

YANMAR

OPERATION MANUAL

MARINE PROPULSION ENGINE

**6AYM-WGT
6AYM-WET
6AYM-WST**

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	6AYM-WGT, 6AYM-WET, 6AYM-WST
	Code No.	0A6AY-G00400

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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 freshwater 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.

DANGER

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.

DANGER

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.

WARNING

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.

⚠ WARNING

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 freshwater 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.

⚠ DANGER

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.

⚠ WARNING**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.

⚠ 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.

⚠ 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 freshwater.

⚠ 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.

NOTICE**No modification**

To keep the engine at normal condition, your engine has been sealed for the engine speed limit control and the fuel injection quantity control. If a seal is released, it will result in wears of the engine sliding parts and moving parts, deterioration in performance, which may shorten the engine life significantly. As a result, it may lead to the increase in lubricating oil consumption, and fuel consumption, seizure in each portion and breakage. Never break the seal. If the seal is released, no warranty will be given even during the warranty period.

5 — FOR YOUR SAFETY

■ Regulation on NOx

Laws on maritime pollution and hazard prevention regulate the replacement of certain parts. The laws require that you keep a record and the signature of personnel who replaces them. All inspections and maintenance must be performed by our professional service technicians with the 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 receive 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

For safe operation, the affixed position of the warning labels is indicated.

Read the remarks of the warning labels carefully to attempt prevention of the accident.

Also, if you need to replace a part that has a label affixed to it, make sure you order the new part and label at the same time.

If the warning labels are damaged or fallen, order them from your authorized YANMAR dealer or distributor.

■ Operation side

1

危険 DANGER

- 高温時にはキャップを開けないで下さい。●熱湯が吹き出しやけどをする恐れあり。
- Never remove the cap while the engine is still hot. ●Hot water may spurt out and burn you.

128296-07260

2

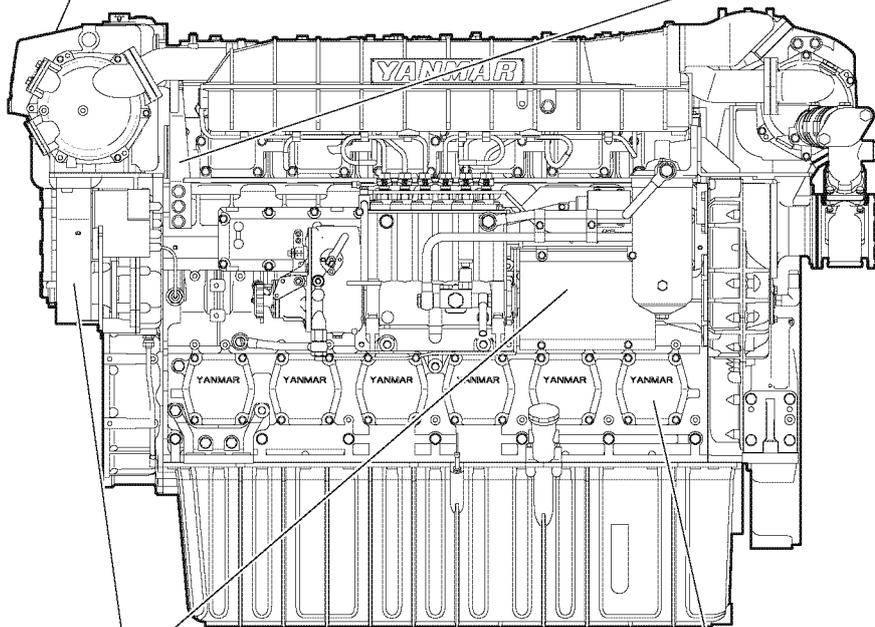
危険 DANGER

機罩の吊り上げには、必ず上図の様に2ヵ所の吊上げ金具を使用して下さい。

When lifting the engine, lift only as shown in diagram.

質量の目安 (ton)	mass
0.5	1
1	2
2	3
3	4
4	5

148616-07362



4

警告 WARNING

- ・運転中は、ぜったいに手や指を入れないでください。
- ・ケガをする恐れがあります。
- ・Exposed moving parts
- ・Can cause injury

141616-07210

3

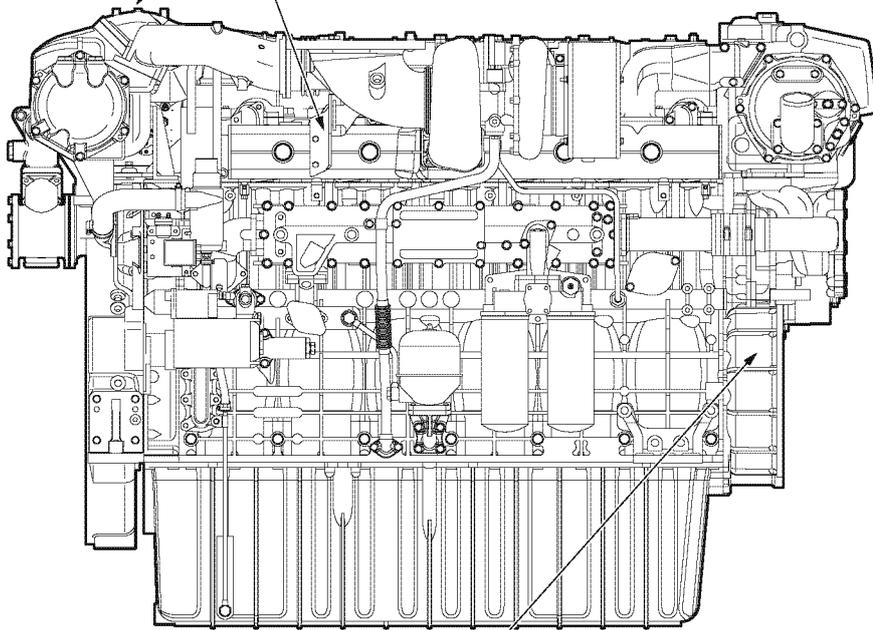
警告 WARNING

- ・停止後、10分間は開けないで下さい。
- ・新気混入により爆発の恐れがあります。
- ・Don't open 10min. after stop
- ・Can cause injury by explosion

141616-07200

No.	Part No.
1	128296-07260
2	148616-07362
3	141616-07200
4	141616-07210

■ Non-operation side



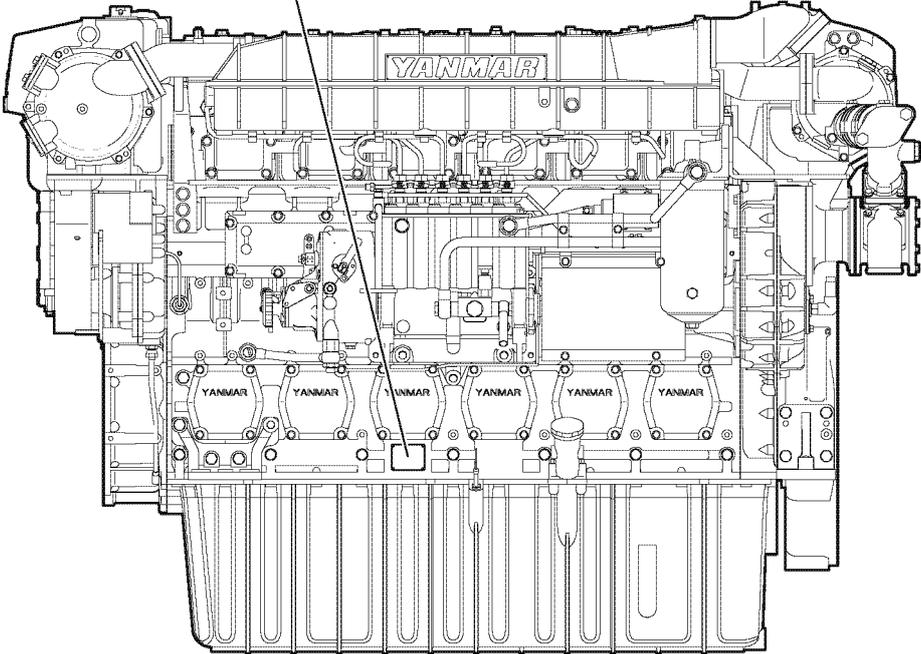
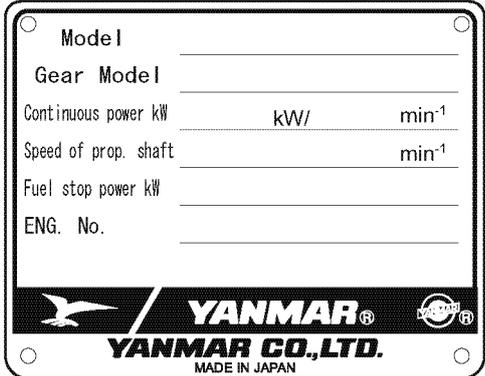
No.	Part No.
1	141616-07220
2	141616-07210

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 under the No.4 cylinder side cover of the cylinder block on the fuel injection pump side.



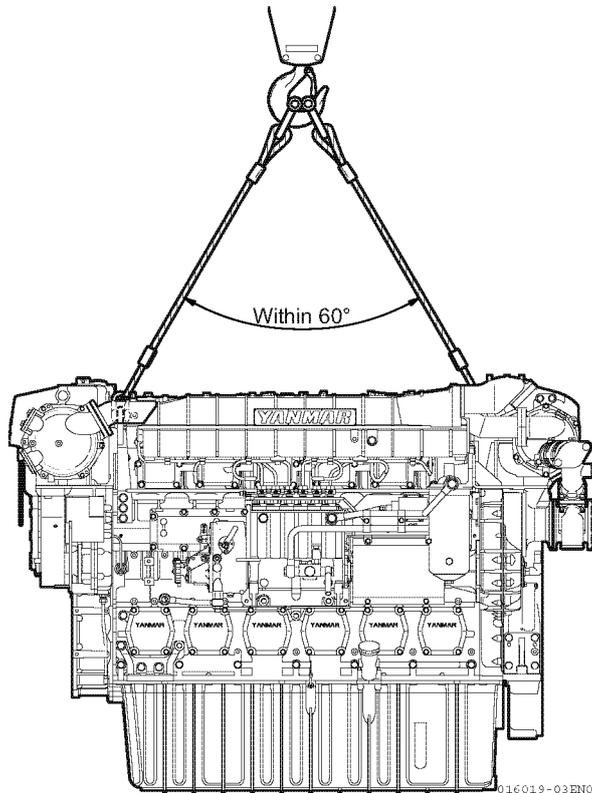
037856-00X00

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.



