YANMAR

M9961-03E091

YANMAR

SERVICE MANUAL

MARINE DIESEL ENGINE

MODEL

3JH4(B)(C)(M)E

4JH4(F)(B)(B4)(C)(M)E

YANMAR CO.,LTD.

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Engine Model:		3JH4(B)(C)(M)E / 4JH4(F)(B)(B4)(C)(M)E			
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FOREWORD

This service manual has been compiled for engineers engaged in sales, service, inspection and maintenance. Accordingly, descriptions of the construction and functions of the engine are emphasized in this manual, while items, which should already be common knowledge, are omitted.

One characteristic of a marine diesel engine is that its performance in a vessel is governed by the applicability of the vessel's hull construction and its steering system.

Engine installation, fitting out and propeller selection have a substantial effect on the performance of the engine and the vessel. Moreover, when the engine runs unevenly or when trouble occurs, it is essential to check a wide range of operating conditions - such as installation to the full and suitability of the ship's piping and propeller - and not just the engine itself. To get maximum performance from this engine, you should completely understand its functions, construction and capabilities, as well as proper use and servicing.

Use this manual as a handy reference in daily inspection and maintenance, and as a text for engineering guidance.

Model 3JH4E has been used for the illustrations in this service manual, but they apply to other models in the JH4 series engines.

California Proposition 65 Warning

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

California Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm.
Wash hands, after handling.

FOR SAFETY

1. SAFETY LABELS

- Most accidents are caused by negligence of basic safety rules and precautions. For accident prevention, it is important to avoid such causes before development to accidents.
  Please read this manual carefully before starting repair or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures.
  Attempting at a repair or maintenance job without sufficient knowledge may cause an unexpected accident.

- It is impossible to cover every possible danger in repair or maintenance in the manual. Sufficient consideration for safety is required in addition to the matters marked ⚠ CAUTION . Especially for safety precautions in a repair or maintenance job not described in this manual, receive instructions from a knowledgeable leader.

- Safety marks used in this manual and their meanings are as follows:

⚠ DANGER	**DANGER**-indicates an imminent hazardous situation which, if not avoided, WILL result in death or serious injury.
⚠ WARNING	**WARNING**-indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury.
⚠ CAUTION	**CAUTION**-indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

- **NOTICE** - indicates that if not observed, the product performance or quality may not be guaranteed.

2. Safety Precautions

(1) SERVICE AREA

⚠ WARNING

• Sufficient Ventilation

Inhalation of exhaust fumes and dust particles may be hazardous to ones health. Running engines welding, sanding, painting, and polishing tasks should be only done in well ventilated areas.

⚠ CAUTION

• Safe / Adequate Work Area

The service area should be clean, spacious, level and free from holes in the floor, to prevent "slip" or "trip and fall" type accidents.

⚠ CAUTION

• Clean, orderly arranged place

No dust, mud, oil or parts should be left on the floor surface.
[Failure to Observe]
An unexpected accident may be caused.

⚠ CAUTION

• Bright, Safely Illuminated Area

The work area should be well lit or illuminated in a safe manner. For work in enclosed or dark areas, a "drop cord" should be utilized. The drop cord must have a wire cage to prevent bulb breakage and possible ignition of flammable substances.

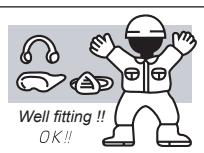
⚠ CAUTION

• Safety Equipment

Fire extinguisher(s), first aid kit and eye wash / shower station should be close at hand (or easily accessible) in case of an emergency.

(2) WORK - WEAR (GARMENTS)

⚠ CAUTION



• Safe Work Clothing

Appropriate safety wear (gloves, special shoes/boots, eye/ear protection, head gear, harness', clothing, etc.) should be used/worn to match the task at hand. Avoid wearing jewelry, unbuttoned cuffs, ties or loose fitting clothes around moving machinery. A serious accident may occur if caught in moving/rotating machinery.

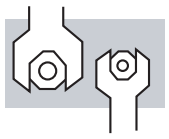
(3) TOOLS

⚠ WARNING

• Appropriate Lifting / Holding

When lifting an engine, use only a lifting device (crane, jack, etc.) with sufficient lifting capacity. Do not overload the device. Use only a chain, cable, or lifting strap as an attaching device. Do not use rope, serious injury may result.
To hold or support an engine, secure the engine to a support stand, test bed or test cart designed to carry the weight of the engine. Do not overload this device, serious injury may result
Never run an engine without being properly secured to an engine support stand, test bed or test cart, serious injury may result.

