A	1	1	146683-49340	COOLING WATER CONCENTRATOR A
	パッキン	1	1	146683-49400	GASKET
	ボルト M10×30	4	4	26206-100302	BOLT M10×30
	冷却水集合管 B	1	1	146673-49350	COOLING WATER CONCENTRATOR B
	ふた	1	1	146673-49570	COVER
	パッキン	1	1	147673-49410	GASKET
	ボルト M10×25	4	4	26206-100252	BOLT M10×25
29	パッキン	1	1	146683-49400	GASKET
	ボルト M10×35	4	4	26206-100352	BOLT M10×35
	ナット M10	4	4	26706-100002	NUT M10
30	冷却水出口管	1	1	146676-49370	COOLING WATER OUTLRT PIPE
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	六角プラグ G1/2	2	2	23897-040002	HEXAGON PLUG G1/2
	銅パッキン 21×1	2	2	23414-210000	GASKET, Copper 21×1
	六角プラグ G3/4	1	1	23897-060002	HEXAGON PLUG G3/4
	銅パッキン 27×1	1	1	23414-270000	GASKET, Copper 27×1

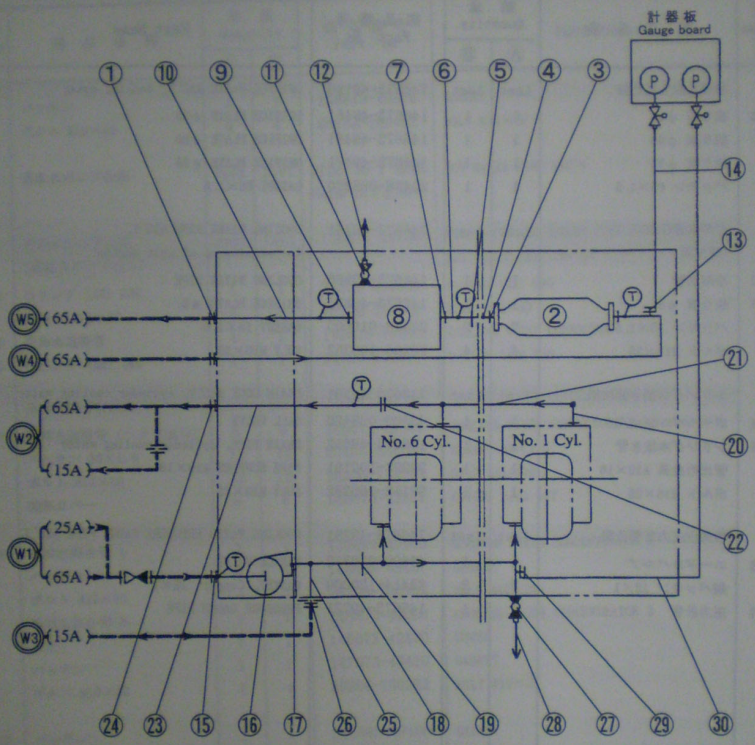
付図33-1. 冷却水管装置 (低温水系：海水ポンプ船体付仕様)

Fig.33-1 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	冷却水絞り板仕組	1set	1set	746673-49190	ORIFICE PLATE ASS'Y, cooling water
31	絞り板 φ25	1	1	146673-49451	ORIFICE PLATE φ25
	絞り板 φ30	1	1	146673-49461	ORIFICE PLATE φ30
	絞り板 φ35	1	1	146673-49471	ORIFICE PLATE φ35
	パッキン 65×1.5	1	1	23438-065000	GASKET 65×1.5
	冷却水管仕組 (暖気用)	1set	1set	746673-49451	COOLING WATER PIPE ASS'Y, for warming up of pair engine
32	冷却水管	1	1	146673-49960	COOLING WATER PIPE
33	絞り板 φ3	1	1	146673-49891	ORIFICE PLATE φ3
	パッキン 15×1.5	2	2	23438-015000	GASKET 15×1.5
	ボルト M10×25	4	4	26206-100252	BOLT M10×25
	シリンダ水抜き管仕組	1set	1set	746673-49201	DRAIN COCK ASS'Y, cylinder cooling water
34	ボールバルブ 3/8	1	1	43600-026420	BALL VALVE
35	シリンダ水抜き管	1	1	146673-49652	DRAIN PIPE, cylinder cooling water
	管止め金具 A10×16	1	1	23297-100161	PIPE SUPPORT A10×16
	ボルト M16×25	1	1	26152-160252	BOLT M10×25
	冷却水圧力計管仕組	1set	1set	746673-49251	COOLING WATER PRESSURE GAUGE PIPE ASS'Y,
36	ニードルバルブ	1	1	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	2	2	23414-120000	GASKET, Copper 12×1
37	圧力計管	1	1	146673-49221	PRESSURE GAUGE PIPE

付図33-2. 冷却水管装置（低温水系：清水ポンプ船体付仕様） 1/5

Fig.33-2 COOLING WATER PIPE SYSTEM,
cold water line : fresh water pump hull fitting spec.



W1	：高温水系清水入口 / Hot water line for Fresh water inlet
W2	：高温水系清水出口 / Hot water line for Fresh water outlet
W3	：高温水系清水出入口 / Hot water line for Fresh water inlet & outlet
W4	：低温水系清水入口 / Cold water line for Fresh water inlet
W5	：低温水系清水出口 / Cold water line for Fresh water outlet

付図33-2. 冷却水管装置 (低温水系：清水ポンプ船体付仕様)

Fig.33-2 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump hull fitting spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	低温水系冷却水管装置			COLD WATER PIPE LINE SYSTEM
	冷却水入口管仕組	1set	746676-49451	COOLING WATER INLET PIPE ASS'Y
1	冷却水入口管	1	146676-49811	COOLING WATER INLET PIPE
	パッキン	1	138613-49220	GASKET
	ボルト M16×40	4	26152-160402	BOLT M16×40
2	潤滑油冷却器仕組	1set	付図 21-2 参照 Refer to Fig.21-2	LUBRICATING OIL COOLER ASS'Y
	冷却水管仕組 (潤滑油冷却器～給気冷却器)	1set	746673-49310	COOLING WATER INLET PIPE ASS'Y, lub. oil cooler ～ air cooler
3	パッキン	1	138673-01990	GASKET
	ボルト M12×30	2	26206-120302	BOLT M12×30
	ボルト M12×35	2	26206-120352	BOLT M12×35
4	冷却水管 (潤滑油冷却器～給気冷却器)	1	146673-49620	COOLING WATER INLET PIPE, lub. oil cooler ～ air cooler
	六角プラグ G3/8	1	23894-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	23414-170000	GASKET, Copper 17×1
5	Oリング (1A) G75	2	24321-000750	O-RING (1A) 75
6	ベンド (給気冷却器入口)	1	146673-49600	BEND, air cooler inlet
	六角プラグ G3/8	1	23894-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	23414-170000	GASKET, Copper 17×1
7	パッキン	1	138673-01990	GASKET
	ボルト M12×30	2	26206-120302	BOLT M12×30
	ボルト M12×100	2	26206-121002	BOLT M12×100
8	給気冷却器仕組	1set	付図 14 参照 Refer to Fig.14	AIR COOLER ASS'Y
	冷却水管仕組 (給気冷却器出口)	1set	746673-49322	COOLING WATER INLET PIPE ASS'Y, air cooler outlet
9	パッキン	1	138673-01990	GASKET
	ボルト M12×30	2	26206-120302	BOLT M12×30
	ボルト M12×90	2	26206-120902	BOLT M12×90
	座金 12	2	22117-120000	WASHER 12

