

YANMAR

OPERATION MANUAL

MARINE PROPULSION ENGINE

**6CH-WDTE
6CH-WUTE**

YANMAR MARINE DIESEL ENGINE OPERATION MANUAL

Thank you for purchasing a YANMAR Marine Diesel Engine.

[INTRODUCTION]

- This Operation Manual describes the operation, maintenance and inspection of the YANMAR marine diesel engine.
- Read this Operation Manual carefully before operating the engine to ensure that the engine is used correctly and that it stays in the best possible condition.
- Keep this Operation Manual in a convenient place for easy access.
- If this Operation Manual is lost or damaged, order a new one from your YANMAR dealer or distributor.
- Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the engine and remain with it.
- Constant efforts are made to improve the quality and performance of YANMAR products, so some details included in this Operation Manual may differ slightly from your engine. If you have any questions about such differences, please contact your YANMAR dealer or distributor.
- The specifications and components (instrument panel, fuel tank, etc) described in this manual may differ from the ones installed on your vessel.
Please refer to the manual provided by the manufacturer of these components.

OPERATION MANUAL	MODEL	6CH-WDTE, 6CH-WUTE
	CODE	0A6CH-G00201

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FOR YOUR SAFETY

Following the precautions described in this manual will enable you to use this engine with complete satisfaction. Failure to observe any of the rules and precautions, however, may result in injury, burns, fires and engine damage. Read this manual carefully and be sure you fully understand it before beginning operation.

Safety Symbols

These are the warning signs used in this manual and on the product.



This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

 **DANGER**

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 **WARNING**

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 **CAUTION**

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which can cause damage to the machine, personal property and/or the environment or cause the equipment to operate improperly.

Safety Precautions

Safety precautions for operation

DANGER



Burns from steam

- Never remove the filler cap from the coolant tank while the engine is still hot. Steam and hot air will spurt out and seriously burn you. After engine stop, wait until the water temperature drops. Wrap a cloth around the filler cap and slowly loosen the cap.
- After inspection, tighten the filler cap firmly. If the cap is not secure, steam or hot air can spurt out during operation and seriously burn you.



Ventilation of the battery area

- Make sure that the area around the battery is well-ventilated and that no flammable materials are near.
- The battery emits hydrogen gas during operation and charging. The gas can catch fire.



Fires from oil ignition

- Be sure to use the correct type of fuel oil. Always double-check before fueling. The wrong fuel oils (e.g. gasoline) can cause a fire.
- Be sure to stop the engine before fueling. If you spill fuel oil, wipe the spillage carefully.
- Keep oil and other inflammable materials away from the engine. They can catch fire.

WARNING



Exhaust gas poisoning

- Never cover or block the windows, air vents, fans or other ventilation devices in the engine room. Always maintain good ventilation in the engine room during operation. Breathing exhaust gas is dangerous to your health.



Moving parts

- Keep your hands, other body parts and clothing away from moving parts (e.g. the front drive shaft, V-belt or propeller shaft). You will get caught and injured.
- Never operate the engine without the covers on the moving parts.
- Before engine start, check that you removed all tools and cloths from the area near the engine.



Alcohol and drugs

- Never operate the engine while you are under the influence of alcohol or drugs. Never operate the engine when you feel ill or unwell.

⚠ CAUTION**Burns**

- Be careful of burns. The entire engine is very hot during and after operation.
- Keep your hands, other body parts and clothing away from the exhaust manifold, exhaust pipes, turbocharger, air cooler and engine body.

Safety precautions for maintenance**⚠ DANGER****Burns from steam**

- Never remove the filler cap from the coolant tank while the engine is still hot. Steam and hot air will spurt out and seriously burn you. After engine stop, wait until the water temperature drops. Wrap a cloth around the filler cap and slowly loosen the cap.
- After inspection, tighten the filler cap firmly. If the cap is not secure, steam or hot air can spurt out during operation and seriously burn you.

**Fires from oil ignition**

- Be sure to use the correct type of fuel oil. Always double-check before fueling. The wrong fuel oils (e.g. gasoline) can cause a fire.
- Be sure to stop the engine before fueling. If you spill fuel oil, wipe the spillage carefully.
- Keep oil and other inflammable materials away from the engine. They can catch fire.

⚠ WARNING**Fires from electric short-circuits**

Always turn off the battery switch or detach the earth cable (-) before you inspect the electrical system. If you cause a short-circuit, a fire can occur.

**Moving parts**

Stop the engine before you inspect it. If you have no choice but to inspect the engine while it operates, keep your hands, other body parts and clothing away from rotating parts. You will get caught and injured.

**Exhaust gas poisoning**

Never cover or block the windows, air vents, fans or other ventilation devices in the engine room. Always maintain good ventilation in the engine room during operation. Breathing exhaust gas is dangerous to your health.

⚠ CAUTION



Battery fluid

Be very careful not to expose your skin or eyes to the battery electrolyte.

The electrolyte is a strong acid and can cause inflammations.

If you come in contact with the battery fluid, wash it off immediately with a lot of tap water.



Burns

• Be careful of burns. The entire engine is very hot during and after operation.

• Keep your hands, other body parts and clothing away from the exhaust manifold, exhaust pipes, turbocharger, air cooler and engine body.

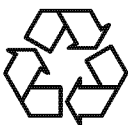
NOTICE

No modification

To keep the engine in good condition, the engine has been sealed to control the engine speed limit and the fuel injection quantity. If a seal is removed, the sliding and moving parts of the engine will suffer from increased wear. Engine performance will deteriorate and service life may shorten significantly. Removing a seal may also lead to increased lubricating oil and fuel consumption, seizure and breakage in all portions of the engine. Therefore, do not remove any seals. If the seal is removed, no warranty will be given even during the warranty period.

Regulation on NOx

Laws on maritime pollution and hazard prevention regulate the replacement of certain parts. The laws require that a record and the signature of personnel who replaces these parts is kept. All inspections and maintenance must be performed by our professional service technicians with the necessary expertise and skills.



Waste disposal

- Never dispose of waste oil, such as lubricating oil, by dumping it into a sewer, river, lake or ocean waters.
- Do not spill waste oil into ocean waters. Use a container to collect waste oil from the engine.
- Comply with relevant laws and/or regulations for the disposal of hazardous materials such lubricating oil, fuel, filters or batteries.

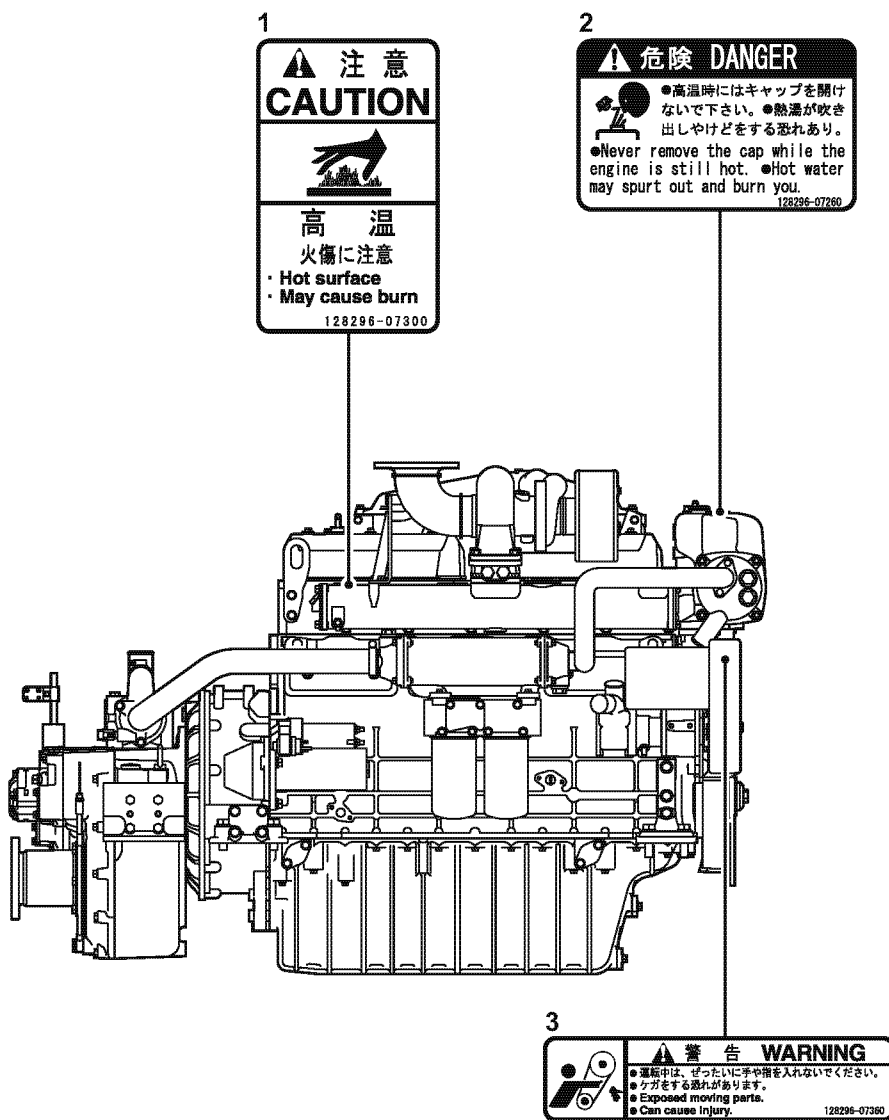
Warning labels

To ensure safe operation, the engine has warning labels attached at the locations described below.

Read the warning labels carefully to prevent accidents.

Also, if you need to replace a part that has a label attached to it, make sure that you order the new part together with the label.

If the warning label is damaged or has fallen off, order a new one from your YANMAR dealer or distributor.



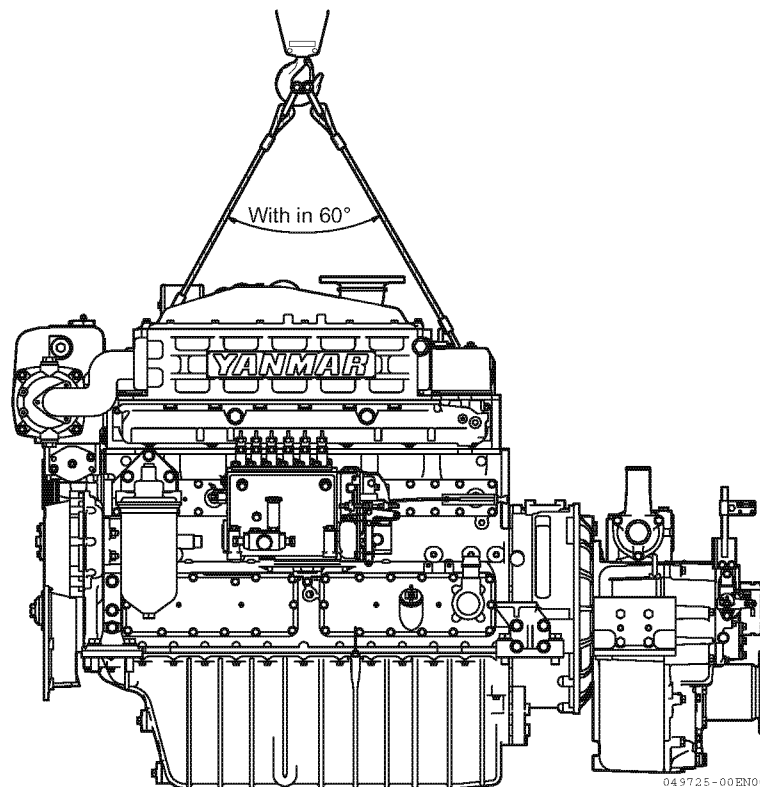
No.	Part No.
1	128296-07300
2	128296-07260
3	128296-07360

Precautions for Lifting the Engine

The engine can cause serious injury when it falls during lifting. Obey the below instructions to prevent accidents during lifting.

⚠ WARNING

- Make sure that the engine is lifted by qualified persons.
- Before lifting, make sure that the engine lifting bracket and mounting bolt have no damage and are in good shape. If you find a fault, stop immediately and contact your YANMAR dealer or distributor.
- Select lifting tools (e.g. wire rope and shackle) that are appropriate for heavy loads.
- Select the wire rope length so that the engine does not tilt during lifting.
- Before lifting, examine the lifting tools and make sure that they have no damage and are in good shape.
- Protect the parts of the engine or driven equipment that touch the wire rope with protective material.
- The tension of the wire rope changes depending on the lifting angle. Make sure that the angle is within 60°.
- If you use a marine gear that is not listed in this operation manual, separate the marine gear from the engine, and lift the marine gear and engine separately.
- During lifting and moving the engine, do not go under the engine or near the engine.



For the mass, refer to Specifications in the Operation Manual.

Engine nameplates

Periodic inspection and maintenance are important to help you enjoy your engine. Your serial number is required at the time of requesting an engine maintenance or ordering a part. Confirm it beforehand.

