YANMAR

MARINE DIESEL ENGINE

MODEL : 1GM10(C)

EPA Certified Engine
It meets the low emission standards set by the EPA

OPERATION MANUAL

California Proposition 65 Warning

Diesel engine exhaust and some of its constituents are recognized by the State of California to cause cancer, birth defects, and other reproductive harm.

002522-00E

Contents

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Introduction

Tank you for purchasing a YANMAR Marine Diesel Engine.

This Operation Manual describes the operation, maintenance and inspection of the 1GM10(C) Yanmar Marine Diesel Engines.

Read this Operation Manual carefully before operating the engine to ensure that it 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 dealer or distributor.

Make sure this manual is transfered to subsequent owners. It should be considered as a permanent part of the engine and remain so.

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 this, please contact your Yanmar dealer or distributor.

The marine gear described in this manual is Yanmar Model KM Series.

Operation Manual (Marine Engine)	**Models**	**1GM10(C)**
	Code. No.	**42221-556060**

With regard to the sail drive, this manual describes lube oil selection and specification only. Please read the Sail Drive Operation Manual, which is supplied with the Sail Drive Unit, for further information.

1. For your safety

1.1 WARNING SYMBOLS

Most operation, maintenance and inspection problems arise due to users' failure to comply with the rules and precautions for safe operation described in this operation manual. Often, users do not understand or recognize the signs of approaching problems. Improper handling can cause burns and other injuries and can result in death.

Be sure to read this operation manual carefully before operating the engine and observe all of the instructions and precautions described in this manual.

Below follow the warning signs used in this manual. Pay special attention to parts containing these words and signs.

⚠ DANGER

002523-00E

DANGER indicates an imminently hazardous situation which, if not avoided, WILL result in death or serious injury.

⚠ WARNING

002524-00E

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

⚠ CAUTION

002525-00E

CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
This sign is also be used to alert against unsafe practices.

The descriptions captioned by ***NOTICE*** 002526-00E are particularly important cautions for handling. If you ignore them, the performance of your machine may deteriorate leading to problems.

1.2 SAFETY PRECAUTIONS

(Observe these instructions for your own safety!)

Precautions for Operation

002527-00E

Filler Cap of Fresh Water Tank

Never open the cap of the fresh water tank while the engine is still hot. Steam and hot water will spurt out and burn you seriously. Wait until the temperature of the fresh water tank has dropped, wrap a cloth around the filler cap and loosen the cap slowly. After inspection, refasten the cap firmly.

1. For your safety

Battery

Never smoke or permit sparks near the battery, because it may emit explosive hydrogen gas. Place the battery in a well-ventilated place.

Fuel

Use only diesel oil. Never use other fuels, including gasoline, kerosene, etc., because they could cause a fire. The wrong fuel could also cause the fuel injection pump and injector to fail due to lack of proper lubrication. Be sure to check that you have selected the correct diesel fuel before filling the fuel tank.

Fire Prevention

Be sure to stop the engine and confirm that there are no open flames in the vicinity before supplying fuel. If you do spill fuel, wipe such spillage carefully and dispose of the wiping materials properly. Wash your hands thorougly with soap and water.
Never place oil or other flammable material in the engine room.
Install a fire extinguisher near the engine room, and familiarize yourself with its use.

Exhaust Gas

Exhaust gas contains poisonous carbon monoxide and should not be inhaled.
Be sure to install ventilation ports or ventilators in the engine room and ensure good ventilation during engine operation.

Moving Parts

Do not touch or let your clothing get caught in the moving parts of the engine, such as the front drive shaft, V-belt or propeller shaft, during engine operation. You will be injured.
Never operate the engine without the covers on the moving parts.

Burns

The whole engine is hot during operation and immediately after stopping. The exhaust manifold, exhaust pipe and high pressure fuel pipe are very hot. Never touch these parts with your body or clothing.

1. For your safety

⚠ WARNING

002534-00E

Alcohol

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

SAFETY PRECAUTIONS FOR INSPECTION

⚠ DANGER

002535-00E

Battery Fluid

Battery fluid is dilute sulfuric acid. It can blind you if it gets in your eyes, or burn your skin. Keep the fluid away from your body. If you touch it, wash it off immediately with a large quantity or fresh water and call your doctor for treatment.

⚠ WARNING

002536-00E

Fire by Electric Short-Circuits

Always turn off the battery switch before inspecting the electrical system.
Failure to do so could cause short-circuiting and fires.

⚠ WARNING

002532-00E

Stop the engine before servicing

Stop the engine before you service it.
Turn the battery switch off. If you must inspect while the engine is in operation, never touch moving parts. Keep your body and clothing well clear of all moving parts.

⚠ CAUTION

002533-00E

Scalds

If extracting oil from the engine while it is still hot, don't let the oil splash on you.
Wait until the temperature has dropped before extracting cooling water
from the engine. Don't let it splash on you.

⚠ DANGER

002537-00E

Forbidden Modifications

Never release the limiting devices such as the engine speed limit, fuel injection limit, etc.
Modification will impair the safety and performance of the product and shorten product life.
Also note that any troubles arising from modification are not covered by our warranty.

⚠ DANGER

002537-00E

Precautions for Treating Waste

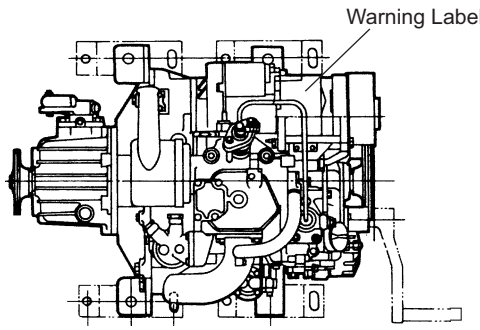
Never dispose of waste oil or other fluid in a field, sewer, river, or the sea. Treat waste matters safely observing regulations or laws.
Ask a waste recovery company to collect it.

1. For your safety

SAFETY PRECAUTIONS FOR INSPECTION

1.3 WARNING LABELS

To insure safe operation, warning device labels have been attached. Their location is shown below and they should always be visible. Please replace if damaged or lost.



1GM10

Part Code No.
128296-07350

002539-00E

2. Product explanation

2.1 USE, DRIVING SYSTEM, ETC.

The engine is equipped with marine gear, connect the marine gear output shaft to the propeller shaft.

In order to obtain full performance from your engine, it is imperative that you check the size and structure of the hull and use a propeller of the appropriate size.

The engine must be installed correctly with safe cooling water and exhaust piping and electrical wiring. The PTO work should be easy to use for onboard equipment.

To handle the drive equipment, driven systems (including the propeller) and other onboard equipment,be sure to observe the instructions and cautions given in the operation manuals supplied by the shipyard and equipment manufacturers.

The laws of some countries may require hull and engine inspections, depending on the use, size and cruising area of the boat.

The installation, fitting and surveying of this engine all require specialized knowledge and engineering skills. Consult Yanmar's local subsidiary in your region or your distributor or dealer.

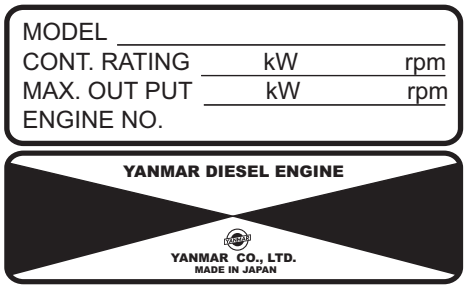
⚠ WARNING

002540-00E

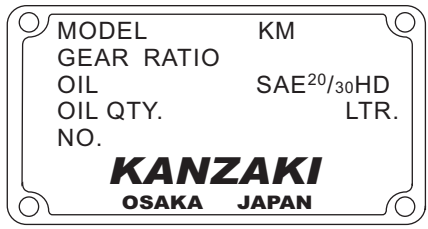
Never modify this product or release the limit devices (which limit engine speed, fuel injection quantity, etc.). Modification will impair the safety and performance of the product and functions and shorten the product life.
Please note that any troubles arising from modification of the product will not be covered by our warranty.

DETAIL OF NAME PLATE

The name plate shown below is attached to the engine. Check the engine's model, output, rpm and serial number on the name plate.



The name plate shown below is described in the marine gear. Check the marine gear's model, gear ratio, oil used, oil quantity and serial number.



002541-00E

2. Product explanation

2.2 Engine Specifications
2.2.1 Direct Seawater Cooling Type, GM series

Engine Model				1GM10		
Type				Vertical 4-cycle water cooled diesel engine		
Combustion system				Swirl pre-combustion chamber		
Number of cylinders				1		
Bore × stroke			mm (in.)	75 × 72 (2.95 × 2.83)		
Displacement			ℓ (cu.in.)	0.318 (19.40)		
Continuous rating output	Output/crankshaft speed		kW/rpm (HP/rpm)	5.9/3400 (8.02/3400)		
	Brake mean effective pressure		kg/cm^2 (lb./in.^{2})	6.66 (94.71)		
	Piston speed		m/sec. (ft./sec.)	8.16 (26.77)		
One hour rating output	Output/crankshaft speed		kW/rpm (HP/rpm)	6.7/3600 (9.1/3600)		
	Brake mean effective pressure		kg/cm^2 (lb./in.^{2})	7.07 (100.54)		
	Piston speed		m/sec. (ft./sec.)	8.64 (28.35)		
Compression ratio				23.0		
Fuel injection timing (b.T.D.C.)			°	15 ± 1		
Fuel injection pressure			kg/cm^2 (lb./in.^{2})	170 ± 5 (2347 - 2489)		
Main power take off				at Flywheel side		
Front power take off				at Crankshaft V-pulley side		
Direction of rotation	Crankshaft			Counter-clockwise viewed from stern		
	Propeller shaft (Ahead)			Clockwise viewed from stern		
Cooling system				Direct seawater cooling (rubber impeller water pump)		
Lubrication system				Complete enclosed forced lubrication		
Starting system	Type			Electric and manual		
	Starting motor			DC 12V, 1.0kW		
	AC generator			12V, 35A		
Marine gear system	Model			KM2P		
	Type			Mechanical cone clutch with single stage for both ahead and astern		
	Reduction ratio	Forward		2.21	2.62	3.22
		Reverse		3.06	3.06	3.06
	Propeller speed	Forward	rpm	1540	1298	1055
		Reverse	rpm	1113	1113	1113
	Lubricating oil capacity		ℓ (cu.in.)	0.3 (18.31)		
	Weight		kg (lb.)	10.3 (22.71)		
Dimensions	Overall length		mm (in.)	554 (21.81)		
	Overall width		mm (in.)	410 (16.14)		
	Overall height		mm (in.)	485 (19.09)		
Lubricating oil capacity (rake angle 8°)	Total		ℓ (cu.in.)	1.3 (79.33)		
	Effective		ℓ (cu.in.)	0.6 (36.61)		
Engine weight with marine gear			kg (lb.)	76 (167)		

(Note) 1. Rating condition: ISO 3046-1 and ISO 8665. 2. 1hp=0.7355 kW.