付図33-2. 冷却水管装置（低温水系：清水ポンプ船体付仕様）

Fig.33-2 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
10	冷却水管（給気冷却器出口）	1	146673-49832	COOLING WATER INLET PIPE, air cooler outlet
	六角プラグ G3/8	1	23894-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	23414-170000	GASKET, Copper 17×1
	サポート	1	146676-49650	SUPPORT
	ボルト M12×20	2	26206-120202	BOLT M12×20
	給気冷却器水抜き管仕組	1set	746673-49480	AIR COOLER DRAIN PIIPE ASS'Y,
11	アスタップコック	1	23637-040022	ASTAP COCK
	銅パッキン 13×1	1	23414-130000	GASKET, Copper 13×1
12	給気冷却器水抜き管	1	146673-49872	AIR COOLER DRAIN PIIPE
	管止め金具 A6×12	2	23297-060121	PIPE SUPPORT A6×12
	ボルト M12×16	1	26206-120162	BOLT M12×16
	冷却水圧力計管仕組	1set	746673-49262	COOLING WATER PRESSURE GAUGE PIPE ASS'Y,
13	ソケット M12-G1/8	1	43570-019170	SOCKET
	銅パッキン 12×1	1	23414-120000	GASKET, Copper 12×1
	ニードルバルブ	1	43600-006951	NEEDLE VALVE
	ナイロンパッキン 10	1	23418-100000	GASKET, nylon 10
14	圧力計管	1	146673-49242	PRESSURE GAUGE PIPE
	ジョイント 6	1	43530-001770	JOINT 6
	袋ナット 6	1	23824-060001	CAP NUT 6
	高温水系冷却水管装置			HOT WATER PIPE LINE SYSTEM
	冷却水入口管仕組（高温水ポンプ入口）	1set	746676-49400	COOLING WATER INLET PIPE ASS'Y, hot water pump inlet
15	冷却水入口管	1	146676-49800	COOLING WATER INLET PIPE
	パッキン	1	138613-49220	GASKET
	ボルト M16×40	4	26152-160402	BOLT M16×40
16	高温水ポンプ仕組	1set	付図30-1a)参照 Refer to Fig.30-1a)	HOT WATER PUMP ASS'Y

付図33-2. 冷却水管装置（低温水系：清水ポンプ船体付仕様）

Fig.33-2 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	冷却水出口管仕組（高温水ポンプ出口）	1set	746673-49160	COOLING WATER OUTLET PIPE ASS'Y, hot water pump outlet
17	Oリング (4D) G90	1	24326-000900	O-RING (4D) G90
	ボルト M12×30	3	26206-120302	BOLT M12×30
18	冷却水連絡管	1	146676-49550	COOLING WATER CONNECTOR
19	Oリング (4D) G80	1	24326-000800	O-RING (4D) G80
	冷却水集合管仕組	1set	746673-49110	COOLING WATER CONCENTRATOR ASS'Y,
20	冷却水連絡管（ヘッド出口）	6	146673-49361	COOLING WATER CONNECTOR, head outlet
	パッキン 36×1.5	12	23428-360000	GASKET 36×1.5
	ボルト M12×30	12	26206-120302	BOLT M12×30
	遮熱カバー	6	146673-13331	COVER, heat off
21	冷却水集合管 A	1	146683-49340	COOLING WATER CONCENTRATOR A
	パッキン	1	146683-49400	GASKET
	ボルト M10×30	4	26206-100302	BOLT M10×30
	冷却水集合管 B	1	146673-49350	COOLING WATER CONCENTRATOR B
	ふた	1	146673-49570	COVER
	パッキン	1	147673-49410	GASKET
	ボルト M10×25	4	26206-100252	BOLT M10×25
22	パッキン	1	146683-49400	GASKET
	ボルト M10×35	4	26206-100352	BOLT M10×35
	ナット M10	4	26706-100002	NUT M10
23	冷却水出口管	1	146676-49370	COOLING WATER OUTLRT PIPE
	六角プラグ G3/8	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	23414-170000	GASKET, Copper 17×1
	六角プラグ G1/2	2	23897-040002	HEXAGON PLUG G1/2
	銅パッキン 21×1	2	23414-210000	GASKET, Copper 21×1
	六角プラグ G3/4	1	23897-060002	HEXAGON PLUG G3/4
	銅パッキン 27×1	1	23414-270000	GASKET, Copper 27×1
	冷却水絞り板仕組	1set	746673-49190	ORIFICE PLATE ASS'Y, cooling water
24	絞り板 φ25	1	146673-49451	ORIFICE PLATE φ25
	絞り板 φ30	1	146673-49461	ORIFICE PLATE φ30
	絞り板 φ35	1	146673-49471	ORIFICE PLATE φ35
	パッキン 65×1.5	1	23438-065000	GASKET 65×1.5

付図33-2. 冷却水管装置（低温水系：清水ポンプ船体付仕様）

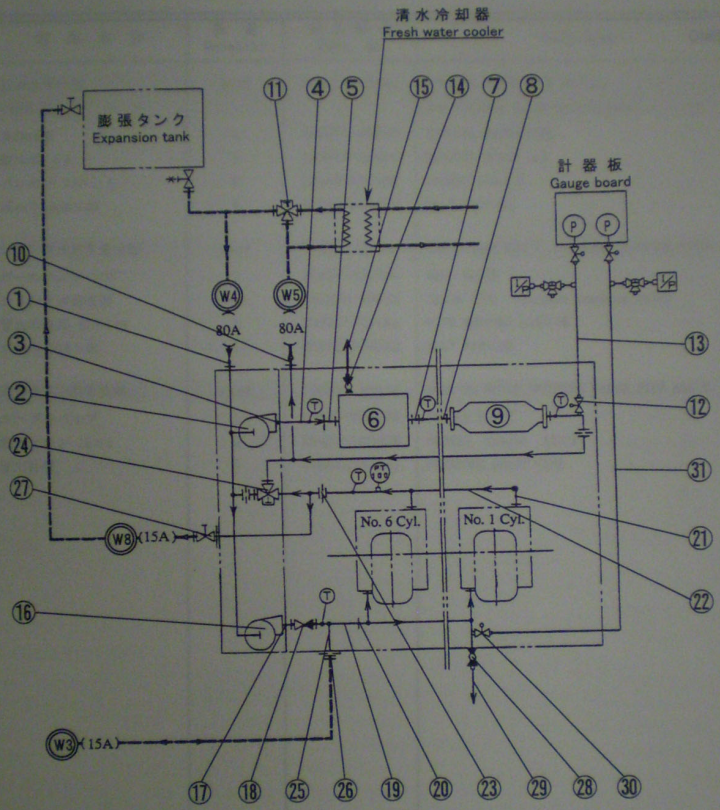
Fig.33-2 COOLING WATER PIPE SYSTEM, cold water line : sea water pump hull fitting spec.

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	冷却水管仕組 (暖気用)	1set	746673-49451	COOLING WATER PIPE ASS'Y, for warming up of pair engine
25	冷却水管	1	146673-49960	COOLING WATER PIPE
26	絞り板 φ3	1	146673-49891	ORIFICE PLATE φ3
	パッキン 15×1.5	2	23438-015000	GASKET 15×1.5
	ボルト M10×25	4	26206-100252	BOLT M10×25
	シリンダ水抜き管仕組	1set	746673-49201	DRAIN COCK ASS'Y, cylinder cooling water
27	ボールバルブ 3/8	1	43600-026420	BALL VALVE
28	シリンダ水抜き管	1	146673-49652	DRAIN PIPE, cylinder cooling water
	管止め金具 A10×16	1	23297-100161	PIPE SUPPORT A10×16
	ボルト M16×25	1	26152-160252	BOLT M10×25
	冷却水圧力計管仕組	1set	746673-49251	COOLING WATER PRESSURE GAUGE PIPE ASS'Y,
29	ニードルバルブ	1	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	2	23414-120000	GASKET, Copper 12×1
30	圧力計管	1	146673-49221	PRESSURE GAUGE PIPE

付図33-3. 冷却水管装置（低温水系：清水ポンプ機付仕様）

1/6

Fig.33-3 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump engine fitting spec.



W3	：高温水系清水出入口 / Hot water line for Fresh water inlet & outlet
W4	：低温水系清水入口 / Cold water line for Fresh water intlet
W5	：低温水系清水出口 / Cold water line for Sea water outlet
W8	：空 気 抜 き / Air vent

付図33-3. 冷却水管装置 (低温水系：清水ポンプ機付仕様)

Fig.33-3 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump engine fitting spec.