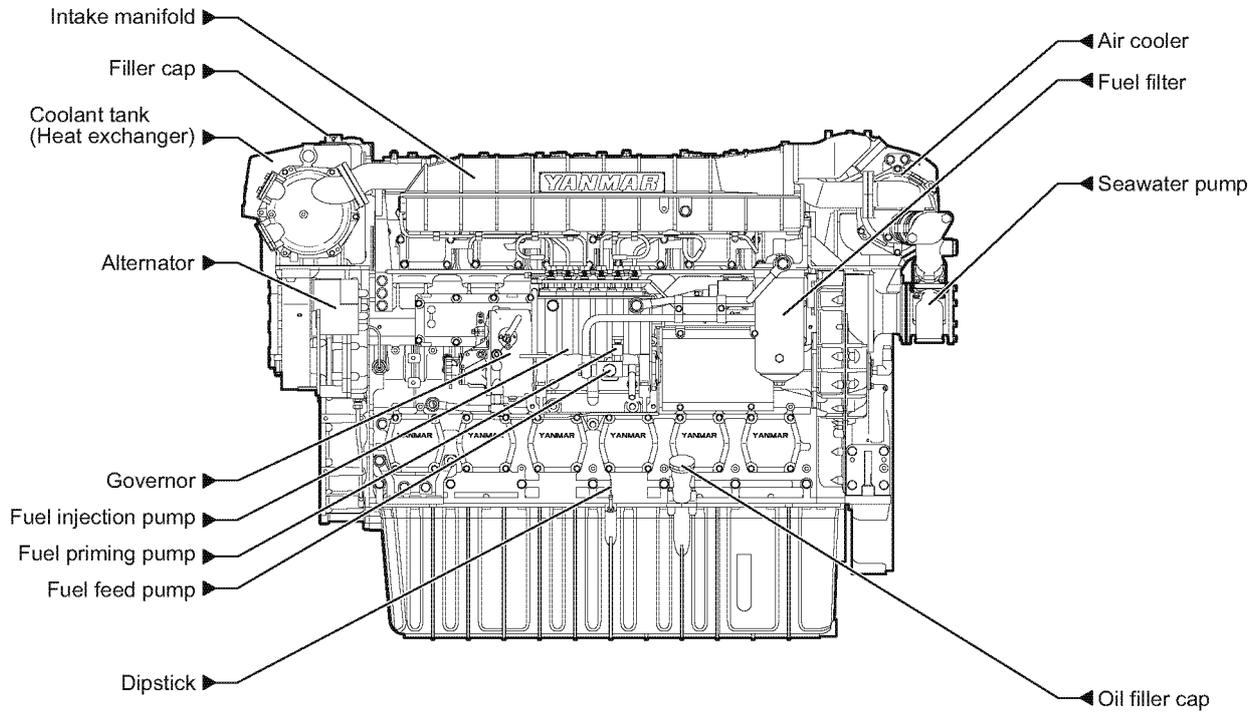
For the mass, refer to Specifications in the Operation Manual.

SPECIFICATIONS

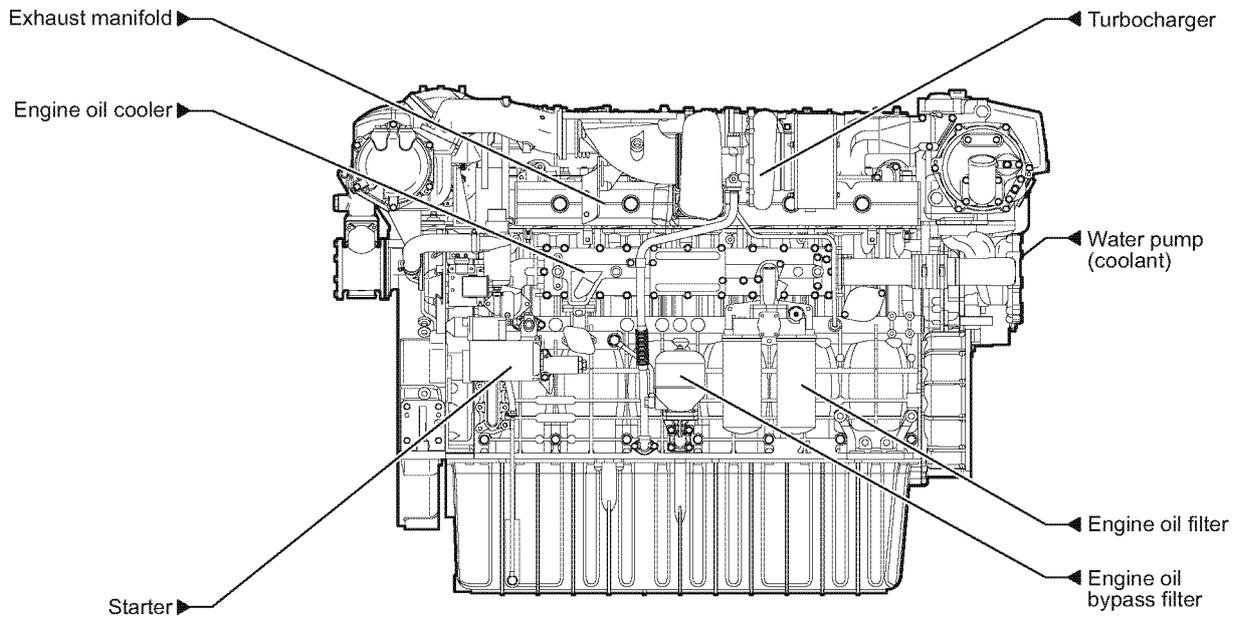
Model		Unit	6AYM-WGT	6AYM-WET		6AYM-WST
Type		–	Vertical, 4-cycle, turbo-charged diesel engine			
No. of cylinders		–	6			
Bore × stroke		mm	155 × 180			
Rated output (flywheel output)		Rating	L	M	H	H
		kW/min ⁻¹ (hp/rpm)	670/1938 (911/1938) (2 hour rating)	610/1900 (829/1900) (10 hour rating)	555/1840 (755/1840) (24 hour rating)	485/1900 (659/1900) (24 hour rating)
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	65			
	Reservoir tank	ℓ	3			
Lubrication system		–	Forced lubrication with gear pump			
Lubricating oil capacity	Engine	ℓ	Standard oil pan: 91 Shallow oil pan: 53			
	Marine gear	ℓ	Refer to marine gear manual			
Starting system		–	Electric starting or air starting			
Engine mass (without marine gear)		kg	2365			

Location of Components

■ Operation side



■ Non-operation side



FUEL OIL, LUBRICATING OIL AND COOLANT

Fuel

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

The properties of fuel 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	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		(Cetane no. of ≥ 45)
Quality criteria equivalent fuel oil	ASTM D975		2D
	BS-2869		Class B1
	ISO 8217		DMX
	EN		590

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 34.

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

- 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:

- A.P.I. classification: Grade CD, CF
- SAE viscosity grade: 40, 15W-40
- T.B.N [mgKOH/g]: 9 - 15

Application	Viscosity (SAE)	Specific gravity	Flash point (°C) (open type)	Pour point (°C)	Kinetic viscosity mm ² /s (cSt)		Viscosity index
					40 °C	100 °C	
Marine propulsion engine	40	0.893	> 240	< -7.5	140 - 155	14 - 15.5	96 - 110
	15W-40	0.88	> 230	< -30	> 100	14 - 15.5	> 140

NOTICE

- Avoid blended use of different brands.
(In the unavoidable case of blended use of different brands of lub, consult your lubricating oil supplier.)
- If lubricating 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 lubricating oil sticks to the high-temperature area together with carbon residue and causes adverse effects as mentioned below: For that reason, use the proper lubricating 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.

Coolant

■ Coolant selection

Use clean coolant (tap water) for the coolant.

Use the water having the properties shown in the following 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 ²⁻) concentration	< 100 ppm
Evaporation residue	< 400 ppm

■ Long Life Coolant (LLC) mixture selection

Always add Long Life Coolant (LLC) to the tap water. This mixture serves as the coolant.

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 the 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 from the above.

Without this mixture, scale or rust is generated inside the parts of the coolant 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 coolant system. The mixing ratio of LLC depends on the temperature. Be careful in using the mixing ratio specified by the manufacturer.

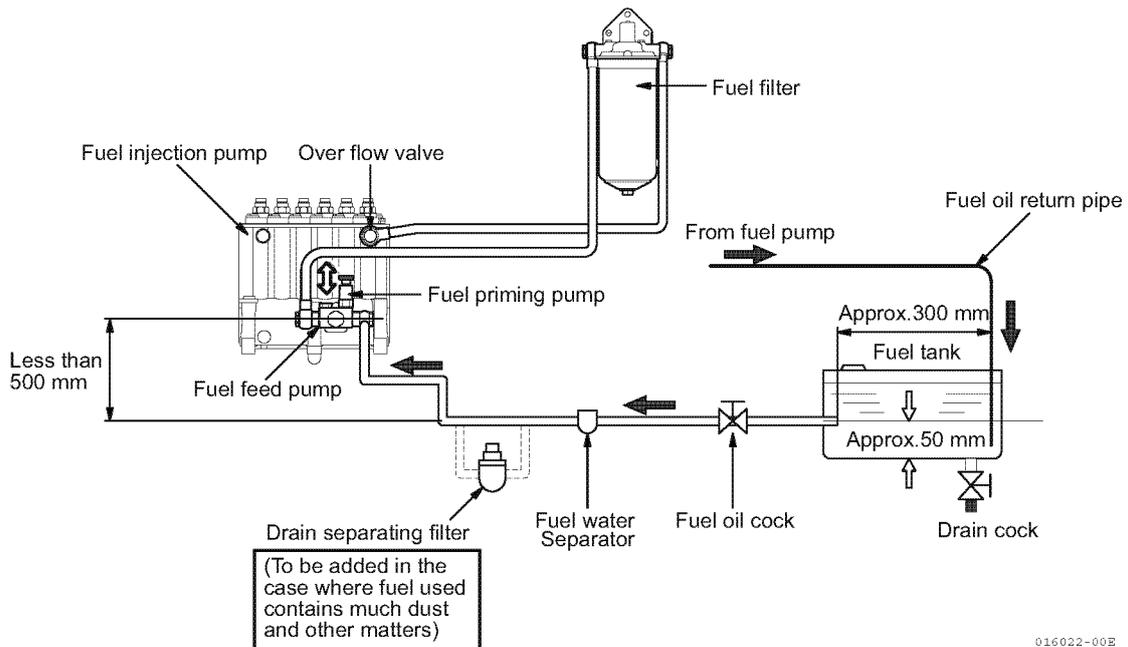
NOTICE

- 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.

RUNNING-IN

When starting a new engine, perform the following procedure.

Fuel



- Check 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 and a fuel/water separator (filter) in the fuel piping.
- Make sure the inside of the fuel tank and fuel lines have been thoroughly cleaned.
- Fill the fuel tank with recommended fuel.

⚠ 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.

Bleed the fuel oil system

If air enters the fuel system, the fuel injection pump does not work correctly.

Bleed the fuel system and obey the following procedure when you fill fuel oil to the fuel tank for the first time, perform maintenance (such as replacing the fuel filter) of the fuel system, after the fuel oil has run out, and there is a failure at startup.

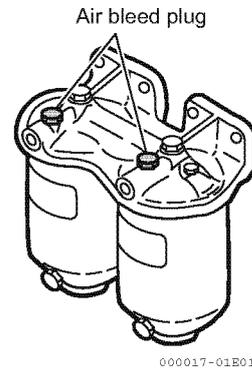
1. Check the fuel oil level in the fuel tank and open the fuel cock (or valve).
2. Loosen the air vent plug on the top of the water separator (option).
3. Loosen the air vent plug on the top of the fuel filter.
4. Fill the fuel oil with the fuel priming pump.

When fuel oil without air bubbles comes out of the air vent plug hole, tighten the air vent plug.

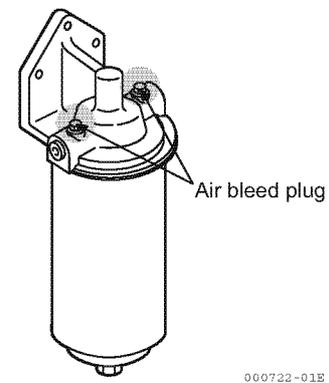
- 1- The knob on the top of the priming pump rises when you turn it counterclockwise.
 - 2- Repeat moving the knob up and down continuously by hand.
- Fuel oil with air bubbles comes out of the air vent plug hole of the fuel filter.

5. When fuel oil without air bubbles comes out of the air vent plug hole, tighten the air vent plug.
6. After you discharged air, screw the priming knob tight while pressing it down.

