



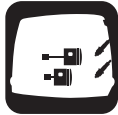





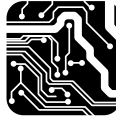











# Description of Pictogram
















The following symbols represent the contents of individual chapters.

Service Information 	Service Data 	Maintenance 	Fuel System (Fuel Injection) 
Power Unit 	Lower Unit 	Bracket 	Electrical System 
Troubleshooting 	Accessories 	Wiring Diagrams 	

The following symbols indicate items needed for the service.

Special Tool 	Lubrication Oil 	Engine RPM 	Tightening Torque 
Specified Electrical Value 	Specified Measurement Value 	Use Limit 	Test Run Adjustment 
Specified Part 			

The following symbols indicate a point to which lubrication oil, sealing agent or screw-locking agent is to be applied.

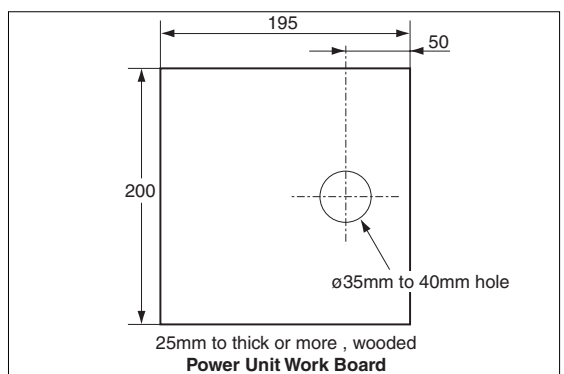
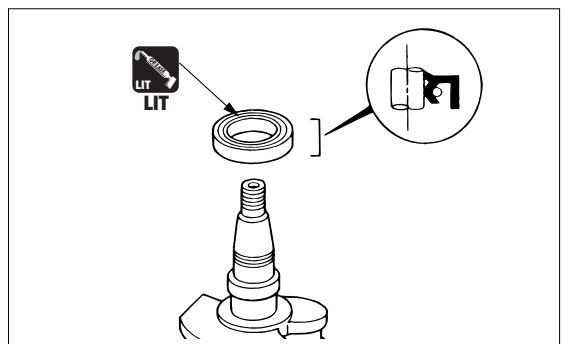
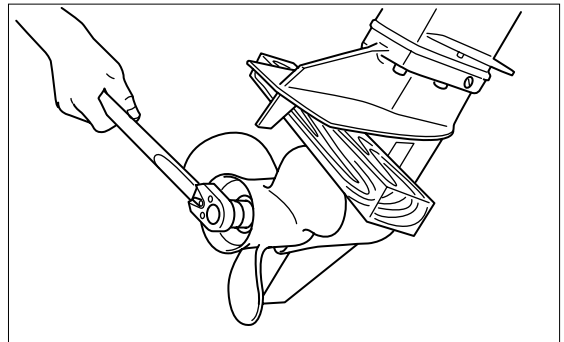
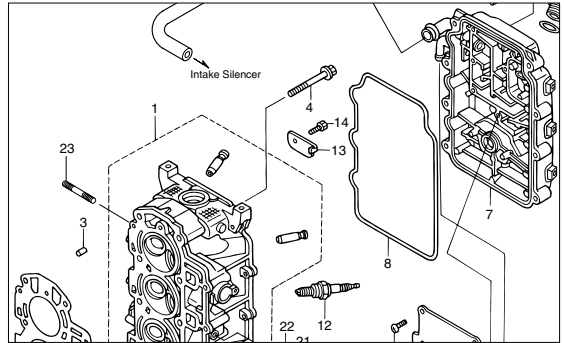
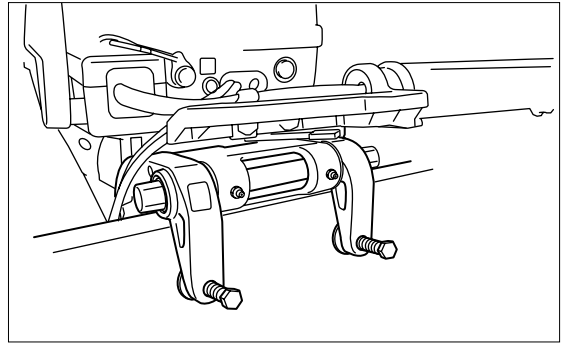
4 stroke engine oil 	2 stroke engine oil 	Gear oil 	ATF DEXRON III 
OBM Grease 	Teflon® Grease TEFLON 	Low Temperature Lithium Grease LITHIUM 	Insulating Grease INS 
Oil Compound [Shietsu Silicon] S.O.C 	[Konishi Bond] • G17 	Sealing Agent [Three Bond®] • 1141C 	Instant Adhesive [Three Bond®] • 1741 
Screw Locking Agent [Loctite®] • 271 	Screw Locking Agent [Three Bond®] • 1342 	Screw Locking Agent [Three Bond®] • 1373B 	



# Service Information

## 7) Cautions in disassembling and assembling components

- (1) Secure outboard motor to dedicated stand firmly.
- (2) Take special care not to scratch painted surface or mating surfaces of cylinder and crankcase.
- (3) Replace un reusable parts such as packings, gaskets, O rings, oil seals, spring pins or split pins with new ones after they were removed . Replace deformed snap rings with new ones.
- (4) When replacing parts, be sure to use genuine parts. For fluids such as gear oil, use genuine product.
- (5) Be sure to use special tools that are specified, and perform the works properly.
- (6) When reassembling parts, use their mating marks. For parts without mating marks, simple marking makes reassembling easier. Use applicable parts list for reference.
- (7) Clean individual parts that have been removed, and check their conditions.
- (8) When reassembling parts, take sufficient care also for details such as fits, repair limits, air tight, clogging of oil holes for lubrication and greasing, packings, wirings and piping. For components using many bolts and nuts for assembling, such as cylinder head and crankcase, tighten all the fasteners evenly to their specified torques clockwise in two or three stages, inner ones first and then outer ones. (Reverse the order when disassembling.)
- (9) When installing bearings, face the flat (numbered) side to the special assembling tool.
- (10) When installing oil seals, be careful not to scratch the surface of the lip that contacts with the shaft, and install them in correct orientation. Apply recommended grease to the lip before installation.
- (11) When applying liquid packing, take sufficient care for the thickness and quantity. Excessive application may be oozed out, adversely affecting interior of the crankcase. Use adhesive after thoroughly reading the instructions.
- (12) When servicing power unit, use of wooden work board makes the work easier.