⚠ CAUTION



• Appropriate Tools

Always use tools that are designed for the task at hand. Incorrect usage of tools may result in damage to the engine and or serious personal injury.

(4) GENUINE PARTS and MATERIALS

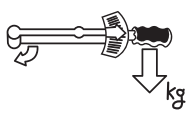
⚠ CAUTION

• Genuine Parts

Always use genuine YANMAR parts or YANMAR recommended parts and goods. Damage to the engine, shortened engine life and or personal injury may result.

(5) FASTENER TORQUE

⚠ WARNING



• Torquing Fasteners

Always follow the torque values and procedures as designated in the service manual. Incorrect values, procedures and or tools may cause damage to the engine and or personal injury.

(6) Electrical

⚠ WARNING

• Short Circuits

Always disconnect the (-) Negative battery cable before working on the electrical system. An accidental "short circuit" may cause damage, fire and or personal injury. Remember to connect the (-) Negative battery cable (back onto the battery) LAST

⚠ WARNING

• Charging Batteries

Charging wet celled batteries produces hydrogen gas. Hydrogen gas is extremely explosive. Keep sparks, open flame and any other form of ignition away. Explosion may occur causing severe personal injury.

⚠ WARNING

• Battery Electrolyte

Batteries contain sulfuric acid. Do NOT allow it to come in contact with clothing, skin and or eyes, severe burns will result.

(7) WASTE MANAGEMENT

⚠ CAUTION

Observe the following instructions with regard to hazardous waste disposal. Negligence of these will have a serious impact on environmental pollution concerns.

1) Waste fluids such as lube oil, fuel and coolant shall be carefully put into separate sealed containers and disposed of properly.
2) Do NOT dispose of waste materials irresponsibly by dumping them into the sewer, overland or into natural waterways.
3) Waste materials such as oil, fuel, coolant, solvents, filter elements and batteries, must be disposed of properly according to local ordinances. Consult the local authorities or reclamation facility.

(8) FURTHER PRECAUTIONS

⚠ WARNING

• Fueling / Refueling

Keep sparks, open flames or any other form of ignition (match, cigarette, etc.) away when fueling/refueling the unit. Fire and or an explosion may result.

⚠ WARNING

• Hot Surfaces.

Do NOT touch the engine (or any of its components) during running or shortly after shutting it down. Scalding / serious burns may result. Allow the engine to cool down before attempting to approach the unit.

⚠ WARNING

• Rotating Parts

Be careful around moving/rotating parts. Loose clothing, jewelry, ties or tools may become entangled causing damage to the engine and or severe personal injury.

⚠ WARNING

• Preventing burns from scalding

1) Never open the radiator filler cap shortly after shutting the engine down.
   Steam and hot water will spurt out and seriously burn you. Allow the engine to cool down before attempt to open the filler cap.
2) Securely tighten the filler cap after checking the radiator.
   Steam can spurt out during engine running, if tightening loose.

⚠ CAUTION

• Safety Label Check

Pay attention to the product safety label.
A safety label (caution plate) is affixed on the product for calling special attention to safety.
If it is missing or illegible, always affix a new one.

3. Precautions for Service Work

(1) Precautions for Safety

Read the safety precautions given at the beginning of this manual carefully and always mind safety in work.

(2) Preparation for Service Work

Preparation is necessary for accurate, efficient service work. Check the customer ledger file for the history of the engine.

- Preceding service date
- Period/operation hours after preceding service
- Problems and actions in preceding service
- Replacement parts expected to be required for service
- Recording form/check sheet required for service

(3) Preparation before Disassembly

- Prepare general tools, special service tools, measuring instruments, oil, grease, non-reusable parts, and parts expected to be required for replacement.
- When disassembling complicated portions, put match-marks and other marks at places not adversely affecting the function for easy reassembly.

(4) Precautions in Disassembly

- Each time a parts is removed, check the part installed state, deformation, damage, roughening, surface defect, etc.
- Arrange the removed parts orderly with clear distinction between those to be replaced and those to be used again.
- Parts to be used again shall be washed and cleaned sufficiently.
- Select especially clean locations and use clean tools for disassembly of hydraulic units such as the fuel injection pump.

(5) Precautions for Inspection and Measurement

Inspect and measure parts to be used again as required to determine whether they are reusable or not.