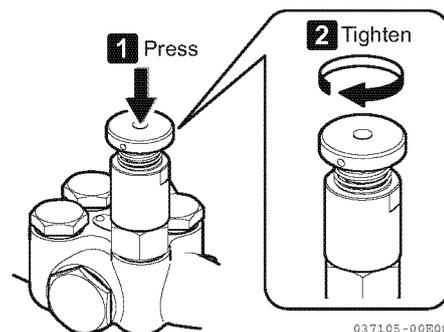
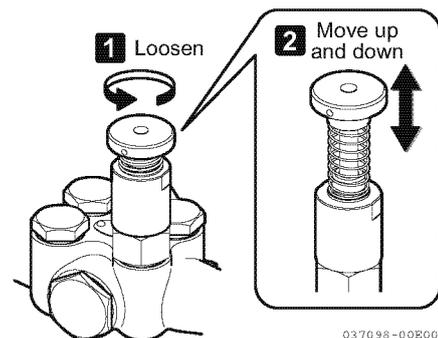
Fuel water separator (option)



Fuel filter



Priming pump



Lubricating Oil

As it is necessary to keep oil level correctly, obey following procedure when you fill the engine lubricating 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

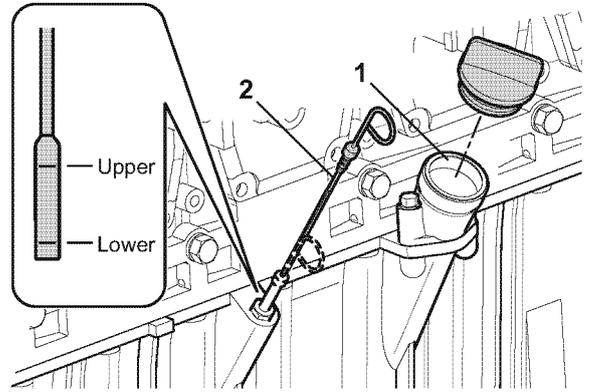
- Be sure to stop the engine before refilling.
- When checking the oil level, insert the dipstick fully.
- Do not overfill with oil, as this may cause oil to be sprayed out from the breather and damage the engine.

Oil capacity	Shallow oil pan	53 ℓ
	Standard oil pan	91 ℓ

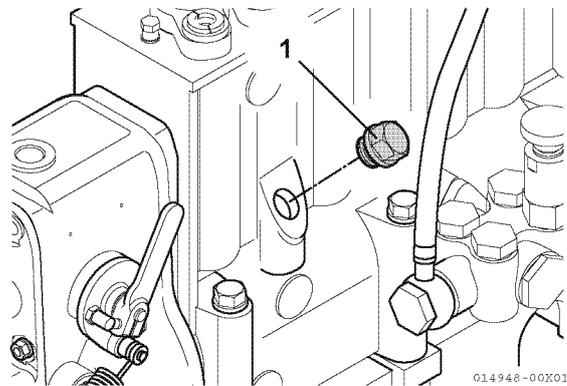
4. Remove the oil filler plug (1) attached to the fuel injection pump.
5. Fill with recommended lubrication oil to the pump.
6. Install the oil filler plug.

Fuel injection pump oil capacity	1.5 ℓ
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7. Fill the marine gear box with what the marine gear manufacture recommended oil up to the proper level.



013813-02E



014948-00X01

Cooling System (Seawater and Coolant)

1. Be sure to check the condition of tighten all the coolant drain cocks before filling coolant.
2. Remove the air vent plug on the thermostat cover of the coolant tank.
3. Remove the filler cap of the coolant tank.
4. Fill the coolant tank with coolant up the filler neck.
5. Fill the reservoir tank with coolant up to the upper level (FULL) mark.

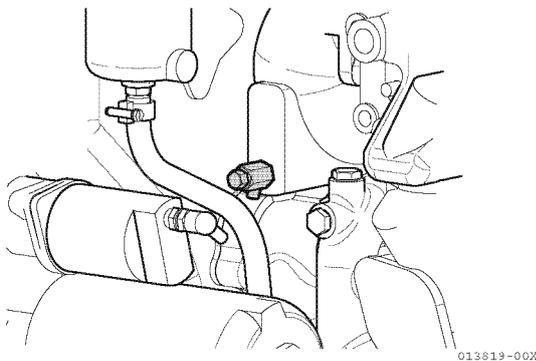
Capacity of all coolant system	Engine	65 ℓ
	Reservoir tank	3 ℓ

NOTICE

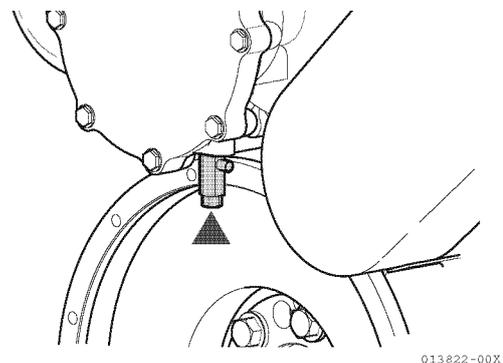
- Always fill with clean coolant.
- Always use coolant mixed with LLC.

6. Tighten the air vent plug on the thermostat cover.
7. Tighten the filler cap securely.
8. Check to be sure that the joint of the overflow pipe between the reservoir tank and coolant tank are securely tightened.
9. Tighten the side cover bolts of the seawater pump.

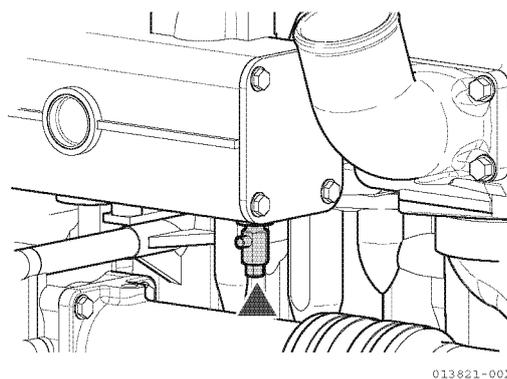
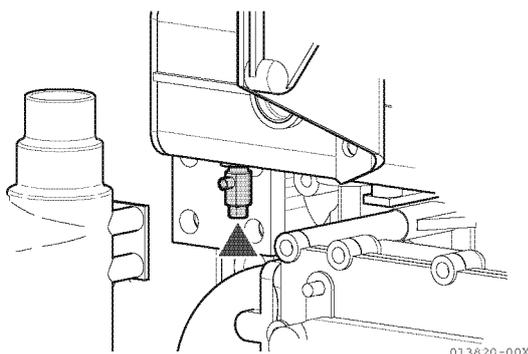
Cylinder block



Water pump (coolant)

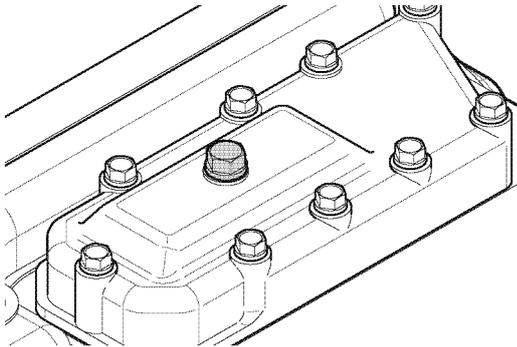


Exhaust manifold



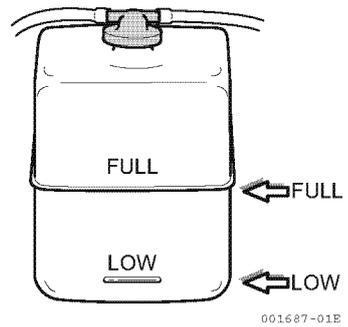
19 — RUNNING-IN

Air vent plug on the thermostat cover



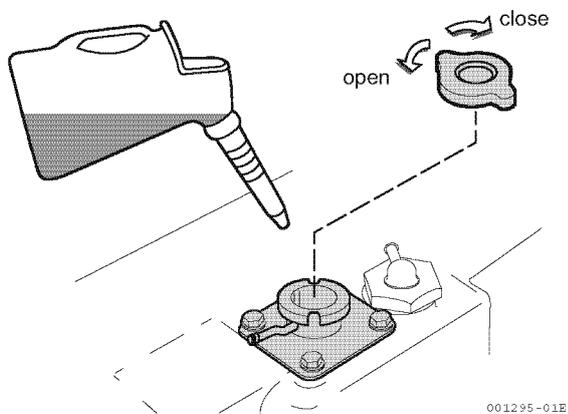
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Coolant reservoir tank



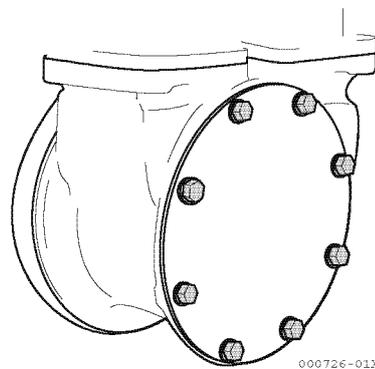
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Coolant filler cap



001295-01E

Seawater pump

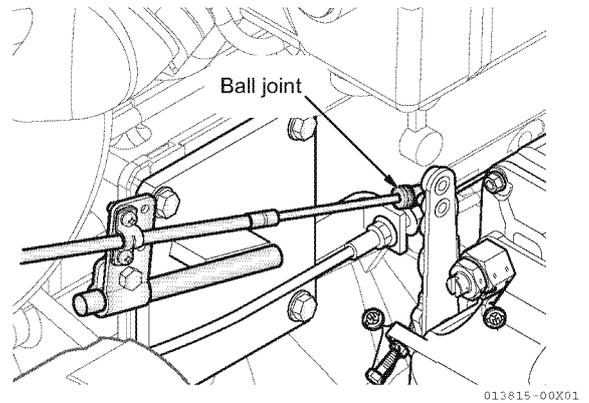


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Lubrication

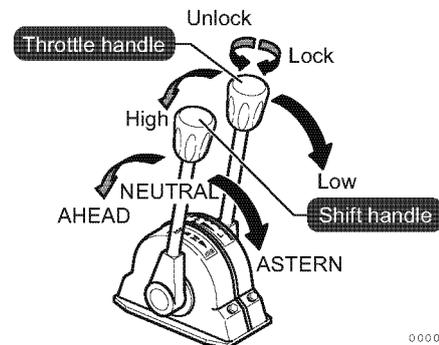
Apply grease to the lubricating points on the ball joints of remote control cable (for the governor).

Governor



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 cable if necessary.

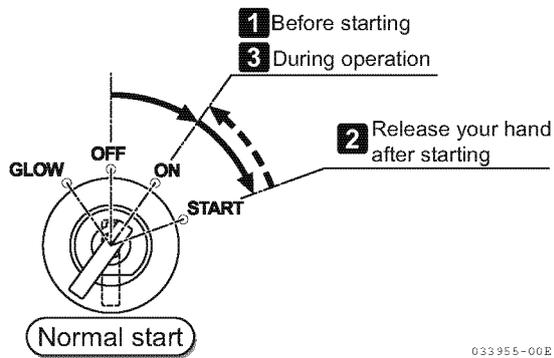


Cranking

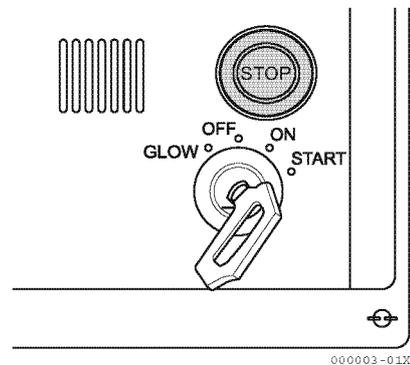
Oil reaches all moving parts of the engine sufficiently, crank the engine according to the following procedure.

