BY series

SERVICE MANUAL

4BY
6BY

P/N: 0BBY0-G00101

YAMAHA

MARINE ENGINES

This *Service Manual* has been developed for the exclusive use of service and repair professionals such as Yanmar authorized Distributors and Yanmar authorized Dealers. It is written with these professionals in mind and may not contain the necessary detail or safety statements that may be required for a non-professional to perform the service or repair properly and / or safely. Please contact an authorized Yanmar repair or service professional before working on your Yanmar product.

Disclaimers:

All information, illustrations and specifications in this manual are based on the latest information available at the time of publishing. The illustrations used in this manual are intended as representative reference views only. Moreover, because of our continuous product improvement policy, we may modify information, illustrations, and / or specifications to explain and / or exemplify a product, service, or maintenance improvement. We reserve the right to make any change at any time.

1206

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.

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Section 1

INTRODUCTION

This manual gives specific instructions for the proper repair of Yanmar BY series marine engines.

Please follow the procedures carefully to ensure quality service.

Yanmar recommends that you read this *Service Manual* completely before starting repairs.

Along with standard tools, Yanmar recommends the use of special tools necessary to perform repairs correctly.

Yanmar products are continuously undergoing improvement. This *Service Manual* has been checked carefully in order to avoid errors. However Yanmar is not liable for any misrepresentations, errors of description or omissions. Contact an authorized Yanmar marine dealer or distributor for any questions you have regarding this *Service Manual.*

REVISION HISTORY

This manual is a living document. Periodic manual revisions are published to document product improvements and changes. This practice ensures the manual has the most current information.

As manual revisions become necessary, individual pages are prepared and sent to those who need the information. If a page, or number of pages should be replaced, the replacement information is sent along with a revised Revision Control Table. Discard the older, obsolete information.

At times, the revision involves inserting additional pages in one or more sections. Replace the Revision Control Table and insert the new pages.

This method of revision control represents the most cost-effective solution to providing current, updated information as needed.

Revision Control Table

Revision Date Revision Number	New Page Numbers Involved	Remarks	Initiating Dept.
NOV 2006 Rev. 1	All	Re-release	YMU

Section 2

SAFETY

Yanmar is concerned for your safety and the condition of your marine engine. Safety statements are one of the primary ways to call your attention to the potential hazards associated with Yanmar marine engines. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your marine engine. Keep the decals from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a decal attached to it, make sure you order the new part and decal at the same time.

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

SAFETY PRECAUTIONS

⚠ DANGER

The safety messages that follow have DANGER level hazards.

There is no substitute for common sense and careful practices. Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation, other bodily injury or death. This information contains general safety precautions and guidelines that must be followed to reduce risk to personal safety. Special safety precautions are listed in specific procedures. Read and understand all of the safety precautions before operation or performing repairs or maintenance.

Avoid injury or equipment damage due to engine falling. ALWAYS secure the engine solidly to prevent the engine from falling during service.

NEVER permit anyone to install or operate the engine without proper training.

- Read and understand this *Service Manual* before you operate or service the engine to ensure that you follow safe operating practices and maintenance procedures.
- Safety signs and labels are additional reminders for safe operating and maintenance techniques.
- See your authorized Yanmar marine dealer or distributor for additional training.

⚠ WARNING

The safety messages that follow have WARNING level hazards.

Explosion Hazard

Avoid serious personal injury or equipment damage. While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery well-ventilated and keep sparks, open flame and any other form of ignition out of the area.

Avoid serious personal injury or equipment damage. ALWAYS turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the equipment.

Avoid unexpected equipment movement. Shift the marine gear into the NEUTRAL position any time the engine is at idle.

Fire Hazard

Avoid personal injury or equipment damage. Have appropriate safety equipment available.

- Keep fire extinguishers handy in case of fire. Clearly indicate the location of the fire extinguishers with a safety sign.
- Ensure that the type of fire extinguishers are appropriate for material that might catch fire. Check with local authorities.
- Have all fire extinguishers checked periodically for proper operation and / or readiness.
- Post evacuation routes prominently. Periodically conduct fire drills.

Avoid personal injury. ALWAYS read and follow safety-related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.

Wipe up all spills immediately.

⚠ WARNING

Entanglement Hazard

Rotating parts can cause severe injury or death. NEVER wear jewelry, unbuttoned cuffs, ties or loose fitting clothing and ALWAYS tie long hair back when working near moving / rotating parts such as the flywheel or PTO shaft. Keep hands, feet and tools away from all moving parts.

Avoid personal injury. ALWAYS stop the engine before beginning service.

Avoid personal injury. NEVER leave the key in the key switch when servicing the engine. Attach a “Do Not Operate” tag near the key switch while performing maintenance on the equipment.

Sever Hazard

Avoid personal injury. The propeller may rotate during towing or if the engine is running at idle speed. NEVER service the engine while being towed or when the engine is running.

Avoid personal injury. If the vessel has more than one engine, NEVER service an engine if either of the engines are running. In multi-engine configurations the propeller for an engine that is shut down may rotate if any of the other engines are running.

Rotating parts can cause severe injury or death. NEVER operate the engine without the guards in place.

Avoid personal injury. NEVER operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.

Electrical Hazard

Make welding repairs safely.

- ALWAYS turn off the battery switch (if equipped) or disconnect the negative battery cable and the leads to the alternator when welding on the equipment.
- Remove the multi-pin connector to the engine control unit. Connect the weld clamp to the component to be welded and as close as possible to the welding point.
- NEVER connect the weld clamp to the engine or in a manner which would allow current to pass through a mounting bracket.
- When welding is completed, reconnect the leads to the alternator and engine control unit prior to reconnecting the batteries.

Exhaust Hazard

Avoid serious injury or death. NEVER block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning.

Burn Hazard

Avoid serious injury. Some of the engine surfaces become very hot during operation and shortly after shut-down. Keep hands and other body parts away from hot engine surfaces.