2. Product explanation

2.2.2 Direct Seawater Cooling Type, GMC series

Engine Model				1GM10C
Type				Vertical 4-cycle water cooled diesel engine
Combustion system				Swirl pre-combustion chamber
Number of cylinders				1
Bore × stroke			mm (in.)	75 × 72 (2.95 × 2.83)
Displacement			ℓ (cu.in.)	0.318 (19.40)
Continuous rating output	Output/crankshaft speed		kW/rpm (HP/rpm)	5.9/3400 (8.02/3400)
	Brake mean effective pressure		kg/cm^2 ($lb./in.^2$)	6.66 (94.71)
	Piston speed		m/sec. (ft./sec.)	8.16 (26.77)
One hour rating output	Output/crankshaft speed		kW/rpm (HP/rpm)	6.7/3600 (9.1/2600)
	Brake mean effective pressure		kg/cm^2 ($lb./in.^2$)	7.07 (100.54)
	Piston speed		m/sec. (ft./sec.)	8.64 (28.35)
Compression ratio				23.0
Fuel injection timing (b.T.D.C.)			°	15 ± 1
Fuel injection pressure			kg/cm^2 ($lb./in.^2$)	170 ± 5 (2347 - 2489)
Main power take off				at Flywheel side
Front power take off				at Crankshaft V-pulley side
Direction of rotation	Crankshaft			Counter-clockwise viewed from stern
	Propeller shaft (Ahead)			Clockwise viewed from stern
Cooling system				Direct seawater cooling (rubber impeller water pump)
Lubrication system				Complete enclosed forced lubrication
Starting system	Type			Electric and manual
	Starting motor			DC 12V, 1.0kW
	AC generator			12V, 35A
Marine gear system	Model			SD20
	Type			Sail drive unit- Dog type clutch, spiral bevel gear type
	Reduction ratio	Forward		2.64
		Reverse		2.64
	Propeller speed	Forward	rpm	1290
		Reverse	rpm	1290
Dimensions	Overall length		mm (in.)	412 (16.22)
	Overall width		mm (in.)	410 (16.14)
	Overall height		mm (in.)	485 (19.09)
Lubricating oil capacity (rake angle 8°)	Total		ℓ (cu.in.)	1.3 (79.33)
	Effective		ℓ (cu.in.)	0.6 (36.61)
Engine weight with sail driver			kg (lb.)	104 (229)

(Note) 1. Rating condition: ISO 3046-1 and ISO 8665. 2. 1hp=0.7355 kW.
(Note) Sail drive unit will be coupled with the engine in the market.

2. Product explanation

2.2.3 Direct Seawater Cooling Type, GMV series

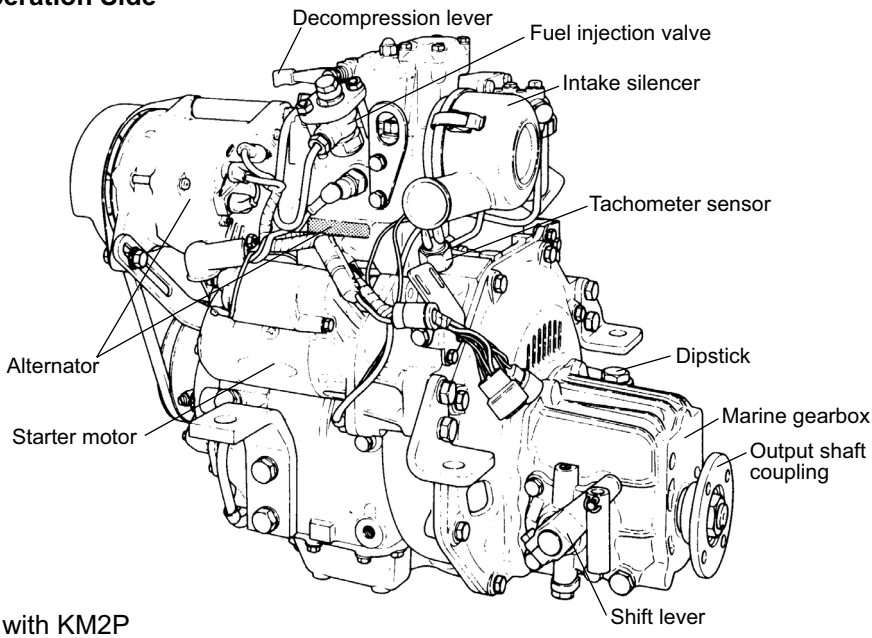
Engine Model				1GM10V
Type				Vertical 4-cycle water cooled diesel engine
Combustion system				Swirl pre-combustion chamber
Number of cylinders				1
Bore × stroke			mm (in.)	75 × 72 (2.95 × 2.83)
Displacement			ℓ (cu.in.)	0.318 (19.40)
Continuous rating output (DIN 6270A)	Output/crankshaft speed		kW/rpm (HP/rpm)	5.9/3400 (8.02/3400)
	Brake mean effective pressure		kg/cm^2 ($lb./in.^2$)	6.66 (94.71)
	Piston speed		m/sec. (ft./sec.)	8.16 (26.77)
One hour rating output (DIN 6270B)	Output/crankshaft speed		kW/rpm (HP/rpm)	6.7/3600 (9.1/3600)
	Brake mean effective pressure		kg/cm^2 ($lb./in.^2$)	7.07 (100.54)
	Piston speed		m/sec. (ft./sec.)	8.64 (28.35)
Compression ratio				23.0
Fuel injection timing (b.T.D.C.)			°	15 ± 1
Fuel injection pressure			kg/cm^2 ($lb./in.^2$)	170 ± 5 (2347 - 2489)
Main power take off				at Flywheel side
Front power take off				at Crankshaft V-pulley side
Direction of rotation	Crankshaft			Clockwise viewed from stern
	Propeller shaft (Ahead)			Clockwise viewed from stern
Cooling system				Direct seawater cooling (rubber impeller water pump)
Lubrication system				Complete enclosed forced lubrication
Starting system	Type			Electric and manual
	Starting motor			DC 12V, 1.0kW
	AC generator			12V, 35A
Marine gear system	Model			KM3V
	Type			V-drive, mechanical cone clutch with single stage for both ahead and astern (Angle 15 degree)
	Reduction ratio	Forward		2.36
		Reverse		3.16
	Propeller speed DIN 6270A rating	Forward	rpm	1441
		Reverse	rpm	1076
	Lubricating oil capacity		ℓ (cu.in.)	0.8 (48.92)
	Weight		kg (lb.)	19.5 (43.0)
Dimensions	Overall length		mm (in.)	680 (26.77)
	Overall width		mm (in.)	450 (17.71)
	Overall height		mm (in.)	554 (21.81)
Lubricating oil capacity (rake angle 8°)	Total		ℓ (cu.in.)	1.3 (79.33)
	Effective		ℓ (cu.in.)	0.6 (36.61)
Engine weight with marine gear			kg (lb.)	90 (198)

(Note) 1. Rating condition: ISO 3046-1 and ISO 8665. 2. 1hp=0.7355 kW.

2. Product explanation

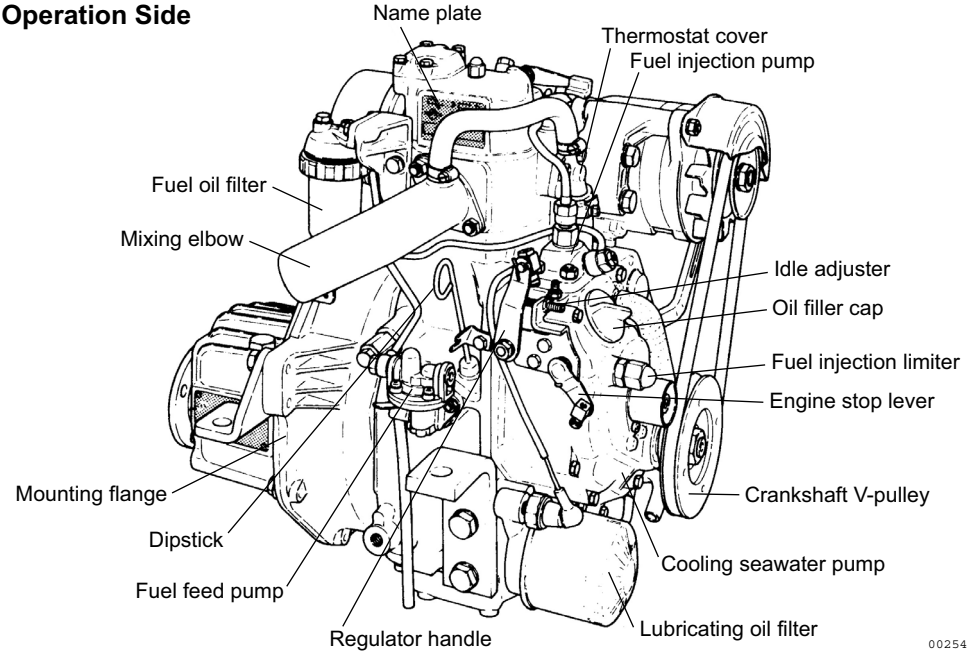
2.3 Names of Parts

Non Operation Side



1GM10 with KM2P

Operation Side



2. Product explanation

2.4 Major Servicing Parts

Name of part	Function
Decompression lever	Opens the exhaust valve and releases the pressure for manual starting.
Fuel filter	Removes dust and water from fuel. Drain the filter periodically. The internal element (filter) should be changed periodically.
Fuel feed pump, Priming lever	Feed fuel to the fuel injection pump. Moving the priming lever up and down feeds the fuel. When there is no fuel, the priming lever is used to bleed air from the fuel system.
Filler port (engine)	Filler port for engine lube oil.
Filler port (marine gear)	Filler port for marine gear lube oil.
Lube oil filter	Filters fine metal fragments and carbon from the lube oil. Filtered lube oil is distributed to the engine's moving parts.
Cooling Water System	Direct seawater cooling.
Seawater cooling	The seawater pump feeds seawater. The flow is controlled automatically by a thermostat which measures the temperature during operation.
Anticorrosion zinc	The metal area of the seawater cooling system is prone to electrical corrosion. The anticorrosion zinc is installed in the cylinder block and/or cylinder head to prevent this. The anticorrosion zinc is itself reduced over time by electrical corrosion, so it must be replaced at fixed intervals before it is completely consumed in order to ensure that the metal area of the seawater cooling system remains fully protected.
Intake air silencer	This is the air intake silencer. The silencer guards against dirt in the air and reduces the noise of air intake.
Name plate	Name plates are provided on the engine and the marine gear and have the model, serial number and other data.
Starter	Starter motor for the engine. Powered by the battery.
Alternator	Rotates by belt drive, generates electricity and charges the battery.

2. Product explanation

2.5 Control Equipment

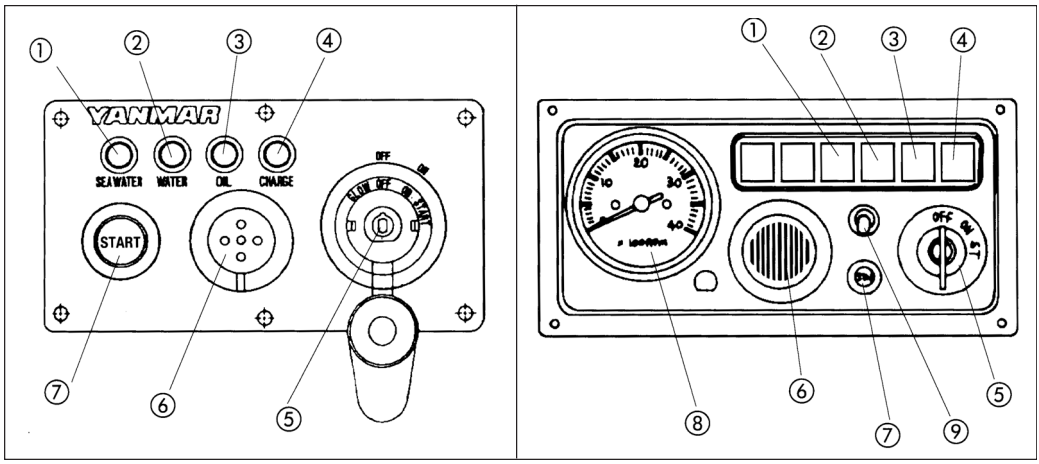
The equipment in the control room, making remote control possible, consists of: the instrument panel, which is connected by wire harness; the remote control handle, which is hooked up by remote control cable to each of the engine control levers, and the stopping equipment.