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 it to the ON position.
 - 2- Pull the engine stop lever or press the "STOP" button of the instruments 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



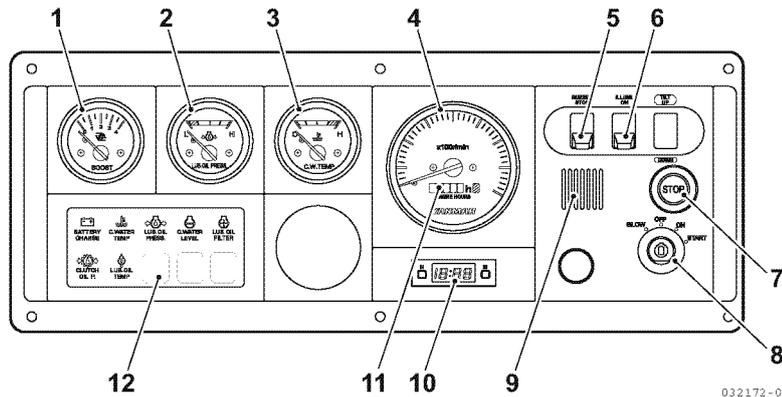
Stop button



Instruments Check before Starting

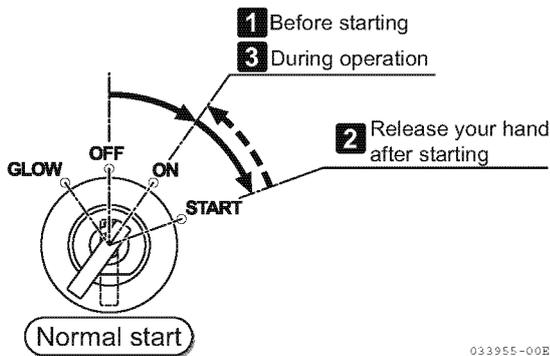
Turn the starter key to the “ON” position.

1. The needle of the oil pressure gauge should indicate “0”.
2. Make sure that the 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 coolant temperature gauge should all come on.

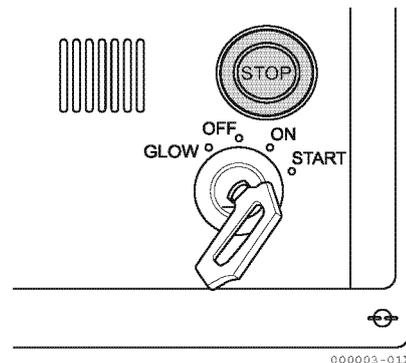


- | | | | |
|-------------------------|--|------------------------------|-------------------|
| 1- Boost pressure gauge | 2- Engine lubricating oil pressure gauge | 3- Coolant temperature gauge | 4- Tachometer |
| 5- Buzzer switch | 6- Illumination switch | 7- Engine stop button | 8- Starter switch |
| 9- Buzzer | 10- Clock | 11- Hourmeter | 12- Alarm display |

Starter switch



Stop button



● Buzzer

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

● Alarm lamps

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

● Buzzer stop switch

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

● Illumination switch

The switch is 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.

● **Hourmeter**

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 caution and dangerous zone. The read value can be used as a guide for judging whether the engine is lubricated properly to prevent accidents.

● **Coolant temperature gauge**

It shows the coolant temperature by $^{\circ}\text{C}$ (centigrade). The red zone is caution and dangerous zone of high temperature.

The read value can be used as a guide for judging whether the engine is cooling properly to prevent accidents.

● **Boost pressure gauge**

It shows the air pressure that flows to the combustion chamber by 10^{-1} MPa.

The read value can be used as a guide for judging whether the turbocharger is working properly to prevent accidents.

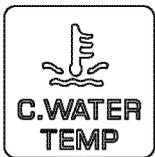
Alarm devices



000092-01X

BATTERY CHARGE

Comes on if the charge is abnormal. The buzzer will not sound. Check for failures such as a slip or 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

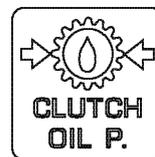
Comes on if the coolant level drops below the lower level. Continuing operation at temperatures exceeding the maximum will result in coolant temperature rise, damage and seizure. Check the coolant level. In addition, check that there is no leakage from the cooling system.



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

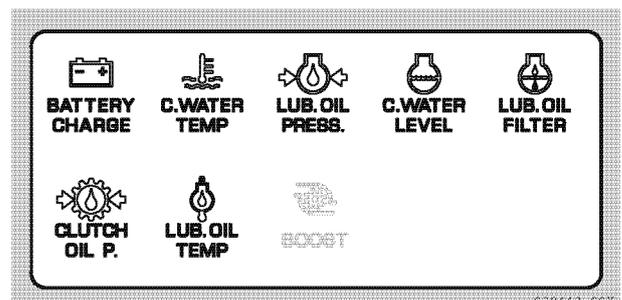
Comes on if the marine gear lubricating oil pressure drops below the limit level. Continuing operation with insufficient oil will result in damage and seizure. Check the marine gear lubricating oil level. It is useful if is coupled with YANMAR marine gear.



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.



030443-00X

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.
- Check the coolant level of the coolant reservoir and the coolant tank.

Add coolant to the upper level if necessary.

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

Electric starter motor starting

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

- Before starting engine

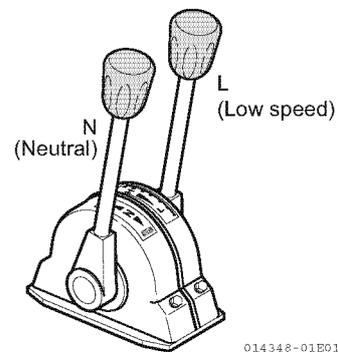
- 1- Turn ON the battery switch.

- 2- Put the key in the starter switch.

Turn the key from the OFF to ON position and check that alarm devices shown in the table "Normal function of alarm devices" on page 26 are working properly.

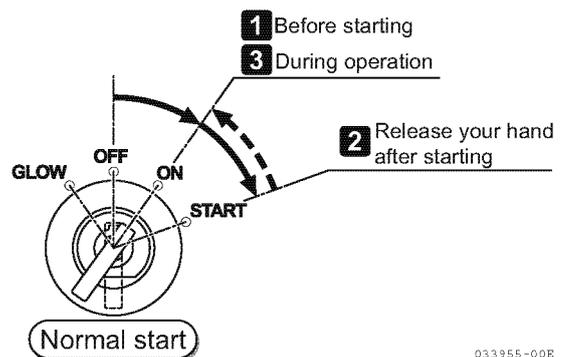
- The buzzer sounds briefly (for approx. 1 second).
- The battery charge lamp should sequentially lighted; other alarm lamps should lighted and off after approx. 3 seconds.

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.



014348-01E01

Starter switch



033955-00E

NOTICE

- 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 and prevent to over heat the starter.
- 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.

4. Checking the alarm devices just after starting engine.

- Turn the key from the START to ON position and check that alarm devices are shown in the table below “Normal function of alarm devices” are working properly.

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

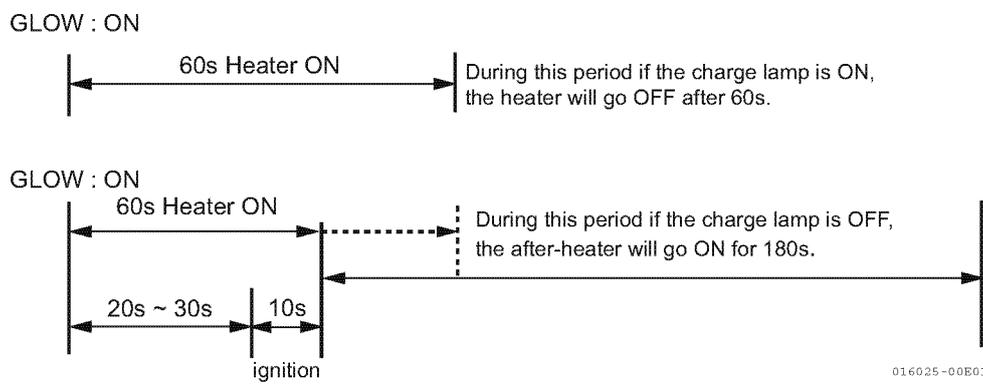
By performing these procedures, it can be determined whether or not the electric circuit of the buzzer and alarm lamps is in good working order. If there is any problem, consult your authorized YANMAR dealer or distributor for investigation and repair.

Normal function of alarm devices		
Starter switch operation	Before starting OFF→ON	After starting START→ON
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

Cold start (option)

■ Air heater operation

1. When starting during cold condition, first turn the starter switch to GLOW (for a few moments) to activate the heater.
2. Next, after 20 - 30 seconds turn the starter switch to START. When the engine starts, the microcomputer catches the engine revolution and activates the after-heater which remains on for 3 minutes.
3. The heater will operate for a maximum of 1 minute before the after-heat mechanism is activated. During this period if the engine does not start, the after-heater will not be activated. Start the engine within 1 minute after turning the key to "GLOW".
4. When starting under normal conditions, the "GLOW" position is not used, and the heating mechanism is not activated.



■ Procedure

1. Put the shift handle in "N".
2. Put the throttle handle at low idle position.
3. Turn the starter switch key to "GLOW" (for a moment).
4. After 30 seconds, turn the key to "START", and the engine starts.
5. Release your hand from the key after starting; the key will return automatically to "ON".

Notice after starting

- With the shift handle in the neutral position, observe the following instructions after starting.
 - After starting, set the engine speed to 600 min⁻¹ (600 rpm).
 - 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.

NOTICE

Do not turn off the key in the starter switch and the battery switch in the "OFF" position when operating the engine.

Air Motor Starting System (Special Order)

1. Make sure the air reservoir and the regulator valve are at the specified pressure.

Air reservoir: 2.45 - 2.94 MPa (25 - 30 kgf/cm²)

Regulator valve setting: 0.69 - 0.97 MPa (7.0 - 9.9 kgf/cm²)

2. Check the oil level in the oiler.

1-When supplying oil, remove the filler plug and add oil until it reaches the upper limit of the level gauge.
[capacity: 220 ml]

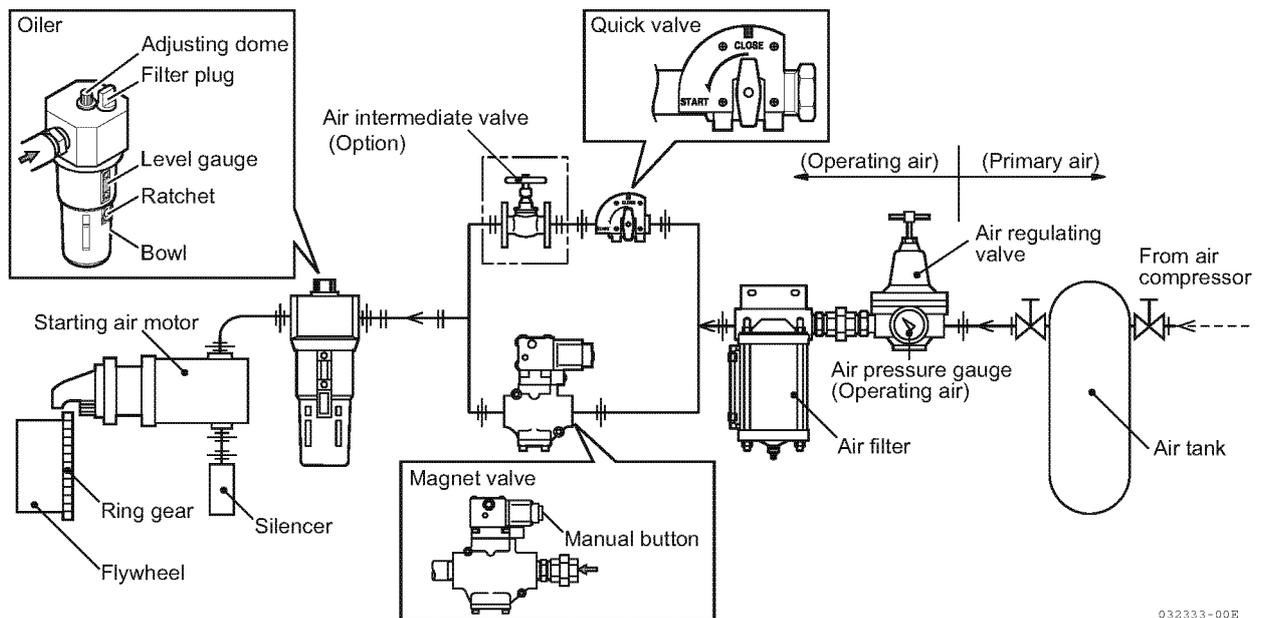
* When removing the bowl and supplying oil, loosen the filler plug to release the internal pressure.