Handle hot components with heat-resistant gloves.

Sudden Movement Hazard

Avoid personal injury or equipment damage. The engine lifting eyes are engineered to lift the weight of the marine engine only. ALWAYS use the engine lifting eyes when lifting the engine.

To prevent accidental equipment movement, NEVER start the engine in gear.

⚠ WARNING

Lifting Hazard

Avoid serious personal injury. Additional equipment is necessary to lift the marine engine and marine gear together. ALWAYS use lifting equipment with sufficient capacity to lift the marine engine.

If you need to transport an engine for repair, have a helper assist you in attaching it to a hoist and load it on a truck.

Alcohol and Drug Hazard

NEVER operate the engine while you are under the influence of alcohol or drugs or are feeling ill.

Exposure Hazard

To avoid injury, ALWAYS wear personal protective equipment including appropriate clothing, gloves, work shoes, eye and hearing protection as required by the task at hand.

Tool Hazard

Avoid personal injury or equipment damage. Always remove any tools or shop rags used during maintenance from the area before operation.

⚠ CAUTION

The safety messages that follow have CAUTION level hazards.

Avoid personal injury. ALWAYS wear eye protection when servicing the engine or when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.

Poor Lighting Hazard

Avoid personal injury or equipment damage. Ensure that the work area is adequately illuminated. ALWAYS install wire cages on portable safety lamps.

Tool Hazard

Avoid personal injury or equipment damage. ALWAYS use tools appropriate for the task at hand and use the correct size tool for loosening or tightening machine parts.

NOTICE

The safety messages that follow have NOTICE level hazards.

Any part which is found defective as a result of inspection or any part whose measured value does not satisfy the standard or limit must be replaced.

ALWAYS tighten components to the specified torque. Loose parts can cause equipment damage or cause it to operate improperly.

Only use replacement parts specified. Other replacement parts may affect warranty coverage.

NEVER attempt to modify the engine design or safety features such as defeating the engine speed limit control or the diesel fuel injection quantity control.

Modifications may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may void its warranty. Be sure to use Yanmar genuine replacement parts.

ALWAYS be environmentally responsible.

Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

NEVER dispose of hazardous materials by dumping them into a sewer, on the ground or into ground water or waterways.

If any indicator illuminates during engine operation, stop the engine immediately. Determine the cause and repair the problem before you continue to operate the engine.

Make sure the engine is installed on a level surface. If a Yanmar Marine Engine is installed at an angle that exceeds the specifications stated in the Yanmar Marine Installation manuals, engine oil may enter the combustion chamber causing excessive engine speed, white exhaust smoke and serious engine damage. This applies to engines that run continuously or those that run for short periods of time.

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Section 3

GENERAL SERVICE INFORMATION

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SAFETY PRECAUTIONS

⚠ WARNING

Fire Hazard

Avoid injury or equipment damage from fire. Undersized wiring systems can cause an electrical fire.

Electrical Hazard

Avoid personal injury or equipment damage. ALWAYS keep the electrical connectors and terminals clean. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.

NEVER turn off the battery switch (if equipped) or short the battery cables during operation. Damage to the electrical system will result.

ENGINE OUTLINE DRAWINGS

Note: All dimensions are metric. Contact Yanmar Marine for the most current drawings.