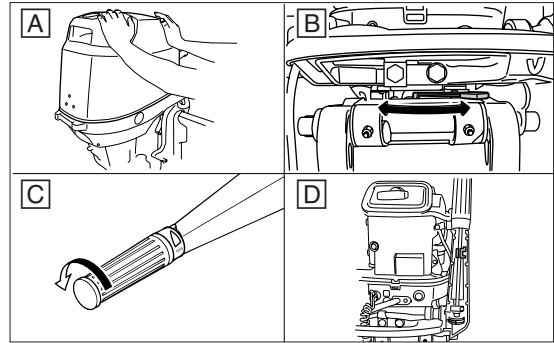


# Service Information

## 4. Pre-delivery Inspection

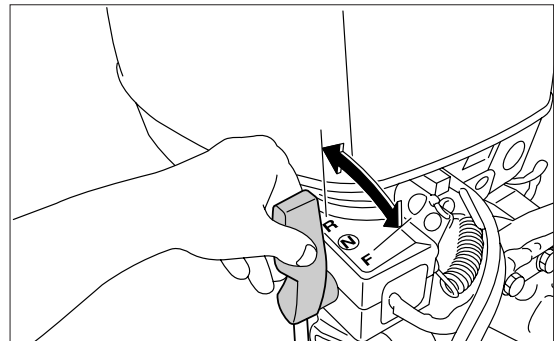
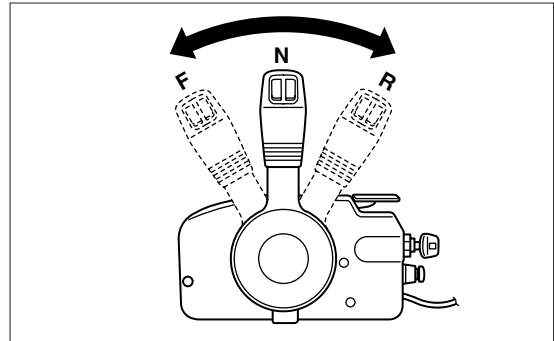
### 1) Steering Handle

- [A] Check installations for clattering and play.
- [B] Adjust steering friction.
- [C] Check throttle grip for movement. (full open/full close).
- [D] Adjust throttle friction.



### 2) Gear Shift

Check that gear shifts from neutral (N) to forward (F) and reverse (R) smoothly.



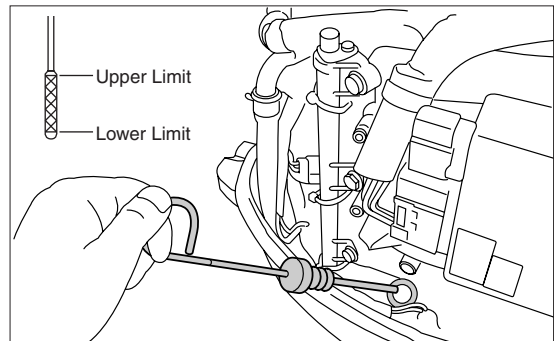
### 3) Engine Oil

Fill engine with engine oil.

	<b>4 Stroke Engine Oil :</b>
	1.6 L (1.7 US.qt)[without oil filter replacement] 1.8 L (1.9 US.qt)[oil filter replaced]

Use oil level gauge to check oil quantity.

	<b>CAUTION</b>
<b>Engine oil is removed before shipment to prevent leakage during transportation.</b>	

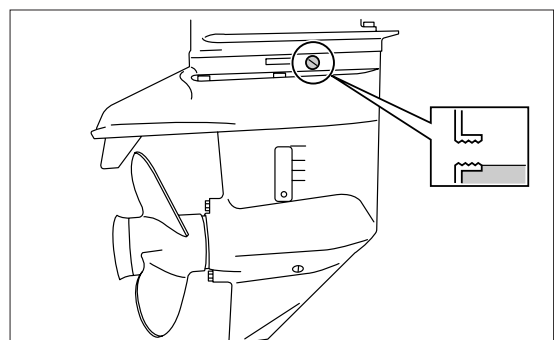


### 4) Gear Oil

Check quantity of gear oil.

	<b>Gear Oil :</b>
	350 cm <sup>3</sup> (11.8 fl.oz)

	Spill of some oil from plug hole as plug is removed indicates that gear case is filled with specified quantity of gear oil.
--	---





# Service Data

Item Name	Part Name													Remarks				
	Thread Lock		Instantaneous Adhesive				Sealing Agent	Bond	Insulation Grease		Teflon Grease	Low Temperature Resistant Lithium Grease	OBM Grease		4 Stroke Engine Oil	Gear Oil	"Shinetsu Silicon" Oil Compound	PTT Fluid
	Loctite	Three Bond	1373B	1141	1141C	Konishi Bond	INS	TEF	LIT	OBM	4ST	GEAR	SOC		ATF			
Exhaust Plug [D-Shaft Housing]																		
Seal Rubber [Engine Base & Apron]																		
Bolt [Pump Case (Upper)]																	Thread	
Pump Case (Upper)																	Impeller Sliding Area	
Water Pipe Seal (Lower)																	Connection	
Drive Shaft [Housing Side]																	Periphery	
Oil Seal [Engine Base]																	Lip	
[Pump Case (Lower) : Gear Case Side]																	Periphery	
Cam Rod Bushing (Pump Case [Lower])																	Sliding area	
Oil Seal (Pump Case [Lower])																	Lip	
Pump Case (Lower)																	O-Ring Groove	
Bolt [Pump Case (Lower)]																	Thread	
Drive Shaft																	Spline (Crankshaft Side)	
Needle Bearing [Pinion Gear (B Gear)]																		
Needle Bearing [Propeller Shaft]																		
Taper Roller Bearing [Forward Gear(A Gear)]																		
Push Rod																	Sliding area	
Oil Seal [Propeller Shaft Housing]																	Lip	
Housing : Propeller Side																	Periphery	
O-Ring [Propeller Shaft Housing]																		
Bolt [Propeller Shaft Housing]																	Thread	
Propeller Shaft																	Spline	
Gear Case																	Oil Capacity : 280cm <sup>3</sup> (9.5fl-oz)	
Bolt [Lower Unir]																	Thread	
Pinion Nut (B Gear Nut)																	Thread	
Shift Lever Shaft																	Bearing Sliding Area	
Throttle Link																	Sliding area	
Bushing (Handle)																	Inner and Outer Faces	
Bolt [Steering Bracket]																	Thread	

## 29) Flushing with Water

### ⚠ CAUTION

**Touching rotating propeller could lead to injury. Be sure to remove propeller before running engine on the land.**

### ⚠ WARNING

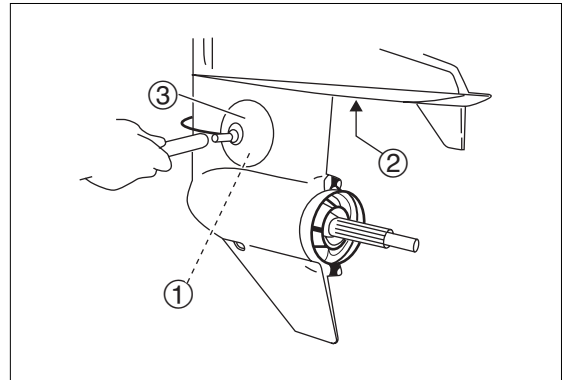
**Exhaust gas contains carbon monoxide, which will cause gas poisoning. Do not start engine with outboard motor placed in a closed area such as boat house.**

Flushing with water using drive cleaner ③

1. Remove propeller and thrust holder.
2. Close sub water strainer ② with tape.
3. Attach driver cleaner ③ to water strainer ① area.
4. Put water hose to driver cleaner ③ and run water.
5. Set gear shift to neutral (N) and start engine.
6. Check that cooling water check port discharges water, and run engine for 3 to 5 minutes at low speed.
7. Stop engine and stop water supply, remove driver cleaner ③, and remove tape, and then, install propeller.



