YAMAHA

F150A
FL150A

SERVICE MANUAL

290503

63P-28197-3F-11

Contents

General information

How to use this manual

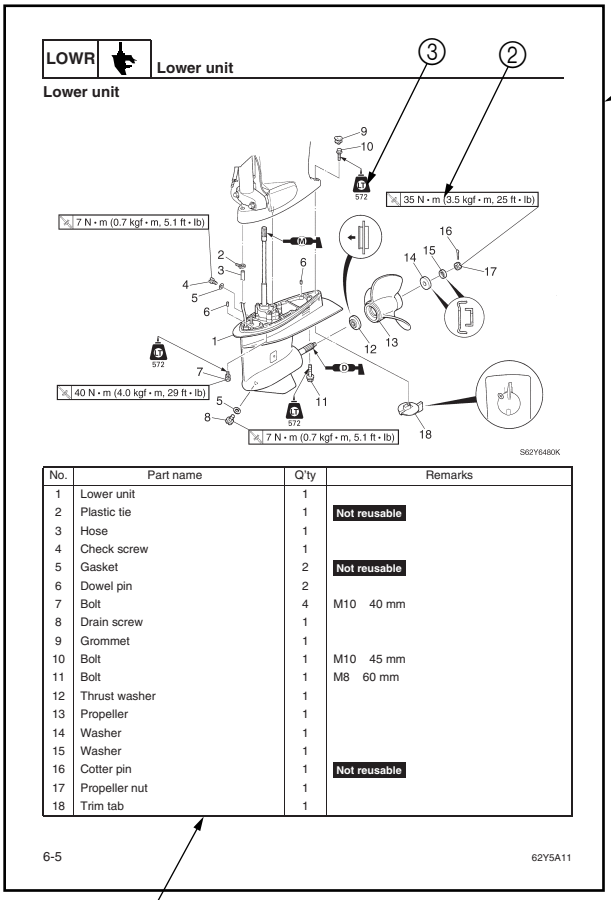
Manual format

The format of this manual has been designed to make service procedures clear and easy to understand. Use the information below as a guide for effective and quality service.

① Parts are shown and detailed in an exploded diagram and are listed in the components list.
② Tightening torque specifications are provided in the exploded diagrams and after a numbered step with tightening instructions.
③ Symbols are used to indicate important aspects of a procedure, such as the grade of lubricant and lubrication point.
④ The components list consists of part names and part quantities, as well as bolt and screw dimensions.
⑤ Service points regarding removal, checking, and installation are shown in individual illustrations to explain the relevant procedure.

NOTE:

For troubleshooting procedures, see Chapter 9, “Troubleshooting.”



No.	Part name	Q'ty	Remarks
1	Lower unit	1	
2	Plastic tie	1	Not reusable
3	Hose	1	
4	Check screw	1	
5	Gasket	2	Not reusable
6	Dowel pin	2	
7	Bolt	4	M10 40 mm
8	Drain screw	1	
9	Grommet	1	
10	Bolt	1	M10 45 mm
11	Bolt	1	M8 60 mm
12	Thrust washer	1	
13	Propeller	1	
14	Washer	1	
15	Washer	1	
16	Cotter pin	1	Not reusable
17	Propeller nut	1	
18	Trim tab	1	

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④

⑤

LOWR Lower unit

Removing the drive shaft

1. Remove the drive shaft assembly and pinion, and then pull out the forward gear.

S62Y6850K

Drive shaft holder 4 ①: 90890-06518
Pinion nut holder ②: 90890-06505
Socket adapter 2 ③: 90890-06507

Disassembling the drive shaft

1. Install the pinion nut ①, tighten it finger tight, and then remove the drive shaft bearing ② using a press.

S62Y6735K

CAUTION:

- **Do not press the drive shaft threads ⓐ directly.**
- **Do not reuse the bearing, always replace it with a new one.**

Bearing inner race attachment ③: 90890-06639

Disassembling the forward gear

1. Remove the taper roller bearing from the forward gear using a press.

S62Y6740K

CAUTION:

Do not reuse the bearing, always replace it with a new one.

Bearing separator ①: 90890-06534

2. Remove the needle bearing from the forward gear.

S62Y6750K

CAUTION:

Do not reuse the bearing, always replace it with a new one.

Stopper guide plate ②: 90890-06501
Stopper guide stand ③: 90890-06538
Bearing puller ④: 90890-06535
Bearing puller claw 1 ⑤: 90890-06536

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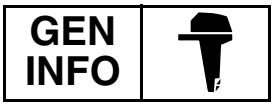
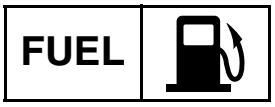
Symbols

The symbols below are designed to indicate the content of a chapter.

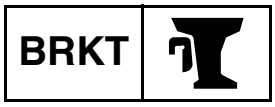
General information



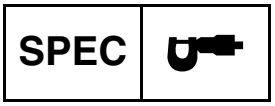
Fuel system



Bracket unit

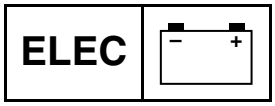


Specifications



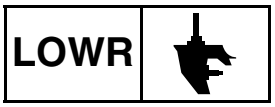
Power unit

Electrical systems

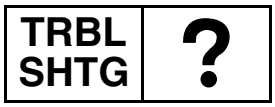


Periodic checks and adjustments

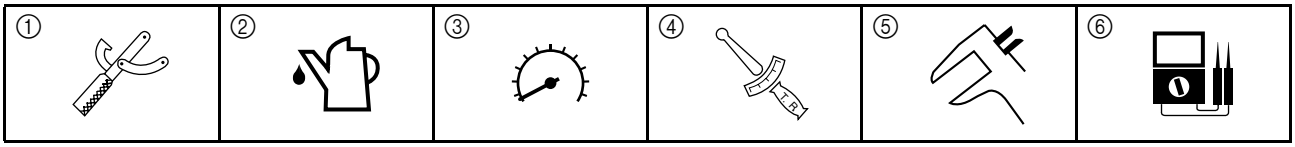
Lower unit



Troubleshooting

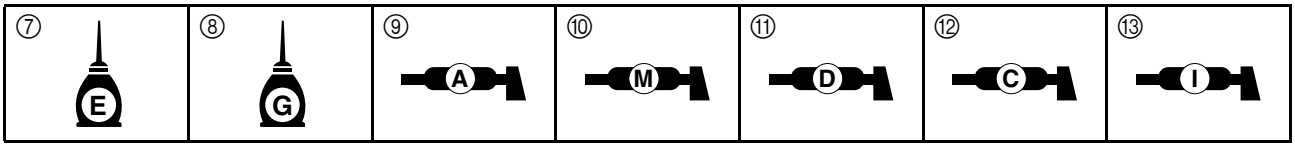


Symbols ① to ⑥ indicate specific data.



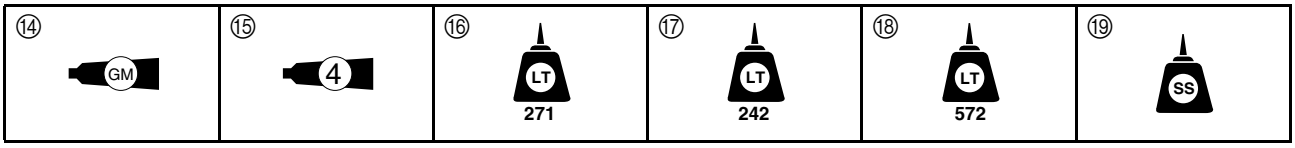
① Special tool
② Specified oil or fluid
③ Specified engine speed
④ Specified tightening torque
⑤ Specified measurement
⑥ Specified electrical value (resistance, voltage, electric current)

Symbols ⑦ to ⑬ in an exploded diagram indicate the grade of lubricant and the lubrication point.



⑦ Apply Yamaha 4-stroke motor oil
⑧ Apply gear oil
⑨ Apply water resistant grease (Yamaha grease A)
⑩ Apply molybdenum disulfide grease
⑪ Apply corrosion resistant grease (Yamaha grease D)
⑫ Apply low temperature resistant grease (Yamaha grease C)
⑬ Apply injector grease

Symbols ⑭ to ⑲ in an exploded diagram indicate the type of sealant or locking agent and the application point.



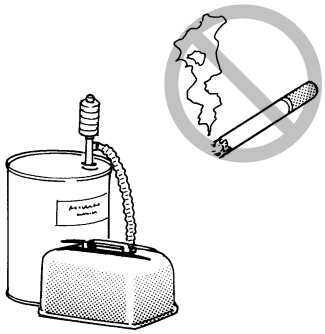
⑭ Apply Gasket Maker
⑮ Apply Yamabond No. 4
⑯ Apply LOCTITE 271 (red)
⑰ Apply LOCTITE 242 (blue)
⑱ Apply LOCTITE 572
⑲ Apply silicon sealant

Safety while working

To prevent an accident or injury and to ensure quality service, follow the safety procedures provided below.

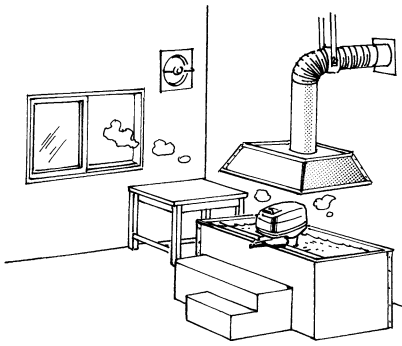
Fire prevention

Gasoline is highly flammable.
Keep gasoline and all flammable products away from heat, sparks, and open flames.


S69J1010

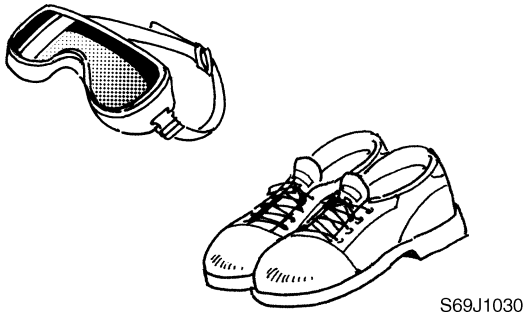
Ventilation

Gasoline vapor and exhaust gas are heavier than air and extremely poisonous. If inhaled in large quantities they may cause loss of consciousness and death within a short time. When test running an engine indoors (e.g., in a water tank) be sure to do so where adequate ventilation can be maintained.


S69J1020

Self-protection

Protect your eyes by wearing safety glasses or safety goggles during all operations involving drilling and grinding, or when using an air compressor.
Protect your hands and feet by wearing protective gloves and safety shoes when necessary.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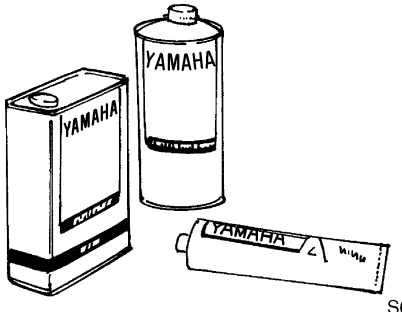
Parts, lubricants, and sealants

Use only genuine Yamaha parts, lubricants, and sealants or those recommended by Yamaha, when servicing or repairing the outboard motor.



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Under normal conditions, the lubricants mentioned in this manual should not harm or be hazardous to your skin. However, you should follow these precautions to minimize any risk when working with lubricants.

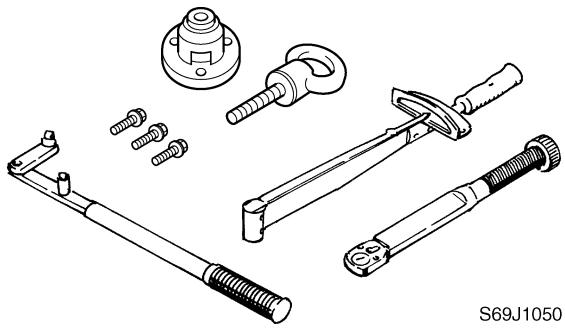
1. Maintain good standards of personal and industrial hygiene.
2. Change and wash clothing as soon as possible if soiled with lubricants.
3. Avoid contact with skin. Do not, for example, place a soiled rag in your pocket.
4. Wash hands and any other part of the body thoroughly with soap and hot water after contact with a lubricant or lubricant soiled clothing has been made.
5. To protect your skin, apply a protective cream to your hands before working on the outboard motor.

6. Keep a supply of clean, lint-free cloths for wiping up spills, etc.

Good working practices

Special service tools

Use the recommended special service tools to protect parts from damage. Use the right tool in the right manner—do not improvise.