2-When starting the engine, make sure that the inside of the adjusting dome is brimming with oil while the air motor is running.

* The amount of oil to be applied to the air motor is adjusted by turning the adjusting dome. However, since the adjusting dome has already been adjusted when shipped from the factory (one turn back from the closed condition), it does not need to be adjusted. (Turning the adjusting dome counterclockwise allows the amount of oil increase.)

Local starting

- Manual starting version: Open the quick valve and then close it immediately after the engine starts.
- Remote automatic starting version: Press the manual button on the starter solenoid. Release the button immediately after the engine starts.



032333-00B

Air motor's oiler oil selection

- Selection of air motor's oiler oil is shown the following table. Oiler oil is based on the ambient temperature.

Temperature range	Lubricating oil type
5 to 60 °C	ISO VG32 (e.g. Turbine oil #90)
-15 to 5 °C	ISO VG15 (e.g. #90 refrigerating machine oil)

Notice while Running with Load

While running the engine, pay attention to the following.

If problem occurs during operation, try to find the cause. If the cause cannot be found and the vessel is able to continue operation, return to port at a low speed. Consult your YANMAR dealer or distributor after return.

■ 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 seawater pump impeller.
- Clogged cooling seawater pipe and sea cock.

NOTICE

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

■ Coolant

Normally, the coolant temperature during running with load is 75 - 85 °C.

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

- Water leakage (temperature and coolant level warning devices may activate)
- Faulty water pump (coolant) or clogged coolant passage
- Faulty seawater pump or clogged seawater passage
- Insufficient coolant volume
- Heat exchanger restriction

■ Color of exhaust gas

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, turbocharger and particularly fuel injection nozzles. Avoid continuing operation if black smoke is being emitted.

■ 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, low oil pressure and vibration or not.

■ Avoid operating the engine speed at critical speed

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

■ Alarm devices

When the buzzer sounds during engine running, at first check which alarm lamp is on, immediately set the engine speed to low speed and stop the engine, and then try to find the cause.

■ Long time operation at low speed

When the engine is operated for more than 4 hours at low speed, set the shift handle to the "NEUTRAL" position, and increase the engine speed without load for 1 minute at about 1800 min^{-1} (rpm) to discharge residue from cylinders every 4 hours operation.

■ Operation of shift handle

Be sure to operate the throttle handle at a low speed (less than 1000 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.

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 - 700 min⁻¹ (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. Press and hold the STOP button or pull and hold the engine stop lever until engine has stopped.
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.

NOTICE

- Storing the engine without draining may cause the seawater left inside the engine to freeze and damage to parts (heat exchanger, seawater pump) in the cooling water passage.
 - Always use LLC in the coolant system.
-

Long-Term Storage

Storing engine for a long time

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 climate, make sure that you fully drain cooling coolant and seawater from both cooling systems.
- 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 agent 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 restarting an engine which has been stored for 6 months or longer.

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

CHECKING AND SERVICING THE TURBOCHARGER

■ Wash the pre-filter

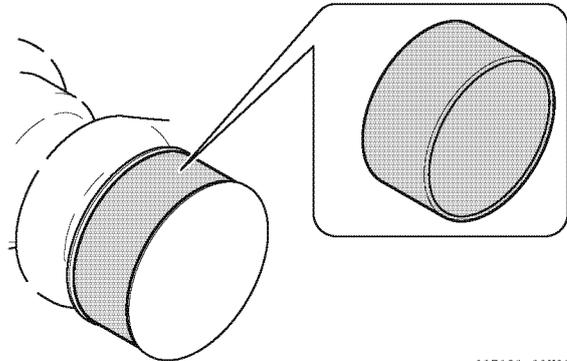
A pre-filter removes contaminations in the air and keeps the engine output in good condition.

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

■ 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 boost pressure drops (approx. 10 % pressure drop compared with normal condition).

1. Prepare the blower wash fluid, freshwater, and oiler.
2. Remove the pre-filter from the intake silencer, and remove the water filler plug.
3. During the load operation, fill 50cc of the blower wash fluid slowly from the water filler in approx. 10 seconds.
4. Approx. 3 minutes after filling the blower wash fluid, fill 50 cc of the freshwater from the water filler in approx. 10 seconds.
5. Continue the load operation for approx. 10 minutes to dry and check the output recovery.
6. Repeat the above washing operation for 3 to 4 times, if the performance is not recovered. Consult your YANMAR dealer or distributor for repair.

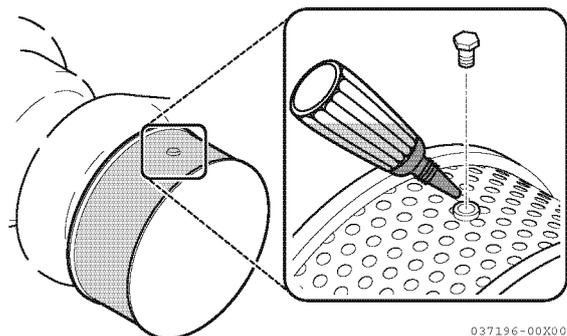


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Interval	Pre-Filter	When the boost pressure drops by 10 % in comparison with the trial run. Or every 250 hours.
	Blower	

NOTICE

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



037196-00X00

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.
- Please contact YANMAR dealer or distributor to inspect your engine or to replace any parts if you will.
- Consult YANMAR dealers about scheduling the engine overhaul.

Periodic Maintenance Schedule

○: Check ⊙: Replace ●: Consult your YANMAR dealer or distributor.

Item			Service period						Remarks	
			Daily	Every 50 hrs	Every 250 hrs	Every 500 hrs	Every 6 months	Every year		
Fuel system	Check fuel level and refill		○							
	Drain fuel tank deposit and water		○ (When replenished)							
	Drain fuel filter			○						
	Drain fuel-water separator deposit and water			○						
	Replace fuel filter and fuel-water separator					⊙				
Lubrication system	Check oil pressure		○							
	Check oil level and refill (oil pan)		○							
	Replace oil filter			⊙ (1st time)		⊙				
	Clean by-pass filter			○ (1st time)	○					
	Clean oil cooler							●		
	Replace oil (oil pan)	Standard	Gas (light) oil				⊙			
			Diesel (heavy) oil			⊙				
		Shallow	Gas (light) oil				⊙			Per 300 running hrs.
Diesel (heavy) oil					⊙				Per 150 running hrs.	
Cooling seawater system	Check cooling seawater discharging condition		○							
	Replace seawater pump impeller							⊙		
	Check and replace zinc anodes	Heat exchanger			○	⊙				
		Air cooler			○	⊙				
	Clean seawater system							●		
Cooling coolant system	Check coolant temperature		○							
	Check coolant level		○							
	Change coolant							⊙		
	Clean coolant system							●		
	Check and clean thermostat							●		
	Check water leakage from mechanical seal		○							
	Replace mechanical seal							●	Replace if found water leakage	

35 — PERIODICAL MAINTENANCE

○: Check ⊙: Replace ●: Consult your YANMAR dealer or distributor.

Item		Service period						Remarks
		Daily	Every 50 hrs	Every 250 hrs	Every 500 hrs	Every 6 months	Every year	
Fuel injection pump and nozzle	Check injection timing			● (1st time)		●		
	Check deflector						●	
	Check major parts						●	
	Check injection pressure and spray form				● (1st time)	●		
	Check nozzle carbon				● (1st time)	●		
	Replace injection nozzle						●	
Cylinder head	Check and adjust valve clearance				●			
	Check valve rotator, stem seal, valve spring						●	
	Check oil feeding condition of rocker arm			●				
Fuel feed pump	Check major parts						●	
	Replace oil seal						●	
	Check oil leakage from oil seal	○						
Crankshaft	Measure and adjust deflection					●		
Turbo charger	Clean pre-filter and washing blower			○				
	Replace pre-filter						⊙	
	Check air/gas leakage	○						
	Check major parts						●	
Clean air cooler							●	
Check and adjust the governor link					●			
Check and adjust remote control cables			○ (1st time)			○		
Re-tighten hose clips (Fuel, lubricating oil, cooling water, breather and air line)			○ (1st time)			○		
Check rubber hoses (Fuel, lubricating oil, cooling water, breather and air line)							○	
Electric device	Check tachometer	○						
	Check alarm lamp	○						
	Check battery electrolyte level and specific gravity			○				
	Check battery terminals						○	
	Check alternator V-belt tension		○ (1st time)		○		⊙	
	Check wire harness					○		
Check temperature and pressure switch							●	
Exterior	Check looseness of bolts and nuts	○						
	Check water/oil/gas leakage at various parts	○						

Fuel System

(For fuel system diagram, refer to [Bleed the fuel oil system] on page 16.)

■ Fuel level check

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

Refill as required.

■ Fuel tank deposit draining

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

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

■ Fuel filter and fuel-water separator draining

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

Service period	Every 50 hours
----------------	----------------

■ Replace element of fuel filter and fuel-water separator

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

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

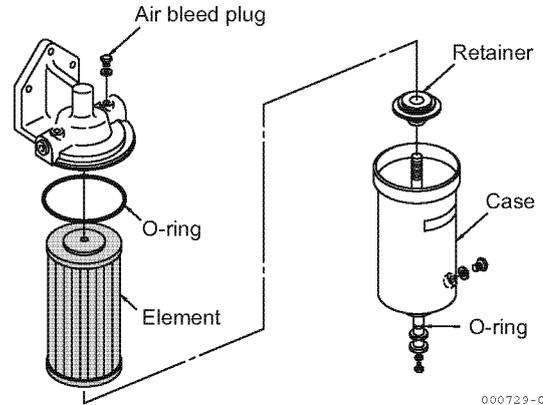
Replace the element with a new one.

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

NOTICE

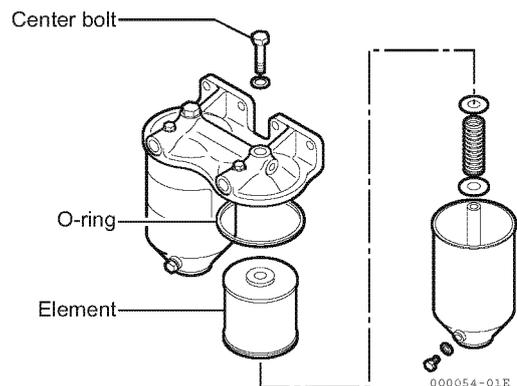
- Before installing the element, clean the inside of the filter case.
- Do not forget to install the spring, retainer and O-rings.
- After replacing the element, be sure to bleed air from the fuel system.

Fuel filter



000729-01E

Fuel water separator



000054-01E

Lubricating Oil System

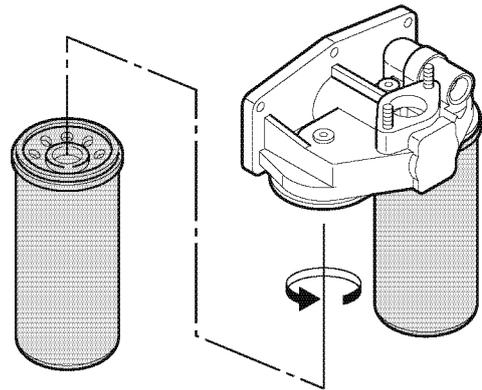
Oil level checking

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)
-----------------------	-----------------------------------

Replacement of oil filter

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 lubricating 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.