Ⓐ ：給気冷却器自動温度調節装置付仕様 / Ⓐ ：With auto-thermostat for air cooler Spec.
Ⓑ ：給気冷却器自動温度調節装置無仕様 / Ⓑ ：Non auto-thermostat for air cooler Spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	低温水系冷却水管装置				COLD WATER PIPE LINE SYSTEM
1	冷却水入口管仕組 (温度調節装置付仕様)	1set		付図 33-4 参照 Refer to Fig.33-4	COOLING WATER INLET PIPE ASS'Y, with auto-thermostat spec.
1	冷却水入口管仕組 (温度調節装置無仕様)		1set	付図 33-5 参照 Refer to Fig.33-5	COOLING WATER INLET PIPE ASS'Y, non auto-thermostat spec.
2	低温水ポンプ仕組	1set	1set	付図30-1b)参照 Refer to Fig.30-1b)	COLD WATER PUMP ASS'Y
	冷却水管仕組 (冷却水ポンプ～給気冷却器)	1set	1set	746673-49300	COOLING WATER INLET PIPE ASS'Y, cooling water pump ～ air cooler
3	パッキン (ポンプ出口)	1	1	146673-49560	GASKET, pump outlet
	ボルト M12×40	3	3	26206-120402	BOLT M12×40
	ナット M12	3	3	26706-120002	NUT M12
4	冷却水管 (冷却水ポンプ～給気冷却器)	1	1	146673-49611	COOLING WATER INLET PIPE, cooling water pump ～ air cooler
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	六角プラグ G3/4	2	2	23897-060002	HEXAGON PLUG G3/4
	銅パッキン 27×1	2	2	23414-270000	GASKET, Copper 27×1
5	ベンド (給気冷却器入口)	1	1	146673-49600	BEND, air cooler inlet
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	Oリング (1A) G75	2	2	24321-000750	O-RING (1A) G75
	パッキン	1	1	138673-01990	GASKET
	ボルト M12×100	2	2	26206-121002	BOLT M12×100
	ボルト M12×30	2	2	26206-120302	BOLT M12×30
6	給気冷却器仕組	1set	1set	付図 14 参照 Refer to Fig.14	AIR COOLER ASS'Y,

付図33-3. 冷却水管装置 (低温水系：清水ポンプ機付仕様)

Fig.33-3 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump engine fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	冷却水管仕組 (給気冷却器～潤滑油冷却器)	1set	1set	746673-49310	COOLING WATER INLET PIPE ASS'Y, air cooler ～ lub. oil cooler
7	ベンド (給気冷却器出口)	1	1	146673-49600	BEND, air cooler outlet
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	パッキン	1	1	138673-01990	GASKET
	ボルト M12×100	2	2	26206-121002	BOLT M12×100
	ボルト M12×30	2	2	26206-120302	BOLT M12×30
	Oリング (1A) G75	2	2	24321-000750	O-RING (1A) G75
8	冷却水管 (給気冷却器～潤滑油冷却器)	1	1	146673-49620	COOLING WATER INLET PIPE, air cooler ～ lub. oil cooler
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	パッキン	1	1	138673-01990	GASKET
	ボルト M12×30	2	2	26206-120302	BOLT M12×30
	ボルト M12×35	2	2	26206-120352	BOLT M12×35
9	潤滑油冷却器仕組	1set	1set	付図 21-2 参照 Refer to Fig.21-2	LUBRICATING OIL COOLER ASS'Y
10	冷却水出口管仕組 (温度調節装置付仕様)	1set		付図 33-4 参照 Refer to Fig.33-4	COOLING WATER INLET PIPE ASS'Y, with auto-thermostat spec.
10	冷却水出口管仕組 (温度調節装置無仕様)		1set	付図 33-5 参照 Refer to Fig.33-5	COOLING WATER INLET PIPE ASS'Y, non auto-thermostat spec.
11	自動温度調節弁仕組	1set		付図 33-4 参照 Refer to Fig.33-4	AUTO-THERMOSTAT VALVE ASS'Y
	冷却水圧力計管仕組	1set	1set	746673-49262	COOLING WATER PRESSURE GAUGE PIPE ASS'Y,
12	ソケット M12-G1/8	1	1	43570-019170	SOCKET
	銅パッキン 12×1	1	1	23414-120000	GASKET, Copper 12×1
	ニードルバルブ	1	1	43600-006951	NEEDLE VALVE
	ナイロンパッキン 10	1	1	23418-100000	GASKET, nylon 10

付図33-3. 冷却水管装置 (低温水系：清水ポンプ機付仕様)

Fig.33-3 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump engine fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
13	圧力計管	1	1	146673-49242	PRESSURE GAUGE PIPE
	ジョイント 6	1	1	43530-001770	JOINT 6
	袋ナット 6	1	1	23824-060001	CAP NUT 6
	給気冷却器水抜き管仕組	1set	1set	746673-49480	AIR COOLER DRAIN PIIPE ASS'Y,
14	アスタップコック	1	1	23637-040022	ASTAP COCK
	銅パッキン 13×1	1	1	23414-130000	GASKET, Copper 13×1
15	給気冷却器水抜き管	1	1	146673-49872	AIR COOLER DRAIN PIIPE
	管止め金具 A6×12	2	2	23297-060121	PIPE SUPPORT A6×12
	ボルト M12×16	1	1	26206-120162	BOLT M12×16
	高温水系冷却水管装置				HOT WATER PIPE LINE SYSTEM
16	高温水ポンプ仕組	1set	1set	付図30-1a)参照 Refer to Fig.30-1a)	HOT WATER PUMP ASS'Y
	逆止弁仕組 (高温水ポンプ出口)	1set	1set	746673-49150	CHECK VALVE ASS'Y, hot water pump outlet
17	パッキン (ポンプ出口)	1	1	146673-49560	GASKET, pump outlet
	ボルト M12×85	3	3	26206-120852	BOLT M12×85
18	逆止弁 (バタフライ式)	1	1	43600-015400	CHECK VALVE, butterfly type
	Oリング (4D) G90	1	1	24326-000900	O-RING (4D) G90
19	冷却水連絡管	1	1	146673-49550	COOLING WATER INLET PIPE
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	Oリング (4D) G90	1	1	24326-000900	O-RING (4D) G90
20	Oリング (4D) G80	1	1	24326-000800	O-RING (4D) G80
	冷却水集合管仕組	1set	1set	746673-49100	COOLING WATER CONCENTRATOR ASS'Y,
21	冷却水連絡管 (ヘッド出口)	6	6	146673-49361	COOLING WATER CONNECTOR, head outlet
	パッキン 36×1.5	12	12	23428-360000	GASKET 36×1.5
	ボルト M12×30	12	12	26206-120302	BOLT M12×30
	遮熱カバー	6	6	146673-13331	COVER, heat off

付図33-3. 冷却水管装置 (低温水系：清水ポンプ機付仕様)

Fig.33-3 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump engine fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
22	冷却水集合管 A	1	1	146673-49341	COOLING WATER CONCENTRATOR A
	冷却水集合管 B	1	1	146673-49350	COOLING WATER CONCENTRATOR B
	冷却水集合管 C	1	1	146673-49370	COOLING WATER CONCENTRATOR C
	プラグ	1	1	146673-11950	PLUG
	パッキン (プラグ)	1	1	146673-11960	GASKET, plug
	六角プラグ G3/8	1	1	23897-030002	HEXAGON PLUG G3/8
	銅パッキン 17×1	1	1	23414-170000	GASKET, Copper 17×1
	六角プラグ G1/2	2	2	23897-040002	HEXAGON PLUG G1/2
	銅パッキン 21×1	2	2	23414-210000	GASKET, Copper 21×1
	六角プラグ G3/4	1	1	23897-060002	HEXAGON PLUG G3/4
	銅パッキン 27×1	1	1	23414-270000	GASKET, Copper 27×1
	パッキン	2	2	146673-49410	GASKET
	パッキン	2	2	138673-01990	GASKET
	ボルト M10×25	4	4	26206-100252	BOLT M10×25
	ボルト M10×35	4	4	26206-100352	BOLT M10×35
	ナット M10	4	4	26706-100002	NUT M10
	ボルト M12×35	4	4	26206-120352	BOLT M12×35
	冷却水絞り板仕組	1set	1set	746673-49190	ORIFICE PLATE ASS'Y, cooling water
23	絞り板 φ25	1	1	146673-49451	ORIFICE PLATE φ25
	絞り板 φ30	1	1	146673-49461	ORIFICE PLATE φ30
	絞り板 φ35	1	1	146673-49471	ORIFICE PLATE φ35
	パッキン 65×1.5	1	1	23438-065000	GASKET 65×1.5
24	冷却水サーモスタット仕組	1set	1set	付図 32 参照 Refer to Fig.32	COOLING EATER THERMOSTAT ASS'Y
	冷却水管仕組 (暖気用)	1set	1set	746673-49451	COOLING WATER PIPE ASS'Y, for warming up of pair engine
25	冷却水管	1	1	146673-49960	COOLING WATER PIPE
26	絞り板 φ3	1	1	146673-49891	ORIFICE PLATE φ3
	パッキン 15×1.5	2	2	23438-015000	GASKET 15×1.5
	ボルト M10×25	4	4	26206-100252	BOLT M10×25

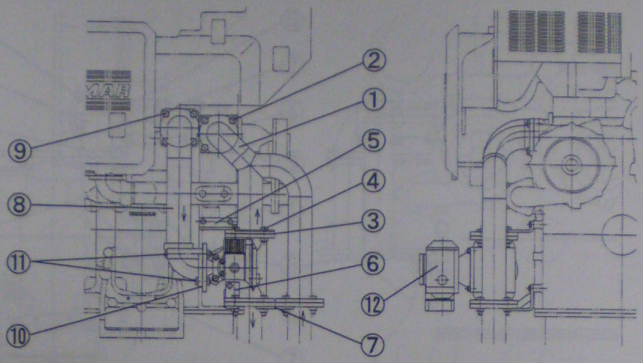
付図33-3. 冷却水管装置 (低温水系：清水ポンプ機付仕様)

Fig.33-3 COOLING WATER PIPE SYSTEM, cold water line : fresh water pump engine fitting spec.

