



ME422STI

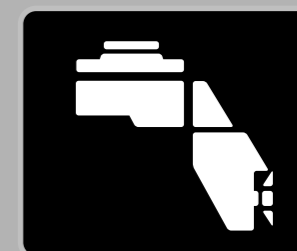
ENGINE SERVICE MANUAL



**E** ENGINE  
SERVICE MANUAL

070026

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ME422STI

N60-28197-ZH-11



YAMAHA MOTOR CO., LTD.

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(ME422STI)  
(E)

## NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

**ME422STI**  
**ENGINE SERVICE MANUAL**  
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## HOW TO USE THIS MANUAL

### MANUAL FORMAT

This manual provides the mechanic with descriptions of the operations of disassembly, repair, assembly and check, each of which is presented in a sequential, step-by-step procedure.

To assist you in finding your way around this manual, the section title and major heading is given at the head of each page.

A table of contents is provided on the first page of each section.

### ILLUSTRATIONS

Some illustrations in this manual may differ from the model you have. This is because a procedure described may relate to several models, though only one is illustrated. (The name of the model described will be mentioned in the description).

To help you identify components and understand the correct procedures of disassembly and assembly, exploded diagrams are provided. Steps in the procedure are numbered: 1), 2), 3). Parts shown in the illustrations are identified as: ①, ②, ③.

### REFERENCES

These have been kept to a minimum. References to other sections of the manual include the relevant page number.

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## IMPORTANT INFORMATION

In this Service Manual particularly important information is distinguished in the following ways.

⚠ The safety Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

### **⚠ WARNING**

Failure to follow **WARNING** instructions could result in severe injury or death to the marine vehicle operator, a bystander, or a person checking or repairing the Stern Drive.

### **CAUTION:**

A **CAUTION** indicates special precautions that must be taken to avoid damage to the Stern Drive.

### **NOTE:**

A **NOTE** provides key information to make procedures easier or clearer.

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# CONSTRUCTION OF THIS MANUAL

This manual consists of chapters for the main categories of subjects. (See "Symbols" on the next page.)

1st title ① : This is a chapter with its symbol on the upper right of each page.

2nd title ② : This title appears on the top of the each page, to the left of the chapter symbol.

3rd title ③ : This title appears only in the chapter "Periodic check and adjustment".

All the procedures in this manual are organized in a sequential, step-by-step order. The information has been compiled to provide the mechanic with an easy-to-read, handy reference that contains comprehensive explanations of all disassembly, check, repair, and assembly procedures.

Important procedures including removing, checking, and assembling steps ④ are explained in detail.

## IMPORTANT FEATURES

- Important engine data and information about special tools framed in a box together with an illustrative symbol ⑤.
- A circled numeral ⑥ indicates a part name. A circled lower case letter indicates data or an alignment mark ⑦. Illustrations are sometimes labeled with an upper case letter ⑧.
- An arrow ⑨ indicates the course of action required to remedy the started condition of a component.

## EXPLODED DIAGRAM

Each chapter begins with exploded diagrams which facilitate correct disassembly and assembly.

① **ENG OVER** ② **TIMING BELT AND TIMING PULLEYS** ③ **E**

**Removal**

1. Drain:
  - Engine coolant
  - Refer to "Coolant and Seawater Draining" on page 4-xx.
2. Remove:
  - Bracket ① (with seawater strainer assembly ②)
  - Cooling pipe #4 ③
  - Gasket ④
3. Remove:
  - Timing belt cover
4. Remove:
  - Timing belt ①

**Removal steps**

- 1) Turn the crankshaft pulley clockwise, and align the grooves ② on the #1 ③ and #2 ④ camshaft pulleys with the BDC marks ⑤ on the timing gear cover ⑥.

**CAUTION:**  
By positioning the #1 cylinder at the BDC, interference between valves and pistons is avoided, even if the camshaft is rotated.

**NOTE:**  
If the timing belt is to be reused, draw a direction arrow ⑦ on the timing belt (in the direction of the engine revolutions), and make matching marks ⑧ on the pulleys and timing belt.

5-9

④ **ENG OVER** ⑤ **CYLINDER HEAD** ⑥ **E**

**Camshaft**

1. Install:
  - Thrust plate ①
  - Camshaft bearings ② (to #1 bearing cap ③ and #1 journal ④ of the cylinder head)

**NOTE:**  
Align the projection ⑤ of the bearings with the notch ⑥ in the #1 bearing cap ③ and the #1 journal ④ of the cylinder head.

2. Install:
  - Camshaft (onto cylinder head)

**NOTE:**  
The key groove ⑦ should now face upward ⑧.

3. Install:
  - Dowel pins
  - Bearing caps

**NOTE:**  
The bearing caps are numbered from front to rear.

⑨












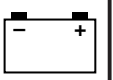












• Connecting rod twist

Use rod aligner.  
Out of specification → Replace connecting rod assembly.