4BY with KMH40A

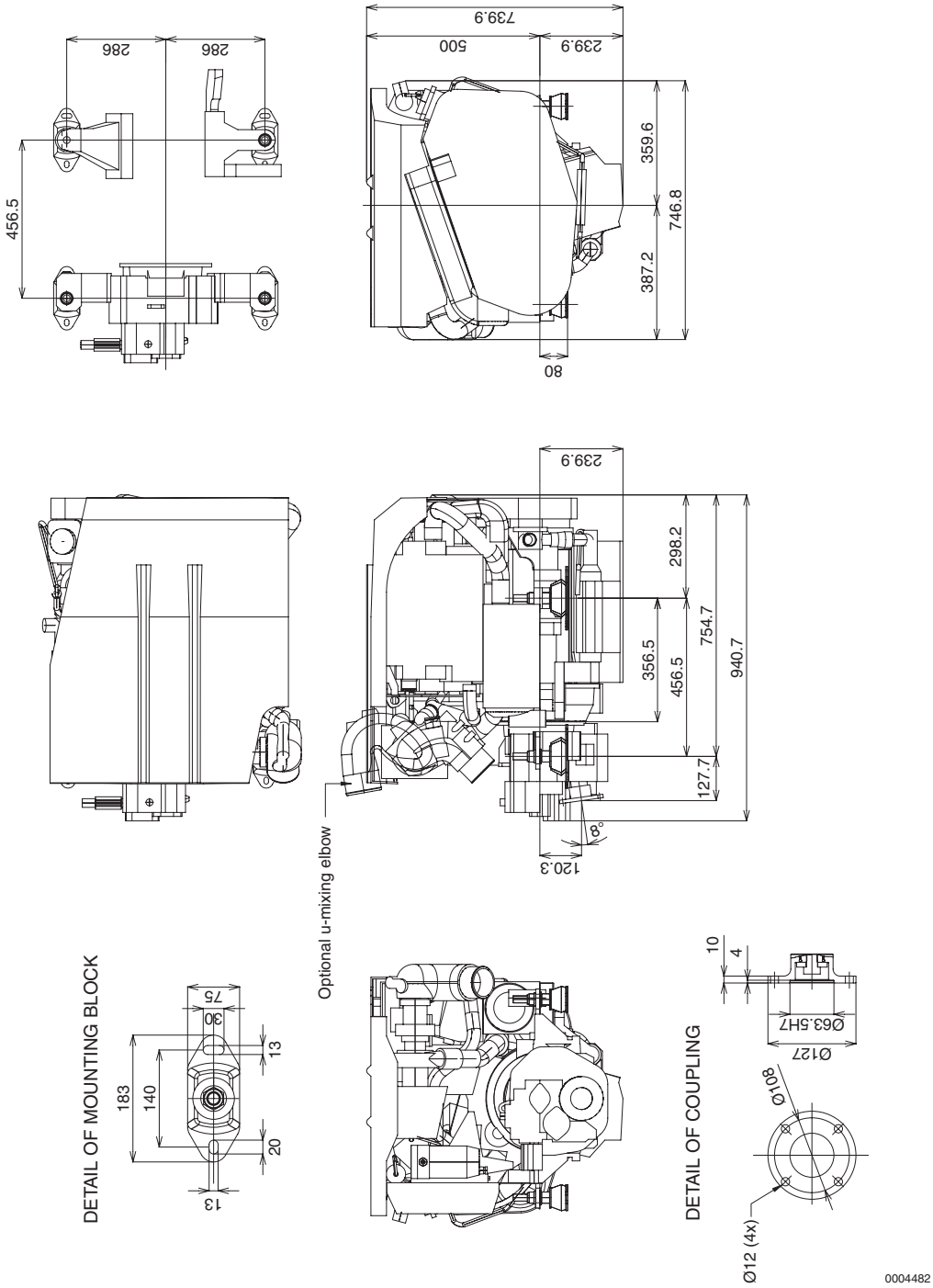

Figure 3-1

6BY with KMH40A

Note: All dimensions are metric. Contact Yanmar Marine for the most current drawings.