2.5.1 Control Panel

Electric Operation

There are two control panel options. The controls and alarm lamps included are shown below.

(A) (B)

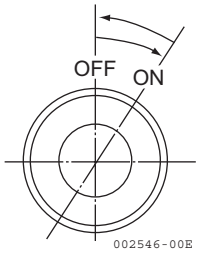


①Water Proof (sail drive)
②High temp. cooling water
③Low lube oil pressure
④Charge
⑤Key switch
⑥Buzzer
⑦Start switch
⑧Tachometre
⑨Illumination switch 002543-00E

2. Product explanation

(1) Controls and Equipment

Note: The mark Ⓑ indicates equipment for type B control panel only.

Controls and Equipment	Mechanism
	Key Switch Rotary switch with 2 positions. In the OFF position, the switch key can be inserted or removed. In OFF, all electric current is cut off. In ON (1 position to the right), the engine is turned on. In ON, electric current to the controls and equipment is turned on. The engine cannot be stopped with the key switch.
Alarm Lamps	Lamps come on when there is a problem. See Section 2 for the types of lamps and the way they work.
Alarm Buzzer	Buzzer goes off when there is a problem.
Ⓑ Illumination Switch	The switch turns on the control panel lamps.
Ⓑ Tachometre	The engine's rotation speed is indicated by the needle.
Ⓑ Hour Metre (optional)	The number of hours of operation is indicated, and can be used as a guide for periodic maintenance checks. The hour meter is at the bottom of the tachometre.

(2) Alarm Equipment (lamps and buzzer)

Mechanism

When the sensor detects a problem during operation, the lamps come on and the buzzer goes off.

Control Panel (TypeA)

There are 4 separate alarm monitors on the upper left side of the control panel.

Control Panel (TypeB)

Alarm monitors are located on the upper right side of the control panel. Under normal conditions, the monitors are off.

When there is a problem, the monitors light up.

(3) Alarm Devices

Check that the pilot lamps on the instrument panel are as shown below when the starter key is turned on:

Pilot lamps	Low L.O. pressure alarm lamp	Lit
	Charge lamp	Lit
	Cooling water temp. alarm lamp	Off

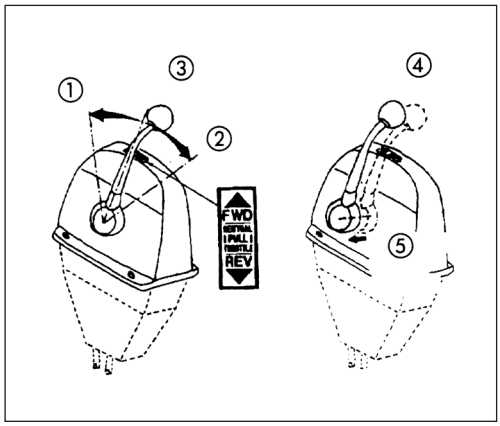
NOTE:

All these signals will continue until the engine starts up or the key is turned off.

2.5.2 Single Lever Remote Control Handle (Morse Type) - Optional.

This remote control system uses a single handle to operate marinegear-clutch-(neutral, forward, reverse) and to control the engine speed.

NEUTRAL: Power to the propeller shaft is cut off and the engine idles.
FWD (FORWARD)
REV (REVERSE)



① FWD(forward)
② REV(reverse)
③ NEUTRAL(boat is stopped)
④ Clutch is disengaged
⑤ Pull out handle

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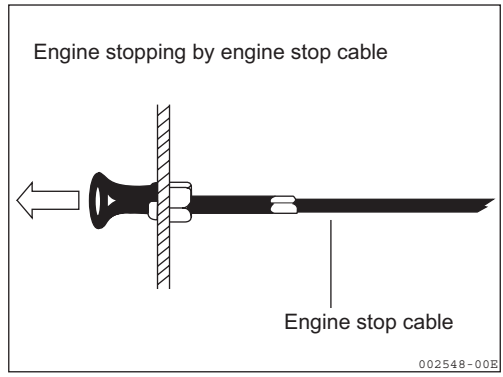
The handle controls the course of the boat (ahead or astern) and, at the same time, acts as an accelerator increasing the engine speed as it is pushed further in the FWD or REV direction. If the handle is pulled out, engine speed can be controlled without engaging the clutch (clutch remains in the NEUTRAL, no load position).

2.5.3 Stopping Equipment

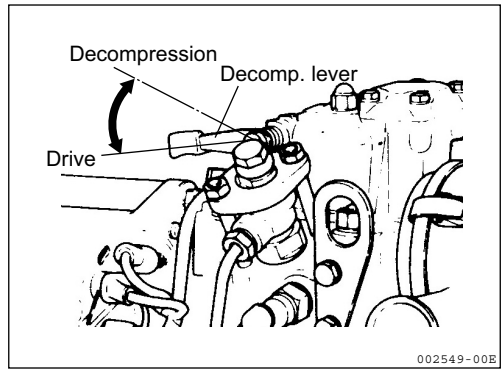
Manual Operation

The engine is stopped by pulling out the engine stop knob, which catches the fuel injection pump stop lever thus cutting off fuel injection.



2.5.4 Decompression Equipment

The decompression lever is used for manual starting.
When the decompression lever is pulled, the exhaust valve opens causing decompression inside the cylinders and making hand-turning possible. Returning the lever to the original position closes the exhaust valve, allowing compression and operation condition.



3. Operation

3.1 Fuel Oil, and Lube Oil

3.1.1 Fuel Oil

NOTICE

002550-00E

When other than the specified fuel oil is used, the engine will not perform to full capacity and parts may be damaged.

(1) Selection of Fuel Oil

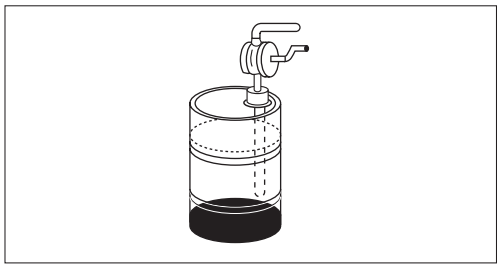
Use diesel fuels for best engine performance.

Cetane fuel number should be 45 or greater.

(2) Handling of Fuel Oil

1)Water and dust in the fuel cause engine failure. When fuel is stored, be sure that the inside of the storage container is clean, and that the fuel is stored away from dirt or rain water.

2)Keep the fuel container stationery for several hours to allow any dirt or water to settle to the bottom. Use a pump to extract the clear, filtered fuel from the top of the container for use.

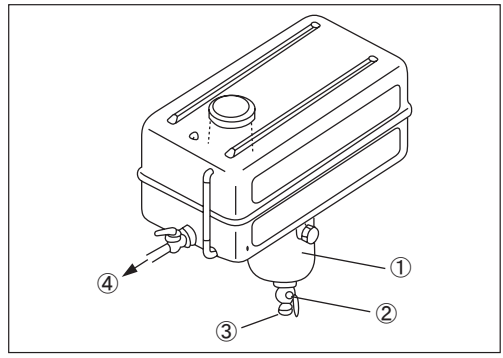


Use the clear filtered fuel from the upper middle section of the container only, leaving any contaminated fuel at the bottom. 002551-00E

(3) Fuel Tank (optional)

Be sure to attach a drain cock to the fuel tank to enable dirt and water to settle at the bottom of the tank to be drained off.

The fuel outlet should be positioned 20-30mm above the bottom of the tank so that only clean fuel is used.



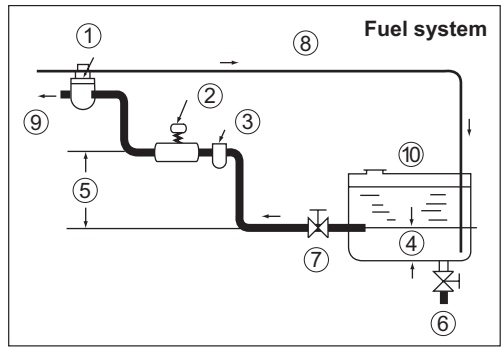
① Sediment ②③ Drain cock ④ To engine

002552-00E

(4) Fuel System

Install the fuel pipe from the fuel tank to the fuel pump in accordance with the diagram.

The oil/water separator (optional) is placed at the centre section of the line.



① Fuel filter
② Fuel feed pump (priming lever)
③ Oil/Water separator
④ Approx. 25 mm
⑤ Within 500 mm
⑥ Drain cock
⑦ Fuel cock
⑧ Fuel returm
⑨ To fuel injection pump
⑩ Fuel tank

002553-00E

3.1.2 Lube Oil

NOTICE

002550-00E

Using other than the specified lube oil will lead to seizure of parts, abnormal wear, andshorten engine life.

(1) Selection of Engine Lube Oil

Use the following lube oil:

- API Classification.....CD
- SAE Viscosity.....15W40

(2) Selection of Oil for Marine Gear

- SAE Viscosity.....30

(3) The Sail Drive attached to

- SAE Viscosity.....30

(4) Handling the Lube Oil

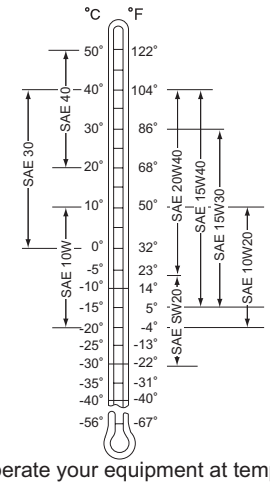
1)When handling and storing lube oil, be careful not to allow dust and water to enter the lube oil. Clean around the filter port before refilling.

2)Do not mix lube oils of different types or brands. Mixing may cause the chemical characteristics of the lube oil to change and lubricating performance to drop, reducing the engine's life.
Before supplying lube oil to the engine and marine gear for the first time, extract all the lube oil already in the tank. Use new lube oil.

3)Lube oil supplied to the engine will undergo natural degeneration with time even when the engine is not used.
Lube oil should be replaced at the specified intervals, regardless of whether the engine is being used or not.

Air temperature

Single grade Multi grade



If you operate your equipment at temperatures below the limits shown, consult four dealer for special lubricants and starting aids.

002554-00E

3. Operation

3.2 Before Initial Operation

Perform the following before using the engine for the first time:

3.2.1 Supply Fuel Oil

⚠ DANGER

002529-00E

Using gasoline, etc. may cause a fire.
To avoid mistakes, be sure to double-check the kind of fuel before inserting. Wipe off any spilled fuel carefully.

1. Before filling with fuel, wash out the fuel tank and fuel system with clean kerosene or light oil.
2. Fill the tank with clean fuel oil free of dirt and water.

3.2.2 Supply Engine Lube Oil

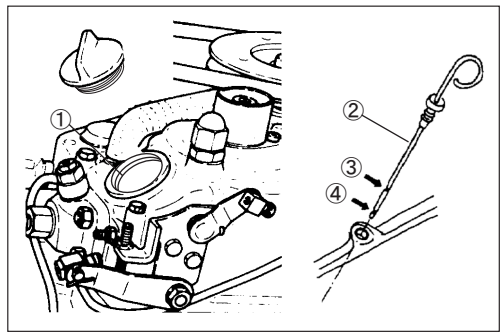
1. Remove the filler port cap (yellow), and fill with engine oil.
2. Fill with oil to the upper limit on the dipstick. Insert the dipstick fully to check the level. (Check the level without screwing the dipstick in.)
3. Tighten the filler port cap securely by hand.

Engine Oil Capacity (Oil Pan)	
1GM10(V)(C)	Full:1.5ℓ/Effective:0.8ℓ

NOTICE

002550-00E

Overfilling will cause oil to be sprayed out from breather and lead to engine problems.

