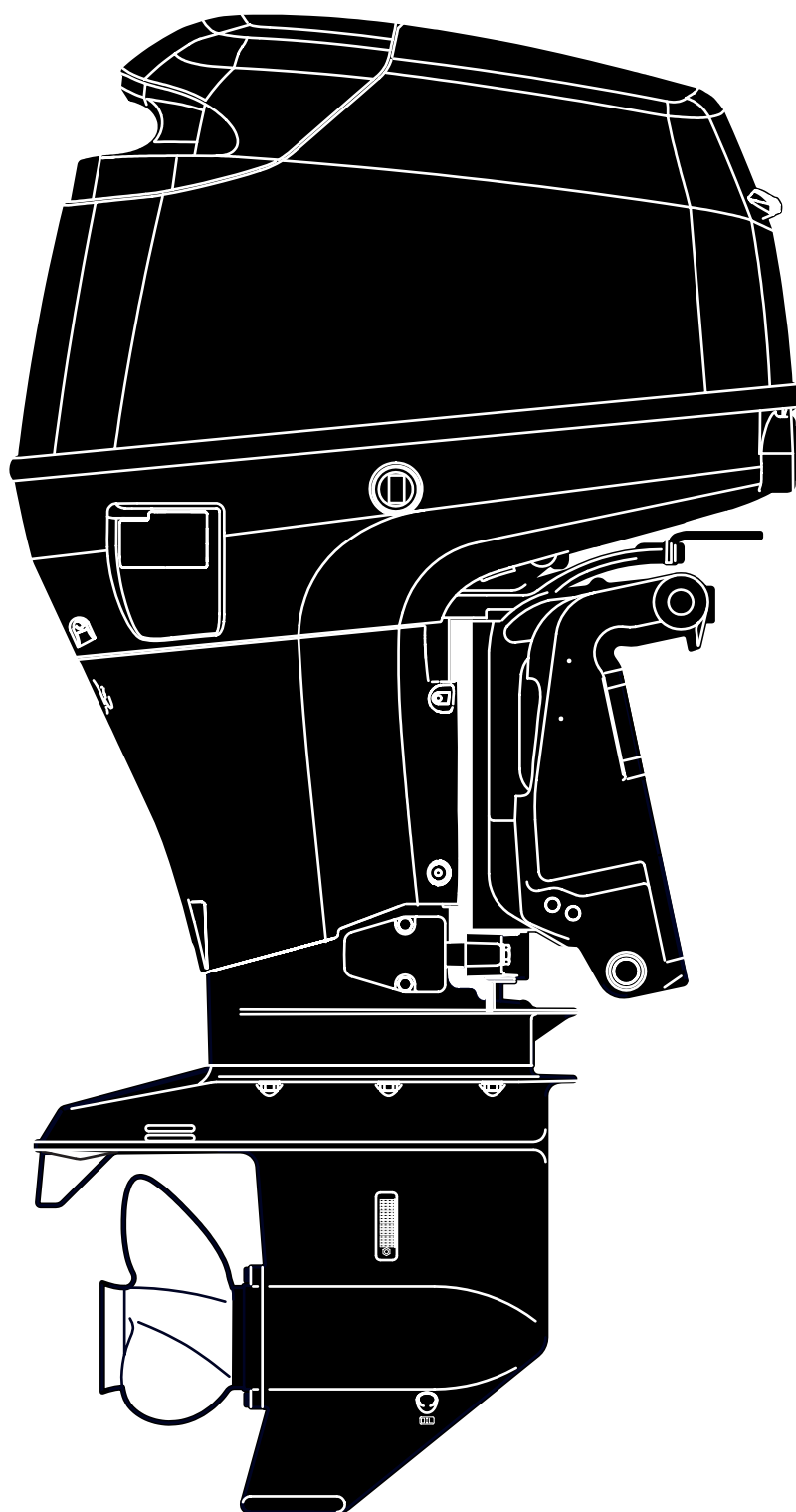


# SERVICE MANUAL

 **TOHATSU**  
Outboards



*T/DFI*

**MD**

**75/90C2  
Models**

**OB No.003-21052-2  
11-01 NB**



# Introduction

## Before reading this manual

This service manual provides information that is needed for inspection, service and repair of applicable outboard motors. For information about operation of the products that are not described in this document, refer to the owners manual. For our customers' safe and comfortable use of the products for long term, it is essential to maintain the performance and quality of the outboard. To ensure this, the maintenance and service have to be done properly by service technicians with fundamental knowledge and skills. This manual is utilized so that our customers can always use their outboard motor with full satisfaction.

## Safety Information

### Safety Statements

The following safety statements are found throughout this manual and indicate information which, if ignored, could result in fatal safety hazards or property damages:

#### **DANGER**

**Indicates the presence of a hazard which, if ignored, will result in severe injury or death.**

#### **WARNING**

**Indicates the presence of a hazard or an unsafe activity which, if ignored, could result in severe injury or death.**

#### **CAUTION**

**Indicates the presence of a hazard or an unsafe activity which, if ignored, could result in minor personal injury or damage to the products or facilities.**



Attention.

## Composition and use of this manual

**Understand the following matters well for efficient service and repair.**

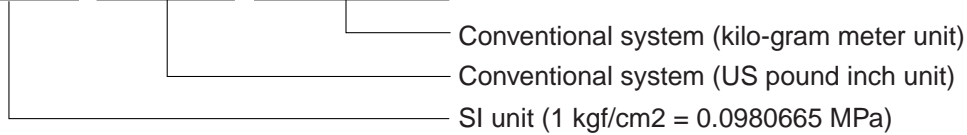
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This manual uses SI unit system (International System of Units) for the pressure, force (load), torque and stress. This manual newly adopts the international unit construction system (SI unit system) followed by the conventional imperial and metric systems enclosed by ( ) and [ ] as described below.

Example : <Pressure>

**0.90 MPa (128 psi) [9.0 kgf/cm<sup>2</sup>]**



\* Measurements are shown using SI unit followed by conventional units (US unit) and [Japanese domestic unit].

Example : <Driving torque>

**18 N·m (13lb-ft) [1.8 kgf-m]**

\* The conventional unit for measurement of force uses "kgf (kilogram force)" to discriminate it from "kg (mass kilogram)" of SI unit system.

Example : <Volume>

**900 cm<sup>3</sup> (30.4 fl.oz)**

Example : <Length>

**10 mm (0.39 in)**

## <Reference>

What is the SI unit system?

Although the measurement unit is standardized mostly with metric system in the world, the metric system includes different kinds of unit systems.

Though the metric system was established expecting that a single unit system is used in the world, various physical units were established later, resulting in branching the metric system in different unit systems.











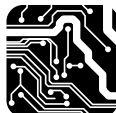
The new unit system is called "International System of Units" because it was established for the purpose of unifying the different unit systems.

Since the metric system was initially established in France, and International Bureau of Weights and Measures (IBWM) is located in Paris, General Conference of Weights and Measures (GCWM) passes a resolution of the international unit system as "Système International d'Unités (French)" that is abbreviated as "SI unit".










For example, conventional metric system uses the unit of mass (kg) and unit of force (kg or kgf) without discriminating them, but the SI unit system uses, for example, "kg" as the unit of mass, and "N" as the unit of force, aiming to apply a kind of unit for a kind of physical quantity.

# Description of Pictograph














The following symbols represent the contents of individual chapters.

Service Information 	Service Data 	Inspections and Adjustments 	Fuel System 
Power Unit 	Lower Unit 	Bracket 	Electrical System 
Troubleshooting 	Rigging 	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.

2 stroke Engine Oil 	Gear Oil 	ATF DEXRON III 	Waterproof Grease 
Low Temperature Resistant Lithium Grease 	Molybdenum Grease • Moly Paste 500 	TEFLON Grease T.E.F 	Oil Compound [Shinetsu Silicon] S.O.C 
[Konishi Bond] • G17 	Instant Adhesive [Three Bond®] • 1741 	Gasket Seal Agent [Loctite®] • 518 	Screw Lock Agent [Three Bond®] • 1342 
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## 1

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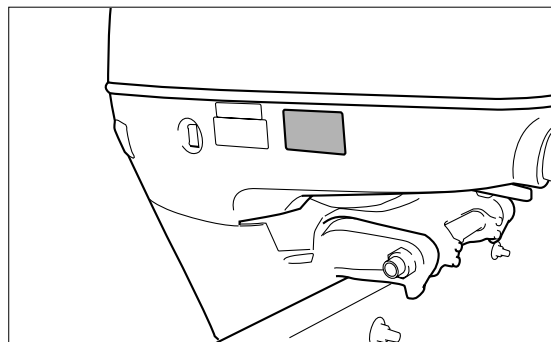
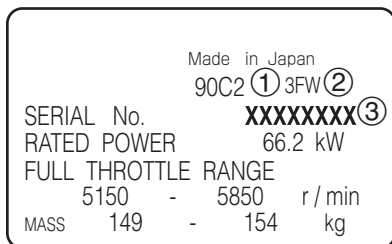


# Service Information

## 1. Identification (Engine Serial Number)

Engine serial number is stamped on the bottom cowl of outboard motor body.

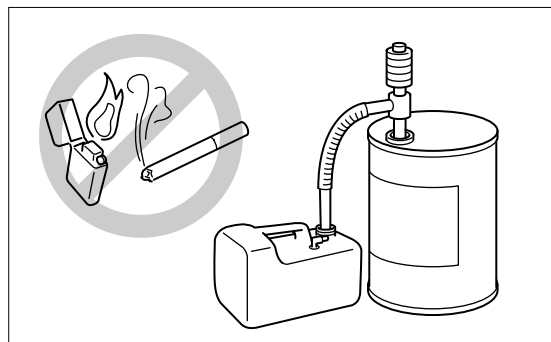
- ① Model Name
- ② Model Type
- ③ Serial Number



## 2. Work Safety

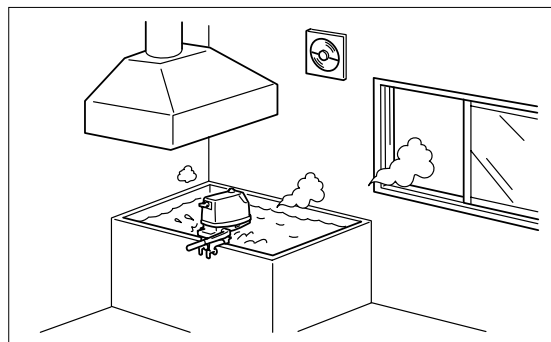
### 1) Fire Prevention

Gasoline is hazardous material and very flammable. Do not handle gasoline near ignition source such as spark or static electricity.



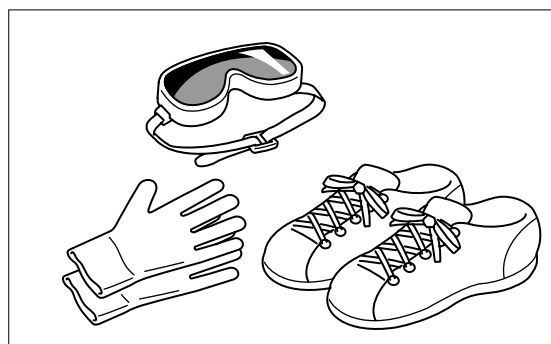
### 2) Ventilation

Exhaust gas or gasoline vapor is hazardous. Be sure to ventilate well when working indoors.



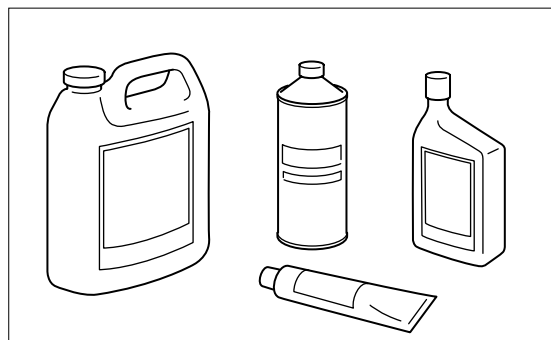
### 3) Protection

Wear a pair of goggles, working gloves and safety shoes to protect skin from chemicals and oils and eyes from particles generated by grinding or polishing. Avoid contact of oil, grease or sealing agent to the skin. In case of exposure to such matters, wash away with soap or warm water immediately.



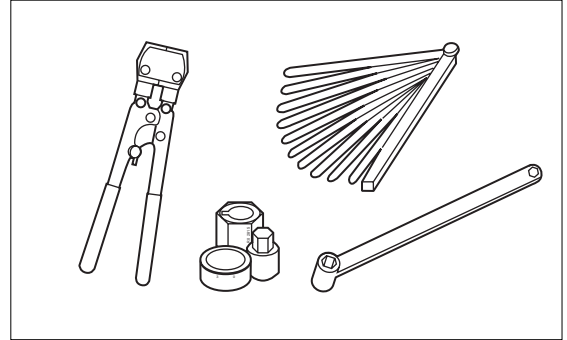
### 4) Genuine Parts

Use parts and/or chemicals that are genuine items or recommended.



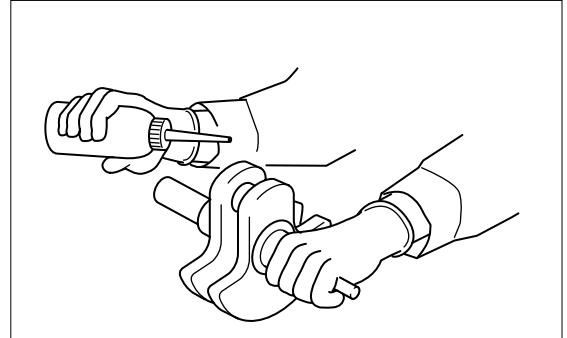
## 5) Tools

Use specified special tools to prevent damaging to parts and to perform work safely and surely. Be sure to follow installation procedures described in this manual and use tightening torque specified.



## 6) Recommendations on Service

Remove foreign substances and dirt from outboard motor and individual parts by cleaning. Apply recommended oil or grease to rotating areas and sliding surfaces. After individual assembly, always perform verifications such as ensuring smooth movement and sealing.

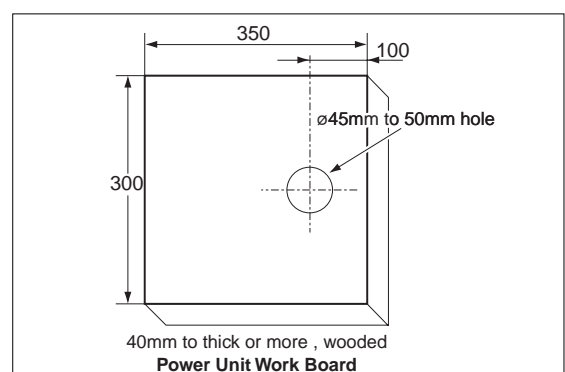
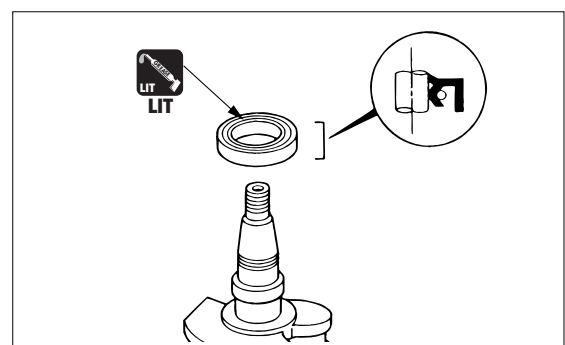
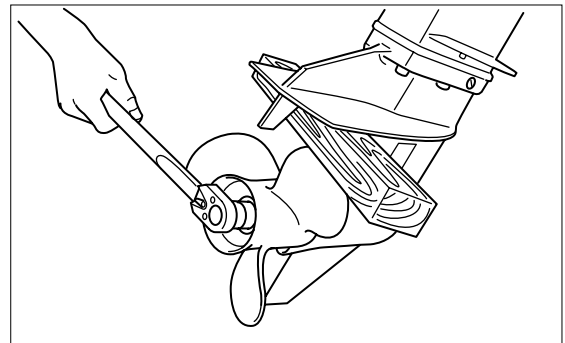
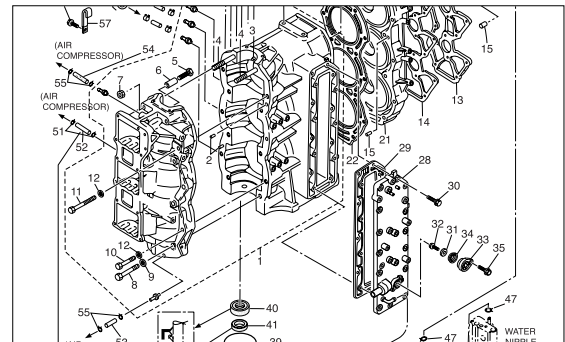
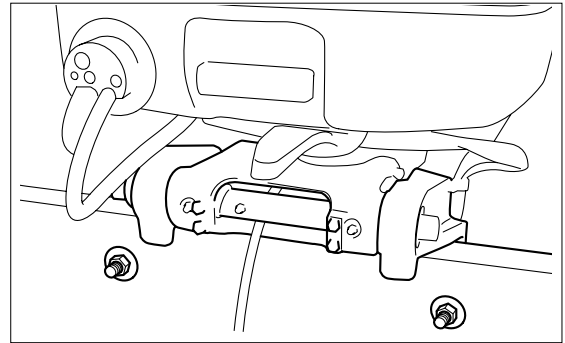




# Service Information

## 7) Cautions in Disassembling and Assembling Components

- (1) Secure outboard motor to dedicated stand firmly.
- (2) Take special care not to scratch painted surfaces or mating surfaces of cylinder and crankcase.
- (3) Replace parts such as packings, gaskets, O rings, oil seals, spring pins or split pins with new ones after they are 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 work 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 condition.
- (8) When assembling, be careful of the fit, repair limits, air-tightness, clogging of oil holes for oil feeding or greasing, packings, wirings, pipings and other detailed parts. For the components that use many bolts and nuts such as cylinder head or crank case, tighten the fasteners in the order shown by the numbers to prevent uneven tightening. If the numbers are not shown, tighten the fasteners in diagonal or clockwise order from inner ones to outer ones evenly to specified torque. In either case, tighten the fasteners to the specified torque in two or three steps. (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 sealant, take care to use sparingly. 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.



### 3. Tools and Instruments

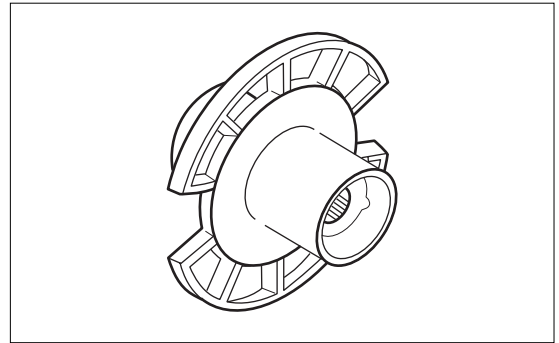
#### 1) Test Propeller

P/N. 3T1-64111-0

Outer diameter : 278mm

With : 25mm

Model	Rotational speed at WOT (Wide Open Throttle) (r/min)
TLDI75C2	approximately 5,000 - 5,100
TLDI90C2	approximately 5,500 - 5,600



1

#### 2) Measuring Instruments

For the following measuring instruments, use commercially available ones.

Circuit tester ( Resistance : 1Ω, 10Ω, 10 kΩ, AC voltage : 30 to 300V, DC voltage : 30V, Internal voltage 3V or less )

Vernier calipers ( M1 type, 300 mm )

Micrometer ( minimum graduation of 0.01, outer, 0 to 25 mm, 25 to 50 mm, 50 to 75 mm )

Cylinder gauge ( 4 to 6 mm, 10 to 25 mm, 25 to 30 mm, 50 to 75 mm )

Ring gauge ( ø5.5, ø16, ø25, ø30, ø61 )

Dial gauge ( minimum graduation of 0.01 )

Thickness gauge ( 0.03 to 0.3 mm )

V block


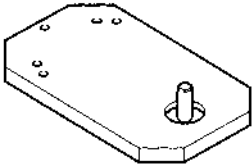


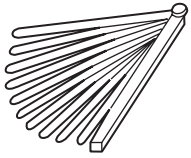
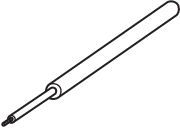
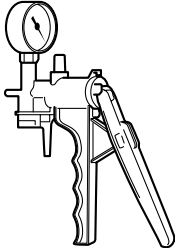
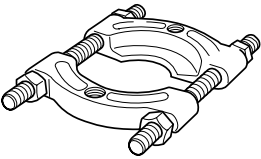
Surface plate ( 500 mm x 500 mm )

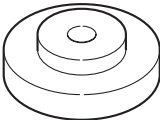
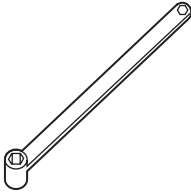
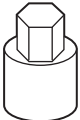
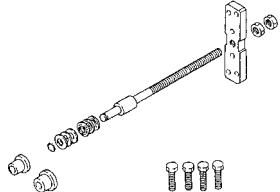
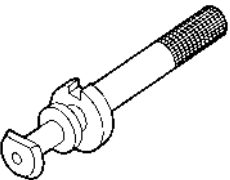
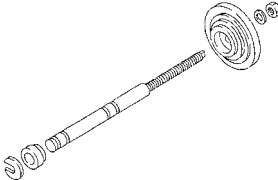
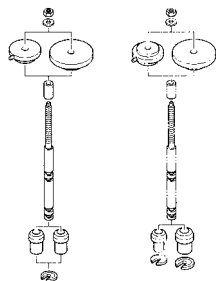
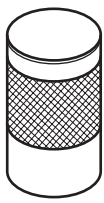
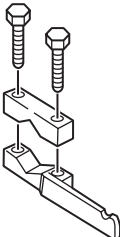
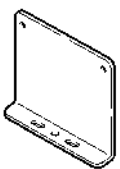
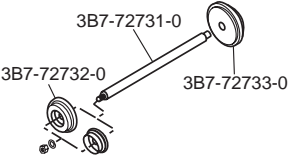
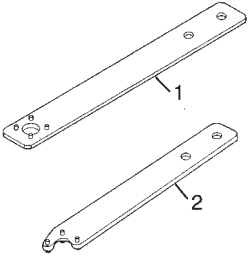
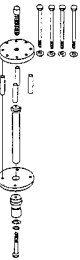
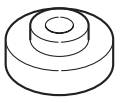
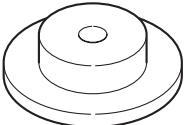
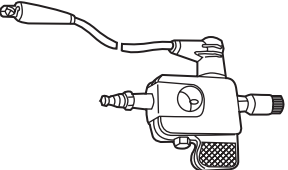
Dial gauge magnet base or dial gauge stand



# Service Information

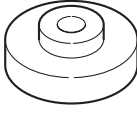
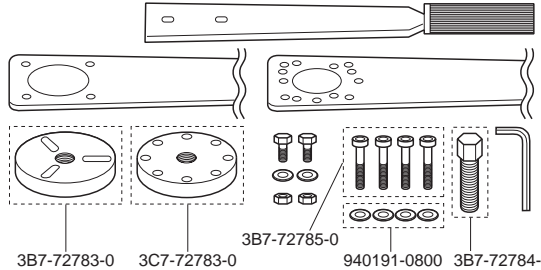
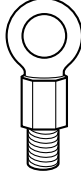
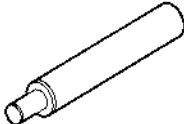

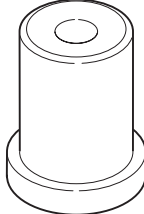
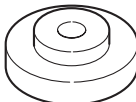
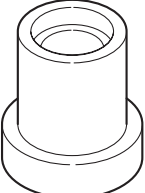
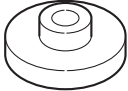

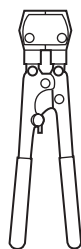
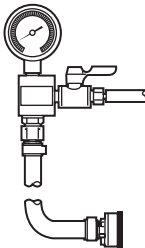
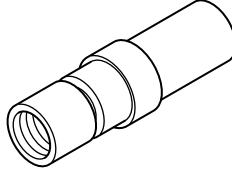
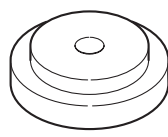
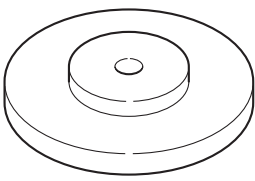
## 3) Special Tools

			
Clutch Pin Snap Tool P/N. 345-72229-0	Power Head Stand P/N. 353-72247-1	Shift Rod Joint Puller P/N. 353-72248-0	Piston Ring Tool P/N. 353-72249-0
Attaching clutch pin	Holding power head when disassembling or assembling power head	Used for pulling up shift rod in case the components are reassembled with the shift rod at 'R' position in the gear case. * This tool is not required when the components are assembled with the shift rod at 'F' position in the gear case.	Removing or attaching piston rings
			
Thickness Gauge P/N. 353-72251-0	Propeller Shaft Housing Puller Ass'y P/N. 353-72252-0	Spring Pin Tool A (ø3.5) P/N. 369-72217-0	Spring Pin Tool B (ø3.5) P/N. 369-72218-0
Measuring gaps	Removing propeller shaft housing	Removing spring pin	Installing spring pin
			
Bevel Gear Bearing Puller Ass'y P/N. 3B7-72755-0	Tachometer P/N. 3AC-99010-0	Vacuum/Pressure Gauge P/N. 3AC-99020-0	Compression Gauge P/N. 3AC-99030-0
Removing forward (A) gear bearing outer race	Measuring engine revolution speed	Inspecting pressure	Measuring compression pressure
	ø100 x ø79.5 x ø51.5 x ø61.5 		
Slide Hammer Kit P/N. 3AC-99080-0	Center Plate P/N. 3AC-99701-0	Driver Rod P/N. 3AC-99702-0	Universal Puller Plate P/N. 3AC-99750-0
Removing forward (A) gear bearing outer race	Removing or installing propeller shaft housing bearing	Used in combination with center plate and various attachments	Removing reverse (C) gear bearing

 ø49.5 x ø29.5			
Oil Seal Attachment P/N. 3Y9-99820-0	Bevel Gear B Nut Wrench P/N. 3B7-72231-0	Drive Shaft Socket P/N. 3B7-72232-0	Backlash Measuring Tool A Kit P/N. 3B7-72234-0
Used in combination with driver rod Attaching propeller shaft housing oil seal	Removing or attaching pinion (B) gear nut	Removing or attaching pinion (B) gear nut	Measuring backlash between forward (A) gear and pinion (B) gear
			
Shimming Gauge P/N. 3B7-72250-0	Backlash Measuring Tool B Kit P/N. 3B7-72255-0	Needle Bearing Puller Kit P/N. 3B7-72700-0	Bevel Gear Bearing Install Tool P/N. 3B7-72719-0
Adjusting pinion (B) gear height	Measuring backlash between pinion (B) gear and reverse (C) gear	Removing or attaching gear case and propeller shaft housing needle bearing	Installing forward (A) gear bearing
			
Backlash Measuring Tool Clamp P/N. 3B7-72720-0	Dial Gauge Plate P/N. 3B7-72729-0	Bearing Outer Press Kit P/N. 3B7-72739-0	1 : Trim Rod Guide Wrench P/N. 3B7-72792-0 2 : Trim Rod Guide Wrench P/N. 3C8-72791-1
Measuring backlash	Used to attach dial gauge when measuring backlash	Attaching forward (A) gear bearing outer race	Removing or attaching PTT piston rod ass'y
	 ø34.5 x ø19	 ø57.5 x ø34.5	
Needle Bearing Press Kit P/N. 3C7-72900-1	Oil Seal Attachment P/N. 3C7-99820-0	Oil Seal Attachment P/N. 3E0-99820-0	Spark Tester P/N. 3F3-72540-0
Removing or attaching gear case needle bearing	Used to press-fit crank case head oil seal	Used to press-fit crank case head oil seal	Checking sparks



# Service Information

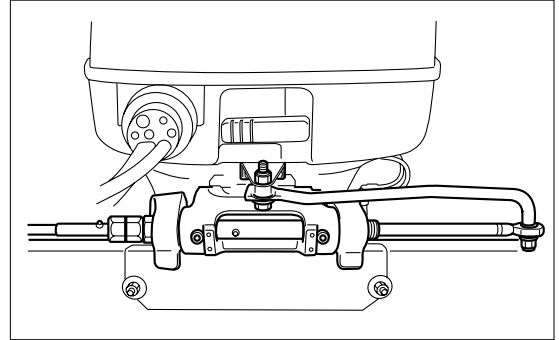
<p>ø 41.5 x ø21.5</p> 	 <p>3B7-72783-0 3C7-72783-0 3B7-72785-0 940191-0800 3B7-72784-0</p>		
<p>Oil Seal Attachment P/N. 3J6-99820-0</p>	<p>Flywheel Puller Kit P/N. 3T1-72211-0</p>		<p>Eye Bolt (Powerhead Lift Ring) P/N. 3T1-72212-0</p>
<p>Attaching pump case (lower) oil seal</p>	<p>Removing or attaching flywheel</p>		<p>Used to hook power unit when hanging</p>
	 <p>3T1-72871-0</p>	<p>ø31.5 x ø25.0</p> 	
<p>Piston Pin Tool P/N. 3T1-72215-0</p>	<p>Piston Slider P/N. 3T1-72871-0</p>	<p>Needle Bearing Attachment P/N. 3T1-99710-0</p>	<p>Oil Seal Attachment P/N. 3T1-99820-0</p>
<p>Removing or attaching piston pin</p>	<p>Assembling piston for air compressor</p>	<p>Used to press-fit forward (A) gear needle bearing</p>	<p>Attaching air compressor oil seal</p>
<p>ø79.5 x ø39.5</p> 	<p>ø51.5 x ø39.5</p> 		
<p>Bearing install Tool P/N. 3T1-99900-0</p>	<p>Bearing Attachment P/N. 3T1-99905-0</p>	<p>O Ring Set Tool (ø24) P/N. 3T5-72863-0</p>	<p>Clamp Pliers P/N. 3T5-72864-0</p>
<p>Attaching drive shaft bearing</p>	<p>Attaching air compressor bearing</p>	<p>Assembling O ring into fuel injector</p>	<p>Caulking clamps made by OETIKER</p>
	<p>ø31.5 x ø25 x H32</p> 	<p>ø51.5 x ø39.5</p> 	<p>ø79.5 x ø39.5</p> 
<p>Pressure Gauge Ass'y P/N. 3T5-72880-0</p>	<p>Needle Bearing Attachment P/N. 3U1-99710-0</p>	<p>Oil Seal Attachment P/N. 3U1-99820-0</p>	<p>Bearing Attachment P/N. 3U1-99905-0</p>
<p>Measuring air rail fuel pressure and air pressure</p>	<p>Used in combination with driver rod and center plate Attaching propeller shaft housing needle bearing</p>	<p>Used to press-fit coil bracket oil seal</p>	<p>Attaching propeller shaft housing bearing</p>



## 4. Pre-delivery Inspection

### 1) Steering Handle

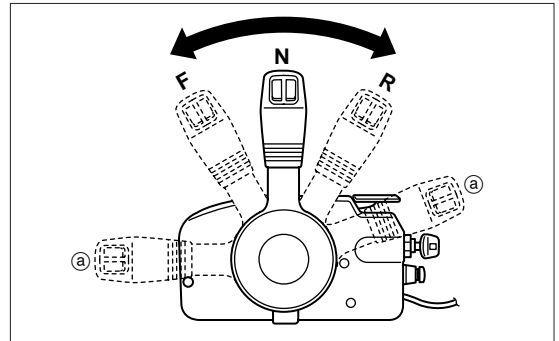
Check installation of drag link.



### 2) Gear Shift and Throttle

Shift into forward (F), back to neutral (N) and then shift into reverse (R) to check that the shift operations are smooth.

Then, set the lever to position ① to check that the throttle operations are smooth.



### 3) Engine Oil

Supply engine oil.



#### Engine Oil :

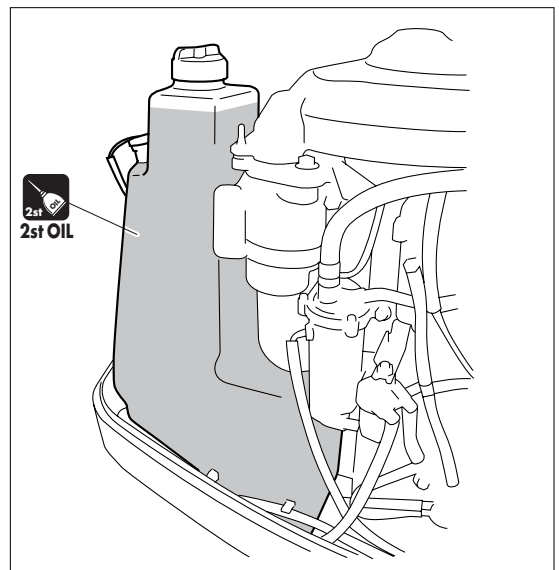
Genuine Oil

(Oil for two stroke direct injection engine recommended by the outboard manufacturer)



#### CAUTION

**Engine oil is removed before shipment to prevent leakage during transportation.**



### 4) Gear Oil

Check quantity of gear oil.

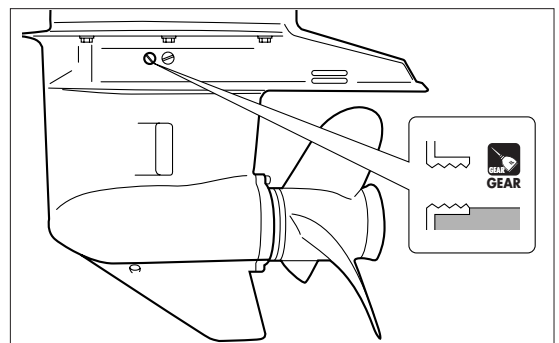


#### Gear Oil :

900 cm<sup>3</sup> (30.4 fl.oz)



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







# Service Information

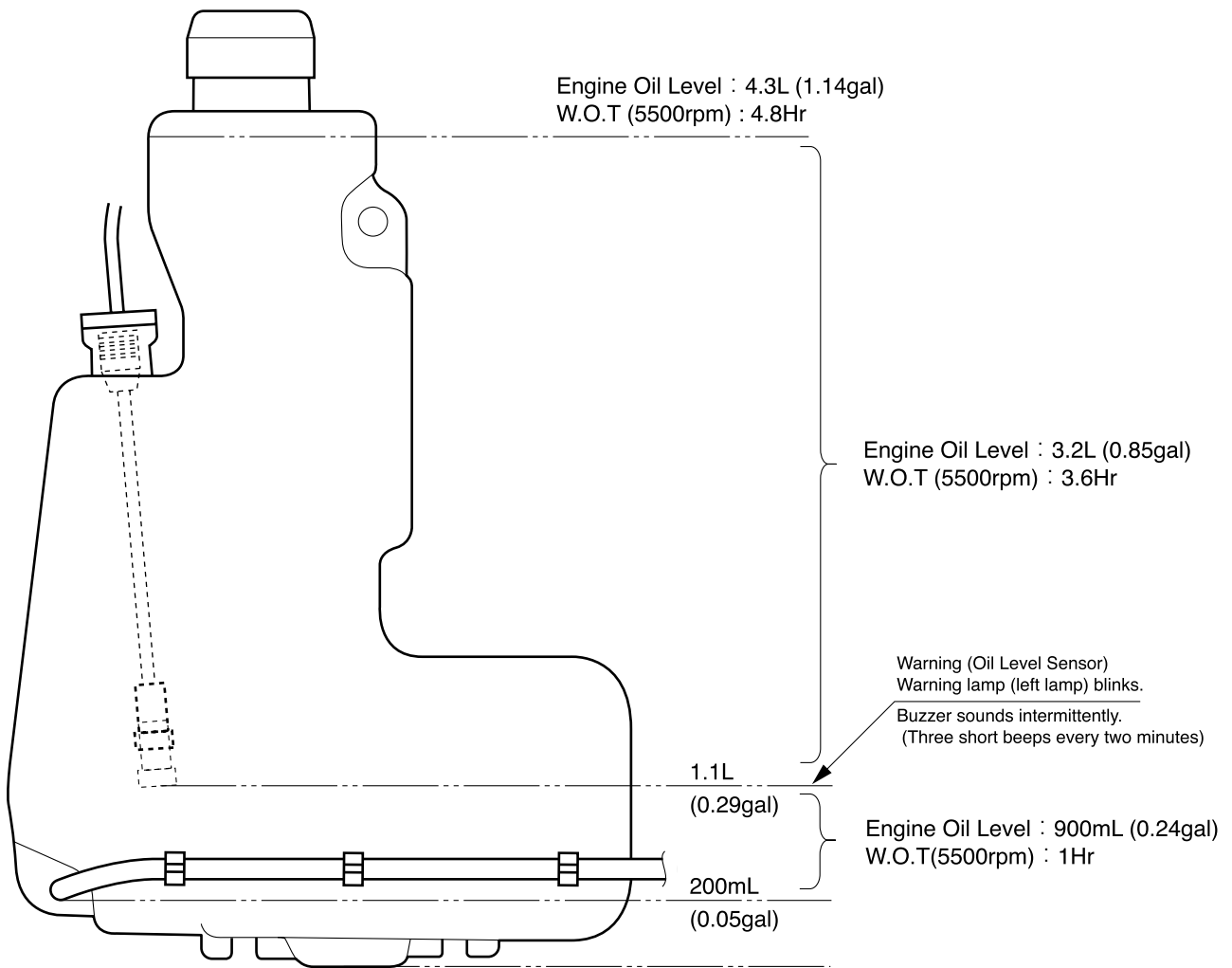
## 5) Check quantity of engine oil.

1. Set outboard motor to vertical position.
2. Check engine oil level.

 **Oil Tank Capacity :**  
4.3L (1.14 gal)

 **Engine Oil :**  
Genuine Oil  
(Oil for two stroke direct injection engine  
recommended by the outboard manufacturer)

 **CAUTION**  
**When quantity of fills below 1.1L (0.29gal),  
oil warning lamp blinks and the buzzer  
sounds three times successively every two  
minutes.**



## 6) Fuel Line

Check that fuel tank contains sufficient amount of gasoline, fuel line is connected and does not leak.

### CAUTION

**Supply only unleaded regular octane gasoline into fuel tank. Never use fuel mixed with oil. Use of fuel mixed with engine oil will cause engine trouble.**

## 7) Installation of Outboard Motor (Rigging)

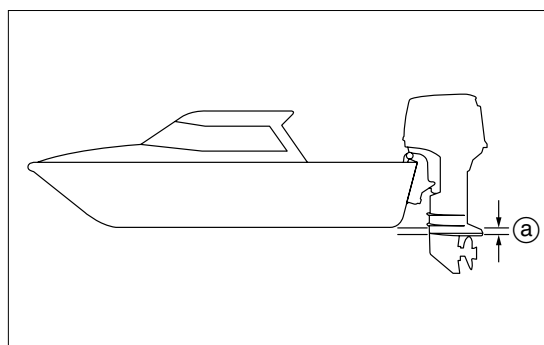
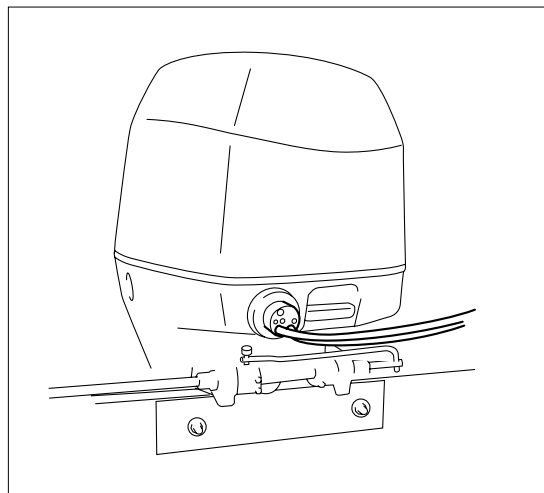
Check that outboard motor is fixed on the hull with installation bolts and nuts securely. Check location of anti-ventilation plate relative to boat bottom.



Test-run to determine the best installation height.



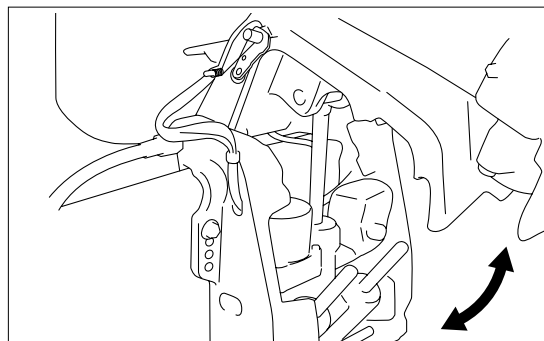
**Anti-ventilation plate standard position (a) :**  
5 - 25 mm (0.2 - 1.0in) below boat bottom



(a) 5 - 25 mm (0.2 - 1.0 in)

## 8) Inspection of PTT Unit

1. Operate PTT switch to check that outboard motor tilts up/down smoothly.
2. Operate PTT switch to check that tilting up/down outboard makes no abnormal noise.
3. Tilt up outboard motor and steer fully to the right and left to check that cables and hoses do not interfere with each other and with any part of hull.
4. Tilt outboard motor down to check that trim meter indicates the lowest position.





# Service Information

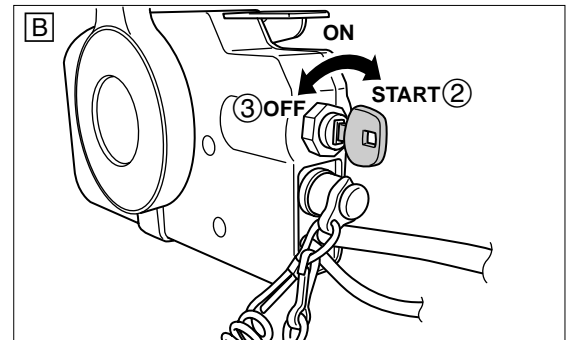
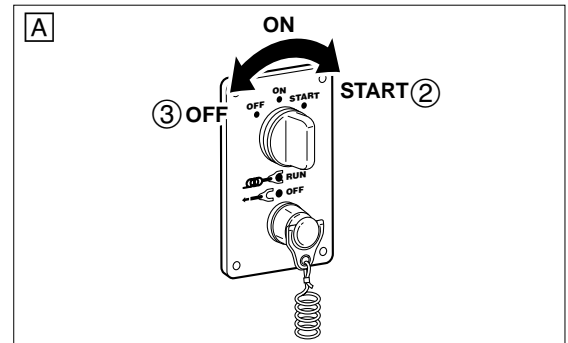
## 9) Inspection of Start Switch and Stop switch

1. Turn main switch to START ② to check that engine starts.

2. Turn main switch to OFF ③ to check that engine stops.

**A** Switch Panel Model

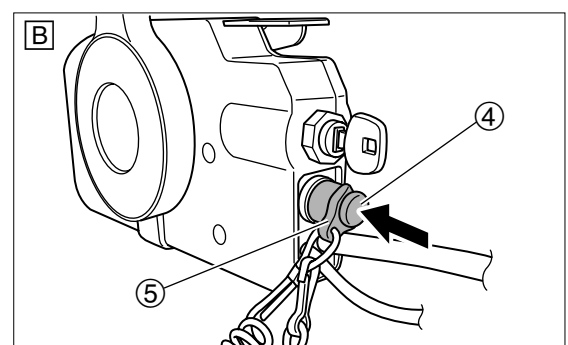
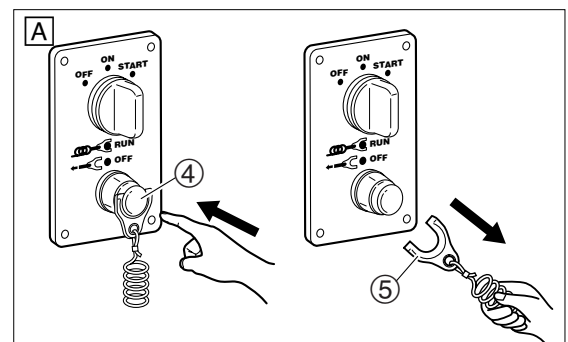
**B** Remote Control Model



3. Press stop switch ④ hard or pull out lock plate ⑤ from stop switch ④ to check that engine stops.

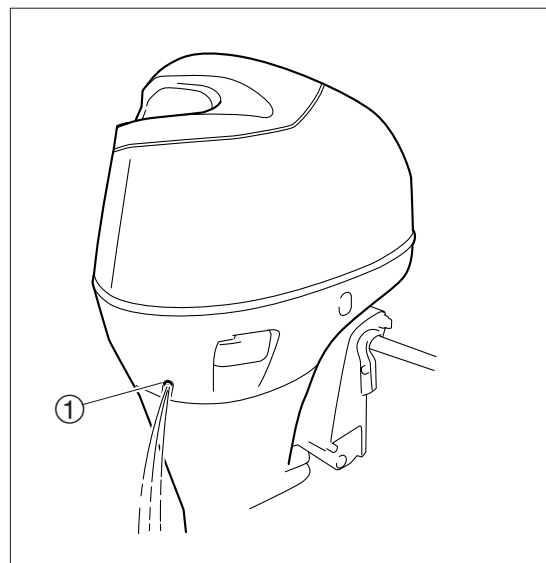
**A** Switch Panel Model

**B** Remote Control Model




## 10) Cooling Water Check Port

Check that cooling water check port ① discharges water during engine operation.

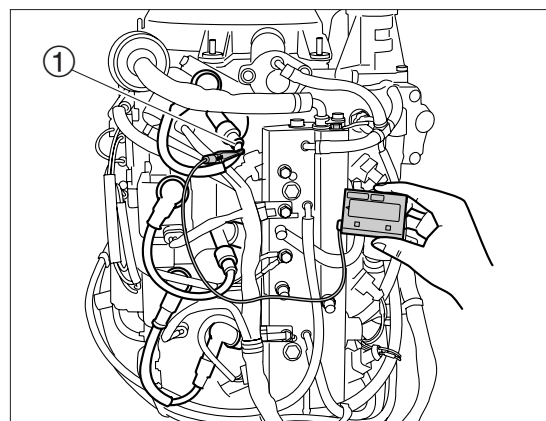


## 11) Idling

After engine has warmed up, use tachometer to check idle speed is as specified, using key switch depression.


**Idle Speed :**  
 700 800 900 r/min


**Tachometer :**  
 P/N. 3AC-99010-0




① High tension cord

## 12) Propeller Selection

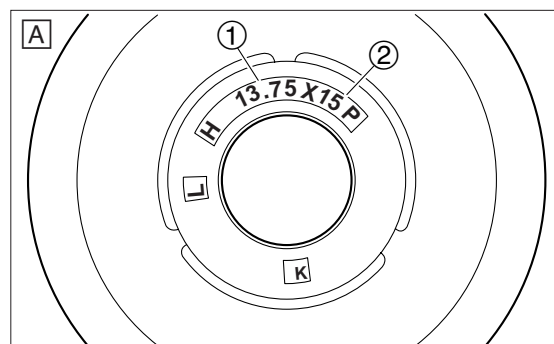
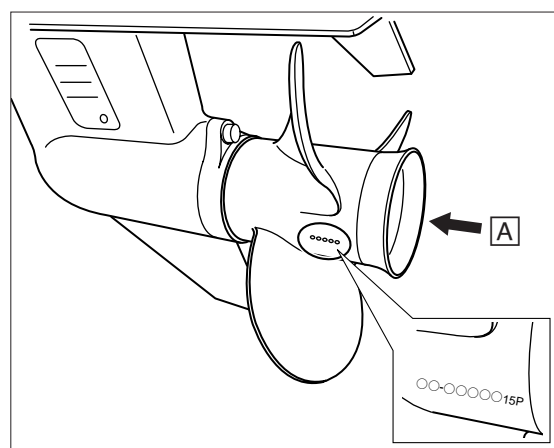
Select a propeller that is best-suited to type of boat and application.


**Range of operating engine speed at WOT\* :**  
 5,150 - 5,850r/min


**\*WOT: Wide Open Throttle**

### ⚠ CAUTION

**Miss-selection of propeller can cause adverse effects on engine life, fuel consumption, etc. as well as on performance.**



① Diameter ② Pitch



## Service Information

Propeller (No. of Blades x Diameter x Pitch) [in/mm]	11P	(3 x 14.0 x 11.0)	[3 x 355 x 279]
	13P	(3 x 14.0 x 13.0)	[3 x 355 x 330]
	15P	(3 x 13.75 x 15.0)	[3 x 349 x 381]
	16P	(3 x 13.25 x 16.0)	[3 x 336 x 406]
	17P	(3 x 13.25 x 17.0)	[3 x 336 x 432]
	19P	(3 x 13.0 x 19.0)	[3 x 330 x 483]
	21P	(3 x 12.75 x 21.0)	[3 x 324 x 533]

### 13) Trim Tab

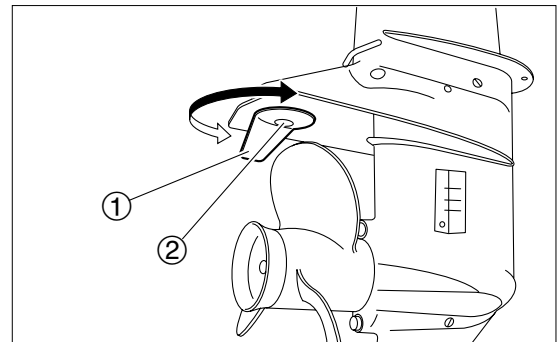
Adjustment of trim tab angle

After installing outboard motor on the boat, use trim tab to achieve balance between port and starboard steering loads. Loosen trim tab nut ②, adjust angle of trim tab 1 as described below, and then tighten the nut to specified torque.



**Trim Tab Nut ② :**

13 N · m (9 lb · ft) [1.3 kgf · m]



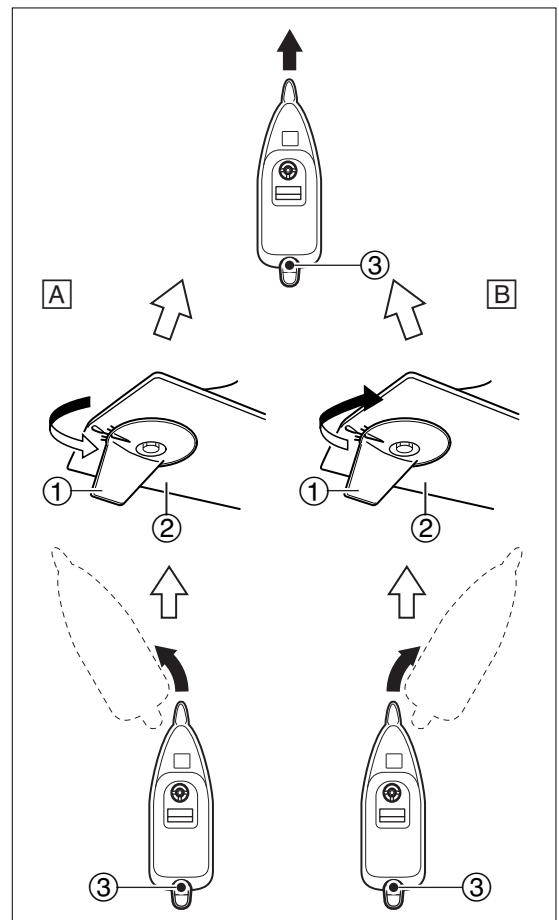
② Trim Tab **Do not reuse.**

#### Example of Adjustment

- A** If it is necessary to steer to starboard to make boat run straight or if boat steers itself to port when steering is held amidships, move trailing edge of trim tab to port side, or
- B** If it is necessary to steer to port to make boat run straight or if boat steers itself to starboard when steering is held amidships, move trailing edge of trim tab to starboard side.



Change trim tab angle a little for each test run and repeat the process several times until the best position is found.



① Trim Tab  
② Anti-Ventilation Plate  
③ Steering Pivot (Swivel Shaft)

# 5. Break-In Operation

Break-in operation is needed for the purpose of smoothening sliding surfaces between components such as pistons, piston rings, piston pins, cylinder, and gears.

Break-In Operation...10 Hours

Time	0	10 minutes	2 hours	3 hours	10 hours
Method of break-in operation	Trolling or idling	Throttle Opening: 1/2 of WOT at approximately 3,000 r/min	Throttle Opening: 3/4 of WOT at approximately 4,000 r/min	Throttle Opening: 3/4 of WOT at approximately 4,000 r/min	Regular operation

▽  
Run at the lowest speed.

▽Running at WOT for one minute every 10 minutes is acceptable.

▽Running at WOT for short period is acceptable.

# 6. Test Run

1. Start engine and check if gear shift can be made smoothly.
2. After warming up the engine, read tachometer to check idling engine speeds specified below.



**Idling Engine Speeds :**  
 700 · 800 · 900 r/min

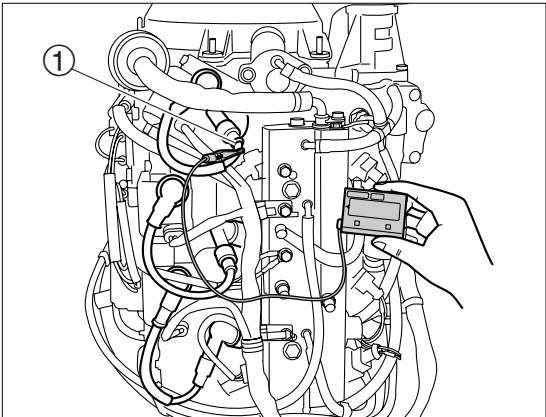
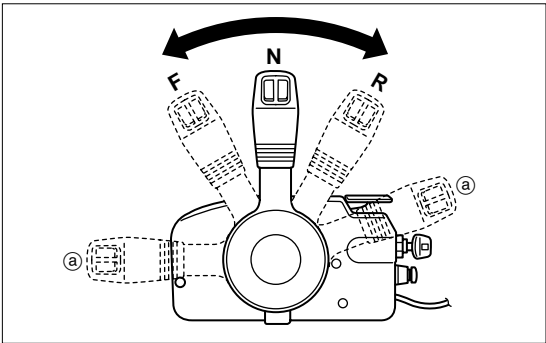

**Tachometer :**  
 P/N. 3AC-99010-0

3. Shift gear into forward (F) and at idle slow for approximately 10 minutes.


**Trolling Engine Speeds :**  
 700 · 800 · 900 r/min

4. Run at 3,000 r/min or half of WOT for initial 2 hours, then at 4,000r/min or 3/4 of WOT for 1 hour.
5. Check that shifting into reverse (R) will not tilt up outboard motor and allow water to run into boat.



 Complete test run during break-in operation.



① High Tension Cable

# 7. Checks After Test Run

1. Check that no water is present in gear oil.


 Gear oil turns to creamy white if mixed with water invading into gear case.

2. Check that no fuel leaks in the cowl.
3. Check that no oil and water leak in the cowl and no water is present in engine oil.
4. After test run, use flushing kit or flushing attachment and fresh water to wash cooling water path by idling engine.



## **Service Information**

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# 2

## Service Data



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<b>1. Outboard Dimensions</b> .....	2-2	<b>4. Maintenance Data</b> .....	2-8
1) Body dimensions .....	2-2	<b>5. Torque Specifications</b> .....	2-14
2) Clamp Dimensions .....	2-3	<b>6. Sealant And Lubricant</b> .....	2-16
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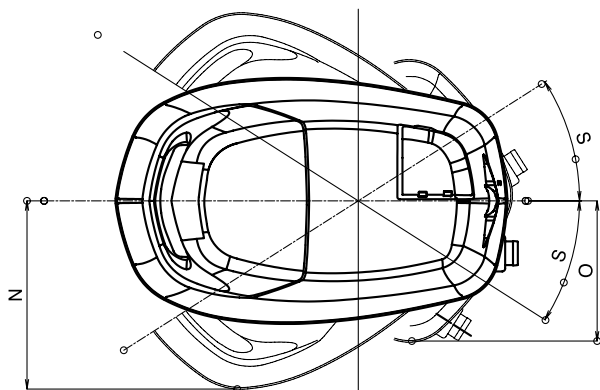
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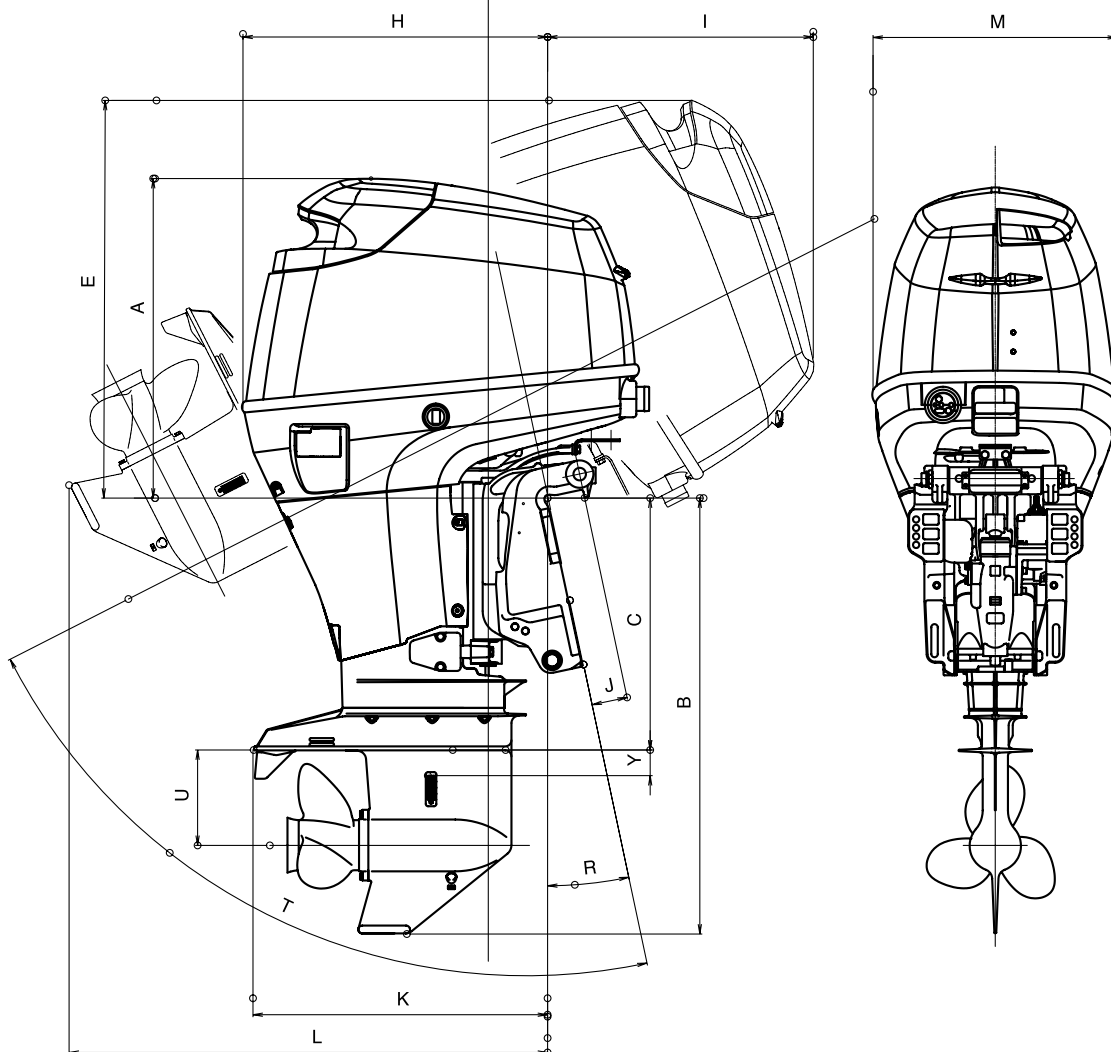
# Service Data

## 1. Outboard Dimensions

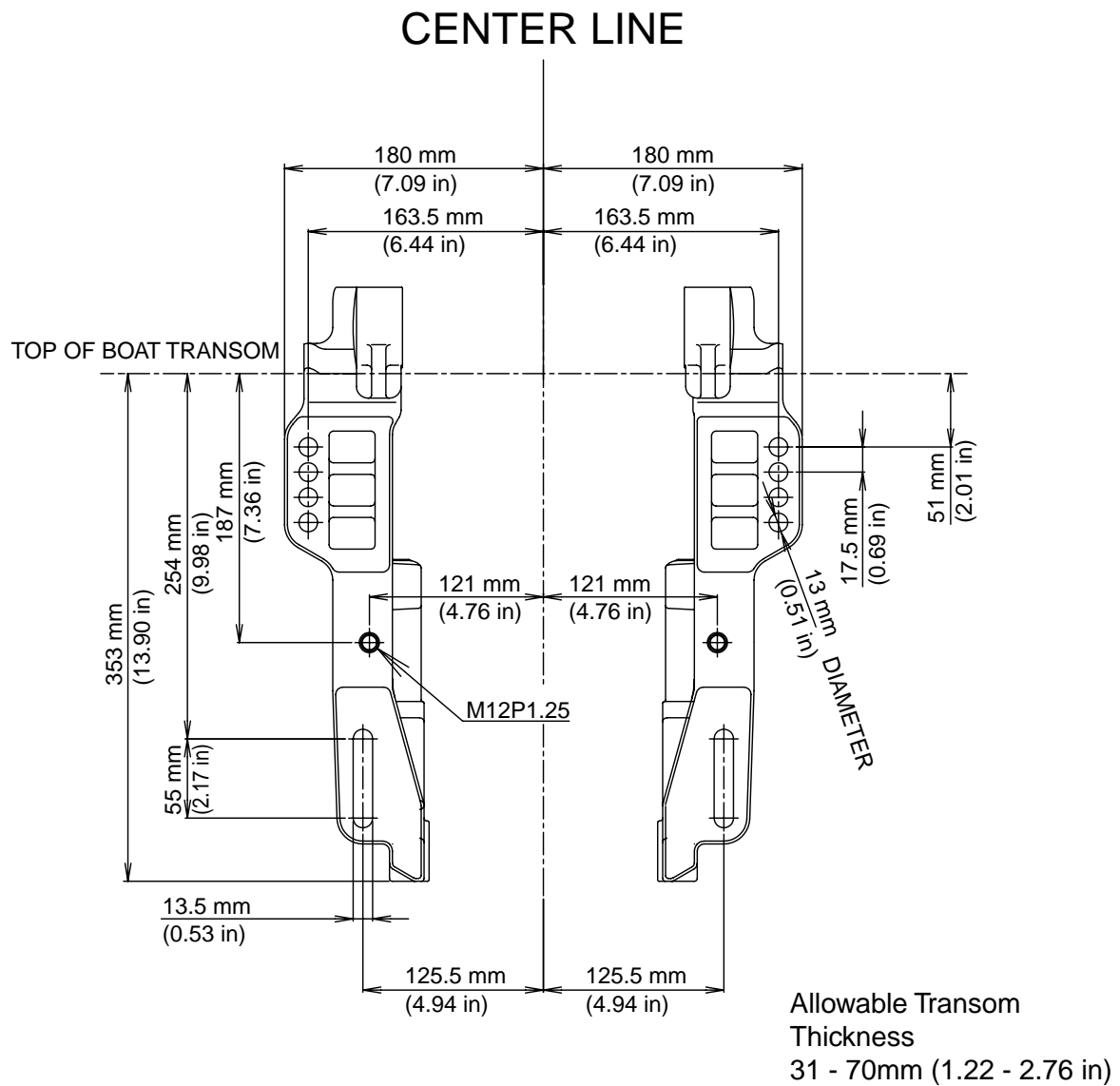
### 1) Body dimensions



Item	Type	Unit	TLDI75/90C2	
			mm	in
A		mm/in	650	25.59
B	Transom (L)	mm/in	890	35.04
	Transom (UL)	mm/in	1017	40.04
C	Transom (L)	mm/in	517	20.35
	Transom (UL)	mm/in	644	25.35
E		mm/in	810	31.89
H		mm/in	623	24.53
I		mm/in	544	21.42
J		mm/in	31~70	1.22~2.76
K		mm/in	598	23.54
L	Transom (L)	mm/in	967	38.07
	Transom (UL)	mm/in	1084	42.68
M		mm/in	508	20.00
N		mm/in	389	15.32
O		mm/in	292	11.50
R		deg.	12	
S		deg.	33	
T		deg.	75	
U		mm/in	194	7.64
Y		mm/in	52	2.05

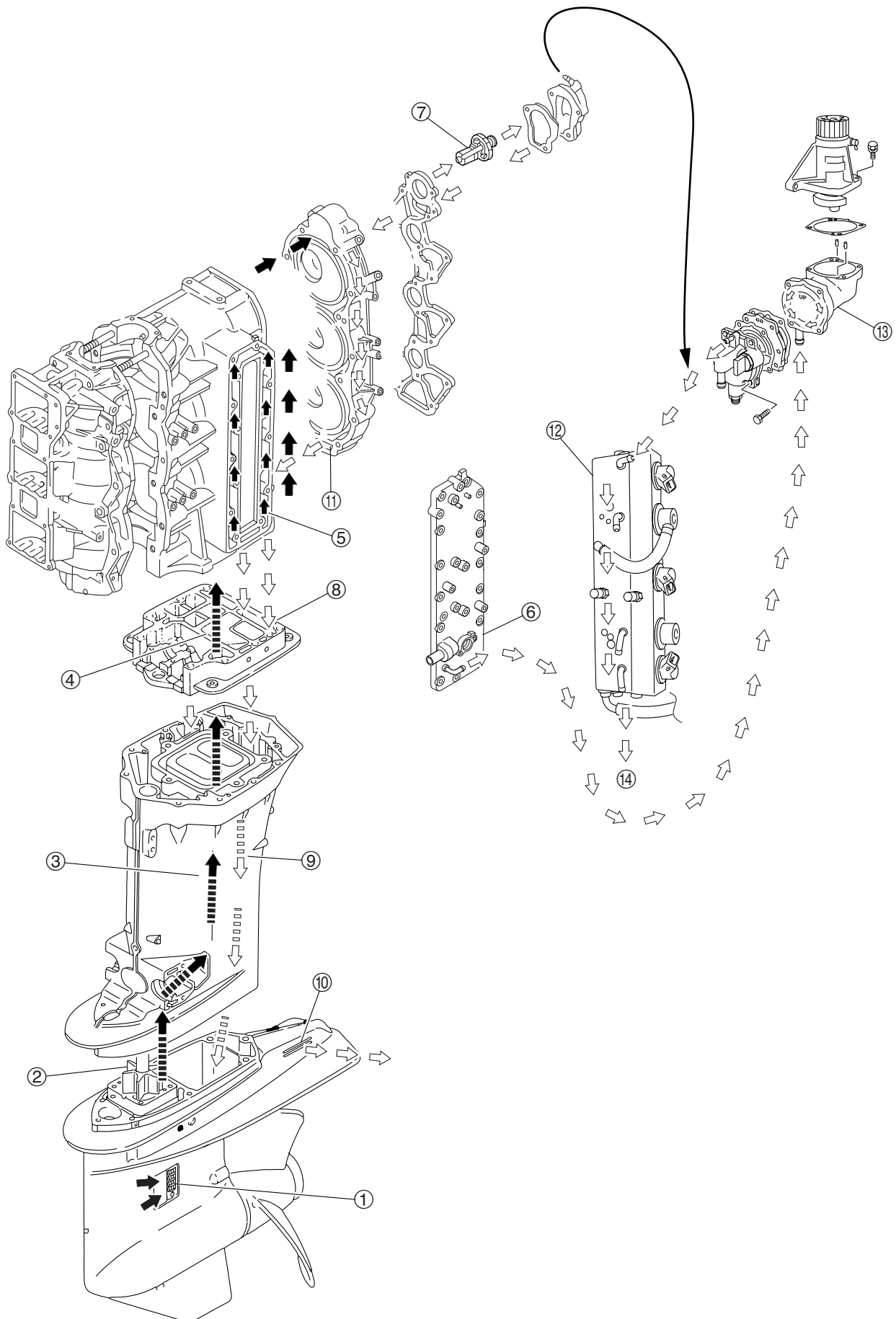


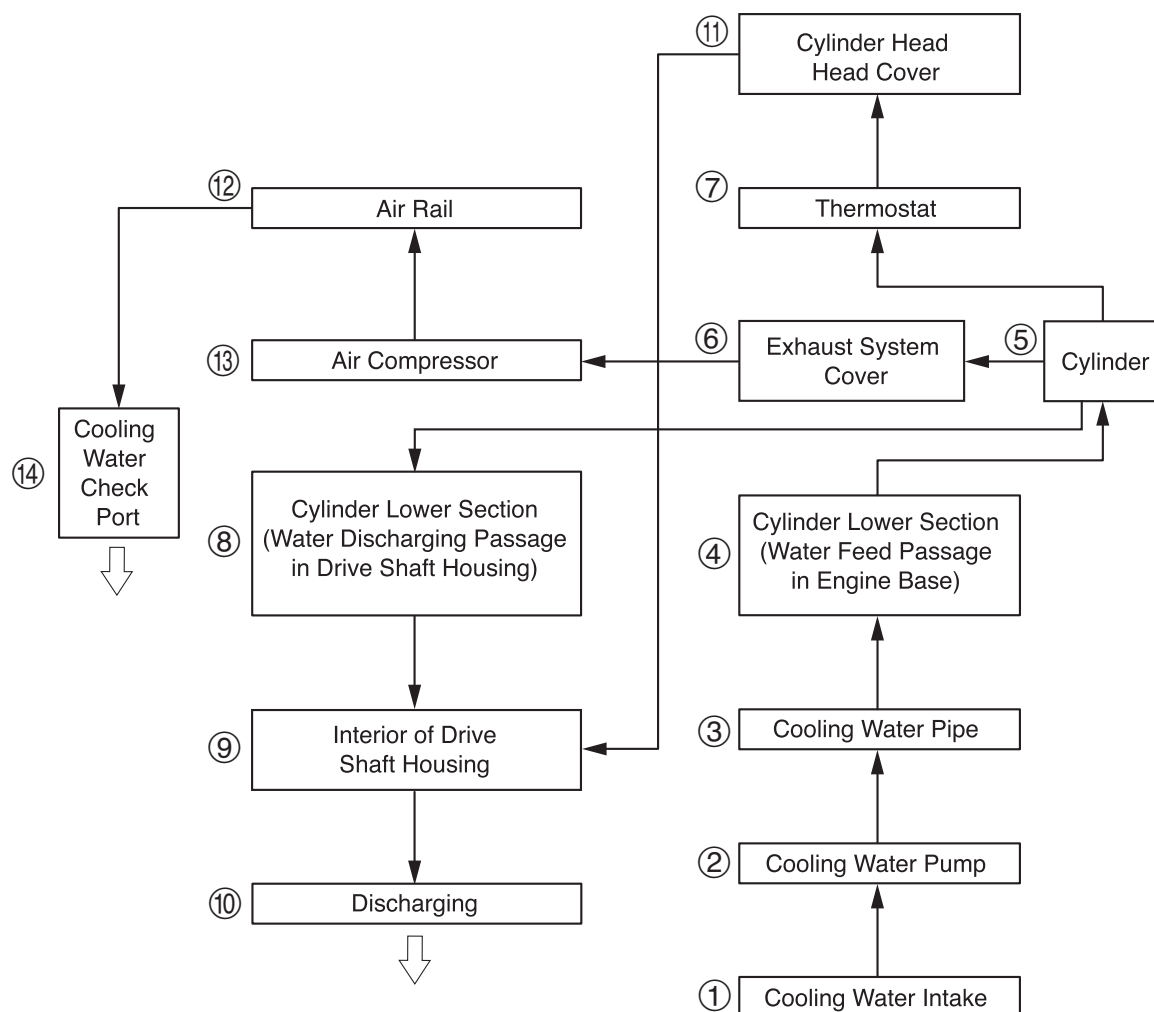
## 2) Clamp Dimensions





## 2. Cooling Water System Diagram







## 3. Specifications

Item	Unit	Model	
		TLDI75C2 EPT0	TLDI90C2 EPT0

### Dimensions (Approximate)

Overall Length		mm (in)	810 (31.89)
Overall Width		mm (in)	508 (20.00)
Overall Height	L	mm (in)	1,540 (60.63)
	UL	mm (in)	1,667 (65.63)
Transom Height	L	mm (in)	517 (20.35)
	UL	mm (in)	644 (25.35)

### Weight (Approximate)

	L	kg (lb)	150 (330)
	UL	kg (lb)	153 (337)

### Performance

Max. Output		kW (ps)	55.2 (75)	66.2 (90)
Revolution range at WOT		r/min	5,150 – 5,850	
Max. Fuel Consumption		L (gal.)/hr	26 (6.87)	30 (7.93)
Idling Revolution (at [N] shift)		r/min	700/800/900	
Trolling Revolution (at [F] shift)		r/min	700/800/900	

### Power Unit

Type of Engine			2 stroke-direct fuel injection (TLDI)
Number of Cylinders			3
Total Displacement		cm <sup>3</sup> (cu in)	1,267 (77)
Bore x Stroke		mm (in)	86 x 72.7 (3.36 x 2.86)
Compression Ratio			6.9 : 1
Compression			Refer : 0.9 MPa (128 psi) [9.2 kgf · cm <sup>2</sup> ]
Gear Shift Operation System			Remote Control
Engine Starting System			Electric Starting
Lubrication System			Auto-Lube (Oil Injection)
Lubricant Control			ECU Control
Cooling Water Control			Thermostat (with pressure relief valve)
Ignition Timing Control			ECU Control
Cooling System			Water Cooling (Impeller type)
Air-Intake System			Reed Valve
Scavenging System			Loop 5 Port
Exhaust System			Thru-Hub Exhaust
Ignition System			Electro-magnetic Induction (Inductive Ignition)
Order of Ignition			1 – 2 – 3
Spark Plug			IZFR6Q [NGK]
Alternator Output			12V – 490W
Battery			12V 100 – 120AH (600 – 700 C.C.A)

Item	Unit	Model	
		TLDI75C2 EPT0	TLDI90C2 EPT0

### Fuel and Oil

Type of Fuel			Unleaded Gasoline (Reserch Octane Number 90 or over, Pump posted Octane Number 87 or over)
Engine oil	Type		Genuine Oil (Oil for two stroke direct injection engine recommended by the outboard manufacturer)
	Quantity	L(gal)	4.3L (1.14 us gal)
Gear oil	Type		Hypoid Gear Oil
	Grade	*1	API
		*1	SAE
	Quantity	cm <sup>3</sup>	900 (30.4 fl.oz)

### Lower Unit

Gear Shift			F – N – R
Gear Ratio			1 : 2.33 (12 : 28)
Type of Gear			Spiral Bevel Gear
Type of Clutch			Dog Clutch
Propeller Shaft Driving Method			Spline
Propeller Rotation			Clockwise at forward (F) shift as view from rear
Propeller			11P, 13P, 15P, 16P, 17P, 19P, 21P

### Bracket

Trim Steps.		Steps	Adjustable
Trim Angle (Transom 12°)	*2	Degrees	-4 – +12
Shallow Water Drive Angle (Transom 12°)	*2	Degrees	Adjustable
Max. Tilt Angle	*3	Degrees	75
Steering Angle	*4	Degrees	33+33
Allowable Transom Board Thickness		mm(in)	31 – 70 (1.22 – 2.75)

\*1 To fill both API and SAE requirements.

\*2 Angle with reference to horizontal propeller shaft when transom angle is 12 degrees

\*3 Tilt operation range

\*4 Angle between full starboard and port steering.



## 4. Maintenance Data

Engine Parts	Description	Item	Standard Values
Cylinder Head		Build up of carbon in combustion chamber	
		Distortion or damage on mating surface	0.03 mm (0.0012in) or less for scratches 0.03 mm (0.0012in) or less for distortion
		Corrosion	
		Cooling water passage clogged	
Cylinder		Mating surface scratches and wear	0.03 mm (0.0012in) or less for scratches 0.03 mm (0.0012in) or less for distortion
		Seizure, cylinder liner damage, or wear	ø86.00 – 86.02 mm <0.5 oversize : ø86.5 mm> ø3.3858 – 3.3866in <0.0197 in oversize : ø3.4055 in>
		Deposits in water jacket	
		Engine anode	
Piston		Diameter <Measure the external diameter at a point 11.5mm (0.45 in) above the lower edge of the piston skirt.>	ø85.85 mm <0.5 oversize : ø86.35 mm> *Value with piston coating
		Piston clearance <The gap between cylinder and piston.>	0.13 – 0.20 mm (0.0051 – 0.0079 in) *Value with piston coating
		Carbon build up on piston crown and in ring grooves	
		Scratch on the sliding surface	
		Measure clearance between piston ring and ring groove.	Top : 0.04 – 0.08 mm (0.0016 – 0.0032 in) Second : 0.04 – 0.08 mm (0.0016 – 0.0032 in) Second : 0.04 – 0.08 mm (0.0016 – 0.0032 in)
		Measure piston pin hole diameter	ø23.00 mm (ø0.9055 in)
		Clearance between piston pin and pin hole	0.015 – 0.025 mm (0.00059 – 0.00098 in)
Piston Rings		Ring end gap Note: Measurement of ring end gap ; If ring gauge is not available, use cylinder bore top or bottom with small wear.	Top : 0.25 – 0.40 mm (0.0098 – 0.0157 in) Second : 0.25 – 0.40 mm (0.0098 – 0.0157 in) Third : 0.25 – 0.40 mm (0.0098 – 0.0157 in)
Piston Pin		Outer diameter	ø23.00 mm (0.9056 in)
Crank Shaft		Deflection <Measure with both ends supported.>	0.05 mm (0.0020 in) or less
		Bearing external diameter	Upper area of #1 : ø36.0 mm (1.4173 in) #1 – 2, #2 – 3 : ø35.0 mm (1.3780 in) Lower area of #3 : ø40.0 mm (1.574 in)
		Oil seal scratches	
Connecting Rod		Loose rod	
		Small end inner diameter	ø28.00 mm (1.102 in)
		Small end area side gap	0.20 – 0.55 mm (0.0079 – 0.0217 in)
Reed Valve Stopper		Lift height	9.2 – 9.4 mm (0.362 – 0.370 in)
Reed Valve		Fails to close, is worn or damaged	
Engine Block		Compression Note: Remove all spark plugs and measure after warming with the throttle fully open and safety lanyard removed.	0.9 MPa (128 psi) [9.2 kgf/cm <sup>2</sup> ]



Functional Limit	Action To Be Taken
	Clean and remove build up.
Scratches or deflection of 0.03mm (0.0012 in)	Repair by polishing the surface plate, starting with #240 to #400 grit sandpaper and finishing with #600 grit sandpaper. Replace if over specified limit.
	Repair or replace depending on the extent of damage.
	Clean and remove obstruction.
Scratches or deflection of 0.03 mm (0.0012 in)	Repair by polishing the surface plate, starting with #240 to #400 grit sandpaper and finishing with #600 grit sandpaper. Replace if over specified limit.
ø86.08 mm (3.3890 in) When the cylinder liner cannot be repaired using #400 to #600 grit sandpaper due to deep scratching or scuffing to the sliding surface in contact with the piston or when the difference between the minimum and maximum points of wear in the liner bore is 0.06 mm (0.0024 in) or more.	Bore and hone to 0.5 oversize piston diameter. Check ports and grind if necessary. (Use 0.5 oversize pistons and piston rings.) Replace if over specified limit.
	Clean and remove build up.
	Replace if excessively worn.
ø85.79 mm (ø3.3776 in)	Replace if less than specified limit.
0.30 mm (0.0118 in)	Replace if over specified limit.
	Clean and remove build up.
	Repair or replace depending on the extent of damage. (Repair using #400 to #600 grit sandpaper.)
0.10 mm (0.0039 in)	Replace if over specified limit.
ø23.03 mm (0.9067 in)	
0.040 mm (0.0016 in)	
0.80 mm (0.0315 in) 0.80 mm (0.0315 in) 0.80 mm (0.0315 in)	Replace if over specified limit.
ø22.97 mm (0.9045 in)	Replace if less than specified limit.
0.05 mm (0.0020 in)	Replace with new crankshaft assembly. Replace if over specified limit.
Abnormally wear or damage	Replace with new part.
2 mm (0.08 in)	Replace if over specified limit.
When the difference in standard value	Replace with new part.
When the end reed valve fails to close Excessive wear on valve seat Valve is damaged	Replace entire valve assembly.
When the difference in compression between cylinders exceeds 0.1 MPa (14.9 psi) [1.05 kg/cm <sup>2</sup> ] When abnormally higher than standard value	Remove carbon from piston crown and cylinder head. Bore and hone to 0.5 mm (0.020 in) oversize piston diameter. Check ports and grind if necessary. (Use 0.5 oversize pistons and piston rings.)



# Service Data

	Description	Item	Standard Values									
Engine Parts	Air Rail	Wear and damage on O-rings										
	Air Regulator	Air pressure	0.65 MPa (94.3 psi) [6.5 kgf/cm <sup>2</sup> ] ±10%									
	Fuel Regulator	Fuel pressure	Measured air pressure + 0.07 MPa (10.1 psi ) [0.71kgf/cm <sup>2</sup> ] ±10%									
	Vapor Separator	Seal ring wear and damage										
		Float										
	Air Compressor	Cylinder bore	50.00 — 50.02 mm (1.9685 — 1.9694 in)									
		Piston diameter <maximum diameter> <Measure at a point 10mm(0.394 in) above the lower edge of the piston skirt.>	49.96 — 48.98 mm (1.9670 — 1.9677 in)									
		Piston ring end gap	Top : 0.10 — 0.25 mm (0.004 — 0.010 in) Second : 0.10 — 0.25 mm (0.004 — 0.010 in)									
		Reed valve tip clearance	0.2 mm (0.008 in) or less									
	Drive Belt	Tension and appearance	Tension : 100 — 150N (Tension measuring instrument by Yunitta)									
Electrical Parts	Ignition Coil	Primary coil resistance (between L — B/R, B/W, B/G, B/L lines)	0.4 — 0.6 Ω 20°C (68°F)									
		Secondary coil resistance (between high tension cord and B line)	6.8 — 10.2 kΩ 20°C (68°F) *10.8 — 16.2 kΩ ( With spark plug cap)									
	Spark Plug Cap	Resistance	3.75 — 6.25 kΩ 20°C (68°F)									
	Engine Control Unit (ECU)	Low-speed ESG trigger	App. 3,000 r/min									
		High-speed ESG trigger	App. 6,000 r/min									
	Magnetor (Alternator)	Alternator (max.)	490W									
		Charging performance	700 r/min 12V — 17.5A or more 6000 r/min 12V — 39A or more									
		Charge coil resistance <Y—Y—Y wire>	0.12 — 0.19 Ω @20°C (68°F)									
	Spark Plug	Standard plug	IZFR6Q [NGK]									
		Plug gap	0.7 mm — 0.8 mm (0.029 — 0.032 in)									
	Air Injector	Resistance between terminals	1.2 — 1.4 Ω 20°C (68°F)									
		Operating condition										
	Fuel Injector	Resistance between terminals	1.7 — 1.9 Ω 20°C (68°F)									
	Fuel Feed Pump (FFP)	Wear and damage on seals and grommets										
		Operating condition										
	Crank-position Sensor	Gap with encoder ring <flywheel>	0.7 — 1.0 mm (0.028 — 0.039 in)									
		Pickup coil resistance value <L/B wire to G/R wire>	425 — 637 Ω 20°C (68°F)									
	Throttle Position Sensor (TPS)	Measured values of resistance between connector terminals	Between upper and lower terminals: 4.0 — 6.0 kΩ Between upper and middle terminals: resistance value <table><tr><td></td><td>Fully closed</td><td>Fully opened</td></tr><tr><td>TPS1</td><td>4 — 5</td><td>0.5 — 1</td></tr><tr><td>TPS2</td><td>0.5 — 1</td><td>4 — 5</td></tr></table>		Fully closed	Fully opened	TPS1	4 — 5	0.5 — 1	TPS2	0.5 — 1	4 — 5
		Fully closed	Fully opened									
	TPS1	4 — 5	0.5 — 1									
	TPS2	0.5 — 1	4 — 5									
	Water Temperature Sensor	Resistance between terminals	0.91 — 1.37 kΩ 20°C (68°F) 0.13 — 0.19 kΩ 100°C (212°F)									
	Oil Level Sensor	Resistance between terminals	Sensor ON position : ∞ Sensor OFF position : 0 Ω									
	MAT Sensor (option)	Resistance between terminals	2.21 — 2.70 Ω 20°C (68°F) 0.30 — 0.35 Ω 80°C (176°F)									
	Rectifiers	Resistance between terminals	Refer to tester checkpoint table (refer to chapter 8)									
	Electric Oil Pump	Resistance between terminals	1.84 — 2.08 Ω 20°C (68°F)									
	Stator Motor	Output	12 V 1.4 kW									
Brush length		16 mm (0.62 in)										
Commutator undercut		0.5 — 0.8 mm (0.020 — 0.032 in)										
Commutator outer diameter		29 mm (1.14 in)										
Starter Solenoid	Rated voltage	12V (DC)										
	Rated timing	30sec (80A)										
	Exciting current	4A or less										
	Exciting coil resistance	3.52 - 5.28 Ω										
Fuse	Capacity	15A X 1, 25A X 1, 30A X 1										
Power Relay	Resistance between terminals	90 — 110 Ω										
MAP Sensor (option)	Output	3.1 — 4.6 V@25°C (77°F)										

\*The spark plug cap (5kΩ resistance) is assembled to the ignition coil with an adhesive agent.

Functional Limit	Action To Be Taken
When parts are worn or damaged	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
When parts are worn or damaged	Replace with new part.
When parts show deterioration or contamination by fuel	
When parts are worn or damaged	Replace with new part.
When parts are worn, damaged or stretched out of shape	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
1) 0.9mm (0.036 in)	Repair so that parts conform to standard values.
2) When electrodes show excessive wear	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
No clicking sound when 12 volts is applied to the terminal	
When parts no longer conform to standard values	Replace with new part.
When parts are worn or damaged	Replace with new part.
No clicking sound when 12 volts is applied to the terminal	
When parts no longer conform to standard values	Repair so that parts conform to standard values.
When the resistance value between upper and lower connectors $\infty\Omega$ or $0\Omega$ When the resistance value between upper and middle connectors becomes erratic	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
When parts no longer conform to standard values	Replace with new part.
12 mm (0.47 in)	Replace if less than specified limit.
0.2 mm (0.008 in)	
28 mm (1.102 in)	
	Replace with new part.
When the fuse burns out	After repairing the cause of the burn-out, replace with a new fuse.
When parts no longer conform to standard values	Replace with new part.
When parts no longer conform to standard values	Replace with new part.



# Service Data

	Description	Item	Standard Values
Power Trim & Tilt Parts	Pump Assembly	Relief valve opening pressure	Tilted up : 8.8 — 11.8 MPa (1,281 — 1,707 psi) [90 — 120 kgf/cm <sup>2</sup> ] Tilted down : 3.9 — 7.4 MPa (569 — 1,067 psi) [40 — 75 kgf/cm <sup>2</sup> ]
		Spool check valve opening pressure	Upper chest : 0.24 MPa (34.1 psi) [2.4 kgf/cm <sup>2</sup> ] Lower chest : 0.12 MPa (17.1 psi) [1.2 kgf/cm <sup>2</sup> ]
		Oil capacity	682cm <sup>3</sup> (23.1 fl.oz)
		Recommended oil type	ATF <DEXRON III>
		Oil filter	150 mesh
	Trim Cylinder	Piston diameter	38.0 mm (1.496 in)
		Piston rod diameter	17.8 mm (0.701 in)
		Stroke	96.9 mm (3.815 in)
	Tilt Cylinder	Shock absorber valve opening pressure	14.7 — 18.6 MPa (150 — 190 kgf/cm <sup>2</sup> ) 2134 — 2703 psi
		Piston diameter	45.0 mm (1.772 in)
		Piston rod diameter	19.0 mm (0.748 in)
		Stroke	157.3 mm (6.193 in)
	PTT Motor	Rated timing	60 sec.
		Rated voltage	12 V (DC)
		Output	400 W
		Direction of rotation	Forward / Reverse
	PTT Solenoid (UP/DN)	Rated voltage	12V (DC)
		Rated timing	60sec
		Exciting current	4A or less
		Exciting coil resistance	4.16 — 6.24 Ω
Cooling System	Thermostat	Opening and closing of thermostat valve	With wax type Pressure Relief Valve (PRV) Valve start temperature: 60°C (140°F) Valve full-open temperature: 75°C (167°F) or higher
	Pump Impeller	Wear and cracks	
	Pump Case Liner	Wear	
	Guide Plate	Wear	
	Anode	Corrosion	
Lower Unit	Propeller Shaft	Damage to bearing	
		Wear on lip of oil seal	
		Backlash between bevel gears	
	Drive Shaft	Damage to bearing	
		Shaft runout	0.3 mm (0.012 in) or less <Using both center holes for reference>
		Wear on lip of oil seal	
Other	Propeller	Wear, warping, cracking, chipping	
	Oil Seales	Wear, damage	

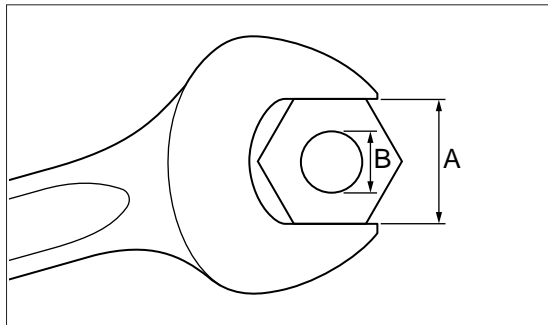
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## 5. Torque Specifications

	Tightening Location	Wrench A	Screw B x Pitch	Type of Fastner	Temporary Driving Torque			Driving Torque			Remarks
					N · m	lb · ft	kgf · m	N · m	lb · ft	kgf · m	
Engine	Cylinder Head Cover	10	M6 x 1.0	Bolt	②2.0	1.4	0.2	④6.0	4	0.6	Driving sequence ①→②→③→④
	Cylinder Head Cover & Cylinder Head	13	M8 x 1.25	Bolt	①12	9	1.2	③32	23	3.2	
	Crankcase	13	M8 x 1.25	Bolt	②13	9	1.3	④25	18	2.5	Driving sequence ①→②→③→④
		17	M10 x 1.25	Bolt	①20	14	2.0	③40	29	4.0	
		17	M10 x 1.25	Nut	①20	14	2.0	③40	29	4.0	
	Compressor Head	10	M6 x 1.0	Bolt	—	—	—	9	7	0.9	
	Air Box	10	M6 x 1.0	Bolt	—	—	—	9	7	0.9	
	Throttle Body	10	M6 x 1.0	Bolt	—	—	—	9	7	0.9	
	Water Temp Sensor	19	—	—	—	—	—	22	16	2.2	
	Driven Pulley	17	M10 x 1.25	Nut	—	—	—	50	36	5.0	
	Drive Pulley (Flywheel Nut)	30	M18 x 1.5	Nut	—	—	—	260	190	26.0	
	Spark Plug	16	M12 x 1.25	—	—	—	—	25	18	2.5	
	Hose Joint Adapter (FFP)	17	—	—	—	—	—	15	11	1.5	
	Hose Joint Nut (Air Compressor)	17	—	—	—	—	—	15	11	1.5	
Lower Unit	Engine Mount Bolt (Engine Base & Drive Shaft Housing)	13	M8 x 1.25	Bolt	—	—	—	25	18	2.5	
	Exhaust Pipe	10	M6 x 1.0	Bolt	—	—	—	11	8	1.1	
	Shift Lever Shaft Holder	13	M8 x 1.25	Bolt	—	—	—	7	5	0.7	
	Mount Rubber (Upper)	17	7/16-20UNF	Bolt	—	—	—	45	33	4.5	
	Mount Rubber (Lower)	17	M12 x 1.25	Nut	—	—	—	32	23	3.2	
	Stern Bracket	32	7/8-14UNF	Nylon Nut	—	—	—	25	18	2.5	
	Gear Case	13	M8 x 1.25	Bolt	—	—	—	25	18	2.5	
		14	M10 x 1.25	Bolt	—	—	—	40	29	4.0	
	Pinion Gear (B Gear)	22	M16 x 1.5	Nut	—	—	—	110	80	11.0	
	Propeller Shaft Housing	13	M8 x 1.25	Bolt	—	—	—	25	18	2.5	
	Cable Joint Nut	8	10-32UNF	Nut	—	—	—	1.5	1.1	0.15	

Tightening Location		Wrench A	Screw B x Pitch	Type of Fastner	Temporary Driving Torque			Driving Torque			Remarks
					N · m	lb · ft	kgf · m	N · m	lb · ft	kgf · m	
Power Trim & Tilt	Oil Reserve Tank Installation Bolt	3/8	1/4-20UNC	Bolt	—	—	—	5	4	0.5	
	Oil Reserve Cap	—	—	—	—	—	—	7	5	0.7	
	Manual Valve	—	—	—	—	—	—	3	2	0.3	
	Tilt Motor Ass'y Bolt	3/8	1/4-20UNC	Bolt	—	—	—	4	3	0.4	
	Gear Pump Bolt	1/4	5/16-18UNC	Cap Bolt	—	—	—	9	7	0.9	
	Trim Rod Guide	—	—	—	—	—	—	80	58	8.0	
	Tilt Rod Guide	—	—	—	—	—	—	130	94	13.0	
Standard Torque	M4			—	—	—	—	1.5	1.1	0.15	
	M5			—	—	—	—	3	2	0.3	
	M6			—	—	—	—	6	4	0.6	
	M8			—	—	—	—	13	9	1.3	
	M10			—	—	—	—	27	20	2.7	





# Service Data

## 6. Sealant And Lubricant

	Applied to	Remarks													
		PTT Fluid													
		Tohatsu genuine Gear Oil													
		Tohatsu genuine 2st Engine Oil													
		Molybdenum Grease MOL													
		Silicone Grease SOC													
		Teflon grease TEF													
		Waterproof Grease OBM													
		Low Temperature Resistant Lithium Grease LIT													
		Instantaneous Adhesive													
		Adhesive													
		Gasket Seal Agent													
		High Strength Screw Lock Agent													
		Low Strength Screw Lock Agent													
		ThreeBond													
		Loctite													
		Korishi													
		Three Bond													
		Centax L2													
		FM-531													
		LM-902													
		KS-64													
		SUMICO													
		500													
		ATF ("1)													
Engine Block	Piston														Ring grooves and outer circumference (Piston pin outer circumference)
	Piston Pin														Piston pin holes
	Piston Ring														
	Cylinder Liner														Inner wall
	Small End Bearing														Sliding faces
	Big End Bearing														Sliding faces
	Main Bearing Upper														Sliding faces
	Main Bearing Center														Sliding faces
	Main Bearing Lower														Sliding faces
	Small End Bearing Washer														Sliding faces
	Big End Bearing Washer														Sliding faces
	Seal Ring														Sliding faces
	Main Bearing Upper Oil Seal														Lip area
	Crank Shaft Lower Oil Seal														Lip area (Oil seal in the crank case head)
	Drive Shaft Oil Seal														Lip area (Oil seal in the crank case head)
	Crank Case Head O Ring														
	Air Chamber Bolt														
	Throttle Body Bolt														
	Cylinder-Crank Case Mating Surface														Be careful of application thickness.
	Water Temp. Sensor														a : Apply to O Ring b : Terminal
	High Tension Cord														a : Plug cap side, b : Ignition coil side
	Spark Plug Cap														Interior
	Advancer Arm														Sliding section
	Throttle Cam														Sliding section
	Throttle Cam Bolt														
	Throttle Cam Boal Joint														
	Shift Arm														Sliding section
	Ball Joint Cap														Sliding section
	Cable Joint (Shift Arm Section)														Sliding section
	Rectifier Bolt														
	Starter Motor														a : Pinion section, b : Terminal section, c : Planetary Gear
	Solenoid Switches (Starter Motor, 2 locations)														Terminal section
	Solenoid Switches (PTT, 6 locations)														Terminal section
	ECU Mount Rubber														ECU mounting section (3 locations)



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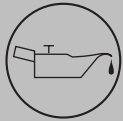

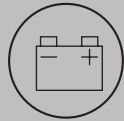
# Service Data

Applied to		Remarks																												
		PTT Fluid		Tohatsu genuine Gear Oil		Tohatsu genuine 2st Engine Oil		Molybdenum Grease MOL		Silicone Grease SOC		Teflon grease TEF		Waterproof Grease OBM		Low Temperature Resistant Lithium Grease LIT		Instantaneous Adhesive		Adhesive		Gasket Seal Agent		High Strength Screw Lock Agent		Low-Strength Screw Lock Agent				
		ATF (T1)																												
Lower Unit	Shift Lever Shaft Holder Mounting Bolt	○																											Screw section	
	Shift Lever Shaft Holder																												Sliding section and interior (small amount)	
	Exhaust Housing Grommet																													
	Extension Housing Bolt	○																												Below neck
	Seal Rubber (for Apron)																													
	Drive Shaft																													Engine side spline section
	Pinion Gear (B Gear) Nut	○																												After degreasing screw section completely
	Forward Thrust Washer																													Taper section
	Cam Rod Bushing																													Whole circumference
	Cam Rod Bushing O Ring 1.9-6.8																													
	Cam Rod Bushing O Ring 3.5-27.7																													
	Cam Rod Bushing Stopper Bolt																													Below neck
	Gear Case Plate Screw	○																												Screw section
	Trim Tab Mounting Bolt																													Stub bolt thread section
	Gear Case Lubrication Oil																													Oil q'ty : 900cm <sup>3</sup> 30.4 fl.oz
	Gear Case Bolt																													Below neck
	Pump Case (Lower)																													Inside
	Pump Case O Ring																													
	Pump Case Oil Seal																													Lip area
	Pump Case Bolt																													Below neck
	Water Pipe Grommet Upper Seal Rubber																													Inner face
	Water Pipe Grommet Lower Seal Rubber																													a : Case mounting section, b : Inner face
	Water Pipe Grommet Guide Rubber																													Whole face
	Pump Case Liner																													Thinly on the inner face
	Propeller Shaft Housing																													Inside
	Propeller Shaft Housing O Ring																													
	Propeller Shaft Oil Seal																													Lip area
	Propeller Shaft																													Spline section
	Propeller Shaft Housing Bolt	○																												Below neck

Applied to		Remarks													
PTT Fluid	ATF (*1)														
Tohatsu genuine Gear Oil															
Tohatsu genuine 2st Engine Oil															
Molybdenum Grease MOL															
Silicone Grease SOC															
Teflon grease TEF															
Waterproof Grease OBM															
Low Temperature Resistant Lithium Grease LIT															
Instantaneous Adhesive															
Adhesive															
Gasket Seal Agent															
High Strength Screw Lock Agent															
Low Strength Screw Lock Agent															
		ThreeBond	Loctite	Koniishi	Three Bond	Centax L2	CHUO YUKA	Shinetsu Silicones	SUMICO						
		1342	1373B	518	G17	1741	FM-531	LM-902	KS-64	500					
Stern Bracket Components	Bracket Bolt						○								Fill with grease
	Bracket Bolt Cap						○								Inner surface
	Stern Bracket Washer						○								Both faces
	Swivel Bracket						○								Fill interior with grease
	Steering Shaft						○								Sliding section
	Steering Shaft Bushing						○								Sliding section
	Steering Shaft Sealing						○								
	Thrust Plate						○								Sliding section
	Upper Mounting Bolt	○													Screw section
	Lower Mounting Bolt		a○				b○								a : Screw section, b : Outer circumference
	Mounting Bracket						○								Spline section
	Tilt Stopper						○								Sliding section
Bottom Cowl	Hook Lever						○								Sliding section
	Hook Lever Bushing						○								Sliding sections (Both upper and lower)
	Hook Lever O Ring						○								
	Hook Lever Bolt	○													Screw section
Top Cowl	Filler Lid Seal Rubber					○									
PT/T Components	PTT Trim Receiver						○								Head section
	PTT Upper Cylinder Pin						○								
	Tilt Rod Nut	○													Screw section
	PTT Assembly Bolt						○								Below neck
	Trim Rod Nut	○													
	PTT Sensor Bolt	○													Screw section
	PTT Switch								○						Terminal section
	PTT Oil											○			*1 Oil equivalent to ATF DEXRON III
Remote Control Components	Bolt (Shift Lever)	○													Screw section
	Shift Lever						○								Sliding section
	Shift Rod Grommet						○								Rod hole
	Bushing 10.2-12-29.5						○								
	Drag Link						○								Sliding section
	Control Box						○								Sliding section
Nipples		○													Press-fit section



## 7. Warning Indication List • • • Display for abnormalities during operation

Warning Indicators				ESG Speed Control (※1)
Buzzer Sounding	 Indicator A	 Indicator B	 Indicator C	
Continuous	x	x	x	High speed ESG
Intermittent (3 beeps for every 2 minutes)	Flashing	x	x	-
Continuous	x	Flashing	x	Low speed ESG
Continuous	x	Flashing	x	Forced idling
Continuous	x	Flashing	x	-
Continuous	x	Flashing	x	Low speed ESG
-	x	x	Flashing	Low speed ESG
-	x	x	Flashing	-
-	Flashing	Flashing	Flashing	Low speed ESG
-	Flashing	Flashing	Flashing	Engine stop
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	Forced idling
-	Flashing	Flashing	Flashing	Low speed ESG
-	Flashing	Flashing	Flashing	Forced idling
-	Flashing	Flashing	Flashing	Low speed ESG
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
Intermittent (3 beeps for every 2 minutes)	Flashing	Flashing	Flashing	Forced idling

Fault Description	Reference	Remedy
Engine over-rev.	Approx. 6,000 r/min	Readjust propeller, outboard engine mounting height and/or trim.
Low oil level	Approx. 1.1L or less	Replenish engine oil in tank.
Cooling water temp. high	85°C (185°F)	Refer to troubleshooting.
Engine cooling water temp. abnormally high	90°C (194°F)	
Air compressor cooling water temp. high	90°C (194°F)	
Air compressor cooling water temp. abnormally high	100°C (212°F)	
Battery voltage abnormally low	Approx. 9V or less	
Battery voltage low	Approx. 10V or less	
Battery voltage high	Approx. 18V or over	Refer to fault indication table.  *1.ESG speed control · High speed ESG : Regulated to approx. 6,000 rpm. · Low speed ESG : Regulated to approx. 3,000 rpm. Approx. · Forced idling : Regulated to idling speed  *2.TPS : Throttle Position Sensor  *3.FFP : Fuel Feed Pump (Electric)  *4.CPS : Crank Position Sensor
Battery voltage abnormally high	Approx. 20V or over	
TPS (*2) Idling position faulty		
TPS malfunction (2)	TPS1 and TPS2	
TPS malfunction (1)	TPS1 or TPS2	
TPS power supply malfunction (2)	TPS1 and TPS2	
TPS power supply malfunction (1)	TPS1 or TPS2	
Air injector malfunction		
Fuel injector malfunction		
Ignition coil malfunction		
FFP (*3) malfunction		
CPS (*4) malfunction		
Temp. sensor malfunction	Engine or air compressor	
MAP sensor malfunction		
MAP sensor malfunction		
Main power relay malfunction		
Oil pump malfunction		



## Service Data

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## 3

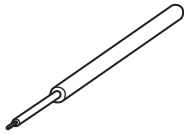
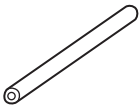
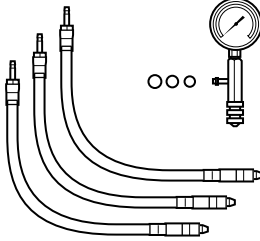
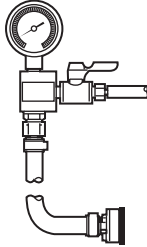
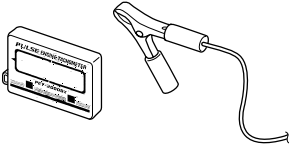
## Maintenance



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## 1. Special Tools

			
Spring Pin Tool A (ø3.5) P/N. 369-72217-0	Spring Pin Tool B (ø3.5) P/N. 369-72218-0	Compression Gauge P/N. 3AC-99030-0	Pressure Gauge Ass'y P/N. 3T5-72880-0
Removing spring pin	Installing spring pin	Measuring compression pressure	Measuring air rail fuel pressure and air pressure
			
Tachometer P/N. 3AC-99010-0			
Measuring engine revolution speed			



## 2. Inspection Schedule

Section	Inspection Part	Inspection Period					Inspection Item	Remarks
		Initial 20 hours or initial 1 month	50 hours or Every 3 months	100 hours or Every 6 months	200 hours or Every year	Every 2 years		
Fuel System and Compression System	Fuel Filter	○	○	○	○	○	Inspection and filter cleaning	
	High Pressure Fuel Filter		○	○	○	Replace	Inspection	Cartridge type
	Piping	○	○	○	○	Replace	Damage Damage and leak through joints	
	Air Filter				○	Replace	Inspection	
	Drive Belt				○	Replace	Inspection	
	Fuel Pressure				○	○		
	Air Pressure				○	○		
Ignition System	Spark Plugs	○		○	○	○	Spark gap, and carbon cleaning	Gap 0.7 — 0.8 mm (0.029 — 0.032 in)
Starting System	Starter Motor			○	○	○	Adhesion of salt, and battery cables	
	Battery	○	○	○	○	○	Installation, electrolyte level, specific gravity	
Oil System	Oil Tank	○		○	○	○	Oil leak, damage	
	Oil Pipe	○		○	○	○	Clip existence, location	
	Oil Filter	○		○	○	○	Filter cleaning	
Lower System	Propeller	○	○	○	○	○	Blade Bent, damage, wear	
	Gear Oil	○ Replace	○	○ Replace	○ Replace	○ Replace	Replace oil or replenish Check water leak	Gear oil (GL5, SAE80 — 90)
	Water Pump		○	○	Replace	Replace	Impeller and liner wear and crack	
Others	Thermostat			○	○	○	Foreign substance in the gap, defective operation	
	Warning System		○	○	○	○	Inspection	
	PTT Unit	○		○	○	○	Oil check and replenish	
	Bolts and Nuts	○	○		○	○	Retighten	
	Sliding and Rotating Areas	○	○	○	○	○	Greasing	
	Grease Nipple	○	○	○	○	○	grease	
	Anode		○	○	○	○	Deterioration, corrosion	

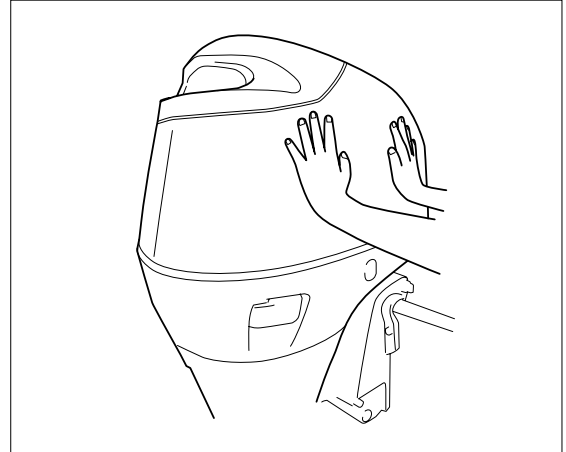
Note : It is recommended to perform complete inspection every 300 hours of operation.



## 3. Inspection Items

### 1) Inspection of Top Cowl

1. Push top cowl using both hands to check for looseness and state of closing.

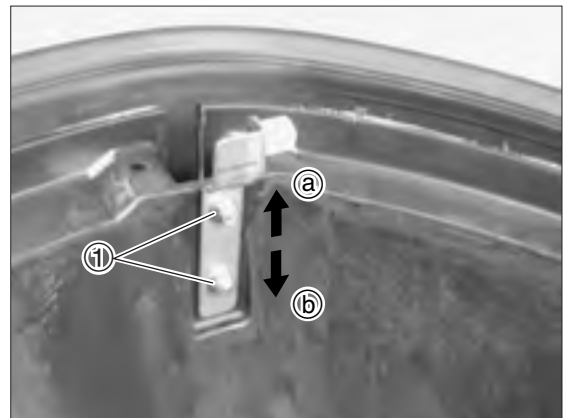


2. Loosen cover stay securing nuts ①, adjust fit of cowl, and then, tighten the nuts.



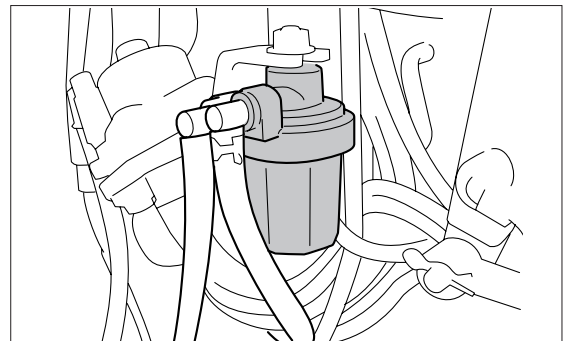
Turn toward ① to loosen cowl.

Turn toward ② to tighten cowl.



### 2) Oil Filter and Oil Tank

1. Only clean if debris, water, or contamination is present.  
If cleaned then you must bleed the oil system.
2. Reinstall oil tank and fill the tank with fresh oil.
3. Set outboard motor to vertical position, and check amount of engine oil.  
Refer to "Check quantity of engine oil" in Chapter 1.  
Replenish if necessary.

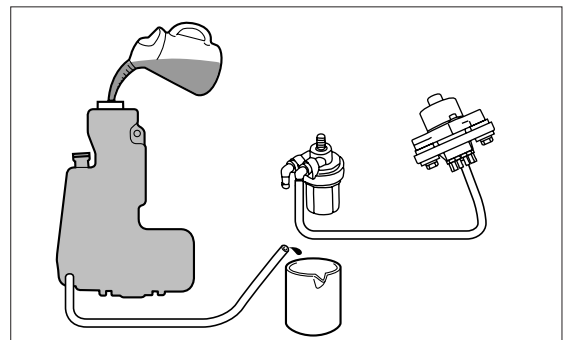


### 3) Air Bleeding

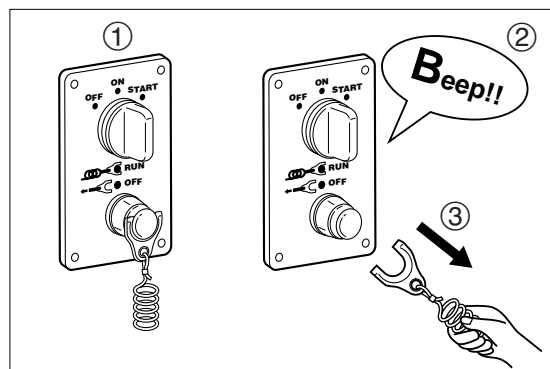
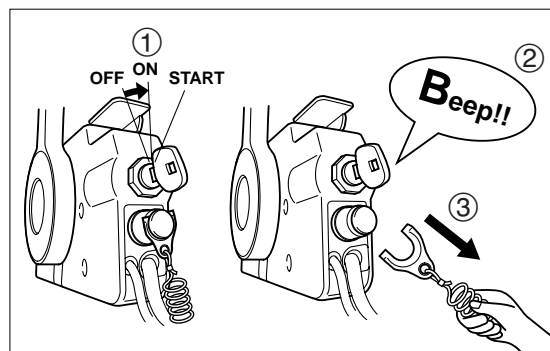
#### ⚠ CAUTION

**Put the drained oil in a vessel to prevent it from spreading on the machine.**

1. Visually check if any air is found in the oil line from oil tank to cylinder block, and if any air is found, bleed the air by using the following procedure.
2. Fill oil tank.
3. Disconnect oil filter inlet hose, and then reconnect the hose when oil containing no air bubbles flows out.



4. Set key switch ① a to "ON".
5. Pull off lock plate ③ within one second from the moment warning buzzer ② stops.



6. Pull stop switch ④ twice within two seconds.

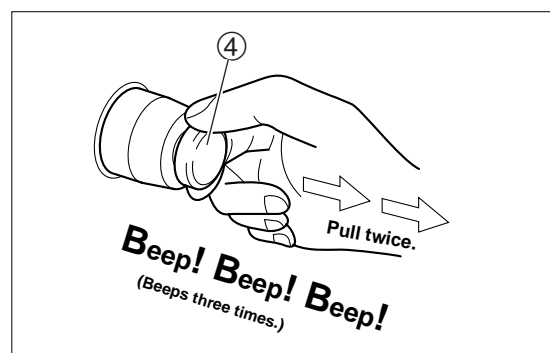


When the above operation is completed, the buzzer sounds three times and oil pump starts to run. If the buzzer does not sounds three times, set the key switch to "OFF" and repeat the above steps.

7. The oil pump continues to operate to feed oil. When air is bled from the oil, set the key switch to "OFF".



The oil pump stops automatically at approximately one minute.

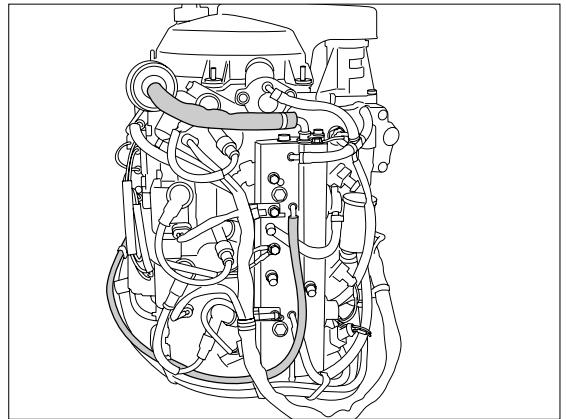
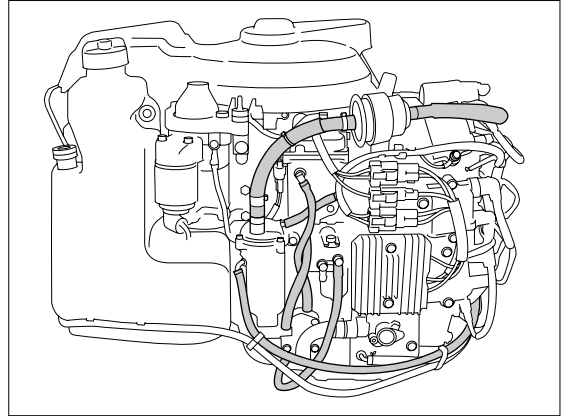




## 4. Fuel System

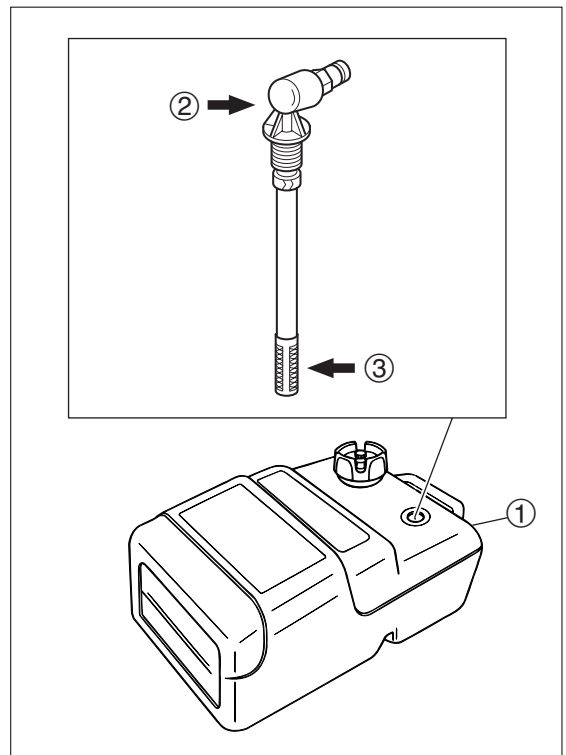
### 1) Inspection of Fuel Pipes and Joints

Check the fuel system piping for fuel leak, dirt, deterioration and damage, and replace or clean parts if necessary.



### 2) Inspection of Fuel Tank (option)

Turn fuel pick up elbow ② of fuel tank ① counterclockwise to remove the part, and clean the filter ③. Remove dirt and water from fuel tank ① if any.



- ② Fuel pickup elbow
- ③ Filter

### 3) Inspection of Low Pressure Fuel Filter

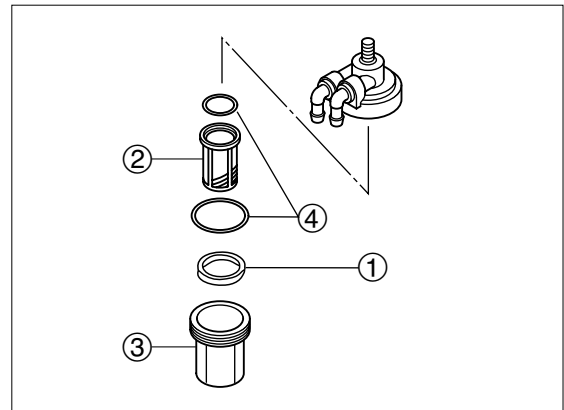
#### ⚠ CAUTION

- If red float ① is floating in the filter, water is in the cup.
- Remove the cup and drain the water.

Check fuel filter ② for contamination, and fuel filter cup ③ for invasion of foreign matter and cracks. Clean fuel filter cup with gasoline, and replace fuel filter ② if necessary.



Since the high pressure fuel filter is disposable, replace it periodically.



④ O Ring **Do not reuse.**

### 4) Inspection of Air Compressor Air Filter

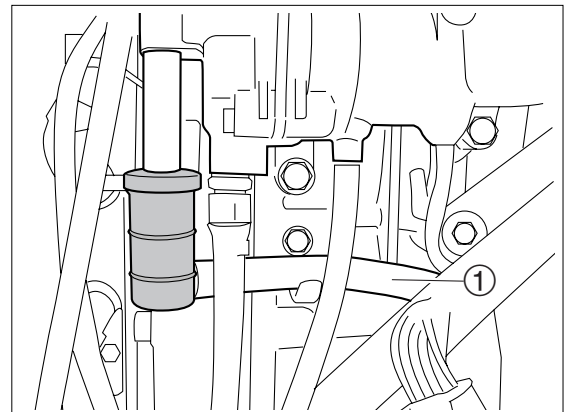
#### ⚠ CAUTION

**Continuing engine operation with the air filter clogged will lead to severe trouble of engine speed and power.**

1. Replace the air filter if it is severely clogged.



- The paper strainer of air filter turns brownish when it is clogged. Replace the part if it is brownish.
- Be sure to attach the filter air inlet pipe ①, because it is for prevention of noise.



### 5) Inspection of Air Pressure

#### ⚠ CAUTION

**When attaching the pressure gauge ass'y, screw in carefully until it is set securely.**

1. Remove cap ①.
2. Attach pressure gauge ass'y ② to air pressure inspection valve ③.



**Pressure gauge ass'y:**  
P/N. 3T5-72880-0

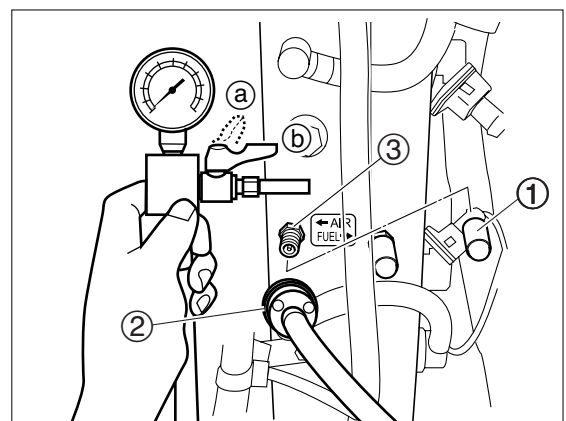
3. Set the lever of pressure gauge ass'y to position ①.
4. Measure air pressure while idling the engine or cranking for 15 seconds.



The air pressure reduces gradually after stopping the engine or cranking.



**Air Pressure : Specified Value**  
0.61 - 0.70 MPa (88.47 - 101.53 psi) [6.1 - 7.0 kgf/cm<sup>2</sup>]





# Maintenance

5. Set the lever of pressure gauge ass'y to position ② to relief pressure, after engine stopping.
6. Remove pressure gauge ass'y and attach cap.

## 6) Inspection of Fuel Pressure

### ⚠ CAUTION

**When attaching pressure gauge ass'y, cover the joint of inspection valve and gauge with rag to prevent spread of fuel that leaks.**

**Screw in the pressure gauge carefully until it is set securely.**

1. Remove cap.
2. Attach pressure gauge ass'y to fuel pressure inspection valve ①.



**Pressure Gauge Ass'y:**  
P/N. 3T5-72880-0

3. Set the lever of pressure gauge ass'y to position ①.
4. Measure fuel pressure while idling the engine or cranking for 15 seconds.

### ⚠ WARNING

**Do not move the lever of the gauge during the measurement. Moving the lever causes highly pressurized fuel to blast out, which is very dangerous.**



The fuel pressure reduces gradually after stopping the engine or cranking.



#### Fuel Pressure : Specified Value

0.67 MPa - 0.78 MPa (97.17 - 113.13 psi) [6.7 - 7.8 kgf/cm<sup>2</sup>]

Measured Air Pressure + 0.07 MPa (10.1 psi) [0.71 kgf/cm<sup>2</sup>] ±10%

5. Set the lever of pressure gauge ass'y to position ② to relief pressure, after engine stopping.

### ⚠ CAUTION

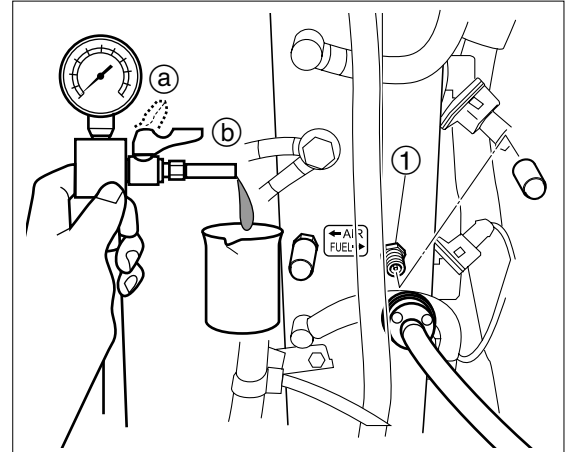
**When depressuring, collect fuel that spills from the tip of the gauge.**

6. Remove gauge.

### ⚠ CAUTION

**Be careful not to let the fuel in the gauge leak when removing the gauge.**

7. Attach the cap.



## 7) Inspection of Drive Belt

1. Remove ring gear cover.

### **⚠ DANGER**

**Make sure to check engine stopped.**

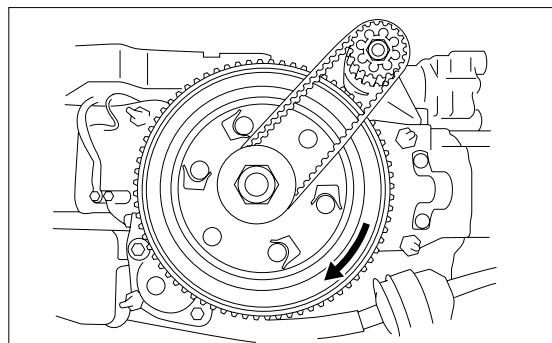


2. Check drive belt for wear and damage on the inner and outer faces while turning flywheel clockwise. Check if oil or dirt is adhered to the belt.

Replace with new one if any of the problems exists.



For replacement of drive belt, refer to "Removing Drive Belt" in Chapter 4.



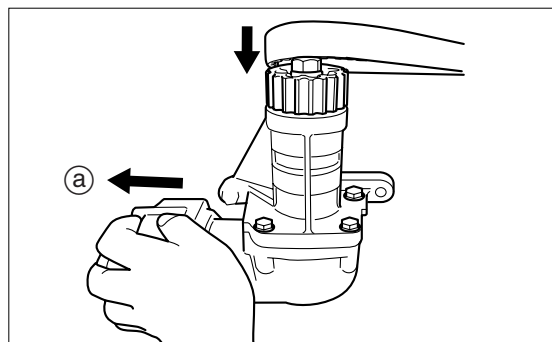
**3**

## 8) Adjustment of Drive Belt Tension

### **⚠ CAUTION**

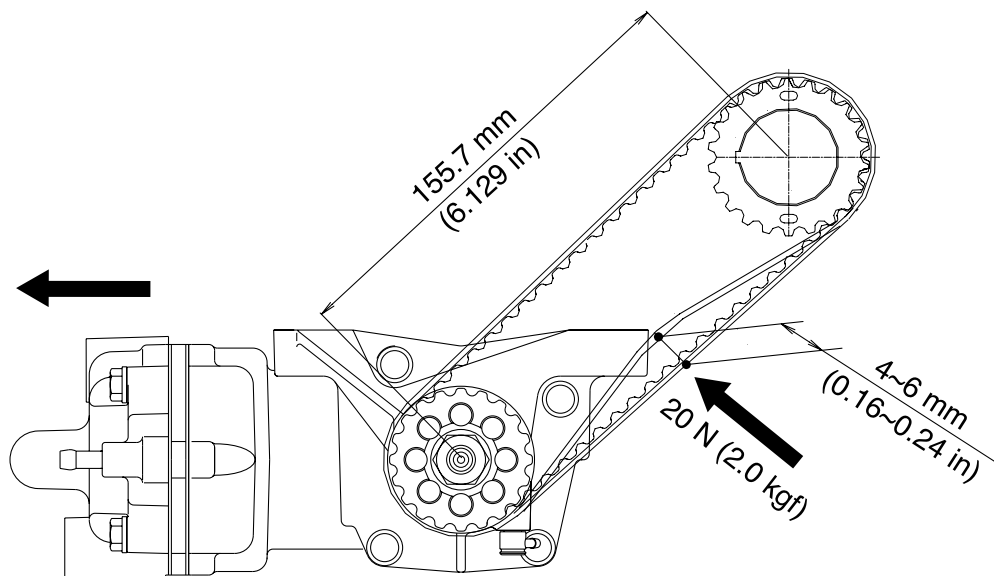
- Be careful that oil or grease does not adhere to the belt.
- Perform belt tension adjustment when the engine is cold.