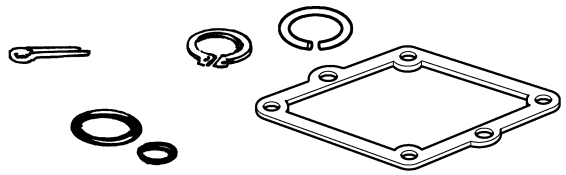
S69J1050

Tightening torques

Follow the tightening torque specifications provided throughout the manual. When tightening nuts, bolts, and screws, tighten the large sizes first, and tighten fasteners starting in the center and moving outward.

Non-reusable parts

Always use new gaskets, seals, O-rings, cotter pins, circlips, etc., when installing or assembling parts.



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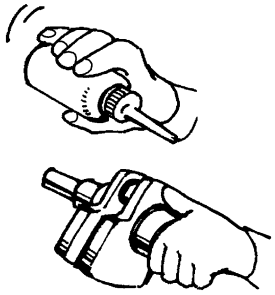
Disassembly and assembly

1. Use compressed air to remove dust and dirt during disassembly.

2. Apply engine oil to the contact surfaces of moving parts before assembly.



S69J1070

3. Install bearings with the manufacture identification mark in the direction indicated in the installation procedure. In addition, be sure to lubricate the bearings liberally.

4. Apply a thin coat of water-resistant grease to the lip and periphery of an oil seal before installation.

5. Check that moving parts operate normally after assembly.

Identification

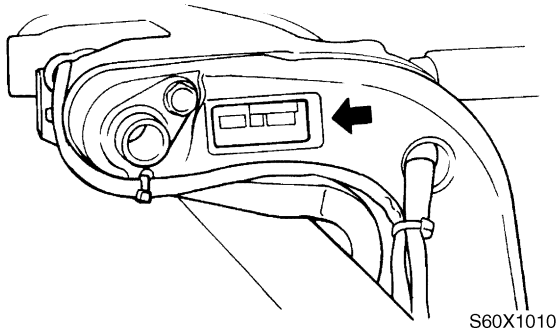
Applicable models

This manual covers the following models.

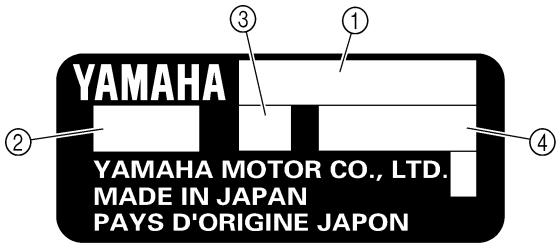
Applicable models
F150AET, FL150AET

Serial number

The outboard motor serial number is stamped on a label attached to the port clamp bracket.



S60X1010



S69J1090N

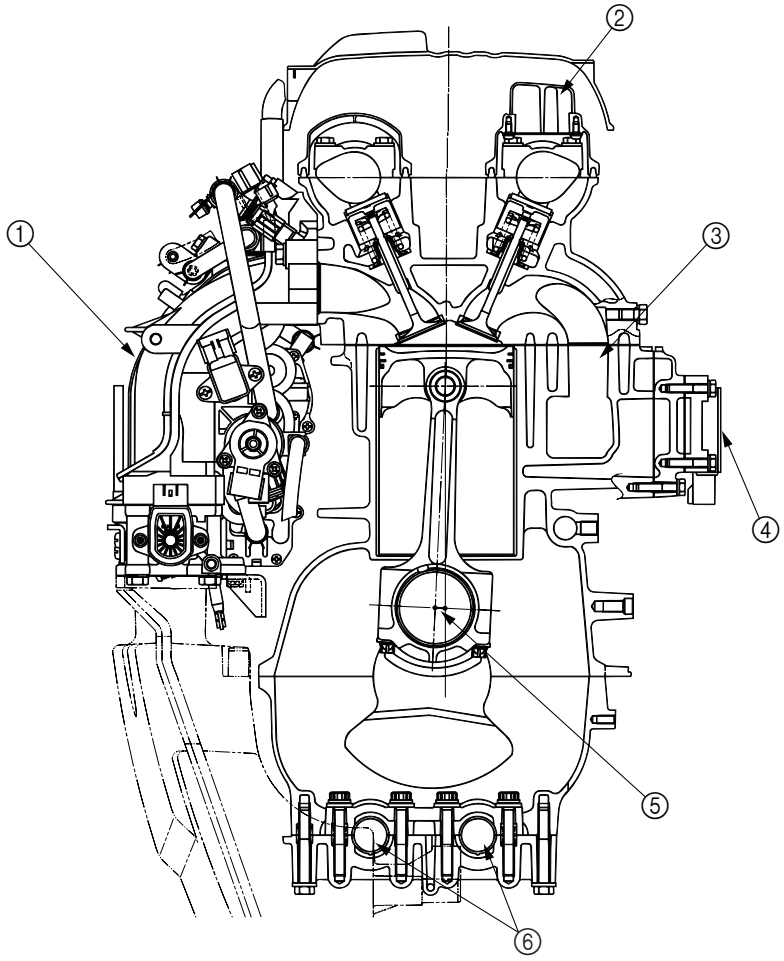
① Model name
② Approved model code
③ Transom height
④ Serial number

Model name	Approved model code	Starting serial No.
F150AET	63P	L: 1000017–
		X: 1000044–
FL150AET	64P	L: 1000013–
		X: 1000009–

Features and benefits

Crankshaft and cylinder

The center of the crankshaft is offset 10 mm (0.39 in) from the center of the cylinder to make more space to incorporate the throttle body assembly.
This design produces good engine balance and allows a compact design.
Exhaust gas from each cylinder flows directly into the exhaust manifold to obtain a compact design for the exhaust system.

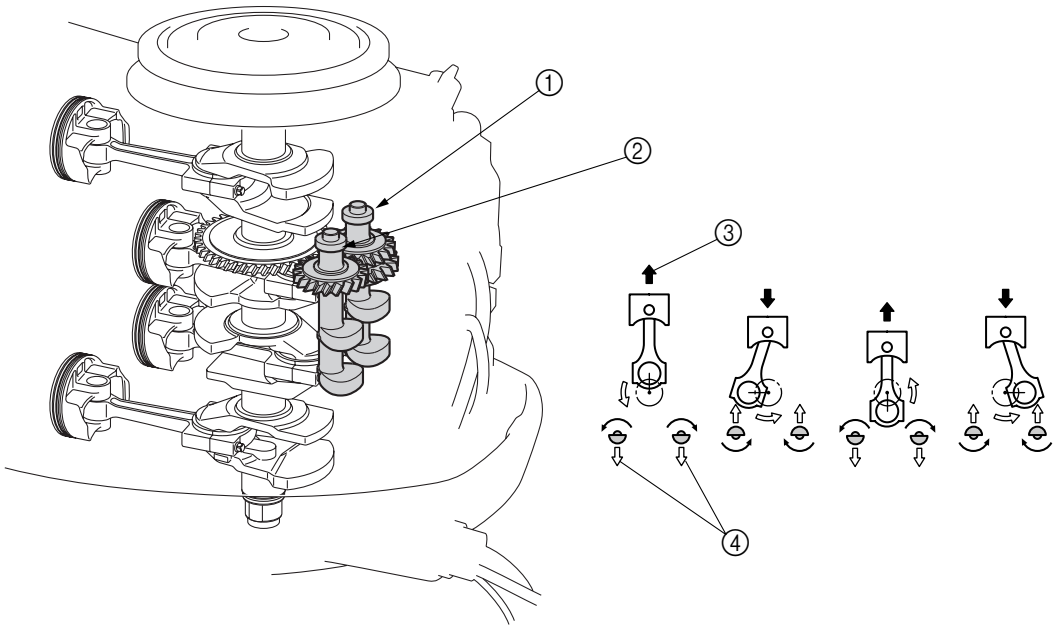


S63P1070

① Throttle body assembly
② Oil/gas separator
③ Direct exhaust system
④ Rectifier Regulator
⑤ Offset 10 mm (0.39 in)
⑥ Balancer shafts

Balancer

A two-piece balancer is used in the crankcase to reduce the secondary forces of inertia produced by reciprocating pistons.
The balancer shaft 1 is driven by the gear on the crankshaft.
The balancer shaft 2 is driven by the gear on the balancer shaft 1.
The two counterrotating balancer shafts rotate at twice the speed of the crankshaft and reduce the forces of inertia of the connecting rods and each balancer shaft.
Therefore, engine vibration is reduced.

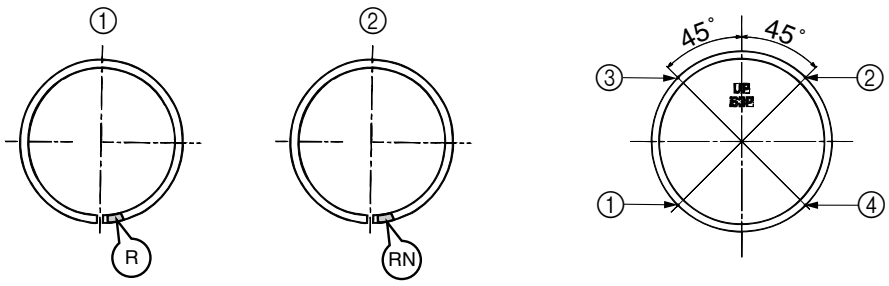


S63P1080

① Balancer shaft 1
② Balancer shaft 2
③ Piston secondary force of inertia
④ Balancer force of inertia

Piston and piston ring

A forged piston has been adopted for durability.
Hard chromium plating is applied to the piston rings.
The top and 2nd piston rings differ and are identified by a mark on each ring.
Install the piston rings on the piston with the identification marks facing up.

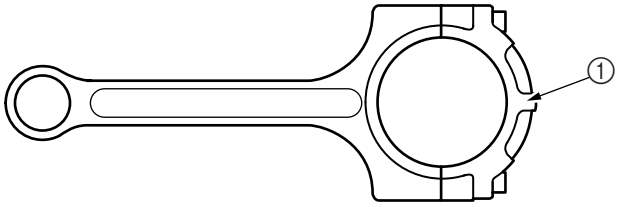


S63P1090

① Top ring
② 2nd ring
③ Upper oil ring rail
④ Lower oil ring rail

Connecting rod

A direction mark for installing the connecting rod to the crankshaft in the proper direction is on the connecting rod cap.
The direction mark should face the flywheel.
The connecting rod and connecting rod cap are manufactured as a single piece. Then, they are split using impact force. Only use the connecting rods and connecting rod caps in their original combinations, do not interchange them.

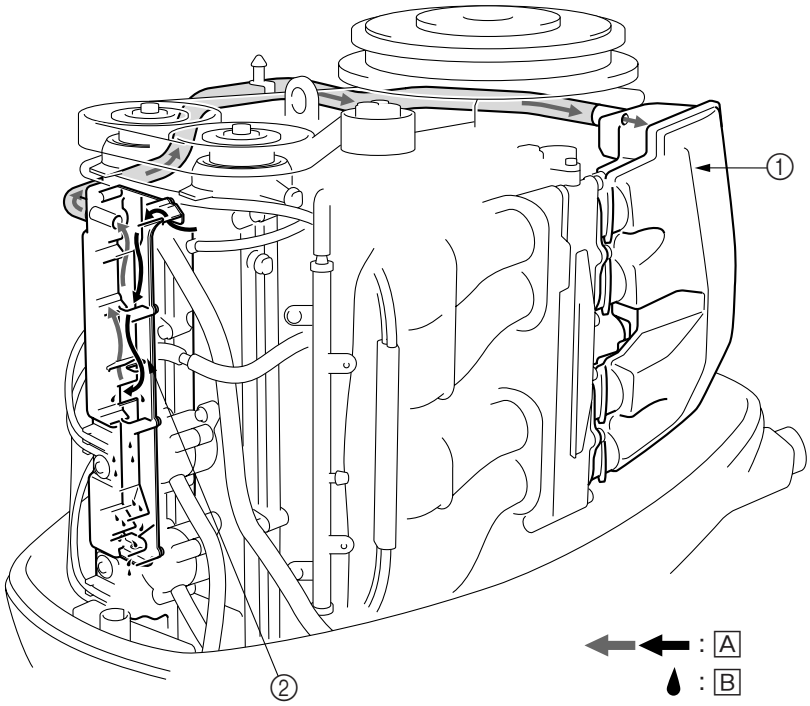


S63P1100

① Direction mark

Cylinder head cover

The oil/gas separator is used to obtain low emissions and is built into the cylinder head cover to obtain a compact design.
The gas and oil flow is shown below.