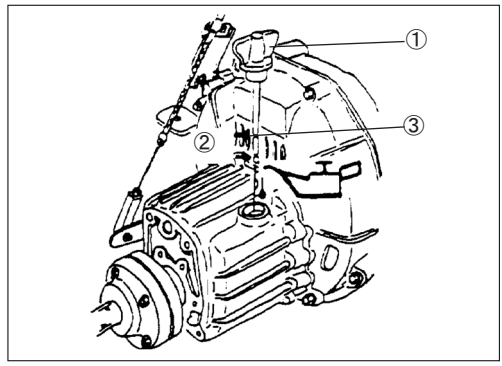


①Filler port ③Upper limit
②Dipstick ④Lower Limit 002555-00E

3.2.3 Supply Clutch Lube Oil

1. Remove the filler port cap at the top of the marine gear, and fill with marine gear- clutch- lube oil.
2. Fill with oil to the upper limit on the dipstick. insert the dipstick fully to check the level.
3. Tighten the filler port cap securely by hand.

Marine gear oil capacity	
KM2P	0.3ℓ

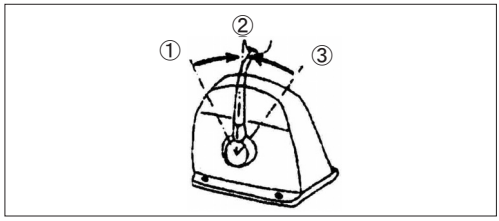


①Oil filler port cap
②Upper limit/Lower limit
③Dipstick 002556-00E

3.2.4 Cranking

When the engine has not been used for a long period of time, lube oil will not be distributed to all of the operating parts.
Using the engine in this condition will lead to seizure.
After a long period of disuse, distribute lube oil to each part by cranking. Perform in accordance with the following procedures
before beginning operation.

1. Open Kingston cock.
2. Open fuel tank cock.
3. Put remote control lever in NEUTRAL.

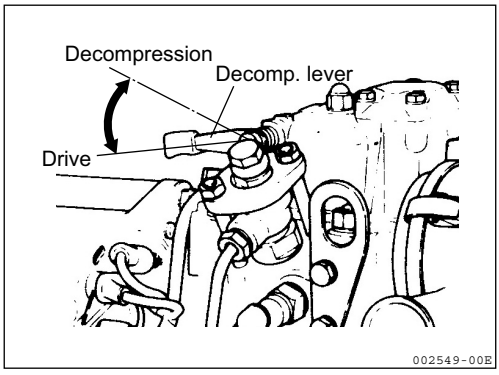


① Forward ② Neutral ③ Reverse

002557-00E

Manual Operation

4. Pull out decompression lever.
5. Put starting handle on the starting shaft, and turn about 10 times. Check for abnormal noise while cranking.



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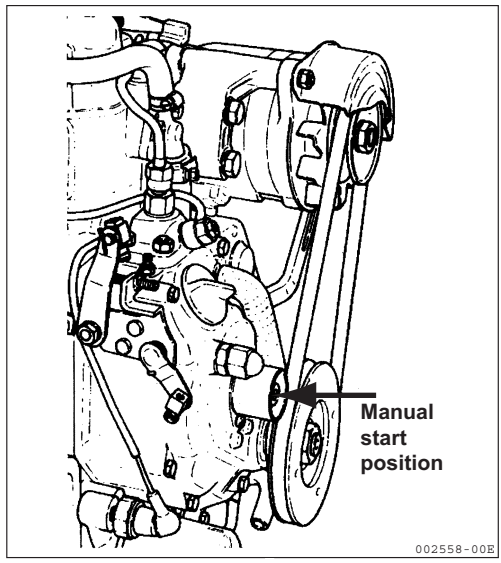


002558-00E

Electric Operation

4. Turn on battery switch and insert key into key switch. Turn the key to the ON position.
5. Pul the stop knob continuously while cranking.
6. When the start button is pushed, the engine will begin cranking. Continue cranking for about 5 seconds, and check for abnormal noise during that time. (If you remove your hand from the stop knob while cranking, the engine will start. Pull continuously.)

3.2.5 Check and Resupply Lube Oil

When engine oil or clutch oil is supplied for the first time or when they must be replaced, conduct a trial operation of the engine for about 5 minutes and check the quantity of lube oil. The trial engine operation will send the lube oil to the parts, so the lube oil level will drop. Check and resupply as necessary.

1. Supplying engine lube oil (See 3.2.2)
2. Supplying marine gear lube oil (See 3.2.3)

3. Operation

3.3 Operating your engine

⚠ WARNING
002540-00E

To prevent exhaust gas poisoning, ensure good ventilation during operation. Install ventilation windows, ports or ventilators in the engine room.
Never touch or allow your clothes to touch the moving parts of the engine during operation. If the front drive shaft, V-belt, propeller shaft, etc. catches your body or clothes, serious injury may result. Check that no tools, cloth, etc. are left on or around the engine.

⚠ CAUTION
002696-00E

The engine is very hot during operation and immediately after stopping, especially the exhaust pipe. Avoid burns! Never touch or allow your clothes to touch any part of the engine.

3.3.1 Inspection Before Starting

Before starting the engine, make it a daily rule to conduct the following inspections:

(1) Visual Checks
Check for the following:
1. Lube oil leakage from the engine
2. Fuel oil leakage from the fuel system
3. Water leakage from the cooling water system
4. Damage to parts
5. Loosening or loss of bolts

If any problem is found, do not operate the engine before completing repairs.

(2) Checking and Resupplying Fuel Oil
Check the fuel level inside the fuel tank and supply with the recommended fuel, if necessary. (See 3.2.1)

(3) Checking and Resupplying Engine Lube Oil
1. Check the engine oil level with the oil dipstick.
2. If the oil level is low, supply with the recommended lube oil using the filler port. Supply oil up to the top mark on the oil dipstick. (See 3.2.2)

(4) Checking and Resupplying Clutch Lube Oil
1. Check the clutch oil level with the oil dipstick.
2. If the oil level is low, supply with the recommended lube oil using the filler port. Supply oil up to the top mark on the oil dipstick. (See 3.2.3)

(5) Checking the Remote Control Handle
Be sure to check that the remote control handle lever moves smoothly before use. If it is hard to operate, lubricate the joints of the remote control cable and also the lever bearings.
If the lever comes out or there is play in the lever, adjust the remote control cable. (See 4.3.4(3))

(6) Checking the Alarm Devices Electric Operation
When operating the key switch, check that the alarm devices work normally. (See 2.5.1(3))

(7) Preparing Fuel, and Lube Oil in Reserve
Prepare sufficient fuel for the day's operation. Always store lube oil in reserve (for at least one refill) onboard, to be ready for emergencies.

3.3.2 How to Start the Engine

(1) Start the engine according to the following procedures:

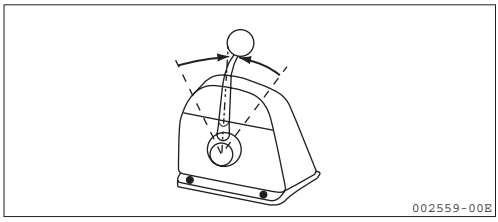
Electric Operation

1. Open the Kingston cock.
2. Open the fuel tank cock.
3. Set the remote control lever in NEUTRAL.

NOTICE

002550-00E

Safety equipment (optional) makes it impossible to start the engine in any other position than NEUTRAL.

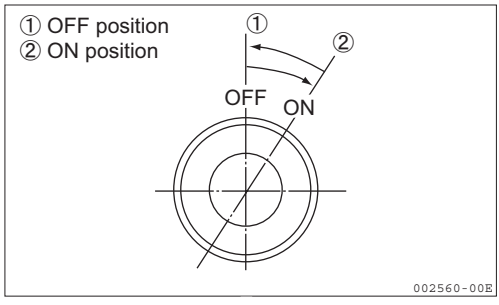


002559-00E

4. Turn on the battery switch.
5. Insert the key into the key switch and turn the key to ON. If the alarm buzzer sounds and alarm lamps come on, the alarm devices are normal.

Note: The cooling water temp. warning lamp does not come on. (See 2.5.1.(3))

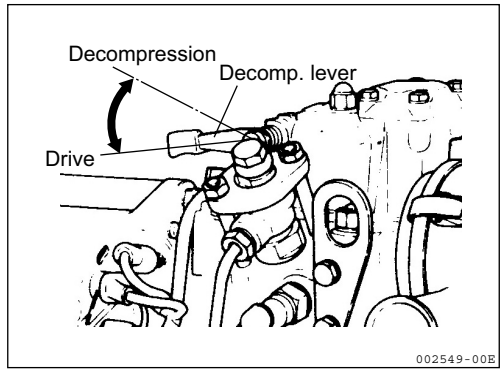
6. Push the start button to start the engine. Release the start button when the engine has started. The alarm buzzer should stop and the alarm lamps go out.



002560-00E

Manual Operation

1. Open the Kingston cock.
2. Open the fuel tank cock.
3. Set the remote control lever in NEUTRAL.
4. Pull out the decompression lever.
5. Put the starter handle on the starter shaft, align the groove and pin, and turn by hand. When you begin turning, you will hear the sound of fuel being injected.
6. Turn the handle vigorously. When the rotation is rapid, return the decompression lever to original position. The engine starts.
7. Remove the starter handle from the starter shaft.



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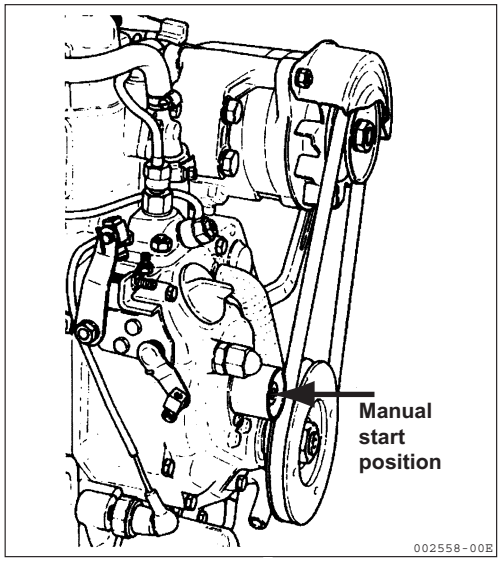
(2) Restarting After Starting Failure

Before pushing the start button again, be stopped completely. If the engine is restarted while the engine still has not stopped, the pinion gear of the starter motor will be damaged.



Electric Operation

NOTICE

002550-00E

Do not hold the start button on for more than 15 seconds at a time. If the engine does not start the first time, wait for about 15 seconds before trying again. After the engine has started, do not turn the key off. (It should remain ON.)
Alarm devices will not work when the key is OFF.

(3) Air Venting of the Fuel System After Starting Failure

If the engine only idles and won't start after several attempts, there may be air in the fuel system. If air is in the fuel system, fuel cannot reach the fuel injection pump. Vent the air in the system according to the following procedures.

Fuel System Air Venting Procedures

1. Check the fuel level in the fuel tank. Replenish if insufficient.
2. Loosen the air vent bolt at the top of the oil/water separator by turning it 2 or 3 times. When fuel which does not contain air bubbles comes out of the bolt hole, tighten the air vent bolt.
3. Loosen the air vent bolts of the fuel filter and the fuel injection pump by turning them 2 or 3 times.
4. Feed fuel with the fuel feed pump by moving the lever on the left side of the feed pump up and down.
5. Allow the fuel containing air bubbles to flow out from the air vent bolt holes. When the fuel coming out no longer contains bubbles, tighten the air vent bolts.
   This completes the air venting of the fuel system. Try starting the engine again.