■ Location of engine nameplate:

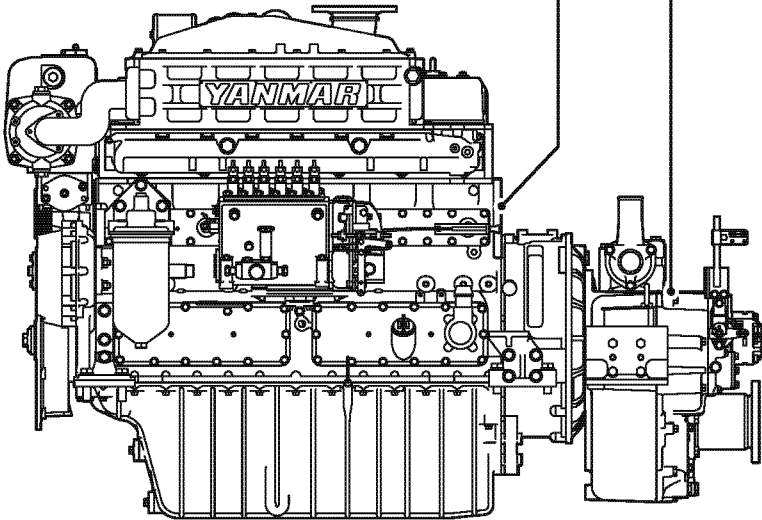
It is affixed the top part of the cylinder block on the marine gear side.

■ Location of marine gear nameplate:

It is affixed on the back side of the lubricating oil cooler mounted of the marine gear box.

Model	_____
Gear Model	_____
Continuous power kW	_____ kW/ _____ min ⁻¹
Speed of prop.shaft	_____ min ⁻¹ _____
Fuel stop power kW	_____ / _____ min ⁻¹
ENG.No.	_____
MFG.DATE	____/____/____
YANMAR YANMAR CO.,LTD. MADE IN JAPAN	

MODEL	_____		
REDUCTION RATIO	_____		
AHEAD	_____	ASTERN	_____
MFG.No.	_____		
YANMAR KANZAKI KOKYUKOKI MFG CO.,LTD. MADE IN JAPAN			



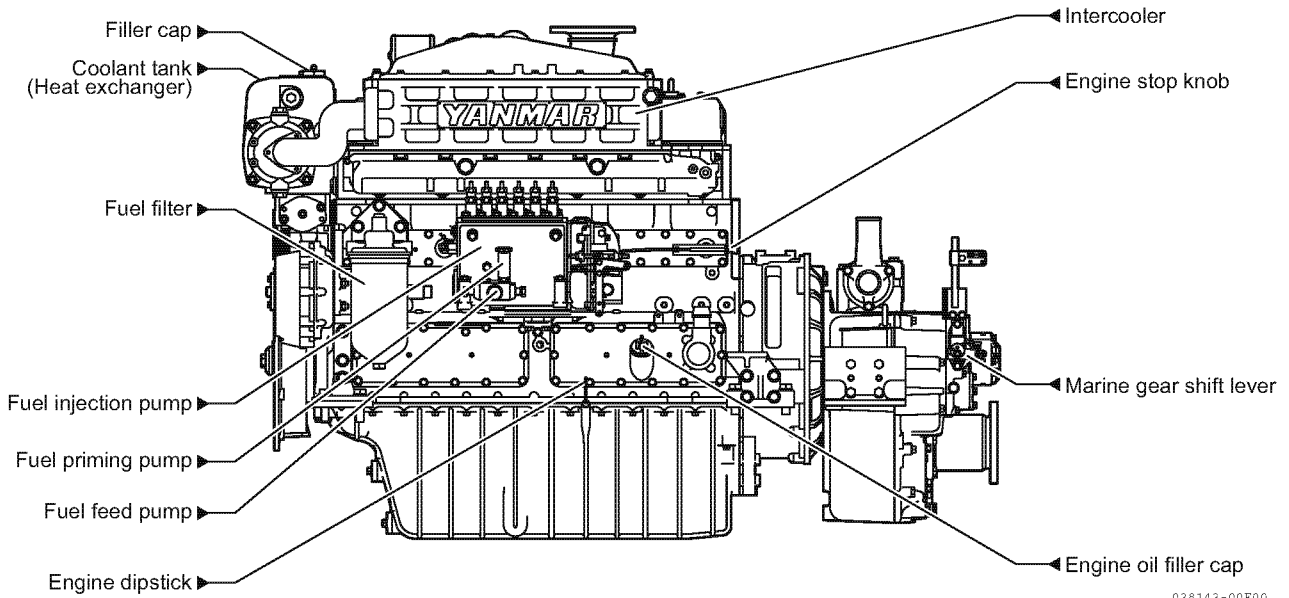
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SPECIFICATIONS

Model		Unit	6CH-WDTE	6CH-WUTE	
Type		-	Vertical, 4-cycle, turbo-charged diesel engine		
No. of cylinders		-	6		
Bore × Stroke		mm	105 × 125		
Rated output	Rating	M	kW/min ⁻¹	154/2550	188/2550
		L	kW/min ⁻¹	169/2600	206/2600
Direction of rotation		-	Counterclockwise (Viewed from flywheel side)		
Firing order (Flywheel side is No.6.)		-	1-4-2-6-3-5-1		
Combustion system		-	Direct injection		
Cooling system		-	Constant temperature cooling system (with heat exchanger)		
Coolant capacity	Engine	ℓ	23		
	Reservoir tank	ℓ	0.8		
Lubrication system		-	Forced lubrication with gear pump		
Lub. oil capacity	Engine	ℓ	18.5	23	
	Marine gear	ℓ	5.5		
Starting system		-	Starter motor, DC 24V, 4kW		
Marine gear	Model	-	YX-71-4		
	Reduction ratio (A head/Astem)	-	2.07/2.07, 2.58/2.58, 2.91/2.91, 3.53/3.53		
Engine mass (with marine gear)		kg	900	940	

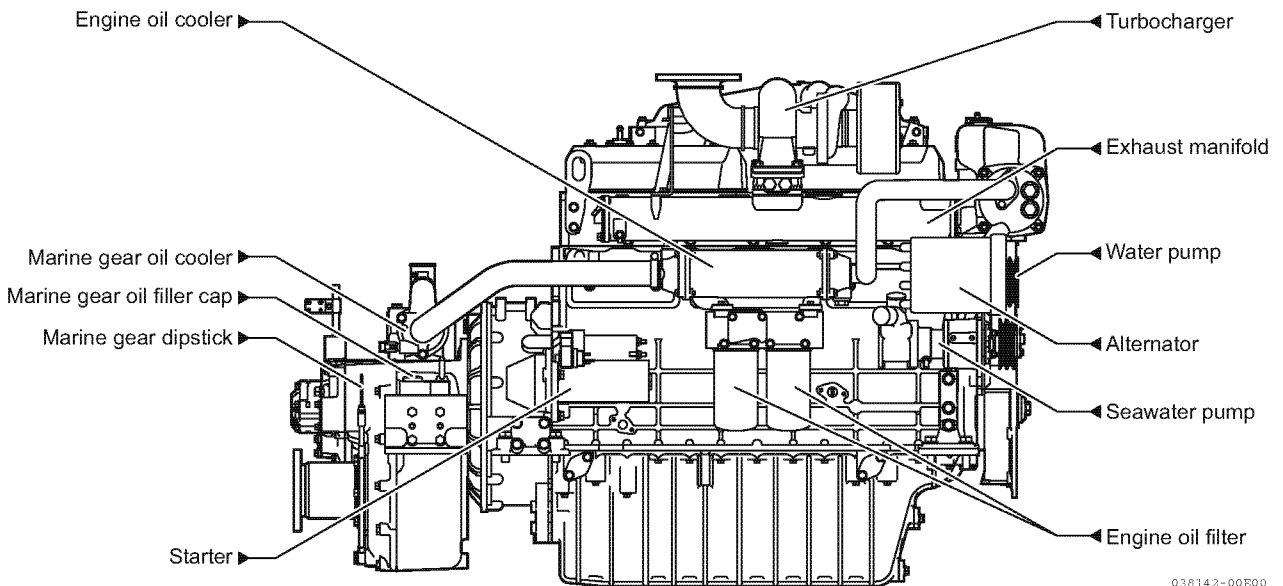
Location of components

■ Operation side



038143-00E00

■ Non-operation side



038142-00E00

FUEL OIL, LUBRICATING OIL & COOLING WATER

Fuel

The specification of fuel oil for this model is shown in the following table.

The proper 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.

■ Quality criteria of fuel oil

Viscosity	at 50°C	mm ² /s (cSt)	3 ~ 8
Property critical value	Specific gravity at 15 °C	g/cm ³	< 0.86
	Flash point	°C	> 60
	Residual carbon	mass. %	< 0.7
	Sulfur content	mass. %	< 1.0
	Ash content	mass. %	< 0.03
	Moisture content	vol. %	< 0.1
	Vanadium	ppm	–
	Sodium	ppm	–
	Aluminum	ppm	–
	Diesel index		
Quality criteria equivalent fuel oil	ASTEM D975		2D
	BSI-2869		Class B1
	ISO 8217		DMX

NOTICE

The fuel injection system consists of precision parts and for that reason, do not use fuel to which water and dust are mixed in. If such fuel is used, it causes a trouble. Consequently, pay attention to the following in supply of fuel. Besides, as for daily maintenance, carry out draining and maintenance servicing of fuel filter mentioned in Periodic Maintenance on page 36.

In time of fuel supply

- When supplying fuel stored in a drum, stand the drum still for longer than one whole day to settle the impurity, and supply supernatant liquid of the drum to this engine.
- In the case of supplying fuel from a storage tank to the service tank, supply such fuel after more than one whole day elapsed from when fuel is supplied to the storage tank.

Lubricating Oil

■ Engine oil selection

● Selection of lubricating oil is very important for a diesel engine. If improper lubricating oil is used or change of lubricating oil is neglected, it causes sticking of piston rings, seizure or early wear of pistons and cylinder liners and faster wear of bearings and various other moving parts that reduce the durability of the engine.

● Service Categories

Use an engine oil that meets or exceeds the following guidelines and classifications:

Application	6CH-WDTE	6CH-WUTE
A.P.I. Classification	Grade CD	Grade CD
SAE Viscosity grade	15W-40	30 or 40

Application	Viscosity (SAE)	Specific Gravity	Flash Point (°C) (Open Type)	Pour Point (°C)	Kinematic Viscosity (cSt)		Viscosity Index	T.B.N. (mgKOH/g)
					40°C	100°C		
6CH-WDTE	15W-40	0.88	> 230	< -30	> 100	14 - 15.5	> 140	9 - 15
6CH-WUTE	30	0.89	> 230	< -10	105 - 125	11 - 12.5	96 - 110	9 - 15
	40	0.893	> 240	< -7.5	140 - 155	14 - 15.5	96 - 110	9 - 15

NOTICE

- Avoid blended use of different brands.
(In the unavoidable case of blended use of different brands of lub, consult your lub. oil supplier.)
- 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-by if intruded into exhaust valves.

■ Marine gear oil selection

● Service Categories

Use marine gear oil that meets or exceeds the following guidelines and classifications:

- A.P.I. Classification: Grade CD or higher
- SAE Viscosity grade: 30

NOTICE

- Always use the specified SAE viscosity 30 oil.
Never use multi-grade oil or mix oil types.

Cooling water (Coolant)

■ Cooling water selection

Use clean coolant (tap water) for the cooling water.

Use the water having the properties shown in the right table.

Water quality for coolant	
pH 298K (25°C)	6.5 - 8.0
Total hardness (CaCO ₃)	< 100 ppm
M alkalinity	30 -100 ppm
Ammonium ion (NH ₄ ⁺) concentration	< 0.05 ppm
Chloride ion (Cl ⁻) concentration	< 100 ppm
Sulfate ion (SO ₄ ⁻) concentration	< 100 ppm
Evaporation residue	< 400 ppm

■ Long life coolant (LLC) mixture selection

Always add Long Life Coolant (LLC) to the cooling water.

YANMAR recommends the following Long Life Coolant (LLC):

- TEXACO LONG LIFE COOLANT/standard and premixed
Product Code 7997 and 7998
- HAVOLINE EXTENDED LIFE ANTIFREEZE/COOLANT
Product Code 7994

or equivalent to above LLC.

NOTICE

Choose LLC which will not have any adverse effects on the materials (cast iron, aluminum, copper, etc.) used in the engine's cooling system, if different above.

Without this mixture, scale or rust is generated inside the parts of the cooling water system, thus deteriorating cooling performance. In winter, never neglect to use LLC in order to prevent freezing.

If LLC use is neglected, the cooling water freezes and expands inside the engine, resulting in breakage of parts in the cooling water system. The mixing ratio of LLC depends on the temperature. Be careful in using the mixing ratio specified by the manufacturer.

NOTICE

- Excess LLC deteriorates cooling performance.
A thin mixture which does not provide protection sufficient for the lowest temperature will freeze and damage the cooling water system.
- Never mix different types (brands) of LLC, chemical reactions may make the LLC useless and engine trouble could result.