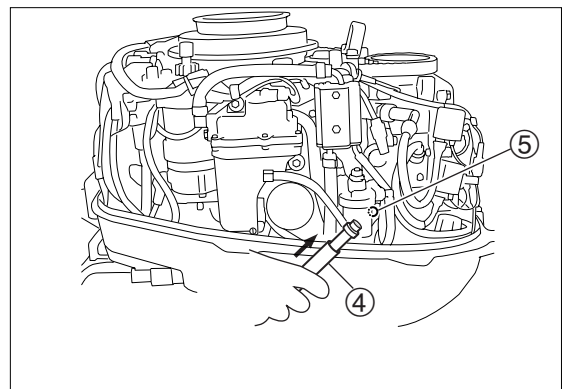
Remove tape after flushing with water.



3

Flushing with water using flushing attachment ④ (hose adapter)

1. Remove propeller and thrust holder.
2. Close water strainer ① and sub water strainer ② with tape.
3. Remove water plug ⑤ of outboard motor, and attach flushing attachment ④.
4. Put water hose on flushing attachment ④ and run water.
5. Set shift lever to neutral (N) and start engine.





# Fuel System (Fuel Injection)

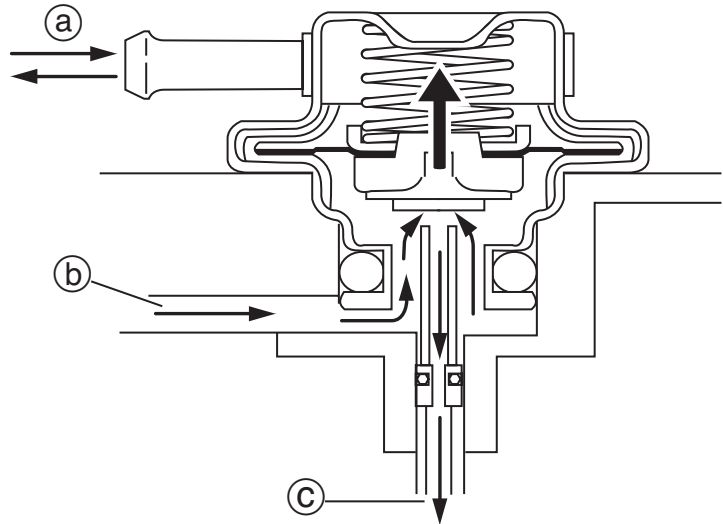
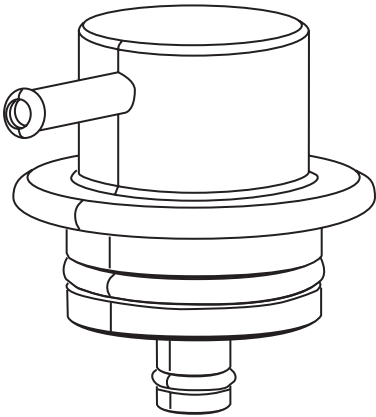
## 3) Fuel Regulator

Fuel regulator located on the upper section of vapor separator serves to keep regular fuel pressure.

Fuel regulator consists of diaphragm with built in spring that actuates valve/seat, and returns (pressurized) excessive fuel to vapor separator when the pressure exceeds certain value.

Excessive fuel is returned to vapor separator through internal pipe below fuel level to prevent it from bubbling.

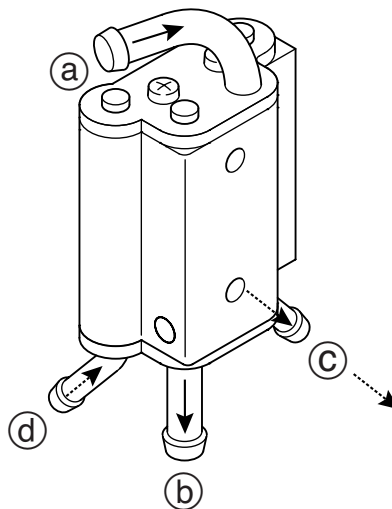
Spring side (a) of diaphragm is open to air so that change of atmospheric pressure is applied to diaphragm.



- (a) To Bottom Cowl (open to air)
- (b) High Pressure Fuel from Fuel Cooler
- (c) Excessive fuel returns to vapor separator.

## 4) Fuel Cooler

Fuel cooler (heat exchanger) is connected between vapor separator and high pressure fuel filter, and uses engine cooling water to cool high pressure fuel to fuel injector and excessive fuel to vapor separator. It serves to prevent fuel vapor lock and fuel feed pump (FFP) from wear by removing heat from circulating excessive (high pressure) fuel.



- (a) Fuel from Vapor Separator/FFP
- (b) Fuel to High Pressure Fuel Filter
- (c) Cooling Water from Cylinder Block
- (d) Cooling Water to Check Port



# Power Unit

## 4) Removing Power Unit

1. Disconnect upper and lower starter lock cables.
2. Remove recoil starter, belt cover and starter pulley.
3. Loosen flywheel nut.



Loosen flywheel nut before removing power unit to make the work easier.



**A** Flywheel Holder :

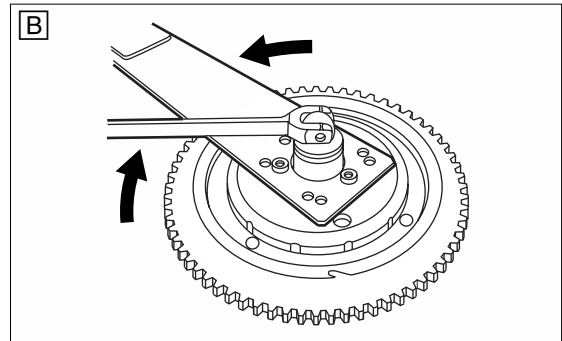
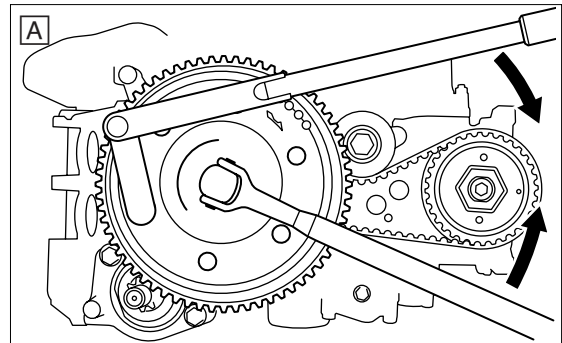
P/N. 3AC-99200-0