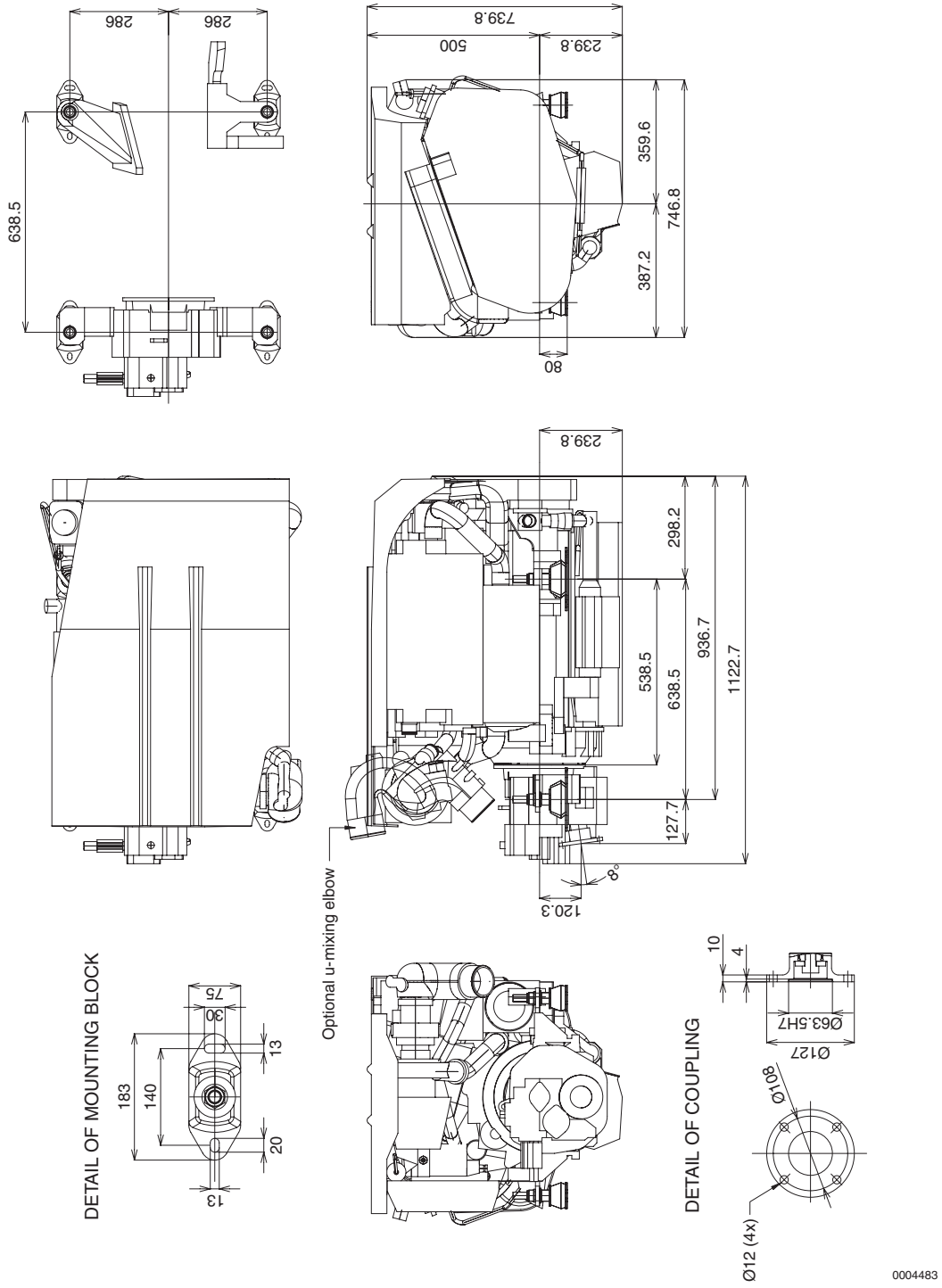

Figure 3-2

ENGINE PIPING DIAGRAMS

Fuel Flow

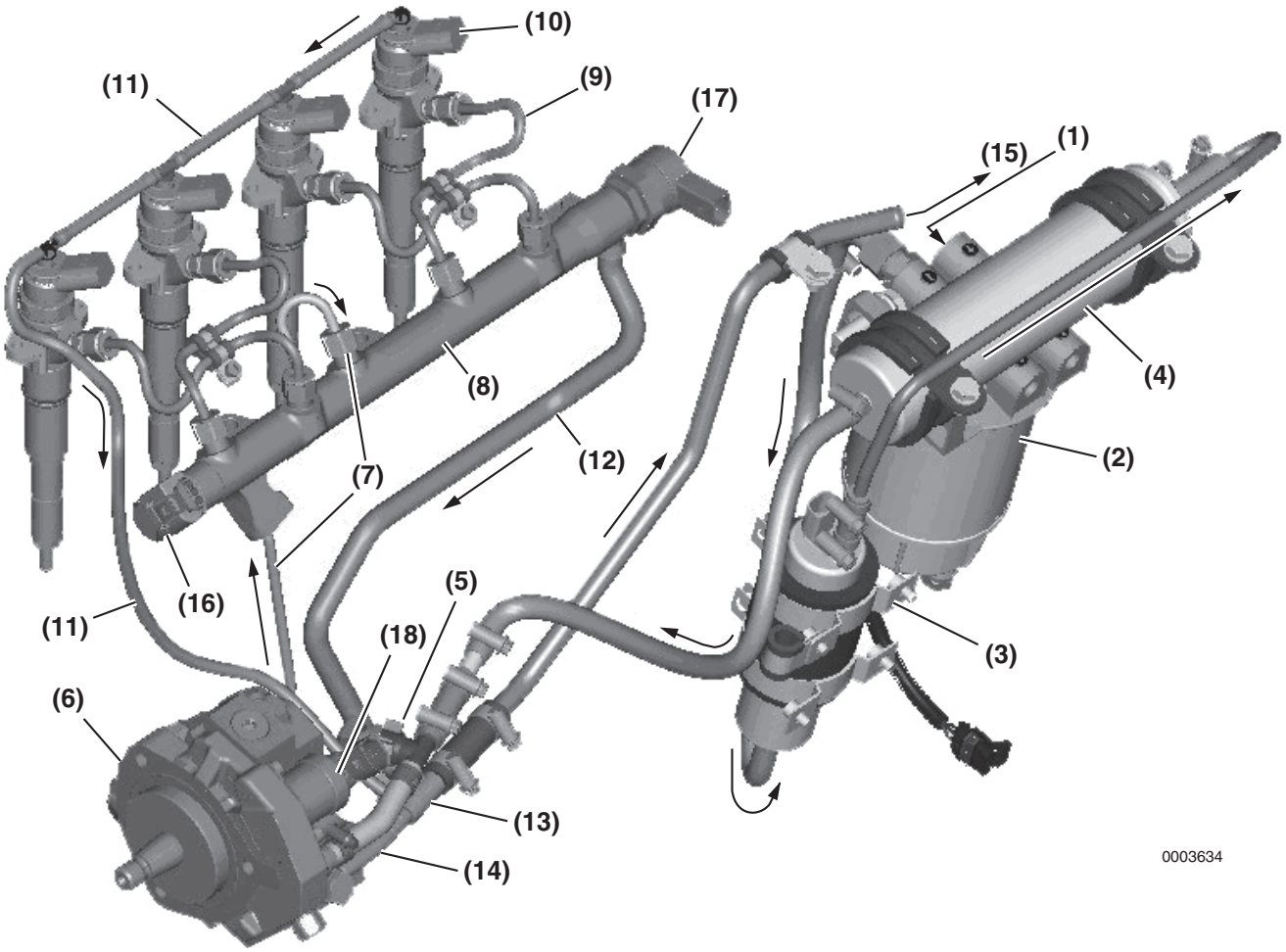

Figure 3-3

Note: Typical 4BY engine shown. 6BY is similar.

1 – Fuel from Tank
2 – Fuel Filter / Water Separator
3 – Fuel Feed Pump
4 – Fine Fuel Filter
5 – Inlet Fuel Temperature Sensor
6 – High-Pressure Fuel Pump
7 – High-Pressure Fuel Supply Line
8 – Common Fuel Rail
9 – Fuel Injection Line (1 each injector)
10 – Fuel Injector (1 each cylinder)
11 – Fuel Injector Return Fuel Hose
12 – Common Rail Return Fuel Line
13 – Tee
14 – Fuel Return from High-Pressure Pump
15 – Return Fuel to Fuel Tank
16 – Fuel Pressure Sensor
17 – Fuel Pressure Regulator (ECU-Controlled)
18 – High-Pressure Fuel Flow Regulator (ECU-Controlled)