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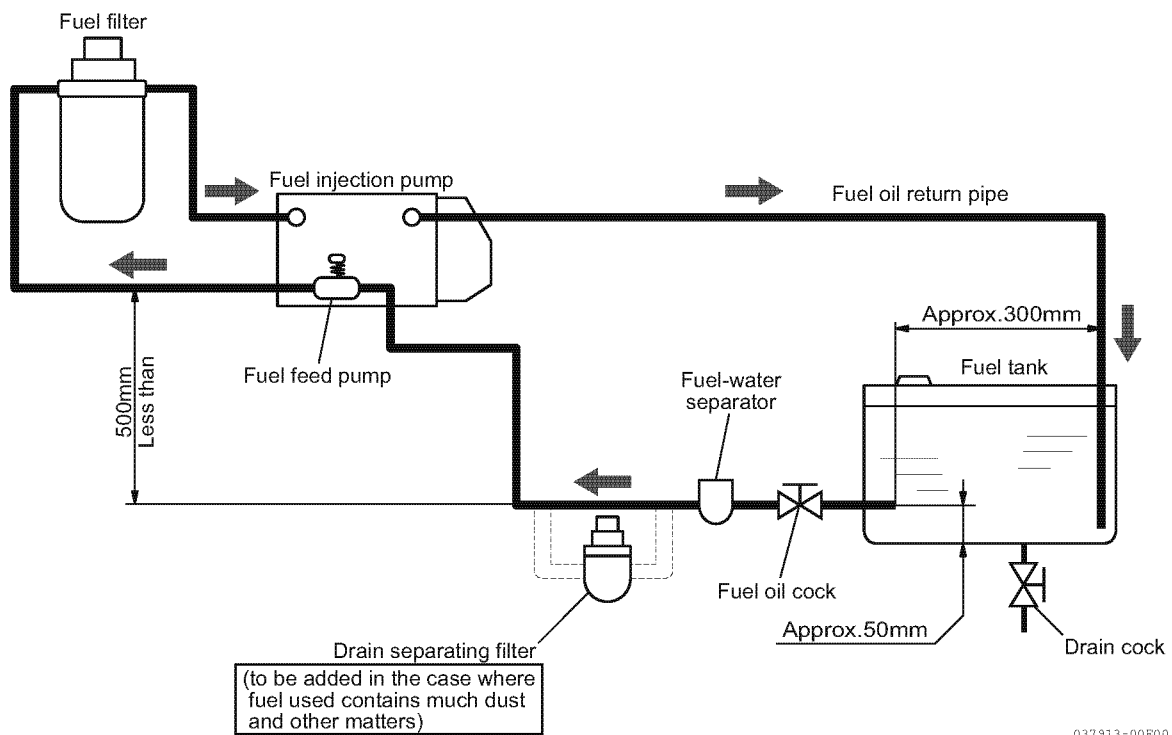
RUNNING-IN

When starting a new engine, perform the following procedure.

Fuel

- Make sure the inside of the fuel tank and fuel lines have been thoroughly cleaned.
Fill the fuel tank with fuel.

Fuel system



- Fuel piping

Install the piping between the fuel tank and the engine as illustrated above.
Be sure to install a drain cock at the bottom of the fuel tank to remove drain.
Install a fuel/water separator and a fuel filter in the fuel piping.

Lubricating oil (Engine and Marine gear)

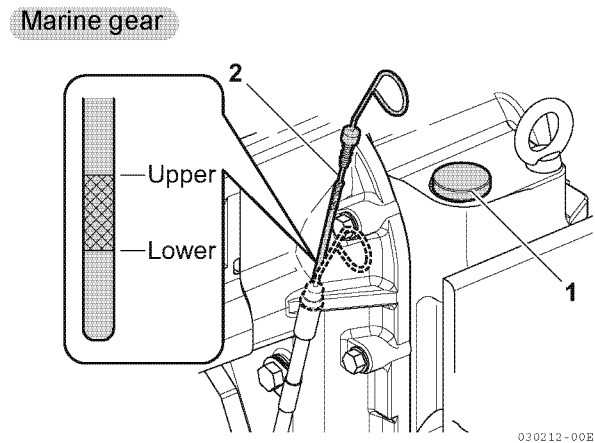
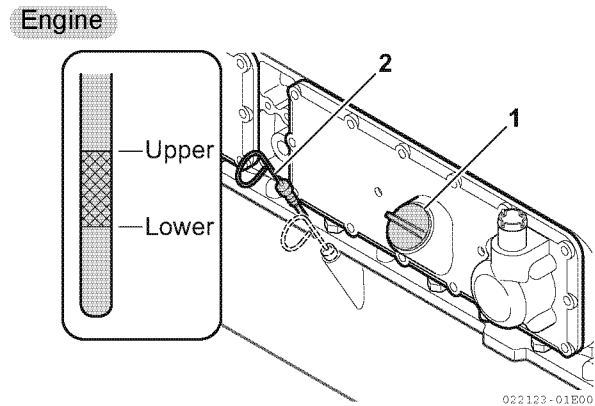
As it is necessary to keep oil level correctly, please follow the following if you need to pour and add engine and marine gear oil.

1. Remove the oil filler cap (1).
2. Fill recommended oil to the upper level mark on the dipstick (2) while checking the level with the dipstick (2).
3. Install the oil filler cap.

NOTICE

- Be sure to stop the engine before refueling with engine lubricating oil.
- When checking the oil level, insert the dipstick fully.
- Do not overfill with oil, as this may cause oil to be sprayed out from the breather and damage the engine, or marine gear.

Engine	-WDTE	18.5ℓ
	-WUTE	23ℓ
Marine gear	-WDTE	5.5ℓ
	-WUTE	5.5ℓ



Cooling system (seawater and coolant)

1. Tighten all the coolant drain cocks before filling coolant.
2. Make sure the clamps at both ends of the rubber hose between the reservoir tank and the coolant tank are securely tightened.
The reservoir tank should be installed so that its top is positioned approximately 5 cm below the coolant tank top surface.
3. Fill the coolant tank with coolant up to the filler neck.
4. Fill the reservoir tank with coolant up to the upper level (FULL) mark.

Capacity of all coolant system	Engine	23ℓ
	Reservoir tank	0.8ℓ

NOTICE

- Always fill with clean coolant.
- Always use coolant mixed with LLC.

5. Tighten the filler cap securely.
6. Check to be sure that the joint of the overflow pipe between the reservoir tank and coolant tank are securely tightened.

⚠ DANGER

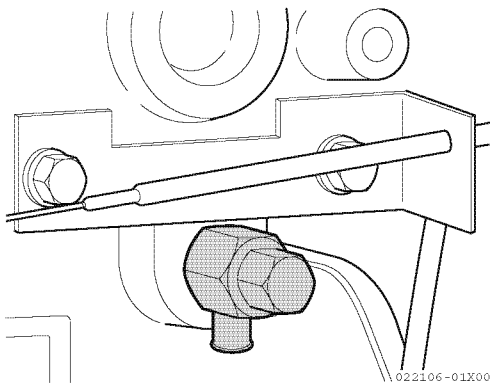
Burns from steam



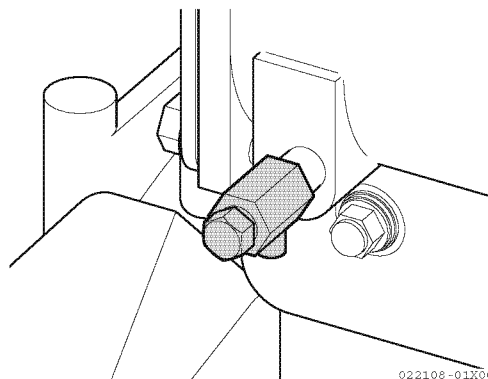
Never open the pressure cap while the engine is hot. Steam and hot water can spurt out and burn you badly. Wrap the cap with a rag and open the slowly after the engine has cooled down. Fasten the filler cap tightly after checking and adding water.

7. Tighten the seawater drain cocks at the marine gear lub. oil cooler and heat exchanger.
8. Tighten the side cover bolts of the seawater pump.

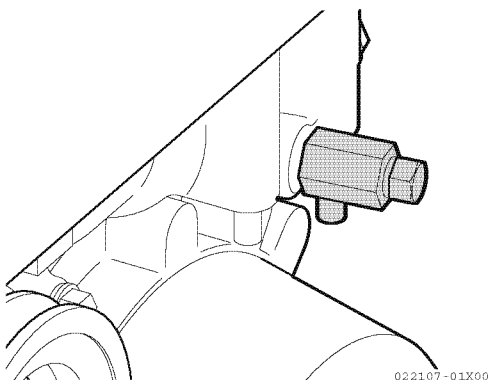
Cylinder block



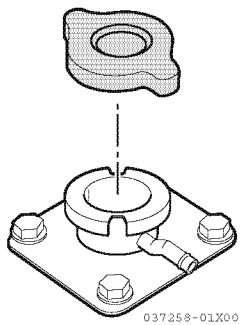
Exhaust manifold



coolant pump

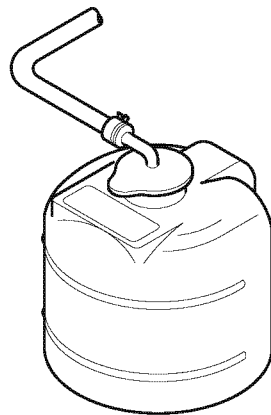


Coolant filler cap



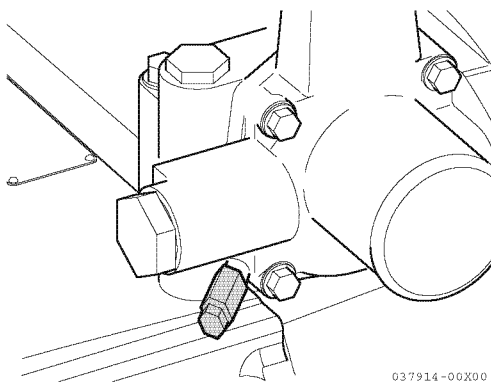
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Coolant reservoir tank



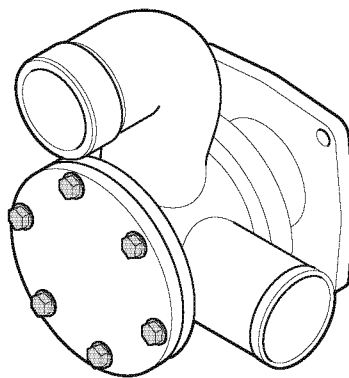
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Marine gear Lub. oil cooler



037914-00X00

Seawater pump



030247-01X00

Fuel system

The fuel system goes from the fuel tank to the fuel injection nozzle. If air enters this system, fuel is not injected. Bleed air completely out of the system by the following procedure.

1. The air bleeding is needed after the replacement of the fuel filter element as well.
 - 1- Open all cocks of the fuel system.

- 2- Loosen the air bleed plug on the top of the fuel water separator.

Make sure that fuel flows out of the air bleed plug and air is completely bled, and then tighten the plug.

- 3- Turn the priming pump knob on the fuel feed pump counterclockwise until the priming pump can be moved up and down.

- 4- Loosen the air bleed plug at the fuel filter, and operate the priming pump up and down. Make sure that fuel flows out of the air bleed plug and air is completely bled, and then tighten the plug and priming pump knob completely, otherwise fuel oil may leak.

2. When air is in the fuel oil system

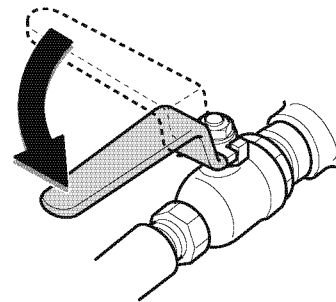
The fuel oil system has an automatic air bleeding device. In order to bleed the air, simply press down and up the fuel priming pump.

⚠ DANGER



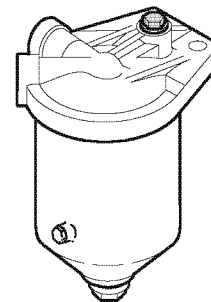
- Use only diesel fuel. Never use other fuels, including gasoline, kerosene, etc., because they could cause a fire. Be sure to check that you have selected diesel fuel before filling the fuel tank.
- Be sure to stop the engine and confirm that there are no open flames in the vicinity before supplying fuel.
- If you spill fuel, wipe such spillage carefully.

Fuel cock



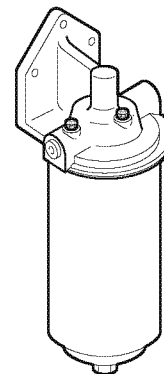
000016-01X01

Fuel water separator (option)



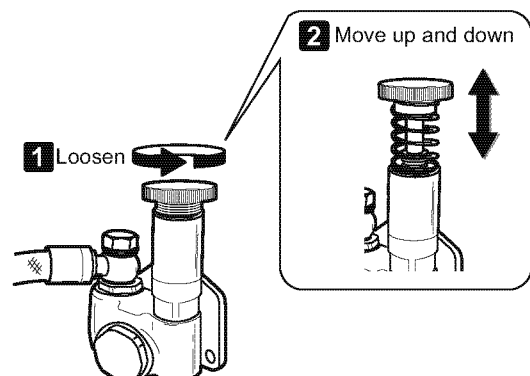
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Fuel filter



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Priming pump

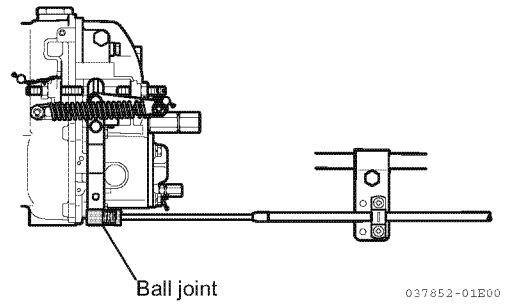


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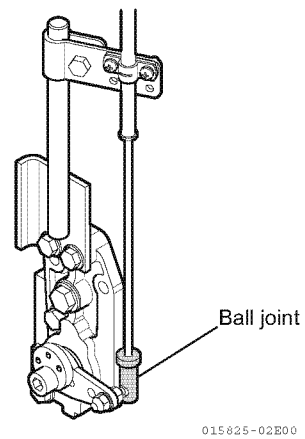
Lubrication

Apply grease to the lubricating points on the ball joints of remote control cable (for the governor and marine gear).