**B** Flywheel puller kit :

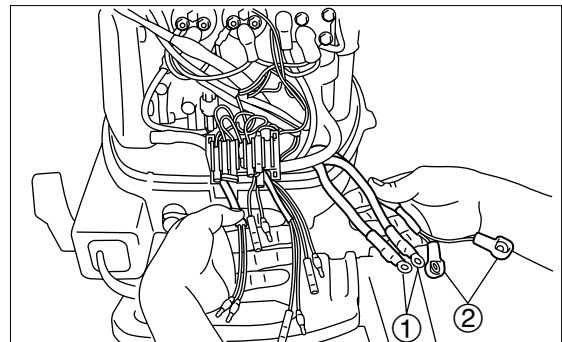
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### **CAUTION**

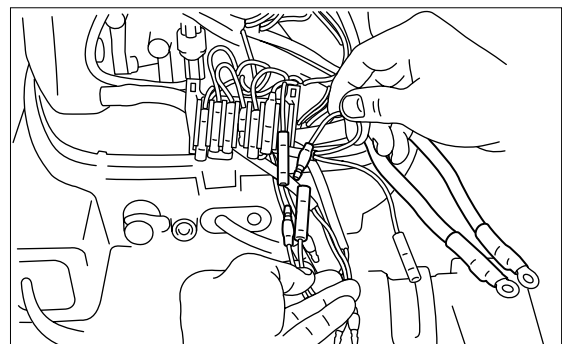
**Apply forces to tools toward directions as shown, and perform work taking care not to allow flywheel holder to remove.**



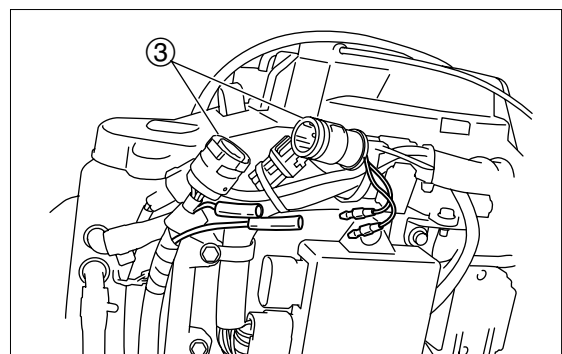
4. Disconnect battery cables ① (2) and PTT motor leads ② (2).  
(Electric start model and PTT model)



5. Disconnect warning lamp, starter switch and stop switch.  
(Tiller Handle Model)



6. Disconnect remote control harness coupler ③ and connectors.  
(Remote Control Model)





# Power Unit

## 17) Inspection of Oil Pump

1. Use micrometer, cylinder gauge, depth gauge and thickness gauge to measure dimensions shown below. Replace oil pump if over specified value.



### Functional Limit :

**Clearance between Outer Rotor and Body (a) :**

0.25 mm ( 0.0098 in )

**Clearance between outer and inner rotors (b) :**

0.16 mm ( 0.0063 in )

**Clearance between sides of rotor and body (c) :**

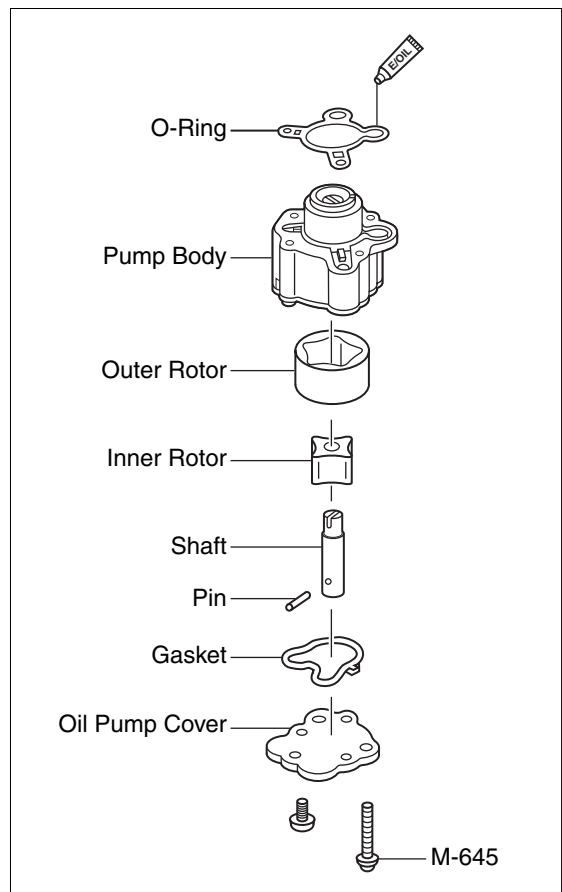
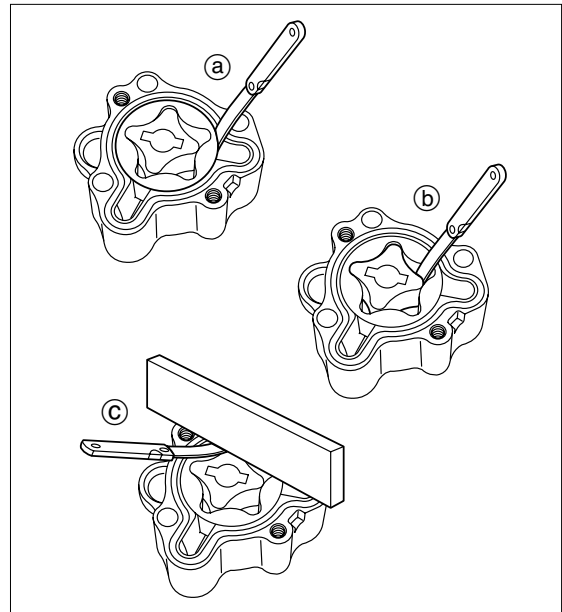
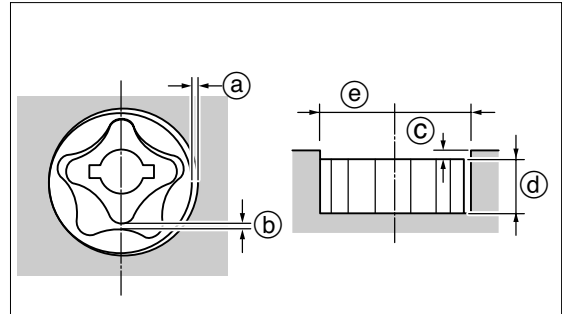
0.11 mm ( 0.0043 in ) ( including wear of oil pump cover )

**Height of Outer Rotor (d) :**

14.96 mm ( 0.5890 in )

**Pump Body Inner Diameter (e) :**

40.8 mm ( 1.605 in )