(6) Precautions for Reassembly

- Reassemble correct parts in correct order according to the specified standards (tightening torques, and adjustment standards). Apply oil important bolts and nuts before tightening when specified.
- Always use genuine parts for replacement.
- Always use new oil seals, O-rings, packing and cotter pins.
- Apply sealant to packing depending on the place where they are used. Apply of grease to sliding contact portions, and apply grease to oil seal lips.

(7) Precautions for Adjustment and Check

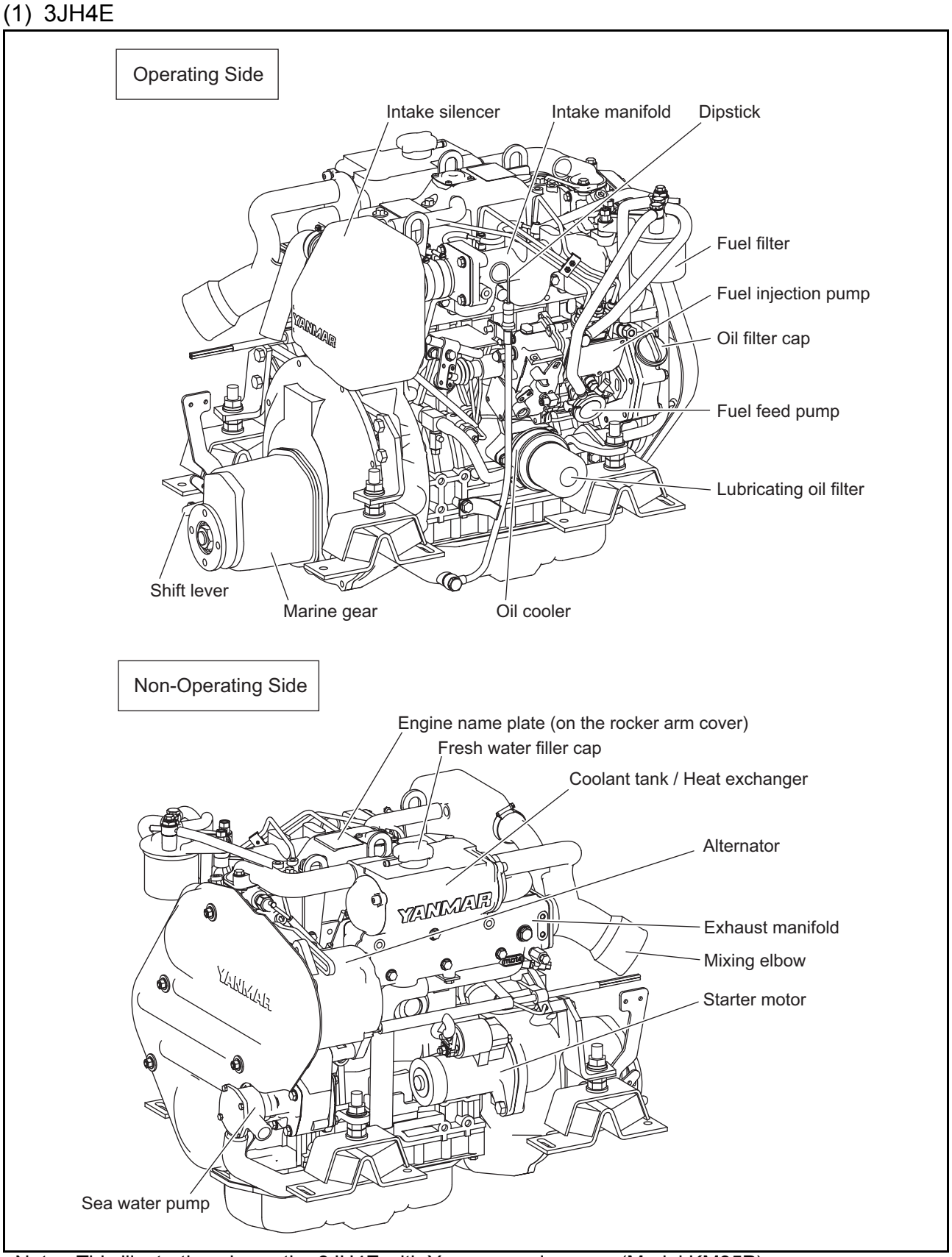
Use measuring instruments for adjustment to the specified service standards.

CONTENTS

1. General

1.1 Exterior views

(1) 3JH4E



<Note> This illustration shows the 3JH4E with Yanmar marine gear (Model:KM35P).