Cooling Flow

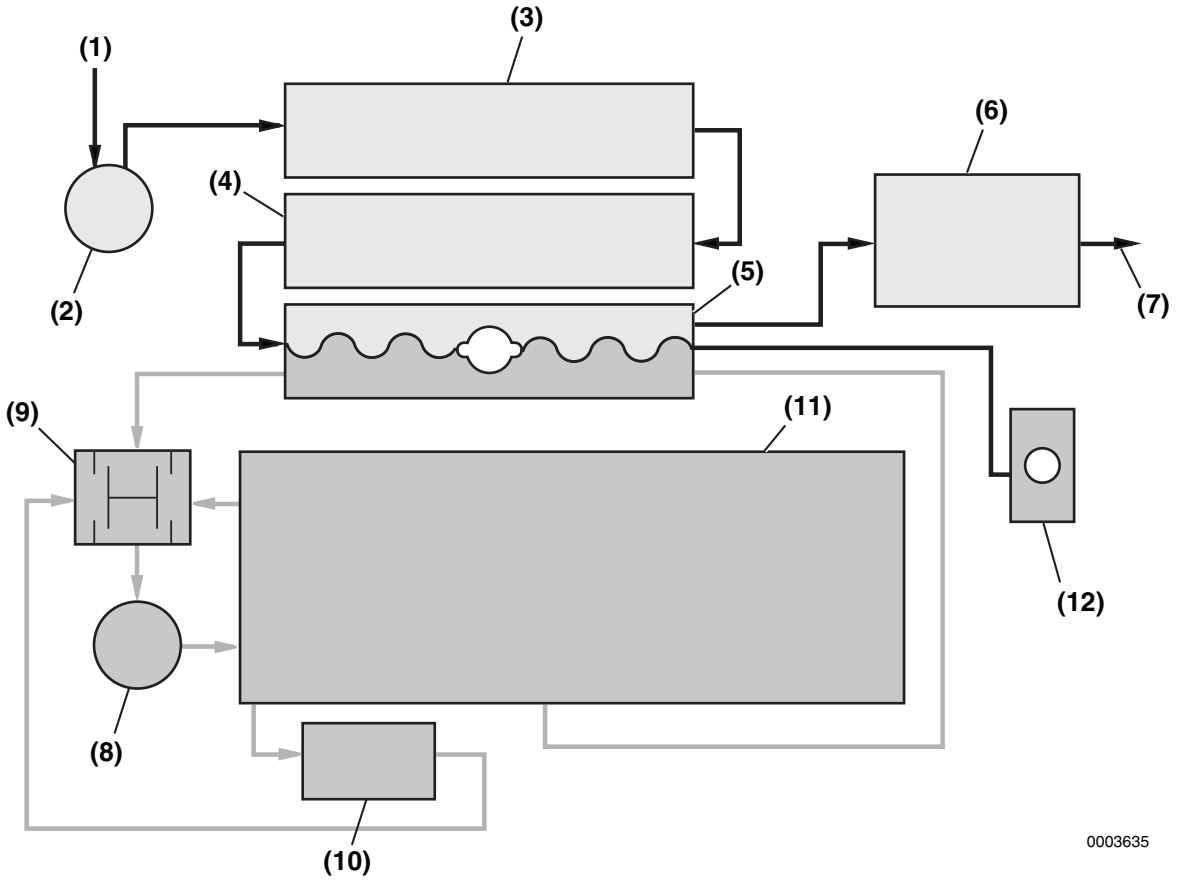

Figure 3-4

Note: Typical 4BY engine shown. 6BY is similar.

1 – Seawater Supply
2 – Seawater Pump
3 – Hydraulic Oil Cooler
4 – Charge Air Cooler
5 – Engine Heat Exchanger
6 – Exhaust Elbow
7 – Exhaust / Seawater Exit
8 – Engine Coolant Pump
9 – Thermostat
10 – Engine Oil Cooler
11 – Engine Coolant Passages
12 – Coolant Recovery Tank

LOCATION OF NAMEPLATES

The following figures show the location of informational nameplates on Yanmar BY marine engines.

Engine Nameplates (Typical)

Engine Data and Drive Information Nameplates

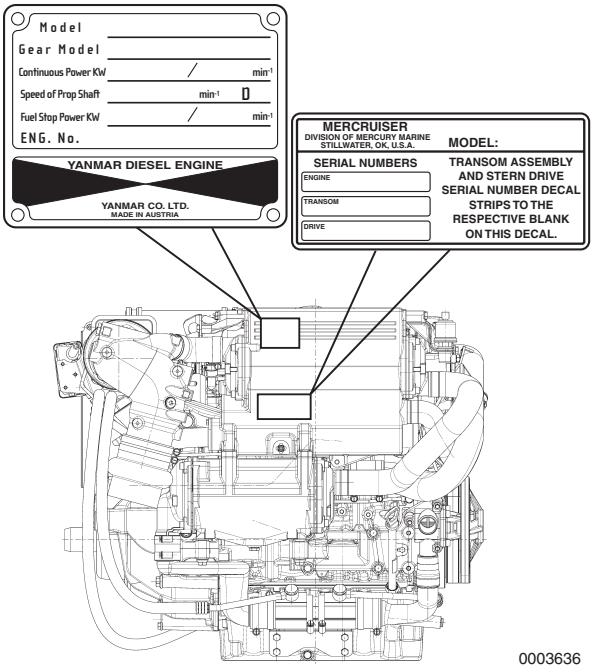

Figure 3-5

The typical location of the engine nameplates is shown for Yanmar 4BY Series marine engines **(Figure 3-5)**. 6BY engines are similar.

Engine Block Serial Identification

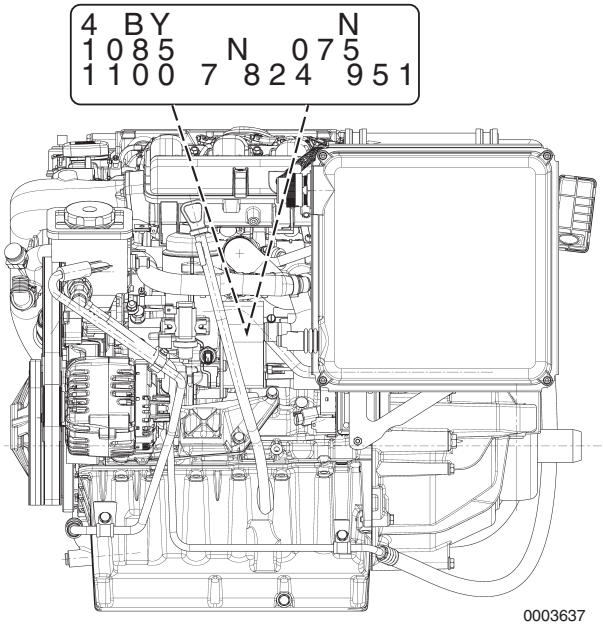

Figure 3-6

The engine block information identification is etched into the cylinder block and is located behind the engine oil cooler near the end of the starting motor.

DIESEL FUEL

Diesel Fuel Specifications

Diesel fuel should comply with the following specifications. The table lists several specifications for diesel fuels.