**Connecting rod twist:**  
<Limit>  
0.15 mm (0.0059 in.) per 100 mm (3.94 in.)

⑤

5-81

① GEN INFO 	② SPEC 
③ CHK ADJ 	④ REM INST 
⑤ ENG OVER 	⑥ FUEL 
⑦ EXHT 	⑧ COOL 
⑨ LUB 	⑩ TURB 
⑪ STEER 	⑫ ELEC 
⑬ TRBL 	⑭ 
⑮ 	⑯ 
⑰ 	⑱ 
⑲ 	⑳ 
㉑ 	㉒ 
㉓ 	㉔ 

## SYMBOLS

Symbols ① to ⑪ are designed as thumb-tabs and indicate the content of a chapter.

- ① General information
- ② Specifications
- ③ Periodic check and adjustment
- ④ Engine removal and installation
- ⑤ Engine
- ⑥ Fuel system
- ⑦ Exhaust system
- ⑧ Cooling system
- ⑨ Lubrication system
- ⑩ Turbocharger
- ⑪ Power steering system
- ⑫ Electrical system
- ⑬ Troubleshooting

Symbols ⑭ to ⑳ indicate specific data:

- ⑭ Special tool
- ⑮ Recommended fuel
- ⑯ Lubricant
- ⑰ Engine speed
- ⑱ Tightening torque
- ⑲ Specified value, service, limit
- ⑳ Resistance ( $\Omega$ ), Voltage (V), Electric current (A)

Symbols ㉑ and ㉒ in an exploded diagram indicate grade of lubricant and location of lubrication point:











- ㉑ Apply Yamaha gear-case lubricant
- ㉒ Apply water resistant grease (Yamaha marine grease A, Yamaha marine grease)

Symbols ㉓ and ㉔ in an exploded diagram indicate grade of sealing or locking agent, and location of application point:

- ㉓ Apply LOCTITE<sup>®</sup> No. 243, 271, 572
- ㉔ Apply Three Bond<sup>®</sup> TB-1207B, 1322, 1324

**NOTE:** \_\_\_\_\_  
Some of the above symbols may not appear in this manual.  
\_\_\_\_\_

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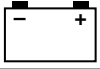
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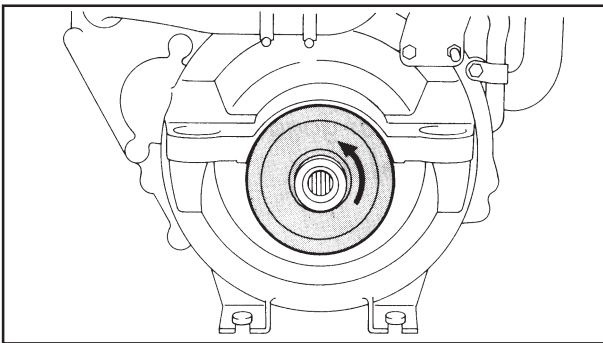
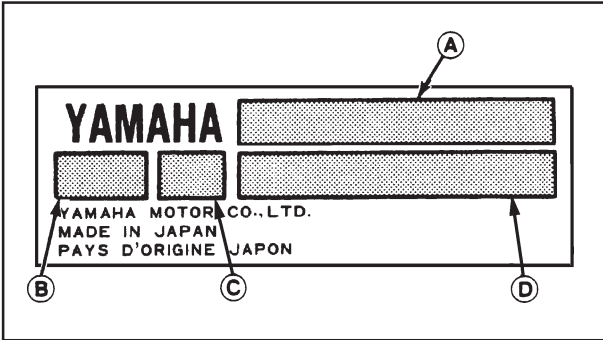
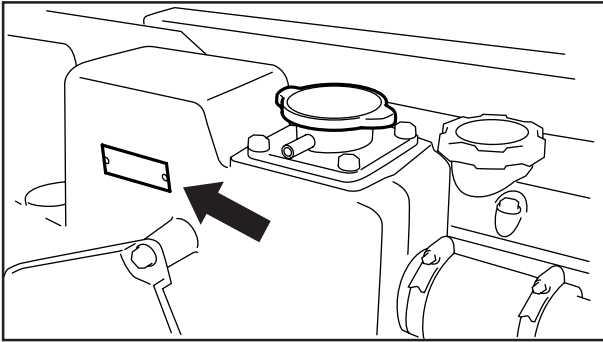
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## CHAPTER 1 GENERAL INFORMATION



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## ENGINE IDENTIFICATION

When servicing, inspecting or ordering the spare part of the engine or marine gear, check the identification number as follows.

**NOTE:**

Because of the identification number plate is stuck with special method, the engine number and the serial number will be invalid when removed.

The model and serial number plate is located on the header tank.

The different models can be identified by checking the model and serial number plate and using the following table.

MODEL	PREFIX	VARIATION*	SERIAL NO.
(A)	(B)	(C)	(D)
ME422STIP1	N611	SP	*****
	N612	P	*****
ME422STIP2	N601	SP	*****
	N602	P	*****

## PROPELLER AND ENGINE ROTATION

DO NOT rely on propeller rotation to be in the same direction as engine rotation.

Engine rotation is determined by looking at the flywheel end of the engine.

The Yamaha engines covered in this manual rotate counterclockwise (to the left) as viewed from the flywheel.