# 6

## Lower Unit



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<b>1 Special Tools</b> .....	6-2	17) Disassembly of Clutch Cam and Cam Rod	6-15
<b>2 Parts Layout</b> .....	6-4	18) Inspection of Cam Rod and Clutch Cam	6-16
Gear Case .....	6-4	19) Assembly of Cam Rod and Clutch Cam	6-16
Drive System & Water Pump .....	6-5	20) Removing Drive Shaft .....	6-16
Shift .....	6-7	21) Disassembly of Drive Shaft .....	6-16
<b>3 Inspection Items</b> .....	6-8	22) Inspection of Drive Shaft .....	6-17
1) Draining Gear Oil .....	6-8	23) Disassembly of Forward Gear (A Gear)	6-17
2) Removing Propeller .....	6-8	24) Inspection of Pinion Gear (B Gear)	
3) Removing Lower Unit .....	6-9	and Forward Gear (A Gear) .....	6-17
4) Disassembly of Water Pump .....	6-9	25) Assembly of Forward Gear (A Gear)	6-17
5) Inspection of Water Pump .....	6-10	26) Assembly of Drive Shaft .....	6-18
6) Removing Propeller Shaft Housing Ass'y	6-10	27) Disassembly of Gear Case .....	6-18
7) Disassembly of Propeller Shaft Ass'y	6-11	28) Inspection of Gear Case .....	6-19
8) Inspection of Propeller Shaft .....	6-11	29) Assembly of Lower Unit.....	6-19
9) Assembly of Propeller Shaft Ass'y	6-11	30) Installation of Pinion Gear (B Gear)	6-20
10) Disassembly of Propeller Shaft Housing	6-12	31) Settling Pinion Gear (B Gear) Height	6-21
11) Inspection of Propeller Shaft Housing	6-13	32) Settling Forward Gear (A Gear) Backlash	6-24
12) Assembly of Propeller Shaft Housing	6-14	33) Reassembly of Pinion Gear Nut (B Gear Nut)	6-27
13) Removing Pump Case (Lower) .....	6-15	34) Assembly of Propeller Shaft Housing	6-27
14) Disassembly of Pump Case (Lower).....	6-15	35) Reassembly of Pump Case (Lower)	6-28
15) Assembly of Pump Case (Lower) .....	6-15	36) Assembly of Water Pump .....	6-28
16) Removing Clutch Cam and Cam Rod	6-15	37) Installation of Lower Unit .....	6-30

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# Lower Unit

5. Install pump case (lower) and gasket to guide plate. (Secure guide plate with small bolts ⑤.)

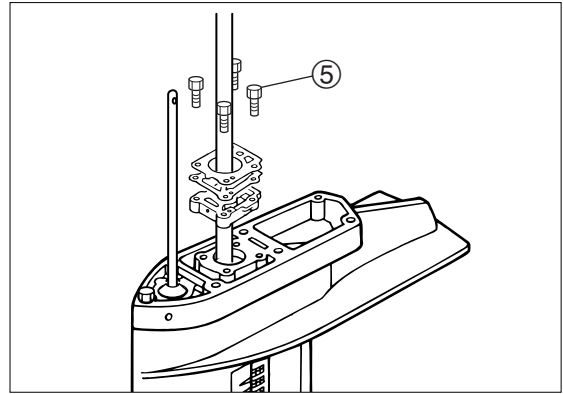


Use four short bolts ⑤. M6 P1.0 L=30 mm



**Short Bolts for Inspection ⑤ :**

6 N·m ( 4 lb·ft ) [ 6 kgf·m ]



6. Put shimming gauge 2 ⑥ into gear case, and lay down gear case by 90 degrees as shown.

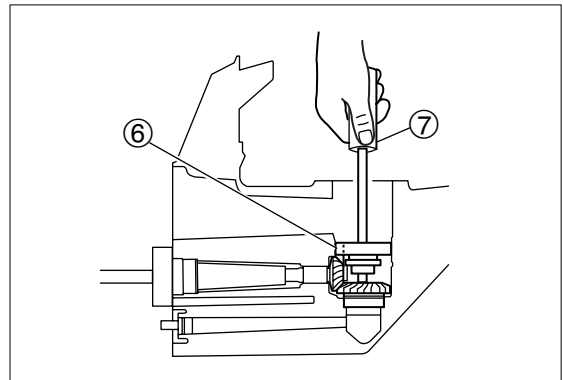


**Shimming Gauge 2 ⑥ :**

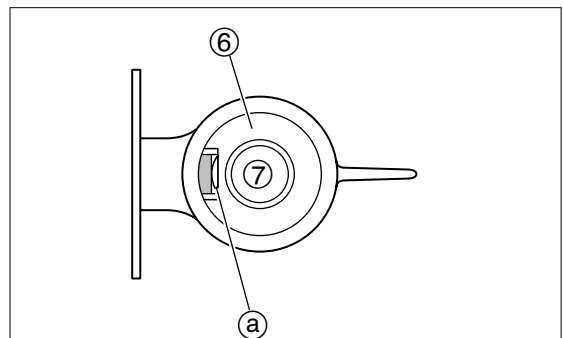
P/N. 3AC-99250-0

**Driver Rod 2 ⑦ :**

P/N. 3AD-99702-0



7. Position cut (a) as shown.





# Bracket

## 20) Removing Tilt Cylinder

1. Retract tilt rod.
2. Use vise to fix PTT unit ① that is protected at both sides with wood pieces or aluminum plates ③.
3. Secure joint ② and loosen nut ③ by using wrench, and remove joint ② and nut ③.
4. Use 36mm deep socket to loosen tilt cylinder ④, stretch tilt rod and remove tilt cylinder ②.

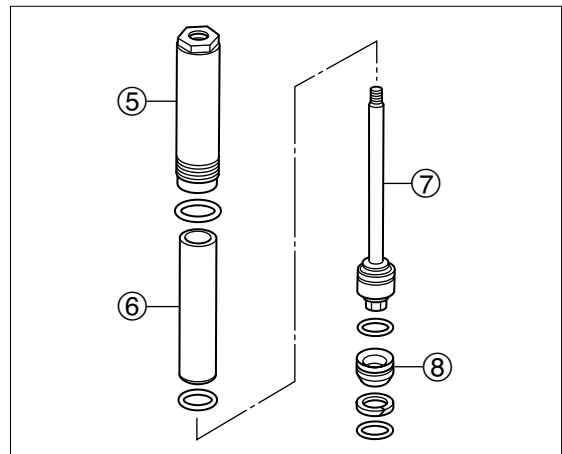
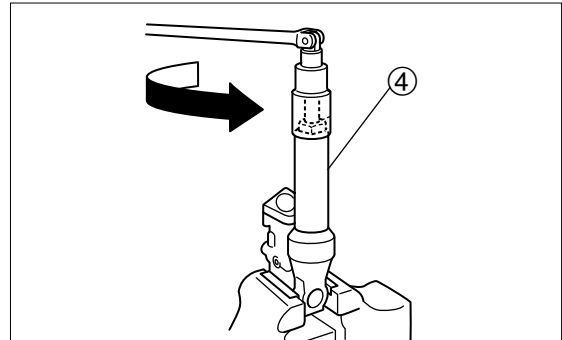
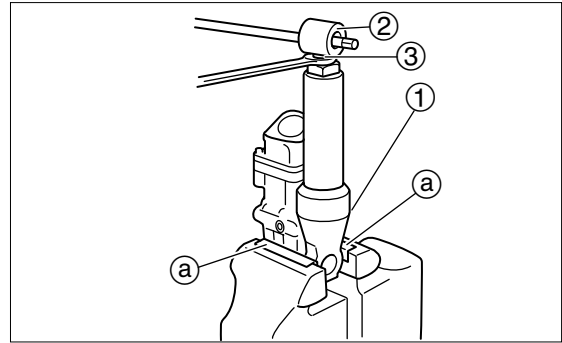