Item	部品名称	数量 Quantity Ⓐ	数量 Quantity Ⓑ	部品番号 Part No.	Part Name
	空気抜玉形弁仕組	1set	1set	T000L-0034C0	AIR VENT VALVE ASS'Y
27	空気抜玉形弁	1	1	43600-033180	AIR VENT VALVE
	パッキン 15×1.5	1	1	23438-015000	GASKET 15×1.5
	ボルト M10×30	4	4	26206-100302	BOLT M10×30
	ナット M10	4	4	26706-100002	NUT M10
	シリンダ水抜き管仕組	1set	1set	746673-49201	DRAIN COCK ASS'Y, cylinder cooling water
28	ボールバルブ 3/8	1	1	43600-026420	BALL VALVE
29	シリンダ水抜き管	1	1	146673-49652	DRAIN PIPE, cylinder cooling water
	管止め金具 A10×16	1	1	23297-100161	PIPE SUPPORT A10×16
	ボルト M16×25	1	1	26152-160252	BOLT M10×25
	冷却水圧力計管仕組	1set	1set	746673-49251	COOLING WATER PRESSURE GAUGE PIPE ASS'Y,
30	ニードルバルブ	1	1	43600-030772	NEEDLE VALVE
	銅パッキン 12×1	2	2	23414-120000	GASKET, Copper 12×1
31	圧力計管	1	1	146673-49221	PRESSURE GAUGE PIPE

付図33-4. 冷却水管仕組(給気冷却器自動温度調節装置付) (1/1)

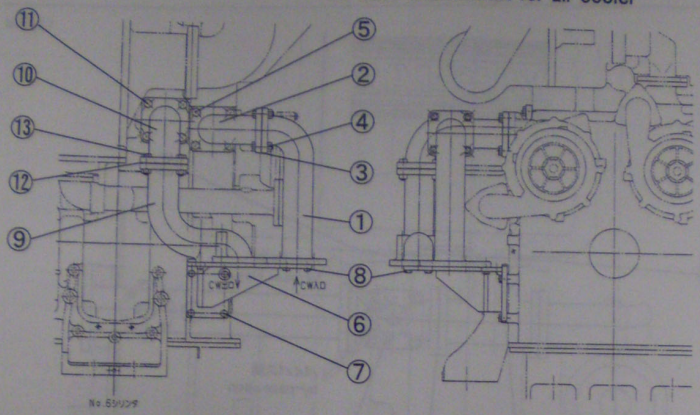
Fig.33-4 COOLING WATER PIPE ASS'Y, with auto-thermostat for air cooler



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	冷却水入口管仕組	1set	746673-49421	COOLING WATER INLET PIPE ASS'Y,
1	冷却水入口管	1	146673-49900	COOLING WATER INLET PIPE,
2	パッキン	1	138613-49220	GASKET
	ボルト M16×35	4	26152-160352	BOLT M16×35
3	パッキン	1	138613-49220	GASKET
4	ボルト M16×45	3	26152-160452	BOLT M16×45
	ボルト M16×55	1	26152-160552	BOLT M16×55
	ナット M16	4	26732-160002	NUT M16
5	サポート A	1	146673-49921	SUPPORT A
	ボルト M12×25	2	26206-120252	BOLT M12×55
6	サポート B	1	146673-49930	SUPPORT B
	ボルト M12×25	1	26206-120252	BOLT M12×55
7	サポート	1	146673-49940	SUPPORT
	冷却水出口管仕組	1set	746673-49430	COOLING WATER OUTLET PIPE ASS'Y,
8	冷却水出口管	1	146673-49910	COOLING WATER OUTLET PIPE,
9	パッキン	1	138613-49220	GASKET
	ボルト M16×35	4	26152-160352	BOLT M16×35
10	パッキン	1	138613-49220	GASKET
11	ボルト M16×45	2	26152-160452	BOLT M16×45
	ボルト M16×170	2	26152-161702	BOLT M16×170
	ナット M16	4	26732-160002	NUT M16
12	自動温度調節弁	1set	43600-029820	AUTO-THERMOSTAT VALVE

付図33-5. 冷却水管仕組(給気冷却器自動温度調節装置無)

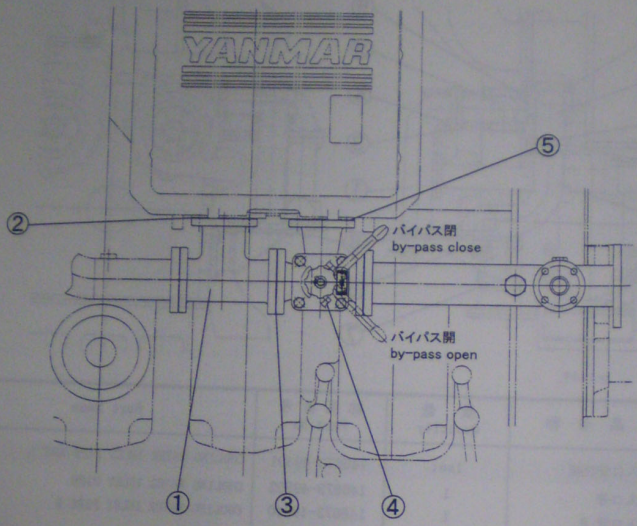
Fig.33-5 COOLING WATER PIPE ASS'Y,
non auto-thermostat for air cooler



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	冷却水入口管仕組	1set	746673-49401	COOLING WATER INLET PIPE ASS'Y,
1	冷却水入口管	1	146673-49802	COOLING WATER INLET PIPE
2	冷却水入口管 B	1	146673-49840	COOLING WATER INLET PIPE B
3	パッキン	1	138613-49220	GASKET
4	ボルト M16×55	4	26152-160552	BOLT M16×55
	ナット M16	4	26732-160002	NUT M16
5	パッキン	1	138613-49220	GASKET
	ボルト M16×40	4	26152-160402	BOLT M16×40
6	サポート	1	146673-49821	SUPPORT
7	ボルト M12×30	4	26206-120302	BOLT M12×30
8	ボルト M12×25	4	26206-120252	BOLT M12×55
	冷却水出口管仕組	1set	746673-49411	COOLING WATER OUTLET PIPE ASS'Y
9	冷却水出口管	1	146673-49812	COOLING WATER OUTLET PIPE
10	冷却水出口管 B	1	146673-49850	COOLING WATER OUTLET PIPE B
11	パッキン	1	138613-49220	GASKET
	ボルト M16×40	4	26152-160402	BOLT M16×40
12	パッキン	1	138613-49220	GASKET
13	ボルト M16×55	4	26152-160552	BOLT M16×55
	ナット M16	4	26732-160002	NUT M16

付図33-6. 冷却水バイパス管仕組(給気冷却器)