(4) After the Engine has Started

After the engine has started, check the following items at a low engine speed:

1. Check that the gauges and alarm devices on the instrument panel are normal.
2. Check for water or oil leakage from the engine.
3. Check that exhaust colour, engine vibrations and sound are normal.
4. When there are no problems, keep the engine at low speed with the boat still stopped to send lube oil to all parts of the engine.

5. Check that sufficient cooling water is discharged from the seawater outlet pipe. Operation with too small seawater discharge will burn the impeller of the seawater pump. If seawater discharge is too small, stop the engine immediately. Identify the cause and repair.

   - Is the Kingston cock open?
   - Is the inlet of the Kingston cock on the full bottom clogged?
   - Is the seawater suction hose broken, or does the hose suck in air due to a loose joint?

NOTICE

002550-00E

The engine will seize if it is operated when cooling seawater discharge is too small or if load is applied without any warming up operation.

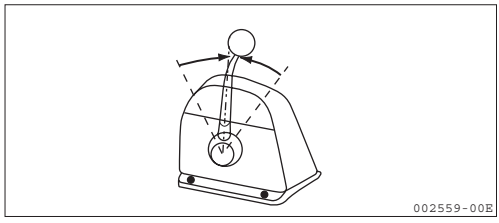
3.3.3 Operation

(1) Engine Acceleration and Deceleration

Use the governor handle to control acceleration and deceleration. Move the handle slowly.

(2) FORWARD-NEUTRAL (boat stopped) - REVERSE Clutch

Use the clutch handle to change from FORWARD to NEUTRAL (boat stopped) to REVERSE.



002559-00E

NOTICE

002550-00E

Shifting the clutch while operating at high speed or not pushing the handle fully into position (half clutch) will result in damage to clutch parts and abnormal wear.

1. Before using the clutch, be sure to move the governor handle to a low speed position (1000 rpm or less). Move the governor handle to a high speed position after completing clutch operation.
2. When changing between FORWARD and REVERSE, bring the clutch to NEUTRAL and pause before slowly shifting to the desired position. Do not shift abruptly from FORWARD to REVERSE or vice versa.
3. Move the clutch handle accurately and fully into the FORWARD, NEUTRAL, and REVERSE positions.

3.3.4 Cautions During Operation

Always be on the lookout for problems during engine operation.
Pay particular attention to the following:

(1) Is sufficient water being discharged from the seawater outlet pipe?

If the discharge is small, stop the engine immediately, identify the cause and repair.

(2) Is the exhaust colour normal?

The continuous emission of black exhaust indicates engine overloading. This shortens the engine's life and should be avoided.

(3) Are there abnormal vibrations or noise?

Do not operate at speeds which produce violent vibrations. Depending on the hull structure, engine and hull resonance may suddenly become great at a certain engine speed range, causing heavy vibrations.

Avoid operation in this speed range. If you hear any abnormal sounds, stop the engine and inspect.

Electric Operation

(4) Alarm buzzer sounds during operation.

If the alarm buzzer sounds during operation, lower the engine speed immediately, check the warning lamps, and stop the engine for repairs.

(5) Is there water, oil, or gas leakage, or are there any loose bolts?

Check the engine room periodically for any problems.

(6) Is there sufficient fuel oil in the fuel oil tantk?

Replenish fuel oil in advance to avoid running out of fuel during operation.

(7) When operating the engine at low speed for long periods of time, race the engine once every 2 hours.

Note: Racing the Engine

With the clutch in NEUTRAL, accelerate from the low speed position to the high speed position and repeat this process about 5 times. This is done to clean out carbon from the cylinders and the fuel injection valve.

Neglecting to race the engine will result in poor exhaust colour and reduce engine performance.

NOTICE

002550-00E

Electric Operation

Never turn off the battery switch or spark the battery cable during operation. Damage to parts in the electric system will result.

3.3.5 Stopping the Engine

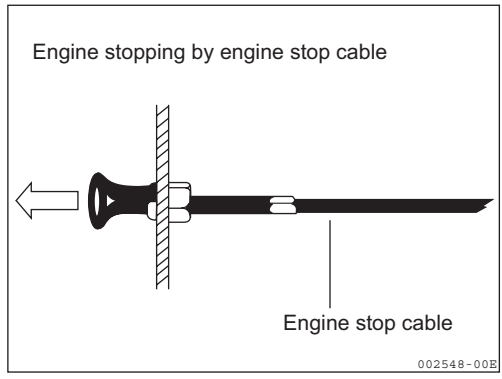
Stop the engine in accordance with the following procedures:

1. Put the remote control handle in NEUTRAL.
2. Be sure to race the engine before stopping it. (See 3.3.4(7))
3. Cool down the engine at low speed (approximately 1000 rpm) for about 5 minutes.

NOTICE

002550-00E

Stopping the engine suddenly while operating at high speed will cause the engine temperature to rise quickly, causing deterioration of the oil and sticking of parts.



4. Continue to pull out the engine stop knob (stop lever) until the engine is completely stopped. If you release the knob before the engine has completely stopped, it may restart.
5. Close the fuel tank cock.
6. Close the sea cock.

NOTICE
002550-00E

Neglecting to close the Kingston cock will allow water to leak into the boat and may cause it to sink. Be sure to close the cock.

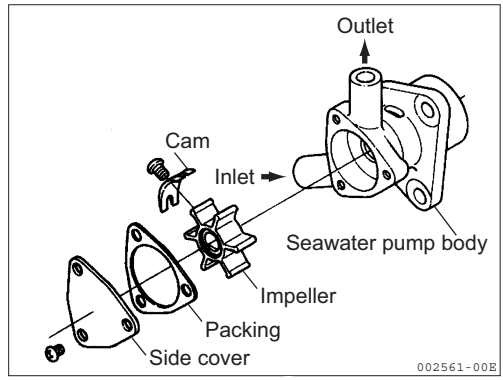
Note: The engine may be stopped by pulling out the decompression lever, but avoid doing so except in times of emergency.
In this case, the engine is stopped by cutting off the air pressure. However, fuel injection does not stop, and fuel is leftover in the combustion chamber.
This will lead to abnormal combustion when the engine is restarted and is not desirable.

3.4 Long Term Storage

In cold temperatures or before long term storage, be sure to drain the water from the seawater cooling system.

⚠ CAUTION
002696-00E Drain water from the cooling system after the engine has cooled down. Be careful to avoid burns.

NOTICE
002550-00E If water is left inside, it may freeze and damage parts of the cooling system cylinder block, seawater pump, etc.)



1. Loosen the drain cock at the side of the thermostat cover, and drain off the water inside.
2. Loosen the 3 bolts fixing the side cover of the seawater pump, remove the cover and drain the water from inside. Retighten the bolts when finished.
3. Close the drain cock.

4. Maintenance & Inspection

4.1 General Inspection Rules

Conduct Periodic Inspection for Your Safety.
The functions of engine components will degenerate and engine performance will drop according to the use of the engine. If countermeasures are not taken, you may encounter unexpected troubles while cruising at sea. Consumption of fuel or lube oil may become excessive and exhaust gas and engine noise may increase. These all shorten the life of the engine. Daily and periodic inspection and servicing increase your safety at sea.

Inspect Before Starting.
Make it a daily rule to inspect before starting. (See 3.3.1)

Periodic Inspections at Fixed Intervals.
Periodic inspections must be made after every 50, 150, 300 and 600 hours of use. Conduct periodic inspections according to the procedures described in this Operation Manual.

Use Genuine Parts.
Be sure to use genuine parts for consumable and replacement parts. Use of other parts will reduce engine performance and shorten the life of the engine.

NOTICE
002550-00E

Consult Your YANMAR Dealer or Distributor.
Specialized technicians are ready to assist you with periodic inspections and maintenance. Consult your YANMAR dealer or distributor in accordance with the service agreement.

Servicing Tools
Prepare servicing tools onboard to be ready for inspecting and servicing the engine and other equipment.

Tightening Torque of Bolts & Nuts
Over-tightening of bolts and nuts causes them to come off or their threads to be damaged. Insufficient tightening causes oil leakage from the installation face or troubles due to the loosening of bolts. Bolts and nuts must be tightened to the appropriate tightening torque. Important parts must be tightened with a torque wrench to the correct tightening torque and in the right order. Consult with your dealer or distributor if the servicing requires the removal of such parts.

The standard tightening torque for standard bolts & nuts is listed below.

Apply the following tightening torque to bolts having "7" on the head. (JIS strength classification: 7T)
Tighten bolts with no "7" mark to 60% tightening torque.
If the parts to be tightened are made from light alloy aluminum, tighten the bolts to 80% tightening torque.

Bolt dia. × pitch mm	M6×1.0	M8×1.25	M10×1.5	M12×1.75	M14×1.5	M16×1.5
Tightening torque Nm	11±01	26±03	50±05	90±10	140±15	230±20

4. Maintenance & Inspection

4.2 List of Periodic Inspection Items

Daily and periodic inspections are important to keep the engine in its best condition. The following is a summary of inspection and servicing items by inspection interval. Periodic inspection intervals should vary depending on the uses, loads, fuels and lube oils used and handling conditions, and are hard to establish definitively. The following should be treated as a general standard only. Section 4.3 gives a detailed explanation of which parts must be inspected and the procedure for doing so for each interval.

NOTICE

002550-00E

Schedule your own periodic inspection plan according to the operational conditions of your engine and inspect every item.
Neglect of periodic inspection may head to engine troubles and shorten the life of the engine.
Inspection and servicing at 600 hours and thereafter require special knowledge and techniques. Consult your Yanmar dealer or distributor.

4. Maintenance & Inspection

○: Check ⓪:Replace ●:Consult local dealer

System	Item		Before starting	After50 hrs or one month	Every 150 hrs	Every 300hrs	Every 600 hrs (1 year)
Fuel system*	Check the fuel level, and refill		○				
	Drain the fuel tank			○(first)		○	
	Drain the fuel filter			○			
	Replace the fuel filter					⓪	
	Check the injection timing						●
	Check the injection spray condition						●
Lubricating system	Check the lube oil level	Crankcase	○				
		Marine gear	○				
	Replace the lube oil	Crankcase		⓪(first)	⓪		
		Marine gear		⓪(first)	⓪		
	Check the oil pressure warning lamp function		○				
	Replace the lube oil filter			⓪(first)		⓪	
Cooling system	Seawater outlet		○ During operation				
	Check the impeller of the cooling water pump (seawater pump)						○
	Check and replace the anticorrosion zinc					⓪	
	Adjust the tension of the seawater pump driving blet			○(first)		○	
Air intake and exhaust system	Clean the element of the air intake silencer					○	
	Clean the exhaust/water mixing elbow					○	
	Clean the breather pipe					○	
	Check the exhaust gas condition		○ During operation				
Electrical system	Check the charge lamp function		○				
	Check the electrolyte level in the battery		○		○		
	Adjust the tension of the alternator driving belt			○(first)		○	
	Check the wiring connectors					○	
Cylinder head, etc.	Check for leakage of water and oil		○ (After starting)				
	Retighten all major nuts and bolts						●
	Adjust intake/exhaust valve clearance			○(first)			●
Remote control system, etc.	Check the remote control operation			○(first)			●
	Adjust the propeller shaft alignment			○(first)			●

*For EPA Requirements, see also 4.4

4. Maintenance & Inspection

4.3 Periodic Inspection Items

4.3.1 Inspection on Initial 50 Hrs. of Operation (or after 1 Month)

(1) Replacing the Engine Lube Oil and Lube Filter (1st time)

During initial operation of the engine, the oil is quickly contaminated due to the initial wear of internal parts. The lube oil must therefore be replaced early. Replace the lube oil filter at the same time.

It is easiest and most effective to drain the engine lube oil after operation while the engine is still warm.