Governor

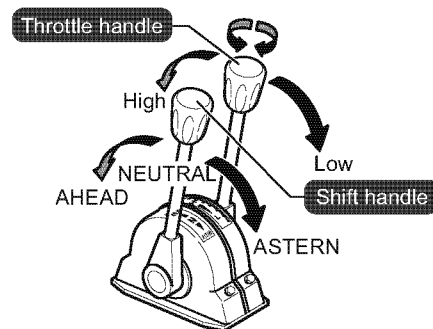


Marine gear



Remote control device (option)

1. Operate the throttle handle from the position "L" to the (full) position "H" and check that the governor lever at the governor moves into correct position. Adjust the control cable if necessary.
2. Operate the shift handle into "AHEAD", "NEUTRAL" and "ASTERN" and check that the marine gear control lever at the shift moves into correct positions. Adjust the control lever if necessary.

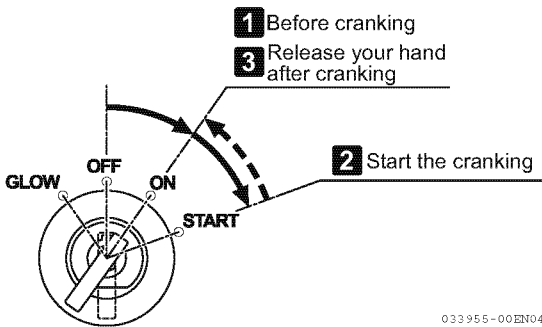


Cranking

So that oil reaches all moving parts of the engine sufficiently, crank the engine according to the following procedure.

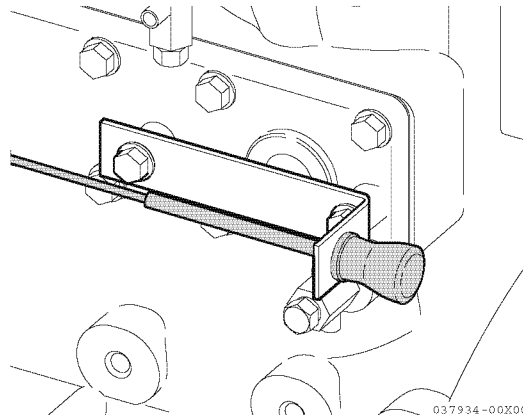
1. Open the sea cock.
2. Set the shift handle into the "NEUTRAL" position.
3. Set the throttle handle into the "L" position.
4. Turn the battery switch "ON".
5. Start cranking.
 - 1-Put the key in the starter switch and turn to ON position.
 - 2-Pull the engine stop knob while turning the key to the START position to start the cranking.
 - 3-Cranking time is 5 seconds; check for abnormal sounds during that time.

Starter switch



033955-00EN04

Stop knob

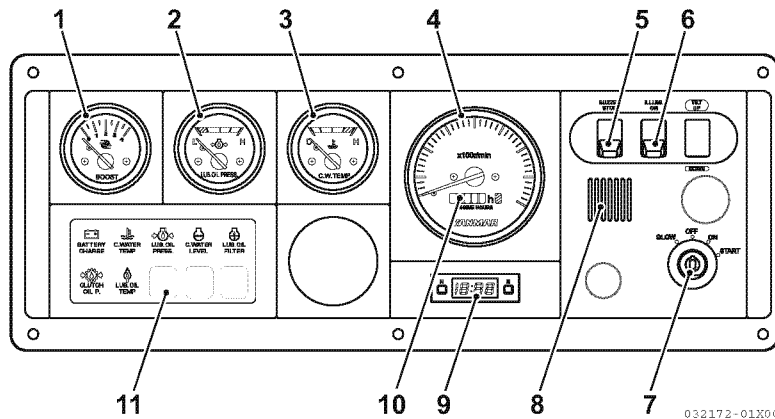


037934-00X00

Instruments check before starting

Turn the starter key to the "ON" position.

1. The needle of the oil pressure gauge should indicate "0".
2. Make sure that the cooling water (coolant) temperature gauge operates properly.
3. The hourmeter should be working.
4. With the illumination switch ON, the illumination lamps of the LO. pressure gauge, the boost pressure gauge, the tachometer, and the c.w. temperature gauge should all come on.



- | | | | |
|-------------------------|--|------------------------------|---------------|
| 1- Boost pressure gauge | 2- Engine lubricating oil pressure gauge | 3- Coolant temperature gauge | 4- Tachometer |
| 5- Buzzer stop switch | 6- Illumination switch | 7- Starter switch | 8- Buzzer |
| 9- Clock | 10- Hour meter | 11- Alarm display | |

● Buzzer

If one of the alarm lamps mentioned on below comes on, the buzzer will sound intermittently. However, no buzzer will sound when the charge lamp and lub.oil filter clogged alarm lamp comes on.

● Alarm lamps

Should any failure occurs, the corresponding alarm lamp will come on.

● Buzzer stop switch

The switch used to pause the buzzer sound. Do not turn off the buzzer stop switch unless you check for a failure.

● Illumination switch

The switch used to illuminate the instrument panel.

● Tachometer

It shows the engine speed by min^{-1} (rpm). The read value can be used as a guide for judging the load condition and the boat speed.

● Hour meter

It shows accumulate operation time.

The read value can be used as a guide for periodic maintenance checks. The information is displayed in a window inside the tachometer.

● Engine lubricating oil pressure gauge

It shows the engine oil pressure by 10^{-1} MPa. The red zone is a danger zone. The read value can be used as a guide for judging whether the engine is lubricated properly to prevent engine troubles.

● Coolant temperatures gauge

It shows engine coolant temperature by $^{\circ}\text{C}$ (centigrade). The red zone is a danger zone. The read value can be used as a guide for judging the engine cooling condition.

● Boost pressure gauge

It shows the pressure of the air that flows from turbo-charger by 10^{-1} MPa. The read value can be used as a guide for judging the turbocharger condition.

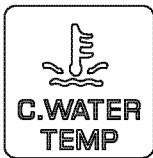
Alarm devices



000092-01X

BATTERY CHARGE

When the charge is abnormal, the lamp will come on. In this case, however, the buzzer will not sound. Check for failures such as a broken V-belt in the alternator.



000093-01X

COOLANT TEMPERATURE HIGH ALARM LAMP

Comes on if the coolant temperature becomes abnormally high. Continuing operation at temperatures exceeding the maximum will result in damage and seizure. Check the load and the water cooling system for any abnormalities.



000094-01X

LUBRICATING OIL PRESSURE LOW ALARM LAMP

Comes on if the engine lubricating oil pressure drops below the lower level. Continuing operation with insufficient oil will result in damage and seizure. Check the oil level.



000096-01X

COOLANT LEVEL LOW ALARM LAMP

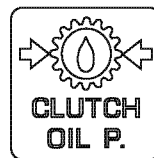
Comes on if the coolant level drops below the lower level. Continuing operation at temperatures exceeding the maximum will result in coolant temperature rise, damage and seizure. Check the coolant level. In addition, check that there is no leakage from the cooling system.



000097-01X

LUBRICATING OIL FILTER CLOGGED ALARM LAMP

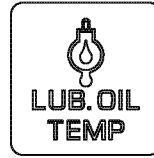
Comes on if the lubricating oil filter is clogging. The buzzer will not sound. Replace the filter element (cartridge) as soon as possible.



000095-01X

MARINE GEAR LUBRICATING OIL PRESSURE LOW ALARM LAMP

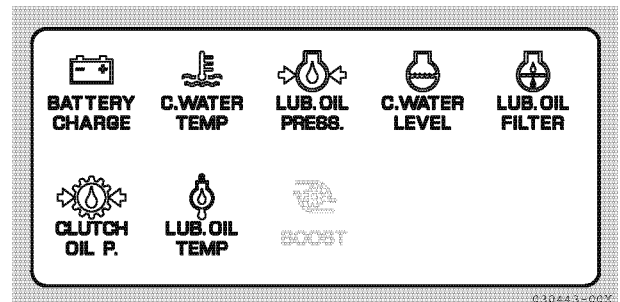
Comes on if the marine gear lubricating oil pressure drops below the limit level. Continuing operation with insufficient oil will result in damage and seizure. Check the marine gear lubricating oil level.



000098-01X

ENGINE LUBRICATING OIL TEMPERATURE HIGH ALARM LAMP

Comes on if the engine lubricating oil temperature becomes abnormally high. Continuing operation at temperatures exceeding the maximum will result in damage and seizure. Check the failures in the seawater cooling system.



Rechecking after starting

When a new engine is operated for the first time, the oil level of the oil pan will drop due to the engine oil circulating to the oil cooler, oil filter, etc.

Therefore, stop the engine after operating for two to three minutes.

Wait for about five minutes and then check the following items:

- Check the engine oil level with the dipstick, and add oil up to the upper level if necessary.
- Check the marine gear oil level with the dipstick, and add oil up to the upper level if necessary.
- Remove the filler cap from the coolant tank, and check the coolant level.

The coolant level may drop due to escaping air trapped in the cooling system up to the coolant tank.

If the level is below the filler neck, add coolant up to the filler neck.

DANGER



Never remove the filler cap when the engine is hot (above 60°C).

The coolant is under pressure and severe scalding could result.

OPERATION

Prior to starting the engine, check to see if there is nothing nearby the engine, particularly the rotating parts that may cause damage.

Starting

1. Move the shift handle to the neutral position "N".
2. Move the throttle handle to the position "L".

- Before starting engine

- 1- Turn ON the battery switch.

- 2- Put the key in the starter switch.

Turn the key from the OFF to ON position and check that alarm devices are shown in the table on page right "Before Starting" are working properly.

- The buzzer sounds briefly (for approx. 1 second).
- The battery charge lamp should sequentially-lighted; other alarm lamps should lighted and off after approx. 3 seconds.

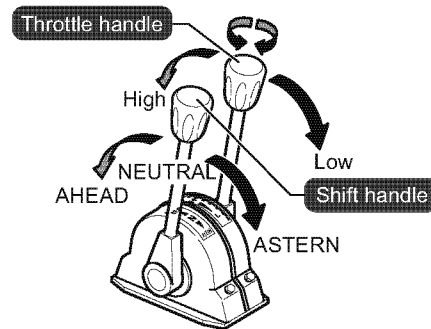
3. Turn it to the "START" position. Once the engine starts, release your hand from the key. Then it will return to the "ON" position automatically. With the key in the "ON" position, the power source of the instruments and warning devices is engaged.

- Checking just after starting engine

Check that alarm devices are shown in the table on page right "After Starting" are working properly.

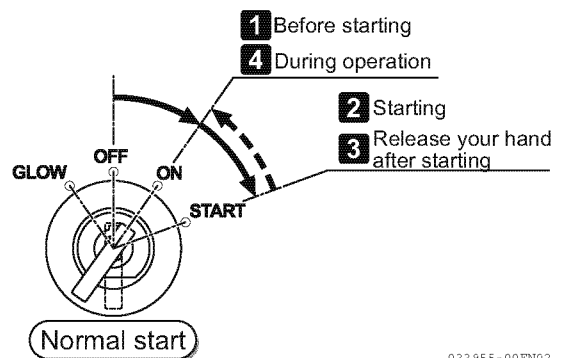
- The buzzer stops.
- All alarm lamps go off.

By performing these procedures, it can be determined whether or not the electric circuit of the buzzer and alarm lamps is in good working order. If there is any problem, consult your authorized Yanmar dealer or distributor for investigation and repair.



000044-03E01

Starter switch



033955-00EN02

Normal function of alarm devices		
	Before starting OFF→ON	After starting START→ON
Starter switch operation		
Buzzers	On	Off
Alarm lamps		
Battery charge lamp	On	OFF
Coolant temperature	On briefly	OFF
Engine lubricating oil pressure	On briefly	OFF
Marine gear lubricating oil pressure	On briefly	OFF
Coolant level	On briefly	OFF
Lubricating oil filter clogged	On briefly	OFF
Engine lubricating oil temperature	On briefly	OFF

NOTICE

- Do not turn off the battery switch when operating the engine.
- Do not turn off the key in the "OFF" position when operating the engine.
- If the engine did not start, do not continue cranking for longer than 15 seconds at any one attempt. Allow at least 30 seconds of rest between attempts. This will permit the battery to recover.
- When restarting, turn the starter switch after stopping the engine completely.
If the starter switch is turned on before the engine comes to a complete stop, serious damage to the starting motor pinion and ring gear of flywheel may result.