## SAFETY WHILE WORKING

### Prepare for Emergencies

Be prepared for possible fires.  
Keep the following items handy:

- First Aid Kit
- Fire Extinguisher
- Emergency Phone Numbers



### Handle Fuel Safety

Use care when handling fuel; it is highly flammable. **DO NOT** smoke or have open flames or sparks nearby when handling fuel.

Always clean up spilled fuel oil and dispose of cleaning materials properly.

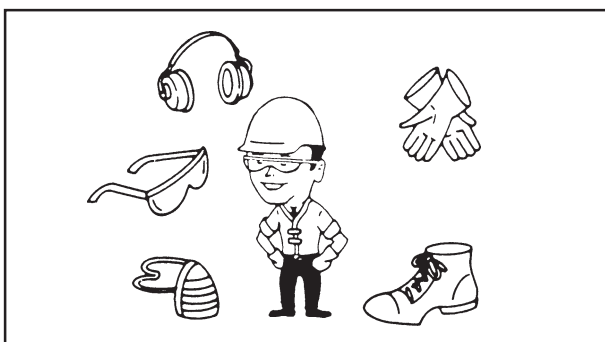


### Prevent Battery Explosion

Batteries produce explosive gases. Keep sparks and flames away from batteries. Check battery electrolyte level using a flashlight.

Never check battery state of charge by connecting the battery posts with a conductor. Use a voltmeter or hydrometer. Always disconnect the negative (-) cable first and reconnect it last.

**DO NOT** charge a battery if the battery is frozen. Allow the battery to warm up first. Charge the battery in a well-ventilated area. Battery electrolyte is poisonous and dangerous. It contains sulfuric acid and causes severe burns. Avoid contact with skin, eyes or clothing. If electrolyte gets in the eyes, flush with water for 15 minutes and get prompt medical attention.

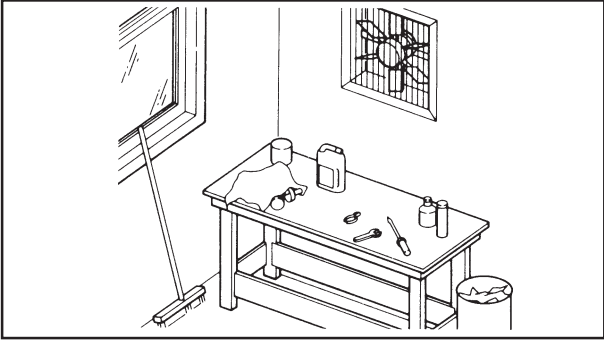


### Wear Protective Clothing

Wear safety equipment whenever necessary:

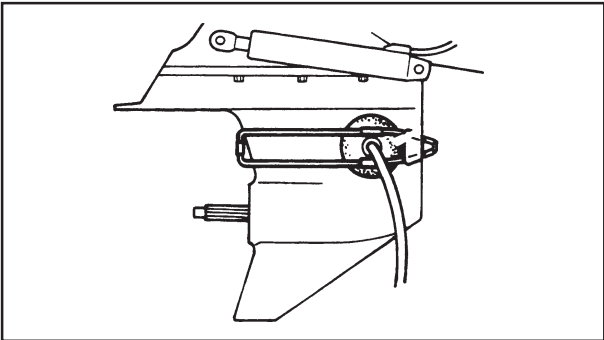
- Safety glasses or goggles
- Earmuffs or earplugs
- Safety shoes
- Gloves
- Respiratory protection

Avoid wearing loose clothing and jewelry.



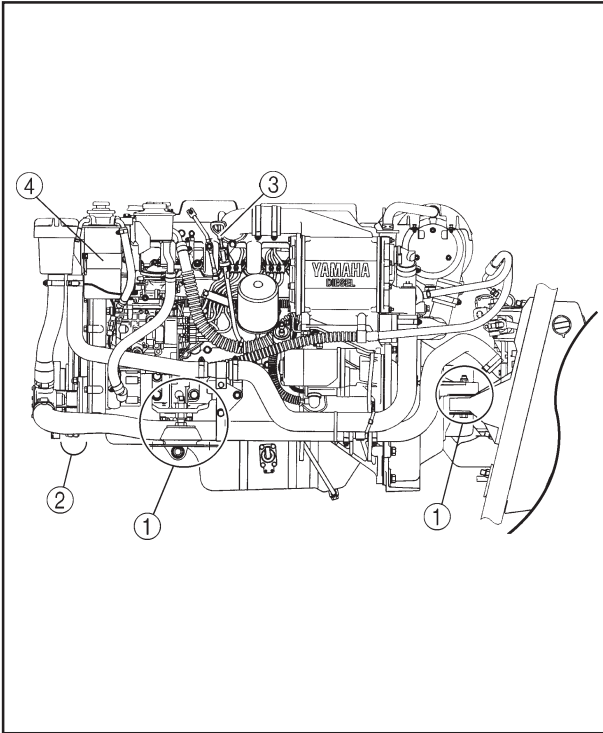
**Keep Work Area Clean**

Properly ventilate your work area. Keep the shop bench and floor clean and dry. Cover all parts and part opening when they are not being worked on, to prevent foreign materials from entering and damaging the engine. Cleaning and protection of machined surfaces and friction areas are part of the repair procedure; this is considered standard shop practice.