1. Loosen compressor securing bolts.
2. While pushing compressor toward cylinder head (a), tighten the securing bolts to fix the compressor.



### **Deflection of Belt:**

4 - 6 mm (0.16 - 0.24 in) when pushing the belt with 20 N (2.0 kg) .

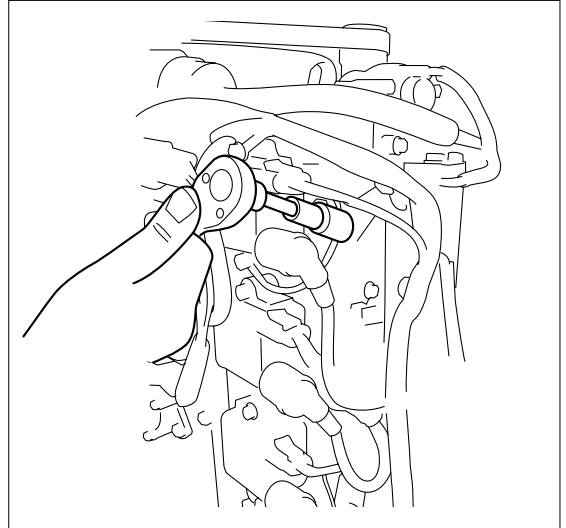




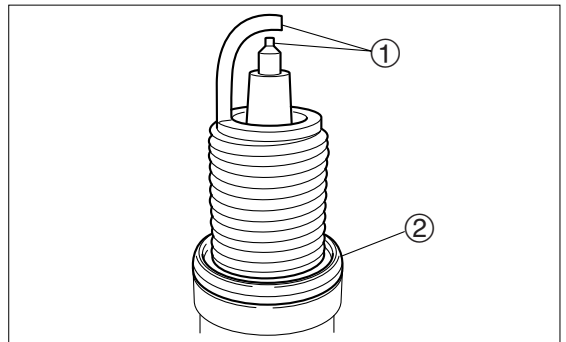
## 5. Power Unit

### 1) Inspection of Spark Plugs

1. Remove plug caps and then spark plugs.



2. Clean spark plug electrodes ① by using spark plug cleaner. Replace if necessary.
3. Check electrodes ① for corrosion or excessive build up of carbon, and washer ② for damage. Replace if necessary.
4. Check spark plug gap ③. Replace if it is over specified value. Adjust gap if it is out of specified range.

**Spark Plug Gap ③: Standard Value**

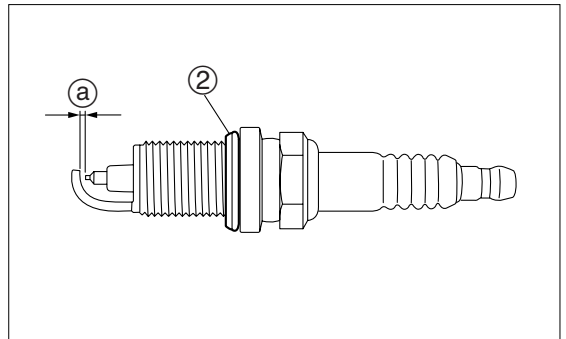
0.7 - 0.8 mm (0.029 - 0.032 in)

**Functional Limit:**

0.9 mm (0.036 in)

**Specified Spark Plug:**

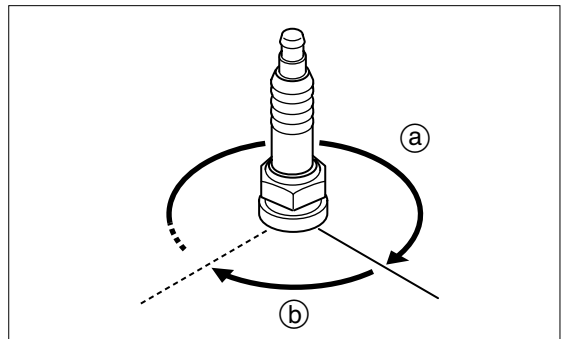
IZFR6Q [NGK]



5. Install spark plug, fully hand-tighten ④, and then use plug wrench to tighten to specified torque ⑤.

**Spark Plug:**

25 N · m (18 lb · ft) [2.5 kgf · m]





## 2) Inspection of Compression Pressure

### CAUTION

- To prevent accidental start of the engine, remove lock plate (of stop switch lanyard) from stop switch before measuring compression pressure.
- Clean areas around spark plugs on the cylinder before removing spark plugs to prevent dirt from entering cylinder.

1. Start and idle engine for 5 minutes to warm up, and then stop.
2. Shift gear into neutral (N).
3. Remove lock plate (of stop switch lanyard) from stop switch.
4. Remove all spark plug caps and then all spark plugs ①.
5. Install compression gauge to plug hole.



#### Compression Gauge:

P/N. 3AC-99030-0

6. Set free throttle lever to full open position, crank engine until compression gauge indication stabilizes, and then measure compression pressure.



#### Compression Pressure (Reference):

0.9 MPa (128 psi) [9.2 kgf/cm<sup>2</sup>]



Compression pressure is affected much by cranking speed, and normally changes in the range from 10% to 20%. Charge the battery if low.

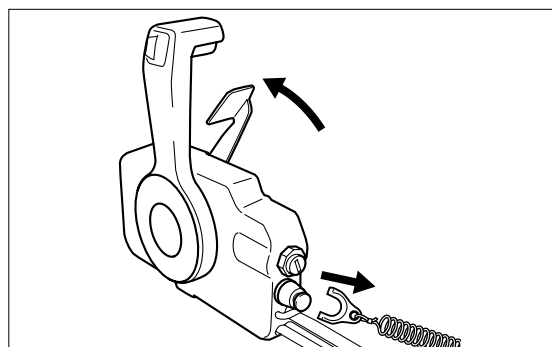
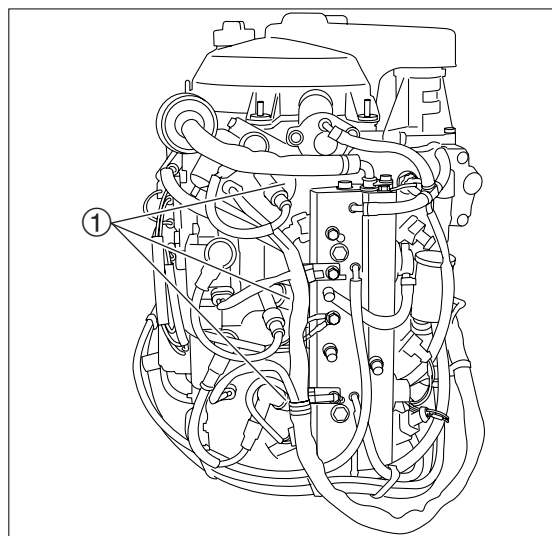
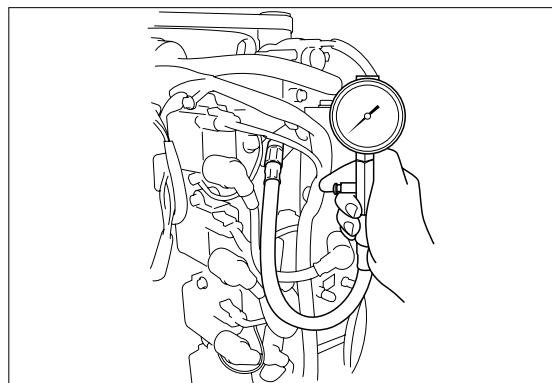
7. If compression pressure is below specified value or varies much among cylinders, put small amount of engine oil into cylinders, and perform the test again.



- If compression pressure increases after the above measure, check pistons and piston rings for wear. Replace if necessary.
- If compression pressure does not increase, check air injector O-ring and disc spring condition.
- Check cylinder head gasket if the compression pressure does not rise. Adjust or replace if necessary.

If any of the following results is obtained by the measurement, it is necessary to repair or replace relevant part(s).

- The measurement is lower than specified value,
- Different between compression pressure of the cylinders exceeds; 0.105 MPa (15 psi) [1.05 kgf/cm<sup>2</sup>], or
- The measurement is abnormally higher than specified value.

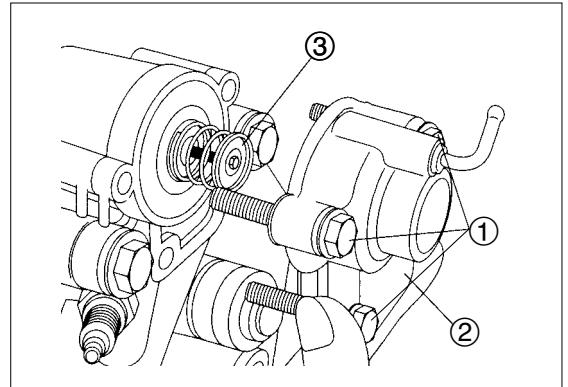
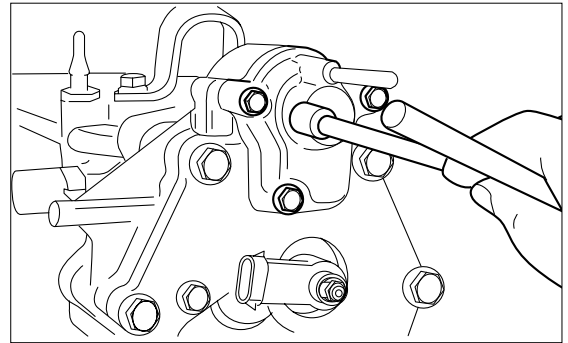




# Maintenance

## 3) Inspection of Thermostat

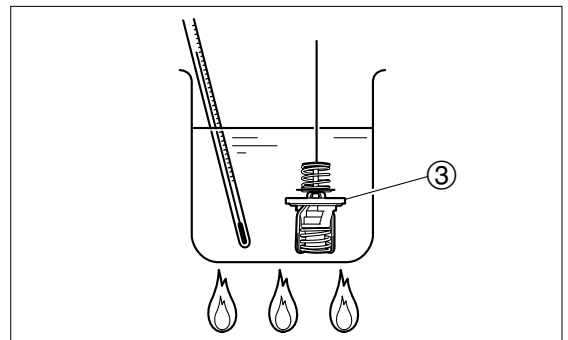
1. Remove air rail.
2. Loosen cover installation bolts ①, remove them, and then remove cover ② and thermostat ③.



3. Hang thermostat ③ in the water contained in vessel.
4. Put thermometer in the water, and warm up water to measure valve opening temperature.



Put a piece of thread in the closed valve gap and hang it in the water. Valve opening moment can be known when thermostat is released to drop due to opening with rise of temperature.

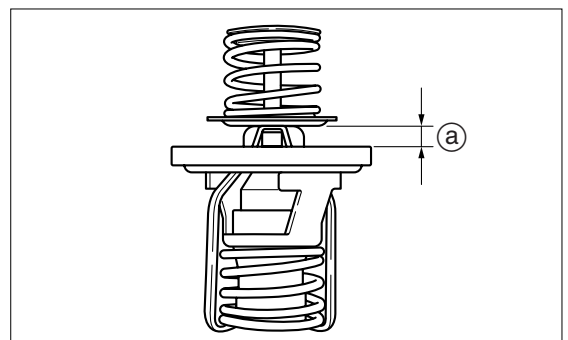


**Valve Opening Temperature:**  
60°C (140°F)

5. Measure valve lift ① of thermostat when prescribed temperature has been reached. Replace if the length is less than specified value.



Water Temperature	Valve Lift ①
75°C (167°F)	4.5 mm (0.177 in) or more



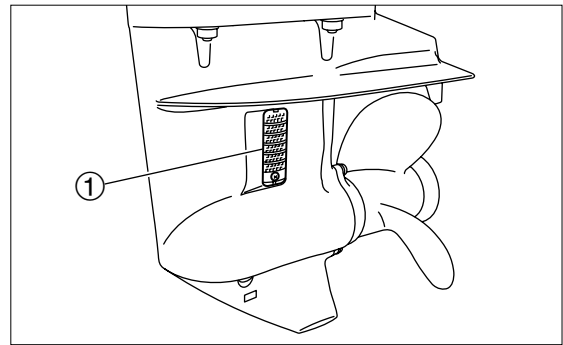
6. Install thermostat, new gasket and cover.



**Thermostat Cover Bolt:**  
6 N · m (4 lb · ft) [0.6 kgf · m]

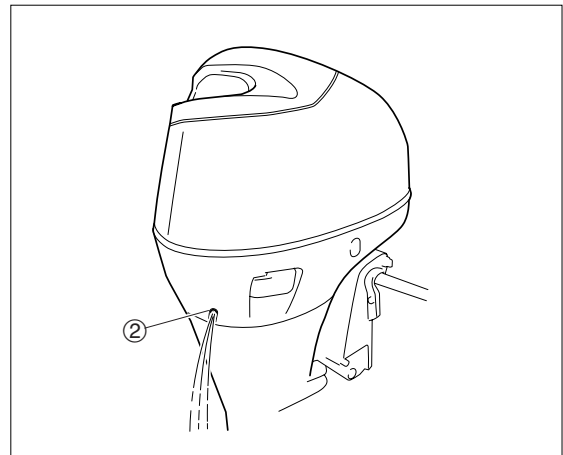
## 4) Inspection of Cooling Water Passage

1. Check cooling water intake for clog. Clean if necessary.



2. Set lower unit in the water and start engine.

3. Check that cooling water check port ② ejects water.

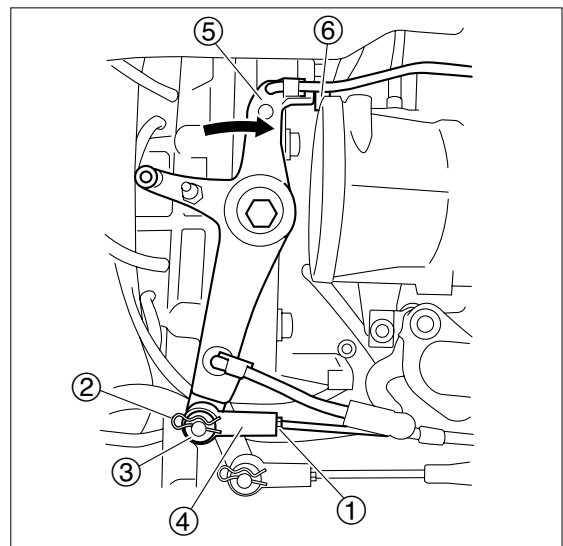


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## 6. Operating System

### 1) Adjustment of Throttle Cable

1. Loosen lock nut ①.
2. Remove "R" shaped pin ② and washer ③.
3. Remove cable joint ④ from advancer arm ⑤.
4. Bring advancer arm ⑤ to full close stopper ⑥.
5. Set remote control lever to neutral (N) position ⑦.
6. Adjust cable joint screw-in length so that the pin of advancer arm is aligned with the hole of cable joint ④.

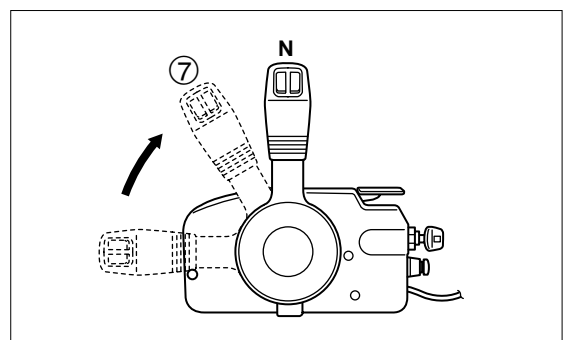


**⚠ CAUTION**

**Adjust cable joint screw-in length ⑧ to 10mm (0.39in) or over.**



Adjust the cable joint so that advancer arm pushes the full close stopper a little.



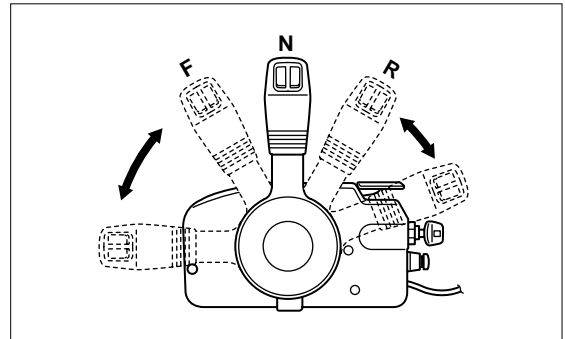


# Maintenance

7. Attach cable joint, washer and “R” shaped pin to advancer arm.
8. Check if throttle control can be made smoothly. If necessary, readjust by following the steps 1 to 7. Make sure the cable pushes the throttle arm against the stop at WOT in forward against.

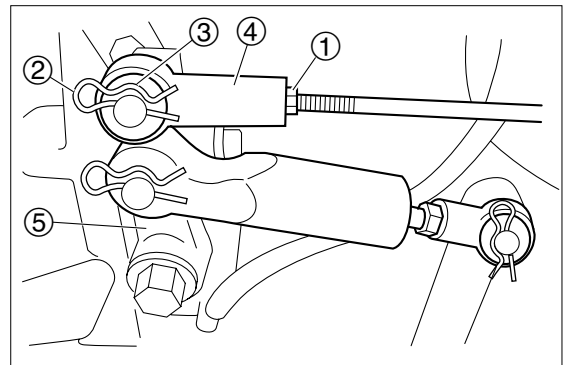
## ⚠ CAUTION

**TPS error occurs if advancer arm does not touch the full close stopper when remote control lever is at throttle full close position.**  
**Refer to Chapter “10” for resetting the error.**



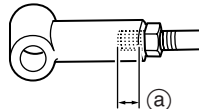
## 2) Adjustment of Shift Cable

1. Loosen lock nut ①.
2. Remove “R” shaped pin ② and washer ③.
3. Remove cable joint ④ from shift arm ⑤.
4. Set shift lever to neutral position (N).
5. Set remote control lever to neutral position (N).
6. Adjust cable joint screw-in length so that the pin of shift arm is aligned with the hole of cable joint.

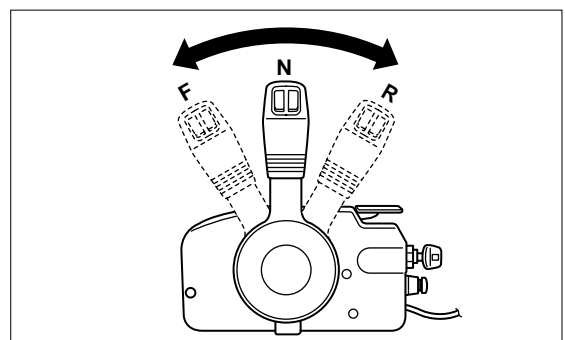
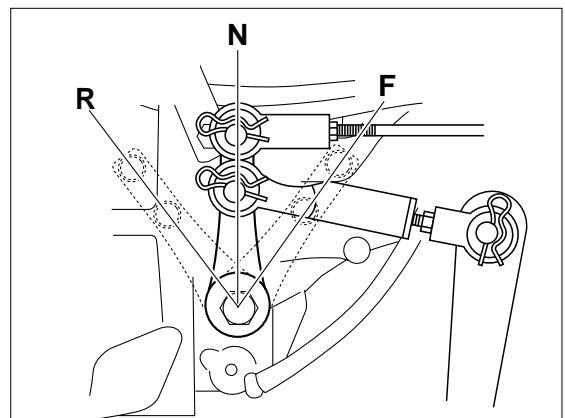


## ⚠ CAUTION

**Adjust cable and cable joint screw-in length**  
**Ⓐ to 10mm (0.39m) or over.**



7. Attach cable joint, washer and “R” shaped pin to advancer arm.
8. Check if shift control can be made smoothly. If necessary, readjust by following the steps 1 to 7.



### 3) Inspection of Idle Engine Speed

1. Start engine and run for 5 minutes to warm up.
2. Attach tachometer to high tension cord ① to check idle speed.



- More accurate and stable reading can be obtained when tachometer lead is connected with high tension cords of individual cylinders linked with each other.
- Idle engine speed that is set at variable trolling is maintained. Idle speed is changed by depressing key switch while idling.



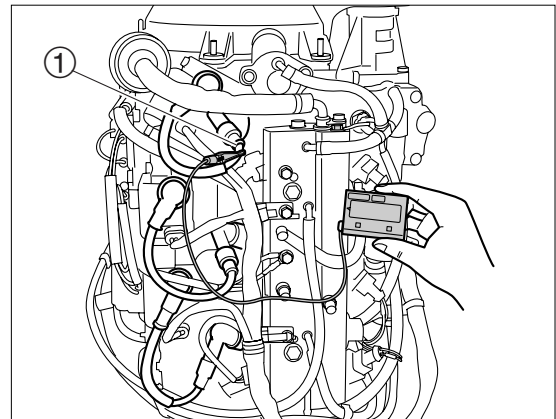
#### Tachometer :

P/N. 3AC-99010-0



#### Idle Speed :

700 · 800 · 900 r/min



① High tension cord

3

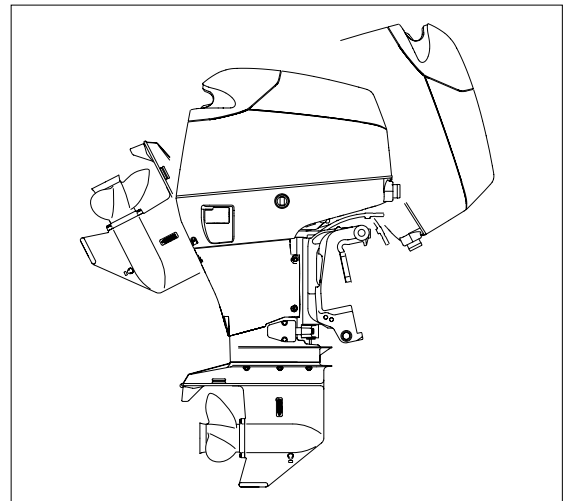
## 7. PTT System

### 1) Inspection of PTT Unit Operation

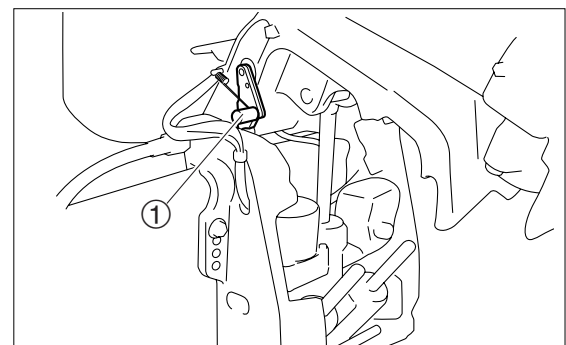
1. Tilt up and down outboard motor several times to check that unit operates smoothly in full range. Check PTT fluid quantity if necessary. Refer to "Inspection of PTT Fluid Quantity".



- Check that PTT motor produces noise of normal revolution.



2. Fully tilt up outboard motor, lock with tilt stopper ①, and check that stopper ① lock mechanism functions normally.

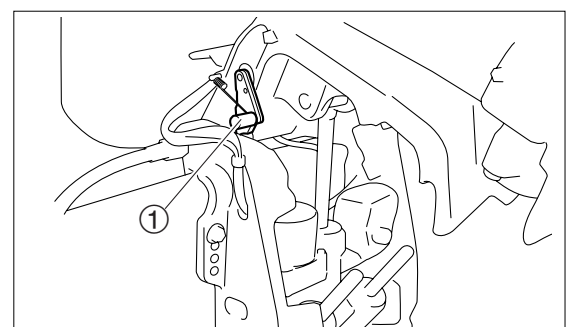


### 2) Inspection of PTT Fluid Quantity

#### ⚠ WARNING

**Be sure to lock outboard motor with tilt stopper after tilting up. Danger! Outboard motor may come down if hydraulic pressure of PTT unit reduces accidentally.**

1. Fully tilt up outboard motor and lock with tilt stopper ①.





# Maintenance

2. Remove cap ② and check PTT fluid quantity.

## ⚠ CAUTION

**Be sure to remove the cap when outboard motor is in full tilt up position. Removal of the cap in other than full tilt up position may cause the fluid to blast out.**



Quantity of PTT fluid is normal when some fluid spills out of cap hole when cap is removed.

3. Replenish to the specified quantity if the fluid lacks.



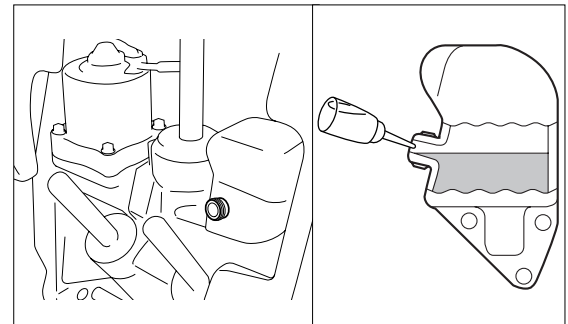
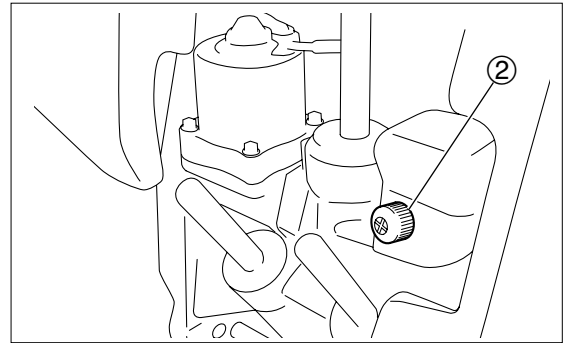
**PTT Fluid:**  
ATF DEXRON III

**PTT Fluid Quantity:**  
682 cm<sup>3</sup> (23.1 fl.oz)

4. Attach the cap.



**Reservoir Cap:**  
7 N · m (5 lb · ft) [0.7 kgf · m]



## 8. Lower Unit

### 1) Inspection of Gear Oil Quantity

1. Tilt down outboard motor to make it vertical.
2. Remove upper oil plug ① and gasket ②, and check level of gear oil in the gear case.



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

3. Add recommended gear oil to specified level if it is low.

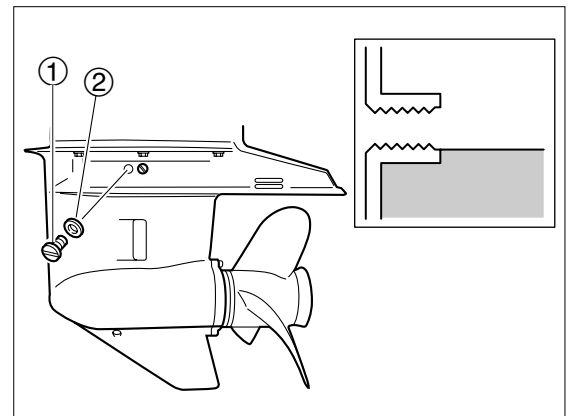


**Gear Oil:**  
Hypoid Gear Oil  
API : GL - 5 SAE : # 90



If the oil is low, add through lower oil plug hole.

4. Attach upper oil plug ① and new gasket ②.



② Gasket **Do not reuse.**

## 2) Replacement of Gear Oil

1. Tilt outboard motor a little as shown.
2. Place drain oil pan below oil plug ①, remove lower oil plug ① and then upper oil plug ② to drain oil.



Remove lower oil plug first when draining.

3. Check gear oil for presence of metal particles, change of color (abnormal if clouded), and viscosity. Check lower unit internal components if necessary.
4. Fill with gear oil (from oil tube or pump) through lower plug hole ① until gear oil starts to leak from upper oil plug hole ② without air bubble.



Use lower plug hole when filling with gear oil. Upper hole cannot be used because doing so will not allow air to escape from gear case.

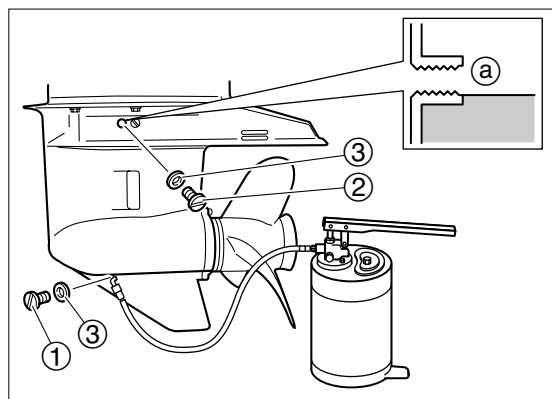
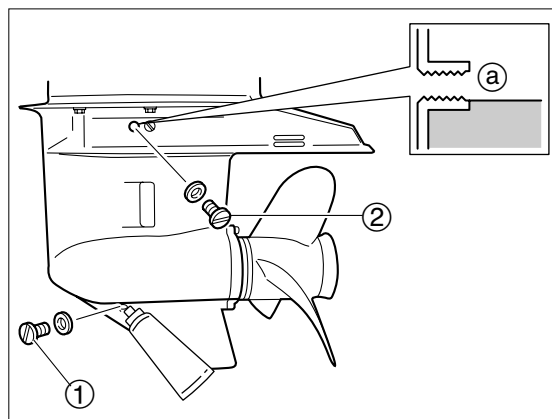
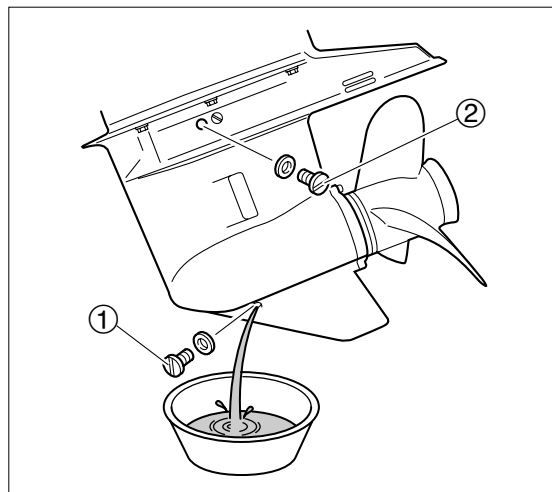


### Gear Oil:

Tohatsu genuine Gear Oil or Hypoid Gear Oil  
API : GL-5 SAE : #80~90

### Gear Oil Quantity:

900 cm<sup>3</sup> (30.4 fl.oz)



③ Gasket **Do not reuse.**

5. Attach new gasket ③ and upper oil plug ②, and then new gasket ③ and lower oil plug ① quickly.



When fully filled with oil, attach upper oil plug first.



# Maintenance

## 3) Inspection of Gear Case (for leakage)

1. Drain gear oil.
2. Remove upper oil plug ① and connect a commercially available leakage tester to this hole.
3. Apply specified pressure to gear case, and check if the pressure is maintained without further compression for 10 seconds.

### ⚠ CAUTION

- Do not apply pressure to gear case over specified value.
- Doing so can cause damage to oil seal.

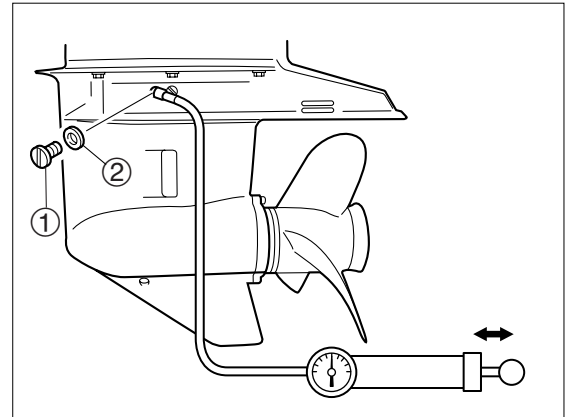


- Rotating propeller shaft while maintaining pressure and testing with gear oil drained make it easy to find leakage due to wear of oil seal lip.
- Depressurize gear case and cover oil plug area with a piece of rag before disconnecting leakage tester.



**Specified Gear Case Maintained Pressure:**  
0.05 MPa (7 psi) [0.5 kgf/cm<sup>2</sup>]

4. If the specified pressure cannot be maintained, check oil seals of drive shaft and propeller shaft and O ring of shift shaft, and propeller shaft housing and water pump case lower for damages.



② Gasket Do not reuse.

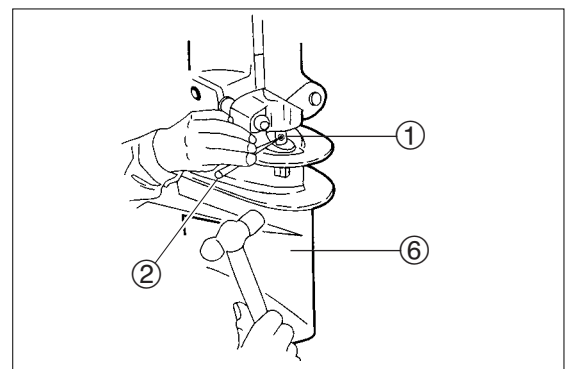
## 4) Inspection of Water Pump

1. Remove the following part.  
Drive out spring pin ① by using spring pin tool ②.



**Spring Pin Tool A ② (ø3.0):**  
P/N. 369-72217-0

- Remove gear case ass'y from drive shaft housing.

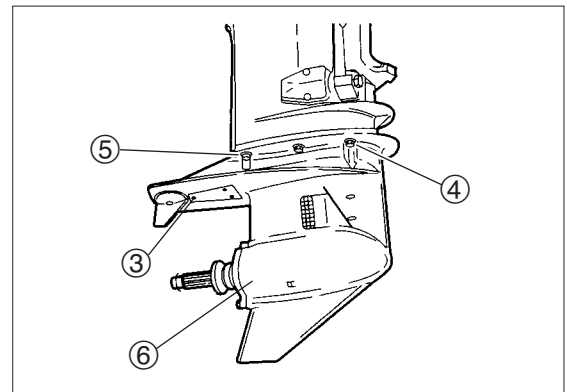


① Do not reuse.

2. Remove the following parts.  
③ Gear Case Plate (One M10 bolt is behind the plate.)  
④ Bolts : M8 4 pcs.  
⑤ Bolts : M10 2 pcs.  
⑥ Gear Case Ass'y (Pull downward to remove.)



Speed meter pipe is put on the nipple of gear case ass'y. After gear case has come down slightly, remove pipe from nipple.



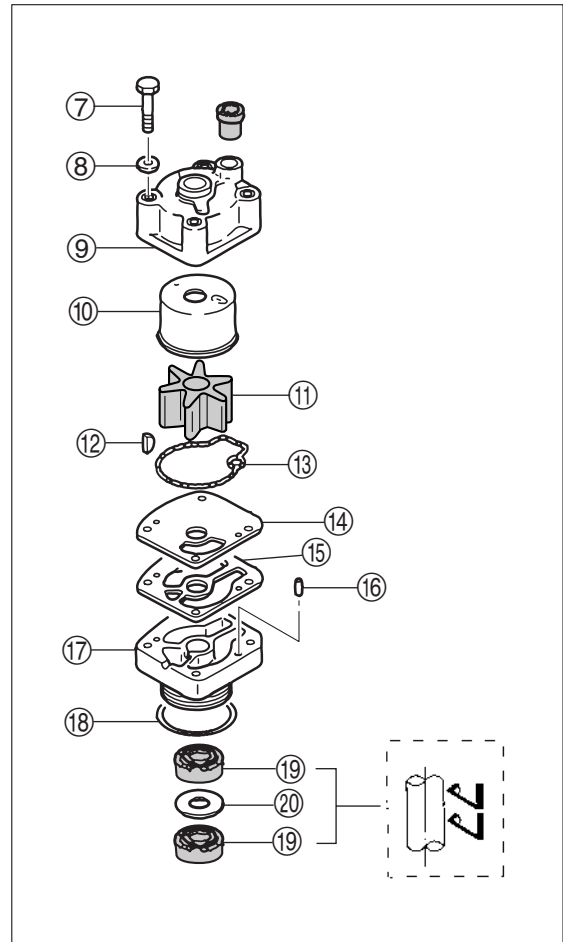


3. Check following parts.

- ⑦ Bolts : M8 4 pcs.
- ⑧ Washers 4 pcs.
- ⑨ Pump Case (Upper)
- ⑩ Pump Case Liner
- ⑪ Pump Impeller → Replace with new one.
- ⑫ Key
- ⑬ Seal → Replace with new one.
- ⑭ Guide Plate
- ⑮ Gasket → Replace with new one.
- ⑯ Dowel Pin
- ⑰ Pump Case (Lower)
- ⑱ O Ring
- ⑲ Oil Seals
- ⑳ Shim

**Inspection**

1. ⑥ - ⑮ : Replace with new one if worn or damaged.
- ⑲ Be sure to install oil seal in correct orientation.



⑪ ⑮ ⑱ ⑲ Do not reuse.

## 9. Others

### 1) Replacement of Anode

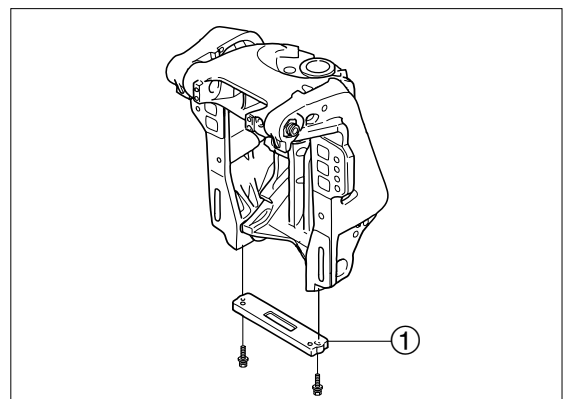
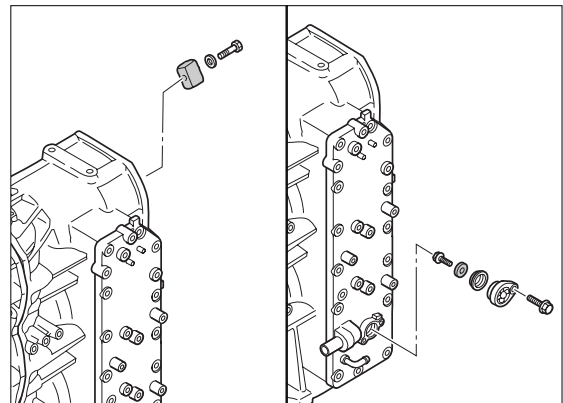
1. Dirt on Anode and Trim Tab  
Check if grease or oil is adhered to the components.  
Clean if necessary.

**CAUTION**

**Anode protects outboard motor from galvanic corrosion. Do not paint or apply grease or oil to anode. Doing so disables the anode.**



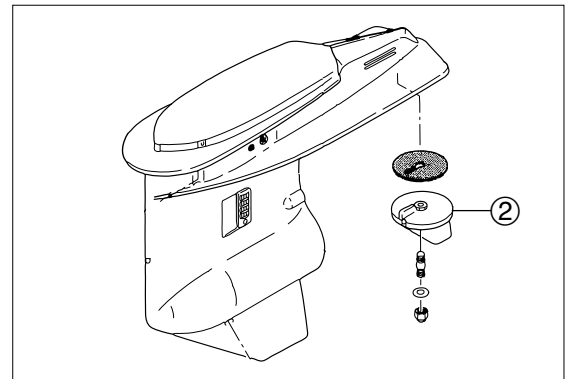
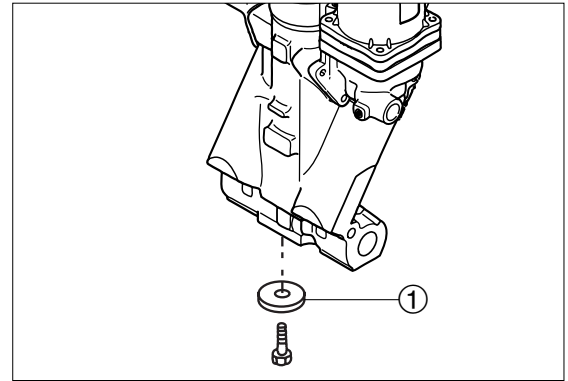
- Anodes are used in the exhaust cover, cylinder body, clamp bracket and gear case trim tab.
- When it is necessary to disassemble outboard motor for inspection of anode, refer to disassembly procedure described in this manual. Reduction of anode volume can lead to outboard motor body damage.





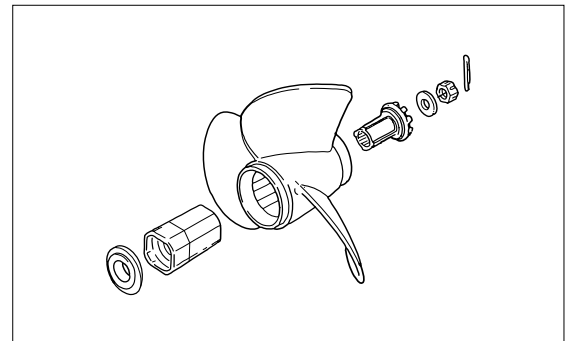
# Maintenance

2. Check anode ① a and trim tab ② for deterioration. Replace anode (or trim tab) if volume is reduced to 2/3 of new part.



## 2) Inspection of Propeller

1. Check propeller blades and hub for cracks, damages, wear and corrosion. Check spline for twist, and replace propeller if necessary.



### 3) Inspection of Battery

1. Inspect battery liquid level. If lower than "LOWER" mark ①, add distilled water until the level goes in between "UPPER" and "LOWER" marks.
2. Measure specific gravity of battery liquid. Charge battery if specific gravity is less than specified value.

#### ⚠ WARNING

**Electrolyte contains sulfuric acid that is poisonous and highly corrosive, which is dangerous. Always be careful of the following matters to prevent accident.**

- Handle electrolyte carefully not to allow adherence to any part of body, or it could cause serious chemical burn or blindness.
- Wear protective glasses when working near battery or handling battery.

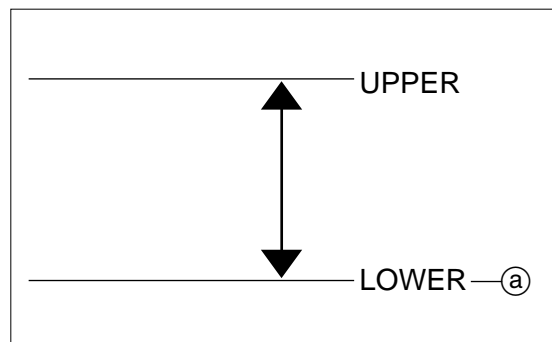
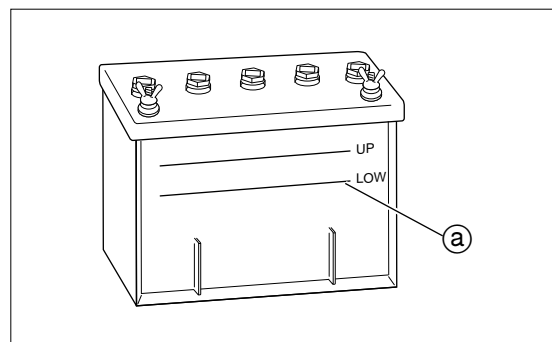
**First Aid in Emergency (if electrolyte adheres to body):**

- Flush well with fresh water if adhered to skin.
- If gets in eye, flush well with fresh water for 15 minutes, and have ophthalmologic evaluation immediately.

**First Aid in Emergency (if swallowed)**

- Gargle using much water, drink much water or milk, and then, seek immediate medical attention.
- Battery produces highly inflammable hydrogen gas. Always be careful of the following matters to prevent accident.
- Charge battery in well ventilated place.
- Keep battery away from fire, sparks or flame (such as live cigarette or operating welding machine).
- Do not allow smoking when handling or charging battery.

**Keep battery and electrolyte out of reach of children.**



- Batteries are available with various types, varying among manufacturers. For any unclear matters, refer to manual attached to battery.
- Disconnect battery cables in the following order; negative (-) cable first and then positive cable (+).



#### Battery:

12V100AH or more	12V120AH or more (in cold regions)
CCA : 850	CCA : 1000
MCA : 500	MCA : 850



#### Specific Gravity of Battery Electrolyte:

1.280 (at 20°C) (68°F)



**Charging data :** Example 12V100AH Battery

**Charging current :** 100AH x 1/10 = 10A

**Charging period :** 100AH ÷ 10A = 10H



# Maintenance

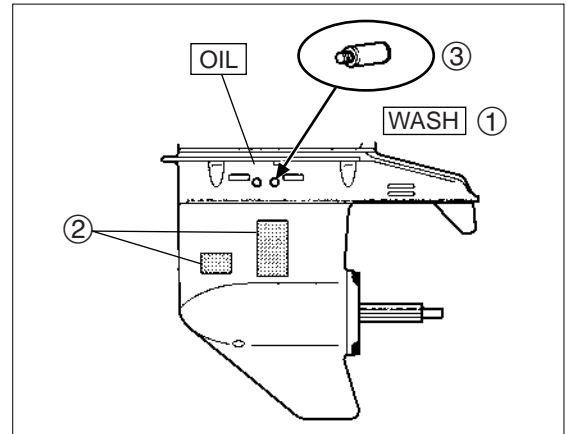
## 4) Flushing with Water

### ⚠ WARNING

**Exhaust gas contains carbon monoxide which can cause intoxication if inhaled. Do not operated engine in a closed space such as interior of boat house.**

### ⚠ WARNING

**Be careful not to touch rotating propeller. Be sure to remove propeller before running engine on the land.**



- ② Tape
- ③ Flushing Attachment

### Flushing using flushing attachment (P/N3B7-60007-0).

1. Remove the following parts.
  - Propeller and thrust holder
  - ① Water plug.
2. Attach the following parts.
  - ② Tape: Two locations (on the water strainer)
  - ③ Flushing attachment
    - Put water hose from water outlet to ③ and run water.
    - Set shift lever to neutral (N) and start engine.
    - Check that cooling water check port discharges water, and run engine for 3 to 5 minutes at idle speed.
    - Stop engine and stop water supply, remove ③, attach and tighten ①, and then, reinstall propeller parts removed.

### Flushing using drive cleaner (P/N353-72406-0)

1. Put drive cleaner ① on the gear case from the front so that the drive cleaner covers cooling water inlet as shown.

2. Put water hose to drive cleaner and run water.

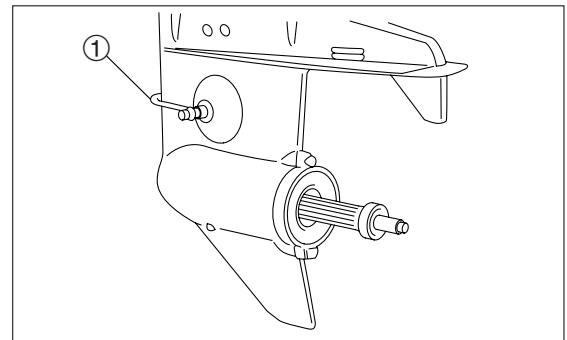


Adjust water flow so that water leaks from driver cleaner a little.

3. Set shift lever to neutral (N) and start engine.
4. Check that cooling water check port discharges water, and run engine for 3 to 5 minutes at idle speed.



After starting engine, no cooling water should spill from the drive cleaner and should be discharged from cooling water outlet because water is sucked by the impeller.



### Flushing using flushing device

1. Set outboard motor to vertical position.
2. Take out flushing connector cap ① and attach flushing attachment ② to it.
3. Put water hose on the flushing attachment and run water for 3 to 5 minutes.

#### CAUTION

**The flushing can be made without running the engine.**

**Water pressure:**

**0.12 - 0.2MPa (1.74 - 29.0psi) [1.2 - 2.0kgf/cm<sup>2</sup>]**

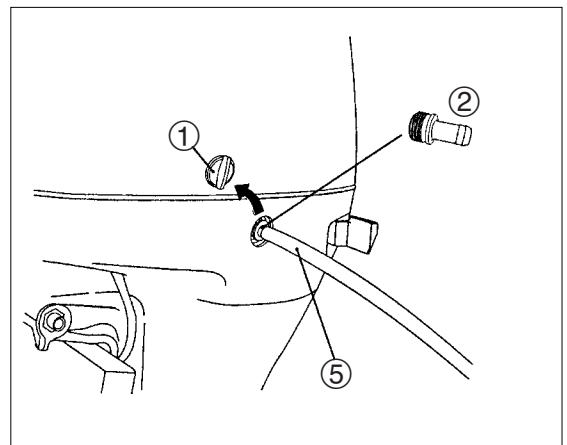
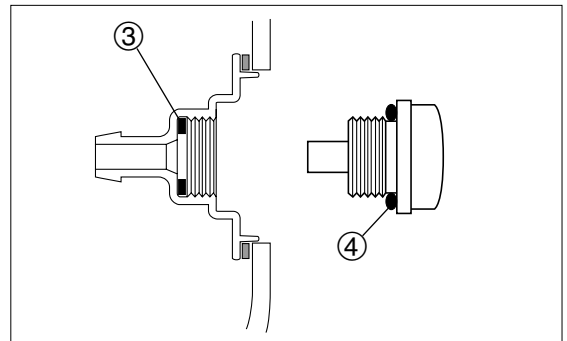
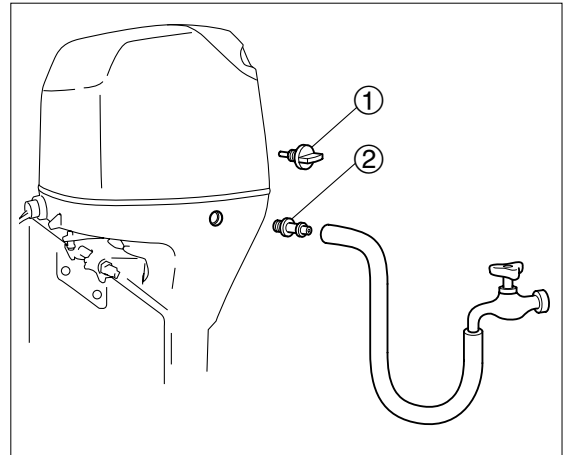
4. Remove flushing attachment.

5. Check if seal rubber ③ and O ring ④ are not damaged, and if not damaged, reattach the flushing connector cap.

#### CAUTION

**Leak of cooling water can cause troubles such as overheating.**

**Put flushing connector cap securely.**

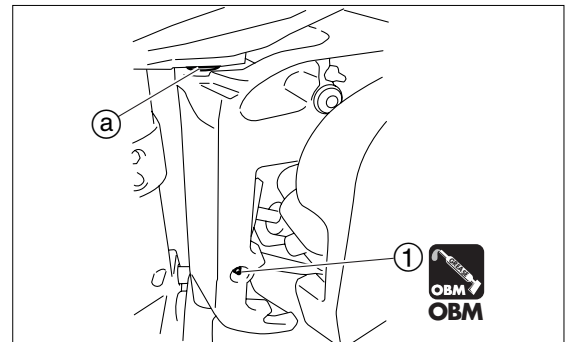
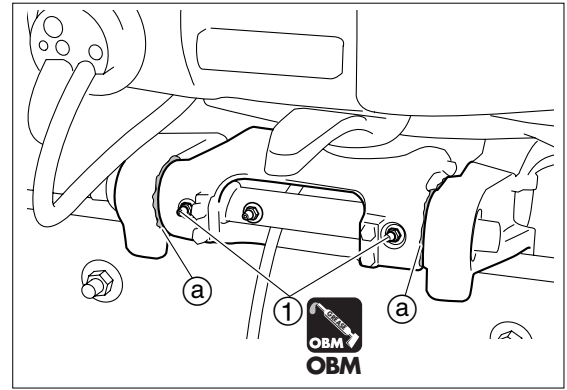


⑤ Hose

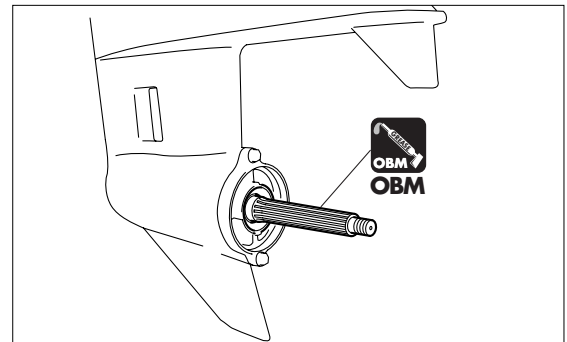


## 5) Greasing

1. Inject grease through grease nipple ① until excessive grease appears from ②.



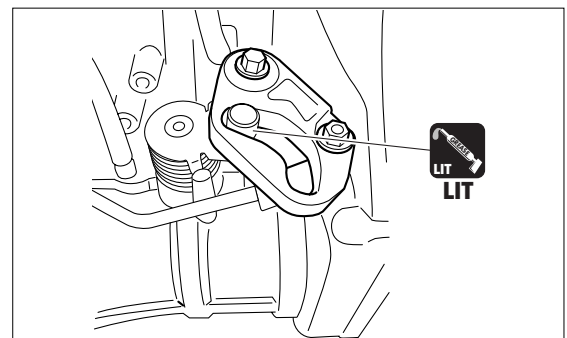
2. Apply grease to propeller shaft spline.



3. Only under pinion on splines outside will wear on pinion and flywheel.



4. Apply grease to throttle cam sliding areas.



# 4

## Fuel System (TLDI)



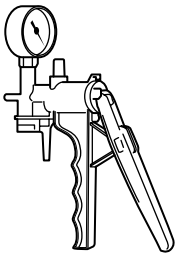
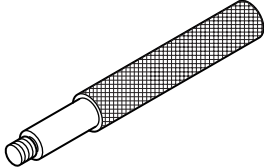
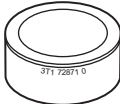
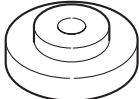
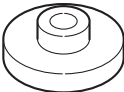

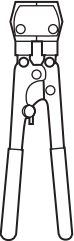
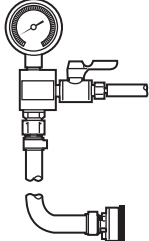
# 4

<b>1. Special Tools</b> .....	4-2	4) Removing Vapor Separator	4-26
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ECU	4-15	3) Inspection of Drive Belt	4-32
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1) Decompression of Fuel Line and Air Line	4-19	8) Assembly of Compressor Housing	4-35
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2) Installation of Fuel Hose Ass'y	4-25		
3) Draining Fuel from FFP Vapor Separator	4-26		



# Fuel System (TLDI)

## 1. Special Tools

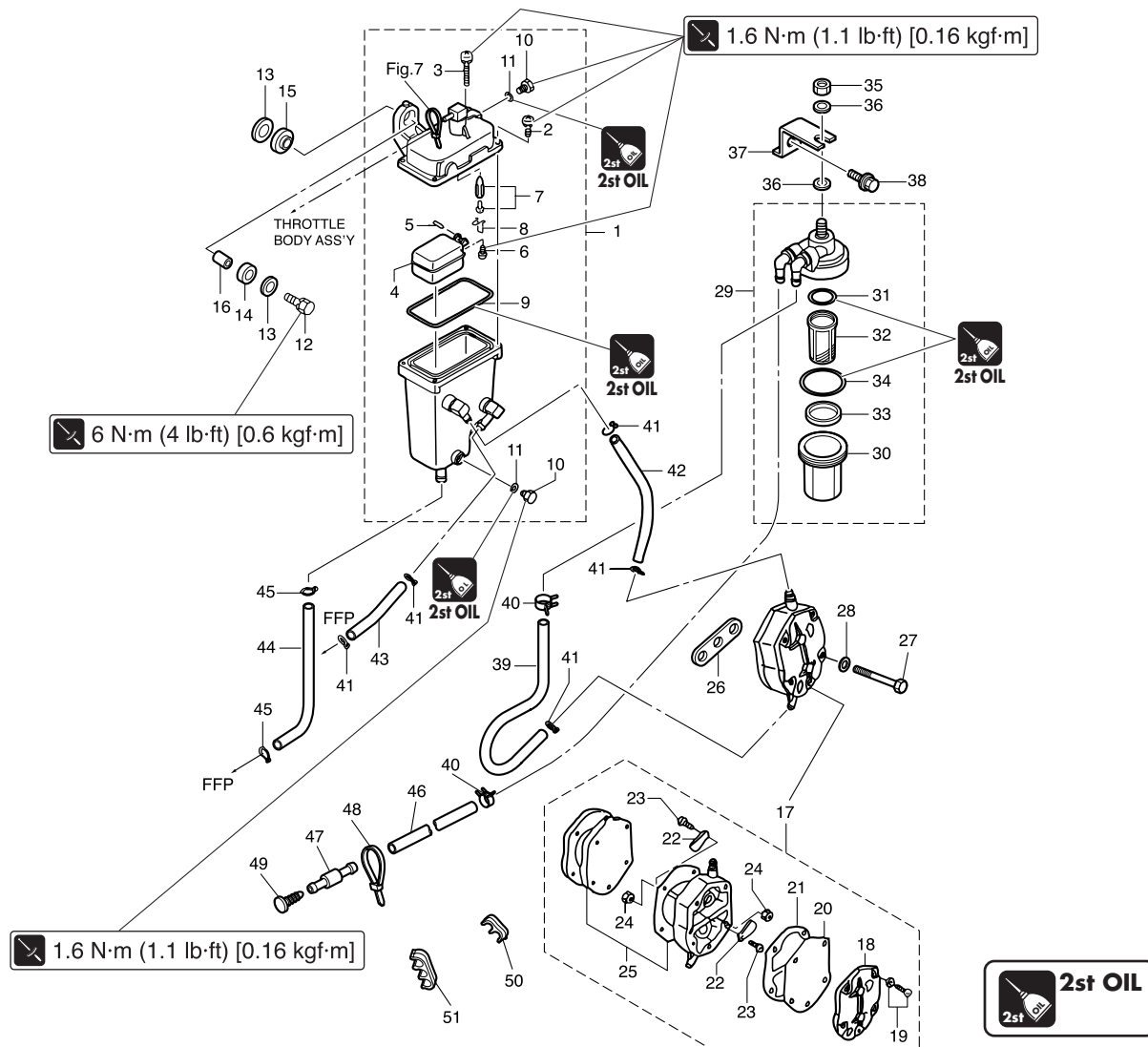
			
Vacuum/Pressure Gauge P/N. 3AC-99020-0	Driver Rod P/N. 3AC-99702-0	Piston Slider P/N. 3T1-72871-0	Oil Seal Attachment P/N. 3T1-99820-0
Inspecting pressure	Used in combination with center place and various attachments	Assembling piston for air compressor	Used to press-fit crank case head oil seal
ø51.5 x ø39.5 			
Bearing Attachment P/N. 3T1-99905-0	O Ring Set Tool (ø24) P/N. 3T5-72863-0	Clamp Pliers P/N. 3T5-72864-0	Pressure Gauge Ass'y P/N. 3T5-72880-0
Attaching air compressor bearing	Assembling O ring into fuel injector	Caulking clamps made by OETIKER	Measuring air rail fuel pressure and air pressure



## 2. Parts Layout

P/L Fig. 8

### Vapor Separator & Fuel Line



Ref. No.	Description	Q'ty	Remarks
1	Vapor Separator Ass'y	1	
2	Screw	3	M4 L=14mm
3	Screw	1	M4 L=30mm
4	Float Vapor Separator	1	
5	Arm Pin Float	1	
6	Screw	1	M4 L=8mm
7	Float Valve Ass'y (With Valve Pin)	1	
8	Clip	1	
9	O-Ring	1	Do not reuse.
10	Drain Screw	2	
11	Gasket	2	Do not reuse.
12	Bolt	2	M6 L=30mm
13	Washer 6.5-21-1	4	
14	Mount Rubber 8.5-14-2.5	2	
15	Mount Rubber 8.5-14-2.5	2	
16	Spacer 6.2-9-15.7	2	
17	Fuel Pump Ass'y	1	
18	Fuel Cover	1	
19	Screw	3	M5 L=28mm
20	Diaphragm Fuel Pump	1	
21	Gasket B Diaphragm	1	Do not reuse.
22	Check Valve	2	
23	Screw	2	M3 L=6mm
24	Nut	2	M3
25	Diaphragm Set	1	
26	Gasket Fuel Pump	1	Do not reuse.

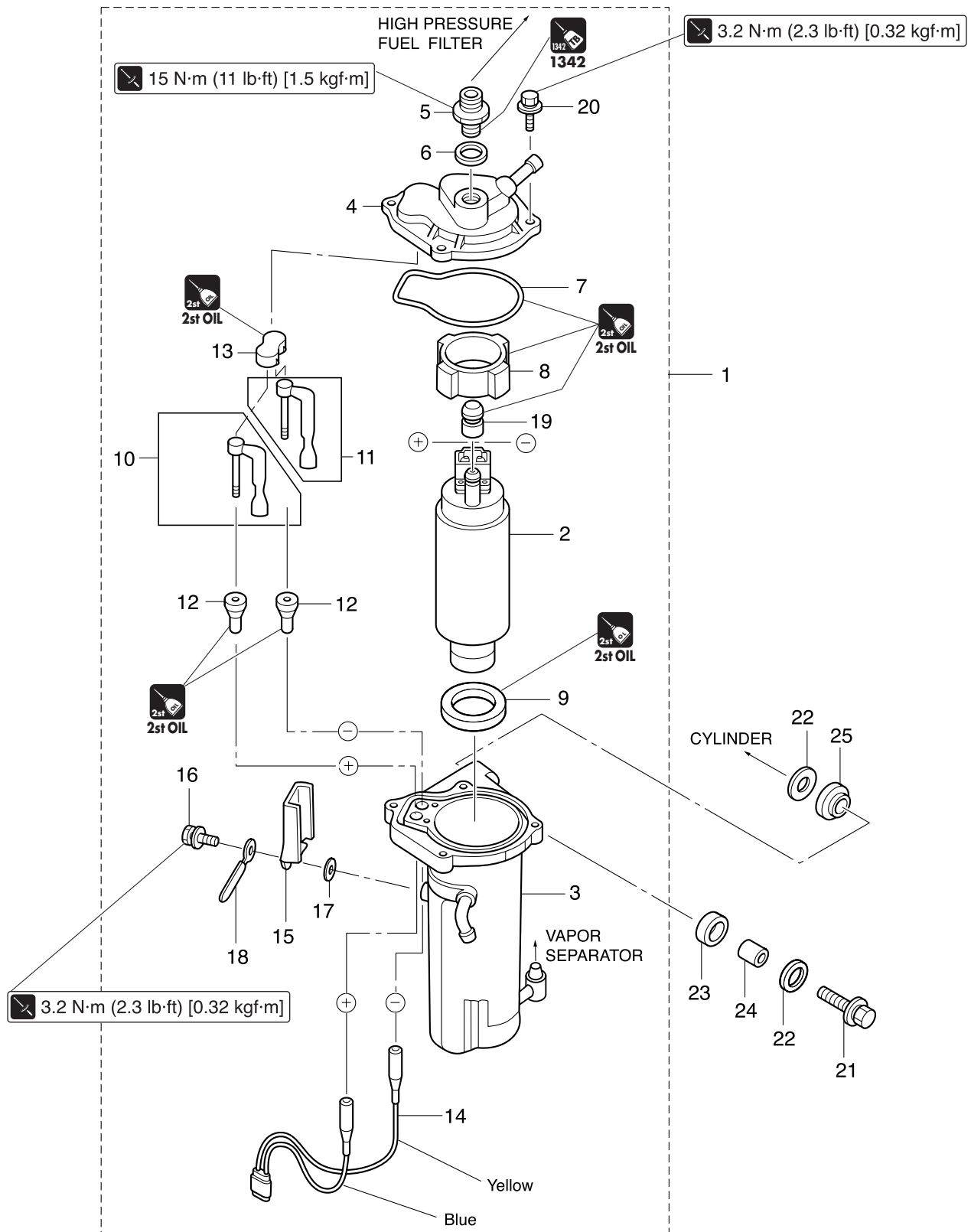
Ref. No.	Description	Q'ty	Remarks
27	Bolt	2	M6 L=40mm
28	Washer	2	
29	Fuel Filter Ass'y	1	
30	Cup	1	
31	O-Ring A	1	Do not reuse.
32	Filter	1	
33	Float Fuel Filter	1	
34	O-Ring B	1	Do not reuse.
35	Nut	1	M8
36	Washer	2	M8
37	Plate Filter	1	
38	Bolt	1	M6 L=16mm
39	Fuel Hose L=280	1	
40	Clip 11.3ø	2	
41	Clip Fuel Pipe ø10	8	
42	Rubber Hose	1	
43	Rubber Hose	1	
44	Rubber Hose	1	
45	Clip	2	
46	Hose	1	
47	Fuel Hose Nipple	1	
48	Band Lead Wire L=104	1	Do not reuse.
49	Fuel Hose Nipple Cap	1	
50	Clamp	2	
51	Clamp	3	



# Fuel System (TLDI)

FFP Ass'y

P/L Fig. 6



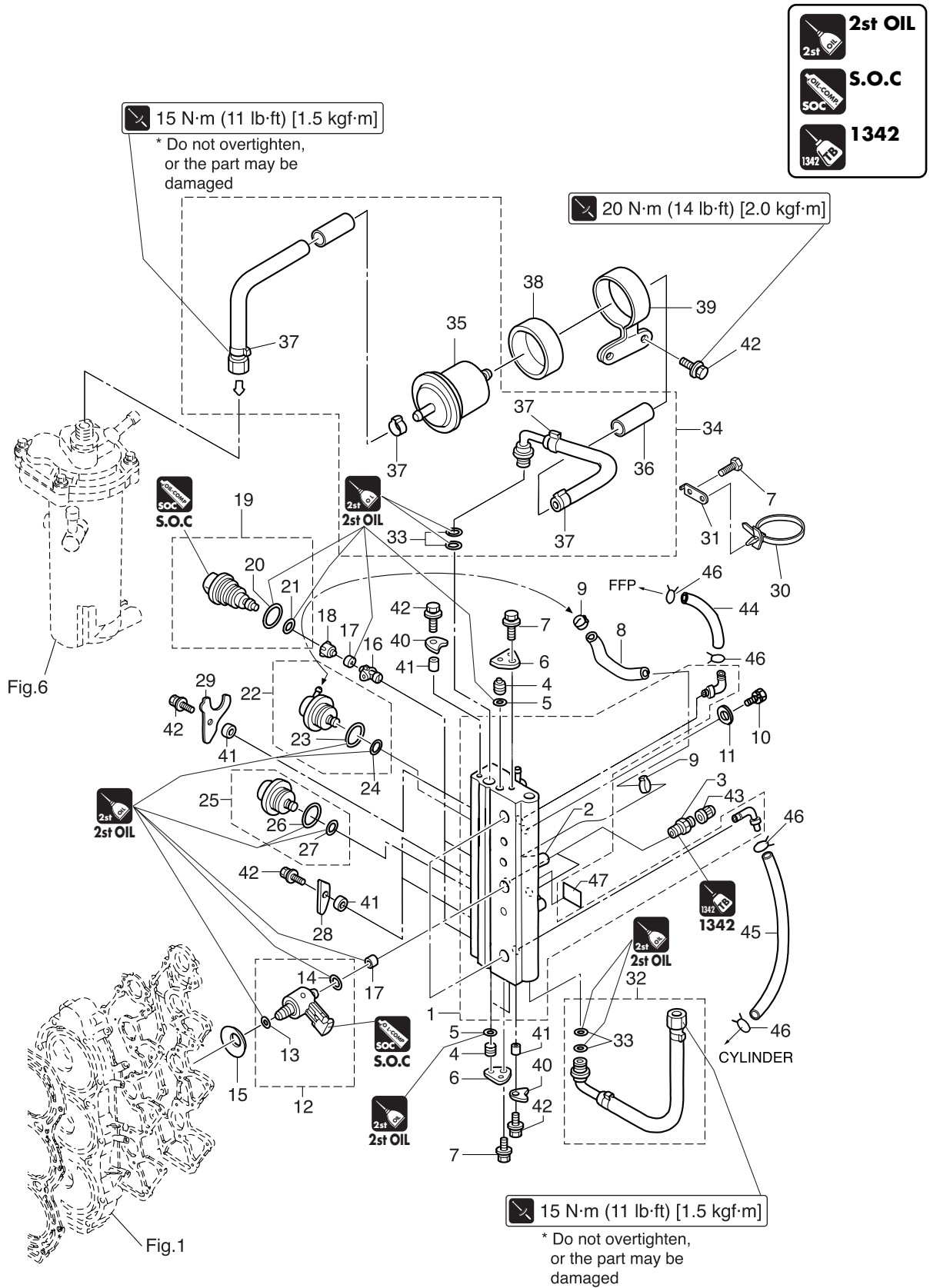
Ref. No.	Description	Q'ty	Remarks
1	Fuel Feed Pump Ass'y	1	
2	Fuel Feed Pump	1	
3	Case Ass'y	1	
4	Upper Case FFP	1	
5	Adapter Hose Joint	1	
6	Metal Washer 10.2-17-2	1	Do not reuse.
7	Seal FFP	1	Do not reuse.
8	Grommet Upper FFP	1	
9	Grommet Lower FFP	1	
10	Cable Terminal Ass'y (+)	1	
11	Cable Terminal Ass'y (-)	1	
12	Grommet Cable Terminal	2	
13	Grommet Upper Cable Terminal	1	
14	Cord FFP	1	
15	Cover Cord FFP	1	
16	Bolt	1	M5 L=12mm
17	Washer	1	M5
18	Clamp 6.5-47.5P	1	
19	Grommet Pipe	1	
20	Bolt	4	M5 L=18mm
21	Bolt	2	M6 L=30mm
22	Washer 6-16-1.5	4	M6
23	Mount Rubber 8.5-12-2	2	
24	Spacer 6.2-9-15.7	2	
25	Mount Rubber 8.5-18-7	2	



# Fuel System (TLDI)

## Air Rail

## P/L Fig. 4



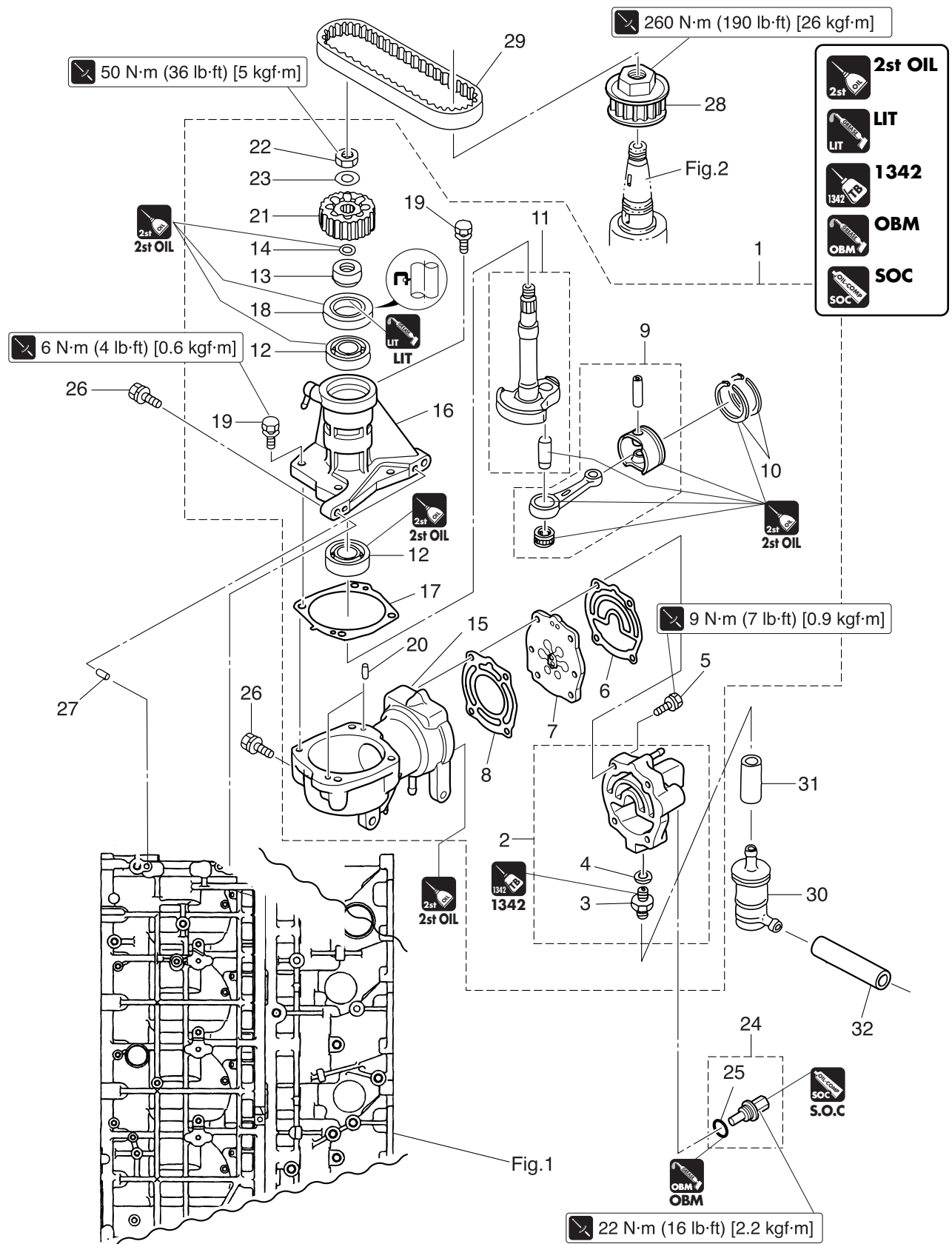
Ref. No.	Description	Q'ty	Remarks
1	Air Rail Ass'y	1	
2	L-Nipple	1	
3	Valve Ass'y	2	
4	Plug 10.5	3	
5	O-Ring 6.8-1.9	3	Do not reuse.
6	Stopper Plug	2	
7	Bolt	4	M6 L=12mm
8	Hose	1	M8
9	Clamp 29-64	2	Do not reuse.
10	Bolt	2	M8 L=65mm
11	Washer	2	M8
12	Air Injector Complete	3	Orange
13	O-Ring 5-52	1	Do not reuse.
14	O-Ring 2.4-9.5	1	Do not reuse. Brown
15	Set Piece Air Injector	3	
16	Inserting Fuel B Injector	3	
17	Seal Compression	6	
18	Adapter Fuel Injector	3	
19	Fuel Injector	3	Mark : 37003 (Blue)
20	O-Ring 2.8-20.2	1	Do not reuse.
21	O-Ring 3.5-7.5	1	Do not reuse.
22	Regulator Fuel	1	
23	O-Ring 2.5-20	1	Do not reuse.
24	O-Ring 5-2.5	1	Do not reuse.
25	Regulator Air	1	650Kpa
26	O-Ring 2.5-20	1	Do not reuse.
27	O-Ring 5-2.5	1	Do not reuse.
28	Plate Fuel Injector	2	
29	Holding Plate	1	
30	Lead Wire Band 170	2	Do not reuse.
31	Lead Wire Band Stay	2	
32	Air Hose Ass'y	1	
33	O-Ring 1.9-9.8	2	Do not reuse.
34	Fuel Hose Ass'y	1	
35	Fuel Filter	1	for High Pressure
36	Protector L=210	1	Do not reuse.
37	Clamp 21/32	4	
38	Rubber Fuel Filter	1	
39	Fuel Filter Band	1	
40	Plate Nipple	2	
41	Collar 6.7-12.7-3	5	
42	Bolt	5	M6 L=16mm
43	Cap Valve	2	
44	Hose	1	
45	Hose	1	
46	Clip Fuel Pipe ø10	4	
47	Label Air Rail	1	



# Fuel System (TLDI)

## Air Compressor

## P/L Fig. 5



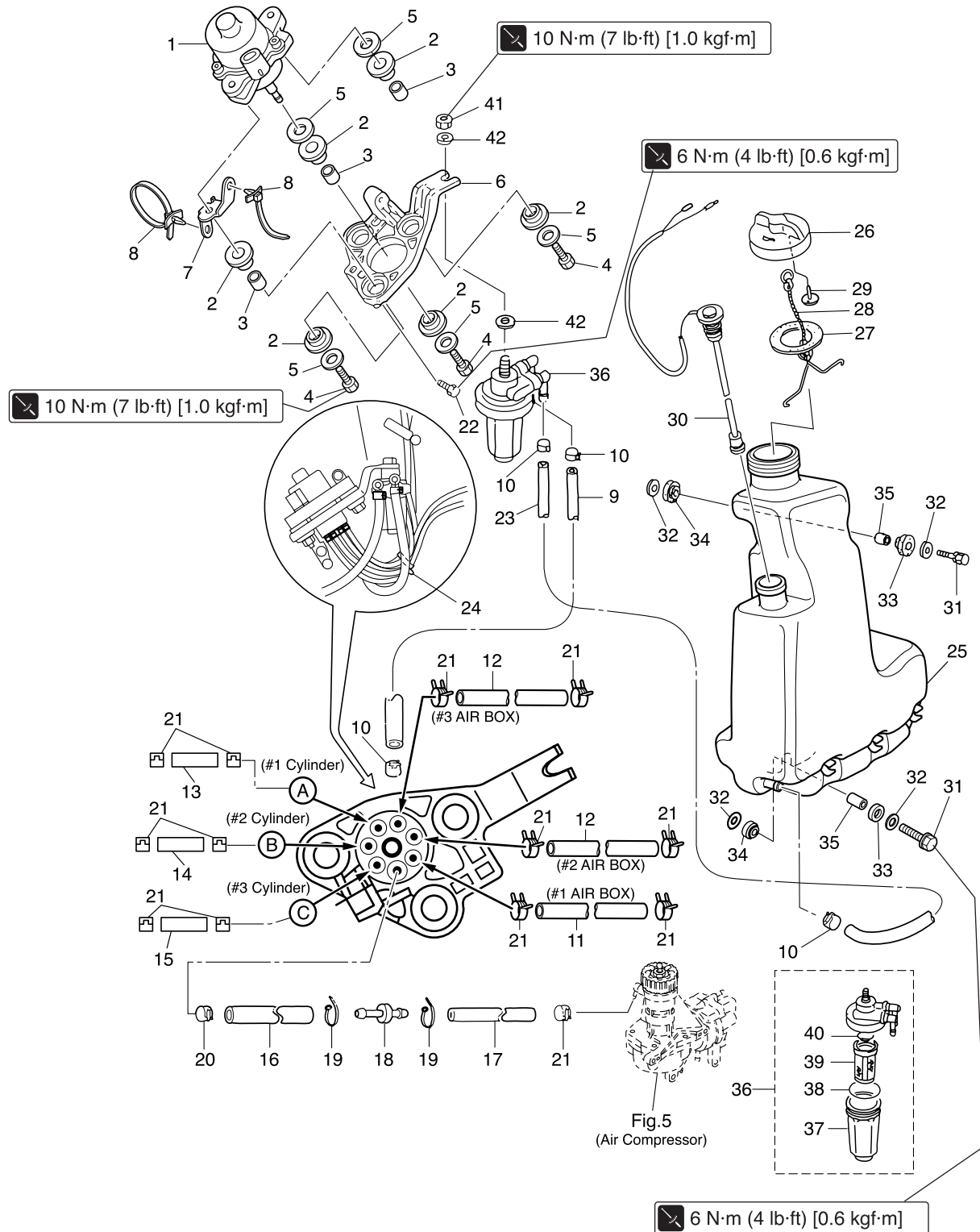
Ref. No.	Description	Q'ty	Remarks
1	Air Compressor Ass'y	1	
2	Compressor Head Ass'y	1	
3	Adapter Hose Joint	1	
4	Metal Washer 10.2-17-2	1	Do not reuse.
5	Bolt	4	M6 L=35mm
6	Gasket Compressor Head	1	Do not reuse.
7	Reed Valve Ass'y	1	
8	Valve Seat Gasket	1	Do not reuse.
9	Air Compressor Piston Connecting Rod	1	
10	Piston Ring (Compressor)	2	Do not reuse.
11	Compressor Crankshaft Ass'y	1	
12	Ball Bearing	2	Do not reuse.
13	Collar 13.5-25-13	1	
14	O-Ring 1.9-13	1	Do not reuse.
15	Compressor Cylinder	1	
16	Compressor Housing	1	
17	Compressor Housing Gasket	1	Do not reuse.
18	Oil Seal 25-45-8	1	Do not reuse.
19	Bolt	4	M6 L=25mm
20	Dowel Pin 4-10	2	
21	Driven Pulley	1	
22	Nut M10P1.25	1	
23	Washer 10.5-20-3.2	1	
24	Water Temperature Sensor (W/O-Ring)	1	
25	O-Ring 2.0-10.0	1	Do not reuse.
26	Bolt	4	M8 L=30mm
27	Dowel Pin 6-12	2	
28	Drive Pulley M18P1.5	1	
29	Drive Belt	1	
30	Air Filter	1	
31	Hose	1	L=60mm
32	Hose	1	L=140mm



# Fuel System (TLDI)

## Oil Pump

## P/L Fig. 13





Ref. No.	Description	Q'ty	Remarks
1	Oil Pump Ass'y	1	
2	Mount Rubber 12-18-2.5	6	
3	Spacer 8.4-12-17	3	
4	Bolt	3	M8 L=35mm
5	Washer 8.5-24-1.5	5	
6	Bracket Oil Pump	1	
7	Stay	1	
8	Lead Wire Band 170	2	
9	Pipe	1	L=200mm
10	Clip ø9.5	4	
11	Pipe	1	Oil Pump to # 1 Air Box L=560mm
12	Pipe	2	Oil Pump to # 2 # 3 Air Box L=380mm
13	Pipe	1	Oil Pump to # 1 Cylinder L=395mm
14	Pipe	1	Oil Pump to # 2 Cylinder L=275mm
15	Pipe	1	Oil Pump to # 3 Cylinder L=180mm
16	Pipe	1	L=40mm
17	Pipe	1	L=465mm
18	Joint Nipple	1	Reducer Nipple
19	Band Lead Wire L=104	2	Do not reuse.
20	Clip ø8	1	
21	Clip ø7	13	
22	Bolt	2	M6 L=30mm
23	Pipe	1	L=1150mm
24	Band Lead Wire 158	1	Do not reuse.
25	Oil Tank	1	
26	Cap Oil Tank	1	
27	Gasket 36-52-2	1	
28	Hook Tank Cap	1	
29	Check Valve Oil Tank	1	
30	Oil Level Sensor	1	
31	Bolt	3	M6 L=30mm
32	Washer 6.5-21-1	6	
33	Mount Rubber 8.5-14-2.5	3	
34	Mount Rubber 8.5-14-2.5	3	
35	Spacer 6.2-9-15.7	3	
36	Filter Ass'y	1	
37	Cup	1	
38	O-Ring A	1	Do not reuse.
39	Filter	1	
40	O-Ring B	1	Do not reuse.
41	Nut	1	M8
42	Washer	2	M8



# Fuel System (TLDI)

## 3. What is TLDI?

### Direct Fuel Injection System

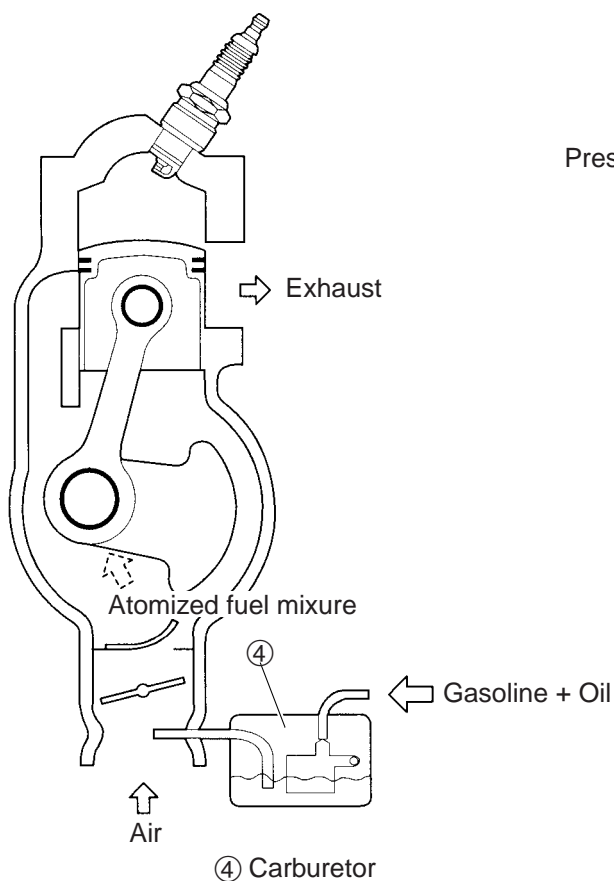
#### 1. TLDI (Two-stroke Low-pressure Direct injection)

TLDI is a kind of two stroke engine system that adopts air-assisted low pressure direct fuel injection.

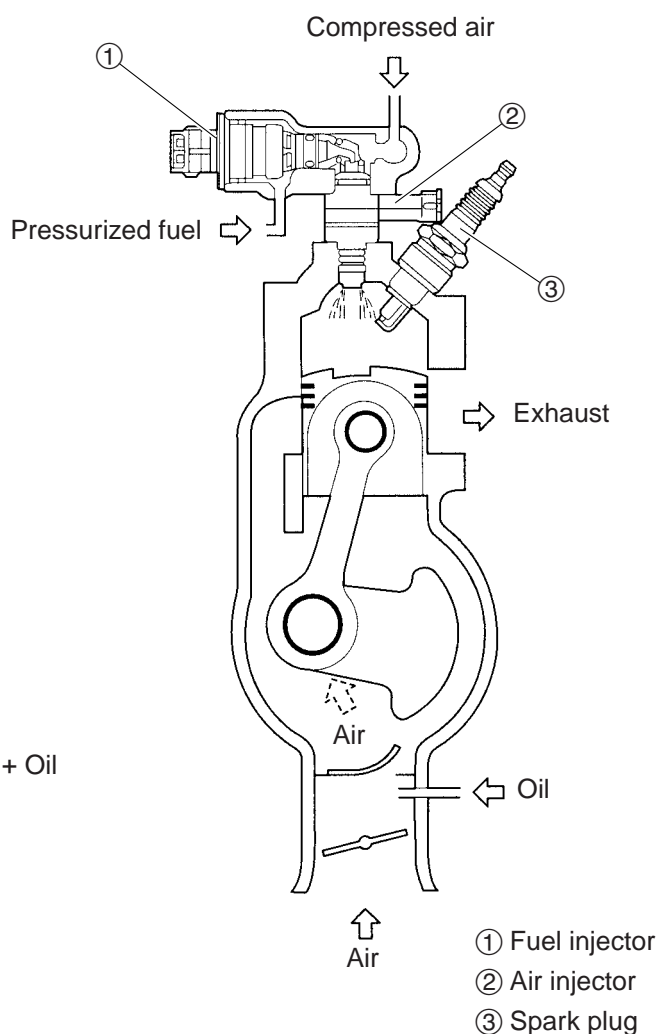
The adoptions of the air-assisted low pressure direct fuel injection system and digital inductive ignition system and control of factors by means of ECU (Engine Control Unit) such as fuel injection amount, fuel injection timing and ignition timing provide fuel combustion at higher efficiency, lower fuel consumption and lower emission, as well as powerful performance that is one of outstanding features of two stroke engines.

#### 2. Air-assisted low pressure direct fuel injection

The air-assisted low pressure direct fuel injection is a system that directly injects fuel compressed with a fuel pump into the combustion chamber with the assistance of the air that is compressed with an air compressor. The injected fuel is an air-mixture that is very finely atomized, providing fuel combustion at higher efficiency.



**ENGINE WITH CARBURETOR**



**TLDI**

## Inductive Ignition

TLDI adopts an inductive ignition system that provides the fuel combustion at higher efficiency, lower fuel consumption and lower emission.

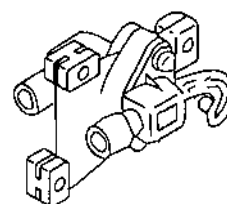
The inductive ignition of TLDI has spark plug ignition duration that is longer than that of conventional two stroke carbureted engines for surer combustion of the air-fuel mixture in the combustion chamber, ensuring more stabilized engine operation under varied operating environment. The adoption of this ignition system allows to achieve smoother engine operation with lower fluctuation of engine speeds during idling.

### 1. TPS (Throttle Position Sensor) Assembly

TPS consists of two sections, TPS1 and TPS2, that function together to detect openings of intake valve (throttle butterfly) and throttle (advancer arm) of the throttle body, and transmits the signals to ECU.

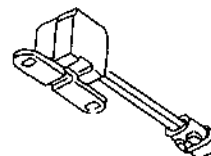
#### ⚠ CAUTION

**Remove only as an assembly. Do not remove the two-phillips head screws (with paint that hold sensors together).**



### 2. CPS (Crank Position Sensor)

CPS detects the crank shaft position and revolution speed by detecting the encoders located on the ring gear of the flywheel, and transmits the signals to ECU.



### 3. Water Temperature Sensor

The water temperature sensor detects the temperature of cooling water that flows through interior of cylinder and air compressor, and transmits the signals to ECU.



### 4. Oil Level Sensor

During operation of the engine, the oil level sensor operates and informs of low engine oil level through the oil lamp of tachometer and buzzer if the oil level is lower than the limit.

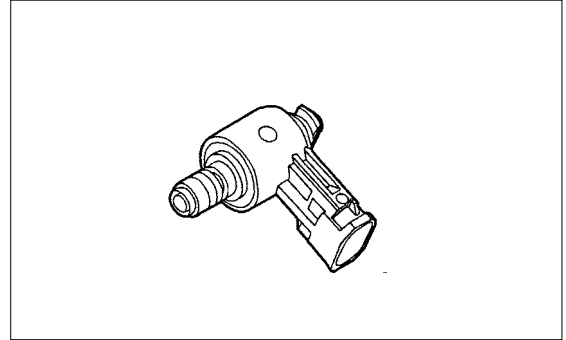




# Fuel System (TLDI)

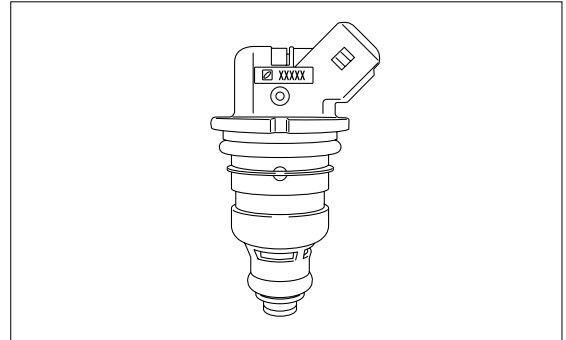
## 5. Air Injector

The air injector injects fuel and compressed air into the combustion chamber of each cylinder. The component is controlled by ECU to inject the amount of fuel mixture at the timing that is best suited to the current engine operation conditions based on the information from sensors.



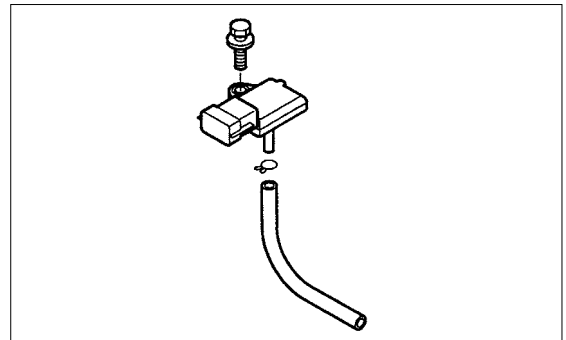
## 6. Fuel Injector

The fuel injector supplies the gasoline contained in the air rail to the air injector through the set piece. The component is controlled by ECU to supply the amount of fuel that is best suited to the current engine operation conditions based on the information from sensors.



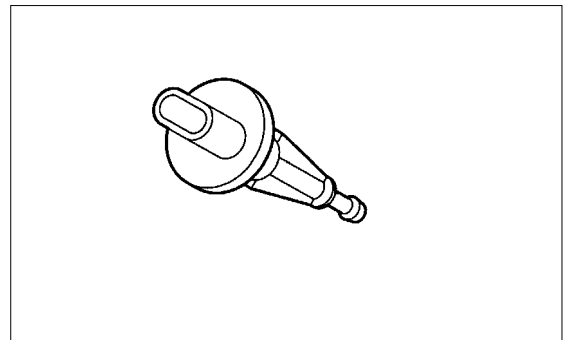
## 7. MAP (Manifold Pressure) Sensor

MAP sensor is located on the upper area of air chamber, and measures the air chamber inner pressure (vacuum pressure) and sends the signal to ECU. ECU uses this signal to establish fuel injection amount and ignition timing.



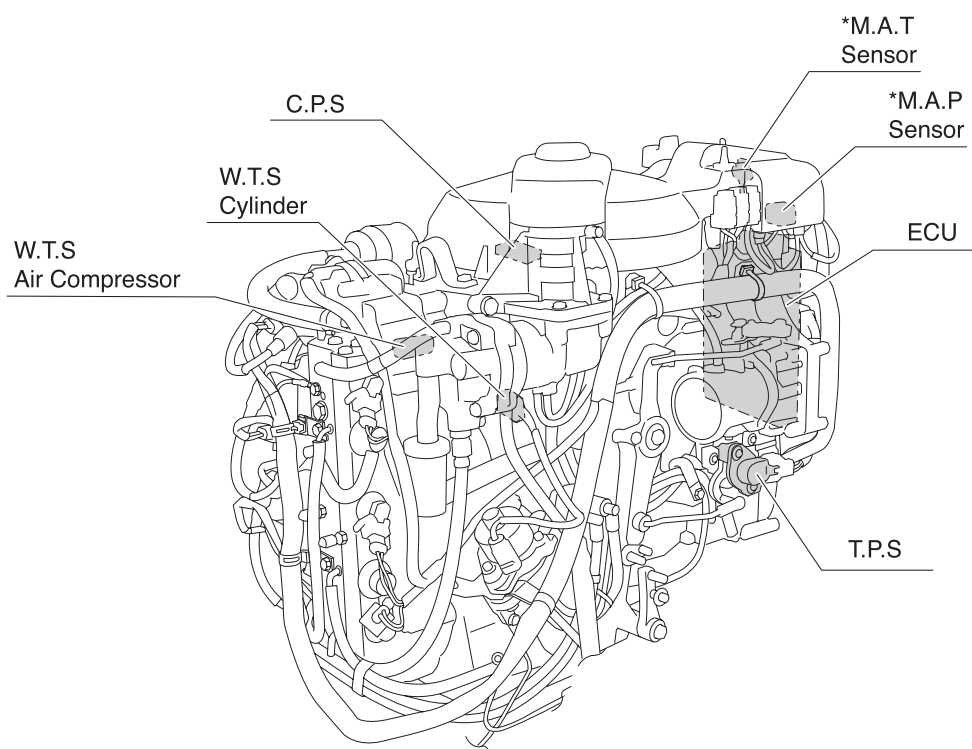
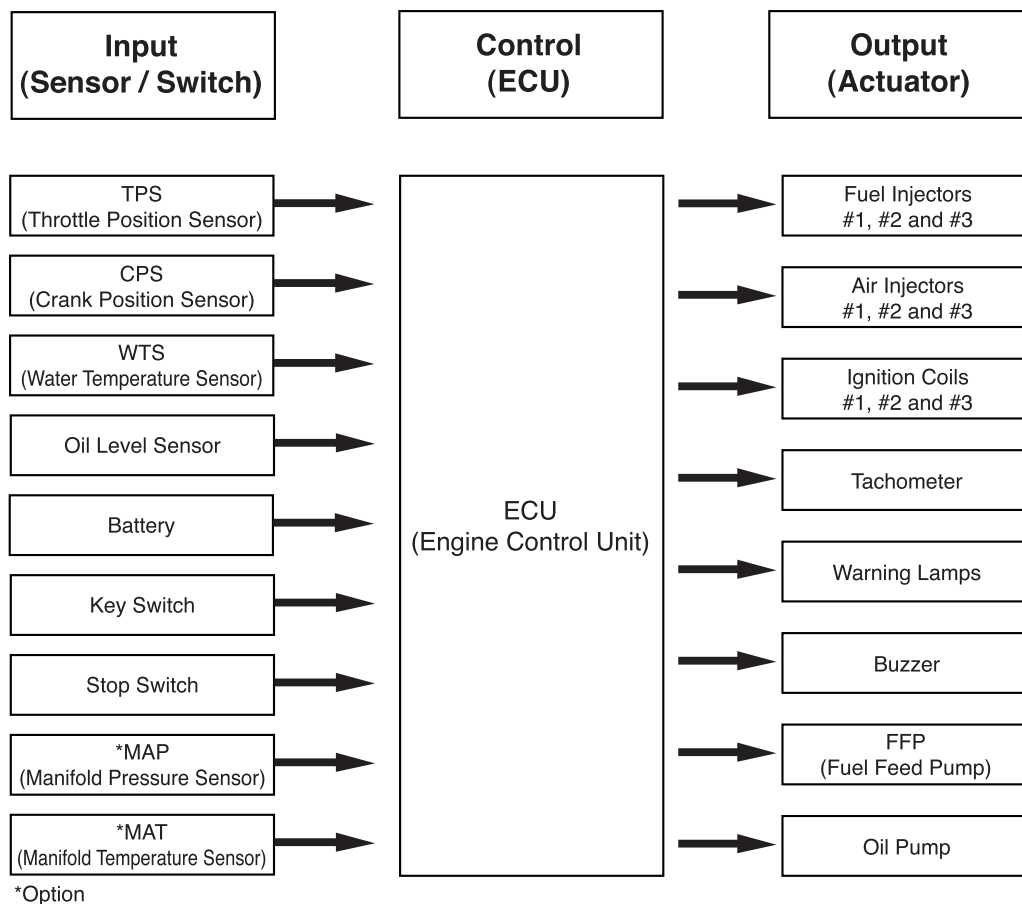
## 8. MAT (Manifold Temperature) Sensor

MAT sensor is located on the upper area of air chamber, and measures intake air temperature and sends the signal to ECU.



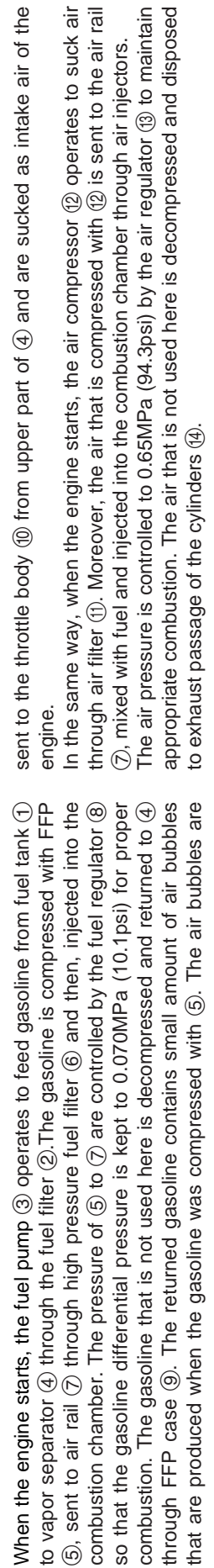
## ECU

TLDI uses ECU to control factors such as fuel injection amount, injection timing and ignition timing to the best suited conditions based on the information from the sensors. Moreover, the TLDI achieves lean combustion through stratified charge in the low engine speed range, and highly efficient combustion through electronic control of premixed charge that provides homogeneous fuel distribution in the combustion chamber in the high speed range.

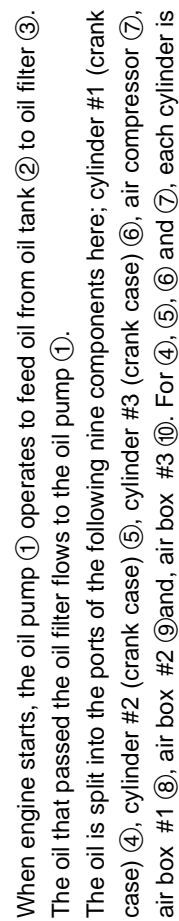




## 4-16



TLDI 75/90C2 2010



The oil that lubricated interior of the air compressor ⑦ flows to the crank case, where it lubricates upper main bearing ⑪ and bearing ⑫.

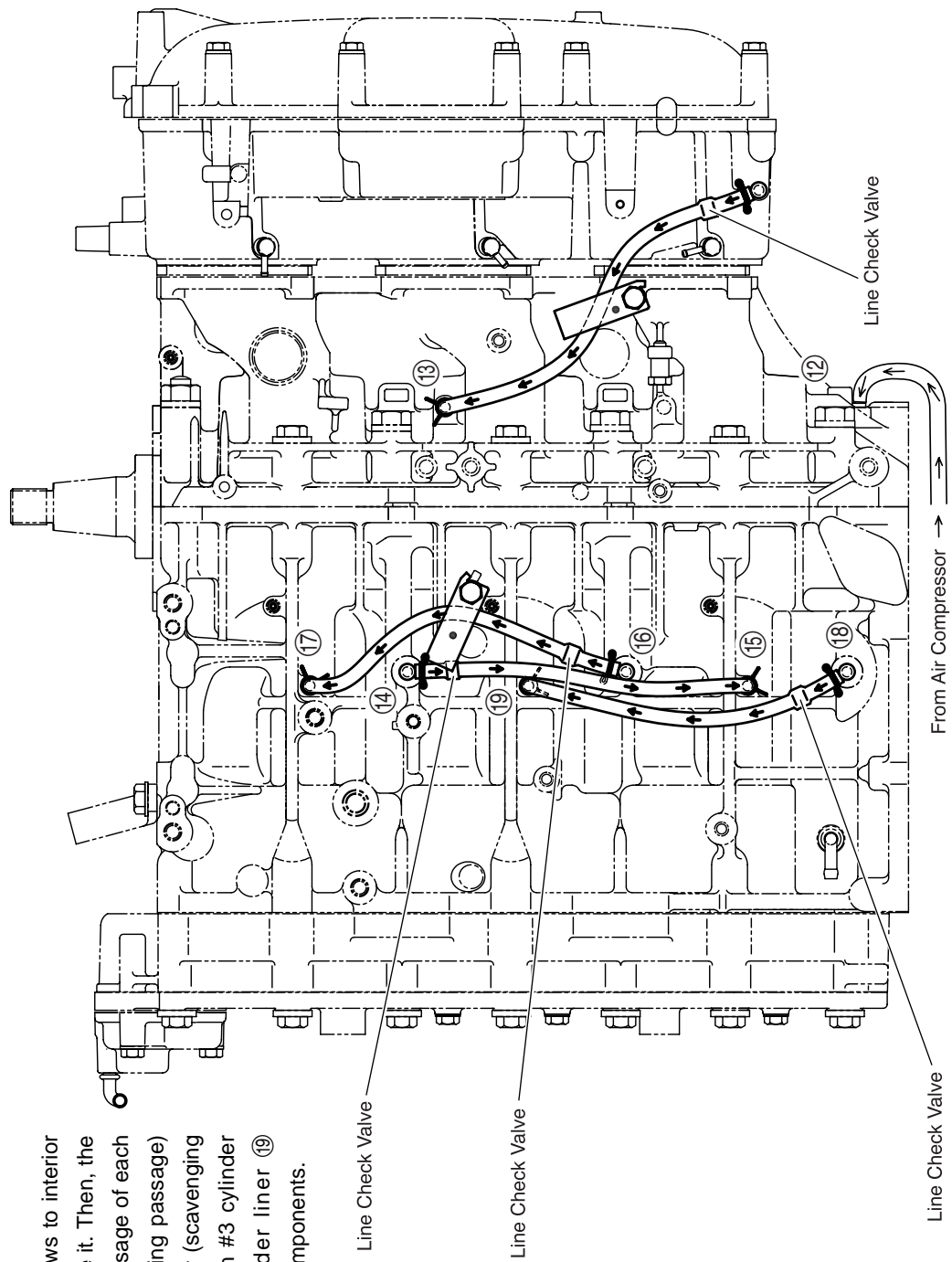
The ports ⑧, ⑨, ⑩ lubricate reed valves and crank shaft also.



## Recirculation System

The oil that lubricates the air compressor flows to the crank case ⑫.

The oil that is deposited in the air box flows to interior of crank case ⑬ of cylinder #2 to lubricate it. Then, the oil that is deposited in the scavenging passage of each cylinder flows from #1 cylinder (scavenging passage) ⑭ to #3 cylinder liner ⑮, from #2 cylinder (scavenging passage) ⑯ to #1 cylinder liner ⑰, from #3 cylinder (scavenging passage) ⑱ to #2 cylinder liner ⑲ respectively to additionally lubricate the components.





## 4. Removing Air Rail

### ⚠ WARNING

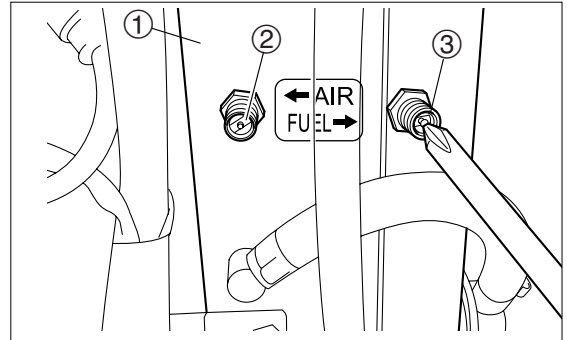
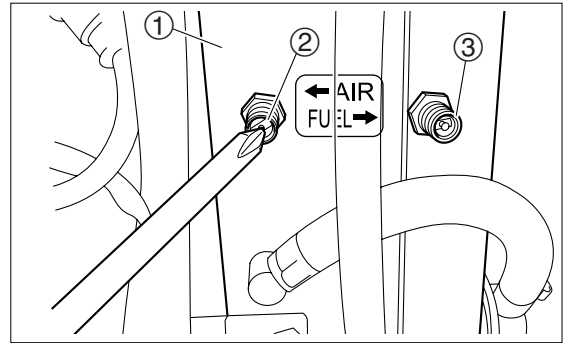
- Be sure to decompress fuel and air before disassembling fuel system components.
- Disassembling fuel system components can cause spurting of compressed fuel.

### 1) Decompression of Fuel Line and Air Line

1. Push in the air valve ② attached to air rail ① to decompress the air line.
2. Push in the fuel valve ③ attached to air rail ① to decompress the fuel line.



Cover the fuel valve area with clean cloth to prevent fuel from spurting when decompressing.



4

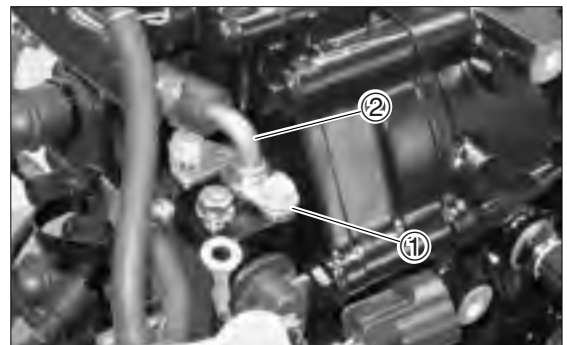
### 2) Removing Air Rail Ass'y

1. Remove stopper plate ① and pull out hose ②.

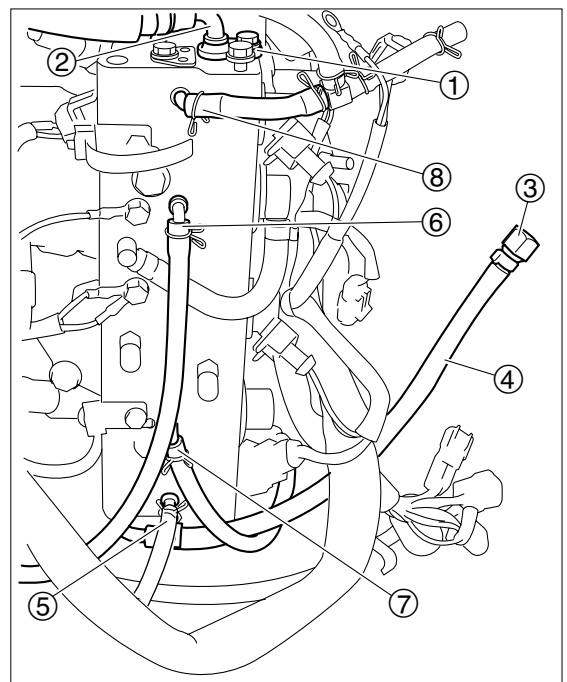


Disconnect fuel injector cord wires before removing the air rail.

Refer to "Chapter 5 Removing Cord Ass'y and electrical parts".



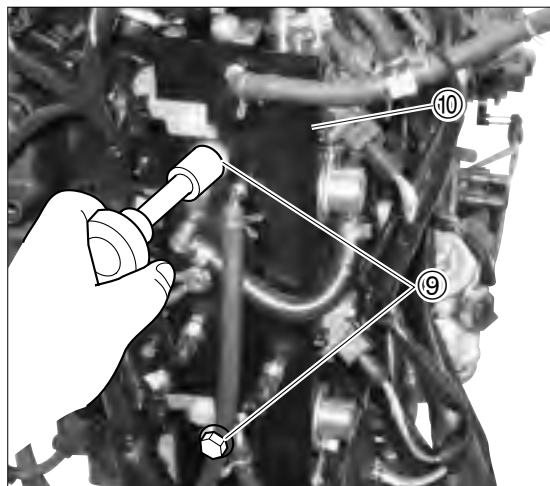
2. Remove compressor side hose joint ③ and remove air hose ass'y ③.
3. Remove cooling water outlet hose ⑦, and then, fuel return hose ⑥, air exhaust hose ⑤ and cooling water inlet hose ④.





## Fuel System (TLDI)

- Loosen two bolts ⑨ that secure air rail, and remove air rail ass'y ⑩ carefully.

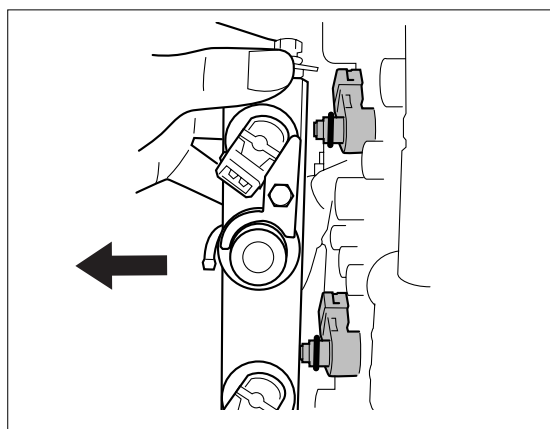


- When removing the air rail, leave the air injectors on the cylinder side.



Be careful not to drop O ring located on the air injectors.

Pull the air rail straight without applying force to the air injectors.



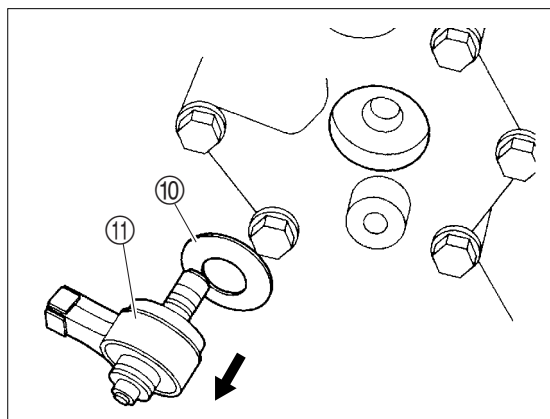
- After removing air rail ass'y, remove three air injectors ⑪ and air injector set pieces ⑩.

### ⚠ CAUTION

**Handle fuel injectors carefully. Impacting their tips can cause malfunction.**



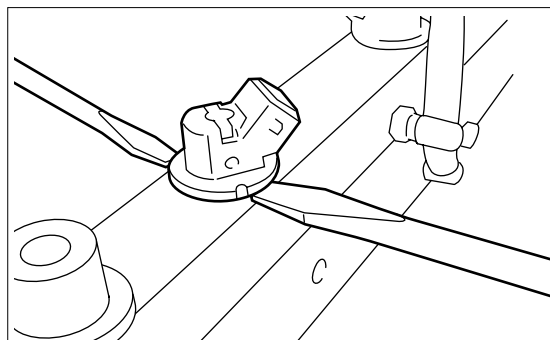
When removing the air injectors, pull out them straight without applying force to their tips.



- Turn each fuel injector carefully to loosen O ring, and insert bladed screw drivers from both sides to remove it up straight evenly.

### ⚠ CAUTION

**Handle fuel injectors carefully. Impacting their tips can cause malfunction.**



### 3) Inspection of Injectors

1. Check air injectors and fuel injectors for cracks and damages. Replace if necessary.
2. Check disc springs of air injectors for dirt, correct position settling and damages Clean, or replace if necessary. (Refer to "Injector Assembling Diagram" in page 4-23.)

## 5. Assembly of Air Rail

### ⚠ CAUTION

**Impacting the tip of air injector or fuel injector can cause defective operation of the injector, possibly damaging the engine.**

### 1) Installing of Injectors and Regulators

1. Use O ring set tool to attach O rings ② and ③ to fuel injector ①.



**O Ring Set Tool (ø24):**  
P/N. 3T5-72863-0

### ⚠ CAUTION

**To avoid incorrect installation of the fuel injectors, check the marking ① on each injector.**

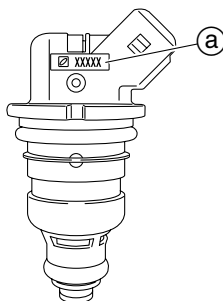
**For TLDI40/50B, TLDI40/50B2,**

**TLDI70/90B and 75/90C2 :**

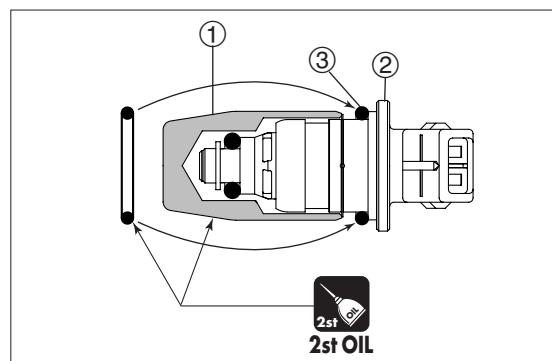
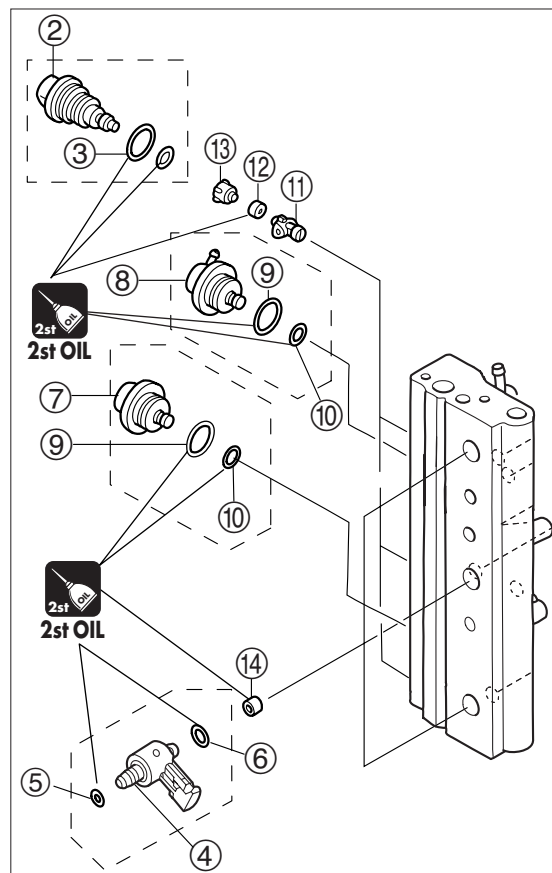
**Marking of "37003" on the blue plastic area**

**For 115A and TLDI115A2 :**

**Marking of "37001" on the pink plastic area**



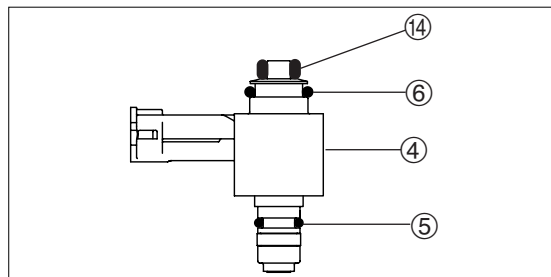
**2st OIL**



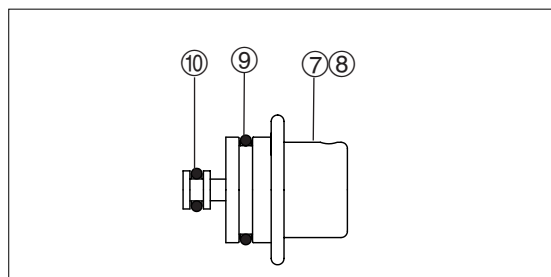


## Fuel System (TLDI)

2. Attach O rings ⑤ and ⑥ and compression seal ⑭ to air injector ④.



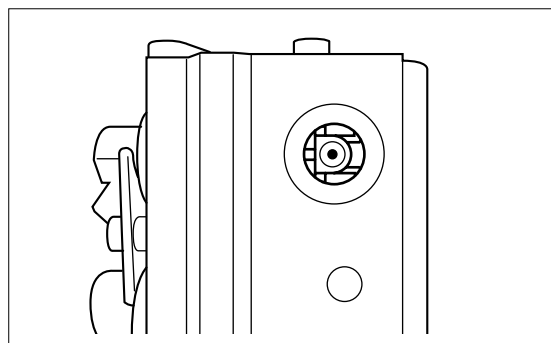
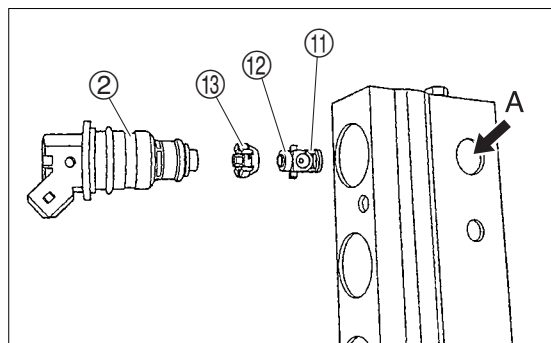
3. Attach O rings ⑨ and ⑩ to air regulator ⑦ and fuel regulator ⑧.



4. Attach compression seal ⑫ to fuel injector insert ⑪, and then, attach the assembly to the air rail.



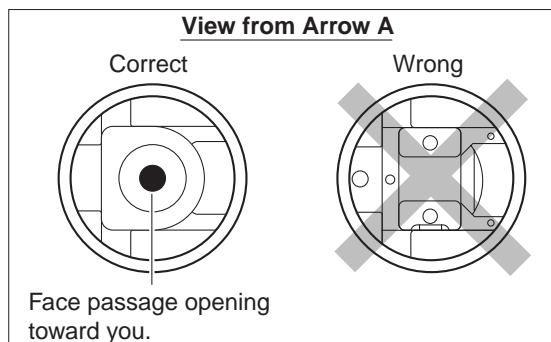
- Attach the insert ⑪ in a correct orientation shown by arrow A.
- Check that injectors are free from waste textile and other dirt before installing.



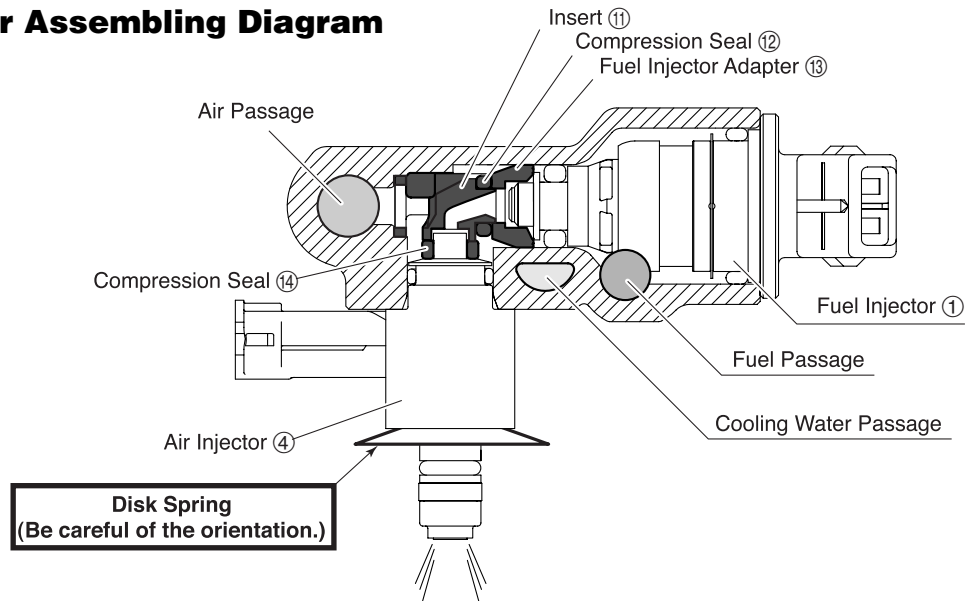
5. Attach fuel injector adapter ⑬ and fuel injector ② to the air rail.
6. Attach compression seal ⑭ to air injector ④, and then, attach the assembly to the air rail.
7. Install air regulator ⑦ and fuel regulator ⑧.



Air regulator is marked with orange paint. Fuel regulator is marked with white paint.



## Injector Assembling Diagram



### 8. Attaching Hose Clamps

#### (1) Attach the following parts.

Install fuel regulator ① and air regulator ③, secure them using collars ④, plate ⑤ and bolt ⑥, and attach clamp ⑦.



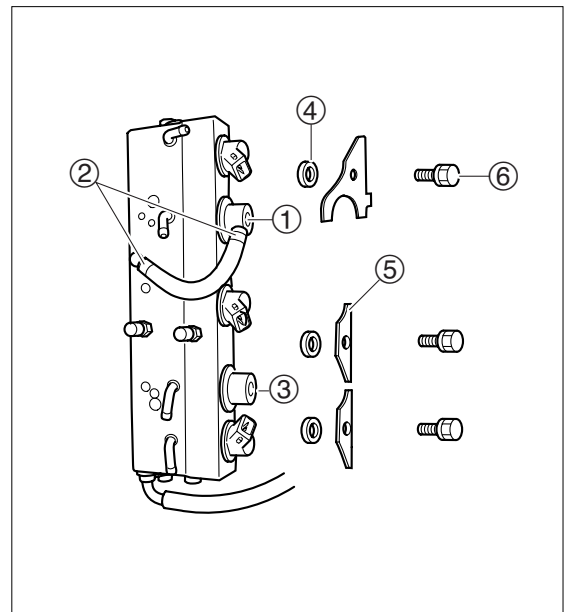
Be sure to install collar ④ below plate ⑤.

Attach hose to fuel regulator by using hose clamp ②.

Do not reuse hose clamp. Always use new one.



**Clamp Pliers :**  
P/N. 3T5-72864-0



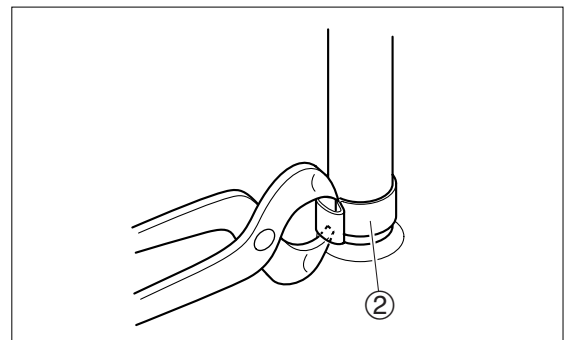
② Do not reuse

#### (2) Removing hose clamp

Cut joint of hose clamp ② and remove the clamp.

#### ⚠ CAUTION

**Remove hose clamp without cutting joint will damage fuel hose.**



② Do not reuse



## Fuel System (TLDI)

- (3) Attaching hose clamp. Lightly Lubricate inside of clamp to prevent hose damage.  
Crush hose clamp ② as shown to tighten the hose securely.