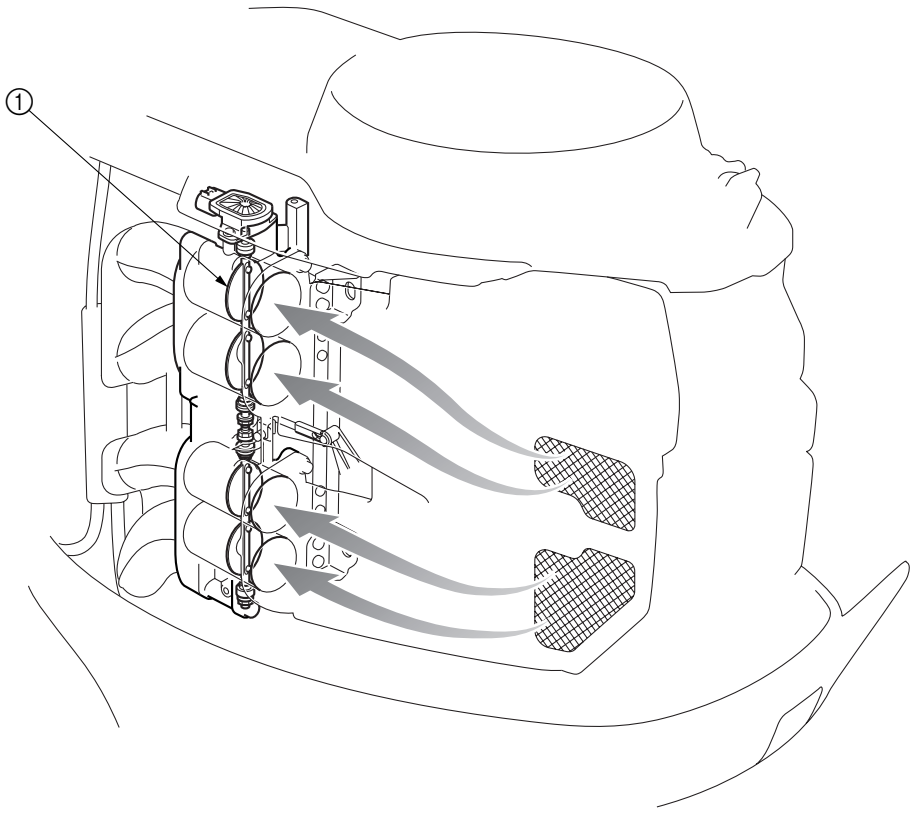
S63P1110

① Intake silencer
② Cylinder head cover (with gas/oil separator)

A Blowby gas
B Oil

Intake system

Multi-point, group fuel injection with four separate throttle valves is adopted for the intake system.
Intake air volume is calculated according to engine speed, Intake air pressure, and throttle position, and then the fuel injection volume is determined by the intake air volume to obtain a precise air and fuel ratio under all operating conditions.
The cylinders are grouped, #1/#4 and #2/#3. Fuel is injected twice during each full cycle of each cylinder, once during the exhaust stroke and once during the compression stroke. Fuel is injected during the compression stroke of the #1 cylinder and the exhaust stroke of the #4 cylinder and during the exhaust stroke of the #1 cylinder and the compression stroke of the #4 cylinder. The same occurs during the compression and exhaust strokes of the #2 and #3 cylinders.
This allows a simpler fuel injection control system.



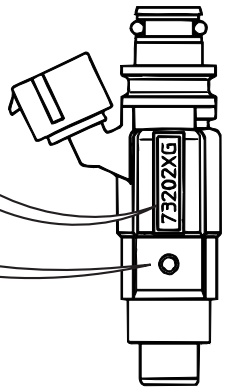
	Initial injection timing			
	BTDC10 ▼	▼	▼	▼
#1 cylinder	Compression	Combustion	Exhaust	Intake
#3 cylinder	Intake	Compression	Combustion	Exhaust
#4 cylinder	Exhaust	Intake	Compression	Combustion
#2 cylinder	Combustion	Exhaust	Intake	Compression

S63P1120

① Four separate throttle valve

The shape of the fuel injectors is the same for the F115, F150, F200 and F225.
Therefore, each fuel injector is identified by color because the specifications of each fuel injector are different.

A	B	C
F115	D	732
F150	E	731
F200 F225	F	741

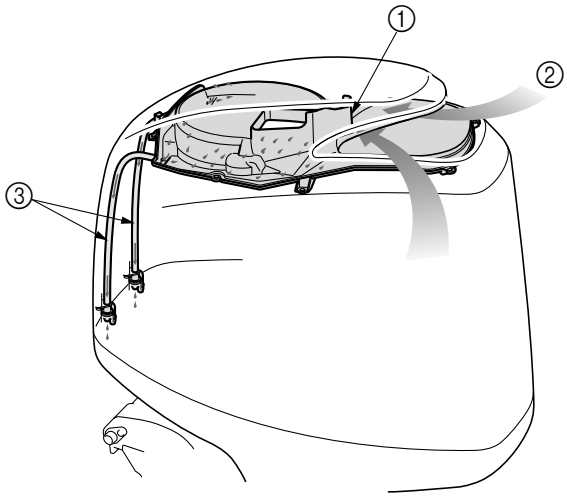


S63P1130

A Model
B Injector color
C First three digits
D Orange
E Yellow
F Ivory

Top cowling

Water is separated from the intake air and flows down through the drain hoses before draining out through the bottom cowling.
The structure of the top cowling helps to prevent water from accumulating in the top cowling and entering the power unit.



S63P1140

① Water separator
② Air (including water)
③ Drain hoses

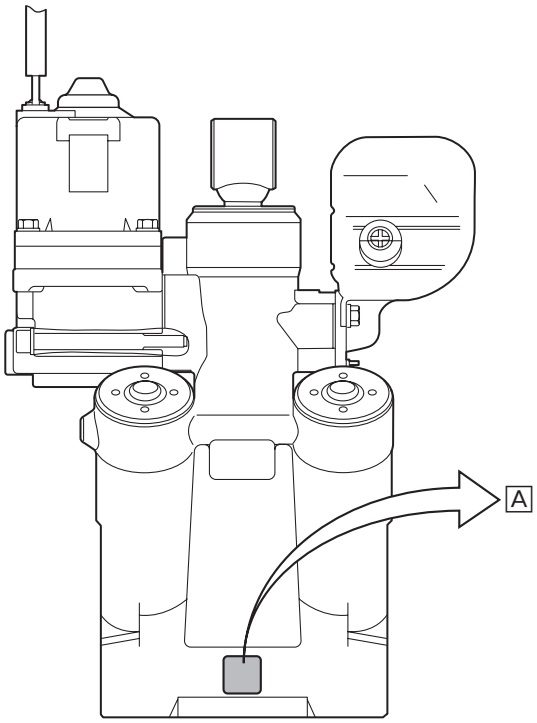
A Water

64E type power trim and tilt unit

The 64E type clamp bracket and power trim and tilt unit used for current V4 and V6 outboard motors have been adopted.

This allows easier interchanging of Yamaha outboards with the same classification because the mounting dimensions are the same.

For the power trim and tilt unit, only the impact absorber valve opening pressure of the tilt piston fluid circuit has been changed. The pressure is distinguished from those of other models by an identification mark stamped on the power trim and tilt unit.



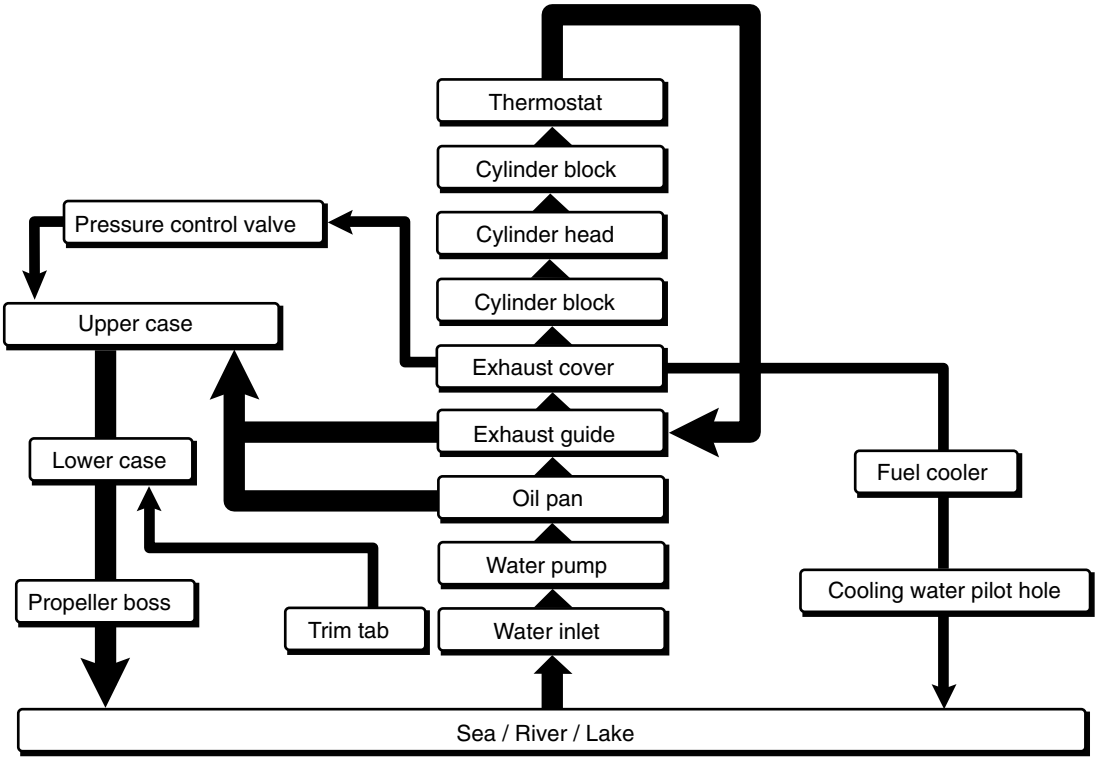
S63P1150

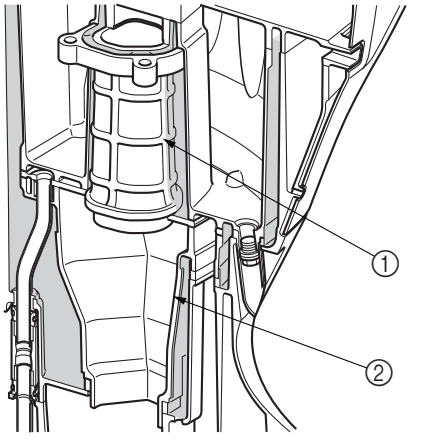
A

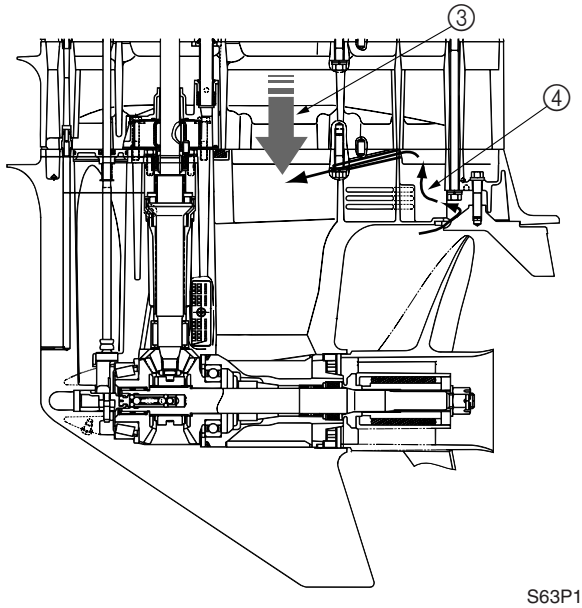
Identification mark	Applicable models
YA	Carbureted V4 and V6 (2.6)
YB	N/A
YC	Electronic fuel injected V6 (2.6), HPDI (2.6), VX200 (200H), VX225 (225G), and VX250 (250C)
YD	F115 (F115A), LF115 (FL115A), and (F100B)
YE	VZ225 (Z225H) and VZ250 (Z250F)
YF	F150 (F150A) and LF150 (FL150A)

Cooling system

The cooling water flow diagram is as follows.
To cool the propeller damper, the cooling system is designed so that fresh cooling water is taken in from the front of the trim tab and supplied to the exhaust passage of the lower case to cool the exhaust gas.
Cooling water also accumulates around the exhaust muffler to cool the upper case and reduce exhaust noise.