**Operate Stern Drive Safely**

Remove the propeller. DO NOT operate engine without cooling water supplied to the water inlet ports on the drive unit.



**PRE-DELIVERY CHECK**

Perform the following checks to prepare the engine for delivery to the customer.

**Check Engine Alignment**

- Use an engine alignment tool to check engine alignment. Make any adjustments as necessary. Refer to “Engine Installation” on page 4-5.
- Make sure all engine mounting hardware ① is tight.

**Check Drive Belts**

- Check the tension of the alternator and circulation pump belts ②.

**Check Engine Oil**

- Make sure break-in oil is at the proper level ③.

**Check Fuel System**

- Make sure all fuel lines and hoses are connected and do not leak.
- If water separator warning light comes on, drain the water from the water separator ④.

**Check Engine Exterior**

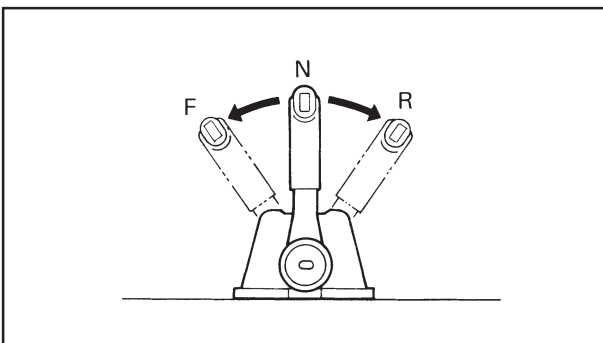
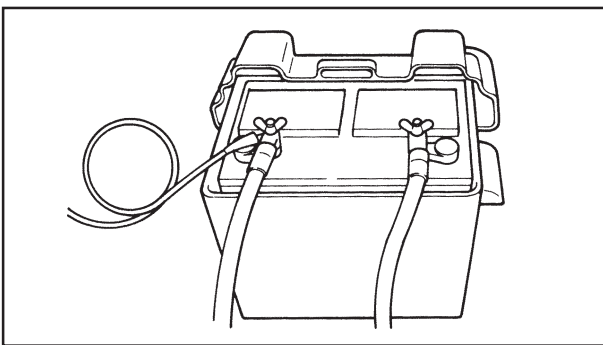
- Touch-up any painted surfaces with matching paint.
- Replace any parts damaged in shipping.

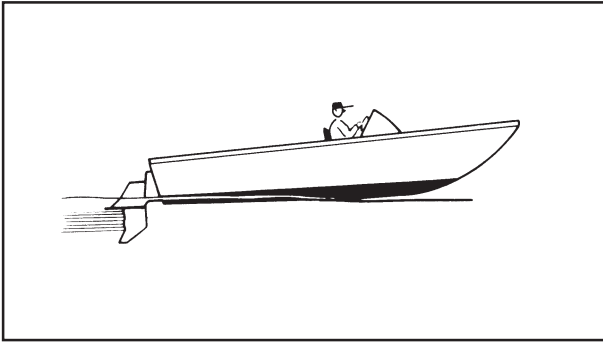
**Check Battery and Electrical Connections**

- Check the battery fluid level.
- Check if the battery is fully charged.
- Verify that the battery is securely attached to the boat.
- Check that the battery cables are correctly and securely connected.
- Check all wire harness connections for proper contact and tightness.

**Check Remote Control Operation**

- Make sure the engine can be controlled properly with the remote control.





**Perform Test Run**

- Be sure gear shifting and steering is smooth.
- Check for leaks in the transom.

**OFF-SEASON STORAGE**

If the boat is kept unused for a long period, internal parts of the engine or drive unit might rust through of lack of lubrication and protection. If the boat is stored in below-freezing temperatures, seawater inside the seawater cooling system may freeze, causing extensive engine damage. Therefore precautions must be taken, to prevent rusting and freezing.

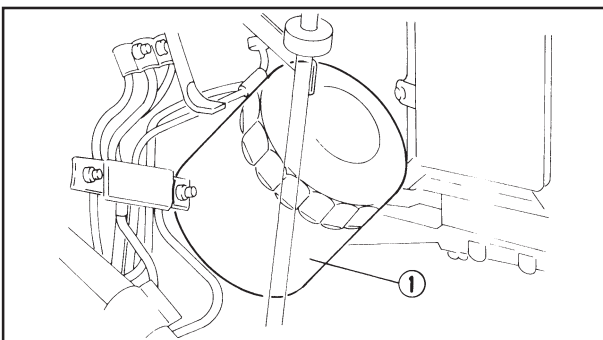
**Engine**

**▲ WARNING**

**When working in the engine compartment, run the bilge blower if the boat has one. If not, insure that the engine compartment is sufficiently ventilated.**