DIESEL FUEL SPECIFICATION	LOCATION
No. 2-D, No. 1-D, ASTM D975-94	USA
EN590:96	European Union

Additional Technical Fuel Requirements

- The fuel cetane number should be equal to 48 or higher.
- The sulfur content must not exceed 0.3% by volume. Less than 0.05% is preferred.
- Water and sediment in the fuel should not exceed 0.05% by volume.
- Ash content not to exceed 0.01% by mass.
- Carbon residue content not to exceed 0.35% by volume. Less than 0.1% is preferred.
- Total aromatics content should not exceed 35% by volume. Less than 30% is preferred.
- PAH (polycyclic aromatic hydrocarbons) content should be below 10% by volume.
- NEVER mix kerosene, used engine oil, or residual fuels with the diesel fuel.
- NEVER use Biocide or mix winter and summer fuels.
- Keep the fuel tank and fuel-handling equipment clean at all times.
- Poor quality fuel can reduce engine performance and / or cause engine damage.
- Fuel additives are not recommended. Some fuel additives may cause poor engine performance.

Diesel Fuel Lines

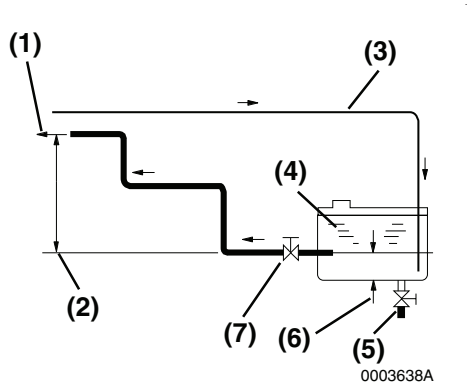

Figure 3-7

1 – To Fuel Feed Pump
2 – Less than 500 mm (19.68 in.)
3 – Fuel Return Line
4 – Fuel Tank
5 – Fuel Tank Drain Cock
6 – 20 to 30 mm (0.75 to 1.125 in.)
7 – Fuel Shutoff Valve

NOTICE: The fuel supply line between the fuel tank and engine must be a minimum diameter of 8 mm (0.315 in.).

Shown is a typical installation of a boat fuel system. Fuel supply **(Figure 3-7, (2))** and return **(Figure 3-7, (4))** lines connect to fittings at the engine.

Install a drain cock **(Figure 3-7, (6))** at the bottom of the fuel tank to remove water and contaminants.

Boat fuel supply system restriction must not exceed 1000 mmAq (39.37 in.Aq).

Boat fuel return system restriction must not exceed 200 mmAq (7.87 in.Aq).

Note: Yanmar does not recommend installing additional fuel filtration before the engine. The engine is equipped with a fuel / water separation filter, plus a fine filter.

Bleeding the Fuel System

The fuel system needs to be bled under certain conditions. *See Bleed the Fuel System on page 6-21.*

- Starting the engine for the first time.
- After running out of fuel and fuel has been added to the fuel tank.
- After fuel system maintenance such as changing fuel filters, draining the fuel filter / water separator, or replacing a fuel system component.

NOTICE: NEVER crank the engine using the starter motor to prime the fuel system. This may cause the starter motor to overheat and damage the starter.

ENGINE OIL

Engine Oil Specifications

Use a full-synthetic long-life engine oil that meets or exceeds the following guidelines and classifications:

Service Categories

- API Service Categories SM, SL, SJ, SH/CF and CF
- ACEA Service Categories A3, B3 and B4

Definitions

- API Classification (American Petroleum Institute)
- ACEA Classification (Association des Constructeurs Européens d'Automobilies)

Note:

1. Be sure the engine oil, engine oil storage containers, and engine oil filling equipment are free of sediment and water.
2. Change the engine oil after the first 50 hours of operation and then at every 250 hours (or annually) thereafter.
3. Select the oil viscosity based on the ambient temperature where the engine is operated. *See the SAE Service Grade Viscosity Chart.*
4. Yanmar does not recommend the use of engine oil "additives."

Engine Oil Viscosity

Select the appropriate engine oil viscosity based on the ambient temperature shown in the SAE Service Grade Viscosity Chart **(Figure 3-8)**.

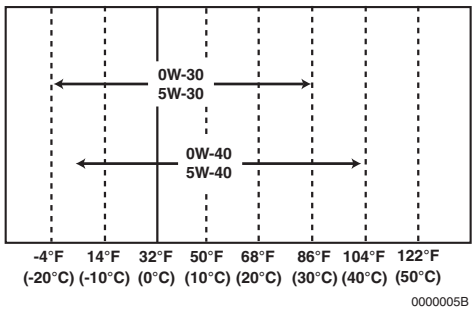

Figure 3-8

Note: Yanmar recommends using genuine Yanmar marine oil, specifically formulated for the BY engine. Contact your authorized Yanmar dealer or distributor.

Acceptable Engine Oil

LongLife 01 Oils

Trade Name	Producer/Supplier
Addinol Super power MV 0537	Addinol Lube Oil GmbH
Agip Formula LL B 01	ENI S.p.A. Refining and Marketing Division
Agip Sint 2000 Evolution	ENI S.p.A. Refining and Marketing Division
Agip TECSINT SL	ENI S.p.A. Refining and Marketing Division
ALPINE Longlife	Mitan Mineralöl GmbH
Aral SuperTronic B	Aral
Aral SuperTronic G	Aral
AXCL S-Class Motor Oil	AXCL Gulf FZE
BMW Quality Longlife 01	BMW
BP Visco 7000	BP Oil International
BP Visco 7000 GM	BP Oil International
BP Visco 7000 Turbo Diesel	BP Oil International
Castrol Edge	Castrol Limited
Castrol Formula RS Power and Protection	Castrol Limited
Castrol Formula SLX	Castrol Limited
Castrol Formula SLX LL01	Castrol Limited
Castrol Formula SLX Long Tex	Castrol Limited
Castrol Formula SLX Turbodiesel	Castrol Limited
Castrol Syntec	Castrol Limited
Castrol Syntec 0W-30 European Formula	Castrol Limited
Castrol Super Racing 0W-40	Castrol Limited
Castrol TXT Softec LL01	Castrol Limited
Cepsa Star Mega Synthetic	Cepsa Lubricantes S.A.
Divinol Syntholight	Zeller+Gmelin
Elf Excellium Full-Tech	Total
Elf Excellium LDX	Total
Elf Excellium XLL	Total
Esso Ultron FE	ExxonMobil
Galp Formula XLD	Petrogal SA
Gulf Formula TLX	Total
Havoline Synthetic BM	Chevron Texaco
Havoline Ultra BM	Chevron Texaco
Igol Process Compact P	Igol France S.A.
INA Futura Compact P	INA Maziva Rijeka
Jet Top Level	ConocoPhillips GmbH
Labo RC	Fuchs Labo Auto S.A.
Liqui Moly Longtime High Tech	Liqui Moly