Loosen tilt cylinder with tilt rod retracted, and then, remove with tilt rod fully stretched.

### CAUTION

**Before removing tilt rod, make sure it is fully extended to relieve high pressure in the tilt cylinder.**

5. Drain PTT fluid.
6. Remove inner tube ass'y from tilt cylinder ⑤ (including inner tube ⑥, tilt rod ass'y ⑦, and free piston ⑧).
7. Remove tilt rod ass'y ⑦ and free piston ⑧ from inner tube ⑥.

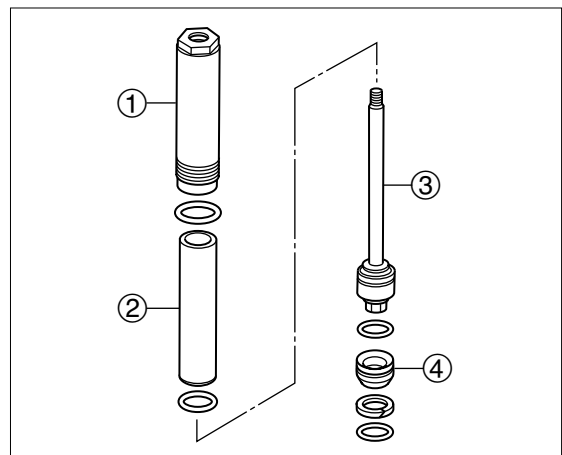


## 21) Inspection of Tilt Cylinder

1. Check tilt cylinder ① and inner tube ② for scratch and damage on the inner and outer wall. Replace if necessary.
2. Check tilt rod ass'y ③ and free piston ④ for scratch and damage on their surfaces. Replace if necessary.
3. Check tilt rod ③ for bend and excessive corrosion. Use sand paper of No. 400 to 600 to remove moderate corrosion, or replace if necessary.



Tilt cylinder dust seal and O-ring are not reusable. Be sure to replace.



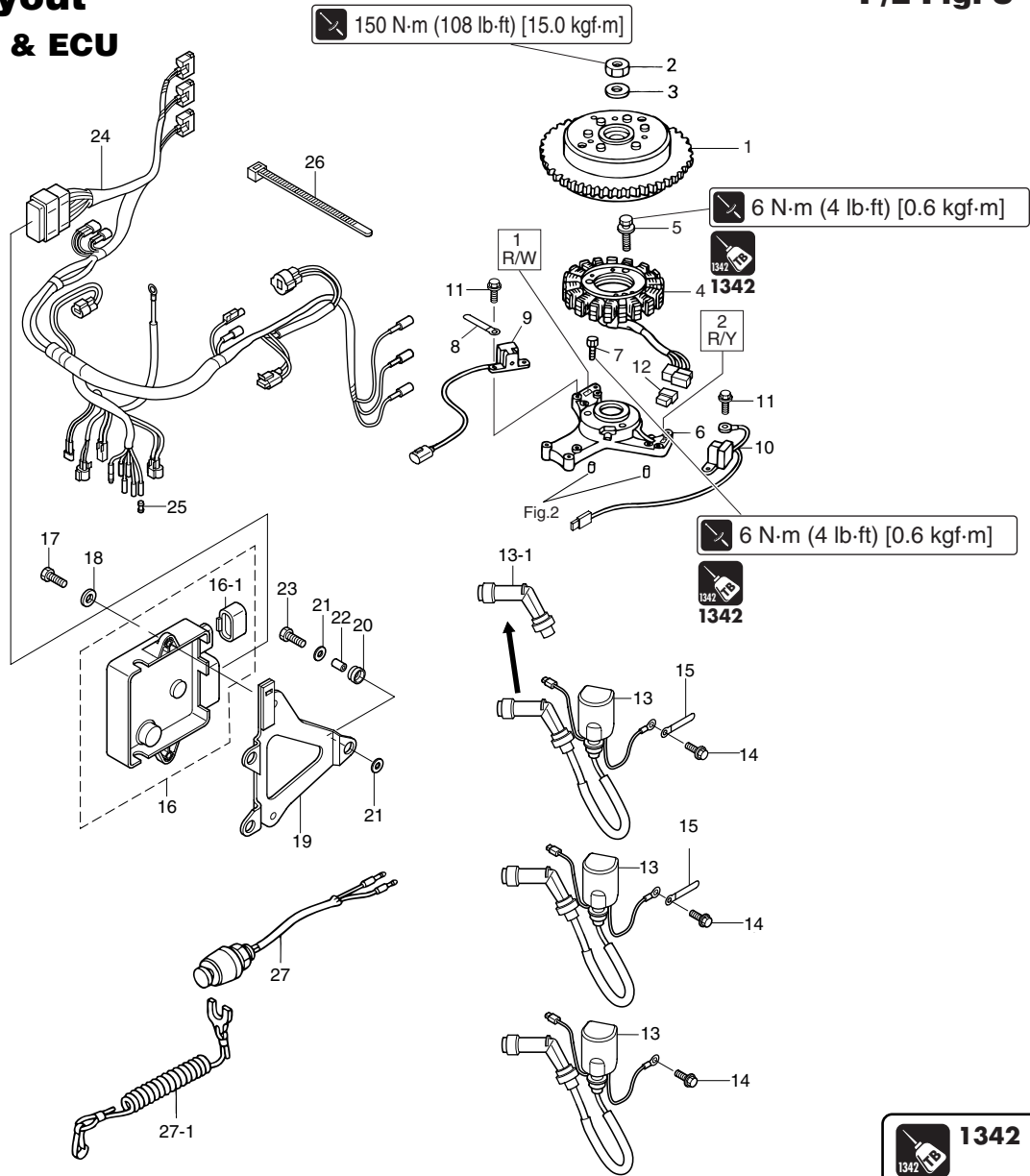


# Electrical System

## 3.Parts Layout

### Magneto & ECU

P/L Fig. 8



Ref. No.	Description	Qty	Remarks
1	Flywheel Cup	1	with FF 90 Ring Gear
2	Nut, M18-P1.5	1	
3	Washer, 19-34-3	1	
4	Alternator	1	
5	Bolt	3	M6 L=25mm
6	Coil Bracket	1	
7	Bolt	3	M6 L=30mm
8	Clamp, 6.5-47.5P	1	
9	Pulser Coil # 1	1	
10	Pulser Coil # 2	1	
11	Bolt	4	M5 L=12mm
12	Plug (Alternator Coupler)	1	Recoil Start Model
13	Ignition Coil	3	
13-1	Plug Cap (Resistance)	3	
14	Bolt	3	M6 L=20mm
15	Clamp, 6.5-47.5P	2	
16	ECU, 30	1	
	ECU, 30	1	for EU
	ECU, 25	1	
	ECU, 25	1	for EU
16-1	Plug (ECU)	1	
17	Bolt	2	M6 L=16mm
18	Washer, 6-16-1.5	2	
19	ECU Bracket	1	