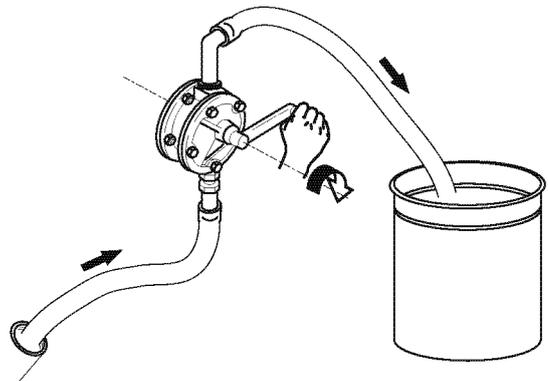


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Service period	1st time	50 hours
	2nd time and after	Every 500 hours

Engine oil change

Wait for about one to two hours after stopping the engine, connect the end of the rotary pump vinyl tube to the oil drain port, and drain oil. Fill the oil pan with recommended oil.



000056-01X01

Service period	1st time		50 hours
	2nd time and after	Standard oil pan	Every 500 hours (gas oil)
			Every 250 hours (diesel oil)
	2nd time and after	Shallow oil pan	Every 300 hours (gas oil)
Every 150 hours (diesel oil)			

■ Cleaning of lubricating oil bypass filter

The lubricating oil system is equipped with a lubricating oil bypass filter.

NOTICE

Stop the engine before cleaning the bypass filter.
If you disassemble the bypass filter while the engine is running, oil mist may be blown off, causing burns.

Disassembly and cleaning

Service period	1st time	50 hours
	2nd time and after	Every 250 hours

● Disassembly

Disassemble and clean the lubricating oil bypass filter according to the following procedures.

1. Loosen the cap nut and then remove the cover.
2. Loosen the nut and remove the rotor body.
3. Loosen the lock nut and remove the rotor cover, then remove the insulator and spring.
4. Remove the sludge inside the rotor with a spatula.

NOTICE

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

5. Check for clogging of the nozzle and clean the nozzle a brass wire brush.
6. Check each part and the O-rings. If any damage or excessive wear is found, replace the part.

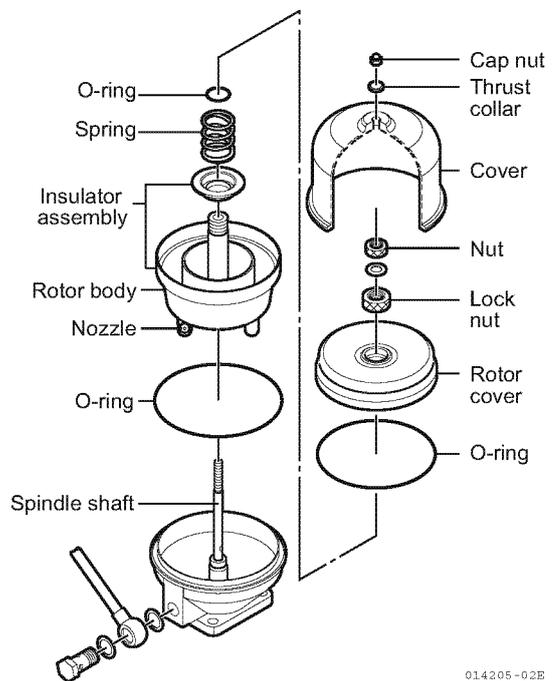
● Assembly

Assemble the filter in the sequence reverse to disassembly while observing the following precautions.

1. Install the insulator spring into the rotor body and cover the rotor body with the rotor cover.

NOTICE

Ensure that the fitting of rotor and rotor cover is secure. When the fitting is not aligned, the rotor speed becomes unbalanced and it may damage the equipment.



39 — PERIODICAL MAINTENANCE

2. Tighten the rotor cover to the rotor body with a lock nut.
(Lock nut tightening torque: hand-tighten)
3. Insert the rotor to the spindle shaft and tighten the nut by hand-tighten

Nut tightening torque	Hand-tighten
------------------------------	---------------------

4. Cover the cover, install the thrust collar (upper), and tighten the cap nut.

Cap nut tightening torque	9.8 N•m (1.0 kgf•m)
----------------------------------	----------------------------

NOTICE

Avoid overtightening the nut and cap nut. When the cap nut is overtightened, the tightening power is lost during loosening at the next time and it may cause the spindle shaft to loosen.

-
5. While operating the filter, make sure oil does not leak from connected sections. Also, make sure the filter is not vibrating abnormally.

Cooling Water 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.

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

■ Checking and replacement of zinc anodes

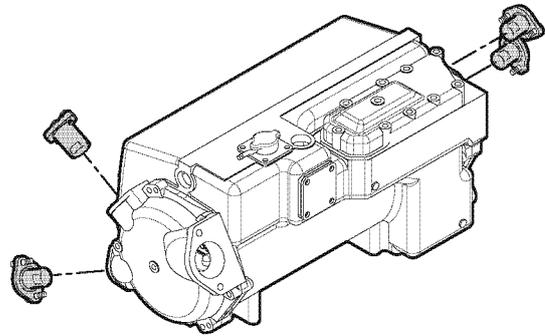
Remove the zinc anode and scrape or remove with a wire brush the coating on the zincs. If more than 50 % of the zinc is corroded away, it should be replaced with new zinc.

Zinc anodes are built into the following places:

	Q'ty
Heat exchanger	4
Air cooler	4

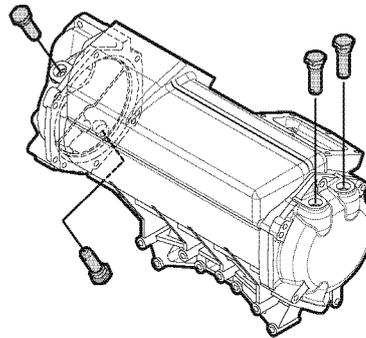
Service period	Checking	Every 250 hours
	Replacement	Every 500 hours

Heat exchanger



013295-01X

Air cooler



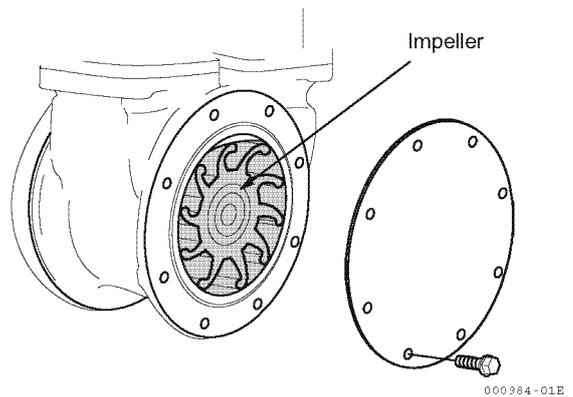
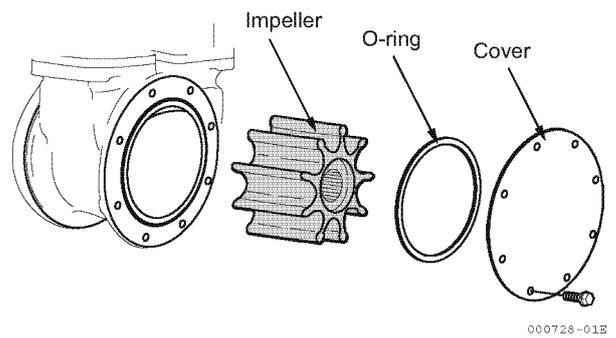
013300-01X

41 — PERIODICAL MAINTENANCE

■ Replacement of seawater pump impeller

1. Remove the seawater pump cover and pull out the impeller. Check the wear plate and cover 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 the illustration at right.

Service period	Every year
----------------	------------



■ Seawater system cleaning

As the engine is used, coolers become foul, their cooling effect worsens, and coolant and intake air temperature becomes abnormally high.

Consequently, eliminate fouling of the seawater system, coolers in particular.

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

Service period	Every year
----------------	------------

Coolant system

■ Coolant level checking

Check the coolant level before starting the engine in the cold condition.

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 coolant 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 (coolant) leakage checking

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

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

Service period	Every year
-----------------------	-------------------

■ **Coolant change**

Service period	Every year
----------------	------------

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 [Coolant])

Turbocharger

■ **Clearing of prefilter and turbocharger**

Refer to [CHECKING AND SERVICING THE TURBO-CHARGER].

■ **Checking each joint area**

Check the turbocharger-to-charge air cooler and turbo-charger-to-exhaust manifold connections for damage or leaks.

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

Injection Nozzle

■ **Replacement**

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

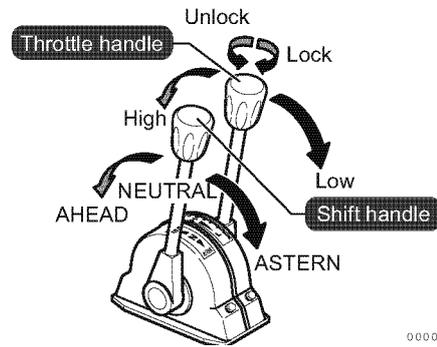
Consult your YANMAR dealer or distributor.

Service period	Every year
----------------	------------

Remote Control Cables

■ Throttle handle

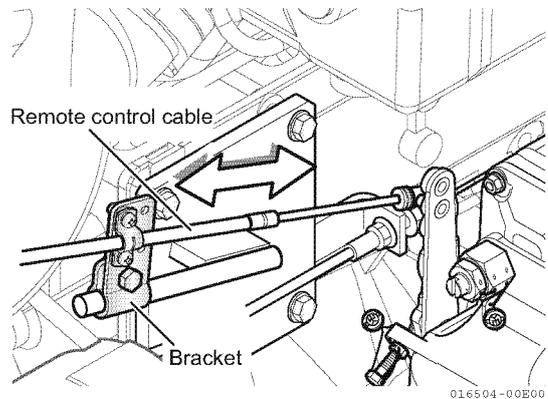
Operate the throttle handle from the position “L” to the position “H”, and check if the governor lever at the governor moves into the correct position. If there is disalignment between the throttle handle and the governor lever in their position, adjust the control cable by changing the clamping position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



■ 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.

Service period	1st time	50 hours
	2nd time	Every 6 months



Electrical Parts

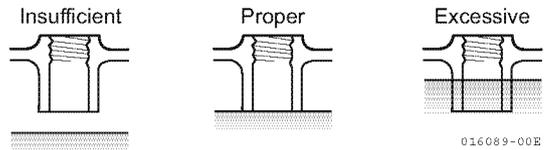
■ Checking the alarm devices

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

■ Checking the battery fluid level

Battery electrolyte decreases as charging and discharging are repeated. Check normal electrolyte level is 10 - 20 mm above the pole plates. If level is low, add distilled water, refer to the illustration at right.

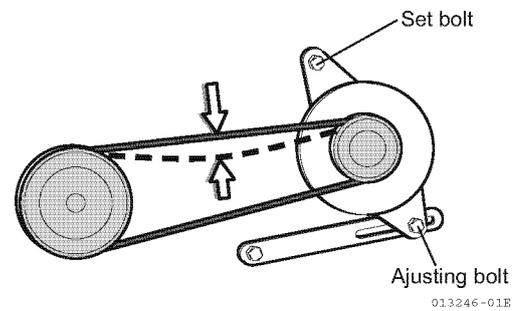
Service period	Every 250 hours
----------------	-----------------



■ 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 10 - 12 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.