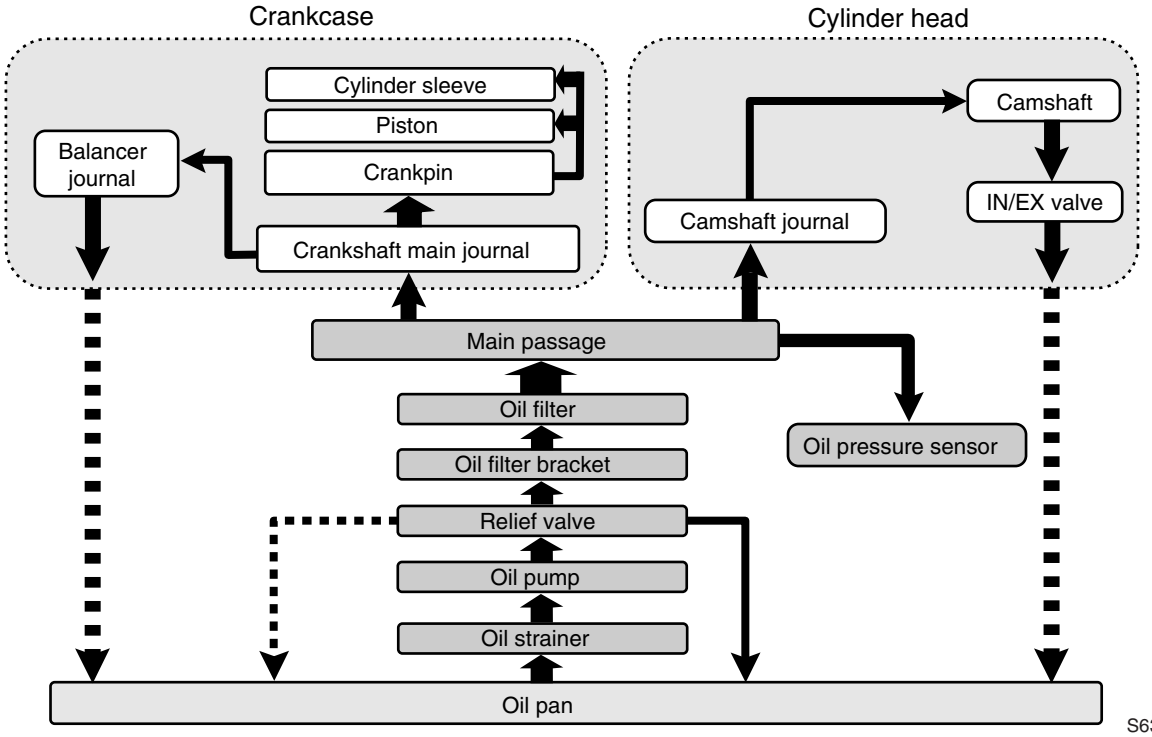
S63P1170

① Exhaust manifold
② Muffler
③ Exhaust gas
④ Water

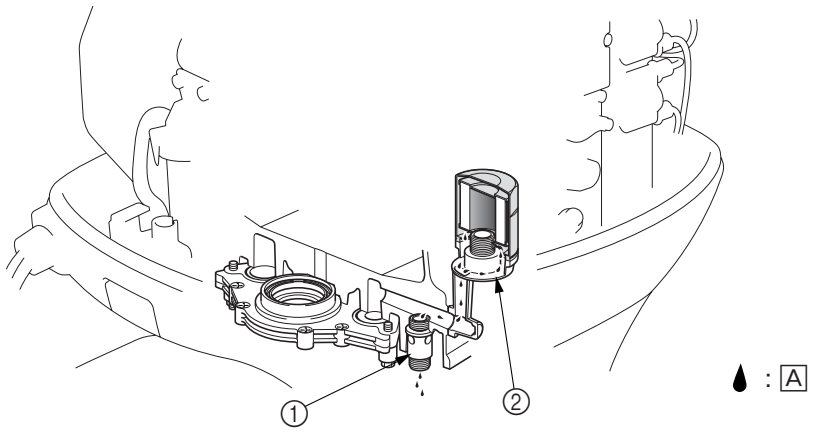
A Water

Lubrication system

The lubrication oil flow diagram is as follows.



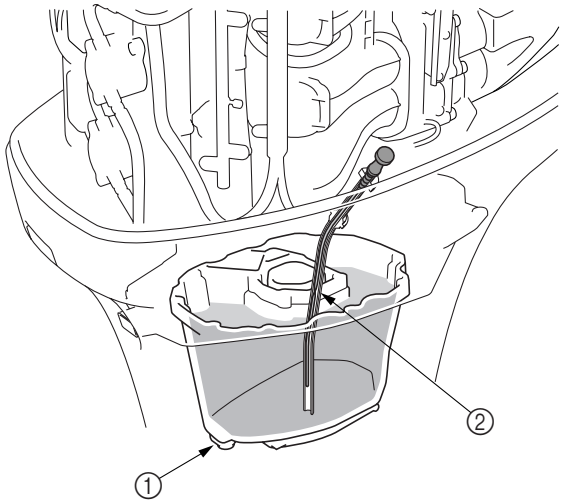
There is a small hole in the relief valve to allow oil to drain from the oil filter bracket so that it does not remain in the oil filter. This prevents oil from spilling out when replacing the oil filter.



① Relief valve
② Oil filter bracket

A Oil

A dual oil drain system is adopted.
An oil drain bolt is located on the bottom of the oil pan.
A long dipstick guide, which reaches the bottom of the oil pan, can also be used to pump out the oil completely with an oil-extracting tool.

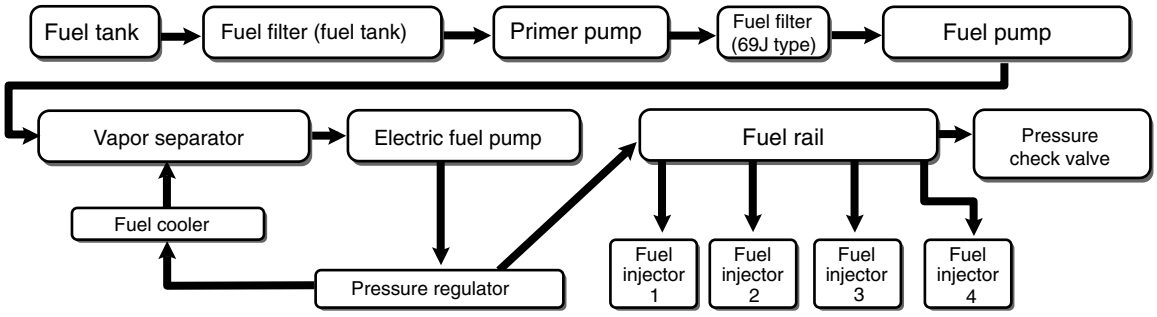


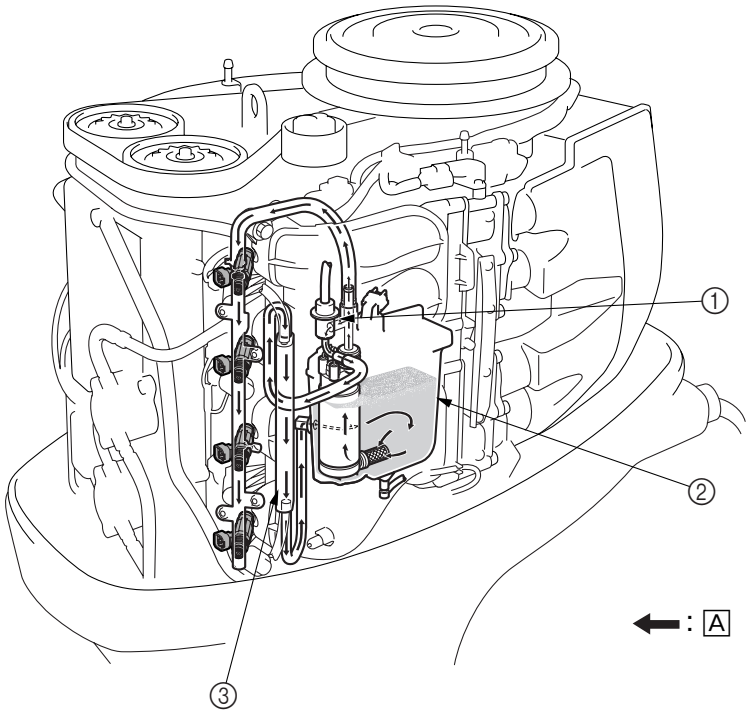
S63P1190

① Drain bolt
② Dipstick guide

Fuel system

A fuel pressure regulator is incorporated onto the outlet of the electric fuel pump to obtain a compact design and simple fuel delivery.
Fuel discharged from the pressure regulator returns to the vapor separator after being cooled in the fuel cooler.
The pressure check valve is incorporated onto the fuel rail for easier servicing of the fuel system.





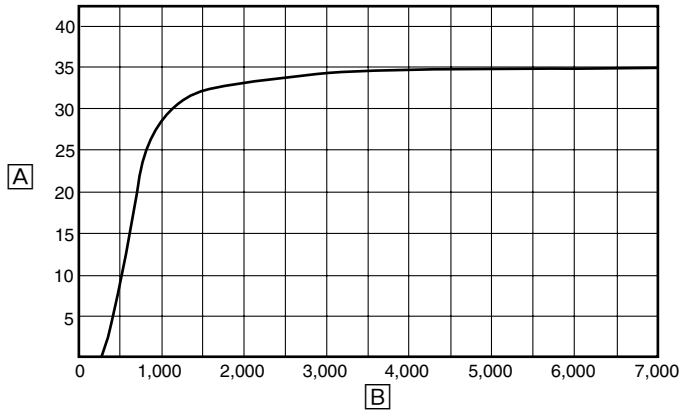
S63P1200

① Pressure regulator
② Vapor separator
③ Fuel cooler

A Fuel flow

Rectifier Regulator

A water-cooled Rectifier Regulator is incorporated onto the exhaust outer cover.
This allows for a compact engine design and produces a large electric current output for charging the battery under low engine speed.



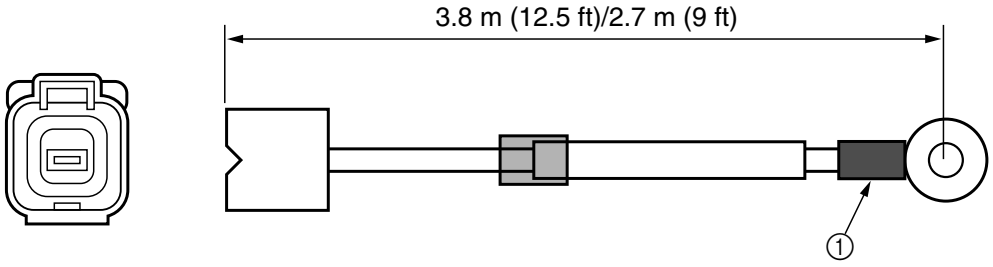
S63P1210

A Charging current (A)
B Engine speed (r/min)

Isolator

An isolator is incorporated into the Rectifier Regulator. If a second battery is used, connect an optional isolator lead.

Isolator lead P/N:	69J-81949-00 (3.8 m/12.5 ft)
	68F-81949-00 (2.7 m/9 ft)



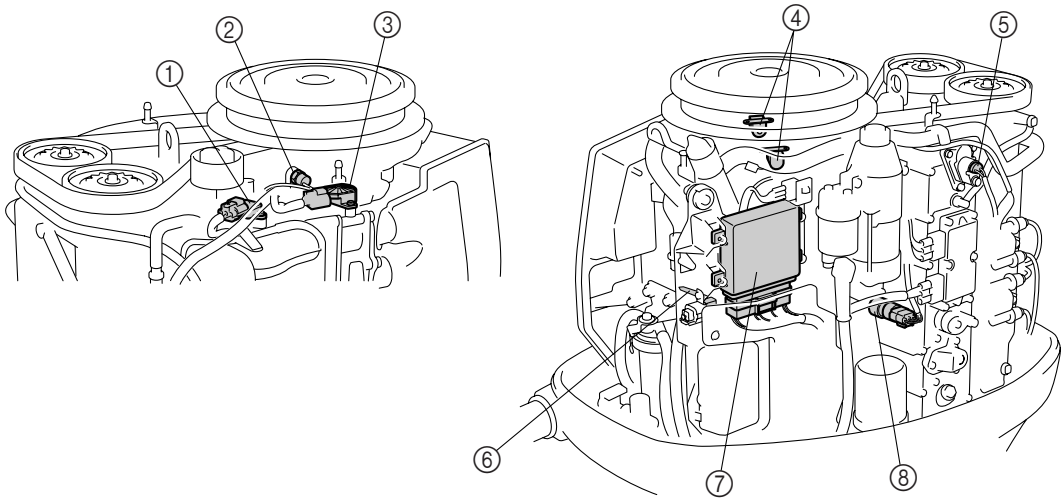
S63P1220

① Red tube

Technical tips

Electronic control system

The electronic control system consists of the sensors and the ECM (electronic control module). Under various conditions, the ECM provides the best suitable engine operation.