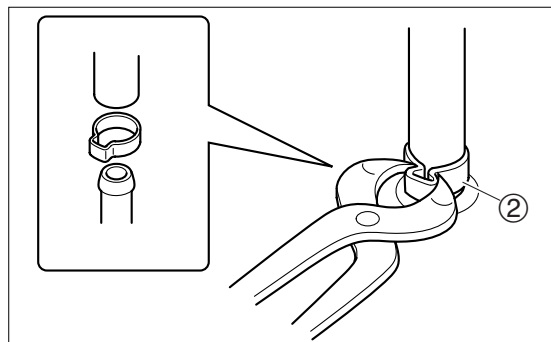
### ⚠ WARNING

**Do not reuse hose clamp. Be sure to use new one.**

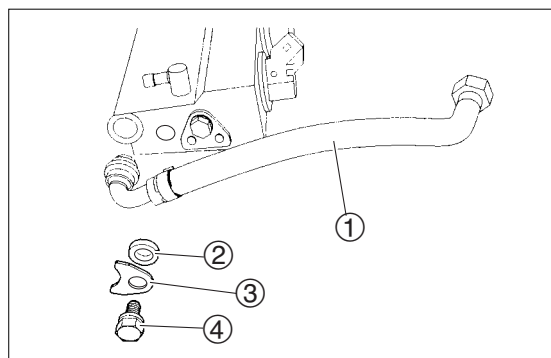


Do not crush hose clamp too much, or the hose may be damaged.

9. Attach the following parts.
- (1) Attach air hose ass'y using collar ②, nipple plate ③ and bolt ④ in this order.



② Do not reuse



## 2) Installation of Air Rail

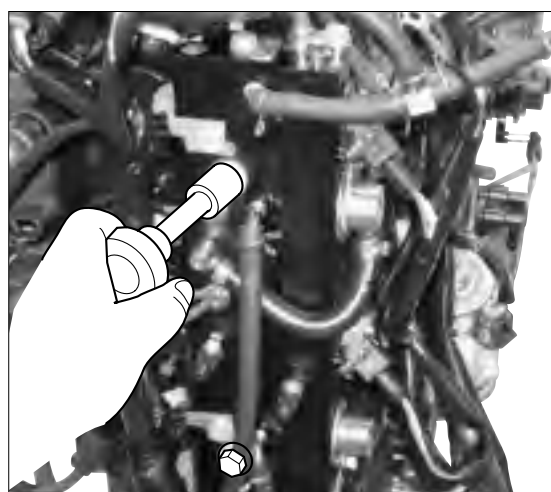
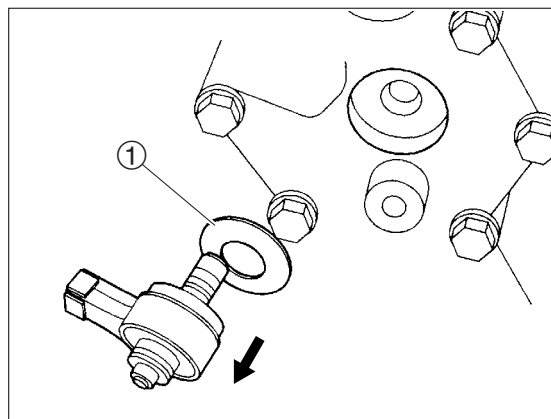
1. Install air rail ass'y to cylinder head, and secure with bolts.

### ⚠ CAUTION


**When installing air rail ass'y, be careful of orientation of disc spring ①. Installing the part in wrong orientation can cause squirt of fuel. Refer to "Injector Assembling Diagram" in page 4-23.**




- Set air injector with coupler side directing to port side of engine.
- Check that injectors are free from waste textile and other dirt before installing.
- Install air rail ass'y on the cylinder head horizontally, and tighten all bolts evenly.

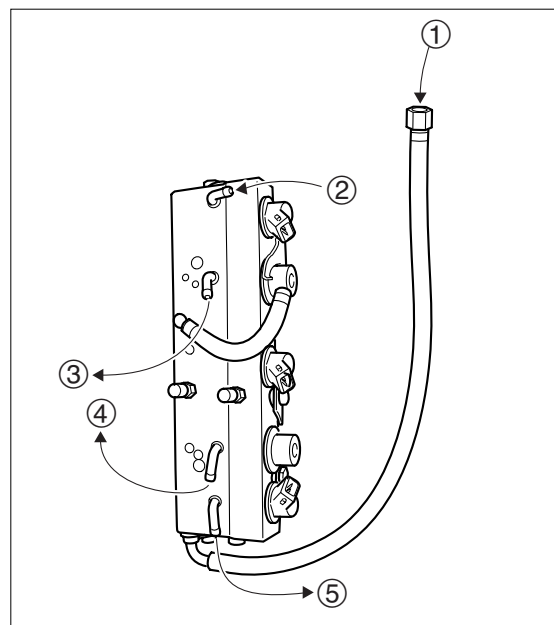


2. Arrange the pipes as shown.  
Attach air hose ass'y ① to air compressor hose joint adapter with fasteners tightened to specified torque.

 **Air Hose Ass'y ① :**  
15 N·m (11 lb·ft) [1.5 kgf·m]

 Do not tighten with excessive torque. The part may be damaged.

from air compressor (air) ①  
from air compressor (cooling water) ②  
to FFP (fuel) ③  
to cylinder (air) ④  
to bottom cover (cooling water) ⑤




## 6. Removing and installation of Fuel System


### 1) Removing High Pressure Fuel Hose Ass'y

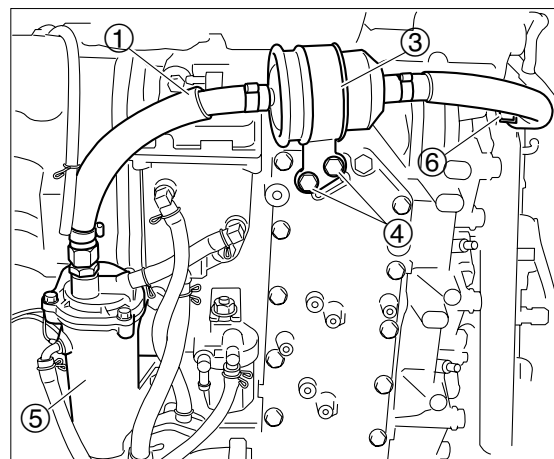
Remove following parts.

1. Remove fuel hose ass'y ① after loosening joint between FFP ⑤ and air rail ⑥.

 Before removing fuel hose ass'y, disconnect coupler of cord holder, and then, remove cord holder.  
Refer to "Removing Cord Ass'y" in Chapter 5.

2. Remove high pressure fuel filter ③ from mounting bolt ④ and exhaust cover.


 Use rag to catch fuel that spills from the parts ⑤ and ⑥ when they are removed.




### 2) Installation of Fuel Hose Ass'y


Reverse the removing steps.

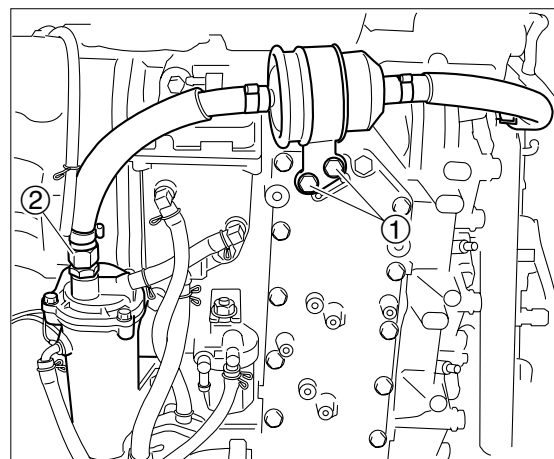
Fuel Filter Band Securing Bolt ④

 **Fuel Filter Band Bolt ④ :**  
20 N·m (14 lb·ft) [2.0 kgf·m]

Nut for attaching to FFP

 **Fuel Hose Ass'y Nut ⑦ :**  
15 N·m (11 lb·ft) [1.5 kgf·m]

 Do not tighten with excessive torque. The part may be damaged.





# Fuel System (TLDI)

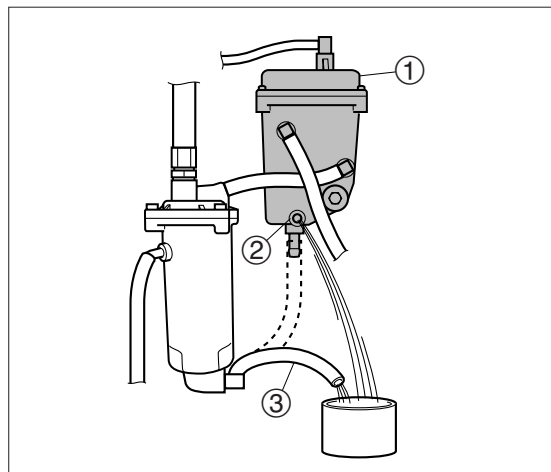
## 3) Draining Fuel from FFP Vapor Separator

1. Decompress fuel and air pressures.

**⚠ WARNING**

**Compressed fuel and/or air may spurt if it is not decompressed.**

2. Loosen air vent screw ①, and then, drain screw ② to drain fuel from vapor separator and collect it in a container.
3. Disconnect hose ③ at vapor separator side to drain fuel from FFP and collect it in a container.



## 4) Removing Vapor Separator

Use the following steps to drain fuel from vapor separator.

1. Loosen air vent screw ① and then drain screw ②.



Use rag to catch fuel that spills from the part ② when it is loosened.

2. Pull out following hoses.

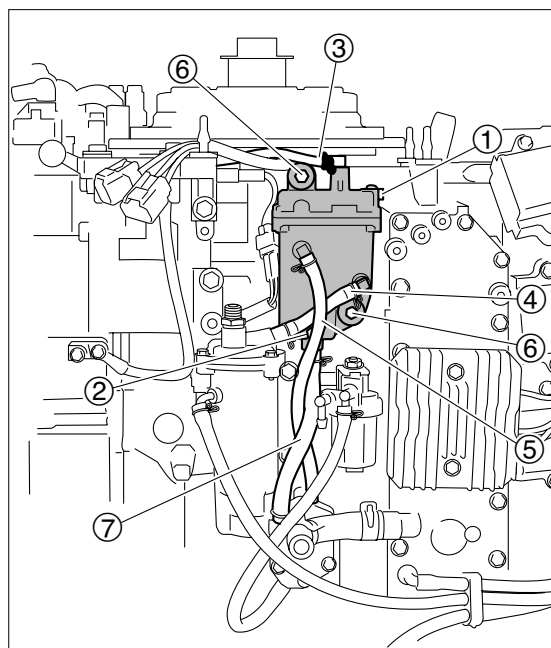
Vapor Exhaust Hose ③ : Vapor Separator → Throttle Body

Vapor Return Hose ④ : FFP → Vapor Separator

Fuel Inlet Hose ⑤ : Fuel Pump → Vapor Separator



Use rag to catch fuel that spills from hose ④ when it is disconnected.



Remove following parts to remove vapor separator.

Bolts ⑥ : 2 pcs.

Fuel Outlet Hose ⑦ : Vapor Separator → FFP

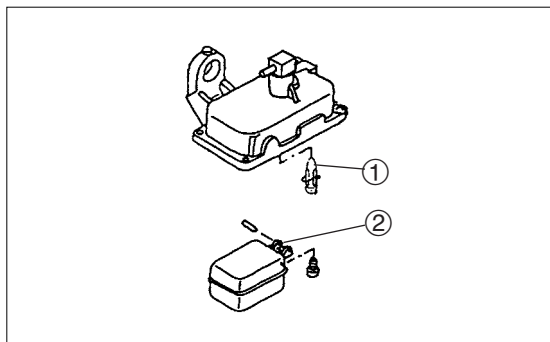


Use a container to catch fuel that spills from hose ⑦ when it is disconnected.

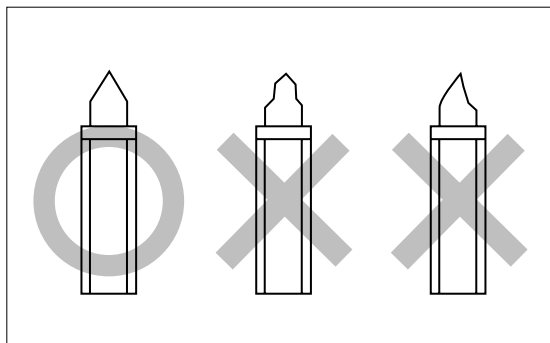


## 5) Disassembly and Inspection of Vapor Separator

1. Remove float chamber of vapor separator, and then, remove float valve ① and float ②.



2. Inspection of Vapor Separator
  1. Check needle valve ① for deformation and wear.
  2. Check float ② for deformation, crack and other defects.  
Replace if necessary.
  3. Check if any dirt or dust is in the vapor separator.  
Replace if necessary.



4

## 6) Assembly of Vapor Separator

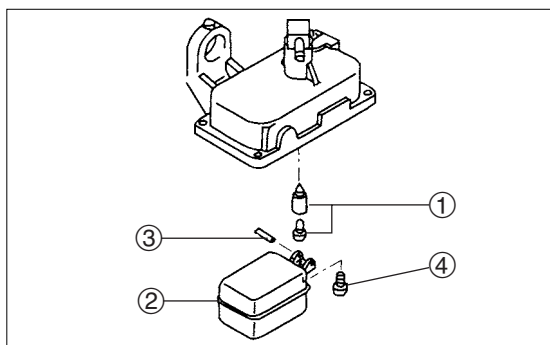
1. Assemble following parts.

- ① Float Valve
- ② Float
- ③ Float Arm Pin
- ④ Tighten screw.



**Screw ④ :**

1.6 N·m (1.1 lb·ft) [0.16 kgf·m]



- ⑤ Drain Screws : Tighten two screws.

- ⑥ O Rings : 2 pcs.



**Draw Screw ⑤ :**

1.6 N·m (1.1 lb·ft) [0.16 kgf·m]



**O Ring ⑥ :**

Genuine Engine Oil

- ⑦ O Ring
- ⑧ Tighten Screw.
- ⑨ Tighten Screw.



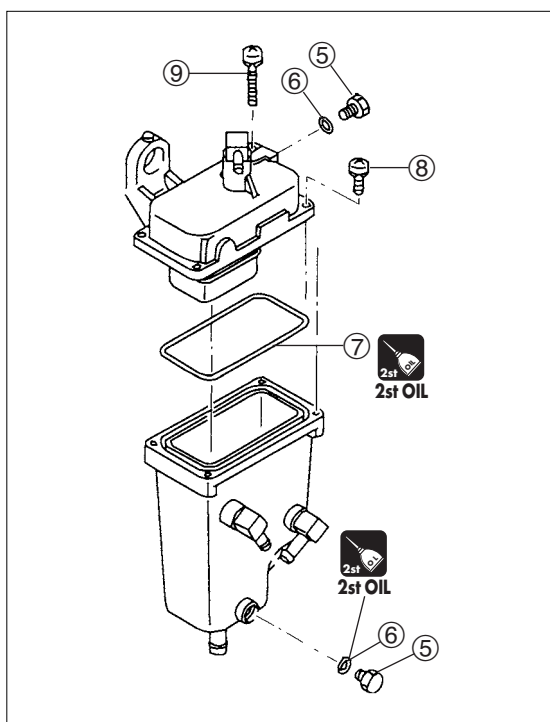
**Screws ⑧ and ⑨ :**

1.6 N·m (1.1 lb·ft) [0.16 kgf·m]



**O Ring ⑦ :**

Genuine Engine Oil





# Fuel System (TLDI)

## 7) Assembly of Vapor Separator Ass'y

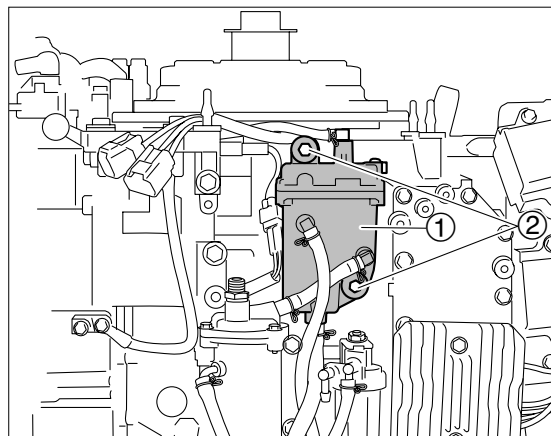
- Reverse the removing steps.

- ① Vapor Separator Ass'y
- ② Tighten bolts.



**Bolts ② :**

6 N·m (4 lb·ft) [0.6 kgf·m]



## 8) Removing FFP\* Ass'y

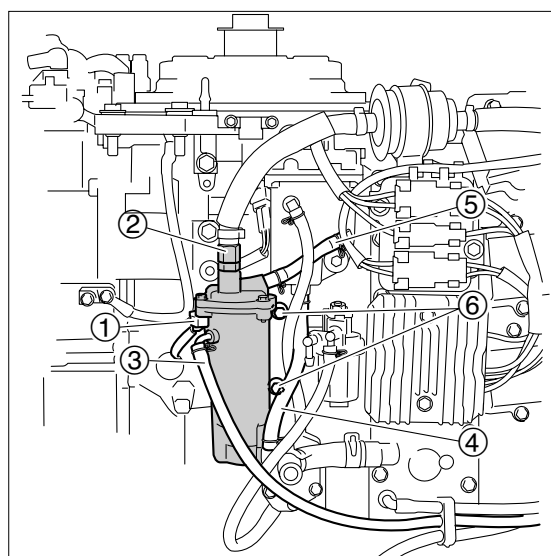
\* FFP : Fuel Feed Pump

- Remove parts in the order described below.  
Disconnect FFP connector ①, loosen hose joint ②, and then remove fuel hose ass'y.
- Remove following hoses.  
Fuel Return Hose ③ : Air Rail → FFP  
Vapor Return Hose ④ : FFP → Vapor Separator  
Fuel Hose ⑤ : Vapor Separator → FFP
- Loosen two bolts ⑥ and remove FFP.



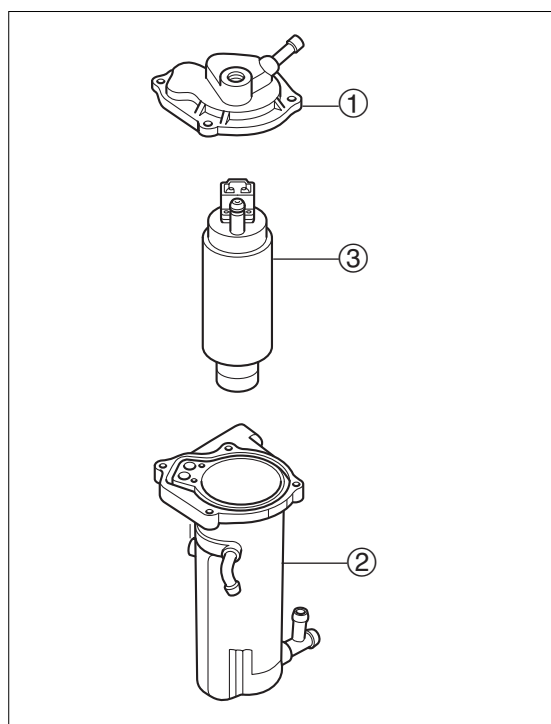
Use rag to catch fuel that spills from each hose when it is disconnected.

- Remove low pressure side fuel pump.



## 9) Disassembly and Inspection of FFP


- Loosen upper case ① securing bolts and take out FFP from FFP case ②.
- Inspection of FFP  
Check if any contamination is found in the case ②.  
Clean if necessary.
- Check if any corrosion found on the FFP body ③, or upper or lower resin part is damaged or cracked, and clean or replace if necessary.





## 10) Assembly of FFP Ass'y

Assemble following parts.


1. Attach hose joint adapter ① and metal washer ② to upper case ③.

 **Hose Joint Adapter ① :**  
14 - 16 N·m (10 - 12 lb·ft) [1.4 - 1.6 kgf·m]

 **Degrease edge and then apply adhesive :**  
ThreeBond 1342

 Replace metal washer ② with new one if FFP is disassembled.

2. Attach pipe grommet ④ and lower grommet ⑤ to FFP ⑥.


 **Pipe Grommet ④, Lower Grommet ⑤ :**  
Genuine Engine Oil

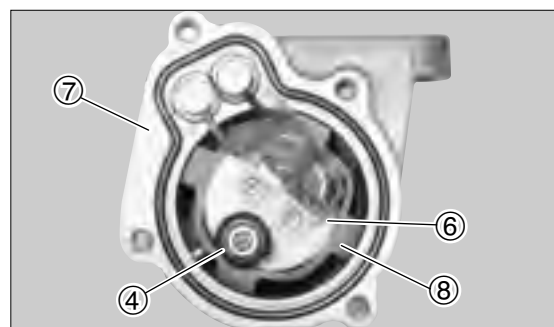
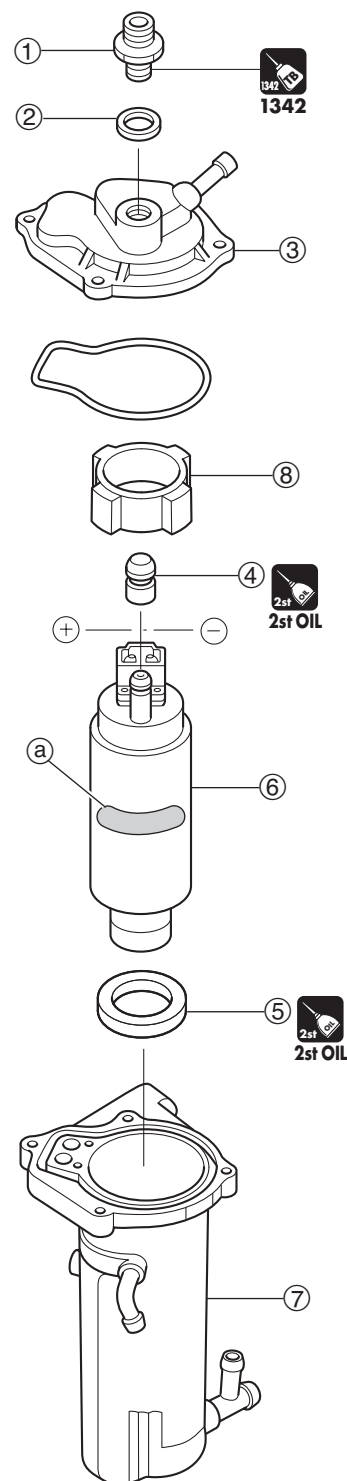
3. Install FFP ⑥ to case ⑦.

### CAUTION

**To avoid the use of FFP ⑥ on another model, check the marking (a) on the body, before assembly.**

**For TLDI40/50B, TLDI40/50B2, TLDI70/90B and TLDI90C : "GSC434"**  
**For TLDI75/90C2, TLDI115A and TLDI115A2 : "GSC295"**

-  Adjust position of FFP body so that pipe grommet ④ can be inserted into upper case ③.
- Lightly applying 2 stroke engine oil on inside and outside of upper grommet ④ makes adjustment of position of FFP body easier.
- Installation orientation of ⑥ to ⑦ is as shown. Put upper case ③ on the top and check the position.
- Install upper case taking care that motor leads are not caught between upper case and FFP body.





# Fuel System (TLDI)

- Attach upper grommet ⑧ and cable terminal grommets ⑨.



**Terminal area of parts ⑧, ⑨, ⑩ and ⑪ :**  
Genuine Engine Oil

Attach black wire ⑩ ( - ) and red wire ⑪ ( + ) of cable terminal to FFP case.



Be sure to connect the wires to their corresponding flat terminals ( - and + ).

- Connect FFP cords ⑫ to their corresponding terminals ⑩ and ⑪.. (Y... Yellow ⊖ L... Blue ⊕)



Push down cables terminals to connect terminals securely. Be careful that the cords are not caught.

Attach cord cover ⑮ and clamp ⑯ to the body by using spacer (washer) ⑬ and bolt ⑭.



**FFP Bolt ⑭ :**  
3.2 N·m (2.3 lb-ft) [0.32 kgf·m]

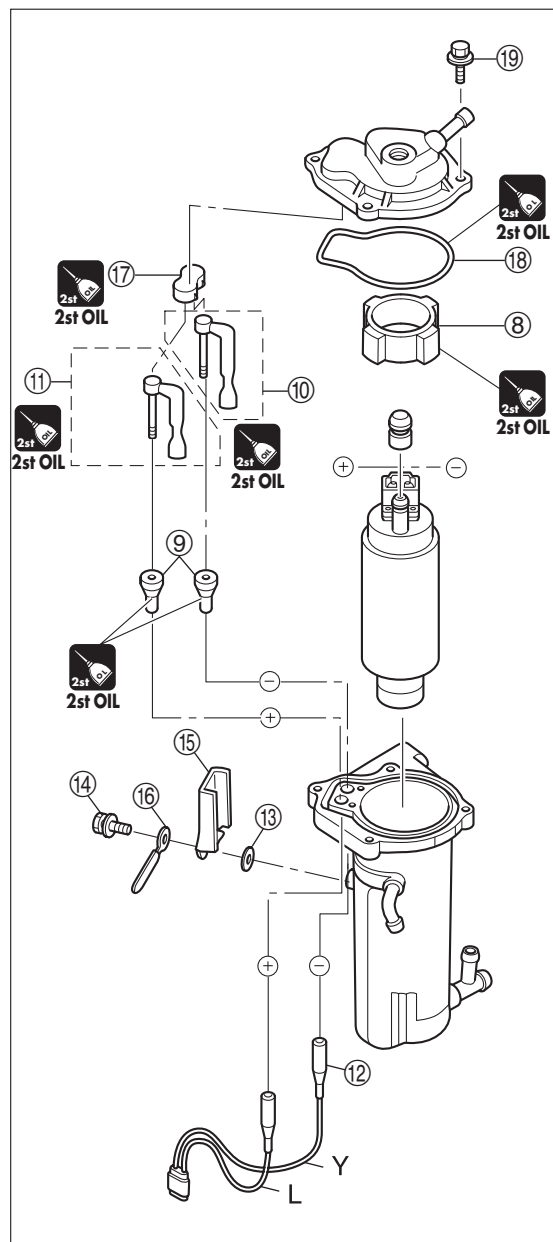
- Attach cable terminal grommet (upper) ⑰, put seal ring (O ring) ⑱ and upper case ③ and then, secure the parts with bolts ⑲.



**Cable Terminal Grommet Upper ⑰, O Ring ⑱ :**  
Genuine Engine Oil



**FFP Case (Upper) Bolt ⑲ :**  
3.2 N·m (2.3 lb-ft) [0.32 kgf·m]



## 11) Inspection of Fuel Pump

- Remove fuel hoses (2) from fuel pump.

### CAUTION

**Catch fuel that spills when the hoses are removed.**

- Connect vacuum/pressure gauge to inlet of fuel pump.



Fill fuel pump with 20:1 gasoline-oil mixture.

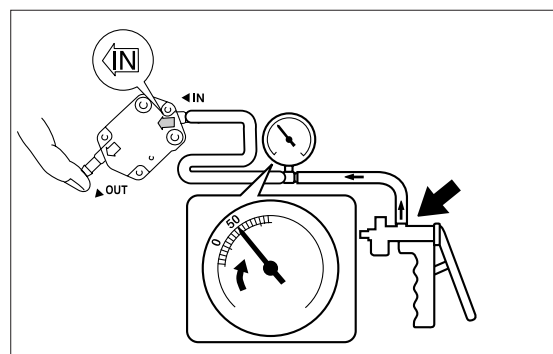
- Close fuel pump outlet with a finger and apply specified pressure. Check if no air leaks through diaphragm.



**Vacuum/Pressure Gauge :**  
P/N. 3AC-99020-0



**Specified Pressure :**  
0.05 MPa (7 psi) [0.5 kgf/cm<sup>2</sup>]



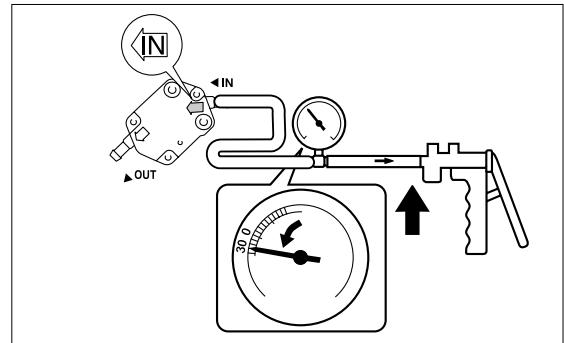
4. Apply specified vacuum pressure to check that no air leaks through check valve located in the fuel pump.



**Specified Vacuum Pressure :**

-0.03MPa (-4 psi) [-0.3 kgf/cm<sup>2</sup>]

5. Connect vacuum / pressure gauge to outlet of fuel pump.



6. Apply specified pressure to check that no air leaks through check valve located in the fuel pump. Replace fuel pump if necessary.

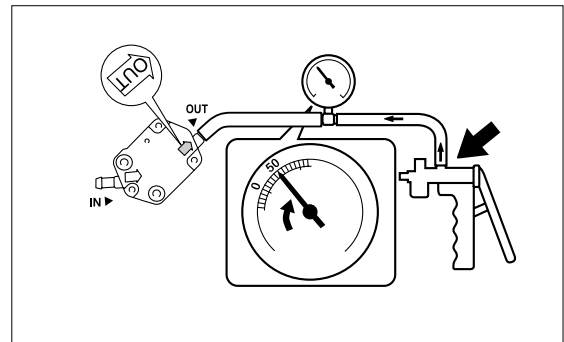


Air-tightness of fuel pump can be increased by making the interior wet with gasoline.



**Specified Pressure :**

0.03 MPa (4 psi) [0.3 kgf/cm<sup>2</sup>]



**4**

## 12) Installation of FFP Ass'y to Cylinder

1. Attach FFP Ass'y ① by using bolt ②.



**Bolt ② :**

6 N·m (4 lb·ft) [0.6 kgf·m]

Put fuel hose ③, fuel return hose ④ and vapor return hose ⑤ and secure them by using hose clips.

2. Attach high pressure fuel hose ⑥ to FFP ①.



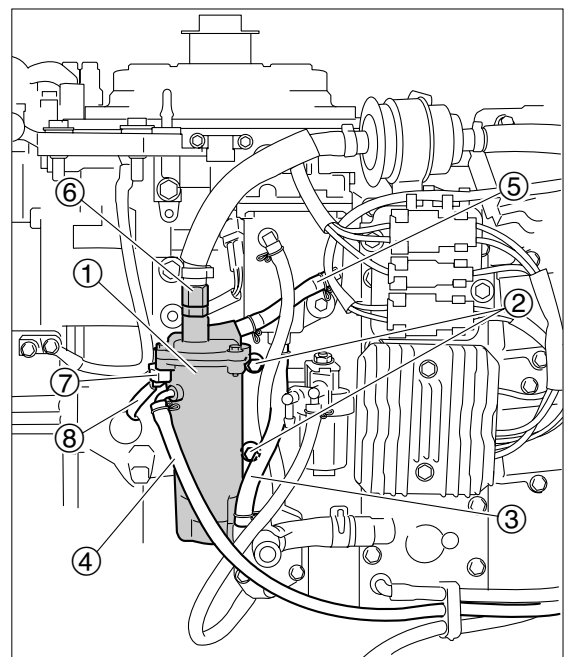
**High Pressure Fuel Hose Nut ⑥ :**

15 N·m (11 lb·ft) [1.5 kgf·m]

Connect FFP cord connector (cord ass'y) ⑦ and secure it with clamp ⑧.



Use clamp of FFP ass'y to secure FFP cord connector.





# Fuel System (TLDI)

## 7. Removing and Installation of Air Compressor

### 1) Removing Drive Belt

1. Mark drive belt with an arrow as shown to indicate orientation.

#### ⚠ CAUTION

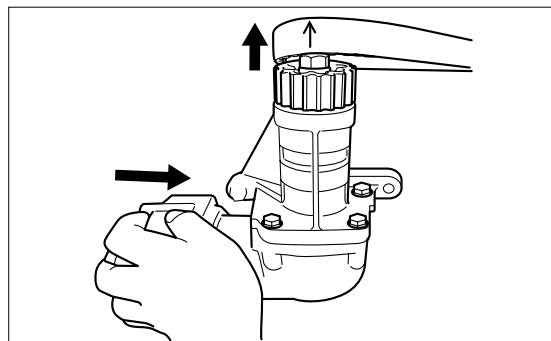
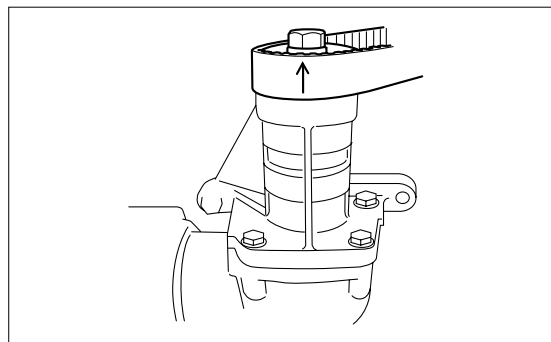
**When reusing the drive belt, install it in its original orientation indicated by the arrow.**

2. Loosen compressor mounting bolts and slide the compressor to crank case side.
3. Move the belt upward to remove.



The belt can be made slack when it is slid because it is located with two knocks.

If the belt cannot be removed by using the above method, remove the bolt and then remove the belt while turning pulley of the air compressor.



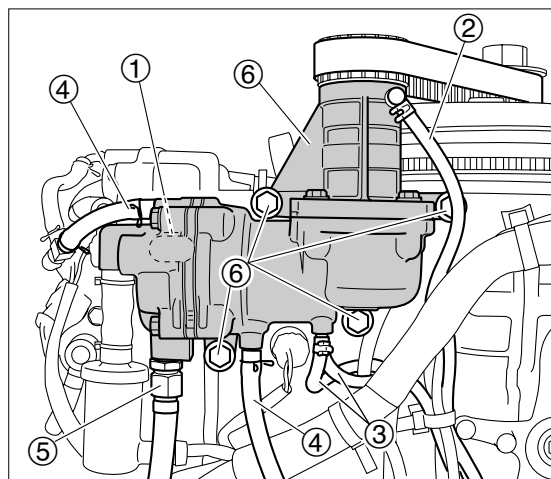
### 2) Removing Air Compressor

Remove compressor by using the following steps.

1. Remove water temperature sensor coupler ① of compressor.
2. Loose the clamps of oil pipe ②, Recirculation pipe ③ and cooling water pipe ④ at compressor side and pull hoses out.
3. Loosen nut of high pressure air hose ⑤ and disconnect the hose.
4. Remove bolts ⑥ and remove the compressor.

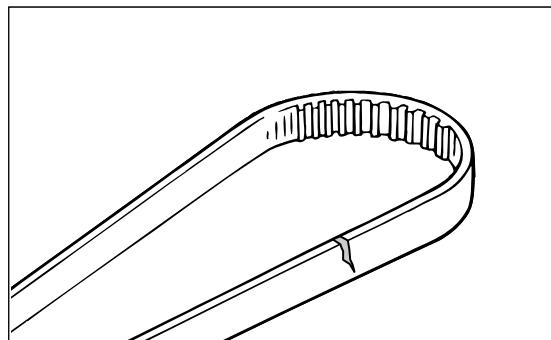


If performing the work after stopping the engine, do it after cooling the high pressure hose because it is made hot during the operation.



### 3) Inspection of Drive Belt

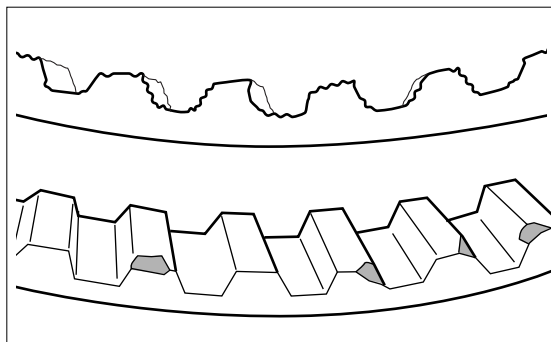
1. Check drive belt for crack, damage and wear on both faces.



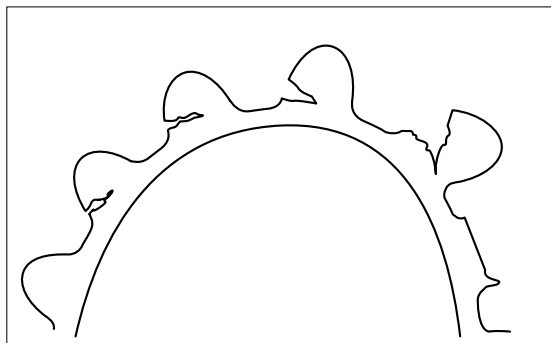
2. Check drive belt for missing tooth (teeth) and adherence of oil.



Replace the belt with new one if any of the above problems exists.



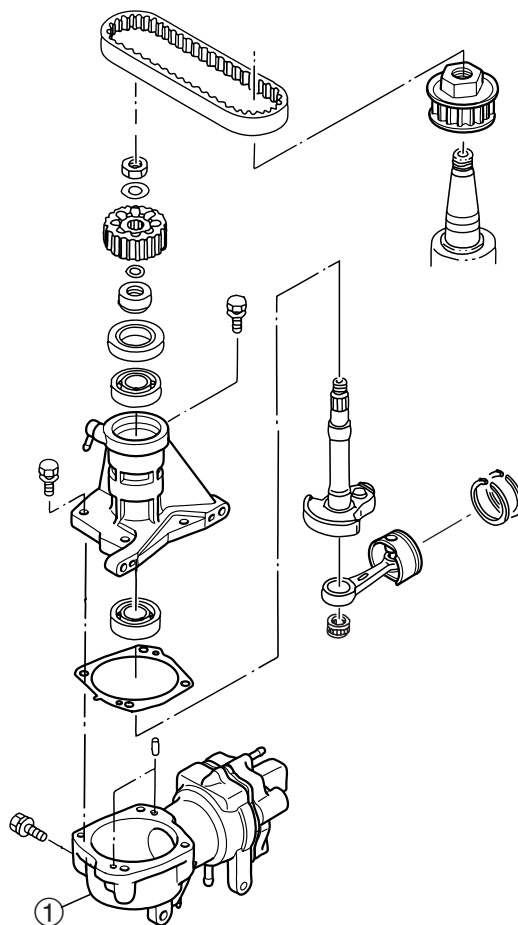
Crack or chip of the belt, if any, can be found easily when it is turned over.



4

#### 4) Removing Driven Pulley

1. Remove compressor cylinder ① from air compressor ass'y by referring to exploded diagram.



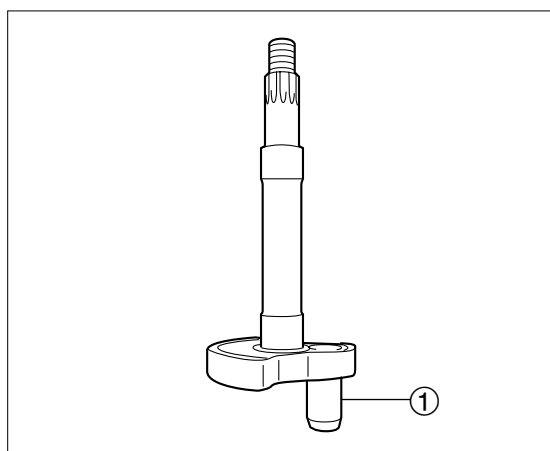
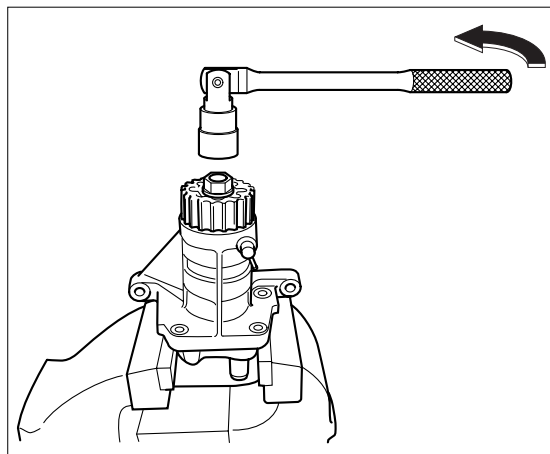


## Fuel System (TLDI)

2. Fix crank shaft at its lower end by using a vice, loosen driven pulley securing nut, and then remove driven pulley.

### ⚠ CAUTION

**Be careful not to damage the crank pin ① area when fixing crank shaft using a vice.**



① Crank Pin

## 5) Disassembly of Compressor Housing

1. Remove oil seal ① and bearing ②.



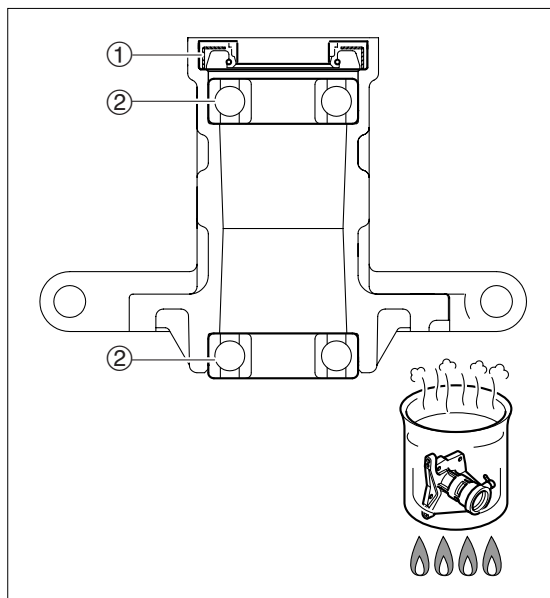
Heat compressor housing to 60 to 70 degrees Centigrade (140 to 158 degrees Fahrenheit) by using hot water before removing bearing ②.

### ⚠ CAUTION

**Do not reuse removed bearing.**



Heating of compressor housing can also be made by using a heat gun or heat lamp.



① ② **Do not reuse**

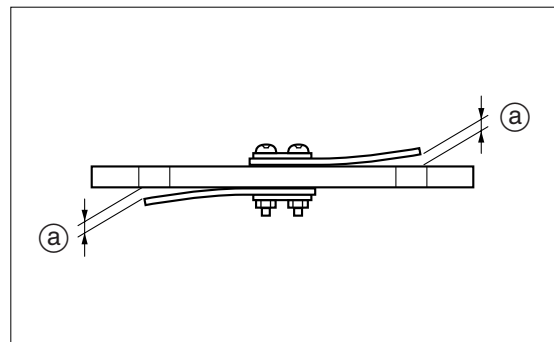


## 6) Inspection of Reed Valve

1. Check if reed valve is bent, damaged or worn.  
Replace reed valve ass'y if the reed valve gap is over the specified limit.

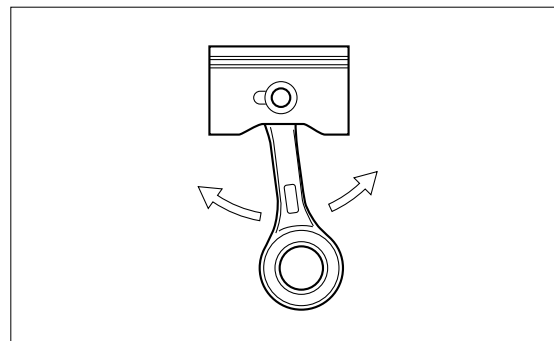


**Gap of Reed Valve at the Tip ① :**  
0.2 mm (0.008 in) or less



## 7) Inspection of Cylinder and Piston

1. Clean compressor cylinder, compressor head and compressor housing, check the parts for cracks damages.  
Replace if necessary.
2. Check cylinder wall for wear or scuffing.  
Replace if necessary.
3. Clean piston and check for crack and damages.  
Replace if necessary.
4. Check that connecting rod small end moves smoothly.  
Replace if necessary.



4

## 8) Assembly of Compressor Housing

1. Apply two stroke engine oil to periphery of bearing ③, and install it into compressor housing by using a press.



**Driver Rod ① :**

P/N. 3AC-99702-0

**Bearing Attachment ② :**

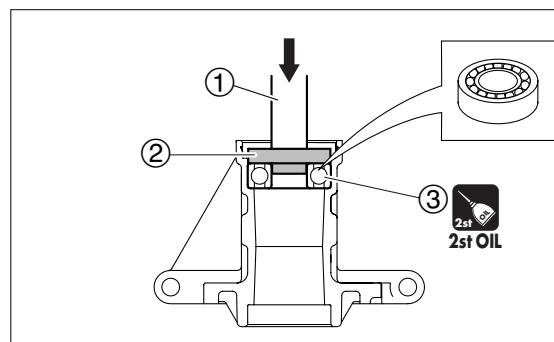
P/N. 3T1-99905-0



- Do not reuse removed bearing.
- Install bearing with manufacturer's mark facing bearing driving tool.

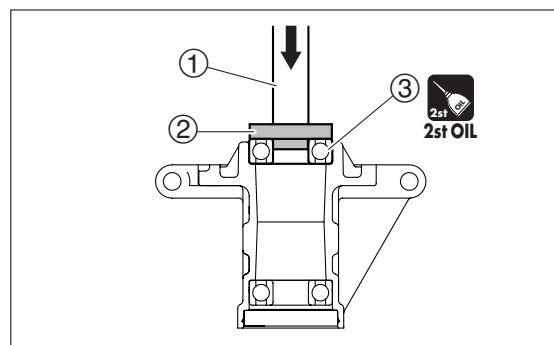


**2st OIL**



③ Bearing

**Do not reuse**



③ Bearing

**Do not reuse**



## Fuel System (TLDI)

2. Apply two stroke engine oil to periphery of oil seal ⑤, lithium grease to the lip area, and install it into compressor housing by using a press.



**Driver Rod ① :**

P/N. 3AC-99702-0

**Oil Seal Attachment ④ :**

P/N. 3T1-99820-0



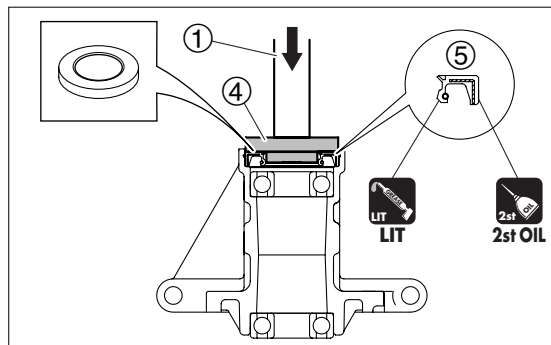
Be careful of orientation of oil seal when it is installed.



**2st OIL**



**LIT**



⑤ Oil seal

**Do not reuse**

### 9) Installation of Crank Shaft

1. Install crank shaft ① to the housing ②, and fix the crank shaft at its lower end by using a vice.
2. Attach collar ③, O ring ④, and driven pulley ⑤, and tighten nut ⑥ to the specified torque.



**Driven Pulley Nut ⑥**

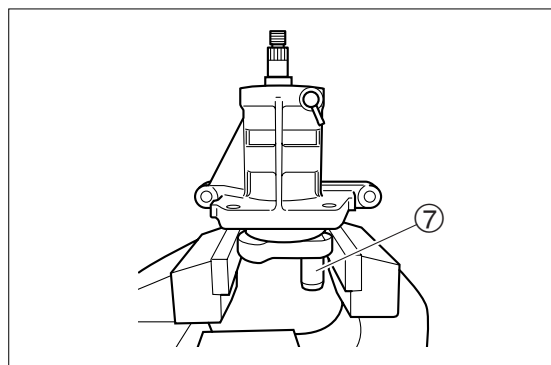
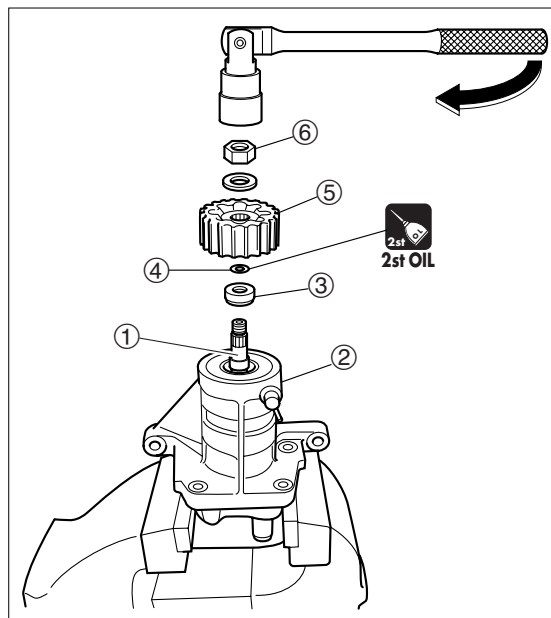
50N·m (36 lb·ft) [5.0kgf·m]

#### **CAUTION**

**Be careful not to damage the crank pin area ⑦ when fixing crank shaft using a vice.**



**2st OIL**



## 10) Installation of Piston

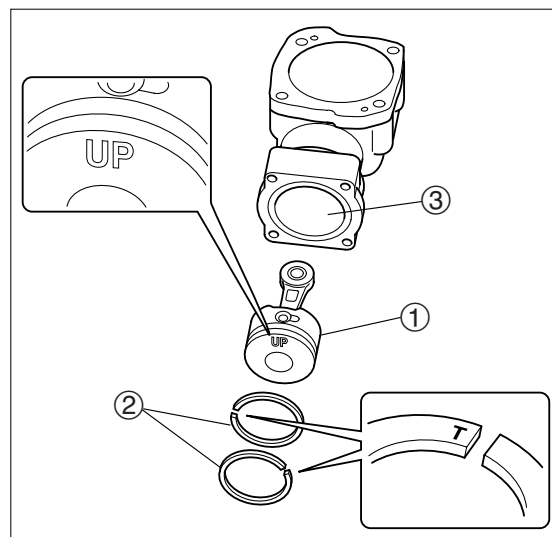
1. Attach piston rings ② to piston ①.

### ⚠ CAUTION

**Bring piston ring gaps away from each other.**

### ⚠ CAUTION

**Be careful not to scratch piston when attaching the rings.**



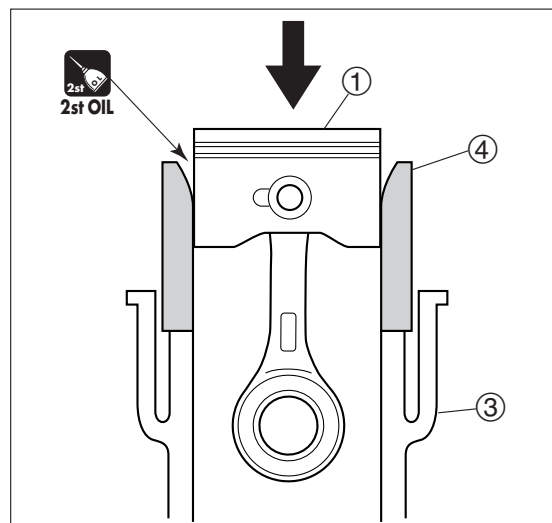
2. Apply two stroke engine oil to cylinder inner wall ③, piston periphery, and piston rings, and install piston ass'y to the cylinder so that "UP" mark of the piston head is at the pulley side.



**Piston Slider ④ :**  
P/N. 3T1-72871-0



**2st OIL**



**4**



# Fuel System (TLDI)

## 11) Installation of Compressor Housing Ass'y

1. Attach dowel pins ② to compressor cylinder ①.
2. Install compressor housing ass'y ③ and gasket by using bolt ④.



Put crank pin into connecting rod big end and install the assembly while shaking crank shaft a little.



**Compressor Housing Bolt ④ :**  
6N·m (4 lb·ft) [0.6kgf·m]

3. Install head ⑤, reed valve ass'y ⑥ and gasket ⑦ by using bolt ⑧.



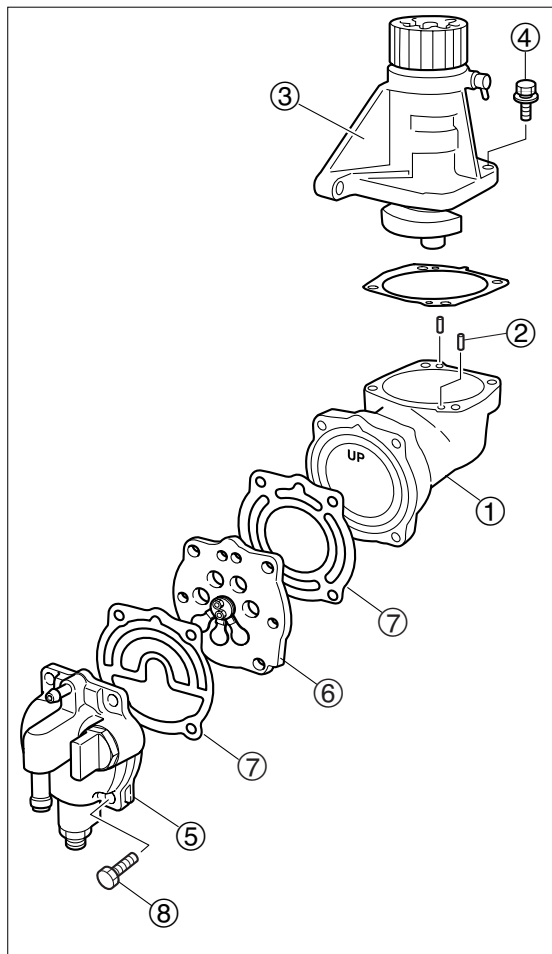
Be careful of the orientations of reed valve ass'y and gasket when installing them.



Degrease both mating faces of compressor head gasket and valve seat gasket before installing them.



**Cylinder Head Bolt ⑧ :**  
9N·m (7 lb·ft) [0.9kgf·m]



## 12) Measurement of Fuel Pressure and Air Pressure

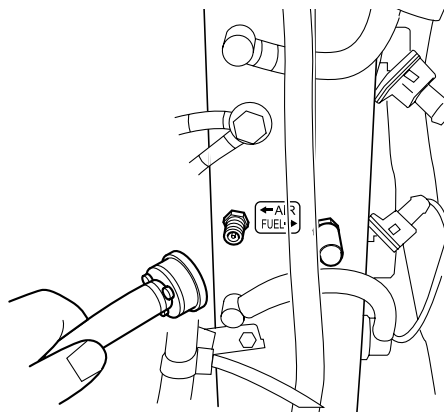
1. Use pressure gauge ass'y to measure fuel pressure and air pressure in the air rail.



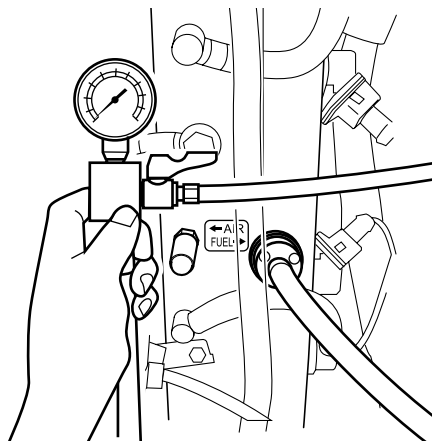
**Pressure Gauge Ass'y :**

P/N. 3T5-72880-0

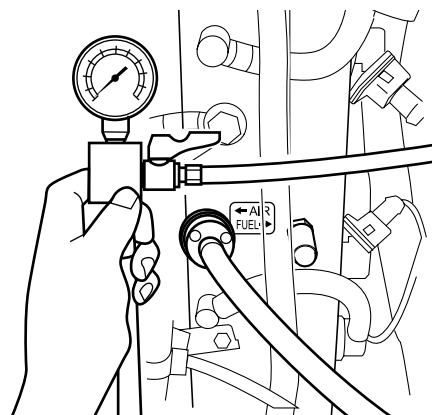
Perform the measurements by using the method described below.



Fuel Pressure



Air Pressure



4



# Fuel System (TLDI)

## How to Use Pressure Gauge

### 1. Pressure Gauge Ass'y

Measurement of Fuel Pressure and Air Pressure

1. Set the lever (3T5-72883-0) to position "A" shown below.
2. Screw adapter B (3T5-72884-0) into a valve of air rail for measuring air pressure or fuel pressure.

#### **⚠ WARNING**

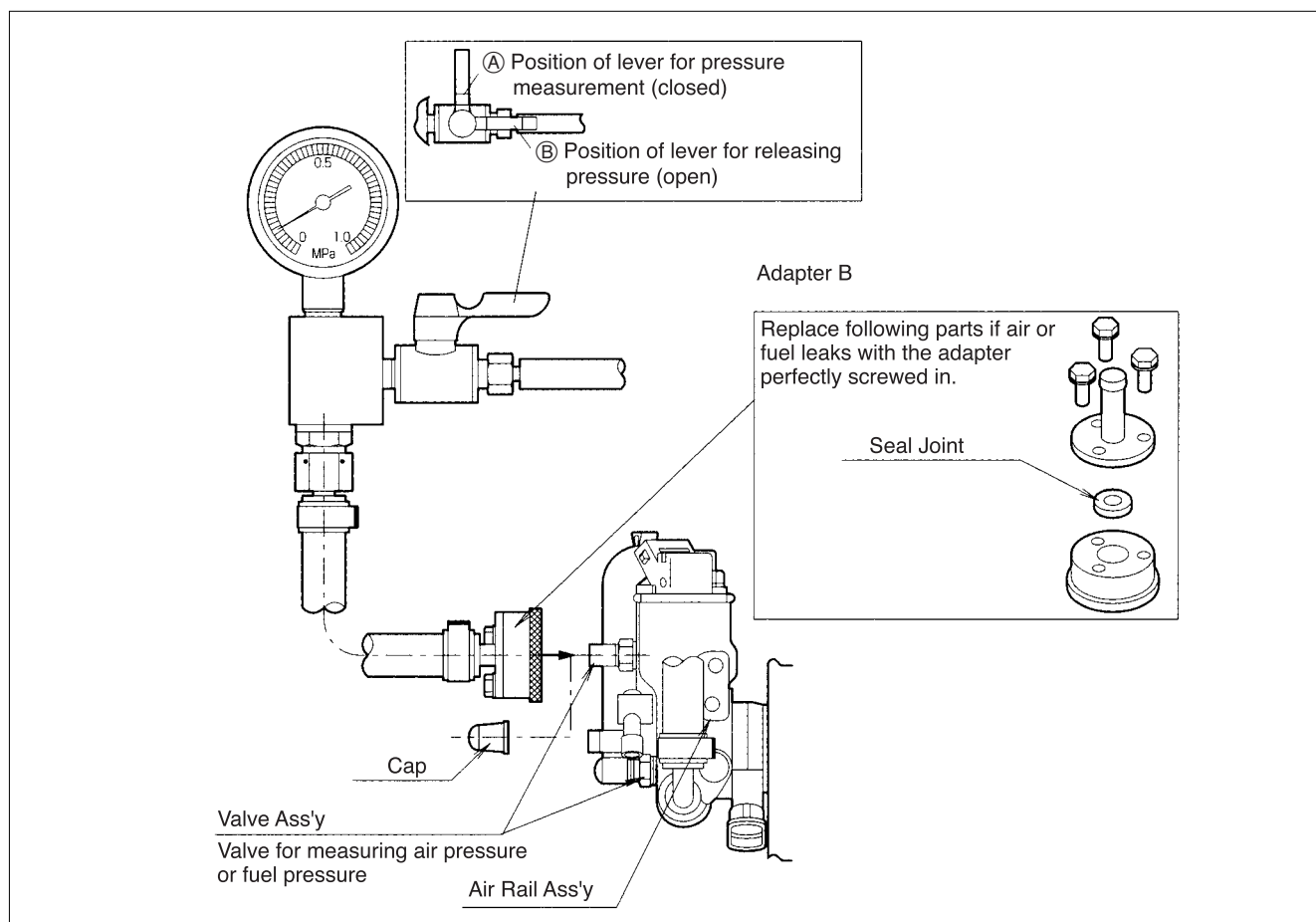
**Be careful of fuel that spurts when screwing the adapter into the fuel pressure measuring valve.**

3. Turn key switch from "OFF" to "START" position to crank the engine for approximately 15 seconds. (Run the engine for 15 seconds at idling speed of 700 r/min.)
4. The fuel system and air system are normal when the gauge indicates specified air and fuel pressures.  
(If the measurement of the pressure is out of the specified range, troubleshoot by referring to this service manual.)

Pressure Measurement	Typical Value	Specified Range of Pressure	Remarks
AIR PRESSURE	0.65 MPa (94.3 psi) [6.5 kgf/cm <sup>2</sup> ]	0.61 - 0.58 MPa (88.47 - 101.53 psi) [6.1 - 7.0 kgf/cm <sup>2</sup> ]	The pressure reduces gradually after stopping the cranking.
FUEL PRESSURE	0.72 MPa (104.4 psi) [7.2 kgf/cm <sup>2</sup> ]	Air Pressure +0.06 - 0.08 MPa (8.70 - 11.60 psi) [0.6 - 0.8 kgf/cm <sup>2</sup> ]	

5. After the measurement, set the key switch to "OFF", cock lever to position "B" to release the inner pressure, and then, remove adapter B from the measuring valve.

After measuring the fuel pressure, use a container to catch fuel that flows out from the tip of hose when the cock lever is set to position "B" (open). Bring cock side below the valve to drain fuel completely from the hose before removing adapter B.



### 13) Inspection of Oil Filter

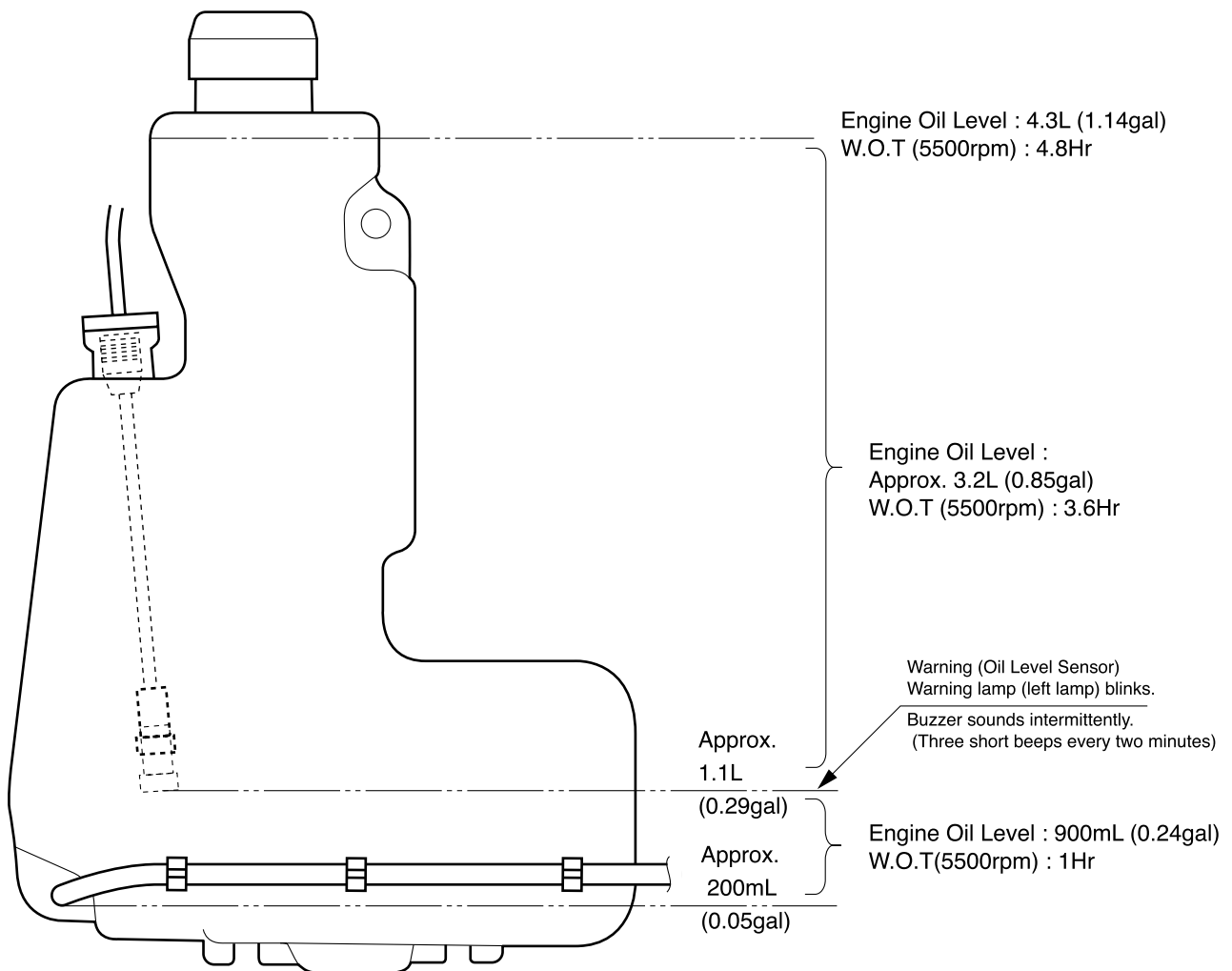
Check if oil filter is cracked, damaged or leaks, or if dirt or water is in it.

Clean or replace if necessary.

### 14) Inspection of Oil Tank

Check if oil tank is cracked, damaged or leaks, or if dirt or water is in it.

Clean or replace if necessary.





# Fuel System (TLDI)

## 15) Air Bleeding

1. Visually check if any air is found in the oil line from oil tank to cylinder block, and if any air is found, bleed the air by using the following procedure.

2. Fill oil tank.

3. Disconnect oil filter inlet hose, and then reconnect the hose when oil containing no air bubble flows out.

Then loosen nut on top of oil-filter and pull assembly away from the down head.

Pull outlet hose off and turn filter on its side(inlet,outlet facing up)and allow all air to escape from filter,then return to normal position and slide outlet line back on filter.

### CAUTION

**Put the drained oil in a container to prevent it from spreading on the engine.**

4. Set key switch ① to "ON".

5. Pull off lock plate ③ within one second from the moment warning buzzer ② stops.

6. Pull stop switch ④ twice within two seconds.

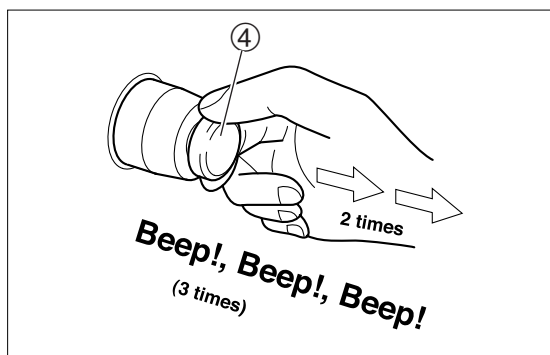
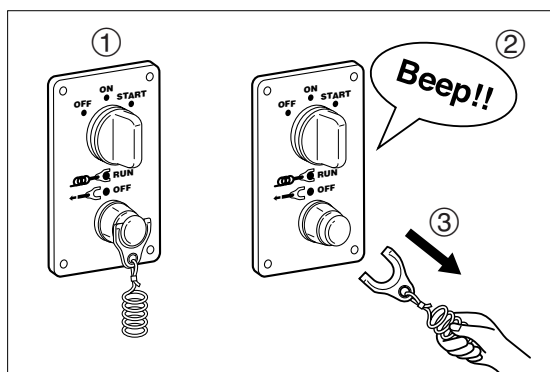
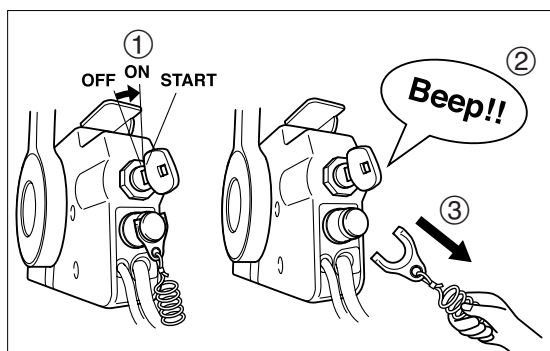
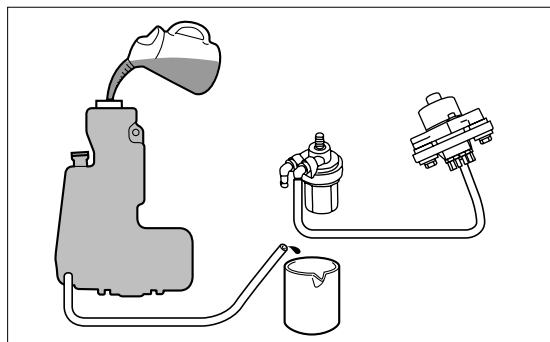


When the above operation is performed exactly, the buzzer pips three times and oil pump starts to run. If the buzzer does not pips three times, set the key switch to "OFF" and repeat the above steps.

7. The oil pump continues to operate to feed oil. When air is bled from the oil, set the key switch to "OFF".



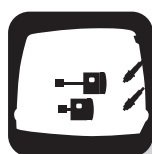
The oil pump stops automatically at approximately one minute.





# 5

## Power Unit



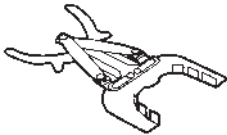
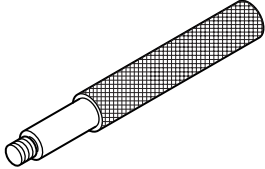
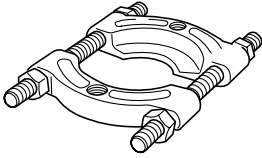
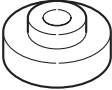
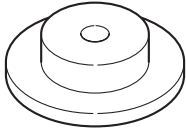
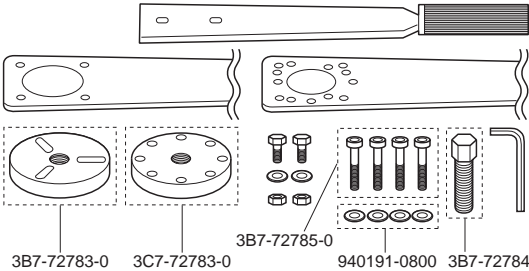
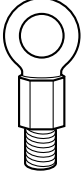
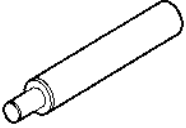
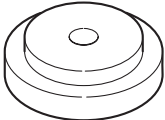
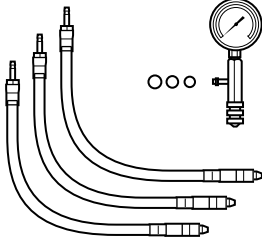
5

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5) Removing Alternator .....	5-20	33) Installation of Air Chamber .....	5-48
6) Removing Starter Motor .....	5-21	34) Installation of Recirculation Hoses .....	5-50
7) Removing Cord Ass'y .....	5-22	35) Installation of Throttle Link .....	5-50
8) Removing Oil Pump.....	5-25	36) Installation of Oil Pump .....	5-50
9) Removing Throttle Link .....	5-25	37) Installation of Fuel System .....	5-51
10) Inspection of Throttle Body.....	5-26	38) Installation of Cord Ass'y and	
11) Removing Air Chamber .....	5-27	Electrical Parts .....	5-51
12) Removing Thermostat.....	5-28	39) Installation of Starter Motor .....	5-51
13) Inspection of Thermostat .....	5-29	40) Installation of Alternator .....	5-51
14) Removing Fuel System .....	5-29	41) Installation of Drive Pulley and	
15) Removing Cylinder Head /		Flywheel.....	5-52
Head Cover .....	5-29	42) Installation of Air Compressor .....	5-52
16) Inspection of Cylinder Head .....	5-30	43) Installation of Power Unit .....	5-52



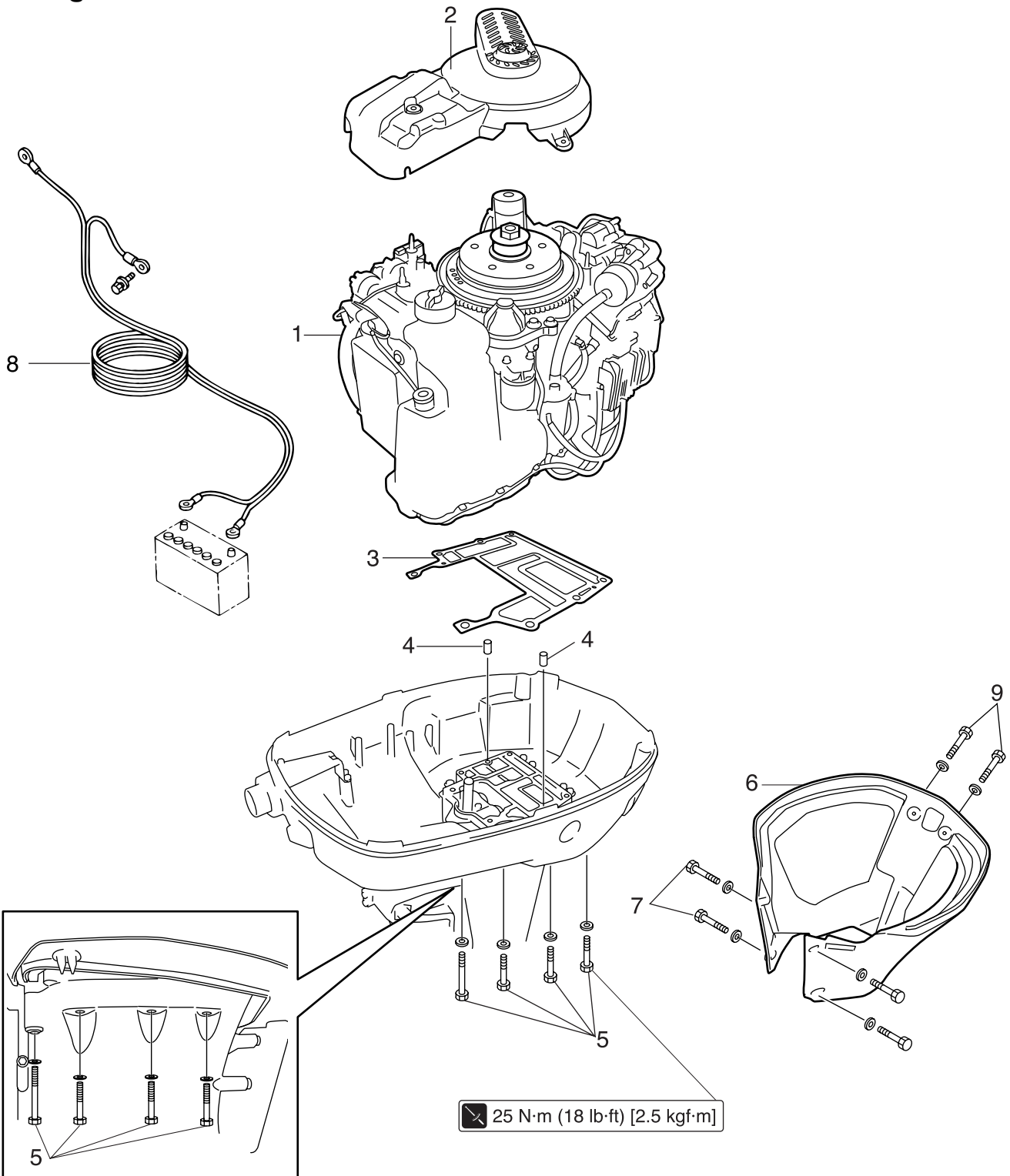
# Power Unit

## 1. Special tools

			<p>ø34.5 x ø19</p> 
<p>Piston Ring Tool P/N. 353-72249-0</p>	<p>Driver Rod P/N. 3AC-99702-0</p>	<p>Universal Puller Plate P/N. 3AC-99750-0</p>	<p>Oil Seal Attachment P/N. 3C7-99820-0</p>
<p>ピストンリングの取外し、 取付け</p>	<p>Used in combination with center place and various attachments</p>	<p>Removing reverse (C) gear bearing</p>	<p>Used to press-fit crank case head oil seal</p>
<p>ø57.5 x ø34.5</p> 	 <p>3B7-72783-0 3C7-72783-0 3B7-72785-0 940191-0800 3B7-72784-0</p>		
<p>Oil Seal Attachment P/N. 3E0-99820-0</p>	<p>Flywheel Puller Kit P/N. 3T1-72211-0</p>		<p>Eye Bolt (Powerhead Lift Ring) P/N. 3T1-72212-0</p>
<p>Used to press-fit crank case head oil seal</p>	<p>Removing or attaching flywheel</p>		<p>Used to hook power unit when hanging</p>
	<p>ø51.5 x ø39.5</p> 		
<p>Piston Pin Tool P/N. 3T1-72215-0</p>	<p>Oil Seal Attachment P/N. 3U1-99820-0</p>	<p>Compression Gauge P/N. 3AC-99030-0</p>	
<p>Removing or attaching piston pin</p>	<p>Used to press-fit coil bracket oil seal</p>	<p>Measuring compression pressure</p>	

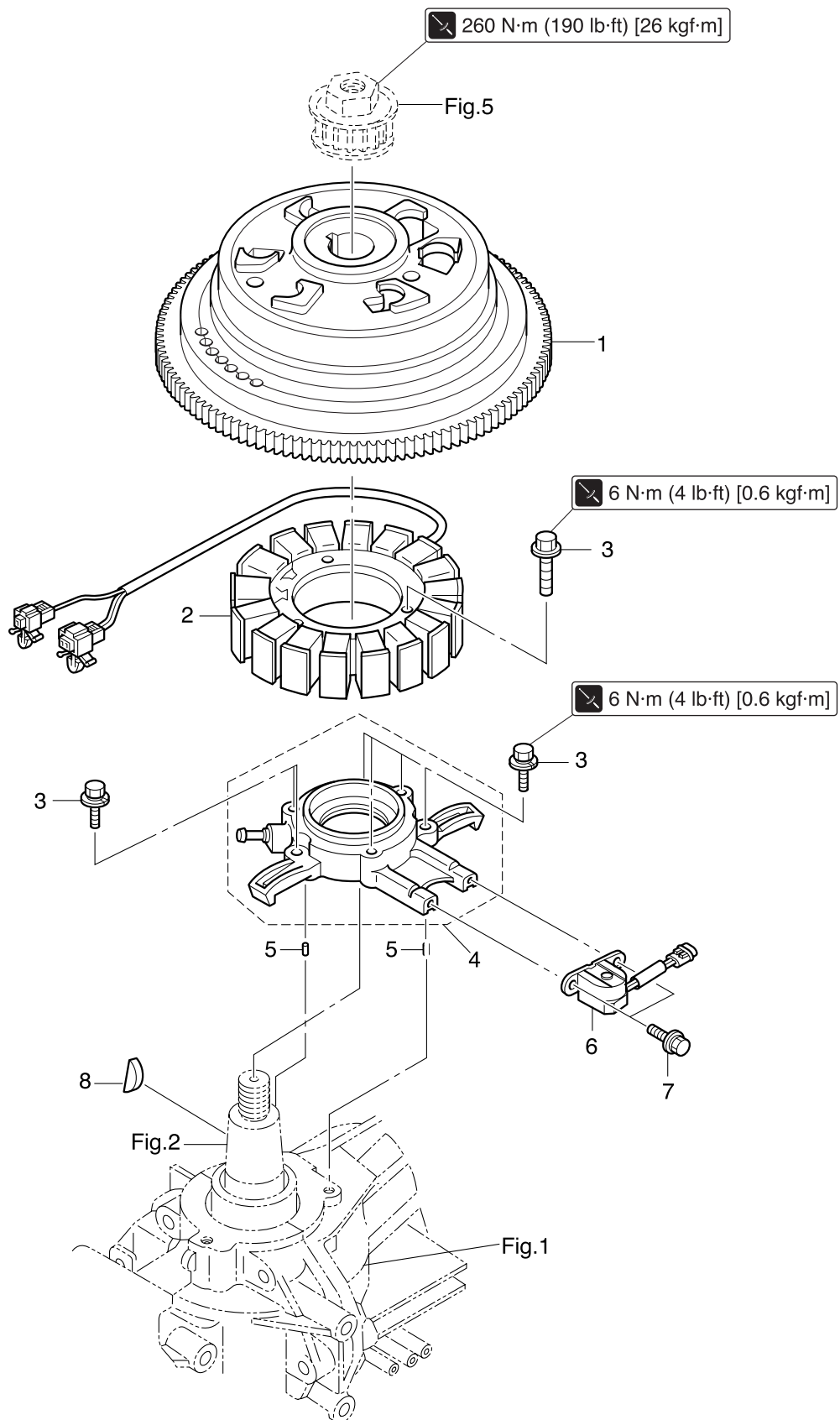
## 2. Parts Layout

### Engine



Ref. No.	Description	Q'ty	Remarks
1	Power Unit	1	
2	Ring Gear Cover Ass'y	1	
3	Gasket	1	
4	Dowel Pin	2	
5	Bolt	8	L=107mm x 6, L=120mm x 2

Ref. No.	Description	Q'ty	Remarks
6	Apron	1	
7	Screw	4	M6 L=12mm W/PW
8	Battery Cord	1	
9	Screw	2	M6 L=16mm W/PW



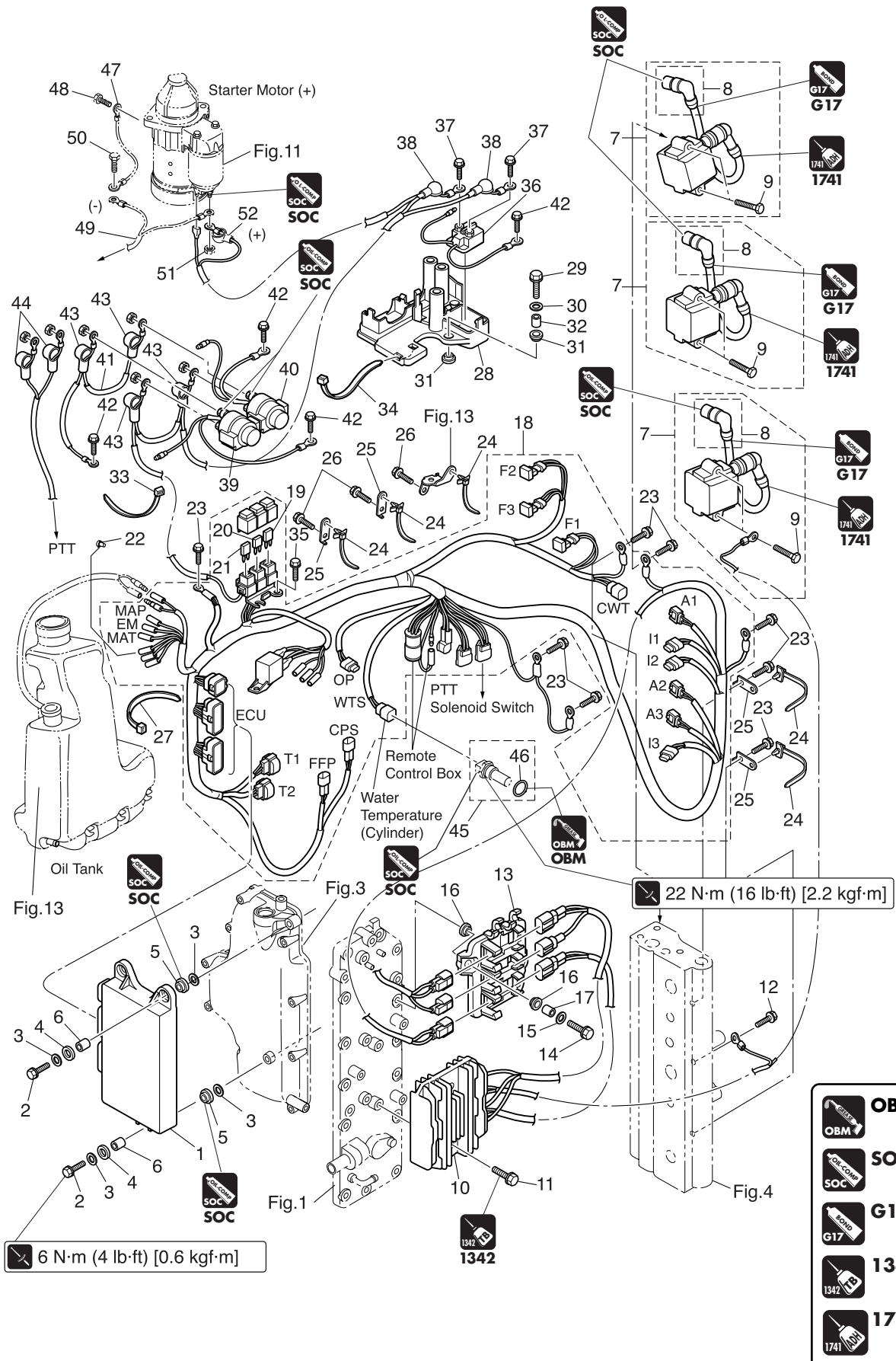
Ref. No.	Description	Q'ty	Remarks
1	Flywheel (W/Gear)	1	
2	Alternator Ass'y	1	
3	Bolt	7	M6 L=30mm
4	Coil Bracket	1	
5	Dowel Pin 6-12	2	
6	Crank Position Sensor	1	
7	Bolt	2	M5 L=12mm
8	Key (Magnet)	1	



# Power Unit

## Electric Parts (ECU•Diagram)

P/L Fig. 10

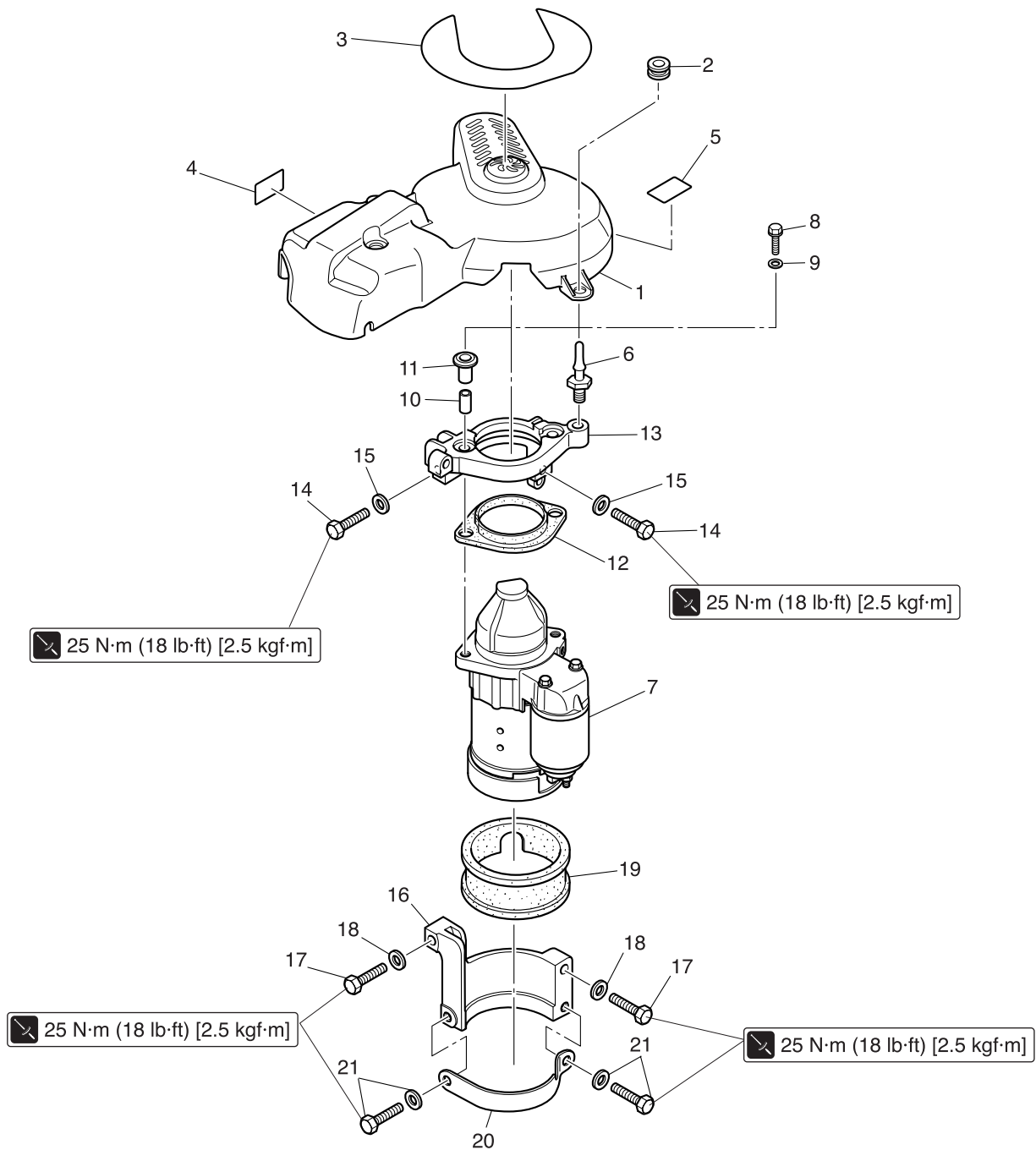


Ref. No.	Description	Q'ty	Remarks
1-1	ECU Ass'y	1	90ps 3FW10AA
1-2	ECU Ass'y	1	75ps 3FY10AA
2	Bolt	3	M6 L=30mm
3	Washer 6.5-21-1	6	
4	Mount Rubber 8.5-14-2.5	3	
5	Mount Rubber 8.5-14-2.5	3	
6	Spacer 6.2-9-16.6	3	
7	Ignition Coil	3	
8	Plug Cap (Resistance)	3	
9	Bolt	6	M6 L=30mm
10	Rectifier Complete	1	
11	Bolt	2	M6 L=25mm
12	Bolt	1	M6 L=12mm
13	Cable Terminal Holder	1	
14	Bolt	2	M6 L=20mm
15	Washer 6-16-1.5	2	
16	Mount Rubber 8.5-12-2	4	
17	Spacer 6.2-9-10.7	2	
18	Cord Ass'y	1	
19	Fuse 30A	1	
20	Fuse 25A	1	
21	Fuse 15A	1	
22	Plug B Cable Terminal	6	
23	Bolt	6	M6 L=12mm
24	Lead Wire Band 170	5	
25	Stay	4	
26	Bolt	3	M6 L=12mm
27	Band Lead Wire 158	2	
28	Electric Bracket	1	
29	Bolt	3	M6 L=25mm
30	Washer 6-16-1.5	3	
31	Mount Rubber 8.5-12-2	6	
32	Spacer 6.2-9-10.7	3	
33	Band Lead Wire L=200	1	
34	Band Lead Wire L=104	1	
35	Tapping Screw 6-16	2	
36	Starter Solenoid	1	
37	Bolt	2	M6 L=8mm
38	Terminal Cap	2	
39	Solenoid Switch A P-T/T	1	UP
40	Solenoid Switch B P-T/T	1	DN
41	Ground Cord	1	
42	Bolt	3	M6 L=12mm
43	Terminal Cap	4	
44	Cap Starter Terminal	2	
45	Water Temperature Sensor (W/O-Ring)	1	
46	O-Ring 2.0-10.0	1	Do not reuse.
47	Starter Cord L=270	1	
48	Bolt	2	M6 L=12mm
49	Battery Cable	1	
50	Bolt	1	M6 L=12mm
51	Nut	1	M8
52	Terminal Cap	1	



## Electric Parts (Starter Motor)

P/L Fig. 1 1



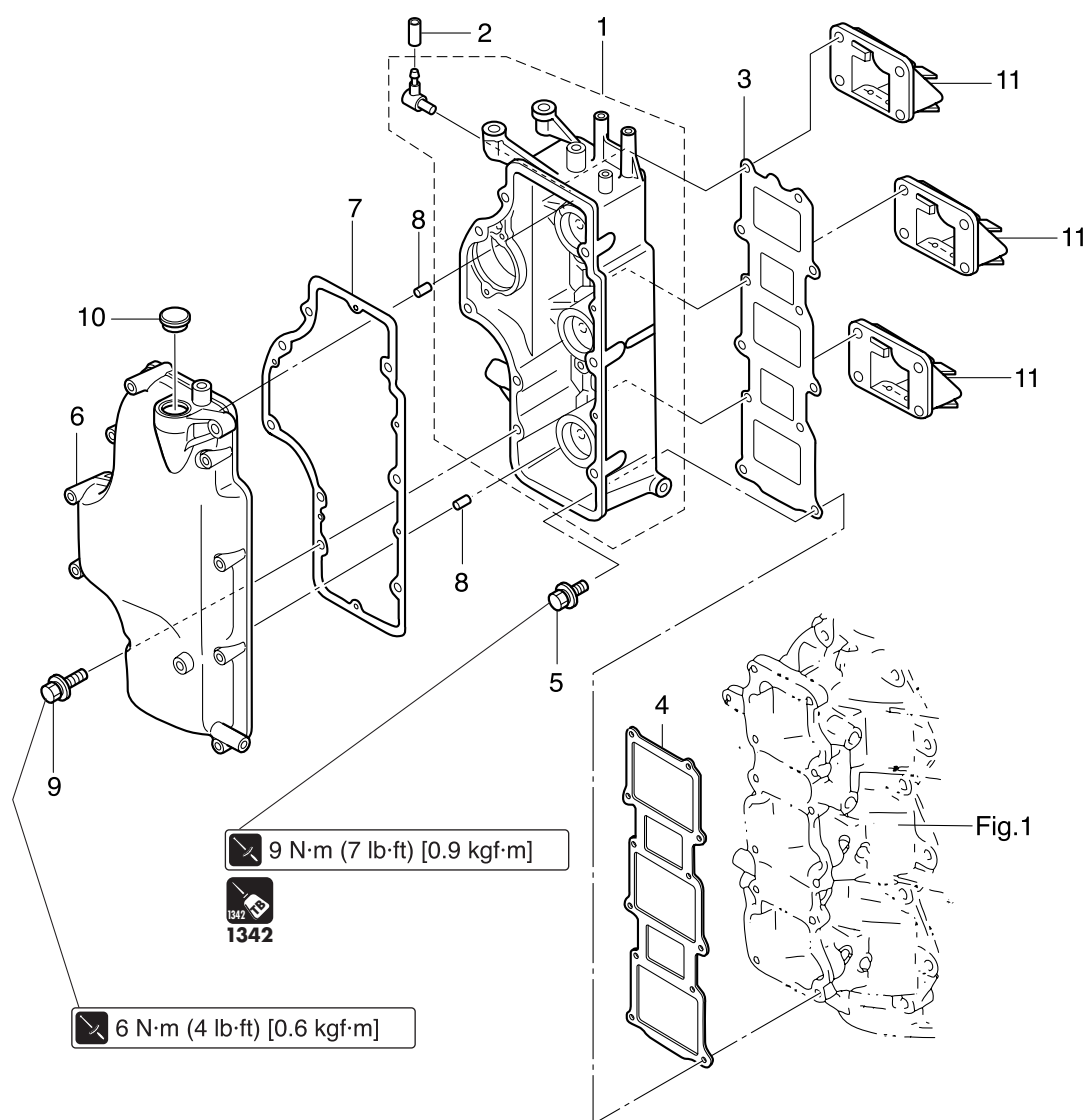
Ref. No.	Description	Q'ty	Remarks
1	Ring Gear Cover	1	
2	Grommet 16-2.5	5	
3	Caution Decal (B)	1	
4	Label Fuse	1	
5	Spark Plug Decal	1	
6	Hook Cover	5	
7	Starter Motor Ass'y	1	See Fig12
8	Bolt	2	M6 L=40mm
9	Washer 8.5-24-1.5	2	
10	Spacer 8.4-12-21.5	2	
11	Mount Rubber A Starter	2	

Ref. No.	Description	Q'ty	Remarks
12	Starter Motor Mount	1	
13	Starter Motor Bracket Upper	1	
14	Bolt	2	M8 L=45mm
15	Washer	2	M8
16	Starter Motor Bracket Lower	1	
17	Bolt	2	M8 L=45mm
18	Washer	2	M8
19	Damper	1	
20	Starter Motor Band	1	
21	Bolt	2	M8 L=20mm

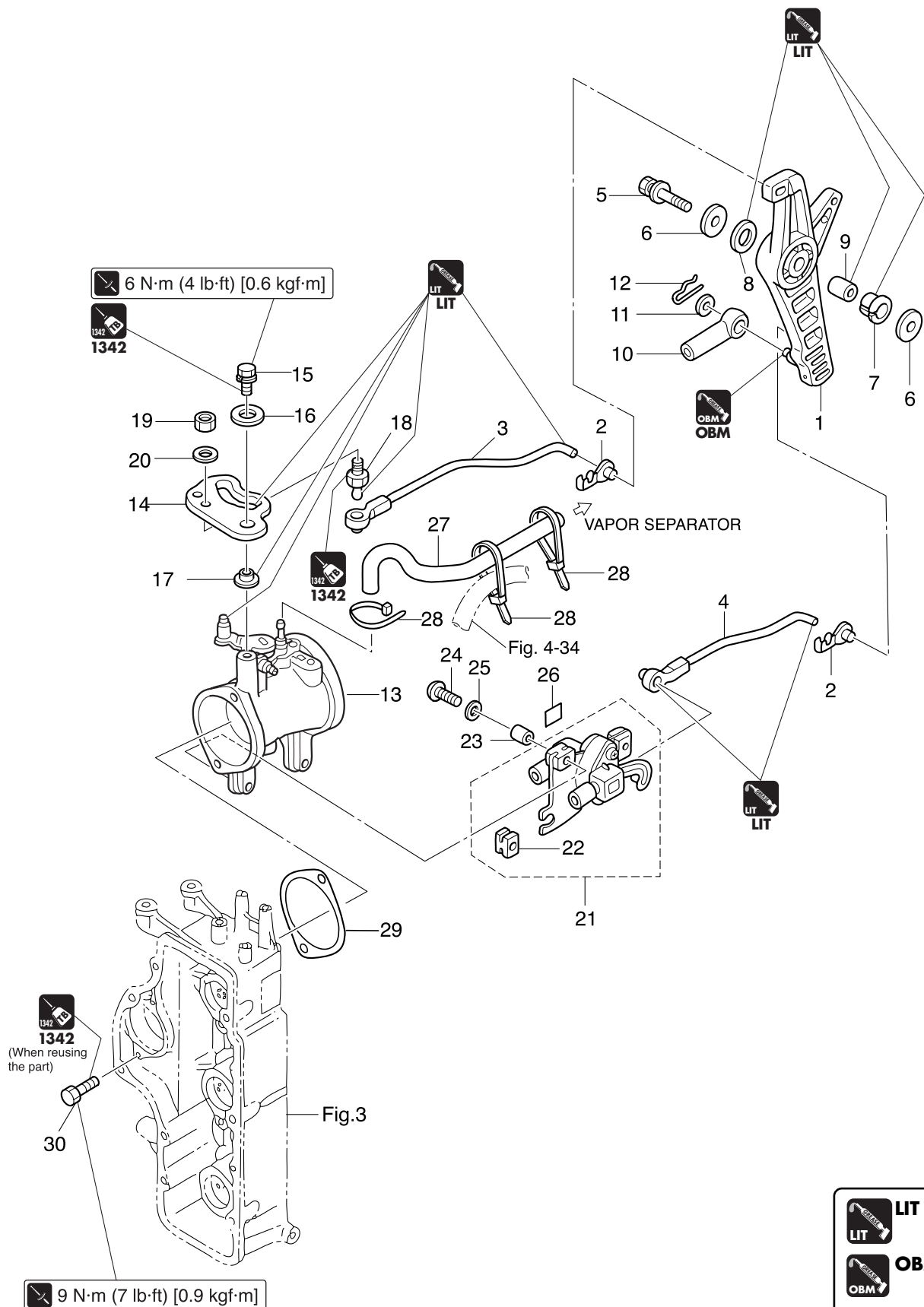


## Air Chamber (Air Box)

P/L Fig. 3



Ref. No.	Description	Q'ty	Remarks
1	Air Chamber Ass'y	1	
2	Sealing Cap	1	
3	Gasket Air Box	1	Do not reuse.
4	Gasket Inlet Manifold	1	Do not reuse.
5	Bolt M6-35	12	M6 L=35mm
6	Air Chamber Cover	1	
7	Air Chamber Cover Gasket	1	Do not reuse.
8	Dowel Pin 4-10	2	
9	Bolt	9	M8 L=45mm
10	Grommet	1	
11	Reed Valve Ass'y	3	



Ref. No.	Description	Q'ty	Remarks
1	Advancer Arm	1	
2	Rod Snap 5-3	2	
3	Throttle Link Rod	1	
4	Link Rod Ass'y (TPS)	1	
5	Bolt	1	M8 L=35mm
6	Washer 8.5-24-1.5	2	
7	Bushing 12-14-15.5	1	
8	Washer 12.5-24-1	1	
9	Collar 8.4-12-17	1	
10	Cable Joint	2	
11	Washer 8.5-18-1.6	1	
12	R-Pin d=8	1	
13-1	Throttle Body Ass'y	1	90ps Mark 3T9
13-2	Throttle Body Ass'y	1	75ps Mark 3FY
14	Throttle Cam	1	
15	Bolt	1	M6 L=16mm
16	Washer 6.5-21-1	1	
17	Bushing 6-24-7	1	
18	Ball Joint B	1	
19	Nut	1	M6
20	Washer	1	M6
21	TPS Ass'y	1	
22	Mount Rubber	3	
23	Collar 4.2-6-10.5	3	
24	Screw	3	M4 L=18mm
25	Washer 4.2-12.5-0.8	3	
26	Label T.P.S.	1	
27	Hose	1	L=390mm
28	Band Lead Wire L=104	3	Do not reuse.
29	Gasket Throttle Body	1	Do not reuse.
30	Bolt 6-25 Precoated	2	M6 L=25mm



**P/L Fig. 1**

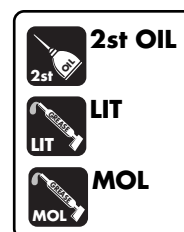
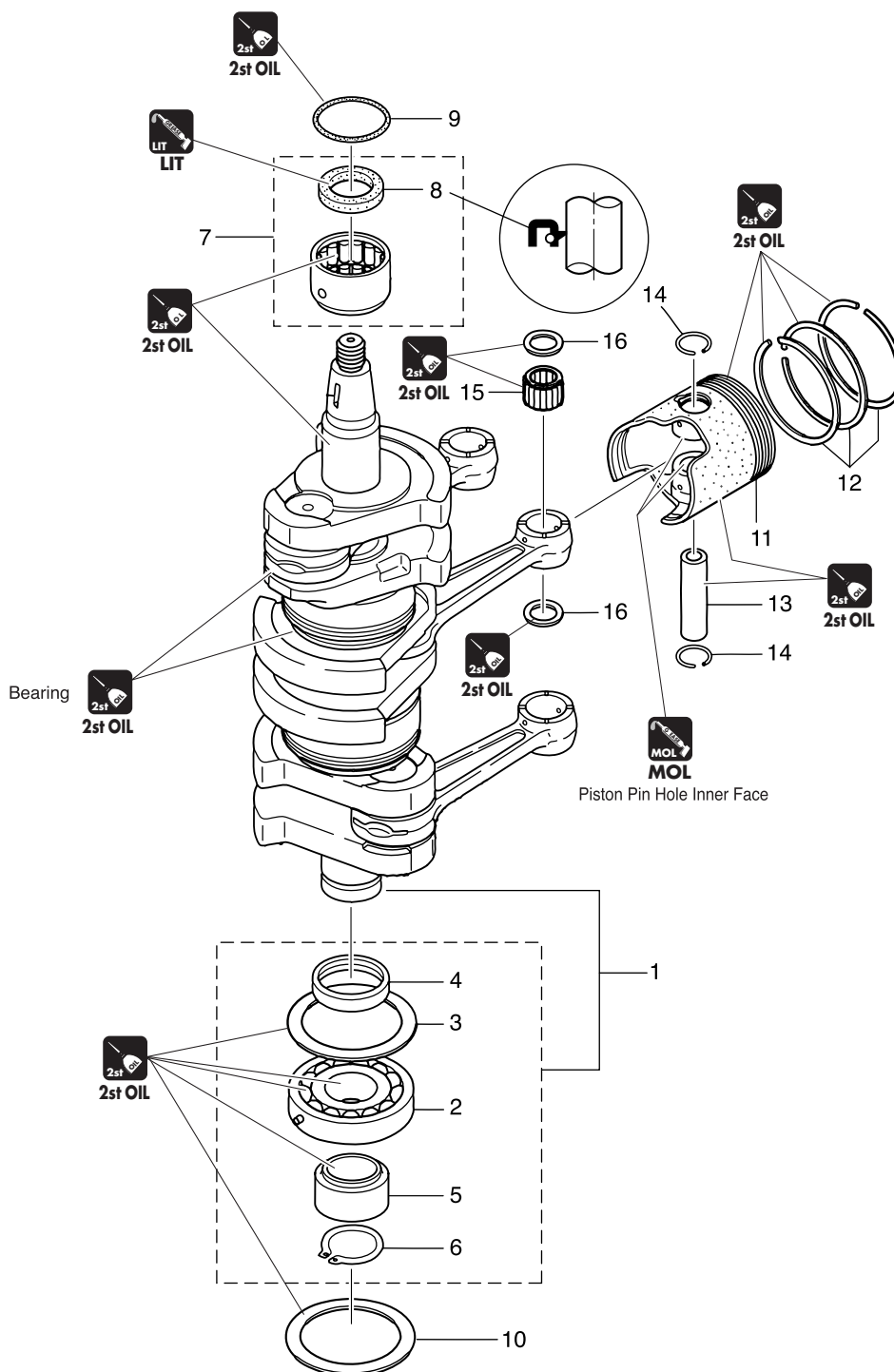


Ref. No.	Description	Q'ty	Remarks
1	CYL Block - Crankcase Ass'y	1	
2	Dowel Pin 6-12	2	
3	Knock Main Bearing	1	
4	Stud Bolt M10-P1.25	2	M10
5	Bolt	1	M6 L=18mm for Advancer arm stopper
6	Collar 6.2-9-9.3	1	for Advancer arm stopper
7	Nut M10-P1.25	2	M10
8	Bolt	6	M10 L=65mm
9	Washer 10.5-20-3.2	8	
10	Bolt L=50	5	M8 L=50mm
11	Bolt L=65	1	M8 L=65mm
12	Washer 8.5-19.5-3.2	6	
13	Cover Cylinder Head	1	
14	Gasket Cylinder Head Cover	1	Do not reuse.
15	Dowel Pin 4-10	2	
16	Bolt	3	M6 L=25mm
17	Thermostat	1	
18	Cap Thermostat (W/Nipple)	1	
19	Gasket Thermostat Cap	1	Do not reuse.
20	Bolt	3	M6 L=40mm
21	Cylinder Head	1	
22	Gasket Cylinder Head	1	Do not reuse.
23	Bolt	14	M8 L=75mm
24	Washer 8.5-19.5-3.2	14	
25	Hanger	1	
26	Bolt	2	M8 L=20mm
27	Washer	2	M8
28	Exhaust Cover Ass'y	1	
29	Gasket Exhaust Cover	1	Do not reuse.
30	Bolt	16	M6 L=25mm
31	Anode	1	
32	Bolt	1	M6 L=16mm
33	Anode Plug	1	
34	Seal Ring	1	
35	Bolt	1	M6 L=20mm
36	Anode	1	
37	Bolt	1	M6 L=30mm
38	Crankcase Head	1	
39	O-Ring 2-74.5	1	Do not reuse.
40	Oil Seal 35-58-9	1	Do not reuse.
41	Oil Seal 19.6-35-10	1	Do not reuse.
42	Bolt	2	M6 L=20mm
43	Spark Plug (IZFR6Q)	3	NGK
44	Rubber Hose	1	L=780mm
45	Rubber Hose	2	Air rail to T-Nipple, T-Nipple to Compressor L=65mm
46	Rubber Hose	1	T-Nipple to Cap, Thermostat L=115mm
47	Clip Fuel Pipe ø10	9	
48	T-Nipple (W/Valve)	1	
49	Rubber Hose	3	Transfer Passage to Cylinder L=185mm
50	Check Valve	4	
51	Clip	6	
52	Hose	1	#3 Crank Case ~ Bearing Upper L=240mm
53	Oil Pipe	1	Air Compressor ~ #3 Crank Case L=320mm
54	Oil Pipe	1	L=590mm
55	Clip ø7	4	
56	Clamp	1	
57	Clamp	2	
58	Bolt	3	M6 L=12mm



## Piston & Crank Shaft

P/L Fig. 2



Ref. No.	Description	Q'ty	Remarks
1	Crankshaft Ass'y	1	
2	Bearing	1	
3	Washer 66-85-2	1	
4	Spacer 40-52-7	1	
5	Spacer 35-48.6-16	1	
6	C-Ring	1	d=35
7	Main Bearing Upper	1	
8	Oil Seal 36-46-6	1	
9	O-Ring 2.4-44.7	1	

Ref. No.	Description	Q'ty	Remarks
10	Washer 66-85-2	1	
11-1	Piston (STD)	3	STD
11-2	Piston (0.5 O/S)	3	OPT 0.5O/S
12-1	Piston Ring 1st (STD)	9	STD 1st · 2nd · 3rd
12-2	Piston Ring 1st (0.5mm O/S)	9	OPT 1st · 2nd · 3rd 0.5O/S
13	Piston Pin	3	
14	Clip Piston Pin	6	
15	Needle Bearing 23-28-28	3	
16	Small End Bearing Washer	6	

### 3. Inspection Items

#### 1) Inspection of Compression Pressure

##### CAUTION

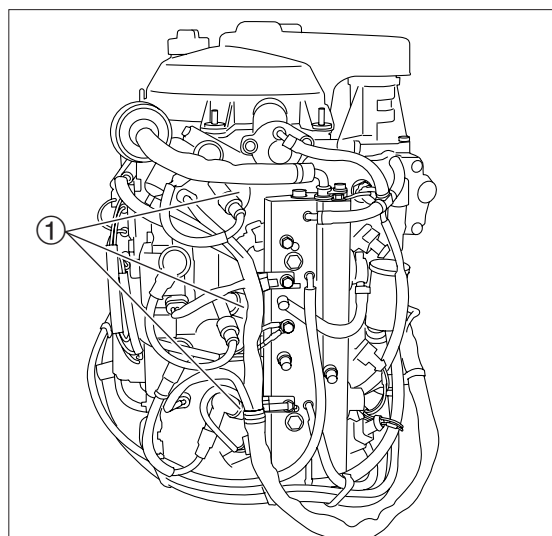
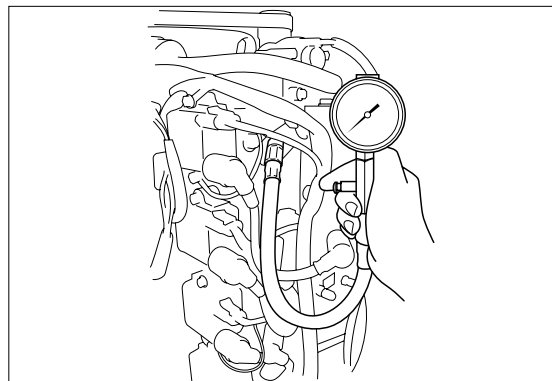
- To prevent accidental start of the engine, remove lock plate (of stop switch lanyard) from stop switch before measuring compression pressure.
- Clean areas around spark plugs on the cylinder before removing spark plugs to prevent dirt from entering cylinder.

1. Start and idle engine for 5 minutes to warm up, and then stop.
2. Shift gear into neutral (N).
3. Remove lock plate (of stop switch lanyard) from stop switch.
4. Remove all spark plug caps and then all spark plugs ①.
5. Install compression gauge to plug hole.



##### Compression Gauge:

P/N. 3AC-99030-0



6. Set free throttle lever to full open position, crank engine until compression gauge indication stabilizes, and then measure compression pressure.

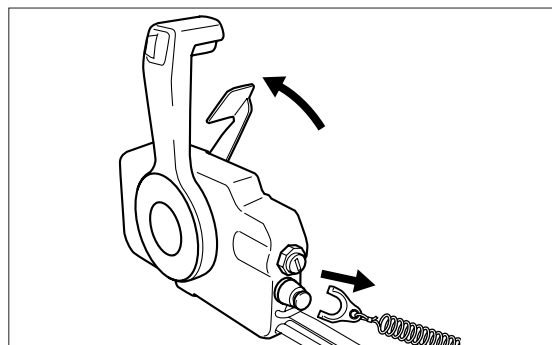


##### Compression Pressure (Reference):

0.9 MPa (128 psi) [9.0 kgf/cm<sup>2</sup>]



Compression pressure is affected much by cranking speed, and normally changes in the range from 10% to 20%. Charge the battery.



7. If compression pressure is below specified value or varies much among cylinders, put small amount of engine oil into cylinders, and perform the test again.



- If compression pressure increases after the above measure, check pistons and piston rings for wear. Replace if necessary.
- Check cylinder head gasket if the compression pressure does not rise. Adjust or replace if necessary.

If any of the following results is obtained by the measurement, it is necessary to repair or replace relevant part(s).

- The measurement is lower than specified value,
- Different between compression pressure of the cylinders exceeds; 0.105 MPa (15 psi) [1.05 kgf/cm<sup>2</sup>], or
- The measurement is abnormally higher than specified value.



# Power Unit

## 2) Removing Power Unit

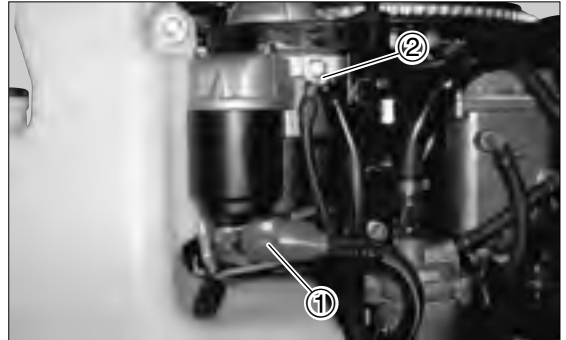
1. Remove ring gear cover.



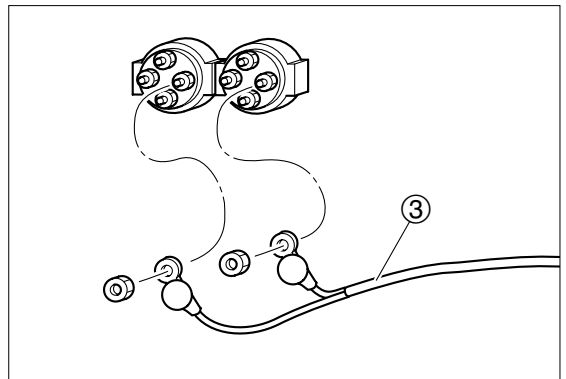
Disconnect battery cables from battery terminal.



2. Disconnect battery cables  $\oplus$  ① from starter motor, and then  $\ominus$  ②.



3. Remove PTT cable ③ from solenoid switch.



4. Disconnect connector ④ of PTT switch.

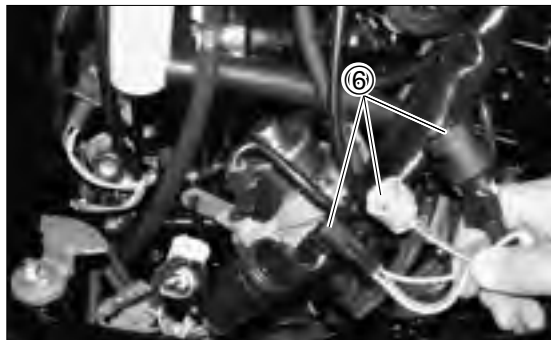




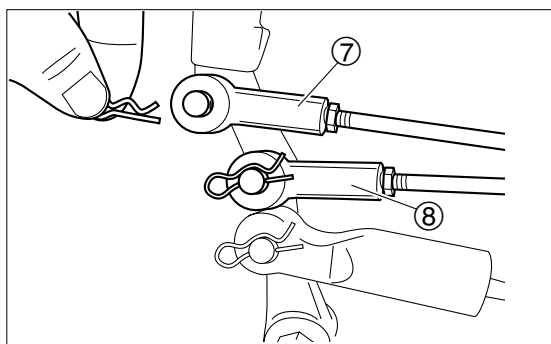
5. Disconnect ground wire ⑤ from bottom cowl.



6. Disconnect remote control harness connectors ⑥.



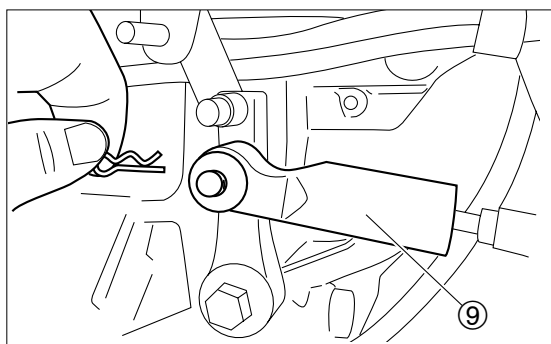
7. Remove "R" shaped pins and then throttle cable ⑦ and shift cable ⑧.



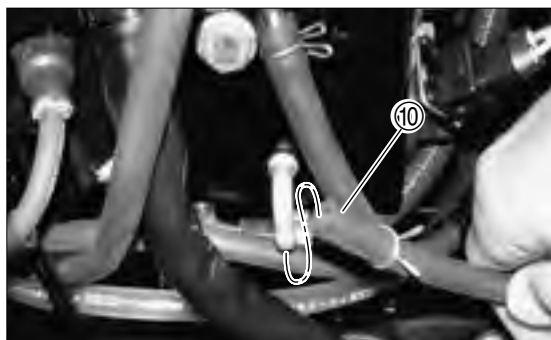
8. Remove shift assist ass'y ⑨ from shift arm.



Be careful not to lose washers that are removed together with cables.



9. Loosen clip of cooling water check port hose ⑩ clip located below air compressor and disconnect the hose.





# Power Unit

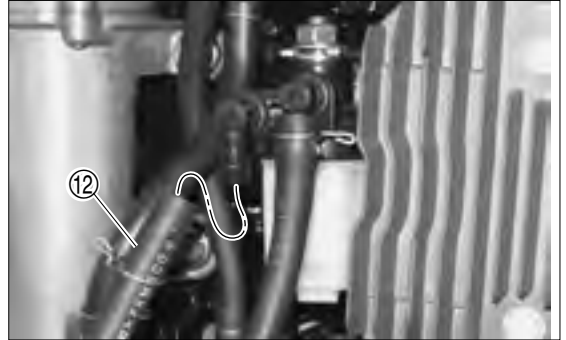
10. Disconnect hose ⑪ for flushing device located on the port side of bottom cowl.



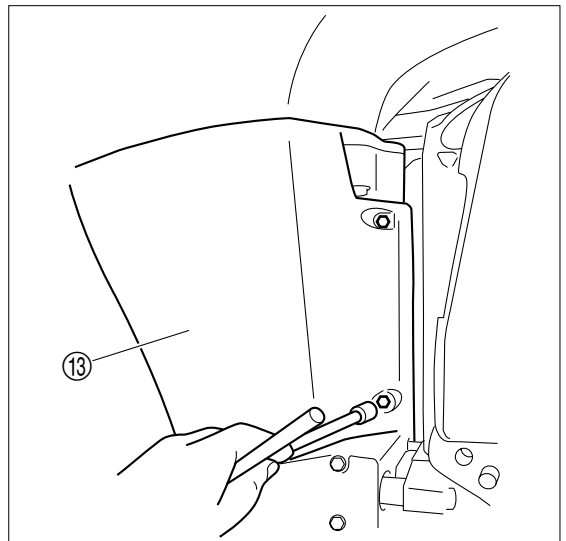
11. Disconnect fuel hose ⑫ from fuel filter.

**⚠ WARNING**

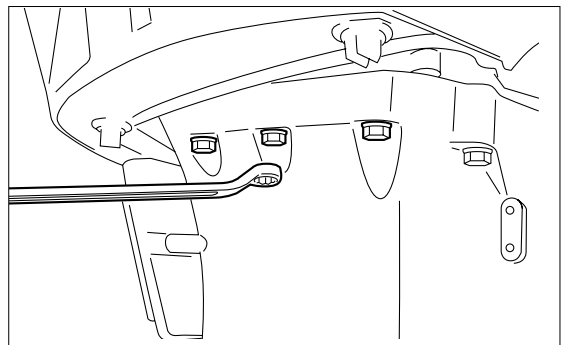
**Disconnect hose while holding with waste cloth to soak fuel that spills.**



12. Remove apron ⑬.



13. Loosen outside engine mount bolts first and then remove all of them.



14. Hoist power unit by using eye bolt ⑬.

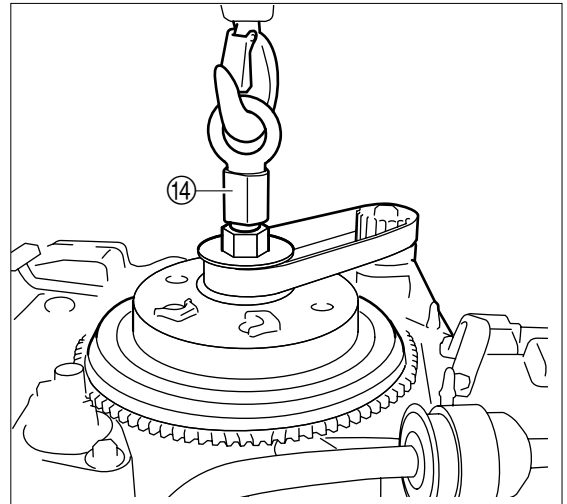


Hoist power unit taking care not to catch wires and hoses.



**Eye Bolt ⑭ :**

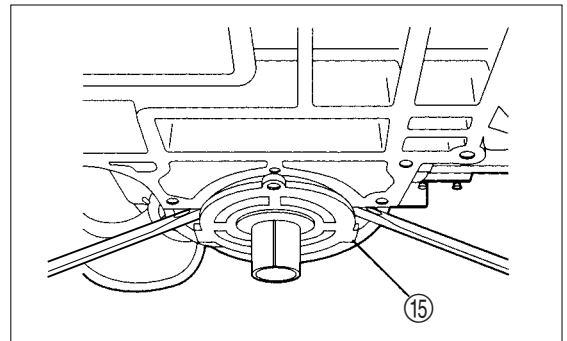
P/N. 3T1-72212-0



15. Remove 2-crank case bolts. Remove crank case head ⑮.



Put the tip of bladed screw driver in the mating face of crank case head as shown to separate from the engine body evenly.



### 3) Removing Air Compressor

Refer to "Removing Air Compressor" in chapter 4.



# Power Unit

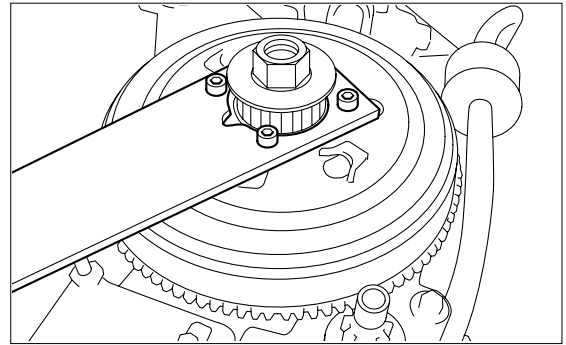
## 4) Removing Flywheel

1. Attach flywheel puller kit to flywheel.



**Flywheel Puller Kit:**

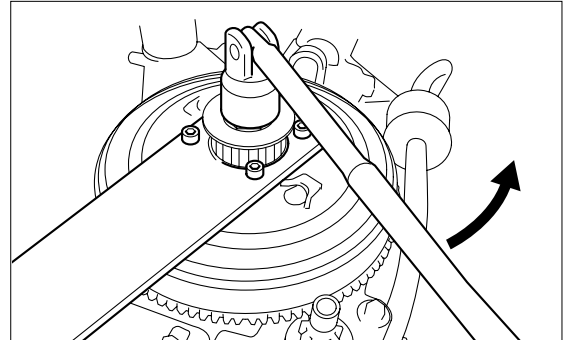
P/N. 3T1-72211-0



2. Fix flywheel puller, and loosen drive pulley (Magneto nut) and remove it.



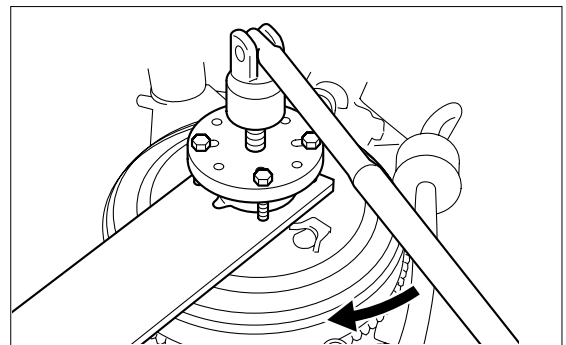
Drive pulley (Magneto nut) is threaded right-hand.



3. Remove magneto by using flywheel puller kit and flywheel center plate.



Turn center bolt clockwise to remove flywheel.