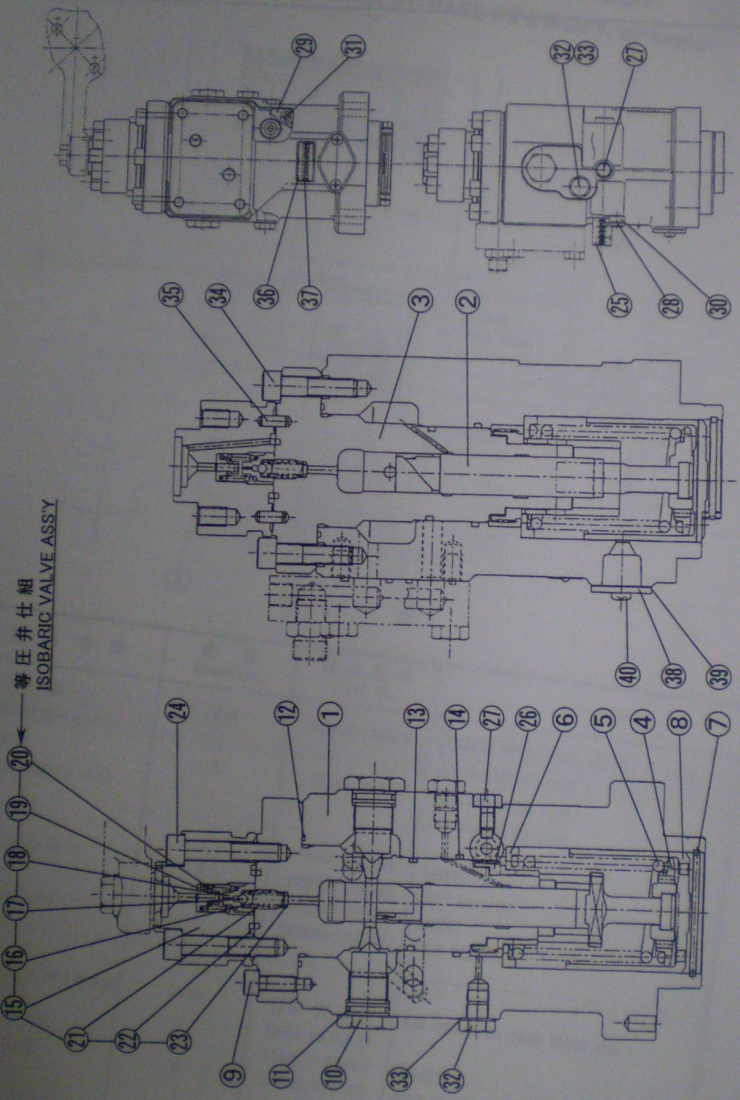
Fig.33-6 COOLING WATER BY-PASS PIPE ASS'Y, air cooler



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	冷却水管仕組 (給気冷却器バイパス)	1set	746683-49422	COOLING WATER PIPE ASS'Y, air cooler by-pass
1	冷却水管 (給気冷却器バイパス)	1	146683-49621	COOLING WATER PIPE, air cooler by-pass
2	パッキン	1	138673-01990	GASKET
	ボルト M12×30	4	26206-120302	BOLT M12×30
3	パッキン	1	138673-01990	GASKET
	ボルト M12×35	4	26206-120352	BOLT M12×35
4	給気冷却器バイパス弁仕組	1set	付図 31 参照 Refer to Fig.31	AIR COOLER BY-PASS VALVE ASS'Y
5	パッキン	1	138673-01990	GASKET
	ボルト M12×30	4	26206-120302	BOLT M12×30

付図34. 燃料噴射ポンプ仕組 (1/3)

Fig.34 FUEL INJECTION PUMP ASS'Y



付図34. 燃料噴射ポンプ仕組
Fig.34 FUEL INJECTION PUMP ASS'Y

A 仕様 : 燃料 A重油 / B Spec. : Fuel Oil M.D.O.
B 仕様 : 燃料 低質油 / B Spec. : Fuel Oil H.F.O.

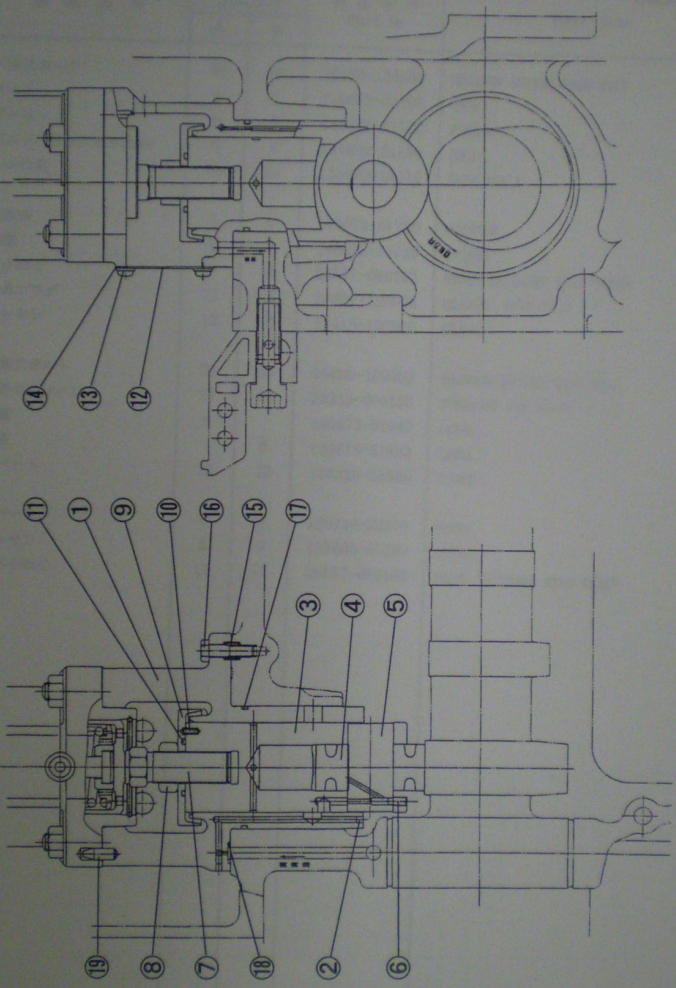
Item	部品名称	数量 Quantily		部品番号 Part No.	Part Name
		A	B		
	燃料噴射ポンプ仕組				FUEL INJECTION PUMP ASS'Y
	A重油仕様	6set		746673-51203	M.D.O. SPEC.
	低質油仕様		6set	746673-51104	H.F.O. SPEC.
1	ポンプ本体	6	6	146673-51010	BODY, fuel injection pump
	プランジャ仕組 (A重油)	6s		146673-51200	PLUNGER ASS'Y, M.D.O.
	プランジャ仕組 (低質油)		6s	146673-51100	PLUNGER ASS'Y, H.F.O.
2	プランジャ	(6)		146673-51230	PLUNGER
	プランジャ		(6)	146673-51130	PLUNGER
3	バレル	(6)		146673-51210	BARREL
	バレル		(6)	146673-51110	BARREL
4	シート (プランジャ)	6	6	146673-51170	SEAT, plunger
5	ばね (プランジャ)	6	6	151673-51170	SPRING, plunger
6	ばね受 (プランジャ)	6	6	151673-51180	SHOE, plunger
7	リテーナ (プランジャガイド)	6	6	146673-51191	RETAINER, plunger guide
8	プランジャガイド	6	6	151673-51201	PLUNGER GUIDE
9	ボルト (バレル廻り止め)	6	6	151673-51250	BOLT, barrel lock
10	デフレクタ	12	12	146673-51261	PROTECTOR
11	Oリング	12	12	159646-51270	O-RING
12	Oリング	6	6	146673-51811	O-RING
13	Oリング	6	6	146673-51820	O-RING
14	Oリング	6	6	146673-51830	O-RING
	等圧弁仕組	6s	6s	146673-51300	ISOBARIC VALVE ASS'Y
15	等圧弁本体	(6)	(6)	146673-51340	BODY, isobaric valve
16	ばね受 (リターンバルブ)	(6)	(6)	146673-51360	SHOE, return valve
17	鋼球	(6)	(6)	24190-060003	STEEL BALL
18	吐出弁	(6)	(6)	146673-51310	DELIVERY VALVE
19	吐出弁ストッパ	(6)	(6)	146673-51320	STOPPER, delivery valve
20	吐出弁ばね	(6)	(6)	146673-51331	SPRING, delivery valve
21	リターンバルブスプリング	(6)	(6)	146673-51370	SPRING, return valve
22	角リング	(6)	(6)	146673-51800	SQUARE RING
23	シム	(6)	(6)	146673-51350	SHIM