S63P1230

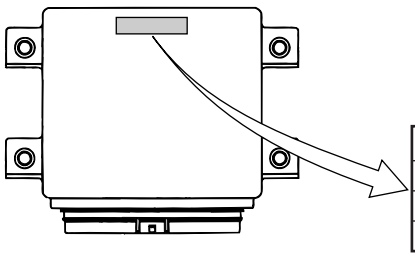
① Intake air pressure sensor
② Engine temperature sensor
③ Throttle position sensor
④ Pulser coil
⑤ Thermoswitch
⑥ Intake air temperature sensor
⑦ ECM
⑧ Oil pressure sensor

ECM

This engine is controlled by the ECM to obtain precise combustion under various operating conditions for high power output, low fuel consumption, and low emissions.

The ECM controls the ignition timing, the fuel injection timing, and the fuel injection volume and ensures that optimum ignition timing and an optimum air and fuel ratio can be achieved under all operating conditions such as starting the engine, normal operation, and quick acceleration.

The self-diagnostic function is incorporated into the ECM, and can quickly detect a malfunction when a personal computer is used with the optional software installed. (Refer to the “Yamaha Diagnostic System Instruction Manual”.)



A	B
63P-00	EUR
63P-10	USA, CAN, OCE
63P-20	JPN

S63P1240

A ECM identification
B Destination

Fail-safe control

If the electrical components malfunction, the ECM controls the ignition and fuel injection as shown in the table.

Malfunctioning item	Details	Ignition control	Fuel control
Pulser coil	No signal received during four consecutive crankshaft rotations	Fixed to BTDC 10°	Fixed to BTDC 10°
Throttle position sensor	Output voltage is 0.3 V or lower or 4.7 V or higher	Controlled according to the basic injection map	Controlled by Intake air pressure and engine speed
Intake air pressure sensor	Output voltage is 0.2 V or lower or 4.5 V or higher	Normal control	Fuel injection volume is controlled by the throttle position sensor
Engine temperature sensor	Output voltage is 0.18 V or lower or 4.93 V or higher	Normal control	Normal control
Intake air temperature sensor	Output voltage is 0.10 V or lower or 4.61 V or higher	Normal control	Normal control
Neutral switch	Switch is off when starting the outboard motor	Normal control	Normal control
Thermoswitch	The switch is on when the engine temperature is 40 °C (104 °F) or lower or the switch is off when the engine temperature is 130 °C (266 °F) or higher.	Normal control	Normal control
Shift cut switch	Output voltage is 4.50 V or higher, the switch is on when the outboard motor is started, or both the shift cut switch and neutral switch are on for 5 seconds	Normal control	Normal control
Oil pressure sensor	Output voltage is 0.3 V or lower or 4.8 V or higher	Normal control	Normal control

During fail-safe control, the engine idle speed increases to 900 r/min except if the neutral switch is off when the outboard motor is started.

Warning control

This outboard motor is equipped with warning control functions to avoid serious engine damage. The engine speed is limited to approximately 2,000 r/min if the engine overheats, if the oil pressure is low, or if a dual engine system (DES) is operated.
When a switch turns on, the engine speed is controlled as shown in the table.

Thermo-switch	Engine temperature sensor	Oil pressure sensor	DES signal	Engine speed	
				Less than 2,000 r/min	2,000 r/min or more
On	130 °C (266 °F) or higher (0.63 V or lower)	Below specified oil pressure due to engine speed	On	Fuel injection begins again in the cylinder order #3, #4, and #1	Fuel injection is shut off in the cylinder order #1, #4, and #3.
Overheat warning indicator lights and buzzer sounds		Oil pressure warning indicator lights and buzzer sounds	Buzzer sounds	**NOTE:** • The warning indicators light for 3 seconds after the engine start switch is turned on. • The buzzer sounds if the lanyard is removed from the engine stop lanyard switch while starting the outboard motor.	

Fuel injection is shut off in the cylinder order #1, #4, and #3 at 2.5-second intervals when the engine is running at 2,000 r/min or more.
Fuel injection to the #2 cylinder is not shut off.
When the throttle-opening angle is 30 degrees or less, fuel injection to the #3 cylinder will begin again.
When the engine speed decreases to less than 2,000 r/min, fuel injection will begin again in the cylinder order #3, #4, and #1 at 0.2-second intervals.
The warning control mode deactivates when the engine speed is less than 1,600 r/min or the throttle-opening angle is less than 7 degrees.

Shift cut control

This outboard motor is equipped with a shift cut control system for easier shifting.
This device misfires and retards the ignition of some cylinders to fluctuate the engine speed instantly when the engine is running from 400 to 2,000 r/min. This allows smooth engagement and/or disengagement of the dog clutch.
When shifting, the ignition is shut off as shown in the table.

Engine speed (r/min) / Shift cut switch	less than 400	400 to 729	730 to 2,000	2,001 or more
Off	N/A	N/A	N/A	N/A
On	N/A	Retards ignition timing	Misfires the #1 and #4 cylinders, and then retards ignition timing	N/A

N/A: No misfire control

Over-revolution control

This outboard motor is equipped with an over-revolution control system to protect the engine.
If the engine speed exceeds 6,200 r/min, the fuel injection is shut off as shown in the table below.

Engine speed (r/min)	Injected cylinder	Note
6,199 or less	#1, #2, #3, and #4	Normal operation
6,200 to 6,300	#2 and #3	Over-revolution control mode
6,301 to 6,550	#2	
6,551 or more	None	

Fuel pump control

The electric fuel pump operates for 3 seconds after the engine start switch is turned on and continues to operate while the engine is running.
The electric fuel pump stops 1 second after the engine is stopped.

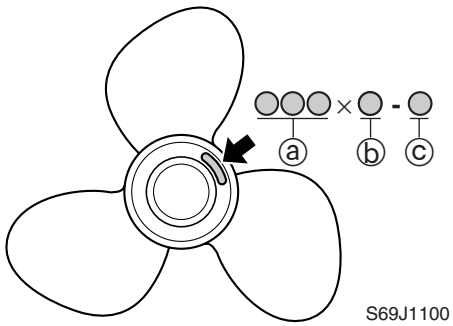
NOTE:
After the engine start switch is turned on, all of the fuel injectors are driven to prevent them from sticking before the electric fuel pump is driven.

Propeller selection

The performance of a boat and outboard motor will be critically affected by the size and type of propeller you choose. Propellers greatly affect boat speed, acceleration, engine life, fuel economy, and even boating and steering capabilities. An incorrect choice could adversely affect performance and could also seriously damage the engine.
Use the following information as a guide for selecting a propeller that meets the operating conditions of the boat and the outboard motor.

Propeller size

The size of the propeller is indicated on the propeller boss end.



ⓐ Propeller diameter (in inches)
ⓑ Propeller pitch (in inches)
ⓒ Propeller type (propeller mark)

Selection

When the engine speed is at the full throttle operating range (5,000–6,000 r/min), the ideal propeller for the boat is one that provides maximum performance in relation to boat speed and fuel consumption.

Regular rotation model

Propeller size (in)	Material
13 1/2 × 23 - M	Aluminum
13 3/4 × 21 - M	
14 × 19 - M	
14 1/2 × 17 - M	
15 1/4 × 15 - M	
13 3/8 × 23 - M	Stainless
13 3/8 × 25 - M	
13 3/4 × 17 - M2	
13 3/4 × 19 - M2	
13 3/4 × 21 - M	
14 1/2 × 15 - M	
14 1/2 × 21 - M	
14 1/2 × 23 - M	
14 1/2 × 25 - M	
14 1/2 × 27 - M	
14 7/8 × 21 - M	
15 × 19 - M	
15 1/4 × 15 - M	
15 1/4 × 17 - M	
15 3/4 × 13 - M	

Counter rotation model

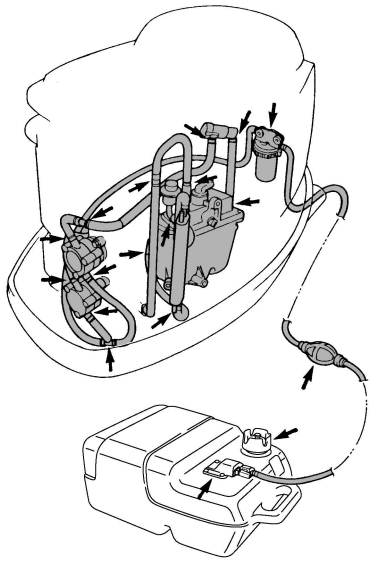
Propeller size (in)	Material
14 × 19 - ML	Aluminum
14 1/2 × 17 - ML	
13 3/8 × 23 - ML	Stainless
13 3/4 × 17 - ML1	
13 3/4 × 19 - ML1	
13 3/4 × 21 - ML	
14 1/2 × 23 - ML	
14 7/8 × 21 - ML	
15 1/4 × 15 - ML	
15 1/4 × 17 - ML	
15 1/4 × 19 - ML	

Predelivery checks

To make the delivery process smooth and efficient, the predelivery checks should be completed as explained below.

Checking the fuel system

1. Check that the fuel hoses are securely connected and that the fuel tank is full with fuel.



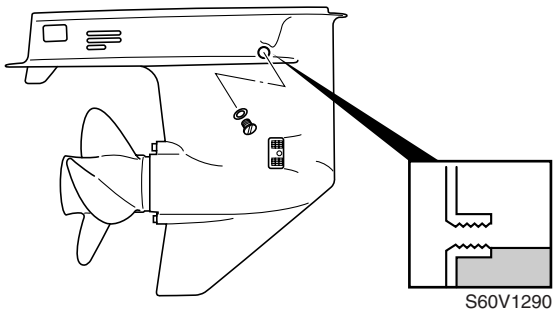
S63P1030

CAUTION:

This is a 4-stroke engine. Never use premixed fuel.

Checking the gear oil level

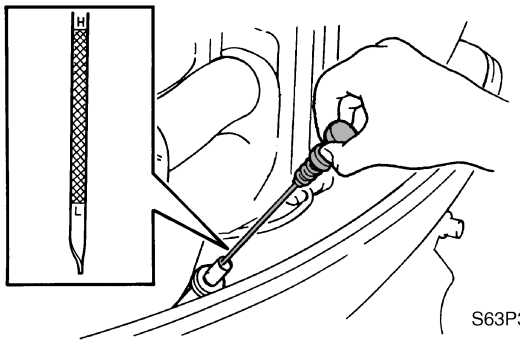
1. Check the gear oil level.



S60V1290

Checking the engine oil level

1. Check the engine oil level.



S63P3050

NOTE:

- If the engine oil is above the maximum level mark (H), extract sufficient oil with an oil changer or drain it until the level is between (H) and (L).
- If the engine oil is below the minimum level mark (L), add sufficient oil until the level is between (H) and (L).

Recommended engine oil:
4-stroke motor oil
API: SE, SF, SG, SH, or SJ
SAE: 10W-30 or 10W-40
Oil capacity:
Without oil filter replacement:
5.2 L (5.5 US qt, 4.6 Imp qt)

Checking the battery

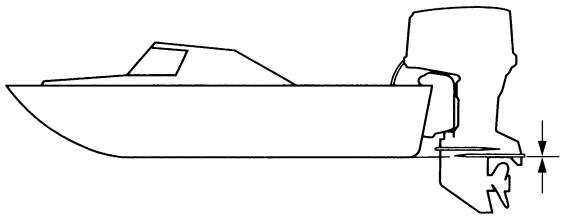
1. Check the capacity, electrolyte level, and specified gravity of the battery.

Recommended battery capacity:
CCA/EN: 711 A
20HR/IEC: 100 Ah
Electrolyte specified gravity:
1.280 at 20 °C (68 °F)

2. Check that the positive and negative battery leads are securely connected.

Checking the outboard motor mounting height

1. Check that the anti-cavitation plate is aligned with the bottom of the boat. If the mounting height is too high, cavitation will occur and propulsion will be reduced. Also, the engine speed will increase abnormally and cause the engine to overheat. If the mounting height is too low, water resistance will increase and reduce engine efficiency.