**CAUTION:**

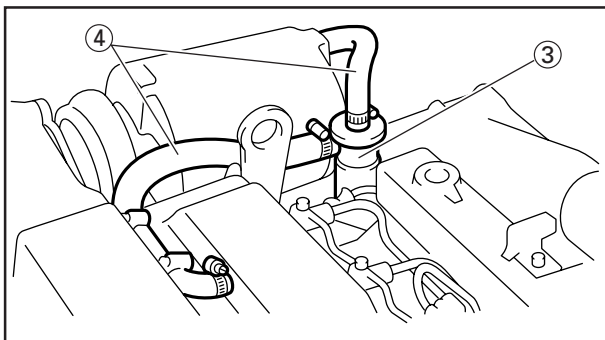
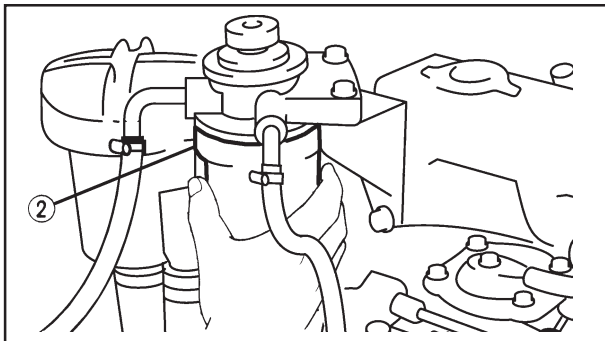
- While running the engine, be sure to use flushing gear or a water tank to provide cooling water to the cooling system. Also keep the engine speed at idling.
- While operating the engine, be sure the water temperature and oil temperature are kept within the proper range to prevent engine overheating and subsequent damage.



When carrying out the following storage preparation, be sure to flush the cooling system thoroughly. Refer to "Cooling System Flushing" on page 3-42.

- 1) Warm up the engine to normal operating temperature.
- 2) Stop the engine, drain the engine oil and replace the oil filter ①.





- 3) Tighten the drain bolt to the specified torque, and add the indicated amount of new engine oil. (Refer to "Engine Oil Level Check" on page 3-7.)
- 4) Start the engine and run it at a speed between 1000 – 1200 r/min. Be sure no oil leaks from the oil filter joint.
- 5) Stop the engine and check with an oil level gauge whether the oil is at the specified level. (Refer to "Engine Oil Level Check" on page 3-7.)
- 6) Turn the fuel cock on the fuel tank side to "OFF".
- 7) Install a new filter ② and filter cover. (Refer to "Fuel Filter Replacement" on page 3-31.)
- 8) Drain all diesel fuel from the fuel tank, or alternatively, fill the tank completely.
- 9) Clean the oil separator ③ and blow-by hose ④, then reinstall it securely.
- 10) After turning off the main switch, turn the battery switch "OFF" (if the boat is equipped with one), or disconnect the battery cables from the terminals.

**CAUTION:**

- **DO NOT turn off the battery switch while the ignition switch is still on.**  
**This could damage the voltage regulator.**
- **When disconnecting the battery cables, start with the (-) terminal.**

- 11) Remove the battery and clean it. Add distilled water to the specified level and recharge the battery. Apply petroleum-based grease to the terminals.  
Store the battery in a cool, dry place.

**CAUTION:**

**If the battery is stored without being properly charged, there is a danger that it will freeze. A stored battery should be checked once a month and appropriate maintenance should be performed.**

- 12) Lubricate the shift and throttle cables and the linking mechanisms.



**Drain Cooling System**

To protect the cooling system from rust and damage from freezing, drain coolant from the cooling system completely.

**CAUTION:**

**DO NOT store the engine with water left in the cooling system.**

**NOTE:**

- When draining coolant, cover all electrical parts and accessories with a plastic cover to prevent them from getting wet.
- After draining the coolant, remove the drain bolt on the bottom of the boat to drain any coolant that has collected in the bilge (provided the boat is on land). If the boat is in the water, use a bilge pump instead. After draining, rinse thoroughly with clean water and dry.
- If possible, lift the front of the engine slightly, so that the coolant water drains completely from the cylinder block.

- 1) Remove the drain cocks, plugs and hoses located as shown, and drain the coolant.

**Coolant:**

- Drain plug ① on the port side of the cylinder block
- Drain plug ② on the turbo charger housing
- Hose ③ connected to the heat exchanger

**Seawater:**

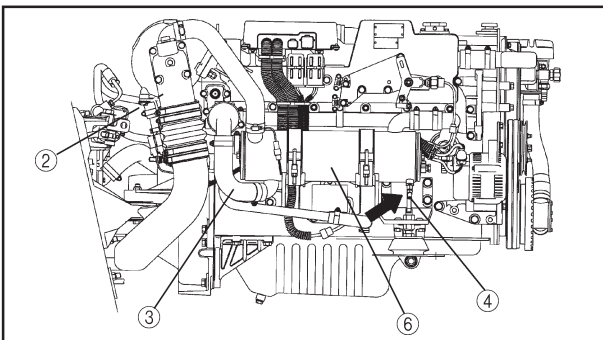
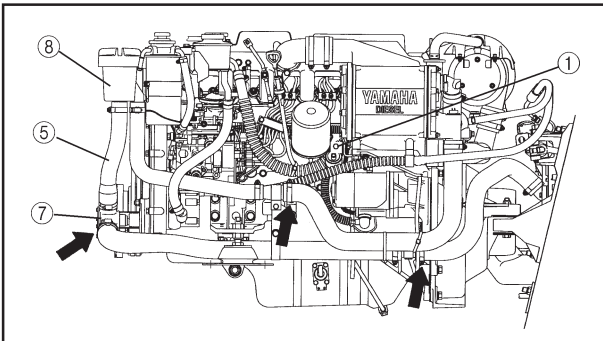
- Drain cock ④ on the heat exchanger
- Seawater hose ⑤

- 2) Loosen clamps of the hoses in the location described below then disconnected the hoses.