Cautions after starting

NOTICE

With the shift handle in the neutral position, observe the following instructions after starting.

- After starting, set the engine speed to 600 min⁻¹.
- Make sure that seawater is coming out from the cooling water (seawater) outlet.
- Check that the battery charge warning lamp (CHARGE) turning off consequently.
- Make sure that the coolant temperature gauge, on the instrument panel, reads 40°C or more.

Cautions during running with load

During running the engine, pay attention to the following.

■ Cooling water (seawater)

Make sure that water is coming out from the cooling water (seawater) outlet.

When water is coming out intermittently or in small volume, check the following.

- Air in the cooling system.
- Faulty cooling water pump impeller.
- Clogged cooling water pipe and sea cock.

If the cause can not be found, return to port at a low speed, and consult your nearest YANMAR dealer or distributor.

NOTICE

Never operate the engine if the seawater pump is not sucking up water. The seawater pump impeller will seize in about 30 seconds and become impossible to use again.

■ Coolant

Normally, the coolant temperature during running with load is 70 - 80°C.

If the temperature exceeds 85°C, check the following.

- Water leakage (temperature and water level warning devices activate)
- Faulty water pump or clogged coolant passage
- Faulty seawater pump or clogged seawater passage
- Insufficient cooling of coolant due to heat exchanger restriction

If the cause can not be found, return to port at a low speed, and consult your nearest YANMAR dealer or distributors.

NOTICE

As the coolant temperature rises after starting, hot water overflows from the coolant tank into the reservoir tank and the reservoir tank level rises. However this is not abnormal. After the engine is stopped, coolant returns naturally to the coolant tank.

■ Black smoke

Black smoke is a sign that the engine is overloaded. Such operation will shorten the life of intake and exhaust valves, piston rings, cylinder liners and particularly fuel injection nozzles. Avoid continuing operation if black smoke is being emitted, and consult your nearest YANMAR dealer or distributor.

■ Water leakage, oil leakage and other operational conditions

Always check whether there are water leakage, oil leakage, gas leaks, loose fasteners, and abnormal noise or temperature, and vibration or not.

■ Check for irregular vibration or noise.

Avoid operating the engine speed that produce resonance (critical speed). Depending upon the construction of hull, the engine and ship resonate at a certain rate of revolutions, and vibration may suddenly become great. Avoid operating the engine at critical speed.

■ Operation of shift handle

Be sure to operate the throttle handle at a low speed (less than 700 min^{-1} (rpm)).

If the marine gear is engaged or disengaged during high-speed or if it is used under half-clutch, the marine gear will damage or its life will be shortened.

■ Alarm devices

When the buzzer sounds during engine running check which alarm lamp is on, and then turn off the buzzer stop switch. Stop the engine immediately, and check for cause. If there is no abnormality, return to port at a low speed, and consult your nearest YANMAR dealer or distributor.

■ Long time operation at low speed

When the engine is operated for more than four hours at low speed, set the shift handle to the "NEUTRAL" position, and increase the engine speed without load for one minute at about 1800 min^{-1} (rpm) to discharge residue from cylinders every four hours operation.

Stopping

To stop the engine, set the shift handle to the "NEUTRAL" position, and perform the after no-load running at a low speed ($600 \sim 700\text{min}^{-1}(\text{rpm})$) for about five minutes.

NOTICE

If the engine stops at hot condition due to over heating, the temperature of the coolant and various engine parts will rise abruptly, and the engine may be damaged.

1. When stopping the engine, be sure to pull the engine stop knob until the engine stops.
2. Set the starter key switch to the "OFF" position after stopping engine.
3. Remove the key from the starter switch, and turn off the battery switch.
4. Close the fuel cock.
5. Close the sea cock.
6. While the engine is still warm, wipe off dust and dirt from the engine.
7. Discharge of cooling water

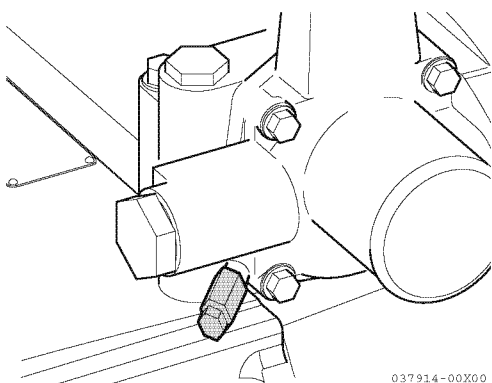
Because there is the possibility that cooling water (seawater) will freeze in sub zero temperature, be sure to close the sea cock and drain seawater after use of the engine. If the engine will not be used for a long time, also drain seawater completely. If this is not done the heat exchanger or seawater pump may be damaged by the freezing of cooling water in the seawater system.

NOTICE

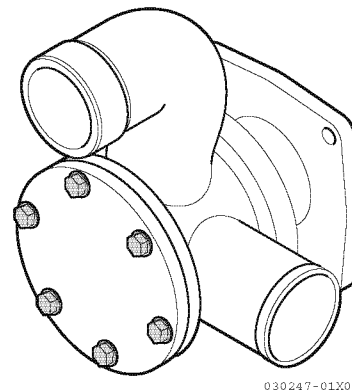
Always use LLC in the coolant system under these conditions. (Refer to [Cooling water (Coolant)])

Loosen the drain cock at the marine gear lub. oil cooler, and loosen also the seawater pump cover bolts to drain seawater.

marine gear Lub. oil cooler



Seawater pump



You do not need to drain the coolant if it is mixed with LLC.

NOTICE

Storing the engine without draining may cause the seawater left inside the engine to freeze and damage to parts (heat exchanger, lubricating oil cooler, seawater pump) in the cooling water passage.

Long-term storage

When the engine will not be used for a long term, perform the following.

Consult your YANMAR dealer or distributors.

- Choose a dry, dust-free location for storage.
- In cold areas, there is the danger of freezing and the cooling water should be completely drained off.
(Refer to [Stopping])
- Loosen the V-belt.
- Disconnect the battery terminals from the engine, and store the battery fully charged. Charge the battery once a month to compensate for the battery's self discharge.
- Remove any dirt, grime, or oil on the exterior and wipe it clean, and apply a coat of antirust oil or clean oil.
- Cover the exhaust pipe, intake, and electric devices with vinyl sheets to guard against moisture and dust.

Operating after long-term storage

Follow the steps below when reusing an engine which has been stored for 6 months or longer.

- Refer to [RUNNING-IN] before starting.
- Remove the rocker cover, and apply lub. oil to the rocker arms.
- Perform cranking before operation to distribute lub. oil to all of the parts. (Refer to [Cranking])
- Check the cracks of the V belt and adjust the V belt tension.
- Check the damage of the impeller of the seawater pump.

PERIODICAL MAINTENANCE

- Periodical maintenance is an important factor in keeping the engine in the best condition. In accordance with operating hours given in the following maintenance schedule, perform periodic maintenance.
- When the parts are disassembled for checking and/or servicing, reassemble them properly.

Periodic maintenance schedule

○ : Check or drain and clean, refill, adjust, lubricate, repair or replace if necessary.

⊙ : Replace

● : Please order YANMAR dealer or distributor to inspect your engine or to replace any parts if you will.

○: Inspection ⊙: Parts replacement ●: Contact your authorized YANMAR marine dealer or distributor

Item		Service period						Refer to page
		Daily	Every 50h (or weekly)	Every 250h (or monthly)	Every 500h (or every 3months)	Every 1000h (or every 6months)	Every 2500h (or annually)	
Fuel system	Check fuel level and refill	○						15
	Drain fuel tank deposit and water	○ (When replenished)						15
	Drain fuel-water separator deposit and water		○					36
	Replace fuel filter				⊙			36
	Clean fuel-water separate element				○			36
Lubrication system	Check oil pressure	○						22
	Check oil level and refill (oil pan and marine gear)	○						16
	Replace oil filter		⊙ (1st time)		⊙			37
	Clean by-pass oil filter (6CH-WUTE)		●		○			-
	Clean oil cooler						●	-
	Replace oil	Engine		⊙ (1st time)	⊙ (Sulfur content 0.5 ~ 1.0%)	⊙ (Sulfur content ≤ 0.5%)		
Marine gear			⊙ (1st time)		⊙			38
Cooling seawater system	Check cooling water discharging condition	○						27
	Check and replace seawater pump impeller					○	●	40
	Check zinc anodes				⊙			39
	Clean seawater system						●	-
Cooling coolant system	Check coolant temperature	○						22
	Check coolant level	○						41
	Change coolant						⊙	42
	Clean coolant system						●	41
Marine gear	Check and clean lube oil strainer		⊙ (1st time)		○			38
	Check and clean lube oil cooler						●	-
	Disassemble, check and clean parts						● Every 5000hrs (or 2 years)	-

○: Inspection ⊙: Parts replacement ●: Contact your authorized YANMAR marine dealer or distributor

Item		Service period						Refer to page
		Daily	Every 50h (or weekly)	Every 250h (or monthly)	Every 500h (or every 3months)	Every 1000h (or every 6months)	Every 2500h (or annually)	
Fuel injection pump and nozzle	Check injection timing			● (1st time)			●	-
	Overhaul fuel feed pump					● Every 5000hrs (or 2 years)		-
	Check injection pressure and spray form					●		-
	Replace injection nozzle						●	-
Cylinderhead	Check valve clearance		● (1st time)			●		35
	Lap valve and valve seat					● Every 5000hrs (or 2 years)		-
Piston	Draw-out of piston & removal of carbon					● Every 5000hrs (or 2 years)		-
	Check of piston rings & replacement					● Every 5000hrs (or 2 years)		-
Connecting rod	Check of crankpin bearing					● Every 5000hrs (or 2 years)		-
Cylinder liner	Measure cylinder bore					● Every 5000hrs (or 2 years)		-
Turbo charger	Clean prefilter and turbocharger			○				31
	Check air/gas leakage	○						-
	Overhaul					● Every 5000hrs (or 2 years)		-
Check and adjust the remote control cables				○ (1st time)	○			44
Re-tighten hose clips (Fuel, lub.oil, cooling water, breather and air line)			○ (1st time)		○			-
Check and replacement of rubber hoses (Fuel, lub.oil, cooling water, breather and air line)		○Check : per 2500 hrs ⊙Replacement : per 5000 hrs (or 2 years)						-
Electric device	Check warning lamp	○						22
	Check battery electrolyte level			○				45
	Check alternator drive belt tension		⊙ (1st time)		○			45
	Check wire harness					○		-
Engine exterior	Check on looseness of bolts & nuts	○						-
	Check on water / oil / gas leakage at various parts	○						-

Valve clearance adjustment

Adjusting the valve clearance should be done while the engine is cold. Please consult to your YANMAR nearest dealers or Distributors.

■ Valve bridge parallel adjustment

Adjustment procedures for the intake and exhaust valves are the same.

1. Turn the flywheel until the No.1 cylinder is at T.D.C. (Top Dead Center) on the compression stroke.
2. Loosen the valve bridge lock nut and loosen the bridge adjusting screw 1 - 2 turns.
3. Loosen the rocker arm lock nut and screw in the adjusting screw until the rocker arm tip just touches to the bridge center.

NOTICE

Do not tighten the adjusting screw or it will compress the valve spring, when it not possible to adjust.

4. Screw in the valve bridge adjusting screw until it just touches the valve stem.

NOTICE

Be careful not to screw in the adjusting screw since it will compress the valve spring.

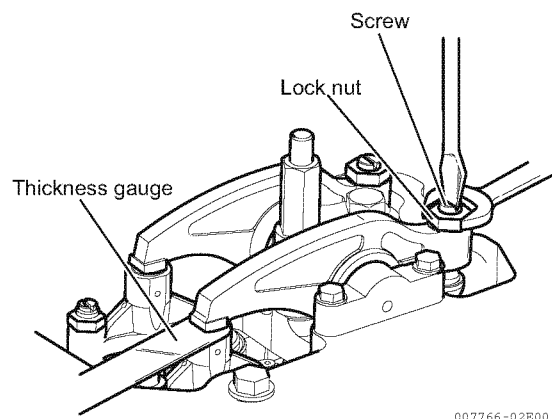
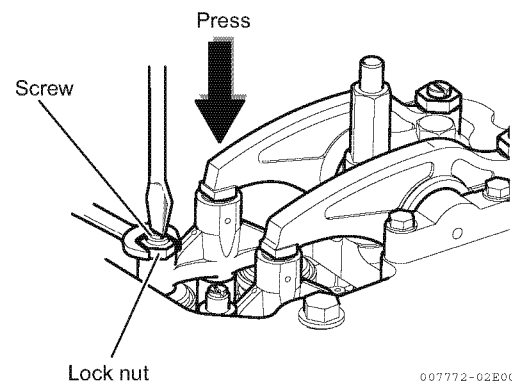
5. Keep the adjusting screw in this position and tighten the bridge lock nut with an open end wrench.
6. For other cylinders also follow same above procedure.