S69J1160

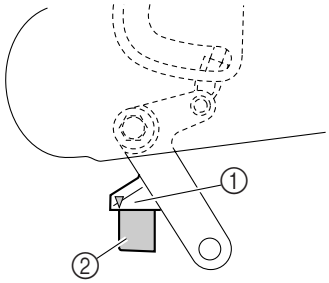
NOTE:
The optimum mounting height is affected by the combination of the boat and the outboard motor. To determine the optimum mounting height, test run the outboard motor at different heights.

2. Check that the clamp brackets are secured with the clamp bolts.

Checking the remote control cables

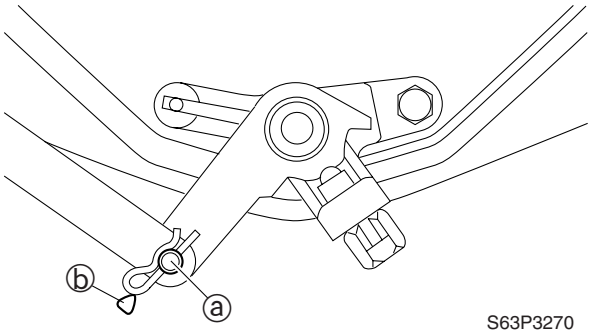
1. Set the remote control lever to the neutral position and fully close the throttle lever.

2. Check that the stopper ① on the throttle lever 2 contacts the fully closed stopper ② on the cylinder block.

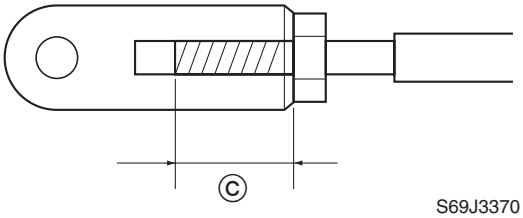


S63P1040

3. Check that the center of the set pin ⓐ is aligned with the alignment mark ⓑ on the bottom cowling.



S63P3270



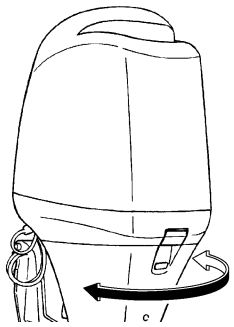
S69J3370

CAUTION:
The shift/throttle cable joint must be screwed in a minimum of 8.0 mm (0.31 in) ⓒ.

Checking the steering system

1. Check the steering friction for proper adjustment.

2. Check that the steering operates smoothly.



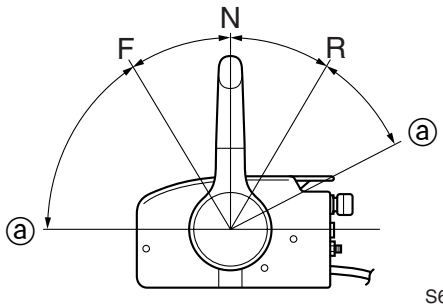
S63P1060

3. Check that there is no interference with wires or hoses when the outboard motor is steered.

Checking the gear shift and throttle operation

1. Check that the gear shift operates smoothly when the remote control lever is shifted from neutral to forward or reverse.

2. Check that the throttle operates smoothly when the remote control lever is shifted from forward or reverse to the fully open position ⓐ.



S69J1210

Checking the power trim and tilt system

1. Check that the outboard motor tilts up and down smoothly when operating the power trim and tilt unit.

2. Check that there is no abnormal noise produced when the outboard motor is tilted up or down.

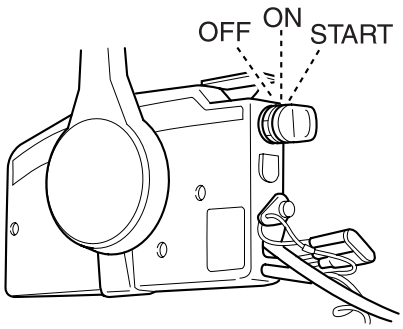
3. Check that there is no interference with wires or hoses when the tilted-up outboard motor is steered.

4. Check that the trim meter points down when the outboard motor is tilted all the way down.

Checking the engine start switch and engine stop lanyard switch

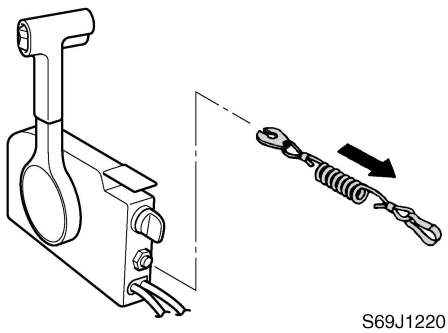
1. Check that the engine starts when the engine start switch is turned to START.

2. Check that the engine turns off when the engine start switch is turned to OFF.



S60V1070

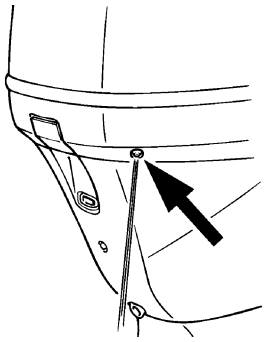
3. Check that the engine turns off when the engine stop lanyard is pulled from the engine stop lanyard switch.



S69J1220

Checking the cooling water pilot hole

1. Check that cooling water is discharged from the cooling water pilot hole.



S63P3120

Test run

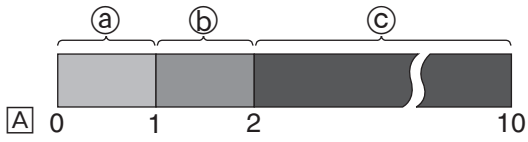
1. Start the engine, and then check that the gear shift operates smoothly.
2. Check the engine idle speed after the engine has been warmed up.
3. Operate at trolling speed.
4. Run the outboard motor for 1 hour at 2,000 r/min or at half throttle, then for another hour at 3,000 r/min or at 3/4 throttle.
5. Check that the outboard motor does not tilt up when shifting into reverse and that water does not flow in over the transom.

NOTE:
The test run is part of the break-in operation.

Break-in

During the test run, perform the break-in operation in the following three stages.

1. One hour ⓐ at 2,000 r/min or at approximately half throttle
2. One hour ⓑ at 3,000 r/min or 3/4 throttle and 1 minute out of every 10 at full throttle
3. Eight hours ⓒ at any speed, however, avoid running at full speed for more than 5 minutes



S69J1240

A Hour

After test run

1. Check for water in the gear oil.
2. Check for fuel leakage in the cowling.
3. Flush the cooling water passage with fresh water using the flushing kit and with the engine running at idle.

Specifications

General specifications

Item	Unit	Model	
		F150AET	FL150AET
Dimension			
Overall length	mm (in)	822 (32.4)	
Overall width	mm (in)	511 (20.1)	
Overall height			
(L)	mm (in)	1,714 (67.5)	
(X)	mm (in)	1,842 (72.5)	
Boat transom height			
(L)	mm (in)	508 (20.0)	
(X)	mm (in)	635 (25.0)	
Weight			
(with aluminium propeller)			
(L)	kg (lb)	214.0 (472)	
(X)	kg (lb)	218.0 (481)	
(with stainless propeller)			
(L)	kg (lb)	216.0 (476)	
(X)	kg (lb)	220.0 (485)	
Performance			
Maximum output	kW (hp)	110.3 (150) at 5,500 r/min	
Full throttle operating range	r/min	5,000–6,000	
Maximum fuel consumption	L (US gal, lmp gal)/hr	55.8 (14.7, 12.3) at 6,000 r/min	
Engine idle speed	r/min	700 ± 50	
Power unit			
Type		4-stroke L	
Cylinder quantity		4	
Total displacement	cm^3 (cu. in)	2,670 (162.9)	
Bore × stroke	mm (in)	94.0 × 96.2 (3.70 × 3.79)	
Compression ratio		9.0	
Control system		Remote control	
Starting system		Electric	
Fuel system		Fuel injection	
Ignition system		TCI	
Maximum generator output	V, A	12, 35	
Spark plug		LFR5A-11 (NGK)	
Cooling system		Water	
Exhaust system		Propeller boss	
Lubrication system		Wet sump	

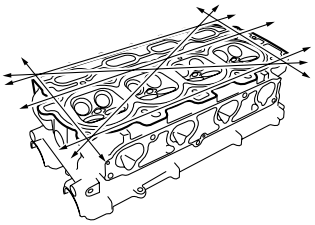
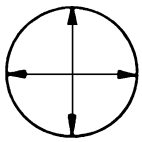
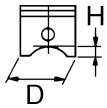
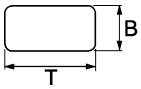
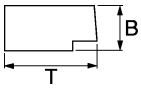
Item	Unit	Model	
		F150AET	FL150AET
Fuel and oil			
Fuel type		Regular unleaded gasoline	
Fuel minimum rating	RON(*1)	91	
	PON	86	
Engine oil		4-stroke motor oil	
Engine oil grade	API	SE, SF, SG, SH, or SJ	
	SAE	10W-30 or 10W-40	
Engine oil quantity			
(without oil filter replacement)	L (US qt, Imp qt)	5.2 (5.5, 4.6)	
(with oil filter replacement)	L (US qt, Imp qt)	5.4 (5.7, 4.8)	
Gear oil type		Hypoid gear oil	
Gear oil grade	SAE	90	
Gear oil quantity	cm^3 (US oz, Imp oz)	980 (33.1, 34.6)	870 (29.4, 30.7)
Bracket unit			
Trim angle (at 12° boat transom)	Degree	–4.0 to 16.0	
Tilt-up angle	Degree	70.0	
Steering angle	Degree	35.0 + 35.0	
Drive unit			
Gear shift positions		F-N-R	
Gear ratio		2.00 (28/14)	
Reduction gear type		Spiral bevel gear	
Clutch type		Dog clutch	
Propeller shaft type		Spline	
Propeller direction (rear view)		Clockwise	Counterclockwise
Propeller mark		M	ML
Electrical			
Battery minimum capacity(*2)			
CCA/EN	A	711	
20HR/IEC	Ah	100	

(*1) RON: Research Octane Number
PON: Pump Octane Number =
(RON + Motor Octane Number)/2

(*2) CCA: Cold Cranking Ampere
EN: European Norm (European standard)
IEC: International Electrotechnical Commission

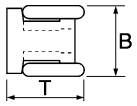
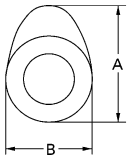
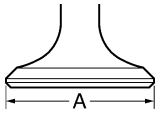
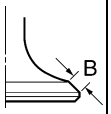
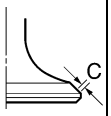
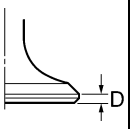
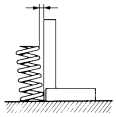
Maintenance specification

Power unit

Item	Unit	Model	
		F150AET	FL150AET
Power unit			
Minimum compression pressure(*1)	kPa (kgf/cm², psi)	880 (8.8, 128)	
Lubrication oil pressure(*2)	kPa (kgf/cm², psi)	450 (4.5, 65.3) at engine idle speed	
Cylinder head			
Warpage limit	mm (in)	0.10 (0.0039)	
 (lines indicate straightedge position)			
Camshaft cap inside diameter	mm (in)	25.000–25.021 (0.9843–0.9851)	
Cylinders			
Bore size 	mm (in)	94.000–94.017 (3.7008–3.7014)	
Taper limit	mm (in)	0.08 (0.0032)	
Out-of-round limit	mm (in)	0.05 (0.0020)	
Pistons			
Piston diameter (D) 	mm (in)	93.928–93.934 (3.6979–3.6982)	
Measuring point (H)	mm (in)	5.0 (0.20)	
Piston-to-cylinder clearance	mm (in)	0.075–0.080 (0.0030–0.0031)	
Piston pin boss bore	mm (in)	21.004–21.015 (0.8269–0.8274)	
Piston rings			
Top ring			
Dimension B 	mm (in)	1.17–1.19 (0.0461–0.0469)	
Dimension T	mm (in)	2.80–3.00 (0.1102–0.1181)	
End gap	mm (in)	0.15–0.30 (0.0059–0.0118)	
Side clearance	mm (in)	0.04–0.08 (0.0016–0.0031)	
2nd piston ring			
Dimension B 	mm (in)	1.17–1.19 (0.0461–0.0469)	
Dimension T	mm (in)	3.70–3.90 (0.1457–0.1535)	
End gap	mm (in)	0.30–0.45 (0.0118–0.0177)	
Side clearance	mm (in)	0.03–0.07 (0.0012–0.0028)	

(*1) Measure conditions:
Ambient temperature 20 °C (68 °F), wide open throttle, with spark plugs removed from all cylinders.
The figures are for reference only.