Ref. No.	Description	Qty	Remarks
20	Rubber Mount	3	
21	Washer	6	
22	Collar, 6.2-9-7.4	3	
23	Bolt	3	M6 L=20mm
24	ECU Cord	1	※
	ECU Cord	1	▲
25	Cable Terminal Plug	3	※
26	Lead Wire Band, L=150	4	
27	Stop Watch	1	
27-1	Stop Switch Lanyard	1	

※ Tiller Handle Model

▲ Remote Control Model



# Electrical System

## 7. Battery Charging System

### 1) Inspection of Alternator

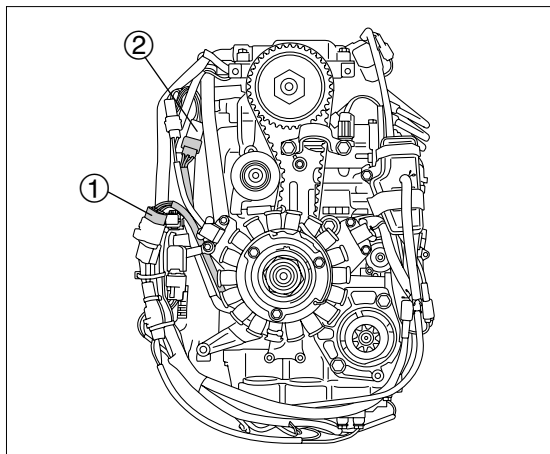
1. Disconnect alternator coupler (3 pin).
2. Measure alternator resistance. Replace if other than specified value.



This test can be made without removing parts.



**Alternator (Charge Coil) Resistance : Reference Value (at 20°C)**  
Between Yellow (Y) and Yellow (Y) (three types)  
0.29 to 0.43 Ω



- ① Alternator (3 Pin) (Charge Coil)  
② Alternator (6 Pin) (Exciter Coil, ECU/Charge Coil)

### 2) Inspection of Rectifier

- Check wire harness for disconnection of lead wire and defective connection.
- Check conductivity between each point by referring to the following table. Value in ( ) is reference value.
- Perform the measurement with all connections disconnected to make the component a separated unit.



This test can be made without removing parts.

Rectifier Tester Check Chart "ON" means "conductive", and "OFF" means "non-conductive".

		Tester Lead Positive (+) Side (Red)				
		Red	Yellow	Black	Yellow	Yellow
Tester Lead Negative (+) Side (Black)	Red		OFF CON (∞)	OFF (∞)	OFF CON (∞)	OFF CON (∞)
	Yellow	ON (5kΩ)※		ON (2.5kΩ)	ON (5kΩ)	ON (5kΩ)
	Black	ON (6kΩ)※	ON (2.5kΩ)		ON (2.5kΩ)	ON (2.5kΩ)
	Yellow	ON (5kΩ)※	ON (5kΩ)	ON (2.5kΩ)		ON (5kΩ)
	Yellow	ON (5kΩ)※	ON (5kΩ)	ON (2.5kΩ)	ON (5kΩ)	



- Measurement Conditions : Type of Circuit Tester : HIOKI3030
- Measurement Range : 1kΩ
- Permissible Error of Resistance : ±20%
- ※ : The resistance values may vary widely among circuit testers because of their error characteristics.

- Note :
- ① It is recommended to use "HIOKI HiTESTER MODEL 3030" for this measurement. Use of other instrument model for the measurement can cause indication of abnormal value for normal condition, resulting in inaccurate measurement.
  - ② Disconnect all connections, and measure as an independent unit.
  - ③ Any movement of pointer indicates "ON" or "conductive" state.
  - ④ "CON" means that the pointer moves once and then returned to the value shown in ( ) because of characteristic of capacitor.
  - ⑤ The value in ( ) is the condition applied when "1kΩ" range is used. The measurement varies widely among types of instrument, situations (such as inner power supply), or measurement ranges due to diodes used in the unit.



# Troubleshooting

## 7) Function Test

Set switch of diagnosis harness to "ON" when performing function test.

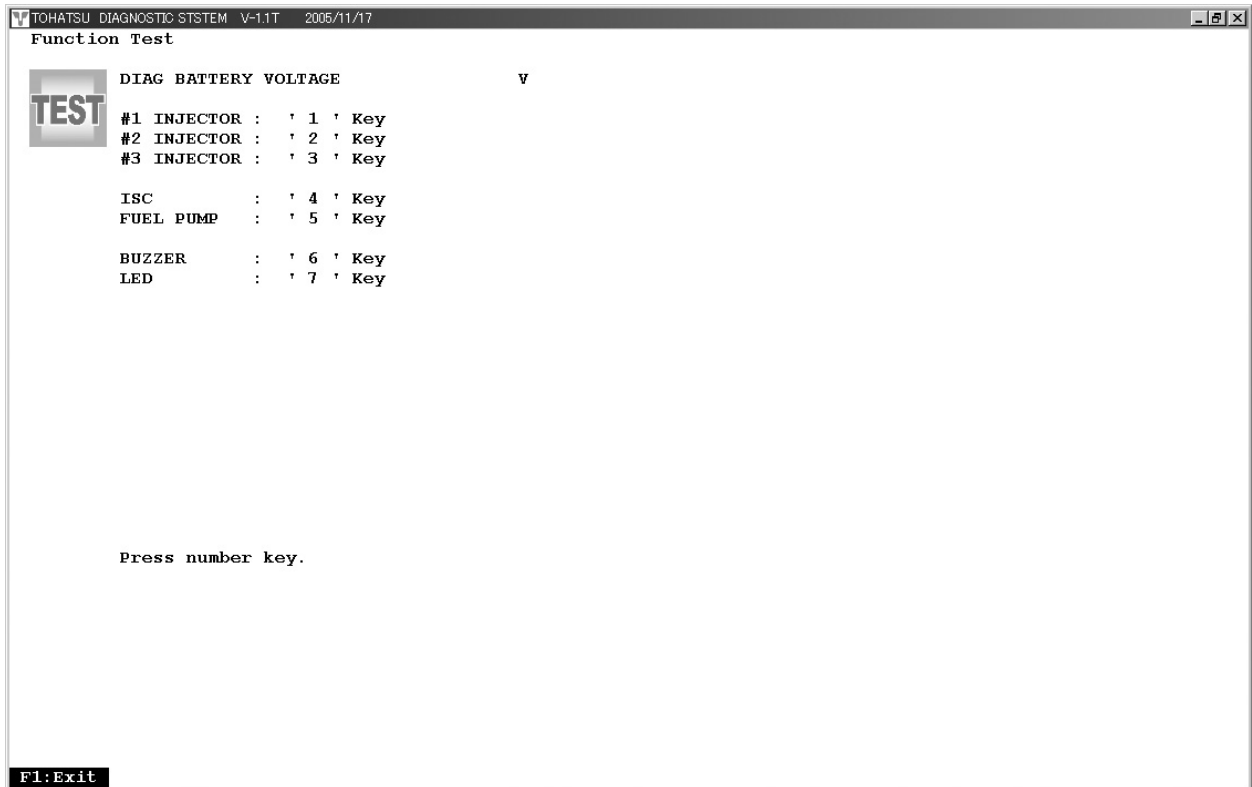
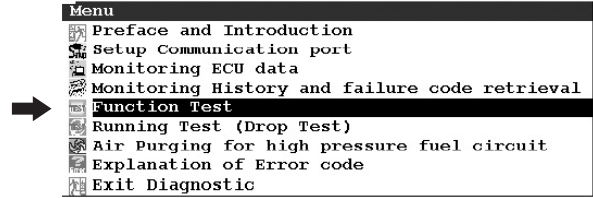