付図34. 燃料噴射ポンプ仕組
Fig.34 FUEL INJECTION PUMP ASS'Y

Item	部品名称	数量 Quantily		部品番号 Part No.	Part Name
		A	B		
24	六角穴ボルト	36	36	26450-100502	HEXAGON SOCKET HAED BOLT
25	ラック	6	6	146673-51502	RACK
26	ピニオン	6	6	146673-51510	PINION
27	ボルト（ラック廻り止め）	6	6	151673-51550	BOLT
28	シム仕組	6s	6s	138688-51570	SHIM ASS'Y
29	指示板	6	6	146673-51730	POINTER
30	間座	6	6	146673-51740	SPACER
31	皿小ねじ	6	6	26577-060162	SROSS RECESSED HEAD SCREW
32	六角プラグ	12	12	23887-120002	HEXAGON HEAD PLUG
33	パッキン	12	12	23415-120000	GASKET
34	六角穴ボルト	36	36	26450-100402	HEXAGON SOCKET HAED BOLT
35	平行ピン 6×12	24	24	22312-060120	STRAIGHT PIN 6×12
36	銘板	6		146673-51942	LABEL
	銘板		6	146673-51933	LABEL
37	リベット	12	12	124220-51890	RIVET
38	カバー	6	6	129110-52200	COVER
39	パッキン	6	6	153605-51250	GASKET
40	なべ小ねじ	12	12	26557-060102	SROSS RECESSED HEAD SCREW

付図35. 燃料噴射ポンプ駆動装置 (1/2)

Fig.35 FUEL INJECTION PUMP DRIVING CEVICE



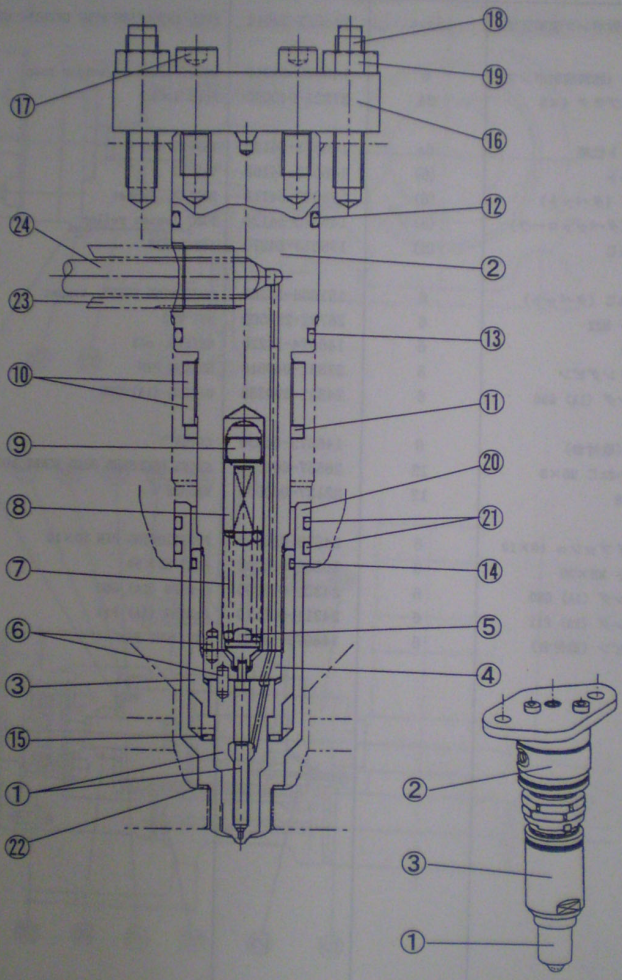
付図35. 燃料噴射ポンプ駆動装置 (2/2)

Fig.35 FUEL INJECTION PUMP DRIVING DEVICE

Item	部品名称	数量 Quantily	部品番号 Part No.	Part Name
	燃料噴射ポンプ駆動装置	6set	746673-54014	FUEL INJECTION PUMP DRIVING DEVICE
1	取付台（燃料噴射ポンプ）	6	146673-54012	MOUNT, fuel injection pump
2	打込みプラグ 4×5	24	27221-040050	PULG 4×5
	タペット仕組	6s	146673-54130	TAPPET ASS'Y
3	タペット	(6)	146673-54102	TAPPET
4	ローラ（タペット）	(6)	153623-54111	ROLLER, tappet
5	ピン（タペットローラ）	(6)	146673-54120	PIN, tappet roller
6	止めねじ	(6)	138613-54270	SET SCREW
7	調整ねじ（タペット）	6	151605-54200	ADJUSTING SCREW, tappet
8	ナット M22	6	26782-220002	NUT M22
9	油切り	6	146674-54220	SHIELD, oil
10	スプリングピン	6	22351-040010	SPRING PIN
11	Oリング（1A）G35	6	24321-000350	O-RING (1A) G35
12	ふた（取付台）	6	146673-54030	COVER
13	なべ小ねじ M6×8	12	26557-060082	CROSS RECESSED HEAD SCREW M6×8
14	座金 6	12	22137-060000	WASHER 6
15	ドライブッシュ 10×10	6	24550-010100	POSITIONING PIN 10×10
16	ボルト M8×30	6	26206-080302	BOLT M8×30
17	Oリング（1A）G80	6	24321-000800	O-RING (1A) G80
18	Oリング（1A）P11	6	24311-000110	O-RING (1A) P11
19	平行ピン（取付台）	6	146673-54040	STRAIGHT PIN

付図36-1. 燃料噴射弁仕組（A重油仕様） (1/2)

Fig.36-1 FUEL INJECTION VALVE ASS'Y
for Engine Using M.D.O. (Marine Diesel Oil) Spec.



付図36-1. 燃料噴射弁仕組(A重油仕様)

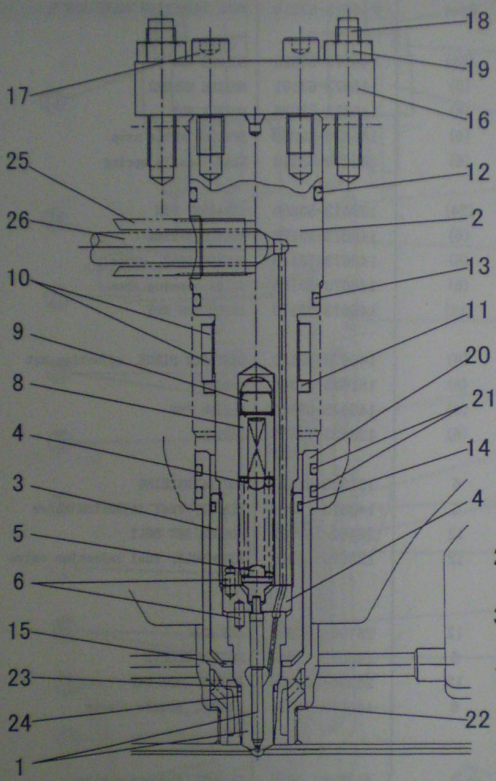
Fig.36-1 FUEL INJECTION VALVE ASS'Y for Engine Using M.D.O. (Marine Diesel Oil) Spec.

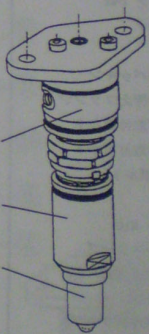
Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
▽	燃料噴射弁仕組	6set	746673-53510	FUEL INJECTION VALVE ASS'Y,
1	ノズル仕組	(6s)	146673-53520	NOZZLE ASS'Y
2	ノズルホルダ	(6)	146673-53101	NOZZLE HOLDER
3	ノズルナット	(6)	146673-53080	NOZZLE NUT
4	バルブストップスペーサ	(6)	146673-53230	SPACER, valve stop
5	ノズルスプリングシート	(6)	146673-53210	SEAT, nozzle spring
6	平行ピン	(24)	138613-53200	STRAIGHT PIN
7	ノズルスプリング	(6)	146673-53120	NOZZLE SPRING
8	ばね受(上部)	(6)	146673-53140	SPRING SHOE, upper
9	ばね受ガイド	(6)	146673-53160	GUIDE, spring shoe
10	調整ナット	(12)	146673-53170	ADJUSTING NUT
11	スペーサ(調整ナット)	(6)	146673-53150	DISTANCE PIECE, adjusting nut
12	Oリング	(6)	151673-51380	O-RING
13	Oリング P42	(6)	146673-53900	O-RING P42
14	Oリング	(6)	128633-11880	O-RING
15	ノズルパッキン	6	137600-53091	NOZZLE PACKING
16	燃料弁押えフランジ	6	146673-11880	FLANGE, fuel injection valve
17	ホルダ取付ボルト	12	26450-100302	HOLDER SET BOLT
18	燃料弁取付ボルト (植込ボルト)	12	133670-54310	STUD BOLT, fuel injection valve
19	ナット M10	12	26706-100002	NUT M10
20	ノズルスリーブ	6	146673-11860	NOZZLE SLEEVE
21	Oリング (4D) G40	12	24326-000400	O-RING (4D) G40
22	パッキン (ノズルスリーブ)	6	146673-11870	GASKET, nozzle sleeve
23	噴射管スリーブ	6	付図 37 参照	SLEEVE, injection pipe
24	燃料噴射管	6	Refer to Fig.37	FUEL INJECTION PIPE

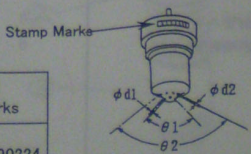
付図36-2. 燃料噴射弁仕組（低質油仕様） (1/2)

Fig.36-2 FUEL INJECTION VALVE ASS'Y for Engine Using H.F.O. (Heavy Fuel Oil) Spec.