(*2) The figures are for reference only.

Item	Unit	Model	
		F150AET	FL150AET
Oil ring			
Dimension B 	mm (in)	2.40–2.47 (0.0945–0.0972)	
Dimension T	mm (in)	2.30–2.70 (0.0906–0.1063)	
End gap	mm (in)	0.15–0.60 (0.0059–0.0236)	
Side clearance	mm (in)	0.04–0.13 (0.0016–0.0051)	
Camshafts			
Intake (A) 	mm (in)	45.300–45.400 (1.7835–1.7874)	
Exhaust (A)	mm (in)	44.350–44.450 (1.7461–1.7500)	
Intake and exhaust (B)	mm (in)	35.950–36.050 (1.4154–1.4193)	
Camshaft journal diameter	mm (in)	24.960–24.980 (0.9827–0.9835)	
Camshaft journal oil clearance	mm (in)	0.020–0.060 (0.0008–0.0024)	
Camshaft runout limit	mm (in)	0.03 (0.0012)	
Valves			
Valve clearance (cold)			
Intake	mm (in)	0.20 ± 0.03 (0.008 ± 0.001)	
Exhaust	mm (in)	0.34 ± 0.03 (0.013 ± 0.001)	
Head diameter (A)			
Intake 	mm (in)	34.85–35.15 (1.37–1.38)	
Exhaust	mm (in)	29.85–30.15 (1.18–1.19)	
Face width (B)			
Intake 	mm (in)	2.11 (0.0831)	
Exhaust	mm (in)	2.43 (0.0957)	
Seat contact width (C)			
Intake 	mm (in)	1.10–1.40 (0.0433–0.0551)	
Exhaust	mm (in)	1.40–1.70 (0.0551–0.0669)	
Margin thickness (D)			
Intake 	mm (in)	0.70 (0.0276)	
Exhaust	mm (in)	1.00 (0.0394)	
Stem diameter			
Intake	mm (in)	5.477–5.492 (0.2156–0.2162)	
Exhaust	mm (in)	5.464–5.479 (0.2151–0.2157)	
Guide inside diameter			
Intake and exhaust	mm (in)	5.504–5.522 (0.2167–0.2174)	
Stem-to-guide clearance			
Intake and exhaust	mm (in)	0.025–0.058 (0.0010–0.0023)	
Stem runout limit	mm (in)	0.01 (0.0004)	
Valve springs			
Free length 	mm (in)	44.20 (1.7402)	
Minimum free length	mm (in)	42.60 (1.6771)	
Tilt limit	mm (in)	1.5 (0.06)	

Item	Unit	Model	
		F150AET	FL150AET
Valve lifters			
Valve lifter outside diameter	mm (in)	32.982–32.997 (1.2985–1.2990)	
Valve lifter-to-cylinder head clearance	mm (in)	0.020–0.055 (0.0008–0.0022)	
Valve shims			
Valve shim thickness (in 0.020 mm increments)	mm (in)	2.3–2.9 (0.09–0.12)	
Connecting rods			
Big-end inside diameter	mm (in)	53.025–53.045 (2.0876–2.0884)	
Crankpin oil clearance	mm (in)	0.027–0.052 (0.0011–0.0020)	
Big-end bearing thickness			
Green	mm (in)	1.496–1.502 (0.0589–0.0591)	
Blue	mm (in)	1.505–1.511 (0.0593–0.0595)	
Red	mm (in)	1.514–1.520 (0.0596–0.0598)	
Crankshaft			
Crankshaft journal diameter	mm (in)	51.980–52.000 (2.0465–2.0472)	
Crankpin diameter	mm (in)	49.980–50.000 (1.9677–1.9685)	
Crankpin width	mm (in)	22.00–22.10 (0.8661–0.8701)	
Runout limit	mm (in)	0.03 (0.0012)	
Crankcase			
Crankshaft main journal oil clearance	mm (in)	0.021–0.050 (0.0008–0.0020)	
Upper crankcase main journal bearing thickness			
Green	mm (in)	2.506–2.509 (0.0987–0.0988)	
Red	mm (in)	2.512–2.515 (0.0989–0.0990)	
Yellow	mm (in)	2.518–2.521 (0.0991–0.0993)	
Lower crankcase main journal bearing thickness			
Green	mm (in)	2.506–2.509 (0.0987–0.0988)	
Red	mm (in)	2.512–2.515 (0.0989–0.0990)	
Yellow	mm (in)	2.518–2.521 (0.0991–0.0993)	
Blue + green	mm (in)	2.524–2.527 (0.0994–0.0995)	
Main journal bearing #3 thickness (lower)			
Green	mm (in)	2.504–2.509 (0.0986–0.0988)	
Red	mm (in)	2.510–2.515 (0.0988–0.0990)	
Yellow	mm (in)	2.516–2.521 (0.0991–0.0993)	

Item	Unit	Model	
		F150AET	FL150AET
Oil pump			
Discharge at 97–103 °C (207–217 °F) with 10W-30 engine oil	L (US gal, lmp gal)/min	8.0 (2.113, 1.760) at 700 r/min	
Pressure	kPa (kgf/cm^2, psi)	132.0–162.0 (1.32–1.62, 19.1–23.5)	
Relief valve opening pressure	kPa (kgf/cm^2, psi)	392–490 (3.92–4.90, 56.84–71.05)	
Thermostats			
Opening temperature	°C (°F)	58–62 (136–144)	
Fully open temperature	°C (°F)	70 (158)	
Valve open lower limit	mm (in)	4.3 (0.17)	

Lower unit

Item	Unit	Model	
		F150AET	FL150AET
Gear backlash			
Pinion-to-forward gear	mm (in)	0.14–0.46 (0.0055–0.0181)	0.14–0.42 (0.0055–0.0165)
Pinion-to-reverse gear	mm (in)	0.32–0.67 (0.0126–0.0264)	0.23–0.58 (0.0090–0.0228)
Pinion shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Forward gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Reverse gear shims	mm	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50	
Propeller shaft shims	mm	—	0.10, 0.12, 0.15, 0.18, 0.30, 0.40, 0.50
Propeller shaft			
End play	mm (in)	—	0.25–0.35 (0.0098–0.0138)

Electrical

Item	Unit	Model	
		F150AET	FL150AET
Ignition and ignition control system			
Ignition timing (cylinder #1)	Degree	TDC at engine idle speed	
Spark plug gap	mm (in)	1.0–1.1 (0.039–0.043)	
Ignition coil resistance			
Primary coil (R – B/W)			
at 20 °C (68 °F)	Ω	1.53–2.07	
Secondary coil			
at 20 °C (68 °F)	kΩ	12.50–16.91	
ECM output peak voltage (B/O, B/W – B)			
at cranking (loaded)	V	260	
at 1,500 r/min (loaded)	V	260	
at 3,500 r/min (loaded)	V	270	
Pulser coil output peak voltage (W/R, W/B – B)			
at cranking (unloaded)	V	3.5	
at cranking (loaded)	V	3.6	
at 1,500 r/min (loaded)	V	23.9	
at 3,500 r/min (loaded)	V	49.7	
Pulser coil resistance(*1) (W/R, W/B – B)	Ω	459–561	
Pulser coil air gap	mm (in)	0.3–0.7 (0.0118–0.0276)	
Throttle position sensor			
Input voltage (O – B)	V	5	
Output voltage (P – B)	V	0.70 ± 0.02 at engine idle speed	
Intake air temperature sensor resistance			
at 20 °C (68 °F)	kΩ	2.20–2.70	
Engine temperature sensor resistance (B/Y – B/Y)			
at 20 °C (68 °F)	kΩ	54.2–69.0	
at 100 °C (212 °F)	kΩ	3.12–3.48	
Fuel control system			
Fuel injector resistance(*1)			
at 20 °C (68 °F)	Ω	14.0–15.0	

(*1) The figures are for reference only.

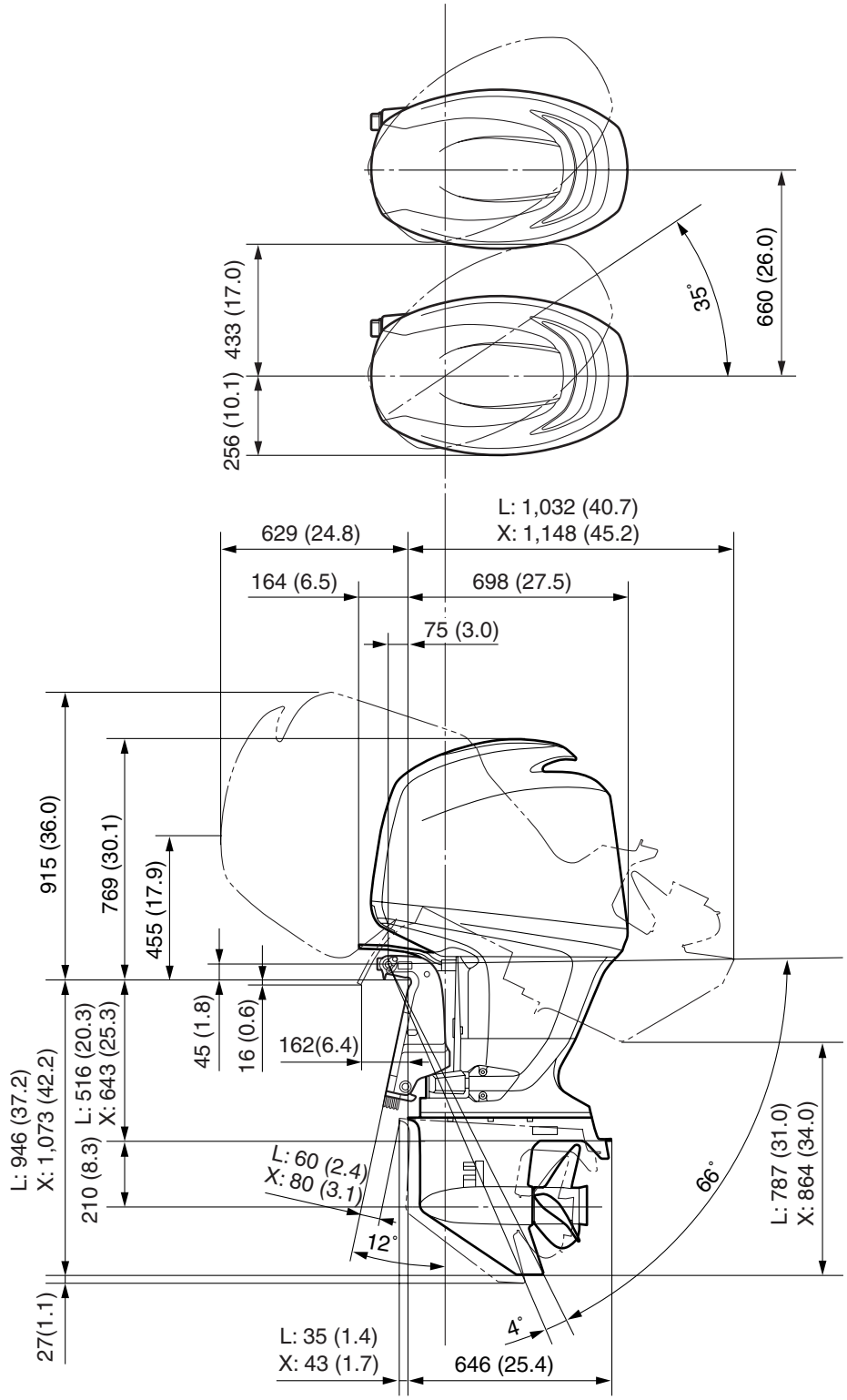
Item	Unit	Model	
		F150AET	FL150AET
Starter motor			
Type		Sliding gear	
Output	kW	1.40	
Cranking time limit	Second	30	
Brushes			
Standard length	mm (in)	15.5 (0.61)	
Wear limit	mm (in)	9.5 (0.37)	
Commutator			
Standard diameter	mm (in)	29.0 (1.14)	
Wear limit	mm (in)	28.0 (1.10)	
Mica			
Standard undercut	mm (in)	0.5–0.8 (0.02–0.03)	
Wear limit	mm (in)	0.2 (0.01)	
Charging system			
Fuse	A	20, 30, 50	
Stator coil output peak voltage (G – G)			
at cranking (unloaded)	V	12	
at 1,500 r/min (unloaded)	V	50	
at 3,500 r/min (unloaded)	V	110	
Stator coil resistance(*1)			
at 20 °C (68 °F) (G – G)	Ω	0.20–0.30	
Rectifier Regulator output peak voltage (R – B)			
at 1,500 r/min (unloaded)	V	13.0	
at 3,500 r/min (unloaded)	V	13.0	
Power trim and tilt system			
Trim sensor			
Setting resistance (P – B)	Ω	9–11	
Resistance (P – B)	Ω	9–378.8	
Fluid type		ATF Dexron II	
Brushes			
Standard length	mm (in)	9.8 (0.39)	
Wear limit	mm (in)	4.8 (0.19)	
Commutator			
Standard limit	mm (in)	22.0 (0.87)	
Wear limit	mm (in)	21.0 (0.83)	
Mica			
Standard undercut	mm (in)	1.3 (0.05)	
Wear limit	mm (in)	0.8 (0.03)	

(*1) The figures are for reference only.