- Heat exchanger ⑥
- Seawater pump ⑦
- Seawater strainer ⑧

**NOTE:**

- After removing the hoses, if necessary, drain any remaining coolant and seawater by bending, lifting or shaking the hose.
- If sand or other dirt clogs up a drain hole, use a needle or similar tool to free it.

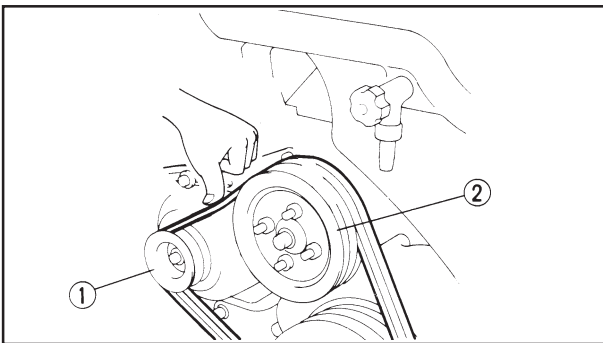




- 3) When all coolant and seawater has been drained, apply a sealant to the drain plugs and tighten them to the specified torque.
- 4) Check that the hoses are neither cracked nor damaged and re-connect them. Be sure to tighten the hose clamps securely.

### Preparation After Storage

To prepare an engine after it has been stored for a long time, perform the checks and the maintenance described below, as well as those described in "CHECKS BEFORE LAUNCHING AND STARTING THE ENGINE" (Refer to "CHECKS BEFORE LAUNCHING AND STARTING THE ENGINE" on page 1-9.)



- 1) Tighten the drain plugs of the water cooling system. Check the condition of the cooling system hoses. Check if the hose clamps are in good condition and tightened securely.
- 2) Check the condition of the drive belts on the alternator ① and circulation pump ②. Adjust the tension of the drive belts to the specified deflection.
- 3) Check that the engine mount, drive unit, and power trim cylinder are securely attached, that the steering and throttle cables are properly connected, and that the electrical system connectors are firmly attached.
- 4) After engine check is completed, install and securely connect a fully charged battery.



- 5) Check all the items listed under "CHECKS BEFORE LAUNCHING AND STARTING THE ENGINE", and perform any necessary maintenance.
- 6) Test run the engine on land or in the water and make sure there are no problems of any kind.

## CHECKS BEFORE LAUNCHING AND STARTING THE ENGINE

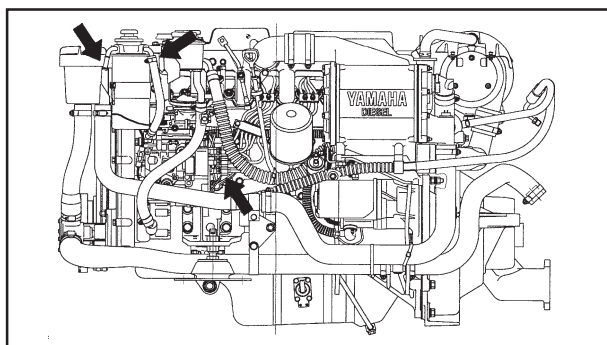
The following items should be checked before starting the engine.

### CAUTION:

- **Make sure all periodic check, maintenance, and periodic replacement of parts have been performed. (Refer to "PERIODIC CHECK AND ADJUSTMENT" on page CHAPTER 3.)**
- **From time to time, check the water intake area of the drive unit. Make sure the opening is not clogged with seaweed or anything else.**

### ⚠ WARNING

**Explosive battery fumes may collect in the engine compartment. Before starting the engine, ventilate the engine compartment. If the boat has a bilge blower, let it run for at least 3 minutes. If not, open the hatch and ventilate for at least 5 minutes.**



- 1) Check that no fuel is leaking from a fuel line or connection. Also, verify that no oil or fuel has leaked into the engine compartment. (Refer to "FUEL LINE CHECK" on page 3-26.)
- 2) Check that the drain plugs of the cooling system are securely tightened, and that no water leakings into the bilge.
- 3) Check the battery fluid level (Refer to "Battery Check" on page 3-43.)

Check that the battery terminals are not loose, corroded, or damaged. Securely fasten the battery to the boat.