Deflection	10 - 12 mm (pressed by 98 N)	
Service period	1st time	50 hours
	2nd time	Every 500 hours

TROUBLESHOOTING AND 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)**
- **Bad color of exhaust gas**
- **Lubricating 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 starting system <ul style="list-style-type: none"> • Battery voltage drop • Failure of starter motor 	Charge the battery. Consult your YANMAR dealer or distributor.
2. Air starting system <ul style="list-style-type: none"> • Clogging of air filter or silencer • Failure of air starter 	Check and clean the filter or silencer. Consult your YANMAR dealer or distributor.
3. Too high viscosity of lubricating oil	Change the correct lubricating oil with a low-viscosity one.
4. Seizure of moving part <ul style="list-style-type: none"> • Seizure of piston and cylinder liner • 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 • Closing of fuel cock (valve) • Clogging of fuel filter • Failure of fuel feed pump • Air mixed in fuel system 	Supply the fuel to the fuel tank. Open fuel cock (valve). Replace the filter element. Consult your YANMAR dealer or distributor. Check and repair the fuel system, then bleed air.
2. Poor airtightness of intake/exhaust valve <ul style="list-style-type: none"> • Inadequate intake/exhaust valve clearance • Sticking of intake/exhaust valve • Damage of seat of intake/exhaust valve 	Consult your YANMAR dealer or distributor. Consult your YANMAR dealer or distributor. Consult your YANMAR dealer or distributor.
3. Low cetane number of fuel oil	Use a high- quality fuel oil.

Rotational speed dropped spontaneously

Cause	Countermeasure
1. Clogging of fuel 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 system	Check and repair the fuel system, then bleed air.
4. Moisture content in fuel system	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 system	Check and repair the fuel system, then bleed air.
2. Moisture content in fuel system	Drain the filter, tank, etc.
3. Fuel injection volume not in uniformity among cylinders	Consult your YANMAR dealer or distributor.

Bad color of exhaust gas

Cause	Countermeasure
1. Inadequate fuel injection timing	Consult your YANMAR dealer or distributor.
2. Inadequate intake/exhaust valve clearance or damage of intake/exhaust valve seat	Consult your YANMAR dealer or distributor.
3. Sticking of intake/exhaust valve	Consult your YANMAR dealer or distributor.
4. Damage of intake/exhaust cam	Consult your YANMAR dealer or distributor.
5. Defect of turbocharger <ul style="list-style-type: none"> • Clogging of pre-filter • Fouling of the blower side or turbine side 	Wash the pre-filter. Wash the turbocharger/blower.
6. Fouling of charge air cooler (too high temperature of boost air)	Consult your YANMAR dealer or distributor.
7. Low-quality of fuel oil	Use a high-quality fuel oil.
8. Overload	Reduce the load.

Lubricating oil pressure dropped below the specified pressure

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

Unusual sounds heard (knocking occurred) during operation

Cause	Countermeasure
1. Inadequate intake/exhaust valve clearance	Consult your YANMAR dealer or distributor.
2. Inadequate fuel injection timing	Consult your YANMAR dealer or distributor.
3. Loosen some parts	Check and fix.

Coolant temperature too high

Cause	Countermeasure
1. Shortage of cooling water volume	
• Clogging of seawater inlet passage	Check and clean the seawater strainer, sea cock and pipes.
• Failure of seawater pump impeller	Check and repair the impeller.
• Failure of water pump (coolant)	Consult your YANMAR dealer or distributor.
2. Coolant level is low.	Refill with coolant.
3. Coolant is leaking.	Check and tighten the leaking part.
4. Sticking of coolant thermostatic valve	Consult your YANMAR dealer or distributor.

Exhaust temperature of all the cylinders too high

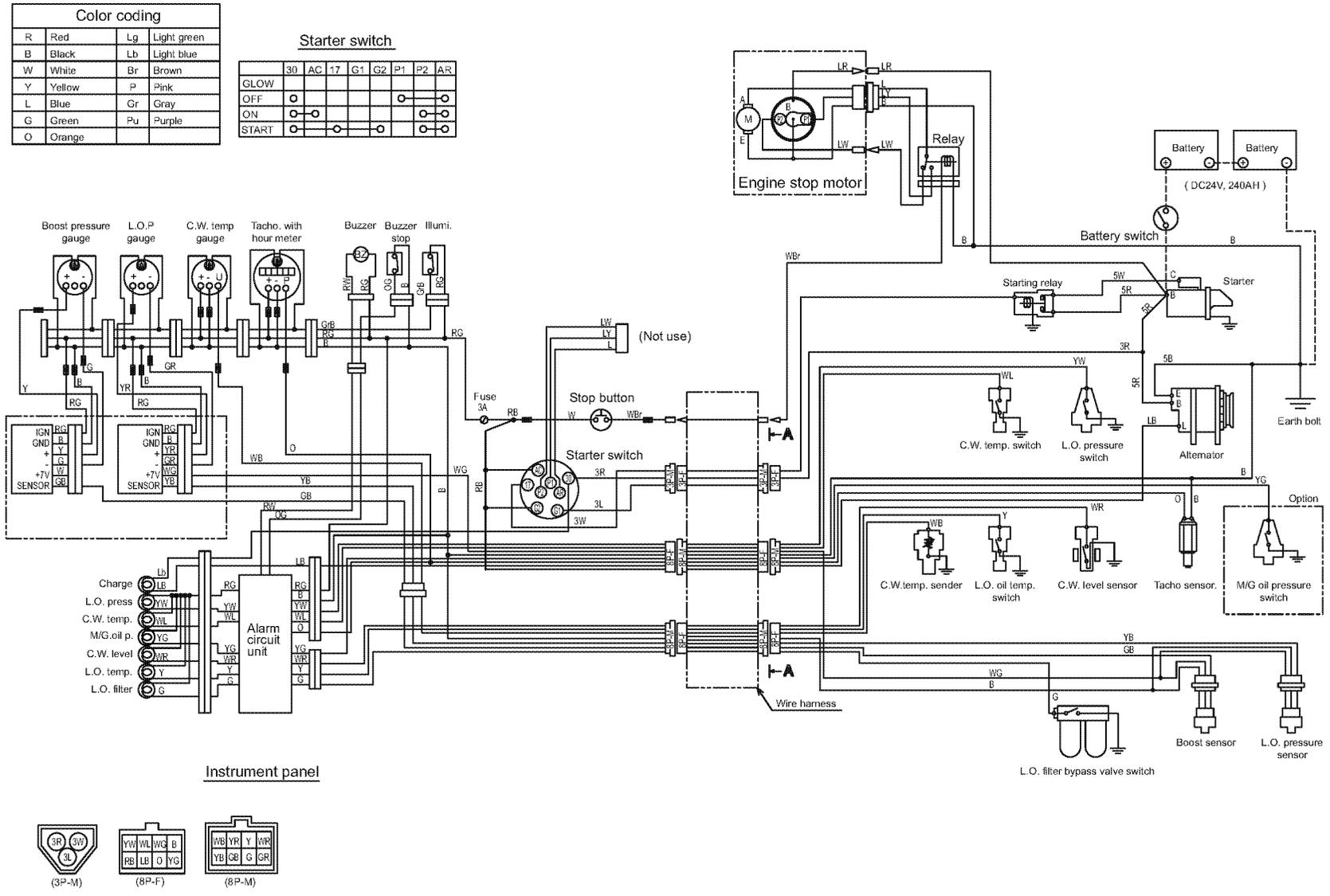
Cause	Countermeasure
1. Charge air temperature too high <ul style="list-style-type: none"> • Shortage of charge air cooler cooling water volume • Fouling of charge air cooler (cooling water side and air side) • Engine room temperature too high 	Check and repair the seawater pump. Consult your YANMAR dealer or distributor.
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	Use a high-quality fuel oil.
4. Overload	Reduce the load.

Engine stopped suddenly

Cause	Countermeasure
1. Fuel tank empty	Replenish the fuel oil.
2. Air mixed in fuel system	Bleed air from the fuel system.
3. Clogging of fuel filter	Replace the filter element.
4. Seizure of moving part (piston, main bearing, crank-pin bearing, timing gear, etc.)	Consult your YANMAR dealer or distributor.

WIRING DIAGRAMS

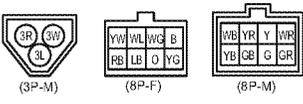
■ 24 V engine negative ground type without air heater (standard)



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

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

Instrument panel

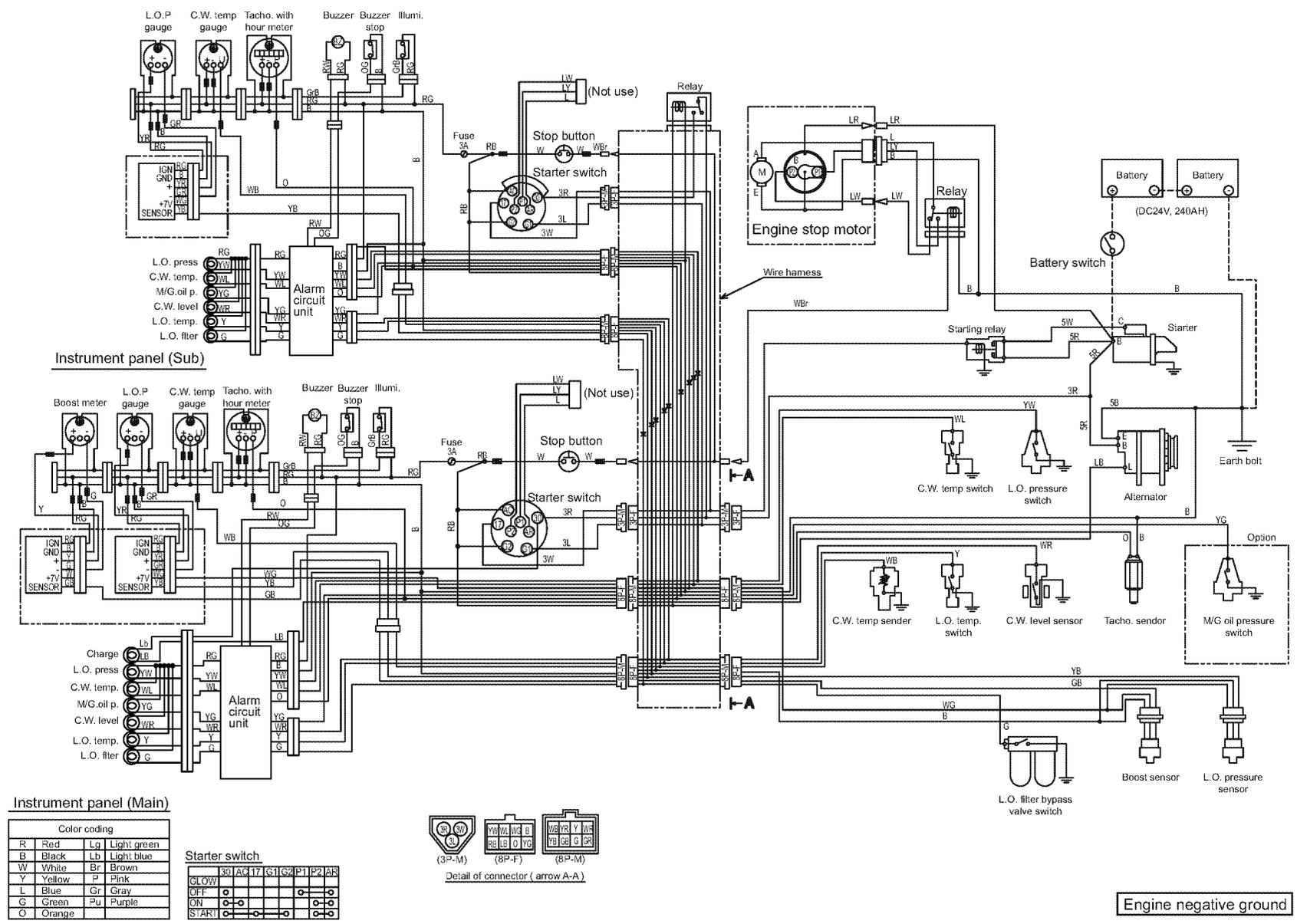


Detail of connector (arrow A-A)

Engine negative ground

016093-02E00

■ 24 V engine negative ground type without air heater (tow-place gauge)