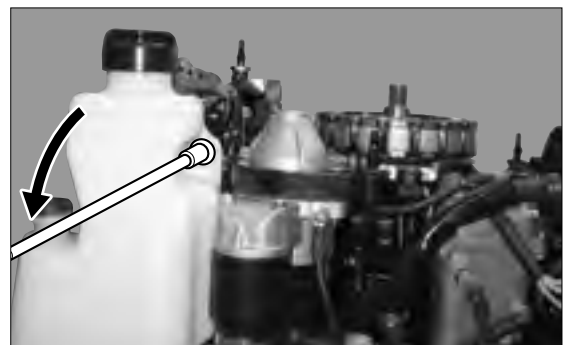
4. Remove magneto key.

## 5) Removing Alternator

1. Remove oil tank installation bolt (upper one) and move oil tank a little.



- Before removing oil tank, disconnect oil level gage connector, and oil hose at oil filter side.
- Bend oil hose at the tip to prevent oil from spilling.



2. Disconnect CPS connector that is located in the back of oil tank.



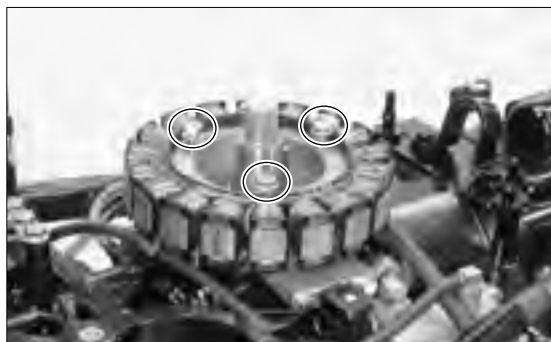
Removing breather hose of vapor separator makes the work easier.



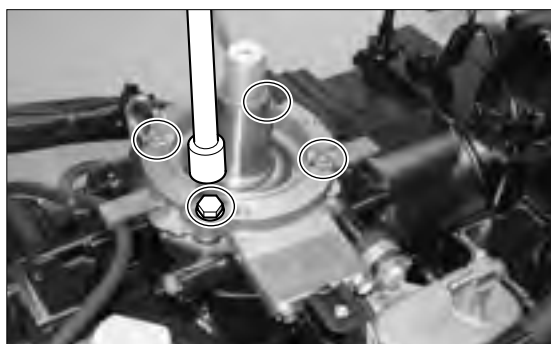
3. Disconnect alternator connectors.



4. Loosen alternator securing bolts (M6, 3 pieces) and remove alternator.



5. Loosen coil bracket securing bolts (M6, 4 pieces) and remove bracket.



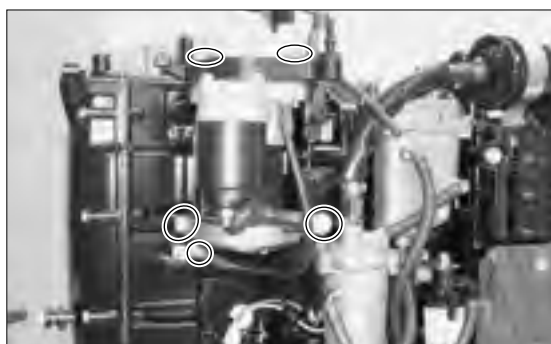
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## 6) Removing Starter Motor

1. Remove starter motor securing band and securing bolts (M8, 2 pcs.) on the upper surface, and then, starter motor from bracket.



Disconnect grounding wire from air chamber.

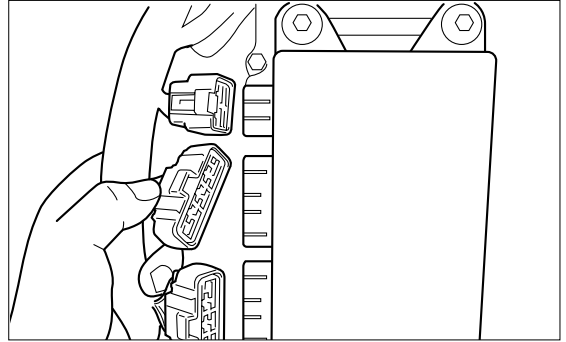




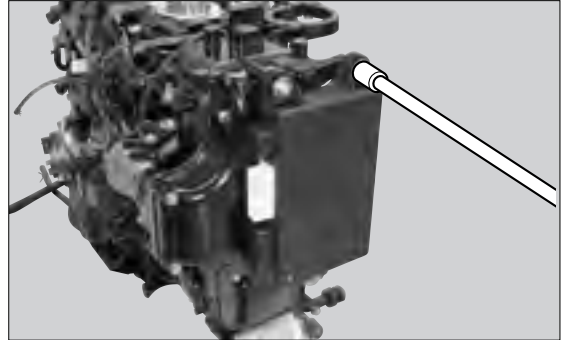
## 7) Removing Cord Ass'y

### Removing ECU

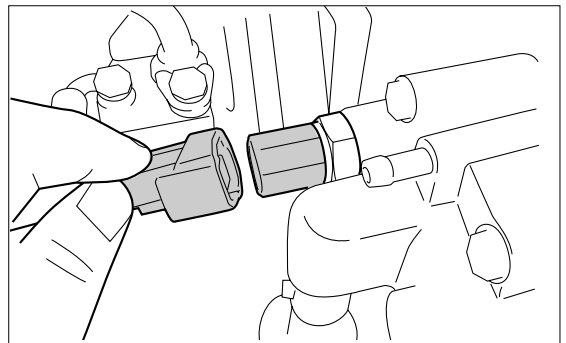
1. Disconnect ECU connectors while pushing hook of ECU connector and pull apart.



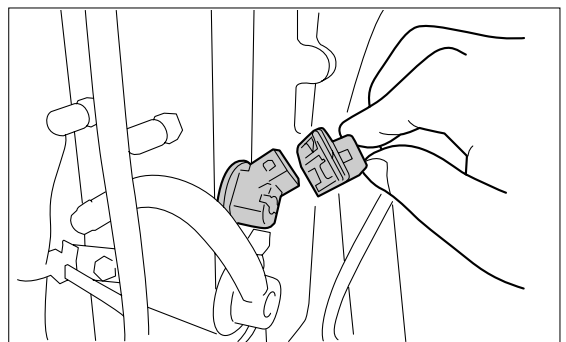
2. After removing top two ECU mount rubber bolts, remove ECU by pulling it upward.



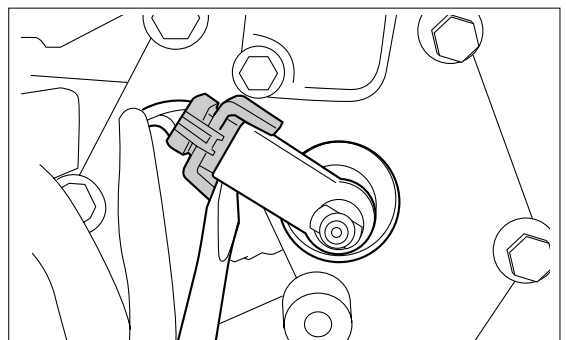
3. Disconnect air compressor water temperature sensor connector while pushing hook of the connector.



4. Disconnect fuel injector connector while pushing hook of the connector. Repeat this step for three cylinders.



5. Disconnect air injector connector while opening locks located on both sides of the connector by using a bladed screw driver. Repeat this step for three cylinders.



6. Disconnect FFP connector while pushing hook of the connector.



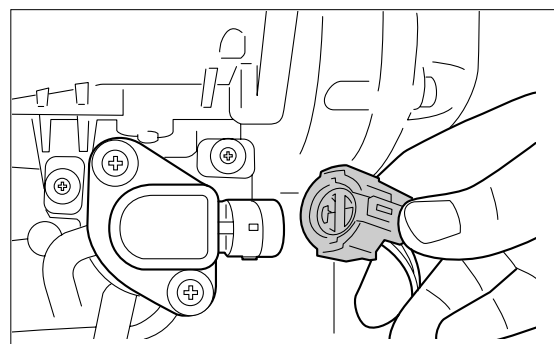
7. Disconnect oil pump connector while pulling hook of the connector.



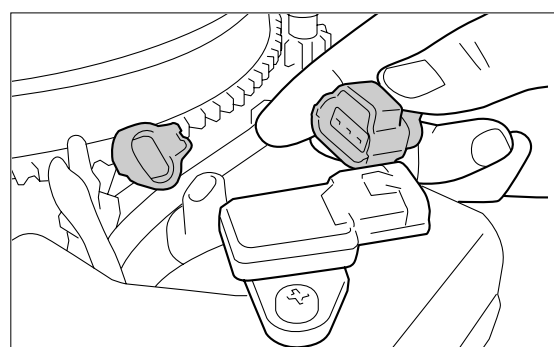
8. Disconnect TPS connectors while pushing hook of the connector.



- Connector on the outer → Blue (T2)
- Connector in the inner → Gray (T1)



9. Disconnect MAP and MAT sensor connector while pushing hook of the connector.(option)



9. Disconnect rectifier connector while pushing lock of the connector.

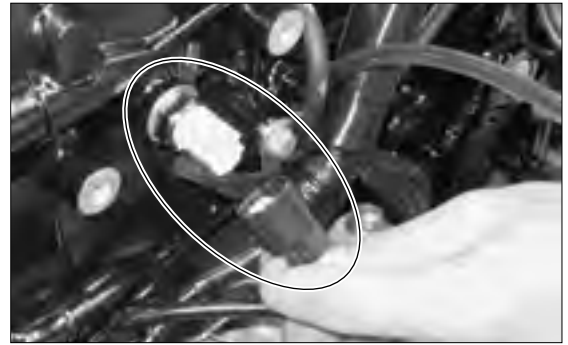






## Power Unit

11. Disconnect overheat sensor connector located on the cylinder block while pushing lock of the connector.



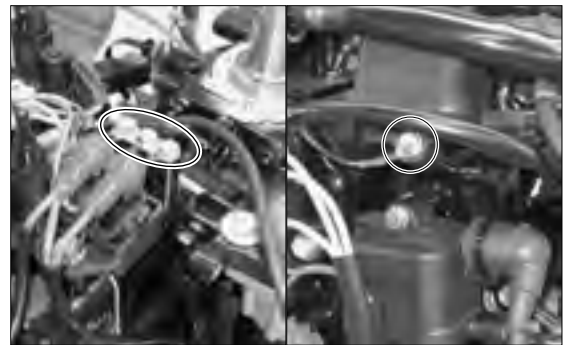
12. Disconnect ignition coil connector while pulling lock of the connector. Repeat this step for four cylinders.



13. Disconnect cord ass'y from terminal.  
Remove ignition coil #1 lower side installation bolt, and then, disconnect grounding wire.



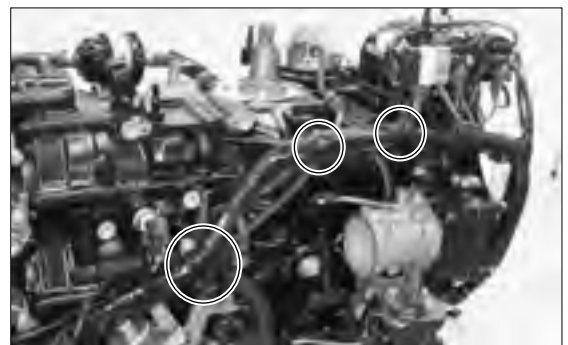
Note that grounding wire of cord ass'y is secured together.



14. Loosen band that secures cord ass'y, and then, remove cord ass'y from power unit.



- Note that grounding wire of cord ass'y is secured together.
- Refer to "Electrical Wiring Assembling Instruction Diagrams 1 and 2" in Chapter 11.

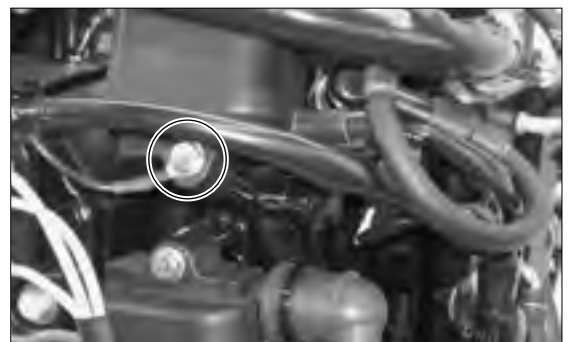


### Removing Ignition Coils

1. Loosen mounting bolt of ignition coils #1, #2 and #3, and remove the coils.



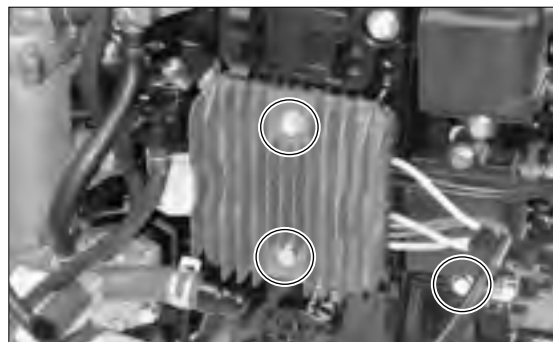
Earth wire of cord ass'y and other wires are secured together by #1 coil lower bolts.



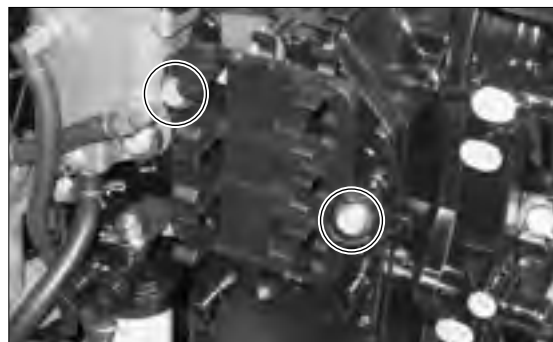


## Removing Rectifier

1. Loosen two rectifier mounting bolts and remove the unit.  
Remove ignition coil #3 lower side installation bolt, and then, grounding wire.



2. Remove terminal.

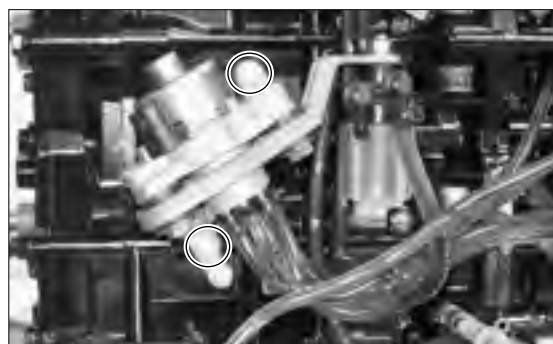


## 8) Removing Oil Pump

1. Remove oil pump securing bolts (M6, 2 pcs.), and then, remove pump together with pump bracket.



- Disconnect oil hose from crank case.  
Refer to "Oil System" in Chapter 4.
- Use waste cloth to let it soak with oil if spilt from hose.

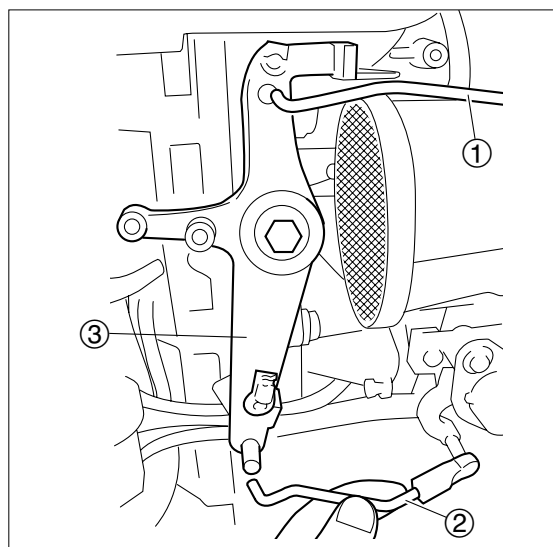


## 9) Removing Throttle Link

1. Remove throttle link rod ① and TPS link rod ②.



- Remove each link rod at the advancer arm side ③ first.
- When removing each link rod at the ball joint side, be careful not to apply force to the arm.



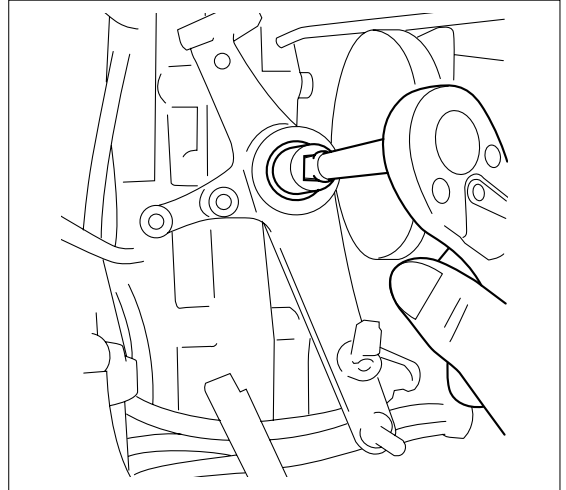


# Power Unit

2. Loosen advancer arm mounting bolt and remove the arm.



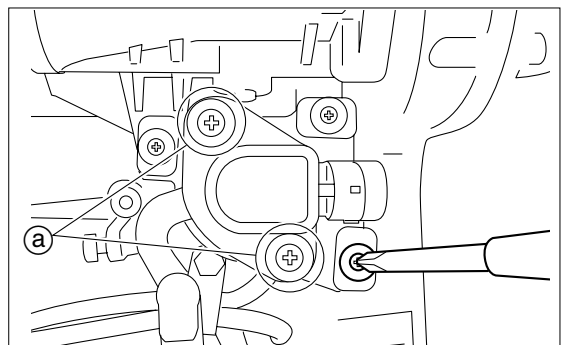
Check ball joint cap for wear and damage link rod for bend.



3. Remove throttle position sensor's lower mounting screw. That is rubber mounted.



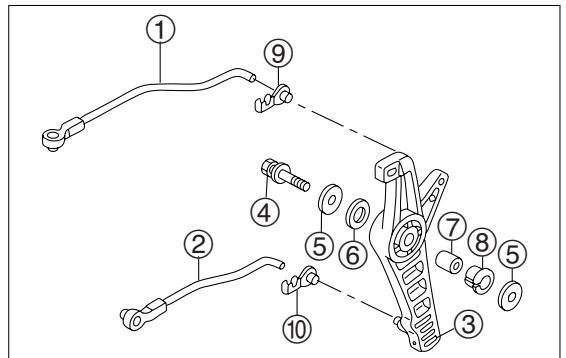
Do not remove or loosen screws (a).



- ④ Mount Bolt
- ⑤ Washer ( 8.5-24-1.5)
- ⑥ Washer (12.5-24-1)
- ⑦ Collar
- ⑧ Bushing
- ⑨ Throttle Link Rod Snap
- ⑩ Rod Snap



Check link rod snap for wear and damage.

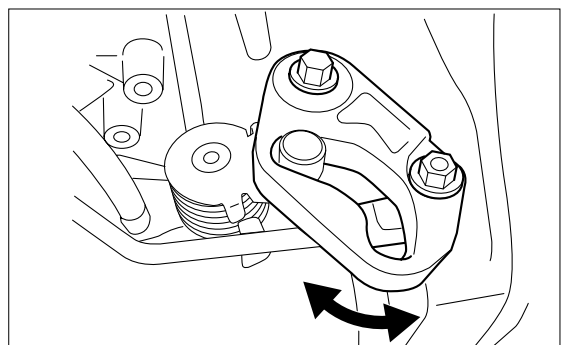


## 10) Inspection of Throttle Body

1. Check throttle body for wear of throttle cam and cam roller, and check if throttle cam and roller move smoothly.



Do not move adjust screw located on the upper part of throttle body.

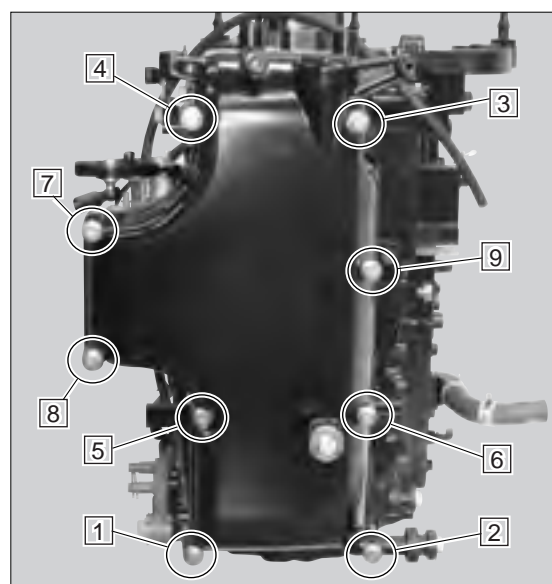


## 11) Removing Air Chamber

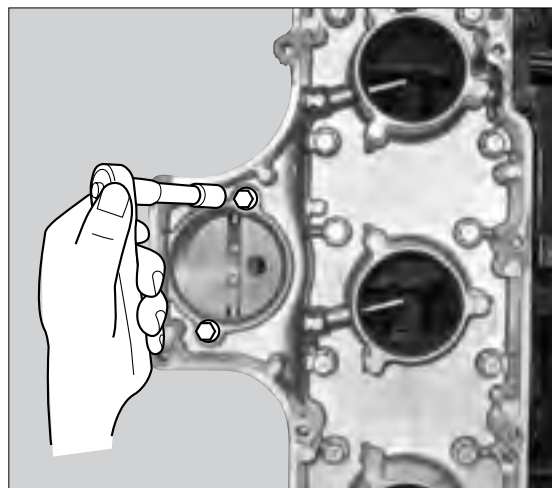
1. Loosen air chamber cover mounting bolts in the order shown, remove them, and remove air chamber cover.



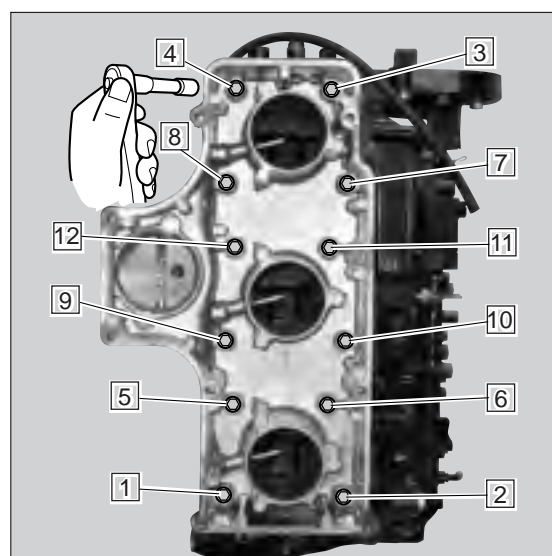
- Disconnect recirculation hose. Refer to "Recirculation System" in Chapter 4.
- When air chamber cover is removed, the oil collected in the cover may flow out. Use rag to catch the oil.



2. Loosen throttle body mounting bolt and remove the throttle body.



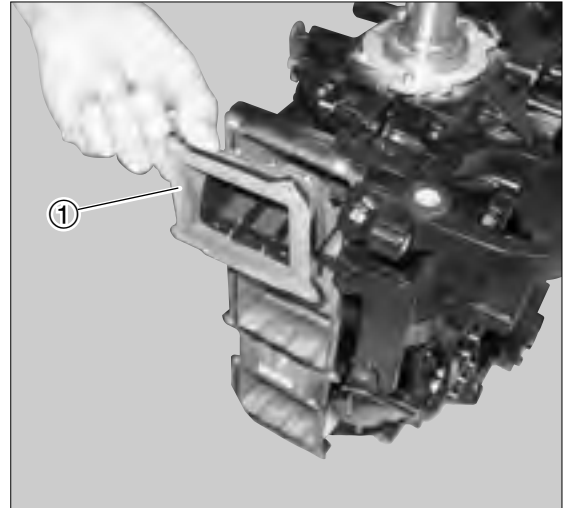
3. Loosen air chamber mounting bolts in the order shown, remove them, and remove air chamber.





# Power Unit

4. Remove air chamber and remove reed valve ass'y ①.



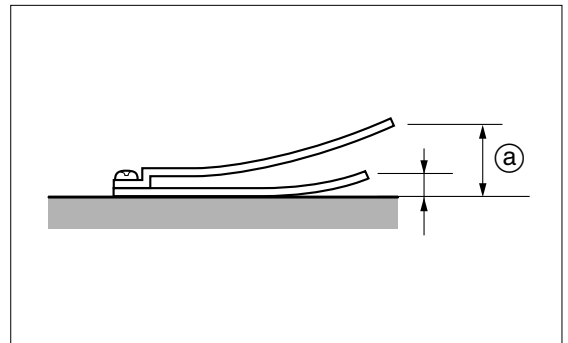
5. Inspection of Reed Valve Ass'y  
Check reed valve and valve seat surface for bend, wear and damage. Replace if the bend is out of the specified range.

**Reed Valve Stopper Height ⑥ :**

9.2 - 9.4 mm (0.362 - 0.370 in)

**Reed Valve Bend ⑦ :**

Replace reed valve with new one if its bend is over the limit.

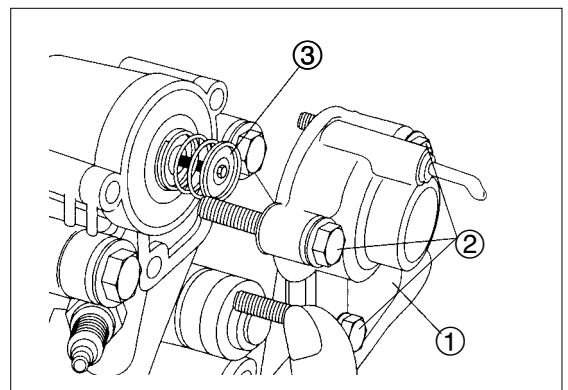
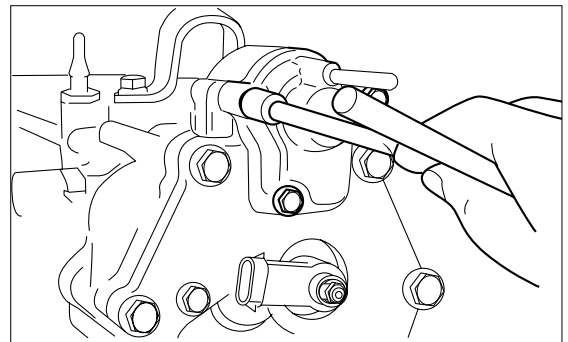


## 12) Removing Thermostat

1. Loosen thermostat cap mounting bolts ②, remove them, remove cap ①, and take out thermostat ③.



If thermostat cap is seized, tap lightly using a plastic hammer and then remove.



### 13) Inspection of Thermostat

1. Put thermostat in the vessel containing water, heat it, and measure the temperature at which the thermostat starts to open.



Replace thermostat if the valve is open even a little at ambient temperature.



**Valve Opening Temperature :**

60°C (140°F)

**Valve Full Open Temperature :**

75°C (167°F)

2. Measure valve lift of thermostat when prescribed temperature has been reached. Replace if the length is less than specified value.

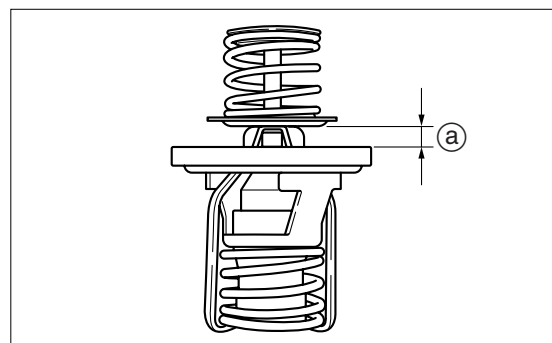
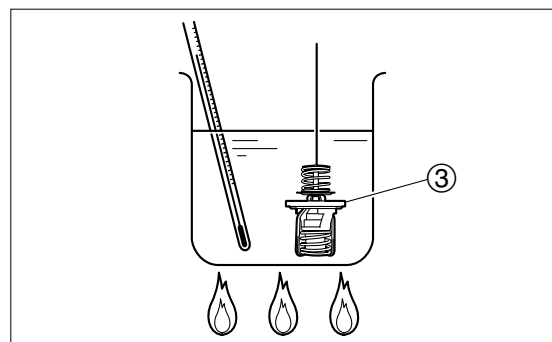


**Water Temperature**

75°C (167°F)

**Valve Lift (a)**

4.5mm (0.177in) or over

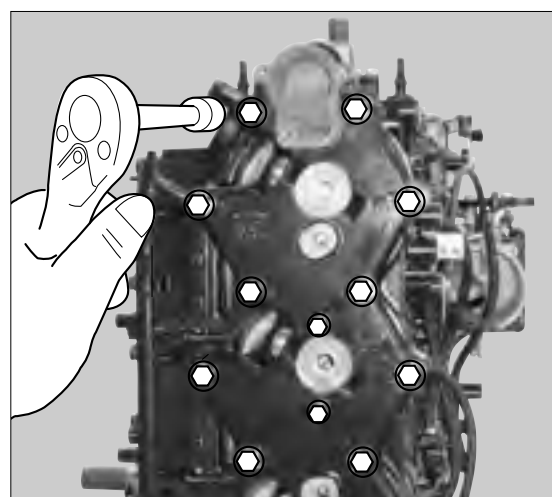


### 14) Removing Fuel System

Refer to "Removing and Installation of Fuel System" in Chapter 4.

### 15) Removing Cylinder Head / Head Cover

1. Remove air rail and fuel injectors.  
Refer to "Removing Air Rail" in chapter 4.



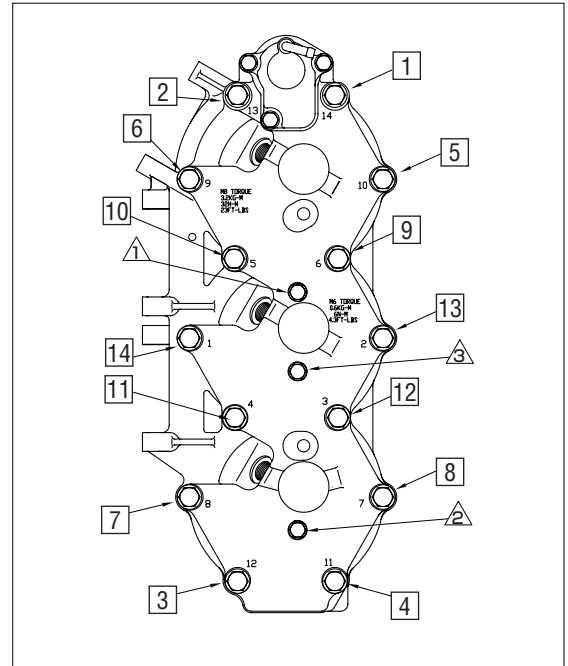


# Power Unit

- Loosen cylinder head / head cover mounting bolts in the order shown, remove them, and remove cylinder head / head cover.



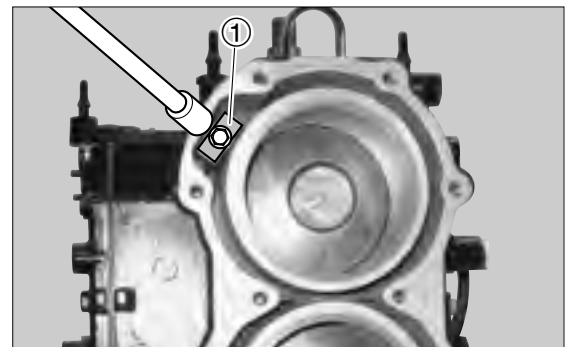
- When loosening M8 bolts, loosen in descending order of the numbers shown embossed on the head cover.
- Handle cylinder head / head cover taking care not to scratch their mating surfaces.



- Remove engine anode ① and check it.



Replace it if it is reduced to 2/3 of the original size.



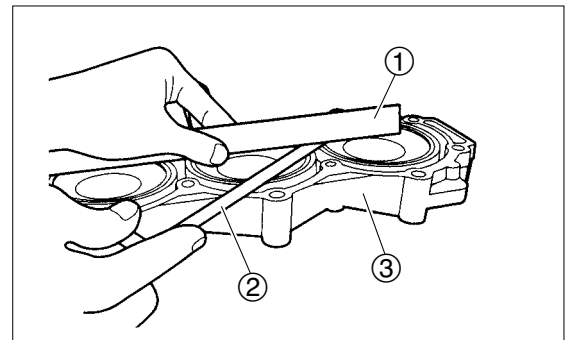
## 16) Inspection of Cylinder Head

- Remove carbon deposit in the combustion chamber of cylinder head, and check the interior for degradation, damage and other defects.

- Check water jacket interior for deposits.



When cleaning mating surfaces of cylinder head by using a means such as a scraper or wire brush, be careful not to scratch the surfaces.



- Use straight edge ① and thickness gauge ② to check distortion of cylinder head ③ in the directions shown. Repair or replace if the distortion is over the specified limit.



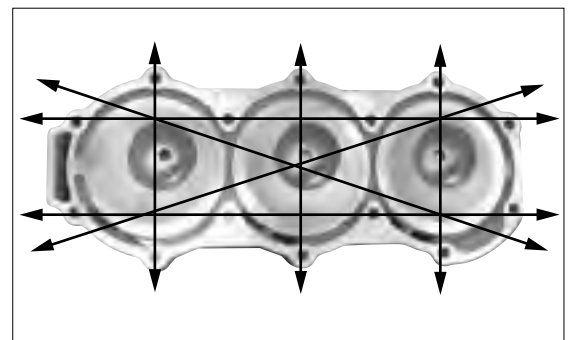
**Thickness Gauge :**

Commercially Available Item

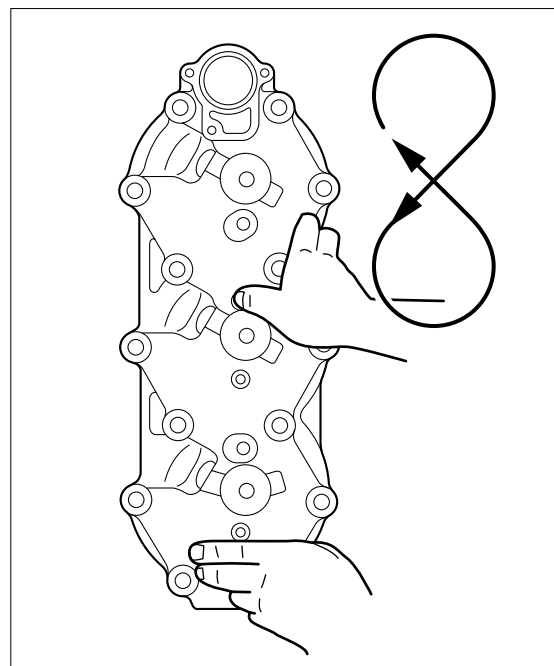


**Functional Limit :**

0.03 mm (0.0012 in)



4. If the distortion is over the limit, lap the component by using a sheet of sand paper #240 - #400 placed on a surface plate or thick plate glass and moving it on the paper drawing the letter "8" on it. Finish by using sand paper #600.

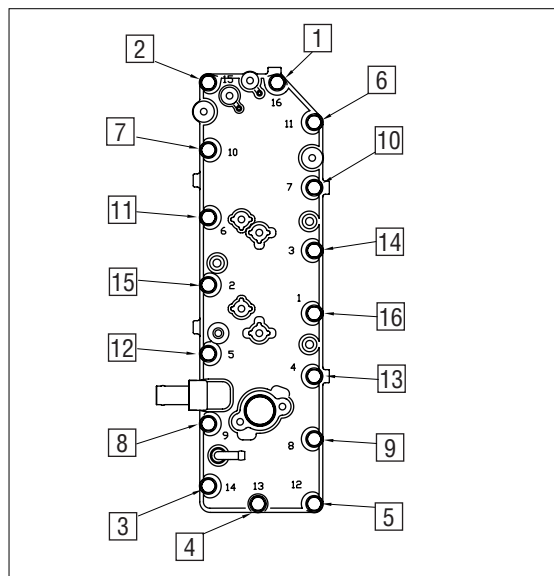
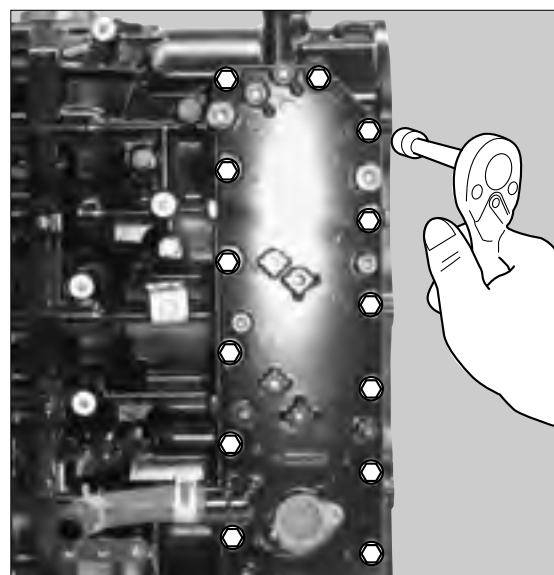


## 17) Removing Exhaust Cover

1. Loosen exhaust cover mounting bolts in the order shown, remove them, and remove exhaust cover.



Loosen the bolts in descending order of the numbers embossed on the exhaust cover.



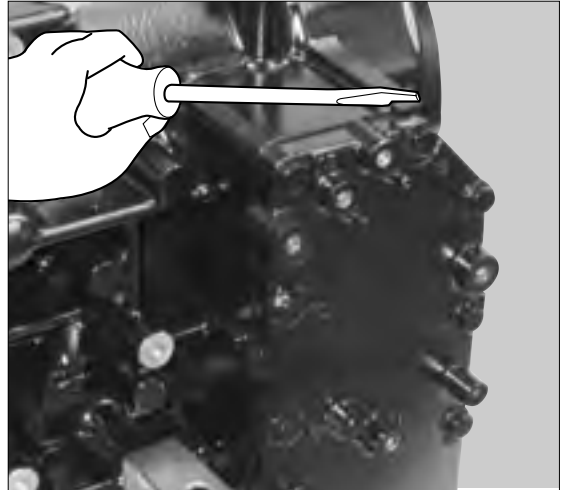




# Power Unit



- Pry the gap of the cover at five grooves one by one by using a bladed screw driver.
- The cover can be removed easier if parts cleaning agent is applied in the gap one by one from the top one.
- Be careful to pry the gap evenly, or the cover may be damaged or warped.



## 18) Inspection of Exhaust Cover

1. Check the removed outer exhaust cover and inner exhaust cover for damages such as distortion or scratches on their mating surface.



Remove clogs and debris from cooling water passage of exhaust cover.

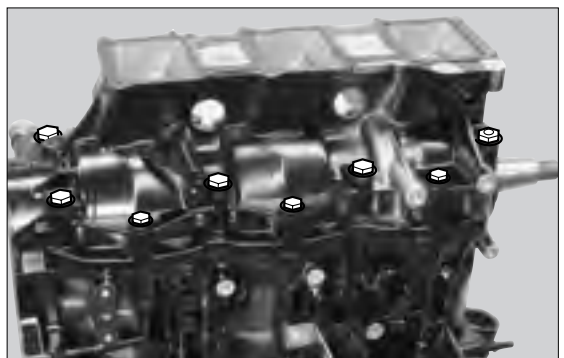
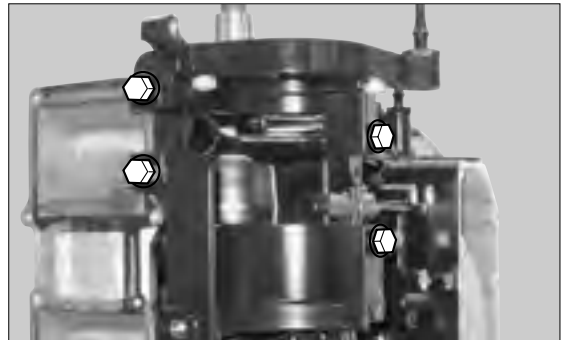
2. Check exhaust cover anode.



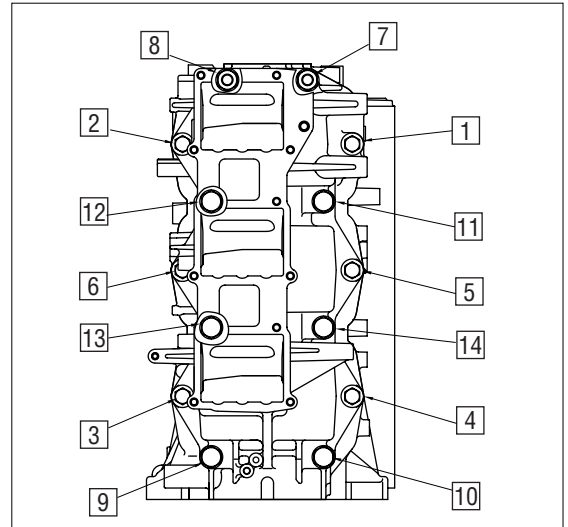
Replace if 2/3 of the original size.

## 19) Removing Crank Case

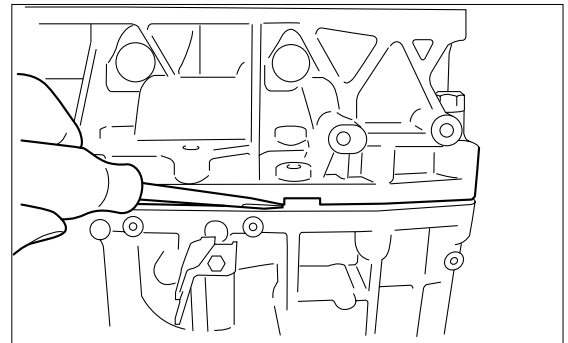
1. Remove starter motor bracket.
2. Loosen crank case mounting bolts in the order shown, remove them, and remove crank case.







- When removing crank case, pry the gap at the groove of crank case by using a bladed screw driver.
- Note that there are two knock pins on the mating surface of crank case.

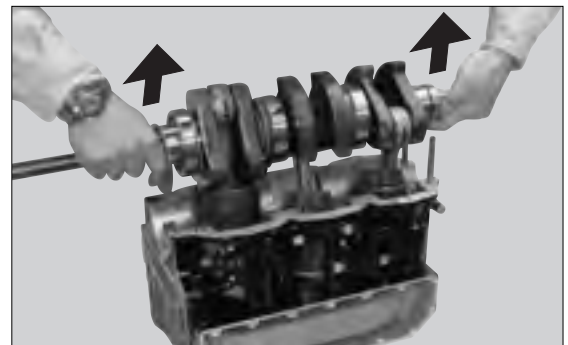


**5**

3. Remove crank shaft ass'y.  
Put a pipe of  $\varnothing 19\text{mm}$  ( $0.748\text{ in}$ ) in the drive shaft side of crank shaft ass'y, hold the crank shaft ass'y using both hands, lift it in parallel with the cylinder block to remove taking care not to damage the piston rings.



The crank shaft ass'y can be removed easier by lifting it while rocking it up and down a little.





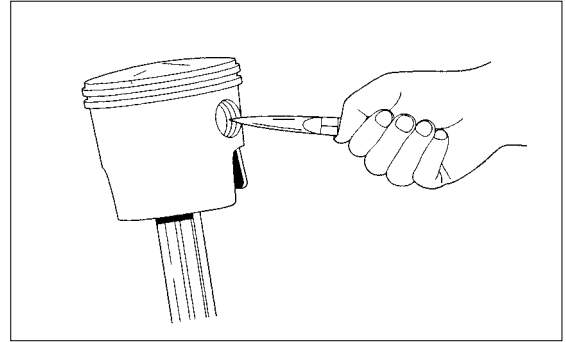
# Power Unit

## 20) Removing Pistons

1. Remove piston pin clip by using a pair of pointed nose pliers.



When removing piston pin clip, be careful not to damage the piston pin hole.



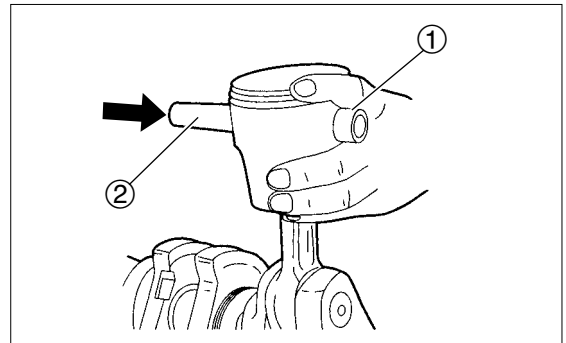
2. Remove piston pin ①, washer and needle bearing.



Use piston pin tool ② if necessary. Put the piston pin tool on the piston pin and tap it lightly taking care not to apply excessive force to the connecting rod. Be careful not to tap small end washer.



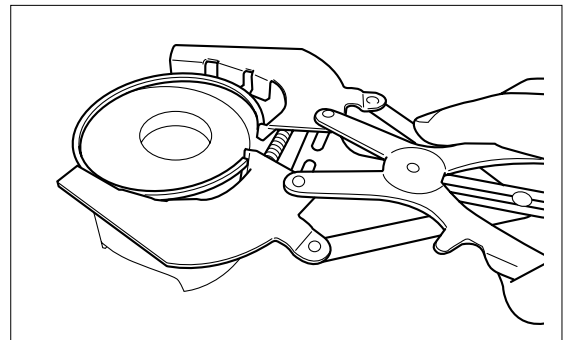
**Piston Pin Tool ② :**  
P/N. 3T1-72215-0



3. Remove piston rings.  
Use piston ring remover.



**Piston Ring Tool :**  
P/N. 353-72249-0



## 21) Disassembly of Crank Shaft

1. Remove main bearing (Lower).  
Remove "C" ring ① and pull out spacer ②.  
Remove main bearing (lower) ③ by using universal puller plate and universal puller.

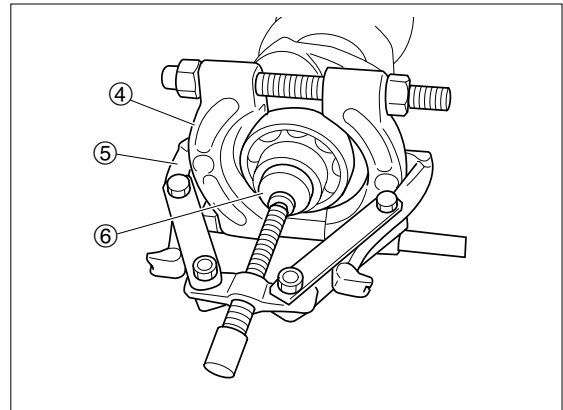
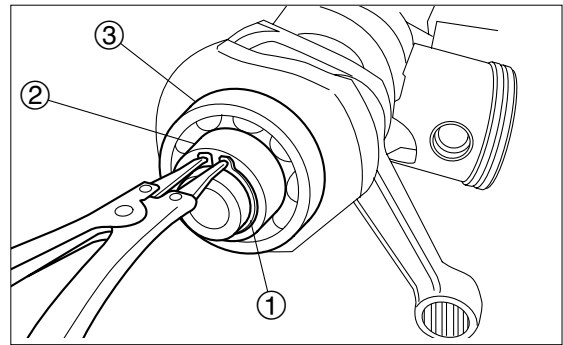


**Universal Puller Plate ④ :**

3AC-99750-0

**Puller ⑤ :** Commercially Available Item

**Protecting Plate ⑥ :**



## 22) Inspection of Crank Shaft

1. Visually check crank shaft ass'y upper and lower end bearings for flaws, wear and other damages. Replace crank shaft ass'y if necessary.

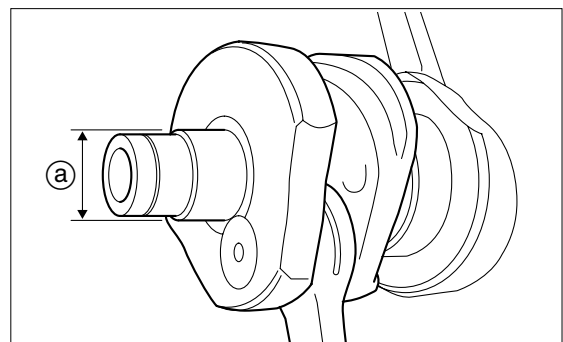
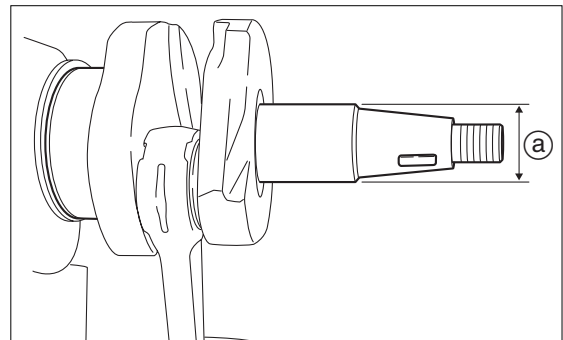


**Specified Value (a):**

#1, Top  $\phi 36.0$  mm (1.4173 in)

#1~2, between #2~3  $\phi 35.0$  mm (1.3780 in)

#3, Under  $\phi 40.0$  mm (1.574 in)



2. · Check if main bearing rotates smoothly. Replace crank shaft ass'y if necessary.



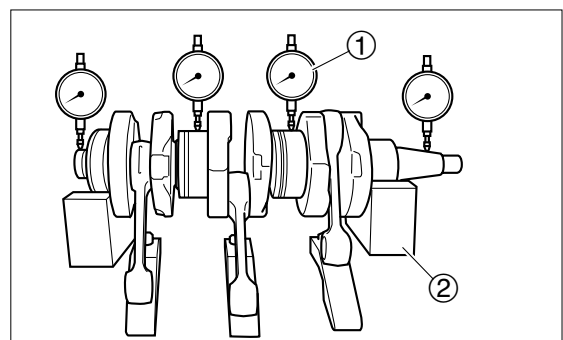
**Dial Gauge ① :** Commercially Available Item

V Block ② : Commercially Available Item



**Crank Shaft Deflection Limit :**

0.05 mm (0.0020 in)



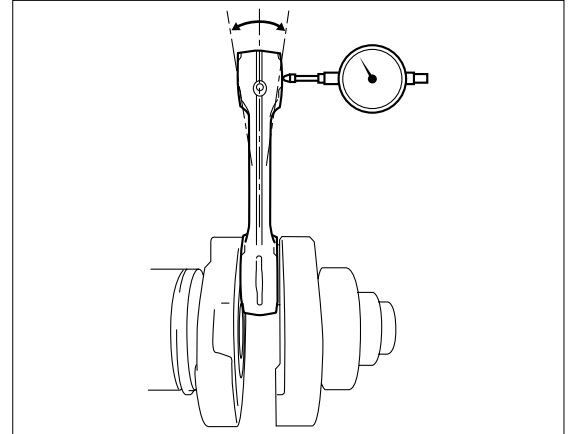


# Power Unit

- Replace crank shaft ass'y if the deflection is over the standard value.



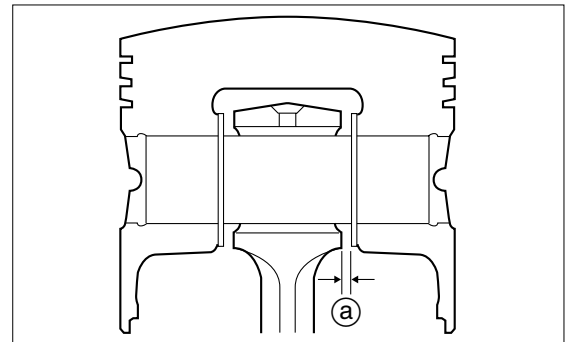
**Connecting Rod Deflection Limit :**  
2.0 mm (0.0800 in)



- Check small end side gap. Replace washer or piston, crank if the gap is over the standard value.



**Small End Side Gap (a) : Standard Value**  
0.20 - 0.55 mm (0.0079 - 0.0217 in)



## 23) Inspection of Cylinder

- Measure cylinder inner diameters (D1 - D6) at (a), (b) and (c).  
If any of the diameter is over the limit, replace the cylinder or bore the liner to make it compatible with an oversize piston.

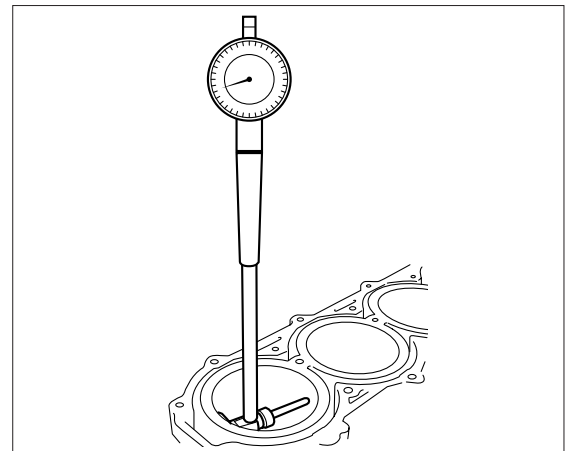


**Cylinder Inner Diameters (D1 - D6) : Standard Value**  
86.00 - 86.02 mm (3.3858 - 3.3866 in)

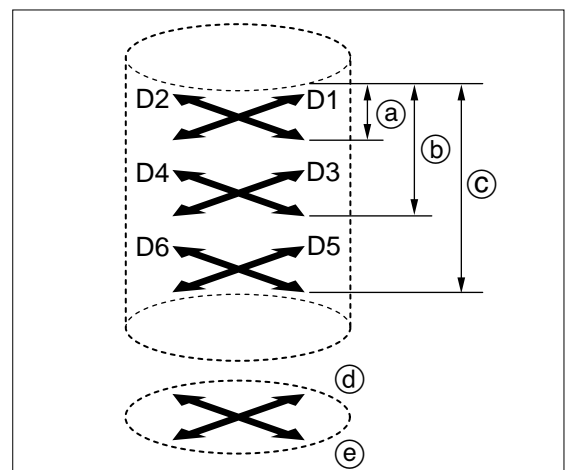
**Oversize Piston :**  
86.5 mm (3.4055 in)



**Functional Limit :**  
86.08 mm (3.3890 in)



- Measure at the area of the largest wear.
- The measurement heights (b) and (c) represent location 5 mm above and below exhaust port. (a) represents diameter in crank shaft direction, (e) represents the one in crank web direction.
- Replace the cylinder in any of the following cases; the piston sliding surface is severely damaged such as deeply scratched or scuffed so that it cannot be repaired with water-proof sand paper of #400 - 600, or the difference of liner inner diameter between the largest worn area and minimum worn area is 0.06mm (0.0024 in) or over.



(a) 10mm (0.39 in)  
(b) 30mm (1.18 in)  
(c) 80mm (3.15 in)

(d) Crank Shaft Direction  
(e) Crank Web Direction

2) Calculate taper of inner diameter of the cylinder.

Replace the cylinder or use oversized piston if the taper is equal to or over the specified value.



**Calculation of taper :**

D1-D5 (Measurement Point) (a)

D2-D6 (Measurement Point) (c)



**Functional Limit of taper :**

0.08 mm (0.0032 in)

3) Calculate out-of-roundness of inner diameter of the cylinder.

Replace the cylinder or use oversized piston if the out-of-roundness is equal to or over the specified value.



**Calculation of out-of-roundness :**

Maximum of the following value

(D2-D1)

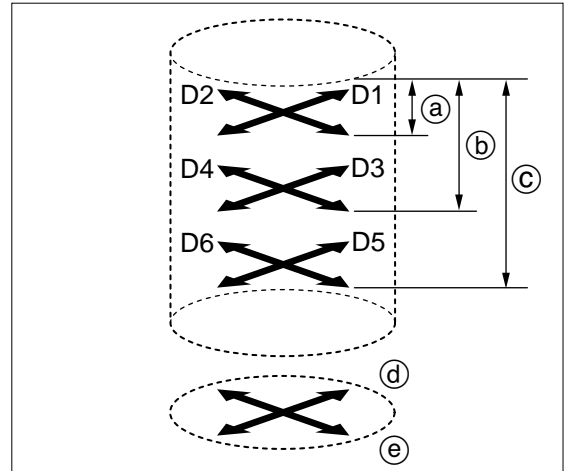
(D4-D3)

(D6-D5)



**Functional Limit of out-of-roundness :**

0.05 mm (0.0020 in)



(a) 10mm (0.39 in)  
(b) 30mm (1.18 in)  
(c) 80mm (3.15 in)

(d) Crank Shaft Direction  
(e) Crank Web Direction

## 24) Inspection of Pistons

1. Inspection of Piston Outer Diameter

Measure piston outer diameter, and replace the piston if the outer diameter is less than the functional Limit.



**Measurement Point (b) :**

11.5 mm (0.45 in) above bottom end of piston skirt.  
approximately 90 degrees from pin hole.

**Standard Value (a) :**

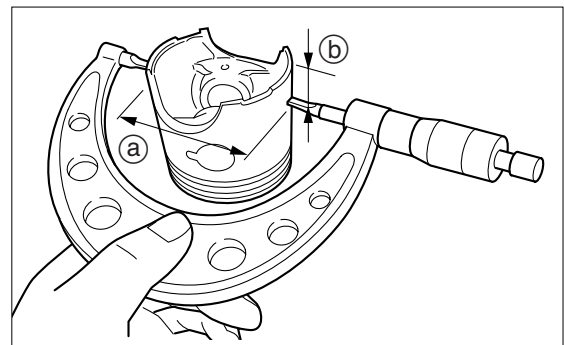
Standard Piston : 85.85 mm (3.3799 in)

Oversized Piston : 86.35 mm (3.3996 in)



**Functional Limit (a) :**

85.79 mm (3.3776 in)



2. Inspection of Piston Clearance

Calculate piston clearance, and if it is over the limit, replace piston or any of piston rings, replace cylinder, or use oversized piston.



**Piston Clearance :**

Standard Value : 0.13 - 0.20 mm (0.0051 - 0.0079 in)



**Functional Limit :**

0.30 mm (0.0118 in)



**Calculation of Piston Clearance :**

Cylinder Inner Diameter - Piston Outer Diameter



Use the maximum value of the cylinder inner diameter measured.



# Power Unit

## 3. Inspection of Piston Rings

- 1) Push a piston ring into the cylinder by using top surface of a piston.
- 2) Use thickness gauge to measure piston ring gap.  
Replace piston ring if the gap is over specified value.



### Thickness Gauge :

Commercially Available Item



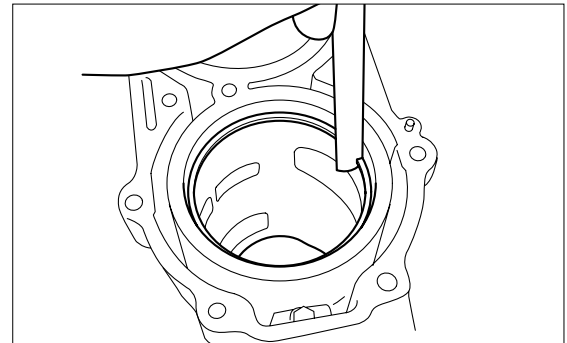
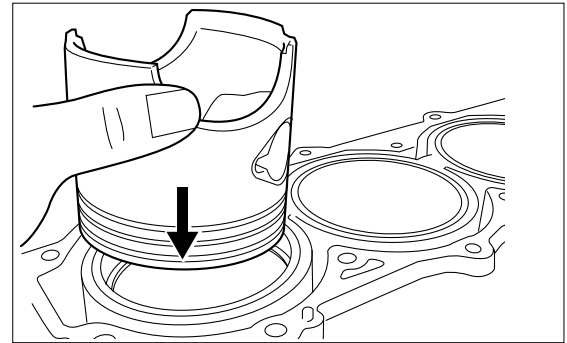
### Piston Ring End Gap : Standard Value

Top Ring	} 0.25 - 0.40 mm (0.0098 - 0.0157 in)
Second Ring	
Third Ring	



### Functional Limit :

① Top Ring	} 0.8 mm (0.0315 in)
② Second Ring	
③ Third Ring	



## 4. Inspection of Piston Ring Side Clearance

- 1) Attach a piston ring to piston, and measure piston ring side clearance. Replace piston ring if the clearance is over specified value.



### Piston Ring Tool :

P/N. 353-72249-0



### Piston Ring Side Clearance :

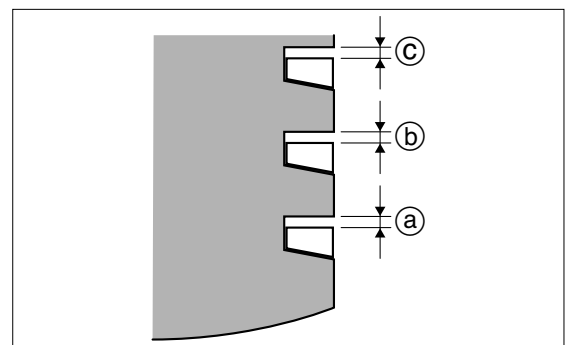
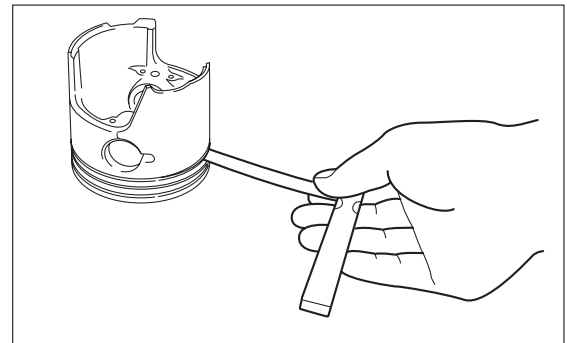
Standard Value :

Top Ring	} 0.04 - 0.08 mm (0.0016 - 0.0032 in)
Second Ring	
Third Ring	





### Functional Limit :

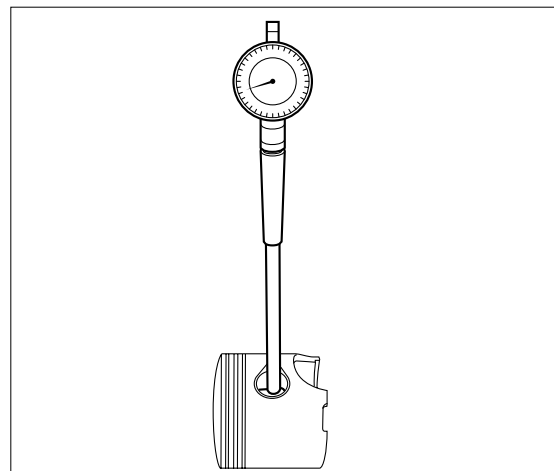
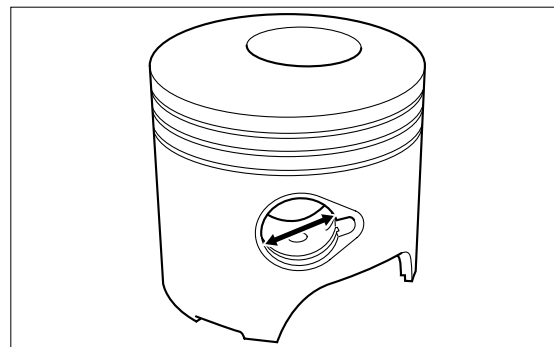
① Top Ring	} 0.10 mm (0.0039 in)
② Second Ring	
③ Third Ring	



## 5. Inspection of Piston Pin Hole



Measure piston pin hole inner diameter, and replace piston if the inner diameter is over the limit.

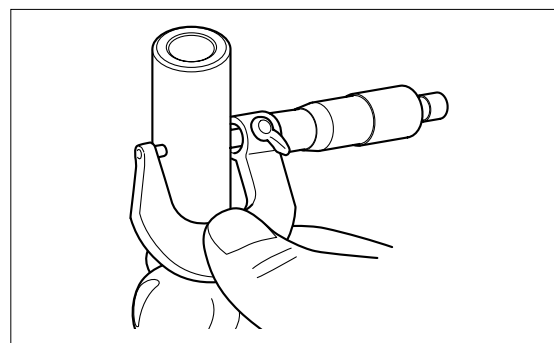
	<b>Piston Pin Hole : Standard Value</b> 23.00 mm (0.9056 in)
	<b>Functional Limit :</b> 23.03 mm (0.9067 in)



## 6. Inspection of Piston Pins



Measure piston pin outer diameter, and replace piston pin if the outer diameter is over the limit.


	<b>Piston Pin Outer Diameter : Standard Value</b> 23.00 mm (0.9056 in)
	<b>Functional Limit :</b> 22.97 mm (0.9045 in)
	<b>Measuring Locations :</b>
	D1 and D3    10 mm (0.394 in) from top end and bottom end respectively
	D2            35 mm (1.378 in) from the end

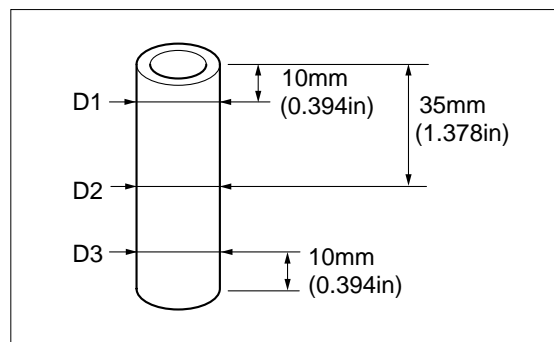


## 7. Inspection of Piston Pin Clearance

Calculate piston pin clearance, and replace piston and piston pin together if the clearance is over the limit.

	<b>Calculation of Piston Pin Clearance :</b> Piston Pin Hole Inner Diameter - Piston Pin Outer Diameter
	<b>Standard Value :</b> 0.015 - 0.025 mm (0.00059 - 0.00098 in)
	<b>Functional Limit :</b> 0.040mm (0.0016 in)

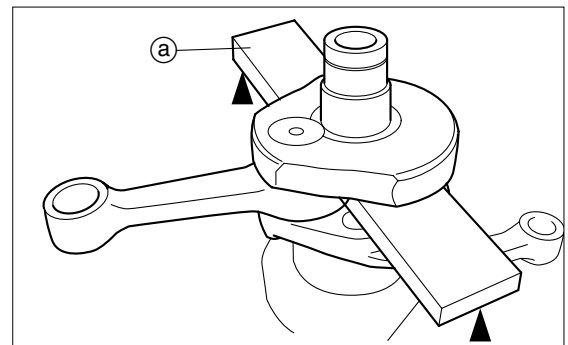
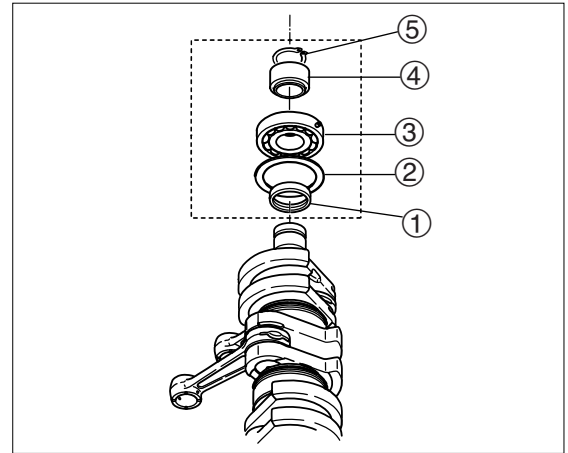
 Use the maximum values of piston pin hole inner diameters and piston pin outer diameters measured respectively.





## 25) Assembly of Crank Shaft

1. Press-fitting Bearing
  - 1) Insert a holding bar ① in between crank webs and press-fit bearing.



Attach spacer 40-52-7 ① and washer 66-85-2 ② and then press-fit bearing 6208 ③.



**Bearing Press-Fitting Tool ⑦ :**

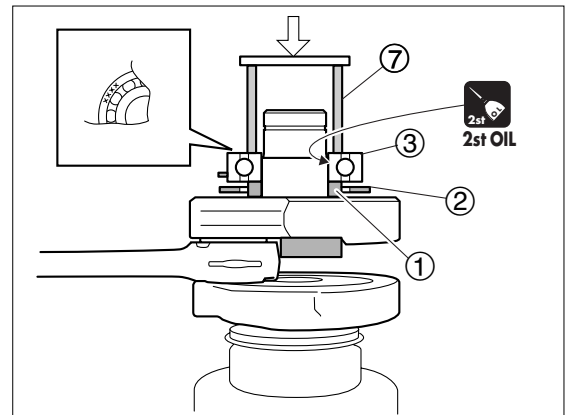
Inner Diameter:  $\varnothing 45$  mm (1.575 in)



Do not reuse removed bearing.



**2st OIL**



2. Press-fit spacer 35-48.6-16 ④ and attach "C" ring.

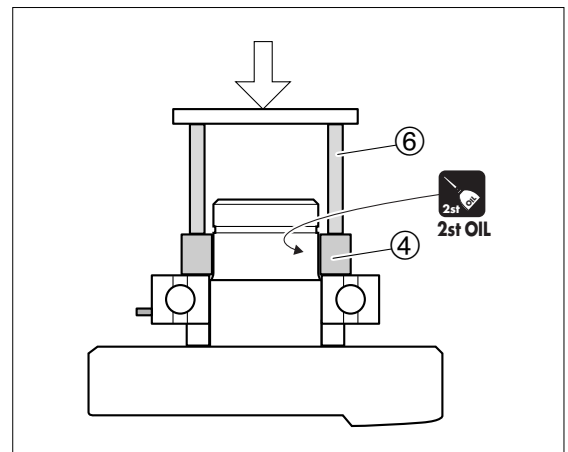


**Spacer Press-Fitting Tool ⑥ :**

Inner Diameter:  $\varnothing 36$  mm (1.417 in)



**2st OIL**





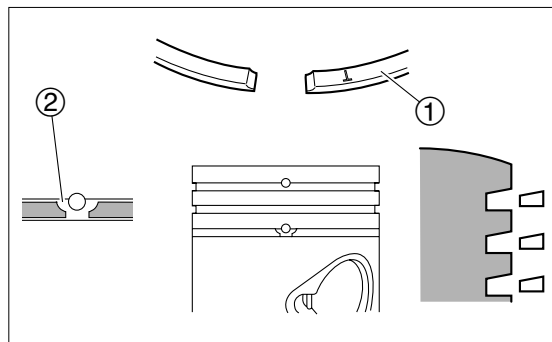
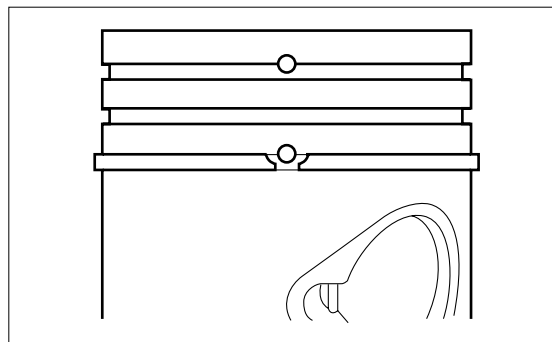
## 26) Installation of Pistons

### 1. Installation of Piston Rings

Complete 3rd ring first.



- When attaching a piston ring, face the side of the ring marked with "T" upward ①.
- Bring piston ring gap to knock pin ②.

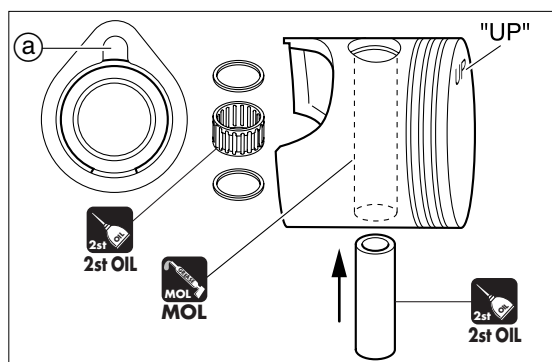


### 2. Installation of Piston Pin

Attach piston to washer, needle bearing and connecting rod by using piston pin.



- Attach a piston pin clip to a groove in the piston pin hole.
- Assemble the parts so that the side marked with "UP" on the piston head faces flywheel side.
- Set the piston pin clip so that the gap of the clip is at the opposite side of the opening (a) located in the piston pin clip groove.
- When a new piston is used, apply molybdenum grease (Moly-paste 500) to piston pin hole and two-stroke engine oil to piston pin.
- Use piston pin tool if necessary.



**Piston Pin Tool :**

P/N. 3T1-72215-0



**MOL**



**2st OIL**

## 27) Inspection of Crankcase

### 1. Check the crankcase for cracks and damages.

Replace if necessary.



# Power Unit

## 28) Assembly of Power Unit Parts

1. Install main bearing (upper) ① to crank shaft ass'y.



- Face the marking on the bearing to flywheel side.
- Apply LIT grease to the oil seal lip.



**2st OIL**



**LIT**

2. Install crank shaft ass'y to cylinder.

Apply genuine engine oil to the following parts before assembling them.

- Big End of Connecting Rod
- Small End of Connecting Rod
- Main Bearing
- Piston Ring and Entire Circumference of Piston, and Entire Cylinder Wall
- O Ring of Upper Bearing



- Before assembling parts, remove residual gasket on the surface of bearings and mating surfaces of crankcase halves.
- When installing crank shaft ass'y, lower the ass'y gradually so that crank shaft is held parallel with the cylinder face.
- Insert pistons one by one while confirming that each piston enters vertically in the cylinder liner. Pistons can be inserted easier while moving them up and down a little.
- Put a piece of round bar or pipe ③ of  $\phi 19$  mm (0.75 in) in the drive shaft opening to make it easier to hold.



**2st OIL**

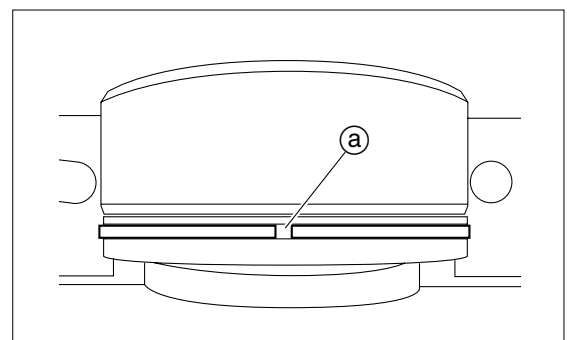
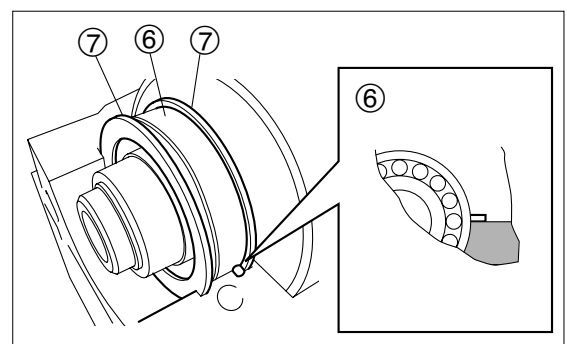
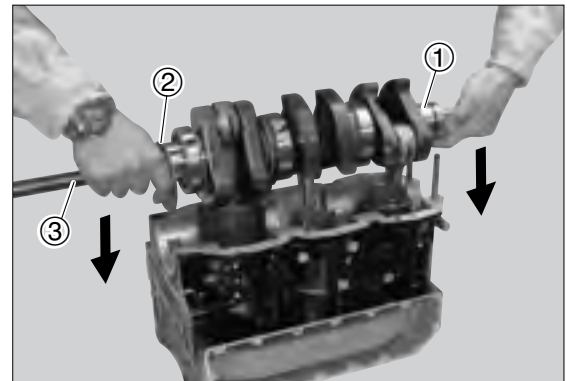
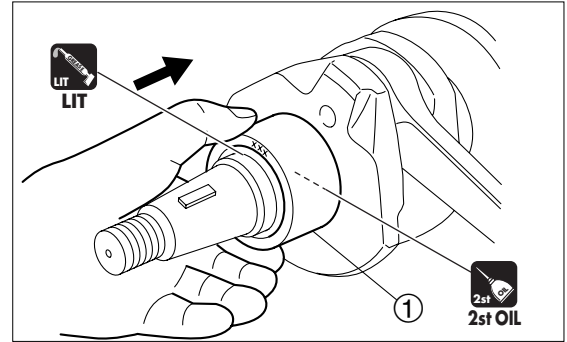
3. Positioning bearing

Put the pin of bearing (lower) on the cylinder and then, put washers ⑦ in the cylinder grooves snugly.

4. Bring seal ring gap ① to crank case side center.



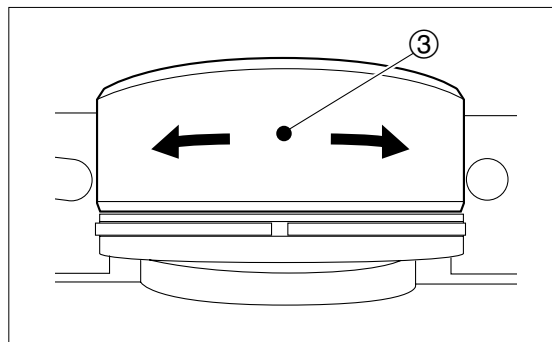
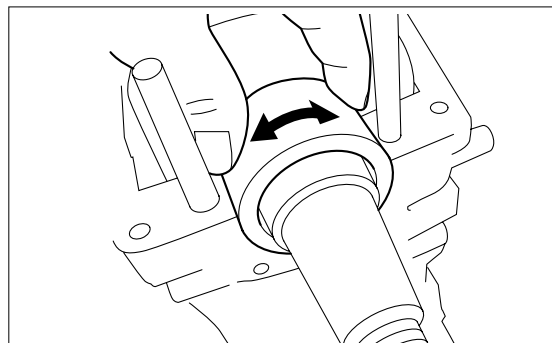
- Before completely assembling crank shaft parts, position the bearing, washer and seal rings properly.



## 6. Positioning Upper Bearing and Main Bearing

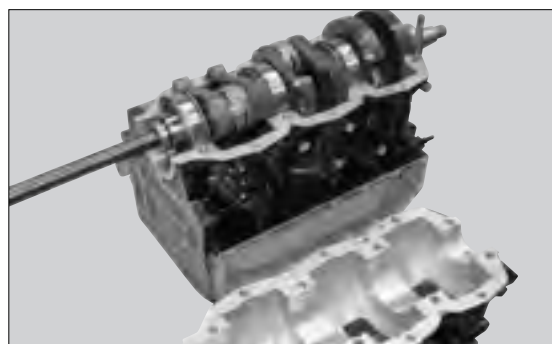


- Bring knock hole of each bearing to dowel pin of cylinder's journal areas.
- Attempt to move each bearing lightly to check if dowel pin is in the hole snugly.
- Each bearing is provided with a bearing lubrication hole ③ on the opposite side of knock hole to check the location.



## 29) Assembly of Crank Case Halves

1. Degrease crank case and cylinder mating faces.



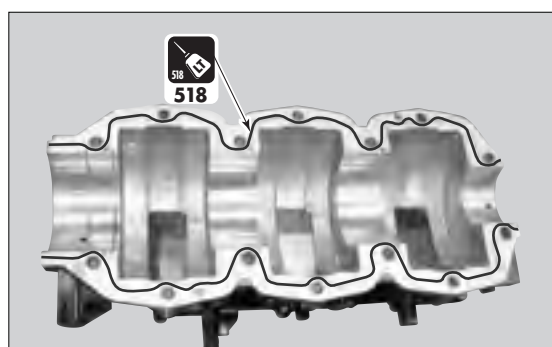
2. Apply sealing agent to crank case's mating surface.



- Be careful not to allow sealing agent to squeeze out.
- Apply sealing agent on the area inside of the bolt holes continuously in width of approximately 1 mm as shown.



518



3. When installing crank case, check position of dowel pins ①.



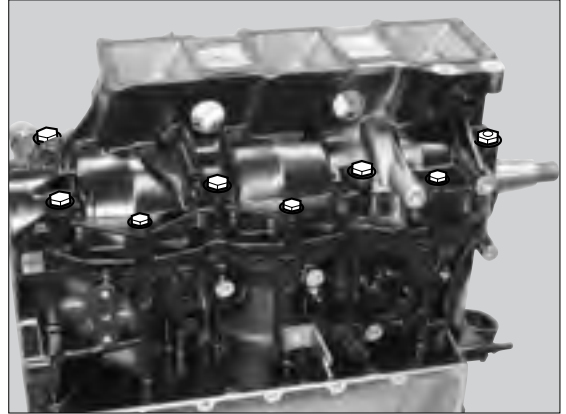


# Power Unit

## 4. Install crank case to cylinder.



Before securing with bolts, fit crank case snugly to the cylinder by tapping with a plastic hammer to make the gap between surfaces even.



## 5. Tighten crank case securing bolts and nuts (M10) 1 to 8 in the order of the numbers shown.



### Temporary Tightening :

20 N · m (14 lb · ft) [2.0 kgf · m]

### Final Tightening :

40 N · m (30 lb · ft) [4.0 kgf · m]

Then, tighten bolts (M8) 9 to 14 in the order of the numbers shown.



### Temporary Tightening :

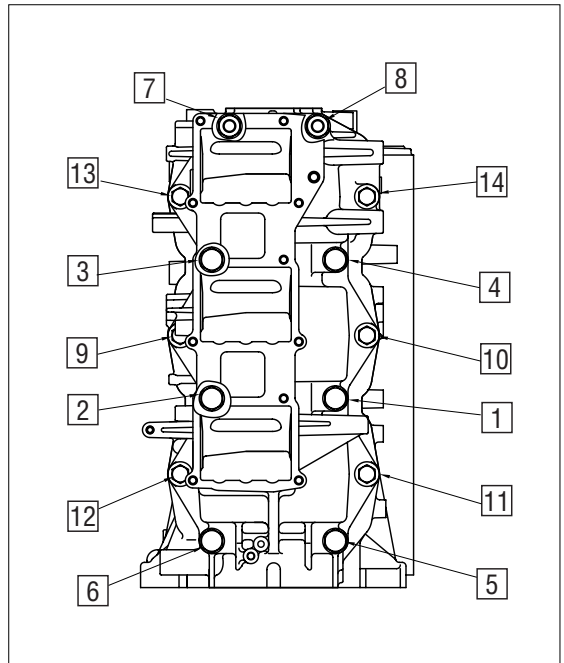
13 N·m (9 lb · ft) [1.9 kgf · m]

### Final Tightening :

25 N·m (18 lb · ft) [2.5 kgf · m]



- Temporary tighten M10 bolts after temporary tightening bolts M8.
- Tighten crank case securing bolts and nuts in two steps to their specified torque.
- Wipe off excess Loctite 518 from mating surface.
- Rotate Crankshaft to ensure it is not binding.

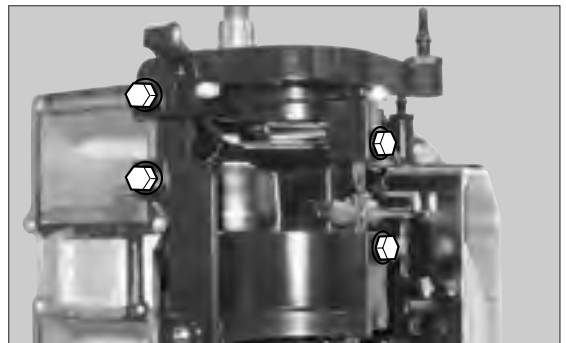


## 6. Install starter motor bracket.



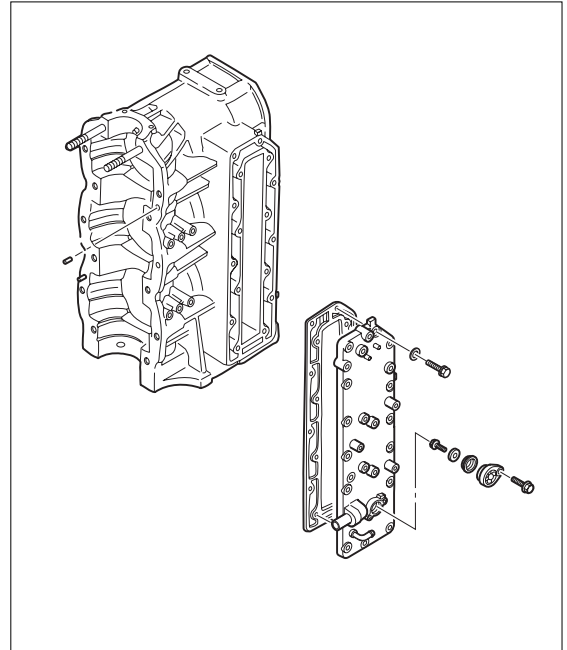
### Starter Motor Bracket Bolt :

25 N·m (18 lb · ft) [2.5 kgf · m]



## 23) Installation of Exhaust Cover

1. Assemble exhaust cover, gasket, anode and anode cap.



2. Attach exhaust cover securing bolts 1 to 16 (M6) and tighten them in the order of their numbers shown to specified torque.

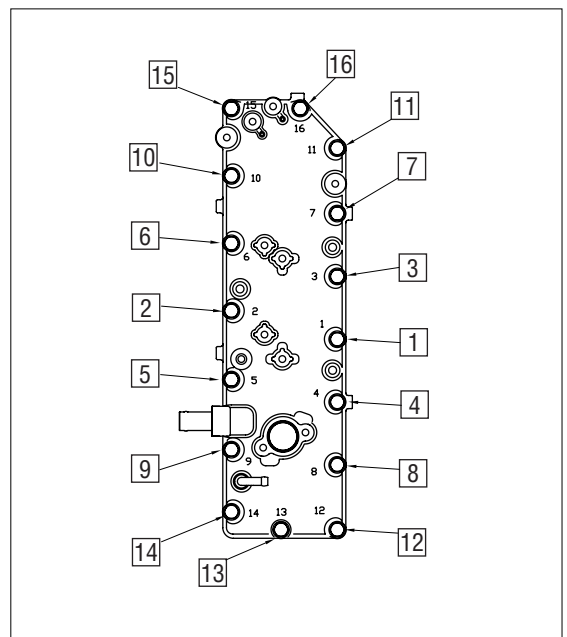


### Exhaust cover Bolts :

6 N · m (4 lb · ft) [0.6 kgf · m]



Tighten the bolts in the order of the numbers marked on the exhaust cover.



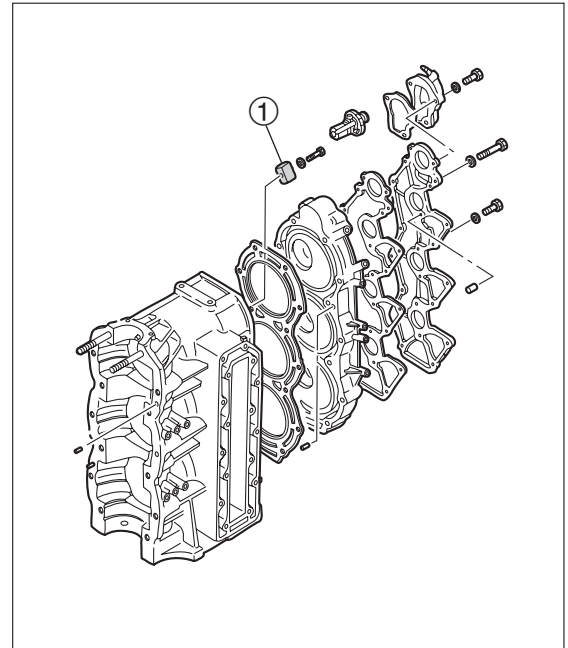


## 31) Installation of Cylinder Head

1. Attach anode ① to cylinder.
2. Attach dowel pins to cylinder head, and then attach gaskets and cylinder head cover.  
Temporary tighten cylinder cover securing bolts (M6) in the order of the numbers shown.

**Temporary Tightening :**

2 N · m (1.4 lb · ft) [0.2 kgf · m]



3. Attach cylinder head with head cover and cylinder head gasket to cylinder.  
Tighten cylinder head securing bolts (M8) ① to ⑭ in the order of the numbers shown.

**Temporary Tightening :**

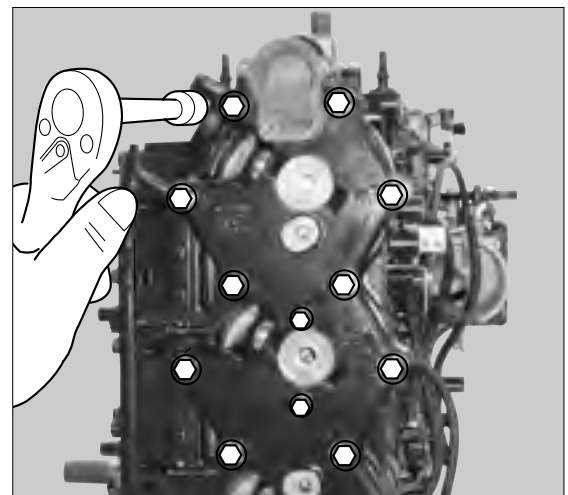
12 N · m (9 lb · ft) [1.2 kgf · m]

**Final Tightening :**

32 N · m (23 lb · ft) [3.2 kgf · m]



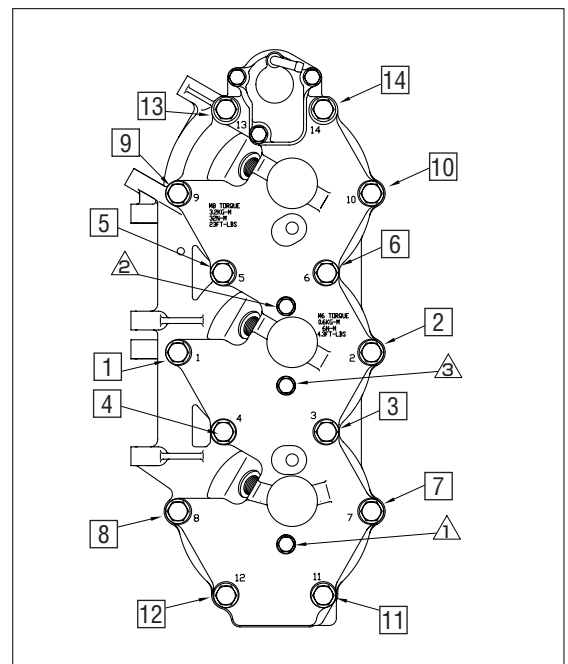
Tighten cylinder head securing bolts in two steps to specified torque.



4. Finally tighten cylinder head cover securing bolts (M6).

**Final Tightening :**

6 N · m (4 lb · ft) [0.6 kgf · m]



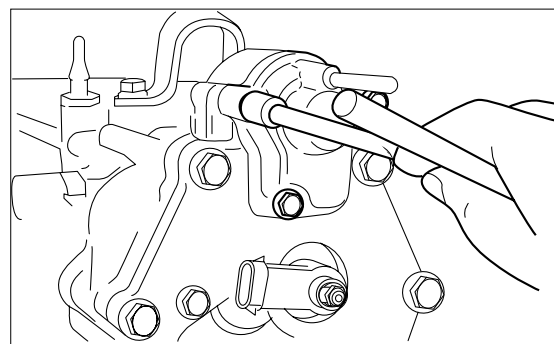
5. Attach air injectors and air rail to cylinder head.  
Refer to "Assembly of Air Rail" in Chapter 4.

6. Install thermostat, thermo-cap and gasket.



#### Thermostat Cap Bolts

6 N · m (4 lb · ft) [0.6 kgf · m]



## 32) Assembly of Crank Case Head

1. Apply grease and oil to oil seal 19.6-35-10 and press-fit it to crank case head.

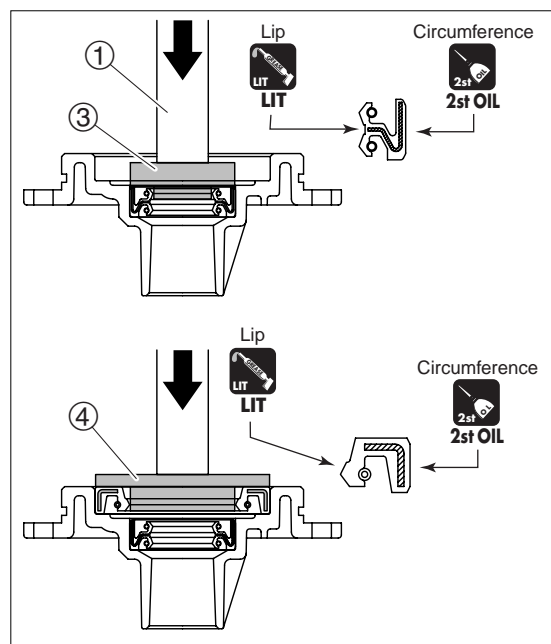


#### Driver Rod ① :

P/N. 3AC-99702-0

#### Oil Seal Attachment ③ :

P/N. 3U1-99820-0



2. Apply grease and oil to oil seal 35-589 and press-fit it to crank case head.



#### Driver Rod ① :

P/N. 3AC-99702-0

#### Oil Seal Attachment ④ :

P/N. 3E0-99820-0



LIT



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5



# Power Unit

## 33) Installation of Air Chamber

1. Attach reed valve, air chamber and gaskets to crank case. Attach and tighten securing bolts (M6) ① to ⑫ (M6) to specified torque in the order of the numbers shown.



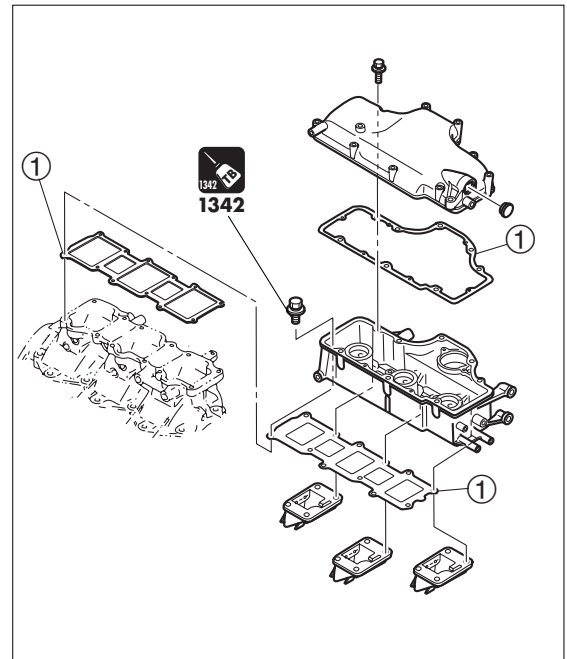
- Use new gaskets.
- When reusing bolts, apply screw lock #1342.



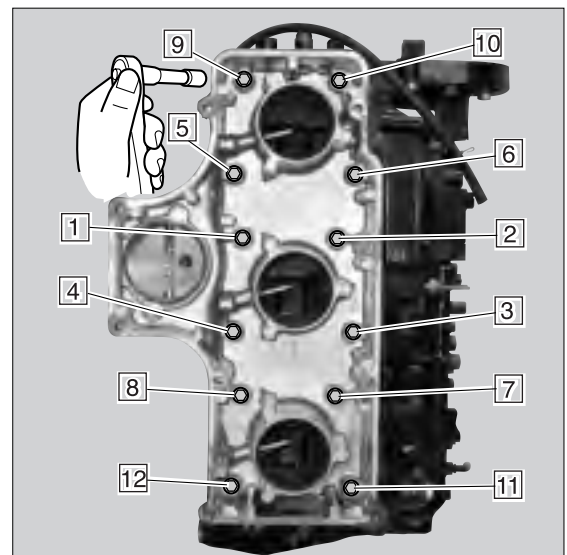
**Air Chamber Bolts (M6) ① - ⑫ :**  
9 N · m (7 lb · ft) [0.9 kgf · m]



**1342**



① Gasket **Do not reuse.**



2. Install throttle body, then tighten bolts (M6) to specified torque.



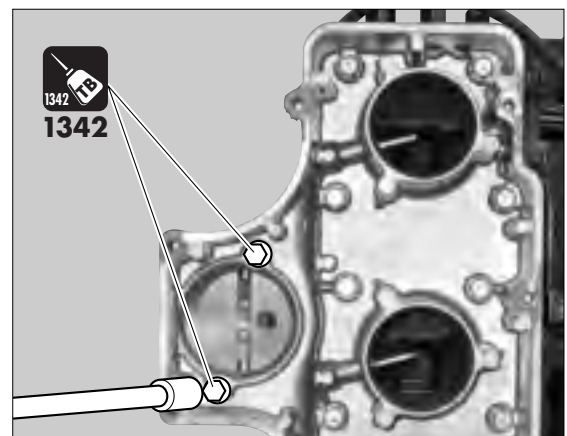
- When reusing bolts, apply screw lock #1342.



**Throttle Body Bolts ( M6 ) :**  
9 N · m (7 lb · ft) [0.9 kgf · m]



**1342**







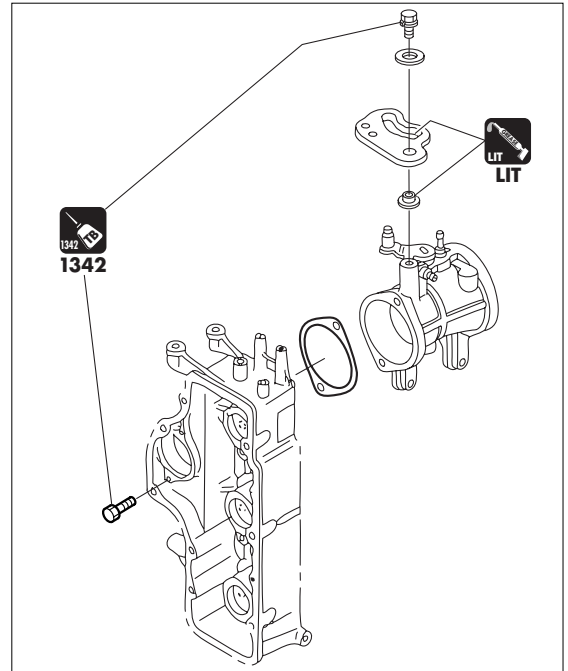
- Apply LIT grease to sliding faces of throttle cam and roller.
- Apply ThreeBond 1342 to throttle body securing bolts.



LIT



1342

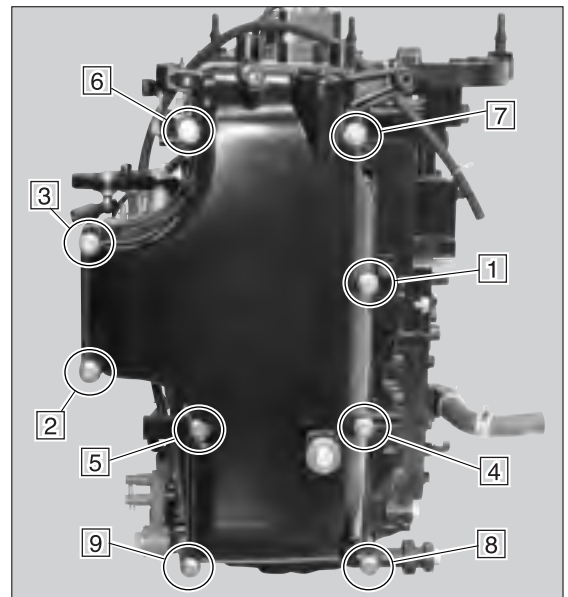


3. Attach air chamber cover and gasket. Attach and tighten air chamber securing bolts (M6) 1 to 9 to specified torque in the order of the numbers shown.



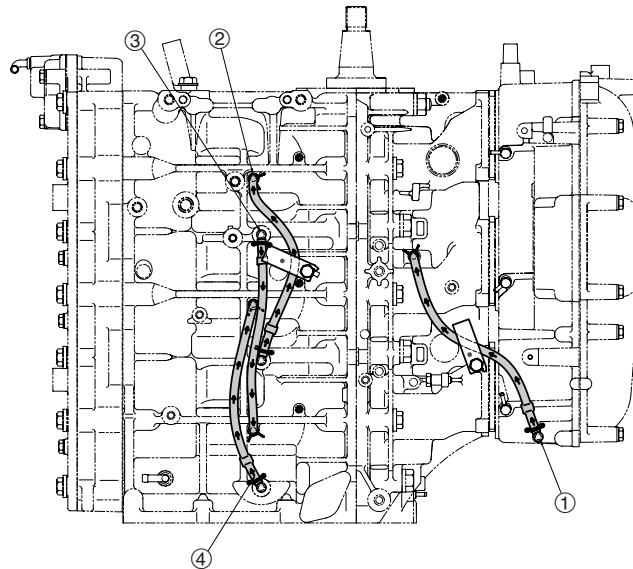
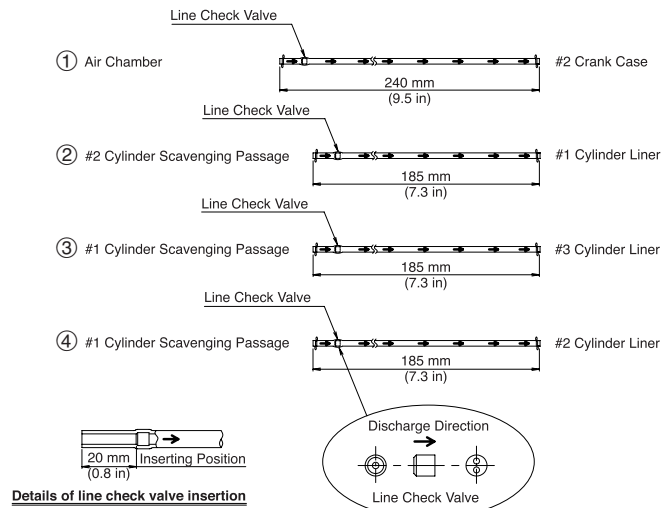
**Air Chamber Bolts :**

6 N · m (4 lb · ft) [0.6 kgf · m]





## 34) Installation of Recirculation Hoses



## 35) Installation of Throttle Link

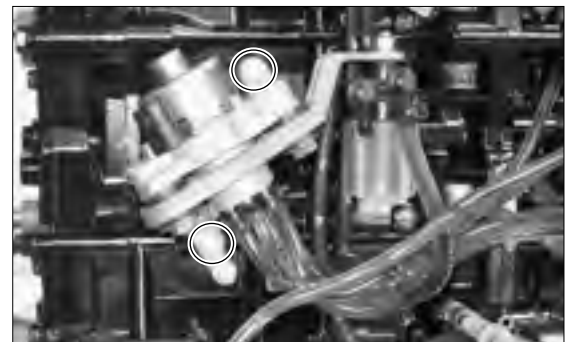
Reverse throttle link removing procedure described in “Removing Throttle Link” in Chapter 5.

## 36) Installation of Oil Pump

1. Install oil pump ass'y together with bracket to cylinder ass'y by using bolts.



- Reconnect oil hose to crankcase. “Refer to Oil System diagram” in Chapter 4.
- Use waste cloth to let it soak with oil if spilled from hose.



### 37) Installation of Fuel System

Refer to "Removing and Installation of Fuel System" in Chapter 4.

### 38) Installation of Cord Ass'y and Electrical Parts

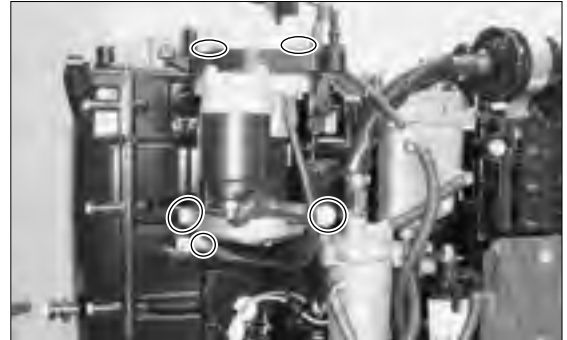
Reverse cord ass'y removing procedure described in "Removing Cord Ass'y" in Chapter 5.

### 39) Installation of Starter Motor

1. Secure starter motor mounting band by using bolts (M10, 2 pcs.) on the upper surface of the motor, and then, install starter motor to bracket.



Connect grounding cord to air chamber.



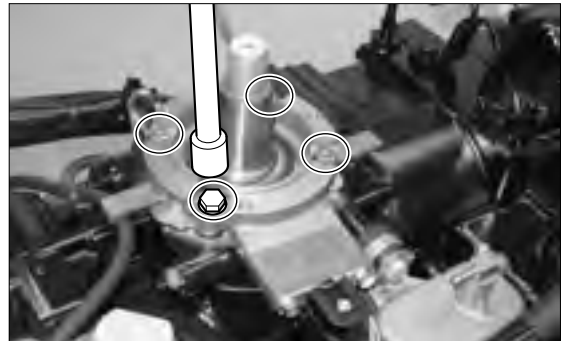
### 40) Installation of Alternator

1. Tighten coil bracket securing bolts to specified torque.



**Coil Bracket bolts : ①**

6 N · m (4 lb · ft) [0.6 kgf · m]



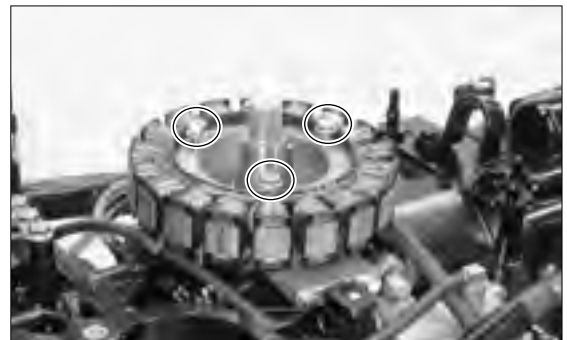
2. tighten alternator securing bolts to specified torque.



**Alternator Securing Bolts :**

6 N · m (4 lb · ft) [0.6 kgf · m]

3. Install other parts by reversing removing procedure.





# Power Unit

## 41) Installation of Drive Pulley and Flywheel

1. Attach key, flywheel and drive pulley to crank shaft, and tighten the nut to specified torque.



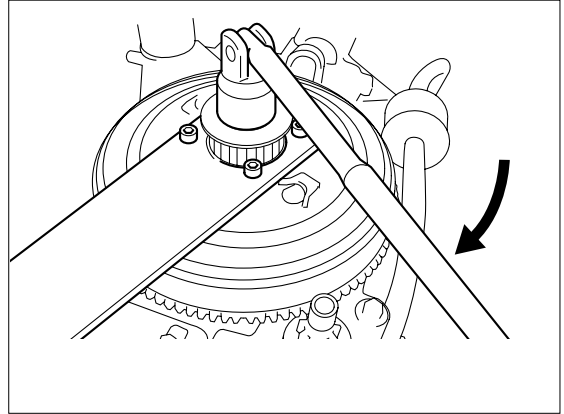
**Flywheel Puller Kit :**  
P/N. 3T1-72211-0



**Drive Pulley :**  
260 N · m (190 lb · ft) [26 kgf · m]



Degrease tapered areas of crank shaft and flywheel before installing them.



## 42) Installation of Air Compressor

Refer to "Removing and Installation of Air Compressor" in Chapter 4.

## 43) Installation of Power Unit

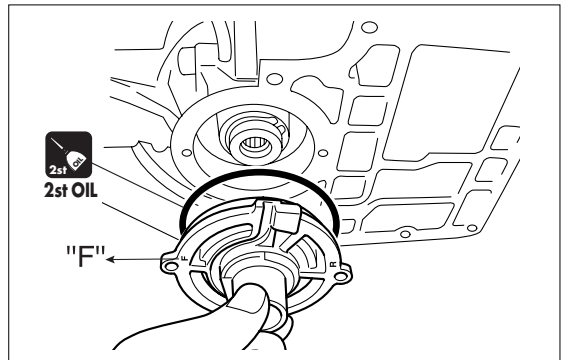
1. Attach O ring coated with two stroke engine oil to crank case head.
2. Attach crank case head to cylinder ass'y taking care of the orientation.



Install crank case head so that the mark "F" is at front side (crank case side) of engine.



**2st OIL**



3. Clean mating faces of engine base and cylinder ass'y, and then, attach dowel pins ④ gasket.



Use new engine base gasket.

4. Install power unit securely, and tighten engine mount bolts ② specified torque.



**Engine Mount Bolts ② :**

25 N · m (18 lb · ft) [2.5 kgf · m]

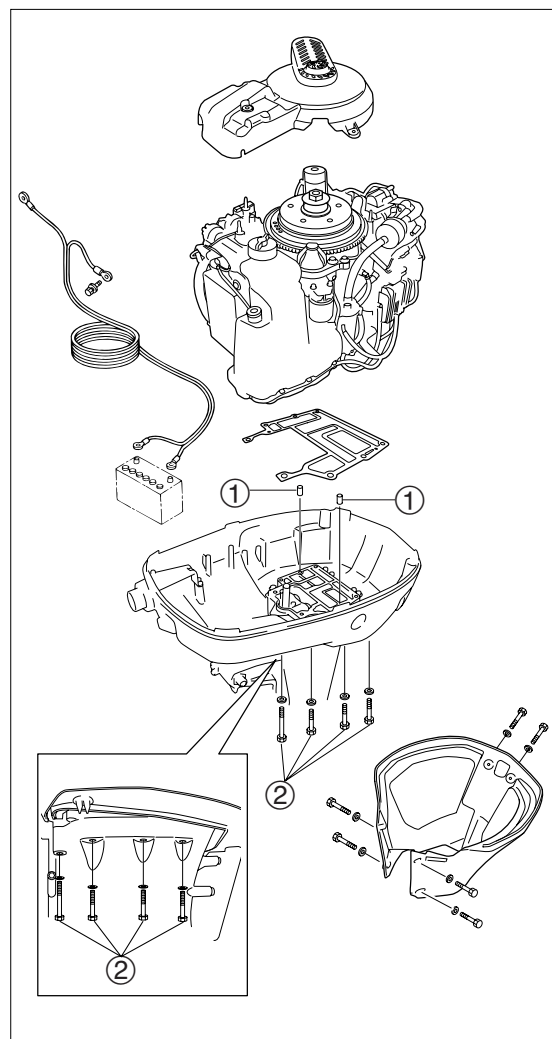


Be careful not to catch wires and hoses and other parts between engine base mating surfaces.

5. Install other parts reverse of their removing steps.



Refer to "Electrical Wiring Assembling Instruction Diagrams 1 and 2" in Chapter 11.





## Power Unit

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# 6

## Lower Unit

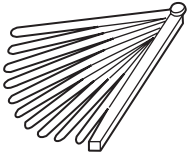
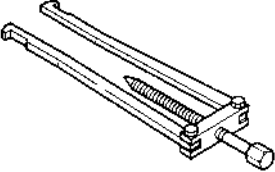
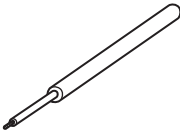
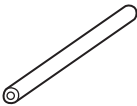
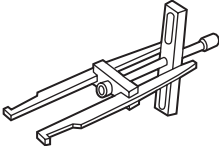
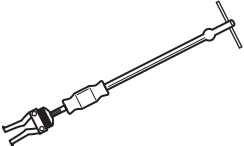
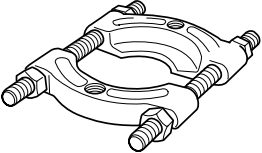
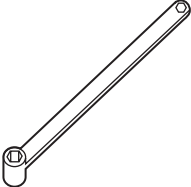
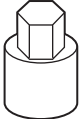
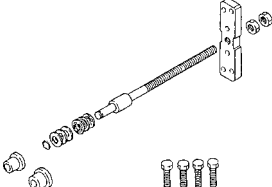
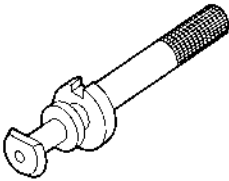
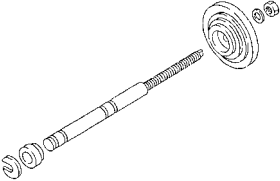
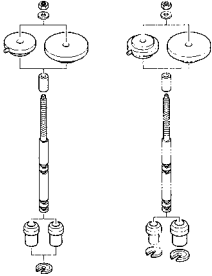



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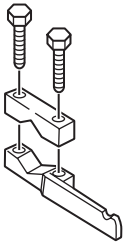
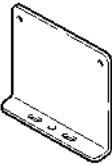
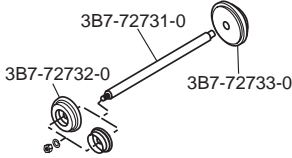
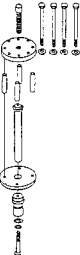
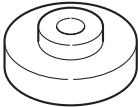
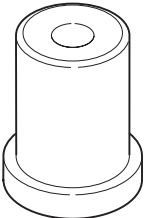
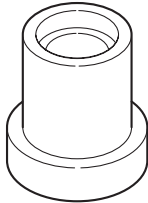
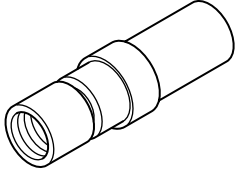
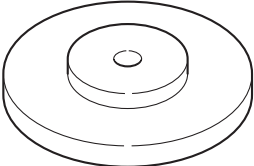
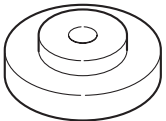


# Lower Unit

## 1. Special Tools

			
Thickness Gauge P/N. 353-72251-0	Propeller Shaft Housing Puller Ass'y P/N. 353-72252-0	Spring Pin Tool A (ø3.5) P/N. 369-72217-0	Spring Pin Tool B (ø3.5) P/N. 369-72218-0
Measuring gaps	Removing propeller shaft housing	Removing spring pin	Installing spring pin
		ø100 x ø79.5 x ø51.5 x ø61.5	
Bevel Gear Bearing Puller Ass'y P/N. 3B7-72755-0	Slide Hammer Kit P/N. 3AC-99080-0	Center Plate P/N. 3AC-99701-0	Driver Rod P/N. 3AC-99702-0
Removing forward (A) gear bearing outer race	Removing forward (A) gear bearing outer race	Removing or installing propeller shaft housing bearing	Used in combination with center plate and various attachments
			
Universal Puller Plate P/N. 3AC-99750-0	Bevel Gear B Nut Wrench P/N. 3B7-72231-0	Drive Shaft Socket P/N. 3B7-72232-0	Backlash Measuring Tool A Kit P/N. 3B7-72234-0
Removing reverse (C) gear bearing	Removing or attaching pinion (B) gear nut	Removing or attaching pinion (B) gear nut	Measuring backlash between forward (A) gear and pinion (B) gear
			
Shimming Gauge P/N. 3B7-72250-0	Backlash Measuring Tool Kit P/N. 3B7-72255-0	Needle Bearing Puller Kit P/N. 3B7-72700-0	Bevel Gear Bearing Install Tool P/N. 3B7-72719-0
Adjusting pinion (B) gear height	Measuring backlash between pinion (B) gear and reverse (C) gear	Removing or attaching gear case and propeller shaft housing needle bearing	Installing forward (A) gear bearing



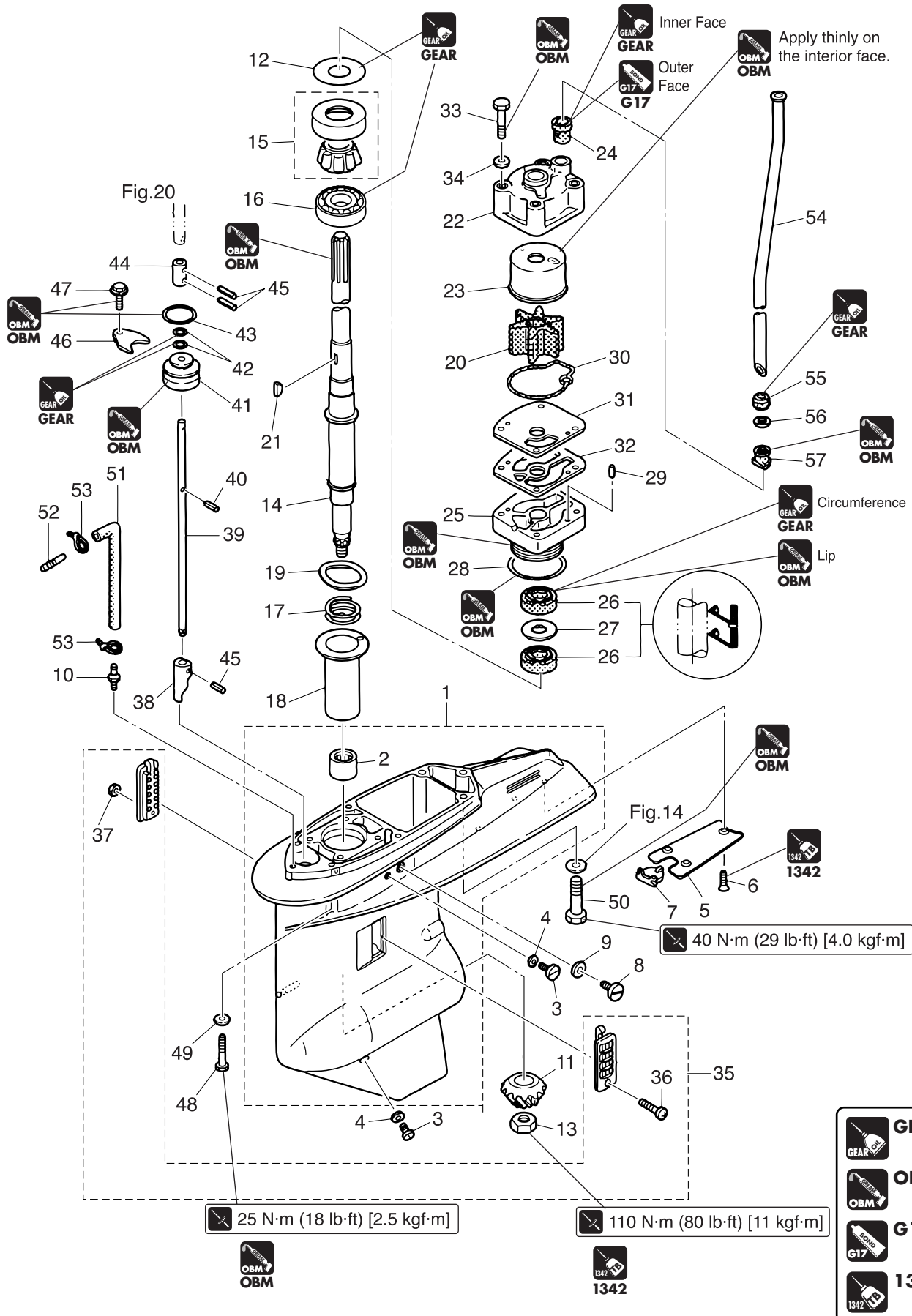
			
Backlash Measuring Tool Clamp P/N. 3B7-72720-0	Dial Gauge Plate P/N. 3B7-72729-0	Bearing Outer Press Kit P/N. 3B7-72739-0	Needle Bearing Press Kit P/N. 3C7-72900-1
Measuring backlash	Used to attach dial gauge when measuring backlash	Attaching forward (A) gear bearing outer race	Removing or attaching gear case needle bearing
ø 41.5 x ø21.5 	ø31.5 x ø25.0 	ø79.5 x ø39.5 	ø31.5 x ø25 x H32 
Oil Seal Attachment P/N. 3J6-99820-0	Needle Bearing Attachment P/N. 3T1-99710-0	Bearing install Tool P/N. 3T1-99900-0	Needle Bearing Attachment P/N. 3U1-99710-0
Attaching pump case (lower) oil seal	Used to press-fit forward (A) gear needle bearing	Attaching drive shaft bearing	Used in combination with driver rod and center plate Attaching propeller shaft housing needle bearing
ø79.5 x ø39.5 	ø49.5 x ø29.5 		
Bearing Attachment P/N. 3U1-99905-0	Oil Seal Attachment P/N. 3Y9-99820-0		
Attaching propeller shaft housing bearing	Used in combination with driver rod Attaching propeller shaft housing oil seal		



# Lower Unit

## 2. Parts Layout Gear Case (Drive Shaft)

P/L Fig. 15



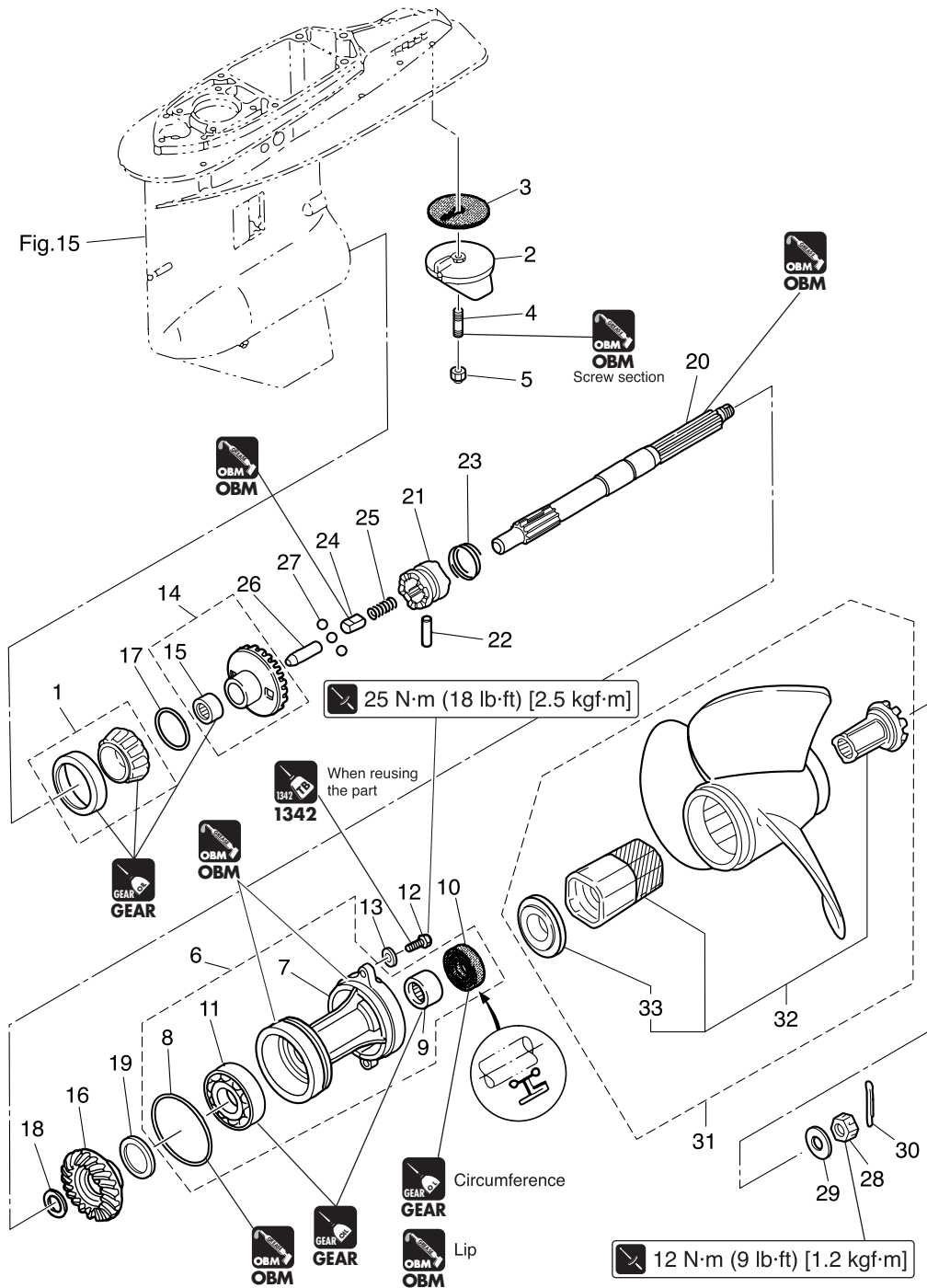
Ref. No.	Description	Q'ty	Remarks
1	Gear Case Ass'y	1	
2	Needle Bearing 28.6-38.1-3	1	Do not reuse.
3	Oil Plug Water Plug M8P1.25	2	
4	Gasket 8.1-15-1	2	Do not reuse.
5	Plate Gear Case	1	
6	Screw	3	M6 L=14mm
7	Hole Plug Gear Case	1	
8	Water Plug M10P1.25	1	
9	Gasket 10.1-15-1	1	Do not reuse.
10	Nipple 6-1/8	1	
11	Bevel Gear B	1	
12-1	Shim 52-60.5-0.3	A	} Selection if necessary
12-2	Shim 52-60.5-0.15	A	
12-3	Shim 52-60.5-0.1	A	
13	Nut Bevel Gear B M16-P1.5	1	
14-1	Drive Shaft L	1	for Transom "L"
14-2	Drive Shaft UL	1	for Transom "UL"
15	Tapered Roller Bearing 0506	1	Do not reuse.
16	Ball Bearing 16007	1	Do not reuse.
17	Spring Drive Shaft	1	
18	Guide Drive Shaft Spring	1	
19	Wave Washer d=47.2	1	
20	Impeller Water Pump	1	
21	Key Water Pump Impeller	1	
22	Water Pump Case	1	
23	Liner Water Pump Case	1	
24	Lower Seal Rubber Water Pipe	1	
25	Pump Case Lower	1	
26	Oil Seal 22-42-7	2	
27	Shim 35-41. 9-0.5	1	
28	O-Ring 3.1-54.4	1	Do not reuse.
29	Dowel Pin 4-10	2	
30	Seal Water Pump Case	1	Do not reuse.
31	Guide Plate Water Pump	1	
32	Gasket Pump Guide Plate	1	Do not reuse.
33	Bolt	4	M8 L=85mm
34	Washer	4	M8
35	Water Strainer Set	1	
36	Screw	1	M4 L=45mm
37	Nylon Nut	1	M4
38	Clutch Cam	1	
39-1	Cam Rod L	1	for Transom "L" ø7
39-2	Cam Rod UL	1	for Transom "UL" ø7
40	Spring Pin 3.5-10	1	Do not reuse. ø3.5 L=10mm
41	Bushing Cam Rod	1	
42	O-Ring 1.9-6.8	2	Do not reuse.
43	O-Ring 3.5-27.7	1	Do not reuse.
44	Joint Shift Rod	1	
45	Spring Pin 3.5-16	2	Do not reuse. ø3.5 L=10mm
46	Stopper Drive Shaft Housing	1	
47	Bolt	1	M6 L=12mm
48	Bolt M8-35	4	M8 L=35mm
49	Washer	4	M8
50-1	Bolt M10-40	3	M10 L=40mm Transom "L"
50-2	Bolt M10-40	2	M10 L=40mm Transom "UL"
51-1	Hose	1	for Transom "L" L=800mm
51-2	Hose	1	for Transom "UL" L=920mm
52	Nipple 6-6	1	
53	Band Lead Wire L=100	2	Do not reuse.
54-1	Water Pipe L	1	for transom "L"
54-2	Water Pipe UL	1	for transom "UL"
55	Upper Seal Rubber Water Pipe	1	
56	Collar 18-20-4.5	1	
57	Locking Rubber Water Pipe	1	



# Lower Unit

## Gear Case (Propeller Shaft)

P/L Fig. 16



Ref. No.	Description	Q'ty	Remarks
1	Tapered Roller Bearing 30209	1	Do not reuse.
2	Trim Tab	1	
3	Packing Trim Tab	1	Do not reuse.
4	Stud Bolt	1	M8 L=25mm
5	Nylon Nut	1	M8
6	Propeller Shaft Housing Ass'y	1	
7	Propeller Shaft Housing	1	
8	O-Ring 3.1-94.4	1	Do not reuse.
9	Needle Bearing 30-40-30	1	Do not reuse.
10	Oil Seal 30-50-12	1	Do not reuse.
11	Ball Bearing	1	Do not reuse.
12	Bolt 8-30 Pre-Coated	2	M8 L=30mm
13	Washer	2	M8
14	Bevel Gear Ass'y (A)	1	
15	Needle Bearing 25-32-26	1	Do not reuse.
16	Bevel Gear C	1	
17-1	Shim 47-57-0.15	A	} Selection if necessary
17-2	Shim 47-57-0.1	A	
18-1	Washer t=3.2	A	} Selection if necessary
18-2	Washer t=3.0	A	
18-3	Washer t=3.0	A	
19-1	Shim 42-50-0.15	A	} Selection if necessary
19-2	Shim 42-50-0.1	A	
20	Propeller Shaft	1	
21	Clutch	1	
22	Clutch Pin	1	Do not reuse.
23	Snap Clutch Pin	1	
24	Spring Holder Clutch	1	
25	Spring Clutch	1	
26	Push Rod Clutch	1	
27	Ball	3	
28	Nut Propeller M16P1.5	1	M16
29	Washer 17-32-3	1	
30	Split Pin	1	Do not reuse.
31-1	Propeller M-11 (3x14.0x11.0)	1	OPT
31-2	Propeller M-13 (3x14.0x13.0)	1	OPT
31-3	Propeller M-15 (3x13.75x15.0)	1	OPT
31-4	Propeller M-16 (3x13.25x16.0)	1	OPT
31-5	Propeller M-17 (3x13.25x17.0)	1	OPT
31-6	Propeller M-19 (3x13.0x19.0)	1	OPT
31-7	Propeller M-21 (3x12.75x21.0)	1	OPT
32	Propeller Hub Kit	1	
33	Forward Thrust Washer	1	



# Lower Unit

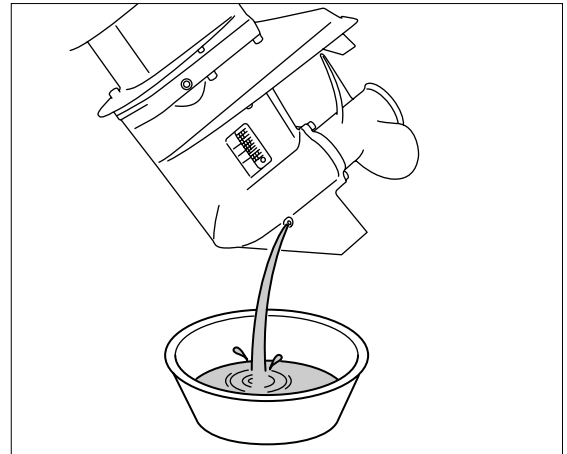
## 3. Inspection Items

### 1) Draining Gear Oil

1. Drain gear oil. Refer to “Replacement of Gear Oil” in Chapter 3.



- Drain all gear oil, and check if any metal particle is found in the drained oil.
- Check gear oil color. White or cream color possibly indicates that water is contained in the gear oil.
- Note the above matters and use them as a reference if disassemble is required.