Dimensions

Exterior

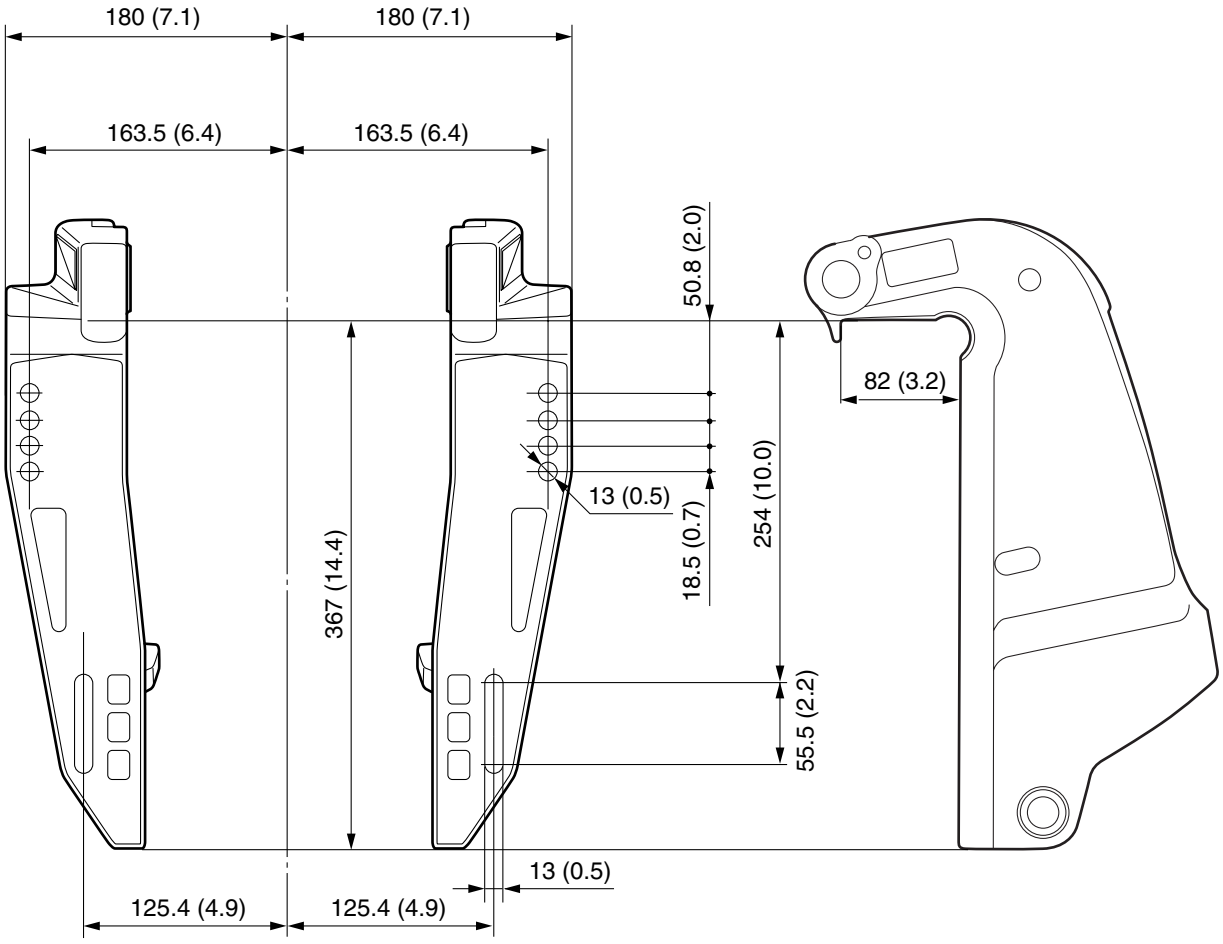
mm (in)



S63P2010

Clamp bracket

mm (in)



S63P2020

Tightening torques

Specified torques

Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Fuel system					
Fuel filter holder bolt		M6	8	0.8	5.9
Fuel filter bracket bolt		M6	8	0.8	5.9
Fuel pump mounting bolt		M6	10	1.0	7.4
Fuel pump screw		ø6	4	0.4	3.0
Fuel cooler bolt		M6	5	0.5	3.7
Vapor separator mounting bolt		M6	5	0.5	3.7
Fuel rail mounting bolt		M8	13	1.3	9.6
Throttle body mounting bolt		M8	13	1.3	9.6
Power unit					
Power unit mounting bolt		M8	20	2.0	14.8
		M10	42	4.2	31.0
Apron bolt		M6	8	0.8	5.9
Apron screw		ø6	4	0.4	3.0
Flywheel magnet nut		(M24)	270	27.0	199.1
Starter motor bolt		M8	29	2.9	21.4
Starter motor terminal nut		(M8)	9	0.9	6.6
Starter relay lead bolt		M6	4	0.4	3.0
Ignition coil bolt		M6	7	0.7	5.2
Oil filter		—	18	1.8	13.3
PTT relay nut		(M6)	4	0.4	3.0
PTT motor lead bolt		M6	4	0.4	3.0
Positive battery cable nut		(M8)	9	0.9	6.6
Timing belt tensioner bolt		—	39	3.9	28.8
Drive sprocket bolt		M5	7	0.7	5.2
Driven sprocket bolt		M10	60	6.0	44.3
Camshaft cap bolt	1st	M7	8	0.8	5.9
	2nd		17	1.7	12.5
Cylinder head cover plate screw		ø4	2	0.2	1.5
Cylinder head cover bolt	1st	M6	8	0.8	5.9
	2nd		8	0.8	5.9
Cylinder head bolt	1st	M8	14	1.4	10.3
	2nd		28	2.8	20.7
	1st	M10	19	1.9	14.0
	2nd		37	3.7	27.3
	3rd		90°		
Spark plug		—	25	2.5	18.4
Engine temperature sensor		—	15	1.5	11.1
Cylinder block plug		M14	23	2.3	17.0
Engine hanger bolt		M6	12	1.2	8.9
Oil pressure sensor		—	18	1.8	13.3

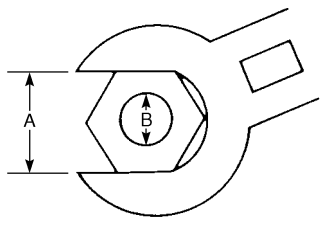
Part to be tightened		Thread size	Tightening torques		
			N·m	kgf·m	ft·lb
Exhaust cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Thermostat cover bolt	1st	M6	6	0.6	4.4
	2nd		12	1.2	8.9
Exhaust cover plug		M14	23	2.3	17.0
		M18	55	5.5	40.6
Oil filter union bolt		—	34	3.4	25.1
Balancer bolt	1st	M6	7	0.7	5.2
	2nd		13	1.3	9.6
	1st	M8	18	1.8	13.3
	2nd		31	3.1	22.9
Oil pump screw		—	4	0.4	3.0
Crankcase bolt	1st	M8	14	1.4	10.3
	2nd		26	2.6	19.2
	1st	M10	30	3.0	22.1
	2nd		90°		
Main bearing cap bolt	1st	M10	30	3.0	22.1
	2nd		90°		
Connecting rod cap	1st	—	23	2.3	17.0
	2nd		43	4.3	31.7
	3rd		90°		
Lower unit (regular rotation model)					
Gear oil drain screw		—	9	0.9	6.6
Gear oil check screw		—	9	0.9	6.6
Lower case mounting bolt		M10	47	4.7	34.7
Trim tab bolt		M10	42	4.2	31.0
Propeller nut		(M18)	52	5.2	38.4
Ring nut		—	142	14.2	104.7
Cooling water inlet cover screw		—	4	0.4	3.0
Pinion nut		(M16)	93	9.3	68.6
Lower unit (counter rotation model)					
Gear oil drain screw		—	9	0.9	6.6
Gear oil check screw		—	9	0.9	6.6
Lower case mounting bolt		M10	47	4.7	34.7
Trim tab bolt		M10	42	4.2	31.0
Propeller nut		(M18)	52	5.2	38.4
Ring nut		—	142	14.2	104.7
Cooling water inlet cover screw		—	4	0.4	3.0
Pinion nut		(M16)	93	9.3	68.6
Bracket unit					
Shift rod detent bolt		—	18	1.8	13.3
Flushing hose adapter screw		ø6	3	0.3	2.2
Upper mount bracket bolt		M10	54	5.4	39.8

Part to be tightened	Thread size	Tightening torques		
		N·m	kgf·m	ft·lb
Muffler assembly bolt	M8	20	2.0	14.8
	M10	42	4.2	31.0
Engine oil drain bolt	M14	27	2.7	20.0
Baffle plate screw	ø5	4	0.4	3.0
Muffler bolt	M8	20	2.0	14.8
Exhaust manifold bolt	M8	20	2.0	14.8
Oil pan bolt	M8	20	2.0	14.8
Oil strainer bolt	M6	10	1.0	7.4
Upper mounting nut	(M14)	74	7.4	54.6
Lower mounting nut	(M14)	74	7.4	54.6
Trim stopper nut	(M10)	48	4.8	35.4
Self-locking nut	—	15	1.5	11.1
Trim sensor cam screw	ø6	2	0.2	1.5
Grease nipple	—	3	0.3	2.2
Power trim and tilt unit				
Reservoir cap	—	0.7	0.07	0.5
Reservoir mounting bolt	M6	5	0.5	3.7
PTT motor mounting bolt	M6	5	0.5	3.7
Gear pump cover bolt	—	6	0.6	4.4
Gear pump housing mounting bolt	—	8	0.8	5.9
Manual valve	—	3	0.3	2.2
Trim cylinder end screw	—	78	7.8	57.5
Tilt cylinder end screw	—	130	13.0	96.0
Tilt piston nut	—	96	9.6	70.8

General torques

This chart specifies tightening torques for standard fasteners with a standard ISO thread pitch. Tightening torque specifications for special components or assemblies are provided in applicable sections of this manual. To avoid warpage, tighten multi-fastener assemblies in a crisscross fashion and progressive stages until the specified torque is reached. Unless otherwise specified, torque specifications require clean, dry threads. Components should be at room temperature.

Nut (A)	Bolt (B)	General torque specifications		
		N·m	kgf·m	ft·lb
8 mm	M5	5	0.5	3.6
10 mm	M6	8	0.8	5.8
12 mm	M8	18	1.8	13
14 mm	M10	36	3.6	25
17 mm	M12	43	4.3	31



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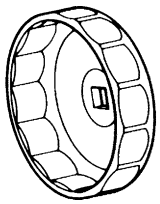
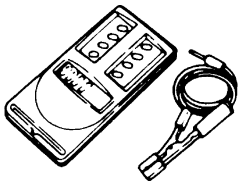
Periodic checks and adjustments

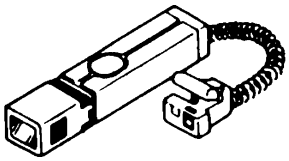
Special service tools



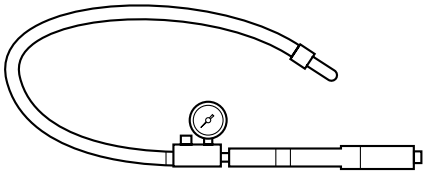
Oil filter wrench
90890-06830



Digital tachometer
90890-06760



Timing light
90890-03141



Leakage tester
90890-06840