1.2 Specifications

(1) 3JH4E, 3JH4BE, 3JH4CE, 3JH4ME

Official engine model name		unit	3JH4E			
Company internal model name		-	3JH4E	3JH4BE	3JH4CE	3JH4ME
Marine gear model		-	KM35P	KM35A	SD40	Bobtail
Use		-	Pleasure use			
Type		-	Vertical water cooled 4 cycle diesel engine			
Combustion system		-	Direct injection			
Air charging		-	Naturally aspirated			
Number of cylinders		-	3			
Bore x stroke		mm(inch)	88 x 90 (3.46 x 3.54)			
Displacement		L	1 .642			
Continuous power	Output at crankshaft / Engine speed	kW(HP)/ min^{-1}	26.7(36.3) / 2907 (at Fuel temp. 25°C)*			
Fuel stop power	Output at crankshaft / Engine speed	kW(HP)/ min^{-1}	29.4(40.0) / 3000 (at Fuel temp. 25°C)* 28.7(39.0) / 3000 (at Fuel temp. 40°C)* *			
	Output at propeller shaft / Engine speed	kW(HP)/ min^{-1}	28.0(38.1) / 3000 (at Fuel temp. 25°C)* 27.4(37.3) / 3000 (at Fuel temp. 40°C) **		-	-
Installation		-	Flexible mounting			
Fuel injection timing		deg b.T.D.C.	FID 12±1 (FIC-Air 13±1)			
Fuel injection opening pressure		MPa (kgf/cm^2)	21.6±0.5 (2.12±0.05)			
Main power take off		-	At flywheel side			
Direction of rotation	Crankshaft	-	Counter-clockwise viewed from stern			
	Propeller shaft (Ahead)	-	Clockwise viewed from stern		-	-
Cooling system		-	Fresh water cooling with heat exchanger			
Lubrication system		-	Complete enclosed forced lubrication			
Cooling water capacity (fresh)		L(quart)	Engine:4.5 (4.8), Coolant recovery tank : 0.8 (0.8)			
Lubricating oil capacity (engine)	Rake angle	deg.	at rake angle 8 deg	at rake angle 0 deg		-
	Total (Note 4)	L(quart)	5.0±0.3 (5.3±0.3)	5.5±0.3 (5.8±0.3)	5.5±0.3 (5.8±0.3)	5.5±0.3 (5.8±0.3)
	Oil pan only		4.5±0.3 (4.8±0.3)	5.0±0.3 (5.3±0.3)	5.0±0.3 (5.3±0.3)	5.0±0.3 (5.3±0.3)
	Effective (Note 5)		1.1 (1.2)	1.2 (1.3)	1.2 (1.3)	1.2 (1.3)
Starting system	Type	-	Electric			
	Starting motor	V-kW	DC 12V-1.4 kW			
	AC generator	V-A	12V-60A (12V-80A optional)			
Engine Dimension	Overall length	mm(inch)	777 (30.6)	776 (30.6)	700 (27.6)	700 (27.6)
	Overall width		539 (21.2)	539 (21.2)	539 (21.2)	539 (21.2)
	Overall height		623 (24.5)	623 (24.5)	623 (24.5)	623 (24.5)
Flywheel major dimension		mm(inch)	Ø300 x 66 (11.8 x 2.6)			
Engine dry mass (include marine gear)		kg	185	186	212 (engine:173)	173

(2) 4JH4E series (4JH4E, 4JH4FE, 4JH4BE, 4JH4B4E, 4JH4CE, 4JH4ME)