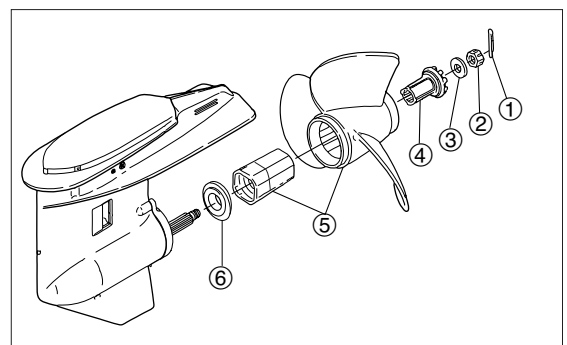
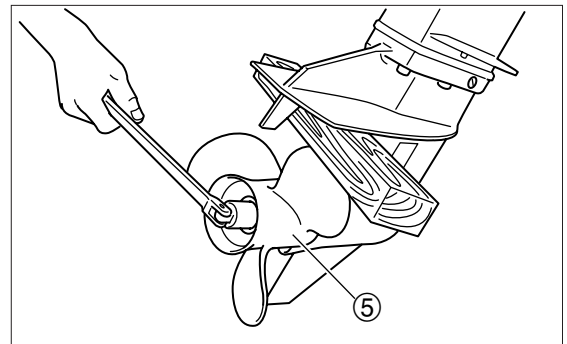


### 2) Removing Propeller

#### ⚠ WARNING

- Before removing or installing propeller, be sure to disconnect battery cables from battery and remove stop switch lock plate.
- When removing or installing propeller, do not handle propeller with bare hands.
- Put a piece of wooden block between anti-cavitation plate and propeller to prevent rotation of propeller when removing or installing propeller.

1. Shift gear into forward (F).
2. Put a piece wood between anti-cavitation plate and propeller ⑤ to prevent the propeller ⑤ from accidental rotation. Pull out split pin ①, loosen propeller nut ②, and then, propeller ⑤.



- ① Split Pin
- ② Propeller Nut
- ③ Washer
- ④ Propeller Hub Kit
- ⑤ Propeller and Drive Sleeve
- ⑥ Thrust Holder

### 3) Removing Lower Unit

#### **WARNING**

**When working with outboard motor in tilt up position, be sure to lock with tilt stopper.**



- Removal of lower unit does not require removal of power unit from outboard motor body.
- When removing lower unit from outboard motor, tilting the outboard motor makes the work easier.

1. Shift the gear into forward (F) to set shift rod to upper position.
2. Remove spring pin and disconnect shift rod.



- Disconnect shift rod at upper side of shift rod joint ①.
- Use spring pin tool A ② to remove spring pin.
- Do not reuse removed spring pin.
- To hold lower unit, keep spring pin tool inserted until the step of removal of lower unit.



**Spring Pin Tool A ② (ø3.5) :**  
P/N. 369-72217-0

3. Remove lower unit installation bolts, and pull lower unit ass'y downward to remove.

#### **CAUTION**

**Hold lower unit while removing it to prevent it dropping on the floor.**



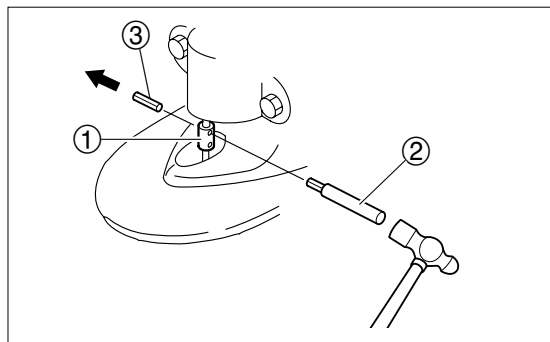
- Loosen all lower unit securing bolts except B (2 pcs.) in diagonal order, remove bolts B, and then, remove all other bolts.
- Disconnect speedometer pipe ④ from the nipple before separating lower unit from the drive shaft housing.

### 4) Disassembly of Cam Rod

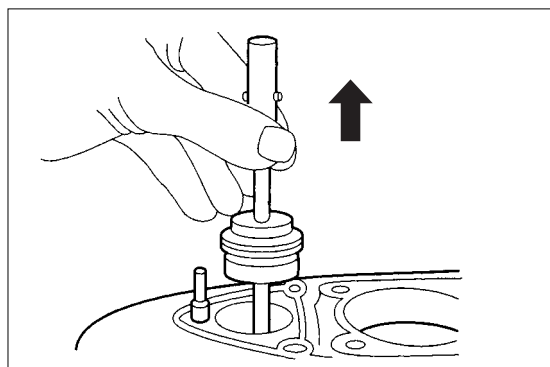
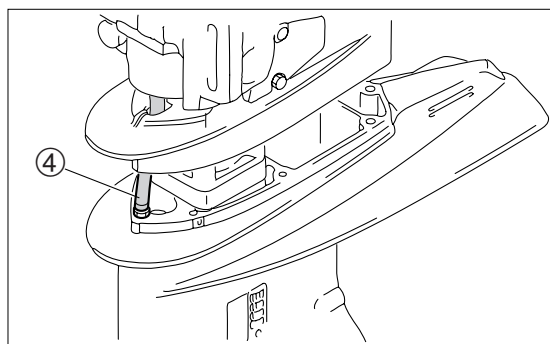
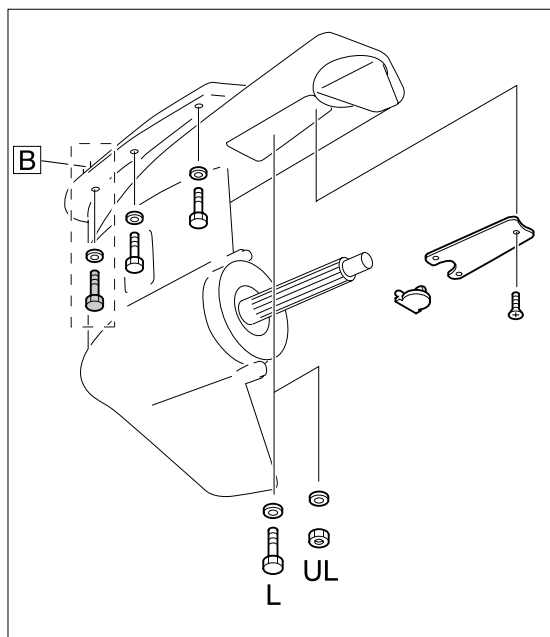
1. Remove stopper, pull out cam rod bushing, and take out cam rod from gear case.



- When removing cam rod bushing, put a bladed screw driver into groove of the bushing and pull out while lifting it.



③ Spring Pin **Do not reuse.**



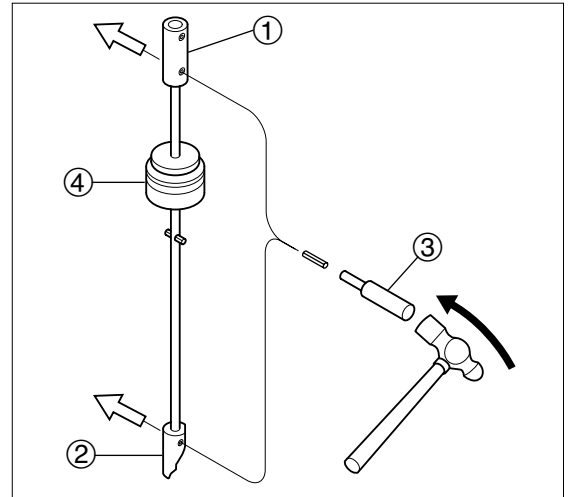


# Lower Unit

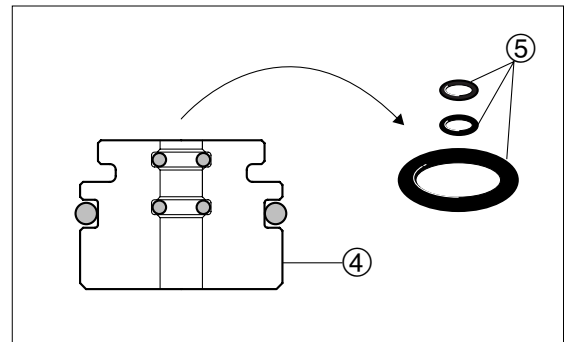
- Remove shift rod joint ① and clutch cam ②.



**Spring Pin Tool A ③ (ø3.5):**  
P/N. 369-72217-0



- Remove O ring ⑤ from cam rod bushing ④.



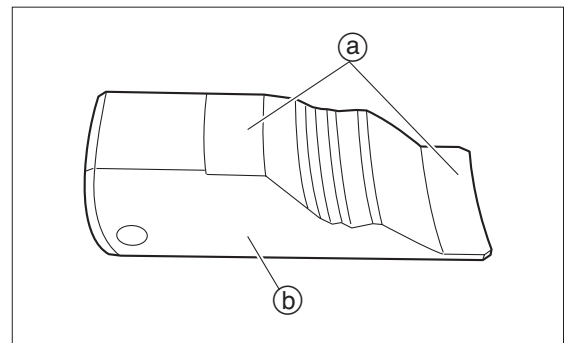
⑤ O Ring **Do not reuse.**

## 5) Inspection of Clutch Cam

- Check the part for wear and damage.  
Replace if necessary.



Check especially for wear on the face ① that scrapes against push rod and flaws on the circumference ②.



## 6) Assembly of Clutch Cam Parts

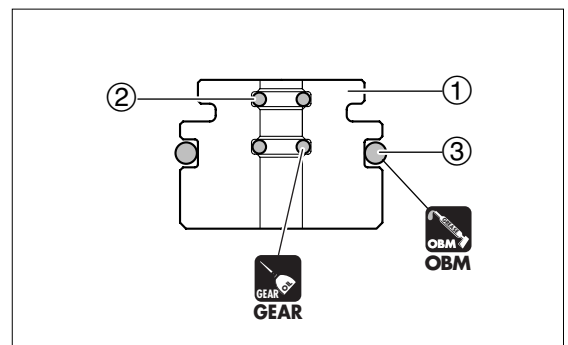
- Attach O rings 1.9-6.8 ② and O ring 3.5-27.7 ③ to cam rod bushing ①.



**OBM**



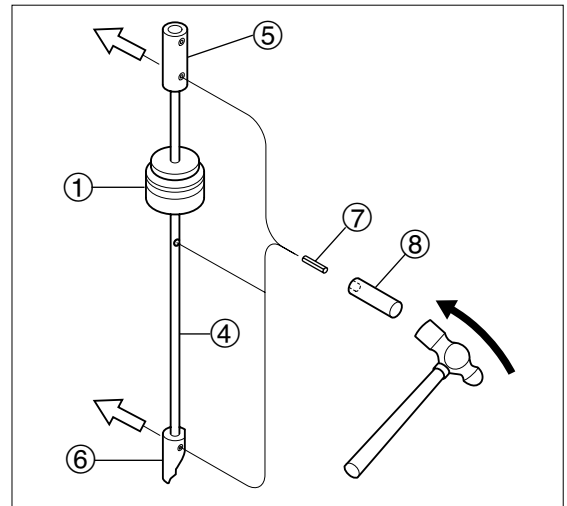
**GEAR**



②③ O Rings **Do not reuse.**



- Attach cam rod bushing ①, shift rod joint ⑤ and clutch cam ⑥ to cam rod ④.



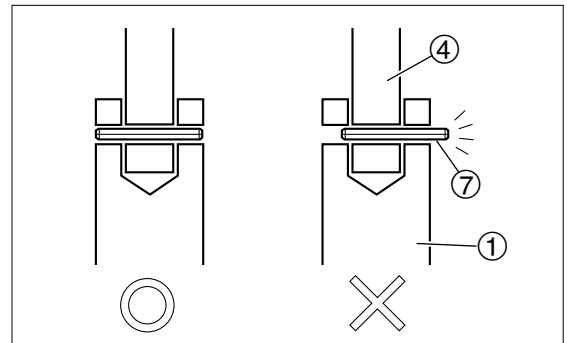
⑦ Spring Pin **Do not reuse.**

- Drive spring pin ⑦.

**⚠ CAUTION**

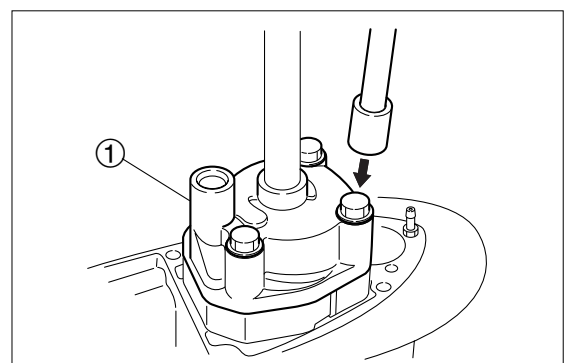
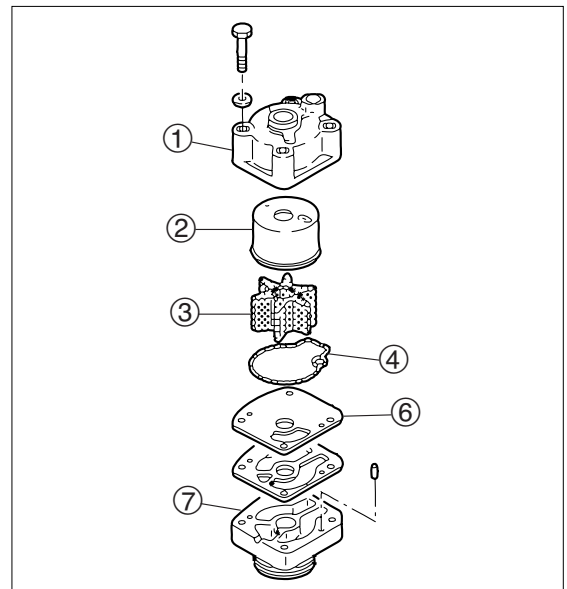
**Drive spring pin ⑦ so that it is flush with clutch cam surface as shown.**

**Spring Pin Tool B ⑧ (ø3.5) :**  
P/N. 369-72218-0



## 7) Removing Water Pump

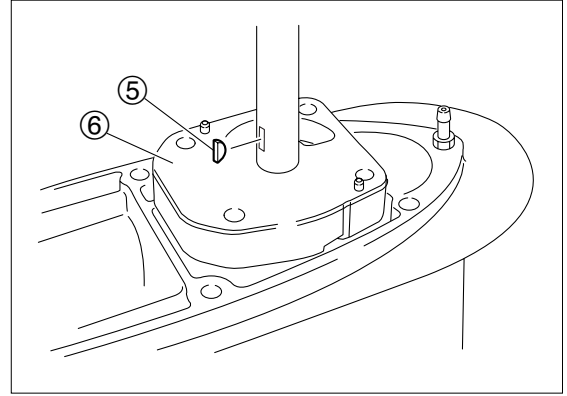
- Loosen and remove pump case (upper) bolts, and remove pump case (upper) parts ①, ②, ③ and ④ in this order.





## Lower Unit

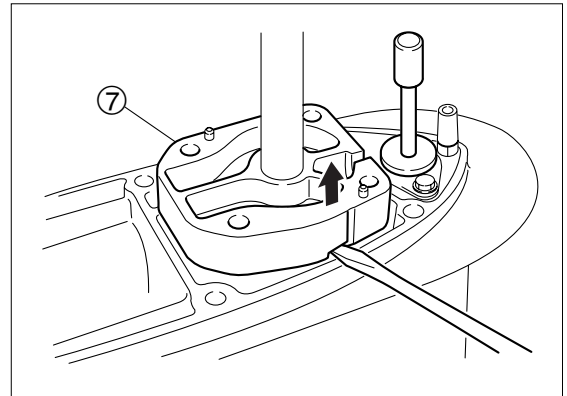
2. Remove water pump impeller key ⑤.



3. Remove guide plate ⑥ and pump case (lower) ⑦.



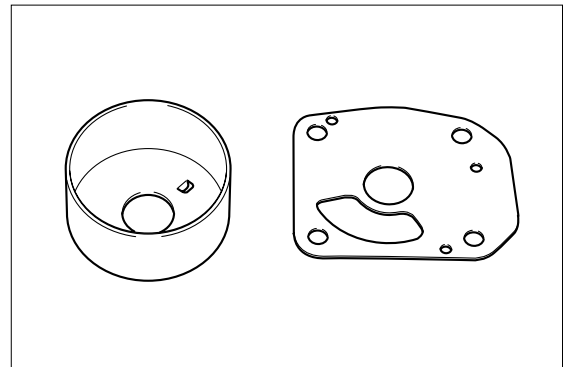
When removing pump case (lower), insert bladed screw driver into the groove of the case, and pry slowly to separate the part.



### 8) Inspection of Water Pump

1. Check pump case liner and guide plate for deformation and wear.

Replace if necessary.

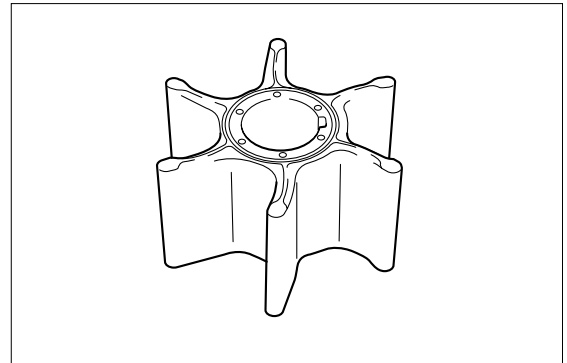


2. Check pump impeller for crack, damage and wear.

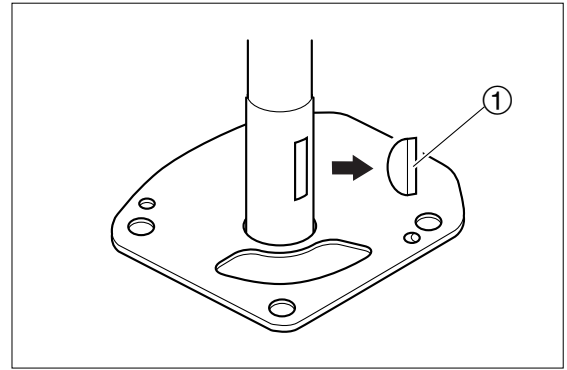
Replace if necessary.



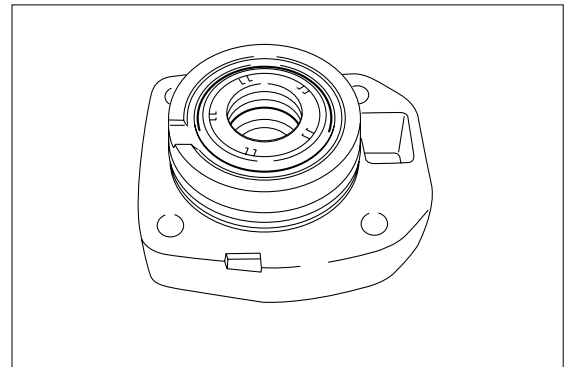
- The impeller may show gloss or have melted area if it is rotated with insufficient water.
- Even if impeller shows no abnormality on its surface, the blade(s) may be separated from the hub.
- Replace guide plate if a groove(s) of 0.5 mm or over is produced on it due to wear by impeller.



3. Check impeller key ① and key groove for wear.  
Replace if necessary.



4. Check oil seal for wear and crack on the lip area.  
Replace if necessary.

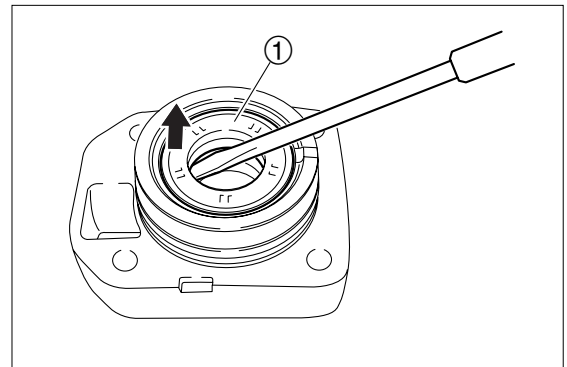


## 9) Disassembly of Water Pump Case (Lower)

1. Use bladed screw driver or seal remover to remove oil seal ①.



- Two oil seals are used. Note that there is a shim in between oil seals.
- Be careful not to give flaw to oil seal press fit face.





# Lower Unit

## 10) Assembly of Water Pump Case (Lower)

1. Install oil seal ① and shim ② by using oil seal attachment ③ and driver rod ④ and then press-fit.



- Apply gear oil to oil seal circumference before installing oil seal.
- Apply OBM grease to oil seal lip.



**Oil Seal Attachment ③ :**

P/N. 3J6-99820-0

**Driver Rod ④ :**

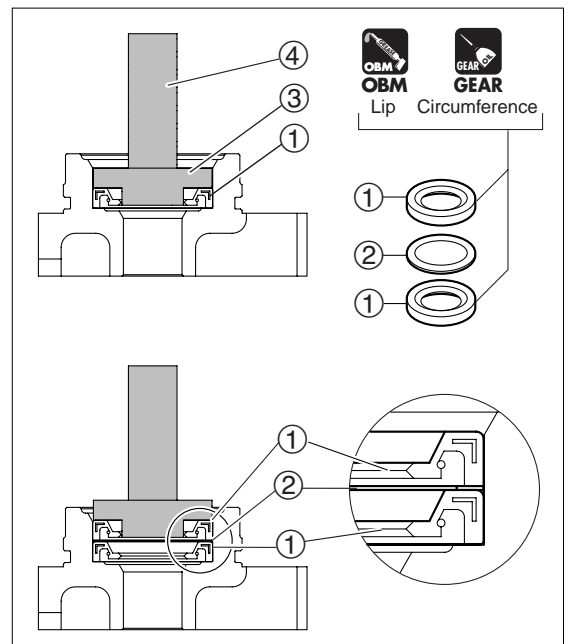
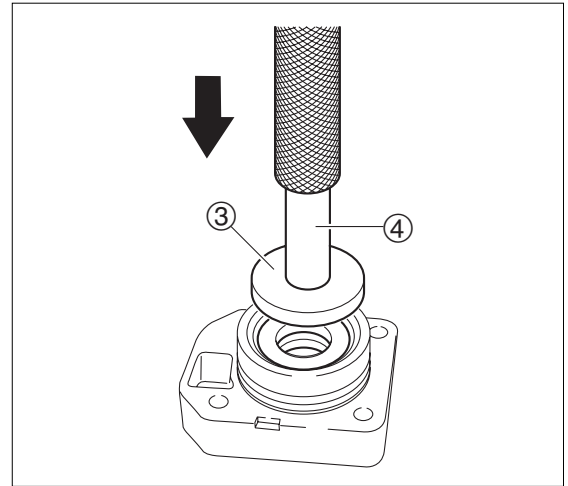
P/N. 3AC-99702-0



**OBM**

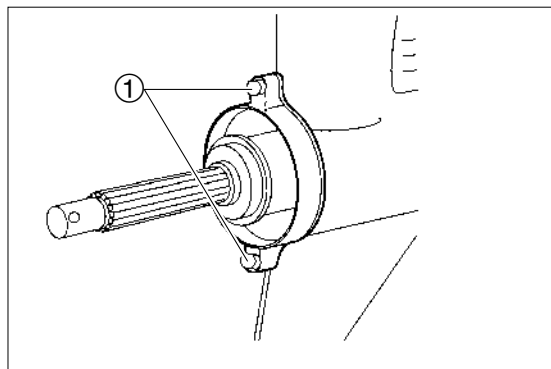


**GEAR**



## 11) Removing Propeller Shaft Housing Ass'y

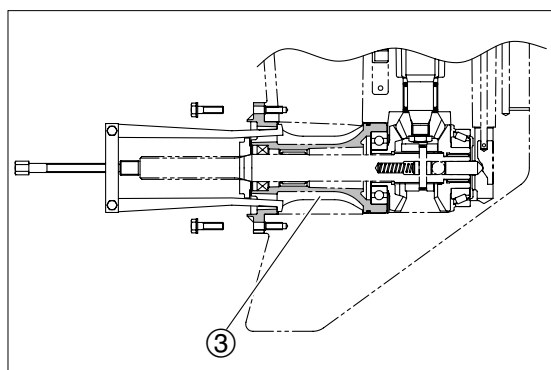
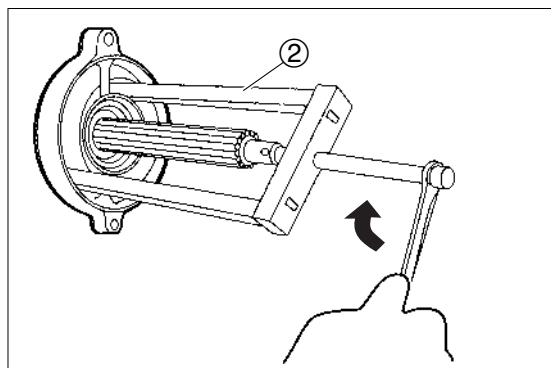
1. Loosen and remove bolts ①.



2. Use propeller shaft housing puller to pull out propeller shaft housing to the position where O ring of the housing can be removed.



**Propeller Shaft Housing Puller Ass'y ② :**  
P/N. 353-72252-0

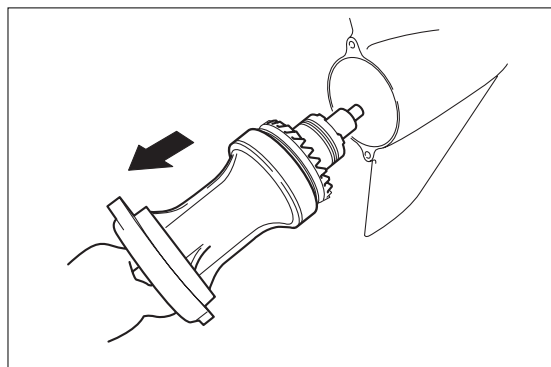


③ Propeller Shaft Housing Ass'y

3. Hold propeller shaft and remove propeller shaft housing ass'y.



When pulling out propeller shaft housing ass'y, remove clutch push rod and steel balls together with the housing ass'y.



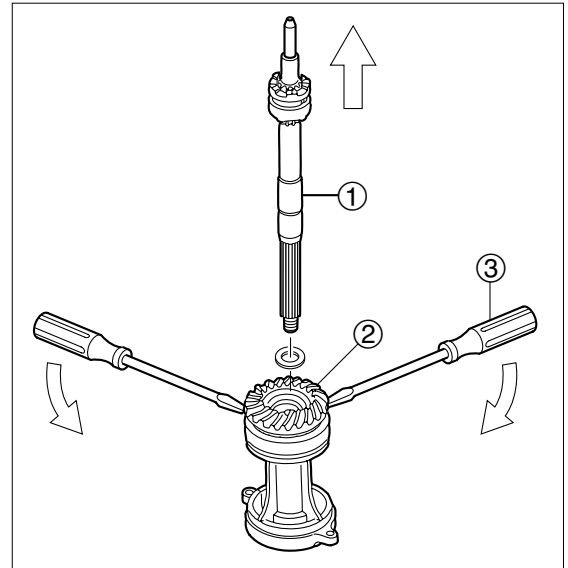


# Lower Unit

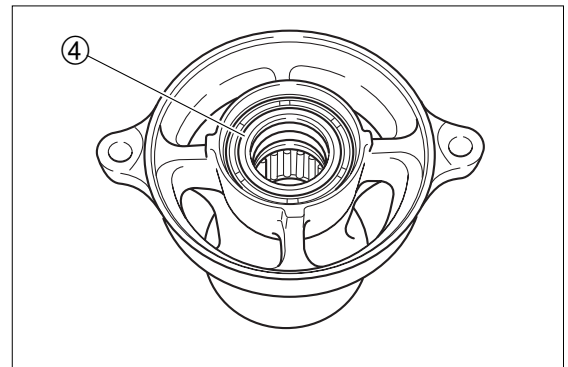
## 12) Disassembly of Propeller Shaft

### Housing Ass'y

1. Pull out propeller shaft ass'y ①.
2. Remove reverse (C) gear by using bladed screw drivers ③.



3. Check oil seal ④ for wear and crack.  
Replace if necessary.



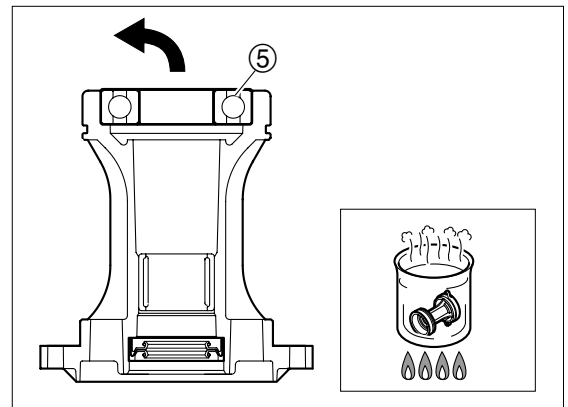
4. Remove bearing ⑤.

**CAUTION**  
Heat propeller shaft housing by putting it in the hot water of approximately 60 - 70°C (140 - 158°F), and remove bearing ④.

**CAUTION**  
Be careful not to burn.



Heating of propeller shaft housing can also be made by using a heat gun or heat lamp.



⑤ Bearing **Do not reuse.**

5. Use a press to remove oil seal ④ and needle bearing ⑥ at the same time.



- Before removing, check bearing for play or deflection. Replace if necessary.
- Direct the side of attachment without O-ring to needle bearing.



#### Needle Bearing Attachment ⑦ :

P/N. 3T1-99710-0

#### Driver Rod ⑧ :

P/N. 3AC-99702-0

#### Center Plate ⑨ :

P/N. 3AC-99701-0

This work can be done also by using the following tool kit.



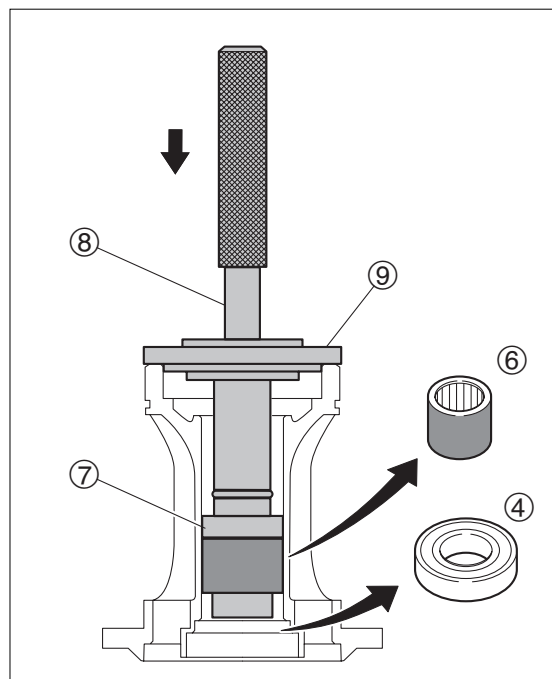
#### Needle Bearing Puller Kit :

P/N. 3B7-72700-0

6. When removing only oil seal, use bladed screw driver to pry apart.



Be careful not to give flaw to propeller shaft housing when removing oil seal.



⑤ Oil Seal

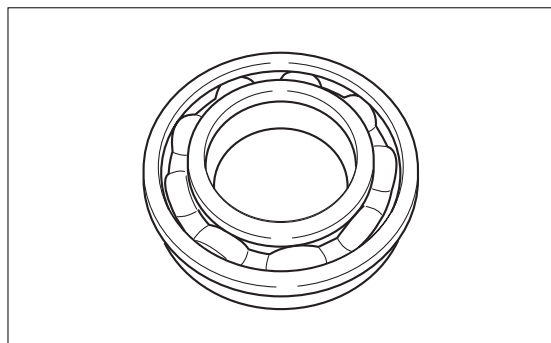
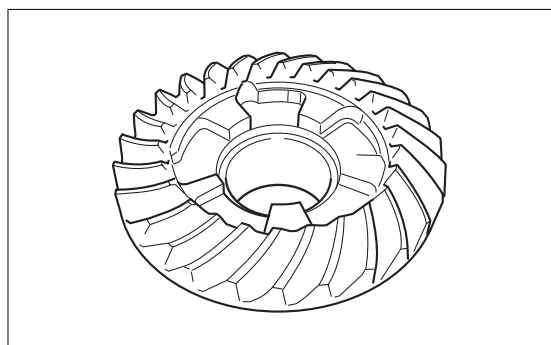
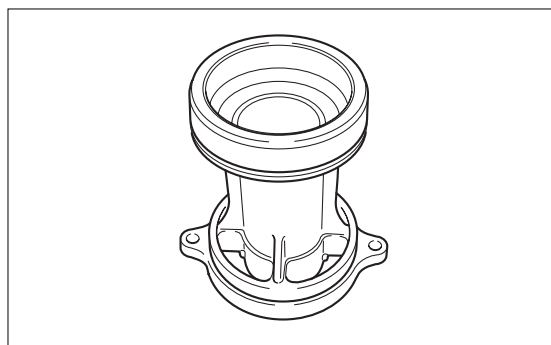
⑥ Needle Bearing

Do not reuse.

Do not reuse.

## 13) Inspection of Propeller Shaft Housing

1. Clean the part by using a solvent and then check.  
Replace if necessary.
2. Check reverse (C) gear for crack or abnormal wear of the teeth and dog.  
Replace if necessary.
3. Check bearing for abnormality.  
Replace if necessary.





# Lower Unit

## 14) Assembly of Propeller Shaft Housing

### ⚠ CAUTION

**When gear case, propeller shaft, bearing, housing or reverse (C) gear is replaced, measure the backlash and perform shim adjustment.**

1. Use a press to push new needle bearing ④ into propeller shaft bearing to specified depth.



- Install needle bearing with the manufacturer's mark (a) facing the tool side.
- Screw in needle bearing attachment ② lightly by a hand so that no gap is made at driver rod ①.
- Clean needle bearing installation face and apply gear oil before installation.



#### Driver Rod ① :

P/N. 3AC-99702-0

#### Needle Bearing Attachment ② :

P/N. 3U1-99710-0

#### Center Plate ③ :

P/N. 3AC-99701-0



#### Depth of Installation (b) :

87.25 - 87.75 mm (3.435 - 3.455 in)



#### GEAR

This work can be done also by using the following tool kit.



#### Needle Bearing Puller Kit :

P/N. 3B7-72700-0

2. Install oil seal ⑤.

Use a press to install new oil seal to propeller shaft housing.



- Install oil seal with the marking facing tool side.
- Clean oil seal installation face and apply gear oil before installation.
- Apply grease to lip of oil seal after installing it.



#### Driver Rod ① :

P/N. 3AC-99702-0

#### Oil Seal Attachment ⑥ :

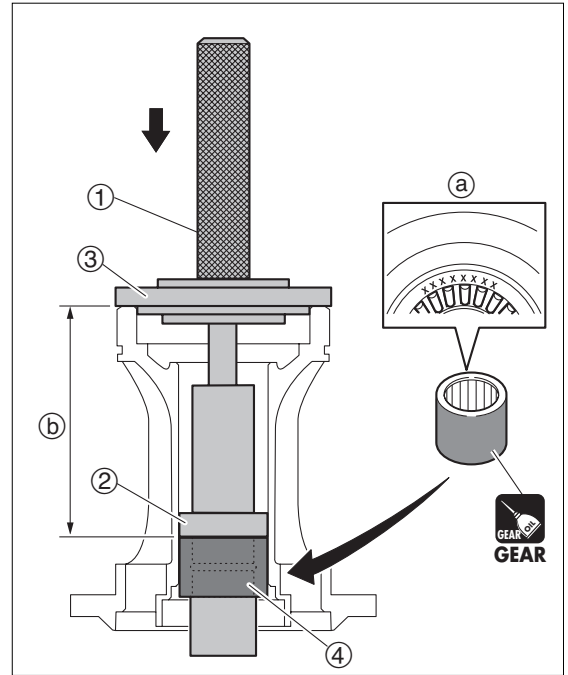
P/N. 3Y9-99820-0



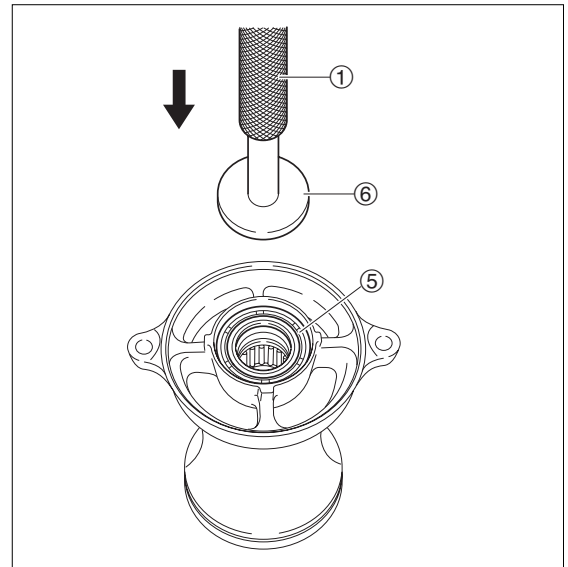
#### OBM



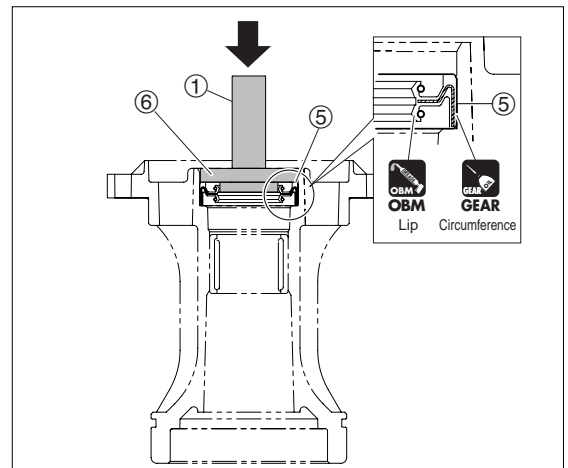
#### GEAR



④ Needle Bearing **Do not reuse.**



⑤ Needle Bearing **Do not reuse.**



⑤ Oil Seal **Do not reuse.**



3. Install bearing ⑦.

Use a press to install new bearing to propeller shaft housing.



Clean bearing installation face and apply gear oil before installation.



**Bearing Attachment ⑧ :**

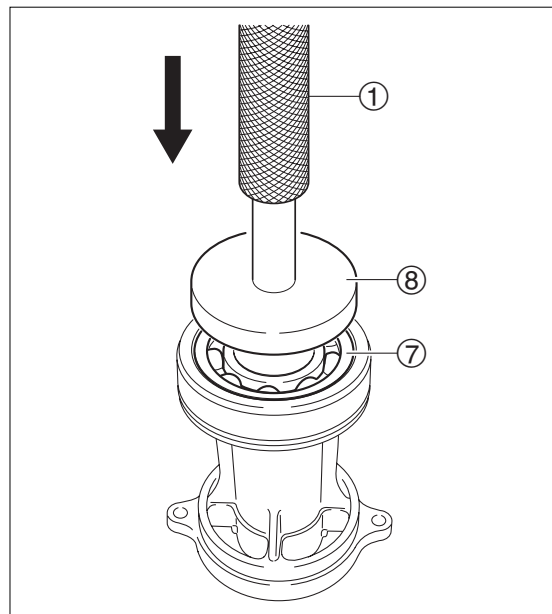
P/N. 3U1-99905-0

**Driver Rod ① :**

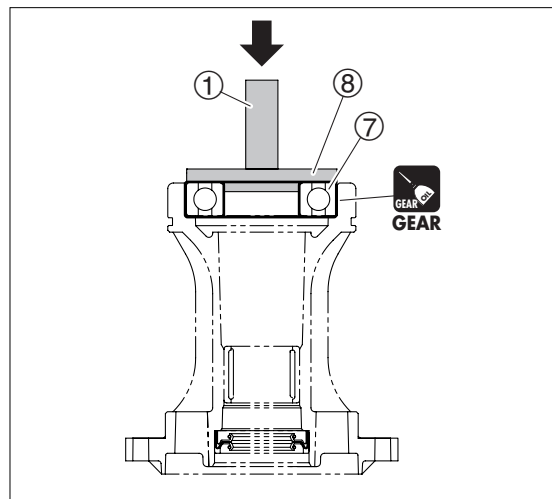
P/N. 3AC-99702-0



**GEAR**



⑦ Bearing **Do not reuse.**



⑦ Bearing **Do not reuse.**

4. Attach shim ⑩ used on the reverse (C) gear ⑨ to the gear.

Use press to install reverse (C) gear ⑨.



Clean reverse (C) gear bearing installation face and apply gear oil before installation.

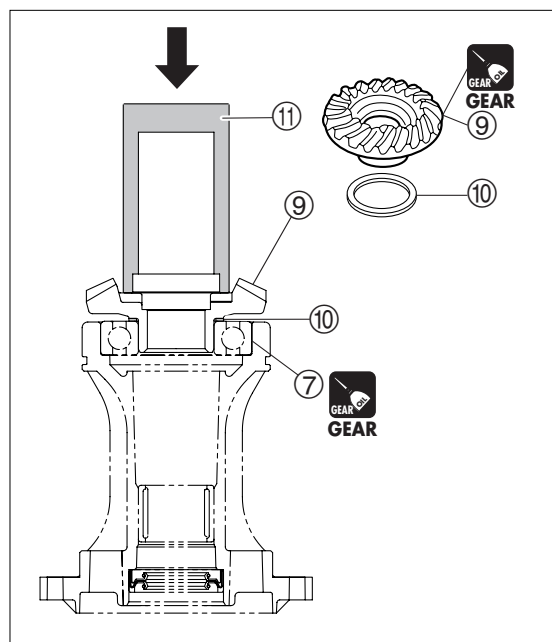


**Bevel Gear Bearing Install Tool ⑪ :**

P/N. 3B7-72719-0



**GEAR**



⑦ Bearing **Do not reuse.**

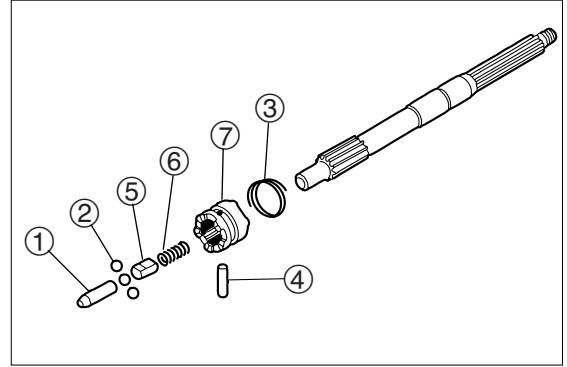


# Lower Unit

## 15) Disassembly of Propeller Shaft

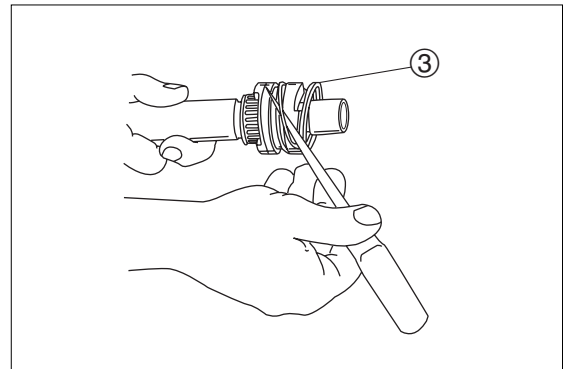
### Ass'y

1. Remove push rod ① and steel balls ② (3 pcs.).



③ Clutch Pin Snap **Do not reuse.**

2. Put a bladed screw driver into one of clutch pin snap ③ end, and take the snap out from the clutch groove while winding it.

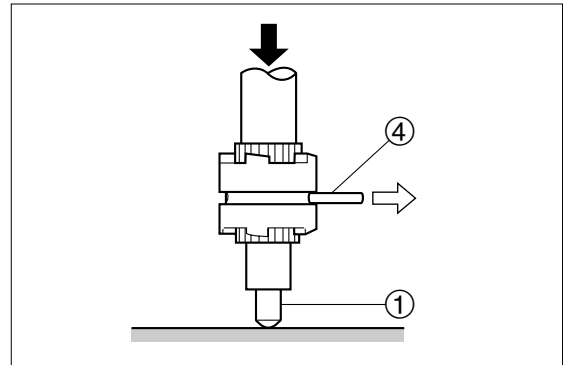


③ Clutch Pin Snap **Do not reuse.**

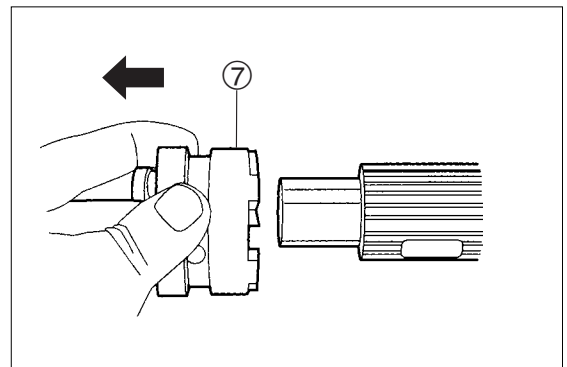
3. Pull out clutch pin ④, and remove clutch spring retainer ⑤, clutch spring ⑥, and clutch by referring to the figure.

**⚠ WARNING**

- **When removing clutch pin, wear protective glasses, and do not point opening of propeller shaft to your face or body while holding the propeller shaft. Clutch pin or spring holder may fly out very quickly.**
- **Install push rod ①, and pull out pin ④ while pushing propeller shaft onto a plane to prevent retainer ⑤ and spring ⑥ from flying out.**



4. After taking out clutch spring retainer ⑤ and clutch spring ⑥, remove clutch ⑦ from propeller shaft.



## 16) Inspection of Propeller Shaft Ass'y

1. Check propeller shaft for bend, wear and damage.  
Replace if necessary.

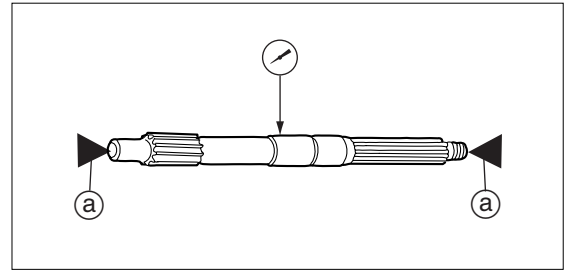
2. Measure propeller shaft runout.



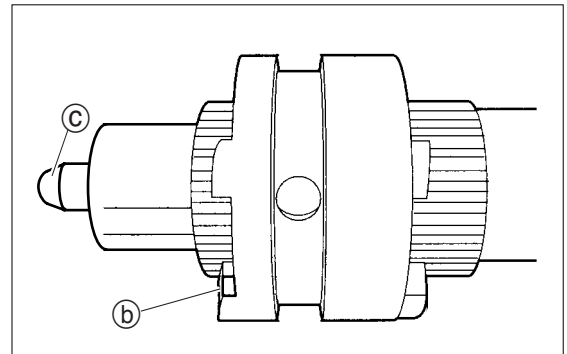
**Runout Limit :**

0.05 mm (0.0020 in)

3. Check clutch dog (b) and push rod (c) for crack and wear.  
Replace if necessary.



(a) Supporting Points



## 17) Assembly of Propeller Shaft Ass'y

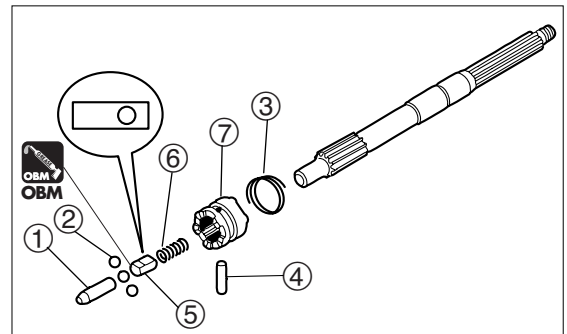
1. Attach spring (6), spring retainer (5), steel balls (2) (3 pcs.), push rod (1), clutch (7) and clutch pin (4) to propeller shaft.



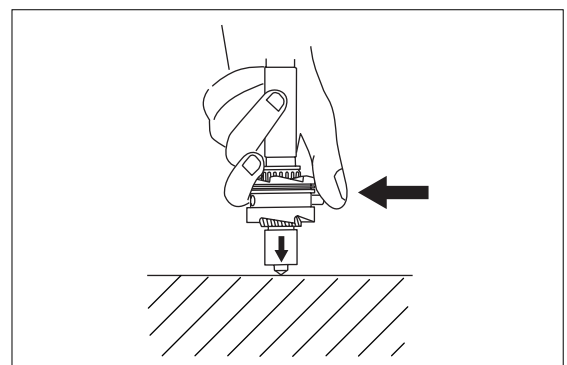
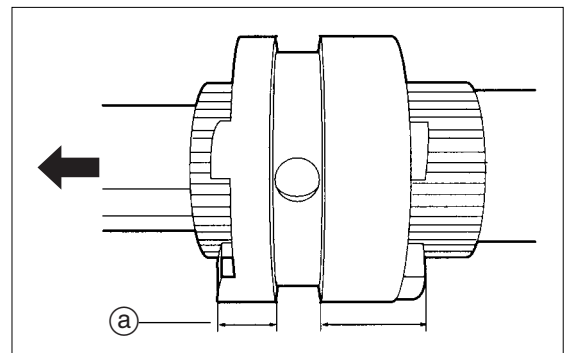
- When attaching clutch, face the narrower claw (a) to push rod side.
- When installing spring retainer, direct the end farther away from the hole toward forward gear (a).
- Install clutch pin while applying preload to push rod.
- Apply OBM grease to spring retainer to prevent ball from dropping.
- Be careful not to allow ball to fly out by spring tension.



**OBM**



③ Clutch Pin Snap **Do not reuse.**





## Lower Unit

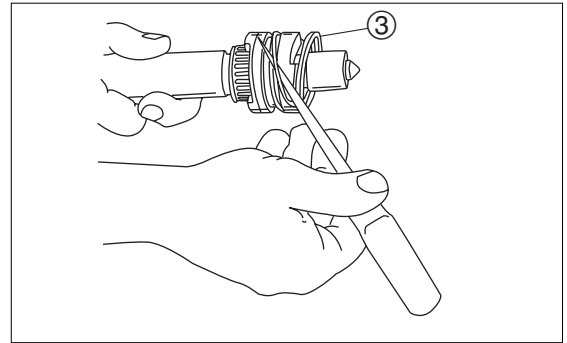
2. Attach new clutch pin snap ③ by using a bladed screw driver to turn the snap.

### ⚠ CAUTION

**Do not reuse removed clutch pin snap.**



When attaching clutch pin snap, do not apply excessive force to the part, or the snap may expand during operation of the engine, resulting in damaging gear and/or other parts severely.



③ Clutch Pin Snap **Do not reuse.**

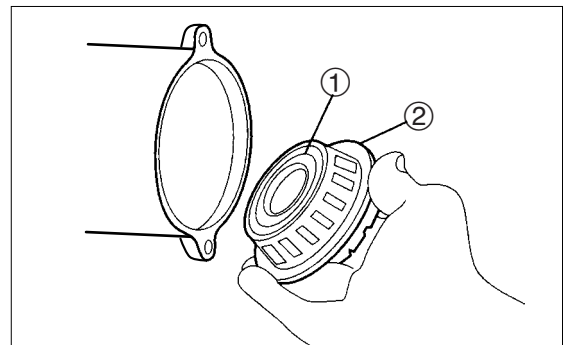
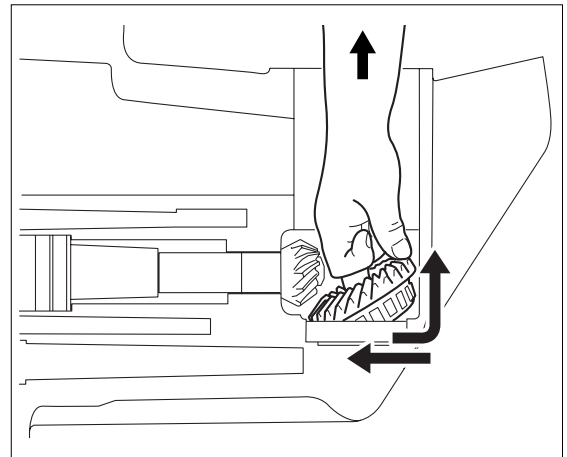
3. After assembling, check that clutch can be operated smoothly, taking care not to allow push rod to drop out.

## 18) Removing Forward (A) Gear Ass'y

1. Take out bearing ① and forward (A) gear ② by using a hand put in the gear case.



- Put mid finger into forward (A) gear hole and take it between the finger and the first finger (thumb), and lift the thumb side of the gear to remove it.
- Take forward (A) gear out taking care not to hit pinion (B) gear.



## 19) Disassembly of Forward Gear (A)

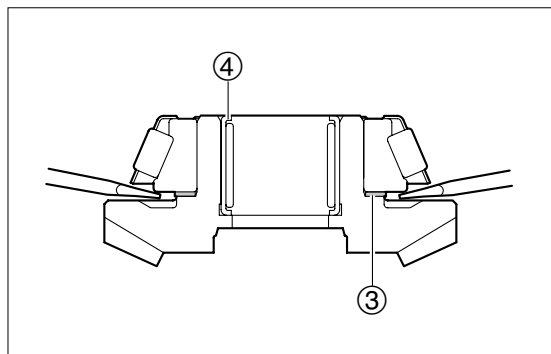
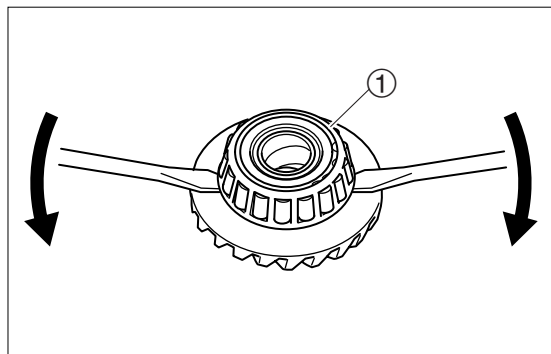
### Gear

1. Remove taper roller bearing ①.  
Use two bladed screw drivers to remove taper roller bearing from forward gear (A) gear.  
Put the drivers into grooves of forward (A) gear, and pry out taking care not to damage the shim.



#### CAUTION

Be careful not to damage shim ③.

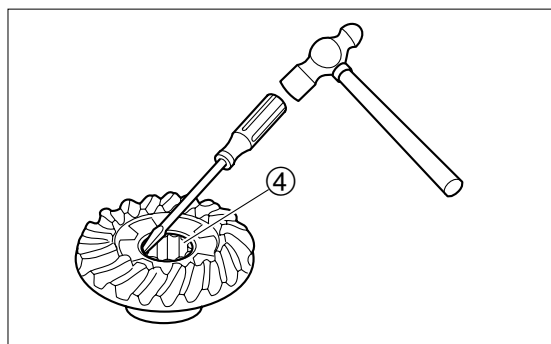


2. Remove needle bearing ④.  
Drive out needle bearing from the gear by using a bladed screw driver or a punch and a hammer at teeth side of the gear.



#### CAUTION

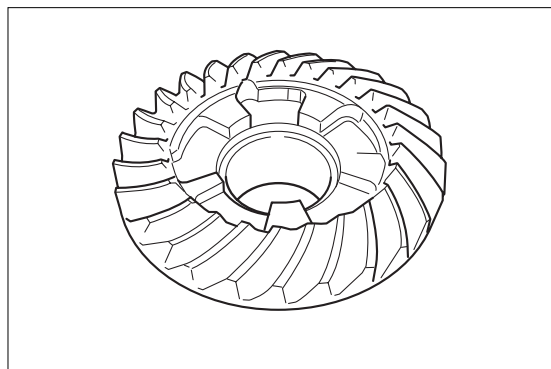
- When removing needle bearing, take care not to scratch forward (A) gear bearing face.
- Do not reuse removed needle bearing.



④ Needle Bearing **Do not reuse.**

## 20) Inspection of Forward (A) Gear

1. Check forward (A) gear teeth and clutch claws for crack, damage and wear.  
Replace if necessary.





# Lower Unit

## 21) Assembly of Forward (A) Gear Parts

### ⚠ CAUTION

**When gear case, forward (A) gear or bearing is replaced, measure backlash and attach a proper shim.**

**Refer to “Chapter 6 Shim Adjustment”.**

1. Install needle bearing ①.  
Apply gear oil to press-fit face when press-fitting needle bearing.

### ⚠ CAUTION

**When press-fitting needle bearing, face the marking side to tool side.**



Apply gear oil to press-fit face when press-fitting needle bearing.



**Needle Bearing Attachment ② :**

P/N. 3T1-99710-0

**Driver Rod ③ :**

P/N. 3AC-99702-0



**GEAR**

2. Attach shim ⑤ used before disassembly to taper roller bearing ②, and press-fit the part.



Apply gear oil to press-fit face when press-fitting taper roller bearing.

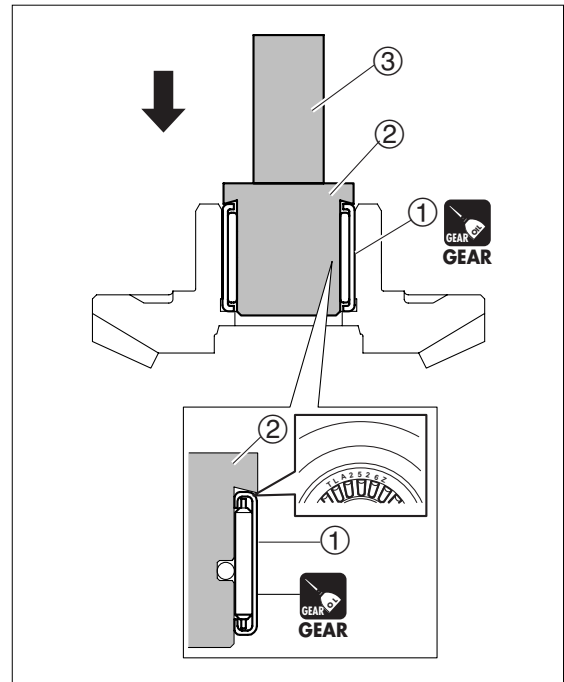


**Bevel Gear Bearing Install Tool ④ :**

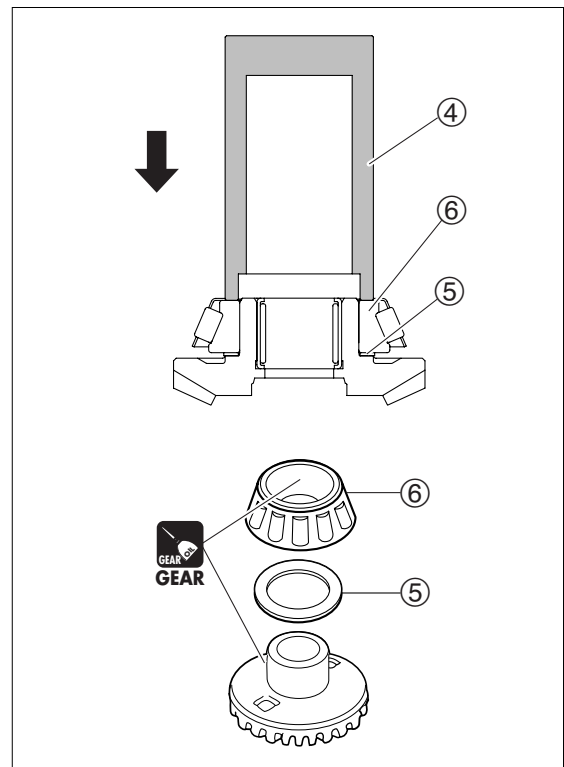
P/N. 3B7-72719-0



**GEAR**



① Needle Bearing **Do not reuse.**



## 22) Removing Drive Shaft Ass'y

1. Remove pinion (B) gear nut ④, and then, remove pinion (B) gear ③ and drive shaft.



- Degrease pinion (B) gear nut completely so that the nut wrench does not slip on the nut.
- Loosen and remove the nut by using a drive shaft socket and a wrench and turning the wrench counterclockwise. Cover the wrench ② with rag to prevent it from hitting the case directly.
- This work can be made easier when the opening of gear case of propeller shaft side is faced upward and fixed horizontally with a holder.

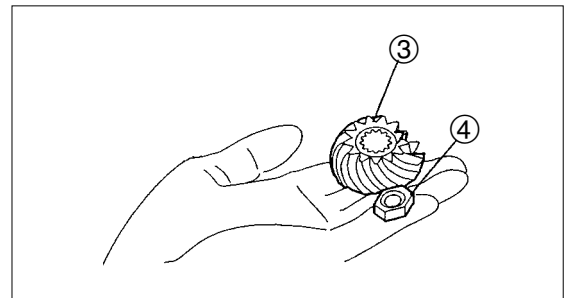
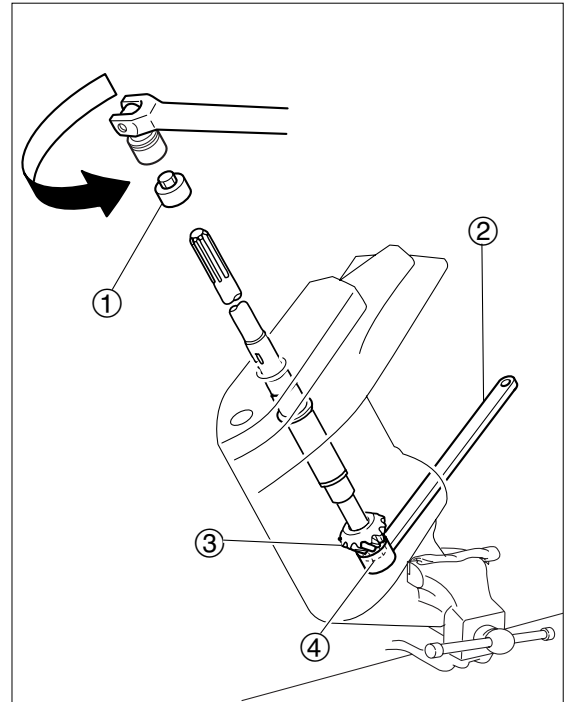


**Drive Shaft Socket ① :**

P/N. 3B7-72232-0

**Bevel Gear B Nut Wrench ② :**

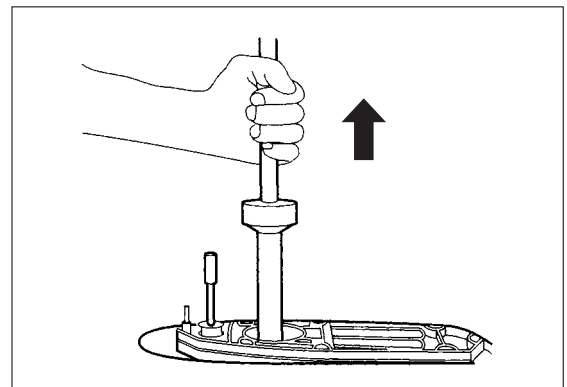
P/N. 3B7-72231-0



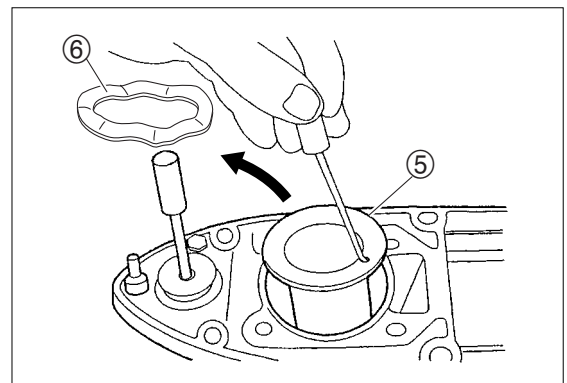
2. Pull out drive shaft from gear case.



- When removing drive shaft, be careful not to give damage to shim on the bearing outer race and not to lose the part.
- Replace shim with new one of the same thickness if any deformation or damage is found on it.



3. Remove wave washer ⑥ and drive shaft spring guide ⑤.





# Lower Unit

## 23) Disassembly of Drive Shaft Ass'y

1. Remove outer race ① and shim ②.
2. Remove drive shaft spring ③.
3. Remove taper roller bearings ④ and ⑤ by using press and universal puller ⑥.

### ⚠ CAUTION

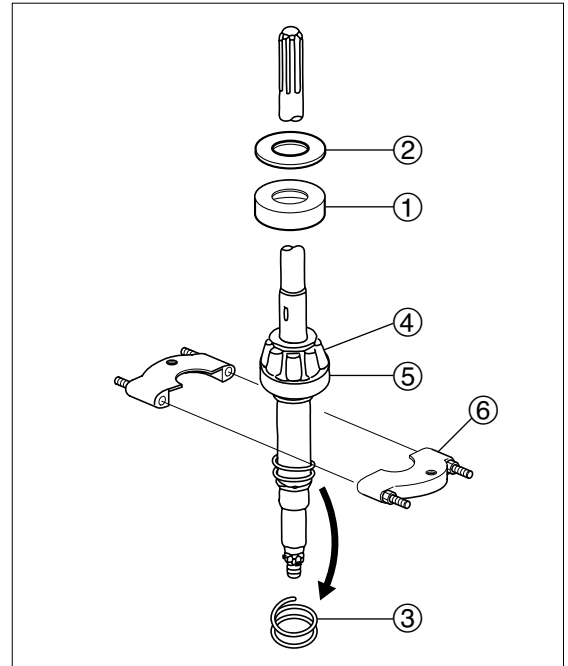
**Do not reuse removed bearing.  
Be sure to replace with new one.**



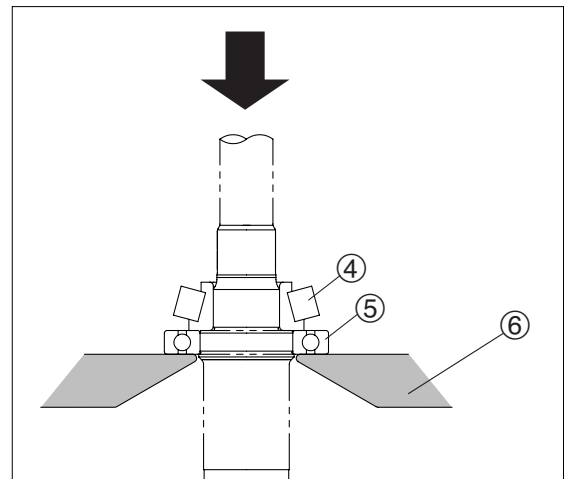
- Check bearing for play or deflection before removing, and replace if necessary.
- When putting universal puller plate on the bearing, hook the tip of puller's claw on the inner race of bearing correctly.



**Universal Puller Plate ⑥ :**  
P/N. 3AC-99750-0



④⑤ Bearings **Do not reuse.**



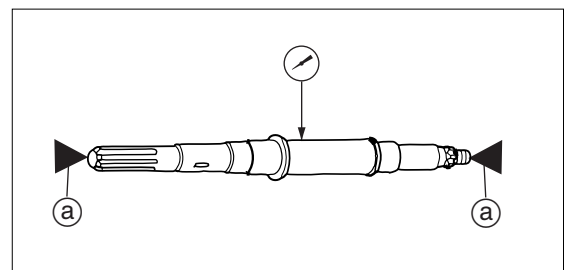
④⑤ Bearings **Do not reuse.**

## 24) Inspection of Drive Shaft

1. Check drive shaft for bend and wear.  
Replace if necessary.
2. Measure drive shaft runout.



**Runout Limit :**  
0.3 mm (0.012 in)

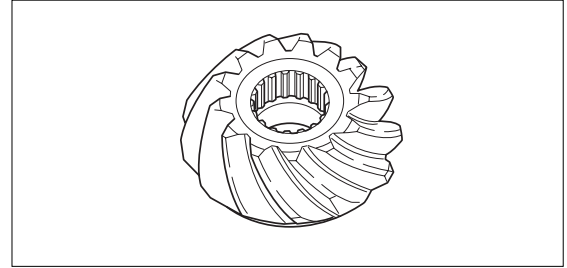


① Supporting Points



## 25) Inspection of Forward (A) Gear and Pinion (B) Gear

1. Check gear teeth and dog for crack, wear and damage.  
Replace if necessary.



## 26) Assembly of Drive Shaft Parts

1. Attach pinion (B) gear nut ① to drive shaft temporarily.
2. Install bearing ① by using press.  
Before installing bearing, be sure to clean drive shaft installation face and apply gear oil.

### ⚠ CAUTION

**Do not press drive shaft thread ① directly.**  
**Put ① piece of protector (steel plate) on the tip of the shaft.**



A nut that fits the thread can be used to protect the shaft tip when pressing.



**Bearing Install Tool ② :**  
P/N. 3T1-99900-0



**GEAR**

3. Install taper roller bearing ③ by using press.  
Before installing taper roller bearing, be sure to clean drive shaft installation face and apply gear oil.

### ⚠ CAUTION

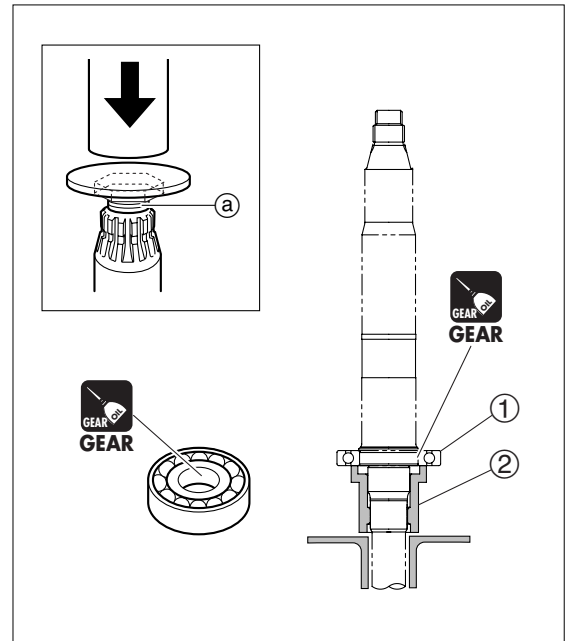
**Do not press drive shaft thread ① directly.**  
**Put ① piece of protector (steel plate) on the tip of the shaft.**



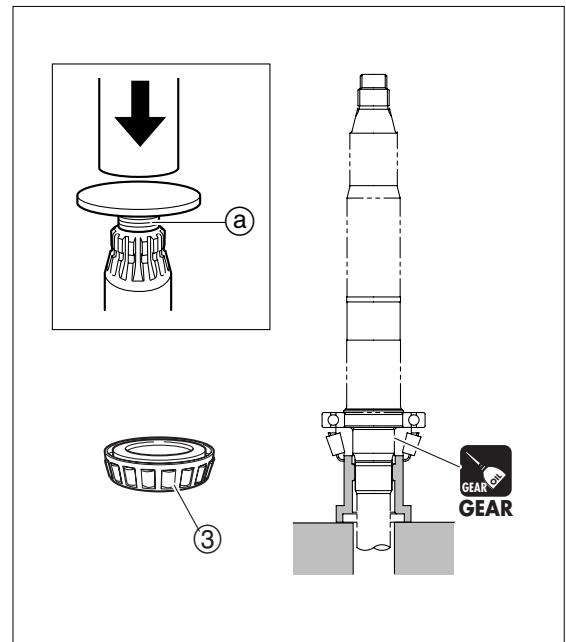
**Bearing Install Tool ② :**  
P/N. 3T1-99900-0



**GEAR**



① Bearing **Do not reuse.**



③ Taper Roller Bearing **Do not reuse.**



# Lower Unit

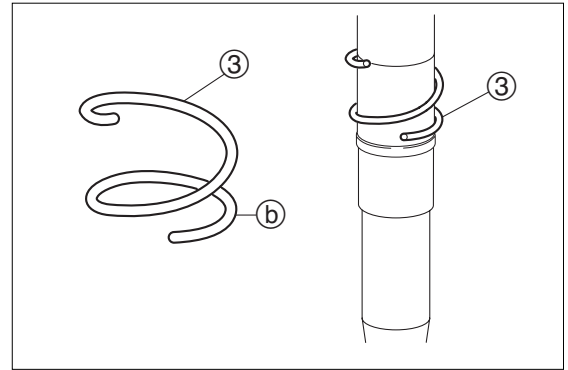
4. Attach drive shaft spring ③.

## ⚠ CAUTION

**When attaching the spring, face the side ⑥ toward pinion (B) gear side.**



Attach spring as illustrated.



## 27) Disassembly of Gear Case

1. Remove needle bearing ① by using the following tools.



### Needle Bearing Press Kit :

P/N. 3C7-72900-1

### Bearing Outer Press Guide ② :

P/N. 3Y9-72905-0

### Needle Bearing Press Rod ③

### Needle Bearing Press ④ :

P/N. 3Y9-72770-0

### O Ring ⑤

### Bolt M8-80 ⑥

### Washer M8 ⑦

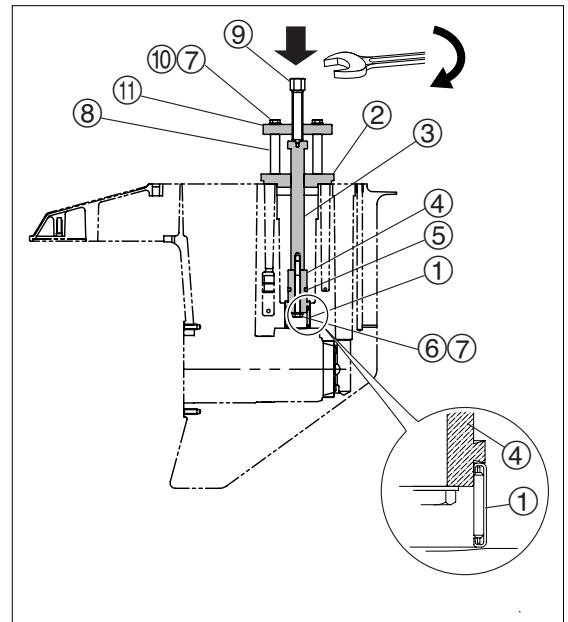
### Needle Bearing Press Collar ⑧

### Needle Bearing Press Bolt ⑨

### Bolt M8-110 ⑩

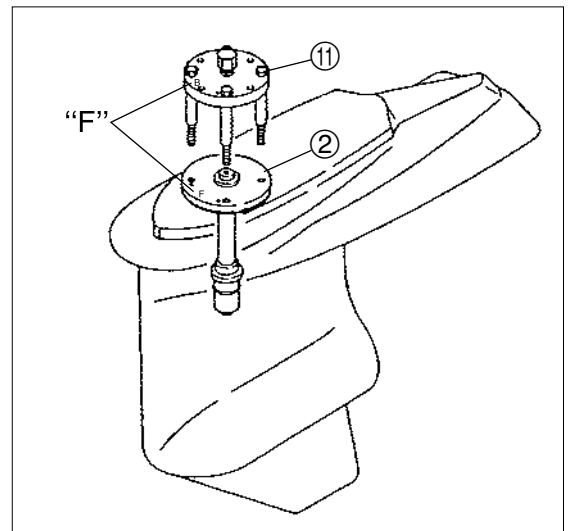
### Needle Bearing Press Flange ⑪ :

P/N. 3AC-72901-0



① Needle Bearing **Do not reuse.**

**⚠ CAUTION**  
**When installing guide ② and flange ⑪, face "F" mark forward direction.**



2. Remove taper roller bearing outer race ⑫.  
Put the slide hammer in the gear case, hook claw of slide hammer on the outer race to fix it, and slide the hammer to pull out the outer race.



**Slide Hammer Kit :**

P/N. 3AC-99080-0



Confirm the position of insertion groove in the back of outer race, and put the claw of slide hammer in the groove.

This work can also be done by using the following tool.

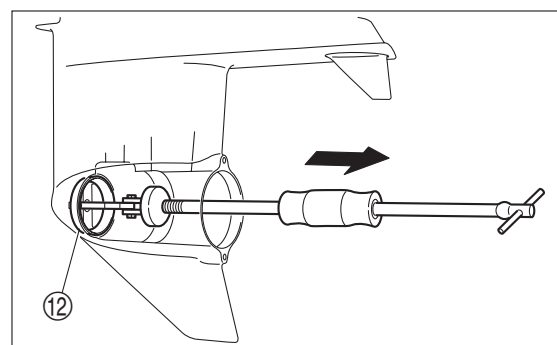
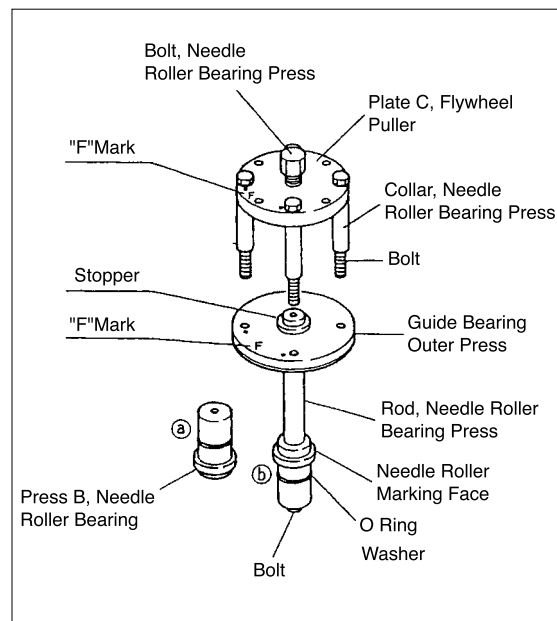


**Bevel Gear Bearing Puller Ass'y :**

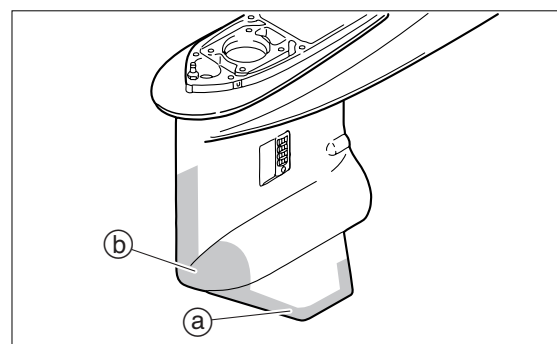
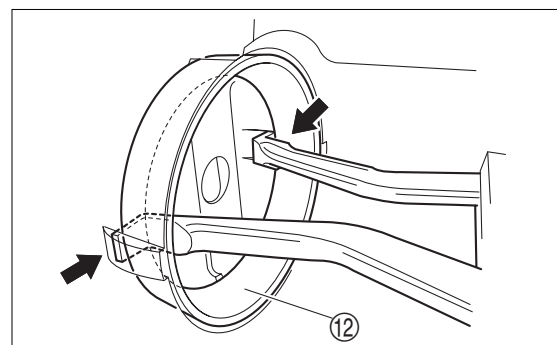
P/N. 3B7-72755-0

## 28) Inspection of Gear Case

1. Also check skag ① and torpedo-like area ② for crack and other damage.  
Replace if necessary.



⑫ Outer Race **Do not reuse.**





# Lower Unit

## 29) Assembly of Gear Case Parts

### ⚠ CAUTION

**When gear case, forward (A) gear or bearing is replaced, measure backlash and attach a proper shim.  
Refer to “Chapter 6 Shim Adjustment”.**

1. Use the following tools to install taper roller bearing ① outer race.



#### Bearing Outer Press Kit :

P/N. 3B7-72739-1

**Bearing Outer Press Plate ②**

**Bearing Outer Press Guide ③**

**Bearing Outer Press Rod ④**

**Nut M10 ⑤**

**Spring Washer ⑥**

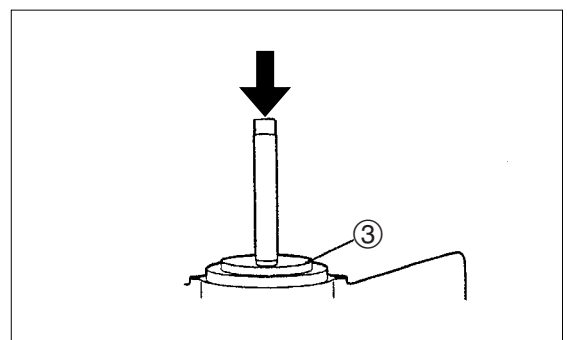
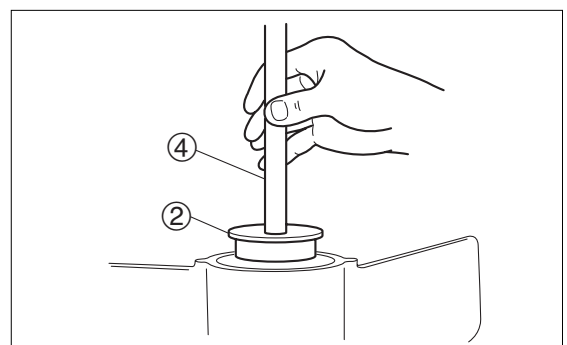
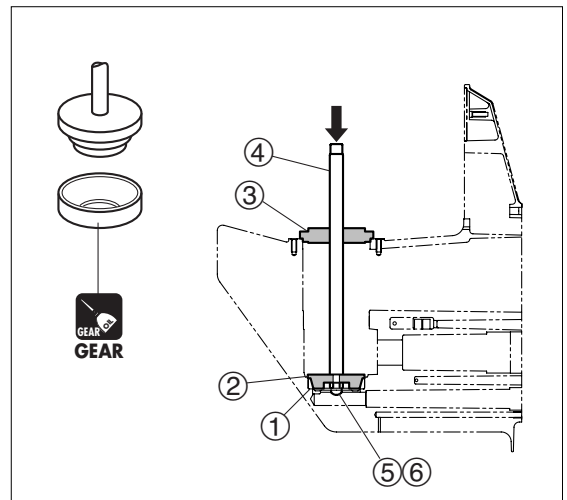
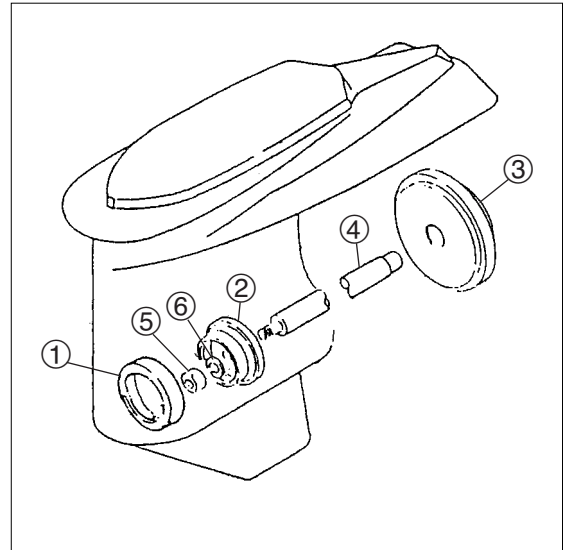
2. Fix gear case on a holder with its propeller shaft opening facing upward.
3. Clean outer race installation face in the gear case and apply gear oil.
4. Apply gear oil to external face of outer race, and put the outer race in the center of the housing with the marked face of the race facing in the housing.



**GEAR**

5. Put rod ass'y into gear case slowly so that plate ② contacts inside of the outer race, and put the guide on the rod and set it in the opening of the gear case.

6. Tap the end of the rod with a hammer to press-fit the outer race in the housing securely.



7. Install needle bearing by using the following tools.



**Needle Bearing Press Kit :**

P/N. 3C7-72900-1

**Bearing Outer Press Guide ② :**

P/N. 3Y9-72905-0

**Needle Bearing Press Rod ③**

**Needle Bearing Press ④ :**

P/N. 3Y9-72770-0

**O Ring ⑤**

**Bolt M8-80 ⑥**

**Washer M8 ⑦**

**Needle Bearing Press Collar ⑧**

**Needle Bearing Press Bolt ⑨**

**Bolt M8-110 ⑩**

**Needle Bearing Press Flange ⑪ :**

P/N. 3AC-72901-0

**⚠ CAUTION**

- When installing guide ② and flange ⑪, face "F" mark forward direction.
- Install bearing so that marked side faces upward.



- Before installing bearing, be sure to clean bearing installation face and apply gear oil.
- Do not reuse needle bearing. Use new part.

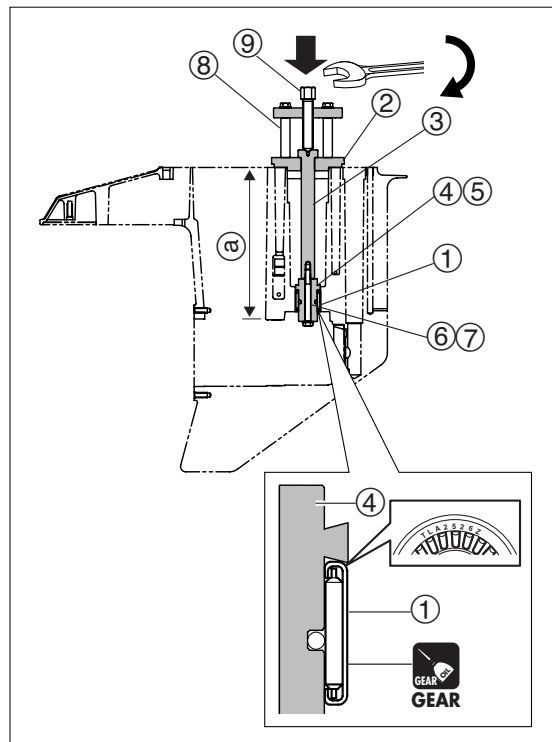


**Installation Depth ① :**

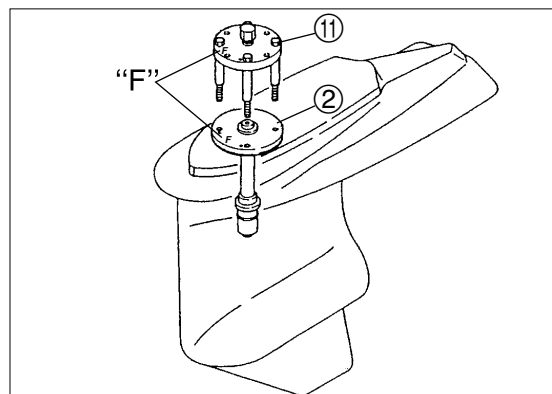
189.45 - 190.05 mm (7.4587 - 7.4823 in)



**GEAR**



① Needle Bearing **Do not reuse.**





# Lower Unit

## 30) Measurement of Pinion (B) Gear Height and Shim Selection

### ⚠ CAUTION

**When gear case, drive shaft or pump case (lower) is replaced, measure pinion (B) gear height and back lash between gears, and perform shim adjustment.**

1. Before measuring back lash of each gear, measure drive shaft pinion (B) gear height and adjust the height to proper value if necessary.

In accordance with procedure described in "Assembly of Lower Unit" steps 2 to 7 on Chapter 6, install the parts up to pump case ①, and secure it by using M8 bolt (L=35mm) and flat washer ②.



Remove forward (A) gear before beginning the work.



**M8 Bolt (L=35mm) + Flat Washer ② :**  
13N · m (9.0 lb · ft) [1.3kgf · m]

2. This work can be made easier when the opening of gear case of propeller shaft side is faced upward and fixed horizontally with a holder.

Put a shimming gauge ③ into gear case, and measure gap ④ between shimming gauge ③ and pinion (B) gear ④.

### ⚠ CAUTION

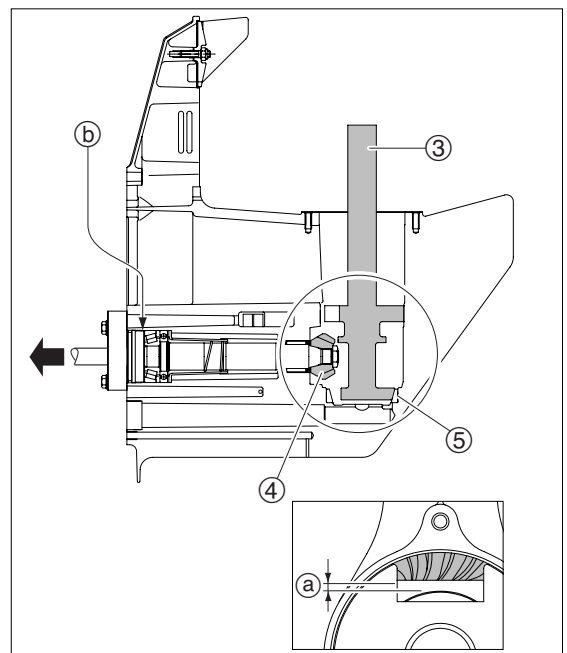
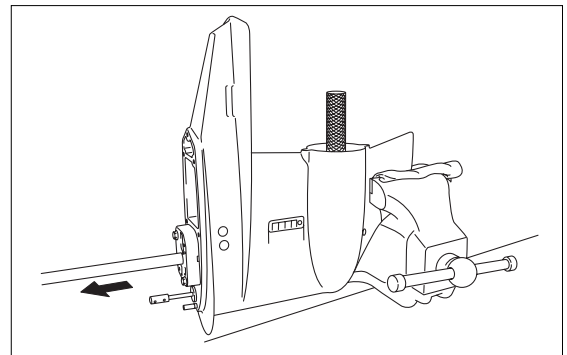
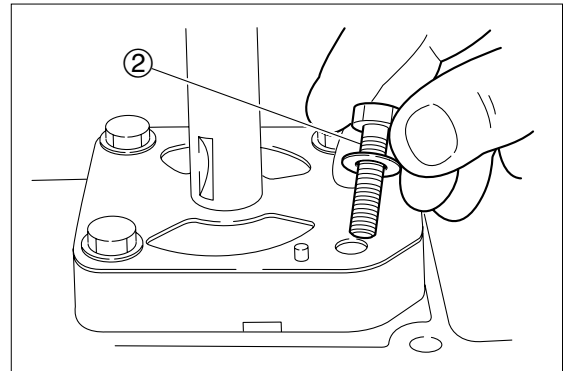
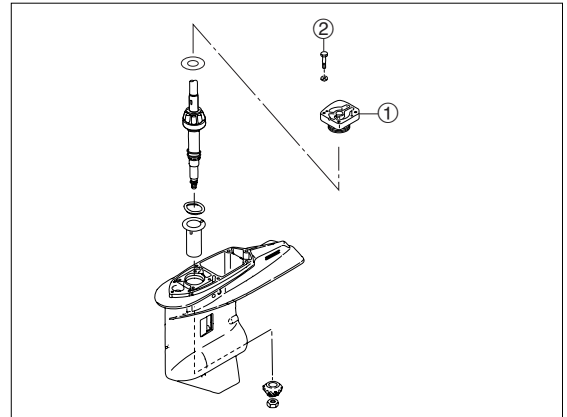
- **Contact shimming gauge ③ with taper roller bearing ① outer race tapered face.**
- **When measuring the gap, fully pull up drive shaft to eliminate the play.**



Thickness gauge measures the gap between shimming gauge ③ and pinion (B) gear end.



**Shimming Gauge ③ :**  
P/N. 3B7-72250-0  
**Thickness Gauge :**  
P/N. 353-72251-0

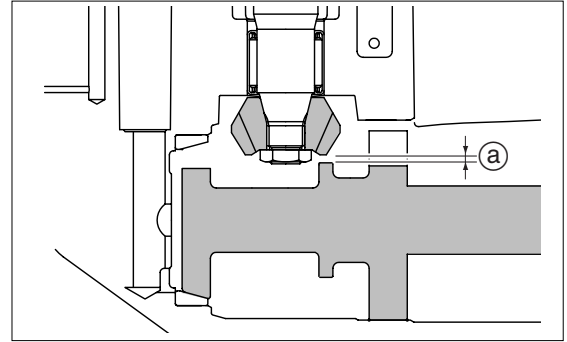


6. Add shim ⑥ to bottom of ⑤ pump case (lower) to adjust the gap ③ to specified value.



**Pinion (B) Gear Height ③ :**

0.45 - 0.49 mm (0.0177 - 0.0193 in)

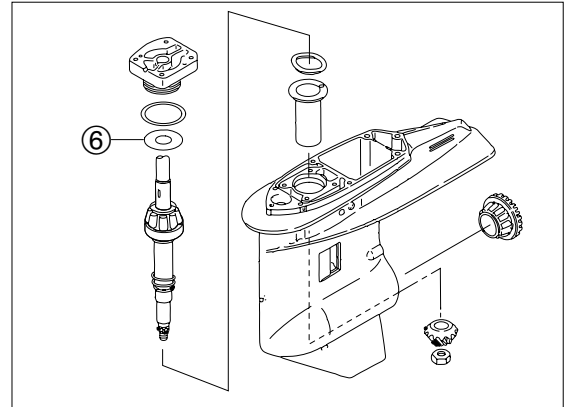


**Type of Shims ④ Applicable :**

0.1 mm (0.0039 in) P/N. 353-64016-0

0.15 mm (0.0059 in) P/N. 353-64015-0

0.3 mm (0.0118 in) P/N. 353-64014-0





# Lower Unit

## 31) Measurement of Back Lash between Forward (A) and Pinion (B) Gears and Shim Selection

### ⚠ CAUTION

**Before measuring backlash between forward (A) and pinion (B) gears, measure pinion (B) gear height.**

**Refer to “Measurement of Pinion (B) Gear Height and Shim Selection” in Chapter 6.**

1. In accordance with procedure described in “Assembling Lower Unit” steps 1 to 7 on Chapter 6, install parts up to pump case (lower).
2. Install dial gauge plate ① and secure it with bolt (M8-35) and flat washer ⑧.



**M8 Bolt (L=35mm) + Flat Washer ⑧ :**  
13N · m (9.0 lb · ft) [1.3kgf · m]

3. Install backlash measuring tool parts ② to ⑦ and secure them with installation bolts (M8 L=30mm) ⑧.



**Dial Gauge Plate ① :**  
P/N. 3B7-72729-0

**Backlash Measuring Tool Kit :**  
P/N. 3B7-72234-0

**Backlash Measuring Tool Shaft ② :**  
P/N. 3B7-72723-0

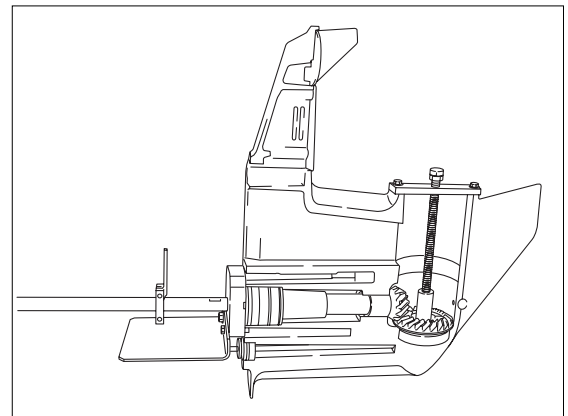
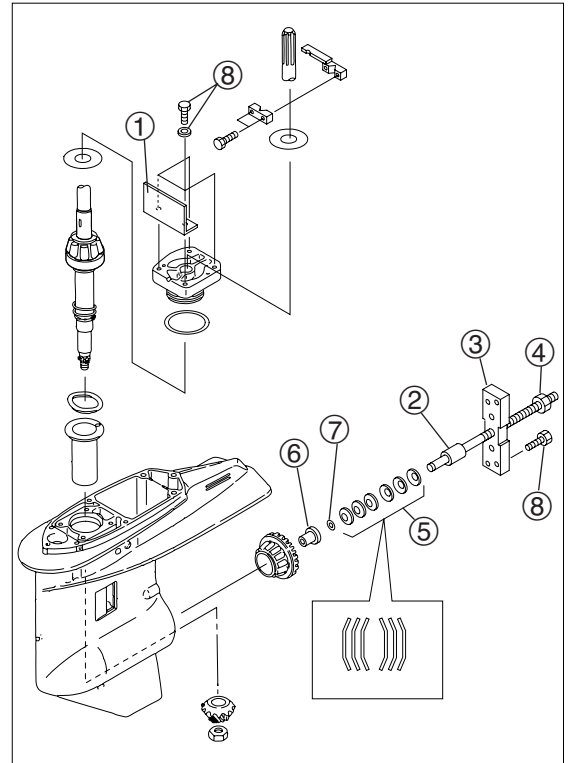
**Backlash Measuring Tool Plate ③ :**  
P/N. 3B7-72724-0

**Nut M12P1.5 ④ :**  
P/N. 3B7-72735-0

**Cone Disk Spring ⑤ :**  
P/N. 3B7-72734-0

**Measuring Tool Set Piece ⑥ :**  
P/N. 3B7-72245-0

**O Ring ⑦ :**  
P/N. 332-60002-0



- Fixing gear case on the holder with its propeller shaft opening facing upward makes the work easier.
- Be sure that cone discs ⑤ are arranged as illustrated. Put three of the parts aligned in the same direction, and then, put both sets of the parts with their convex sides face-to-face.



4. Tighten shaft ② until drive shaft ⑨ starts to move (rotate).  
When drive shaft starts to move, additionally tighten shaft ② 1/2 of a turn (180°).



- As an alternative to the above measuring tool, a tool used for pulling out the following propeller shaft housing can be used to secure forward gear (A) gear.
- When performing the work, assemble propeller shaft ass'y and housing ass'y and bolts to tighten to specified torque.



**Propeller Shaft Housing Bolt ⑪ :**

25 N · m (18 lb · ft) [2.5 kgf · m]



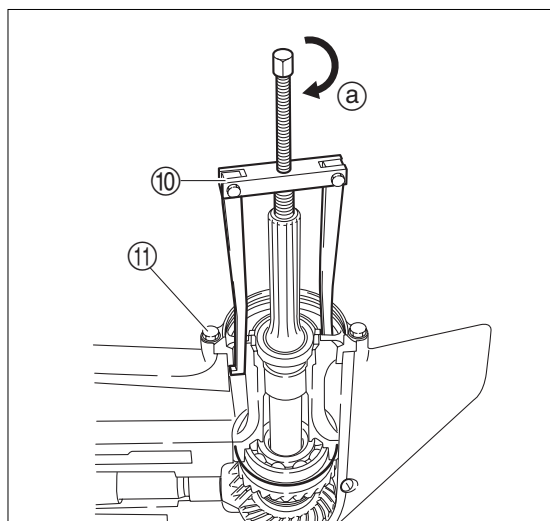
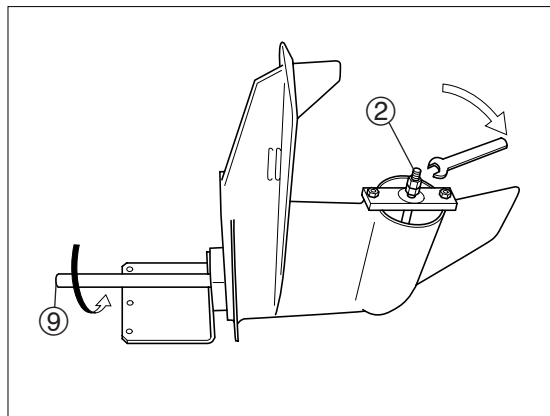
**Propeller Shaft Housing Puller ⑩ :**

P/N. 353-72252-0



**Tightening Torque for Inspection ① :**

Tighten bolt gradually until propeller shaft stops to turn.



5. Attach backlash measuring tool clamp ⑫ to drive shaft.
6. Turn drive shaft ⑨ clockwise / counterclockwise slowly while pulling it up, and read change of dial gauge ⑬ indication.



When measuring, contact dial gauge tip to inside of V groove located in the clamp ass'y.



**Backlash Measuring Tool Clamp ⑫ :**

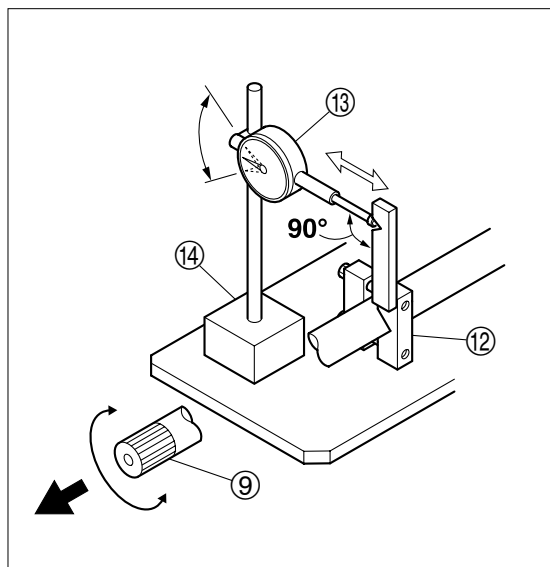
P/N. 3B7-72720-0

**Dial Gauge ⑬ :**

Commercially Available Item

**Magnetic Stand ⑭ :**

Commercially Available Item





# Lower Unit

7. Select proper thickness of shim based on the backlash measured with dial gauge and on the table shown.



- Confirm dial gauge reading and adjust backlash by using thickness of shim selected.
- Measure backlash several times while changing gear teeth contact position.
- When measuring backlash, make drive shaft pulling up force equal among the measurements.
- This work can be made easier when the opening of gear case of propeller shaft side is faced upward and fixed horizontally with a holder.



## Proper Backlash :

0.67 - 0.94 mm (0.0264 - 0.0370 in)

Dial Gauge Reading : mm (in)		Shim Thickness : mm (in) + means addition of shim/ - means removal of shim
0.40~0.54	(0.0157~0.0213)	- 0.10 (0.0039)
0.55~0.66	(0.0217~0.0260)	- 0.05 (0.0019)
0.67~0.94	(0.0264~0.0370)	0.00
0.95~1.06	(0.0374~0.0417)	+ 0.05 (0.0019)
1.07~1.24	(0.0421~0.0488)	+ 0.10 (0.0039)
1.25~1.41	(0.0492~0.0555)	+ 0.15 (0.0059)
1.42~1.59	(0.0559~0.0626)	+ 0.20 (0.0078)
1.60~1.77	(0.0630~0.0697)	+ 0.25 (0.0098)
1.78~1.94	(0.0701~0.0764)	+ 0.30 (0.0118)
1.95~2.12	(0.0768~0.0835)	+ 0.35 (0.0137)
2.13~2.30	(0.0839~0.0906)	+ 0.40 (0.0157)
2.31~2.47	(0.0909~0.0972)	+ 0.45 (0.0177)
2.48~2.65	(0.0976~0.1043)	+ 0.50 (0.0196)

8. Add shim ① into the gap between forward (A) gear ⑮ and taper roller bearing ⑯ if necessary.

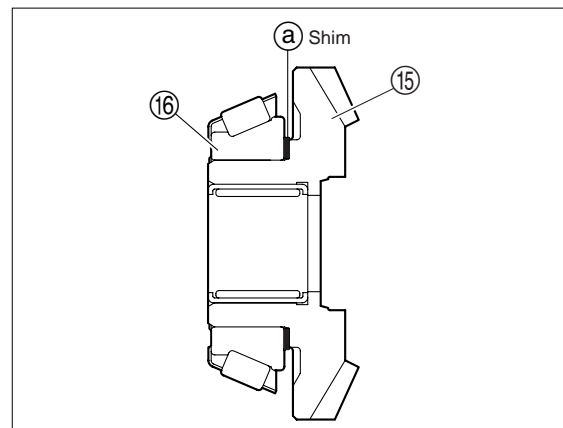
## ⚠ CAUTION

**For removal or installation of taper roller bearing, refer to;**  
**“Disassembly of Forward (A) Gear” or**  
**“Assembly of Forward (A) Gear”**  
**respectively.**



## Types of Shims ① :

0.1 mm (0.0039 in) P/N. 3B7-64016-0  
 0.15 mm (0.0059 in) P/N. 3B7-64015-0



## 32) Measurement of Back Lash between Pinion (B) and Reverse (C) Gears and Shim Selection

### **CAUTION**

**Before measuring backlash between pinion (B) and reverse (C) gears, establish pinion (B) gear height.**

**Refer to “Measurement of Pinion (B) Gear Height and Shim Selection” in Chapter 6.**

1. In accordance with procedure described in “Assembling Lower Unit” steps 2 to 7 on Chapter 6, install parts up to pump case (lower).



Remove forward (A) gear before beginning the work.

2. Attach dial gauge plate ① and secure it using bolt (M8, L=35mm) ② and flat washer ②.
3. Attach backlash measuring tool kit parts ③ to ⑧ to propeller shaft housing ass'y ⑨, put the assembly in the gear case, and secure it using bolt (M8, L=30mm) ⑩ and flat washer ⑩.



#### **Backlash Measuring Tool Kit**

P/N. 3B7-72255-0

**Nut M12-P1.5 ③**

P/N. 3B7-72735-0

**Washer 13-21-2.5 ④**

P/N. 3B7-72707-0

**Backlash Measuring Tool Plate ⑤**

P/N. 3B7-72725-0

**Backlash Measuring Tool Shaft ⑥**

P/N. 3B7-72726-0

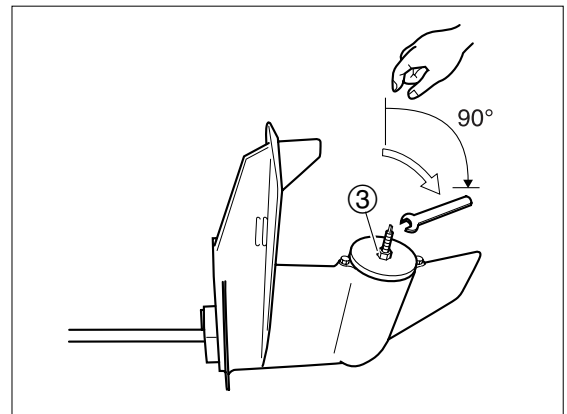
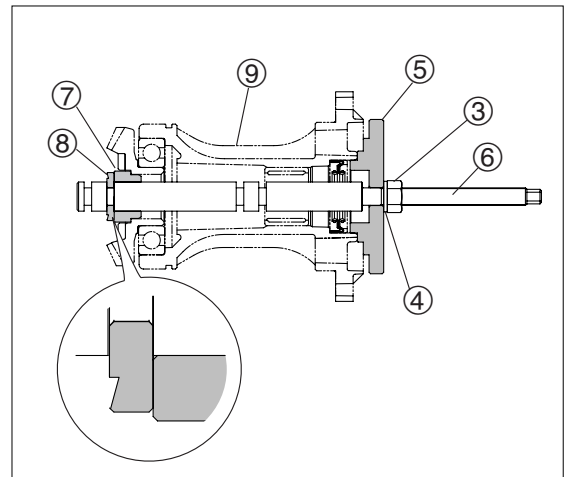
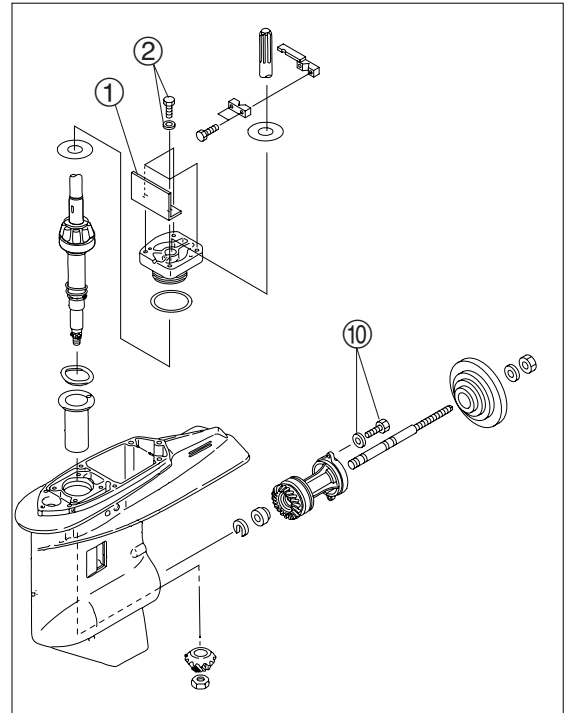
**Measuring Tool Set Piece ⑦**

3B7-72727-0

**Measuring Tool Retainer ⑧**

3B7-72903-0

4. Fix shaft ⑥ at the tip by using a tool, finger-tighten nut ③ until stop it, and then additionally tighten 1/4 of a turn (90°) by using a tool.





# Lower Unit

5. Attach backlash measuring tool clamp ⑫ to drive shaft.
6. Turn drive shaft ⑪ clockwise / counterclockwise slowly while pulling it up, and read change of dial gauge indication.



When measuring, contact dial gauge tip to inside of V groove located in the clamp ass'y.



## Backlash Measuring Tool Clamp ⑫ :

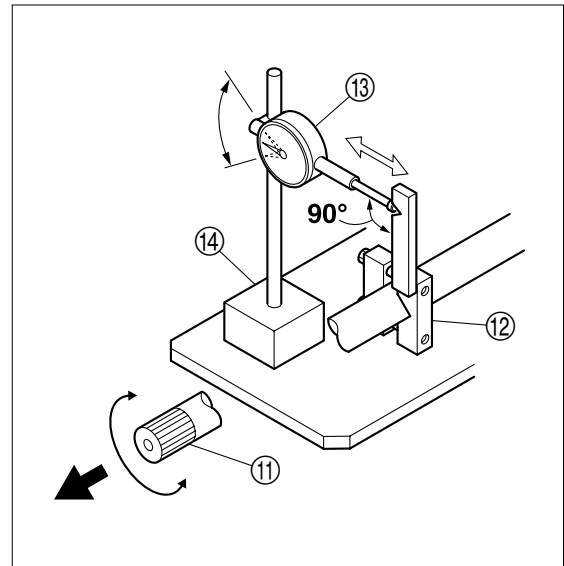
P/N. 3B7-72720-0

## Dial Gauge ⑪ :

Commercially Available Item

## Magnetic Stand ⑬ :

Commercially Available Item



7. Select shim thickness required based on the change of dial gauge indication and the table shown.



- Confirm dial gauge reading and adjust backlash by using thickness of shim selected.
- Measure backlash several times while changing gear teeth contact position.
- When measuring backlash, make drive shaft pulling up force equal among the measurements.
- This work can be made easier when the opening of gear case of propeller shaft side is faced upward and fixed horizontally with a holder.



## Proper Backlash :

0.67 - 0.94 mm (0.0264 - 0.0370 in)

Dial Gauge Reading : mm (in)		Shim Thickness : mm (in) + means addition of shim/ - means removal of shim	
0.40~0.54	(0.0157~0.0213)	-0.10	(0.0039)
0.55~0.66	(0.0217~0.0260)	-0.05	(0.0019)
0.67~0.94	(0.0264~0.0370)	0.00	
0.95~1.06	(0.0374~0.0417)	+0.05	(0.0019)
1.07~1.24	(0.0421~0.0488)	+0.10	(0.0039)
1.25~1.41	(0.0492~0.0555)	+0.15	(0.0059)
1.42~1.59	(0.0559~0.0626)	+0.20	(0.0078)
1.60~1.77	(0.0630~0.0697)	+0.25	(0.0098)
1.78~1.94	(0.0701~0.0764)	+0.30	(0.0118)
1.95~2.12	(0.0768~0.0835)	+0.35	(0.0137)
2.13~2.30	(0.0839~0.0906)	+0.40	(0.0157)
2.31~2.47	(0.0909~0.0972)	+0.45	(0.0177)
2.48~2.65	(0.0976~0.1043)	+0.50	(0.0196)

8. Add shim(s) into gap ⑥ between reverse (C) gear ⑮ and bearing ⑯ if necessary.

## ⚠ CAUTION

**For removal or installation of reverse (C) gear, refer to;**

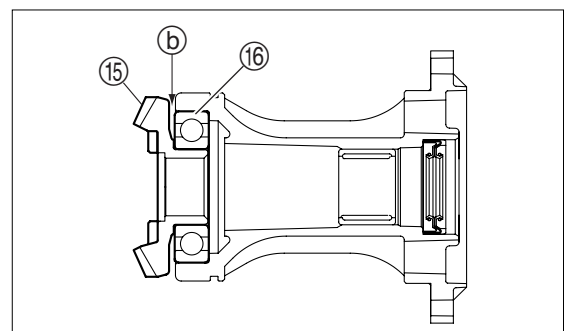
**“Disassembly of Propeller Shaft Housing Ass’y” or “Assembly of Lower Unit” in Chapter 6 respectively.**



## Type of Shims :

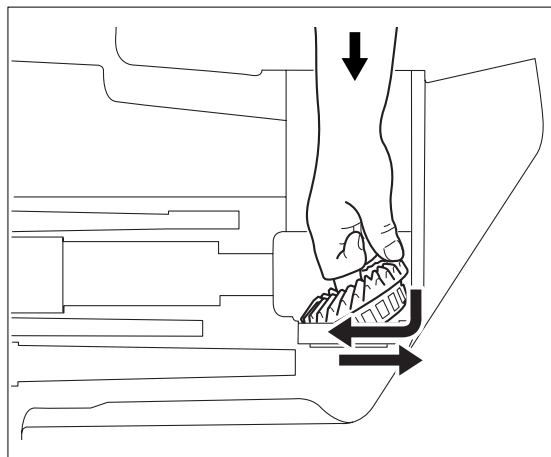
0.1 mm (0.0039 in) P/N. 3B7-64037-0

0.15 mm (0.0059 in) P/N. 3B7-64036-0



### 33) Assembly of Lower Unit Parts

1. Install forward (A) gear ①.



2. Install drive shaft spring guide ②, wave washer ③ and drive shaft ④.

#### ⚠ CAUTION

Align protrusion **a** of spring guide ② with gear case groove **b**.



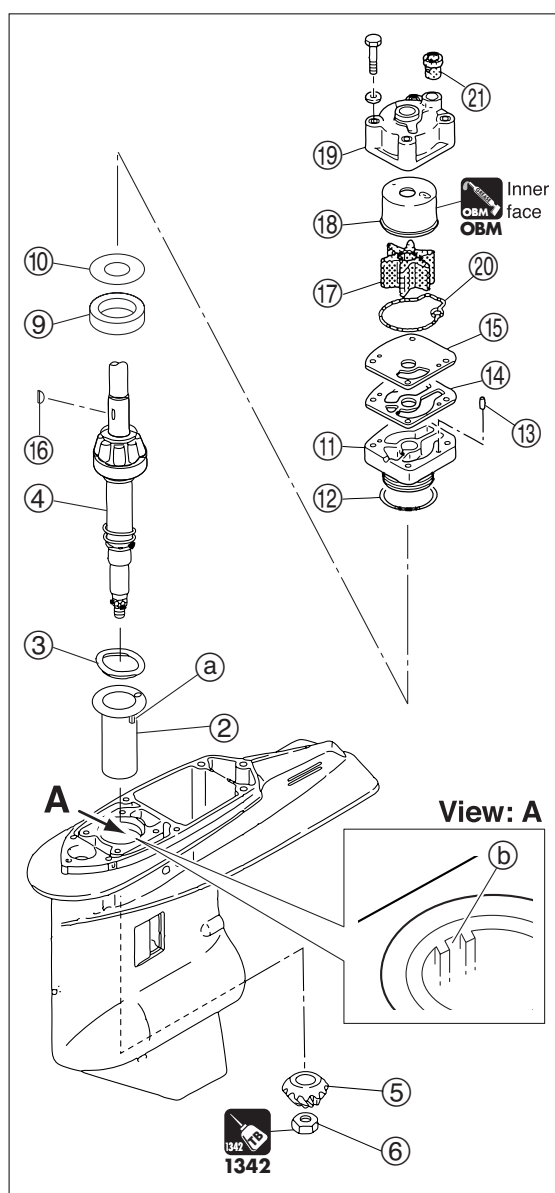
OBM



GEAR



1342



⑫⑭⑳ Do not reuse.



## Lower Unit

3. Install pinion (B) gear ⑤ and tighten pinion (B) gear nut ⑥ to specified torque.



- Tighten the nut by using a drive shaft socket ⑧ and a wrench and turning the wrench clockwise. Cover the wrench ⑦ with rag to prevent it from hitting the case directly.
- This work can be made easier when the opening of gear housing of propeller shaft side is faced upward and fixed horizontally with a holder.
- Before tightening pinion (B) gear and nut, apply ThreeBond 1342 to the thread.
- Degrease taper area of drive shaft pinion (C) gear installation section and thread of gear nut completely.



**Bevel Gear B Nut Wrench ⑦ :**

P/N. 3B7-72231-0

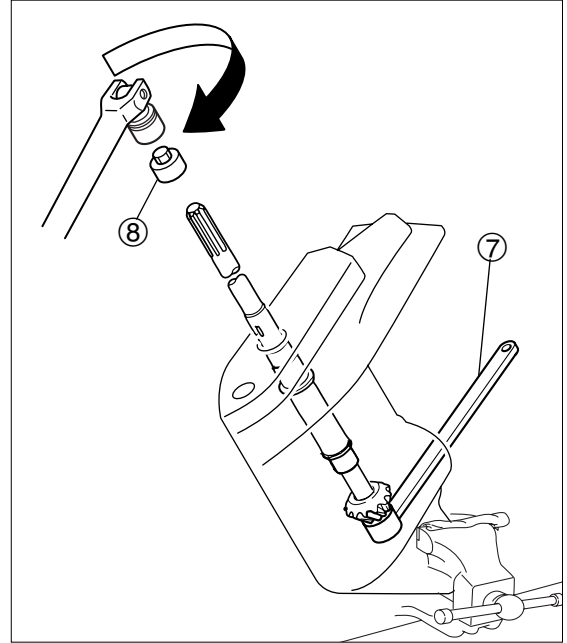
**Drive Shaft Socket ⑧ :**

P/N. 3B7-72232-0



**Pinion (B) Gear Nut ⑥ :**

110N · m (80 lb · ft) [11kgf · m]



4. Attach shim ⑩ that is removed when disassembling taper roller bearing outer race ⑨.

5. Attach O ring ⑫ to pump case (lower) ⑪ and install pump case (lower) to gear case.



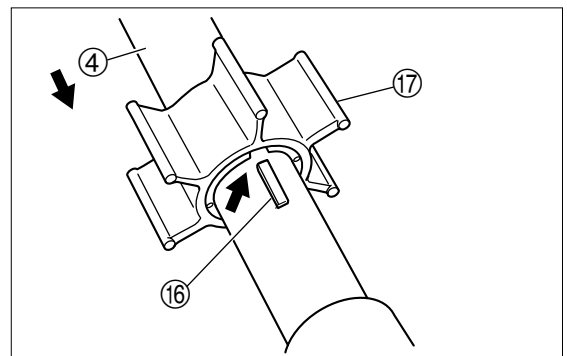
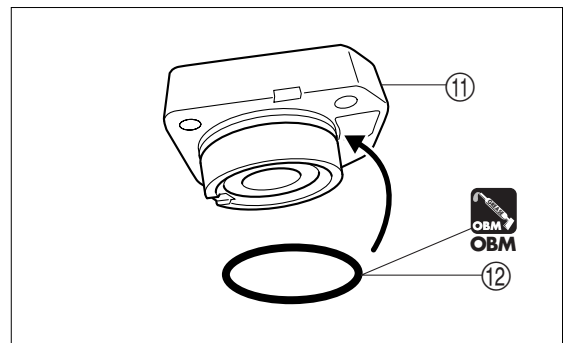
Apply OBM grease to O ring.



**OBM**

6. Put dowel pin ⑬ on the pump case (lower) ⑪, and attach pump case guide plate gasket ⑭ and pump case guide plate ⑮.

7. Attach water pump impeller key ⑯ to drive shaft ④, align the key with the water pump impeller ⑰ side key groove, and install the impeller.



8. Attach water pump liner (18) to pump case (upper) (19).

**CAUTION**

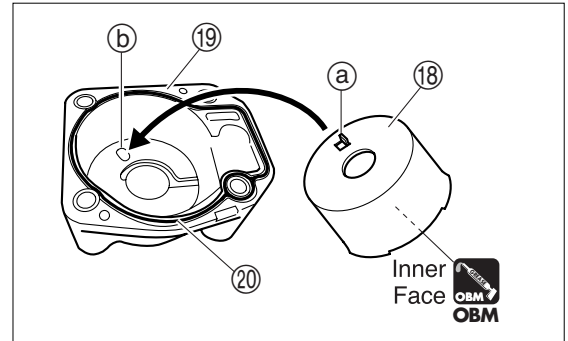
**Align pump liner (18) protrusion (a) with pump case (upper) (19) concave (b).**



Apply OBM grease to inside of water pump liner.