■ Valve clearance adjustment

Valve clearance	Intake	0.25mm
	Exhaust	0.35mm

Insert a thickness gauge between the rocker arm and the center of the bridge and adjust valve clearance by turning the adjusting screw. Tighten the lock nut and recheck the valve clearance.

Service period	1st time	50 hours
	2nd time and after	Every 1000 hours (or every 6 months)



Fuel system

(For fuel system diagram, refer to [Fuel system] on page 19.)

1. Fuel level check

Service period	Daily
-----------------------	--------------

Refill as required.

2. Fuel tank deposit draining

Open the drain cock on the tank to drain out sediment and water at the tank bottom.

Service period	Daily
-----------------------	--------------

3. Fuel filter element replacement

Service period	Every 500 hours
-----------------------	------------------------

Loosen the bolt in the center of the fuel filter and remove the filter case and element.

Replace the element with a new one.

When installing the new element and case, use new O-rings and Gasket; tighten the center bolt securely.

4. Fuel-water separator cleaning

Service period	Every 500 hours
-----------------------	------------------------

Loosen the center bolt and remove the filter case and element.

Clean the element by clean fuel oil.

When installing the clean element and case use new O-rings and Gasket; tighten the center bolt securely.

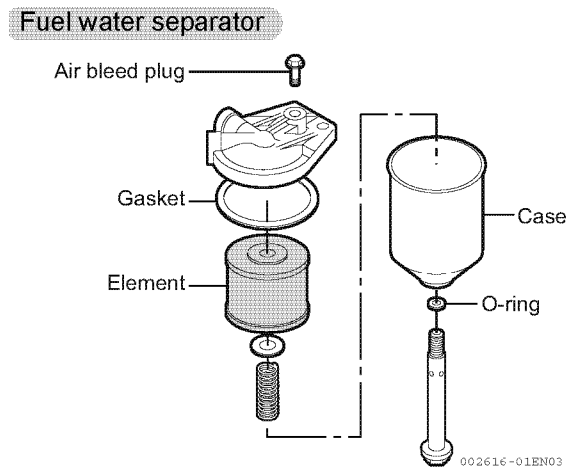
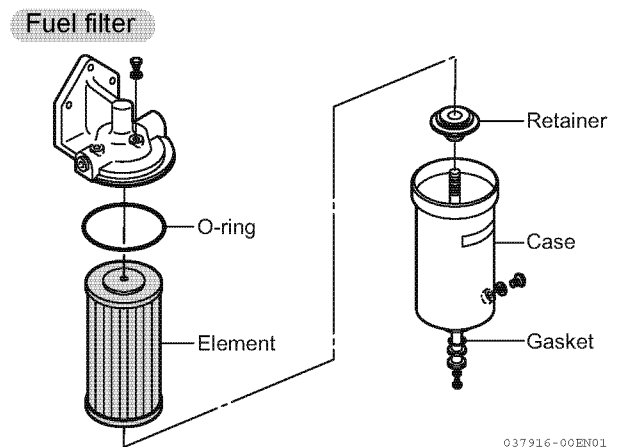
NOTICE

- Before installing the element, clean the inside of the filter case.
- Do not forget to install the spring, retainer and O-rings.
- After replacing and cleaning the element, be sure to bleed air from the fuel system.

5. Fuel-water separator draining

Remove the drain plug to drain water from the fuel-water separator.

Service period	Every 50 hours (or weekly)
-----------------------	---------------------------------------



Lubricating system

⚠ CAUTION

Be sure to stop the engine before you change oil and filter. If you disassemble while the engine operates, oil mist can spray out and burn you.

■ Oil level checking (Engine and Marine gear)

Check the oil level with the dipstick. Oil level must be maintained between the upper and lower level marks on the dipstick. Add the recommended oil up to the upper level mark, if necessary.

Service period	Daily (prior to operation)
-----------------------	-----------------------------------

■ Engine oil filter replacement

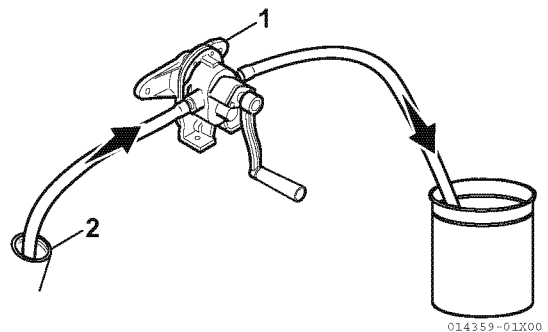
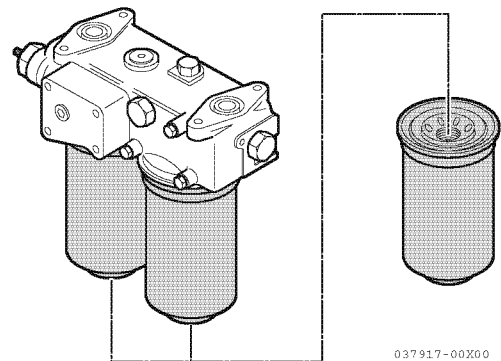
1. Remove the filter with the filter wrench. (Turn to the left.)
2. Before installing the filter, carefully wipe the installation side and apply lubricating oil to the packing surface.
3. Tighten the lub. oil filter fully by hand, and then use a filter wrench to further tighten the filter. (Turn to the right.)
4. Check for oil leakage during operation.

Service period	1st time	50 hours
	2nd time and after	Every 500 hours (or every 3 months)

■ Engine oil change

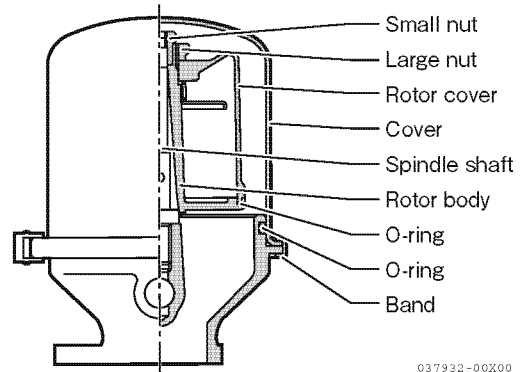
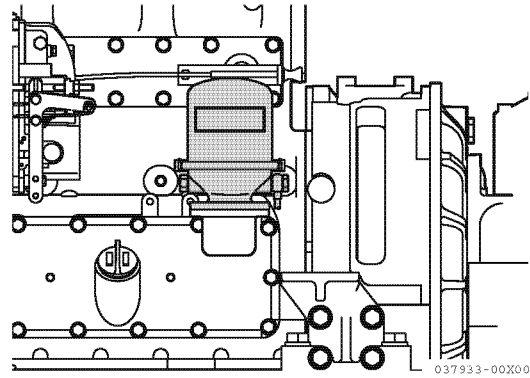
Wait for about one to two hours after stopping the engine, connect the end of the rotary pump (1) vinyl tube to the oil port (2), and drain oil. Fill the oil pan with recommended oil (refer to [Lubricating Oil]).

Service period	1st time	50 hours
	2nd time and after	Every 500 hours (or every 3 months)



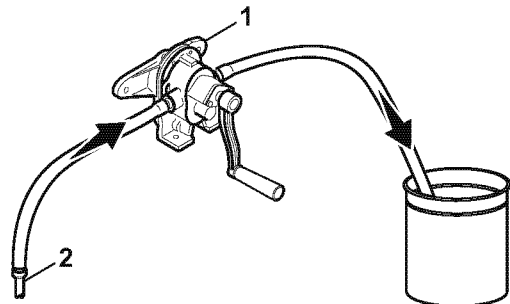
■ Clean the engine lubricating oil bypass filter (centrifugal type) (6CH-WUTE only)

1. Take off the band and remove the cover.
2. Loosen the nuts and remove the rotor cover and body.
3. Scratch the sludge is the rotor cover and body with a spatula and clean the inside.
4. Install the rotor cover on the body with the large nut by hand. When installing, use new O-ring and be careful not to forget the spring.
5. Tighten the small nut firmly.
6. Put in the band the cover.

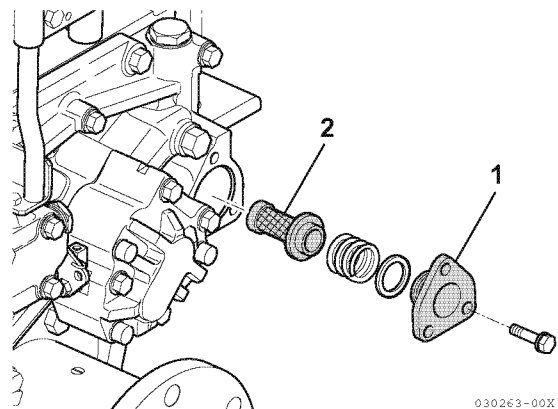


■ Changing the marine gear oil and cleaning the marine gear oil strainer

1. Remove the marine gear dipstick.
2. Connect the end of the rotary pump (1) vinyl tube to the top of dipstick (2), and drain oil.



3. Remove the side cover (1) and remove the filter element (net).
4. Clean the filter element (2) thoroughly with kerosene or clean diesel fuel.
5. Install the filter element, spring, seal and cover.
6. Tighter the cover bolts firmly.
7. Fill the marine gear box with recommended oil.



Service period	1st time	50 hours
	2nd time and after	Every 500 hours (or every 3 months)

Cooling system (seawater and coolant)

Seawater system

Discharging seawater

From time to time during operation, check if water is coming out of the seawater outlet pipe. If water comes out intermittently or its volume is low during a high-speed run, stop the engine immediately, and check for the cause. (Refer to [Fuel system]).

Service period	Daily (durings operation)
----------------	---------------------------

Checking and replacement of zinc anodes

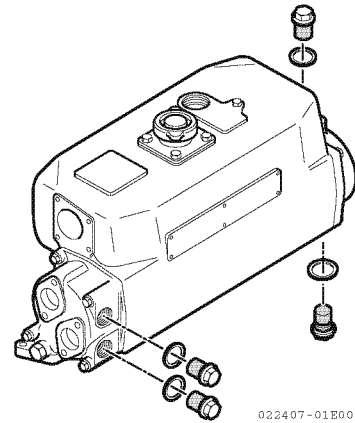
Remove the zinc anode and scrape or remove with a wire brush the coating on the zincs. If more than 50% of the zinc is corroded away, it should be replaced with new zinc.

Zinc anodes are built into the following places:

	Q'ty
Heat exchanger	4
Air cooler	2
Engine lub. oil cooler	2
Marine gear lub. oil cooler	2

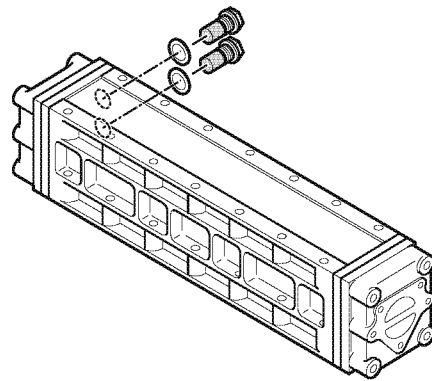
Service period	Every 500hours (or every 3months)
----------------	--------------------------------------

Heat exchanger



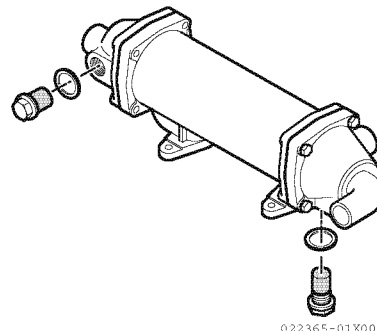
022407-01E00

Air cooler



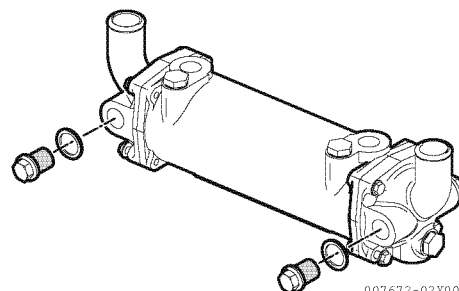
022408-01X00

Engine lub. oil cooler



022365-01X00

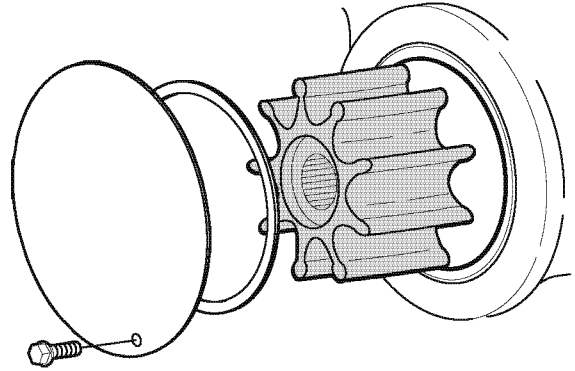
Marine gear lub. oil cooler



007672-02X00

■ Checking and replacement of seawater pump impeller and casing

1. Remove the seawater pump cover and pull out the impeller. Check the impeller, wear plate, cover, and mechanical seal for wear or damage.
2. If the wear plate and cover are excessively worn, replace them with new ones.
3. When reassembling the pump, apply grease to the fitting area of the pump shaft and impeller, both end faces of the impeller and the tip of impeller blades.
4. When installing the impeller, position blades of the impeller as shown in figure at right.