Official engine model name		unit	4JH4E					
Company internal model name		-	4JH4E	4JH4FE	4JH4BE	4JH4B4E	4JH4CE	4JH4ME
Marine gear model		-	KM35P	ZF30M	KM35A2	KM4A1	SD40	Bobtail
Use		-	Pleasure use					
Type		-	Vertical water cooled 4 cycle diesel engine					
Combustion system		-	Direct injection					
Air charging		-	Naturally aspirated					
Number of cylinders		-	4					
Bore x stroke		mm(inch)	88 x90 (3.46 x 3.54)					
Displacement		L	2.190					
Continuous power	Output at crankshaft / Engine speed	kW(HP)/ min^{-1}	36.8(50.0) / 2907 (at Fuel temp. 25°C)*					
Fuel stop power	Output at crankshaft/ Engine speed	kW(HP)/ min^{-1}	40.5(55.1) / 3000 (at Fuel temp. 25°C)* 39.6(53.8) / 3000 (at Fuel temp. 40 °C)* *					
	Output at propeller shaft / Engine speed	kW(HP)/ min^{-1}	38.5(52.3) / 3000 (at Fuel temp. 25 °C)* 37.6(51.1) / 3000 (at Fuel temp. 40°C) **				-	
Installation		-	Flexible mounting					
Fuel injection timing		deg b.T.D.C.	FID 13± 1 (FIC-Air 14± 1)					
Fuel injection opening pressure		MPa	21.6±0.5					
Main power take off		-	At Flywheel side					
Direction of rotation	Crankshaft	-	Counter-clockwise viewed from stern					
	Propeller shaft (Ahead)	-	Clockwise viewed from stern				-	
Cooling system		-	Fresh water cooling with heat exchanger					
Lubrication system		-	Complete enclosed forced lubrication					
Cooling water capacity (fresh)		L(quart)	Engine 6.0(6.3), Coolant recovery tank : 0.8(0.8)					
Lubricating oil capacity (engine)	Rake angle	deg.	at rake angle 8 deg		at rake angle 0 deg			
	Total (Note 4)	L(quart)	5.0±0.3(5.3±0.3)		5.5±0.3(5.8±0.3)			
	Oil pan only		4.5±0.3(4.8±0.3)		5.0±0.3(5.3±0.3)			
	Effective (Note 5)		1.2(1.3)		1.4(1.5)			
Starting system	Type	-	Electric					
	Starting motor	V-kW	DC 12V - 1.4 kW					
	AC generator	V-A	1 2V - 60A (1 2V - 80A optional)					
Engine Dimension	Overall length	mm(inch)	871(34.3)	950(37.4)	864(34.0)	922(36.3)	795(31.3)	
	Overall width		560(22.0)	560(22.0)	560(22.0)	560(22.0)	560(22.0)	
	Overall height		618(24.3)	618(24.3)	618(24.3)	618(24.3)	618(24.3)	
Flywheel major dimension		mm(inch)	Ø300 x 66(11.8 x 2.6)					
Engine dry mass (include marine gear)		kg	212	228	213	228	239 (engine:200)	200

(Note)

1. Rating condition : ISO 3046-1, 8665
2. 1HP (metric horse power) ≒ 0.7355 kW
3. Fuel condition : Density at 15°C = 0.842
   * Fuel temperature 25°C at the inlet of the fuel injection pump. (ISO 3046-1)
   ** Fuel temperature 40°C at the inlet of the fuel injection pump. (ISO 8665)
4. The "Total" oil quantity includes: oil in oil pan and oil in channels, coolers and filter.
5. The effective amount of oil shows the difference in maximum scale of the dipstick and minimum scale.

1.3 Fuel oil, lubricating oil and cooling water

1.3.1 Fuel oil

IMPORTANT:
Only use the recommended fuel to obtain the best engine performance and prevent damage of parts, also prevent air pollution.

(1) Selection of fuel oil

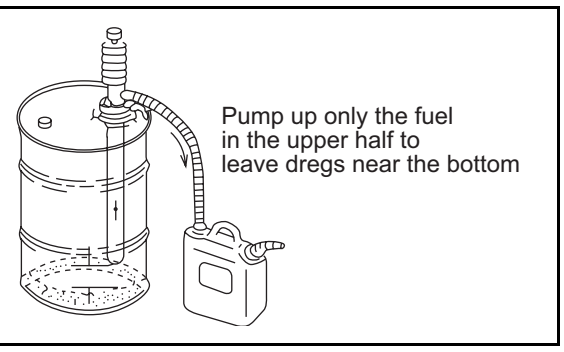
Use the following diesel fuels for best engine performance:
BS 2869 A1 or A2

Fuels equivalent to Japanese Industrial Standard, JIS. No. K2204-2

Fuel cetane number should be 45 or greater

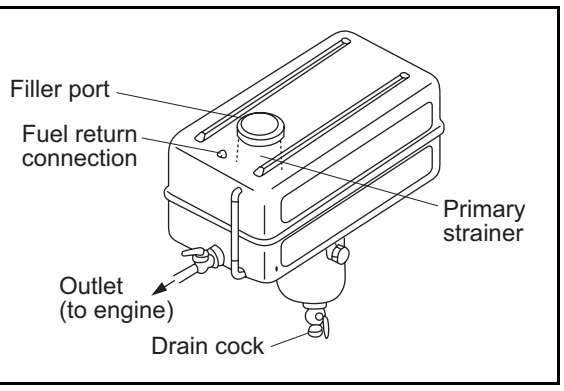
(2) Fuel handling

- Water and dust in the fuel oil can cause operation failure. Use containers which are clean inside to store fuel oil. Store the containers away from rain water and dust.
- Before supplying fuel, let the fuel container rest for several hours so that water and dust in the fuel are deposited on the bottom. Pump up only the clean fuel.