Trade Name	Producer/Supplier
Megol Motorenöl New Generation	Meguin GmbH
Mobil 1	ExxonMobil
Mobil 1 Turbo Diesel	ExxonMobil
Mobil 1 Spezial XS	ExxonMobil
Motorex Profile B-XL	Bucher AG
Motorex Select SP-X	Bucher AG
Motul Specific LL-01	Motul S.A.
OMV full syn plus	OMV AG
Opaljet Longlife	Unil Opal
Panolin Exclusive BD	Panolin AG
Pennzoil European Formula Ultra	Pennzoil-Quaker State
Pentospeed 0W-30 VS*	Deutsche Pentosin-Werke
Petronas Syntium 3000 LL	Petronas
Q8 Formula Special	Kuwait Petroleum
Quaker State European Formula Ultra	Pennzoil-Quaker State
Ravenol HCL	Ravensburger Schmierstoffvertrieb GmbH
Repsol Elite Common Rail	Repsol YPF
Shell Helix Ultra AB	Shell International Petroleum Company
Shell Helix Ultra AL	Shell International Petroleum Company
Statoli LazerWay B	Statoil Lubricants
Tecar Motorenöl Supersyn	Techno-Einkauf GmbH
Titan Supersyn SL	Fuchs Petrolub AG
Titan Supersyn SL Longlife	Fuchs Petrolub AG
Tor Synthetic LL	De Oliebron
Total Activa Expertise 9000	Total
Total Quartz Expertise 9000	Total
Valvoline SynPower MXL	Valvoline
Veedol Powertron LL01	Veedol International
Veedol Syntron	Veedol International
Veritas Syntolube	Ölwerke Julius Schindler GmbH
Wako's Super Synthe	Wako Chemical Co.Ltd
Wintershall VIVA 1 Longlife	SRS Schmierstoff Vertrieb GmbH
Yacco VX 1600	Yacco S.A.S.

LongLife 04 Oils

Trade Name	Producer/Supplier
Addinol Super power MV 0537	Addinol Lube Oil GmbH
Agip Formula MS B04	ENI S.p.A.
Aral SuperTronic	Aral
BMW Longlife-04	BMW
Castrol Edge Sport	Castrol Limited
Castrol Edge Turbo Diesel	Castrol Limited
Castrol Formula RS	Castrol Limited
Castrol GTX Magnatec	Castrol Limited
Castrol SLX LL-04	Castrol Limited
Castrol TXT LL-04	Castrol Limited
Elf Excellium LSX	Total
Galp Energy Ultra LS	Petrogal SA
Liqui Moly TopTec 4100	Liqui Moly
Midland ® Synova	Oel-Brack AG
Midland ® Synova	Oel-Brack AG
Mobil 1 ESP Formula	ExxonMobil
Motorenöl Low Emission	Meguin GmbH
Motul 1 Specific LL-04	Motul S.A.
OMV eco plus	OMV AG
Repsol Elite Evolution	Repsol YPF
Shell Helix Ultra AP	Shell International Petroleum Company
Titan GT1	Fuchs Petrolub AG
Wintershall VIVA 1 topsynth alpha LS	SRS Schmierstoff Vertrieb GmbH
York 848	Ginouves SAS

Recommended Marine Gear or Stern Drive Oil

Refer to the documentation supplied with each marine gear or stern drive.

Recommended Power Steering Fluid

Refer to the documentation supplied with each stern drive.

ENGINE COOLANT

Engine Coolant Specifications

Note: In the U.S., LLC is required for the warranty to be valid.

Engine Coolant Mixture

NOTICE: Always add LLC to deionized soft water - especially when operating in cold weather. Without LLC, cooling performance will decrease due to scale and rust in the cooling system. Water alone may freeze and form ice; it expands approximately 9% in volume.

Use the proper amount of coolant concentrate for the ambient temperature as specified by the LLC manufacturer. LLC concentration should be a minimum of 30% to a maximum of 60%. Too much LLC will decrease the cooling efficiency.

Do not mix different types or brands of LLC or a harmful sludge may form.

Do not use hard water. Use deionized water.

Follow the manufacturer's recommendations. Use the proper LLC which will not have any adverse effects on the materials (cast iron, aluminum, copper, etc.) of the engine's fresh water cooling system. *See Engine Coolant Specifications on page 3-15*.

Remove scale from the cooling system periodically by flushing the system.

Note: Yanmar recommends using genuine Yanmar antifreeze / coolant. Contact your authorized Yanmar dealer or distributor.

Acceptable Engine Coolant

Trade Name	Manufacturer
Addinol Antifreeze Super	Addinol Lube Oil GmbH
Aral Antifreeze Extra	Aral AG
AVIA Antifreeze APN	AVIA Mineralöl AG
BMW Coolant	BMW AG
BP anti-frost X 2270A	BP Schmierstoff GMBH, Hamburg
Caltex CX Engine Coolant	Caltex
Castrol ANTI-FREEZE NF	Castrol International
Fridex G48	Velena s.a.
Glacelf Plus	Total
GlycoShell	Shell International
Glyco star	Bremin Mineralöl GmbH & Co.
Glysantin G48-24 Engine Coolant	UNICO Ltd.
Glysantin Protect Plus / G48	BASF
GUSOFROST LV 505	Chemische Industrielle Gesellschaft
Mobil Frostchutz 600	Mobil Schmierstoff GmbH
Havoline AFC (BD04)	Chevron Texaco/Arteco
Mobil Frostschutz 600	ExxonMobil
OMV Kühlerfrostschutz	OMV AG
Total Thermofreeze Plus	Total