間接冷却型 / Indirect-Cooling type







噴射角度 Injection angle	噴射径一穴数 Nozzle-size Hole	刻印 Stamp Marks
θ1=90° deg.	φd1=0.22-4	YDLL15328T90224
θ2=153° deg.	φd2=0.28-8	

付図36-2. 燃料噴射弁仕組（低質油仕様）

Fig.36-2 FUEL INJECTION VALVE ASS'Y for Engine Using H.F.O. (Heavy Fuel Oil) Spec.

間接冷却型 / Indirect-Cooling type

Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
▽	燃料噴射弁仕組	6set	746673-53520	FUEL INJECTION VALVE ASS'Y.
1	ノズル仕組	(6s)	146673-53540	NOZZLE ASS'Y
2	ノズルホルダ	(6)	146673-53101	NOZZLE HOLDER
3	ノズルナット	(6)	146673-53080	NOZZLE NUT
4	バルブストップスペーサ	(6)	146673-53230	SPACER, valve stop
5	ノズルスプリングシート	(6)	146673-53210	SEAT, nozzle spring
6	平行ピン	(24)	138613-53200	STRAIGHT PIN
7	ノズルスプリング	(6)	146673-53120	NOZZLE SPRING
8	ばね受（上部）	(6)	146673-53140	SPRING SHOE, upper
9	ばね受ガイド	(6)	146673-53160	GUIDE, spring shoe
10	調整ナット	(12)	146673-53170	ADJUSTING NUT
11	スペーサ（調整ナット）	(6)	146673-53150	DISTANCE PIECE, adjusting nut
12	Oリング	(6)	151673-51380	O-RING
13	Oリング P42	(6)	146673-53900	O-RING P42
14	Oリング	(6)	128633-11880	O-RING
15	ノズルパッキン	6	137600-53091	NOZZLE PACKING
16	燃料弁押えフランジ	6	146673-11880	FLANGE, fuel injection valve
17	ホルダ取付ボルト	12	26450-100302	HOLDER SET BOLT
18	燃料弁取付ボルト（植込ボルト）	12	133670-54310	STUD BOLT, fuel injection valve
19	ナット M10	12	26706-100002	NUT M10
20	ノズルスリーブ	6	146673-11611	NOZZLE SLEEVE
21	Oリング（4D）G40	12	24326-000400	O-RING (4D) G40
22	パッキン（ノズルスリーブ）	6	147643-11870	GASKET, nozzle sleeve
23	押え輪（テフロンリング）	6	146673-11800	RETAINER, teflon ring
24	テーパーブッシュ（銅）	6	146673-11622	TAPER BUSH, copper
25	噴射管スリーブ	6	付図 37 参照	SLEEVE, injection pipe
26	燃料噴射管	6	Refer to Fig.37	FUEL INJECTION PIPE

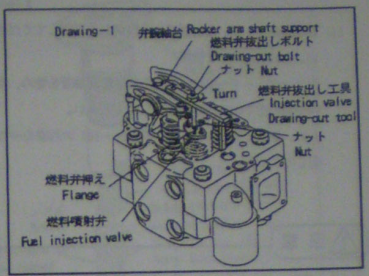
付図36-3. 燃料噴射弁メンテナンスサービス要領（間接冷却ノズル）

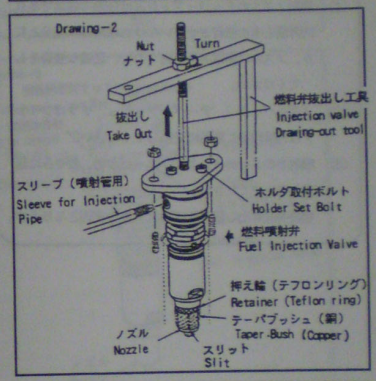
Fig.36-3 Maintenance service procedure of Fuel Injection Valve (Indirect-cooling type)

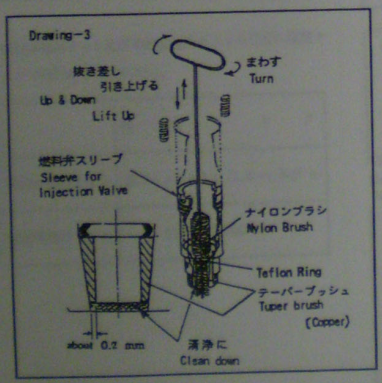
Unlike the non-cooled fuel injection valve, the indirectly cooled injection valve must be serviced or maintained in the following procedure:

1 Dismantling the injection valve

1) Use the injection valve removing tool. Remove the injection pipe and injection sleeve beforehand. Ref. Drawings 1 and 2.
2) Remove the Teflon ring which holds the taper bush of the nozzle. Use the supplied nylon brush for easy removal. If hard to remove the Teflon ring, arrange a hooked stick to rake out the ring.
3) Fully insert the nylon bush in the taper bush and turning the brush 4-5 times, draw it in and out several times until the carbon scale is removed from the bush end. (Ref. Drawing 3.) Make sure the stepped tip of the bush remover catches the taper bush end.
4) Assemble the taper bush remover. Do not screw in the extension shaft excessively. (Ref. Drawing 4)
5) Insert the taper bush remover until its shoulder hits the taper bush. Ref. drawing 5.







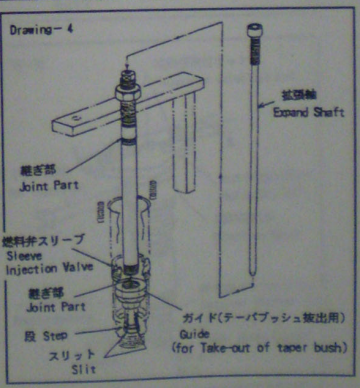


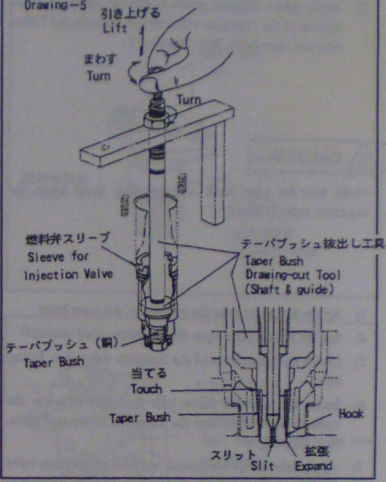
Fig.36-3 Maintenance service procedure of Fuel Injection Valve (Indirect-cooling type)

⚠ CAUTION

Do not drive the bush remover tool with a hammer or the like. Should the bush be broken at the shoulder, the bush remover will stay at an improper location and the subsequent operation can damage the bush remover.

6) Turn the extension shaft of the taper remover bush clockwise with a hand. When you feel a hit, lift the shaft. If hard to lift it up, turn the nut on the shaft with a spanner to remove the taper bush (Ref. Drawing 5).

Drawing-5



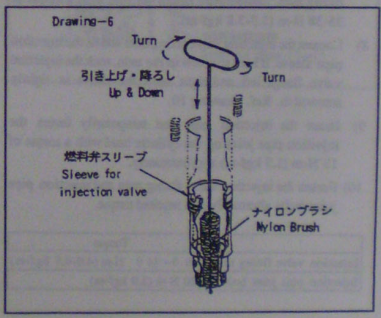
2 Adjusting the fuel injection valve and environment

1) Disassemble and clean the injection valve and adjust the injection pressure. Refer to the engine manual, section 6 for the detailed procedure.