(3) Fuel tank

Be sure to attach a drain cock, precipitation trap and primary strainer to the fuel tank as shown illustration right.



1.3.2 Lubricating oil

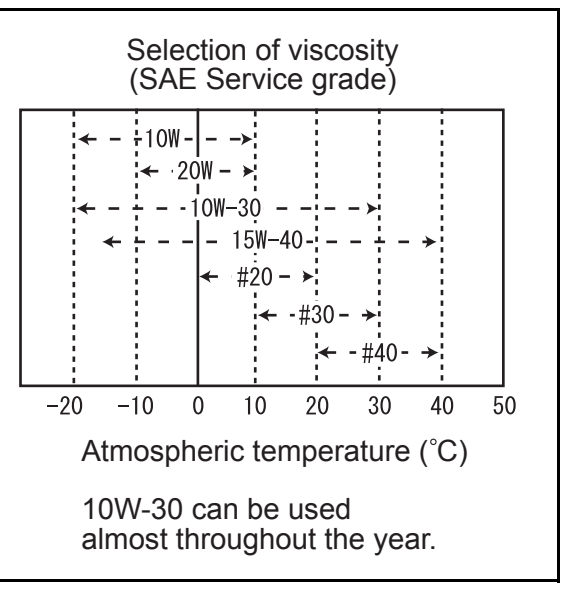
IMPORTANT:
Use of other than the specified engine oil may cause inner parts seizure or early wear, leading to shorten the engine service life.

(1) Selection of engine lube oil

Use the following engine oil

- API classification .....CD or better
  (Standards of America Petroleum Institute)
- SAE viscosity 10W-30, 15W-40
  (Standard of Society of Automotive Engineering)

Engine oil with 10W30 can be used throughout the year.
(Refer to the right figure.)



(2) Selection of marine gear lube oil

KM35P, KM35A2 for 3JH4E series
KM35P, KM35A2 and KM4A1 for 4JH4(B)(B4)E

Use the following engine oil

- API classification .....CD or better
  (Standards of America Petroleum Institute)
- SAE viscosity ..... #20 or #30
  (Standard of Society of Automotive Engineering)

Apply ATF oil to marine gear ZF30M for 4JH4FE.

(3) Selection of lube oil for Sail Drive Unit SD40

- API service grade.....GL4, 5
- SAE Viscosity.....#90 or 80W90

or QuickSilver High Performance Gear Lube
QuickSilver® is registered trademark of Brunswick Corporation.

(4) Handling of engine oil

- Carefully store and handle the oil so as to prevent dust or dirt entrance. When supplying the oil, pay attention and clean around the filler port.
- Do not mix different types of oil as it may adversely affect the lubricating performance.

⚠ CAUTION When touching engine oil by hand, the skin of the hand may become rough. Be careful not to touch oil with your hands without protective gloves. If touch, wash your hands with soap and water thoroughly.

1.3.3 Cooling water

Use clean soft water and be sure to add the Long Life Coolant Antifreeze (LLC) in order to prevent rust built up and freezing. If there is any doubt over the water quality, distilled water or pre-mixed coolant should be used.
The coolants / antifreezes, which are good performance for example, are shown below.

- ITEXACO LONG LIFE COOLANT ANTIFREEZE, both standard and pre-mixed.
  Product codes 7997 and 7998
- IHAVOLINE EXTENDED LIFE ANTIFREEZE / COOLANT
  Product code 7994

IMPORTANT:

- IBe sure to add Long Life Coolant Antifreeze (LLC) to soft water. In cold season, the LLC is especially important. Without LLC, cooling performance will decrease due to scale and rust in the cooling water line. Without LLC, cooling water will freeze and expand to break the cooling line.
- IBe sure to use the mixing ratios specified by the LLC manufacturer for your temperature range.
- IDo not mix different types (brand) of LLC, chemical reactions may make the LLC useless and engine trouble could result.
- IReplace the cooling water every once a year.

⚠ CAUTION When handling Long Life Coolant Antifreeze, wear protective rubber gloves not to touch it. If LLC gets eyes or skin, wash with clean water at once.