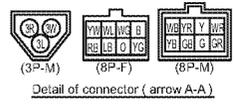


Instrument panel (Main)

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

Starter switch

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



Engine negative ground

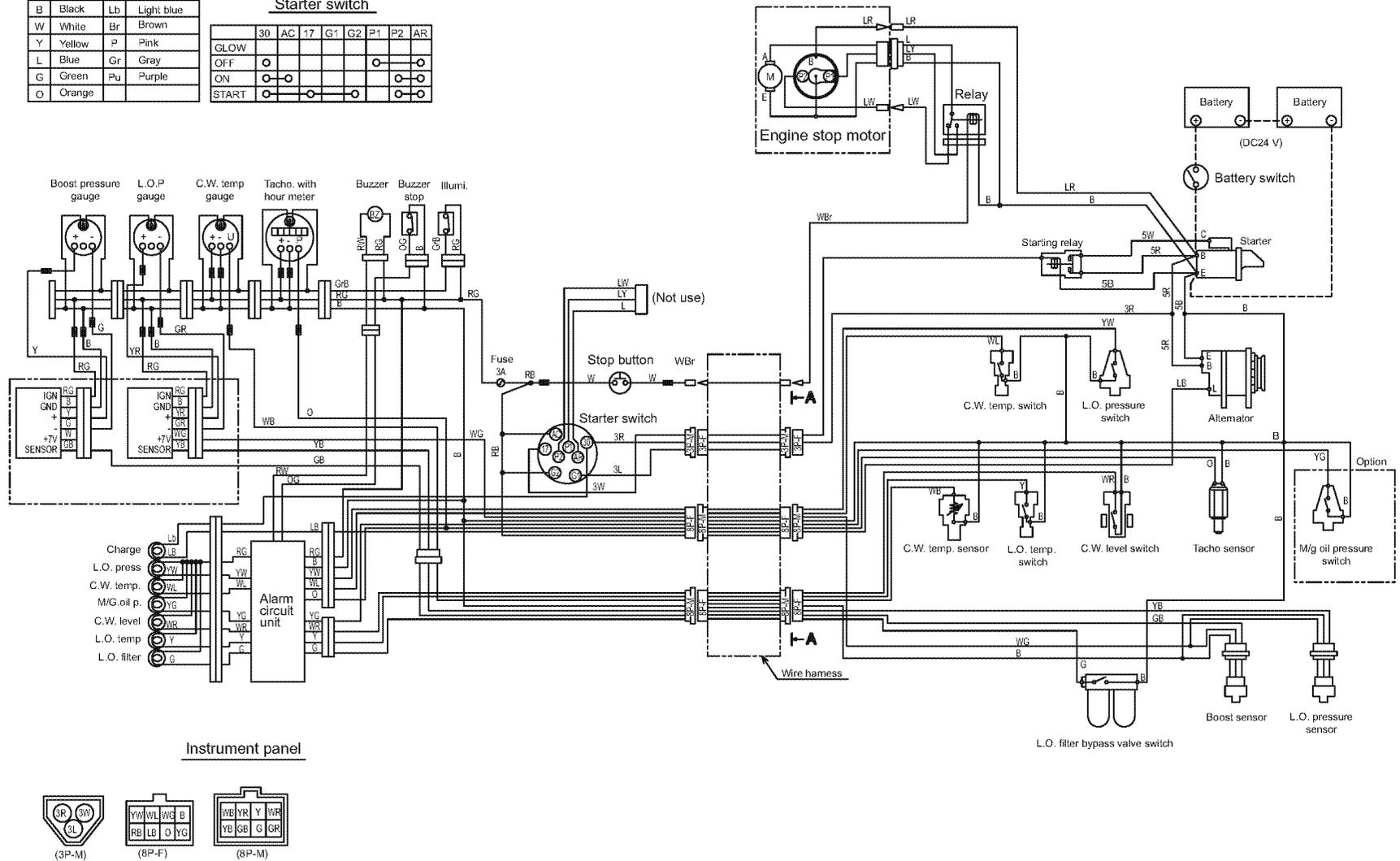
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■ 24 V insulated ground connection without air heater (option)

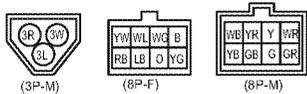
Color coding			
R	Red	Lg	Light green
B	Black	Lb	Light blue
W	White	Br	Brown
Y	Yellow	P	Pink
L	Blue	Gr	Gray
G	Green	Pu	Purple
O	Orange		

Starter switch

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



Instrument panel

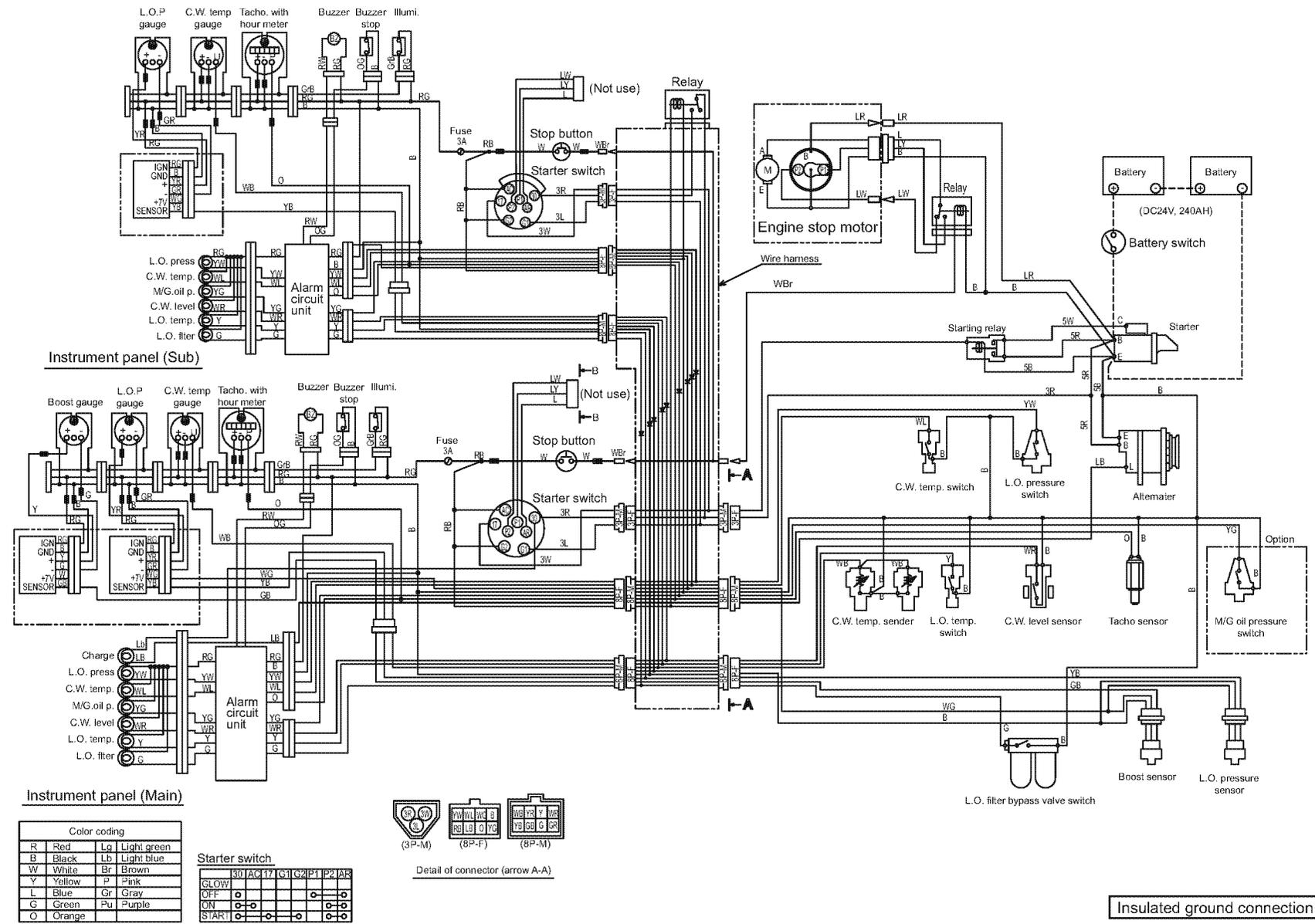


Detail of connector (Arrow A-A)

Insulated ground connection

016095-02E01

■ 24 V insulated ground connection without air heater (low-place gauge)



Insulated ground connection

016096-02E00

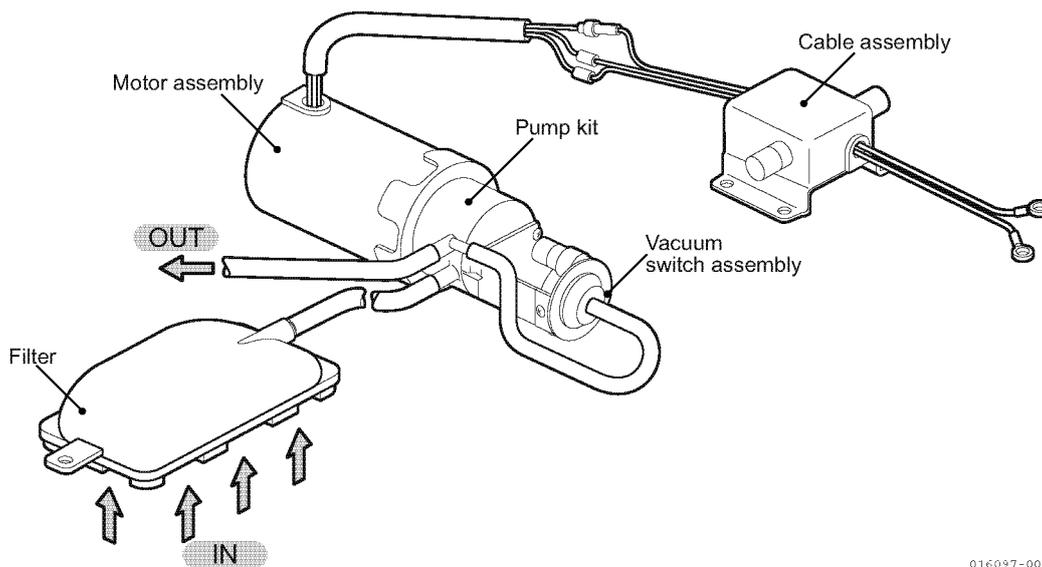
YANMAR STANDARD MOTOR-DRIVEN BILGE PUMP (OPTION)

■ 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 3 m long cord.
- Fit the strainer part of the bilge pump to the ship bottom by use of metal fittings.



016097-00E

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
Mannual
YANMAR

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Phone: 81-6-6428-3251 Fax: 81-6-6421-5549

Overseas Office

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Phone: 31-36-5493200 Fax: 31-36-5493209

■ Yanmar Asia (Singapore) Corporation Pte Ltd. (YASC)

4 Tuas Lane, Singapore 638613
Phone: 65-6595-4200 Fax: 65-6862-5189

■ Yanmar America Corporation (YA)

101 International Parkway
Adairsville, GA 30103, U.S.A.
Phone: 1-770-877-9894 Fax: 1-770-877-9009

■ Yanmar Engine (Shanghai). Co., Ltd.

10F, E-Block POLY PLAZA, No.18 Dongfang Road,
Pudong Shanghai, CHINA P.R.C 200120
Phone: 21-6880-5090 Fax: 21-6880-8090

■ Yanmar South America Industria De Maquinas Ltda (YSA)

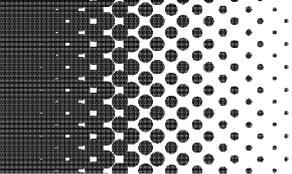
AV. Presidente Vargas, 1400 Indaiatuba/SP
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OPERATION MANUAL

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