**OBM**



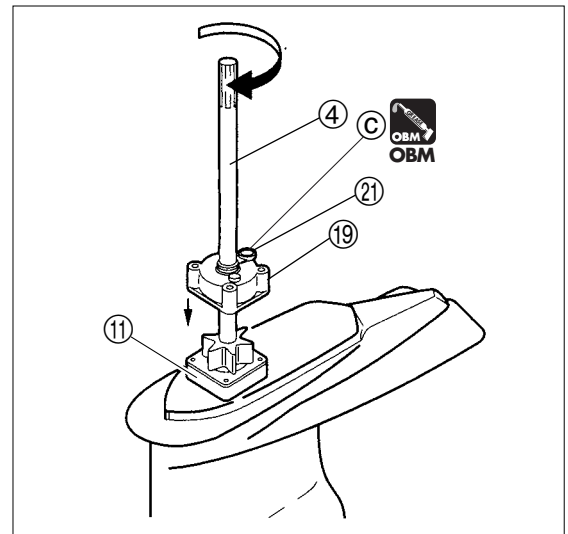
9. Put pump case (upper) (19) and pump case seal (20) on the drive shaft, and install them on the pump case (lower) (11).

**CAUTION**

**While installing pump case (19), turn drive shaft (4) clockwise to bend all impeller blades in counterclockwise on power unit direction.**



**OBM**



10. Attach water pipe seal (21) (RP).



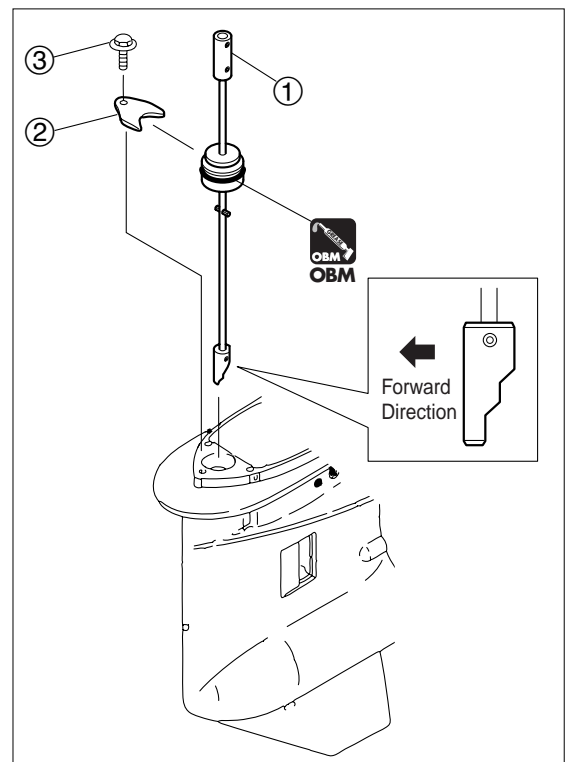
Apply OBM grease thinly on the inside (C) of water pipe seal so that water pipe can be inserted smoothly.



Apply OBM grease to O ring of clutch cam ass'y, and install the assembly by pushing cam rod bushing into gear case. Be careful of direction of clutch cam.



**OBM**



### 34) Attaching Clutch Cam Ass'y

1. Install clutch cam ass'y (1).

2. Attach stopper (2) and bolt (3).



# Lower Unit

3. Attach O ring ② to propeller shaft housing ①.



Apply OBM grease to O ring.

4. Attach steel balls (3pcs.) ④, clutch push rod ⑤ and washer ⑥ that was removed when disassembling to propeller shaft ③.

## CAUTION

**When gear case, propeller shaft or propeller shaft housing is replaced, measure propeller shaft play (forward direction) and select thickness of washer ⑥ according to the measurement.**

**Refer to “Measurement of Propeller Shaft Play and Selection of Washer Thickness”.**

5. Install propeller shaft ③ to propeller shaft housing ①, and install the assembly to gear case.



- Install propeller shaft housing to gear case securely, and tighten the securing bolts after confirming that O ring is set in the case properly.
- Apply ThreeBond 1342 to thread of propeller shaft housing installation bolts.

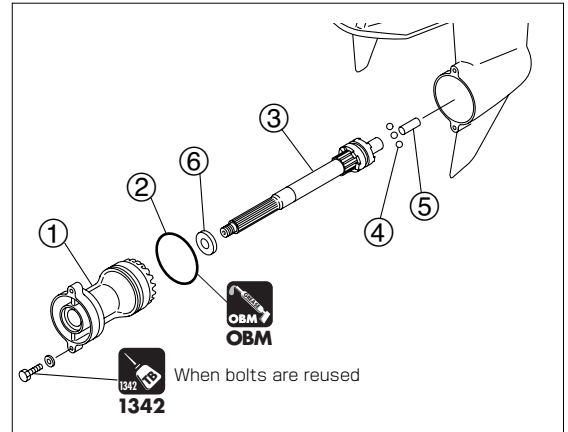


### Propeller Shaft Housing Bolts :

25 N · m (18 lb · ft) [2.5 kgf · m]



1342



③ O Ring Do not reuse.

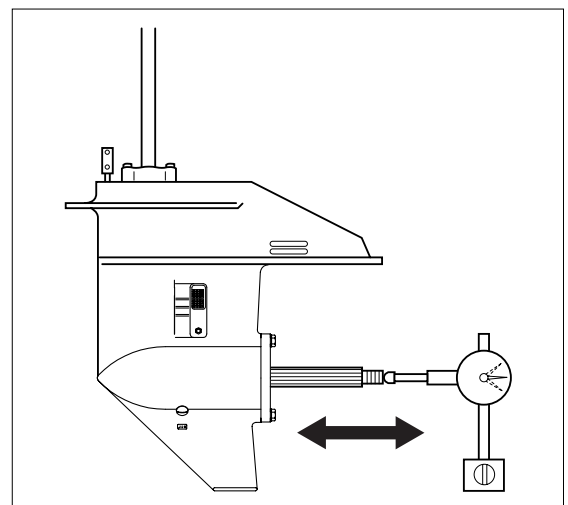
## 35) Measurement of Propeller Shaft Play and Selection of Washer Thickness

### CAUTION

**Before measuring propeller shaft play, adjust backlash between forward (A) and pinion (B) gears and reverse (C) and pinion (B) gears.**

**Refer to “Measurement of Backlash between Forward (A) and Pinion (B) Gears and Shim Selection” and “Measurement of Backlash between Pinion (B) and Reverse (C) Gears and Shim Selection” in Chapter 6.**

1. Assemble lower unit parts in accordance with procedure described in “Assembling Lower Unit Parts” in Chapter 6.
2. Measure play of propeller shaft in forward and reverse directions.





3. Select washer ① thickness so that the play is within the specified range.



**Specified Value of Play :**

0.2 - 0.4 mm (0.0078 - 0.0157 in)



**Type of Washers :**

2.8 mm (0.110 in) P/N. 3B7-64035-0

3.0 mm (0.118 in) P/N. 3B7-64034-0

3.2 mm (0.126 in) P/N. 3B7-64032-0

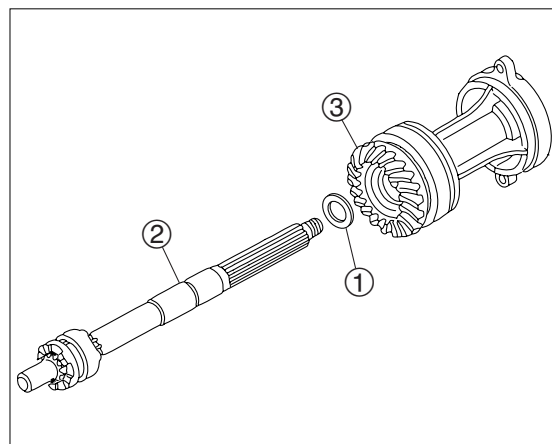
4. Replace washer ① between propeller shaft ② and reverse (C) gear ③ if necessary.

**CAUTION**

**For removal or installation of propeller shaft housing, refer to:  
“Removing Propeller Shaft” and “Assembling Lower Unit Parts” in Chapter 6.**



Play of propeller shaft in forward-reverse direction out of the specified range can cause revolution of propeller even in neutral gear while engine is operating.



## 36) Installation of Lower Unit

1. Operate manual valve of PTT unit, tilt-up outboard motor by using hands, and lock with tilt stopper.
2. Set shift rod ① to up position.



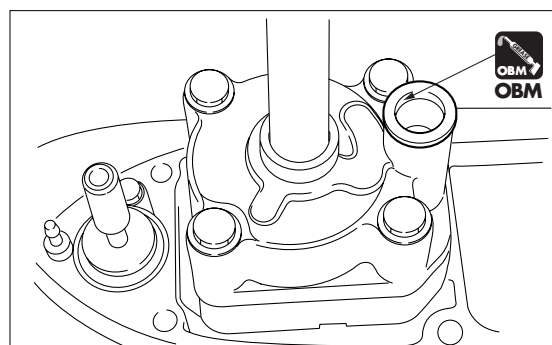
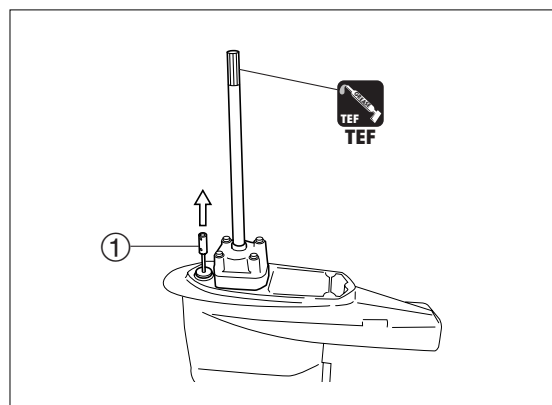
- Apply thin coat of OBM grease to spline of drive shaft before assembling.
- Apply thin coat of OBM grease to water pipe seal rubber.
- Lower unit installation can be made easier with the outboard motor tilted up.
- When installing the lower unit, insert water pipe into seal rubber properly.



**TEF**



**OBM**



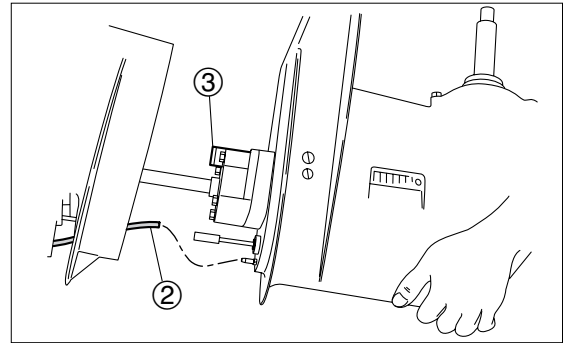


## Lower Unit

- Put lower unit ass'y into drive shaft housing.  
Connect speedometer pick up tube ②, and align positions of water pipe and water pipe seal ③.



Reconnect speedometer tube, and secure the tube using tie band.



- Tighten lower unit ass'y installation bolts and nut to specified torque.
- Attach gear case plate plug ④ and gear case plate ⑤.

### CAUTION

**To make centering of lower unit ass'y to drive shaft housing, attach bolts to two locations **B** marked on the lower unit ass'y first. After all bolts are attached, tighten the two bolts first.**



**M8 :**

25N · m (18 lb · ft) [2.5kgf · m]

**M10 :**

40N · m (29 lb · ft) [4.0kg · m]



**OBM**

- Connect shift rod joint ⑥ and shift rod ⑦, and drive in spring pin ⑧.

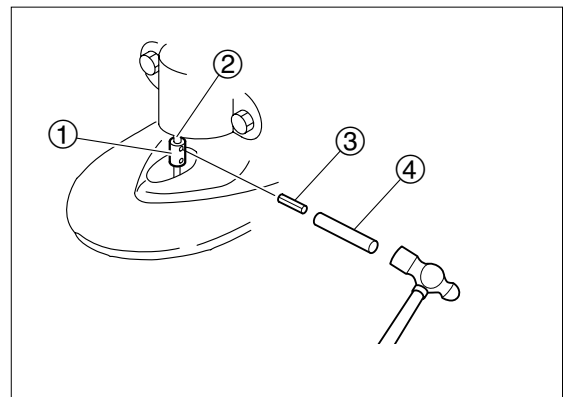
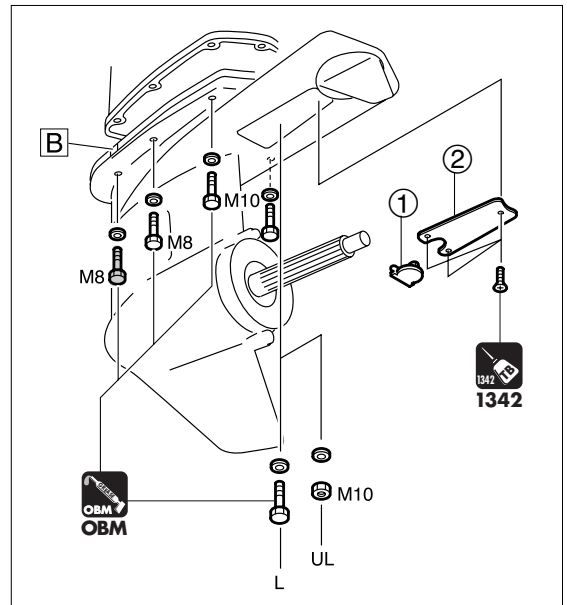


- Do not reuse spring pin.
- Replace with new one when removed.



**Spring Pin Tool B ⑨ : (ø3.5)**

P/N. 369-72218-0



③ Spring Pin **Do not reuse.**

7. Attach propeller and tighten propeller nut ⑩ to specified torque.

**CAUTION**

- Before removing or installing propeller, be sure to disconnect battery cables from battery and remove stop switch lock plate.
- When removing or installing propeller, do not handle propeller with bare hands.
- Put a piece of wooden block between anti-ventilation plate and propeller to prevent rotation of propeller when removing or installing propeller.



Propeller Nut ⑩ :  
12N · m (9 lb · ft) [1.2kgf · m]

8. Attach split pin ⑪.

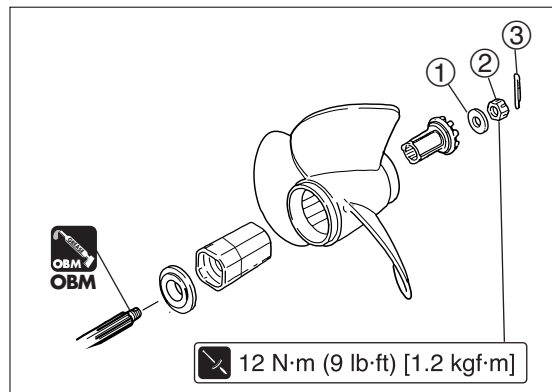
**CAUTION**

If propeller shaft pin hole and propeller nut pin groove do not align, additionally tighten the nut until they align.

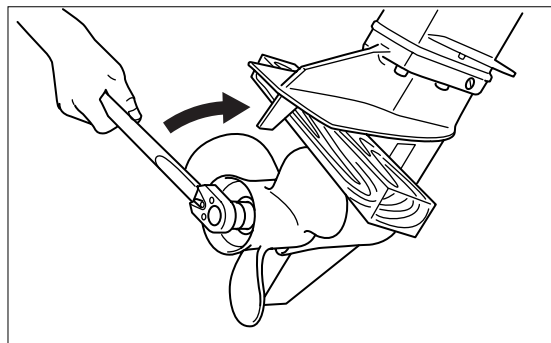
9. Fill gear case with gear oil to specified level.  
Refer to "Replacement of Gear Oil" in Chapter 3.



Perform "Inspection of Gear Case (Air Leakage)" in Chapter 3 if necessary.



⑪ Split Pin Do not reuse.





## Lower Unit

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# 7

## Cowl, Bracket and PTT Unit



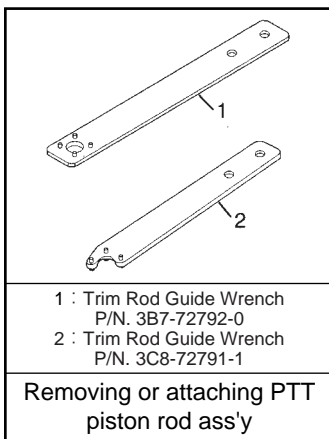
<b>1. Special Tools</b> .....	7-2	9) Removing Steering Shaft Arm	7-24
<b>2. Parts Layout</b> .....	7-3	10) Removing PTT Unit	7-25
Top Cowl (Motor Cover Upper) .....	7-3	11) Removing Clamp Bracket	7-27
Bottom Cowl (Motor Cover Lower) .....	7-4	12) Assembly of Clamp Bracket	7-28
Shift .....	7-6	13) Installation of PTT Unit	7-28
Drive Shaft Housing.....	7-8	14) Assembly of Steering Arm	7-30
Bracket .....	7-10	15) Removing PTT Motor	7-31
Power Trim & Tilt .....	7-12	16) Inspection of PTT Motor	7-32
<b>3. Inspection Items</b> .....	7-14	17) Assembly of PTT Motor	7-33
1) Removing Top Cowl	7-14	18) Removing Reservoir	7-34
2) Adjustment of Cover Hook	7-14	19) Disassembly and Assembly of	
3) Removing Bottom Cowl	7-14	Gear Pump	7-35
4) Removing Drive Shaft Housing	7-15	20) Disassembly of Tilt Cylinder and	
5) Disassembly of Drive Shaft Housing	7-17	Trim Cylinder.....	7-36
6) Inspection of Drive Shaft Housing	7-19	21) Assembly of PTT Unit	7-37
7) Assembly of Drive Shaft Housing	7-20	22) Air Bleeding PTT Unit	7-40
8) Installing Drive Shaft Housing	7-23		



# Cowl, Bracket and PTT Unit

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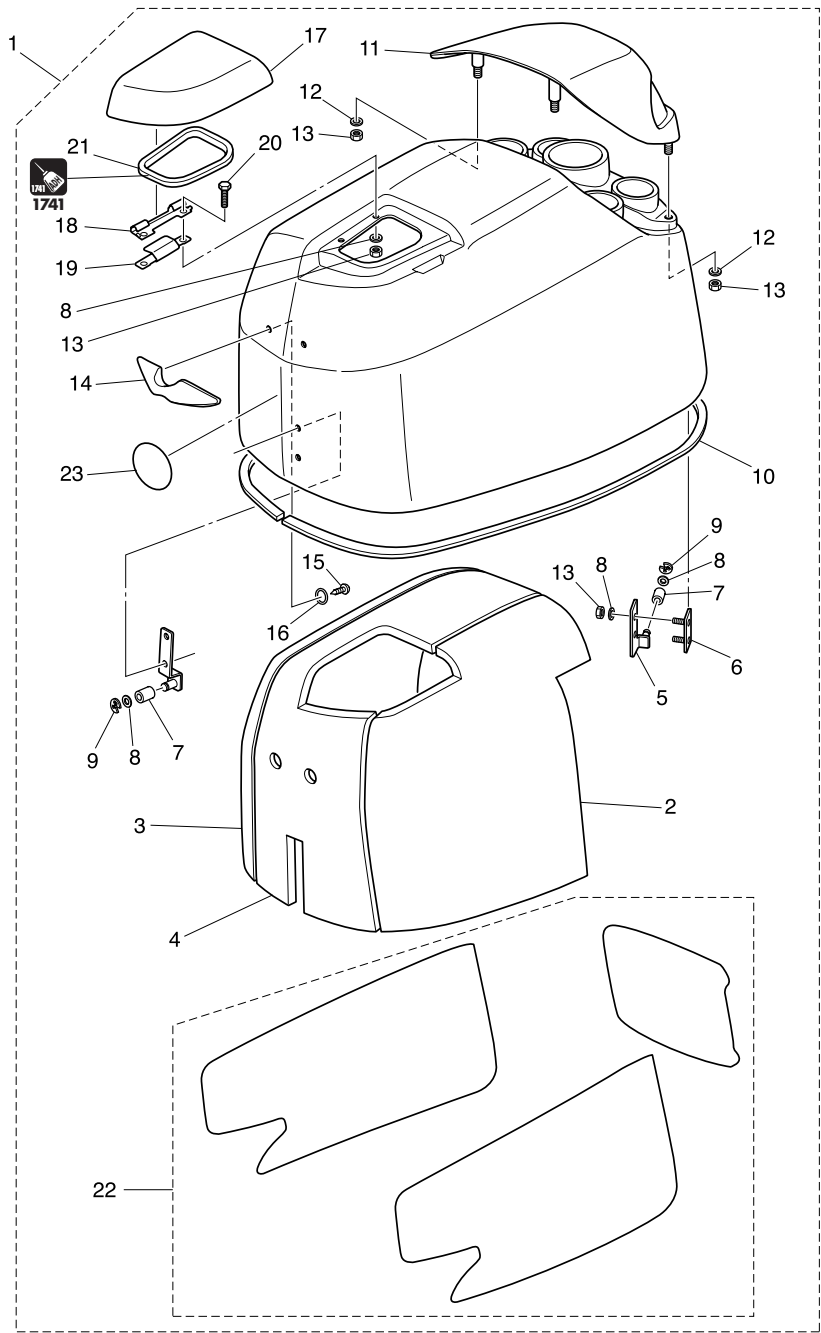
## 1. Special Tools



## 2. Parts Layout

### Top Cowl (Motor Cover Upper)

P/L Fig. 21



Ref. No.	Description	Q'ty	Remarks
1	Top Cowl Ass'y (Service)	1	Motor Cover (Upper)
2	Sound Isolation (Left)	1	
3	Sound Isolation (Right)	1	
4	Sound Isolation (Top)	1	
5	Cover Stay (Rear)	2	
6	Plate	2	
7	Roller 6.1-14.7-14	3	
8	Washer	9	M6
9	E-Ring	3	Do not reuse.
10	Top Cowl Seal	1	
11	Tilt Handle	1	
12	Washer 6-16-1.5	6	M6

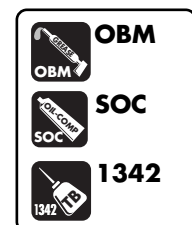
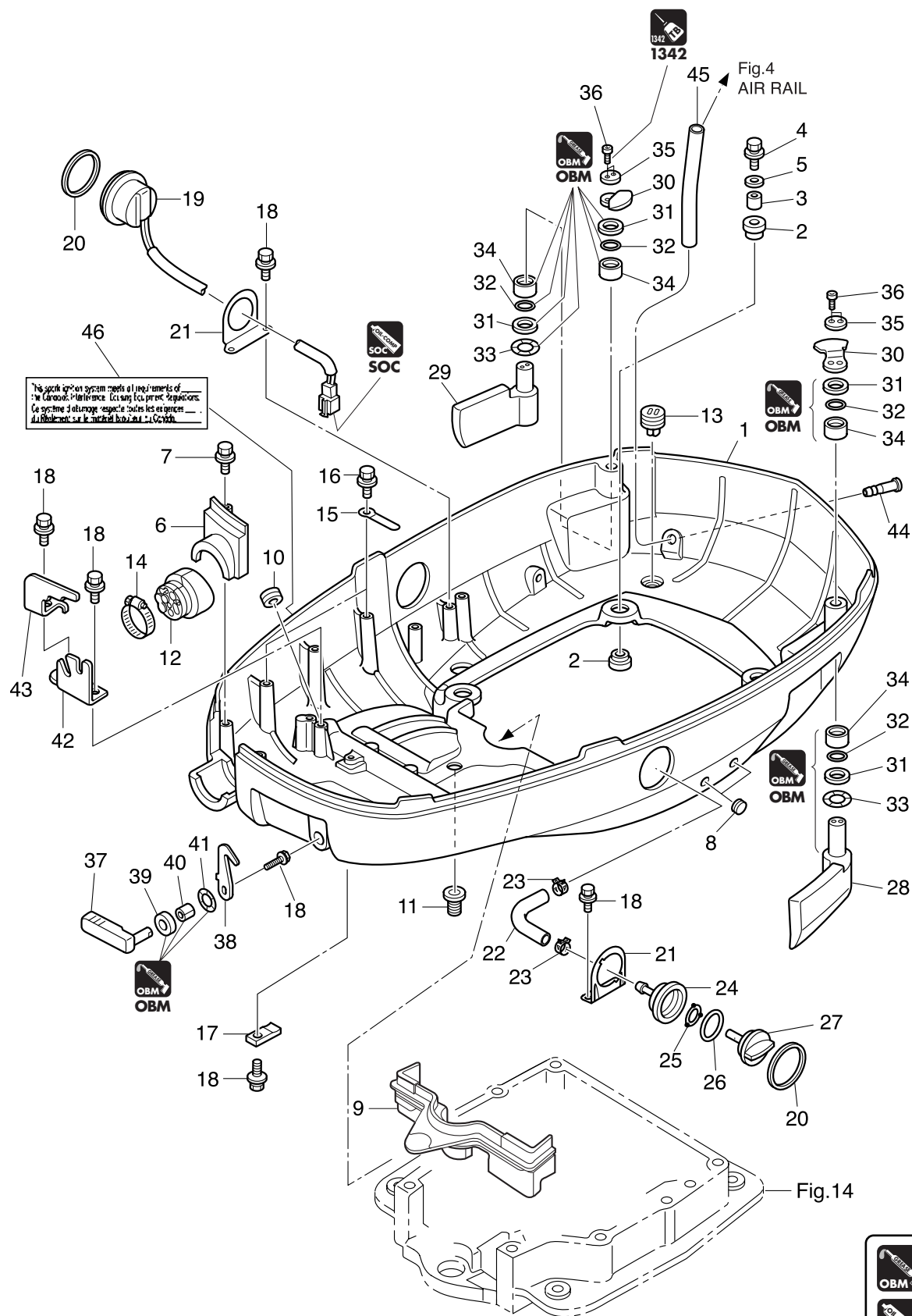
Ref. No.	Description	Q'ty	Remarks
13	Nylon Nut 6P1.0	10	M6
14	Cowl Handle	1	
15	Tapping Screw 6-16	2	
16	Washer 6.5-23-1.5	2	
17	Filler Lid Ass'y	1	
18	Filler Lid Hinge	1	
19	Filler Lid Spring	1	
20	Bolt	2	M6 L=16mm
21	Seal Filler Lid	1	
22-1	Decal Set TLDI90C2	1	90ps
22-2	Decal Set TLDI75C2	1	75ps
23	Front Decal	1	



# Cowl, Bracket and PTT Unit

## Bottom Cowl (Motor Cover Lower)

P/L Fig. 19

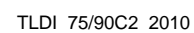




Ref. No.	Description	Q'ty	Remarks
1	Bottom Cowl	1	Motor Cover (Lower)
2	Mount Rubber Motor Cover Lower 12-18-2.5	8	
3	Spacer 8.4-12-17	4	
4	Bolt	4	M8 L=35mm
5	Washer 8.5-24-1.5	4	
6	Clamp	1	
7	Bolt	2	M6 L=25mm
8	Grommet 17-2.7	2	
9	Grommet A Lower Cover	1	
10	Grommet Power Trim · Tilt Cord Ass'y	1	
11	Grommet 17-3	1	
12	Cord Grommet	1	
13	Grommet	4	
14	Clamp L=60	1	
15	Clamp 6.5-67P	2	
16	Bolt	4	M6 L=12mm
17	Clamp Power Trim · Tilt	1	
18	Bolt	7	M6 L=16mm
19	PTT Switch	1	
20	Gasket PTT Switch Ass'y	2	
21	PTT Switch Bracket	2	
22	Flushing Hose	1	
23	Clip 17.8ø	2	
24	Flushing Connector	1	
25	Seal Ring	1	
26	O-Ring 3.1-24.4	1	Do not reuse.
27	Flushing Connector Cap	1	
28	Hook Lever Ass'y (Left)	1	
29	Hook Lever Ass'y (Right)	1	
30	Cover Hook	2	
31	Washer 18.5-30-1.0	4	
32	O-Ring ø3.5-18	4	Do not reuse.
33	Wave Washer 18.7-26-0.3	2	
34	Bushing 18-24-19	4	
35	Washer	2	
36	Bolt	4	M5 L=20mm
37	Hook Lever	1	
38	Cover Hook	1	
39	Seal Ring Hook Lever	1	
40	Bushing 14-16-18	1	
41	Wave Washer	1	
42	Cable Clip	1	
43	Cable Clip	1	
44	Water Nipple	1	
45	Hose	1	L=180mm
46	Label Inter Ference	1	For USA Model



**P/L Fig. 20**



Ref. No.	Description	Q'ty	Remarks
1	Shift Rod Lever	1	
2	Nylon Nut	1	M10
3	Shift Lever Shaft	1	
4	Holder Shift Lever Shaft	2	
5	Bolt	2	M8 L=25mm
6	Washer 10.5-18-1.5	2	
7	Cable Pin	1	
8	Nut	1	M6
9	Shift Arm	1	
10	Bolt	1	M8 L=35mm
11	Bushing 12-14-15.5	1	
12	Collar 8.4-12-17	1	
13	Washer 8.5-24-1.5	2	
14	Washer 12.5-24-1	1	
15	Shift Rod	1	
16	Snap Pin d=6	1	
17	Washer 7-18-1.6	1	
18	Shift Assist Ass'y	1	
19	R-Pin d=8	3	
20	Washer 8.5-18-1.6	3	



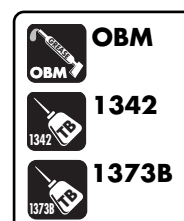
**P/L Fig. 14**



Ref. No.	Description	Q'ty	Remarks
1	Engine Basement	1	
2	Drain Plug Engine Base	2	
3	Exhaust Plug	1	
4	Seal Rubber Lower Cover L=690	1	
5	Engine Basement Gasket	1	Do not reuse.
6	Dowel Pin 6-12	4	
7	Bolt	2	M6 L=35mm
8	Exhaust Pipe	1	
9	Bolt M6-35 Pre-coated	7	M6 L=35mm
10	Gasket Exhaust Pipe	1	Do not reuse.
11	Exhaust Housing	1	
12	Grommet	1	
13	Grommet Idle Port	1	
14	Bolt	4	M8 L=30mm
15	Washer	4	M8
16	Gasket Exhaust Housing	1	Do not reuse.
17	Drive Shaft Housing	1	
18	Bolt M8-105	6	M8 L=105mm
19	Bolt M8-115	2	M8 L=115mm
20	Washer	8	M8
21	Gasket Drive Shaft Housing	1	Do not reuse.
22	Extension Housing UL	1	for transom "UL"
23	Bolt M8-35	3	M8 L=35mm for transom "UL"
24	Stud Bolt	1	M8 L=25mm for transom "UL"
25	Nut	1	M8 for transom "UL"
26	Washer	4	M8 for transom "UL"
27	Bolt M10-40	2	M10 L=40mm for transom "UL"
28	Washer	2	M10 for transom "UL"
29	Stud Bolt 10x165	1	M10 L=105mm
30	Nut 10P-1.25	1	M10
31	Washer	3	M10
32	Reverse Gas Passage	1	
33	Idle Exhaust Passage	1	
34	Idle Exhaust Passage Separation	1	
35	Idle Exhaust Passage Cover	1	
36	Passage Cover Gasket	1	Do not reuse.
37	Bolt	4	M6 L=20mm
38	Bolt	4	M6 L=35mm
39	Water Outlet Hose	1	
40	Apron Grommet	1	
41	Apron Ass'y	1	
42	Apron Seal	4	
43	Bolt	4	M6 L=12mm
44	Bolt	2	M6 L=16mm



**P/L Fig. 17**



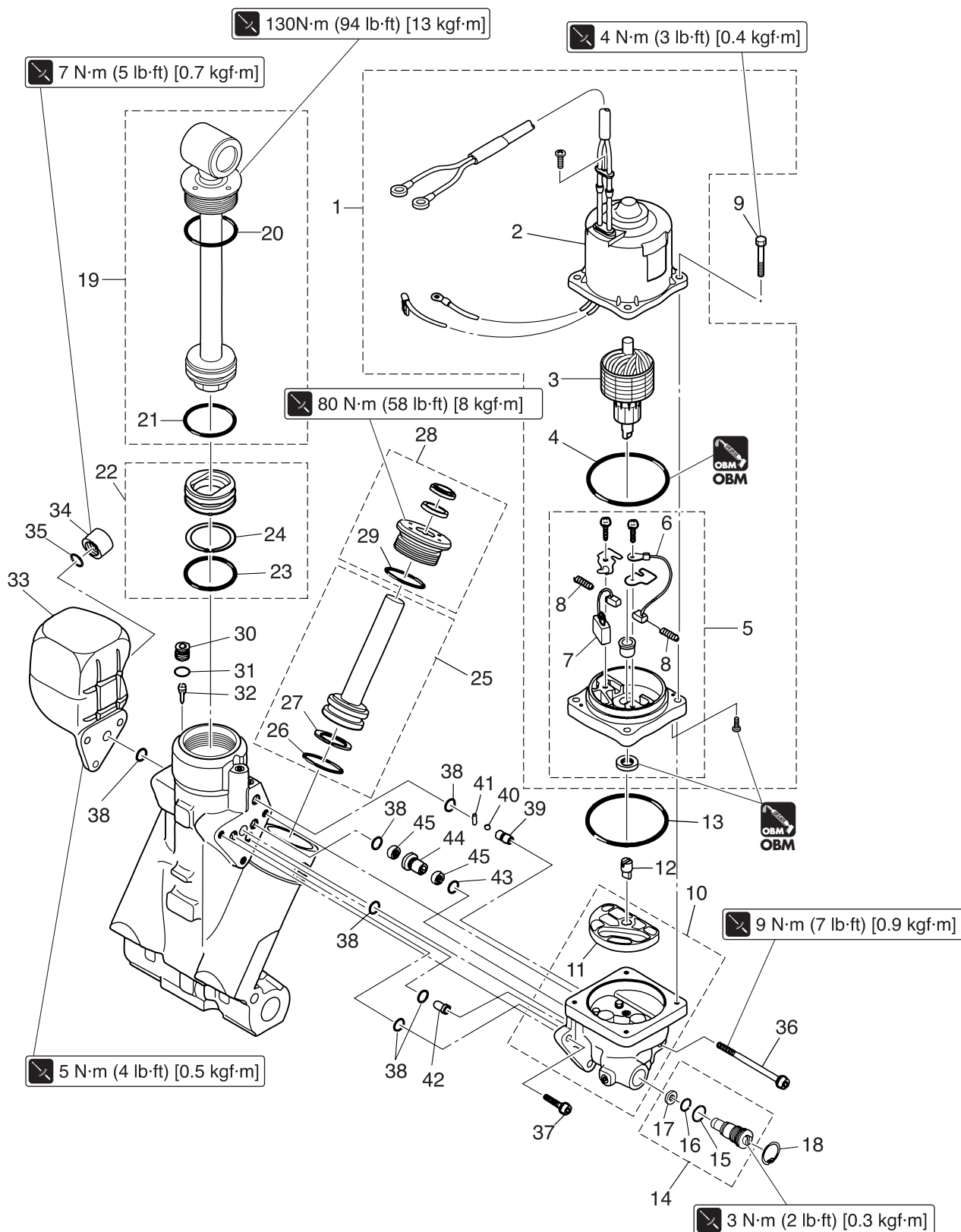
Ref. No.	Description	Q'ty	Remarks
1	Swivel Bracket Ass'y	1	
2	Grease Fitting	4	
3	Bolt	4	M6 L=10mm
4	Bolt 12-20	2	M12 L=20mm
5	Clamp Bracket (Right)	1	Stern Bracket (Right) Starboard
6	Clamp Bracket (Left)	1	Stern Bracket (Left) Port
7	Bolt	1	M10 L=20mm
8	Washer	2	M10
9	Trim Sender	1	
10	Bolt	2	M6 L=20mm
11	Washer 6-16-1.5	2	M6
12	Extension Cord Trim Sensor L=6000	1	
13	Clamp 6.5-47.5P	3	
14	Bolt	3	M6 L=12mm
15	Clamp 6.5-14	1	
16	Screw	1	M6 L=12mm
17	Bracket Bolt Ass'y	1	Bracket Bolt
18	Grease Fitting	1	
19	Washer	1	M6
20	Bushing 25.6-28.6-40	2	
21	Nylon Nut 7/8	1	7/8-14UNF
22	Washer 25.7-50-1	2	
23	Thrust Rod	1	
24	Pin Thrust Rod	1	
25	Anode Stern Bracket	1	
26	Bolt	2	M6 L=30mm
27	Tilt Stopper Ass'y	1	
28	Spring Pin 3.5-16	1	Do not reuse.
29	Tilt Stopper Grip	1	
30	Spring Tilt Stopper	1	
31	Collar 10.2-12-12	2	
32	Steering Shaft Ass'y	1	
33	Steering Hook Plate	1	
34	Bolt	2	M10 L=30mm
35	Seal Ring Steering Shaft	1	Do not reuse.
36	Bushing 32-40-45	2	
37	Thrust Plate 32.9-56-2	2	
38	O-Ring 4.5-32	1	Do not reuse.
39	C-Ring	1	d=32
40	Upper Mount Rubber	2	
41	Bolt 7/16-20-114.5	2	
42	Damper Rubber 21-36-5	2	
43	Washer 11.5-32-3	2	
44	Cap Mount Rubber Upper	1	Rubber Mount Cap (Upper)
45	Bolt	3	M8 L=35mm
46	Damper Mount Rubber Upper	1	
47	Bolt	1	M6 L=25mm
48	Washer 6-16-1.5	1	
49	Mount Bracket	1	
50	Mount Rubber Lower	2	
51	Bolt Mount Bracket M12-151	2	M12 L=151mm
52	Washer Mount Bracket 12.2-25-2	2	
53	Washer 13-34-3	2	
54	Damper Rubber 21-36-5	2	
55	Nut 12-P1.5	2	M12
56	Washer	2	M12
57	Mount Holding Plate (Lower)	2	Rubber Mount Cap (Lower)
58	Bolt 8-25	4	M8 L=25mm
59	Damper Rubber	1	
60	Ground Wire	1	
61	Ground Wire	1	
62	Ground Wire	1	
63	Bolt	4	M6 L=12mm
64	Drag Link Ass'y	1	
65	Spacer	1	
66	Bolt 3/8-24-50	1	
67	Nylon Nut 3/8-24	2	
68	Washer 9.6-18-2	3	
69	Seal Ring Drag Link	1	
70	Upper Cylinder Pin	1	
71	Washer 6.5-23-1.5	1	
72	Bolt	1	M6 L=12mm
73	Bushing 18-24-19	2	
74	Bushing 18-20-20.5	2	
75	Anode	1	
76	Bolt	1	M6 L=16mm
77	Cylinder Pin (Lower)	1	
78	Washer 22.6-30-2	2	
79	Clip	2	
80	Bushing 22-25.4-23.5	4	
81	Band Lead Wire L=104	2	Do not reuse.
82	Power Trim · Tilt	1	



# Cowl, Bracket and PTT Unit

Power Trim & Tilt

P/L Fig. 18





Ref. No.	Description	Q'ty	Remarks
1	Motor Ass'y	1	
2	Yoke Ass'y	1	
3	Armature Ass'y	1	
4	O-Ring	1	Do not reuse.
5	Bracket Ass'y	1	
6	Brush Ass'y	1	
7	Breaker	1	
8	Spring	2	
9	Bolt	4	
10	Pump	1	
11	Filter B	1	
12	Coupling Pump	1	
13	O-Ring	1	Do not reuse.
14	Manual Valve	1	
15	O-Ring	1	Do not reuse.
16	Packing	1	Do not reuse.
17	Back Up Ring	1	
18	C-Ring	1	
19	Piston Rod Ass'y	1	
20	O-Ring	1	Do not reuse.
21	O-Ring	1	Do not reuse.
22	Free Piston	1	
23	O-Ring	1	Do not reuse.
24	Back-Up Ring	1	
25	Piston Trim Ass'y	2	
26	O-Ring	2	Do not reuse.
27	Back-Up Ring	2	
28	Rod Guide Sub-Ass'y	2	
29	O-Ring	2	Do not reuse.
30	Plug	1	
31	O-Ring	1	Do not reuse.
32	Filter	1	
33	Reservoir Tank	1	
34	Cap	1	
35	O-Ring	1	Do not reuse.
36	Bolt	1	
37	Bolt	2	
38	O-Ring	6	Do not reuse.
39	Orifice	1	
40	Ball	1	
41	Pin	1	
42	Orifice	1	
43	O-Ring	1	Do not reuse.
44	Valve Seat	1	
45	Filter	2	

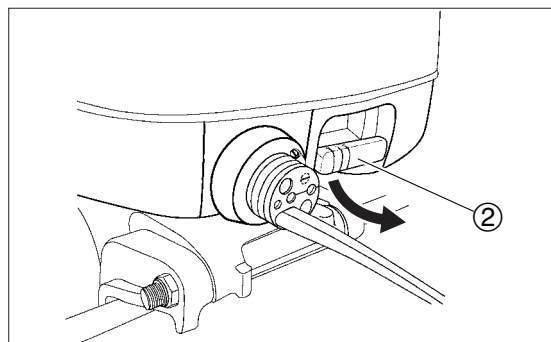
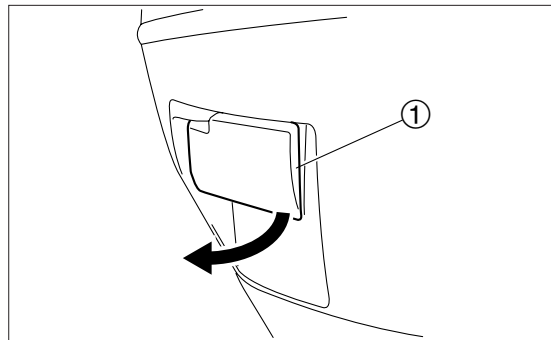


# Cowl, Bracket and PTT Unit

## 3. Inspection Items

### 1) Removing Top Cowl

1. Pull outward upper motor cover hook levers ① and turn down lever ② and remove upper motor cover.



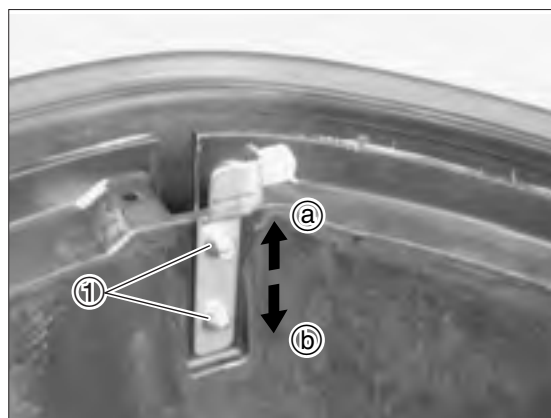
### 2) Adjustment of Cover Hook

1. Push cover to check for play, and adjust if necessary.
2. Loosen cover stay securing nuts ①, adjust fit of cowl, and then, tighten the nuts.



Turn toward (a) to loosen cowl.

Turn toward (b) to tighten cowl.



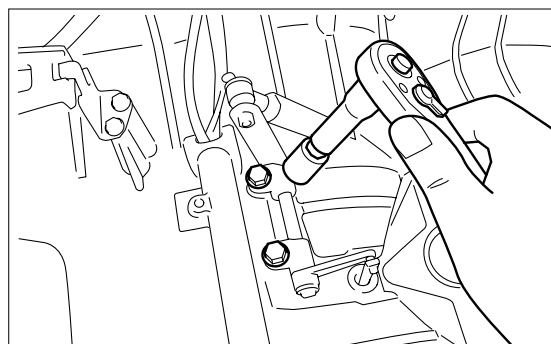
### 3) Removing Bottom Cowl

1. First refer to "Removing Power Unit" in Chapter 4.
2. Remove power trim pump electrical cables from bottom cowl.

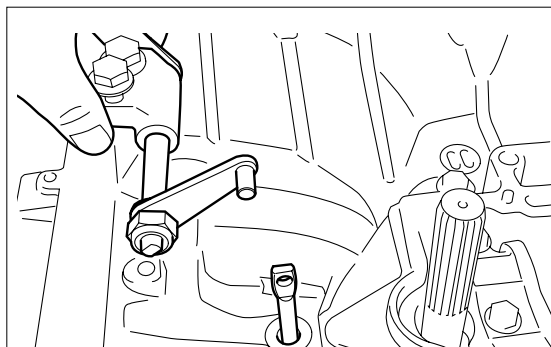


There is a clamp on the back of bottom cowl for securing cables.

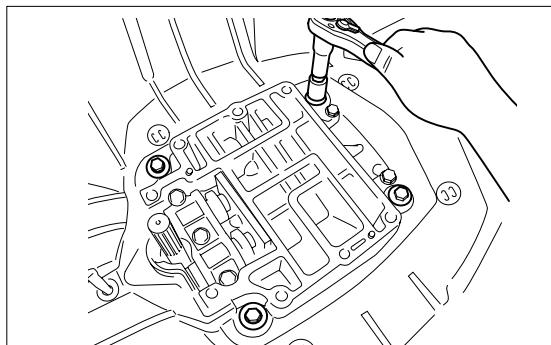
3. Loosen bolts that secures shift lever shaft holder.



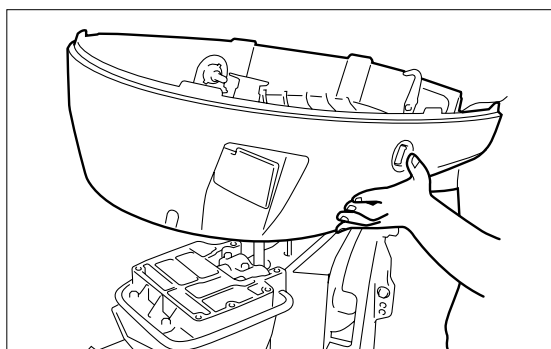
4. Remove pin and washer, then shift rod lever from shift rod.



5. Loosen and remove four bolts that secure bottom cowl to engine base.



6. Remove bottom cowl.



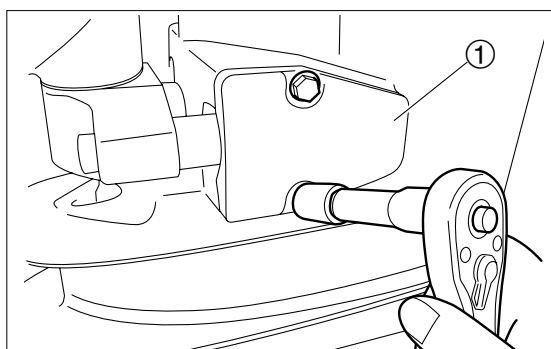
#### 4) Removing Drive Shaft Housing

Use the following steps to remove drive shaft housing.

1. Loosen and remove lower rubber mount cap installation bolts to remove mount cap ①.



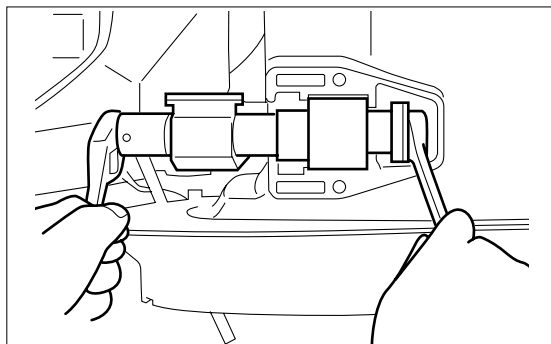
Remove grounding wire from gear case before beginning the work.



2. Loosen lower rubber mount cap installation bolt and remove the nut.



- Fully tilt down outboard motor when loosening mount bolt.
- Remove only the nut and do not remove mount bolt.



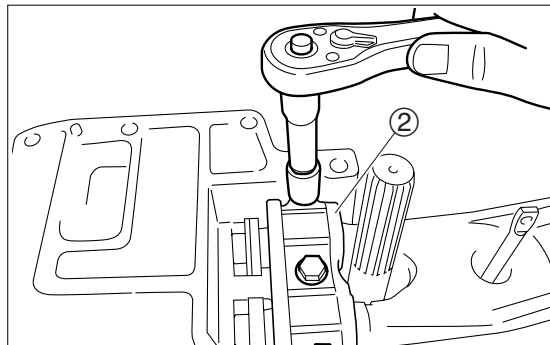


## Cowl, Bracket and PTT Unit

- Loosen and remove upper rubber mount cap installation bolts to remove mount cap ②.

**⚠ CAUTION**

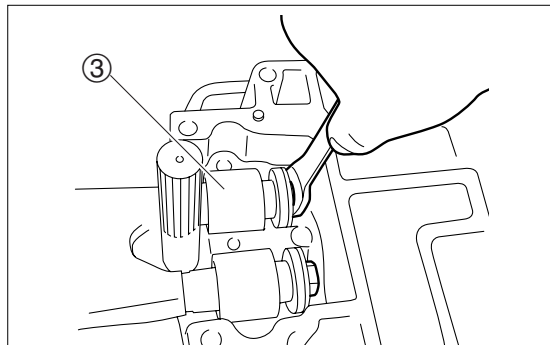
**Drive shaft housing drops if mount bolt is removed in this step.**



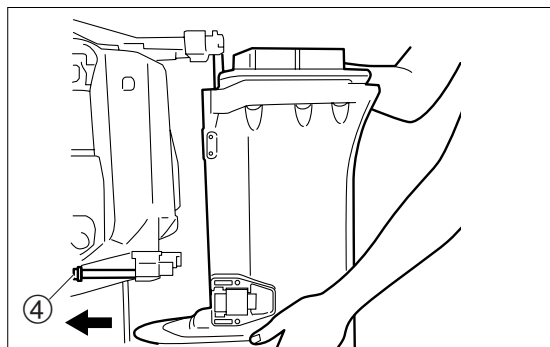
- Loosen and remove upper rubber mount installation bolts to remove rubber mount ③.



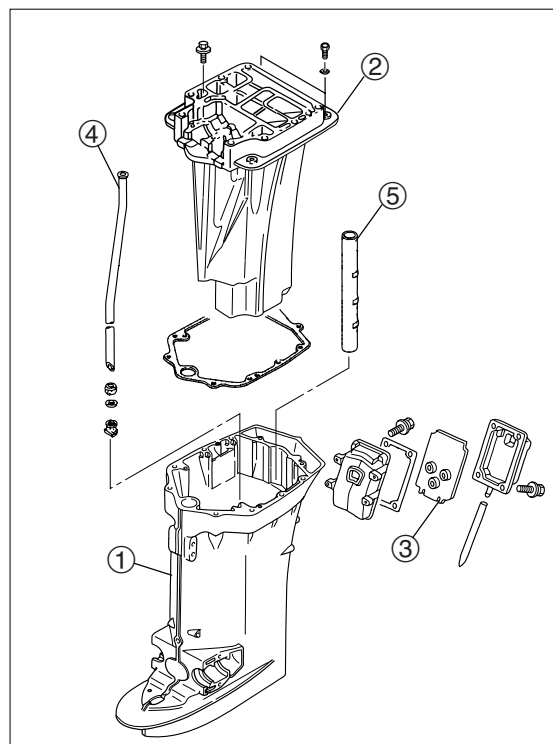
Loosen right and left rubber mount installation bolts in several steps alternately and equally.



- Pull out lower rubber mount bolt ④ while holding drive shaft housing at its top and bottom securely, and remove drive shaft housing.



## 5) Disassembly of Drive Shaft Housing

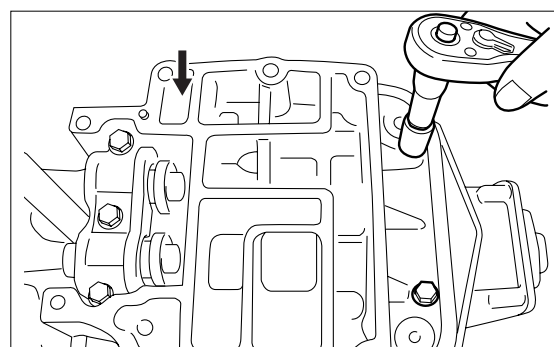


- ① Drive Shaft Housing
- ② Engine Base
- ③ Idle Exhaust Passage
- ④ Water Pipe
- ⑤ Reverse Gas Passage

1. Remove bolts that secure engine base to drive shaft housing.



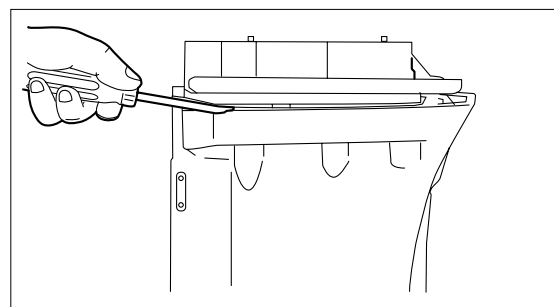
Remove M6 installation bolt located in the area shown by the arrow.



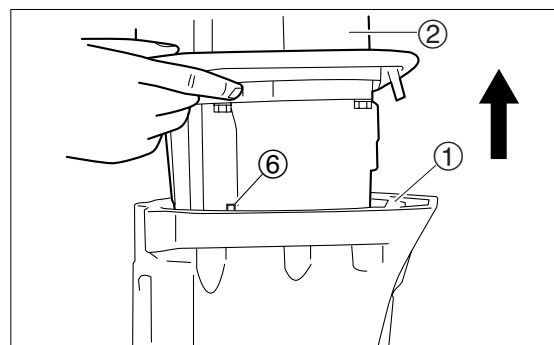
2. Tap lightly with a plastic hammer to separate engine base from the housing if it is seized.



If necessary, use a bladed screw driver to pry the engine base taking care not to scratch mating surface.



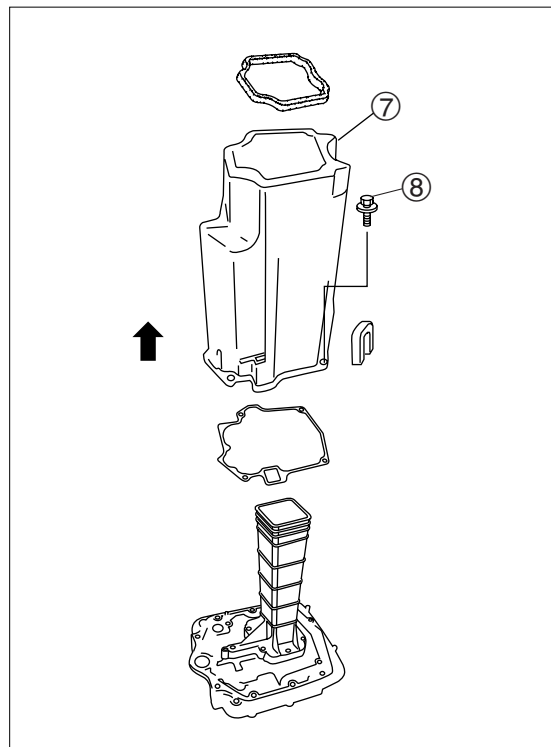
3. When removing drive shaft housing ①, be careful not to lose dowel pin ⑥ for locating engine base ②.



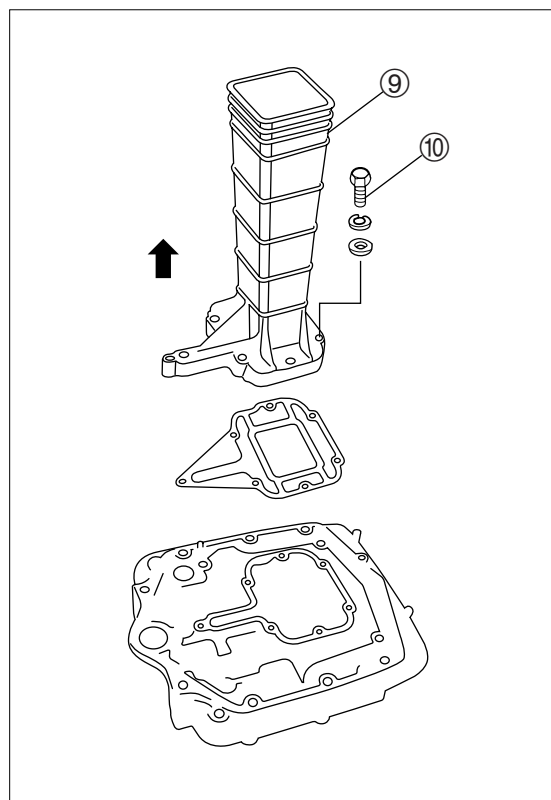


## Cowl, Bracket and PTT Unit

- Loosen and remove bolts ⑧ that secure exhaust housing to engine base and remove exhaust housing ⑦.

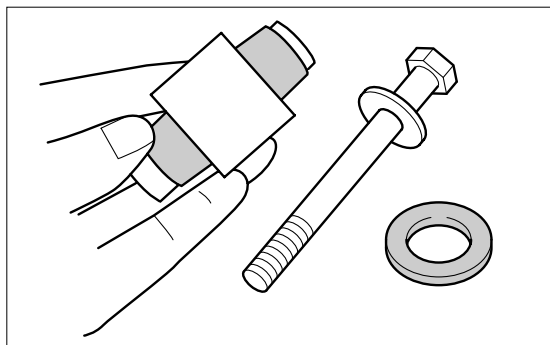


- Loosen and remove bolts ⑩ that secure exhaust pipe ⑨ to engine base and remove exhaust pipe.

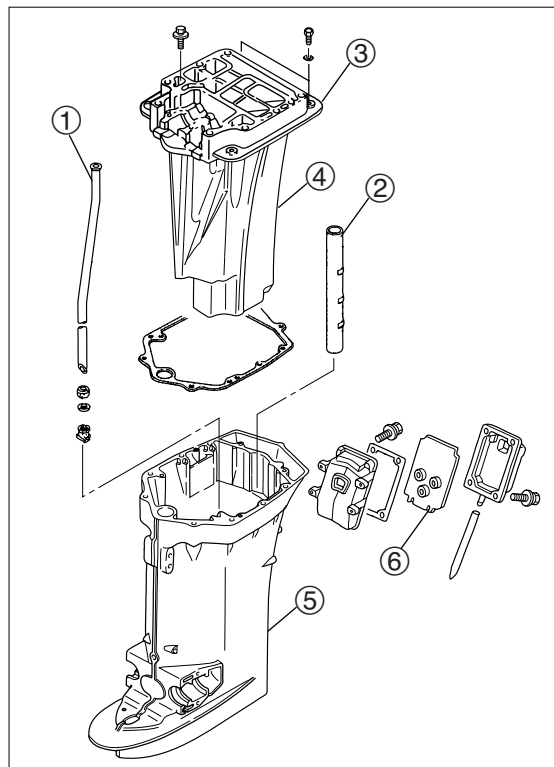


## 6) Inspection of Drive Shaft Housing

1. Check mount rubber and dumper rubber for crack and deterioration. Replace if necessary.



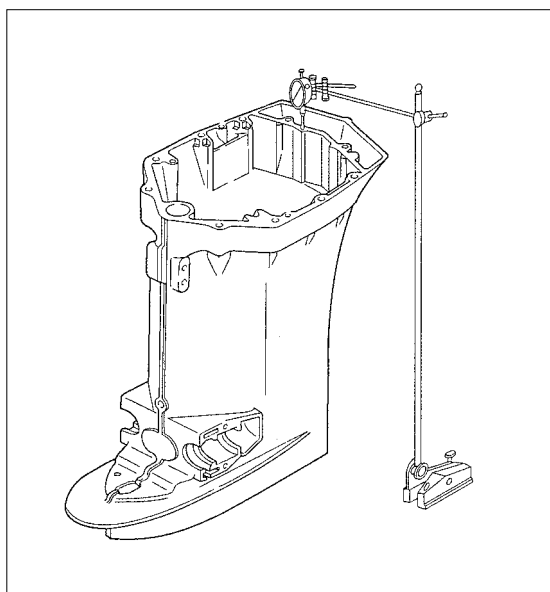
2. Check water pipe ① and reverse gas passage ② for corrosion and deformation. Replace if necessary.
3. Check engine base ③, exhaust housing ④ and drive shaft housing ⑤ for corrosion, and idle exhaust passage ⑥ for damage.



4. Check if drive shaft housing is distorted. Place the housing on the surface plate and use dial gauge to measure distortion on the upper face of the housing. Replace if the difference is over 0.228mm (0.0090in) on each measuring point.

### CAUTION

**Use of distorted drive shaft housing may cause severe wear of drive shaft spline which may lead to damage on the crank shaft spline.**





# Cowl, Bracket and PTT Unit

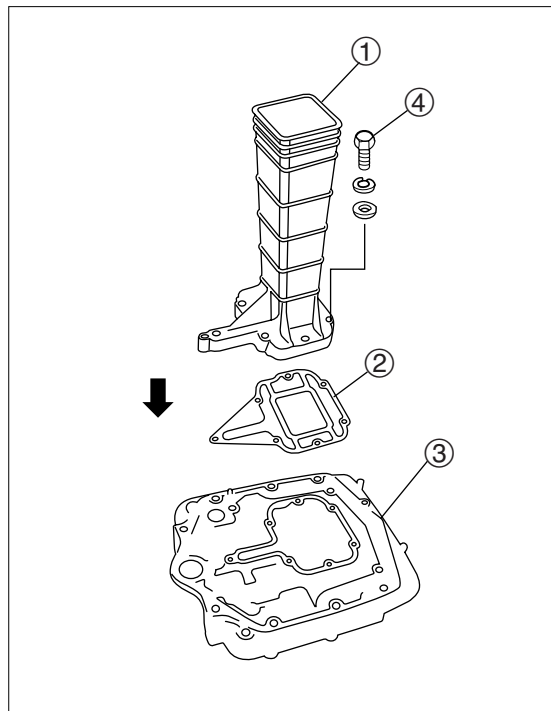
## 7) Assembly of Drive Shaft Housing

1. Install exhaust pipe ① and gasket ② to engine base ③ and tighten bolts ④ to specified torque.



**Exhaust Pipe Bolts ④ :**

11 N · m (8 lb · ft) [1.1 kgf · m]



2. Install exhaust housing grommet ⑤ to exhaust housing ⑥.



When installing the grommet by using adhesive, clean adhering area to remove dirt and oil and dry the area before applying adhesive.



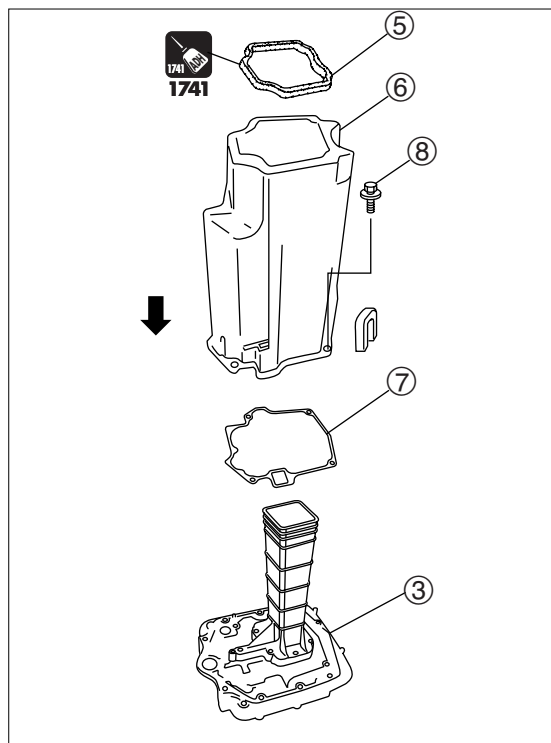
**1741**

3. Install exhaust housing ⑥ and gasket ⑦ to engine base ③ and tighten bolts ⑧ to specified torque.



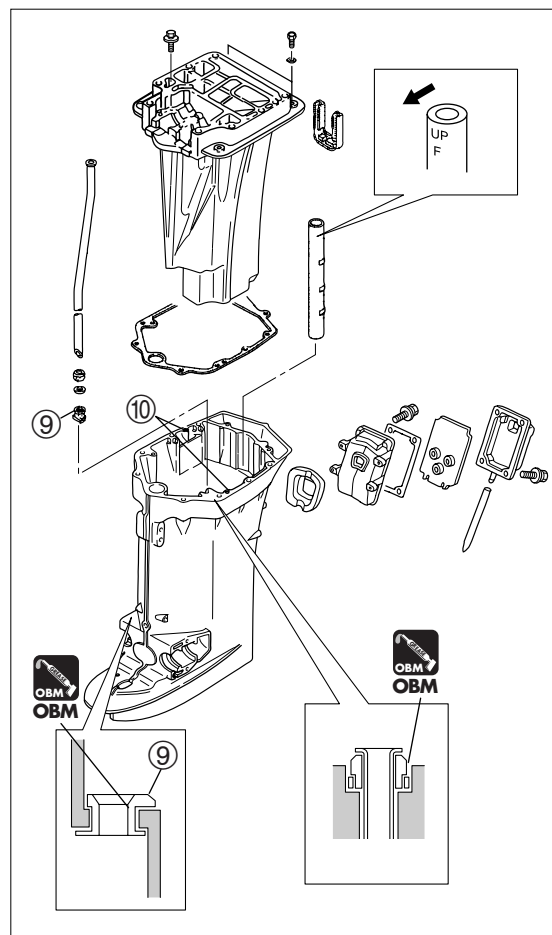
**Exhaust Housing Bolts ⑧ :**

15 N · m (11 lb · ft) [1.5 kgf · m]

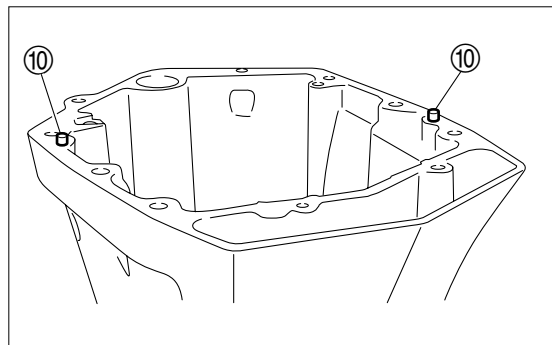
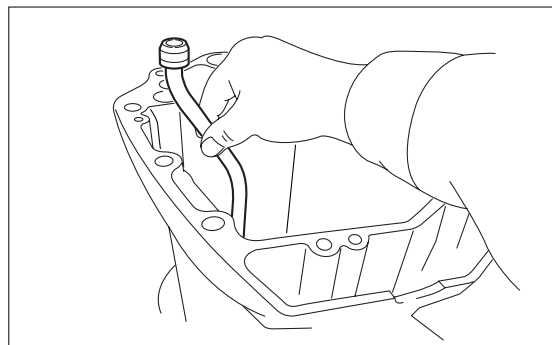




4. Install water pipe auxiliary mount ⑨ to drive shaft housing.



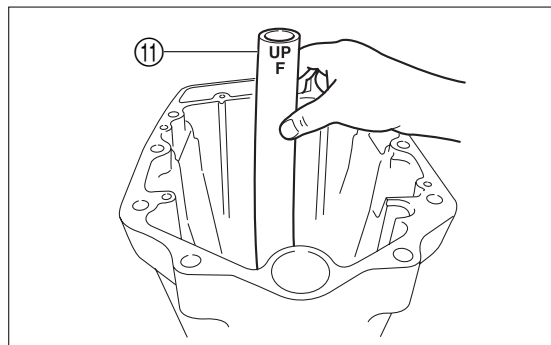
5. Install water pipe to drive shaft housing, and attach gasket after confirming that dowel pins ⑩ are on the drive shaft housing.



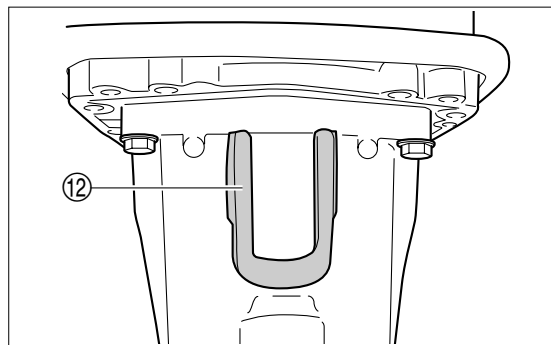


## Cowl, Bracket and PTT Unit

6. Attach reverse gas passage in the drive shaft housing facing “UP” mark of reverse gas passage ⑪ upward and “F” mark forward.



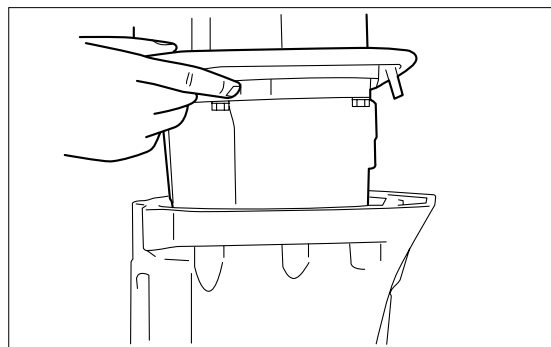
7. Install idle exhaust port grommet ⑫ to exhaust housing.



8. Check that drive shaft housing dowel pin is placed and secured to engine base properly.



Check that water pipe is at joint of engine base.



9. Install engine base to drive shaft housing by tightening installation bolts to specified torque.



**Engine Base Bolts :**

13 N · m (9 lb · ft) [1.3 kgf · m]

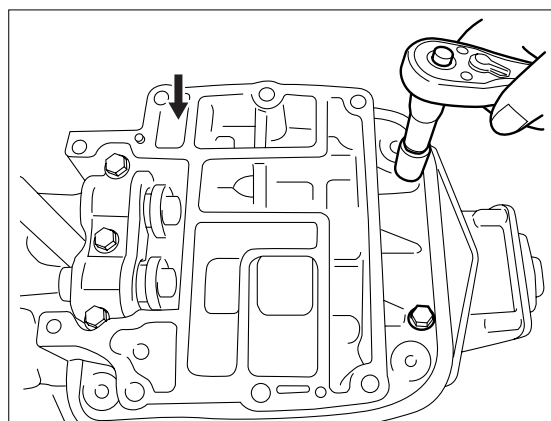


Tighten M6 bolt in the area shown with the arrow to specified torque.



**M6 Bolt :**

6 N · m (4 lb · ft) [0.6 kgf · m]



## 8) Installing Drive Shaft Housing



Drive shaft housing can be supported easily if it is attached at upper mount side first.

1. Install upper mount ① and tighten bolts ② to specified torque.

### ⚠ CAUTION

**Install the mount with the side of smaller size ① facing forward.**



**Upper Rubber Mount Bolts ② :**  
45 N · m (33 lb · ft) [4.5 kgf · m]

2. Install upper mount holding plate ③.
3. Install damper rubber ⑤ to mount bracket ④.

### ⚠ CAUTION

**Install damper rubber with the grooved side ⑤ facing forward.**

4. Put lower rubber mount ⑥ to drive shaft housing and tighten bolts ⑦ and nuts ⑧ to specified torque.

### ⚠ CAUTION

**Install the mount with the side of smaller size ⑥ facing forward.**

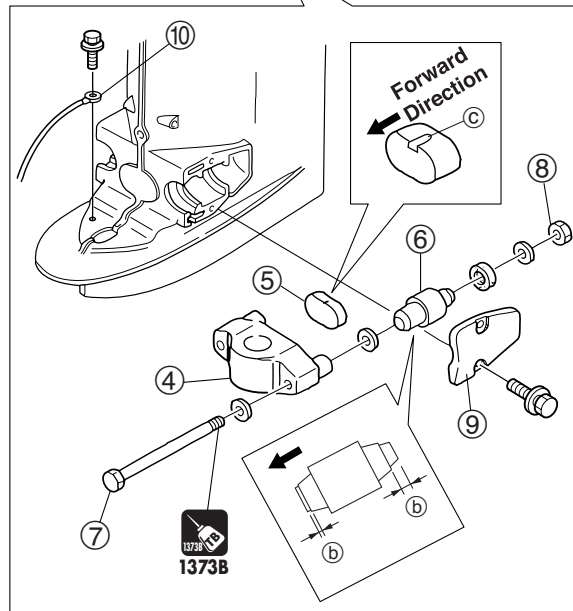
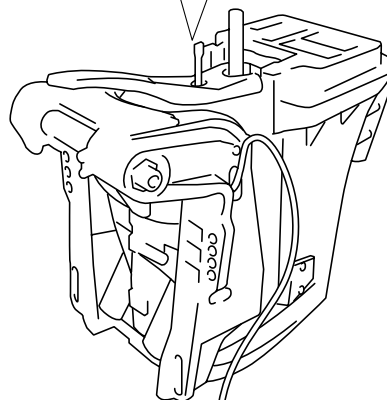
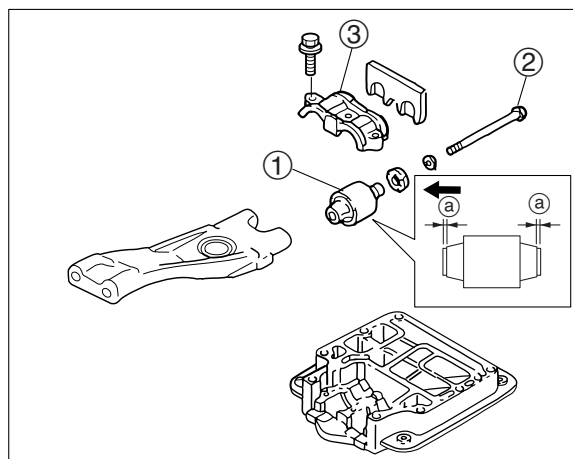


**Lower Rubber Mount Bolt and Nut ⑦ and ⑧ :**  
32 N · m (23 lb · ft) [3.2 kgf · m]



**1373B**

5. Install mount holding plates ⑨.
6. Attach ground wire ⑩.





## Cowl, Bracket and PTT Unit

### 7. Install idle exhaust passage.

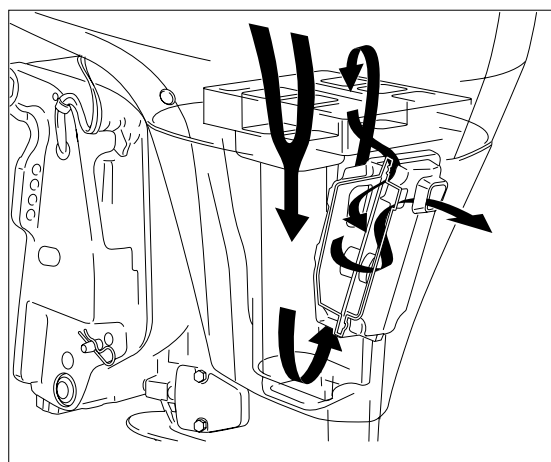
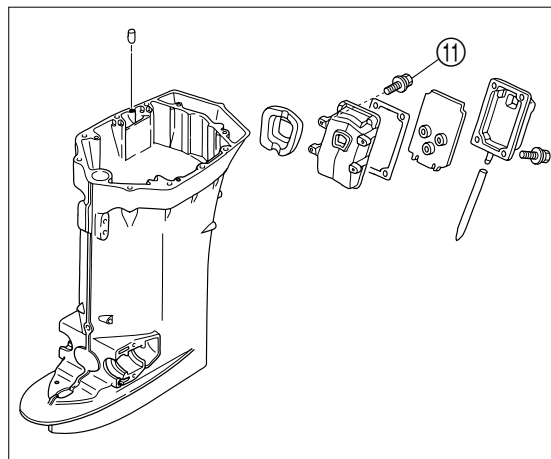
Idle exhaust passage is designed to reduce engine idling noise.

After installing the idle exhaust passage, check that no exhaust gas and cooling water leak through the installation face.



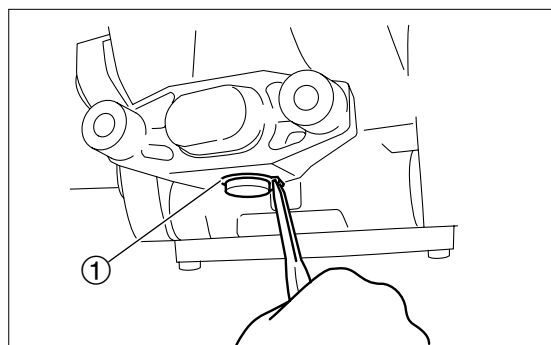
**Idle Exhaust Installation Bolts ⑪ :**

6 N · m (4 lb · ft) [0.6 kgf · m]



## 9) Removing Steering Shaft Arm

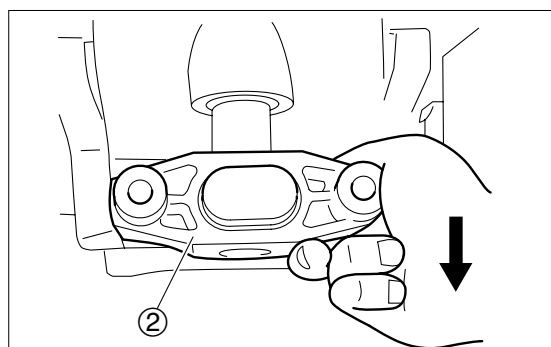
### 1. Remove “C” ring ① that supports mount bracket.



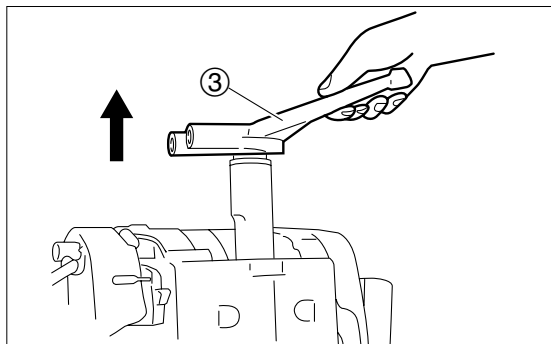
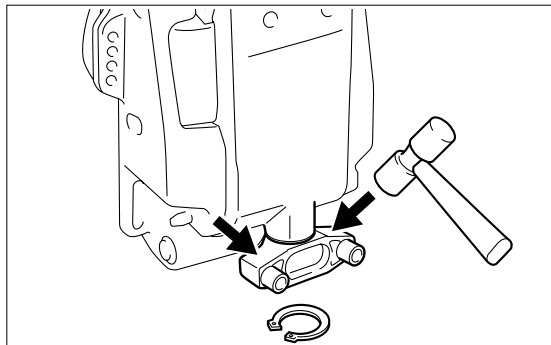
### 2. Remove mount bracket ②.



When mount bracket cannot be removed, tap the bracket at both ends alternately by using a plastic hammer.



3. Pull up steering shaft arm ③ to remove.

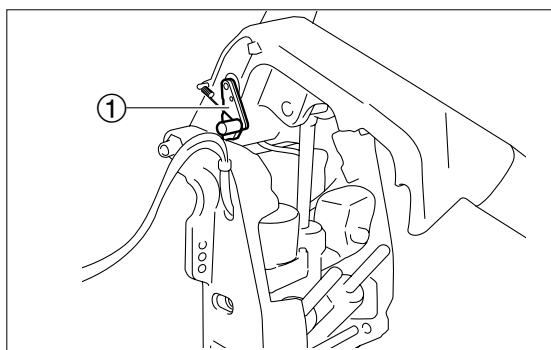


## 10) Removing PTT Unit

1. Fully tilt up outboard motor and lock with tilt stopper ①.

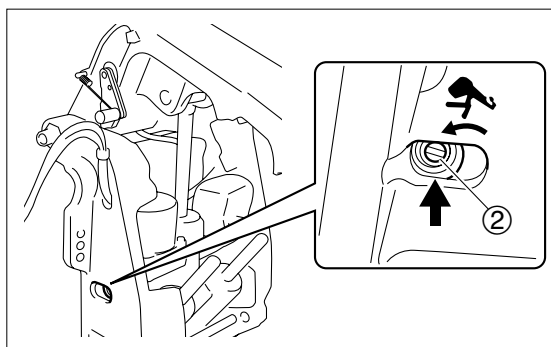
### WARNING

- Be sure to lock outboard motor with tilt stopper after tilting up. Leaving outboard motor up without locking may lead to accidental descent due to reduction of PTT hydraulic pressure.
- When removing PTT unit without removing power unit, hold outboard motor using hoist at tilt up position. Without such means, outboard motor can tilt down, causing danger.



### CAUTION

To prevent O-ring damage, open once fully for releasing oil pressure and then tighten, when closing manual valve.



If PTT unit will not operate, open manual valve and lift up outboard motor with hands. When manual valve is opened, be sure to tighten it with specified torque after tilting up outboard motor.



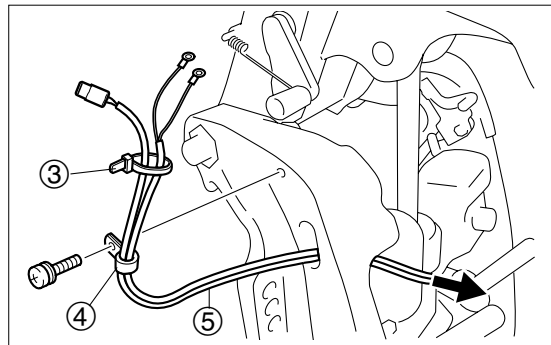
#### Manual Valve ② :

3 N · m (2 lb · ft) [0.3 kgf · m]



## Cowl, Bracket and PTT Unit

2. Remove tie wrap ③ and clamp ④ and draw PTT wires ⑤ to the direction shown.



3. Remove upper cylinder piston stopper washer and bolt, and remove cylinder pin ⑥.



Cylinder pin can be pulled out easier while adjusting trim rod length.



4. Operate PTT unit, to retract tilt rod and trim rods.

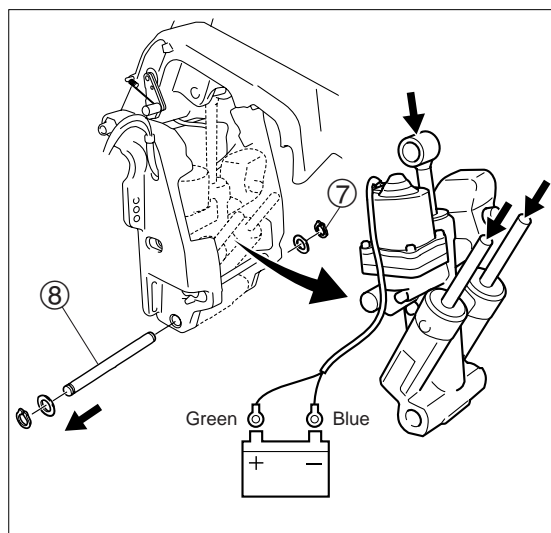
### **⚠ WARNING**

- Check that tilt stopper locks the outboard motor securely.
- Connecting electrical wires to battery terminals may cause sparks to occur. Do not perform this work when inflammable matter is near the working area.

5. Remove “C” ring ⑦ and cylinder pin lower ⑧, and remove PTT unit.

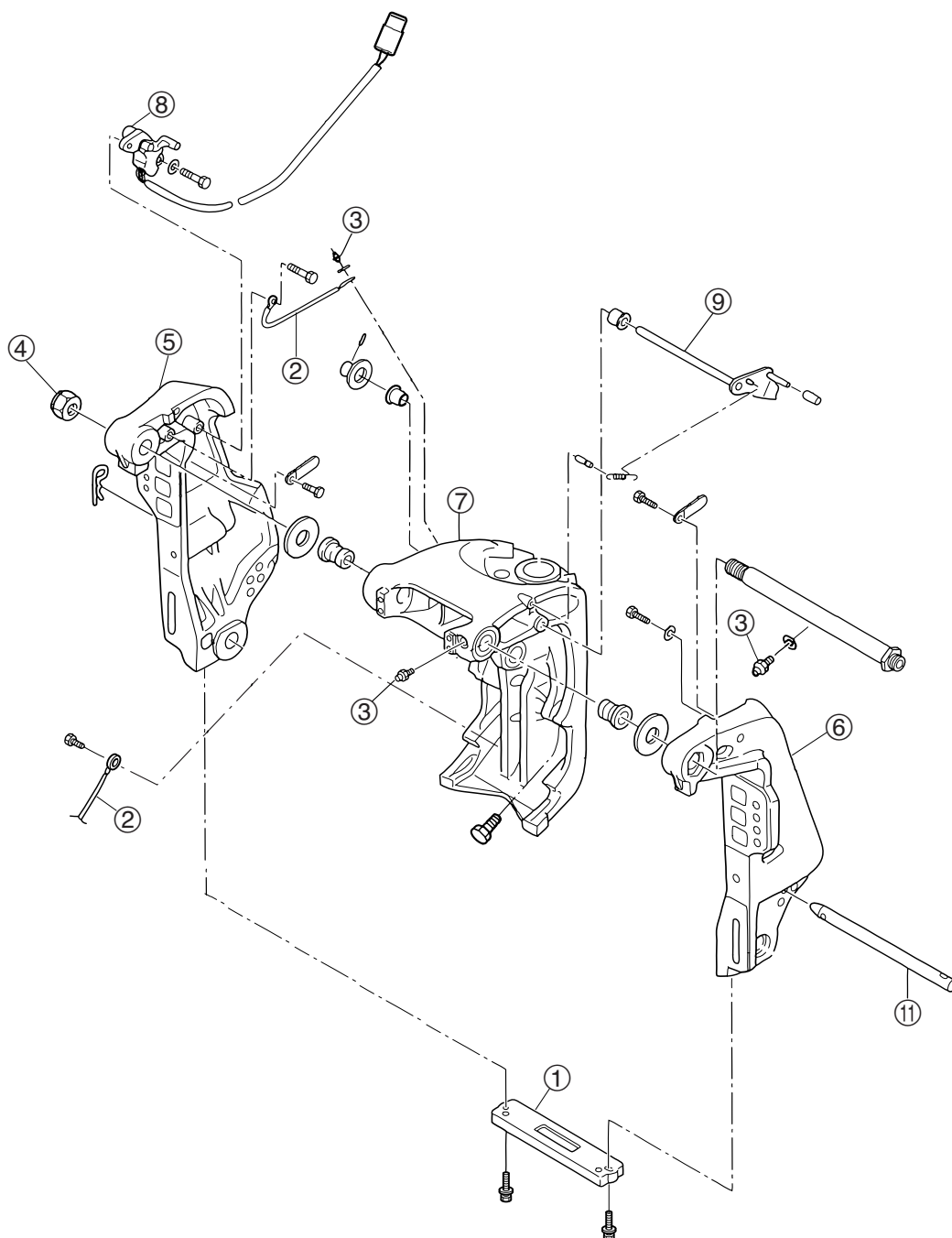
### **⚠ CAUTION**

When pulling out cylinder pin lower ⑧, use a hand to hold PTT and another hand to pull out pin.



## 11) Removing Clamp Bracket

1. Remove anode ①.
2. Remove ground wire ② and grease nipple ③.
3. Remove thrust rod ⑪.
4. Loosen nylon nut ④, and separate clamp brackets ⑤ and ⑥ and swivel bracket ⑦ from each other.
5. Remove trim sensor ⑧.
6. Remove tilt stopper ⑨.





# Cowl, Bracket and PTT Unit

## 12) Assembly of Clamp Bracket

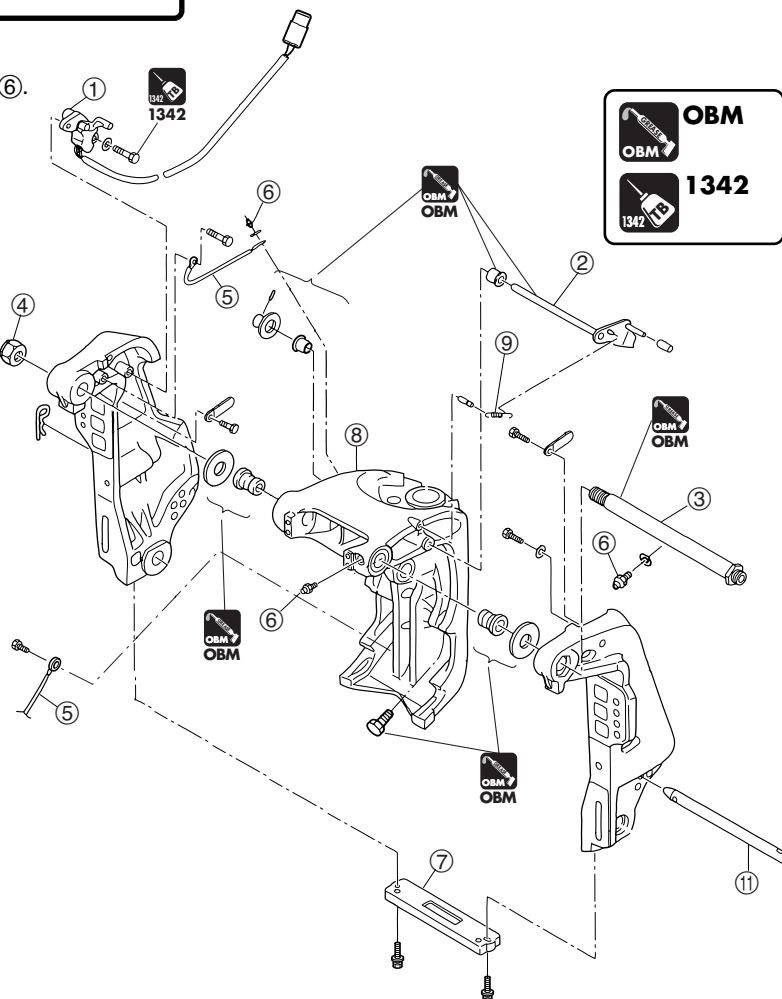
1. Install trim sensor ① to clamp bracket.
2. Install tilt stopper ② and tilt stopper spring ⑨ to swivel bracket ⑧.
3. Run swivel shaft ③ through clamp brackets, swivel bracket, bushing and washer, and tighten nylon nut ④ to specified torque.



**Nylon Nut ④ :**

25 N · m (18 lb · ft) [2.5 kgf · m]

4. Attach ground wire ⑤ and grease nipple ⑥.
5. Attach anode ⑦.



## 13) Installation of PTT Unit

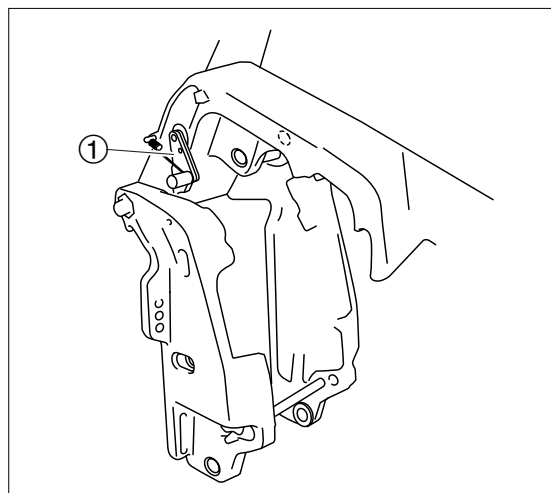
1. Fully tilt up outboard motor and lock with tilt stopper ①.



**WARNING**

**Check that tilt stopper lock the outboard motor securely.**

2. Retract tilt rod and trim rods.
3. Attach bushings to PTT (lower) and clamp bracket.
4. Install cylinder pin lower ② and secure it with "C" ring ③.





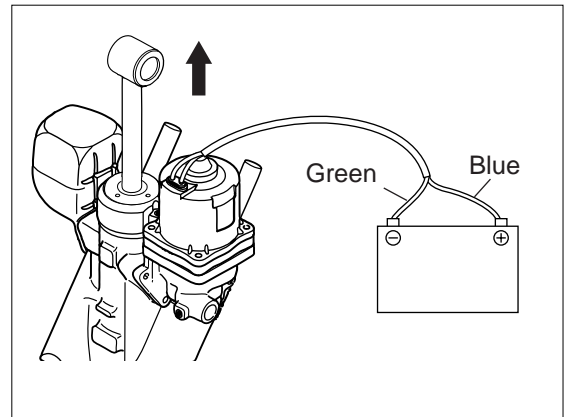
5. Attach bushings to PTT (upper) and swivel bracket.
6. Extend tilt rod until PTT tilt rod hole aligns with swivel bracket hole.

**⚠ WARNING**

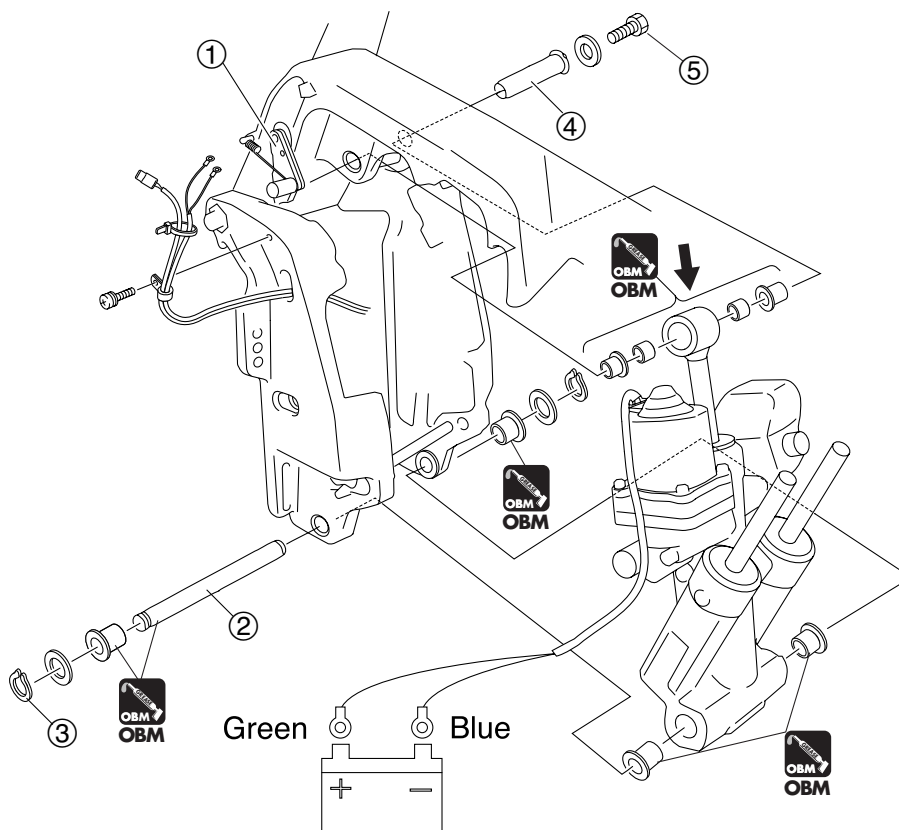
**Connecting electrical wires to battery terminals may cause sparks to occur. Do not perform this work when flammable matter is near the working area.**



- Connect blue lead to battery positive terminal to extend tilt rod.
- Connect green lead to battery positive terminal to retract tilt rod.



7. Install cylinder pin upper ④ and secure with bolt ⑤.
8. Run PTT and trim sensor leads through clamp bracket hole and collect them using wire clamp and tie strap.





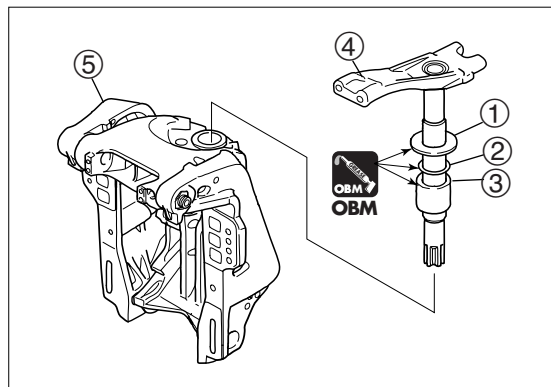
# Cowl, Bracket and PTT Unit

## 14) Assembly of Steering Arm

1. Put thrust plate ①, seal ring ② and bushing ③ on the steering shaft ④, and install the steering shaft from above.



OBM



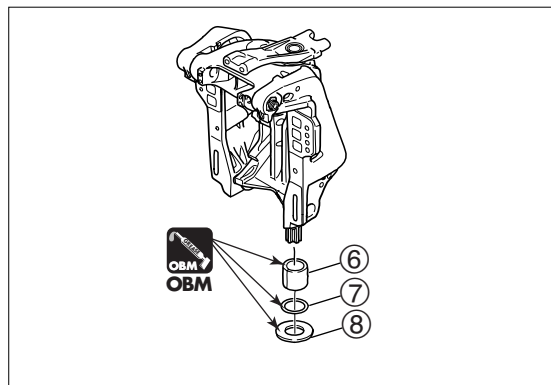
2. Put bushing ⑥, O ring ⑦ and thrust plate ⑧ on the shaft.



Be sure to put bushing ⑥ fully to the end on the steering shaft.



OBM



3. Install mount bracket ⑨.

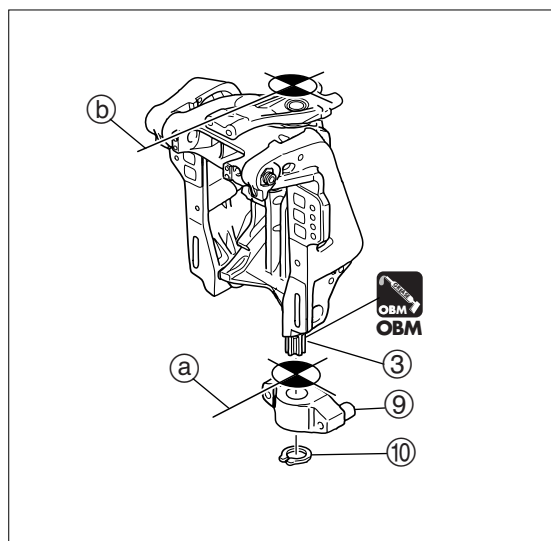
### ⚠ CAUTION

**When installing mount bracket ⑨, make center line ① of mount bracket parallel with center line ② of steering arm.**



OBM

4. Attach "C" ring ⑩.
5. Grease through grease nipple.
6. Install ground cable.



## 15) Removing PTT Motor

### ⚠ WARNING

- Connecting electrical wires to battery terminals may cause sparks to occur. Do not perform this work when flammable matter is near the working area.
- Before removing PTT motor, fully extend trim rods and tilt arm to prevent the fluid from spurting due to internal pressure.
- When removing tilt motor from PTT unit, do not push down trim rod or tilt arm. Doing so causes fluid to spurt.

### ⚠ CAUTION

- Check that tilt rod and trim rods are fully extended.
- Disassembling the unit with the rods retracted causes the hydraulic fluid to spurt.
- When working on the PTT unit, tilt down the outboard motor to vertical position.

1. Operate PTT unit to fully extend tilt rod and trim rods.
2. Remove PTT motor ②, O ring ③ and gear pump filter ④ from pump ①.
3. Clean or replace gear pump filter ④ if it is clogged or damaged.

4. Move lead holder ① and rubber spacer ② away from stator ③, and remove stator ③.

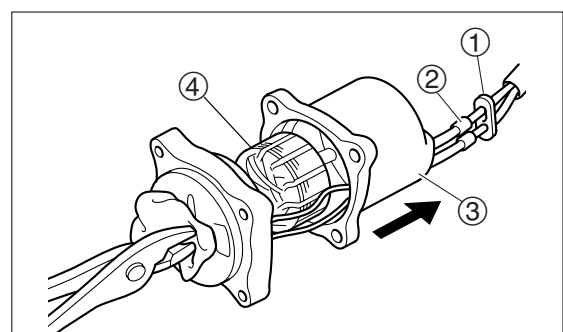
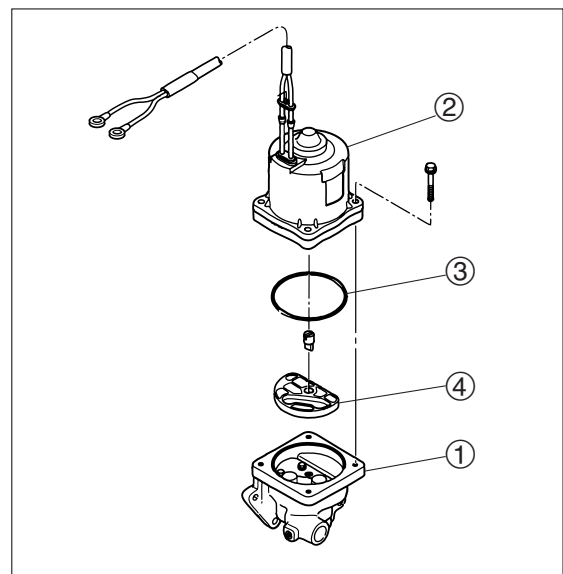
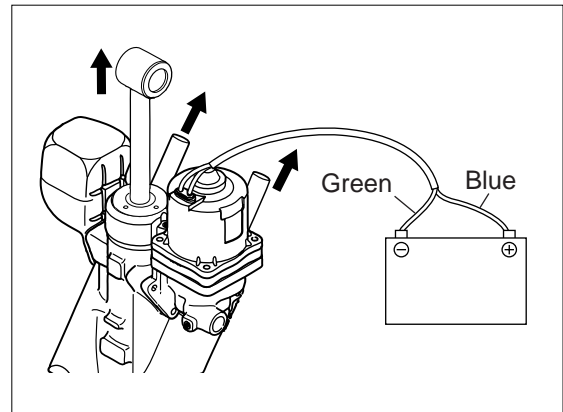


- Remove tape of lead wires, move protection tube and then, push lead wires into stator to make removal of motor base easier.
- Cover armature shaft end with clean cloth, hold the shaft using a pair of pliers, and remove armature ④ from stator carefully.

5. Remove armature from PTT motor base.



- Do not apply grease or oil to commutator.



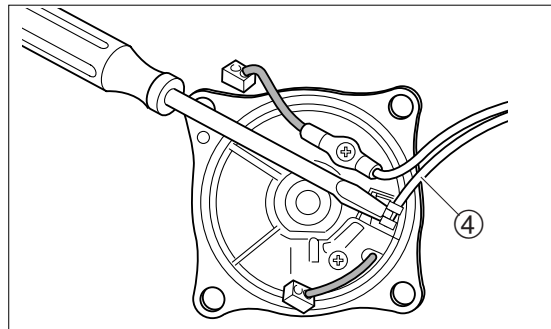


# Cowl, Bracket and PTT Unit

6. Disconnect PTT motor lead wire ④.



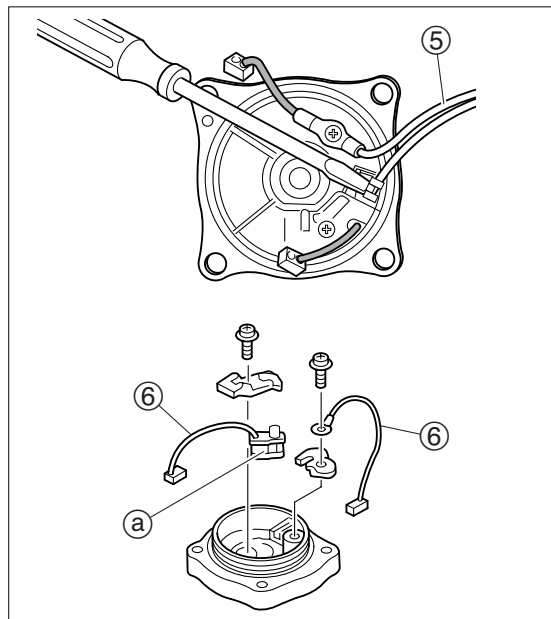
Hold the plug with a bladed screw driver and pull out PTT motor lead.



7. Remove screw, disconnect PTT motor lead ⑤, and then, remove brushes ⑥.

## ⚠ CAUTION

**Do not touch bi-metal ①. Doing so affects operation of circuit breaker.**

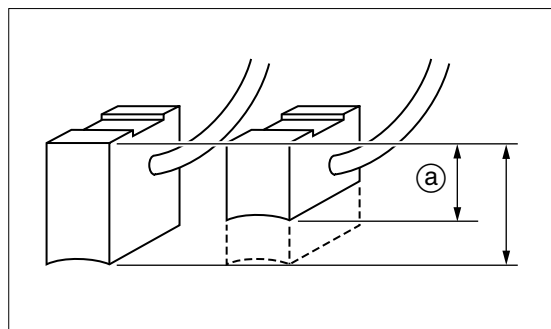


## 16) Inspection of PTT Motor

1. Measure brush length.  
Replace if it is less than specified value.



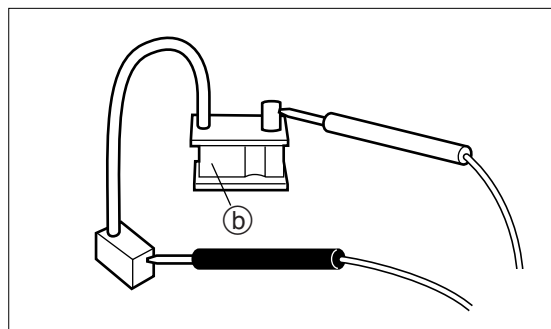
**Brush Wear Limit ① :**  
4.8 mm (0.19 in.)



2. Check electrical conductivity of brush and circuit breaker.  
Replace if not conductive.

## ⚠ CAUTION

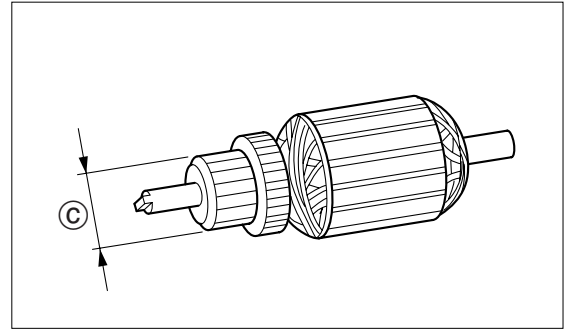
**Do not touch bi-metal ②. Doing so affects operation of circuit breaker.**



3. Measure diameter of commutator.  
Replace if the following specification is not met.



**Lower Limit of Commutator Diameter ③ :**  
21.0 mm (0.83 in.)

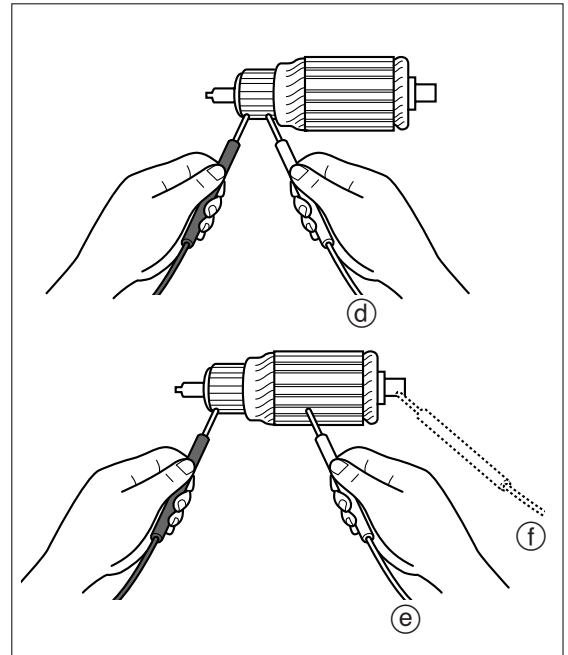


4. Check electrical conductivity of armature.  
Replace if any of the following conditions is not met.



**Armature Conductivity**

Commutator	Conductive
Commutator ④ - Armature Core ⑤	Not Conductive
Commutator ④ - Armature Shaft ⑥	Not Conductive



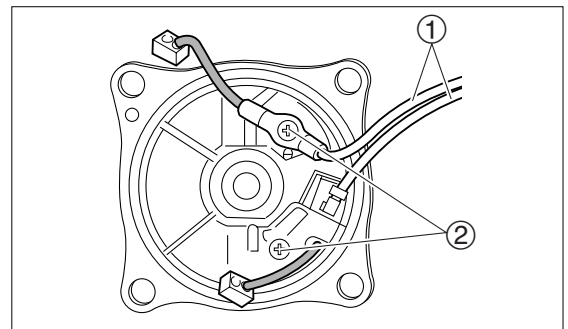
5. Check the base for crack and damage, and replace if necessary.
6. Check bearing and oil seal for damage, and replace if necessary.

**⚠ CAUTION**

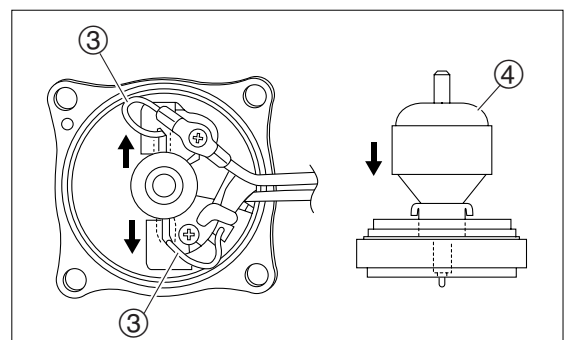
**When bearing or oil seal is removed, replace it with new one.**

## 17) Assembly of PTT Motor

1. Connect PTT motor leads ① and secure them with screws ②.



2. Put brushes ③ into brush holders, and attach armature ④.



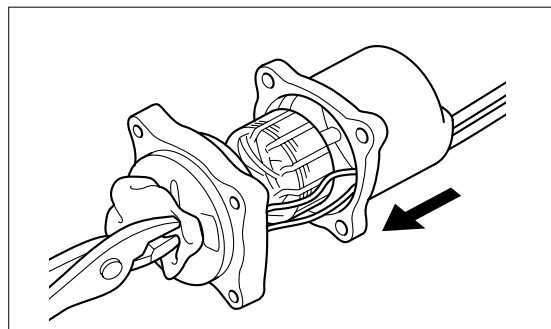


# Cowl, Bracket and PTT Unit

3. Install stator to base.



- Cover armature shaft end with clean cloth, hold the shaft using a pair of pliers, and install armature to stator carefully.
- Assemble lead holder and spacer, pull lead wires carefully, move protection tube back to original position, and then, tie lead wires by using tape.



## 18) Removing Reservoir

### ⚠ WARNING

- Before removing PTT motor, fully extent trim rods and tilt arm to prevent the fluid from spurting due to internal pressure.
- When removing tilt motor from PTT unit, do not push down trim rod or tilt arm. Doing so causes fluid to spurt.

### ⚠ CAUTION

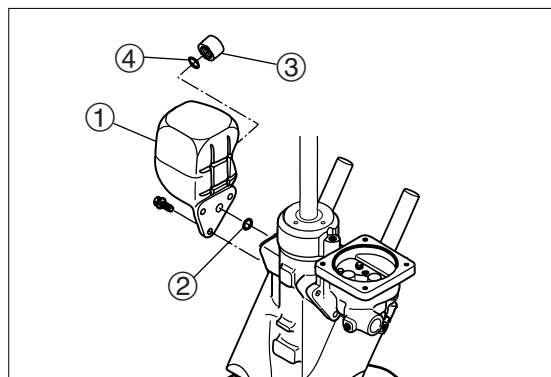
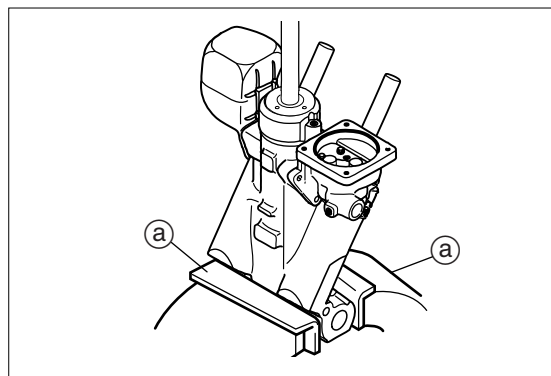
- When working on the PTT unit, tilt down the outboard motor to vertical position.
- Check that tilt rod and trim rods are fully extended.
- Disassembling the unit with the rods retracted causes the hydraulic fluid to spurt.
- Do not use rag or paper to clean the hydraulic system.
- Using rag or paper causes the fiber to remain on the unit, causing malfunction.

1. Put an aluminum plate on each side of (a) vise as shown, and hold PTT unit with the vise.



Place a vessel below PTT unit to catch PTT fluid if it is spilt.

2. Remove reservoir ① and O ring ②.
3. Drain PTT fluid from reservoir, and check the interior for damage.  
Replace if necessary.
4. Check reservoir cap ③ and O ring ④ and replace if necessary.



## 19) Disassembly and Assembly of Gear Pump

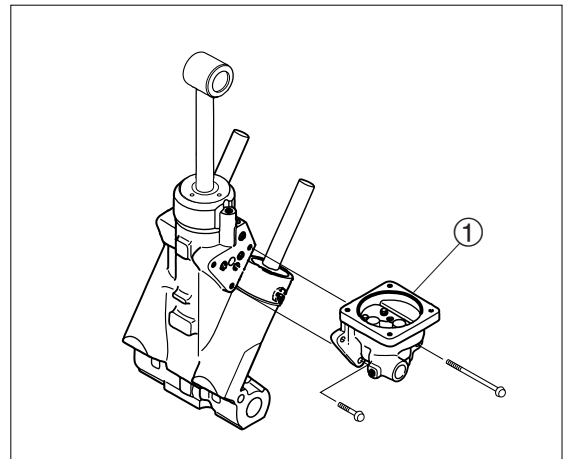
1. Remove gear pump ①.

### ⚠ CAUTION

**Confirm the order of assembling of valve seat ass'y, valve pin and O ring when disassembling.**



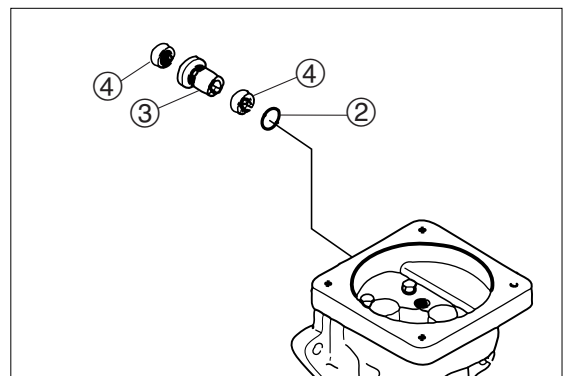
Before removing, loosen manual valve to release hydraulic pressure.



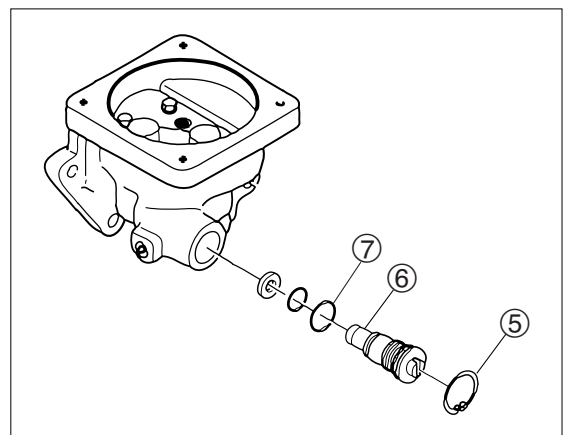
2. Remove O ring ②, down relief valve ③ and filter ④ from gear pump.

### ⚠ CAUTION

**Remove the back filter using compressed air, being careful not to blow the filter out abruptly.**



3. Remove "C" ring ⑤, and then, manual valve ⑥.
4. Attach a new O ⑦ ring to down relief valve ③.

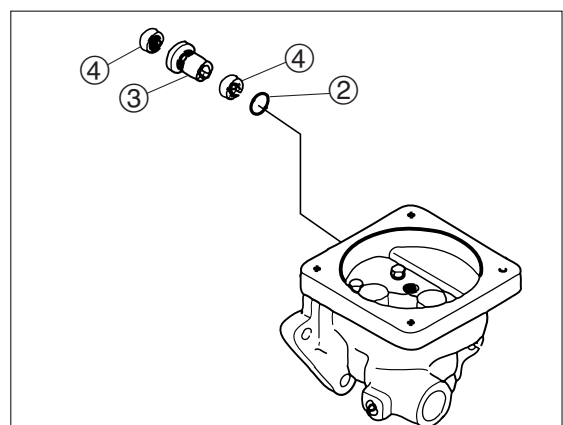


5. Attach filter ④ to down relief valve ③, and put the filter assembly ④ in the gear pump.
6. Attach new O ring ② to manual valve.
7. Install manual valve to gear pump and secure it with "C" ring.



### Manual Valve :

3 N · m (2.2 lb · ft) [0.3 kgf · m]





# Cowl, Bracket and PTT Unit

## 20) Disassembly of Tilt Cylinder and Trim Cylinder

### ⚠ CAUTION

**When removing tilt cylinder rod guide, fully extend trim rods and tilt arm.**

1. Loosen and remove tilt cylinder rod guide ② by using trim rod guide wrench ① and remove tilt piston ass'y.



**Trim Rod Guide Wrench ① :**  
P/N. 3C8-72791-1

2. Drain PTT fluid.
3. Loosen and remove trim cylinder rod guide ④ by using trim rod guide wrench ③ and remove trim piston ass'y.



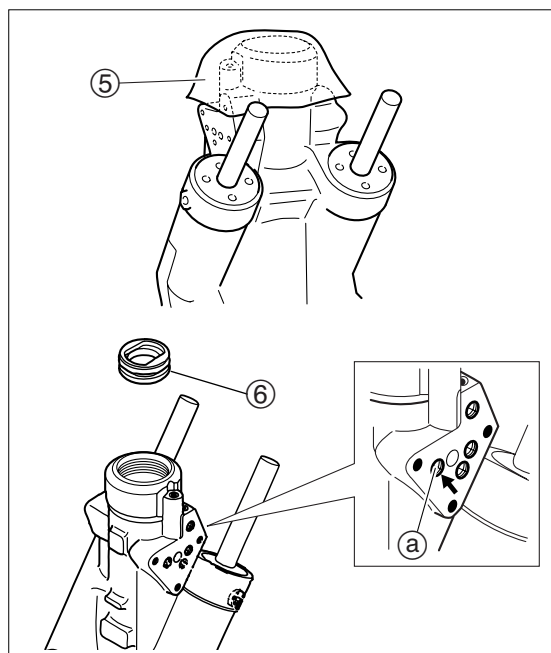
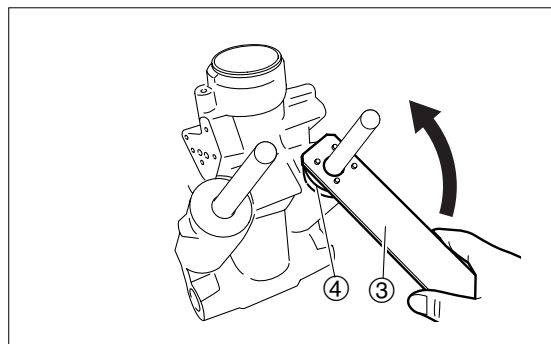
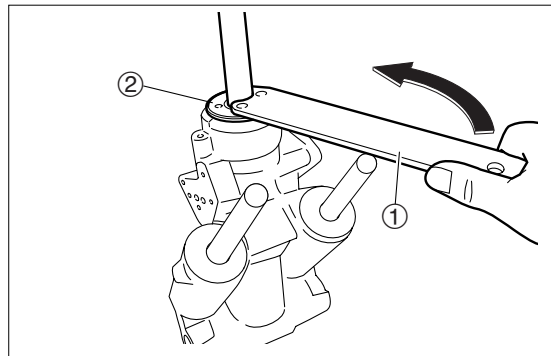
**Trim Rod Guide Wrench ③ :**  
P/N. 3B7-72792-0

4. Drain PTT fluid.
5. Install piston ass'y and temporary tighten trim cylinder rod guide.
6. Cover tilt cylinder opening with clean cloth ⑤ and apply compressed air from hole (a) to remove free piston ⑥.

### ⚠ WARNING

**Do not look into tilt cylinder opening because free piston or power trim fluid may fly out of the opening due to the internal pressure.**

7. Loosen tilt cylinder rod guide and take out trim piston ass'y.





## 21) Assembly of PTT Unit

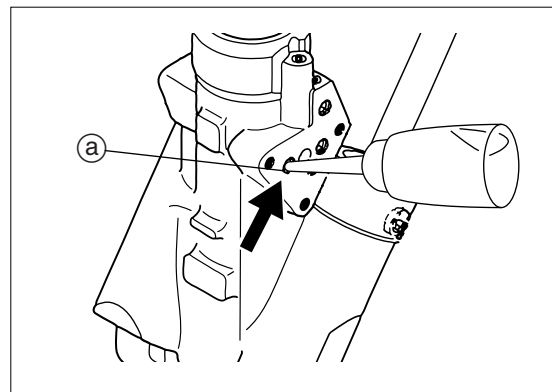
1. Put recommended PTT fluid into the unit through hole ①.



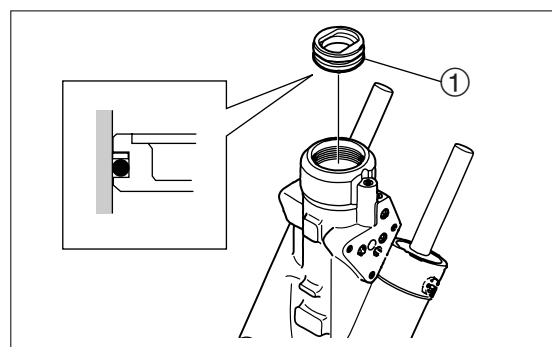
### Recommended PTT Fluid:

ATF DEXRON III

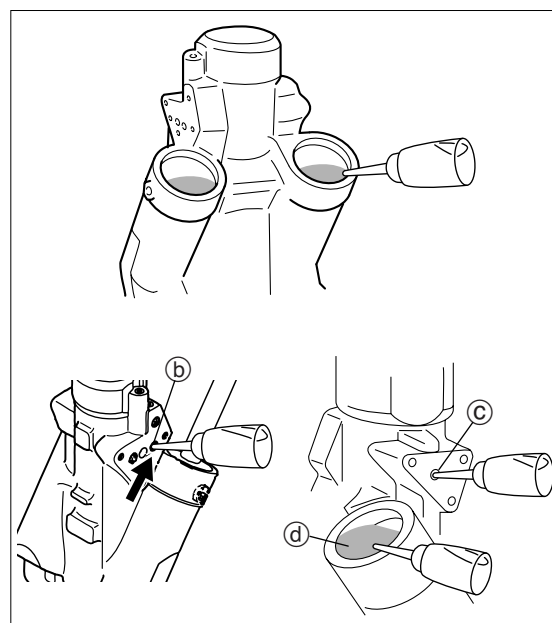
682 cm<sup>3</sup> (23.0 floz.)



2. Push free piston ① into tilt cylinder unit fully to the bottom.



3. Fill with PTT fluid from ②, ③, and ④ to a proper level.



4. Install trim piston ass'y to trim cylinder, and tighten trim rod guide ② to specified torque.

### ⚠ CAUTION

- When installing, check that trim rods are fully extended.
- After installing trim piston ass'y, do not push trim rod. Doing so will cause fluid to spurt.