1. Remove the lube oil dipstick. Attach the oil drain pump and drain off oil.
2. Remove the lube oil filter with the filter detach/attach tool. (Turn to the left.)
3. Clean the filter installation face and attach the new filter, tightening by hand.
4. Turn an additional 3/4 of a turn with the attachment tool. (Turn to the right. Tightening torque: 20~24 Nm)
5. Fill with new lube oil. (See 3.2.2)
6. Perform a trial run and check for oil leakage.
7. Approximately 10 minutes after stopping the engine, remove the oil dipstick and check the oil level. Add oil if the level is too low.

⚠ CAUTION

002696-00E

Beware of oil splashes if extracting the lube oil while it is hot.

(2) Replacing the Clutch Lube Oil (1st time)

During initial operation, the oil is quickly contaminated due to the initial wear of internal parts. The lube oil must therefore be replaced early.

1. Remove the cap from the filler port and attach the oil drain pump. Drain off oil.
2. Fill with new lube oil. (See 3.2.3)
3. Perform a trial run and check for oil leakage.

(3) Draining the (optional) Fuel Tank

Open the drain cock and drain off any water or dirt collected on the bottom.

Put a pan under the drain to catch the fuel.

Once the water and dirt has been drained off and the fuel coming out is clear, close the drain cock.

4.3.2 Inspection Every 50 Hours (or Monthly)

(1) Draining the Fuel Filter

1. Close the fuel oil cock.
2. Remove the fuel filter cover and drain off any water and dirt collected inside.
3. After reassembly, be sure to vent air from the fuel system. (See 3.3.2(3))

(2) Inspection and adjustment of Intake/Exhaust Valve Clearance (1st time)

Setting of a new engine and individual engine use will cause changes in the intake/exhaust valve and rocker arm clearance, and adjustment is necessary. This adjustment requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

(3) Adjusting the Remote Control Cable

The various control levers on the engine side are connected to the remote control lever by the remote control cable. The cable will become stretched and the attachments loose after long hours of use causing deviation. It is dangerous to control operation under these conditions, and the remote control cable must be checked and adjusted periodically.

A) Adjusting the Governor Remote Control Cable

Check to see that the control lever on the engine side moves to the high speed bolt position and low speed bolt position when the remote control lever is moved to H(high speed) and L(low speed) respectively.

When there is deviation, loosen the bracket for the remote control cable on the engine side and adjust.

Adjust the high speed bolt position first and then adjust the low speed idling.

B) Adjusting the Clutch Remote Control Cable

Check to see that the control lever moves to the correct position when the remote control handle is put in NEUTRAL, FORWARD, REVERSE.

Use the NEUTRAL position as the standard for adjustment. When there is deviation, loosen the bracket for the remote control cable on the clutch side and adjust.

(4) Electric Operation

⚠ WARNING

002540-00E

Before inspecting the electrical system, be sure either to turn off the battery switch or to disconnect the (-) terminal of the earth cable. Otherwise, a shortcircuit could cause a fire.

Ensure good ventilation when charging the battery. The use of open flames is strictly prohibited. Hydrogen gas may also catch fire.

Battery fluid is diluted sulfuric acid. It can blind you or burn your eyes or skin. Wear goggles and gloves when handling battery fluid. Should the fluid be deposited on your skin, wash with a large quantity of fresh water and seek treatment from a doctor.

1) If operation continues with insufficient battery fluid, the battery will be destroyed. Check the fluid level periodically. If the level is lower than specified, resupply battery fluid (available in the market) up to the upper limit of the battery.

(Battery fluid tends to evaporate in high temperatures, especially in summer. In such cases, inspect the bettery earlier than specified.)

2) If the engine speed will not rise and the engine cannot be started, measure the specific gravity with a pycnometre (available in the market).

The specific gravity of the fluid when fully charged is over 1.27(at 20°C).

Fluid with a specific gravity of below 1.24 needs charging. If the specific gravity cannot be raised by charging, the battery must be replaced.

NOTICE

002550-00E

The capacities of the standard alternator and the recommended battery assume only the power necessary for regular operation.

If the power is also used for inboard lighting or other purposes, the generating and charging capacities may be insufficient. In such cases, consult your Yanmar dealer or distributor.

4.3.3 Inspection Every 150 hours.

Replace the engine oil and the clutch lube oil.
After the second oil change, the engine oil should be replaced after every 150 hours.

4.3.4 Inspection Every 300 Hrs.

(1) Replacing the Fuel Filter

When there is dirt in the fuel, the filter becomes clogged, and the fuel will not flow easily. Check and replace the inside element.

1. Close the fuel cock.
2. Remove the filter case by loosening the retainer ring (turn to the left) with the filter wrench.
3. Pull the element out from the bottom, and replace with a new one.
4. Clean the inside of the case thoroughly, put on the O-ring, and close with the retainer ring. (Turn to the right. Tightening torque: 12Nm)
5. Air will enter into the fuel system when the filter is disassembled, and should be vented. (See 3.3.2(3))

(2) Adjusting the Tension of the Alternator Driving Belt.

When there is not enough tension in the V-belt, the alternator will not turn and power will not be generated.

When there is too much tension in the V-belt, the belt will become damaged more quickly, and the alternator bearing may be damaged.

1. Check the tension of the V-belt by pressing down on the middle of the belt with your finger.
   With proper flexion, the V-belt should sink 8~10mm.
2. Loosen the set bolt and move the alternator to adjust V-belt tension.
3. Be careful not to get any oil on the V-belt. Oil on the belt causes slipping and stretching. Replace the belt if it is marred.

(3) Inspecting and Replacing Anticorrosion Zinc

The timing for replacing anticorrosion zinc varies depending on the characteristics of the seawater and operational conditions. Inspect the zinc periodically and remove any corroded areas.

Replace the anticorrosion zinc when it has been reduced to less than 1/2 of its original size. If replacement of zinc is neglected and operation is continued with a small volume of anticorrosion zinc, corrosion of the seawater cooling system will occur and water leakage or parts breakage will result. The anticorrosion zinc is on the inside of the anticorrosion zinc plug which is labeled with a sticker reading: Anticorrosion Zinc.

(4) Replacing the Engine Oil and Lube Oil Filter

(See 4.3.1(1))

(5) Cleaning the Intake Silencer

Disassemble the intake silencer and clean the inside thoroughly.

Remove the cover by taking off the clamp. Clean the element with a neutral detergent. Reassemble after it is completely dry.

4.3.5 Inspection Every 600 Hrs.

(1) Inspecting Inner Parts of the Seawater Pump

Depending on the use, the inside parts of the seawater pump deteriorate and discharge performance drops. At the specified interval or when the volume of seawater discharged is reduced, inspect the seawater pump i accordance with the following procedures:

1. Loosen the side cover set bolts and remove the side cover.
2. Illuminate the inside of the seawater pump with a flashlight and inspect.
3. If any of the following problems is found, disassembly and maintenance are necessary:

a) Impeller blades are cracked or nicked. Edges or surfaces of the blades are marred or scratched.

Note: The impeller must be replaced periodically (every 1000 hrs.).

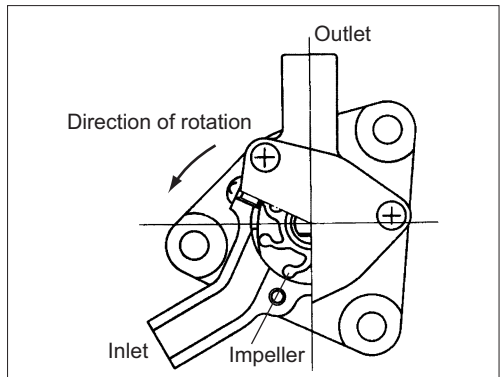
b) Pump body is damaged.

4. If no damage is found when inspecting the inside of the pump, reassemble the side cover.
   If a large amount of water leaks continuously from the water drain pipe beneath the seawater pump during operation, disassembly and maintenance (replacement of the oil seal) are necessary.
   When disassembly and maintenance of the seawater pump are necessary, consult your Yanmar dealer or distributor.

NOTICE

002550-00E

The seawater pump turns in the counterclockwise direction, but the impeller must be installed by turning in the clockwise direction. If the Impeller has been removed for any reason and must be reassembled, be very careful not to make a mistake and turn it in the wrong direction. Additionally, if the engine is being turned manually, be careful to turn it in the correct direction. Incorrect turning will twist the impeller and damage it.



(Seawater pump)
002651-00E

(2) Inspection and Adjustment of Intake/Exhaust Valve Clearance.

When operating for long periods of time, the clearance between the intake/exhaust valve and the rocker arm will change and affect operation performance. Adjustment is necessary.
Adjustment requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

(3) Inspecting and Adjusting the Fuel Injection Spray Condition.

Adjustment is necessary to obtain the optimal fuel injection to ensure the best possible engine performance. This inspection requires specialized knowledge and techniques. Consult your Yanmar dealer or distributor.

(4) Adjusting the Remote Control cable

(See page 38, 4.3.2(3))

(5) Inspecting and Adjusting the Fuel Injection Timing

Fuel injection timing must be adjusted to ensure optimal engine performance.

This maintenance requires specialized knowledge.

Consult your Yanmar dealer or distributor.

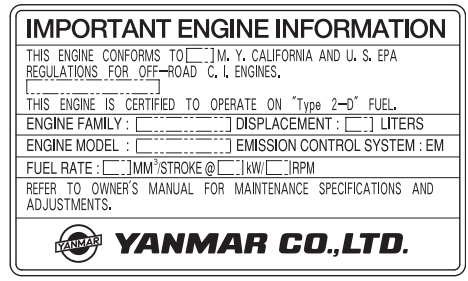
4.4 EPA Requirements

4.4.1 EPA and ARB Certification Plate

1GM10 series

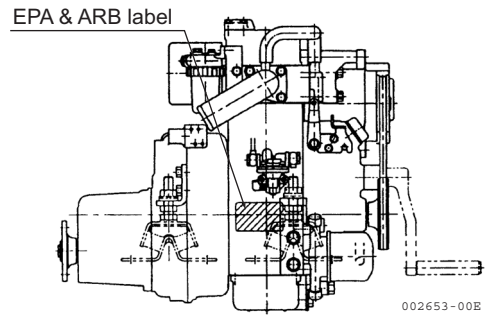
This engine has the following EPA & ARB Certification Plate attached:

- EPA Certification Plate



1GM10 series
(EPA & ARB label) 002652-00E

- **Attachment Position for Certification Plate**
- 1GM10(C)(V) series:
  attached on the exhaust side of the cylinder block.



4. Maintenance & Inspection

4.4.2 Conditions to Insure Compliance with Emission Standards

This product is an EPA & ARB approved engine. The following are the conditions that must be met in order to insure that the emission during operation meets the EPA standards. Be sure to follow these.

- **The surrounding conditions should be as follows:**
  a) Ambient temperature: -20 ~ 40 °C
  b) Relative humidity: 80% or lower
  c) Permissable value for intake negative pressure: 0.5kPa (50mmAq) or lower
  d) Permissable value for exhaust back pressure: 6.9kPa (700mmAq) or lower

- **The fuel and lube oil used should be as follows:**
  a) Fuel: The diesel gas oil ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No. 45 minimally.)
  b) Lube oil: Type API, class CD

- **Do not remove the seals limiting the amount of fuel injected and the speed.**

- **Be sure to carry out inspections.**
  Follow the basic guidelines outlined in 4.3 (Periodic Inspection Items) of this manual and keep a record of the results. Pay particular attention to these important points: replacing the lube oil, lube oil filter, the fuel filter and cleaning the intake silencer element.

Note: Inspections are divided into two sections in accordance with whom is in charge of carrying out the inspection: (the User) and (the Maker).