- 4) Check that the engine oil is at the specified level (Refer to "Engine Oil Level Check" on page 3-7.) and that there is no water, metal gratings, or anything else irregular in the oil. Check that no oil is leaking from any part of the engine.
- 5) Check the oil level (Refer to "DE-DHD STERN DRIVE SERVICE MANUAL") in the drive unit and make sure no oil is leaking from the unit.
- 6) Check that the drive belts are not loose, cracked, or damaged in any way.  
(Refer to "Drive Belt Check" on page 3-21.)
- 7) Check the oil level in the power steering pump. (Refer to "DE-DHD STERN DRIVE SERVICE MANUAL")

**INTERNATIONAL SYSTEM OF UNITS [SI]**

The unit system currently applied in our daily life is called gravitational system of units. Both gravitational system of units and International System of Units belong to the metric system of measurement, and basically the same units are used in both systems, i.e. “meter” to indicate length, “second” to indicate time, and “kilogram” to indicate mass.

Essential difference found in International System of Units in comparison with the gravitational system is the clear distinction between the unit of “mass” and the unit of “force”.

In addition, the different units of “force” applied in the SI system results in the different units of “amount” (e.g. amount of energy) related to the force.

The abbreviation “SI” stands for the French expression of International System of Units (Le System International d’ Unites ).

**Description of “SI” Units in This Service Manual**

Both SI units and gravitational system of units are indicated in this service manual. e.g.) Tightening torque 98 N·m (10 kgf·m, 71 lbf·ft)

**Examples for major units**

ITEM	SI UNIT	OLD UNIT	EQUIVALENT (1 [FORMER UNIT] = X [SI UNIT])	REMARKS
Force	N	kgf	1 kgf = 9.80665 N	
Torque	N·m	kgf·cm	1kgf·cm = 0.0980665 N·m	
Pressure	Pa	kgf/cm <sup>2</sup>	1 kgf/cm <sup>2</sup> = 98.0665 kPa = 0.0980665 MPa	10 kgf/cm <sup>2</sup> = 980 kPa, 0.98 Mpa 100kgf/cm <sup>2</sup> = 9.8 MPa
		mmHg	1 mmHg = 0.133322 kPa	
Rotational speed	r/min	rpm	1 rpm = 1 r/min	
	min <sup>-1</sup>		1 rpm = 1 min <sup>-1</sup>	
Output power	W	PS	1 PS = 0.735499 kW	1 HP = 0.745 kW 1 HP = 1.01387 PS
	W·h	cal	1 kcal = 1.16279 W·h	
Specific fuel consumption	g/W·h	g/PS·h	1 g/PS·h = 1.3596 g/W·h	

**SPECIAL TOOLS**

The proper special tools are necessary for complete and accurate adjustment and assembly. Using special tools will help avoid damage caused by the use of improper tools or incorrect procedures.

(These special tools are recommended by Yamaha. The tool numbers indicated below are those of TOYOTA Motor Corporation, except for the tools marked with \*.)

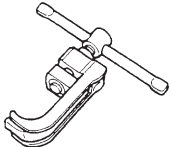
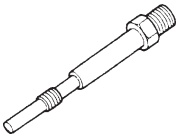
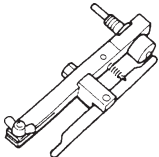

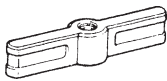
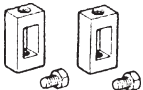

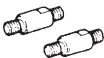
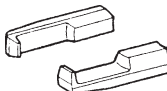


ILLUSTRATION	TOOL No.	TOOL NAME	REMARKS
	09248-64011	Valve clearance adjusting tool	To valve clearance adjustment (Page 3-14)
	*TDG-7 (from BANZAI) *NO.30 (from IYASAKA)	Compression gauge attachment	To measure compression (Page 3-19)
	09275-54001	Plunger stroke measuring tool	To check injection timing (Page 3-28)
	09950-40011	Puller B set	(Page 5-11, 5-20, 5-22, 5-23)
	09951-04010	Hanger 150	To remove camshaft timing pulley, oil pump drive gear, crankshaft timing gear and injection pump drive gear bearing
	09952-04010	Slide arm	To remove camshaft timing pulley, oil pump drive gear, crankshaft timing gear and injection pump drive gear bearing
	09953-04010	Center bolt 150	To remove camshaft timing pulley, oil pump drive gear, crankshaft timing gear and injection pump drive gear bearing
	09354-04010	Arm 25	To remove camshaft timing pulley, oil pump drive gear, crankshaft timing gear and injection pump drive gear bearing
	09955-04060	Claw No.6	To remove camshaft timing pulley, crankshaft timing gear and injection pump drive gear
	09955-04011	Craw No.1	To remove injection pump drive gear bearing, oil pump drive shaft gear
	09957-04010	Attachment	To remove injection pump drive gear bearing



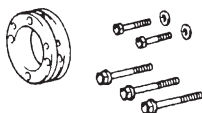
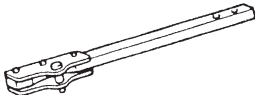
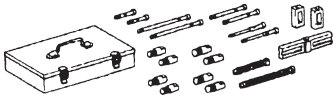
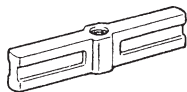
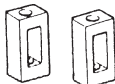

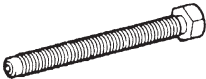
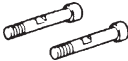