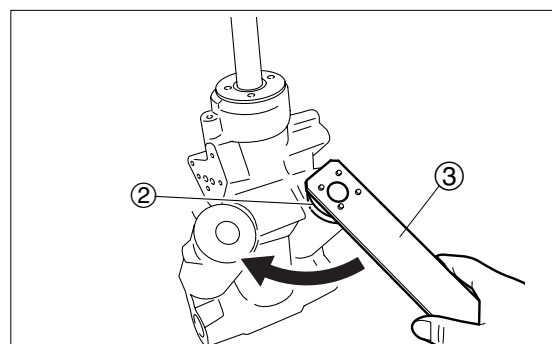
### Trim Rod Guide ② :

80 N · m (58 lb · ft) [8.0 kgf · m]



### Trim Rod Guide Wrench ③ :

P/N. 3B7-72792-0





# Cowl, Bracket and PTT Unit

5. Attach new O ring (4), valve pin (5) and valve seat ass'y (6) to tilt cylinder.

6. Install gear pump (7).



**Gear Pump Installation Bolts :**  
9 N · m (7 lb · ft) [0.9 kgf · m]

7. Put O ring on the reservoir cap.

8. Install reservoir (8), and put O ring on the gear pump.



**Reservoir Mount Bolts :**  
5 N · m (4 lb · ft) [0.5 kgf · m]

9. Put PTT fluid in the tilt cylinder through hole (a) to a proper level.

10. Install tilt piston to cylinder, and tighten tilt rod guide (9) to specified torque.

## ⚠ CAUTION

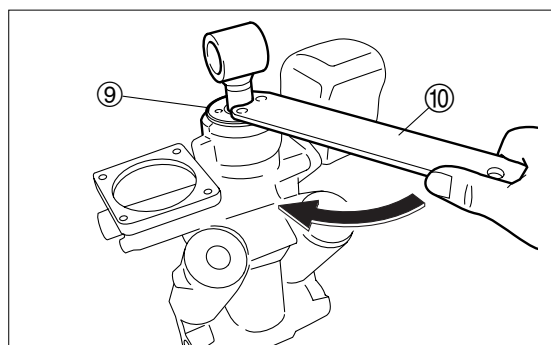
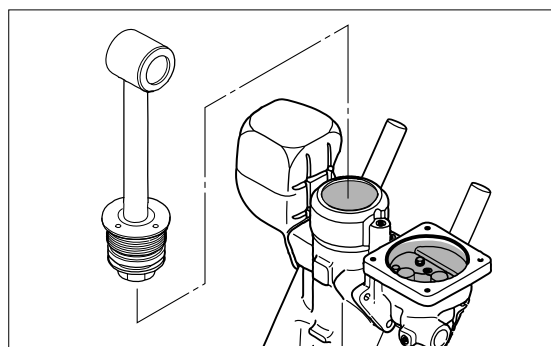
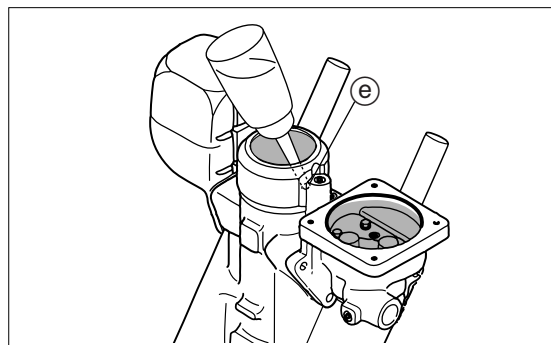
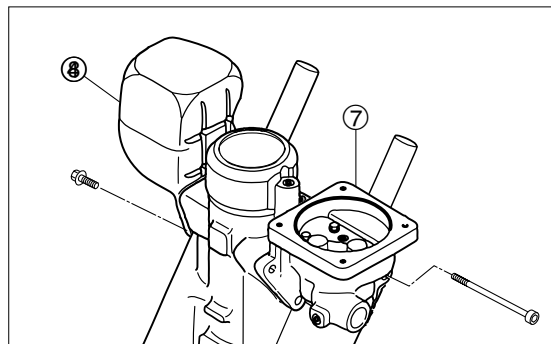
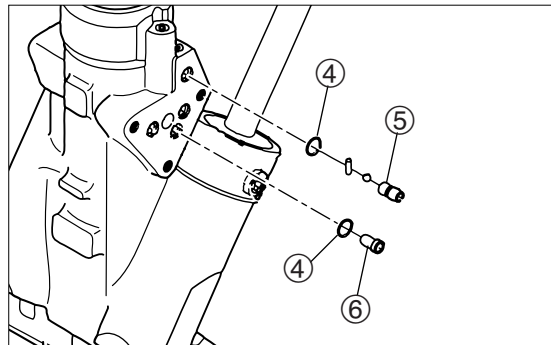
- When installing, check that tilt rod is fully extended.
- After installing tilt piston, do not push tilt rod. Doing so will cause fluid to spurt.



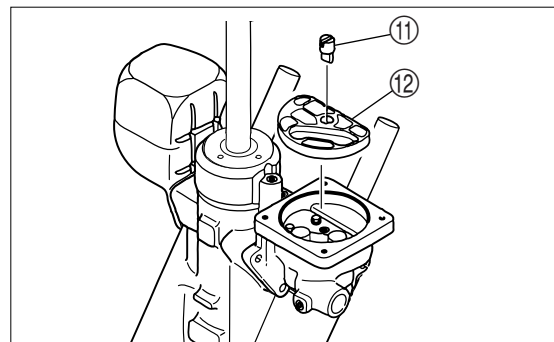
**Tilt Rod Guide (9) :**  
130 N · m (94 lb · ft) [13.0 kgf · m]



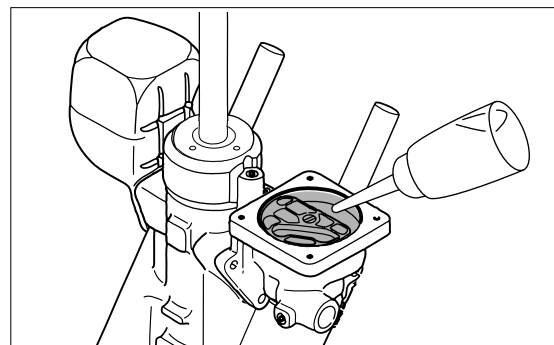
**Trim Rod Guide Wrench (10) :**  
P/N. 3C8-72791-1



11. Attach joint ⑪ and gear pump filter ⑫ to gear pump.



12. Fill gear pump with PTT oil to a proper level.



13. Remove air bubbles by using a means such as a syringe.

14. Install O ring ⑬ and PTT motor ass'y ⑭, and tighten bolts ⑮ to specified torque.

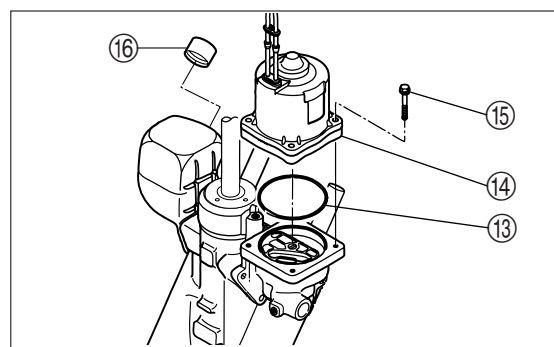
**⚠ CAUTION**

**Engage armature shaft joint groove with the shaft of pump.**



**PTT Motor Ass'y Installation Bolts ⑮ :**

4 N · m (3 lb · ft) [0.4 kgf · m]



15. Remove reservoir cap ⑯ and check PTT fluid level.

**⚠ CAUTION**

**The fluid quantity is acceptable if the fluid level is at the top of the filter hole.**

16. Add fluid until filter hole is filled if necessary.

17. Tighten reservoir cap ⑯ to specified torque.



**Reservoir Cap :**

7 N · m (5 lb · ft) [0.7 kgf · m]

18. Air Bleed from PTT unit.

Refer to page 7-40 in Chapter 7



# Cowl, Bracket and PTT Unit

## 22) Air Bleeding PTT Unit

1. Turn manual valve ① clockwise to tighten.
2. Set PTT unit upright.
3. Remove reservoir cap and check PTT fluid level.

### ⚠ CAUTION

**If the fluid level is correct, the fluid should overflow out of the filter hole when the reservoir cap is removed.**

4. Add fluid until filter hole is filled if necessary.



**PTT Fluid :**  
ATF DEXRON III

5. Tighten reservoir cap to specified torque.



**Reservoir Cap :**  
7 N · m (5 lb · ft) [0.7 kgf · m]

6. Connect PTT motor leads to battery terminals to retract power trim and tilt rods.

Rod	PTT Motor Lead	Battery Terminal
DOWN	Green	⊕
	Blue	⊖

### ⚠ WARNING

**Connecting electrical wires to battery terminals may cause sparks to occur. Do not perform this work when flammable matter is near the working area.**

7. Reverse the motor lead connections to fully extend the rods.

Rod	PTT Motor Lead	Battery Terminal
UP	Blue	⊕
	Green	⊖

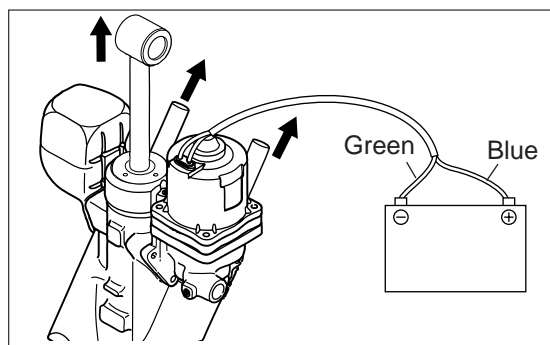
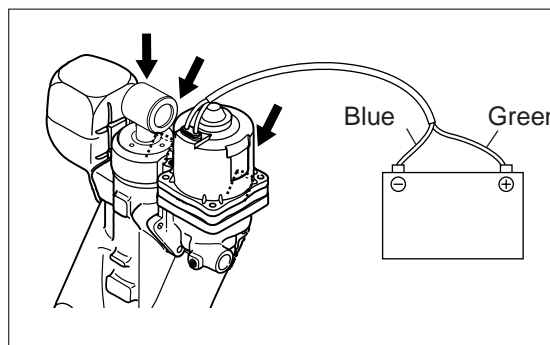
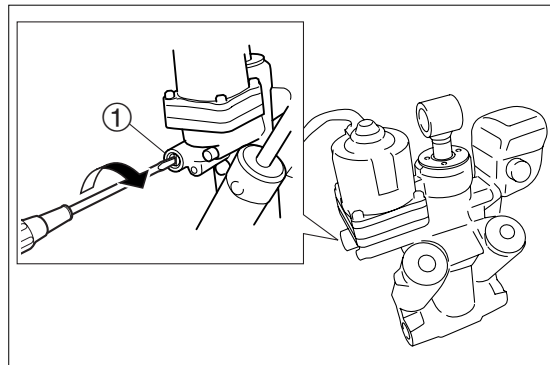
### ⚠ CAUTION

- Repeat these steps several times to retract and extend the rods.  
(Take time between the steps to assure this process.)
- If the rods cannot extend and retract well, assist the motion with hand.

8. Fully extent tilt rod and check fluid level.  
Add fluid if necessary.



After bleeding air, take time to settle the fluid, and then, perform air bleeding again.

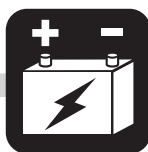




# 8



## Electrical System



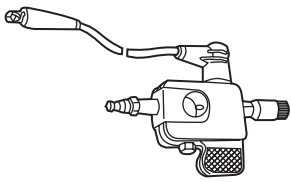
<b>1. Special Tools</b> .....	8-2	13) Inspection of Rectifier Complete	8-14
<b>2. Parts Layout</b> .....	8-3	14) Inspection of Throttle Position Sensor	8-15
Starter Motor .....	8-3	15) Inspection of Water Temperature Sensor	8-15
<b>3. Inspection Items</b> .....	8-4	16) Inspection of Power Relay	8-15
1) Disassembly of Starter Motor .....	8-4	17) Inspection of Air Injectors	8-16
2) Inspection of Armature	8-7	18) Inspection of Fuel Injectors	8-16
3) Inspection of Brushes	8-8	19) Inspection of MAT sensor (Manifold	
4) Inspection of Starter Motor Pinion	8-8	Temperature Sensor) (Option)	8-16
5) Inspection of Magneto Switch	8-8	20) Inspection of MAP Sensor (Manifold	
6) Assembly of Starter Motor	8-9	Absolute Air Pressure Sensor) (Option)	8-16
7) Inspection of Ignition and spark	8-11	21) Inspection of Starter Solenoid	8-17
8) Inspection of Plug Cap	8-11	22) Inspection of Oil Level Sensor	8-17
9) Inspection of Ignition Coils	8-12	23) Inspection of Oil Pump	8-17
10) Inspection of Pick Up Coil		24) Inspection of Fuel Feed Pump (FFP)	8-18
(Crank Position Sensor)	8-12	25) Inspection of PTT Solenoid	8-18
11) Inspection of Pick Up Coil Air Gap	8-12	26) Inspection of PTT Switch	8-19
12) Inspection of Alternator	8-13		



# Electrical System

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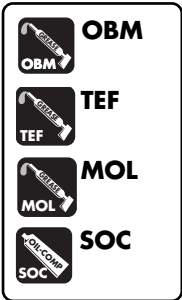
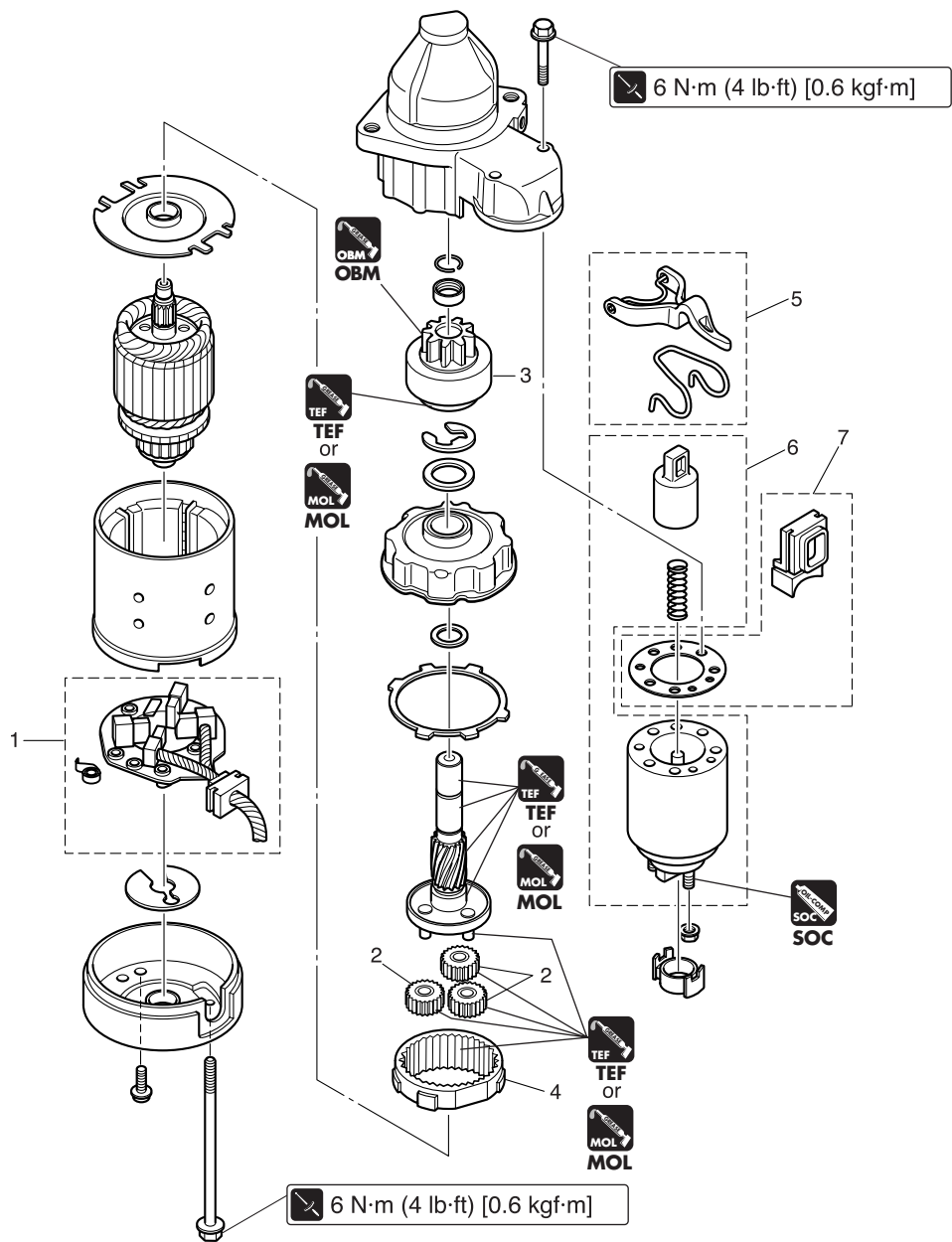
## 1. Special Tools

	
Spark Tester P/N. 3F3-72540-0	
Checking sparks	

## 2. Parts Layout

### Starter Motor

P/L Fig. 12



Ref. No.	Description	Qty	Remarks
1	Brush Holder	1	
2	Internal Gear	3	
3	Pinion Ass'y	1	
4	Planet Gear	1	
5	Shift Lever Set	1	
6	Magnetic Switch	1	
7	Dust Cover Set	1	



# Electrical System

## 3. Inspection Items

### 1) Disassembly of Starter Motor

1. Remove starter motor from power unit.  
Refer to "Removing Starter Motor" in chapter 5.
2. Loosen M8 nut ① of magneto switch terminal, and then, remove motor lead.
3. Loosen bolts ③ (M5, 2 pcs.) of starter motor rear cover ②, and then, remove the cover.



Take care not to give damage to permanent magnets of yoke when pulling out armature.

4. Loosen screws ④ (M4, 2 pcs.) of starter motor rear cover, and then, remove armature.

#### ⚠ CAUTION

**Take care not to lose thrust washers that are located on the bottom of metal bearing of rear cover.**



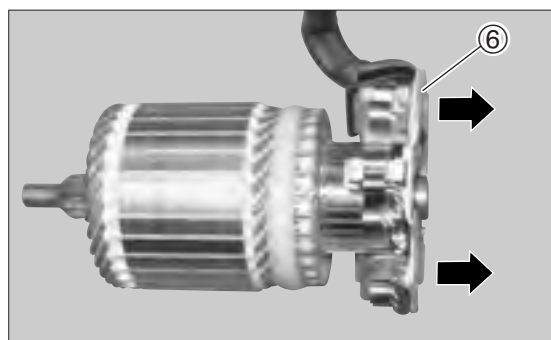
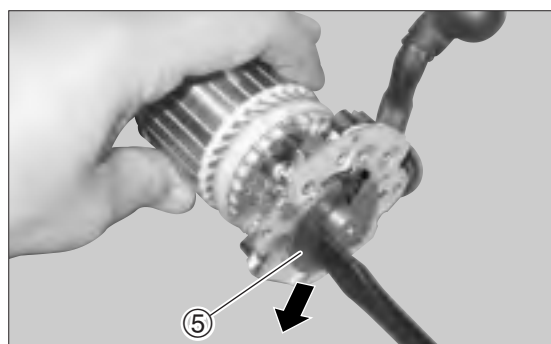
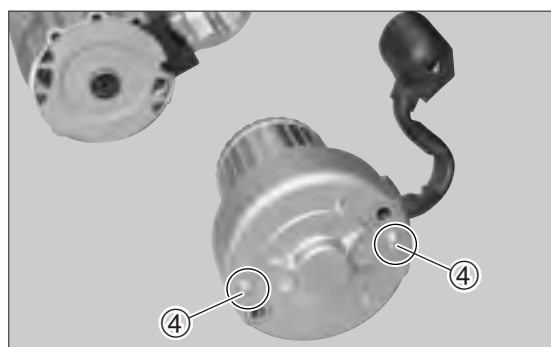
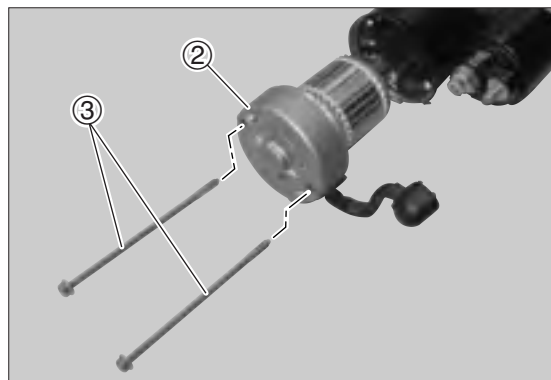
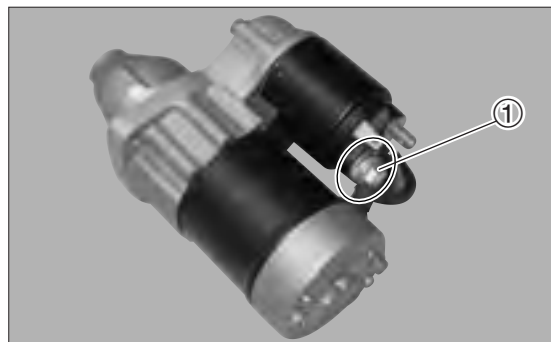
Brush holders are left in the motor body at the time rear cover is removed.

5. Use bladed screw driver to remove thrust washer A ⑤ from groove of armature shaft.

#### ⚠ CAUTION

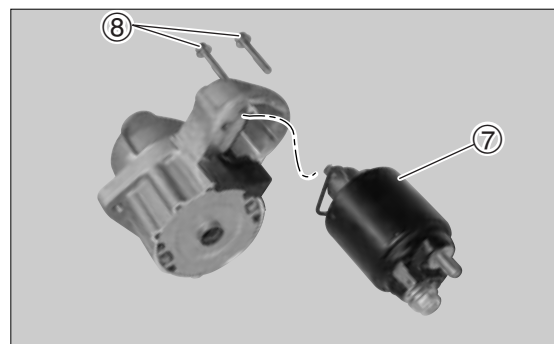
**Be careful not to give damage to brushes and commutator.**

6. Remove brush holder ⑥ from commutator carefully, and then, remove armature.

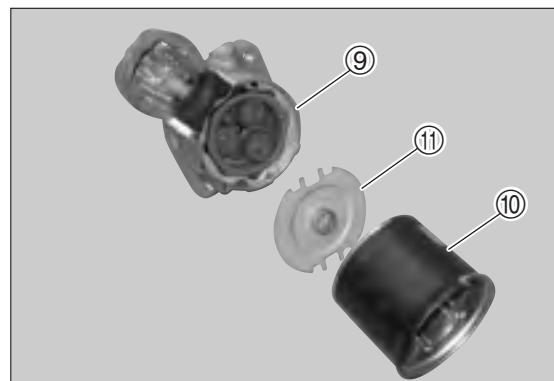




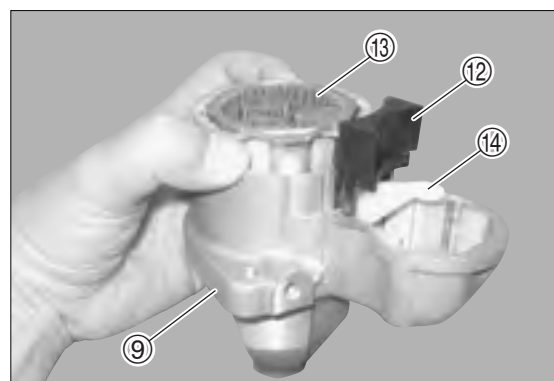
7. Loosen bolts ⑧ (M6, 72 pcs.) on the upper part of magneto switch ⑦, and then, remove magneto switch ass'y.



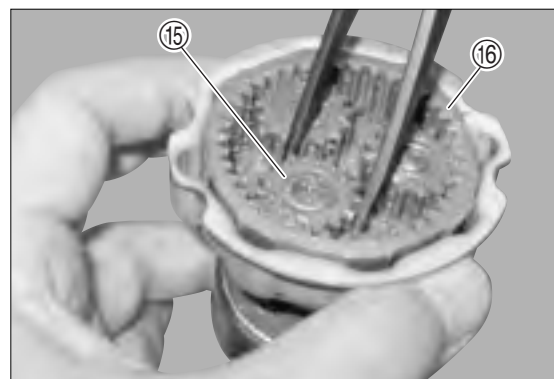
8. Remove yoke ⑩ and center bracket A ⑪ from gear case ⑨.



9. After removing dust rubber ⑫ from gear case ⑨, remove shift lever ⑭ together with center bracket ass'y ⑬. Check dust rubber for cracks and damages. Check shift lever for wears and damages. Replace if necessary.



10. Remove planetary gear ⑮ and outer gear ⑯ from center bracket ass'y. Check planetary gear and outer gear for wears and damages. Replace if necessary.





# Electrical System

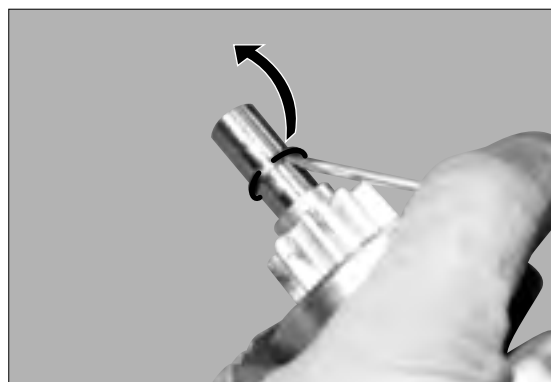
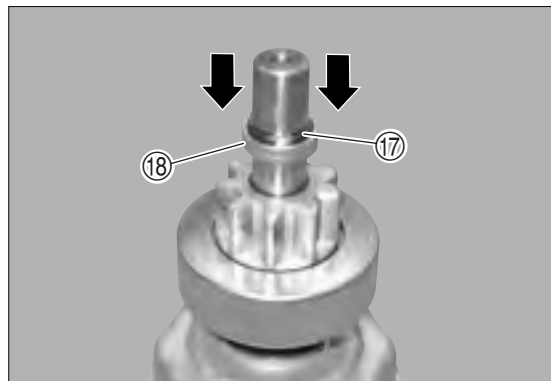
11. Remove clip ⑰ from pinion shaft, and then, remove pinion clutch.

## ⚠ CAUTION

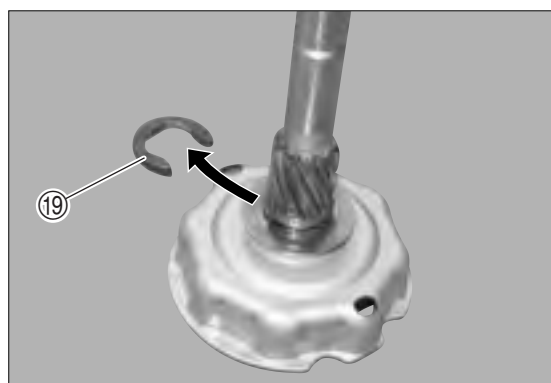
**When removing clip, be careful not to give damage to surface of pinion shaft.**



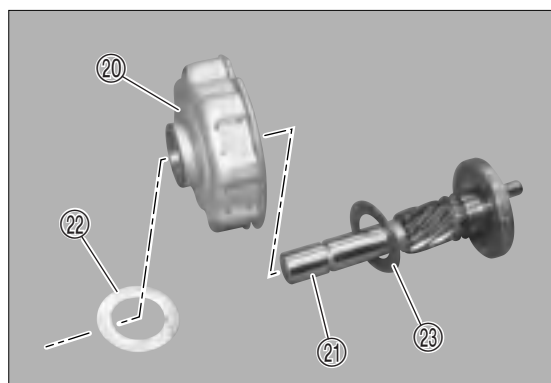
- Move pinion stopper ⑱ fully to clutch side.
- Use bladed screw driver to remove clip from groove of shaft.
- Do not reuse clip.



12. Remove E clip ⑲ from groove of pinion shaft.

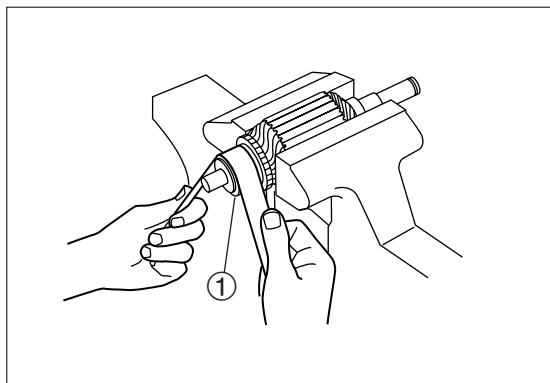


13. Remove pinion shaft ⑳, and 2 washers ㉒ and ㉓ from center bracket ㉑.



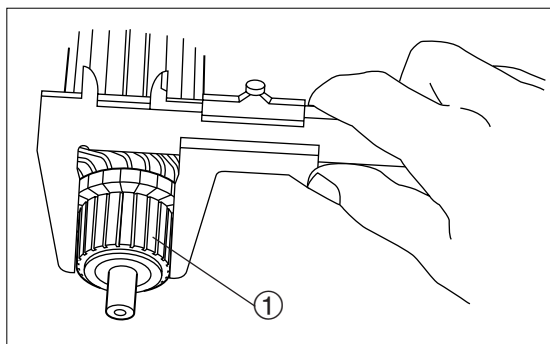
## 2) Inspection of Armature

1. Check commutator ① for dirt. If necessary, clean by using sand paper of No. 600 or by air-blowing.



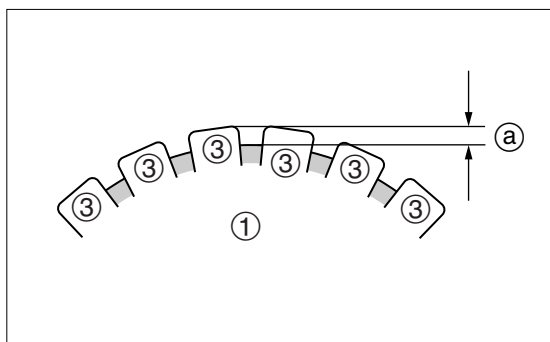
2. Measure commutator ① outer diameter. Replace starter motor ass'y if outer diameter is less than specified value.

	<b>Commutator Outer Diameter : Standard Value</b> 29.0 mm (1.14 in)
	<b>Wear Limit :</b> 28.0 mm (1.10 in)



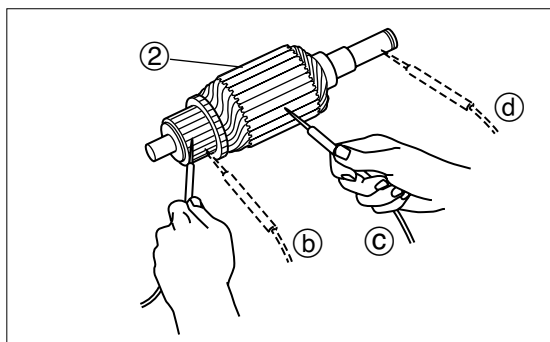
3. Measure undercut ③ of commutator ①. Replace starter motor ass'y if less than specified value.

	<b>Commutator Undercut : Standard Value</b> 0.5 - 0.8 mm (0.020 - 0.031 in)
	<b>Wear limit ③ :</b> 0.2 mm (0.008 in)



4. Check electrical conductivity of armature ②. Replace starter motor ass'y if other than specified condition.

	<b>Armature Conductivity :</b>
③ between commutator segments ③-③	Conductive
④ Between Segment - Armature Core	Non-conductive
⑤ Between Segment - Armature Shaft	Non-conductive





# Electrical System

## 3) Inspection of Brushes

1. Measure brush length (a), and replace brush if the length is less than specified value.



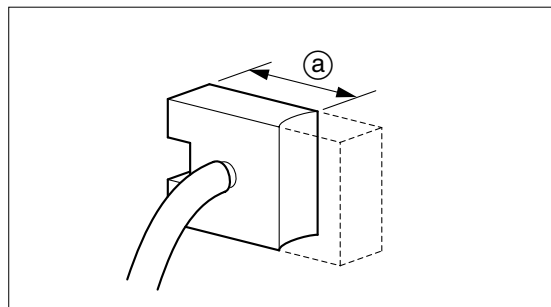
**Brush Length (a) : Standard Value**

16 mm (0.63 in)



**Wear Limit :**

12 mm (0.47 in)



2. Check conductivity between brush and starter terminal. Replace brush ass'y if any of the following conditions are not met.



Brush—Brush

②—③

Conductive

④—⑤

Brush—Starter motor terminal

②—①

Conductive

③—①

Brush—Starter motor terminal

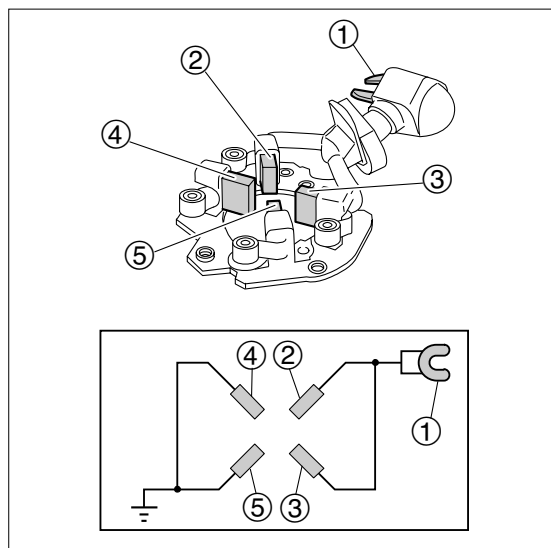
④—①

Non-Conductive

⑤—①

For all brush and terminal combinations not listed above

Non-Conductive

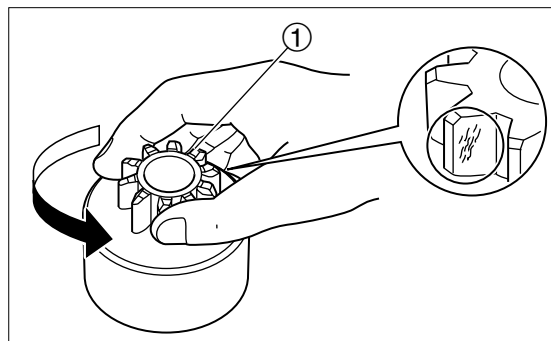


## 4) Inspection of Starter Motor Pinion

1. Check pinion teeth for crack and wear. Replace if necessary.
2. Turn only pinion to check that pinion ① can be rotated smoothly in one direction. Replace if necessary.



Turn pinion ① counterclockwise to check that it can move up smoothly, and then clockwise to check that it can be locking.



## 5) Inspection of Magneto Switch

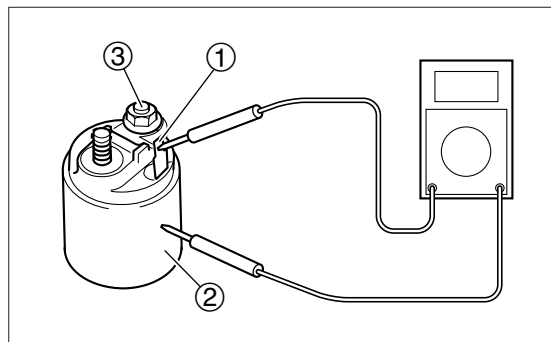
1. Measure resistance of magneto switch. Replace magneto switch if the resistance is out of specified range.



**Resistance of magneto switch at 20°C (68 °F)**

Holding side (between ① and ②): 0.56 to 0.68 Ω

Attracting side (between ① and ③): 0.33 to 0.41 Ω

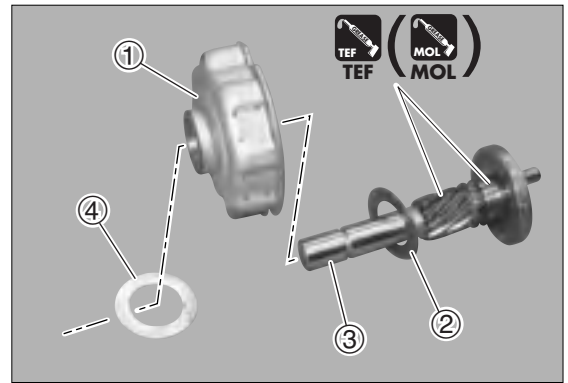


## 6) Assembly of Starter Motor

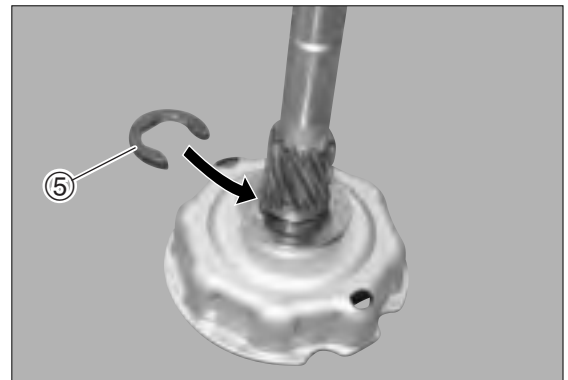
1. Attach washer ②, pinion shaft ③ and washer ④ to center bracket ① in this order.



Apply TEF grease or molybdenum grease to pinion shaft.



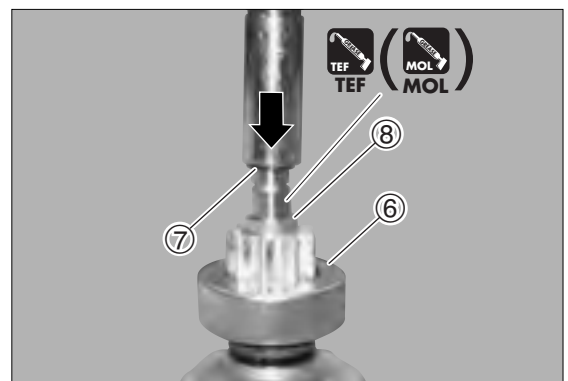
2. Attach E clip ⑤ to groove of pinion shaft.



3. Attach pinion clutch ⑥ to pinion shaft, and secure with clip ⑦.



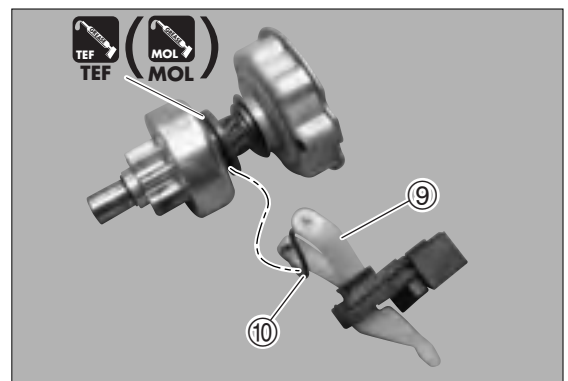
- Use new clip.
- Apply TEF grease or molybdenum grease to pinion shaft.
- Use 13mm deep socket wrench or equivalent when putting clip in the groove of pinion shaft.
- After attaching clip, raise pinion stopper ⑧ to lock it.



4. Insert torsion spring ⑩ of shift lever ⑨ into groove of pinion collar.



Apply TEF grease or molybdenum grease to pinion collar.



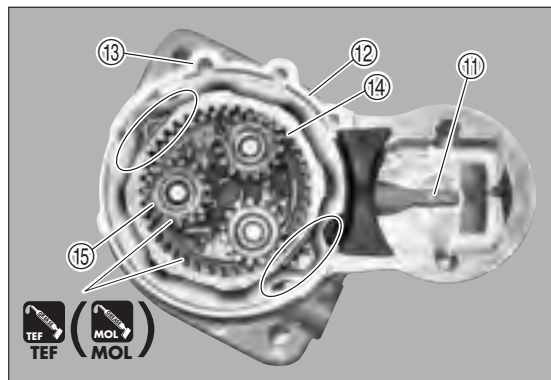


# Electrical System

5. Attach shift lever ⑪ and pinion shaft ass'y ⑫ to center bracket ass'y ⑬, and then, put outer gear ⑭ and planetary gear ⑮.



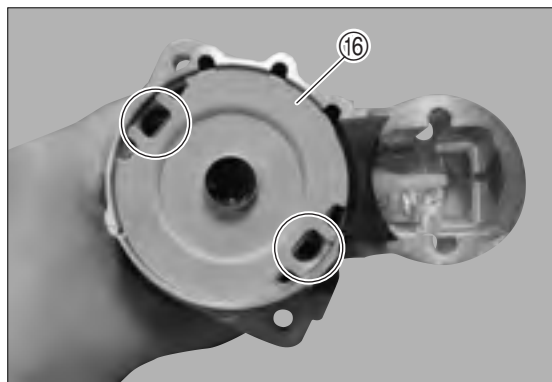
- Align center bracket ass'y and outer gear with bolt through holes, and attach to location shown.
- Put outer gear with chamfered side facing bracket.
- Apply TEF grease or molybdenum grease to pinion gear and outer gear.



6. Attach center plate A ⑯ to center bracket.



- Align center place A with bolt through holes, and attach to location shown.



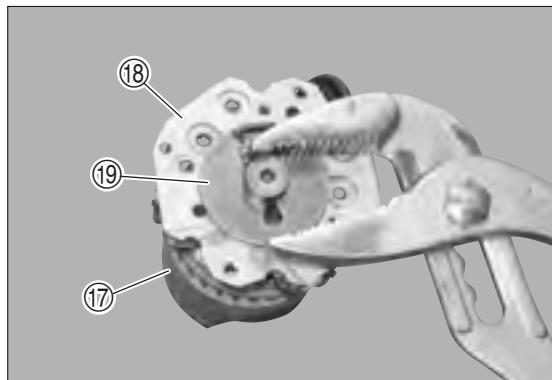
7. Attach armature ⑰ to brush holder ⑱, and install thrust washer A ⑲ to groove of shaft.

## CAUTION

**When attaching armature to brush holder, be careful not to give flaw and damage to commutator and brushes.**



- Insert commutator while pushing each brush outward.



8. Attach armature ass'y to starter motor rear cover, and secure with screws (M4, 2 pcs.).

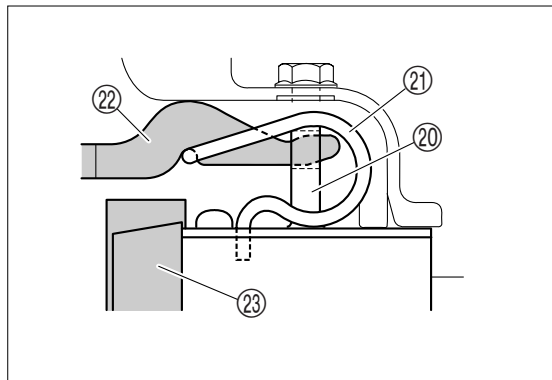
9. Attach magneto switch ass'y, and secure by tightening bolts (M6, 2 pcs.) to specified torque.



- Attach plunger ⑳, torsion spring ㉑, shift lever ㉒ and dust cover ㉓ of magneto switch by referring to illustration.



**Magneto switch mounting bolt:**  
7 N · m (5 lb · ft) [0.7 kgf · m]



10. Attach other parts by reversing disassembling procedure.



**Starter motor through bolt:**  
6 N · m (4 lb · ft) [0.6 kgf · m]

## 7) Inspection of Ignition and spark

### **WARNING**

- When testing, put electrode cap assuredly to prevent direct contact with spark tester wiring and leak of electrical current, and perform test carefully.
- Keep flammable gas, fuel, oil away from tester to prevent them from catching sparks. If not using an in-line tester, remove fuel injector connectors when checking spark.



This test can be made without removing parts.

1. Disconnect plug cap ① from spark plugs.
2. Connect plug cap ① to spark tester.
3. Connect spark tester clip to spark plug tip electrode.



#### **Spark Tester :**

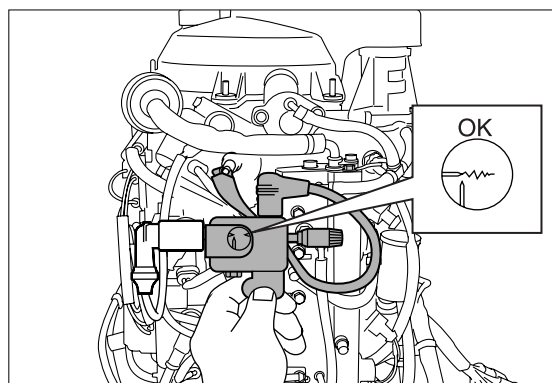
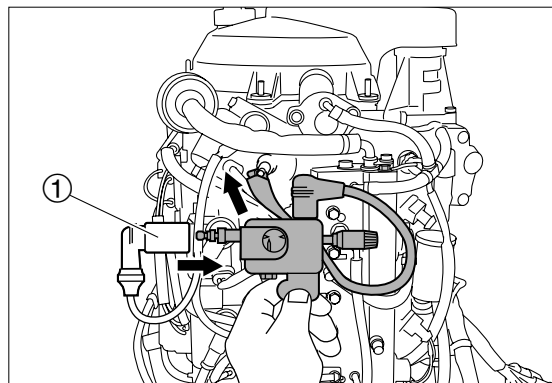
P/N. 3F3-72540-0

4. Start engine and check spark. Check spark system when sparks are weak.



#### **Spark Performance :**

10 mm (0.4 in) or over



## 8) Inspection of Plug Cap



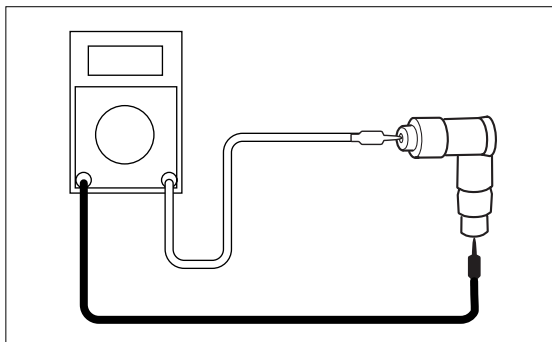
Remove the part and test it as a separate unit.

1. Disconnect plug cap from spark plug.
2. Remove plug cap from high tension cable. by twisting counterclockwise.
3. Measure plug cap resistance. Replace if other than specified value.



#### **Plug Cap Resistance :**

5 k $\Omega$  @20°C (68 °F)





# Electrical System

## 9) Inspection of Ignition Coils



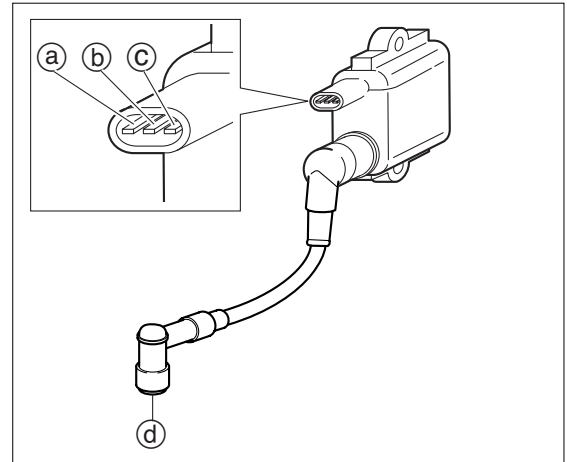
This test can be made without removing parts.

1. Remove ignition coil coupler.
2. Measure ignition coil resistance. Replace if other than specified value.



### Ignition Coil Resistance :

Primary Side : Between (a) and (b) 0.4 - 0.6  $\Omega$   
Secondary Side : Between (c) and (d) 10.8 - 16.2 k $\Omega$   
(6.8 - 10.2 k $\Omega$  without plug cap)



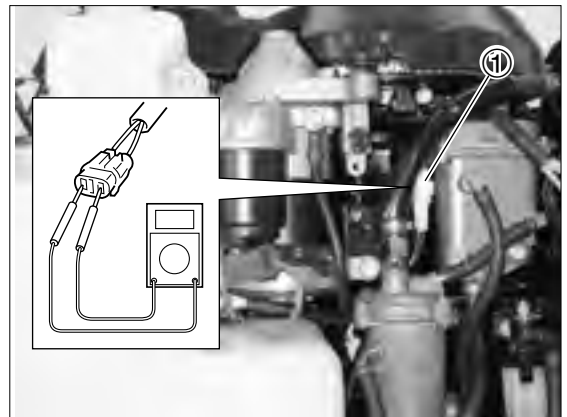
3. Install plug cap onto high tension cord by twisting clockwise.
4. Connect plug cap to spark plug.

## 10) Inspection of Pick Up Coil (Crank Position Sensor)

2. Disconnect pick up coil ① connector.
3. Measure resistance between terminals.  
Replace pick up coil if the resistance is out of specified range.



Resistance between Terminals : @20°C (68 °F)  
425 - 637  $\Omega$

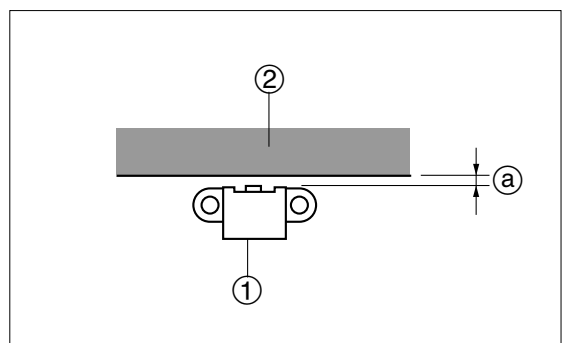


## 11) Inspection of Pick Up Coil Air Gap

1. Measure air gap (a) between pick up coil ① and flywheel ②.  
Adjust air gap if out of specified range.



Air Gap (a) :  
0.7 - 1.0 mm (0.028 - 0.039 in)





## 12) Inspection of Alternator

1. Disconnect alternator connector and measure resistance between terminals.

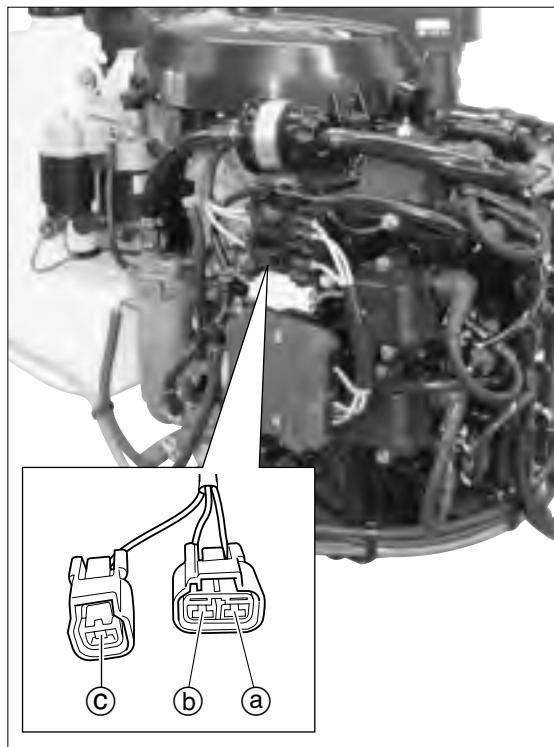
Replace alternator if the resistance is out of specified range.



**Resistance between Terminals of Connectors (a,**

**b) and c) : @20°C (68 °F)**

**0.12 - 0.19 Ω**





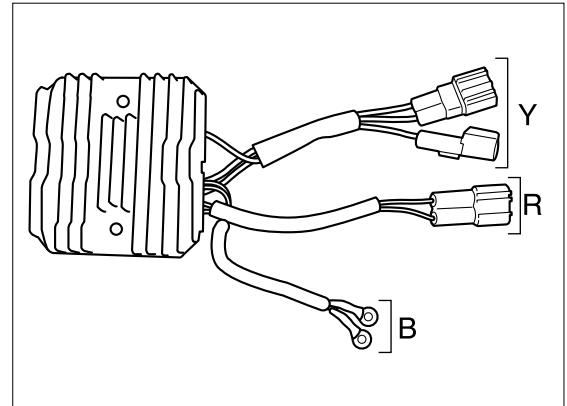
# Electrical System

## 13) Inspection of Rectifier Complete

1. Measure resistance between terminals.



This test can be made without removing parts.



Rectifier Tester Check Table

“ON” means conductive and “OFF” means no conductivity.

		Positive Tester Lead (Red)						
Tester Lead Negative (-) Side (Black)		Red	Red	Black	Black	Yellow	Yellow	Yellow
	Red		ON (0Ω)	OFF	OFF	OFF	OFF	OFF
	Red	ON (0Ω)		OFF	OFF	OFF	OFF	OFF
	Black	ON (4kΩ)	ON (4kΩ)		ON (0Ω)	ON (2.3kΩ)	ON (2.3kΩ)	ON (2.3kΩ)
	Black	ON (4kΩ)	ON (4kΩ)	ON (0Ω)		ON (2.3kΩ)	ON (2.3kΩ)	ON (2.3kΩ)
	Yellow	ON (3.4kΩ)	ON (3.4kΩ)	ON (2.4kΩ)	ON (2.4kΩ)		ON (4.8kΩ)	ON (4.8kΩ)
	Yellow	ON (3.4kΩ)	ON (3.4kΩ)	ON (2.4kΩ)	ON (2.4kΩ)	ON (4.8kΩ)		ON (4.8kΩ)
	Yellow	ON (3.4kΩ)	ON (3.4kΩ)	ON (2.4kΩ)	ON (2.4kΩ)	ON (4.8kΩ)	ON (4.8kΩ)	

### Notes:

- ① Use HIOKI HiTESTER MODEL 3030 or equivalent tester for this measurement, and do not use megger or other instrument.
- ② Disconnect all connections, and measure as an independent unit.
- ③ When the tester's pointer moves, the result is “ON”, or “OFF” when not.
- ④ The value enclosed by ( ) is approximately value measured using 1kΩ range of the tester. Note that the value varies among conditions of the tester (internal power supply), measurement ranges and models.
- ⑤ Perform this inspection only as a guide.

## 14) Inspection of Throttle Position Sensor



This test can be made without removing parts.

1. Measure resistance between terminals.  
Replace throttle position sensor if the resistance is out of specified range.

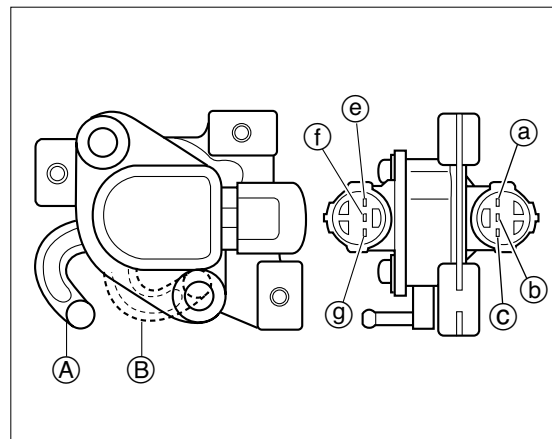


**When lever is at position (A) (wide open throttle) :**

Between (a) - (c) : 4 - 6 kΩ  
Between (e) - (g) : 4 - 6 kΩ  
Between (a) - (b) : 0.5 - 1 kΩ  
Between (e) - (f) : 0.5 - 1 kΩ

**When lever is at position (B) (fully closed throttle) :**

Between (a) - (c) : 4 - 6 kΩ  
Between (e) - (g) : 4 - 6 kΩ  
Between (a) - (b) : 0.5 - 1 kΩ  
Between (e) - (f) : 0.5 - 1 kΩ

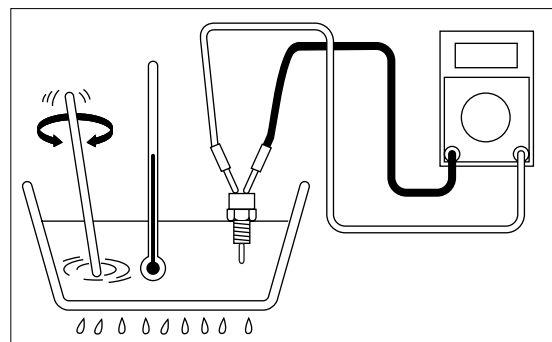


## 15) Inspection of Water Temperature Sensor



Remove the part and test it as a separate unit.

1. Remove water temperature sensor from engine.
2. Put water temperature sensor in the water, and warm up water slowly.
3. Measure water temperature sensor resistance. Replace if other than specified value.



**Water Temperature Sensor Resistance (Reference Value) :**

0.91 - 1.37 kΩ at 20°C (68 °F)

0.13 - 0.19 kΩ at 80°C (176 °F)

## 16) Inspection of Power Relay



· This test can be made without removing parts.  
· Insert probe to covered area of terminals, then measure resistance.

1. Measure resistance between (a) and (b) terminals.  
Replace relay if the resistance is out of specified range.



**Resistance between (a) and (b) terminals :  
@20°C (68°F)  
90 - 110 Ω**

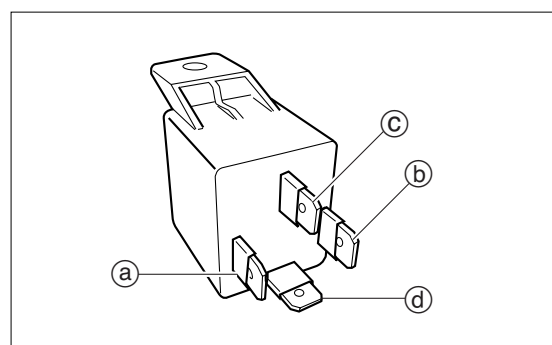
2. Apply 12V between terminals (a) and (b) and check conductivity between (c) and (d).



**Resistance between terminals : @20°C (68°F)**

To be conductive when 12V is applied between (a) and (b).

To be non conductive when no voltage is applied between (a) and (b).





# Electrical System

## 17) Inspection of Air Injectors



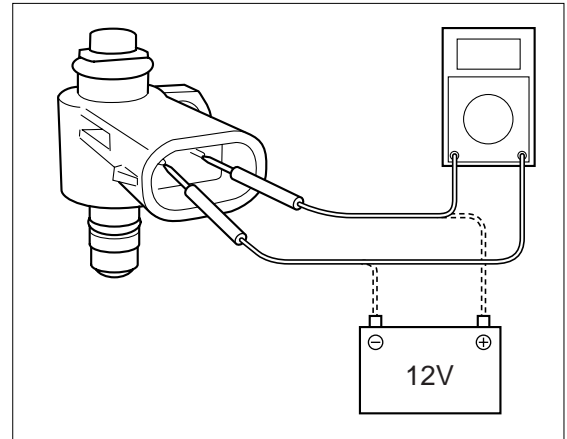
This test can be made without removing parts.

1. Measure resistance between terminals.  
Replace air injector if the resistance is out of specified range.



**Resistance between terminals : @20°C (68 °F)**  
1.2 - 1.4  $\Omega$

2. Apply 12V to the terminals to check if the part “clicks”.  
If not, replace air injector.



## 18) Inspection of Fuel Injectors



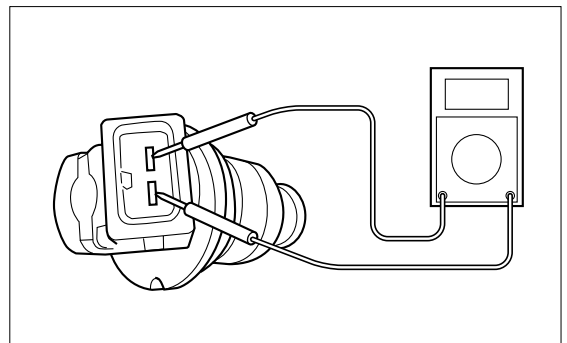
This test can be made without removing parts.

1. Measure resistance between the terminals, and replace fuel injector if the resistance is out of specified range.



**Resistance between terminals : @20°C (68°F)**  
1.7 - 1.9  $\Omega$

2. Apply 12V to the terminals to check if the part “clicks”.  
If not, replace fuel injector.



## 19) Inspection of MAT sensor (Manifold Temperature Sensor) (Option)

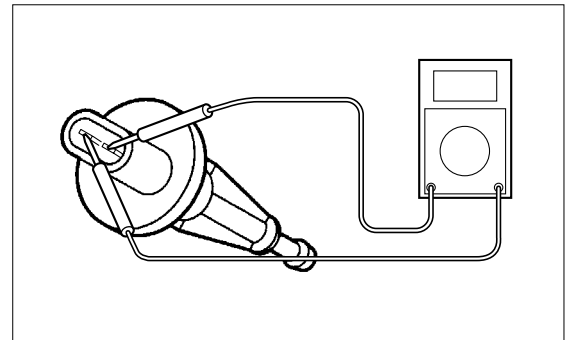


This test can be made without removing parts.

1. Measure MAT sensor resistance. Replace if other than specified value.



**MAT (Manifold Temperature) Sensor**  
**Temperature (Reference Value) :**  
2.35 - 2.55k $\Omega$  at 20°C (68°F)  
0.30 - 0.35k $\Omega$  at 80°C (176°F)



## 20) Inspection of MAP Sensor (Manifold Absolute Air Pressure Sensor) (Option)

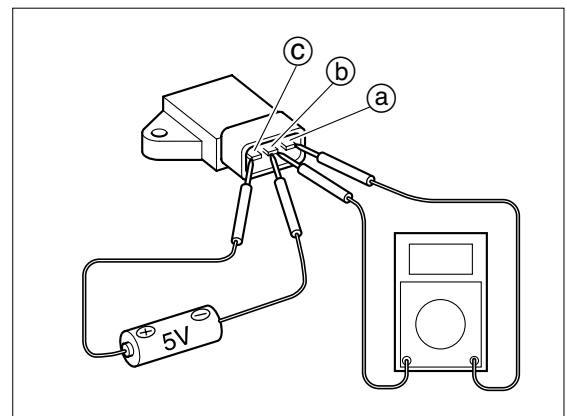


This test can be made without removing parts.

1. Apply 5V between terminals ③ and ②, and measure output voltage between terminals ① and ②.  
Replace MAP sensor if the output voltage is out of specified range.



**Output Voltage between ① and ② : @25°C (77°F) and atmospheric pressure**  
3.1 - 4.6V

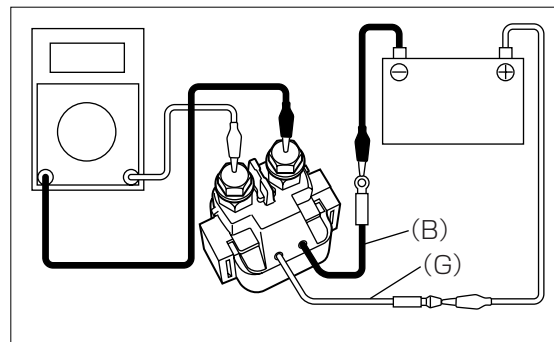


## 21) Inspection of Starter Solenoid



This test can be made without removing parts.

1. Connect tester lead wires to both terminal of starter solenoid.
2. Connector green (G) lead wire to battery positive terminal.
3. Connector black (B) lead wire to battery negative terminal.
4. Check electrical conductivity between terminals of starter solenoid. Replace if no conductivity.
5. Remove battery terminal from green (G) or black (B) lead wire, and check there is no conductivity between starter solenoid terminals. Replace if conductive.



## 22) Inspection of Oil Level Sensor



This test can be made without removing parts.

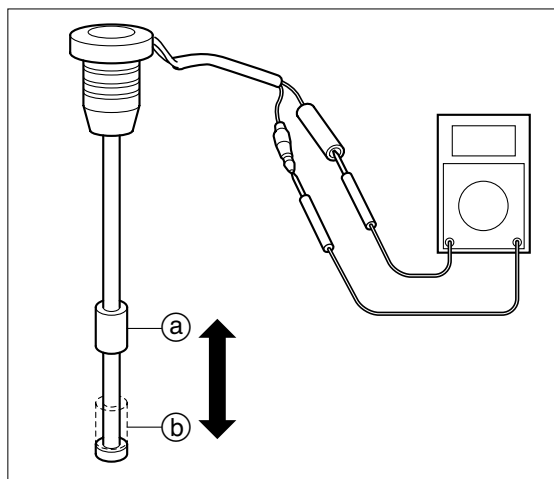
1. Check electrical conductivity between terminals of oil level sensor.

Check oil level sensor if out of specified range.



To be non conductive if float is at position (a).

To be conductive if float is at position (b).



## 23) Inspection of Oil Pump



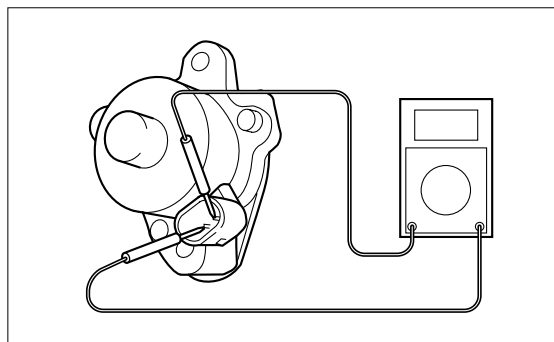
This test can be made without removing parts.

1. Measure resistance between terminals, and replace oil pump if the resistance is out of specified range.



Resistance between terminals : @20°C (68 °F)

1.84 - 2.08  $\Omega$





# Electrical System

## 24) Inspection of Fuel Feed Pump (FFP).



- This test can be performed without removing parts.
- Fuel feed pump (FFP) operates approximately 2 seconds when main switch is set to "ON".

1. Check that fuel feed pump (FFP) operation noise is heard. If no noise is heard, check fuel system.

## 25) Inspection of PTT Solenoid



This test can be made without removing parts.

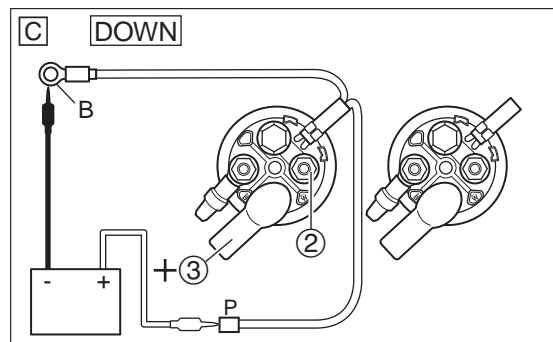
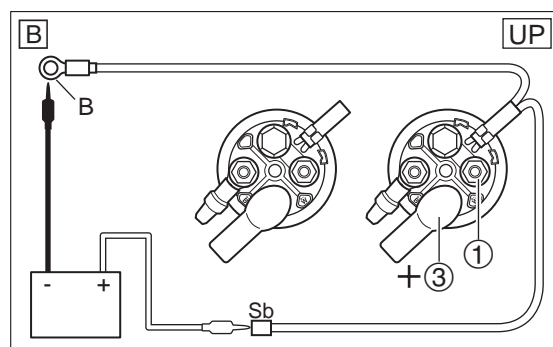
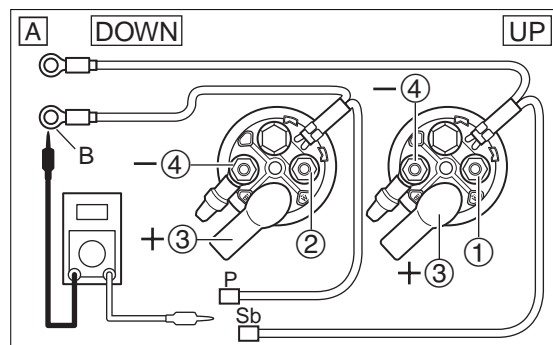
1. Disconnect positive and negative cables from battery.
2. Disconnect PTT leads from terminals ① and ②.
3. Check electrical conductivity of PTT solenoid. Replace if other than specified value.



### PTT Solenoid Conductivity


Sky Blue (Sb) -Black (B)	Conductive
Pink (P) -Black (B)	Conductive
Terminal ① - Terminal ④ (-)	Conductive
Terminal ② - Terminal ④ (-)	Conductive
Terminal ① - Terminal ③ (+)	No Conductivity
Terminal ② - Terminal ③ (+)	No Conductivity

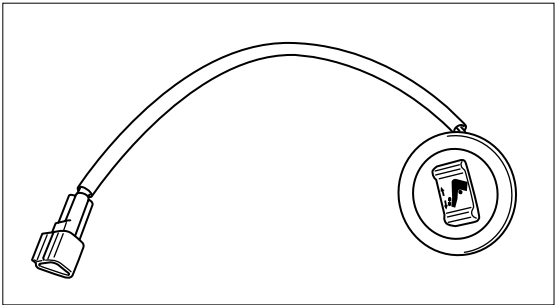
4. Connect circuit tester leads between terminals ① and ③ of PTT solenoid.
5. As shown in diagram [B], connect sky blue (Sb) terminal to positive battery terminal, and black (B) lead wire to negative battery terminal.
6. Check electrical conductivity between terminals ① and ③. If non conductive, replace UP side PTT solenoid.
7. Connect circuit tester leads between terminals ② and ③ of PTT solenoid.
8. As shown in diagram [C], connect pink (P) terminal to positive battery terminal, and black (B) lead wire to negative battery terminal.
9. Check electrical conductivity between terminals ② and ③. If non conductive, replace DOWN side PTT solenoid.



26) Inspection of PTT Switch

- 1. Check electrical conductivity of PTT switch. Replace if other than specified value.

	Lead Wires		
	Switch Position	Sky Blue (Sb)	Red (R)      Pink (P)
	Up (Ascend)	○ —	○ —
	Free		
	Down (Descend)		○ —      ○ —





# Electrical System

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# 9

## Troubleshooting



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# Troubleshooting

## 1. Troubleshooting

Note: This information is applicable also to 40B/50B and 70B/90B.

This troubleshooting information covers malfunctions and abnormalities of electrical parts which are warned of by the buzzer and warning lamp.

For the operations of the buzzer and warning lamp, refer to "Warning Indication List".




Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level) 	Warning lamp B (Water temp.) 	Warning lamp C (Battery volt.) 
1. Starter motor will not rotate or is slow.	1-1.	Shift					
	1-2.	Battery	○				Flashing
	1-3.	Fuse					
	1-4.	Wiring					
	1-5.	Electrical components					
2. Engine can be cranked but will not start.	2-1. Power head	Fuel tank					
	2-2. Fuel system	Fuel tank					
		Fuel filter					
		Fuel pressure is low. Normal value range: 0.67 - 0.78 MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]	○		Flashing	Flashing	Flashing

FFP(\*1) : Fuel Feed Pump

Cause		Action to be taken (Refer to reference value or service data.)
1-1-1.	Shift is in "F" or "R" position.	Shift into neutral position.
1-2-1.	Battery is low, or battery cable or circuit connection is loose or corroded.	Replace battery or charge. Check terminals and cables.
1-3-1.	Fuse is burned.	Check all of three fuses. Check areas related to the fuses, and repair the part(s) and then, replace the fuse.
1-4-1.	Defective wire or electrical connections	
1-5-1.	Main switch, neutral switch, starter solenoid or starter motor malfunctions.	Check and replace as necessary.
2-1-1.	Piston ring(s) is seized.	Check, repair or replace as necessary.
2-1-2.	Reed valve has a gap, is worn or damaged.	
2-2-1.	Fuel tank is empty or fuel level is low.	Replenish fuel and perform operation described in 2-2-5.
2-2-2.	Air vent is closed.	Open air vent and perform operation described in 2-2-5.
2-2-3.	Water is found in the fuel filter. (Water raises red float in the filter.)	Check if any water exists in the fuel line, and clean if necessary.
2-2-4.	Fuel is not supplied to fuel line.	Check if primary bulb is hard. Squeeze to make it hard if necessary, and set main switch to ON for 2 seconds. Repeat the operation until the bulb becomes hard.
2-2-5.	Lack of or no operation to feed fuel to fuel line after replenishing fuel.	
2-2-6.	Fuel filter is clogged.	Check interior of fuel tank, hull, and engine fuel filter, and clean or replace fuel filter if necessary.
2-2-7.	Air pressure in the air rail is low.	Refer to 2-3.
2-2-8.	Fuel hose is clogged.	Check fuel hose if they are twisted, collapsed or bent.
2-2-9.	FFP (*1) is not operating.	Check that the motor in the FFP (*1) assembly generates operating noise for approximately 2 seconds when main switch key is turned from [OFF] to [ON] position.
2-2-10.	FFP (*1) internal component(s) is damaged.	Replace FFP (*1) with new one.
2-2-11.	FFP (*1) leaks in the case.	Check FFP or seal rubber of its internal parts.

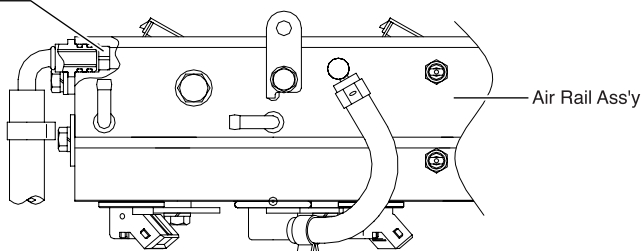


# Troubleshooting

Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level) 	Warning lamp B (Water temp.) 	Warning lamp C (Battery volt.) 
2. Engine can be cranked but will not start.	2-2. Fuel System	Fuel pressure is low. Normal value range: 0.67 - 0.78MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]					
		Air rail internal fuel pressure is high. Normal value range: 0.67 - 0.78MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]					
	2-3. Air Compressor System	Air pressure is low. Normal value range: 0.61 - 0.70MPa (88.47 - 101.53psi) [6.1 - 7.0kg/cm <sup>2</sup> ]					
		Air pressure is high. Normal value range: 0.61 - 0.70MPa (88.47 - 101.53psi) [6.1 - 7.0kg/cm <sup>2</sup> ]					
	2-4. Electrical System	Fuse					
		Stop Switch					
		Air Injector					
		Spark Plug	○		Flashing	Flashing	Flashing

Olifice(\*2)




Olifice



Cause		Action to be taken (Refer to reference value or service data.)
2-2-12.	Fuel regulator leaks.	Replace.
2-2-13.	Fuel leak	Check hose damage and joints.
2-2-14.	Return circuit from fuel regulator outlet to vapor separator is obstructed.	Check, and repair if necessary.
2-2-15.	Fuel regulator is faulty.	Replace.
2-2-16.	Fuel pressure is high.	Refer to 2-3-9 and 2-3-10.
2-3-1.	Air hose joint nut is loose.	Check, and repair if necessary.
2-3-2.	Air filter is clogged.	Check, and replace if necessary.
2-3-3.	Orifice (*2) is clogged. (fuel inlet at air/fuel rail)	Check, and replace if necessary.
2-3-4.	Air hose joint O ring is damaged.	Check, and repair if necessary.
2-3-5.	Air hose is collapsed.	
2-3-6.	Air regulator leaks.	Replace.
2-3-7.	Air compressor reed valve is damaged.	Check, and replace if necessary.
2-3-8.	Air compressor cylinder or piston ring is worn much.	
2-3-9.	Air regulator malfunctions.	Replace.
2-3-10.	Passage following air regulator is clogged.	Check, and repair if necessary.
2-4-1.	Fuse is burnt.	Check the cause of fuse burning (overload), and replace the fuse after repairing.
2-4-2.	Lock is removed.	Check.
2-4-3.	Stop switch is short-circuited.	Check, and repair if necessary.
2-4-4.	Fuel injector is deposited with carbon or malfunctions.	Clean, or replace if necessary. Connect injector(s) to harness, and the injector should produce operating noise (click) during cranking.
2-4-5.	Spark plug (s) is faulty.	Correct the gap is out of specified range. Electrode is worn much. Replace if cracked or damaged. Replace if electricity leaks at the gap due to carbon deposit or electrode is entirely black due to carbon deposits. Replace if fuel fouled, also a carbon fouled plug will give an ignition coil code replace plug and clear the code.



# Troubleshooting

Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level) 	Warning lamp B (Water temp.) 	Warning lamp C (Battery volt.) 
2. Engine can be cranked but will not start.	2-4. Electrical System	Spark Plug Cap					
		Crank Position Sensor					
		ECU					
		Self-diag. reports that battery voltage is abnormally low.	○				Flashing
		Self-diag. reports that a component is abnormal.	○				
		Self-diag. reports that TPS (*3) idle position is faulty.	○				
		Engine revolution is slow (seizure).	○				
3. Engine can be cranked and starts, but idling cannot be maintained or is unstable.	3-1. Power Head	Compression insufficient					
	3-2. Fuel System	Fuel Tank					
		Fuel Tank					
		Fuel pressure is low. Normal value range: 0.67 - 0.78MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]					

TPS(\*3) : Throttle Position Sensor

Lift Pump (\*4) : Diaphragm type fuel pump

Reset TPS when (\*5): ① The set of remote control cables were readjusted because TPS error message was displayed due to incorrect setting of the cables.

② TPS or ECU was replaced.




③ Link or rod snap was replaced due to wear or deformation of links.

It is necessary to reset ECU and TPS after performing the above work. Reset TPS initial value by referring to the chapter of self-diagnosis function.

Cause		Action to be taken (Refer to reference value or service data.)
2-4-6.	Cap is loose.	Check.
2-4-7.	Cap is faulty.	Replace.
2-4-8.	CPS Gap.	Check, and adjust if necessary.
2-4-9.	ECU malfunction.	Replace ECU.
2-4-10.	Battery power is low. Battery voltage becomes less than 10 V at cranking due to faulty starter motor.	Replace battery or charge. Check terminals and cables. Check starter motor.
2-4-11.	AS component malfunction, connection is faulty or wire-harness is broken.	Check, and repair or replace if necessary.
2-4-12.	TPS(*3) initial setting is incorrect.	Check, and repair if necessary. Then, reset TPS (*5).
2-4-13.	TPS(*3 or ECU was replaced.	Reset TPS (*5).
3-1-1.	Piston has a scratch or a cause that produces resistance.	Check, and repair if necessary.
3-1-2.	Piston ring(s) is seized.	
3-1-3.	Reed valve has a gap, is worn or damaged.	
3-1-4.	Cylinder head gasket or engine base gasket is faulty.	
3-1-5.	Head bolt(s) or crank case bolt(s) is loose.	
3-2-1.	Fuel is empty or low in the tank.	Refer to 2-2-1.
3-2-2.	Air vent is closed.	Refer to 2-2-2.
3-2-3.	Water is deposited in the fuel filter.	Check interior of fuel tank, hull, and engine fuel filter, and clean or replace fuel filter if necessary.
3-2-4.	Fuel filter is clogged.	
3-2-5.	Fuel hose is clogged.	Check fuel hoses if they are twisted, collapsed or bent.
3-2-6.	Lift pump (*4) is not operating.	Check, and repair if necessary. Or replace.
3-2-7.	FFP leaks in the case.	Refer to 2-2-11.



# Troubleshooting




Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level) 	Warning lamp B (Water temp.) 	Warning lamp C (Battery volt.) 
3. Engine can be cranked and starts, but idling revolution cannot be maintained or is unstable.	3-2. Fuel System	Fuel pressure is low. Normal value range: 0.67 - 0.78MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]					
		Fuel pressure is high. Normal value range: 0.67 - 0.78MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]					
	3-3. Air System	Air pressure is low. [Normal value range: 0.61 - 0.70MPa (88.47 - 101.53psi)] [6.1 - 7.0kg/cm <sup>2</sup> ]					
		Air pressure is high.					
	3-4. Electrical System	Spark Plug					
		Spark Plug Cap					
		Self-diag. reports component abnormality.	○		Flashing	Flashing	Flashing
		Self-diag. reports component abnormality.	○		Flashing	Flashing	Flashing
		Self-diag. reports component abnormality.	○		Flashing	Flashing	Flashing
		Air Injector					
4. Idling speed is too high.	4-1. Electrical System	Key switch					
		Self-diag. reports TPS idle position incorrect.	○		Flashing	Flashing	Flashing
			○		Flashing	Flashing	Flashing
5. Engine revolution is unstable at 3000rpm or higher.	5-1.	Spark Plug					
	5-2.	Engine speed is controlled. (due to ESG)					
	5-3.	Fuel or air pressure is low.					
	5-4.	TPS(*1) function is faulty.					
6. Engine will not fully increase speed with wide open throttle.	6-1. Power Head	Advancer arm will not move.					
		Compression insufficient					



Cause		Action to be taken (Refer to reference value or service data.)
3-2-8.	Fuel regulator leaks.	Refer to 2-2-12.
3-2-9.	Fuel leaks.	Refer to 2-2-13.
3-2-10.	Air rail internal air pressure is low.	Refer to 2-3.
3-2-11.	Fuel regulator is faulty.	Replace.
3-2-12.	Return circuit from fuel regulator outlet to vapor separator is obstructed.	Check, and repair if necessary.
3-3-1.	Refer to 2-3.	Refer to 2-3.
3-3-2.		
3-4-1.	Refer to 2-4-3.	Refer to 2-4-3.
3-4-2.	Cap is loose.	Check.
3-4-3.	Cap is faulty.	Replace.
3-4-4.	Component malfunction or loose connection	Check, and repair if necessary. Or replace.
3-4-5.	TPS initial setting is incorrect.	Refer to 2-4-13.
3-4-6.	TPS or ECU was replaced.	Refer to 2-4-13.
3-4-7.	Malfunction	Clean, or replace if necessary. Connect injector(s) to harness, and the injector should produce operating noise (click) during cranking.
4-1-1.	Idle revolution setting is changed.	Change setting of idling revolution by using variable idle switch.
4-1-2.	TPS initial setting is incorrect.	Refer to 2-4-13.
4-1-3.	TPS or ECU was replaced.	Refer to 2-4-13.
5-1-1	Refer to 2-4-3.	Refer to 2-4-3.
5-1-2	Refer to 10-1.	Refer to 10-1.
5-1-3	Refer to 3-3.	Refer to 3-3.
5-1-4	2-4-12, Refer to 2-4-13.	2-4-12, Refer to 2-4-13.
6-1-1.	Remote control cable is installed incorrectly.	Check, and adjust if necessary.
6-1-2.	Throttle link component(s) is deformed or worn.	Check, and replace if necessary.
6-1-3.	Piston or cylinder liner is scratched.	Check, and repair if necessary.
6-1-4.	Combustion chamber is deposited with carbon.	
6-1-5.	Piston ring is worn abnormally or seized.	






# Troubleshooting

Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level) 	Warning lamp B (Water temp.) 	Warning lamp C (Battery volt.) 
6 Engine will not fully increase speed with wide open throttle.	6-1. Power Head	Compression insufficient					
	6-2. Air System	Air rail internal air pressure is low.					
		Air rail internal air pressure is high.					
	6-3. Fuel System	Fuel Tank					
		Fuel Hose					
		Fuel Filter					
		Fuel pressure is low. Normal value range: 0.67 - 0.78MPa (97.17 - 113.13psi) [6.7 - 7.8kg/cm <sup>2</sup> ]					
	6-4. Electrical System	Spark Plug					
		Air Injector					
		Self-diag. reports component abnormality.	○				
7 Engine accelerates but boat will not.	7-1. Outboard Motor	Propeller					
		Installation					
		Boat					
8 Turning of main switch will not stop engine.	8-1. Electrical System	Main Switch					
		Stop Switch					
		Ground Wire					

Cause		Action to be taken (Refer to reference value or service data.)
6-1-6.	Crankcase head oil seal is faulty.	Check, and repair if necessary.
6-2-1.	Refer to 2-3.	Refer to 2-3.
6-3-1.	Fuel tank is empty or fuel level is low.	Refer to 2-2-1.
6-3-2.	Air vent is closed.	Refer to 2-2-2.
6-3-3.	Sucks air through crack or loose connection.	Check, and repair if necessary.
6-3-4.	Water is in the fuel filter.	Check and clean if necessary.
6-3-5.	Fuel filter is clogged.	Check interior of fuel tank, hull, and engine fuel filter, and clean or replace fuel filter if necessary.
6-3-6.	Fuel hose is clogged.	Check fuel pipes if they are twisted, collapsed or bent.
6-3-7.	Lift pump is not operating.	Check, and repair if necessary. Or replace.
6-3-8.	FFP leaks in the case.	Check internal component rubber seal and electric fuel pump.
6-3-9.	Fuel regulator leaks.	Replace.
6-3-10.	Fue leaks.	Check hose damage and connections.
6-3-11.	Air pressure is low.	Refer to 2-3.
6-4-1.	Refer to 2-4-3.	Refer to 2-4-3.
6-4-2.	Fuel injector deposited with carbon.	Check. and clean, or replace if necessary.
6-4-3.	Component(s) malfunctions or connections are loose.	Check, and repair or replace if necessary.
7-1-1.	Incorrect propeller selection	Check, and repair or replace if necessary.
7-1-2.	Propeller slips on the shaft.	
7-1-3.	Propeller is deformed or damaged.	
7-1-4.	Shaft length - boat transom mismatching	Check, and adjust if necessary.
7-1-5.	Trim angle incorrect	
7-1-6.	Boat's bottom is foul.	Check, and clean if necessary.
7-1-7.	Boat loading position incorrect	Check, and adjust if necessary.
7-1-8.	Boat is overloaded.	
7-1-9.	Hull shape incorrect.	
8-1-1.	Main switch contact point is faulty or harness is internally broken.	Check, and repair if necessary. Or replace.
8-1-2.	Stop switch contact point is faulty or harness is internally broken.	
8-1-3.	Ground wire connection is loose or harness is internally broken.	



# Troubleshooting

Symptom	Item		Self-diagnosable (○)	Beep	Warning indicator A (Oil level) 	Warning lamp B (Water temp.) 	Warning lamp C (Battery volt.) 
9. Throttling up will not increase engine speed. Engine speed is reduced to idling during operation.	9-1. Electrical Control	Cooling water temp. is high. (Water temp. lamp is flashing.)	○	Continuous sounding		Flashing	
			○	Continuous sounding		Flashing	
		Battery voltage is abnormally high. (Battery lamp is flashing.)	○				Flashing
			○				Flashing
		TPS does not function.	○		Flashing	Flashing	Flashing
		Electric oil pump does not function.	○		Flashing	Flashing	Flashing
	9-2. Remote Control	Advancer arm is not operating.					
10 Throttling up will not increase engine speed over 3000rpm. Engine speed is reduced to 3000rpm and is limited.	10-1. Electrical Control	Cooling water temp. is high. (Water temp. lamp is flashing.)	○	Continuous sounding		Flashing	
			○	Continuous sounding		Flashing	
			○	Continuous sounding		Flashing	
			○	Continuous sounding		Flashing	
		Battery voltage is abnormally low. (Battery lamp is flashing.)	○				Flashing
			○				Flashing
			○				Flashing
			○				Flashing
		TPS does not function.	○		Flashing	Flashing	Flashing
		Remote control					

Cause		Action to be taken (Refer to reference value or service data.)
9-1-1.	Cooling water inlet is blocked.	Check.
9-1-2.	Water pump is faulty.	Check, and repair if necessary. Replace.
9-1-3.	Battery is faulty, or two batteries are connected in series.	Check.
9-1-4.	Rectifier-regulator is faulty.	Check, and replace if necessary.
9-1-5.	TPS malfunctions, wire is not connected or wire harness is broken.	Check, and repair if necessary. Replace.
9-1-6.	TPS connectors (TPS1 and TPS2) are connected in reverse.	Connected to normal positions.
9-1-7.	Electric oil pump malfunction, or wire is not connected or wire harness is broken.	Check, and replace if necessary.
9-2-1.	Remote control cable is installed incorrectly, or remote control box is faulty.	Check, and repair if necessary. Replace.
10-1-1.	Cooling water inlet is blocked.	Check, and repair if necessary. Replace. Air compressor cooling water temp is high (Cooling water does not come of from water nipple)
10-1-2.	Water pump is faulty.	
10-1-3.	Thermostat is faulty.	
10-1-4.	Cooling water passage is blocked.	
10-1-5.	Battery is faulty.	Replace.
10-1-6.	Charging coil is faulty.	Check, and replace if necessary.
10-1-7.	Charging coil wiring is broken.	Check, and repair if necessary.
10-1-8.	Battery cable or electrical connection is faulty.	
10-1-9.	Rectifier-regulator is faulty.	Check, and replace if necessary.
10-1-10.	TPS malfunctions, wire is not connected or wire harness is broken.	Check, and repair if necessary. Replace.
10-1-11.	Warm up lever was raised to start the engine.	Return the lever and try to start the engine again.



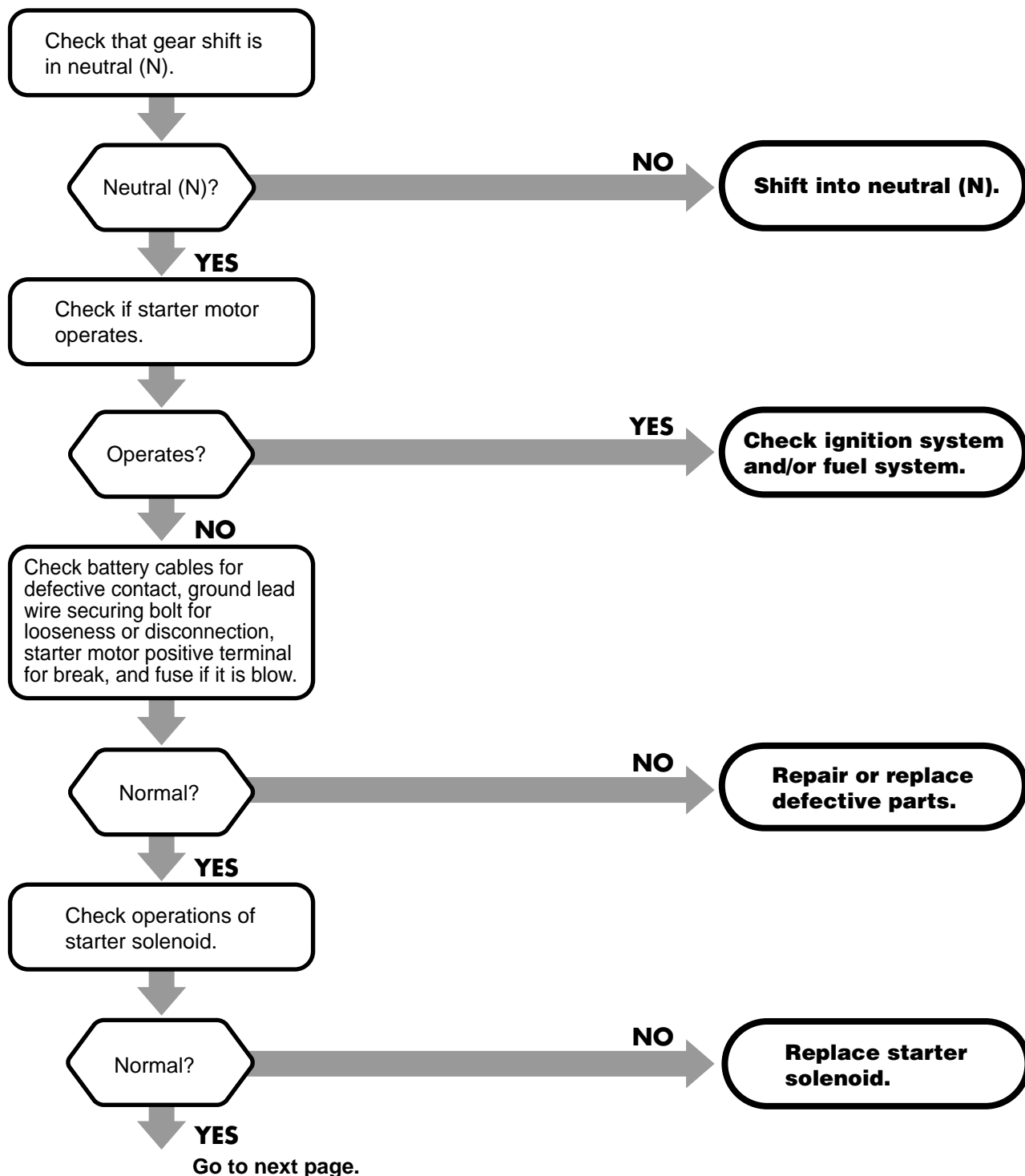
# Troubleshooting

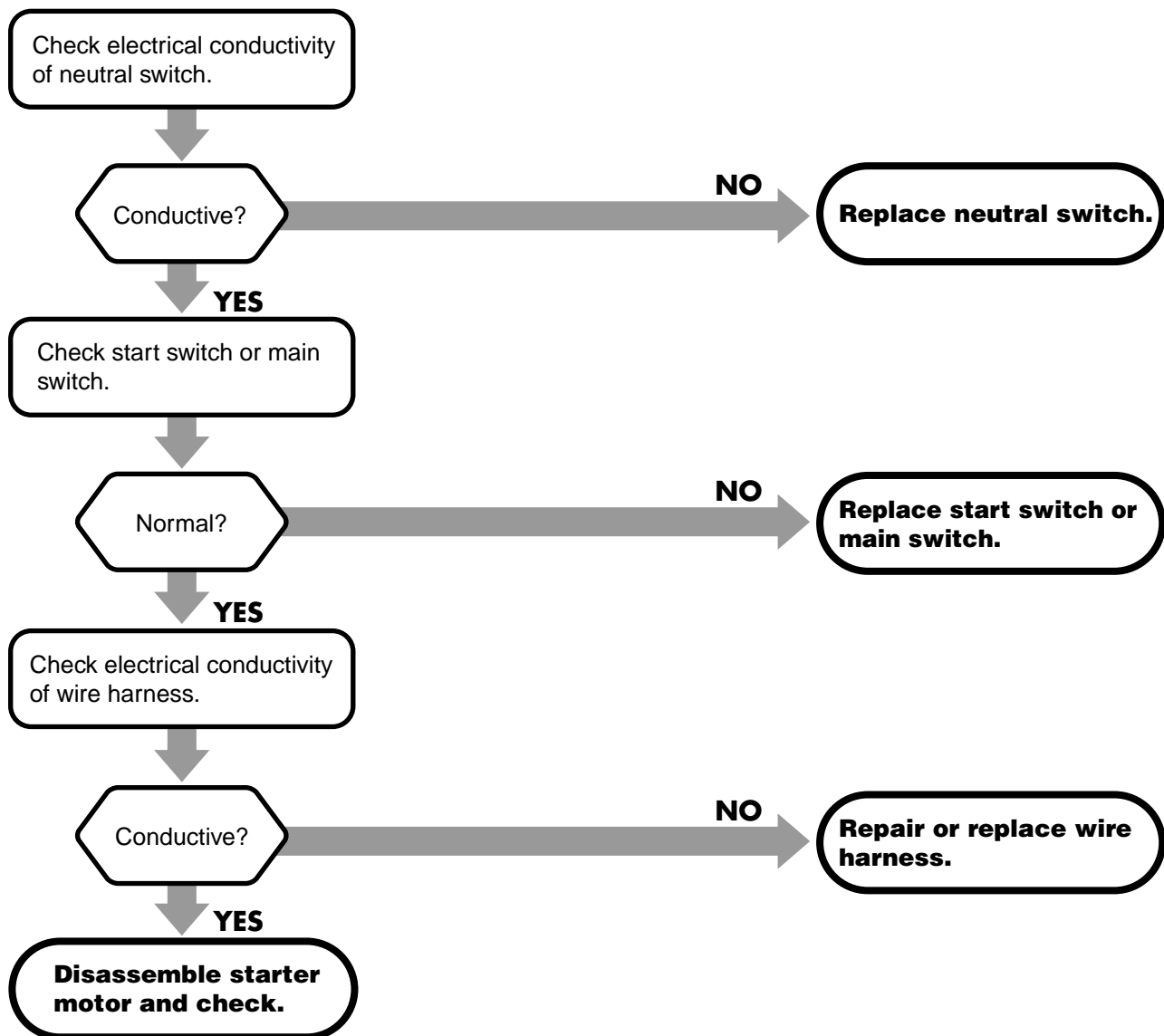
Before working on the engine, check that hull, rigging and engine installation are normal, and then battery is fully charged. For mechanical troubleshooting, refer to relevant troubleshooting section in this chapter. For checking and servicing outboard motor, refer to service procedures described in this manual to perform the work safely.

## Power Unit

**State 1** Engine will not start or is hard to start.

### Starting System

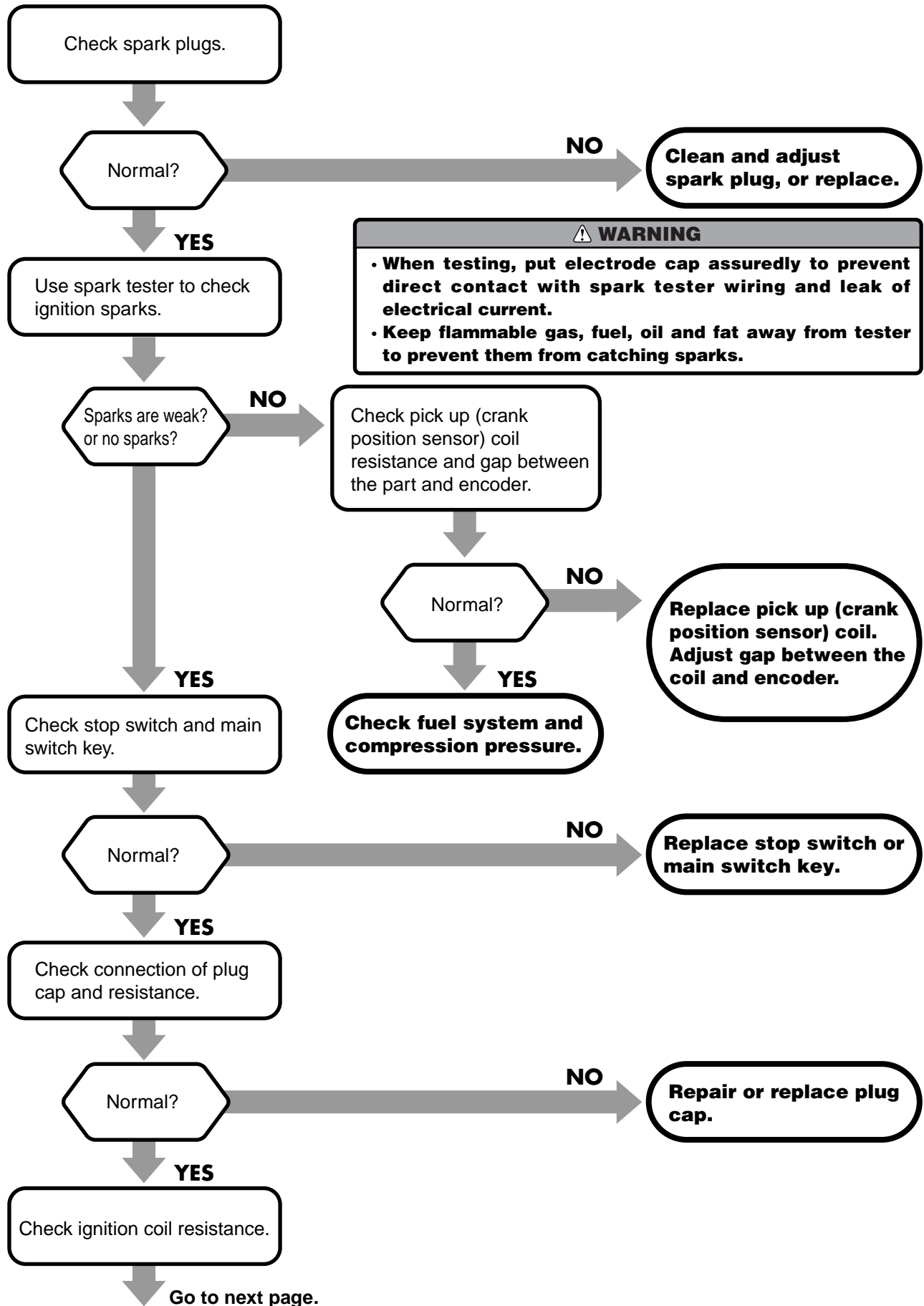




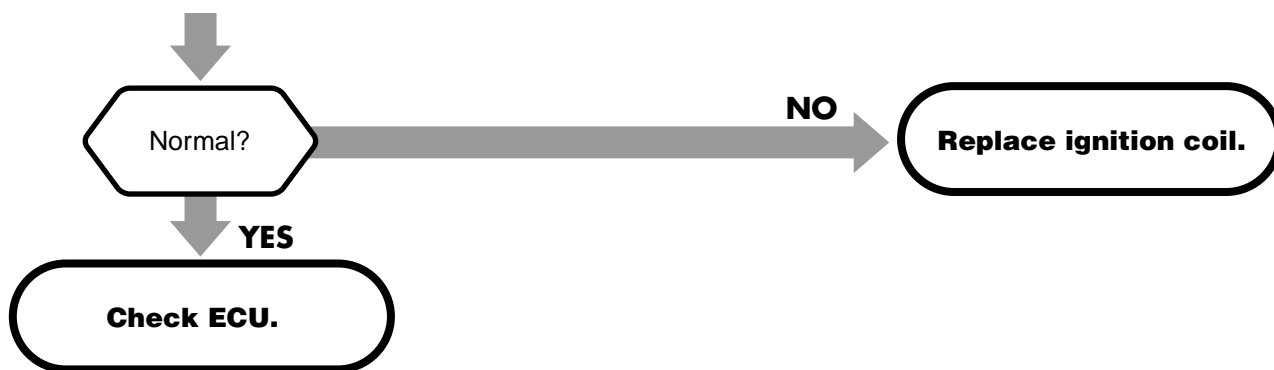


# Troubleshooting

## Ignition System



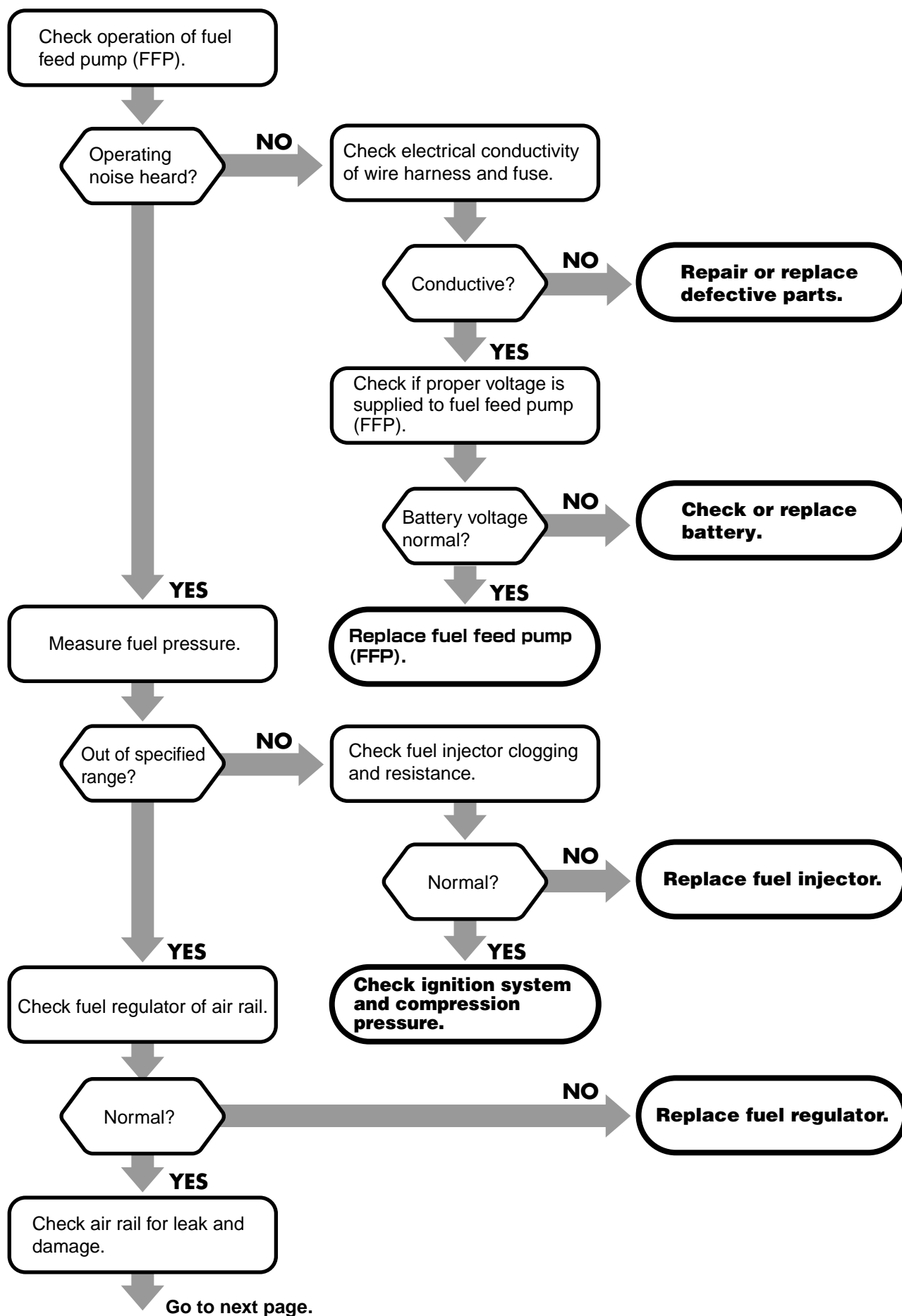


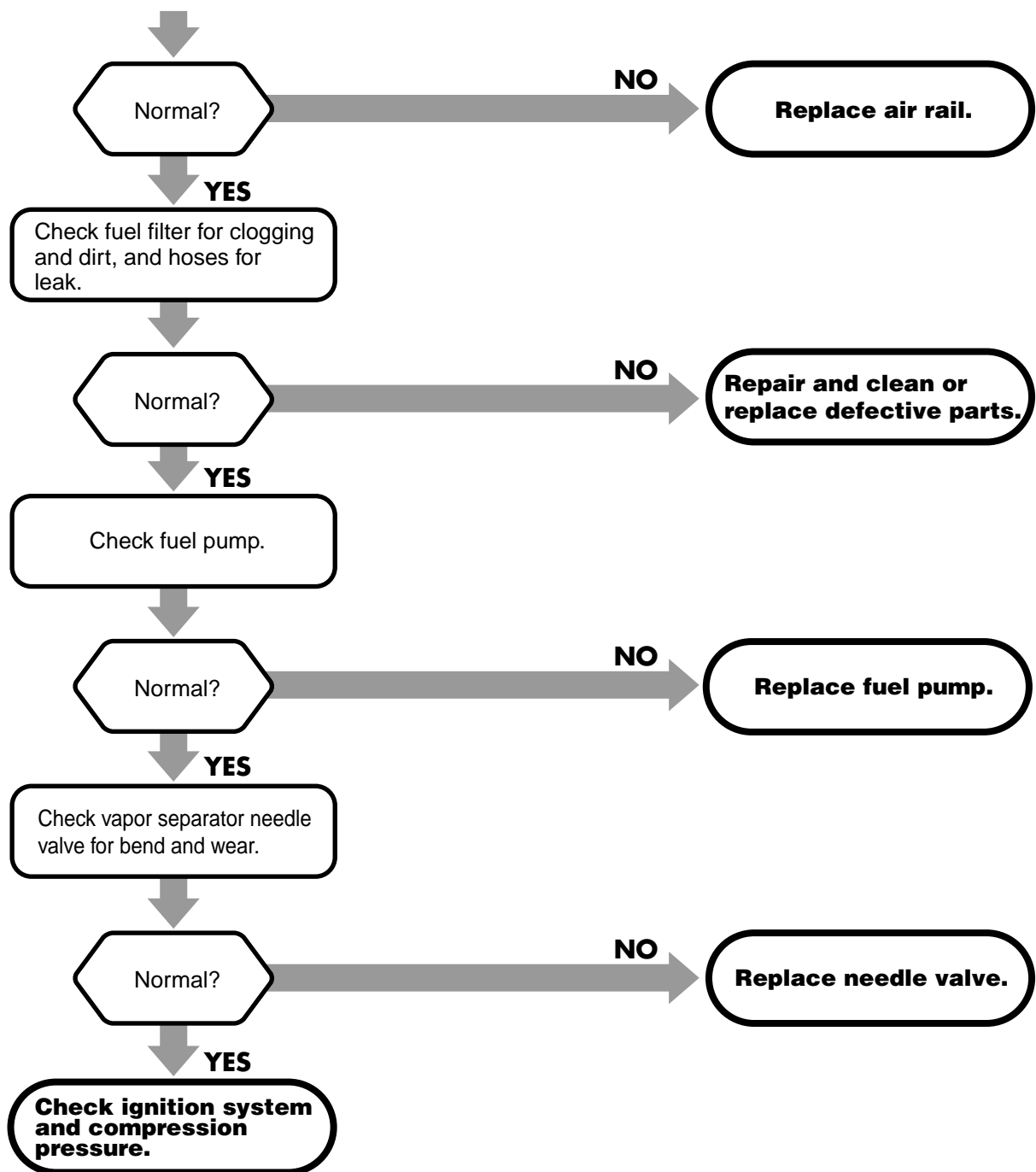




# Troubleshooting

## Fuel System

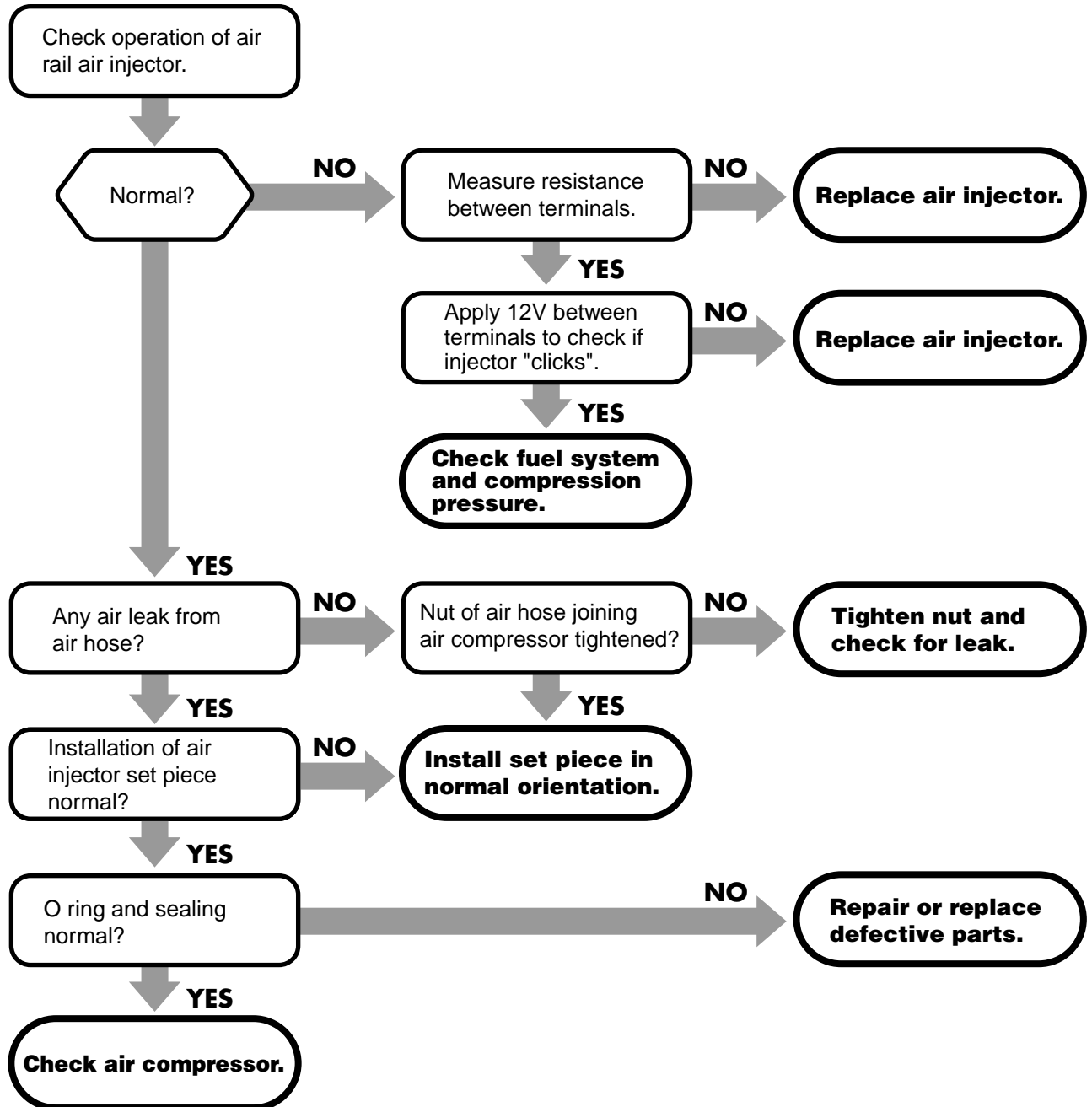


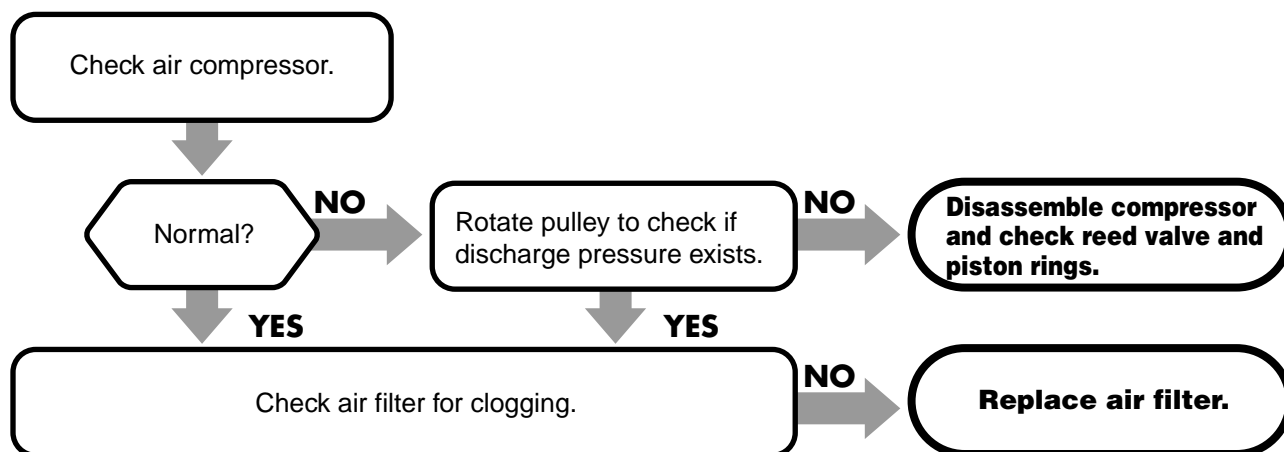




# Troubleshooting

## Air System

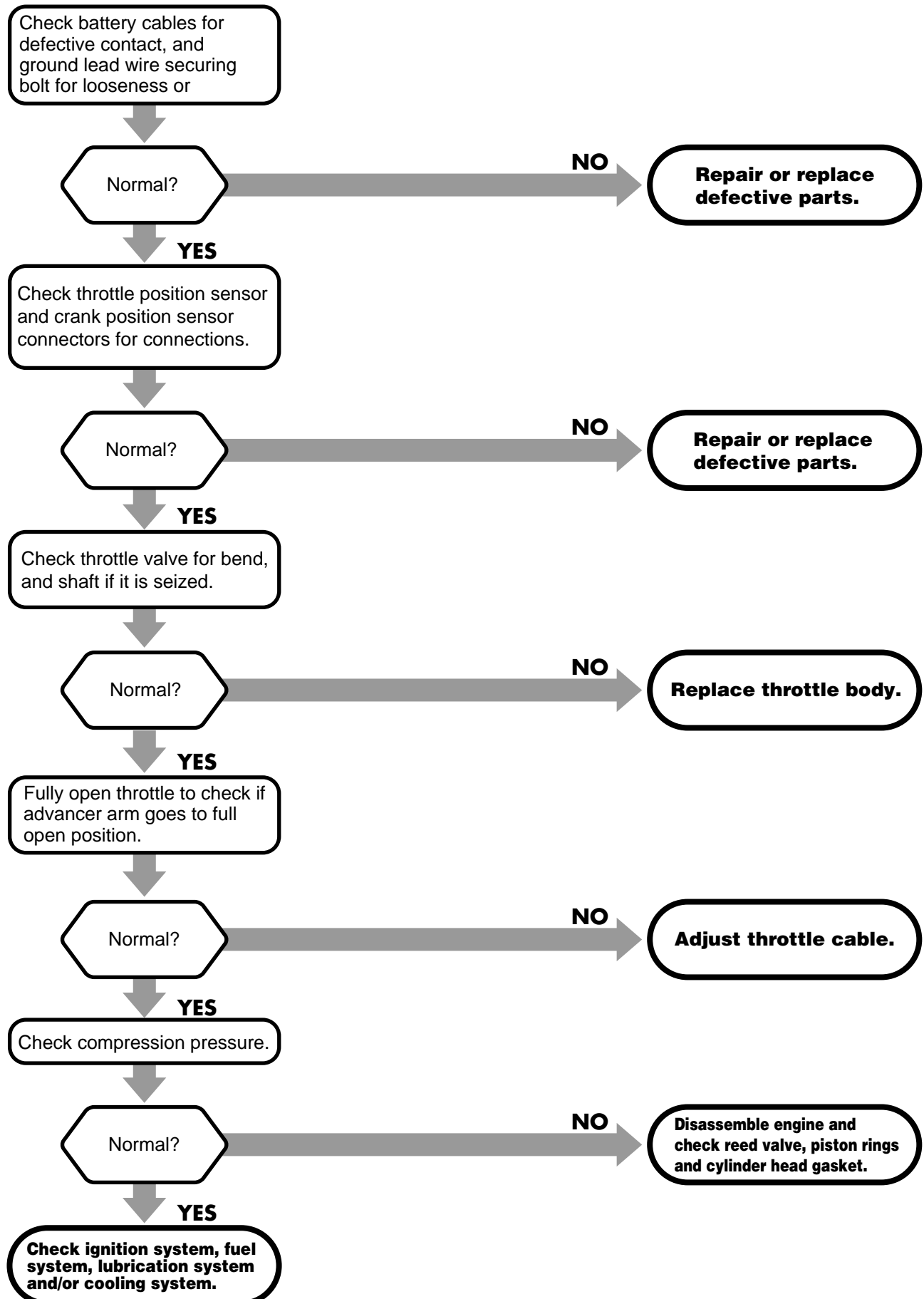




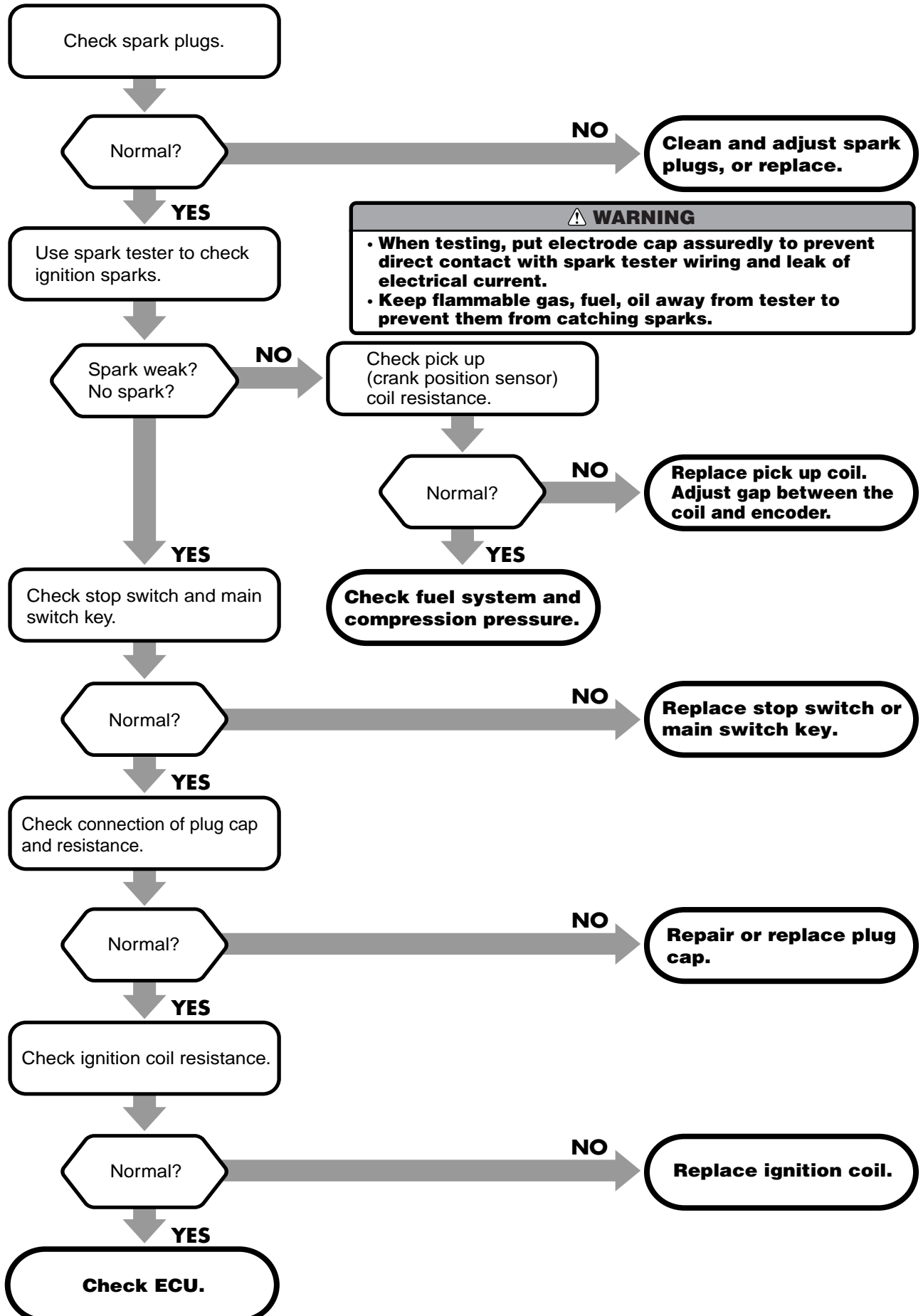


# Troubleshooting

**State 2** Full throttle engine revolution speed is low, engine revolution speed falls off, or engine stalls.



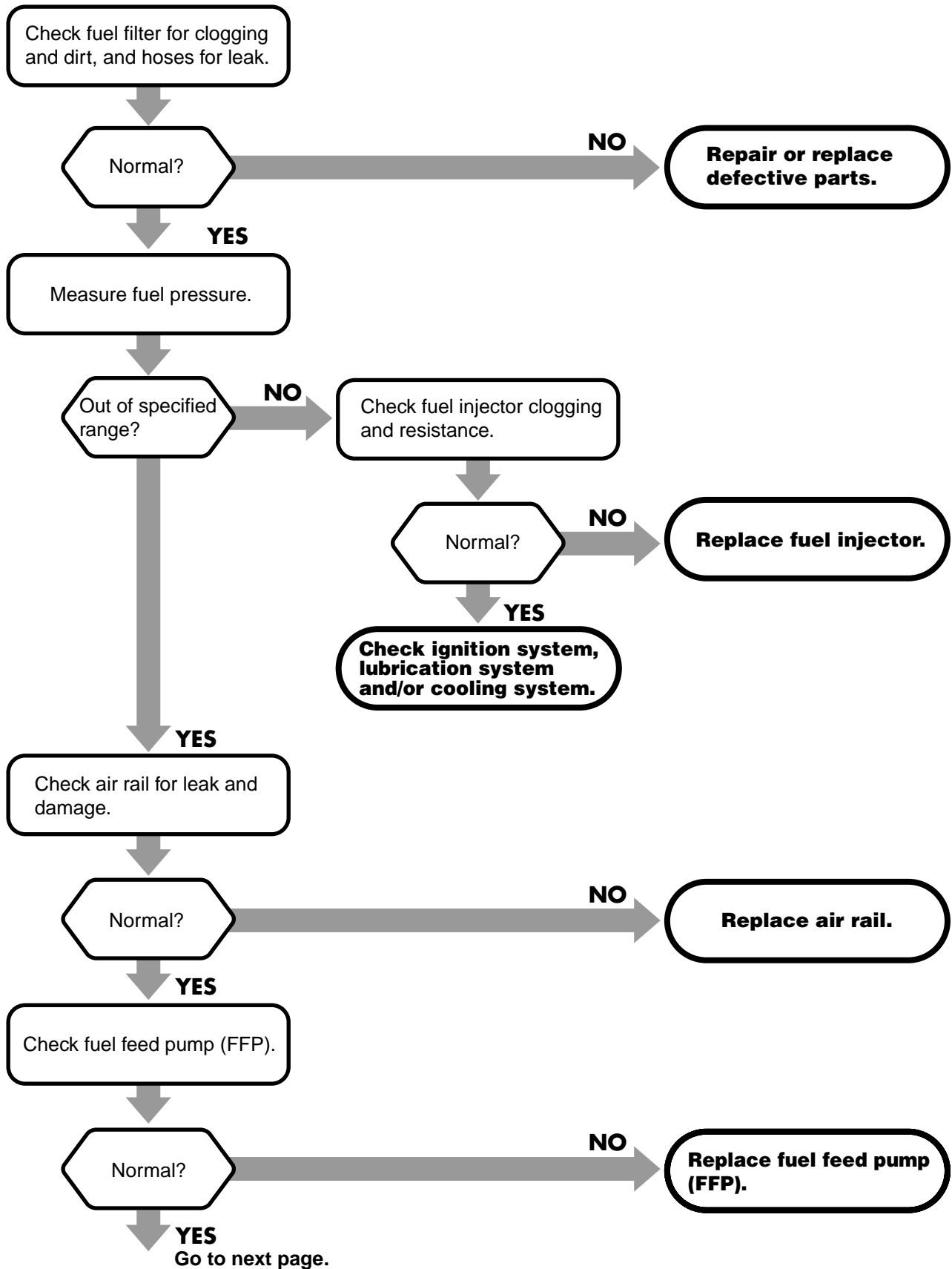
## Ignition System



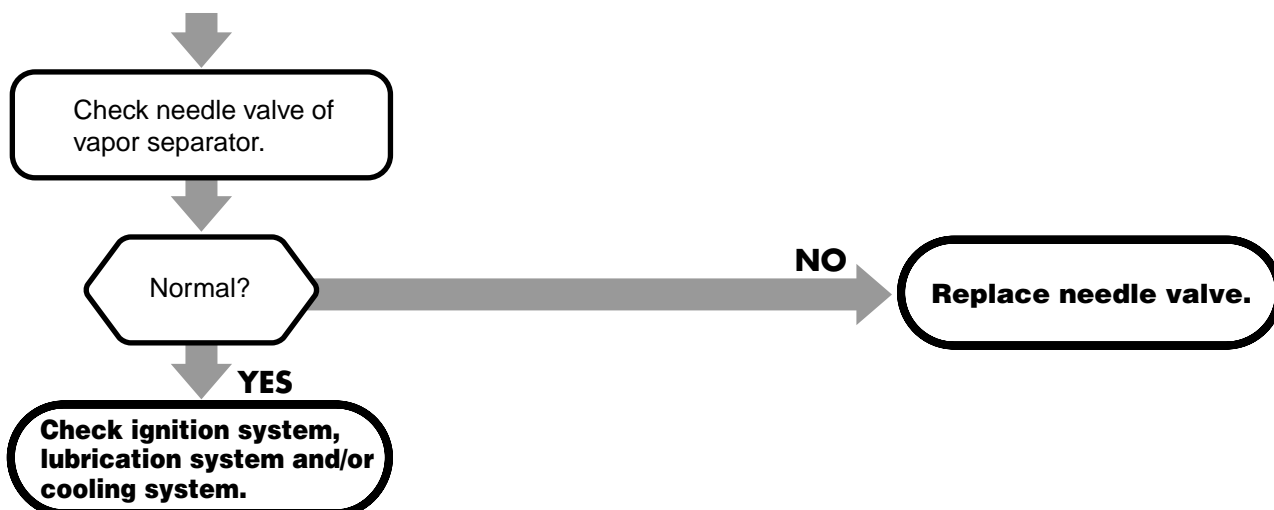


# Troubleshooting

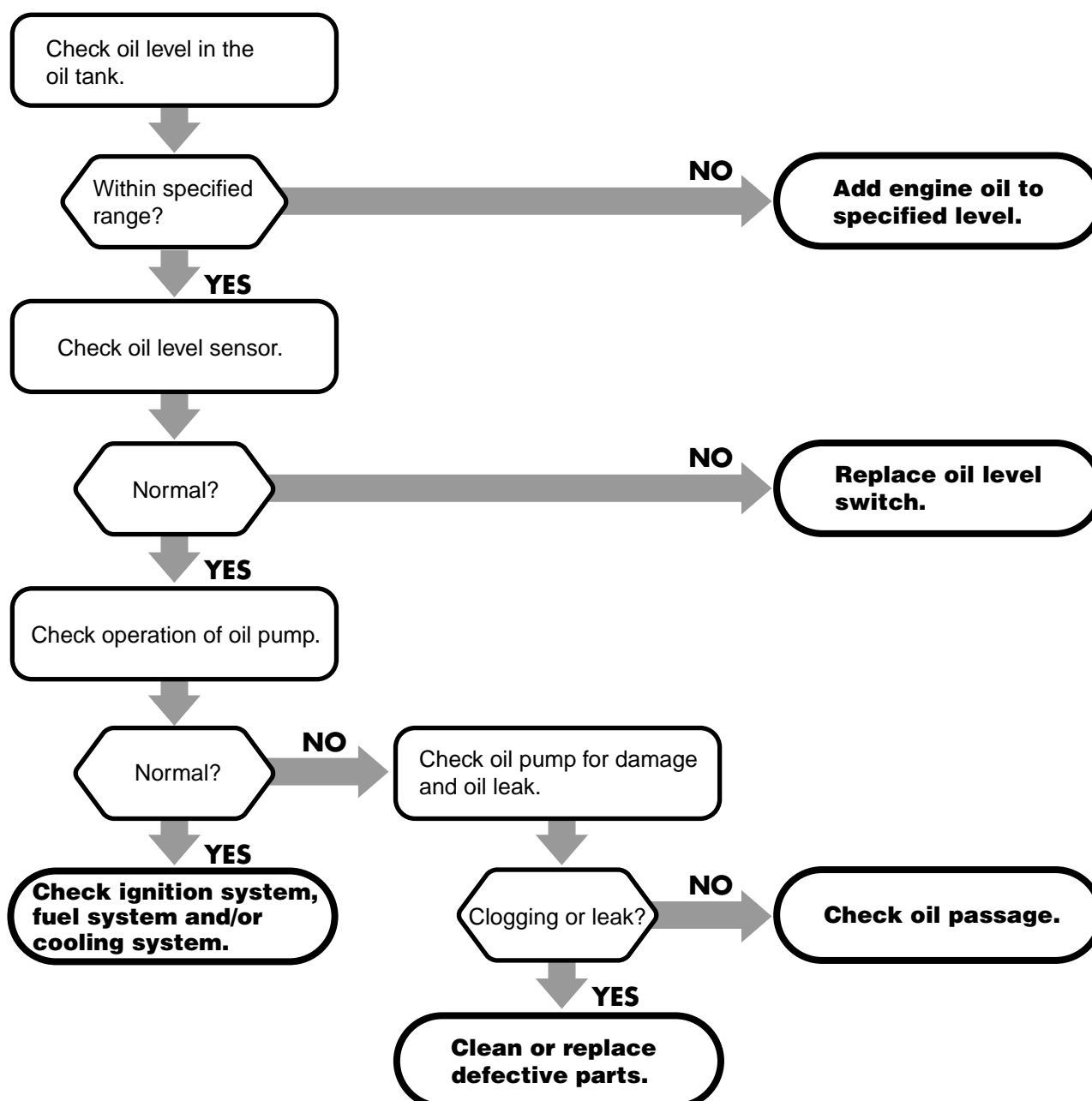
## Fuel System







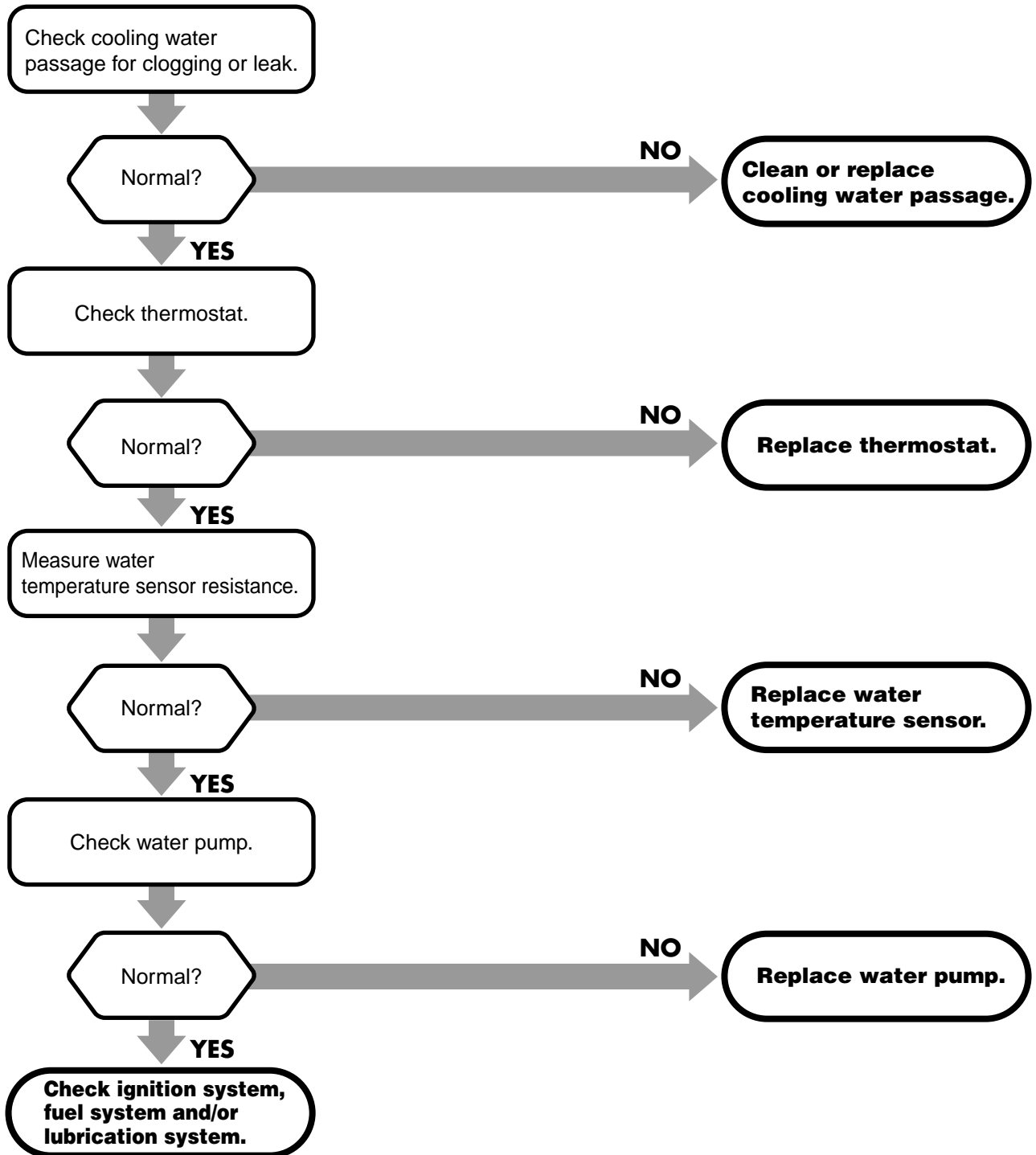
### Lubrication system



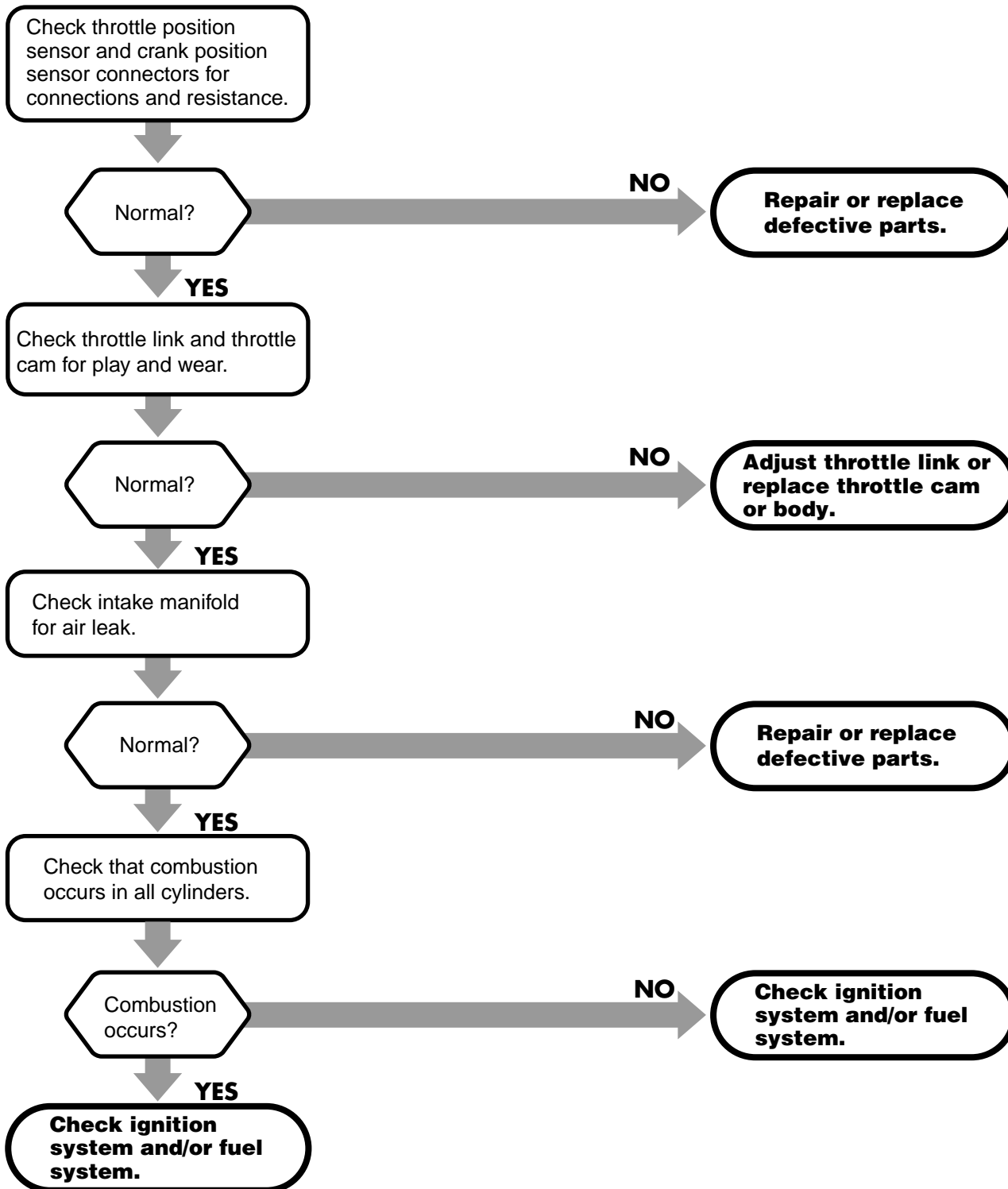


# Troubleshooting

## Cooling System



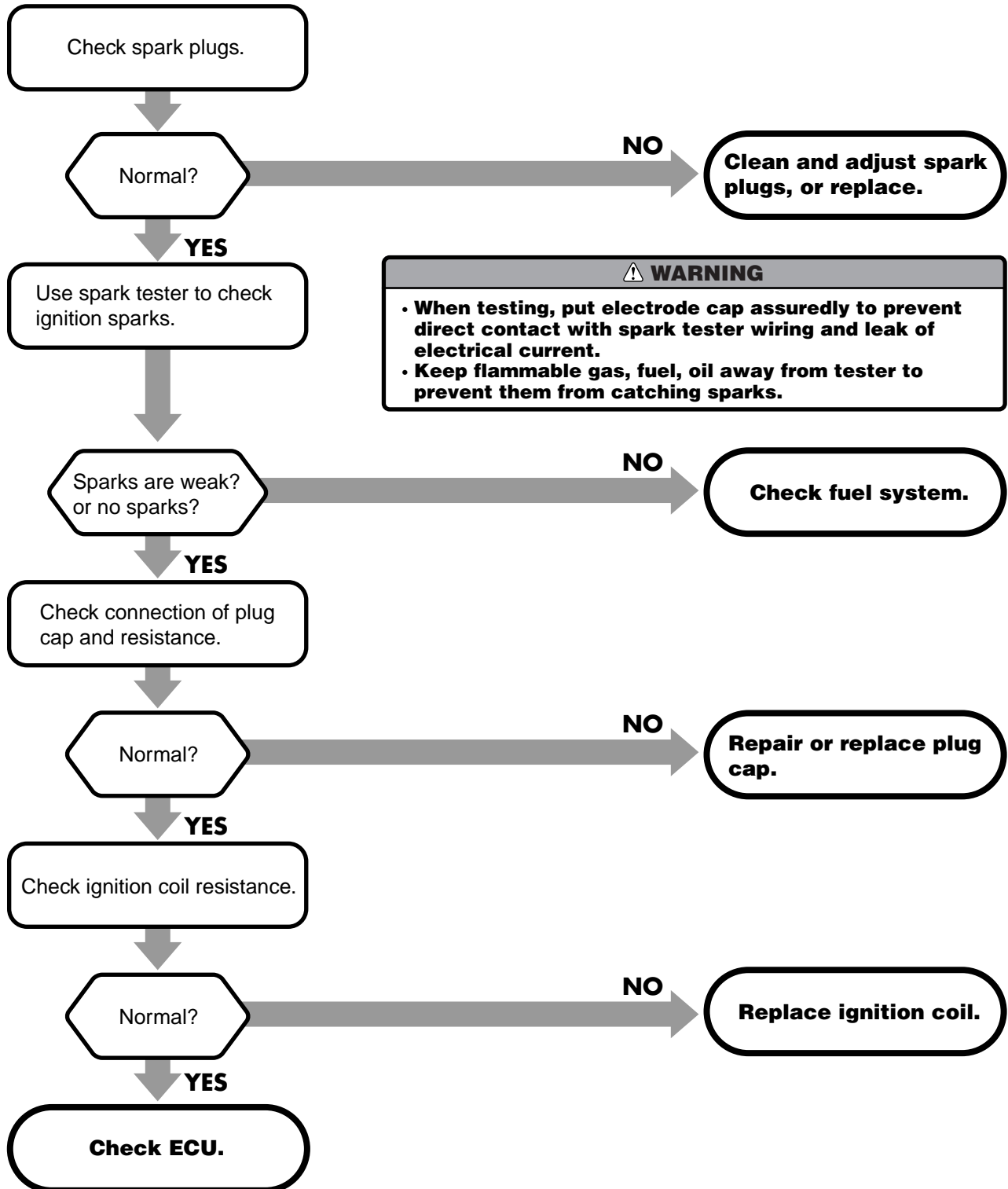
**State 3 Engine rotation is unstable or surging occurs in low speed range.**