2) Clean the interior of the injection valve sleeve of the cylinder head. Insert the nylon brush into the taper bush hole and draw up and down the brush while turning it with a hand. Ref. Drawing 6.

3) Make sure the taper bush is cleaned by using a flash light.

Drawing-6



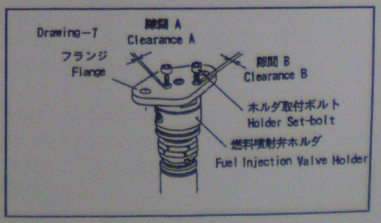
⚠ CAUTION

Fitting the nozzle at the dirty taper bush insert can cause the nozzle to deteriorate easily. (misinjection).

3 Mounting the injection valve

1) Mounting the flange on the injection valve holder
Fit the flange with M10 bolts with a fastening torque 45-54 N-m (4.5-5.5 kgf-m).

Drawing-7



付図36-3. 燃料噴射弁メンテナンスサービス要領（間接冷却ノズル）

Fig.36-3 Maintenance service procedure of Fuel Injection Valve (Indirect-cooling type)

2) Apply grease (lithium grease or Pro-Tec grease) over the outside of the injection valve nozzle, then fit the Teflon ring and taper bush. Ref. Drawing 8.

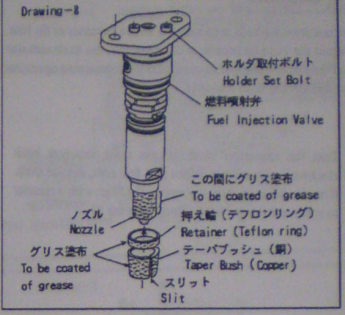
⚠ CAUTION

Make sure the taper bush will not drop down when the injection valve is lifted.

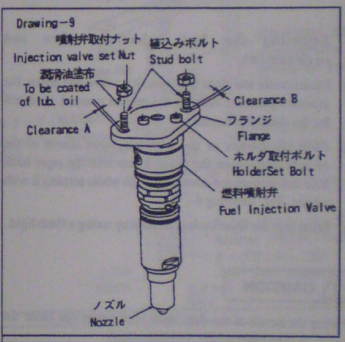
3) Apply the grease over the exterior of the taper bush.
4) Set the nozzle packing in the injection valve sleeve.
5) Check the orientation of the injection valve pipe fitting hole.
6) Insert the injection valve into the valve hole on the cylinder head. Make sure the flange fits in the stud bolts. Ref. Drawing 9.
7) Apply lube oil on the threads and seats of injection valve fixing nuts. Temporarily fasten the nuts with a torque of 35-38 N-m (3.5-3.8 kgf-m).
8) Loosen the injection valve fixing nuts and fit the injection pipe sleeve. If hard to screw in the nuts, rock the injection valve flange left and right until the sleeve is tightly screwed in. Ref. Drawing 10.
9) Insert the injection pipe and temporarily fasten the injection pipe joint on the cylinder head with a torque of 15 N-m (1.5 kgf-m) approximately.
10) Fasten the injection valve fixing nuts and injection pipe joint bolts alternately at a required torque.

	Torque
Injection valve fixing nut	39.0 - 44.0 N-m (4.0-4.5 kgf-m)
Injection pipe joint bolt	20 N-m (2.0 kgf-m)

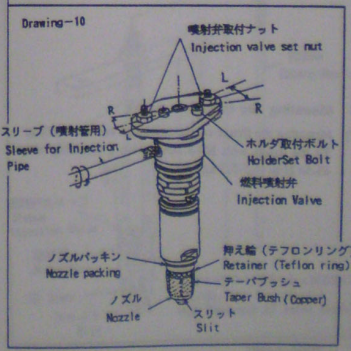
Drawing-8



Drawing-9



Drawing-10



付図36-3. 燃料噴射弁メンテナンスサービス要領（間接冷却ノズル）

Fig.36-3 Maintenance service procedure of Fuel Injection Valve (Indirect-cooling type)

11) Perform trial run to check the injection pipe for a leak (Ref. Drawing 12). Loosen the leak-out pipe at the cylinder head to check the oil for any leak. If a leak is found, do steps 6-10 above.

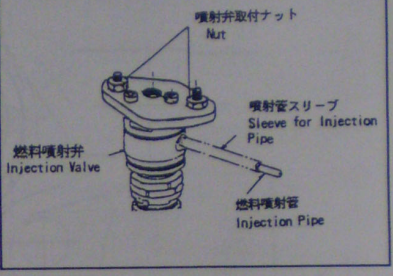
⚠ CAUTION

(1) The taper bush of the injection nozzle has a heat transfer property. It is important to put it in close contact on the interior and exterior; otherwise, the sufficient cooling effect will not be obtained, resulting even in early deterioration of the nozzle. Accurate adjustment is required.

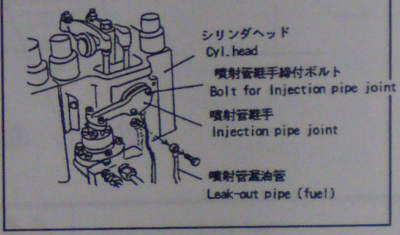
(2) Replace the nozzle packing, taper bush, and Teflon ring with new one every time they are disassembled.

(3) Do not prolong the maintenance intervals of the injection valve unnecessarily. The injection valve may become hard to be removed or misinjection may result.

Drawing-11

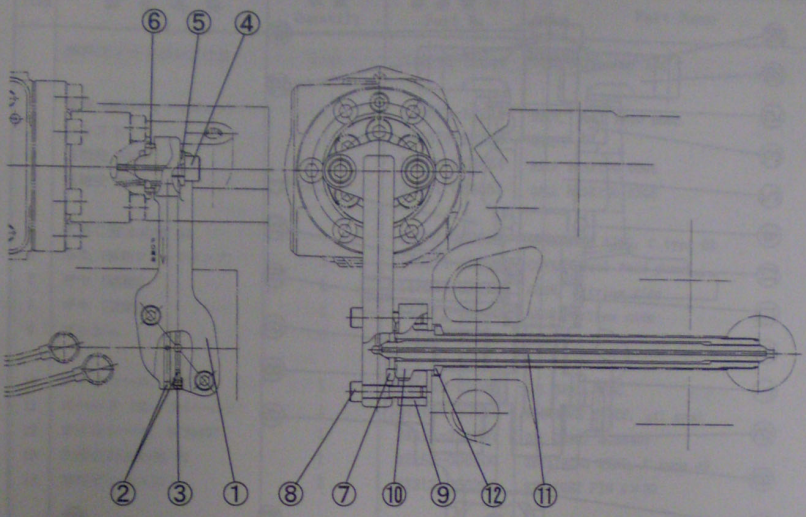


Drawing-12



付図37. 燃料噴射管仕組 (1/1)

Fig.37 FUEL INJECTION PIPE ASS'Y



Item	部品名称	数量 Quantity	部品番号 Part No.	Part Name
	燃料噴射管仕組	6set	746673-59200	FUEL INJECTION PIPE ASS'Y
1	噴射管継手	6s	146673-59062	JOINT, injection pipe
2	打込みプラグ 3×8	(12)	27221-030080	DRIVING PLUG 3×8
3	六角穴止めねじ 6×6	(6)	26979-060062	HEADLESS SET SCREW 6×6
4	六角穴ボルト M10×45	12	26450-100452	HEXAGON SOCKET HEAD BOLT M10×45
5	球面座金 10	12	146673-59240	SPHERICAL WASHER 10
6	パッキン	6	146673-59020	GASKET
7	パッキン	6	146673-59250	GASKET
8	六角穴ボルト M8×40	12	26450-080402	HEXAGON SOCKET HEAD BOLT M8×40
9	小判フランジ	6	146673-59201	FLANGE, oval shape
10	袋ナット (噴射管)	6	146673-59180	SLEEVE NUT, injection pipe
11	燃料噴射管	6	146673-59230	FUEL INJECTION PIPE
12	パッキン	6	146673-59220	GASKET

付図38-1. 燃料フィードポンプ仕組（A重油仕様） (1/3)

Fig.38-1 FUEL FEED PUMP ASS'Y, marine diesel oil spec.