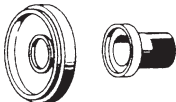
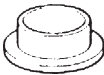

ILLUSTRATION	TOOL No.	TOOL NAME	REMARKS
	09213-58013	Flange base	To secure crankshaft pulley (Page 5-18, 5-28)
	09330-00021	Flange holder	To secure crankshaft pulley (Page 5-18, 5-21, 5-26, 5-28)
	09950-50013	Puller C set	(Page 5-19, 5-21, 6-20)
	09951-05010	Hanger 150	To remove crankshaft pulley and injection pump drive gear
	09952-05010	Slide arm	To remove crankshaft pulley and injection pump drive gear
	09953-05010	Center bolt 100	To remove injection pump drive gear
	09953-05020	Center bolt 150	To remove crankshaft pulley
	09954-05020	Claw No.2	To remove crankshaft pulley and injection pump drive gear
	09214-76011	Crankshaft pulley replacer	To install injection pump drive gear oil seal (Page 5-24)
	09223-78010	Oil seal replacer	To install crankshaft front oil seal (Page 5-24, 5-25)
	09316-20011	Oil seal replacer	To install injection pump oil seal (Page 5-24, 5-25)
	09223-00010	Cover and seal replacer	To mount crankshaft timing gear and oil pump drive gear (Page 5-26, 5-27)





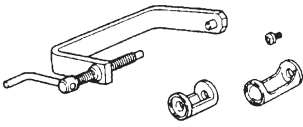
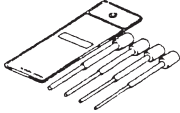
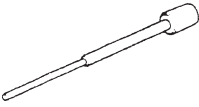
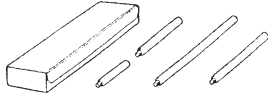

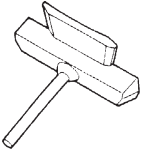
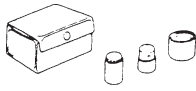
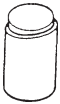


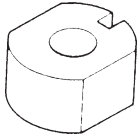

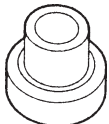

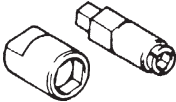
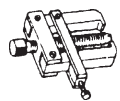
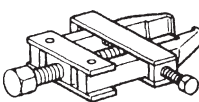
ILLUSTRATION	TOOL No.	TOOL NAME	REMARKS
	09202-70020	Valve spring compressor	To remove and install valve (Page 5-40, 5-57)
	09201-10000	Valve guide bush re- mover and replacer set	(Page 5-43, 5-44)
	09201-01080	Valve guide bush re- mover and replacer 8	To remove and install valve guide bush
	09950-70010	Handle set	(Page 5-43, 5-44)
	09951-07200	Handle 200	To install camshaft oil seal
	09032-00100	Oil pan seal cutter	To remove oil pan (Page 9-3)
	09222-17011	Connecting rod bush remover and replacer	(Page 5-85)
	09222-05021	Remover and replacer	To remove and install connecting rod bush
	09222-05031	Guide	To install connecting rod bush
	09222-05041	Base	To remove and install connecting rod bush
	• 95093-10230 (from DENSO)	2-spring base	To measure injection nozzle (Page 6-7, 6-8)
	• 95093-10300 (from DENSO)	Attachment measure	To measure injection nozzle (Page 6-7)



ILLUSTRATION	TOOL No.	TOOL NAME	REMARKS
	• 95093-10330 (from DENSO)	Master spring seat	To measure injection nozzle (Page 6-11)
	• PSG-6TB (from BANZAI)	Power steering fluid pressure gauge set	To check power steering fluid pressure (Page 11-4)
	09820-63010	Alternator wrench	To remove and install alternator pulley (Page 12-29, 12-35)
	09286-46011	Alternator bearing puller	To remove alternator rectifier end fram and starter motor armature bearing (Page 12-17, 12-30)
	09820-00021	Alternator bearing puller	To remove alternator rotor bearing (Page 12-34)



## OTHER EQUIPMENT TOOLS

TOOL NAME	REMARKS
Vernier caliper	
Outside micrometer	0 ~ 25 mm, 25 ~ 50 mm, 50 ~ 75 mm, 75 ~ 100 mm
V Block	
Power wrench (4 times)	
Cylinder gauge	50 ~ 150 mm
Battery hydrometer	
Radiator cap tester	
Compound (Red lead)	
Valve lapping compound	
Hand valve lapper	
Piston ring tool	
Piston oil heater	
Piston vise	
Piston ring compressor	
Straight edge	
Square gauge	
Plasti gauge	
Surface plate	
Digital circuit tester	
Oil pressure gauge	0 ~ 500 kPa
Thickness gauge (Filler gauge)	
Torque wrench	~ 100 kgf/cm, ~ 450 kgf/cm, ~ 900 kgf/cm, ~ 1800 kgf/cm
Dial gauge	
Magnetic base	
Heater gun	
Flat chisel	
Diesel compression gauge set	
Diesel tachometer	
Nozzle tester	
Snap ring plier	
Pin punch	
Thermometer	100°C