PRINCIPAL ENGINE SPECIFICATIONS

Engine Model	4BY150 / 150Z	4BY180 / 180Z	6BY220 / 220Z	6BY260 / 260Z
Application Design	Models numbers with no suffix letter are used in marine gear applications. Models having a "Z" suffix are used with stern drive.			
Number of Cylinders	In-line 4		In-line 6	
Type	15° inclined, water-cooled, dual overhead camshaft, 4-cycle diesel			
Combustion System	Direct injection			
Aspiration	Turbocharged with charge air cooler			
Bore x Stroke	84 mm x 90 mm (3.307 in. x 3.543 in.)			
Displacement	1.995 L (121.7 cu in.)		2.993 L (182.6 cu in.)	
Firing Order*	1-3-4-2		1-5-3-6-2-4	
Compression Ratio	16.5:1		16.5:1	
Rated Power Output**	4BY150 / 4BY150Z	4BY180 / 4BY180Z	6BY220 / 6BY220Z	6BY260 / 6BY260Z
Continuous Output (at 3600 rpm)	85 kW (114 hp)	102 kW (137 hp)	124 kW (166 hp)	147 kW (197 hp)
Maximum Output (at 4000 rpm)	110 kW (150 hp)	132 kW (180 hp)	162 kW (220 hp)	191 kW (260 hp)
Mean Pressure	1.66 MPa (240.76 psi)	1.98 MPa (287.18 psi)	1.62 MPa (234.96 psi)	1.92 MPa (278.47 psi)
Torque	317 N·m (234 ft-lb)	355 N·m (262 ft-lb)	487 N·m (359 ft-lb)	545 N·m (402 ft-lb)
Low Idle Speed (Warm Engine @ 88°C [190°F])	750 rpm (ECU-controlled)		670 rpm (ECU-controlled)	
Cold Start Speed @ 20°C (68°F)	1200 rpm gradually decreasing to warm engine idle @ 88°C (190°F) (ECU-controlled)			
High Idle Speed	4600 rpm			
Rev Limit (fuel cut-off)	4600 rpm (ECU-controlled)		4600 rpm (ECU-controlled)	
Rotation Direction	Counterclockwise (viewed from flywheel)			
No. of Valves per Cylinder	4			
Valve Adjustment	Hydraulic self-adjusting			
Turbocharger	MHI with pneumatic wastegate		HOLSET with pneumatic wastegate	
Charge Air Cooler	Seawater cooled			
Electrical System	12 V			
Starter	12 V / 2 kW (2.7 hp)			
Charging System	12 V / 150 A			
Battery Capacity - Recommended	12 V / 74 Ah / 680 CCA (cold cranking amps)			
Fuel Injection System	Common rail (ECU-controlled)			
Fuel Injection Pressure	Variable depending on rpm; 250 - 1600 bar (3626 - 23,206 psi)			
Injection Timing	Variable (ECU-controlled)			
ECU Threshold Voltage	7.8 V			
Maximum Allowable Exhaust Backpressure	1835 mmAq (72.3 in.Aq)		2039 mmAq (80.3 in.Aq)	
Cooling System	Closed cooling system with heat exchanger			
Coolant Capacity (Approximate)	10.0 L (10.6 qt)		13.5 L (14.3 qt)	

Engine Model	4BY150 / 150Z	4BY180 / 180Z	6BY220 / 220Z	6BY260 / 260Z
Seawater Pump	Rubber impeller, belt driven			
Capacity	140 L / hour minimum (37 gal / hour minimum) at 4000 engine rpm			
Maximum Lift	2000 mm (78.75 in.)			
Hydraulic Oil Cooler	Seawater cooled			
Lubrication System	Totally enclosed, forced lube system			
Oil Cooler	Engine coolant system			
Lube Oil Pressure at 4000 rpm	3.5 - 6.0 bar (51 - 87 psi)			
Lube Oil Pressure at 1000 rpm	0.6 - 1.0 bar (8.7 - 14.5 psi)			
Lube System Capacity***	8.0 L (8.45 qt)****		11.0 L (11.5 qt)****	
Crankcase Ventilation	Closed, with filter			
Drive Options				
Stern Drive	Bravo-1, -2, -3			
Marine Gear	KMH40		KMH40 or KMH50	
Installation Angles: Static Angle				
Front-to-Rear	± 4°			
Left-to-Right	± 0°			
Operational Angles: Front-to-Rear and Left-to-Right				
Continuous	10° maximum			
Peak	20° maximum			
Height	721 mm (28.4 in.)			
Length (without marine gear)				
Stern Drive (front-to-middle of engine mount)	760 mm (29.9 in.)		942 mm (37.1 in.)	
Marine Gear (front-to-marine gear mounting face)	644 mm (25.4 in.)		825.5 mm (32.5 in.)	
Overall Length	861 mm (33.9 in.)		1001 mm (39.4 in.)	
Width	670 mm (26.4 in.) (local exceeding)			
Weight (without marine gear)				
Dry (without mixing elbow)	250 kg (551 lb)		310 kg (683 lb)	
Wet (with mixing elbow)	270 kg (595 lb)		340 kg (750 lb)	

* Cylinder numbering starts at the coolant pump end of the engine.

** Rating condition: ISO 8665. Temperature of fuel: 40°C (104°F) at fuel pump inlet.
Fuel condition: Density at 15°C (59°F) = 0.827 g/cm^3.
Fuel temperature at the inlet of the fuel injection pump.
1 hp (metric horsepower) = 0.7355 kW

*** The “Total Engine Lubricating Oil Capacity” includes oil in the oil pan, channels, coolers, and filter.
The “Effective Engine Lubricating Capacity” indicates the difference in maximum scale of the dipstick and minimum scale.

****Capacity may vary depending on installation angle.