Malfunction of injectors or their operating state can be checked.

Enter the number of item to be checked.

- "1" : Operation (on/off) of #1 injector
  - "2" : Operation (on/off) of #2 injector
  - "3" : Operation (on/off) of #3 injector
  - "4" : Operation (on/off) of ISC valve
  - "5" : Operation (on/off) of fuel feed pump (FFP) in vapor separator
  - "6" : Operation of warning buzzer
  - "7" : Lighting of warning lamp
- Tiller Handle Model : Warning lamp (LED) on the front of bottom cowl
- Remote control model : Warning lamp (oil) on the tachometer

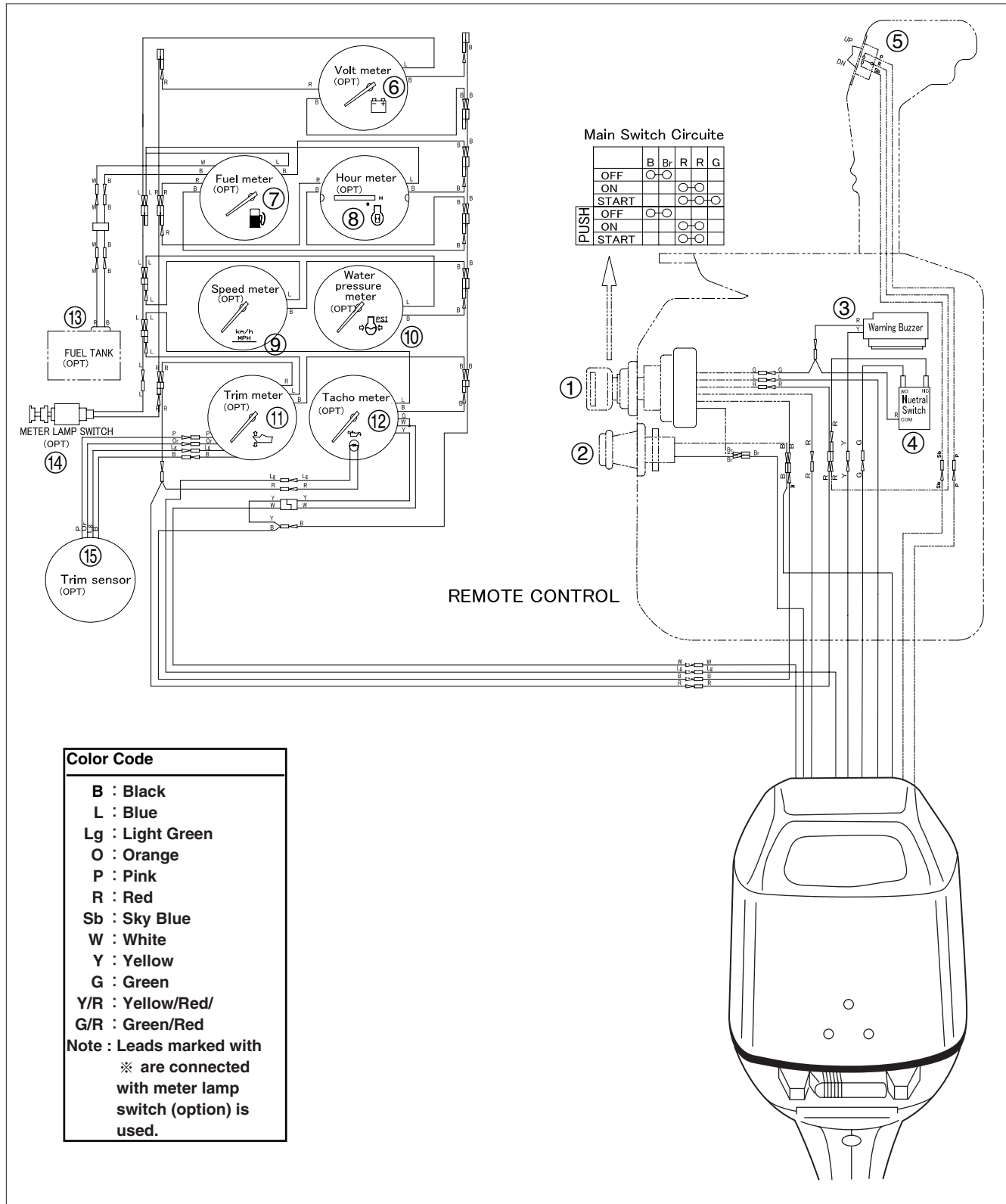
Press "F1" key to return to "Menu" screen.





# Accessories

## 3) Wiring Diagram of Remote and Control Meters



- |                   |                        |                     |
|-------------------|------------------------|---------------------|
| ① Main Switch Key | ⑥ Volt Meter           | ⑪ Trim Meter        |
| ② Stop Switch Key | ⑦ Fuel Meter           | ⑫ Tachometer        |
| ③ Warning Buzzer  | ⑧ Hour Meter           | ⑬ Fuel Tank Sensor  |
| ④ Neutral Switch  | ⑨ Speedometer          | ⑭ Meter Lamp Switch |
| ⑤ PTT Switch      | ⑩ Water Pressure Meter | ⑮ Trim Sensor       |