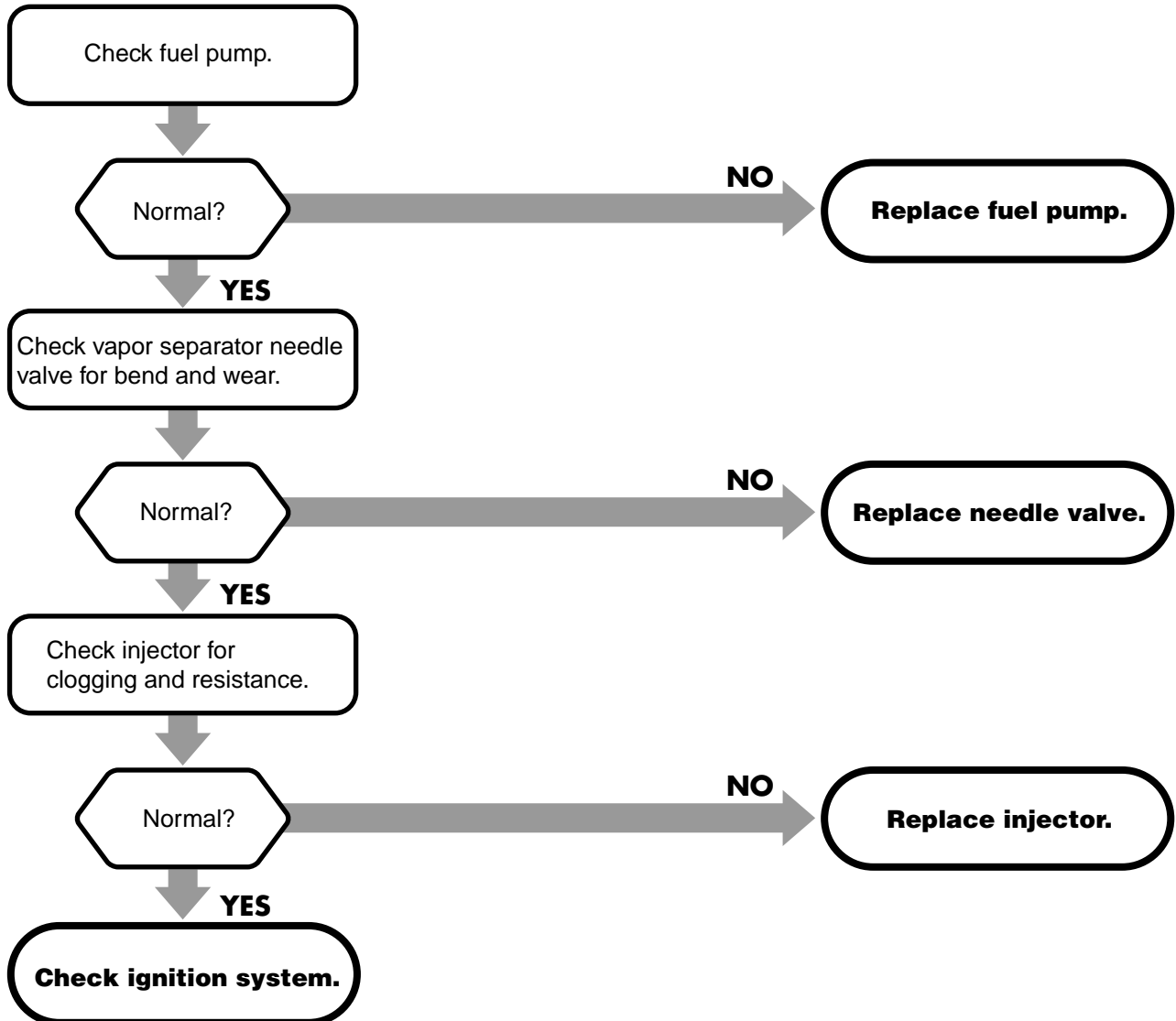


# Troubleshooting

## Ignition System



## Fuel System

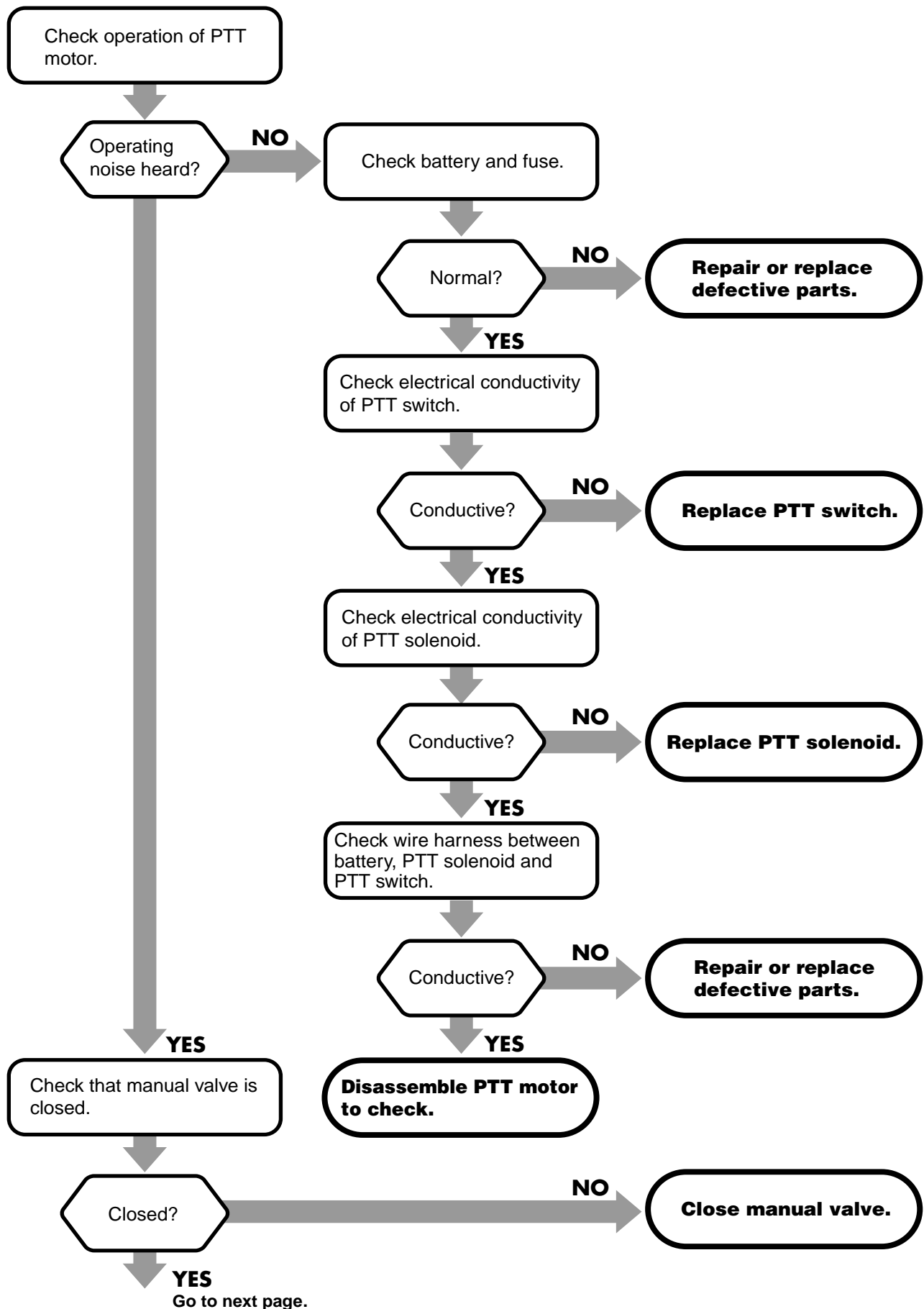


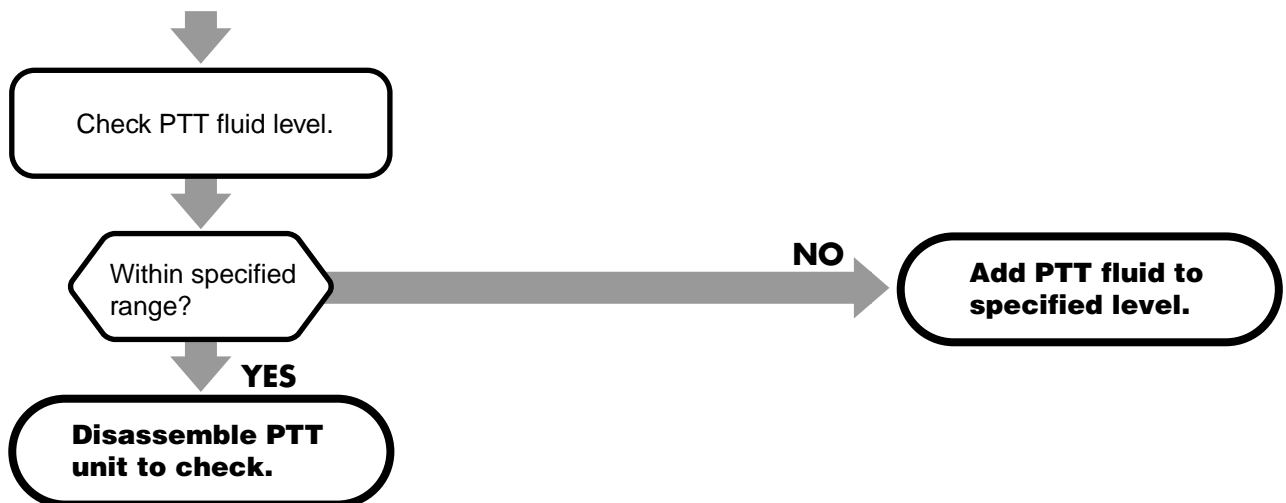


# Troubleshooting

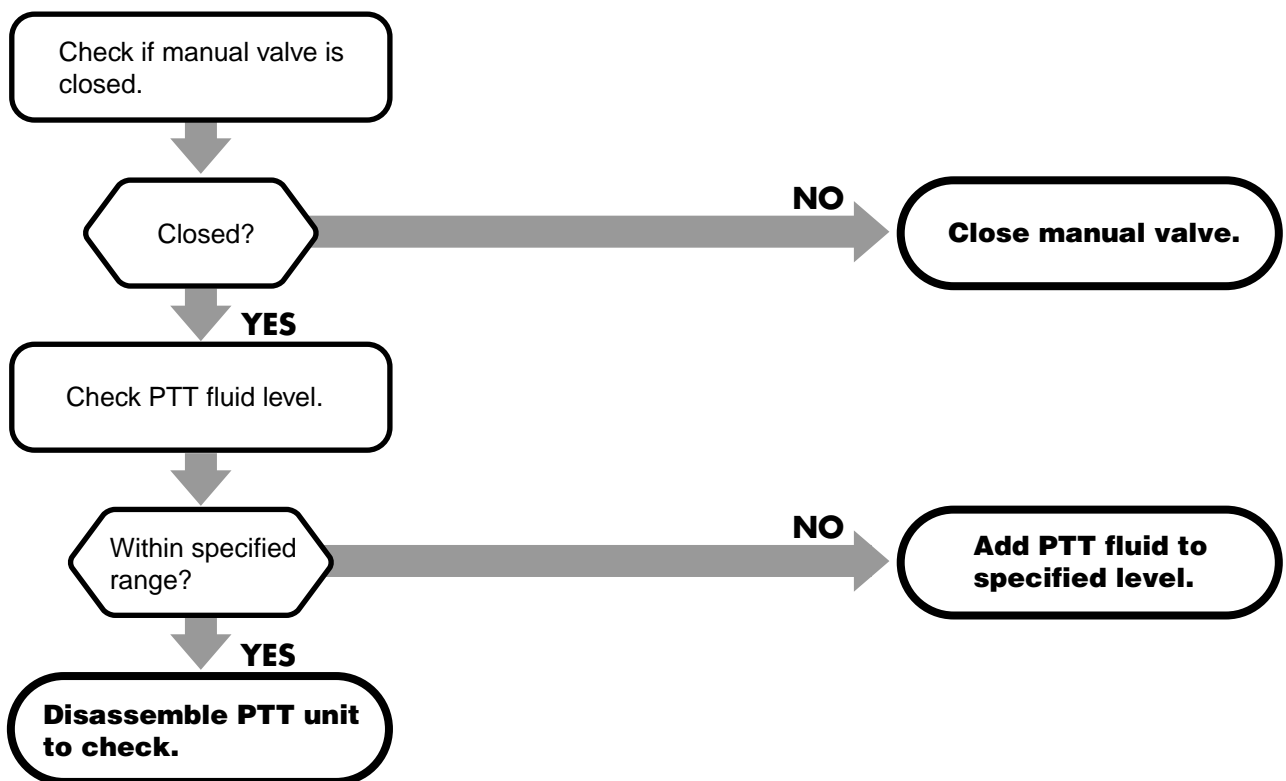
## PTT Unit

**State 1** PTT unit will not operate.





**State 2 PTT is not capable of sustaining outboard motor.**





## 2. Self-Diagnosis Function of TLDI

The self-diagnosis function detects a trouble(s) of electrical system of TLDI engine and displays the part by using ECU installed in the engine. TLDI engine requires no instruments and special equipment such as personal computer when executing the self-diagnosis function that uses key switch operation, tachometer's RPM indication and a combination of three warning lamps to show information necessary for troubleshooting through the following four modes.

The self-diagnosis function of TLDI engine consists of the following four modes.

- Mode 1·····Tachometer operation test
- Mode 2·····Display of engine operation hours
- Mode 3·····Display of fault location and fault history
- Mode 4·····Deletion of fault history

### 1) Terms related to self-diagnosis function

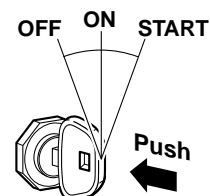
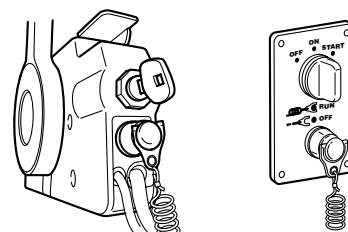
#### Key Switch

Key switch is on the remote control box or switch panel.

The key positions include the following four positions; "OFF", "ON", "START" and push-in position when it is at "ON".

The self-diagnosis function is enabled when the key is at "ON".

**Remote Control Box    Switch Panel**

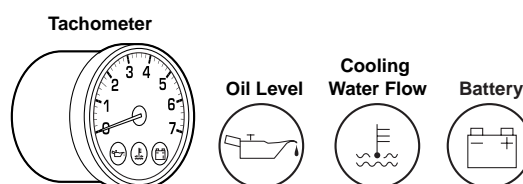


#### Warning Lamp

The warning lamp is mounted on the tachometer to indicate abnormality of cooling water temperature, oil level and battery in case it occurred.

In case of electrical part trouble or abnormality, three lamps blink at the same time to inform of the trouble. (Refer to Warning Indications List.)

The self-diagnosis function uses combinations of these three lamps and tachometer indication to inform of the type of trouble occurred. (Refer to Trouble Indication List.)



#### Warning Buzzer

The warning buzzer is built in the remote control box or switch panel.

The buzzer uses one of the following four operation patterns to inform of a trouble.

- Beep··Two seconds
- Beep··0.3 second
- Beep, Beep, Beep··Three times in every two minutes
- Continuous sounding

#### Trouble History

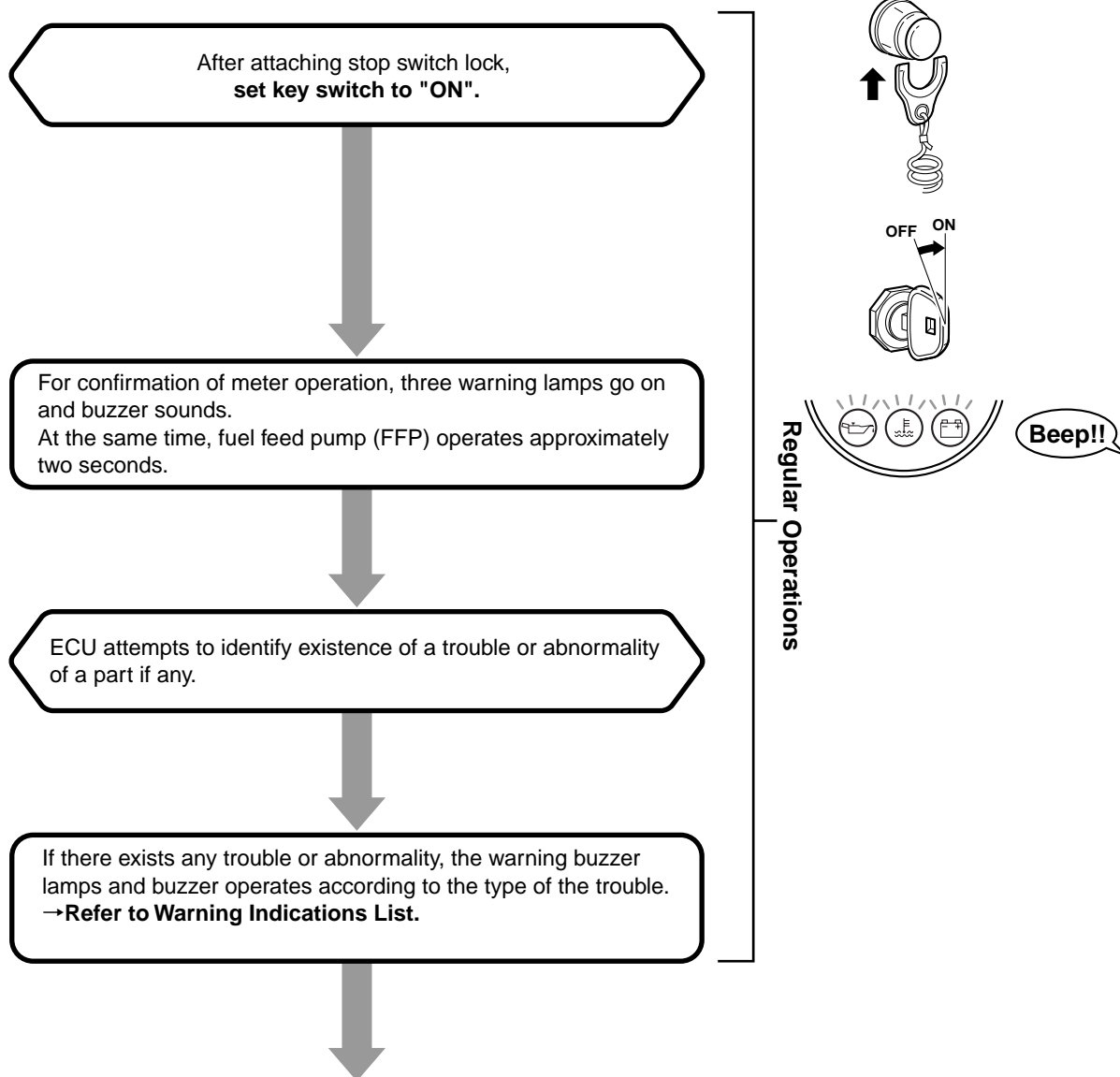
The function stores the history of the troubles or abnormalities that occurred and then recovered in the memory of ECU.

The function allows confirmation of the trouble history.



## 2) Operation Procedure of Self-Diagnosis Function

- \* The self-diagnosis function is enabled only when the engine is stopped state.
- \* The self-diagnosis function is stopped at any moment during the following procedure when the key switch is set to "OFF".

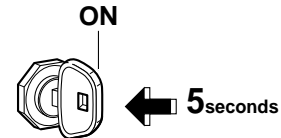




# Troubleshooting

Go into process of the self-diagnosis operation from here.

Set the key to "ON", and push it in (for approximately 5 seconds) until the buzzer sounds.



Beep!!

## Self-Diagnosis Mode 1[Tachometer Operation Test]

After the pointer returns to "zero", the process goes to mode 2 automatically.

Beep!! Beep!!

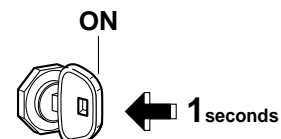


## Self-Diagnosis Mode 2[Indication of engine operation hours]

A combination of tachometer indication and three warning lamps represents engine operation hours.

→**Refer to Operating Hours Indication List.**

Set the key to "ON", and push it in (for approximately 1 seconds) until the buzzer sounds to proceed to mode 3.



Beep!!

## Self-Diagnosis Mode 3[Indication of fault location(s) and fault history]

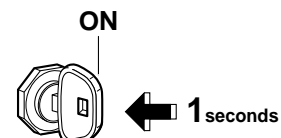
After the buzzer "Beeps" once, a combination of tachometer indication and three warning lamps represents the first fault location and fault history.

→**Take action(s) by referring to the fault indication list.**

Then, every time the key switch is pushed in at "ON" position for approximately 1 second until the buzzer sound, the next fault location and the fault history are represented.

When all the fault locations are represented by going through the above operations, a state of no indication occurs. Then, when the key switch is pressed, representation of the fault locations starts again from the first one.

No indications are represented when there is no fault history (Tachometer and warning lamps do not operate.)

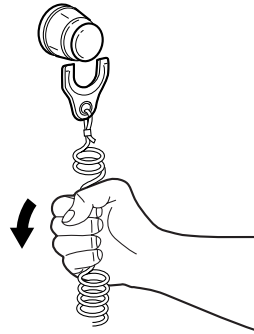


Beep!!

**Self-Diagnosis Mode 4 [Deletion of fault history]**

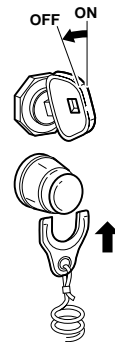
In any of the states in the self-diagnosis mode 3, the fault history is deleted by removing stop switch lock plate and pushing in key for approximately 3 seconds. At this moment, the buzzer "Beeps" three times.

**Note: The operating hours is not deleted.**



**Beep!!  
Beep!!  
Beep!!**

Set key switch to "OFF".  
The self-diagnosis function ends.  
Attach stop switch lock plate.



**Regular operation is resumed.**

The warning lamps and buzzer operate if any fault or abnormality is left unsolved.




→**Refer to Warning Indications List.**

Note : The self-diagnosis function is stopped at any moment during the above procedure when the key switch is set to "OFF".



# Troubleshooting

## 3) Warning Indication List • • • Display for abnormalities during operation





Warning Indicators				ESG Speed Control (*1)
Buzzer Sounding	 Indicator A	 Indicator B	 Indicator C	
Continuous	×	×	×	High speed ESG
Intermittent (3 beeps for every 2 minutes)	Flashing	×	×	-
Continuous	×	Flashing	×	Low speed ESG
Continuous	×	Flashing	×	Forced idling
Continuous	×	Flashing	×	-
Continuous	×	Flashing	×	Low speed ESG
-	×	×	Flashing	Low speed ESG
-	×	×	Flashing	-
-	Flashing	Flashing	Flashing	Low speed ESG
-	Flashing	Flashing	Flashing	Engine stop
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	Forced idling
-	Flashing	Flashing	Flashing	Low speed ESG
-	Flashing	Flashing	Flashing	Forced idling
-	Flashing	Flashing	Flashing	Low speed ESG
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
-	Flashing	Flashing	Flashing	-
Intermittent (3 beeps for every 2 minutes)	Flashing	Flashing	Flashing	Forced idling

Fault Description	Reference	Remedy
Engine over-rev.	Approx. 6,000 r/min	Readjust propeller, outboard engine mounting height and/or trim.
Low oil level	Approx. 1.4L (3.7 gal) or less	Replenish engine oil.
Cooling water temp. high	Approx. 85°C (185°F) *	} *Varies depending on engine speed.
Engine cooling water temp. abnormally high	Approx. 90°C (194°F) *	
Air compressor cooling water temp. high	90°C (194°F)	Refer to troubleshooting.
Air compressor cooling water temp. abnormally high	95°C (212°F)	
Battery voltage abnormally low	Approx. 9V or less	
Battery voltage low	Approx. 10V or less	
Battery voltage high	Approx. 18V or over	Refer to fault indication table.  *1.ESG speed control •High speed ESG : Regulated to approx. 6,000 rpm. •Low speed ESG : Regulated to approx. 3,000 rpm. Approx. •Forced idling : Regulated to idling speed *2.TPS : Throttle Position Sensor *3.FFP : Fuel Feed Pump (Electric) *4.CPS : Crank Position Sensor
Battery voltage abnormally high	Approx. 20V or over	
TPS(*2) Idling position faulty		
TPS malfunction	TPS1 and TPS2	
TPS malfunction	TPS1 or TPS2	
TPS power supply malfunction	TPS1 and TPS2	
TPS power supply malfunction	TPS1 or TPS2	
Air injector malfunction		
Fuel injector malfunction		
Ignition coil malfunction		
FFP(*3) malfunction		
CPS(*4) malfunction		
Temp. sensor malfunction	Engine or air	
MAP sensor malfunction	compressor	
MAP sensor malfunction		
Main power relay malfunction		
Oil pump malfunction		



# Troubleshooting

## 4) Operating Hour Indication List (Self Diagnosis • Mode 2)





Engine Operating Hours (hours)	 Tach. Indication (r/min)	Lamp Indication		
		 Lamp A	 Lamp B	 Lamp C
0 - 1	1,000	—	—	—
1 - 2	2,000	—	—	—
2 - 3	3,000	—	—	—
3 - 4	4,000	—	—	—
4 - 5	5,000	—	—	—
5 - 6	6,000	—	—	—
6 - 7	7,000	—	—	—
7 - 8	800	—	—	Goes on.
8 - 9	900	—	—	Goes on.
9 - 10	1,000	—	—	Goes on.
10 - 20	2,000	—	—	Goes on.
20 - 30	3,000	—	—	Goes on.
30 - 40	4,000	—	—	Goes on.
40 - 50	5,000	—	—	Goes on.
50 - 60	6,000	—	—	Goes on.
60 - 70	7,000	—	—	Goes on.
70 - 80	800	—	Goes on.	Goes on.
80 - 90	900	—	Goes on.	Goes on.
90 - 100	1,000	—	Goes on.	Goes on.
100 - 200	2,000	—	Goes on.	Goes on.
200 - 300	3,000	—	Goes on.	Goes on.
300 - 400	4,000	—	Goes on.	Goes on.
400 - 500	5,000	—	Goes on.	Goes on.
500 - 600	6,000	—	Goes on.	Goes on.
600 - 700	7,000	—	Goes on.	Goes on.
700 - 800	800	Goes on.	Goes on.	Goes on.
800 - 900	900	Goes on.	Goes on.	Goes on.
900 - 1,000	1,000	Goes on.	Goes on.	Goes on.
1,000 - 2,000	2,000	Goes on.	Goes on.	Goes on.
2,000 - 3,000	3,000	Goes on.	Goes on.	Goes on.

---



# Troubleshooting

## 5) Trouble Indication List (Self Diagnosis • Mode 3)

Malfunction / Failure Indication		Description of Problem	Fault Log	
			Fault	Fault Log (Yes)
 Tachometer Indication (r/min)	 Indicator A		 Indicator B	 Indicator C
0	Off	No malfunction of failure	Off	Off
0	On	Battery voltage high	Lighting of the lamp means that the wiring is broken or a component malfunctions.	Lighting of the lamp means that the wiring is broken or a component malfunctions.
0	Flashing	Battery voltage abnormally high		
1,000	Off	#1 Air injector malfunction		
1,000	On	# 1Fuel injector malfunction		
1,000	Flashing	#1 Ignition coil malfunction		
2,000	Off	#2 Air injector malfunction		
2,000	On	#2 Fuel injector malfunction		
2,000	Flashing	#2 Ignition coil malfunction		
3,000	Off	#3 Air injector malfunction		
3,000	On	#3 Fuel injector malfunction		
3,000	Flashing	#3 Ignition coil malfunction	Does not go on even when the wiring is broken or a component malfunctions. →Refer to *1.	Refer to *2.
500	Off	Oil level low		
500	On	Battery voltage low		
500	Flashing	Battery voltage abnormally low		
4,500	Flashing	Oil pump malfunction		
5,000	Off	CPS (*3) malfunction		
5,000	On	#1TPS (*4) Idle position incorrect		
5,000	Flashing	#2TPS Idle position incorrect		
5,500	Off	#1TPS malfunction		
5,500	On	#1TPS Power voltage high		
5,500	Flashing	#1TPS Power voltage low	Lighting of the lamp means that the wiring is broken or a component malfunctions.	Lighting of the lamp means that the wiring was once broken or a component once malfunctioned.
6,000	Off	#2TPS malfunction		
6,000	On	#2TPS Power voltage high		
6,000	Flashing	#2TPS Power voltage low		
6,500	Off	Engine water temp. sensor malfunction		
3,500	On	Air compressor water temp. sensor malfunction		

\*3.CPS:Crank Position Sensor

\*4.TPS:Throttle Position Sensor

\*5.FFP:Fuel Feed Pump (electric)



## Remedial Measures and Added Notes

Refer to troubleshooting.

Replace the component, or check wiring and connections for abnormality, and repair if necessary.

- \*1. When an injector or ignition coil malfunctions, the lamp B does not go on in the self-diagnosing mode where engine is not operating to check that the components are under control of ECU.
- \*2. If the lamp C goes on, the wiring may be broken or a component may be faulty at present.
  - Corrective action : Delete current fault log (Mode 4. Refer to "Deleting Malfunction Log".) Then, start the engine (or crank for 5 seconds or longer) to confirm the details of malfunction or abnormality in the self-diagnosing mode. Take a corrective action if the same malfunction or abnormality is indicated with the lamp C.
  - If an ignition is suspected to be defective --- Check wirings and connectors, and if no problem is found, replace injector.
  - If an ignition coil is suspected to be defective --- If "only one malfunctions" indication is displayed, replace the component with new one, and if the fault indication still appears, check the wiring.
  - If "all of four malfunction" indication is displayed, a short-circuit may exist, or any one of the ignition coils may be short-circuited internally.
- \*3. Ignition coil malfunction may be indicated if the insulation resistance is reduced due to build up of carbon on the spark plug. Thus, check spark plug also before replacing ignition coil.

Replenish engine oil.

- \* If the lamp indicating a malfunction is still lit after replenishing engine oil, a short-circuit may exist or a component may be faulty.

Refer to troubleshooting.

Replace the component, or check wiring and connections for abnormality, and repair if necessary.

Replace the component, or check wiring and connections for abnormality, and repair if necessary.





- \* The lamp may show malfunction even when no faulty component or wiring exists if the engine revolution changes much.

Refer to TPS initial value resetting method.

Replace the component, or check wiring and connections for abnormality, and repair if necessary.



# Troubleshooting

Malfunction / Failure Indication		Description of Problem	Fault Log	
 Tachometer Indication (r/min)	 Indicator A		Fault	Fault Log (Yes)
			 Indicator B	 Indicator C
6,500	On	Engine cooling water temp high	Lighting of the lamp means that the cooling water temperature is high.	Lighting of the lamp means that the cooling water temperature was once high.
6,500	Flashing	Engine cooling water temp. abnormally high		
7,000	On	Air compressor cooling water temp. high		
7,000	Flashing	Air compressor cooling water temp. abnormally high		
7,000	Off	FFP (*5) malfunction	Off	Off
4,500	On	MAP sensor malfunction	Lighting of the lamp means that the wiring is broken or a component malfunctions.	Lighting of the lamp means that the wiring is broken or a component malfunctions.
4,500	Off	MAT sensor malfunction		
2,500	Off	Main power relay malfunction		

\*5 FFP : Fuel Feed Pump

Remedial Measures and Added Notes

Refer to troubleshooting.

Refer to troubleshooting.

Refer to troubleshooting.



# Troubleshooting

## 6) Resetting TPS Initial Values

Use the following procedures to reset the ECU and TPS idling position in case where self-diagnosing indicates idling position errors for TPS1 and TPS2.

- ① When either the TPS or ECU is replaced or control cables replaced :
- ② When the self-diagnosing function indicates "TPS Idling Position Error" :
- ③ When links and rod snap rings are replaced due to warping or wear in the linkage :
- ④ When the TPS idling Position Error indication appears after performing engine disassembly and assembly operations :
- ⑤ When a new engine is first put into service :

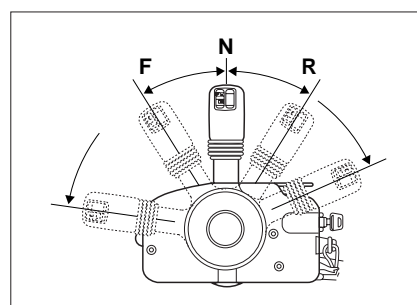
It is necessary to reset the ECU and TPS idling position if any of the above conditions occurs.

### Reset Procedure

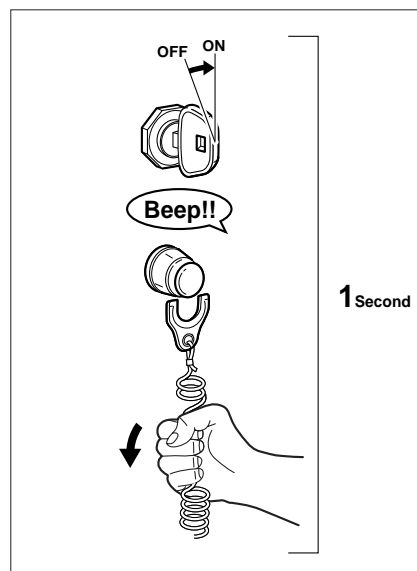
1. With the throttle in the fully closed position adjust the cables or wires in order bring the advancer arm into contact with the fully closed stopper position. Then, move the throttle several times to confirm that the arm is seated snugly against the fully closed stopper.

**Refer of chapter3.**

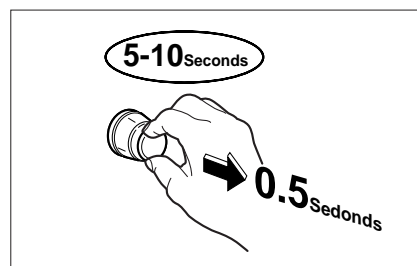
2. Perform the following procedures with the throttle in the fully closed position. (Refer to the figure below.)



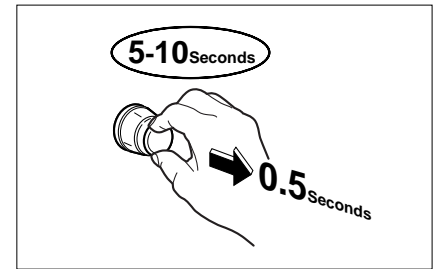
- ① set the key switch to the On position. Disconnect the stop lock switch with in one second after the beep stops sounding.



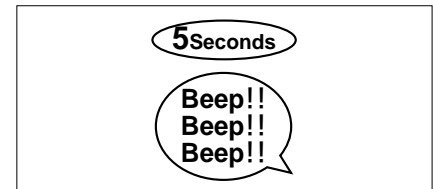
- ② Wait about 5 to 10 seconds, Pull the red knob on the stop switch and immediately release the switch.



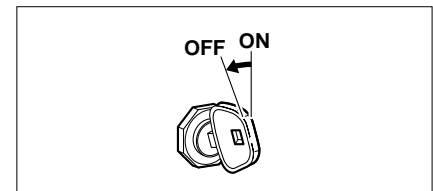
- ③ Wait another 5 to 10 seconds, again pull the red knob on the stop switch for about 0.5 seconds, then release the switch.



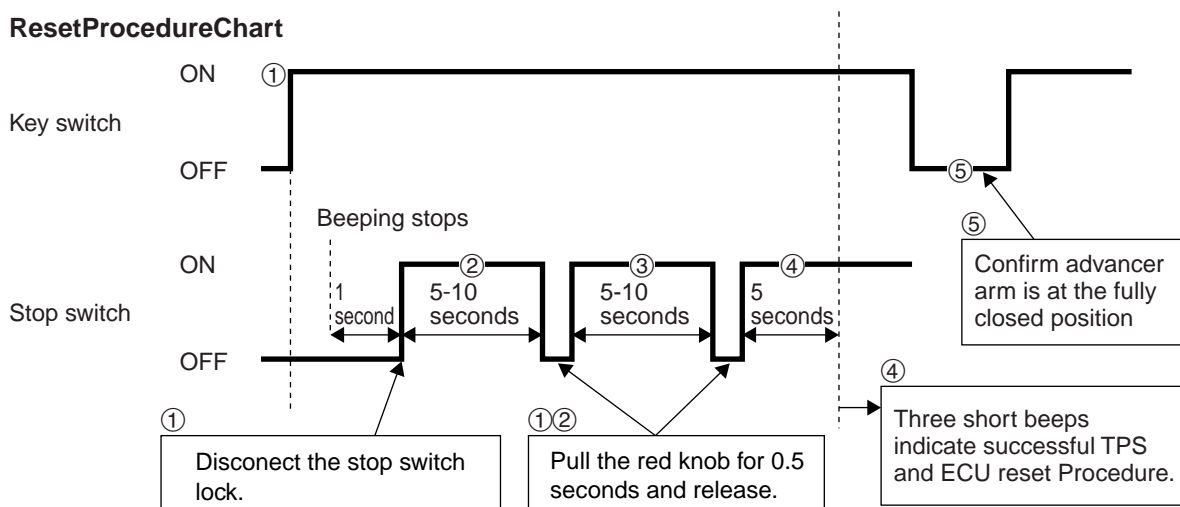
- ④ Resetting of TPS and ECU is completed when the buzzer “Beeps” three times approximately 5 seconds after the knob of stop switch is returned to original position.



- ⑤ Next, set the key switch to the Off position, confirm that the throttle (advancer arm) is at the fully closed position, then turn the key switch to the On position.



#### ResetProcedureChart





# Troubleshooting

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# 10

## Rigging



r/min

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# Rigging

## 1. Service Information

The persons who perform the rigging should take sufficient care for prevention of damages to himself or herself and the products, prevention of fire, and ventilation of the shop.

The persons who operate the boat equipped with this product for test run should read the operating instructions of the outboard, and be familiar with the operating procedure.

## 2. Service Data

### 1) Load Limit of Boat

Do not over-power the boat and take care not to over-load the engine. Boat manufacturers specify the maximum allowable engine power and complement of their boats in accordance with certain standards and show the data on the plate attached to the boats. For unknown matters, if any, inquire of the dealer or manufacturer of the boat.

#### **WARNING**

**Never use boat equipped with an outboard motor(s) that outputs power exceeding the maximum allowable limit specified by the manufacturer of the boat, or the following problems can occur.**

- **The boat can go out of control.**
- **The buoyancy property of the boat varies from the designed value if the boat is overloaded especially at the transom.**
- **The boat may crack or be damaged around the transom.**

**Over-powering boats can cause serious injury, fatal accident and/or serious damages to the hull.**

### 2) Installation Dimensions

Minimum Allowable Size of Transom Opening : (a)

Single Machine Installation (Remove Control Models)

848 mm (33.39 in.)

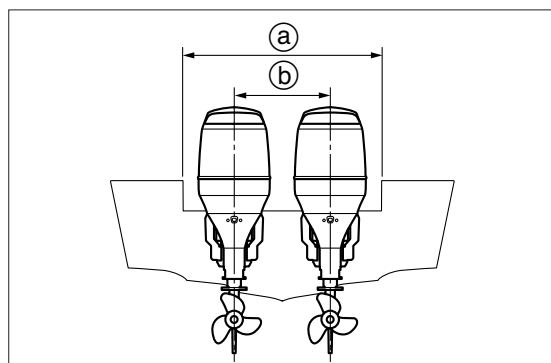
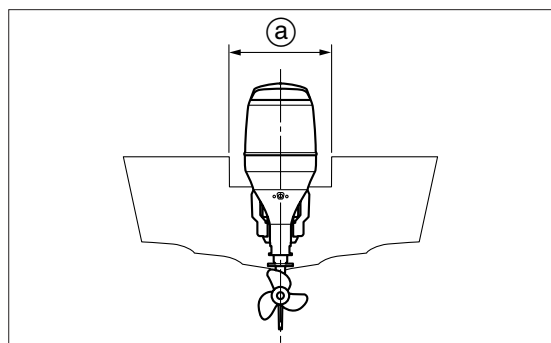
Twin Machine Installation     1,518mm (59.76 in.)

Minimum center-to-center distance for twin installation : (b)

700 - 890 mm (27.55 - 35.04 in.)

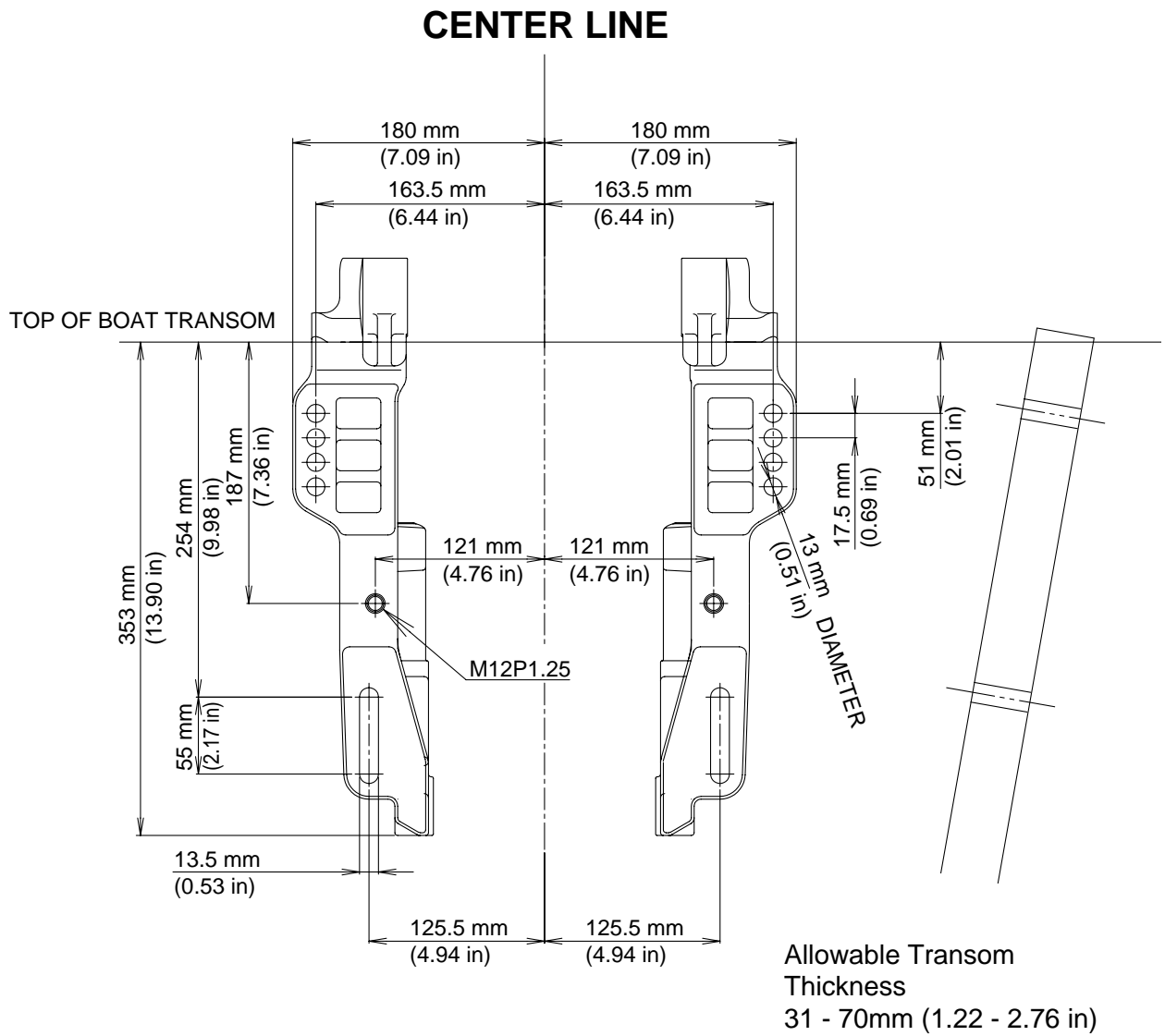


Installation of an outboard motor(s) at higher position(s) can cause engine overheating and/or damages to gear case components.





### 3) Clamp Dimensions

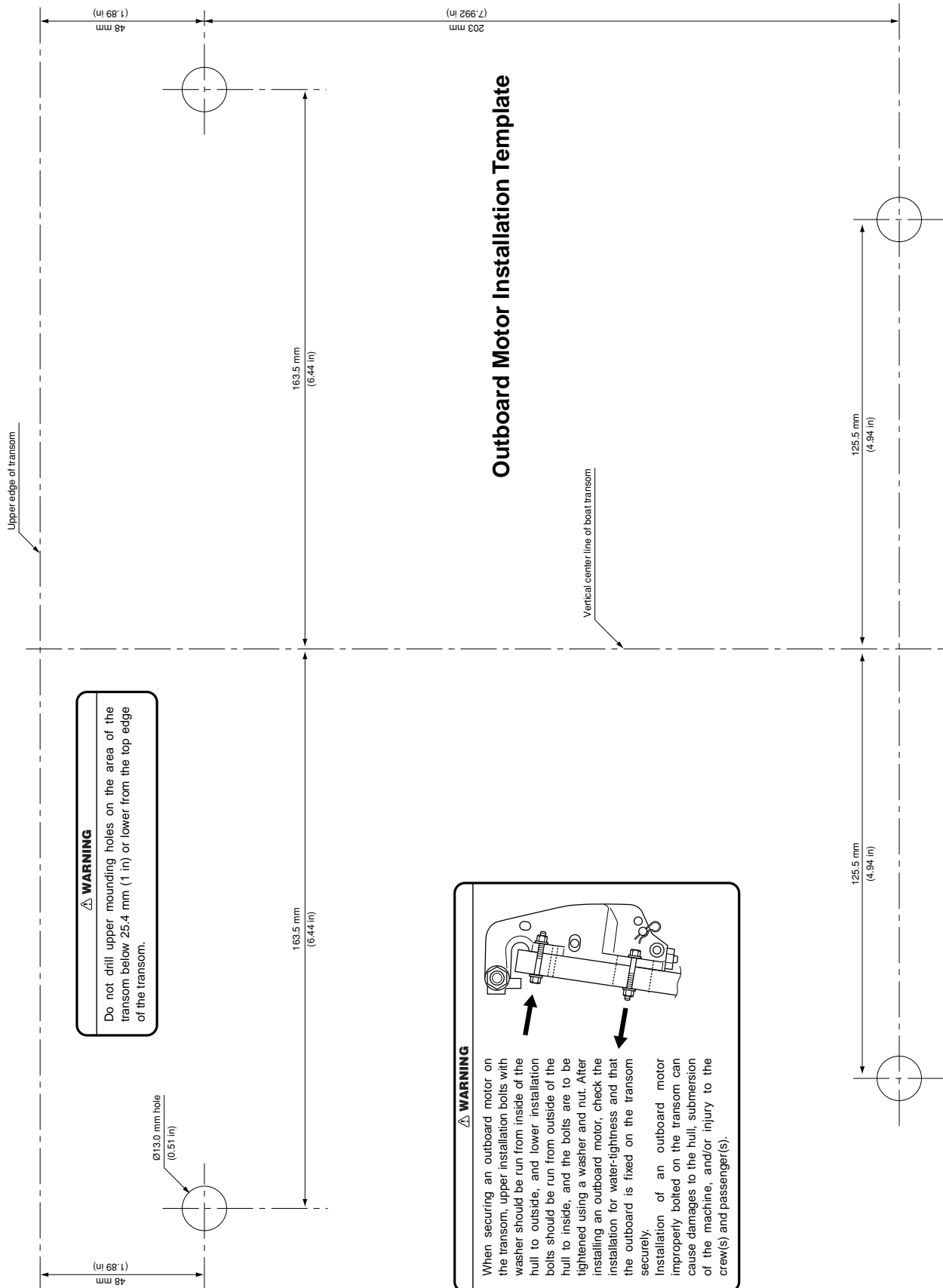




# Rigging

## Transom Dimensions and Drilling Template (An example)

\* Full scale transom dimensions and drilling template is shown at the end of this manual.

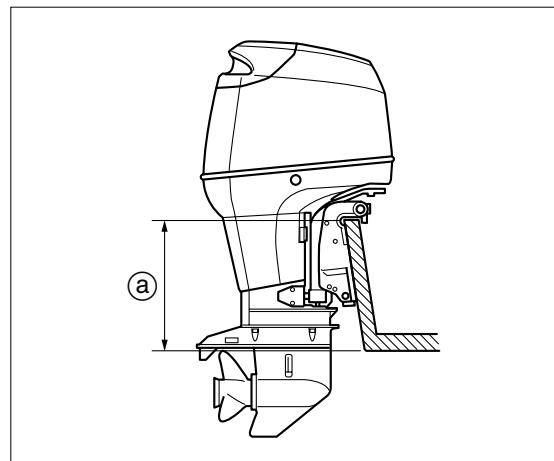




Installation of an outboard motor at higher position can cause the matters described below.

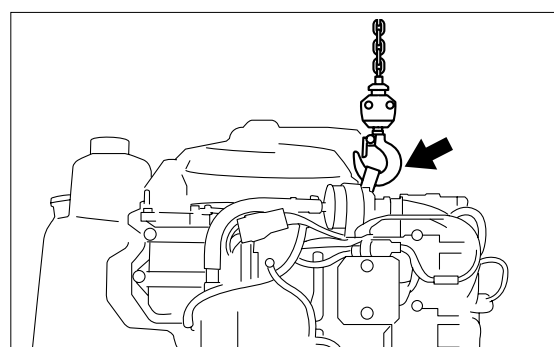
- 1) Lower steering torque
- 2) Higher top speed
- 3) More stable boat attitude
- 4) Propeller can easily run above water surface (over-revs) during planning or when the boat is heavily loaded.

- Ⓐ : Outboard installation height is the distance from the boat's bottom to upper edge of outboard motor transom bracket.



#### 4) Hanging Outboard Motor

Use hanger installed on the engine.

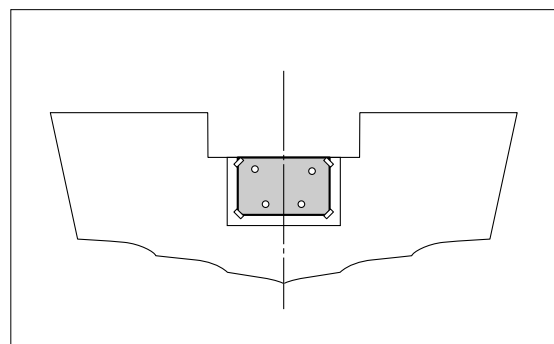


#### 5) Installation of Outboard Motor

1. Put the outboard motor installation template on the transom.



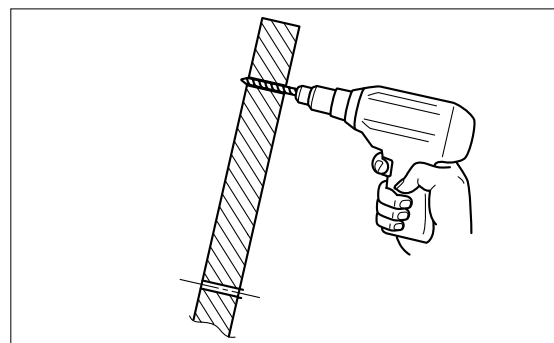
Align center line of template with center line of transom accurately.



2. Mark up the transom with four 13 mm (0.53 in) mounting holes and drill.



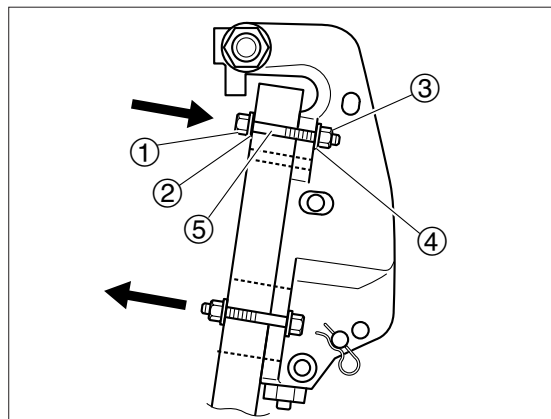
Drill at right angle to transom surface to align the transom holes with outboard motor's transom bracket holes accurately.





# Rigging

3. Install outboard motor(s).
4. Secure the outboard motor by using fasteners contained in the package of the product.
  - ① : 12.7mm (1/2in.) Bolts (4 pcs.)
  - ② : Flat Washers (4 pcs.)
  - ③ : Lock Nuts (4 pcs.)
  - ④ : Flat Washers (4 pcs.)
  - ⑤ : Marine Sealant : Apply to the bolts' surface excluding their threaded area.



## 3. Fuel System

It is recommended to install additional large sized fuel/water separator on the boat to effectively remove water and foreign substances contained in the fuel. At the same time however, note that the fuel filter added to the fuel system may prevent smooth flow of fuel, possibly causing the engine to stall at low speeds, or fuel to be lean at higher engine speed resulting in giving damage to the engine. Use of valve fitting can also cause similar troubles.

### ⚠ WARNING

**To prevent damaging to the engine, use the following steps to prime the electric oil pump, pressure-feed the oil, and air-purge the oil in the order described below before starting the engine initially after the installation of the outboard motor.**

### 1) Fuel

Avoid the use of old gasoline or gasoline containing impurities such as sand or mud in any occasion such as break-in operation of the engine and even after the break-in.

### ⚠ WARNING

**Do not use gasoline pre-mixed with engine oil for this engine.**

### 2) Oil

Use Genuine MD Oil. (Oil for two stroke direct injection engine recommended by the outboard manufacture)



Use of low quality engine oil can cause serious damage to the engine.

### 3) Electric Fuel Pump

Electric fuel pump pressure, if used in conjunction with engine mechanical fuel pump, must be limited to no more than 0.03 MPa (4 psi) [0.3kg/cm<sup>2</sup>].

### 4) Installation of Fuel Filter

#### <Portable Fuel Tank>

Fix the tank on the proper location of the boat taking into consideration the engine's fuel hose length.

#### <Stationary Fuel Tank>

Install the tank in accordance with regulations relevant to grounding, anti-siphoning protection, ventilation and other matters.

## 5) Connection of Fuel Hose

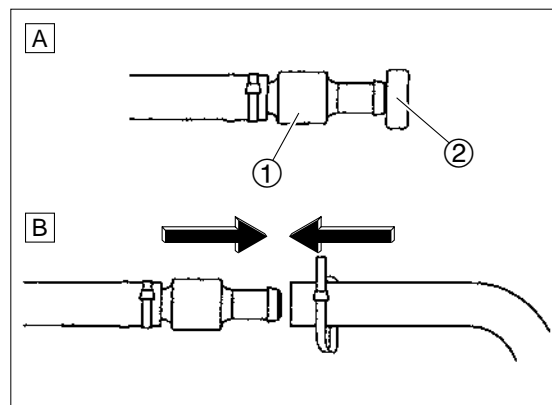
Secure remote fuel hose to the fitting by using hose tie.

**A** : Remove cap ② from tip of hose nipple ① of fuel hose.

**B** : Use hose tie to secure remote fuel hose.



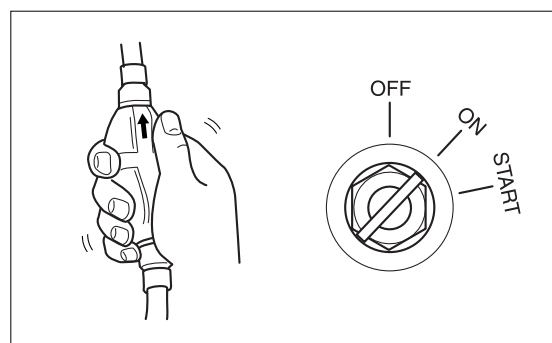
For fuel hose, use independent fuel line / fuel tank pick up for individual engines, and use fuel hose of minimum inner diameter of 8mm (0.315 in, 5/16 in).



## 6) Filling Fuel System

Fill the fuel system as described below before initially starting new engine, after engine exhausted fuel, or after draining fuel from engine.

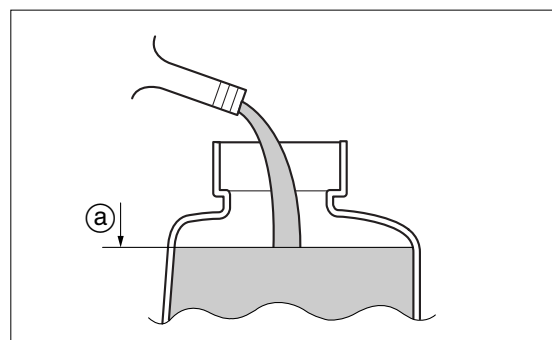
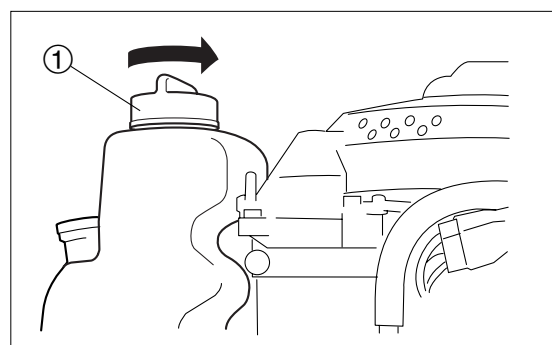
1. Squeeze priming bulb of fuel hose until it becomes stiff.
2. Set key switch to "ON" position for three seconds to operate electric fuel pump.
3. Return key switch to "OFF" position and squeeze priming bulb again until it becomes stiff. Set key switch to "ON" position for three seconds again. Repeat these steps until primary bulb of fuel hose becomes stiff.



## 7) Filling Oil Tank

Note: Oil tank capacity is 4.3L (1.14gal).

1. Remove top cowl, and then turn oil tank cap ① counter clockwise to remove.
  2. Pour specified quantity of engine oil into oil tank. Do not overfill. Oil level should be below filler neck ②.
  3. Put oil tank cap on the tank and tighten. Reinstall top cowl.
- ② : Oil Upper Level 4.3L (1.14gal)





# Rigging

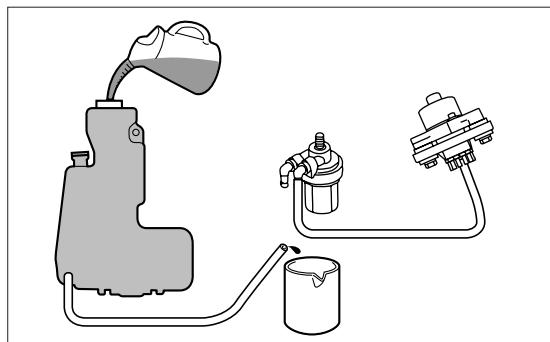
## 8) Priming Oil Pump

After installing outboard motor, prime oil pump before initially starting the engine. The priming removes all air bubbles contained in the pump, oil feed hose and internal oil passage.

Refer to “Air Purging” in Chapter 4.

### WARNING

**To prevent damaging to fuel pump, fill engine's fuel system with fuel. If not, the fuel pump operates without fuel during priming of oil pump.**

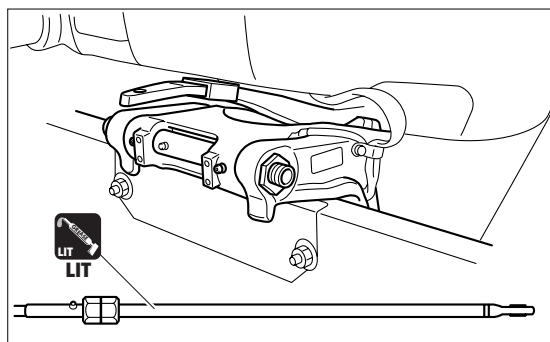


## 4. Connections to Outboard Motor

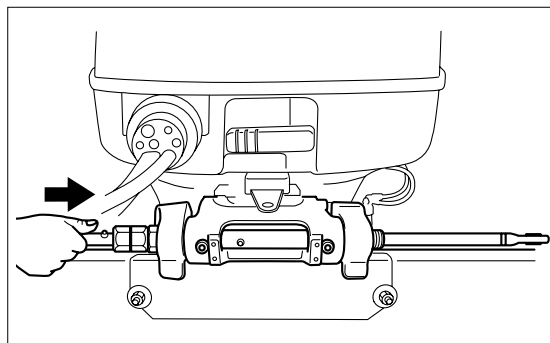
### 1) Steering Cable

Cable arranged on the starboard side

1. Apply thin coat of grease to entire area of cable end.



2. Run steering cable into tilt tube.



3. Tighten nut to specified torque.

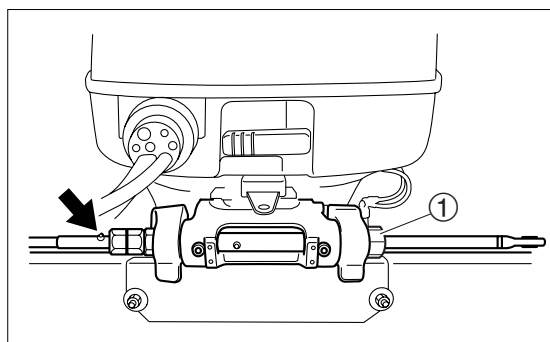


**Nut :**

48 N · m (35 lb · ft) [4.8 kgf · m]



Be sure to attach drag link seal ring ① 3F3-84908-0.



## 2) Drag Link

1. Attach drag link as shown.



When installing steering rod that connects engine and steering cable, be sure to use special bolt ( ① : 3E0-84917-0) and nylon lock nuts ( ② : 353-84918-0 and ③ : 353-84916-0). Do not use regular non-lock type nuts in place of these lock nuts, or the nuts may be loosened due to mechanical vibration resulting in disconnection of the link rod.

### WARNING

**Disconnection of steering rod will cause the boat to turn accidentally. The sudden turn of the boat may cause the passenger to be thrown overboard, leading to serious injury or fatal accident.**



**Bolt ① P/N. 3E0-84917-0 :**

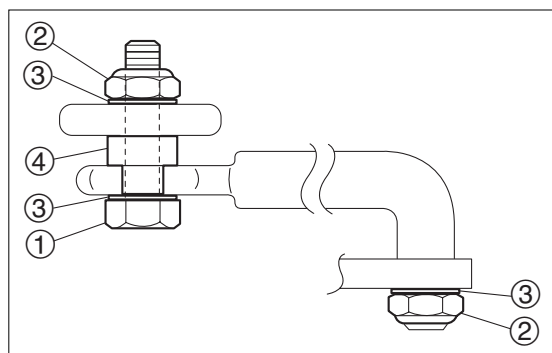
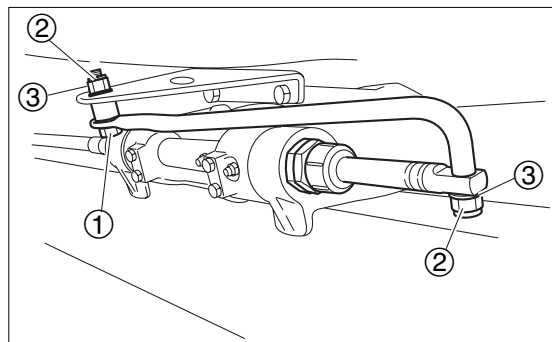
27.1 N · m (20 lb · ft) [2.7 kgf · m]

**Nylon Nuts ② P/N. 353-84918-0 :**

Fully tighten, and then loosen 1/4 of a turn.

Washer ③ P/N. 353-84916-0

Drag Link Spacer ④ P/N. 3FW-84914-0

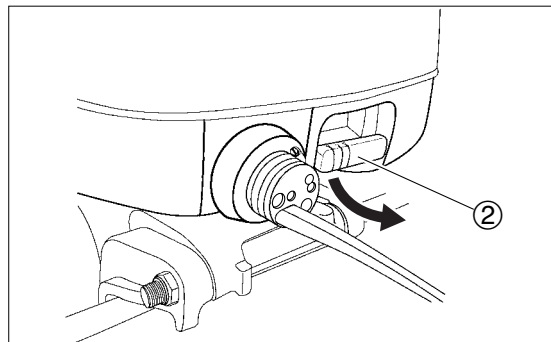
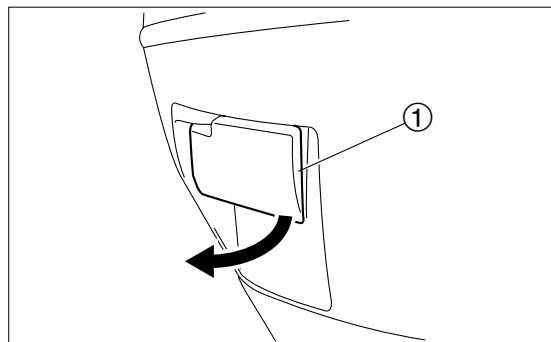




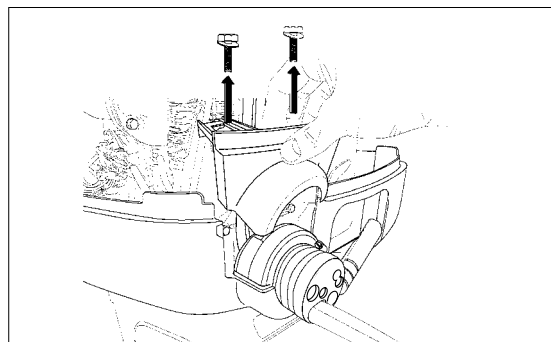
# Rigging

## 3) Installation of Remote Control Cable (Engine Side)

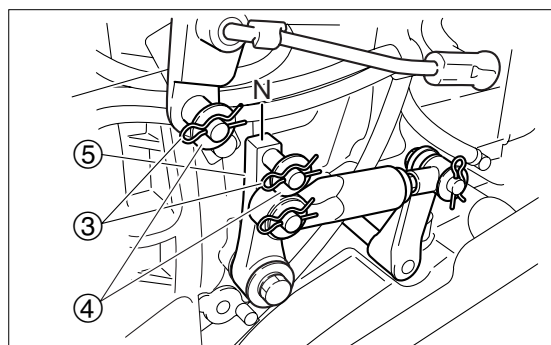
1. Turn upper motor cover hook levers ① and ② and remove upper motor cover.



2. Remove cord clamp installation bolts and remove cord clamp and grommet.



3. Remove "R" shaped pin ③ and washer ④ of throttle side and shift side, and set shift arm ⑤ to F, N, R positions and then to N.

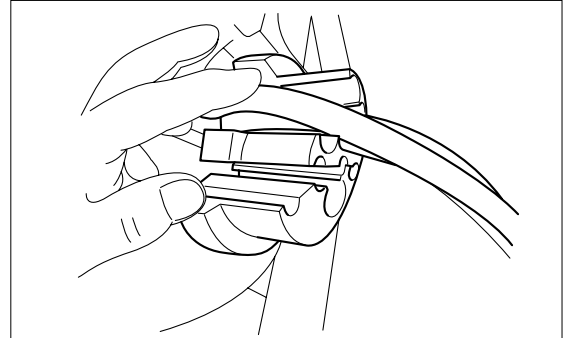
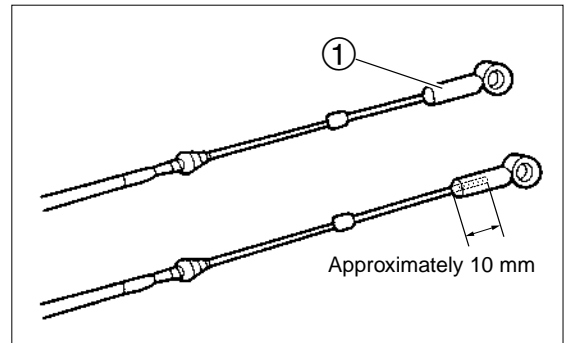




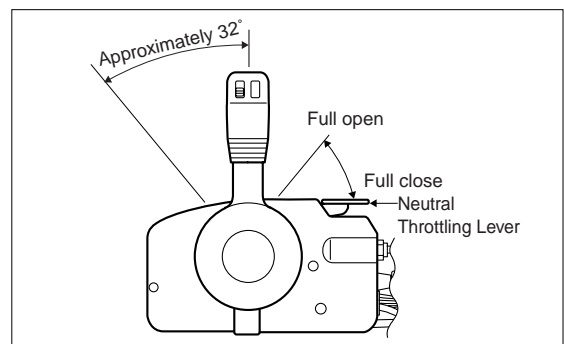
4. Screw cable joint ① on the tip of remote control cable by approximately 10mm. Open the cut of grommet and run meter cord ass'y and cord ass'y B attached to remote control box from front of lower motor cover. Then, run two remote control cables.



The screw-in distance of cable joint, 10 mm, is equivalent to approximately 9 threads.



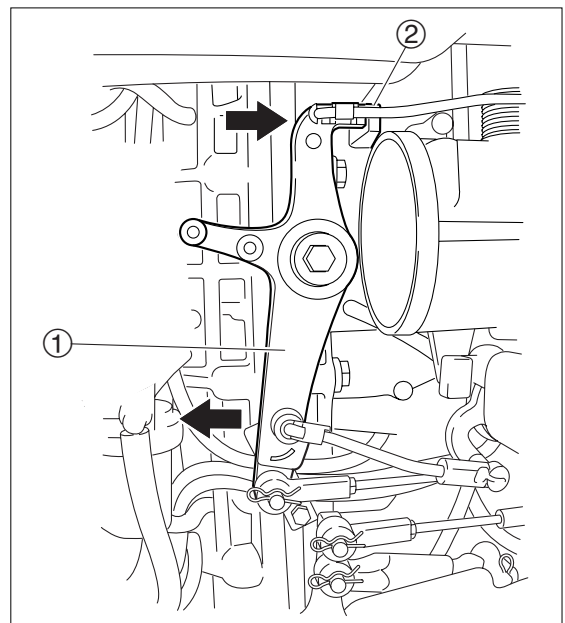
5. Shift cable is the one of which tip is moved when remote control lever is set to forward (F) side until it stops once (approx. 32 degrees).
6. Set remote control lever to neutral (N), and check that neutral throttling lever is at full close position.



7. Set advancer arm to full close position.



Check that advancer arm ① is surely in contact with full close side stopper ②.





# Rigging

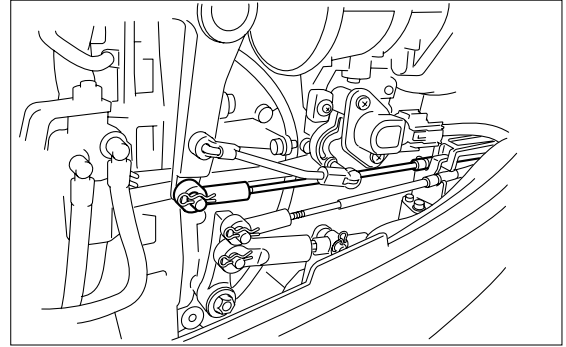
8. Adjust screw in length of cable joint so that cable joint hole aligns with shift arm and advancer arm pins, lock the joint with nut, and then, set it on the arm pin and secure with "R" pin and washer.

Put the cable in cable clip groove, and then secure it by using cord clamp.



Check that shifting control lever forward (F) by approximately 32 degrees, where it is stopped once, makes the gear engage, and fully shifting the lever makes throttle valve fully open, and then, check that shifting the lever reverse (R) by approximately 32 degrees, where it is stopped once, makes the gear engage, and fully shifting the lever makes throttle valve fully open.

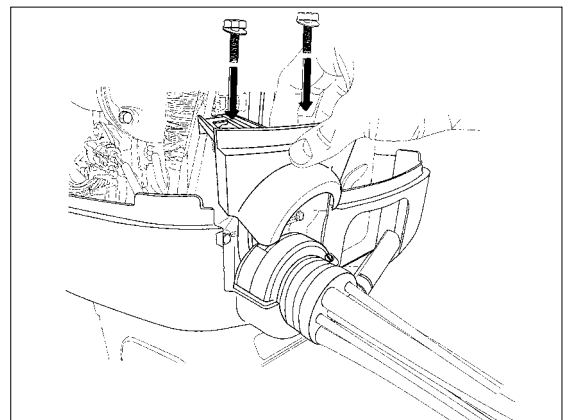
Then, check that, when control lever is returned to neutral position (N), advancer arm of the outboard motor side is at full close position. Since throttle position sensor (TPS) operates incorrectly if advancer arm does not contact with full close stopper, readjust cable joint position at outboard motor side and reinstall it if the valve is not fully closed in this case.



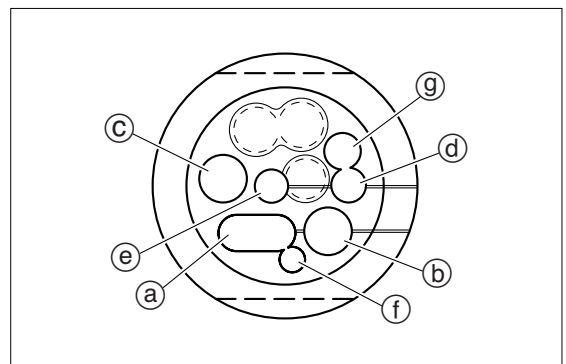
9. Run cord ass'y, hose and control cables through their specified holes of the cord grommet, secure them using cord clamps, and attach hose clamp to secure the cord grommet as shown.



Before securing hose clamp, check that the hoses and cords are put surely in their specified holes. If they are put in the holes improperly, the hoses may collapse, and cord clamp cannot be attached to the lower cowl.



- (a) Battery Cables
- (b) Fuel Hose
- (c) Cord Ass'y (B) (Remote Control Harness)
- (d) Throttle Cable
- (e) Shift Cable
- (f) Meter Cord Ass'y
- (g) Trim Sensor, for extension (optional part)



## 5. Lower Unit

### 1) Installation of Propeller

#### WARNING

- Before removing or installing propeller, be sure to disconnect battery cables from battery and remove stop switch lock plate.
- When removing or installing propeller, do not handle propeller with bare hands.
- Put a piece of wooden block between anti-cavitation plate and propeller to prevent rotation of propeller when removing or installing propeller.

1. Set shift lever to neutral (N) position.
2. Remove spark plug caps from spark plugs.
3. Apply grease to propeller shaft.
4. Put propeller parts on the propeller shaft in the order as shown.
5. Put a piece of wood in between gear case and propeller, and tighten nut to specified torque.



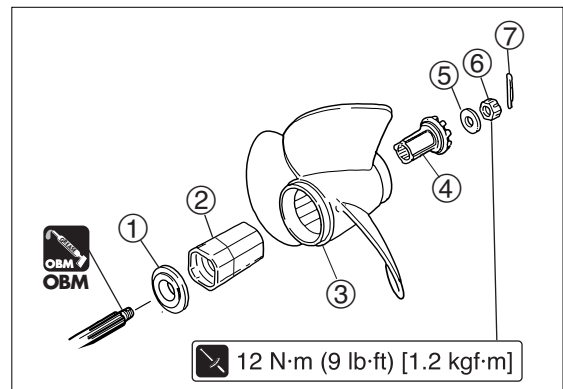
#### Propeller Nut ⑥ :

12 N · m (9 lb · ft) [1.2 kgf · m]

6. Put split pin in the nut and bend.

#### CAUTION

**Check nut for looseness at least every 20 hours of operation.**



#### Float Torque II Drive Hub Propeller :

Put thrust washer ①, replaceable drive sleeve ②, propeller ③, drive sleeve adapter ④, washer ⑤, propeller nut ⑥, and then split pin ⑦ on the propeller shaft.



# Rigging

## 6. Electric System

### 1) Battery Capacity

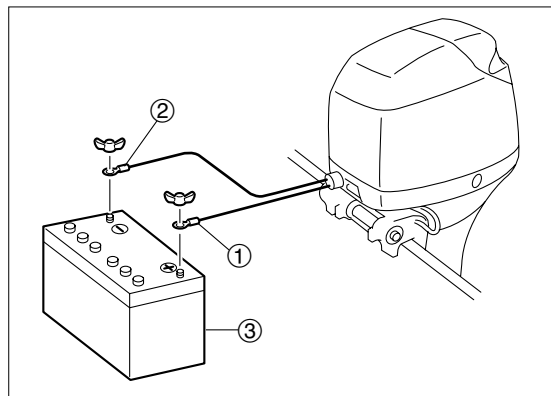


12V100 AH or more	12V120 AH or more (in cold regions)
CCA : 850	CCA : 1000
MCA : 500	MCA : 850

### 2) Connection of Battery Cables

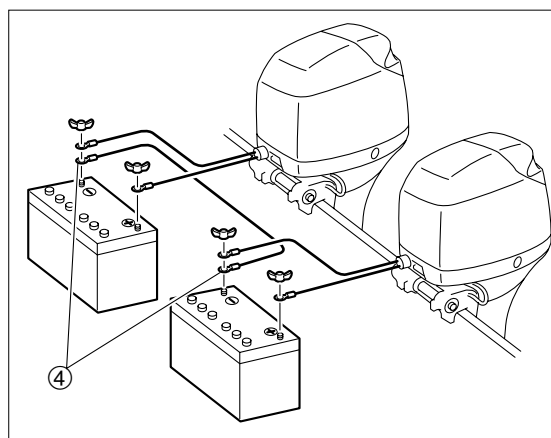
#### 1. Single Outboard Installation

- ① : Red Sleeve (Positive Side)
- ② : Black Sleeve (Negative Side)
- ③ : Starting Battery



#### 2. Twin Outboard Installation

Be sure to connect negative terminals of the starting batteries by using common earth lead ④ of which size is equal to that of the main battery cables.

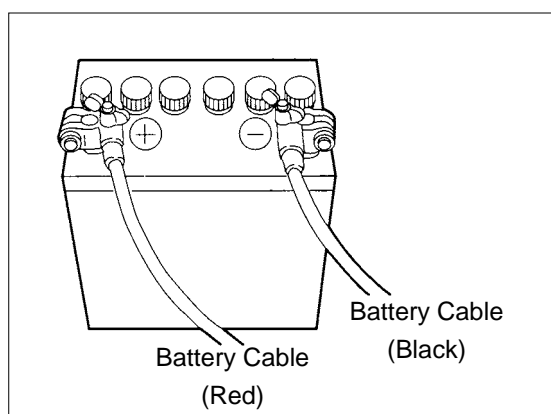


### 3) Installation of Battery (ies)

This outboard motor cannot be operated without using battery.  
Use battery of 12V.100AH (12V.120AH for use in cold areas)

- Battery should be stored in battery storage box and secured to hull to prevent it from falling due to rolling or pitching or any shock in the place where it is protected from water spray.
- When connecting battery cables, connect red cable first, and then black one. (Reverse the order when disconnecting.)

Positive cable is the one with red tube on the terminal end.



#### ⚠ CAUTION

- Before using battery, thoroughly read warning label.
- Do not disconnect battery cable during engine operation.

## 7. Accessories and Meters

### 1) Accessories.

Start In-Gear Protection (Neutral Safe Starting Switch)

The remote control box connected to the outboard motor is equipped with start in-gear protection (neutral safe starting switch) This function disables the engine starting when shift gear is engaged.

#### WARNING

**If engine starts with the shift gear engaged, the boat may start to move unexpectedly, possibly leading to serious injury or fatal accident. To prevent this accident, the outboard motor is equipped with the start in-gear protection (neutral safe starting switch), which must not be disabled.**

#### <Selection of Outboard Motor Accessories>

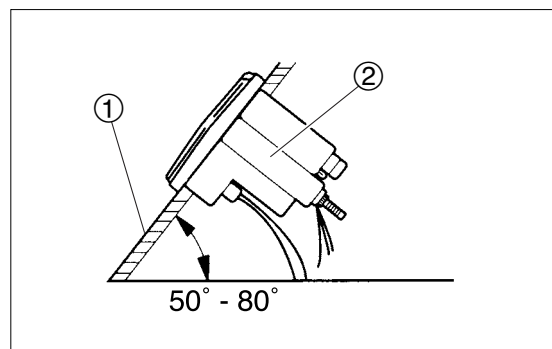
For this outboard motor, use the manufacturer's genuine parts and accessories.

For safety reasons, it is not recommended to use parts and accessories supplied by other than the manufacturer. Before using any accessories, thoroughly read the installation manual and operation manual.

### 2) Installation of Meters

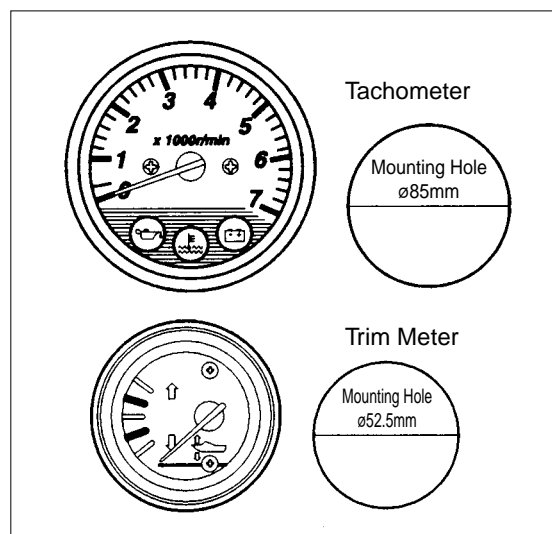
When installing meters, select a place on the dash board ① where operator can watch them easily and they are not exposed to water spray.

The meters can be installed on the dashboard of 2 to 11 mm thick. When the thickness is over 11mm, cut fitting plate ② so that the meters can be installed.



#### <Installation Angle>

Install meters so that the angle is in between 50 to 80 degrees from horizontal plane.

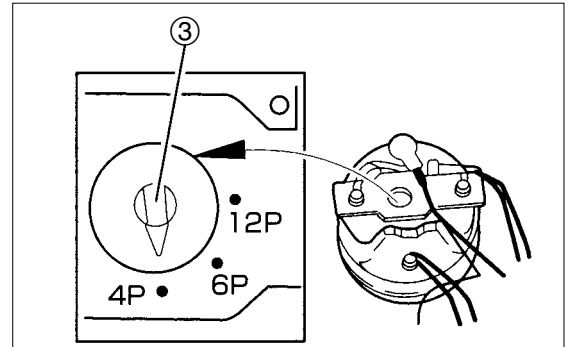




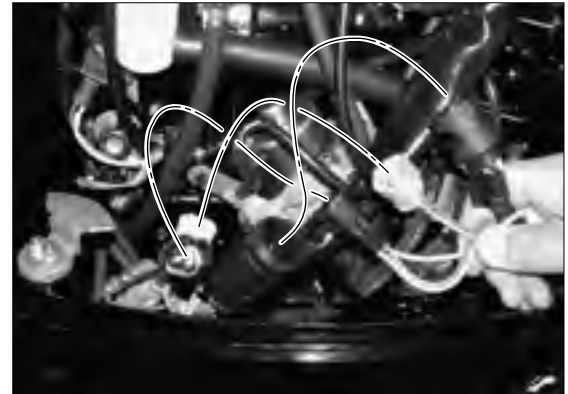
# Rigging

## <Tachometer>

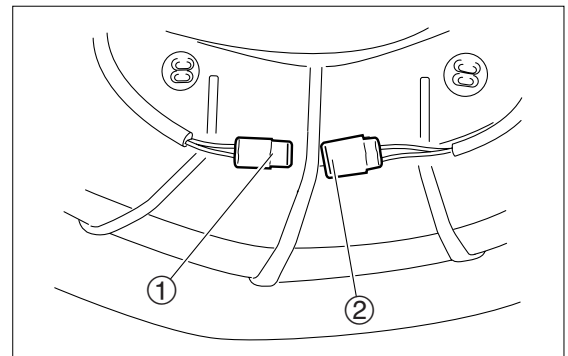
Set selector ③ to "4P" on the back of the meter.



1. Connect cord ass'y B and meter lead wire to cord ass'y A.

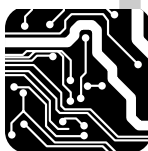


2. Connect trim sensor ① with trim sensor extension cord ②.



# 11

## Wiring Diagram



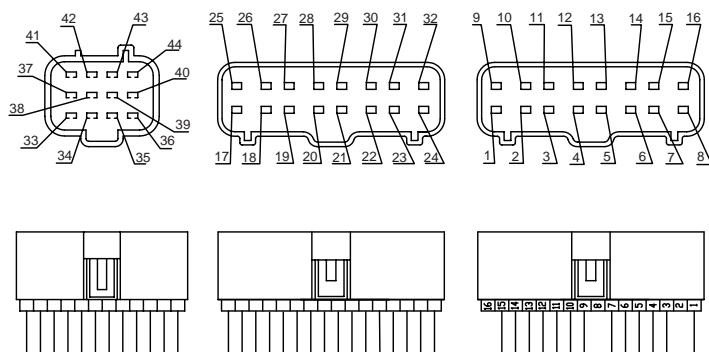
<b>TLDI Wire Harness Terminals and Connections</b>	11-2
<b>Main Harness Diagram</b>	11-3
<b>75/90C2 EPTO Electrical Circuit</b>	11-5
<b>Electrical Wiring Assembling</b>	

<b>Instruction Diagram -1</b>	11-7
<b>Electrical Wiring Assembling</b>	
<b>Instruction Diagram -2</b>	11-8
<b>Outboard Motor Installation Template</b>	11-9



# Wiring Diagram

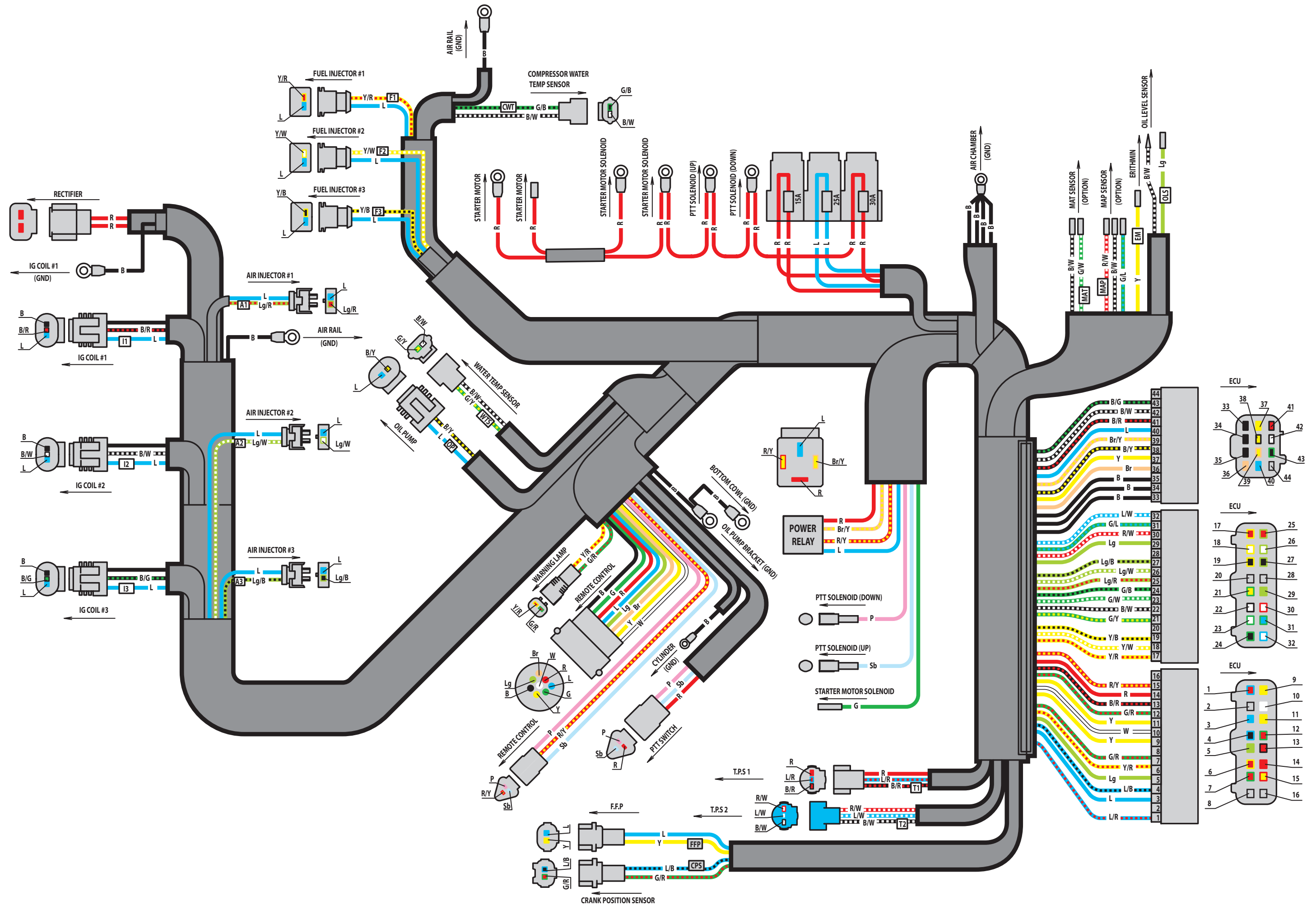
## TLDI Wire Harness Terminals and Connections



NO	Component	Lead Wire Color	
1	TPS1 (Throttle Position Sensor 1)	L/R	Blue/Red
2			
3	Key Switch (PUSH)	L	Blue
4	CPS (Crank Position Sensor)	L/B	Blue/Black
5	Warning Lamp (Oil)	Lg	Light green
6	Warning Lamp (Temp.)	Y/R	Yellow/Red
7	Warning Lamp (Battery)	G/R	Green/Red
8			
9	Buzzer	Y	Yellow
10	Tachometer	W	White
11	EM (Engine Monitor)	Y	Yellow
12	CPS (Crank Position Sensor)	G/R	Green/Red
13	Ground (TPS1)	B/R	Black/Red
14	Power Source (TPS1)	R	Red
15	Power Source (Key Switch)	R/Y	Red/Yellow
16			
17	#1 Fuel Injector	Y/R	Yellow/Red
18	#2 Fuel Injector	Y/W	Yellow/White
19	#3 Fuel Injector	Y/B	Yellow/Black
20			
21	WTS (Water Temp. Sensor)	G/Y	Green/Yellow
22	Ground (TPS2, MAP, Water Temp. Sensor, MAT, Oil Level Sensor and Air Compressor Water Temp. Sensor)	B/W	Black/White
23	MAT Sensor (Option)	G/W	Green/White
24	CWT ( Air Compressor Water Temp. Sensor)	G/B	Green/Black
25	#1 Air Injector	Lg/R	Light green/Red
26	#2 Air Injector	Lg/W	Light green/White
27	#3 Air Injector	Lg/B	Light green/Black
28			
29	Oil Level Sensor	Lg	Light green
30	Power Source (TPS2, MAP)	R/W	Red/White
31	MAP Sensor (Option)	G/L	Green/Blue
32	TPS2 (Throttle Position Sensor 2)	L/W	Blue/White
33	Ground Terminal	B	Black
34	Ground Terminal	B	Black
35	Ground Terminal	B	Black
36	Stop Switch	Br	Brown
37	FFP (Fuel Feed Pump)	Y	Yellow
38	Electric Oil Pump	B/Y	Black/Yellow
39	Main Power relay	Br/Y	Brown/Yellow
40	Main Power Source (ECU)	L	Blue
41	#1 Ignition Coil	B/R	Black/Red
42	#2 Ignition Coil	B/W	Black/White
43	#3 Ignition Coil	B/G	Black/Green
44			



## Main Harness Diagram



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# Wiring Diagram

## TLDI 75/90C2 EPTO Electrical Circuit

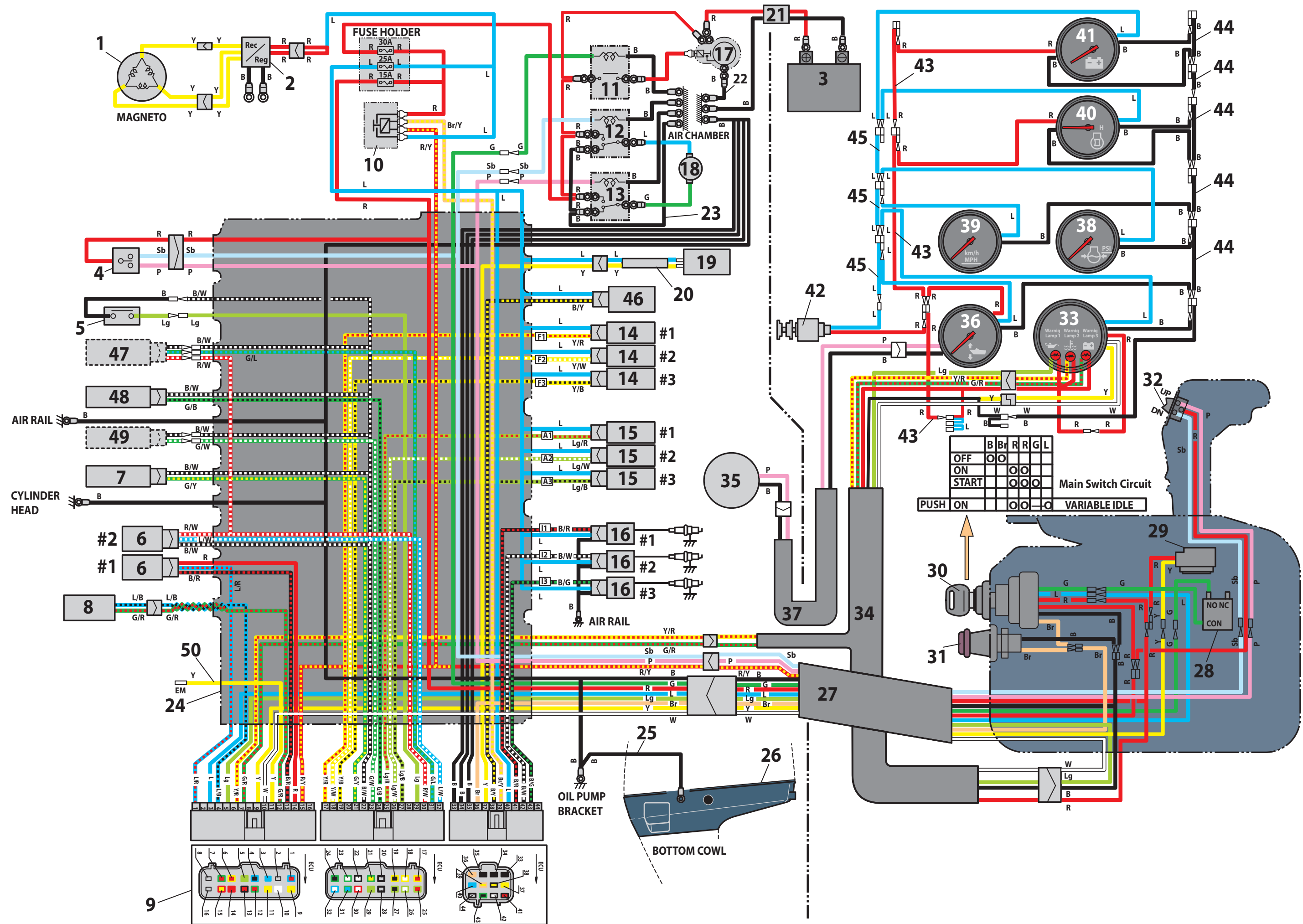
NO	Name of Component	NO	Name of Component
1	Alternator Ass'y	27	Cord Ass'y B
2	Rectifier Complete	28	Neutral Switch
3	Battery (Local)	29	Buzzer
4	PTT switch	30	Main Switch
5	Oil Level Sensor	31	Lanyard Stop Switch
6	Throttle Position Sensor	32	PTT Switch
7	Water Temp. Sensor	33	Tach Meter
8	Crank Position Sensor	34	Meter Lead Wire
9	ECU (Engine Control Unit)	35	Trim Sender
10	Main Power Relay	36	Trim Meter
11	Starter Solenoid	37	Trim Sensor Extension Cord
12	PTT Solenoid Switch A	38	Water Pressure Meter
13	PTT Solenoid Switch B	39	Speed Meter
14	Fuel Injector	40	Hour Meter
15	Air Injector	41	Volt Meter
16	Ignition Coil	42	Meter Lamp Switch
17	Starter Motor	43	Assist Cord Red
18	PTT (Power Trim & Tilt)	44	Assist Cord Black
19	FFP (Fuel Feed Pump)	45	Assist Cord Blue
20	FFP Cord	46	Oil Pump Ass'y
21	Battery Cable	47	MAP Sensor (Option)
22	Starter Cord	48	Air Compressor Water Temp. Sensor
23	Earth Cord	49	MAT Sensor (Option)
24	Cord Ass'y A	50	EM Cord (Engine Monitor)
25	Ground Cord		
26	Lower Motor Cover		

### Cord Color

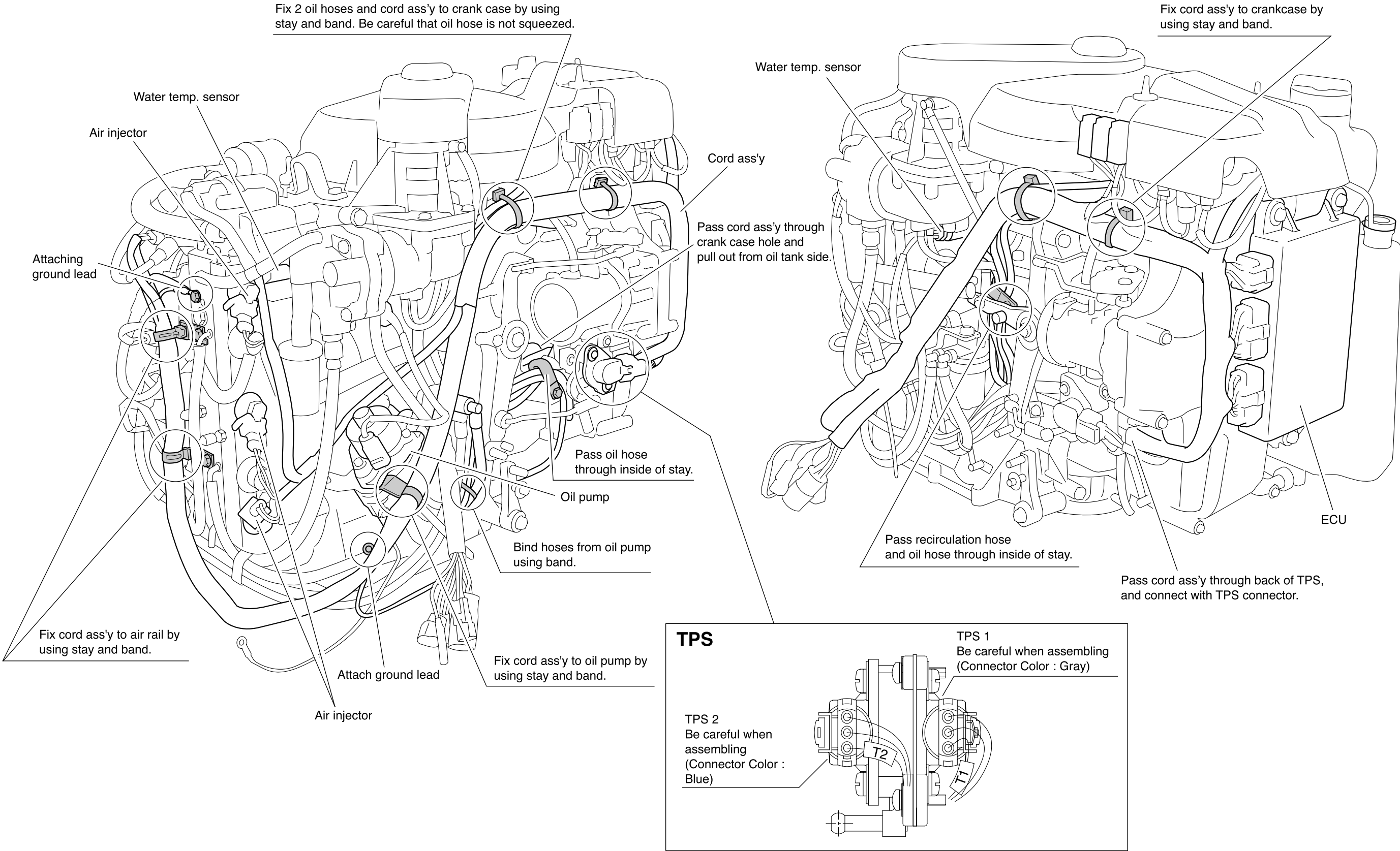
B	Black	G/L	Green/Blue
Br	Brown	G/R	Green/Red
L	Blue	G/W	Green/White
Lg	Light green	G/Y	Green/Yellow
P	Pink	L/B	Blue/Black
R	Red	L/R	Blue/Red
Sb	Sky blue	L/W	Blue/White
W	White	Lg/B	Light green/Black
Y	Yellow	Lg/R	Light green/Red
B/G	Black/Green	Lg/W	Light green/White
B/R	Black/Red	R/W	Red/White
B/W	Black/White	R/Y	Red/Yellow
B/Y	Black/Yellow	Y/B	Yellow/Black
Br/Y	Brown/Yellow	Y/R	Yellow/Red
G/B	Green/Yellow	Y/W	Yellow/White

Note: "/" means cords with striped colors.

TLDI 75/90C2 EPTO Electrical Circuit

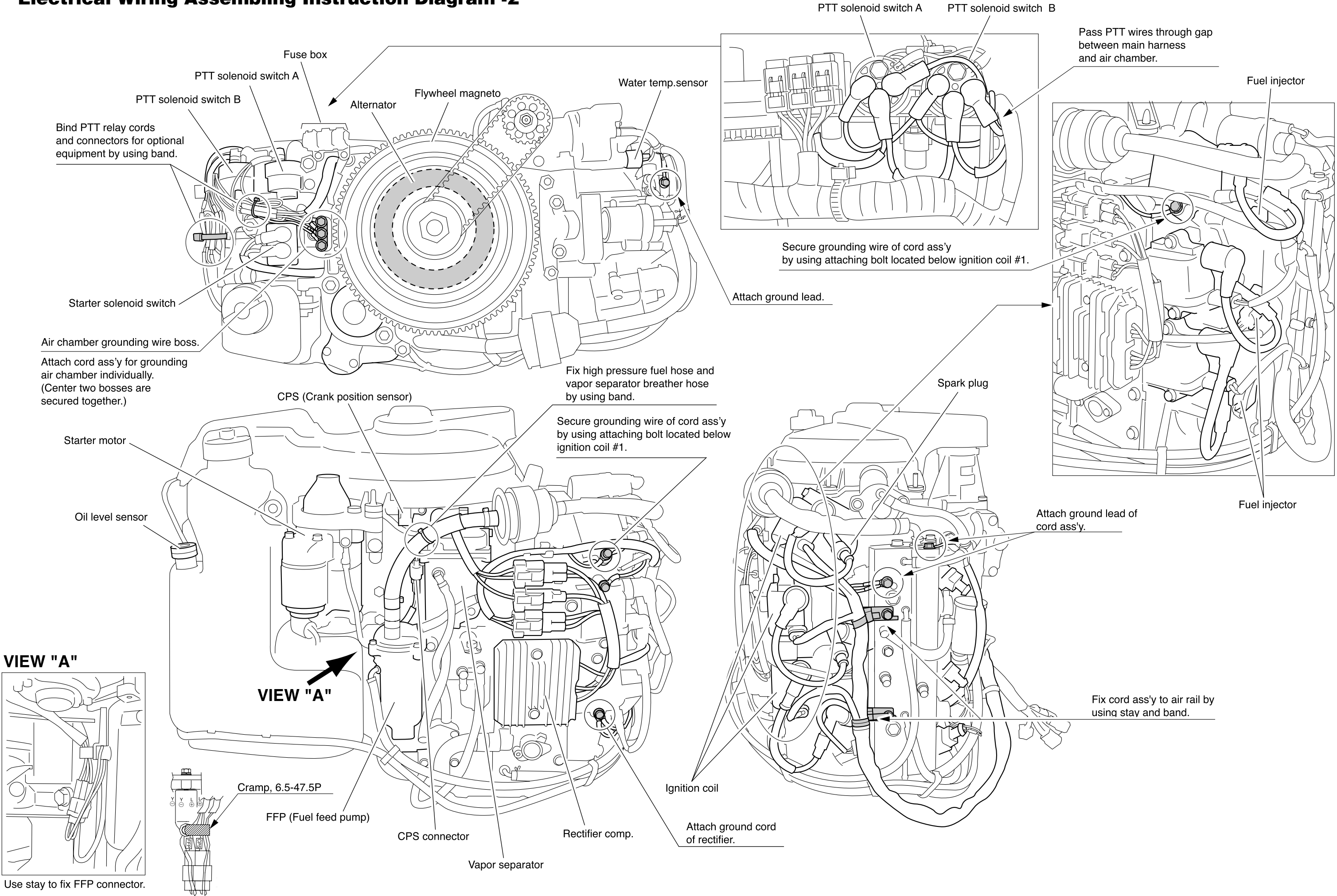


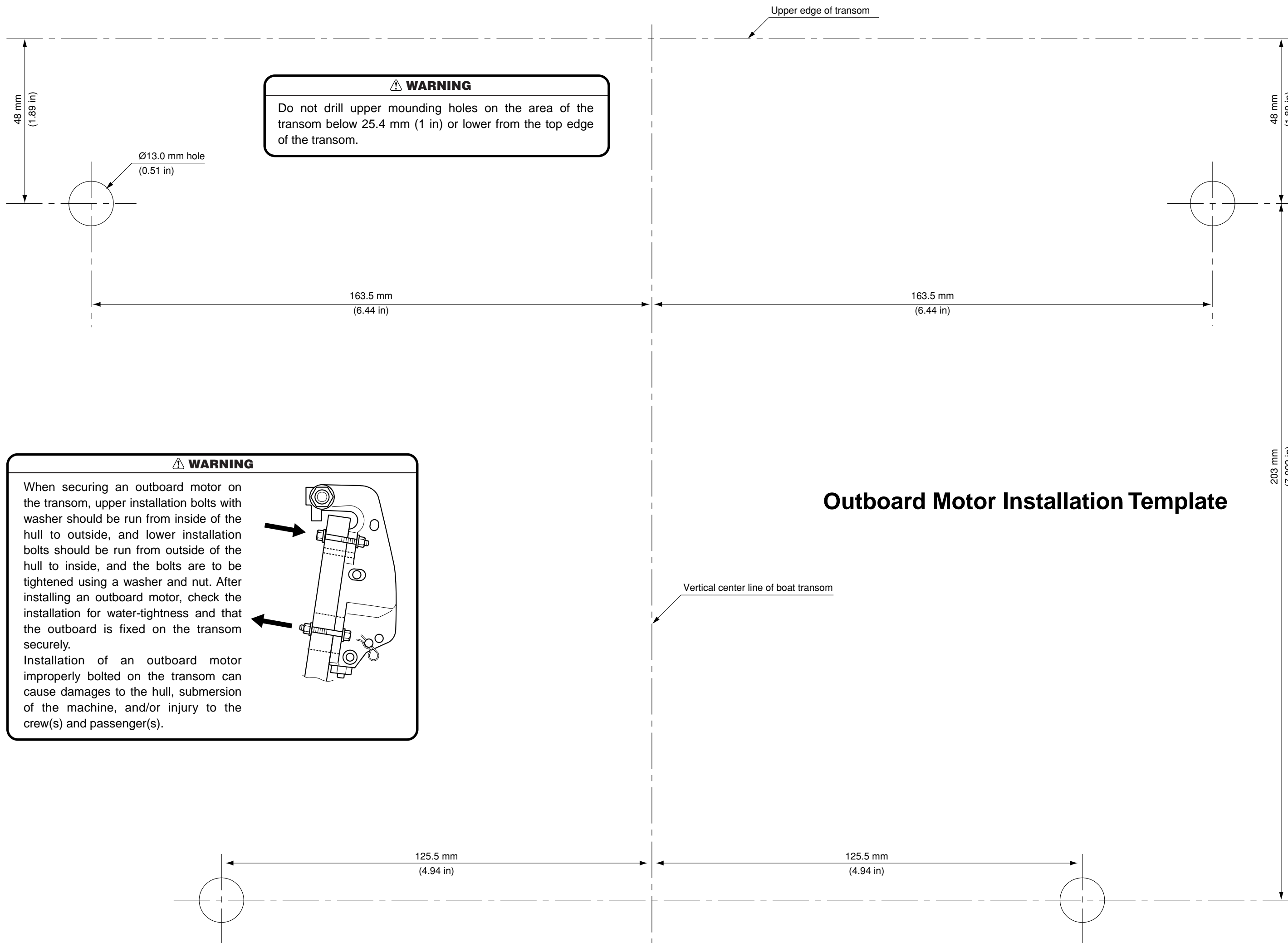
Electrical Wiring Assembling Instruction Diagram -1





Electrical Wiring Assembling Instruction Diagram -2









**SERVICE MANUAL**

*TLPI*

**MD**

**75/90C2  
Models**

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