- **Warranty period for emission parts**
  If the schedule of periodic maintenance outlined in 4.4.3 (Inspection and Maintenance) is followed, the warranty period is determined by the age of the engine or the number of hours of operation as indicated below:

Name of parts	**Warranty period (hours of operation/age, whichever occurs first)**
	< 19kW
Fuel injection pump assembly	1500 / 2
Fuel injection valve assembly	

4.4.3 Inspection and Maintenance

Inspection and maintenance for EPA related parts are shown in the chart below.
(Inspection and maintenance not noted below are the same, see 4.2 and 4.3)

Item	Content	Interval term
Fuel oil	Check fuel valve nozzle (clean)	1000
	Check & adjustment of fuel injection pressure & atomizing condition	1000
	Check fuel pump (adjust)	2000

Note: The inspection and maintenance shown above are to be performed at your Yanmar dealer or distributor

4.4.4 Emission System Warranty Statement

EPA/USA EMISSIONS CONTROL WARRANTY STATEMENT
Yanmar Diesel Engine Co., Ltd. (Hereinafter referred to as Yanmar) warrants initial owner and each subsequent owner that the engine is designed, built and equipped so as to conform with applicable regulations for its warranty period.

Specific emissions-related parts and components are warranted for the period of 5 years or 3,000 hours, whichever comes first, after the date of delivery to the initial owner. If any emissions-related part is defective during the warranty period, the part will be repaired or replaced by Yanmar.

To maintain engine performance and compliance with the regulations, the owner is responsible for the performance of the required maintenance listed in the owner's manual during the warranty period.

This emissions warranty does not cover.
1. Failure caused by any of the following:
- Abuse, neglect, improper maintenance or use of non-genuine parts.
- Use of fuel oil and lubricating oil not recommended for the engine.
- Improper application and installation.

2. Add-on or modification affecting engine emissions.
3. Incidental or consequential damage.

The complete engine warranty statement, except for emissions-related parts and components, is provided separately in the "YANMAR WARRANTY HANDBOOK".

5. Trouble and Troubleshooting

Trouble	Probable Cause	Measure	Reference
Alarm Buzzer and Alarm Lamps On During Operation	**NOTICE** 002550-00E **Shift to low speed operation immediately, and check which lamp has come on. Stop the engine for inspection. If no abnormality is identified and there is no problem with operation, return to port at your lowest speed and request repairs.**		
Eng.Lube Oil Press. Warning Lamp goes on	Engine Lube Oil insufficient; Fuel filter clogged.	Check Lube Oil Level. Replenish or replace.	3.2.2 4.3.1(1)
*Water proof warning lamp goes on	Breakage of seal mount on the sail drive.	Check and change the rubber mount.	
Faulty Warning Devices	**NOTICE** 002550-00E **Do not operate the engine if alarm devices are not repaired.** **Serious accidents may result if difficulties are not spotted due to faulty alarm lamps.** **When switch is turned ON:** **Alarm buzzer does not sound. Circuit broken or buzz**er defective. Ask for repairs.		
Warning lamps do not go on	Eng. Lube Oil Press. Seawater. No current available. Circuit broken or lamp burnt out.	Ask for repairs.	
One of the warning lamps does not go out	Sensor switches faulty.	Ask for repairs.	
Charge lamp does not go out during operation	V-belt is loose or broken. Battery defective. Alternator power generator failure.	Replace V-belt; adjust tension. Check fluid level, specific gravity; replace. Ask for repairs.	4.3.4(3) 4.3.2(4)

*Note: Other warning lamps do not go on when the switch is turned on. They only go on when there is an abnormality.

5. Trouble and Troubleshooting

Trouble	Probable Cause	Measure	Reference
Starting Failures			
Starter turns, but engine does not start	No fuel. Fuel filter is clogged. Improper fuel. Faulty fuel injection. Compression leakage from Intake/exhaust valve.	Replenish fuel; vent air. Replace element. Replace with recommended fuel. Ask for repairs. Ask for repairs.	3.3.2(3) 4.3.4(1)
Starter does not turn or turns slowly (Engine can be turned manually)	Faulty clutch position. Insufficient battery charge. Cable terminal contact failure. Faulty safety switch device. Faulty starter switch. Power lacking due to other use.	Shift to NEUTRAL and start. Check fluid lever, recharge; replace. Remove rust from terminal; retighten. Ask for repairs. Ask for repairs. Ask for repairs. Consult your dealer.	3.3.2(1) 4.3.2(4)
Engine cannot be turned manually	Internal parts seized; broken.	Ask for repairs.	
Abnormal Exhaust Colour Black smoke	Load increased. Contaminated intake silencer. Improper fuel. Faulty spraying of fuel injection valve. Incorrect intake/exhaust valve head clearance.	Inspect propeller. Clean element. Replace with recommended fuel. Ask for repairs. Ask for repairs.	4.3.4(6) 3.1.1
White smoke	Improper fuel. Faulty spraying of fuel injection valve. Fuel injection timing off. Lube oil burns; excessive consumption.	Ask for repairs. Ask for repairs. Ask for repairs. Ask for repairs.	3.1.1

Consulting Your Yanmar Dealer or Distributor

Refer difficult problems and repairs to your Yanmar dealer or distributor.
At the time of trouble, check and report the following:

1. Engine model and number:
2. Boat name, material of hull, size (tons):
3. Use, type of fishing done, no. of hours run:
4. Total no. of operation hours (refer to hour metre), age of boat:
5. Condition before trouble (engine rpm, type of operation, load condition, etc.):
6. Details of trouble:
   (exhaust colour; sound of engine; does engine start; can engine be turned manually; type of fuel used; brand and viscosity of lube oil; etc.)
7. Past problems and repairs:

5. Trouble and Troubleshooting

WARRANTY SERVICE

Owner Satisfaction

Your satisfaction and goodwill are important to us and to your dealer.
Normally any problems concerning the product will be handled by our dealer's service department. If you have a warranty problem that has not been handled to your satisfaction, we suggest you take the following action:

- Discuss your problem with a member of the dealership management.
  Complaints can often quickly be resolved at this level. If the problem has already been reviewed with the Service Manager, contact the owner of the dealership or the General Manager.

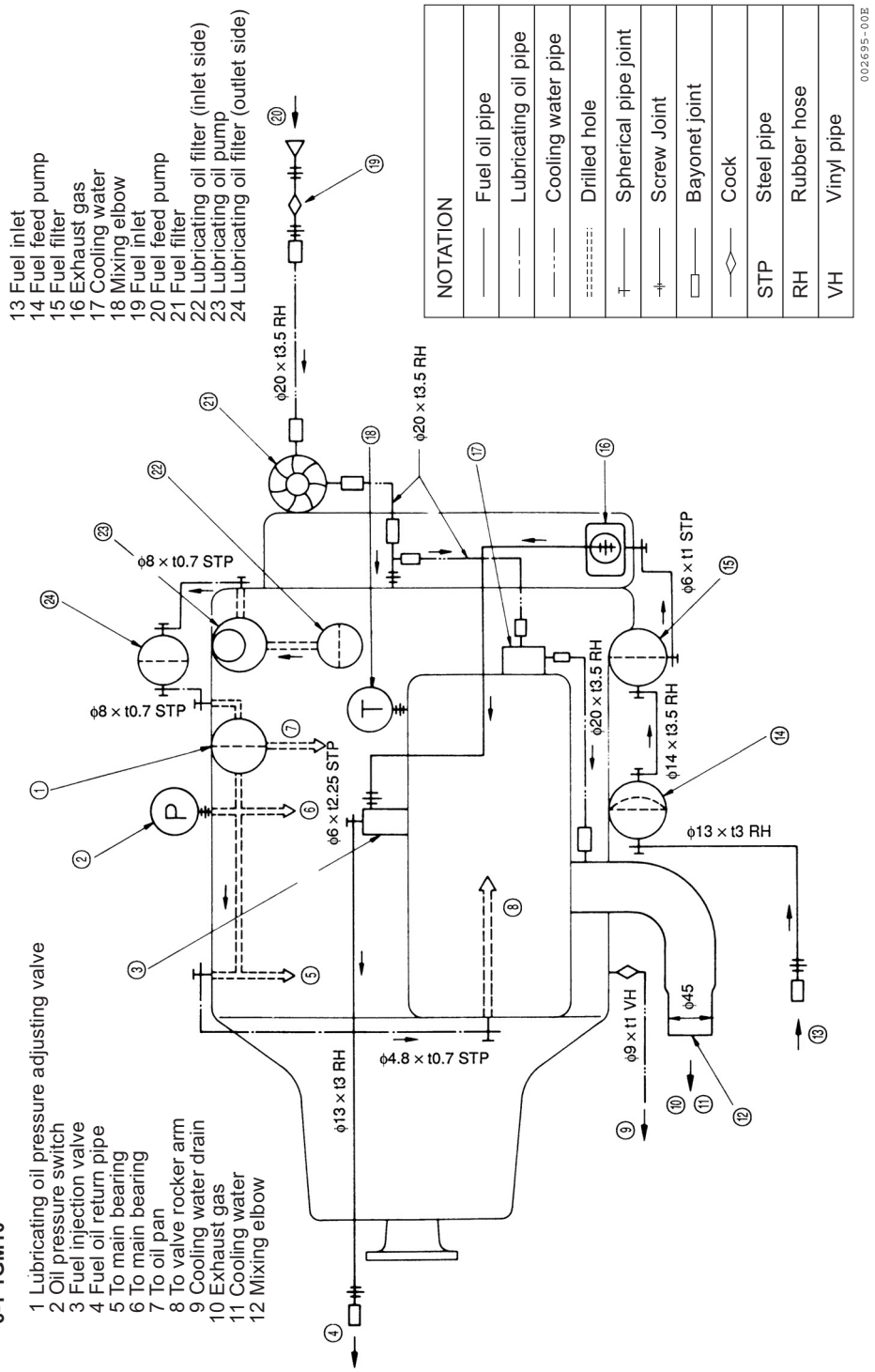
- If your problem still has not been resolved to your satisfaction, contact your local Yanmar Subsidiary Company. (See the back of this manual for addresses)

We will need the following information in order to assist you:

- Your name, address and telephone number
- Product model and serial number
- Purchase date
- Dealer's name and address
- Nature of the problem

After reviewing all the facts involved, you will be advised of what action can be undertaken. Please remember that your problem will most likely be resolved at the dealership, using the dealer's facilities, equipment and personnel. It is therefore very important that your initial contact be with the dealer.