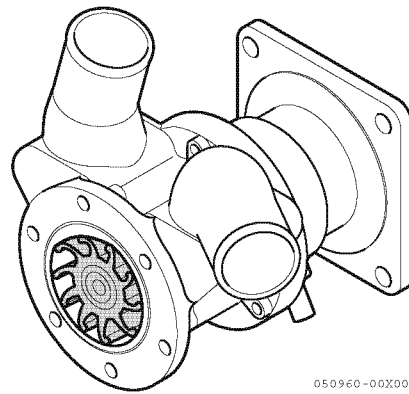
050981-00X00

Service period	Checking	Every 1000 hours (or every 6 months)
	Impeller replacement	Every 2500 hours (or annually)

■ Seawater system cleaning

As the engine is used, coolers become fouled, their cooling effect worsens, and coolant temperature becomes abnormally high (above 85°C). Consequently, eliminate fouling of the seawater system, coolers in particular.

To clean the seawater system, consult your nearest YANMAR dealer or distributor.



050960-00X00

Coolant system

■ Coolant level checking

1. Remove the filler cap from the coolant tank, and check coolant level.

The level should be at the filler neck. If the level is low, add coolant up to the filler neck.

DANGER



Do not remove the filler cap when the engine is hot (above 60°C)
The coolant is under pressure and severe scalding could result.

2. On the cooling system with reservoir tank, check the coolant level in the reservoir tank. The level should be between the "FULL" and "LOW" level marks. Add coolant up to the "FULL" mark.

Service period	Daily
-----------------------	--------------

■ Water pump leakage checking

Leakage of coolant may cause serious problems, such as seizure of the engine, as the volume of coolant decreases.

Check that there is no water leakage from the water pump.

If there is water leakage, consult your nearest YANMAR dealer or distributor.

Service period	Daily
-----------------------	--------------

■ Coolant system cleaning

As the coolant system becomes dirty naturally, cooling efficiency worsens, and coolant temperature becomes abnormally high (above 85°C) when the engine is operated for long time: clean the coolant system periodically. At the same time, clean the thermostats. As for periodic servicing, consult your nearest YANMAR dealer or distributor.

Service period	Every 2500hours (or annually)
-----------------------	--

■ Coolant change

Service period	Every 2500hours (or annually)
----------------	----------------------------------

NOTICE

- Be sure to replace the coolant at the specified time.
- Be sure to follow the correct mixture ratio for long life coolant (LLC). (Refer to [Cooling water (Coolant)])

Turbocharger

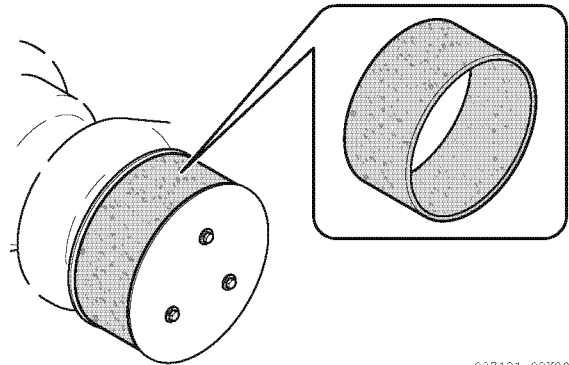
Clearing of prefilter and turbocharger

If you notice that the engine seems sluggish or the smoke color is abnormal, the turbocharger pre-filter and blower may be contaminated.

■ Wash the pre-filter

A pre-filter removes contaminations in the air and keeps the engine output in good condition.

1. Wash the pre-filter with a neutral detergent.
2. Wash the pre-filter with tap water, dry it sufficiently, and install.

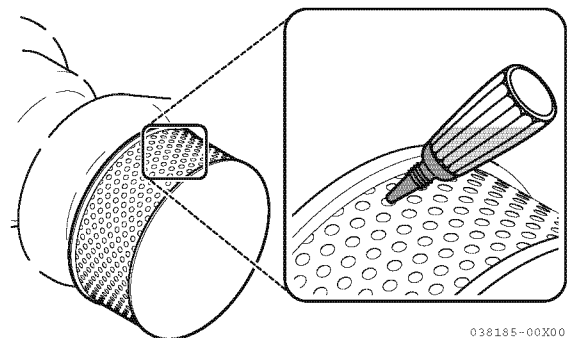


037121-02X00

■ Wash the blower

If the turbocharger blower is contaminated, the blower speed decreases and the boost pressure drops, causing the engine output to fall. Wash the blower, if the pressure drops (approx. 10% pressure drop compared with normal condition).

1. Prepare the blower wash fluid, tap water, and oiler.
2. Remove the pre-filter from the intake silencer.
3. During the load operation, fill 50cc of the blower wash fluid slowly in approx. 10 seconds.
4. Approx. 3 minutes after filling the blower wash fluid, fill 50cc of the tap water in approx. 10 seconds.
5. Continue the load operation for approx. 10 minutes to dry and check the output recovery.



038185-00X00

6. Repeat the above washing operation for 3 to 4 times, if the performance is not recovered. Contact your YANMAR dealer or distributor for repair, if the performance does not recover after repeating the washing operation for 3 to 4 times.

Interval	Pre-filter	When the boost pressure drops by 10% in comparison with the trial run. Or every 250 hours (1 month).
	Blower	

NOTICE

Do not fill a large amount of the wash fluid and tap water at once. It may result in a water hammer accident.

■ **Checking each joint area**

Check the turbocharger-to-intercooler and turbocharger-to-exhaust manifold connections for damage or leaks.

Service period	Daily
----------------	-------

■ **Overhaul**

Consult your nearest YANMAR dealer or distributor.

Service period	Every 5000hours (or 2years)
----------------	--------------------------------

Charge air cooler

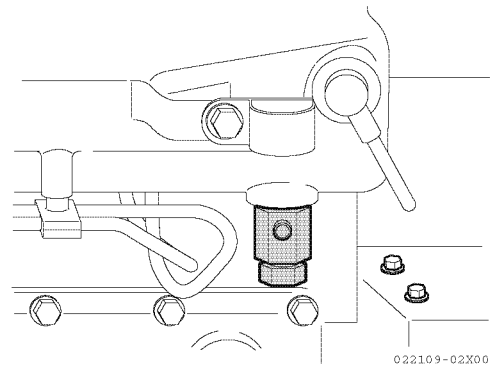
- **Checking and replacement of zinc anodes (refer to [Cooling system (sea-water and coolant)])**

Service period	Every 500hours (or every 3months)
----------------	--------------------------------------

- **Drainage (air intake manifold)**

Condensed water may remain in the bottom of the intake manifold during engine operation. Be sure to drain before and after engine operation. Also, check for water leakage in the intercooler.

Service period	Daily
----------------	-------



Injection nozzle (consult your YANMAR dealer or distributor)

- **Replacement**

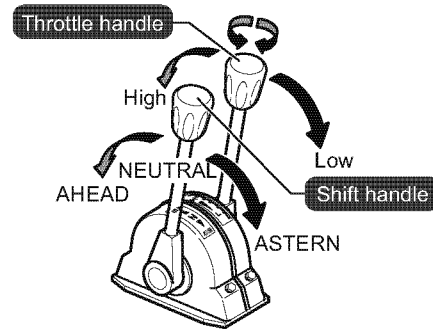
Remove the injection nozzle, and replace it with a new one.

Service period	Every 2500hours (or annually)
----------------	----------------------------------

Remote control cables

■ Throttle handle

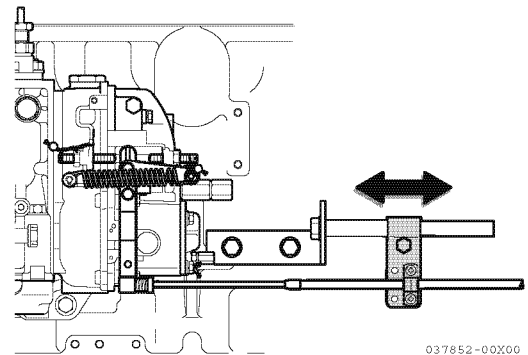
Operate the throttle handle from the position "L" to the position "H", and check if the governor lever at the governor moves into the correct position. If there is disalignment between the throttle handle and the governor lever in their position, adjust the control cable by changing the clamping position of the bracket.



000044-03E01

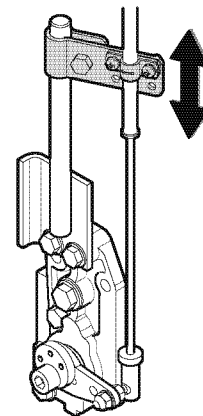
■ Shift handle

Check if the control lever at the marine gear moves when the shift handle is operated in the ahead, neutral and astern positions. If there is a disalignment between the lever and the handle, adjust the control cable by changing the clamping position of the bracket.



037852-00X00

Service period	1st time	50 hours
	2nd time	Every 500 hours (or 3months)



015825-02X00

Electrical parts

■ Checking warning lamps and devices

⚠ DANGER

Ventilation of the battery area



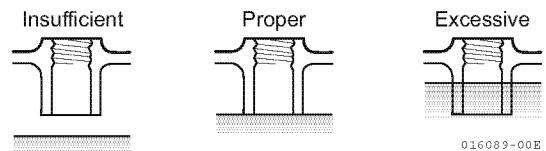
Recharging produces hydrogen gas. Provide a good ventilation and keep open flames and sparks away from the area.

Refer to [Alarm devices].

Service period	Daily
----------------	-------

■ Battery electrolyte level

Battery electrolyte decreases as charging and discharging are repeated. Check if the electrolyte level is 10 ~ 20 mm above the pole plates. If level is low, add distilled water, referring to the figure at right.



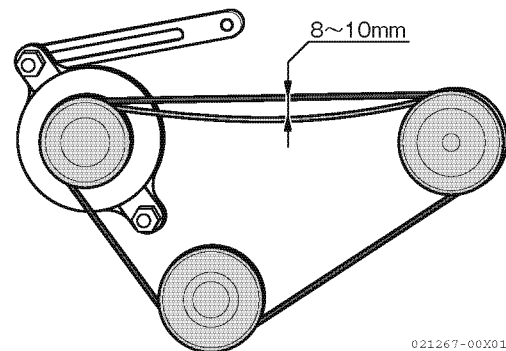
016089-00E

Service period	Every 250hours (or every months)
----------------	-------------------------------------

■ Alternator drive belt tension

If tension of the V-belt is too strong, wear and tear of the V-belt are more rapid. If too weak, V-belt slips and the alternator does not charge. Check if the belt deflection is within 8 to 10 mm by pushing the center of the belt between the pulleys with a finger.

To adjust, adjusting bolts and move the alternator until the proper belt tension is obtained.



021267-00X01

Deflection	within 10 mm
Service period	Every 500 hours (or every 3months)

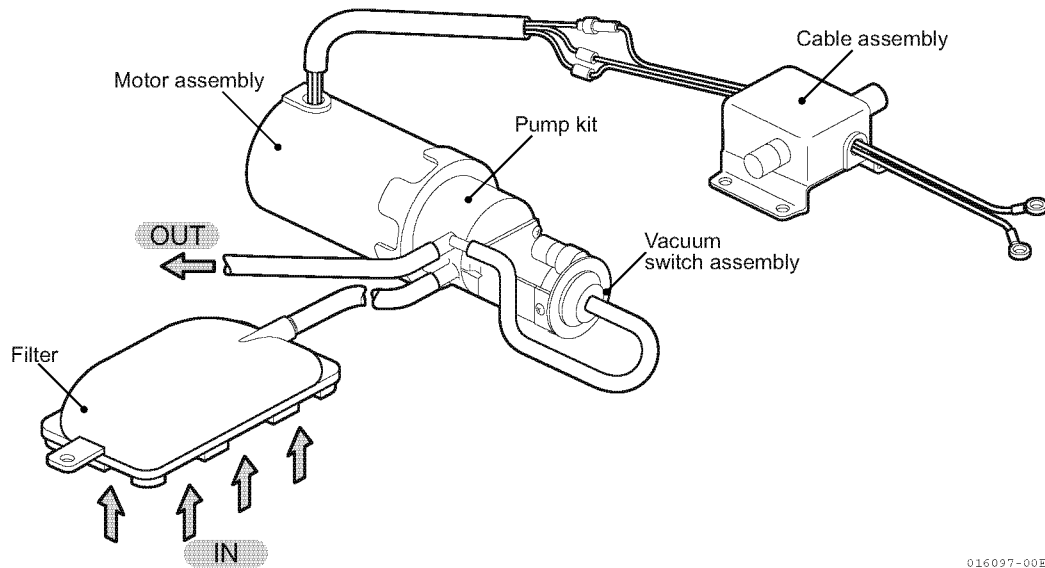
YANMAR Standard motor-driven bilge pump (option)

■ Features

- Since parts of this bilge pump that come in contact with bilge are made of polyvinyl chloride (PVC) and acid and alkali resistant materials, you may use this pump without worrying about its wearing out.
- There is no need to worry about idling or seizure of this bilge pump because it is equipped with a protective device which brings about an automatic stop when bilge is gone and the pump does not lift anything.