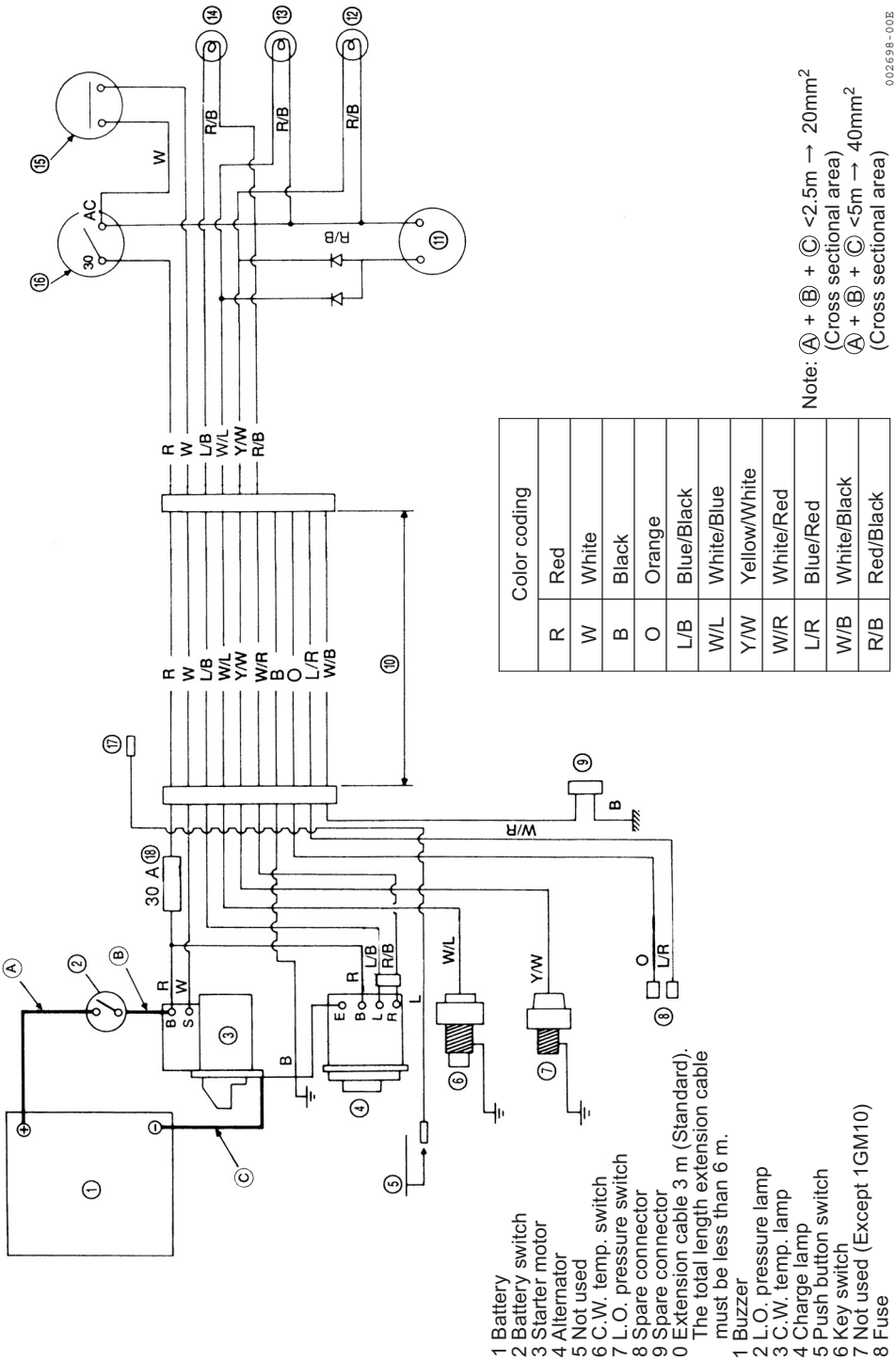
6. Piping diagrams



6-1 1GM10

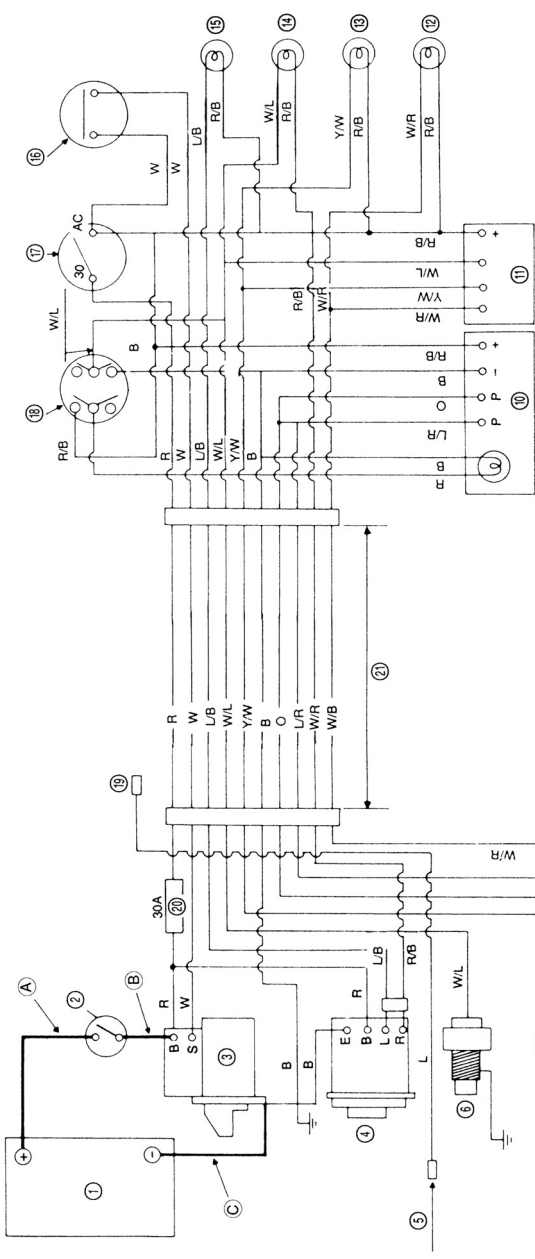
7. Wiring diagrams

7-1 For the A-type instrument panel



7. Wiring diagrams

7-2 For the B-type instrument panel



1 Battery
2 Battery switch
3 Starter motor
4 Alternator
5 Not used
6 C.W. temp. switch
7 L.O. pressure switch
8 Tachometer sender
9 Sail-drive connector (Rubber seal switch)
10 Tachometer
11 Buzzer
12 Rubber seal lamp (Sail-drive)
13 L.O. pressure lamp
14 C.W. temp. lamp
15 Charge lamp
16 Push button switch
17 Key switch
18 Light switch
19 Not used (Except 1GM10)
20 Fuse
21 Extension cable 3 m (Standard). The total length extension cable must be less than 6m.

Color coding	
R	Red
W	White
B	Black
O	Orange
L/B	Blue/Black
W/L	White/Blue
Y/W	Yellow/White
W/R	White/Red
L/R	Blue/Red
W/B	White/Black
R/B	Red/Black

Note: Ⓐ + Ⓑ + Ⓒ <2.5m → 20mm^2 (Cross sectional area)
Ⓐ + Ⓑ + Ⓒ <5m → 40mm^2 (Cross sectional area) 002711-00E

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust emission requirements of Directive 94/25/EC as amended by 2003/44/EC

(To be completed by manufacturer of inboard engines without integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

Street: 1-32 **Town:** Chayamachi, Kitaku, Osaka-City

Post Code: 530-8311 **Country:** Japan

Name of Authorised Representative: Yanmar Marine International B.V.

Street: Brugplein 11 **Town:** Almere-de Vaart

Post Code: 1332 BS **Country:** The Netherlands

Name of Notified Body for exhaust emission assessment: Société Nationale de Certification et d'Homologation

Street: 11, route de Luxembourg **Town:** Sandweiler

Post Code: L-5230 **Country:** Luxembourg **ID Number:** 0499

Module used for exhaust emission assessment: ☐ B+C ☒ B+D ☐ B+E ☐ B+F ☐ G ☐ H

or engine type-approved according to: ☐ **stage II of Directive 97/68/EC** ☐ **Directive 88/77/EC**

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type:
- ☐ z or sterndrive without integral exhaust
- ☒ Inboard engine

Fuel Type:
- ☒ Diesel
- ☐ Petrol

Combustion cycle:
- ☐ 2 stroke
- ☒ 4 stroke

Essential requirements	Standards Used	Other normative document used	See technical file
Annex I.B – Exhaust Emissions			
engine identification			
exhaust emission requirements	EN ISO 8178-1:1996		X
durability			
owner's manual			
Annex I.C – Noise Emissions	see craft manufacturer's Declaration of Conformity		

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
	SNCH*94/25*2003/44*
RCD-1GM10X1	0009*00
RCD-2YM15X1	0004*00
RCD-3YM30X1	0005*00
RCD-4JH4X1	0014*00
RCD-4JH3TX1	0011*01
RCD-4LHAX1	0015*00
RCD-6LPADX1	0012*00
RCD-6LPASX1	0007*00
RCD-6CXMX1	0006*00
RCD-6LY2X1	0008*00
RCD-6LY3X1	0010*00
RCD-4JH3TX2	0016*00
RCD-4JH4TX2	0017*00

I declare on behalf of the engine manufacturer that the engine(s) will meet the exhaust emission requirements of Directive 94/25/EC as amended by Directive 2003/44/EC when installed in a recreational craft, in accordance with the engine manufacturer's supplied instructions and that this (these) engine(s) must not be put into service until the recreational craft into which it is (they are) to be installed has been declared in conformity with the relevant provisions of the above mentioned Directive.

Name: G. D. Mantel
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title: (or an equivalent marking) President, Yanmar Marine Int'l

Date: (yr/month/day) 2005 / 10 / 21

Declaration of Conformity for Recreational Craft Propulsion Engine with the Exhaust and Noise emission requirements of Directive 94/25/EC as amended by 2003/44/EC

(To be completed by manufacturer of outboard or inboard engines with integral exhaust)

Name of engine manufacturer: Yanmar Co., Ltd.

Street: 1-32 **Town:** Chayamati, Kitaku, Osaka-City

Post Code: 530-8311 **Country:** Japan

Name of Authorised Representative (if applicable)**:** Yanmar Marine International B.V.

Street: Brugplein 11 **Town:** Almere-de Vaart

Post Code: 1332 BS **Country:** The Netherlands

Name of Notified Body for exhaust emission assessment: Société National de Certification et d'Homologation

Street: 11, route de Luxembourg **Town:** Sandweiler

Post Code: L-5230 **Country:** Luxembourg **ID Number:** 0499

Name of Notified Body for noise emission assessment: Nederlands Keurings Instituut voor Pleziervaartuigen

Street: Nipkowweg 9 **Town:** Joure

Post Code: 8500 AB **Country:** The Netherlands **ID Number:** 0613

Module used for exhaust emission assessment: B+C ☐ B+D ☒ B+E ☐ B+F ☐ G ☐ H ☐
or engine type-approved according to: ☐ **stage II of Directive 97/68/EC** ☐ **Directive 88/77/EC**

Module used for noise emission assessment: Aa ☒ G ☐ H ☐

Other Community Directives applied: 89/336/EEC

DESCRIPTION OF ENGINE(s) AND ESSENTIAL REQUIERMENTS

Engine Type:
☐ Outboard
☒ z or sterndrive with integral exhaust

Fuel Type:
☒ Diesel
☐ Petrol

Combusion cycle:
☐ 2 stroke
☒ 4 stroke

Essential requirements	Standards Used	Other normative document used	See technical file
Annex I.B – Exhaust Emissions			
engine identification (I.B.1)			☐
exhaust emission requirements	EN ISO 8178-1:1996		☒
durability			☐
owner's manual			☐
Annex I.C – Noise Emissions			
Noise emission levels (I.C.1)	EN ISO 14509		☒
owner's manual (I.C.2)			☐

ENGINE(S) COVERED BY THIS DECLARATION

Engine model(s) or engine family name(s):	EC Type certificate number (exhaust)
	SNCH*94/25*2003/44*
RCD-4LHAX1	0015*00
4LHA-HTZP	
RCD-6LY2X1	0008*00
4LHA-DTZP	
4LHA-STZP	
RCD-6LPADX1	0012*00
6LPA-DTZP	
RCD-6LPASX1	0007*00
6LPA-STZP	

I declare on behalf of the engine manufacturer that the engine(s) mentioned above complie(s) with all applicable essential requirements in the way specified and is in conformity with the type for which above mentioned EC type examination certificate(s) has been issued.

Name: G. J. Mantel
(identification of the person empowered to sign on behalf of the engine manufacturer or his authorised representative)

Signature and title: President, Yanmar Marine Int'l
(or an equivalent marking)

Date: (yr/month/day) 2005 / 10 / 20