■ Method of fitting and use

- Connect the red wire to positive (+) and black wire to negative (–) respectively, avoid mis-wiring.
- Install the pump body where it can be used easily with the battery and operating switch as the pump body is connected with 3m long cord.
- Fit the strainer part of the bilge pump to the ship bottom by use of metal fittings.



016097-00B

Operation
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TROUBLESHOOTING & COUNTERMEASURES

The causes of abnormalities and troubles are diverse, and they break out from composite 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.

- **Starting failure**
 - Flywheel not turned.
 - Flywheel turned, but ignition not taken place.
- **Rotational speed dropped spontaneously**
- **Output of each cylinder not in uniformity**
 - (Dispersion of the exhaust temperature is large among cylinders)
- **Black smoke, white smoke**
- **Lub. oil pressure dropped below the specified pressure**
- **Unusual sounds heard (knocking occurred) during operation**
- **Coolant temperature too high**
- **Exhaust temperatures of all the cylinders too high**
- **Engine stopped suddenly**

NOTICE

- Although some failures can be solved by the user, others are not. For failures that require disassembly for repair and servicing or those that are not covered in this chapter, consult your Yanmar dealer or distributor.
 - If you judge that you can continue using the engine after inspection, cruise at a slow speed to return to port and, when landed, ask for repairs. If you cannot judge on your own, ask your Yanmar dealer or distributor.
 - Do not operate the engine if alarm devices are not working properly. Doing so may lead to a severe accident in case of a failure because you will not receive any alarm notifications.
-

Starting failure

■ Flywheel not turned

Cause	Countermeasure
1. Electric power starting system <ul style="list-style-type: none"> • Battery voltage drop • Failure of starter motor 	Charge the battery. Check and repair the starter motor. Warm up the engine or change the current lub. oil with a low-viscosity one.
2. Too high viscosity of lubricating oil	
3. Seizure of moving part <ol style="list-style-type: none"> 1. Seizure of piston and cylinder liner 2. Seizure of main bearing and / or camshaft bearing 	
	Consult your YANMAR dealer or distributor. Consult your YANMAR dealer or distributor.

■ Flywheel turned, but ignition not taken place

Cause	Countermeasure
1. Fuel oil not sent under pressure to fuel injection pump <ul style="list-style-type: none"> • Fuel tank empty • Clogging of fuel oil pipe (improper opening and closing of each valve) • Clogging of fuel oil filter • Failure of fuel feed pump • Air entry through each joint 	Supply the fuel to the fuel tank. Check the opening and closing status of each valve. Clean the filter. Consult your YANMAR dealer or distributor. Check and repair each joint, then bleed air.
2. Poor airtightness of intake / exhaust valve	
1. No clearance at head of intake / exhaust valve 2. Sticking of intake / exhaust valve 3. Damage of seat of intake / exhaust valve	
3. Too low cetane number of fuel	Use a high- quality fuel oil.

Rotational speed dropped spontaneously

Cause	Countermeasure
1. Clogging of fuel oil filter	Replace the filter element.
2. Seizure of moving part (piston, main bearing or turbocharger)	Consult your YANMAR dealer or distributor.
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.

Output of each cylinder not in uniformity

(Dispersion of the 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	Consult your YANMAR dealer or distributor.

Black smoke, white smoke

Cause	Countermeasure
1. Improper adjustment of boost compensator	Check and adjust the boost compensator.
2. Improper injection timing	Consult your YANMAR dealer or distributor.
3. Improper adjustment of intake / exhaust valve clearance or damage of intake / exhaust valve seat	Consult your YANMAR dealer or distributor.
4. Sticking of intake / exhaust valve	Consult your YANMAR dealer or distributor.
5. Damage of intake / exhaust cam	Consult your YANMAR dealer or distributor.
6. Defect of turbocharger	
• Clogging of filter	Wash the filter.
• Fouling of the blower side or turbine side	Wash the turbocharger / blower.
7. Fouling of charge air cooler (too high temperature of boost air)	Consult your YANMAR dealer or distributor.
8. Shortage of fuel oil	Use a high-quality fuel oil.
9. Overload	Reduce the load.

Lub. oil pressure dropped below the specified pressure

Cause	Countermeasure
1. Looseness of lub. oil pipe	Check and repair the lub. oil pipe.
2. Clogging of lub. oil filter	Replace the lub. oil filter.
3. Excessive clearance of crankshaft bearing	Consult your YANMAR dealer or distributor.
4. Sticking of lub. oil pressure regulating valve or loose adjusting bolt	Consult your YANMAR dealer or distributor.
5. Sticking of lub. oil safety valve	Consult your YANMAR dealer or distributor.
6. Too high temperature of lub. oil	
• Shortage of cooling water volume	Check the cooling water pump.
• Fouling of lub. oil cooler	Check the cooler, then overhaul and clean it.
• Excessive blow-by (gas leak) into the crankcase	Check the piston rings and cylinder liner.
7. Air sucked in lub. oil pump (shortage of lub. oil volume)	Replenish the lub. oil.

Unusual sounds heard (knocking occurred) during operation

Cause	Countermeasure
1. Excessive clearance of bearing for crankshaft and camshaft	Consult your YANMAR dealer or distributor.
2. Loose bolts	
• Connecting rod bolts	Consult your YANMAR dealer or distributor.
• Flywheel clamping bolts	Consult your YANMAR dealer or distributor.
3. Improper adjustment of intake / exhaust valve head clearance or loose bolt	Consult your YANMAR dealer or distributor.
4. Improper adjustment of fuel injection timing	Consult your YANMAR dealer or distributor.
5. Increase of gear backlash or wear of gear bearing	Consult your YANMAR dealer or distributor.

Coolant temperature too high

Cause	Countermeasure
1. Shortage of cooling water volume	Check and repair the cooling water pump.
2. Sticking of cooling water thermostatic valve	Check or replace the thermostatic valve.
3. Coolant level is low.	Refill with coolant.
4. Coolant is leaking.	Locate where leakage is present and take corrective measure such as tightening and replacing part.

Exhaust temperature of all the cylinders too high

Cause	Countermeasure
1. Charge air temperature too high <ul style="list-style-type: none"> • Charge air cooler cooling water temperature too high • Shortage of charge air cooler cooling water volume • Fouling of charge air cooler (cooling water side & air side) • Engine room temperature too high 	Check the cooling water system, and lower the cooling water temperature to the specified range. Check and repair the cooling water pump. Consult your YANMAR dealer or distributor. Check and service the engine room ventilation equipment.
2. Boost pressure too high <ul style="list-style-type: none"> • 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.

Engine stopped suddenly

Cause	Countermeasure
1. Protective device switched on <ul style="list-style-type: none"> • Overspeed • Lub. oil pressure drop • Temperature rise of cooling water excessive 	Check the switch, then repair the defective part. If necessary, replace the pertinent part.
2. Fuel tank empty	Replenish the fuel oil.
3. Air mixed in fuel oil system	Bleed air from the filter and oil pipe.
4. Clogging of fuel oil filter	Replace the filter element.
5. Seizure of interlocking part (piston, main bearing, crank-pin bearing, timing gear, etc.)	Consult your YANMAR dealer or distributor.

Handling of emergency bolts for marine gear trouble

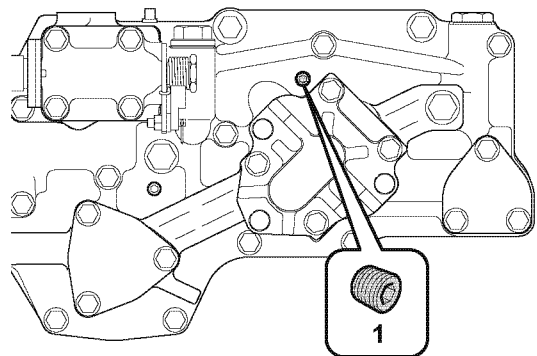
If trouble occurs in the marine gear lube oil pressure system during operation, the boat will not run. In case of this emergency, follow the following procedure for using the clutch emergency bolt to return to port.

⚠ WARNING

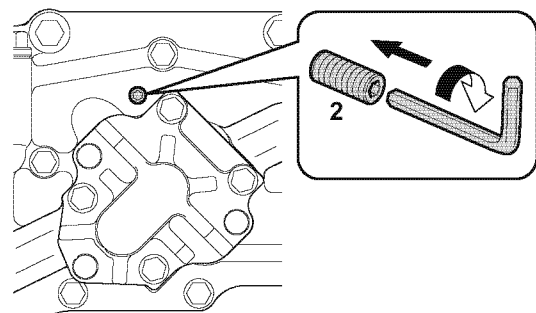
- Using the emergency bolt directly connects the clutch to the engine making it possible to turn the propeller. However, when the engine is started and the propeller turns, the boat will only move forward. The neutral and reverse positions cannot be used. The emergency bolt should only be used in cases where it is impossible to operate the clutch and the boat must return to port. Ask your Yanmar dealer for repairs immediately after returning to port.
- When using the emergency bolt, never use the shift handle.
- Operate at low speed, 1000 min^{-1} or less, and navigate carefully.
When approaching the pier, turn off the engine early and stop the boat.
- High speed operation may cause seizure of the clutch disc or metal.

1. Stop the engine and remove the emergency bolt plug (1) from the marine gear case. Then slightly and uniformly tighten four emergency bolts (2) on the clutch rotation section by turning them clockwise. After that, firmly tighten the bolts again. To view the emergency bolts again, the engine must be rotated slowly until the emergency bolt are visible through the emergency bolt plug hole.
2. Now the clutch is connected to the ahead side. You can temporarily run the engine at a low speed (1000 min^{-1} or less).

Note: To tighten the emergency bolts, turn the engine until the head of the bolt lines up with the hole, and tighten the four bolts evenly.



030455-00X



030456-00X03

WIRING DIAGRAMS

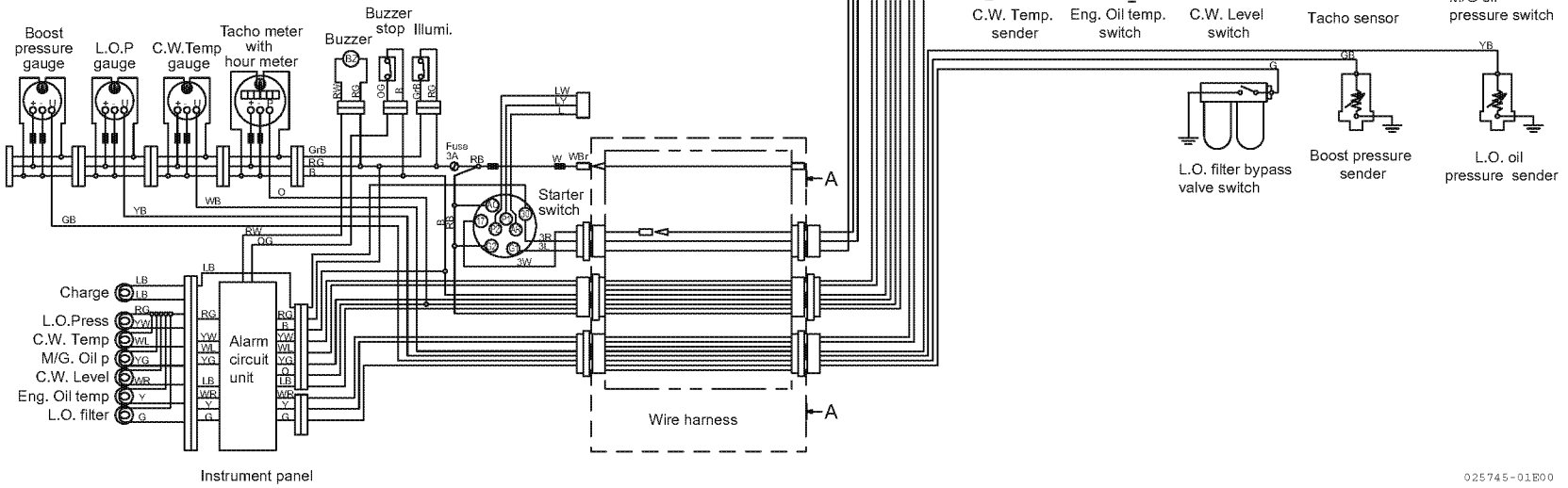
■ 24V engine negative ground type

Color coding	
R	Red
B	Black
W	White
Y	Yellow
L	Blue
G	Green
O	Orange
Lg	Light green
Lb	Light blue
Br	Brown
P	Pink
Gr	Gray
Pu	Purple

Starter switch		30	AC	17	G1	G2	P1	P2	AR
GLOW	OFF	○					○	○	
ON	○	○					○	○	
START	○	○	○	○			○	○	



Detail of connector (Arrow A-A)



025745-01E00

RECORD OF OWNERSHIP

Take a few moments to record the information you need when you contact Yanmar for service, parts or literature.

Engine Model: _____

Engine Serial No.: _____

Date Purchased: _____

Dealer: _____

Dealer Phone: _____

Operation
Manual
YANMAR

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**MARINE PROPULSION
ENGINE**

YANMAR

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